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Integrated Services Digital Network (ISDN); Signalling System No.7; Signalling Connection Control Part (SCCP) (connectionless and connection-oriented class 2) to support international interconnection; Part 1: Protocol specification

[ITU-T Recommendations Q.711 to Q.714 and Q.716 (1993), modified]

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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Foreword

This final draft third edition European Telecommunication Standard (ETS) has been produced by the Signalling Protocols and Switching (SPS) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Voting phase of the ETSI standards approval procedure.

The third edition of ETS 300 009 covering the Signalling System No.7 Signalling Connection Control Part (SCCP) to support international interconnection is structured as a multi-part standard (of which this ETS forms part 1) as described below:

Part 1: "Protocol specification [ITU-T Recommendations Q.711 to Q.714 and Q.716 (1993), modified]";

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

Part 3: "Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma specification".

This ETS implies the existence of a number of functional subsets of the SCCP protocol without however explicitly identifying them. Depending on their functional requirements, conforming implementations would probably only implement a subset of the overall functions, e.g. a switch might only implement Class 2 embedded, or a GSM basestation might not handle Global Titles. The possibility of having such implementations is reflected by the optionality of the corresponding capabilities in the PICS proforma specification, ETS 300 009-2.

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

Endorsement notice

The text of ITU-T Recommendations Q.711 (1993), Q.712 (1993), Q.713 (1993), Q.714 (1993) and Q.716 (1993) was approved by ETSI as an ETS with agreed modifications as given below.

NOTE: New or modified text is indicated using sidebars. In addition, underlining and/or strikeout are used to highlight detailed modifications where necessary.

Global modifications to ITU-T Recommendations Q.711 to Q.714 and Q.716

Insert the following three clauses (scope, normative references and abbreviations):

Scope

This first part of ETS 300 009 defines the Signalling Connection Control Part (SCCP) signalling protocol of Signalling System No.7 for use in and between international relay points and gateways and, optionally, in public networks.

This ETS covers the use of connectionless functions (Class 0 and Class 1) and connection-oriented functions (Class 2, including embedded connection setup).

NOTE: The SCCP gateway functions are relay functions that bridge two Message Transfer Part (MTP) networks.

This ETS is applicable to the international network and does not intend to restrict national networks. However, to facilitate SCCP interworking, its adoption within national networks is recommended.

Concerning the interconnection of SCCPs, this ETS is based on the assumption that the Message Transfer Part (MTP) specified in ETS 300 008 [1] supports the SCCP.

Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 008 (1991): "Signalling System No.7; Message Transfer Part (MTP) to support international interconnection".

Abbreviations

For the purposes of this ETS, the following abbreviations apply:

CC	Connection Confirm message
CR	Connection Request message
CREF	Connection Refused message
DPC	Destination Point Code
ERR	protocol data unit Error message
GT	Global Title
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
IT	Inactivity Test message
MTP	Message Transfer Part
OPC	Originating Point Code
RI	Routing Indicator
RLC	Release Complete message
RLSD	Released message
SCCP	Signalling Connection Control Part
SLS	Signalling Link Selection
SPC	Signalling Point Code
SS	Subsystem
SSN	Subsystem Number
UDT	Unitdata message
UDTS	Unitdata Service message
UUS3	User-to-User Signalling, service 3
XUDT	Extended Unitdata message
XUDTS	Extended Unitdata Service message

Modifications to ITU-T Recommendation Q.711

Page 4, subclause 2

Class 3 is not in the scope of this ETS.

Page 4, subclause 2.1

Permanent signalling connections are not in the scope of this ETS.

Page 5, subclause 2.1.1.1.2

Sequence control and flow control are not in the scope of this ETS.

Page 6, subclause 2.1.1.2.1

N-EXPEDITED DATA, N-DATA ACKNOWLEDGE, and N-RESET are not in the scope of this ETS.

Page 8, figure 7/Q.711

Add the following note to figure 7/Q.711:

NOTE: ISUP requests connection setup with the REQUEST Type 1 or REQUEST Type 2 interface elements.

Page 8, subclause 2.1.1.2.2

Negotiation of expedited data is not in the scope of this ETS.

Page 9, subclause 2.1.1.2.3

N-EXPEDITED DATA, N-DATA ACKNOWLEDGE, and N-RESET are not in the scope of this ETS.

Page 13, subclause 2.1.1.3.2

Connection establishment interface elements are used by ISUP for the embedded setup of connections. The "receipt confirmation selection" shall be set to false. The "quality of service parameter set" shall indicate Class 2.

NOTE: In the international network, the REQUEST Type 1 interface element would normally not be used. This interface element only applies at the originating node in the national network. However, it should be possible that ISUP performs an association ("chaining") of connection sections itself on the user level (see figure 12 of ITU-T Recommendation Q.730 as modified by ETS 300 356-2). This may be necessary if different versions of SCCP are used in the national and international networks, or if User-to-user data is transported in the national network in another way.

Page 14, subclause 2.1.2

Delete subclause 2.1.2. Permanent signalling connections are not in the scope of this ETS.

Page 15, subclause 2.2.1

If the in-sequence delivery is not required (Protocol Class 0), the SCCP shall insert Signalling Link Selection (SLS) codes with respect to the appropriate load sharing within the signalling network. If the in-sequence delivery is required (Protocol Class 1), the SCCP, at the originating node, while adhering to the sequence control instruction from the user, shall allocate SLS codes between sequence streams with respect to appropriate load sharing within the signalling network.

As in relay nodes, user sequence control is not available. There shall be a fixed mapping between incoming and outgoing SLS code values for Class 1. This mapping may be different for different signalling relations.

Page 18, subclause 2.3.2.1

N-COORD is only needed in nodes that contain local replicated subsystems.

Page 19, subclause 2.3.2.3.1

N-COORD is only needed in nodes that contain local replicated subsystems.

Page 21, table 16/Q.711, note b)

Replace note b) by:

b) The Cause parameter in the MTP-STATUS primitive may take the values:

"Signalling network congested";
"User Part unavailable".

For the cause "Signalling network congested", and where an MTP according to ETS 300 008 [1] is used, no congestion levels are reported. MTPs employed in national networks may provide congestion levels.

NOTE: The values:

- "User Part unavailability: unknown";
- "User Part unavailability: unequipped remote user";
- "User Part unavailability: inaccessible remote user",

occur in ITU-T Recommendation Q.701, clause 8. The first one corresponds to "User Part unavailable" in ETS 300 008 [1], the latter two are not part of ETS 300 008 [1].

Page 21, subclause 3.2.4, first paragraph

Insert after the first paragraph:

The Cause parameter in the MTP-STATUS primitive may take the values:

- "Signalling network congested";
- "User Part unavailable".

For the cause "Signalling network congested", and where an MTP according to ETS 300 008 [1] is used, no congestion levels are reported. MTPs employed in national networks may provide congestion levels.

NOTE: The values:

- "User Part unavailability: unknown";
- "User Part unavailability: unequipped remote user";
- "User Part unavailability: inaccessible remote user",

occur in ITU-T Recommendation Q.701, clause 8. The first one corresponds to "User Part unavailable" in ETS 300 008 [1], the latter two are not part of ETS 300 008 [1].

Page 22, subclause 4.1

Class 3 functions are not in the scope of this ETS.

Page 22, subclause 4.1.1.2

Flow control is not in the scope of this ETS.

Expedited data support is not in the scope of this ETS.

Missequence detection is not in the scope of this ETS.

Reset is not in the scope of this ETS.

Receipt confirmation is not in the scope of this ETS.

Page 23, subclause 4.1.2

Delete subclause 4.1.2. Functions for permanent signalling connections are not in the scope of this ETS.

Page 23, subclause 4.3

Co-ordinated state change is only needed in nodes that contain local replicated subsystems.

Page 23, subclause 4.4

The routing and translation function of SCCP does not apply for the embedded method.

NOTE: ISUP executes its own routing function. It provides the minimally necessary information for SCCP in the MTP-routing label and the Originating Point Code (OPC) field of the embedded request (see subclause 3.15 of ITU-T Recommendation Q.763 as modified by ETS 300 356-1).

Modifications to ITU-T Recommendation Q.712

Page 1, subclause 1.4

Delete subclause 1.4. Data acknowledgement is not in the scope of this ETS.

Page 1, subclause 1.6

Delete subclause 1.6. Data form 2 is not in the scope of this ETS.

Page 1, subclause 1.7

Delete subclause 1.7. Expedited data is not in the scope of this ETS.

Page 1, subclause 1.8

Delete subclause 1.8. Expedited data acknowledgement is not in the scope of this ETS.

Page 2, subclause 1.13

Delete subclause 1.13. Reset confirm is not in the scope of this ETS.

Page 2, subclause 1.14

Delete subclause 1.14. Reset request is not in the scope of this ETS.

Page 2, subclause 1.16

Subsystem-out-of-service-grant is only needed in nodes that contain local replicated subsystems.

Page 2, subclause 1.17

Subsystem-out-of-service-request is only needed in nodes that contain local replicated subsystems.

Page 3, subclause 2.4

Delete subclause 2.4. Credit is not in the scope of this ETS.

Page 4, subclause 2.6

Delete subclause 2.6. Diagnostic is not in the scope of this ETS.

Page 4, subclause 2.11

Delete subclause 2.11. Receive sequence number is not in the scope of this ETS.

Page 4, subclause 2.14

Delete subclause 2.14. Reset cause is not in the scope of this ETS.

Page 4, subclause 2.17

Delete subclause 2.17. Sequencing/segmenting is not in the scope of this ETS.

Modifications to ITU-T Recommendation Q.713

Page 6, subclause 3.4.1, third paragraph

Insert after the third paragraph, beginning with "A "1" in bit 2 ...":

On transmission of the called or calling party address, the Subsystem Number (SSN) indicator field shall always be included and set to 0 if unknown.

Page 7, subclause 3.4.1, last paragraph

Insert after the last paragraph:

Bit 8 (reserved for national use) shall always be coded 0 and is not evaluated.

Page 8, subclause 3.4.2.2, list of subsystem numbers

Replace all codepoints below 0000 1010 (AUC) by:

0000 1011	ISS (ISDN Supplementary Services)
0000 1100	INAP (Intelligent Network Application Protocol)
0000 1101 to 1111 1110	Spare
1111 1111	Reserved for expansion

NOTE: Except for ISUP, there are currently no SCCP users in the international network. Nevertheless, SSNs need to be allocated for all those SCCP subsystems whose messages may cross network boundaries, so that international agreement is required for the SSNs used. An additional SSN is required for ISDN Supplementary Services (ISS) to identify the services that are based on Transaction Capabilities (TC) (CCBS, Reverse charging, etc.).

Page 9, subclause 3.4.2.3.1

Global title indicator = 0001 is not in the scope of this ETS.

Page 10, subclause 3.4.2.3.2

Global title indicator = 0010 is not in the scope of this ETS.

Page 11, subclause 3.4.2.3.3

Global title indicator = 0011 is not in the scope of this ETS.

Page 12, subclause 3.5, last paragraph

Insert after the last paragraph:

If segmenting/reassembly of connectionless messages or the return option are used, an unambiguous[1)] identification of the originating SCCP user (possibly complemented by additional MTP information) shall be supplied in the calling party address.

Page 13, subclause 3.8

Delete subclause 3.8. Receive sequence number is not in the scope of this ETS.

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1) "unambiguous" is used here as defined in ITU-T Recommendation X.650:
"A name is unambiguous within a given scope when it identifies one and only one object within that scope. Unambiguity does not preclude the existence of synonyms".

Page 14, subclause 3.9

Delete subclause 3.9. Sequencing/segmenting is not in the scope of this ETS.

Page 14, subclause 3.10

Delete subclause 3.10. Credit is not in the scope of this ETS.

Page 15, subclause 3.13

Delete subclause 3.13. Reset cause is not in the scope of this ETS.

Page 21, subclause 4.8

Delete subclause 4.8. Data form 2 is not in the scope of this ETS.

Page 22, subclause 4.9

Delete subclause 4.9. Data acknowledgement is not in the scope of this ETS.

Page 23, subclause 4.12

Delete subclause 4.12. Expedited data is not in the scope of this ETS.

Page 24, subclause 4.13

Delete subclause 4.13. Expedited data acknowledgement is not in the scope of this ETS.

Page 24, subclause 4.14

Delete subclause 4.14. Reset request is not in the scope of this ETS.

Page 25, subclause 4.15

Delete subclause 4.15. Reset confirm is not in the scope of this ETS.

Page 30, annex A

Annex A has the status of a normative annex.

Modifications to ITU-T Recommendation Q.714

Page 1, subclause 1.1.2

Class 3 procedures are not in the scope of this ETS.

Page 2, subclause 1.1.2.2, last paragraph

Insert after the last paragraph:

The in-sequence delivery not only relies on the properties of the MTP network, but also SCCP shall guarantee the sequential processing of SCCP messages. This excludes e.g. arbitrary parallel processing of Global Title translations in relay nodes.

Page 2, subclause 1.1.2.4

Delete subclause 1.1.2.4. Protocol Class 3 is not in the scope of this ETS.

Page 2, subclause 1.1.3

Insert after the last paragraph:

NOTE: The ITU-T White Book (1993) leaves the possibility of having relay points without coupling for connection-oriented services for further study, because it is not clear how a connection can be completed (with a Connection Confirm (CC) message) to the originator without changing or including the Calling address parameter of the Connection Request (CR) message in relay nodes.

For the embedded method, there is in fact the possibility of having no association in an ISUP relay point (ISUP would in this case simply pass the embedded request further on, without issuing a REQUEST Type 2). This is in this case no problem, since the OPC of the originating node or of the last relay node with coupling is included in the embedded connect request of the IAM message. It is therefore always possible to route back the CC message to the correct originator.

Page 3, subclause 1.2.1, last paragraph

Insert after the last paragraph:

When the embedded method is used, ISUP determines whether association of connection sections is required or not. If the SCCP receives a REQUEST Type 2 from ISUP, with the "reply bit" set, an association of connection sections shall be performed.

NOTE: The ITU-T White Book (1993) leaves the possibility of having relay points without coupling for connection-oriented services for further study, because it is not clear how a connection can be completed (with a CC message) to the originator without changing or including the Calling address parameter of the CR message in relay nodes.

For the embedded method, there is in fact the possibility of having no association in an ISUP relay point (ISUP would in this case simply pass the embedded request further on, without issuing a REQUEST Type 2). This is in this case no problem, since the OPC of the originating node or of the last relay node with coupling is included in the embedded connect request of the IAM message. It is therefore always possible to route back the CC message to the correct originator.

Page 3, subclause 1.2.2

Flow control is not in the scope of this ETS.

Expedited data support is not in the scope of this ETS.

Missequence detection is not in the scope of this ETS.

Reset is not in the scope of this ETS.

Receipt confirmation is not in the scope of this ETS.

Page 7, subclause 2.2.2, last paragraph

Insert after the last paragraph:

If an SCCP message is routed across network boundaries, a Global Title shall always be provided in the called address. For routing from one network to another, passing through the international network, the Routing Indicator (RI) shall always be set to route on Global Title.

NOTE: The routing of the embedded connect requests for ISUP is not performed by SCCP, but by ISUP itself. The other connection-oriented messages are routed on Destination Point Code (DPC) only.

Page 11, clause 3

Class 3 procedures are not in the scope of this ETS.

Page 12, subclause 3.1.3.1, last paragraph

Insert after the last paragraph:

If a connection request for Protocol Class 3 is received, and the node only supports Class 2, the class shall be lowered to Class 2 in response.

Page 12, subclause 3.1.3.2

Delete subclause 3.1.3.2. Flow control window negotiation is not in the scope of this ETS.

Page 12, subclause 3.1.4.1

In the REQUEST Type 1 interface element the proposed protocol class shall be Class 2. No initial credit shall be indicated.

Page 13, subclause 3.1.4.2

If the protocol class received in the CC message is higher than the one proposed (i.e. either the class or the window or both are larger), the connection release procedure shall be initiated on the signalling connection, and the Release cause parameter shall indicate "Inconsistent connection data".

Page 13, subclause 3.1.5.1

If a connection request for Protocol Class 3 is received, and the relay point with coupling does only support Class 2, the class shall be lowered to Class 2 in response.

Page 14, subclause 3.1.5.2

If the protocol class received in the CC message is higher than the one proposed (i.e. either the class or the window or both are larger), the connection refusal procedure shall be initiated (see subclause 3.2.1 of Q.714 as modified by this ETS).

Page 14, subclause 3.1.6.1

If a connection request for Protocol Class 3 is received, and the destination node supports only Class 2, the class shall be lowered to Class 2 in response.

Page 15, subclause 3.2.1, item 2) b)

Insert after item 2) b):

c) the reception of a CC message, with a protocol class higher than the one proposed in the associated CR message.

Page 15, subclause 3.2.1, last paragraph

Replace last paragraph by:

If the connection refusal procedure is initiated at a relay node due to the reception of a CC message, with a protocol class higher than the one proposed in the associated CR message (see subclause 3.1.5.2 of ITU-T Recommendation Q.714 as modified by this ETS), then the connection release procedure is initiated on that connection section and a Connection Refused message with refusal cause “Inconsistent connection data” is transferred on the associated connection section.

In either of the three above cases at an intermediate node, if the connection set-up was initiated using a REQUEST interface element, then the SCCP user is informed by invoking the N-DISCONNECT indication primitive.

Page 18, subclause 3.4

Support of supervision of connection by the SCCP user function is not required. The SCCP itself shall perform this supervision. The inactivity test procedure shall apply on all connection sections.

Page 19, subclause 3.5.1

Only the DT1 message is in the scope of this ETS.

Page 19, subclause 3.5.2

Delete subclause 3.5.2. Flow control is not in the scope of this ETS.

Page 21, subclause 3.6

Delete subclause 3.6. Expedited data support is not in the scope of this ETS.

Page 22, subclause 3.7

Delete subclause 3.7. Reset is not in the scope of this ETS

Page 25, subclause 3.8.2.1, item 3)

Delete item 3). Permanent signalling connections are not in the scope of this ETS.

Page 25, subclause 3.9

Permanent signalling connections are not in the scope of this ETS.

Page 28, subclause 4.1.1

Insert the following note:

NOTE: The principle of Segmenting/Reassembly of connectionless messages is such that no actions are necessary in relay nodes, except for routing the XUDT and XUDTS messages in the same way as UDT and UDTS messages.

Page 29, subclause 4.1.1.2.3

Insert after the last paragraph:

The timeout of the reassembly timer shall be considered as one of the errors for which this procedure applies.

Page 32, subclause 5.2.4

Additional information for handling MTP level congestion is given in annex ZC of this ETS.

Page 35, subclause 5.3.5

Insert the following note:

NOTE: Co-ordinated state change is only needed in nodes that contain local replicated subsystems.

Page 36, subclause 5.3.6.6

Where an MTP according to ETS 300 008 [1] is used, no congestion levels are reported. MTPs employed in national networks may provide congestion levels.

Page 38, annex A

Annex A has the status of a normative annex.

Page 43, annex B

Annex B has the status of a normative annex.

Page 47, annex C

Annex C has the status of a normative annex.

Page 48, clause C.4, timers

Insert at the end of clause 4:

The following constraint shall be obeyed for the timers:

$$T(guard) \geq T(interval) + T(iar) + \Delta \text{ (see note)}$$

It may be advantageous to make sure that the inactivity receive timer T(iar) is at least twice the inactivity send timer T(ias), as used in the nodes at the other side of the connection section. This avoids that the loss of one single Inactivity Test (IT) message (e.g. due to short term MTP congestion) causes the inadvertent release of an otherwise inactive SCCP connection. Loss of more messages (e.g. due to SPC failures) will, however, still cause the connection to get released.

$$T(iar) \geq 2 \times T(ias) + \Delta \text{ (see note)}$$

NOTE: Δ is a margin for the inaccuracy of timers at both ends of the connection and for the transit delay of the IT message. A value of about one minute may be appropriate.

Page 91, annex D

Annex D has the status of a normative annex.

Page 107, annex E

Annex E has the status of an informative annex.

Modifications to ITU-T Recommendation Q.716

No modifications identified.

Annex ZA (normative): Compatibility issues

ZA.1 Interface to MTP

MTP according to the ITU-T White Book (1993) defines separate values for the causes: "User Part unavailability: unknown"; "User Part unavailability: unequipped remote user" and "User Part unavailability: inaccessible remote user". If interworking with a MTP according to the ITU-T White Book is necessary, these values should also be accepted and reacted to by using the SCCP management procedures as described in clause 5 of ITU-T Recommendation Q.714.

ZA.2 Segmenting/Reassembly of connectionless messages

The mechanism for the connectionless segmenting reassembly are not compatible with the CCITT Blue Book (1988). Two messages had to be introduced in the ITU-T White Book (1993) because the current UDT and UDTS message did not foresee the possibility of adding optional parameters. There is no compatibility mechanism foreseen to fallback on use of UDT/UDTS if communication is not successful using the XUDT/XUDTS procedures. The introduction of this feature in the network should therefore be executed in carefully planned stages:

1) before the introduction of any implementations using segmenting/reassembly, all relay nodes that will be passed shall be equipped with the ability to accept and route XUDT(S) messages;

2) new implementations using segmenting/reassembly are introduced. In this phase, all messages from applications have to be sent as UDT/UDTS messages, as long as they fit within one UDT/UDTS message. For applications according to CCITT Blue Book (1988), there shall not be any change in behaviour of SCCP. This maximizes the chances for successful interworking;

3) as soon as the network is completely retrofitted according to the second or later editions of this ETS, it is allowed to segment messages that would otherwise fit into an UDT/UDTS message. This may be done e.g. to restrict the mean length of the messages sent over the network. In this case all messages larger than a certain limit (the value "X" from the ITU-T White Book (1993)) are subjected to segmenting;

4) the final goal is the complete replacement of UDT/UDTS messages by XUDT/XUDTS messages. For a certain period of time, it is nevertheless required to be able to receive and relay UDT messages.

It is out of the scope of this ETS to define whether and when each of these stages is to be achieved.

ZA.3 Embedded method

Failure situations resulting from compatibility problems are covered in annex ZB.

ZA.4 Introduction of SCCP into national networks

The introduction of SCCP into national networks needs to cope with the fact that in other national networks capabilities like Class 3 might be already in place. The following text describes the negotiation procedures that apply in that case to make sure that connections are setup with the maximum available protocol class and window. It does not introduce any new requirements, since the procedures are fully covered by clause 3 of ITU-T Recommendation Q.714 as modified by this ETS.

In the originating node, when a N-CONNECT-req primitive is received with Class 3, window = x, and when SCCP does not support Class 3, SCCP shall lower the class proposed in the outgoing CR message to Class 2 automatically.

In a relay point without coupling, when a CR message is received with Class 3, window = x, it shall be passed transparently (only SCRC routes the message, SCOC procedures are not invoked).

In a relay point with coupling, when a CR message is received with Class 3, window = x, and when SCCP does not support Class 3, SCCP shall lower the class proposed in the outgoing CR message to Class 2 automatically.

In the destination node, when a CR message is received with Class 3, window = x, and when SCCP does not support Class 3, SCCP shall lower the class proposed in the N-CONNECT indication primitive to Class 2 automatically.

When a user in the destination node receives a N-CONNECT indication, it shall check whether the proposed protocol class is still sufficient to service the connection. If not, the connection shall be refused and a N-DISCONNECT indication shall be returned, otherwise the connection shall be completed with N-CONNECT response.

In a relay point with coupling, when a CC message is received, SCCP shall check whether the protocol class is lower than or equal to the one it proposed in its outgoing CR message. If it is not, the connection shall be refused with a Connection Refused (CREF) message in the backward direction, and the already completed connection sections shall be released in the forward direction with a Released (RLSD) message.

In the originating node, when a CC message is received, SCCP shall check whether the protocol class is lower than or equal to the one it proposed in its outgoing CR message. If it is not, the already completed connection sections shall be released in the forward direction with RLSD.

When a user in the originating node receives a N-CONNECT confirmation, it shall check whether the proposed protocol class is still sufficient to service the connection. If not, the connection shall be released and a N-DISCONNECT indication shall be returned, otherwise the connection shall be completed and be now in the active state.

For the window negotiation similar procedures apply. These procedures maximize the protocol class offered to a connection to the maximum available from the participating nodes. In this way, interworking problems are minimized. The procedures are embedded in the protocol and do not require any database setup or other provisioning.

Annex ZB (normative): Additional requirements for the embedded method

ZB.1 Service request for UUS3

UUS3 may be requested from ISUP both in the call setup phase and in the active phase of the call. As seen from the SCCP there is no difference between these phases, and the request shall be treated in the same way for both cases.

ZB.2 Treatment in transit exchanges

The decision whether a transit exchange is a SCCP relay point with coupling is under the control of ISUP. ISUP has total control over the setup of the signalling connection. In any transit exchange, i.e. where circuits are terminated, ISUP may decide whether or not association of connection sections shall be performed.

If so, this information is given to the SCCP by invoking the REQUEST Type 2 interface element with "reply request" set. The decision is based on local knowledge of the connectivity in the MTP network routing.

If no knowledge is available, or when crossing network boundaries, association shall always be performed.

NOTE: When association is performed, ISUP puts the OPC of the gateway in the embedded connect request. If no association is performed, ISUP passes on the complete embedded connection request transparently without invoking SCCP.

ISUP may also decide to perform chaining of SCCP connections on its own (see figure 12 of ITU-T Recommendation Q.730 as modified by ETS 300 356-2). This may ease exercising congestion control in transit nodes.

ZB.3 Failure situations

Due to the implementation strategy for SCCP in the networks of different operators, or implemented versions of the SCCP, several failure situations may occur during the setup of a signalling connection using the SCCP embedded method across network boundaries.

Subclauses ZB.3.1 to ZB.3.4 cover possible failure situations and the reactions on these.

ZB.3.1 SCCP not existing in another network

If a setup of UUS3 using the SCCP embedded method enters a network where SCCP is not existing, this will be detected by the ISUP in the gateway node. The embedded connection request shall be discarded, and the ISDN setup shall continue indicating that the link-by-link method is available.

The already partly established SCCP connection sections will be released by the connection establishment timers in the actual nodes.

ISUP in the originating node will be informed by the N-DISCONNECT indication primitive with reason "Abnormal condition".

ZB.3.2 Embedded method not supported by SCCP

If the SCCP in another network does not support the embedded method, this will be detected by the ISUP due to lack of the interface elements REQUEST Type 1/2 and the actions performed shall be similar to those described in subclause ZB.3.1.

ZB.3.3 ISUP fails to invoke a REQUEST Type 2 primitive in a transit exchange

If the ISUP fails to invoke the REQUEST Type 2 primitive in a transit exchange, it might be impossible to route the CC message back to the originating node. In this case, the CC message is lost (since the OPC is not reachable by MTP routing), and the connection on the originating side will be released by the connection establishment timers. On the terminating side, the connection will be released by the inactivity receive timer.

ISUP will in both ends be informed by the N-DISCONNECT indication primitive with reason "Abnormal condition".

ZB.3.4 Node restarting during setup

If a node or the SCCP in a node restarts during the setup, all connection data in this node might be lost, and the setup will fail. This will be detected in the other nodes by connection establishment timer expiry, and expiry of the inactivity timers.

ISUP will in both ends be informed by the N-DISCONNECT indication primitive with reason "Abnormal condition".

Annex ZC (informative): Congestion handling

This annex contains additional information on SCCP signalling point status management to provide congestion handling for MTP level congestion. This information is additional to the procedures in clause 5 of ITU-T Recommendation Q.714.

Because of the use of Global Title addressing, congestion measures are necessary within SCCP, since the user has no knowledge about the SPCs which it gets reported in the N-PCSTATE primitives.

The actions to be taken when the SCCP itself is congested are outside the scope of this ETS.

When SCCP is informed by the MTP-STATUS (congestion) indication about congestion in the signalling network, SCCP shall immediately take the necessary measures to reduce traffic. When it is decided that it is necessary to start discarding messages, messages with low priority are to be favoured for discard at first. In the absence of a priority indication for SCCP messages, the relay point should base itself on the SCCP message type.

CR, other load initiating and XUDTS messages are to be considered as low priority messages, RLSD, RLC, ERR and other load reducing messages should be given high priority.

NOTE: In the originating node, the priority can explicitly be passed by the SCCP application in an implementation specific extension of the primitive interface. In this way, fine control over the congestion measures can be exercised by the SCCP applications.

At higher congestion levels (which might be derived similarly to the mechanism described in subclause 2.10 of ITU-T Recommendation Q.764 as modified by ETS 300 356-1, or reported by MTP if one of the national options for MTP congestion is used), more traffic needs to be discarded.

The way in which the congestion levels are prepared is left implementation dependent. In exchanges where ISUP and SCCP are running in parallel, the actions taken when congestion occurs should be synchronized sufficiently to avoid one type of traffic suppressing the other.

For discarded CR messages, the refusal procedure shall be invoked. The Refusal cause parameter in the CREF message shall be set to "Network resource - QOS not available/transient".

For discarded (X)UDT messages, the return on error procedures shall be invoked. The Return cause parameter in the (X)UDTS shall be set to "Network congestion".

The end of congestion is detected through the fact that reception of more MTP-STATUS indications has ceased (in a timer-controlled manner), or by "congestion level = 0" reported in the MTP-STATUS when one of the national options for MTP congestion is in use.

Further information concerning congestion handling is available in ITU-T.

Annex ZD (informative): Specification and Description Language (SDL) diagrams for connectionless segmenting/reassembly

The SDL diagrams refer to the fields of the XUDT message as follows:

CL	In sequence delivery option
F	First bit
PC	requested Protocol Class
REF	segmenting REFerence
RS	Remaining Segments
SEG	SEGmentation parameter
UDL	User Data Length

In addition, following state-variables are used:

#SEG	number of SEGments
RSE:	Remaining Segments Expected

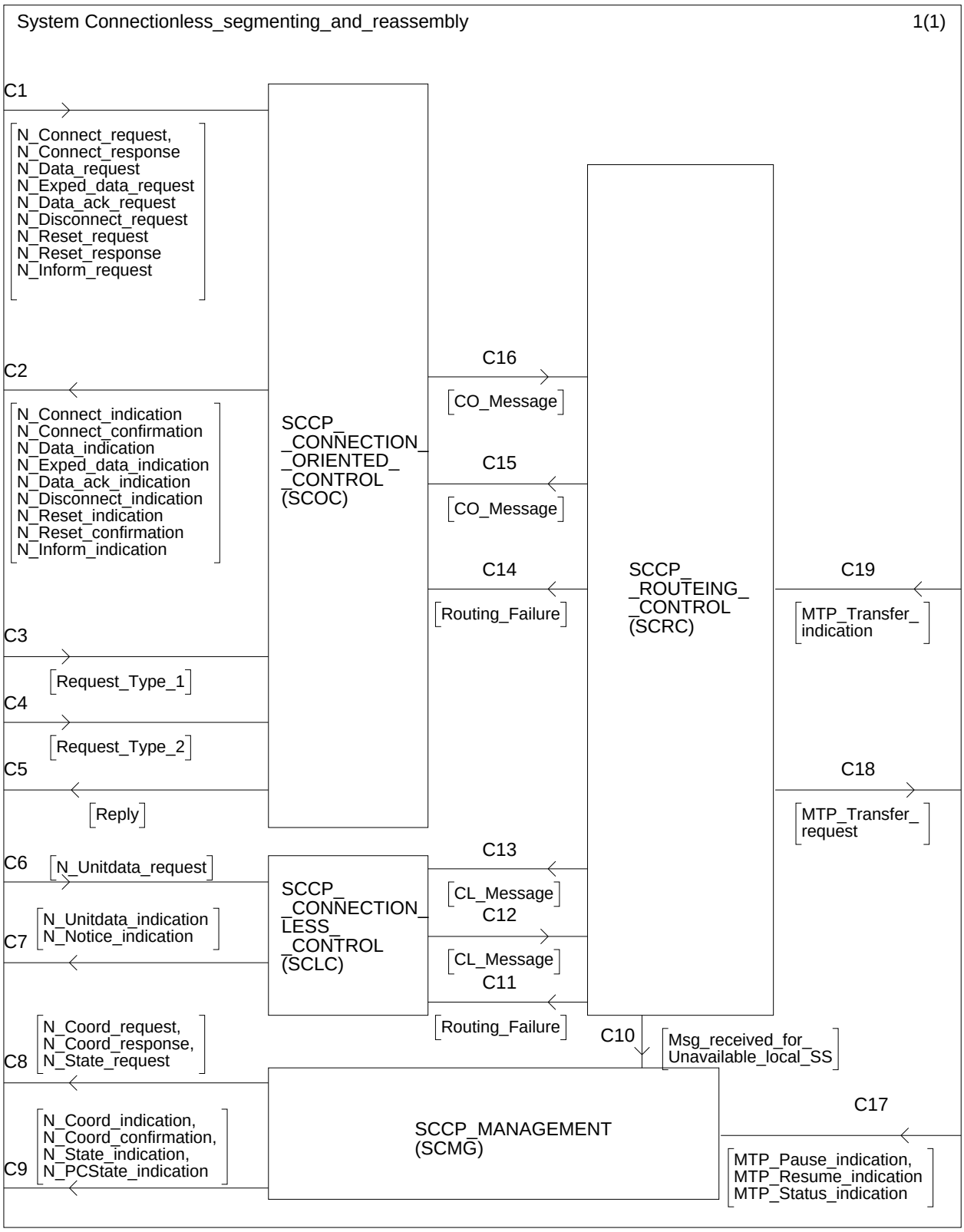

Figure ZD.1: System diagram for SCCP Connectionless Control (SCLC)

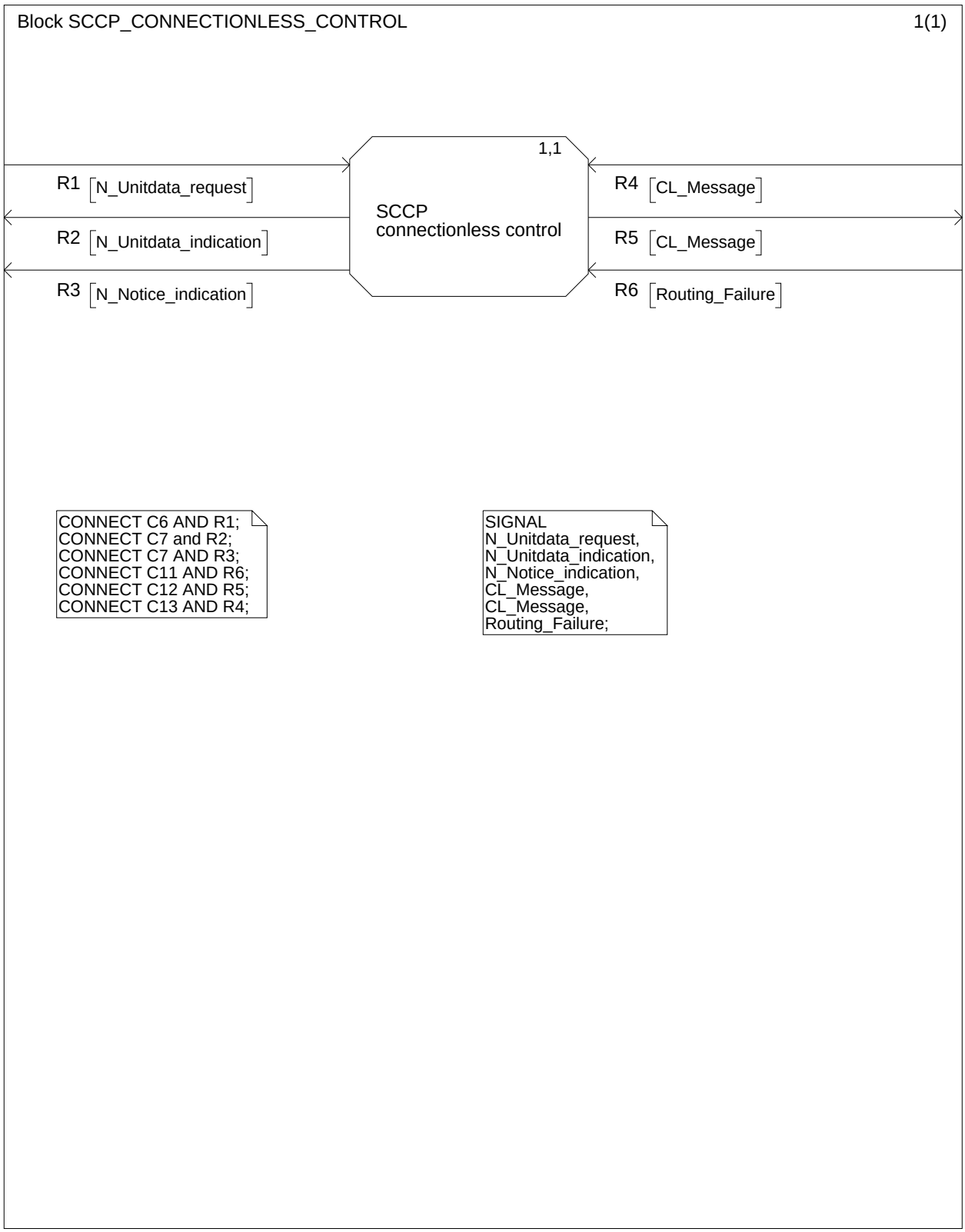

Figure ZD.2: Block diagram for SCLC

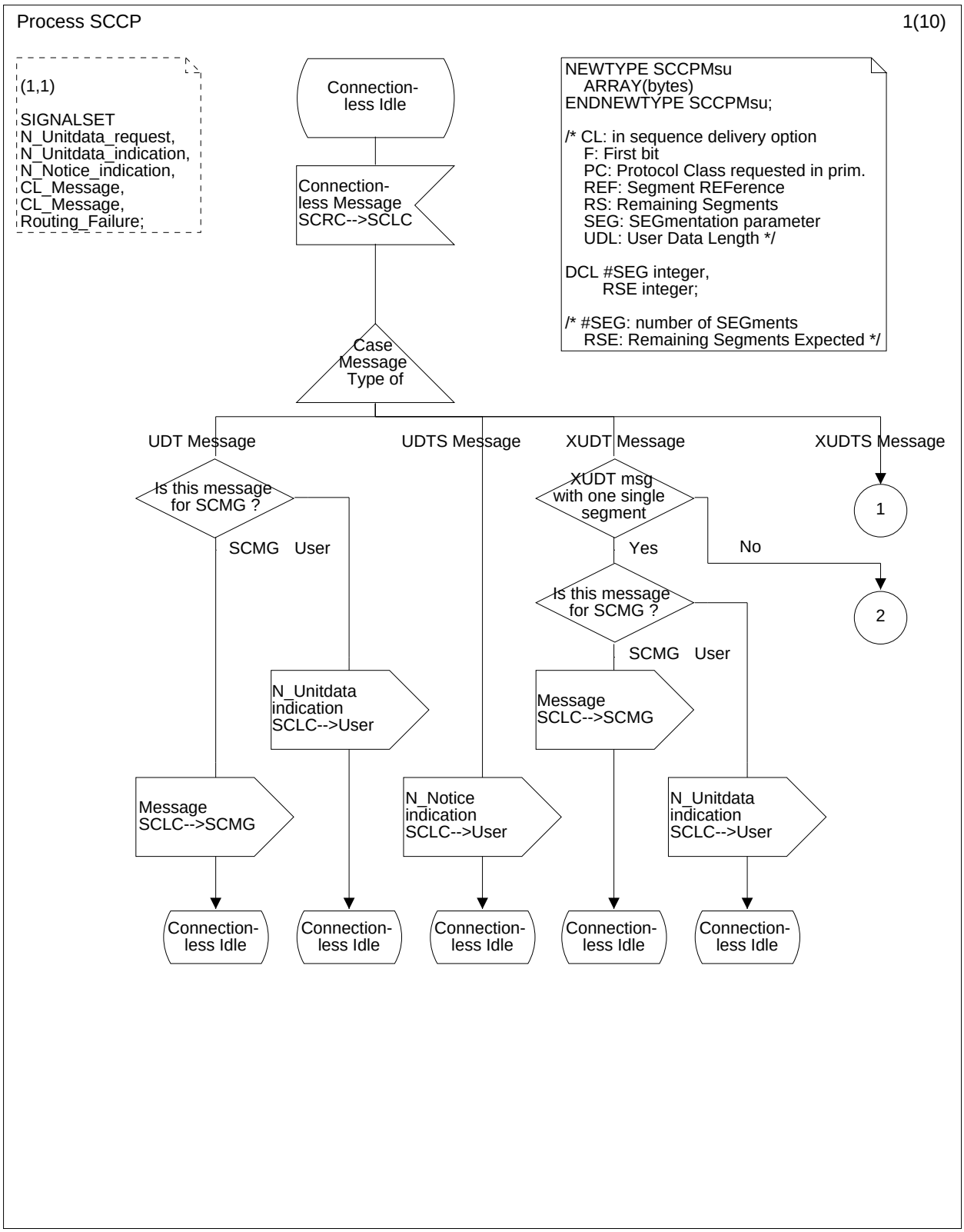

Figure ZD.3 (sheet 1 of 10): Process diagram for SCLC

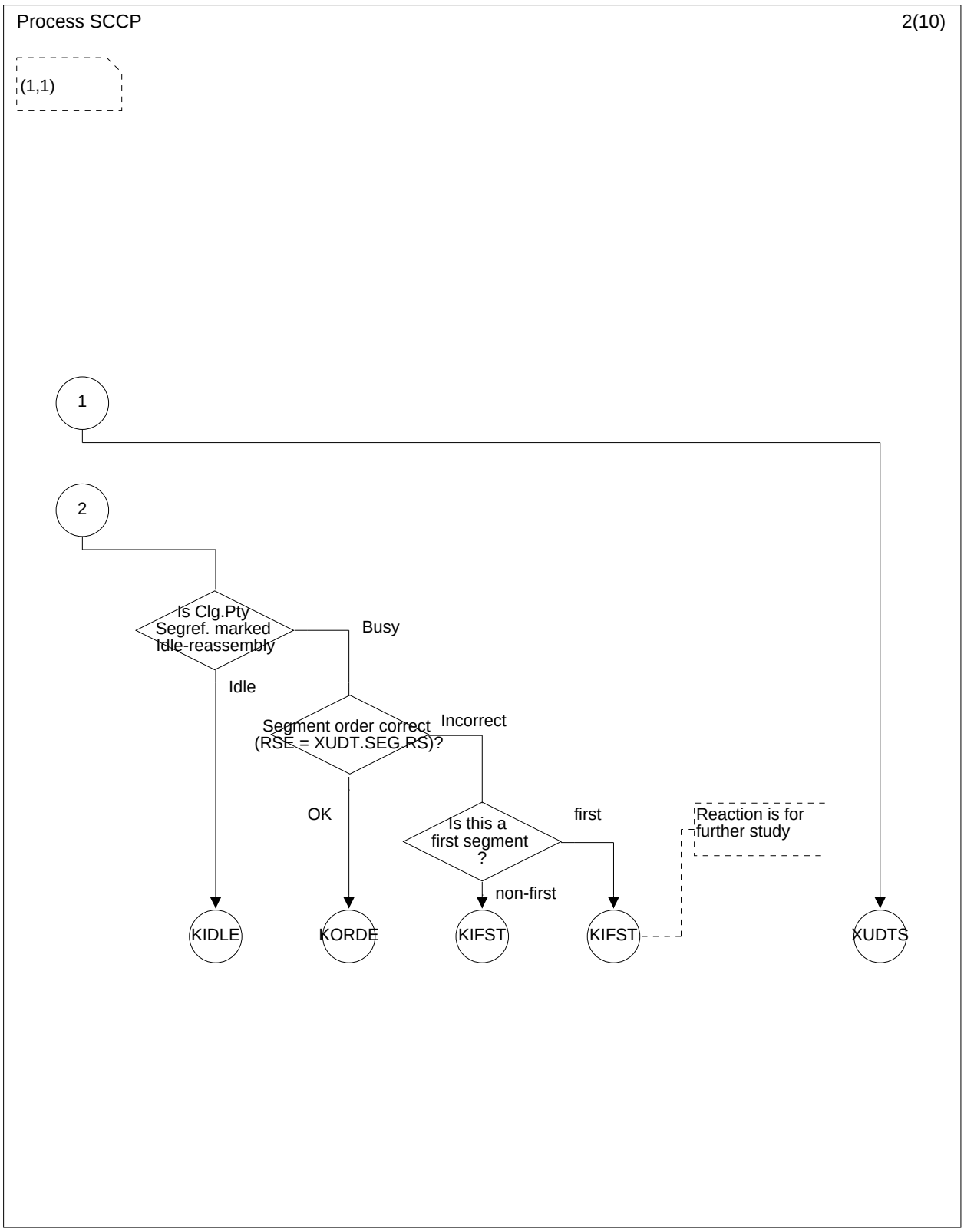

Figure ZD.3 (sheet 2 of 10): Process diagram for SCLC

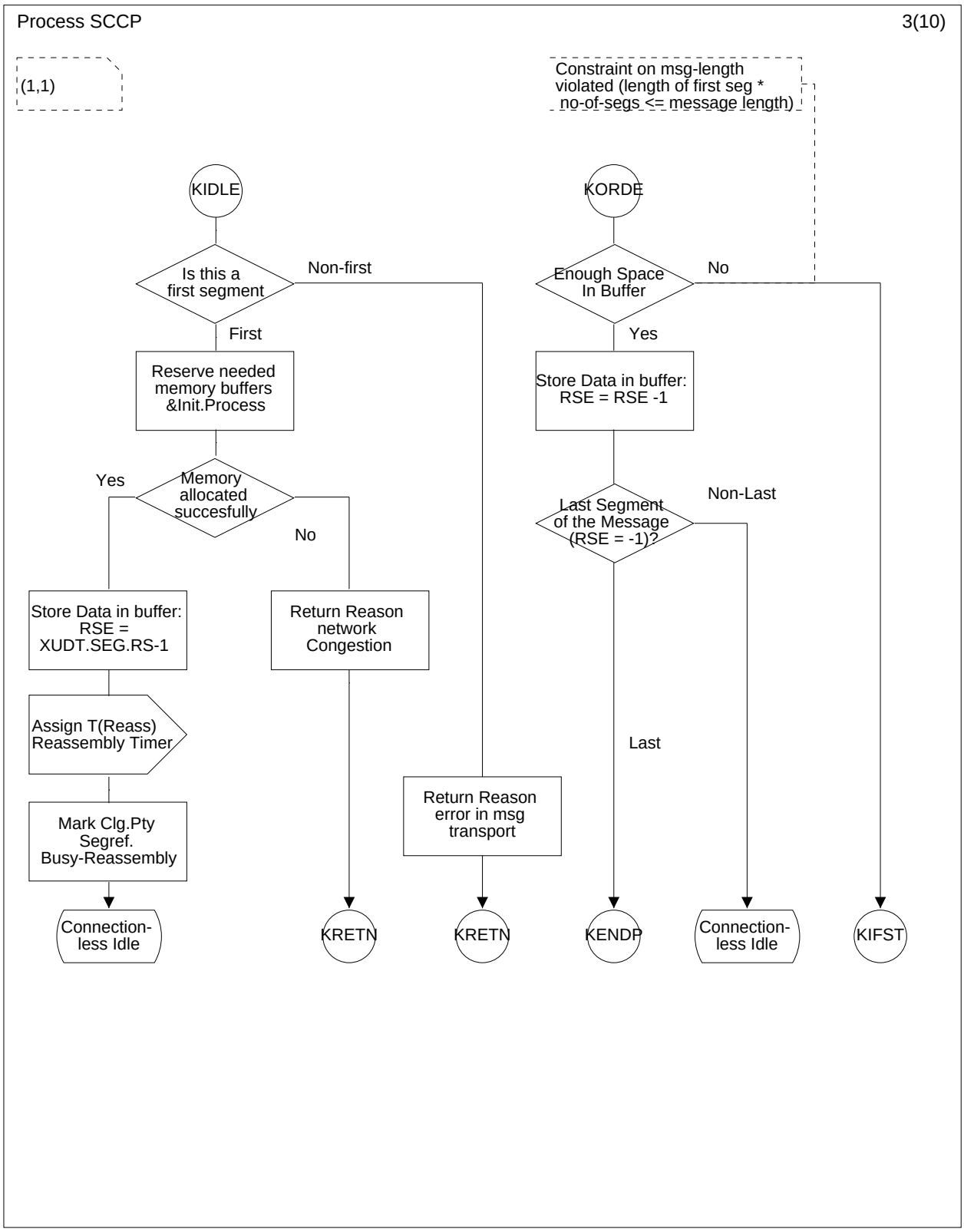

Figure ZD.3 (sheet 3 of 10): Process diagram for SCLC

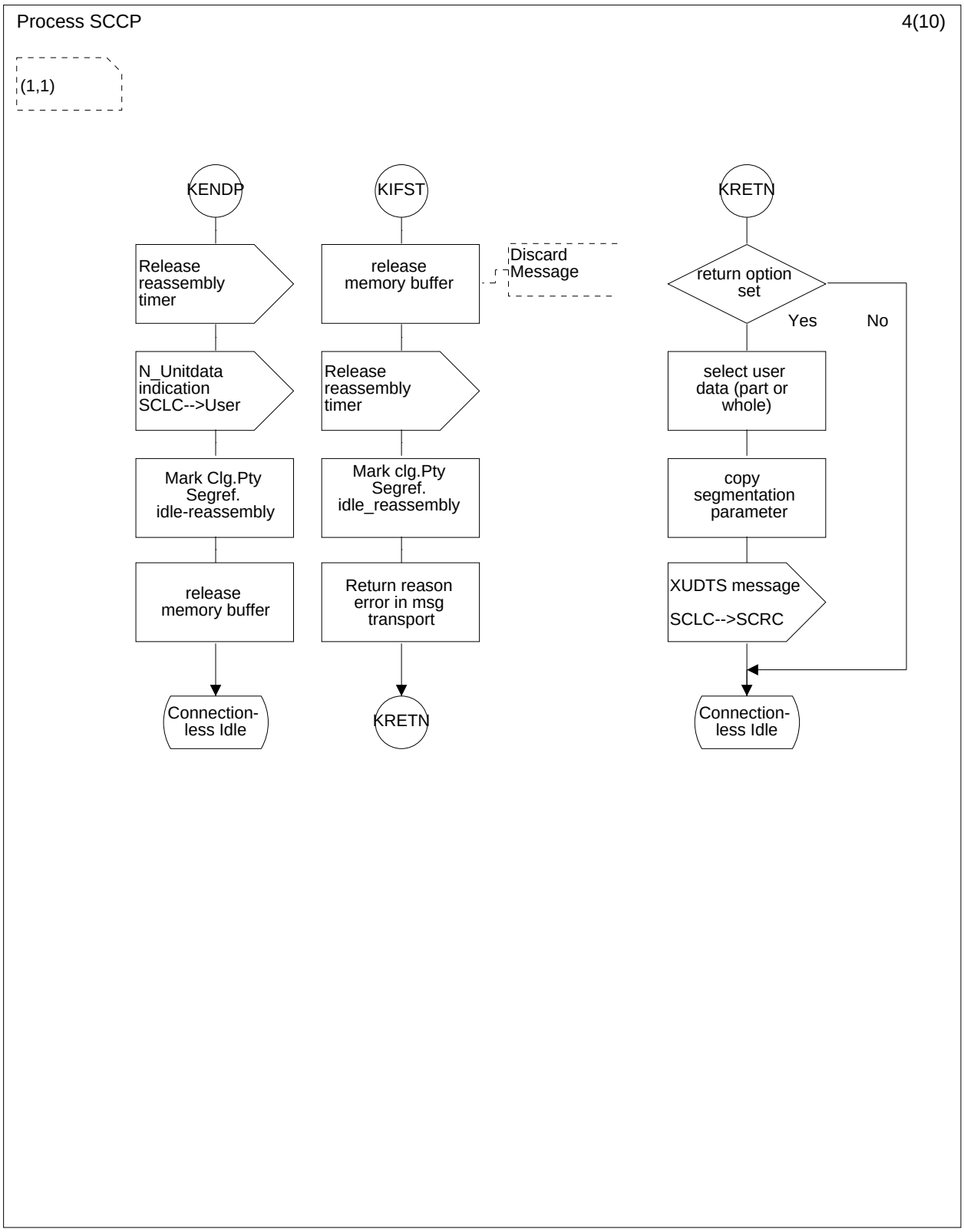

Figure ZD.3 (sheet 4 of 10): Process diagram for SCLC

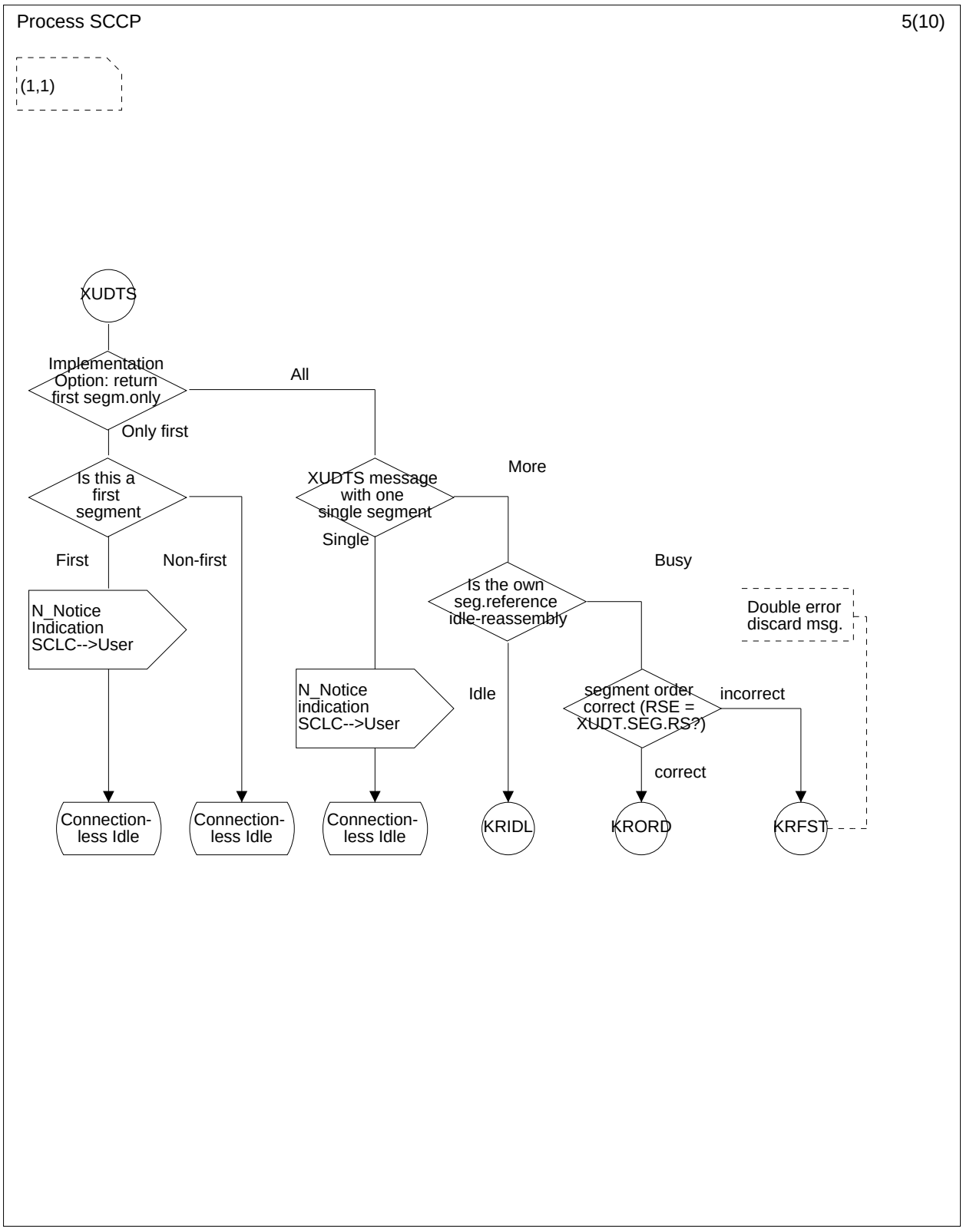

Figure ZD.3 (sheet 5 of 10): Process diagram for SCLC

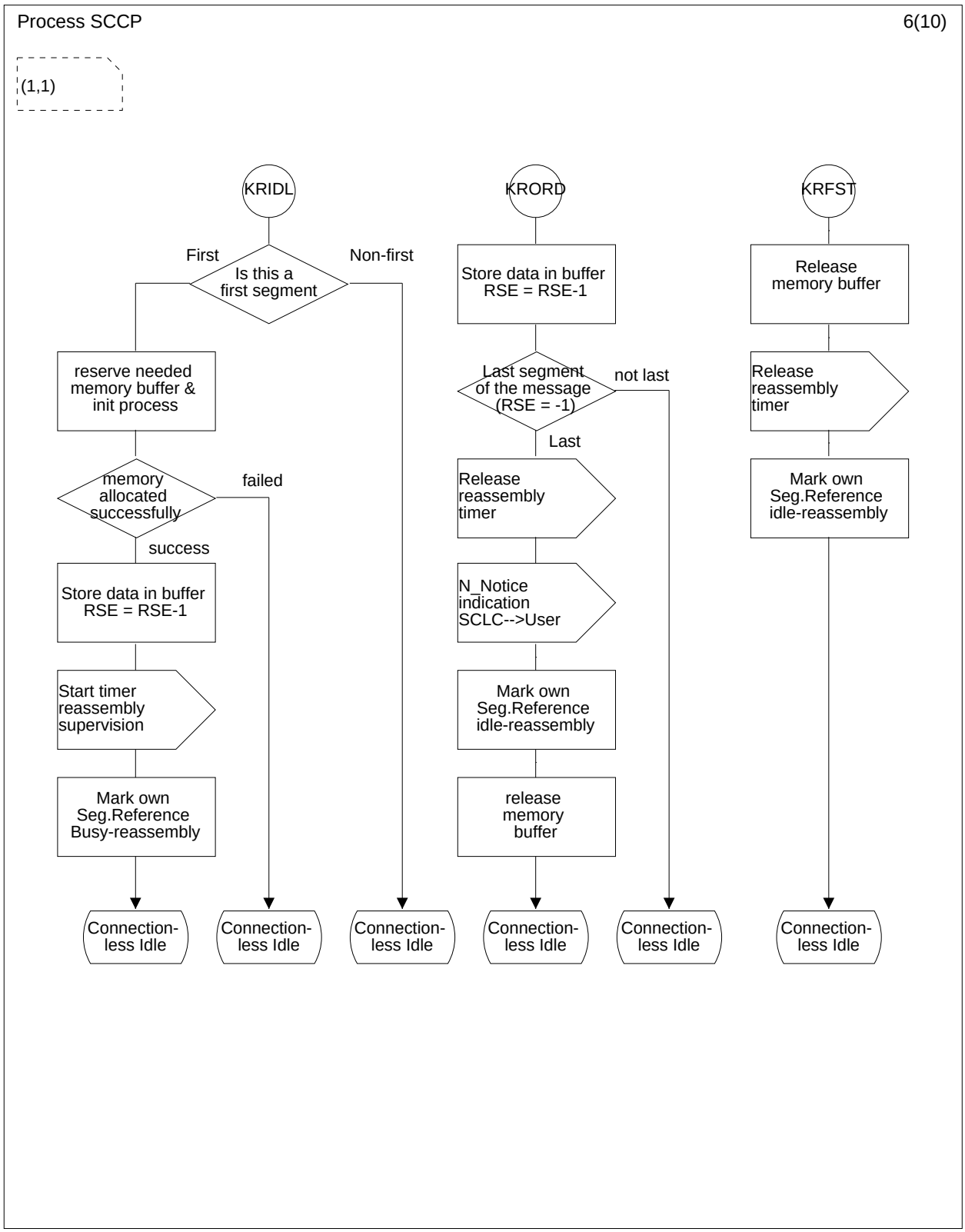

Figure ZD.3 (sheet 6 of 10): Process diagram for SCLC

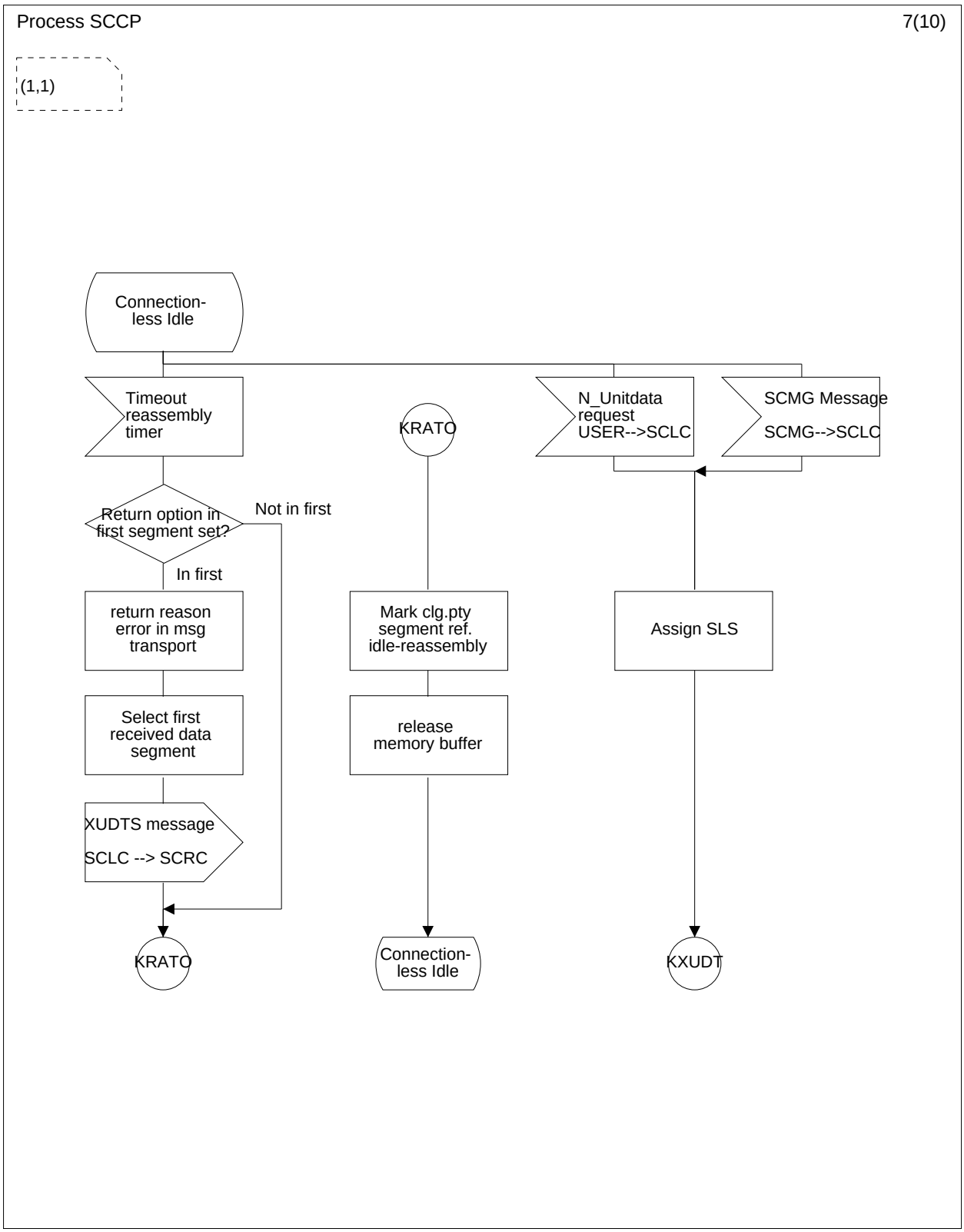

Figure ZD.3 (sheet 7 of 10): Process diagram for SCLC

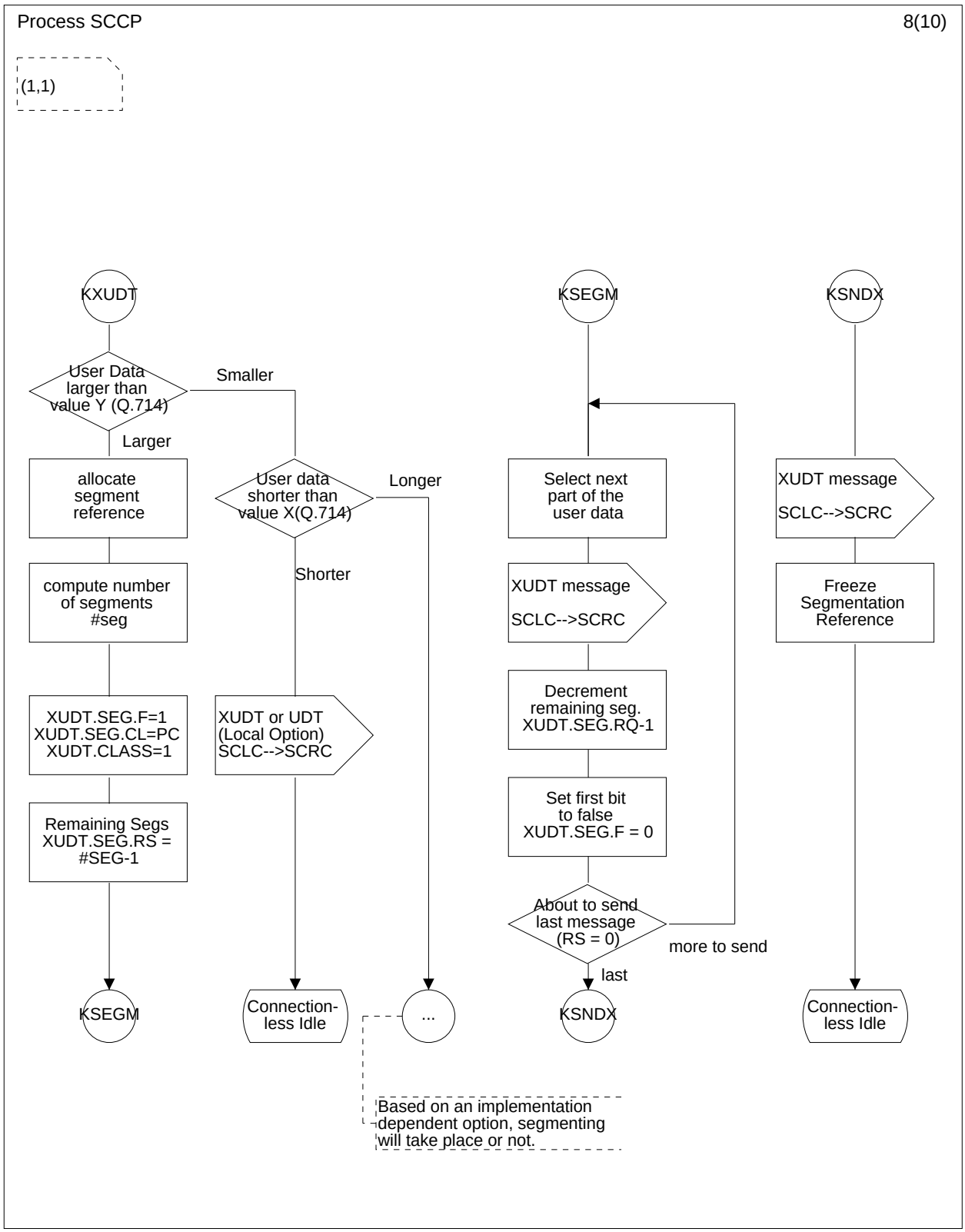

Figure ZD.3 (sheet 8 of 10): Process diagram for SCLC

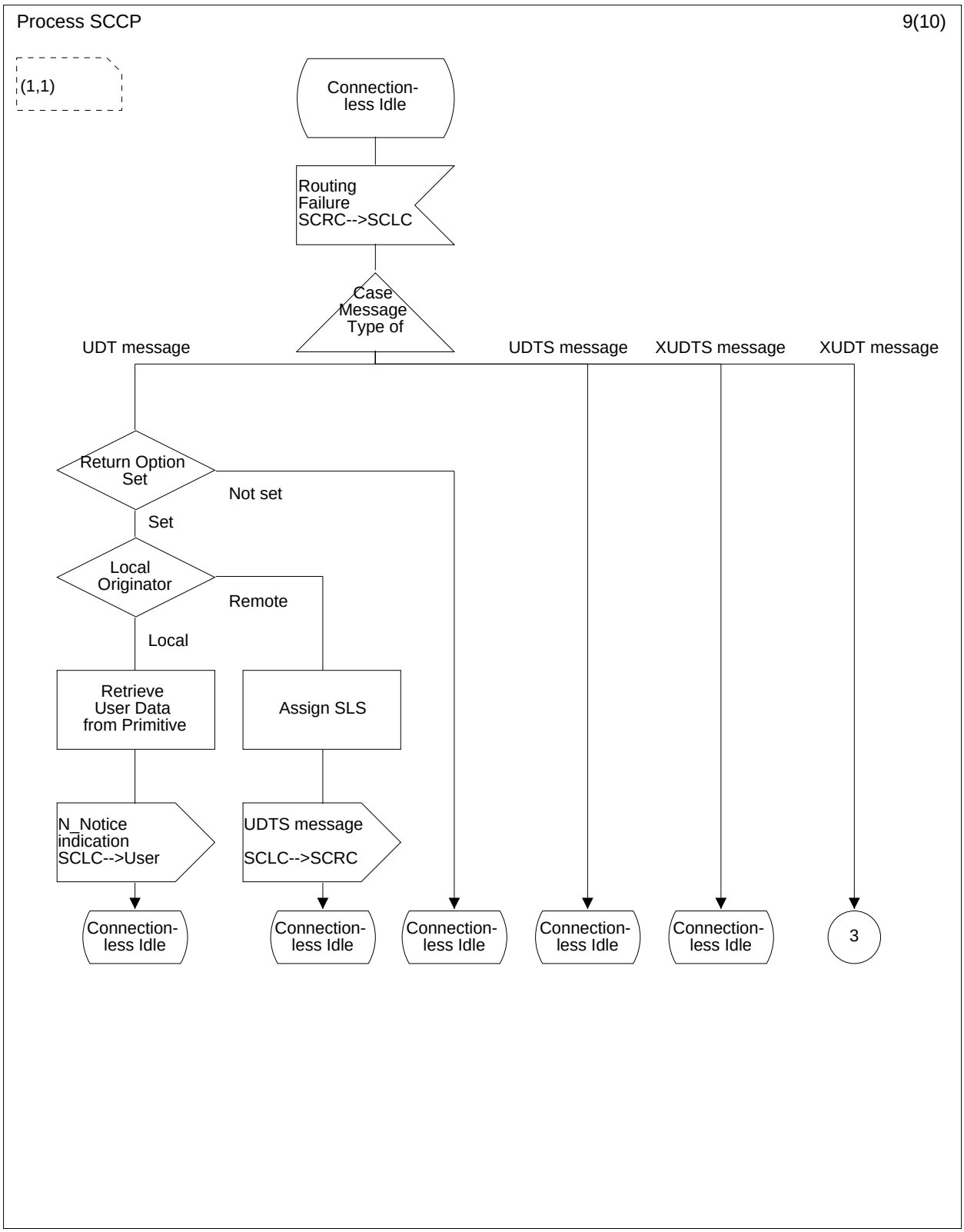

Figure ZD.3 (sheet 9 of 10): Process diagram for SCLC

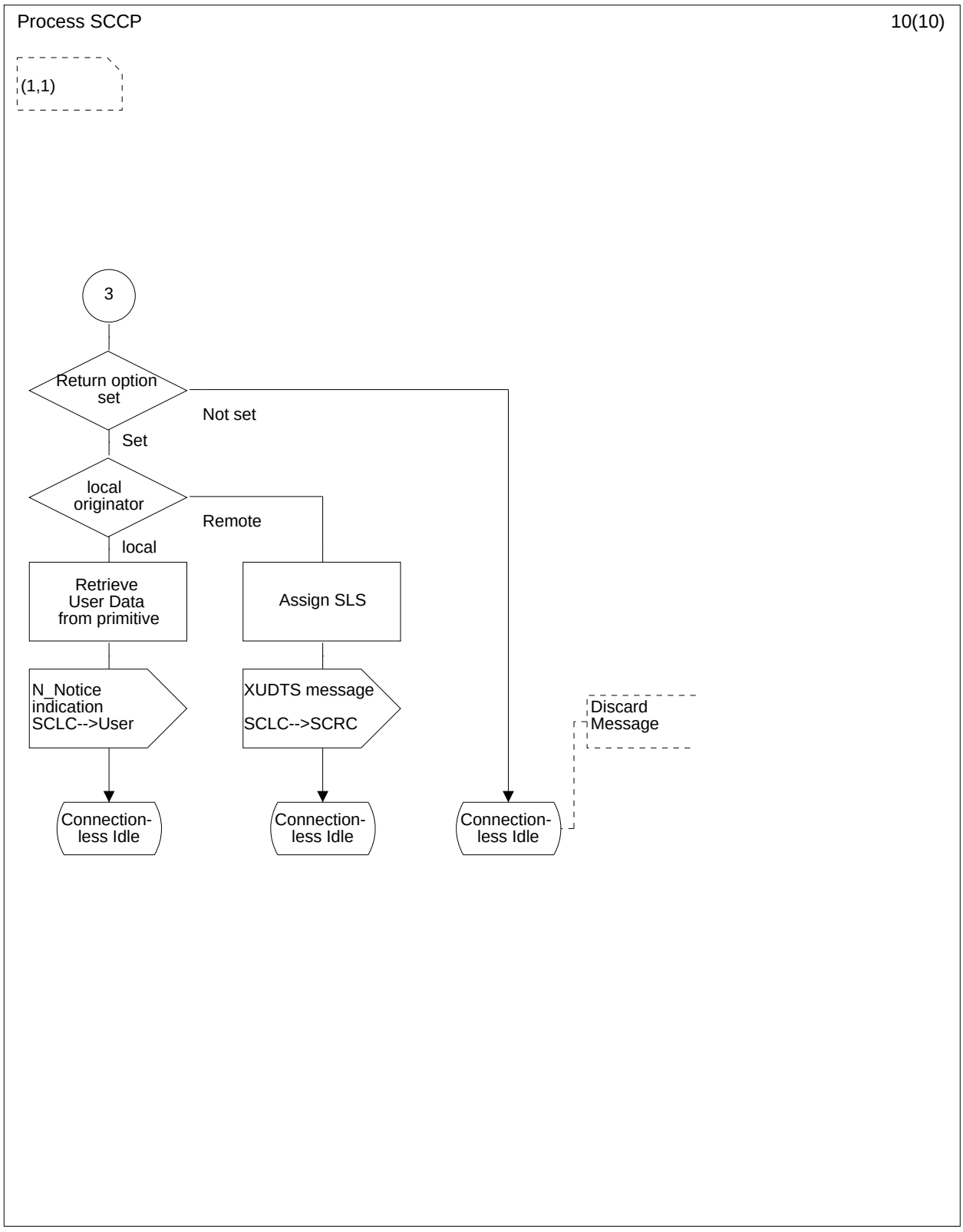

Figure ZD.3 (sheet 10 of 10): Process diagram for SCLC

Annex ZE (informative): Bibliography

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