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Integrated Services Digital Network (ISDN); Generic functional protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Signalling Protocols and Switching (SPS), and is now submitted for the Voting phase of the ETSI standards Two-step Approval Procedure (TAP).

The present document is part 1 of a multi-part standard covering the Digital Subscriber Signalling System No. one (DSS1) protocol specification for the Integrated Services Digital Network (ISDN) generic functional protocol for the support of supplementary services, as described below:

Part 1: "Protocol specification";

Part 2: "Protocol Implementation Conformance Statement (PICS) proforma specification";

Part 3: "Test Suite Structure and Test Purposes (TSS&TP) specification for the user";

Part 4: "Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma specification for the user";

Part 5: "TSS&TP specification for the network";

Part 6: "ATS and partial PIXIT proforma specification for the network".

The present document is an extended and updated version of ETS 300 196-1 (1993) and its amendment A1 (1995).

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

This first part of EN 300 196 specifies the functional protocol for the pan-European Integrated Services Digital Network (ISDN) as provided by European public telecommunications operators for the application to a range of supplementary services at the T reference point or coincident S and T reference point (as defined in ITU-T Recommendation I.411 [3]) by means of the Digital Subscriber Signalling System No. one (DSS1) protocol.

The functional protocol is based on the use of the Facility information element and the FACILITY message, as well as on other specific functional messages specified in subclause 11.1. The protocol is symmetrical, and is applicable to both the basic and primary rate access structures.

To be functional this protocol requires knowledge of supplementary services supported by the user equipment. This facilitates user equipment operation without human intervention by defining semantics for the protocol elements which user equipment can process on its own.

The procedures specified in the present document can be used for:

- activation and deactivation;
- invocation and operation;
- interrogation;
- status request; and
- status notification,

of supplementary services in association with existing calls or outside any existing call.

In addition, the present document specifies the generic procedures for the channel reservation function performed by the network as it is applied by several supplementary services (e.g. call hold).

Furthermore, the functional signalling procedures that support the delivery of notifications at the user-network interface are covered.

The application of the present document to individual supplementary services is outside the scope of the present document and is defined in those standards which specify the individual supplementary services.

Further parts of the present document specify the method of testing required to identify conformance to the present document.

The present document is applicable to equipment, supporting supplementary services using the functional protocol, to be attached at either side of a T reference point or coincident S and T reference point when used as an access to the public ISDN.

2 Normative references

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ITU-T Recommendation I.112 (1993): "Vocabulary of terms for ISDNs".

[2] ITU-T Recommendation I.210 (1993): "Principles of telecommunication services supported by an ISDN and the means used to describe them".

[3] ITU-T Recommendation I.411 (1993): "ISDN user-network interfaces - Reference configurations".

[4] CCITT Recommendation Q.9 (1988): "Vocabulary of switching and signalling terms".

[5] CCITT Recommendation X.208 (1988): "Specification of Abstract Syntax Notation One (ASN.1)".

[6] CCITT Recommendation X.209 (1988): "Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)".

[7] CCITT Recommendation X.219 (1988): "Remote operations: Model, notation and service definition".

[8] CCITT Recommendation X.229 (1988): "Remote operations: Protocol specification".

[9] ITU-T Recommendation Z.100: "Specification and Description Language (SDL)".

[10] ETS 300 052-1: "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".

[11] ETS 300 061-1: "Integrated Services Digital Network (ISDN); Subaddressing (SUB) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".

[12] ETS 300 122-1: "Integrated Services Digital Network (ISDN); Generic keypad protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".

[13] EN 300 267-1: "Integrated Services Digital Network (ISDN); Telephony 7 kHz, videotelephony audiographic conference and videoconference teleservices; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".

[14] ETS 300 402-2: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer; Part 2: General protocol specification".

[15] EN 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification".

3 Definitions

The following definitions apply:

3.1 General definitions

all services: If for the control of supplementary services the parameter basic service is set to "all services", then all the basic services shall be affected that the user is subscribed to, and for which the supplementary service applies and is subscribed to, at the point in time that the request is received.

auxiliary state: A state as defined in subclause 7.1.2. An auxiliary state may exist for a call reference in parallel with the call state.

basic access: See CCITT Recommendation Q.9 [4], definition 1551.

basic service: A bearer service or teleservice. The terms "bearer service" and "teleservice" are defined in ITU-T Recommendation I.112 [1], definitions 202 and 203.

call control message: A message as defined in EN 300 403-1 [15], subclause 3.1, which on sending or receipt causes a change of the call state at either the network or the user. Call control messages also include the INFORMATION message and PROGRESS message.

call reference: (excluding dummy call reference) an identifier of a signalling transaction. The signalling transaction may either be bearer related, in which case the signalling transaction can be used to control that bearer, or bearer independent, in which case there is no bearer associated with that signalling transaction. Where there is only one bearer required for a call, then the call reference of the associated bearer-related signalling transaction may be used to identify the call.

call state: A state as defined in EN 300 403-1 [15], subclause 2.1,for either the user or the network as appropriate. A call state may exist for each call reference value (and for each additional responding Connection Endpoint Identifier (CEI) in the incoming call states).

call: See CCITT Recommendation Q.9 [4], definition 2201.

component: Data structure as defined in clause D.1.

connection: See CCITT Recommendation Q.9 [4], definition 0011. In the present document the use of this term is taken to include a bearer and its associated control signalling.

Data Link Connection Endpoint Identifier; Connection Endpoint Identifier (CEI): Identifier used by a layer 3 protocol entity to address its peer entity.

dummy call reference: A null value indicating that the message is not applicable to an identified signalling transaction. Other rules specify the association of DSS1 protocol entities.

functional protocol: A functional protocol consists of a sequence of functional information elements. A functional information element requires a degree of intelligent processing by a terminal in either generation or analysis.

initiator: An entity (user or network) requesting establishment of a signalling connection between an initiator and the responder.

Integrated Services Digital Network (ISDN): See ITU-T Recommendation I.112 [1], definition 308.

network: The DSS1 protocol entity at the network side of the user-network interface.

point-to-point configuration: See EN 300 403-1 [15]

point-to-multipoint configuration: See EN 300 403-1 [15]

primary rate access: See CCITT Recommendation Q.9 [4], definition 1552.

responder: The entity (user or network) responding to a request from an initiator on establishing a signalling connection.

service; telecommunication service: See ITU-T Recommendation I.112 [1], definition 201.

signalling connection: An association of DSS1 protocol entities using the bearer-independent supplementary service procedure with the connection-oriented transport mechanism.

stimulus protocol: A stimulus protocol consists of a sequence of stimulus information elements. A stimulus information element is generated as a result of a single event at the user-network interface or contains a basic instruction from the network to be executed by the user.

supplementary service: See ITU-T Recommendation I.210 [2], subclause 2.4.

user: The DSS1 protocol entity at the user side of the user-network interface.

3.2 Remote operations definitions

The common information element category makes use of the following terms defined in CCITT Recommendation X.219 [7]:

- Remote operation;
- Operation;
- Operation classes (class 1 to class 5);
- Association (initiator; responder);
- Invoking (application entity; invoker).

invoke component: See subclause 8.2.2.1. Where reference is made to a "xxxx" invoke component, an invoke component is meant with its operation value set to the value of the operation "xxxx".

return result component: See subclause 8.2.2.2. Where reference is made to a "xxxx" return result component, a return result component is meant which is related to a "xxxx" invoke component.

return error component: See subclause 8.2.2.3. Where reference is made to a "xxxx" return error component, a return error component is meant which is related to a "xxxx" invoke component.

reject component: See subclause 8.2.2.4.

3.3 Definition of procedures using the common information element approach

bearer-related transport mechanism: A procedure tied to the procedures for basic call control and tied to a connection in progress, active or in the clearing phase. The call reference used by the basic call control procedure is adopted by the bearer-related service invocations to correlate with the appropriate basic call control transaction.

bearer-independent transport mechanism: A procedure independent of the procedures for basic call control and not correlated to a connection.

connection-oriented transport mechanism: A mechanism requiring the establishment of a data link and a transport association between the service requesting entity and the service provider. It provides a facility to access common information element category operations where success and/or failure reporting is required. It provides a call reference within the transport association as a means to associate uniquely among the related transport messages.

connectionless transport mechanism: A mechanism where no transport association exists but a single transport message transfer is provided using the dummy call reference.

4 Abbreviations

The following abbreviations apply:

ASN.1	Abstract Syntax Notation One
BER	Basic Encoding Rules
CEI	Connection Endpoint Identifier
DSS1	Digital Subscriber Signalling System No. one
ISDN	Integrated Services Digital Network
LSB	Least Significant Bit
MSB	Most Significant Bit
ROSE	Remote Operations Service Element
SDL	Specification and Description Language

5 Co-existence of generic protocols for the control of supplementary services

5.1 Support of various generic protocols

Networks may support more than one generic protocol for the control of supplementary services, e.g. the keypad protocol and the functional protocol. The support of multiple generic protocols is a network option. Users shall be informed by the service provider at subscription time of the supplementary services available, and of the generic protocols supported on their access.

5.2 Co-existence of generic protocols

As a general rule, the functional protocol shall be used unless the network specifies the use of a stimulus protocol for the control of certain supplementary services.

Networks may support one or more of the generic protocols; it is a network option as to whether one or more generic protocols are supported on a given access.

In general, the keypad protocol, as defined in ETS 300 122-1 [12], has only local significance while the functional protocol may have other than local significance.

For a given call instance, the protocol applied at a local interface may be different from the one applied at a remote user's interface. For example, one of the stimulus protocols may be used at the requesting user's interface, while a functional protocol may be applied at the remote user's interface.

5.3 Arrangements by which co-existence of protocols may be supported by a network

Some networks may support only one of the generic protocols per user access for the control of supplementary services. Other networks may choose to support a single generic protocol for the control of supplementary services, depending on the user-network interface type (e.g. keypad on the basic access, functional on the basic access and primary rate access). This has to be arranged at subscription time.

Networks supporting multiple generic protocols per access in the user-to-network direction will implicitly recognize the protocol option chosen by the user on the basis of the received message type or information element type.

Networks supporting multiple generic protocols per access in the network-to-user direction (i.e. at the remote-user interface) may choose to apply a particular protocol depending on the supplementary services involved.

6 General principles applied for the functional control of supplementary services

6.1 Introduction

This clause specifies the general principles applied for the functional control of supplementary services at the user-network interface. The generic protocol utilizes functions and services provided by EN 300 403-1 [15] basic call control procedures and the functions of the data link layer as defined in ETS 300 402-2 [14].

6.2 Scope of the procedures

The procedures defined in clauses 7 to 10 specify the basic methodology for the control (e.g. invocation, notification, deactivation, etc.) of supplementary services. The procedures are independent of whether or not the user-network interface is at a basic or primary rate access.

6.3 Categories of procedures

Two categories of procedures are defined for the functional control of supplementary services. The first category, called the separate message approach, utilizes separate message types to indicate a desired function. The HOLD and RETRIEVE family of messages are used for this category. This approach is used when synchronization of resources between the user and the network is required.

The second category, called the common information element approach, utilizes the Facility information element and applies only to supplementary services that do not require synchronization of resources between the user and the network.

Both categories are specified in a symmetrical manner and can be signalled both in the network-to-user and the user-to-network directions.

6.4 Supplementary service functions

The control of supplementary services by either the network or the user includes the following functions:

a) the control of supplementary services during the establishment of a call;

b) the control of supplementary services during the clearing of a call;

c) the control of bearer-related supplementary services during the Active call state of a call;

d) the control of supplementary services independent from an active call;

e) the control of multiple, different supplementary services within a single message;

f) the control of supplementary services related to different calls;

g) the provision of notifications.

The correlation of a bearer-related supplementary service and the call which it modifies is provided by use of the call reference (functions a), b), c), e), f) and g) listed above).

The correlation of bearer-independent supplementary service requests and their responses, is provided by the combination of the call reference of the message containing the Facility information element and the invoke identifier present within the Facility information element itself (refer to functions d), e) and g)).

The identification of different supplementary service requests within one single message is provided by the invoke identifier of the corresponding Facility information element (refer to functions e) and g)). The identification of supplementary service requests related to different calls is provided by different messages with the corresponding call reference of the appropriate call and connection (refer to function f)), i.e. different call reference values are used to identify each call individually.

7 Control of supplementary services using the separate message approach

The messages defined in this clause are specified as separate functional messages for invoking specific functions which require changes of the resources and auxiliary states and also require synchronization of the peer-to-peer state machines. These functions cannot be performed in conjunction with the call establishment and clearing procedures relying on call states alone. They are used in conjunction with a two-dimensional state model which enables the specification of functions which require synchronization of resources in the context of call establishment and call clearing procedures. These functions may be used to perform various supplementary service applications. The functions of these messages are not to be duplicated or overlapped by those of the common information element approach.

7.1 Hold and Retrieve functions

7.1.1 Messages for the Hold and Retrieve function

The Hold function is used to release a B-channel from a connection. The call reference of the held call shall be retained for subsequent call actions.

The Retrieve function is used to reconnect a B-channel to the connection.

The Hold and Retrieve functions may be used in a symmetrical manner, i.e. the initiator of a hold request or a retrieve request may reside at either side of the interface. Furthermore, the initiating entity of the Hold function can be the responding entity of the Retrieve function, and vice versa.

The invocation of the Hold or Retrieve function does not affect the existing call state.

The Hold and Retrieve procedures use the following messages which are defined in subclauses 11.1.1.2 to 11.1.1.7.

- HOLD;
- HOLD ACKNOWLEDGE;
- HOLD REJECT;
- RETRIEVE;
- RETRIEVE ACKNOWLEDGE;
- RETRIEVE REJECT.

The error handling procedures defined in EN 300 403-1 [15], subclause 5.8,are applicable to these messages.

NOTE: The Hold and Retrieve functions do not support calls requiring more than one connection.

7.1.2 Auxiliary states for the Hold and Retrieve function

The Hold and Retrieve function may be performed in the call states specified in subclause 7.2.1.1. The concept of a two dimensional state model is being introduced to ensure state synchronization between the user and the network. In this way, two states will be associated with each call. The first will be an EN 300 403-1 [15] call state and the second will be an auxiliary state associated with the Hold and Retrieve function. If a call state transition occurs, the first co-ordinate is updated. If a call is put on hold, the second co-ordinate is updated. When the held call is reconnected, the second co-ordinate is updated again.

There shall be six auxiliary states associated with the Hold and Retrieve functions:

- Idle;
- Hold Request: a request has been made for the Hold function;
- Hold Indication: a request has been received for the Hold function;
- Call Held: the call is held;
- Retrieve Request: a request has been made for the Retrieve function;
- Retrieve Indication: a request has been received for the Retrieve function.

If the call state enters the Idle call state or one of the call states not listed in subclause 7.2.1.1 with the exception of the U12, N12 Disconnect Indication call state then:

- for a call in the Hold Request or Retrieve Request auxiliary state, the entity shall stop the appropriate timer (i.e. T-HOLD or T-RETRIEVE) and enter the Idle auxiliary state;
- for a call in the Hold Indication, Retrieve Indication or Call Held auxiliary state, the entity shall enter the Idle auxiliary state.

If the call enters the U12, N12 Disconnect Indication call state then:

- for a call in the Hold Request auxiliary state, the entity shall stop the appropriate timer (i.e. T-HOLD) and enter the Idle auxiliary state;
- for a call in the Hold Indication auxiliary state, the entity shall enter the Idle auxiliary state;
- for a call in the Call Held or Retrieve Request or Retrieve Indication auxiliary state, no change in auxiliary state shall occur.

EXAMPLE: When a call is in the Outgoing Call Proceeding call state, the two-dimensional state shall be: (Outgoing Call Proceeding, Idle).

Then the user requests the Hold function, the two-dimensional state shall become: (Outgoing Call Proceeding, Hold Request).

The call shall then be put on hold. The user shall become aware of this upon receiving the HOLD ACKNOWLEDGE message from the network. The two-dimensional state shall now be: (Outgoing Call Proceeding, Call Held).

The user may receive subsequent call progress messages which shall change the two-dimensional state to:
(Active, Call Held).

Then the user requests the Retrieve function. The two-dimensional state shall become: (Active, Retrieve Request).

When the call is reconnected, the two-dimensional state shall be:
(Active, Idle).

7.2 Hold procedures

If both sides of an interface have requested the Hold function, a message collision pertaining to a given call reference may occur. In this case priority shall be given to the network initiated Hold function according to the procedure of subclause 7.2.2.1.

7.2.1 Initiating entity

7.2.1.1 Normal operation

The Hold function shall be initiated by sending a HOLD message containing the call reference of the call to be put on hold to the responding entity. On sending of the HOLD message, the initiating entity shall start timer T-HOLD (the value of timer T-HOLD is specified in subclause 7.5), enter the Hold Request auxiliary state and wait for a HOLD ACKNOWLEDGE message. The auxiliary states are described in subclause 7.1.2.

The call to be put on hold shall be allocated to a single Connection Endpoint Identifier (CEI), and a B-channel shall be selected for the call and/or for the CEI. Therefore the Hold function shall only be invoked in the Idle auxiliary state and the following call states:

- Outgoing Call Proceeding (U3, N3);
- Call Delivered (U4, N4);
- Call Received (U7, N7) (note);
- Connect Request (U8, N8) (note);
- Incoming Call Proceeding (U9, N9) (note);
- Active (U10, N10).

NOTE: Applicable only if a point-to-point configuration exists.

On receipt of a HOLD ACKNOWLEDGE message in the Hold Request auxiliary state the initiating entity shall stop timer T-HOLD, release the B-channel and enter the Call Held auxiliary state.

7.2.1.2 Exceptional procedures

On receipt of a HOLD REJECT message in the Hold Request auxiliary state, the initiating entity shall stop timer T-HOLD and enter the Idle auxiliary state.

If timer T-HOLD expires, the initiating entity shall enter the Idle auxiliary state.

7.2.2 Responding entity

7.2.2.1 Normal operation

On receipt of a HOLD message:

- in the Idle auxiliary state and one of the call states specified in subclause 7.2.1.1, the responding entity shall enter the Hold Indication auxiliary state and determine whether the Hold function is permitted;
- in the Hold Request auxiliary state for the user, the responding entity shall stop timer T-HOLD, enter the Hold Indication auxiliary state and determine whether the Hold function is permitted;
- in the Hold Request auxiliary state for the network, the responding entity shall ignore the received HOLD message and remain in the Hold Request auxiliary state.

Determination of whether the Hold function is permitted is supplementary service specific and shall be specified in the appropriate supplementary service standard(s).

If the Hold function is permitted, the responding entity shall release the B-channel, send a HOLD ACKNOWLEDGE message to the initiating entity and enter the Call Held auxiliary state.

7.2.2.2 Exceptional procedures

If the HOLD message is received in an auxiliary state other than Idle and Hold Request, then the receiving entity shall send a HOLD REJECT message with cause #101 "message not compatible with call state" to the initiating entity and remain in the same auxiliary state it was in prior to the reception of the HOLD message.

If the HOLD message is received in a call state not listed in subclause 7.2.1.1, except for the call states U12, N12 Disconnect Indication, and U19, N19 Release Request, then the responding entity shall send a HOLD REJECT message with cause #101 "message not compatible with call state" to the initiating entity and remain in the Idle auxiliary state.

If the HOLD message is received for a call in the process of being cleared which is in the call states U12, N12 Disconnect Indication or U19, N19 Release Request, the responding entity shall ignore the request and remain in the Idle auxiliary state.

If the Hold function is not permitted, then the responding entity shall send a HOLD REJECT message containing an appropriate cause to the initiating entity and remain in the Idle auxiliary state. The cause value shall be specified in the appropriate supplementary service standard(s).

7.3 Call Held auxiliary state

While in the Call Held auxiliary state, a B-channel shall not be allocated even if an event occurs that would cause a B-channel connection according to the procedures of EN 300 403-1 [15] (e.g. receipt of a CONNECT message).

7.4 Retrieve procedure

If both sides of an interface have implemented the Retrieve function as both initiating and responding entity, a message collision pertaining to a given call reference may occur. In this case priority shall be given to the network initiated Retrieve function according to the procedure of subclause 7.4.2.1.

7.4.1 Initiating entity

7.4.1.1 Normal operation

The Retrieve function shall be initiated by sending a RETRIEVE message containing the call reference of the held call to the responding entity.

The RETRIEVE message shall only be sent in the Call Held auxiliary state.

On sending the RETRIEVE message, the initiating entity shall start timer T-RETRIEVE (the value of timer T-RETRIEVE is specified in subclause 7.5), enter the Retrieve Request auxiliary state and wait for a RETRIEVE ACKNOWLEDGE message.

The Retrieve function shall provide channel selection procedures according to EN 300 403-1 [15], subclause 5.1.2 (if the RETRIEVE message is sent by the user) or according to subclause 5.2.3.2 (if the RETRIEVE message is sent by the network), using the Channel identification information element in the RETRIEVE message. If the RETRIEVE message is sent by the network, the network shall not use the codepoint "no B-channel available" in the Channel identification information element.

If the initiating entity indicated "Channel is indicated, no acceptable alternative" or "Channel is indicated, any alternative acceptable" in the RETRIEVE message then on receipt of a RETRIEVE ACKNOWLEDGE message without a Channel identification information element, the initiating entity shall stop timer T-RETRIEVE, connect to the selected B-channel if appropriate for this call state under normal operation, and enter the Idle auxiliary state.

If the initiating entity did not indicate "Channel is indicated, no acceptable alternative" in the RETRIEVE message then on receipt of a RETRIEVE ACKNOWLEDGE message, with a Channel identification information element, the initiating entity shall stop timer T-RETRIEVE, connect to the indicated B-channel and enter the Idle auxiliary state.

7.4.1.2 Exceptional procedures

On receipt of a RETRIEVE REJECT message in the Retrieve Request auxiliary state the initiating entity shall stop timer T-RETRIEVE, release the B-channel, if applicable, and enter the Call Held auxiliary state.

At expiration of timer T-RETRIEVE, the initiating entity shall release the B-channel if applicable, and enter the Call Held auxiliary state.

7.4.2 Responding entity

7.4.2.1 Normal operation

On receipt of a RETRIEVE message:

- in the Call Held auxiliary state, the responding entity shall complete B-channel selection procedures according to the procedures of EN 300 403-1 [15], subclause 5.1.2 (if the RETRIEVE message is received by the network) or according to subclause 5.2.3.2 (if the RETRIEVE message is received by the user), enter the Retrieve Indication auxiliary state and determine whether the Retrieve function is permitted;

- in the Retrieve Request auxiliary state, the user shall stop timer T-RETRIEVE, release the B-channel if one has been selected, complete B-channel selection procedures according to the procedures of EN 300 403-1 [15], subclause 5.2.3.2, enter the Retrieve Indication auxiliary state and determine whether the Retrieve function is permitted;

- in the Retrieve Request auxiliary state, the network shall ignore the received RETRIEVE message and remain in the Retrieve Request auxiliary state.

Determination of whether the Retrieve function is permitted is supplementary service dependent and shall be specified in the appropriate supplementary service standard(s).

If the Retrieve function is permitted the responding entity shall:

- if in the Active call state, connect to the selected B-channel and if not in the Active call state, optionally connect to the selected B-channel; and

- send a RETRIEVE ACKNOWLEDGE message to the initiator;

- if the responding entity selected the B-channel, then the RETRIEVE ACKNOWLEDGE message shall indicate the selected B-channel to be used as "Channel is indicated, no acceptable alternative" in a Channel identification information element; and

NOTE: If the responding entity accepts the B-channel indicated in the RETRIEVE message, then the responding entity need not include a Channel identification information element in the RETRIEVE ACKNOWLEDGE message.

- enter the Idle auxiliary state.

7.4.2.2 Exceptional procedures

If the RETRIEVE message is received in an auxiliary state other than Call Held and Retrieve Request, then the receiving entity shall send a RETRIEVE REJECT message with cause #101 "message not compatible with call state" to the initiating entity and remain in the same auxiliary state it was in prior to the reception of the RETRIEVE message.

If the RETRIEVE message is received in the Call Held auxiliary state and other than the call states as listed in subclause 7.2.1.1 and in addition call state U12, N12 Disconnect Indication, then the responding entity shall respond with a RETRIEVE REJECT message containing cause #101 "message not compatible with call state" and remain in the Call Held auxiliary state.

If a RETRIEVE message indicates an "exclusive" B-channel, and that channel is not available to retrieve the held call, then the receiving entity shall send a RETRIEVE REJECT message with cause value #44 "requested circuit/channel not available" to the initiating entity.

If a RETRIEVE message indicates a "preferred" or "any" B-channel, or if a Channel identification information element is not included, and no channel is available to retrieve the held call, then the receiving entity shall send a RETRIEVE REJECT message with cause value #34 "no B-channel available" to the initiating entity.

If the Retrieve function is not permitted then the responding entity shall send a RETRIEVE REJECT message containing an appropriate cause to the initiating entity and move to the Call Held auxiliary state. The cause value shall be specified in the appropriate supplementary service standard(s).

7.5 Parameter values (timers)

Table 1 shows the timers used for the Hold function and the Retrieve function.

Table 1

Timer value	Time out value	Cause for start	Normal stop	At expiry
T-HOLD	4 s	HOLD sent	Receipt of HOLD ACKNOWLEDGE or HOLD REJECT	Return to Idle auxiliary state
T-RETRIEVE	4 s	RETRIEVE sent	Receipt of RETRIEVE ACKNOWLEDGE or RETRIEVE REJECT	Return to Call Held auxiliary state

7.6 Clearing of a held call

A call in the Call Held auxiliary state may be cleared in either direction by sending a DISCONNECT message via the user-network interface in accordance with the call clearing procedure of EN 300 403-1 [15], subclause 5.3. On receiving or sending of a RELEASE COMPLETE message the held call shall move to the Idle auxiliary state.

8 Control of supplementary services using the common information element approach

8.1 General

8.1.1 Introduction

In the common information element approach the Facility information element and the Extended facility information element are used to transport information for the control of supplementary services, conveying components as application-oriented elements complemented by the necessary procedures for operations and transport mechanisms. Operations and transport mechanisms may either be related to a connection or may be used independent of a connection.

The common information element approach is modelled as remote operations as specified in CCITT Recommendations X.219 [7] and X.229 [8]. According to this model, one entity requests that a particular operation be performed whereas the responding entity attempts to perform the operation and responds to the invoking entity. Therefore an operation of the common information element approach is regarded as a request/reply interaction, supported by the application function and carried out within the context of an application association (for definitions see clause 3).

An error is used to report the unsuccessful outcome of an operation. For each operation the appropriate errors, if required, need to be indicated.

In the following part of this clause 8 each time the term "Facility information element" is used this shall be interpreted as "Facility or Extended facility information element".

8.1.2 Scope of the procedures

The common information element approach applies only to supplementary services where no synchronization of resources is required between the two signalling entities. However, the user equipment is required to have the capability to track the operation of the supplementary service procedures through various states.

8.2 Application of operations

8.2.1 Definitions

For the appropriate definitions see clause 3.

8.2.2 Procedures for operations

The specification of procedures for operations of this subclause is in alignment with the definition of elements of procedure of CCITT Recommendation X.229 [8] but uses only those elements which are specified for application within the Facility information element as defined in the present document. In addition, this subclause includes some extensions to ROSE concerning the error procedures.

The common information element approach procedures for operations are defined in terms of the interactions between peer-to-peer protocol machines through the use of a transport mechanism of the DSS1 protocol. The operation protocol comprises of the following procedures:

- invocation;
- return result;
- return error; and
- reject.

The structure, contents and encoding of the appropriate components are defined in clause 11 of the present document. Dependent on the specific operation, return result and return error components can be applicable. This is specified in the standards for the individual supplementary services.

In the following subclauses a summary of the procedures of each of these components is given as far as applicable to the present document.

8.2.2.1 Invocation

An application entity (invoker) shall use the invocation procedure to initiate an operation to be performed by the other application entity (performer). The invocation procedure shall use the invoke component as described in table D.1. The invoke component shall be delivered towards the remote peer entity within a Facility information element sent within an appropriate transport message (e.g. call control messages, FACILITY or REGISTER).

The operation value shall be used to identify the operation to be invoked, e.g. a specific supplementary service, a part of a specific supplementary service or a generic function.

The invoke identifier shall be used to identify the request of a ROSE-invoke service (CCITT Recommendation X.219 [7], subclause 10.1) and to correlate this request with the corresponding replies. The value is assigned by the invoker.

The invoke identifier shall be significant within a certain call reference value. The value (invoke identifier, call reference, data link connection endpoint identifier) shall uniquely identify an instance of an operation. In this respect the dummy call reference shall be regarded as a call reference as well.

An invoke identifier value shall not be re-used as long as a response is expected pertaining to the invocation identified by this invoke identifier.

The linked identifier shall be used within a ROSE-invoke service (CCITT Recommendation X.219 [7], subclause 10.1), when the invoked operation is a child operation and this parameter identifies the linked parent operation.

8.2.2.2 Return result

An application entity (performer) shall use the return result procedure to request the transfer of the result of a successfully performed operation to the other application entity (invoker). The return result procedure shall use the return result component as described in table D.1.

The return result component shall be delivered towards the remote peer entity in a Facility information element within an appropriate transport message.

8.2.2.3 Return error

An application entity (performer) shall use the return-error procedure to request the transfer of the error information in the case of an unsuccessfully performed operation to the other application entity (invoker). The return error procedure shall use the return error component as described in table D.1. Error values shall be defined specifically for each individual operation.

The return error component shall be delivered towards the remote peer entity in a Facility information element within an appropriate transport message.

8.2.2.4 Reject

An application entity shall use the reject procedure to reject the request (invocation) or reply (result or error) of the other application entity. The reject procedure shall be used by the receiver when the received request or reply cannot be processed because of errors in the received component (e.g. mistyped component or unrecognized operation). The receipt of a reject component shall not result in the start of a reject procedure.

The reject procedure shall use the reject component as described in table D.1 and shall use the definition of problems as specified in table 2. The reject component shall be delivered towards the remote peer entity in a Facility information element within an appropriate transport message.

Table 2: Problem code definitions

Problem code	Definition
General-problem	
unrecognized-component	signifies that the type of the component, as evidenced by its type identifier, is not one of the four defined in clause D.1 of the present document
mistyped-component	signifies that the structure of the component does not conform to clause D.1 of the present document
badly-structured-component	signifies that the structure of the components does not conform to the standard notation and encoding, defined in CCITT Recommendations X.208 [5] and X.209 [6]
Invoke-problem	
duplicate-invocation	signifies that the invoke-identifier parameter violates the assignment rules of CCITT Recommendation X.219 [7]
unrecognized-operation	signifies that the operation is not one of those agreed between the user and the network
mistyped-argument	signifies that the type of the operation argument supplied is not that agreed between the user and the network (note 2)
resource-limitation	the performing user or network is not able to perform the invoked operation due to resource limitation
initiator-releasing	the application is not willing to perform the invoked operation because it is about to attempt to release the connection oriented transport mechanism
unrecognized-linked-identifier	signifies that there is no operation in progress with an invoke- identifier equal to the specified linked-identifier
linked-response-unexpected	signifies that the invoked operation referred to by linked-identifier is not a parent-operation
unexpected-child-operation	signifies that the invoked child-operation is not one that the invoked parent-operation referred to by the linked-identifier allows

(continued)

Table 2 (concluded): Problem code definitions

Problem code	Definition
Return-result-problem	
unrecognized-invocation	signifies that no operation with the specified invoke-identifier is in progress
result-response-unexpected	signifies that the invoke operation does not report a result
mistyped-result	signifies that the type of the result parameter supplied is not that agreed between the user and the network (note 2)
Return-error-problem	
unrecognized-invocation	signifies that no operation with the specified invoke-identifier is in progress
error-response-unexpected	signifies that the invoked operation does not report failure
unrecognized-error	signifies that the reported error is not one of those agreed between the user and the network
unexpected-error	signifies that the reported error is not one that the invoked operation may report
mistyped-parameter	signifies that the type of the error parameters supplied is not that agreed between the user and the network (note 2)
NOTE 1: The above definitions are adapted from subclauses 7.4.4.2 and 7.5.4.2 of CCITT Recommendation X.229 [8].	
NOTE 2: This problem code shall not be used if all values (data elements) which are neither optional nor have default values assigned are correctly received (see subclause 8.4.2).	

8.2.2.5 Formal definition of Data Types

The formal definition of the OPERATION and ERROR macro shall be as given in figure 4 of CCITT Recommendation X.219 [7] and is described in ASN.1 using the ASN.1 macro concept. These macros shall be used in the standards for the individual supplementary services to define the required operations and errors.

NOTE: These definitions are reproduced in annex E.

8.3 Transport of components

The transport function for operations is performed by the exchange of components via DSS1 messages as specified in EN 300 403-1 [15] and in clause 11 of the present document. Procedures described in subclause 8.3 specify the rules governing the relation between supplementary service operations and basic call control messages.

A supplementary service functional protocol (using the Facility information element) may use an existing bearer-related call reference if it is to be coupled to the connection, or it may use a bearer-independent call reference.

8.3.1 Bearer-related transport

NOTE: The definition of "Bearer-related transport mechanism" is given in subclause 3.3.

This subclause defines the transport of components using the messages for the establishment and the clearing of connections. The procedures for connection control are described in EN 300 403-1 [15], clause 5. These procedures are not influenced by the components carried. Bearer-related transport procedures and operations shall operate independently of each other, however operations shall follow the specified procedures and transport capabilities of bearer connections according to basic call control (EN 300 403-1 [15]).

The bearer-related transport mechanisms are divided into the following two categories:

- point-to-point transport mechanism;
- broadcast transport mechanism.

8.3.1.1 Point-to-point transport mechanism

8.3.1.1.1 Normal operation

For bearer-related point-to-point transport of components the call state of the bearer connection shall be in a state (or about to enter a state) other than the Null call state (U0, N0). For transport, any call control message as defined in EN 300 403-1 [15], subclause 3.1 (except STATUS, STATUS ENQUIRY and NOTIFY, see subclause 11.2.2.1 of the present document), and the messages defined in subclause 11.1.1 of the present document, may be used to carry the components in a Facility information element.

For general rules, format and coding of call reference values, EN 300 403-1 [15], subclause 4.3,is applicable.

The call reference provides the means to correlate messages belonging to the same signalling transaction of a connection. When a supplementary service affects more than one connection, different call references are used to identify each connection individually. This implies the use of different messages in order to manage each connection separately.

The implicit call-control association provided by an EN 300 403-1 [15] call reference shall always be cleared when a connection is released.

The Cause information element shall only be used to report EN 300 403-1 [15] errors outside the component portion of the Facility information element (octets 1 to 3). When no EN 300 403-1 [15] protocol error is found, the Cause information element shall convey cause #31 "normal unspecified". For protocol errors in the component portion of the Facility information element (octets 4, etc.) see subclause 8.4.1.

8.3.1.1.2 Exceptional procedures

If for some reason the network or user recognizes a supplementary service request but is not able to process the bearer-related invocation of a supplementary service contained in a received SETUP message, then the following options shall apply:

- the network or user may clear the call request and reject the supplementary service invocation by means of an appropriate call-clearing message which contains the Cause information element and a return error or reject component type with the appropriate parameters in the Facility information element;
- the network or user may continue to process the call request according to the call control procedures of EN 300 403-1 [15], and reject the supplementary service invocation by including a return error or reject component type with the appropriate parameters in the Facility information element by means of a FACILITY message or in an appropriate call control message;
- the network or user may continue to process the call request according to the call control procedures of EN 300 403-1 [15], and ignore the supplementary service invocation.

The option to be used depends on the individual supplementary service procedures which are the subject of other standards.

If the user, or network, begins clearing and there is an outstanding request, the network, and user, shall continue with the clearing procedures. If the call reference value is released before a response can be sent, the resulting status of the supplementary service depends on the individual supplementary service specifications which are the subject of other standards. No response message shall be sent after the call reference value has been released.

The procedures of subclause 8.3.1.1 are an extension to the procedures of EN 300 403-1 [15] and as such the general error handling procedures as defined in EN 300 403-1 [15], subclause 5.8,apply. The handling of errors in components is specified in subclause 8.4 of the present document. The procedures for the treatment of outstanding supplementary service requests is subject to the standards for the individual supplementary services.

8.3.1.2 Broadcast transport mechanism

8.3.1.2.1 Normal operation

If it is required for the network to deliver a component to the user in a SETUP message and a multipoint configuration exists, then the network shall include the component in a Facility information element in the SETUP message, and send the SETUP message to the user according to the procedures of EN 300 403-1 [15], subclause 5.2.1.

On receipt of a SETUP message containing a component, the user shall proceed according to subclause 8.3.1.1. In response to a broadcast supplementary service invocation the network may receive different basic call control messages (ALERTING, RELEASE COMPLETE, CALL PROCEEDING etc.) carrying different component-types (e.g. Return result, Return error). The processing of these responses is application dependent and shall be specified in the context of the individual supplementary services. After processing of the responses on a broadcasted invocation the transport mechanism is in the point-to-point mode and follows the procedures as specified in subclause 8.3.1.1.

The user shall not send a FACILITY message in call state Call Present (U6), i.e. as a first response to a broadcasted SETUP message.

8.3.1.2.2 Exceptional procedures

The exceptional procedures for receipt of a component on the broadcast data link are given in subclause 8.3.1.1.2.

8.3.2 Bearer-independent transport

This subclause defines the transport functions employed for operations independent of a connection. These transport functions are provided at the user-network interface by means of message exchange according to EN 300 403-1 [15] and the present document and utilizes the data link services as described in ETS 300 402-2 [14]. The messages used for transport (i.e. REGISTER, FACILITY, RELEASE and RELEASE COMPLETE) carry the Facility information elements containing the application oriented operation components.

The context among the various transport messages is provided by means of the call reference value of each message.

For general rules, format and coding of call reference values see EN 300 403-1 [15], subclause 4.3.

The bearer-independent transport functions are divided into the following four categories:

- point-to-point (connection-oriented) (note);
- point-to-point (connectionless) (note);
- broadcast (connection-oriented);
- broadcast (connectionless).

NOTE: A definition of the terms "connection-oriented" and "connectionless" is given in subclause 3.3.

Within this subclause, DL-service primitives are used to illustrate the communication between protocol layers and are not intended to specify or constrain implementations.

8.3.2.1 Point-to-point transport mechanism (connection-oriented)

The transport mechanism described in this subclause is symmetrical, i.e. both the user and the network can initiate the procedure. Therefore the procedures in this subclause use the terms initiator and responder instead of user and network.

For the purpose of this transport mechanism the following call states are identified:

- Null (U0, N0): No signalling connection exists;
- Bearer Independent Transport (U31, N31): This state exists when a signalling connection is active;
- Release Request (U19, N19): This state exists when a protocol entity has requested the peer entity to release the signalling connection and is waiting for a response.

8.3.2.1.1 Connection establishment

8.3.2.1.1.1 Normal operation

To establish a signalling connection towards the responder, the initiator shall first establish, if not already available, a reliable data link connection between the initiator and the responder using the DL-ESTABLISH-REQUEST service primitive as described in ETS 300 402-2 [14]. Establishment of the data link connection is confirmed by the DL-ESTABLISH-CONFIRM primitive. Only this data link connection shall be used by the connection-oriented transport mechanism.

Once the data link has been established the initiator shall initiate establishment of the signalling connection by sending a REGISTER message towards the responder using the DL-DATA-REQUEST service primitive and enter the Bearer Independent Transport call state (U31/N31). The responder, on receiving the REGISTER message, shall also enter the Bearer Independent Transport call state (N31/U31).

The signalling connection is identified by the call reference included in the REGISTER message. The call reference value shall be chosen in compliance to the procedures of EN 300 403-1 [15], subclause 4.3.

The initiator may send data (i.e. the component structures) to the responding entity by including a Facility information element in a REGISTER message.

NOTE: If the REGISTER message contains a Facility information element a clear distinction between connection establishment and data transfer phase cannot be made.

8.3.2.1.1.2 Exceptional procedures

If a REGISTER message is received indicating a call reference value that is currently in use, it shall be ignored and a STATUS message with a Cause information element indicating cause value #101 "message not compatible with call state" and a Call state information element indicating the appropriate call state shall be returned using the call reference of the received REGISTER message.

If a Facility information element is received with an invalid protocol profile, the REGISTER message shall be discarded. The responder shall respond by sending a RELEASE COMPLETE message containing cause #100 "invalid information element contents" using the call reference of the received REGISTER message.

Other protocol errors shall be handled according to EN 300 403-1 [15], subclause 5.8,incorporating the following amendments:

- change in subclause 5.8.3.2 item a) and d) "SETUP" to "SETUP, REGISTER";
- change in subclause 5.8.6.1 "SETUP" to "SETUP, REGISTER";
- change in subclause 5.8.6.2 "SETUP" to "SETUP, REGISTER".

8.3.2.1.2 Data transfer phase

8.3.2.1.2.1 Normal operation

After establishment, the signalling connection can be used to exchange data between the initiator and the responder involved in the connection. The initiator and the responder are completely free to send data, i.e. there exists no predetermined sending scheme.

To transfer data to the peer entity, the entity shall send a FACILITY message to the peer entity using the DL-DATA-REQUEST service primitive. Sending a FACILITY message shall not affect the call state. The call reference identifying this connection shall be included in this FACILITY message. The data, i.e. the component structures, shall be included in the Facility information element.

8.3.2.1.2.2 Exceptional procedures

Only the FACILITY message, RELEASE message, RELEASE COMPLETE message, STATUS message, and the STATUS ENQUIRY message shall be sent using the call reference that was assigned by a REGISTER message. If any other message is received, the entity shall ignore it and shall return a STATUS message with cause value #101, "message not compatible with call state", and a Call state information element indicating call state U31, N31 "Bearer Independent Transport".

If a Facility information element is received with an invalid protocol profile, the FACILITY message shall be discarded. The receiver shall respond by sending a STATUS message with cause value #100 "invalid information element contents" using the call reference of the received FACILITY message.

The procedures for sending and receiving a STATUS ENQUIRY message are as defined in EN 300 403-1 [15], subclause 5.8.10. The procedures on receipt of a STATUS message are defined in EN 300 403-1 [15], subclause 5.8.11.

If either protocol entity receives an indication that the data link has been released via the DL-RELEASE-INDICATION primitive, it shall release the call reference, enter the Null call state (U0, N0) and regard the signalling connection as released.

If either protocol entity receives an indication that the data link has spontaneously been reset via the DL-ESTABLISH-INDICATION primitive, it shall send a RELEASE COMPLETE message with the appropriate call reference, and with the Cause information element indicating cause value #41 "temporary failure", release the call reference, enter the Null call state (U0, N0) and regard the signalling connection as released.

Other protocol errors shall be handled according to EN 300 403-1 [15], subclause 5.8.

8.3.2.1.3 Connection release

8.3.2.1.3.1 Normal operation

The release procedure shall be considered as symmetrical, i.e. both the initiator and the responder can initiate connection release.

To release the signalling connection, a protocol entity shall send a RELEASE message using the DL-DATA-REQUEST primitive, start timer T308, as defined in clause 9 of EN 300 403-1 [15] and enter the Release Request state (N19, U19). The Cause information element shall indicate an appropriate cause.

The call reference identifying this signalling connection shall be included in the RELEASE message.

On receipt of a RELEASE message, as indicated by the DL-DATA-INDICATION primitive, the protocol entity shall send a RELEASE COMPLETE message using the DL-DATA-REQUEST primitive, release the used call reference and enter the Null call state (U0 or N0).

On receipt of the RELEASE COMPLETE message, as indicated by the DL-DATA-INDICATION primitive, the protocol entity shall stop timer T308, release the used call reference and enter the Null call state (U0 or N0).

A protocol entity may send data (i.e. the component structures) to the other protocol entity by including a Facility information element in the RELEASE or RELEASE COMPLETE message.

NOTE: If the RELEASE or RELEASE COMPLETE message contains a Facility information element, then a clear distinction between connection release and the data transfer phase cannot be made.

The Cause information element shall only be used to report EN 300 403-1 [15] errors outside the component portion of the Facility information element (octets 1 to 3). When no EN 300 403-1 [15] protocol error is found, the Cause information element shall convey cause #31 "normal, unspecified". For protocol errors in the component portion of the Facility information element (octets 4, etc.) see subclause 8.4.1.

8.3.2.1.3.2 Exceptional procedures

If timer T308 expires the first time, the protocol entity shall retransmit the RELEASE message including the cause value and restart timer T308.

If timer T308 expires the second time, the protocol entity shall release the call reference and enter the Null call state (N0, U0).

NOTE: If timer T308 expires the second time, and after consideration of other usage of the interface, the restart procedure as defined in EN 300 403-1 [15], subclause 5.5,could be used.

8.3.2.2 Point-to-point transport mechanism (connectionless)

8.3.2.2.1 Normal operation

If a point-to-point data link is known to exist or can be established, a connectionless transport mechanism can be used using a reliable data link connection.

The connectionless transport mechanism is based on FACILITY messages like the connection-oriented transport mechanism. However, the connectionless transport mechanism shall only use the dummy call reference value as specified in EN 300 403-1 [15], subclause 4.3.

Before data can be sent the user shall first establish, if not already available, a reliable data link connection between the user and the network using the DL-ESTABLISH-REQUEST service primitive as described in ETS 300 402-2 [14]. Completion of establishment of this connection is indicated by a DL-ESTABLISH-CONFIRM primitive.

The FACILITY message is used to carry the "user" information, i.e. the component structures in the Facility information element.

The contents of the FACILITY message can be extended by the Called party number and Called party subaddress information elements.

When the multiple subscriber number supplementary service is provided to the user, and the network is to address the user with a multiple subscriber number, then the network shall send the multiple subscriber number to the user in a Called party number information element in the FACILITY message. The Called party number information element shall be coded according to ETS 300 052-1 [10], subclause 9.2.1.

When the subaddressing supplementary service is provided to the user, and the network is to address the user with a subaddress provided by the same or another user, then the network shall send the subaddress to the user in a Called party subaddress information element in the FACILITY message. The Called party subaddress information element shall be coded according to ETS 300 061-1 [11].

If the Called party number or Called party subaddress information elements are included in the FACILITY message, the receiving user shall check the identity according to EN 300 403-1 [15], clause B.3, with the exception that "SETUP" needs to be replaced with "FACILITY". The FACILITY message shall be sent using the DL-DATA-REQUEST service primitive as described in ETS 300 402-2 [14].

8.3.2.2.2 Exceptional procedures

If a Facility information element is received with an invalid protocol profile, the receiving entity shall discard the FACILITY message.

If a FACILITY message is received and it does not contain the Facility information element, the receiving entity shall discard the FACILITY message.

When a message other than FACILITY is received using the dummy call reference, and which does not apply to some other application of the dummy call reference, the receiving entity shall discard the message.

If either protocol entity receives an indication that the data link has been released via the DL-RELEASE-INDICATION primitive, or that the data link has spontaneously been reset via the DL-ESTABLISH-INDICATION primitive, then the procedures as they affect the higher layer protocol are outside the scope of the present document.

NOTE: The handling of layer 2 errors is supplementary service dependent and shall therefore be specified in the individual supplementary services referencing this subclause.

8.3.2.3 Broadcast transport mechanism (connection-oriented)

Currently not specified in the present document or elsewhere.

8.3.2.4 Broadcast transport mechanism (connectionless)

8.3.2.4.1 Normal operation

The connectionless transport mechanism is based on FACILITY messages which are sent from the network to the user. However, the connectionless transport mechanism shall only use the dummy call reference value as specified in EN 300 403-1 [15], subclause 4.3.

The contents of the FACILITY message may be extended by the Called party number and Called party subaddress information elements.

When the multiple subscriber number supplementary service is provided to the user, and the network is to address the user with a multiple subscriber number, then the network shall send the multiple subscriber number to the user in a Called party number information element in the FACILITY message. The Called party number information element shall be coded according to ETS 300 052-1 [10], subclause 9.2.1.

When the subaddressing supplementary service is provided to the user, and the network is to address the user with a subaddress provided by the same or another user, then the network shall send the subaddress to the user in a Called party subaddress information element in the FACILITY message. The Called party subaddress information element shall be coded according to ETS 300 061-1 [11].

If a Called party number, or Called party subaddress information element is included in the FACILITY message, the receiving user shall check the identity according to EN 300 403-1 [15], clause B.3, with the exception that "SETUP" needs to be replaced by "FACILITY".

The FACILITY message is used to carry the "user" information, i.e. the component structures in the Facility information element.

The network shall send this FACILITY message, using the DL-UNIT DATA-REQUEST service primitive for the broadcast datalink as described in ETS 300 402-2 [14].

8.3.2.4.2 Exceptional procedures

If a Facility information element is received with an invalid protocol profile, the receiving entity shall discard the FACILITY message.

If a FACILITY message is received and it does not contain the Facility information element, the receiving entity shall discard the FACILITY message.

When a message other than FACILITY is received using the dummy call reference, and which does not apply to some other application of the dummy call reference, the receiving entity shall discard the message.

If either protocol entity receives an indication that the data link has been released via the DL-RELEASE-INDICATION primitive, or that the data link has spontaneously been reset via the DL-ESTABLISH-INDICATION primitive, then the procedures as they affect the higher layer protocol are outside the scope of the present document.

NOTE: The handling of layer 2 errors is supplementary service dependent and shall therefore be specified in the individual supplementary services referencing this subclause.

8.4 Error procedures

8.4.1 Component error handling

If a network or user receives a Facility information element containing errors in a component, then the receiving entity shall reject the component by invoking the reject procedure defined in subclause 8.2.2.4. The problem code shall be one of those defined in table 2 of the present document. On invoking the reject procedure the entity shall proceed as if the component had not been received, e.g. if the component was transported in a SETUP message, then basic call handling according to EN 300 403-1 [15] shall continue, or if the invoke component was transported in a REGISTER message, then the receiving entity shall still establish the call reference and enter the Bearer Independent Transport call state (N31, U31).

The receipt of a reject component shall be dealt with according to the procedures defined in the individual supplementary service standards.

NOTE: If the receiving entity does not implement clause 8 of the present document, then the receipt of a Facility information element containing a component shall be handled according to the procedures of EN 300 403-1 [15], subclause 5.8.7.

8.4.2 Error handling of mistyped data values

If an unknown value (data element) is received in an argument, result or parameter, and if all values which are neither optional nor have default values assigned are correctly received, the receiving entity shall not reject these components with problem code of "mistyped argument", "mistyped result" or "mistyped parameter". The receiving entity shall ignore these unknown values.

8.5 Response to multiple supplementary service invocations

The possible correlation of responses to multiple supplementary service invocations is subject of future standards and currently not applicable.

9 Generic notification procedures

9.1 General

This clause specifies the functional signalling procedures that support the delivery of notifications at the user-network interface.

Notifications can be characterized by the following properties:

- they do not cause any change of state on either side of the user-network interface;
- they represent a one-way flow of information that shall not generate a response; and
- they provide additional information that can be discarded without the need for significant error recovery if they are unrecognized by a user.

As a consequence of these properties it is possible to provide a generic set of procedures optimized to support the delivery of notifications at the user-network interface.

9.2 Categories of notification procedures

The generic procedures for the delivery of notification can be categorized by the type of information contained in the notification.

Procedures are defined for three types of notification information, as follows:

a) the delivery of simple notification "indicators" based on the Notification indicator information element, with codepoints as defined in the standards for individual supplementary services;

b) within the range of the allowed maximum message length the delivery of notification "parameters" that are specified as information elements using the encoding scheme defined in EN 300 403-1 [15], subclause 4.5.1 including information elements defined in EN 300 403-1 [15], in the present document and in the standards for individual supplementary services;

c) the delivery of notification "indicators" and "parameters" using an extension codepoint in octet 3 of the Notification indicator information element and Basic Encoding Rules (BER) encoded information in subsequent octets.

When no "parameters" are present, option a) shall be used. When "parameters" are present, individual supplementary services shall specify which options are applicable.

An application requiring notification shall encode the required information in the Notification indicator information element or some other specified information element. The notification shall be sent using the appropriate transport mechanism, as specified by the application, and as defined in subclause 9.3 or subclause 9.4.

9.3 Transport of bearer-related notifications

These procedures are provided as part of the basic call and do not require subscription to any individual supplementary service.

This subclause enhances in a compatible manner the basic call control procedures specified in EN 300 403-1 [15], subclause 5.9.

9.3.1 Normal operation

The delivery of bearer-related notifications shall use an active call reference of the call the notification is associated with and its underlying data link connection. In this context a call reference shall be active from the initiation of call establishment (including the SETUP message) to the completion of call clearing (including the RELEASE COMPLETE message).

If the delivery of the notification coincides with call establishment or clearing procedures, the notification information can be carried in the associated call control messages. If the delivery of the notification indication coincides with the sending of a FACILITY message, the notification information can be carried in that message. In all other cases, the notification information shall be delivered in a NOTIFY message. In addition a NOTIFY message may be sent or received by the user or by the network only after the first response to a SETUP message has been sent or received and before clearing of the call reference is initiated.

If a notification is received by the network, the network shall: optionally ensure that the contents of the notification are a valid coding; and forward the notification to the other user involved in the call.

No call state change shall occur at either side of the interface following the sending or receipt of a NOTIFY message.

9.3.2 Exceptional procedures

If a user does not recognize an information element in a NOTIFY message or a new codepoint or extension contents of the Notification indicator information element, it shall handle it according to the procedures in EN 300 403-1 [15], subclause 5.8.

NOTE: The preferred option is to discard the unrecognized information in this instance.

If a notification is received by the network and the contents of the notification are determined to be an invalid or unrecognized coding, the notification shall be discarded and not forwarded to the other user involved in the call.

9.4 Transport of bearer-independent notifications

9.4.1 Normal operation

The procedures specified enable the network to notify a user of supplementary service related events when no appropriate call reference is active.

The application of these procedures in the direction user to network is not specified in the present document.

The delivery of bearer-independent notifications requires the underlying services of the data link layer.

Bearer-independent notifications are delivered using the NOTIFY message defined in subclause 11.1.3.2 with the dummy call reference. The dummy call reference is specified in EN 300 403-1 [15], subclause 4.3.

If it is known that a point-to-point configuration exists at the access, then the NOTIFY message shall be sent using the DL-DATA-REQUEST primitive as described in ETS 300 402-2 [14], otherwise the NOTIFY message shall be sent using the DL-UNIT DATA-REQUEST primitive as described in ETS 300 402-2 [14].

9.4.2 Exceptional procedures

If a user does not recognize information in the NOTIFY message then that information shall be discarded.

When a message other than NOTIFY is received using the dummy call reference, and which does not apply to some other application of the dummy call reference, the receiving entity shall discard the message.

10 Other generic procedures

10.1 Network-side channel reservation function

The network-side channel reservation function allows the user to improve the success of a subsequent channel selection by making a channel unavailable for use by another user on the same access.

The user shall be identified by the CEI. Reservations may only be used by a call associated with the same CEI (and thus the same user).

The network-side channel reservation function is limited to calls requiring single 64 kbit/s channels. Calls requiring broadband channels (greater than 64 kbit/s channels) are outside the scope of the present document; however, where a reservation action is provided for a 64 kbit/s call, active broadband calls with the same CEI shall be treated as active calls.

Calls requiring packet-mode connections shall be treated as active calls for a given CEI.

Two methods of reservation are defined: implicit and explicit reservation. Both methods may co-exist on the same user access configuration.

10.1.1 Implicit reservation

Implicit reservation allows user control of the network-side channel reservation function by means of invocation of other functions from the user, e.g. by use of the Hold and Retrieve functions.

10.1.1.1 Implicit reservation creation

On creation of a reservation the network shall reserve a channel against a specified CEI. This reservation renders a channel busy, such that another call may be rejected or enter a call waiting condition, even though not all channels are allocated to active calls.

A call allocated to a CEI with a channel selected is a call:

a) in one of the following call states: Overlap Sending (N2), Outgoing Call Proceeding (N3); Call Delivered (N4) with an Idle or Hold Request auxiliary state; Active (N10) with an Idle or Hold Request auxiliary state; and

b) where a point-to-point configuration is known to exist: the Call Received (N7), Connect Request (N8), Incoming Call Proceeding (N9) and Overlap Receiving call states (N25); and

c) in one of the following call states where that call state was reached via one of the call states listed in (a) or where appropriate (b): Disconnect Request (N11); Disconnect Indication (N12); Release Request (N19).

The following actions on an active call shall create a reservation, if no reservation already exists:

a) if no other existing call for that CEI has a channel selected, then the receipt or sending of a HOLD ACKNOWLEDGE message shall create a reservation against the CEI for which that message was received or sent;

b) if an existing call (1) has a channel selected, and if no reservation already exists, and if an existing call (2) is in the Call Held or Retrieve Request or Retrieve Indication auxiliary state, and if no other existing call for that CEI has a channel selected, then the receipt or sending of a RELEASE COMPLETE message for the call (1) shall create a reservation against the CEI for which that message was received or sent;

c) if an existing call (1) has a channel selected, and if no reservation already exists, and if an existing call (2) is in the Call Held or Retrieve Request or Retrieve Indication auxiliary state, and if no other existing call for that CEI has a channel selected, then the sending of a SUSPEND ACKNOWLEDGE message for the call (1) shall create a reservation against the CEI for which that message was sent;

NOTE 1: On call suspension, the channel is allocated to a call identity, and not to a particular user, as identified by its CEI.

d) if an existing call is in the Call Held or Retrieve Request or Retrieve Indication auxiliary state; and if no other existing call for the CEI has a channel selected (apart from the call with the channel being restarted); then the receipt or sending of a RESTART ACKNOWLEDGE message, when the Restart indicator information element contained in the original RESTART message specified "indicated channels" where that channel is allocated to an existing call, shall create a reservation against the CEI for which that message was received or sent.

NOTE 2: The network or the user may have already begun clearing the call by means of a DISCONNECT, RELEASE and RELEASE COMPLETE sequence of messages, in which case item b) applies.

10.1.1.2 Implicit reservation use

On use of a reservation the network shall perform the associated channel selection procedures applicable to the events concerned and delete the reservation against that CEI.

The following actions shall use a reservation, if such a reservation exists against the CEI for which the action was performed:

- the sending of a SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT message to the user in response to a received SETUP message;

- the sending of a CONNECT ACKNOWLEDGE message to the user in response to a received CONNECT message;

- the sending of a RETRIEVE ACKNOWLEDGE message in response to a received RETRIEVE message;
- the reception of a RETRIEVE ACKNOWLEDGE message in response to the sending of a RETRIEVE message;
- where a point-to-point configuration is known to exist, the receipt of a SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT message from the user in response to a sent SETUP message.

10.1.1.3 Implicit reservation cancellation

On reservation cancellation the network shall delete the reservation against that CEI.

The following actions shall cancel a reservation if such a reservation exists against the CEI for which the action was performed:

- if only one call related to a specified CEI is in the Call Held or Retrieve Request or Retrieve Indication auxiliary state, the sending or receipt of a RELEASE COMPLETE message for the call which is in the Call Held or Retrieve Request or Retrieve Indication auxiliary state;
- the sending of a RESUME ACKNOWLEDGE message;

NOTE: A reservation is not used for call resumption, as a channel is permanently allocated to the suspended call.

- the sending or receipt of a RESTART ACKNOWLEDGE message when the Restart indicator information element contained in the original RESTART message specified "single interface" or "all interfaces";
- the receipt of a DL-RELEASE-INDICATION primitive.

10.1.2 Explicit reservation

Explicit channel reservation provides user control of the network-side channel reservation function by explicit operations which may use a reservation indicator generated, issued and managed by the network. This allows the user to reserve B-channel resources for use by several held calls.

NOTE: This subclause provides operations for the creation, management and cancellation of reservations which the user may use in parallel with the procedures specified in subclause 10.1.1.

The formal definition of the explicit network side channel reservation function shall be as shown in table D.7.

10.1.2.1 Explicit reservation control

To control channel reservation explicitly the user shall include an ExplicitReservationCreationControl invoke component carried by a Facility information element in an appropriate bearer-related transport message.

The invoke component may contain an argument specifying one of three options:

- no reservation required (note 1);
- reservation required without reservation indicator;
- reservation required with reservation indicator (note 2).

NOTE 1: This option can be used to overrule an implicit reservation.

NOTE 2: The purpose of the reservation indicator is to identify a specific reservation related to a given CEI.

If no parameter is included in the invoke component then "reservation required without reservation indicator" is assumed by the network.

On receipt of an ExplicitReservationCreationControl invoke component requesting reservation required, with or without reservation indicator, and the network is able to provide the requested function, the network shall include an ExplicitReservationCreationControl return result component carried by a Facility information element in an appropriate transport message related to the same call. If appropriate (by a subscription parameter, or, as requested in the invoke component), the network shall include a reservation indicator parameter; if this parameter is provided, the network shall store this parameter against the reservation, and shall only grant use of the reservation when this reservation indicator

value is included in the ExplicitReservationManagement invoke component as defined by subclause 10.1.2.2. If the ExplicitReservationCreationControl invoke component was included in a message that released a channel resource or is about to release a channel resource on acknowledgement (i.e. a RELEASE, a RELEASE COMPLETE, a HOLD or a HOLD ACKNOWLEDGE message), that channel resource shall not be allocated to another call if it is required to meet the reservation requirements.

On receipt of an ExplicitReservationCreation control invoke component requesting no reservation required, and the network is able to provide the requested function, the network shall include an ExplicitReservationCreationControl return result component carried by a Facility information element in an appropriate transport message related to the same call. Furthermore the network shall not provide an implicit reservation.

If the network is unable to provide the requested function, the network shall include an ExplicitReservationCreationControl return error component carried by a Facility information element in an appropriate transport message related to the same call. Appropriate errors are:

- maximum number of reservations reached. The maximum number of reservations (default = one) already exists for this CEI;
- function "notAvailable";
- function "notSubscribed";
- unwanted reservation created.

On receipt of the ExplicitReservationCreationControl return result component, the user shall retain knowledge of the reservation indicator, if provided.

10.1.2.2 Explicit reservation management

To manage the use of channel reservation the user shall include an ExplicitReservationManagement invoke component carried by a Facility information element in an appropriate bearer-related transport message performing channel selection (i.e. SETUP, SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING, CONNECT, CONNECT ACKNOWLEDGE, RETRIEVE or RETRIEVE ACKNOWLEDGE). If required by the network (on all reservations as indicated by a subscription parameter, or, as requested in the ExplicitReservationCreationControl invoke component which generated the reservation), the user shall include a reservation indicator parameter since the network shall only grant use of the reservation when the required reservation indicator value is included in the ExplicitReservationManagement invoke component.

If no ExplicitReservationManagement invoke component is included in a call control message selecting a channel then any existing implicit reservations shall be used by the network. If no implicit reservations exist, then any existing explicit reservations shall remain available.

If the user requires that an existing implicit reservation is not to be used by the call control message selecting a channel, then the user shall include an ExplicitReservationManagement invoke component in the call control message. If an explicit reservation with a reservation indicator has been created, then the invoke component shall include the reservation indicator.

If the network is able to provide the requested management function, the network shall include an ExplicitReservationManagement return result component carried by a Facility information element in an appropriate transport message related to the same call.

If the network is unable to provide the requested function, the network shall include an ExplicitReservationManagement return error component carried by a Facility information element in an appropriate transport message related to the same call. Appropriate errors are:

- no explicit reservation exists, or invalid reservation indicator;
- function "notAvailable";
- function "notSubscribed";
- implicit reservation used.

NOTE: Failure of the explicit reservation management operation will not necessarily result in channel selection failure, solely in failure to manage the reservation.

On receipt of the ExplicitReservationManagement return result component, the user shall remove knowledge of the reservation indicator, if used.

10.1.2.3 Explicit reservation cancellation

To cancel an explicit channel reservation the user shall include an ExplicitReservationCancel invoke component carried by a Facility information element in an appropriate call related transport message.

If the network is able to cancel the reservation, the network shall include an ExplicitReservationCancel return result component carried by a Facility information element in an appropriate transport message related to the same call. If required by the network (by a subscription parameter, or, as requested in the invoke component) the user shall include a reservation indicator parameter and the reservation shall only be cancelled if this reservation indicator value is included in the ExplicitReservationCancel invoke component.

Reservation cancellation shall only cancel a single reservation; if multiple reservations exist, multiple reservation cancellations shall be invoked.

If the network is unable to cancel the reservation, the network shall include an ExplicitReservationCancel return error component carried by a Facility information element in an appropriate transport message related to the same call. Appropriate errors are:

- no explicit reservation exists or invalid reservation indicator;
- function "notAvailable";
- function "notSubscribed".

On receipt of the ExplicitReservationCancel return result component the user shall remove knowledge of the reservation indicator, if used.

The network shall cancel all reservations on:

- the sending or receipt of a RELEASE COMPLETE message for the last call on that CEI;
- the sending or receipt of a RESTART ACKNOWLEDGE message when the Restart indicator information element contained in the original RESTART message specified "single interface" or "all interfaces";
- the receipt of a DL-RELEASE-INDICATION primitive.

There is no signalling protocol specific to the Reservation function associated with this action. The user shall likewise remove all knowledge of any reservation indicators.

10.1.3 Effect of reservation on channel selection for a new call

For an incoming call using the channel selection procedures as defined in EN 300 403-1 [15], subclause 5.2.3, the "no B-channel available" condition shall be determined if the number of channels available for use by a user, minus the number of reserved channels, is zero. An implicitly reserved channel shall not be used by this call unless the call is subsequently allocated to the CEI for which the reservation exists. An explicitly reserved channel shall not be used by this call unless an explicit request to use that channel is received according to the procedures of subclause 10.1.2.2.

10.1.4 Interaction between implicit and explicit network-side channel reservation functions on the same CEI

When an implicit reservation exists at the same time as an explicit reservation, then all call control messages not containing an explicit reservation invoke component, that affect channel selection, shall follow the procedures for implicit reservation in subclause 10.1.1.

10.2 Generic procedures for supplementary service management

10.2.1 Introduction

Subclause 10.2 provides for common generic procedures for supplementary service management functions to support particular supplementary service procedures (e.g. diversion supplementary services) at the user-network interface. The procedures described provide the management activities that manage supplementary service specific resource configurations, routing information or other types of supplementary service specific data resident at the service providers database. The type of supplementary service management data may differ depending on supplementary service specific requirements and is the subject of the individual standards for these services.

Certain supplementary services can be activated for an individual attribute value, such that management is required for each attribute value, e.g. an individual basic service or a multiple subscriber number. This is known in the subsequent procedures as management of an instance of the supplementary service. These procedures assume that an operation manages only a single instance of the supplementary service. The management of multiple instances of a supplementary service within a single invoke component is outside the scope of the present document and can be covered in the standards for the individual supplementary services.

The procedures described in subclause 10.2 assume the supplementary service management procedures to be independent of the existence of a bearer.

The required supplementary service management operations are supported by the transport mechanisms as specified in subclause 8.3. The supplementary service management information exchange between served user and service provider may be divided into the following three groups:

- activation of supplementary services. The activation function effects the initiation of certain supplementary services and is employed by the user of the supplementary service. The function may carry supplementary service specific data (e.g. address-information, compatibility information, etc.) which is identified in the standards for the individual supplementary services concerned;

- deactivation of supplementary services. The supplementary service may be deactivated by the user according to the user's requirements;

- interrogation. The interrogation procedure supplies the user with supplementary service specific data stored by the service provider (e.g. which supplementary services are activated, which parameters are specified, etc.). Interrogation is a read-only function and does not change stored data but may require authorization codes. Specific requirements are to be identified within the standards for individual supplementary services using interrogation.

The following subclauses contain the generic procedures for the following operations:

- activation;

- deactivation;

- interrogation;

- status notification.

These operations are specified as a data exchange between certain state machines. The transport protocol messages to be used for transmission of these operations need to be specified in the individual supplementary service standards where applicable.

The states referred to in the following subclauses, and defined in subclause 10.2.6 refer only to the state of a specific supplementary service management request. The state of the service as seen by the user or network is covered by the individual supplementary services referencing these procedures, e.g. the Idle state indicates that no request is in progress, but the service may be activated, or deactivated.

The occurrence of multiple instances of a supplementary service invoke component is to be specified in the standards for the appropriate individual supplementary services.

10.2.2 Activation

10.2.2.1 Normal operation

Having subscribed or being registered to a supplementary service, in order to activate an instance of that service, the served user shall:

- send an activate invoke component to the network, in an appropriate bearer-independent transport message as specified in subclause 8.3.2.2;
- start timer T-ACTIVATE; and
- enter the Activate Request state.

Timer T-ACTIVATE is specified in subclause 10.2.7. The invoke component is specified in table D.1; an appropriate activate invoke component shall be specified in the individual supplementary service specification.

The network, on receiving such an activate invoke component shall enter the Activate Request state.

The service provider may verify that the specific supplementary service parameters are valid before accepting the activation. This verification is done by a check of the specific supplementary service arguments. Furthermore, the service provider may verify whether any restrictions stored (e.g. such as call barring) are applicable. Detailed descriptions of the checks to be performed, if any, shall be given in the appropriate supplementary service descriptions.

If the instance of the supplementary service is successfully activated the network:

- shall send an activate return result component to the user in an appropriate bearer-independent transport message as specified in subclause 8.3.2.2;
- may send as appropriate to the supplementary service being activated a status notification (see subclause 10.2.5);
- shall enter the Idle state.

The user, on receiving such an activate return result component shall stop timer T-ACTIVATE and enter the Idle state.

The user may change the supplementary service data for an existing instance of a supplementary service by using the procedures of subclause 10.2.2 without deactivating this instance first, thus causing any previous activation for that instance of the supplementary service to be overridden.

10.2.2.2 Activation exceptional procedures

If the network is unable to activate an instance of the supplementary service or one of the supplementary services, as correctly requested with an activation invoke component, the network shall send an activation return error component to the user in an appropriate bearer-independent transport message as described in subclause 8.3.2.2 and return to the Idle state.

On receiving such an activation return error component, the user shall stop timer T-ACTIVATE and return to the Idle state.

On expiration of timer T-ACTIVATE, the user shall enter the Idle state. Any subsequent action is dependent on the application.

The procedures on receipt of a reject component by the user or the network are covered in the standards for the individual supplementary services.

If an entity receives a DL-RELEASE-INDICATION primitive in the Activate Request state, then the entity shall abort the activation without informing the other entity, and enter the Idle state.

If an entity receives a DL-ESTABLISH-INDICATION primitive in the Activate Request state, then the entity shall ignore the indication and remain in the current state.

10.2.3 Deactivation

10.2.3.1 Normal operation

In order to deactivate an instance of the supplementary service, the served user shall:

- send a deactivate invoke component to the network, in an appropriate bearer-independent transport message as specified in subclause 8.3.2.2;
- start timer T-DEACTIVATE; and
- enter the Deactivate Request state.

Timer T-DEACTIVATE is specified in subclause 10.2.7. The invoke component is specified in table D.1; an appropriate deactivate invoke component shall be specified in the individual supplementary service specifications.

The network, on receiving such a deactivate invoke component shall enter the Deactivate Request state.

If the requested instance of the supplementary service is successfully deactivated the network:

- shall send a deactivate return result component to the user in an appropriate bearer-independent transport message as specified in subclause 8.3.2.2;
- may send as appropriate to the supplementary service being deactivated a status notification (see subclause 10.2.5);
- shall enter the Idle state.

On receiving such a deactivate return result component, the user shall stop timer T-DEACTIVATE and enter the Idle state.

10.2.3.2 Deactivation exceptional procedures

If the network is unable to deactivate an instance of the supplementary service, as correctly requested with a deactivate invoke component, the network shall send a deactivate return error component to the user in an appropriate bearer-independent transport message as described in subclause 8.3.2.2 and return to the Idle state. The network shall retain the supplementary service specific data as stored before the deactivation request in this case.

On receiving such a deactivate return error component, the user shall:

- stop timer T-DEACTIVATE; and
- return to the Idle state.

On expiration of timer T-DEACTIVATE the user shall enter the Idle state. Any subsequent action is dependent on the application.

The procedures on receipt of a reject component by the user or the network are covered in the standards for the individual supplementary services.

If an entity receives a DL-RELEASE-INDICATION primitive in the Deactivate Request state, then the entity shall abort the deactivation without informing the other entity, and enter the Idle state.

If an entity receives a DL-ESTABLISH-INDICATION primitive in Deactivate Request state, then the entity shall ignore the indication and remain in the current state.

10.2.4 Interrogation

10.2.4.1 Normal operation

The interrogation procedure enables the served user to obtain information about the data stored in the network.

In order to interrogate an instance of the supplementary service, the served user shall:

- send an interrogate invoke component to the network, in an appropriate bearer-independent transport message as specified in subclause 8.3.2.2;
- start timer T-INTERROGATE; and
- enter the Interrogate Request state.

Timer T-INTERROGATE is specified in subclause 10.2.7.

The network, on receiving such an interrogate invoke component shall enter the Interrogate Request state.

After having requested this procedure the network shall return the following information:

- in response to a request to interrogate all instances of a supplementary service the served user shall be given a list of all active instances of the specified supplementary service including the specific supplementary service argument values in one component;
- in response to a request to interrogate a specific instance of a supplementary service, the served user shall be informed whether or not the supplementary service is active or registered, and if so, what specific supplementary service argument values are in use.

If the requested data has been successfully collected the network shall:

- send an interrogate return result component to the user in an appropriate bearer-independent transport message as specified in subclause 8.3.2.2; and
- return to the Idle state.

The user, on receiving such an interrogate return result component shall stop timer T-INTERROGATE and return to the Idle state.

10.2.4.2 Interrogation exceptional procedures

If the network is unable to provide the information requested, as correctly requested with an interrogate invoke component, the network shall send an interrogate return error component to the user in an appropriate bearer-independent transport message as described in subclause 8.3.2.2 and return to the previous state.

The user, on receiving such an interrogate return error component shall stop timer T-INTERROGATE and return to the state prior to the interrogation request.

On expiration of timer T-INTERROGATE, the user shall enter the Idle state. Any subsequent action is dependent on the application.

The procedures on receipt of a reject component by the user or the network are covered in the standards for the individual supplementary services.

If an entity receives a DL-RELEASE-INDICATION primitive in the Interrogate Request state, then the entity shall abort the interrogation without informing the other entity, and enter the Idle state.

If an entity receives a DL-ESTABLISH-INDICATION primitive in the Interrogate Request state, then the entity shall ignore the indication and remain in the current state.

10.2.5 Status notification

10.2.5.1 Normal operation

The status notification procedure enables the served user and all other users at the same access and identified by the served user's number to receive information about the present status of the access due to activation or deactivation of an instance of the supplementary service (e.g. activation of the call forwarding unconditional supplementary service).

The status notification information is provided by the network at the instant and with the information content as specified in the individual operation of the supplementary services concerned.

For transport of status notifications the procedures as specified in subclause 8.3.2.4 are applicable.

NOTE: The status notification is usually carried as a class 5 operation (asynchronous, outcome not reported).

10.2.5.2 Exceptional procedures

On receipt of an unrecognized Facility information element or on receipt of mistyped components the receiving entity shall apply the normal error handling procedures as specified in subclause 8.4.

10.2.6 State definitions

The following states are conceived for the supplementary service management procedures associated with a specific request at the served user's access and are applicable to both the network and the user. The states only refer to the state of the request and not the state of a particular supplementary service:

Idle state: There are no supplementary service management procedures in progress;

Activate Request state: The user has requested that a supplementary service be activated;

Deactivate Request state: The user has requested that a supplementary service shall be deactivated;

Interrogate Request state: The user has requested that a supplementary service be interrogated.

10.2.7 Parameter values (timers)

Table 3 shows the timers used for the supplementary service management procedures.

NOTE: The procedures for activation, deactivation and interrogation make use of the bearer-independent connectionless transport mechanism as specified in subclause 8.3.2. Since no transport association exists when this mechanism is used, the timers specified in this subclause cannot be associated with a call reference. Therefore, these timers shall be considered as belonging to the application process in progress.

Table 3

Timer value	Time out value	Cause for start	Normal stop	At expiry
T-ACTIVATE	(note)	activate invoke sent	activate return result received	Return to Idle
T-DEACTIVATE	(note)	deactivate invoke sent	deactivate return result received	Remain in Activated state
T-INTERROGATE	(note)	interrogate invoke sent	interrogate return result received	Remain in the state prior to the invoke
NOTE: The timeout values are application dependent and shall therefore be specified in the standards for the individual supplementary services.				

10.3 Generic status request procedure

10.3.1 Introduction

The status request procedure allows the network to check whether compatible and incompatible terminal(s) are connected to an interface and whether these terminal(s) are free or busy. This procedure can be used for supplementary services that require the characteristics of the terminals to be known (e.g. completion of calls to busy subscriber supplementary service and freephone supplementary service).

Subclause 10.3 specifies the generic portion of the procedure only. How a supplementary service makes use of the information obtained using these procedures has to be specified in the individual standards referring to subclause 10.3.

10.3.2 Normal operation

The status request procedure is based on the StatusRequest operation. The formal definition of this operation is given in table D.8.

To start the status request procedure the network shall perform the following actions:

a) start timer T-STATUS;

b) request the operation using one of the following procedures:

- if a point-to-multipoint configuration is known to exist the network shall send a StatusRequest invoke component to the user following the procedures of subclause 8.3.2.4;

- if a point-to-point configuration is known to exist, the network shall send a StatusRequest invoke component to the user following the procedures of subclause 8.3.2.2.

In both procedures the StatusRequest invoke component shall contain the compatibilityMode and the relevant basic service(s) as defined by the Bearer capability, and optionally Low layer compatibility and High layer compatibility information elements for which the status is required. The compatibilityMode shall be set to indicate the appropriate compatibility mode. Furthermore, if the network is to address the user with a multiple subscriber number, or subaddress then the FACILITY message shall contain the Called party number, and/or Called party subaddress information elements as defined in subclauses 8.3.2.2 and 8.3.2.4.

If the network wants to determine the status for a single basic service, then the invoke component shall contain a single Bearer capability information element, and optionally, single High layer compatibility and Low layer compatibility information elements. The compatibilityMode is not significant and shall be set the "allBasicServices" or "oneOrMoreBasicServices".

If the network wants to determine the status for multiple basic services, then the invoke component shall contain one or more Bearer capability information elements, and optionally one or more High layer compatibility information elements, with the condition that at least one of these information elements shall be present more than once. The invoke component shall not contain a Low layer compatibility information element. The specification of multiple basic services shall be according to EN 300 267-1 [13]. If compatibility to all indicated basic services is required, then the compatibilityMode shall be set to "allBasicServices". If compatibility to at least one basic service is required, the compatibilityMode shall be set to "oneOrMoreBasicServices";

c) enter the Waiting Status state.

On receipt of a StatusRequest invoke component the user shall provide compatibility checking on the given Bearer capability, Low layer compatibility and High layer compatibility information elements.

If the StatusRequest invoke component contains a single Bearer capability information element, and optionally a single High layer compatibility and Low layer compatibility information element, then the user shall provide compatibility checking as defined in subclauses B.3.2 and B.3.3 of EN 300 403-1 [15]. If the invoke component contains more than one Bearer capability information element or High layer compatibility information element, then the user shall provide compatibility checking for each basic service as indicated by all valid combinations of Bearer capability and High layer compatibility information element as defined in EN 300 267-1 [13], subclause 5.5.5.

The user shall send a StatusRequest return result component containing a StatusResult parameter to the network according to the procedures of subclause 8.3.2.2. The StatusResult parameter shall indicate:

- "compatibleAndFree", if the compatibilityMode indicated "allBasicServices", and the user is free to accept a call for all of these basic services;
- "compatibleAndFree", if the compatibilityMode indicated "oneOrMoreBasicServices", and the user is compatible with at least one of the indicated basic service, and the user is free to accept a call for at least one of these basic services;
- "compatibleAndBusy", if the compatibilityMode indicated "allBasicServices", and the user is compatible with all basic services, and the user is not free to accept calls for all of these basic services;
- "compatibleAndBusy", if the compatibilityMode indicated "oneOrMoreBasicServices", and the user is compatible with at least one of the indicated basic services, and the user is not free to accept a call for any of these basic services;
- "incompatible", if the compatibilityMode indicated "allBasicServices" and the user is not compatible with all the indicated basic services;
- "incompatible", if the compatibilityMode indicated "oneOrMoreBasicServices" and the user is not compatible with any of the indicated basic services.

Whilst in the Waiting Status state, the network shall:

a) on receipt of a StatusRequest return result component:
   - note the result;
   - in a point-to-multipoint configuration remain in the same state. In a point-to-point configuration stop timer T-STATUS, enter the Idle state, and terminate the status request procedure.

b) on expiry of timer T-STATUS:
   - enter the Idle state and terminate the status request procedure.

On termination of the status request procedure, the network will have determined that:

a) in a point-to-point configuration:
   - if a "compatibleAndFree" result has been received then the terminal is compatible and free;
   - if a "compatibleAndBusy" result has been received then the terminal is compatible and busy;
   - if a "incompatible" result has been received then the terminal is incompatible;
   - if no result has been received then the terminal does not support the status request procedure and its compatibility and free/busy status is unknown.

b) in a point-to-multipoint configuration:
   - if one or more "compatibleAndFree", or "compatibleAndBusy" results have been received, then compatible terminal(s) are present;
   - if one or more "compatibleAndFree" results have been received, then compatible and free terminal(s) are present;
   - if one or more "compatibleAndBusy" results have been received, then compatible and busy terminal(s) are present;
   - if one or more "incompatible" results have been received, then incompatible terminal(s) are present;
   - if no response has been received then there are no terminals present that support the status request procedure and their compatibility and free/busy status is unknown.

NOTE: Even when StatusRequest return result component(s) have been received there may be terminal(s) present that do not support the status request procedure and their compatibility and free/busy status is unknown.

A supplementary service utilising the status request procedure in a point-to-multipoint configuration may obtain information it requires before the status request procedure is terminated, e.g. it is known on receipt of the first "compatibleAndFree" result that at least one compatible terminal is present.

10.3.3 Exceptional procedures

Whilst in the Waiting Status state and a reject component is received, with an invoke identifier, the network shall:

- note the result;
- in a point-to-point configuration stop timer T-STATUS, enter the Idle state and terminate the status request procedure;
- in a point-to-multipoint configuration remain in the same state.

On termination of the status request procedure the network will have determined that:

a) in a point-to-point configuration:
   - the terminal does not support the status request procedure;

b) in a point-to-multipoint configuration:
   - terminal(s) that do not support the status request procedure are present;
   - if only reject components have been received, then there are no terminals present that support the status request procedure.

10.3.4 Parameter values (timers)

Table 4 shows the timer used for the status request procedure.

Table 4

Timer value	Time out value	Cause for start	Normal stop	At expiry
T-STATUS	(note 1)	status request invoke sent	status request return result received (note 2)	Return to Idle
NOTE 1: The timeout value is application dependent and shall therefore be specified in the standards for the individual supplementary services. NOTE 2: Only if a point-to-point configuration exists.				

11 Coding requirements

11.1 Message functional definitions and content

This clause should be read in conjunction with clause 3 of EN 300 403-1 [15]. All messages are additional to those defined in that clause and the following tables should be interpreted according to the introduction of EN 300 403-1 [15].

The segmentation rules as given in annex H of EN 300 403-1 [15] shall also apply to the messages defined in the present document.

To determine an information element specified in this standard is allowed to be included in the following messages, see subclause 11.2.

Information elements not defined in subclause 11.2 are only allowed to be included in the following message when explicitly indicated in the message structure.

NOTE: In the following subclauses each time the term "Facility information element" is used, this shall be interpreted as "Facility or Extended facility information element". If a key in the Reference column indicates "11.2.1" this shall be interpreted as "11.2.1 or 11.2.4, respectively".

11.1.1 Additional messages for bearer-related supplementary service control

11.1.1.1 FACILITY

This message may be sent by the network or the user to control a supplementary service using the common information element approach. The operation to control the supplementary service and its associated parameters are contained in the Facility information element. The structure of the FACILITY message is shown in table 5.

Table 5: FACILITY message content

Message type: FACILITY Significance: local (note 1) Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Facility	11.2.2.1	both	M	8-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: This message has local significance; however it may carry information of global significance. NOTE 2: Included if the network provides information that can be presented to the user.				

11.1.1.2 HOLD

This message is sent by the network or the user to request the hold function for an existing call. The structure of the HOLD message is shown in table 6.

Table 6: HOLD message content

Message type: HOLD Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Display	[15] 4.5	n → u	O (note)	2-82
NOTE: Included if the network provides information that can be presented to the user.				

11.1.1.3 HOLD ACKNOWLEDGE

This message is sent by the network or the user to indicate that the hold function has been successfully performed. The structure of the HOLD ACKNOWLEDGE message is shown in table 7.

Table 7: HOLD ACKNOWLEDGE message content

Message type: HOLD ACKNOWLEDGE Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Display	[15] 4.5	n → u	O (note)	2-82
NOTE: Included if the network provides information that can be presented to the user.				

11.1.1.4 HOLD REJECT

This message is sent by the network or the user to indicate the denial of the hold function. The structure of the HOLD REJECT message is shown in table 8.

Table 8: HOLD REJECT message content

Message type: HOLD REJECT Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Cause	[15] 4.5	both	M	4-32
Display	[15] 4.5	n → u	O (note)	2-82
NOTE: Included if the network provides information that can be presented to the user.				

11.1.1.5 RETRIEVE

This message is sent by the network or the user to request the retrieval of a held call. The structure of the RETRIEVE message is shown in table 9.

Table 9: RETRIEVE message content

Message type: RETRIEVE Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Channel identification	[15] 4.5	both	O (note 1)	2-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: Mandatory in the network to user direction. Optional in the user to network direction except when the user wants to indicate the channel. If not included, its absence is interpreted as any channel acceptable. NOTE 2: Included if the network provides information that can be presented to the user.				

11.1.1.6 RETRIEVE ACKNOWLEDGE

This message is sent by the network or the user to indicate that the retrieve function has been successfully performed. The structure of the RETRIEVE ACKNOWLEDGE message is shown in table 10.

Table 10: RETRIEVE ACKNOWLEDGE message content

Message type: RETRIEVE ACKNOWLEDGE Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Channel identification	[15] 4.5	both	O (note 1)	2-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: Mandatory in all cases except when the sender accepts the specific B-channel indicated in the RETRIEVE message. If included, a channel is indicated and specified as exclusive. NOTE 2: Included if the network provides information that can be presented to the user.				

11.1.1.7 RETRIEVE REJECT

This message is sent by the network or the user to indicate the inability to perform the requested retrieve function. The structure of the RETRIEVE REJECT message is shown in table 11.

Table 11: RETRIEVE REJECT message content

Message type: RETRIEVE REJECT Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Cause	[15] 4.5	both	M	4-32
Display	[15] 4.5	n → u	O (note)	2-82
NOTE: Included if the network provides information that can be presented to the user.				

11.1.2 Messages for bearer-independent supplementary service control

11.1.2.1 FACILITY

This message may be sent by the network or the user to control a supplementary service using the common information element approach. The operation to control the supplementary service and its associated parameters are contained in the Facility information element. The structure of the FACILITY message is shown in table 12.

Table 12: FACILITY message content

Message type: FACILITY Significance: local (note 1) Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Facility	11.2.2.1	both	M	8-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: This message has local significance; however it may carry information of global significance. NOTE 2: Included if the network provides information that can be presented to the user.				

11.1.2.2 REGISTER

This message is sent by the network or the user to establish a new signalling connection for bearer-independent transactions. The structure of the REGISTER message is shown in table 13.

Table 13: REGISTER message content

Message type: REGISTER Significance: local (note 1) Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	11.2.1	both	M	1
Facility	11.2.2.1	both	O (note 3)	8-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: This message has local significance; however it may carry information of global significance. NOTE 2: Included if the network provides information that can be presented to the user. NOTE 3: Included if the network or user provides supplementary service specific information.				

11.1.2.3 RELEASE

This message is sent by the user or the network to indicate that the entity sending the message intends to release the signalling connection and the call reference, and that the receiving entity shall release the signalling connection and prepare to release the call reference after sending RELEASE COMPLETE. The structure of the RELEASE message is shown in table 14.

Table 14: RELEASE message content

Message type: RELEASE Significance: local (note 1) Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	[15] 4.4	both	M	1
Cause	[15] 4.5	both	M	4-32
Facility	11.2.2.1	both	O (note 3)	8-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: This message has local significance; however it may carry information of global significance. NOTE 2: Included if the network provides information that can be presented to the user. NOTE 3: Included if the network or user provides supplementary service specific information.				

11.1.2.4 RELEASE COMPLETE

This message is sent by the user or the network to indicate that the entity sending the message has released the signalling connection and the call reference, and that the receiving entity shall release the call reference. The structure of the RELEASE COMPLETE message is shown in table 15.

Table 15: RELEASE COMPLETE message content

Message type: RELEASE COMPLETE Significance: local (note 1) Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	[15] 4.4	both	M	1
Cause	[15] 4.5	both	O (note 4)	4-32
Facility	11.2.2.1	both	O (note 3)	8-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: This message has local significance; however it may carry information of global significance. NOTE 2: Included if the network provides information that can be presented to the user. NOTE 3: Included if the network or user provides supplementary service specific information. NOTE 4: Mandatory in the first clearing message, including when the RELEASE COMPLETE message is sent as a result of an error handling condition.				

11.1.2.5 STATUS

This message is sent from the user or the network in response to a STATUS ENQUIRY message or at any point in time to report certain error conditions. The structure of the STATUS message is shown in table 16.

Table 16: STATUS message content

Message type: STATUS Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	[15] 4.4	both	M	1
Cause	[15] 4.5	both	M	4-32
Call state	[15] 4.5	both	M	3
Display	[15] 4.5	n → u	O (note)	2-82
NOTE: Included if the network provides information that can be presented to the user.				

11.1.2.6 STATUS ENQUIRY

This message is sent by the user or the network at any time to solicit a STATUS message from the peer layer 3 entity. Sending a STATUS message in response to a STATUS ENQUIRY message is mandatory. The structure of the STATUS ENQUIRY message is defined in table 17.

Table 17: STATUS ENQUIRY message content

Message type: STATUS ENQUIRY Significance: local Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	2-3
Message type	[15] 4.4	both	M	1
Display	[15] 4.5	n → u	O (note)	2-82
NOTE: Included if the network provides information that can be presented to the user.				

11.1.3 Messages used with the dummy call reference

11.1.3.1 FACILITY

This message may be sent by the network or the user to control a supplementary service using the common information element approach. The operation to control the supplementary service and its associated parameters are contained in the Facility information element. The structure of the FACILITY message is shown in table 18.

Table 18: FACILITY message content

Message type: FACILITY Significance: local (note 1) Direction: both				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	both	M	1
Call reference	[15] 4.3	both	M	1
Message type	11.2.1	both	M	1
Facility	11.2.2.1	both	M	8-*
Called party number	[15] 4.5	n → u	O	2-23
Called party subaddress	[15] 4.5	n → u	O	2-23
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: This message has local significance; however it may carry information of global significance. NOTE 2: Included if the network provides information that can be presented to the user.				

11.1.3.2 NOTIFY

This message is sent by network to indicate information pertaining to a supplementary service. The structure of the NOTIFY message is shown in table 19.

Table 19: NOTIFY message contents

Message type: NOTIFY Significance: local (note 1) Direction: n → u				
Information element	**Reference**	**Direction**	**Type**	**Length**
Protocol discriminator	[15] 4.2	n → u	M	1
Call reference	[15] 4.3	n → u	M	1
Message type	[15] 4.4	n → u	M	1
Notification indicator	11.2.2.2	n → u	M	2-*
Display	[15] 4.5	n → u	O (note 2)	2-82
NOTE 1: This message has local significance; however it may carry information of global significance. NOTE 2: Included if the network provides information that can be presented to the user.				

11.2 General message format and information element coding

This subclause should be read in conjunction with clause 4 of EN 300 403-1 [15] and contains the coding of the information elements specifically used by the procedures described in the present document.

11.2.1 Message type

The additional message type codings for the purpose of the present document are defined in table 20.

Table 20: Message types

Bits 8 7 6 5 4 3 2 1	
0 0 1 - - - - -	*EN 300 403-1 [15] call information phase message group:*
0 0 1 0 0	HOLD
0 1 0 0 0	HOLD ACKNOWLEDGE
1 0 0 0 0	HOLD REJECT
1 0 0 0 1	RETRIEVE
1 0 0 1 1	RETRIEVE ACKNOWLEDGE
1 0 1 1 1	RETRIEVE REJECT
0 1 1 - - - - -	*EN 300 403-1 [15] miscellaneous message group::*
0 0 0 1 0	FACILITY
0 0 1 0 0	REGISTER

11.2.2 Other information elements

Table 21 shows the additional information elements defined for supplementary service control and those information elements of EN 300 403-1 [15] which are extended for this purpose.

Table 21: Information elements specific to supplementary service control

Bits 8 7 6 5 4 3 2 1		Reference (subclause)	Maximum length (octets)
0 - - - - - - -	*Variable length elements:*		
0 0 1 1 1 0 0	Facility	11.2.2.1	(note 2)
0 1 0 0 1 1 1	Notification indicator	11.2.2.2	(note 2)
0 0 1 0 1 0 0	Call state	11.2.2.3	3
0 0 0 1 1 0 1	Extended facility	11.2.2.4	(note 3)
All other values are reserved (note 1)			

NOTE 1: The reserved values with bits 5 to 8 coded "0 0 0 0" are for future information elements for which comprehension by the receiver is required (see EN 300 403-1 [15], subclause 5.8.7.1).
NOTE 2: The maximum length of the Facility and Notification indicator information elements is application dependent consistent with the maximum length of the message and not exceeding 255 octets.
NOTE 3: The maximum length of the Extended facility information element is application dependent consistent with the maximum length of the message.

11.2.2.1 Facility

The purpose of the Facility information element is to carry components. For the purposes of the present document these components are used to control supplementary services.

The Facility information element can be included in all call control messages and all messages defined in the present document except for the NOTIFY, STATUS and STATUS ENQUIRY messages.

Figure 1 shows the structure of the Facility information element. Table 22 shows the value of the protocol profile field applicable for supplementary services.

Bits 8	7	6	5	4	3	2	1	Octets
	Facility information element identifier							
0	0	0	1	1	1	0	0	1
Length of facility contents								2
1 ext	0 Spare	0	Protocol profile					3
Components (note)								4 etc.

NOTE: One or more components may be included depending on specific service requirements. Multiple components may be sent in one Facility information element or in more than one (individual) Facility information elements. It is a sender's choice to use either one or several Facility information elements taking into account the maximum length of the Facility information element.

Figure 1: Facility information element

Table 22: Facility information element protocol profile

Protocol profile:	
Bits	
5 4 3 2 1	
1 0 0 0 1	Remote operations protocol
All other values are reserved and their usage is the subject of other standards	

The component structures are defined in table D.1 using ASN.1 as specified in CCITT Recommendation X.208 [5]. For illustrative purposes an example of the coding of component structures is shown in annex F.

All data structures in the Facility information element (octet 4, etc.) shall be encoded according to the basic encoding rules as specified in CCITT Recommendation X.209 [6].

NOTE: The following guidelines apply for the application of the different length encodings:

- the short form definitive length encoding should be used to indicate the length of a data value with a length less than 128 octets;
- when the long form definitive length encoding is used, the minimum number of octets should be used;
- OCTET STRING and BIT STRING values should be encoded in a primitive form.

Receiving entities shall be able to interpret all forms of length encoding of the ASN.1 basic encoding rules.

11.2.2.1.1 Treatment of existing Q.931 information elements as parameters

Supplementary service protocol specifications are expected to require new parameters to be defined and to require existing Q.931 information element s.

New parameters shall be defined using CCITT Recommendation X.209 [6] coding if they do not appear elsewhere in Q.931 messages.

Supplementary service protocol specifiers may elect to encapsulate one or more existing Q.931 information elements within a CCITT Recommendation X.209 [6] data element, thereby retaining the EN 300 403-1 [15] coding for these information elements. When this option is chosen, all the Q.931 information elements should be grouped together as the content following the Q.931 information elements tag. This data element may appear by itself or as a member of a sequence or set.

Encapsulation of the Facility information element within Facility information elements shall not be used.

A formal definition of this mechanism using ASN.1 is given in table D.4.

11.2.2.2 Notification indicator

The following revised definition of the Notification indicator information element complements that given in EN 300 403-1 [15].

The purpose of the Notification indicator information element shall be to indicate information pertaining to a call, for example a supplementary service operating at some other user within that call.

The Notification indicator information element can be included in all call control messages and the messages defined in subclauses 11.1.1 and 11.1.3 except for the STATUS and STATUS ENQUIRY message.

The Notification indicator information element shall be coded as shown in figure 2 and table 23. The maximum length of the information element shall be application dependent consistent with the maximum length of the message.

The Notification indicator information element can be repeated in a message.

Bits 8	7	6	5	4	3	2	1	Octets
	Notification indicator information element identifier							
0	0	1	0	0	1	1	1	1
Length of notification indicator contents								2
0/1 ext	Notification description (notes 3 and 4)							3
1 ext	Notification description (note 3)							3a*
NotificationDataStructure (note 1)								4* etc. (note 2)

NOTE 1: One or more NotificationDataStructure (as defined in table D.9) may be included depending on specific service requirements.
NOTE 2: Octet 4 shall only be included when the notification description in octet 3 indicates the extension to BER encoded data structure usage.
NOTE 3: Bit eight in octet 3 is used to extend the notification description field. If bit eight is 0, then another octet follows; if bit eight is 1, then octet 3 is the last octet. The value for a one octet field ranges from 1 to 127. For a multi-octet field, the order of bit values progressively decreases as the octet number increases.
NOTE 4: The codepoints for the Notification description are defined in the standards for the individual supplementary services that use notifications.

Figure 2: Notification indicator information element

Table 23 shows the notification description value to be used to indicate the use of extended notifications.

Table 23: Notification indicator information element notification description

Notification description (octet 3):	
Bits	
7 6 5 4 3 2 1	
0 0 0 0 0 1 1	Discriminator for BER encoded notification extension
All other values are reserved or defined in the standards for individual supplementary services.	

Table D.9 shows the NOTIFY macro to be used in the standards for the individual supplementary services to define a particular extended notification. Further table D.9 shows the notification data structure which will carry the notification information.

11.2.2.3 Call state

The Call state information element shall be coded as shown in figure 4-13 and table 4-8 of EN 300 403-1 [15]. Table 24 contains an additional codepoint required for use within supplementary service control.

Table 24: Call state information element

Call state value (octet 3):	
Bits	
6 5 4 3 2 1	
0 1 1 1 1 1	Bearer Independent Transport

11.2.2.4 Extended facility information element

The Extended facility information element serves the same purposes as the Facility information element. It does however allow the inclusion of components which would be too long to be included in the Facility information element. The Extended facility information element can be used in any message that can contain a Facility information as a replacement for Facility information elements, or used together with Facility information elements.

The Extended facility information shall only be used to convey a component when that component cannot be included in a Facility information element without other components.

NOTE: Application of the Extended facility information element in implementations where maximum I-frame length is set to the default value specified in ETS 300 402-2 [14] (i.e. 260 octets) will usually require the support of the message segmentation procedures as specified in annex H of EN 300 403-1 [15].

Only the coding of the information element identifier and the length of the Extended facility information element contents are different from the Facility information element. Figure 3 shows the structure of the Facility information element.

Bits 8	7	6	5	4	3	2	1	Octets
	Extended facility information element identifier							
0	0	0	0	1	1	0	1	1
Length of extended facility contents								2, 2.1, 2.2* etc
1 ext	0	0	Protocol profile					3
	Spare							
Components (note)								4 etc.

NOTE: One or more components may be included depending on specific service requirements. Multiple components may be sent in one Extended facility information element or in more than one (individual) Extended facility information elements. It is a sender's choice to use either one or several Extended facility information elements.

Figure 3: Extended facility information element

The length of the Extended facility information element shall be encoded as follows:

1) the length octets shall consist of two or more octets, and shall represent the number of octets of the information element following the length octets;

2) the length octets shall consist of an initial octet and one or more subsequent octets. The initial octet shall be coded as follows:

   a) bit 8 shall be one;

   b) bits 7 to 1 shall encode the number of subsequent octets in the length octets with bit 7 as the most significant bit;

   c) the value 1 1 1 1 1 1 1 shall not be used. This value is reserved for future extensions;

3) subsequent octets of the length of information element contents shall be encoded as follows:

   Bits 8 to 1 of the first subsequent octet, followed by bits 8 to 1 of the second subsequent octet, followed in turn by bits 8 to 1 of each further octet, up to and including the last subsequent octet shall represent an unsigned binary integer equal to the information element length with bit 8 of the first subsequent octet as the most significant bit.

Annex A (normative): Dynamic descriptions

A.1 Dynamic description of the Hold and Retrieve functions

This clause contains the Specification and Description Language (SDL) description for the Hold and Retrieve functions for the initiating and receiving side.

The description consists of the following figures specified according to ITU-T Recommendation Z.100 [9]:

Figure A.1: Hold function initiating entity SDL diagrams;
Figure A.2: Retrieve function initiating entity SDL diagrams;
Figure A.3: Hold function responding entity SDL diagrams;
Figure A.4: Retrieve function responding entity SDL diagrams;
Figure A.5: SDL diagram of channel selection macro.

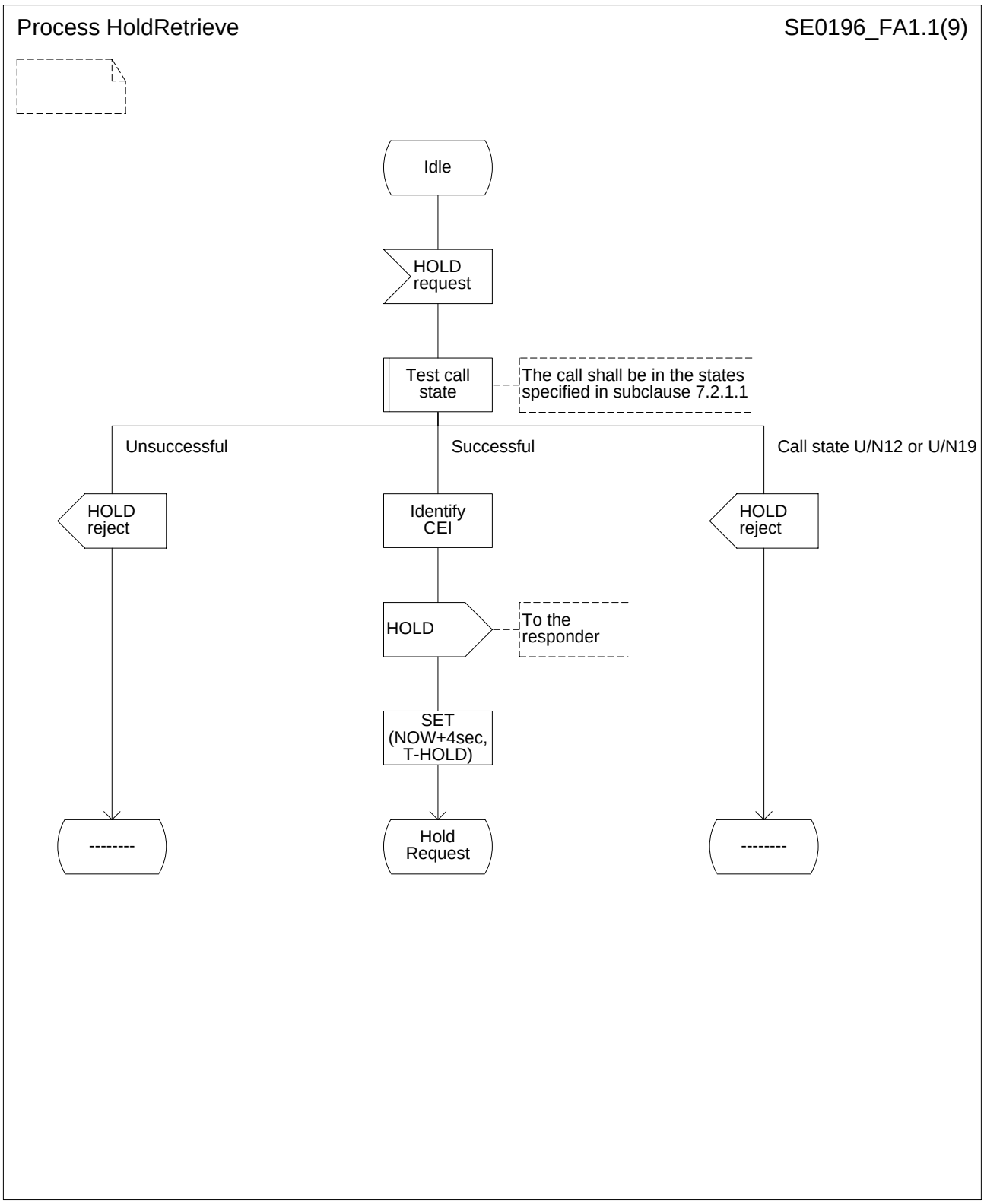

Figure A.1 (sheet 1 of 2): Hold function initiating entity SDL diagrams

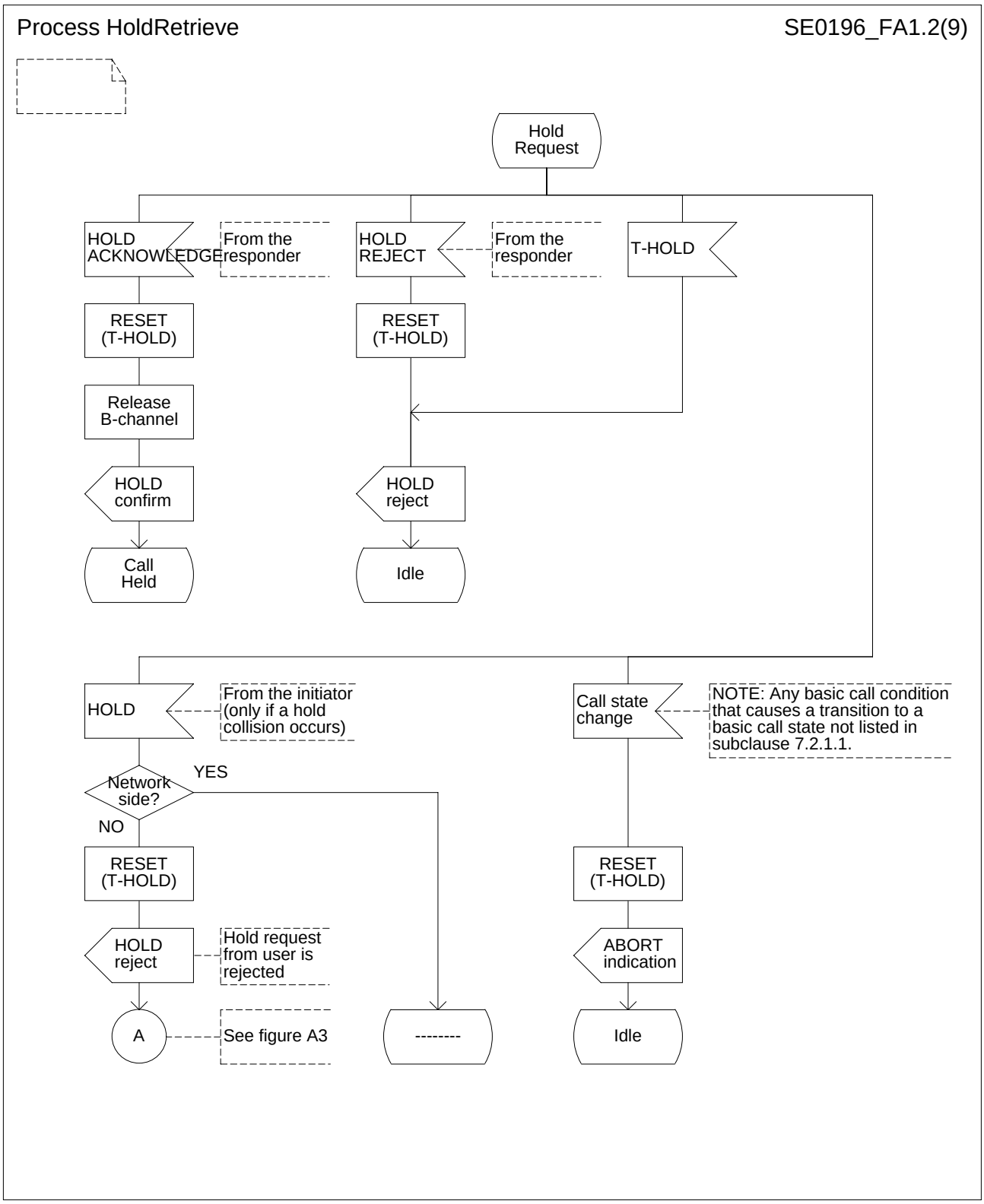

Figure A.1 (sheet 2 of 2): Hold function initiating entity SDL diagrams

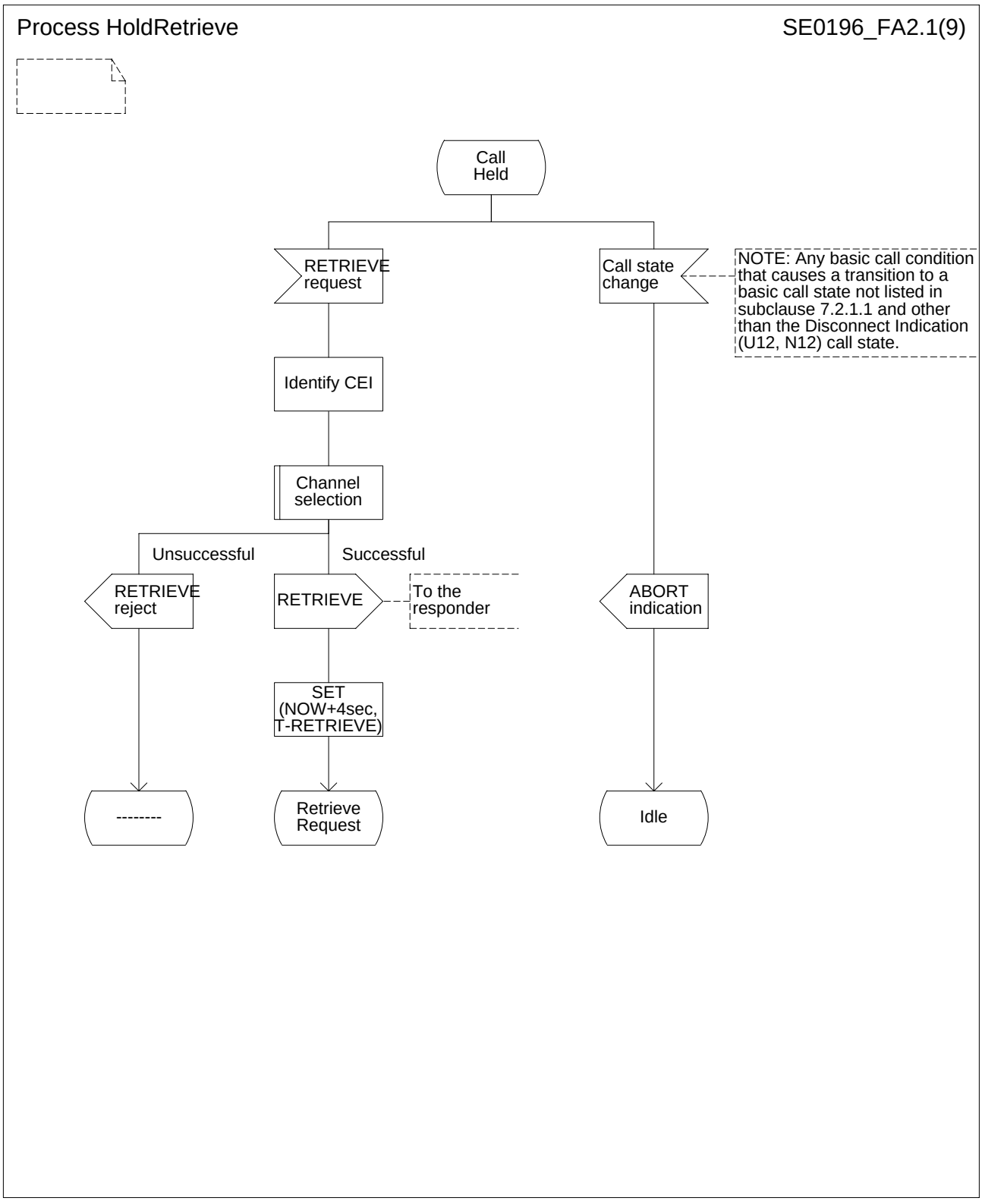

Figure A.2 (sheet 1 of 3): Retrieve function initiating entity SDL diagrams

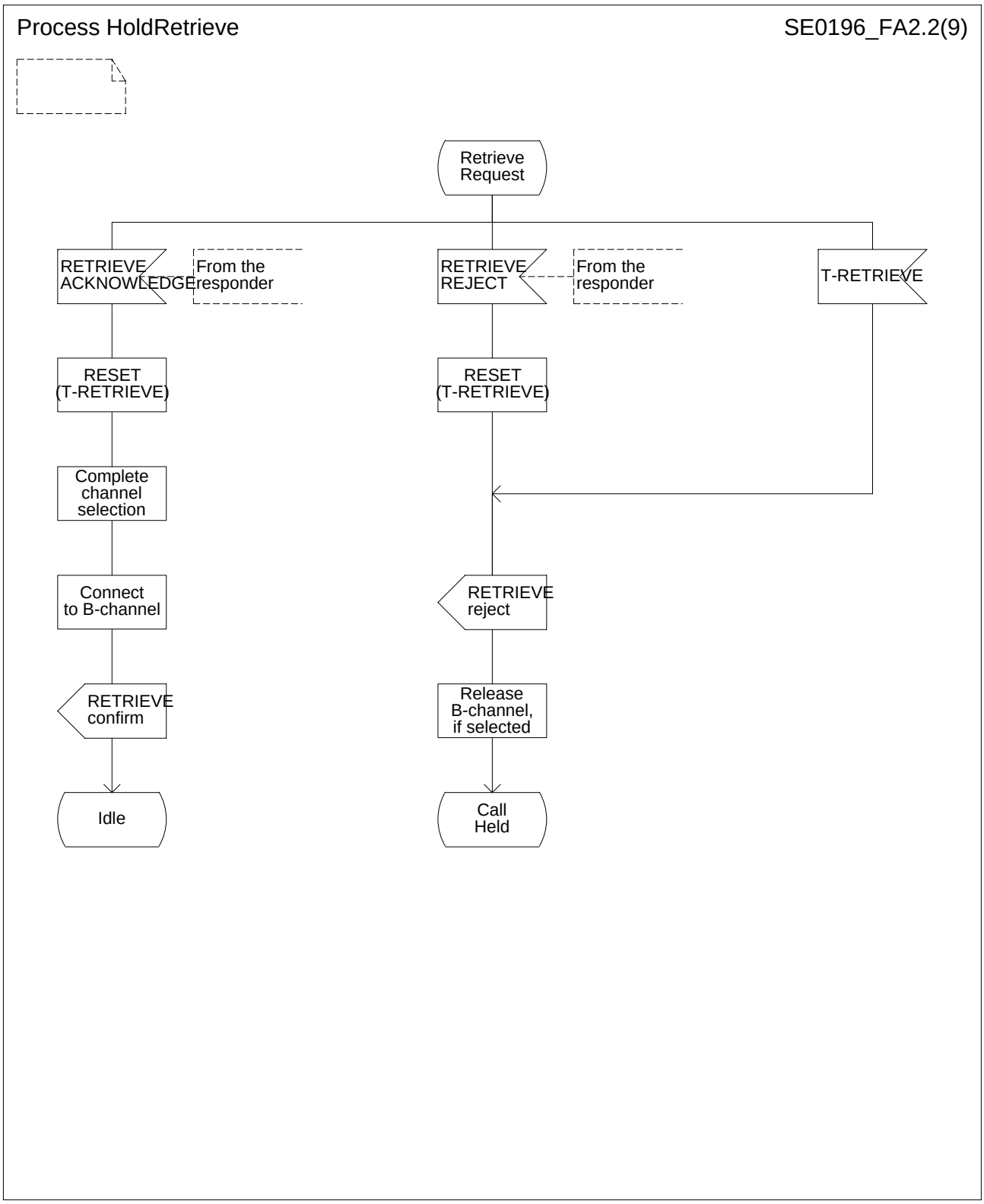

Figure A.2 (sheet 2 of 3): Retrieve function initiating entity SDL diagrams

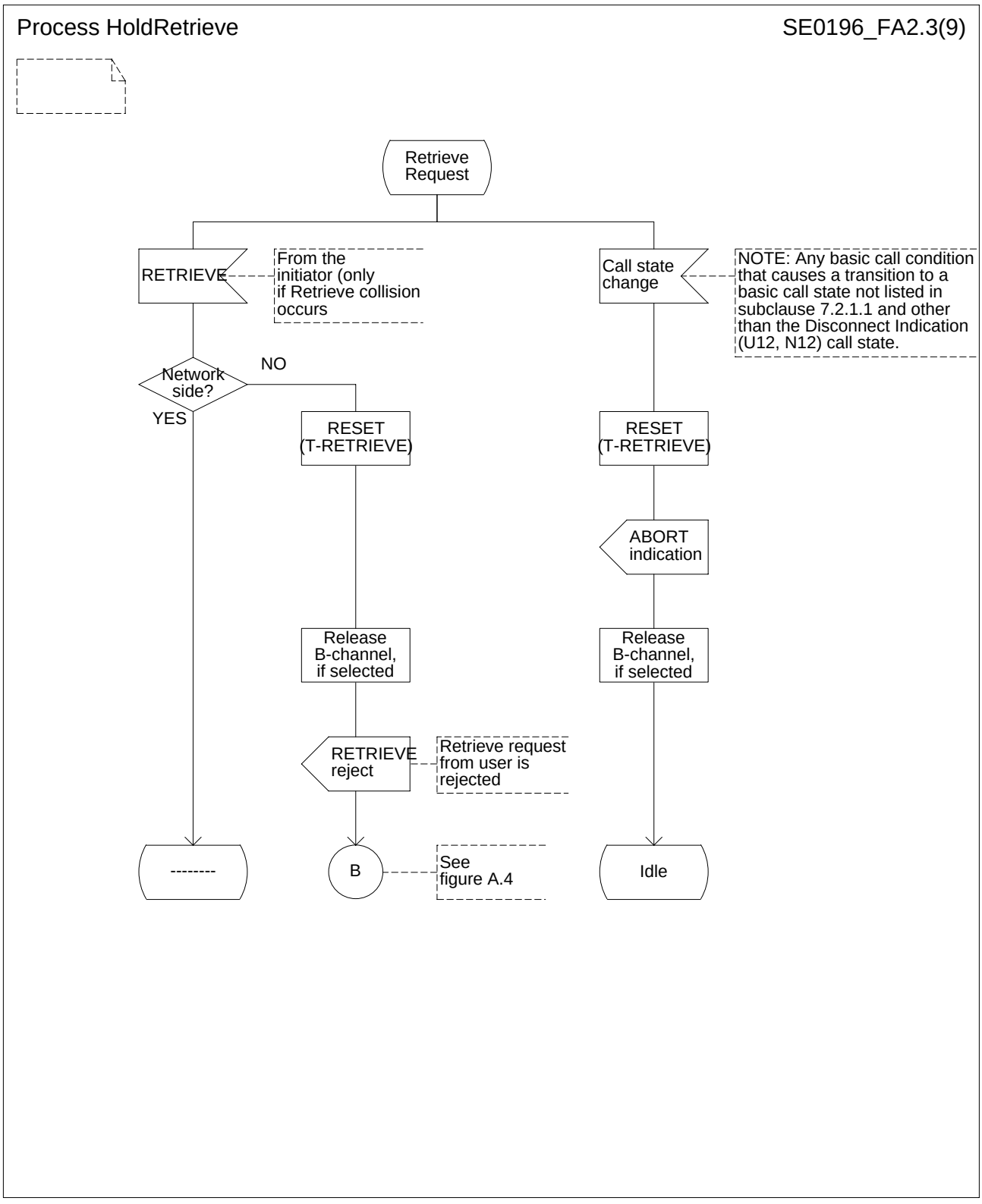

Figure A.2 (sheet 3 of 3): Retrieve function initiating entity SDL diagrams

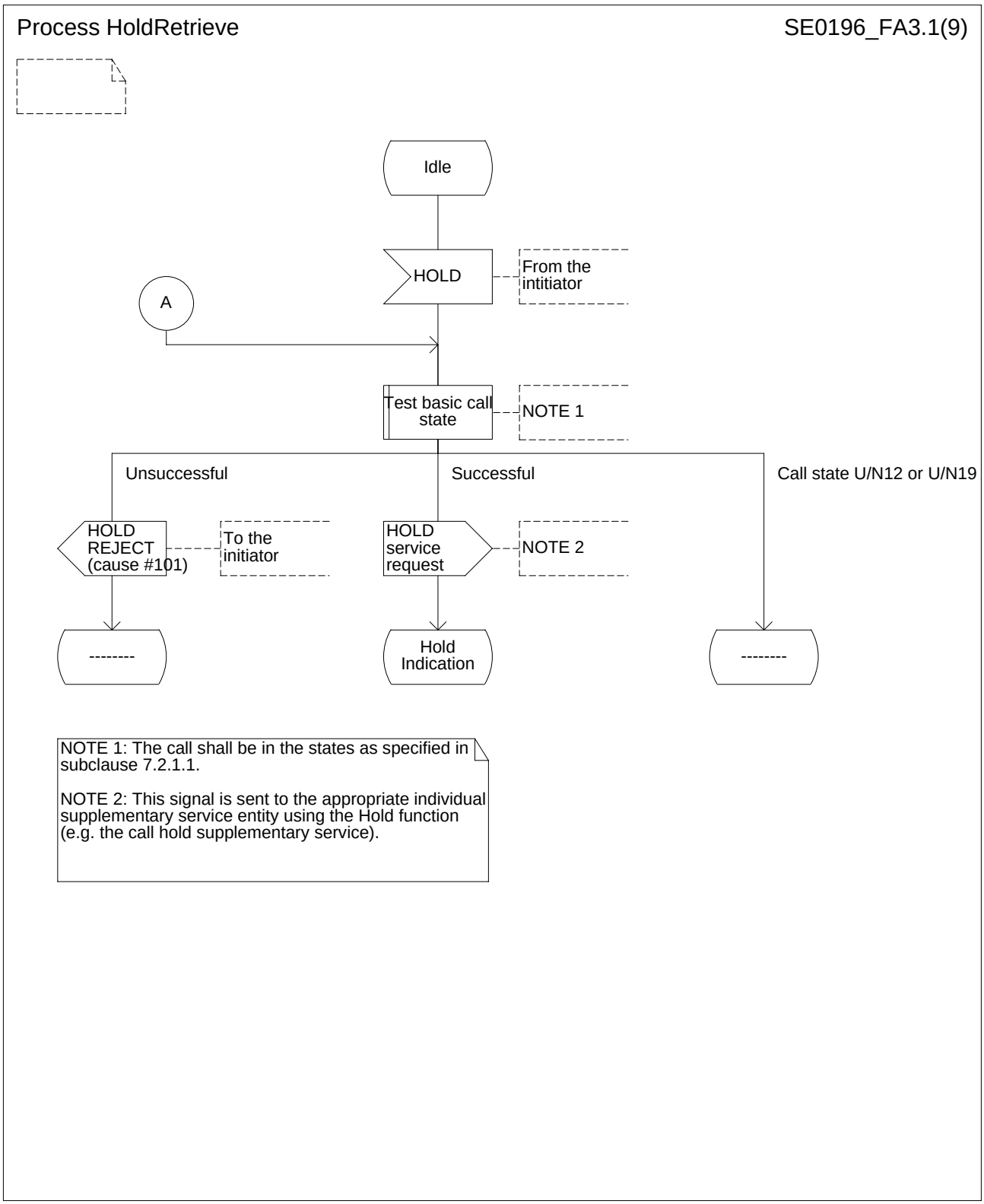

Figure A.3 (sheet 1 of 2): Hold function responding entity SDL diagrams

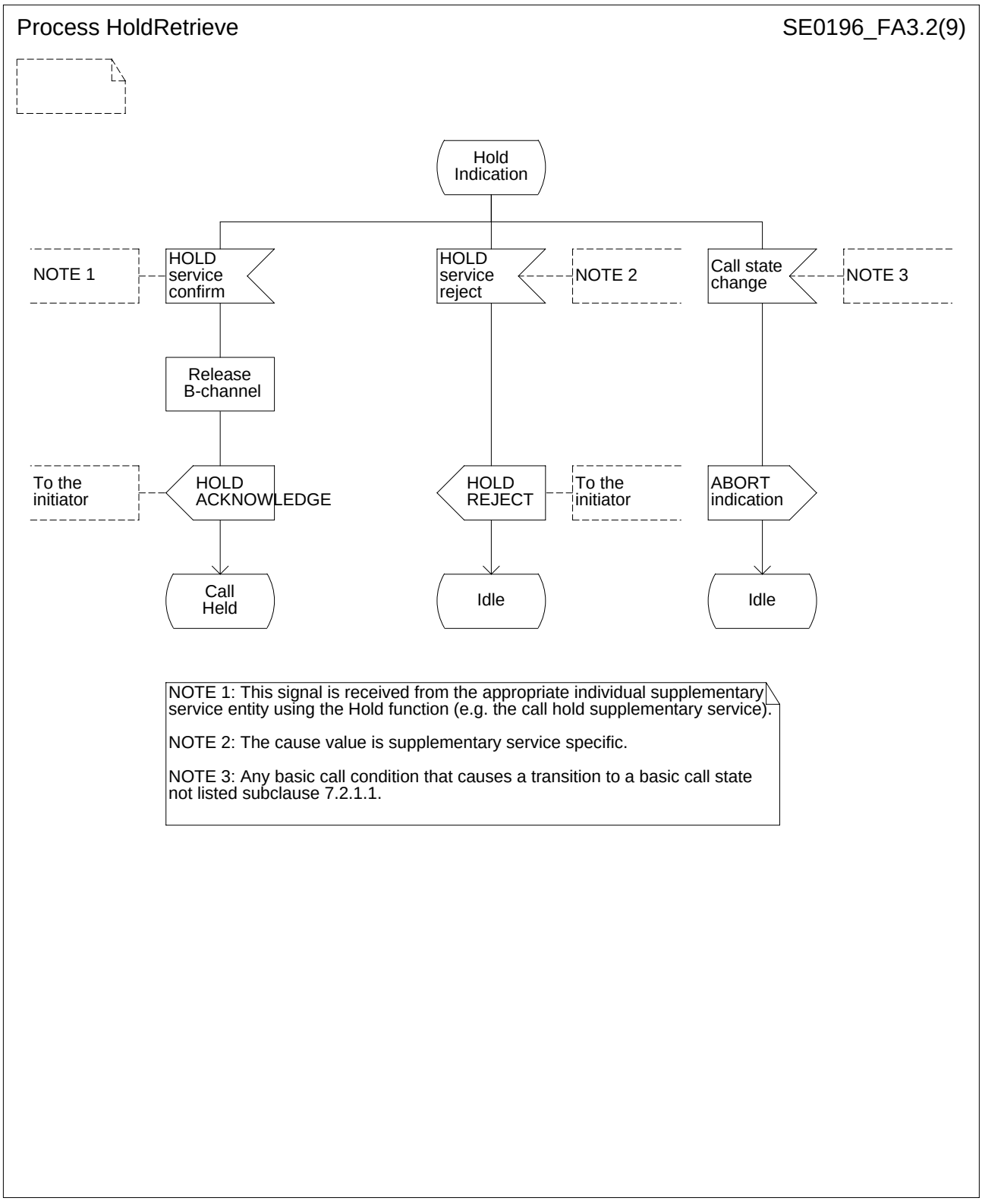

Figure A.3 (sheet 2 of 2): Hold function responding entity SDL diagrams

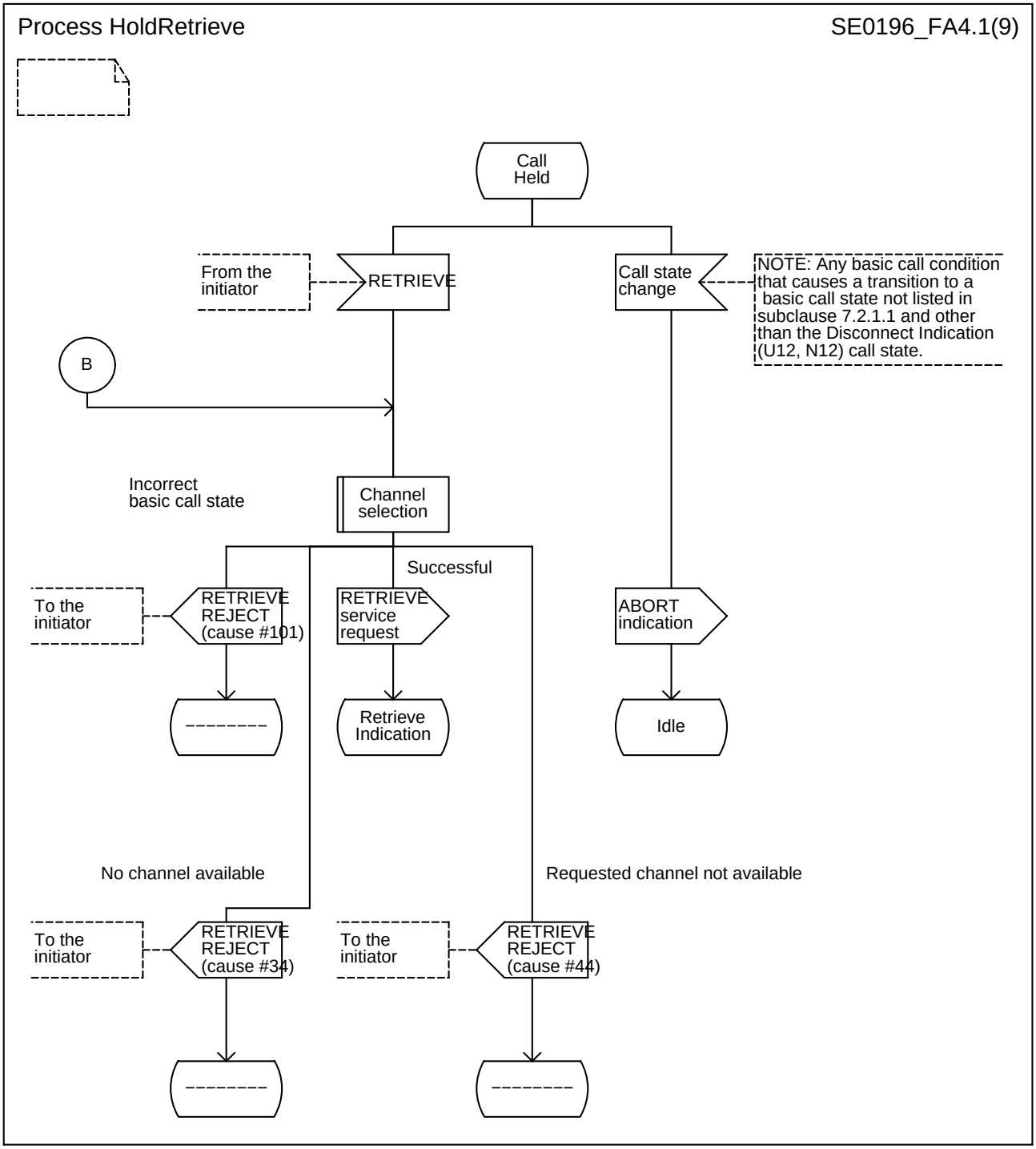

Figure A.4 (sheet 1 of 2): Retrieve function responding entity SDL diagrams

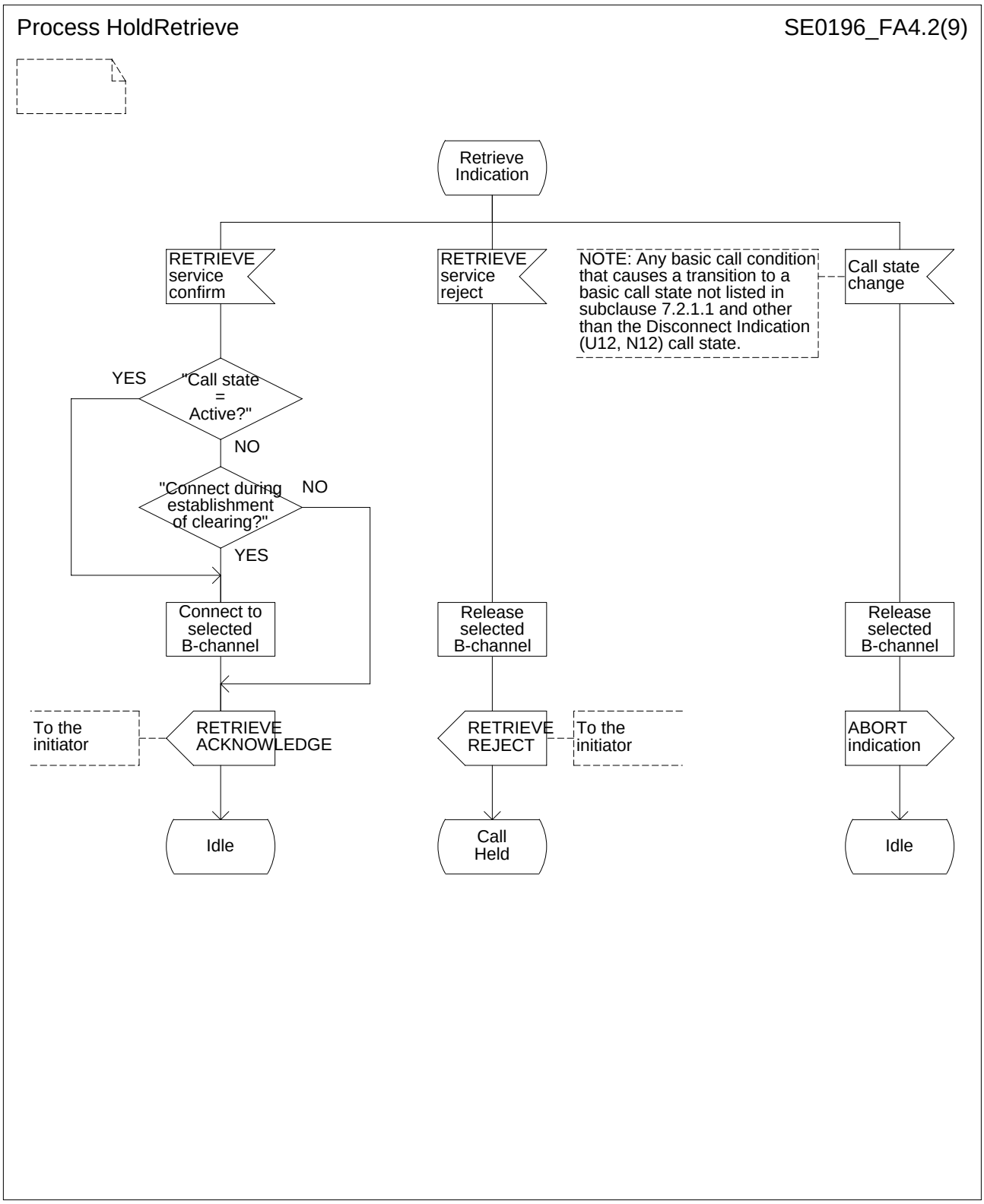

Figure A.4 (sheet 2 of 2): Retrieve function responding entity SDL diagrams

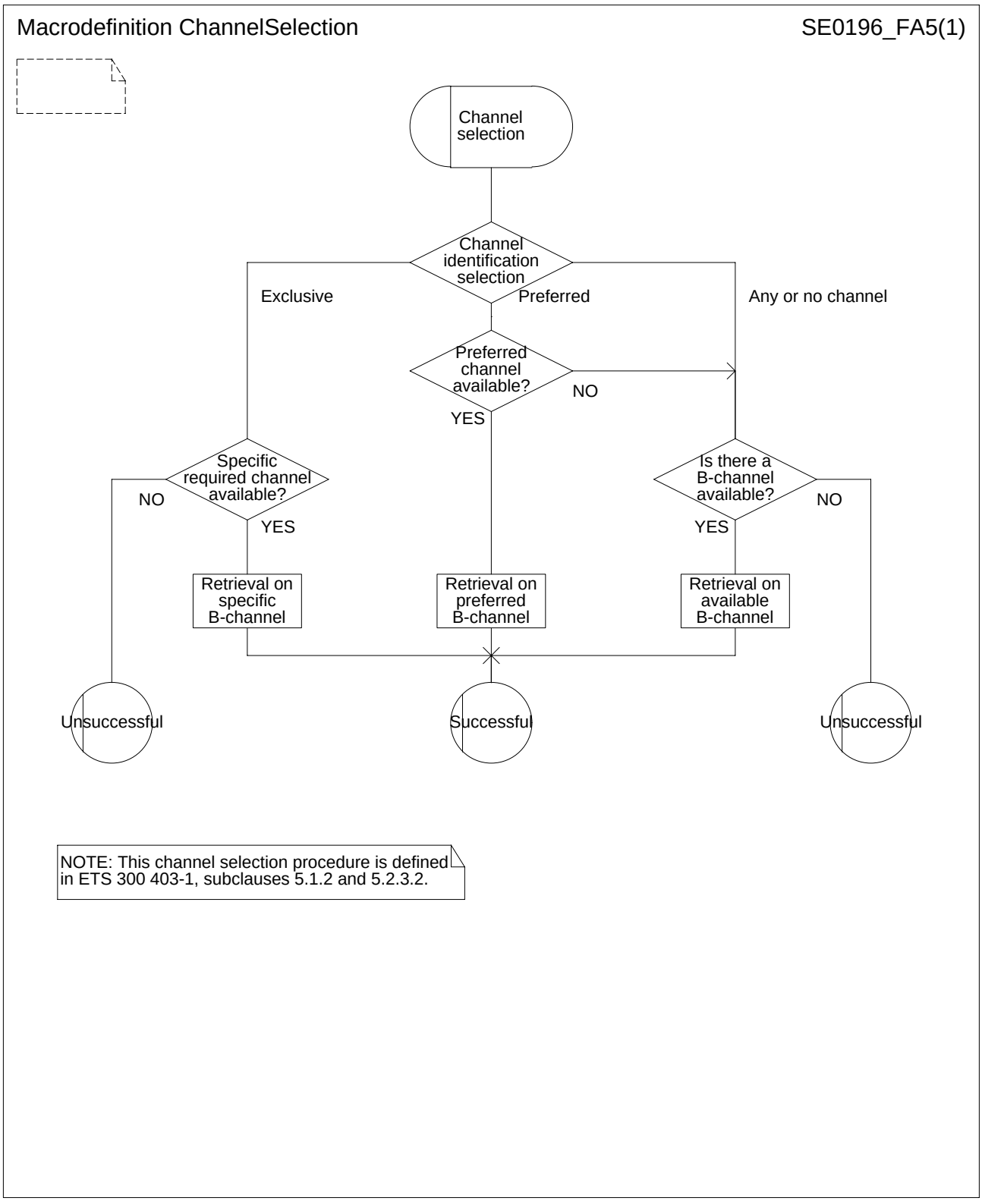

Figure A.5: SDL diagram of channel selection macro

A.2 Dynamic description of the status request procedure

This clause contains the SDL description for the status request procedure for the user and the network.

The description consists of the following figures specified according to ITU-T Recommendation Z.100 [9]:

Figure A.6: user SDL diagrams;

Figure A.7: network SDL diagrams.

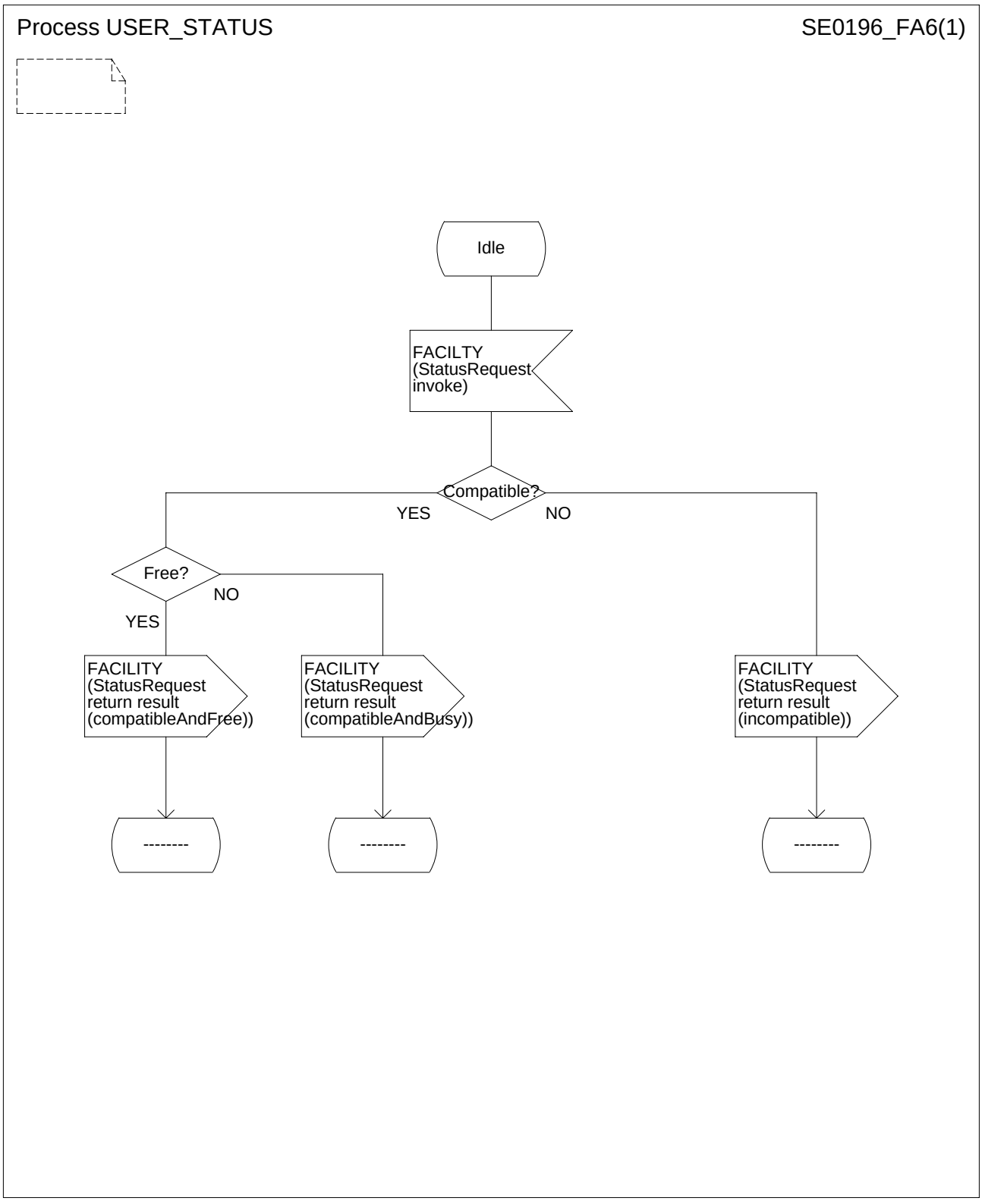

Figure A.6: Status request procedure - user SDL diagrams

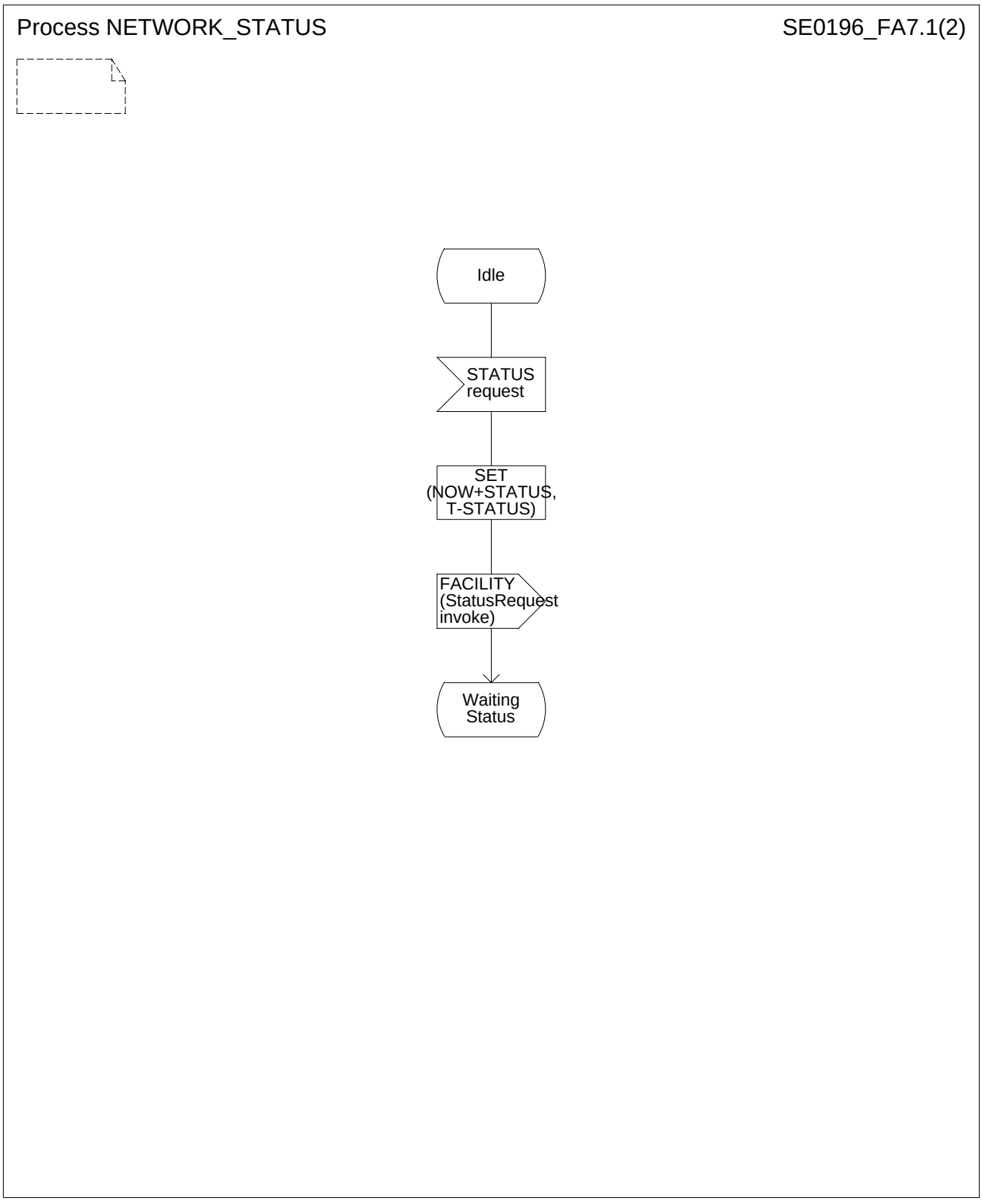

Figure A.7 (sheet 1 of 2): Status request procedure - network SDL diagrams

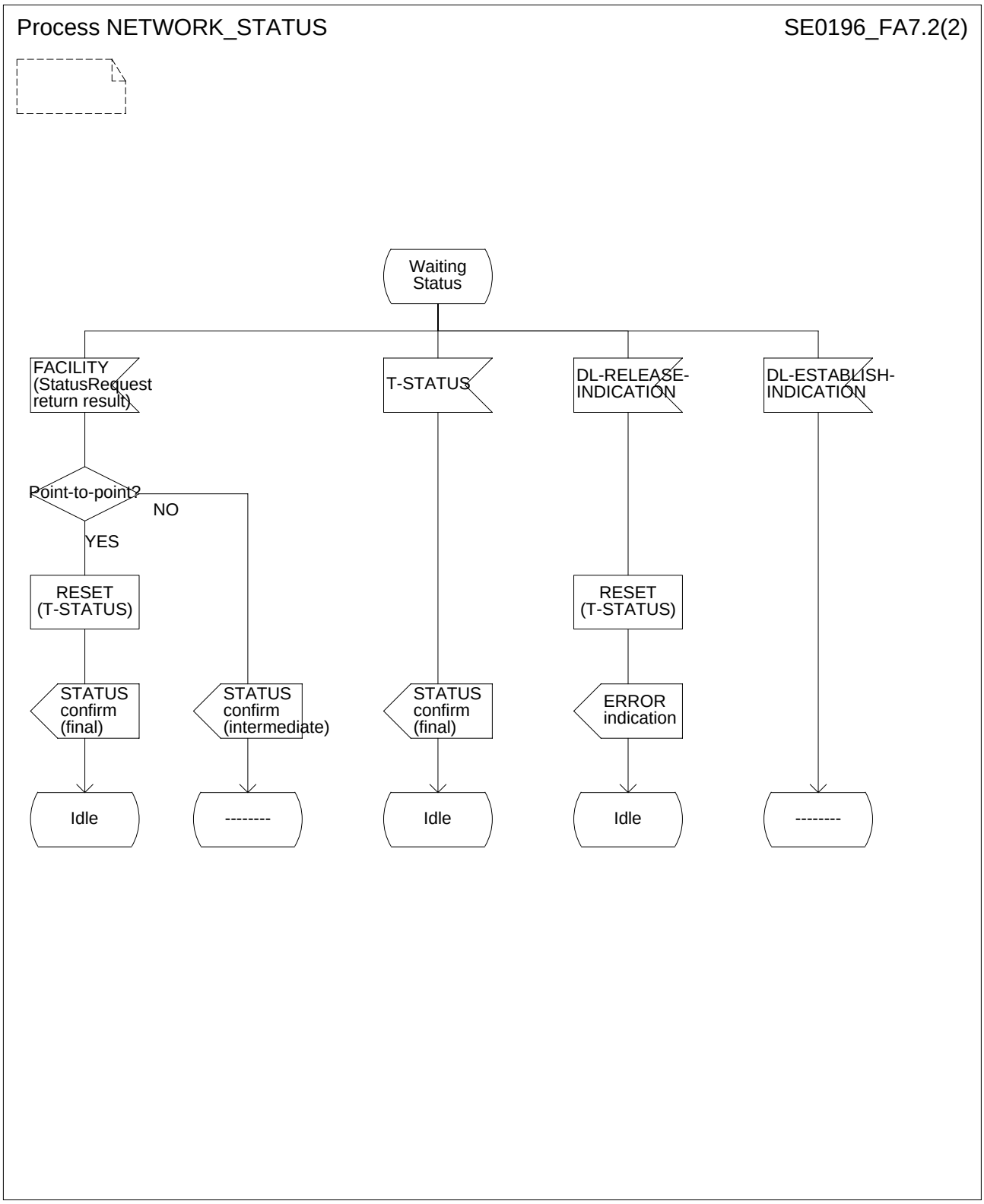

Figure A.7 (sheet 2 of 2): Status request procedure - network SDL diagrams

A.3 Dynamic description of the supplementary service management function

This clause contains the SDL description for the supplementary service management procedures for the user and the network.

The description consists of the following figures specified according to ITU-T Recommendation Z.100 [9]:

Figure A.8: user SDL diagrams;

Figure A.9: network SDL diagrams.

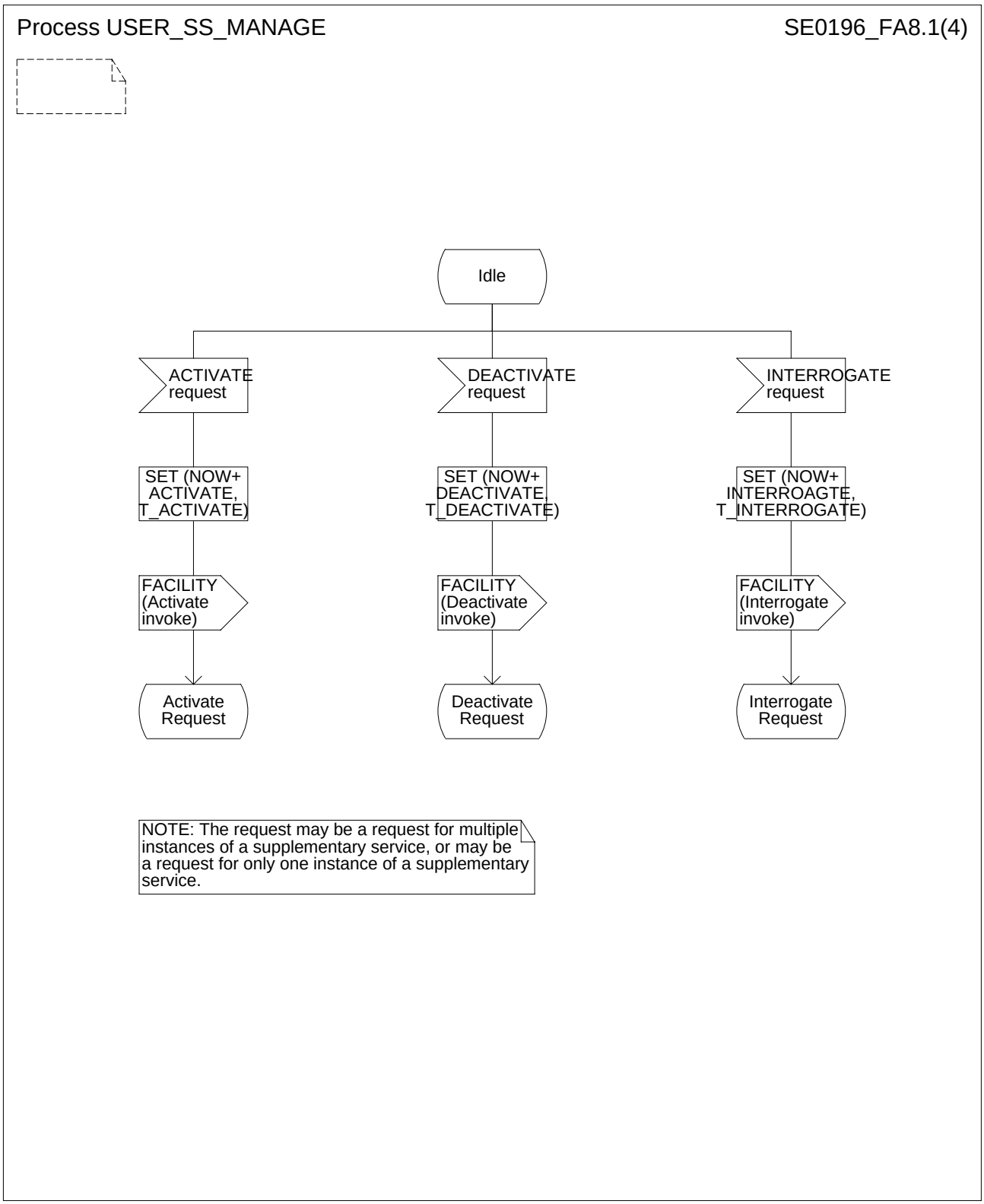

Figure A.8 (sheet 1 of 4): Supplementary service management procedures - user SDL diagrams

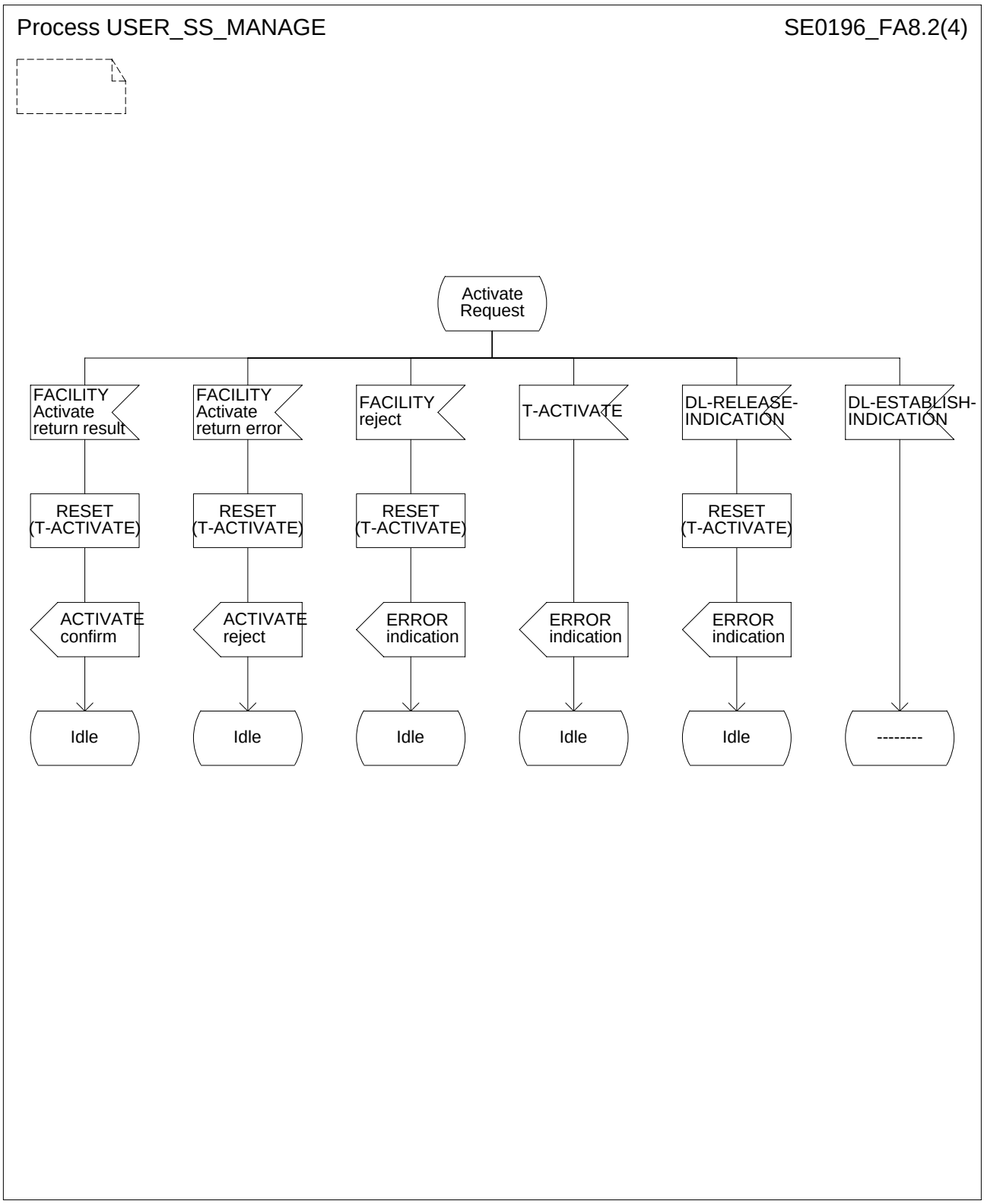

Figure A.8 (sheet 2 of 4): Supplementary service management procedures - user SDL diagrams

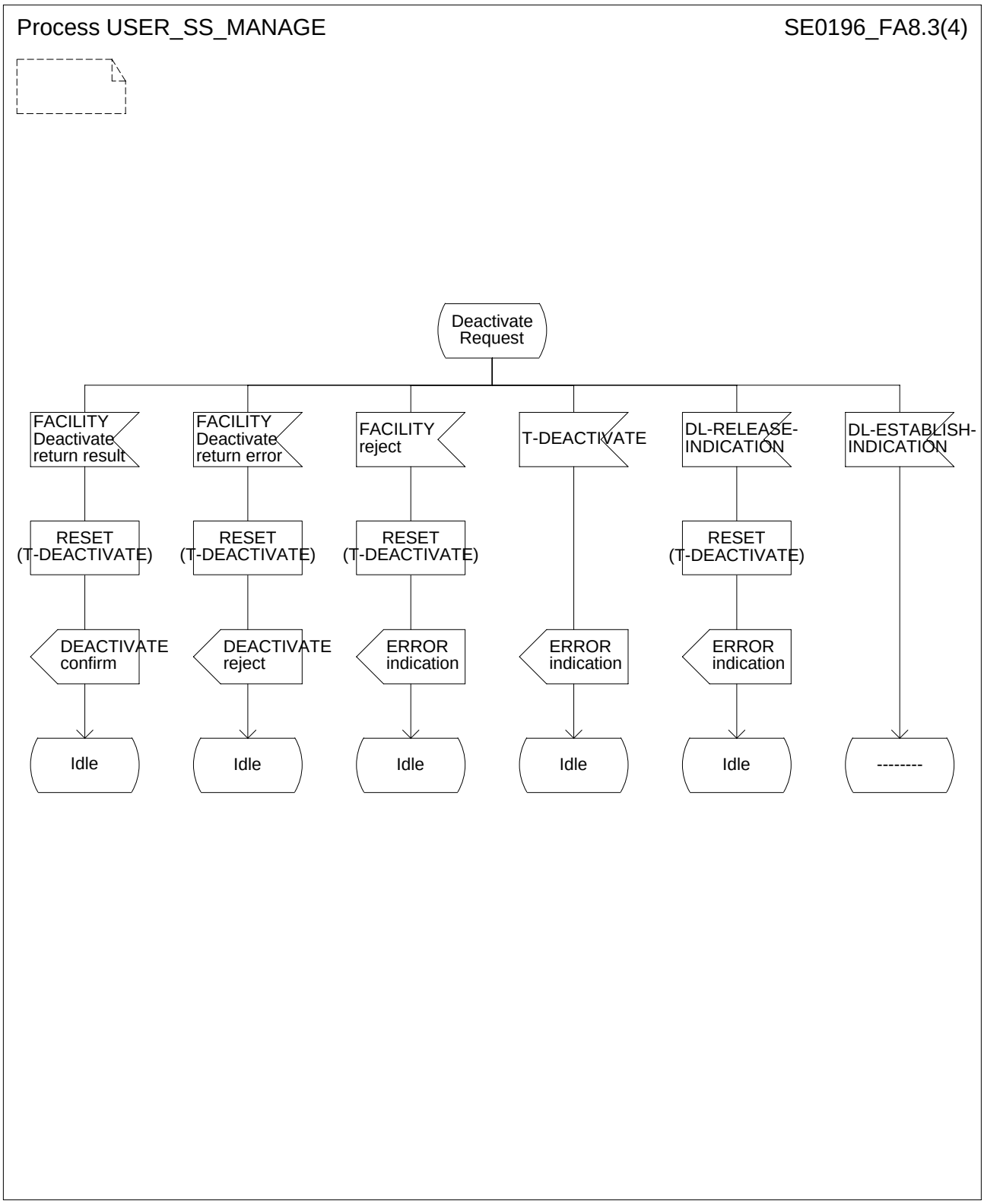

Figure A.8 (sheet 3 of 4): Supplementary service management procedures - user SDL diagrams

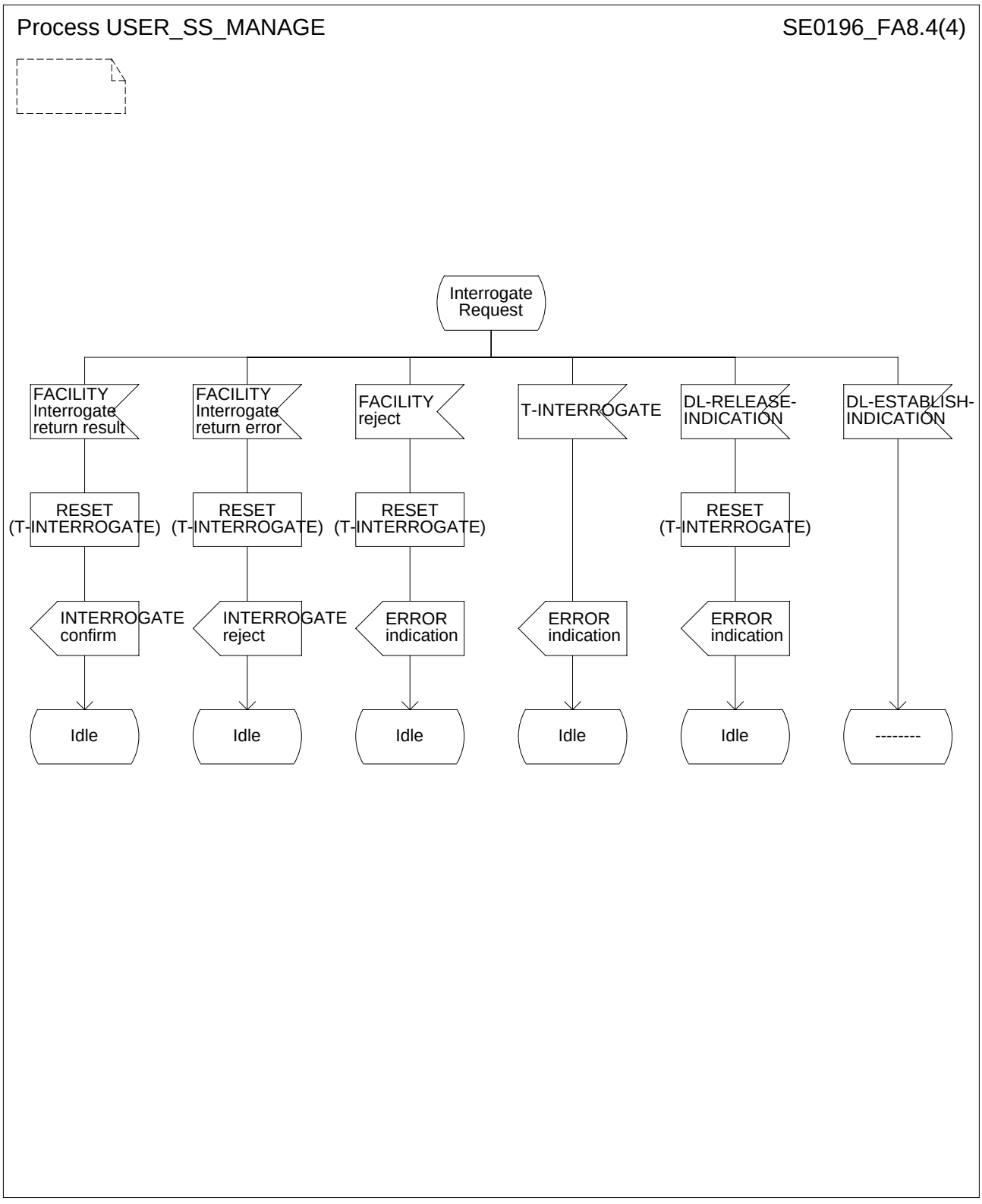

Figure A.8 (sheet 4 of 4): Supplementary service management procedures - user SDL diagrams

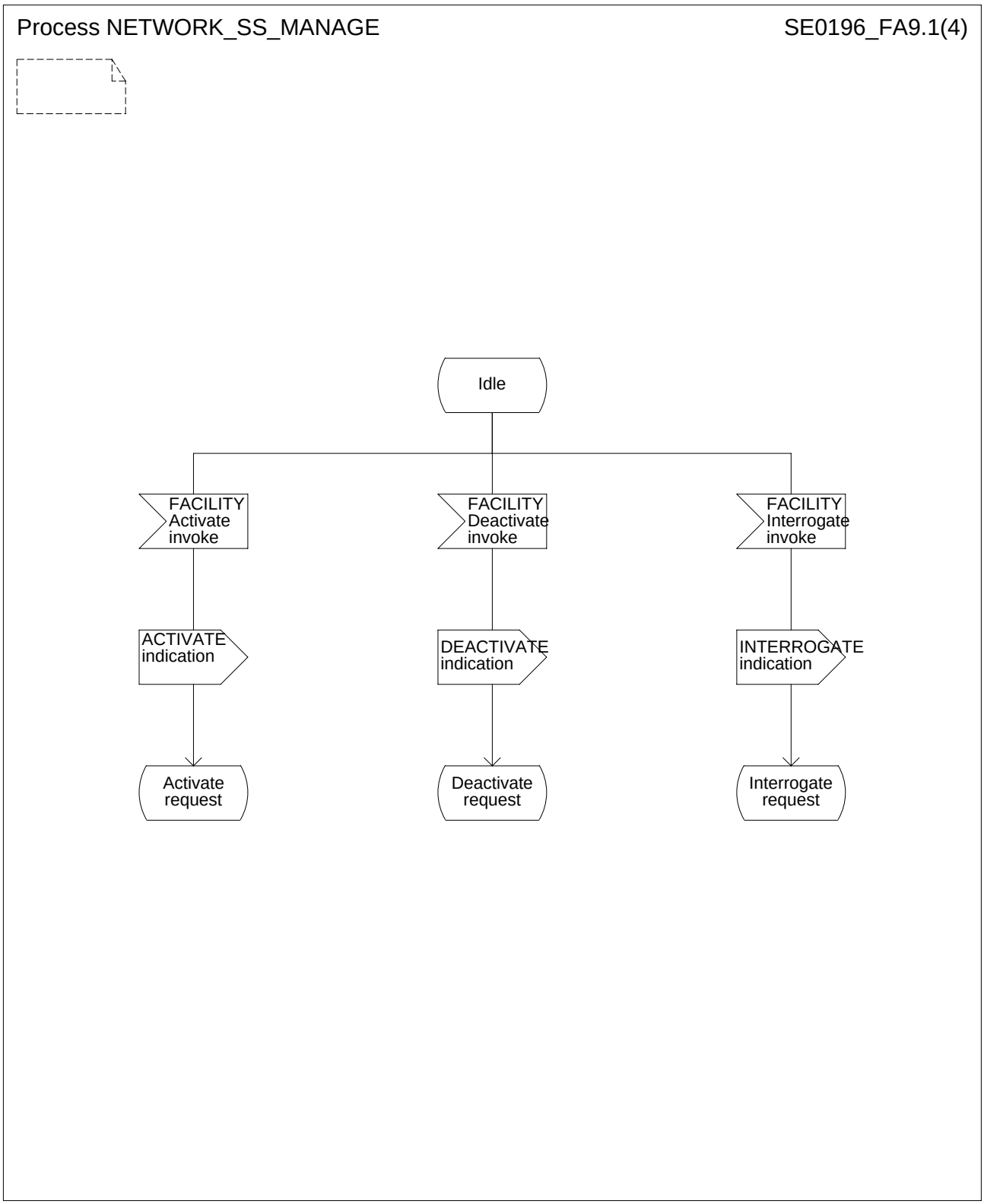

Figure A.9 (sheet 1 of 4): Supplementary service management procedures - network SDL diagrams

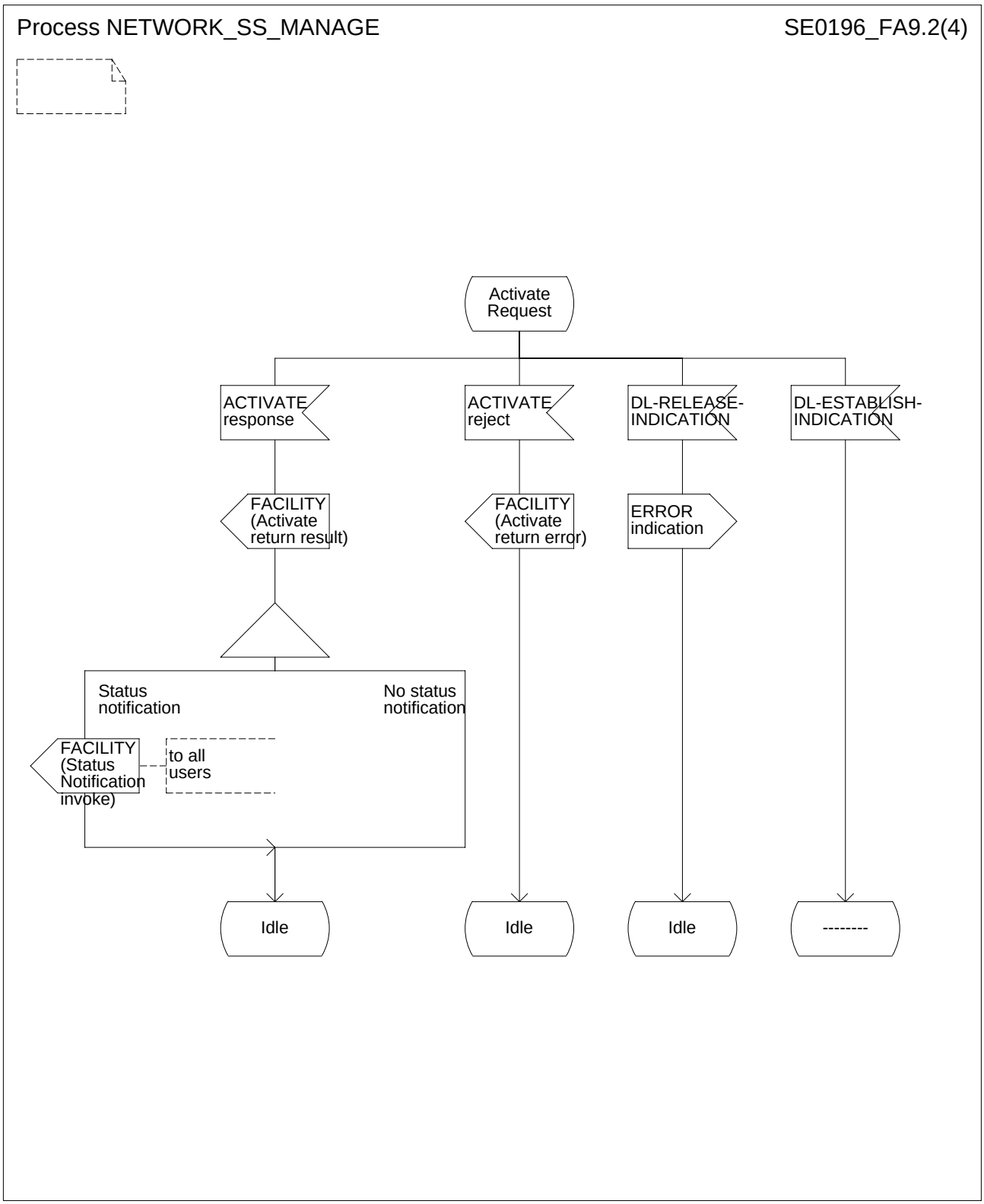

Figure A.9 (sheet 2 of 4): Supplementary service management procedures - network SDL diagrams

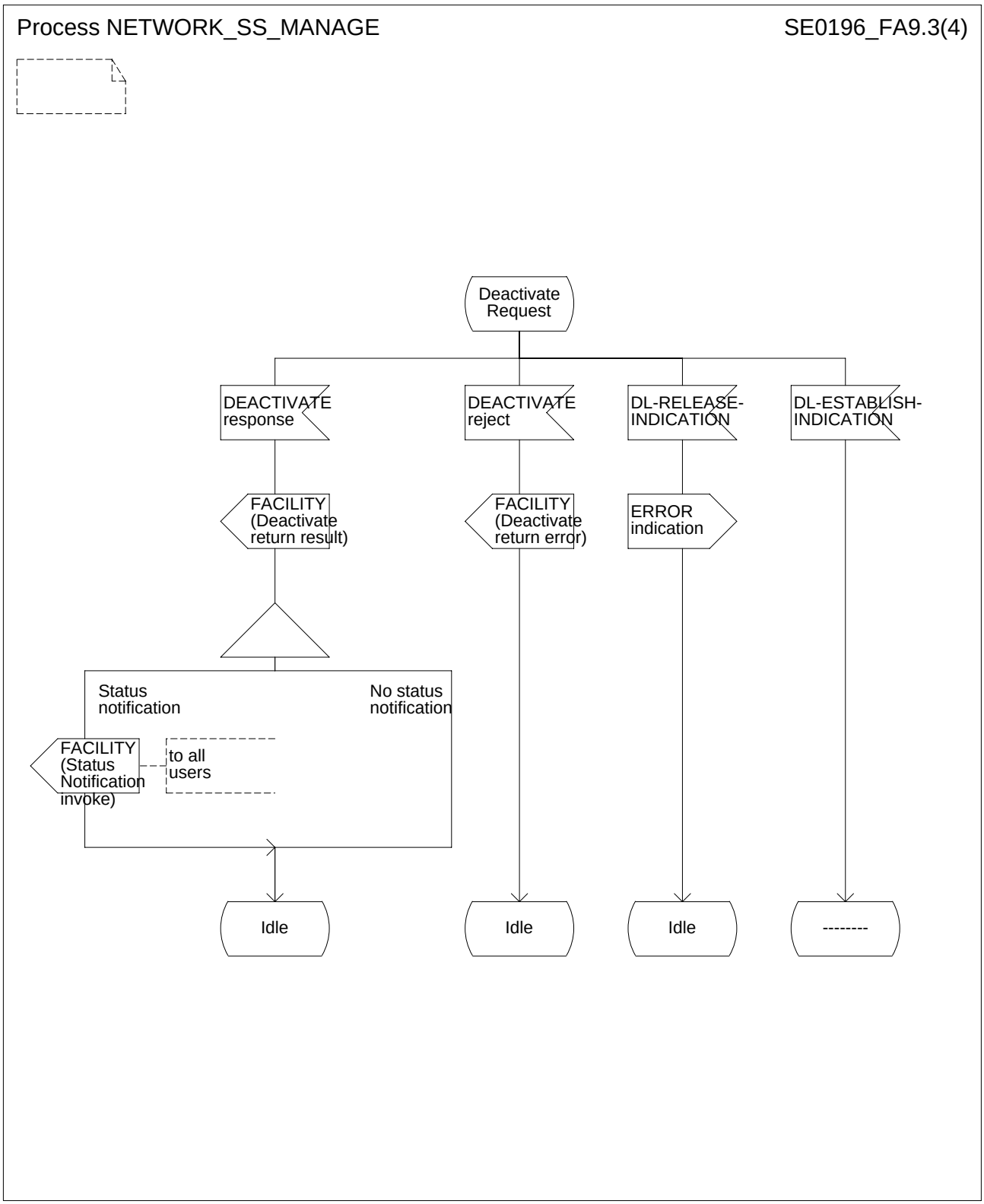

Figure A.9 (sheet 3 of 4): Supplementary service management procedures - network SDL diagrams

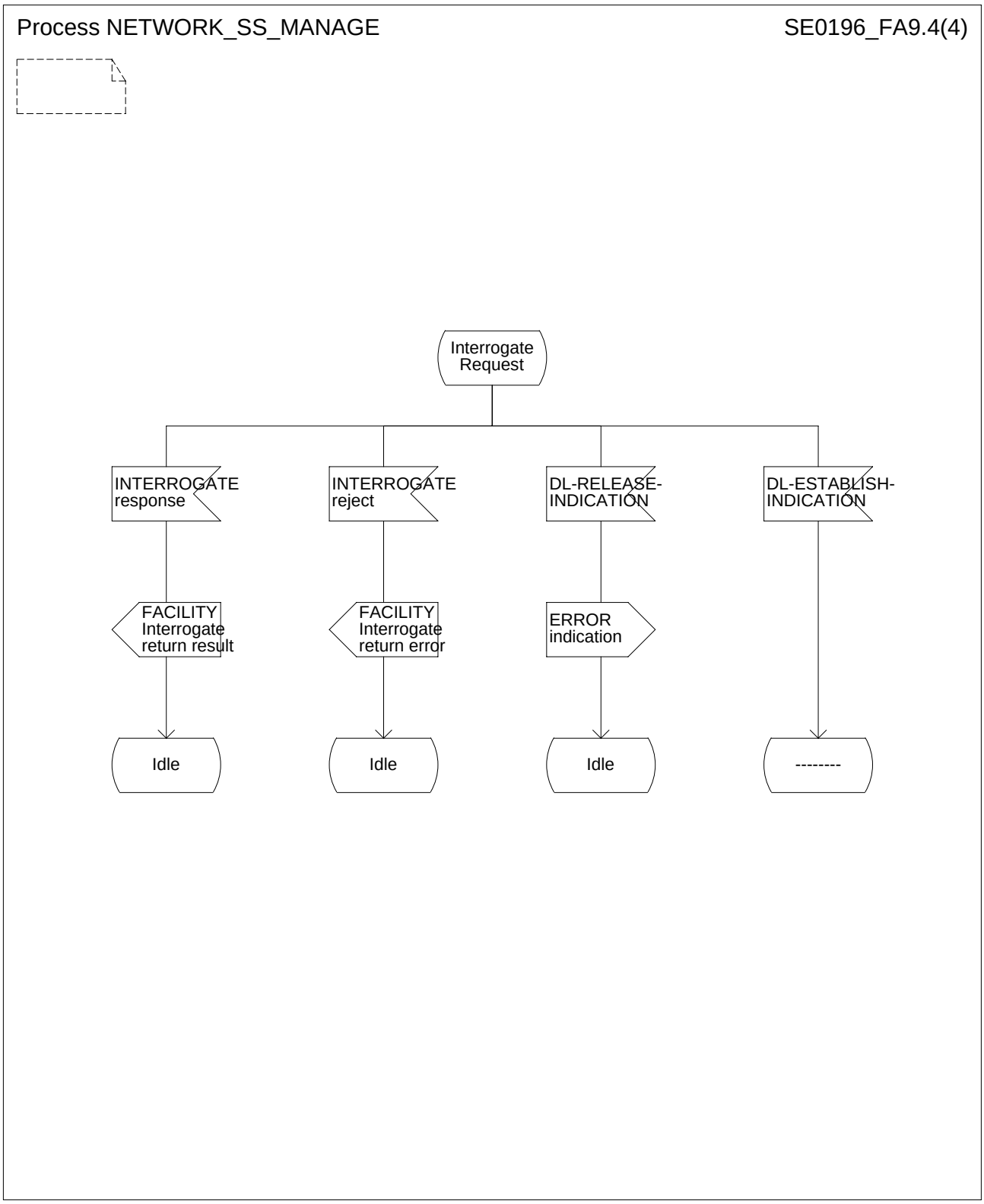

Figure A.9 (sheet 4 of 4): Supplementary service management procedures - network SDL diagrams

Annex B (informative): Guidelines for the application of the generic procedures for the design of individual supplementary services

B.1 Introduction

This annex provides guidelines for the application of either the generic procedures specified in the present document or other mechanisms for the design of individual supplementary services.

The main text of the present document specifies a set of generic procedures that can be used to design individual supplementary services, i.e.:

- the separate message category;
- the common information element category; and
- the notification category.

The functions and procedures of the above categories are described in clauses 7 to 9, respectively. The functions provided by one category do not overlap with the functions of the other categories. Consequently, one generic function cannot be used to provide the functions of another category. The generic functions may however be used in combination, concurrently and sequentially, in order to provide more complex functionality.

In addition, a number of supplementary services use mechanism that are not based on the generic functions and procedures described above. These supplementary services use normal call control messages and information elements described in EN 300 403-1 [15]. The transfer of these messages and information elements provides functions that correspond to the common information element category, and to the notification category. The procedures for these mechanisms are outside the scope of the present document.

New supplementary services requiring new codings shall use the generic functions and procedures specified in the present document.

B.2 Separate message category

B.2.1 Application of the separate message categories for new services defined by ITU-T

If a new supplementary service requires procedures that change resources, also new messages defined by ITU-T shall be used.

B.2.2 Application of the separate message category for new services defined by ETSI

If a new supplementary services requires procedures that change resources, also new messages defined by ITU-T shall be used.

B.2.3 Application of the separate message category for supplementary services defined by other organizations

If a new supplementary service requires procedures that change resources, also new messages defined by ITU-T shall be used.

B.3 Common information element category

Two procedures are defined for the delivery of information:

a) the delivery of "indicators" and "parameters" using the Facility or Extended facility information element and ASN.1 encoded information in subsequent octets;

b) the delivery of "indicators" and "parameters" that are specified as information elements using the encoding scheme defined in EN 300 403-1 [15], subclause 4.5.1 including the information elements defined in EN 300 403-1 [15].

Procedures using option b) are outside the scope of the present document.

B.3.1 Application of the common information element category for services defined by ITU-T

Either option a) or option b) shall be used.

When option b) is used information elements may also be embedded in the component structure of the Facility or Extended facility information element.

Unless existing information elements defined in EN 300 403-1 [15] can be used, option a) is the preferred option.

B.3.2 Application of the common information element category for services defined by ETSI

Either option a) or option b) shall be used.

When option a) is used, operations shall be defined with operation values defined using object identifiers.

When option b) is used information elements may also be embedded in the component structure of the Facility or Extended facility information element.

Unless existing information elements defined in EN 300 403-1 [15] can be used, option a) is the preferred option.

B.3.3 Application of the common information element category for supplementary services defined by other organizations

Either option a) or option b) shall be used.

When option a) is used, operations shall be defined with operation values defined using object identifiers.

When option b) is used information elements may also be embedded in the component structure of the Facility or Extended facility information element.

Unless existing information elements defined in EN 300 403-1 [15] can be used, option a) is the preferred option.

B.4 Notification category

There are three types of notification information, which may be used in procedures:

a) the delivery of simple notification "indicators" based on the Notification indicator information element, using codepoints defined in the standards for individual supplementary services;

b) the delivery of notification "parameters" that are specified as information elements using the encoding scheme defined in EN 300 403-1 [15], subclause 4.5.1 including information elements defined in EN 300 403-1 [15];

c) the delivery of notification "indicators" and "parameters" using an extension codepoint in octet 3 of the Notification indicator information element and ASN.1 encoded information in subsequent octets.

Procedures using option b) are outside the scope of the present document.

B.4.1 Application of the notification category for services defined by ITU-T

When no parameters have to be delivered, option a) shall be used.

When parameters have to be delivered, the individual supplementary service shall specify which options have to be applied in a given situation. In this case, the notification indicator shall be carried using either option a) or option c). When option a) is used, the parameters can only be carried using also option b). Where option c) is used, the transfer of parameters is possible. In addition, information elements, as defined for option b), may also be embedded in the component structure of the Notification indicator information element.

B.4.2 Application of the notification category for services defined by ETSI

When appropriate codings defined by ITU-T are available, these codings shall be used in accordance with the application rules of subclause B.4.1.

In all other cases, option c) shall be used.

The notification may be supplemented by extra parameters using ITU-T or ETSI defined information elements as defined in option b). These information elements may be embedded in the component structure of the Notification indicator information element or provided as separate information elements.

When option c) applies, the notification shall be defined with notification values using object identifiers.

B.4.3 Application of the notification category for supplementary services defined by other organizations

When appropriate codings defined by ITU-T or by ETSI are available, these codings should be used in accordance with the application rules in subclause B.4.1.

In all other cases, option c) shall be used.

The notification may be supplemented by extra parameters using ITU-T, or ETSI, or other organization defined information elements, as defined in option b). These information elements may be embedded in the component structure of the Notification indicator information element or provided as separate information elements.

When option c) is used, the notification shall be defined with notification values using object identifiers.

Annex C (informative): ASN.1 subtypes and proposed mechanism for enhancements of the future protocol

ASN.1 is defined in CCITT Recommendation X.208 [5], clause 4 "Subtypes" a mechanism to define subtypes. A subtype specifies a restriction which needs to be met by the data values, e.g. only some specific integer values are used for the encoding of an error value of a specific operation.

The enhanced data types of a future protocol shall be such that the previous protocol is a subtype of the future protocol. In this case all data values of the previous protocol belong also to the future protocol.

The enhancements are applicable for primitive and constructed types as well as for the data types which are used within another constructed data type. Therefore a "data value" can be e.g. an argument or the result of an operation or it may be a parameter within another data value.

The following enhancements may be possible. The order of topics is according to CCITT Recommendation X.208 [5], clause 37 "Subtype Value Sets".

- for Single Value:

  New data values of a specific data type may be specified; e.g. new values for parameter of integer or enumeration types.

- for Value Range:

  The range (i.e. the lower bound and/or upper bound) of an integer or real subtype may be extended.

- for Size Constraint:

  For string types, sequence-of types and set-of types the number of data elements within the constructed data type can be restricted. These restricted number of elements may be extended in future versions of the protocol.

- for Permitted Alphabet:

  The characters allowed within a character string can be restricted to a subset.

  In future versions of the protocol this restriction may be enhanced up to the "maximum" alphabet of the data type in the previous protocol. The "maximum" alphabet is specific for each character string type within ASN.1.

- for Inner Subtyping:

  In the subtype of a constructed type the presence or absence of optional parameters can be specified.

  In future versions of the protocol additional optional data elements may be specified within sequence types or set types. In a sequence type the additional data elements should only be included at the end of the sequence. This will enable the ASN.1 decoder to detect missing data elements of the previous protocol.

  The data types of the included parameters may be different from the parameters of the previous protocol according to CCITT Recommendation X.208 [5], subclauses 20.3 and 22.3. Therefore new parameters can be distinguished by type and/or position from these ones of the previous protocol.

To avoid unnecessary complexity of the future protocol and to allow error handling for the previous protocol a data type should never be changed in any protocol version, i.e. in the future protocol the tag of any data type should be the same as in any previous protocol. This should also apply for data types within constructed data types.

To make it possible for the future to use different data types for one data value, this needs to be already specified in the previous protocol. For example, in the current DSS1 protocol the data value for remote operations is specified as a choice of a local integer or of an object identifier. This enables future protocols to use an integer value instead of an object identifier in the current version.

Annex D (normative): Formal definition of data types

This annex provides the ASN.1 modules defined for the purpose of the present document.

D.1 Component types

Table D.1 shows the formal definition of the component data types used in the functional protocol.

Table D.1: Component types

```
Facility-Information-Element-Components {itu-t identified-organization etsi(0) 196
                                         facility-information-element-component(3)}

DEFINITIONS ::=

BEGIN

EXPORTS                 InvokeIDType, Components;

IMPORTS                 OPERATION, ERROR
                        FROM Remote-Operation-Notation
                            {joint-iso-itu-t remote-operations(4) notation(0)};

Components              ::= CHOICE {
                                invokeComp [1] IMPLICIT InvokeComponent,
                                returnResultComp [2] IMPLICIT ReturnResultComponent,
                                returnErrorComp [3] IMPLICIT ReturnErrorComponent,
                                rejectComp [4] IMPLICIT RejectComponent}

InvokeComponent         ::= SEQUENCE {
                                invokeID InvokeIDType,
                                linked-ID [0] IMPLICIT InvokeIDType OPTIONAL,
                                operation-value OPERATION,
                                argument ANY DEFINED BY operation-value OPTIONAL}
                              -- ANY is filled by the single ASN.1 data type following the keyword
                              -- ARGUMENT in the type definition of a particular operation.

InvokeIDType            ::= INTEGER (-32768..32767)

ReturnResultComponent   ::= SEQUENCE {
                                invokeID InvokeIDType,
                                SEQUENCE {
                                    operation-value OPERATION,
                                    result ANY DEFINED BY operation-value
                              -- ANY is filled by the single ASN.1 data type following the keyword
                              -- RESULT in the type definition of a particular operation.
                                }OPTIONAL}

ReturnErrorComponent    ::= SEQUENCE {
                                invokeID InvokeIDType,
                                error-value ERROR,
                                parameter ANY DEFINED BY error-value OPTIONAL}
                              -- ANY is filled by the single ASN.1 data type following the keyword
                              -- PARAMETER in the type definition of a particular error

RejectComponent         ::= SEQUENCE {
                                invokeID CHOICE {
                                            InvokeIDType,
                                            NULL},
                                problem CHOICE {
                                            [0] IMPLICIT GeneralProblem,
                                            [1] IMPLICIT InvokeProblem,
                                            [2] IMPLICIT ReturnResultProblem,
                                            [3] IMPLICIT ReturnErrorProblem}}

GeneralProblem          ::= INTEGER { -- ROSE-provider detected
                                unrecognizedComponent (0),
                                mistypedComponent (1),
                                badlyStructuredComponent (2)}
```

Table D.1 (concluded): Component types

```
InvokeProblem           ::= INTEGER { -- ROSE-user detected
                                      -- supplementary service entity
                                duplicateInvocation (0),
                                unrecognizedOperation (1),
                                mistypedArgument (2),
                                resourceLimitation (3),
                                initiatorReleasing (4),
                                unrecognizedLinkedID (5),
                                linkedResponseUnexpected (6),
                                unexpectedChildOperation (7)}

ReturnResultProblem     ::= INTEGER { -- ROSE-user detected
                                unrecognizedInvocation (0),
                                resultResponseUnexpected (1),
                                mistypedResult (2)}

ReturnErrorProblem      ::= INTEGER { -- ROSE-user detected
                                unrecognizedInvocation (0),
                                errorResponseUnexpected (1),
                                unrecognizedError (2),
                                unexpectedError (3),
                                mistypedParameter (4)}

END -- of Facility-Information-Element-Components
```

D.2 Definition of generally applicable errors

Table D.2 contains the ASN.1 specification of errors which are applicable to supplementary services using the common information element category of the functional protocol as specified in clause 8.

Table D.2: Definition of generally applicable errors

```
General-Errors {itu-t identified-organization etsi(0) 196 general-errors(2)}

DEFINITIONS EXPLICIT TAGS ::=

BEGIN

EXPORTS                 notSubscribed, notAvailable, notImplemented, invalidServedUserNr,
                        invalidCallState, basicServiceNotProvided, notIncomingCall,
                        supplementaryServiceInteractionNotAllowed, resourceUnavailable;

IMPORTS                 ERROR
                        FROM Remote-Operation-Notation
                            {joint-iso-itu-t remote-operations(4) notation(0)};

notSubscribed ERROR                             ::= 0

        -- The requested service or function has not been subscribed for the basic service, and
        -- optionally the served user's ISDN number, included in the activation invoke component.
        -- Alternatively the basic service may not have been subscribed.


notAvailable ERROR                              ::= 3

        -- The requested supplementary service or function is not available for the basic service,
        -- and optionally the served user's ISDN number (e.g. temporary fault).

notImplemented ERROR                            ::= 4

        -- The supplementary service or function requested is not implemented for the basic
        -- service, and optionally the served user's ISDN number (e.g. service not provided).

invalidServedUserNr ERROR                       ::= 6

        -- The served user's number provided is not a valid number.

invalidCallState ERROR                          ::= 7

        -- The supplementary service or function cannot be requested in the current basic call state
        -- or auxiliary state.

basicServiceNotProvided ERROR                   ::= 8

        -- The served user has not subscribed to the basic service (bearer and/or teleservice) for
        -- which the supplementary service or function was requested.

notIncomingCall ERROR                           ::= 9

        -- The supplementary service or function was not requested for an incoming call.

supplementaryServiceInteractionNotAllowed ERROR ::= 10

        -- The performance of the requested supplementary service or function is prohibited
        -- by another supplementary service or function.

resourceUnavailable ERROR                       ::= 11

        -- The resources required to perform adequately the requested supplementary service or
        -- function are not available.

END -- of General-Errors
```

D.3 Definition of address types

Table D.3 contains the ASN.1 definition of general applicable address and number types.

Table D.3: Definition of address types

```
Addressing-Data-Elements {itu-t identified-organization etsi(0) 196 addressing-data-elements(6)}

DEFINITIONS EXPLICIT TAGS ::=

BEGIN

EXPORTS                 PresentedAddressScreened, PresentedAddressUnscreened,
                        PresentedNumberScreened, PresentedNumberUnscreened,
                        Address, PartyNumber, PartySubaddress,
                        ScreeningIndicator, PresentationAllowedIndicator;

PresentedAddressScreened        ::= CHOICE {
                                        presentationAllowedAddress [0] IMPLICIT AddressScreened,
                                        presentationRestricted [1] IMPLICIT NULL,
                                        numberNotAvailableDueToInterworking [2] IMPLICIT NULL,
                                        presentationRestrictedAddress [3] IMPLICIT AddressScreened }

PresentedAddressUnscreened      ::= CHOICE {
                                        presentationAllowedAddress [0] IMPLICIT Address,
                                        presentationRestricted [1] IMPLICIT NULL,
                                        numberNotAvailableDueToInterworking [2] IMPLICIT NULL,
                                        presentationRestrictedAddress [3] IMPLICIT Address}

PresentedNumberScreened         ::= CHOICE {
                                        presentationAllowedNumber [0] IMPLICIT NumberScreened,
                                        presentationRestricted [1] IMPLICIT NULL,
                                        numberNotAvailableDueToInterworking [2] IMPLICIT NULL,
                                        presentationRestrictedNumber [3] IMPLICIT NumberScreened}

PresentedNumberUnscreened       ::= CHOICE {
                                        presentationAllowedNumber [0] PartyNumber,
                                        presentationRestricted [1] IMPLICIT NULL,
                                        numberNotAvailableDueToInterworking [2] IMPLICIT NULL,
                                        presentationRestrictedNumber [3] PartyNumber}

AddressScreened                 ::= SEQUENCE {
                                        PartyNumber,
                                        ScreeningIndicator,
                                        PartySubaddress OPTIONAL}

NumberScreened                  ::= SEQUENCE {
                                        PartyNumber,
                                        ScreeningIndicator}

Address                         ::= SEQUENCE {
                                        PartyNumber,
                                        PartySubaddress OPTIONAL}

PartyNumber                     ::= CHOICE {
                                        unknownPartyNumber [0] IMPLICIT NumberDigits,
                                        -- the numbering plan is the default numbering plan of the
                                        -- network. It is recommended that this value is used.
                                        publicPartyNumber [1] IMPLICIT PublicPartyNumber,
                                        -- the numbering plan is according to
                                        -- CCITT Recommendation E.164.
                                        dataPartyNumber [3] IMPLICIT NumberDigits,
                                        -- not used, value reserved.
                                        telexPartyNumber [4] IMPLICIT NumberDigits,
                                        -- not used, value reserved.
                                        privatePartyNumber [5] IMPLICIT PrivatePartyNumber,
                                        nationalStandardPartyNumber [8] IMPLICIT NumberDigits}
                                        -- not used, value reserved.

PublicPartyNumber               ::= SEQUENCE {
                                        publicTypeOfNumber PublicTypeOfNumber,
                                        publicNumberDigits NumberDigits}

PrivatePartyNumber              ::= SEQUENCE {
                                        privateTypeOfNumber PrivateTypeOfNumber,
                                        privateNumberDigits NumberDigits}
```

Table D.3 (concluded): Definition of address types

```
NumberDigits                    ::= NumericString (SIZE(1..20))

PublicTypeOfNumber              ::= ENUMERATED {
                                        unknown (0),
                                        -- if used number digits carry prefix indicating type of
                                        -- number according to national recommendations
                                        internationalNumber (1),
                                        nationalNumber (2),
                                        networkSpecificNumber (3),
                                        -- not used, value reserved
                                        subscriberNumber (4),
                                        abbreviatedNumber (6)}
                                        -- valid only for called party number at the outgoing
                                        --  access, network substitutes appropriate number.

PrivateTypeOfNumber             ::= ENUMERATED {
                                        unknown (0),
                                        level2RegionalNumber (1),
                                        level1RegionalNumber (2),
                                        pTNSpecificNumber (3),
                                        localNumber (4),
                                        abbreviatedNumber (6)}

PartySubaddress                 ::= CHOICE {
                                        UserSpecifiedSubaddress,
                                        -- not recommended
                                        NSAPSubaddress}
                                        -- according to CCITT Recommendation X.213

UserSpecifiedSubaddress         ::= SEQUENCE {
                                        SubaddressInformation,
                                        oddCountIndicator BOOLEAN OPTIONAL}
                                        -- used when the coding of subaddress is BCD

NSAPSubaddress                  ::= OCTET STRING (SIZE(1..20))
                                        -- specified according to CCITT Recommendation X.213. Some
                                        -- networks may limit the subaddress value to some other
                                        --  length, e.g. 4 octets

SubaddressInformation           ::= OCTET STRING (SIZE(1..20))
                                        -- coded according to user requirements. Some networks may
                                        -- limit the subaddress value to some other length,
                                        -- e.g. 4 octets

ScreeningIndicator              ::= ENUMERATED {
                                        userProvidedNotScreened (0),
                                        -- number was provided by a remote user terminal equipment,
                                        -- and has been screened by a network that is not the
                                        -- local public or local private network.
                                        userProvidedVerifiedAndPassed (1),
                                        -- number was provided by a remote user terminal equipment
                                        -- (or by a remote private network), and has been screened
                                        -- by the local public or local private network.
                                        userProvidedVerifiedAndFailed (2),
                                        -- not used, value reserved
                                        networkProvided (3)}
                                        -- number was provided by local public or local
                                        --  private network

PresentationAllowedIndicator    ::= BOOLEAN

END -- of Addressing-Data-Elements
```

D.4 Definition of Q.931 information elements

Table D.4 contains the ASN.1 definition of a general applicable type used to include Q.931 information elements in ASN.1 definitions.

The Q.931 information elements to be used shall be indicated as comment at the point where the type Q931InformationElement is used.

The various Q.931 information elements may appear in any order within a parameter of type Q931InformationElement. The order of appearance of repeated Bearer capability and High layer compatibility information elements shall be according to EN 300 267-1 [13], subclause 5.3, items a) and b).

Table D.4: Definition of Q.931 information elements

```
Embedded-Q931-Types {itu-t identified-organization etsi(0) 196 embedded-q931-types(7)}

DEFINITIONS EXPLICIT TAGS ::=

BEGIN

EXPORTS                 Q931InformationElement;

Q931InformationElement  ::= [APPLICATION 0] IMPLICIT OCTET STRING

END -- of Embedded-Q931-Types
```

D.5 Formal definition of basic services

For a number of reasons it may be necessary that the network unambiguously identifies the telecommunications service it shall handle. The service information may be applied, e.g.:

- when a service is subscribed to and registered;
- for charging purposes;
- in the case of service interworking;
- in the case of supplementary service management, because some of the supplementary services can be managed individually per basic service (e.g. call forwarding and closed user group supplementary services).

In the DSS1 protocol, a telecommunications service is specified by a combination of values (codepoints) of the High layer compatibility information element and the Bearer capability information elements. The progress indicator shall not effect the selection of the basic service.

Table D.5 specifies the relationship between combinations of Bearer capability and High layer compatibility information element values and a basic service.

Table D.5: Formal definition of basic services

High layer compatibility (octet 4)	Bearer capability (octet 3)					
	Speech **00000** **(note 1)**	**3,1 kHz audio** **10000** **(note 1)**	**Unrestricted digital information** **01000** **(note 1)**	**Unrestricted digital information with tones/ announcements** **10001** **(note 1)**	**Unrestricted digital information** **01000** **(note 6)**	**Other**
Telephony (000 0001)	Telephony 3,1 kHz (note 5)	Audio 3,1 kHz	Unrestricted digital information	Telephony 7 kHz (note 5)	Multirate	(note 4)
Facsimile group 2/3 (000 0100)	Speech	Telefax group 2/3 (note 5)	Unrestricted digital information	(note 7)	Multirate	(note 4)
Facsimile group 4 class 1 (010 0001)	Speech	Audio 3,1 kHz	Telefax group 4 class 1 (note 5)	(note 7)	Multirate	(note 4)
Teletex basic mode (011 0001)	Speech	Audio 3,1 kHz	Teletex (note 5)	(note 7)	Multirate	(note 4)
Videotex (011 0010)	Speech	Audio 3,1 kHz	Syntax based videotex (note 5)	(note 7)	Multirate	(note 4)
Videotelephony (110 0000)	Speech	Audio 3,1 kHz	Videotelephony (notes 2 and 5)	Videotelephony (notes 3 and 5)	Multirate	(note 4)
Eurofile transfer (100 0001) (note 8)	Speech	Audio 3,1 kHz	Eurofile transfer	(note 7)	Multirate	(note 4)
FTAM application (100 0010)	Speech	Audio 3,1 kHz	File transfer access and management	(note 7)	Multirate	(note 4)
Other or no HLC present	Speech	Audio 3,1 kHz	Unrestricted digital information	(note 7)	Multirate	(note 4)
Audiographic conferencing (1100010)	Speech	Audio 3,1 kHz	Audiographic conference (notes 5 & 10)	Audiographic conference (notes 5 & 9)	Multirate	(note 4)
Videoconferencing (11000001)	Speech	Audio 3,1 kHz	Videoconference (notes 5 & 12)	Videoconference (notes 5 & 11)	Multirate	(note 4)

NOTE 1: In this case, octet 4 of the Bearer capability information element is encoded with "circuit-mode" and "64 kbit/s".
NOTE 2: Used for the second connection of the video telephony teleservice.
NOTE 3: Used for the first connection of the video telephony teleservice.
NOTE 4: The use of other information transfer capabilities shall be rejected.
NOTE 5: If the indicated teleservice is not supported by the network, then the basic service related to the bearer service shall apply.
NOTE 6: In this case, octet 4 of the Bearer capability information element is encoded with "circuit-mode" and "multirate".
NOTE 7: No defined appropriate ETSI basic service. Networks and users may implement an appropriate bearer service which is outside the scope of the present document.
NOTE 8: This codepoint is defined for the coding standard "national standard".
NOTE 9: Used for the first connection of the audiographic conference teleservice.
NOTE 10: Used for the second connection of the audiographic conference teleservice.
NOTE 11: Used for the first connection of the videoconference teleservice.
NOTE 12: Used for the second connection of the videoconference teleservice.

Table D.6 contains the ASN.1 definition of ISDN basic services.

Table D.6: Formal definition of basic services

```
Basic-Service-Elements {itu-t identified-organization etsi(0) 196 basic-service-elements(8)}

DEFINITIONS EXPLICIT TAGS ::=

BEGIN

EXPORTS                 BasicService;

BasicService            ::= ENUMERATED {
                                allServices (0),
                                speech (1),
                                unrestrictedDigitalInformation (2),
                                audio3k1Hz (3),
                                unrestrictedDigitalInformationWithTonesAndAnnouncements (4),
                                multirate(5),
                                telephony3k1Hz (32),
                                teletex (33),
                                telefaxGroup4Class1 (34),
                                videotexSyntaxBased (35),
                                videotelephony (36),
                                telefaxGroup2-3 (37),
                                telephony7kHz (38),
                                euroFileTransfer (39),
                                fileTransferAndAccessManagement (40)
                                videoconference (41),
                                audioGraphicConference (42)
                            }

END -- of Basic-Service-Elements
```

The result of using the value "allServices" for the control of supplementary services shall be identical to the subsequent use of the individual basic services the user has subscribed to and for which the supplementary service applies and is subscribed to at the point of time the request is received.

NOTE: A user supporting more than one basic service should on some occasions make multiple operations on supplementary services, one for each basic service. For example, if a user supporting the telephony 3,1 kHz basic service activates call forwarding unconditional with the intention of having all incoming telephony calls forwarded, the user should perform an activation for each of the basic services "telephony 3,1 kHz", "speech", "3,1 kHz audio" and "telephony 7 kHz"

D.6 Operations and errors for explicit channel reservation control

Table D.7 defines the operations and errors necessary for the explicit channel reservation procedures.

Table D.7: Explicit network controlled channel reservation

```
Explicit-Network-Controlled-Channel-Reservation {itu-t identified-organization etsi(0) 196
                                                 explicit-network-controlled-channel-reservation(4)}

DEFINITIONS ::=

BEGIN

EXPORTS                 ExplicitReservationCreationControl, ExplicitReservationManagement,
                        ExplicitReservationCancel, MaximumNumberOfReservationsReached,
                        NoExplicitReservationExistsOrInvalidReservationIndicator,
                        UnwantedReservationCreated, ImplicitReservationUsed, ReservationIndicator;

IMPORTS                 OPERATION, ERROR
                        FROM Remote-Operation-Notation
                            {joint-iso-itu-t remote-operations(4) notation(0)}

                        notAvailable, notSubscribed
                        FROM General-Errors
                            {itu-t identified-organization etsi(0) 196 general-errors(2)};

ExplicitReservationCreationControl  ::= OPERATION
                        ARGUMENT    controlOption ENUMERATED {
                            noReservationRequired (0),
                            reservationRequiredWithReservationIndicator (1),
                            reservationRequiredWithoutReservationIndicator (2)}     -- optional
                        RESULT      ReservationIndicator                            -- optional
                        ERRORS {    maximumNumberOfReservationsReached,
                                    notAvailable,
                                    notSubscribed,
                                    unwantedReservationCreated}

ExplicitReservationManagement       ::= OPERATION
                        ARGUMENT    ReservationIndicator                            -- optional
                        RESULT
                        ERRORS {    noExplicitReservationExistsOrInvalidReservationIndicator,
                                    notAvailable,
                                    notSubscribed,
                                    implicitReservationUsed}

ExplicitReservationCancel           ::= OPERATION
                        ARGUMENT    ReservationIndicator                            -- optional
                        RESULT
                        ERRORS {    noExplicitReservationExistsOrInvalidReservationIndicator,
                                    notAvailable,
                                    notSubscribed}

MaximumNumberOfReservationsReached                          ::= ERROR
NoExplicitReservationExistsOrInvalidReservationIndicator    ::= ERROR
UnwantedReservationCreated                                  ::= ERROR
ImplicitReservationUsed                                     ::= ERROR

ReservationIndicator    ::= INTEGER (-128..127)

explicitReservationCreationControl ExplicitReservationCreationControl   ::= 20
explicitReservationManagement ExplicitReservationManagement             ::= 21
explicitReservationCancel ExplicitReservationCancel                     ::= 22
maximumNumberOfReservationsReached MaximumNumberOfReservationsReached   ::= 33
noExplicitReservationExistsOrInvalidReservationIndicator
            NoExplicitReservationExistsOrInvalidReservationIndicator    ::= 34
unwantedReservationCreated UnwantedReservationCreated                   ::= 35
implicitReservationUsed ImplicitReservationUsed                         ::= 36

END -- of Explicit-Network-Controlled-Channel-Reservation
```

D.7 Operation for status request procedure

Table D.8 defines the operations necessary for the status request procedure.

Table D.8: Status request procedure

```
Status-Request-Procedure {itu-t identified-organization etsi(0) 196 status-request-procedure(9)}

DEFINITIONS EXPLICIT TAGS::=

BEGIN
EXPORTS                 StatusRequest;

IMPORTS                 OPERATION, ERROR
                        FROM Remote-Operation-Notation
                            {joint-iso-itu-t remote-operations(4) notation(0)}

                        Q931InformationElement
                        FROM Embedded-Q931-Types
                            {itu-t identified-organization etsi(0) 196 embedded-q931-types(7)};

StatusRequest               ::= OPERATION
                                    ARGUMENT SEQUENCE {
                                        compatibilityMode CompatibilityMode,
                                        q931InformationElement Q931InformationElement}
                                        -- The BC, HLC (optional) and LLC (optional) information
                                        -- elements shall be embedded in q931InfoElement
                                    RESULT StatusResult

StatusResult                ::= ENUMERATED {
                                    compatibleAndFree (0),
                                    compatibleAndBusy (1),
                                    incompatible (2)}

CompatibilityMode           ::= ENUMERATED {
                                    allBasicServices (0),
                                    oneOrMoreBasicServices (1)}

statusRequest StatusRequest ::= {itu-t identified-organization etsi(0) 196
                                 status-request-procedure(9) statusRequest-operation(1)}

END -- Status-Request-Procedure
```

D.8 Types for notification procedures

Table D.9 defines the types and data structures used for the notification procedures.

Table D.9: ASN.1 definition of the notification indicator

```
Notification-Indicator-IE-Data-Structure {itu-t identified-organization etsi(0) 196
                                          notification-data-structure(5)}

DEFINITIONS ::=

BEGIN

EXPORTS                 NOTIFICATION;

NOTIFICATION MACRO ::=
BEGIN

TYPE NOTATION           ::= Argument
VALUE NOTATION          ::= value (VALUE CHOICE {
                                localValue INTEGER,
                                globalValue OBJECT IDENTIFIER})

Argument                ::= "ARGUMENT" NamedType
NamedType               ::= identifier type | type

END -- of NOTIFICATION MACRO


NotificationDataStructure   ::= SEQUENCE {
                                    notificationTypeID NOTIFICATION,
                                    notificationArgument ANY DEFINED BY notificationTypeID}
                                    -- ANY is filled by the single ASN.1 type following the keyword
                                    -- ARGUMENT in the type definition of a particular notification.

END -- of Notification-Indicator-IE-Data-Structure
```

Annex E (informative): Formal definition of remote operations notation

Table E.1: Formal definition of remote operations data types (extract of CCITT Recommendation X.219 [7] figure 4)

```
Remote-Operation-Notation {joint-iso-itu-t remote-operations(4) notation(0)}

DEFINITIONS ::=

BEGIN

EXPORTS                 OPERATION, ERROR;

-- macro definition for operations

OPERATION MACRO ::=
BEGIN

TYPE NOTATION           ::= ArgumentResultErrorsLinkedOperations
VALUE NOTATION          ::= value (VALUE CHOICE {
                                localValue INTEGER,
                                globalValue OBJECT IDENTIFIER})

Argument                ::= "ARGUMENT" NamedType | empty
Result                  ::= "RESULT" ResultType | empty
ResultType              ::= NamedType | empty
Errors                  ::= "ERRORS" "{" ErrorNames "}" | empty
LinkedOperations        ::= "LINKED" "{" LinkedOperationNames "}" | empty
ErrorNames              ::= ErrorList | empty
ErrorList               ::= Error | ErrorList "," Error
Error                   ::= value (ERROR)       -- shall reference an error value
                          | type                -- shall reference an error type if no error value
is
                                                -- specified
LinkedOperationNames    ::= OperationList | empty
OperationList           ::= Operation | OperationList "," Operation
Operation               ::= value (OPERATION)   -- shall reference an operation value
                          | type                -- shall reference an operation type if no operation
                                                -- value is specified
NamedType               ::= identifier type | type

END -- of OPERATION MACRO


-- macro definition for operations errors

ERROR MACRO ::=
BEGIN

TYPE NOTATION           ::= Parameter
VALUE NOTATION          ::= value (VALUE CHOICE {
                                localValue INTEGER,
                                globalValue OBJECT IDENTIFIER})

Parameter               ::= "PARAMETER" NamedType | empty
NamedType               ::= identifier type | type

END -- of ERROR MACRO

END -- end of Remote-Operation-Notation
```

Annex F (informative): Coding examples

F.1 Coding of component types

Although the coding of the component types is defined by application of the basic encoding rules to the abstract syntax, this annex gives some examples of the coding for illustrative purposes.

Tables F.1, F.2, F.3 and F.4 show the component structure after encoding according to the Basic Encoding Rules as specified in CCITT Recommendation X.209 [6].

Table F.1: Invoke component

Invoke component	Mandatory indication	Octet
Component type tag	Mandatory	4
Component length (note 1)		5
Invoke identifier tag	Mandatory	6
Invoke identifier length		7
Invoke identifier		8
Linked identifier tag	Optional	9
Linked identifier length		10
Linked identifier		11
Operation value tag	Mandatory	12
Operation value length		13
Operation value		14
Argument (note 2)	Optional	15
		etc.

NOTE 1: The component length is coded to indicate the number of octets contained in the component (excluding the component type tag and the component length octets).
NOTE 2: This is a parameter of the invoke component type.

Table F.2: Return result component

Return result component	Mandatory indication	Octet
Component type tag	Mandatory	4
Component length (note 3)		5
Invoke identifier tag	Mandatory	6
Invoke identifier length		7
Invoke identifier		8
Sequence tag	Optional (note 1)	9
Sequence length (note 4)		10
Operation value tag	Optional (note 2)	11
Operation value length		12
Operation value		13
Result (note 5)	Optional	14
		etc.

NOTE 1: If the return result component does not include any result, then the sequence and operational value shall be omitted.
NOTE 2: If a result is included, then the operation value is mandatory and is the first element in the sequence.
NOTE 3: The component length is coded to indicate the number of octets contained in the component (excluding the component type tag and the component length octets).
NOTE 4: The sequence length is coded to indicate the number of octets contained in the sequence (excluding the sequence type tag and the sequence length octets).
NOTE 5: This is a parameter of the return result component type.

Table F.3: Return error component

Return error component		Mandatory indication	Octet
Component type tag		Mandatory	4
Component length (note 1)			5
	Invoke identifier tag	Mandatory	6
	Invoke identifier length		7
	Invoke identifier		8
	Error value tag	Mandatory	9
	Error value length		10
	Error value		11
	Parameter (note 2)	Optional	12
			etc.
NOTE 1: The component length is coded to indicate the number of octets contained in the component (excluding the component type tag and the component length octets).			
NOTE 2: This is a parameter of the return error component type.			

Table F.4: Reject component

Reject component		Mandatory indication	Octet
Component type tag		Mandatory	4
Component length (note)			5
	Invoke identifier tag	Mandatory	6
	Invoke identifier length		7
	Invoke identifier		8
	Problem tag	Mandatory	9
	Problem length		10
	Problem		11
NOTE: The component length is coded to indicate the number of octets contained in the component (excluding the component type tag and the component length octets).			

F.2 Embedding of existing Q.931 information elements

Figure F.1 gives a diagrammatic description of the coding resulting of embedding Q.931 information elements in components. The tag is defined in table F.5.

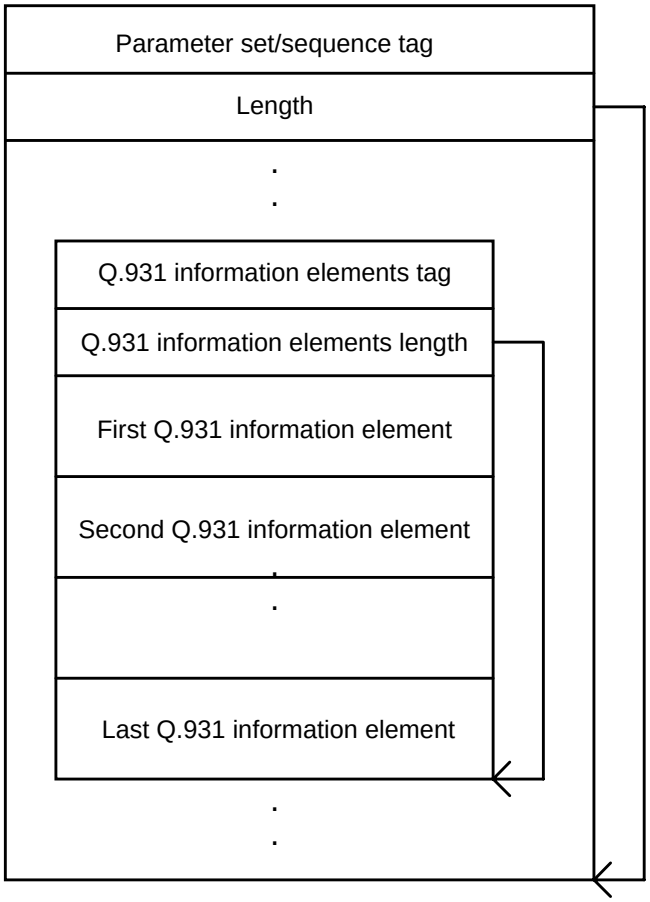

Figure F.1: Encapsulation of Q.931 information elements

Table F.5: Q.931 information elements tag

Tag	8	7	6	5	4	3	2	1
Q.931 information elements	0	1	0	0	0	0	0	0
NOTE: All other values are reserved. This approach may also be applied to coding structures from other standards by defining additional tags as required.								

Annex G (informative): Assignment of object identifier values

The following values are assigned in the present document:

```
{itu-t identified-organization etsi(0) 196 general-errors(2)}
{itu-t identified-organization etsi(0) 196 facility-information-element-component(3)}
{itu-t identified-organization etsi(0) 196 explicit-network-controlled-channel-reservation(4)}
{itu-t identified-organization etsi(0) 196 notification-data-structure(5)}
{itu-t identified-organization etsi(0) 196 addressing-data-elements(6)}
{itu-t identified-organization etsi(0) 196 embedded-q931-types(7)}
{itu-t identified-organization etsi(0) 196 basic-service-elements(8)}
{itu-t identified-organization etsi(0) 196 status-request-procedure(9)}
{itu-t identified-organization etsi(0) 196 status-request-procedure(9) statusRequest-operation(1)}
```

History

Document history				
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