Final draft ETSI EN 300 392-12-13 V1.2.0 (2011-11)

Terrestrial Trunked Radio (TETRA);
Voice plus Data (V+D);
Part 12: Supplementary services stage 3;
Sub-part 13: Call Completion to Busy Subscriber (CCBS)

Reference
REN/TETRA-03213

Keywords
CCBS, data, radio, speech, stage 3,
supplementary service, TETRA, V+D

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This final draft European Standard (EN) has been produced by ETSI Technical Committee Terrestrial Trunked Radio (TETRA), and is now submitted for the ETSI standards One-step Approval Procedure.

The present document is part 12, sub-part 13 of a multi-part deliverable covering Voice plus Data (V+D), as identified below:

EN 300 392-1: "General network design";

EN 300 392-2: "Air Interface (AI)";

EN 300 392-3: "Interworking at the Inter-System Interface (ISI)";

ETS 300 392-4: "Gateways basic operation";

EN 300 392-5: "Peripheral Equipment Interface (PEI)";

EN 300 392-7: "Security";

EN 300 392-9: "General requirements for supplementary services";

EN 300 392-10: "Supplementary services stage 1";

EN 300 392-11: "Supplementary services stage 2";

EN 300 392-12: "Supplementary services stage 3";

- EN 300 392-12-1: "Call Identification (CI)";
- ETS 300 392-12-2: "Call Report (CR)";
- EN 300 392-12-3: "Talking Party Identification (TPI)";
- EN 300 392-12-4: "Call Forwarding (CF)";
- ETS 300 392-12-5: "List Search Call (LSC)";
- EN 300 392-12-6: "Call Authorized by Dispatcher (CAD)";
- ETS 300 392-12-7: "Short Number Addressing (SNA)";
- EN 300 392-12-8: "Area Selection (AS)";
- ETS 300 392-12-9: "Access Priority (AP)";
- EN 300 392-12-10: "Priority Call (PC)";
- ETS 300 392-12-11: "Call Waiting (CW)";
- EN 300 392-12-12: "Call Hold (HOLD)";

EN 300 392-12-13: "Call Completion to Busy Subscriber (CCBS)";

EN 300 392-12-14: "Late Entry (LE)";

EN 300 392-12-16: "Pre-emptive Priority Call (PPC)";

EN 300 392-12-17: "Include Call (IC)";

EN 300 392-12-18: "Barring of Outgoing Calls (BOC)";

EN 300 392-12-19: "Barring of Incoming Calls (BIC)";

EN 300 392-12-20: "Discreet Listening (DL)";

EN 300 392-12-21: "Ambience Listening (AL)";

EN 300 392-12-22: "Dynamic Group Number Assignment (DGNA)";

EN 300 392-12-23: "Call Completion on No Reply (CCNR)";

ETS 300 392-12-24: "Call Retention (CRT)";

ETS 300 392-13: "SDL model of the Air Interface (AI)";

ETS 300 392-14: "Protocol Implementation Conformance Statement (PICS) proforma specification";

TS 100 392-15: "TETRA frequency bands, duplex spacings and channel numbering";

TS 100 392-16: "Network Performance Metrics";

TR 100 392-17: "TETRA V+D and DMO specifications";

TS 100 392-18: "Air interface optimized applications".

NOTE: Part 3, sub-parts 6 and 7 (Speech format implementation), part 4, sub-part 3 (Data networks gateway), part 10, sub-part 15 (Transfer of control), part 13 (SDL) and part 14 (PICS) of this multi-part deliverable are in status "historical" and are not maintained.

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

The present document specifies the stage 3 description of the Supplementary Service CCBS Call Completion on Busy Subscriber for the Terrestrial Trunked Radio (TETRA).

Call Completion on Busy Subscriber allows a calling User A MS, encountering a busy destination user B, to have the call completed when user B becomes non busy, without having to make a new call attempt.

Man-Machine Interface and charging principles are outside the scope of the present document.

The supplementary service stage 3 description is preceded by the stage 1 and the stage 2 description of the service, according to the method described in ITU-T Recommendation I.130 [i.1]. The stage 1 description specifies the service from the user's point of view. The stage 2 description identifies the functional capabilities of each SS and the information flows needed to support the supplementary service as specified in its stage 1 description. The present stage 3 description specifies the protocols at the air interface and at the various Inter-System Interfaces (ISI) to support each Supplementary Service.

NOTE: According to ITU-T Recommendation I.130 [i.1], the stage 3 description of any telecommunication service addresses the network implementation aspects. Consequently it comprises two steps: the specifications of all protocols at the various reference points involved in any of the service procedures (notably the service operation) are the first step of the stage 3 description, and the specifications of the functions of the corresponding network entities are its second step. The latter have not been provided since they can be derived from the specification of the functional entity actions in the stage 2 description.

The present document is applicable to Voice plus Data individual call or group call; the present document is neither applicable to Packet Mode of Operation nor to DMO; more specifically to the following entities:

- the MS of either the calling user or the connected user during an individual call or a group call;
- the originating Switching and Management Infrastructure (SwMI) in an individual call or a group call;
- the group controlling SwMI for a group call;
- the terminating SwMI in an individual call;
- the inter-working SwMI for an individual call.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 300 392-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General network design".

[2] ETSI EN 300 392-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

[3] ETSI EN 300 392-3-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 1: General design".

[4] ETSI EN 300 392-3-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 2: Additional Network Feature Individual Call (ANF-ISIIC)".

[5] ETSI EN 300 392-3-3: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 3: Additional Network Feature Group Call (ANF-ISIGC)".

[6] ETSI EN 300 392-3-5: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 5: Additional Network Feature for Mobility Management (ANF-ISIMM)".

[7] ETSI EN 300 392-9: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 9: General requirements for supplementary services".

[8] ETSI ETS 300 392-10-13: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 10: Supplementary services stage 1; Sub-part 13: Call completion to busy subscriber".

[9] ITU-T Recommendation X.217: "Information technology - Open Systems Interconnection - Service definition for the Association Control Service Element".

[10] ITU-T Recommendation X.219: "Remote operations: Model, notation and service definition".

[11] ITU-T Recommendation X.229: "Remote operations: Protocol specification".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ITU-T Recommendation I.130 (1988): "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN (Blue Book)".

[i.2] ITU-T Recommendation Z.100 (1993): "CCITT Specification and Description Language (SDL)".

[i.3] ECMA 185 (1997): "Private Integrated Services Network (PISN) - Specification, Functional Model and Information Flows - Call Completion Supplementary Services (CCSD), 2nd edition".

[i.4] ITU-T Recommendation I.221 (1993): "Common specific characteristics of services".

[i.5] ECMA-186 (4th edition December 2001): "Private Integrated Services Network (PISN) - Inter-Exchange Signalling Protocol - Call Completion Supplementary Services (QSIG-CC).

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Additional Network Feature (ANF): capability, over and above that of a basic service, provided by a SwMI, but not directly to a user

bearer service: type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces

busy: called user engaged in a service

NOTE: Busy is a property of a user for whom either a "network determined user busy" or "user determined user busy" condition (see clause 3.1 of ITU-T Recommendation I.221 [i.4]) exists.

call, basic call: instance of the use of a basic service

call completion: successful presentation of a previously unsuccessful Call to a destination user (user B) which occurs when the call has entered an alerting phase or has been answered

compatible MS: MS presenting the same basic TETRA class of service as the TETRA class of service requested by the calling user MS. By analogy to ISDN "compatible terminal"

free: property of a user who can accept any attempt by the SwMI to present a call to that user (i.e. allow the call to reach the alerting or answered state)

Network Determined User Busy (NDUB): network cannot allocate an additional call for the user

NOTE: If all of the appropriate user-network interface information channels are busy (channels busy) and either the network does not support the offering of additional calls beyond the number of appropriate channels, or the maximum number of such additional calls has been reached, the network will clear the call and indicate network determined user busy (see clause 3.1.4 of ITU-T Recommendation I.221 [i.4]).

path reservation: reservation of resources prior to SS-CCBS Recall in order that a connection path through the SwMI is available when User A MS accepts the SS-CCBS Recall

NOTE 1: Path Reservation would not guarantee that user B be free when User A MS accepts the SS-CCBS Recall.

NOTE 2: Due to mobility considerations, path reservation will not be used in the TETRA environment (a path reserved would have to be re-reserved each time a migration occurs).

recall timer: user A response waiting timer

NOTE: This timer specifies the length of time the network waits for a response from User A MS to a CCBS Recall.

retention timer: originating call information timer

NOTE: This timer specifies the period of time the network retains the originating call information after a valid call attempt is released.

SS-CCBS recall: indication informing User A MS that user B is no longer busy (in the case of SS-CCBS) or acceptance of this indication by User A MS will cause the call to be completed by the SwMI

SS-CCBS service duration timer: service active timer

NOTE: This timer specifies the length of time that the service is active within the network.

supplementary service: supplementary service modifies or supplements a bearer service or a tele-service

NOTE: A supplementary service cannot be offered to a customer as a standalone service. It should be offered in combination with a bearer service or a tele-service.

Switching and Management Infrastructure (SwMI): all of the TETRA equipment for a Voice plus Data (V+D) network except for subscriber terminals

NOTE: The SwMI enables subscriber terminals to communicate with each other via the SwMI

tele-service: type of telecommunications service that provides the complete capability, including terminal equipment functions, for communication between users according to agreed protocols

user A MS: specific user that originated the call and requested the supplementary service

user B: user that was initially addressed in the original call set up

user determined user busy: user rejecting a call

NOTE 1: the called user does not accept the call as he is busy.

NOTE 2: If no compatible terminal responds "positively" to the call offering but one or more compatible terminal responds "user busy", then when the response-to-call-offering time-out occurs, the network will clear the call with the indication "user determined user busy" (see clause 3.1.5 of ITU-T Recommendation I.221 [i.4])

3.2 Symbols

For the purposes of the present document, there are no additional symbols besides the symbols defined and used in ITU-T Recommendation Z.100 [i.2].

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACSE	Association Control Service Element
AE	Application Entity
ANF	Additional Network Feature
APDU	Application Protocol Data Unit
AS	Area Selection
CC	Call Control (functional entity)
CCBSI	Call Completion to Busy Subscriber Identifier
CMCE	Circuit Mode Control Entity
CPTI	Called Party Type Identifier
CR	Cancellation Reason
GSSI	Group Short Subscriber Identity
ISDN	Integrated Services Digital Network
ISI	Inter System Interface
ISSI	Individual Short Subscriber Identity
ITSI	Individual TETRA Subscriber Identity
LSC	List Search Call
MM	Mobility Management
MMI	Man-Machine Interface
MNI	Mobile Network Identity
MS	Mobile Station
PINX	Private Integrated Services Network Exchange
OSI	Open System Interconnect
PC	Priority Call
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
PISN	Private Integrated Services Network
RC	Reject Cause
RL	Request List
RO	Remote Operations
ROSE	Remote Operation Service Element
RTSE	Reliable Transport Service Element
SAP	Service Access Point
SDL	Specification and Description Language
SS	Supplementary Service

NOTE: The abbreviation SS is only used when referring to a specific supplementary service.

SSI	Short Subscriber Identity
SwMI	Switching and Management Infrastructure
TCH	Traffic CHannel
TETRA	Terrestrial Trunked Radio
TSI	TETRA Subscriber Identity
V+D	Voice Plus Data

For the purposes of the present document, the following supplementary service abbreviations apply:

AL	Ambiance Listening
AoC	Advice of Charge
AP	Access Priority
AS	Area Selection
BIC	Barring of Incoming Calls
BOC	Barring of Outgoing Calls
CAD	Call Authorized by Dispatcher
CCBS	Call Completion to Busy Subscriber
CCNR	Completion of Calls on No Reply (sometimes called Completion of Call on No Reply)
CFB	Call Forwarding on Busy
CFNRy	Call Forwarding on No Reply
CFNRc	Call Forwarding on Not Reachable
CFU	Call Forwarding Unconditional
CLIP	Calling Line Identification Presentation
CLIR	Calling/Connected Line Identification Restriction
COLP	Connected Line Identification Presentation
COLR	Connected Line Identification Restriction
CR	Call Report
CRT	Call Retention
CW	Call Waiting
DGNA	Dynamic Group Number Assignment
DL	Discreet Listening
HOLD	Call Hold
IC	Include Call
LE	Late Entry
LSC	List Search Call
PC	Priority Call
PPC	Pre-emptive Priority Call
SNA	Short Number Addressing
TPI	Talking Party Identification

4 SS-CCBS Service Description

4.1 General

Completion of Calls to Busy Subscribers (SS-CCBS) is a supplementary service which allows a calling User A MS, on encountering a busy called user B, to request that the SwMI monitors user B and indicates to User A MS when user B becomes not busy. On response by User A MS to that indication the SwMI will attempt to complete the call to user B.

These supplementary services are applicable to all basic circuit mode services defined in EN 300 392-2 [2].

4.2 SS-CCBS services offered over the TNSS-SAP

This clause describes SS-CCBS specific services offered by the Circuit Mode Control Entity (CMCE) at the Supplementary Services service access point (TNSS-SAP) of the TETRA voice plus data layer 3 service boundary in a TETRA Mobile Station (MS). The SS-CCBS service access point is a conceptual boundary in MSs.

NOTE 1: As the present document only deals with the SS-CCBS all the service primitives have been shown without a TNSS-CCBS-prefix e.g. the TNSS-CCBS-REQUEST request is shorten into a REQUEST request.

NOTE 2: As man-machine interface or User A MS applications are outside the scope of the present document the service primitives are used to define information exchange to and from the standardized part of the MS. Those primitives may be only indirectly accessible.

The SS-CCBS service primitives at the served user MS TNSS-SAP are:

- CALL-INFORMATION-RELEASE indication;
- CALL-INFORMATION-RETENTION indication;
- CANCEL request/confirm;
- CANCELLED indication;
- FAILED indication;
- LIST-CCBS request/confirm;
- RECALL request;
- RECALL-ACCEPTED request;
- REQUEST request/confirm;
- USER-B-FREE indication.

NOTE 3: FREE NOTIFICATION does not correspond to a primitive seen by the User A MS application.

NOTE 4: CANCELLATION by the network does not correspond to a primitive seen by the User A MS application.

4.2.1 CALL-INFORMATION-RELEASE indication

The CALL-INFORMATION-RELEASE indication primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP to release the call set-up parameters needed to invoke SS-CCBS after expiration of call information retention timer.

The CALL-INFORMATION-RELEASE indication primitive shall contain the SS-CCBS parameters listed in table 1.

Table 1: Parameters for the primitive CALL-INFORMATION- RELEASE indication

Parameter	Indication
TETRA Call Identifier	M

4.2.2 CALL-INFORMATION-RETENTION indication

The CALL-INFORMATION-RETENTION indication primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP to indicate the initial call set-up parameters needed to invoke SS-CCBS.

The CALL-INFORMATION-RETENTION indication primitive shall contain the SS-CCBS parameters listed in table 2.

NOTE: The Call-Information-Retention indication does not indicate the details of the invoked supplementary services which are assumed to be kept by the originating SwMI.

Table 2: Parameters for the primitive CALL-INFORMATION-RETENTION indication

Parameter	Indication
TETRA Call Identifier	M
Basic Service Information	M
Area Selection	M
Call Priority	M
SS-CLIR/SS-COLR invoked for that call	M
Called Party Identity	M

4.2.3 CANCEL request

The CANCEL request primitive shall be sent by the User A MS application to the MS CMCE over TNSS-SAP to request cancellation of a CCBS request.

The CANCEL request primitive shall contain the SS-CCBS parameters listed in table 3.

Table 3: Parameters for the primitive CANCEL request

Parameter	Request
CCBS Identifier (CCBSI)	M

4.2.4 CANCEL confirm

The CANCEL confirm primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP to inform the User A MS application of the result of the CANCEL request result.

The CANCEL confirm primitive shall contain the SS-CCBS parameters listed in table 4.

Table 4: Parameters for the primitive CANCEL response

Parameter	Confirm
Cancellation Result	M
CCBS Identifier (CCBSI)	M

4.2.5 CANCELLED indication

The CANCELLED indication primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP to inform the User A MS application that the CCBS request has been canceled with a reason for the cancellation.

The CANCELLED indication primitive shall contain the SS-CCBS parameters listed in table 5.

Table 5: Parameters for the primitive CANCELLED indication

Parameter	Indication
Cancellation Reason (CR)	M
CCBS Identifier (CCBSI)	M

4.2.6 FAILED indication

The FAILED indication primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP to indicate the failure of SS-CCBS invocation and the reason for the failure.

The FAILED indication primitive shall contain the SS-CCBS parameters listed in table 6.

Table 6: Parameters for the primitive FAILED indication

Parameter	Indication
CCBS Identifier (CCBSI)	M
Failure Cause	M
Request Maintained	M

4.2.7 LIST-CCBS request

The LIST-CCBS request primitive shall be sent by the User A MS application to the MS CMCE over TNSS-SAP as a result of SS-CCBS operation. The LIST-CCBS request primitive shall contain the SS-CCBS parameters listed in table 7.

Table 7: Parameters for the primitive LIST-CCBS request

Parameter	Request
Format of list	M

4.2.8 LIST-CCBS confirm

The LIST-CCBS confirm primitive shall be sent to the User A MS application by the MS CMCE over TNSS-SAP to inform it of the result of a previous LIST-CCBS request.

The LIST-CCBS confirm primitive shall contain the SS-CCBS parameters listed in table 8.

Table 8: Parameters for the primitive LIST-CCBS confirm

Parameter	Confirm
Reject Cause (RC)	O (note 1)
List Request (RL)	O (note 2)
NOTE 1: This parameter will be included if the CCBS LIST request reply indicates rejection and indicates reason for rejection. NOTE 2: This service element will be included if the CCBS-LIST request response indicates successful list request and will include a list of TETRA numbers on which User A MS has invoked SS-CCBS.	

4.2.9 RECALL request

The RECALL request primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP to indicate that user B has become non busy and that the calling User A MS has now the possibility of calling user B.

The RECALL request primitive shall contain the SS-CCBS parameters listed in table 9.

Table 9: Parameters for the primitive RECALL request

Parameter	Request
CCBS Identifier (CCBSI)	M

4.2.10 RECALL-ACCEPTED request

The RECALL-ACCEPTED request primitive shall be sent by the User A MS application to the MS CMCE over TNSS-SAP to indicate that User A MS has accepted the RECALL request and that the calling User A MS is now requesting calling of user B. This RECALL-ACCEPTED request primitive is equivalent to a basic call U-SETUP primitive with the addition of a CCBSI.

The RECALL-ACCEPTED request primitive shall contain the SS-CCBS parameters listed in table 10.

Table 10: Parameters for the primitive RECALL-ACCEPTED request

Parameter	Request
CCBS Identifier (CCBSI)	M

4.2.11 REQUEST request

The REQUEST request primitive shall be sent by the User A MS application to the MS CMCE over TNSS-SAP to request Call Completion on Busy Subscriber.

If the previous request has been addressed to the originating SwMI for identical parameters, that SwMI shall accept the new request.

The REQUEST request primitive shall contain the SS-CCBS parameters listed in table 11.

Table 11: Parameters for the primitive REQUEST request

Parameter	Request
TETRA Call Reference	M

4.2.12 REQUEST confirm

The REQUEST confirm primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP to report on the result of the REQUEST request of SS-CCBS.

The REQUEST confirm shall support one CCBS identity.

The REQUEST confirm primitive shall contain the SS-CCBS parameters listed in table 12.

Table 12: Parameters for the primitive REQUEST confirm

Parameter	Confirm
CCBS Identifier (CCBSI)	M
CCBS Request Result	M
Reject Cause	C (note)
NOTE: Conditional on CCBS Request result.	

4.2.13 USER-B-FREE indication

The USER-B-FREE indication primitive shall be sent by the MS CMCE to the User A MS application over TNSS-SAP, in the case where User A MS is known to be busy, to indicate that user B has become non busy and that the calling User A MS has now the possibility of calling user B.

The USER-B-FREE indication primitive shall contain the SS-CCBS parameters listed in table 13.

Table 13: Parameters for the primitive USER-B-FREE indication

Parameter	Indication
CCBS Identifier (CCBSI)	M

4.3 Parameter description

- Area Selection
- Basic Service
- Call Priority:
  - low priority;
  - high priority;
  - emergency priority.

The default value for that parameter shall be the same level as the priority level of the original call:

- Called Party Identity;
- Calling Party Identity;
- Cancellation Result;

- CCBS Identifier (CCBSI):
  - 000 dummy;
  - 001 to 101 normal values;
  - 110 last value (cancel);
  - 111 all values (cancel).
- CCBS REQUEST result:
  - unsuccessful request;
  - successful request.
- Failure Cause:
  - Already accepted;
  - Call failure reason not busy;
  - Failure to match;
  - Incompatible basic service;
  - Inter-working with a network that does not support SS-CCBS;
  - Invalid CCBSI reference;
  - Invalid PDU contents;
  - Lack of resources at terminating SwMI;
  - Lack of resources at User A MS;
  - Maximum number of invocations exceeded locally;
  - Maximum number of invocations exceeded remotely;
  - Network congestion;
  - No invoked SS-CCBS requests exist;
  - Not ready for call;
  - Other long term denial;
  - Other short term denial;
  - Rejected for any reason;
  - Signaling Connection failed;
  - SS-CCBS not provided locally;
  - SS-CCBS not provided remotely;
  - Supplementary service interaction not allowed;
  - Unrecognized operation;
  - User A MS busy;
  - User B busy (again);
  - User not subscribed to service;
  - Wrong TETRA Call Identifier.

- List Request:
  - number of CCBS invocations;
  - list of CCBSI;
  - detailed list with CCBSI, called party identity and basic service.
- List Request result:
  - unsuccessful request;
  - successful request.

If the list request has been unsuccessful, one of the following reasons shall be indicated:

- rejected for any reason;
- not an Authorized user;
- no outstanding CCBS request.

If the list request has been successful, the result will list by chronological order with the CCBSI the outstanding CCBS requests:

- Recall Destination Identity:
  - same parameters as calling party identity.
- Reject Cause (RC):
  - see failure causes above.
- Request Maintained:
  - request maintained;
  - request not maintained.
- SS-CLIR invoked for that call:
  - SS-CLIR invoked for initial call;
  - SS-CLIR not invoked for initial call.
- TETRA Call Identifier:
  - See EN 300 392-2 [2], clause 14.

5 Signaling protocol for the support of SS-CCBS

5.1 SS-CCBS Operational requirements

5.1.1 Requirements on the served user MS

The served user MS shall comply with the requirements in clause 14 of EN 300 392-2 [2] which apply to the tele and bearer services which it supports. In addition, it shall comply with the relevant call related requirements in clauses 7 and 11 of EN 300 392-9 [7].

5.1.2 Requirements on the Originating SwMI

That SwMI shall support the served user MS complying with the requirements for individual calls set in clause 4.5.1.

It shall also support the served user MS complying with the requirements for group calls set in clause 4.5.1 if it is different from the group controlling SwMI.

If the call is over the ISI, the originating SwMI shall comply with the corresponding ISI requirements, set in EN 300 392-3-2 [4], for individual calls and in EN 300 392-3-3 [5], for group calls. It shall also comply with the relevant call related in clauses 9 to 11 of EN 300 392-9 [7].

5.1.3 Requirements on the Terminating SwMI

The terminating SwMI shall support the incoming individual call set-up and release as specified in EN 300 392-2 [2].

Generic procedures for the call related control of supplementary services, as specified in EN 300 392-9 [7] shall apply. The generic procedures for the call independent control (connection oriented) of supplementary services as specified in EN 300 392-9 [7] shall apply.

If the call is over the ISI, the terminating SwMI shall comply with the corresponding ISI requirements, set in EN 300 392-3-2 [4], for individual calls and in EN 300 392-3-3 [5], for group calls. It shall also comply with the relevant call related requirements in clauses 9 to 11 of EN 300 392-9 [7].

5.1.4 Requirements on a Participating SwMI

There are no particular requirements on a participating SwMI besides those of basic call establishment and call clearing at a participating SwMI.

5.1.5 Requirements on the Group Controlling SwMI

If the served user MS is registered in the group controlling SwMI, that SwMI shall support this MS complying with the requirements for participating in a group call set in clause 14 of EN 300 392-2 [2]. This SwMI shall also comply with the relevant call related requirements in clauses 7 to 11 of EN 300 392-9 [7].

If the served user MSs is not registered in the group controlling SwMI, that SwMI shall comply with the ISI requirements necessary to support group calls, set in EN 300 392-3-3 [5]. It shall also comply with the relevant call related requirements in clauses 9 to 11 of EN 300 392-9 [7].

5.2 SS-CCBS Coding Requirements

5.2.1 SS-CCBS PDUs

The information contained in the following description tables correspond to the following key:

- Length: length of the sub-argument in bits;
- Type: element type (1, 2 or 3) described in clause 14.7 of EN 300 392-2 [2];
- C/O/M: conditional/optional/mandatory;
- Remark: comment or reference to note(s).

5.2.1.1 CALL-INFORMATION-RELEASE PDU

The CALL-INFORMATION-RELEASE PDU is sent by the originating SwMI to User A MS application to indicate that call information retention can now be released. The normal occurrence of this PDU will be the case of User A MS not wishing to invoke SS-CCBS or expiration of the T4 timer.

CALL-INFORMATION-RELEASE PDU shall contain the SS-CCBS information elements described in table 14.

Table 14: CALL-INFORMATION-RELEASE PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		CALL-INFORMATION-RELEASE
TETRA Call Identifier	14	1	M		

5.2.1.2 CALL-INFORMATION-RETENTION PDU

The CALL-INFORMATION-RETENTION PDU is sent by the originating SwMI to the served user MS to initiate possible invocation of CCBS when user B is found to be busy and to retain all basic call related parameters for that CCBS later invocation. The originating SwMI expects a call set-up with CCBSI as a response to that CALL INFORMATION RETENTION PDU.

CALL-INFORMATION-RETENTION PDU shall contain the SS-CCBS information elements described in table 15.

Table 15: CALL-INFORMATION-RETENTION PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		CALL-INFORMATION-RETENTION
TETRA Call Identifier	14	1	M		
Area Selection	4	1	M		
Priority	4	1	M		
SS-CLIR/COLR invoked	2	1	M		
Basic Service Information	8	2	M		
Called Party SSI	24	1	M		note
Called Party Extension	24	1	M		
NOTE: User B present address; all elements of identity are mandatory to keep track of mobility; Called Party Type Identifier is not needed since full ITSI is always used.					

5.2.1.3 CANCEL PDU

The CANCEL PDU may be sent by the served user to the originating SwMI to cancel the CCBS-REQUEST. The served user expects a CANCEL ACK PDU as a confirm.

CANCEL PDU shall contain the SS-CCBS information elements described in table 16.

Table 16: CANCEL PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		CANCEL
CCBSI	3	1	M		note
NOTE: The value CCBSI 110_2 beyond the value of 5 will correspond to the cancellation of the last request (in chronological order); the value CCBSI 111_2 will correspond to the cancellation of all outstanding requests.					

NOTE: In the above PDU, there is no need to indicate the basic service information since the CCBS identifier will correspond to a unique combination of User A MS, User B and basic service information.

5.2.1.4 CANCEL ACK PDU

The CANCEL ACK PDU may be sent by the originating SwMI to the served user to confirm the cancellation of the CCBS-REQUEST. The served user expects a reason code in the case its request is rejected and a confirm that the cancellation has occurred in the other case.

The CANCEL ACK PDU shall contain the SS-CCBS information elements described in table 17.

Table 17: CANCEL ACK PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		CANCEL ACK
CCBSI	3	1	M		
Cancellation Result	1	1	M		
Reject Cause	5	1	C		note
NOTE: Conditional on unsuccessful cancellation result; if cancellation successful no information element needs to be provided.					

NOTE: In the above PDU, there is no need to indicate the basic service information since the combination of CCBS identifier and User A MS address will correspond to a unique combination of User A MS, User B and basic service information.

5.2.1.5 CANCELLATION PDU

The CANCELLATION PDU may be sent by the originating SwMI to the terminating SwMI to cancel the CCBS-REQUEST.

CANCELLATION PDU shall contain the SS-CCBS information elements described in table 18.

Table 18: CANCELLATION PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		CANCELLATION
CCBSI	3	1	M		notes 1, 3
Calling Party SSI	24	1	M		note 2
Calling Party Extension	24	1	M		User A MS MNI
Called Party SSI	24	1	M		note 2
Called Party Extension	24	1	M		User B MNI if known.
Cancellation Cause	3	1	M		
NOTE 1: The value CCBSI 111_2 will correspond to the cancellation of all outstanding requests. NOTE 2: Users A and B present addresses; all elements of identity are mandatory to keep track of mobility; Called/Calling Party Type Identifier is not included since full ITSI is always used. NOTE 3: In the above PDU, there is no need to indicate the basic service information since the combination of CCBS identifier and User A MS full ITSI will correspond to a unique combination of User A MS, User B and basic service information.					

5.2.1.6 CANCELLED PDU

The CANCELLED PDU may be sent by the originating SwMI to the served User to indicate that cancellation of the CCBS-REQUEST by the network has occurred. The served user expects a reason cause for the network defined cancellation. This CANCELLED PDU is not the confirm of the CANCEL PDU.

CANCELLED PDU shall contain the SS-CCBS information elements described in table 19.

Table 19: CANCELLED PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		CANCELLED
CCBSI	3	1	M		note
Cancellation Cause	3	1	M		
NOTE: In this PDU, there is no need to indicate the basic service information since the combination of CCBS identifier and User A MS address identifies uniquely the basic call setup parameters including basic service.					

5.2.1.7 CCBSI PDU

The CCBSI PDU shall be sent by the served user MS to associate the TETRA SETUP corresponding to the RECALL-ACCEPTED with the CCBS Identifier. The same PDU will also be used to identify the TETRA ISI SETUP with the value of CCBSI. The CCBSI PDU may contain the User A MS associated CCBS identifier; the same PDU format may also be used to carry the user B associated CCBS identifier. This CCBSI PDU will be contained within the Facility field of the U-SETUP at the air interface.

CCBSI PDU shall contain the SS-CCBS information elements described in table 20.

Table 20: CCBSI PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		CCBSI
CCBSI	3	1	M		notes 1 and 2
NOTE 1: This information element is always associated to a calling User A MS full ITSI for ISI. NOTE 2: This information element need not be associated to a calling User A MS full ITSI in the case of an Air Interface call related or call unrelated exchange.					

5.2.1.8 FAILED PDU

The FAILED PDU may be sent by the originating SwMI to the served user to indicate that SS-CCBS has failed subsequent to recall and to indicate the reason for the failure.

FAILED PDU shall contain the SS-CCBS information elements described in table 21.

Table 21: FAILED PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		FAILED
CCBSI	3	1	M		
Failure Cause	3	1	M		
Request Maintained	1	1	M		note
NOTE: It is assumed that in case of TETRA, the request for CCBS is maintained until either completion of the call or cancellation by user or by network of SS-CCBS.					

NOTE: In the above PDU, there is no need to indicate the basic service information since the CCBS identifier will correspond to a unique combination of User A MS, User B and basic service information.

5.2.1.9 FREE-NOTIFICATION PDU

FREE-NOTIFICATION PDU shall be sent from the terminating SwMI to the originating SwMI to indicate that user B has become non busy.

FREE-NOTIFICATION PDU shall contain the SS-CCBS information elements described in table 22.

Table 22: FREE-NOTIFICATION PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		FREE-NOTIFICATION
CCBSI	3	1	M		note 2
Calling Party SSI	24	1	M		
Calling Party Extension	24	1	M		
Called Party SSI	24	1	M		
Called Party Extension	24	1	M		Includes User B MNI
NOTE 1: Users A and B full ITSIs; all elements of identity are mandatory to keep track of mobility; Calling/Called Party Type Identifier is not included since full ITSI is always used. NOTE 2: In the above PDU, there is no need to indicate the basic service information since the combination of CCBS identifier and User A MS address will correspond to a unique combination of User A MS, User B and basic service information.					

5.2.1.10 LIST PDU

The LIST PDU may be sent by the served User to the originating SwMI to request the list of his outstanding CCBS requests. The served user expects a LIST ACK PDU as a confirm of the LIST request, from the network.

LIST PDU shall contain the SS-CCBS information elements described in table 23.

Table 23: LIST PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		LIST
List Request	2	1	C		note
NOTE: It indicates the format under which the list is to be presented.					

5.2.1.11 LIST ACK PDU

The LIST ACK PDU may be sent by the originating SwMI to the served user to reply to the request for the list of outstanding CCBS requests.

LIST ACK PDU shall contain the SS-CCBS information elements described in table 24.

Table 24: LIST ACK PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		LIST ACK
Accept/Reject	1	1	M		
Reject Cause	5	1	C		note 1
Length of CCBS List	3	1	C		notes 2 and 7
List Request	2	1	C		notes 2 and 3
Number of CCBS requests	3	1	C		note 4
CCBSI	3	1	C		notes 5 and 6

NOTE 1: This conditional element will be included if the LIST is rejected (as defined by the bit accept/reject) and will indicate the reason for rejection; otherwise, it will be omitted.
NOTE 2: This conditional element will be included if the LIST is accepted.
NOTE 3: It indicates the format under which the list is presented.
NOTE 4: This conditional element will be included if the LIST is accepted and if the list request format indicates to present only the number of outstanding CCBS requests.
NOTE 5: This conditional element will be included if the LIST request is accepted and if the list request format indicates to present either the list of CCBSI or the full details of the list; it will be repeated in series until the number of CCBS request is reached in the following way CCBSI(1), CCBSI(2), …/…, CCBSI(n) where n is the length of CCBS list.
NOTE 6: This conditional element will be included if the LIST request is accepted and if the list request format indicates to present the full details of the list; it will be repeated in series until the number of CCBS request is reached in the following way CCBSI(1), Called Party SSI(1), Called Party Extension (1), CCBSI(2), Called Party SSI(2), Called Party Extension (2), …/…, CCBSI(n), Called Party SSI(n), Called Party Extension(n) where n is the number of CCBS list.
NOTE 7: It gives the number of elements in the list.

5.2.1.12 MONITOR PDU

The MONITOR PDU shall be sent by the originating SwMI to the terminating SwMI to either initiate or re-initiate monitoring by terminating SwMI for free user B which was found busy at the first occurrence of the call.

MONITOR PDU shall contain the SS-CCBS information elements described in table 25.

Table 25: MONITOR PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		MONITOR
CCBSI	3	1	M		
Calling Party SSI	24	1	M		
Calling Party Extension	24	1	M		
Called Party SSI	24	1	M		
Called Party Extension	24	1	M		Includes User B MNI
Call Priority	4	1	M		
Basic Service Information	8	2	M		
Retain Capability	2	1	M		Always set to retain in the case of TETRA call, note 2

NOTE 1: Users A and B present addresses; all elements of identity are mandatory to keep track of mobility; Calling/Called Party Type Identifier is not needed since full ITSI is always used.
NOTE 2: May have different values for inter-working.

5.2.1.13 MONITOR ACK PDU

The MONITOR ACK PDU shall be sent by the terminating SwMI to the originating SwMI to reply to either initiation or re-initiation of monitoring by terminating SwMI for free user B which was found busy at the first occurrence of the call. This response indicates only that the MONITOR PDU has been correctly received with the proper parameters and has been registered by the terminating SwMI. It does not report on the actual status of user B.

MONITOR ACK PDU shall contain the SS-CCBS information elements described in table 26.

Table 26: MONITOR ACK PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		MONITOR ACK
CCBSI	3	1	M		
Calling Party SSI	24	1	M		
Calling Party Extension	24	1	M		Includes User A MS MNI
Called Party SSI	24	1	M		
Called Party Extension	24	1	M		Includes User B MNI
Accept/Reject	1	1	M		
Reject Cause	5	1	C		note 3
Call Priority	4	1	M		note 4
Basic Service Information	8	2	M		
Area Selection	4	1	M		note 4
Retain Capability	2	1	O		Always set to retain in the case of TETRA call, note 2

NOTE 1: Users A and B addresses; all elements of identity are mandatory to keep track of mobility; Called/Calling Party Type Identifier is not needed since full ITSIs are always used.
NOTE 2: May be used in the case of inter-working.
NOTE 3: Conditional on MONITOR reject; will indicate cause for rejections among which:
- limits of requests reached for user B;
- CCBS not supported;
- either User A MS has requested CCBS with a different basic service from the one of the initial call; or
- user B has changed of basic service, the new service does not match the MONITOR request.

NOTE 4: The coding of these parameters would allow to change their values at the request of the called user (downgrade in service).

5.2.1.14 RECALL PDU

The RECALL PDU shall be sent by the originating SwMI to the served user to indicate that user B has been found to be not busy. User A MS will normally reply to this request by RECALL-ACCEPTED. This PDU is called rem-user-free in ECMA 185 [i.3].

RECALL PDU shall contain the SS-CCBS information elements described in table 27.

Table 27: RECALL PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		RECALL
CCBSI	3	1	M		

5.2.1.15 RECALL-ACCEPTED PDU

The RECALL-ACCEPTED PDU shall be sent by the served user to the originating SwMI to indicate that User A MS has accepted the RECALL and wishes to complete the original call to user B; the CCBSI element shall be carried as a facility element in a TETRA call set-up.

RECALL-ACCEPTED PDU shall contain the SS-CCBS information elements described in table 28; those elements are identical to a U-SETUP PDU at the air interface; the recall-accepted is in fact a CCBS call set-up at the air interface.

Message: U-SETUP (alias RECALL-ACCEPTED)
Response to: -
Response expected: D-CALL PROCEEDING/D-ALERT/D-CONNECT
Short description: This PDU shall be the request for a call set-up from a MS and for a CCBS recall-accepted PDU.

Table 28: RECALL-ACCEPTED PDU contents

Information element	Length	Type	Owner	C/O/M	Remark
PDU Type	5	1	CC	M	
Area selection	4	1	CC	M	note 3
Hook method selection	1	1	CC	M	note 3
Simplex/duplex selection	1	1	CC	M	note 3
Basic service information	8	1	CC	M	note 3
Request to transmit/send data	1	1	CC	M	note 3
Call priority	4	1	CC	M	note 3
SS-CLIR	2	1		M	note 1
Called party type identifier	2	1	CC	M	Short/SSI/TSI
Called party short number address	8	1	CC	C	note 2
Called party SSI	24	1	CC	C	note 2
Called party extension	24	1	CC	C	note 2
External subscriber number		3	CC	O	
Facility		3	SS	C	note 4
Proprietary		3	-	O	
NOTE 1: As used for SS-CLIR. NOTE 2: Shall be conditional on the value of Called Party Type Identifier (CPTI): CPTI = 0; Called Party SNA; CPTI = 1; Called Party SSI; CPTI = 2; Called Party SSI + Called Party Extension. NOTE 3: All set up parameters are picked-up by the MS from the call retention parameters. NOTE 4: This facility field includes CCBSI.					

5.2.1.16 REQUEST PDU

The REQUEST PDU shall be sent by the served user to the originating SwMI to invoke the CCBS supplementary service. This PDU should reproduce all elements of the initial call request. The served user expects a response to that request in the form of a request response indicating either acceptance or rejection of the request.

REQUEST PDU shall contain the SS-CCBS information elements described in table 29.

Table 29: REQUEST PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		REQUEST
TETRA Call Identifier	14	1	M		The call reference of the call to user B which did not complete due to user B busy.

5.2.1.17 REQUEST ACK PDU

The REQUEST ACK PDU shall be sent by the originating SwMI to the served user to indicate whether the CCBS supplementary service request has either been accepted or rejected and in the case of rejection the cause of rejection. This response will assign a CCBS Identifier which will be unique to that CCBS service invocation in the case where the CCBS request has been accepted.

REQUEST ACK PDU shall contain the SS-CCBS information elements described in table 30.

Table 30: REQUEST ACK PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		REQUEST ACK
CCBSI	3	1	C		notes 2, 3 and 4
TETRA Call Identifier	14	1	M		note 2
Call Priority	4	1	M		note 2
Basic Service Information	8	2	M		note 2
Accept/Reject	1	1	M		note 2
Reject Cause	5	1	C		note 3
Called Party Type Identifier	2	1	M		note 1
Called Party SSI	24	1	M		
Called Party Extension	24	1	M		
NOTE 1: User B present address; all elements of identity are mandatory to keep track of mobility. NOTE 2: Conditional on CCBS Request accept indicated by the bit Accept/Reject. NOTE 3: The CCBSI is attached to that instance of SS-CCBS for that calling party full identity and is global. The full User A MS ITSI is not repeated in that REQUEST-ACK since it is addressed to User A MS. NOTE 4: There is no recall mode information element in this PDU for TETRA contrary to ECMA 186 [i.5] document.					

5.2.1.18 RESUME-COMPLETION PDU

The RESUME-COMPLETION PDU shall be sent by the originating SwMI to the terminating SwMI to inform the terminating SwMI that User A MS is no longer busy. The originating SwMI does not expect a confirmation in reply to that PDU.

RESUME-COMPLETION PDU shall contain the SS-CCBS information elements described in table 31.

Table 31: RESUME-COMPLETION PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		RESUME-COMPLETION
CCBSI	3	1	M		
Calling Party SSI	24	1	M		
Calling Party Extension	24	1	M		User A MS MNI
Called Party SSI	24	1	M		
Called Party Extension	24	1	M		User B MNI
NOTE 1: Basic service and basic call setup parameters need not be repeated here since the association of CCBSI and User A MS full ITSI is unique. NOTE 2: Full users A and B ITSI needed for mobility considerations; Calling/Called Party Type Identifier is not needed since full ITSIs are always used.					

5.2.1.19 SUSPEND-COMPLETION PDU

The SUSPEND-COMPLETION PDU shall be sent by the originating SwMI to the terminating SwMI to inform the terminating SwMI that User A MS is temporarily busy. No reply PDU is expected.

SUSPEND-COMPLETION PDU shall contain the SS-CCBS information elements described in table 32.

Table 32: SUSPEND-COMPLETION PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		SUSPEND-COMPLETION
CCBSI	3	1	M		
Calling Party SSI	24	1	M		notes 1, 2
Calling Party Extension	24	1	M		User A MS MNI, note 3
Called Party SSI	24	1	M		notes 1, 2
Called Party Extension	24	1	M		User B MNI, note 4
NOTE 1: Full users A and B ITSIs needed for mobility considerations; Calling/Called Party Type Identifier is not needed since full ITSIs are always used. NOTE 2: Basic call parameters do not need to be included since the association CCBSI/User A MS ITSI defines uniquely the CCBS invocation. NOTE 3: If changed since call was initiated. NOTE 4: If known.					

5.2.1.20 USER-B-FREE PDU

The USER-B-FREE PDU shall be sent by the originating SwMI to the served user to inform User A MS when User A MS is known to be busy that user B is now free. This PDU is different from the RECALL PDU which is presented when User A MS is free.

USER-B-FREE PDU shall contain the SS-CCBS information elements described in table 33.

NOTE: User B and called party are different names for identical entities.

Table 33: USER-B-FREE PDU contents

Information element	Length	Type	C/O/M		Remark
SS-Type	6	1	M		Defined in EN 300 392-9 [7]
CCBS-PDU type	5	1	M		USER-B-FREE
CCBSI	3	1	M		

5.2.2 TETRA PDU information element coding

5.2.2.1 Accept/Reject

Accept/Reject Information element is common to a number of PDU responses and shall be coded as defined in table 34.

Table 34: Accept/Reject information element contents

Information element	Length	Value	Remark
Accept/Reject	1	0_2	Accept
		1_2	Reject

5.2.2.2 Basic Service Information

Basic service defines the type of service (speech/data), its half duplex nature, its encrypted. It is encoded as defined in table 90 of EN 300 392-2 [2], the contents of which is reproduced in table 35.

Table 35: Basic service information element contents

Information sub-element	Length	Value	Remark
Circuit Mode Type (see note 1)	3	000_2	Speech: TCH/S
		001_2	Unprotected: TCH/7,2
		010_2	Low Protection: TCH/4,8, N = 1
		011_2	Low Protection: TCH/4,8, N = 4
		100_2	Low Protection: TCH/4,8, N = 8
		101_2	High Protection: TCH/2,4, N = 1
		110_2	High Protection: TCH/2,4, N = 4
		111_2	High Protection: TCH/2,4, N = 8
Encryption Flag	1	0_2	Clear Mode
(see note 2)		1_2	TETRA end-to-end encryption
Communication Type	2	00_2	Point-to-point
		01_2	Point-to-multipoint
		10_2	Point-to-multipoint Acknowledged
		11_2	Broadcast
Slots per frame (see note 3)	2	00_2	One slot
		01_2	Two slots
		10_2	Three slots
		11_2	Four slots
NOTE 1: Indicates the TCH type and the interleaving depth N (see clause 8). NOTE 2: Indicates whether the circuit mode speech or data is end-to-end encrypted. NOTE 3: Indicates the required bit rate for a circuit mode data call. For TCH/7,2, TCH/4,8 and TCH/2,4 the resulting bit rate is the TCH bit rate multiplied by the number of slots per frame. (e.g. TCH/7,2 in four time slots per frame gives a circuit mode data rate of 28,8 kbit/s). For TCH/S this element shall be present (set to 0).			

5.2.2.3 Call Priority

The purpose of the call priority element shall be to inform the SwMI or the MS about the call priority. It is encoded as defined in table 100 of EN 300 392-2 [2], the contents of which is reproduced in table 36.

Table 36: Call priority element contents

Information element	Length	Value	Remark
Call priority	4	0000_2	Priority not defined
		0001_2	Priority 1 (Lowest Priority)
		0010_2	Priority 2
		etc.	etc.
		1011_2	Priority 11
		1100_2	Pre-emptive priority 1
		1101_2	Pre-emptive priority 2
		1110_2	Pre-emptive priority 3
		1111_2	Pre-emptive priority 4 (Emergency)

5.2.2.4 Called party extension

The purpose of the called party extension element shall be to indicate to the SwMI the extended part of the TSI address of the called user. It is encoded as defined in table 95 of EN 300 392-2 [2], the contents of which is reproduced in table 37.

Table 37: Called party extension element contents

Information sub-element	Length	Value	Remark
Country Code	10		See EN 300 392-1 [1], clause 7
Network Code	14		See EN 300 392-1 [1], clause 7

5.2.2.5 Called party SSI

The purpose of the Called party SSI element shall be to indicate to the SwMI the SSI address of the called user. It is encoded as defined in table 96 of EN 300 392-2 [2], the contents of which is reproduced in table 38.

Table 38: Called party SSI element contents

Information element	Length	Value	Remark
Short Subscriber Identity (SSI)	24		See EN 300 392-1 [1], clause 7

5.2.2.6 Called party type identifier

The purpose of the called party type identifier element shall be to indicate the type of address which shall follow in the PDU. It is encoded as defined in table 93 of EN 300 392-2 [2] recalled in the contents of table 39.

Table 39: Called party type identifier element contents

Information element	Length	Value	Remark
Called party type identifier	2	00_2	Short Number Address (SNA)
		01_2	Short Subscriber Identity (SSI)
		10_2	TETRA Subscriber Identity (TSI)
		11_2	Reserved

5.2.2.7 Calling party extension

The purpose of the calling party extension element shall be to indicate the extended part of the TSI address of the calling user. It is encoded as defined in table 98 of EN 300 392-2 [2], the contents of which is reproduced in table 40.

Table 40: Calling party extension element contents

Information sub-element	Length	Value	Remark
Country Code	10		See EN 300 392-1 [1], clause 7
Network Code	14		See EN 300 392-1 [1], clause 7

5.2.2.8 Calling party SSI

The purpose of the Calling party SSI element shall be to indicate the SSI address of the calling user. It is encoded as defined in table 99 of EN 300 392-2 [2], the contents of which is reproduced in table 41.

Table 41: Calling party SSI element contents

Information element	Length	Value	Remark
Short Subscriber Identity (SSI)	24		See EN 300 392-1 [1], clause 7

5.2.2.9 Calling party type identifier

The purpose of the calling party type identifier element coding shall be to indicate the type of address which shall follow in the PDU. It is encoded as defined in table 97 of EN 300 392-2 [2], the contents of which is reproduced in table 42.

Table 42: Calling party type identifier element contents

Information element	Length	Value	Remark
Calling Party Type Identifier	2	00_2	Reserved
		01_2	Short Subscriber Identity (SSI)
		10_2	TETRA Subscriber Identity (TSI)
		11_2	Reserved

5.2.2.10 Cancellation Cause

Cancellation cause Information element indicates the reason of the cancellation in the CANCELLED PDU. It shall be coded as defined in table 43.

Table 43: Cancellation Cause information element contents

Information element	Length	Value	Remark
Cancellation Cause	3	000_2	Canceled for any reason
		001_2	Expiration of service duration timer
		010_2	User B outside area selected at call set-up
		011_2	Normal-unspecified/Call completed to user B
		100_2	Incompatible class of service
		101_2	Due to inter-working
		110_2	Basic call failed
		111_2	Expiration of recall timer (T3)

5.2.2.11 Cancellation Result

Cancellation Result Information element indicates the result of the cancellation request and shall be coded as defined in table 44.

Table 44: Cancellation Result information element contents

Information element	Length	Value	Remark
Cancellation Result	1	0_2	Cancellation Accepted
		1_2	Cancellation Rejected

5.2.2.12 CCBS-PDU type

CCBS-PDU type indicates the type of the CCBS-PDU as defined in table 45.

Table 45: CCBS-PDU type information element contents

Information element	Length	Value	Remark
CCBS-PDU type	5	00000_2	See EN 300 392-9 [7]
		00001_2	See EN 300 392-9 [7]
		00010_2	See EN 300 392-9 [7]
		00011_2	See EN 300 392-9 [7]
		00100_2	See EN 300 392-9 [7]
		00101_2	CALL-INFORMATION-RETENTION
		00110_2	CANCEL
		00111_2	LIST
		01000_2	MONITOR
		01001_2	RECALL
		01010_2	RECALL-ACCEPTED
		01011_2	REQUEST
		01100_2	RESUME-COMPLETION
		01101_2	CANCEL ACK
		01110_2	LIST ACK
		01111_2	MONITOR ACK
		10000_2	REQUEST ACK
		10001_2	CANCELLED
		10010_2	FAILED
		10011_2	FREE-NOTIFICATION
		10100_2	SUSPEND-COMPLETION
		10101_2	USER-B-FREE
		10110_2	CANCELLATION
		10111_2	CCBSI
		11000_2	CALL-INFORMATION-RELEASE
		11001_2	Reserved
		etc.	etc.
		11111_2	Reserved

5.2.2.13 CCBSI

The purpose of the call completion to busy subscriber identifier CCBSI element shall be to identify a specific invocation of call completion to busy subscriber supplementary service. It shall be encoded as defined in table 46. A maximum number of SS-CCBS invocation is set to 5.

Table 46: Call completion to busy subscriber identifier information element contents

Information element	Length	Value	Remark
Call Completion to Busy Subscriber Identifier CCBSI	3	000_2	dummy CCBS identifier
		001_2 to 101_2	identifies CCBS invocation uniquely for a given calling User A MS
		110_2	Used in the CANCEL PDU to indicate the last CCBS request in chronological order
		111_2	Used in the CANCEL PDU to cancel all outstanding CCBS requests

5.2.2.14 Failure Cause

Failure cause Information element indicates the reason of the failure of the SS-CCBS. It shall be coded as defined in table 47.

Table 47: Failure Cause information element contents

Information element	Length	Value	Remark
Failure Cause	3	000_2	Failed for any reason
		001_2	User B busy again
		010_2	Network congestion
		011_2	Signaling Connection failed
		100_2	Incompatible class of service
		101_2	Due to inter-working
		110_2	reserved
		111_2	reserved

5.2.2.15 Length of CCBS List

The purpose of the Length of CCBS List information element shall be to indicate the length of the list of CCBS requests (n). It shall be encoded as defined in table 48. A maximum number of SS-CCBS invocation is set to 5.

Table 48: Length of CCBS List information element contents

Information element	Length	Value	Remark
Length of CCBS List	3	000_2	0 no list
		001_2	1
		010_2	2
		011_2	3
		100_2	4
		101_2	5
		101_2	Reserved
		110_2	Reserved
		111_2	Reserved

5.2.2.16 Number of CCBS requests

The purpose of the Number of CCBS requests information element shall be to indicate the number of CCBS requests (n). It shall normally be equal to the length of list but does not carry the same meaning. It shall be encoded as defined in table 49. A maximum number of SS-CCBS invocation is set to 5.

Table 49: Number of CCBS requests information element contents

Information element	Length	Value	Remark
Number of CCBS requests	3	000_2	0 no list
		001_2	1
		010_2	2
		011_2	3
		100_2	4
		101_2	5
		101_2	Reserved
		110_2	Reserved
		111_2	Reserved

5.2.2.17 Reject Cause

Reject Cause information element is a generic information element which regroups Reject Causes common to several PDUs; some of the values may not apply to some PDUs. Reject Cause information element shall be encoded as defined in table 50.

Table 50: Reject Cause information element contents

Information element	Length	Value	Remarks
Reject Cause	5	00000_2	Rejected for any reason
		00001_2	User not subscribed to service
		00010_2	No invoked SS-CCBS requests exist.
		00101_2	Incompatible basic service
		00100_2	SS-CCBS not provided locally
		00101_2	Invalid PDU contents (note)
		00110_2	Maximum number of invocations exceeded locally
		00111_2	Maximum number of invocations exceeded remotely
		01000_2	Inter-working with a network that does not support SS-CCBS
		01001_2	Network congestion
		01011_2	Call failure reason not busy
		01100_2	User B busy (again)
		01101_2	User A MS busy
		01110_2	Signaling Connection failed
		01111_2	Wrong TETRA Call Identifier
		01111_2	Invalid CCBSI reference
		10000_2	SS-CCBS not provided remotely
		10001_2	Supplementary service interaction not allowed
		10010_2	Lack of resources at terminating SwMI
		10011_2	Other short term denial
		10100_2	Other long term denial
		10101_2	Not ready for call
		10110_2	Already accepted
		10111_2	Lack of resources at User A MS
		11000_2	Unrecognized operation
		11001_2	Failure to match
		11010_2	Reserved
		etc.	etc.
		11111_2	Reserved
NOTE: The PDU contents may be found invalid e.g.: - when some information element values do not exist; or because; - the structure of an air interface PDU is wrong, e.g. O-bit or M-bit absent (see clause 14.7 of EN 300 392-2 [2]).			

5.2.2.18 List Request

The list request information element is common to the LIST and the LIST ACK; it indicates the format in which the list shall be presented. Its coding shall be as defined in table 51.

Table 51: List Request information element contents

Information element	Length	Value	Remark
List Request	2	00_2	Number of CCBS requests
		01_2	CCBSIs
		10_2	CCBSIs and user B addresses
		11_2	Reserved

5.2.2.19 Request Maintained

The Request Maintained information element is common to User A MS status request and response and to user B status request and response. Its coding shall be as defined in table 52.

Table 52: Request Maintained information element contents

Information element	Length	Value	Remark
Request Maintained	1	0_2	Request not maintained
		1_2	Request maintained

5.2.2.20 Retain Capability

The Retain Capability information element indicates whether SS-CCBS shall be retain when user B is found busy after successful completion of recall on User A MS. Its coding shall be as defined in table 53.

Table 53: Retain Capability information element contents

Information element	Length	Value	Remark
Retain Capability	2	00_2	Reserved
		01_2	Retain capability
		10_2	No retain capability
		11_2	Reserved

5.2.2.21 SS-Type

SS-Type indicates the type of supplementary service to which the PDU belongs. The coding of the information element SS type is defined in table 5 of EN 300 392-9 [7] and is recalled in table 54 where SS-CCBS is highlighted.

Table 54: SS type information element contents

Information element	Length	Value	Remark
SS type	6	0 to 12	Other supplementary services
		13	**CCBS Call Completion to Busy Subscriber**
		14 to 63	Other supplementary services or reserved

5.2.2.22 TETRA Call Identifier

The purpose of the TETRA call identifier element shall be to uniquely identify a specific call. It is encoded as defined in table 91 of EN 300 392-2 [2], the contents of which is reproduced in table 55.

Table 55: TETRA Call identifier element contents

Information element	Length	Value	Remark
Call identifier	14	0	dummy call identifier
		1 to 16 383	identifies call uniquely

5.2.3 Additional coding requirements over the ISI

5.2.3.1 Remote operations protocol and application association control

The remote operations (RO) protocol is defined in ITU-T Recommendations X.219 [10] and X.229 [11]. The generic procedures defined in the present document provide an encoding mechanism for the transport and use of this RO protocol in the PISN environment for the provision of supplementary services or additional network features.

In the OSI environment, communication between application processes is represented in terms of communication between a pair of application entities (AEs). Communication between application entities is inherently interactive. Typically, one entity requests that a particular operation be performed; the other entity attempts to perform the operation and then reports the outcome of the attempts. The concept of Remote Operations is a vehicle for supporting interactive applications of this type.

The generic structure of an operation is an elementary request/reply interaction. Operations are carried out within the context of an application-association.

Figure 1 models this view:

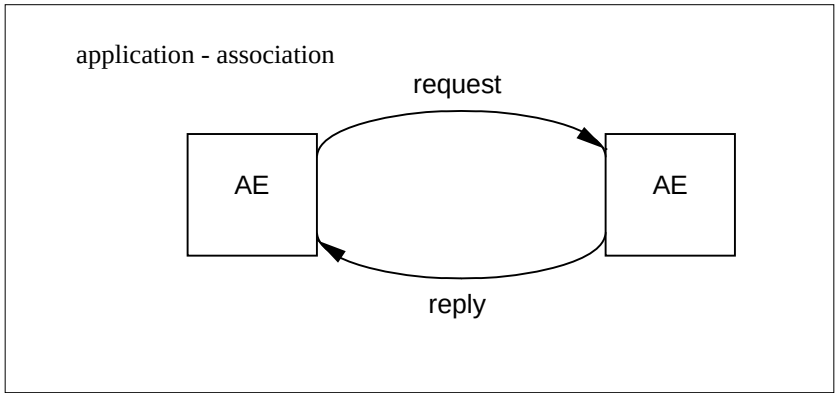


Figure 1: Remote Operations Model

Operations invoked by one AE (the invoker) are performed by the other AE (the performer). Operations may be classified according to whether the performer of an operation is expected to report its outcome:

- in the case of success or failure (a result reply is returned if the operation is successful, an error reply is returned if the operation is unsuccessful);
- in case of failure only (no reply is returned if the operation is successful, an error reply is returned if the operation is unsuccessful);
- in case of success only (a result reply is returned if the operation is successful, no reply is returned if the operation is unsuccessful);
- or not at all (neither a result nor an error reply is returned, whether the operation was successful or not).

Operations may also be classified according to two possible operation modes: synchronous, in which the invoker requires a reply from the performer before invoking another operation; and asynchronous, in which the invoker may continue to invoke further operations without awaiting a reply.

The following Operation Classes are defined:

Operation Class 1:	Synchronous, reporting success or failure (result or error).
Operation Class 2:	Asynchronous, reporting success or failure (result or error)
Operation Class 3:	Asynchronous, reporting failure (error) only, if any
Operation Class 4:	Asynchronous, reporting success (result) only
Operation Class 5:	Asynchronous, outcome not reported

In the present document the Operation Class of each operation is agreed to be Operation Class 3 between application entities for the SS-CCBS Application Protocol.

An application association defines the relationship between a pair of AEs, and is formed by the exchange of application (in this case supplementary services) Protocol Control information through the use of the services of underlying layers. The AE that initiates an association is called the association initiating AE, or the association initiator, while the AE that responds to the initiation of an application association by another AE is called the association responding AE, or the association responder.

NOTE 1: In the application of ROSE for the support of supplementary services in PSS1 the underlying services used by ROSE are those provided by GFT-Control or those provided by the Association Control Service Entity (ACSE). No use is made of the services of the Reliable Transport Service Element (RTSE).

Application associations are classified by which application-entity is allowed to invoke operations:

Association Class 1:	Only the association-initiating application-entity can invoke operations.
Association Class 2:	Only the association-responding application-entity can invoke operations.
Association Class 3:	Both the association-initiating and the association-responding application-entities can invoke operations.

The present document assumes Application associations of Association Class 3.

The explicit control of an application-association (establishment, release and abort) is performed by the Association Control Service Element (ACSE) defined in ITU-T Recommendation X.217 [9].

The following shall apply for the PSS1 facility information element carrying an APDU of the ROSE operation used by ANF-ISISS for SS-CCBS PDUs:

- both the sourceEntity and destinationEntity data elements in the Network Facility Extension of this PSS1 facility information element shall contain the value endPINX;
- no interpretation APDU shall be included in this PSS1 facility information element.

In the case of information flows such as MONITOR which expect a reply MONITOR-ACK, the TETRA PDU such as MONITOR shall be encoded in the IsiArgument tetraMessage IMPLICIT OCTET STRING of the ROSE Invoke APDU in support of TETRA encoding PDU from as defined in clause 8.4.1 of EN 300 392-3-1 [3]. The expected information flow MONITOR ACK TETRA PDU shall be encoded in the IsiArgument tetraMessage IMPLICIT OCTET STRING of another ROSE Invoke APDU (in the opposite direction) defined in the same clause.

In the case of unconfirmed information flows such as FREE-NOTIFICATION, the TETRA PDU such as FREE-NOTIFICATION shall be encoded in the IsiArgument tetraMessage IMPLICIT OCTET STRING of the ROSE Invoke APDU in support of TETRA encoding PDU as defined in clause 8.4.1 of EN 300 392-3-1 [3].

NOTE 2: The actions resulting from reception of ERRORS in reply to the ROSE Invoke APDU such as retry, time-out are outside the scope of the present document.

5.3 SS-CCBS State Definitions

5.3.1 States at User A MS

5.3.1.1 CCBS-Idle

This state exists if SS-CCBS is not active.

5.3.1.2 CCBS-Wait-ACK

This state exists when User A MS has sent a request for CCBS to the network and is waiting for the CCBS REQUEST ACK.

5.3.1.3 CCBS-Invoked_User_A

SS-CCBS has been invoked for User A MS.

5.3.1.4 CCBS-Wait-User-A-Answer

User A MS has received the indication that user B is now free and that he can proceed with recall.

5.3.1.5 Wait-Alert/Connect

The user has accepted the recall and is waiting for D-ALERT/D-CONNECT.

5.3.1.6 CCBS-LIST-Requested

User A MS has requested the list of outstanding CCBS request and is waiting for the response.

5.3.1.7 CCBS-CANCEL-Requested

User A MS has requested CCBS cancellation and is waiting for a response.

5.3.1.8 CCBS_Wait_UserA_Free

User A MS is non free and has received a notification that user B is now free.

5.3.1.9 CCBS-Retention-Idle

User A MS has not yet received the call retention parameters which will be needed for the CCBS REQUEST.

5.3.1.10 CCBS-Retention-Active

User A MS has received the call information retention parameters which will be needed for the CCBS REQUEST which has not yet been invoked.

5.3.2 States at the Originating SwMI

The procedures for the Originating SwMI are written in terms of the following conceptual states existing within the SS-CCBS Supplementary Service Control entity in that SwMI in association with a particular CCBS Request.

5.3.2.1 CCBS-Idle

This state exists if SS-CCBS is not invoked.

5.3.2.2 CCBS-Invoked-User-A

This state exists for an active CCBS Request while waiting for the indication that user B is not busy.

5.3.2.3 CCBS-WAIT-ACK

This state exists during SS-CCBS invocation waiting for the MONITOR-ACK.

5.3.2.4 CCBS-Wait-User-A-Answer

This state exists while waiting for SS-CCBS Recall acceptance from User A MS if no path has been reserved.

5.3.2.5 CCBS-Path-Setup

This state exists while the path setup through the network corresponding to the CCBSI is progressing.

5.3.2.6 CCBS-Wait-User-A-Free

This state exists while User A MS is found not free and user B has been found free.

5.3.2.7 CCBS-Retention-Idle

This state exists while no call information retention has been initiated for User A MS.

5.3.2.8 CCBS-Retention-Active

This state exists while call retention timer is running, call information retention has been initiated for User A MS.

5.3.3 States at the Group Controlling SwMI

The procedures for the Group Controlling SwMI are written in terms of the following conceptual states existing within the SS-CCBS Supplementary Service Control entity in that SwMI in association with a particular CCBS Request.

5.3.3.1 CCBS-Idle

This state exists if SS-CCBS is not active.

5.3.3.2 CCBS-Await-Call-Completion

This state exists while waiting for the incoming CCBS Call after having indicated that Group (user B) is not busy.

5.3.3.3 CCBS-Invoked-Group

This state exists while the Group (user B) is monitored as a result of a CCBS Request received.

5.3.3.4 CCBS-Path-Complete

This state exists when a path has been successfully reserved and CCBS Call completion is pending.

5.3.3.5 CCBS-Suspended-Group

This state exists when a CCBS Call has been postponed because User A MS is busy.

5.3.3.6 CCBS-Wait-Group-Alert

This state exists after a CCBS Call has been extended to the Group (user B), while waiting for acceptance (alerting or connect).

5.3.4 States at the Terminating SwMI

The procedures for the Terminating SwMI are written in terms of the following conceptual states existing within the SS-CCBS Supplementary Service Control entity in that SwMI in association with a particular CCBS Request.

5.3.4.1 CCBS-Idle

This state exists if SS-CCBS is not active.

5.3.4.2 CCBS-Await-Call-Completion

This state exists while waiting for the incoming CCBS Call after having indicated that user B is not busy.

5.3.4.3 CCBS-Invoked-User-B

This state exists while user B is monitored as a result of a CCBS MONITOR Request received.

5.3.4.4 CCBS-Suspended-User-B

This state exists when a CCBS Call has been postponed because User A MS is busy.

5.3.4.5 CCBS-Wait-User-B-Alert

This state exists after a CCBS Call has been extended to user B, while waiting for acceptance (alerting or connect).

5.3.5 States at User B

There are no additional states defined for user B.

5.4 SS-CCBS Signaling Procedures

5.4.1 Major Options

The following major options in support of TETRA SS-CCBS shall be provided:

- Path Reservation

  Here is only one method of establishing the TETRA SS-CCBS Call:

  - **non-path reservation method**: a bearer connection between the Originating and Terminating SwMIs is established after User A MS responds to SS-CCBS Recall and the service is canceled if network congestion is encountered.

- Release of signaling connection

  In the signaling connection release method, the signaling connection is cleared after each phase of call independent signaling and a new signaling connection is established for each subsequent phase of call independent signaling. In TETRA support of SS-CCBS, the signaling connection shall be retained for the duration of SS-CCBS.

- Service retention

  The service retention applies when user B is found busy again after User A MS has accepted the recall. In order to insure actual completion of call to busy subscriber and in support of TETRA SS-CCBS, both the originating SwMI and the terminating SwMI shall retain SS-CCBS relevant parameters as long as the service duration timer has not expired (in the originating SwMI) and as long as a cancel has not been received either from the user MS or due to network conditions. As a result of the choice of this option for TETRA SS-CCBS, the terminating SwMI shall start monitoring of user B again when user B is found busy.

- Check for identical calls

  The network shall check if SS-CCBS is already requested for a call identical to a previous one for which CCBS has already been invoked; in that case, the previous request shall be upgraded, the service duration timer restarted and the new request shall not be counted as an additional request.

5.4.2 Actions at the served user MS

5.4.2.1 Normal procedures

The SDL process at User A MS is given in figure A.3. The served User A MS actions are best described in conjunction with the originating SwMI actions as done in clause 5.4.3 of the present document.

5.4.3 Actions at the Originating SwMI

The SDL representation of procedures at the originating SwMI is shown in figure A.1.

5.4.3.1 Normal Procedures

5.4.3.1.1 Invocation

In order that User A MS who has subscribed to SS-CCBS may invoke the service when a busy destination B is encountered, it is necessary for the originating SwMI to use the call information retention procedure. The originating SwMI shall provide the call information retention procedure as described below when the following conditions apply:

- CCBS subscribed;
- call failure cause is busy;
- CCBS is available at the destination SwMI;

- User A MS CCBS queue limit has not been reached; and
- there are no other supplementary services that preclude CCBS.

NOTE 1: The condition that CCBS has not been invoked for an identical call is not required in the case of TETRA CCBS.

NOTE 2: These conditions do not prevent the originating SwMI from providing the call retention procedures in other circumstances.

The call related information retained by the User A MS shall contain all basic call information needed to set-up the call at the time of the recall is accepted; in relation to the initial call, it consists of:

- TETRA Call Identifier; and
- Basic service information; and
- Call priority; and
- Calling party address information; and
- Called party address information.

This call related information is provided by the originating (User A MS) SwMI.

The call related information that shall be retained by the User A MS SwMI shall be, in relation to the initial call:

- list of invoked supplementary services.

Furthermore, the originating SwMI shall retain the following information provided by terminating SwMI in order to decide if CCBS is permitted or not:

- call failure reason; and
- CCBS available indication.

When interacting with other supplementary services, retention of further information may be mandatory.

5.4.3.1.1.1 Call information retention

The call information retention procedure is used for a specific call if a supplementary service which needs the call information may be in operation for that call. This procedure is described in generic terms so that it could be picked up by other supplementary services.

To provide the call information retention procedure, the SwMI shall:

- use and keep the value for the TETRA call identifier; and
- retain the call information and the TETRA call identifier; and
- start Timer T4; and
- send a CALL INFORMATION RETENTION PDU containing the TETRA call identifier and the user B ITSI in an appropriate clearing message according to the procedure described in EN 300 392-2 [2].

The SwMI may restrict the number of calls that can simultaneously be subject to the call information retention procedure.

The TETRA call identifier used in the CCBS context is an identifier used to make reference to the retained call information and has significance on the local access.

On receipt of the CALL INFORMATION RETENTION PDU, the User A MS shall retain those parameters contained in that PDU and use it to control that SS-CCBS. On operation of SS-CCBS that requires the call information, the SwMI shall add the relevant supplementary services invoked to the call information available for CCBS from User A MS.

At the expiration of the call information retention timer, the SwMI shall release the call information and the TETRA call identifier which becomes available for other calls. If the originating SwMI releases the call information on operation of SS-CCBS, the originating SwMI shall stop timer T4, release the TETRA Call Identifier parameter and make the value available for subsequent use, release unwanted retained call information and shall notify User A MS in a CALL-INFORMATION-RELEASE PDU that the call information including the TETRA Call Identifier may be released.

5.4.3.1.1.2 Invocation - Detailed procedure

To invoke SS-CCBS, User A MS shall send a CCBS REQUEST PDU including the TETRA Call Identifier described above to the originating SwMI, using the procedures of a call unrelated facility in EN 300 392-2 [2]. On receiving this CCBS REQUEST PDU and after checking its validity, the originating SwMI shall send CCBS MONITOR PDU to the terminating SwMI, shall enter the state CCBS-Wait-Ack and shall start timer T1.

On receiving confirmation that CCBS MONITOR request has been accepted by the terminating SwMI in a CCBS MONITOR ACK PDU, the originating SwMI shall assign a new value for the CCBSI (CCBS Identifier), send a CCBS REQUEST ACK PDU to User A MS including the CCBSI parameter, place the CCBS request in queue A, stop timer T1 and start the CCBS service duration timer T2. The combination of the CCBSI parameter and of User A MS full identify shall have significance on the whole access and its value shall not be reused until it is released. The originating SwMI shall then be in state CCBS-Invoked-A.

User A MS shall retain the CCBSI parameter for further reference.

The originating SwMI shall send a MONITOR PDU to the terminating SwMI which shall request monitoring of user B for non busy; in this MONITOR request PDU, the capability of the originating SwMI for service retention shall be described; the terminating SwMI shall reply with a MONITOR ACK PDU and the originating SwMI shall determine whether service retention is to be used (in the case of TETRA).

5.4.3.1.2 Operation

If the originating SwMI is informed that the user B has become not busy, the originating SwMI shall determine whether User A MS is neither busy nor CCBS busy.

Four different cases may occur:

- User A MS is not busy and the non-path reservation method is to be used; or
- User A MS is busy and the non-path reservation method is to be used.

The general operations will be defined first in the two different cases. Details of the procedures shall be given second.

5.4.3.1.2.1 User A MS is not busy and the non-path reservation method is to be used

If User A MS is not busy and the Originating SwMI chooses the non-path reservation method for establishing the CCBS Call, the Originating SwMI shall indicate the SS-CCBS Recall to User A MS, start the recall timer T3 and enter state CCBS-Wait-User-A-Answer-N.

If the SS-CCBS Recall is accepted before timer T3 expires the Originating SwMI shall send a SETUP message towards the Terminating SwMI with the CCBS Identifier contained in a Facility element, stop timer T3 and enter state CCBS-RINGOUT.

If in state CCBS-RINGOUT an ALERTING or a CONNECT message is received the Originating SwMI shall stop the service duration timer T2, cancel the CCBS Request and return to state CCBS-Idle. If a call independent signaling connection for SS-CCBS still exists it may be released. The CCBS Call shall continue.

5.4.3.1.2.2 User A MS is busy and the non-path reservation method is to be used

- Suspend procedure:

  If User A MS is busy and the Originating SwMI chooses the non-path reservation method, the Originating SwMI shall send a CCBS SUSPEND PDU to the Terminating SwMI in a FACILITY message on a call independent signaling connection, start monitoring User A MS and enter state CCBS-Suspended-User-A.

- Resume procedure:

  If User A MS, for whom a CCBS Request in state CCBS-Suspended-A exists, becomes not busy the Originating SwMI shall send a FACILITY message with a CCBS RESUME PDU on a call independent signaling connection and enter state CCBS-Invoked-User-A-RET, waiting for another indication that User B is not busy.

5.4.3.1.2.3 User A MS monitoring procedure

Whenever the originating SwMI needs to know the status of User A MS, the originating SwMI shall have to decide if User A MS is CCBS busy or not.

5.4.3.1.2.4 Recall request

If User A MS is neither busy nor CCBS busy, then the originating SwMI shall start timer T3 and indicate that it is prepared for establishment of the requested call, by sending a RECALL PDU to User A MS. The RECALL PDU shall contain the CCBSI.

If User A MS is busy or CCBS busy, then the network shall proceed as described in clause 5.4.3.1.2.9.

On receipt of the CCBS RECALL PDU, User A MS shall ignore the PDU unless the service provided by User A MS is compatible with the service indicated in the CCBS RECALL PDU.

User A MS upon accepting that RECALL PDU shall retain the CCBSI parameter and may proceed to establish a call as indicated in clause 5.4.3.1.2.6.

5.4.3.1.2.5 Basic call information and compatibility checking at User A MS

The originating SwMI shall send the CCBS Identifier to User A MS in order to allow User A MS to determine whether it is compatible with a particular CCBS request, and to allow User A MS to identify the basic call information retained for a given CCBS request.

On receipt of a RECALL PDU containing this information, User A MS shall determine if it accepts the RECALL PDU.

User A MS may either accept the CCBS RECALL or it may ignore it by letting the RECALL timer run out.

5.4.3.1.2.6 CCBS Call set-up

To establish the CCBS call, User A MS shall send a CCBS RECALL ACCEPTED PDU identical to a U-SETUP to the originating SwMI in accordance with clause 14 of EN 300 392-2 [2]. This CCBS RECALL ACCEPTED PDU shall contain the basic service information element from the original call and a facility information element which includes the CCBSI parameter received in the RECALL PDU. User A MS shall retain the CCBSI value after sending the CCBS RECALL ACCEPTED PDU.

NOTE: In relation with other supplementary services further information elements may be present in the ISI-SETUP message to invoke those supplementary services between SwMIs.

On receiving the CCBS RECALL ACCEPTED PDU, the originating SwMI shall stop timer T3, discard any received call information which is subject to call information retention as described above and proceed with basic call set-up as described in either EN 300 392-2 [2] or EN 300 392-3-2 [4] for call over ISI using the retained supplementary service information.

5.4.3.1.2.7 CCBS call establishment

On accepting a call set-up with the CCBSI PDU, the originating SwMI shall proceed to establish a call to user B.

On receiving an indication that user B alerting has been initiated at the called address, the originating SwMI shall proceed with basic call procedures; furthermore, SS-CCBS shall be canceled as described below in clause 5.4.3.1.2.8. The CCBS CANCELLED cause shall be "normal-unspecified".

5.4.3.1.2.8 Network initiated deactivation procedure

Whenever the originating SwMI cancel the instance of SS-CCBS, the originating SwMI shall:

- Stop timer T2; and
- Stop timer T3; and
- Send a CANCEL ACK PDU to User A MS; this CANCEL ACK PDU shall include the CCBS CANCELLATION CAUSE, the called User A MS address and the basic service information; the cancellation cause shall include the values "normal-unspecified", Time-out T2, Time-out T3 or basic call failed as appropriate; and
- release the CCBSI value and make it available for subsequent uses; and
- remove the request from queue A; and
- release all retained call information.
- On receipt of the CANCELLED PDU, User A MS shall remove knowledge of the indicated CCBS request, release the CCBSI and the call information retained.

5.4.3.1.2.9 B free but A busy procedure

If the originating SwMI is informed that user B is not busy, and User A MS is either busy or CCBS busy, then the originating SwMI shall inform User A MS by sending a USER-B-FREE PDU to User A MS, suspend CCBS processing and wait for User A MS becoming not busy.

The originating SwMI shall send to User A MS the USER-B-FREE PDU which includes the CCBSI, the called User A MS address and the basic service information.

On receipt of USER-B-FREE PDU, User A MS shall ignore the PDU parameters unless they are compatible with the initial request.

In case of CCBS requests being suspended, the originating SwMI shall apply the User A MS monitoring procedures for all suspended CCBS requests in the following situations:

- on User A MS becoming not CCBS busy; or
- if a busy or reserve Resource becomes free while User A MS is not CCBS busy.

  Each request for which User A MS indicates to be free shall be resumed. For each resumed CCBS request, the originating SwMI shall continue according to the procedures in clause 5.4.3.1.2.4. CCBS requests for which User A MS indicated to be busy shall remain suspended.

5.4.3.1.3 User initiated cancellation procedure

To cancel one invocation of SS-CCBS, User A MS shall send a CCBS CANCEL PDU including reference parameter CCBSI to the originating SwMI using the facility field of a call unrelated process.

On receipt of the CCBS CANCEL PDU, the originating SwMI shall send a CCBS CANCEL ACK, reply result and SS-CCBS shall be canceled with a cause "normal-unspecified".

If User A MS receives a correctly encoded CCBS CANCEL ACK PDU, then User A MS shall proceed with the cancellation and shall remove knowledge of the CCBS invocation identified by the CCBSI and release the call information retained.

To cancel all CCBS requests at once, User A MS shall send the parameter binary 111 in place of actual individual CCBSI values (binary 111 is normally an illegal value).

5.4.3.1.4 CCBS List Request

To perform a list request of all CCBS requests, User A MS shall send a CCBS LIST PDU without a CCBSI parameter to the originating SwMI using the procedure of call unrelated exchange of PDUs. User A MS may supply its calling User A MS address in that LIST PDU. At the time User A MS sends that LIST request, User A MS starts timer T5.

On receiving this LIST PDU, the originating SwMI shall send a LIST ACK PDU which shall include in chronological order the list of CCBS requests for that access, if any. The originating SwMI shall send a LIST ACK PDU in reply, the format of which will depend on the requested LIST format (number of requests, list of CCBSIs or details of each request with CCBSI and calling user identities). In the case of the detail list format, the originating SwMI shall provide User A MS with the CCBSI and the called User A MS address for each outstanding service request; if there are no requests, the reply to the LIST PDU shall be the format number of requests null. Upon receiving that LIST ACK PDU, User A MS shall stop timer T5.

5.4.3.2 Exceptional Procedures

5.4.3.2.1 Invocation

If the originating SwMI cannot accept the CCBS REQUEST because User A MS has not subscribed to SS-CCBS, the originating SwMI shall send a CCBS REQUEST ACK PDU with a Reject Cause "User not subscribed to service" to User A MS using the procedure in clause 14 of EN 300 392-2 [2].

If the originating SwMI cannot accept the CCBS REQUEST because User A MS has provided an invalid TETRA Call Identifier, then the originating SwMI shall send a CCBS REQUEST ACK PDU with a Reject Cause "Wrong TETRA Call Identifier" using the procedure in clause 14 of EN 300 392-2 [2]. User A MS shall remove knowledge of this TETRA Call Identifier.

If the originating SwMI cannot accept the CCBS REQUEST because the call failure reason of the call identified by the TETRA Call Identifier was not "busy", then the originating SwMI shall send a CCBS REQUEST ACK PDU with a Reject Cause "Call failure reason not busy" using the procedure in clause 14 of EN 300 392-2 [2].

If the originating SwMI cannot accept the CCBS REQUEST because queue A is full (number of maximum CCBS requests reached), then the originating SwMI shall send a CCBS REQUEST ACK PDU with a Reject Cause "Maximum number of invocations exceeded locally" using the procedure in clause 14 of EN 300 392-2 [2].

If the originating SwMI receives a CCBS REQUEST identical to an outstanding CCBS request in queue A, the originating SwMI will not reject the request but will reset timers relating to that identical request and will not increment the number of CCBS requests.

To determine whether the call indicated by the TETRA Call Identifier and a call in queue A are identical, the following basic call information shall be compared:

- Basic Service Information;
- Calling Party Address;
- Called Party Address.

NOTE 1: Identical calling User A MS address implies identical user since the user may have migrated since the first CCBS invocation; the same apply to identical called User A MS address. See interaction with ANF Mobility.

If the originating SwMI cannot accept the CCBS REQUEST because there are invalid supplementary service(s) interactions between SS-CCBS and the call identified by the TETRA Call Identifier, then the originating SwMI shall send a CCBS REQUEST ACK PDU with a Reject Cause "Supplementary service interaction not allowed" using the procedure in clause 14 of EN 300 392-2 [2].

If the originating SwMI cannot accept the CCBS REQUEST identified by the TETRA Call Identifier because CCBS is not available at the terminating SwMI, then the originating SwMI shall send a CCBS REQUEST ACK PDU with a Reject Cause "SS-CCBS not provided remotely" (a long term denial) using the procedure in clause 14 of EN 300 392-2 [2].

NOTE 2: This includes the case where the terminating SwMI did not indicate that CCBS was available when the call failed, and the case that the request for SS-CCBS was rejected by the terminating SwMI.

If the originating SwMI cannot accept the CCBS REQUEST identified by the TETRA Call Identifier because CCBS is not available at the terminating SwMI at this time, then the originating SwMI shall send a CCBS REQUEST ACK PDU with a Reject Cause "Maximum number of invocations exceeded remotely" (a short term denial) using the procedure in clause 14 of EN 300 392-2 [2].

If timer T2 expires locally, the originating SwMI shall cancel SS-CCBS invocation, shall send a CANCELLED PDU and shall indicate as a cancellation cause "Expiration of local service duration timer".

On expiration of timer T1 and User A MS has not received any response to the CCBS REQUEST PDU, then User A MS shall consider this request for SS-CCBS has failed.

If establishment of the call independent signaling connection fails, or if after sending a CCBS MONITOR PDU no answer is received from the Terminating SwMI before timer T1 expires, or if the answer is a return error PDU or a reject PDU, a failure indication shall be given to User A MS, and the Originating SwMI shall return to state CCBS-Idle. Timer T1 shall be stopped if still running.

A CCBS CANCEL PDU for which no matching CCBS REQUEST exists shall be ignored.

If the Reject Cause of CCBS invocation indicates "for any reason", then User A MS shall not take any action.

5.4.3.2.1.1 Call Information Retention

If the originating SwMI receives a reject component and the CCBSI is included, then the network may wait for the expiration of timer T4, else may stop timer T4, release the TETRA Call Identifier value and make the value available for subsequent use, and release all retained call information; the originating SwMI shall notify user A MS by sending a CALL INFORMATION RELEASE PDU.

5.4.3.2.2 User initiated cancellation procedure

If the originating SwMI cannot accept the CANCEL PDU because User A MS has provided an invalid CCBSI, or User A MS has not subscribed to SS-CCBS, then the originating SwMI shall send a CANCEL ACK PDU with a Reject Cause indicating either "Invalid CCBSI reference" or "No invoked SS-CCBS requests exists" to User A MS using the procedure in clause 14 of EN 300 392-2 [2]. On receiving this rejection, User A MS shall remove knowledge of SS-CCBS request identified by this CCBSI.

On expiration of timer T1 and User A MS has not received any response to the CANCEL PDU, then User A MS shall consider that this attempt to cancel SS-CCBS has failed and that SS-CCBS may still be invoked.

5.4.3.2.3 CCBS List request

If the originating SwMI cannot accept the LIST PDU because User A MS has not subscribed to SS-CCBS, then the originating SwMI shall send a LIST ACK PDU with a Reject Cause "User not subscribed to service" using the procedure in clause 14 of EN 300 392-2 [2]. User A MS shall remove knowledge of all CCBS requests, if any.

On expiration of timer T5 and User A MS has not received any response to the CCBS List PDU, then User A MS shall consider that this attempt to list the SS-CCBS requests has failed.

5.4.3.2.4 Operation

5.4.3.2.4.1 Recall request

If on receipt of RECALL PDU, User A MS does not want to accept the CCBS call, then User A MS shall either:

- ignore the RECALL PDU; or
- initiate the cancellation procedure by sending a CANCEL PDU.

If either timer T2 or timer T3 expire, SS-CCBS shall be canceled, the originating SwMI shall send a CANCELLED PDU with a cancellation cause either "Expiration of service duration timer (T2)" or "Expiration of recall timer (T3)" respectively.

If the service duration timer T2 expires while the originating SwMI is in state CCBS-Invoked-User-A, CCBS-Suspended-User-A, or CCBS-Wait-User-A-Free, the Originating SwMI shall cancel the CCBS Request, using the procedure described below. In any other state, the Originating SwMI may defer action until reaching one of the states above or may cancel the SS-CCBS request immediately.

If a reject PDU is received and the CCBSI is not included, the originating SwMI shall take no action.

5.4.3.2.4.2 Basic call information and compatibility checking at User A MS

Not applicable.

5.4.3.2.4.3 CCBS Recall accepted

If the originating SwMI cannot accept the RECALL ACCEPTED PDU because User A MS provided an invalid CCBSI, the originating SwMI shall send a Reject Cause "Invalid CCBSI reference" to User A MS in a D-DISCONNECT PDU according to the clause 14 of EN 300 392-2 [2]. User A MS shall remove knowledge of the CCBSI parameter value and shall release call related information.

If the originating SwMI cannot accept the RECALL ACCEPTED PDU because recall timer T3 is not running for the given CCBSI (e.g. the terminating SwMI is still monitoring user B or T3 has expired), the originating SwMI shall send, with a Reject Cause "Not ready for call", to User A MS in a D-DISCONNECT PDU according to the clause 14 of EN 300 392-2 [2].

If the originating SwMI cannot accept the RECALL ACCEPTED PDU because there are no available resource at User A MS, the originating SwMI shall send, with a Reject Cause "Lack of resources at User A MS" to User A MS in a D-DISCONNECT PDU according to the clause 14 of EN 300 392-2 [2]. User A MS shall remove knowledge of the CCBSI parameter value. The originating SwMI shall suspend the CCBS MONITOR request to the terminating SwMI and resume monitoring of User A MS.

If the originating SwMI cannot accept the RECALL ACCEPTED PDU because the call has already been accepted with the same CCBSI, the originating SwMI shall send, with a Reject Cause "Already accepted", to User A MS in a D-DISCONNECT PDU according to the clause 14 of EN 300 392-2 [2]. User A MS shall remove knowledge of the CCBSI parameter value and shall release the call retained information. The originating SwMI shall suspend the CCBS MONITOR request to the terminating SwMI and resume monitoring of User A MS as described in the status request clause 5.4.3.1.2.3. User A MS may retain the CCBSI reference for the purpose of LIST and CANCEL.

5.4.3.2.4.4 CCBS call establishment

If the terminating SwMI cannot establish the call because user B is busy again, the originating SwMI receives a CCBSI PDU associated to the ISI-DISCONNECT with a Reject Cause user B busy (again) and the CCBS MONITOR request has not been canceled, with the TETRA option "CCBS request retention", then as a result of the terminating SwMI proceeding with normal call clearing, the originating SwMI shall clear the call according to the procedures in clause 14 of EN 300 392-2 [2], go back to state CCBS-Invoked-A and the terminating SwMI shall resume monitoring user B for being not busy.

If the terminating SwMI cannot establish the call for any reason other than user B being busy again, the originating SwMI receives a CCBSI PDU associated to an ISI-DISCONNECT with a Reject Cause either "failure to match" or "unspecified", then as a result of the terminating SwMI proceeding with normal call clearing, the originating SwMI shall clear the call according to the procedures in clause 14 of EN 300 392-2 [2]. Furthermore, if the CCBS MONITOR request has not been canceled the CCBS supplementary service shall be canceled by the originating SwMI which shall stop timer T2, indicate the failure to User A MS according to the normal procedure. The Cancellation Cause information element shall indicate "Basic call failed".

If timer T2 expires before sending the ALERTING or CONNECT message to User A MS, the CCBS supplementary service shall be canceled according to the normal procedure above. The Cancellation Cause information element shall indicate "Expiration of service duration timer (T2)".

If clearing of the CCBS call is initiated by User A MS before the ALERTING or CONNECT message is sent to User A MS, the originating SwMI shall proceed with clearing according to the procedures in clause 14 of EN 300 392-2 [2]. Furthermore the CCBS supplementary service shall be canceled according to the normal procedure above. The Cancellation Cause information element shall indicate "basic call failed".

If User A MS requests cancellation of a CCBS request while the CCBS call associated with that request is in the process of being established, then the normal procedure above shall be followed and the establishment of the CCBS call shall continue according to the procedures in clause 14 of EN 300 392-2 [2].

If the CCBS call set-up fails without a CCBSI PDU being received, the originating SwMI shall cancel the CCBS Request.

5.4.3.2.4.5 Network initiated cancellation procedures

None.

5.4.3.2.4.6 B-free but A-busy procedure

None.

5.4.4 Actions at the Terminating SwMI

The SDL representation of procedures at the originating SwMI is shown in figure A.2.

5.4.4.1 Normal Procedures

5.4.4.1.1 Determination that CCBS is available

CCBS is available at the terminating SwMI, when the following set of conditions apply:

- a clearing message has been received from user B with cause value (user busy) or (no circuit/channel available) or the call fails due to network determined user busy; and
- the maximum length of queue B is greater than zero.

5.4.4.1.2 Acceptance of a CCBS MONITOR request

A request to activate CCBS MONITOR to a given destination shall be accepted by the terminating SwMI and queued if:

- user B has subscribed to the given basic service; and
- the limit on the number of CCBS requests to the given destination has not been exceeded (this limit is a network provider option with a maximum value of 5); and
- user B has not invoked a supplementary service which prohibits the activation of the CCBS supplementary service against that destination; and
- user B compatibility requirements are met (the service is an existing service, user B is free or user B is busy).

5.4.4.1.3 Queue B processing

The CCBS MONITOR requests in queue B shall be processed in chronological order, although the actual mechanism for processing queue B is outside the scope of the present document. During the processing of queue B, the CCBS MONITOR requests which are currently suspended shall be ignored.

Queue B processing shall start if a busy user B becomes free.

If a new request is queued and queue processing is not active, then for this new request the determination of user B free shall take place according to the above procedure.

If on resumption of a CCBS MONITOR request queue processing is not active, then for this request the determination of user B free shall take place according to the procedure below.

On selection of a CCBS MONITOR request the determination of user B free shall take place according to the normal procedure.

If, for any reason, no CCBS call results from the processing of a CCBS request, then the next CCBS request against user B shall be selected for processing.

If the whole queue B has been processed and no CCBS call results, processing is complete and shall only be restarted, if the conditions for starting (as specified above) are fulfilled again or became fulfilled again while the previous processing of queue B was ongoing.

5.4.4.1.4 Determination of user B free

User B shall be determined to be free if:

- there is a free user B resource; and
- the service is an existing service corresponding to the basic service invoked in the CCBS Call.

If user B is determined to be free, then the terminating SwMI shall start timer T6 and limit incoming calls during the time that T6 is running.

If the terminating SwMI receives only an indication "compatible and busy", the terminating SwMI shall select the next CCBS request in queue B and continue processing, and cancel any incoming call limitations.

Limitation of incoming call to user B in this case means that the last free B resource shall not be allocated to an incoming call during the time T6 is running and assuming incoming call priority is not superior to the CCBS call priority. The reserved user B resource may be used for outgoing calls. After expiration of timer T6, incoming calls shall be offered to user B only if they have service requirements and address information not identical to the CCBS request currently being processed. Identical calls shall be rejected with cause (no terminating SwMI resource available).

5.4.4.1.5 CCBS Call set-up

5.4.4.1.6 CCBS Call without Path Reservation

If a basic call SETUP message is received with a CCBSI PDU, the terminating SwMI shall attempt to associate the incoming CCBS Call with a CCBS MONITOR Request in state CCBS-Await-Call-Completion and if successful and User B is still not busy, extend the CCBS Call to User B and enter state CCBS-Wait-User-B-Alert.

The association shall be achieved by comparing the basic call information locally stored (including the user A CCBSI and its full ITSI) with the information elements of the received SETUP message. A match shall be deemed to occur if all the elements stored locally match the corresponding information elements of the SETUP message; any information element in the SETUP message for which no corresponding element is stored shall be ignored during the comparison.

If in state CCBS-Wait-User-B-Alert an ALERTING or a CONNECT message is sent to the Originating SwMI, the Terminating SwMI shall cancel the respective CCBS MONITOR Request and enter state CCBS-Idle. The associated signaling connection shall be released. The CCBS Call shall continue.

5.4.4.2 Exceptional Procedures

5.4.4.2.1 CCBS Invocation

A CCBS MONITOR Request may be accepted if it is a duplicate of an already stored CCBS MONITOR Request excepted that the CCBS user B queue shall not be incremented and both requests will be merged.

NOTE: Duplicate requests can also be caused by the Terminating SwMI discarding part of the received basic call information.

If a request for CCBS MONITOR cannot be accepted, the Terminating SwMI shall return an ISI-RELEASE message with a CCBS MONITOR ACK PDU. Cause "normal call clearing" shall be used.

If the failure condition is persistent (e.g. service not provided for User B), an error value corresponding to a long term denial shall be included.

If the failure condition is transient (e.g. allowed number of active CCBS Requests exceeded), an error value corresponding to short term denial shall be included.

5.4.4.2.1.1 Determination that CCBS is available

If a call independent CCBS CANCELLATION PDU which cannot be associated with a CCBS Request is received by the terminating SwMI the PDU shall be ignored.

If a call related ISI-SETUP message is received with a CCBSI PDU that cannot be associated with a CCBS MONITOR Request in state CCBS-Await-Call-Completion, the Terminating SwMI shall return an ISI-DISCONNECT message with a CCBSI PDU with Reject Cause "failure to match".

5.4.4.2.2 Acceptance of a CCBS Monitor Request

The following situation shall be treated as "long Term Denial":

- the maximum length of queue B is zero;
- user B has not subscribed to the basic service.

If the terminating SwMI cannot accept the request to invoke CCBS for any other reason, then the terminating SwMI shall inform the originating SwMI that the CCBS request shall be rejected indicating an error value corresponding to "short Term Denial".

5.4.4.2.3 Queue B processing

Not applicable.

5.4.4.2.4 Determination of user B free

If user B is not compatible for the basic service requested, the terminating SwMI shall release the user B resource reservation (limitation to incoming calls) and cancel the CCBS supplementary service. On expiration of timer T6 and if there is no user B resource available, the terminating SwMI shall cancel any user B resource reservation (limitation to incoming calls) and wait for a user B resource to become free.

5.4.4.2.5 CCBS Call set-up

If User A MS establishes the CCBS call set-up, and user B is determined to be busy again, then the terminating SwMI shall inform the originating SwMI, and shall maintain the CCBS MONITOR request.

If User B is busy again when receiving a CCBSI PDU, in a SETUP message while in state CCBS-Await-Call-Completion, the Terminating SwMI shall return a DISCONNECT message with a CCBSI PDU with error value user B busy (again). The service retention option being in use, the CCBS MONITOR Request shall be retained and monitoring of User B shall be resumed, returning to state CCNR-Invoked-User-B.

If User A MS does not request the CCBS call set-up and the originating SwMI cancels the CCBS MONITOR request, then the terminating SwMI shall cancel the CCBS MONITOR request and cancel the user B resource reservation (limitation of incoming calls).

If User A MS requests the CCBS call set-up and user B does not accept the call, or the call is rejected for any reason except busy, then the terminating SwMI shall cancel the CCBS MONITOR request and inform the originating SwMI.

If the originating SwMI indicates suspension of the CCBS request, then the terminating SwMI shall suspend the CCBS MONITOR request and cancel the user B resource reservation (limitation of incoming calls).

If a DISCONNECT message without any SS-CCBS PDU is received for a CCBS Call in progress the associated CCBS MONITOR Request shall be canceled, and state CCBS-Idle shall be entered.

5.4.5 Actions at the Group Controlling SwMI

The SDL representation of procedures at the originating SwMI is shown in figure A.2.

5.4.5.1 Normal Procedures

5.4.5.1.1 Determination that CCBS is available

CCBS is available at the Group Controlling SwMI, when the following set of conditions apply:

- a clearing message has been received from group B with cause value (group busy) or (no circuit/channel available) or the call fails due to network determined user busy; and
- the maximum length of queue (group) B is greater than zero.

5.4.5.1.2 Acceptance of a CCBS Monitor Request

A request to activate CCBS MONITOR to a given destination shall be accepted by the Group Controlling SwMI and queued if:

- group B has subscribed to the given basic service (group B compatibility with requested service); and
- the limit on the number of CCBS requests to the given destination has not been exceeded (this limit is a network provider option with a maximum value of 5); and
- group B has not invoked a supplementary service which prohibits the activation of the CCBS supplementary service against that destination; and
- there is no status request user B processing in the case of group B; the determination of group B busy is outside the scope of the present document.

5.4.5.1.3 Queue B processing

The CCBS MONITOR requests in queue B shall be processed in chronological order, although the actual mechanism for processing queue B is outside the scope of the present document. During the processing of queue B, the CCBS MONITOR requests which are currently suspended shall be ignored. Queue B processing shall start if a busy group B becomes free.

If a new request is queued and queue processing is not active, then for this new request the determination of group B free shall take place.

If on resumption of a CCBS MONITOR request, queue processing is not active, then for this request the determination of group B free shall take place. On selection of a CCBS MONITOR request the determination of group B free shall take place as well.

If, for any reason, no CCBS call results from the processing of a CCBS request, then the next CCBS request against group B shall be selected for processing.

If the whole queue B has been processed and no CCBS call results, processing is complete and shall only be restarted, if the conditions for starting (as specified above) are fulfilled again or became fulfilled again while the previous processing of queue B was ongoing.

5.4.5.1.4 Determination of Group B free

While the mechanism to determine that group B is free is outside the scope of the present document, the following minimum criteria shall be met before group B can be determined as free:

- there is a free group B resource; and
- the service, in which group B is, is an existing service corresponding to the basic service invoked in the CCBS Call.

If group B is determined to be free, then the group controlling SwMI shall start timer T6 and limit incoming calls to that group during the time that T6 is running.

If the group controlling SwMI receives only an indication "compatible and busy", the group controlling SwMI shall select the next CCBS request in queue B and continue processing, and cancel any incoming call limitations.

Limitation of incoming call to group B in this case means that the last free group B resource shall not be allocated to an incoming call during the time T6 is running and assuming incoming call priority is not superior to the CCBS call priority. The reserved group B resource may be used for group calls. After expiration of timer T6, incoming calls shall be offered to group B. Calls which have service requirements and address information identical to the CCBS request currently being processed shall be recognized and running timers for those CCBS calls shall be reset.

5.4.5.1.5 CCBS Call set-up

5.4.5.1.5.1 CCBS Call without Path Reservation

If a basic call SETUP message is received with a CCBSI PDU, the group controlling SwMI shall attempt to associate the incoming CCBS Call with a CCBS MONITOR Request in state CCBS-Await-Call-Completion and, if successful and group B is still not busy, extend the CCBS Call to group B and enter state CCBS-Wait-Group-B-Connect.

The association shall be achieved by comparing the basic call information locally stored with the information elements of the received SETUP message including the user A CCBSI and its full ITSI. A match shall be deemed to occur if all the elements stored locally match the corresponding information elements of the SETUP message; any information element in the SETUP message for which no corresponding element is stored shall be ignored during the comparison.

If in state CCBS-Wait-Group-B-Connect a CONNECT message is sent to the Originating SwMI, the Group Controlling SwMI shall cancel the respective CCBS MONITOR Request and enter state CCBS-Idle. The associated signaling connection shall be released. The CCBS group Call shall continue.

5.4.5.1.5.2 Determination that CCBS is available

If a call independent SETUP message is received with a CCBS CANCEL PDU which cannot be associated with a CCBS MONITOR Request the PDU shall be ignored.

If a call related SETUP message is received with a CCBSI PDU that cannot be associated with a CCBS MONITOR Request in state CCBS-Await-Call-Completion, the Group Controlling SwMI shall return a DISCONNECT message with a CCBSI PDU with Reject Cause "failure to match".

5.4.5.1.6 Acceptance of a CCBS Monitor Request

The following situation shall be treated as "long Term Denial":

- the length of queue B is zero;
- group B has not subscribed to the basic service.

If the Group Controlling SwMI cannot accept the request to invoke CCBS Monitor for any other reason, then the Group Controlling SwMI shall inform the originating SwMI that the CCBS MONITOR request shall be rejected indicating "short Term Denial".

5.4.5.1.7 Queue B processing

Not applicable.

5.4.5.1.8 Determination of group B free

If group B is not compatible for the basic service requested, the group controlling SwMI shall release the group B resource reservation (limitation to incoming calls) and cancel the CCBS supplementary service. On expiration of timer T6 and if there is no Group B resource available, the group controlling SwMI shall cancel any group B resource reservation (limitation to incoming calls) and wait for a group B resource to become free.

5.4.5.1.9 CCBS Call set-up

If User A MS establishes the CCBS call, and group B is determined to be busy again, then the group controlling SwMI shall inform the originating SwMI, and shall maintain the CCBS MONITOR request.

If Group B is busy again when receiving a CCBSI PDU in a SETUP message while in state CCBS-Await-Call-Completion, the Group Controlling SwMI shall return a DISCONNECT message with a CCBSI ACK PDU with error value Group B busy (again). The service retention option being in use, the CCBS MONITOR Request shall be retained and monitoring of Group B shall be resumed, returning to state CCBS-Invoked-Group.

If User A MS does not establish the CCBS call and the originating SwMI cancels the CCBS MONITOR request, then the Group Controlling SwMI shall cancel the CCBS MONITOR request and cancel the Group B resource reservation (limitation of incoming calls).

If User A MS establishes the CCBS call and Group B does not accept the call, or the call is rejected for any reason except busy, then the Group Controlling SwMI shall cancel the CCBS MONITOR request and inform the originating SwMI.

If the originating SwMI indicates suspension of the CCBS MONITOR request, then the Group Controlling SwMI shall suspend the CCBS MONITOR request and cancel the Group B resource reservation (limitation of incoming calls).

If a DISCONNECT message without any SS-CCBS PDU is received for a CCBS Call in progress the associated CCBS MONITOR Request shall be canceled, and state CCBS-Idle shall be entered. If a signaling connection still exists it shall be released.

5.4.6 Actions at the Participating SwMI

There are no particular actions at the participating SwMI.

5.5 Impact of inter-working with public ISDN

The SS-CCBS procedures specified in the present document are compatible with the public ISDN procedures for the T reference point. When inter-working with the public ISDN, a Gateway SwMI shall perform the procedures specified below.

If the terminating SwMI cannot establish the call because user B is busy again, and the CCBS request has not been canceled, and in the case or inter-working, the inter-working network option "CCBS request retention" is set to "no", then as a result of the terminating SwMI proceeding with normal call clearing, the originating SwMI shall clear the call according to the procedures in clause 14 of EN 300 392-2 [2], and allow User A MS to invoke SS-CCBS again using the normal invocation procedure above. Furthermore, the CCBS supplementary service shall be canceled according to the normal procedure above. The Cancellation Cause information element shall indicate "Basic call failed".

5.5.1 Incoming Gateway SwMI procedures: SS-CCBS request from a public ISDN

If a call from the public ISDN encounters a busy User B in the TETRA network and if the public ISDN requires to be informed if SS-CCBS is available, the Incoming Gateway SwMI shall indicate to the public ISDN that SS-CCBS is available, unless it is known that SS-CCBS is not available.

If a CCBS request is received from the public ISDN, the Incoming Gateway SwMI shall establish a call independent signaling connection towards the Terminating SwMI. The SETUP message shall include a CCBS REQUEST PDU, which shall contain in its argument the data received from the public ISDN, the element retain-sig-connection with value TRUE and optionally element can-retain-service, reflecting the corresponding indication from the public ISDN.

The Incoming Gateway SwMI shall translate the following PDUs received from the Terminating SwMI into corresponding information and send it to the public ISDN: a CCBS REQUEST ACK PDU; a RECALL PDU; a CCBS CANCEL PDU.

CCBS CANCEL, CCBS SUSPEND or CCBS RESUME PDUs shall be generated and sent to the Terminating SwMI when the Incoming Gateway SwMI receives corresponding indications from the public ISDN.

All call independent signaling for a particular CCBS Request shall use the same call independent signaling connection, which shall remain active until that CCBS Request terminates.

If a CCBS Call is received from the public ISDN it shall be extended by the Incoming Gateway SwMI towards the Terminating SwMI, including a CCBSI PDU in the SETUP message.

When the call independent signaling connection to the Terminating SwMI is released the Incoming Gateway SwMI shall release the call independent signaling association at the T reference point.

5.5.2 Outgoing Gateway SwMI procedures: SS-CCBS request to a public ISDN

If a CCBS request is destined for the public ISDN the Outgoing Gateway SwMI shall translate the CCBS REQUEST PDU and send it to the public ISDN according to the procedures for the T reference point. When receiving a response the Outgoing Gateway SwMI shall generate a CCBS REQUEST ACK PDU (if the CCBS request was accepted) or a Reject Cause PDU (if the CCBS request was rejected) and send it to the Originating SwMI in a CONNECT message (return result) or in a RELEASE message (return error). The return result PDU shall contain element no-path-reservation with value TRUE and optionally element retain-service, reflecting the corresponding indication from the public ISDN.

NOTE: The sending of the return result PDU in a CONNECT message is in accordance with the connection retention method. This overrides the value FALSE in element retain-sig-connection, if present in the CCBS REQUEST PDU.

RECALL or CCBS CANCEL PDUs shall be generated and sent to the Originating SwMI when the Outgoing Gateway SwMI receives corresponding indications from the public ISDN.

The Outgoing Gateway SwMI shall translate the following PDUs received from the Originating SwMI into corresponding information and send it to the public ISDN:

- a CCBS SUSPEND PDU;
- a CCBS RESUME PDU;
- a CCBS CANCEL PDU.

All call independent signaling for a particular CCBS Request shall use the same call independent signaling connection, which shall remain active until that CCBS Request terminates.

A CCBS Call without Path Reservation shall be extended by the Outgoing Gateway SwMI to the public ISDN.

When the call independent signaling connection to the Originating SwMI is released the Outgoing Gateway SwMI shall release the call independent signaling association at the T reference point.

5.6 Protocol Interaction between SS-CCBS and Other Supplementary Services and ANFs

Interactions with other supplementary services and ANFs for which SwMI standards were available at the time of publication of the present document are specified below with the following exceptions; supplementary services with which either "no possible interaction" or "SS-CCBS shall not have any interaction with SS-XXX" were defined in EN 300 392-10-13 [8] have not been repeated below.

5.6.1 Calling/Connected Line Identification Restriction (SS-CLIR)

If User A MS requests presentation restriction for a call (does not use the default value for a call), and the call encounters a busy user B, the request to restrict presentation of the calling line identification shall be retained by the network and shall apply to a call resulting from the use of SS-CCBS.

5.6.2 Call Completion on Busy Subscriber (SS-CCBS)

A user can be both a "User A MS" and a "user B" simultaneously: that user can have activated the CCBS supplementary service and have SS-CCBS requests outstanding whilst at the same time that user can be the destination of CCBS recalls from other users.

If a user receives a SS-CCBS recall while that user's B queue is being processed, then the CCBS recall shall take priority over the handling of the user B SS-CCBS queue. The handling of SS-CCBS requests activated by this user shall have priority over the handling of SS-CCBS requests activated by other users on this user.

If one of the user's CCBS request matures as a result, then the user shall be given a SS-CCBS recall and the served user's B idle guard timer shall be canceled.

5.6.3 Call Completion on No Reply (SS-CCNR)

If User A MS has SS-CCNR activated on user B, and User A MS requests SS-CCBS on user B, this request shall be treated as a duplicate SS-CCBS request.

NOTE: When user B is busy (the pre-requisite for invocation of SS-CCBS by User A MS) before SS-CCNR Recall has been started relating to a previous SS-CCNR request, the pending SS-CCNR request has effectively become an SS-CCBS request, as it is awaiting a free user B in order to recall User A MS. If an SS-CCBS request is then received from User A MS, relating to user B, this is therefore effectively a duplicate SS-CCBS request and is treated as such by the network.

5.6.4 Call Forwarding Unconditional (SS-CFU)

The following interactions shall apply.

5.6.4.1 Originating SwMI procedures for invoking SS-CCBS at a SS-CFU diverted-to user

NOTE: In this case the Originating SwMI with regard to SS-CCBS is also the Originating SwMI with regard to SS-CFU.

If SS-CCBS is to be invoked at a busy diverted - to user, the Originating SwMI shall store the content of element nominated-number, if received in the argument of operation diverting-leg-information1, and use it as:

- element number-B in the argument of any SS-CCBS operation which requires this element;
- Called party number information element in the SETUP message of any call independent signaling procedure;
- Called party number information element in the SETUP message of the CCBS Call.

The address of the originally called user shall not be used for CCBS.

If element nominated-number is not available, a SS-CCBS request received from User A MS shall be rejected.

5.6.4.2 Originating SwMI procedures if SS-CFU is activated by User A MS

NOTE 1: In this case the Originating SwMI with regard to SS-CCBS is the Served User SwMI with regard to SS-CFU.

NOTE 2: If SS-CCBS User A MS, having a SS-CCBS request outstanding against User B, has activated SS-CFU and the connection release option of SS-CCBS applies, an arriving call independent signaling connection (conveying either a CCBS RECALL PDU or a CCBS CANCEL PDU is not an incoming call and therefore will not be diverted.

5.6.4.3 Terminating SwMI procedures if SS-CFU is activated by User B after SS-CCBS has been invoked

No protocol interaction.

5.6.5 Call Forwarding Busy (SS-CFB)

The following interaction shall apply.

5.6.5.1 Originating SwMI procedures for invoking SS-CCBS at a SS-CFB diverted-to user

NOTE: In this case the Originating SwMI with regard to SS-CCBS is also the Originating SwMI with regard to SS-CFB.

The procedures of clause 5.6.4.1 shall apply.

5.6.5.2 Originating SwMI procedures if SS-CFB is activated by User A MS

No protocol interaction.

5.6.5.3 Terminating SwMI procedures if SS-CFB is activated by User B after SS-CCBS has been invoked

No protocol interaction.

5.6.6 Call Forwarding on No Reply (SS-CFNR)

No protocol interaction.

5.6.7 List Search Call (SS-LSC)

User A MS shall not be able to invoke SS-CCBS if the original call has failed due to the attendants in the list search call being busy.

5.6.8 Call Authorized by Dispatcher (SS-CAD)

If the original call placed by User A MS was given authorization by a dispatcher for completion, then subsequent invocation of SS-CCBS by User A MS to the Authorized destination, shall not require further authorization by a dispatcher. In the CCBS Call set-up, an indication that the call set-up belongs to a CCBS Call shall be needed; this will imply an additional bit in the ISI call set-up. This additional bit will insure that dispatcher is by-passed in the subsequent CCBS call.

5.6.9 Area Selection (SS-AS)

If User A MS invokes SS-CCBS to user B and subsequently user B moves outside of the selected area, then the request shall be canceled and User A MS shall receive a notification of the reason for cancellation.

If User A MS sets-up its CCBS call with a new area selected, SS-CCBS shall be canceled and User A MS will get a cause for the cancellation.

5.6.10 Priority Call (SS-PC)

Call completion to busy subscriber shall not have any interaction with priority call. If the priority call leads to invocation of SS-CCBS, (finding user B busy), the CCBS call shall use the same priority as the original call.

5.6.11 Interactions with ISI Mobility Management (ANF-ISIMM)

5.6.12 User A MS migrates

User A MS may migrate with two different situations in relation to SS-CCBS:

- User A MS has not yet invoked SS-CCBS for any call;
- User A MS has already invoked at least once SS-CCBS; SS-CCBS is not idle for User A MS when User A MS migrates.

The initial migration process will be similar in both above cases; the completion of the migration process will be different in the two cases.

NOTE: User B may be in a situation where user B is both invoking CCBS as a User A MS (case 2) and has CCBS invoked on him by another User A MS (case 3); in this combination of cases the exchange of both "User A MS profile" (described above) and "user B profile" (described below) will need to be performed in sequence.

Step 1: Once informed that User A MS has migrated from User A MS SwMI to User A MS visited SwMI, User A MS home SwMI shall send the following SS-CCBS profile information to the User A MS visited SwMI through ANF-ISIMM:

- SS-CCBS provided or not to User A MS.

The User A MS visited SwMI shall reply to User A MS home SwMI with an indication that CCBS is supported with the proper subscription parameters within User A MS visited SwMI.

As long as no invocation of CCBS by User A MS takes place, the process will be completed at that time.

SS-CCBS provision or non provision and the possible optional CCBS parameters shall be sent by the home SwMI to the visited SwMI as part of ANF-ISIMM basic profile information, in the ANF-ISIMM PROFILE UPDATE PDU (see table 57).

The visited SwMI shall acknowledge the transfer of that information, in indicating to the home SwMI, also through ANF-ISIMM in the ANF-ISIMM PROFILE UPDATE RES PDU (see table 58), as acknowledgment of the basic profile information, whether or not it supports:

- SS-CCBS as served user SwMI.

As to the SS-CCBS invocation possibly with optional subscription parameters, they shall be indicated as part of the ANF-ISIMM original SS-migration profile sent by the home SwMI in the SS-CCBS profile information element defined in table 84 part of the ANF-ISIMM SS-PROFILE UPDATE PDU (see table 59). The visited SwMI shall acknowledge the SS-CCBS profile information element in sending back the profile ACK information element defined in table 85, part of the ANF-ISIMM SS-PROFILE UPDATE RES PDU (see table 60). The latter shall acknowledge the SS-CCBS invocation requested for the subscriber. If the activation had been requested with optional subscription parameters, the response shall take into account those supported by the visited SwMI. In case the exchange of either profile update or SS-profile update does not succeed, PROFILE REJECT respectively SS-PROFILE REJECT will be received.

Step 2: When User A MS, who has already invoked SS-CCBS for at least one call, migrates to a visited SwMI, his home SwMI shall inform User A MS SwMI that User A MS has migrated to User A MS visited SwMI (giving the User A MS SwMI the MNI of the User A MS visited SwMI).

Step 3: The User A MS SwMI shall establish a signaling connection mechanism with the User A MS visited SwMI and shall send on this signaling connection information concerning the progress of the CCBS requests in process at the time of User A MS; the User A MS SwMI shall release signaling connection with user B SwMI and the User A MS visited SwMI shall build that signaling path.

The User A MS SwMI shall send the following SS-CCBS profile information to the User A MS visited SwMI:

- SS-CCBS provided or not to User A MS;
- SS-CCBS invoked with which optional subscription parameters:
  - service retention.
- User A MS queue length;
- CCBSI(s);
- active timers at the time of migration;
- possible restrictions due to invocation of other supplementary services;
- initial call retention parameters including call priority, area selection, basic service information and list of other invoked supplementary services and user A MS and user B MS initial addresses for each CCBSI; (if user B has migrated since the initial call was placed, the new user B MNI shall replace the original user B MNI);
- state(s) in which SS-CCBS invocations were considered to be at the time of User A MS migration.

5.6.12.1 PROFILE EXCHANGE PDUS

The SS-CCBS specific profile PDUs are given below. Since there is no activation/deactivation/definition/interrogation/ for SS-CCBS, there is no need for profile upgrade.

5.6.12.1.1 PROFILE REJECT

The PDU shall be used to reject the invoked profile update service and shall be coded as specified in table 56.

Direction: User A MS visited SwMI MM to User A MS home SwMI MM
Response to: PROFILE UPDATE
Response expected: none

Table 56: PROFILE REJECT

Information element	Length	Type	C/O/M	Remark
PDU type	6	1	M	
ANF-ISIMM invoke id	16	1	M	
SSI (ISSI or GSSI)	24	1	M	
Profile rejection cause	4	1	M	
Recovery	1	1	M	
Proprietary		3	O	

5.6.12.1.2 PROFILE UPDATE

The PDU shall be used to invoke the profile update service across the ISI and shall be coded as specified in table 57.

Direction: User A MS home SwMI MM to User A MS visited SwMI MM
Response to: none
Response expected: PROFILE UPDATE RESPONSE

Table 57: PROFILE UPDATE

Information element	Length	Type	C/O/M	Remark
PDU type	6	1	M	
ANF-ISIMM invoke id	16	1	M	
SSI (ISSI or GSSI)	24	1	M	
Following conditional element(s) present	1	1	M	
MNI (of the subscriber or of the group)	24	1	C	note 1
MNI (of the visited SwMI MM)	24	1	C	note 1
Profile type (individual /group)	1	1	M	
Basic migration profile (original)	variable	1	M	notes 2 and 3
SS-profile update indicator	2	1	M	
Recovery	1	1	M	
Proprietary		3	O	
NOTE 1: The element shall be present if the value of preceding "Following conditional element(s) present" is "Present", otherwise the element shall be omitted. NOTE 2: Based on the SSI the information element shall contain either the original basic migration profile of an individual subscriber or of a group. NOTE 3: Type 1 indicates that there is no additional PDU encoding bits other than those in the basic profile information element itself.				

5.6.12.1.3 PROFILE UPDATE RESPONSE

The PDU shall be used to report the successful outcome of the profile update service and shall be coded as specified in table 58.

Direction: User A MS visited SwMI MM to User A MS home SwMI MM
Response to: PROFILE UPDATE
Response expected: none

Table 58: PROFILE UPDATE RESPONSE

Information element	Length	Type	C/O/M	Remark
PDU type	6	1	M	
ANF-ISIMM invoke id	16	1	M	
SSI (ISSI or GSSI)	24	1	M	
Profile type (individual/group)	1	1	M	
Basic migration profile info	1	1	M	
Basic migration profile (temporary)	variable	1	C	notes 1 and 2
Recovery	1	1	M	
Proprietary		3	O	
NOTE 1: The service element shall be present if the Basic profile info has the value "Redefined, sent to the home SwMI MM", otherwise the element shall be omitted. If included, based on the SSI the information element shall contain the temporary basic migration profile either of an individual subscriber or of a group. NOTE 2: Type 1 indicates that there is no additional PDU encoding bits other than those in the basic profile information element itself.				

5.6.12.1.4 SS-PROFILE UPDATE

The PDU shall be used to invoke the SS-profile update service across the ISI and shall be encoded as specified in table 59.

Direction: User A MS home SwMI MM to User A MS visited SwMI MM
Response to: none
Response expected: PROFILE UPDATE RESPONSE

Table 59: SS-PROFILE UPDATE

Information element	Length	Type	C/O/M	Remark
PDU type	6	1	M	
ANF-ISIMM invoke id	16	1	M	
SSI (ISSI or GSSI)	24	1	M	
Following conditional element(s) present	1	1	M	
MNI (of the subscriber or of the group)	24	1	C	note 1
MNI (of the visited SwMI MM)	24	1	C	note 1
Profile type (individual /group)	1	1	M	
Recovery	1	1	M	
Number of SS-migration profiles	6	1	M	
SS-migration profiles (original)	variable		C	note 2
Proprietary		3	O	
NOTE 1: The element shall be present if the value of preceding "Following conditional element(s) present" is "Present", otherwise the element shall be omitted. NOTE 2: The element shall be repeated as indicated by the Number of SS-migration profiles information element. Each element shall contain the information of one original SS-migration profile.				

5.6.12.1.5 SS-PROFILE UPDATE RESPONSE

The PDU shall be used to report the successful outcome of the SS-profile update service and shall be encoded as specified in table 60.

Direction: visited SwMI MM to home SwMI MM
Response to: PROFILE UPDATE
Response expected: none

Table 60: SS-PROFILE UPDATE RESPONSE

Information element	Length	Type	C/O/M	Remark
PDU type	6	1	M	
ANF-ISIMM invoke id	16	1	M	
SSI (ISSI or GSSI)	24	1	M	
Profile type	1	1	M	
Recovery	1	1	M	
Number of not supported SSs	6	1	M	
Not supported SS	6	1	C	note 1
Number of SS-migration profiles	6	1	M	
SS-migration profile (temporary)	variable		O	note 2
Proprietary		3	O	
NOTE 1: The element shall be present as many times as indicated by the element "Number of not supported SSs". NOTE 2: The element shall be repeated as indicated by the Number of SS-migration profiles information element. Each element shall contain information on one temporary SS-migration profile.				

5.6.12.1.6 Individual basic migration profile

Void.

5.6.12.1.7 SS-migration profile (original and temporary)

The SS-migration profile mechanism (original and temporary) for an individual subscriber or a group shall not be used for CCBS; the User A MS SwMI shall directly inform the User A MS visited SwMI of the detailed invocation and state parameters of the CCBS.

5.6.12.1.8 SS-information

The SS-information element shall indicate if a supplementary service should be supported for the individual subscriber or for the group in the visited SwMI. The SS-information element shall refer to a given supplementary service as indicated by the SS-type information sub-element. The SS-information shall be coded as specified in table 61.

Table 61: SS-information contents

Information sub-element	Length	Type	C/O/M	Remark
SS-type	6	1	M	SS-CCBS
SS-status	2	1	M	

5.6.12.1.9 SS-information response

The SS-information element shall indicate if a supplementary service is supported or not for the individual subscriber or for the group in the visited SwMI MM. The SS-information element shall refer to a given supplementary service as indicated by the SS-type information sub-element and shall be coded as specified in table 62.

Table 62: SS-information response contents

Information sub-element	Length	Type	C/O/M	Remark
SS-type	6	1	M	SS-CCBS
SS-response status	2	1	M	

5.6.12.1.10 SS-response status

The SS-response status information element shall indicate whether a supplementary service is supported or not in the visited SwMI. SS-response status shall be coded as specified in table 63.

Table 63: SS-response status

Information sub-element	Length	Value	Remark
SS-response status	2	00_2	Not supported
		01_2	Supported
		10_2	Reserved
		11_2	Reserved

5.6.12.1.11 SS-status

The SS-status information element shall indicate whether a supplementary service should or should not be supported in the visited SwMI MM. The SS-status information element shall be coded as specified in table 64.

Table 64: SS-status

Information sub-element	Length	Value	Remark
SS-status	2	00_2	Not supported
		01_2	Supported, with original SS-migration profile
		10_2	Supported, without original SS-migration profile
		11_2	Reserved

5.6.12.1.12 SS-type

SS-type shall specify the TETRA supplementary service as defined in EN 300 392-9 [7], clause 8.1.

The case of mobility during a call is not dealt with in the present document.

NOTE: Call restoration has no impact on SS-CCBS; call restoration occurs after the completion of the call and after the completion of actions of SS-CCBS.

5.6.12.2 SS-CCBS profiles

5.6.12.2.1 SS-CCBS migration original profile

SS-CCBS migration original profile is actually an ANF-ISIMM information element, sent by the home SwMI to the visited SwMI of User A MS.

SS-CCBS migration original profile shall contain information elements as defined in table 65.

Table 65: SS-CCBS migration original profile information element contents

Information element	Length	Type	C/O/M	Value	Remark
SS-Type	6	1	M		SS-CCBS
SS-CCBS Provided/Non Provided	1	1	M	1_2 0_2	provided non-provided
Service retention	1	1	C	1_2 0_2	provided non-provided

5.6.12.3 User A MS SS-CCBS migration information PDU

The following information shall be sent by the User A MS SwMI to the User A MS visited SwMI once the signaling connection is established between those two SwMIs. This information flow shall be unconfirmed; in case of transmission errors detected on the lower layer, repetition of the transmission of the User A MS SS-CCBS migration information shall be operated. The User A MS SS-CCBS migration information PDU shall be coded as specified in table 66.

Table 66: User A MS SS-CCBS migration information PDU

Information element	Length	Type	C/O/M	Value	Remark
SS-Type	6	1	M		SS-CCBS
Number of invocations n	3	1	M	0-5	note 1
CCBSI(i)	3	1	C		notes 2, 3 and 6
TETRA Call Identifier(i)	14	1	C		notes 2, 3, 5 and 6
Call Priority(i)	4	1	C		notes 2, 3 and 6
Basic service information (initial call)(i)	8	2	C		notes 2, 3 and 6
Service retention(i)	1	1	C	1_2 0_2	provided non-provided notes 2 and 3
Timer T1(i) running	1	1	C		notes 2 and 3
Timer T2 (i) running	1	1	C		notes 2 and 3
Timer T3 (i) running	1	1	C		notes 2 and 3
Timer T4 (i) running	1	1	C		notes 2 and 3
Timer T5 (i) running	1	1	C		notes 2 and 3
Present User A MS SSI	24	1	C		
Present User A MS MNI (extension)	24	1	C		
Present user B SSI (i)	24	1	C		notes 2 and 3
Present user B MNI (extension) (i)	24	1	C		notes 2 and 3
User B free (i)	1	1	C		notes 2 and 3
Number of other supplementary service invoked s (i)	3	1	C		notes 2 and 3
List of other supplementary service by SS-TYPE PDUs (i)	variable				notes 2, 3 and 4
State reached by SS-CCBS (i) in User A MS SwMI at the time of the migration	4	1	C		notes 2 and 3

NOTE 1: If 0, no invocation, only provision needs to be supplied.
NOTE 2: (i) indicates range from 1 to number of SS-CCBS invocation.
NOTE 3: Conditional on n non zero.
NOTE 4: 5 bits per SS in sequence from 1 to s for each value of I.
NOTE 5: Conditional on whether CCBSI has been allocated to CCBS request.
NOTE 6: Same coding as air interface basic call set-up elements.

5.6.12.3.1 SS-CCBS state at User A MS SwMI at the time of the User A MS migration information element

The coding of the SS-CCBS state(i) at User A MS SwMI at the time of the User A MS migration information element shall be as defined in table 67, i will take the values from 1 to the number of CCBS invocations. This information element corresponds to a "snapshot" of the SS-CCBS protocol and corresponds to sending the state the SDL process for CCBS has reached at the time of the migration.

Table 67: User A SS-CCBS State(i) Information Element contents

Information element	Length	Value	Remark
User A SS-CCBS State(i)	4	0000_2	CCBS-Idle
		0001_2	CCBS-Invoked-User-A
		0010_2	CCBS-Path-Set-up
		0011_2	CCBS-Ringout
		0100_2	CCBS-Wait-ACK
		0101_2	CCBS-Wait-User-A-Answer
		0110_2	CCBS-Wait-User-A-Free
		0111_2	CCBS-Retention-Idle
		1000_2	CCBS-Retention-Active
		1001_2	Reserved
		etc.	etc.
		1111_2	Reserved

5.6.12.3.2 Timer T_j(i) running Information Element content

The timer Tj(i) running information indicates to the User A MS visited SwMI which timers are running at the time of the migration. Upon receipt of those timer running information, the new SwMI starts those timers from the value 0 and let them run to their respective completion. As an example, if the service duration timer T2 was running at the time of the migration, had been running for 12 minutes, had a maximum value of 30 minutes and if User A MS migrates to a new SwMI where timer T2 has value 15 minutes, the bit Tj(i) shall be set to 1 (running) and the new SwMI shall start its timer T2 for that call and that User A MS from the value 0; the end result if the timer is let to go to expiration will be an extended value of 12 + 30 = 42 minutes which is not detrimental to User A MS.

The coding of the Timer Tj(i) information element shall be as defined in table 68, j will take the values from 1 to 6 with the same coding and i will take the values from 1 to the number of CCBS invocations.

NOTE: Timer T6 is not running for User A MS but for user B.

Table 68: Timer T_j(i) Running Information Element contents

Information element	Length	Value	Remark
Timer T_j(i) Running	1	0_2	Timer not running
		1_2	Timer running

Those timer Tj(i) running information elements will be gathered in a matrix 6 x n, where n is the number of CCBS invocations on User A MS at the time of the migration. As an example, the following table 69 gives the coding for three invocations of CCBS on User A MS.

Table 69: Example of timer running coding

	T1	T2	T3	T4	T5
CCBS 1	0	1	0	0	0
CCBS 2	0	1	0	0	0
CCBS 3	0	1	0	0	0

5.6.12.4 User B migrates

Three cases may occur at the time user B migrates:

- Case 1: user B is not involved in any CCBS call; the length of user B CCBS queue is zero and its migration is only subject to the basic migration requirements;
- Case 2: user B is not involved in any SS-CCBS call invoked upon him by another User A MS but has invoked himself at least one instance of SS-CCBS; in that case user B appears like User A MS and its ss-migration process is as specified for User A MS above;
- Case 3: user B is involved in at least one invocation of SS-CCBS by another User A MS.

Only case 3 needs to be specified.

NOTE: User B may be in a situation where user B is both invoking CCBS as a User A MS (case 2) and has CCBS invoked on him by another User A MS (case 3); in this combination of cases the exchange of both "User A MS profile" (described above) and "user B profile" (described below) will need to be performed in sequence.

The migration of user B from a user B SwMI to a user B visited SwMI shall follow the following steps given first in general terms and then in more detailed terms:

- Step 1: user B home SwMI sends profile and SS-profile to user B visited SwMI;
- Step 2: user B home SwMI indicates to user B SwMI the user B visited SwMI where user B has migrated to;
- Step 3: user B SwMI sends to user B visited SwMI all the elements of user B relating to the CCBS invocation(s);
- Step 4: user B SwMI sends to User A MS SwMI the new location (MNI) of user B;
- Step 5: User A MS SwMI sends to user B visited SwMI the MONITOR through a new signaling connection between user A MS SwMI and the user B visited SwMI.

Step 1: Once informed that user B has migrated from user B SwMI to user B visited SwMI, user B home SwMI shall send the following SS-CCBS profile information to the user B visited SwMI through ANF-ISIMM:

- SS-CCBS invoked on user B.

The user B visited SwMI shall reply to user B home SwMI with an indication that CCBS is supported with the proper subscription parameters within user B visited SwMI.

SS-CCBS support or non support and the possible optional CCBS parameters shall be sent by the user B home SwMI to the user B visited SwMI as part of ANF-ISIMM basic profile information, in the ANF-ISIMM PROFILE UPDATE PDU (see clause 34.1.36 of EN 300 392-3-5 [6]).

The user B visited SwMI shall acknowledge the transfer of that information, in indicating to the home SwMI, also through ANF-ISIMM in the ANF-ISIMM PROFILE UPDATE ACK PDU (see clause 34.1.37 of EN 300 392-3-5 [6]), as acknowledgment of the basic profile information, whether or not it supports:

- SS-CCBS as affected user SwMI.

As to the SS-CCBS invocation possibly with optional subscription parameters, they shall be indicated as part of the ANF-ISIMM original SS-migration profile sent by the user B home SwMI in the SS-CCBS profile information element defined in table 84 part of the ANF-ISIMM SS-PROFILE UPDATE PDU (see clause 34.1.43 of EN 300 392-3-5 [6]). The user B visited SwMI shall acknowledge the SS-CCBS profile information element in sending back the profile ACK information element defined in table 85, part of the ANF-ISIMM SS-PROFILE UPDATE ACK PDU (see clause 34.1.44 of EN 300 392-3-5 [6]). If the activation had been requested with optional subscription parameters, the response shall take into account those supported by the user B visited SwMI. In case the exchange of either profile update or SS-profile update does not succeed, PROFILE REJECT respectively SS-PROFILE REJECT will be received.

Step 2: assuming successful completion of step 1 indicating that the user B visited SwMI supports SS-CCBS as user B affected user with the proper subscription parameters, user B home SwMI shall now indicate to user B SwMI the MNI of the user B visited SwMI in a MIGRATION-req-ind which contains the MNI of the individual subscriber as specified in EN 300 392-3-5 [6], clause 33.17, table 17; the MIGRATION request shall be acknowledged by the MIGRATION-resp-conf defined in the same clause.

Step 3: the user B SwMI shall send to the user B visited SwMI in a confirmed information flow the user B SS-CCBS PROFILE which shall be acknowledge by a response.

SS-CCBS migration user B original profile is actually information element, sent by the user B SwMI to the user B visited SwMI.

SS-CCBS migration original profile shall contain information elements as defined in table 70.

Table 70: SS-CCBS migration user B original profile information element contents

Information element	Length	Type	C/O/M	Value	Remark
SS-Type	6	1	M		SS-CCBS
Number of invocations m	3	1	M	0 to 5	note 1
CCBSI(i)	3	1	C		notes 2 and 3
Present user B basic service information (i)	8	2	C		notes 2 and 3
Terminating SwMI state (i)	3	1	C		notes 2 and 3
Present user B SSI	24	1	C		note 3
Present user B MNI (extension)	24	1	C		note 3
Present User A MS SSI (i)	24	1	C		notes 2 and 3
Present User A MS MNI (extension) (i)	24	1	C		notes 2 and 3
Timer T6(i) Running	1	1	C		notes 3 and 4
NOTE 1: If 0, no invocation, only provision needs to be supplied. NOTE 2: (i) indicates range from 1 to number of SS-CCBS invocation m. NOTE 3: Conditional on m non zero. NOTE 4: The only timer running for user B is the idle guard timer T6.					

User B SS-CCBS migration original profile response shall contain the same information elements defined in table 70.

All information elements are already specified excepted for the user B SwMI states and the T6(i) timer running element given below.

5.6.12.4.1 SS-CCBS state at terminating SwMI at the time of the user B migration information element

The coding of the SS-CCBS state(i) at user B SwMI at the time of the user B migration information element shall be as defined in table 71, i will take the values from 1 to the number of CCBS invocations. This information element corresponds to a "snapshot" of the SS-CCBS protocol and corresponds to sending the state the SDL process for CCBS has reached at the terminating SwMI at the time of the migration.

Table 71: SS-CCBS user B State(i) Information Element contents

Information element	Length	Value	Remark
User B SS-CCBS State(i)	3	000_2	CCBS-Idle
		001_2	CCBS-Await-Call-Completion
		010_2	CCBS-Invoked-User-B
		011_2	CCBS-Suspended-User-B
		100_2	CCBS-Wait-User-B-Alert
		101_2	Reserved
		etc.	etc.
		111_2	Reserved

5.6.12.4.2 Timer T6(i) running Information Element content

The timer T6(i) running information indicates to the user B visited SwMI which timer is running at the time of the migration. Upon receipt of this timer running information, the user B visited SwMI starts this timer from the value 0 and let it run to its respective completion.

The coding of the Timer T6(i) running information element shall be as defined in table 72, i will take the values from 1 to the number of CCBS invocations.

Table 72: Timer T6(i) Running Information Element contents

Information element	Length	Value	Remark
Timer T6(i) Running	1	0_2	Timer not running
		1_2	Timer running

Step 4: user B SwMI indicates to the User A MS SwMI the new location of user B using the same migration PDU specified above.

Step 5: User A MS requests Monitoring of user B with the MONITOR PDU with the proper parameters (service retention) sent to the user B visited SwMI. At that point the migration of user B may be considered as completed.

5.7 Parameter values (timers)

5.7.1 Timers at the Originating SwMI

The Originating SwMI shall implement the following timers.

Timer T1: Request Protection and Cancel Protection

This timer is started by User A MS either when sending a CCBS REQUEST PDU and stopped on receipt of CCBS REQUEST ACK or when sending a CCBS CANCEL PDU and stopped on receipt of CCBS CANCEL ACK PDU.

If timer T1 expires a failure indication is sent to User A MS in both cases.

Timer T1 shall have a duration in the range 10 seconds to 30 seconds.

Timer T2: SS-CCBS Service Duration

This timer is started on receipt of the CCBS REQUEST PDU and stopped either on completion of the CCBS call or if the CCBS Request is canceled.

If timer T2 expires the CCBS Request is canceled.

While the duration of timer T2 is implementation dependent, its value shall be between 15 minutes and 45 minutes.

Timer T3: Recall

This timer is started when SS-CCBS RECALL is indicated to User A MS and stopped when User A MS presents RECALL ACCEPTED.

If timer T3 expires the CCBS Request is canceled.

Timer T3 shall have a duration in the range 10 seconds to 30 seconds.

Timer T4: Call Information Retention Timer

This timer is started when information retention occurs as a result of an uncompleted call to a busy subscriber and stopped on receipt of CCBS REQUEST from user A MS.

If timer T4 expires, the call information retention is terminated, the call related information is released and user A MS receives CALL INFORMATION RELEASE PDU.

Timer T4 shall have a value above 15 seconds.

Timer T5: List Request by User A MS

This timer T5 is started by User A MS when sending the LIST PDU and stopped when User A MS receives a LIST ACK PDU.

If timer T5 expires, the LIST request operation is canceled and User A MS considers that the LIST attempt has failed.

Timer T5 shall have a value between 20 seconds and 60 seconds.

5.7.2 Timers at the Terminating SwMI

Timer T6: Guard Time User B

This timer T6 is started by user B when becoming free.

If timer T6 expires, the guard against incoming calls shall be terminated.

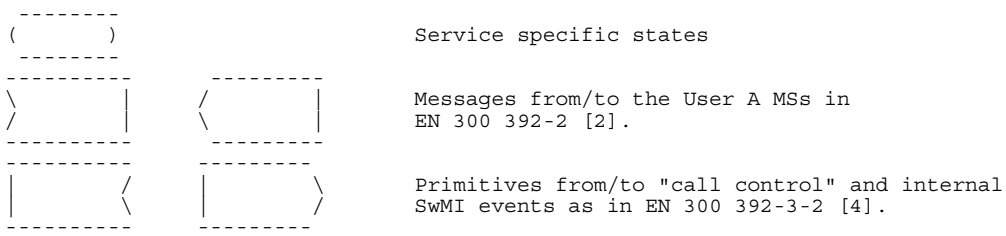
Timer T6 shall have a value between 0 seconds and 15 seconds. If set to 0, it is equivalent to an inhibition of the guard function.

Annex A (informative): SDL Representation of Procedures

The dynamic descriptions specified in figures A.1 to A.4 are according to ITU-T Recommendation Z.100 [i.2].

A.1 Behavior of the Originating SwMI

CCBS originating SwMI side process SDL diagrams



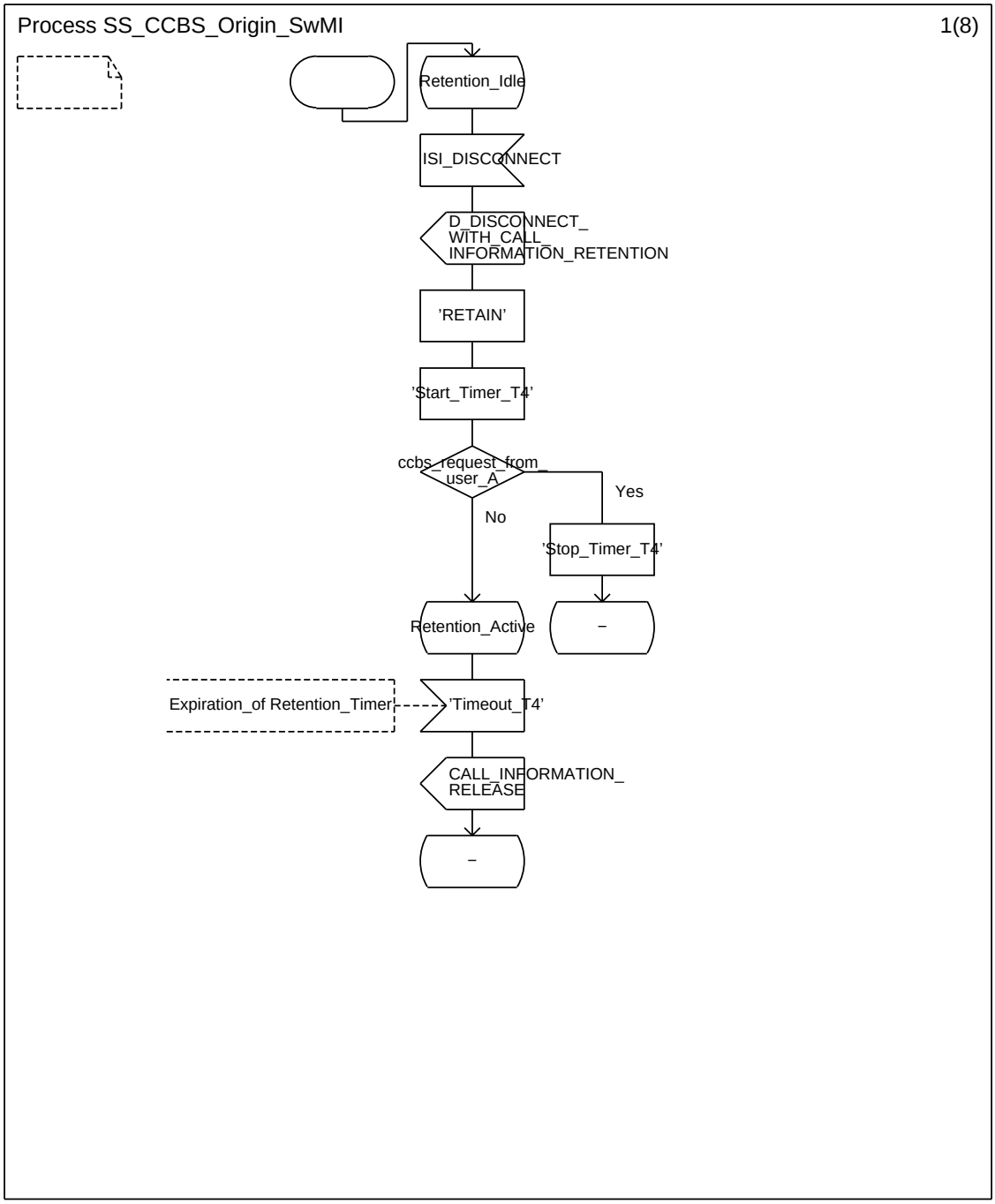


Figure A.1: Originating SwMI process (sheet 1 of 8)

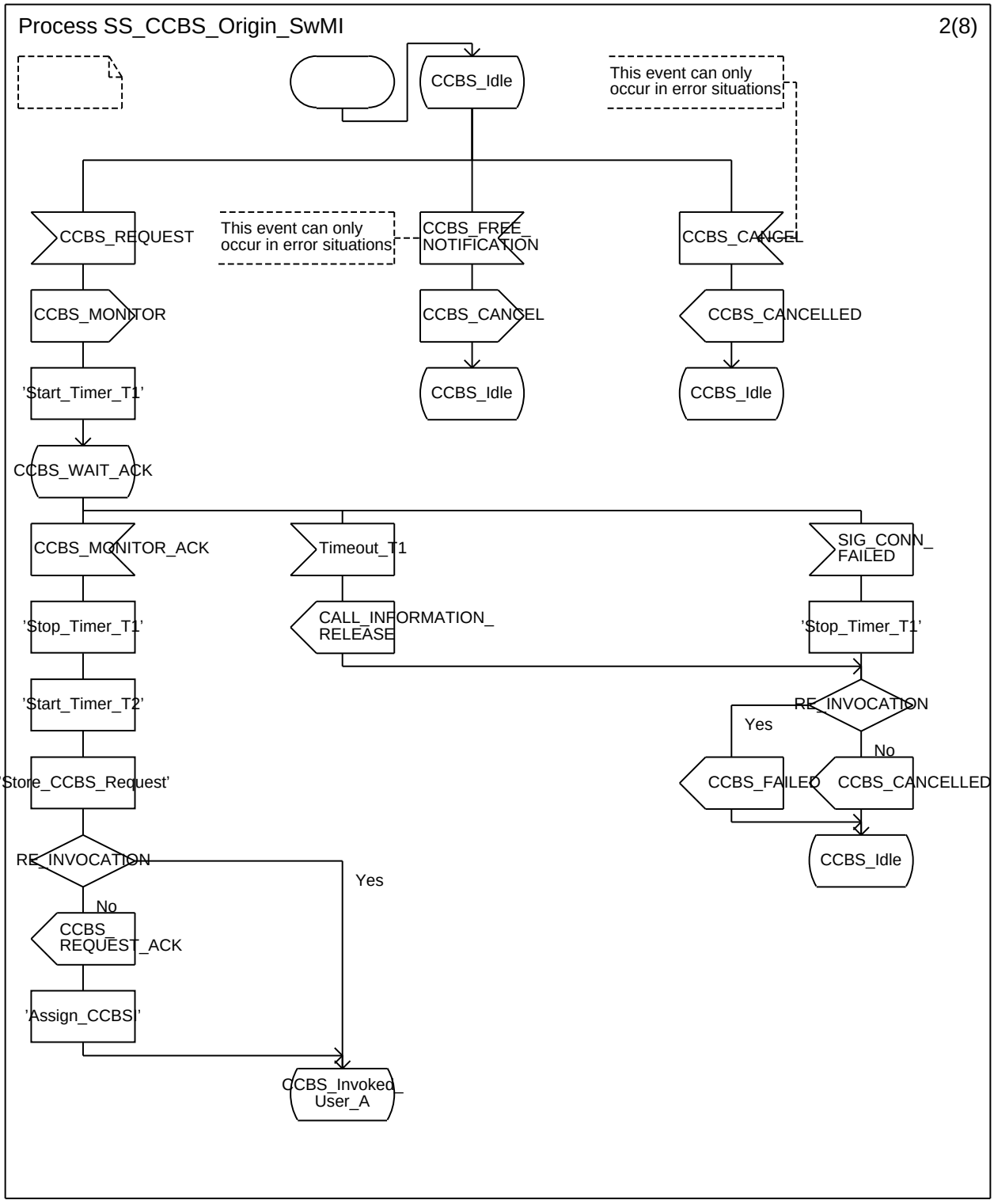


Figure A.1: Originating SwMI process (sheet 2 of 8)

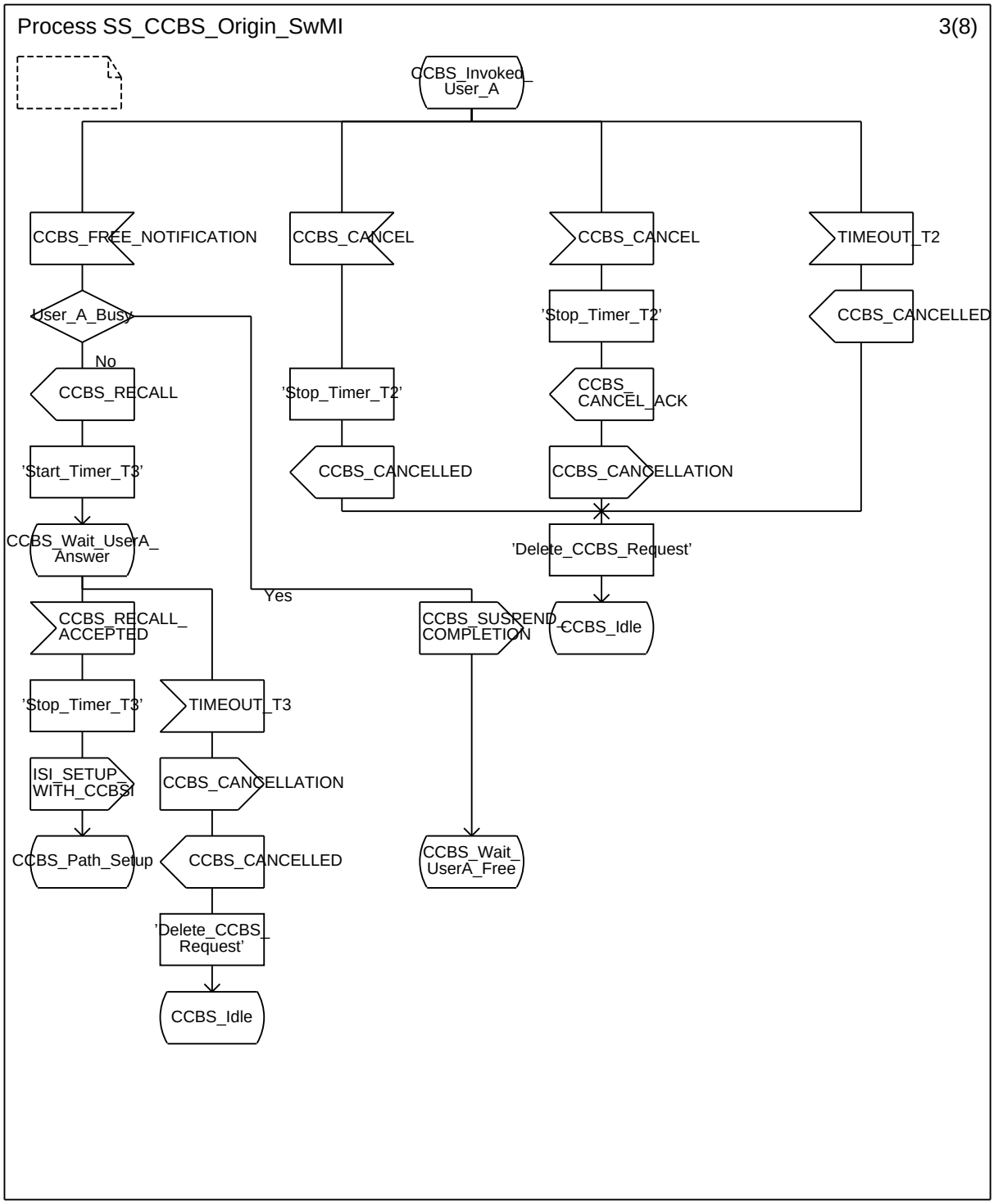


Figure A.1: Originating SwMI process (sheet 3 of 8)

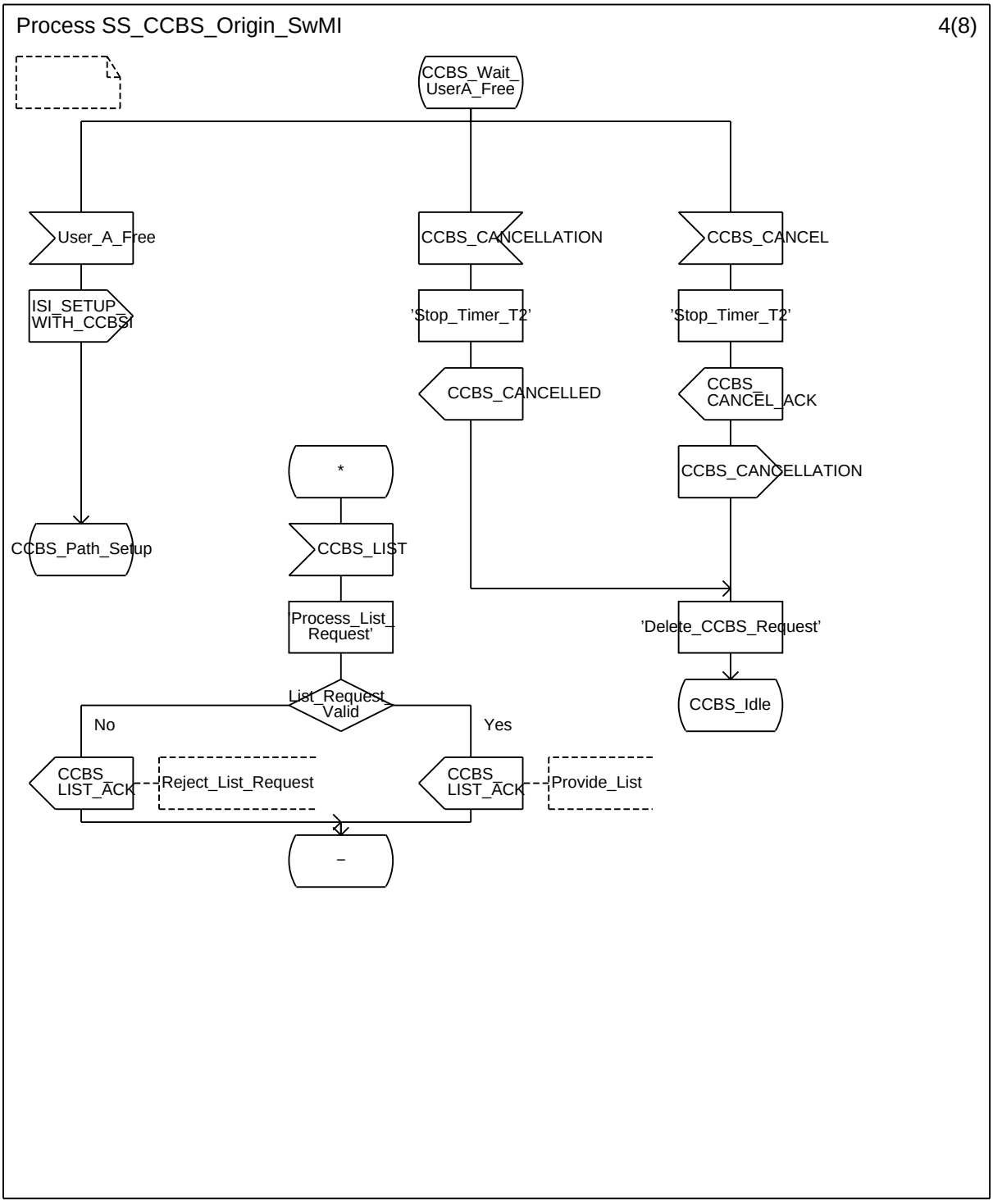


Figure A.1: Originating SwMI process (sheet 4 of 8)

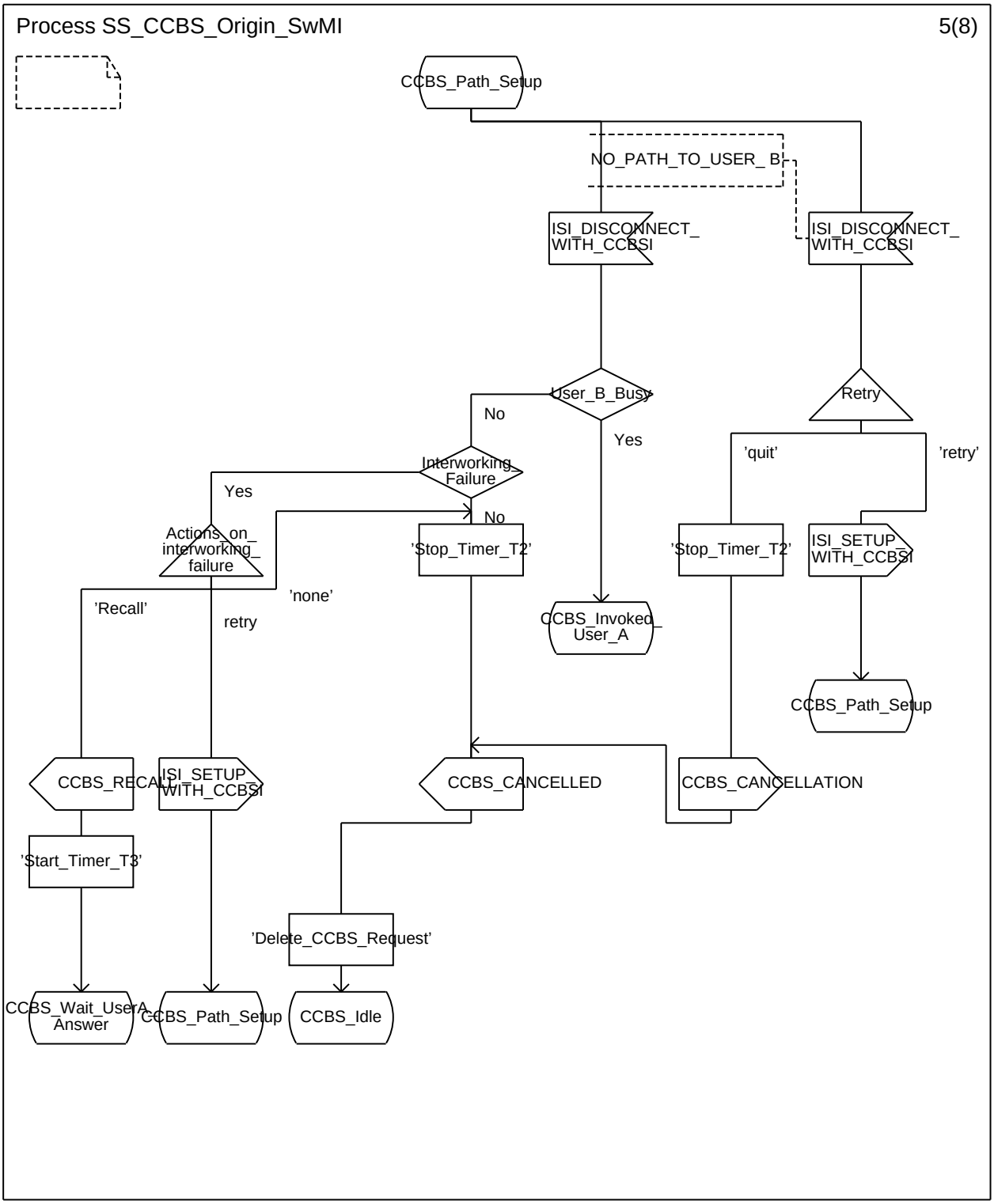


Figure A.1: Originating SwMI process (sheet 5 of 8)

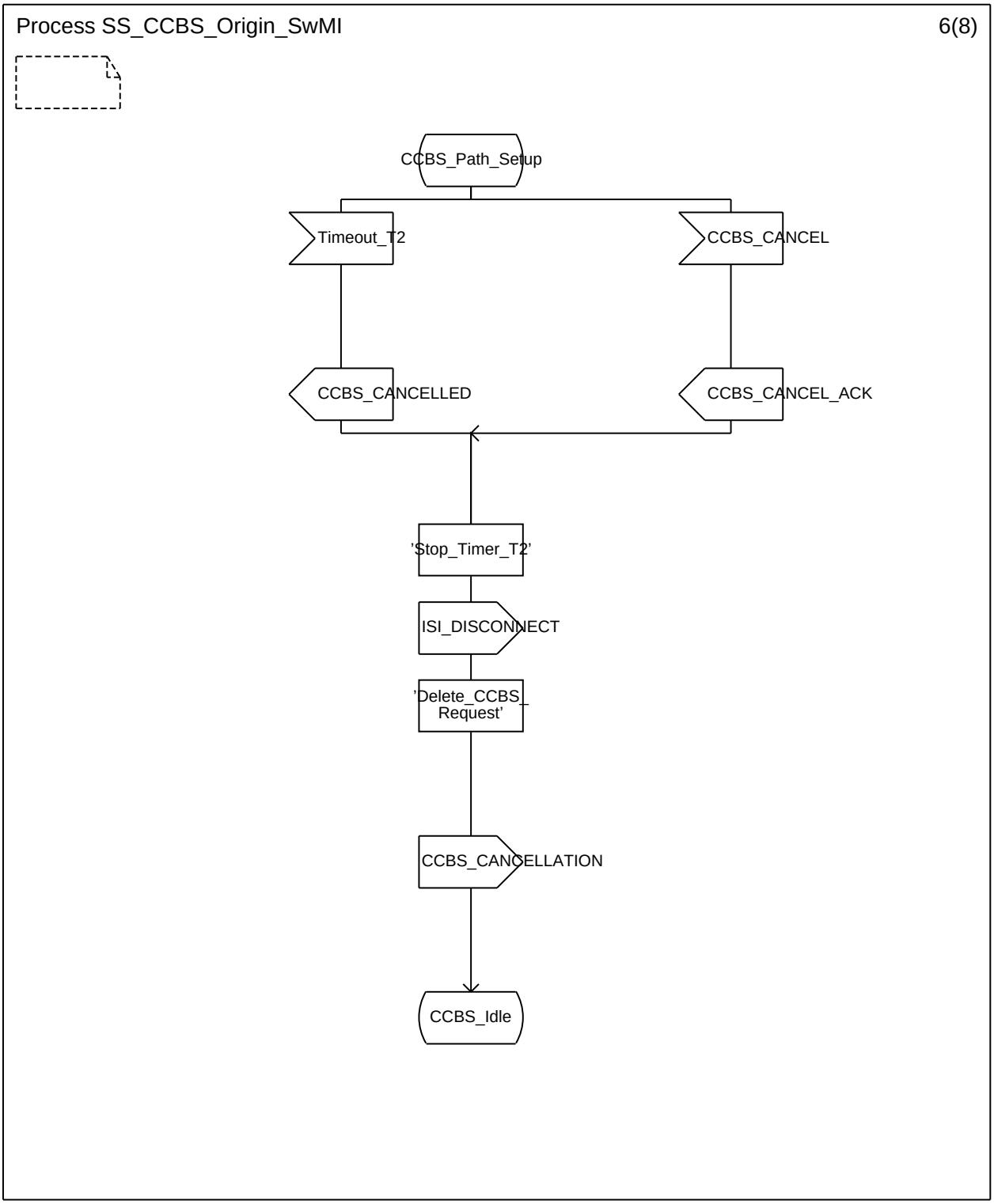


Figure A.1: Originating SwMI process (sheet 6 of 8)

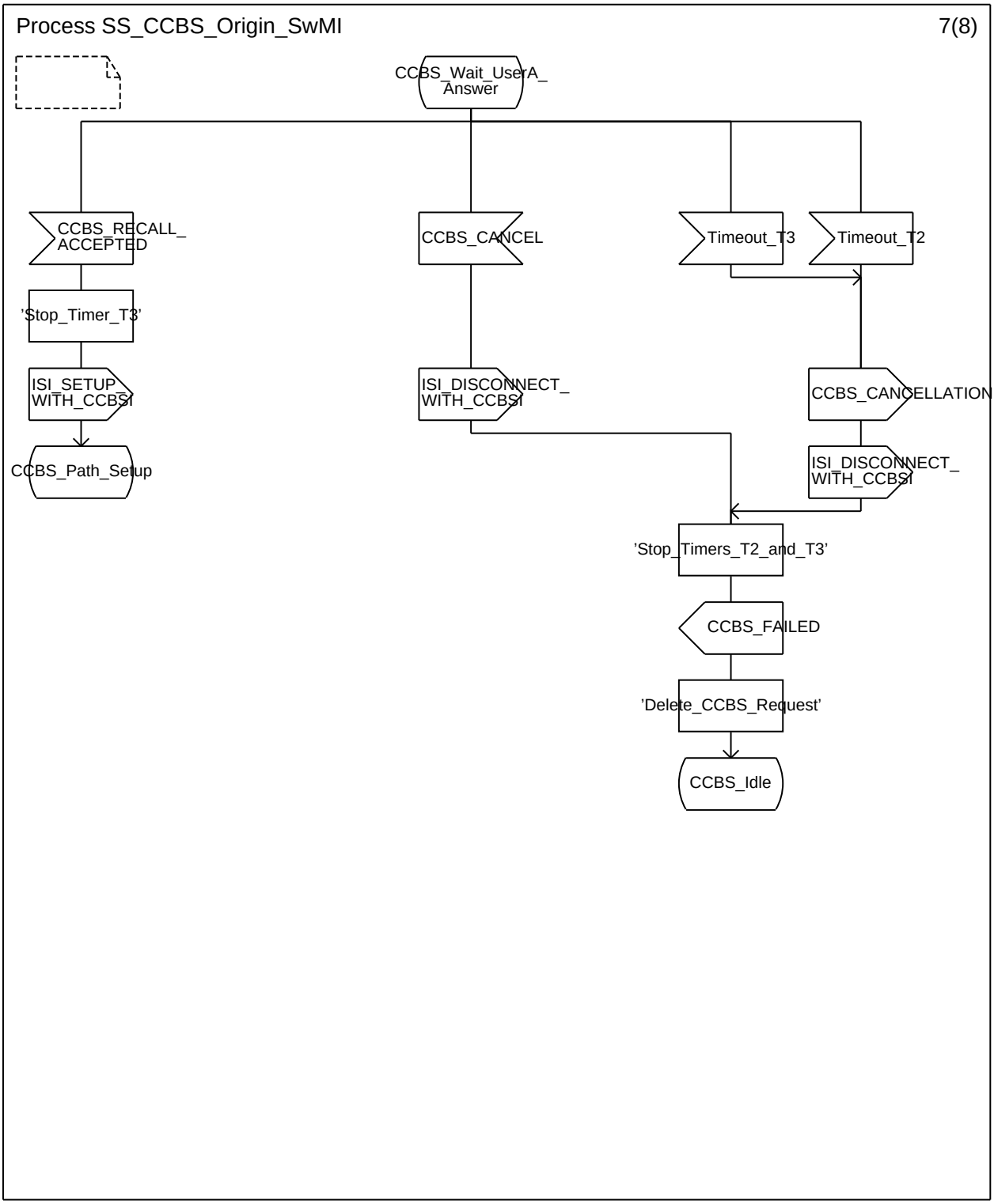


Figure A.1: Originating SwMI process (sheet 7 of 8)

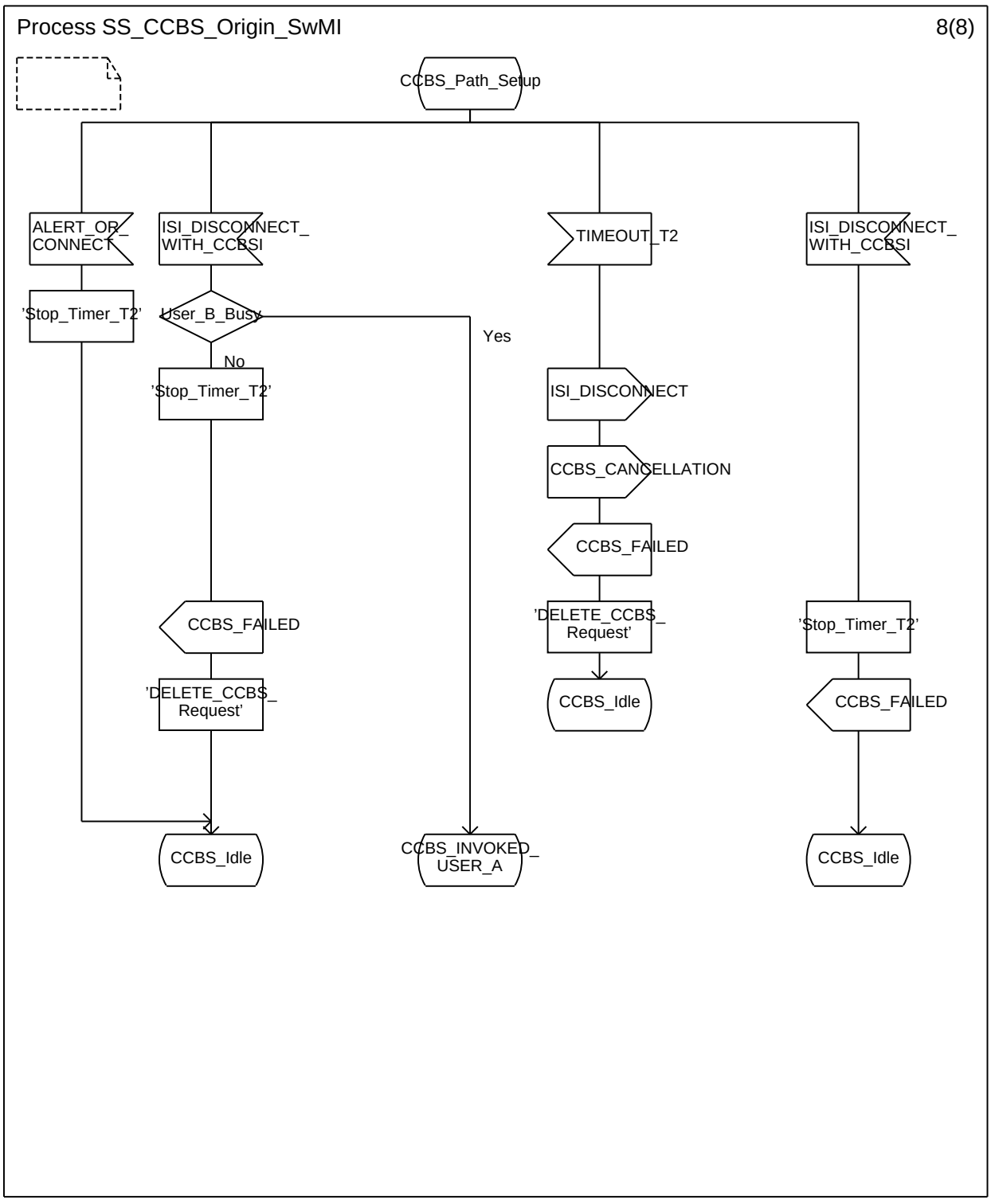


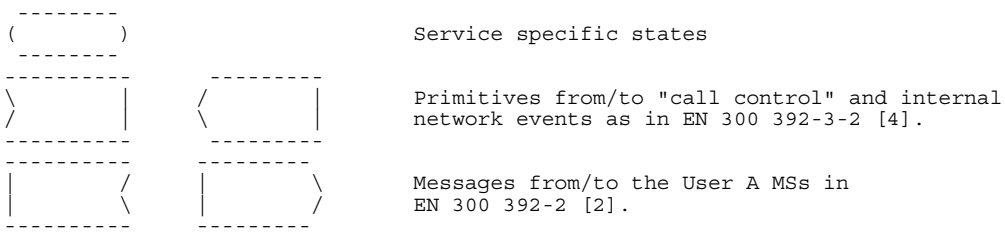
Figure A.1: Originating SwMI process (sheet 8 of 8)

A.2 Behavior of the Group Controlling SwMI

The same SDL as the Terminating SwMI applies with the exception that user B is replaced by the group B.

A.3 Behavior of the Terminating SwMI

CCBS destination SwMI side process SDL diagrams



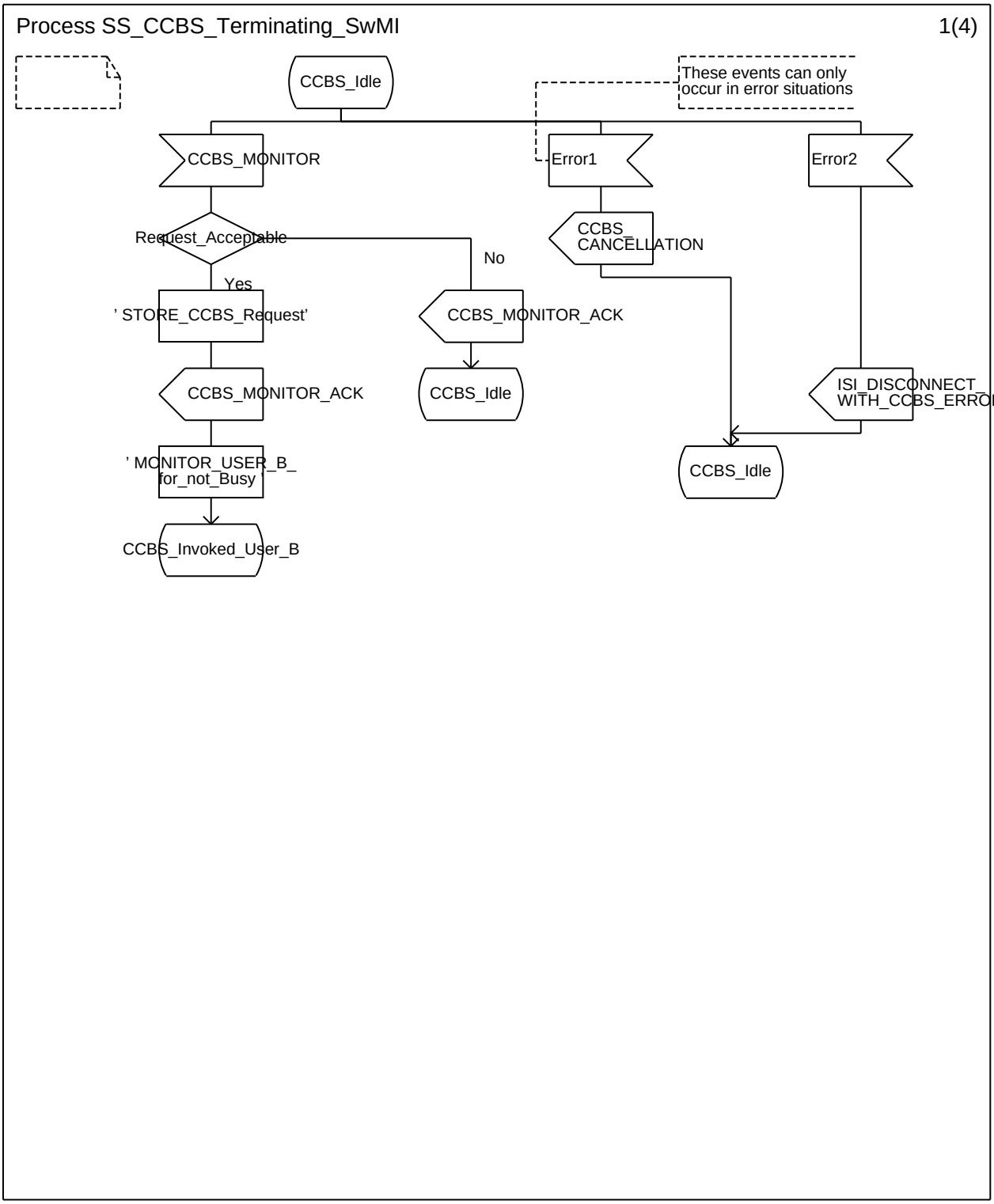


Figure A.2: Terminating SwMI process (sheet 1 of 4)

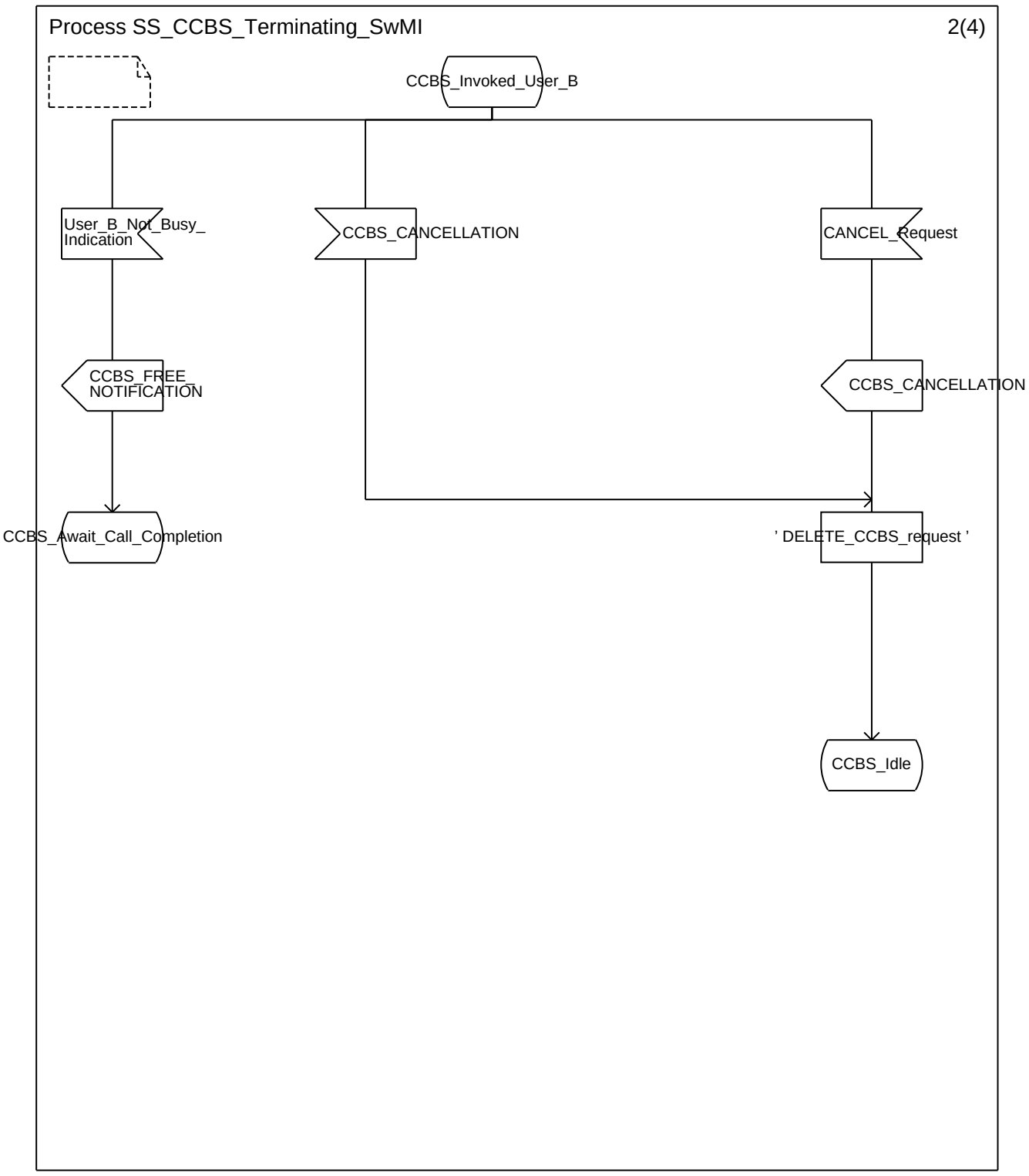


Figure A.2: Terminating SwMI process (sheet 2 of 4)

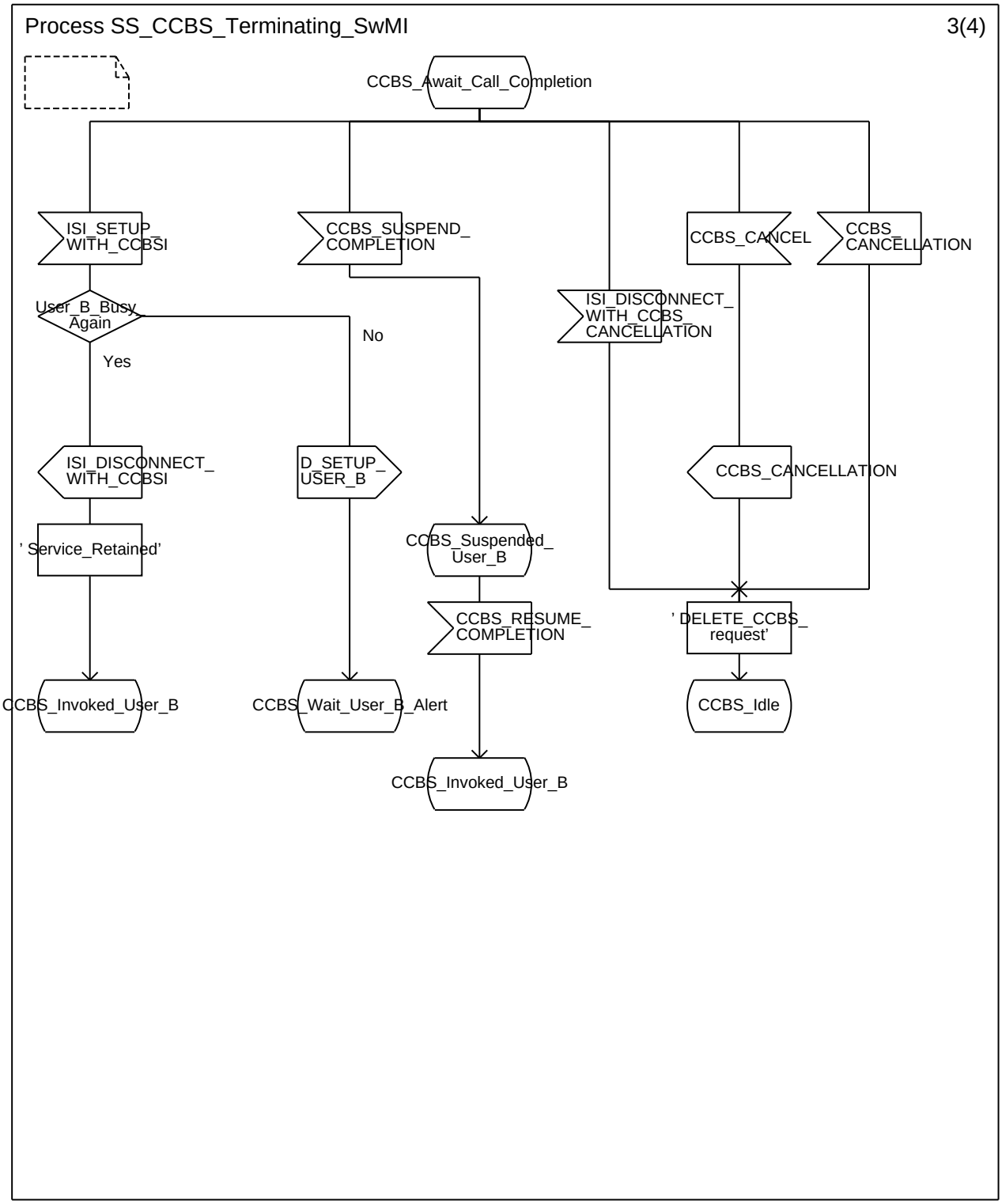


Figure A.2: Terminating SwMI process (sheet 3 of 4)

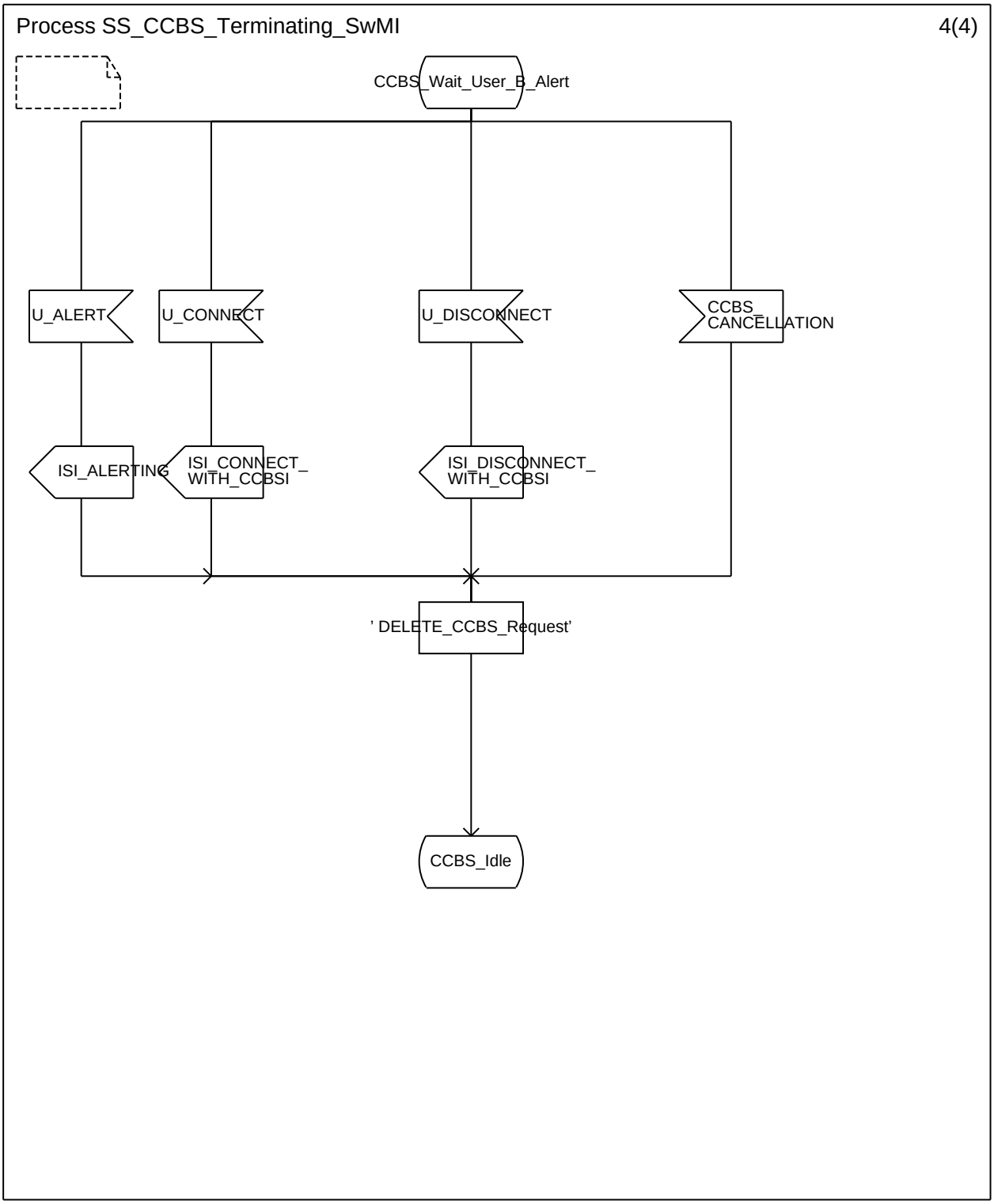
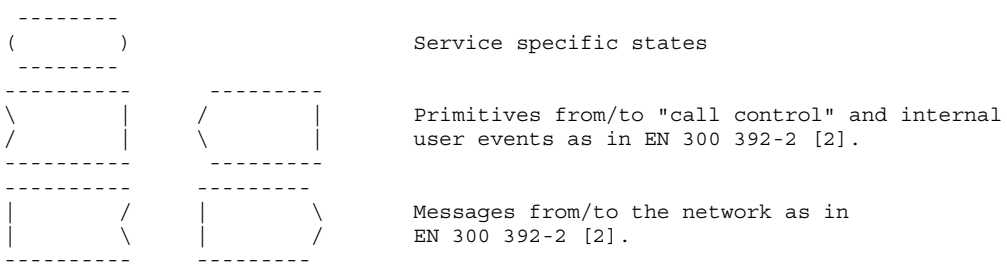


Figure A.2: Terminating SwMI process (sheet 4 of 4)

A.4 Behavior at CCBS User A MS

CCBS user side process SDL diagrams



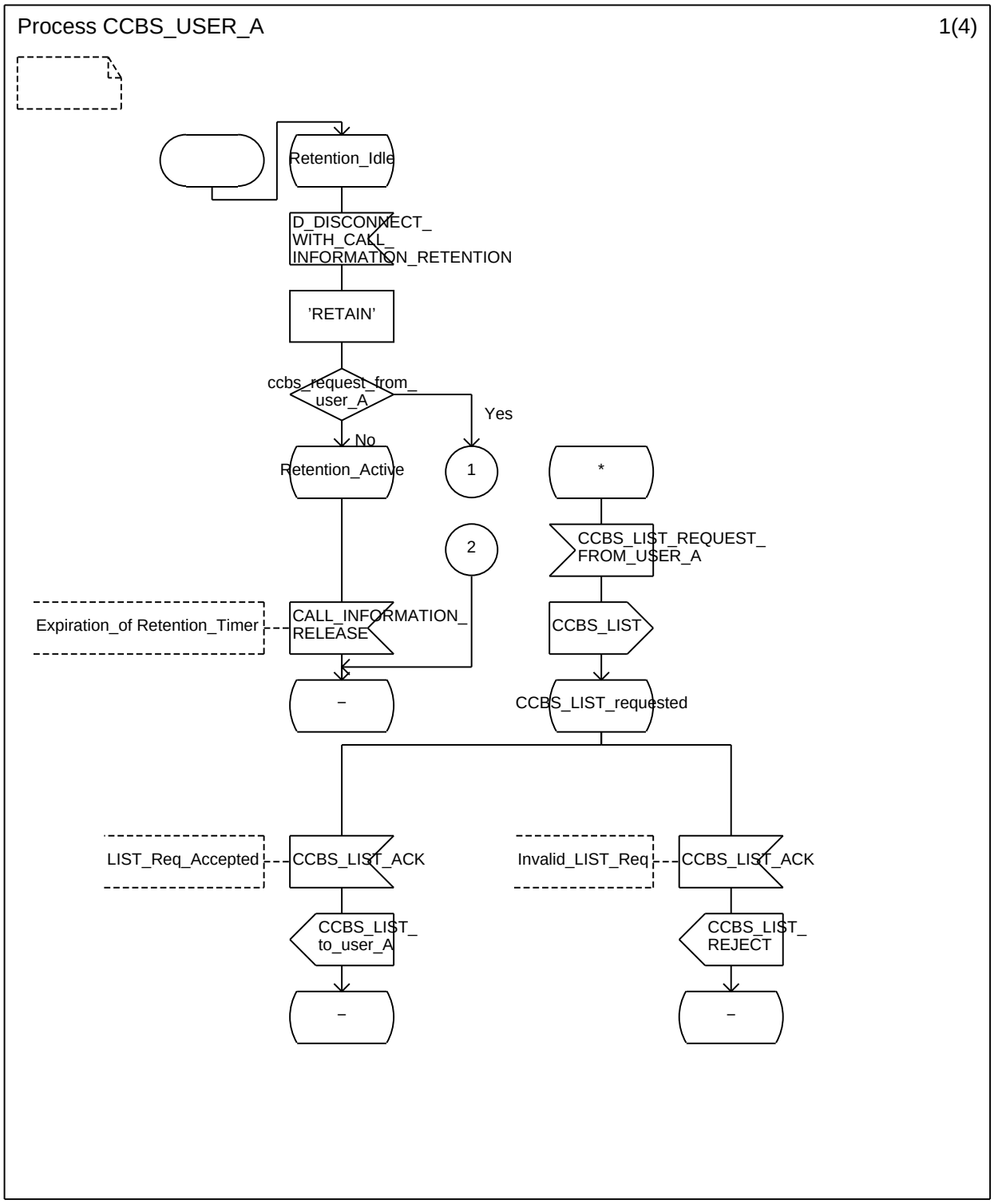


Figure A.3: CCBS Served User (User A MS) process (sheet 1 of 4)

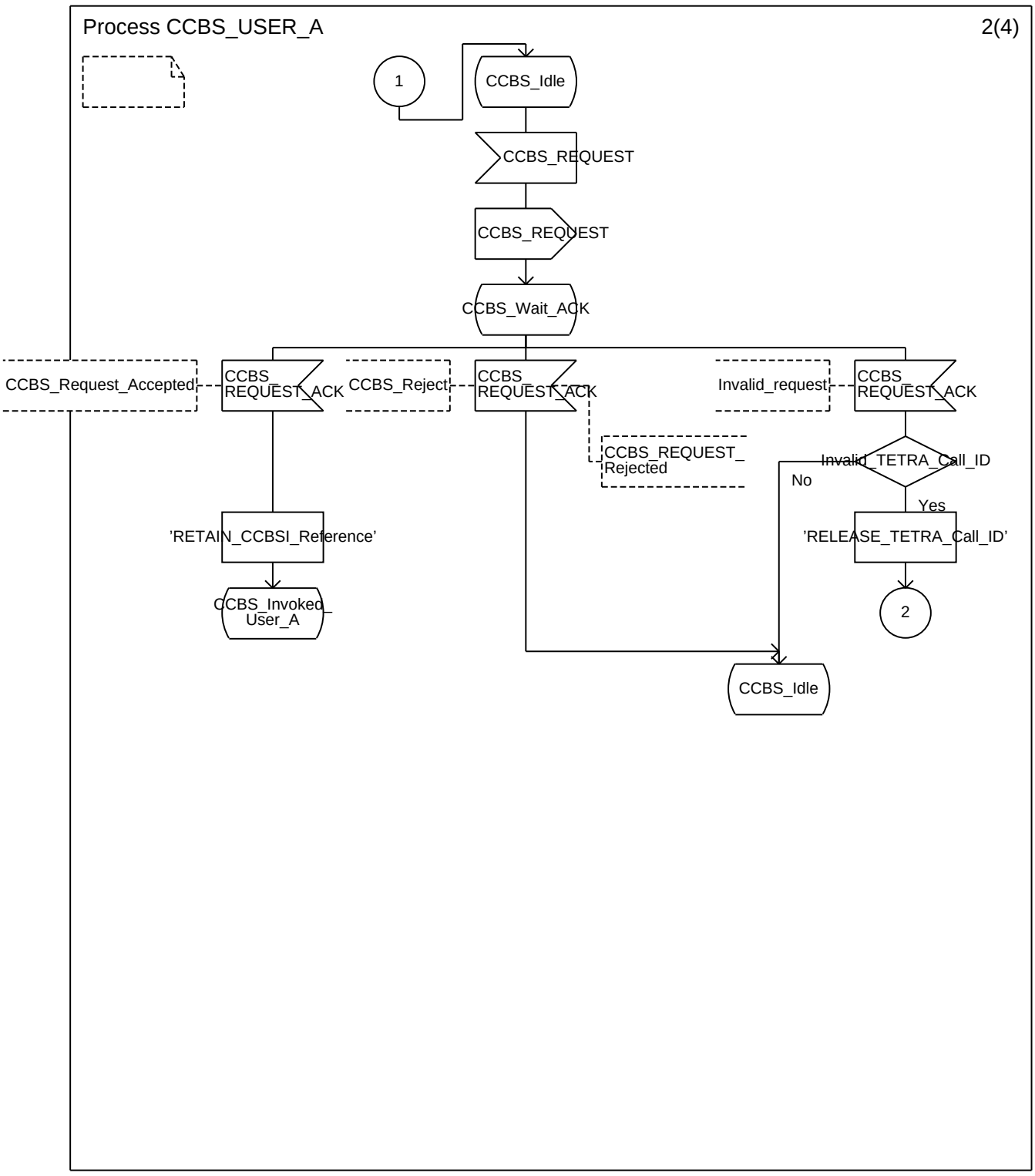


Figure A.3: CCBS Served User (User A MS) process (sheet 2 of 4)

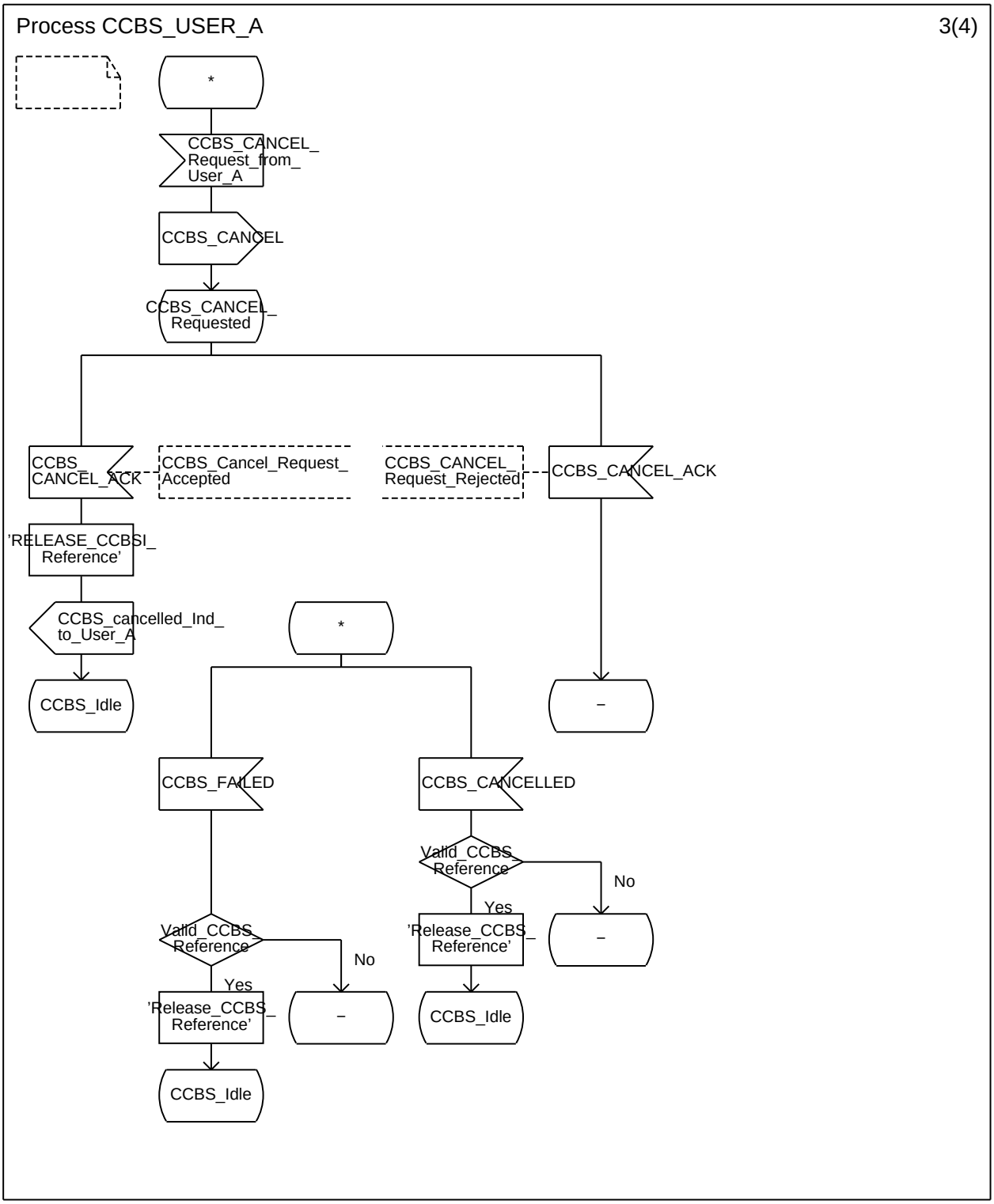


Figure A.3: CCBS Served User (User A MS) process (sheet 3 of 4)

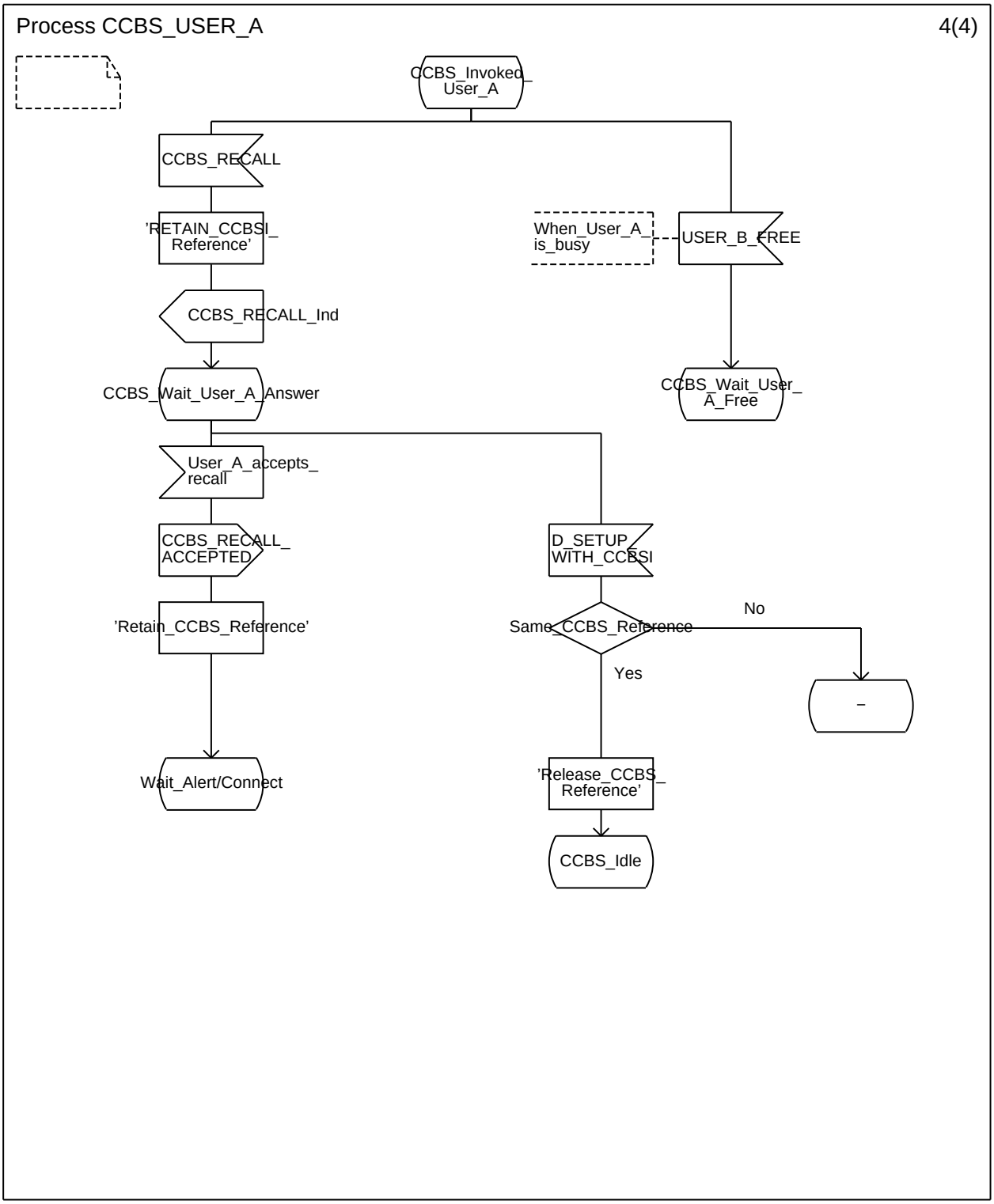


Figure A.3: CCBS Served User (User A MS) process (sheet 4 of 4)

Annex B (informative): Bibliography

- ITU-T Recommendation I.112 (1993): "Vocabulary of terms for ISDN (Blue Book)".
- ITU-T Recommendation I.210 (1988): "Principles of telecommunication services supported by an ISDN and the means to describe them (Blue Book)".
- ETSI EN 300 171 (1992): Private Telecommunication Network (PTN); Specification, functional models and information flows; Control aspects of circuit mode basic services; ECMA-BCSD".
- ETSI ETS 300 392-11-13: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 11: Supplementary services stage 2; Sub-part 13: Call Completion to Busy Subscriber (CCBS)".

Annex C (informative): Change requests

The present document includes change requests since edition 1 as presented in table C.1.

Table C.1: Change requests

No	CR vers.	Standard Version	Clauses affected	Title	CR Status
001	10	Ed. 1	5.2.2.12	CALL-INFORMATION-RELEASE PDU type should be "11000"	WG3 approved 110908
002	10	Ed. 1	Many	Editorial modifications	WG3 approved 110908

History

Document history		
Edition 1	March 2000	Publication as ETS 300 392-12-13
V1.2.0	November 2011	One-step Approval Procedure OAP 20120310: 2011-11-11 to 2012-13-03