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History of Revised Versions

Version	Date	Outline
01	April 17, 1996	Established
01	Dec. 17, 1996	• Document No. is changed. (Formerly IF2.02) • Document title is changed. (Formerly Personal Handy-Phone System Public Cell Station-ISDN Interface-Layer 3 Specification-)
02	July 31, 1998	• Takeover of Annex of B-IF2.51(TR) for upgrading B-IF2.51-02-TR to TS and error correction

Public Personal Handy-Phone System: Interface between Public Cell Station and ISDN-based PHS Switching Center-Layer 3 Specification

< Summary >

1. Relation with International Standards

This specification conforms to ITU-T Recommendation Q.931 in principle and specifies the signalling system consistent with the air interface specified by "PERSONAL HANDY PHONE SYSTEM ARIB STANDARD (RCR STD-28) VERSION 2".

2. Differences from ITU-T Recommendation Q.931

This specification is to be revised in the near future in order to include items specified in ITU-T Q.931 as many as possible. For the time being the minimum set specification, which is a sub-set of ITU-T Q.931, is attached as a reference which is necessary to realize the minimum PHS functions. The differences between the minimum set specification and ITU-T Q.931 are summarized in the following table.

3. References

ITU-T Recommendation Q.931
ARIB STANDARD RCR STD-28
PHS MoU Specification IF1.00, IF2.00, IF2.03

4. Items for Further Study

It is under study to include items, which are not included in the minimum set specification at present but specified in ITU-T Q.931, in this layer 3 specification as many as possible in the near future.

Table 1/IF2.02(Q.931)

Differences between the minimum set specification and ITU-T Q.931

Item	Difference	Reasons
1) Common terms	(1) "user" is changed to "public cell station" and "network" to "ISDN" (2) "U0, U1, ..." which are the call states of the user side are changed to "C0, C1, ..." which are the call states of the public cell station side.	(1) This change makes clear what "user" and "network" mean. (2) The call states refer to the public cell station (CS).
2) Protocol discriminator	New protocol discriminator value is used.	This interface is used as NNI.
3) Mode	"packet mode" and "user signalling bearer service" are not used.	Usage of the both modes has not been clarified.
4) Messages for circuit mode connection control	(1) SETUP ACKNOWLEDGE message is not used. (2) RESUME, RESUME ACKNOWLEDGE, RESUME REJECT, SUSPEND, SUSPEND ACKNOWLEDGE, and SUSPEND REJECT messages are not used. (3) INFORMATION message is not used.	(1) Usage has not been clarified. (2) Not provided in this specification. (3) Messages and information elements for stimulus procedure are out of scope.
5) Information elements for circuit mode connection control	(1) More data information element, Congestion level information element, Call identity information element, Network-specific facilities information element, Display information element, Date/time information element, Transit network selection information element, and User-user information element are not used. (2) Sending complete information element is not used. (3) Keypad facility information element and Signal information element are not used.	(1), (2) Not provided in this specification. (3) Messages and information elements for stimulus procedure are out of scope.
6) Connection configurations	Point-to-point connection between public cell station and ISDN are used. In case of incoming call to public cell station, DL-UNITDATA-REQUEST primitive is sent from ISDN. And call state management in above case corresponds to that of point-to-multipoint connection, for which call abort status is defined.	It is out of scope to connect multiple public cell stations to an interface. Invalid messages for an incoming call are also to be avoided.
7) First response for incoming call	The first response to SETUP message from public cell station must be CALL PROCEEDING message. Only public cell station which can confirm consistency of end-to-end connection sends this message. (When CONNECT message or other one from personal station is received.)	These conditions for sending the first response is for the ISDN not to receive invalid messages.
8) Action of public cell station which cannot confirm end-to-end call connection	Public cell station which can not confirm end-to-end call connection releases the call reference and shall not send any messages to ISDN.	Invalid messages for an incoming call are to be avoided.

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Table 1/IF2.02(Q.931) *(continued)*

Item	Difference	Reasons
9) Circuit-switched call control procedures	(1) The description of overlap sending and receiving are deleted. (2) The description of transit network selection, call rearrangements, bearer capability selection, and high layer capability selection are deleted. (3) Channel negotiation procedure is not used.	(1), (2) Not provided in this specification. (3) In normal call, public cell station make choice of channel.
10) Deletion of the information elements from messages	(1) Bearer capability information element is not provided for each of ALERTING, CALL PROCEEDING, CONNECT, and PROGRESS messages. (2) Bearer capability information element is not provided for NOTIFY message. (3) Channel identification information element is not provided for each of ALERTING and CONNECT messages.	(1), (2) Bearer capability information element in these messages are for the bearer capability selection, which is not provided in this specification. (3) These messages can not be the first response to SETUP message.
11) NOTIFY message	NOTIFY is used only for ISDN-to-public cell station direction.	Not provided in this specification.
12) SETUP message	Calling party number information element in outgoing call from public cell station and Called party number information element in incoming call to/outgoing call from public cell station are mandatory.	Calling party number information element in outgoing call is necessary for specifying a calling side. Called party number information element in outgoing call is necessary for specifying a called side. Called party number information element in incoming call is necessary for specifying a called side.
13) Call reference information element	Length of call reference value is fixed 2 octets.	The number of active incoming calls can be large.
14) Call reference information element	Dummy call reference number is not used.	Not provided in this specification.
15) Bearer capability information element	Octets 6,7 (User information layer 2 protocol and layer 3 protocol) are not used.	Packet mode is not provided in this specification.
16) Call state information element	(1) C2/N2 (Overlap sending), (2) C25/N25 (Overlap receiving), (3) C15/N15 (Suspend request), (4) C17/N17 (Resume request) are not used.	(1), (2) Overlap sending and receiving are not provided in this specification.
17) Calling/called party number information element	Only international number / national number / network specific number / reserved for extension / spare are used as Type of number. Only ISDN/telephony numbering plan / national standard numbering plan / private numbering plan / reserved for extension / spare are used as Numbering plan.	Other Type of number and Numbering plan are not provided in this specification.
18) Progress indicator information element	The network is regarded as ISDN on inter-network interworking	This is to clarify the interworking with other network.
19) Progress indicator information element	"private network serving local user" is not used.	Public cell station serving private network has not been defined.

Table 1/IF2.02(Q.931) (end)

Item	Difference	Reasons
20) Timer	(1) The following timers are not used at the ISDN side: T302, T304, T307, T320. (2) The following timers are not used at the public cell station side: T302, T304, T318, T319. (3) T303 on the ISDN is changed to 4 through 5 seconds.	(1), (2) These are timers for the functions which are not provided in this specification. (3) The value depends on requirement of public cell station.
21) Constraints in incoming call	(1) Channel identification information element in incoming call to public cell station is constrained as follows; 1) Information channel selection field indicates "B1 channel" or "B2 channel", and Preferred/Exclusive field indicates "exclusive", or 2) Information channel selection field indicates "any channel", and Preferred/ Exclusive field indicates "indicated channel is preferred". (2) If there is no response for re-transmitted SETUP message, cause No. 20 "subscriber absent" is sent to the calling user side. (3) Public cell station receiving an incoming call with bearer capability which is not implemented sends cause No. 65 "Bearer capability not implemented" only if establishment of the end-to-end connection is possible. (4) The local action of the public cell station is not described. (5) Section 5.2.9 is not used.	(1) Channel is to be hunt by the public cell station. (2) This cause value is for mobile communicatio (3) Action is clarified when "subscriber absent" situation, which is peculiar to mobile communication, and incoming call with unimplemented bearer capability occur at the same time. (4) The description is for the local action of terminal equipment and is not applied to the public cell station. (5) The connection is restricted to point-to-point connection.
22) Annex A	The above changes are applied.	
23) Annex C	Not included.	Not provided in this specification.
24) Annex D	Not included.	Not required.
25) Annex E	Not included.	Not provided in this specification.
26) Annex G	Not included.	Not required.
27) Annex H	The above changes are applied.	
28) Annex K	Not included.	Not provided in this specification.
29) Annex L	Not included.	Not provided in this specification.
30) Appendix I	Cause No. 20 is added.	This is a cause value for mobile communications.
31) Appendix II	Not included.	Not provided in this specification.
32) Appendix IV	Descriptions beyond the bound of an interface are arranged as Appendix.	It is necessary to clarify the details beyond the bound of an interface.

(4) B-IF2.02-02-TS

Public Personal Handy-Phone System
Interface Between Public Cell Station and ISDN-Based PHS Switching Center-Layer 3 Specification

This specification specifies the layer 3 of the Personal Handy-Phone System public cell station-ISDN interface.

This specification conforms to ITU-T Recommendation Q.931 in principle. The minimum set specification, which is a sub-set of ITU-T Q.931, is attached as a reference specification which is necessary to realize the minimum PHS functions.

Note : This means that the minimum functions of PHS can be realized with the minimum set specification and does not restrict implementation of functions which are not specified in the minimum set specification. This specification is to be revised in the near future in order to include items, which are not included in the minimum set specification at present but specified in ITU-T Q.931, as many as possible.

Attachment

Personal Handy-Phone System Public Cell Station-ISDN Interface Layer 3 Specification

- Minimum Set Specification -

Public Personal Handy-Phone System: Interface between Public Cell Station and ISDN-based PHS Switching Center-Layer 3 Specification

Contents

* : This mark indicates sections which are specified in ITU-T Q.931 but are not included in this PHS MoU specification.

†} : This mark indicates sections which are to be specified in the next version of the PHS MoU specification.

* : This mark indicates sections which are specified in ITU-T Q.931 but are not included in this PHS MoU specification.

LIST OF TABLES

1. General

This specification specifies the procedures for the establishing, maintaining, and clearing of network connections at the public cell station-ISDN interface. These procedures are defined in terms of messages exchanged over the D-channel of basic and primary rate interface structures. The functions and procedures of this protocol, and the relationship with other layers, are described in general terms in B-IF 2.00.

This specification is intended to specify the essential features, procedures, and messages required for call control in the D-channel. However, there are some details of procedure which have not yet been specified, and which will be the subject of further study.

1.1 Scope of the specification

The procedures currently described in this specification are for the control of circuit-switched. The transport of other message-based information flows on the D-channel is a subject for further study.

Note 1: The term "layer 3" is used for the functions and protocol described in this specification. The terms "data link layer" and "layer 2" are used interchangeably to refer to the layer immediately below layer 3.

Note 2: Alignment of the functions and protocol with those of OSI network layer is for further study.

1.2 Application to interface structures

The layer 3 procedures apply to the interface structures defined in B-IF 2.00. They use the functions and services provided by layer 2.

The layer 3 procedures request the services of layer 2 and receive information from layer 2 using the primitives defined in layer 2 specification B-IF 2.03. These primitives are used to illustrate the communication between the protocol layers and are not intended to specify or constrain implementations.

2. Overview of call control

In this specification the terms "incoming" and "outgoing" are used to describe the call as viewed by the public cell station side of the interface.

In the subclauses which follow states are defined for circuit switched calls in 2.1 (call states), and for the interface in 2.4 (global call reference states).

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 signalling on the D-channel. Because several calls may exist simultaneously at a public cell station-ISDN interface, and each call may be in a different state, the state of the interface itself cannot be unambiguously defined.

Note : Additional states and SDL diagrams may be defined when new procedures are developed.

A detailed description of the procedures for call control is given in clause 5 in terms of:

(a) the messages defined in clause 3 which are transferred across the public cell station-ISDN interface; and

(b) the information processing and actions that take place at the public cell station side and the ISDN side.

Overview and detailed SDL diagrams for call control of circuit-switched calls are contained in Annex A.

Throughout this specification, references are made to B-channels.

2.1 Circuit switched calls

This subclause 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 public cell station side of the interface

The states which may exist on the public cell station side of the public cell station-ISDN interface are defined in this subclause.

2.1.1.1 Null state (C0)

No call exists.

2.1.1.2 Call initiated (C1)

This state exists for an outgoing call, when the public cell station requests call establishment from the ISDN.

2.1.1.3 Overlap sending (C2)*

2.1.1.4 Outgoing call proceeding (C3)

This state exists for an outgoing call when the public cell station has received acknowledgement that the ISDN has received all call information necessary to effect call establishment.

2.1.1.5 Call delivered (C4)

This state exists for an outgoing call, when the calling public cell station has received an indication that remote side alerting has been initiated.

2.1.1.6 Call present (C6)

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

2.1.1.7 Call received (C7)

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

2.1.1.8 Connect request (C8)

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

2.1.1.9 Incoming call proceeding (C9)

This state exists for an incoming call when the public cell station has sent acknowledgement that the public cell station can proceed the call and has received all call information necessary to effect call establishment.

2.1.1.10 Active (C10)

This state exists for an incoming call when the public cell station has received an acknowledgement from the ISDN that the public cell station has been awarded the call. This state exists for an outgoing call when the public cell station has received an indication that the remote side has answered the call.

2.1.1.11 Disconnect request (C11)

This state exists when the public cell station has requested the ISDN to clear the end-to-end connection (if any) and is waiting for a response.

2.1.1.12 Disconnect indication (C12)

This state exists when the public cell station has received an invitation to disconnect because the ISDN has disconnected the end-to-end connection (if any).

2.1.1.13 Suspend request (C15)*

2.1.1.14 Resume request (C17)*

2.1.1.15 Release request (C19)

This state exists when the public cell station has requested the ISDN to release and is waiting for a response.

2.1.1.16 Overlap receiving (U25)*

2.1.2 ISDN call states

The call states that may exist on the ISDN side of the public cell station-ISDN interface are defined in this subclause.

2.1.2.1 Null state (N0)

No call exists.

2.1.2.2 Call initiated (N1)

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

2.1.2.3 Overlap sending (N2)*

2.1.2.4 Outgoing call proceeding (N3)

This state exists for an outgoing call when the ISDN has sent acknowledgement that the ISDN 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 ISDN has indicated that remote side alerting has been initiated.

2.1.2.6 Call present (N6)

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

2.1.2.7 Call received (N7)

This state exists for an incoming call when the ISDN has received an indication that the public cell station 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 ISDN has received an answer from the public cell station but the ISDN has not yet awarded the call.

2.1.2.9 Incoming call proceeding (N9)

This state exists for an incoming call when the ISDN has received acknowledgement that the public cell station cann proceed the call and 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 ISDN has awarded the call to the called public cell station. This state exists for an outgoing call when the ISDN has indicated that the remote side has answered the call.

2.1.2.11 Disconnect request (N11)

This state exists when the ISDN has received a request from the public cell station to clear the end-to-end connection (if any).

2.1.2.12 Disconnect indication (N12)

This state exists when the ISDN has disconnected the end-to-end connection (if any) and has sent an invitation to disconnect the public cell station-ISDN connection.

2.1.2.13 Suspend request (N15)*

2.1.2.14 Resume request (N17)*

2.1.2.15 Release request (N19)

This state exists when the ISDN has requested the public cell station to release and is waiting for a response.

2.1.2.16 Call abort (N22)

This state exists for an incoming call when the call is being cleared before any user has been awarded the call.

2.1.2.17 Overlap receiving (N25)*

2.2 Packet-mode access connections *

2.3 Temporary signalling connections *

2.4 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 are contained in 5.5.

There is only one global call reference per interface.

2.4.1 Call states at the public cell station side of the interface

The states which may exist on the public cell station side of the public cell station-ISDN interface are defined in this subclause.

2.4.1.1 Null (Rest 0)

No transaction exists.

2.4.1.2 Restart request (Rest 1)

This state exists for a restart transaction when the public cell station has sent a restart request but has not yet received an acknowledgement response from the ISDN.

2.4.1.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the ISDN and responses have not yet been received from all locally active call references.

2.4.2 Call states at the ISDN side of the interface

The states which may exist on the ISDN side of the public cell station-ISDN interface are defined in this subclause.

2.4.2.1 Null (Rest 0)

No transaction exists.

2.4.2.2 Restart request (Rest 1)

This state exists for a restart transaction when the ISDN has sent a restart request but has not yet received an acknowledgement response from the public cell station.

2.4.2.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the public cell station and a response has not yet been received from all locally active call references.

3. Message functional definitions and content

This subclause provides an overview of the Q.931 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 ISDN;

   3) Dual significance, i.e. relevant in either the originating or terminating access and in the ISDN; or

   4) Global significance, i.e. relevant in the originating and terminating access and in the ISDN.

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

   1) the clause of this specification describing the information element;

   2) the direction in which it may be sent; i.e. public cell station to ISDN ("c → n"), ISDN to public cell station ("n → c"), or both;

   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;

   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 dependant;

Note : All messages may contain information elements from codesets 5, 6 and 7 and corresponding locking and non-locking shift information elements which comply with the coding rules specified in 4.5.4. None of these information elements, however, are listed in any of the tables in clause 3;

c) further explanatory Notes, as necessary.

3.1 Messages for circuit mode connection control

Table 3-1 summarizes the messages for circuit-mode connection control.

Table 3-1/B-IF2.02(Q.931)
Messages for circuit-mode connection control

	Reference (subclauses)
Call establishment messages:	
ALERTING	3.1.1
CALL PROCEEDING	3.1.2
CONNECT	3.1.3
CONNECT ACKNOWLEDGE	3.1.4
PROGRESS	3.1.8
SETUP	3.1.14
Call clearing messages:	
DISCONNECT	3.1.5
RELEASE	3.1.9
RELEASE COMPLETE	3.1.10
Miscellaneous messages:	
NOTIFY	3.1.7
STATUS	3.1.16
STATUS ENQUIRY	3.1.17

3.1.1 ALERTING

This message is sent by the called public cell station to the ISDN and by the ISDN to the calling public cell station, to indicate that called public cell station alerting has been initiated. See Table 3-2.

Table 3-2/B-IF2.02(Q.931)
ALERTING message content

Message type: ALERTING Significance: global Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Progress indicator	4.5.23	n → c	O (Note)	2-4
Note: Included in the event of interworking. Included in the ISDN-to-public cell station direction in connection with the provision of in-band information/patterns.				

3.1.2 CALL PROCEEDING

This message is sent by the called public cell station to the ISDN or by the ISDN to the calling public cell station to indicate that requested call establishment has been initiated and no more call establishment information will be accepted. See Table 3-3.

Table 3-3/B-IF2.02(Q.931)
CALL PROCEEDING message content

Message type: CALL PROCEEDING Significance: local Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Channel identification	4.5.13	Both	O (Note 1)	2-*
Progress indicator	4.5.23	n → c	O (Note 2)	2-4
Note 1: Mandatory in the ISDN-to-public cell station direction if this message is the first message in response to a SETUP message. It is mandatory in the public cell station-to-ISDN direction if this message is the first message in response to a SETUP message, unless the public cell station accepts the B-channel indicated in the SETUP message. Note 2: Included in the event of interworking. Included in the ISDN to public cell station direction in connection with the provision of in-band information/patterns.				

3.1.3 CONNECT

This message is sent by the called public cell station to the ISDN and by the ISDN to the calling public cell station, to indicate call acceptance by the called public cell station. See Table 3-4.

Table 3-4/B-IF2.02(Q.931)
CONNECT message content

Message type: CONNECT Significance: global Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Progress indicator	4.5.23	Both	O (Note 1)	2-4
Low layer compatibility	4.5.19	Both	O (Note 2)	2-18
Note 1: Included in the event of interworking or in connection with the provision of in-band information/patterns. Note 2: Included in the public cell station-to-ISDN direction when the answering side wants to return low layer compatibility information to the calling side. Included in the ISDN-to-public cell station direction if the called side awarded the call included a Low layer compatibility information element in the CONNECT message. Optionally included for low layer compatibility negotiation, but some ISDNs may not transport this information element to the calling side (see Annex J).				

3.1.4 CONNECT ACKNOWLEDGE

This message is sent by the ISDN to the called public cell station to indicate the public cell station has been awarded the call. It may also be sent by the calling public cell station to the ISDN to allow symmetrical call control procedures. See Table 3-5.

Table 3-5/B-IF2.02(Q.931)
CONNECT ACKNOWLEDGE message content

Message type: CONNECT ACKNOWLEDGE Significance: local Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1

3.1.5 DISCONNECT

This message is sent by the public cell station to request the ISDN to clear an end-to-end connection or is sent by the ISDN to indicate that the end-to-end connection is cleared. See Table 3-6.

Table 3-6/B-IF2.02(Q.931)
DISCONNECT message content

Message type: DISCONNECT Significance: global Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Cause	4.5.12	Both	M	4-32
Progress indicator	4.5.23	(Note 1)	O (Note 2)	2-4
Note 1: Included in the ISDN-to-public cell station direction if the ISDN provides in-band tones. Note 2: Included by the ISDN if in-band tones are provided.				

3.1.6 INFORMATION*

3.1.7 NOTIFY

This message is sent by the ISDN to indicate information pertaining to a call, such as user suspended. See Table 3-8.

Table 3-8/B-IF2.02(Q.931)
NOTIFY message content

Message type: NOTIFY Significance: access Direction: n → c				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	n → c	M	1
Call reference	4.3	n → c	M	3
Message type	4.4	n → c	M	1
Notification indicator	4.5.22	n → c	M	3

3.1.8 PROGRESS

This message is sent by the public cell station or the ISDN to indicate the progress of a call in the event of interworking or in relation with the provision of in-band information/patterns. See Table 3-9.

Table 3-9/B-IF2.02(Q.931)
PROGRESS message content

Message type: PROGRESS Significance: global Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Cause	4.5.12	Both	O (Note)	2-32
Progress indicator	4.5.23	Both	M	4
Note: Included by the public cell station or the ISDN to provide additional information concerning the provision of in-band information/patterns.				

3.1.9 RELEASE

This message is sent by the public cell station or the ISDN to indicate that the equipment sending the message has disconnected the channel (if any) and intends to release the channel and the call reference. Thus the receiving equipment should release the channel and prepare to release the call reference after sending a RELEASE COMPLETE. See Table 3-10.

Table 3-10/B-IF2.02(Q.931)
RELEASE message content

Message type: RELEASE Significance: local (Note 1) Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Cause	4.5.12	Both	O (Note 2)	2-32
Note 1: This message has local significance; however, it may carry information of global significance when used as the first call clearing message. Note 2: Mandatory in the first call clearing message, including when the RELEASE message is sent as a result of an error handling condition.				

3.1.10 RELEASE COMPLETE

This message is sent by the public cell station or the ISDN to indicate that the equipment sending the message has released the channel (if any) and call reference, the channel is available for reuse, and the receiving equipment shall release the call reference. See Table 3-11.

Table 3-11/B-IF2.02(Q.931)
RELEASE COMPLETE message content

Message type: RELEASE COMPLETE Significance: local (Note 1) Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.5	Both	M	1
Cause	4.5.12	Both	O (Note 2)	2-32
Note 1: This message has local significance; however, it may carry information of global significance when used as the first call clearing message. Note 2: Mandatory in the first call clearing message, including when the RELEASE COMPLETE message is sent as a result of an error handling condition.				

3.1.11 RESUME*

3.1.12 RESUME ACKNOWLEDGE*

3.1.13 RESUME REJECT*

3.1.14 SETUP

This message is sent by the calling public cell station to the ISDN and by the ISDN to the called public cell station to initiate call establishment. See Table 3-15.

Table 3-15/B-IF2.02(Q.931)
SETUP message content

Message type: SETUP Significance: global Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Bearer capability	4.5.5	Both	M	4-10
Channel identification	4.5.13	Both	O (Note 1)	2-*
Progress indicator	4.5.23	Both	O (Note 2)	2-4
Calling party number	4.5.10	Both	O (Note 3)	2-*
Calling party subaddress	4.5.11	Both	O (Note 4)	2-23
Called party number	4.5.8	Both	M	2-*
Called party subaddress	4.5.9	Both	O (Note 5)	2-23
Repeat indicator	4.5.24	Both	O (Note 6)	1
Low layer compatibility	4.5.19	Both	O (Note 7)	2-18
High layer compatibility	4.5.17	Both	O (Note 8)	2-5

Note 1: Mandatory in the ISDN-to-public cell station direction. Included in the public cell station-to-ISDN direction when a public cell station wants to indicate a channel. If not included, its absence is interpreted as "any channel acceptable".
Note 2: Included in the event of interworking or in connection with the provision of in-band information/patterns.
Note 3: May be included by the calling side or the ISDN to identify the calling side. May not be included in the ISDN-to-public cell station direction for basic call control. Mandatory in the public cell station-to-ISDN direction.
Note 4: Included in the public cell station-to-ISDN direction when the calling side wants to indicate the calling party subaddress. May be included in the ISDN-to-public cell station direction for basic call.
Note 5: Included in the public cell station-to-ISDN direction when the calling public cell station wants to indicate the called party subaddress. Included in the ISDN-to-public cell station direction if a Called party subaddress information element is included in the SETUP message.
Note 6: Included when two or more Low layer compatibility information elements are included for low layer compatibility negotiation.
Note 7: Included in the public cell station-to-ISDN direction when the calling side wants to pass low layer compatibility information to the called side. Included in the ISDN-to-public cell station direction if the calling side included a Low layer compatibility information element in the SETUP message. Two, three or four information elements may be included in descending order of priority, i.e. highest priority first, if the low layer compatibility negotiation procedures are used (see Annex J).
Note 8: Included in the public cell station-to-ISDN direction when the calling side wants to pass high layer compatibility information to the called side. Included in the ISDN-to-public cell station direction if the calling side included a High layer compatibility information element in the SETUP message.

3.1.15 SETUP ACKNOWLEDGE*

3.1.16 STATUS

This message is sent by the public cell station or the ISDN in response to a STATUS ENQUIRY message or at any time during a call to report certain error conditions listed in 5.8. See Table 3-17.

Table 3-17/B-IF2.02(Q.931)
STATUS message content

Message type: STATUS Significance: local Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1
Cause	4.5.12	Both	M	4-32
Call state	4.5.7	Both	M	3

3.1.17 STATUS ENQUIRY

This message is sent by the public cell station or the ISDN at any time to solicit a STATUS message from the peer layer 3 entity. Sending a STATUS message in response to a STATUS ENQUIRY message is mandatory. See Table 3-18.

Table 3-18/B-IF2.02(Q.931)
STATUS ENQUIRY message content

Message type: STATUS ENQUIRY Significance: local Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	3
Message type	4.4	Both	M	1

3.1.18 SUSPEND*

3.1.19 SUSPEND ACKNOWLEDGE*

3.1.20 SUSPEND REJECT*

3.2 Messages for packet mode connection control *

3.3 Messages for user signalling bearer sevice control *

3.4 Messages with the global call reference

Table 3-48 summarizes the messages which may use the global call reference defined in 4.3.

Table 3-48/B-IF2.02(Q.931)
Messages used with the global call reference

Messages	Reference (subclause)
RESTART	3.4.1
RESTART ACKNOWLEDGE	3.4.2
STATUS	3.4.3

3.4.1 RESTART

This message is sent by the public cell station or ISDN to request the recipient to restart (i.e. return to an idle condition) the indicated channel(s) or interface. See Table 3-49.

Table 3-49/B-IF2.02(Q.931)
RESTART message content

Message type: RESTART Significance: local Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M (Note 1)	3
Message type	4.4	Both	M	1
Channel identification	4.5.13	Both	O (Note 2)	2-*
Restart indicator	4.5.25	Both	M	3
Note 1: This message is sent with the global call reference defined in 4.3. Note 2: Included when necessary to indicate the particular channel(s) to be restarted.				

3.4.2 RESTART ACKNOWLEDGE

This message is sent to acknowledge the receipt of the RESTART message and to indicate that the requested restart is complete. See Table 3-50.

Table 3-50/B-IF2.02(Q.931)
RESTART ACKNOWLEDGE message content

Message type: RESTART ACKNOWLEDGE Significance: local Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M (Note 1)	3
Message type	4.4	Both	M	1
Channel identification	4.5.13	Both	O (Note 2)	2-*
Restart indicator	4.5.25	Both	M	3
Note 1: This message is sent with the global call reference defined in 4.3. Note 2: Included when necessary to indicate the particular channel(s) which have been restarted.				

3.4.3 STATUS

This message is sent by the public cell station or the ISDN at any time during a call to report certain error conditions listed in 5.8 See Table 3-51

Table 3-51/B-IF2.02(Q.931)
STATUS message content

Message type: STATUS Significance: local Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M (Note 1)	3
Message type	4.4	Both	M	1
Cause	4.5.12	Both	M	4-32
Call state	4.5.7	Both	M	3
Note 1: This message may be sent with the global call reference defined in 4.3.				

4. General message format and information elements coding

The figures and text in this clause 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.

4.1 Overview

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

a) protocol discriminator;
b) call reference;
c) message type;
d) other information elements, as required.

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

This organization is illustrated in the example shown in Figure 4-1.

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

Bit 8	7	6	5	4	3	2	1	Octets
Protocol discriminator								1
0	0	0	0	Length of call reference value (in octets)				2
Call reference value								3
0	Message type							etc.
Other information elements as required								

Figure 4-1/B-IF2.02(Q.931)
General message organization example

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 the field.

4.2 Protocol discriminator

The purpose of the protocol discriminator is to distinguish messages for user-network call control from other messages (to be defined). It also distinguishes messages of this Standard from those OSI network layer protocol units which are coded to other ITU-T Recommendations and other standards.

The protocol discriminator is the first part of every message. The protocol discriminator is coded according to Table 4-1.

Bit 8	7	6	5	4	3	2	1	Octet
Q.931/I.451 public cell station -digital network call control messages								
0	1	0	0	0	1	1	0	1
Protocol discriminator								

Figure 4-2/B-IF2.02(Q.931)
Protocol discriminator

The value of the protocol discriminator is based on the figure 4-1/B-IF2.02(Q.931).

Table 4-1/B-IF2.02(Q.931)
Protocol discriminator

8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	
•	Assigned in subclause 4.5.30; not available for use in the message protocol discriminator
0 0 0 0 0 1 1 1	
0 0 0 0 1 0 0 0	Recommendation Q.931/I.451 user-network call control messages
0 0 0 1 0 0 0 0	
•	Reserved for other network layer or layer 3 protocols, including Recommendation X.25 (Note)
0 0 1 1 1 1 1 1	
0 1 0 0 0 0 0 0	National use
0 1 0 0 0 0 0 1	National use. Assigned in subclause 4.5.30; not available for use in the message protocol discriminator
0 1 0 0 0 0 1 0	National use. PBX-PBX digital interface, common channel signaling system.
0 1 0 0 0 0 1 1	RCR STD-28 radio control message on radio section
0 1 0 0 0 1 0 0	RCR STD-28 mobility control message on radio section
0 1 0 0 0 1 0 1	RCR STD-28 call control message on radio section
0 1 0 0 0 1 1 0	Recommendation Q.931 public cell station - digital network call control messages
0 1 0 0 0 1 1 1	
•	National use
0 1 0 0 1 1 1 1	
0 1 0 1 0 0 0 0	
•	Reserved for other network layer or layer 3 protocols, including Recommendation X.25 (Note)
1 1 1 1 1 1 1 0	
All other values are reserved.	
Note : These values are reserved to discriminate these protocol discriminators from the first octet of a Recommendation X.25 packet including general format identifier.	

4.3 Call reference

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

The call reference is the second part of every message. The call reference is coded as shown in Figure 4-3. 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 octets 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.

All digital networks and public cell station must be able to support a call reference value of two octets.

The call reference information element includes the call reference value and the call reference flag.

Call reference values are assigned by the originating side of the public cell station-digital network 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 (except in the case of call suspension). 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.

Bit 8	7	6	5	4	3	2	1	Octets
0	0	0	0	Length of call reference value (in octets)				1
Flag								2
Call reference value								etc.

call reference flag (octet 2):
bit 8

0 the message is sent from the side that originate the call reference.
1 the message is sent to the side that originates the call reference.

Figure 4-3/B-IF2.02(Q.931)
Call reference information element

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".

Hence the call reference flag identifies who allocated the call reference value for this call 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 which use the global call reference (e.g. restart procedures).

Note : 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. See Figure 4-5.

Bit 8	7	6	5	4	3	2	1	Octets
0	0	0	0	Length of call Reference value 0	0	1	0	1
0/1 Flag	0	0	0	0	0	0	0	2
0	0	0	0	Call reference value 0	0	0	0	3

b) Two octet call reference value

Figure 4-5/B-IF2.02(Q.931)
Exemples of the encoding for 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. The message type is coded as shown in Figure 4-6 and Table 4-2.

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

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

Figure 4-6/B-IF2.02(Q.931)
Message type

Table 4-2/B-IF2.02(Q.931)
Message types

Bit 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Escape to nationally specific message type (Note)
0 0 0 - - - - -	Call establishment message:
0 0 0 0 1	- ALERTING
0 0 0 1 0	- CALL PROCEEDING
0 0 1 1 1	- CONNECT
0 1 1 1 1	- CONNECT ACKNOWLEDGE
0 0 0 1 1	- PROGRESS
0 0 1 0 1	- SETUP
0 1 0 - - - - -	Call clearing messages:
0 0 1 0 1	- DISCONNECT
0 1 1 0 1	- RELEASE
1 1 0 1 0	- RELEASE COMPLETE
0 0 1 1 0	- RESTART
0 1 1 1 0	- RESTART ACKNOWLEDGE
0 1 1 - - - - -	Miscellaneous messages:
0 0 0 0 0	- SEGMENT
0 1 1 1 0	- NOTIFY
1 1 1 0 1	- STATUS
1 0 1 0 1	- STATUS ENQUIRY

Note : When used, the message type is defined in the following octet(s), according to the national specification.

4.5 Other information elements

4.5.1 Coding rules

The coding of other information elements follows the coding rules described below. These rules are formulated to allow each equipment which processes a message to find information elements important to it, and yet remain ignorant of information elements not important to that equipment.

Two categories of information elements are defined:

(1) single octet information elements (see diagrams a) and b) of Figure 4-7);
(2) variable length information elements (see diagram c) of Figure 4-7).

Bit 8	7	6	5	4	3	2	1	Octet
1	Information element identifier			Contents of information element				1

a) Single octet information element format (type 1)

Bit 8	7	6	5	4	3	2	1	Octet
1	Information element identifier							1

b) Single octet information element format (type 2)

Bit 8	7	6	5	4	3	2	1	Octet
1	Information element identifier							1
Length of contents of information element (octets)								2
Contents of information element								3 etc.

c) Variable length information element format

Figure 4-7/B-IF2.02(Q.931)
Formats of information elements

For the information elements listed below, the coding of the information element identifier bits is summarized in Table 4-3.

Table 4-3/B-IF2.02(Q.931)
Information element identifier coding

Bit 8	7	6	5	4	3	2	1		Reference (subclause)	Maximum Length (octets) (Note 1)
1	:	:	:	-	-	-	-	Single octet informaiton elements:		(octet)
	0	0	0	-	-	-	-	Reserved		(note1)
	0	0	1	-	-	-	-	Shift (Note 2)	4.5.3/4.5.4	1
	0	1	0	0	0	0	0	More data		(non-standard)
	0	1	0	0	0	0	1	Sending complete		(non-standard)
	0	1	1	-	-	-	-	Congestion level		(non-standard)
	1	0	1	-	-	-	-	Repeat indicator	4.5.24	1
0	:	:	:	:	:	:	:	Variable length information element:		
	0	0	0	0	0	0	0	Segmented message	4.5.26	
	0	0	0	0	1	0	0	Bearer capability	4.5.5	5
	0	0	0	1	0	0	0	Cause (Note 2)	4.5.12	32
	0	0	1	0	0	0	0	Call identity		(non-standard)
	0	0	1	0	1	0	0	Call state	4.5.7	3
	0	0	1	1	0	0	0	Channel identification	4.5.13	(Note 4)
	0	0	1	1	1	1	0	Progress indicator (Note 2)	4.5.23	•
	0	1	0	0	0	0	0	Network-specific facilities		(non-standard)
	0	1	0	0	1	1	1	Notification indicator	4.5.22	3
	0	1	0	1	0	0	0	Display		(non-standard)
	0	1	0	1	0	0	1	Date/time		(non-standard)
	0	1	0	1	1	0	0	Keypad facility		(non-standard)
	0	1	1	0	1	0	0	Signal		(non-standard)
	1	0	0	0	0	0	0	Information rate		(non-standard)
	1	0	0	0	0	1	0	End-to-end transit delay		(non-standard)
	1	0	0	0	0	1	1	Transit delay selection and indication		(non-standard)
	1	0	0	0	1	0	0	Packet layer binary parameters		(non-standard)
	1	0	0	0	1	0	1	Packet layer window size		(non-standard)
	1	0	0	0	1	1	0	Packet size		(non-standard)
	1	0	0	0	1	1	1	Closed user group		(non-standard)
	1	0	0	1	0	1	0	Reverse charge indication		(non-standard)
	1	1	0	1	1	0	0	Calling party number	4.5.10	(Note 4)
	1	1	0	1	1	0	1	Calling party subaddress	4.5.11	23
	1	1	1	0	0	0	0	Called party number	4.5.8	(Note 4)
	1	1	1	0	0	0	1	Called party subaddress	4.5.9	23
	1	1	1	0	1	0	0	Redirecting number		(non-standard)
	1	1	1	1	0	0	0	Transit network selection		(non-standard)
	1	1	1	1	0	0	1	Restart indicator	4.5.25	3
	1	1	1	1	1	0	0	Low layer compatibility(Note2)	4.5.19	18
	1	1	1	1	1	0	1	High layer compatibility	4.5.17	5
	1	1	1	1	1	1	0	User-user		(non-standard)
	1	1	1	1	1	1	1	Escape for extension (Note 3)		
All other values are reserved (Note 5)										

Note 1: The length limits described for the variable length information elements take into account only the present CCITT standardized coding values. Future enhancements and expansions to this Recommendation will not be restricted to these limits.

Note 2: This information element may be repeated.

Note 3: 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 4-8.

Note 4: The maximum length is digital network dependent.

Note 5: The reserved values with bits 5-8 coded "0000" are for future information elements for which comprehension by the receiver is required (see 5.8.7.1).

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 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 elements.

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

The second octet of a variable length information element indicates the total length of the contents of that information element regardless of the coding of the first octet (i.e. the length starting with octet 3). It is the binary coding of the number of octets of the contents, with bit 1 as the least significant bit ($2^{\bullet}$).

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 variable length information elements (octets 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 some 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 continues through the next octet. The bit value "1" indicates that this octet is the last octet. If one octet (Nb) is present, also 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 equipments shall be prepared to receive such additional octets although the equipment need not be able to interpret or act upon the content of these octets.

d) In addition to the extension mechanism defined above, an octet (N) may be extended through the next octet(s) (N1, N2 etc.) by indications in bits 7-1 (of octet N).

e) The mechanisms in c) and d) may be combined. Mechanism c) shall take priority in the ordering,

such that all octets Na, Nb, etc. shall occur before octets N1, N2, etc. This rule shall apply even where the extension to octets N1, N2, etc. is indicated in one of octet Na, Nb, etc.

f) Similar conventions apply even when mechanism d) is being repeated, i.e. octets N.1 shall occur before octets N.1.1, N.1.2, etc.

g) Optional octets are marked with asterisks (*).

Note 1: It is not possible to use mechanism c) repeatedly, i.e. it is not possible to construct an octet 4a as this would become octet 4b.

Note 2: Protocol designers should exercise care in using multiple extension mechanisms to ensure that a unique interpretation of the resultant coding is possible.

Note 3: For a number of information elements there is a field that defines the coding standard. When the coding standard defines a national standard it is recommended that the national standard be structured similar to the information element defined in this Recommendation.

Bit 8	7	6	5	4	3	2	1	Octet
	Escape for extension							
0	1	1	1	1	1	1	1	1
Length of information element contents 2								2
1 ext.	Information element identifier							3
Contents of information element								4
								etc.

Figure 4-8/B-IF2.02(Q.931)
Information element format using escape for extension

4.5.2 Extensions of codesets

There is a certain number of possible information element identifier values using the formatting rules described in 4.5.1; 128 from the variable length information element format and at least 8 from the single octet information element format.

One value in the single octet format is specified for shift operations described below. 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 contents 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.

Codeset 4 is reserved for use by ISO/IEC standards.

Codeset 5 is reserved for information elements reserved for national use.

Codeset 6 is reserved for information elements specific to the local network (either public or private).

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.

An information element belonging to codesets 4, 5, 6, or 7, may appear together with information elements belonging to codeset 0 (being the active codeset) by using the non-locking shift procedure (see 4.5.4).

The public cell station or digital network shall have the capability to recognize a Shift information element and to determine the length of the following information element, although the equipment need not be able to interpret and act upon the content of the information element. This enables the equipment to determine the start of a subsequent information element.

Codeset 7 information element 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 digital network for a specific public cell station.

Codeset 6 is reserved for information elements specific to the local digital network (either public or private). As such they do not have significance across the boundaries between local digital 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 local network boundary, unless allowed by bilateral agreement.

Codeset 5 is reserved for information elements reserved for national use. 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 4 is reserved for information elements specified in ISO/IEC standards.

4.5.3 Locking shift procedure

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 which 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 which 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 and coding shown in Figure 4-9 and Table 4-4.

4.5.4 Non-locking shift procedure

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

Bit 8	7	6	5	4	3	2	1	Octet
1	0	Shift 0 identifier	1	0	New condeset Identification			1

↑
"0" in this position
indicates locking shift

Figure 4-9/B-IF2.02(Q.931)
Locking Shift information element

Table 4-4/B-IF2.02(Q.931)
Locking Shift information element

Codeset identification (bits 3 to 1):			
Bit			
3	2	1	
0	0	0	Not applicable
0	0	1	Reserved
	to,		
0	1	1	
1	0	0	Codeset 4: information elements for ISO/IEC use
1	0	1	Codeset 5: information elements for national use (note)
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

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

The non-locking Shift information element uses the single octet information element format and coding shown in Figure 4-10 and Table 4-5.

Bit 8	7	6	5	4	3	2	1	Octet
1	0	Shift 0 identifier	1	1	New condeset Identification			1

↑
"1" in this position
indicates non-locking shift

Figure 4-10/B-IF2.02(Q.931)
Non-locking Shift information element

Table 4-5/B-IF2.02(Q.931)
Non-locking Shift information element

Codeset identification (bits 3 to 1):			
Bit			
3	2	1	
0	0	0	Codeset 0 (initially active): Q.931 information elements
0	0	1	
to Reserved			
0	1	1	
1	0	0	Codeset 4: information elements for ISO/IEC use
1	0	1	Codeset 5: information elements for national use
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 Recommendation I.231 [6] bearer service to be provided by the digital network. It contains only information which may be used by the digital network (see Annex I).

The use of the Bearer capability information element in relation to compatibility checking is described in Annex B.

The Bearer capability information element is coded as shown in Figure 4-11 and Table 4-6.

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

The maximum length of this information element is 12 octets.

Bit 8	7	6	5	4	3	2	1	Octets
0	Bearer capability 0	0	0	0	1	0	0	1
	Information element identifier							
Length of the bearer capability contents								2
1 ext.	Coding standard		Information transfer capability					3
1 ext.	Transfer mode		Information transfer rate					4
1 ext.	Rate multiplier							4.1* (Note 1)
0/1 ext.	0 Layer 1	1 ident.	User information layer 1 protocol					5*
0/1 ext.	Synch./ asynch	Negot.	User rate					5a* (Note 2)
0/1 ext.	Intermediate rate		NIC on Tx	NIC on Rx	Flow control on Tx	Flow control on Rx	0 Spare	5b* (Note 3)
0/1 ext.	Hdr/ no Hdr	Multi frame	Mode	LLI negot.	Assignor/ee	In-band neg.	0 Spare	5b* (Note 4)
0/1 ext.	Number of stop bits		Number of data bits		Parity			5c* (Note 2)
1 ext.	Duplex mode	Modem type						5d* (Note 2)

Note 1: This octet is required if octet 4 indicates multirate (64 kbit/s base rate). Otherwise, it shall not be present.

Note 2: This octet may be present if octet 3 indicates unrestricted digital information and octet 5 indicates either of the ITU-T standardized rate adaptions V.110 and X.30 or V.120 [9]. It may also be present if octet 3 indicates 3.1 kHz audio and octet 5 indicates G.711.

Note 3: This octet is significant only if octet 5 indicates ITU-T standardized rate adaption (see Recommendation V.110 [7] and X.30 [8]

Note 4: This octet is significant only if octet 5 indicates ITU-T standardized rate adaption see Recommendation V.120 [9].

Figure 4-11/B-IF2.02(Q.931)
Bearer capability information element

Table 4-6/B-IF2.02(Q.931)
Bearer capability information element

Coding standard (octet 3)

Bit 7 6	
0 0	ITU-Tstandardized coding as described below
0 1	ISO/IEC standard (Note1)
1 0	National standard (Note1)
1 1	Standard defined for the network (either public or private) present on the network side of the interface(Note)

Note 1: These other coding standards should be used only when the desired bearer capability cannot be represented with theITU-T-standardized coding.

Information transfer capability (octet 3)

Bit 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
1 1 0 0 0	Video

All other values are reserved.

Transfer mode (octet 4)

Bit 7 6	
0 0	Circuit mode
1 0	Packet mode (note)

All other values are reserved.
(note) The use of this code is a subject in future.

Information transfer rate (octets 4)

Bit 5 4 3 2 1	Circuit mode	
0 0 0 0 0	-	This code shall be used for packet mode calls(note3)
1 0 0 0 0	64 kbit/s	-
1 0 0 0 1	2 × 64 kbit/s	-
1 0 0 1 1	384 kbit/s	-
1 0 1 0 1	1536 kbit/s	-
1 0 1 1 1	1920 kbit/s	-
1 1 0 0 0	Multirate (64 kbit/s base rate)	

All other values are reserved.

Note 1: When the information transfer rate 2 × 64 kbit/s is used, the coding of octets 3 and 4 refer to both 64 kbit/s channels.
Note 2: Additional attributes are defined in Table 4-7.
Note 3: The use of this code is a subject in future.

Rate mutiplier (octet 4.1)

Note 4: 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.

User information layer 1 protocol (octet 5)

Bit 5 4 3 2 1	
0 0 0 0 1	ITU-T standardized rate adaption 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	Recommendation G.771 u-law
0 0 0 1 1	Recommendation G.711 A-law
0 0 1 0 0	Recommendation G.721 [11] 32 kbit/s ADPCM and Recommendation I.460.
0 0 1 0 1	Recommendations H.221 and H.242
0 0 1 1 1	Non-ITU-T standardized rate adaption. This implies the presence of octet 5a and, optionally, octets 5b, 5c and 5d. The use of this code point 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 adaption.
0 1 0 0 0	ITU-T standardized rate adaption V.120 [9]. This implies the presence of octets 5a and 5b as defined below, and optionally octets 5c and 5d.
0 1 0 0 1	ITU-T standardized rate adaption X.31 [14] HDLC flag stuffing.

All other values are reserved.

Note : 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 to be identified only to the addressed entity octet 5 shall be omitted. Packet mode is for farther study. Otherwise, octet 5 shall be present.

Synchronous/Asynchronous (octet 5a)

Bit 7	
0	Synchronous data
1	Asynchronous data

Note 1: Octets 5b - 5d may be omitted in the case of synchronous user rates.

Negotiation (octet 5a)

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

Note 2: See Recommendations V.110 [7] and X.30 [8] or modem type recommendation

Table 4-6/B-IF2.02(Q.931) (cont.)
Bearer capability information element

User rate (octet 5a)

Bit 5 4 3 2 1	
0 0 0 0 0	Rate is indicated by E-bits specified in Recommendation I.460 [15] or may be negotiated in-band
0 0 0 0 1	0.6 kbit/s Recommendations V.6 [16] and X.1 [17]
0 0 0 1 0	1.2 kbit/s Recommendation V.6
0 0 0 1 1	2.4 kbit/s Recommendations V.6 and X.1
0 0 1 0 0	3.6 kbit/s Recommendation V.6
0 0 1 0 1	4.8 kbit/s Recommendations V.6 and X.1
0 0 1 1 0	7.2 kbit/s Recommendation V.6
0 0 1 1 1	8 kbit/s Recommendation I.460
0 1 0 0 0	9.6 kbit/s Recommendations V.6 and X.1
0 1 0 0 1	14.4 kbit/s Recommendation V.6
0 1 0 1 0	16 kbit/s Recommendation I.460
0 1 0 1 1	19.2 kbit/s Recommendation V.6
0 1 1 0 0	32 kbit/s Recommendation I.460
0 1 1 1 0	48 kbit/s Recommendations V.6 and X.1
0 1 1 1 1	56 kbit/s Recommendation V.6
1 0 1 0 1	0.1345 kbit/s Recommendation X.1
1 0 1 1 0	0.100 kbit/s Recommendation X.1
1 0 1 1 1	0.075/1.2 kbit/s Recommendations V.6 and X.1 (Note 3)
1 1 0 0 0	1.2/0.075 kbit/s Recommendations V.6 and X.1 (Note 3)
1 1 0 0 1	0.050 kbit/s Recommendations V.6 and X.1
1 1 0 1 0	0.075 kbit/s Recommendations V.6 and X.1
1 1 0 1 1	0.110 kbit/s Recommendations V.6 and X.1
1 1 1 0 0	0.150 kbit/s Recommendations V.6 and X.1
1 1 1 0 1	0.200 kbit/s Recommendations V.6 and X.1
1 1 1 1 0	0.300 kbit/s Recommendations V.6 and X.1
1 1 1 1 1	12 kbit/s Recommendation V.6

All other values are reserved.

Note 3: 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 V.110 and X.30 rate adaption

Intermediate rate (octet 5b)

Bit 7 6	
0 0	Not used
0 1	8 kbit/s
1 0	16 kbit/s
1 1	32 kbit/s

Table 4-6/B-IF2.02(Q.931) (cont.)
Bearer capability information element

Network independent clock (NIC) on transmission (Tx) (octet 5b) (Note 1)

Bit
5
0 Not required to send data with network independent clock
1 Required to send data with network independent clock

Note 1: Refers to transmission in the forward direction of the call.
Note 2: See Recommendations V.110 [7] and X.30.

Network independent clock (NIC) on reception (Rx) (octet 5b) (Note 3)

Bit
4
0 Cannot accept data with network independent clock (i.e. sender does not support this optional procedure)
1 Can accept data with network independent clock (i.e. sender does support this optional procedure)

Note 3: Refers to transmission in the backward direction of the call.
Note 4: See Recommendations V.110 [7] and X.30 [8].

Flow control on transmission (Tx) (octet 5b) (Note 5)

Bit
3
0 Not required to send data with flow control mechanism
1 Required to send data with flow control mechanism

Note 5: Refers to transmission in the forward direction of the call.
Note 6: See Recommendations V.110 and X.30.

Flow control on reception (Rx) (octet 5b) (Note 7)

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 7: Refers to transmission in the backward direction of the call
Note 8: See Recommendations V.110 and X.30.

Octet 5b for V.120 [9] rate adaption
Rate adaption header/no header (octet 5b)

Bit
7
0 Rate adaption header not included
1 Rate adaption header included

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

Bit
6
0 Multiple frame establishment not supported. Only UI frames allowed
1 Multiple frame establishment supported

Table 4-6/B-IF2.02(Q.931) (concl.)
Bearer capability information element

Mode of operation (octet 5b)

Bit 5	
0	Bit transparent mode of operation
1	Protocol sensitive mode of operation

Logical link identifier negotiation (octet 5b)

Bit 4	
0	Default, LLI = 256 only
1	Full protocol negotiation (Note)

Note : A connection over which protocol negotiation will be executed 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-band negotiation (octet 5b)

Bit 2	
0	Negotiation is done with USER INFORMATION messages on a temporary signalling connection
1	Negotiation is done in-band using logical link zero

Note : USER INFORMATION messages is not the object of this standard.

Number of stop bits (octet 5c)

Bit 7 6	
0 0	Not used
0 1	1 bit
1 0	1.5 bits
1 1	2 bits

Number of data bits excluding parity Bit if present (octet 5c)

Bit 5 4	
0 0	Not used
0 1	5 bits
1 0	7 bits
1 1	8 bits

Parity information (Octet 5c)

Bit 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.

Table 4-6/B-IF2.02(Q.931) (concl.)
Bearer capability information element

Mode duplex (octet 5d)

Bit 7	
0	Half duplex
1	Full duplex

Modem type (octet 5d)

Bit 6 5 4 3 2 1	
0 0 0 0 0 0	
through	national use
0 0 0 1 0 1	
0 1 0 0 0 1	Recommendation V.21 [55]
0 1 0 0 1 0	Recommendation V.22 [56]
0 1 0 0 1 1	Recommendation V.22 bis [57]
0 1 0 1 0 0	Recommendation V.23 [58]
0 1 0 1 0 1	Recommendation V.26 [59]
0 1 0 1 1 0	Recommendation V.26 bis [60]
0 1 0 1 1 1	Recommendation V.26 ter [61]
0 1 1 0 0 0	RecommendationV.27 [62]
0 1 1 0 0 1	Recommendation V.27 bis [63]
0 1 1 0 1 0	Recommendation V.27 ter [64]
0 1 1 0 1 1	Recommendation V.29 [65]
0 1 1 1 0 1	Recommendation V.32 [66]
1 0 0 0 0 0	
through	national use
1 0 1 1 1 1	
1 1 0 0 0 0	
through	user specified
1 1 1 1 1 1	

All other values reserved.

Table 4-7/B-IF2.02(Q.931)
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 symmetric
Circuit	Unrestricted data	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Restricted data	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	3,1 kHz audio	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Unrestricted data with tones/-announcements	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Video	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Note :1 When the information transfer rate 2 × 64 kbit/s is used, 8 kHz integrity with Restricted Differential Time Delay (RDTD) is offered. Note :2 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 identity*

4.5.7 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 2.4).

The Call state information element is coded as shown in Figure 4-13 and Table 4-8.

The length of this information element is three octets.

Bit 8	7	6	5	4	3	2	1	Octets
0	Call state 0	0	1	0	1	0	0 Information element identifier	1
Length of call state contents								2
Coding standard	Call state value / global interface state value (state value is coded in binary)							3

Figure 4-13/B-IF2.02(Q.931)
Call state information element

Table 4-8/B-IF2.02(Q.931)
Call state information element

Coding standard (octet 3)

Bit 8 7	
0 0	ITU-Tstandardized coding, as described below
0 1	ISO/IEC standard (Note)
1 0	National standard (Note)
1 1	Standard defined for the network (either public or private) present on the network side of the interface (Note)

Note : These other coding standards should only be used only when the desired call states cannot be represented by ITU-T-standardized coding.

Call state value (octet 3)

Bit 6 5 4 3 2 1	Public cell station State State	ISDN state
0 0 0 0 0 0	C 0 - Null	N 0 - Null
0 0 0 0 0 1	C 1 - Call initiated	N 1 - Call initiated
0 0 0 0 1 1	C 3 - Outgoing call proceeding	N 3 - Outgoing call proceeding
0 0 0 1 0 0	C 4 - Call delivered	N 4 - Call delivered
0 0 0 1 1 0	C 6 - Call present	N 6 - Call present
0 0 0 1 1 1	C 7 - Call received	N 7 - Call received
0 0 1 0 0 0	C 8 - Connect request	N 8 - Connect request
0 0 1 0 0 1	C 9 - Incoming call proceeding	N 9 - Incoming call proceeding
0 0 1 0 1 0	C10 - Active	N10 - Active
0 0 1 0 1 1	C11 - Disconnect request	N11 - Disconnect request
0 0 1 1 0 0	C12 - Disconnect indication	N12 - Disconnect indication
0 1 0 0 1 1	C19 - Release request	N19 - Release request
0 1 0 1 1 0	- - - - - -	N22 - Call abort

Global interface state value (octet 3)

Bit 6 5 4 3 2 1	State
0 0 0 0 0 0	REST0 - Null
1 1 1 1 0 1	REST1 - Restart request
1 1 1 1 1 0	REST2 - Restart

All other values are reserved.

4.5.8 Called party number

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

The Called party number information element is coded as shown in Figure 4-14 and Table 4-9.

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

Bit 8	7	6	5	4	3	2	1	Octets
0	Called party number- Information element identifier							1
Length of called party number contents								2
1 Ext.	Type of number			Numbering plan identification				3
0	Number digits (IA5 characters) (Note)							4 etc.

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

Figure 4-14/B-IF2.02(Q.931)
Called party number information element

Table 4-9/B-IF2.02(Q.931)
Called party number information element

Type of number (octet 3) (Note 1)

Bit 7 6 5	
0 0 1	International number (Note 2)
0 1 0	National number (Note 2)
0 1 1	Network specific number (Note 3)
1 1 1	Reserved for extension

All other values are reserved.

Note 1: For the definition of international, national and subscriber number, see Recommendation I.330 [18].
Note 2: Prefix or escape digits shall not be included.
Note 3: The type of number "network specific number" is used to indicate administration/service number specific to the serving network, e.g. used to access an operator.

Numbering plan identification (octet 3)

4 3 2 1	
0 0 0 1	ISDN/telephony numbering plan (Recommendation E.164 [19])
1 0 0 0	National standard numbering plan
1 0 0 1	Private numbering plan
1 1 1 1	Reserved for extension

All other values are reserved.

Number digits (octets 4, etc.)

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

4.5.9 Called party subaddress

The purpose of the Called party subaddress information element is to identify the subaddress of the called party of the call.

The Called party subaddress information element is coded as shown in Figure 4-15 and Table 4-10.

For the definition of subaddress see ITU-T Recommendation I.330 [18].

The maximum length of this information element is 23 octets.

Bit 8	7	6	5	4	3	2	1	Octets
	Called party subaddress							
0	1	1	1	0	0	0	1	1
	Information element identifier							
Length of called party subaddress contents								2
1 ext.	Type of subaddress			Odd/even indicator	0	0	0	3
					Spare			
Subaddress information								4

Figure 4-15/B-IF2.02(Q.931)
Called party subaddress information element

Table 4-10/B-IF2.02(Q.931)
Called party subaddress information element

Type of subaddress (octet 3)

Bit 7 6 5	
0 0 0	NSAP (X.213 [23]/ISO 8348 AD2 [24])
0 1 0	User specified subaddress

All other values are reserved.

Odd/even indicator (octet 3)

4	
0	Even number of address signals
1	Odd number of address signals

Note 1: The odd/even indicator is used when the type of subaddress is "user specified" and the coding is BCD.

Subaddress information (octets 4, etc.)

The NSAP X.213/ISO8348AD2 address, shall be formatted as specified by octet 4 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in ITU-T Rec. X.213/ISO 8348 AD2 except when used for Terminal selection at the S interface (see Note 3). For the definition of this type of subaddress, see Recommendation I.334 [25].
For user specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with X.25 [5] networks BCD coding should be applied.

4.5.10 Calling party number

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

The Calling party number information element is coded as shown in Figure 4-16, and Table 4-11.

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

Bit 8	7	6	5	4	3	2	1	Octets
0	Calling party number 1	1	0	1	1	0	0	1
	Information element identifier							
Length of calling party number contents								2
0/1 ext.	Type of number			Numbering plan identification				3
1 ext.	Presentation Indicataor		0	0	0	Screening indicator		3a*
			Spare					
0	Number digits (IA5 characters)							4*

Figure 4-16/B-IF2.02(Q.931)
Calling party number information element

Table 4-11/B-IF2.02(Q.931)
Calling party number information element

Type of number (octet 3) (Note 1)

Bit 7 6 5	
0 0 1	International number (Note 2)
0 1 0	National number (Note 2)
0 1 1	Network specific number (Note 3)
1 1 1	Reserved for extension

All other values are reserved.

Note 1: For the definition of international, national and subscriber number, (see Recommendation I.330 [18]).
Note 2: Prefix or escape digits shall not be included.
Note 3: The type of number "network specific number" is used to indicate administration/service number specific to the serving network, e.g. used to access an operator.

Numbering plan identification (octet 3)
Numbering plan (applies for type of number = 000, 001, 010 and 100)

Bit 4 3 2 1	
0 0 0 1	ISDN/telephony numbering plan (Recommendation E.164 [19])
1 0 0 0	National standard numbering plan
1 0 0 1	Private numbering plan
1 1 1 1	Reserved for extension

All other values are reserved.

Table 4-11/B-IF2.02(Q.931) (concluded)
Calling party number information element

Presentation indicator (octet 3a)

Bit 7	Bit 6	Meaning
0	0	Presentation allowed
0	1	Presentation restricted
1	0	Number not available due to interworking
1	1	Reserved

Note 1: The meaning and the use of this field is defined in 3/Q.951 and 4/Q.951.

Screening indicator (octet 3a)

Bit 2	Bit 1	Meaning
0	0	User-provided, not screened
0	1	User-provided, verified and passed
1	0	User-provided, verified and failed
1	1	Network provided

Number digits (octets 4, etc.)

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

4.5.11 Calling party subaddress

The purpose of the Calling party subaddress information element is to identify a subaddress associated with the origin of a call.

The Calling party subaddress information element is coded as shown in Figure 4-17 and Table 4-12.

For the definition of subaddress, see Recommendation I.330 [21].

The maximum length of this information element is 23 octets.

Bit 8	7	6	5	4	3	2	1	Octets
	Calling party subaddress							
0	1	1	0	1	1	0	1	1
	Information element identifier							
Length of calling party subaddress contents								2
1 ext.	Type of subaddress			Odd/even indicator	0	0	0	3
					Spare			
Subaddress information								4

Figure 4-17/B-IF2.02(Q.931)
Calling party subaddress information element

Table 4-12/B-IF2.02(Q.931)
Calling party subaddress information element

Type of subaddress (octet 3)

Bit

7 6 5	
0 0 0	NSAP(ITU-T Rec. X.213 [23]/ISO 8348 AD2 [24])
0 1 0	User specified subaddress

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 1: 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 ITU-T Rec. X.213/ISO 8348 AD2 address, shall be formatted as specified by octet 4 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in CCITT Rec. X.213/ISO 8348 AD2 except when used for Terminal selection at the S interface. For the definition of this type of subaddress, see Recommendation I.334 [25].
For user specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with X.25 [5] networks BCD coding should be applied.

4.5.12 Cause

The content and use of the Cause information element is defined in Recommendation Q.850 [67].

4.5.13 Channel identification

The purpose of the Channel identification information element is to identify a channel within the interface(s) controlled by these signalling procedures.

The Channel identification information element is coded as shown in Figures 4-18 and 4-19 and Table 4-13. The channel identification element may be repeated in a message, e.g. to list several acceptable channels during channel negotiation.

The channel identification element may be repeated in a message, e.g. to list several acceptable channels during channel negotiation.The default maximum length for this information element is network dependent.

Bit• 8	7	6	5	4	3	2	1	Octets
Channel identification								
0	0	0	1	1	0	0	0	1
Information element identifier								
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) (Note 5)
Channel number/Slot map (Note 3)								3.3* (Note 2) (Note 4) (Note 5)

Note 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).
Note 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.
Note 3: When channel number is used and a single channel is indicated 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 and coded according to the rules specified in 4.5.1.
Note 4: When channel number is used, this octet may be repeated to indicate multiple channels.
Note 5: These octets shall be omitted when the entire interface is to be identified.

Figure 4-18/B-IF2.02(Q.931)
Channel identification information element

Table 4-13/ B-IF2.02(Q.931)
Channel identification information element

Interface identifier present (octet 3)

Bit
7
0 Interface implicitly identified (Note 1)
1 Interface explicitly identified in one or more octets, beginning with octet 3.1.

Note 1: The interface which 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 (Note 2)

Note 2: 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 3: 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 4: D-channel indication has significance in D-channel use. No other information affects D-channel use.

Information channel selection (octet 3) (Note 5)

Bit 2 1	Basic interface	Other interfaces
0 0	No channel	No channel
0 1	B1 channel	As indicated in following octets
1 0	B2 channel	Reserved
1 1	Any channel (Note 6)	Any channel

Note 5: The information channel selection does not apply to the D-channel.
Note 6: This value shall be used on a basic access when both B-channels are to be identified, e.g. multirate (64 kbit/s base rate). This shall not be used for restart procedures.

Table 4-13/ B-IF2.02(Q.931)(concluded)
Channel identification information element

Interface identifier (octet 3.1)

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

Coding standard (octet 3.2)

Bit 7 6	
0 0	CCITT standardized coding, as described below
0 1	ISO/IEC standard (Note 1)
1 0	National standard (Note 1)
1 1	Standard defined for the network (either public or private) present on the network side of the interface (Note 1)

Note 1: These other coding standards should only be used when the desired call states cannot be represented by CCITT-standardized coding.

Number/map (octet 3.2)

Bit 5	
0	Channel is indicated by the number in the following octet.
1	Channel is indicated by the slot map (Map) in the following octet(s).

Note 2: When the information transfer rate is 64 kbit/s the channel number shall be used unless there exists a bilateral agreement between the user and the network to use the slot map.
Note 3: 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)

Bit 4 3 2 1	
0 0 1 1	B-channel units(Note 4)
0 1 1 0	H0-channel units
1 0 0 0	H11-channel units
1 0 0 1	H12-channel units

All other values are reserved.

Note 4: 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 Recommendation I.431 [27].
Note 1: 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 set to 1, see Figure 4-19. The remaining bits are set to 0.

Note 2: The length of the slot-map (in bits) is defined by the capacity of the interface type (e.g. 1534 kbit/s or 2048 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.

Bit

8	7	6	5	4	3	2	1	Octets
24	23	22	21	20	19	18	17	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

1544 kbit/s

Bit

8	7	6	5	4	3	2	1	Octets
31	30	29	28	27	26	25	24	3.3.1
23	22	21	20	19	18	17	16	3.3.2
15	14	13	12	11	10	9	8	3.3.3
7	6	5	4	3	2	1	0	3.3.4

2048 kbit/s

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

Bit

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

1544 kbit/s

Bit

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

2048 kbit/s

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

Note 1: See Recommendation I.431 [27], Annex A, concerning meaning of a-e.

Note 2: Number within ( ) indicates the associated H0-channel number used when corresponding H0-channel is represented by channel number in octet 3.3.

Bit

8	7	6	5	4	3	2	1	Octets
							H11(1)	3.3

1544 kbit/s

Bit

8	7	6	5	4	3	2	1	Octets
							H12(1)	3.3

2048 kbit/s

c) Primary rate interface, map element type = H1-channel

Note 3: Number within ( ) indicates the associated H1-channel number used when corresponding H1-channel is represented by channel number in octet 3.3.

Note 4: For 2048 kbit/s interface, H11 slot will be indicated by the same format.

Figure 4-19/ B-IF2.02(Q.931)
Slot map field

4.5.14 Corgestion level*

4.5.15 Date/time*

4.5.16 Display*

4.5.17 High layer compatibility

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

The High layer compatibility information element is coded as shown in Figure 4-23 and Table 4-15.

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.

The maximum length of this information element is five octets.

Note : 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 which provides some capabilities to realize teleservices may interpret this information to provide a particular service.

Bit• 8	7	6	5	4	3	2	1	Octets
0	High layer compatibility Information element identifier 1	1	1	1	1	0	1	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 4-23/B-IF2.02(Q.931)
High layer compatibility information element

Table 4-15/B-IF2.02(Q.931)
High layer compatibility information element

Coding standard (octet 3)

Bit 7 6	
0 0	CCITT standardized coding, as described below
0 1	ISO/IEC standard (Note 1)
1 0	National standard (Note 1)
1 1	Standard defined for the network (either public or private) present on the network side of the interface (Note 1)

Note 1: These other coding standards should only be used only when the desired high layer compatibility cannot be represented by CCITT standardized coding.

Interpretation (octet 3)

Bit 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.

Note 2: "Interpretation" indicates how the "High layer characteristics identification" (in octet 4) should be interpreted.

Note 3: 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)

Bit 2 1	
0 1	High layer protocol profile (without specification of attributes)

All other values are reserved.

Note 4: Currently, "Presentation method of protocol profile" has only a single value, i.e. a "profile value" 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.

High layer characteristics identification (octet 4)

Bit 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 (Recommendation F.182 [68])
0 1 0 0 0 0 1	Facsimile Group 4 Class I (Recommendation F.184 [69])
0 1 0 0 1 0 0	Teletex service, basic and mixed mode of operation (Recommendation F.230 [70]) and facsimile service Group 4, Classes II and III (Recommendation F.184)
0 1 0 1 0 0 0	Teletex service, basic and processable mode of operation (Recommendation F.220 [71])
0 1 1 0 0 0 1	Teletex service, basic mode of operation (Recommendation F.200 [72])
0 1 1 0 0 1 0	Syntax based Videotex (Recommendations F.300 [73] and T.102 [74])
0 1 1 0 0 1 1	International Videotex interworking via gateways or interworking units (Recommendations F.300 and T.101 [75])
0 1 1 0 1 0 1	Telex service (Recommendation F.60 [76])
0 1 1 1 0 0 0	Message Handling Systems (MHS) (X.400 - Series Recommendations [77])
1 0 0 0 0 0 1	OSI application (Note 2) (X.200 - Series Recommendations [78])
1 0 1 1 1 1 0	Reserved for maintenance (Note 4)
1 0 1 1 1 1 1	Reserved for management (Note 4)
1 1 0 0 0 0 0	Audio visual (Recommendation F.721 [79])
1 1 0 0 0 0 1 through 1 1 0 1 1 1 1	Reserved for audiovisual services (F.700 - Recommandations Series [80])
1 1 1 1 1 1 1	Reserved

Table 4-15/B-IF2.02(Q.931) (continued)
High layer compatibility information element

All other values are reserved.

Note 1: The coding above applies in case of "Coding standard" = "CCITT standard" and "Presentation method of protocol profile" = "High layer protocol profile".
Note 2: Further compatibility checking will be executed by the OSI high layer protocol.
Note 3: Code points are added only to those services for which CCITT Recommendations are available. See also Recommendation I.241 [34].
Note 4: When this coding is included, octet 4 may be followed by octet 4a.

Extended high layer characteristics identification (octet 4a)

Bit 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 (Recommendation F.182)
0 1 0 0 0 0 1	Facsimile Group 4 Class I (Recommendation F.184)
0 1 0 0 1 0 0	Teletex service, basic and mixed mode of operation (Recommendation F.230) and facsimile service Group 4, Classes II and III (Recommendation F.184)
0 1 0 1 0 0 0	Teletex service, basic and processable mode of operation (Recommendation F.220)
0 1 1 0 0 0 1	Teletex service, basic mode of operation (Recommendation F.200)
0 1 1 0 0 1 0	Syntax based Videotex (Recommendations F.300 and T.102)
0 1 1 0 0 1 1	International Videotex interworking via gateways or interworking units (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 Systems (MHS) (X.400 - Series Recommendations)
1 0 0 0 0 0 1	OSI application (Note 2) (X.200 - Series Recommendations)
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	Audio visual (Recommendation F.721)
1 1 0 0 0 0 1 through 1 1 0 1 1 1 1	Reserved for audiovisual services (F.700 - Series Recommendations)
1 1 1 1 1 1 1	Reserved

All other values are reserved.

Note : It should that high layer regurlated by every country might be used besides these case.

4.5.18 Keypad facility*

4.5.19 Low layer compatibility

The purpose of the Low layer compatibility information element is to provide a means which should be used for capability 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 I.

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

The Low layer compatibility information element is coded as shown in Figure 4-25 and Table 4-16. The maximum length of this information element is 18 octets.

Bit 8	7	6	5	4	3	2	1	Octets
0	Low layer compatibility 1	1	1	1	1	0	0	1
	Information element identifier							
Length of the low layer compatibility 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
1 ext.	Rate multiplier							4.1* (Note 1)
0/1 ext.	0	1	User information layer 1 protocol					5*
	Layer 1 ident.							
0/1 ext.	Synch./ asynch.	Negot.	User rate					5a* (Note 2)
0/1 ext.	Intermediate rate		NIC on Tx	NIC on Rx	Flow control	Flow control	0 Spare	5b* (Note 3)
0/1 ext.	Hdr/no Hdr	Multiframe	Mode	Negot. LLI	Assignor/ Assignoree	In-band negot	0 Spare	5b* (Note 4)
0/1 ext.	Number of stop bits		Number of data bits		Parity			5c* (Note 2)
1 ext.	Duplex mode	Modem type						5d* (Note 2)
0/1 ext.	1	0	User information layer 2 protocol					6*
	layer 2 ident.							
0/1 ext	Mode		0	0	0	Q.933 use		6a* (Note 5)
			Spare					
1 ext.	User specified layer 2 protocol information							6a* (Note 6)
1 ext.	Window size (k)							6b* (Note 5)
0/1 ext	1	1	User information layer 3 protocol					7*
	layer 3 ident.							
0/1 ext.	Mode		0	0	0	0	0	7a* (Note 7)
			Spare					
1 ext.	Optional layer 3 protocol information							7a* (Note 8)
0/1 ext.	0	0	0	Default packet size				7b* (Note 7)
	Spare							
1 ext.	Packet window size							7c* (Note 7)

Figure 4-25/B-IF2.02(Q.931)
Low layer compatibility information element

Note 1: This octet is required if octet 4 indicates multirate (64 kbit/s base rate). Otherwise, it shall not be present.

Note 2: This octet may be present if octet 3 indicates unrestricted digital information and octet 5 indicates either of the CCITT standardized rate adaptions V.110 and X.30 or V.120 [9]. It may also be present if octet 3 indicates 3.1 kHz audio and octet 5 indicates G.711.

Note 3: This octet is significant only if octet 5 indicates CCITT standardized rate adaption (V.110 [7] and X.30 [8]).

Note 4: This octet is significant only if octet 5 indicates CCITT standardized rate adaption V.120 [9].

Note 5: This octet may be present only if octet 6 indicates certain acknowledged mode HDLC elements of procedure as indicated in Table 4-16.

Note 6: This octet may be present only if octet 6 indicates user specified layer 2 protocol.

Note 7: This octet may be present only if octet 7 indicates a layer 3 protocol based on CCITT X.25 | ISO/IEC 8208 or CCITT Rec. X.223 | ISO 8878 as indicated in Table 4-16.

Note 8: This octet may be present only if octet 7 indicates user specified layer 3 protocol.

Table 4-16/B-IF2.02(Q.931)
Low layer compatibility information element

Coding standard (octet 3)

bits 7 6	
0 0	CCITT standardized coding, as described below
0 1	ISO/IEC standard (Note 1)
1 0	National standard (Note 1)
1 1	Standard defined for the network (either public or private) present on the network side of the interface (Note 1)

Note 1: These other coding standards should only be used only when the desired low layer compatibility cannot be represented by CCITT-standardized coding.

Information transfer capability (octet 3)

Bit 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
1 1 0 0 0	Video

All other values are reserved.

Negotiation indicator (octet 3a)

Bit 7	
0	Out-band negotiation not possible
1	Out-band negotiation possible

Note 2: When octet 3a is omitted, "out-band negotiation not possible" shall be assumed.

Transfer mode (octet 4)

Bit 7 6	
0 0	Circuit mode
1 0	Packet-mode

All other values are reserved.

Information transfer rate (octet 4)

Bit 5 4 3 2 1	Circuit mode	Packet-mode
0 0 0 0 0	-	This code shall be used for all packet calls
1 0 0 0 0	64 kbit/s	-
1 0 0 0 1	2 × 64 kbit/s	-
1 0 0 1 1	384 kbit/s	-
1 0 1 0 1	1536 kbit/s	-
1 0 1 1 1	1920 kbit/s	-
1 1 0 0 0	Multirate (64 kbit/s base rate)	

All other values are reserved.

Note 1: When the information transfer rate 2 × 64 kbit/s is used the coding of octets 3 and 4 refer to both 64 kbit/s channels.
Note 2: Additional attributes are defined in Table 4-17.

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.

Table 4-16/B-IF2.02(Q.931) (continued)
Low layer compatibility information element

User information layer 1 protocol (octet 5)

Bit 5 4 3 2 1	
0 0 0 0 1	CCITT standardized rate adaption V.110 [7] and X.30 [8]. This implies the presence of octet 5a and optionally octets 5b, 5c and 5d as defined below.
0 0 0 1 0	Recommendation G.711 [10] m-law.
0 0 0 1 1	Recommendation G.711 A-law.
0 0 1 0 0	Recommendation G.721 [11] 32 kbit/s ADPCM and Recommendation I.460 [15].
0 0 1 0 1	Recommendations H.221 and H.242.
0 0 1 1 1	Non-CCITT standardized rate adaption. This implies the presence of octet 5a and, optionally, octets 5b, 5c and 5d. The use of this code point 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 adaption.
0 1 0 0 0	CCITT standardized rate adaption V.120 [9]. This implies the presence of octets 5a and 5b as defined below, and optionally octets 5c and 5d.
0 1 0 0 1	CCITT standardized rate adaption X.31 [14] HDLC flag stuffing.

All other values are reserved.

Note 3: If the transfer mode is "circuit mode" and if the information transfer capability is "unrestricted digital information" or "Restricted digital information", and if a specific user information layer 1 protocol is to be identified to the addressed entity octet 5 shall be present. If the transfer mode is packet mode, octet 5 may be omitted.

Synchronous/Asynchronous (octet 5a)

Bit 7	
0	Synchronous data
1	Asynchronous data

Note 1: Octets 5b-5d may be omitted in the case of synchronous user rates.

Negotiation (octet 5a)

Bit 6	
0	In-band negotiation not possible
1	In-band negotiation possible

Note 2: See Recommendations V.110 [7] and X.30 [8] or modem type recommendations.

User rate (octet 5a)

Bit 5 4 3 2 1	
0 0 0 0 0	Rate is indicated by E-bits specified in Recommendation I.460 or may be negotiated in-band
0 0 0 0 1	0.6 kbit/s Recommendations V.6 [16] and X.1 [17]
0 0 0 1 0	1.2 kbit/s Recommendation V.6
0 0 0 1 1	2.4 kbit/s Recommendations V.6 and X.1
0 0 1 0 0	3.6 kbit/s Recommendation V.6
0 0 1 0 1	4.8 kbit/s Recommendations V.6 and X.1
0 0 1 1 0	7.2 kbit/s Recommendation V.6
0 0 1 1 1	8 kbit/s Recommendation I.460
0 1 0 0 0	9.6 kbit/s Recommendations V.6 and X.1
0 1 0 0 1	14.4 kbit/s Recommendation V.6
0 1 0 1 0	16 kbit/s Recommendation I.460
0 1 0 1 1	19.2 kbit/s Recommendation V.6
0 1 1 0 0	32 kbit/s Recommendation I.460
0 1 1 1 0	48 kbit/s Recommendations V.6 and X.1

Table 4-16/ B-IF2.02(Q.931) (continued)
Low layer compatibility information element

0 1 1 1 1	56 kbit/s Recommendation V.6
1 0 0 0 0	64 kbit/s Recommendation X.1
1 0 1 0 1	0.1345 kbit/s Recommendation X.1
1 0 1 1 0	0.100 kbit/s Recommendation X.1
1 0 1 1 1	0.075/1.2 kbit/s Recommendations V.6 and X.1 (Note 3)
1 1 0 0 0	1.2/0.075 kbit/s Recommendations V.6 and X.1 (Note 3)
1 1 0 0 1	0.050 kbit/s Recommendations V.6 and X.1
1 1 0 1 0	0.075 kbit/s Recommendations V.6 and X.1
1 1 0 1 1	0.110 kbit/s Recommendations V.6 and X.1
1 1 1 0 0	0.150 kbit/s Recommendations V.6 and X.1
1 1 1 0 1	0.200 kbit/s Recommendations V.6 and X.1
1 1 1 1 0	0.300 kbit/s Recommendations V.6 and X.1
1 1 1 1 1	12 kbit/s Recommendation V.6

All other values are reserved.

Note 3: 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 V.110 [7] and X.30 [8] rate adaption

Intermediate rate (octet 5b)

Bit 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) (Note 1)

Bit 5	
0	Not required to send data with network independent clock
1	Required to send data with network independent clock

Note 1: Refers to transmission in the forward direction of the call.
Note 2: See Recommendations V.110 and X.30.

Network independent clock (NIC) on reception (Rx) (octet 5b) (Note 3)

Bit 4	
0	Cannot accept data with Network Independent Clock (i.e. sender does not support this optional procedure)
1	Can accept data with Network Independent Clock (i.e. sender does support this optional procedure)

Note 3: Refers to transmission in the backward direction of the call.
Note 4: See Recommendations V.110 [7] and X.30 [8].

Table 4-16/ B-IF2.02(Q.931) (continued)
Low layer compatibility information element

Flow control on transmission (Tx) (octet 5b) (Note 5)

Bit
3
0 Not required to send data with flow control mechanism
1 Required to send data with flow control mechanism

Note 5: Refers to transmission in the forward direction of the call.
Note 6: See Recommendations V.110 and X.30.

Flow control on reception (Rx) (octet 5b) (Note 7)

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 7: Refers to transmission in the backward direction of the call.
Note 8: See Recommendations V.110 and X.30.

Octet 5b for V.120 [9] Rate adaption

Rate adaption header/no header (octet 5b)

Bit
7
0 Rate adaption header not included
1 Rate adaption header included

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

Bit
6
0 Multiple frame establishment not supported. Only UI frames 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 negotiation (octet 5b)

Bit
4
0 Default, LLI = 256 only
1 Full protocol negotiation (Note)

Note : A connection over which protocol negotiation will be executed 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"

Table 4-16/ B-IF2.02(Q.931) (continued)
Low layer compatibility information element

In-band/out-band negotiation (octet 5b)

Bit 2	
0	Negotiation is done with USER INFORMATION messages on a temporary signalling connection
1	Negotiation is done in-band using logical link zero

Number of stop bits (octet 5c)

Bit 7 6	
0 0	Not used
0 1	1 bit
1 0	1.5 bits
1 1	2 bits

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

Bit 5 4	
0 0	Not used
0 1	5 bits
1 0	7 bits
1 1	8 bits

Parity information (octet 5c)

Bit 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.

Duplex mode (octet 5d)

Bit 7	
0	Half duplex
1	Full duplex

Table 4-16/ B-IF2.02(Q.931) (continued)
Low layer compatibility information element

Modem type (octet 5d)

Bit 6 5 4 3 2 1	
0 0 0 0 0 0 through 0 0 0 1 0 1	National use
0 1 0 0 0 1	Recommendation V.21
0 1 0 0 1 0	Recommendation V.22
0 1 0 0 1 1	Recommendation V.22 bis
0 1 0 1 0 0	Recommendation V.23
0 1 0 1 0 1	Recommendation V.26
0 1 0 1 1 0	Recommendation V.26 bis
0 1 0 1 1 1	Recommendation V.26 ter
0 1 1 0 0 0	Recommendation V.27
0 1 1 0 0 1	Recommendation V.27 bis
0 1 1 0 1 0	Recommendation V.27 ter
0 1 1 0 1 1	Recommendation V.29
0 1 1 1 0 0	Recommendation V.32
1 0 0 0 0 0 through 1 0 1 1 1 1	National use
1 1 0 0 0 0 through 1 1 1 1 1 1	User specified

All other values reserved.

User information layer 2 protocol (octet 6)

Bit 5 4 3 2 1	
0 0 0 0 1	Basic mode ISO 1745 [36]
0 0 0 1 0	Recommendation Q.921 (I.441) [3] (Note 4)
0 0 1 1 0	Recommendation X.25 [5], link layer (Notes 1, 4)
0 1 1 1 1	Recommendation X.25 Multilink (Note 4)
0 1 0 0 0	Extended LAPB; for half duplex operation (T.71 [37])
0 1 0 0 1	HDLC ARM (ISO 4335) [38] (Note 4)
0 1 0 1 0	HDLC NRM (ISO 4335) (Note 4)
0 1 0 1 1	HDLC ABM (ISO 4335) (Note 4)
0 1 1 0 0	LAN logical link control (ISO 8802/2) [39]
0 1 1 0 1	Recommendation X.75 [40]. Single Link Procedure (SLP) (Note 4)
0 1 1 1 0	Recommendation Q.922 [ ] (Note 4)
0 1 1 1 1	Core aspects of Recommendation Q.922
1 0 0 0 0	User specified (Note 2)
1 0 0 0 1	ISO 7776 DTE-DTE operation (Notes 3, 4)

All other values are reserved.

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

Table 4-16/ B-IF2.02(Q.931) (continued)
Low layer compatibility information element

Octet 6a for CCITT codings
Mode of operation (octet 6a)

Bit

7	6	
0	1	Normal mode of operation
1	0	Extended mode of operation

All other values are reserved.

Q.933 use (octet 6a)

Bit

2	1	
0	0	For use when the coding defined in Recommendation Q.933 is not used

All other values are reserved.

Octet 6a for user protocol
User specified layer 2 protocol information (octet 6a)

The use and coding of octet 6a is according to user defined requirements.

Window size (k) (octet 6b)

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

User information layer 3 protocol (octet 7)

Bit

5	4	3	2	1	
0	0	0	1	0	Recommendation Q.931 (I.451)
0	0	1	1	0	Recommendation X.25, packet layer (Note 2)
0	0	1	1	1	ISO/IEC 8208 [41] (X.25 packet level protocol for data terminal equipment) (Note 2)
0	1	0	0	0	CCITT Rec. X.223 | ISO 8878 [81] (use of ISO/IEC 8208 [41] and Recommendation X.25 to provide the OSI-CONS) (Note 2)
0	1	0	0	1	ISO/IEC 8473 [43] (OSI connectionless mode protocol)
0	1	0	1	0	Recommendation T.70 [32] 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 (Note 1)

All other values are reserved.

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

Octet 7a for CCITT codings
Mode of operation (octet 7a)

Bit

7	6	
0	1	Normal packet sequence numbering
1	0	Extended packet sequence numbering

All other values are reserved.

Table 4-16/ B-IF2.02(Q.931) (continued)
Low layer compatibility information element

Octet 7a for user protocol
User specified layer 3 protocol information (octet 7a)

The use and coding of octet 7a depends on user defined requirements.

Default packet size (octet 7b)

Bit 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 4-17/ B-IF2.02(Q.931)
Low layer compatibility 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 symmetric
Circuit	Unrestricted data	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Restricted data	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	3.1 kHz audio	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Unrestricted data with tones/announcements	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Circuit	Video	8 kHz integrity	Point-to-point	Demand	Bi-directional symmetric
Packet	Unrestricted data	Service data unit integrity	Point-to-point	Demand	Bi-directional symmetric
Note 1:	When the information transfer rate 2 × 64 kbit/s is used, 8 kHz integrity with Restricted Differential Time Delay (RDTD) is offered.				
Note 2:	When multirate (64 kbit/s base rate) is indicated as the information transfer rate, Time Slot Sequence integrity shall be provided.				

4.5.20 More data*

4.5.21 Network-specific facilities*

4.5.22 Notification indicator

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

The Notification indicator information element is coded as shown in Figure 4-28 and Table 4-19.

The maximum length of this information element is three octets.

Bit 8	7	6	5	4	3	2	1	Octets
	Notification indicator							
0	0	1	0	0	1	1	1	1
	Information element identifier							
Length of notification indicator contents								2
1 ext.	Notification description							3

Figure 4-28/B-IF2.02(Q.931)
Notification indicator information element

Table 4-19/B-IF2.02(Q.931)
Notification indicator information element

Notification description (octet 3)

Bit

7	6	5	4	3	2	1	
0	0	0	0	0	0	0	User suspended
0	0	0	0	0	0	1	User resumed

All other values are reserved.

4.5.23 Progress indicator

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

The Progress indicator information element is coded as shown in Figure 4-29 and Table 4-20.

The maximum length of this information element is four octets.

Bit 8	7	6	5	4	3	2	1	Octets
0	Progress indicator 0	0	1	1	1	1	0 Information element identifier	1
Length of progress indicator contents								2
1 ext.	Coding standard		0 Spare	Location				3
1 ext.	Progress description							4

Figure 4-29/B-IF2.02(Q.931)
Progress indicator information element

Table 4-20/B-IF2.02(Q.931)
Progress indicator information element

Coding standard (octet 3)

Bit 7 6	
0 0	ITU-T standardized coding, as described below
0 1	ISO/IEC standard (Note)
1 0	National standard (Note)
1 1	Standard specific to identified location (Note)

Note : These other coding standards should be used only when the desired progress indication can not be represented with the ITU-T-standardized coding.

Location (octet 3)

Bit 4 3 2 1	
0 0 0 0	User
0 0 1 0	Public network serving the local user
0 0 1 1	Transit network (Note 1)
0 1 0 0	Public network serving the remote user
0 1 0 1	Private network serving the remote user
1 0 1 0	Network beyond the interworking point

All other values are reserved.

Note 1: This value may be generated by some networks.
Note 2: Depending on the location of the users, the local public network and remote public network may be the same network.
Note 3: Public cell station is public network serving the local user.

Progress description (octet 4)

Bit 7 6 5 4 3 2 1	No.	
0 0 0 0 0 0 1	1.	Call is not end-to-end ISDN; further call progress information may be
0 0 0 0 0 1 0	2.	Destination address is non ISDN
0 0 0 0 0 1 1	3	Origination address is non ISDN
0 0 0 0 1 0 0	4.	Call has returned to the ISDN
0 0 0 0 1 0 1	5.	Interworking has occurred and has resulted in a telecommunication\
0 0 0 1 0 0 0	8.	In-band information or an appropriate pattern is now available.

All other values are reserved.

Note 1: 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 a progress description No. 1 shall be used. If the destination address is non-ISDN, the progress description No. 2 shall be used.
Note 2: Interwork with PHS system is regarded ISDN.

4.5.24 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 which will be repeated in a message. The Repeat indication information element is coded as shown in Figure 4-30 and Table 4-21.

The length of this information element is one octet.

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.

Bit 8	7	6	5	4	3	2	1	Octets
1	Repeat indicator Information element identifier			Repeat indication				1

Figure 4-30/ B-IF2.02(Q.931)
Repeat indicator information element

Table 4-21/ B-IF2.02(Q.931)
Repeat indicator information element

Repeat indication (octet 1)

Bit 4 3 2 1	
0 0 1 0	Prioritized list for selecting one possibility

All other values are reserved.

4.5.25 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 Restart indicator information element is coded as shown in Figure 4-31 and Table 4-22.

The maximum length of this information element is three octets.

Bit 8	7	6	5	4	3	2	1	Octets
0	Restart indicator Information element identifier							1
Length of restart indicator contents								2
1 ext.	0	0	0	0	Class			3

Figure 4-31/B-IF2.02(Q.931)
Restart indicator information element

Table 4-22/ B-IF2.02(Q.931)
Restart indicator information element

Class (octet 3)

Bit 3 2 1	
0 0 0	Indicated channels (Note 1)
1 1 0	Single interface (Note 2)
1 1 1	All interfaces (Note 3)

All other values are reserved.

Note 1: The channel identification information element must be included and indicates which channels are to be restarted.

Note 2: If non-associated signalling 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.

Note 3: May be used when there are two or more interfaces controlled by the D-channel. The channel identification information element must not be included with this coding.

4.5.26 Segmented message

The purpose of the Segmented message information element is to indicate that the transmission in which it appears is part of a segmented message, in addition to the use of message type SEGMENT. When included in a message segment, it appears directly after the Message type information element (see Annex H).

The Segmented message information element is coded as shown in Figure 4-32 and Table 4-23.

The length of this information element is four octets.

Bit 8	7	6	5	4	3	2	1	Octets
0	Segmented message Information element identifier							1
Length of segmented message contents								2
First segment indicator	Number of segments remaining							3
0	Segmented message type							4

Figure 4-32/ B-IF2.02(Q.931)
Segmented message information element

Table 4-23/B-IF2.02(Q.931)
Segmented message information element

First segment indicator (octet 3)

Bit
8
0 Subsequent segment to first segment
1 First segment of segmented message

Number of seguments remaining (octet 3)

Binary number indicating the number of remainig seguments within the message to sent.

Segmented message type (octet 4)

Type of message being segmented coded as per 4.4

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

4.5.27 Sending complete*

4.5.28 Signal*

4.5.29 Transit network selection*

4.5.30 User-user*

4.6 Information element for packet communications *

5. Circuit-switched call control procedures

This clause provides the D-channel signalling procedures in support of circuit-mode bearer capabilities other than multirate.

The call states referred to in this clause cover the states perceived by the ISDN, states perceived by the Public CS, and states which are common to both Public CS and ISDN. Unless specifically qualified, all states described in the following text should be understood as common (see 2.1.1 and 2.1.2 for Public CS and ISDN call states respectively). An overview diagram of call states is given in Figures A.2 and A.3 (see Annex A).

Detailed specification and description language (SDL) diagrams for the procedures specified in this clause are contained in Figures A.4 through A.6. When there is an ambiguity in the narrative text, the SDL diagrams in Figures A.4 through A.6 should be used to resolve the conflict. Where the text and the SDL are in disagreement, the text should used as the prime source.

Note 1: This clause describes the sequences 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 elsewhere in this Recommendation, in Recommendation Q.932 [4] or the Q.95x-Series Recommendations [83].

All messages in this Recommendation may contain functional information element. Functional information elements are characterized as requiring a degree of intelligent processing by the Public CS 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 Public CS/terminal interface or contain a basic instruction from the ISDN to be executed by the terminal.

In order to accommodate the transfer of Layer 3 messages which exceeds the data link layer maximum frame length (i.e. defined in Recommendation Q.921 [3]), a method of message segmentation and reassembly may optionally be implemented as described in Annex H. Message segmentation shall only be used where all the information comprising the unsegmented message is available at the time of sending the first message segment.

Note 3: Message segmentation is not used to replace existing procedures where information is yet to be provided by call control, e.g. digit by digit sending in overlap mode, although this may be used in addition. Message segmentation shall only be used when the message length exceeds the value of the N201 parameter defined in Recommendation Q.921 [3].

5.1 Call establishment at the originating interface

Before these procedures are invoked, a reliable data link connection must be established between the Public CS and the ISDN. All layer 3 messages shall be sent to the data link layer using a DL-DATA request primitive. The data link services described in Recommendations Q.920/I.440 [45] and Q.921 [3] are assumed.

5.1.1 Call request

A Public CS initiates call establishment by transferring a SETUP message across the Public CS-ISDN interface. Following the transmission of the SETUP message, the call shall be considered by the Public CS to be in the call initiated state. The message shall always contain a call reference, selected according to the procedures given in 4.3. The bearer capability information element is mandatory in the SETUP message.

If the Public CS knows all appropriate channels controlled by the D-channel are in use, it shall not transfer a SETUP message across the Public CS-ISDN interface.

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.

The SETUP message shall contain all the information required by the ISDN 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 completed by the called party subaddress information element;

Called party subaddress information, if present, shall be given in the Called party subaddress information element.

5.1.2 B-channel selection - Originating

In the SETUP message, the Public CS 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, if applicable, octet 3.3, and the preferred/exclusive field (bit 4 of octet 3) is set to “1” in the Channel identification information element]; or

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, if applicable, octet 3.3, 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 indication is included, alternative c) is assumed. In cases a) and b), if the indicated channel is available, the ISDN selects it for the call.

In case b), if the ISDN cannot grant the preferred channel, it selects any other available B-channel associated with the D-channel. In case c), the ISDN 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 ISDN in response to the SETUP message (i.e. CALL PROCEEDING message). After transmitting this message, the ISDN shall activate the B-channel connection.

The Public CS need not attach until receiving a CALL PROCEEDING/PROGRESS/ALERTING message with the progress indicator No. 8, *in-band information or appropriate pattern is now available* or progress indication No. 1, *call is not end-to-end ISDN; further call progress information may be available in-band*. Prior to this time, the ISDN cannot assume that the Public CS has attached to the B-channel. After this time, the Public CS shall be connected to the B-channel, provided the equipment does not generate local tone. Upon receipt of the CONNECT message the Public CS shall attach to 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 No. 44, *requested circuit/channel not available* or No. 34, *no circuit/channel available*, respectively, is sent by the ISDN as described in 5.3.

In case a), if the specified channel does not exist, cause No. 82, *identified channel does not exist* is included in the RELEASE COMPLETE message.

5.1.3 Overlap sending*

5.1.4 Invalid call information

If, following the receipt of a SETUP message or during overlap sending, the ISDN determines that the call information received from the Public CS is invalid, (e.g. invalid number), then the ISDN shall follow the procedures described in 5.3 with a cause such as one of the following:

No. 1 - *Unassigned (unallocated) number*;
No. 3 - *No route to destination;*
No. 22 - *Number changed;*
No. 28 - *Invalid number format (incomplete number).*

5.1.5 Call proceeding

5.1.5.1 Call proceeding

If the ISDN can determine that the SETUP message contains all the information required from the Public CS to establish the call and if the ISDN can determine that access to the requested service is authorized and available, the ISDN shal send a CALL PROCEEDING message to the Public CS. This acknowledges the SETUP message, and indicates that the call is being processed. The ISDN will then enter the Outgoing Call Proceeding state. When the Public CS receives the CALL PROCEEDING message, the Public CS shall also enter the Outgoing Call Proceeding state.

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

No. 57 - *Bearer capability not authorized;*

No. 58 - *Bearer capability not presently available;*
No. 63 - *Service or option not available, unspecified;* or
No. 65 - *Bearer service not implemented.*

Note 1: If a supplementary service is not authorized or is not available, the procedure to be used is defined in the supplementary service control procedures.

Note 2: When the ISDN cannot assign a channel due to congestion, the procedures of 5.1.2 shall be followed.

5.1.5.2 Call proceeding, overlap sending*

5.1.6 Notification of interworking at the originating interface

During call establishment, the call may leave the ISDN environment, e.g. because of interworking with another ISDN, with a non-ISDN Public CS, or with non-ISDN equipment within the called Public CS's premises. When such situations occur a progress indication shall be returned to the calling Public CS either:

a) in an appropriate call control message when a state change is required: CALL PROCEEDING, ALERTING, SETUP ACKNOWLEDGE 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 messages sent to the Public CS, (for further information see Annex G).

1) No. 1 - *Call is not end-to-end ISDN; further call progress information may be available in-band;*
2) No. 2 - *Destination address is non-ISDN;*
3) No. 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 indicator information element is included in the Progress message, no state change will occur but any supervisory timers shall be stopped except ISDN timer T302. In both cases, if indicated by the Progress indicator information element, the Public CS 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 indication 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 ISDN:

i) No. 1 - *Call is not end-to-end ISDN; further call progress information may be available in-band;*
ii) No. 3 - *Origination address is non-ISDN.*

5.1.7 Call confirmation indication

Upon receiving an indication that alerting has been initiated at the destination, the ISDN shall send an ALERTING message across the Public CS-ISDN interface of the calling address, and shall enter the

call delivered state. When the Public CS receives the ALERTING message, the Public CS may begin an internally-generated alerting indication and shall enter the call delivered state.

5.1.8 Call connected

Upon the ISDN receiving an indication that the call has been accepted at the destination, the ISDN shall send a CONNECT message across the Public CS-ISDN interface, and shall enter the Active state. As a ISDN option, the Date/time information element may be included in the CONNECT message.

This message indicates to the calling Public CS that a connection has been established through the ISDN and stops a possible local indication of alerting.

On receipt of the CONNECT message, the originating Public CS shall stop any Public CS-generated alerting indications; may optionally send a CONNECT ACKNOWLEDGE message, and shall enter the active state. The ISDN 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 ISDN or the destination is unable to accept the call, the ISDN shall initiate call clearing at the originating Public CS-ISDN interface as described in 5.3, using the cause provided by the ISDN or the destination.

5.1.10 Transit ISDN selection*

5.2 Call establishment at the destination interface

This procedure assumes that a data link connection providing services described in Recommendation Q.920/I.440 [45] may not exist before the first layer 3 message (SETUP) is transferred across the interface. However, reliable data link connections must be established by each of the Public CSs at the interface before they respond to the SETUP message.

Data link connections may be established by the TA, TE or NT2 as soon as a TEI is assigned (either locally or by automatic assignment procedure), and may be retained indefinitely. This may be recommended as a ISDN option.

The SETUP message offered on a point-to-point data link shall be delivered to layer 2 using a DL-DATA request primitive.

The call reference contained in all messages exchanged across the Public CS-ISDN interface shall contain the call reference value specified in the SETUP message delivered by the ISDN.

5.2.1 Incoming call

The ISDN will indicate the arrival of a call at the Public CS-ISDN interface by transferring a SETUP message across the interface. This message is sent if the ISDN can select an idle B-channel. The SETUP message may also be sent when no B-channel is idle.

In addition to the mandatory information elements, the SETUP message may include, as required, the information elements described in 3.1.14.

After sending the SETUP message, the ISDN starts timer T303 and timer T312. (The values of timers T303 and T312 are specified in 9.1.) The ISDN then enters the call present state.

Note 1: Timer T312 is used to supervise the retention of the call reference. The value of timer T312 is such that if a ISDN disconnect indication is received during the call establishment phase, it maximizes the probability that all responding Public CSs will be released prior to release of the call reference. Refer to 5.3.2 e) and 5.2.5.3 (Case 1) for procedures to be followed on expiry of timer T312.

The SETUP message may contain the Sending complete information element.

Upon receipt of a SETUP message, the Public CS will enter the Call present state.

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

5.2.2 Compatibility checking

A destination receiving a SETUP message shall perform compatibility checking before responding to that SETUP message. Annex B defines compatibility checking to be performed by Public CSs upon receiving a SETUP message.

When the SETUP message is delivered, an incompatible Public CS shall respond with RELEASE COMPLETE message with cause No.65, bearer capability not implemented, or with cause No. 88, *incompatible destination*, and enter the Null state. The ISDN shall process this RELEASE COMPLETE message in accordance with 5.2.5.3.

5.2.3 B-channel selection - Destination

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 ISDN and the Public CS. 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 ISDN will 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, if applicable, octet 3.3, and the preferred/exclusive field (bit 4 of octet 3) is set to “1” in the Channel identification information element]; or

   2) 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]; or

b) In case 1) , if the indicated channel is acceptable and available, the Public CS selects it for the call.

In case 2), the Public CS selects any available B-channel associated with the D-channel, and identifies 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 ISDN, or in case 2) the B-channel indicated in the first response message is unacceptable to the ISDN, it will clear the call by sending a RELEASE message with cause No. 6, *channel unacceptable*.

c) If no Channel identification information element is present in the first response message, the B-channel indicated in the SETUP message will be assumed.

d) When a B-channel has been selected by the Public CS, that channel may be connected by the Public CS.

e) In case 1) if the indicated B-channel is not available, or in cases 2), 3), and 4) if no B-channel is available and the Public CS cannot proceed with the offered call, the Public CS returns a RELEASE COMPLETE message with cause No. 44 *requested circuit/channel not available* or No. 34 *no circuit/channel available*, respectively, and returns to the Null state.

5.2.4 Overlap receiving*

5.2.5 Call confirmation

5.2.5.1 Response to SETUP

When the Public CS determines that sufficient call set-up information has been received and compatibility requirements have been satisfied, the Public CS responds with a CALL PROCEEDING, and enters the Incoming Call Proceeding state.

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 ISDN PABX).

If the Public CS which has checked the existence of PS confirmed the incompatibility of bearer capability information element of SETUP message, a RELEASE COMPLETE message shall be sent with the cause No. 65, *Bearer capability not implemented*, to the ISDN. The ISDN processes this RELEASE COMPLETE message in accordance with 5.2.5.3. The Public CS which does not recognize the existence of PS shall ignore the SETUP message.

If the Public CS wishes to refuse the call while the Public CS confirm end-to-end call connection, a RELEASE COMPLETE message shall be sent with the cause No. 21, *call rejected*, and the Public CS returns to the Null state.

The ISDN processes these RELEASE COMPLETE messages in accordance with 5.2.5.3.

Public CS which could not confirm end-to-end call connection shall ignore the SETUP message.

5.2.5.2 Receipt of CALL PROCEEDING and ALERTING

Upon receipt of the first CALL PROCEEDING message from a Public CS, the ISDN shall stop timer T303; start timer T310, and enter the incoming call proceeding state.

When the SETUP message has been delivered on a broadcast data link, the ISDN shall associate the incoming call proceeding state with each called Public CS that sends a CALL PROCEEDING message as a first response to the broadcast SETUP message prior to expiration of timer T312. Actions to be taken when a Public CS sends a first response to an incoming call after the expiration of timer T312 are described in 5.2.5.4. Timer T310 shall not be restarted.

Upon receipt of the first ALERTING message from a Public CS, the ISDN shall stop T310 (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 origination.

The ISDN shall associate the call received state with each called Public CS that sends an ALERTING message following a CALL PROCEEDING message.

5.2.5.3 Clearing of destination Public CS during SETUP at the destination

Upon receiving a RELEASE COMPLETE message before timer T303 is expired, the ISDN shall initiate clearing the Public CS.

Upon receiving a DISCONNECT or RELEASE, RELEASE COMPLETE message before receiving CONNECT message from the Public CS that is checked compatibility, the ISDN shall initiate clearing of the call.

Upon receiving a DISCONNECT or RELEASE, RELEASE COMPLETE message before receiving CONNECT message from the Public CS that is checked compatibility, the digital ISDN shall initiate clearing of the Public CS.

When the timer T303 is expired (that is, no valid message, like CALL PROCEEDING, is received), the ISDN shall enter the Call Abort state.

5.2.5.4 Call failure

If the ISDN does not receive any response to the retransmitted SETUP message prior to the expiration of timer T303, then the ISDN shall initiate clearing procedures towards the origination with cause No. 20, *subscriber absent*.

If the ISDN receives a Public CS's first response to SETUP when in the Call Abort state but before timer T312 has expired, the ISDN shall initiate clearing to the called Public CS as described in 5.3.2 b), except that the cause No. 102, *recovery on timer expiry* shall be sent. If the ISDN receives a message that is a Public CS's first response to an incoming call after timer T312 has expired, the ISDN will interpret this message as a message received with an invalid call reference value, as described in 5.8.3.2.

If the ISDN 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 ISDN shall initiate clearing procedures towards the origination with cause No. 18, *no Public CS responding* and initiate clearing procedures towards the called Public CS. If the SETUP message is delivered by a broadcast data link, the called Public CS shall be cleared in accordance with 5.3.2 e), except that cause No. 102, *recovery on timer expiry* shall be sent.

If the ISDN has received an ALERTING message, but does not receive a CONNECT or DISCONNECT message prior to the expiry of timer T301 (or a corresponding internal alerting supervision timing function), then the ISDN shall initiate clearing procedures towards the origination with cause No. 19, *Public CS alerting, no answer*; and initiate clearing procedures towards the called Public CS. If the SETUP message was delivered by a broadcast data link, the called Public CS shall be cleared in accordance with 5.3.2 e), except that cause No. 102, *recovery on timer expiry* shall be sent.

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 ISDN, with a non-ISDN Public CS, or with non-ISDN equipment within the calling or called Public CS'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 Public CS:

a) *No. 1 "call is not end-to-end ISDN; further call progress information may be available in-band";*

Note : On receipt of progress indicator No. 1, the called Public CS shall connect to the B-channel in accordance with the procedures of 5.2.8.

b) *No. 3 "origination address is non-ISDN".*

In addition, the Public CS shall notify the calling party if the call has left the ISDN environment within the called Public CS's premises, or upon the availability of in-band information/patterns. When such situations occur, a progress indication shall be sent by the Public CS to the ISDN either

a) in an appropriate call control message when a state change is required (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 ISDN (for further information, see Annex G):

i) No. 1 - *Call is not end-to-end ISDN; further call progress information may be available in-band;*
ii) No. 2 - *Destination address is non-ISDN;*
iii) No. 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 except ISDN timer and T312.

5.2.7 Call accept

A Public CS indicates acceptance of an incoming call by sending a CONNECT message to the ISDN. Upon sending the CONNECT message the Public CS shall start timer T313 (specified in 9.2). If an ALERTING message had previously been sent to the ISDN, 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 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 ISDN shall stop (if running) timers T301 and T310; complete the circuit-switched path to the selected B-channel; send a CONNECT ACKNOWLEDGE message to the Public CS which first accepted the call; initiate procedures to send a CONNECT message towards the origination, 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 origination. Upon receipt of the CONNECT ACKNOWLEDGE message the Public CS shall stop timer T313 and enter the active state.

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

A Public CS which has selected channel may connect to the B-channel as soon as channel selection has been completed.

5.2.9 Call procedure for the grouped multiple interfaces

[moved to Appendix IV]

5.3 Call clearing

5.3.1 Terminology

The following terms are used in this Recommendation 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 Recommendation.
- 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 Public CS or the ISDN 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 Public CS or ISDN 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 SETUP ACKNOWLEDGE message in the case of overlap sending); releasing the call reference, and enter the Null state.

b) In the case of a multipoint terminal configuration, non-selected Public CS call clearing will be initiated with RELEASE message(s) from the ISDN (see 5.2.9).

c) [non-standard]

d) 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. The RELEASE message shall contain cause No. 6, *channel unacceptable*. The ISDN and Public CS shall subsequently follow the procedures of 5.3.3 and 5.3.4.

e) 1) In the case of a SETUP message sent via the broadcast data link, if a ISDN disconnect indication is received during call establishment, and prior to the expiry of timer T312, timer T303 is stopped (if running) and the ISDN enters the Call Abort state. Any Public CS which has responded, or subsequently responds before timer T312 expires, will be cleared by a RELEASE message (with the cause code(s) contained in the ISDN disconnect indication) and the procedures of 5.3.4 are then followed for that Public CS. Upon expiry of timer T312, the ISDN shall treat any subsequent responses according to the procedures defined in 5.8.3.2. The ISDN shall enter the Null state upon completion of clearing procedures for all responding Public CSs.

2) In the case of a SETUP message sent via the broadcast data link, if a ISDN disconnect indication is received during call establishment after expiry of timer T312, any Public CS which has responded shall be cleared by a RELEASE message (with the cause code(s) contained in the ISDN disconnect indication) and the procedures of 5.3.4 are then followed for that Public CS. The ISDN enters the Null state upon completion of clearing procedures for all responding Public CSs.

5.3.3 Clearing initiated by the Public CS

Apart from the exceptions identified in 5.3.2 and 5.8, the Public CS 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 Public CS initiates call clearing by sending a RELEASE message, the procedures described in 5.3.4 are then followed.

The ISDN shall enter the Disconnect Request state upon receipt of a DISCONNECT message. This message then prompts the ISDN to disconnect the B-channel, and to initiate procedures for clearing the ISDN connection to the remote side. Once the B-channel used for the call has been disconnected, the ISDN shall send a RELEASE message to the Public CS; start timer T308 (the value of a timer T.308 is specified in 9.1), and enter the Release Request state.

Note : The RELEASE message has only local significance and does not imply an acknowledgement of clearing from the remote side.

On receipt of the RELEASE message the Public CS 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 Public CS, the ISDN shall stop timer T308; release both the B-channel and the call reference, and return to the Null state.

If timer T305 expires, the Public CS shall send a RELEASE message to the ISDN with the cause number originally contained in the DISCONNECT message; start timer T308 and enter the Release Request state. In addition, the Public CS may indicate a second Cause information element with cause No. 102, *recovery on timer expiry*.

If timer T308 expires for the first time, the ISDN shall retransmit the RELEASE message and timer T308 shall be restarted. In addition, the ISDN may indicate a second Cause information element with cause No. 102, *recovery on timer expiry*. If no RELEASE COMPLETE message is received from the Public CS before timer T308 expires a second time, the ISDN shall place the B-channel in a maintenance condition, release the call reference, and return to the Null state.

Note 1: The restart procedures contained in 5.5 may be used on B-channels in the maintenance condition.

Note 2: Other actions which could be taken by the ISDN upon receipt of a DISCONNECT message are for further study.

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

5.3.4 Clearing initiated by the ISDN

Apart from the exception conditions identified in 5.3.2 and 5.8, the ISDN shall initiate clearing by sending a DISCONNECT message, and entering the Disconnect Indication state. The DISCONNECT message is a local invitation to clear and does not imply that the B-channel has been disconnected at the Public CS-ISDN interface.

Note : When the ISDN initiates clearing by sending a RELEASE message, the procedures described in 5.3.3 are followed.

5.3.4.1 Clearing when tones/announcements provided

When in-band tones/announcements are provided (see 5.4), the DISCONNECT message contains progress indicator No. 8, *in-band information or appropriate pattern now available*. The ISDN shall: start timer T306; and enter the Disconnect Indication state.

On receipt of the DISCONNECT message with progress indicator No. 8, the Public CS may connect (if not already connected) to the B-channel to receive the in-band tone/announcement; and enter the disconnect indication state. Alternatively, to continue clearing without connecting to the in-band tone/announcement, the Public CS shall disconnect the B-channel; send a RELEASE message, start timer T308, and enter the Release Request state.

If the Public CS connects to the provided in-band tone/announcement, the Public CS may subsequently continue clearing (before the receipt of a RELEASE from the ISDN) by disconnecting from the B-channel; sending a RELEASE message; starting timer T308; and entering the Release Request state.

On receipt of the RELEASE message, the ISDN shall stop timer T306; disconnect and release the B-channel; send a RELEASE COMPLETE message; release the call reference, and return to the Null state.

If timer T306 expires, the ISDN shall continue clearing by disconnecting the B-channel; sending a RELEASE message with the cause number originally contained in the DISCONNECT message; starting timer T308, and entering the Release Request state.

In addition to the original clearing cause, the RELEASE message may contain a second cause information element with cause No. 102, *recovery on timer expiry*; this cause may optionally contain a diagnostic field identifying the timer that expired.

On receipt of the RELEASE message, the Public CS shall act according to 5.3.3.

5.3.4.2 Clearing when tones/announcements not provided

When in-band tones/announcements are *not* provided, the DISCONNECT message does *not* contain progress indicator No. 8 *in-band information or appropriate pattern now available*. The ISDN shall initiate clearing by sending the DISCONNECT message; start timer T305; disconnects the B-channel, and enters the Disconnect Indication state.

On the receipt of the DISCONNECT message without progress indicator No. 8, the Public CS 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 ISDN 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 ISDN shall send a RELEASE message to the Public CS with the cause number 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 No. 102, *recovery on timer expiry*.

5.3.4.3 Completion of clearing

Following the receipt of a RELEASE COMPLETE message from the ISDN, the Public CS 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 Public CS 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 ISDN before timer T308 expires a second time, the Public CS may place the B-channel in a maintenance condition; shall release the call reference, and return to the Null state.

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

5.3.5 Clear collision

Clear collision occurs when the Public CS and the ISDN simultaneously transfer DISCONNECT messages specifying the same call reference value. When the ISDN receives a DISCONNECT message whilst in the Disconnect Indication state, the ISDN shall stop timer T305 or T306 (whichever is running); disconnect the B-channel (if not disconnected); send a RELEASE message; start timer T308, and enter the Release Request state. Similarly, when the Public CS receives a DISCONNECT message whilst in the Disconnect Request state, the Public CS shall stop timer T305; 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 whilst within the Release Request state shall stop timer T308; release the call reference and B-channel, and enter the Null state (without sending or receiving a RELEASE COMPLETE message).

5.4 In-band tones and announcements

When in-band tones/announcements not associated with a call state change are to be provided by the ISDN before reaching the Active state, a PROGRESS message is returned simultaneously with the application of the in-band tone/announcement. The PROGRESS message contains the progress indicator No. 8, *in-band information or appropriate pattern is now available*.

When tones/announcements have to be provided together with a call state change, then the appropriate message [e.g. for ALERTING, DISCONNECT, etc., (see appropriate section)] with progress indicator No. 8, *in-band information or appropriate pattern is now available* is sent simultaneously with the application of the in-band tone/announcement.

Note 1: When the ISDN provides CCITT standardized telecommunications services, the service requirement for provision of in-band tones/announcements is as indicated in the I.200-Series Recommendations.

Note 2: When the PROGRESS message is used, the Public CS may initiate call clearing as a result of the applied in-band tone/announcement, according to the procedures specified in 5.3.3.

Note 3: The protocol currently described in 5.4 applies at the calling Public CS-ISDN interface. The protocol to be applied at the interISDN interface and at the called Public CS-ISDN interface requires further study.

5.5 Restart procedure

The restart procedure is used to return calls to the Null state or the interface 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 expiry of timer T308 due to the absence of response to a clearing message). It may also be initiated as a result of local failure, maintenance action or mis-operation.

Note 1: Layer 3 procedures and resources associated with those data links with SAPI = “0000 000” should be initialized by the restart procedures.

Note 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.

5.5.1 Sending RESTART message

A RESTART message is sent by the ISDN or Public CS equipment in order to return channels or interfaces to the Null state. The Restart indicator information element shall be present in the 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 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 enters the Restart Request state, starts timer T316, and waits for a RESTART ACKNOWLEDGE message. Also, no further RESTART messages shall be sent until a RESTART ACKNOWLEDGE is received or timer T316 expires. Receipt of a RESTART ACKNOWLEDGE message stops timer T316, frees the channels and call reference values for reuse, and enters the Null state.

If a RESTART ACKNOWLEDGE message is not received prior to the expiry 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 ISDN shall limit the number of consecutive unsuccessful restart attempts to a default limit of two. When this limit is reached, the ISDN 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.

Note : If a RESTART ACKNOWLEDGE message is received indicating only a subset of the specified channels, an indication shall be given to the maintenance entity. It is the responsibility of the maintenance entity to determine what actions shall be taken on the channel(s) which have not been returned to the idle condition.

The RESTART and RESTART ACKNOWLEDGE message shall contain the global call reference value (all zeros) 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 to 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. Upon completion of internal clearing, timer T317 shall be stopped and a RESTART ACKNOWLEDGE message transmitted to the originator, and the Null state entered.

Note 1: If only a subset of the specified channels have been returned to the idle condition when timer T317 expires, a RESTART ACKNOWLEDGE message should be transmitted to the originator, containing a Channel identification information element indicating the channel(s) that have been returned to the idle condition.

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).

Note 2: 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.

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 indication 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 that interface includes the D-channel then only those calls associated with the D-channel on that interface shall be cleared.

The receiving DSS1 protocol control entity for the global call reference shall indicate a restart request to only those DSS1 protocol control entities for specific call references which

a) are supported by the same Data Link Connection Endpoint Identifier (DLCI) (see Recommendation Q.920) as the DSS1 protocol control entity for the global call reference which received the RESTART message; and

b) correspond to the specified channel(s) or interface(s), or (if the D-channel was implicitly specified) are not associated with any channel, including calls in the call establishment phase for which a channel has not yet been allocated.

5.6 Call rearrangements*

5.7 Call collisions

Call collisions as such cannot occur at the ISDN. 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 ISDN through channel selection mechanisms described in 5.1.2 and 5.2.2.

In the case of such conflicts, the ISDN shall give priority to the incoming call over the call request received from the Public CS. It shall clear the outgoing call whenever the B-channel cannot be, allocated by the ISDN or accepted by the Public CS originating the call.

5.8 Handling of error conditions

All procedures transferring signalling information by using the protocol discriminator of Q.931 Public CS-ISDN call control messages are applicable only to those messages which 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 ISDN to ISDN. However, capabilities facilitating the orderly treatment of error conditions are provided for in this section 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 discrimination error

When a message is received with a protocol discriminator coded other than *Q.931 Public CS-ISDN call control message*, that message shall be ignored, 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 indicate a length greater than the maximum length supported by the receiving equipment (see 4.3), then the message shall be ignored.

5.8.3.2 Call reference procedural errors

Only item f) applies to messages using the global call reference.

a) Whenever any message except SETUP, RELEASE, RELEASE COMPLETE, STATUS or STATUS ENQUIRY is received specifying a call reference which it does not recognize as relating to an active call or a call in progress, clearing is initiated by sending a RELEASE message with cause No. 81, “invalid call reference value” and following the procedures in 5.3, specifying the call reference in the received message.
Alternatively, the receiving entity may send a RELEASE COMPLETE message with cause No. 81, “invalid call reference value” and remain in the Null state.

b) When a RELEASE message is received that specified a call reference which is not recognized as relating to an active call or a call in progress, a RELEASE COMPLETE message with cause No. 81, “invalid call reference value” is returned, specifying the call reference in the received message.

c) When a RELEASE COMPLETE message is received specifying a call reference which it does not recognize as relating to an active call or a call in progress, no action should be taken.

d) When a SETUP or RESUME message is received specifying a call reference which is recognized as relating to an active call or to a call in progress, and with a call reference flag incorrectly set to “1”, that message shall be ignored.

e) When a SETUP message is received specifying a call reference which is recognized as relating to an active call, or a call in progress, this SETUP message shall be ignored.

f) 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 No. 81 “invalid call reference value” shall be returned.

g) When a STATUS message is received specifying a call reference which 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 which is not recognized as relating to an active call or to a call in progress, the procedures of 5.8.10 shall apply.

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 No. 98, *message not compatible with call state or message type non-existent or not implemented* and the corresponding diagnostic. If a ISDN or Public CS can distinguish between unimplemented (or non-existent) message types and implemented message types which are incompatible with the call state, then a STATUS message may be sent with one of the following causes:

a) cause No. 97 message type non-existent or not implemented; or
b) cause No. 101 message not compatible with call state.

Alternatively, a STATUS ENQUIRY message may be sent requesting the call state of the entity (see 5.8.10). No change in state shall be made in either case at this time. This alternative is not applicable to messages using the global call reference.

However, two exceptions to this procedure exist. The first exception is when the ISDN or the Public CS 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 ISDN receives an unexpected RELEASE message, the ISDN shall disconnect and release the B-channel; clear the ISDN connection and the call to the remote side with the cause in the RELEASE message sent by the Public CS or, if not included, cause No. 31, *normal, unspecified*; return a RELEASE COMPLETE message to the Public CS; release the call reference, stop all timers and enter the Null state. Whenever the Public CS receives an unexpected RELEASE message, the Public CS shall disconnect and release the B-channel; return a RELEASE COMPLETE message to the ISDN; release the call reference; stop all timers, and enter the Null state.

The second exception is when the ISDN or the Public CS receives an unexpected RELEASE COMPLETE message. Whenever the ISDN receives an unexpected RELEASE COMPLETE message, the ISDN shall disconnect and release the B-channel; clear the ISDN connection and the call to the remote side with the cause indicated by the Public CS or, if not included, cause No. 111, *protocol error, unspecified*; release the call reference; stop all timers and enter the Null state. Whenever the Public CS receives an unexpected RELEASE COMPLETE message, the Public CS shall disconnect and release the B-channel; release the call reference; stop all timers, and enter the Null state.

5.8.5 General information element errors

The general information element error procedures may also 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 or non-locking shift procedures as described in 4.5.

5.8.5.1 Information element out of sequence

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

If the ISDN or Public CS 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 ISDN or Public CS 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.

Note : Some implementations may choose to process all the information elements received in a message regardless of the order in which they are placed.

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 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 errors

5.8.6.1 Mandatory information element missing

When a message other than SETUP, DISCONNECT, RELEASE or RELEASE COMPLETE is received which 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 No. 96, *mandatory information element is missing*.

When a SETUP or RELEASE message is received which has one or more mandatory information elements missing, a RELEASE COMPLETE message with cause No. 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 No. 31, *normal, unspecified* was

received (see 5.3), with the exception that the RELEASE message sent on the local interface contains cause No. 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 No. 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 which 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 No. 100, “invalid information element contents”.

When a SETUP or RELEASE message is received which has one or more mandatory information elements with invalid content, a RELEASE COMPLETE message with cause No. 100, “invalid information element contents” shall be returned.

When a DISCONNECT message is received with invalid content of the Cause information element, the actions shall be the same as if a DISCONNECT message with cause No. 31, “normal, unspecified” was received (see 5.3), with the exception that the RELEASE message sent on the local interface contains cause No. 100, “invalid information element contents”.

When a RELEASE COMPLETE message is received with invalid content of the Cause information element, it will be assumed that a RELEASE COMPLETE message was received with cause No. 31, “normal, unspecified”.

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

Note : As an option of the the Public CS , cause values, location codes, and diagnostics which are not understood by the Public CS may be passed on to another entity instead of treating the cause value as if it were cause No. 31, *normal, unspecified* and sending cause No. 100, *invalid information element contents* with the RELEASE message. This option is intended to aid Public CS equipment to be compatible with future additions of cause values, location codes and diagnostics to the Recommendation.

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 element

When a message is received which has one or more unrecognized information elements, the receiving entity shall check whether any are encoded to indicate “comprehension required” (refer to Table 4-3/Q.931 for information element identifiers reserved with this meaning). If any unrecognized information element 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. 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 which are recognized and have valid content. When the received message is other than DISCONNECT, RELEASE or RELEASE COMPLETE, a STATUS message may be returned containing one cause information element. The STATUS message indicates the call state of the receiver after taking action on the message. The Cause information element shall contain cause No. 99, “information element non-existent or not implemented”, and the diagnostic field, if present, shall contain the information element identifier for each information element which was unrecognized.

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

a) When a DISCONNECT message is received which has one or more unrecognized information elements, a RELEASE message with cause No. 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 which was unrecognized.

b) When a RELEASE message is received which has one or more unrecognized information elements, a RELEASE COMPLETE message with cause No. 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 which was unrecognized.

c) When a RELEASE COMPLETE message is received which has one or more unrecognized information elements, no action shall be taken on the unrecognized information.

Note : The diagnostic(s) of cause No. 99 facilitates the decision in selecting an appropriate recovery procedure at the reception of a STATUS message. Therefore, it is recommended to provide cause No. 99 with diagnostic(s) if a layer 3 entity expects the peer to take an 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 which has one or more non-mandatory information elements with invalid content, action shall be taken on the message and those information elements which are recognized and have valid content. A STATUS message may be returned containing one Cause information element. The STATUS message indicates the call state of the receiver after taking action on the message. The Cause information element shall contain cause No. 100 “invalid information element contents”, and the diagnostic field, if present, shall contain the information element identifier for each information element which has invalid contents.

Information elements with a length exceeding the maximum length (given in 3) will be treated as an information element with content error. But for access information elements (e.g. Public CS-Public CS information element, Called party subaddress information element), cause No. 43, “access

information discarded" is used instead of cause No. 100 "invalid information element contents". However, in some ISDNs, access information elements may be truncated and processed.

Note : As an option of the Public CS, cause values, location codes, and diagnostics which are not understood by the Public CS may be accepted, or in the case of Public CS, passed on to another entity (e.g. PS) instead of ignoring the cause information element contents and optionally sending a STATUS message with cause No. 100, *invalid information element contents*. This option is intended to aid Public CS equipment to be compatible with future additions of cause values, location codes and diagnostics to the Recommendation.

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 defined 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 defined to be contained in that message, the receiving entity shall follow the procedures of 5.8.6.1.

Note : Some implementations may chose 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 Q.931 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 disestablishment phase (states N11, N12, N19, N22, C11, C12 and C19), no action shall be taken.

b) Calls in the establishment phase (states N1, N3, N4, N6, N7, N8, N9, C1, C3, C4, C6, C7, C8 and C9) and in the Active, Suspend Request, and Resume Request states shall be maintained according to the procedures contained in other parts of 5.

5.8.9 Data link failure

Whenever the ISDN layer 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 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 Q.931 entity shall request layer 2 reestablishment by sending a DL-ESTABLISH request primitive.
When informed of layer 2 re-establishment by means of the DL-ESTABLISH confirmation primitive, the following procedure shall apply:

the Q.931 entity shall stop timer T309, and either:

- the Q.931 entity shall send a STATUS message with cause No. 31, *normal, unspecified* to report the current state to the peer entity; or

- the Q.931 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 ISDN shall clear the ISDN connection and call to the remote side with cause No. 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 Public CS shall clear the attached connection (if any) with cause No. 27, *destination out of order*; disconnect and release the B-channel; release the call reference, and enter the Null state.

The implementation of timer T309 in the Public CS side is optional and in the ISDN side is mandatory.

When a Q.931 entity internally clears the call as a result of data link failure, as an option, it may request the restablishment of the data link in order to attempt to send a DISCONNECT message accross 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 No. 30, *response to STATUS ENQUIRY* or No. 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 No. 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 No. 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 No. 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 subclause 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 the STATUS ENQUIRY message is retransmitted as an implementation dependent value. The call shall be cleared to the local interface with cause No. 41, *temporary failure*, if the STATUS ENQUIRY is retransmitted the maximum number of times. If appropriate, the ISDN shall also clear the ISDN connection, using cause No. 41, *temporary failure*.

5.8.11 Receiving a STATUS message

On receipt of a STATUS message reporting an incompatible state, the receiving entity shall

a) clear the call by sending the appropriate clearing message with cause No. 101, *message not compatible with call state*; or

b) take other actions which attempt to cover from a mismatch and which are an implementation option.

Except for the following rules, the determination of which states are incompatible is left as an implementation decision:

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

    1) send a RELEASE message with cause No. 101, *message not compatible with call state*, and then follow the procedures of 5.3; or

    2) send a RELEASE COMPLETE message with cause No. 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 indicating 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:

i) No. 96 - *Mandatory information element is missing*;
ii) No. 97 - *Message type non-existing or not implemented*;
iii) No. 99 - *Information element non-existent or not implemented*; or
iv) No. 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 the global call reference and reporting an incompatible state in the restart request or restart state, the receiving Q.931 entity shall inform layer management and take no further action on this message.

When in the Null state, then on receipt of a STATUS message with the global call reference no action shall be taken.

Note : Further actions as a result of higher layer activity (e.g. system or layer management) and 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 an implementation option.

5.9 Public CS notification procedure

This procedure allows the ISDN to notify a Public CS of any appropriate call-related event during the active state of a call by sending a NOTIFY message containing a notify indicator to the ISDN; upon receipt of this message, the ISDN must send a NOTIFY message containing the same notify indicator to the other Public CS involved in the call. No state change occurs at any of the interface sides following the sending or the receipt of this message.

5.10 Basic telecommunication service identification and selection *†}

5.11 Signalling procedures for bearer capability selection *†}

5.12 Signalling procedures for high layer compatibility selection *†}

6. Packet communication procedures *

7. User signalling bearer service call control procedures *

8. Circuit-mode multirate (64 kbit/s base rate) procedures *

9. List of system parameters

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.

9.1 Timers in the ISDN side

The timers specified in Table 9-1 are maintained in the ISDN side of the interface.

9.2 Timers in the Public CS side

The timers specified in Table 9-2 are maintained in the Public CS side of the interface. Timers T305, T308 and T313 are mandatory for all Public CS side implementations.

Table 9-1/ B-IF2.02(Q.931)
Timers in the ISDN side

Timer number	Defaut 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		(Note 2)
T303	4~5 s (Note 1)	Call present	SETUP sent	CALL PROC received	Retransmit SETUP; restart T303. If REL COMPLETE has been received, clear the call	Clear ISDN connection. Enter call abort state	Mandatory
T305	30 s	Disconnect indication	DISC without progress indicator No. 8 sent	REL or DISC received	ISDN sends REL	Timer is not restarted	Mandatory

Table 9-1/ B-IF2.02(Q.931) *(continued)*
Timers in the ISDN side

Timer number	Defaut time-out value	State of call	Cause for start	Normal stop	At the first expiry	At the second expiry	Cross-reference
T306	30 s (Note 5)	Disconnect indication	DISC with progress indicator No. 8 sent	REL or DISC received	Stop the tone/announcement. Send REL	Timer is not restarted	Mandatory when inband tones/announce-ments are provided; see 5.4, 5.3.4.1, and Rec. I.300-Series
T308	4 s (Note 1)	Release request	REL sent	REL COMPLETE or REL received	Retransmit REL and restart T308	Place B-channel in maintenance condition Release call reference (Note 6)	Mandatory
T309	90 s	Any stable state	Data link disconnection. Calls in stable states are not lost	Data link reconnected	Clear ISDN connection. Release B-channel and call reference	Timer is not restarted	Mandatory
T310	10 s (Note 7)	Incoming Call Proceeding	CALL PROC received	ALERT, CONNECT or DISC received. If DISC, retain cause and continue timing	Clear call in accordance with 5.2.5.3	Timer is not restarted	Mandatory

Table 9-1/ B-IF2.02(Q.931) (continued)
Timers in the ISDN side

Timer number	Defaut time-out value	State of call	Cause for start	Normal stop	At the first expiry	At the second expiry	Cross-reference
T312	T303 + 2 s	Call Present, Call Abort, etc.	SETUP sent or resent	Timeout	(Note 4)	Timer is not restarted	Mandatory
T314	4 s	Receiving segmented message	Message segment received	Last message segment received	Discard message	Timer is not restarted	Mandatory see Annex H
T316	2 min	Restart request	RESTART sent	RESTART ACK 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

Table 9-1/ B-IF2.02(Q.931) *(end)*
Timers in the ISDN side

Timer number	Defaut time-out value	State of call	Cause for start	Normal stop	At the first expiry	At the second expiry	Cross-reference
T322	4 s	Any all state	STATUS ENQ sent	STATUS DISC REL or REL COMPLETE received	STATUS ENQ may be retransmitted several times	STATUS ENQ may be retransmitted several times	Mandatory when 5.8.10 is implemented

Note 1: This default value assumes the use of 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 for further study.
Note 2: The ISDN 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.
Note 3: The value of this timer is implementation dependent but should be less than the value of T316.
Note 4: If in the call abort state, the call reference is released. Otherwise, no action is taken on expiry of timer T312.
Note 5: The value of timer T306 may depend on the length of the announcement.
Note 6: The restart procedures contained in 5.5 may be used on B-channels in the maintenance condition.

Table 9-2/ B-IF2.02(Q.931)
Timers in the Public CS side

Timer number	Defaut 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	
T303	4 s (Note 1)	Call Initiated	SETUP sent	CALL PROC or REL COMPLETE received	Retransmit SETUP; restart T303. If REL COMPLETE was received, clear the call	Clear internal connection. Send REL COMPLETE. Enter Null state	
T305	30 s	Disconnect Request	DISC sent	REL or DISC received	REL sent	Timer is not restarted	Mandatory

Table 9-2/ B-IF2.02(Q.931) *(continued)*
Timers in the Public CS side

Timer number	Defaut time-out value	State of call	Cause for start	Normal stop	At the first expiry	At the second expiry	Cross-reference
T308	4 s (Note 1)	Release request	REL sent	REL COMPLETE or REL received	Retransmit REL; and restart T308.	B-channel is placed in maintenance condition. Call reference released (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
T310 (Note 4)	30-120 s	Outgoing Call Proceeding	CALL PROC received	ALERT, CONNECT, DISC, or PROGRESS received	Send DISC	Timer is not restarted	
T313	4 s (Note 1)	Connect request	CONNECT sent	CONNECT ACK received	Send DISC	Timer is not restarted	Mandatory
T314	4 s	Receiving Segmented Message	Message segment received	Last message segment received	Discard message	Timer is not restarted	Refer to Annex H Mandatory
T316	2 min	Restart Request	RESTART sent	RESTART ACK 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 reference	Maintenance notification	Timer is not restarted	Mandatory when 5.5 is implemented

Table 9-2/B-IF2.02(Q.931) *(end)*
Timers in the Public CS side

Timer number	Defaut time-out value	State of call	Cause for start	Normal stop	At the first expiry	At the second expiry	Cross-reference
T322	4 s	Any call state	STATUS ENQ sent	STATUS, DISC, REL, REL COMPLETE received	STATUS ENQ may be retransmitted several times	STATUS ENQ may be retransmitted several times	Mandatory when 5.8.10 is implemented

Note 1: This default value assumes the use of default values at layer 2, i.e. [N200 + 1] times T200. Whether these values should be modified when layer 2 default values are odified by an automatic negotiation procedure is for further study.
Note 2: The value of this timer is implementation dependent, but should be less than the value of T316.
Note 3: The Public CS 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.
Note 4: T310 is not started if progress indicator 1 or 2 has been delivered in the CALL PROCEEDING message or in a previous PROGRESS message.
Note 5: The restart procedures contained in 5.5 may be used on B-channels in the maintenance conditions.

Annex A

Public CS side and ISDN side SDL diagrams

(This annex forms an integral part of this specification)

This annex includes overview and detailed SDL diagrams which show Q.931 protocol control for circuits-switched basic calls. In the event of conflict berween 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.

Figure A.1 shows key to Q.931 protocol control SDL diagrams for both public cell station side and ISDN side.

Figures A.2 and A.3 show overview and detailed protocol control SDL diagrams for the public cell station side.

Figures A.5 and A.6 show overview and detailed protocol control SDL diagrams for ISDN side.

Figure A.4 shows detailed SDL diagrams for the global call reference to be applied to both public cell station and ISDN sides. Although Figure A.4 shows SDL diagrams in the public cell station-side only, the same diagrams can be applied to the ISDN side by just changing the direction of input and output symbols.

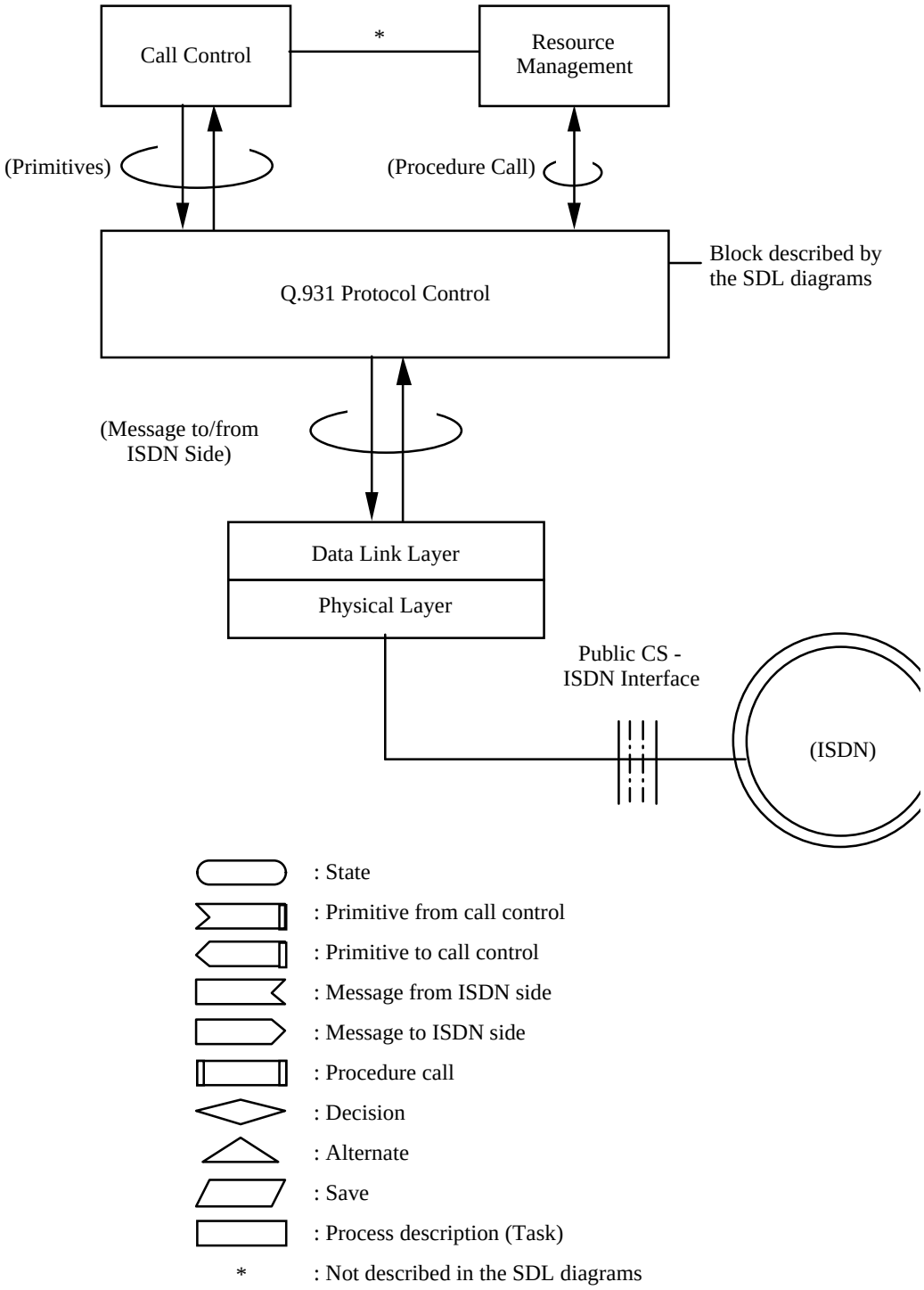


Figure A.1 / B-IF2.02(Q.931) (1/2)

Key to Q.931 protocol control SDL diagrams (Public CS side)

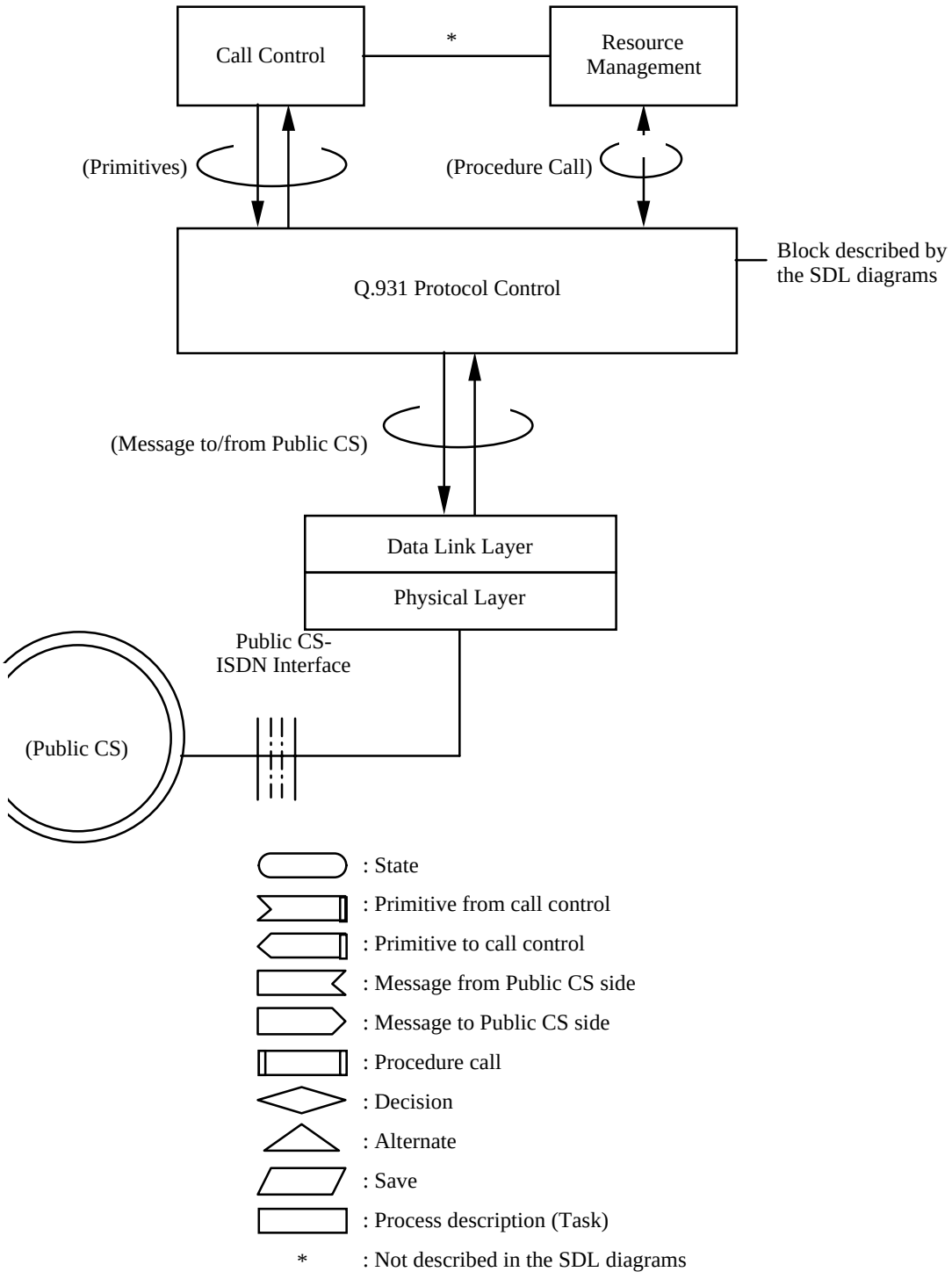
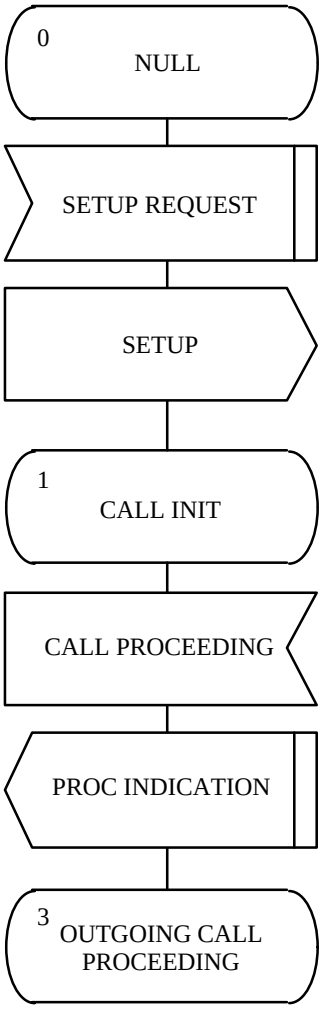


Figure A.1 / B-IF2.02 (Q.931) (2/2)

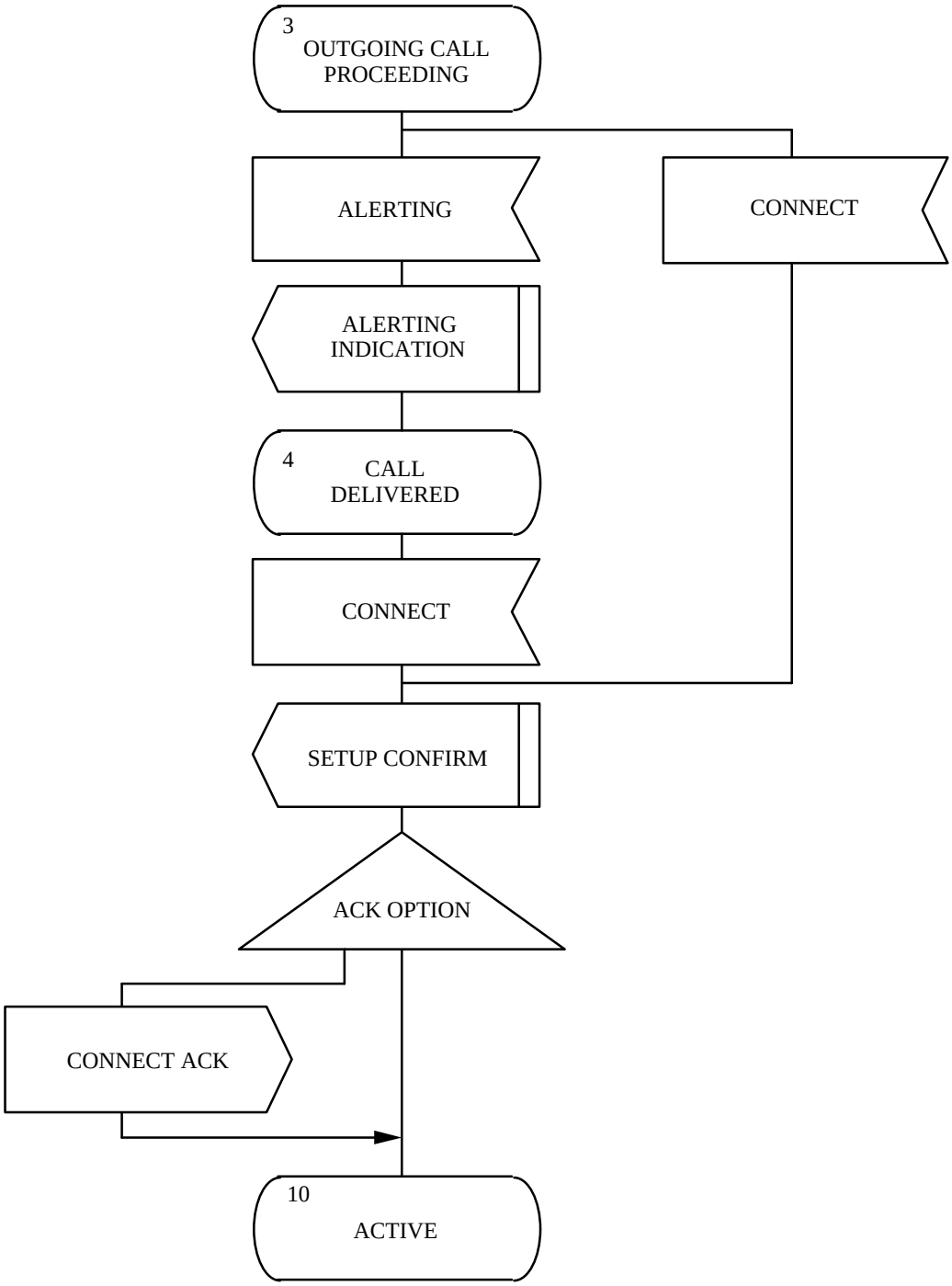
Key to Q.931 protocol control SDL diagrams (ISDN side)



a) Outgoing set-up procedure (1/2)

Figure A.2 / B-IF2.02 (Q.931) (1/8)

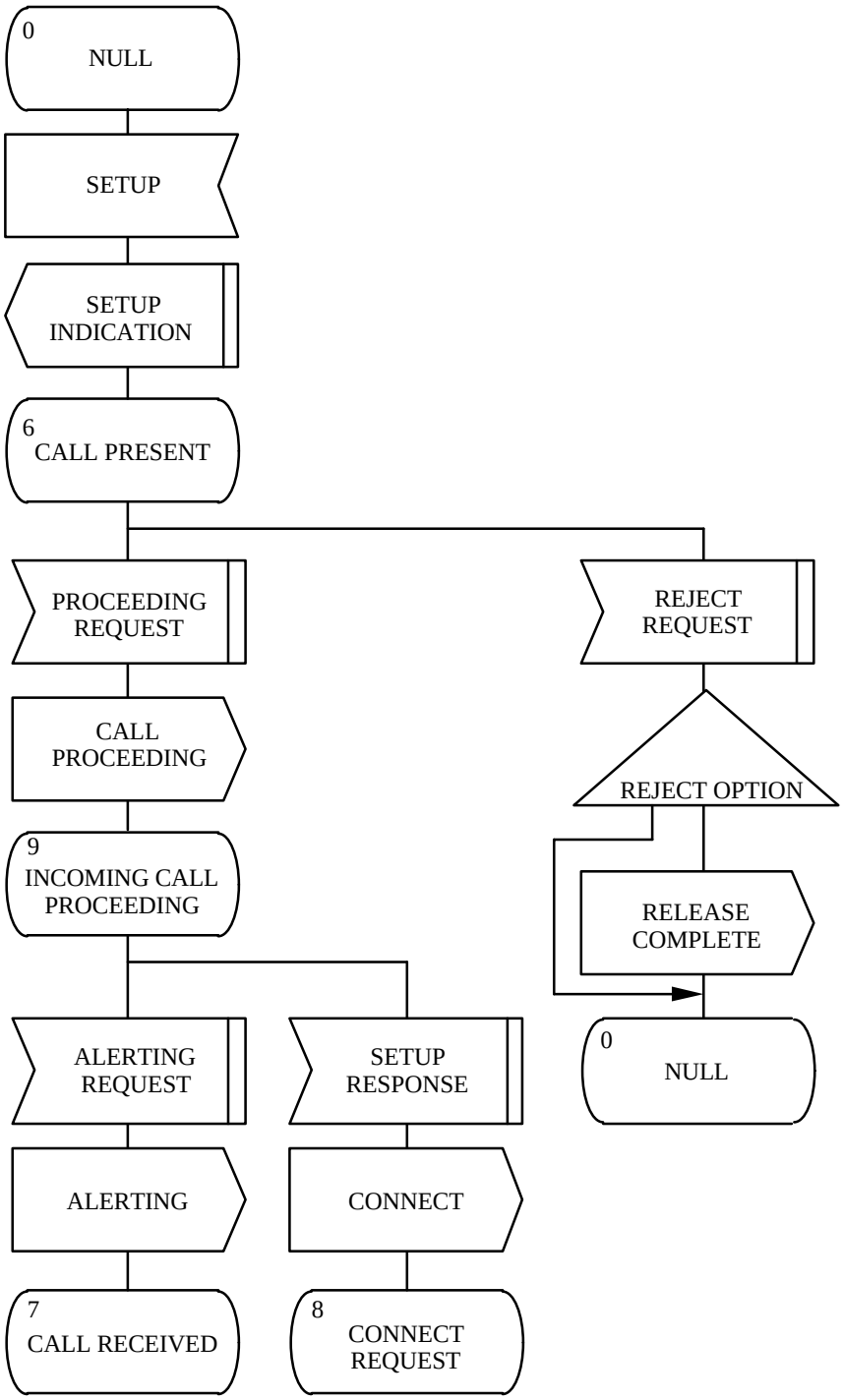
Overview protocol control (public CS side)



a) Outgoing set-up procedure (2/2)

Figure A.2 / B-IF2.02 (Q.931) (2/8)

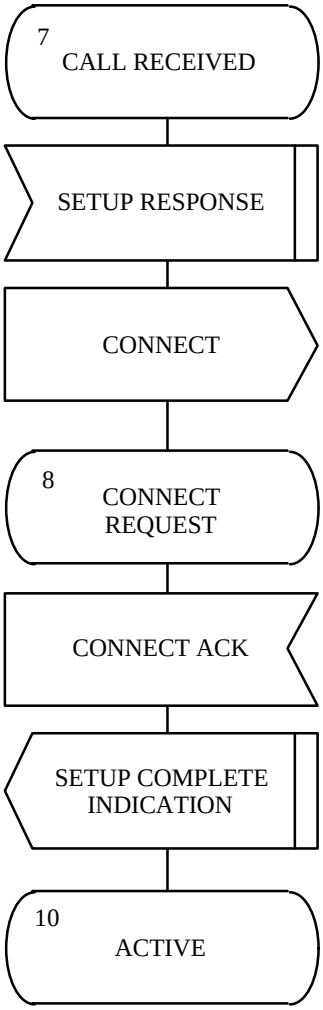
Overview protocol control (public CS side)



b) Incoming set-up procedure (1/2)

Figure A.2 / B-IF2.02 (Q.931) (3/8)

Overview protocol control (public CS side)



b) Incoming set-up procedure (2/2)

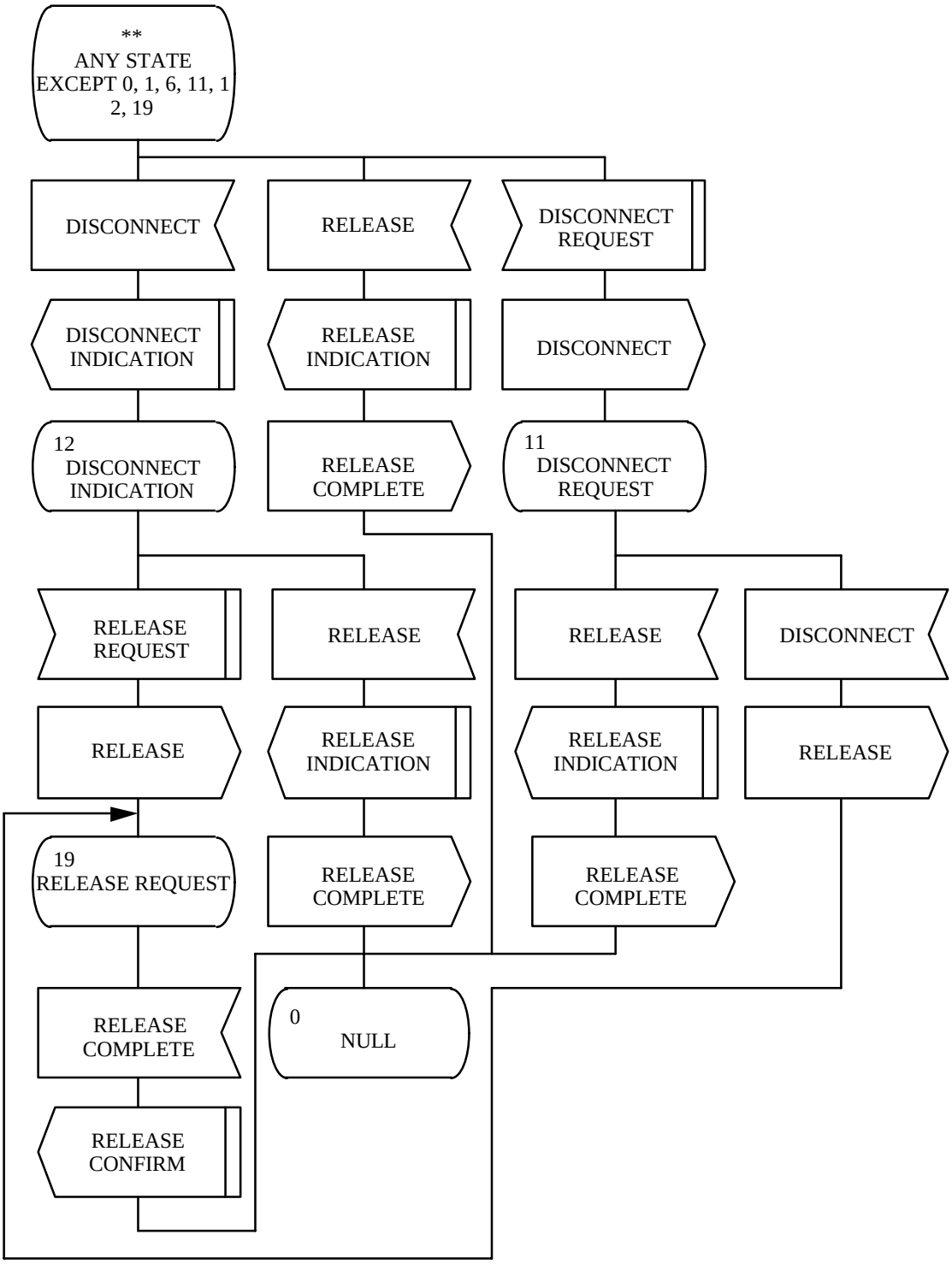
Figure A.2 / B-IF2.02 (Q.931) (4/8)

Overview protocol control (public CS side)

c) Overlap receiving procedure

Figure A.2 / B-IF2.02 (Q.931) (5/8)

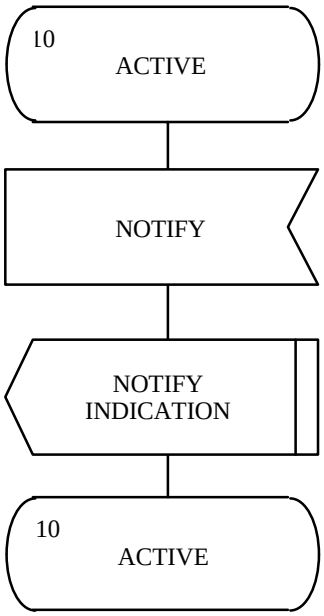
Overview protocol control (public CS side)



d) Clearing procedure

Figure A.2 / B-IF2.02 (Q.931) (6/8)

Overview protocol control (public CS side)



e) Suspend procedure

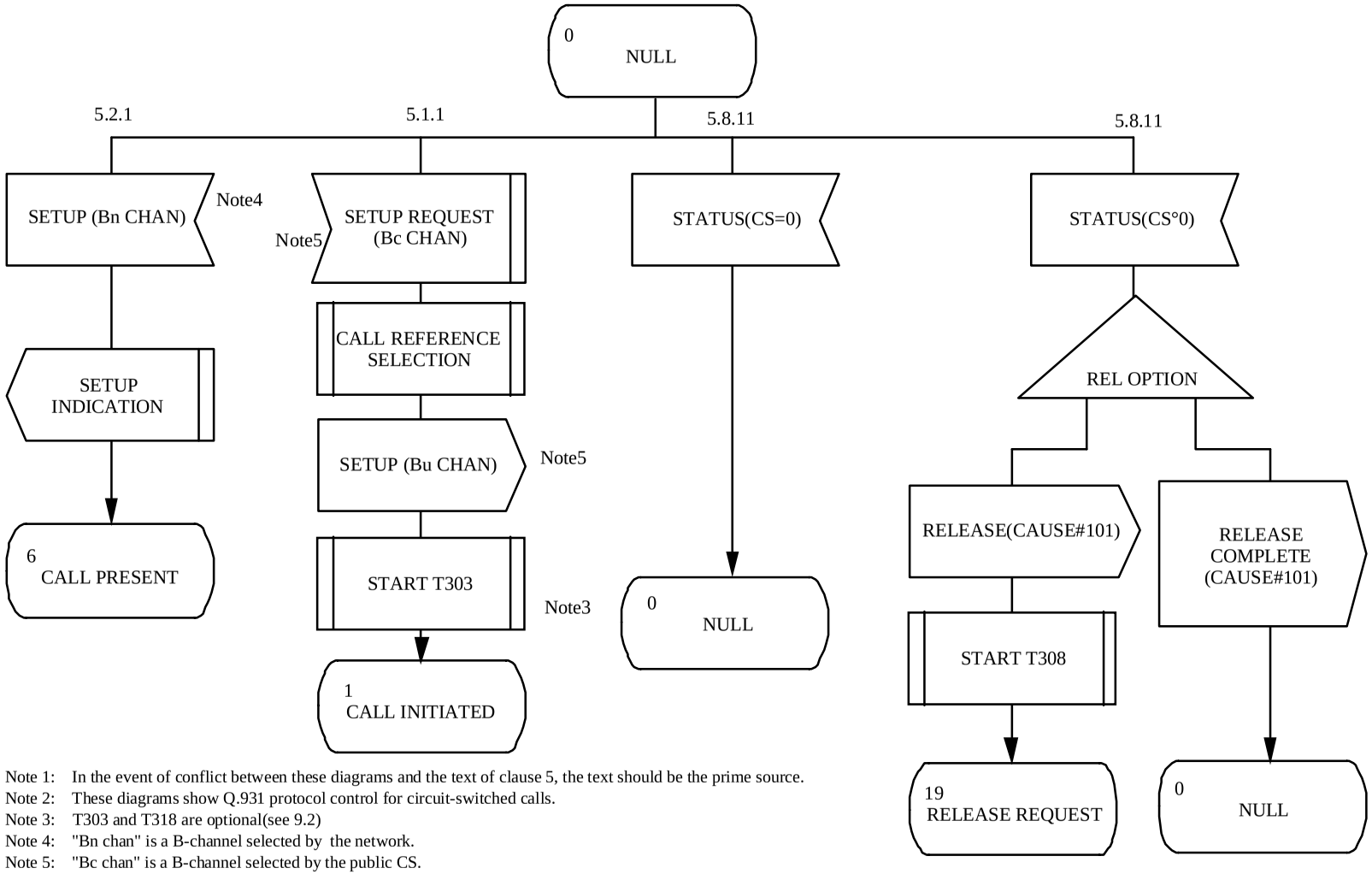
Figure A.2 / B-IF2.02 (Q.931) (7/8)

Overview protocol control (public CS side)

f) Resume procedure

Figure A.2 / B-IF2.02 (Q.931) (8/8)

Overview protocol control (public CS side)



Note 1: In the event of conflict between these diagrams and the text of clause 5, the text should be the prime source.
Note 2: These diagrams show Q.931 protocol control for circuit-switched calls.
Note 3: T303 and T318 are optional(see 9.2)
Note 4: "Bn chan" is a B-channel selected by the network.
Note 5: "Bc chan" is a B-channel selected by the public CS.

Figure A.3 / B-IF2.02 (Q.931) (1/24)

Detailed protocol contro l (public CS side)

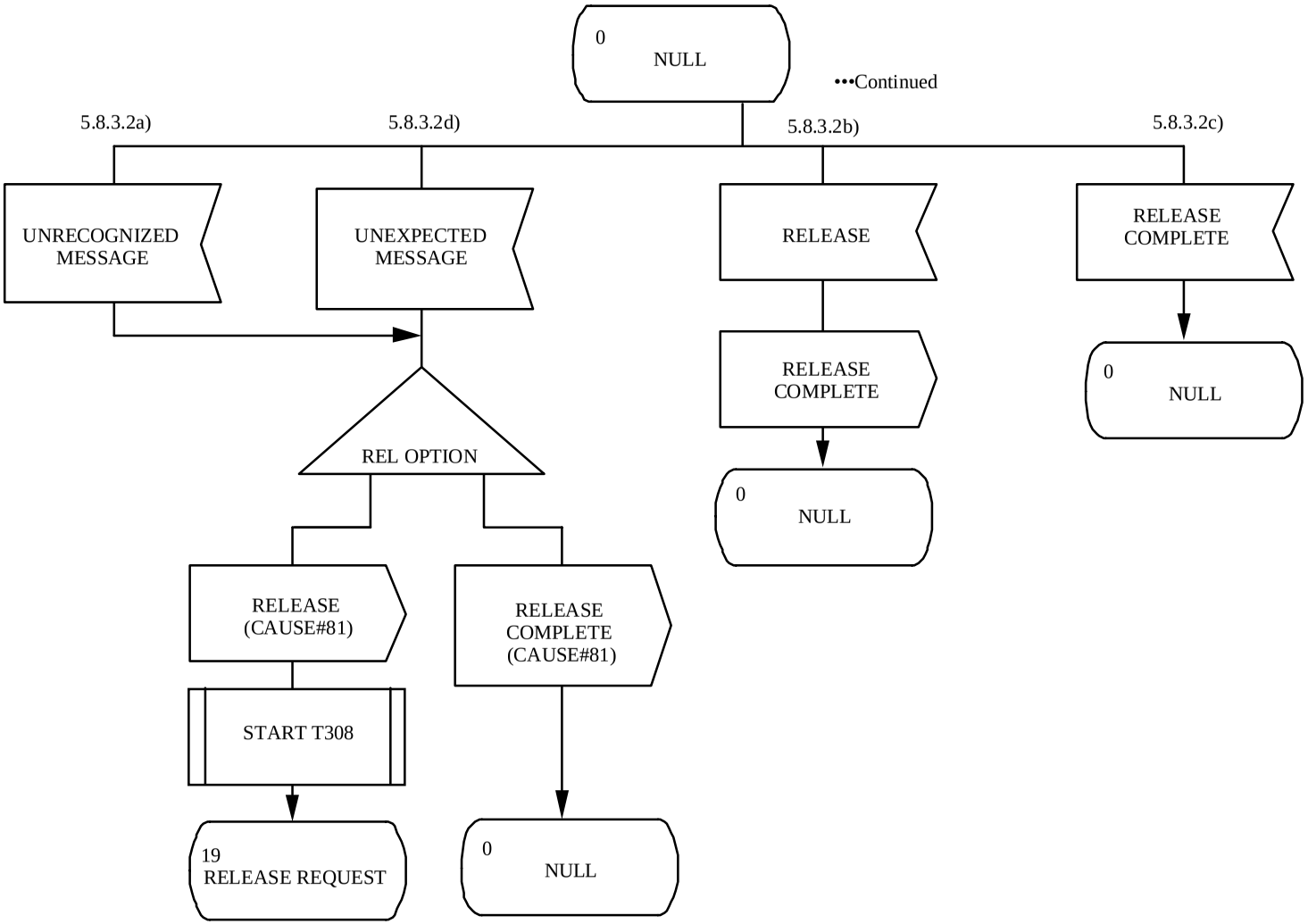
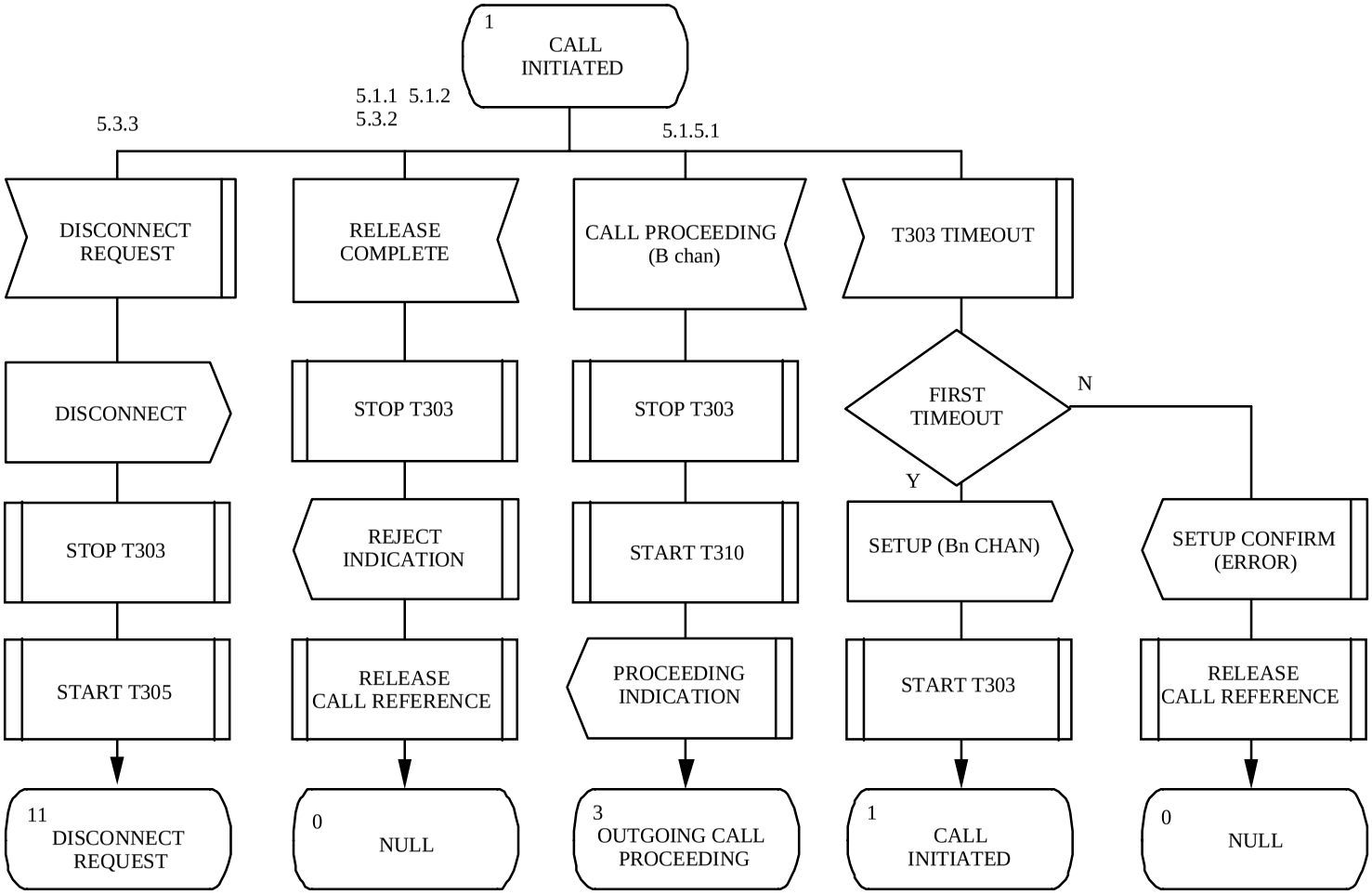


Figure A.3 / B-IF2.02 (Q.931) (2/24)

Detailed protocol control (public CS side)



Note 1: T303,T310 are optional(see 9.2)
Note 2: "B chan" is a B-channel negotiated by the digital network and the public CS

Figure A.3 / B-IF2.02 (Q.931) (3/24)

Detailed protocol control (public CS side)

Figure A.3 / B-IF2.02 (Q.931) (4/24)

Detailed protocol control (public CS side)

Figure A.3 / B-IF2.02 (Q.931) (5/24)

Detailed protocol control (public CS side)

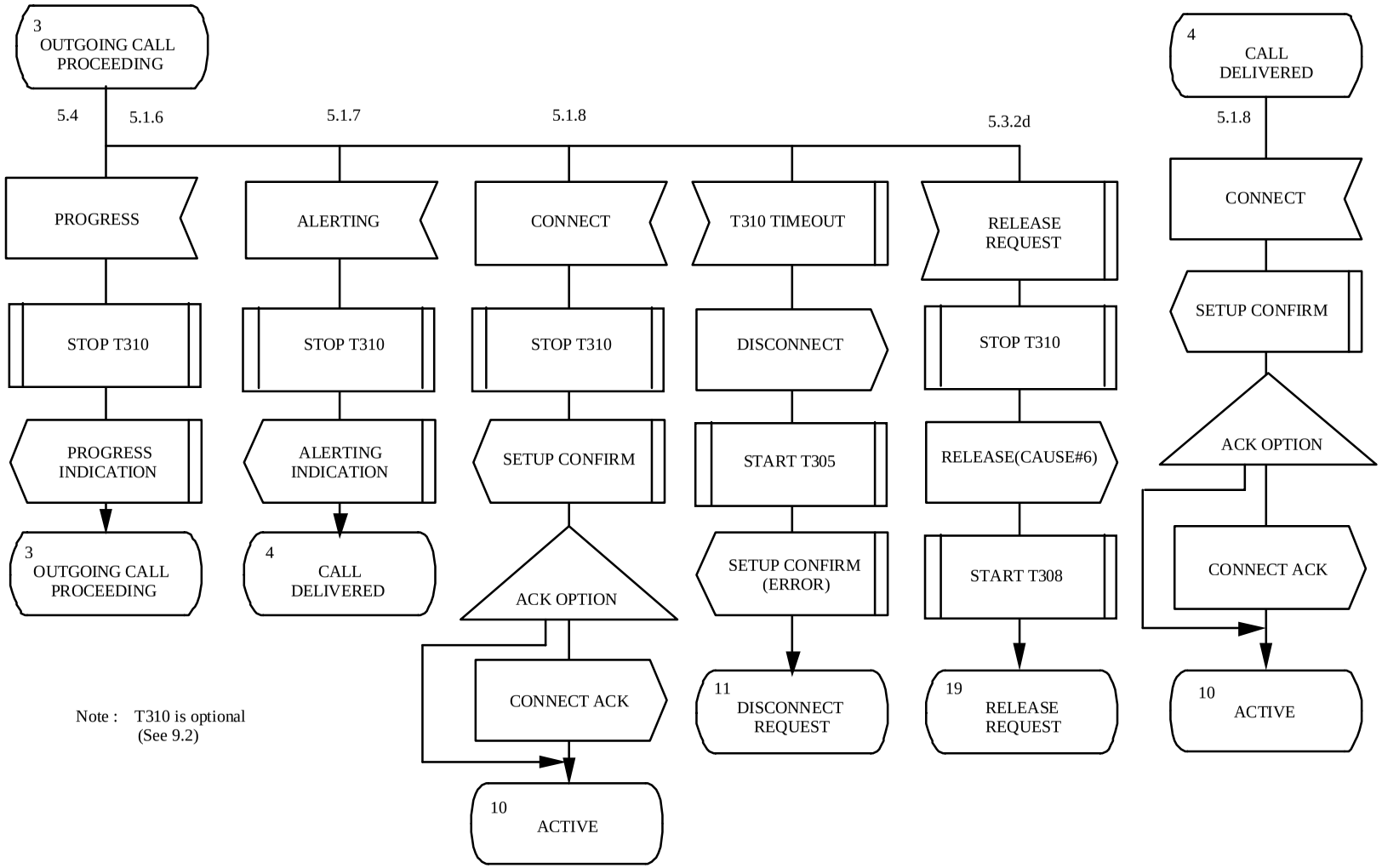
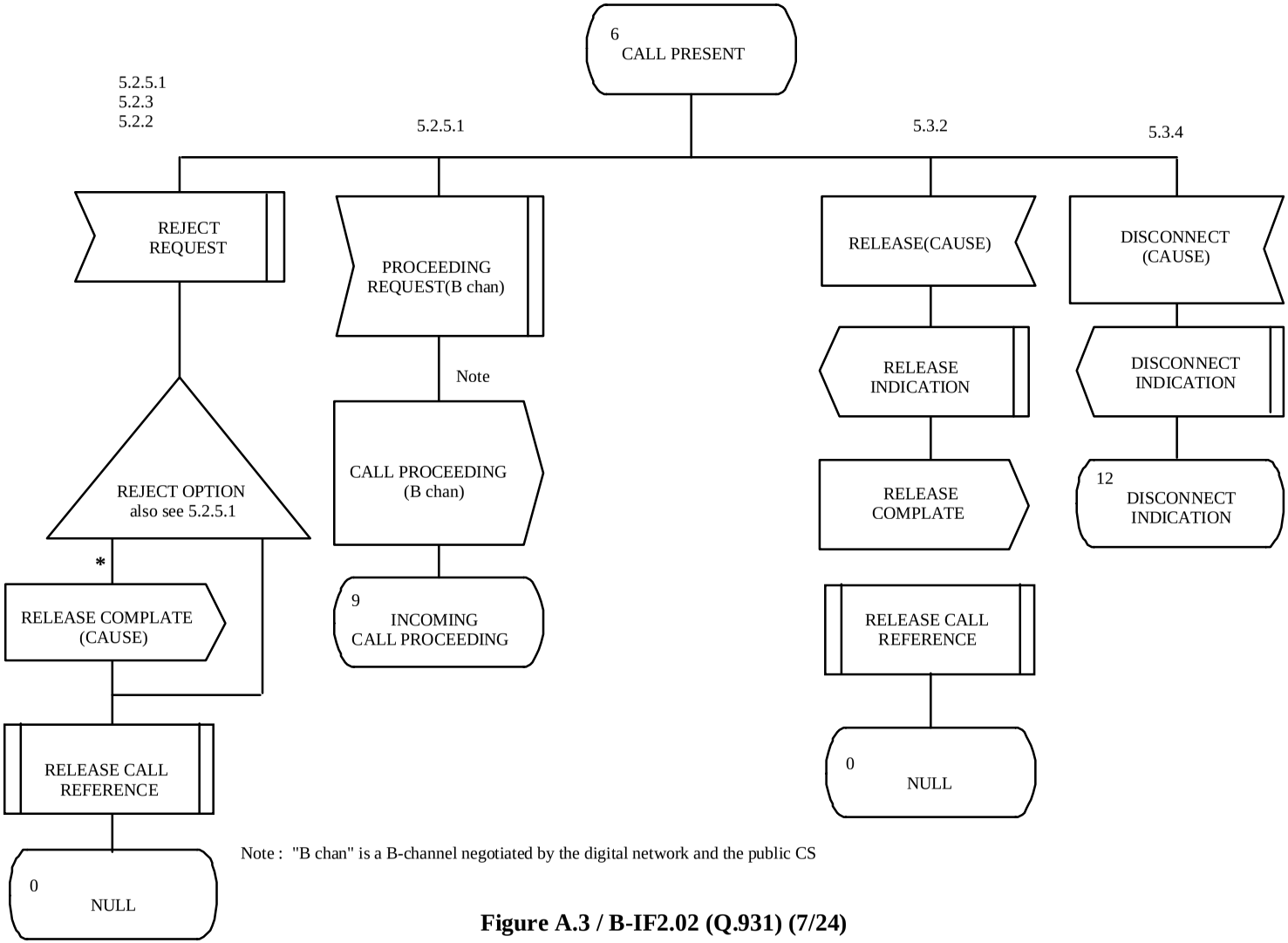


Figure A.3/B-IF2.02 (Q.931) (6/24)

Detailed protocol control (public CS side)



Note : "B chan" is a B-channel negotiated by the digital network and the public CS

Figure A.3 / B-IF2.02 (Q.931) (7/24)

Detailed protocol control (public CS side)

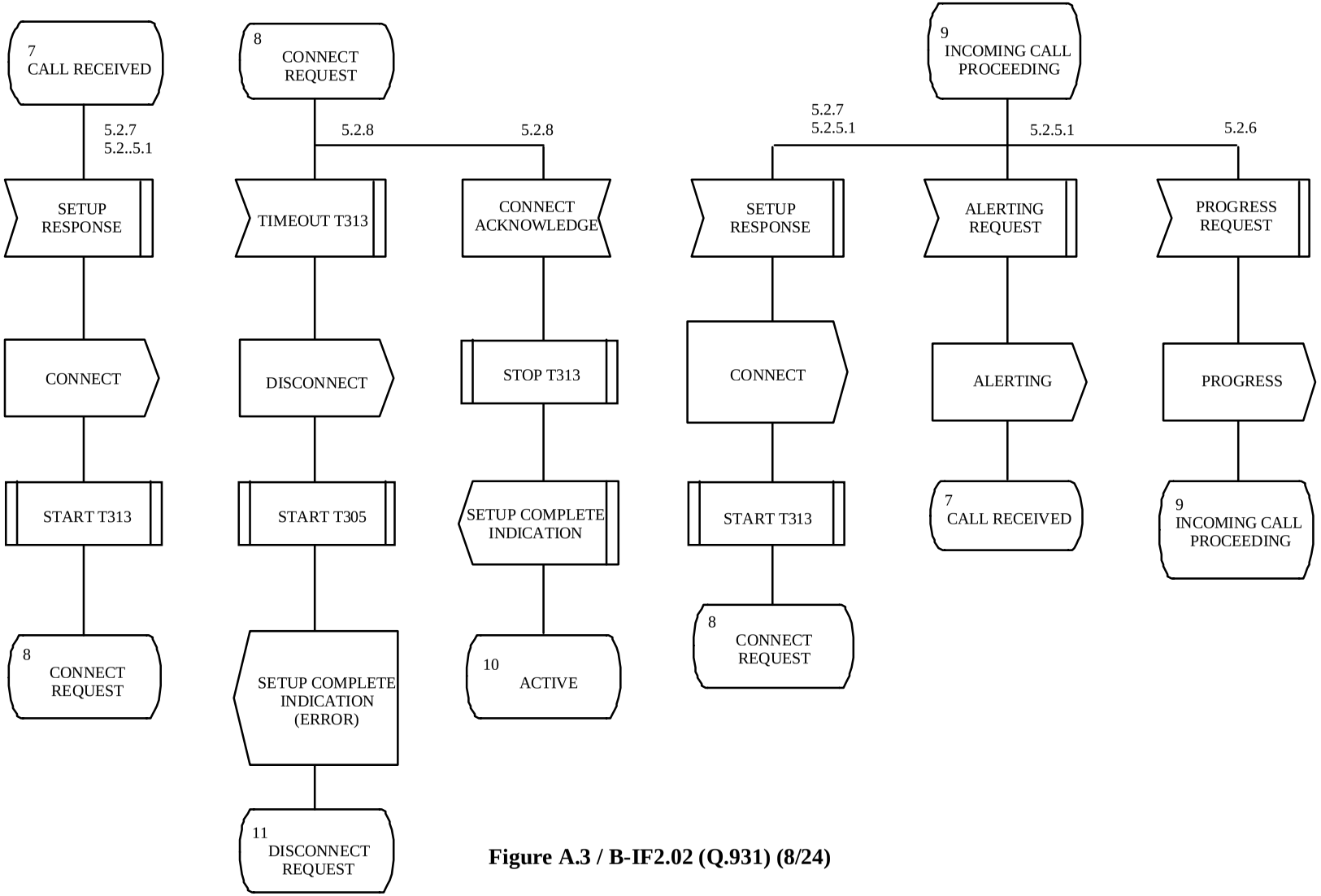


Figure A.3 / B-IF2.02 (Q.931) (8/24)

Detailed protocol control (public CS side)

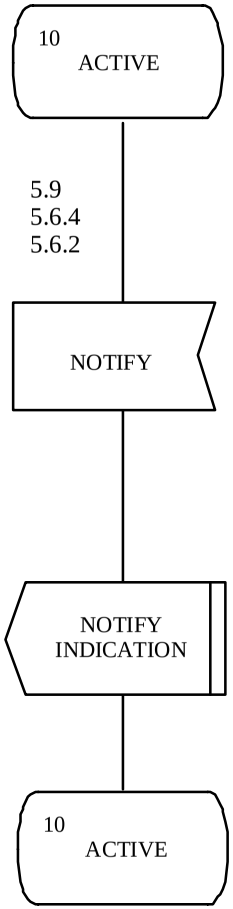


Figure A.3/B-IF2.02(Q.931)(9/24)

Detailed protocol control(public CS side)

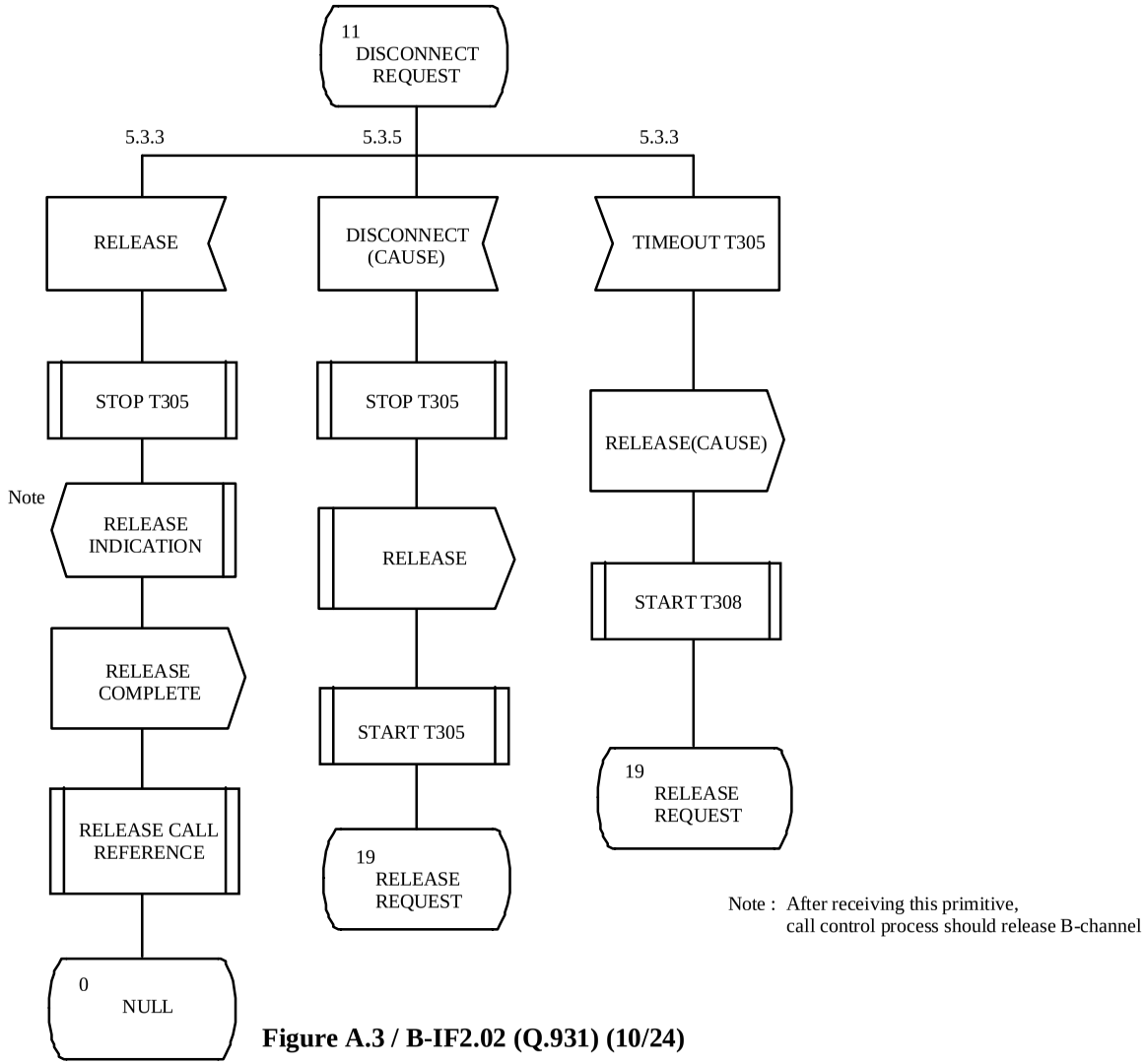


Figure A.3 / B-IF2.02 (Q.931) (10/24)

Detailed protocol control (public CS side)

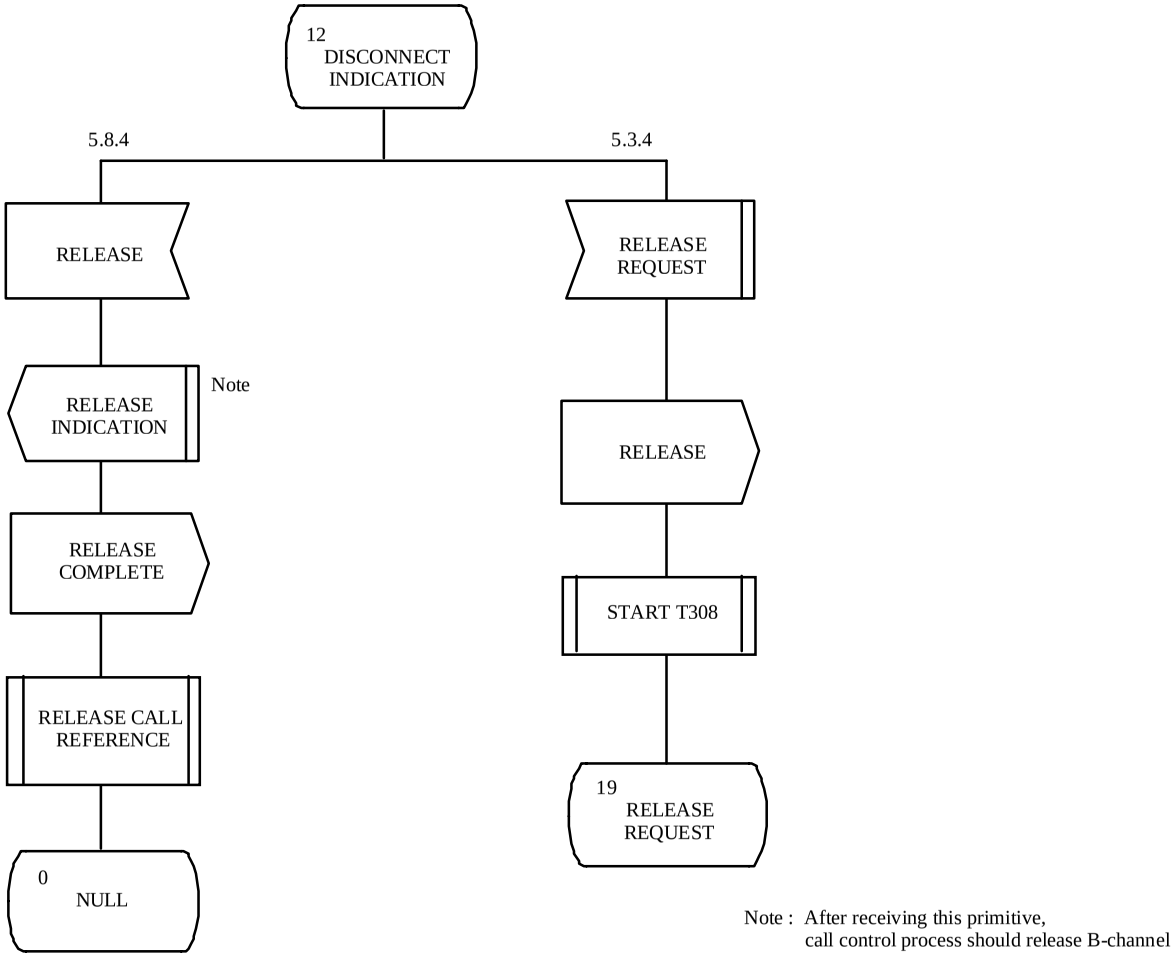


Figure A.3 / B-IF2.02 (Q.931) (11/24)

Detailed protocol control (public CS side)

Figure A.3 / B-IF2.02 (Q.931) (12/24)

Detailed protocol control (public CS side)

Figure A.3 / B-IF2.02 (Q.931) (13/24)

Detailed protocol control (public CS side)

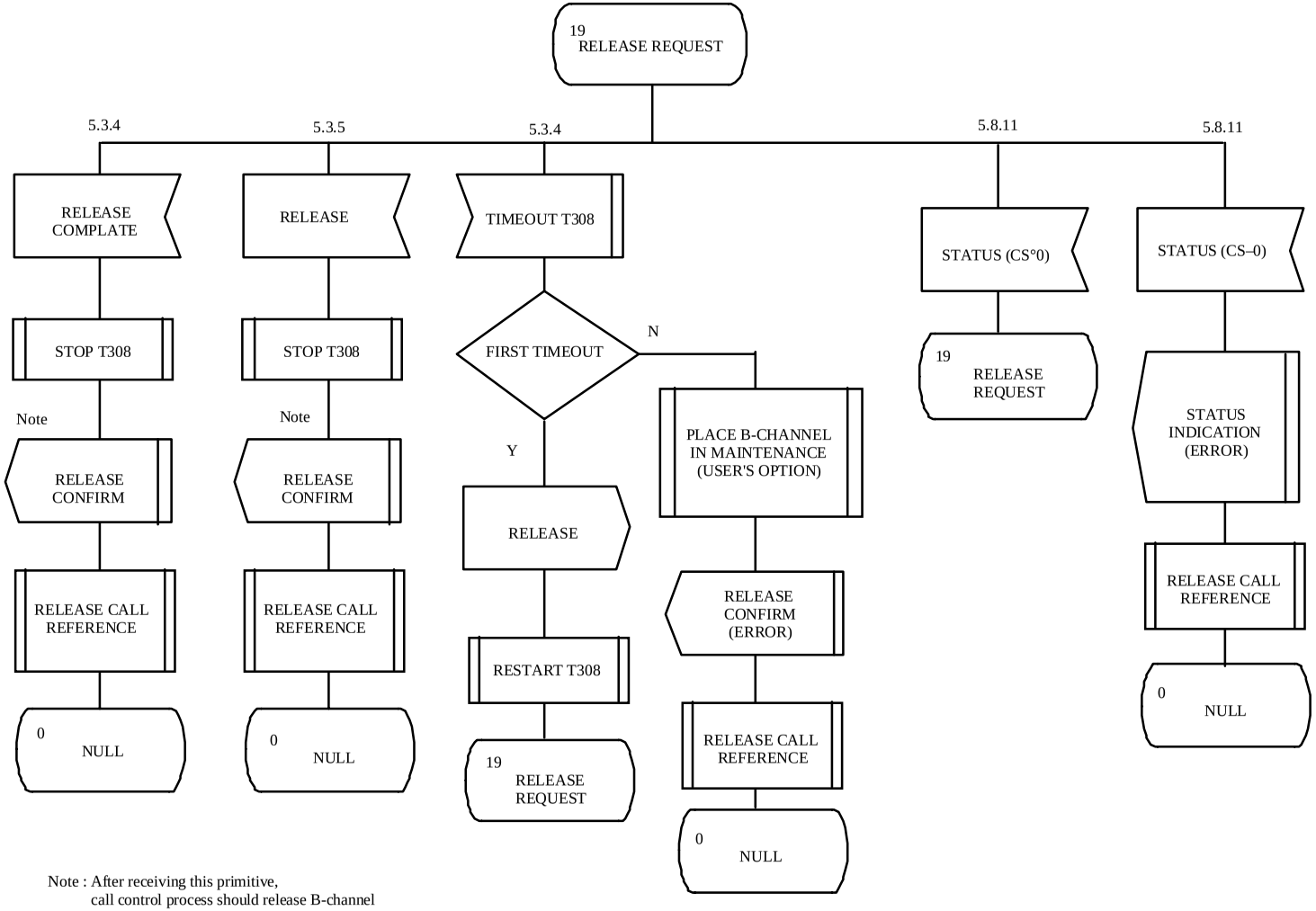
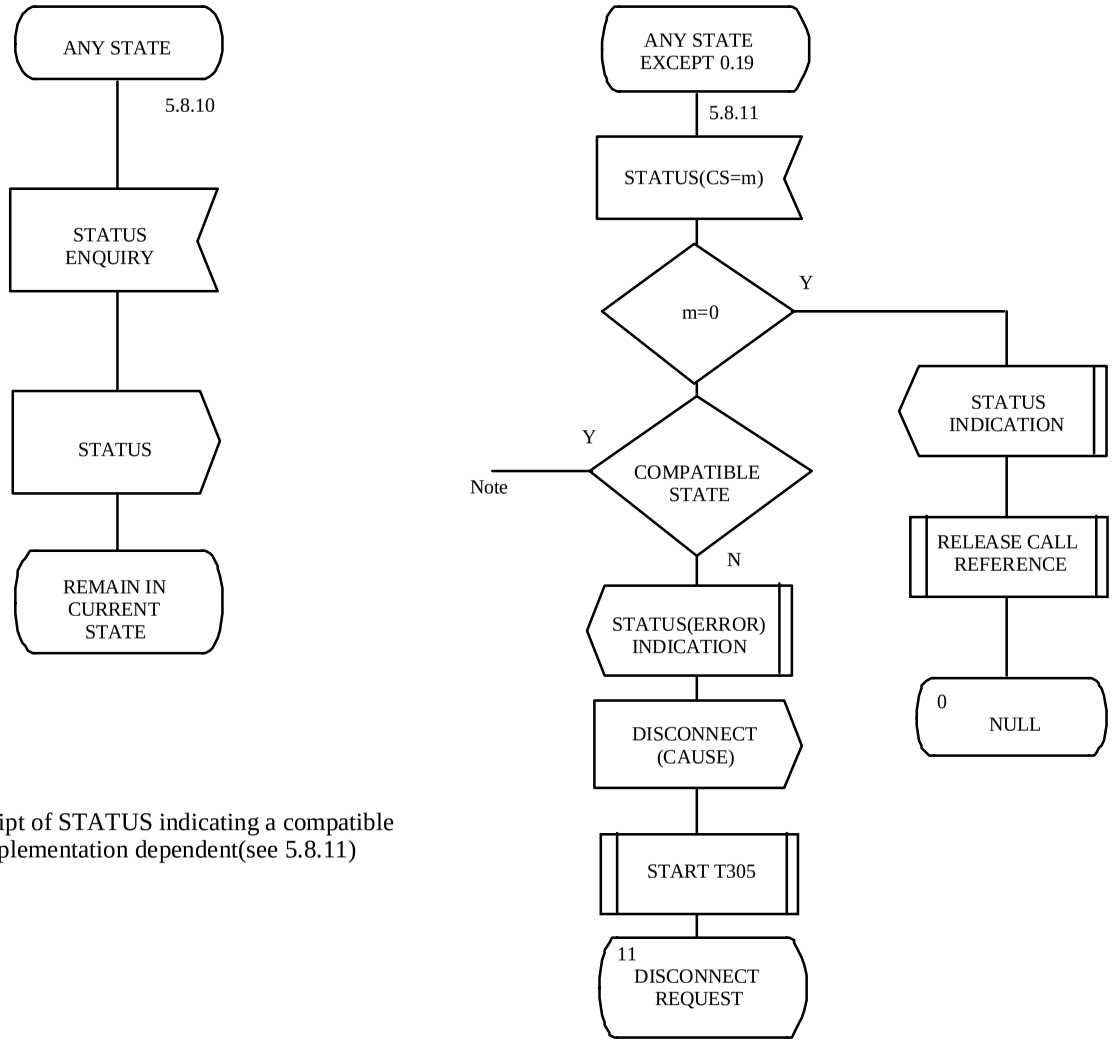


Figure A.3 / B-IF2.02 (Q.931) (14/24)

Detailed protocol control (public CS side)

Figure A.3 / B-IF2.02 (Q.931) (15/24)

Detailed protocol control (public CS side)



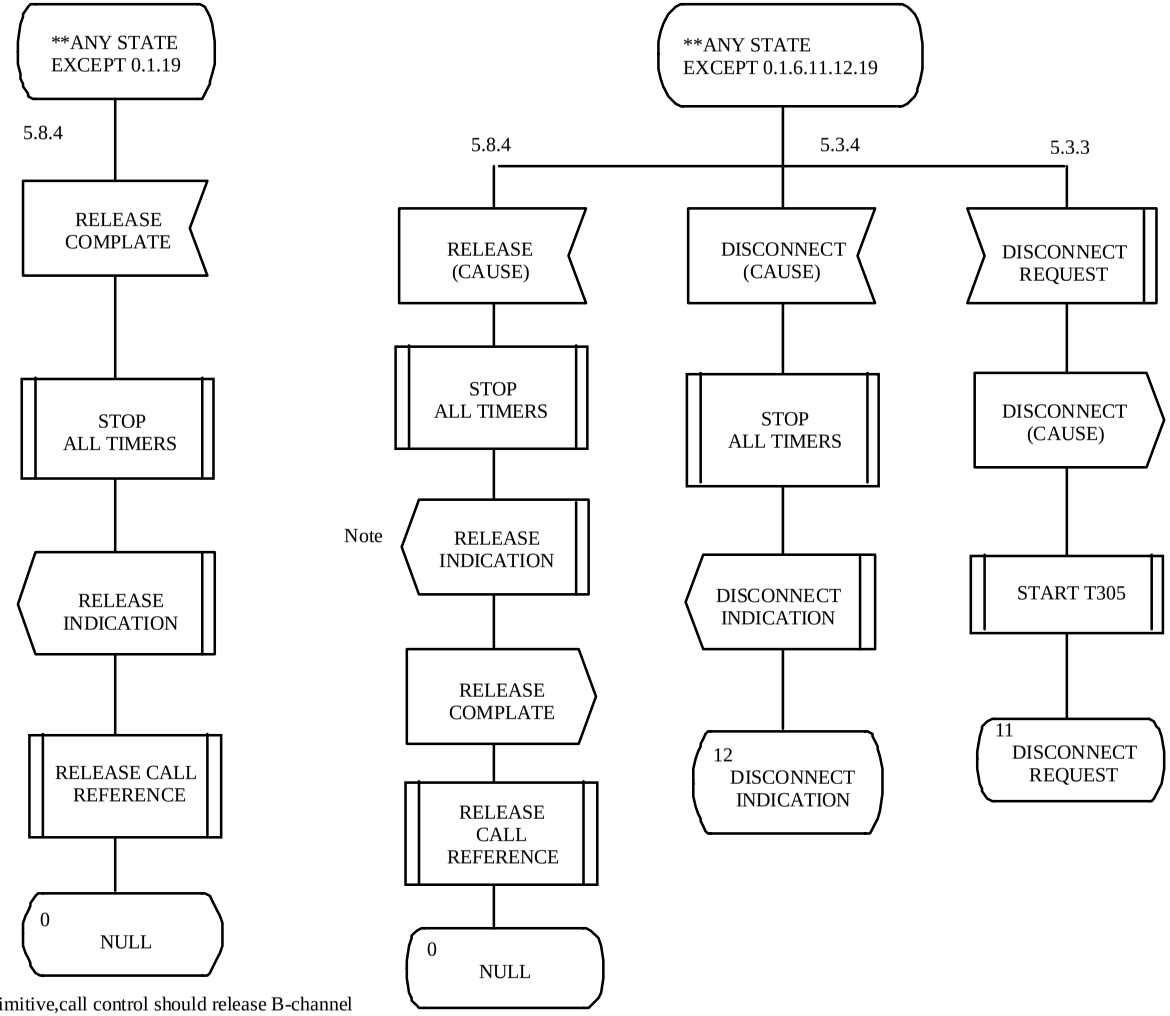
Note : Action on receipt of STATUS indicating a compatible call state is implementation dependent(see 5.8.11)

Figure A.3/B-IF2.02 (Q.931) (16/24)

Detailed protocol control (public CS side)

Figure A.3/B-IF2.02(Q.931)(17/24)

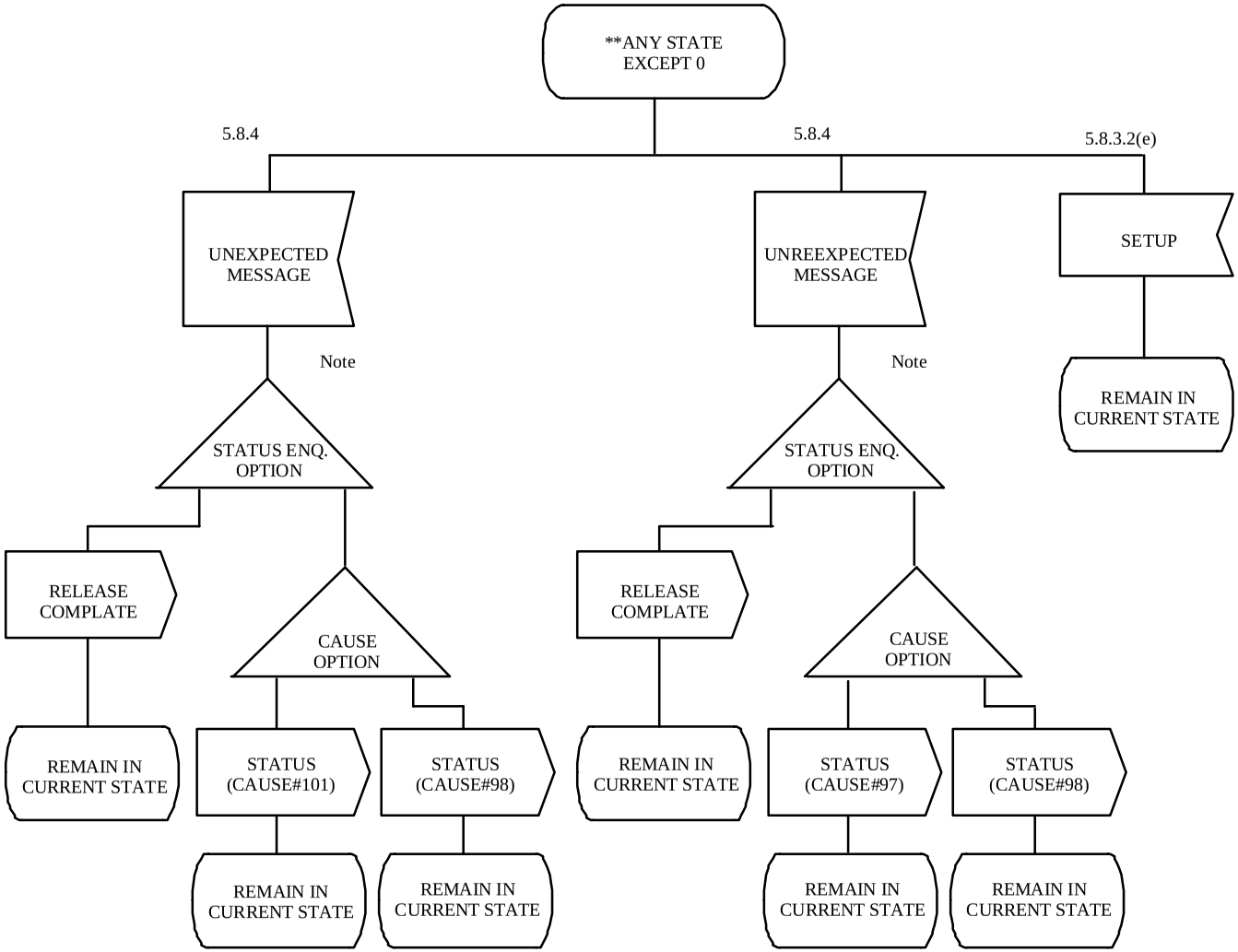
Detailed protocol control(public CS side)



Note : After receiving this primitive,call control should release B-channel

Figure A.3 / B-IF2.02 (Q.931) (18/24)

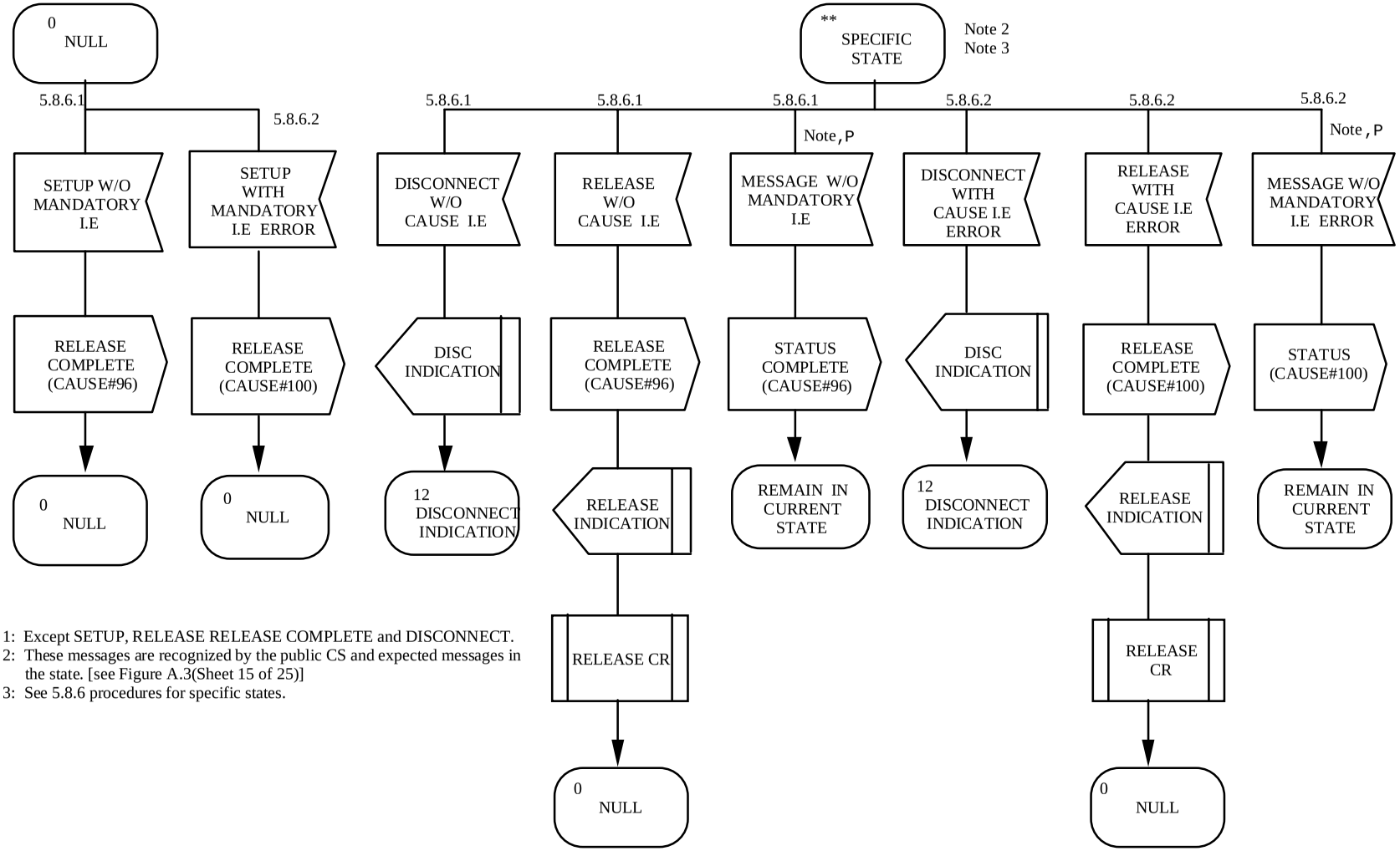
Detailed protocol control (public CS side)



Note : Except RELEASE or RELEASE COMPLATE

Figure A.3 / B-IF2.02 (Q.931) (19/24)

Detailed protocol control (public CS side)



Note 1: Except SETUP, RELEASE RELEASE COMPLETE and DISCONNECT.
Note 2: These messages are recognized by the public CS and expected messages in the state. [see Figure A.3(Sheet 15 of 25)]
Note 3: See 5.8.6 procedures for specific states.

Figure A.3 / B-IF2.02 (Q.931)(20/24)

Detailed protocol control (public CS side)

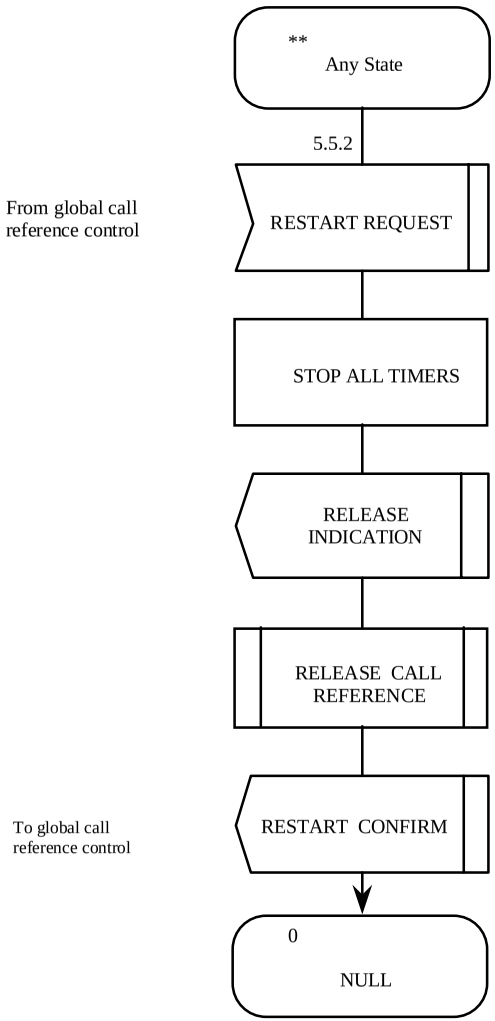


Figure A.3/B-IF2.02(Q.931)(21/24)

Detailed protocol control(public CS side)

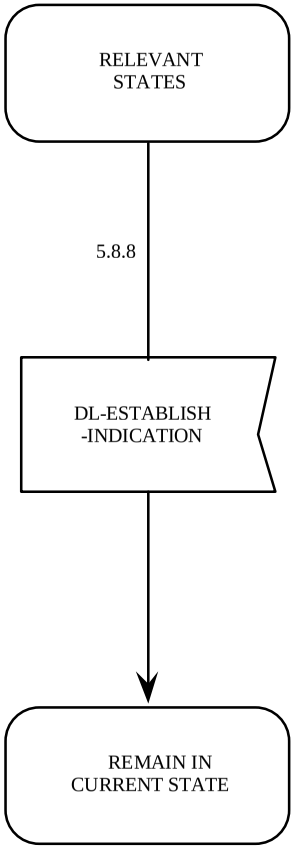
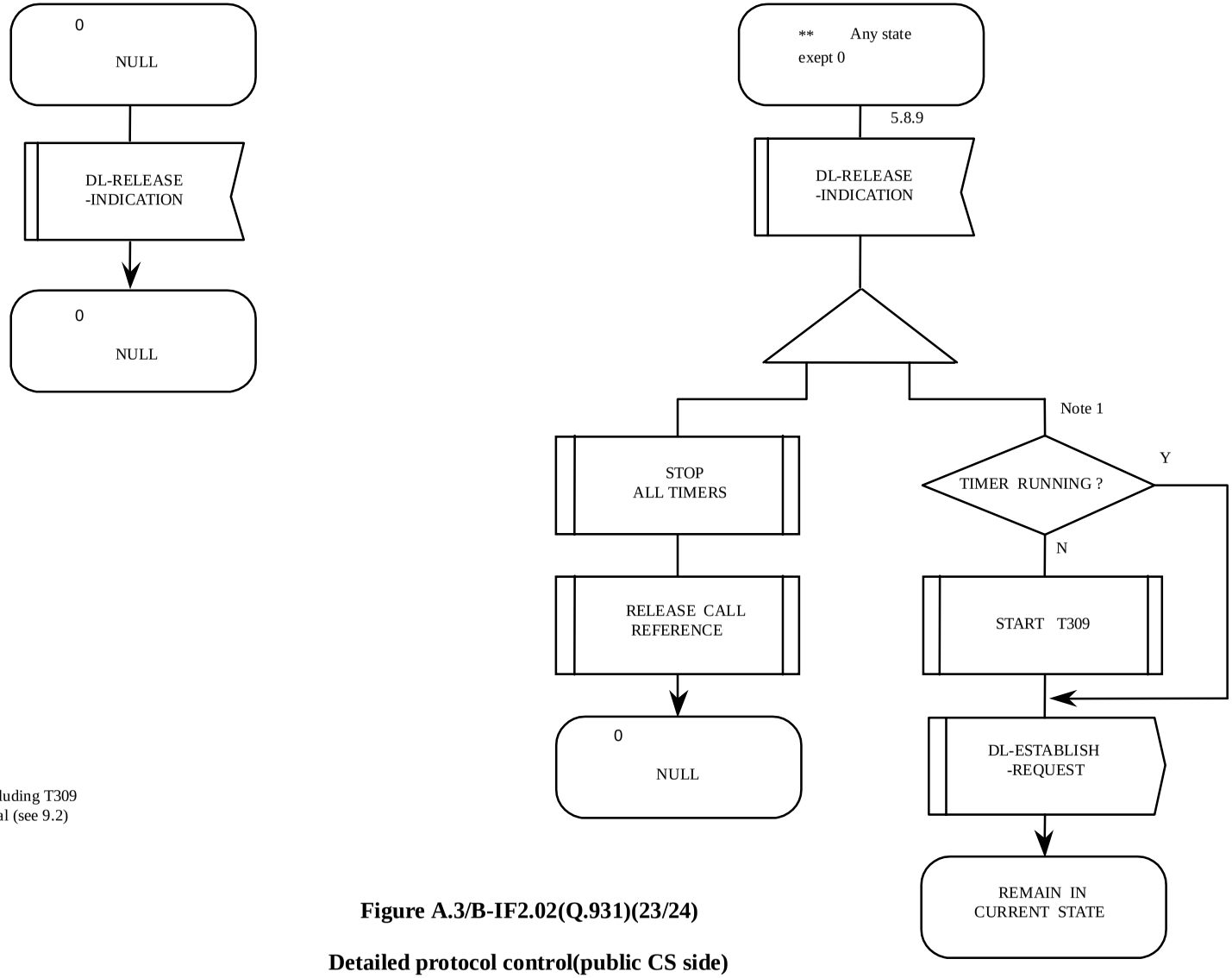


Figure A.3/B-IF2.02(Q.931)(22/24)

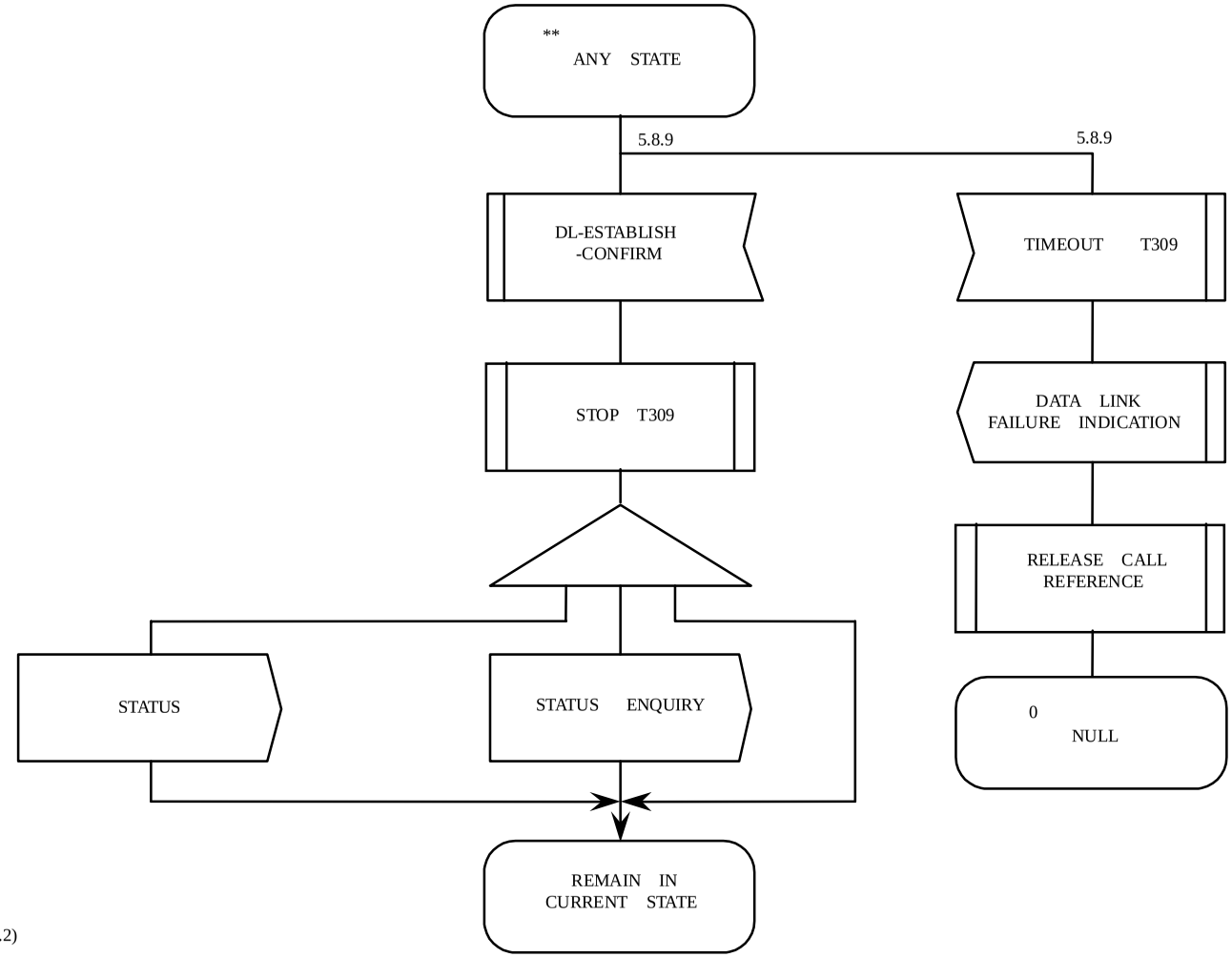
Detailed protocol control(public CS side)



Note 1: Any timers including T309
Note 2: T309 is optional (see 9.2)

Figure A.3/B-IF2.02(Q.931)(23/24)

Detailed protocol control(public CS side)



Note: T309 is optional (see 9.2)

Figure A.3/B-IF2.02(Q.931)(24/24)

Detailed protocol control(public CS side)

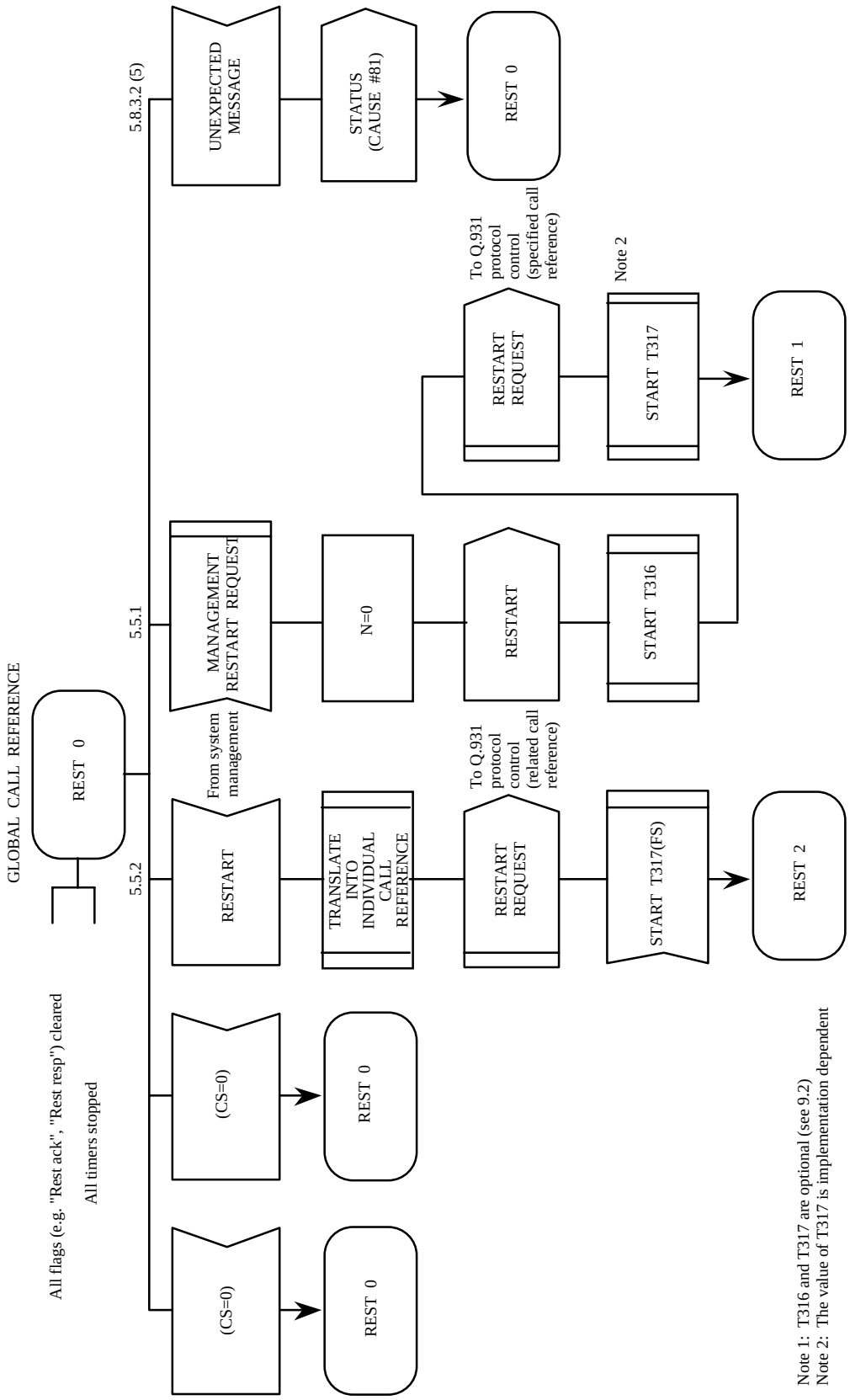


Figure A.4/B-IF2.02(Q.931)(1/4)

Detailed protocol control for the global call reference(public CS side)

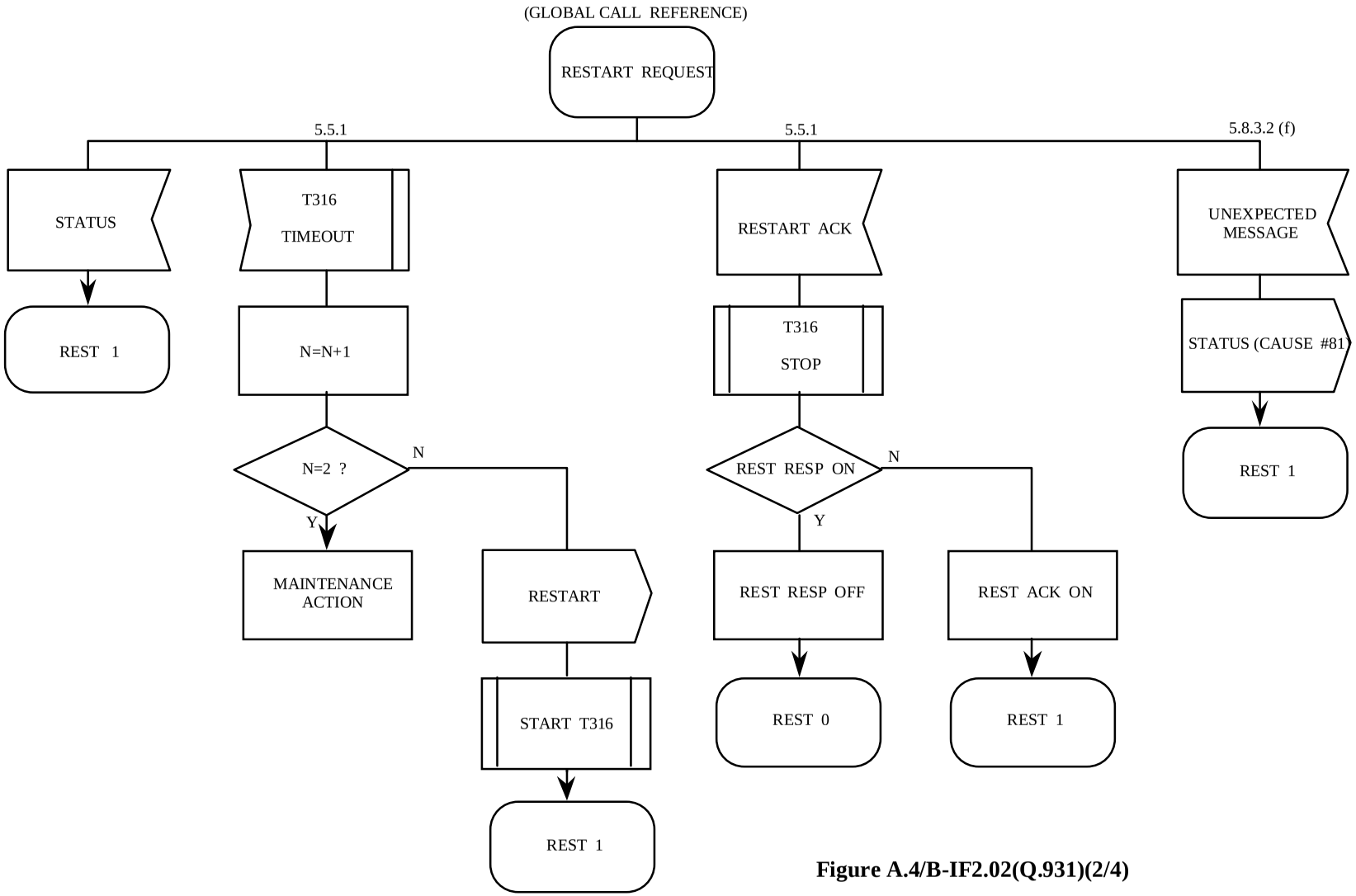
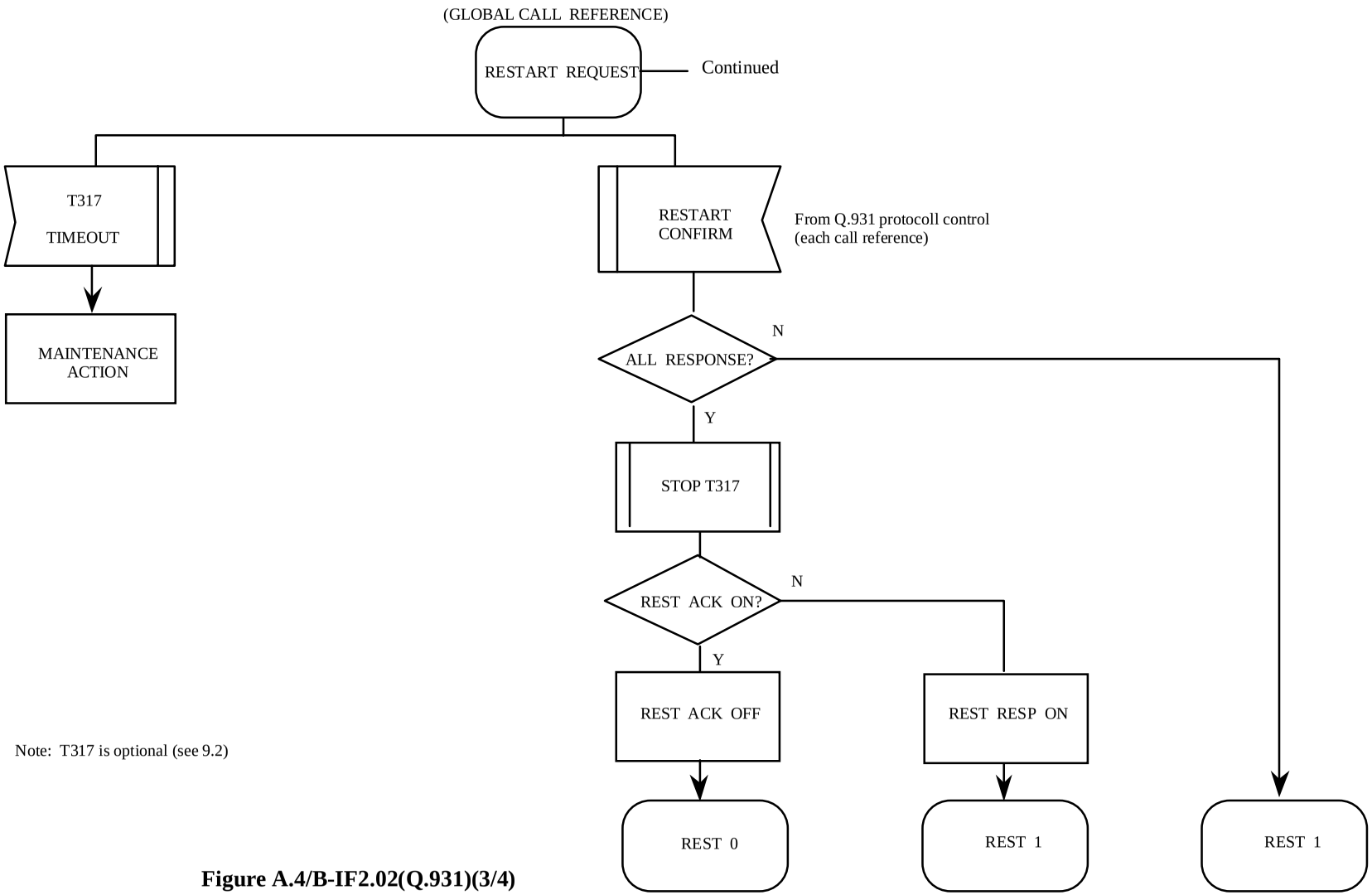


Figure A.4/B-IF2.02(Q.931)(2/4)

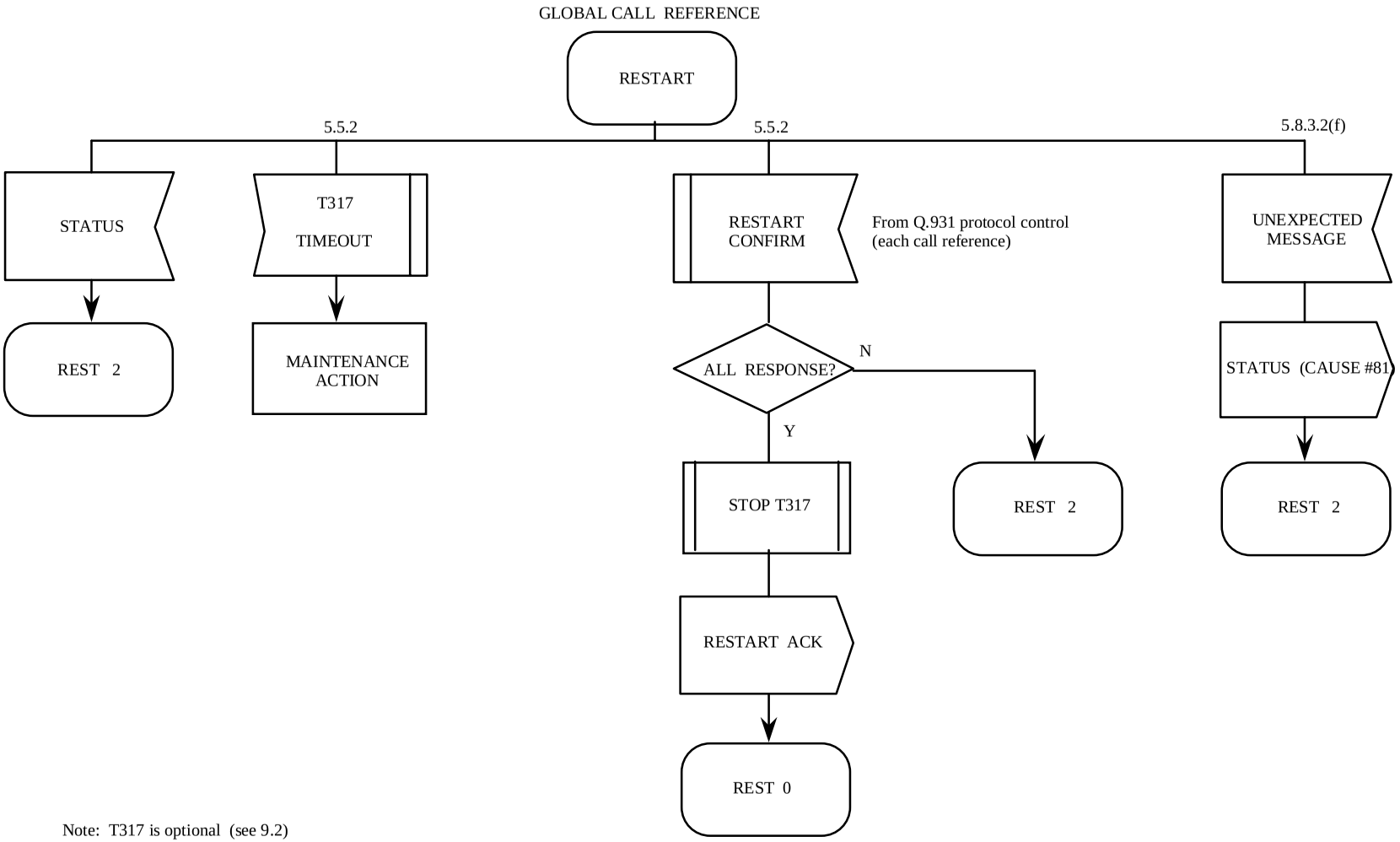
Detailed protocol control for the global call reference(public CS side)



Note: T317 is optional (see 9.2)

Figure A.4/B-IF2.02(Q.931)(3/4)

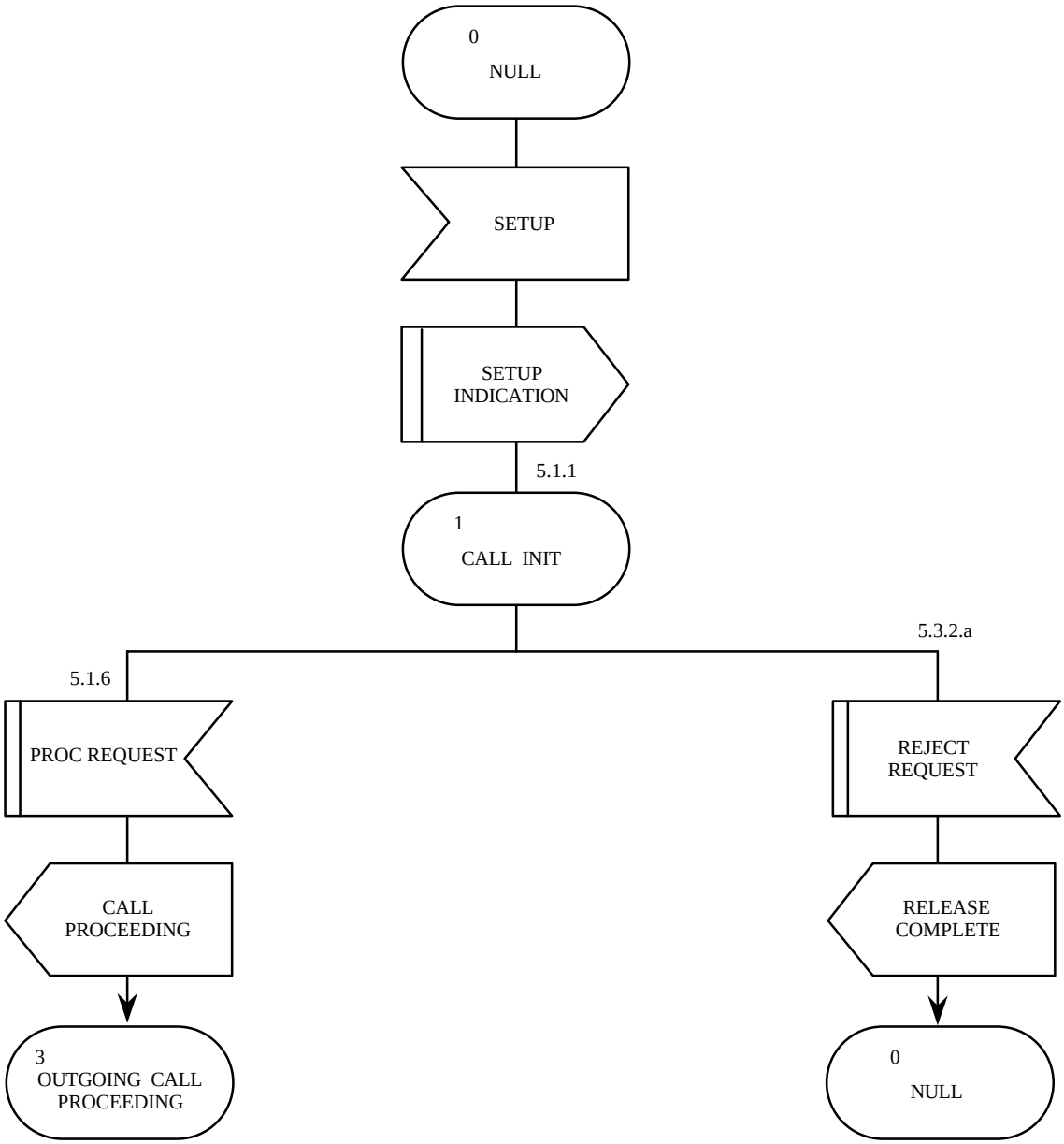
Detailed protocol control for the global call reference(public CS side)



Note: T317 is optional (see 9.2)

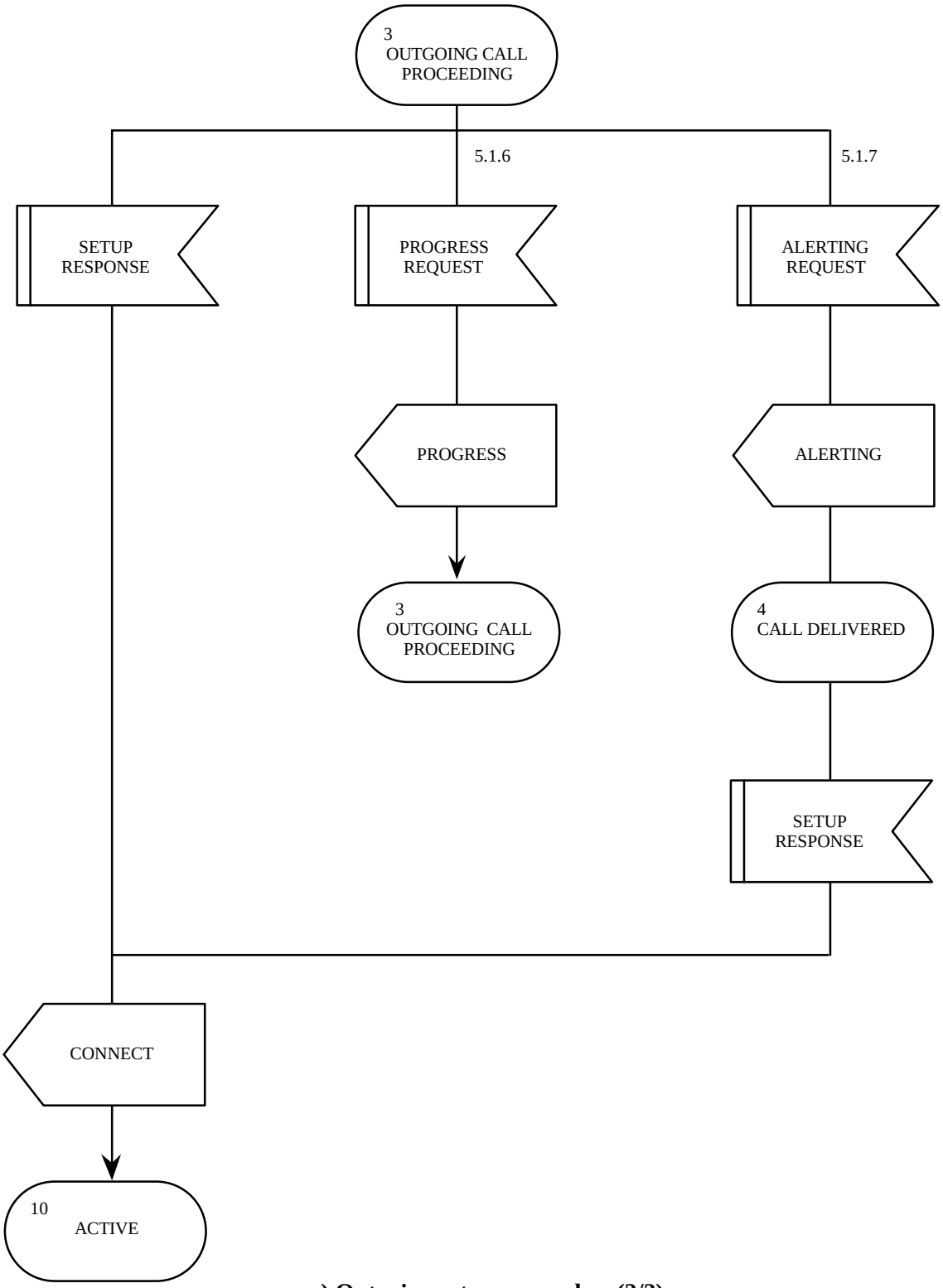
Figure A.4/B-IF2.02(Q.931)(4/4)

Detailed protocol control for the global call reference(public CS side)



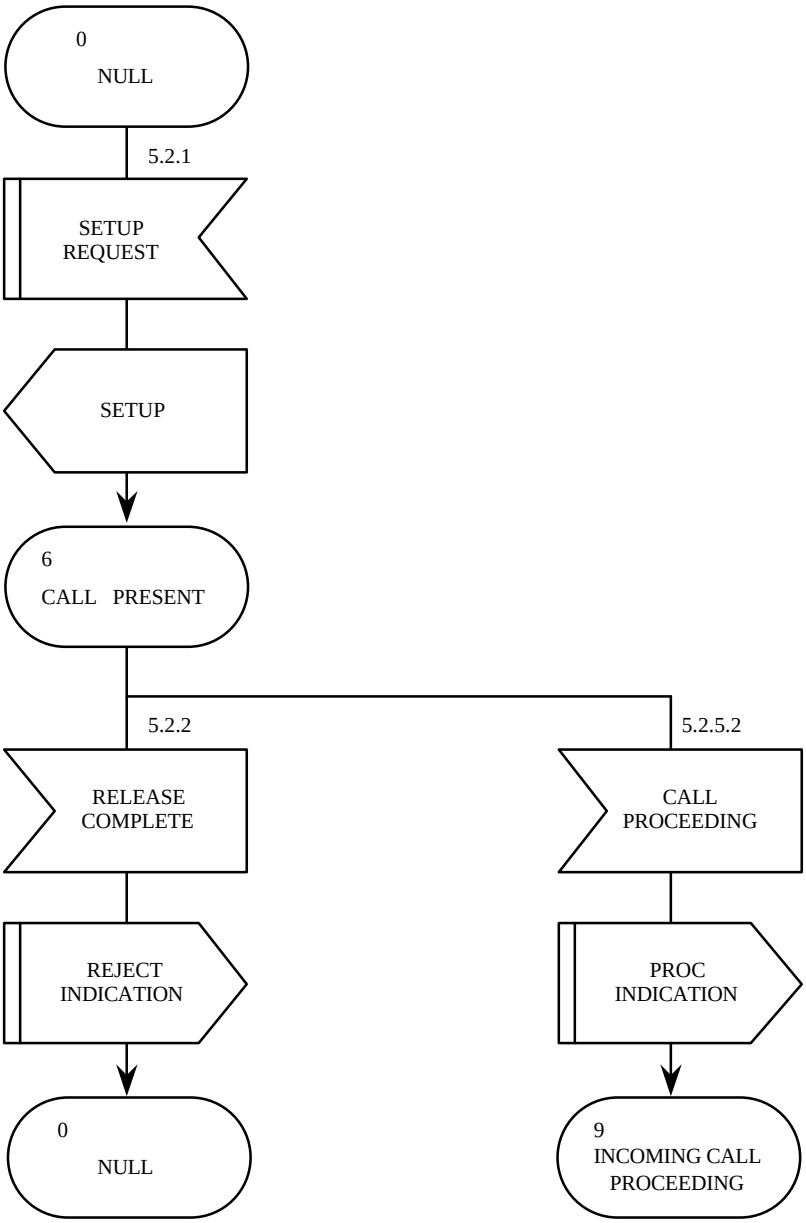
a) Outgoing set-up procedure(1/2)
Figure A.5/B-IF2.02(Q.931)(1/9)

Overview protocol control (ISDN side)



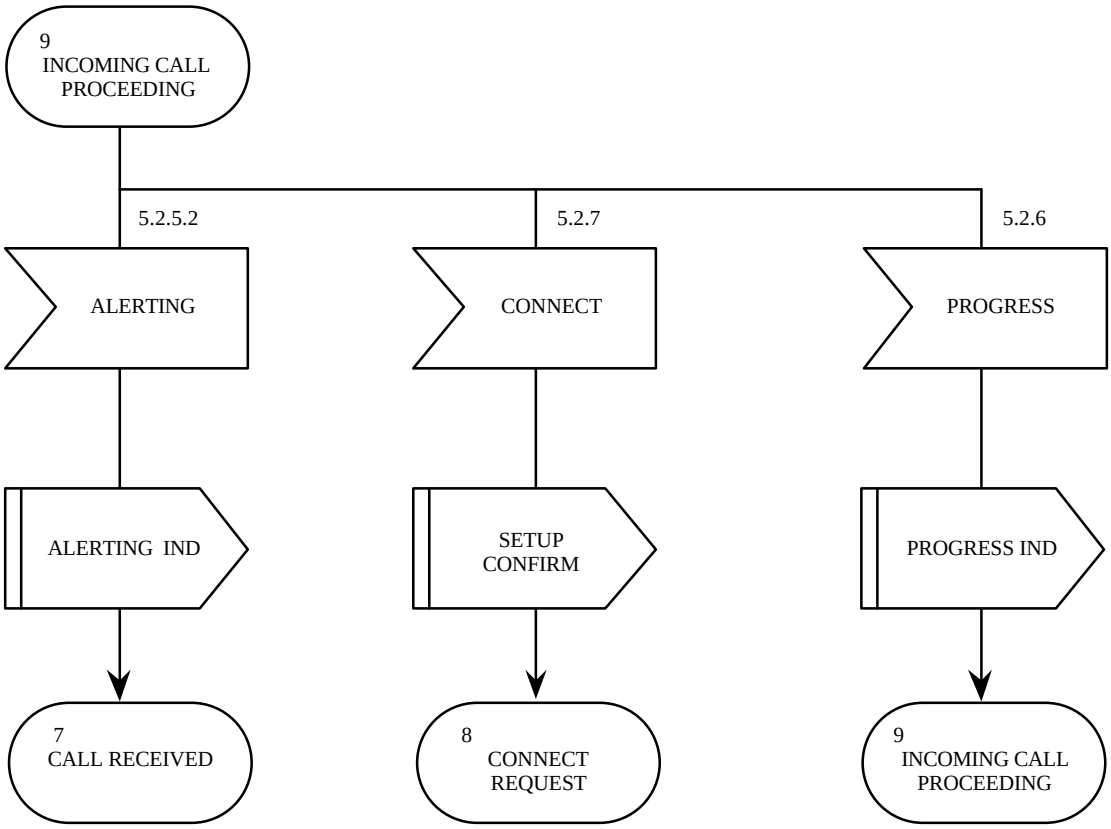
a) Outgoing set-up procedure(2/2)
Figure A.5/B-IF2.02(Q.931)(2/9)

Overview protocol control (ISDN side)



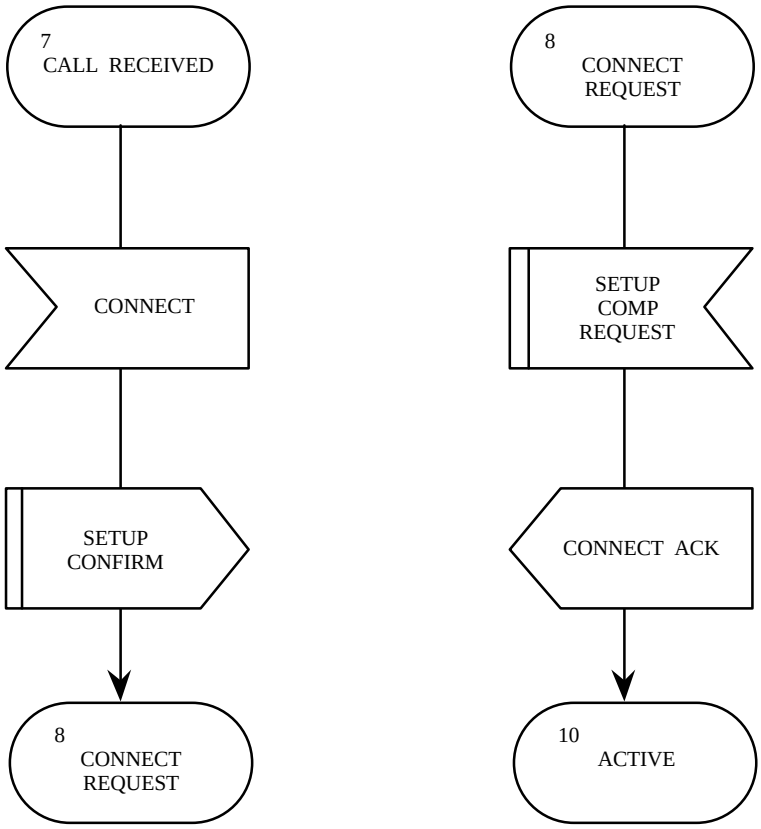
b) Incoming set-up procedure(1/3)
Figure A.5/B-IF2.02(Q.931)(3/9)

Overview protocol control (ISDN side)



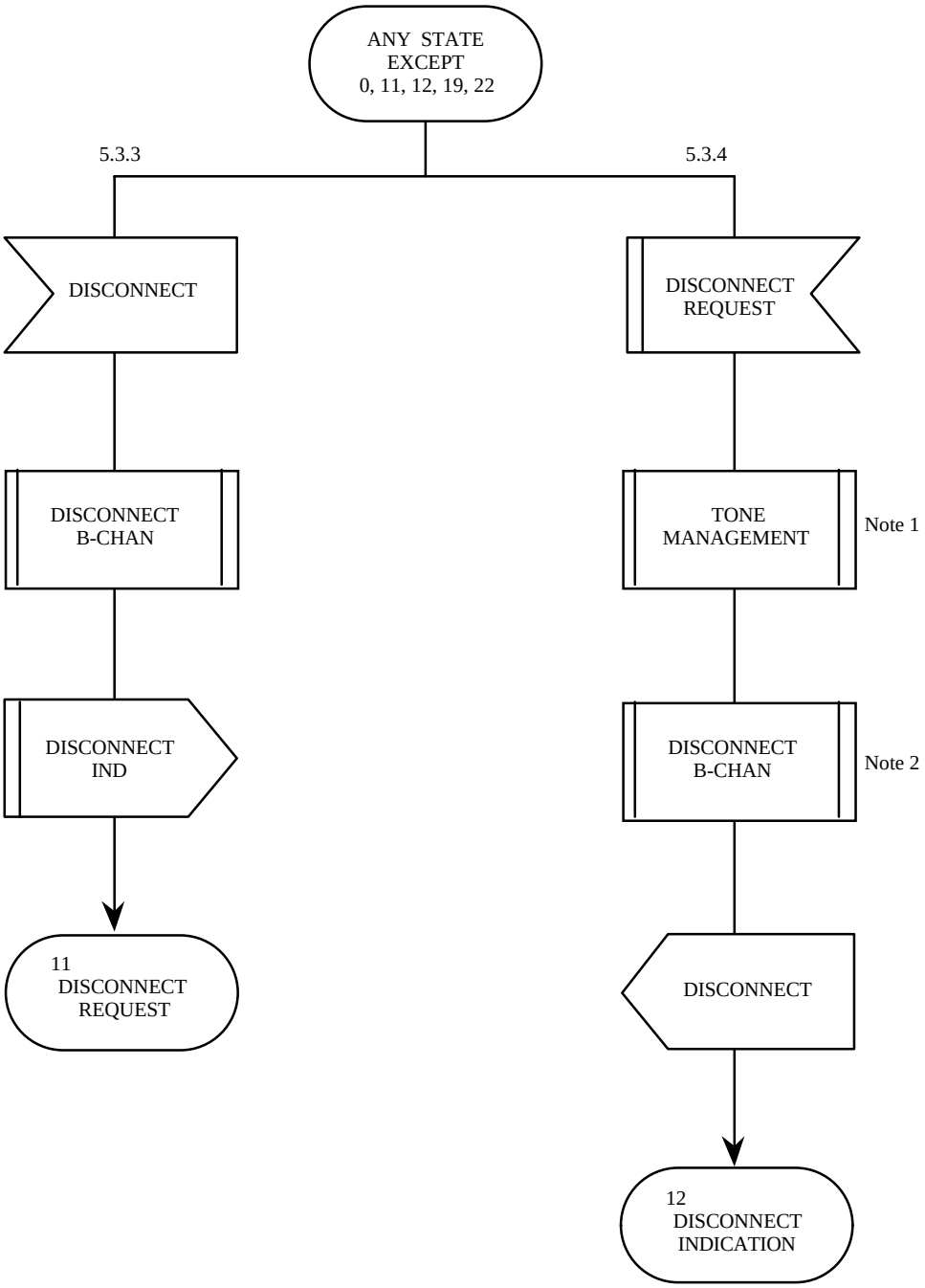
b) Incoming set-up procedure(2/3)
Figure A.5/B-IF2.02(Q.931)(4/9)

Overview protocol control (ISDN side)



b) Incoming set-up procedure(3/3)
Figure A.5/B-IF2.02(Q.931)(5/9)

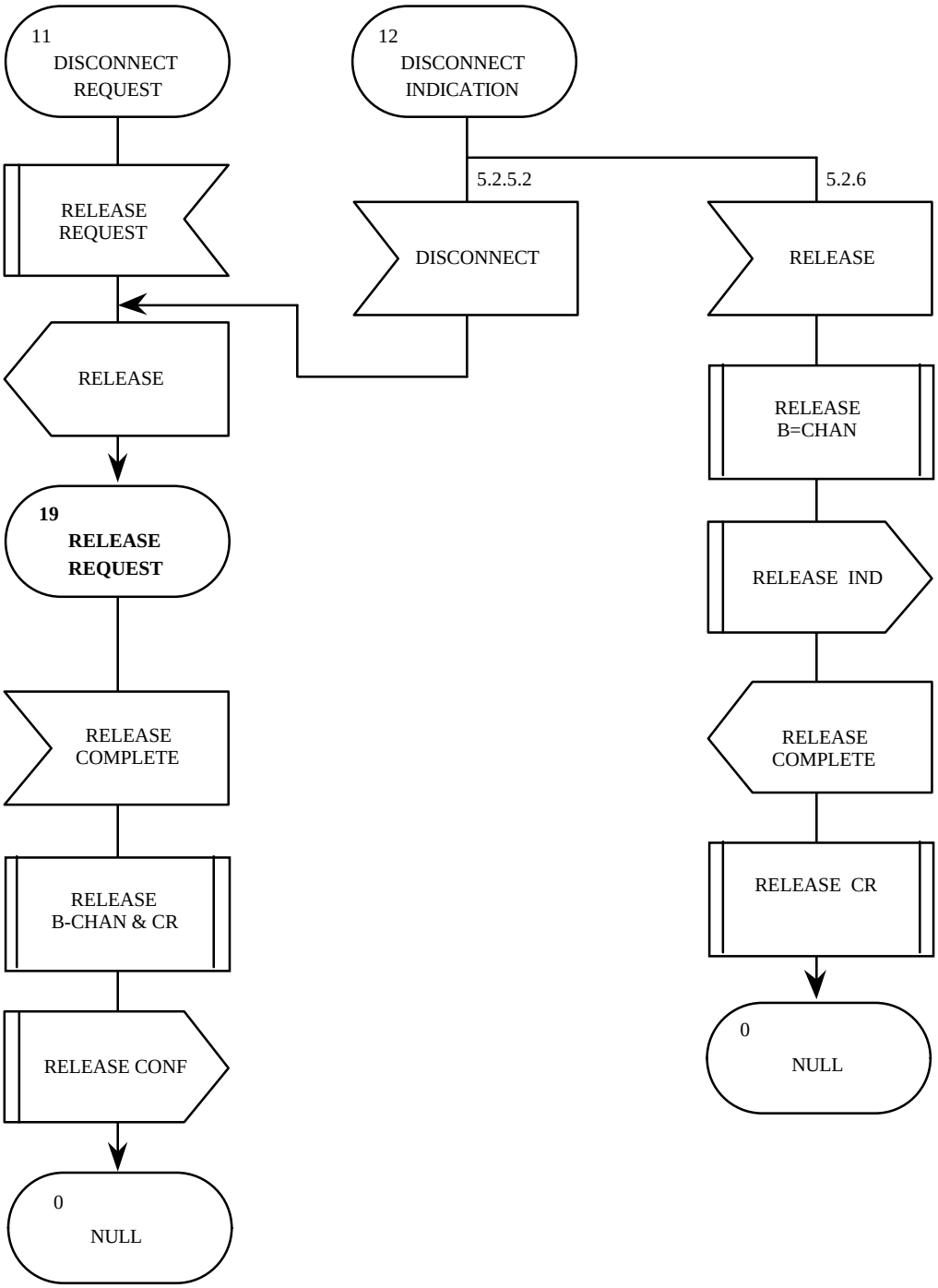
Overview protocol control (ISDN side)



Note1: Optional (for inband tones)
Note2: Dependent on tone management

c) Clearing procedure(1/2)
Figure A.5/B-IF2.02(Q.931)(6/9)

Overview protocol control (ISDN side)

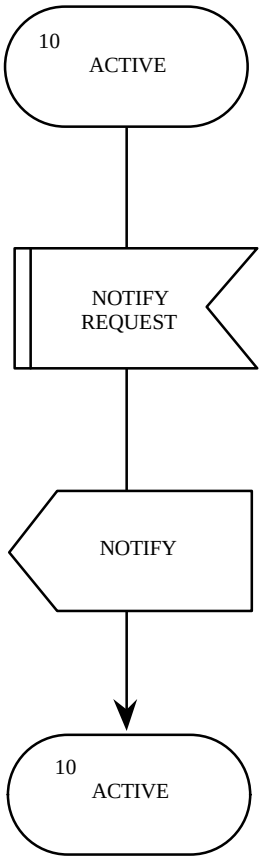


c) Clearing procedure(2/2)
Figure A.5/B-IF2.02(Q.931)(7/9)

Overview protocol control (ISDN side)

d) Resume procedure
Figure A.5/B-IF2.02(Q.931)(8/9)

Overview protocol control (ISDN side)



E) Suspend procedure
Figure A.5/B-IF2.02(Q.931)(9/9)

Overview protocol control (ISDN side)

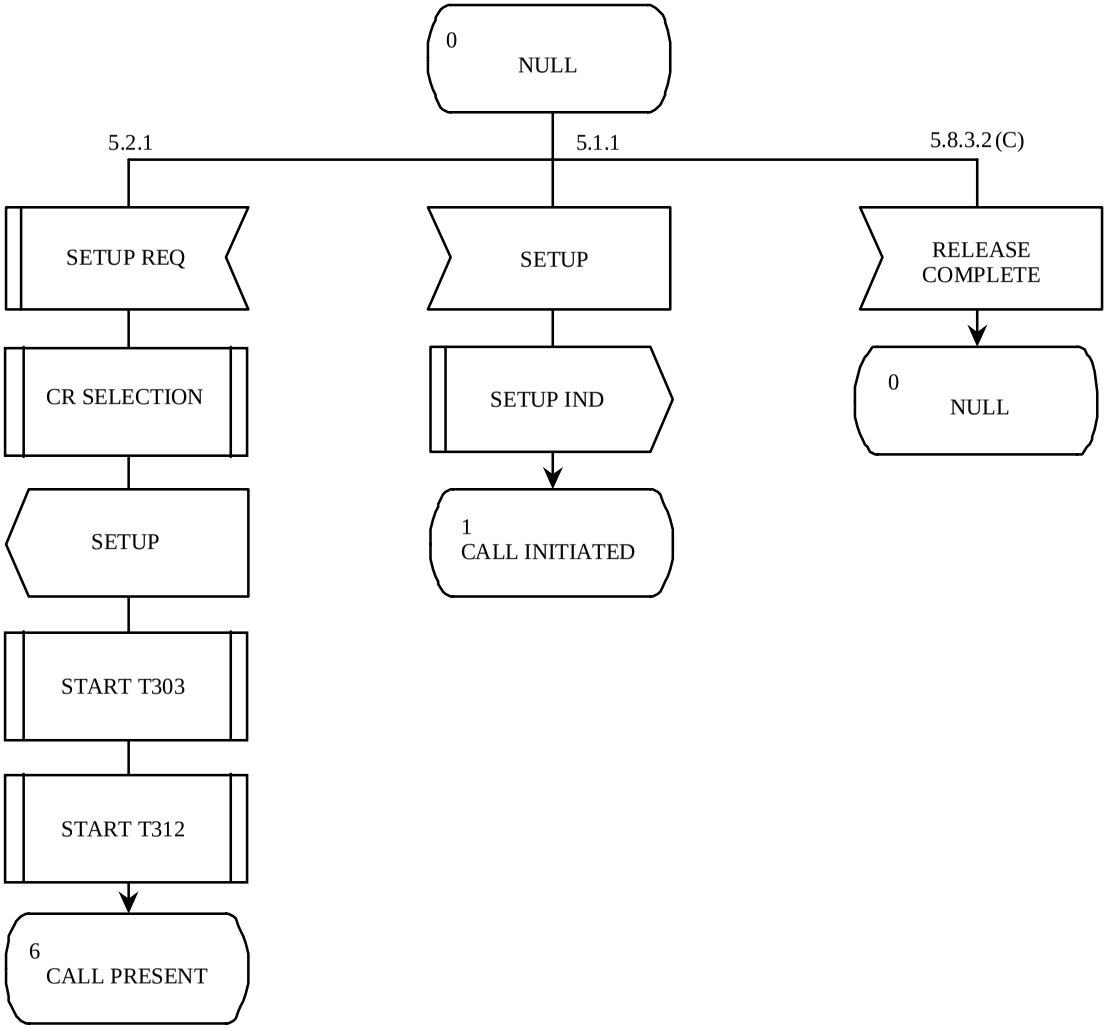


Figure A.6 / B-IF2.02 (Q.931) (1/27)

Detailed protocol control (INDN side)

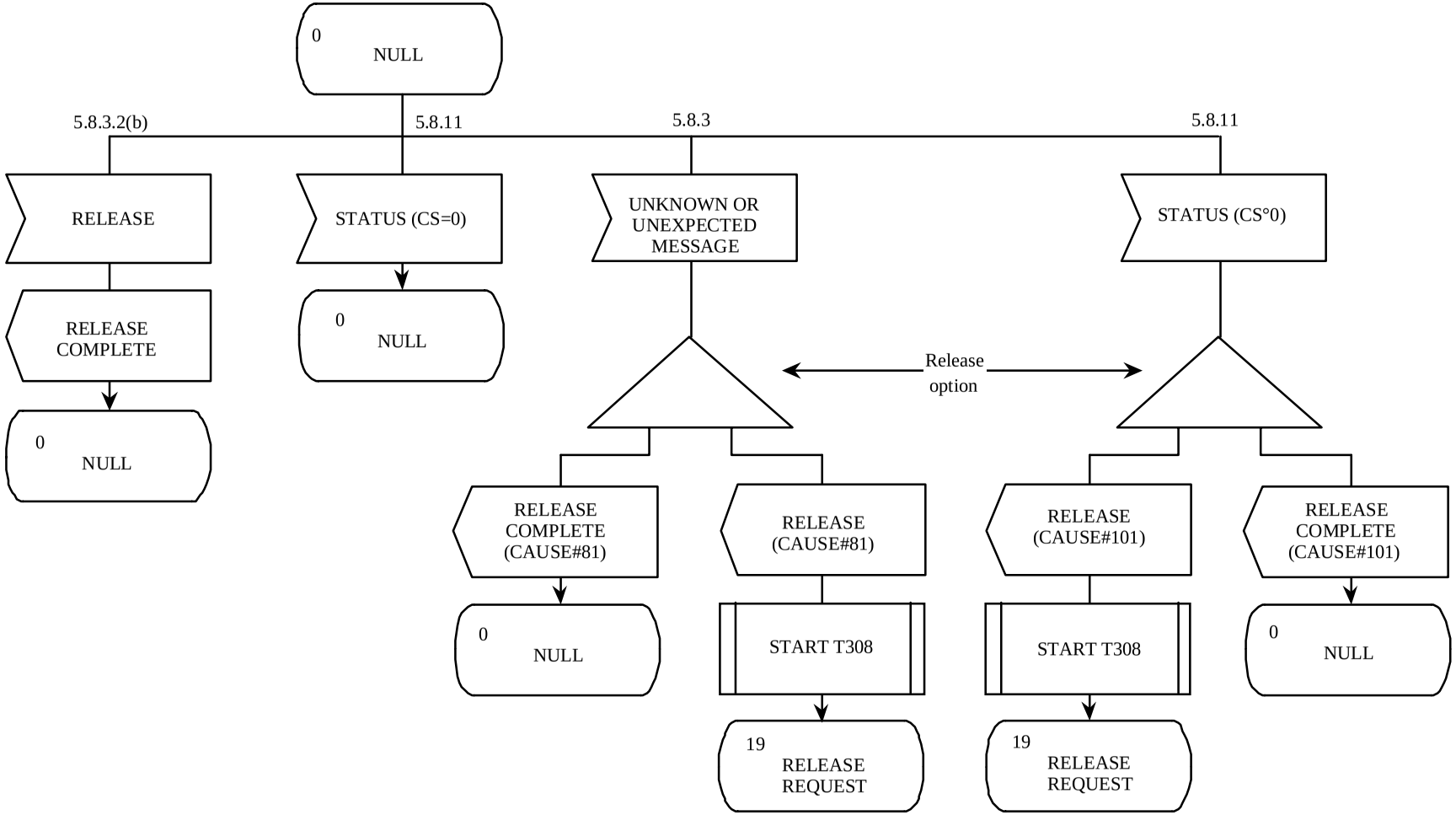


Figure A.6 / B-IF2.02 (Q.931) (2/27)

Detailed protocol control (INDN side)

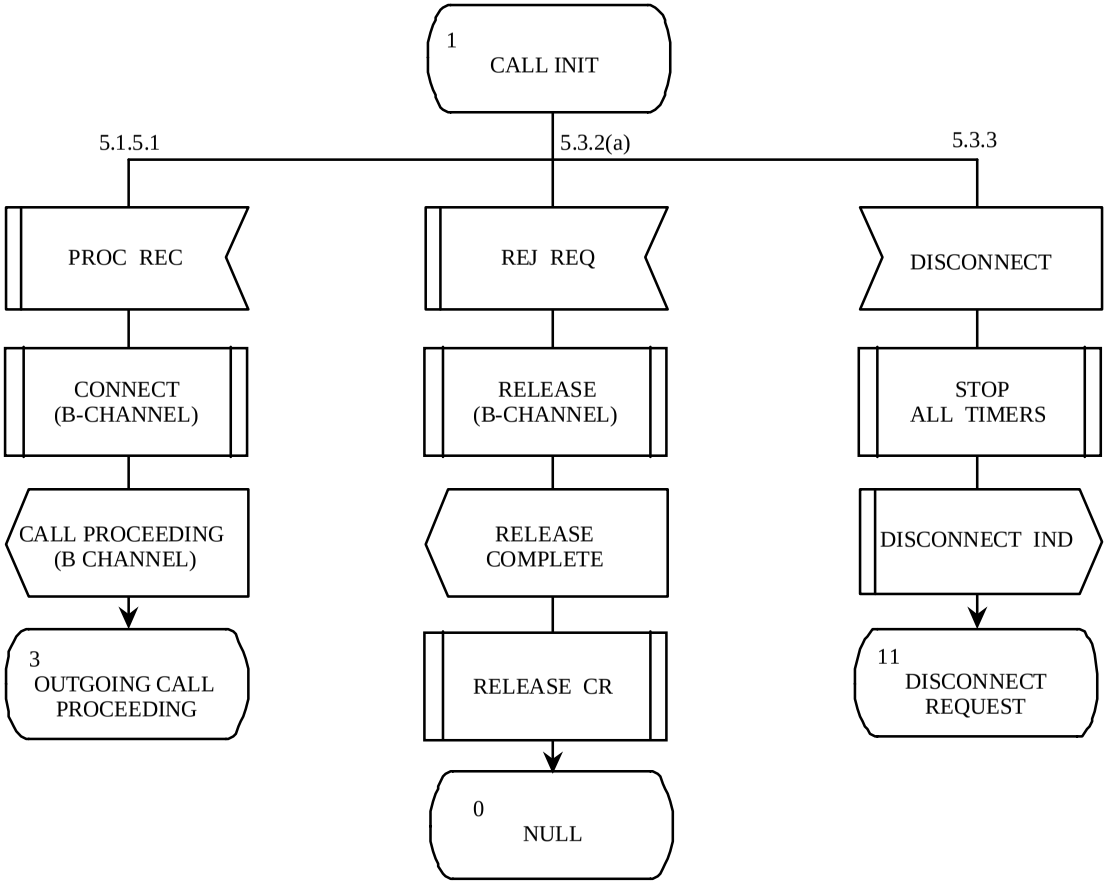


Figure A.6 / B-IF2.02 (Q.931) (3/27)

Detailed protocol control (INDN side)

Figure A.6 / B-IF2.02 (Q.931) (4/27)

Detailed protocol control (INDN side)

Figure A.6 / B-IF2.02 (Q.931) (5/27)

Detailed protocol control (INDN side)

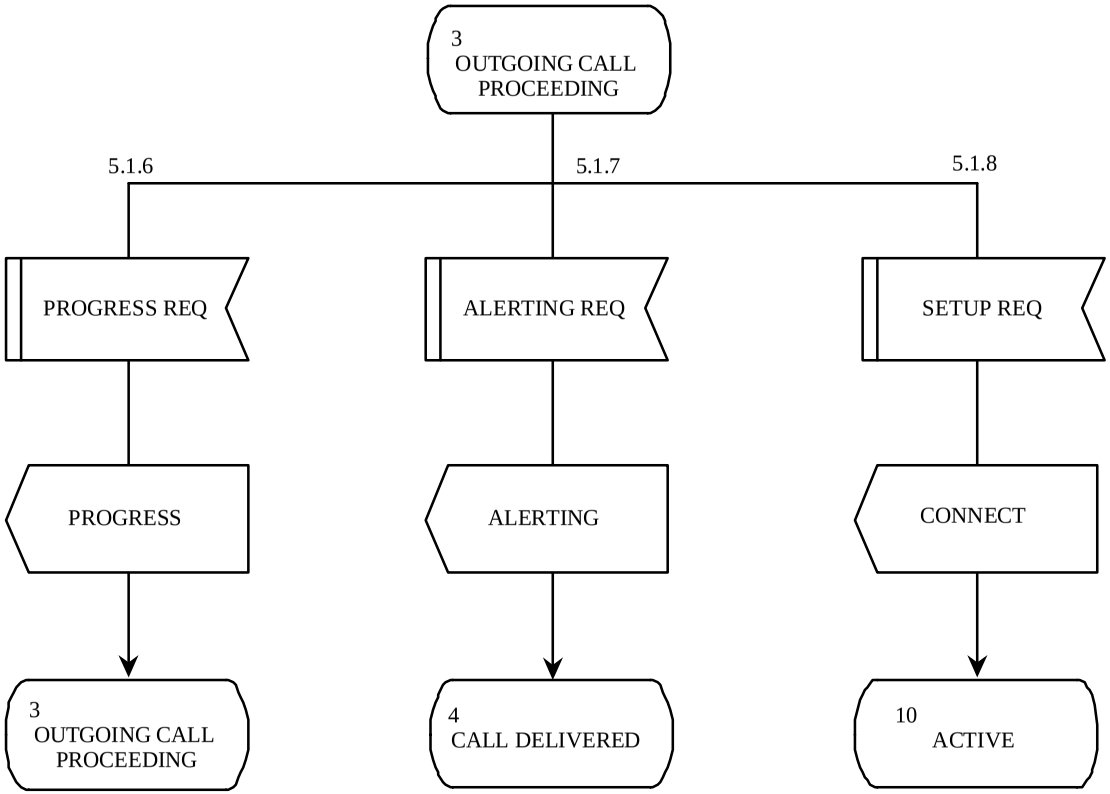


Figure A.6 / B-IF2.02 (Q.931) (6/27)

Detailed protocol control (INDN side)

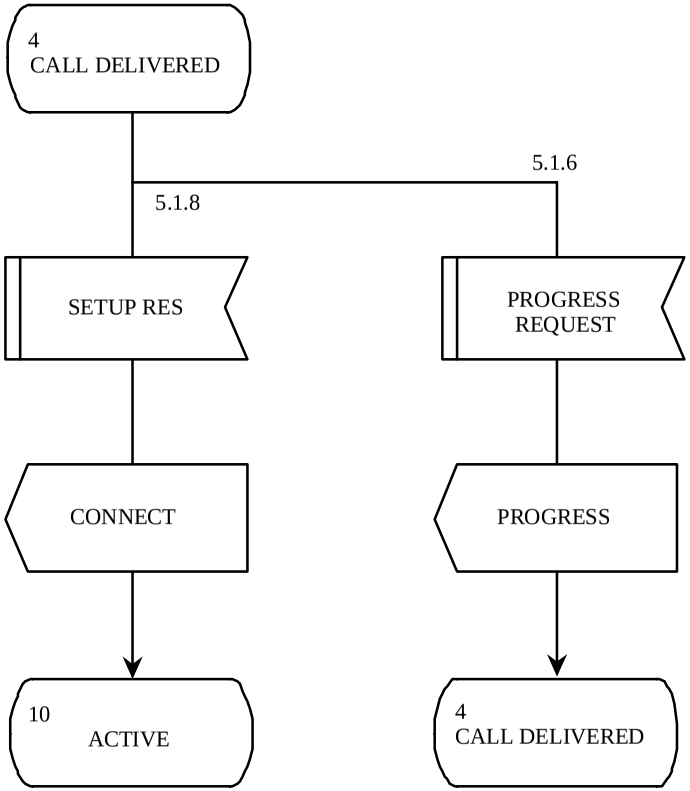


Figure A.6 / B-IF2.02 (Q.931) (7/27)

Detailed protocol control (INDN side)

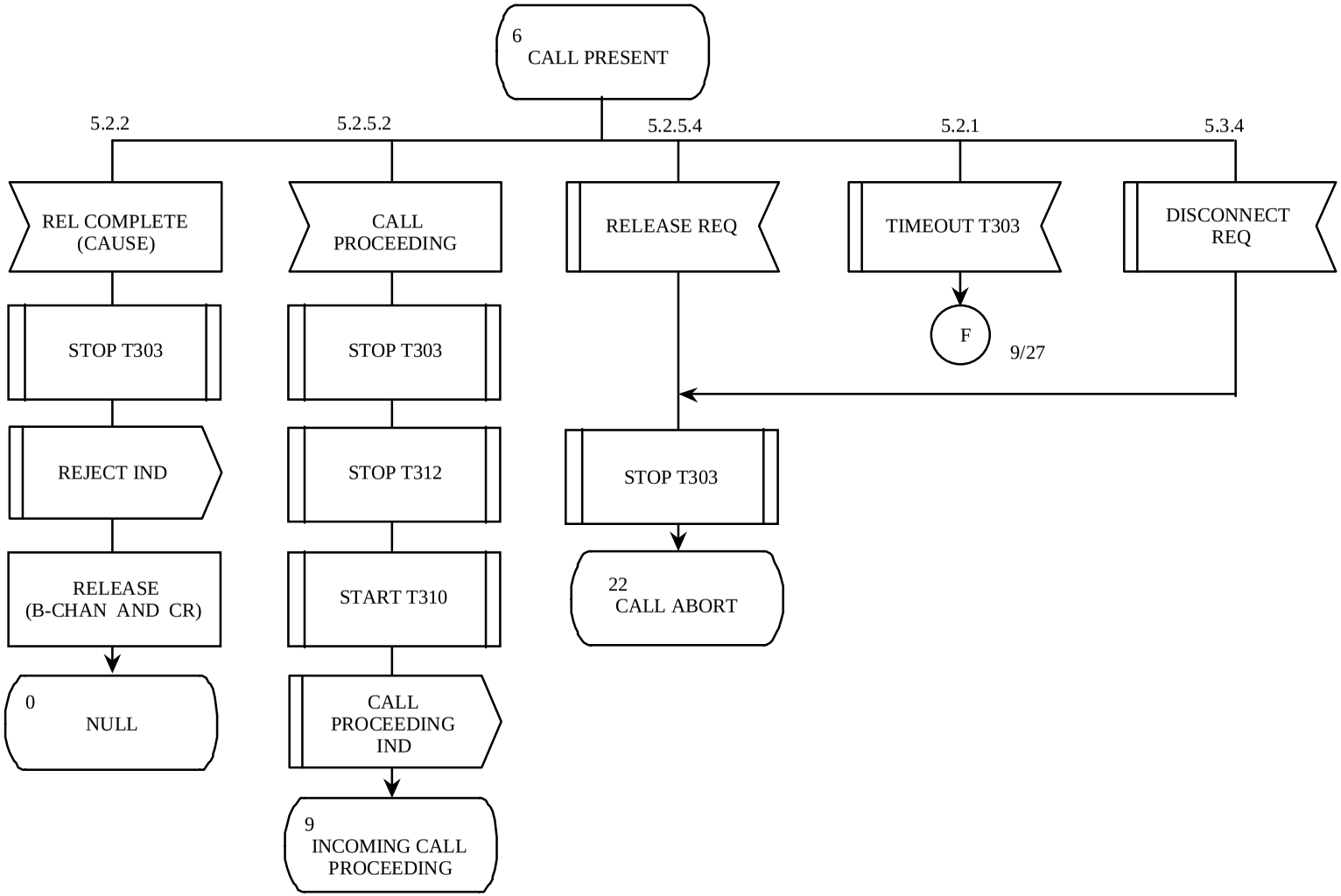


Figure A.6 / B-IF2.02 (Q.931) (8/27)

Detailed protocol control (INDN side)

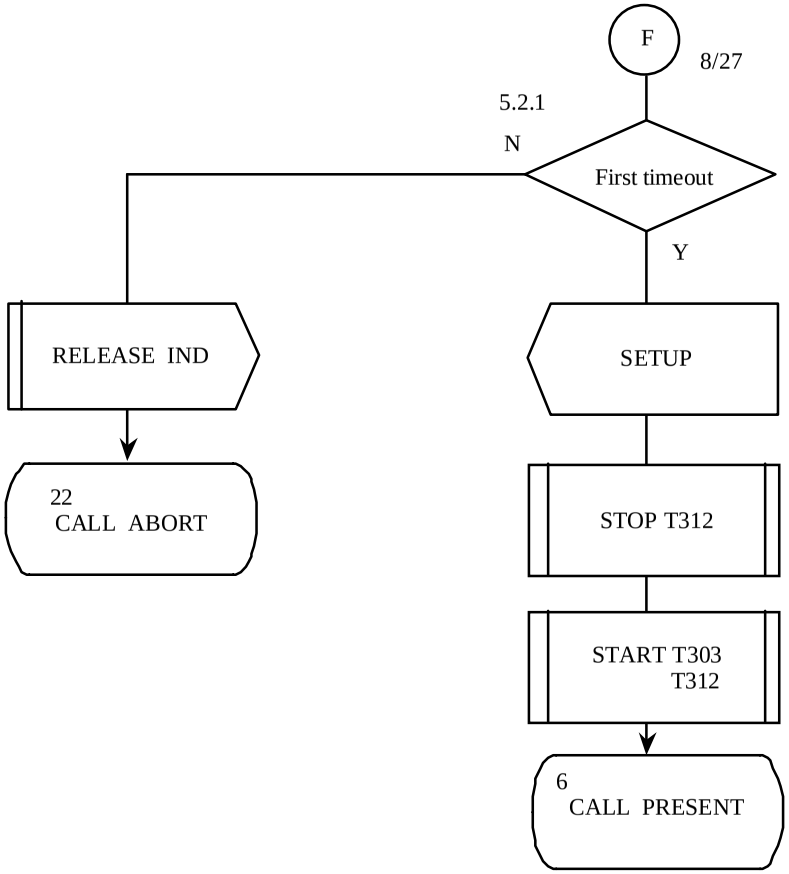
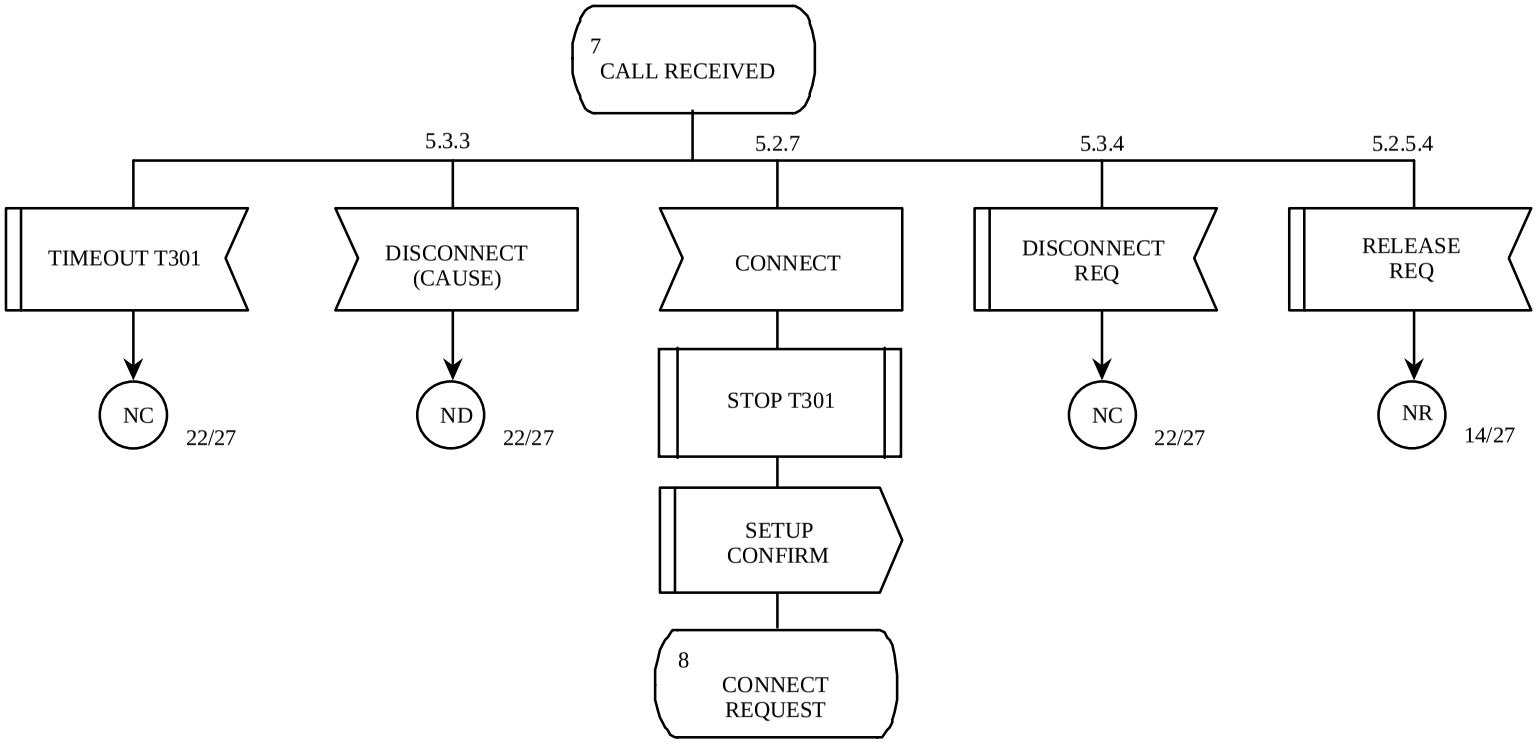


Figure A.6 / B-IF2.02 (Q.931) (9/27)

Detailed protocol control (INDN side)



Note: T301 is optional (see 9.1)

Figure A.6 / B-IF2.02 (Q.931) (10/27)

Detailed protocol control (INDN side)

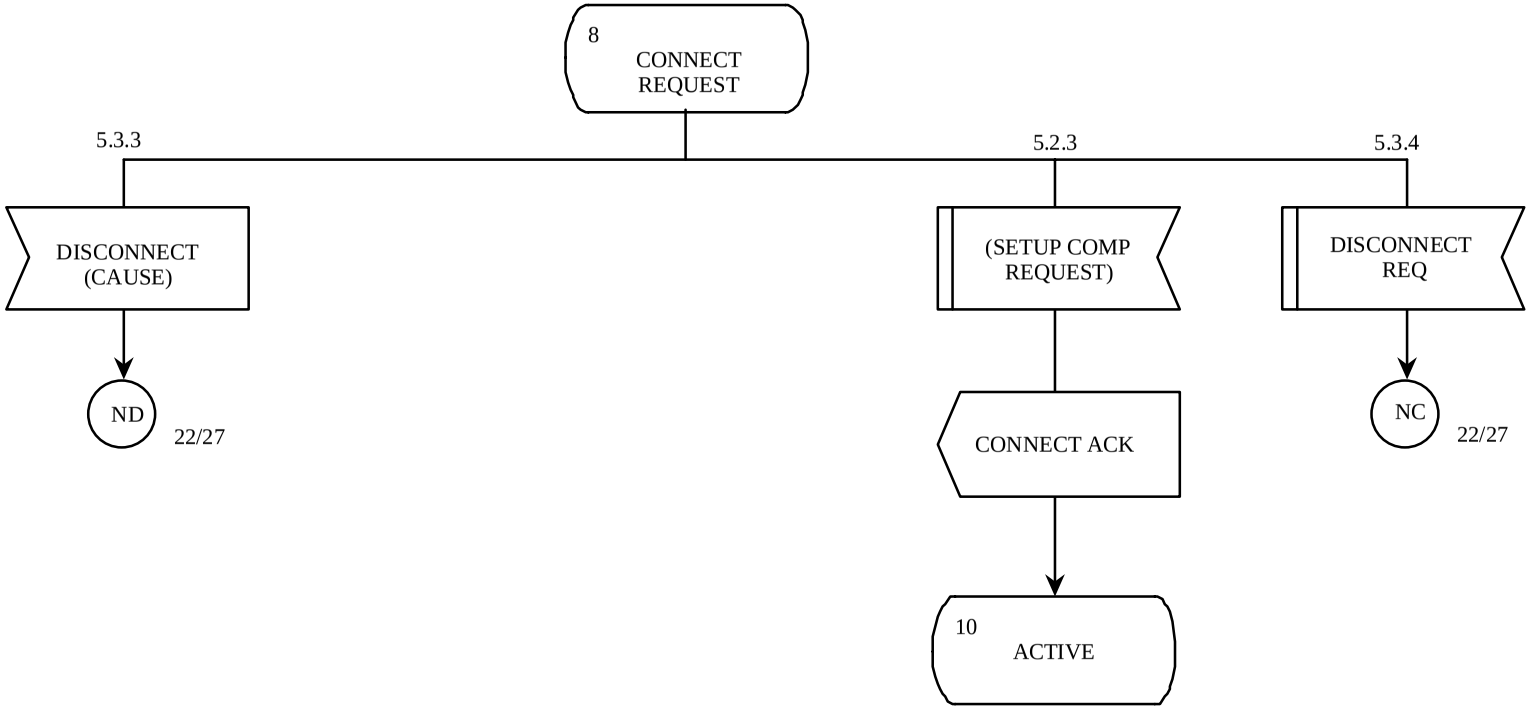


Figure A.6 / B-IF2.02 (Q.931) (11/27)

Detailed protocol control (INDN side)

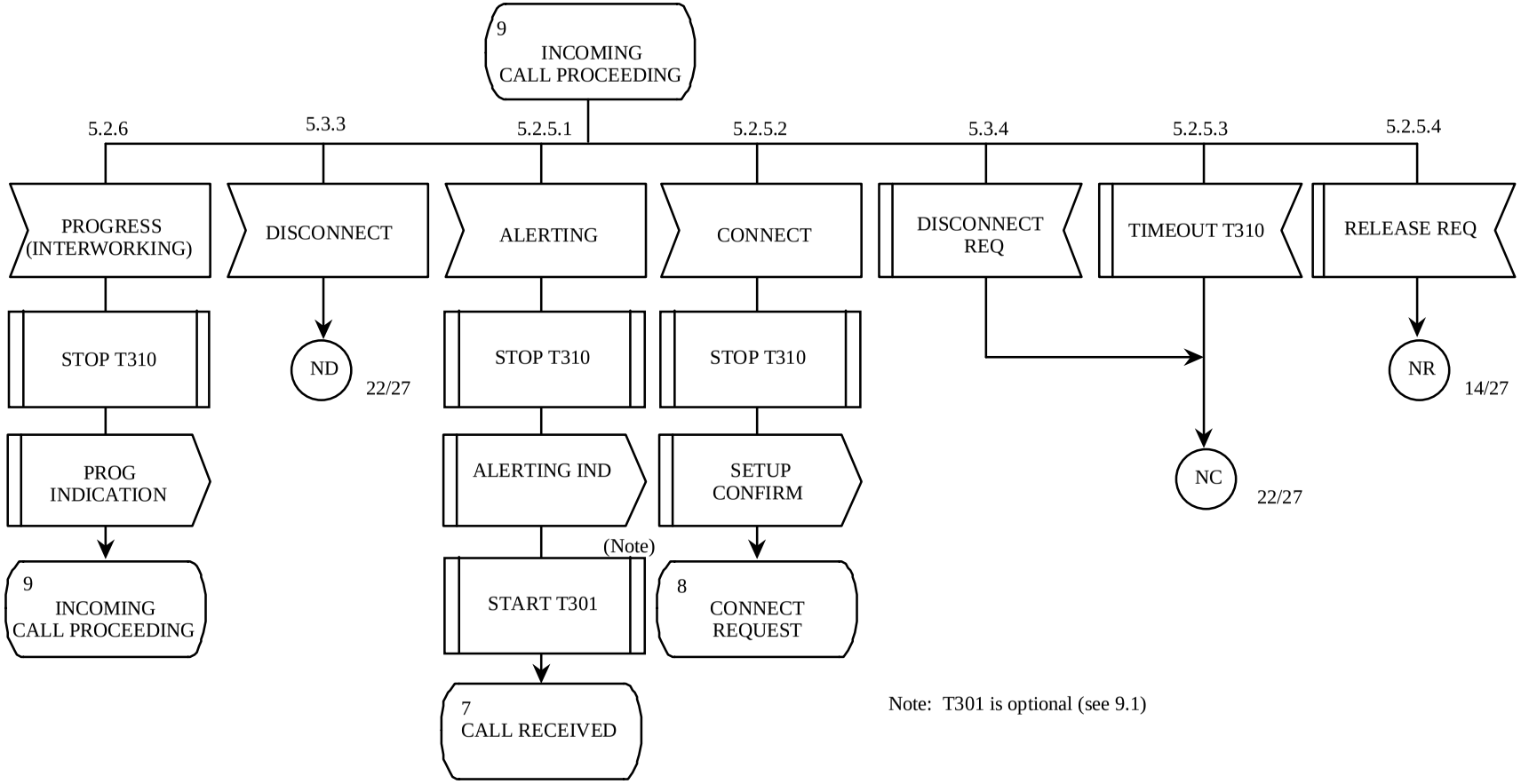


Figure A.6 / B-IF2.02 (Q.931) (12/27)

Detailed protocol control (INDN side)

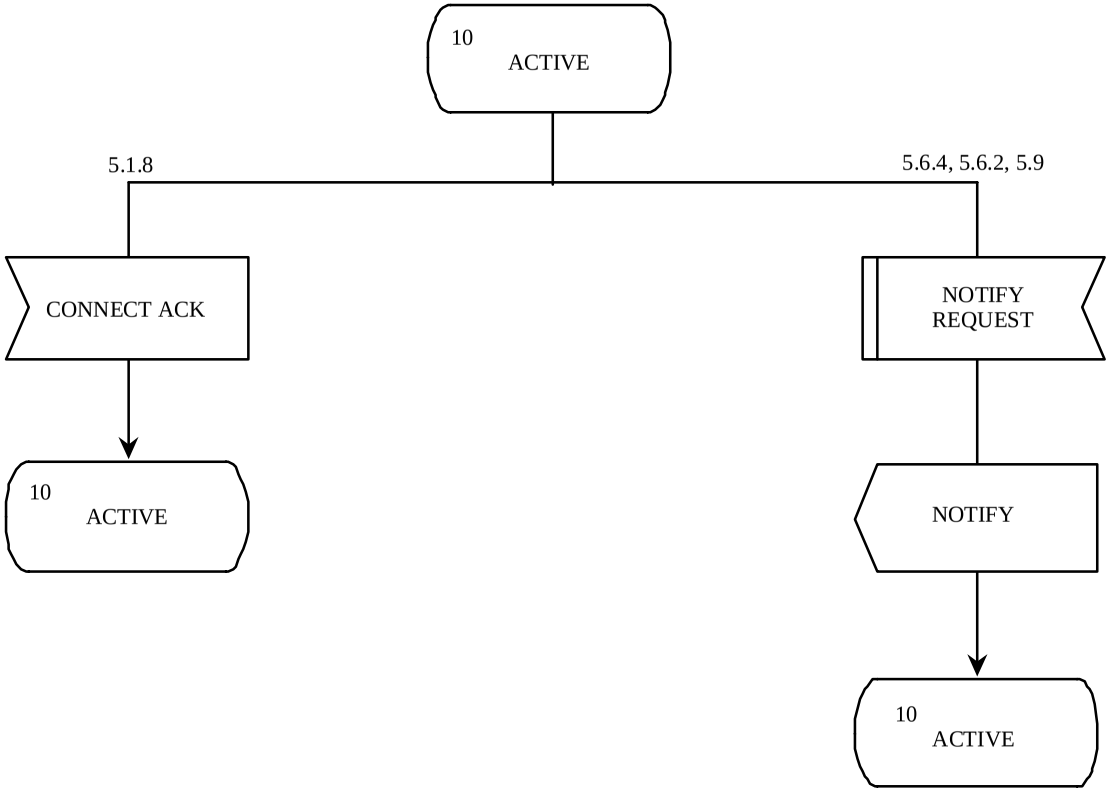


Figure A.6 / B-IF2.02 (Q.931) (13/27)

Detailed protocol control (INDN side)

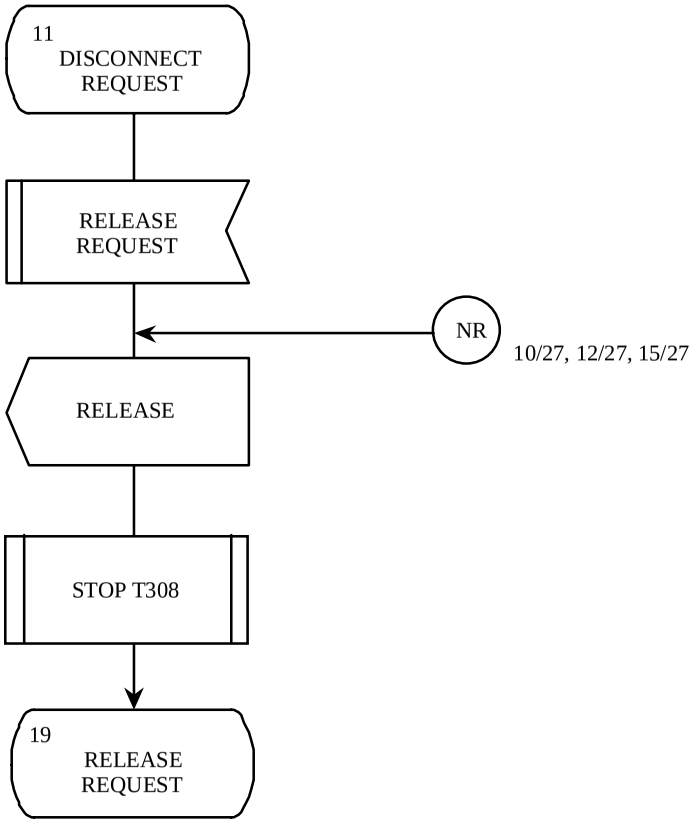


Figure A.6 / B-IF2.02 (Q.931) (14/27)

Detailed protocol control (INDN side)

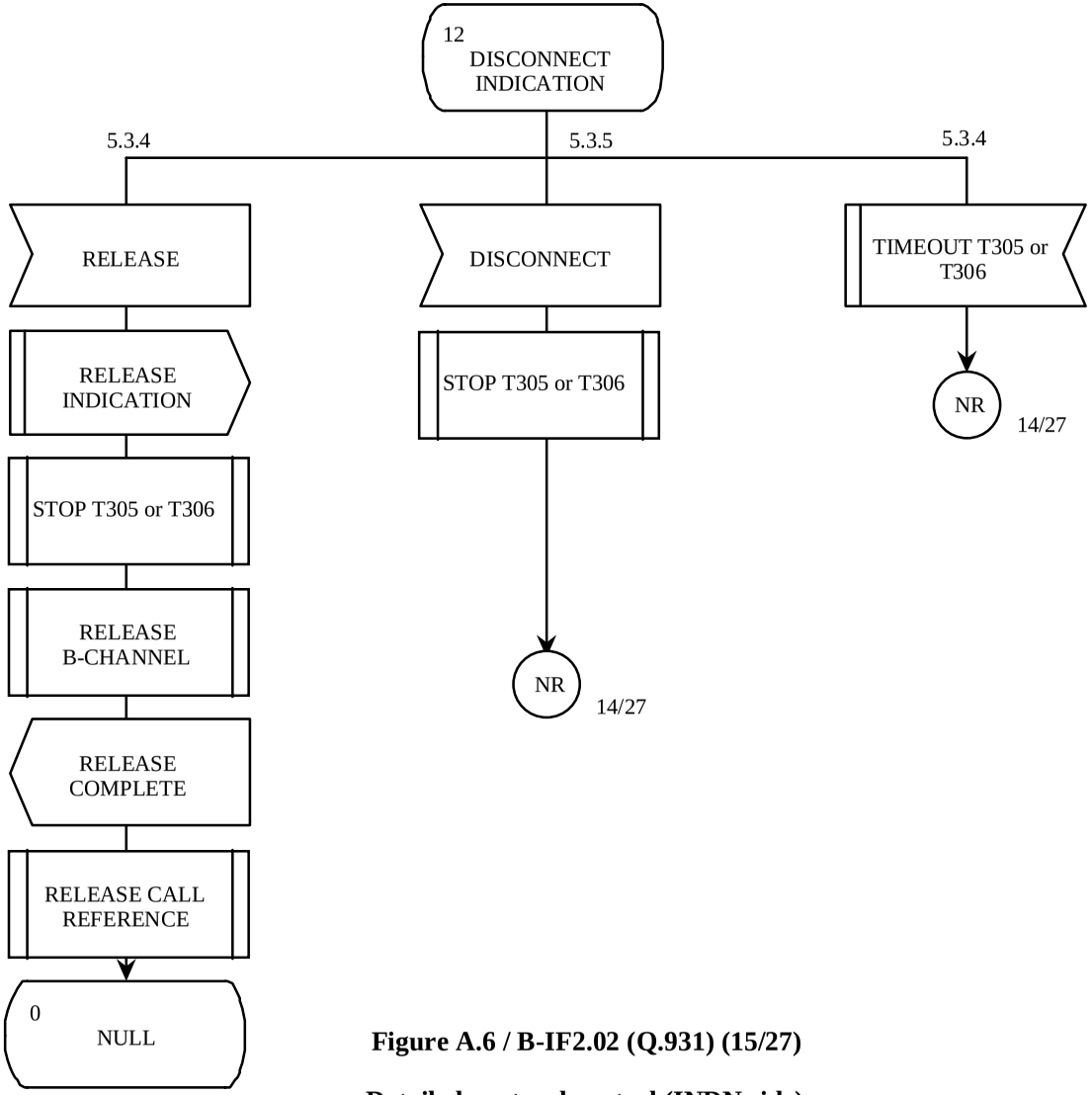
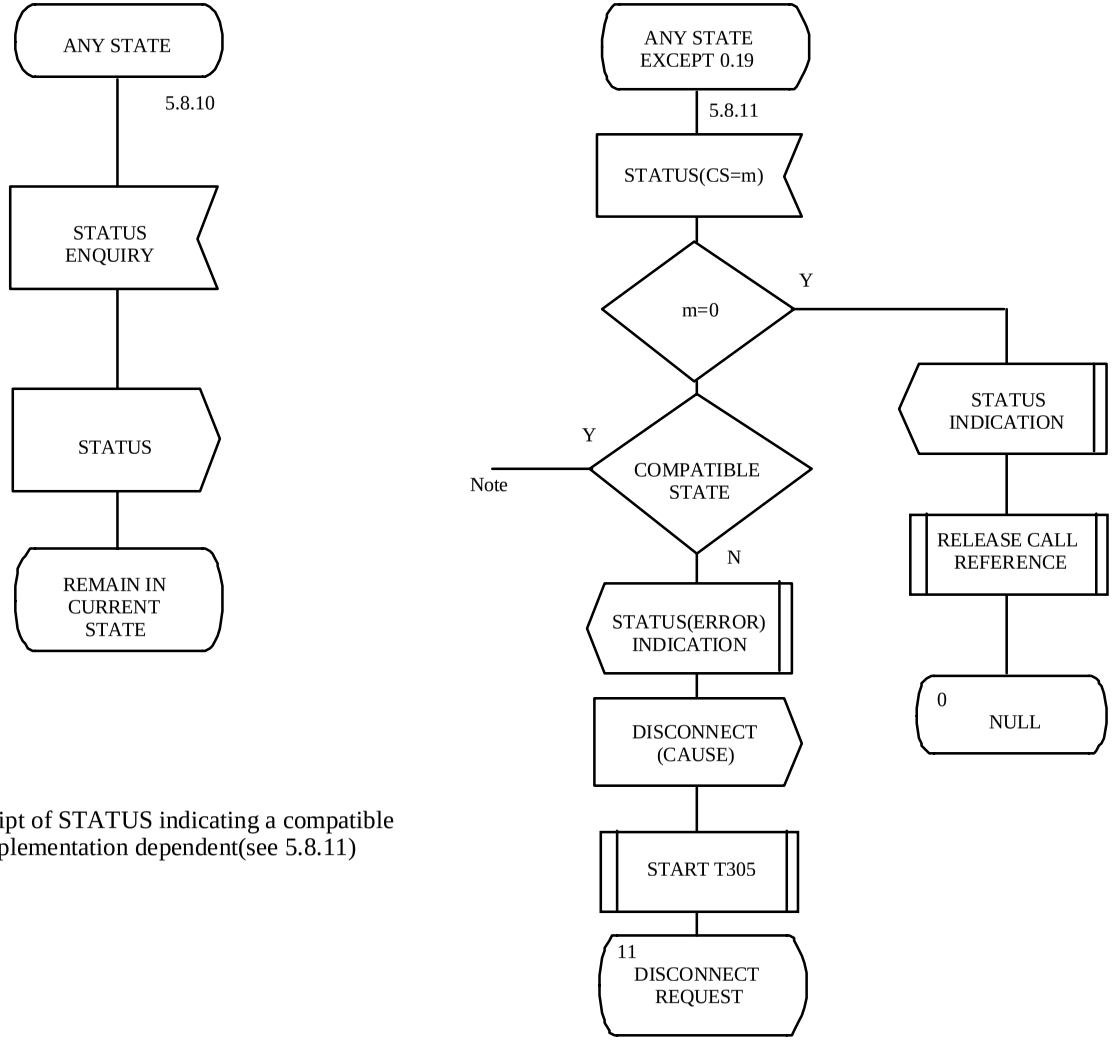


Figure A.6 / B-IF2.02 (Q.931) (15/27)

Detailed protocol control (INDN side)



Note : Action on receipt of STATUS indicating a compatible call state is implementation dependent(see 5.8.11)

Figure A.3/B-IF2.02 (Q.931) (16/24)

Detailed protocol control (public CS side)

Figure A.6 / B-IF2.02 (Q.931) (17/27)

Detailed protocol control (INDN side)

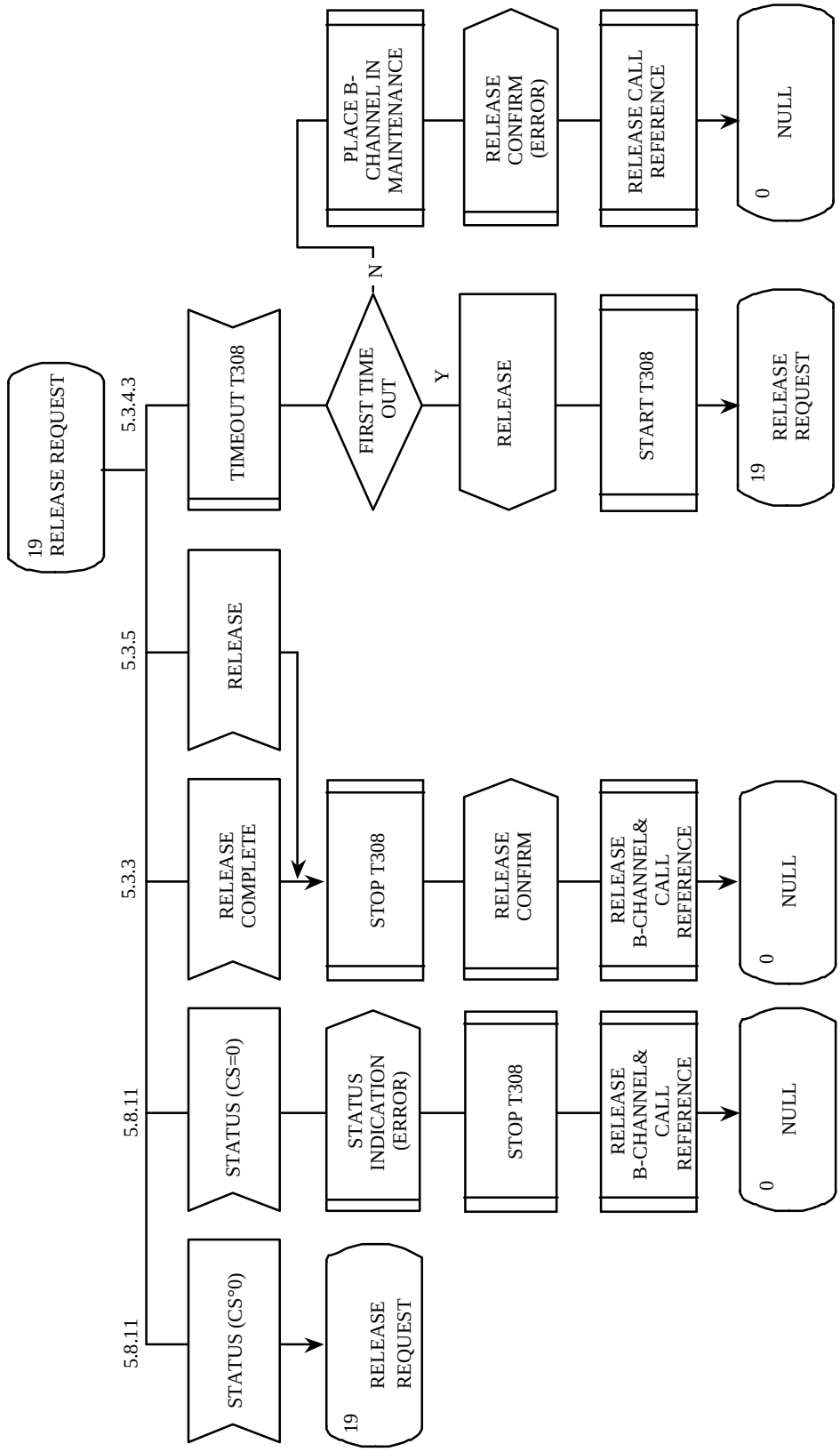
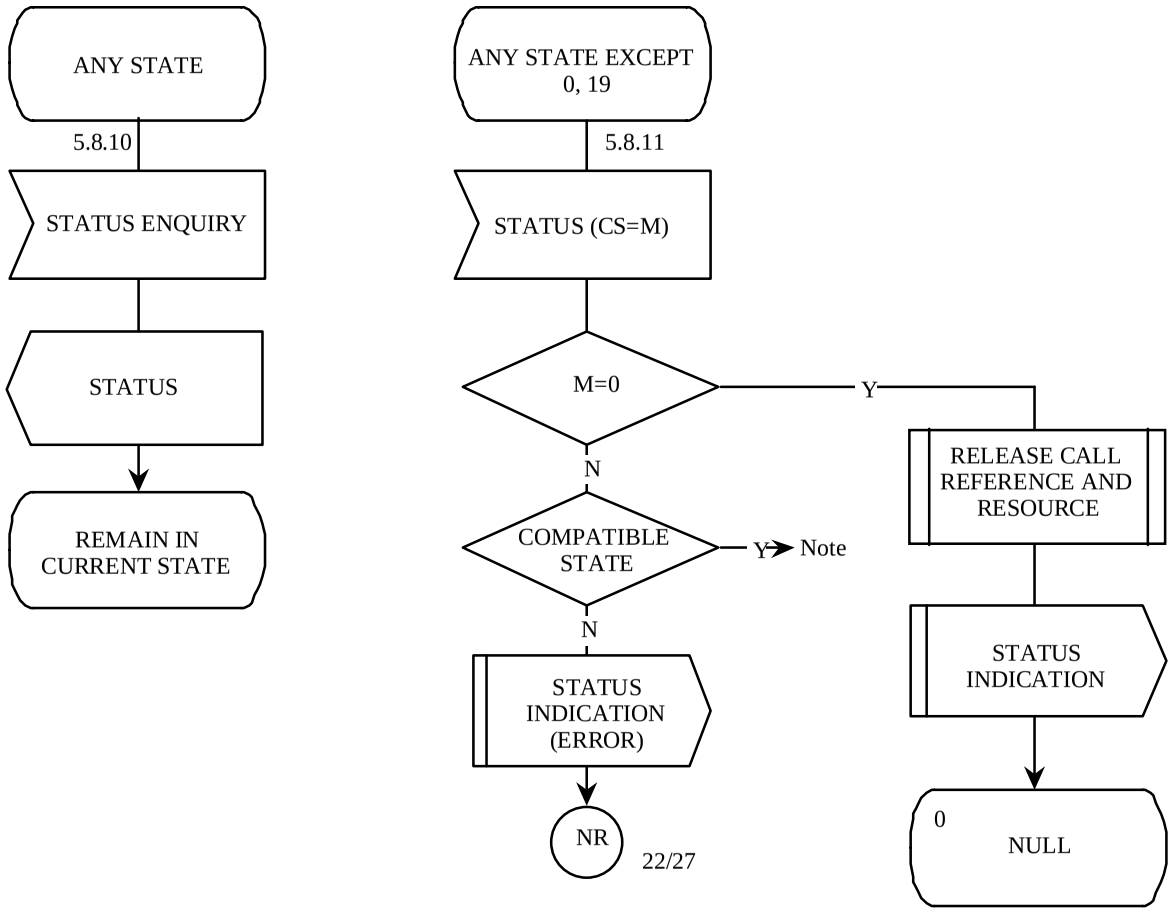


Figure A.6 / B-IF2.02 (Q.931) (18/27)

Detailed protocol control (INDN side)

Figure A.6 / B-IF2.02 (Q.931) (19/27)

Detailed protocol control (INDN side)



Note: Action on receipt of STATUS indicating a compatible call state is implentation dependent (see 5.8.11)

Figure A.6 / B-IF2.02 (Q.931) (20/27)

Detailed protocol control (INDN side)

Figure A.6 / B-IF2.02 (Q.931) (21/27)

Detailed protocol control (INDN side)

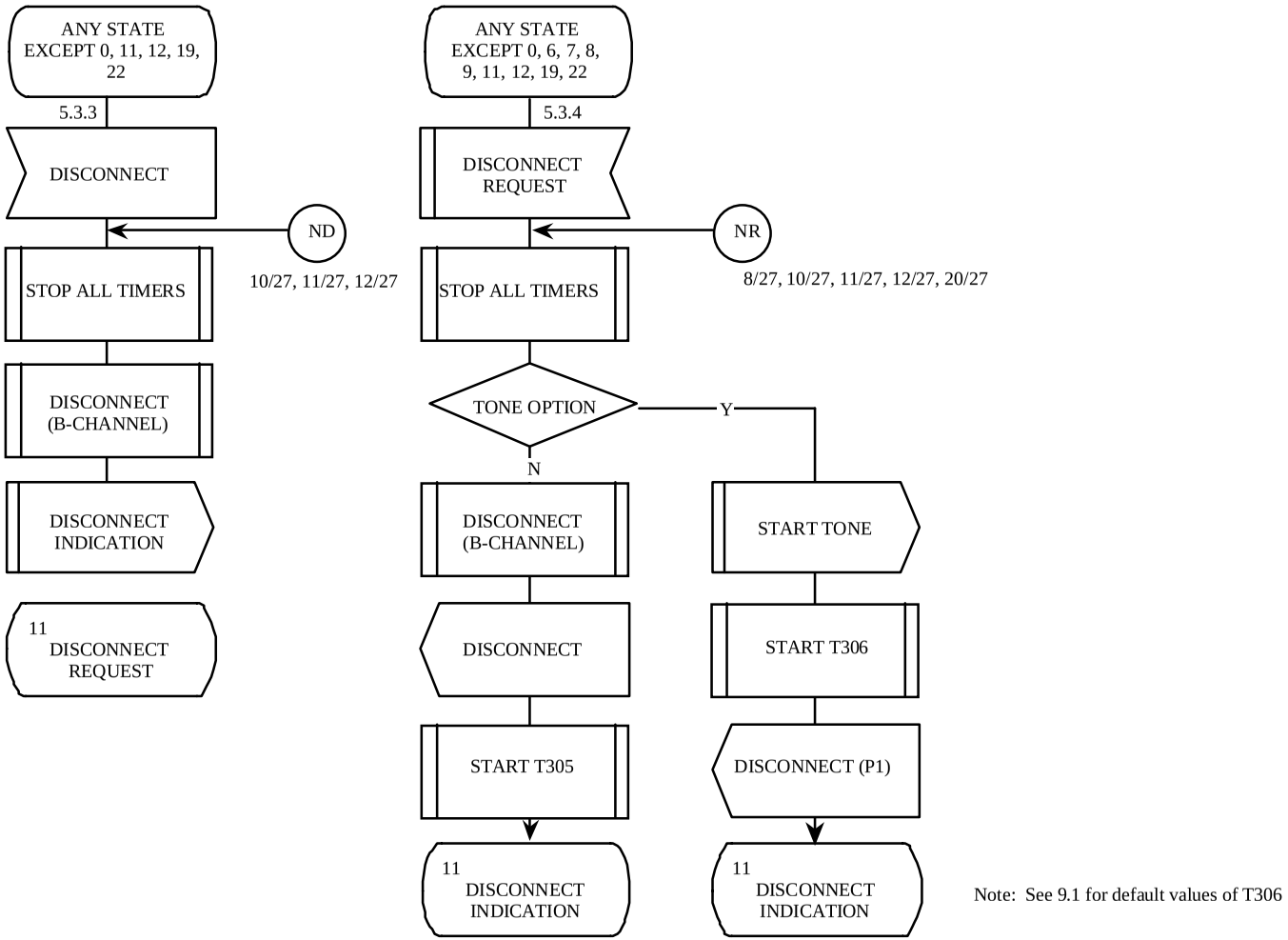
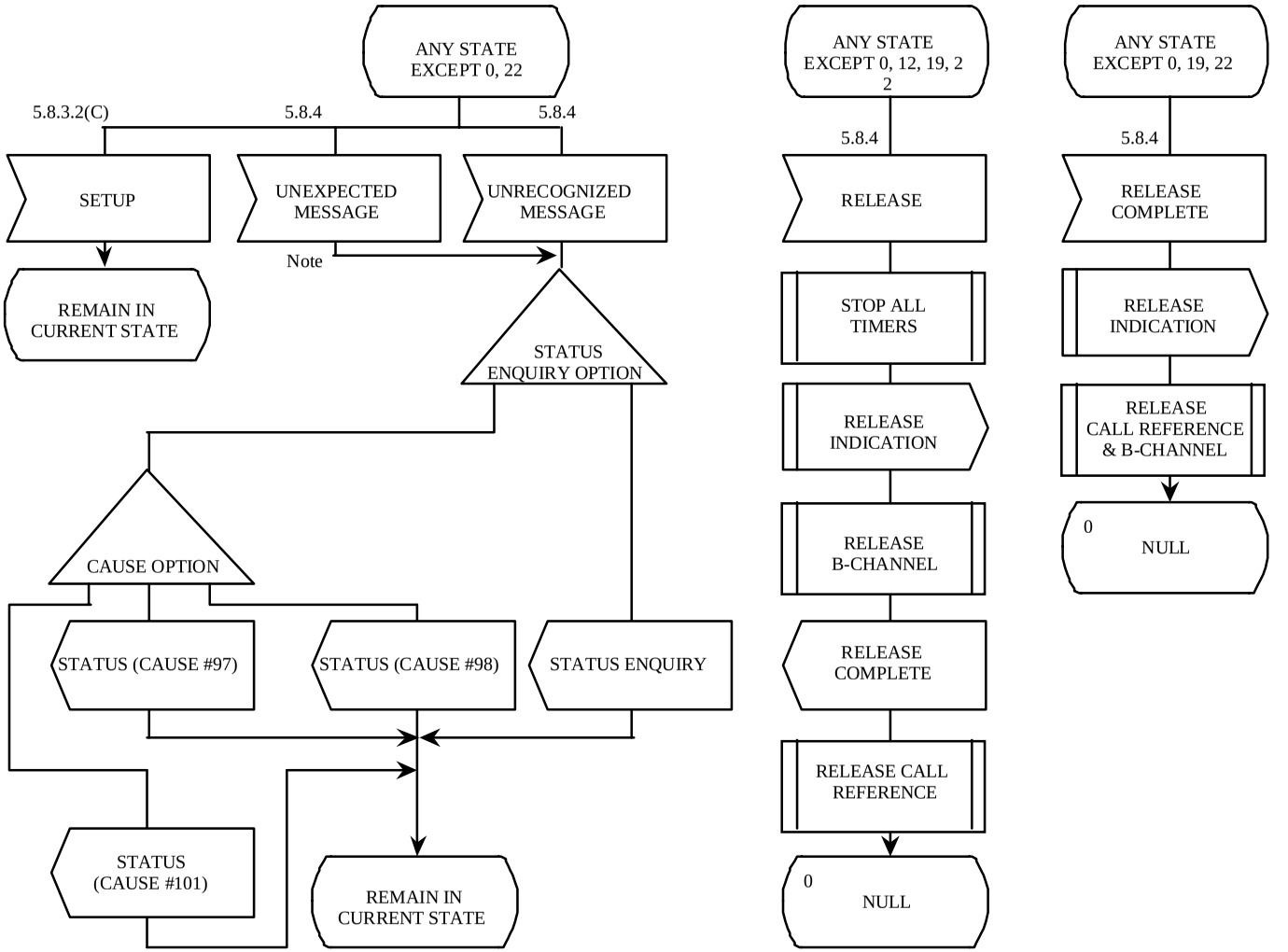


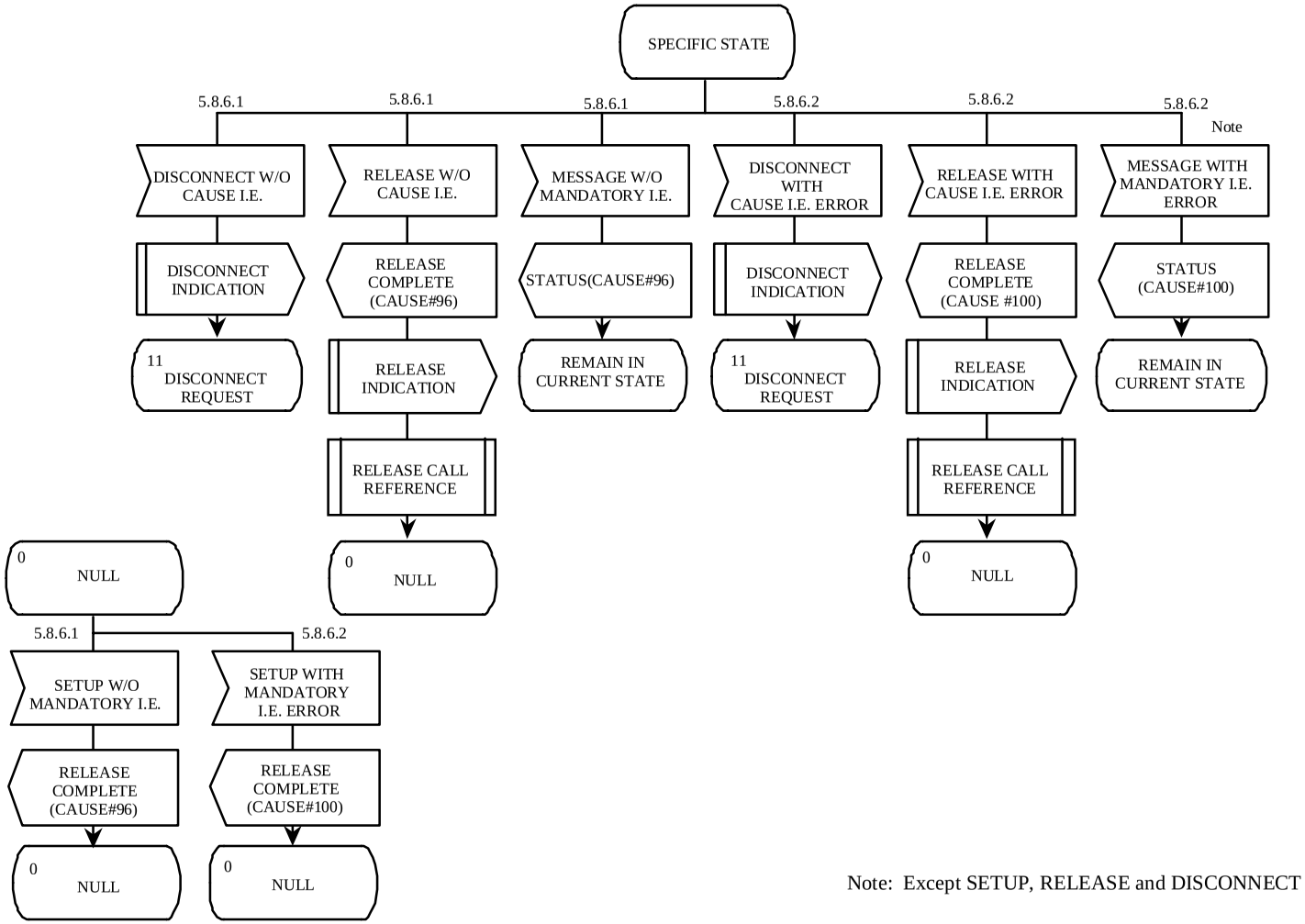
Figure A.6 / B-IF2.02 (Q.931) (22/27)

Detailed protocol control (INDN side)



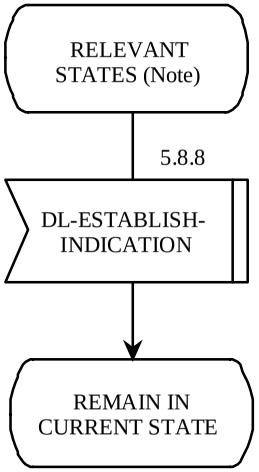
Note: Except RELEASE or RELEASE COMPLETE

Error handling SDL diagram (1/2)
Figure A.6 / B-IF2.02 (Q.931) (23/27)
Detailed protocol control (INDN side)



Note: Except SETUP, RELEASE and DISCONNECT

Error handling SDL diagram (2/2)
Figure A.6 / B-IF2.02 (Q.931) (24/27)
Detailed protocol control (INDN side)



Note: The relevant states are as follows: N1, N3-N4, N6-N12, N19

Figure A.6 / B-IF2.02 (Q.931) (25/27)

Detailed protocol control (INDN side)

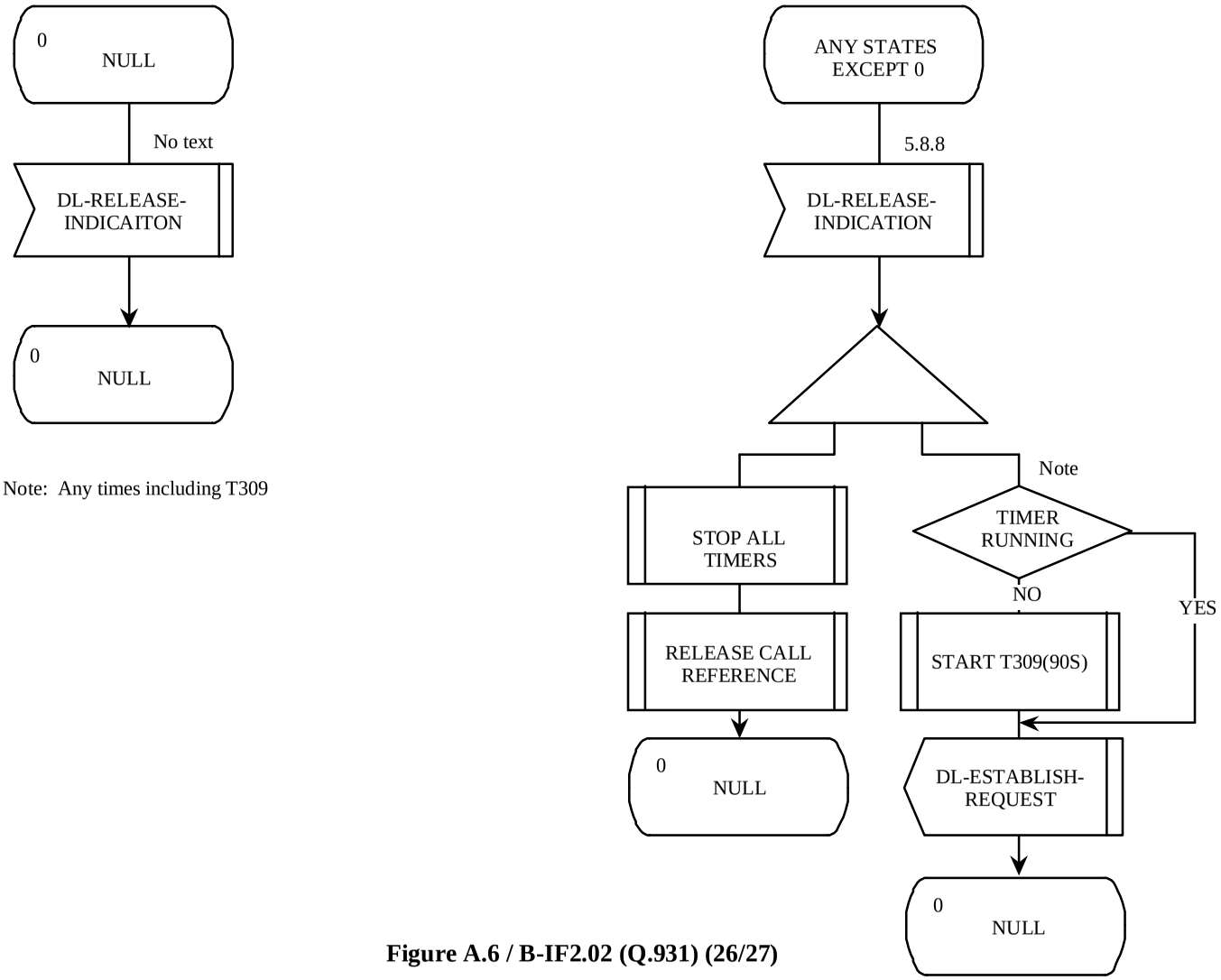


Figure A.6 / B-IF2.02 (Q.931) (26/27)

Detailed protocol control (INDN side)

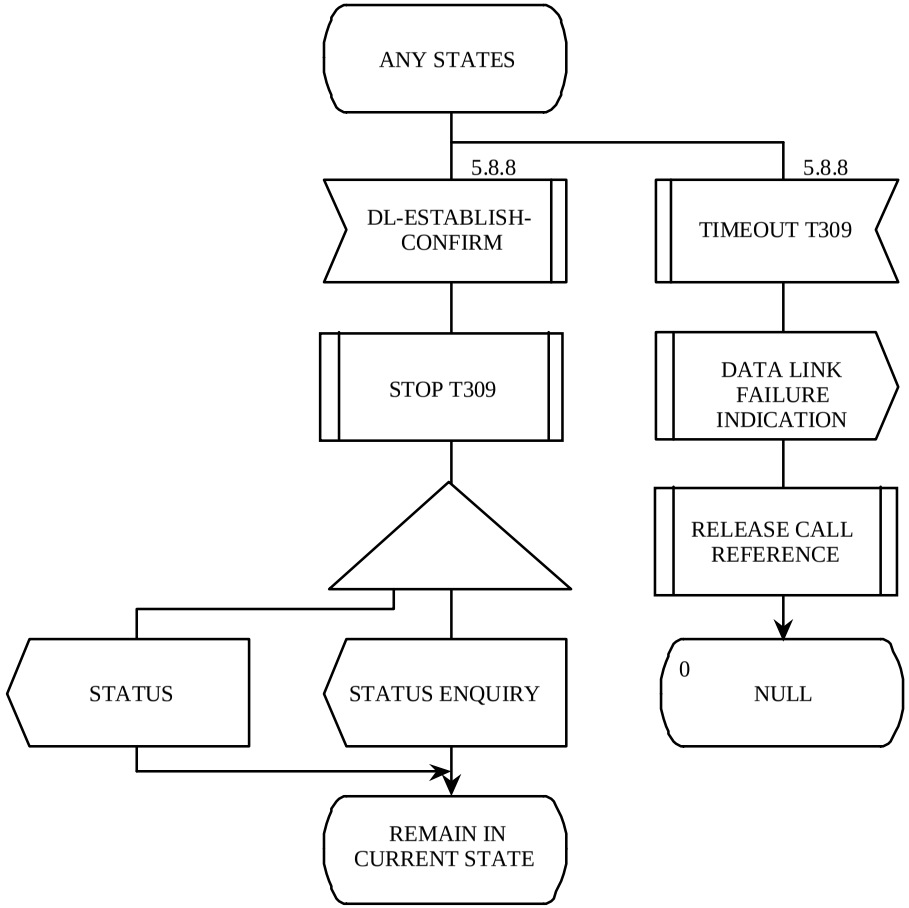


Figure A.6 / B-IF2.02 (Q.931) (27/27-1)

Detailed protocol control (INDN side)

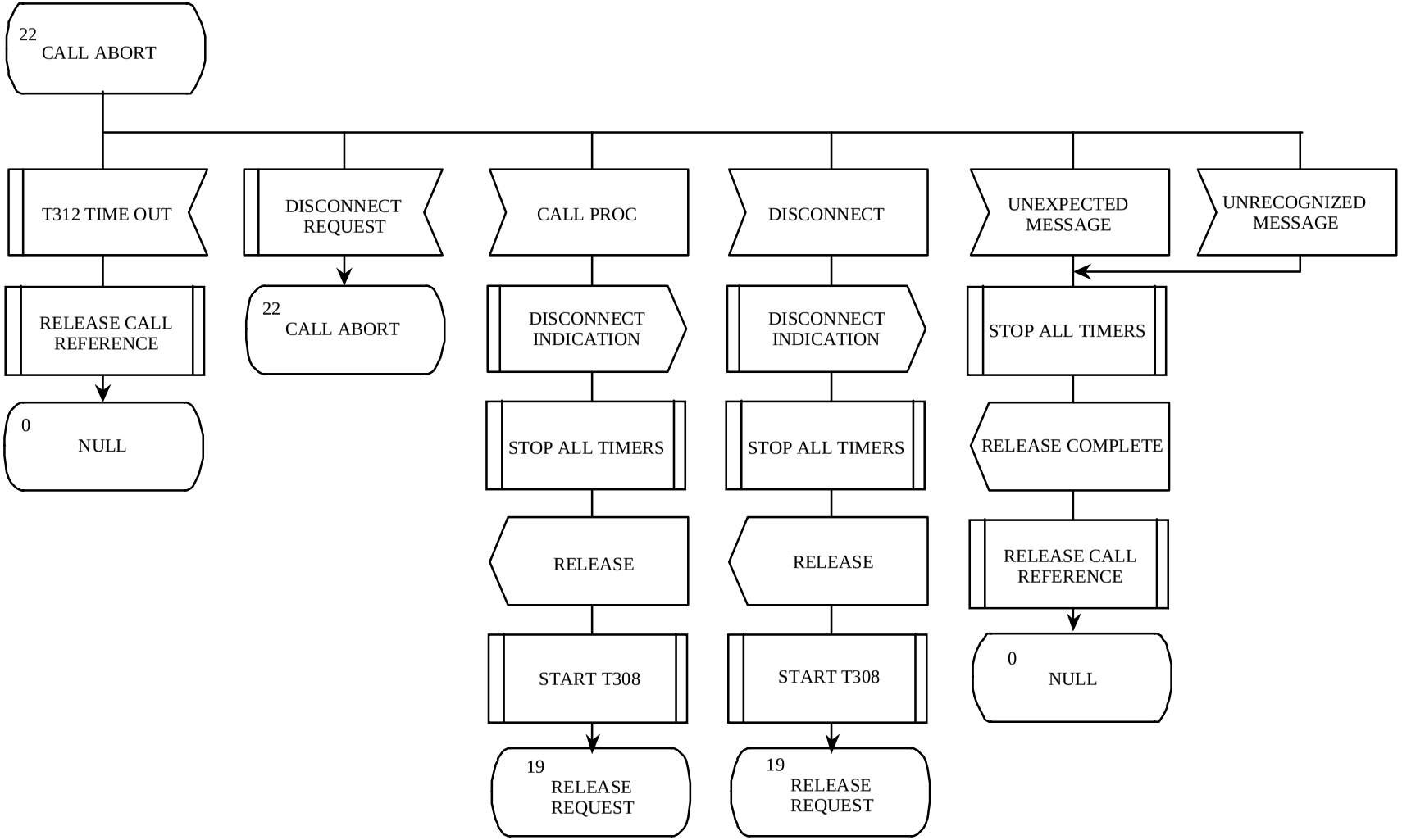


Figure A.6 / B-IF2.02 (Q.931) (27/27-2)

Detailed protocol control (INDN side)

Annex B

Compatibility and address checking

(This annex forms an integral part of this specification)

B.1 Introduction

This annex describes the various compatibility and address checks which should be carried out to ensure that best match of user and network capabilities is achieved on a call within a network.

This annex also covers interworking with existing networks.

Three different processes of checking shall be performed:

i) at the public cell station-to-ISDN interface on the calling side (see B.2);
ii) at the ISDN-to-public cell station interface on the called side (see B.3.2); and
iii) user-to-user (see B.3.3).

Note: In this context and throughout this annex the term "called user" is the endpoint entity which is explicitly addressed. This may be an addressed interworking unit (IWU); see the I.500-Series Recommendations.

For details on the coding of the information required for compatibility checking see Annex I.

B.2 Calling side compatibility checking

At the calling side, the ISDN shall check that the bearer service requested by the calling public cell station in the Bearer capability information element matches with the bearer services provided to that public cell station by the ISDN.

Network services are described in Recommendations I.230 [47] as bearer services.

B.3 Called side compatibility and address checking

In this subclause, 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. either sub-addressing or the appropriate part of the called party number), the following actions will occur:

a) If a number or sub-address is assigned to a destination side, then the information in a Called party number or Called party subaddress information element of the incoming call shall be checked by the called side against the corresponding part of the number assigned to the called side or the called side’s own sub-address. In case of a mismatch, the called side shall ignore the call. In the case of match, the compatibility checking described in B.3.2 through B.3.3 will follow.

b) If a called side has no assigned number or sub-address, then the Called party number and Called party subaddress information element shall be ignored. Then, compatibility checking described in B.3.2 and B.3.3 will follow.

Note: According to called side's requirements, compatibility checking can be performed in various ways from the viewpoint of execution order and information to be checked, e.g. first assigned number/sub-address and then compatibility or vice versa.

B.3.2 ISDN-to-public cell station compatibility checking

When the ISDN is providing a bearer service at the called side, the public cell station shall check that the bearer service offered by the ISDN in the Bearer capability information element matches the bearer services that the public cell station is able to support. If a mismatch is detected, then the public cell station shall either ignore or reject the offered call using cause No. 88, *incompatible destination* (see 5.2.2).

B.3.3 User-to-user compatibility checking

The called side endpoint entity 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).

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 endpoint entity 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.

If a mismatch is detected in checking any of the information elements above, then the endpoint entity shall either ignore or reject the offered call using cause No. 88, *incompatible destination* (see 5.2.2).

B.3.4 Called side action tables

Tables B.1, B.2 and B.3 show the action which shall be carried out as a result of compatibility checking with the calling side's request for a bearer service.

Table B.1/B-IF2.02(Q.931)
Bearer capability compatibility checking

BC mandatory info element	Point-to-point data link (Note 1)		Broadcast data link (Note 1)	
Compatible	Proceed		Proceed	
Incompatible	Ignore [5.2.5.1 a)] (Note 2)	Reject (5.2.5.1)	Ignore [5.2.5.1 a)] (Note 2)	Reject [5.2.5.1 b)] (Note 2)

Table B.2/B-IF2.02(Q.931)
Low layer and high layer compatibility checking –
Compatibility assured with the available description of the call

LLC/HLC Compatibility assured	Point-to-point data link (Note 1)			Broadcast data link (Note 1)		
Compatible	Accept			Accept		
Incompatible	Ignore [5.2.5.1 a)] (Note 2)	Reject (5.2.5.1)	Attempt low layer compatibility negotiation (Annex J)	Ignore [5.2.5.1 a)] (Note 2)	Reject [5.2.5.1 b)] (Note 2)	Attempt low layer compatibility negotiation (Annex J)

Table B.3/B-IF2.02(Q.931)
Low layer and high layer compatibility checking –
Compatibility not assured with the available description of the call

LLC/HLC Compatibility not assured	Point-to-point data link (Note 1)		Broadcast data link (Note 1)	
HLC or LLC Present	Accept or reject (Note 3)	Attempt low layer compatibility negotiation (Annex J)	Accept or reject (Note 3)	Attempt low layer compatibility negotiation (Annex J)

Notes to Tables B.1, B.2 and B.3

Note 1: For broadcast data link endpoint entity which is explicitly addressed using sub-addressing or the appropriate part of the called party number, the point-to-point column in the above table shall be used.

Note 2: When a endpoint entity on a broadcast data link is incompatible, an option of "ignore or reject" is permitted (see 5.2.2).

Note 3: Some endpoint entity on this interface may understand the High layer compatibility or Low layer compatibility information elements and would reject the call if incompatible.

B.4 Interworking with existing networks

Limitations in network or distant user signalling (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 side in the incoming SETUP message. A called side should accept limited compatibility checking (e.g. without the High layer compatibility information element) if a call is routed from an existing network which 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 indicator No. 1, *call is not end-to-end ISDN; further call progress information may be available in band*, or No. 3, *origination address is non-ISDN*.

The endpoint entity receiving a SETUP with a Progress indicator information element shall modify its compatibility checking, the endpoint entity should regard the compatibility as successful if it is compatible with the included information, which as a minimum, will be the Bearer capability information element. A terminal equipment expecting information in addition to the Bearer capability information element need not reject the call if such information is absent but a Progress indicator information element is included.

Annex C

Transit network selection *

Annex D

Extensions for symmetric call operation *

Annex E

Network specific facility selection *

Annex F

D-channel backup procedures

(This annex forms an integral part of this specification)

F.0 Foreword

The procedure defined in this annex can be used when non-associated signalling is applied to multiple primary rate access arrangements. This feature can be provided on a subscription basis and is network dependent.

F.1 General

In associated signalling, the D-channel signalling entity can only assign calls to channels on the interface containing the D-channel. When the D-channel signalling entity can assign calls to channels on more than one interface (including the one containing the D-channel), this is called non-associated signalling. Figure F.1 is an example of associated signalling used on each of the three interfaces between a public cell station and a ISDN. Replacing associated signalling with non-associated signalling on these interfaces results in the example shown in Figure F.2.

When non-associated signalling is employed, the reliability of the signalling 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. The next subclause describes the backup procedure which is optional for end-points that use non-associated signalling.

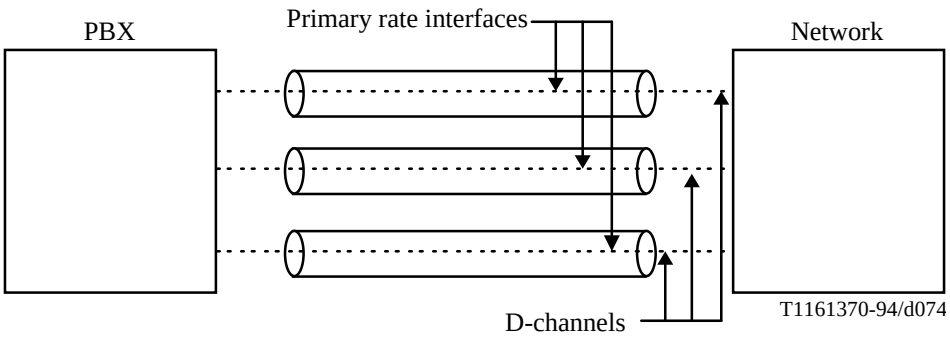


Figure F.1/Q.931
Example of associated signaling on each of the three primary rate interfaces

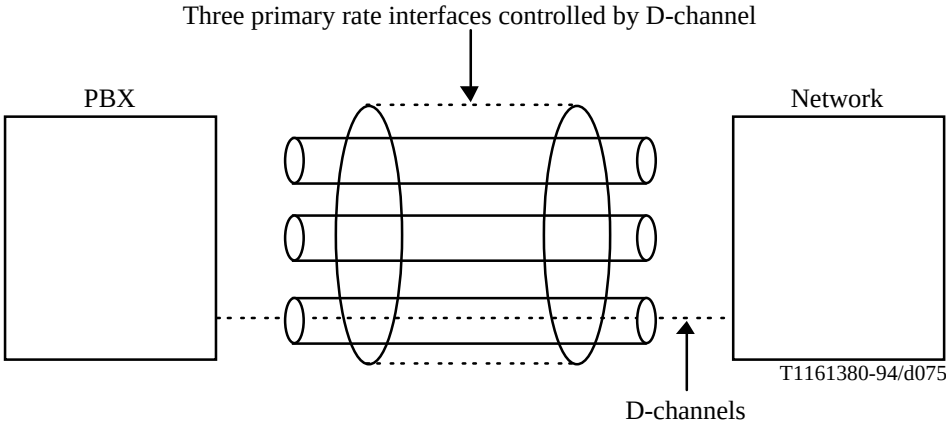


Figure F.2/Q.931
Example of non-associated signaling controlling three primary rate interfaces

F.2 D-channel backup procedure

F.2.1 Role of each D-channel

When two or more interfaces connect a ISDN and a public cell station, a primary D-channel (labelled "one") is always present on one interface. On a different interface, a secondary D-channel (labelled "two") is present that can also send signalling packets. Figure F.3 shows the addition of a secondary (i.e. backup) D-channel to the arrangement shown in Figure F.2.

D-channel one is used to send signalling packets across the public cell station-ISDN interface for multiple interfaces including the interface containing D-channel two. D-channel two is in a standby role and is active at layer 2 only. All SAPI groups (e.g. 0, 16 and 63) are alive and can send packets. 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 signalling link with DLCI = 0 of D-channel two.

Since D-channel two is in a standby role, load sharing between D-channels one and two is not possible. Furthermore, D-channel two can not serve as a B-channel when it is in a standby role. Lastly, D-channel two can only back up the signalling functions provided by D-channel one and not some other D-channel on a different interface.

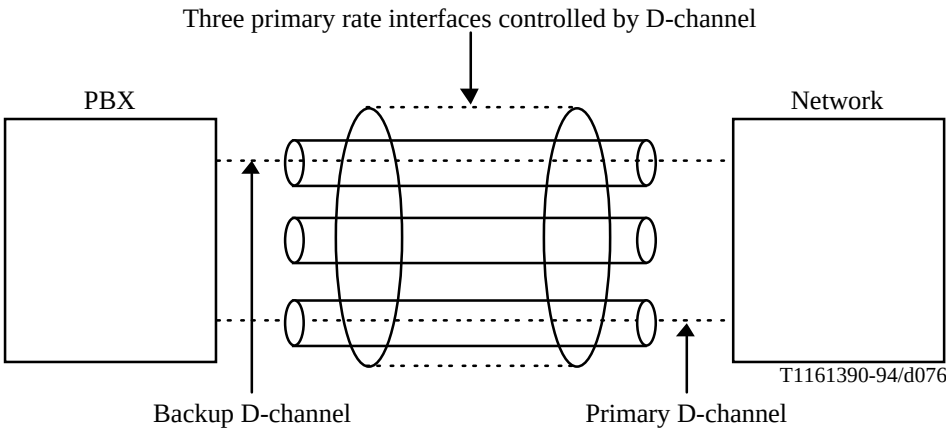


Figure F.3/Q.931
Example of non-associated signaling with backup D-channel controlling three primary rate interfaces

F.2.2 Switchover of D-channels

Failure of D-channel one is determined by the receipt of a DL-RELEASE indication primitive from the data link layer. At this point, optionally additional attempts to re-establish this D-channel may be initiated. Otherwise, it is assumed that D-channel one has failed.

Two states are defined for any D-channel in a backup arrangement. A D-channel is termed out-of-service when layer 2 remains in the TEI-assigned state, after being periodically requested by layer 3 to establish multiple-frame operation. A D-channel is termed maintenance busy when layer 2 is held in the TEI-assigned state by layer 3. While in the maintenance busy condition, the response to an invitation for link establishment is met with the transmission of a DM (Disconnected Mode).

When the D-channel one has failed and if D-channel two is not in an out-of-service condition, the layer 3 shall place D-channel one in a maintenance busy condition, start timer T321 and then issue a DL-ESTABLISH request primitive to re-initialize SAPI 0 link 0 of D-channel two. Upon receipt of this primitive, the data link layer issues an SABME command. Timer T200 is started. The end receiving the SABME command on D-channel two follows the remainder of the Q.931 procedures for establishing logical link with DLCI = 0.

Once the logical link with DLCI = 0 in D-channel two is in the Link Established state, the procedure to establish layer 3 call control signalling can begin on the link.

To establish the backup D-channel for carrying call control signalling, layer 3 should issue an appropriate layer 3 message (e.g. a STATUS ENQUIRY on stable call reference numbers). Once a response to that layer 3 message is received, D-channel two is declared to be the active D-channel, normal layer 3 call control signalling may proceed, timer T321 is stopped, and D-channel one is moved to the out-of-service condition. If the maintenance busy timer T321 expires before a response is received to the layer 3 message, D-channel one is moved to the out-of-service condition and an attempt is made to establish the logical link with DLCI = 0 on D-channel one and D-channel two.

If the logical link with DLCI = 0 of both D-channel one and D-channel two are initialized simultaneously, the designated primary shall be chosen as the D-channel for carrying call control signalling. The designated primary D-channel is agreed upon at subscription time by both sides of the interface.

After a switchover, old D-channel two becomes the new D-channel one and old D-channel one becomes the new D-channel two.

Upon completion of appropriate maintenance activity to D-channel two, the logical links for SAPI = 0 and 63 are made active at layer 2 and the D-channel is removed from the out-of-service condition.

D-channels may only be switched again by a failure of D-channel one or a routing or maintenance request from a peer entity.

Annex G

Use of progress indicators *

Annex H

Message segmentation procedures

(This annex forms an integral part of this specification)

This optional procedure is used on the basis of bilateral agreement between the public cell station and the ISDN.

H.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 Recommen-dation Q.921 [3]).

The architectural relationship to other Q.931 functions is shown in Figure H.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.

In order to support expressed needs for applications requiring message lengths of 10 000 octets, or greater, procedures to support those applications are under study. These procedures will consider backward compatibility and methods to allow information on other call references to be interleaved with segments of a long message. The specifics of these procedures are for further study.

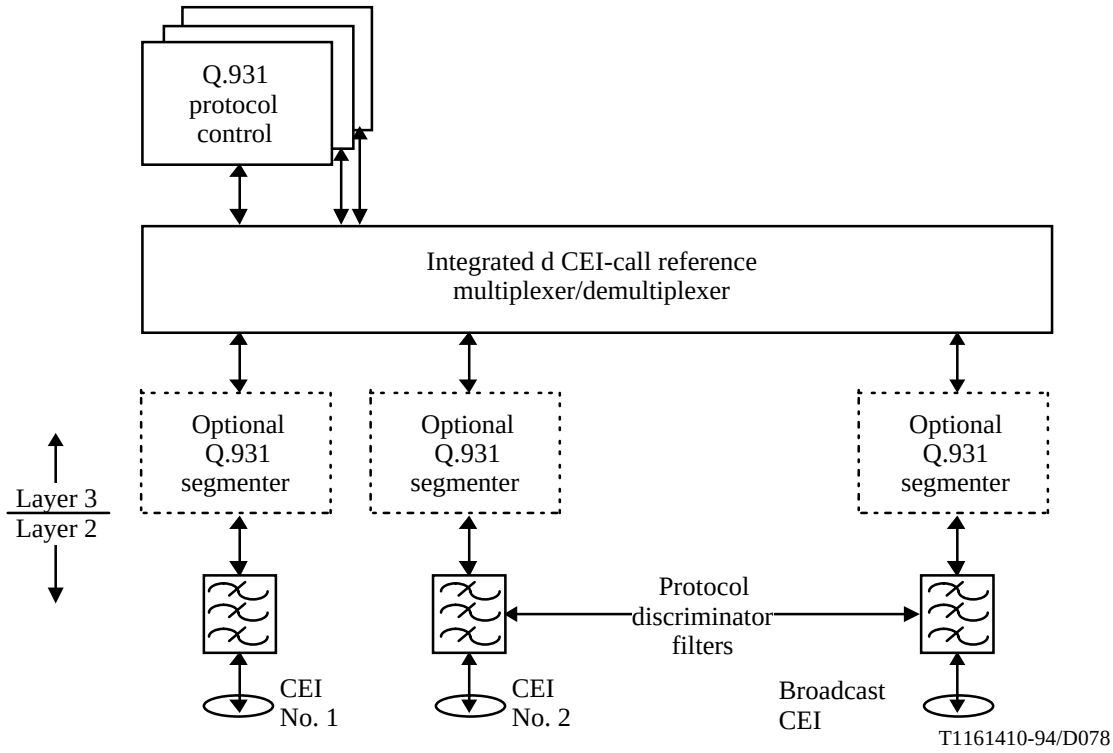


Figure H.1/Q.931
Logical architecture containing segmentation function

H.2 Message segmentation

The following rules apply when Q.931 messages are to be segmented for transmission:

a) The default maximum number of message segments is 8. If the message is too long to be segmented then a local maintenance activity shall be notified.

b) The first message segment shall begin with the Protocol discriminator information element immediately followed by the Call reference information element, the segment message type, the Segmented message information element, and 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.

c) Each subsequent message segment shall begin with the Protocol discriminator information element immediately followed by the Call reference information element, the segment message type, 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.

d) 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.

e) 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 H.2.

f) 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.

g) The transmission of a segmented message may be aborted by sending a message or message segment containing a different call reference; sending a message with the message type not coded "segment message", or stopping the transmission of subsequent message segments pertaining to the same message.

h) 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 any other call reference is sent on that data link connection.

i) The octet order for the segmented message shall be preserved regardless of segment boundary.

H.3 Reassembly of segmented messages

The following rules apply to the receipt and reassembly of segmented Q.931 messages:

a) A reassembly function, on receiving a message segment containing the Segmented message information element with the first segment indicator indicating "first message", and containing the call reference and message type (coded as "segment message") shall enter the Receiving Segmented Message state and accumulate message segments.

b) Timer T314 shall be initialized or re-initialized upon receipt of a message segment 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 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 message segment with a Segmented message information element should 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 zero before delivering the message for further Q.931 processing as specified in 5.8. The reassembly function shall enter the Null state.

d) Upon expiry of timer T314, the reassembly function shall discard all segments of this message so far received; notify the layer 3 management entity for the data link connection that message segments have been lost and enter the Null state.

Note 1: Subsequent message segments relating to the same message shall be discarded according to rule f).

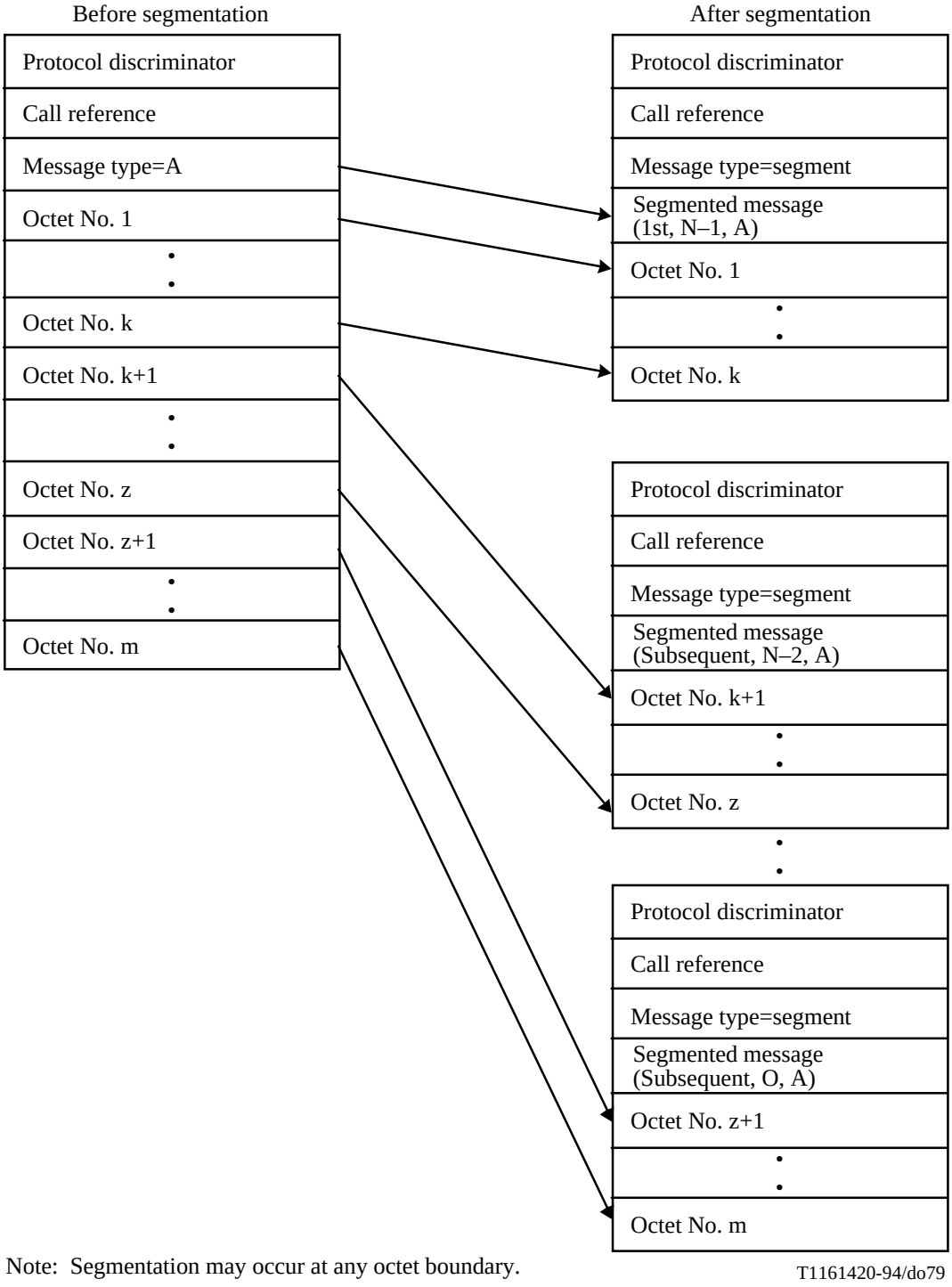


Figure H.2/Q.931
Relation between Message and Segments

e) A reassembly function, upon receiving eight message segments of the same segmented message without receiving a message segment with a number of segments remaining field of the Segmented message information element coded zero, shall discard all message segments so far received; notify the layer 3 management entity for the data link connection that messages have been discarded, and enter the Null state.

Note 2: Subsequent message segments relating to the same message shall be discarded according to rule f).

f) A reassembly function, on receiving a message segment containing a Segmented message information element, but with no call reference or Message type information element, while in the Null state shall discard that message segment and remain in the Null state.

g) A reassembly function, on receiving a message segment containing a Segmented message information element, while in the Receiving Segmented Message state with the number of segments remaining field that is not decremented from the number of segments remaining field in the Segmented message information element of the previous message segment, shall discard all segments of this message so far received, and enter the Null state.

Note 3: Subsequent message segments relating to the same message shall be discarded according to rule f).

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 received message segments so far received; forward the DL-RELEASE indication primitive or DL-ESTABLISH indication primitive for further Q.931 processing, and enter the Null state.

i) A reassembly function, upon receiving a message segment with the first segment indicator of the Segmented message information element indicating "subsequent", while in the Null state, shall discard that message segment, and remain in the Null state.

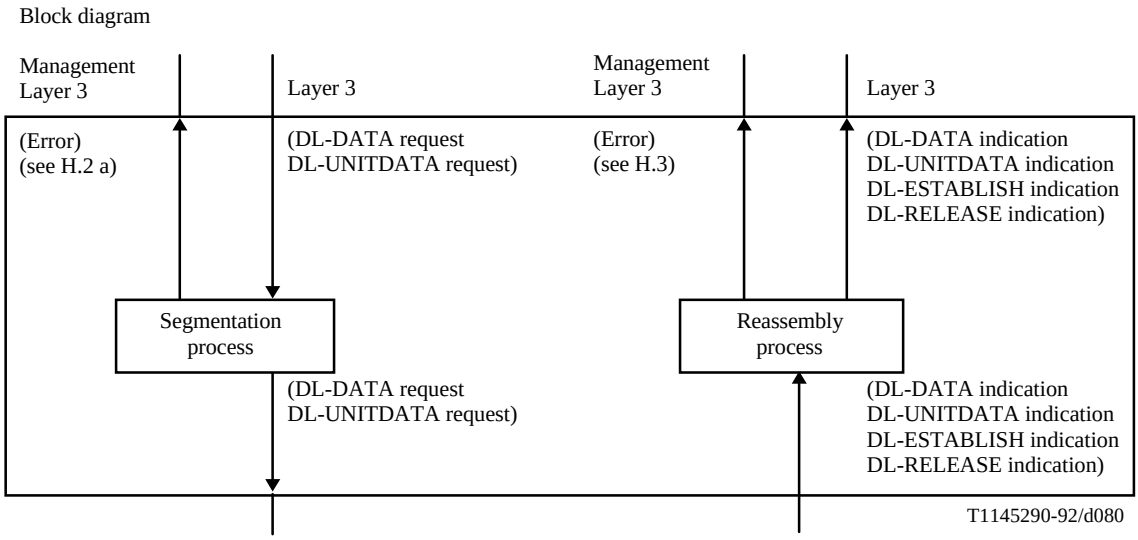


Figure H.3/Q.931
Segmentation Functional Interaction Diagram

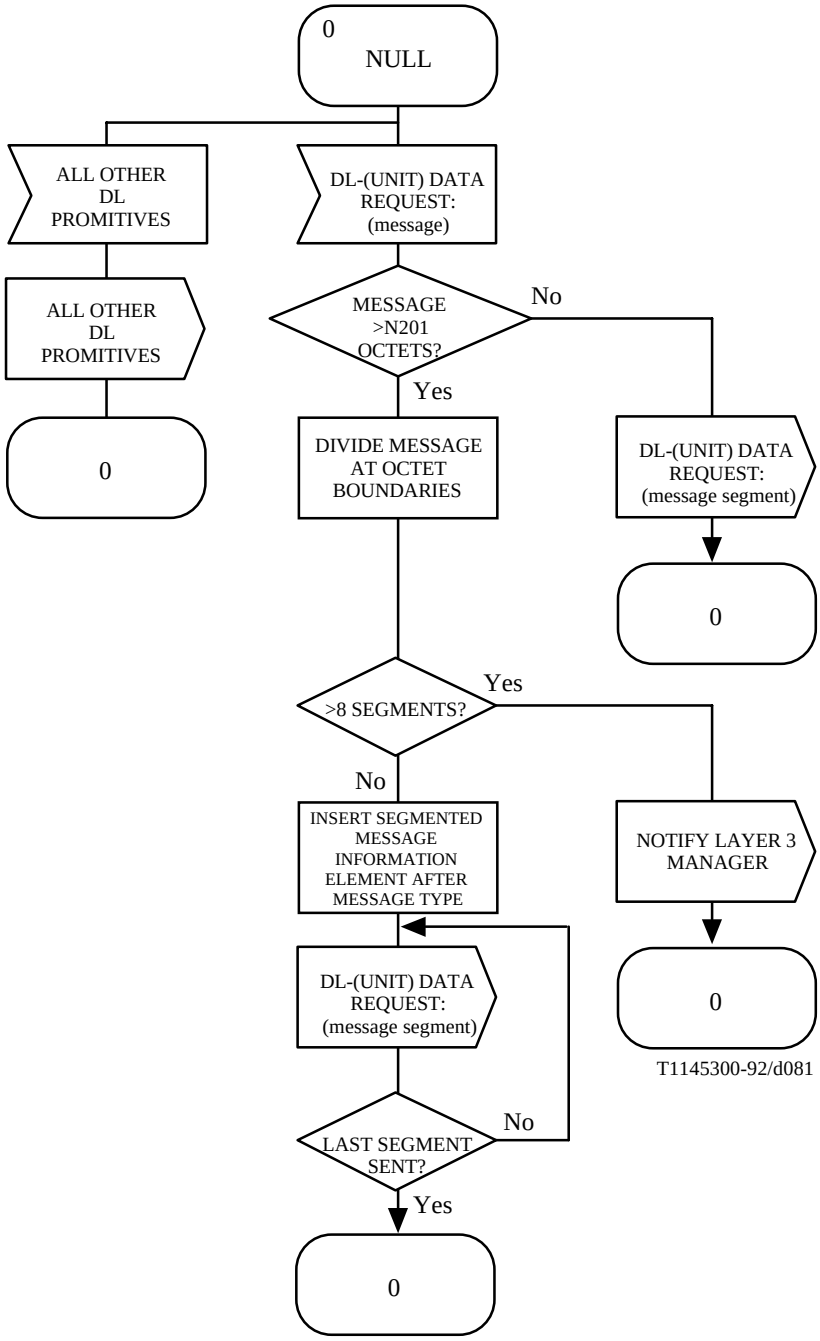


Figure H4/Q931

Message Segmenter SDL

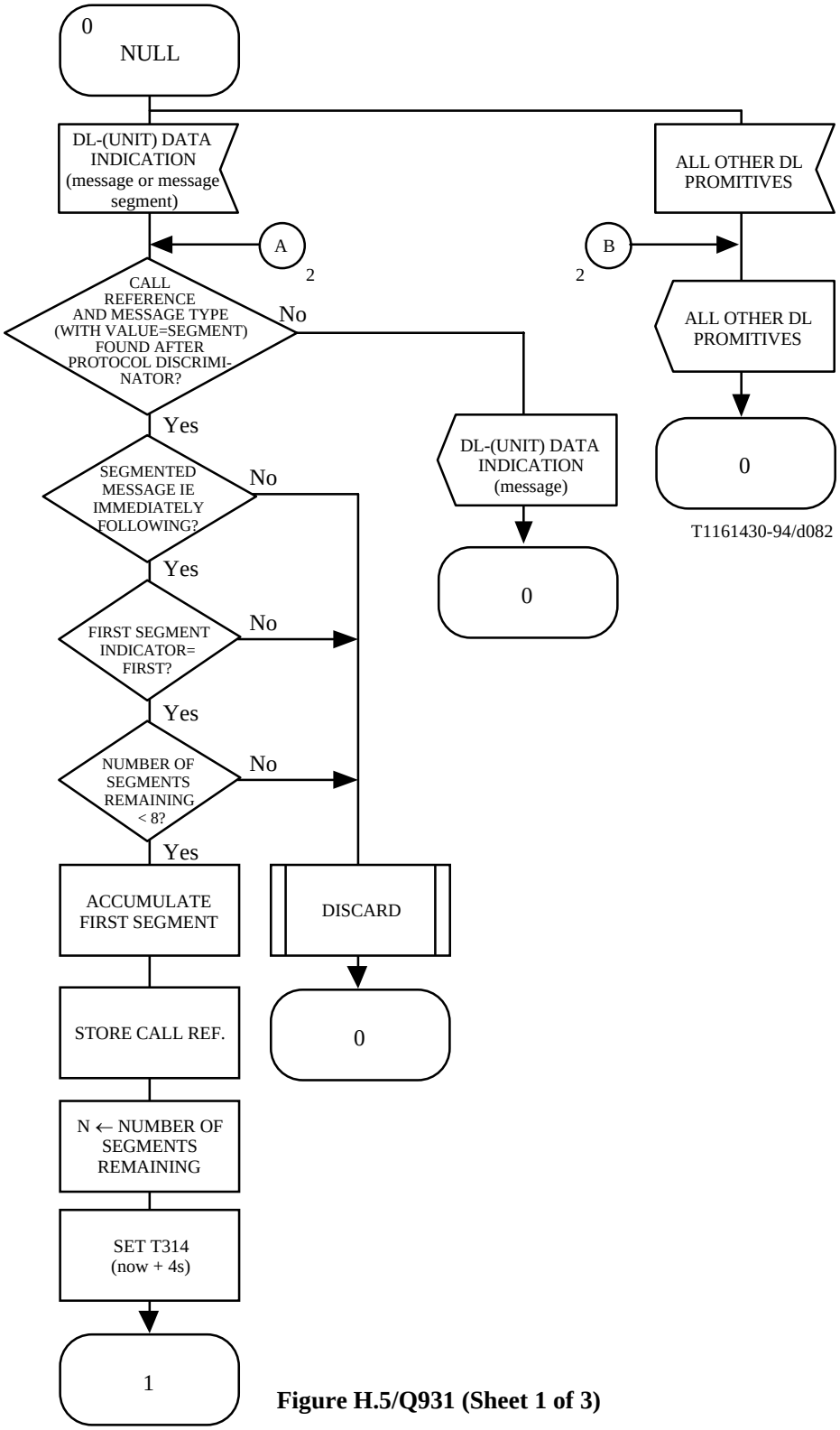


Figure H.5/Q931 (Sheet 1 of 3)

Message Reassembler SDL

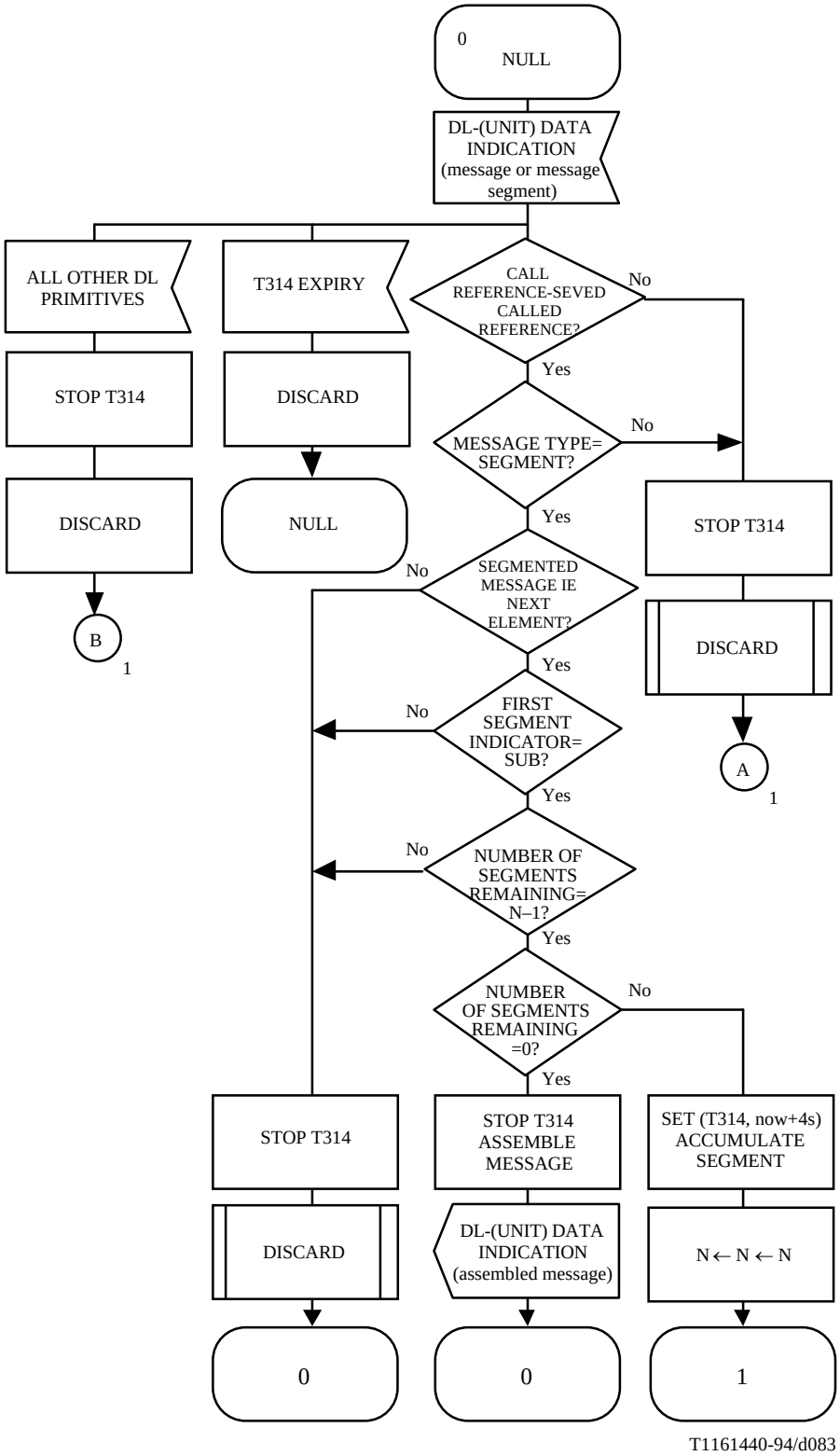


Figure H.5/Q931 (Sheet 2 of 3)
Message Reassembler SDL

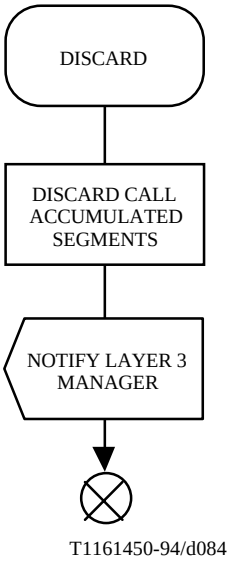


Figure H.5/Q931 (Sheet 2 of 3)
Message Reassembler SDL

Annex I

Low layer information coding principles

(This annex forms an integral part of this specification)

I.1 Purpose

This annex describes principles that shall be used when the calling side specifies information during call set-up regarding low layer capabilities required in the network and by the destination side.

Note: In this context and throughout this annex the term "called user" is the endpoint entity which is explicitly addressed. This may be an addressed interworking unit (IWU) (see I.500-Series Recommendations [51] and Recommen-dation X.31 [14] case A).

I.2 Principles

I.2.1 Definitions of types of information

There are three different types of information that the calling side may specify during call set-up to identify low layer capabilities needed in the network and by the destination side:

a) **type I information** is information about the calling terminal which is only used at the destination end to allow a decision regarding terminal compatibility. An example would be modem type. This information is encoded in octets 5 to 7 of the Low layer compatibility information element;

b) **type II information** is the selection of bearer service from the choices of bearer services offered by the ISDN to which the calling public cell station is connected. This type of information is present even if no interworking occurs. An example is unrestricted digital information (UDI). This information is coded in

   i) octets 3 and 4 of the Bearer capability information element when the transfer mode required by the calling public cell station is circuit mode;

   ii) octets 3 and 4 of the Bearer capability information element when the transfer mode required by the calling public cell station is packet mode;

Note: Use of this transfer mode is for further study.

c) **type III information** is information about the terminal or intended call which is used to decide destination terminal compatibility and possibly to facilitate interworking with other dedicated networks. An example is A-law encoding. This information is encoded in octet 5 of the Bearer capability information element.

I.2.2 Examination by network

Type I information is user-to-user (i.e. not examined by network) while both types II and III should be available for examination by the destination public cell station and the ISDN. The Low layer compatibility information element is an information element which is not examined by the network while the Bearer capability information element is an information element which is examined by the public cell station and the ISDN.

I.2.3 Location of type I information

Type I information (i.e. terminal information only significant to the called side) shall, when used, be included in the Low layer compatibility information element.

I.2.4 Location of type II and III information

Type II (i.e. bearer selection) information shall be included in the Bearer capability information element. Type III information, when used, is included in the Bearer capability information element. The ISDN may use and modify the information (e.g. to provide interworking). The rationale for the user including some terminal related information in the type III information (interworking related) is shown by the following example.

Normally with UDI, the rate adaption technique chosen is related to the terminal. The specification of a particular rate adaption scheme with a UDI bearer service could allow a compatibility decision by the destination. However, it could also conceivably be used to allow interworking with a PSTN, assuming that the appropriate functions (i.e. data extraction, modem pool) are available at the interworking unit.

If the rate adaption information is carried in the Low layer compatibility information element, and not in the Bearer capability information element, then interworking by the ISDN providing the bearer capability would not be possible. However, if the rate adaption information is carried in the Bearer capability information element, interworking would be possible.

Hence, there is some terminal related information which may be considered interworking related. The consequence for the calling side of not including such terminal related information in the Bearer capability information element is that the call may not be completed if an interworking situation is encountered.

Annex J

Low layer compatibility negotiation

(This annex forms an integral part of this specification)

This annex describes an additional low layer compatibility checking procedure that may be applied by the user. However, this procedure is a network option and may not be supported by all of ISDNs.

J.1 General

The purpose of the Low layer compatibility information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g. a remote user or an interworking unit or high layer function network node addressed by the calling user). The Low layer compatibility information element is transferred transparently 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 network and therefore the bearer capability provided by the network 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 network.

The Low layer compatibility information element is coded according to 4.5.19.

J.2 Low layer capability notification to the called user

When the calling user wishes to notify the called user of its information transfer attributes (type II information – octets 3 and 4) or any low layer protocol (type I information - octets 5 to 7) 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 the 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 (unrecognized information element).

J.3 Low layer compatibility negotiation between users

If the negotiation indicator (see 4.5) of the Low layer compatibility information element included in the SETUP message is set to "Out-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 (unrecognized information element). Called users are advised not to include in the Low layer compatibility information element sent to the calling user, attributes which would have the same value as the ones contained in the Low layer compatibility information element received from the calling party.

J.4 Low layer compatibility negotiation options

The Low layer compatibility information element contains a negotiation indicator which may have one of the following values:

a) *Out-band negotiation not possible (default)* – Then the called user shall not invoke negotiation, according to J.3.

b) *Out-band negotiation possible* – The called user may then invoke low layer compatibility negotiation, as needed, according to J.3.

c) *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.

d) *Either in-band or out-band negotiation allowed* – The called user may invoke one or the other low layer compatibility negotiation procedures according to its requirements. If the out-band low layer compatibility negotiation is supported by both of the end-to-end parties, then this method of negotiation is preferred.

J.5 Alternate requested values

If the user wishes to indicate alternative values of low layer compatibility parameters (e.g. alternative protocol suites or protocol parameters), the Low layer compatibility information element is repeated in the SETUP message. Up to four Low layer compatibility information elements may be included in a SETUP message. The first Low layer compatibility information element in the message is preceded by the Repeat indicator information element specifying "priority list for selection". The order of appearance of the Low layer compatibility information elements indicates the order of preference of end-to-end low layer parameters.

Alternatively, the network may discard the lower priority Low layer compatibility information element(s) depending on the signalling capability of the network.

If the network or called side does not support repeating of the Low layer compatibility information element, and therefore discards the Repeat indicator information element and the subsequent Low layer compatibility information elements, only the first Low layer compatibility information element is used in the negotiation.

The called side indicates a single choice from among the options offered in the SETUP message by including the Low layer compatibility information element in the CONNECT message. Absence of a Low layer compatibility information element in the CONNECT message indicates acceptance of the first Low layer compatibility information element in the SETUP message.

Annex K

Procedures for establishment of bearer connection prior to call acceptance *

Annex L

Optional procedures for bearer service change *

Appendix I

Definition of causes values

(This appendix does not form an integral part of this specification)

Table I.2 indicates the usage of cause values within this specification. Other usage may be provided within other Recommendations, e.g. Q.700-Series and Q.699. Other causes may also be used by Q.931 entities where this is not precluded by the procedures defined elsewhere in this specification.

Table I.1 defines the key for the location of generation in Table I.2. For more precise usage of the location codes in the cause information element, see Recommendation Q.850.

Table I.1/B-IF2.02(Q.931)
Key to the location in Table I.2

LU	Local user
LN	Local network
TN	Transit network
RN	Remote network
RU	Remote user
LPE	Local peer entity (for symmetrical operation, see Annex D)
The following abbreviations to message types are used in Table I.2	
CON CON	CONGESTION CONTROL
DISC	DISCONNECT
REL	RELEASE
REL COM	RELEASE COMPLETE
RES REJ	RESUME REJECT
STAT	STATUS
SUSP REJ	SUSPEND REJECT

Table I.2/B-IF2.02(Q.931)
Usage of cause values

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
1	000	0001	Unassigned (unallocated) number	Condition	5.1.4	LN		REL COM DISC
					5.2.4	RU	REL COM DISC	
2	000	0010	No route to specified transit network	Transit network identity/network specific facilities info. elements	C.2	TN		DISC
					E.3	LN		REL COM
3	000	0011	No route to destination	Condition	5.1.4	LN		DISC REL COM
					5.2.4	RU	REL COM DISC	DISC
6	000	0110	Channel unacceptable	–	5.2.3.1 c) 5.3.2 d) 6.2.2.3.1	LN		REL
7	000	0111	Call awarded and being delivered in an established channel	–	6.2.2.3.1	LN		REL
16	001	0000	Normal call clearing	Condition		RU	DISC	DISC
17	001	0001	User busy	–	5.2.5.1 5.2.5.4 b)	RU	REL COM	DISC
					No procedure	RN		DISC

Table I.2/B-IF2.02(Q.931) *(cont.)*

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
18	001	0010	No user responding	–	5.2.5.3	RN		DISC
19	001	0011	User alerting, no answer	–	5.2.5.3	RN		DISC
20	001	0100	Subscriber absent	–	5.2.5.4	RN		DISC
21	001	0101	Call rejected	Condition: user supplied diagnostic	5.2.5.1 5.2.5.4 b)	RU	REL COM	DISC
22	001	0110	Number changed	New destination number	5.1.4	LN		DISC REL COM
					5.2.4	RU	REL COM DISC	DISC
26	001	1010	Non-selected user clearing	–	5.3.2 b) 6.2.2.3.1	LN		REL
27	001	1011	Destination out of order	–	5.8.9	RN		DISC
28	001	1100	Invalid number format (incomplete number)	–		LN		DISC REL COM
					5.2.4	RU	DISC REL COM	DISC
					5.1.5.2	LN		DISC
					5.2.4	RN		DISC
					5.1.4	LN		DISC REL COM

Table I.2/B-IF2.02(Q.931) *(cont.)*

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
29	011	1101	Facility rejected	Facility identification	No procedure in Q.931	LN		REL COM DISC
						RN		DISC
						RU	REL COM DISC	
30	001	1110	Response to STATUS ENQUIRY	–	5.8.10	LU, LN		STAT
31	001	1111	Normal, unspecified	–	5.8.4	RN		REL COM DISC
34	010	0010	No circuit/channel available	–	5.1.1 5.1.2 5.1.5.1 5.1.5.2	LN		REL COM
					5.2.3.1 b) 5.2.3.1 e) 5.2.3.2 6.2.2.3.1	RU	REL COM	DISC
					C.2	LN	REL COM DISC	REL COM DISC
					C.2	TN		DISC
					D.1.1 e) D.3 b)	LPE		REL COM
38	010	0110	Network out of order	–	No procedure			

Table I.2/B-IF2.02(Q.931) *(cont.)*

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
41	010	1001	Temporary failure	–	5.8.8	LU, LN		DISC
					5.8.10	LN, RU, RN	DISC	DISC
42	010	1010	Switching equipment congestion	–	No procedure			REL REL COM
43	010	1011	Access information discarded	Discarded into element identifier(s)	7.1.5.7	RU, LN, RU		CON CON
					7.1.6.1	LN		STAT
					5.8.7.2	LN, LU		STAT
44	010	1100	Requested circuit/channel not available	–	5.1.2 5.1.5.1 5.1.5.2	LN		REL COM
					5.2.3.1 e) 5.2.3.2 6.2.3.3.1	RU	REL COM	DISC
					D.1.1 e)			REL COM
47	010	1111	Resource unavailable, unspecified	–	No procedure			

Table I.2/B-IF2.02(Q.931) *(cont.)*

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
57	011	1001	Bearer capability not authorized	Attributes of bearer capability	5.1.5.2	LN		DISC REL COM
					7.2.2	LN		REL REL COM
58	011	1010	Bearer capability not presently available	Attributes of bearer capability	5.1.5.2	LN		DISC REL COM
					7.2.2	LN		REL REL COM
63	011	1111	Service or option not available, unspecified	–	5.1.5.2	LN		DISC REL COM
65	100	0001	Bearer capability not implemented	Attributes of bearer capability	5.1.5.2	LN		DISC REL COM
					6.1	LN		REL COM
66	100	0010	Channel type not implemented	Channel type	No procedure			
69	100	0101	Requested facility not implemented	Facility identification	7.1.3.6	RU	DISC REL COM	DISC
					7.1.4.3 7.1.5.3	RN		REL DISC
					7.1.7.4	LN		REL REL COM

Table I.2/B-IF2.02(Q.931) *(cont.)*

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
70	100	0110	Only restricted digital information bearer capability is available	–	No procedure (network dependent option)			
79	100	1111	Service or option not implemented, unspecified					
81	101	0001	Invalid call reference value	–	5.8.3.2 a)	LU, LN		REL REL COM
					5.8.3.2 b)	LU, LN		REL COM
					5.8.3.2 f)	LU, LN		STAT
82	101	0010	Identified channel does not exist	Channel identity	5.1.4	LN		DISC REL COM
83	101	0011	A suspended call exists, but this call identity does not	–	5.6.5	LN		RES REJ
84	101	0100	Call identity in use	–	5.6.3	LN		SUSP REJ
85	101	0101	No call suspended	–	5.6.5	LN		RES REJ
86	101	0110	Call having the requested call identity has been cleared		5.6.5	LN		RES REJ

Table I.2/B-IF2.02(Q.931) *(cont.)*

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
88	101	1000	Incompatible destination	Incompatible parameter	5.2.2 5.2.5.1 5.2.5.3 a) B.3.2 B.3.3	RU	REL COM	DISC
91	101	1011	Invalid transit network selection	–	C.2	TN		DISC
						LN		DISC REL REL COM
95	101	1111	Invalid message, unspecified	Message type	5.8	LN		REL COM STAT
96	110	0000	Mandatory information element is missing	Information element identifier(s)	5.8.6.1	LN, LU		REL REL COM STAT
					5.8.11	LN, LU		STAT
97	110	0001	Message type non-existent or not implemented	Message type	5.8.4 5.8.10 5.8.11	LU, LN		STAT
98	110	0010	Message not compatible with call state or message type non-existent or not implemented	Message type	5.8.4	LU, LN		STAT
99	110	0011	Information element non-existent or not implemented	Information element identifier(s)	5.8.7.1 5.8.11	LU, LN		STAT
					5.8.7.1	LN		REL REL COM

Table I.2/B-IF2.02(Q.931) *(end)*

Cause No.	Class	Value	Cause name	Diagnostics	Reference	Typical location of generation	Typical carrying message as identified by receiving side	
							At remote interface	At local interface
100	110	0100	Invalid information element contents	Information element identifier(s)	5.8.6.2	LU, LN		STAT REL REL COM
					5.8.7.2 5.8.11	LU, LN		STAT
101	110	0101	Message not compatible with call state	Message type	5.8.4	LN, LU		STAT
					5.8.11	LN, LU		DISC REL REL COM
102	110	0110	Recovery on time expiry	Timer number	5.2.4 5.2.5.3 5.6.5 5.4.1	LN		DISC
					5.3.3 5.3.4	LN		REL
					5.3.2 f) 5.3.3 5.6.5	LU		REL
111	110	1111	Protocol error, unspecified		5.8.4	RN		DISC
127	111	1111	Interworking, unspecified		No explicit procedure			

Appendix II

Example message flow diagrams and example conditions for cause mapping *

Appendix III

Summary of assigned information element identifier and message type code points for the Q.93x-Series and Q.95x-Series of Recommendations

(This appendix does not form an integral part of this specification)

Table III.1/B-IF2.02(Q.931)
Information element code points

Bit									Recommendation reference
8	7	6	5	4	3	2	1		
1	:	:	:	-	-	-	-	*Single octet information elements:*	
	0	0	0	-	-	-	-	Reserved	Q.931
	0	0	1	-	-	-	-	Shift	Q.931
	0	1	0	0	0	0	0	More data	Q.931
	0	1	0	0	0	0	1	Sending complete	Q.931
	0	1	1	-	-	-	-	Congestion level	Q.931
	1	0	1	-	-	-	-	Repeat indicator	Q.931
0	:	:	:	:	:	:	:	*Variable length information elements:*	
	0	0	0	0	0	0	0	Segmented message	Q.931
	0	0	0	0	1	0	0	Bearer capability	Q.931
	0	0	0	1	0	0	0	Cause	Q.931
	0	0	0	1	1	0	0	Connected address	(Note 1)
	0	0	0	1	1	0	1	Extended facility	Q.932
	0	0	1	0	0	0	0	Call identity	Q.931
	0	0	1	0	1	0	0	Call state	Q.931
	0	0	1	1	0	0	0	Channel identification	Q.931
	0	0	1	1	0	0	1	Data link connection identifier	Q.933
	0	0	1	1	1	0	0	Facility	Q.932
	0	0	1	1	1	1	0	Progress indicator	Q.931
	0	1	0	0	0	0	0	Network specific facilities	Q.931
	0	1	0	0	1	0	0	Terminal capabilities	(Note 1)
	0	1	0	0	1	1	1	Notification indicator	Q.931
	0	1	0	1	0	0	0	Display	Q.931
	0	1	0	1	0	0	1	Date/time	Q.931
	0	1	0	1	1	0	0	Keypad facility	Q.931
	0	1	1	0	0	0	0	Keypad echo	(Note 1)
	0	1	1	0	0	1	0	Information request	Q.932 [4]
	0	1	1	0	1	0	0	Signal	Q.931
	0	1	1	0	1	1	0	Switchhook	(Note 1)
	0	1	1	1	0	0	0	Feature activation	Q.932
	0	1	1	1	0	0	1	Feature indication	Q.932
	0	1	1	1	0	1	0	Service profile identification	Q.932
	0	1	1	1	0	1	1	Endpoint identifier	Q.932
	1	0	0	0	0	0	0	Information rate	Q.931
	1	0	0	0	0	0	1	Precedence level	Q.955 (clause 3)
	1	0	0	0	0	1	0	End-to-end transit delay	Q.931
	1	0	0	0	0	1	1	Transit delay selection and indication	Q.931
	1	0	0	0	1	0	0	Packet layer binary parameters	Q.931
	1	0	0	0	1	0	1	Packet layer window size	Q.931

Table III.1/B-IF2.02(Q.931) (*end*)

Bit									Recommendation reference
8	7	6	5	4	3	2	1		
0	:	:	:	:	:	:	:	*Variable length information elements:*	
	1	0	0	0	1	1	0	Packet size	Q.931
	1	0	0	0	1	1	1	Closed user group	Q.931
	1	0	0	1	0	0	0	Link layer core parameters	Q.933
	1	0	0	1	0	0	1	Link layer protocol parameters	Q.933
	1	0	0	1	0	1	0	Reverse charging indication	Q.931
	1	0	0	1	1	0	0	Connected number	Q.951 [85]
	1	0	0	1	1	0	1	Connected subaddress	Q.951
	1	0	1	0	0	0	0	X.213 priority	Q.933
	1	0	1	0	0	0	1	Report type	Q.933
	1	0	1	0	0	1	1	Link integrity verification	Q.933
	1	0	1	0	1	1	1	PVC status	Q.933
	1	1	0	1	1	0	0	Calling party number	Q.931
	1	1	0	1	1	0	1	Calling party subaddress	Q.931
	1	1	1	0	0	0	0	Called party number	Q.931
	1	1	1	0	0	0	1	Called party subaddress	Q.931
	1	1	1	0	1	0	0	Redirecting number	Q.931, Q.952 [86]
	1	1	1	0	1	1	0	Redirection number	Q.952
	1	1	1	1	0	0	0	Transit network selection	Q.931
	1	1	1	1	0	0	1	Restart indicator	Q.931
	1	1	1	1	1	0	0	Low layer compatibility	Q.931
	1	1	1	1	1	0	1	High layer compatibility	Q.931
	1	1	1	1	1	1	0	User-user	Q.931
	1	1	1	1	1	1	1	Escape for extension	Q.931

Note 1: These code points are reserved to ensure backward compatibility with earlier versions of Recommendation Q.931.

Note 2: All reserved values with bits 5-8 coded "0000" are for future information elements for which comprehension by the user is required (see 5.8.7.1).

Table III.2/B-IF2.02(Q.931)
Message type code points

Bit 8	7	6	5	4	3	2	1		Recommendation reference
0	0	0	0	0	0	0	0	Escape to nationally specific message types	Q.931
0	0	0	-	-	-	-	-	*Call establishment messages:*	
			0	0	0	0	1	ALERTING	Q.931
			0	0	0	1	0	CALL PROCEEDING	Q.931
			0	0	0	1	1	PROGRESS	Q.931
			0	0	1	0	1	SETUP	Q.931
			0	0	1	1	1	CONNECT	Q.931
			0	1	1	0	1	SETUP ACKNOWLEDGE	Q.931
			0	1	1	1	1	CONNECT ACKNOWLEDGE	Q.931
0	0	1	-	-	-	-	-	*Call information phase messages:*	
			0	0	0	0	0	USER INFORMATION	Q.931
			0	0	0	0	1	SUSPEND REJECT	Q.931
			0	0	0	1	0	RESUME REJECT	Q.931
			0	0	1	0	0	HOLD	Q.932 [4]
			0	0	1	0	1	SUSPEND	Q.931
			0	0	1	1	0	RESUME	Q.931
			0	1	0	0	0	HOLD ACKNOWLEDGE	Q.932
			0	1	1	0	1	SUSPEND ACKNOWLEDGE	Q.931
			0	1	1	1	0	RESUME ACKNOWLEDGE	Q.931
			1	0	0	0	0	HOLD REJECT	Q.932
			1	0	0	0	1	RETRIEVE	Q.932
			1	0	0	1	1	RETRIEVE ACKNOWLEDGE	Q.932
			1	0	1	1	1	RETRIEVE REJECT	Q.932
0	1	0	-	-	-	-	-	*Call clearing messages:*	
			0	0	0	0	0	DETACH	(Note)
			0	0	1	0	1	DISCONNECT	Q.931
			0	0	1	1	0	RESTART	Q.931
			0	1	0	0	0	DETACH ACKNOWLEDGE	(Note)
			0	1	1	0	1	RELEASE	Q.931
			0	1	1	1	0	RESTART ACKNOWLEDGE	Q.931
			1	1	0	1	0	RELEASE COMPLETE	Q.931
0	1	1	-	-	-	-	-	*Miscellaneous messages:*	
			0	0	0	0	0	SEGMENT	Q.931
			0	0	0	1	0	FACILITY	Q.932 [4]
			0	0	1	0	0	REGISTER	Q.932
			0	1	0	0	0	CANCEL ACKNOWLEDGE	(Note)
			0	1	0	1	0	FACILITY ACKNOWLEDGE	(Note)
			0	1	1	0	0	REGISTER ACKNOWLEDGE	(Note)
			0	1	1	1	0	NOTIFY	Q.931
			1	0	0	0	0	CANCEL REJECT	(Note)
			1	0	0	1	0	FACILITY REJECT	(Note)
			1	0	1	0	0	REGISTER REJECT	(Note)
			1	0	1	0	1	STATUS ENQUIRY	Q.931
			1	1	0	0	1	CONGESTION CONTROL	Q.931
			1	1	0	1	1	INFORMATION	Q.931
			1	1	1	0	1	STATUS	Q.931

Note: These code points are reserved to ensure backward compatibility with earlier versions of Recommendation Q.931.

Appendix IV Call procedure for the grouped multiple interfaces

In this system, when the Public CS is called, the ISDN shall send SETUP messages to the grouped multiple interfaces equivalent to the paging zone. According to this procedure, this Appendix is described to support to understanding of the behavior.

The ISDN calls for multiple interfaces, thus the number of calls that occur at the same time increases. Therefore, the length of call reference shall be 2 octets. On the other hand, only one call is transferred into active within the called multiple interfaces, the ISDN does not choice the channel for each Public CS, and calls pointing an any channel.

Called Public CSs shall operate the procedure that describes from 5.8.1 to 5.8.7., and the ISDN shall initiate the destination if the Public CS can continue the call. When Public CSs that cannot initiate the Public CSs shall ignore the SETUP message. When a Public CS can initiate the destination but confirm it cannot continue the call, the Public CS shall send RELEASE COMPLETE message to the ISDN with some suitable cause (e.g. cause No. 65, Bearer capability not implemented, cause No. 21, Call rejected). When a Public CS confirms it can continue the communication, but is initiated disconnect of call from the destination, the Public CS shall initiate call clearing procedure to the ISDN with the cause of disconnect. When the case, to be able to initiate the destination, to decide it is able to continue the communication, not to be initiated disconnect of call from the destination, the Public CS shall return CALL PROCEEDING message to the ISDN.

The ISDN may receive some responses from plural Public CSs to a SETUP message.

When the ISDN receives requires of call continue from several Public CSs toward SETUP message that the ISDN sent, the ISDN shall initiate call establishment to only the first Public CS that is checked compatibility of call. At the time, the ISDN has checked compatibility of call, the ISDN shall initiate call clearing procedure by RELEASE message with cause No. 26, Non-selected user clearing, to the other Public CSs that request call communication. After the ISDN has checked compatibility of call, at the case the ISDN receives request of communication from other Public CSs, if the timer T312 is running, then the ISDN shall initiate the clearing of the Public CS by RELEASE message with cause No. 26, Non-selected user clearing, or by DISCONNECT message with some suitable cause (example; cause No. 63, Service or option not available, unspecified). After the timer T312 expired, if the ISDN receives request of communication, then the ISDN shall initiate the clearing of the Public CS by procedure described in Section 5.8.3.2, regarding the response has invalid call reference.

While a call is continue, the ISDN shall ignore RELEASE COMPLETE messages from the Public CSs except the call connected Public CS. If the ISDN receives DISCONNECT messages or RELEASE messages, the ISDN shall follow the interface rules, and these operations give no influence the calls continue on the other interfaces. After re-sending SETUP message and before timer T303 expire, if the ISDN receives cause, the ISDN shall notify the cause to remote side. Several causes can be sent according to protocol, the cause of which location indicates user precedes. If the ISDN does not receive cause, cause No. 20, Subscriber absent, shall be sent.

ACRONYMS USED IN THIS RECOMMENDATION

ABM	Asynchronous Balanced Mode (of HDLC)
ACK	Acknowledgement
ADPCM	Adaptive Differential Pulse Code Modulation
AFI	Authority and Format Identifier
ARM	Asynchronous Response Mode (of HDLC)
AU	Access Unit
BC	Bearer Capability
BCD	Binary Coded Decimal
Bi	Indicated B-Channel
Bi`	An idle B-Channel Bi
Bj	A B-Channel in use
CEI	Connection Endpoint Identifier
CES	Connection Endpoint Suffix
CSPDN	Circuit Switched Public Data Network
D	The D-Channel
DDI	Direct-Dialling-In
DLCI	Data Link Connection Identifier (see Recommendations Q.920 and Q.921)
DSP	Domain Specific Part
DTE	Data Terminal Equipment
HDLC	High Level Data Link Control (procedures)
HLC	High Layer Compatibility
I	Information (frame)
IA5	International Alphabet No. 5 (defined by CCITT)
IDI	Initial Domain Identifier
IE	Information Element
IEC	International Electrotechnical Commission
ISDN	Integrated Services Digital Network
ISO	International Standard Organization
IWF	Interworking Function
IWU	Interworking Unit
LAN	Local Area Network
LAPB	Link Access Protocol-Balanced
LAPD	Link Access Protocol on the D-Channel
LLC	Low Layer Compatibility
LLI	Logical Link Identifier (see Recommendation Q.921)
NACK	Negative Acknowledgement
NIC	Network Independent Clock
NRM	Normal Response Mode (of HDLC)
NSAP	Network Service Access Point
NT2	Network Termination of type two
OSI	Open System Interconnection
PABX	Private Automatic Branch Exchange
PCM	Pulse Code Modulation
PH	Packet Handler
PSPDN	Packet Switched Public Data Network

PSTN	Public Switched Telephony Network
PVC	Permanent Virtual Circuit
RDTD	Restricted Differential Time Delay
SABME	Set Asynchronous Balanced Mode Extended (frame)
SAPI	Service Access Point Identifier (see Recommendation Q.921)
SDL	Functional specification and description language
TA	Terminal Adaptor (see Recommendation I.411)
TE1	Terminal Equipment of type 1 (see Recommendation I.411)
TE2	Terminal Equipment of type 2 (see Recommendation I.411)
TEI	Terminal Endpoint Identifier (see Recommendations Q.920 and Q.921)
TID	Terminal identifier
UDI	Unrestricted Digital Information
UDI-TA	Unrestricted Digital Information with Tones/Announcements
UI	Unnumbered Information (frame)
USID	User service identificator
VC	(Switched) Virtual Circuit

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