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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
customized Applications for Mobile network
Enhanced Logic (CAMEL);
Stage 2
(3GPP TS 23.078 version 5.9.0 Release 5)**

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

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Foreword

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Contents

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

The present document specifies the stage 2 description for the fourth phase (see 3GPP TS 22.078 [6]) of the Customized Applications for Mobile network Enhanced Logic (CAMEL) feature within the 3GPP system.

The contents of present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will then be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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x   the first digit:

1   presented to TSG for information;

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1 Scope

The present document specifies the stage 2 description for the fourth phase (see 3GPP TS 22.078 [6]) of the Customized Applications for Mobile network Enhanced Logic (CAMEL) feature which provides the mechanisms to support services of operators which are not covered by standardized services even when roaming outside the HPLMN.

The CAMEL feature is a network feature and not a supplementary service. It is a tool to help the network operator to provide the subscribers with the operator specific services even when roaming outside the HPLMN.

In the present document, the GSM Service Control Function (gsmSCF) is treated as being part of the HPLMN. The regulatory environment in some countries may require the possibility that the gsmSCF and the HPLMN are controlled by different operators, and the gsmSCF and the HPLMN are therefore distinct entities.

The fourth phase of the CAMEL feature supports, in addition to the third phase of the CAMEL:

- Interactions with Optimal Routing;

- Call Party Handling;

- DTMF Mid call procedure for Mobile Originated and Mobile Terminating calls;

- Inclusion of flexible tone injection;

- Provision of location information of called subscriber;

- Provide location information during ongoing call;

- CAMEL control over MT SMS;

- Notification of GPRS mobility management to CSE;

- Inclusion of ODB data in Any Time Modification;

- Enhancement of Any Time Interrogation and Provide Subscriber Information for PS Domain;

- Mobile Number Portability database interrogation.

CAMEL applicability to IP-based multimedia services is introduced in the fourth phase of the CAMEL. It is specified in 3GPP TS 23.278 [29].

CAMEL is not applicable to Emergency Setup (TS 12), i.e. if an Emergency call is requested, then the gsmSSF shall not be invoked.

The mechanism described in the present document addresses especially the need for information exchange between the VPLMN or IPLMN and the HPLMN for support of operator specific services. Any user procedures for the control of operator specific services are outside the scope of the present document. Subscribers who have subscribed to operator specific services and therefore need the functional support of the CAMEL feature shall be marked in the HPLMN and VPLMN. In case a subscriber is marked to need CAMEL support, the appropriate procedures which provide the necessary information to the VPLMN or the HPLMN are invoked. It is possible for the HPLMN to instruct the VPLMN or IPLMN to interact with a gsmSCF which is controlled by the HPLMN.

The specification of operator specific services is outside the scope of the present document.

1.1 Support of partial implementation of CAMEL phase 4

A functional entity (VMSC, GMSC or SGSN) may support the complete CAMEL phase 4 functionality or, as a network option, it may support the complete CAMEL phase 3 functionality and a partial implementation of CAMEL phase 4.

If a functional entity supports any part of CAMEL phase 4, then the HLR is informed of the CAMEL phase 4 CSIs supported. An SGSN may also indicate support of the Provide Subscriber Information IF. To indicate support of a specific CSI, a functional entity shall have the ability to trigger on any initial service event possible for that CSI.

If a VMSC or GMSC supports any of the CAMEL phase 4 circuit switched CSIs (O-CSI, D-CSI, T-CSI or VT-CSI), then the gsmSCF is informed of the CAMEL phase 4 circuit switched functionalities offered. The gsmSCF shall not send information flows or parameters that conflict with the functionalities offered by the VMSC or GMSC.

If a CAMEL subscriber attempts to register in a VMSC or SGSN which supports at least one CAMEL phase 4 CSI or the enhancement of Provide Subscriber Information IF, then the VMSC or SGSN indicates in the registration request to the HLR the phase of CAMEL which the VMSC or SGSN supports (at least phase 4). In addition, the VMSC or SGSN indicates which CAMEL phase 4 CSIs may be downloaded. An SGSN may also indicate support of the Provide Subscriber Information IF.

If a GMSC supports at least one CAMEL phase 4 CSI, then the GMSC indicates in the Send Routeing Info to the HLR the phase of CAMEL which the GMSC supports (at least phase 4). In addition, the GMSC indicates which CAMEL phase 4 CSIs may be downloaded.

If a VMSC/gsmSSF or GMSC/gsmSSF initiates contact with the gsmSCF using the Initial DP IF, or acknowledges a gsmSCF initiated contact using the Initiate Call Attempt ack IF, then the VMSC/gsmSSF or GMSC/gsmSSF indicates in the IF the CAMEL phase 4 functionalities offered to the gsmSCF.

If a VLR initiates contact with the gsmSCF using a Mobility Management Event Notification IF, then the VLR or SGSN indicates in the IF the functionalities offered to the gsmSCF.

1.1.1 CAMEL Phase 4 CSIs

A network entity may indicate to the HLR an offer of support for the following CAMEL phase 4 CSIs:

- CAMEL phase 4 O-CSI;

- CAMEL phase 4 D-CSI;

- CAMEL phase 4 T-CSI;

- CAMEL phase 4 VT-CSI;

- CAMEL phase 4 MT-SMS-CSI;

- CAMEL phase 4 MG-CSI.

An SGSN may also indicate support of the CAMEL phase 4 Provide Subscriber Information IF.

A functional entity (VMSC, GMSC or SGSN) may offer the CSIs in any combination applicable for this entity. A functional entity shall indicate to the HLR all the CSIs it offers. The HLR may ignore the offer of the supported CSIs if they are not applicable for the sending entity, but it shall not reject the operation in this case.

1.1.2 CAMEL Phase 4 Functionalities

The CAMEL phase 4 functionalities which may be offered to the gsmSCF are the following:

- Creating additional parties in a call, Creating a new call (Initiate Call Attempt);

- Placing an individual call party on hold or moving an individual call party to Call Segment 1, when Call Segment 1 does not exist (Split Leg);

- Connecting an individual call party to the group (Move Leg);

- Releasing an individual call party (Disconnect Leg);

- Indication of the release of a call party or call segment (Entity Released);

- Enhancements for subscriber interactions with the gsmSCF (Disconnect Forward Connection With Argument);

- Inclusion of flexible tone injection (Play Tone);

- DTMF Mid call procedure for MO and VT calls (DP O_Mid_Call, DP T_Mid_Call);

- Provision of Charge Indicator at answer DP (Charge Indicator at DP O_Answer, DP T_Answer);

- Support of Alerting DP (DP O_Term_Seized, DP Call_Accepted);

- Provision of location information of subscriber at alerting DP (Location information at DP O_Term_Seized, DP Call_Accepted);

- Provision of location information during an ongoing call (DP O_Change_Of_Position, DP T_Change_Of_Position);

- Interactions with Basic Optimal Routeing (Basic OR Interrogation Requested in Connect and Continue With Argument, Route Not Permitted in DP O_Abandon);

- Warning tone enhancements (Burstlist for Audible Indicator); and

- Enhancements of Call Forwarding indication (Forwarding Destination Number).

A functional entity (VMSC or GMSC) may offer the functionalities in any combination applicable for this entity and applicable to the offered CSIs.

A functional entity (VMSC or GMSC) shall indicate to the gsmSCF all the functionallities it offers.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1]   3GPP TR 21.905: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications".

[2]   3GPP TS 22.004: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General on supplementary ".

[3]   3GPP TS 22.024: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Description of Charge Advice Information (CAI)".

[4]   3GPP TS 22.041: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Operator Determined Barring (ODB)".

[5]   3GPP TS 22.071: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Location Services (LCS); Service description, Stage 1".

[6]   3GPP TS 22.078: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Customised Applications for Mobile network Enhanced Logic (CAMEL); Service description, Stage 1".

[7]   3GPP TS 23.003: "3rd Generation Partnership Project; Technical Specification Group Core Network; Numbering, addressing and identification".

[8]   3GPP TS 23.008: "3rd Generation Partnership Project; Technical Specification Group Core Network; Organization of subscriber data".

[9]   3GPP TS 23.011: "3rd Generation Partnership Project; Technical Specification Group Core Network; Technical realization of Supplementary Services".

[10]   3GPP TS 23.012: "3rd Generation Partnership Project; Technical Specification Group Core Network; Location management procedures".

[11]   3GPP TS 23.015: "3rd Generation Partnership Project; Technical Specification Group Core Network; Technical realization of Operator Determined Barring (ODB)".

[12]   3GPP TS 23.018: "3rd Generation Partnership Project; Technical Specification Group Core Network; Basic call handling; Technical realization".

[13]   3GPP TS 23.032: "3rd Generation Partnership Project; Technical Specification Group Core Network; Universal Geographical Area Description (GAD)".

[14]   3GPP TS 23.040: "3rd Generation Partnership Project; Technical Specification Group Terminals; Technical realization of the Short Message Service (SMS)".

[15]   3GPP TS 23.060: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description; Stage 2".

[16]   3GPP TS 23.072: "3rd Generation Partnership Project; Technical Specification Group Core Network; Call Deflection (CD) Supplementary Service; Stage 2".

[17]   3GPP TS 23.066: "3rd Generation Partnership Project; Technical Specification Group Core Network; Support of Mobile Number Portability (MNP); Technical realization; Stage 2".

[18]   3GPP TS 23.073: "3rd Generation Partnership Project; Technical Specification Group Core Network; Support of Localised Service Area (SoLSA); Stage 2".

[19]   3GPP TS 23.079: "3rd Generation Partnership Project; Technical Specification Group Core Network; Support of Optimal Routeing (SOR); Technical realization".

[20]   3GPP TS 23.082: "3rd Generation Partnership Project; Technical Specification Group Core Network; Call Forwarding (CF) supplementary services; Stage 2".

[21]   3GPP TS 23.084: "3rd Generation Partnership Project; Technical Specification Group Core Network; Multi Party (MPTY) supplementary service; Stage 2".

[22]   3GPP TS 23.085: "3rd Generation Partnership Project; Technical Specification Group Core Network; Closed User Group (CUG) supplementary service; Stage 2".

[23]   3GPP TS 23.088: "3rd Generation Partnership Project; Technical Specification Group Core Network; Call Barring (CB) Supplementary Services; Stage 2".

[24]   3GPP TS 23.090: "3rd Generation Partnership Project; Technical Specification Group Core Network; Unstructured Supplementary Service Data (USSD); Stage 2".

[25]   3GPP TS 23.091: "3rd Generation Partnership Project; Technical Specification Group Core Network; Explicit Call Transfer (ECT) supplementary service; Stage 2".

[26]   3GPP TS 23.093: "3rd Generation Partnership Project; Technical Specification Group Core Network; Technical realization of Completion of Calls to Busy Subscriber (CCBS); Stage 2".

[27]   3GPP TS 23.172: "3rd Generation Partnership Project; Technical Specification Group Core Network; Technical realization of Circuit Switched (CS) multimedia service; UDI/RDI fallback and service modification; Stage 2".

[28]   3GPP TS 23.271: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Functional stage 2 description of LCS".

[29]   3GPP TS 23.278: "3rd Generation Partnership Project; Technical Specification Group Core Network; Customised Applications for Mobile network Enhanced Logic (CAMEL) - IP Multimedia System (IMS) interworking; Stage 2".

[30]   3GPP TS 24.008: "3rd Generation Partnership Project; Technical Specification Group Core Network; Mobile radio interface layer 3 specification; Core Network Protocols; Stage 3".

[31]   3GPP TS 24.011: '3rd Generation Partnership Project; Technical Specification Group Core Network; Point - to - Point (PP) Short Message Service (SMS); support on mobile radio interface'.

[32]   3GPP TS 25.305: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Stage 2 Functional Specification of UE Positioning in UTRAN".

[33]   3GPP TS 25.413: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; UTRAN Iu interface RANAP signalling".

[34]   3GPP TS 29.002: "3rd Generation Partnership Project; Technical Specification Group Core Network; Mobile Application Part (MAP) specification".

[35]   3GPP TS 29.007: "3rd Generation Partnership Project; Technical Specification Group Core Network; General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[36]   3GPP TS 29.078: "3rd Generation Partnership Project; Technical Specification Group Core Network; Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 4 CAMEL Application Part (CAP) specification".

[37] 3GPP TS 32.205: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication Management; Charging management; Charging data description for the Circuit Switched (CS) domain".

[38] 3GPP TS 32.215: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication Management; Charging management; Charging data description for the Packet Switched (PS) domain".

[39] 3GPP TS 48.008: "3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; Mobile-services Switching Centre - Base Station System (MSC - BSS) interface; Layer 3 specification".

[40] ETSI EN 300 356-1 (V3.2.2): "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 3 for the international interface; Part 1: Basic services[ITU-T Recommendations Q.761 to Q.764 (1997), modified]".

[41] ETSI EN 301 070-1 (V1.2.2): "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 3 interactions with the Intelligent Network Application Part (INAP); Part 1: Protocol specification [ITU-T Recommendation Q.1600 (1997), modified]".

[42] GSM TR 03.47: "Example protocol stacks for interconnecting; Service Centre(s) (SC) and Mobile-services Switching Centre(s) (MSC)".

[43] ITU-T Recommendation Q.763, December 1999: "Signalling System No. 7 - ISDN user part formats and codes".

[44] ITU-T Recommendation Q.1224, September 1997: "Distributed Functional Plane for Intelligent Network Capability Set 2".

3 Definitions and abbreviations

3.1 Definitions

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

Basic Call State Model (BCSM): BCSM provides a high-level model of GMSC- or MSC/VLR-activities required to establish and maintain communication paths for users. As such, it identifies a set of basic call activities in a GMSC or MSC/VLR and shows how these activities are joined together to process a basic call.

Call Control Function (CCF): CCF is the Call Control Function in the network that provides call/service processing and control (see ITU-T Recommendation Q.1224 [44]).

Call Party Handling (CPH) Information Flow: Any of the Disconnect Leg, Move Leg or Split Leg information flows.

Call Segment: A call segment contains one or more legs that are controlled by the same CS_gsmSSF instance. The call parties in the same call segment can communicate with each other (using a conference bridge if necessary). Call segments are identified by a number, eg. CSID1 is the call segment with id number 1.

Call Segment Association (CSA): A CSA contains one or more call segments. Legs can be moved between call segments within the CSA. There is a single CAP dialogue between the CSA and the gsmSCF.

Detection Points (DP): points in processing at which notifications (to the service logic) can occur and transfer of control (to the gsmSCF) is possible are called Detection Points (DPs).

Dialled Service CAMEL Subscription Information (D-CSI): D-CSI identifies the subscriber as having originating CAMEL dialled services.

Forwarding MSC: MSC which is either an MSC invoking a standardized Call Forwarding supplementary service or Call Deflection supplementary service; or an MSC invoking a CAMEL based call forwarding service.

Gateway MLC (GMLC): functional entity that allows external LCS Clients to request real-time information about a Mobile Station. The information that can be requested from the GMLC is:

- location of Mobile Station

See 3GPP TS 23.271 [28] and 3GPP TS 25.305 [32] for information on the GMLC.

Geodetic Information: information defining the location of a mobile station, coded according to ITU-T Recommendation Q.763 [43]. The derivation of this information from other information defining the location of a mobile station is a network operator option. If an entity derives the geodetic information it shall also provide the equivalent geographical information.

Geographical Information: information defining the location of a mobile station, coded according to 3GPP TS 23.032 [13].

GPRS CAMEL Subscription Information (GPRS-CSI): GPRS-CSI identifies the subscriber as having GPRS CAMEL services.

GPRS Dialogue: A dialogue between the gprsSSF and the gsmSCF. A single GPRS Dialogue may consist of one or more TCAP dialogues. Only one TCAP dialogue shall exists at one point in time for one gprsDialogue.

GPRS Service Switching Function (gprsSSF): functional entity that interfaces the SGSN to the gsmSCF. The concept of the gprsSSF is derived from the IN SSF, but uses different triggering mechanisms because of the nature of the mobile network.

GPRS Session: GPRS session starts when the GPRS subscriber attaches to the GPRS data network. It ends when the GPRS subscriber detaches from the GPRS data network.

GSM Service Control Function (gsmSCF): functional entity that contains the CAMEL service logic to implement OSS. It interfaces with the gsmSSF, the gsmSRF, the GMLC and the HLR.

GSM Service Switching Function (gsmSSF): functional entity that interfaces the MSC or GMSC to the gsmSCF. The concept of the gsmSSF is derived from the IN SSF, but uses different triggering mechanisms because of the nature of the mobile network.

GSM Specialised Resource Function (gsmSRF): functional entity which provides various specialized resources. It interfaces with the gsmSCF and with the MSC. This entity is defined in ITU-T Recommendation Q.1224 [44] with variations defined in the present document.

Location Information: indicates the location of the Mobile Station. The provision of location information is independent of the MS status. As part of the location information, an indication of the age of this information may be delivered.

Mobile Originating Short Message Service CAMEL Subscription Information (MO-SMS-CSI): MO-SMS-CSI identifies the subscriber as having MO SMS CAMEL services. MO-SMS-CSI (CAMEL Phase 4) is identical to SMS-CSI (CAMEL Phase 3).

Mobile Station State: similar to **Subscriber State**, but associated only with a Mobile Station, not with a subscriber.

Mobile Terminating Short Message Service CAMEL Subscription Information (MT-SMS-CSI): MT-SMS-CSI identifies the subscriber as having MT SMS CAMEL services.

Mobility Management event CAMEL Subscription Information (M-CSI): M-CSI identifies the subscriber as having Mobility Management event notification CAMEL services.

Mobility Management event GPRS CAMEL Subscription Information (MG-CSI): MG-CSI identifies the GPRS subscriber as having Mobility Management event notification CAMEL services.

NA (North American): prefix attached to certain information items used by North American PLMNs in connection with routing a call to a preferred or dialled long distance carrier.

Network CAMEL Service Information (N-CSI): N-CSI identifies services offered on a per-network basis by the serving PLMN operator for all subscribers.

Originating Basic Call State Model (O-BCSM): originating half of the BCSM. The O-BCSM corresponds to that portion of the BCSM associated with the originating party.

Originating CAMEL Subscription Information (O-CSI): O-CSI identifies the subscriber as having originating CAMEL services.

Point In Association (PIA): PIAs identify MSC/VLR or SGSN activities associated with one or more basic association/connection states of interest to OSS service logic instances.

Point In Call (PIC): PICs identify MSC/VLR (GMSC) activities associated with one or more basic call/connection states of interest to OSS service logic instances.

Service Key: Service Key identifies to the gsmSCF the service logic. The Service Key is administered by the HPLMN, and is passed transparently by the VPLMN/IPLMN to the gsmSCF. The Service Key is a part of the T/O/VT/D/GPRS/SMS/M-CSI.

Serving MLC: functional entity that performs location information retrieval.

Short Message Control Protocol (SM-CP): Protocol between the MSC or SGSN and the MS. This protocol, which is specified in 3GPP TS 24.011 [31], is used to carry RPDU elements between the MSC or SGSN and the MS.

Short Message Service Centre (SMSC): also abbreviation SC is used for SMSC.

Subscriber State: see 3GPP TS 22.078 [6].

Supplementary Service Notification CAMEL Subscription Information (SS-CSI): SS-CSI identifies the subscriber as having supplementary service invocation notification CAMEL services.

Terminating Basic Call State Model (T-BCSM): terminating half of the BCSM. The T-BCSM corresponds to that portion of the BCSM associated with the terminating party.

Terminating CAMEL Subscription Information (in the GMSC) (T-CSI): T-CSI identifies the subscriber as having terminating CAMEL services in the GMSC.

VMSC Terminating CAMEL Subscription Information (VT-CSI): VT-CSI identifies the subscriber as having terminating CAMEL services in the VMSC.

Translation Information Flag (TIF-CSI): TIF-CSI is a flag in the CAMEL subscriber data which indicates that when the subscriber registers a forwarded-to number, that the HLR shall not attempt to perform any translation, number format checks, prohibited FTN checks, call barring checks.

USSD CAMEL Subscription Information (U-CSI): U-CSI identifies a set of subscriber specific mappings from a USSD service code to a gsmSCF address.

USSD General CAMEL Service Information (UG-CSI): UG-CSI globally identifies a set of mappings from a USSD service code to a gsmSCF address. The global mapping applies to all HPLMN subscribers. If, for a particular service code, both U-CSI and UG-CSI are applicable then the U-CSI shall take precedence.

3.2 Abbreviations

Abbreviations used in the present document are listed in 3GPP TR 21.905 [1].

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

BCSM	Basic Call State Model
CAMEL	Customized Applications for Mobile network Enhanced Logic
CPH	Call Party Handling
CS	Call Segment
CS	Circuit Switched
CSA	Call Segment Association
CSID	Call Segment (followed by an identification Number e.g. CSID1)
DP	Detection Point
DTN	Deflected To Number
D-CSI	Dialled Services CAMEL Subscription Information
EDP	Event Detection Point
FTN	Forwarded To Number
GMLC	Gateway MLC
GMSC	Gateway MSC
GPRS	General Packet Radio Service
gprsSSF	GPRS Service Switching Function
GPRS-CSI	GPRS CAMEL Subscription Information
gsmSCF	GSM Service Control Function
gsmSRF	GSM Specialised Resource Function
gsmSSF	GSM Service Switching Function
HLR	Home Location Register
HPLMN	Home PLMN
ICA	Initiate Call Attempt
IE	Information Element
IF	Information Flow
IP	Intelligent Peripheral
IPLMN	Interrogating PLMN
LCS	Location Services
LSA	Localised Service Area
M-CSI	Mobility Management event Notification CAMEL Subscription Information
MF	Mobile Forwarding
MG-CSI	Mobility Management event Notification GPRS CAMEL Subscription Information
MLC	Mobile Location Centre
MNP	Mobile Number Portability
MNP SRF	Mobile Number Portability Signalling Relay Function
MO	Mobile Originating
MO-SMS-CSI	Mobile Originated Short Message Service CAMEL Subscription Information
MSC	Mobile service Switching Centre
MT	Mobile Terminating
MT	Mobile Terminating in GMSC
MT-SMS-CSI	Mobile Terminating Short Message Service CAMEL Subscription Information
N-CSI	Network CAMEL Service Information

NA	North American
NNI	Network Node Interface
O-BCSM	Originating Basic Call State Model
O-CSI	Originating CAMEL Subscription Information
ODB	Operator Determined Barring
OR	Optimal Routeing
OSS	Operator Specific Service
PDP	Packet Data Protocol
PIC	Point In Call
PLMN	Public Land Mobile Network
SGSN	Serving GPRS Support Node
SLPI	Service Logic Program Instance
SM	Short Message
SM-CP	Short Message Control Protocol
SMF	Service Management Function
SMLC	Serving MLC
SMRSE	Short Message Relay Service Element
SMS	Short Message Service
SMSC	Short Message Service Centre
SMS-CSI	Short Message Service CAMEL Subscription Information
SS-CSI	Supplementary Service Notification CAMEL Subscription Information
T-BCSM	Terminating Basic Call State Model
T-CSI	Terminating CAMEL Subscription Information (in the GMSC)
TDP	Trigger Detection Point
TPDU	Transfer Protocol Data Unit
TIF-CSI	Translation Information Flag
U-CSI	USSD CAMEL Subscription Information
UG-CSI	USSD General CAMEL Service Information
UNI	User Network Interface
VLR	Visitor Location Register
VPLMN	Visited PLMN
VT	Mobile Terminating in VMSC
VT-CSI	VMSC Terminating CAMEL Subscription Information

4   Circuit switched Call Control

4.1   Architecture

4.1.1   Functional Entities used for CAMEL

This subclause describes the functional architecture needed to support CAMEL. Also the additions needed to the basic functionality are described. Figure 4.1 shows the functional entities involved in calls requiring CAMEL support. The architecture is applicable to the forth phase of CAMEL.
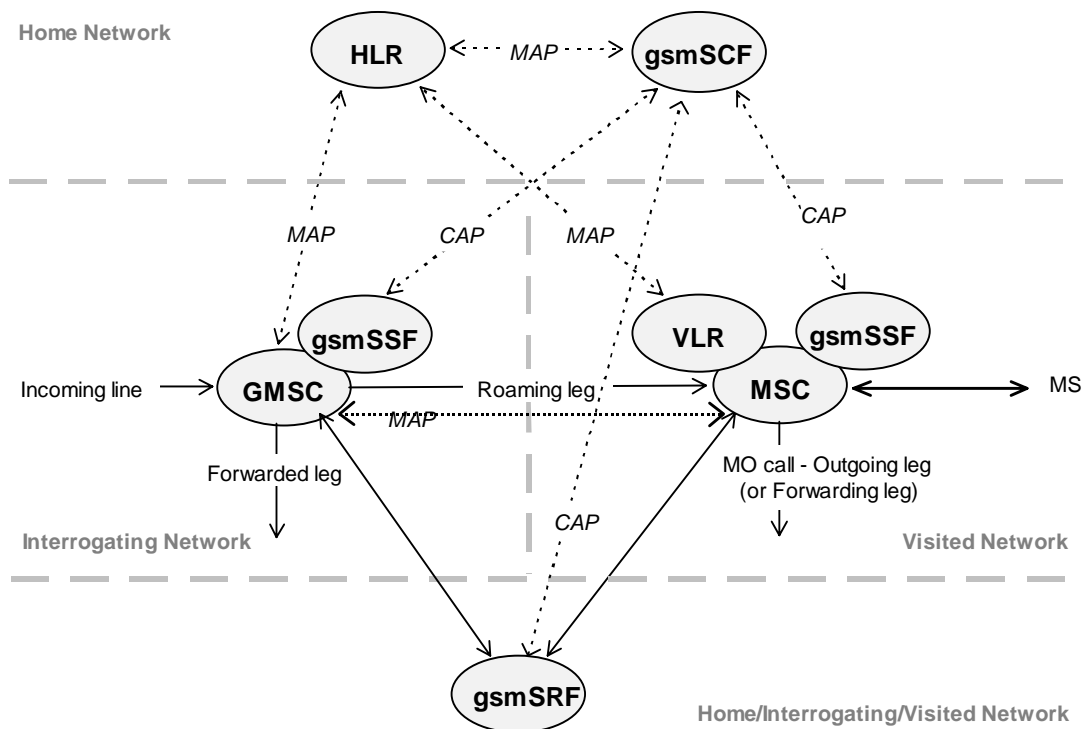
Figure 4.1: Functional architecture for support of CAMEL

HLR: For subscribers requiring CAMEL support, the HLR stores the information relevant to the current subscription regarding O-CSI, D-CSI, T-CSI, VT-CSI and TIF-CSI. The O-CSI is sent to the VLR at Location Update, on data restoration or if the O-CSI is updated by administrative action. The D-CSI is sent to the VLR at Location Update, on data restoration or if the D-CSI is updated by administrative action. The VT-CSI is sent to the VLR at Location Update, on data restoration or if the VT-CSI is updated by administrative action. The TIF-CSI is sent to the VLR at Location Update, on data restoration or if the TIF-CSI is updated by administrative action. The O/D/T-CSI is sent to the GMSC when the HLR responds to a request for routeing information.

GMSC: When processing the calls for subscribers requiring CAMEL support, the GMSC receives an O/D/T-CSI from the HLR, indicating the GMSC to request instructions from the gsmSSF. The GMSC monitors on request the call states (events) and informs the gsmSSF of these states during processing, enabling the gsmSSF to control the execution of the call in the GMSC.

MSC: When processing the calls for subscribers requiring CAMEL support, the MSC receives an O-CSI and / or D-CSI and / or VT-CSI from the VLR indicating the MSC to request instructions from the gsmSSF. The MSC monitors on request the call states (events) and informs the gsmSSF of these states during processing, enabling the gsmSSF to control the execution of the call in the MSC.

VLR: The VLR stores the O-CSI, D-CSI, VT-CSI and TIF-CSI as a part of the subscriber data for subscribers roaming in the VLR area.

gsmSSF: see subclause 3.1.

gsmSCF: see subclause 3.1.

gsmSRF: see subclause 3.1.

4.1.2 Interfaces defined for CAMEL

This subclause describes the different interfaces applicable to CAMEL. It specifies on a high level the functions specific to CAMEL.

4.1.2.1 HLR - VLR interface

This interface is used to send the CAMEL related subscriber data to the visited PLMN and for provision of MSRN. The interface is also used to retrieve subscriber status and location information of the mobile subscriber or to indicate suppression of announcement for a CAMEL service.

4.1.2.2 GMSC - HLR interface

This interface is used at terminating calls to exchange routeing information, subscriber status, location information, subscription information and suppression of announcements. The CAMEL related subscriber data that is passed to the IPLMN is sent over this interface.

4.1.2.3 GMSC - gsmSSF interface

This is an internal interface. The interface is described in the present document to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

4.1.2.4 gsmSSF - gsmSCF interface

This interface is used by the gsmSCF to control a call in a certain gsmSSF and to request the gsmSSF to establish a connection with a gsmSRF. Relationships on this interface are opened as a result of the gsmSSF sending a request for instructions to the gsmSCF or opened as a result of the gsmSCF sending a request to the gsmSSF to initiate a new call.

4.1.2.5 MSC - gsmSSF interface

This is an internal interface. The interface is described in the present document to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

4.1.2.6 gsmSCF - HLR interface

This interface is used by the gsmSCF to request information from the HLR. As a network operator option the HLR may refuse to provide the information requested by the gsmSCF.

4.1.2.7 gsmSCF - gsmSRF interface

This interface is used by the gsmSCF to instruct the gsmSRF to play tones/announcements to the users.

4.1.2.8 GMSC - MSC interface

This interface is used to transfer control of a call from a VMSC back to a GMSC for optimal routeing.

4.2 Detection Points (DPs)

4.2.1 Definition and description

Certain basic call events may be visible to the GSM Service Control Function (gsmSCF). The DPs are the points in call at which these events are detected. The DPs for Mobile Originated Calls and Mobile Terminated Calls are described in subclauses 4.4.2 and 4.4.3.

A DP can be armed in order to notify the gsmSCF that the DP was encountered, and potentially to allow the gsmSCF to influence subsequent handling of the call. If the DP is not armed, the processing entity continues the processing without gsmSCF involvement.

Three different types of DPs are identified:

- Trigger Detection Point - Request (TDP-R).

    This detection point is statically armed and initiates a CAMEL control relationship when encountered and there is no existing relationship due to the same CSI. Processing is suspended when the DP is encountered.

- Event Detection Point - Request (EDP-R).

    This detection point is dynamically armed within the context of a CAMEL control relationship. Processing is suspended when encountering the DP and the gsmSSF waits for instructions from the gsmSCF.

- Event Detection Point - Notification (EDP-N).

    This detection point is dynamically armed within the context of a CAMEL control relationship. Processing is not suspended when encountering the DP.

The DPs are characterized in the following subclauses.

4.2.1.1   Arming/disarming mechanism

A DP may be statically armed or dynamically armed.

The following arming rules apply:

- A DP for mobile terminating call handling is statically armed in the GMSC as a result of T-CSI delivery from the HLR. A DP for mobile terminating call handling is statically armed in the VMSC as a result of VT-CSI delivery from the VLR. A DP for forwarding leg handling is statically armed in the GMSC as result of O-CSI and/or D-CSI delivery from the HLR. A DP for mobile originating call or forwarded leg handling is statically armed in the VMSC as a result of O-CSI and/or D-CSI delivery from the VLR.

- A DP is dynamically armed by the gsmSCF within the context of a CAMEL control relationship (between the gsmSSF and the gsmSCF).

- A Request Report BCSM Event information flow for a detection point for a leg overwrites any previous Request Report BCSM Event information flow for that detection point for that leg.

The following disarming rules apply:

- A statically armed DP is disarmed when the O-CSI, D-CSI, T-CSI or VT-CSI that caused the DP to be statically armed is withdrawn in the HLR. Only TDP-Rs can be disarmed using this mechanism.

- If an armed EDP is met, then it is disarmed.

- If an EDP is met that causes the release of the related leg, then all EDPs related to that leg are disarmed.

- If a call is released, then all EDPs related to that call are disarmed.

- If an EDP is met, then other EDPs are disarmed, in accordance with the implicit disarming rule table (see subclause 4.4.4).

- If an EDP is armed, it can be explicitly disarmed by the gsmSCF by means of the Request Report BCSM Event information flow.

4.2.1.2   Criteria

Criteria are the conditions that must be met in order for the gsmSSF to request instructions from the gsmSCF.

4.2.1.2.1   Criteria at DP Collected_Info

The criteria for a mobile originating call are checked in the originating MSC.

The criteria for a mobile forwarded call are checked in the forwarding MSC.

For early forwarded calls in the GMSC, the HLR may decide not to include the DP Collected_Info trigger criteria in the subscriber data sent to the GMSC if the trigger criteria for the call are not met.

For optimally routed late forwarded calls, the MSC may decide not to include the DP Collected_Info trigger criteria in the Resume Call Handling information flow sent to the GMSC, if the trigger criteria for the call are not met.

The following criteria are applicable for DP Collected_Info:

- Destination number triggering criterion: The HLR may store a list of up to 10 destination numbers and/or up to 3 number lengths. There is no restriction on the nature of address. There is no restriction on the numbering plan indicator. This criterion may be defined to be either "enabling" or "inhibiting".

- Basic service triggering criterion: The HLR may store a list of up to 5 basic service codes, each of which may represent an individual basic service or a basic service group. Compound basic service group codes, as defined in 3GPP TS 29.002 [34], are not allowed for conditional triggering. This list is a triggering list.

- Forwarding triggering criterion: The HLR may store an indicator that triggering shall occur only for a call which has been subject to the Call Forwarding supplementary service, Call Deflection supplementary service or CAMEL call forwarding. This criterion may be defined to be either "enabling" or "inhibiting".

For MO calls, triggering at DP Collected_Info shall be strictly based on the number received over the access network. No service selection information, such as ∗ and # digits, or carrier selection information, dialled by the subscriber, shall be removed from the number before conditional triggering check takes place.

For MF calls at the VMSC, triggering at DP Collected_Info shall be strictly based on the number received over the access network (the Deflected-to-Number in the case of Call Deflection), the Forwarded-to-Number retained in the VLR or the Destination Routing Address received in the Connect information flow from the gsmSCF during a Terminating CAMEL Service at the VMSC.
No service selection information or carrier selection information shall be removed from the number before conditional triggering check takes place.

For MF calls at the GMSC, triggering at DP Collected_Info shall be strictly based on the Forwarded-to-Number received from HLR, on the Destination Routing Address received in the Connect information flow from the gsmSCF during a Terminating CAMEL Service or on the Forwarded-to-Number received in the Resume Call Handling information flow.
No service selection information or carrier selection information shall be removed from the number before conditional triggering check takes place.

One or more DP criteria may be applicable. All applicable triggering criteria must be satisfied before the dialogue is established with the gsmSCF.

If the destination number triggering criterion is enabling, then the gsmSSF may establish a dialogue with the gsmSCF if:

- the destination number matches one of the destination number strings defined in the list, or

- the length of the destination number matches one of the destination number lengths defined in the list.

In this test the destination number matches one of the destination number strings in the list if:

- the nature of address of destination number is the same as the nature of address of the destination number string (The numbering plan indicator is not compared);

- the destination number is at least as long as the destination number string in the list, and

- all the digits in the destination number string in the list match the leading digits of the destination number.

If the destination number triggering criterion is inhibiting, then the gsmSSF may establish a dialogue with the gsmSCF if:

- the destination number does not match any of the destination number strings defined in the list, and

- the length of the destination number does not match any of the destination number lengths defined in the list.

In this test the destination number matches one of the destination number strings in the list if:

- the nature of address of the destination number is the same as the nature of address of the destination number string (The numbering plan indicator is not compared);

- the destination number is at least as long as the destination number string in the list, and

- all the digits in the destination number string in the list match the leading digits of the destination number.

The basic service triggering criterion is met if the basic service for the call matches a stored individual basic service code or is a member of the group defined by a stored basic service group code. For the purpose of this paragraph a general bearer service is a member of the corresponding bearer service group.

If the forwarding triggering criterion is enabling, then the gsmSSF may establish a dialogue with the gsmSCF only if the call has been subject to CAMEL call forwarding or the Call Forwarding supplementary service. If the forwarding triggering criterion is inhibiting, then the gsmSSF may establish a dialogue with the gsmSCF only if the call has not been subject to CAMEL call forwarding or the Call Forwarding supplementary service.

4.2.1.2.2 Criteria at DP Analysed_Information

4.2.1.2.2.1 General

The criteria for a mobile originating call are checked in the originating MSC. The criteria for a mobile forwarded call are checked in the forwarding MSC.

For early forwarded calls in the GMSC, the HLR shall always include the trigger criteria in the subscriber data sent to the GMSC because that the HLR can not check the criteria applicable at DP Analysed_Info, since the number that the criteria check shall be based on, may be modified by a Mobile Terminating or Mobile Forwarding Service Logic for this call.

For optimally routed late forwarded calls, the MSC shall always include the trigger criteria in the Resume Call Handling information flow sent to the GMSC because the MSC can not check the criteria applicable at DP Analysed_Info, since the number that the criteria check shall be based on, may be modified by a Mobile Terminating or Mobile Forwarding Service Logic for this call.

The following criteria are applicable for DP Analysed_Information:

- Destination number triggering criterion: The HLR may store a list of up to 10 destination numbers. There is no restriction on the nature of address. There is no restriction on the numbering plan indicator.

NOTE: The order in which the destination number criteria are checked in the MSC or GMSC is not determined. Hence, overlapping destination number criteria (e.g. use of "0800" and "0800123" for two different services) should be avoided, because they lead to unpredictable behaviour (i.e. either service might be triggered).

For MO calls, triggering at DP Analysed_Info shall be based on the called party number received over the access network or the Destination Routing Address in the Connect information flow from the gsmSCF during a Mobile Originating CAMEL Service.

For MF calls at the VMSC, triggering at DP Analysed_Info shall be based on the number received over the access network (the Deflected-to-Number in the case of Call Deflection), the Forwarded-to-Number retained in the VLR, or the Destination Routing Address in the Connect information flow from the gsmSCF during a Mobile Terminated or Mobile Forwarded CAMEL Service.

For MF calls at the GMSC, triggering at DP Analysed_Info shall be based on the Forwarded-to-Number received from the HLR, on the Destination Routing Address received in the Connect information flow from gsmSCF during a Mobile Terminated or Mobile Forwarded CAMEL Service, or on the Forwarded-to-Number received in the Resume Call Handling information flow.

For NP calls, triggering at DP Analysed_Info shall be based on the number received from gsmSCF. An NP call that is created in the VMSC or GMSC of the served subscriber may be subject to D-CSI service and N-CSI service. An NP call that is created in an MSC other than the VMSC or GMSC of the served subscriber, may be subject to N-CSI service.

For NC calls, triggering at DP Analysed_Info shall be based on the number received from the gsmSCF. An NC call may be subject to N-CSI service.

4.2.1.2.2.2   Removal of information significant to the serving entity

In order to decide whether triggering shall take place, the trigger criteria need to be compared with the address information. Before the comparison takes place the following information shall be removed from the destination address information:

-   Operator specific service selection information that is recognised and treated locally in the serving entity. This shall not lead to a change of the type of number indicator of the address information.

-   Carrier selection information. If the removal of carrier selection information also removes international or national (trunk) prefixes (depending on regulatory requirements), then the type of number indicator of the address information shall be changed to "international number" or "national (significant) number" respectively. Otherwise the type of number indicator shall remain unchanged.

The address information in a subsequent Initial DP information flow at DP Analysed_Info shall not contain the removed information, however in the further call handling the serving entity shall invoke the requested services (e.g. carrier selection).

4.2.1.2.2.3   Number comparison

The following procedure shall be performed for the comparison of the destination number triggering criterion and the address information in the given order.

1. The numbering plan indicators of the destination number triggering criterion and the destination number are ignored.

2. The type of number/nature of address indicators of the destination number triggering criterion and the destination number are compared. If there is a match of the type of number indicator, then the check shall be performed by comparing the digits as defined in step 6. If there is no match of the type of number the comparison procedure shall continue as follows.

3. If either or both of the address information and destination number triggering criterion includes a types of number/nature of address indicator other than "unknown", "national (significant) number" or "international number" then the destination number does not match the destination number triggering criterion. Otherwise the comparison procedure shall continue as follows.

4. If there is a number (address information or destination number triggering criterion) with type of number/nature of address "unknown" this number shall be translated based on the numbering plan of the serving entity in either of the following ways:

    -   if the leading digits refer to an international prefix then those digits shall be removed and the type of number/nature of address shall be set to "international number".

    -   if the leading digits refer to a national (trunk) prefix then those digits shall be removed and the type of number/nature of address shall be set to "national (significant) number".

    If the leading digits refer neither to an international prefix nor to a national (trunk) prefix, then the destination number does not match the destination number triggering criterion.

    If there is a match of the type of number/nature of address indicator after this number modification, then the check shall be performed by comparing the digits as defined in step 6, otherwise the comparison procedure shall continue as follows.

5. If the type of number/nature of address of the address information or of the destination number triggering criterion is "national (significant) number" this number shall be translated based on the numbering plan of the serving entity to international format by adding the country code of the serving entity to the number string. After this modification the destination number triggering criterion and the destination number shall be in international format and shall be checked by comparing the digits as defined in step 6.

6   If the number of digits in the address information are compared with the number of digits in the destination number triggering criterion, then there is a match if:

- the destination number is at least as long as the destination number string of the destination number triggering criterion, and

- all the digits in the destination number string of the destination number triggering criterion match the leading digits of the destination number.

The check described in this subclause shall be repeated for every number contained in the destination number triggering criterion of the D-CSI until there is a match DP Analysed_Info is triggered, or until all the destination numbers have been checked without a match. In the latter case DP Analysed_Info is not triggered.

The procedures for the destination number triggering criterion check for N-CSI are network specific.

The modifications of the address information described in this subclause shall only be done for comparison purposes, i.e. they shall not affect the format of the destination address information sent in the Initial DP information flow.

4.2.1.2.3 Criteria at DP Route_Select_Failure

The HLR may store a list of up to 5 cause values.

The criteria for a mobile originating call are checked in the originating MSC. The criteria for a mobile forwarded call are checked in the forwarding MSC.

For early forwarded calls in the GMSC, the HLR shall always include the trigger criteria in the subscriber data sent to the GMSC because the cause code received from ISUP is used in the trigger criteria check. The cause code is not known at the time of sending the O-CSI to the GMSC.

For optimally routed late forwarded calls, the MSC shall always include the trigger criteria in the Resume Call Handling information flow sent to the GMSC because the cause code received from ISUP is used in the trigger criteria check. The cause code is not known at the time of sending the O-CSI to the GMSC.

The following criteria are applicable for DP Route_Select_Failure:

- Release cause code.

The trigger criteria are met if the cause code received from ISUP is equal to at least one of the cause codes in the trigger criteria list. For the purpose of trigger criteria check, the MSC performing the triggering check shall use the "cause value" field of the ISUP "cause indicators" parameter, as defined in ITU-T Recommendation Q.763 [43].

If an O-BCSM was already invoked and there is a relationship with the gsmSCF at that moment, then no additional relationship shall be initiated.

4.2.1.2.4 Criteria at DP Terminating_Attempt_Authorised

The HLR may store a list of up to 5 basic service codes, each of which may represent an individual basic service or a basic service group. Compound basic service group codes, as defined in 3GPP TS 29.002 [34], are not allowed for conditional triggering. This list is a triggering list.

The criteria for DP Terminating_Attempt_Authorised are checked in the HLR for the GMSC or in the VLR for the MSC. The HLR shall only include T-CSI in the CAMEL subscription information sent to the GMSC if the criteria are met. The VLR shall only include VT-CSI in the CAMEL subscription information sent to the MSC if the criteria are met.

The basic service criterion is met if the basic service for the call matches a stored individual basic service code or is a member of the group defined by a stored basic service group code. For the purpose of this paragraph a general bearer service is a member of the corresponding bearer service group.

4.2.1.2.5 Criteria at DP T_Busy and T_No_Answer

The HLR may store a list of up to 5 cause values.

The criteria for a mobile terminating call are checked in the GMSC or in MSC.

For mobile terminating calls in the GMSC, the HLR shall include the trigger criteria in the subscriber data sent to the GMSC because the cause code received from ISUP is used in the trigger criteria check. The cause code is not known at

the time of sending the T-CSI to the GMSC.
If the Send Routeing Info ack information flow includes the Not Reachable FTN, then the HLR may decide not to include the trigger criteria, if the HLR has identified that T-CSI includes DP T_Busy with cause code Not Reachable.

If the Send Routeing Info ack information flow includes the Not Reachable FTN and also T-CSI, including DP T_Busy with cause code, then the not reachable condition shall be mapped to an ISUP release code, which shall be used for the triggering check.

For Mobile terminating calls in the VMSC, the trigger criteria are received in the VT-CSI from the HLR in the Insert Subscriber Data information flow. The triggering is based on the ISUP release cause code (call set up result).

The following criteria are applicable for DP T_Busy and DP T_No_Answer:

-    Release cause code.

If the cause code is received from ISUP, then the trigger criteria are met if the cause code is equal to at least one of the cause codes in the trigger criteria list. For this check, the MSC shall use the "cause value" field of the ISUP "cause indicators" parameter, as defined in ITU-T Recommendation Q.763 [43].

If the cause code is received from MAP, then the trigger criteria are met if the cause code is equal to at least one of the cause codes in the trigger criteria list. For this check, the MSC shall use the cause values as defined in table 4.1.

If the trigger criteria are satisfied, then the corresponding Service Logic shall be invoked.
If a T-BCSM was already invoked and there is a relationship with the gsmSCF at that moment, then no additional relationship shall be initiated.

When the Resume Call Handling information flow is received in the GMSC and the subscriber has T-CSI then the forwarding reason in the Resume Call Handling information flow shall be used to perform the trigger criteria check for DP T_Busy or DP T_No_Answer. If a match is found, then the corresponding Service Logic shall be invoked.
If a T-BCSM was already invoked and there is a relationship with the gsmSCF at that moment, then no additional relationship shall be initiated.

Table 4.1: Mapping of Send Info For Incoming Call (SIFIC) ack, Send Routeing Info ack (SRI ack) or Resume Call Handling (RCH) to ISUP release causes for triggering criteria check

SIFIC ack / SRI ack / RCH "forwarding reason"	ISUP release cause number	ISUP release cause name
MS not reachable	20	Subscriber absent
MS Busy	17	User busy
Call deflection (note)	21	Call rejected
No reply	19	No answer from user (user alerted)
NOTE: Call Deflection is used only in the Resume Call Handling information flow, and in the VMSC. The same code point in the Send Routeing Info ack indicates CFU. However, the CFU invocation in the GMSC triggers the Terminating_Attempt_Authorised DP; thus the reason code mapping is not needed in the CFU case.		

4.2.1.3   Relationship

If an armed DP is encountered, the gsmSSF provides an information flow via the already established relationship with the gsmSCF.

A relationship between the gsmSSF and the gsmSCF for the purpose of operator specific service processing is considered to be a CAMEL relationship. There are two types of CAMEL relationships:

-    A CAMEL control relationship if the gsmSCF is able to influence the call processing via the relationship.

-    A CAMEL monitor relationship if the gsmSCF is not able to influence the call processing via the relationship.

4.2.2   DP processing rules

The gsmSSF shall apply the following set of rules during DP processing to ensure a single point of control:

-    EDPs are disarmed by the gsmSSF as they are encountered and reported to the gsmSCF, when the occurrence of another EDP causes the implicit disarming of the EDP or when the leg clears.

- A control relationship persists as long as there is 1 or more EDP-R armed for this portion of the call or if the Process CS_gsmSSF is in any state except Monitoring or Idle.

- A control relationship changes to a monitor relationship if the control relationship does not persist and:

  - 1 or more EDP-N is armed, or

  - 1 or more Call information Report is outstanding, or

  - an Apply Charging Report is outstanding.

- If a control relationship does not persist and does not change to a monitor relationship then the relationship terminates. A monitor relationship terminates if there are neither EDP-Ns armed nor reports outstanding or if the call clears.

4.3 Description of CAMEL Subscriber Data

4.3.1 Originating CAMEL Subscription Information (O-CSI)

This subclause defines the contents of the Originating CAMEL Subscription Information.

4.3.1.1 TDP List

The TDP List indicates on which detection point triggering shall take place.

The following trigger detection points are possible: DP Collected_Info and DP Route_Select_Failure.

4.3.1.2 gsmSCF address

The gsmSCF address indicates the address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing. Different gsmSCF addresses may be associated with different TDPs.

4.3.1.3 Service Key

The Service Key indicates to the gsmSCF the service logic to be used. Different Service Keys may be associated with different TDPs.

4.3.1.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested if there is an error in the gsmSSF to gsmSCF dialogue or if the call is subject to call gapping in the gsmSSF. A default call handling shall be associated with each Service Key.

4.3.1.5 DP criteria

The DP criteria indicate whether the gsmSSF shall request instructions from the gsmSCF.

4.3.1.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is requested by the gsmSCF for the service.

The HLR shall not include in a CSI which it sends to a VLR or GMSC any data for a CAMEL phase later than that which the CAMEL capability handling indicates. E.g. if the CAMEL Capability Handling indicates CAMEL phase 1 then the HLR shall not send triggering criteria to the VLR. Different CSIs may contain different values of CAMEL Capability Handling.

NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the VLR, the HLR can decide on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling (eventually support of a lower version of CSI).

4.3.1.7 CSI state

The CSI state indicates whether the O-CSI is active or not.

4.3.1.8 Notification flag

The notification flag indicates whether the change of the O-CSI shall trigger Notification on Change of Subscriber Data.

4.3.2 Dialled Service CAMEL Subscription Information (D-CSI)

This subclause defines the contents of the Dialled Service CAMEL Subscription Information.

4.3.2.1 DP criteria

The DP criteria indicate whether the gsmSSF shall request instructions from the gsmSCF.

4.3.2.2 gsmSCF address

The gsmSCF address indicates the address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing. A gsmSCF address shall be associated with each DP criterion.

4.3.2.3 Service Key

The Service Key identifies to the gsmSCF the service logic to be used. A Service Key shall be associated with each DP criteria.

4.3.2.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested if there is an error in the gsmSSF to gsmSCF dialogue or if the call is submitted to call gapping in the gsmSSF. A default call handling shall be associated with each DP criteria.

4.3.2.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is requested by the gsmSCF for the service.

   NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the VLR, the HLR can decide
           on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling
           (eventually support of a lower version of CSI).

4.3.2.6 CSI state

The CSI state indicates whether the D-CSI is active or not.

4.3.2.7 Notification flag

The notification flag indicates whether changes of the D-CSI shall trigger the Notification on Change of Subscriber Data.

4.3.3 Network CAMEL Service Information (N-CSI)

The N-CSI identifies services offered on a per-network basis by the serving PLMN operator for all subscribers. This CSI shall be stored in the MSC.

4.3.4 Translation Information Flag CAMEL Subscription Information (TIF-CSI)

4.3.4.1 Translation Information Flag

The TIF-CSI in the CAMEL Subscriber data indicates,

- when the subscriber registers a forwarded-to number, that the HLR shall not attempt to perform any translation, number format checks, prohibited FTN checks or call barring checks. (see 3GPP TS 23.082 [20]).

- when the subscriber invokes the Call Deflection supplementary service, that the VLR shall not attempt to perform any translation, number format checks, prohibited DTN checks, call barring checks. (see 3GPP TS 23.072 [16]).

4.3.4.2 Notification flag

The notification flag indicates whether the change of the TIF-CSI shall trigger Notification on Change of Subscriber Data or not.

4.3.5 Terminating CAMEL Subscription Information (in the GMSC) (T-CSI)

This subclause defines the contents of the Terminating CAMEL Subscription Information.

4.3.5.1 TDP List

The TDP List indicates on which detection point triggering shall take place.

The following trigger detection points are possible: DP Terminating_Attempt_Authorised, DP T_Busy, and DP T_No_Answer.

4.3.5.2 gsmSCF address

The gsmSCF address indicates the address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing. Different gsmSCF addresses may be associated with different TDPs.

4.3.5.3 Service Key

The Service Key indicates to the gsmSCF the service logic to be used. Different Service Keys may be associated with different TDPs.

4.3.5.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested if there is an error in the gsmSSF to gsmSCF dialogue or if the call is subject to call gapping in the gsmSSF. A default call handling shall be associated with each Service Key.

4.3.5.5 DP criteria

The DP criteria indicate whether the gsmSSF shall request instructions from the gsmSCF.

4.3.5.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is requested by the gsmSCF for the service.

The HLR shall not include in a CSI which it sends to a GMSC any data for a CAMEL phase later than that which the CAMEL capability handling indicates. Different CSIs may contain different values of CAMEL Capability Handling.

NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the GMSC, the HLR can decide on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling (e.g. support of a lower version of CSI).

4.3.5.7 CSI state

The CSI state indicates whether the T-CSI is active or not.

4.3.5.8 Notification flag

The notification flag indicates whether the change of the T-CSI shall trigger Notification on Change of Subscriber Data or not.

4.3.6 VMSC Terminating CAMEL Subscription Information (VT-CSI)

This subclause defines the contents of the Terminating CAMEL Subscription Information for the VMSC.

4.3.6.1 TDP List

The TDP List indicates on which detection point triggering shall take place.

The following trigger detection points are possible: DP Terminating_Attempt_Authorised, DP T_Busy, and DP T_No_Answer.

4.3.6.2 gsmSCF address

The gsmSCF address indicates the address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing. Different gsmSCF addresses may be associated with different TDPs.

4.3.6.3 Service Key

The Service Key indicates to the gsmSCF the service logic to be used. Different Service Keys may be associated with different TDPs.

4.3.6.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested if there is an error in the gsmSSF to gsmSCF dialogue or if the call is subject to call gapping in the gsmSSF. A default call handling shall be associated with each Service Key.

4.3.6.5 DP criteria

The DP criteria indicate whether the gsmSSF shall request the gsmSCF for instructions.

4.3.6.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is requested by the gsmSCF for the service.

The HLR shall not include in a CSI which it sends to a VLR any data for a CAMEL phase later than that which the CAMEL capability handling indicates.

NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the VLR, the HLR can decide on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling (eventually support of a lower version of CSI).

4.3.6.7 CSI state

The CSI state indicates whether the VT-CSI is active or not.

4.3.6.8 Notification flag

The notification flag indicates whether the change of the VT-CSI shall trigger Notification on Change of Subscriber Data or not.

4.3.7 Other CAMEL data

4.3.7.1 Location information/Subscriber state Interrogation

This data indicates whether additional subscriber information shall be sent to the GMSC as part of the terminating call handling.

- an indication that the HLR shall send the location information of the called subscriber.

- an indication that the HLR shall send the subscriber state of the called subscriber.

4.3.7.2 gsmSCF address list for CSI

The gsmSCF address list for CSI indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

4.4 Description of CAMEL BCSMs

4.4.1 General Handling

The BCSM is used to describe the actions in an MSC or GMSC or VMSC during originating, forwarded or terminating calls.

The BCSM identifies the points in basic call processing when Operator Specific Service (OSS) logic instances (accessed through the gsmSCF) are permitted to interact with basic call control capabilities.

Figure 4.2 shows the components that have been identified to describe a BCSM.
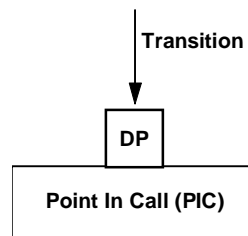
Figure 4.2: BCSM Components

4.4.2 Originating Basic Call State Model (O-BCSM)

4.4.2.1 Description of O-BCSM

The O-BCSM is used to describe the actions in an MSC during originating (MSC) or forwarded (MSC or GMSC) calls.

When encountering a DP the O-BCSM processing is suspended at the DP and the MSC or GMSC indicates this to the gsmSSF which determines what action, if any, shall be taken if the DP is armed. For gsmSCF initiated new calls the O-BCSM is initially suspended at DP Collected_Info.

Basic Call transition
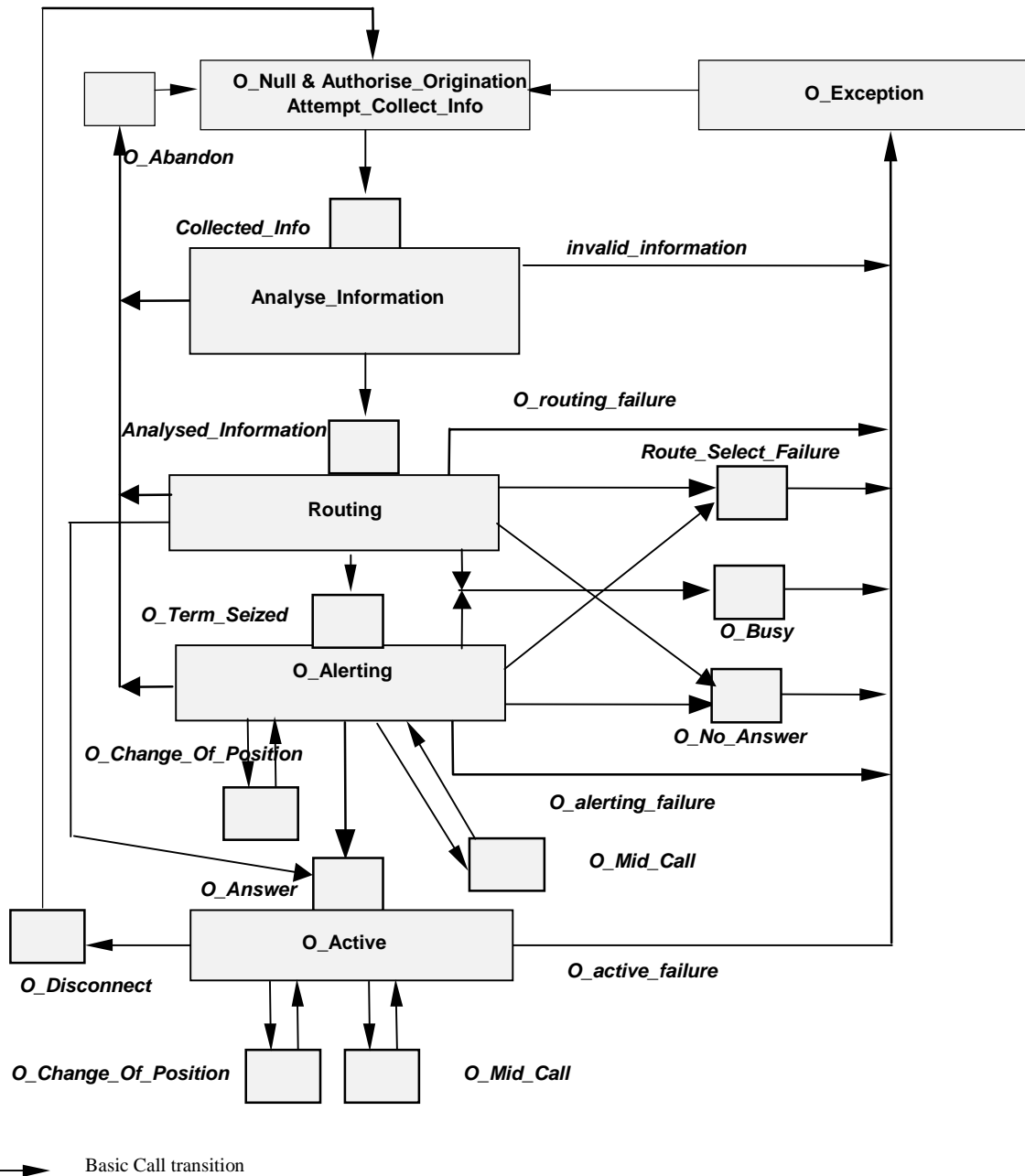
NOTE: The DP O_Busy also includes the 'not reachable' case.

Figure 4.3: Originating BCSM for CAMEL

The table below defines the different DPs which apply to mobile originating and forwarded calls.

Table 4.2: Description of O-BCSM DPs in the MSC

CAMEL Detection Point:	DP Type	Description:
DP Collected_Info	TDP-R	Indication that the O-CSI is analysed or the gsmSCF has initiated a call attempt. In the later case the DP is neither triggered nor reported.
DP Analysed_Information	TDP-R (note 2)	Availability of routeing address and nature of address.
DP Route_Select_Failure	TDP-R (note 3), EDP-N, EDP-R	Indication that the call establishment failed.
DP O_Busy	EDP-N, EDP-R	Indication that: - a busy indication is received from the terminating party, - a not reachable event is determined from a cause IE in the ISUP Release message.
DP O_No_Answer	EDP-N, EDP-R	Indication that: - an application timer associated with the O_No_Answer DP expires, - a no answer event is determined from a cause IE in the ISUP Release message.
DP O_Term_Seized	EDP-N, EDP-R	Indication that the called party is being alerted.
DP O_Answer	EDP-N, EDP-R	Indication that the call is accepted and answered by the terminating party.
DP O_Mid_Call	EDP-N, EDP-R	Indication that a service/service feature indication is received from the originating party (DTMF - note 4, note 5).
DP O_Change_Of_Position	EDP-N	Indication that the originating party has changed position (note 6).
DP O_Disconnect	EDP-N, EDP-R	A disconnect indication is received from the originating party or from the terminating party.
DP O_Abandon	EDP-N, EDP-R	Indication that a disconnect indication is received from the originating party during the call establishment procedure.
NOTE 1: The DPs are defined in ITU-T Recommendation Q.1224 [44].		
NOTE 2: For TDP-R Analysed_Information new relationship to gsmSCF is opened.		
NOTE 3: DP Route_Select_Failure shall be reported as TDP-R when there is no relationship to gsmSCF. If a relationship to gsmSCF is already open, it shall be reported as EDP-R or EDP-N if armed so.		
NOTE 4: DTMF is only applicable for the Mobile Originating Call in the VMSC.		
NOTE 5: Call Processing is suspended at DP O_Mid_Call if a Call Party Handling information flow is handled. However, the DP is not reported.		
NOTE 6: DP O_Change_Of_Position is applicable only for the Mobile Originating Call in the VMSC.		

4.4.2.1.1 Description of the call model (PICs)

This subclause describes the call model for originating and forwarded calls. For each PIC a description can be found of the entry events, functions and exit events.

It should be noted that although the names used for PICs match those used in ITU-T Recommendation Q.1224 [44] the specific descriptions differ.

4.4.2.1.1.1 O_Null & Authorise_Origination_Attempt_Collect_Info

Entry events:

- Disconnection and clearing of a previous call (DP O_Disconnect) or default handling of exceptions by gsmSSF/(G)MSC completed.

- Abandon event is reported from Analyse_Information or Routing and Alerting PIC.

- Exception event is reported.

Actions:

- Interface is idled.

- Originating call: SETUP information flow containing the dialled number is received from MS.

- Originating call: The supplementary service "barring of all outgoing calls" is checked and invoked if necessary.

- Originating call: The ODB category "barring of all outgoing calls" is checked and ODB is invoked if necessary.

NOTE: the ODB category "barring of all outgoing calls when roaming" causes the HLR to send the category "barring of all outgoing call" if the VLR is not in the HPLMN.

- Originating call: CUG checks done in the originating MSC/VLR are performed.

- Information being analysed e.g., O-CSI is analysed.

Exit events:

- Originating CSI is analysed.

- An exception condition is encountered. For this PIC, if the call encounters one of these exceptions during the PIC processing, the exception event is not visible because there is no corresponding DP. Example exception condition: Calling party abandons call.

4.4.2.1.1.2 Analyse_Information

Entry events:

- Originating CSI is analysed. (DP Collected Info).

- The gsmSCF has initiated a call attempt (DP Collected_Info). In this case the DP has neither been triggered nor has it been reported.

- New routeing information is received when the Busy event (DP O_Busy), Route Select Failure event (DP Route_Select_Failure), Not Reachable event (DP O_Busy) or No Answer event (DP O_No_Answer) is reported from the Routing and Alerting PIC.

- New routeing information is received when the Disconnect event is reported from the O_Active PIC.

Actions:

- Compare the called party number with the dialled services information.

Exit events:

- Availability of routeing address and nature of address. (DP Analysed_Information).

- An exception condition is encountered (e.g. wrong number); this leads to the O_Exception PIC.

- The calling party abandons the call; this leads to the O_Abandon DP.

4.4.2.1.1.3 Routing

Entry events:

- Availability of routeing address and nature of address. (DP Analysed_Information).

Actions:

- Information is being analysed and/or translated according to dialling plan to determine routeing address.

- Routeing address being interpreted.

- Originating call: Outgoing barring services and ODB categories not already applied are checked and invoked if necessary.

Exit events:

- An indication is received from the terminating half BCSM that the call is accepted and answered by the terminating party; this leads to O_Answer DP.

- An exception condition is encountered; this leads to the O_Exception PIC.

- The calling party abandons the call; this leads to the O_Abandon DP.

- A busy indication is received from the terminating party; this leads to the O_Busy DP.

- A not reachable indication is received from the terminating party; this leads to the O_Busy DP.

- The attempt to select the route for the call fails; this leads to the Route_Select_Failure DP.

- An alerting indication (ISUP ACM) is received from the terminating party; this leads to the O_Term_Seized DP.

- The no reply timer expires; this leads to the O_No_Answer DP.

4.4.2.1.1.4 O_Alerting

Entry events:

- Called Party is being alerted (DP O_Term_Seized).

- Continue is received in O_Mid_Call DP.

Actions:

- Call is being processed by the terminating half BCSM. Waiting for indication from terminating half BCSM that the call has been answered by terminating party.

- Send a notification to the gsmSCF if the originating party changes position and DP O_Change_Of_Position is armed.

Exit events:

- A service/service feature request is received from the originating party (DTMF) or DP O_Mid_Call is used for Call Party Handling; this leads to the O_Mid_Call DP.

- An indication is received from the terminating half BCSM that the call is accepted and answered by the terminating party; this leads to the O_Answer DP.

- An exception condition is encountered; this leads to the O_Exception PIC.

- The calling party abandons the call; this leads to the O_Abandon DP.

- A route select failure indication is received from the terminating party; this leads to the Route_Select_Failure DP.

- A busy indication (UDUB) is received from the terminating party; this leads to the O_Busy DP.

- A not reachable indication is received from the terminating party; this leads to the O_Busy DP.

- The no reply timer expires; this leads to the O_No_Answer DP.

4.4.2.1.1.5 O_Active

Entry events:

- Indication from the terminating half BCSM that the call is accepted and answered by the terminating party. (DP O_Answer)

- Continue is received in O_Mid_Call DP.

Actions:

- Connection established between originating party and terminating party. Call supervision is provided.

- Send a notification to the gsmSCF if the originating party changes position and DP O_Change_Of_Position is armed.

- Call release is awaited.

Exit events:

- A service/service feature request is received from the originating party (DTMF) or DP O_Mid_Call is used for Call Party Handling (DP O_Mid_Call).

- A disconnection indication is received from the originating party, or received from the terminating party via the terminating half BCSM (DP O_Disconnect).

- An exception condition is encountered.

4.4.2.1.1.6 O_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for a PIC can not be met.

Actions:

- Default handling of the exception condition is being provided. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

    - If any relationship exists between the gsmSSF and the gsmSCF, the gsmSSF shall send an error information flow closing the relationships and indicating that any outstanding call handling instructions will not run to completion.

    - The (G)MSC/gsmSSF should make use of vendor-specific procedures to ensure release of resources within the (G)MSC/gsmSSF, so that line, trunk and other resources are made available for new calls.

Exit events:

- Default handling of the exception condition by gsmSSF/(G)MSC completed.

4.4.3 Terminating Basic Call State Model (T-BCSM)

4.4.3.1 Description of T-BCSM

The T-BCSM is used to describe the actions in a GMSC and in a VMSC during terminating calls.

When encountering a DP the T-BCSM processing is suspended at the DP and the GMSC or VMSC indicates this to the gsmSSF which determines what action, if any, shall be taken if the DP is armed.
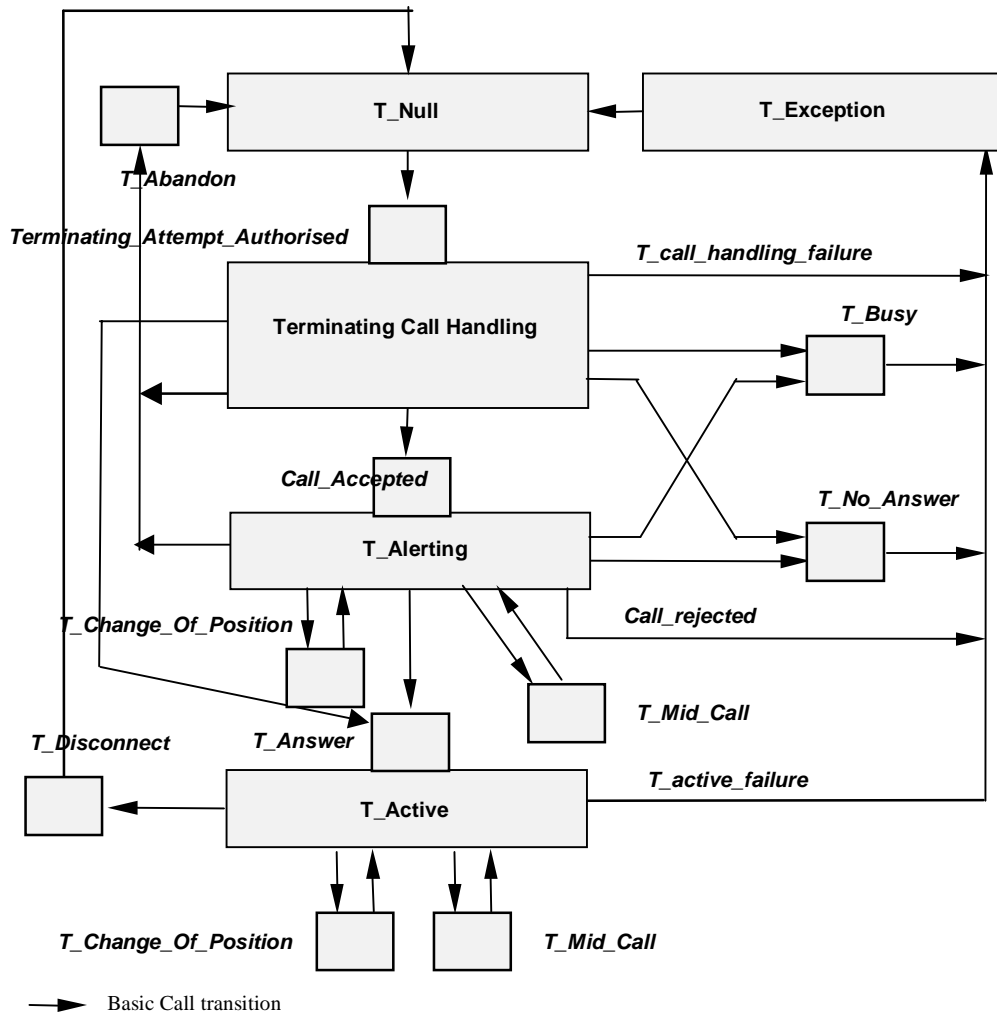
Figure 4.4: T-BCSM in the GMSC or VMSC

In the table below the different DPs (in the T-BCSM) are described.

Table 4.3: Description of T-BCSM DPs in the GMSC or VMSC

CAMEL Detection Point:	DP Type	Description:
DP Terminating_Attempt_ Authorised	TDP-R	Indication that the T-CSI / VT-CSI is analysed.
DP T_Busy	TDP-R (note 2), EDP-N, EDP-R	Indication that: - a busy indication is received from the destination exchange, - Busy event is determined in the visited MSC, - Not reachable or call establishment failure event is determined from the HLR response or upon a cause IE in the ISUP Release message.
DP T_No_Answer	TDP-R (note 2), EDP-N, EDP-R	Indication that an application timer associated with the T_No_Answer DP expires.
DP Call_Accepted	EDP-N, EDP-R	Indication that the called party is being alerted.
DP T_Answer	EDP-N, EDP-R	Call is accepted and answered by terminating party.
DP T_Mid_Call	EDP-N, EDP-R	Indication that a service/service feature is received from the terminating party (DTMF - note 3, note 4).
DP T_Change_Of_Position	EDP-N	Indication that the terminating party has changed position (note 5).
DP T_Disconnect	EDP-N, EDP-R	A disconnect indication is received from the terminating party or from the originating party.
DP T_Abandon	EDP-N, EDP-R	A disconnect indication is received from the originating party during the call establishment procedure.
NOTE 1: The DPs are defined in ITU-T Recommendation Q.1224 [44].		
NOTE 2: DP T_No_Answer and DP T_Busy shall be reported as TDP-R when there is no relationship to gsmSCF. If a relationship to gsmSCF is already open, it shall be reported as EDP-R or EDP-N if armed so.		
NOTE 3: DTMF is only applicable for the VMSC but not for the GMSC. DTMF is not applicable at the T_Alerting PIC.		
NOTE 4: Call Processing is suspended at DP T_Mid_Call if a Call Party Handling information flow is handled. However, the DP is not reported.		
NOTE 5: DP T_Change_Of_Position is applicable only for the Mobile Terminating Call in the VMSC.		

4.4.3.1.1 Description of the call model (PICs)

This subclause describes the call model for terminating calls in the GMSC and in the VMSC. For each PIC a description can be found of the entry events, functions, information available and exit events.

It should be noted that although the names used for PICs match those used in ITU-T Recommendation Q.1224 [44] the specific descriptions differ.

4.4.3.1.1.1 T_Null

Entry events:

- Disconnection and clearing of a previous call (DP T_Disconnect) or default handling of exceptions by gsmSSF/GMSC or VMSC completed.

- Abandon event is reported from Terminating Call Handling PIC.

- Exception event is reported.

Actions:

- Interface is idled.

- If ISUP Initial Address Message is received, the appropriate information is analysed.

- If the T-BCSM is in the GMSC, a Send Routeing Info information flow is sent to the HLR.

- If the T-BCSM is in the VMSC, a Send Info For Incoming Call information flow is sent to the VLR.

- If the T-BCSM is in the GMSC:

    - The supplementary services "barring of all incoming calls" and "barring of incoming calls when roaming" are checked in the HLR and invoked if necessary.

- The ODB categories "barring of all incoming calls" and "barring of incoming calls when roaming" are checked in the HLR and ODB is invoked if necessary.

    - The supplementary service "CUG" is checked in the HLR and invoked if necessary.

- T-CSI/VT-CSI is received and analysed.

Exit events:

- Response is received from HLR or VLR and terminating CSI (if available) is analysed.

- An exception condition is encountered. For this PIC, if the call encounters one of these exceptions during the PIC processing, the exception event is not visible because there is no corresponding DP.

    Example exception condition is:

    - The calling party abandons call.

4.4.3.1.1.2 Terminating Call Handling

Entry events:

- Response is received from HLR or VLR and terminating CSI (if available) is analysed (DP Terminating_Attempt_Authorised).

- New routeing information is received when a Busy or not reachable event (DP T_Busy) or a No Answer event (DP T_No_Answer) is reported from the Terminating Call Handling PIC.

- New routeing information is received when a Disconnect event is reported from the T_Active PIC.

- NOTE: The HLR may use MAP signalling to indicate to the GMSC before the call is extended to the destination VMSC that the terminating party is not reachable, or the destination VMSC may use telephony signalling to indicate to the GMSC after the call has been extended to the destination VMSC that the terminating party is not reachable.

Actions:

- The response from the HLR or VLR is analysed.

- Routeing address and call type are interpreted. The next route or terminating access is selected.

- The Call Forwarding supplementary service is invoked if necessary.

Exit events:

- The call is accepted and answered by terminating party; this leads to the T_Answer DP.

- An indication is received that the called party is being alerted; this leads to the Call_Accepted DP.

- An exception condition is encountered; this leads to the T_Exception PIC. Example exception conditions: the call setup to the MSC or GMSC was not successful.

- The calling party abandons the call; this leads to the T_Abandon DP.

- The terminating access is busy in the VMSC or a busy indication is received from the destination exchange in the GMSC; this leads to the T_Busy DP.

- A not reachable event detected or failure of attempt to select the route for the terminating leg in the GMSC fails or the MS cannot be reached in the VMSC; this leads to the T_Busy DP.

- The no reply timer expires; this leads to the T_No_Answer DP.

4.4.3.1.1.3 T_Alerting

Entry events:

- Called party is being alerted (DP Call_Accepted)

- Continue is received in T_Mid_Call DP.

Actions:

- Waiting for the call to be answered by terminating party.

- The Call Forwarding supplementary service is invoked if necessary.

- Send a notification to the gsmSCF if the terminating party changes position and DP T_Change_Of_Position is armed.

Exit events:

- The call is accepted and answered by terminating party; this leads to the T_Answer DP.

- An exception condition is encountered; this leads to the T_Exception PIC. Example exception conditions: the call setup to the MSC or GMSC was not successful.

- The calling party abandons the call; this leads to the T_Abandon DP.

- A busy indication (UDUB) is received from the destination exchange; this leads to the T_Busy DP.

- A not reachable event is detected or the attempt to select the route for the terminating leg in the GMSC fails or the MS cannot be reached in the VMSC; this leads to the T_Busy DP.

- The no reply timer expires; this leads to the T_No_Answer DP.

- A Call Party Handling information flow is executed; this leads to the T_Mid_Call DP.

4.4.3.1.1.4 T_Active

Entry events:

- Indication that the call is accepted and answered by the terminating party. (DP T_Answer).

- Continue is received in T_Mid_Call DP.

Actions:

- Connection established between originating party and terminating party. Call supervision is being provided.

- Send a notification to the gsmSCF if the terminating party changes position and DP T_Change_Of_Position is armed.

- Wait for call release.

Exit events:

- A disconnection indication is received from the terminating party, or received from the originating party via the originating half BCSM; this leads to the T_Disconnect DP.

- An exception condition is encountered. In addition to the specific examples listed above, exception events include any type of failure that means that the normal exit events for a PIC cannot be met.

- A service/service feature request is received from the called party (DTMF) or a Call Party Handling information flow is executed; this leads to the T_Mid_Call DP.

4.4.3.1.1.5 T_Exception

Entry events:

- An exception condition is encountered. In addition to the specific examples listed above, exception events include any type of failure, which means that the normal exit events for PIC cannot be met.

Actions:

- Default handling of the exception condition is being provided. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

  - If any relationship exists between the gsmSSF and the gsmSCF, the gsmSSF shall send an error information flow closing the relationships and indicating that any outstanding call handling instructions will not run to completion.

  - The GMSC or VMSC / gsmSSF should make use of vendor-specific procedures to ensure release of resources within the GMSC or VMSC / gsmSSF, so that line, trunk and other resources are made available for new calls.

Exit events:

- Default handling of the exception condition by gsmSSF/GMSC is completed.

4.4.4 Rules for Implicit Disarming of Event Detection Points

The tables below give the rules for implicit disarming of event detection points.

Implicit EDP disarming rules are specified in the tables below for Originating BCSM and Terminating BCSM respectively. Each table specifies which EDP's shall be disarmed (i.e. MonitorMode set to Transparent) if/when each EDP is encountered, irrespective of the EDP's Monitor Mode (Transparent, Notify And Continue, or Request).

When EDPs armed with MonitorMode 'Request' (EDP-Rs) are encountered, any implicit EDP disarming shall take place before reporting the EDP and transiting the gsmSSF to the Waiting_For_Instruction state (if not already suspended in the Waiting_For_Instruction state).

If the BCSM has encountered DP O/T_Answer then an originator release must be detected as a DP O/T_Disconnect.

The table entry 'X' means that if the DP is encountered (independently of arming and reporting to the gsmSCF) the marked DP is implicitly disarmed.

It shall be possible to rearm explicitly an implicitly disarmed DP, e.g. for follow on call.

Table 4.4: Implicit disarmed DPs in the O-BCSM

Encountered DP	Implicit disarmed DPs									
	Route_Select_Failure	O_Busy	O_No_Answer	O_Answer	O_Mid_Call Leg 1	O_Disconnect Leg 1	O_Disconnect any other Leg	O_Abandon	O_Term_Seized	O_Change_Of_Position
Route_Select_Failure	X	X	X	X			X		X	
O_Busy	X	X	X	X			X		X	
O_No_Answer	X	X	X	X			X		X	
O_Answer	X	X	X	X				X	X	
O_Mid_Call Leg 1 (note 1)					X					
O_Disconnect Leg 1					X	X		X		X
O_Disconnect any other Leg	X	X	X	X			X		X	
O_Abandon					X	X		X		X
O_Term_Seized									X	
O_Change_Of_Position (note 1)										X
Note 1 If the Automatic Rearm IE was present in the Request Report BCSM Event information flow for the O_Change_Of_Position DP or the O_Mid_Call DP and armed as EDP-N, then the DP shall be automatically rearmed by the gsmSSF when it is encountered.										

Table 4.5: Implicit disarmed DPs in the T-BCSM

Encountered DP	Implicit disarmed DPs								
	T_Busy	T_No_Answer	T_Answer	T_Mid_Call Leg 2	T_Disconnect any other Leg	T_Disconnect Leg 2	T_Abandon	Call_Accepted	T_Change_Of_Position
T_Busy	X	X	X	X		X		X	X
T_No_Answer	X	X	X	X		X		X	X
T_Answer	X	X	X				X	X	
T_Mid_Call Leg 2 (note 1)				X					
T_Disconnect any other Leg					X		X		
T_Disconnect Leg 2	X	X	X	X		X		X	X
T_Abandon					X		X		
Call_Accepted								X	
T_Change_Of_Position (note 1)									X
Note 1 If the Automatic Rearm IE was present in the Request Report BCSM Event information flow for the T_Change_Of_Position DP or the T_Mid_Call DP and armed as EDP-N, then the DP shall be automatically rearmed by the gsmSSF when it is encountered.									

4.4.5 BCSM Modelling of Call Scenarios

This subclause describes how the BCSMs defined above are used to model CS call scenarios. For each scenario the used and unused BCSMs involved in the call are shown.

In some cases these models may have an allocation to physical nodes different from that shown. However, the physical separation of the logical functions shown shall not impact the modelling. This subclause describes the call scenarios without optimal routeing. If optimal routeing is invoked then the physical configurations may be different from those shown, but the modelling is not changed.

CAMEL may be applied simultaneously and independently for each subscriber involved in a call. This is not shown in these scenarios.

Subscribers other than those being served by CAMEL may be either PSTN subscribers, other subscribers or any other addressable subscriber.

4.4.5.1 Mobile Originated Call

For the call from A to B, an instance of the O-BCSM will be created in the MSC (labelled "O(A-B)"). If the A-party has an active O-CSI or D-CSI, or the MSC has an active N-CSI, and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship with gsmSCF(1) shall be established.
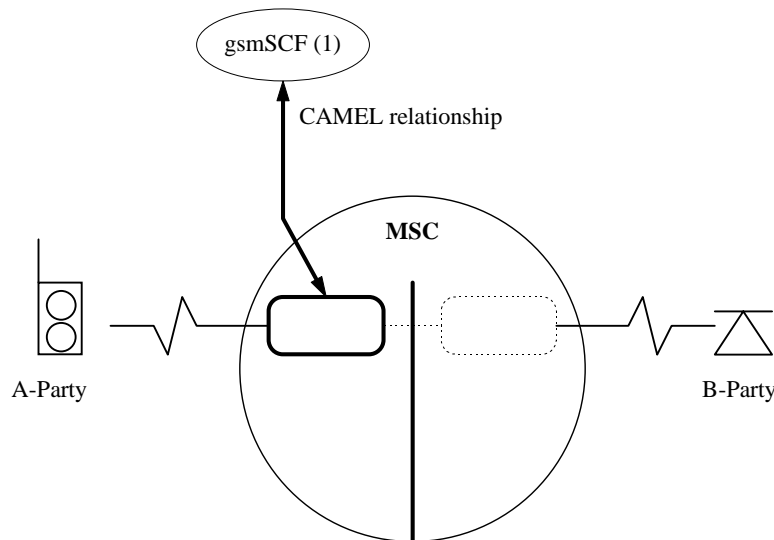
Figure 4.5: BCSM Scenario for Mobile Originated Call

4.4.5.2 Mobile Terminated Call at the GMSC or VMSC

For the call from A to B, an instance of the T-BCSM will be created in the GMSC (labelled "T(A-B)") and an instance of the T-BCSM will be created in the VMSC (labelled "T(A-B)").
If the B-party has an active T-CSI in the GMSC and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC and the gsmSCF(1) shall be established. If the B-party has an active VT-CSI in the VMSC and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the VMSC and the gsmSCF(2) shall be established.

The relationships with gsmSCF (1) and gsmSCF(2) may exist simultaneously. The two gsmSCF endpoints of the relationships are treated independently.

The nodes gsmSCF (1) and gsmSCF (2) may be the same or different entities.
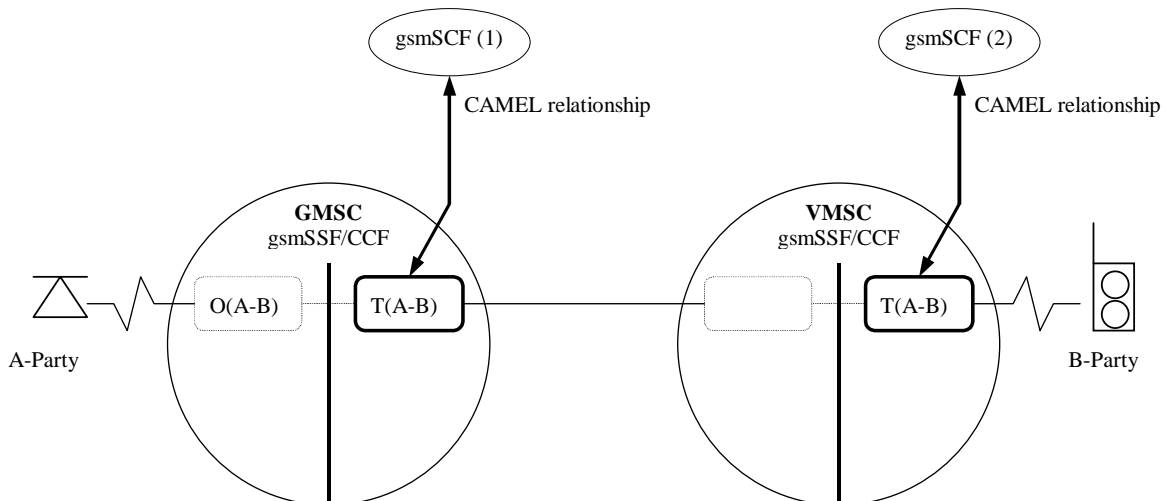
Figure 4.6: BCSM Scenario for Mobile Terminated Calls at the GMSC or VMSC

4.4.5.3 Call Forwarding at the GMSC or VMSC

If the B-party has an active T-CSI in the GMSC or VT-CSI in the VMSC and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC or VMSC and the gsmSCF(1) shall be established.

Following processing at the GMSC or VMSC the call will be extended to the VMSC serving the B-party. This VMSC may be physically integrated with the GMSC.

A new call leg to a "C" party shall be created if:

- a Call Forwarding supplementary service or Call Deflection supplementary service forwards the call to C. An instance of the O-BCSM O(B-C) will be created for the forwarding leg. If the B-party has an active O-CSI or D-CSI in the GMSC or VMSC, or the GMSC or VMSC has an active N-CSI, and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC or VMSC and the gsmSCF(2) shall be established. If the GMSC or VMSC receives the 'Suppress O-CSI' parameter, then O-CSI shall not be used for the forwarding leg or deflecting leg; or

- a CAMEL service in a control relationship with T(A-B) performs a CAMEL-based call forwarding by using a Connect information flow. An instance of the O-BCSM O(B-C) will be created for the forwarding leg. If the B-party has an active O-CSI or D-CSI in the GMSC or VMSC, or the GMSC or VMSC has an active N-CSI, and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC or VMSC and the gsmSCF(2) shall be established. The O-CSI shall be used for the forwarding leg only if the last Connect information flow includes the "O-CSI applicable" flag.

The relationship with gsmSCF (1) and the relationship with gsmSCF(2) may exist simultaneously. The two relationships are treated independently at the GMSC. The instance of the BCSM T(A-B) and the instance of the BCSM O(B-C) are linked by an internal interface which is assumed to behave in a similar way to an ISUP interface.

The nodes gsmSCF (1) and gsmSCF (2) may be the same or different physical entities.
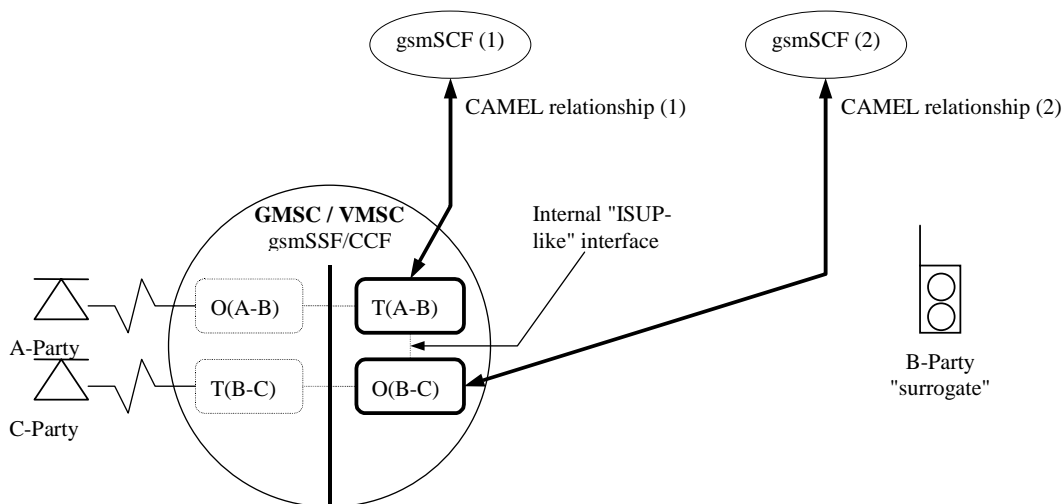
Figure 4.7: BCSM Scenario for Call Forwarding at the GMSC or VMSC

4.4.5.4   gsmSCF Initiated Call

When the gsmSCF wishes to originate a new call, the gsmSCF establishes communication with the network using CAP signalling. When the gsmSCF wishes to originate a new leg within an existing call, the gsmSCF uses the already established communication with the gsmSSF. It sends an Initiate Call Attempt information flow which shall contain the address of the called party. Afterwards the gsmSCF shall instruct the gsmSSF to continue with the call processing. The MSC constructs an ISUP Initial Address Message using the parameters received from the gsmSCF and sends it to the destination exchange.

The O-BCSM for the gsmSCF initiated call to B (labelled "O(M-B)") is invoked on request of the gsmSCF. A control relationship with gsmSCF (1) is created for the initiation of a new call.

NOTE: The term ISUP is used to denote UNI or NNI signalling system used in a given network.
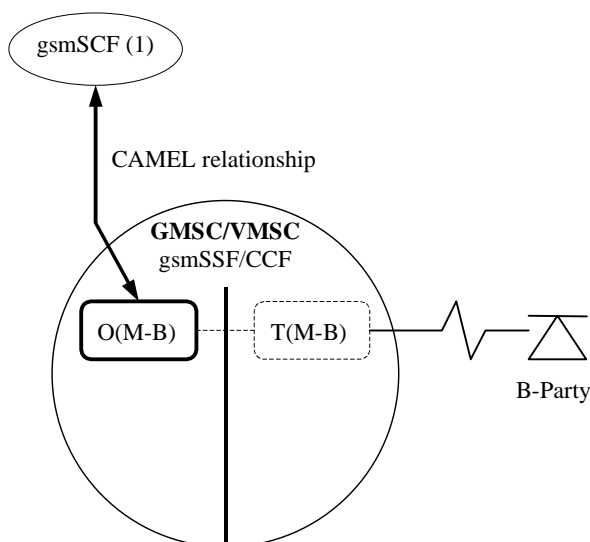
Figure 4.8: BCSM Scenario for gsmSCF Initiated New Call

4.4.6 Leg Handling

A call may consist of several call parties with each party connected to the call, e.g. there may be a calling party and several called parties.

From a call handling point of view it is necessary to distinguish between a leg, which is a concept internal to the call handling model, and a connection, which is the external link to the party. A connection to the call party will be set up using telephony (e.g. ISUP) or radio access signalling. The outgoing leg already exists when the connection is set up. On the other hand, if a connection is released, e.g. because the destination user is busy, the leg still exists, and the gsmSCF can send a Connect Information Flow to connect this leg to another call party.

4.4.6.1 Leg is created

For the purposes of the formal description, one or more legs are created in the following cases:

- When a call is to be established, i.e. when an incoming Setup or ISUP IAM is being handled or when a call is to be forwarded, the incoming leg (leg1) and the outgoing leg (leg2) are created before the first CS_gsmSSF process is invoked for that call in this MSC. In particular, this applies before the Call Control Function (CCF) sends DP_Collected_Info (for originating, forwarded or deflected calls) or DP_Terminating_Attempt_Authorised (for terminating calls) to the CS_gsmSSF process;

- When the CS_gsmSSF process receives an Initiate Call Attempt Information Flow, an outgoing leg is created.

4.4.6.2 Leg continues to exist

For the purposes of the formal description, a leg continues to exist in the following cases:

- The CCF sends any DP to the CS_gsmSSF the leg will continue to exist at least until the CS_gsmSSF instructs the CCF to continue its processing for the leg;

- A connection to a called party is not successful and the gsmSCF sends a new Connect Information Flow for that leg;

- A called party releases her connection and the gsmSCF sends a new Connect Information Flow for that leg;

- The CS_gsmSSF processes either of the Call Party Handling Information Flows Move Leg and Split Leg;

4.4.6.3 Leg is released

Before a leg is released the corresponding connection is released. All outstanding reports for the leg are sent to the gsmSCF and the corresponding call records are closed.

For the purposes of the formal description, a leg ceases to exist when any of the following events occurs:

- The calling party releases the connection, the CCF sends a DP to the CS_gsmSSF and the CCF receives Int_Continue or Int_Continue_With_Argument from the CS_gsmSSF process;

- A connection to a called party is not successful (DPs Route_Select_Failure, O_Busy, O_No_Answer, T_Busy and T_No_Answer), the CCF sends a DP to the CS_gsmSSF and the CCF and the CCF does not receive Int_Connect for that outgoing leg from the CS_gsmSSF;

- The called party releases her connection, the CCF sends a DP to the CS_gsmSSF and the CCF does not receive Int_Connect for that outgoing leg from the CS_gsmSSF;

- The CCF receives Int_Disconnect_Leg from the CS_gsmSSF;

- The timer Tcp expires for a leg and the condition "Release if duration exceeded" is true for that leg;

- The CCF receives Int_Release_Call from the CS_gsmSSF.

If a call is released, either on instruction from the CS_gsmSSF or on normal call handling without any CAMEL interaction, then all legs involved in the call cease to exist.

4.4.6.4 Leg is moved

A leg can be moved from one call segment (source call segment) to another call segment (target call segment) as a result of a Move Leg or Split Leg information flow. When the CSA_gsmSSF receives a Split Leg Information Flow it creates a new call segment and moves the specified leg into this call segment. When the CSA_gsmSSF receives a Move Leg Information Flow it moves the specified leg into call segment 1.

A leg is no longer contained in the source call segment when the source CS_gsmSSF receives Int_Export_Leg_ack from the CCF.

A leg is contained in the target call segment when the target CS_gsmSSF receives Int_Import_Leg_ack from the CCF.

4.5 Procedures for CAMEL

The SDLs in the present document illustrate how CAMEL modifies the normal call handling. They do not attempt to show all the details of call handling in nodes that support CAMEL. Relevant parts of 3GPP TS 23.018 [12] apply in addition to these SDLs. For example, some inputs leading to unsuccessful call attempts are not shown on these diagrams - corresponding clauses in 3GPP TS 23.018 [12] apply.

Note that in some SDL processes and procedures the Release information flow may be sent on both an access interface and an inter-switch interface. If the message is sent on a UNI, its effect is the same as a Release transaction information flow.

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

4.5.1 Overall SDL architecture

The following mapping from the SDL procedures to the Intelligent Network concepts apply:

SDL process	Description	SDL process specification
CSA_gsmSSF	Call Segment Association (CSA). The CSA SDL process distributes the CAP operations to the appropriate Call Segment(s).	3GPP TS 23.078
CS_gsmSSF	Call Segment (CS). Controls one or more BCSMs.	3GPP TS 23.078
OCH_MSC	O-BCSM in VMSC for Mobile Originating call controlling both Leg 1 and Leg 2. If CAP Disconnect Leg (leg 2) is received at the initial detection point (Collected_Info), then the call is not routed to the destination and the process calls the procedure CAMEL_OCH_LEG1_MSC to control Leg 1. If Answer is received, the process spawns the child process CAMEL_OCH_LEG2_MSC to control Leg 2 and calls the procedure CAMEL_OCH_LEG1_MSC to control Leg 1. The handling of the legs after	3GPP TS 23.018

SDL process	Description	SDL process specification
	answer is completely separate.	
MT_GMSC	T-BCSM in the GMSC controlling both Leg 1 and Leg 2. If CAP Disconnect Leg (leg 2) is received at the initial detection point (Terminating_Attempt_Authorised), then the call is not routed to the destination and the process spawns the child process CAMEL_MT_LEG1_GMSC to control Leg 1. The process MT_GMSC terminates. If Answer is received, the process spawns the child process CAMEL_MT_LEG1_GMSC to control Leg 1 and calls the procedure CAMEL_MT_LEG2_GMSC to control Leg 2. The handling of the legs after answer is completely separate.	3GPP TS 23.018
MT_CF_MSC	O-BCSM in the redirecting MSC for Call Forwarding supplementary service, or Call Deflection supplementary service, or for CAMEL-based call forwarding. This process controls both Leg 1 and Leg 2. If CAP Disconnect Leg (leg 2) is received at the initial detection point (Collected_Info), then the call is not routed to the destination and the process calls the procedure CAMEL_MT_CF_LEG1_MSC to control Leg 1. If Answer is received, the process spawns the child process CAMEL_MT_CF_LEG2_MSC to control Leg 2 and calls the procedure CAMEL_MT_CF_LEG1_MSC to control Leg 1. The handling of the legs after answer is completely separate.	3GPP TS 23.018
ICH_MSC	T-BCSM in the VMSC controlling both Leg 1 and Leg 2. If CAP Disconnect Leg (leg 2) is received at the initial detection point (Terminating_Attempt_Authorised), then the call is not routed to the destination and the process spawns the child process CAMEL_ICH_LEG1_MSC to control Leg 1. The process ICH_MSC terminates. If Answer is received, the process spawns the child process CAMEL_ICH_LEG1_MSC to control Leg 1 and calls the procedure CAMEL_ICH_LEG2_MSC to control Leg 2. The handling of the legs after answer is completely separate.	3GPP TS 23.018
Assisting_MSC	The process in the MSC to handle an assist request.	3GPP TS 23.078
CAMEL_ICA_MSC	O-BCSM for gsmSCF initiated new call, or for new party set-up. This process controls the new leg.	3GPP TS 23.078

The following general rules apply:

1   There is only one CSA per CAP dialogue.

2   The CSA controls one or more Call Segments.

3   A Call Segment controls one or more BCSMs. Due to Call Party Handling, legs may be moved from one Call Segment to another and new Call Segments may be created. When legs are moved they take their properties with them, i.e. armed EDPs and pending reports.

4   Legs are not moved between BCSMs.

5   The active legs in the same Call Segment have a voice connection. They hear each other and the same in-band tone and announcements. The following exceptions exist:

-   Apply Charging IF: the warning tone associated with the Apply Charging IF is played to a single call party in the Call Segment.

-   Play Tone IF: the flexible tone from the Play Tone IF may be played to a single call party in the Call Segment.

The following diagrams shows the overall architecture for the SDL diagrams.
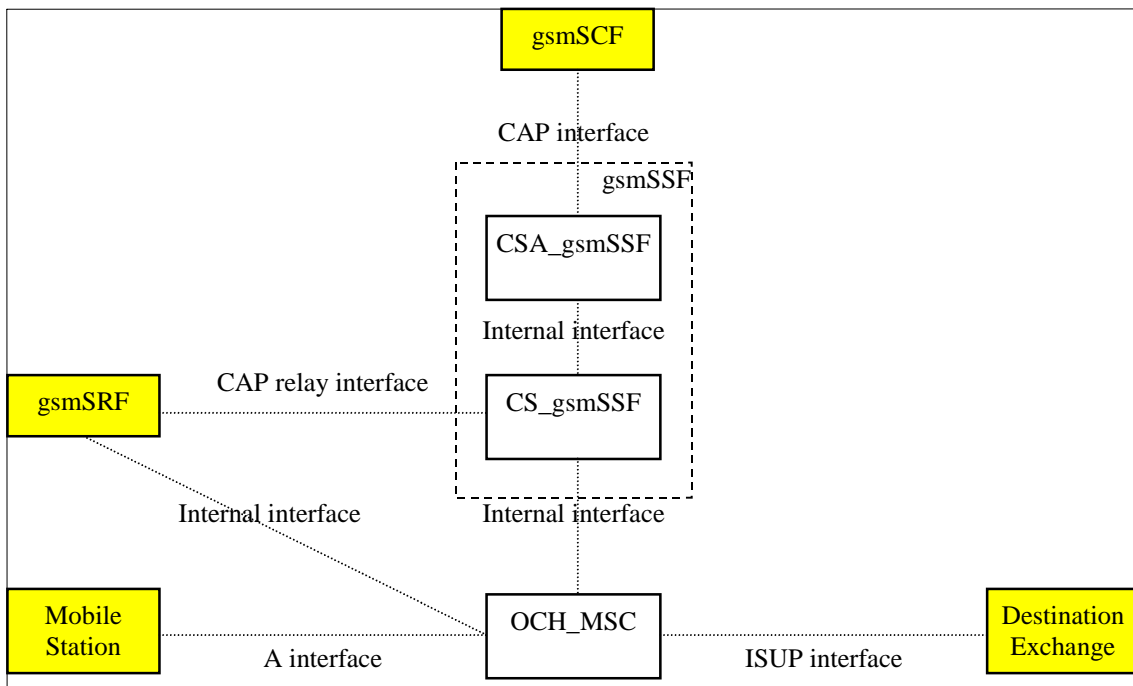
Figure 4.9-1: Outgoing case (gsmSSF relay)
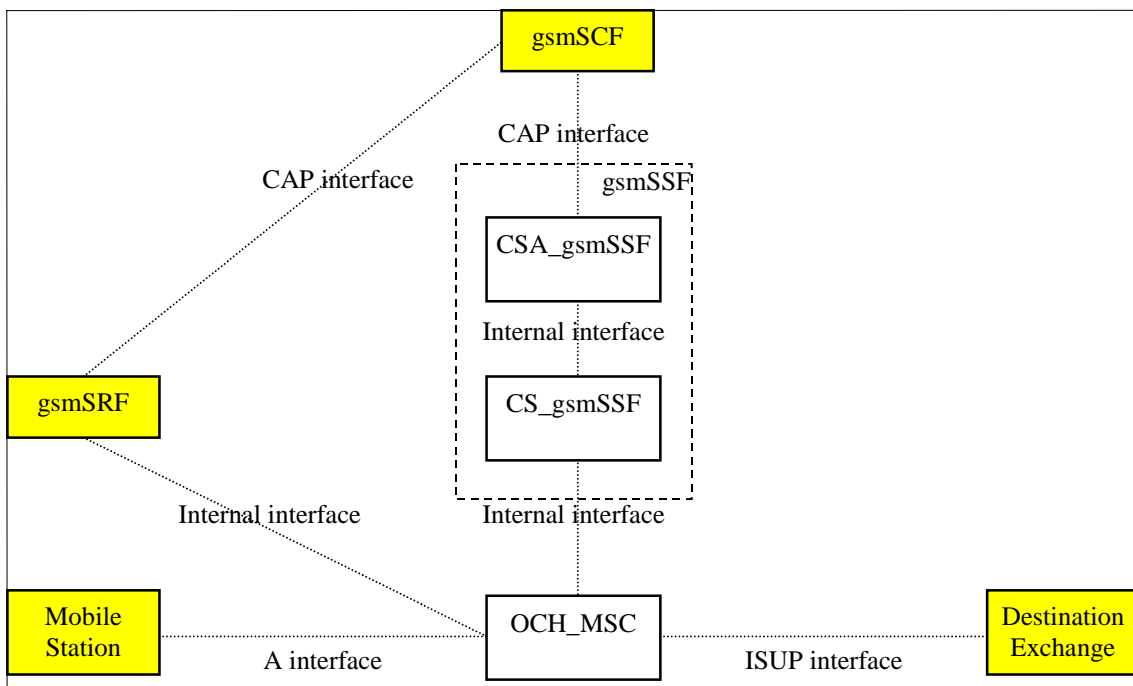
Figure 4.9-2: Outgoing case (direct path gsmSCF to gsmSRF or assist with relay)
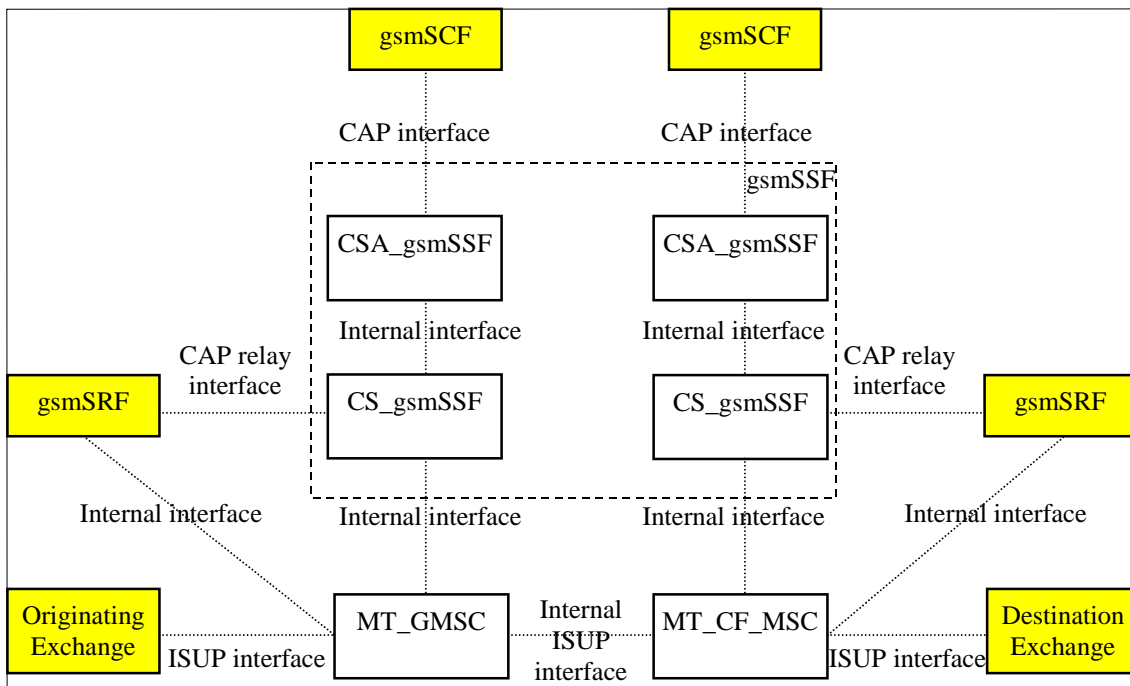
Figure 4.9-3: Terminating GMSC case (gsmSSF relay)
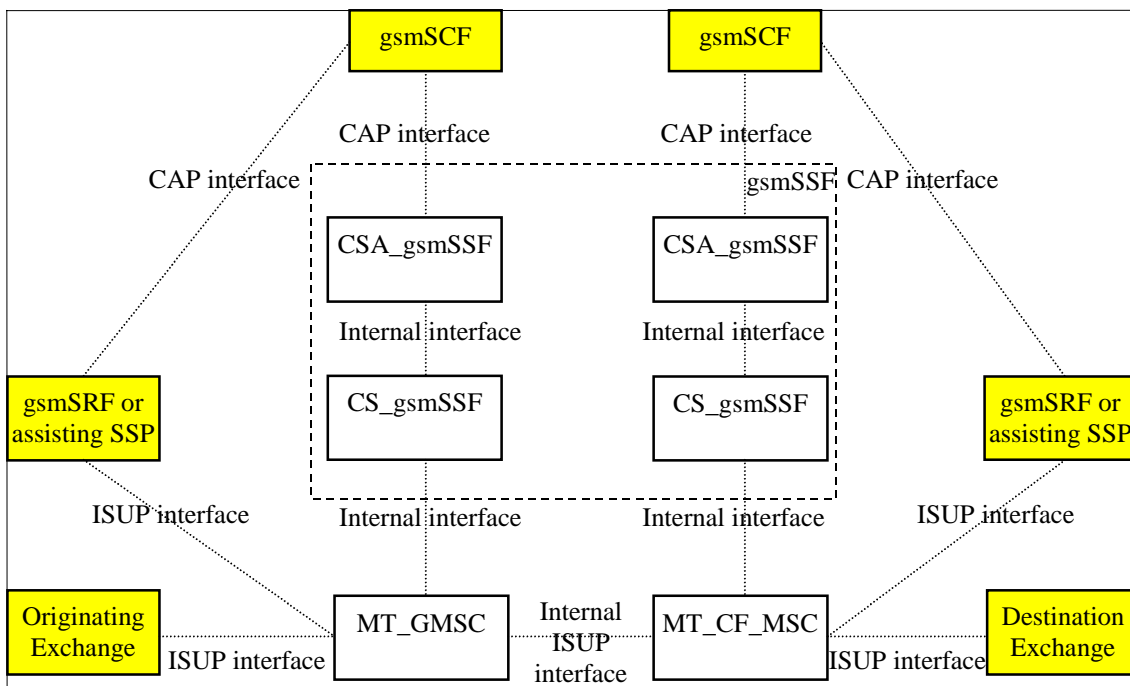
Figure 4.9-4: Terminating GMSC case (direct path gsmSCF to gsmSRF or assist with relay)
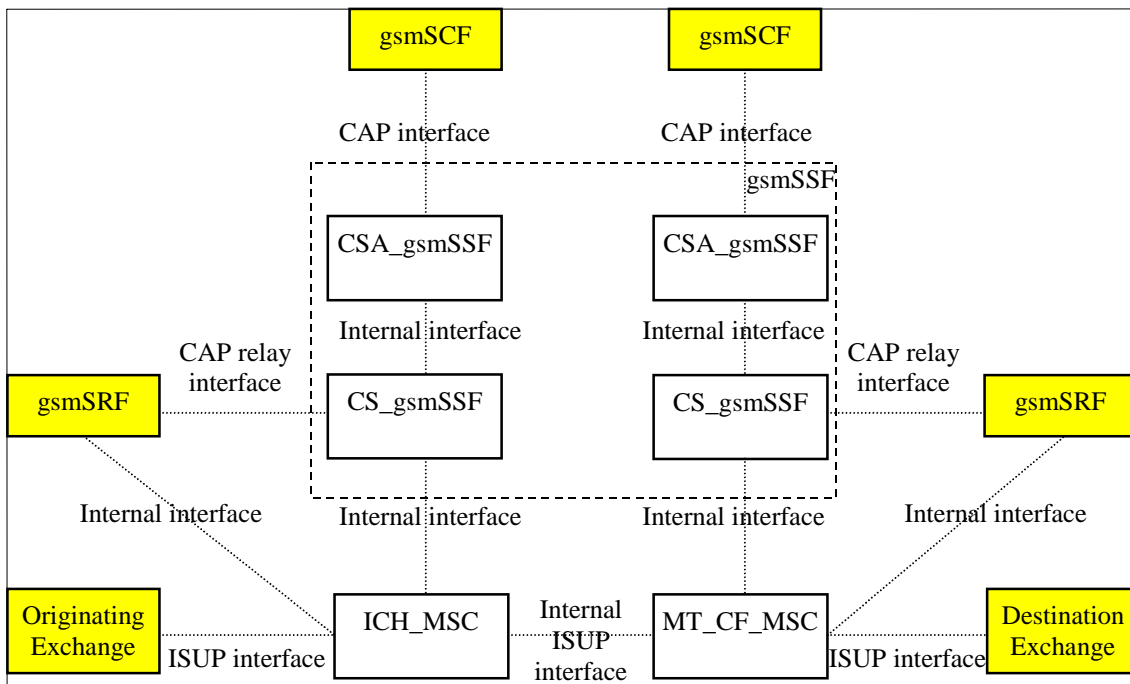
NOTE: The ICH_MSC may also be connected via an A interface to the terminating Mobile Station.

Figure 4.9-5: Terminating VMSC case (gsmSSF relay)
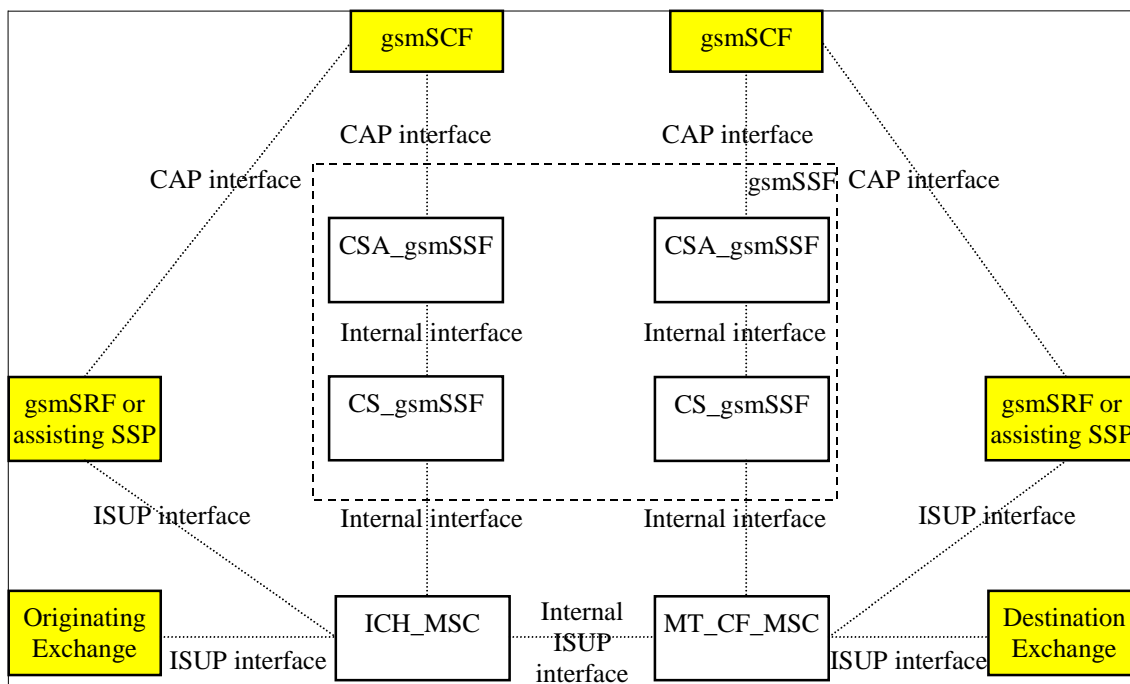
NOTE: The ICH_MSC may also be connected via an A interface to the terminating Mobile Station

Figure 4.9-6: Terminating VMSC case (direct path gsmSCF to gsmSRF or assist with relay)
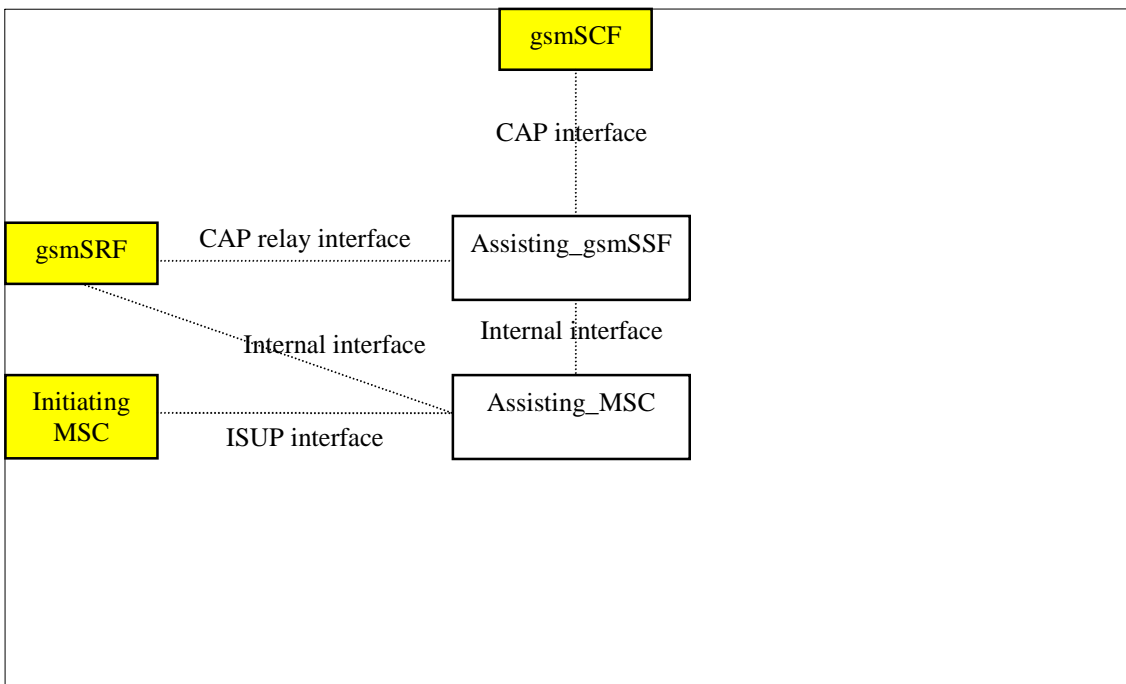
Figure 4.9-7: Assisting case
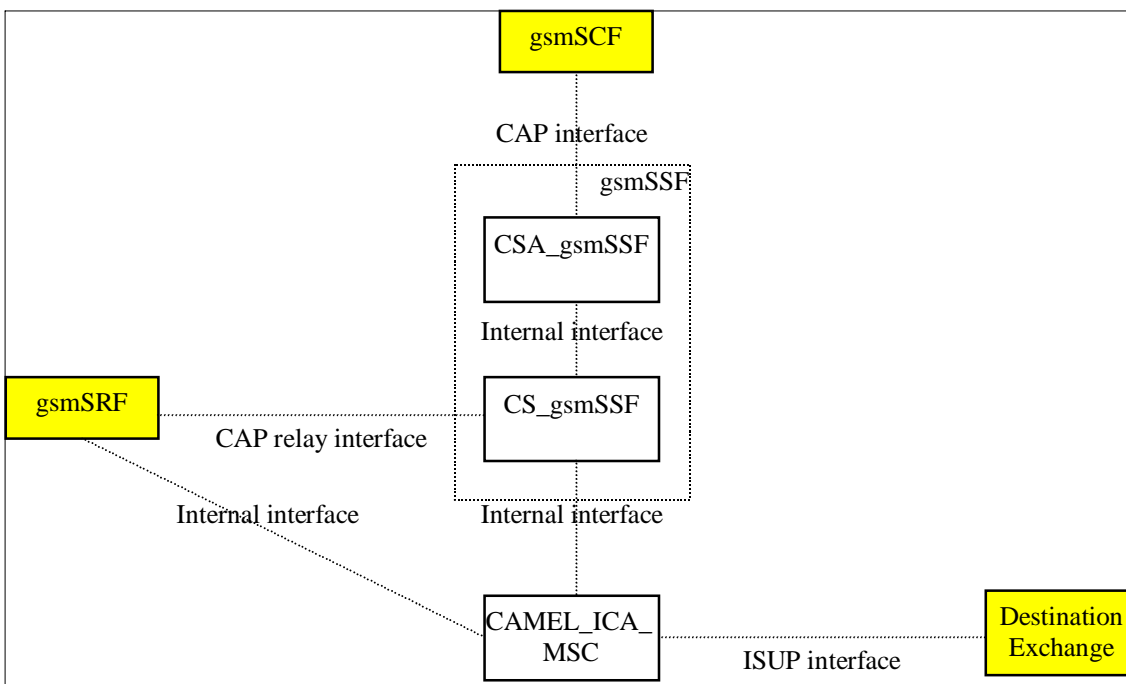
Figure 4.9-8: gsmSCF initiated call case (gsmSSF relay)

4.5.2 Handling of mobile originated calls

4.5.2.1 Handling of mobile originated calls in the originating MSC

The functional behaviour of the originating VMSC is specified in 3GPP TS 23.018 [12]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_OCH_MSC_INIT;

- Procedure CAMEL_MO_Dialled_Services;

- Procedure CAMEL_OCH_MSC_ALERTING;

- Procedure CAMEL_OCH_MSC_ANSWER;

- Procedure CAMEL_OCH_MSC1;

- Procedure CAMEL_OCH_MSC2;

- Procedure CAMEL_OCH_MSC_DISC1;

- Procedure CAMEL_OCH_MSC_DISC2;

- Procedure CAMEL_OCH_MSC_DISC3;

- Procedure CAMEL_OCH_MSC_DISC4;

- Procedure CAMEL_Disconnect_CTR_SRF;

- Procedure CAMEL_OCH_ETC;

- Procedure CAMEL_OCH_CTR;

- Procedure CAMEL_Start_TNRy;

- Procedure CAMEL_Stop_TNRy;

- Procedure CAMEL_Store_Destination_Address;

- Procedure CAMEL_Modify_CUG_Info;

- Procedure CAMEL_N_CSI_CHECK_MSC;

- Procedure CAMEL_OCH_LEG1_MSC;

- Procedure CHECK_DIGIT_STRING_MSC;

- Process CAMEL_OCH_LEG2_MSC;

- Process CAMEL_OCH_RECONNECT_MSC;

- Procedure CAMEL_EXPORT_LEG_MSC;

- Process CAMEL_O_CHANGE_OF_POSITION_MSC.

    NOTE: Procedure CAMEL_OCH_MSC_DISC3 applies to CAMEL Phase 1 only.

The procedure Send_Access_Connect_If_Required is specified in 3GPP TS 23.018 [12].

The procedure CAMEL_OCH_LEG1_MSC supervises the originating party only. The process CAMEL_OCH_LEG2_MSC supervises the terminating party only. Hence, signals from the BSS are received by the procedure CAMEL_OCH_LEG1_MSC and signals from the destination exchange are received by the process CAMEL_OCH_LEG2_MSC.

The following paragraphs give details on the behaviour of the MSC in the procedures CAMEL_OCH_MSC_INIT, CAMEL_OCH_ETC, CAMEL_OCH_ANSWER and CAMEL_Store_Destination_Address.

4.5.2.1.1 Actions of the MSC on receipt of Int_Error

The MSC checks the default Call Handling parameter in the relevant CSI.

If the default call handling is release call, a Release is sent to the MS and an Abort to the VLR. The MSC then releases all call resources and the procedure CAMEL_OCH_MSC_INIT ends.

If the default call handling is continue call, the MSC continues processing without CAMEL support. It sends Send_Info_For_Ougoing_Call to the VLR and waits in state Wait_For_MO_Call_Result.

4.5.2.1.2 Actions of the MSC on receipt of Int_Continue

The MSC continues processing without any modification of call parameters. At DP Analysed_Information it sends Send Info For Ougoing Call information flow to the VLR and waits in state Wait_For_MO_Call_Result.

4.5.2.1.3 Actions of the MSC on receipt of Int_Continue_With_Argument

The MSC continues processing with modified call parameters. The MSC shall replace the call parameters by the information received in the Int_Continue_With_Argument signal. Call parameters which are not included in the Int_Continue_With_Argument signal are unchanged.

Signalling limitations or regulatory requirements may require the Calling Partys Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

4.5.2.1.4 Actions of the MSC on receipt of Int_Connect

The MSC continues processing with modified call parameters. The MSC shall transparently modify the call parameters with the received information. The MSC then sends a PROGRESS message to the MS. Call parameters which are not included in the Int_Connect signal are unchanged.

Signalling limitations or regulatory requirements may require the Calling Partys Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

The network signalling system shall indicate that this is an internal network number.

At DP Collected_Information the MSC sets the O-CSI suppression parameter. If D-CSI and N-CSI are not present, the MSC sends a Send Info For Outgoing Call to the VLR and waits in state Wait_For_MO_Call_Result.

At DP Analysed_Information it sets the D-CSI suppression parameter, sends a Send Info For Outgoing Call to the VLR and waits in state Wait_For_MO_Call_Result.

4.5.2.1.5 Actions of the MSC on receipt of Int_Release_Call

A Release is sent to the MS, an abort to the VLR and a Release is sent to the destination exchange. The release cause received in the Int_Release_Call signal is used. The MSC then releases all call resources and the procedure CAMEL_OCH_MSC_INIT ends.

4.5.2.1.6 Actions of the MSC on receipt of Int_Disconnect_Leg (Leg 2)

If the MSC receives Int_Disconnect_Leg (Leg 2) signal from the gsmSSF, in response to an Initial DP information flow, the MSC will continue the handling of the calling party (Leg1) without routeing the call to a destination.

4.5.2.1.7 Actions of the MSC on receipt of Int_Apply_Warning_Tone

This section applies to all call cases. The MSC will play a tone to the indicated leg or call segment.

The following special cases exist when there is already an existing tone to a leg or call segment:

1 If the MSC is playing a tone to a leg and the Int_Apply_Warning_Tone instructs the MSC to play a tone for another leg (in the same or a different call segment), then the tones will be played independently;

2 The tones for different call segments are independent;

3 If the MSC is playing a tone to a leg and the Int_Apply_Warning_Tone instructs the MSC to play another tone for that leg, then the MSC will stop the existing tone and the latter tone will be played for that leg.

4 If the MSC is playing a tone to a call segment and the Int_Apply_Warning_Tone instructs the MSC to play another tone for that call segment, then the MSC will stop the existing tone and the latter tone will be played for that call segment.

5 If the MSC is playing a tone for the call segment and the Int_Apply_Warning_Tone instructs the MSC to play another tone for a leg in that call segment, then the particular leg shall hear (as an MSC option) either:

    a   The latter tone only, or

    b   Two tones. As an MSC option, the two tones may be played in parallel or in a sequence.

    The other leg(s) shall keep hearing the (old) call segment tone.

6   If the MSC is playing a tone for a leg and the Int_Apply_Warning_Tone instructs the MSC to play another tone for that call segment, then the particular leg shall either hear (as an MSC option):

    a   The latter tone only, or

    b   Two tones. As an MSC option, the two tones may be played in parallel or in a sequence.

    The other leg(s) shall start hearing the new call segment tone.

4.5.2.1.8 Action of the MSC in procedure CAMEL_OCH_MSC_ANSWER

If the MSC received a destination address from the GMSC in the ISUP Answer or Connect Message, the MSC relays the destination address to the gsmSSF in the Int_DP_O_Answer signal.

> NOTE 1: The sending of e-parameters by the gsmSCF after receiving the DP_O_Answer indication may be to late.

> NOTE 2: If the MO call is not subject to Basic OR, then the destination address is generated by the MSC. If the MO call is subject to Basic OR, the MSC will receive a destination address from the GMSC in the ISUP Answer or Connect Message.

4.5.2.1.9 Action of the MSC in procedure CAMEL_OCH_ETC

In procedure CAMEL_OCH_ETC (sheet 2) the MSC will remain in the Wait_For_Assisting_Answer state until it receives an ISUP Answer Message (ANM) or timeout occurs. This is to ensure that a call record is always generated for every successful establishment of a temporary connection to a gsmSRF, especially in the case where the connection is between PLMNs.

> NOTE: This means that it may not be possible to access an SRF which does not generate an ISUP Answer Message (ANM).

If a Progress Message is sent towards the MS the progress indicator shall indicate "In Band Information".

4.5.2.1.10 Procedure CAMEL_OCH_LEG1_MSC

The Int_DTMF_Digit_Received information flow is received from an internal process in the MSC that receives DTMF signalling from the MS. The handling of the internal process that receives DTMF signalling is out of scope of the present document. The playing of the received DTMF tones to the other parties in the call segment is out of scope of the present document.

4.5.2.1.11 Process CAMEL_O_CHANGE_OF_POSITION_MSC

The signals HANDOVER COMPLETE and HANDOVER PERFORMED are specified in 3GPP TS 48.008 [39]. Signals RELOCATION REQUEST ACKNOWLEDGE, LOCATION REPORT and LOCATION REPORTING COMMAND are specified in 3GPP TS 25.413 [33].

4.5.2.1.12 Procedure CAMEL_Start_TNRy

The recommended value range for the default TNRy timer for CAMEL handling is 10 seconds to 3 minutes.

Procedure CAMEL_OCH_MSC_INIT   1(4)

/* Procedure in the MSC to perform CAMEL handling for an outgoing call request */

/* Signals to/from the right are to/from the gsmSSF. */

O-CSI invocation?

No → Result:= pass

Yes → CAMEL_ Invocation := True

Allocate call reference number

Answer_Received := False

Store original call parameters

Int_Invoke_gsmSSF (O-CSI)

Wait_for_ gsmSSF_ Invoked

Int_error → Result:= fail

Int_gsmSSF_ Invoked → Int_DP_ Collected_ Info → DP_ Collected_ Info

Release → Int_O_Exception → Result:= fail
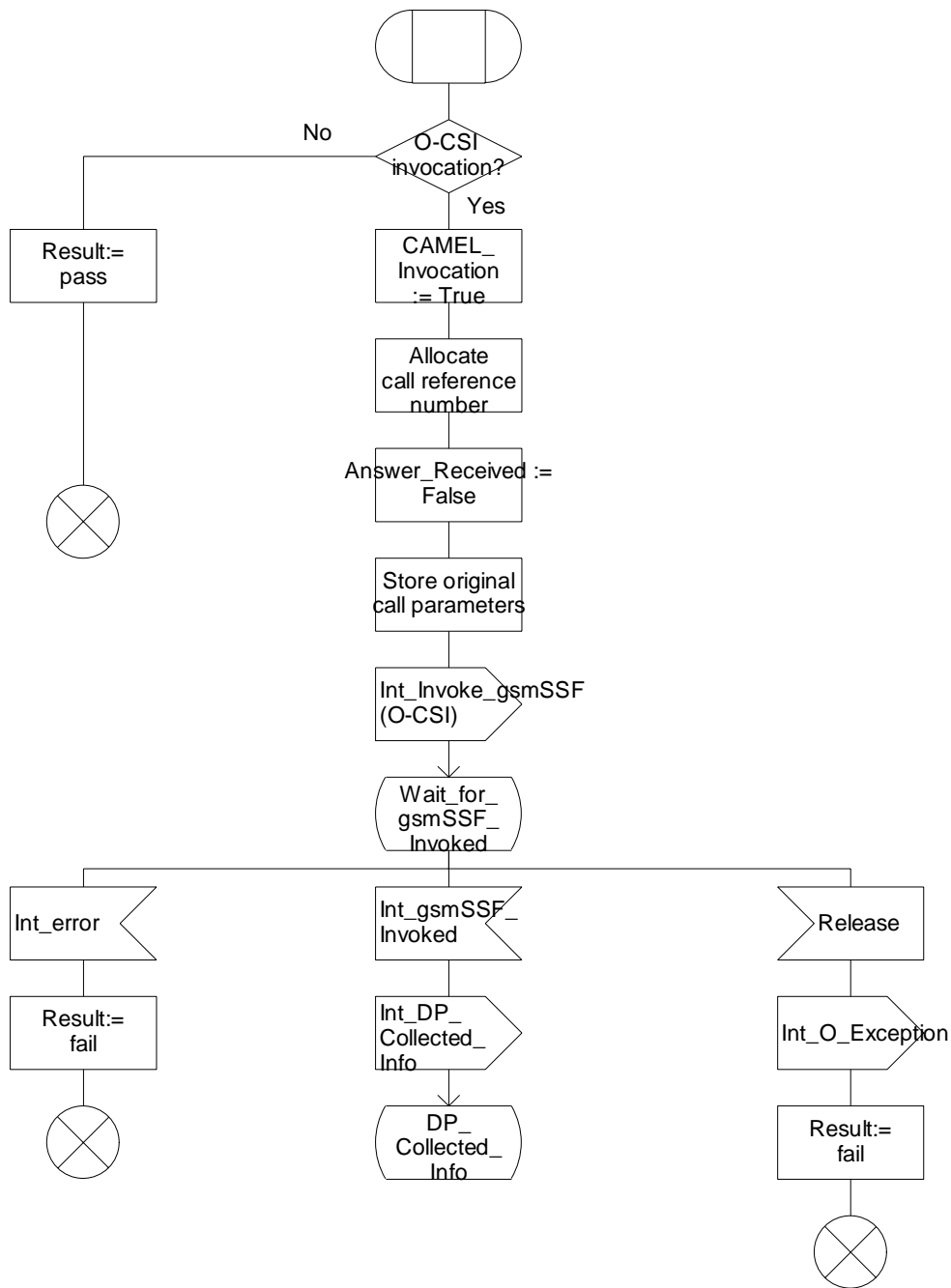
Figure 4.10-1: Procedure CAMEL_OCH_MSC_INIT (sheet 1)

ETSI

Procedure CAMEL_OCH_MSC_INIT 2(4)

/* Procedure in the MSC to perform CAMEL handling for an outgoing call request */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */
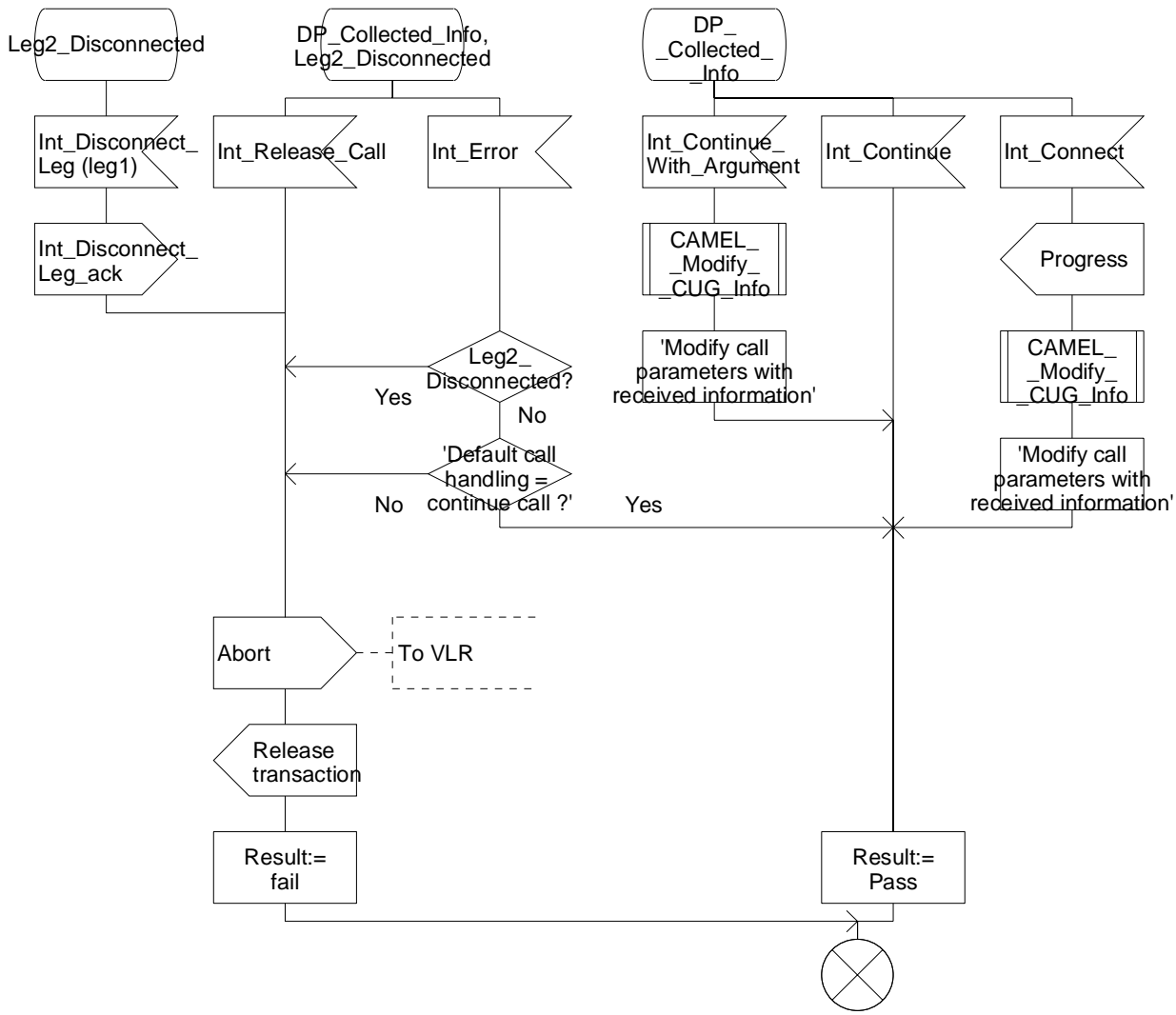
Figure 4.10-2: Procedure CAMEL_OCH_MSC_INIT (sheet 2)

Procedure CAMEL_OCH_MSC_INIT 3(4)

/* Procedure in the MSC to perform CAMEL handling for an outgoing call request */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_ _Collected_ _Info

Int_Disconnect_ Leg (leg2)

Int_Disconnect_ Leg_ack

Leg2_Disconnected

Int_Continue

Int_Continue_ With_Argument

'Modify call parameters with received information'

Result := Leg1_only

⊗

DP_Collected_Info, Leg2_Disconnected

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result= fail?

No

-

Yes

Result:= fail

⊗
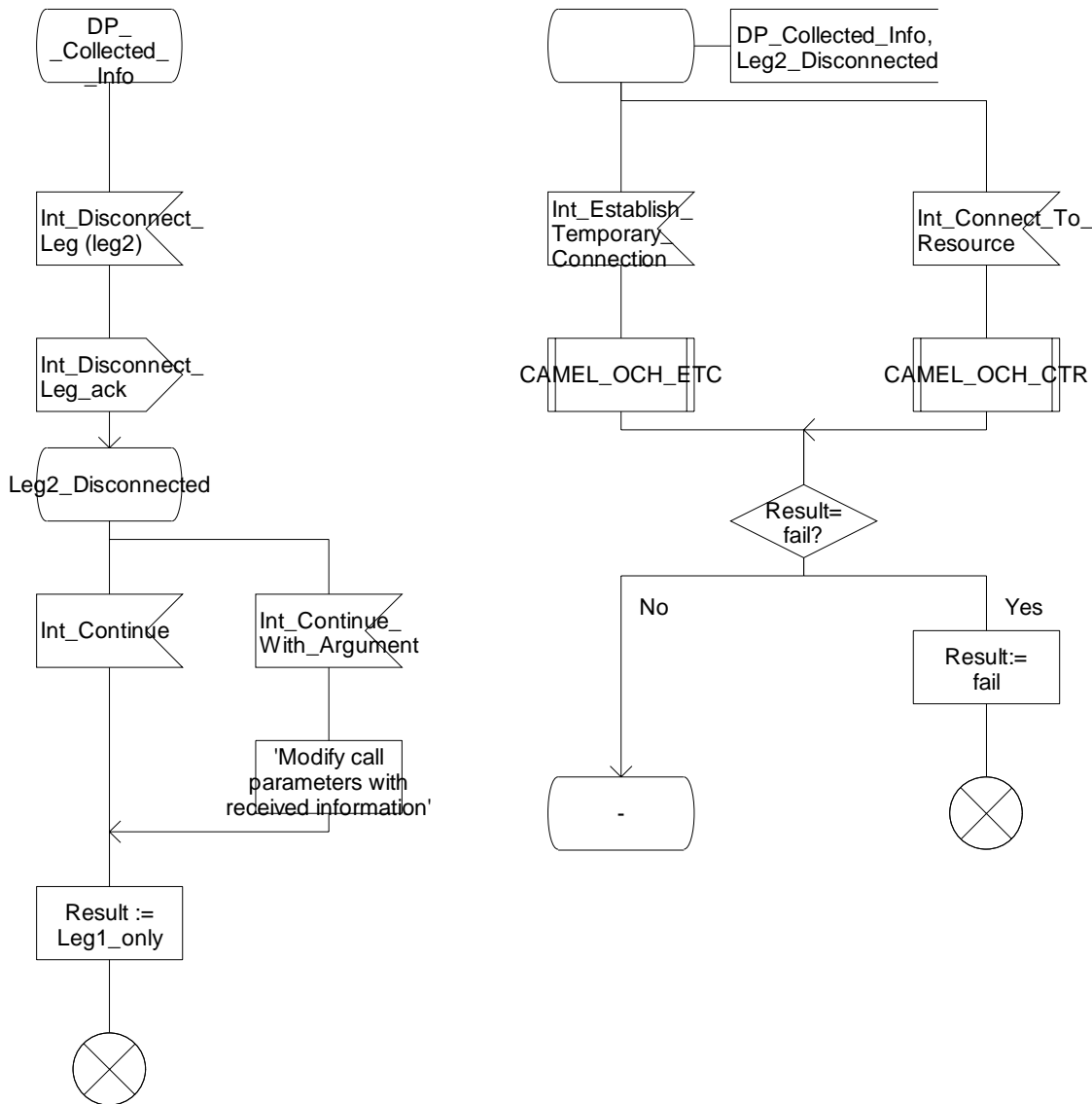
Figure 4.10-3: Procedure CAMEL_OCH_MSC_INIT (sheet 3)

Procedure CAMEL_OCH_MSC_INIT 4(4)

/* Procedure in the MSC to perform CAMEL handling for an outgoing call request */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF. */

DP_Collected_info,
Wait_For_MO_Call_Result,
Leg2_Disconnected

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Int_Continue_With_Argument

Result:= fail
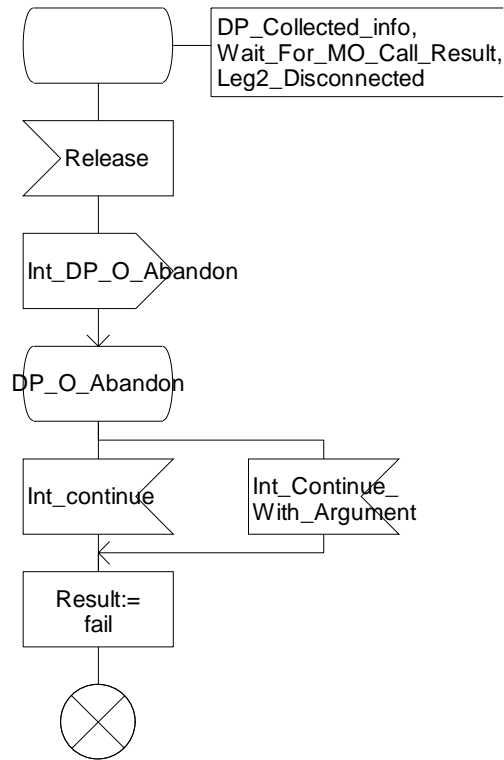
Figure 4.10-4: Procedure CAMEL_OCH_MSC_INIT (sheet 4)

Procedure CAMEL_MO_Dialled_Services 1(3)

/* Procedure in the MSC to process CAMEL dialled services for mobile originated calls */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR. */
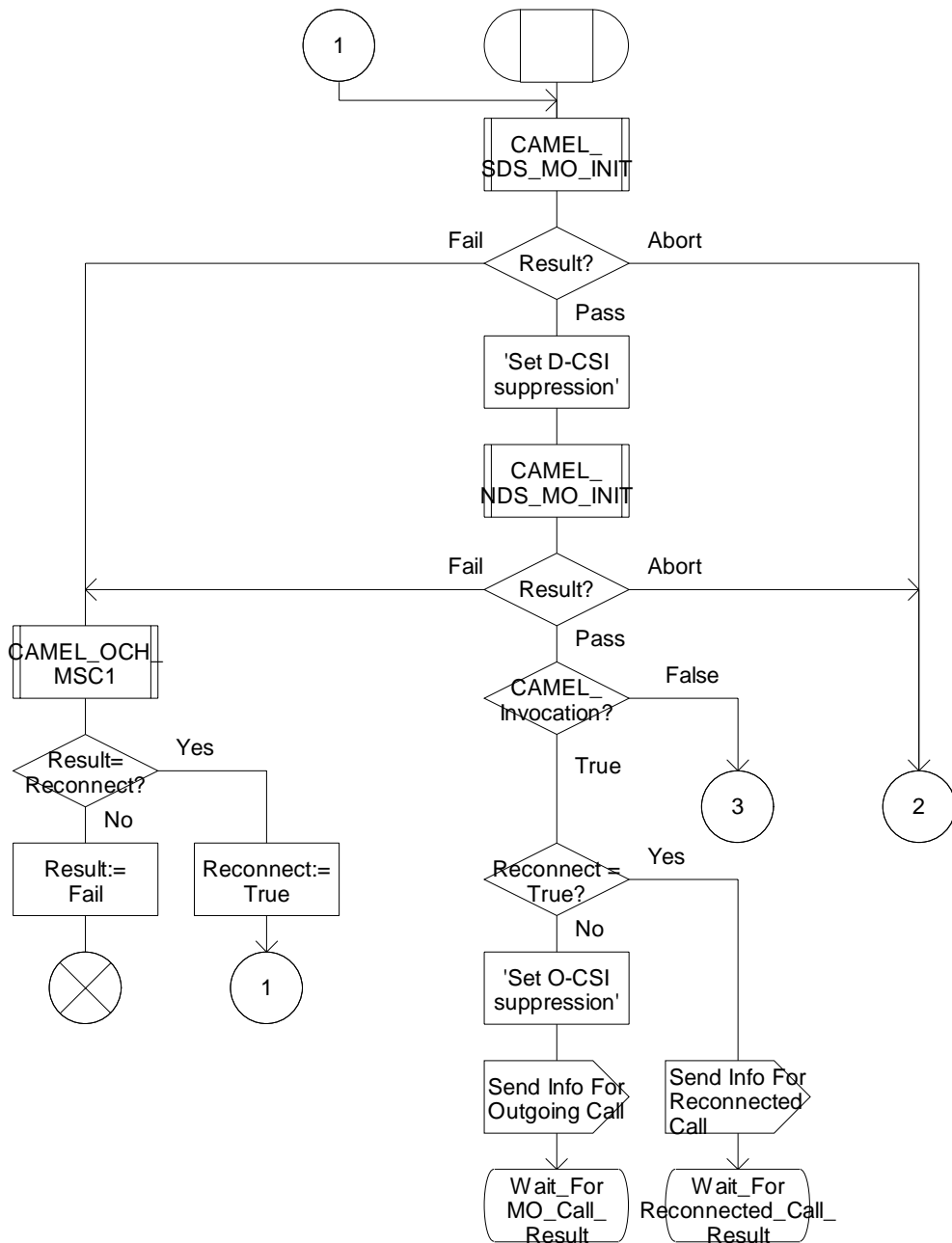
Figure 4.11-1: Procedure CAMEL_MO_Dialled_Services (sheet 1)

Procedure CAMEL_MO_Dialled_Services   2(3)

/* Procedure in the MSC to process CAMEL dialled services for mobile originated calls */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR. */
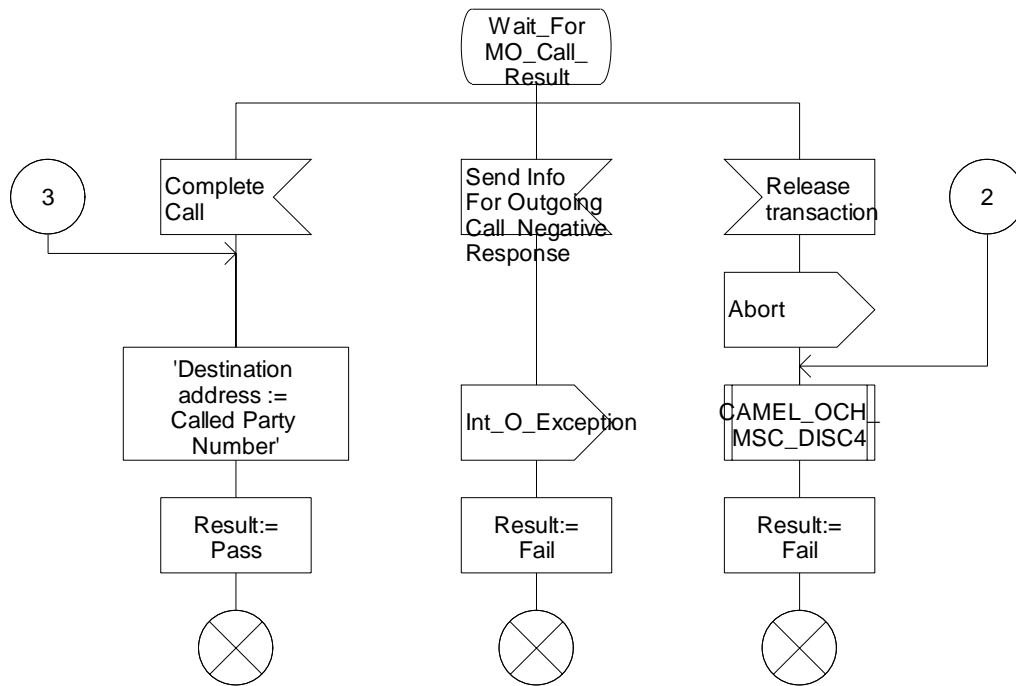
Figure 4.11-2: Procedure CAMEL_MO_Dialled_Services (sheet 2)

Procedure CAMEL_MO_Dialled_Services 3(3)

/* Procedure in the MSC to process CAMEL dialled services for mobile originated calls */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR. */

Wait_For_
Reconnected_Call_
Result

Send Info For
Reconnected Call Ack

Send Info For
Reconnected Call
Negative Response

Release
transaction

'Destination
address :=
Called Party
Number'

Int_O_Exception

Abort

CAMEL_OCH_
MSC_DISC4

Result:=
Pass

Result:=
Fail

Result:=
Fail
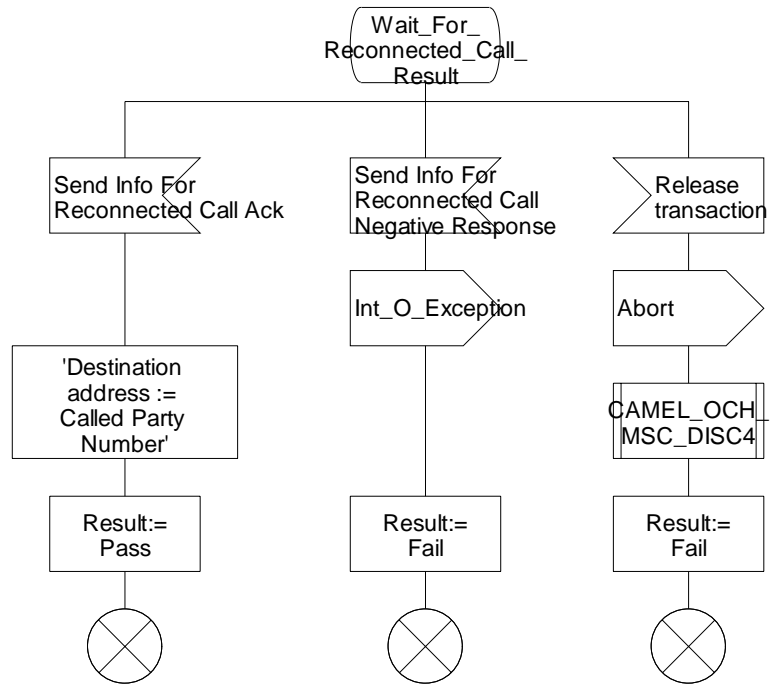
Figure 4.11-3: Procedure CAMEL_MO_Dialled_Services (sheet 3)

Procedure CAMEL_SDS_MO_INIT 1(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF. */

D-CSI invocation?

No → Result= Pass

Yes

CAMEL_ Invocation := True

Call Reference Number stored?

Yes

No

Allocate Call Reference Number

Store Original Call Parameters

Int_Invoke_ gsmSSF (D-CSI)

Wait_for_ gsmSSF_Invoked

Int_gsmSSF_ Invoked

Release transaction

Int_DP_ Analysed_ Info

Int_O_Exception

DP_ Analysed_ Info

Result:= Abort
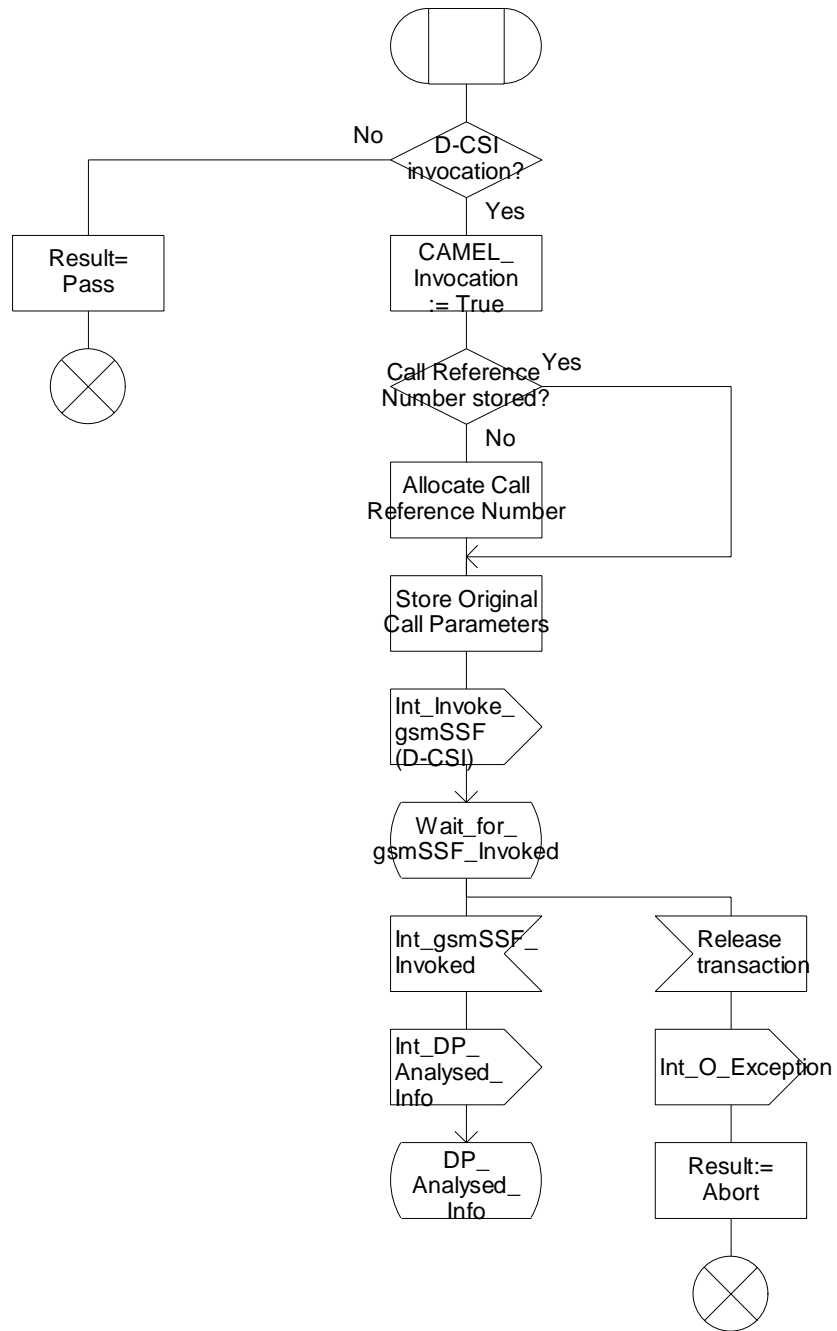
Figure 4.12-1: Procedure CAMEL_SDS_MO_Init (sheet 1)

Procedure CAMEL_SDS_MO_INIT 2(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF. */
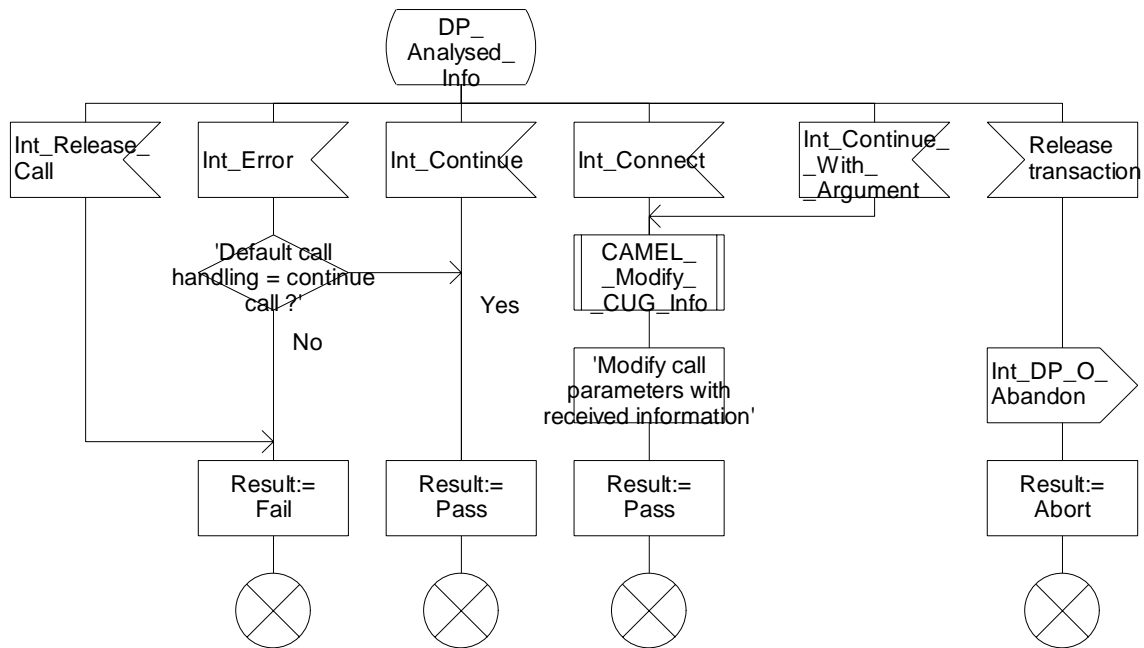
Figure 4.12-2: Procedure CAMEL_SDS_MO_INIT (sheet 2)

Procedure CAMEL_SDS_MO_INIT 3(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result= fail?

No

Yes

Result:= fail

DP_Analysed_ _Info
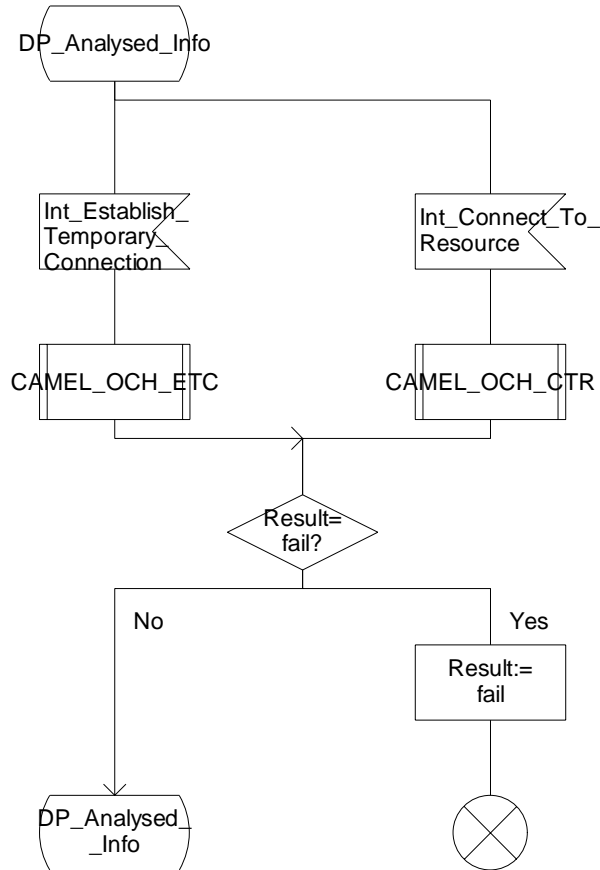
Figure 4.12-3: Procedure CAMEL_SDS_MO_INIT (sheet 3)

Procedure CAMEL_NDS_MO_INIT 1(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls*/

/* Signals to/from the right are
to/from the gsmSSF. */

No ◇ N-CSI
invocation?

Yes

Result=
Pass

CAMEL_
Invocation
:= True

Call Reference Yes
Number stored?

No

Allocate Call
Reference Number

Store Original
Call Parameters

Int_Invoke_
gsmSSF
(N-CSI)

Wait_for_
gsmSSF_Invoked

Int_gsmSSF_
Invoked

Release
transaction

Int_DP_
Analysed_
Info

Int_O_Exception

DP_
Analysed_
Info

Result:=
Abort
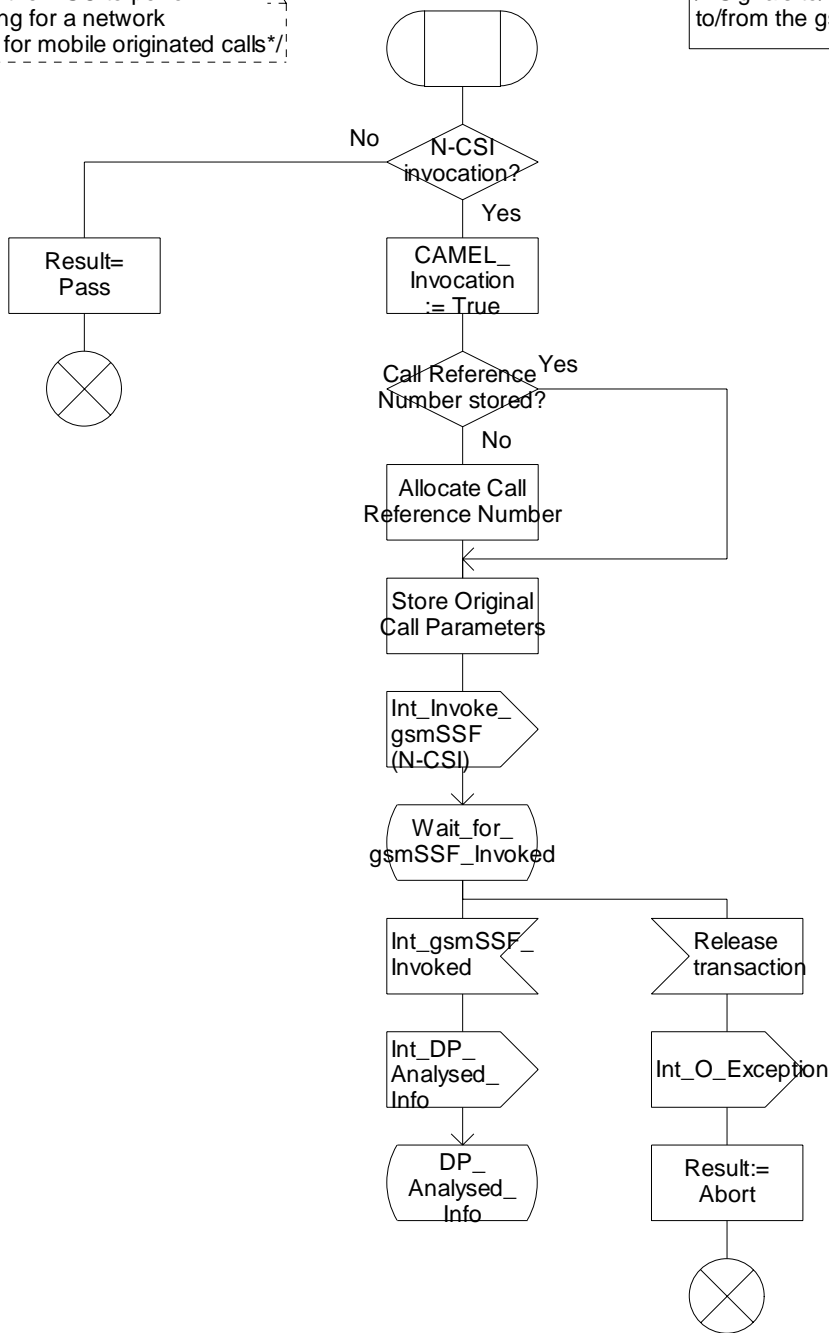
Figure 4.13-1: Procedure CAMEL_NDS_MO_INIT (sheet 1)

ETSI

Procedure CAMEL_NDS_MO_INIT 2(3)

/* Procedure in the MSC to perform CAMEL handling for a network Dialled Service for mobile originated calls*/

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Release_Call

Int_Error

Int_Continue

Int_Connect

Int_Continue_With_Argument

Release transaction

'Default call handling = continue call ?'

Yes

No

CAMEL_Modify_CUG_Info

'Modify call parameters with received information'

Int_DP_O_Abandon

Result:= Fail

Result:= Pass

Result:= Pass

Result:= Abort
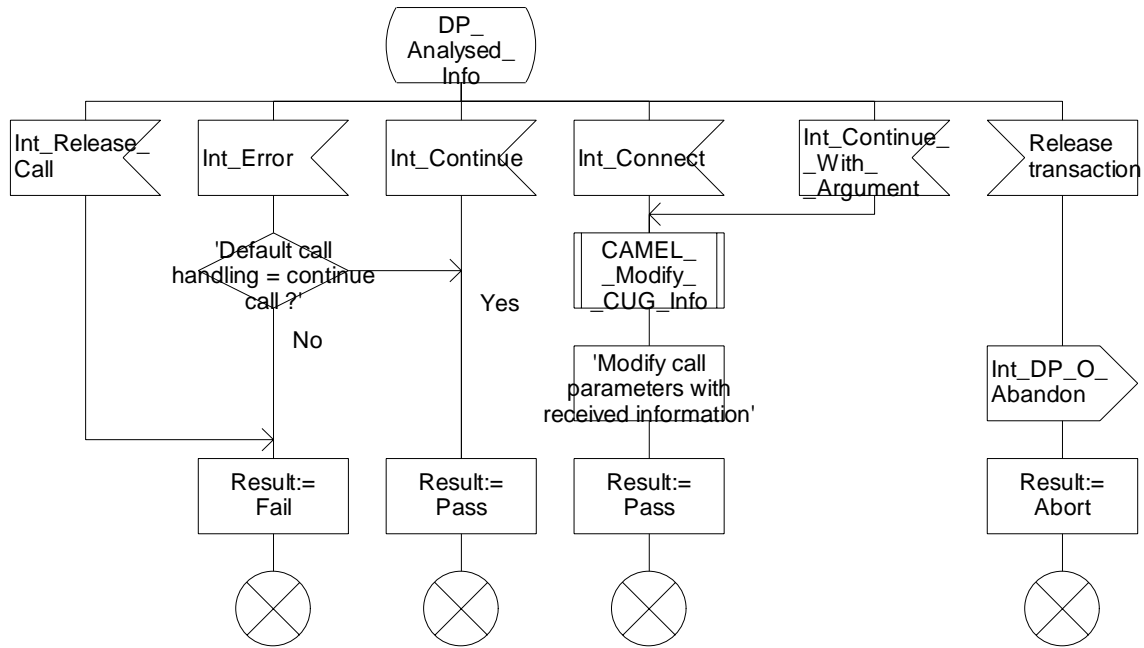
Figure 4.13-2: Procedure CAMEL_NDS_MO_INIT (sheet 2)

ETSI

Procedure CAMEL_NDS_MO_INIT 3(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls*/

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
fail

DP_Analysed_
_Info

⊗
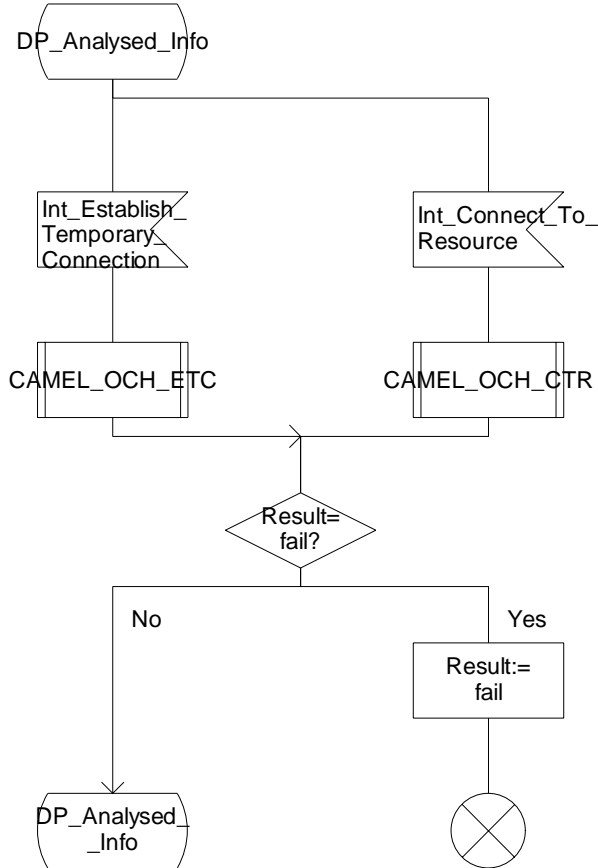
Figure 4.13-3: Procedure CAMEL_NDS_MO_INIT (sheet 3)

ETSI

Procedure CAMEL_OCH_MSC_ALERTING 1(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No → Result:= pass

Yes → Int_DP_O_Term_Seized

To destination exchange

DP_O_Term_Seized

From destination exchange

Internal

From destination exchange

Answer | Int_Release | Int_Continue | Release | Release | TNRy expired

Result=: Answer

Release → Result:= Release

Result:= pass

Int_DP_O_Abandon

Release

DP_O_Abandon

release cause = no answer from user ?

Yes

No

Int_continue With_Argument | Int_continue

CAMEL_OCH_ MSC1

CAMEL_OCH_ MSC2

To destination exchange

Release

Result?

Fail

Reconnect

Continue, Release

Result:= fail | Result:= Release | Result:= reconnect
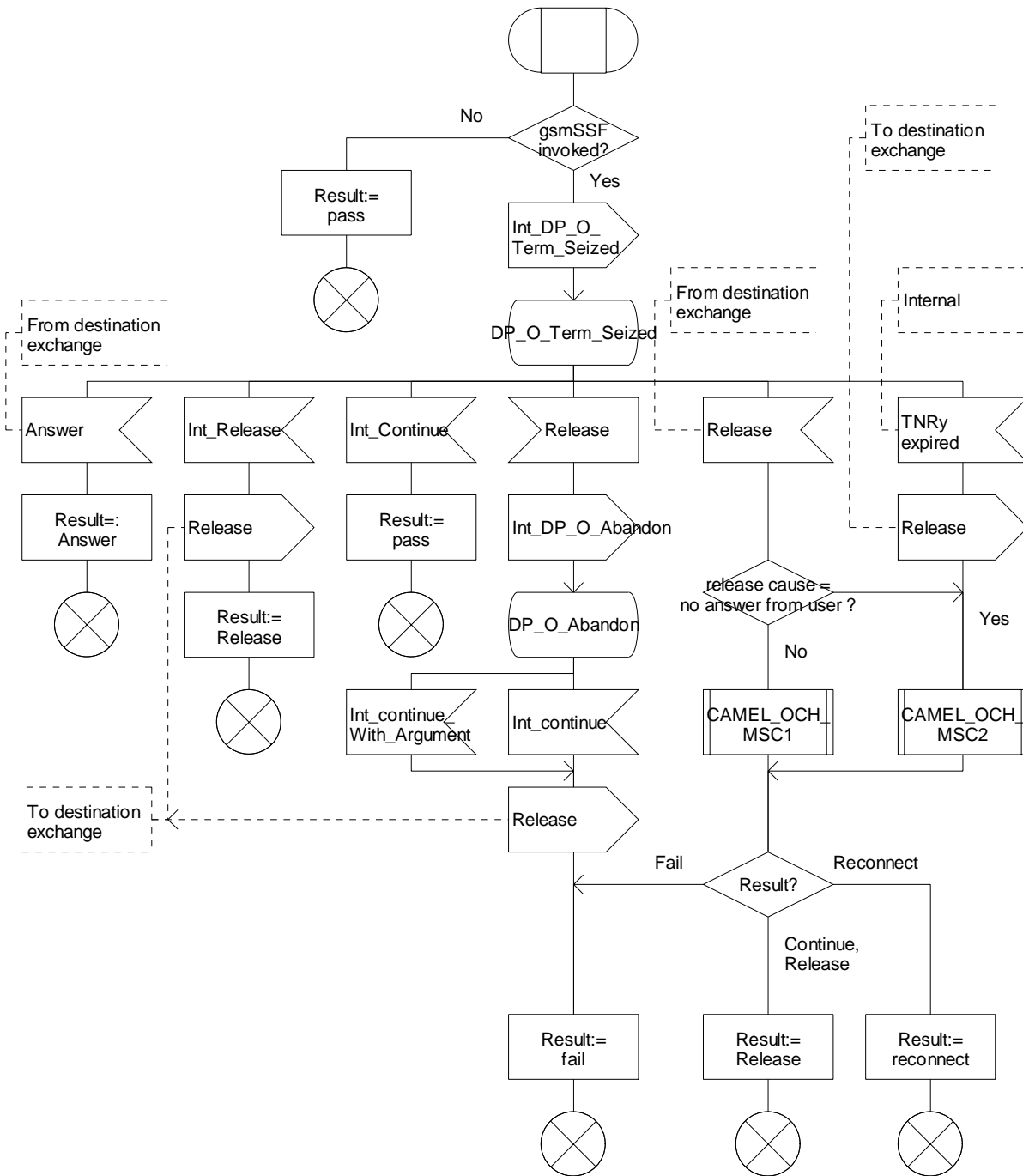
Figure 4.14-1: Procedure CAMEL_OCH_MSC_ALERTING (sheet 1)

Procedure CAMEL_OCH_MSC_ALERTING 2(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_O_Term_Seized

Int_Error

Int_Continue_With_Argument

Default call handling = 'continue call' ?

No

Yes

To destination exchange

Release

Result:= Pass

Result:= fail
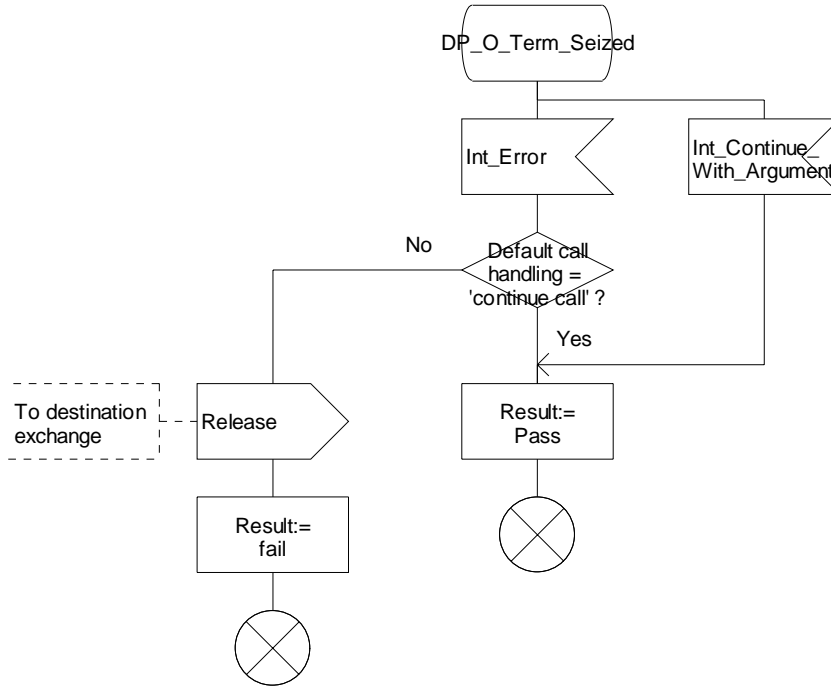
Figure 4.14-2: Procedure CAMEL_OCH_MSC_ALERTING (sheet 2)

Procedure CAMEL_OCH_MSC_ALERTING 3(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_O_Term_Seized

Int_Establish_Temporary_Connection

Int_Connect_To_Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result?

Fail

ELSE

Answer

Result:= fail

Result:= Answer

-
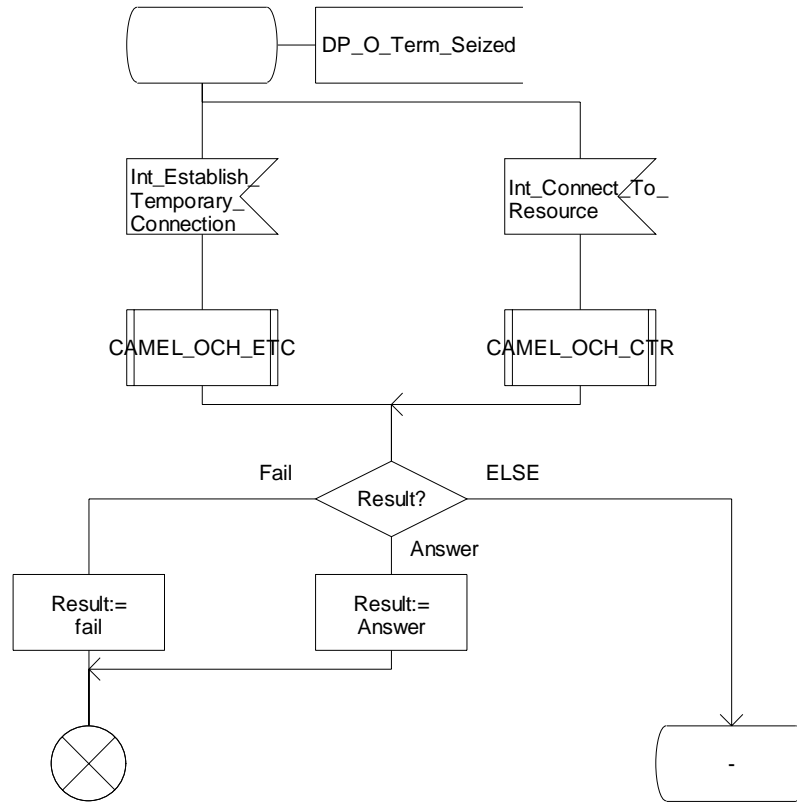
Figure 4.14-3: Procedure CAMEL_OCH_MSC_ALERTING (sheet 3)
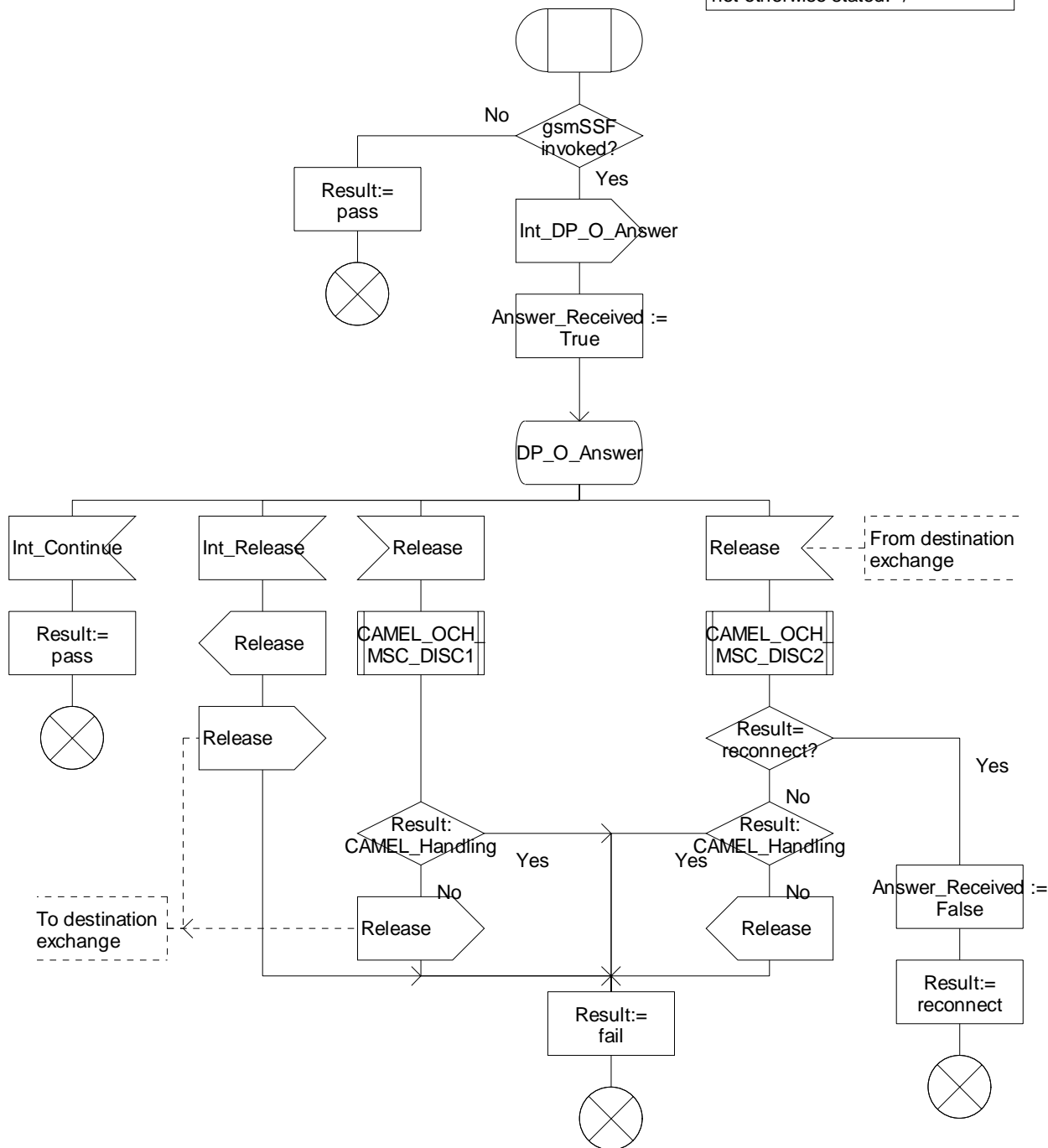
Figure 4.15-1: Procedure CAMEL_OCH_MSC_ANSWER (sheet 1)

Procedure CAMEL_OCH_MSC_ANSWER 2(3)

/* Procedure in the MSC to handle an outgoing call */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_O_Answer

Int_Error

Int_Continue_With_Argument

No ◄─── Default call handling = continue call ?

Yes

Release

Result:= Pass

To destination exchange ─── Release

Result:= fail
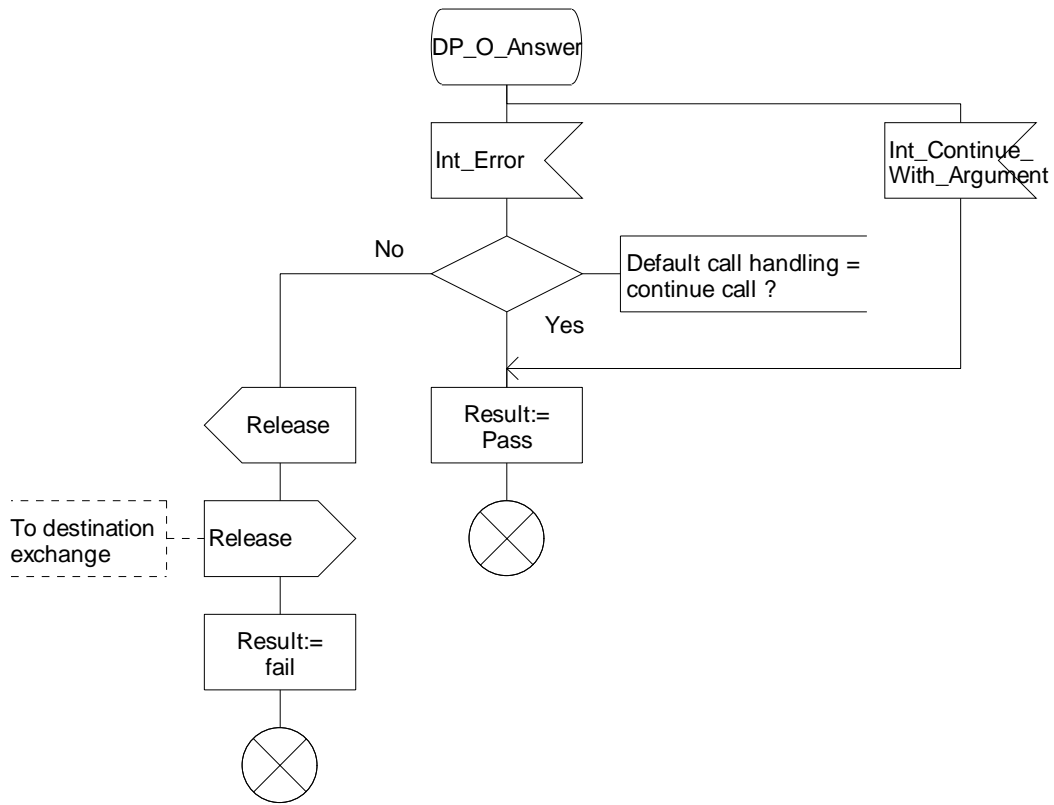
Figure 4.15-2: Procedure CAMEL_OCH_ANSWER (sheet 2)

Procedure CAMEL_OCH_MSC_ANSWER 3(3)

/* Procedure in the MSC to handle an outgoing call */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_O_Answer

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result= fail?

No

Yes

Result:= fail

-
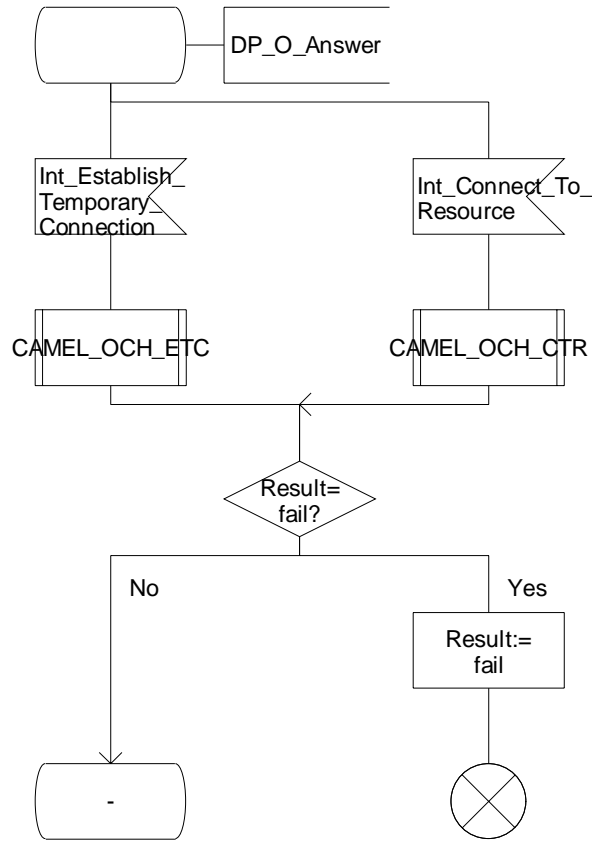
Figure 4.15-3: Procedure CAMEL_OCH_ANSWER (sheet 3)

ETSI
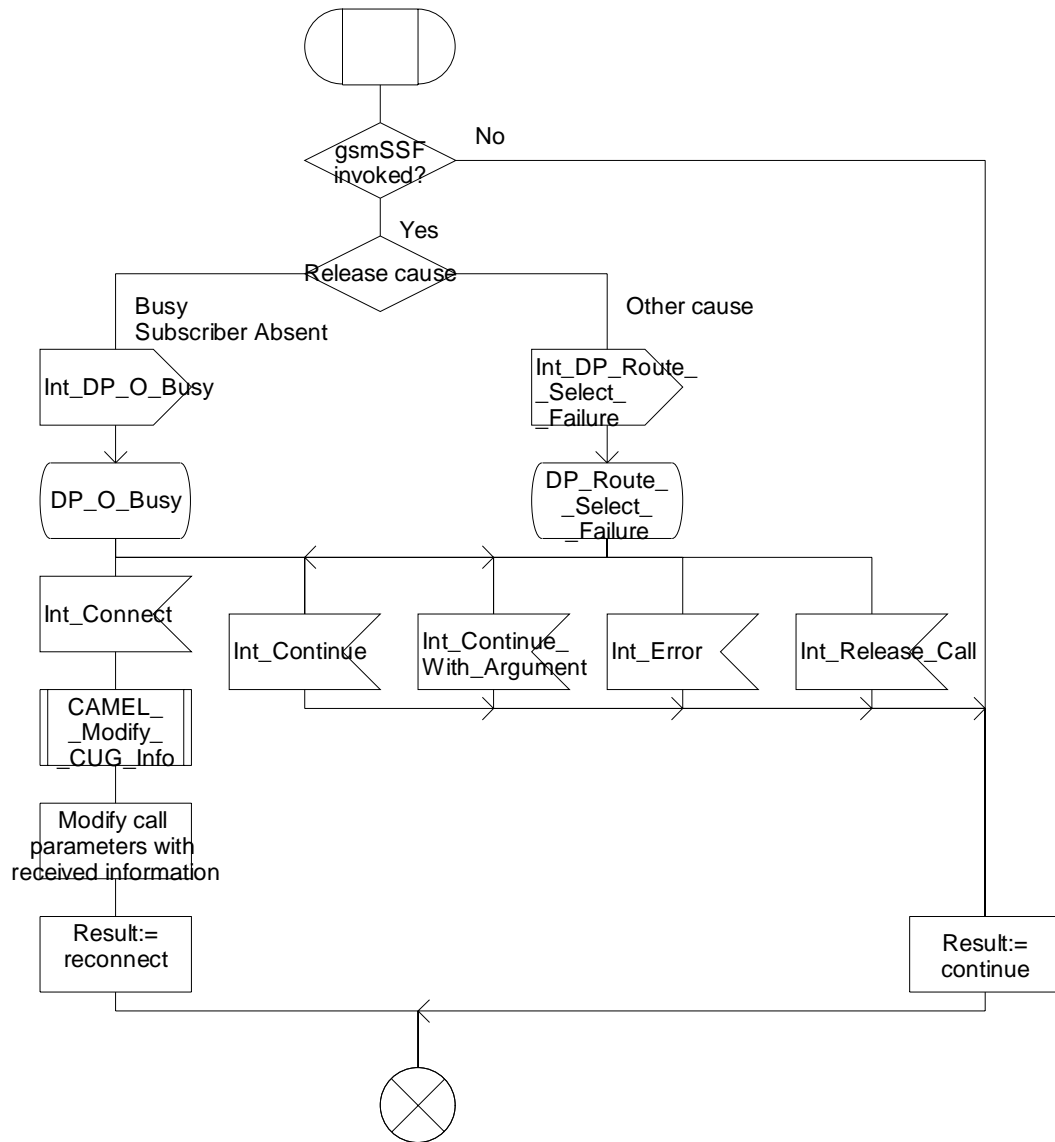
Figure 4.16-1: Procedure CAMEL_OCH_MSC1 (sheet 1)

Procedure CAMEL_OCH_MSC1 2(3)

/* Procedure in the MSC in the case of CAMEL handling to connect a call at DP Busy, Route select failure. */

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated.

DP_O_Busy
DP_Route_Select_Failure

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Int_Continue_
With_Argument

Result:=
continue
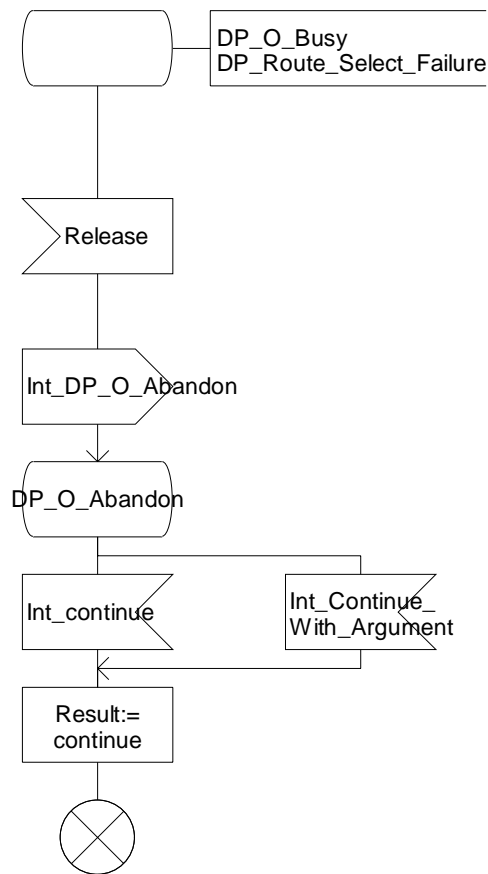
Figure 4.16-2: Procedure CAMEL_OCH_MSC1 (sheet 2)

Procedure CAMEL_OCH_MSC1 3(3)

/* Procedure in the MSC in the
case of CAMEL handling to
connect a call at DP Busy,
Route select failure. */

Signals to/from the right are to/from
the gsmSSF if not otherwise stated.

DP_Route_Select__Failure
DP_O_Busy

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
continue

-

⊗
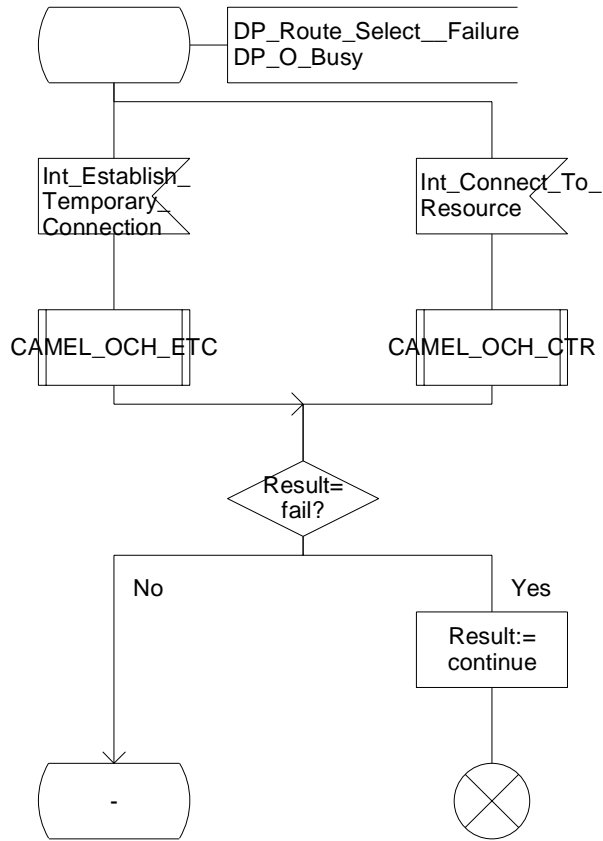
Figure 4.16-3: Procedure CAMEL_OCH_MSC1 (sheet 3)

ETSI

Procedure CAMEL_OCH_MSC2 1(3)

/* Prodecudure in the MSC to connect a call at DP No_Answer */

Signals to/from the right are to/from the gsmSSF if not otherwise stated.

No gsmSSF invoked?

Yes

Int_DP_O_No_Answer

DP_O_No_Answer

Int_Connect

Int_Continue

Int_Continue_With_Argument

Int_Error

Int_Release_Call

CAMEL_ _Modify_ _CUG_Info

Int_O_Exception

Modify call parameters with received information

Result:= continue

Result:= reconnect

Result:= release
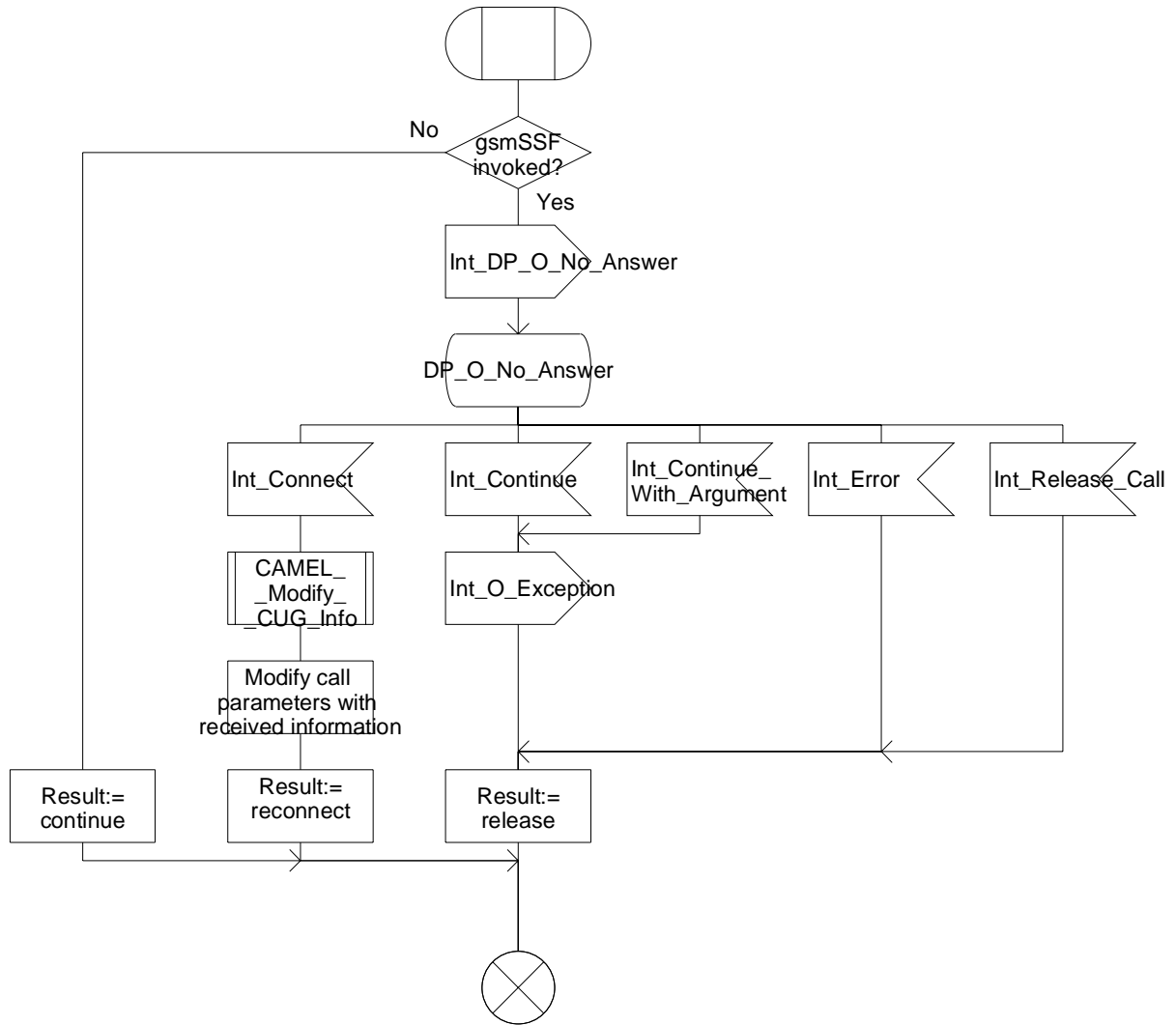
Figure 4.17-1: Procedure CAMEL_OCH_MSC2 (sheet 1)

Procedure CAMEL_OCH_MSC2 2(3)

/* Prodecudure in the MSC to connect a call at DP No_Answer */

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated.

DP_O_No_Answer

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue   Int_Continue_With_Argument

Result:= fail

⊗
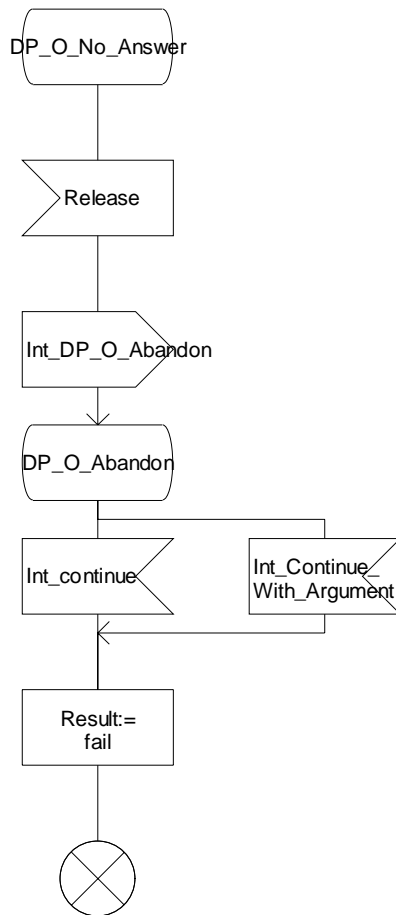
Figure 4.17-2: Procedure CAMEL_OCH_MSC2 (sheet 2)

Procedure CAMEL_OCH_MSC2   3(3)

/* Prodecudure in the MSC to
connect a call at DP
No_Answer */

Signals to/from the right are to/from
the gsmSSF if not otherwise stated.

DP_O_No_Answer

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
release

DP_O_No_Answer
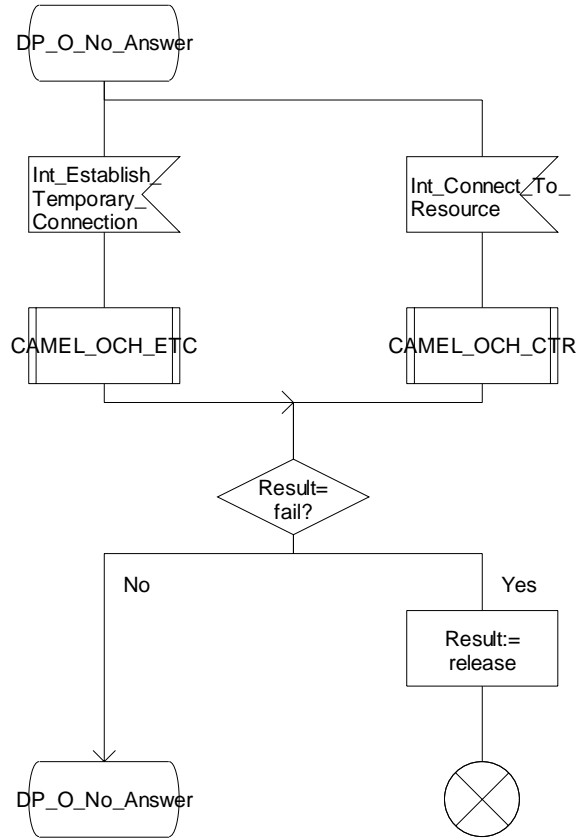
Figure 4.17-3: Procedure CAMEL_OCH_MSC2 (sheet 3)

Procedure CAMEL_OCH_MSC_DISC1 1(1)

/* Procedure in the MSC to perform handling for a call release */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No

Yes

Int_DP_ O_Disconnect /* legId = 1 */

DP_ O_Disconnect_1

Int_Error

Int_Release_Call

Int_Continue

Release ⟵ From destination exchange

Int_Continue_ With_Argument

Int_DP_ O_Disconnect /* legId = 2 */

DP_O_Disconnect

Int_Continue_ With_Argument

Int_Continue

Int_Error

Int_ReleaseCall

result:= normal_ handling

result:= CAMEL_ handling

Figure 4.18-1: Procedure CAMEL_OCH_MSC_DISC1 (sheet 1)

Procedure CAMEL_OCH_MSC_DISC2 1(2)

/* Procedure in the MSC to perform handling for a call release */

/* Signals to/from the left are to/from the BSS or the process MT_GMSC; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No

result:= normal_ handling

Yes

n may have a value of 2 or higher

Int_DP_ _O_Disconnect /* legId = n */

DP_O_ Disconnect_n

Release

Int_Continue

Int_Continue_ With_Argument

Int_Release _Call

Int_error

Int_Connect

Int_DP_ O_Disconnect /* legId = 1 */

CAMEL_ _Modify_ _CUG_Info

DP_O_ Disconnect_1

Modify call parameters with received information

Int_Error

Int_Continue

Int_Continue_ With_Argument

Int_Release_Call

Answer Received := False

result:= CAMEL_ handling

result:= normal_ handling

Result:= reconnect

Figure 4.19-1: Procedure CAMEL_OCH_MSC_DISC2 (sheet 1)

Procedure CAMEL_OCH_MSC_DISC2 2(2)

/* Procedure in the MSC to perform
handling for a call release */

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_O_
Disconnect_n

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
release

DP_O_
Disconnect_n

⊗
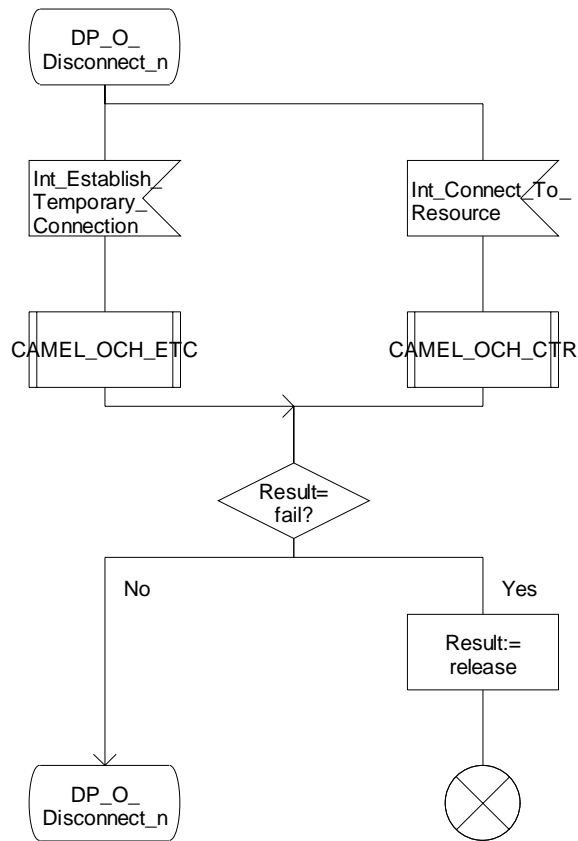
Figure 4.19-2: Procedure CAMEL_OCH_MSC_DISC2 (sheet 2)

Procedure CAMEL_OCH_MSC_DISC3 CAMOD3_1(1)

/* Procedure in the originating VMSC
to handle premature release of a CAMEL call*/

gsmSSF
exists?

No

Yes

Int_O_
_Exception ——— to gsmSSF
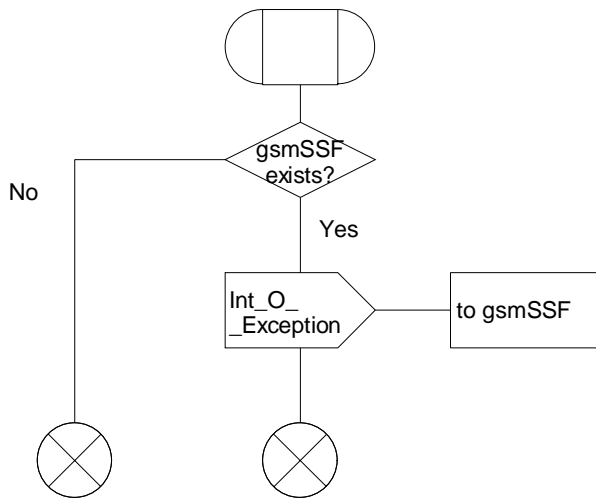
Figure 4.20-1: Procedure CAMEL_OCH_MSC_DISC3 (sheet 1)

Procedure CAMEL_OCH_MSC_DISC4 1(1)

/* Procedure in the MSC to perform
CAMEL handling for a call release */

/* Signals to the right are to
the gsmSSF */

gsmSSF
invoked?

No

Yes

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Int_Continue_
With_Argument
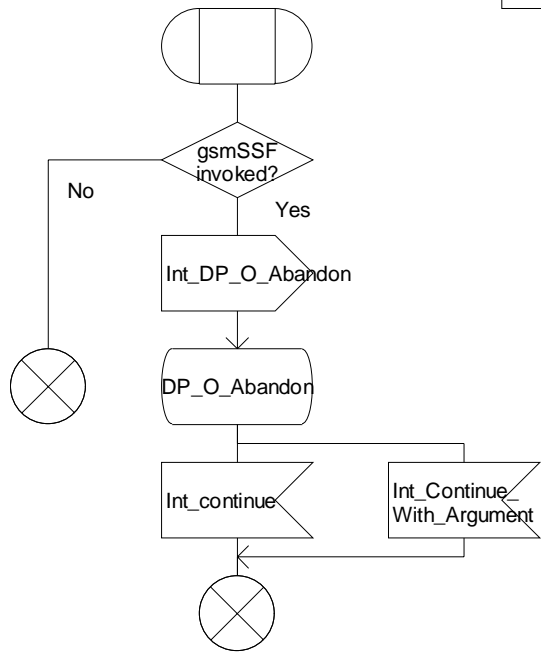
Figure 4.21-1: Procedure CAMEL_OCH_MSC_DISC4 (sheet 1)

Procedure CAMEL_Disconnect_CTR_SRF 1(1)

Procedure in the MSC
to handle releasing of the SRF
in a Connect To Resource situation

Signals to/from the right are
to/from the SRF;

Int_Disconnect
SRF

Await_SRF_
Disconnection

Release

Int_SRF_
Released
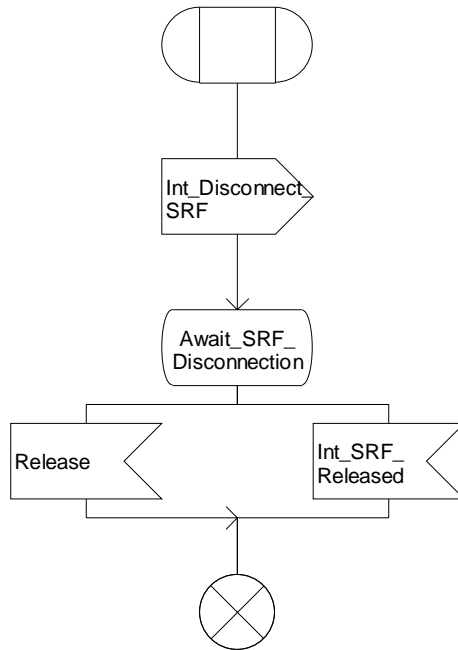
Figure 4.22-1: Procedure CAMEL_Disconnect_CTR_SRF (sheet 1)

Procedure CAMEL_OCH_ETC 1(4)

Procedure in the MSC to handle a temporary connection

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

Initial Address — To CAMEL_Assisting_MSC or SRF

Send_Alerting_If_Required — Procedure defined in 3GPP TS 23.018

Wait_For_Assisting_ACM

Release

Release — From CAMEL_Assisting_MSC or SRF

Int_ETC_Failed

Answer Received

True False

Int_TC_Released

Int_DP_O_Abandon

Result:= pass

DP_O_Abandon

Release — To CAMEL_Assisting_MSC or SRF

Int_continue ← Int_Continue_With_Argument

Release — To SELF

Release — To CAMEL_Assisting_MSC or SRF

Result:= pass

Result:= fail

Figure 4.23-1: Procedure CAMEL_OCH_ETC (sheet 1)

Procedure CAMEL_OCH_ETC 2(4)

Procedure in the MSC to handle a temporary connection

Signals to/from the left are to/from the BSS;
signals to/from the right are to/from the CAMEL_Assisting_MSC or SRF.

Wait_For_Assisting_ACM

Address Complete

Connect

Wait_For_Assisting_Answer

Answer

Bothway through connection required?

No

No

Bothway through connection required?

Procedure defined in 3GPP TS 23.018

Send_Access_Connect_If_Required

Progress

Progress

Send_Access_Connect_If_Required

Procedure defined in 3GPP TS 23.018

Yes

Yes

Int_Temporary Connection Established

Temporary_Connection_Established

Figure 4.23-2: Procedure CAMEL_OCH_ETC (sheet 2)

Procedure CAMEL_OCH_ETC 3(4)

Procedure in the MSC to handle a temporary connection

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

Temporary_Connection_Established Wait_For_Assisting_Answer

Release

Answer Received — false

True

Int_TC_ Released

Int_DP_O_ Abandon

DP_O_Abandon

Release — To CAMEL_ Assisting_MSC or SRF

Release — To SELF

Result:= pass

Release — From CAMEL_ Assisting_MSC or SRF

Int_TC_ Released

Result:= pass

Int_Disconnect_ Forward_ Connection

Int_Disconnect_ Forward_ Connection_ With_Argument

Int_TC_ Released

Release — To CAMEL_ Assisting_MSC or SRF

Result:= pass
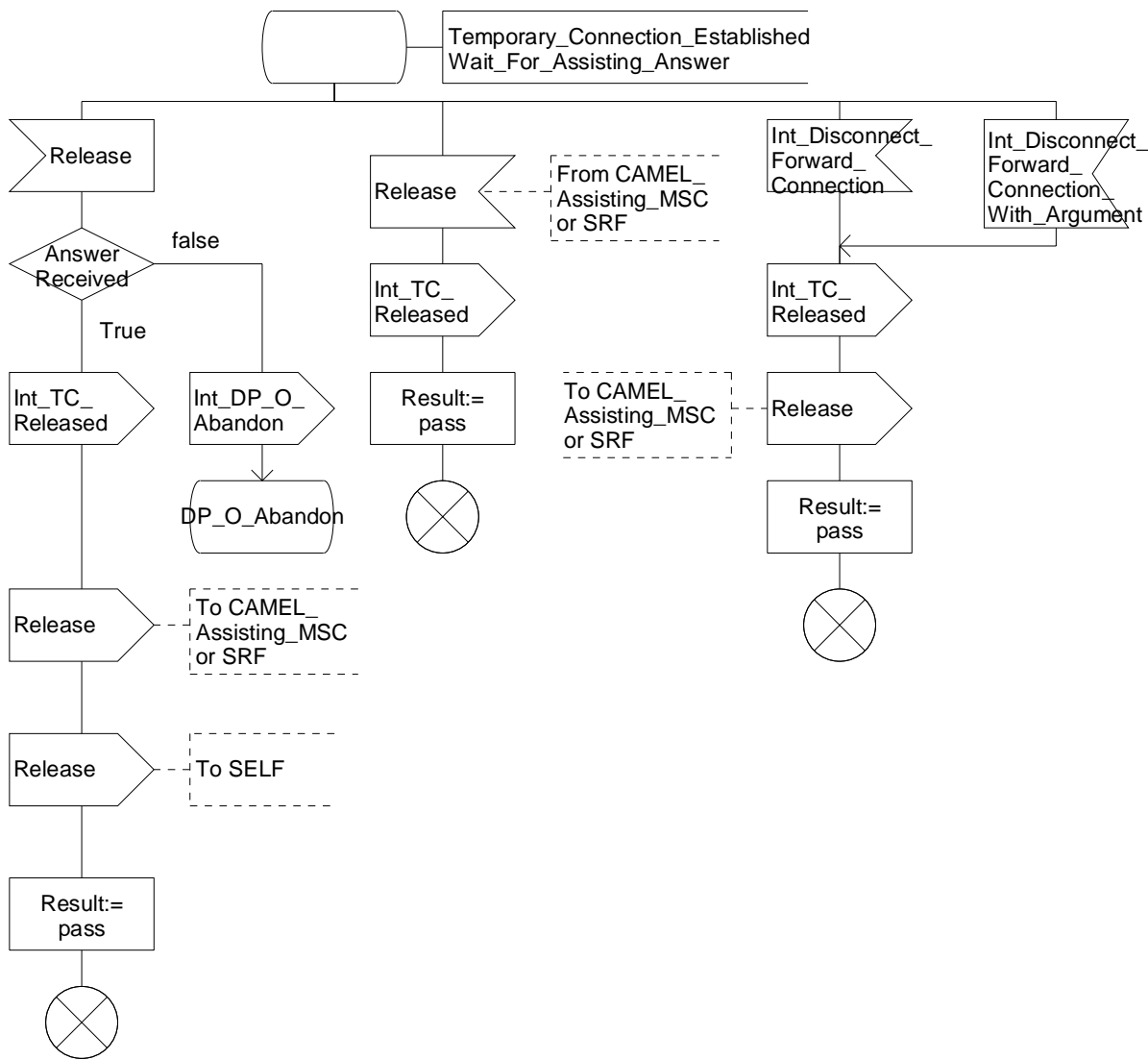
Figure 4.23-3: Procedure CAMEL_OCH_ETC (sheet 3)

Procedure CAMEL_OCH_ETC 4(4)

Procedure in the MSC to handle a temporary connection

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

Temporary_Connection_Established,
Wait_For_Assisting_ACM,
Wait_For_Assisting_Answer

From outgoing leg. ISUP

Release

Answer

Connect

Int_TC_Released

Int_TC_Released

Release — To CAMEL_Assisting_MSC or SRF

Release — To CAMEL_Assisting_MSC or SRF

Release — To SELF

Result:= Answer

Result:= pass
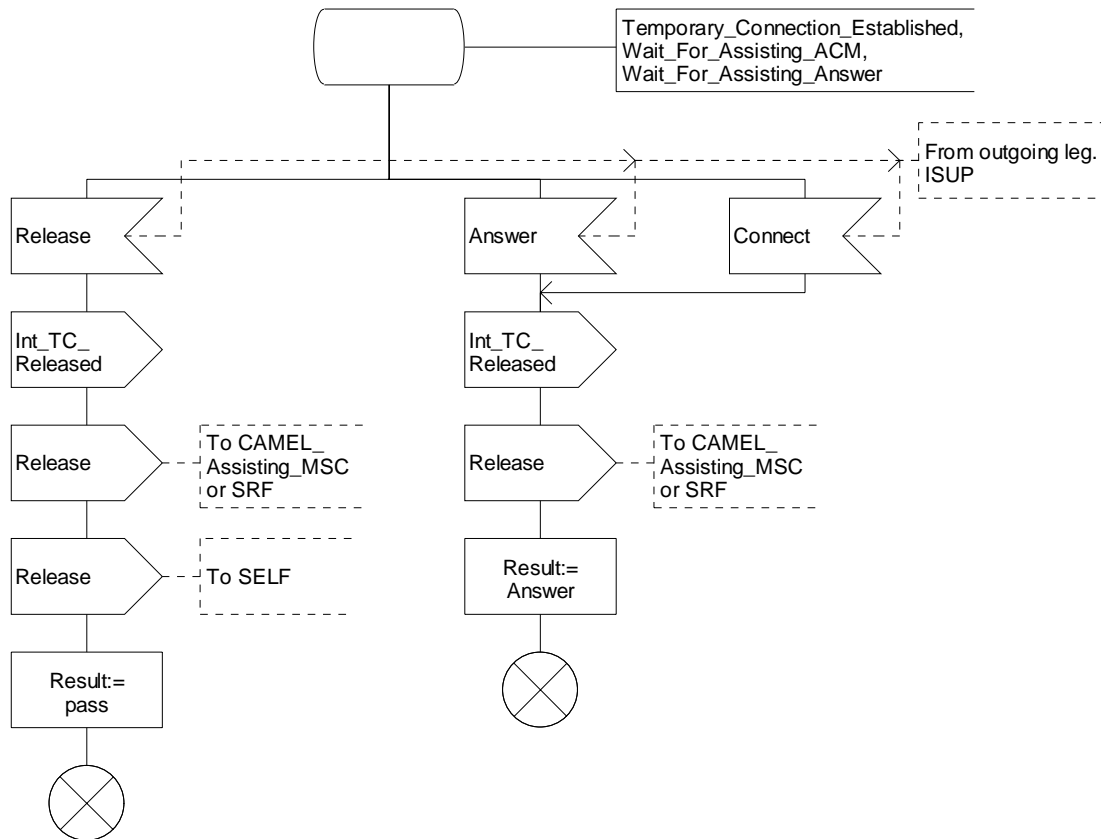
Figure 4.23-4: Procedure CAMEL_OCH_ETC (sheet 4)

Procedure CAMEL_OCH_CTR   1(5)

Procedure in the originating MSC to handle a Connect To Resource operation

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated.

Int_Invoke_SRF — To SRF

Await_SRF_Initialisation

Int_SRF_Connection Failure — from SRF

Int_SRF_Connected — from SRF

Connect SRF to the call

Send_Alerting_If_Required — Procedure defined in 3GPP TS 23.018

Through-connection required?

Yes

No

Send_Access Connect_If_required — Procedure defined in 3GPP TS 23.018

Int_CTR_Failed

Result:= pass

Int_SRF_Connected

relay
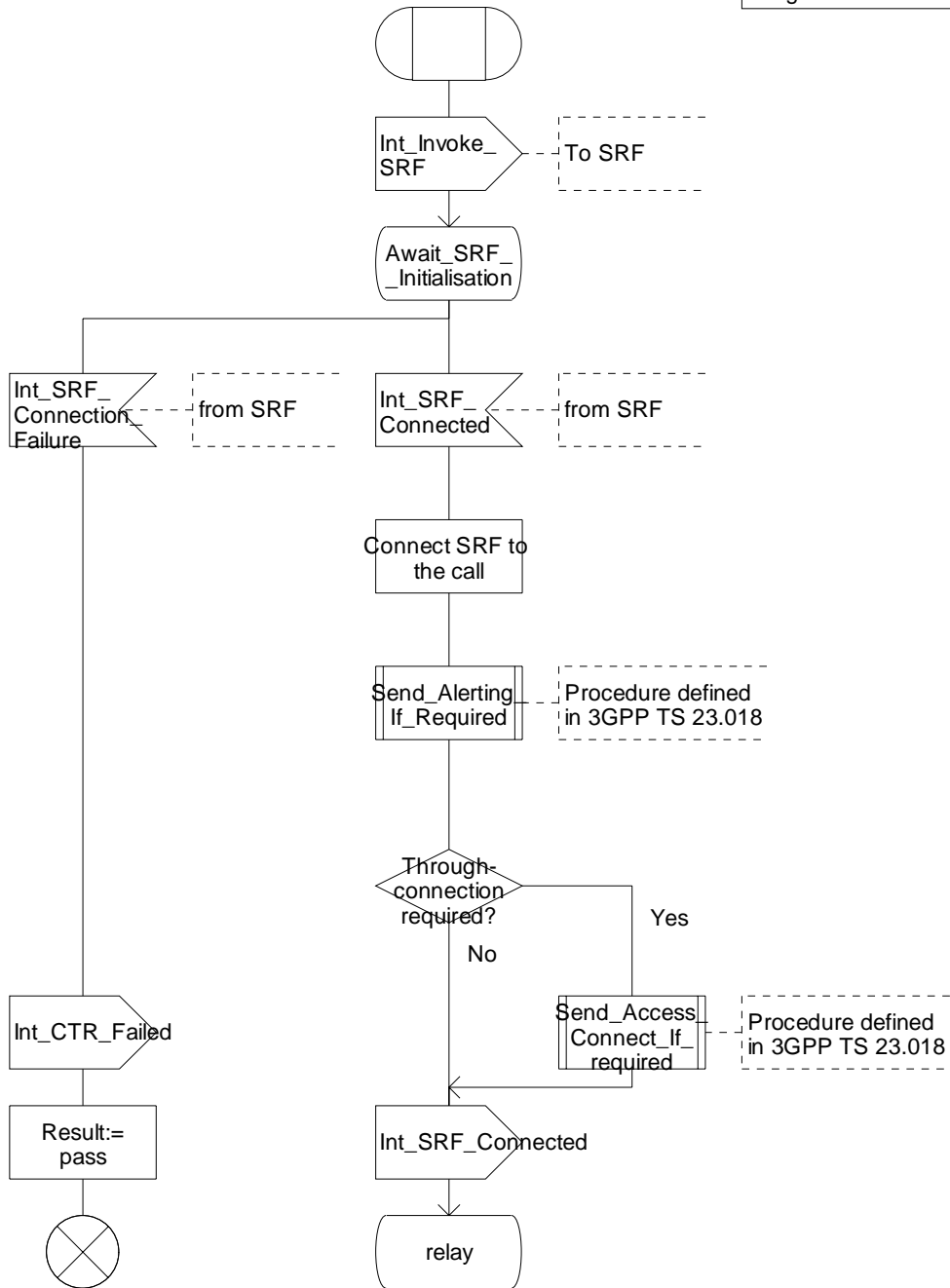
Figure 4.24-1: Procedure CAMEL_OCH_CTR (sheet 1)

Procedure CAMEL_OCH_CTR 2(5)

Procedure in the originating MSC to handle a Connect To Resource operation

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated.

Relay

Release ← From SRF

Int_SRF_Released

Result:= pass

⊗

Int_Disconnect_ Forward_ Connection

Int_Disconnect_ Forward_ Connection_ With_Argument

Release

CAMEL_Disconnect_ CTR_SRF

True Answer Received

False

CAMEL_Disconnect_ CTR_SRF

Int_DP_O_ Abandon /* legID */

To SELF — Release

DP_O_Abandon _DFC

Int_SRF_Released

Int_Continue_ With_Argument

Int_continue

Result:= pass

⊗

Wait_For_Disconnect_ Forward_Connection

Int_Disconnect_ Forward_Connection

CAMEL_Disconnect_ CTR_SRF

Int_SRF_Released

Result:= Fail

⊗
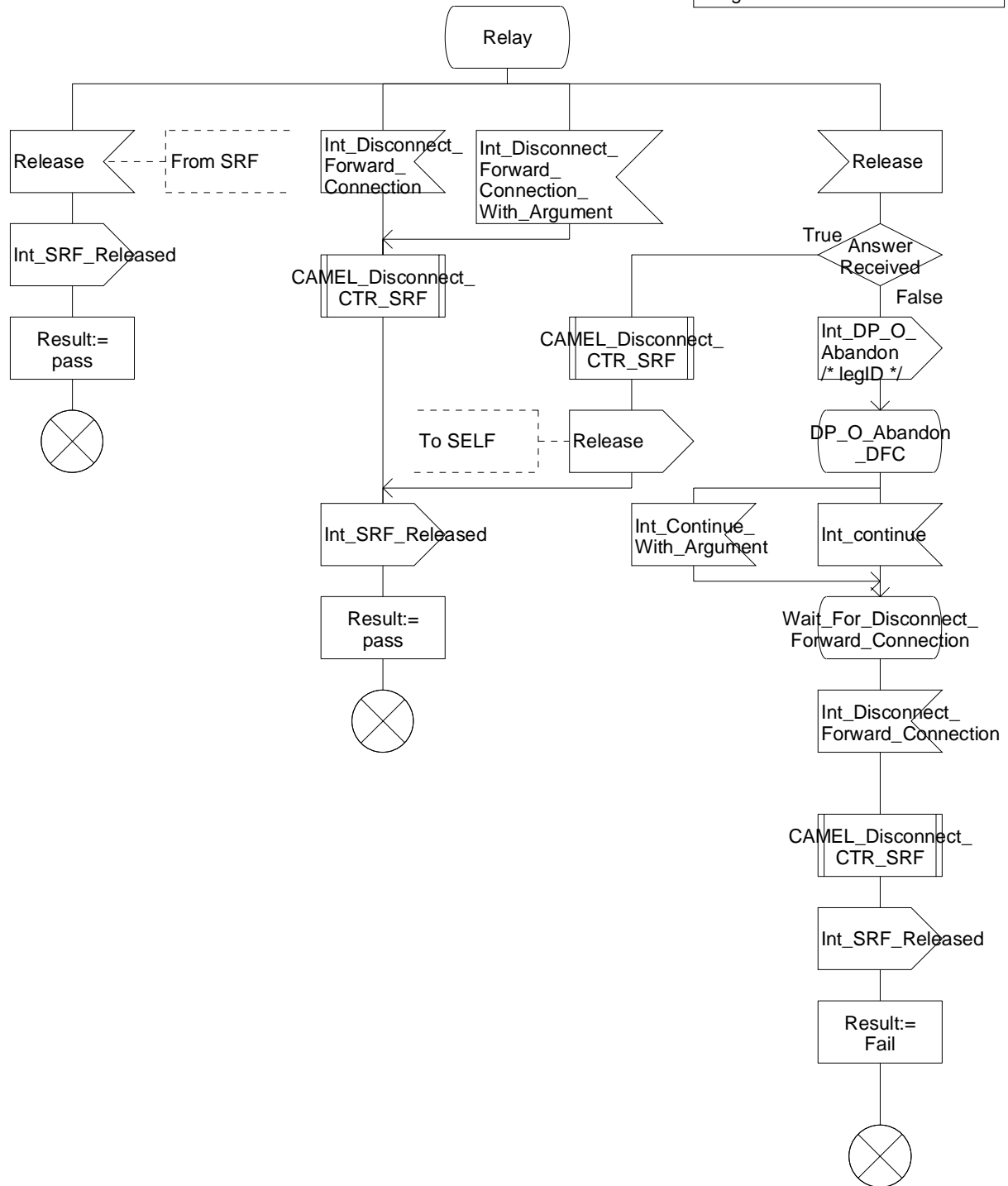
Figure 4.24-2: Procedure CAMEL_OCH_CTR (sheet 2)

Procedure CAMEL_OCH_CTR 3(5)

Procedure in the originating MSC
to handle a Connect To Resource
operation

Signals to/from the right are to/from
the gsmSSF.
Signals to/from the left are to/from
the SRF.

Relay

Int_Play_
Announcement

Int_Prompt_
And_Collect_
User_Information

Int_Specialized_
Ressource_Report

Int_Prompt_
And_Collect_
User_Information ack

Int_Play_
Announcement

Int_Prompt_
And_Collect_
User_Information

Int_Specialized_
Ressource_Report

Int_Prompt_
And_Collect_
User_Information ack

Relay
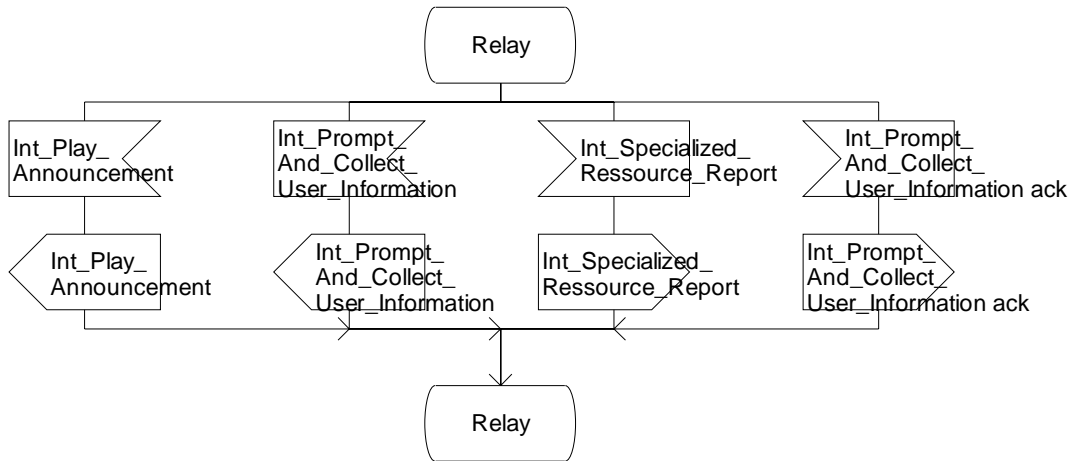
Figure 4.24-3: Procedure CAMEL_OCH_CTR (sheet 3)

Procedure CAMEL_OCH_CTR 4(5)

Procedure in the originating MSC to handle a Connect To Resource operation

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated.

Await_SRF_Initialisation

Release

Answer Received

True · False

CAMEL_Disconnect_ CTR_SRF

Int_SRF_Released

Release → To SELF

Result := pass

Int_DP_O_Abandon

DP_O_Abandon _SRF

Int_continue · Int_Continue_ With_Argument

CAMEL_Disconnect_ CTR_SRF

Int_SRF_Released

Result := Fail
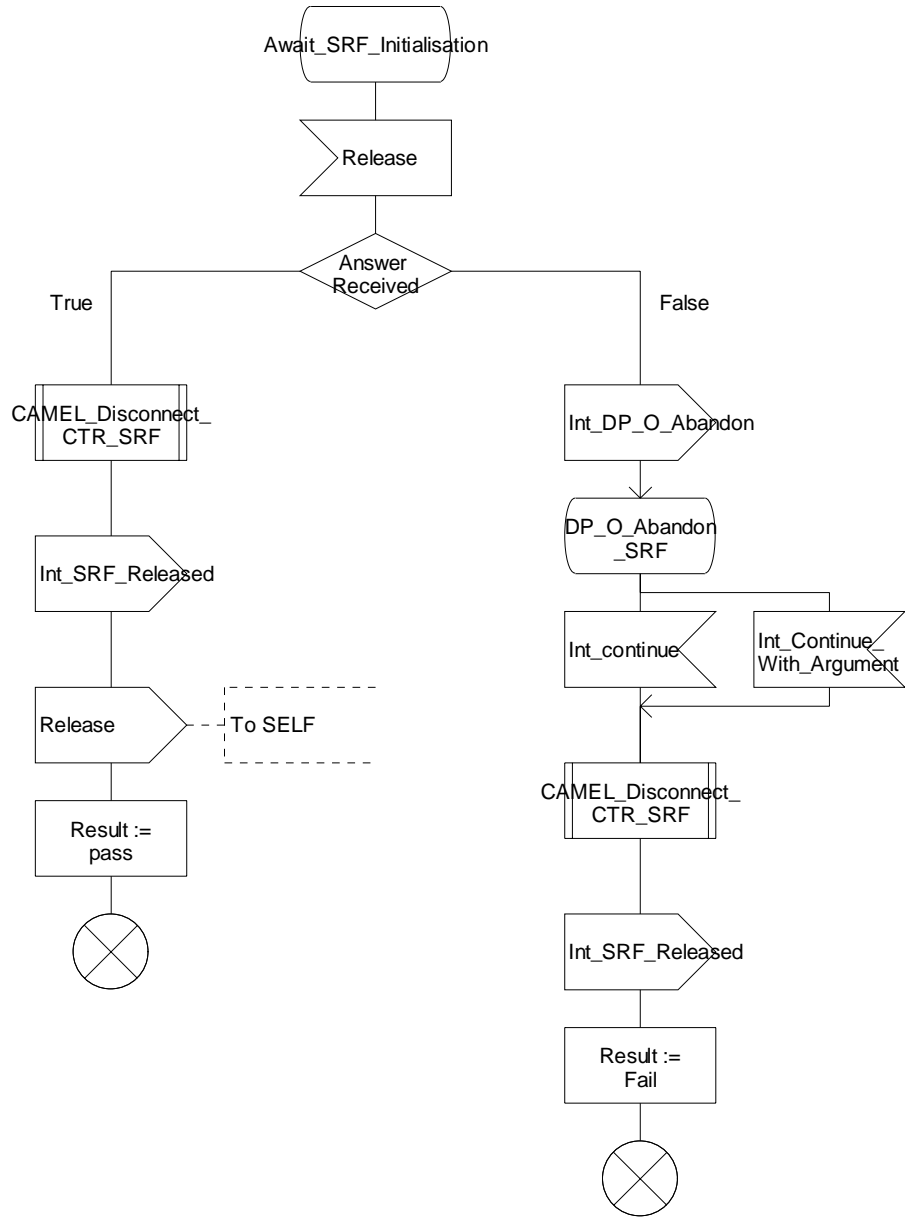
Figure 4.24-4: Procedure CAMEL_OCH_CTR (sheet 4)

ETSI

Procedure CAMEL_OCH_CTR 5(5)
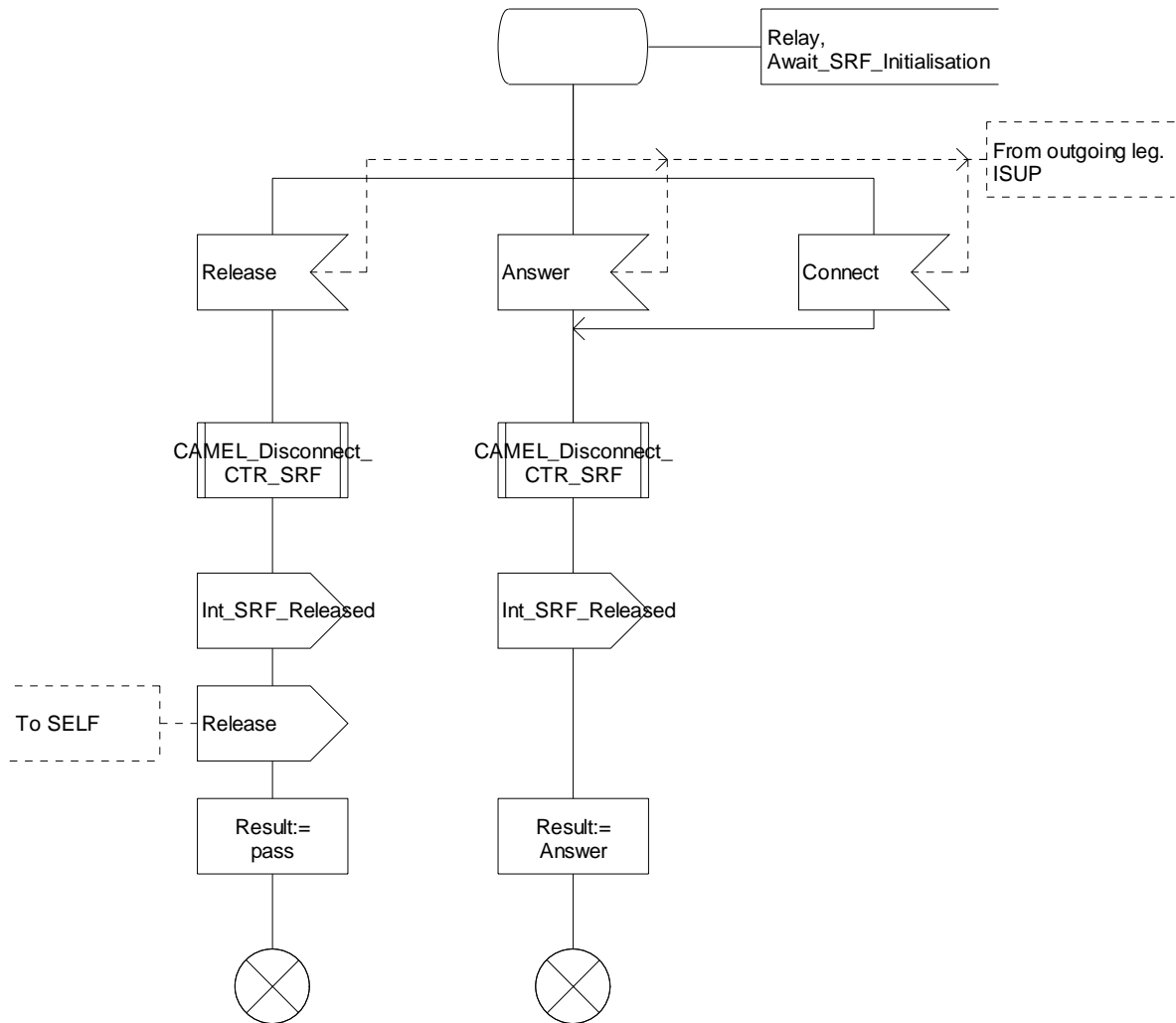
Figure 4.24-5: Procedure CAMEL_OCH_CTR (sheet 5)

Procedure CAMEL_Start_TNRy 1(1)

Prodedure in MSC to start the timer TNRy
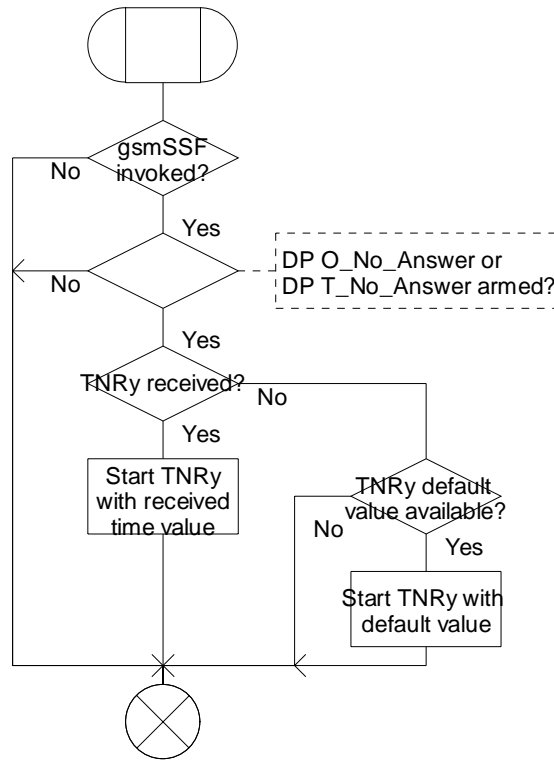
Figure 4.25-1: Procedure CAMEL_Start_TNRy (sheet 1)

Procedure CAMEL_Stop_TNRy   1(1)

Procedure in the MSC
to stop the timer TNRy

gsmSSF
invoked?   No

Yes

TNRy
running?   No

Yes
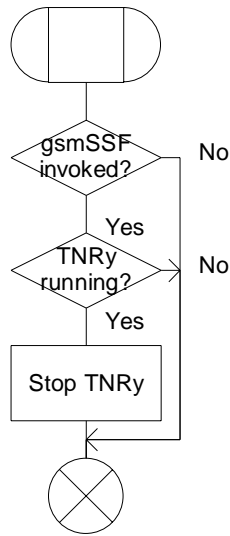
Stop TNRy

Figure 4.26-1: Procedure CAMEL_Stop_TNRy (sheet 1)

Procedure CAMEL_Store_Destination_Address   1(1)

Procedure in the MSC to
store the destination address
for an originating call leg,
roaming leg or forwarding leg
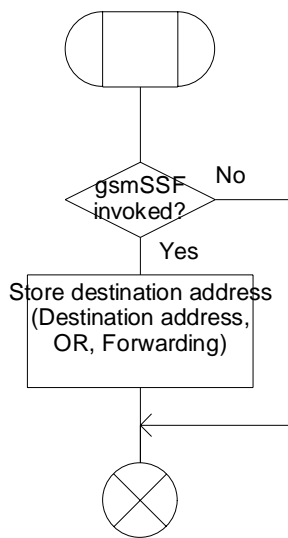
Procedure CAMEL_Store_Destination_Address
FPAR IN OR, Forwarding

gsmSSF
invoked?   No

Yes

Store destination address
(Destination address,
OR, Forwarding)

Figure 4.27-1: Procedure CAMEL_Store_Destination_Address (sheet 1)

Procedure CAMEL_Modify_CUG_Info   1(1)

/* Procedure in the MSC to modify CUG
information for the call as instructed
by the gsmSCF via the gsmSSF. */

Yes — CUG Interlock present?

No

Yes — CUG Outgoing Access present?

No

Modify CUG parameters with received info.

Yes — Non-CUG call present in SII2?

No

Remove CUG parameters from call info.

If both Interlock Code and Outgoing
Access are received from gsmSCF,
then both parameters shall be used
for this call.
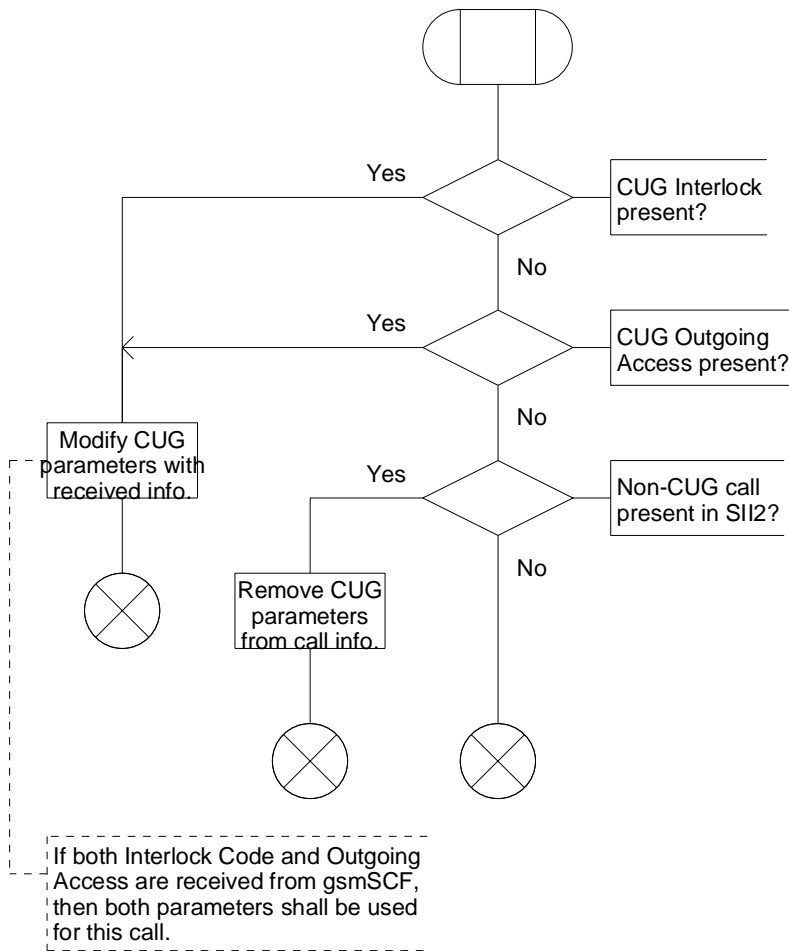
Figure 4.28-1: Procedure CAMEL_Modify_CUG_Info (sheet 1)

Procedure CAMEL_N_CSI_CHECK_MSC 1(1)

/* Procedure in the MSC to check
the N-CSI and set the N-CSI available
parameter for SIFOC accordingly.*/

N-CSI
provisioned? — No

Yes

Set N-CSI available
parameter
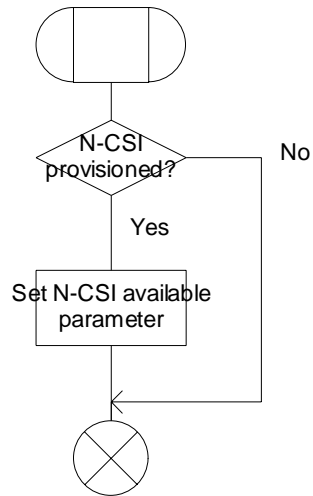
Figure 4.29-1: Procedure CAMEL_N_CSI_CHECK_MSC (sheet 1)

Procedure CAMEL_OCH_LEG1_MSC   1(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the gsmSSF unless otherwise stated */

Int_MidCall_Criteria_Request

Wait_For_MidCall_Criteria

Int_MidCall_Criteria ack

Int_MidCall_Criteria negative response

Store MidCall Criteria

MidCall armed := True

MidCall armed := False

1

*

Int_MidCall_Criteria

Int_Cancel_MidCall

Store MidCall Criteria

MidCall armed := True

MidCall armed := False

Clear Digit String

Stop Interdigit Timer

-
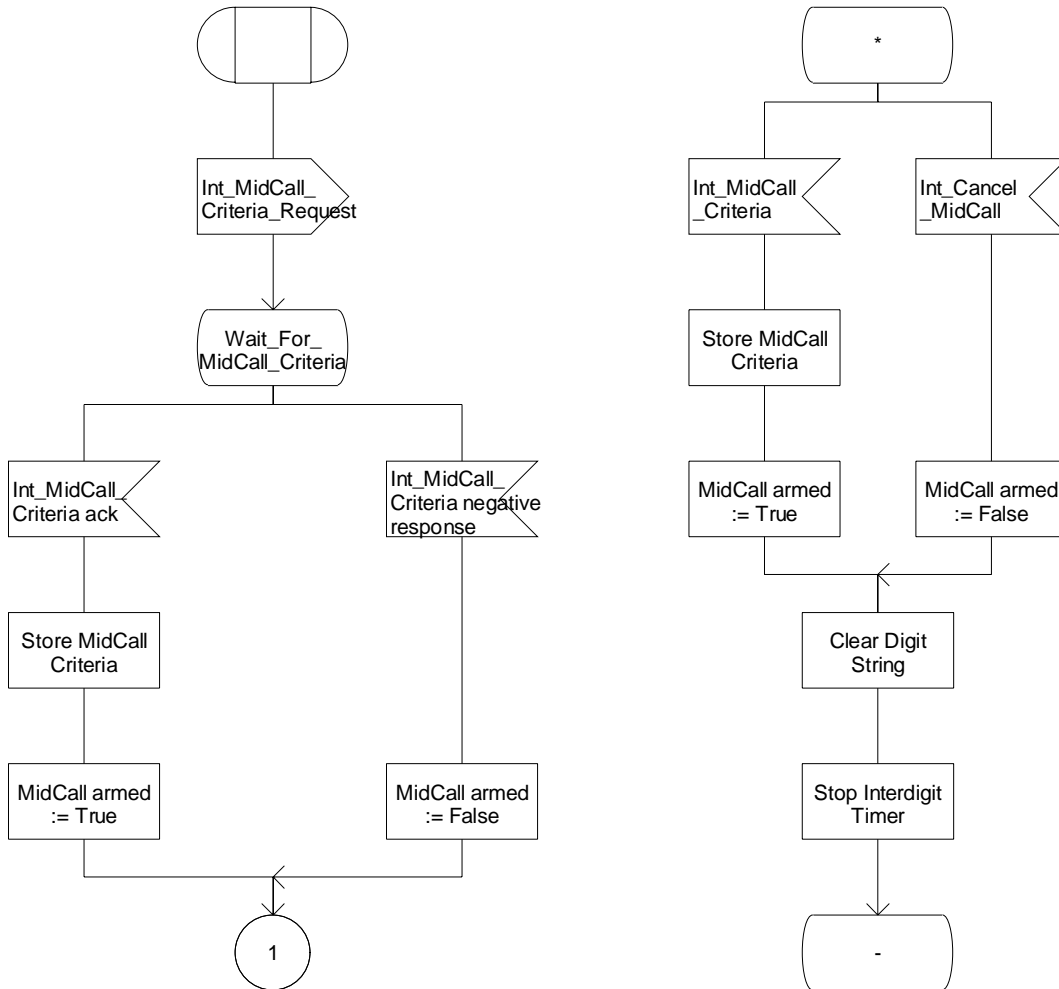
Figure 4.30-1: Procedure CAMEL_OCH_LEG1_MSC (sheet 1)

Procedure CAMEL_OCH_LEG1_MSC 2(11)

/* A procedure in the MSC to
handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the gsmSSF
unless otherwise stated */
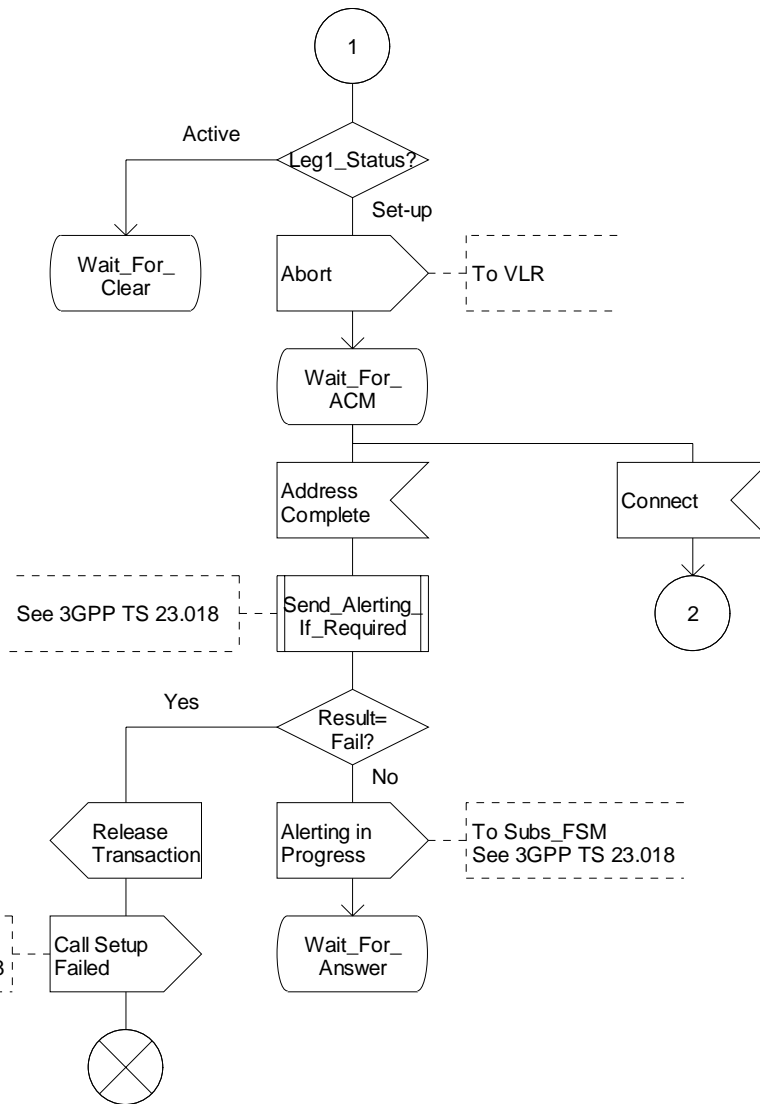
Figure 4.30-2: Procedure CAMEL_OCH_LEG1_MSC (sheet 2)

Procedure CAMEL_OCH_LEG1_MSC 3(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS Signals to/from the right are to/from the gsmSSF unless otherwise stated */
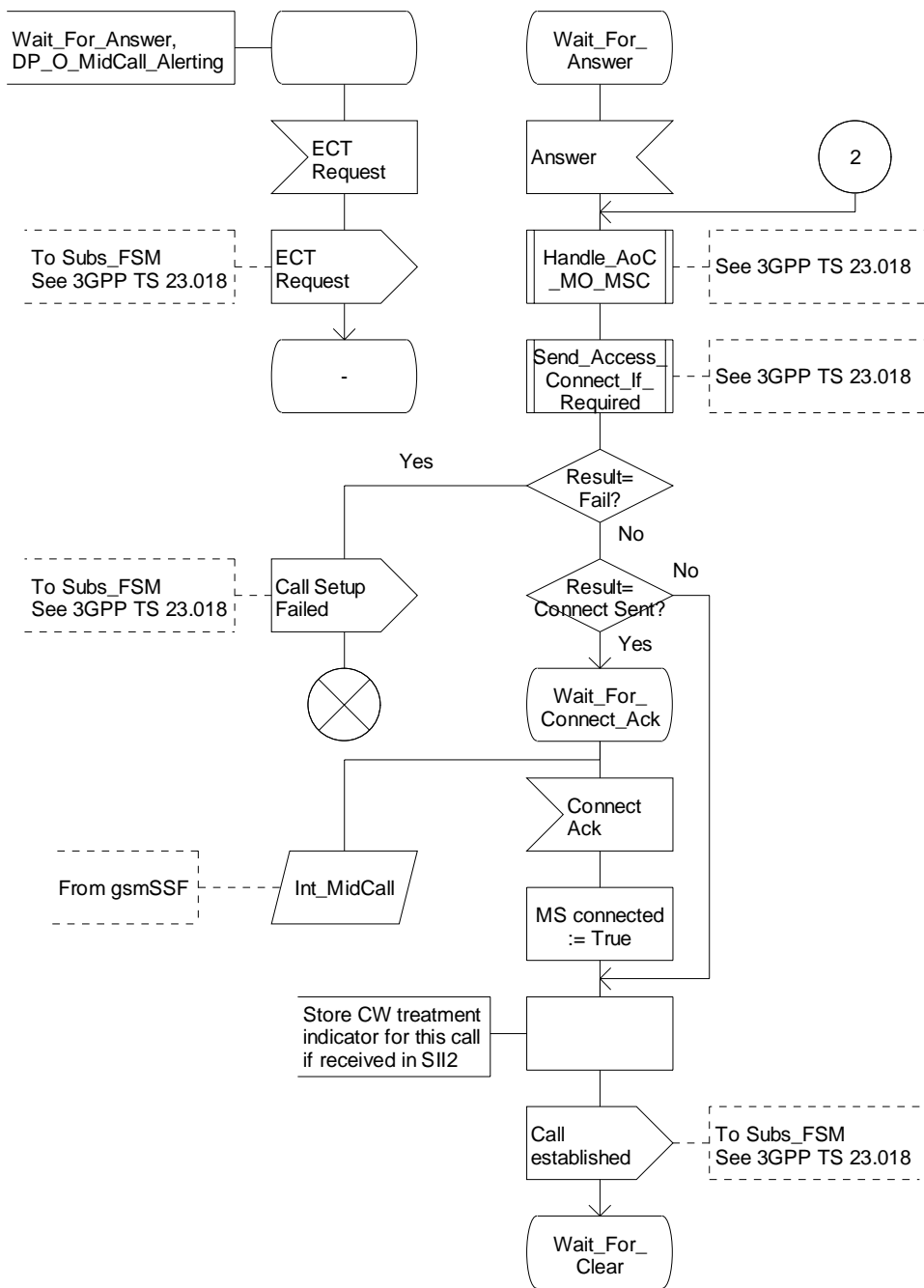
Figure 4.30-3: Procedure CAMEL_OCH_LEG1_MSC (sheet 3)

Procedure CAMEL_OCH_LEG1_MSC 4(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the gsmSSF unless otherwise stated */

Wait_For_ACM,
Wait_For_Answer,
Wait_For_Connect_Ack,
DP_O_MidCall_Alerting

Release transaction

Int_Disconnect Leg

Int_Release Call

CAMEL_OCH_ MSC_DISC4

Release transaction

Release transaction

Int_Disconnect Leg ack

To Subs_FSM See 3GPP TS 23.018

Call Setup Failed

DP_O_MidCall _Alerting

Answer

From gsmSSF

Wait_For_Answer,
DP_O_MidCall_Alerting

Int_MidCall

DP_O_MidCall _Alerting
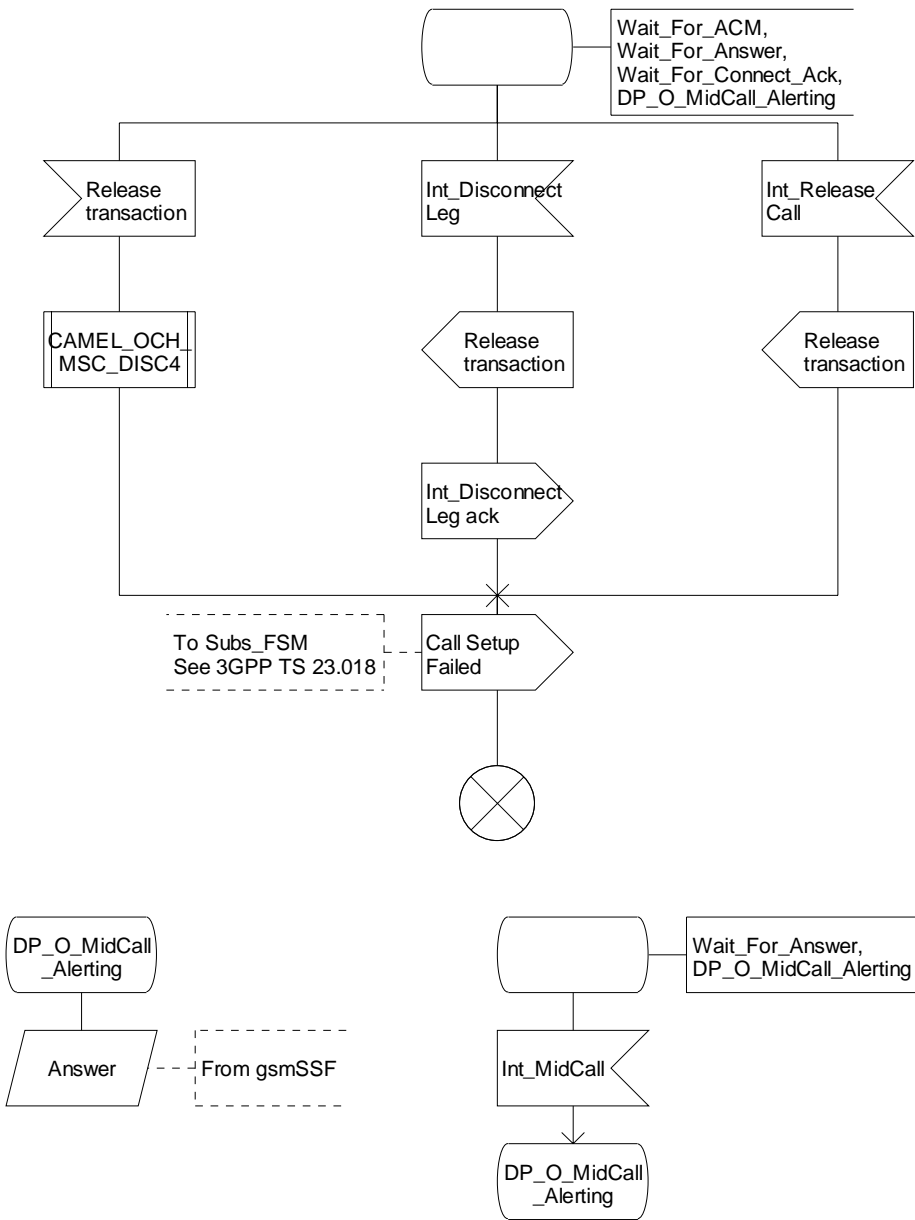
Figure 4.30-4: Procedure CAMEL_OCH_LEG1_MSC (sheet 4)

Procedure CAMEL_OCH_LEG1_MSC 5(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the gsmSSF
unless otherwise stated */
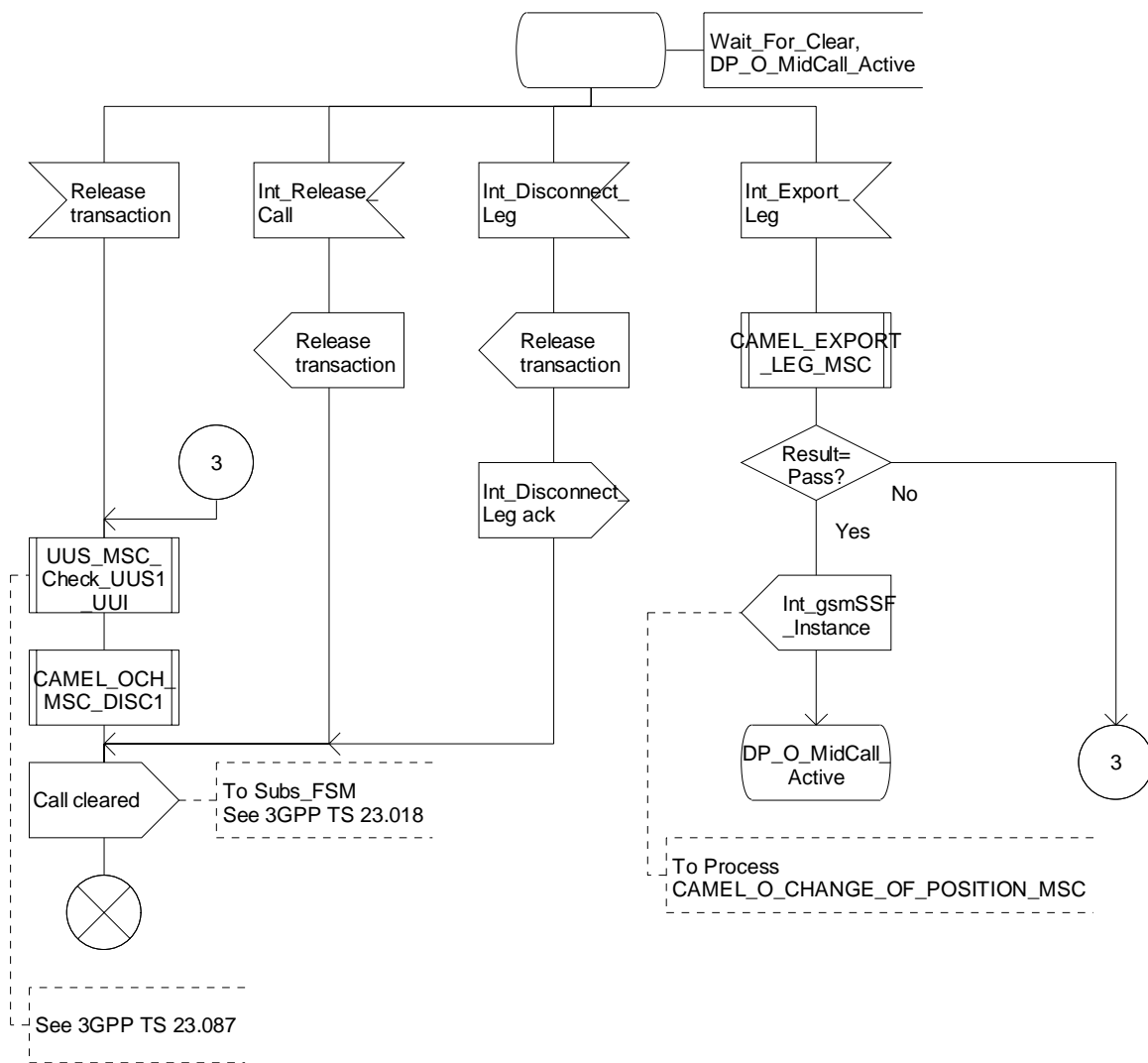
Figure 4.30-5: Procedure CAMEL_OCH_LEG1_MSC (sheet 5)

Procedure CAMEL_OCH_LEG1_MSC   6(11)

/* A procedure in the MSC to
handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the Process
Subs_FSM (See 3GPP TS 23.018). */

Wait_For_Clear,
DP_O_MidCall_Active

Hold
request

Retrieve
request

ECT
request

MPTY
request

Hold
supported?

Hold
supported?

ECT
request

MPTY
request

No   Yes   Yes   No

Hold
reject

Process_Hold
_Request

Process_Retrieve
_Request

Retrieve
reject

-

See 3GPP TS 23.083
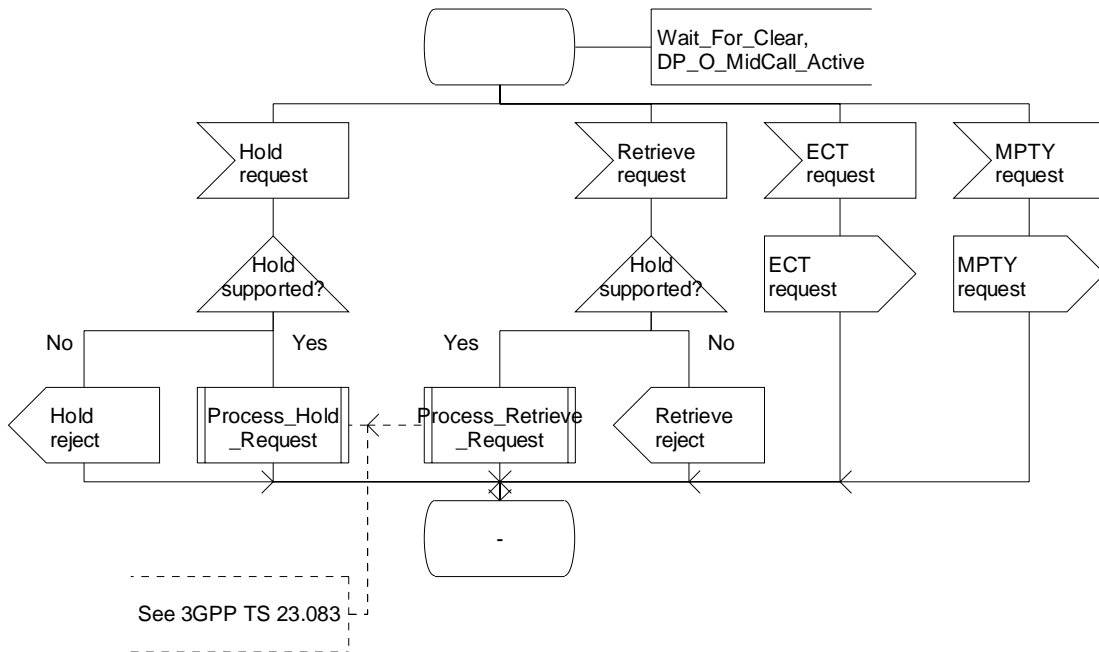
Figure 4.30-6: Procedure CAMEL_OCH_LEG1_MSC (sheet 6)

Procedure CAMEL_OCH_LEG1_MSC 7(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the gsmSSF unless otherwise stated */

DP_O_MidCall _Active

Int_Continue

Int_Continue With Argument

Int_Error

Continue

Default Call Handling

Release

Wait_For_ Clear

Release transaction

DP_O_MidCall _Alerting

Int_Continue

Int_Continue With Argument

Int_Error

Continue

Default Call Handling

Release

Wait_For_ Answer

Release transaction
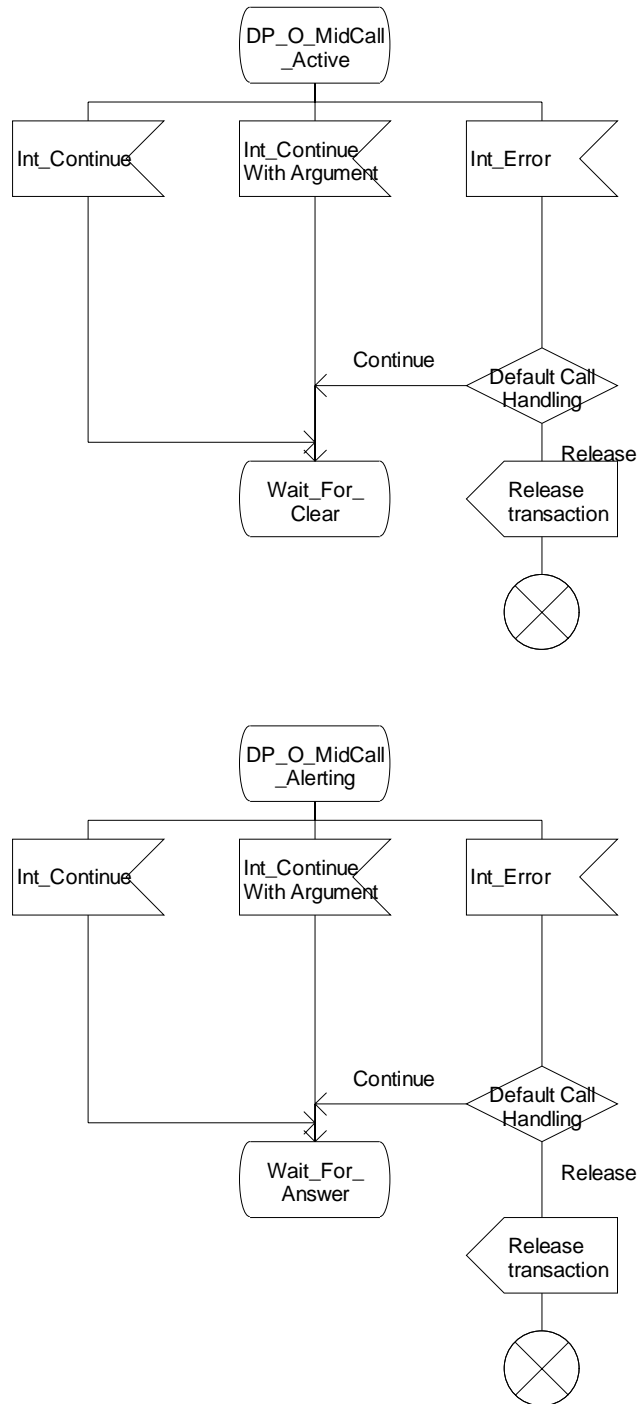
Figure 4.30-7: Procedure CAMEL_OCH_LEG1_MSC (sheet 7)

Procedure CAMEL_OCH_LEG1_MSC 8(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS Signals to/from the right are to/from the gsmSSF unless otherwise stated */

DP_O_MidCall_Active, Wait_For_Clear

Int_MidCall

From MSC process ⤑ Int_DTMF_ Digit_Received

MidCall armed? — False

True

Interdigit Timeout is specified in MidCall Criteria ⤑ Start Interdigit Timer

Add Digit to Digit String

CHECK_DIGIT_ STRING_MSC

Result?

Trigger — Continue

Abort

Stop Interdigit Timer

Stop Interdigit Timer

Int_DP_O_ MidCall

Clear Digit String

Clear Digit String

DP_O_ MidCall _Active

-
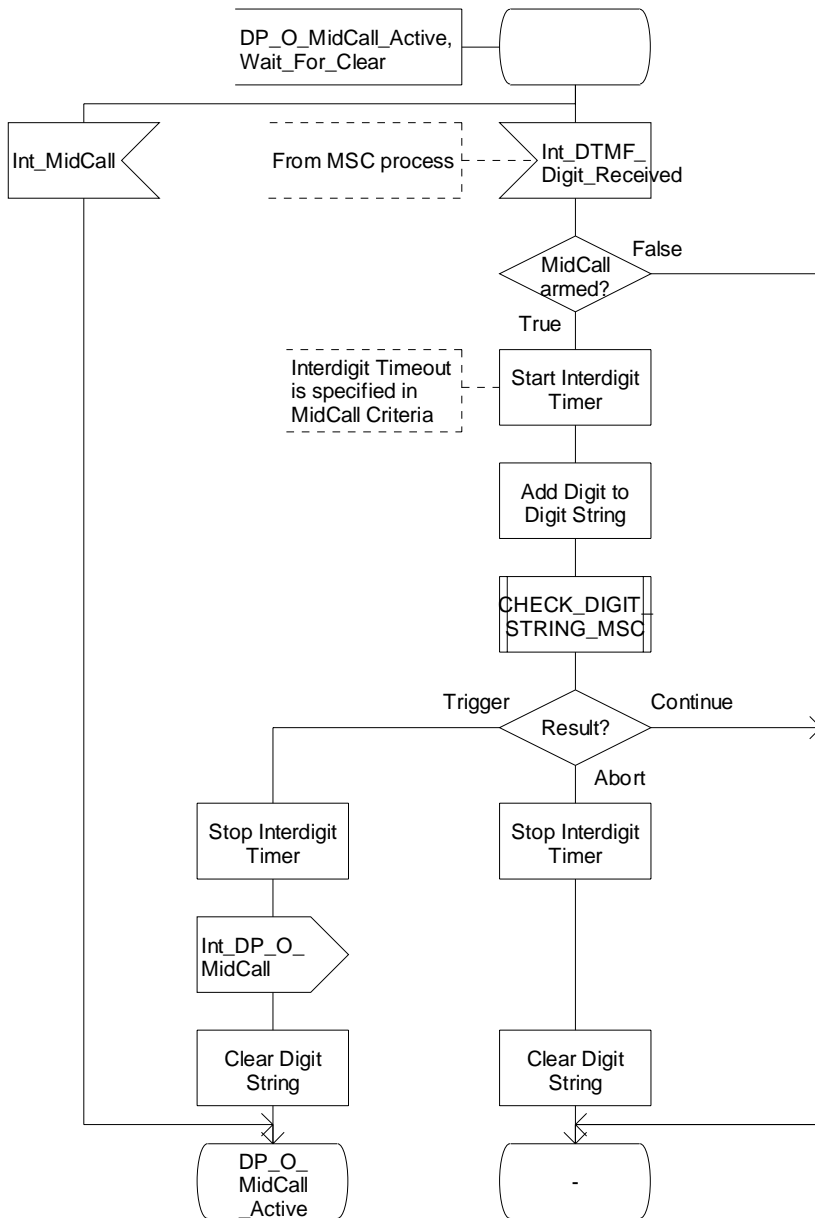
Figure 4.30-8: Procedure CAMEL_OCH_LEG1_MSC (sheet 8)

Procedure CAMEL_OCH_LEG1_MSC 9(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS Signals to/from the right are to/from the gsmSSF unless otherwise stated */
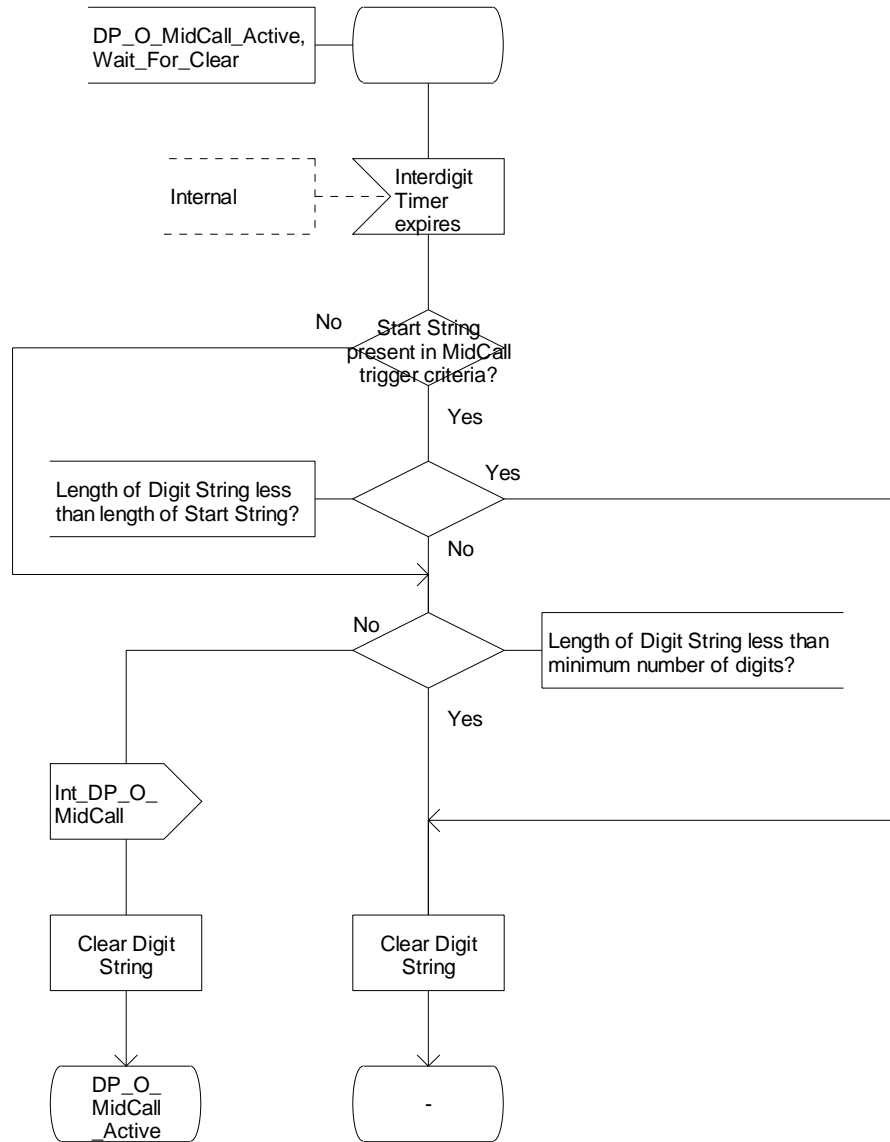
Figure 4.30-9: Procedure CAMEL_OCH_LEG1_MSC (sheet 9)

Procedure CAMEL_OCH_LEG1_MSC 10(11)

/* A procedure in the MSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the gsmSSF unless otherwise stated */

DP_O_MidCall_Alerting

Int_Establish_Temporary_Connection

Int_Connect_To_Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result?

Answer

ELSE

Fail

Result := Answer

Call Setup Failed

To Subs_FSM
See 3GPP TS 23.018

To SELF

Answer

-

Figure 4.30-10: Procedure CAMEL_OCH_LEG1_MSC (sheet 10)

Procedure CAMEL_OCH_LEG1_MSC   11(11)

/* A procedure in the MSC to
handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the BSS
Signals to/from the right are to/from the gsmSSF
unless otherwise stated */

DP_O_MidCall_Active

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC   CAMEL_OCH_CTR

-

Wait_For_ACM

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC   CAMEL_OCH_CTR

Result?

ELSE

Fail

Call Setup
Failed

To Subs_FSM
See 3GPP TS 23.018

-

Figure 4.30-11: Procedure CAMEL_OCH_LEG1_MSC (sheet 11)

procedure CHECK_DIGIT_STRING_MSC 1(1)

/* A procedure in the MSC to check entered digits to see
if the MidCall trigger criteria is met. */

Last digit(s) in Digit String =
Cancel digit String?
— Yes / No

Start Digit String
present in MidCall
trigger criteria?
— No / Yes

Length of Digit String =
length of Start Digit String?
— Yes / No

Number of digits in Digit String =
Maximum number of digits
— Yes / No

Digit String =
Start Digit String?
— No / Yes

End of reply digit
string present in
MidCall trigger criteria?
— No / Yes

Result :=
Abort

Result :=
Continue

Result :=
Trigger

Last digit(s) in Digit String =
End of reply digit string?
— Yes / No

Length of Digit String less than
minimum number of digits?
— Yes / No

Result :=
Trigger

Result :=
Continue

Figure 4.31-1: Procedure CHECK_DIGIT_STRING_MSC (sheet 1)

ETSI
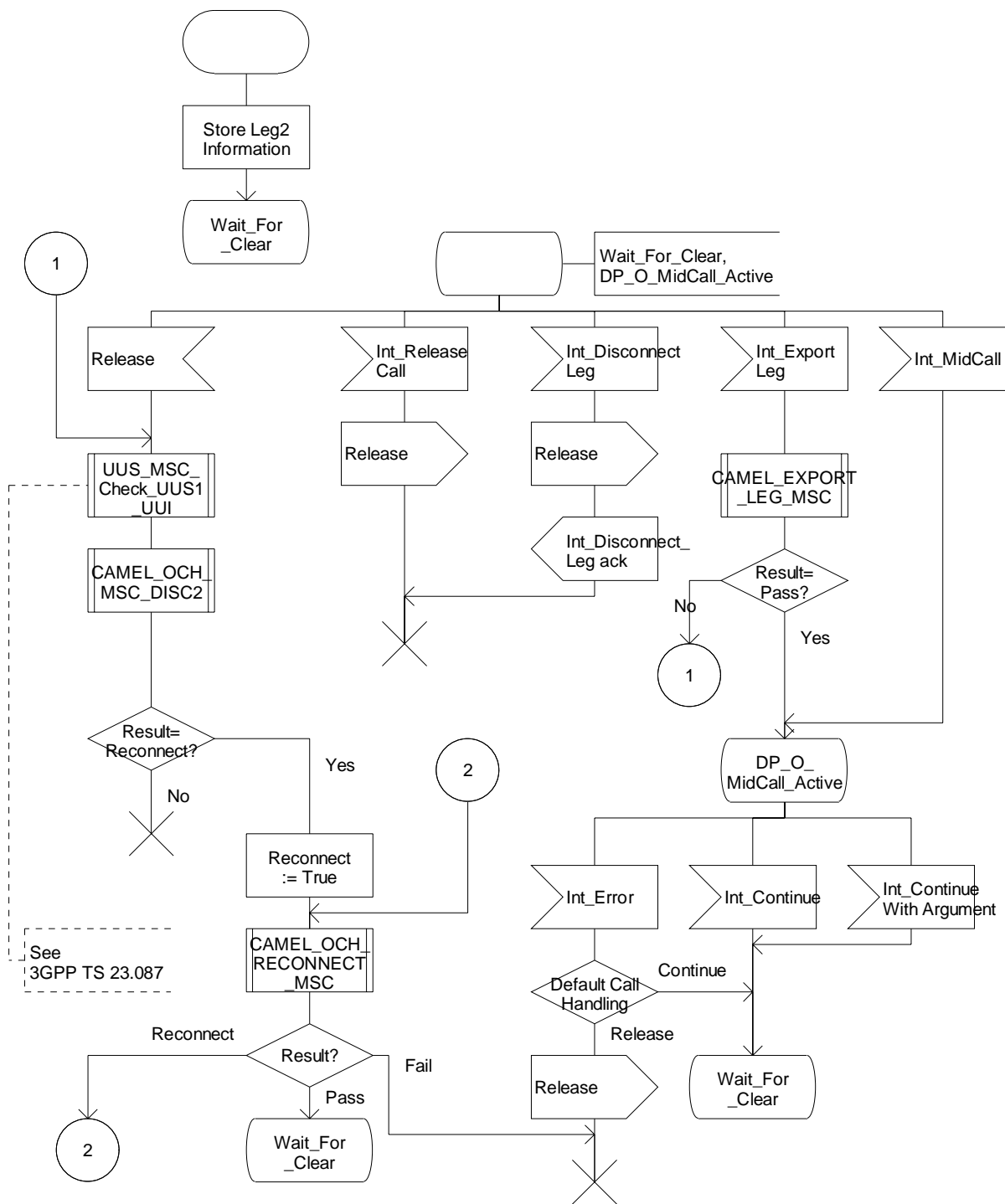
Figure 4.32-1: Process CAMEL_OCH_LEG2_MSC (sheet 1)

Process CAMEL_OCH_LEG2_MSC   2(2)

/* A procedure in the MSC to
handle leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF
Signals to/from the right are to/from the destination
exchange unless otherwise stated */

DP_O_MidCall_Active

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

-
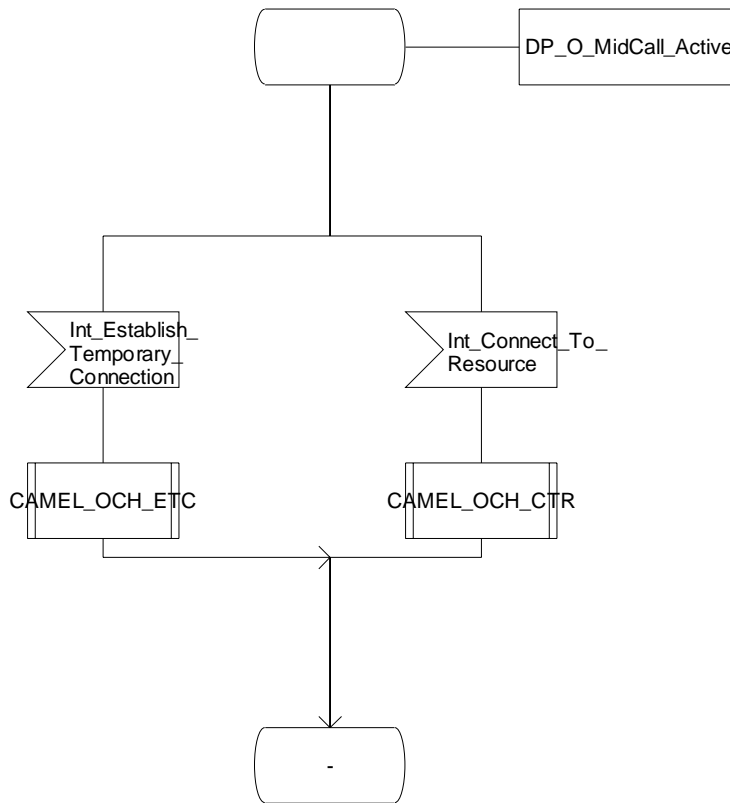
Figure 4.32-2: Process CAMEL_OCH_LEG2_MSC (sheet 2)

Procedure CAMEL_OCH_RECONNECT_MSC 1(9)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange .*/

CAMEL_MO_ DIALLED_SERVICES

Result = Pass?

No

Result := Fail

Yes

MOBILE_NUMBER_ PORTABILITY_ IN_OQoD

See 3GPP TS 23.066

Initial Address

Destination address := IAM.Called Party Number

CAMEL_Store_ Destination _Address (False, False)

Wait_For_ACM
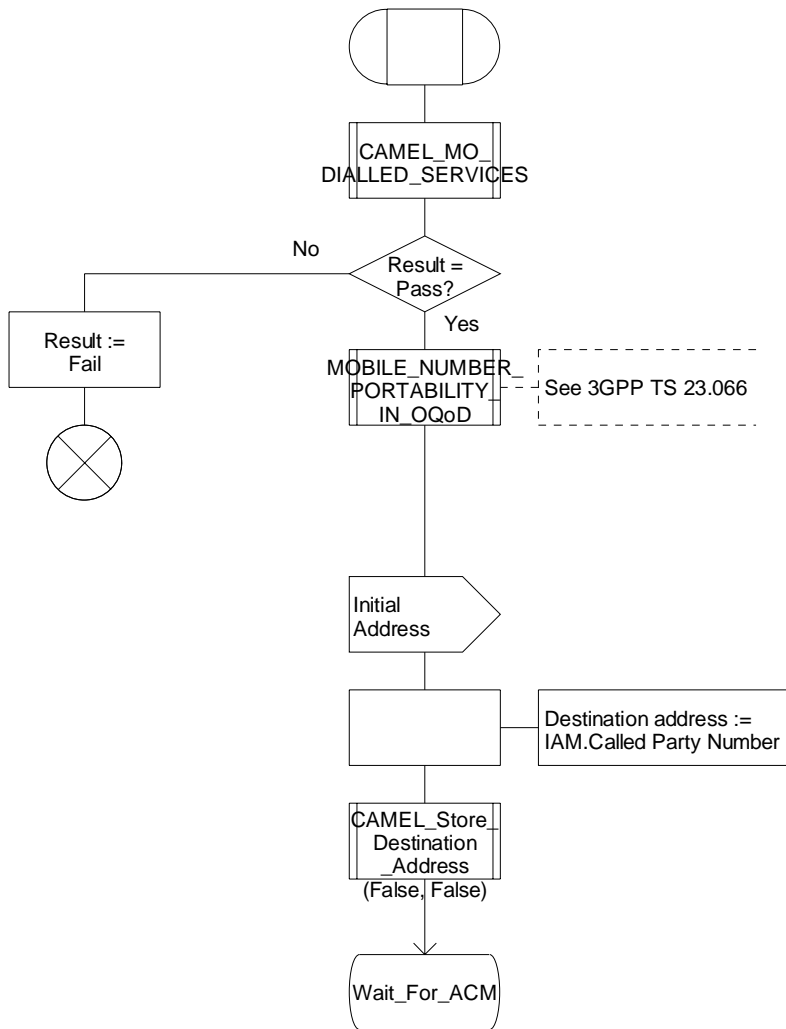
Figure 4.33-1: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 1)

Procedure CAMEL_OCH_RECONNECT_MSC 2(9)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange .*/

```
                              Wait_For_
                                ACM

        Address                                      Connect
        Complete

        CAMEL_
        Start_TNRy

        UTU2CNT := 0

        CAMEL_OCH_
        MSC_ALERTING

        Result?                                                    Answer

        Pass    Reconnect        Fail,
                                Release

      Wait_For_     Result :=      Result :=                          1
       Answer       Reconnect        Fail

                              ⊗
```
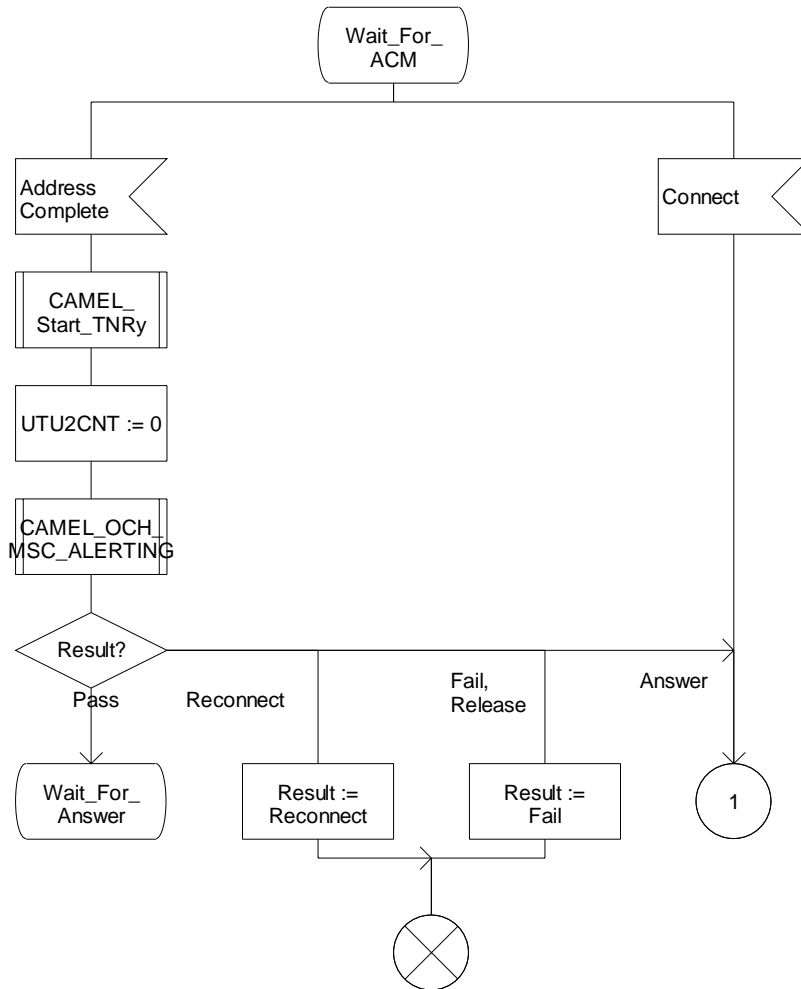
Figure 4.33-2: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 2)

Procedure CAMEL_OCH_RECONNECT_MSC 3(9)

/* A procedure in the MSC to handle a
reconnection after leg 2 disconnects */

/* Signals to/from the right are
to/from the destination exchange .*/

```
          ┌─────────────┐
          │  Wait_For_  │
          │    ACM      │
          └──────┬──────┘
                 │
          ┌──────┴──────┐
          │ Release     │◁
          └──────┬──────┘
                 │
       Yes       ◇       Release cause =
      ┌──────────◇───────  no answer from user?
      │          ◇
      ▼          │ No
   ( 2 )   ┌─────┴─────┐
           ║CAMEL_OCH  ║
           ║ _MSC1     ║
           └─────┬─────┘
                 │
                 ◇          No
             Result =  ─────────────┐
             Reconnect?             │
                 │ Yes              │
          ┌──────┴──────┐    ┌──────┴──────┐
          │ Result :=   │    │ Result :=   │
          │ Reconnect   │    │   Fail      │
          └──────┬──────┘    └──────┬──────┘
                 │                  │
                 └────────⊗─────────┘
```
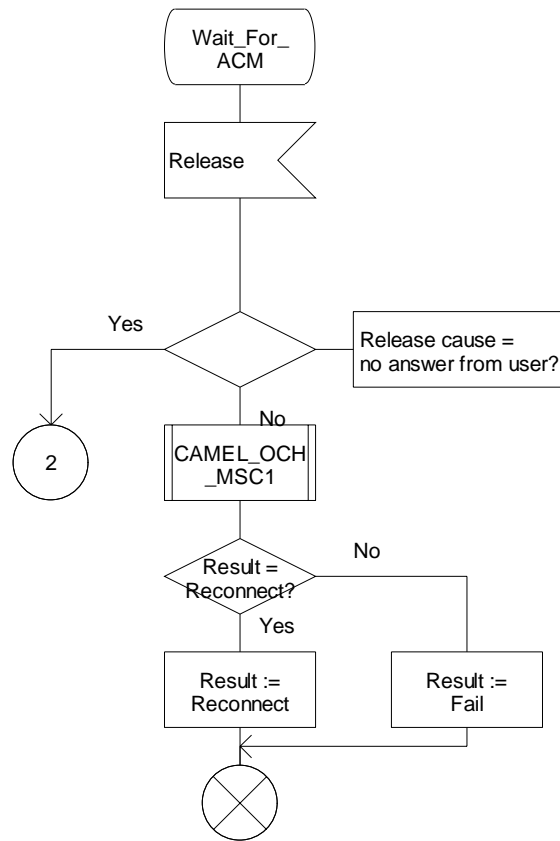
Figure 4.33-3: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 3)

Procedure CAMEL_OCH_RECONNECT_MSC 4(9)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange .*/

Wait_For_ Answer

Answer ◁ (1)

CAMEL_Stop _TNRy

CAMEL_OCH_ MSC_ANSWER

Reconnect / Result? \ Fail

Pass

Handle_AoC_ MO_MSC --- See 3GPP TS 23.018

Store CW treatment indicator for this leg if received in SII2

| Result := Reconnect | Result := Pass | Result := Fail |

⊗

Figure 4.33-4: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 4)

ETSI

Procedure CAMEL_OCH_RECONNECT_MSC 5(9)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange .*/

DP_O_MidCall_Alerting,
Wait_For_Answer

Release | Internal | TNRy Expired

2 | Release

Release cause = no answer from user?

Yes

No

CAMEL_OCH_MSC1

CAMEL_OCH_MSC2

Result = Reconnect?

Yes | Yes

Result = Reconnect?

No | No

Result = Fail

Result := Reconnect

Result := Fail

Figure 4.33-5: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 5)

Procedure CAMEL_OCH_RECONNECT_MSC 6(9)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF .*/

DP_O_MidCall_Alerting, Wait_For_ACM, Wait_For_Answer

Int_Disconnect Leg

Release

Int_Disconnect Leg ack

Int_Release Call

Release

Result := Fail

Figure 4.33-6: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 6)

ETSI

Procedure CAMEL_OCH_RECONNECT_MSC 7(9)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF .*/

DP_O_MidCall_Alerting, Wait_For_Answer

Int_Export Leg

Int_MidCall

CAMEL_EXPORT _LEG_MSC

Result = Pass?

Yes

No

Result := Fail

DP_O_MidCall _Alerting

Int_Error

Int_Continue

Int_Continue With Argument

Answer

Default call handling

Continue

Release

Wait_For_ Answer

Release

Result := Fail

Figure 4.33-7: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 7)

Procedure CAMEL_OCH_RECONNECT_MSC 8(9)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF .*/

DP_O_MidCall_Alerting

Int_Establish_ Temporary_ Connection

Int_Connect_To_ Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result?

Answer   ELSE   Fail

Result := Answer

To SELF ---- Answer

-

Figure 4.33-8: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 8)

Procedure CAMEL_OCH_RECONNECT_MSC 9(9)

/* A procedure in the MSC to handle a
reconnection after leg 2 disconnects */

/* Signals to/from the right are
to/from the destination exchange;
Signals to/from the left are
to/from the gsmSSF .*/

DP_O_MidCall_Active

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

-

Figure 4.33-9: Procedure CAMEL_OCH_RECONNECT_MSC (sheet 9)

Procedure CAMEL_EXPORT_LEG_MSC 1(2)

/* A procedure in the MSC to
change the call segment for a leg. */

/* Signals to/from the left are to/from the old gsmSSF
Signals to/from the right are to/from the new gsmSSF
unless otherwise stated */

Wait_For_
Import_Leg

Int_Import
Leg

Answer

From destination exchange.
Can only occur if Move Leg is
performed on ICA-call during
alerting phase.

Store new
gsmSSF
instance

Int_Import
Leg ack

Int_Export
Leg ack

Result:=
Pass
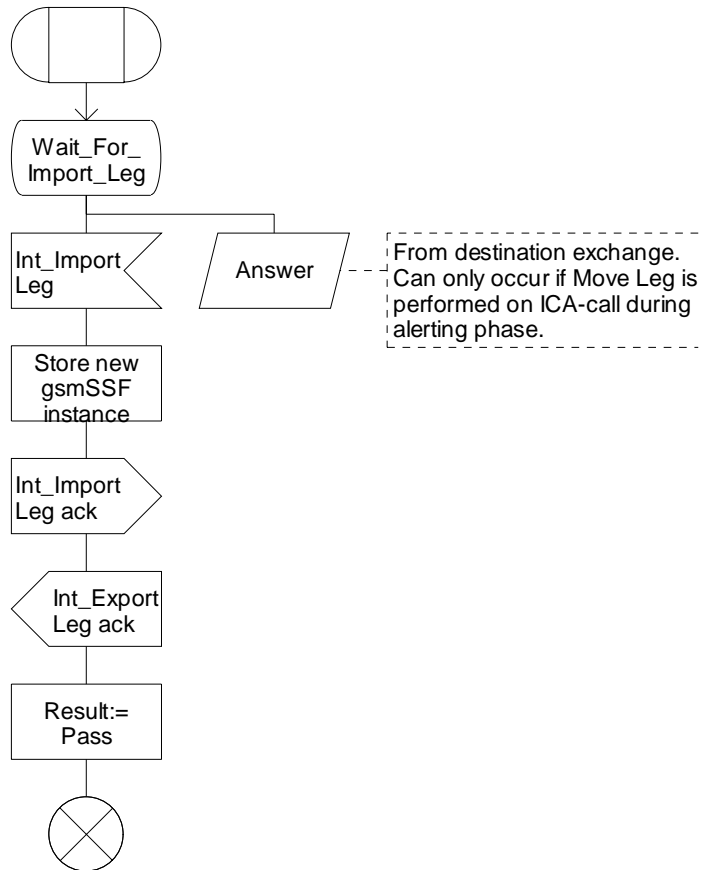
Figure 4.34-1: Procedure CAMEL_EXPORT_LEG_MSC (sheet 1)

Procedure CAMEL_EXPORT_LEG_MSC 2(2)

/* A procedure in the MSC to change the call segment for a leg. */

/* Signals to/from the left are to/from the BSS. Signals to/from the right are to/from the originating of destination exchange.*/

Wait_For_Import_Leg

This can be received if the procedure was called from CAMEL_OCH_LEG1_MSC or CAMEL_ICH_LEG2_MSC

Release Transaction

Release

This can be received if the procedure was not called from CAMEL_OCH_LEG1_MSC or CAMEL_ICH_LEG2_MSC

Result:= Fail
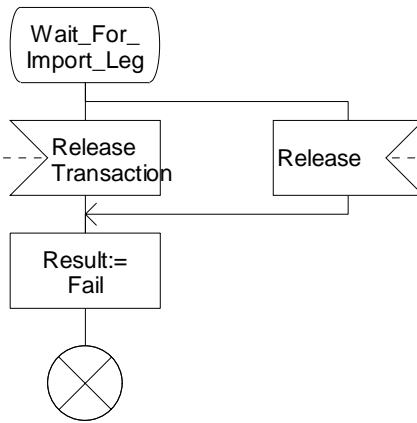
Figure 4.34-2: Procedure CAMEL_EXPORT_LEG_MSC (sheet 2)

Process CAMEL_CHANGE_OF_POSITION_MSC 1(1)

/* Process to handle handover indicatin within MSC */

/* Signals to/from left are to/from the handover process in MSC; signals to/from right are to/from either CAMEL_O_CHANGE_OF_POSITION_MSC or CAMEL_T_CHANGE_OF_POSITION_MSC. */

Null

RELOCATION_REQUEST_ACKNOWLEDGE,
HANDOVER_COMPLETE,
HANDOVER_PERFORMED

Process
CAMEL_O_CHANGE_OF_POSITION_MSC or
CAMEL_T_CHANGE_OF_POSITION_MSC
exists for this subscriber?

No

Yes

Relay signal

Null
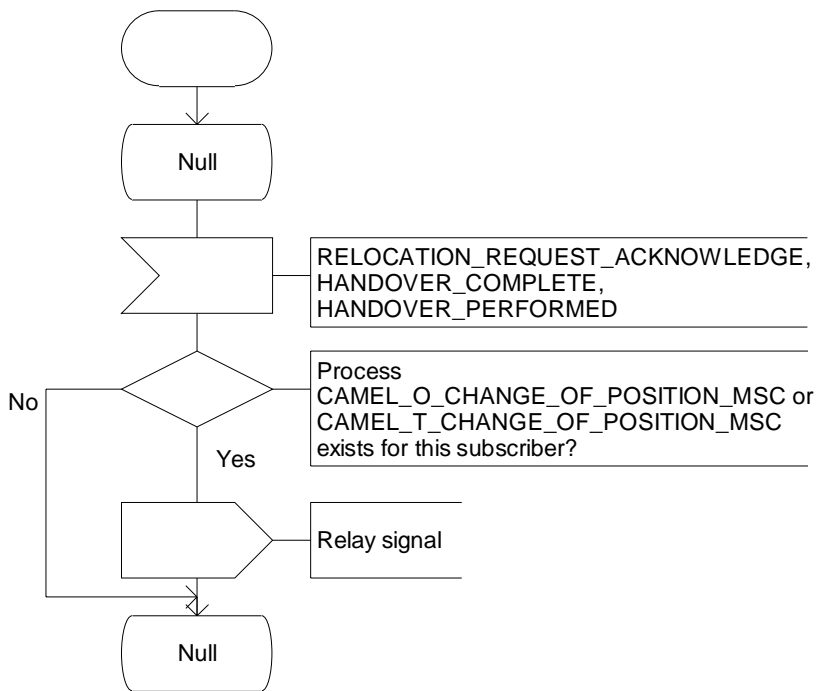
Figure 4.35-1: Process CAMEL_CHANGE_OF_POSITION_MSC (sheet 1)

Process CAMEL_O_CHANGE_OF_POSITION_MSC 1(2)

/* Process in the MSC to handle location information of the MO call */

/* Signals to/from left are to/from the process CAMEL_CHANGE_OF_POSITION_MSC; signals to/from the right are to/from the gsmSSF, unless otherwise stated. */

Idle

Int_Invoke_O_Change_Of_Position_MSC (Monitor Mode)

Monitor Mode

Notify & continue — Other

Subscriber currently in UMTS radio network?

No — Yes

Idle

LOCATION_REPORTING_CONTROL

To RNC
Request type := "change of service area"

Position_Monitoring

Int_gsmSSF_Instance

From Procedure CAMEL_OCH_LEG1_MSC

Store new gsmSSF instance

Position_Monitoring
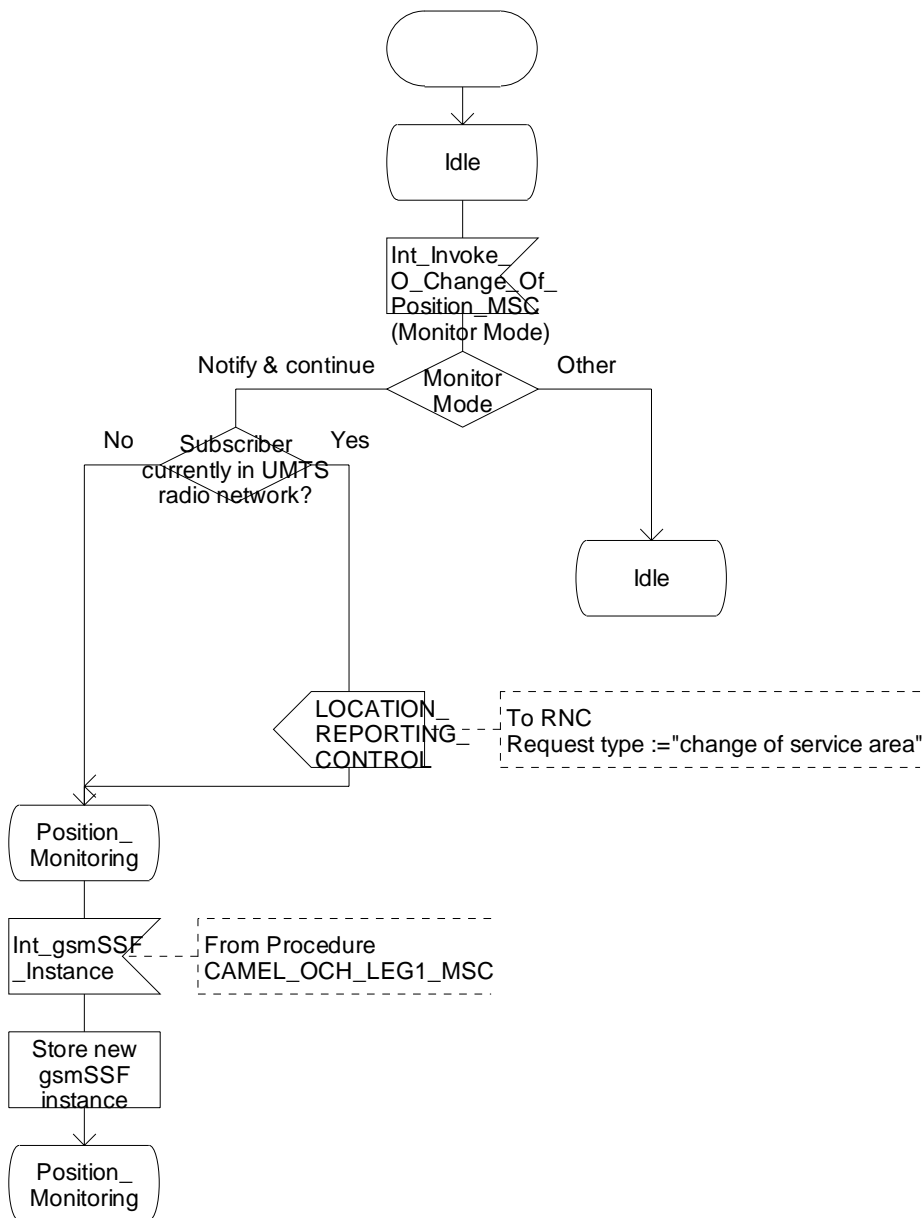
Figure 4.36-1: Process CAMEL_O_CHANGE_OF_POSITION_MSC (sheet 1)

Process CAMEL_O_CHANGE_OF_POSITION_MSC 2(2)

/* Process in the MSC to handle location information of the MO call */

/* Signals to/from left are to/from the process CAMEL_CHANGE_OF_POSITION_MSC; signals to/from the right are to/from the gsmSSF, unless otherwise stated. */

HANDOVER_COMPLETE, HANDOVER_PERFORMED

Position_Monitoring

LOCATION_REPORT

RELOCATION_REQUEST_ACKNOWLEDGE

Int_Invoke_O_Change_Of_Position_MSC ("Transparent")

Obtain current position

No   Subscriber currently in UMTS radio network?   Yes

Int_O_Change_Of_Position

LOCATION_REPORTING_CONTROL

Int_O_Change_Of_Position

LOCATION_REPORTING_CONTROL

From RNC

Position_Monitoring

Idle

To RNC
Request type:=
"change of service area"

To RNC
Request type:="stop"

Figure 4.36-2: Process CAMEL_O_CHANGE_OF_POSITION_MSC (sheet 2)

ETSI

4.5.2.2   Handling of mobile originating calls in the originating VLR

The functional behaviour of the originating VLR is specified in 3GPP TS 23.018 [12]. The procedure specific to CAMEL are specified in this subclause:

- Procedure CAMEL_OCH_VLR;

- Process CAMEL_Reconnected_Call_VLR.

Procedure CAMEL_OCH_VLR   1(1)

Procedure in the VLR
to handle an outgoing call stup

/* Signals to/from the left are
to/from the MSC */

O-CSI or D-CSI present
or N-CSI available received?

No

Yes

Result:=
pass

Complete Call

Wait_for_
SIFOC_2

Abort

Send Info
For Outgoing
Call

Result:=
fail

Result:=
pass
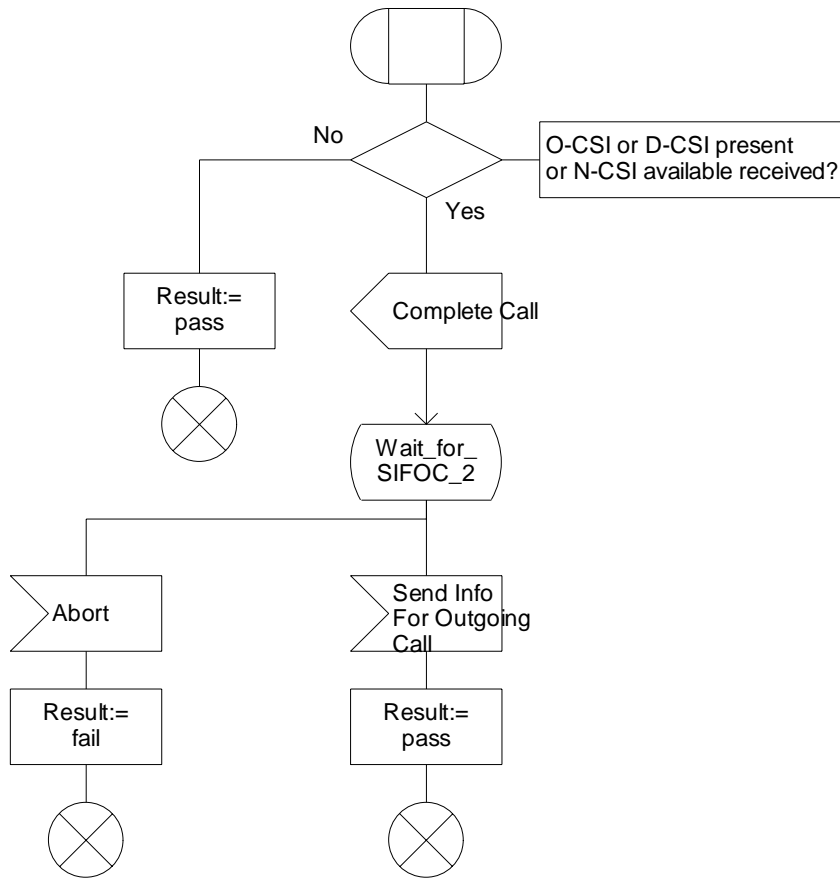
Figure 4.37-1: Procedure CAMEL_OCH_VLR (sheet 1)

Process CAMEL_Reconnected_Call_VLR 1(1)

Process in the VLR
to handle Send_Info_
For_Reconnected_Call

Signals to/from the left are
to/from the MSC.

Idle

Send Info For
Reconnected
Call

Check_OG_
Barring

Check ODB and SS barring.
Specified in 3GPP TS 23.018

Result=
Call barred?

No

Send Info For
Reconnected
Call Ack

Idle

Yes

Set error:=
Call barred

Send Info For
Reconnected Call
Negative Response

Idle
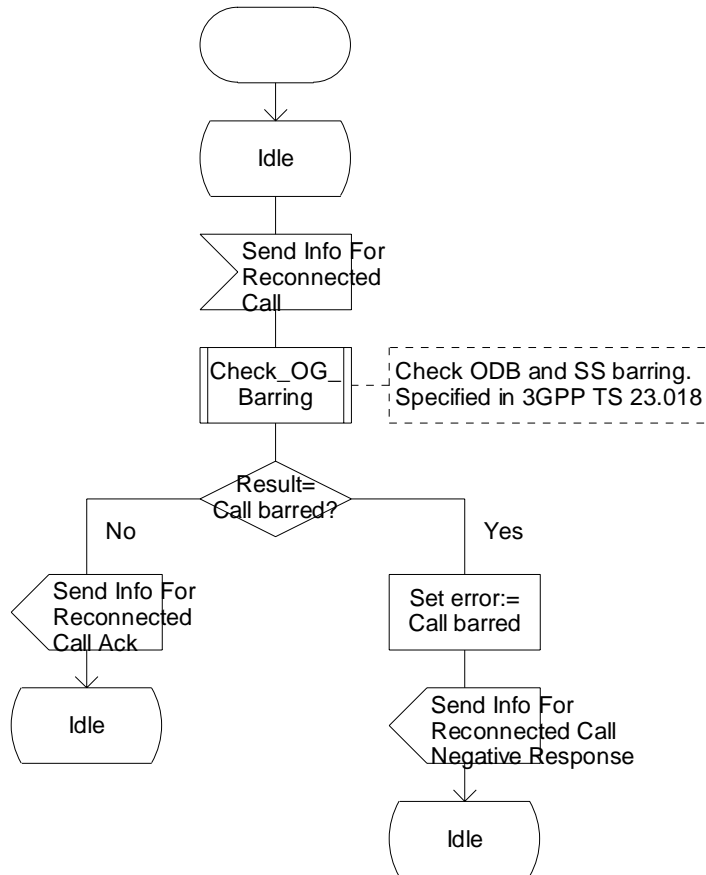
Figure 4.38-1: Process CAMEL_Reconnected_Call_VLR (sheet 1)

4.5.3 Retrieval of routeing information

4.5.3.1 Retrieval of routeing information in the GMSC

The functional behaviour of the GMSC is specified in 3GPP TS 23.018 [12]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_Set_ORA_Parameters;

- Procedure CAMEL_MT_GMSC_INIT;

- Procedure CAMEL_MT_MSC_ALERTING;

- Procedure CAMEL_MT_GMSC_ANSWER;

- Procedure CAMEL_MT_GMSC_DISC1;

- Procedure CAMEL_MT_GMSC_DISC2;

- Procedure CAMEL_MT_GMSC_DISC3;

- Procedure CAMEL_MT_GMSC_DISC4;

- Procedure CAMEL_MT_GMSC_DISC5;

- Procedure CAMEL_MT_GMSC_DISC6;

- Procedure CAMEL_MT_CTR;

- Procedure CAMEL_MT_ETC;

- Procedure CAMEL_Start_TNRy;

- Procedure CAMEL_Stop_TNRy;

- Procedure CAMEL_MT_GMSC_Notify_CF;

- Procedure CAMEL_MT_LEG2_GMSC;

- Process CAMEL_MT_LEG1_GMSC;

- Procedure CAMEL_MT_RECONNECT_GMSC.

    NOTE: Procedure CAMEL_MT_GMSC_DISC3 applies to CAMEL Phase 1 only.

The procedure Send_ACM_If_Required is specified in 3GPP TS 23.018 [12].

The procedure CAMEL_MT_LEG2_GMSC supervises the terminating party only. The process CAMEL_MT_LEG1_GMSC supervises the originating party only. Hence, signals from the destination exchange are received by the procedure CAMEL_MT_LEG2_GMSC and signals from the originating exchange are received by the process CAMEL_MT_LEG1_GMSC.

The following paragraphs give details on the behaviour of the GMSC in the procedure CAMEL_MT_GMSC_INIT.

4.5.3.1.1 Action of the GMSC on receipt of Int_Release_Call

An ISUP Release message is sent to the originating exchange and resources are released.

4.5.3.1.2 Action of the GMSC on receipt of Int_Error

The GMSC checks the default call handling parameter in the T-CSI.

If the default call handling is release call, an ISUP Release message is sent to the originating exchange. The MSC then releases all call resources and the procedure CAMEL_MT_GMSC_INIT returns result=fail.

If the default call handling is continue call, the MSC continues call handling without CAMEL support.

4.5.3.1.3 Action of the GMSC on receipt of Int_Continue

If an FTN has been stored then the information received from the HLR is used to overwrite the corresponding call parameters. Note that the MSISDN is replaced by the FTN as the called party number. The redirection counter is incremented.

If no FTN has been stored then a Send Routeing Info information flow including a T-CSI suppression parameter is sent to the HLR. The Send Routing Info information flow includes an indication of which CAMEL Phases are supported by the GMSC/gsmSSF.

4.5.3.1.4 Action of the GMSC on receipt of Int_Continue_With_Argument

If an FTN has been stored then the information received from the HLR is used to overwrite the corresponding call parameters. The MSISDN is replaced by the FTN as the called party number. The redirection counter is incremented.

If no FTN has been stored then a Send Routeing Info information flow including a T-CSI suppression parameter is sent to the HLR. The Send Routing Info information flow includes an indication of which CAMEL phases are supported by the GMSC/gsmSSF.

The MSC shall replace the call parameters by the information received in the Int_Continue_With_Argument signal. Call parameters which are not included in the Int_Continue_With_Argument message are unchanged.

Signalling limitations or regulatory requirements may require the Calling Partys Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

4.5.3.1.5 Action of the GMSC on receipt of Int_Connect

If the Destination Number received from the gsmSCF (via the gsmSSF) is the same as the ISUP called party number, i.e. the MSISDN, the following parameters, if received, are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [36]): Calling Partys Category and Generic Number. If received, the Announcement Suppression Indicator is stored. The further processing is described in subclause 4.5.3.1.3 with the addition that the Announcement Suppression indicator, if stored, is sent to the HLR in the Send Routeing Info message.

If:

-   the Destination Number received from the gsmSCF (via the gsmSSF) is not the same as the stored ISUP called party number, i.e. the MSISDN, and

-   a CUG active indication was received from the HLR, and

-   CUG information was received in the ISUP IAM for the incoming call;

then an exception event is reported to the process CS_gsmSSF, an ISUP Release Message is sent to the originating exchange. The MSC then releases all call resources and the procedure CAMEL_MT_GMSC_INIT returns result=fail.

Otherwise the following parameters, if received, are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [36]): Destination Number, Calling Partys Category, Generic Number, Original Called Party ID, Redirecting Party ID and Redirection Information. Call parameters that are not included in the Int_Connect signal are unchanged.

As a network operator option loop prevention mechanisms may cause the redirection information to be ignored or modified (e.g., if the Redirection counter has been decreased).

Signalling limitations or regulatory requirements may require the Calling Partys Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

The network signalling system shall indicate that this is an internal network number.

4.5.3.1.6 Action of the GMSC on receipt of Send_Routeing_Info Negative Response (in state Wait_For_Routeing_Info_2)

An exception event is reported to the process CS_gsmSSF. If the Announcement Suppression indicator has been received from the gsmSCF (via the gsmSSF) any announcements or tones shall be suppressed.

4.5.3.1.7 Action of the GMSC on receipt of Send_Routeing_Info ack with MSRN (in state Wait_For_Routeing_Info_2)

An ISUP IAM with the MSRN as the called party number is constructed.

4.5.3.1.8 Action of the GMSC on receipt of Send_Routeing_Info ack with FTN (in state Wait_For_Routeing_Info_2)

The information received from the HLR is used to overwrite the corresponding call parameters (for details see 3GPP TS 23.018 [12]). The redirection counter is incremented.

4.5.3.1.9 Action of the GMSC on receipt of Send_Routeing_Info ack with O-CSI and/or D-CSI and FTN (at state Wait_For_Routeing_Info_2)

The information received from the HLR is used to overwrite corresponding call parameters. The redirection counter is incremented. The Called Party Number is set to the FTN. The O-CSI and/or D-CSI is stored.

4.5.3.1.10 Action of the GMSC in procedure CAMEL_MT_ETC

In the procedure CAMEL_MT_ETC (sheet 2) the GMSC will remain in the Wait_For_Assiting_Answer state until it receives an ISUP Answer Message (ANM) or timeout occurs. This is to ensure that a call record is always generated for every successful establishment of a temporary connection to a gsmSRF, especially in the case where the connection is between PLMNs.

> NOTE: This means that it may not be possible to access an SRF which does not generate an ISUP Answer Message (ANM).

If a Progress Message is sent towards the MS the progress indicator shall indicate "In Band Information".

4.5.3.1.11 Action of the GMSC in procedure CAMEL_MT_GMSC_Notify_CF

The Forwarding reason is taken from the Send Routeing Info ack information flow (for early call forwarding) or the Resume Call Handling information flow (for Optimal Routeing of Late Call Forwarding).

The Int_DP_T_No_Answer signal and Int_DP_T_Busy signal include a parameter to indicate that the call has encountered conditional call forwarding. The gsmSSF will transfer this parameter to the Event Report BCSM information flow which it sends to the gsmSCF.

4.5.3.1.12 Action of the MSC on receipt of Int_Disconnect_Leg (Leg 2)

If the MSC receives Int_Disconnect_Leg (Leg 2) signal from the gsmSSF, in response to an Initial DP information flow, the MSC will continue the handling of the calling party (Leg1) without routeing the call to a destination.

Procedure CAMEL_Set_ORA_Parameters 1(1)

/* Procedure in the GMSC
to set CAMEL parameters for
the procedure Obtain_Routeing_Address. */

Call reference
Number
allocated ?

No

Allocate Call
reference number

Yes
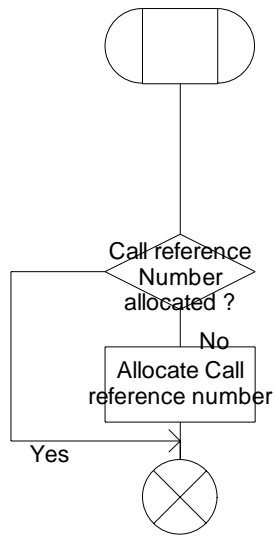
Figure 4.39-1: Procedure CAMEL_Set_ORA_Parameters (sheet 1)

ETSI

Procedure CAMEL_MT_GMSC_INIT   1(8)

/* Process in the GMSC to perform CAMEL handling for a terminating call request */

/* Signals to/from the right are to/from the gsmSSF. */

Reconnect= true? — Yes → (2)

No

CAMEL information Received in SRIack? — No → MSRN received?

Yes

MSRN received? — No → FTN Received?

yes

FTN Received? — yes

No

Result:= MSRN ⊗

Result:= GSM_FTN ⊗

Result:= Fail ⊗

Content of SRI ack

| T-CSI | T-CSI O-CSI and/or D-CSI | T-CSI FTN | FTN T-CSI O-CSI and/or D-CSI | FTN O-CSI and/or D-CSI |

set CSI=T-CSI

Set CSI=T-CSI

Set CSI=T-CSI

Set CSI=T-CSI

Set CSI=O-CSI and/or D-CSI

Store O-CSI and/or D-CSI

Store FTN

Store O-CSI and/or D-CSI & FTN

set redirection information

Result:= GSM_FTN

⊗

Int_Invoke gsmSSF (T-CSI)

wait_for_ gsmSSF_Invoked

Figure 4.40-1: Procedure CAMEL_MT_GMSC_INIT (sheet 1)

ETSI

Procedure CAMEL_MT_GMSC_INIT 2(8)

/* Process in the GMSC to perform CAMEL handling for a terminating call request */

Signals to/from the left are to/from the orginating exchange; signals to/from the right are to/from the gsmSSF
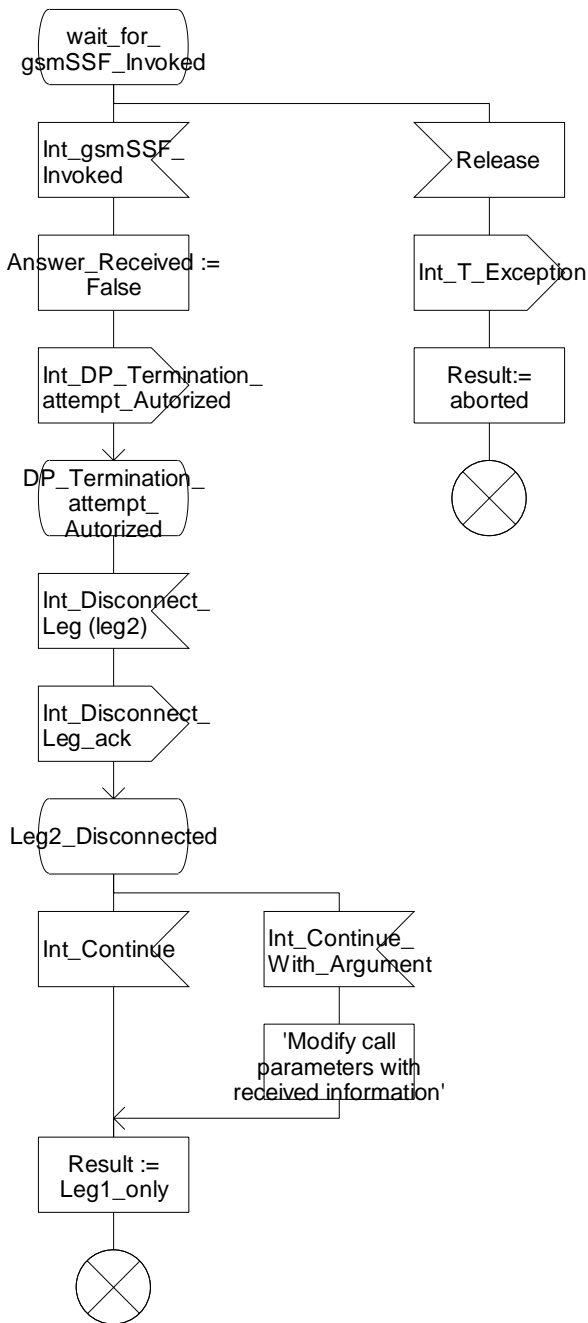
Figure 4.40-2: Procedure CAMEL_MT_GMSC_INIT (sheet 2)

Procedure CAMEL_MT_GMSC_INIT   3(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

DP_Termination_
Attempt
_Authorised

Int_Continue_
With
_Argument

Int_Continue

Int_Connect

'Modify call
parameters with
received information'

2

Send_ACM_
If_Required

Procedure defined
in 3GPP TS 23.018

Yes   Destination
Number=
called MSISDN

No

1   Modify call
parameters
with received
information.

Original
Called Party Subscribed
To CUG?

Yes

No

CAMEL_
Modify
_CUG_Info

FTN
stored ?

Yes

No

CAMEL_CHECK
_SII2_CDTI

No   CUG info
received in
incoming call?

No   Result=
Pass

Modify call
parameters
with received
information

Yes

CFU   Type of
Call forwarding?

Yes

Set T-CSI
suppression

Others

Set redirection
information

FTN:=
Destination Routing
Address

Int_Exception

CLI_MT_
GMSC

Int_DP_T_Busy

Result:=
GSM_FTN

Result:=
CAMEL_FTN

Result:=
fail

Send
Routeing
Info

DP_T_Busy

See 3GPP TS 23.081

Wair_For_
Routeing
_Info_2

To HLR

Figure 4.40-3: Procedure CAMEL_MT_GMSC_INIT (sheet 3)

Procedure CAMEL_MT_GMSC_INIT 4(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

Signals to/from the left are to/from
the originating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

DP_Termination_Attempt_Authorised,
Leg2_Disconnected

Leg2_Disconnected

DP_Termination_Attempt_Authorised,
Leg2_Disconnected

Release

Int_Disconnect_
Leg (leg1)

Int_ReleaseCall

Int_Error

Int_DP_
_T_Abandon

Int_Disconnect_
Leg_ack

Leg2_Disconnected?

Yes

No

DP_T_Abandon

Default Call
Handling = Continue
Call?

Int_continue

Int_Continue_
With_Argument

No

Yes

Result:=
fail

1

Result:=
aborted
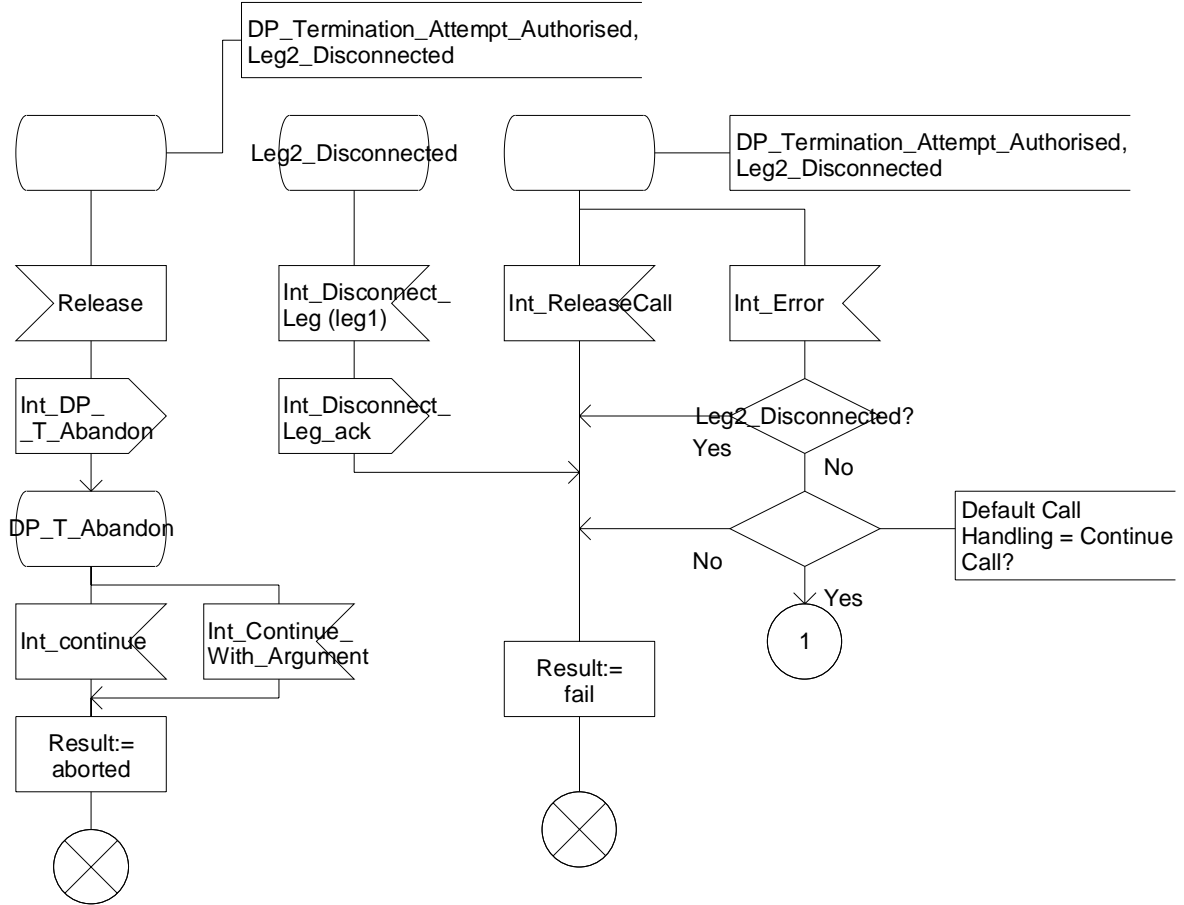
Figure 4.40-4: Procedure CAMEL_MT_GMSC_INIT (sheet 4)

Procedure CAMEL_MT_GMSC_INIT   5(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

Signals to/from the right are to/from
the gsmSSF.

DP_Termination_Attempt_Authorised,
DP_T_Busy,
Leg2_Disconnected

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No   Yes

Result:=
fail

-
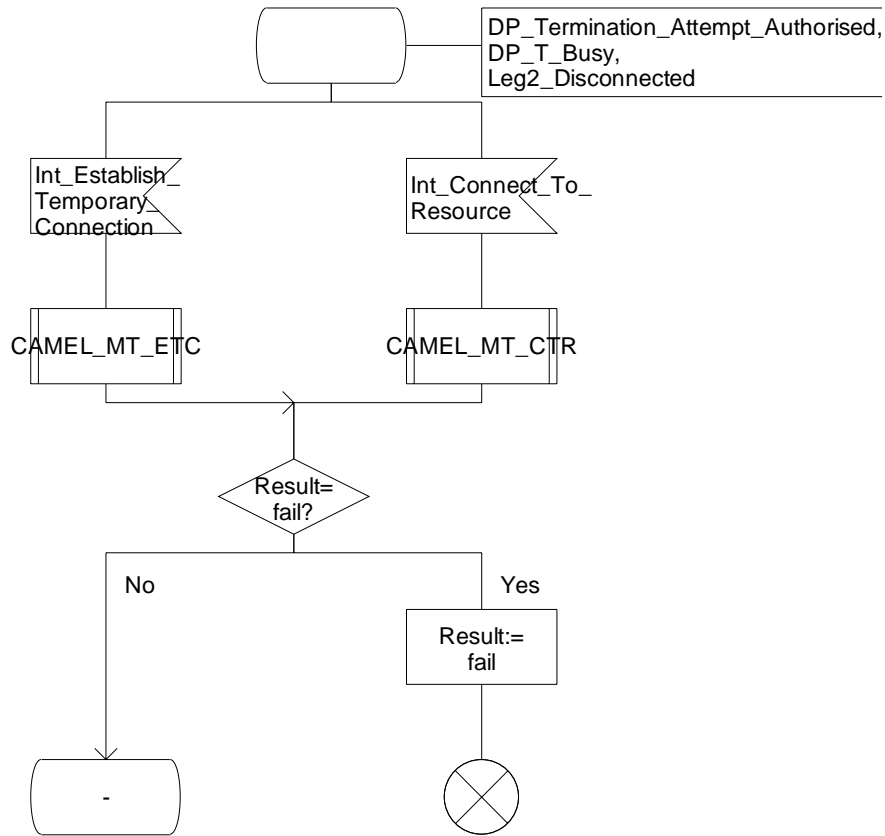
Figure 4.40-5: Procedure CAMEL_MT_GMSC_INIT (sheet 5)

Procedure CAMEL_MT_GMSC_INIT   6(8)

Process in the GMSC
to perform CAMEL handling
for a terminating call request

Signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

Wait_For_
Routeing_
Info_2

Send Routeing
Info   From HLR
Negative Response

Int_Release_Call

Int_DP_T_Busy

DP_T_Busy

Result=
Fail

⊗
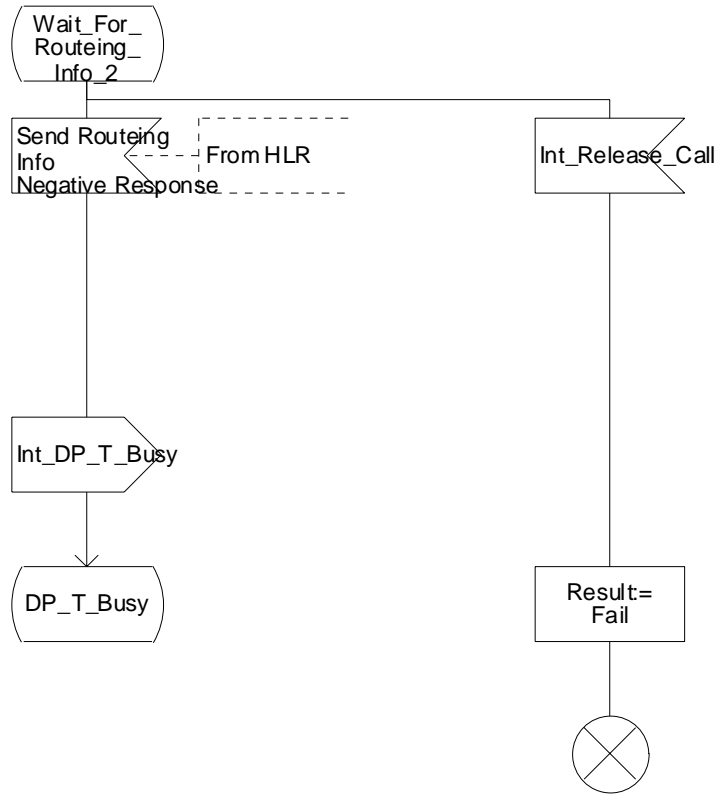
Figure 4.40-6: Procedure CAMEL_MT_GMSC_INIT (sheet 6)

Procedure CAMEL_MT_GMSC_INIT 7(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

/* Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated. */

Wait_For_
Routeing
__Info_2

Send Routeing
Info Ack
/* FTN */   From HLR

Send Routeing
Info Ack
/* FTN, O-CSI
and/or D-CSI */   From HLR

Send Routeing
Info Ack
/* MSRN */   From HLR

Store O-CSI
and/or D-CSI

Set redirection
information

Result:=
MSRN

Result:=
GSM_FTN
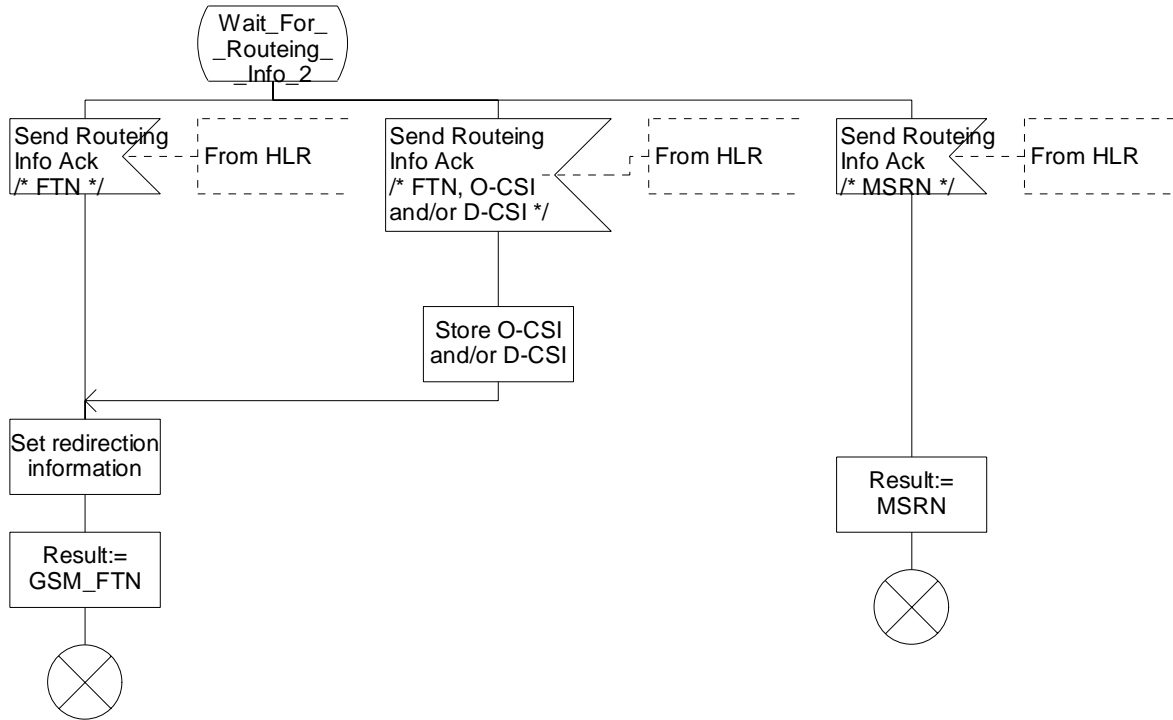
Figure 4.40-7: Procedure CAMEL_MT_GMSC_INIT (sheet 7)

Procedure CAMEL_MT_GMSC_INIT 8(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

DP_T_busy

| Release | Int_Release | Int_Error | Int_Continue | Int_Continue_With_Argument | Int_Connect |

Int_T_Abandon

Result:=
fail

Int_T_Exception
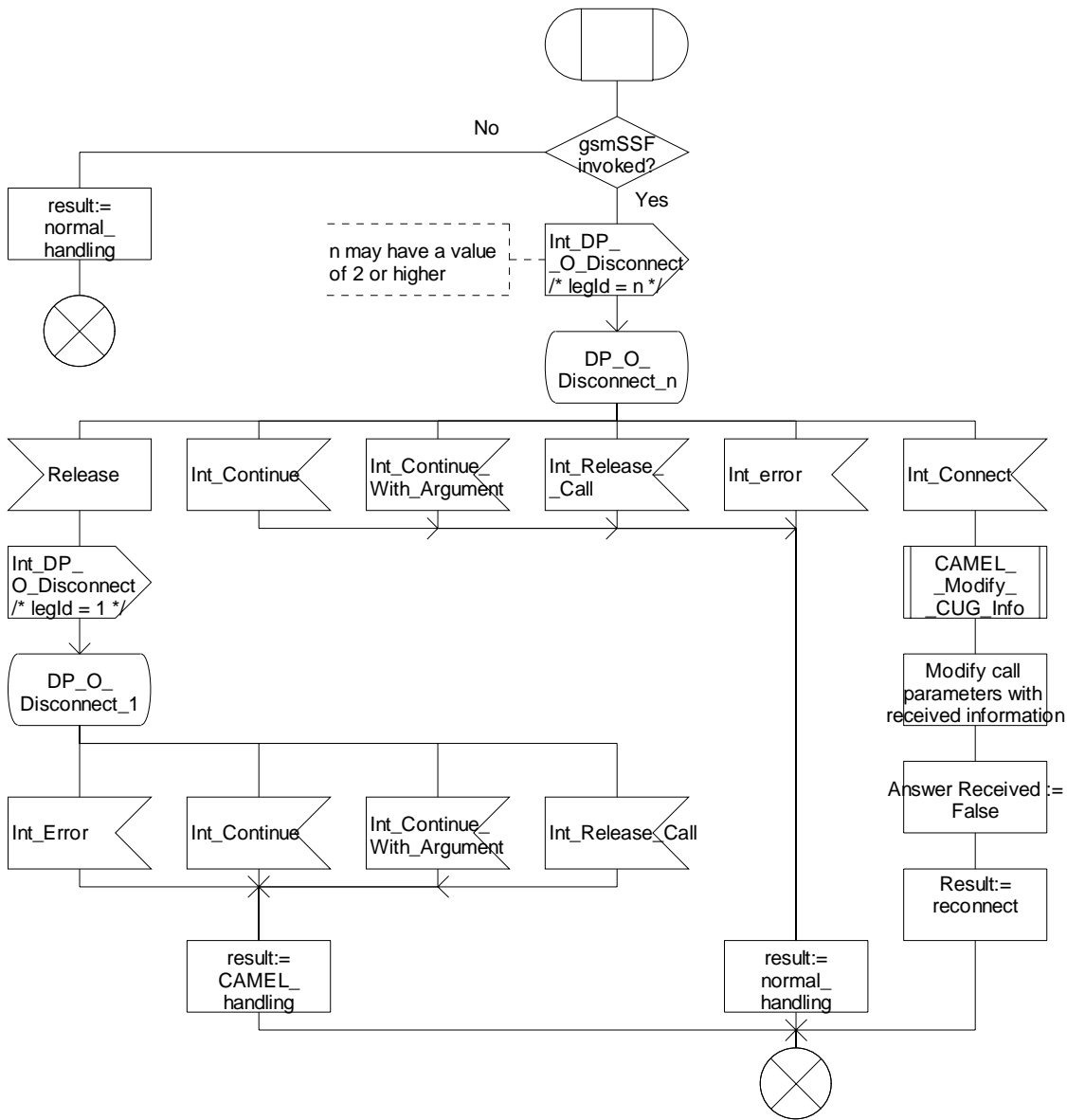
DP_T_Abandon

Result:=
fail

2

Figure 4.40-8: Procedure CAMEL_MT_GMSC_INIT (sheet 8)

Procedure CAMEL_MT_MSC_ALERTING 1(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the terminating exchange if not otherwise stated. */

gsmSSF invoked?

No

Result:= pass

Yes

Int_DP_Call _Accepted → to gsmSSF

DP_T_Call_Accepted → from gsmSSF

Answer

Connect

Int_Continue With_Argument

Int_continue

Int_Release

From BSS

Release

From destination exchange

Result=: Answer

Result:= pass

Result:= release
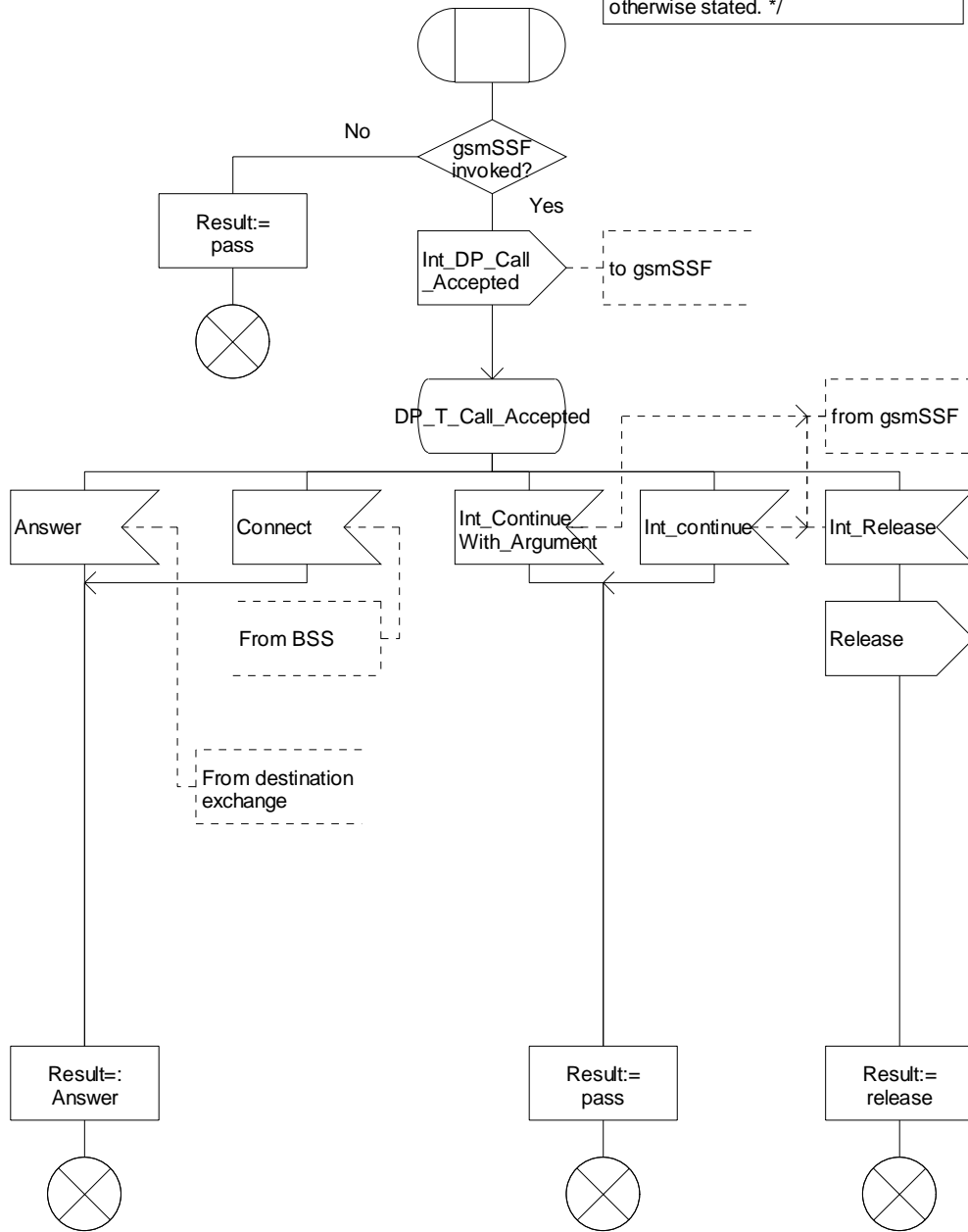
Figure 4.41-1: Procedure CAMEL_MT_MSC_ALERTING (sheet 1)

Procedure CAMEL_MT_MSC_ALERTING 2(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the terminating exchange if not otherwise stated. */
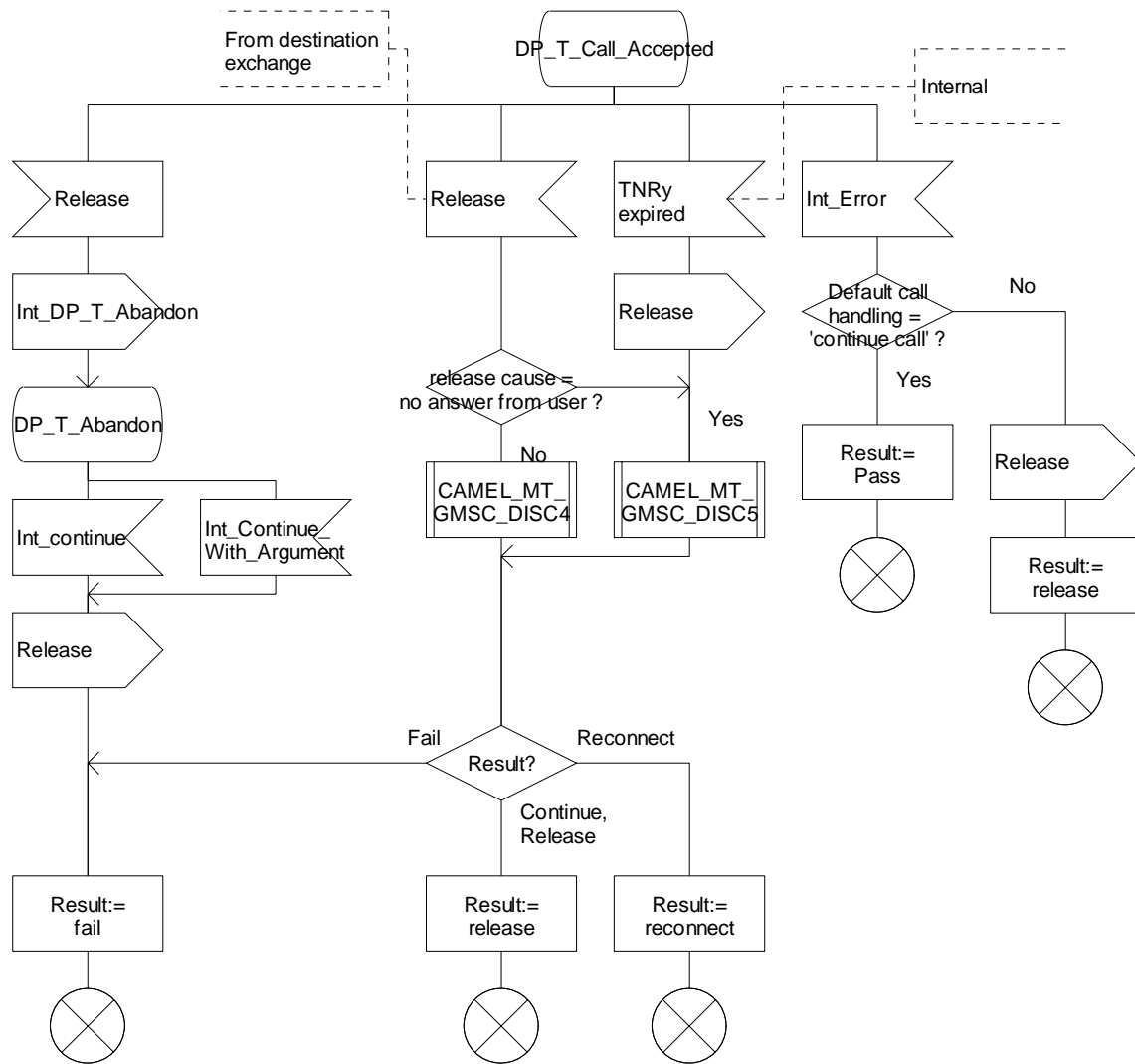
Figure 4.41-2: Procedure CAMEL_MT_MSC_ALERTING (sheet 2)

Procedure CAMEL_MT_MSC_ALERTING 3(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the terminating exchange if not otherwise stated. */

DP_T_Call_Accepted

From gsmSSF

Int_Establish_ Temporary_ Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result?

Fail

Answer

ELSE

Result := fail

Result := Answer

-
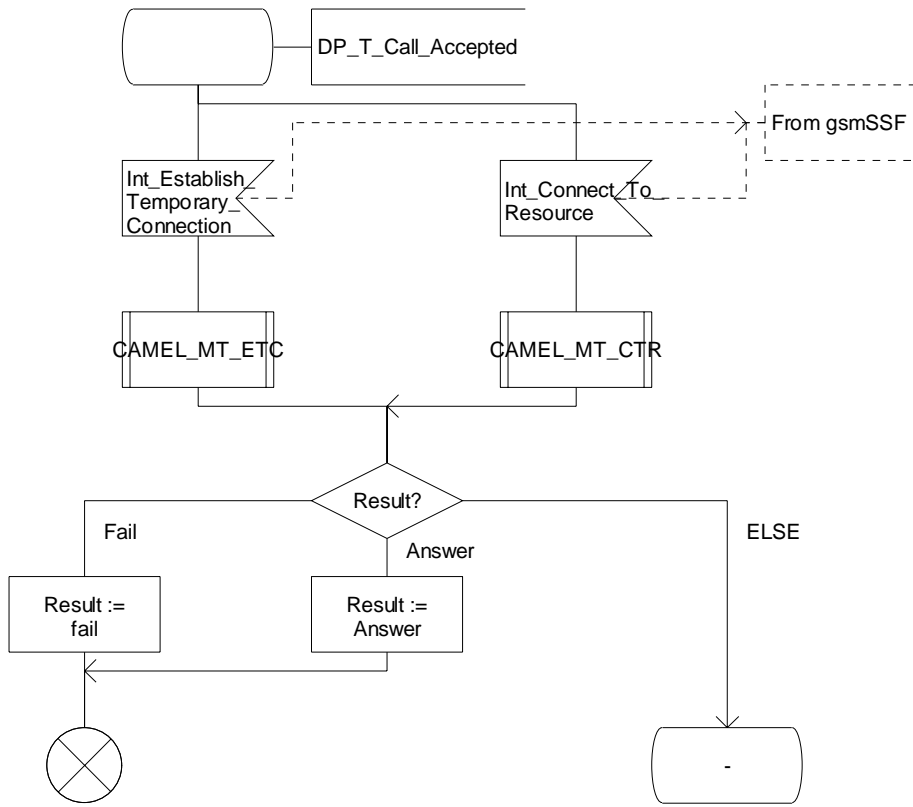
Figure 4.41-3: Procedure CAMEL_MT_MSC_ALERTING (sheet 3)

Procedure CAMEL_MT_GMSC_ANSWER 1(3)

/* Process in the GMSC to handle a terminating call request */

/* Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the terminating exchange if not otherwise stated. */

gsmSSF invoked?

no

Result:=
pass

yes

Int_DP_T_Answer - - - to gsmSSF

Answer Received :=
True

DP_T_Answer

Int_Release

Release

Result:=
release

Int_Continue_
With_Argument

Int_continue

from gsmSSF

Result:=
pass

Release

CAMEL_MT_
GMSC_DISC1

Result=
CAMEL_handling?

Yes

No

Release

Result:=
fail

Release

CAMEL_MT_
GMSC_DISC2

Result=
reconnect?

Yes

Yes

No

Result=
CAMEL_handling?

No

Result:=
release

Answer Received :=
False

Result:=
reconnect
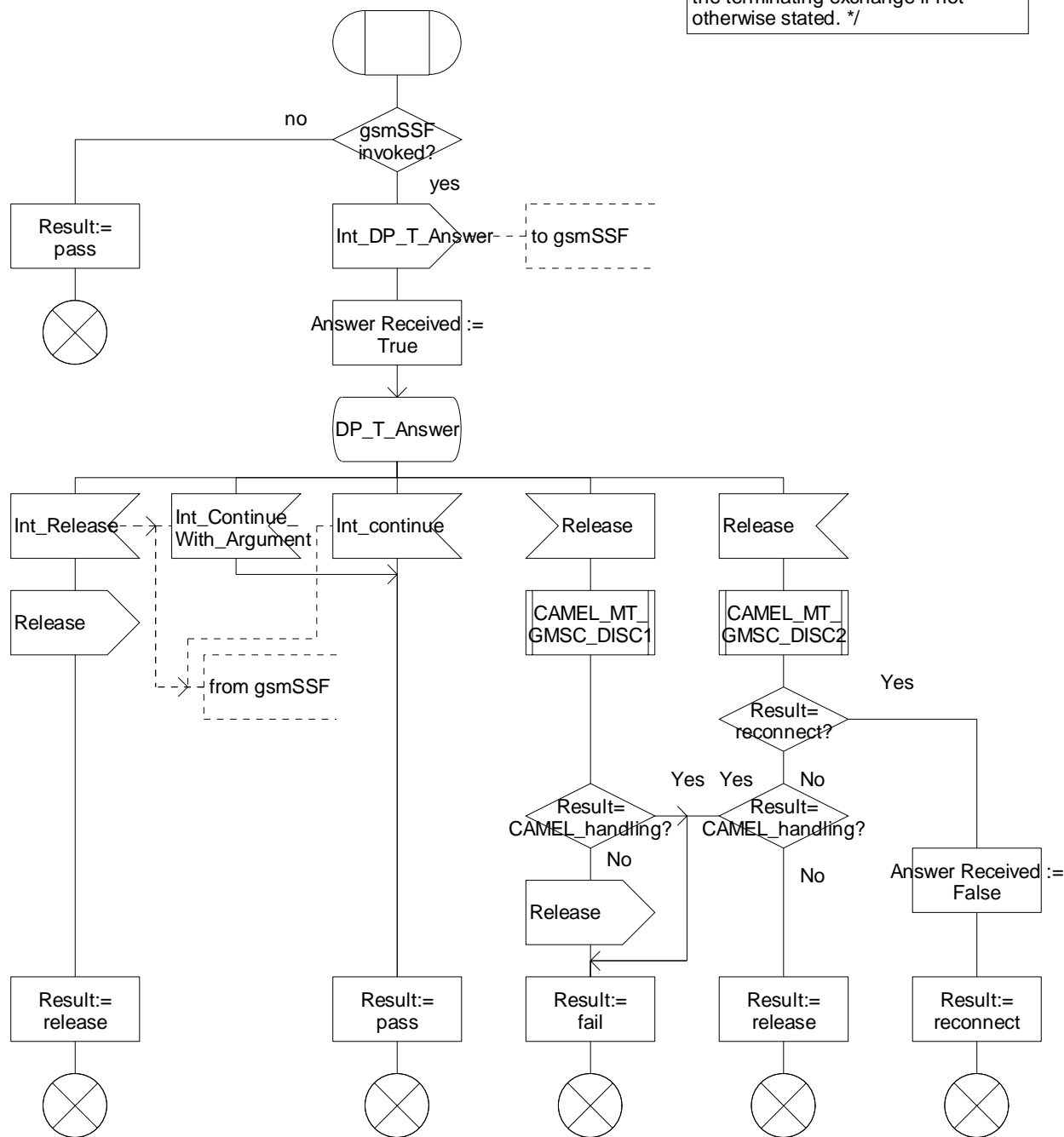
Figure 4.42-1: Procedure CAMEL_MT_GMSC_ANSWER (sheet 1)

Procedure CAMEL_MT_GMSC_ANSWER 2(3)

/* Process in the GMSC
to handle a
terminating call request */

/* Signals to/from the left are to/from
the originating exchange;
signals to/from the right are to/from
the terminating exchange if not
otherwise stated. */

DP_T_Answer

Int_Error

No ◇ Default call handling =
continue call ?

Yes

Release

Result:=
release

Result:=
Pass

⊗ ⊗
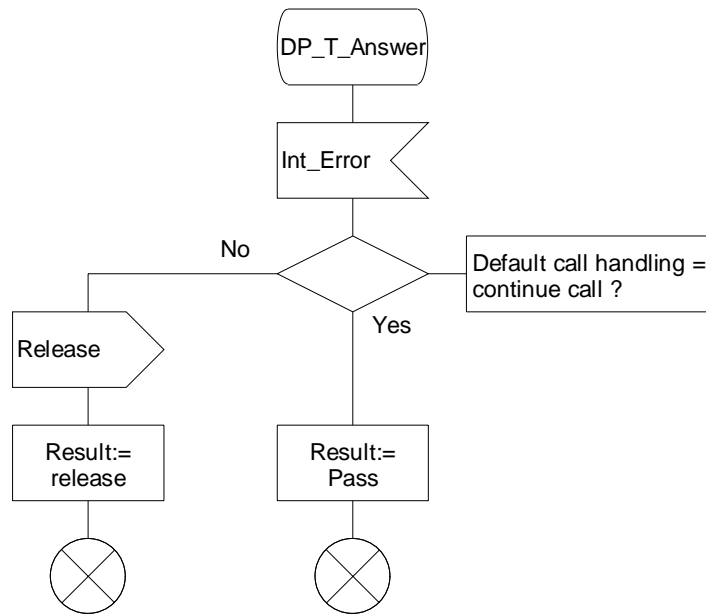
Figure 4.42-2: Procedure CAMEL_MT_GMSC_ANSWER (sheet 2)

Procedure CAMEL_MT_GMSC_ANSWER 3(3)

/* Process in the GMSC to handle a terminating call request */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_T_Answer

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result= fail?

No

Yes

Result:= fail

-
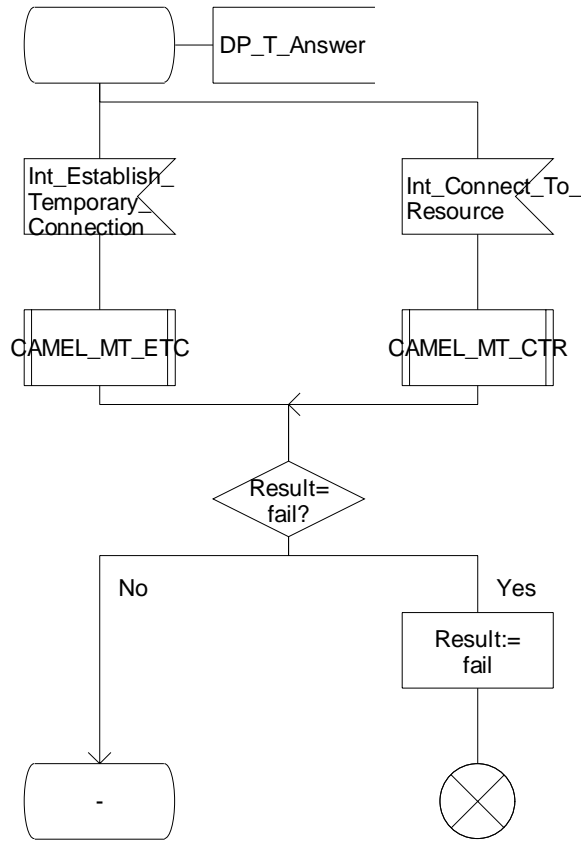
Figure 4.42-3: Procedure CAMEL_MT_GMSC_ANSWER (sheet 3)

Procedure CAMEL_MT_GMSC_DISC1 1(1)

/* Process in the GMSC to handle a terminating call request */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No

Yes

Int_DP_T_Disconnect /* legId = 1 */

DP_T_Disconnect_1

Int_Error

Int_Release_Call

Int_Continue

Release

From destination exchange or process MT_CF_MSC

Result:= normal_handling

Int_DP_T_Disconnect /* legId = 2 */

DP_T_Disconnect

Int_Continue

Int_Error

Int_ReleaseCall

Result:= CAMEL_Handling
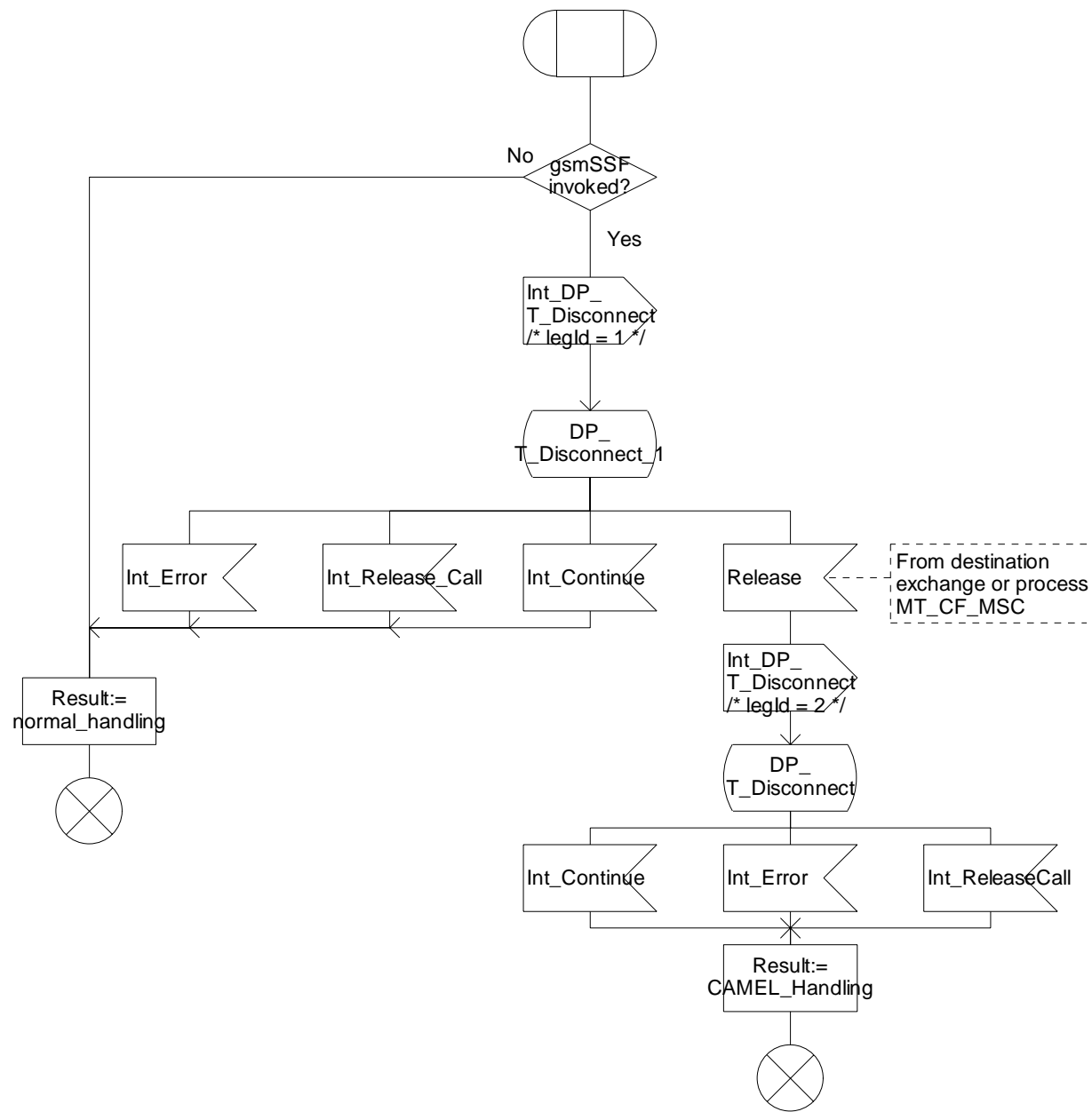
Figure 4.43-1: Procedure CAMEL_MT_GMSC_DISC1 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC2

1(2)

/* Process in the GMSC to handle a terminating call request */

/* Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No → Result:= normal_handling

Yes → Int_DP_ T_Disconnect /* legId = 2 */

DP_ T_Disconnect_2

Int_Connect → Answer Received := False → CAMEL_ _Modify_ _CUG_Info → Modify call parameters with received information → Result:= reconnect

Int_Error

Int_Release_Call / **Int_Continue** → Result:= normal_handling

Int_Continue_ With_Argument

Release → Int_DP_ T_Disconnect /* legId = 1 */ → DP_ T_Disconnect

Int_Continue / **Int_Continue_ With_Argument** / **Int_Error** / **Int_ReleaseCall** → Result:= CAMEL_handling
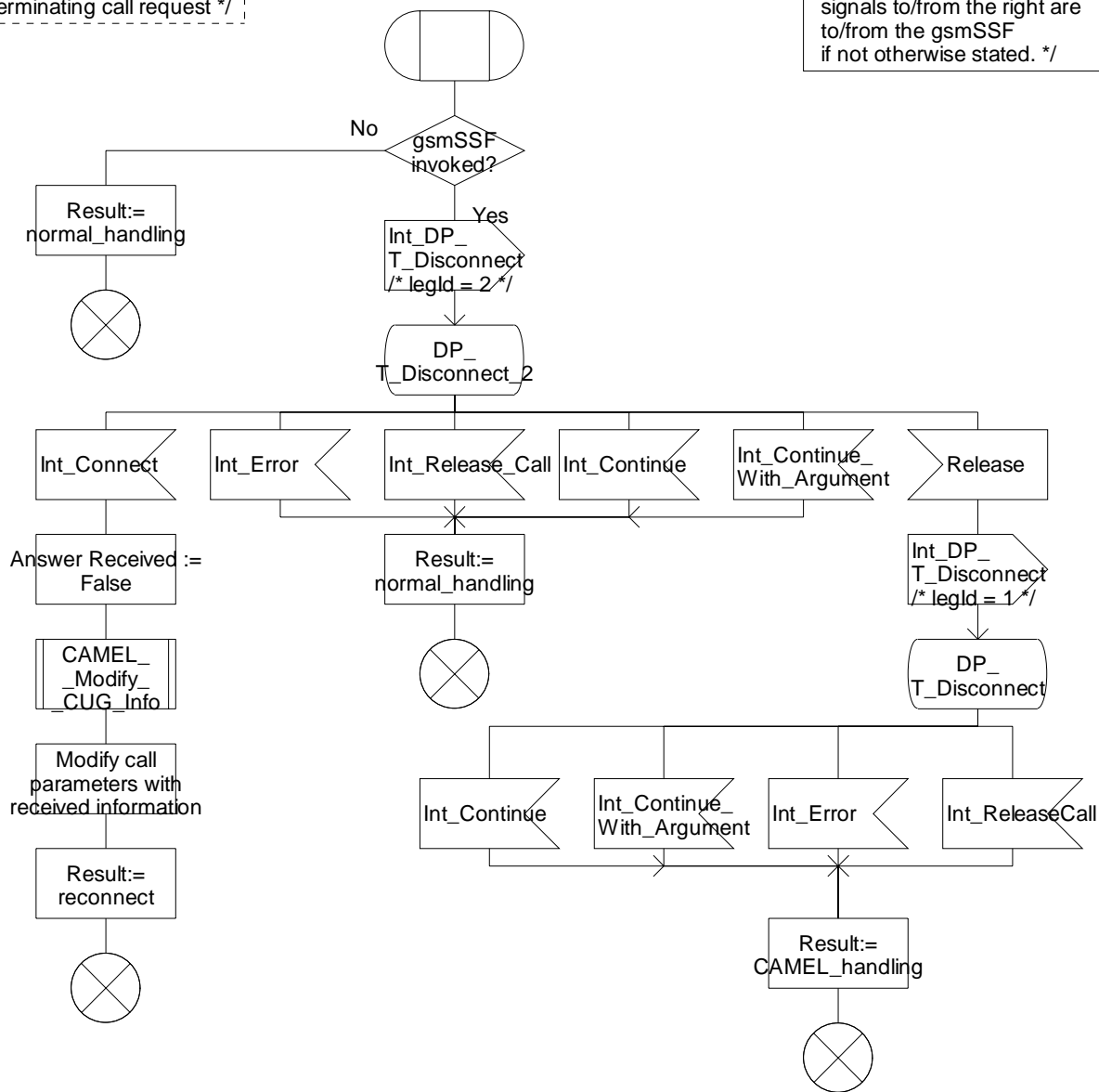
Figure 4.44-1: Procedure CAMEL_MT_GMSC_DISC2 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC2   2(2)

/* Process in the GMSC
to handle a
terminating call request */

/*Signals to/from
the right are to/from the
gsmSSF.*/

DP_T_Disconnect_2

Int_Establish_
Temporary_Connection

Int_Connect_
To_Ressource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No

DP_T_Disconnect_2

Yes

Result:=
fail

⊗
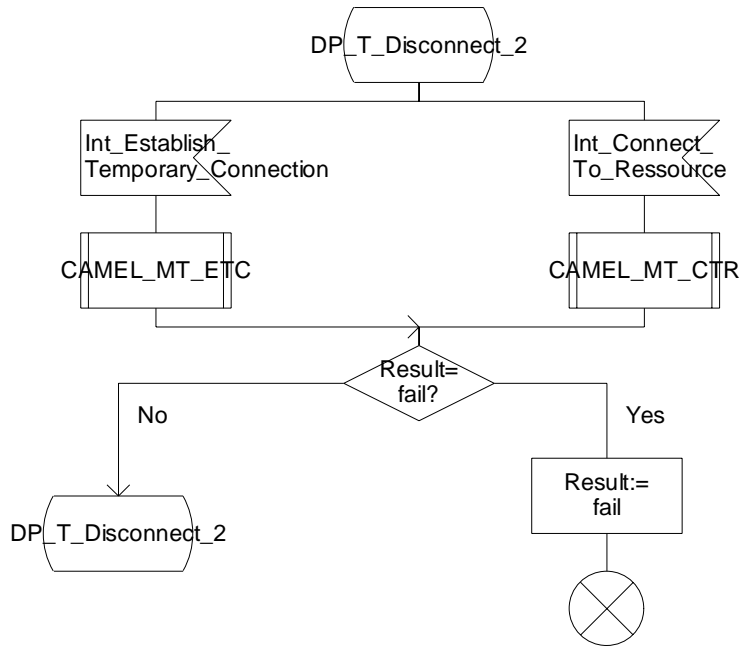
Figure 4.44-2: Procedure CAMEL_MT_GMSC_DISC2 (sheet 2)

Procedure CAMEL_MT_GMSC_DISC3   CAMTD3_1(1)

Procedure in the GMSC to handle
premature release of a CAMEL call

gsmSSF
exists?

No

Yes

Int_T_
Exception ----- To gsmSSF
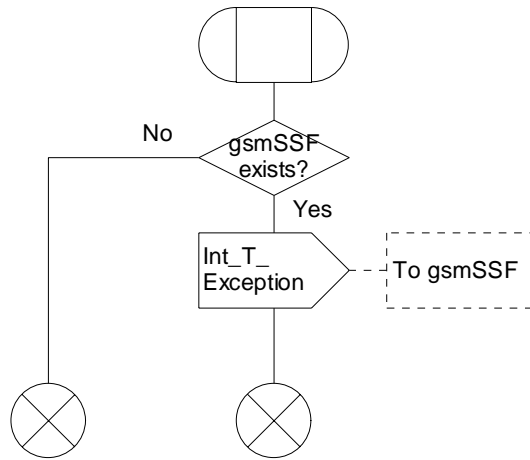
Figure 4.45-1: Procedure CAMEL_MT_GMSC_DISC3 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC4 1(3)

/* Procedure in the GMSC to handle a terminating call request */

/* Signals to/from the left are to/from the orginating exchange; signals to/from the right are to/from the gsmSSF. */

gsmSSF invoked?

No

Result:= fail

Yes

Int_DP_T_Busy

DP_T_Busy

Int_Connect

CAMEL_ _Modify_ _CUG_Info

Modify call parameters with received information

Result:= reconnect

Int_Continue

Int_Continue_ With_Argument

Int_Error

Int_Release_Call

Result:= fail
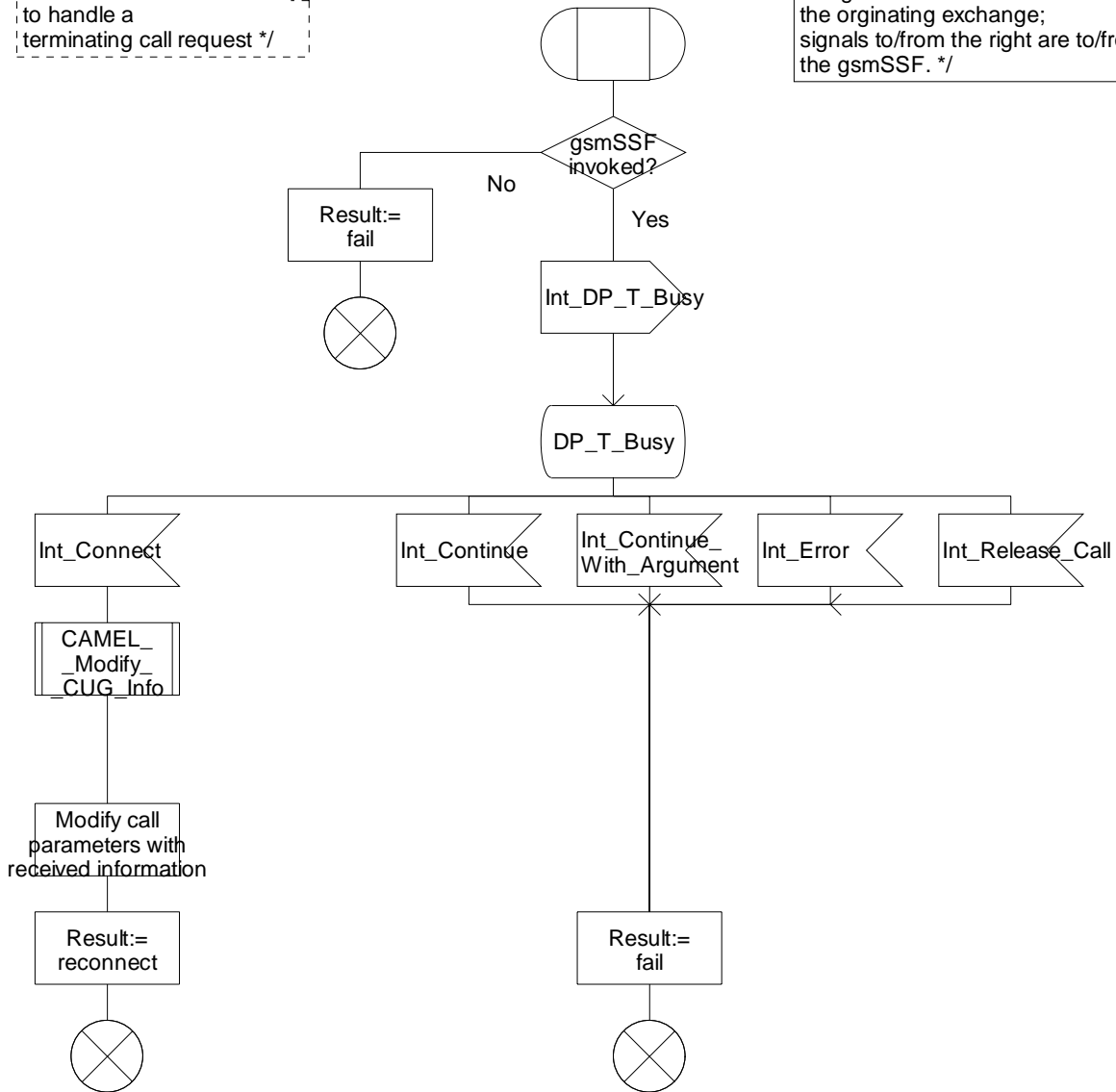
Figure 4.46-1: Procedure CAMEL_MT_GMSC_DISC4 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC4 2(3)

/* Procedure in the GMSC to handle a terminating call request */

Signals to/from the right are to/from the gsmSSF if not otherwise stated.

DP_T_Busy

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result= fail?

No

Yes

Result:= fail

-

⊗
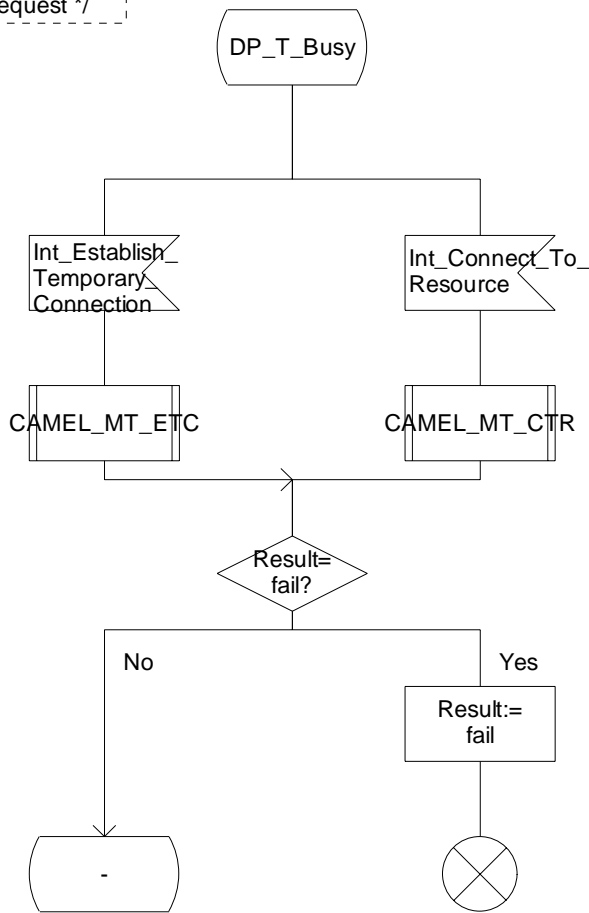
Figure 4.46-2: Procedure CAMEL_MT_GMSC_DISC4 (sheet 2)

Procedure CAMEL_MT_GMSC_DISC4   3(3)

/* Procedure in the GMSC
to handle a
terminating call request */

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF.

DP_T_Busy

Release

Int_DP_T_Abandon

DP_T_Abandon

Int_continue   Int_Continue_
                                    With_Argument

Result:=
fail

⊗
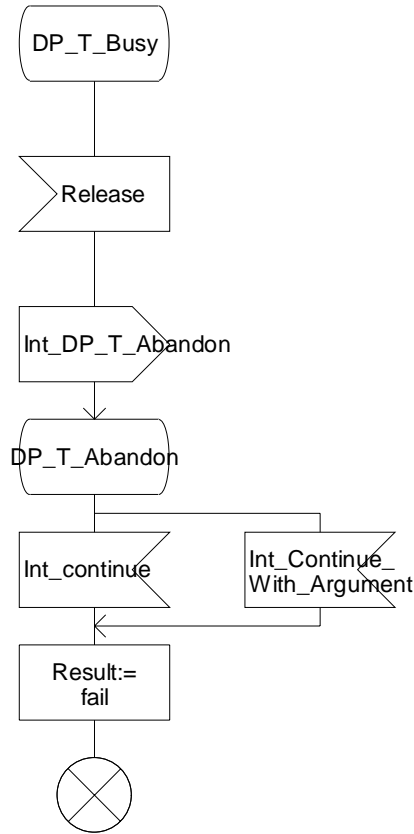
Figure 4.46-3: Procedure CAMEL_MT_GMSC_DISC4 (sheet 3)

Procedure CAMEL_MT_GMSC_DISC5 1(3)

Process in the GMSC to handle a terminating call request

Signals to/from the right are to/from the gsmSSF; if not otherwise stated.
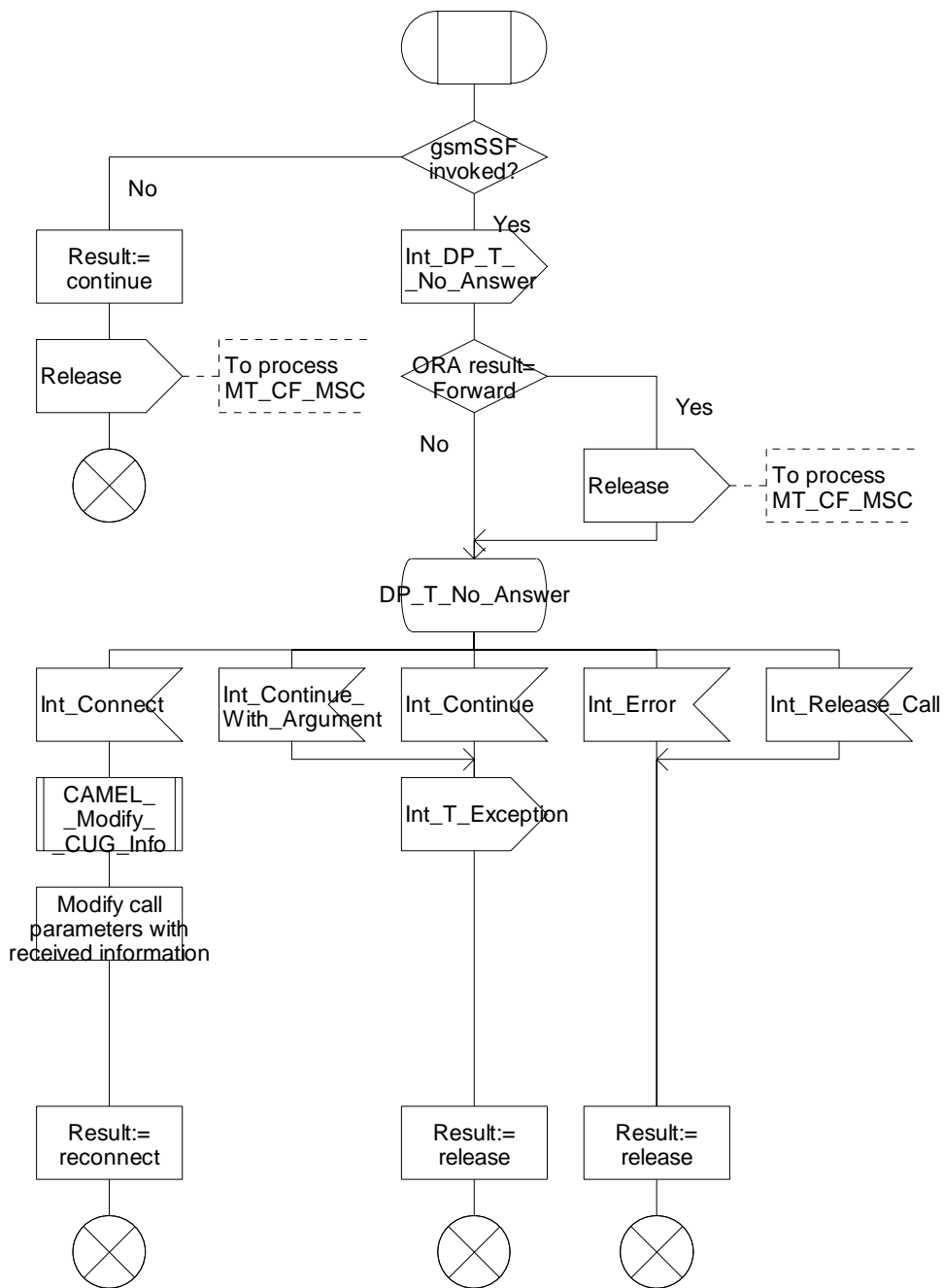
Figure 4.47-1: Procedure CAMEL_MT_GMSC_DISC5 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC5 2(3)

Process in the GMSC to handle a terminating call request

Signals to/from the right are to/from the gsmSSF if not otherwise stated.

DP_T_No_Answer

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result= fail?

No

Yes

Result:= release

DP_T_No_Answer
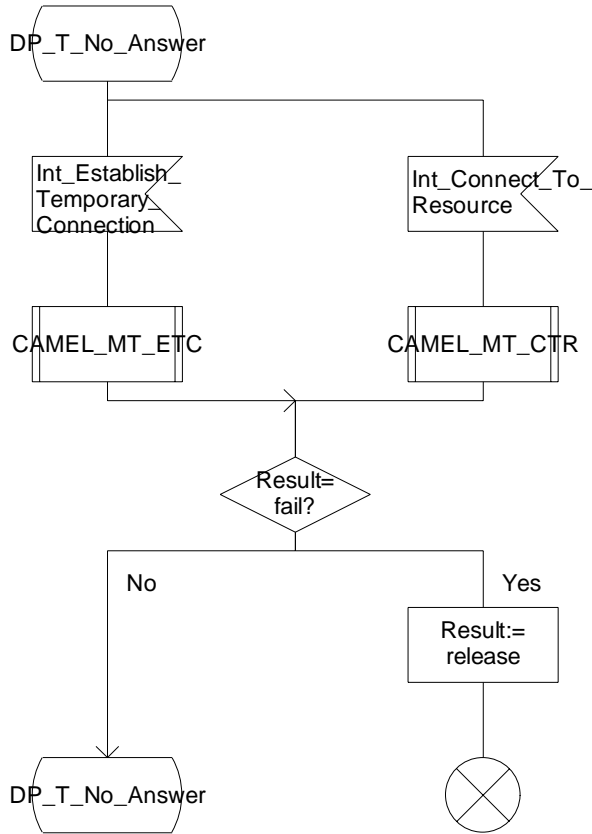
Figure 4.47-2: Procedure CAMEL_MT_GMSC_DISC5 (sheet 2)

Procedure CAMEL_MT_GMSC_DISC5   3(3)

Process in the GMSC
to handle a
terminating call request

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

DP_T_No_Answer

Release

Int_DP_T_Abandon

DP_T_Abandon

Int_continue

Int_Continue_
With_Argument

Result:=
fail
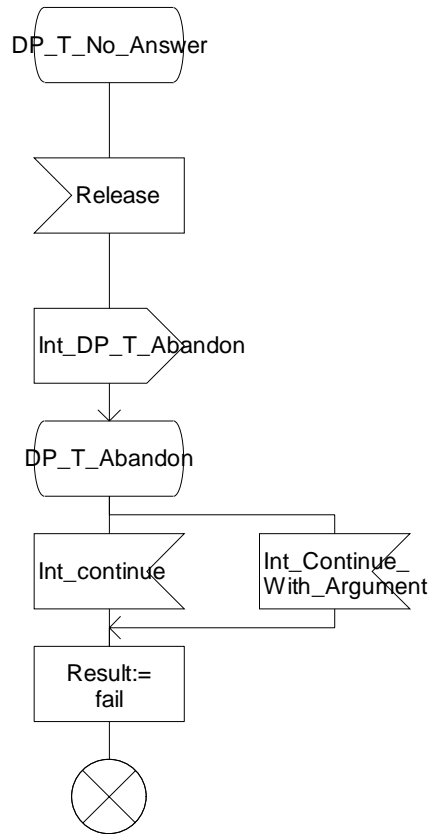
Figure 4.47-3: Procedure CAMEL_MT_GMSC_DISC5 (sheet 3)

Procedure CAMEL_MT_GMSC_DISC6   1(1)

/* Process in the GMSC
to handle a
terminating call request */

/* Signals to/from the right are to/from
the gsmSSF;
if not otherwise stated. */

gsmSSF
invoked?

No

Yes

Result:=
continue

Int_DP_T_Abandon

DP_T_Abandon

Int_continue

Int_Continue_
With_Argument

Result:=
fail
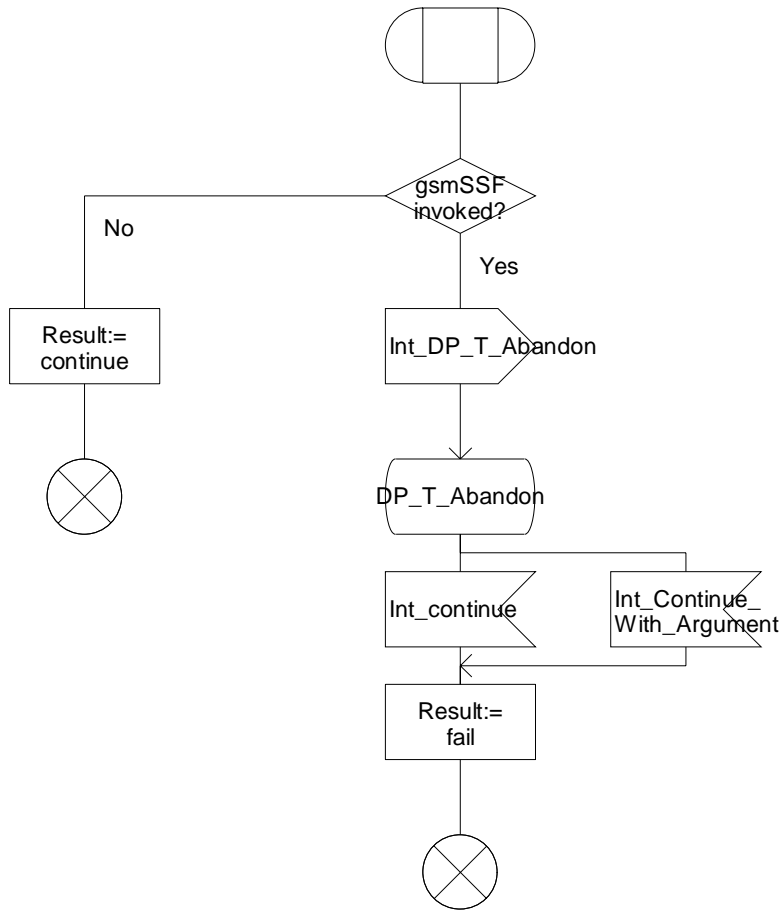
Figure 4.48-1: Procedure CAMEL_MT_GMSC_DISC6 (sheet 1)
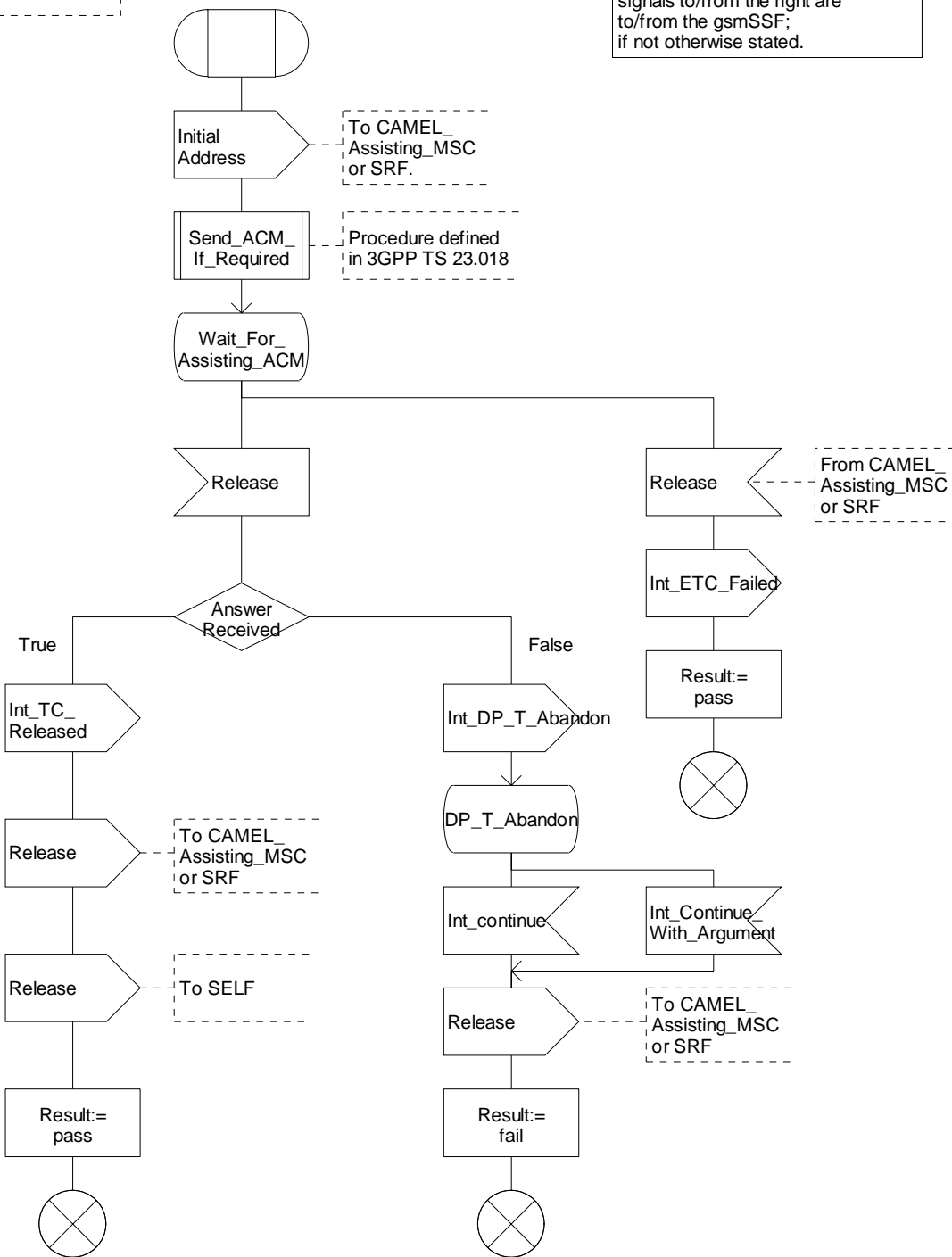
Figure 4.49-1: Procedure CAMEL_MT_ETC (sheet 1)

Procedure CAMEL_MT_ETC 2(4)

Procedure in the GMSC to handle a temporary connection

Signals to/from the left are to/from the originationg exchange; signals to/from the right are to/from the CAMEL_Assisting_MSC or SRF.

Wait_For_Assisting_ACM

Address Complete

Connect

Wait_For_Assisting_Answer

Answer

Bothway through connection required?

No

Yes

Send_Answer_If_Required

Send_ACM_If_Required

Progress

Bothway through connection required?

No

Yes

Send_Network_Connect_If_Required
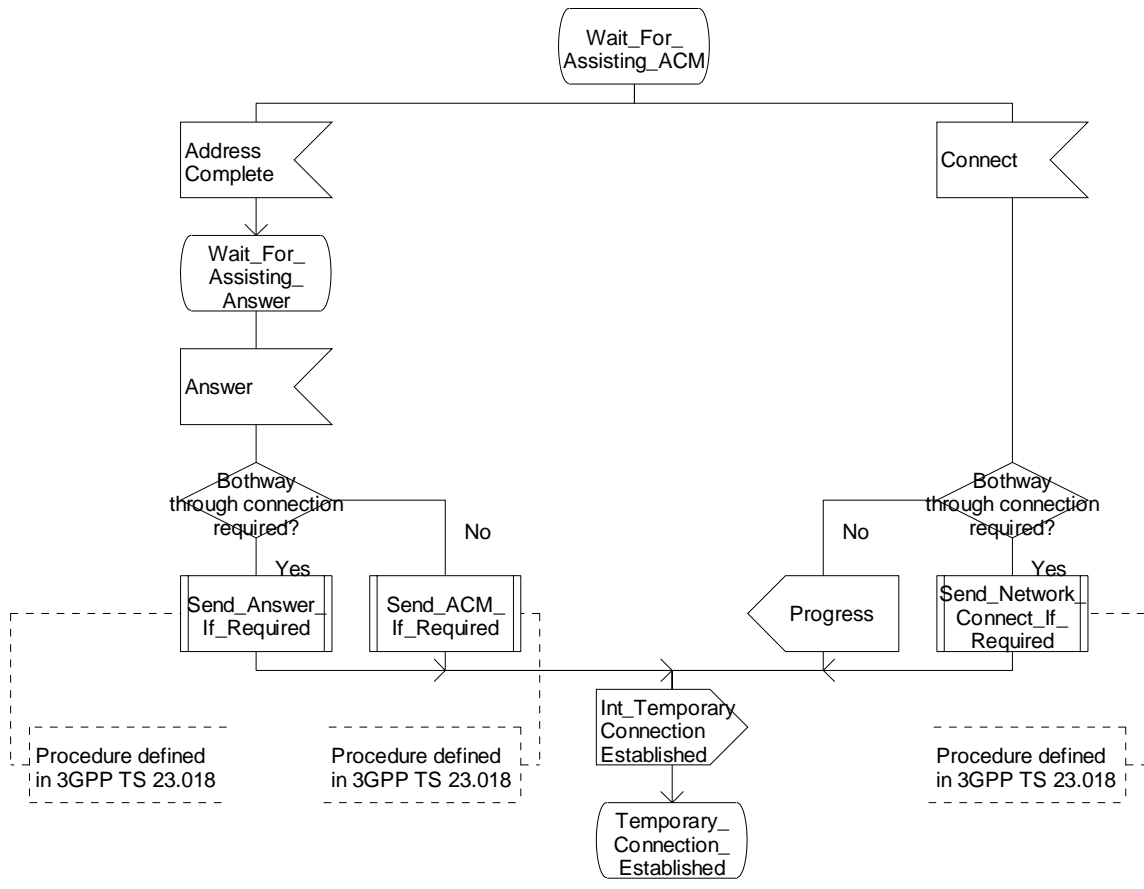
Procedure defined in 3GPP TS 23.018

Procedure defined in 3GPP TS 23.018

Int_Temporary Connection Established

Procedure defined in 3GPP TS 23.018

Temporary_Connection_Established

Figure 4.49-2: Procedure CAMEL_MT_ETC (sheet 2)

Procedure CAMEL_MT_ETC 3(4)

Procedure in the GMSC to handle a temporary connection

Signals to/from the left are to/from the orinating exchange; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

Temporary_Connection_Established
Wait_For_Assisting_Answer

Release

Answer Received

True / false

Int_DP_T_Abandon

DP_T_Abandon

Int_TC_Released

Release — To CAMEL_Assisting_MSC or SRF

Release — To SELF

Result := pass

Release ← From CAMEL_Assisting_MSC or SRF

Int_TC_Released

Result:= pass

Int_Disconnect_Forward_Connection

Int_TC_Released

Release — To CAMEL_Assisting_MSC or SRF

Result:= pass
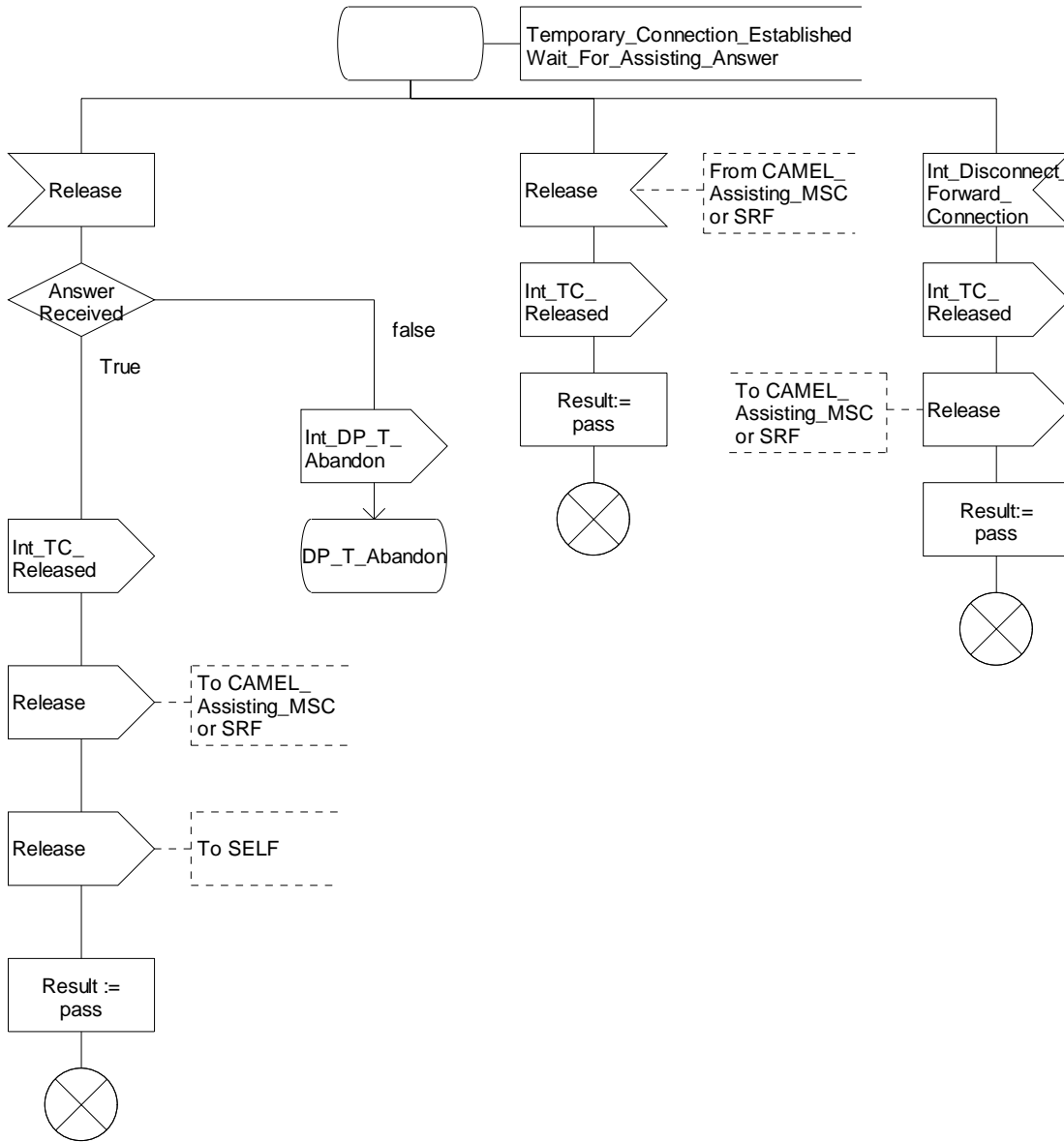
Figure 4.49-3: Procedure CAMEL_MT_ETC (sheet 3)
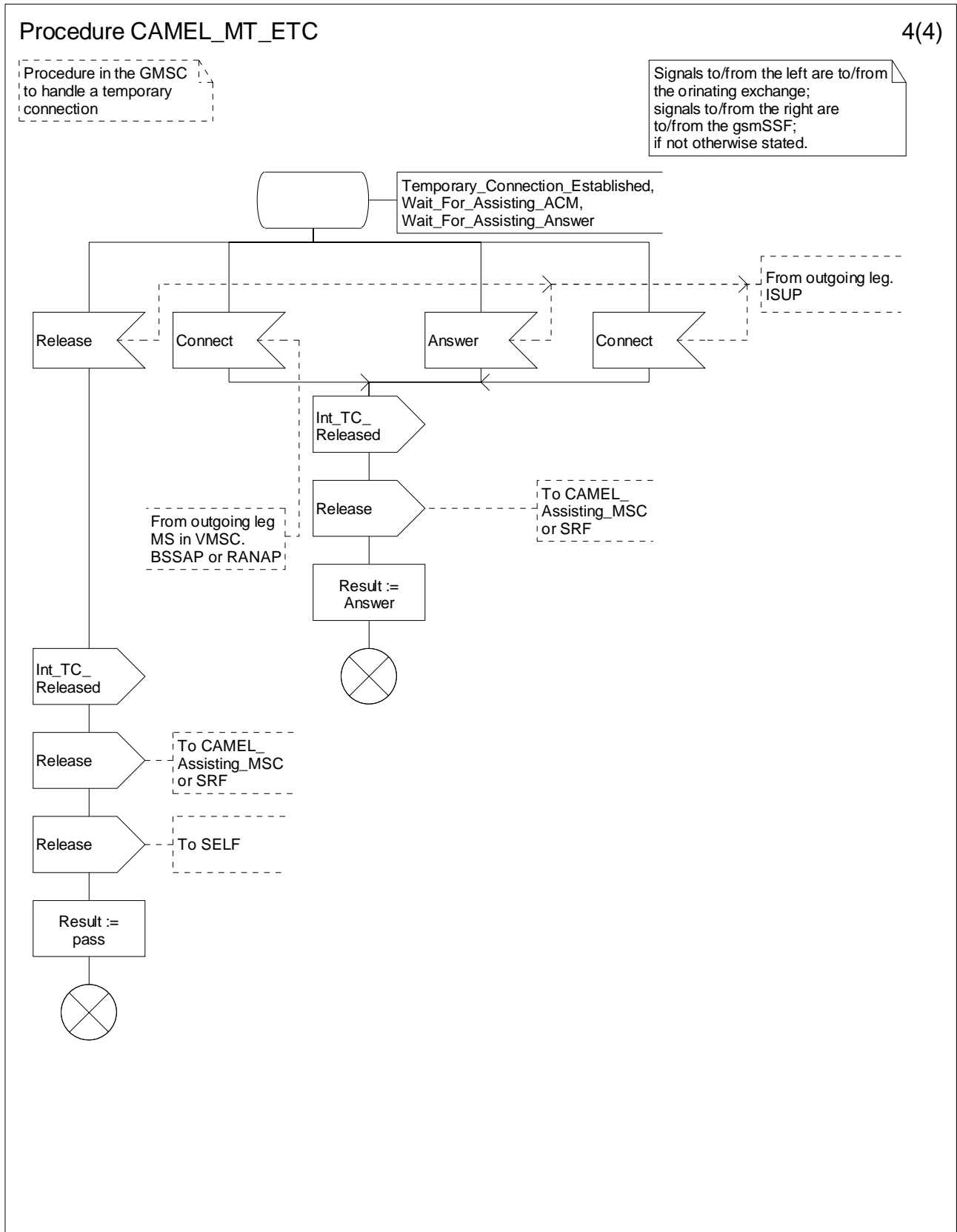
Figure 4.49-4: Procedure CAMEL_MT_ETC (sheet 4)
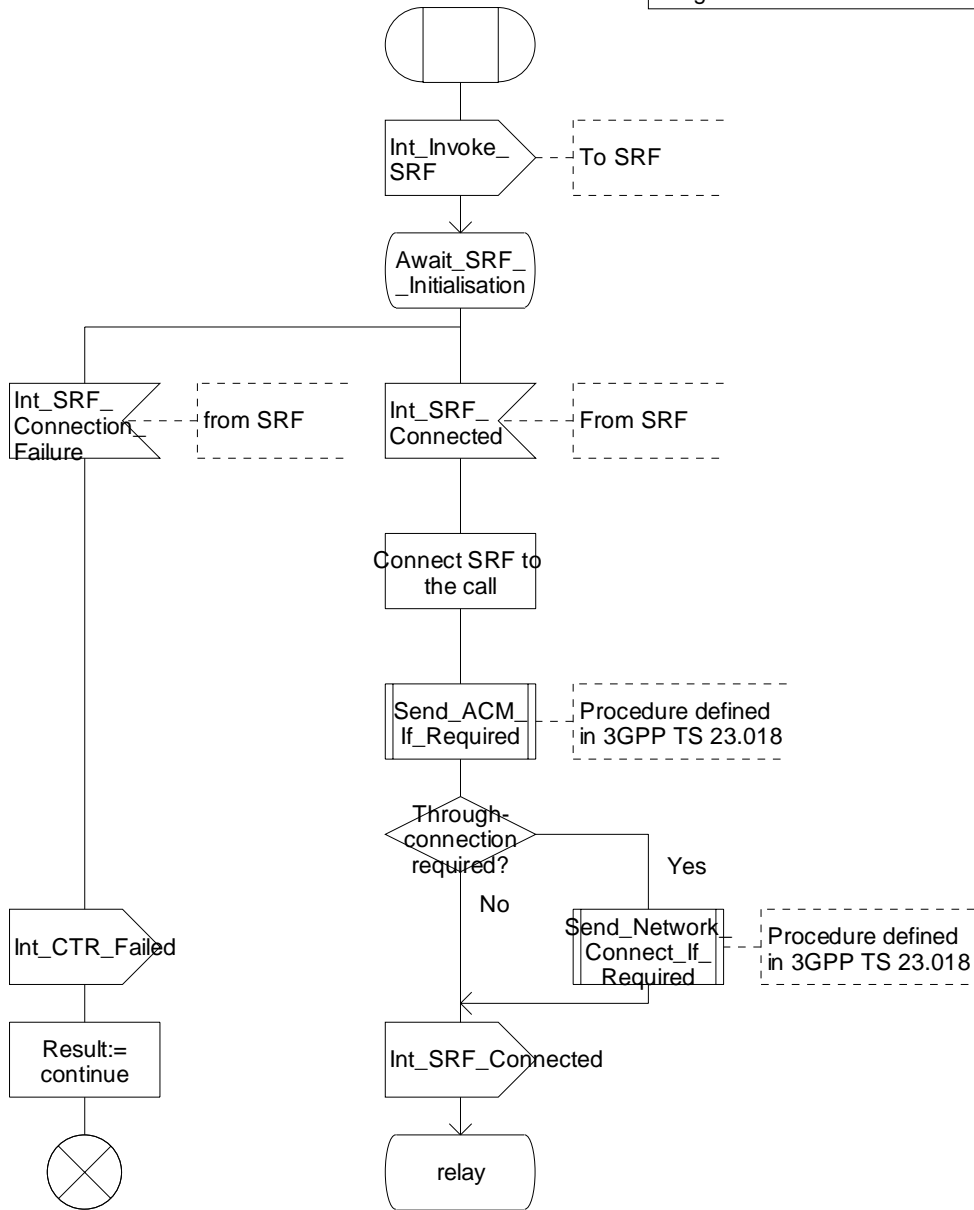
Figure 4.50-1: Procedure CAMEL_MT_CTR (sheet 1)

Procedure CAMEL_MT_CTR 2(5)

Procedure in the GMSC to handle a Connect To Resource operation

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF if not otherwise stated.
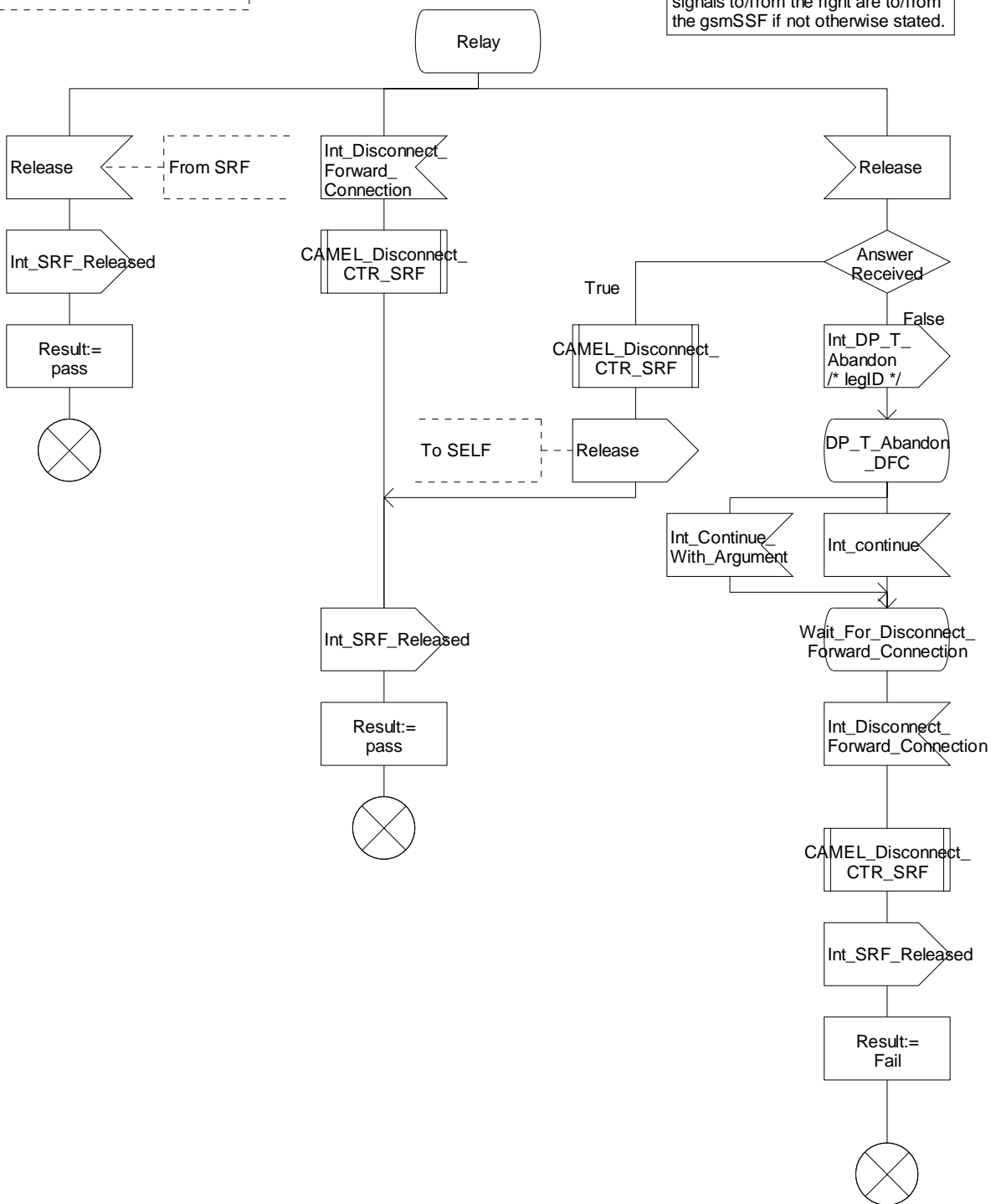
Figure 4.50-2: Procedure CAMEL_MT_CTR (sheet 2)

Procedure CAMEL_MT_CTR 3(5)

Procedure in the GMSC to handle
a Connect To Resource operation

Signals to/from the right are to/from
the gsmSSF.
Signals to/from the left are to/from
the SRF.

Relay

Int_Play_
Announcement

Int_Prompt_
And_Collect_
User_Information

Int_Specialized_
Ressource_Report

Int_Prompt_
And_Collect_
User_Information ack

Int_Play_
Announcement

Int_Prompt_
And_Collect_
User_Information

Int_Specialized_
Ressource_Report

Int_Prompt_
And_Collect_
User_Information ack

Relay
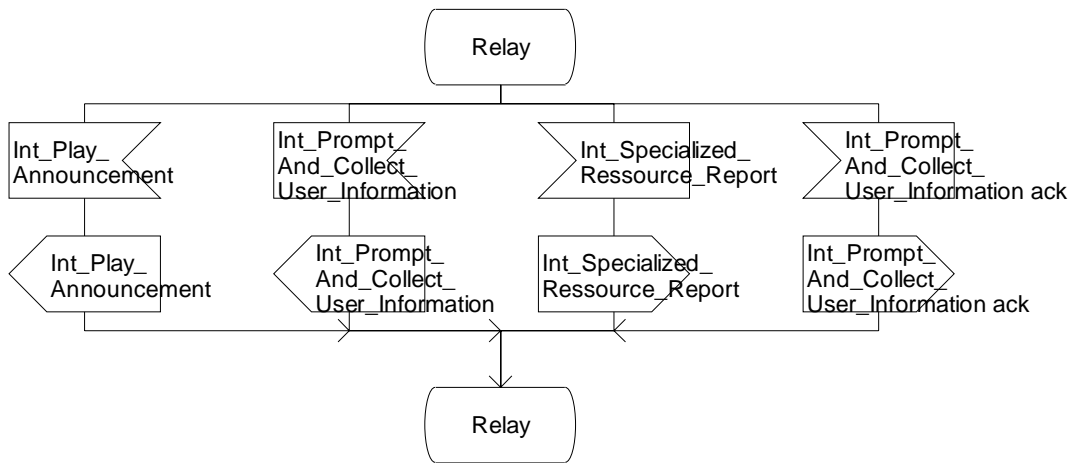
Figure 4.50-3: Procedure CAMEL_MT_CTR (sheet 3)

Procedure CAMEL_MT_CTR   4(5)

Procedure in the GMSC to handle
a Connect To Resource operation

Signals to/from the left are
to/from the originating exchange;
signals to/from the right are to/from
the gsmSSF if not otherwise stated.

Await_SRF_Initialisation

Release

Answer
Received

True   False

CAMEL_Disconnect_   Int_DP_T_Abandon
CTR_SRF

Int_SRF_Released   DP_O_Abandon
                                                    _SRF

To SELF   Release   Int_continue   Int_Continue_
                                                     With_Argument

Result :=   CAMEL_Disconnect_
pass   CTR_SRF

                                 Int_SRF_Released

                                 Result :=
                                 Fail
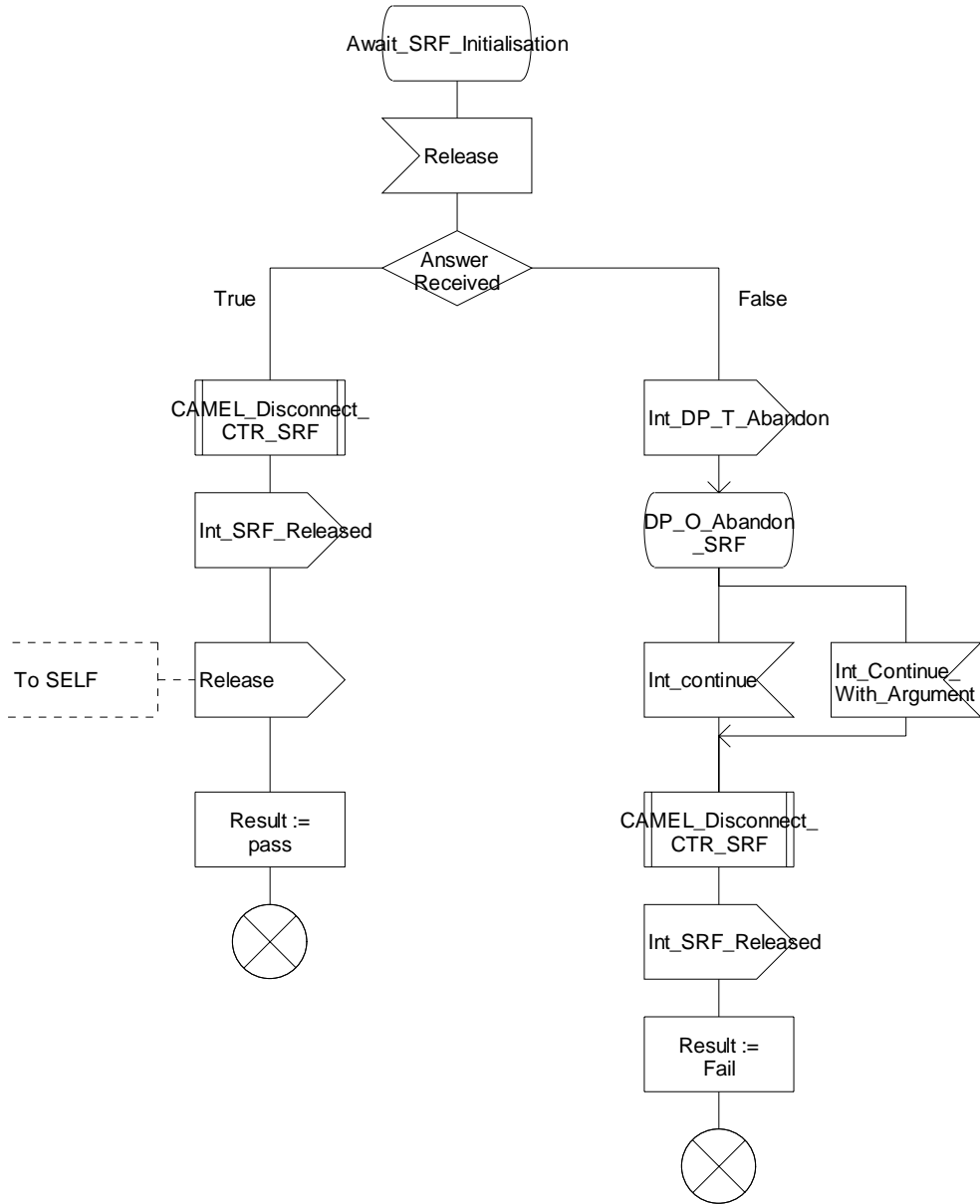
Figure 4.50-4: Procedure CAMEL_MT_CTR (sheet 4)

ETSI

Procedure CAMEL_MT_CTR 5(5)

Procedure in the GMSC to handle a Connect To Resource operation

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF if not otherwise stated.
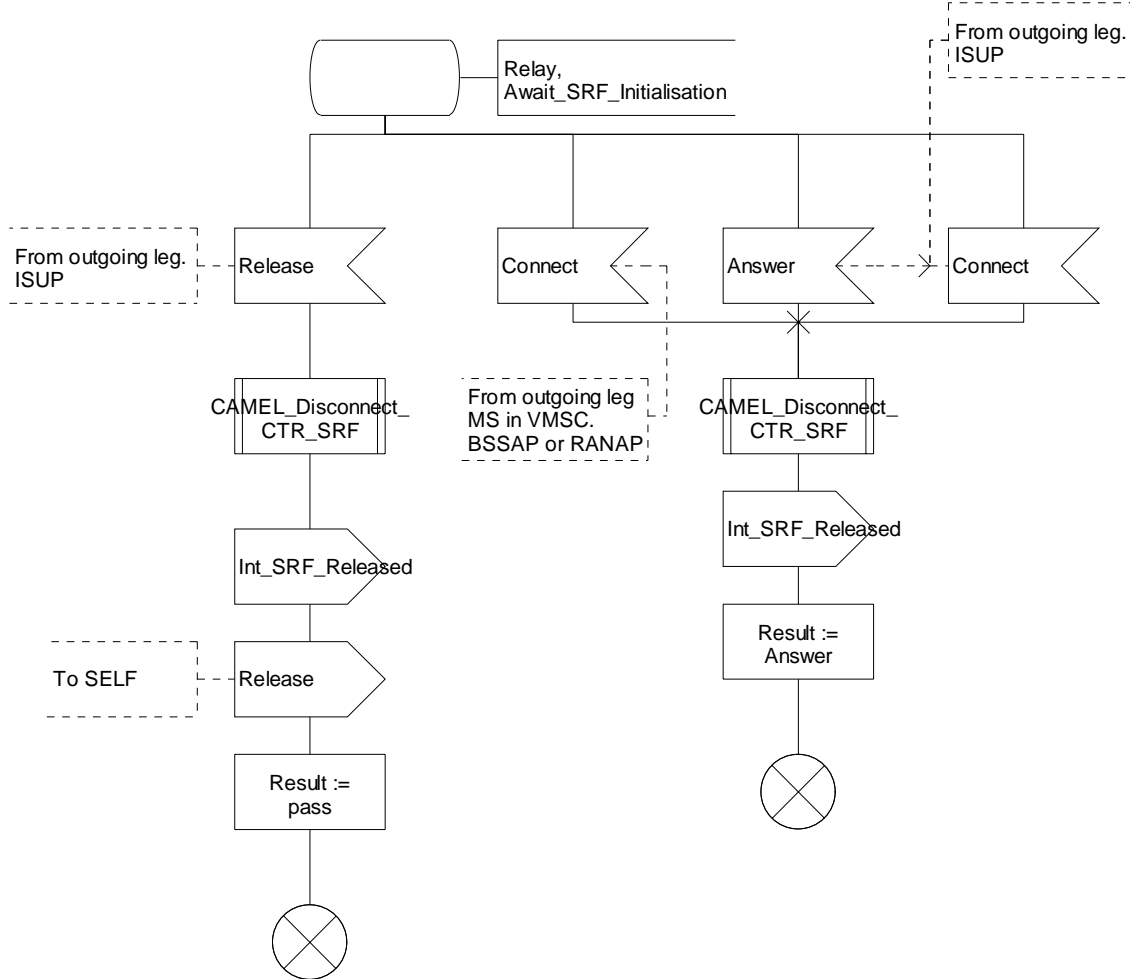
Figure 4.50-5: Procedure CAMEL_MT_CTR (sheet 5)
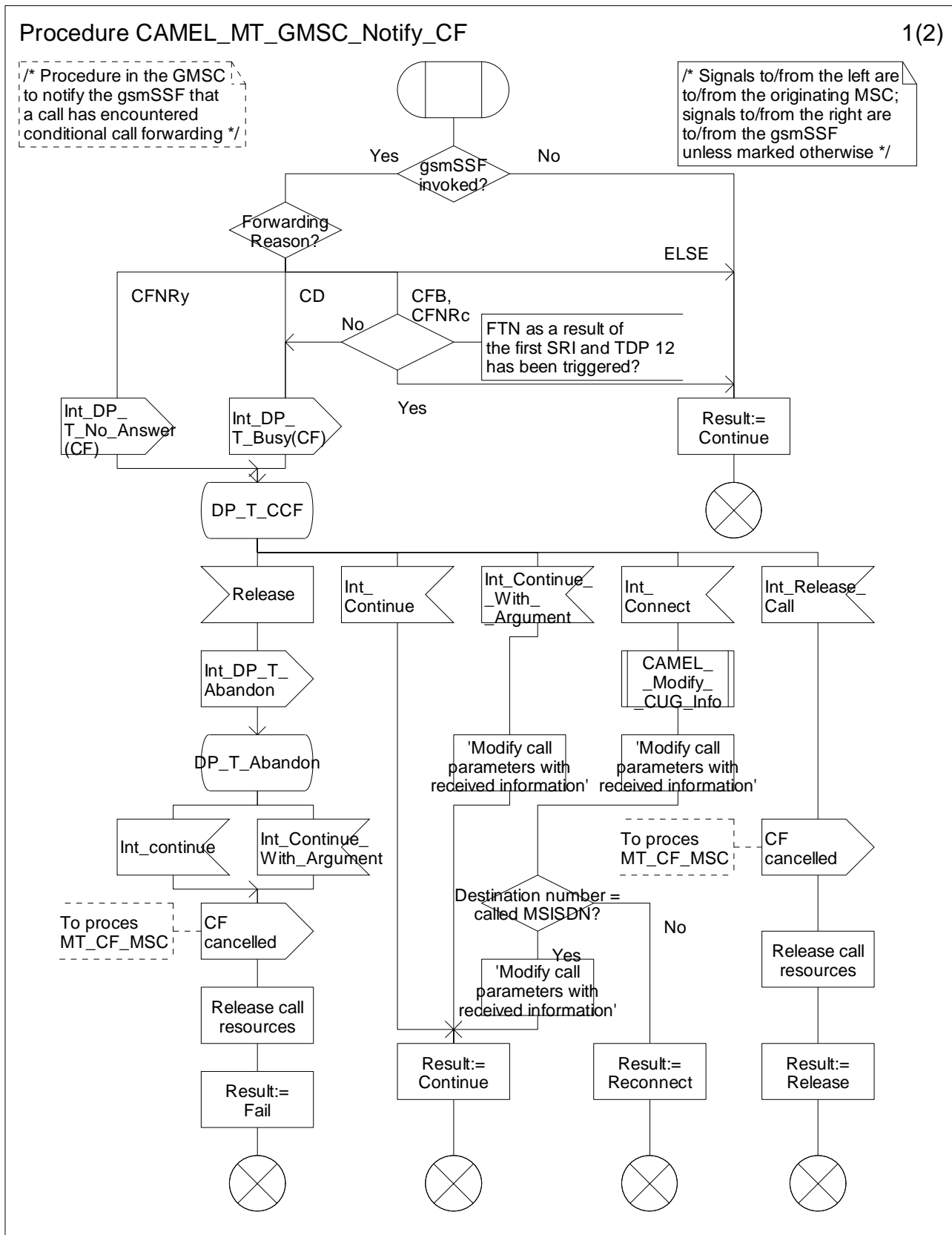
Figure 4.51-1: Procedure CAMEL_MT_GMSC_Notify_CF (sheet 1)

Procedure CAMEL_MT_GMSC_Notify_CF 2(2)

/* Procedure in the GMSC
to notify the gsmSSF that
a call has encountered
conditional call forwarding */

/* Signals from the right are
from the gsmSSF,
unless marked otherwise */

DP_T_CCF

Int_Error

Default call handling =
continue call ?

No

Yes

To process
MT_CF_MSC

CF
cancelled

Release call
resources

Result:=
Release

Result:=
Continue
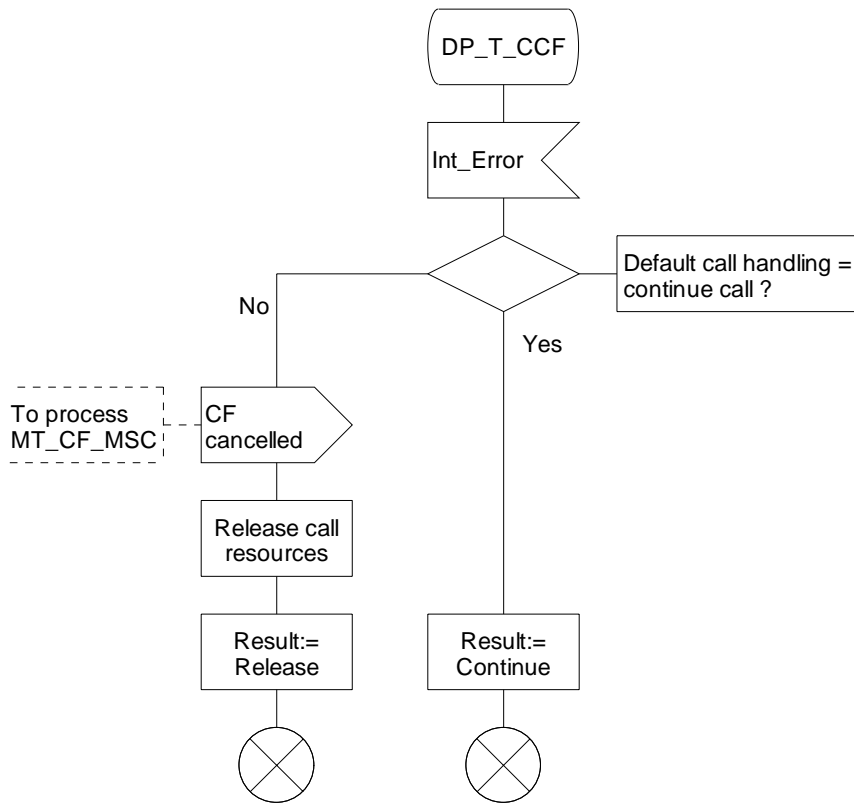
Figure 4.51-2: Procedure CAMEL_MT_GMSC_Notify_CF (sheet 2)

ETSI
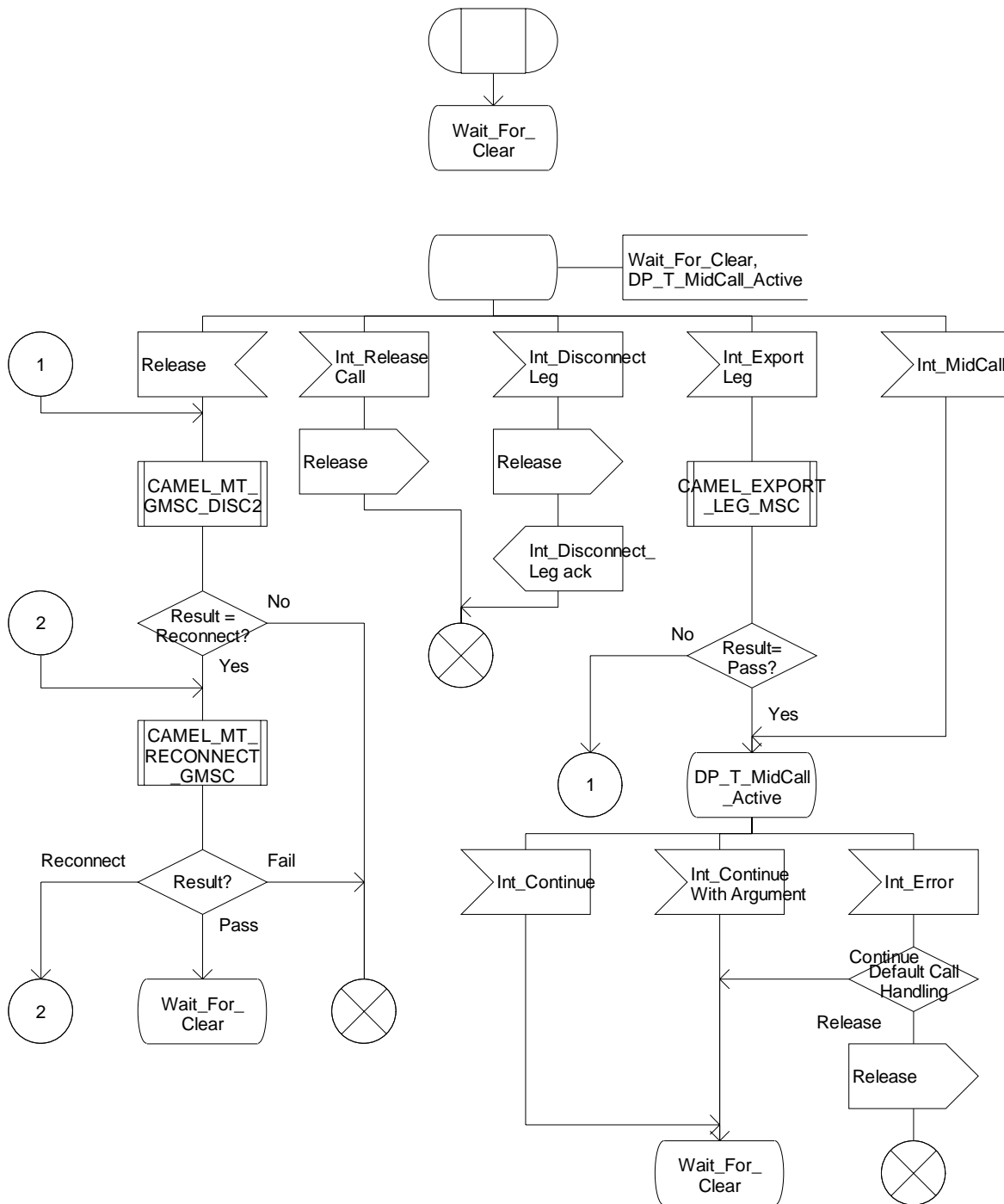
Figure 4.52-1: Procedure CAMEL_MT_LEG2_GMSC (sheet 1)

Procedure CAMEL_MT_LEG2_GMSC 2(2)

/* A procedure in the GMSC to handle leg 2 of an active call. */

/* Signals to/from the left are to from the gsmSSF; Signals to/from the right are to/from the destination exchange; unless otherwise stated. */

DP_T_MidCall_Active

Int_Establish_ Temporary_ Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

-
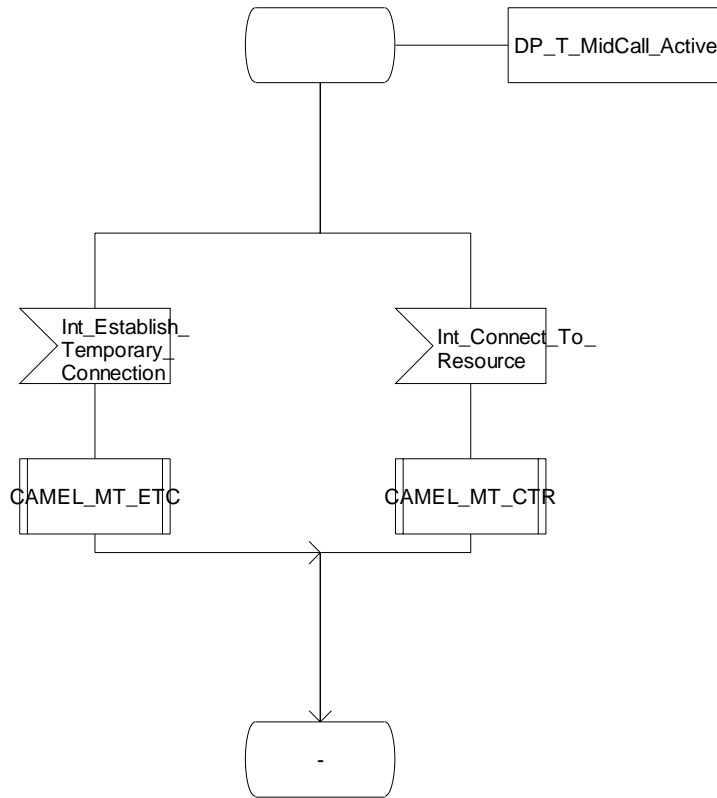
Figure 4.52-2: Procedure CAMEL_MT_LEG2_GMSC (sheet 2)

Process CAMEL_MT_LEG1_GMSC 1(5)

/* A process in the GMSC to handle leg 1 in a CPH configuration. */

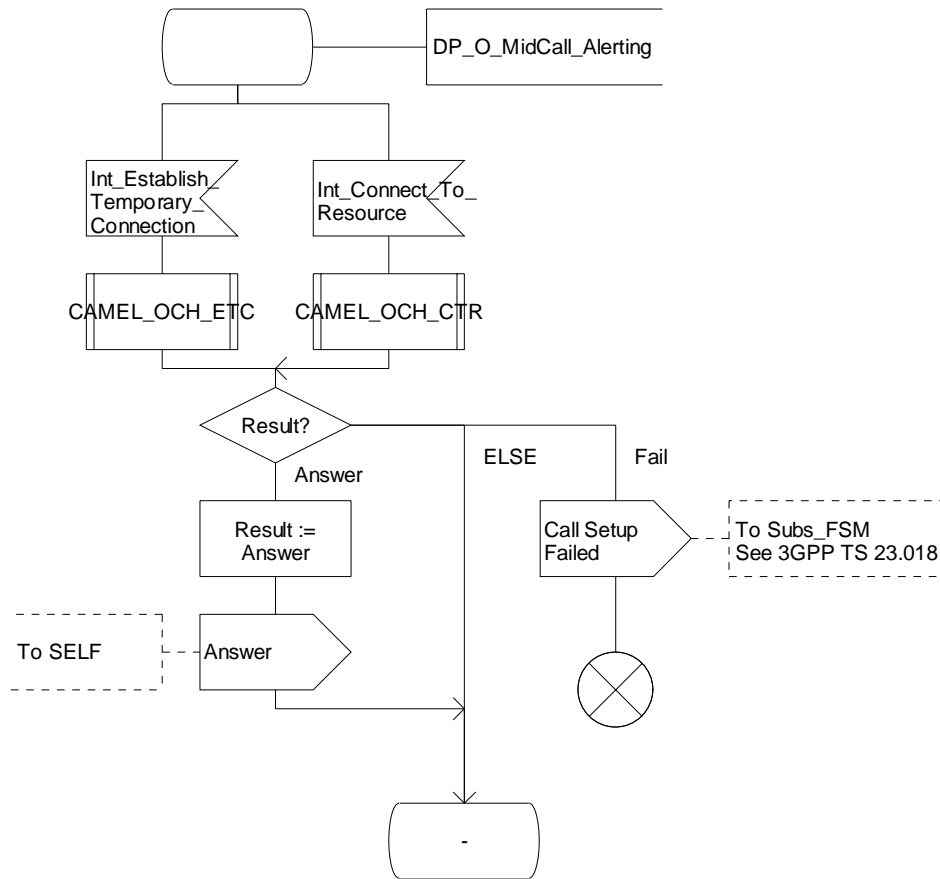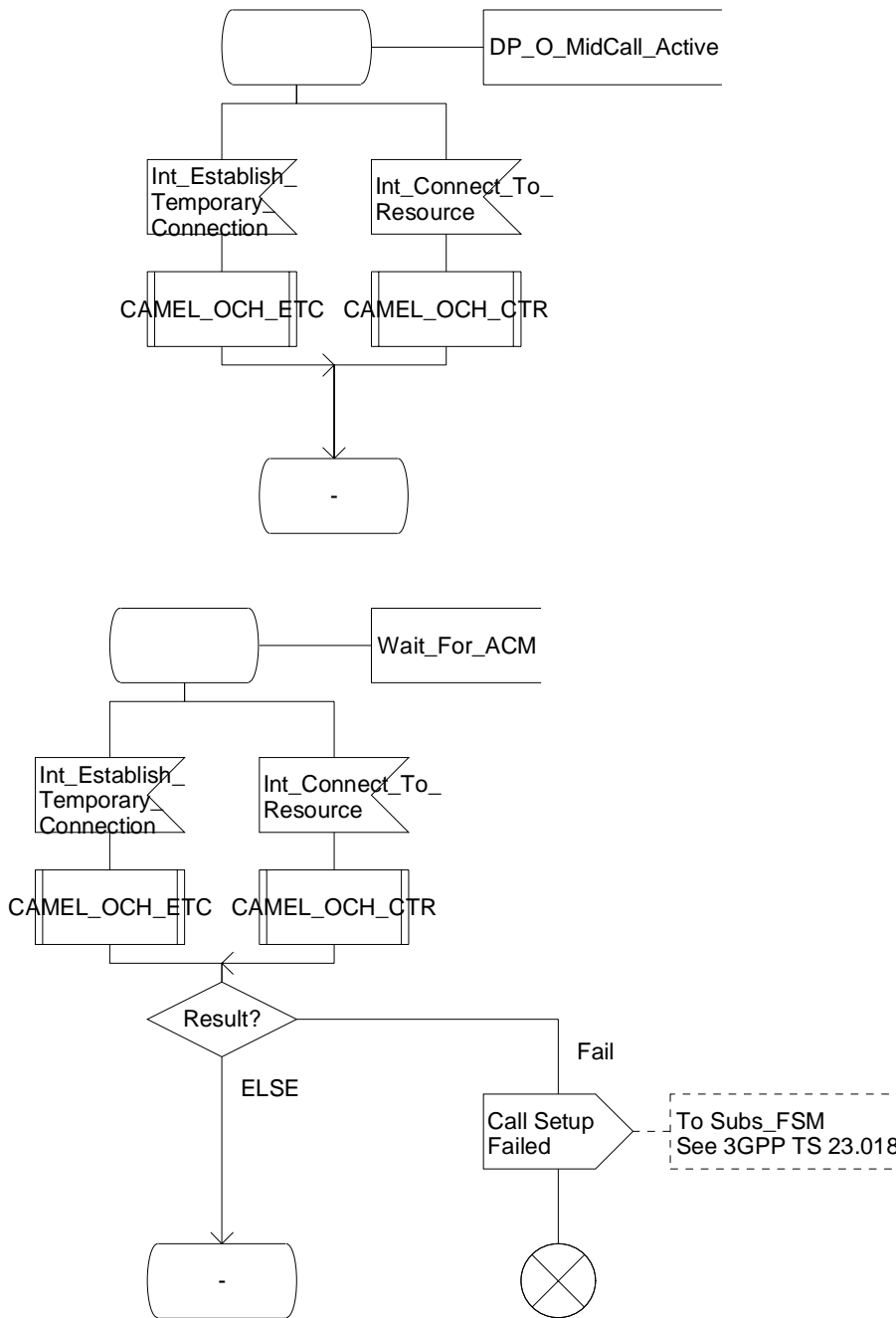/* Signals to/from the left are to/from the originating exchange; Signals to/from the right are to/from the gsmSSF unless otherwise stated. */

Store Leg1 information

Leg1_status?

Active

Set-up

Wait_For_ Clear

Wait_For_ ACM

Address Complete

Connect

See 3GPP TS 23.018

Send_ACM_ If_Required

Send_Network_ Connect_If_ Required

See 3GPP TS 23.018

Wait_For_ Answer

Wait_For_ Clear

Answer

See 3GPP TS 23.018

Send_Answer_ If_Required

Wait_For_ Clear
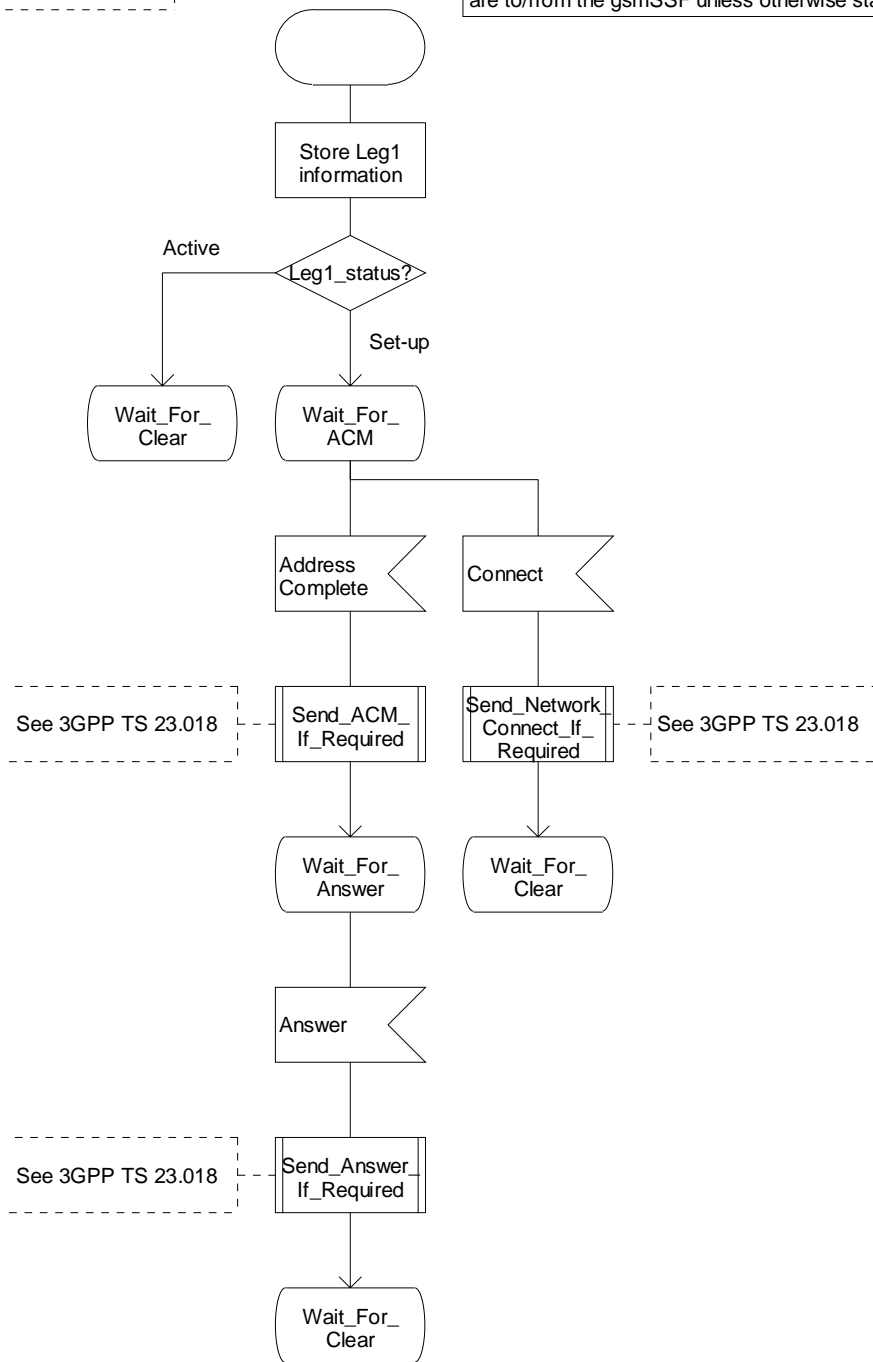
Figure 4.53-1: Process CAMEL_MT_LEG1_GMSC (sheet 1)

Process CAMEL_MT_LEG1_GMSC 2(5)

/* A process in the GMSC to handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from the originating exchange; Signals to/from the right are to/from the gsmSSF unless otherwise stated. */

Wait_For_ACM,
Wait_For_Answer,
DP_T_MidCall_Alerting

Release

Int_Disconnect_Leg

Int_Release_Call

CAMEL_MT_GMSC_DISC6

Release

Release

Int_Disconnect_Leg_ack

From gsmSSF

DP_T_MidCall_Alerting

Wait_For_Answer,
DP_T_MidCall_Alerting

Answer

Int_Error

Int_Continue

Int_Continue With Argument

Int_MidCall

Default Call Handling

Continue

Release

DP_T_MidCall_Alerting

Release

Wait_For_Answer
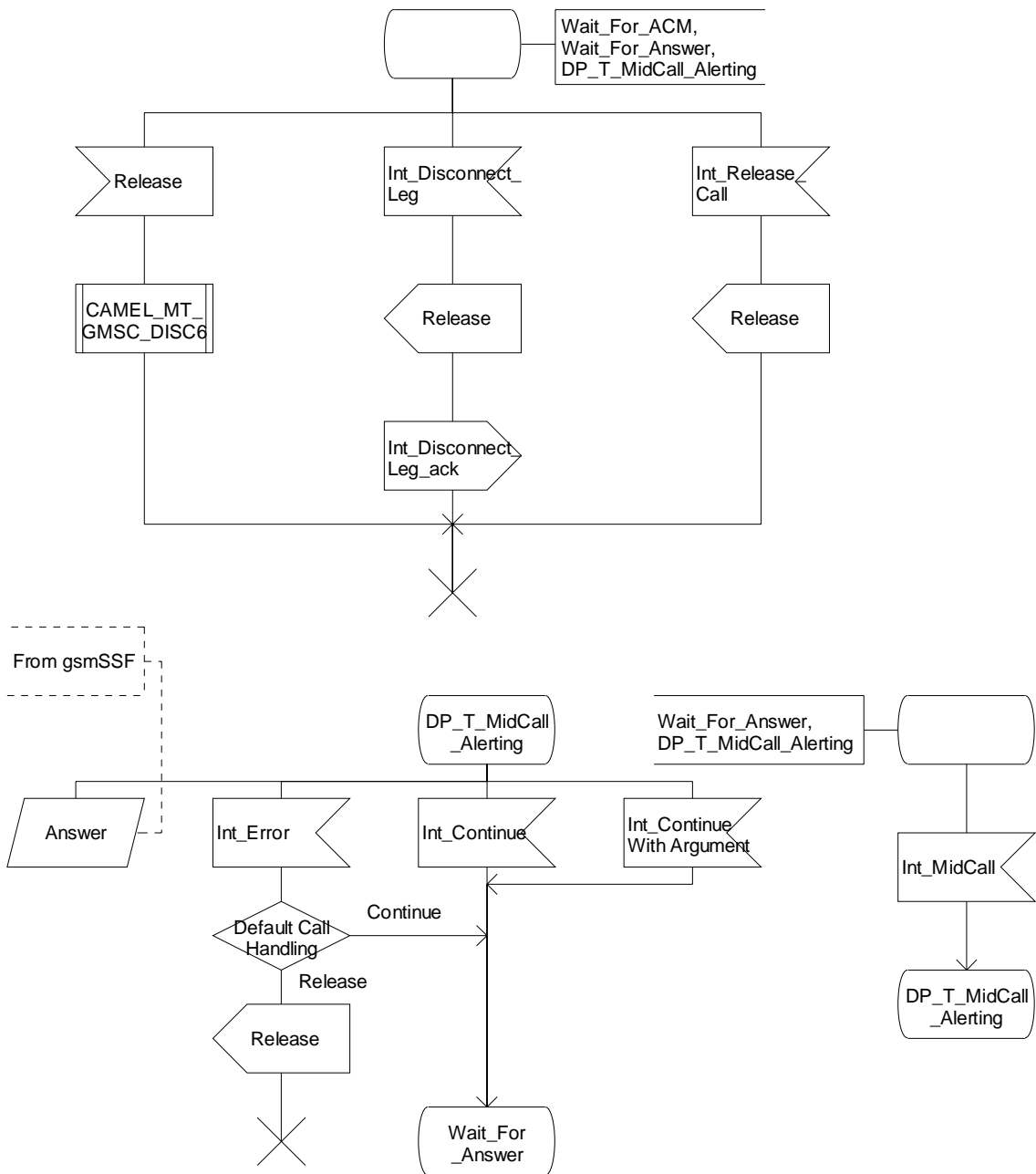
Figure 4.53-2: Process CAMEL_MT_LEG1_GMSC (sheet 2)

Process CAMEL_MT_LEG1_GMSC   3(5)

/* A process in the GMSC to
handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from
the originating exchange; Signals to/from the right
are to/from the gsmSSF unless otherwise stated. */

Wait_For_Clear,
DP_T_MidCall_Active

1   Release   Int_Release Call   Int_Disconnect Leg   Int_Export Leg   Int_MidCall

CAMEL_MT_ GMSC_DISC1   Release   Release   CAMEL_EXPORT _LEG_MSC

Int_Disconnect Leg ack

No

Result= Pass?

Yes

1   DP_T_MidCall _Active

DP_T_MidCall _Active

Int_Error   Int_Continue   Int_Continue With Argument

Default Call Handling   Continue

Release

Release

Wait_For _Clear
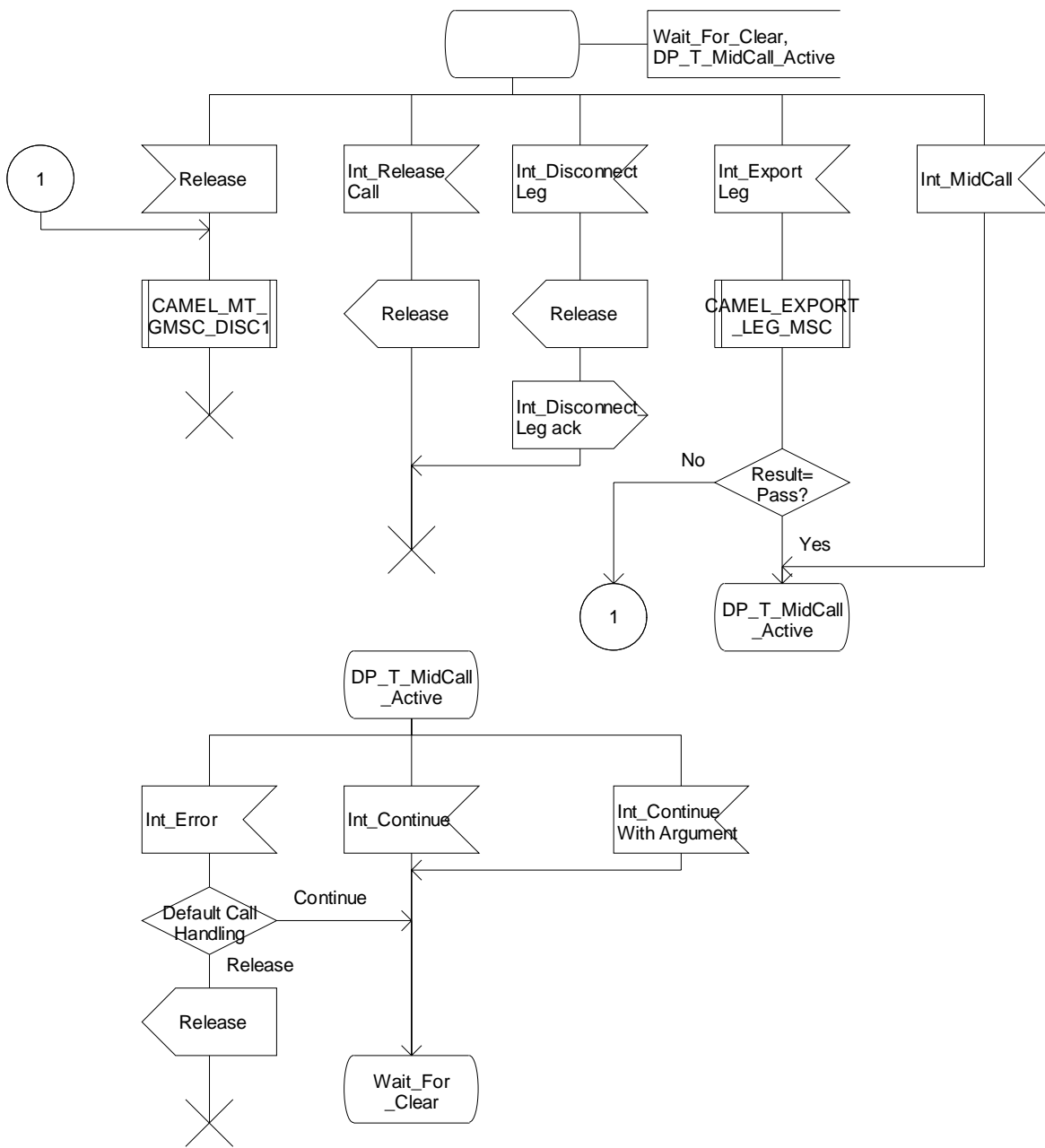
Figure 4.53-3: Process CAMEL_MT_LEG1_GMSC (sheet 3)

ETSI

Process CAMEL_MT_LEG1_GMSC 4(5)

/* A process in the GMSC to
handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from
the originating exchange; Signals to/from the right
are to/from the gsmSSF unless otherwise stated. */

DP_T_MidCall_Alerting

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result?

Answer

Fail

ELSE

Result :=
Answer

To SELF

Answer

-
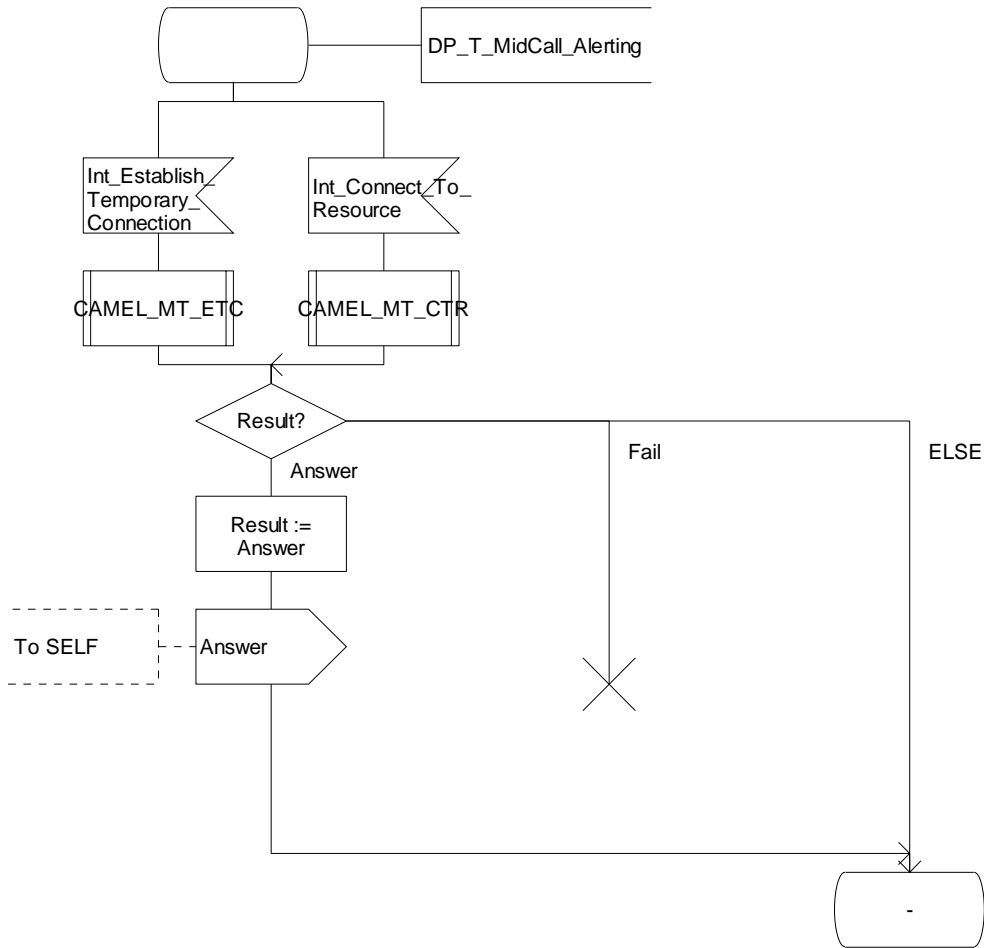
Figure 4.53-4: Process CAMEL_MT_LEG1_GMSC (sheet 4)

Process CAMEL_MT_LEG1_GMSC 5(5)

/* A process in the GMSC to
handle leg 1 in a CPH configuration. */

/* Signals to/from the left are to/from
the originating exchange; Signals to/from the right
are to/from the gsmSSF unless otherwise stated. */

DP_T_MidCall_Active

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

-

Wait_For_ACM

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result?

Fail

ELSE

-
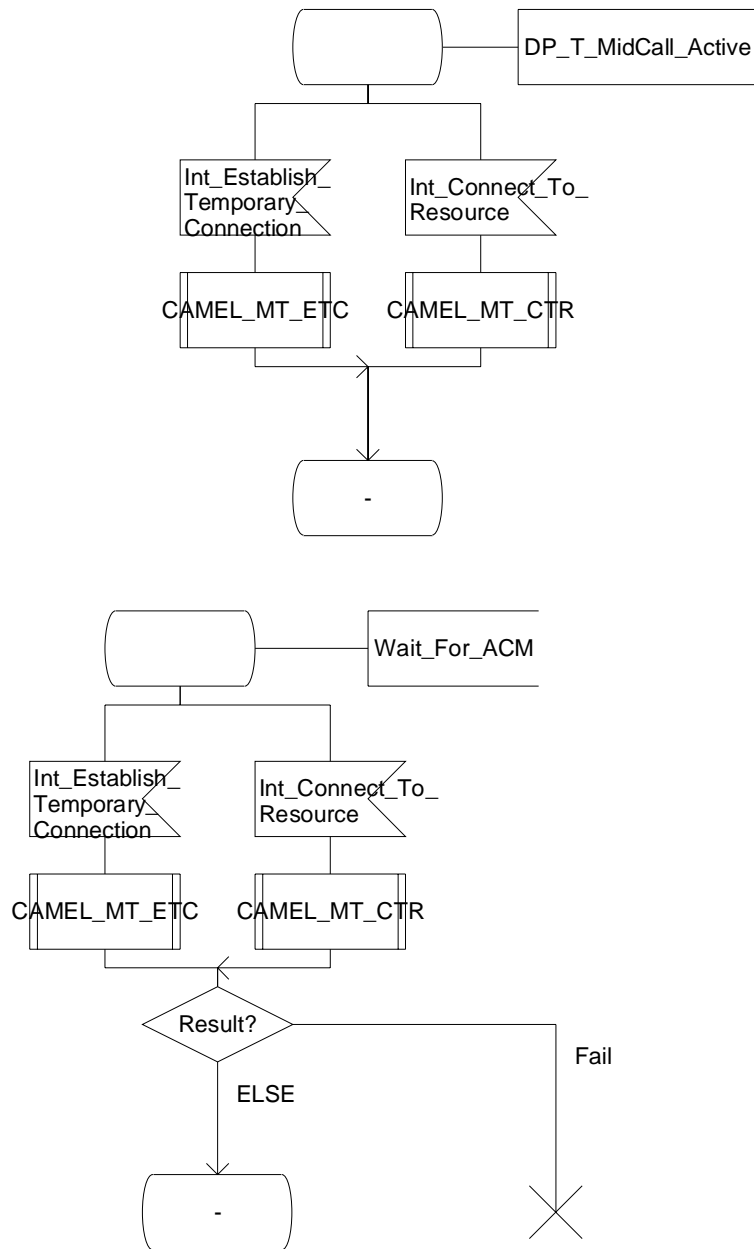
Figure 4.53-5: Process CAMEL_MT_LEG1_GMSC (sheet 5)

Procedure CAMEL_MT_RECONNECT_GMSC 1(7)

/* A procedure in the GMSC to handle a reconnection after leg 2 disconnect. */

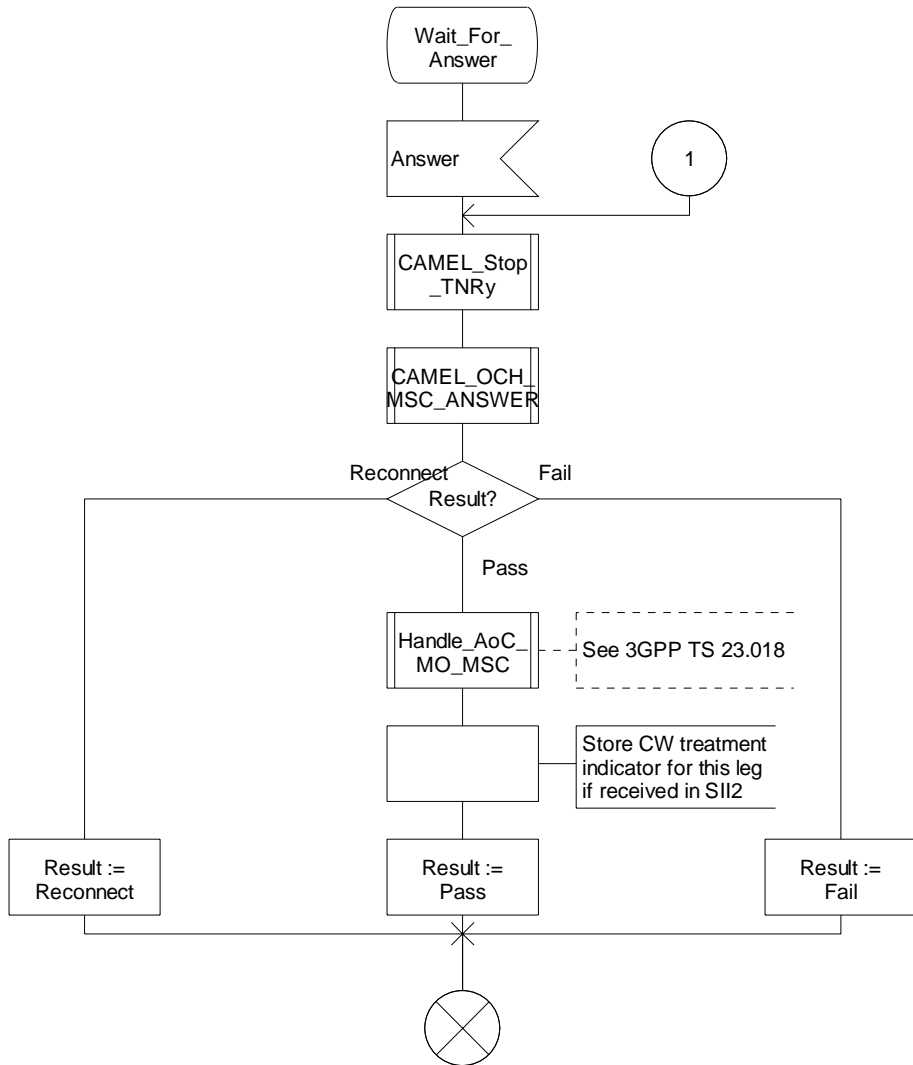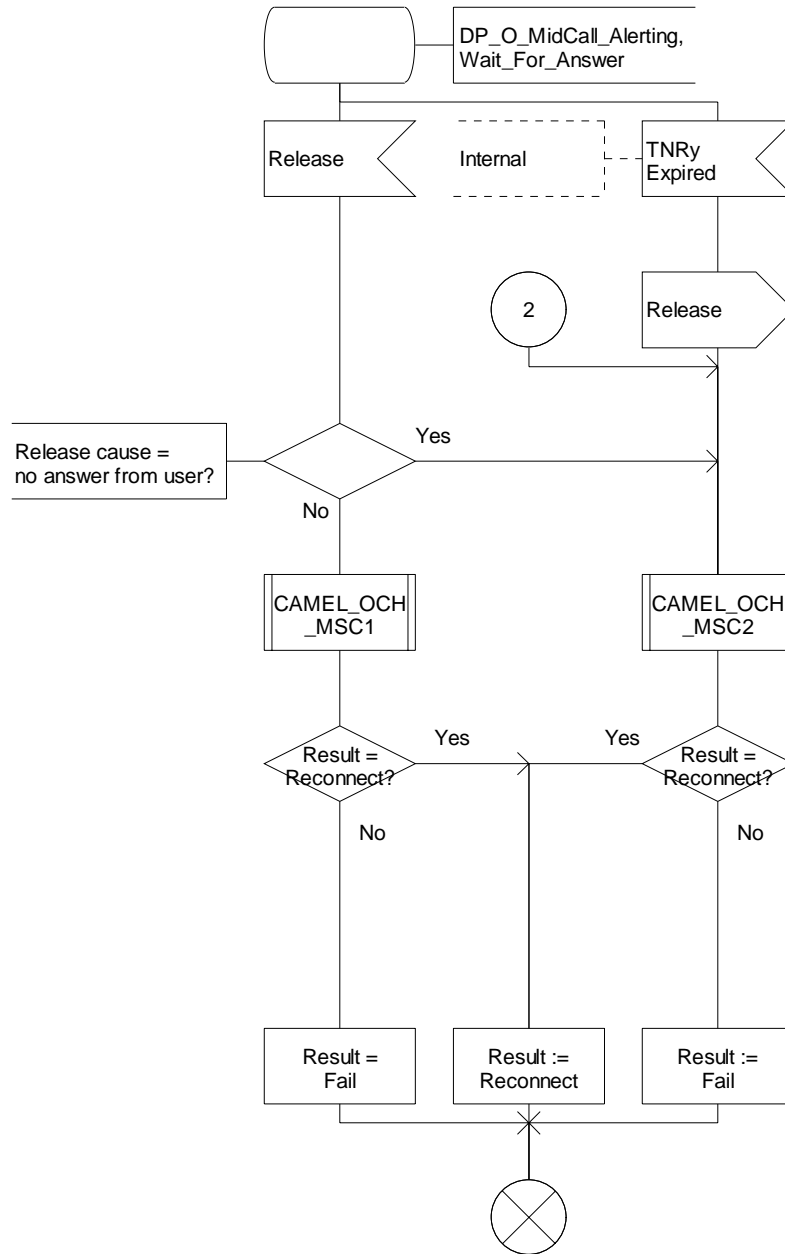/* Signals to/from the right are to/from the destination exchange. */

See 3GPP TS 23.079 ----- OR_Set_ORA_ Parameters

See 3GPP TS 23.018 -----

Obtain_Routeing_Address
(Called party address, Reference address,
OR, Own PLMN, Routeing address,
Destination address, Result)

Result?

Fail, Aborted

Pass, Forward

Routeing Number

Result := Fail

Initial Address (Routeing Address)

Initial Address (Routeing Address)

CAMEL_Store_ Destination_ Address
(OR, False)

Wait_For_ ACM
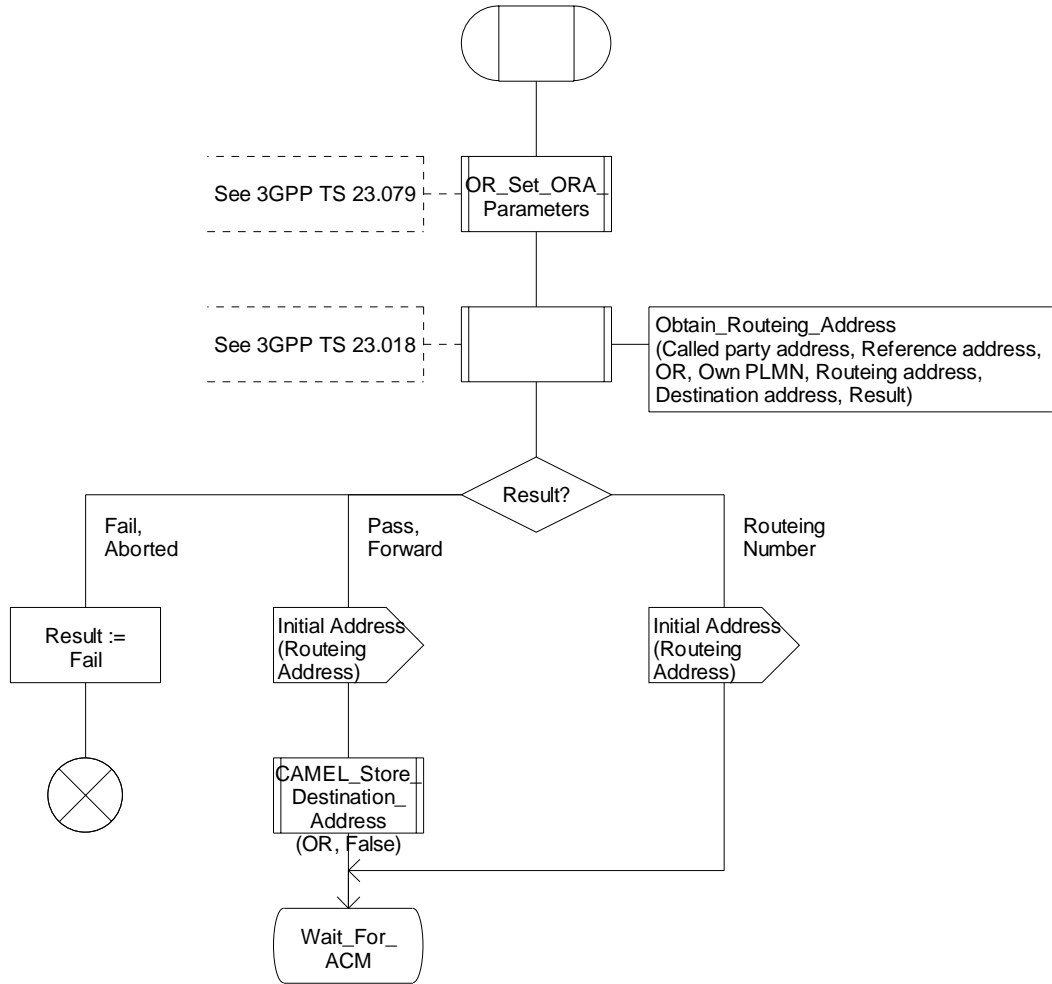
Figure 4.54-1: Procedure CAMEL_MT_RECONNECT_GMSC (sheet 1)

Procedure CAMEL_MT_RECONNECT_GMSC 2(7)

/* A procedure in the GMSC to handle a reconnection after leg 2 disconnect. */

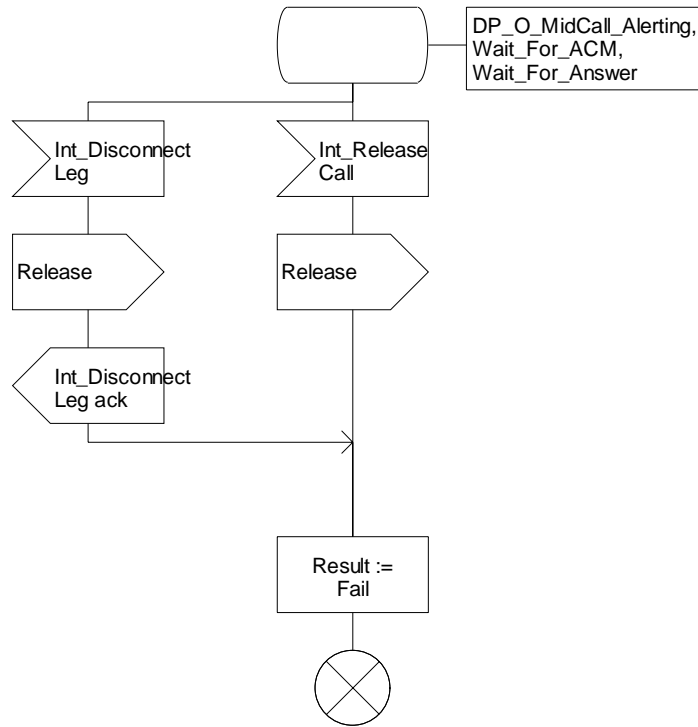/* Signals to/from the right are to/from the destination exchange. */
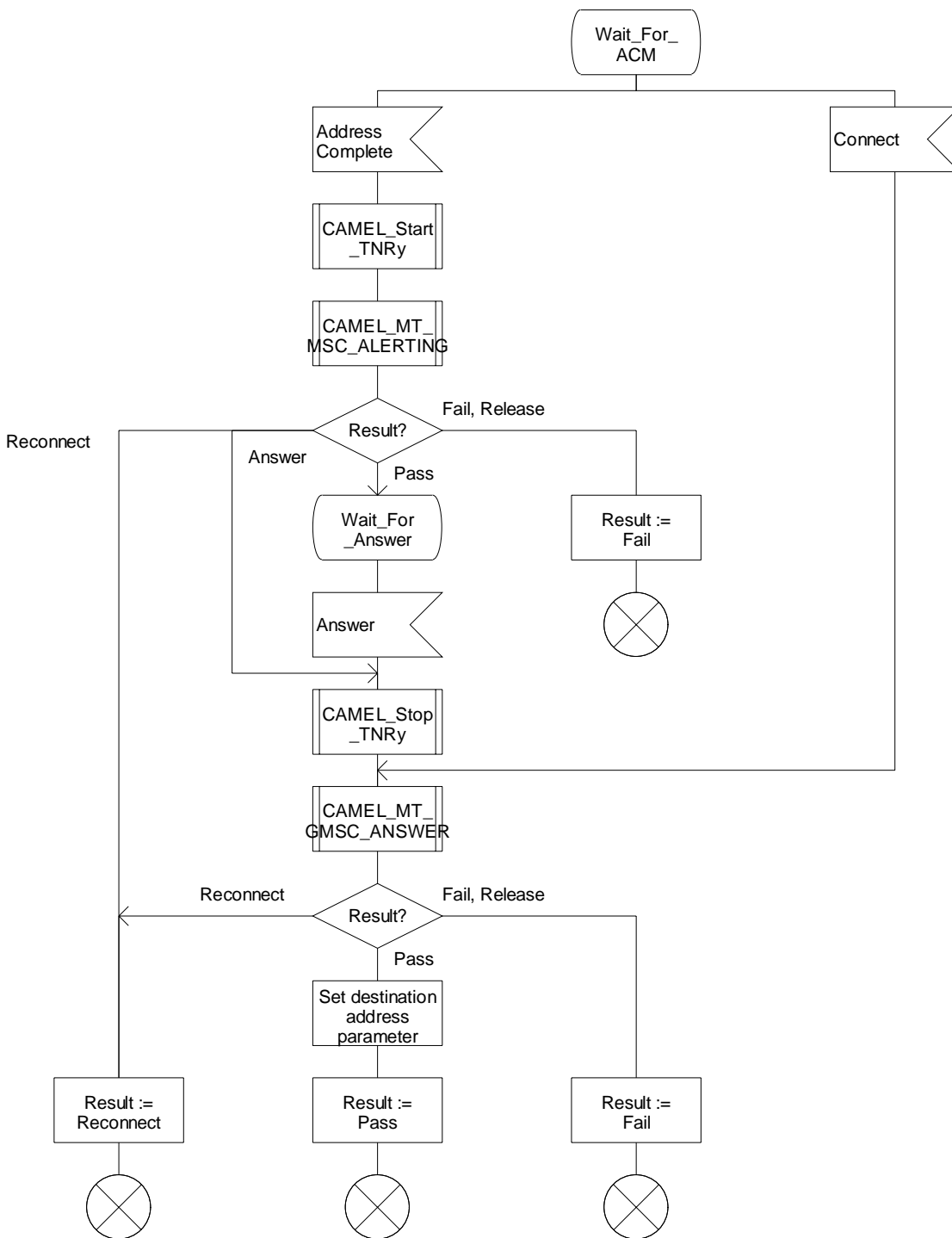
Figure 4.54-2: Procedure CAMEL_MT_RECONNECT_GMSC (sheet 2)

Procedure CAMEL_MT_RECONNECT_GMSC 3(7)

/* A procedure in the GMSC to handle a reconnection after leg 2 disconnect. */

/* Signals to/from the right are to/from the destination exchange. */

Wait_For_ACM, Wait_For_Answer

Resume Call Handling

Resume call := True

OR_Handle _RCH — — — See 3GPP TS 23.079

Result?

Fail | Reconnect | Pass | Refuse

Result := Fail

Result := Reconnect

Wait_For _ACM

-
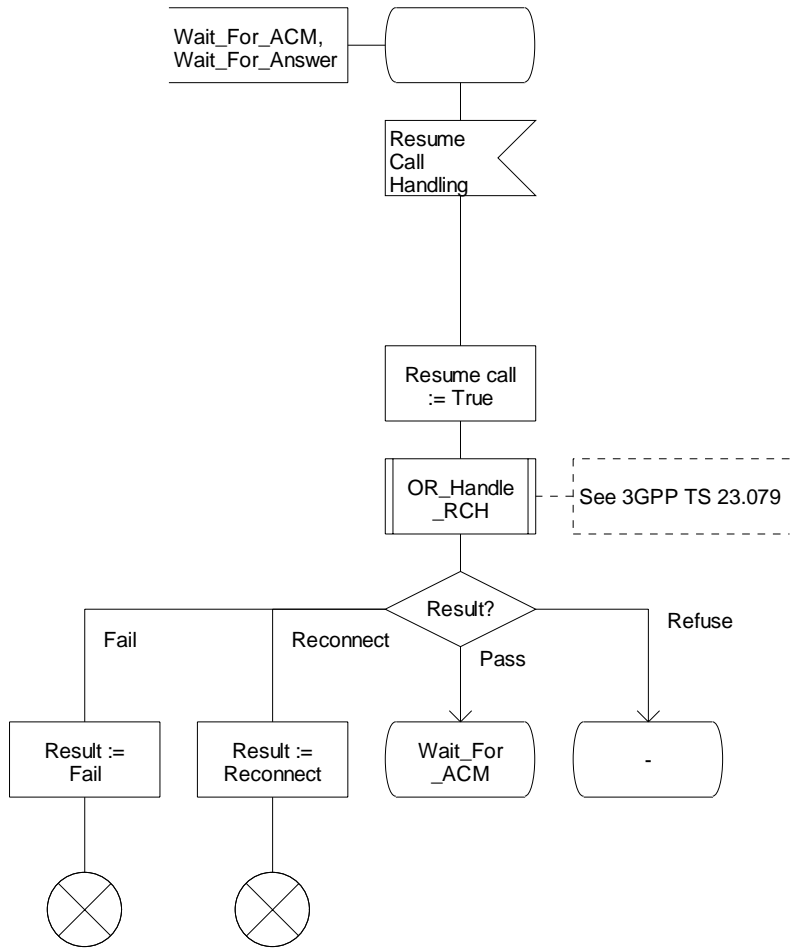
Figure 4.54-3: Procedure CAMEL_MT_RECONNECT_GMSC (sheet 3)

Procedure CAMEL_MT_RECONNECT_GMSC 4(7)

/* A procedure in the GMSC to handle a reconnection after leg 2 disconnect. */

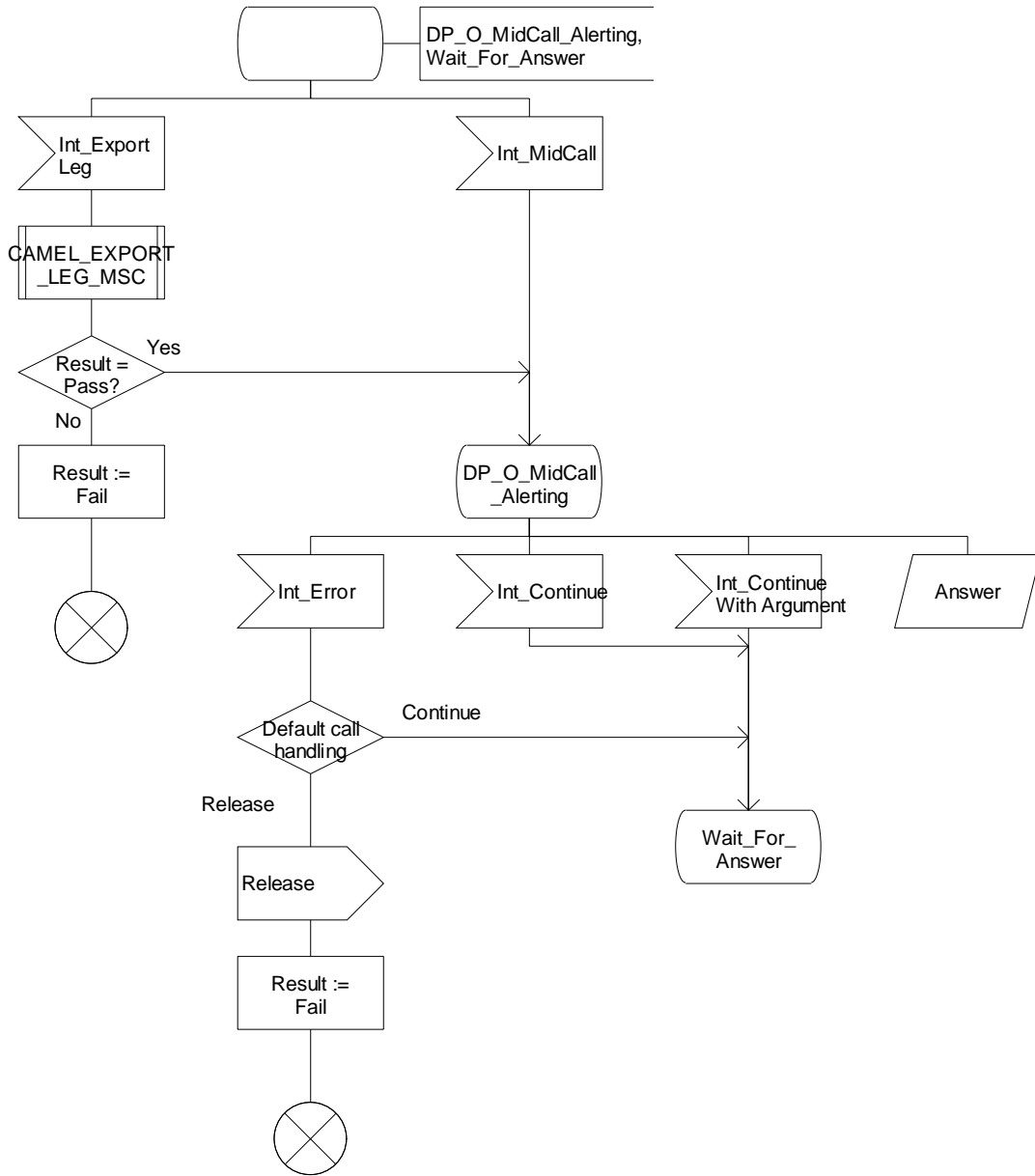/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF. unless otherwise stated. */
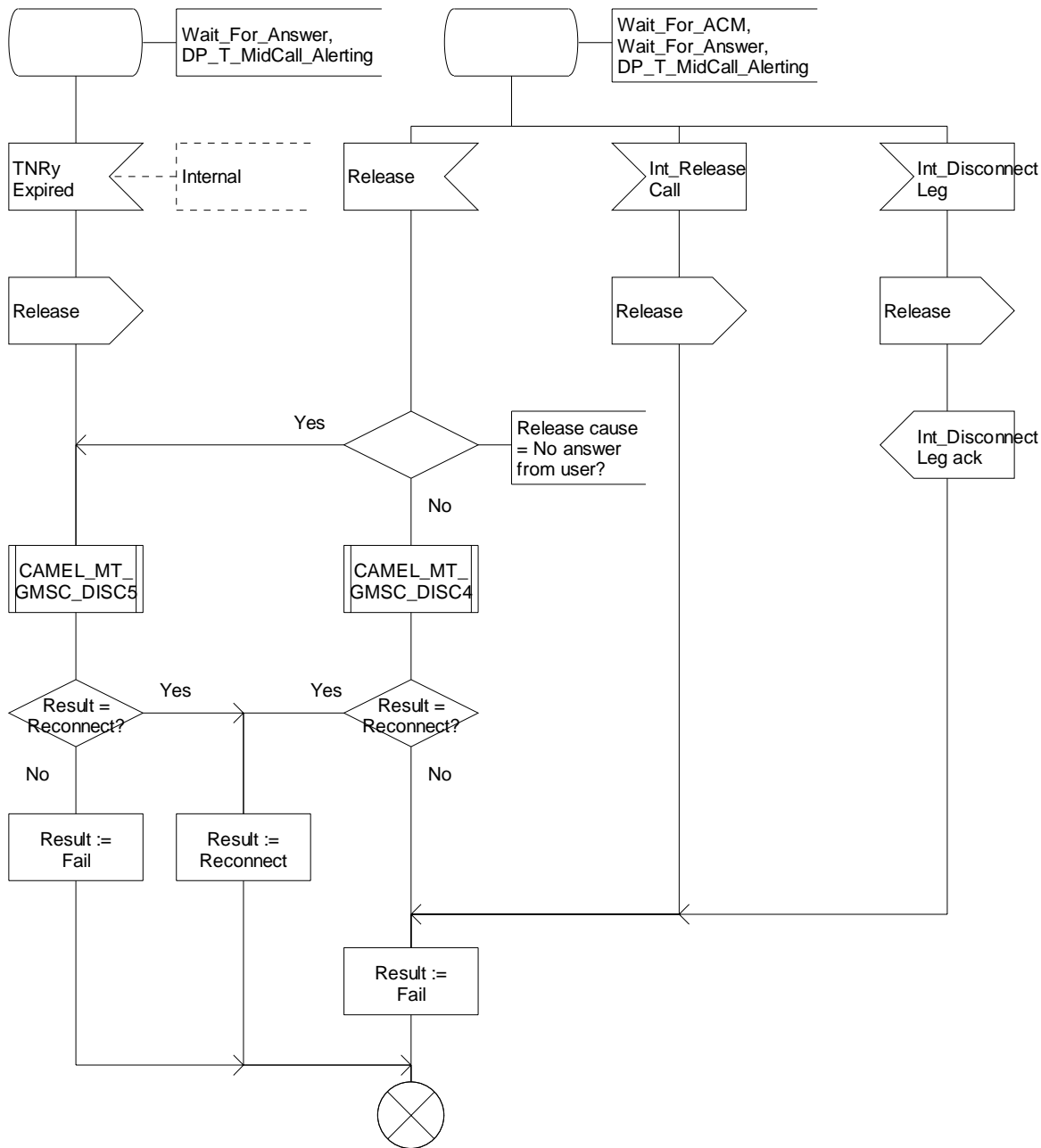
Figure 4.54-4: Procedure CAMEL_MT_RECONNECT_GMSC (sheet 4)

ETSI

Procedure CAMEL_MT_RECONNECT_GMSC 5(7)

/* A procedure in the GMSC to handle a reconnection after leg 2 disconnect. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF. */
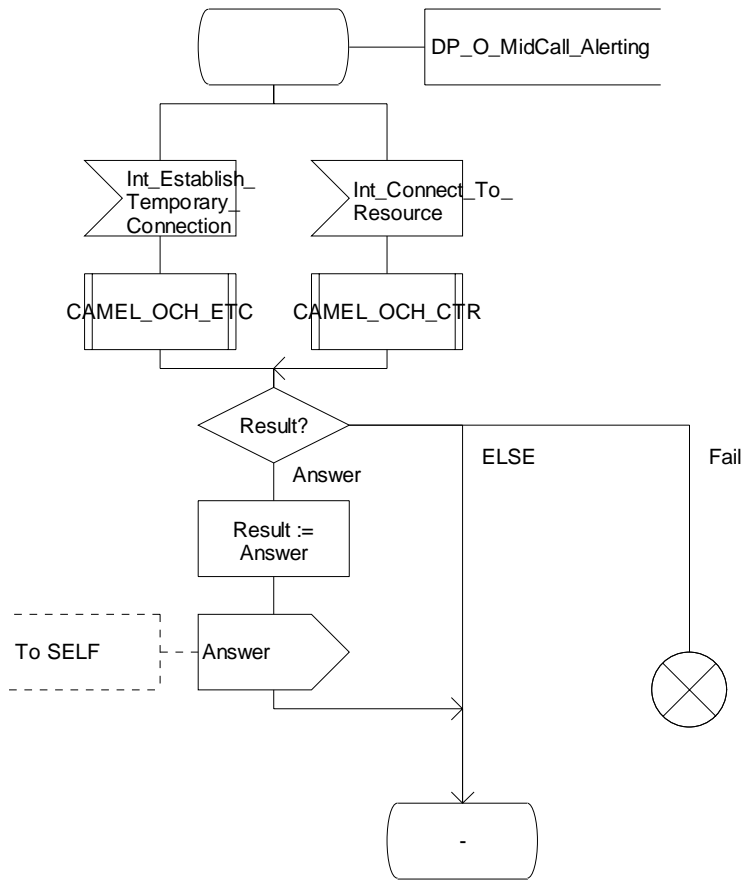
Wait_For_Answer, DP_T_MidCall_Alerting

Int_Export Leg

Int_MidCall

CAMEL_EXPORT _LEG_MSC

Result = Pass?

Yes

No

Result := Fail

⊗

DP_T_MidCall _Alerting

Int_Error

Int_Continue

Int_Continue With Argument

Answer

Resume Call Handling

Default call handling

Continue

Release

Release

Wait_For_ Answer

Result := Fail

⊗
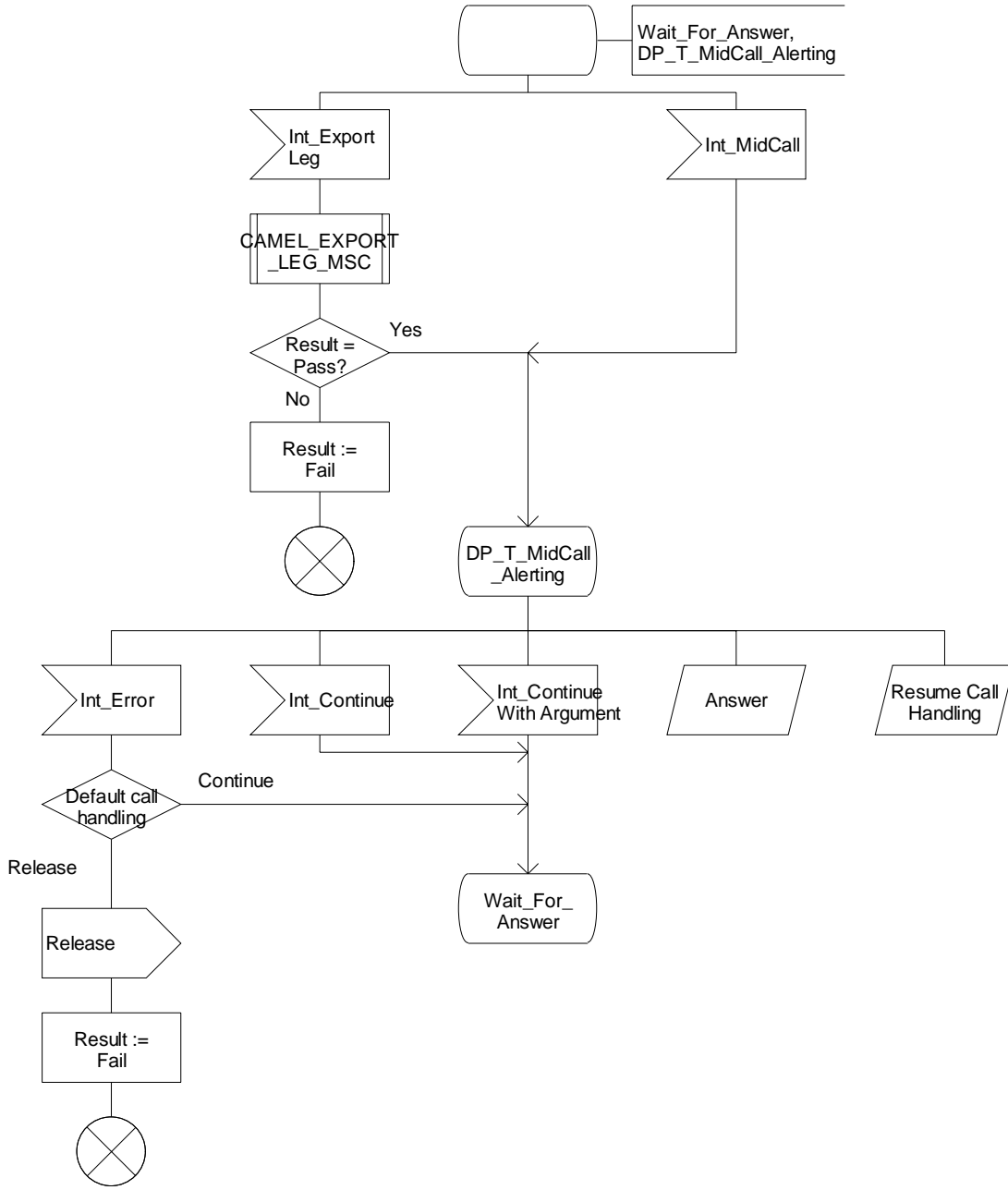
Figure 4.54-5: Procedure CAMEL_MT_RECONNECT_GMSC (sheet 5)

Procedure CAMEL_MT_RECONNECT_GMSC 6(7)

/* A procedure in the GMSC to handle a
reconnection after leg 2 disconnect. */

/* Signals to/from the right are to/from
the destination exchange;
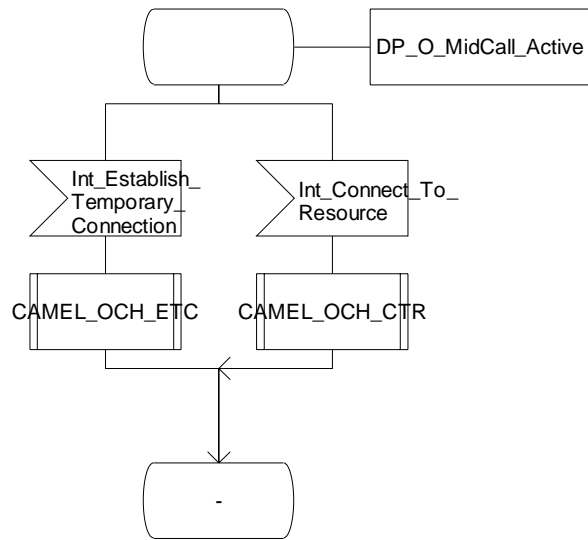Signals to/from the left are to/from
the gsmSSF. */

DP_T_MidCall_Alerting

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result?

Answer   Fail   ELSE

Result :=
Answer

To SELF   Answer

-
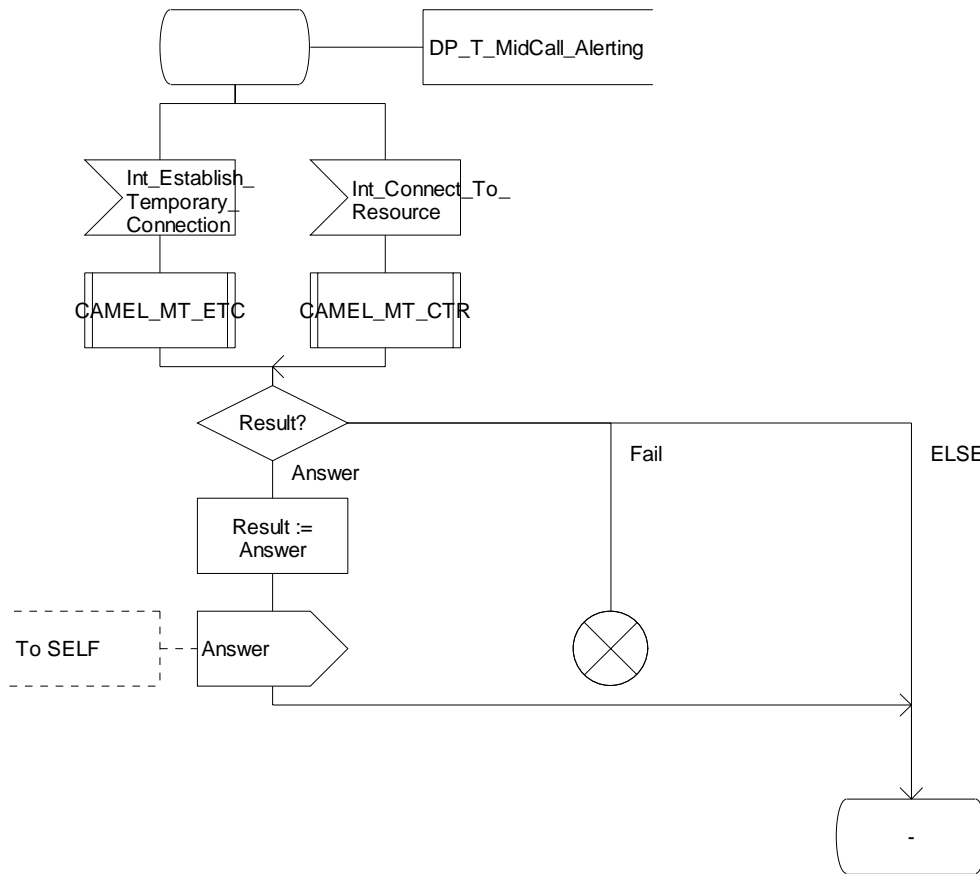
Figure 4.54-6: Procedure CAMEL_MT_RECONNECT_GMSC (sheet 6)

Procedure CAMEL_MT_RECONNECT_GMSC 7(7)

/* A procedure in the GMSC to handle a
reconnection after leg 2 disconnect. */

/* Signals to/from the right are to/from
the destination exchange;
Signals to/from the left are to/from
the gsmSSF. */

DP_T_MidCall_Active

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

-
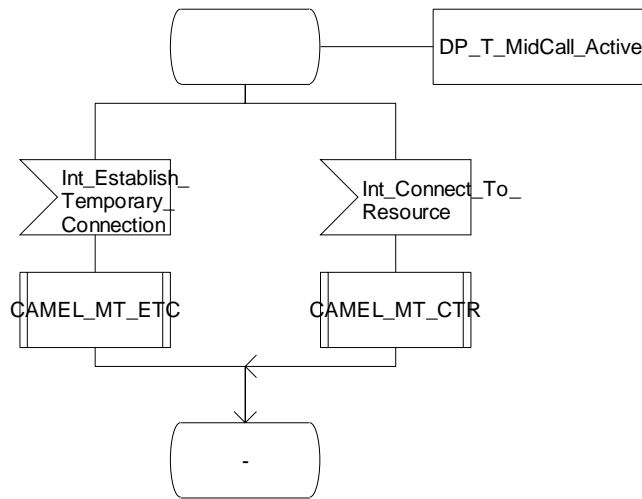
Figure 4.54-7: Procedure CAMEL_MT_RECONNECT_GMSC (sheet 7)

4.5.3.2 Retrieval of routeing information in the HLR

The functional behaviour of the HLR is specified in 3GPP TS 23.018 [12]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_HLR_INIT;

- Procedure CAMEL_CSI_Check_HLR;

- Procedure CAMEL_O_CSI_CHECK_HLR;

- Procedure CAMEL_D_CSI_CHECK_HLR;

- Procedure CAMEL_T_CSI_CHECK_HLR;

- Procedure CAMEL_CHECK_SII2_CDTI.

The procedure CAMEL_Provide_Subscriber_Info is specified in subclause 4.5.9.

Procedure CAMEL_HLR_INIT   1(2)

Procedure in the HLR to handle a request for routeing information for an MT call.

CAMEL subscriber — No

Yes

Triggering criteria stored? — No

Yes

Triggering criteria fulfilled? — No

Yes

GMSC supports CAMEL phase 4 — No

Yes

supported CSIs for CAMEL phase 4 sufficient? — Yes

No

GMSC supports CAMEL phase 3 — No

Yes

CAMEL phase 3 sufficient? — Yes

No

GMSC supports CAMEL phase 2 — No

Yes

CAMEL phase 2 sufficient? — Yes

No

GMSC supports CAMEL phase 1 — No

Yes

CAMEL phase 1 sufficient? — Yes

No

1

Result:= pass
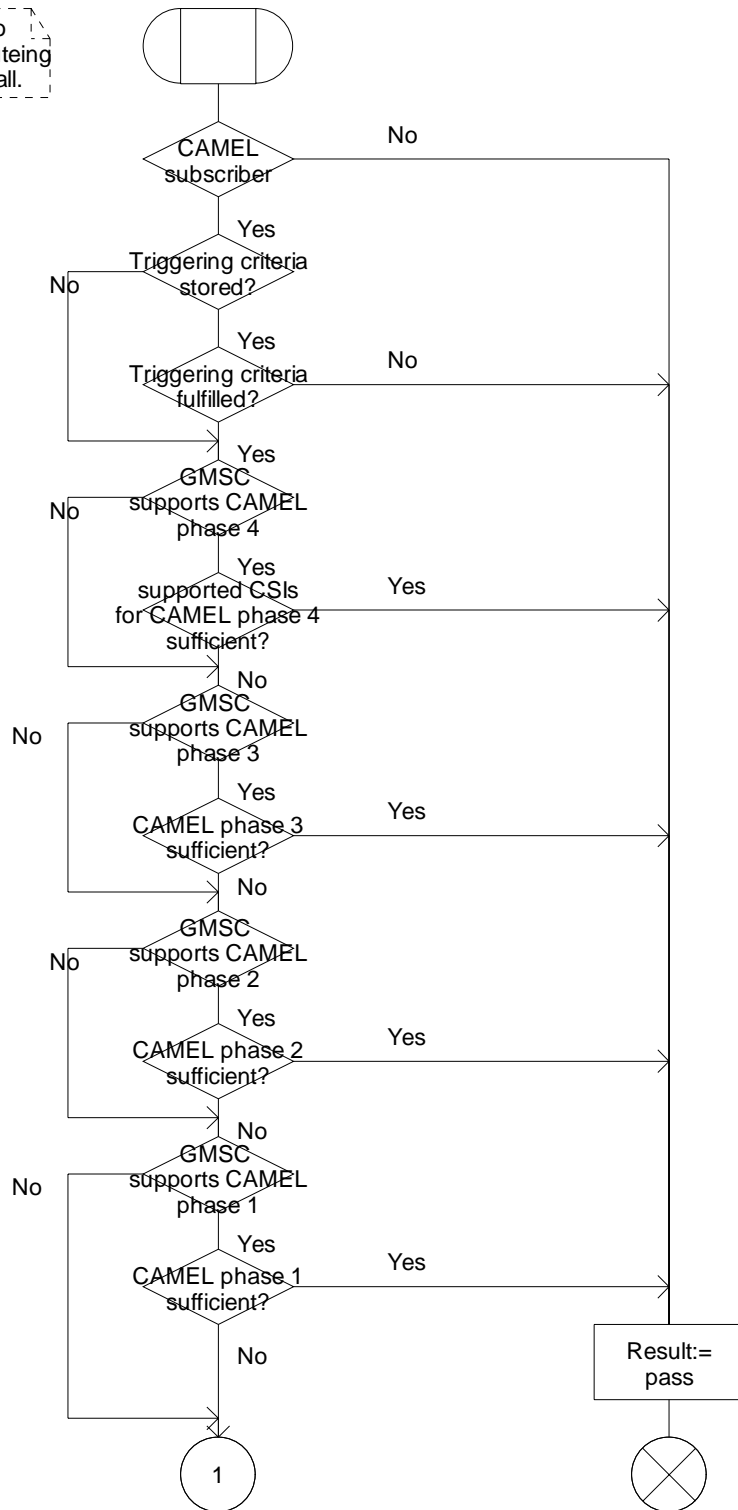
Figure 4.55-1: Procedure CAMEL_HLR_INIT (sheet 1)

Procedure CAMEL_HLR_INIT 2(2)

Procedure in the HLR to handle a request for routeing information for an MT call.

① 1

Default handling?

ODB | Continue | Network specific

Set negative response: Call Barred

Normal call handling according to 3GPP TS 23.018

Network specific handling

Result:= fail

Result:= pass
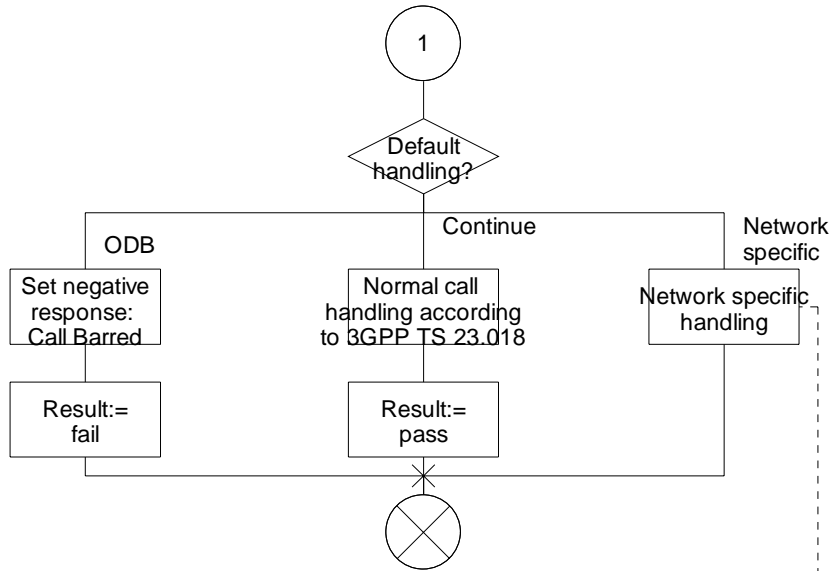
The network specific handling shall include the result of the procedure CAMEL_HLR_INIT (fail, pass)

Figure 4.55-2: Procedure CAMEL_HLR_INIT (sheet 2)

Procedure CAMEL_CSI_Check_HLR 1(1)

/* This procedure in the HLR to perform the handling for a forwarded CAMEL call. */

CAMEL_T_CSI_
CHECK_HLR

Result=
T-CSI
active?

Yes

No

CAMEL_O_CSI_
CHECK_HLR

CAMEL_D_CSI_
CHECK_HLR

Result:=
CSI active

Result:=
CSI not active
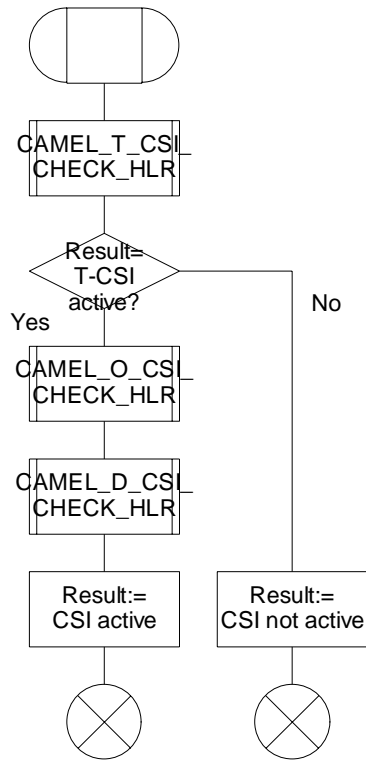
Figure 4.56-1: Procedure CAMEL_CSI_Check_HLR (sheet 1)

Procedure CAMEL_O_CSI_CHECK_HLR 1(1)

/* Procedure in the HLR to check the O-CSI and set the O-CSI parameter for SRI ack accordingly. */

O-CSI present and active?

No

Yes

Set O-CSI parameter (note 1, note 2)
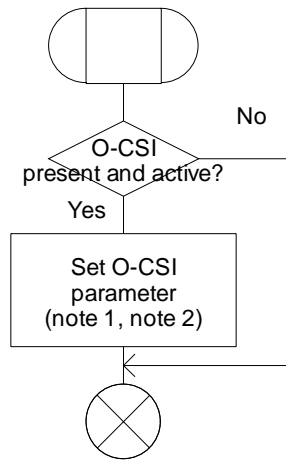
Note 1:
In case of GSM call forwarding, as an implementation option, the HLR may perform conditional triggering check for DP Collected Info services in O-CSI.
If the check passes, O-CSI shall be sent to the GMSC without conditional triggering criteria for DP Collected info.
If the check fails, DP Collected Info triggers shall not be sent to the GMSC.

Note 2:
The HLR shall not send O-CSI data to the GMSC if the GMSC does not support O-CSI or the CAMEL phase indicated in CAMEL Capability Handling of O-CSI.

Figure 4.57-1: Procedure CAMEL_O_CSI_CHECK_HLR (sheet 1)

Procedure CAMEL_D_CSI_CHECK_HLR 1(1)

/* Procedure in the HLR to check
the D-CSI and set the D-CSI
parameter for SRI ack accordingly. */

D-CSI
present and active? — No

Yes

Set D-CSI
parameter
(see Note 1)

⊗
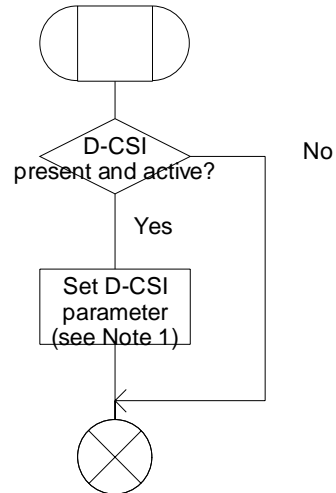
Note 1:
The HLR shall not send D-CSI data to the GMSC if the GMSC does not support D-CSI or the CAMEL phase
indicated in CAMEL Capability Handling of D-CSI.

Figure 4.58-1: Procedure CAMEL_D_CSI_CHECK_HLR (sheet 1)

Procedure CAMEL_T_CSI_CHECK_HLR   1(1)

/* Procedure in the HLR to
check the T-CSI and set the SRI ack
parameter accordingly */
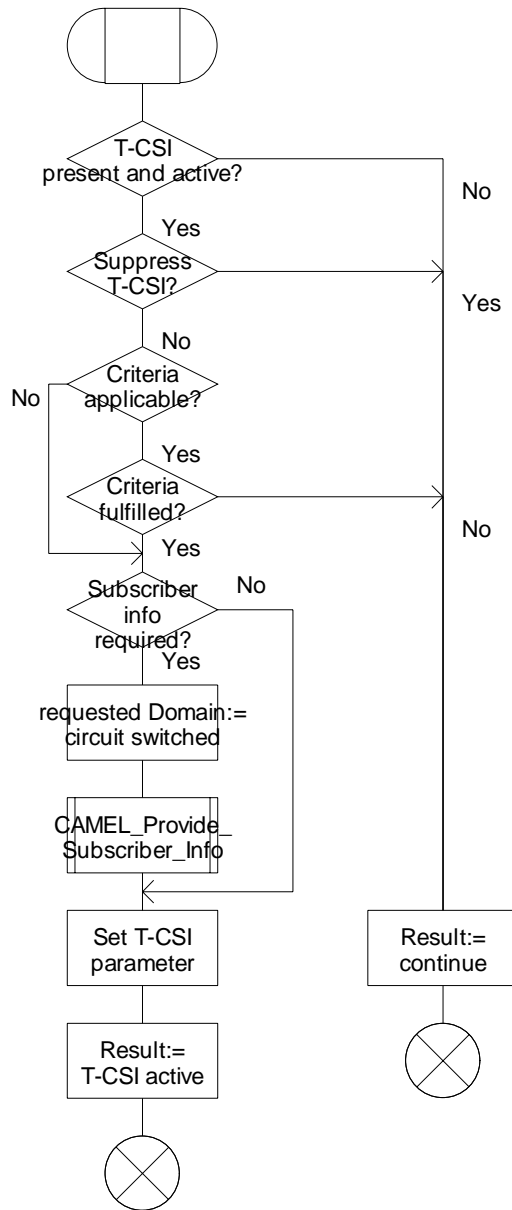
Figure 4.59-1: Procedure CAMEL_T_CSI_CHECK_HLR (sheet 1)

Procedure CAMEL_CHECK_SII2_CDTI 1(1)

/* Procedure in the HLR or MSC to
determine if the SII2 allows or disallows
invocation of Call Forwarding or Call
Deflection. */

Yes

Call Diversion Treatment
Indicator present in SII2?

No

Call Diversion Treatment
Indicator set to Call
Diversion allowed?

Yes

No

Result :=
Fail

Result :=
Pass
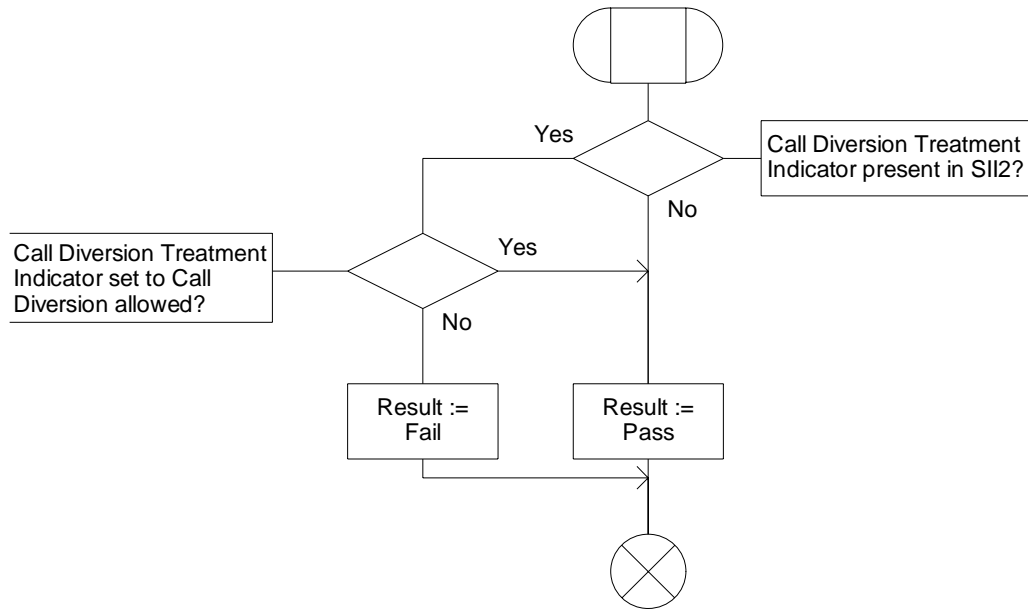
Figure 4.60-1: Procedure CAMEL_CHECK_SII2_CDTI (sheet 1)

4.5.3.3 Handling of provide roaming number request in the VLR

The functional behaviour of the VLR is specified in 3GPP TS 23.018 [12]. The procedure specific to CAMEL is specified in this subclause:

- Procedure CAMEL_SET_SOA.

Procedure CAMEL_SET_SOA 1(1)

Procedure in the VLR to set the
suppression of announcement
indicator as required for this call
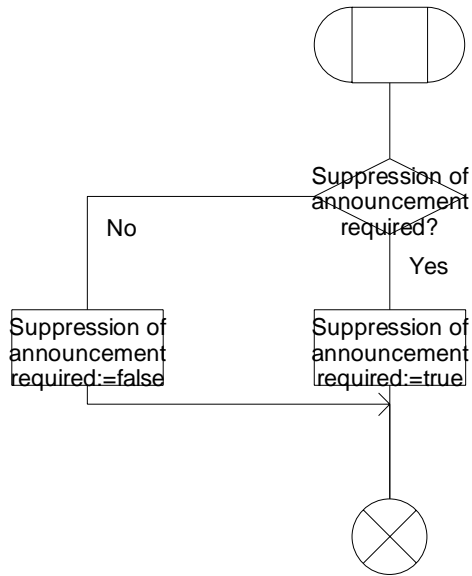
Figure 4.61-1: Procedure CAMEL_SET_SOA (sheet 1)

4.5.4 Handling of mobile terminating calls

4.5.4.1 Handling of mobile terminating calls in the terminating VMSC

The functional behaviour of the terminating VMSC is specified in 3GPP TS 23.018 [12].

The behaviour specific to CAMEL is:

- the inclusion of the O-CSI and/or D-CSI parameter in the Perform Call Forwarding information flow sent to the process MT_CF_MSC if O-CSI and/or D-CSI was received in the Send Info For Incoming Call ack information flow;

- the requirement to suppress the connection of announcements or tones if the VLR includes the suppression of announcements parameter in the Send Info For Incoming Call negative response information flow.

The processes and procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_ICH_VLR;

- Procedure CAMEL_O_CSI_Check_VLR;

- Procedure CAMEL_D_CSI_Check_VLR;

- Procedure CAMEL_VT_CSI_Check_VLR;

- Procedure CAMEL_ICH_MSC_INIT;

- Procedure CAMEL_MT_VMSC_Notify_CF;

- Procedure CAMEL_ICH_LEG2_MSC;

- Procedure CAMEL_ICH_LEG2_CF_MSC;

- Process CAMEL_ICH_LEG1_MSC;

- Procedure CAMEL_ICH_RECONNECT_MSC;

- Process CAMEL_T_CHANGE_OF_POSITION_MSC.

The procedure CAMEL_ICH_LEG2_MSC supervises the terminating party only. The procedure CAMEL_ICH_LEG2_CF_MSC supervises the forwarded-to party only. The process CAMEL_ICH_LEG1_MSC supervises the originating party only. Hence, signals from the BSS are received by the procedure CAMEL_ICH_LEG2_MSC, signals from the destination exchange are received by the procedure CAMEL_ICH_LEG2_CF_MSC and signals from the originating exchange are received by the process CAMEL_ICH_LEG1_MSC.

4.5.4.1.1 Action of the VMSC in procedure CAMEL_MT_VMSC_Notify_CF

The Forwarding reason is taken from the Complete Call information flow from the VLR.

The Int_DP_T_No_Answer signal and Int_DP_T_Busy signal include a parameter to indicate that the call has encountered conditional call forwarding. The gsmSSF will transfer this parameter to the Event Report BCSM information flow which it sends to the gsmSCF.

4.5.4.1.2 Action of MSC on receipt of Int_Disconnect_Leg (Leg 2)

If the MSC receives Int_Disconnect_Leg (Leg 2) signal from the gsmSSF, in response to an Initial DP information flow, the MSC will continue the handling of the calling party (Leg1) without routeing the call to a destination.

4.5.4.1.3 Procedure CAMEL_ICH_LEG2_MSC

The Int_DTMF_Digit_Received information flow is received from an internal process in the MSC that receives DTMF signalling from the MS. The handling of the internal process that receives DTMF signalling is out of scope of the present document. The playing of the received DTMF tones to the other parties in the call segment is out of scope of the present document.

4.5.4.1.4 Process CAMEL_T_CHANGE_OF_POSITION_MSC

The signals HANDOVER COMPLETE and HANDOVER PERFORMED are specified in 3GPP TS 48.008 [39]. Signals RELOCATION REQUEST ACKNOWLEDGE, LOCATION REPORT and LOCATION REPORTING COMMAND are specified in 3GPP TS 25.413 [33].

Procedure CAMEL_ICH_VLR 1(1)

/* This procedure is called in
ICH_VLR (in 3GPP TS 23.018) */

/* Signals to/from the left
are to/from the MSC. */
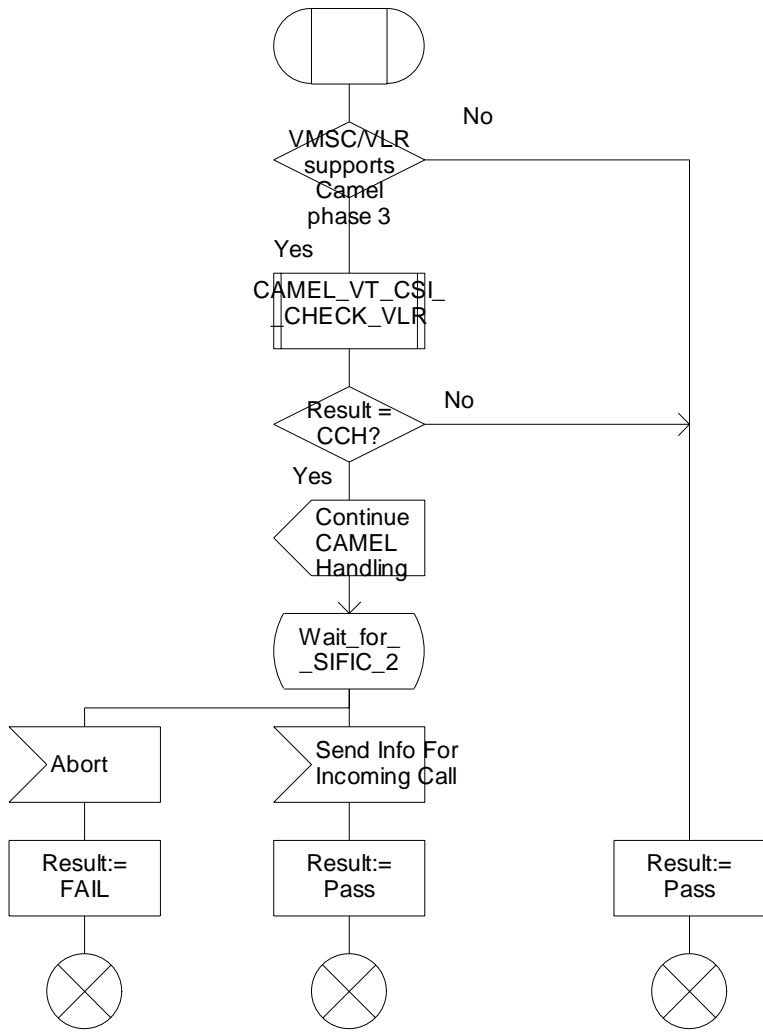
Figure 4.62-1: Procedure CAMEL_ICH_VLR (sheet 1)

Procedure CAMEL_O_CSI_CHECK_VLR 1(1)

Procedure in the VLR to check
the O-CSI and set the O-CSI
parameter for SIFIC ack accordingly.

O-CSI
provisioned?

Yes

Set O-CSI
parameter

No
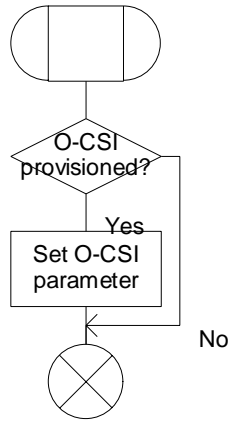
Figure 4.63-1: Procedure CAMEL_O_CSI_Check_VLR (sheet 1)

Procedure CAMEL_D_CSI_CHECK_VLR   1(1)

/* Procedure in the VLR to check
the D-CSI and set the D-CSI
parameter for SIFIC ack accordingly. */

D-CSI
provisioned?   No

Yes

Set D-CSI
parameter
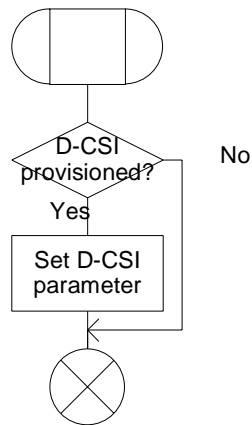
Figure 4.64-1: Procedure CAMEL_D_CSI_Check_VLR (sheet 1)

ETSI

Procedure CAMEL_VT_CSI_CHECK_VLR 1(1)

/* Procedure in the VLR to
check the VT-CSI and set the SIFIC ack
parameter accordingly */

VT-CSI provisioned? — No

Yes

Suppress VT-CSI? — Yes

No

Criteria applicable? — No

Yes

- Check basic service code criteria
- Check VT-CSI in VMSC-B

Criteria fulfilled? — No

Yes

Set VT-CSI parameter

Result:= CCH

Result:= continue
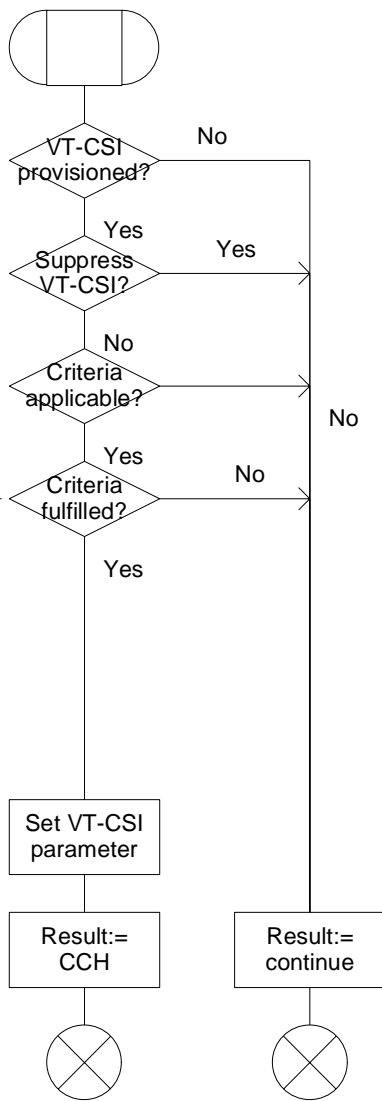
Figure 4.65-1: Procedure CAMEL_VT_CSI_Check_VLR (sheet 1)

Procedure CAMEL_ICH_MSC_INIT 1(5)

/* Process in the VMSC-B to handle a terminating call request */

/* Signals to/from the right are to/from the gsmSSF */

set
CSI=VT-CSI

Int_Invoke
gsmSSF
(VT-CSI)

wait_for_
gsmSSF_Invoked
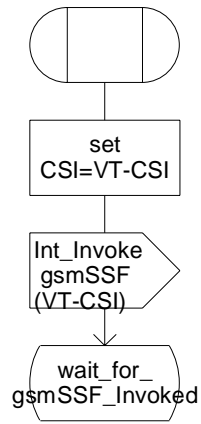
Figure 4.66-1: Procedure CAMEL_ICH_MSC_INIT (sheet 1)

Procedure CAMEL_ICH_MSC_INIT 2(5)

/* Process in the VMSC-B to handle a terminating call request */

/* Signals to/from the left are to/from the orginating exchange; signals to/from the right are to/from the gsmSSF */

wait_for_gsmSSF_Invoked

Int_gsmSSF_Invoked

Release

Call_Active := False

Int_T_Exception

Int_DP_Termination_Attempt_Autorized

Result:= aborted

DP_Termination_Attempt_Autorized

Int_Disconnect_Leg (leg2)

Int_Disconnect_Leg_ack

Leg2_Disconnected

Int_Continue

Int_Continue_With_Argument

'Modify call parameters with received information'

Result := Leg1_only
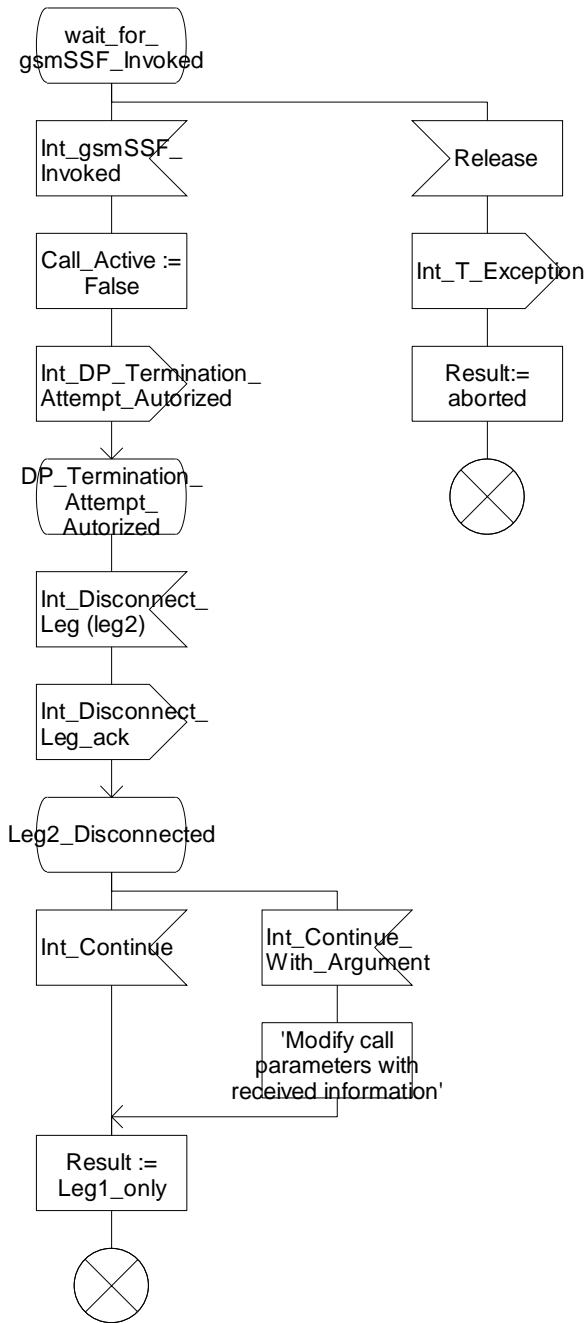
Figure 4.66-2: Procedure CAMEL_ICH_MSC_INIT (sheet 2)
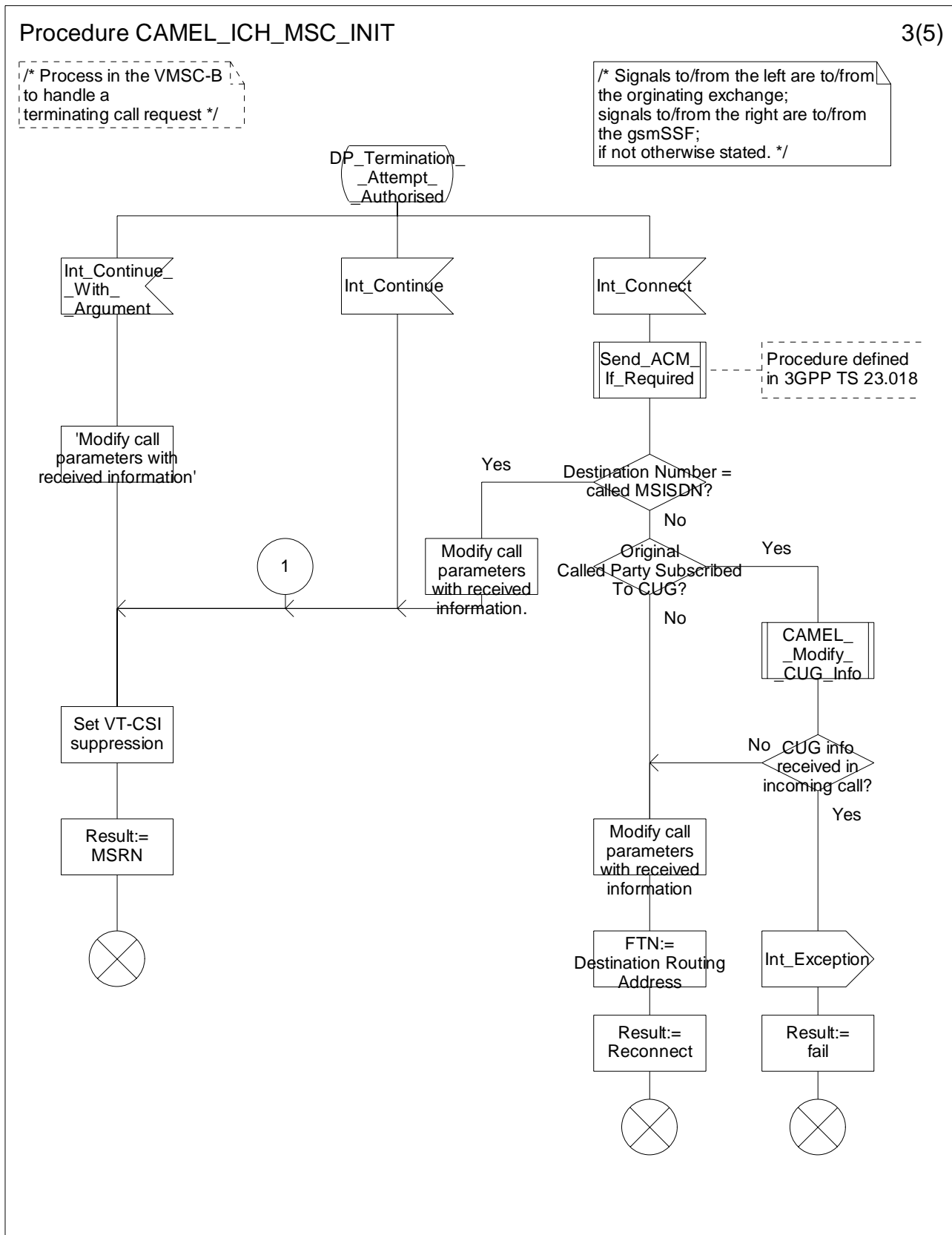
Figure 4.66-3: Procedure CAMEL_ICH_MSC_INIT (sheet 3)

Procedure CAMEL_ICH_MSC_INIT 4(5)

/* Process in the VMSC-B to handle a terminating call request */

/* Signals to/from the left are to/from the orginating exchange; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */

DP_Termination_Attempt_Authorised, Leg2_Disconnected

Leg2_Disconnected

DP_Termination_Attempt_Authorised, Leg2_Disconnected

Release

Int_Disconnect_ Leg (leg1)

Int_ReleaseCall

Int_Error

Int_Disconnect_ Leg_ack

Leg2_Disconnected?

Yes

No

Int_DP_ _T_Abandon

Default Call Handling = Continue Call?

DP_T_Abandon

No

Release

Yes

Int_continue

Int_Continue_ With_Argument

1

Result:= aborted

Result:= Aborted

Figure 4.66-4: Procedure CAMEL_ICH_MSC_INIT (sheet 4)

Procedure CAMEL_ICH_MSC_INIT   5(5)

/* Process in the VMSC-B to handle a terminating call request */

/* Signals to/from the right are to/from the gsmSSF. */

DP_Termination_Attempt_Authorised,
DP_T_Not_Reachable,
Leg2_Disconnected

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No

Yes

Result:=
fail

-

⊗
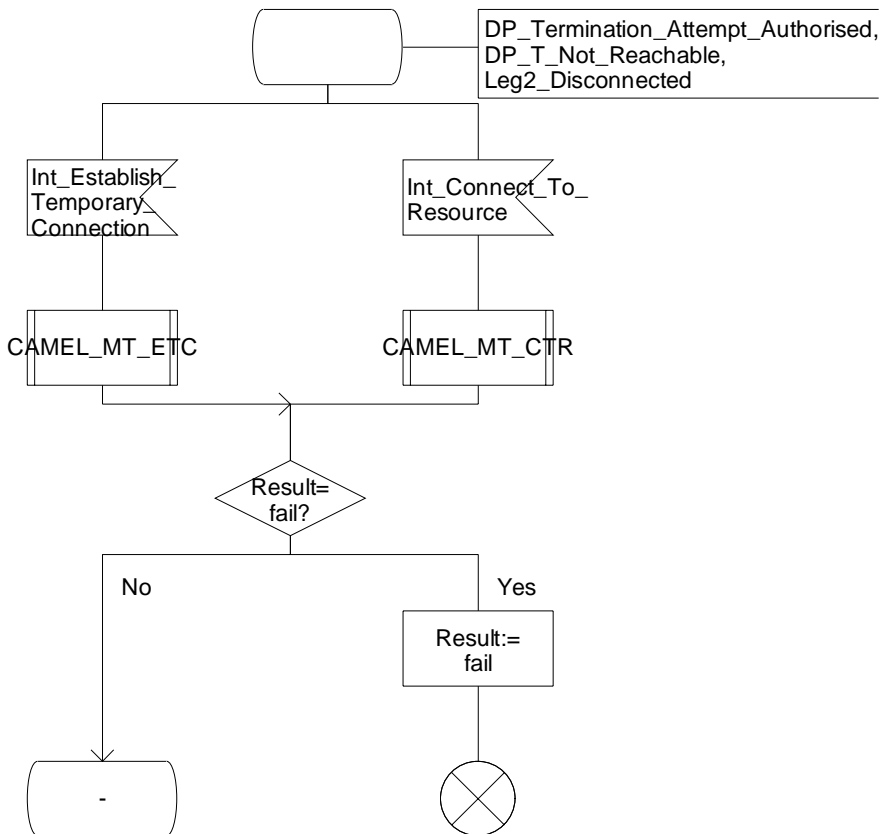
Figure 4.66-5: Procedure CAMEL_ICH_MSC_INIT (sheet 5)

ETSI

Figure 4.67-1: Procedure CAMEL_MT_VMSC_Notify_CF (sheet 1)

Procedure CAMEL_MT_VMSC_Notify_CF 2(2)

/* Procedure in the VMSC
to notify the gsmSSF that
a call has encountered
conditional call forwarding */

/* Signals to/from the left are
to/from the VMSC;
signals to/from the right are
to/from the gsmSSF
unless marked otherwise */

DP_T_CCF

Int_Error

No ◇ Default call handling =
continue call ?

Yes

Release

To process
MT_CF_MSC — CF
cancelled

Release call
resources

Result:=
Fail

Result:=
Continue

⊗ ⊗
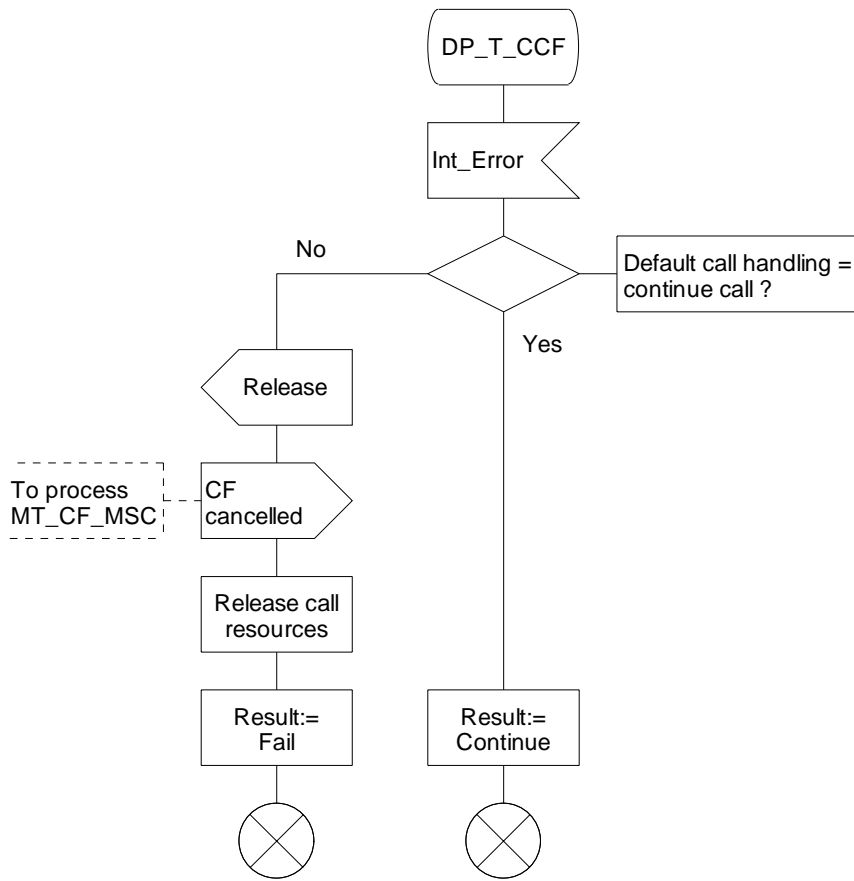
Figure 4.67-2: Procedure CAMEL_MT_VMSC_Notify_CF (sheet 2)

Procedure CAMEL_ICH_LEG2_MSC 1(7)

/* A procedure in the MSC to handle leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from the BSS; unless otherwise stated. */
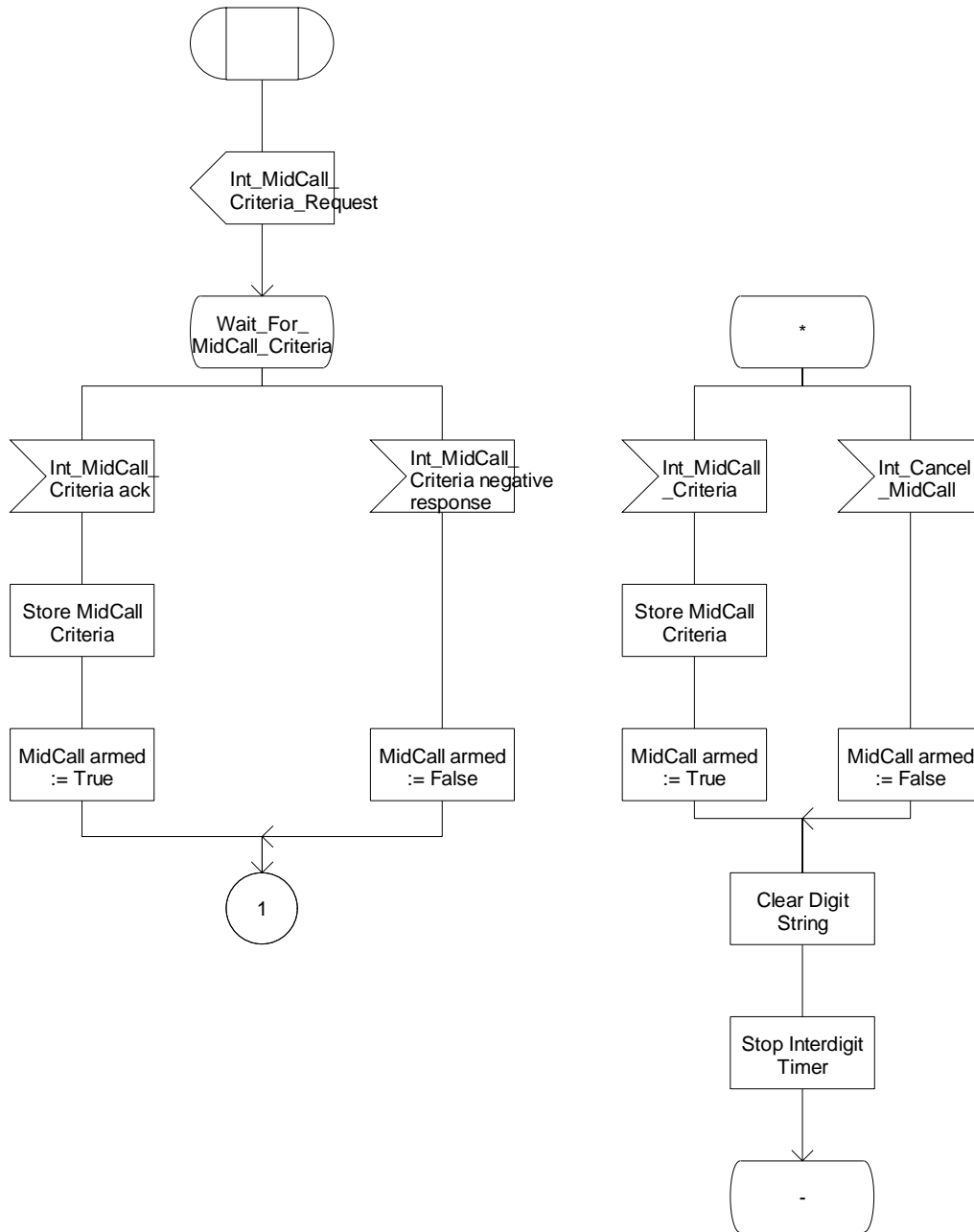
Figure 4.68-1: Procedure CAMEL_ICH_LEG2_MSC (sheet 1)

Procedure CAMEL_ICH_LEG2_MSC   2(7)

/* A procedure in the MSC to
handle leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF;
Signals to/from the right are to/from the BSS;
unless otherwise stated. */
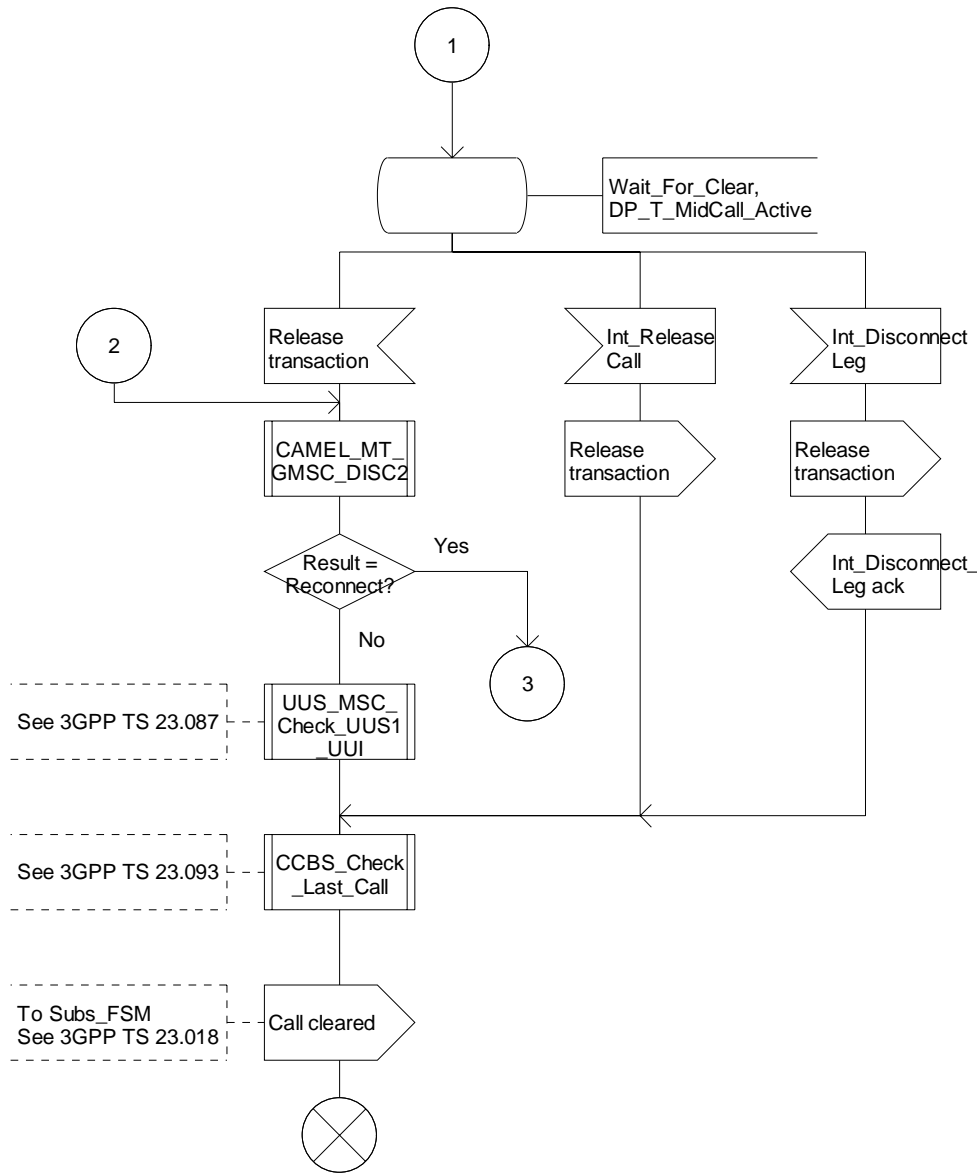
Figure 4.68-2: Procedure CAMEL_ICH_LEG2_MSC (sheet 2)

Procedure CAMEL_ICH_LEG2_MSC 3(7)

/* A procedure in the MSC to handle leg 2 of an active call. */

/* Signals to/from the left are to/from the Subs_FSM (See 3GPP TS 23.018); Signals to/from the right are to/from the BSS; unless otherwise stated. */

Wait_For_Clear, DP_T_MidCall_Active

Hold Request

Retrieve Request

ECT request

MPTY request

Hold supported?

Hold supported?

ECT request

MPTY request

No / Yes

Yes / No

Hold reject

Process_Hold _Request

Process_Retrieve _Request

Retrieve reject

-

See 3GPP TS 23.083
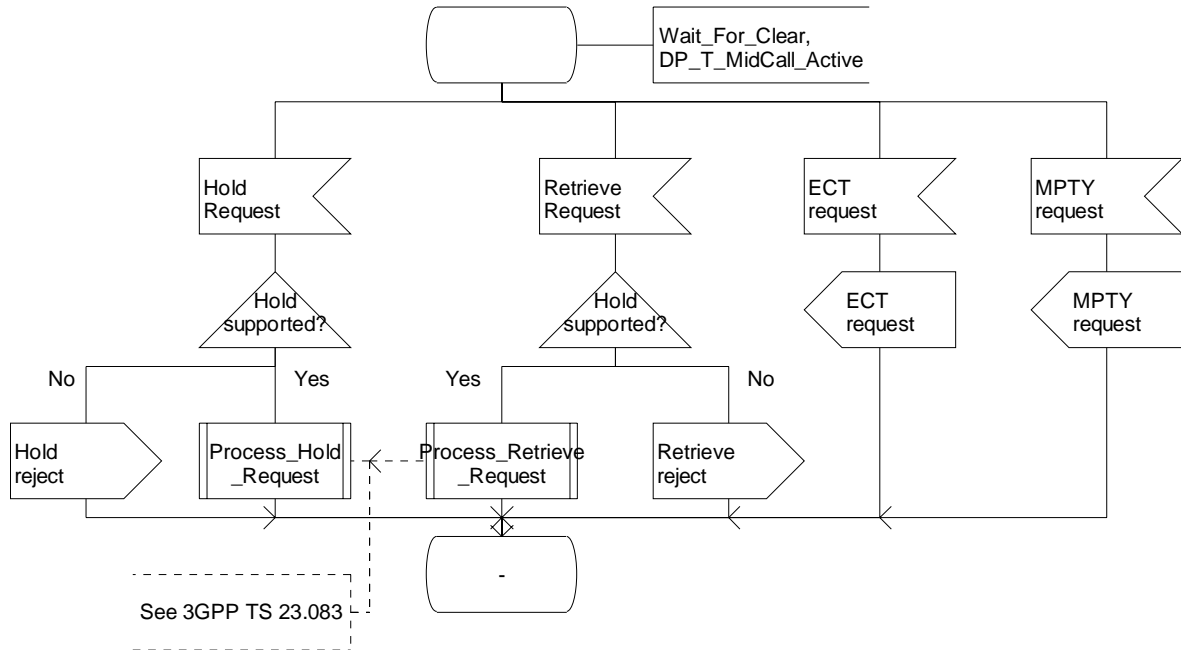
Figure 4.68-3: Procedure CAMEL_ICH_LEG2_MSC (sheet 3)

Procedure CAMEL_ICH_LEG2_MSC 4(7)

/* A procedure in the MSC to handle leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from BSS; unless otherwise stated. */
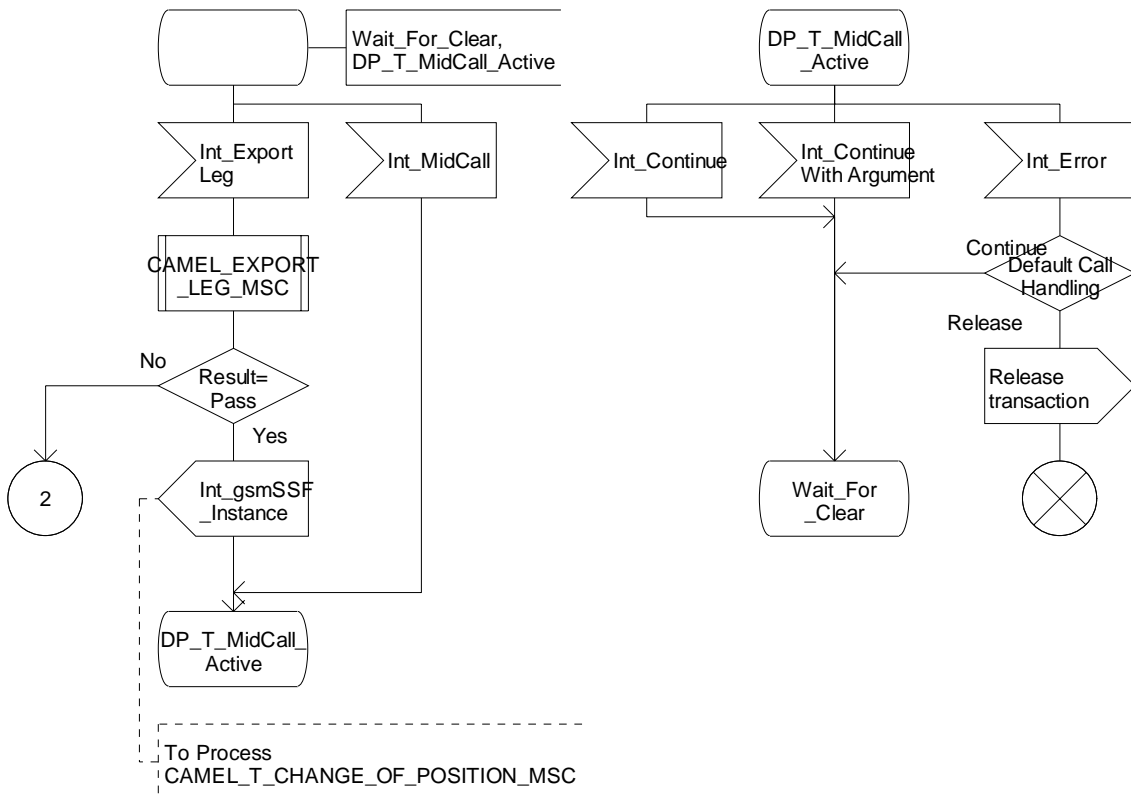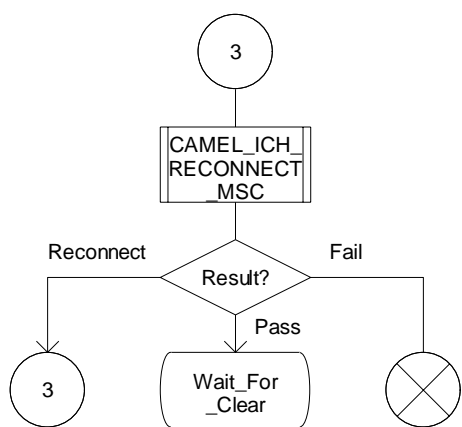
Figure 4.68-4: Procedure CAMEL_ICH_LEG2_MSC (sheet 4)

Procedure CAMEL_ICH_LEG2_MSC 5(7)

/* A procedure in the MSC to handle leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from BSS; unless otherwise stated. */

DP_T_MidCall_Active, Wait_For_Clear

From MSC process — Int_DTMF_ Digit_Received

MidCall armed? — False

True

Interdigit Timeout is specified in MidCall Criteria — Start Interdigit Timer

Add Digit to Digit String

CHECK_DIGIT_ STRING_MSC

Result?
Trigger — Continue
Abort

Stop Interdigit Timer

Stop Interdigit Timer

Int_DP_T_ MidCall

Clear Digit String

Clear Digit String

DP_T_ MidCall _Active

-
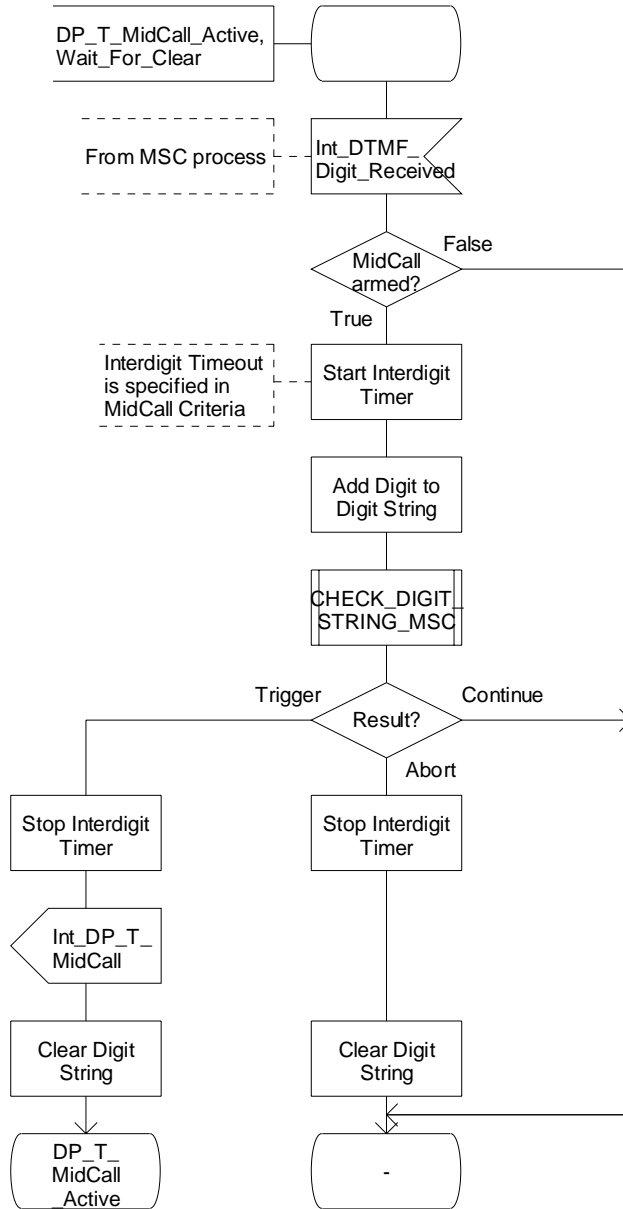
Figure 4.68-5: Procedure CAMEL_ICH_LEG2_MSC (sheet 5)

Procedure CAMEL_ICH_LEG2_MSC 6(7)

/* A procedure in the MSC to handle leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from BSS; unless otherwise stated. */
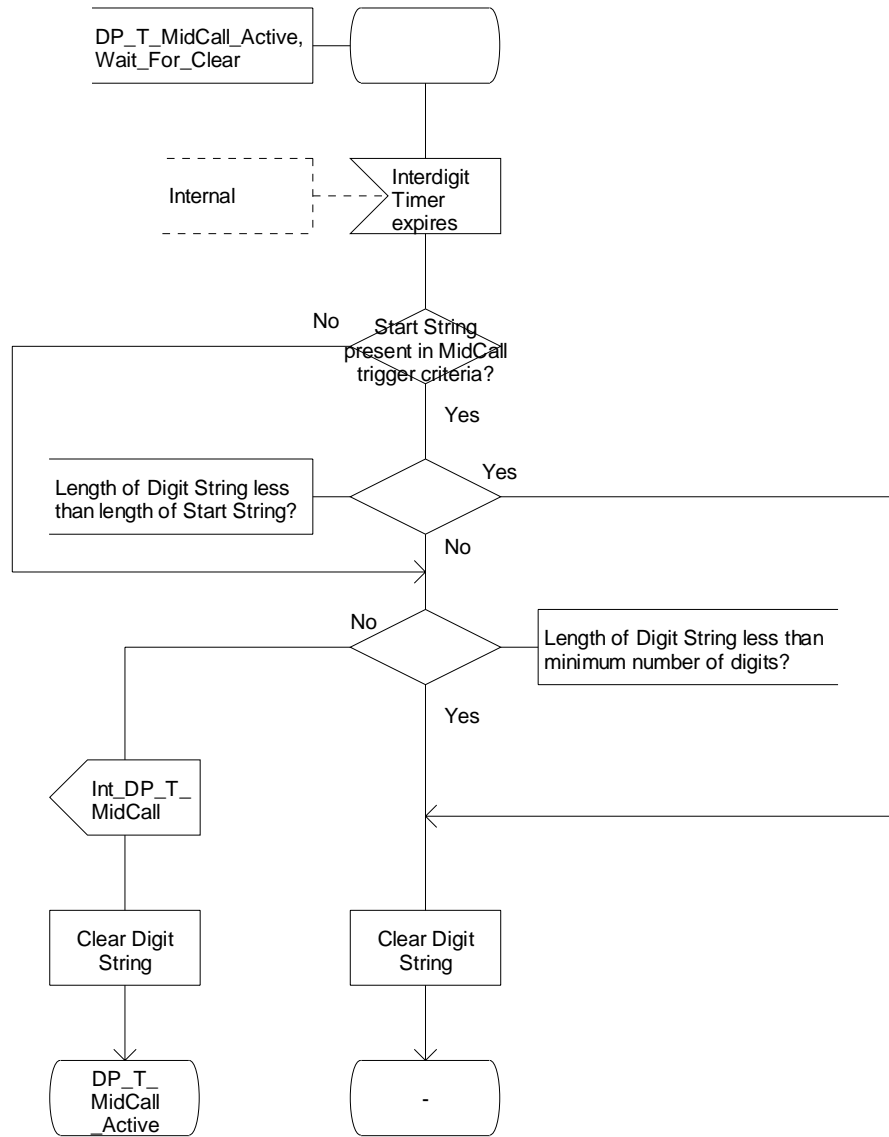
Figure 4.68-6: Procedure CAMEL_ICH_LEG2_MSC (sheet 6)

Procedure CAMEL_ICH_LEG2_MSC 7(7)

/* A procedure in the MSC to handle leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from BSS; unless otherwise stated. */

DP_T_MidCall_Active

Int_Establish_ Temporary_ Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

-
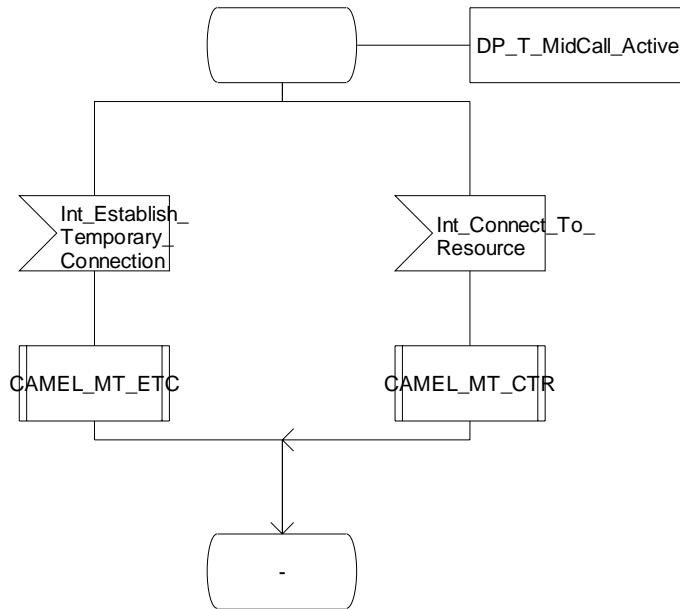
Figure 4.68-7: Procedure CAMEL_ICH_LEG2_MSC (sheet 7)

Figure 4.69-1: Process CAMEL_ICH_LEG2_CF_MSC (sheet 1)

Procedure CAMEL_ICH_LEG2_CF_MSC 2(2)

/* A procedure in the MSC to handle a forwarded leg 2 of an active call. */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from MT_CF_MSC; unless otherwise stated. */

DP_T_MidCall_Active

Int_Establish_ Temporary_ Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

-
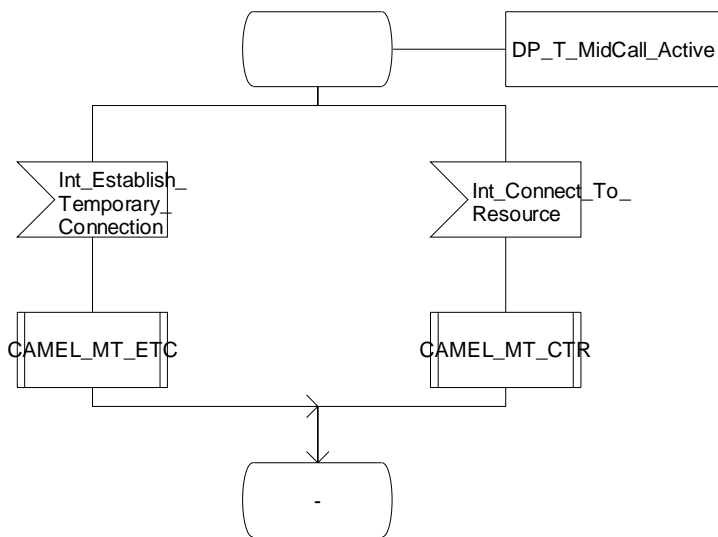
Figure 4.69-2: Process CAMEL_ICH_LEG2_CF_MSC (sheet 2)

Process CAMEL_ICH_LEG1_MSC   1(5)

/* A process in the MSC to
handle leg 1 of a CPH configuration. */

/*Signals to/from the left are to/from the GMSC;
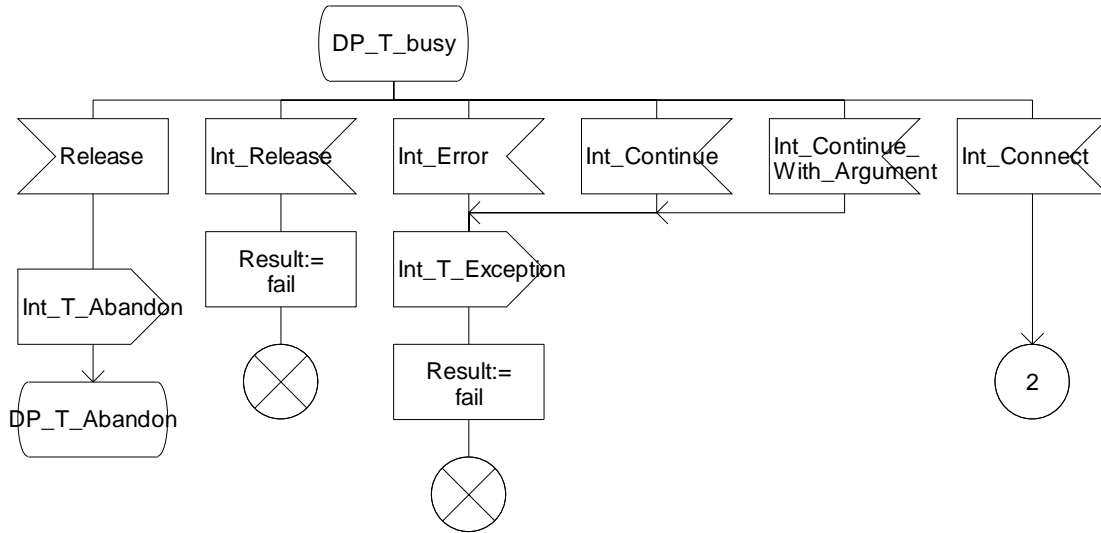Signals to/from the right are to/from the gsmSSF;
unless otherwise stated. */

Store Leg1
information

Leg1_status?

Active → Wait_For_
Clear

Set-up

Abort - - → To VLR

Wait_For_
Alerting

Alerting

Connect

See 3GPP TS 23.018 - - Send_ACM_
If_Required

Send_Network_
Connect_If_
Required - - See 3GPP TS 23.018

Wait_For_
Answer

Wait_For_
Clear

Answer

See 3GPP TS 23.018 - - Send_Answer_
If_Required

Wait_For_
Clear
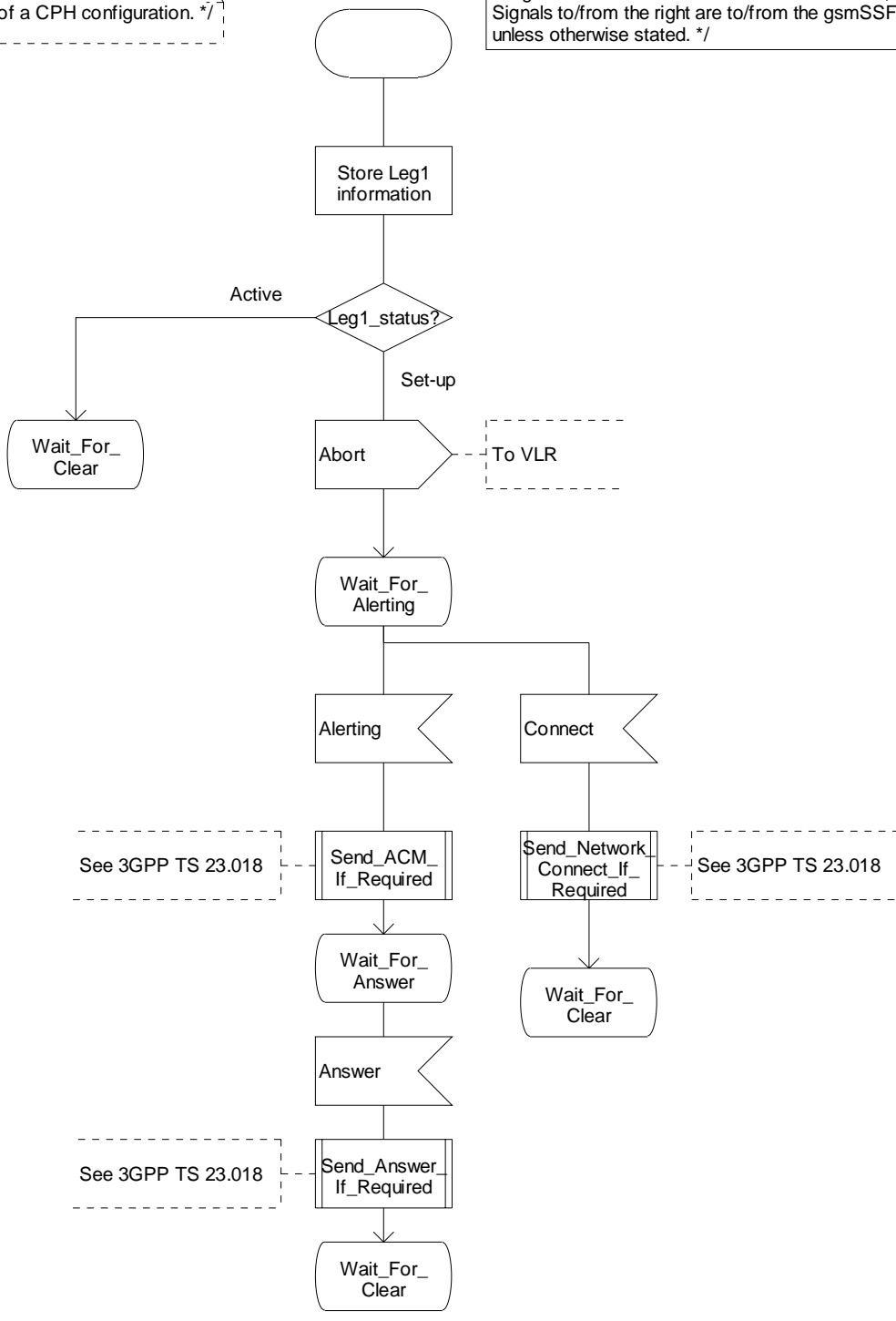
Figure 4.70-1: Process CAMEL_ICH_LEG1_MSC (sheet 1)

ETSI

Process CAMEL_ICH_LEG1_MSC 2(5)

/* A process in the MSC to
handle leg 1 of a CPH configuration. */

/*Signals to/from the left are to/from the GMSC;
Signals to/from the right are to/from the gsmSSF;
unless otherwise stated. */

Wait_For_Alerting,
Wait_For_Answer,
DP_T_MidCall_Alerting

Release

CAMEL_MT_
GMSC_DISC6

Int_Disconnect_
Leg

Release

Int_Disconnect
Leg_ack

Int_Release
Call

Release

From gsmSSF

DP_T_MidCall
_Alerting

Answer

Int_Continue

Int_Continue
With Argument

Wait_For_Answer,
DP_T_MidCall_Alerting

Int_MidCall

DP_T_MidCall
_Alerting

Wait_For_
Answer
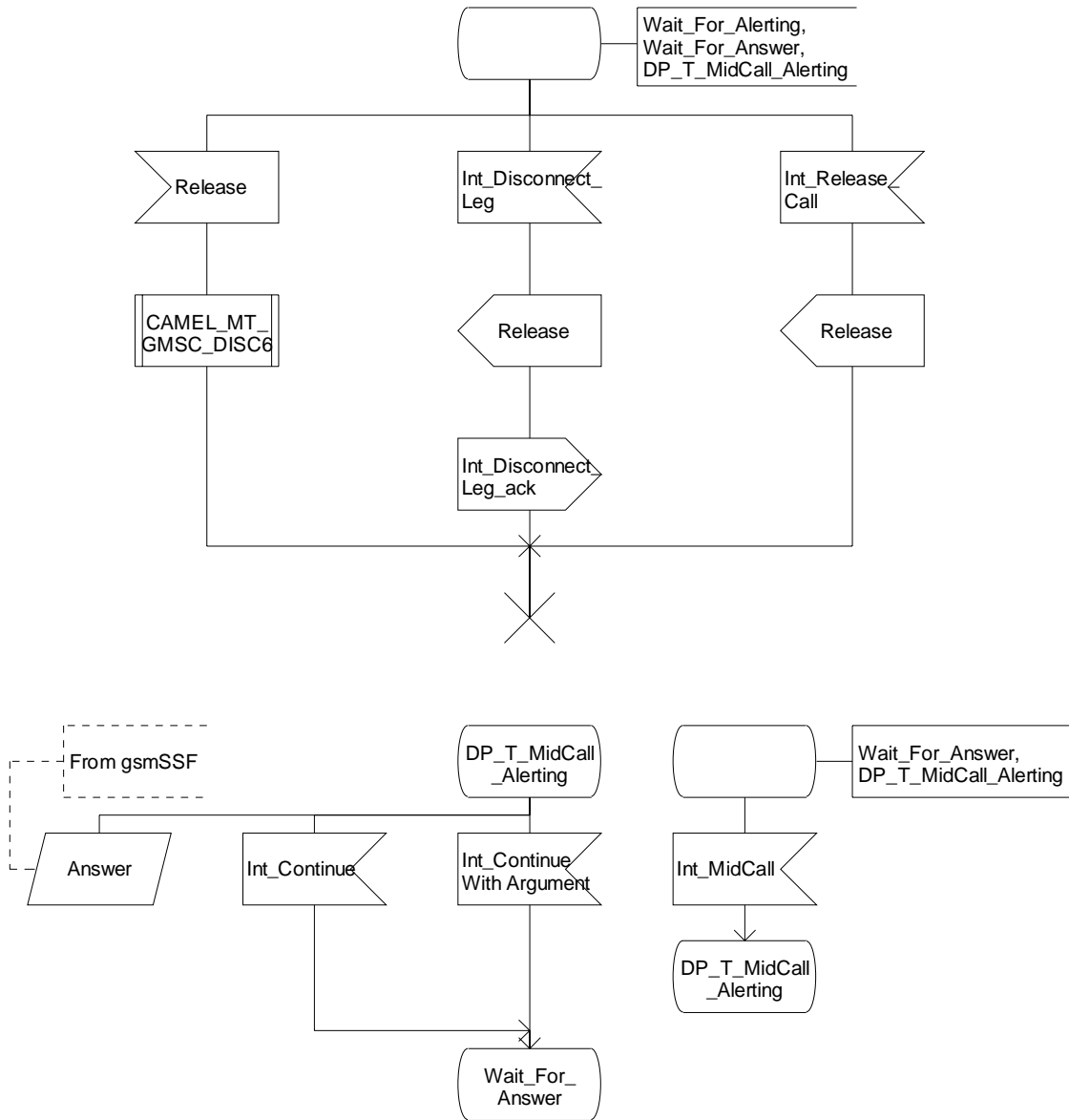
Figure 4.70-2: Process CAMEL_ICH_LEG1_MSC (sheet 2)

Process CAMEL_ICH_LEG1_MSC   3(5)

/* A process in the MSC to
handle leg 1 of a CPH configuration. */

/*Signals to/from the left are to/from the GMSC;
Signals to/from the right are to/from the gsmSSF;
unless otherwise stated. */

Figure 4.70-3: Process CAMEL_ICH_LEG1_MSC (sheet 3)

Process CAMEL_ICH_LEG1_MSC 4(5)

/* A process in the MSC to
handle leg 1 of a CPH configuration. */

/*Signals to/from the left are to/from the GMSC;
Signals to/from the right are to/from the gsmSSF;
unless otherwise stated. */

DP_T_MidCall_Alerting

Int_Establish
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result?

ELSE

Fail

Answer

Result :=
Answer

To SELF

Answer

-
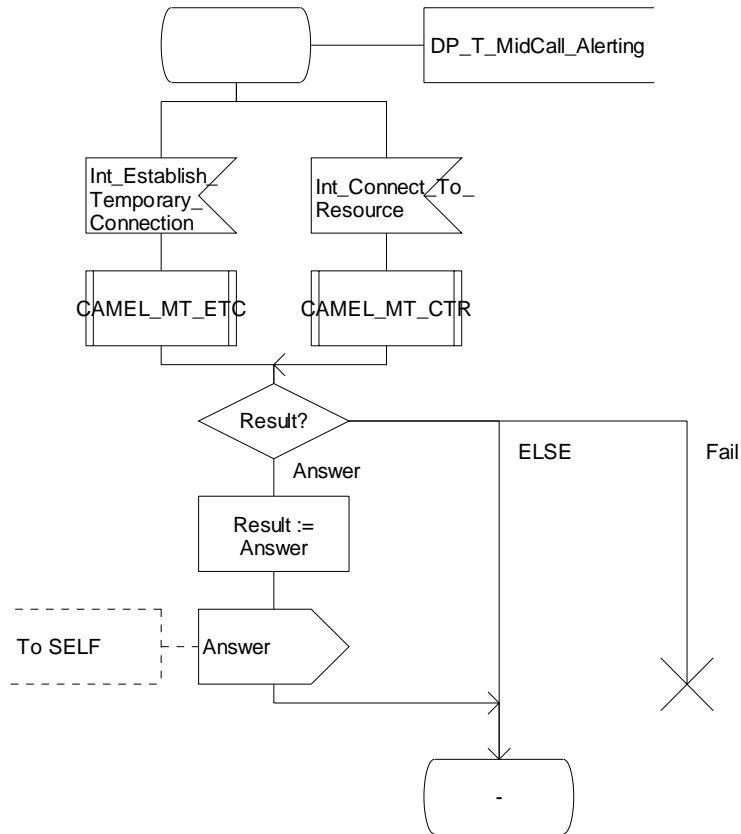
Figure 4.70-4: Process CAMEL_ICH_LEG1_MSC (sheet 4)

Process CAMEL_ICH_LEG1_MSC 5(5)

/* A process in the MSC to handle leg 1 of a CPH configuration. */

/*Signals to/from the left are to/from the GMSC; Signals to/from the right are to/from the gsmSSF; unless otherwise stated. */

DP_T_MidCall_Active

Int_Establish_Temporary Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

-

Wait_For_ACM

Int_Establish_Temporary Connection

Int_Connect_To_ Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result?

Fail

ELSE

-
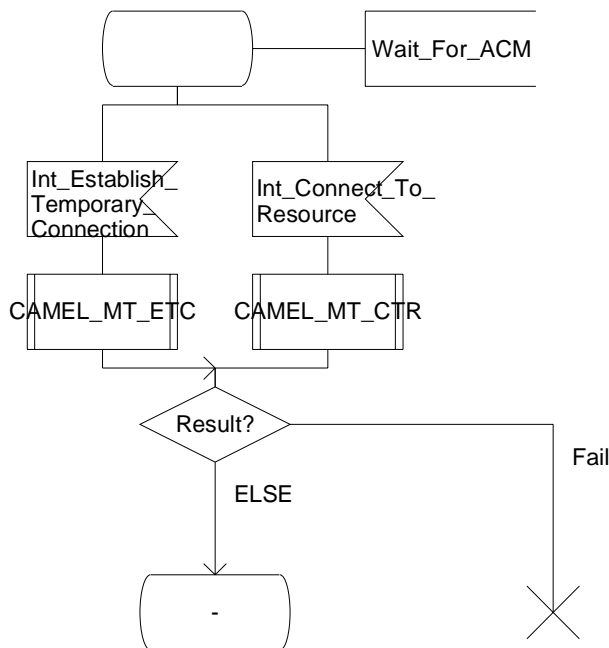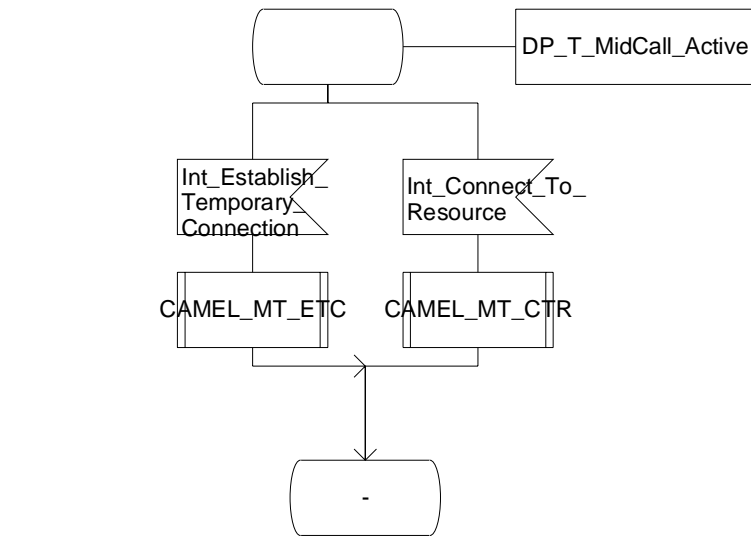
Figure 4.70-5: Process CAMEL_ICH_LEG1_MSC (sheet 5)

Procedure CAMEL_ICH_RECONNECT_MSC 1(7)

/* A proecedure in the MSC to handle a reconnection after leg 2 disconnect */

/* Signals to/from the right are to/from the VLR; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */

Send Info For MT Reconnected Call

Wait_For_ Reconnected _Call_Result

Int_Release _Call

Abort

Send Info For MT Reconnected Call negative response

Int_ Exception

Result := Fail

Send Info For MT Reconnected Call ack

1

Int_Disconnect Leg

Abort

Int_Disconnect Leg ack

Result := Fail
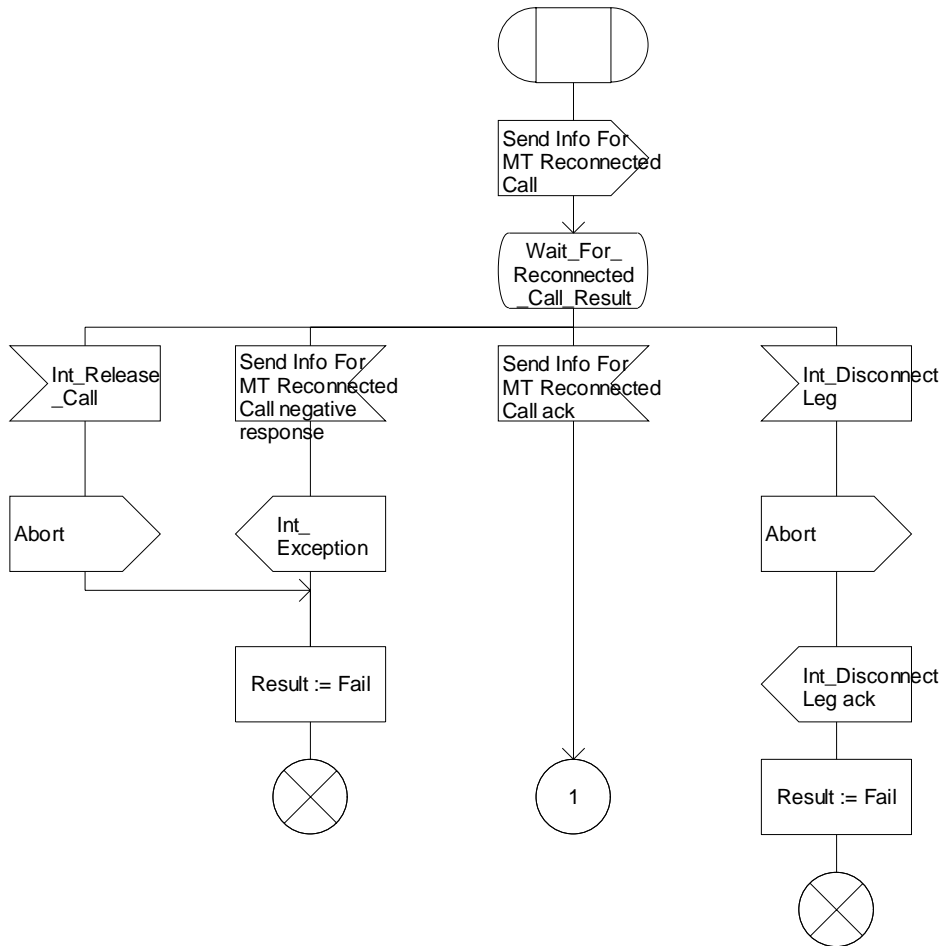
Figure 4.71-1: Procedure CAMEL_ICH_RECONNECT_MSC (sheet 1)

Procedure CAMEL_ICH_RECONNECT_MSC   2(7)

/* A procedure in the MSC to handle
a reconnection after leg 2 disconnect */

/* Signals to/from the right are to/from the VLR;
Signals to/from the left are to/from the gsmSSF;
unless otherwise stated. */
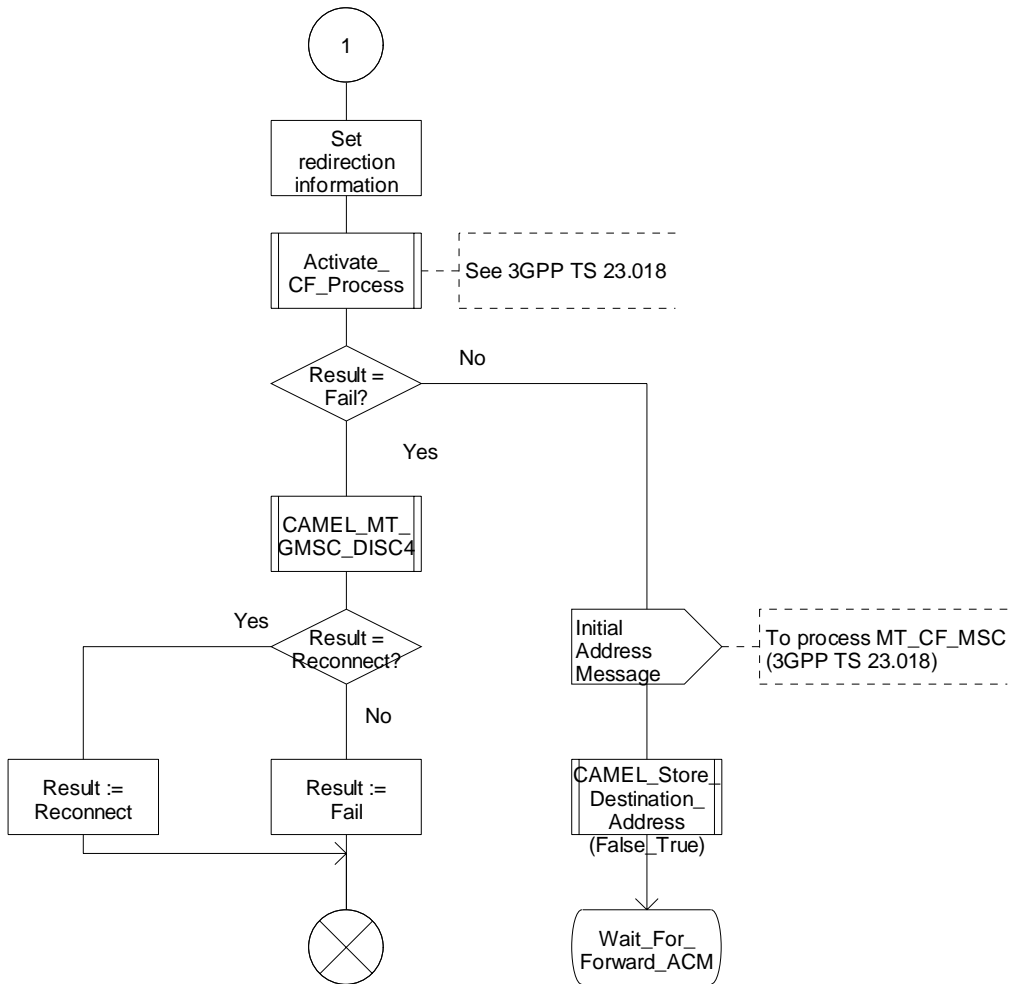
Figure 4.71-2: Procedure CAMEL_ICH_RECONNECT_MSC (sheet 2)

Procedure CAMEL_ICH_RECONNECT_MSC 3(7)

/* A proecedure in the MSC to handle a reconnection after leg 2 disconnect */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the process MT_CF_MSC; unless otherwise stated. */
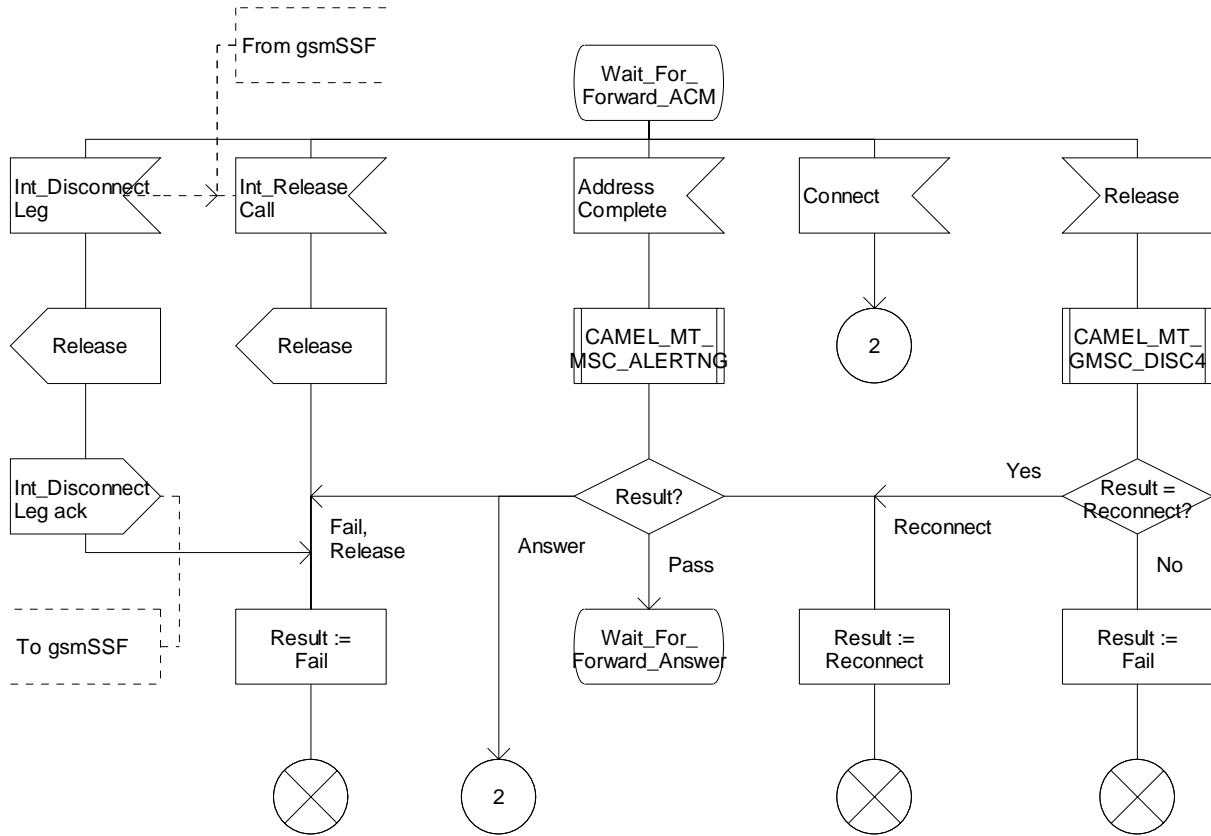
Figure 4.71-3: Procedure CAMEL_ICH_RECONNECT_MSC (sheet 3)

Procedure CAMEL_ICH_RECONNECT_MSC 4(7)

/* A proecedure in the MSC to handle a reconnection after leg 2 disconnect */

/* Signals to/from the right are to/from the destination exchange; signals to/from the left are to/from the gsmSSF. */
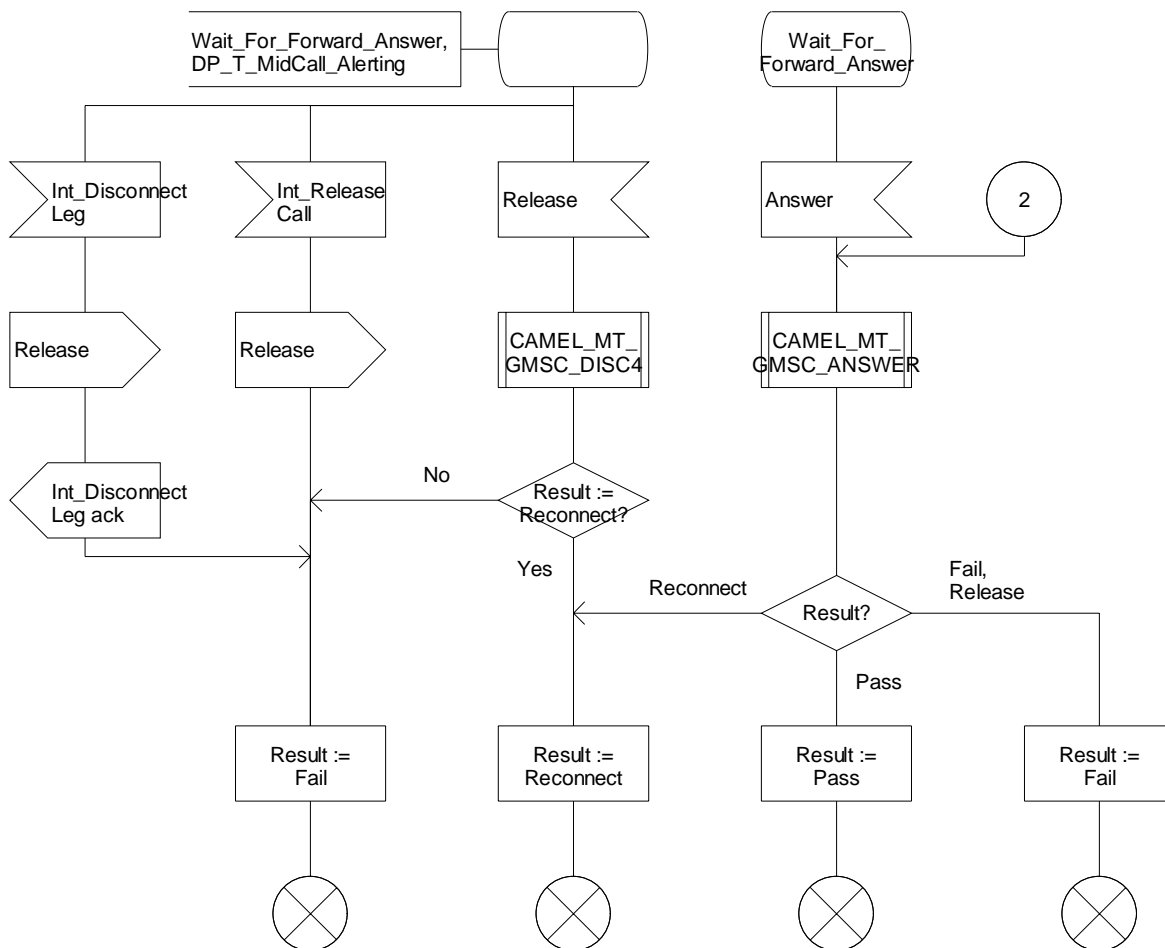
Figure 4.71-4: Procedure CAMEL_ICH_RECONNECT_MSC (sheet 4)

Procedure CAMEL_ICH_RECONNECT_MSC 5(7)

/* A proecedure in the MSC to handle a reconnection after leg 2 disconnect */

/* Signals to/from the right are to/from the destination exchange; signals to/from the left are to/from the gsmSSF. */
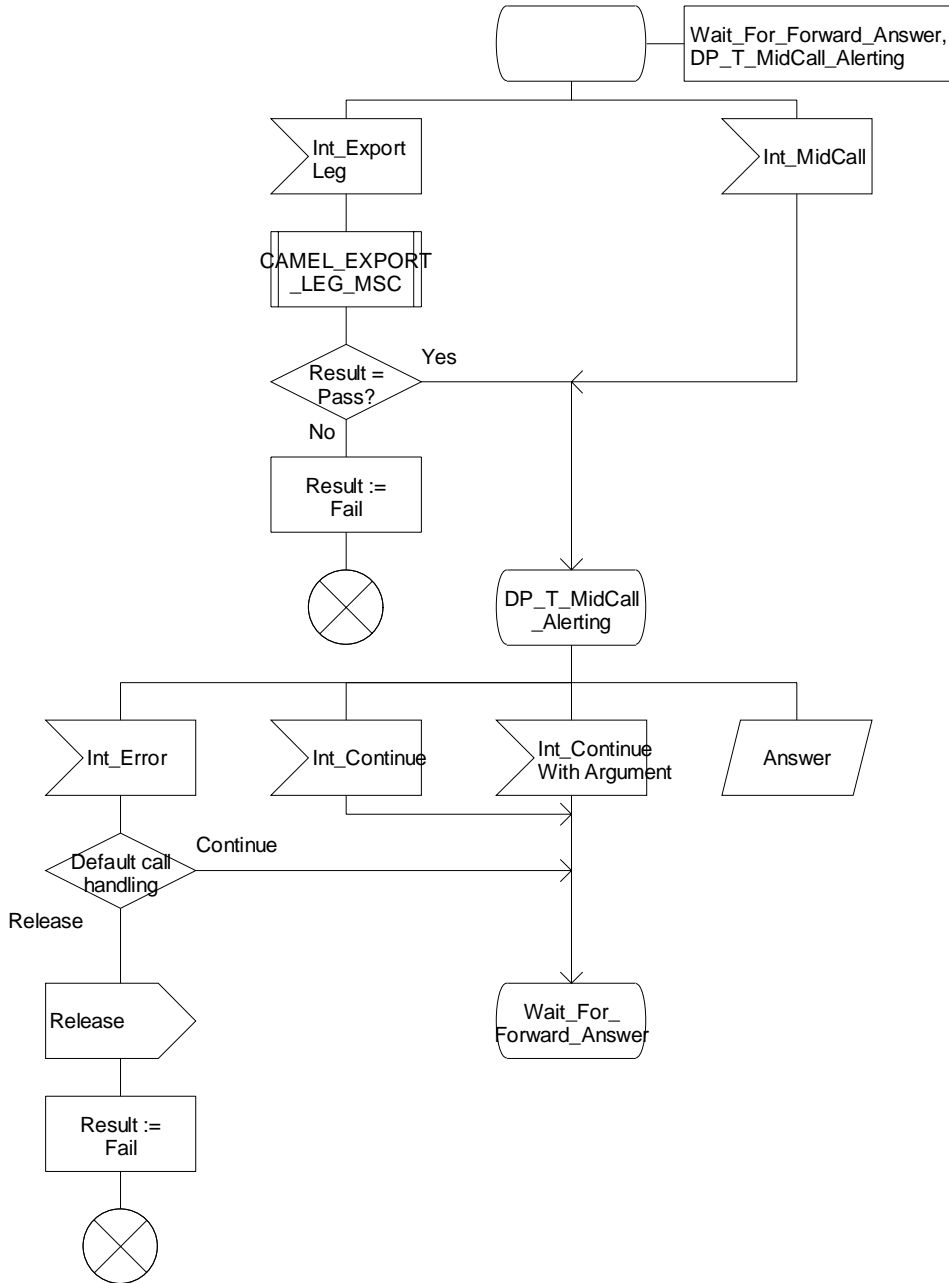
Figure 4.71-5: Procedure CAMEL_ICH_RECONNECT_MSC (sheet 5)

Procedure CAMEL_ICH_RECONNECT_MSC   6(7)

/* A proecedure in the MSC to handle
a reconnection after leg 2 disconnect */

/* Signals to/from the right are
to/from the destination exchange;
signals to/from the left are
to/from the gsmSSF. */

DP_T_MidCall_Alerting

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result?

Answer   ELSE   Fail

Result :=
Answer

To SELF — Answer

-
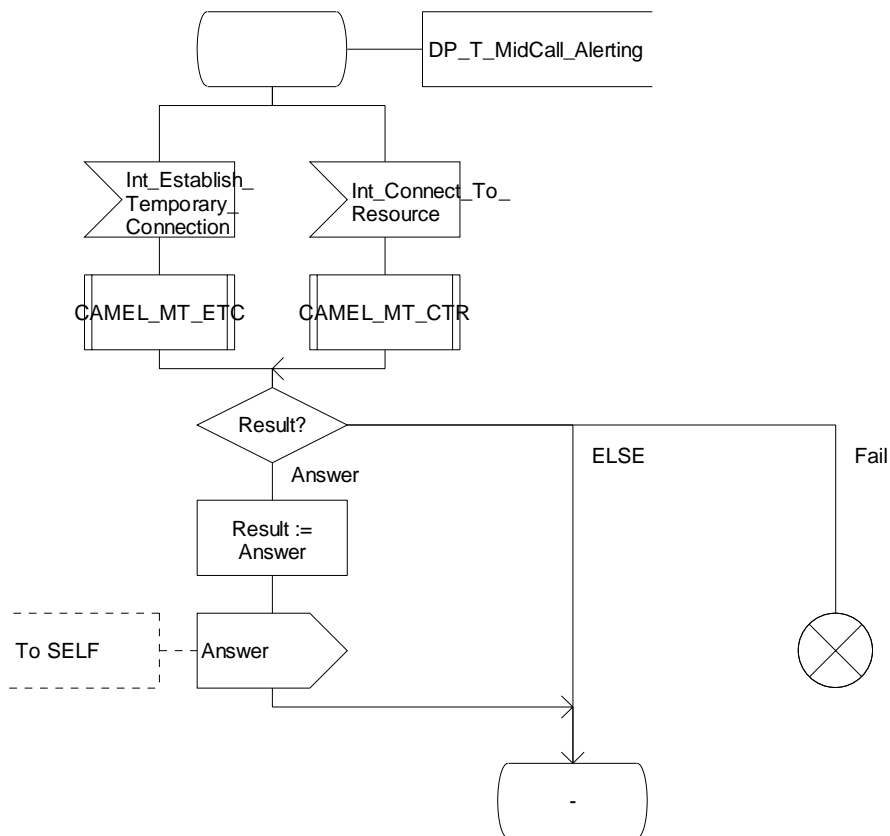
Figure 4.71-6: Procedure CAMEL_ICH_RECONNECT_MSC (sheet 6)

ETSI

Procedure CAMEL_ICH_RECONNECT_MSC 7(7)

/* A proecedure in the MSC to handle
a reconnection after leg 2 disconnect */

/* Signals to/from the right are
to/from the destination exchange;
signals to/from the left are
to/from the gsmSSF. */

DP_T_MidCall_Active

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

-
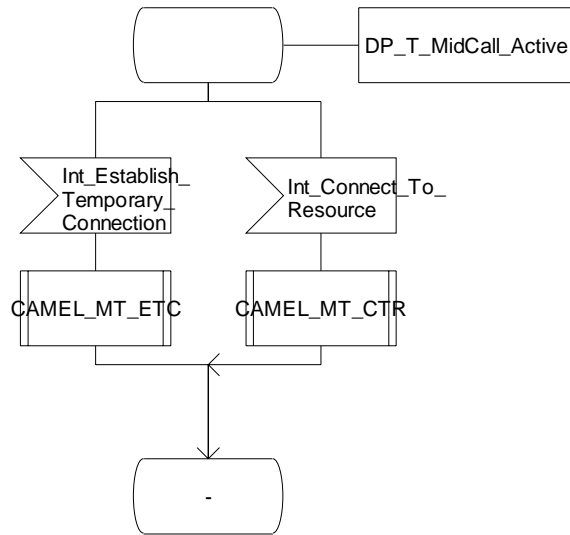
Figure 4.71-7: Procedure CAMEL_ICH_RECONNECT_MSC (sheet 7)

Process CAMEL_T_CHANGE_OF_POSITION_MSC 1(2)

/* Process in the MSC to transfer location information to the gsmSSF */

/* Signals to/from left are to/from the process CAMEL_CHANGE_OF_POSITION_MSC; signals to/from the right are to/from the gsmSSF, unless otherwise stated. */

Idle

Int_Invoke_
T_Change_Of_
Position_MSC
(Monitor Mode)

Monitor Mode

Notify & continue

Other

Subscriber currently in UMTS radio network

Yes

No

Position_
Monitoring

Radio connection established?

No

Yes

Wait_For_
Radio_Connection_
Established

Int_Continue

Int_Invoke_
T_Change_Of_
Position_MSC
("Transparent")

LOCATION_
REPORTING
CONTROL

To RNC
Request type:="change of service area"

Position_
Monitoring

Idle

Int_gsmSSF
_Instance

From Procedure
CAMEL_ICH_LEG2_MSC

Store new
gsmSSF
instance

Position_
Monitoring
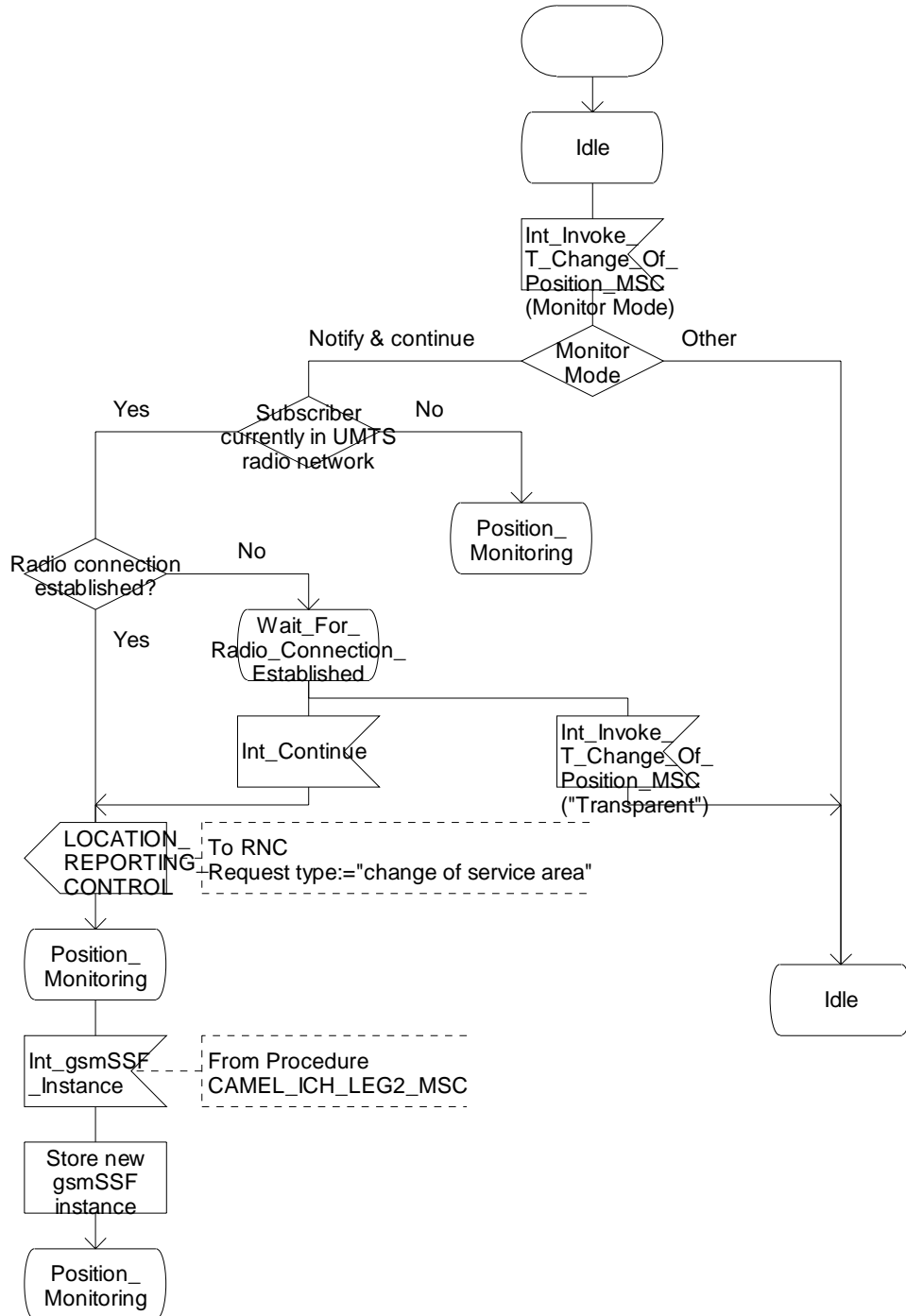
Figure 4.72-1: Process CAMEL_T_CHANGE_OF_POSITION_MSC (sheet 1)

Process CAMEL_T_CHANGE_OF_POSITION_MSC 2(2)

/* Process in the MSC to transfer location information to the gsmSSF */

/* Signals to/from left are to/from the process CAMEL_CHANGE_OF_POSITION_MSC; signals to/from the right are to/from the gsmSSF, unless otherwise stated. */
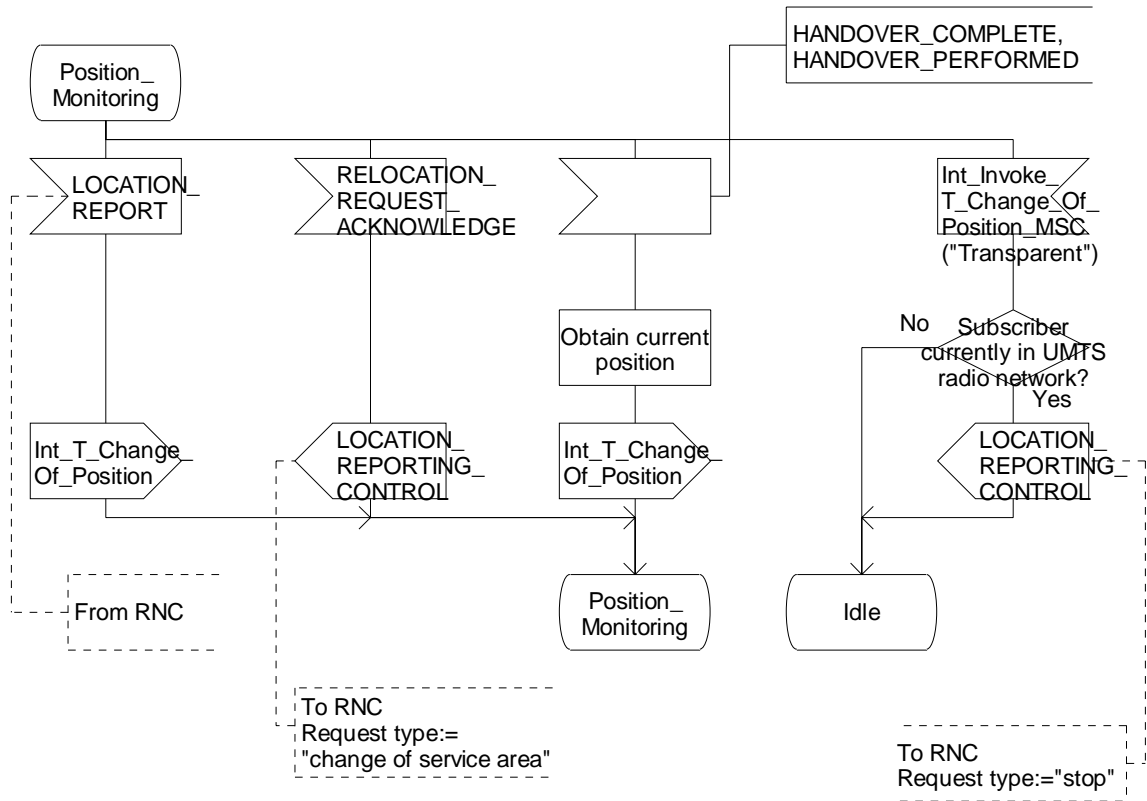
Figure 4.72-2: Procedure CAMEL_T_CHANGE_OF_POSITION_MSC (sheet 2)

4.5.4.2 Handling of mobile terminating calls in the VLR

The functional behaviour of the terminating VLR is specified in 3GPP TS 23.018 [12]. The process specific to CAMEL is specified in this subclause:

- Process Reconnected_MT_Call_VLR.

The behaviour specific to CAMEL is:

- the inclusion of the O-CSI and/or D-CSI parameter in the Send Info For Incoming Call ack information flow if the call is to be forwarded and O-CSI and/or D-CSI is included in the subscriber data for that subscriber in the VLR;

- the inclusion of the suppression of announcements parameter in the Send Info For Incoming Call negative response information flow if it was received in the Provide Roaming Number information flow from the HLR.

Process Reconnected_MT_CALL_VLR   RMTC_VLR1(1)

/* Process in the VLR to
handle a request for information
for a reconnected incoming (MT) call */

/* Signals to/from the left
are to/from the MSC. */
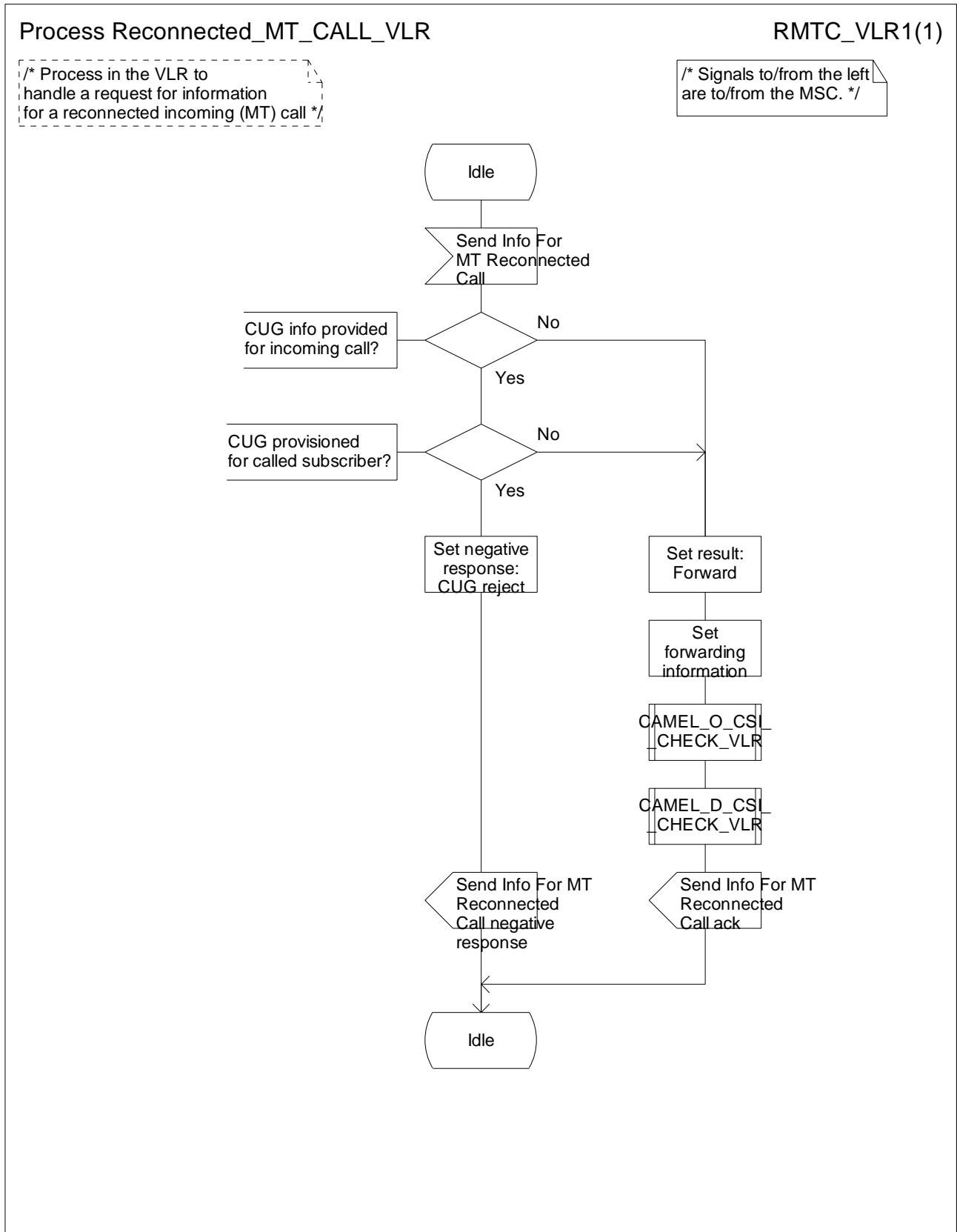
Figure 4.73-1: Process Reconnected_MT_Call_VLR (sheet 1)

4.5.5 Handling of forwarded calls

The handling of forwarded calls in the GMSC or the terminating VMSC is specified in 3GPP TS 23.018 [12]. The processes and procedures specific to CAMEL are specified in this subclause.

- Procedure CAMEL_Check_ORLCF_VMSC;

- Procedure CAMEL_CF_MSC_INIT;

- Procedure CAMEL_CF_MSC_ALERTING;

- Procedure CAMEL_CF_MSC_ANSWER;

- Procedure CAMEL_CF_ETC;

- Procedure CAMEL_CF_CTR;

- Procedure CAMEL_MT_CF_LEG1_MSC;

- Process CAMEL_MT_CF_LEG2_MSC;

- Procedure CAMEL_MF_RECONNECT_MSC.

The procedure CAMEL_MT_CF_LEG1_MSC supervises the originating party only. The process CAMEL_MT_CF_LEG2_MSC supervises the forwarding-to party only. Hence, signals from the originating exchange are received by the procedure CAMEL_MT_CF_LEG1_MSC and signals from the destination exchange are received by the process CAMEL_MT_CF_LEG2_MSC.

A mobile terminated call can be forwarded either in the GMSC (indicated by provision of Forwarded-To-Number from the HLR or gsmSCF) or in the MSC (indicated by provision of Forwarded-To-Number from the VLR).

4.5.5.1 Procedure CAMEL_CF_MSC_INIT: handling of Int_Continue_With_Argument

The received parameters are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [36]). Call parameters which are not included in the Int_Continue_With_Argument signal are unchanged.

Signalling limitations or regulatory requirements may require the Calling Partys Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

4.5.5.2 Procedure CAMEL_CF_MSC_INIT: handling of Int_Connect

The received parameters are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [36]. Call parameters which are not included in the Int_Connect signal are unchanged.

As a network operator option, loop prevention mechanisms may cause the redirection information to be ignored or modified (e.g., if the Redirection counter has been decreased).

Signalling limitations or regulatory requirements may require the Calling Partys Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

The network signalling system shall indicate that this is an internal network number.

4.5.5.3 Procedure CAMEL_CF_MSC_INIT: handling of Int_Disconnect_Leg (Leg 2)

If the MSC receives Int_Disconnect_Leg (Leg 2) signal from the gsmSSF, in response to an Initial DP information flow, the MSC will continue the handling of the calling party (Leg1) without routeing the call to a destination.

4.5.5.4 Action of the MSC in procedure CAMEL_CF_MSC_ANSWER

If the MSC received a destination address from the GMSC in the ISUP Answer or ISUP Connect Message then the MSC relays the destination address to the gsmSSF in the Int_DP_O_Answer signal.

4.5.5.5 Action of the MSC in procedure CAMEL_CF_ETC

In procedure CAMEL_CF_ETC (sheet 2) the GMSC or terminating VMSC will remain in the Wait_For_Assisting_Answer state until it receives an ISUP Answer Message (ANM) or timeout occurs. This is to ensure that a call record is always generated for every successful establishment of a temporary connection to a gsmSRF, especially in the case where the connection is between PLMNs.

NOTE: This means that it may not be possible to access an SRF which does not generate an ISUP Answer Message (ANM).

Procedure CAMEL_Check_ORLCF_VMSC 1(2)

/* Procedure in the VMSC to check which CSIs have to be included in RCH for Optimal Routeing of Late Forwarded calls*/

Notes
1. When CAMEL Capability handling is not present in O-CSI, it is assumed to be CAMEL Phase 1.
2. When GMSC Supported CAMEL Phases was not received from HLR (in PRN), it is assumed to be CAMEL Phase 1.

If No O-CSI or D-CSI is present in VLR, then non-CAMEL ORLCF shall be invoked.

O-CSI or D-CSI present in VMSC? — No

Yes

If the required CAMEL Phases are not supported by GMSC, then Forwarding shall be done in the VMSC. (note 1, 2)

Requested CAMEL phases supported by GMSC? — No

Yes

Requested CAMEL Phase 4 supported by GMSC? — No

Yes

This check is needed only if CAMEL Phase 4 is requested. The supported CAMEL Phase 4 CSIs in GMSC, is indicated in "Offered CAMEL4 CSIs in Interrogating node", in MAP PRN from HLR.

O-CSI present? — No

Yes

DP Collected _Info in O-CSI? — No

Yes

If DP Collected Info criteria are fulfilled, then the DP Collected Info shall be included in RCH. Otherwise, DP Collected Info shall not be included in RCH.

criteria fullfilled? — No

Yes

'Mark DP Collected_Info for inclusion in RCH (no criteria shall be included in RCH)'

DP Route Select Failure, if available, shall be included in RCH.

DP Route_Select _Failure in O-CSI? — No

Result := VMSCCF   Result := ORLCF

Yes

'Mark DP Route_Select_ _Failure for inclusion in RCH'

⊗

1
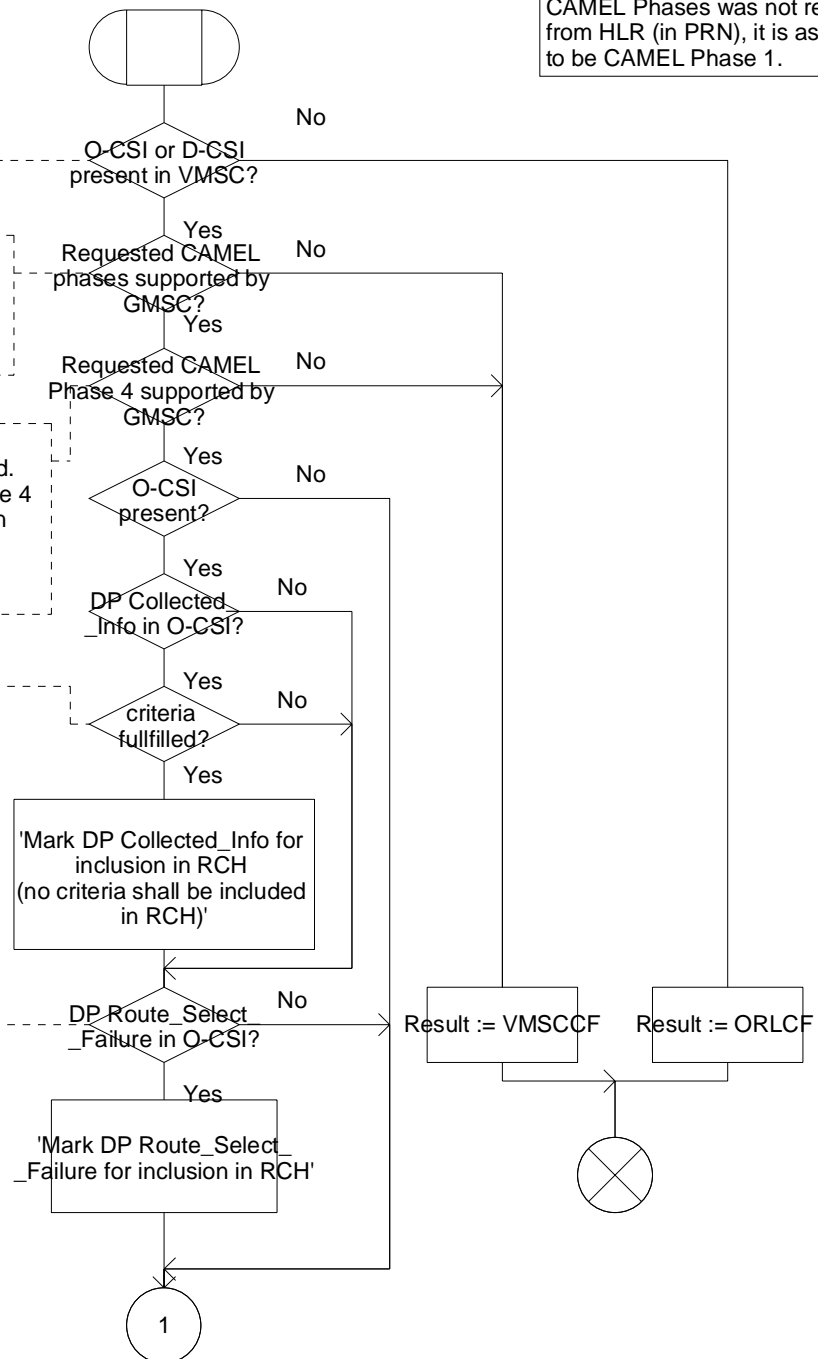
Figure 4.74-1: Procedure CAMEL_Check_ORLCF_VMSC (sheet 1)

Procedure CAMEL_Check_ORLCF_VMSC   2(2)

/* Procedure in the VMSC to check which CSIs
have to be included in RCH for Optimal
Routeing of Late Forwarded calls*/

```
                                ( 1 )
                                  │
                                  │           No
              D-CSI, if available, shall   ◇ D-CSI ├──────┐
              be included in RCH        present      │
                                  │ Yes            │
                             ┌────┴────┐           │
                             │Mark D-CSI for│       │
                             │inclusion in RCH│     │
                             └────┬────┘           │
                                  │◄───────────────┘
                             ┌────┴────┐
                             │Reult := ORLCF│
                             └────┬────┘
                                  │
                                  ⊗
```
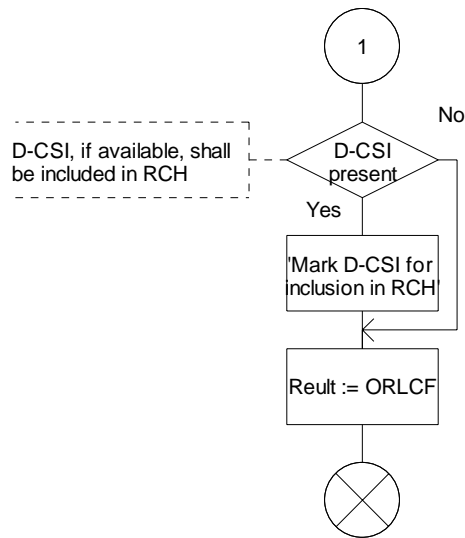
Figure 4.74-2: Procedure CAMEL_Check_ORLCF_VMSC (sheet 2)

Procedure CAMEL_CF_Dialled_Services 1(1)

Procedure in the MSC to process CAMEL dialled services for forwarded calls

/* Signals to/from the left are to/from the origination Exchange. */

CAMEL_SDS_CF_INIT

Result?

Fail · Abort · Pass

CAMEL_NDS_CF_INIT

Result?

Fail · Abort · Pass

CAMEL_OCH_MSC_DISC4

Result:= Fail

Result:= Pass

Result:= Abort
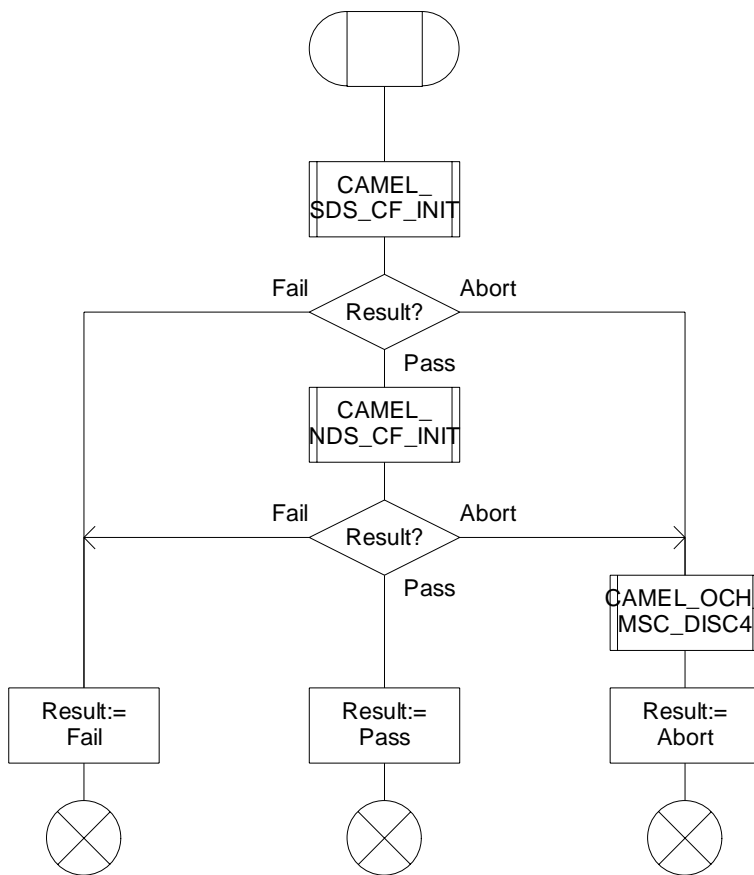
Figure 4.75-1: Procedure CAMEL_CF_Dialled_Services (sheet 1)
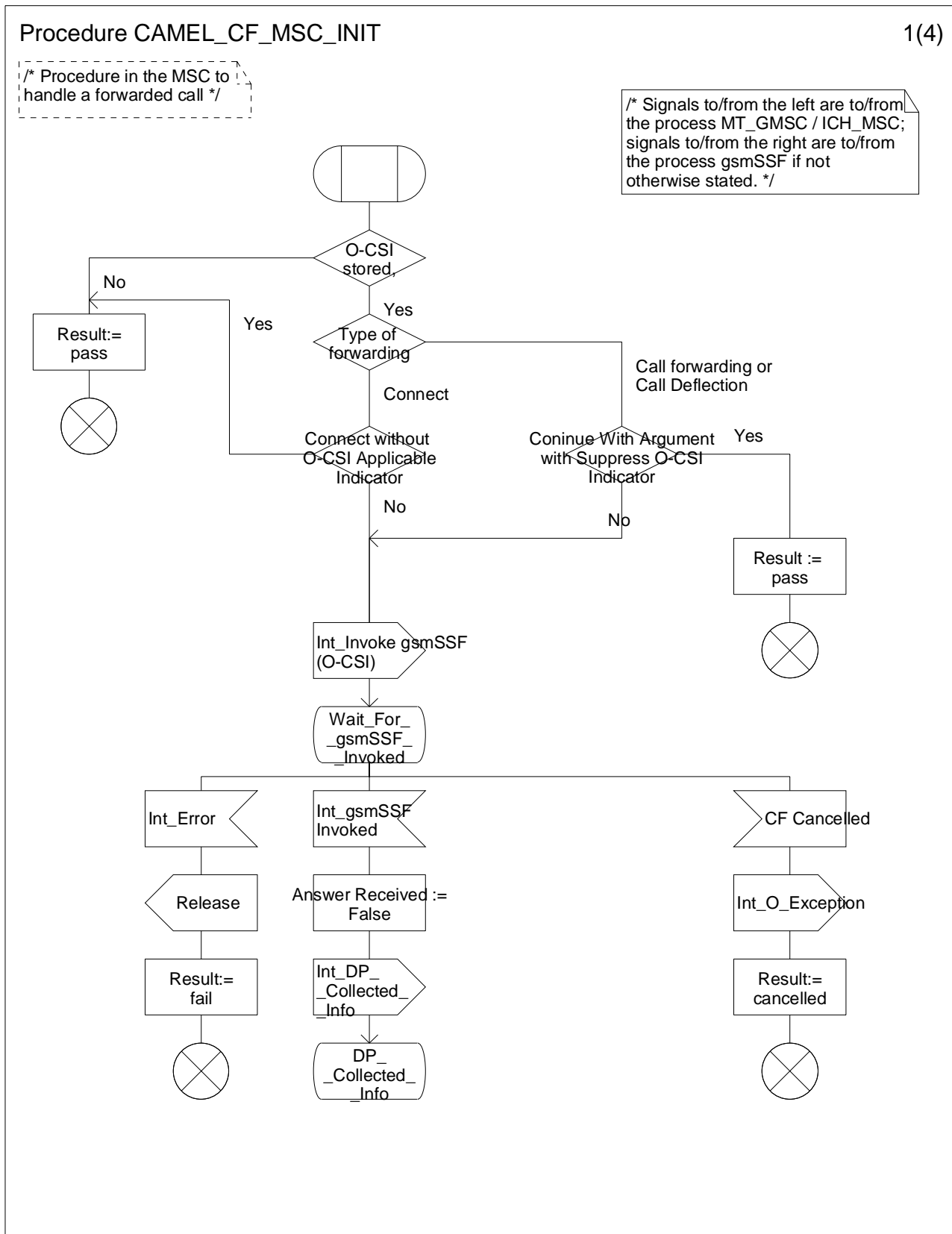
Figure 4.76-1: Procedure CAMEL_CF_MSC_INIT (sheet 1)

Figure 4.76-2: Procedure CAMEL_CF_MSC_INIT (sheet 2)

ETSI

Procedure CAMEL_CF_MSC_INIT   3(4)

/* Procedure in the MSC to handle a forwarded call */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */
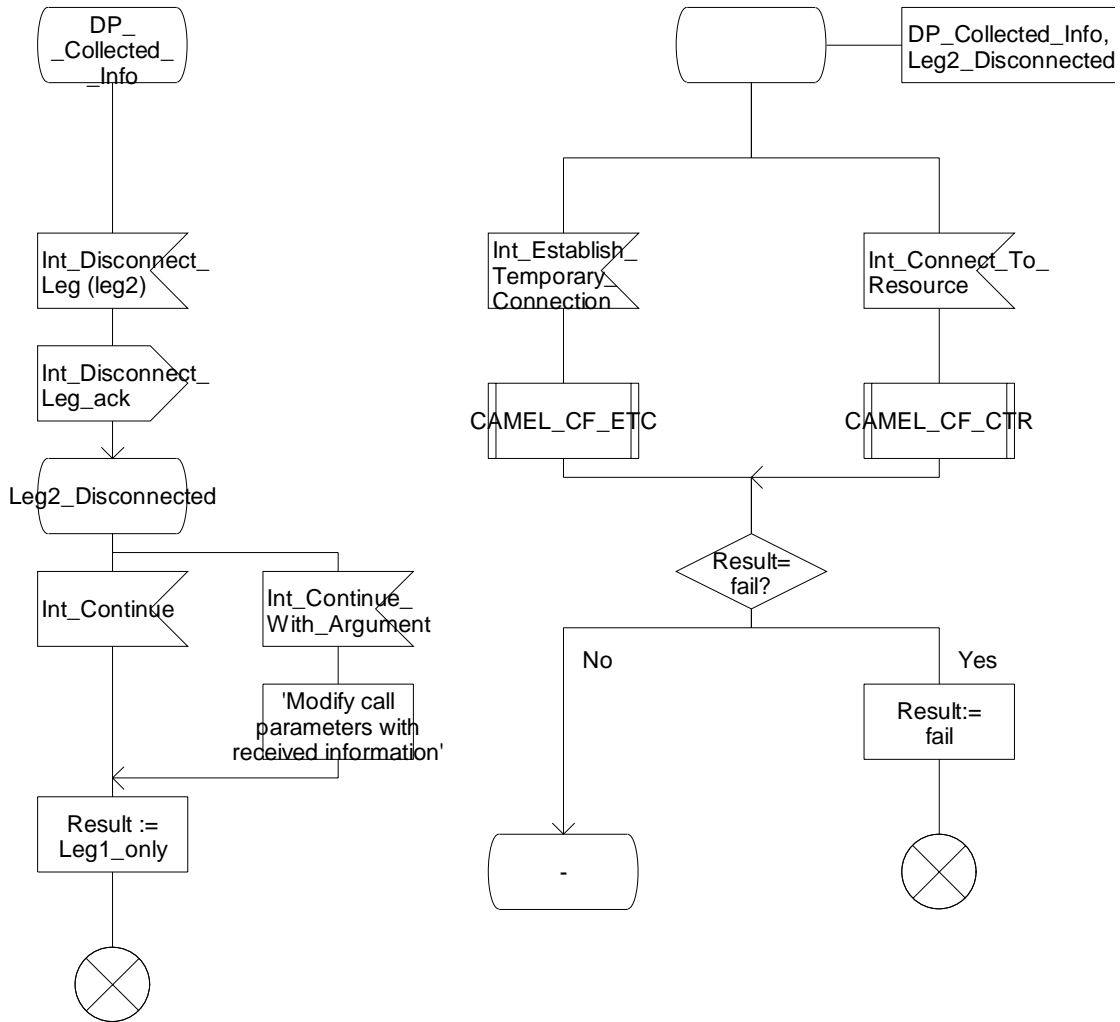
Figure 4.76-3: Procedure CAMEL_CF_MSC_INIT (sheet 3)

Procedure CAMEL_CF_MSC_INIT 4(4)

/* Procedure in the MSC to handle a forwarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */

DP_Collected_Info,
Leg2_Disconnected

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue   Int_Continue_
With_Argument

Result:=
fail

⊗
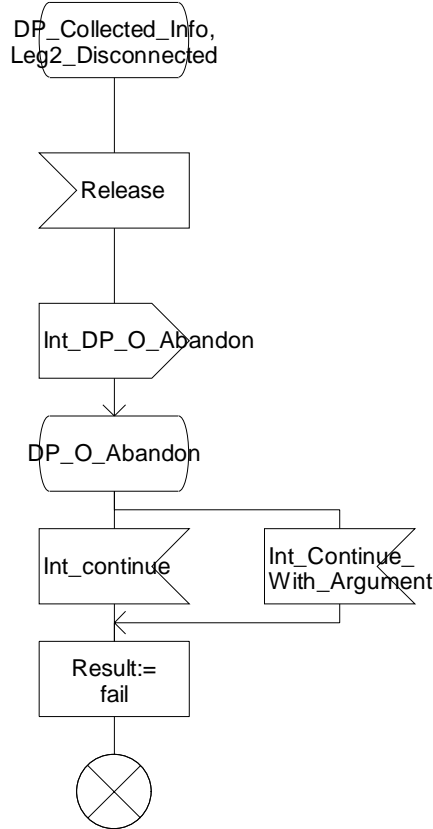
Figure 4.76-4: Procedure CAMEL_CF_MSC_INIT (sheet 4)

Procedure CAMEL_SDS_CF_INIT   1(3)

/* Procedure in the MSC to perform
CAMEL handling for a subscribed
Dialled Service */

/* Signals to/from the left are
to/from parent process; signals to/from the right are
to/from the gsmSSF. */

D-CSI
invocation?

No → Result=
Pass

Yes

Call Reference
Number stored?

Yes →

No

Allocate Call
Reference Number

Store Original
Call Parameters

Int_Invoke_
gsmSSF
(D-CSI)

Wait_for_
gsmSSF_Invoked

Int_gsmSSF_
Invoked

CF
cancelled

Int_DP_
Analysed_
Info

Int_O_Exception

DP_
Analysed_
Info

Result:=
Abort
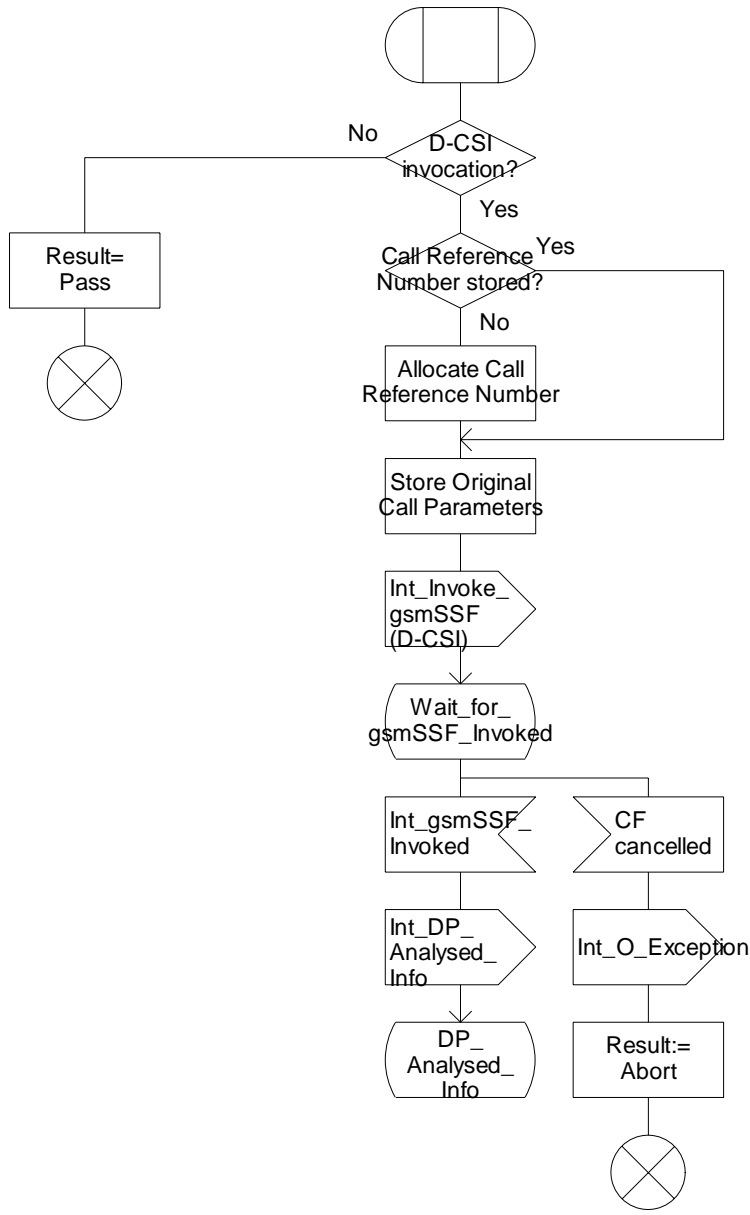
Figure 4.77-1: Procedure CAMEL_SDS_CF_INIT (sheet 1)

Procedure CAMEL_SDS_CF_INIT 2(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the left are to/from the parent process; signals to/from the right are to/from the gsmSSF. */

DP_ Analysed_ Info

Int_Release_ Call

Int_Error

Int_Continue

Int_Continue_ _With_ _Argument

Int_Connect

CF cancelled

'Default call handling = continue call ?'

Yes

No

CAMEL_ _Modify_ _CUG_Info

'Modify call parameters with received information'

Int_DP_O_ Abandon

Result:= Fail

Result:= Pass

Result:= Pass

Result:= Abort
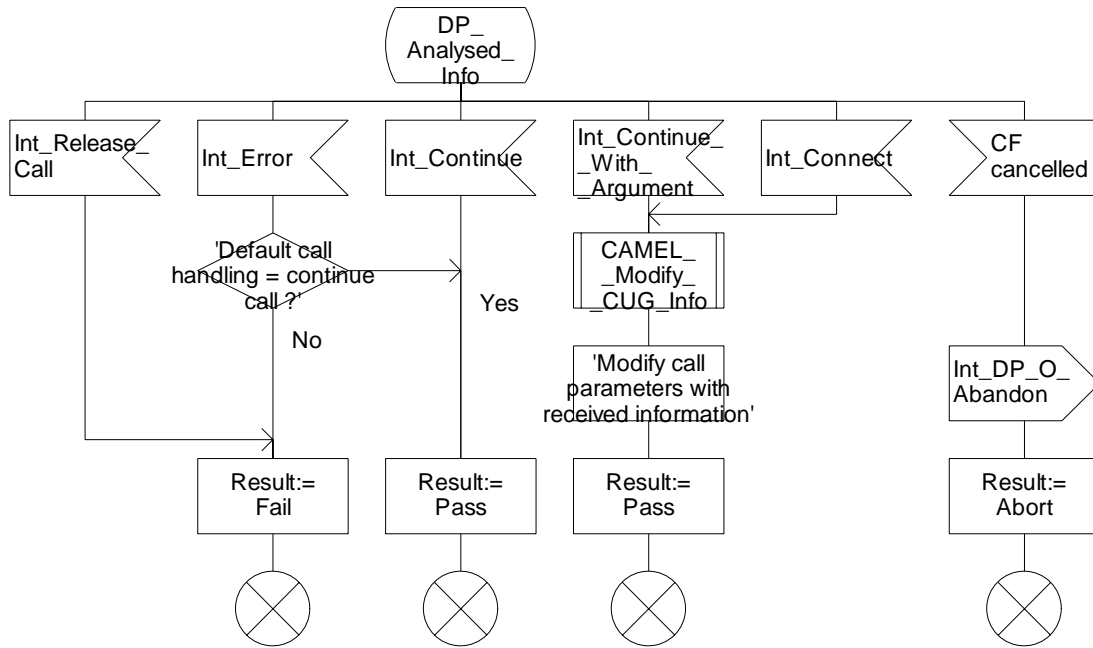
Figure 4.77-2: Procedure CAMEL_SDS_CF_INIT (sheet 2)

Procedure CAMEL_SDS_CF_INIT   3(3)

/* Procedure in the MSC to perform
CAMEL handling for a subscribed
Dialled Service */

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result=
fail?

No   Yes

Result:=
fail

DP_Analysed_
_Info
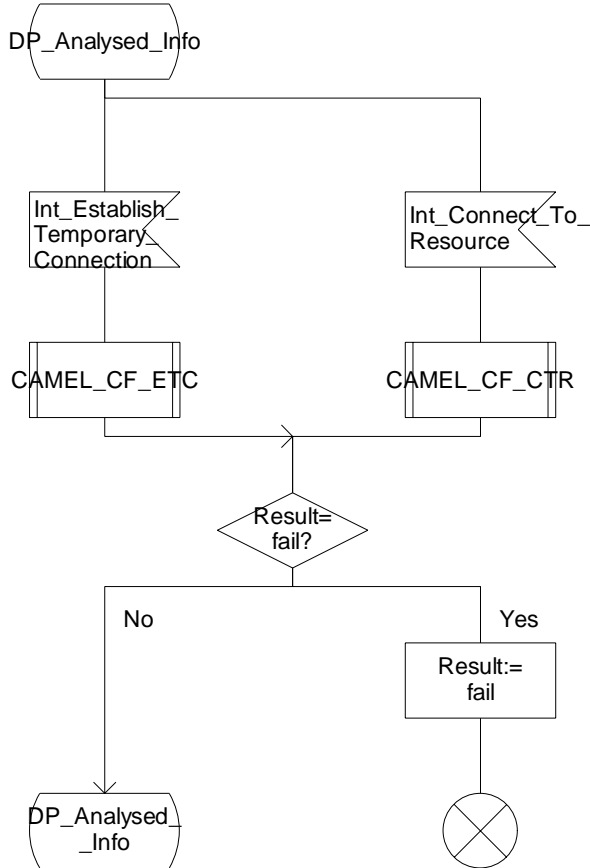
Figure 4.77-3: Procedure CAMEL_SDS_CF_INIT (sheet 3)

Procedure CAMEL_NDS_CF_INIT 1(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls */

/* Signals to/from the left
are to/from parent process; signals
to/from the right are to/from the gsmSSF. */
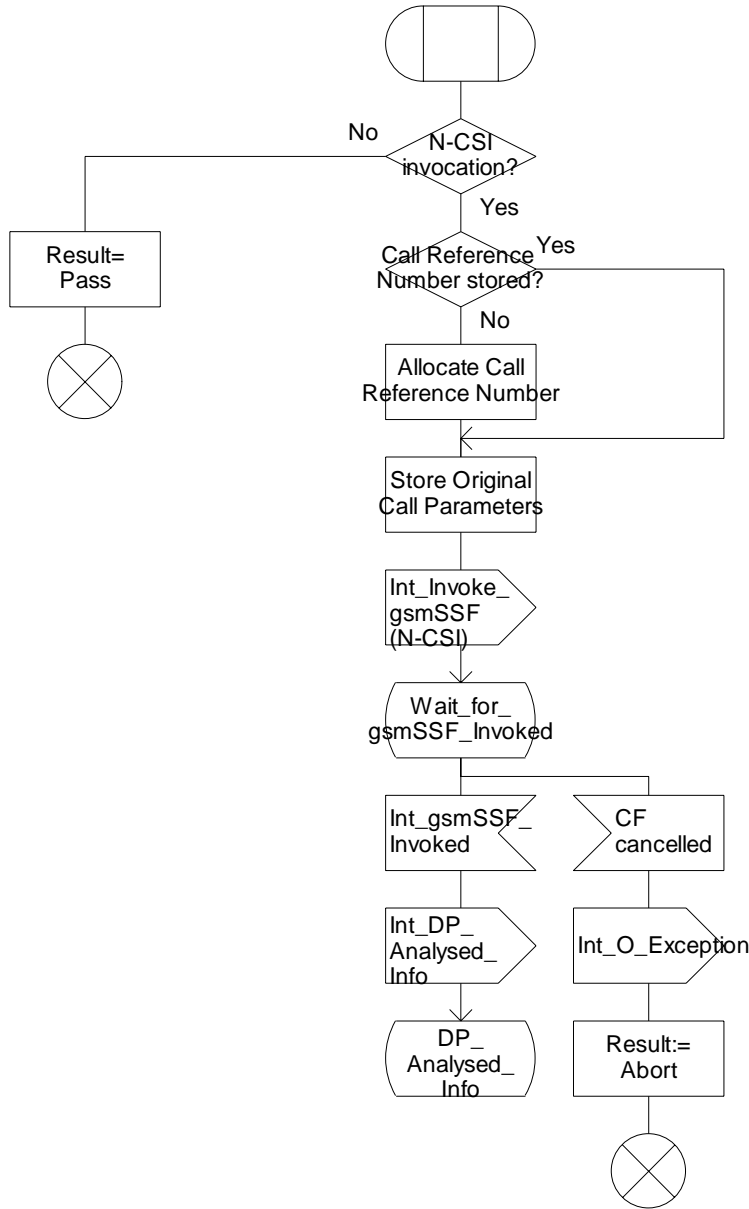
Figure 4.78-1: Procedure CAMEL_NDS_CF_INIT (sheet 1)

Procedure CAMEL_NDS_CF_INIT 2(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls */

/* Signals to/from the left
are to/from parent process; signals
to/from the right are to/from the gsmSSF. */
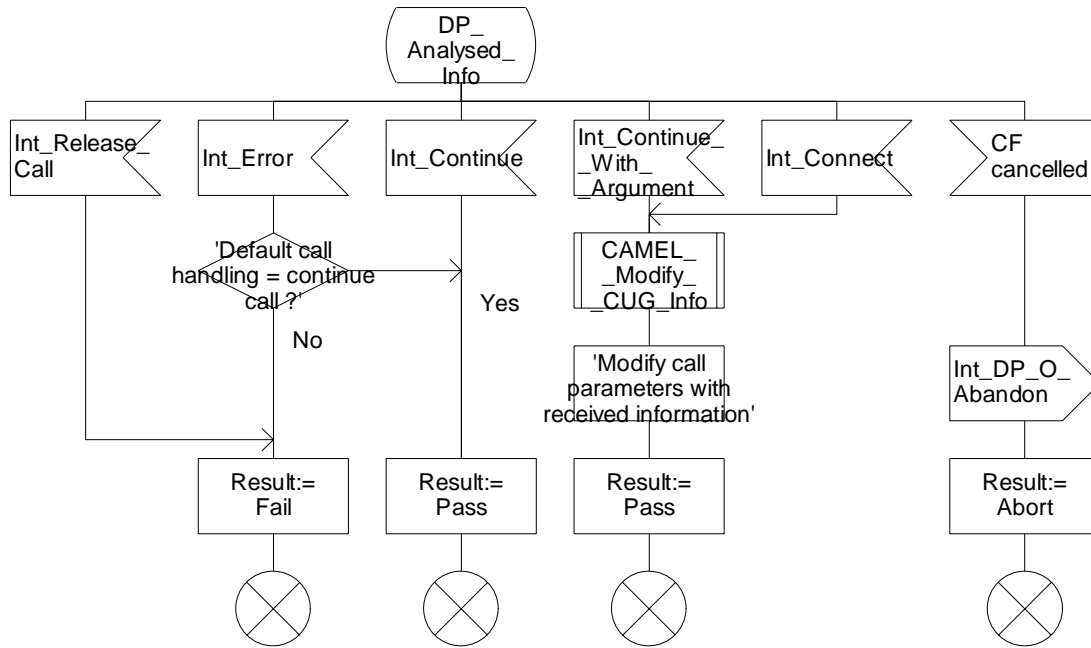
Figure 4.78-2: Procedure CAMEL_NDS_CF_INIT (sheet 2)

Procedure CAMEL_NDS_CF_INIT 3(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls */

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result=
fail?

No   Yes

Result:=
fail

DP_Analysed
_Info

⊗
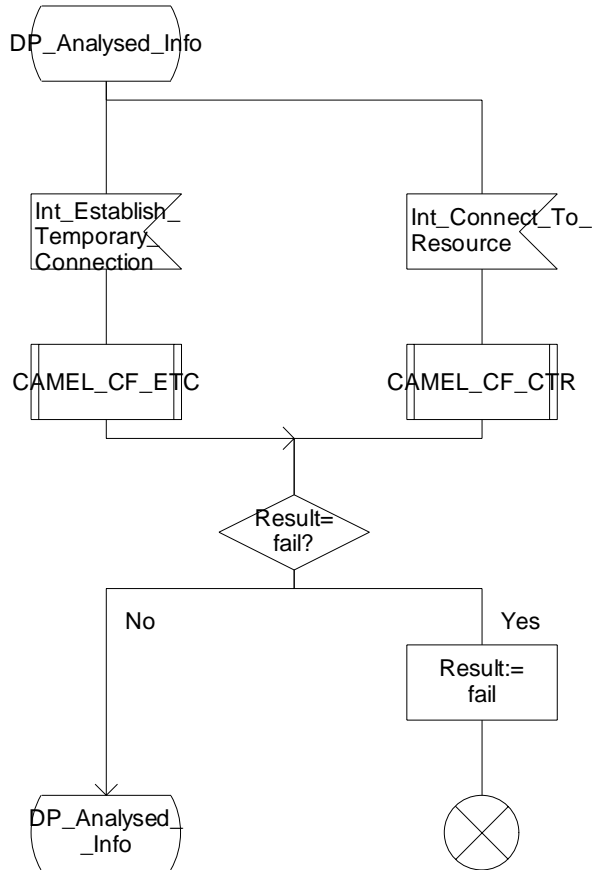
Figure 4.78-3: Procedure CAMEL_NDS_CF_INIT (sheet 3)
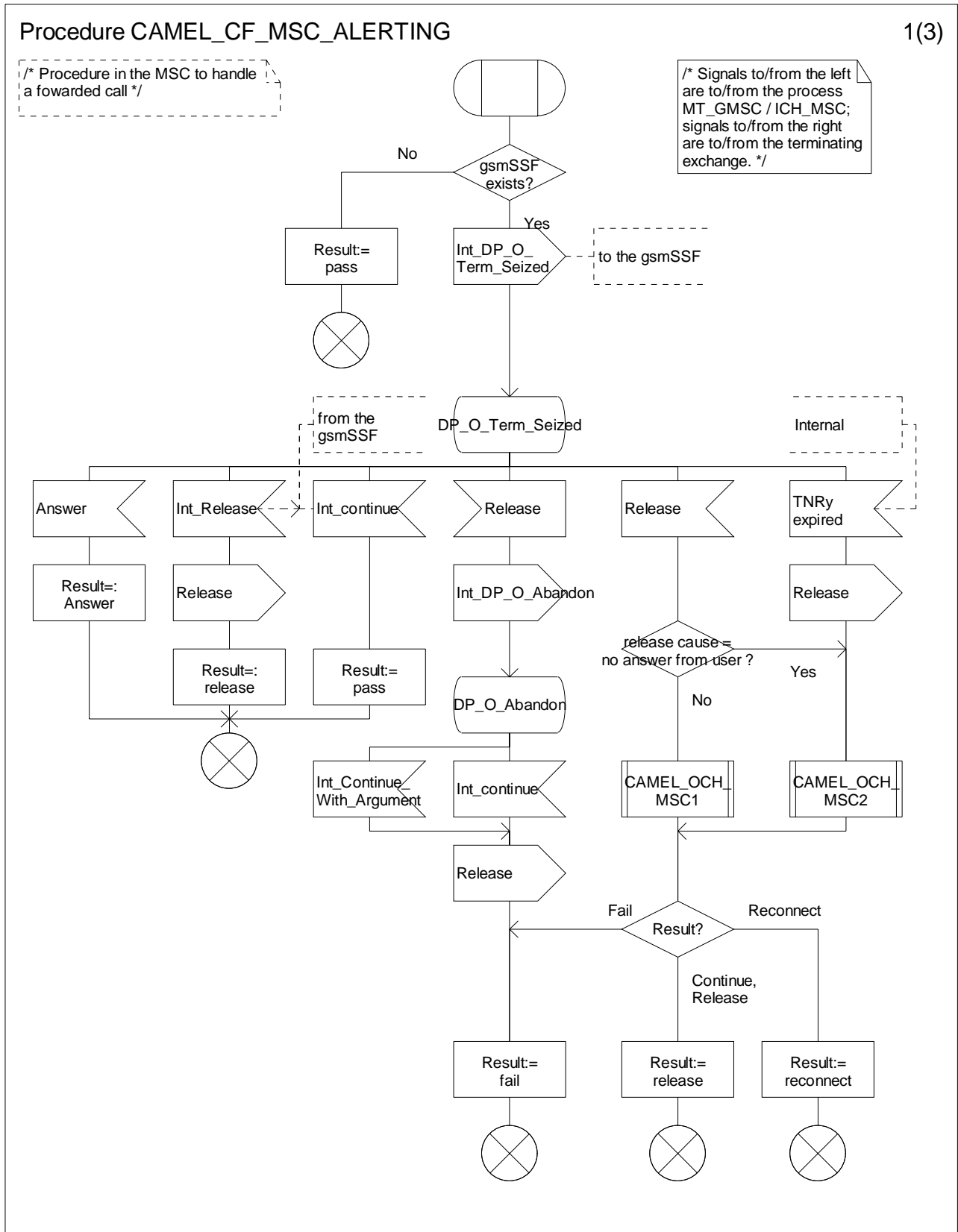
Figure 4.79-1: Procedure CAMEL_CF_MSC_ALERTING (sheet 1)

Procedure CAMEL_CF_MSC_ALERTING 2(3)

/* Procedure in the MSC to handle a fowarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the terminating exchange. */

DP_O_Term_Seized

Int_Error

Int_Continue With_Argument

Default call handling = continue call ?

No

Yes

Release

Result:= release

Result:= Pass

From the gsmSSF
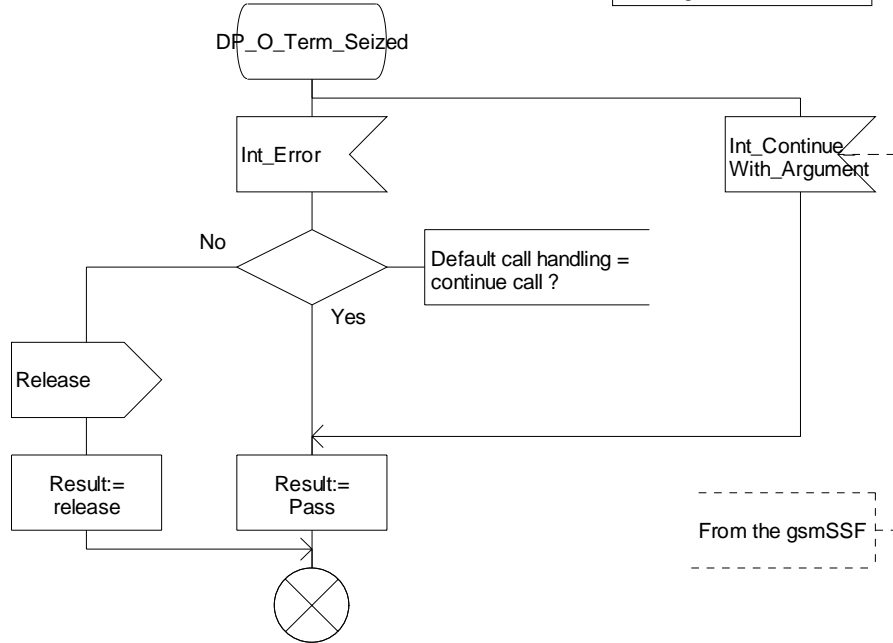
Figure 4.79-2: Procedure CAMEL_CF_MSC_ALERTING (sheet 2)

Procedure CAMEL_CF_MSC_ALERTING 3(3)

/* Procedure in the MSC to handle
a fowarded call */

/* Signals to/from the left
are to/from the process
MT_GMSC / ICH_MSC;
signals to/from the right
are to/from the terminating
exchange. */

DP_O_Term_Seized

From gsmSSF

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result?

Fail

Answer

ELSE

Result :=
fail

Result :=
Answer

-
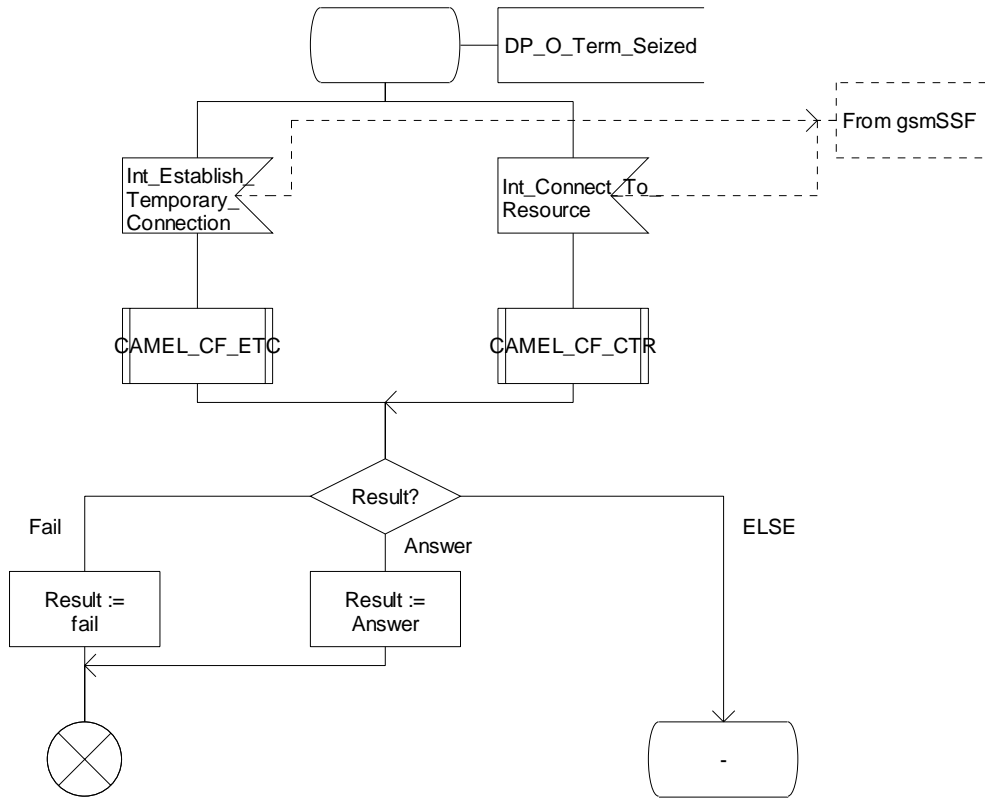
Figure 4.79-3: Procedure CAMEL_CF_MSC_ALERTING (sheet 3)

Procedure CAMEL_CF_MSC_ANSWER 1(3)

/* Procedure in the MSC to handle a fowarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the terminating exchange. */

gsmSSF exists?

No

Yes

Result=pass

Int_O_Answer — to the gsmSSF

Answer Received := True

from the gsmSSF

DP_O_Answer

Int_Release

Int_continue

Release

Release

Release

CAMEL_OCH_MSC DISC_1

CAMEL_OCH_MSC DISC_2

Result= reconnect?

Yes

No

Result:= release

Result:=pass

Result= CAMEL_handling?

Result= CAMEL_handling?

YesYes

No

No

Release

Answer Received := False

Result:=fail

Result:= release

Result:= reconnect
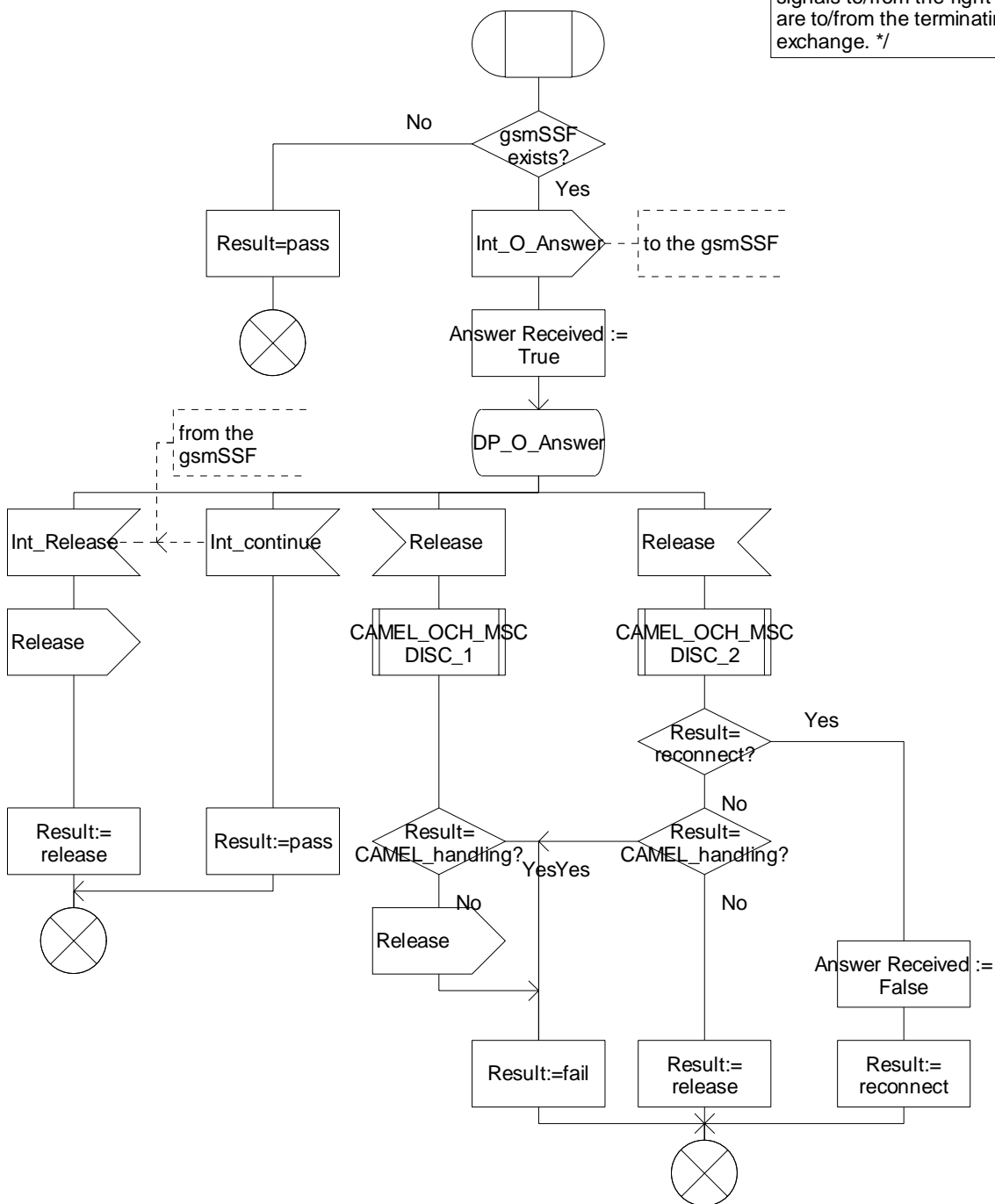
Figure 4.80-1: Procedure CAMEL_CF_MSC_ANSWER (sheet 1)

Procedure CAMEL_CF_MSC_ANSWER   2(3)

/* Procedure in the MSC to handle a fowarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the terminating exchange. */

DP_O_Answer

Int_Error

Int_Continue_With_Argument

Default call handling = continue call ?

No

Yes

Release

Result:= release

Result:= Pass
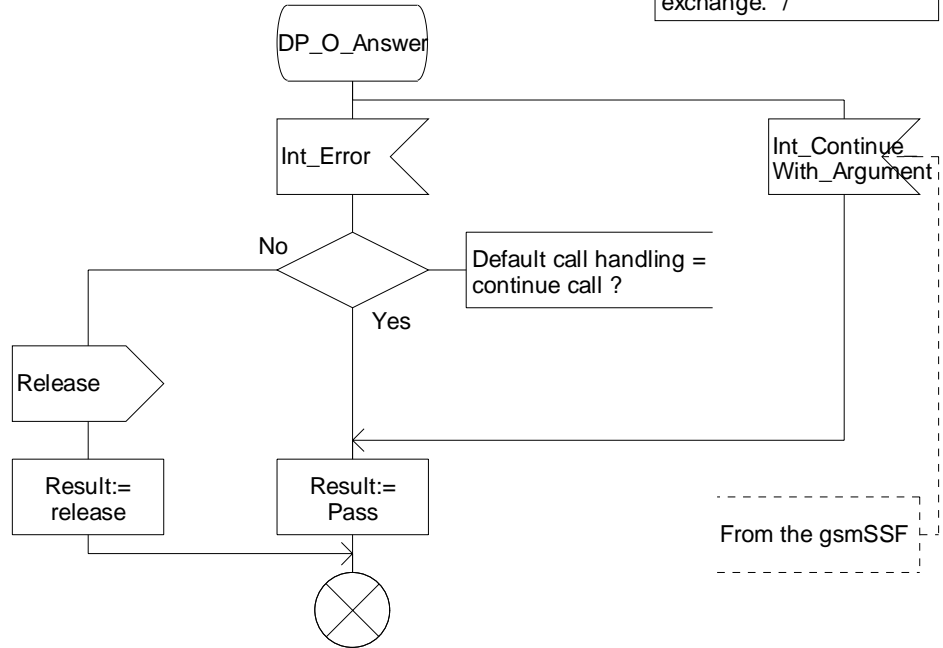
From the gsmSSF

Figure 4.80-2: Procedure CAMEL_CF_MSC_ANSWER (sheet 2)

Procedure CAMEL_CF_MSC_ANSWER 3(3)

/* Procedure in the MSC to handle a fowarded call */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_O_Answer

Int_Establish_Temporary_Connection

Int_Connect_To_Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result= fail?

No

Yes

Result:= fail

-

⊗
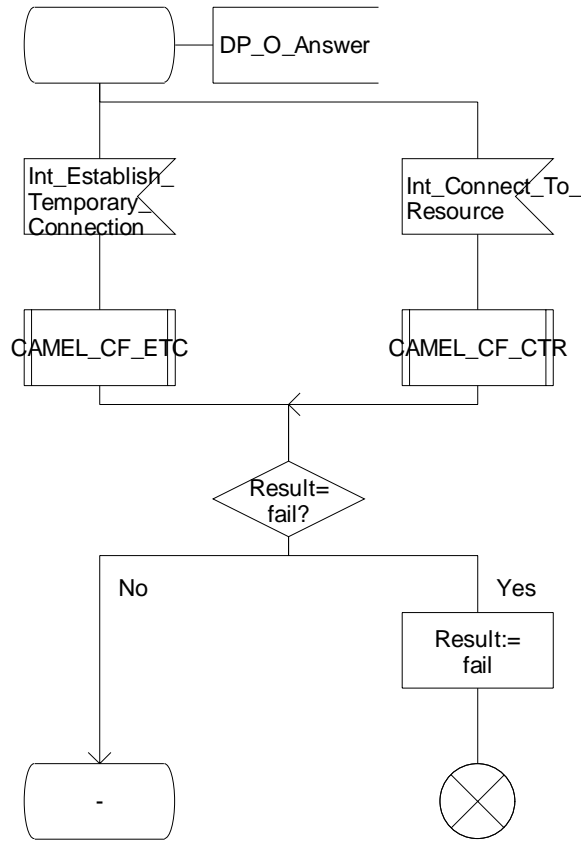
Figure 4.80-3: Procedure CAMEL_CF_MSC_ANSWER (sheet 3)

Procedure CAMEL_CF_ETC

1(4)

/* Procedure in the MSC to handle a temporary connection */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */

Initial Address → To CAMEL_Assisting_MSC or SRF

Send_ACM_If_Required — Procedure defined in 3GPP TS 23.018

Wait_For_Assisting_ACM

Release

Release ← From CAMEL_Assisting_MSC or SRF

Answer Received

Int_ETC_Failed

True

False

Int_TC_Released

Int_DP_O_Abandon

Result := pass

⊗

Release → To CAMEL_Assisting_MSC or SRF

DP_O_Abandon

Release → To SELF

Int_continue

Int_Continue_With_Argument

Release → To CAMEL_Assisting_MSC or SRF

Result := pass

Result := fail

⊗

⊗
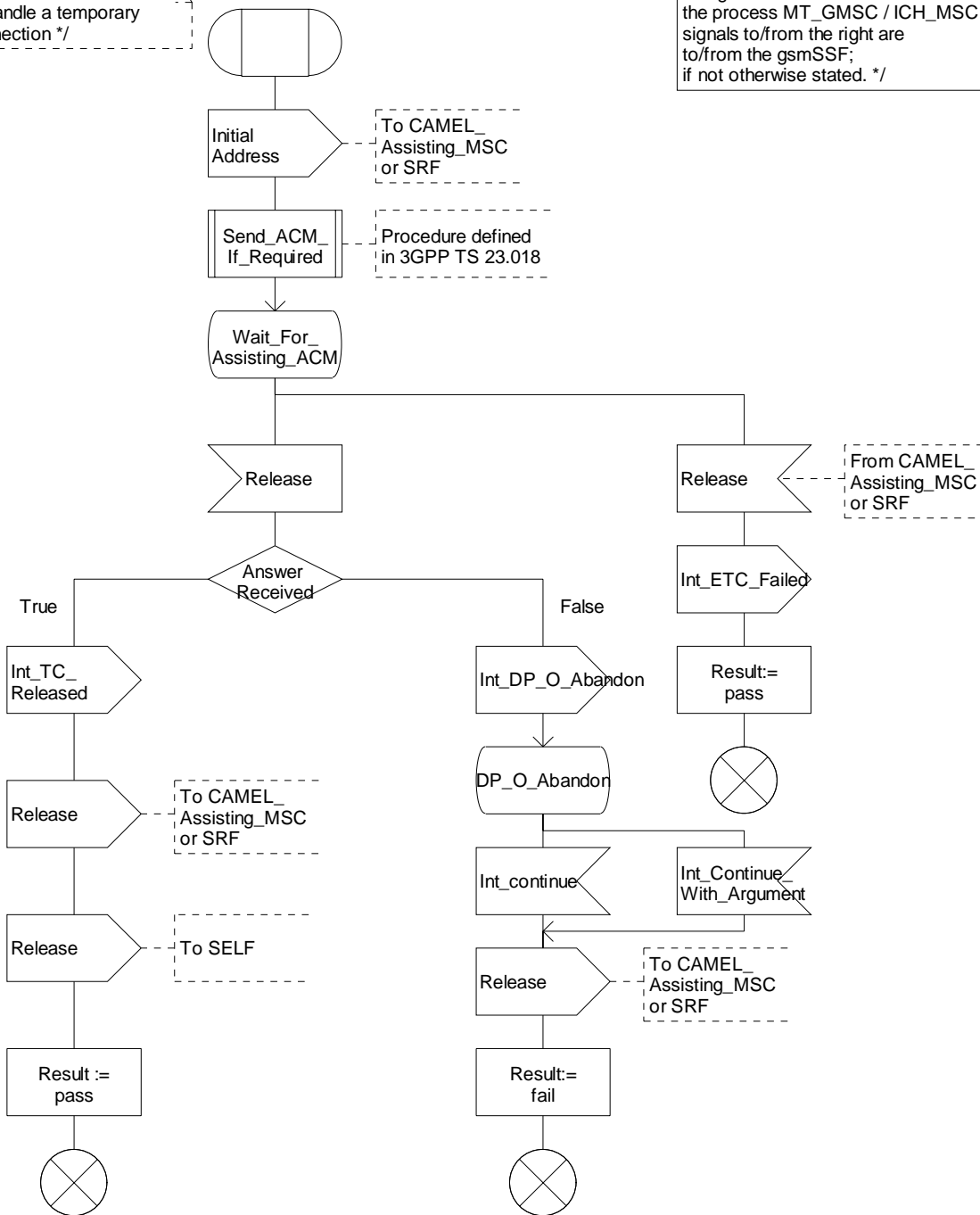
Figure 4.81-1: Procedure CAMEL_CF_ETC (sheet 1)

Procedure CAMEL_CF_ETC 2(4)

/* Procedure in the MSC to handle a temporary connection */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the CAMEL_Assisting_MSC or SRF. */

Wait_For_Assisting_ACM

Address Complete

Connect

Wait_For_Assisting_Answer

Answer

Bothway through connection required?

No

Yes

Bothway through connection required?

No

Yes

Send_Answer_If_Required

Send_ACM_If_Required

Procedure defined in 3GPP TS 23.018

Progress

Send_Network_Connect_If_Required

Int_Temporary Connection Established

Procedure defined in 3GPP TS 23.018

Temporary_Connection_Established

Procedure defined in 3GPP TS 23.018
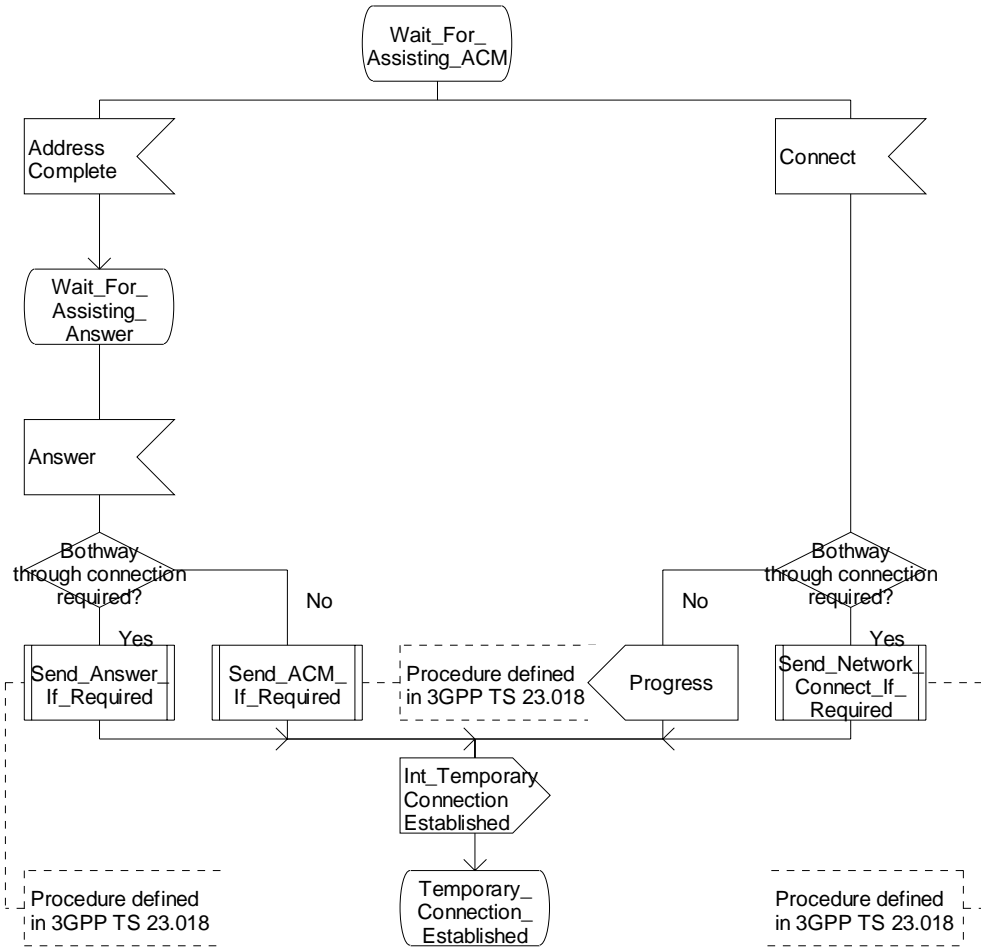
Figure 4.81-2: Procedure CAMEL_CF_ETC (sheet 2)

Procedure CAMEL_CF_ETC   3(4)

/* Procedure in the MSC
to handle a temporary
connection */

/* Signals to/from the left are to/from
the process MT_GMSC / ICH_MSC;
signals to/from the right are
to/from the gsmSSF;
if not otherwise stated. */

Temporary_Connection_Established
Wait_For_Assisting_Answer

Release

Answer
Received

True   false

Int_TC_
Released

Int_DP_O_
Abandon

DP_O_Abandon

Release   To CAMEL_
                 Assisting_MSC
                 or SRF

Release   To SELF

Result :=
pass

Release   From CAMEL_
                 Assisting_MSC
                 or SRF

Int_TC_
Released

Result:=
pass

Int_Disconnect_
Forward_
Connection

Int_TC_
Released

To CAMEL_   Release
Assisting_MSC
or SRF

Result:=
pass
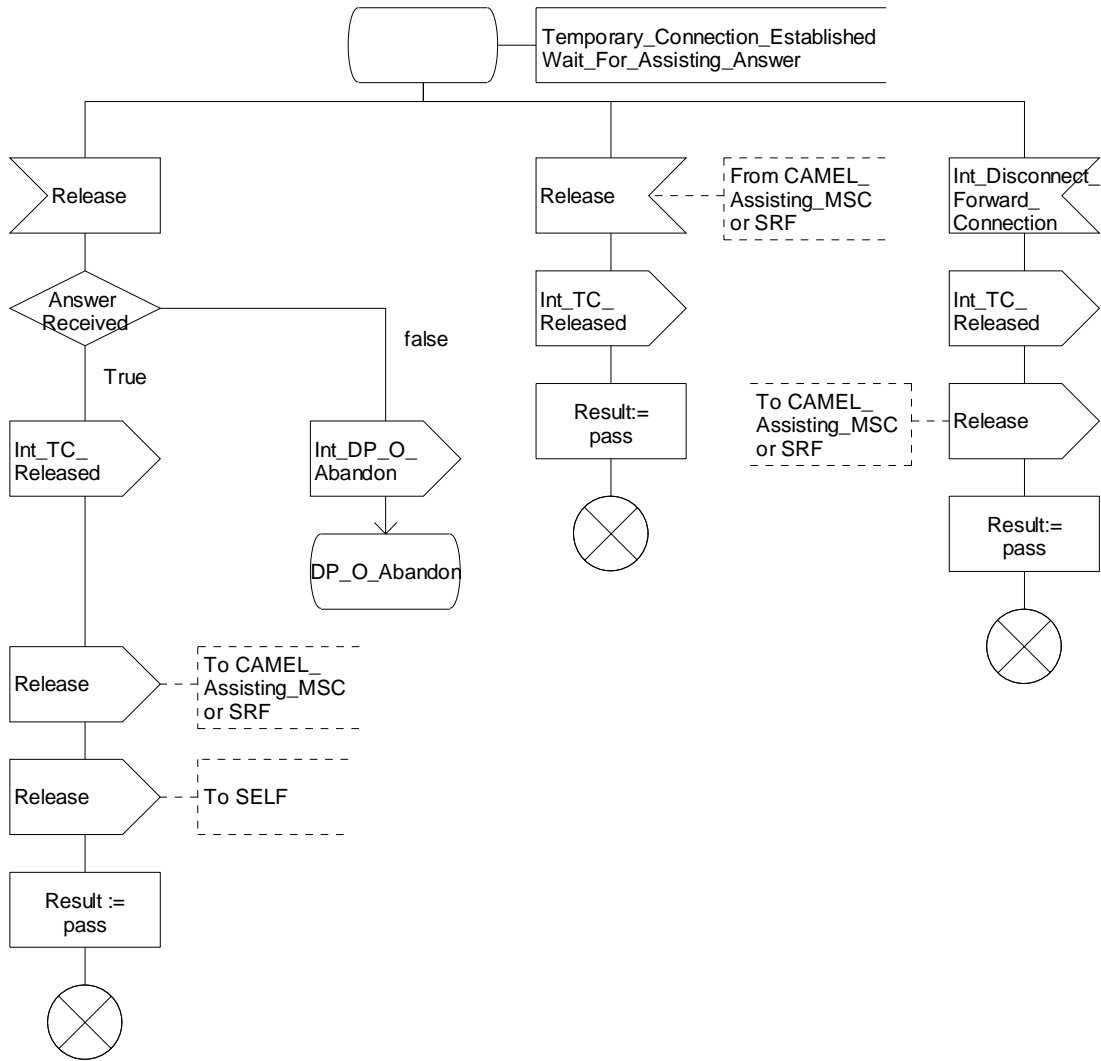
Figure 4.81-3: Procedure CAMEL_CF_ETC (sheet 3)
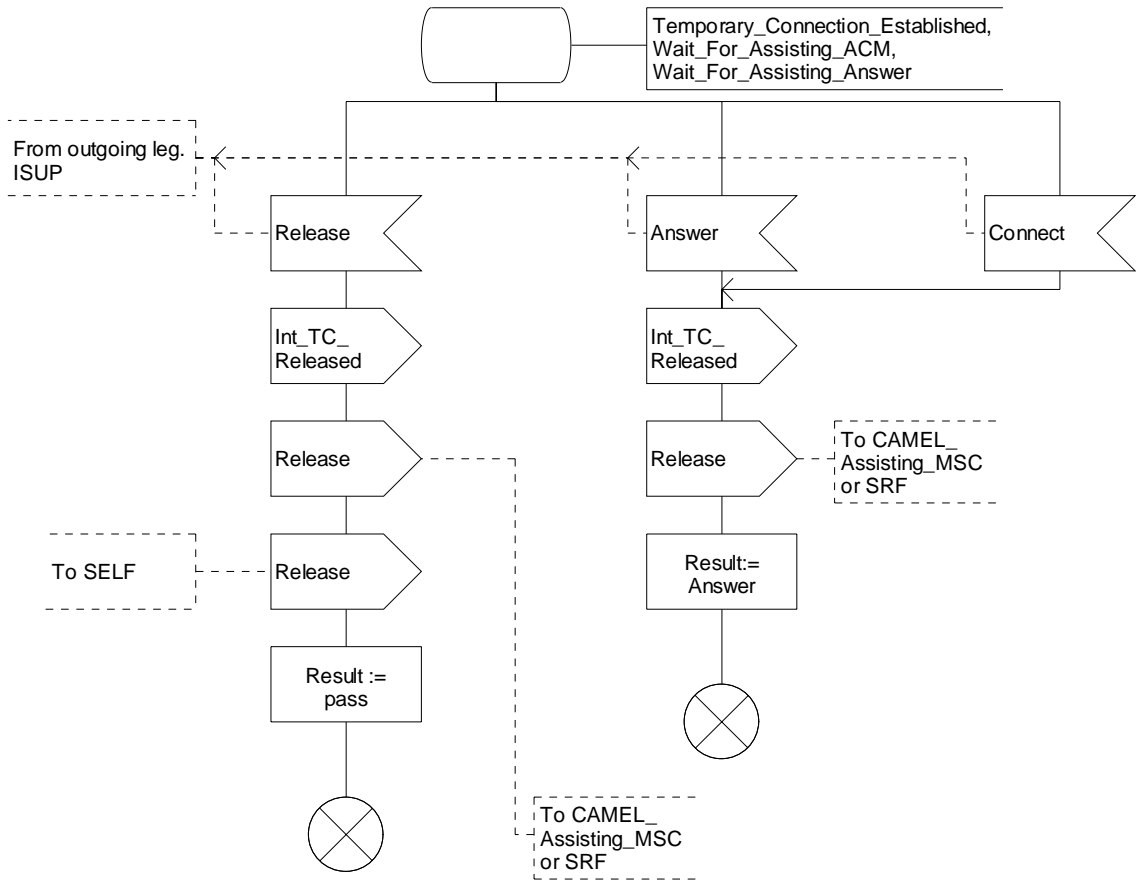
Figure 4.81-4: Procedure CAMEL_CF_ETC (sheet 4)
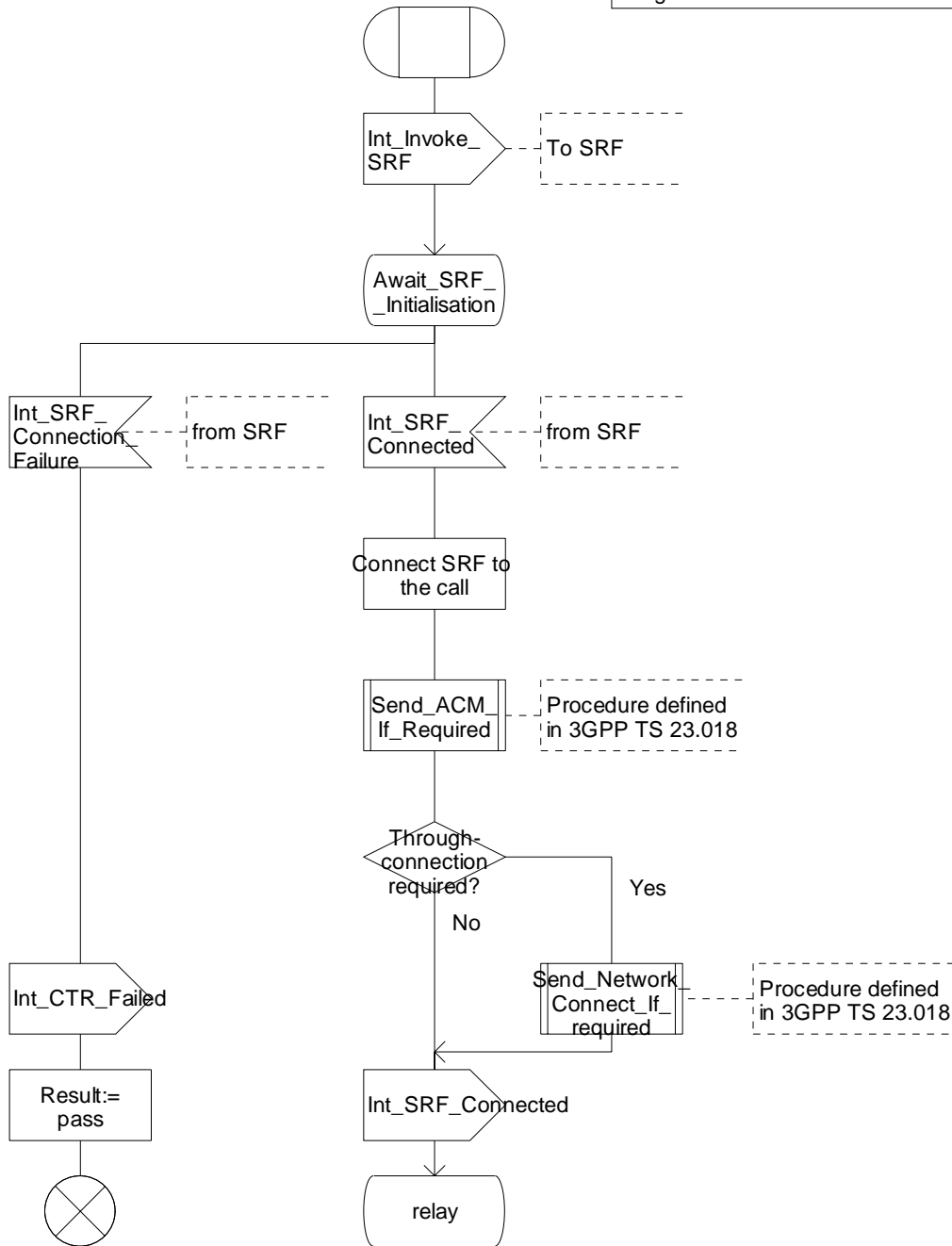
Figure 4.82-1: Procedure CAMEL_CF_CTR (sheet 1)

Procedure CAMEL_CF_CTR 2(5)

/* Procedure in the MSC
to handle a Connect To Resource
operation */

/* Signals to/from the left are
to/from the process MT_GMSC / ICH_MSC;
signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

Relay

Release ←-- From SRF

Int_SRF_Released

Result:=
pass

⊗

Int_Disconnect_
Forward_
Connection

CAMEL_Disconnect_
CTR_SRF

Int_SRF_Released

Result :=
pass

⊗

CAMEL_Disconnect_
CTR_SRF

To SELF --- Release

Release

Answer
Received

True

False

Int_DP_O_
Abandon
/* legID */

DP_O_Abandon
_DFC

Int_continue   Int_Continue_
With_Argument

Wait_For_Disconnect_
Forward_Connection

Int_Disconnect_
Forward_Connection

CAMEL_Disconnect_
CTR_SRF

Int_SRF_Released

Result :=
Fail

⊗
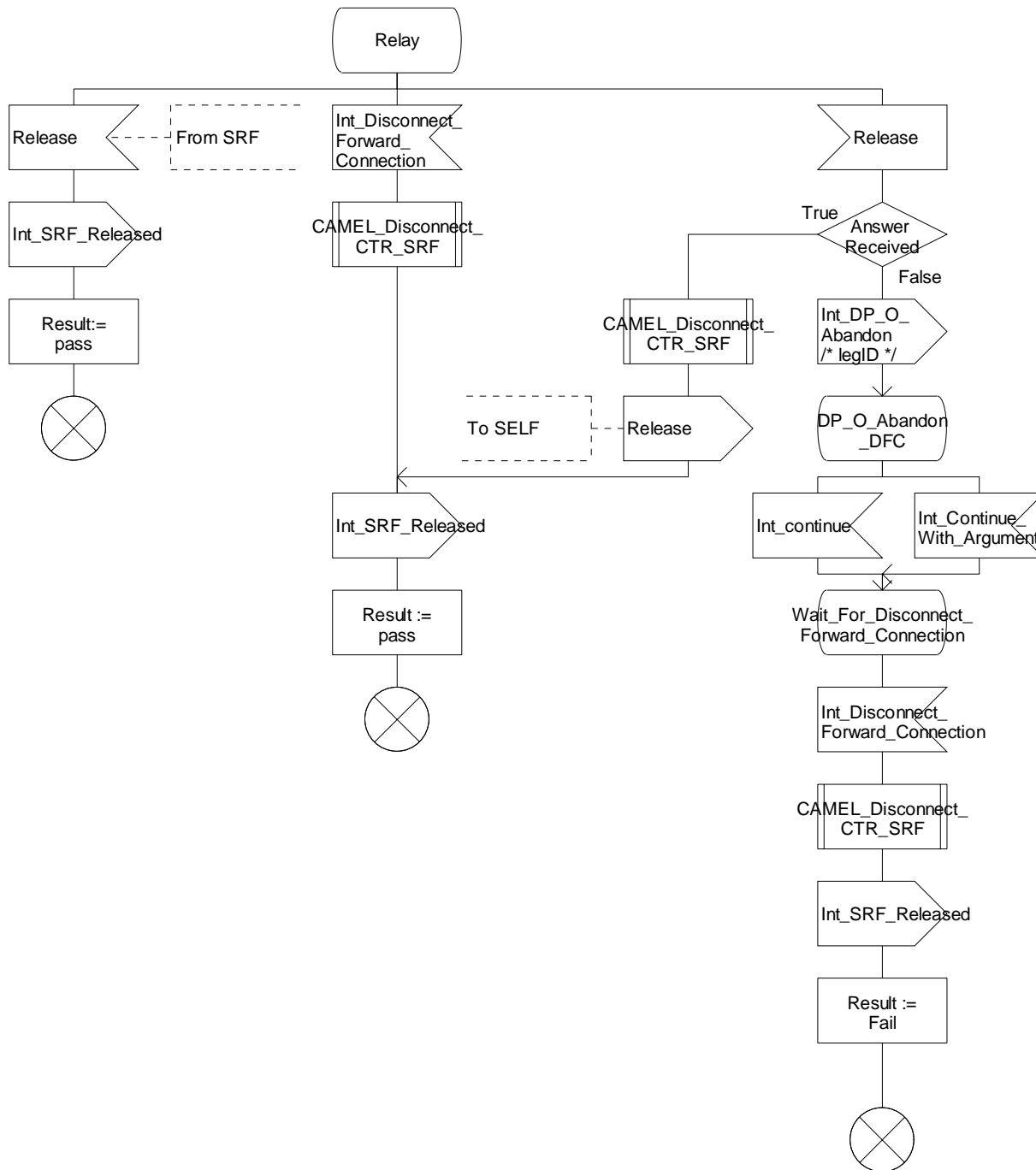
Figure 4.82-2: Procedure CAMEL_CF_CTR (sheet 2)

Procedure CAMEL_CF_CTR 3(5)

/* Procedure in the MSC
to handle a Connect To Resource
operation */

/* Signals to/from the right are to/from
the gsmSSF.
Signals to/from the left are to/from
the SRF. */

Relay

Int_Play_
Announcement

Int_Prompt_
And_Collect_
User_Information

Int_Specialized_
Ressource_Report

Int_Prompt_
And_Collect_
User_Information ack

Int_Play_
Announcement

Int_Prompt_
And_Collect_
User_Information

Int_Specialized_
Ressource_Report

Int_Prompt_
And_Collect_
User_Information ack

Relay
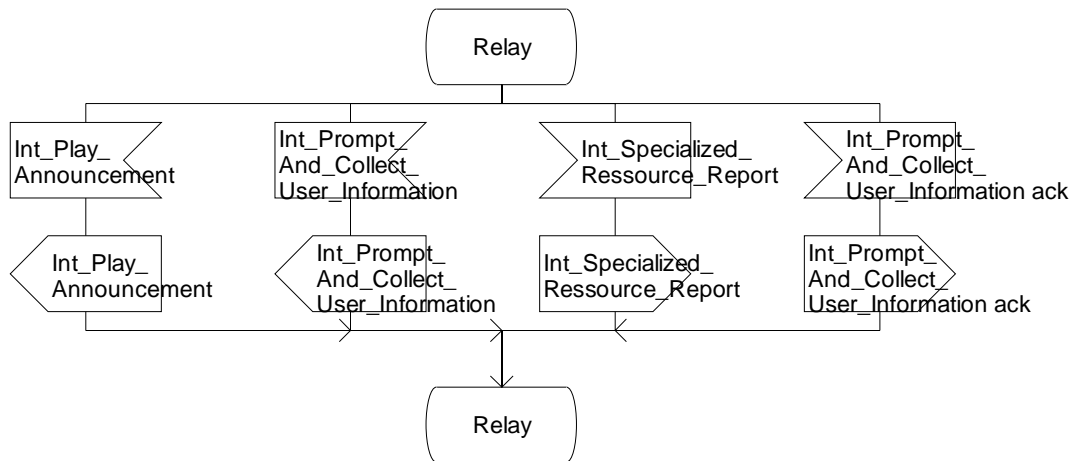
Figure 4.82-3: Procedure CAMEL_CF_CTR (sheet 3)

Procedure CAMEL_CF_CTR 4(5)

/* Procedure in the MSC to handle a Connect To Resource operation */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

Await_SRF_Initialisation

Release

Answer Received

True

False

CAMEL_Disconnect_CTR_SRF

Int_DP_O_Abandon

Int_SRF_Released

DP_O_Abandon_SRF

To SELF

Release

Int_continue

Int_Continue_With_Argument

Result := pass

CAMEL_Disconnect_CTR_SRF

Int_SRF_Released

Result := Fail
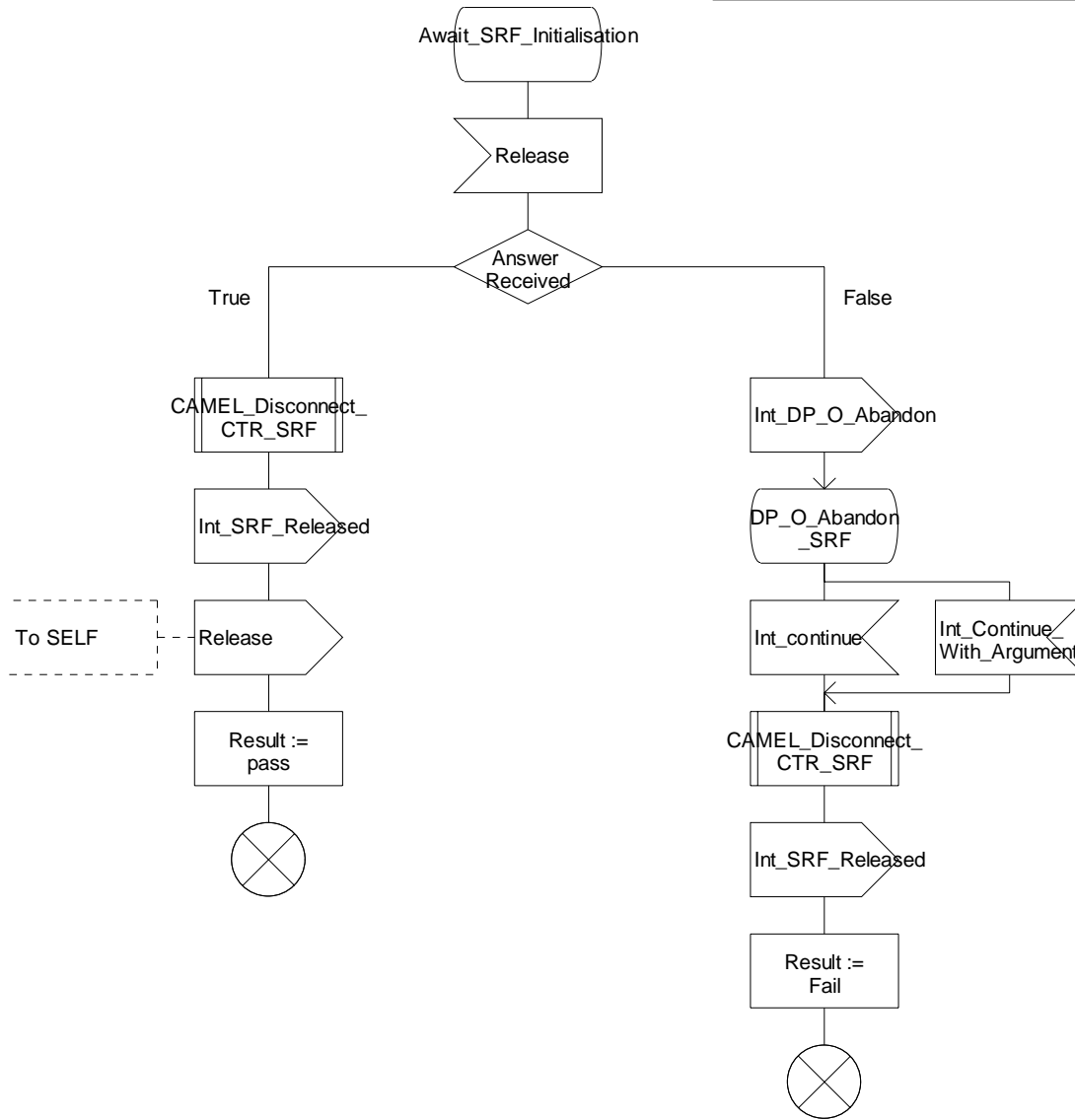
Figure 4.82-4: Procedure CAMEL_CF_CTR (sheet 4)

Procedure CAMEL_CF_CTR   5(5)

/* Procedure in the MSC
to handle a Connect To Resource
operation */

/* Signals to/from the left are
to/from the process MT_GMSC / ICH_MSC;
signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

Relay,
Await_SRF_Initialisation

From outgoing leg.
ISUP

Release

Answer

Connect

CAMEL_Disconnect_
CTR_SRF

CAMEL_Disconnect_
CTR_SRF

Int_SRF_Released

Int_SRF_Released

To SELF   Release

Result :=
Answer

Result :=
pass
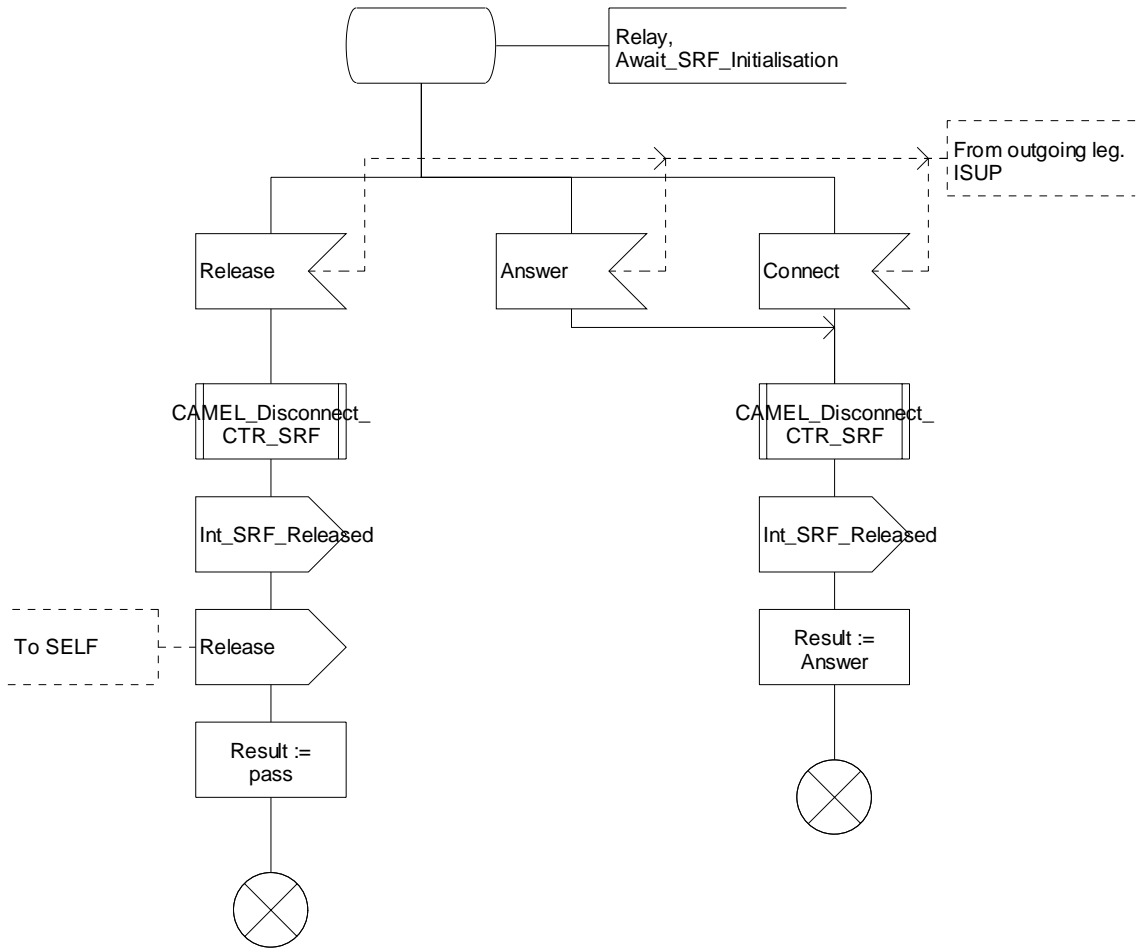
Figure 4.82-5: Procedure CAMEL_CF_CTR (sheet 5)

Procedure CAMEL_MT_CF_LEG1_MSC 1(6)

/* A procedure in the MSC to
handle leg 1 of a forwarded call. */

/* Signals to/from the left are to/from
the parent process; Signals to/from
the right are to from the gsmSSF;
unless otherwise stated. */

Active — Leg1_status?

Set-up

Wait_For
_Clear

Perform call
forwarding ack

Wait_For_
IAM

Initial
Address

CF
cancelled

Wait_For_
ACM

CAMEL_OCH_
MSC_DISC4

⊗

Figure 4.83-1: Procedure CAMEL_MT_CF_LEG1_MSC (sheet 1)

Procedure CAMEL_MT_CF_LEG1_MSC   2(6)

/* A procedure in the MSC to
handle leg 1 of a forwarded call. */

/* Signals to/from the left are to/from
the parent process; Signals to/from
the right are to from the gsmSSF;
unless otherwise stated. */

Wait_For_
ACM

Address
Complete

Connect

Address
Complete

Connect

Wait_For_
Answer

Wait_For_
Clear

Answer

Answer

Wait_For_
Clear
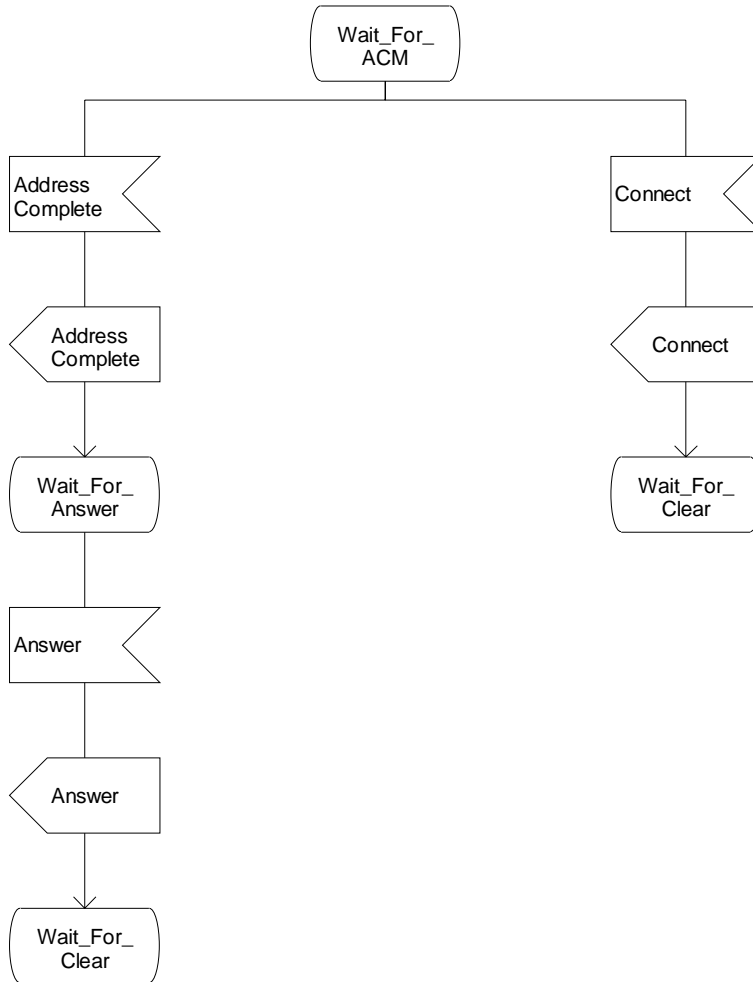
Figure 4.83-2: Procedure CAMEL_MT_CF_LEG1_MSC (sheet 2)

Procedure CAMEL_MT_CF_LEG1_MSC 3(6)

/* A procedure in the MSC to handle leg 1 of a forwarded call. */

/* Signals to/from the left are to/from the parent process; Signals to/from the right are to from the gsmSSF; unless otherwise stated. */
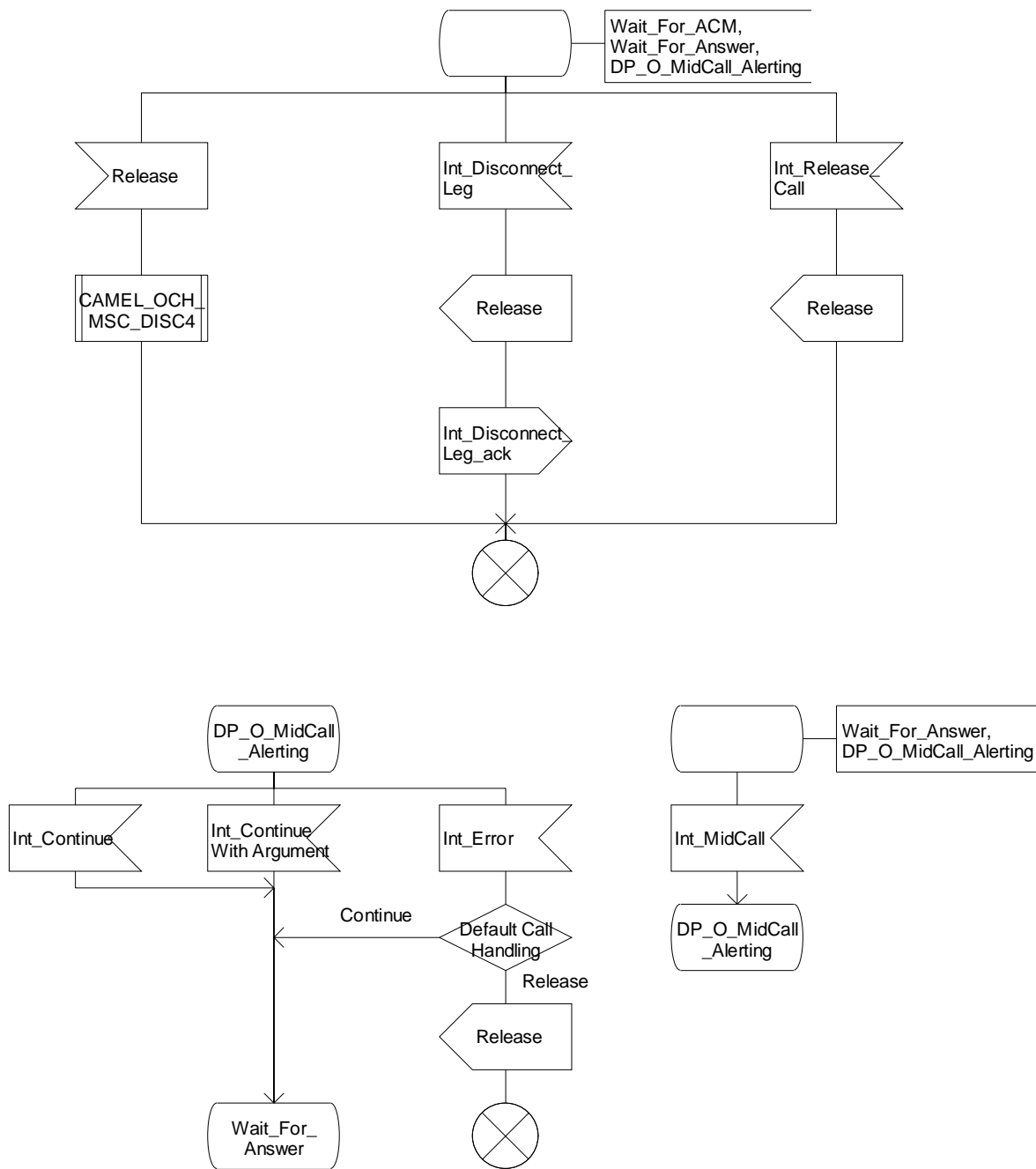
Figure 4.83-3: Procedure CAMEL_MT_CF_LEG1_MSC (sheet 3)
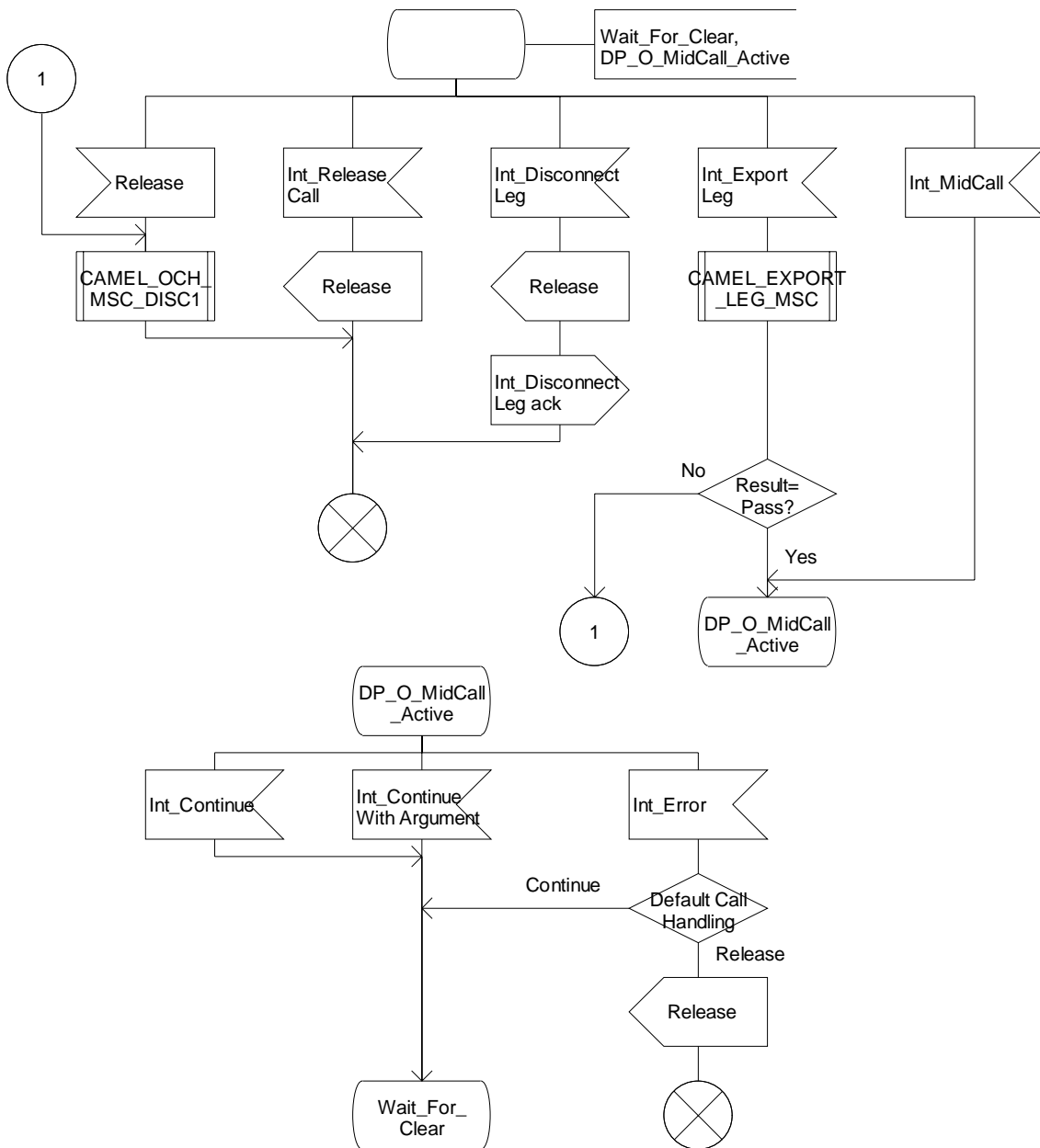
Figure 4.83-4: Procedure CAMEL_MT_CF_LEG1_MSC (sheet 4)

Procedure CAMEL_MT_CF_LEG1_MSC 5(6)

/* A procedure in the MSC to handle leg 1 of a forwarded call. */

/* Signals to/from the left are to/from the parent process; Signals to/from the right are to from the gsmSSF; unless otherwise stated. */

DP_O_MidCall_Alerting

Int_Establish_Temporary_Connection

Int_Connect_To_Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result?

Answer   ELSE   Fail

Result := Answer

To SELF   Answer

-
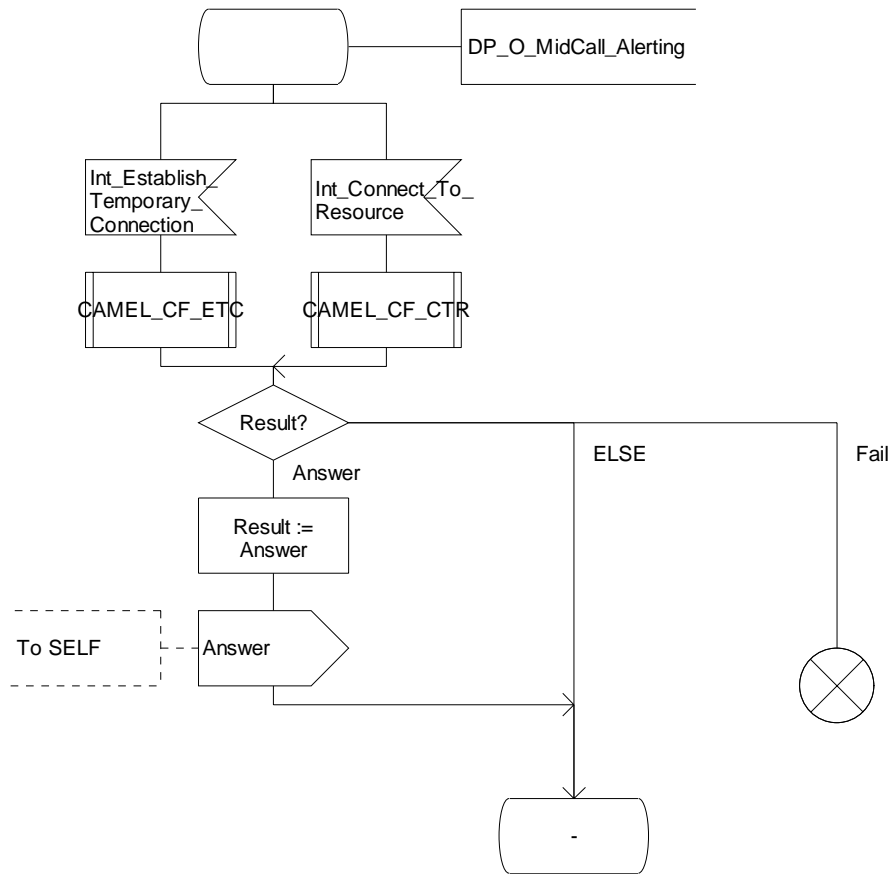
Figure 4.83-5: Procedure CAMEL_MT_CF_LEG1_MSC (sheet 5)

Procedure CAMEL_MT_CF_LEG1_MSC 6(6)

/* A procedure in the MSC to handle leg 1 of a forwarded call. */

/* Signals to/from the left are to/from the parent process; Signals to/from the right are to from the gsmSSF; unless otherwise stated. */
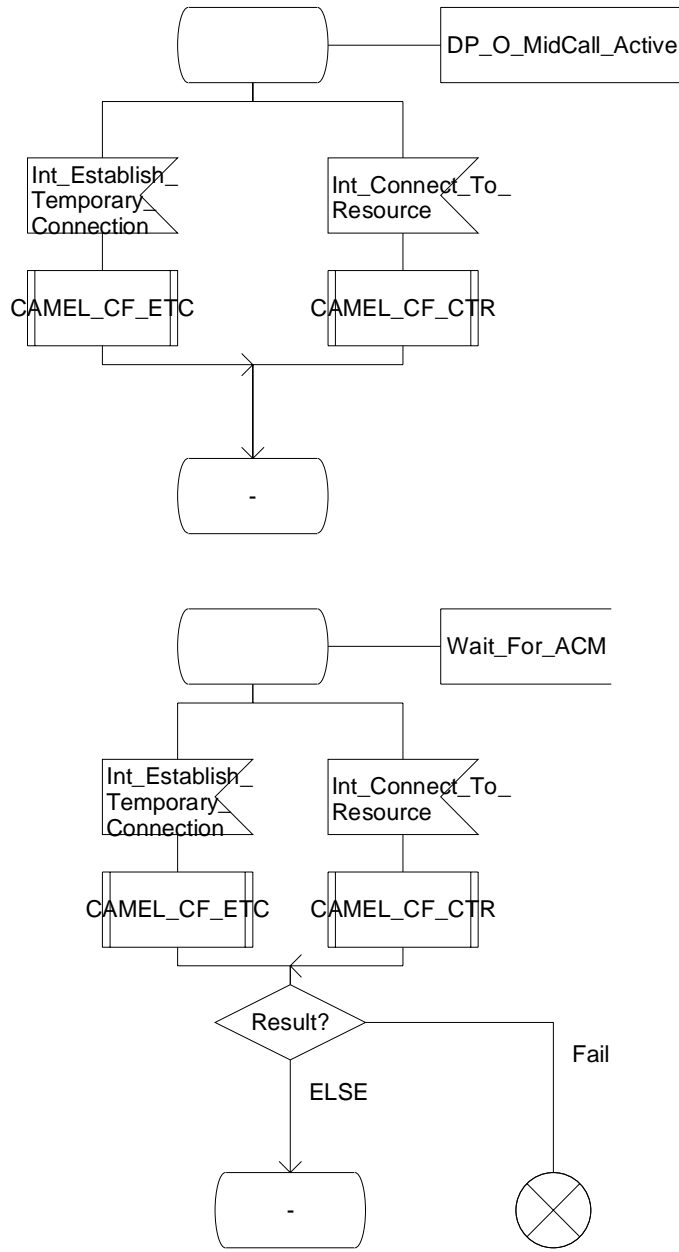
Figure 4.83-6: Procedure CAMEL_MT_CF_LEG1_MSC (sheet 6)
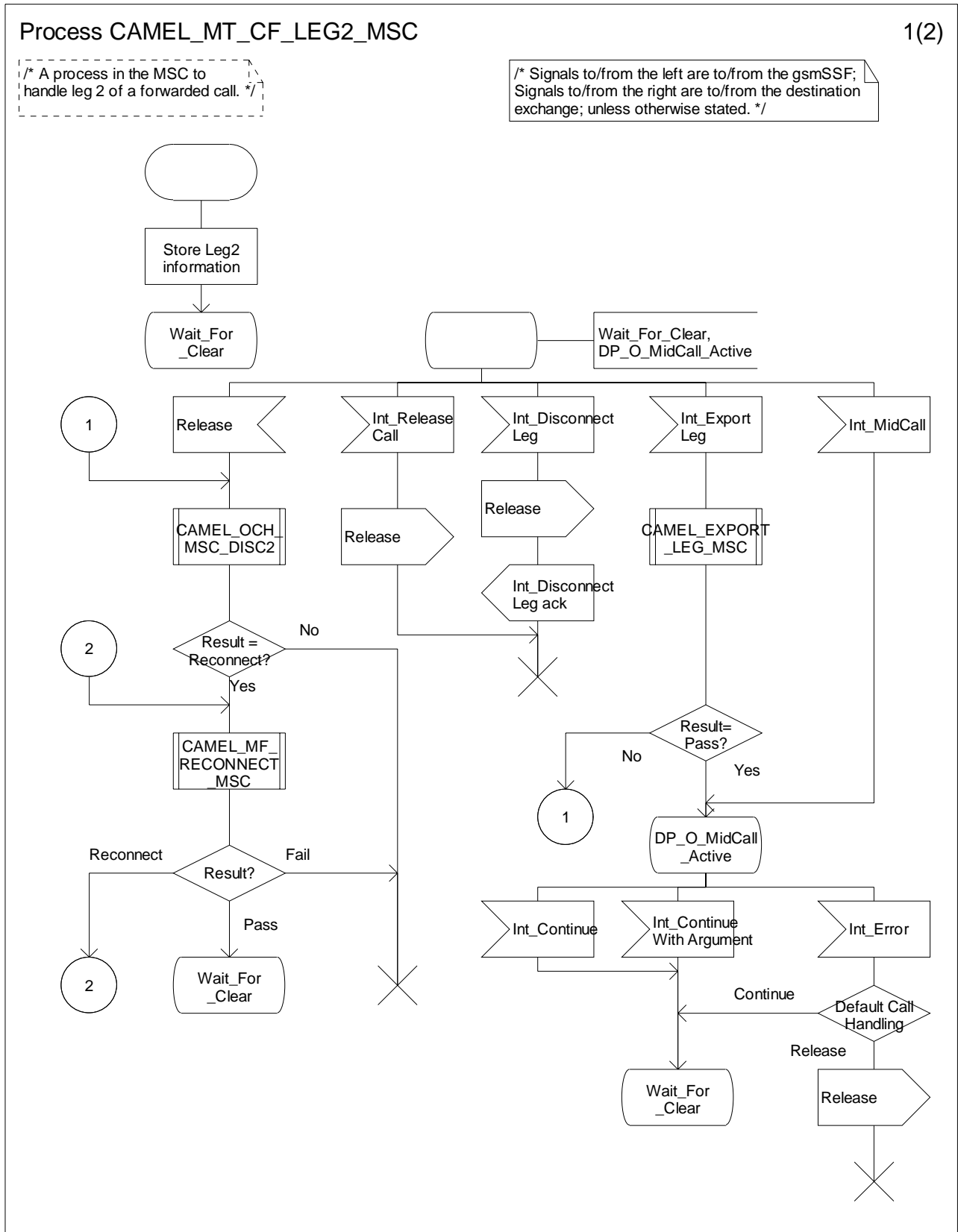
Figure 4.84-1: Process CAMEL_MT_CF_LEG2_MSC (sheet 1)

Process CAMEL_MT_CF_LEG2_MSC   2(2)

/* A process in the MSC to
handle leg 2 of a forwarded call. */

/* Signals to/from the left are to/from the gsmSSF;
Signals to/from the right are to/from the destination
exchange; unless otherwise stated. */

DP_O_MidCall_Active

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

-

Figure 4.84-2: Process CAMEL_MT_CF_LEG2_MSC (sheet 2)

Procedure CAMEL_MF_RECONNECT_MSC   1(6)

/* A procedure in the MSC to handle
a reconnection after leg 2 disconnects */

/* Signals to/from the right are
to/from the destination exchange. */
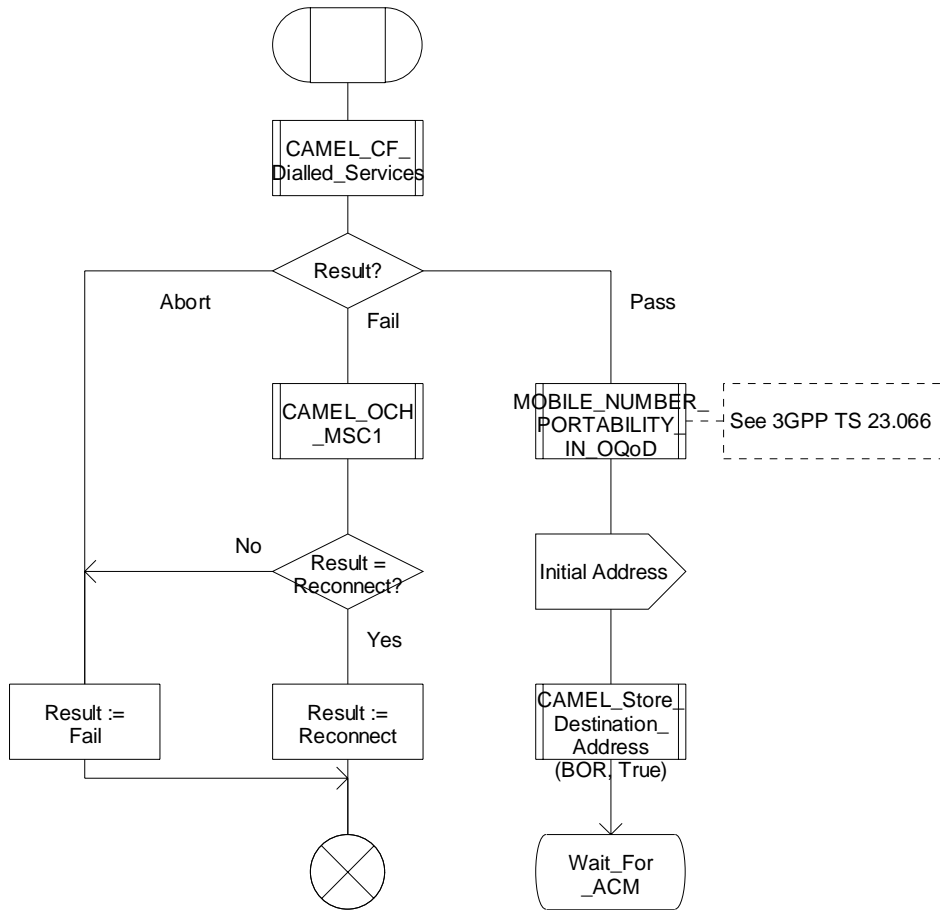
Figure 4.85-1: Procedure CAMEL_MF_RECONNECT_MSC (sheet 1)

Procedure CAMEL_MF_RECONNECT_MSC 2(6)

/* A procedure in the MSC to handle
a reconnection after leg 2 disconnects */

/* Signals to/from the right are
to/from the destination exchange. */
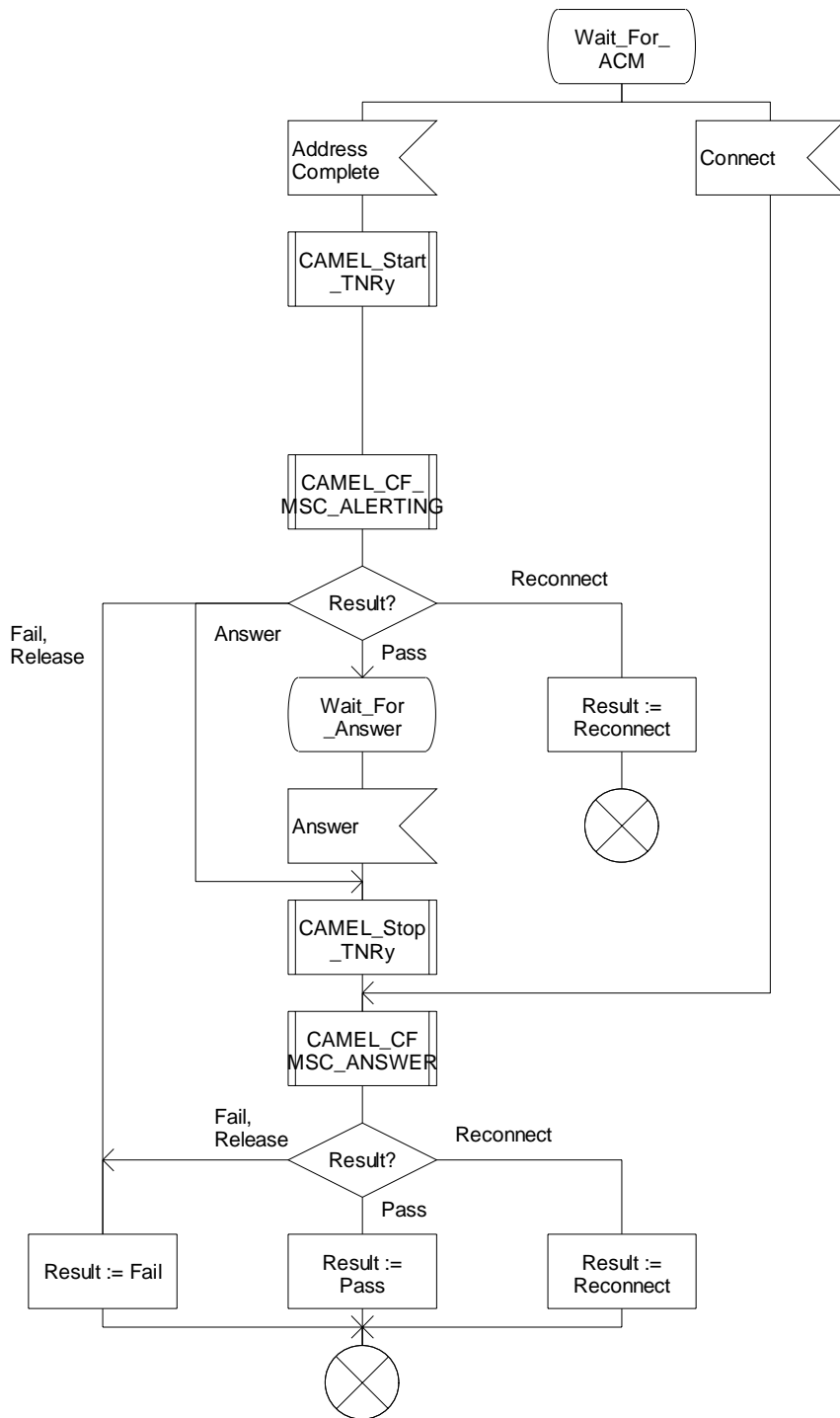
Figure 4.85-2: Procedure CAMEL_MF_RECONNECT_MSC (sheet 2)

Procedure CAMEL_MF_RECONNECT_MSC 3(6)

/* A procedure in the MSC to handle a reconnection after leg 2 disconnects */

/* Signals to/from the right are to/from the destination exchange unless otherwise stated. */

Wait_For_Answer, DP_O_MidCall_Alerting

Wait_For_ACM, Wait_For_Answer, DP_O_MidCall_Alerting

TNRy Expired ◁---- Internal

Release ◁

Int_Release Call ◁---- From gsmSSF

Release ▷

Release ▷

Release Cause = No answer from user

Yes

No

CAMEL_OCH_ MSC2

CAMEL_OCH _MSC1

Result := Fail

⊗

Result = Reconnect? No

No

Result = Reconnect?

Yes

Yes

CAMEL_Stop _TNRy

Result := Reconnect

Result := Fail

Result := Reconnect

⊗
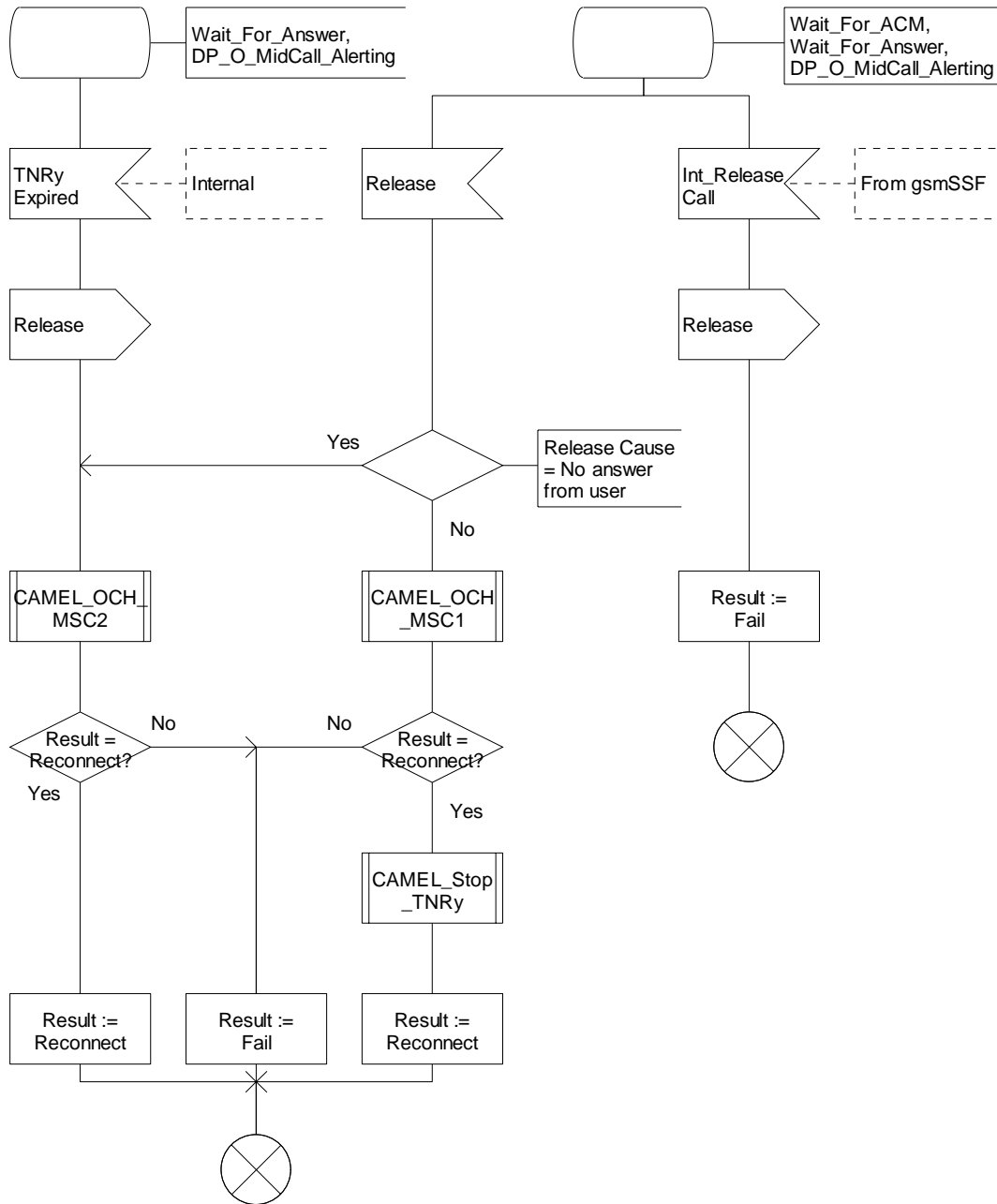
Figure 4.85-3: Procedure CAMEL_MF_RECONNECT_MSC (sheet 3)

Procedure CAMEL_MF_RECONNECT_MSC 4(6)

/* A procedure in the MSC to handle
a reconnection after leg 2 disconnects */

/* Signals to/from the right are
to/from the destination exchange;
signals to/from the left are
to/from the gsmSSF
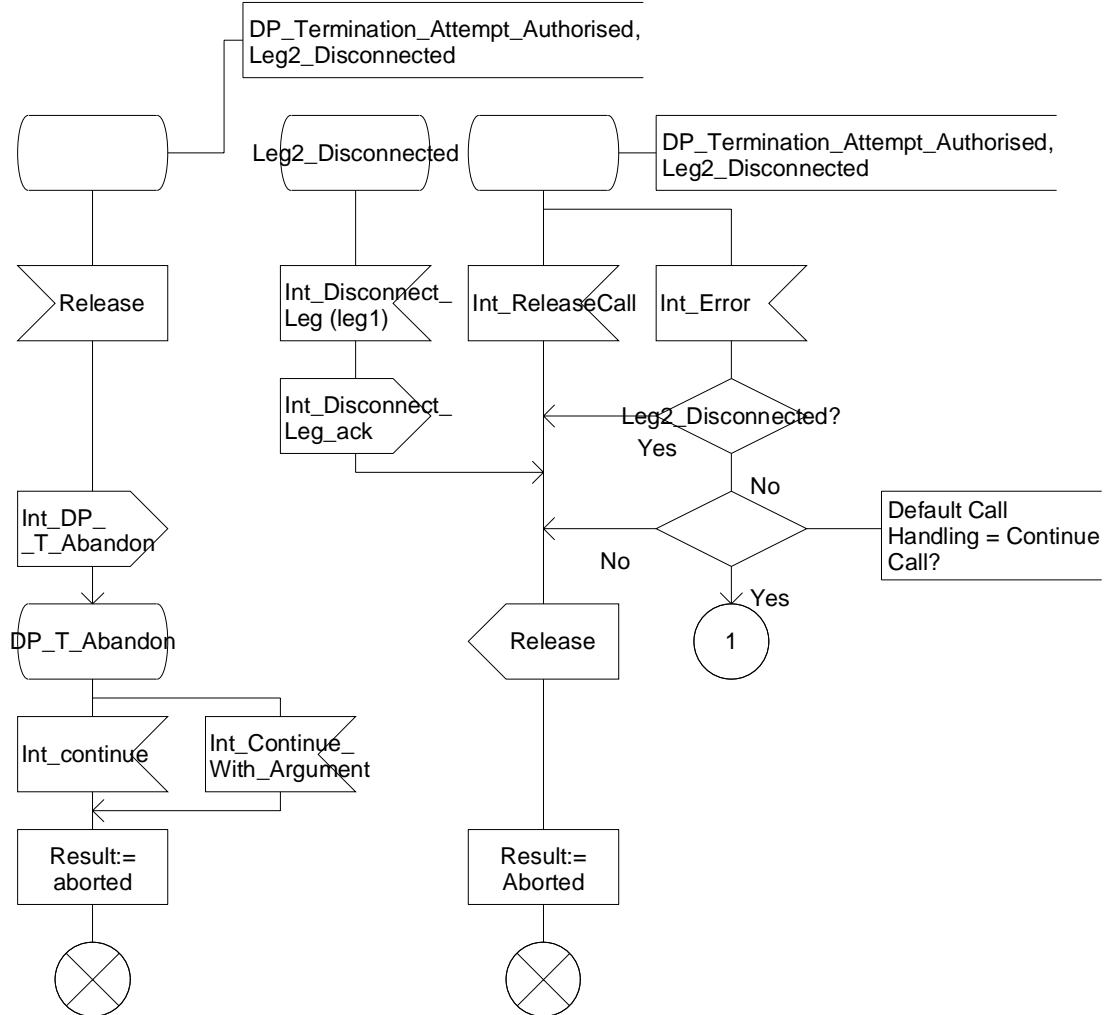unless otherwise stated. */

Wait_For_Answer,
DP_O_MidCall_Alerting

Int_Export
Leg

Int_MidCall

CAMEL_EXPORT
_LEG_MSC

Result =
Pass?

Yes

No

Result :=
Fail

⊗

DP_O_MidCall
_Alerting

Int_Error

Int_Continue

Int_Continue
With Argument

Answer

Default call
handling

Continue

Release

Release

Result :=
Fail

⊗

Wait_For_
Answer
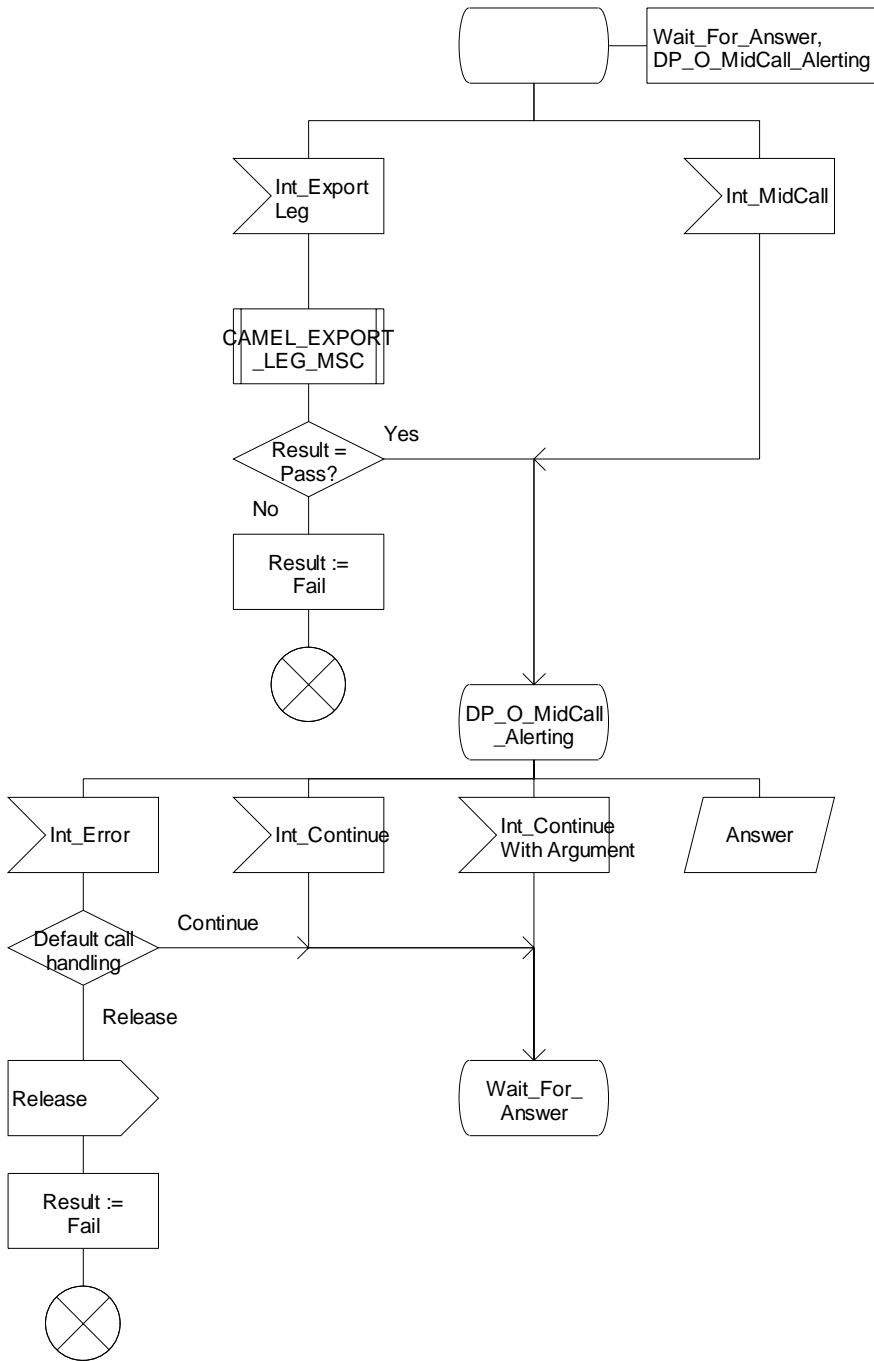
Figure 4.85-4: Procedure CAMEL_MF_RECONNECT_MSC (sheet 4)

ETSI

Procedure CAMEL_MF_RECONNECT_MSC 5(6)

/* A procedure in the MSC to handle
a reconnection after leg 2 disconnects */

/* Signals to/from the right are
to/from the destination exchange;
signals to/from the left are
to/from the gsmSSF
unless otherwise stated. */

DP_O_MidCall_Alerting

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result?

ELSE

Fail

Answer

Result :=
Answer

To SELF

Answer

-
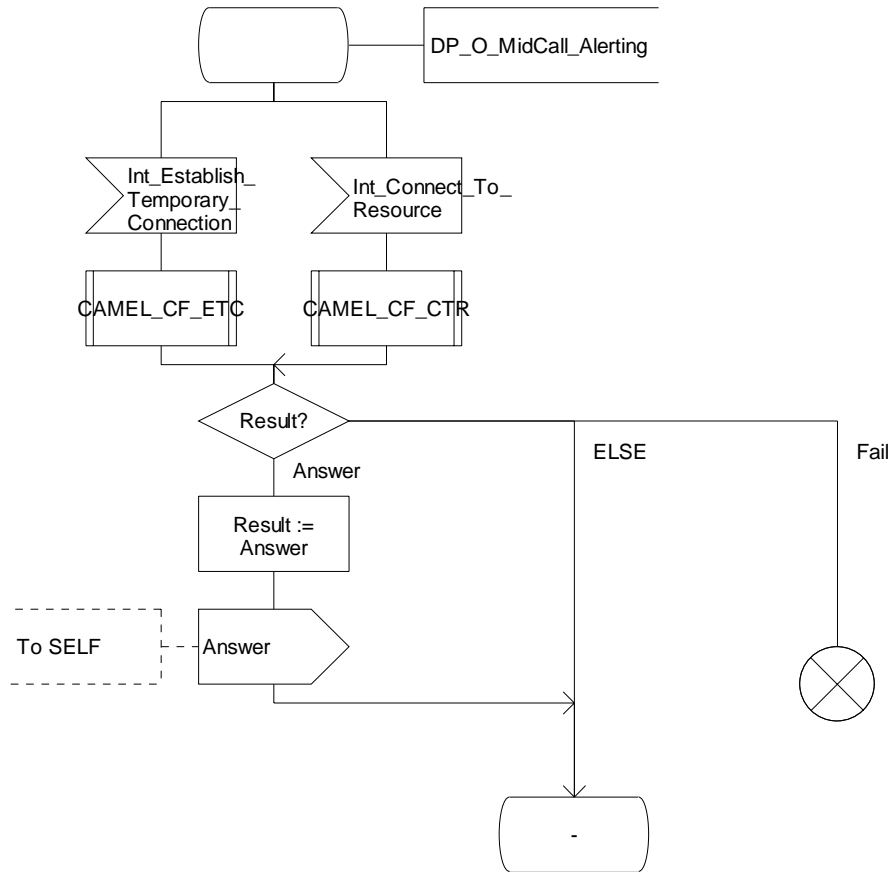
Figure 4.85-5: Procedure CAMEL_MF_RECONNECT_MSC (sheet 5)

Procedure CAMEL_MF_RECONNECT_MSC 6(6)

/* A procedure in the MSC to handle
a reconnection after leg 2 disconnects */

/* Signals to/from the right are
to/from the destination exchange;
signals to/from the left are
to/from the gsmSSF
unless otherwise stated. */
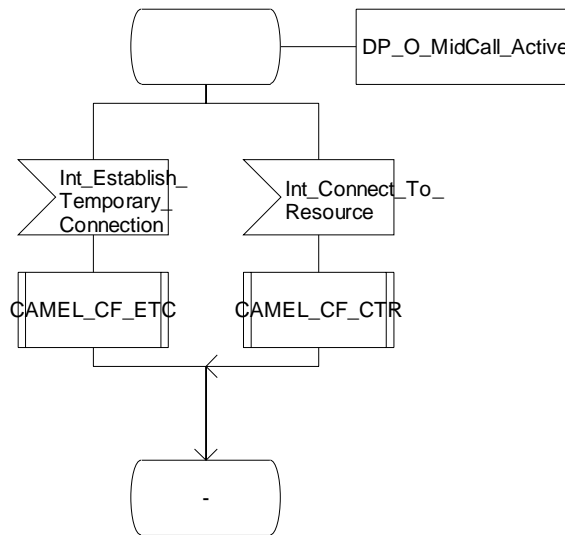
Figure 4.85-6: Procedure CAMEL_MF_RECONNECT_MSC (sheet 6)

4.5.6 Handling of gsmSCF initiated calls

4.5.6.1 Handling of gsmSCF initiated calls in the MSC

Handling of gsmSCF initiated calls in the MSC involves the following process and procedures:

- Process CAMEL_ICA_MSC;

- Procedure CAMEL_ICA_MSC_ALERTING;

- Procedure CAMEL_ICA_MSC_ANSWER;

- Procedure CAMEL_ICA_MSC1;

- Procedure CAMEL_ICA_MSC2;

- Procedure CAMEL_ICA_Dialled_Services.

The Process CAMEL_ ICA_MSC handles both gsmSCF initiated new calls and gsmSCF initiated new parties.

The following paragraphs give details on the behaviour of the MSC in the process CAMEL_ICA_MSC.

4.5.6.1.1 Actions of the MSC on receipt of Int_Error

The process CAMEL_ICA_MSC returns to idle.

4.5.6.1.2 Actions of the MSC on receipt of Int_Continue

The MSC continues processing without any modification of call parameters.

4.5.6.1.3 Actions of the MSC on receipt of Int_Continue_With_Argument

The MSC continues processing with modification of call parameters.

4.5.6.1.4 Actions of the MSC on receipt of Int_Disconnect_Leg

A Release is sent to the destination exchange if required. The release cause received in the Int_Disconnect_Leg signal is used. The process CAMEL_ICA_MSC returns to idle.

4.5.6.1.5 Actions of the MSC on receipt of Int_Release_Call

A Release is sent to the destination exchange if required. The release cause received in the Int_Release_Call signal is used. The MSC then releases all call resources and the process CAMEL_ ICA_MSC returns to idle.

Process CAMEL_ICA_MSC   1(9)

/* A process in the MSC to handle
a gsmSCF initiated new call or
new party set-up. */

/* Signals to/from the right are to/from
the destination exchange; Signals to/from
the left are to/from the gsmSSF;
unless otherwise stated. */

/* The ICA Default Call Handling indicates
whether the call shall be released or continued
as requested. */

Idle

Int_Initiate
Call Attempt

No ──────────── Is ICA creating a new
party in an existing call?

Yes

Store call reference
number and
gsmSCF Address

Yes ──────────── Was original call
created using ICA?

No

Release Call ──────────── Default Call Handling of
CSI initiating CAP dialogue

Continue Call

ICA Default
Call Handling :=
Release Call

ICA Default
Call Handling :=
Continue Call

Int_Initiate
Call Attempt
ack

DP_
Collected_
Info
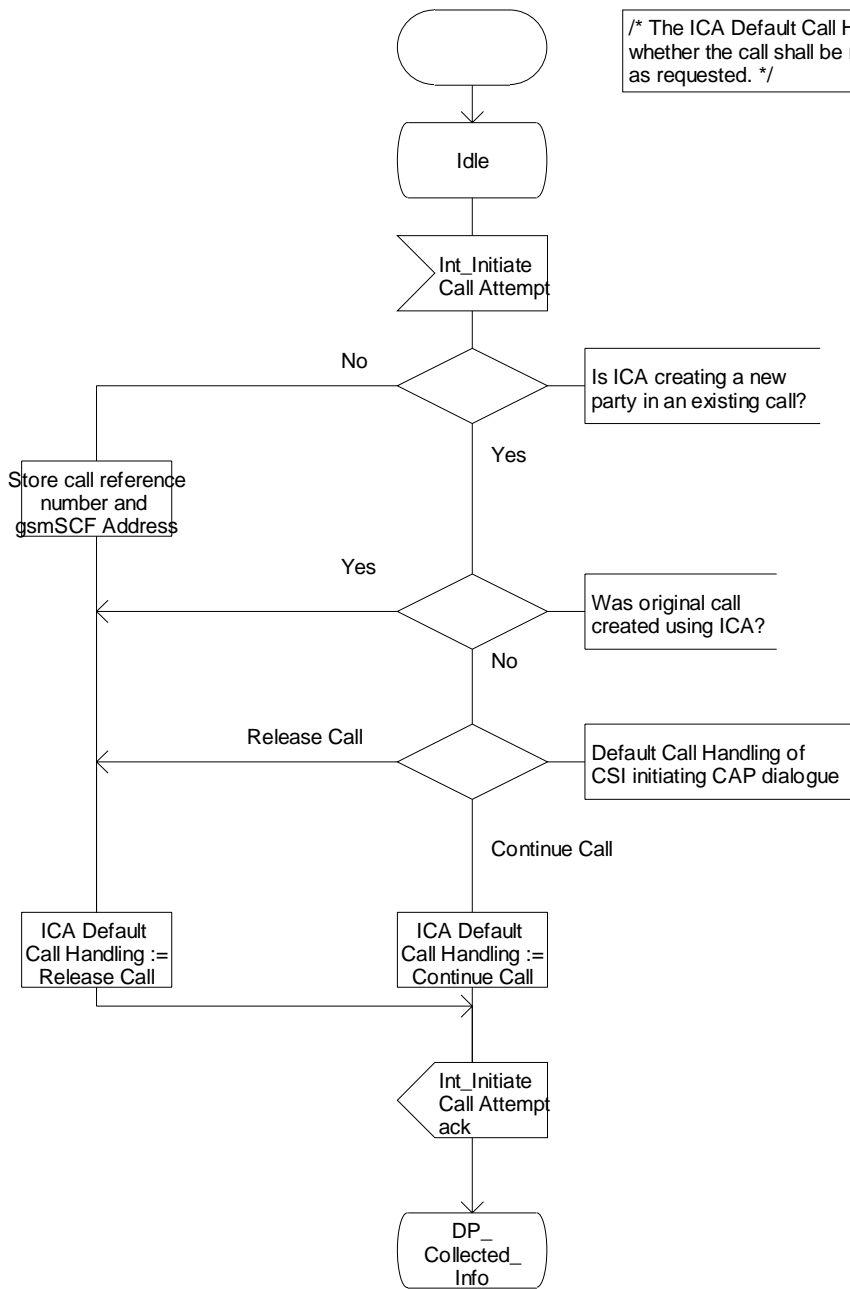
Figure 4.86-1: Process CAMEL_ICA_MSC (sheet 1)

ETSI

Process CAMEL_ICA_MSC   2(9)

/* A process in the MSC to handle a gsmSCF initiated new call or new party set-up. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */
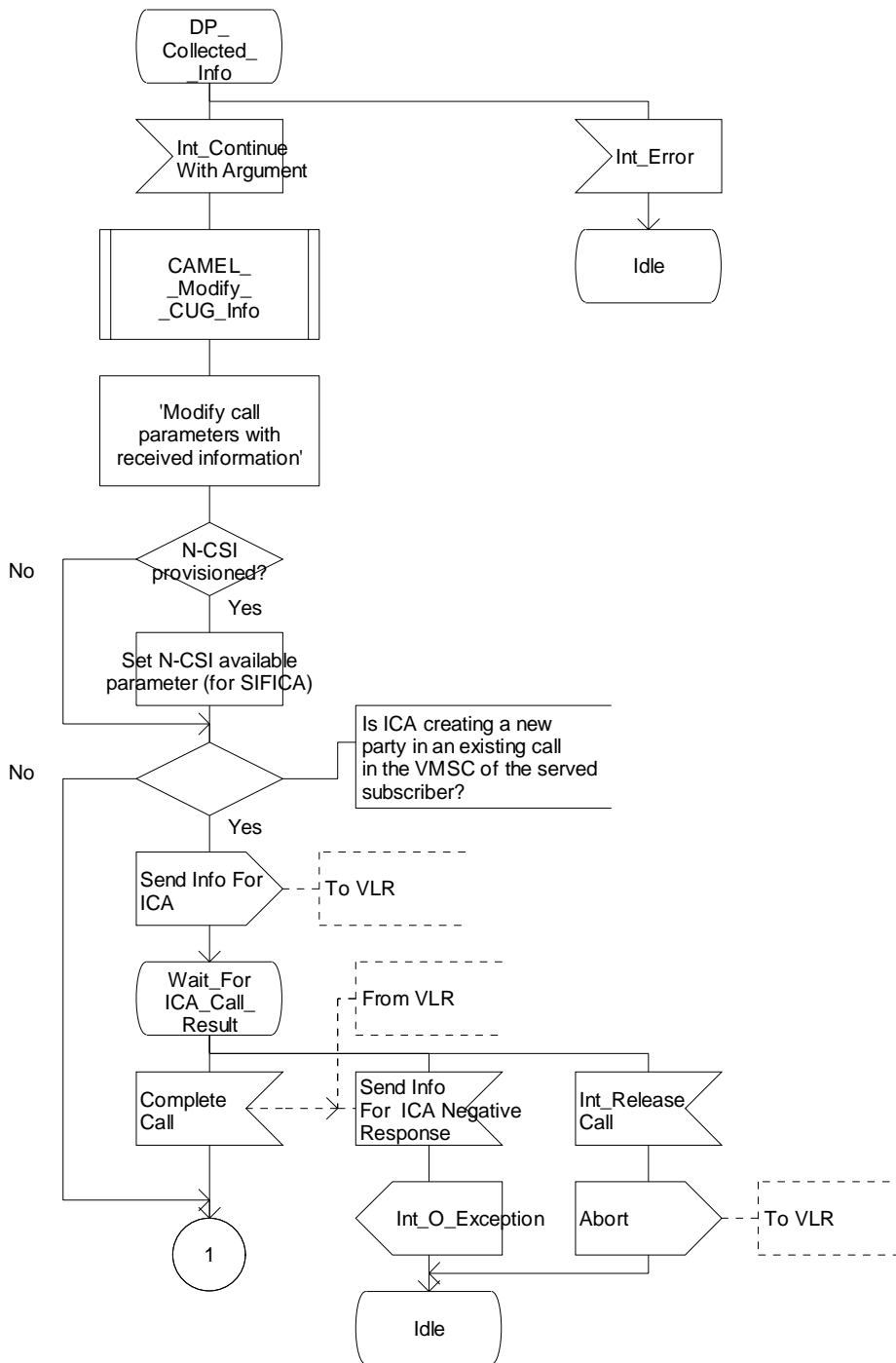
Figure 4.86-2: Process CAMEL_ICA_MSC (sheet 2)

Process CAMEL_ICA_MSC 3(9)

/* A process in the MSC to handle a gsmSCF initiated new call or new party set-up. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */
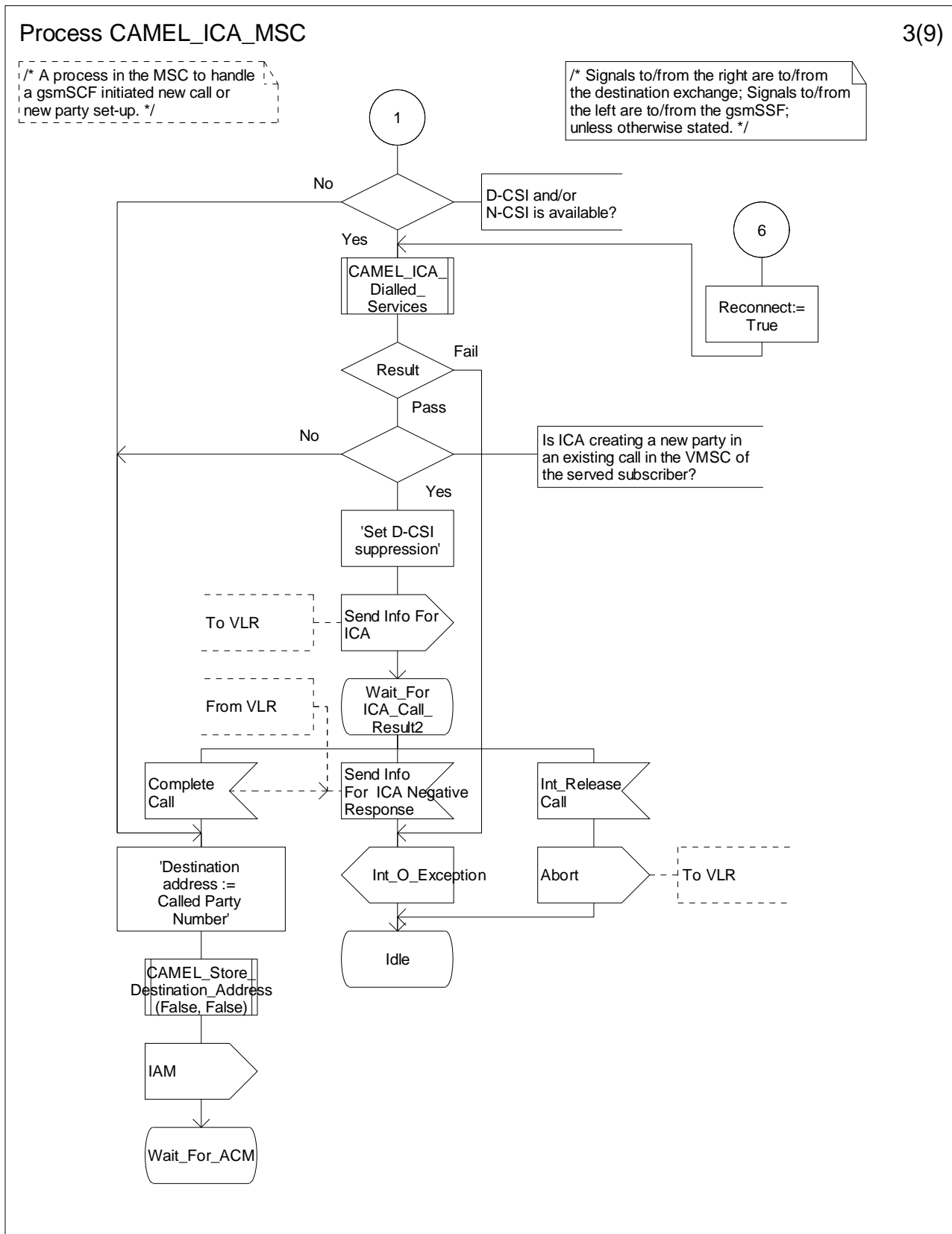
Figure 4.86-3: Process CAMEL_ICA_MSC (sheet 3)

ETSI

Process CAMEL_ICA_MSC 4(9)

/* A process in the MSC to handle a gsmSCF initiated new call or new party set-up. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */
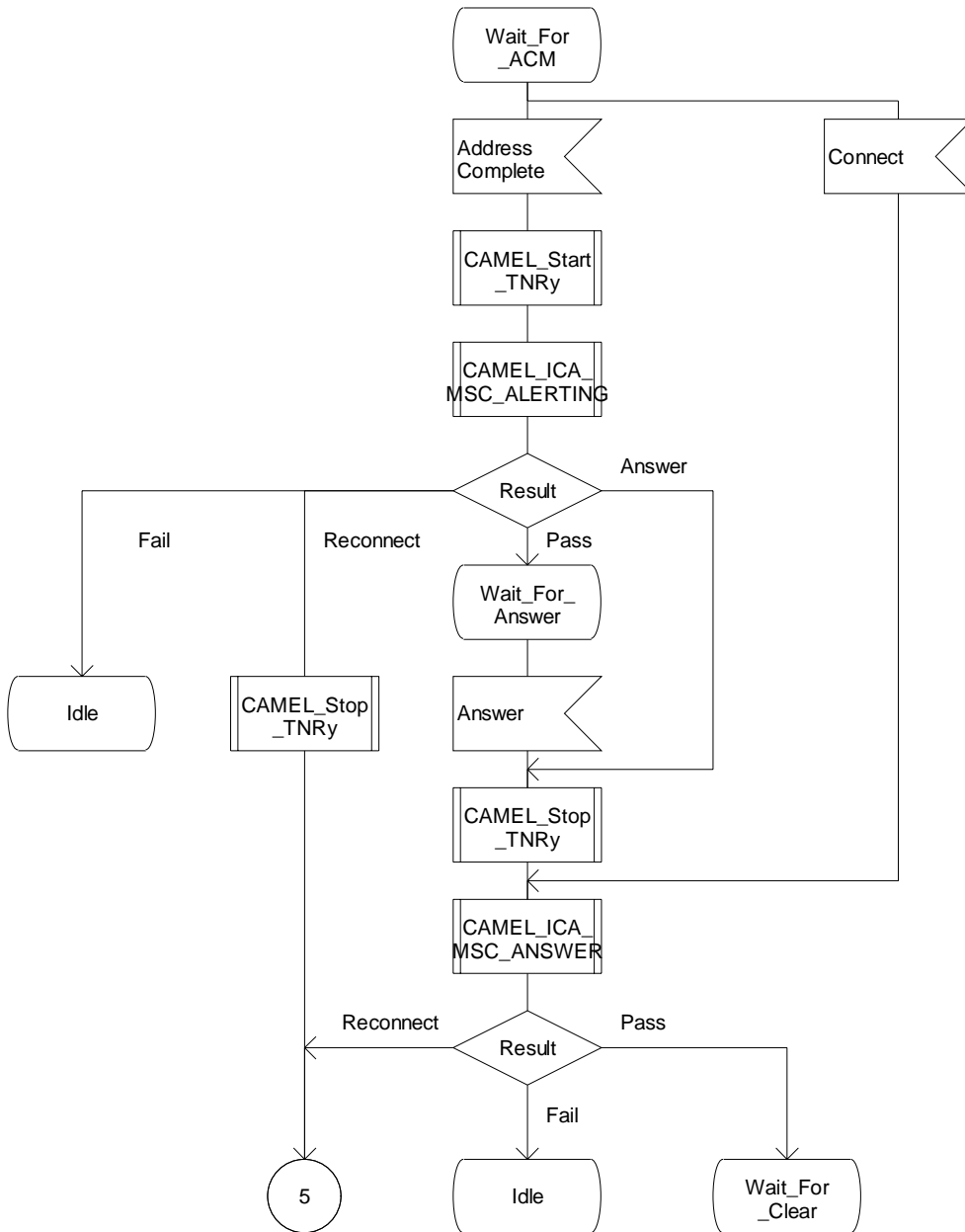
Figure 4.86-4: Process CAMEL_ICA_MSC (sheet 4)

Process CAMEL_ICA_MSC 5(9)

/* A process in the MSC to handle a gsmSCF initiated new call or new party set-up. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */

Wait_For_Answer, DP_O_MidCall_Alerting

Int_MidCall

DP_O_MidCall_Alerting

Int_Export Leg

CAMEL_EXPORT_LEG_MSC

Result = Pass?

No

Yes

DP_O_MidCall_Alerting

2

TNRy expired — Internal

Release

3

Wait_For_Clear, DP_O_MidCall_Active

Int_MidCall

Int_Export Leg

CAMEL_EXPORT_LEG_MSC

Result= Pass?

No

Yes

DP_O_MidCall_Active

Release

CAMEL_OCH_MSC_DISC2

5
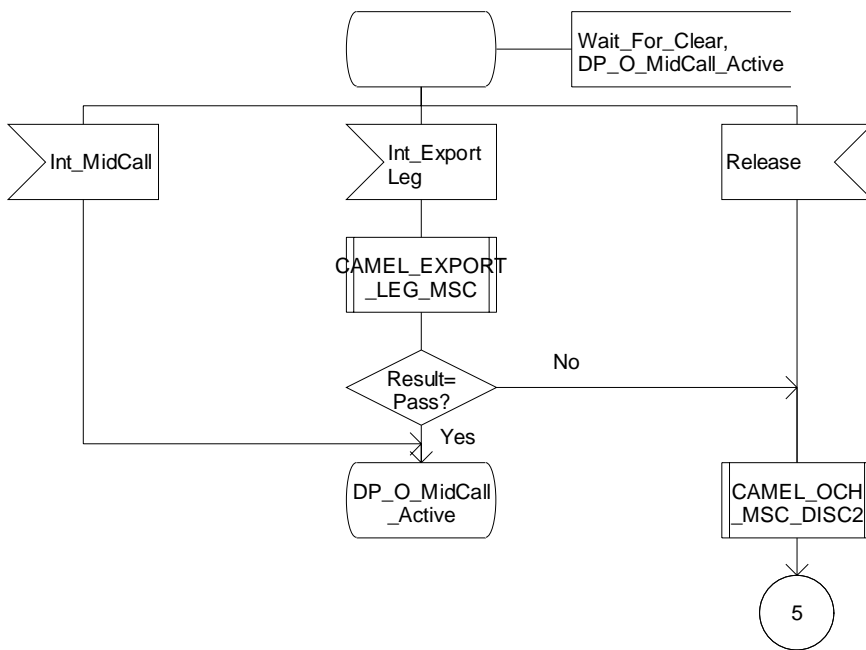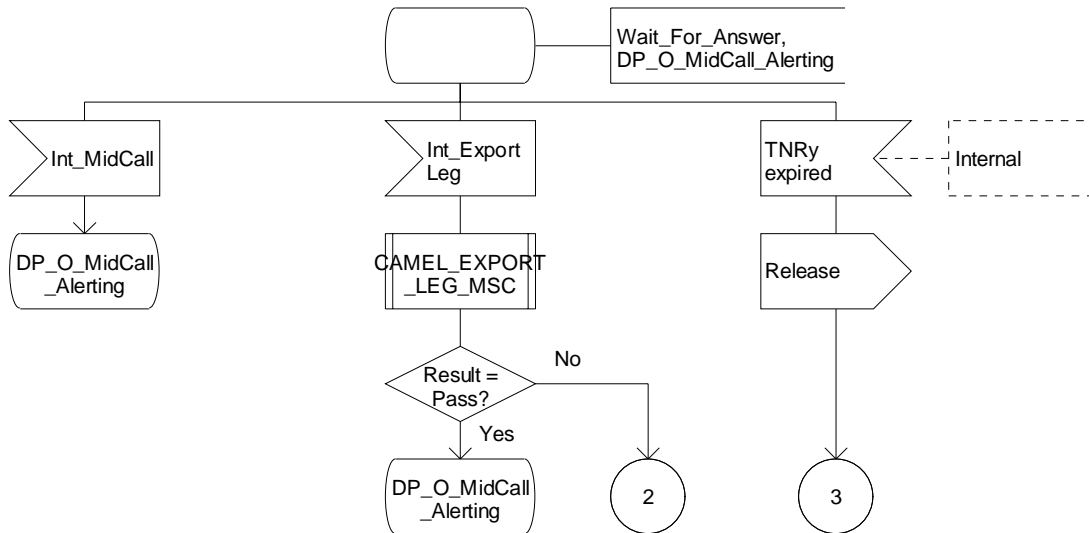
Figure 4.86-5: Process CAMEL_ICA_MSC (sheet 5)

Process CAMEL_ICA_MSC 6(9)

/* A process in the MSC to handle a gsmSCF initiated new call or new party set-up. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */

Wait_For_ACM,
Wait_For_Answer,
DP_O_MidCall_Alerting

Release 3

Release cause = No answer from user?

No

Yes

CAMEL_ICA_MSC1

CAMEL_ICA_MSC2 5

Result= Reconnect?

No

Yes

Idle 6

Wait_For_ACM,
Wait_For_Answer,
Wait_For_Clear,
DP_O_MidCall_Alerting,
DP_O_MidCall_Active

Int_Release Call

Release

Idle

DP_O_MidCall _Alerting

Int_Error

Default Call Handling

Continue

Release

Wait_For_ Answer

Release

Idle

DP_O_MidCall _Active

Int_Error

Release

Default Call Handling

Continue

Wait_For_ Clear
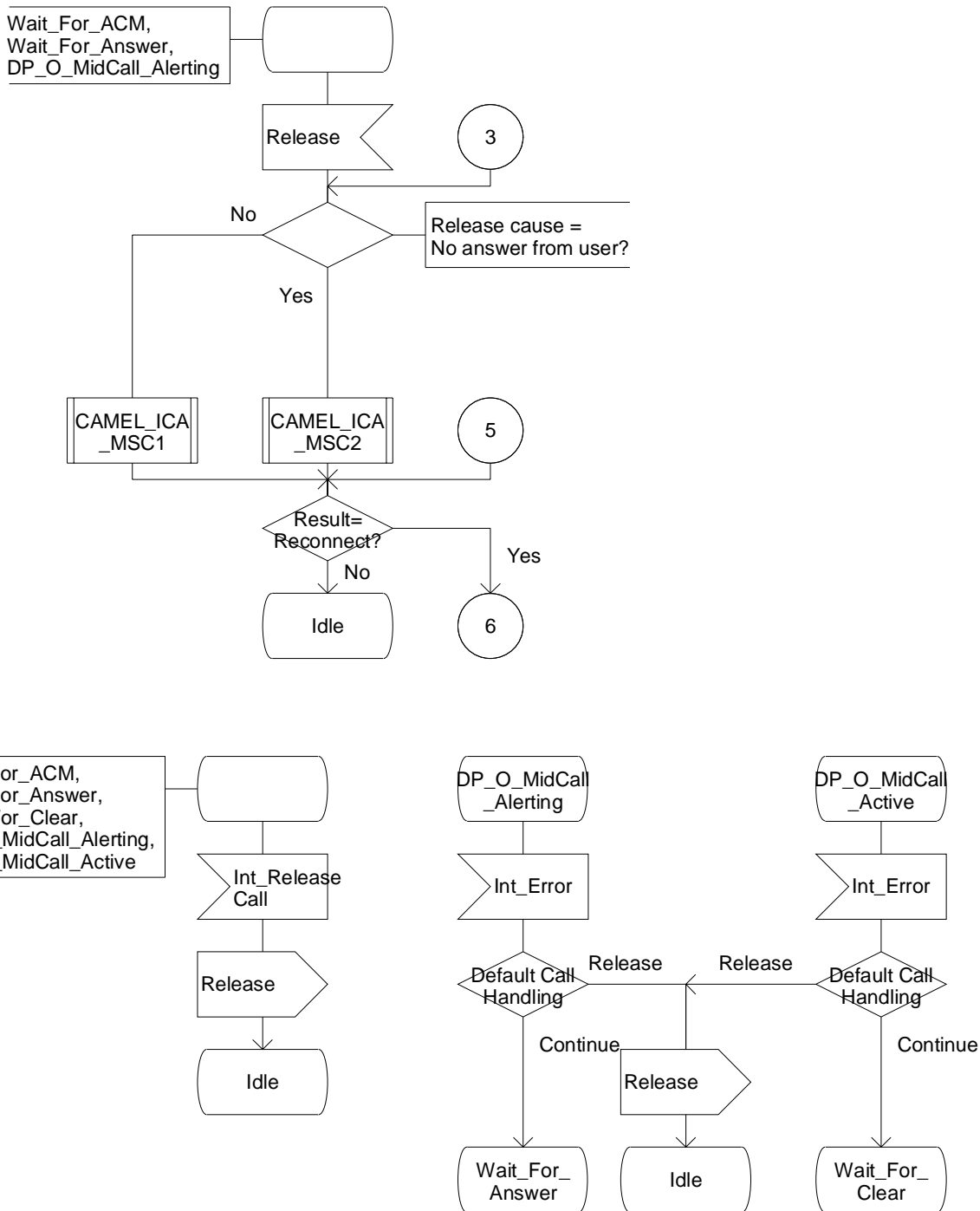
Figure 4.86-6: Process CAMEL_ICA_MSC (sheet 6)

ETSI

Process CAMEL_ICA_MSC 7(9)

/* A process in the MSC to handle a gsmSCF initiated new call or new party set-up. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */

Wait_For_ACM,
Wait_For_Answer,
Wait_For_Clear,
DP_O_MidCall_Alerting,
DP_O_MidCall_Active

Int_Disconnect Leg

Release

Int_Disconnect Leg ack

Idle

Wait_For_ICA_Call_Result,
Wait_For_ICA_Call_Result2

Int_Disconnect Leg

Abort

To VLR

From gsmSSF

DP_O_MidCall _Alerting

Answer

Int_Continue

Int_Continue With Argument

Wait_For_ Answer

DP_O_MidCall _Active

Int_Continue

Int_Continue With Argument

Wait_For_ Clear
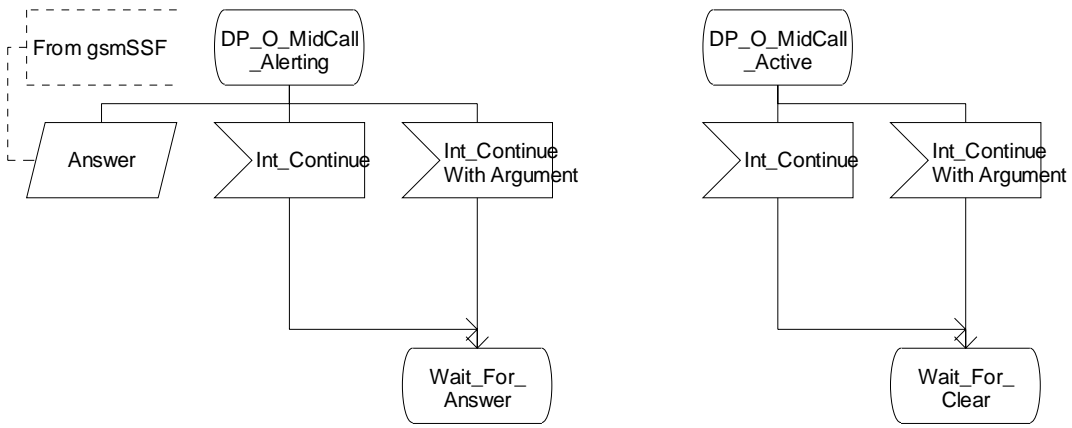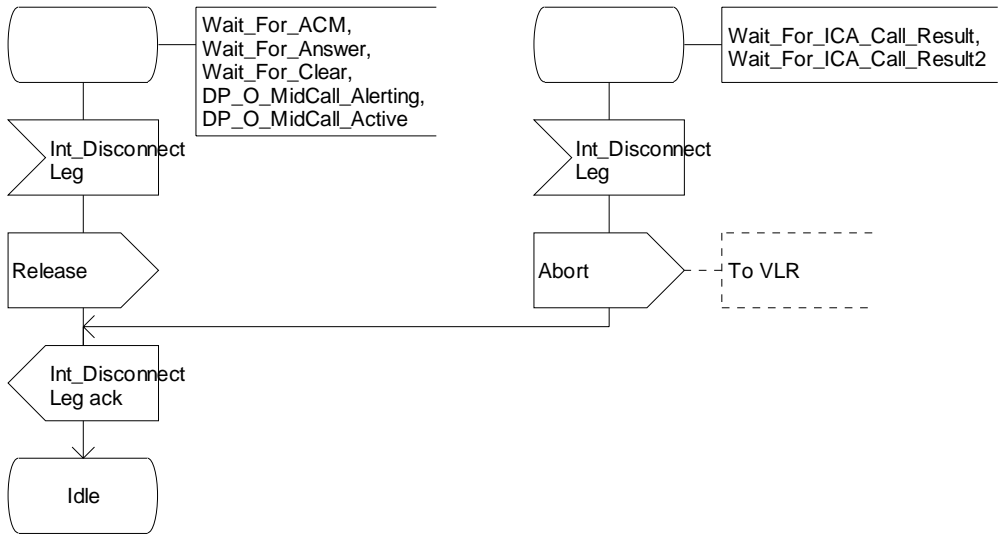
Figure 4.86-7: Process CAMEL_ICA_MSC (sheet 7)

Process CAMEL_ICA_MSC 8(9)

/* A process in the MSC to handle a gsmSCF initiated new call or new party set-up. */

/* Signals to/from the right are to/from the destination exchange; Signals to/from the left are to/from the gsmSSF; unless otherwise stated. */

DP_O_MidCall_Alerting

Int_Establish_Temporary_Connection

Int_Connect_To_Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result?

Answer

ELSE

Fail

Result := Answer

Answer

-
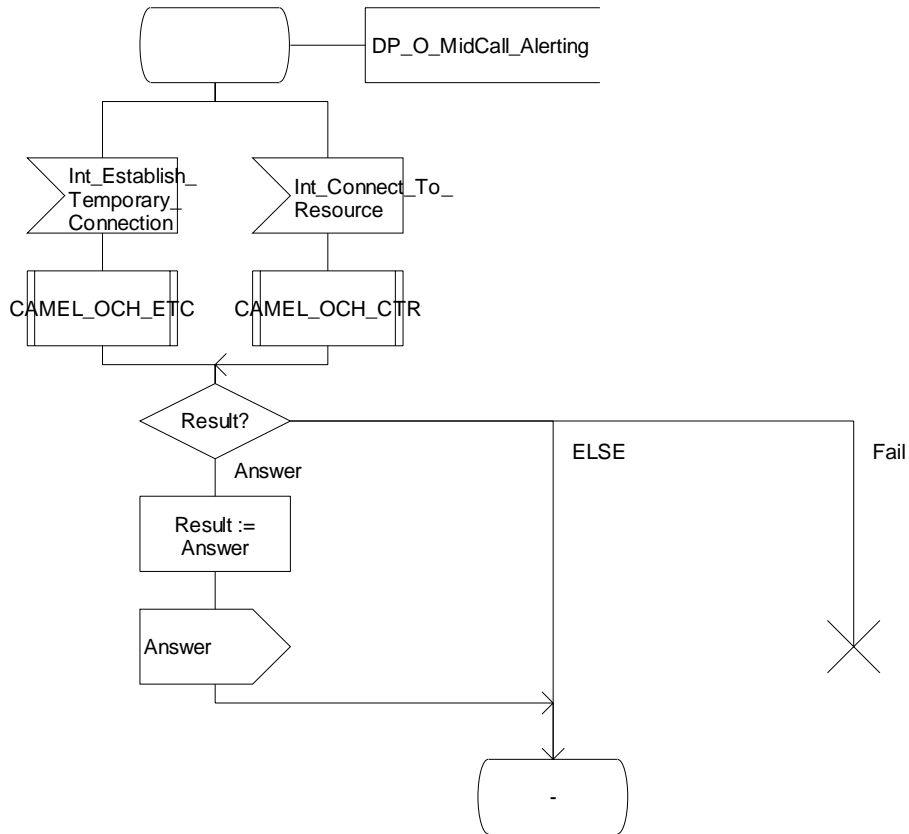
Figure 4.86-8: Process CAMEL_ICA_MSC (sheet 8)

ETSI

Process CAMEL_ICA_MSC   9(9)

/* A process in the MSC to handle
a gsmSCF initiated new call or
new party set-up. */

/* Signals to/from the right are to/from
the destination exchange; Signals to/from
the left are to/from the gsmSSF;
unless otherwise stated. */

DP_O_MidCall_Active

Int_Establish_
Temporary_
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

-
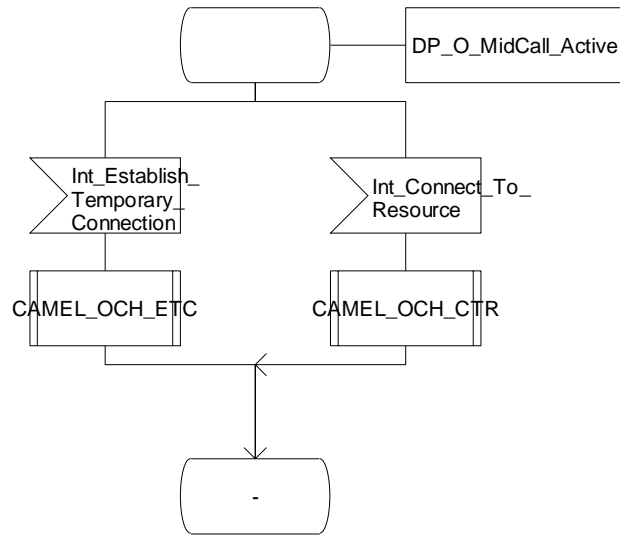
Figure 4.86-9: Process CAMEL_ICA_MSC (sheet 9)

Procedure CAMEL_ICA_MSC_ALERTING 1(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from the destination exchange; unless otherwise stated. */

Int_DP_O_Term_Seized

DP_O_Term_Seized

Internal

Answer

Int_Continue

Int_Release

Release

TNRy Expired

Release

Release Cause = No answer from user?

Yes

No

Result:= Answer

Result:= Pass

Result:= Fail

CAMEL_ICA_MSC1

CAMEL_ICA_MSC2

Result

Reconnect

Continue, Release, Fail

Result:= Fail

Result:= Reconnect

Figure 4.87-1: Procedure CAMEL_ICA_MSC_ALERTING (sheet 1)

Procedure CAMEL_ICA_MSC_ALERTING 2(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from the destination exchange; unless otherwise stated. */
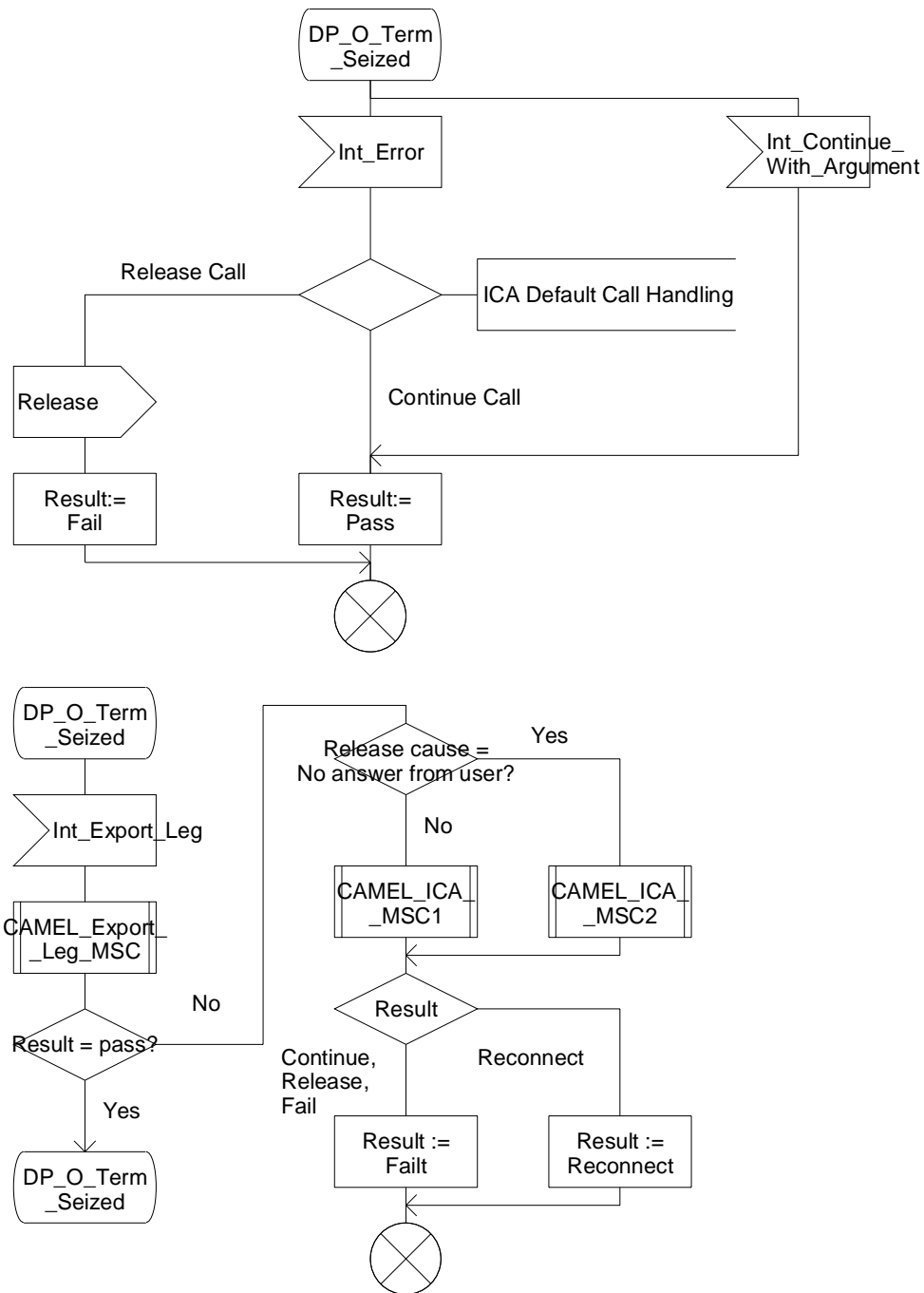
Figure 4.87-2: Process CAMEL_ICA_MSC_ALERTING (sheet 2)

Procedure CAMEL_ICA_MSC_ALERTING 3(3)

/* Procedure in the MSC to inform the gsmSSF that the call is in the alerting phase */

/* Signals to/from the left are to/from the gsmSSF; Signals to/from the right are to/from the destination exchange; unless otherwise stated. */

DP_O_Term_Seized

Int_Establish_Temporary_Connection

Int_Connect_To_Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result?

Fail

Answer

ELSE

Result := fail

Result := Answer

-

Figure 4.87-3: Process CAMEL_ICA_MSC_ALERTING (sheet 3)

Procedure CAMEL_ICA_MSC_ANSWER 1(3)

/* Procedure in the MSC to inform the gsmSSF that the call has been answered. */

/* Signals to/from the left are to/from the gsmSSF; signals to/from the right are to/from the destination exchange unless otherwise stated. */

Int_DP_O_Answer

DP_O_Answer

Int_Continue

Int_Continue_With_Argument

Int_Release

Release

Release

CAMEL_OCH_MSC_DISC2

Result=Reconnect?

No

Yes

Result:=Pass

Result:=Fail

Result:=Reconnect

Figure 4.88-1: Procedure CAMEL_ICA_MSC_ANSWER (sheet 1)

Procedure CAMEL_ICA_MSC_ANSWER   2(3)

/* Procedure in the MSC to inform the gsmSSF that the call has been answered. */

/* Signals to/from the left are to/from the gsmSSF; signals to/from the right are to/from the destination exchange unless otherwise stated. */

DP_O_Answer

Int_Error

Release Call ← ◇ → ICA Default Call Handling

Continue Call

Release

Result:= Fail   Result:= Pass

⊗

DP_O_Answer

Int_Export_Leg

CAMEL_Export_ _Leg_MSC

Result = pass?

No

CAMEL_OCH_ _MSC_DISC2

Yes

DP_O_Answer

Result = Reconnect?

Yes   No

Result := Reconnect   Result := Failt

⊗

Figure 4.88-2: Process CAMEL_ICA_MSC_ANSWER (sheet 2)

Procedure CAMEL_ICA_MSC_ANSWER 3(3)

/* Procedure in the MSC to inform the gsmSSF that the call has been answered. */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_O_Answer

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
fail

-
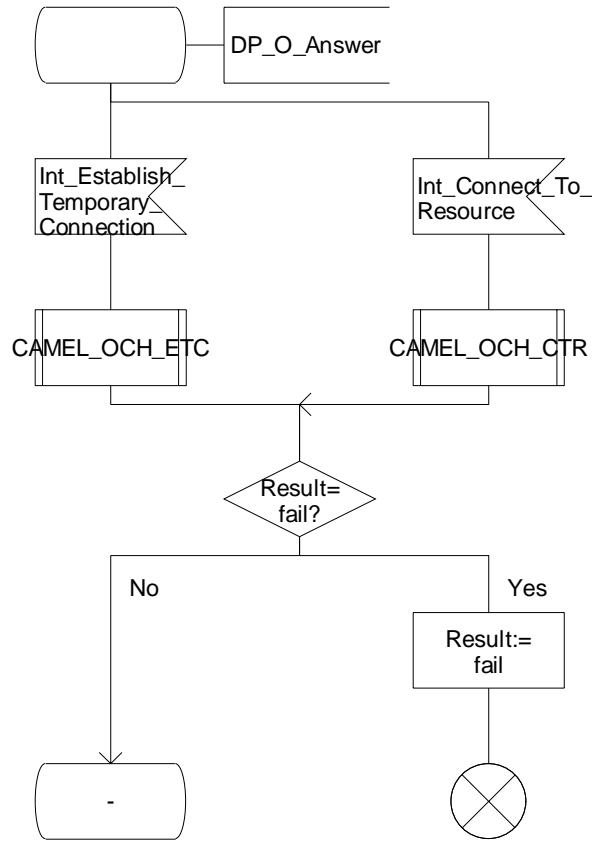
Figure 4.88-3: Process CAMEL_ICA_MSC_ANSWER (sheet 3)

Procedure CAMEL_ICA_MSC1 1(1)

/* Procedure in the MSC in the case of CAMEL handling to connect a call at DP O_Busy and DP Route_Select_Failure. */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated.*/

Release cause

Busy, Subscriber Absent

Other cause

Int_DP_O_Busy

Int_DP_Route_ _Select_ _Failure

DP_O_Busy

DP_Route_ _Select_ _Failure

DP_O_Busy, DP_Route_Select_Failure

Int_Connect

Int_Continue

Int_Continue_ With_Argument

Int_Error

Int_Release_Call

CAMEL_ _Modify_ _CUG_Info

Modify call parameters with received information

Result:= Reconnect

Result:= Continue
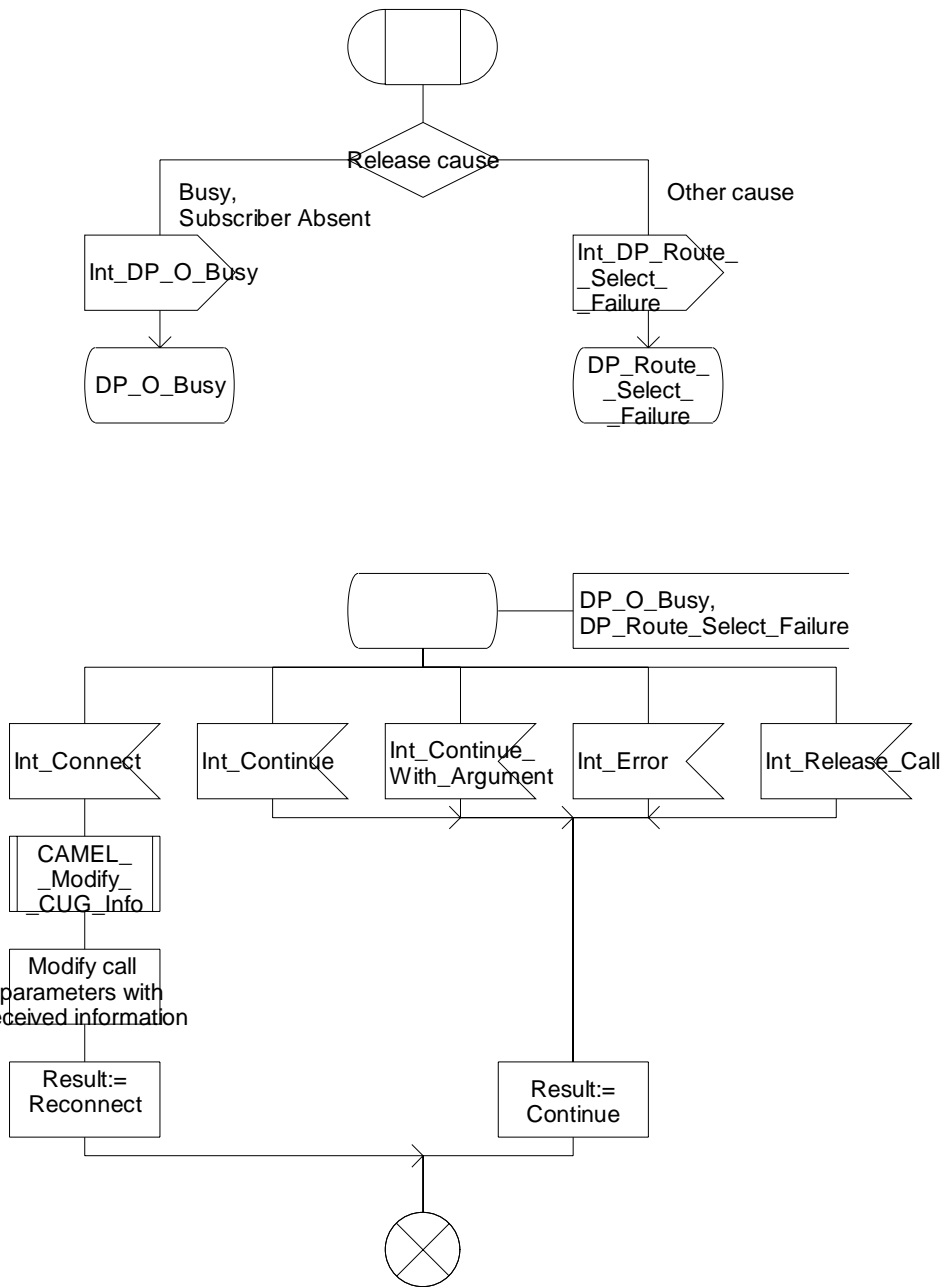
Figure 4.89-1: Procedure CAMEL_ICA_MSC1 (sheet 1)

Procedure CAMEL_ICA_MSC2 1(1)

/* Prodecu/re in the MSC to connect a call at DP O_No_Answer */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated.*/

Int_DP_O_No_Answer

DP_O_No_Answer

Int_Connect

Int_Continue

Int_Continue_ With_Argument

Int_Error

Int_Release_Call

CAMEL_ _Modify_ _CUG_Info

Int_O_Exception

Modify call parameters with received information

Result:= Reconnect

Result:= Release
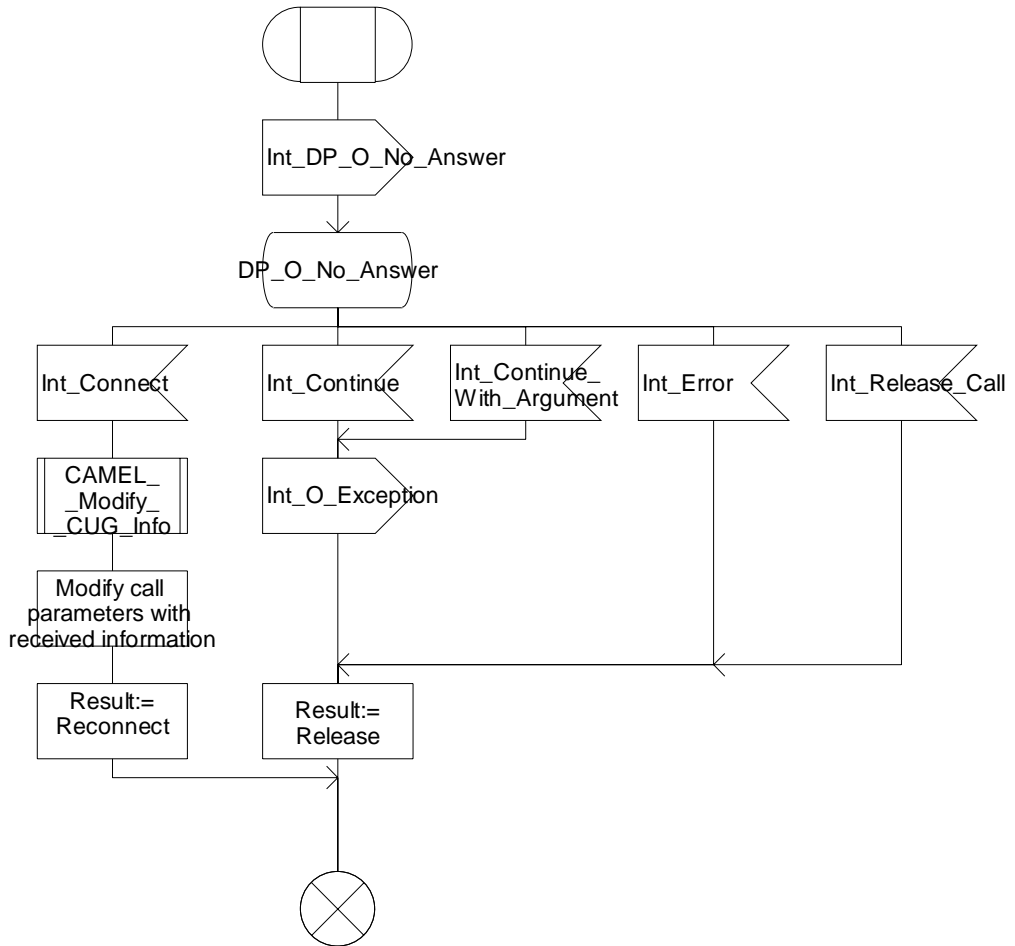
Figure 4.90-1: Procedure CAMEL_ICA_MSC2 (sheet 1)
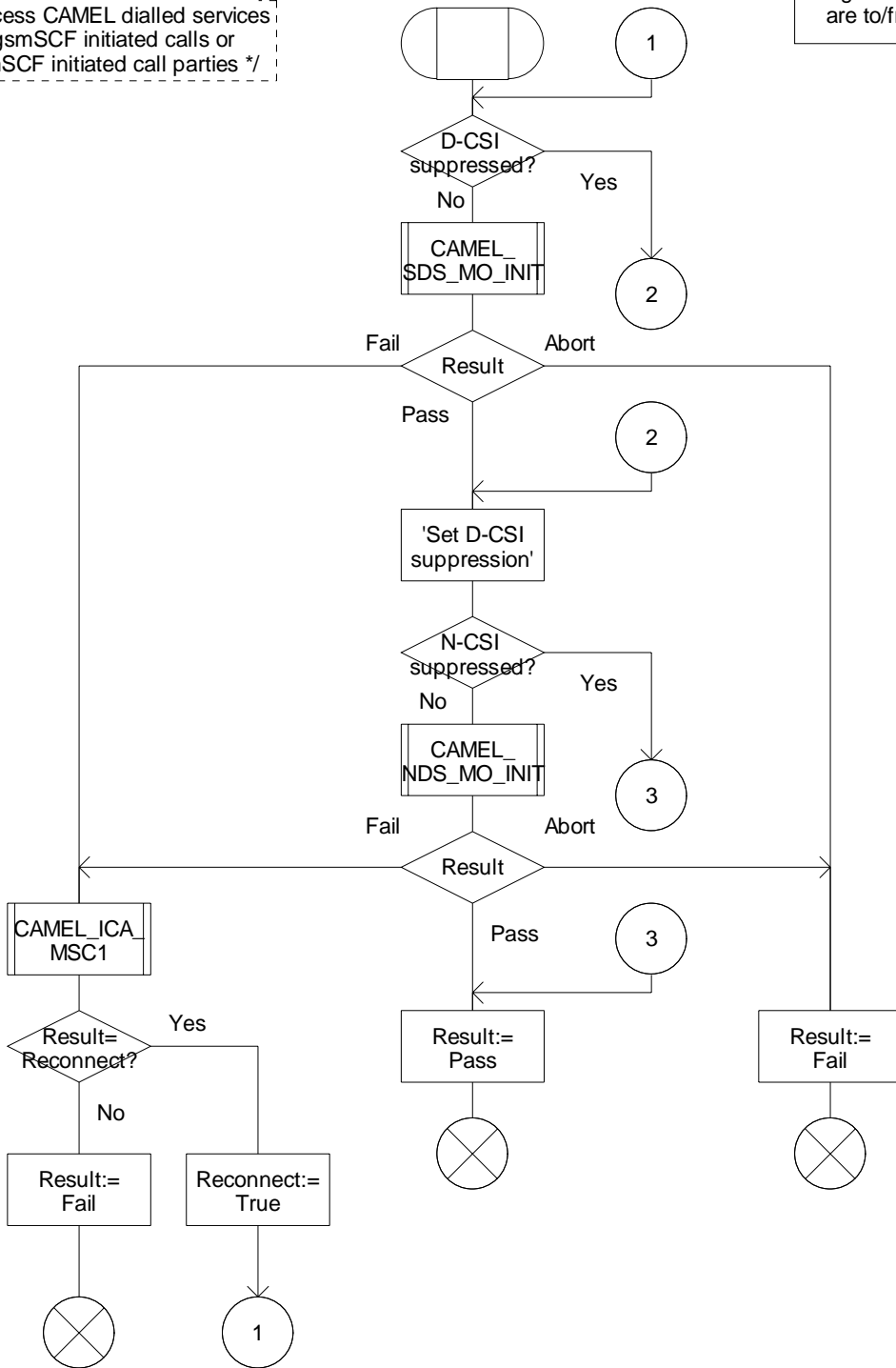
Figure 4.91-1: Procedure CAMEL_ICA_Dialled_Services (sheet 1)

4.5.6.2 Handling of gsmSCF initiated calls in the VLR

Handling of gsmSCF initiated calls in the VLR involves the following process and procedures:

- Process CAMEL_ICA_VLR.

Process CAMEL_ICA_VLR 1(2)

/* A process in the VLR to handle a gsmSCF initiated call set-up. */

/* Signals to/from the left are to/from the MSC */

Idle

Send Info for ICA

OCB suppressed? — Yes

No

Check_BAOC - - - See 3GPP TS 23.018

Result = Call barred? — Yes

No

NP leg is created within VT call? — No

Yes

IC or "non-CUG call" provided by gsmSCF? — Yes

No

OG_CUG_Check - - - See 3GPP TS 23.018. OG_CUG_Check uses MO CUG Call Authorisation Function in VLR, specified in a table in 3GPP TS 23.085. For this call to OG_CUG_Check, VLR shall use the column indicated by "No CUG Info", under the header "Information provided by calling user".

Result = Call allowed? — No

Yes

For the current process, procedure Get_LI_Subscription_Info_MO_VLR shall not perform the COLP check for the call.

Get_LI_Subscription_Info_MO_VLR - - - See 3GPP TS 23.018

Send Info for ICA negative response

1

Idle

Figure 4.92-1: Process CAMEL_ICA_VLR (sheet 1)

Process CAMEL_ICA_VLR   2(2)

/* A process in the VLR to handle
a gsmSCF initiated call set-up. */

/* Signals to/from the left
are to/from the MSC */

(1)

No ← D-CSI present
and/or N-CSI available received?

Yes

Complete Call

Wait_for_
SIFICA_2

Send Info
for ICA   Abort

Yes ← OCB
suppressed?   Idle

No

See 3GPP TS 23.018 ---- Check_OG_
Barring

Result =   Yes
Call barred?

No

Complete   Send Info for ICA
Call   negative response

Idle   Idle
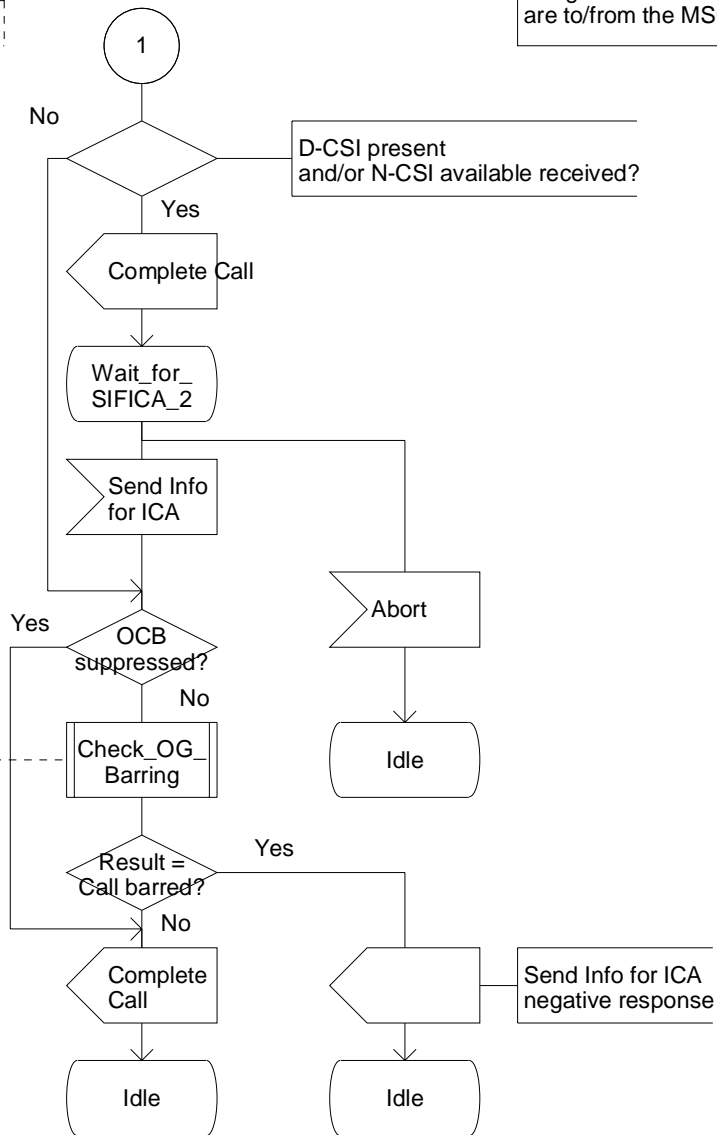
Figure 4.92-2: Process CAMEL_ICA_VLR (sheet 2)

4.5.7 Handling of mobile calls in the gsmSSF

Handling of mobile calls in the gsmSSF involves the following processes and procedures:

- Process CS_gsmSSF;

- Procedures and process Check_Criteria;

- Procedure Connect_To_Resource;

- Procedure Handle_AC;

- Procedure Handle_ACR;

- Procedure Handle_CIR;

- Procedure Handle_CIR_leg;

- Procedure Complete_FCI_record;

- Procedure Complete_all_FCI_records;

- Procedure Handle_SCI;

- Process CSA_gsmSSF;

- Procedure Handle_O_Answer;

- Procedure Handle_T_Answer.

The detailed error handling for the process CS_gsmSSF and the associated procedures is specified in 3GPP TS 29.078 ([36]).

4.5.7.1 Call duration control

4.5.7.1.1 Information flow for call duration control

The following diagram shows the handling of the different timers that are used in the process CS_gsmSSF and in the procedures Handle_AC, Handle_ACR, Handle_CIR. Timers Tssf, Tcp, Tsw, Tw and DELTA are defined in the process CS_gsmSSF.
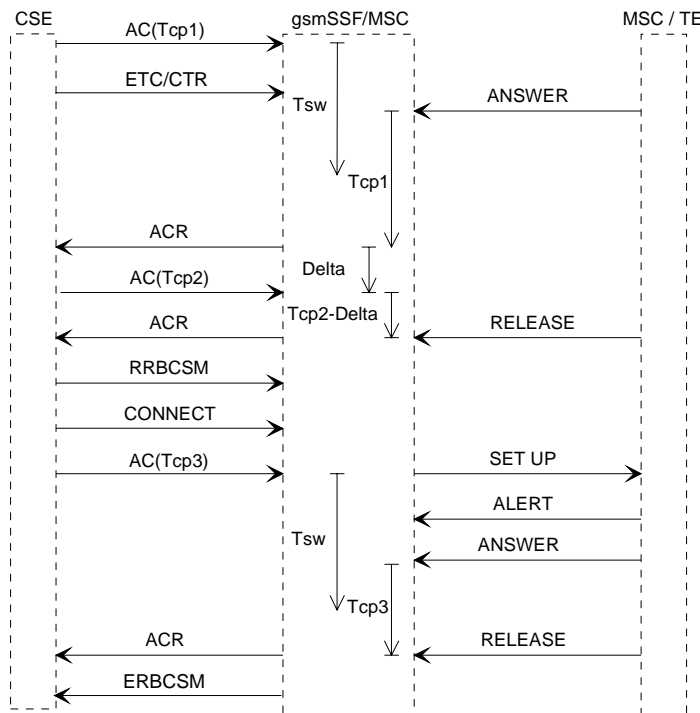
Figure 4.93: Information flow for call control duration

4.5.7.1.2 Audible indicators for call duration control

The gsmSCF may instruct the gsmSSF to play either a fixed sequence of tones or a variable sequence of tones with the Apply Charging information flow. The gsmSCF may also instruct the gsmSSF to play a variable sequence of tones with the Play Tone information flow.

For the case of the fixed sequence of tones, the gsmSSF shall play a single sequence of three tones. The duration of each of the tones shall be 200 milliseconds with an intertone interval of 200 milliseconds. This shall be played 30 seconds before the end of a call period. For the case of a variable sequence of tones, or a burst list, the gsmSCF shall indicate the number of tones per burst, the number of bursts to be played, the tone duration, interval between the tones and the interval between the bursts. In addition, the gsmSCF shall indicate in the Apply Charging information flow, the warning time before call period expiry at which the playing of the burst list shall start. Figure 4.94 provides a graphical representation of the variable burst list in the case where there are three tones per burst and three bursts in the burst list. The Warning Period in figure 4.94 applies to the Apply Charging information flow only.
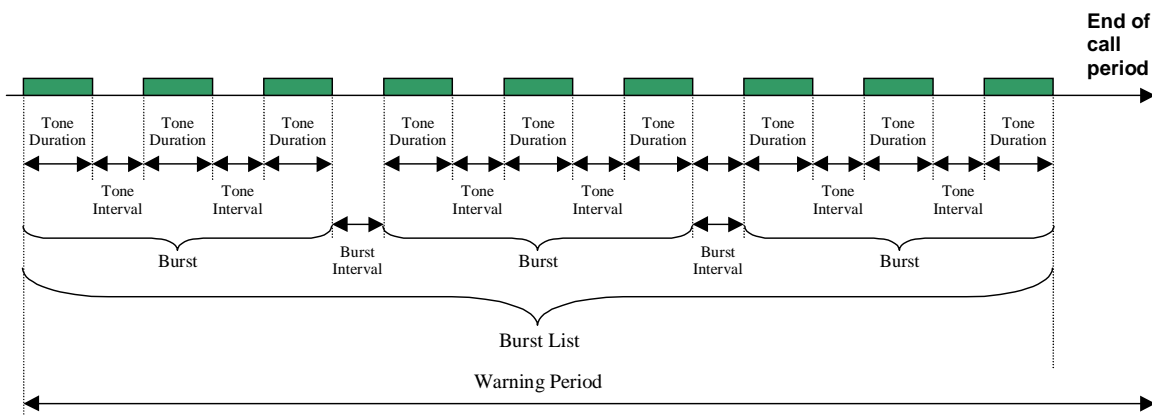
Figure 4.94: Representation of burst list

4.5.7.2 The gsmSCF control of e-values

4.5.7.2.1 Procedure Handle_SCI

There are independent Tariff Switch Timers for the control of the call duration Tsw(pty) and for the gsmSCF control of e-values Tsw(SCI). The gsmSCF control of e-values is via the Send Charging Information information flow.

The following terminology has been used for e-parameters:

- Applicable and in use. The set of e-parameters is currently applicable in the MSC and the set has been sent to the MS.

- Applicable but waiting. The set of e-parameters is currently applicable in the MSC but the set has not yet been sent to the MS.

- Applicable but not in use. The set of e-parameters is currently applicable in the MSC but it cannot be sent to the MS, e.g. because the Advice of Charge supplementary service is not subscribed.

- Stored. The set of e-parameters is not yet applicable. The stored set of e-parameters becomes applicable when a tariff switch occurs.

The table below defines the actions of the Procedure Handle_SCI.

Table 4.6: Handling of SCI in the gsmSSF

received Tsw(SCI) and set of e-parameters in the SCI information flow		Primary dialogue (note 1)				Secondary dialogue (note 2, 8)
		no active call / SRF connection		active call / SRF connection		
		Tsw(SCI) not running and no e-parameters stored	Tsw(SCI) running and e-parameters stored	Tsw(SCI) not running and no e-parameters stored	Tsw(SCI) running and e-parameters stored	
Tsw(SCI) not received	1 set	send 1st set to MSC	stop Tsw(SCI); discard stored set; send 1st set to MSC	send 1st set to MSC	stop Tsw(SCI); discard stored set; send 1st set to MSC	send 1st set to MSC
Tsw(SCI) not received	2 sets	**error**	**error**	**error**	**error**	**error**
Tsw(SCI) received	1 set	**error**	**error**	store 1st set; start Tsw(SCI)	stop Tsw(SCI); discard stored set; store 1st set; start new Tsw(SCI)	**error**
Tsw(SCI) received	2 sets	send 1st set to MSC, store 2nd set; start Tsw(SCI)	stop Tsw(SCI); discard stored set; send 1st set to MSC; store 2nd set; start new Tsw(SCI)	**error**	**error**	send 1st set to MSC; store 2nd set; start Tsw(SCI)

received Tsw(SCI) and set of e-parameters in the SCI information flow	Primary dialogue (note 1)				Secondary dialogue (note 2, 8)
	no active call / SRF connection		active call / SRF connection		
	Tsw(SCI) not running and no e-parameters stored	Tsw(SCI) running and e-parameters stored	Tsw(SCI) not running and no e-parameters stored	Tsw(SCI) running and e-parameters stored	

NOTE 1: Primary dialogue: The primary dialogue is initiated due to TDP Collected_Info, TDP Analysed_Information, or TDP Route_Select_Failure, TDP Terminating_Attempt_Authorised, TDP T_Busy or TDP T_No_Answer. A dialogue initiated due to TDP Analysed_Information is only the primary dialogue, if there is no ongoing dialogue due to TDP Collected_Info.

NOTE 2: Secondary dialogue: The secondary dialogue is initiated due to TDP Analysed_Information.

NOTE 3: The condition "active call / SRF connection" is true if there is at least one active leg in this call (CSA) or if an SRF is connected to a Call Segment in this CSA. Incoming legs are active after an answer is sent and before the leg begins to release. Outgoing legs are active after an answer is received and before the leg is begins to release.

NOTE 4: If the gsmSSF sends a set of e-parameters to the MSC this will overwrite the current set of e-parameters in the MSC, if e-parameters are applicable in the MSC.

NOTE 5: The MSC shall store the received e-parameters to be sent subsequently to the MS. The MSC shall send these e-parameters to the MS in a Connect message or in a Facility message.

NOTE 6: Secondary dialogue gsmSCF can only give e-parameter(s)/Tsw(SCI) when they have not previously been provided by the primary dialogue gsmSCF. After secondary dialogue gsmSCF gives e-parameter(s) / Tsw(SCI), Primary dialogue gsmSCF shall not give further on-line charging instructions (i.e. Send Charging Information).
For D-CSI, this is ensured by service subscription restriction by a home network operator. For N-CSI, this is ensured by a roaming agreement between the home network operator and the visited network operator or is only applicable within a home network.

NOTE 7: When a gsmSCF relationship is closed then the *stored* e-parameters given by that dialogue are discarded. Any Tariff Switch timer (Tsw(SCI)) is also stopped when the gsmSCF relationship is closed. If the gsmSCF has given any e-parameters which are not *stored* but which are applicable (regardless of whether they are *applicable and in use*, *applicable but waiting,* or *applicable but not in use*) when the gsmSCF relationship is closed, those e-parameters are also valid after the gsmSCF relationship is closed. If any subsequent CAP dialogues give e-parameters those new e-parameters shall overwrite the applicable e-parameters given by the preceding CAP dialogues.

NOTE 8: The secondary dialogue is not applicable to VT calls.

4.5.7.2.2 Process Tsw_For_SCI

The process Tsw_For_SCI exists per call. That is there is one process instance per CSA. The Tariff Switch Timers for the gsmSCF control of e-values Tsw(SCI).

Process Tsw_For_SCI   1(2)

/* Signals to/from the left are to/from the MSC of the leg
   concerned (the CAMEL subscriber); signals to/from the right
   are to/from the process CS_gsmSSF of the leg concerned
   (the CAMEL subscriber. */

/* Timers used in the Tsw_For_CSI process:

Tsw(SCI): Timer for tariff switch for the gsmSCF controlled e-values.
  At the expiration of this timer, a new tariff for the gsmSCF controlled e-values shall be started.

The CS_gsmSSF related to leg of the CAMEL subscriber is setting the timer Tsw(SCI)
in the procedure Handle_SCI).
The timer Tsw(SCI) is stopped on release of the leg of the CAMEL subscriber or
when the relationship to the gsmSCF is closed.

*/

Idle

Set Timer

Start
Tsw(SCI) ---- with received value

Running
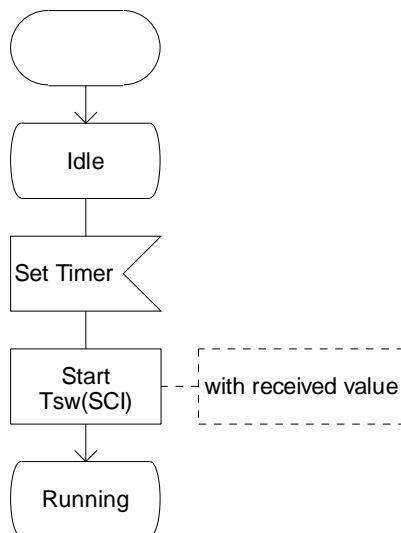
Figure 4.95-1: Process Tsw_For_SCI (sheet 1)

Process Tsw_For_SCI   2(2)

/* Signals to/from the left are to/from the MSC of the leg
concerned (the CAMEL subscriber); signals to/from the right
are to/from the process CS_gsmSSF of the leg concerned
(the CAMEL subscriber. */

Running

Internal ---- Tsw(SCI) expired   Stop Timer   Set Timer

Stored e-parameters? ---- No

Yes

No stored e-parameters exist after this setting ---- Set stored e-parameters as applicable   Restart Tsw(SCI) ---- with received value

Running

Answer sent to MS? ---- No

Yes

This provokes the MSC to send e-parameters to the CAMEL subscriber. ---- Send_e_ Parameters

Idle
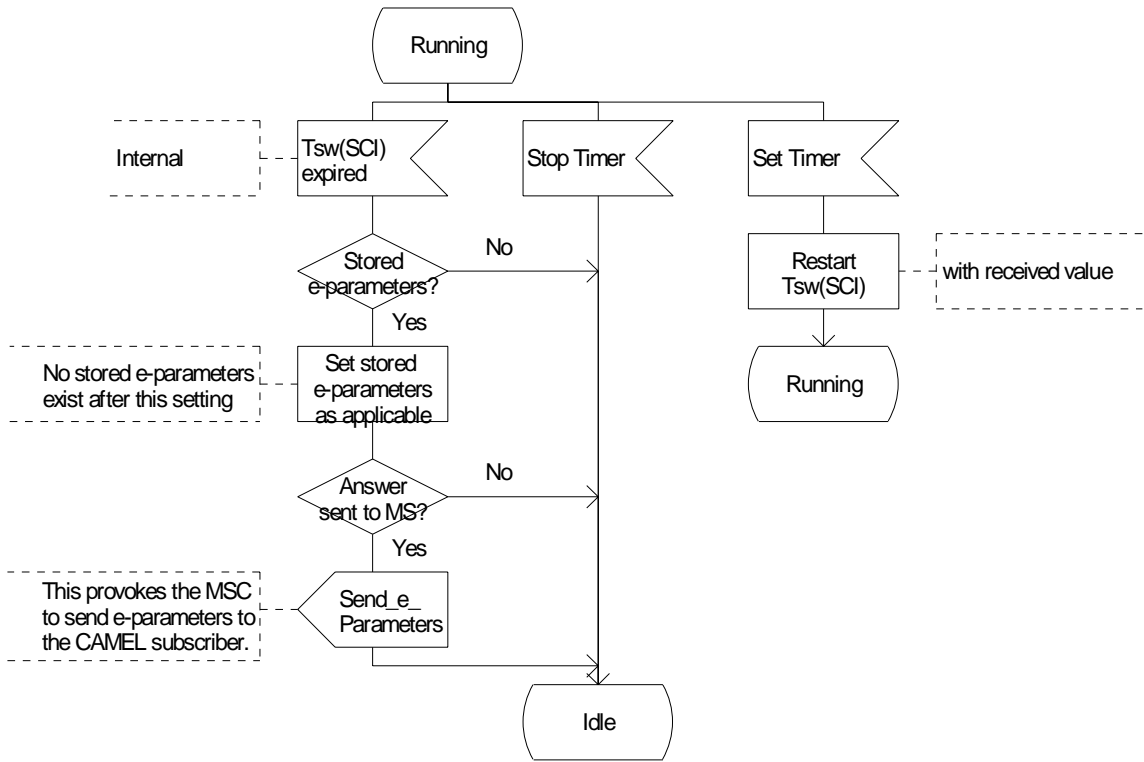
Figure 4.95-2: Process Tsw_For_SCI (sheet 2)

4.5.7.3 Behaviour of the gsmSSF in the process CS_gsmSSF

The following paragraphs give details on the behaviour of the gsmSSF in the process CS_gsmSSF.

4.5.7.3.1 Actions of the gsmSSF on receipt of CAP_Request_Report_BCSM_Event (in the state Waiting_For_Instructions)

The process CS_gsmSSF arms the requested EDP, if the arming rules are fulfilled and returns to the state Waiting_For_Instructions.

The gsmSCF may request EDPs for any one or more of Answer, Busy, No Answer, Abandon, Route Select Failure and Disconnect event for a party in the call.

4.5.7.3.2 Actions of the gsmSSF on receipt of CAP_Continue (in the state Waiting_For_Instructions)

An Int_Continue signal is sent to instruct the GMSC or MSC to continue the call set-up with the original call parameters.

4.5.7.3.3 Actions of the gsmSSF on receipt of CAP_Release_Call (in the state Monitoring)

When a control relationship exists between the gsmSCF and gsmSSF (at least one EDP-R is armed), the gsmSCF may spontaneously instruct the gsmSSF to release the call at any time using the Release Call information flow. The Release Call information flow shall not be sent from the gsmSCF if only monitor relationship exists between the gsmSSF and the gsmSCF.

4.5.7.3.4 Actions of the gsmSSF on receipt of Int_DP_T_Busy or Int_DP_T_No_Answer including the parameter Call Forwarded (in the state Monitoring)

If the handling of Int_DP_T_Busy signal or Int_DP_T_No_Answer signal including the parameter Call Forwarded leads to the gsmSSF sending a CAP_Event_Report_BCSM to the gsmSCF, the gsmSSF shall include the parameter Call Forwarded in the Event Specific Information BCSM.

4.5.7.4 Outstanding Request Counter and Rules for CAMEL

In the following the rules on handling of the 'outstanding requests' variables in the process CS_gsmSSF are given. They are storing the number of required resumptions.

1) There shall be one outstanding requests variable ORC_Leg (legID) per leg to handle TDP-R and EDP-R reports and ICA.

2) In addition there shall be one outstanding requests variable ORC_CS (CSID) per call segment to handle the CPH IFs.

3) A leg will only be resumed if the ORC_Leg (legID) variable for this leg and the ORC_CS (CSID) for the call segment containing the leg are 0.

4) Events that cause the suspension of the call processing are signalling events armed as TDP-Rs or EDP-Rs, or the processing of a CPH IF (Disconnect Leg, Split Leg or Move Leg) or Initiate Call Attempt sent by the gsmSCF.

   a) For TDP-R or EDP-R events the number of required resumptions relative to the associated leg will be incremented by 1.

   b) For CPH IFs the number of required resumptions per call segment will be set to one if it is still 0. Otherwise the number of resumptions remains unchanged. For Split Leg the number of required resumptions for each of the source call segment and the target call segment will be set to one if it is still 0

   c) For ICA the number of required resumptions relative to the associated leg will be set to 1.

5) In addition the CS_gsmSSF stores information about the events (DP with the associated leg, CPH) that require resumption and keep track of the order of events for TDP-Rs and EDP-Rs for each leg . The order of resumptions for a leg shall be the order in which the suspension events occured for that leg.

6) For DP event resumption Continue with Argument with legID or Continue are valid. If not otherwise stated below, for each received resumption the number of required resumption for that leg will be decremented by 1 if it was a valid resumption for the event that has to be handled first. Decrementing of the outstanding requests variables does not go below 0.

7) For CPH resumption Continue with Argument with CSID is valid. On receipt of the resumption the number of required resumptions for that call segment will be set to 0.

8) For ICA resumption Continue with Argument with LegId is valid. On receipt of the resumption the number of required resumptions for that Leg will be set to 0.

9) If Continue with Argument with neither LegID nor CSID is received, then the number of resumptions required for the leg that was reported will be decremented by 1. If reporting is performed on more than one leg, then the related leg will be selected following the sequence of the reporting.

10) If Continue is received, then the number of resumptions required for the leg that was reported will be decremented by 1. If reporting is performed on more than one leg, then the related leg will be selected following the sequence of the reporting.

11) The processing of a Connect with a LegID causes the number of required resumptions for that leg to be decremented by 1. The processing of a Connect without a LegID causes the number of resumptions for the LegID = 2 to be set to 0.

12) The processing of Tssf expiry and of TC Abort causes the number of resumptions required to be set to 0 and the call processing to be resumed. All stored resumption events are discarded.

13) On receipt of a Disconnect Leg the number of resumptions required for the corresponding leg is set to 0.

14) If Release Call is used, nothing needs to be resumed.

4.5.7.5 Process CS_gsmSSF and procedures

Process CS_gsmSSF   1(61)

/* Invocation of CS_gsmSSF */

/* Timers used in the CS_gsmSSF process:

Tssf: Application timer in the ssf.

The following timers are applicable for call legs as well as for the connected SRF (srf ID).
That is 'pty' may be a leg ID or an srf ID.
Tcp(pty): Timer for call period.
  This timer measures the duration of a call period.
Tsw(pty): Timer for tariff switch.
  At the expiration of this timer, a new tariff shall be started.
Tw(pty): Warning timer.
  At the expiration of this timer, a warning tone shall be played to the CAMEL subscriber.
  For the New Call case (NC-call) the first party created shall receive the tone.
DELTA(pty): time, measured in the CS_gsmSSF, elapsed between the time an
  ApplyChargingReport operation is sent to the gsmSCF and an
  ApplyCharging operation is received from the gsmSCF for that pty.
Tccd(pty): Control of call duration timer.
  This timer supervises if after sending of ACR a new AC is received for that pty.
  Tccd has a value range of 1 to 20 seconds.

Ranges for the default values for Tssf.
  - non user interaction Tssf timer value: 1 second to 20 seconds
  - user interaction Tssf timer value: 1 minute to 30 minutes
*/

Figure 4.96-1: Process CS_gsmSSF (sheet 1)

Process CS_gsmSSF   2(61)

/* Invocation of CS_gsmSSF */

/* Decision box definitions (1)

'armed TDPs for this CSI?'
It is questioned whether or not the ongoing call can encounter further TDPs which are
indicated in the current CSI.

'Call to be released?'
It is questioned whether or not the ongoing call will be released immediately after CS_gsmSSF
has responded; that is the ongoing call will not send any signals further on to the CS_gsmSSF.
NOTE: In this case, the CS_gsmSSF FSM shall also transit to the Idle state.
*/

/* Decision box definitions (2)
The following decisions are used by procedures in CCF.

'gsmSSF invoked?'
Is the CS_gsmSSF process in any state other than Idle?
*/

/*
Note to the task box "Perform implicit disarming of DPs";

If DP O_Change_Of_Position and/or DP T_Change_Of_Position are disarmed by this task, then
the CS_gsmSSF sends
Int_Invoke_O_Change_Of_Position_MSC to the CAMEL_O_CHANGE_OF_POSITION_MSC and/or
Int_Invoke_T_Change_Of_Position_MSC to the CAMEL_T_CHANGE_OF_POSITION_MSC
with the parameter "Transparent, respectively.
*/

/* Information per each leg:

The following information is present for each leg:
- The timers applicable per leg: Tcp(pty), Tsw(pty), Tw(pty), DELTA(pty) and Tccd(pty).
- AC(pty) pending
- ACR(pty) sent
- Call Information Request (legID)
- Logical call record for FCI (legID)
- ORC_Leg (legID)

If a leg is split or moved into another call segment, then also the information for this leg is moved
together with this leg.
*/

Figure 4.96-2: Process CS_gsmSSF (sheet 2)

Process CS_gsmSSF 3(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */
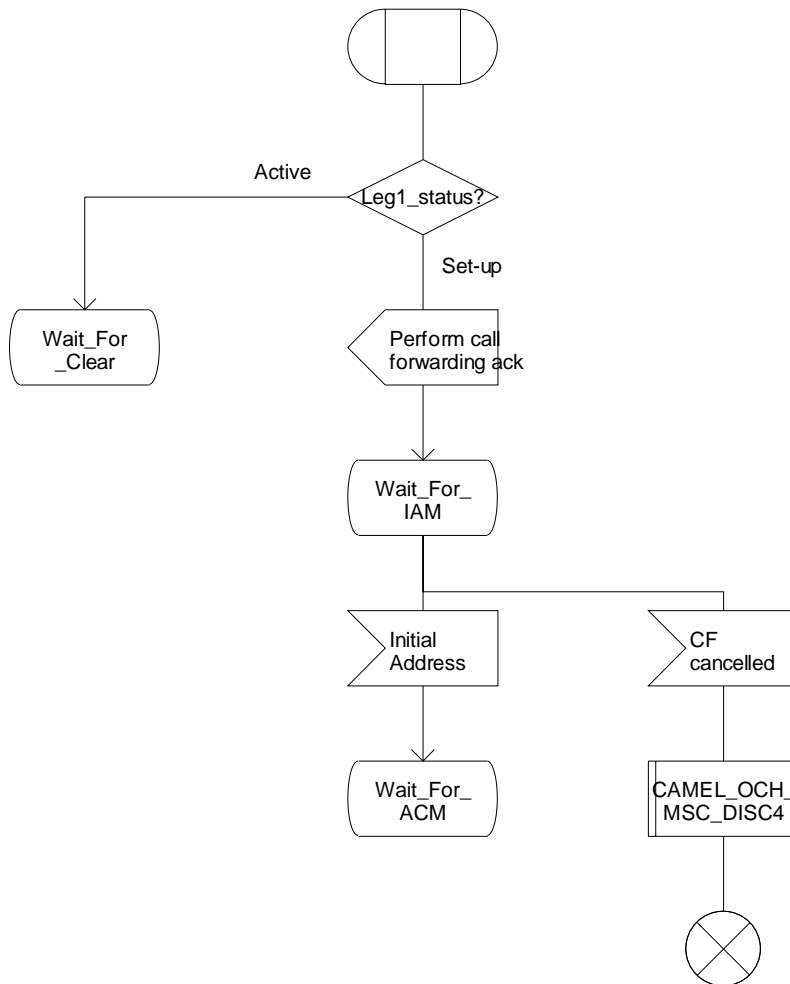
Start_State

Idle

ORC_CS (CSID) := 0

Idle

Int_Invoke gsmSSF (O-CSI)

Int_Invoke gsmSSF (T-CSI)

Int_Invoke gsmSSF (VT-CSI)

Int_Invoke gsmSSF (D-CSI)

Int_Invoke gsmSSF (N-CSI)

Arm DP

The received CSI states whether DP Collected_Info or DP Analysed_Information or DP Route_Select_Failure or DP T_Busy or DP T_No_Answer or DP Terminating_Attempt_ Authorised shall be armed as TDP.

Int_gsmSSF Invoked

Wait_For_ _Request
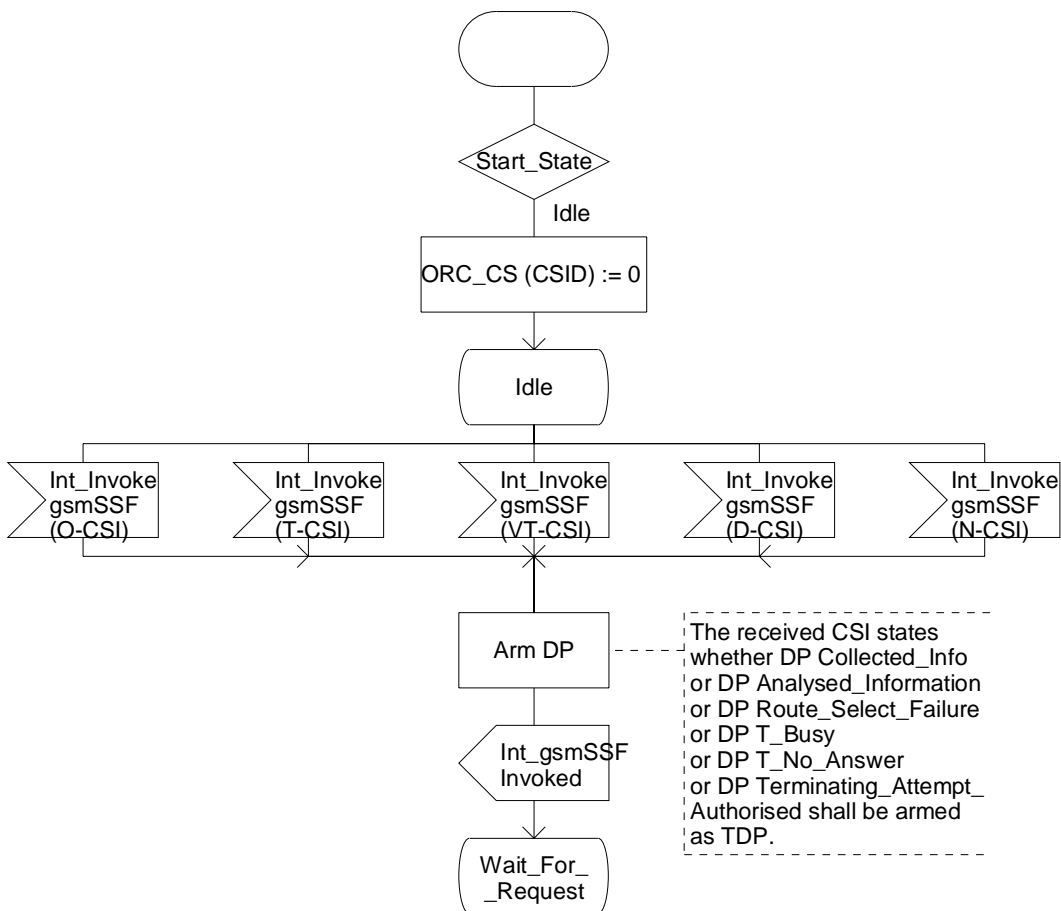
Figure 4.96-3: Process CS_gsmSSF (sheet 3)

Process CS_gsmSSF 4(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Idle

Int_O_Exception, Int_T_Exception

Int_Continue

Int_Invoke gsmSSF

Int_gsmSSF Invoked

Idle

Wait_For_ ICA_Or_ Import_Leg

Int_DP_O_Answer,
Int_DP_T_Answer,
Int_DP_Analysed_Info,
Int_DP_O_Term_Seized,
Int_DP_Call_Accepted,
Int_DP_O_MidCall,
Int_DP_T_MidCall,
Int_DP_O_Change_Of_Position,
Int_DP_T_Change_Of_Position
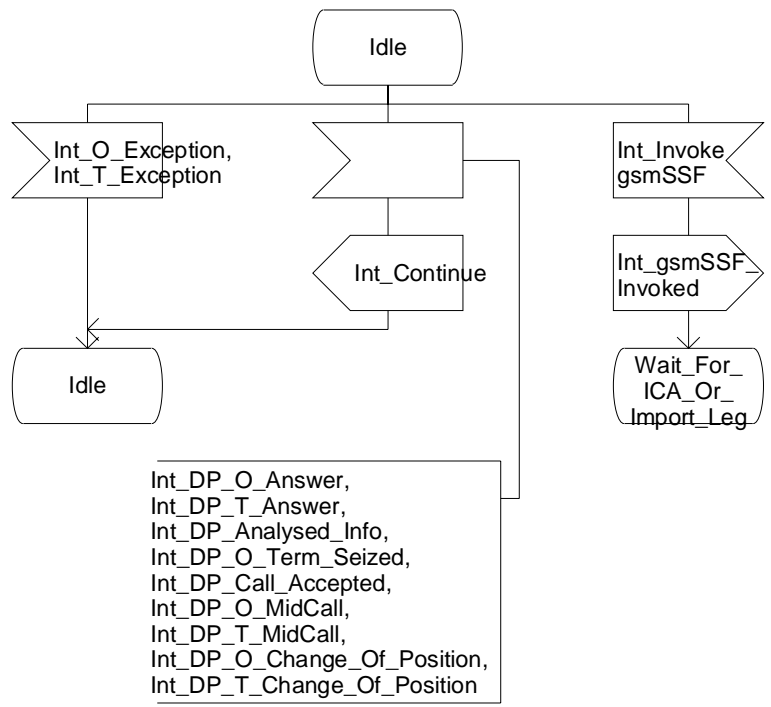
Figure 4.96-4: Process CS_gsmSSF (sheet 4)

Process CS_gsmSSF 5(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Int_DP_Route_Select_Failure,
Int_DP_T_Busy,
Int_DP_T_No_Answer

Wait_For_ _Request

Int_DP_ _Collected_ _Information

Check_Criteria_ Collected_Info

Result= pass?

No

Int_Continue

'armed TDPs for this CSI?'

No

Yes

Wait_For_ _Request

Idle

Check_Criteria_ Unsuccessful

Result= pass?

Yes

No

10

Check_Gap_ _Criteria

Result = pass?

No

No

Yes

1

3

Int_DP_ _Analysed_ Information

Check_Criteria_ _Analysed_Info

Result= pass?

No

Yes

Int_Continue

Idle

Check_Gap_ _Criteria

Result = pass?

Yes

2
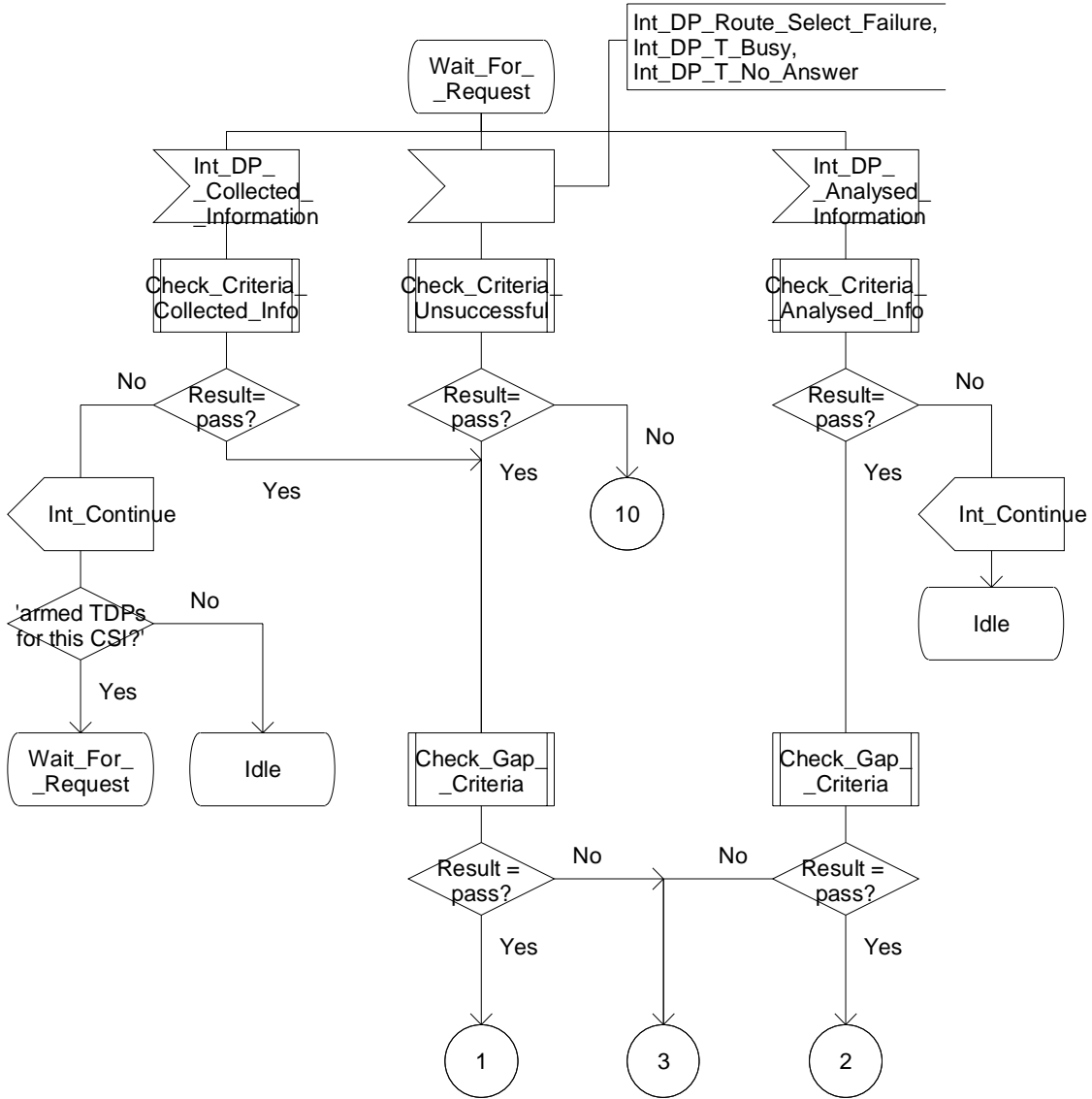
Figure 4.96-5: Process CS_gsmSSF (sheet 5)

Process CS_gsmSSF 6(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

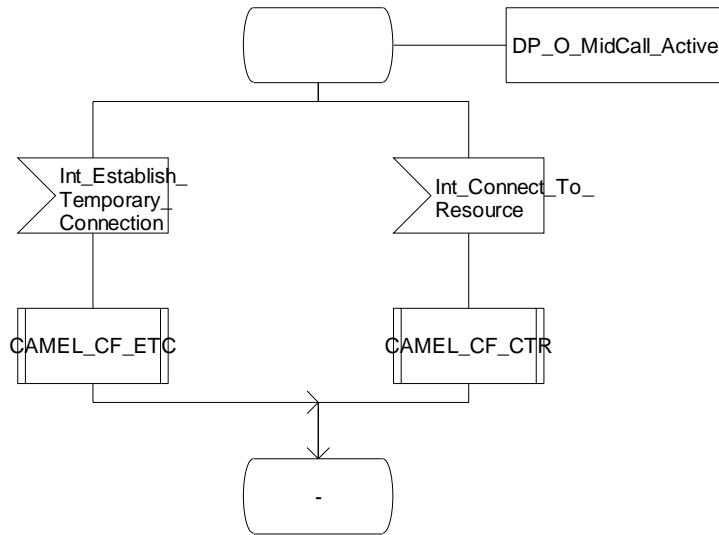Wait_For_ _Request

Int_DP_ _Terminating_ _Attempt_ _Authorized

Int_T_Exception, Int_O_Exception

Int_DP_O_Answer, Int_DP_T_Answer, Int_DP_O_Term_Seized, Int_DP_Call_Accepted, Int_DP_O_MidCall, Int_DP_T_MidCall

'DP_ _Terminating_ _Attempt_ _Authorized_ armed?'

No

Yes

Int_Continue

Int_Continue

'armed TDPs for this CSI?'

No

Yes

Check_Gap_ _Criteria

Wait_For_ _Request

Idle

Result = pass?

No

Yes

1

3
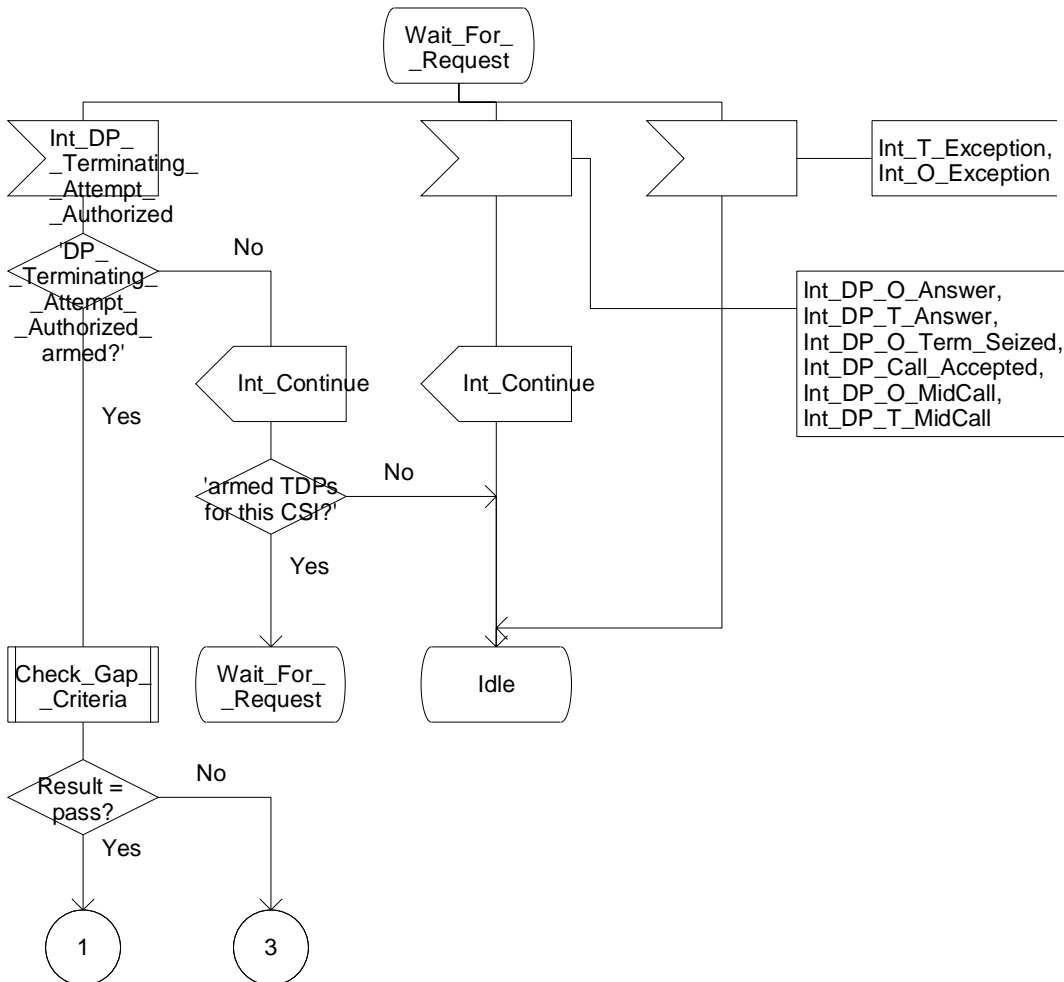
Figure 4.96-6: Process CS_gsmSSF (sheet 6)

ETSI

Process CS_gsmSSF 7(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

(1)

'Set Tssf to default non user interaction Tssf timer interval and restart Tssf'

Application_Begin

'Set Control Relationship'

Int_InitialDP

Waiting_for_ _Instructions

Oustanding Call Information Report := 0
For all new legs, i.e. leg1 and leg2:
  ACR(legID) sent := false
  AC(legID) pending := false
For the leg on which the TDP occurs
  ORC_Leg (legID2) := 1
For all other legs of the CS
  ORC_Leg (legID) := 0

(2)

'Set Tssf to default non user interaction Tssf timer interval and restart Tssf'

Application_Begin

'Set Control Relationship'

Int_InitialDP

Waiting_for_ _Instructions_ for DS

(3)

Yes ◇ No

Apply Gap treatment if present

Int_Continue   Int_ReleaseCall

'armed TDPs for this CSI?'   No

Yes

Wait_For_ _Request   Idle

Gap treatment depends on the info received in the Call Gap message (i.e. tone/announce, cause, etc.)

Default Call Handling = Continue Call?

Figure 4.96-7: Process CS_gsmSSF (sheet 7)

Process CS_gsmSSF   8(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

Wait_For_
Request

10

Idle

Int_DP_O_Abandon,
Int_DP_T_Abandon,
Int_DP_O_No_Answer,
Int_DP_O_Busy

Number of legs in this CS
(including leg being released)

ELSE

Int_DP_O_Abandon,
Int_DP_T_Abandon,
Int_DP_Route_Select_Failure,
Int_DP_O_No_Answer,
Int_DP_T_No_Answer,
Int_DP_O_Busy,
Int_DP_T_Busy

2

To MSC process of
remaining leg

Int_Release
Call

To MSC process of
leg being released

Int_Continue

Idle
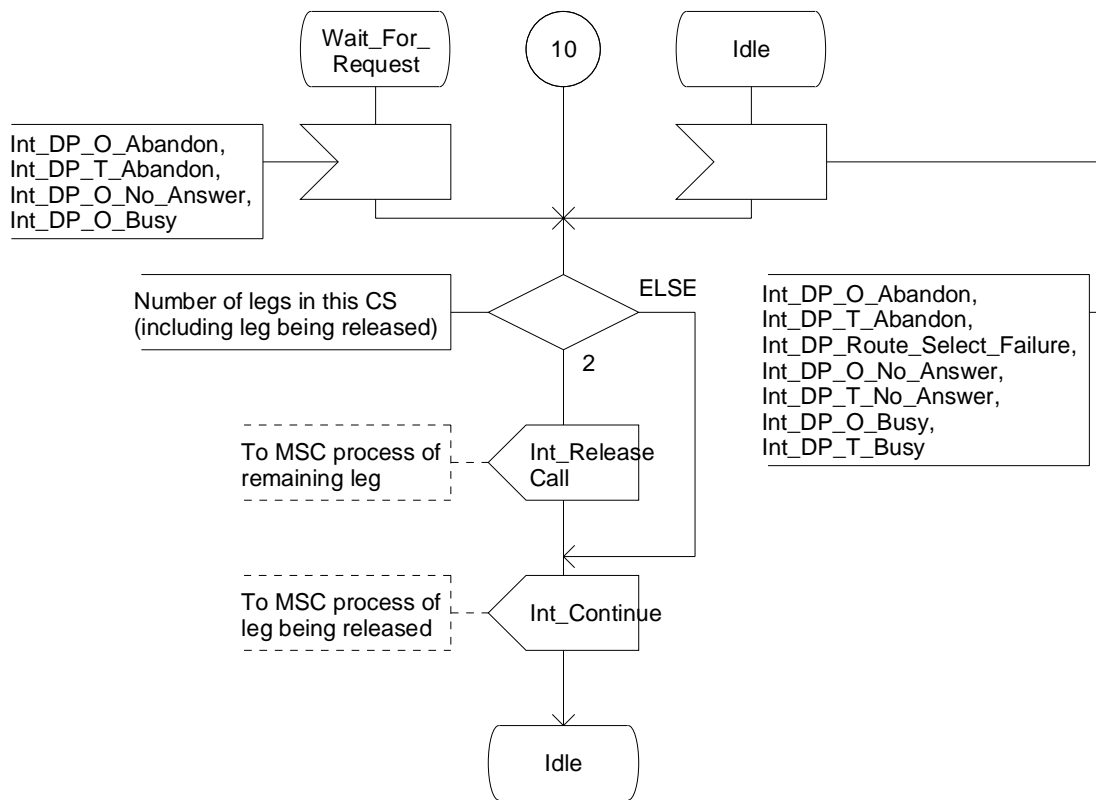
Figure 4.96-8: Process CS_gsmSSF (sheet 8)

Process CS_gsmSSF   9(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Idle,
Wait_For_Request

Int_DP_O_
_Disconnect
/* legID */

Int_DP_T_
_Disconnect
/* legID */

No

CS contains only two legs
(before DP Disconnect)
and each leg has its own
MSC process?

Yes

Int_ReleaseCall ── to MSC for remaining leg

Int_Continue ── to MSC for leg being released

Idle
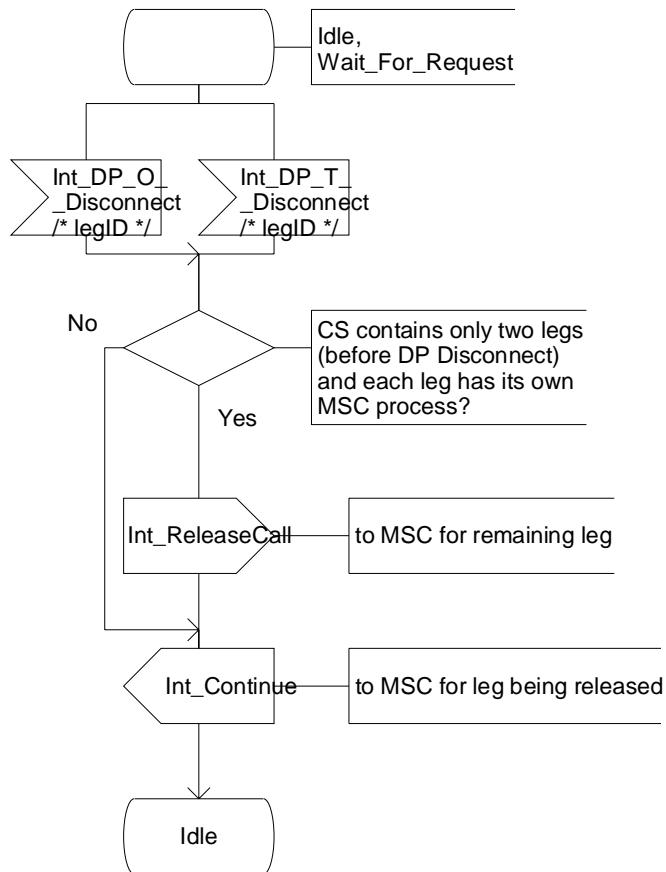
Figure 4.96-9: Process CS_gsmSSF (sheet 9)

Process CS_gsmSSF   10(61)

/* Invocation of CS_gsmSSF */   /* Signals to/from the left are to/from the MSC; unless otherwise marked. */
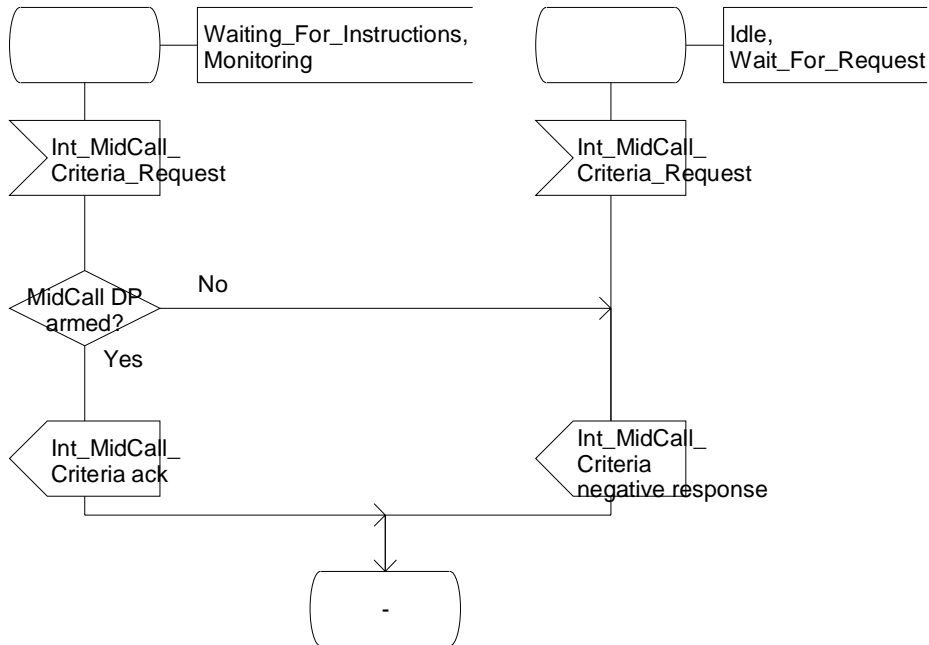
Figure 4.96-10: Process CS_gsmSSF (sheet 10)

Process CS_gsmSSF 11(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Wait_For_ ICA_Or_ Import_Leg

Int_Import_ Leg

Int_Import_ Leg

Wait_For_SL_ Import_Leg_ack

Int_Import_ Leg_ack

Int_Import_ Leg_ack

UpdateSignalling (for the current Call Segment)

to all legs in the call segment

Int_MidCall

ORC_CS (CSID) := 1

Set Tssf to default non-user interaction Tssf timer value and restart Tssf

Waiting_For_ Instructions

Int_Initiate Call Attempt

Int_Initiate Call Attempt

For the new leg:
 ACR(legID) sent := false
 AC(legID) pending := false
 ORC_Leg(legID) := 1
For the CSID
 ORC_CS(CSID) := 0
Oustanding Call Information Report := 0

Wait_For_ ICA_Ack

Int_Initiate Call Attempt ack

Int_Initiate Call Attempt ack

Set Tssf to default non-user interaction Tssf timer value and restart Tssf

Waiting_For _Instructions

Figure 4.96-11: Process CS_gsmSSF (sheet 11)

Process CS_gsmSSF 12(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_ _Instructions

Int_DP_O_Answer

Int_DP_T_Answer

Int_Leg Status Report (active)

Int_Leg Status Report (active)

Handle_O_ Answer (legID)

Handle_T_ Answer (legID)

UpdateSignalling (for the curent Call Segment)

DP armed for legID? — No

DP armed as EDP-R? — No / Yes

Perform implicit disarming of DPs.

Int_Event_ _Report_BCSM (Notify & Continue)

Int_Event_ _Report_BCSM (Interrupted)

Disarm this DP. Perform implicit disarming of DPs.

Disarm this DP. Perform implicit disarming of DPs.

ORC_Leg (legID) := ORC_Leg (legID) +1

Set Tssf to default non user interaction Tssf timer value and restart Tssf

Waiting_For_ _Instructions

Figure 4.96-12: Process CS_gsmSSF (sheet 12)

Process CS_gsmSSF   13(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

Waiting_For_
_Instructions

Int_DP_
Call_Accepted

Int_DP_O_
Term_Seized

DP T_Change_Of_Position is armed AND
the process CAMEL_T_CHANGE_OF_POSITIN_MSC is
in the "Waiting_For_Radio_Connection_Established" state?

Yes

No

To process CAMEL_T_CHANGE_OF_POSITION_MSC

Int_Continue

Int_Leg status
report (alerting)

UpdateSignalling
(for the current
Call Segment)

No

DP armed
for legID?

Yes

No

DP armed
as EDP-R?

Yes

Int_Event_
_Report_BCSM
(Notify & Continue)

Int_Event_
_Report_BCSM
(Interrupted)

Perform implicit
disarming of DPs.

Disarm this DP.
Perform implicit
disarming of DPs.

Disarm this DP.
Perform implicit
disarming of DPs.

ORC_Leg (legID) :=
ORC_Leg (legID) +1

Set Tssf to default
non user interaction
Tssf timer value and
restart Tssf

Waiting_For_
_Instructions

Figure 4.96-13: Process CS_gsmSSF (sheet 13)

Process CS_gsmSSF 14(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_For_ _Instructions

This signal will only be received from the MSC if the DP is armed for the leg and the triggering criteria are met.

Int_DP_O_MidCall, Int_DP_T_MidCall

DP armed as EDP-R?

Yes

No

Int_Event_ Report_BCSM (Notify & Continue)

Int_Event_ Report_BCSM (Interrupted)

Disarm this DP

Automatic Rearm?

True

False

Disarm this DP

ORC_Leg (legID) := ORC_Leg (legID) +1

Set Tssf to default non user interaction Tssf timer value and restart Tssf

Int_Cancel_ MidCall

Waiting_For_ Instructions
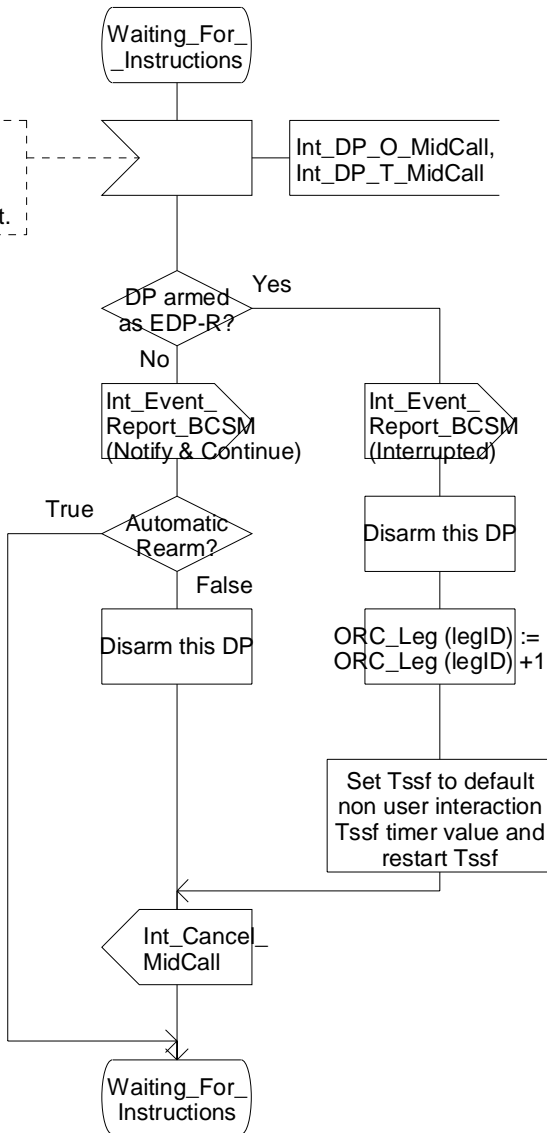
Figure 4.96-14: Process CS_gsmSSF (sheet 14)

Process CS_gsmSSF   15(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_
_Instructions

Int_Apply_
Charging

Handle_AC
(pty)

Set Tssf to last
used time interval
and restart Tssf

Waiting_For_
_Instructions

Int_Call_
Information_Request

Set Tssf to last
used time interval
and restart Tssf

store request

Int_Cancel (All)

Disarm all
EDPs

Cancel all
reports

Set Tssf to last
used time interval
and restart Tssf

Outstanding Call Information Report:=
Outstanding Call Information Report +1

Figure 4.96-15: Process CS_gsmSSF (sheet 15)

Process CS_gsmSSF 16(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_ _Instructions

Int_Connect (LegID)

Int_ConnectTo Resource

Stop Tssf

Stop Tssf

Connect_To_ Resource

LegActive := FALSE

LegID included_ or Leg 1 available ?

No

result

fail

Yes

pass

Int_Connect

Int_Continue

AC (srfID) pending?

Handle_ACR (srfID)

No

Yes

ELSE   Message was received due to DP of Leg ID

in DP_List (Connect in WFI)

Start Tcp (srfID)

Set Tssf to last used time interval and restart Tssf

Complete_ FCI_record (LegID)

If LegID is not included, then Leg2 is assumed

Tw(srfID)>0?

No

Yes

LegID included?

No

ORC_Leg (legID) := 0

For the LegID2 of the single Call Segment

Start Tw(srfID)

Return appropriate error to the CSA_gsmSCF

Yes

ORC_Leg (legID) := ORC_Leg (legID) -1

Set Tssf to user interaction timer value and restart Tssf

Waiting_For_ Instructions

Outstanding_ _Requests > 0 ?

No

Waiting_For_ _End_Of_ User_Interaction

Yes

Set Tssf to last used time interval and restart Tssf

DP_List (Connect in WFI) = (DP_O_No_answer of LegID, DP_T_No_answer of LegID, DP_O_Busy of LegID, DP_T_Busy of LegID, DP_Route_Select_Failure of LegID, DP_O_Disconnect of LegID, DP_T_Disconnect of LegID)

Waiting_For_ _Instructions

4

Figure 4.96-16: Process CS_gsmSSF (sheet 16)

Figure 4.96-17: Process CS_gsmSSF (sheet 17)

Process CS_gsmSSF 18(61)

/* Invocation of CS_gsmSSF */

Waiting_for_ _Instructions

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

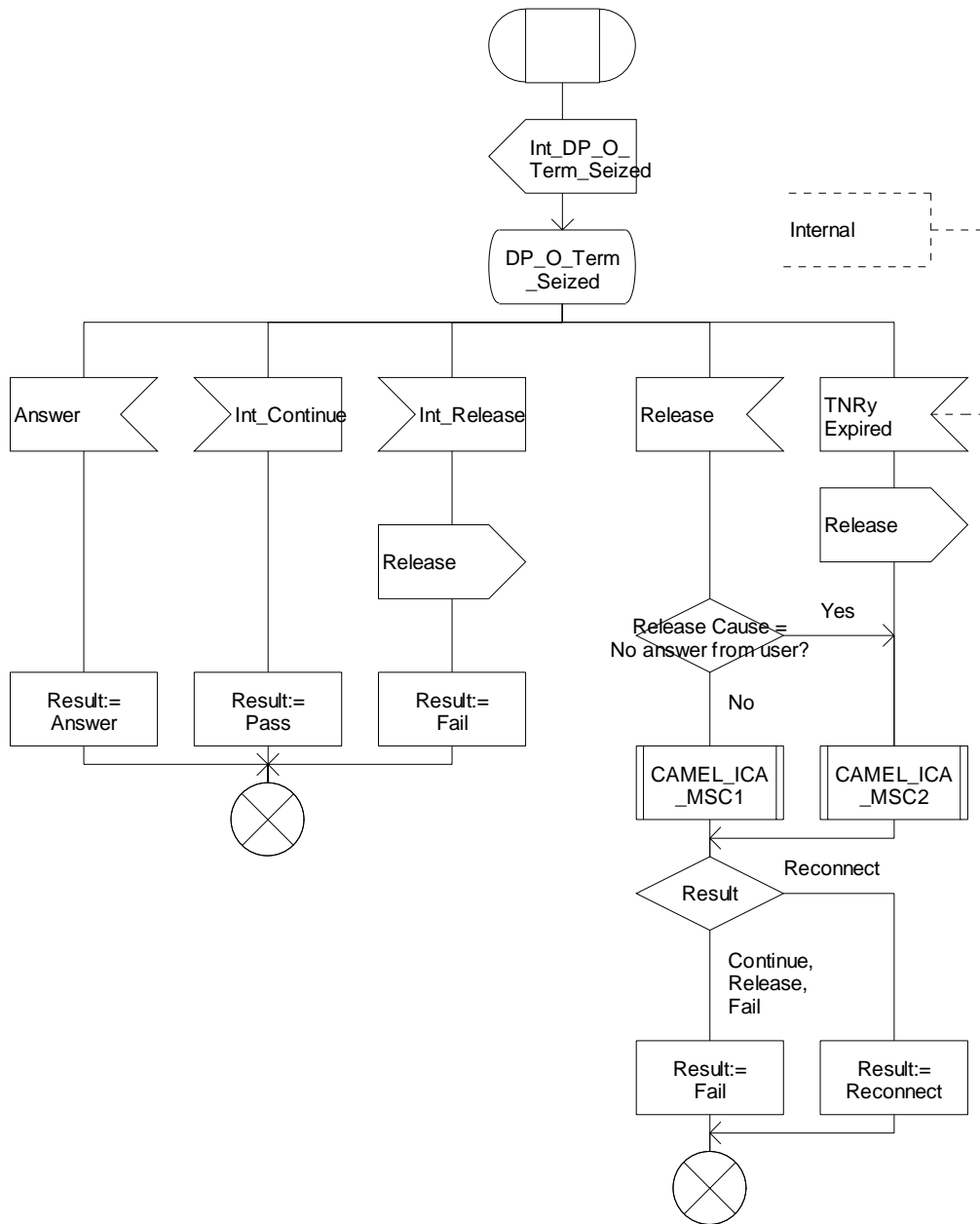Int_Continue_ With_Argument (legID or CSID or nothing)

Stop Tssf

DP_List (ContinueWithArgument in WFI 1) = (DP_Route_Select_Failure, DP_O_Busy, DP_T_Busy, DP_O_No_Answer, DP_T_No_Answer, DP_O_Disconnect, DP_T_Disconnect, DP_O_Abandon, DP_T_Abandon)

Int_Continue_With_Argument contains LegID or CSID?

neither LegID nor CSID included

CSID → CSID

LegID → LegID

ORC_CS (CSID) = 0 ?

No

for the single CS

See section 4,5,7.4

ORC_Leg (legID) := ORC_Leg(legID) -1

Yes

Set Tssf to last used time interval and restart Tssf

ORC_Leg (legID) = 0 ?

Yes

Waiting_For_ _Instructions

See section 4,5,7.4

ORC_Leg (legID) := ORC_Leg(legID) -1

No

ORC_Leg (legID) = 0 ?

No

Yes

to MSC process for legID

Int_Continue_ _With_ _Argument

legID was in DP

other DP or suspended due to CPH

in DP_List (ContinueWithArgument in WFI 1)

Int_Leg_Status _Report (disconnect)

4

Figure 4.96-18: Process CS_gsmSSF (sheet 18)

Process CS_gsmSSF   19(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

**Figure 4.96-19: Process CS_gsmSSF (sheet 19)**

Process CS_gsmSSF 20(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */
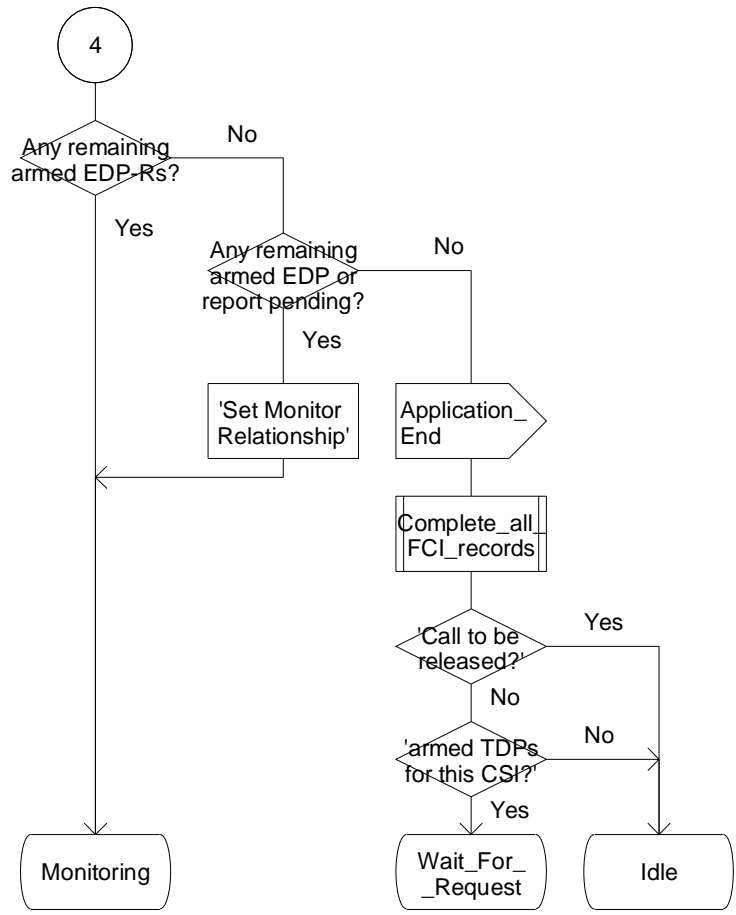
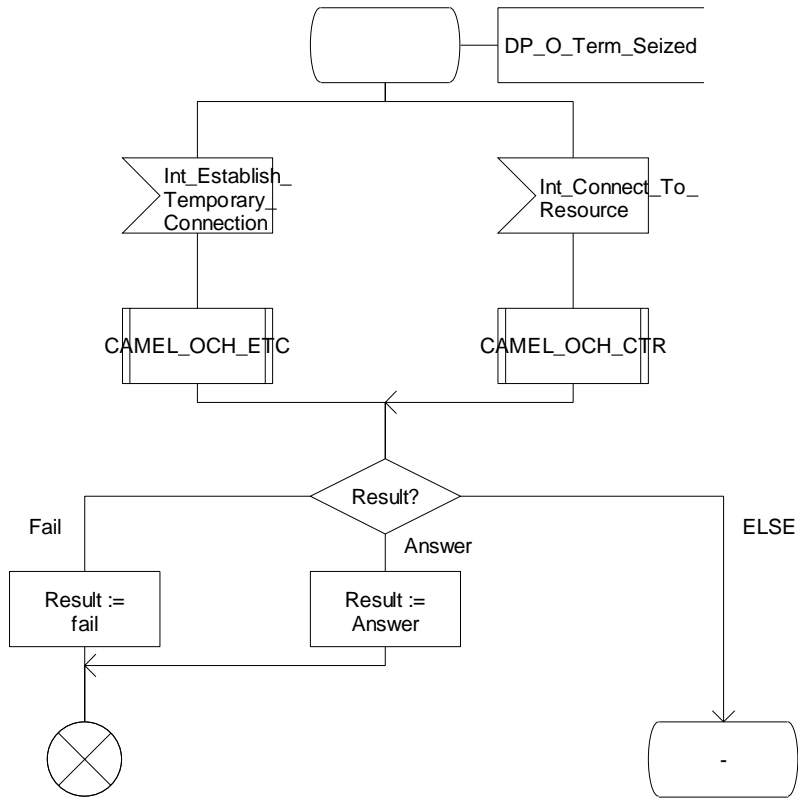**Figure 4.96-20: Process CS_gsmSSF (sheet 20)**

Process CS_gsmSSF 21(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */
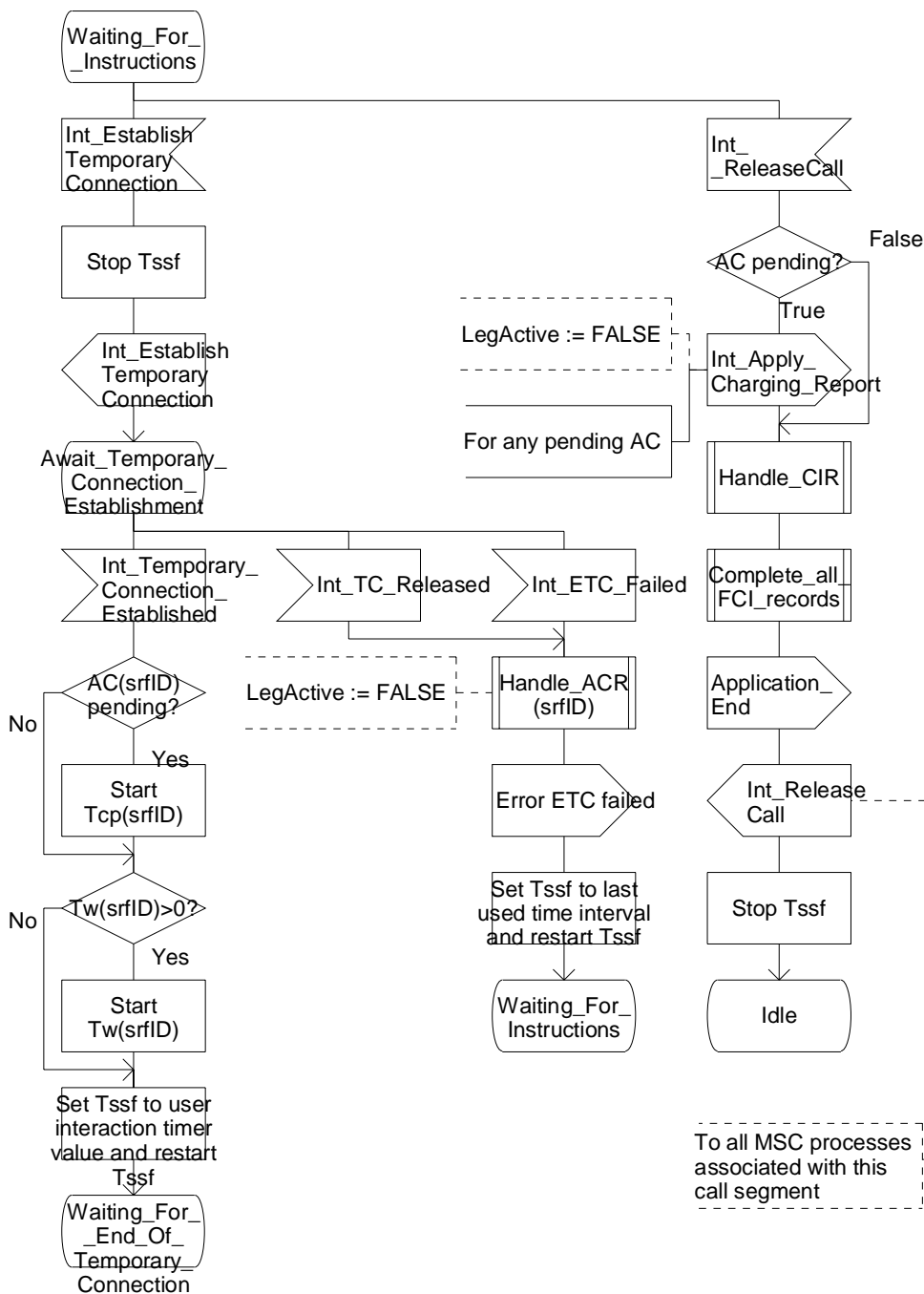
Figure 4.96-21: Process CS_gsmSSF (sheet 21)

Process CS_gsmSSF　　　　　　　　　　　　　　　　　　　　　　22(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

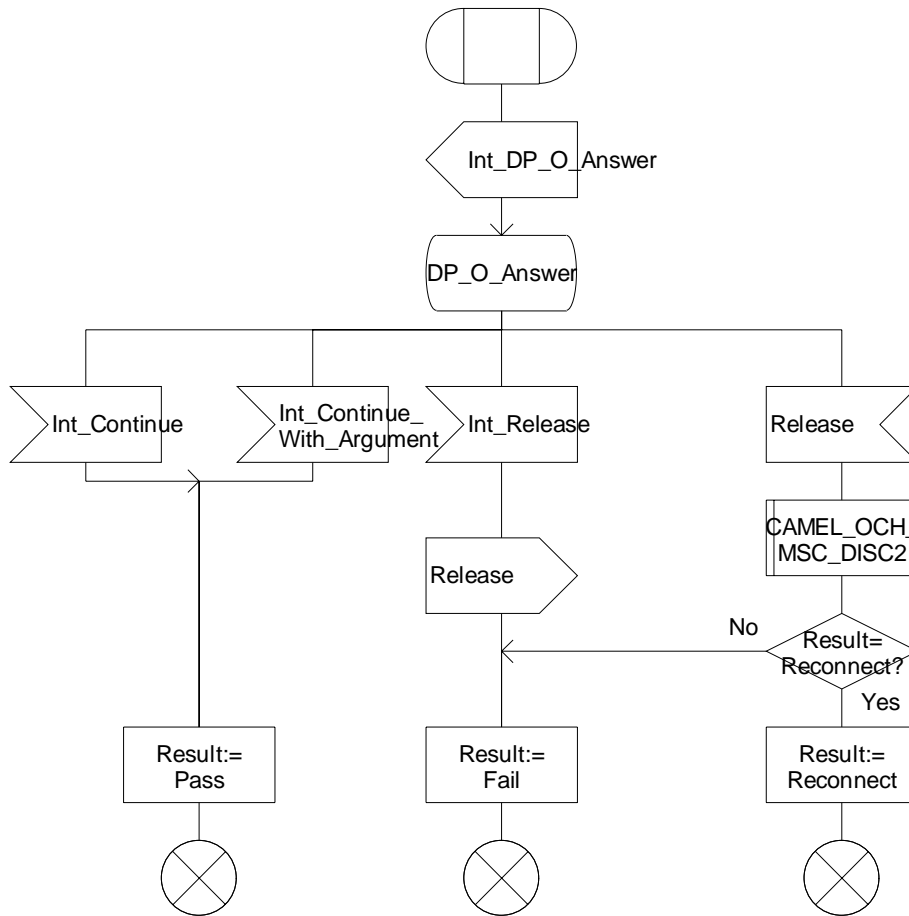Waiting_For_
_Instructions

Int_Request_
ReportBCSM
_Event

Set Tssf to last
used time interval
and restart Tssf

Arming rules
fulfilled?

No

Yes

Event

Else

O_Change_
Of_Position

T_Change_
Of_Position

O_MidCall,
T_MidCall

Transparent
mode?

No

Yes

Int_Invoke_
O_Change_Of_
Position_MSC
(Monitor Mode)

Int_Invoke_
T_Change_Of_
Position_MSC
(Monitor Mode)

Int_MidCall_
Cancel

Int_MidCall_
Criteria

Error
Unexpected
Data Value

Arm EDP
and/or
disarm EDP

/* Signal Int_Invoke_O_Change_Of_Position_MSC is sent
to the process CAMEL_O_Change_Of_Position_MSC;
Signal Int_Invoke_T_Change_Of_Position_MSC is sent
to the process CAMEL_T_Change_Of_Position_MSC. */

Waiting_For_
_Instructions

Figure 4.96-22: Process CS_gsmSSF (sheet 22)

Process CS_gsmSSF 23(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */
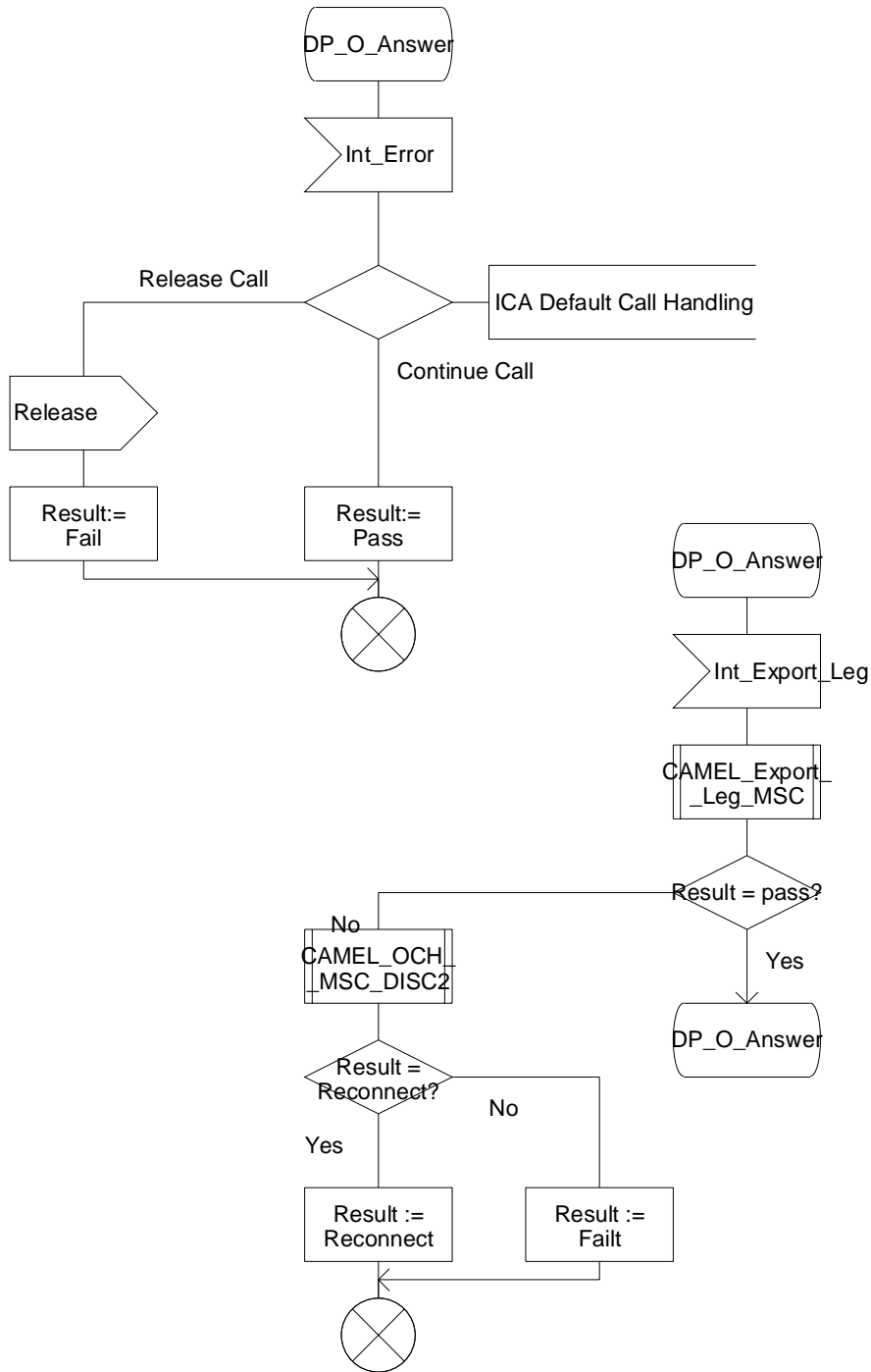
Waiting_for_ _Instructions

Int_T_Exception, Int_O_Exception

Timer expiry Tssf —— Internal

AC pending? —— False

True

LegActive := FALSE

Int_Apply_ Charging_Report

For any pending AC

Handle_CIR

Complete_all_ FCI_records

Abort

Stop Tssf

Idle

Abort

Int_Error

Complete_all_ FCI_records

'Default call handling = continue call?' —— No

Yes

'armed TDPs for this CSI?' —— No

Yes

Wait_For_ _Request

Idle
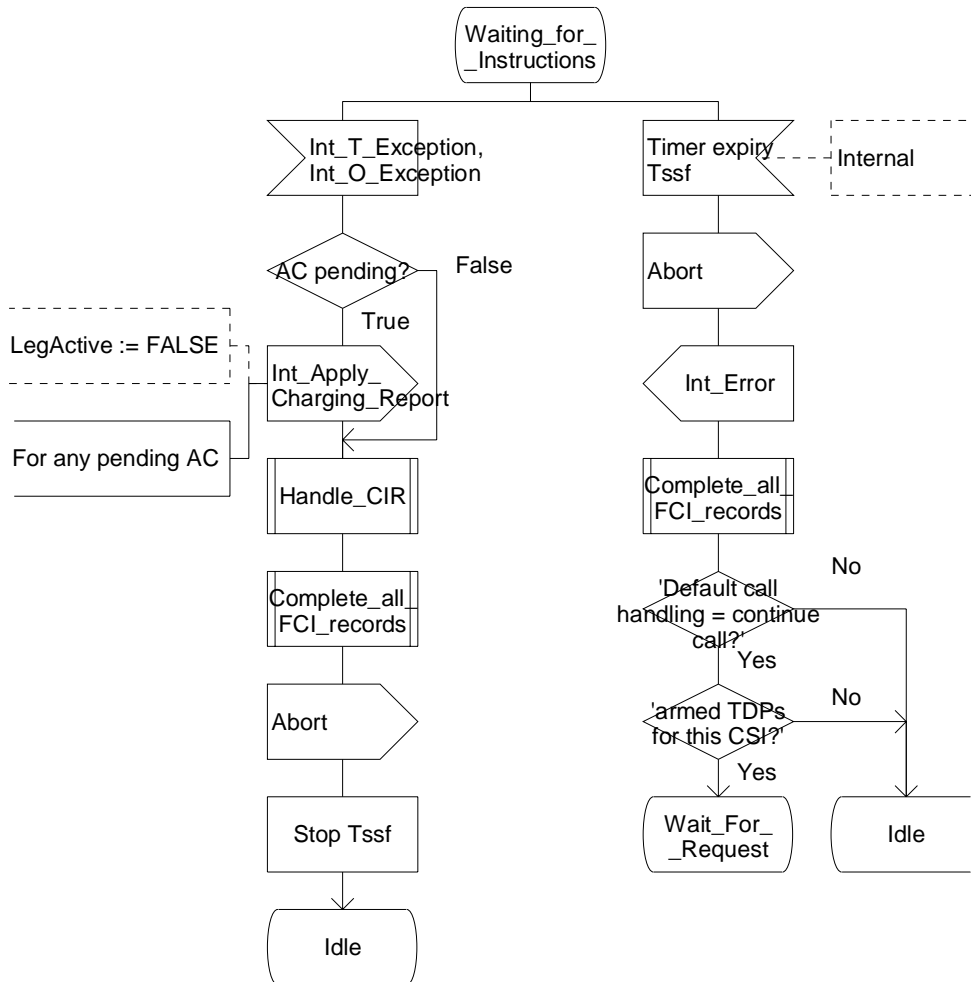
Figure 4.96-23: Process CS_gsmSSF (sheet 23)

Process CS_gsmSSF   24(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
  signals to/from the right are to/from the process
  CSA_gsmSSF unless otherwise marked. */

Waiting_for_Instructions,
Waiting_for_Instructions_For_DS

Int_Reset_Timer

Set Tssf to
Int_Reset_Timer
time interval and
restart Tssf

-
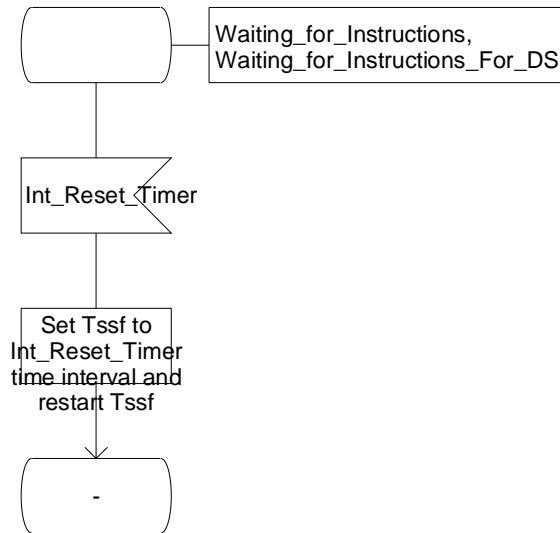
Figure 4.96-24: Process CS_gsmSSF (sheet 24)
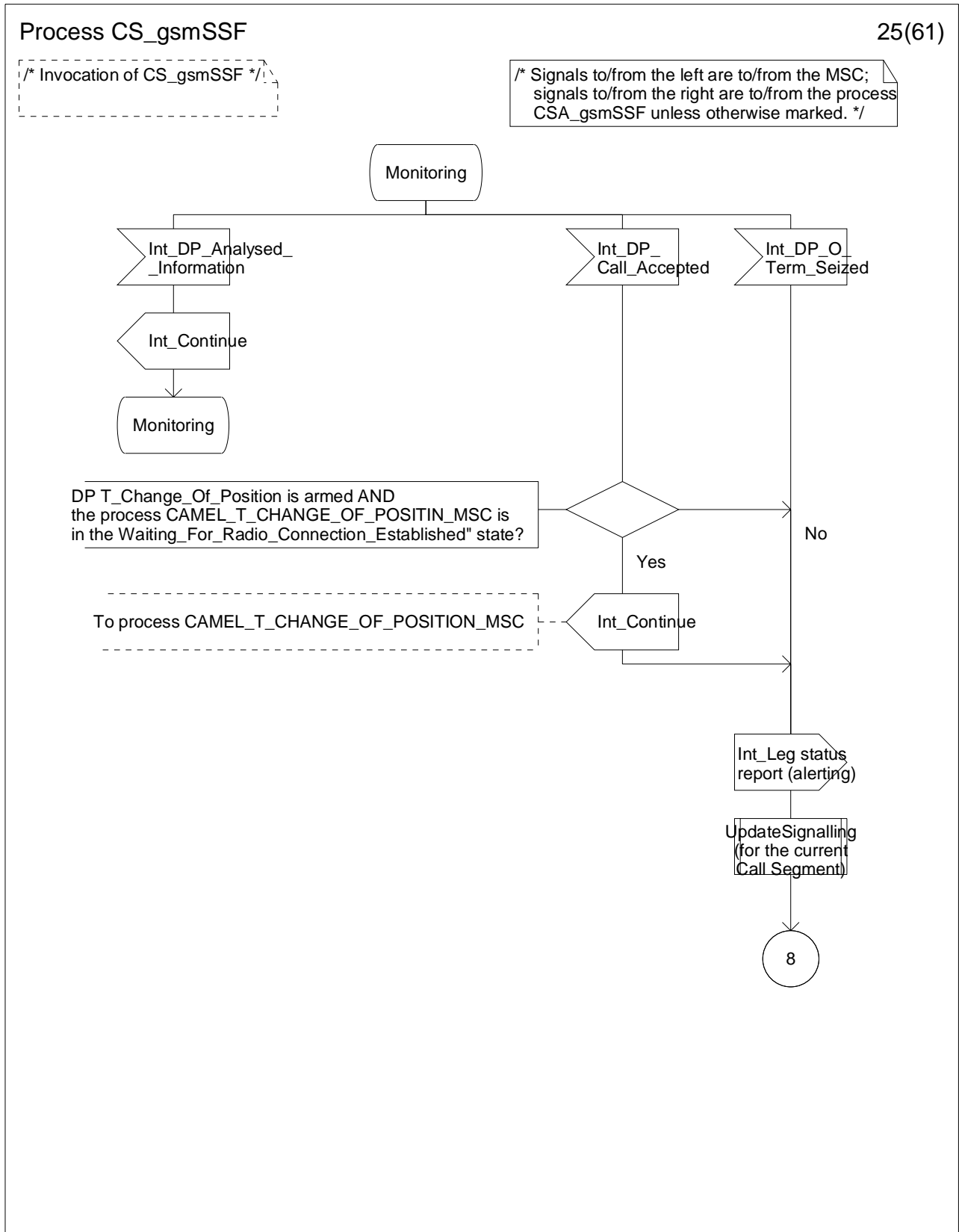
Figure 4.96-25: Process CS_gsmSSF (sheet 25)

Process CS_gsmSSF   26(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

8

DP armed for legID? — No

Yes

DP armed as EDP-R? — No

Yes

Int_Event_
_Report_BCSM
(Notify & Continue)

Int_Event_
_Report_BCSM
(Interrupted)

Perform implicit
disarming of DPs.

Disarm this DP.
Perform implicit
disarming of DPs.

Disarm this DP.
Perform implicit
disarming of DPs.

Any remaining
armed EDPs or
outstanding report?

No

Yes

ORC_Leg (legID)
:= 1

Application_
End

Int_Continue

Set Tssf to default
non user interaction
Tssf timer value and
restart Tssf

Complete_all_
FCI_record

Monitoring

Waiting_For_
_Instructions

Int_Continue

armed TDPs
for this CSI? — No

Yes

Wait_For_
_Request

Idle

Figure 4.96-26: Process CS_gsmSSF (sheet 26)

Process CS_gsmSSF 27(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Monitoring

Int_DP_O_Answer

Int_Leg_Status _Report (active)

Handle_O_ Answer (legID)

Int_DP_T_Answer

Int_Leg_Status _Report (active)

Handle_T_ Answer (legID)

UpdateSignalling (for the current Call Segment)

9
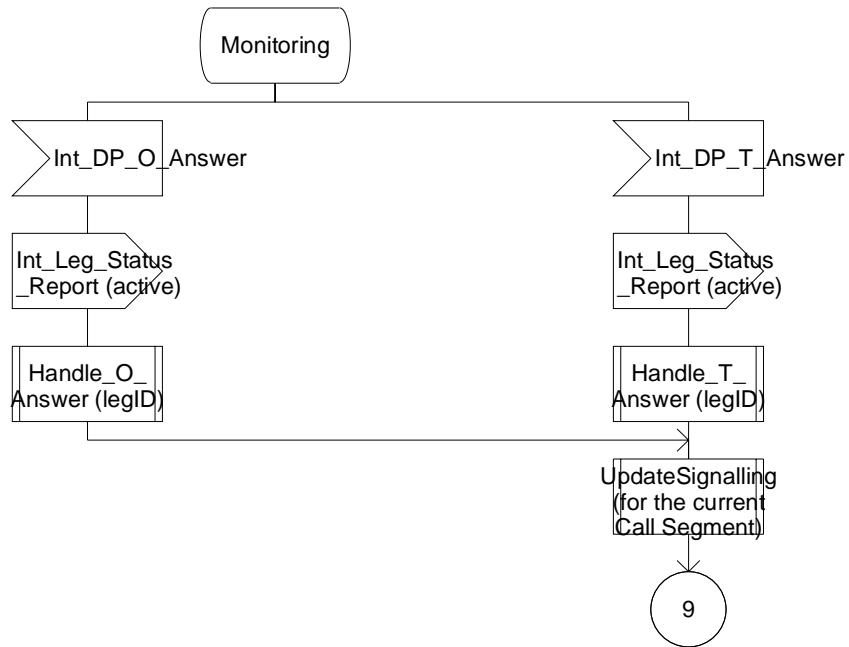
Figure 4.96-27: Process CS_gsmSSF (sheet 27)

Process CS_gsmSSF   28(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */
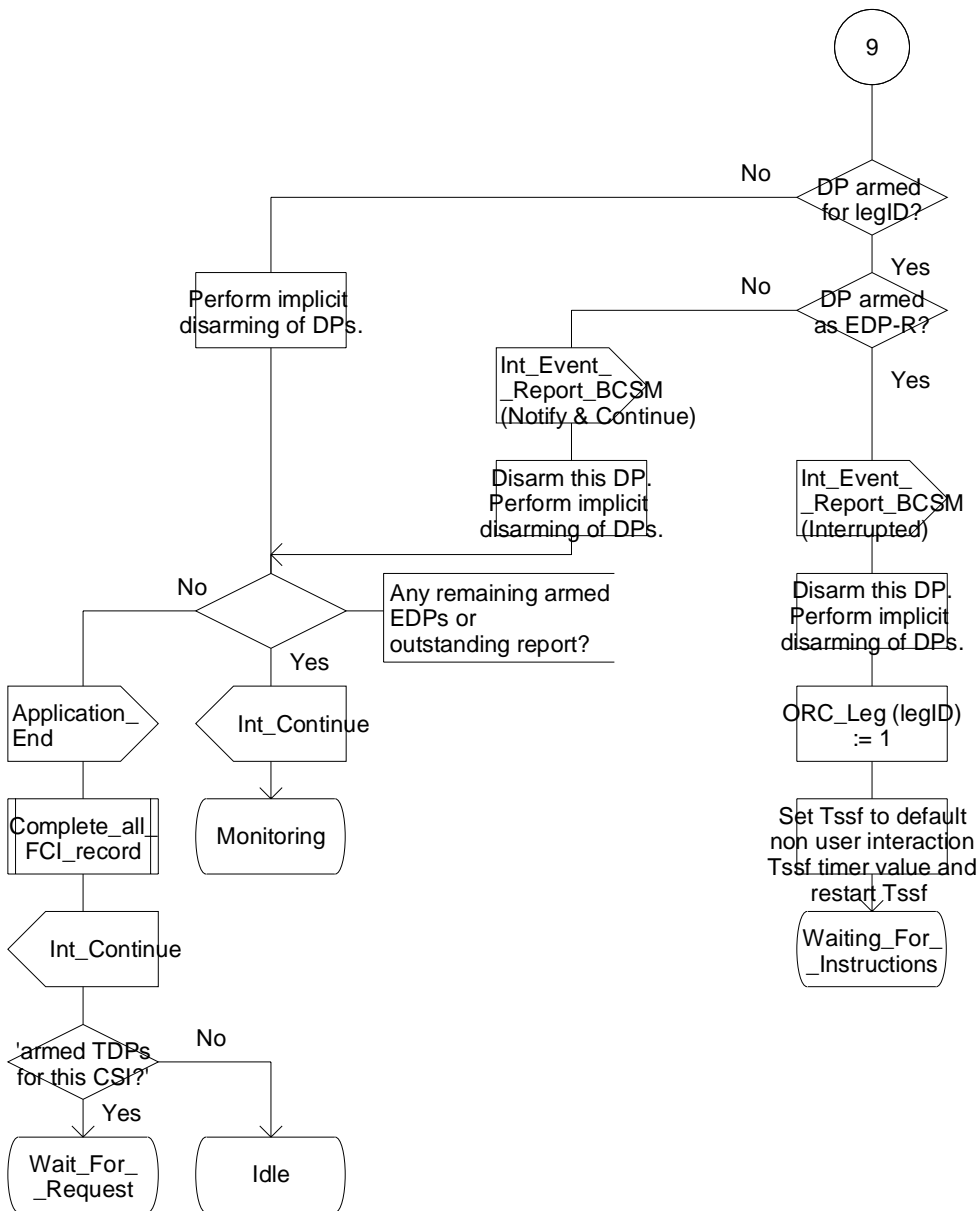
Figure 4.96-28: Process CS_gsmSSF (sheet 28)
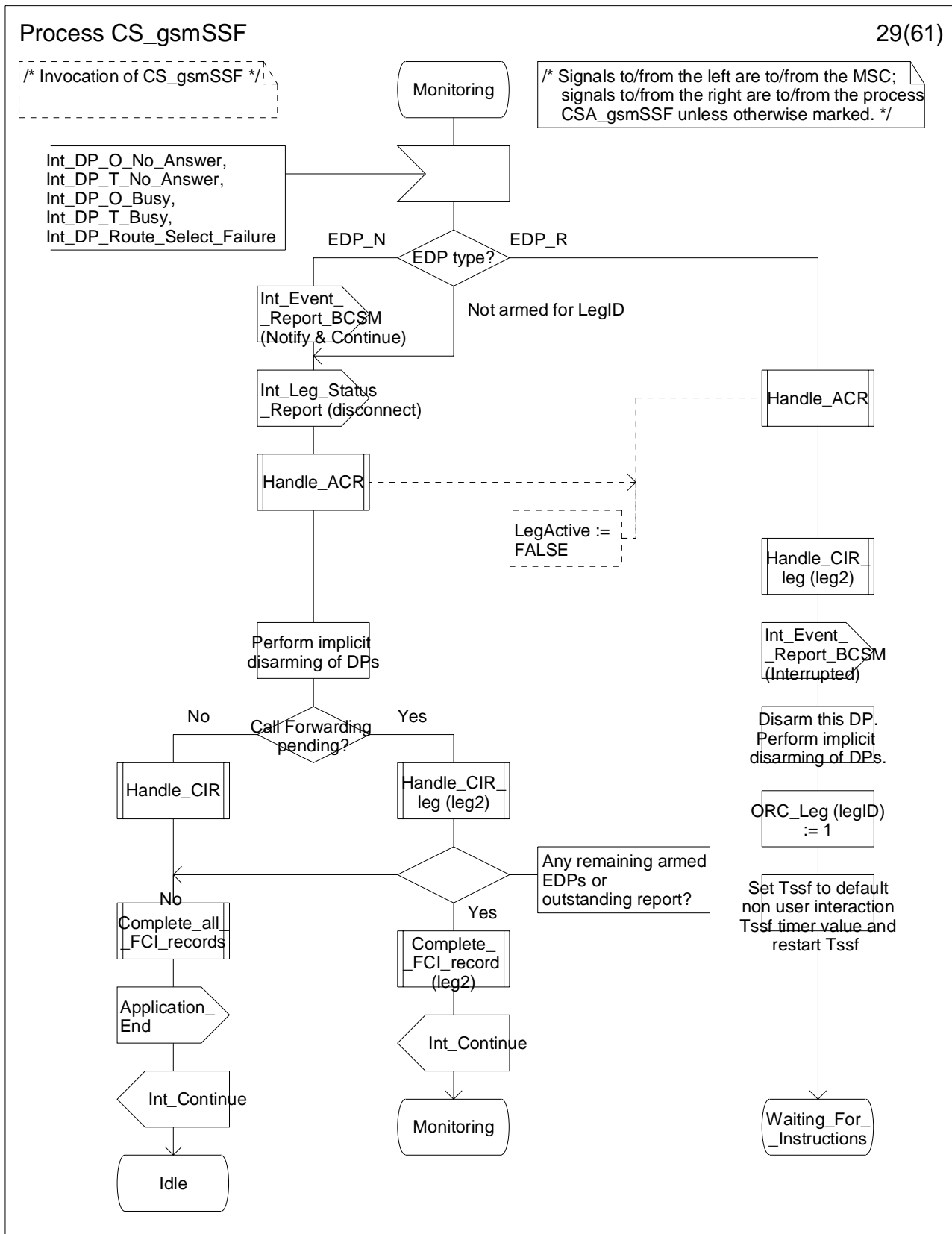
Figure 4.96-29: Process CS_gsmSSF (sheet 29)
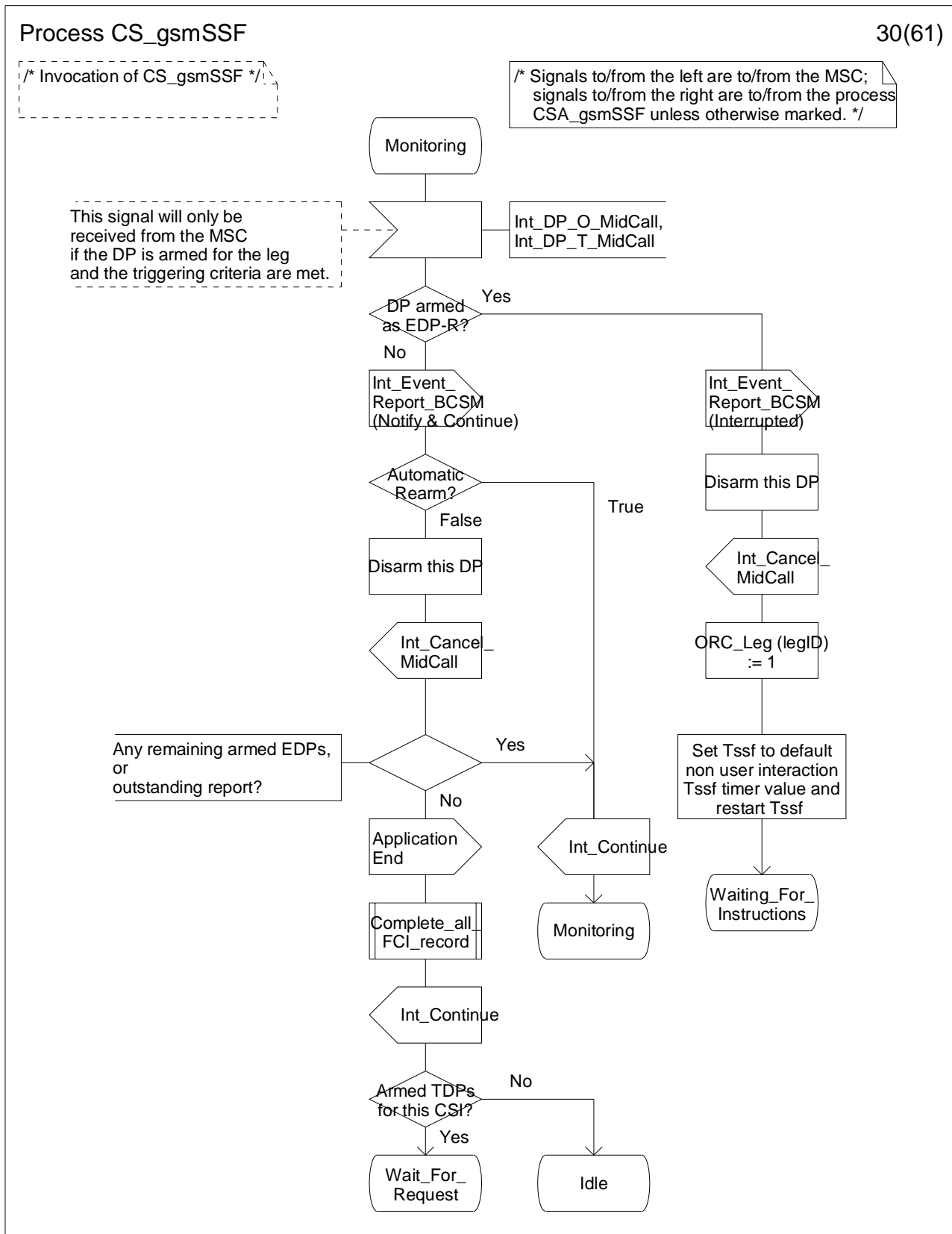
Figure 4.96-30: Process CS_gsmSSF (sheet 30)

Process CS_gsmSSF   31(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Monitoring

Int_O_Exception,
Int_T_Exception

AC pending — False

True

LegActive := FALSE

Int_
Apply_Charging_
Report

For any pending AC

Handle_CIR

Complete_all_
FCI_records

Abort

Idle
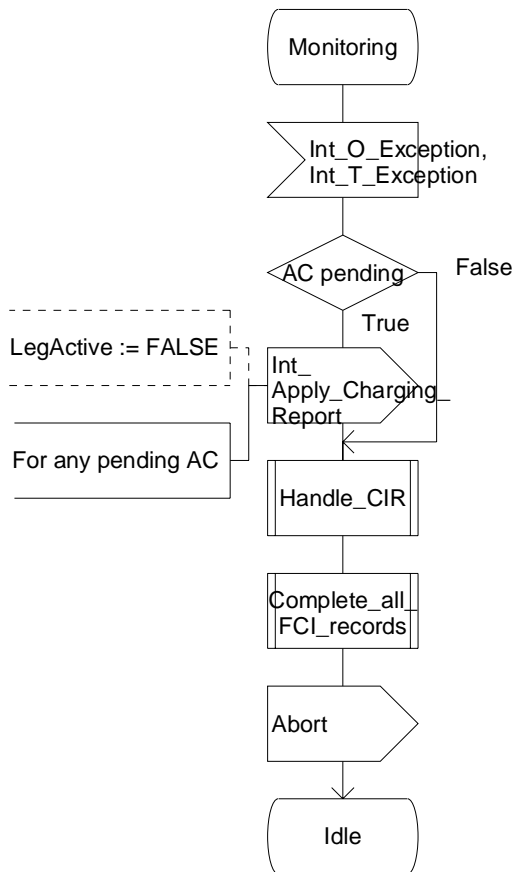
Figure 4.96-31: Process CS_gsmSSF (sheet 31)

Process CS_gsmSSF 32(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

Monitoring

Int_
Apply_Charging

Int_Apply_
Warning_Tone
(legID)

Handle_AC
(pty)

Int_Apply_
Warning_Tone
(legID)

Monitoring

This provokes the MSC to play a tone.
See subclause 4.5.2.1.7.

Figure 4.96-32: Process CS_gsmSSF (sheet 32)

Process CS_gsmSSF 33(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Non-completed CAMEL logical call record exists for this legID?

Monitoring

Int_Cancel (All)

Disarm all EDPs

Cancel all reports

Application_ End

Complete_all_ FCI_record

Int_Continue

Int_ Furnish_Charging_ Information

No

Yes

"Append"

AppendFree FormatData in FCI?

Not present, "Overwrite"

No
'armed TDPs for this CSI?'
Yes

Idle

Wait_For_ _Request

Append free format data to existing logical call record

Overwrite all CAMEL logical call record data with this FCI data

Create CAMEL logical call record

Write FCI data in CAMEL logical call record

Monitoring
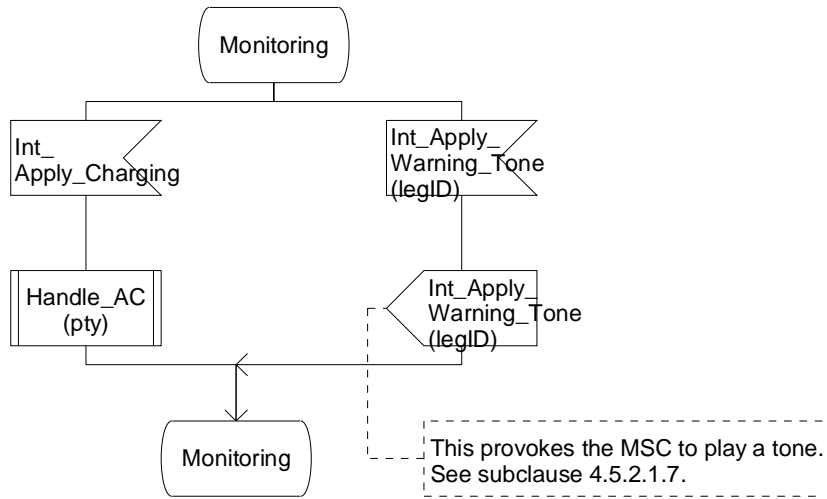
Figure 4.96-33: Process CS_gsmSSF (sheet 33)

Process CS_gsmSSF 34(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Monitoring

Int_ReleaseCall

Handling of Int_Release_Call is only specified in a control relationship.
The gsmSCF shall not send a Int_Release_Call in a monitor relationship

Int_Send_Charging_Information

Handle_SCI

-

See subclause 4.5.7.2

False

AC pending

True

Int_Apply_Charging_Report

LegActive := FALSE

For any pending AC

This signal will not be relayed to the gsmSCF if the dialogue has terminated (i.e. process CSA_gsmSSF is in 'idle' state)

Handle_CIR

Call Informtion Reports will not be relayed to the gsmSCF if the dialogue has terminated.

Complete_all_FCI_records

Application_End

Int_Release_Call

To all MSC processes associated with this call segment

Idle

Figure 4.96-34: Process CS_gsmSSF (sheet 34)

Process CS_gsmSSF 35(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Monitoring

Int_Request_Report_BCSM_Event

Arming rules fulfilled? — No

In state 'Monitoring', only requests to disarm DPs or to sent notifications are allowed

Yes

Event

O_Change_Of_Position

T_Change_Of_Position

O_MidCall, T_MidCall

Transparent mode? — No

Yes

Else

Int_Invoke_O_Change_Of_Position_MSC (Monitor Mode)

Int_Invoke_T_Change_Of_Position_MSC (Monitor Mode)

Int_MidCall_Cancel

Int_MidCall_Criteria

Error: Unexpected Data Value

Arm DP and/or disarm DP

/* Signal Int_Invoke_O_Change_Of_Position_MSC is sent to the process CAMEL_O_Change_Of_Position_MSC; Signal Int_Invoke_T_Change_Of_Position_MSC is sent to the process CAMEL_T_Change_Of_Position_MSC. */

Any armed EDP or report pending? — Yes

Monitoring

No

Complete_all_FCI_records

Application_End

'armed TDPs for this CSI?' — No

Yes

Wait_For__Request

Idle

Figure 4.96-35: Process CS_gsmSSF (sheet 35)

Figure 4.96-36: Process CS_gsmSSF (sheet 36)

Process CS_gsmSSF   37(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Monitoring

Tsw(pty)
expired ⟵ --- Internal

Store curent
value of Tcp (pty)

-
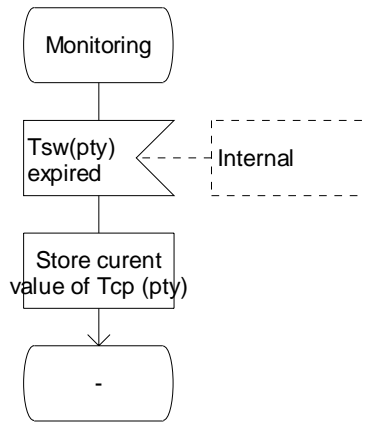
Figure 4.96-37: Process CS_gsmSSF (sheet 37)

Process CS_gsmSSF   38(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */
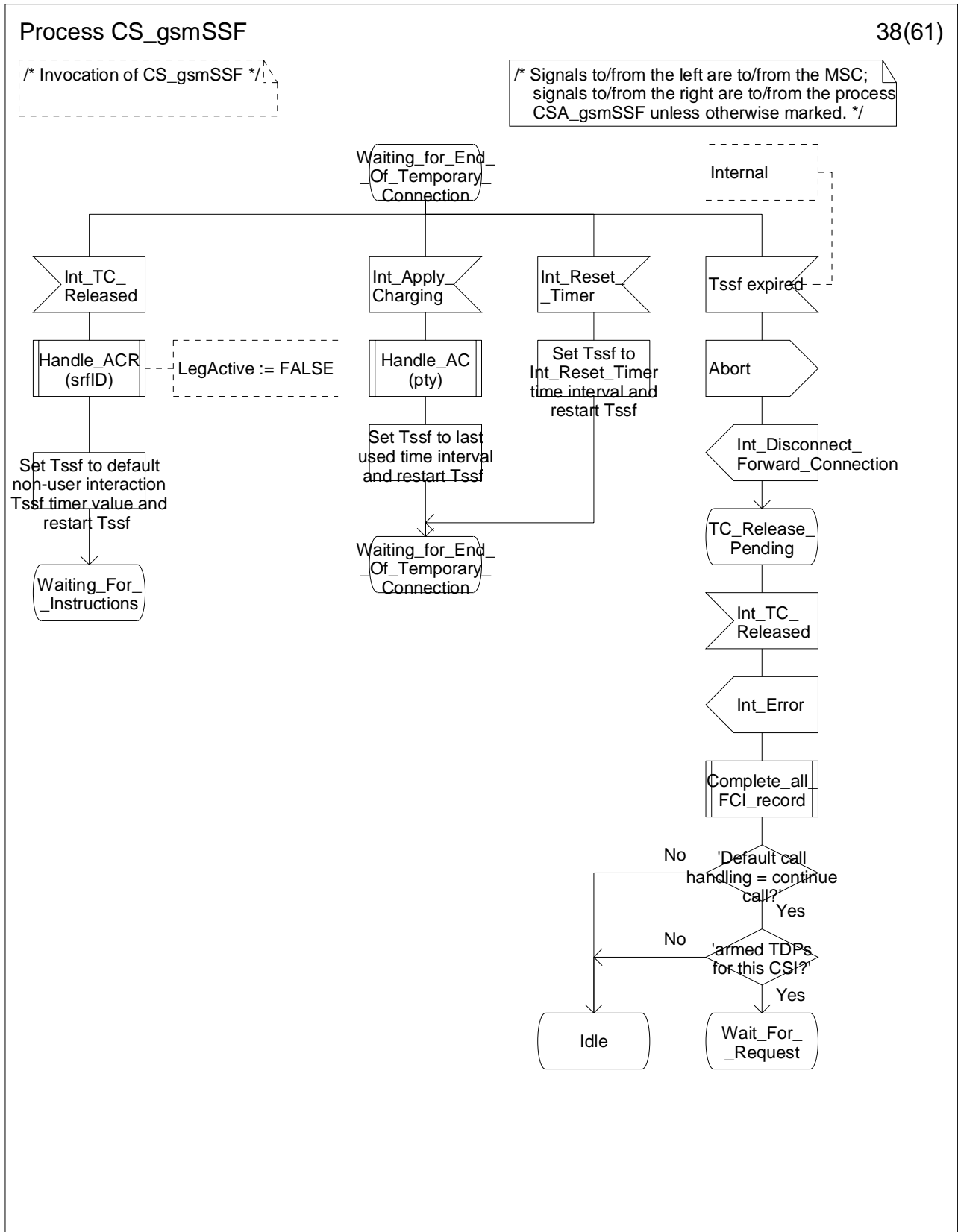
Figure 4.96-38: Process CS_gsmSSF (sheet 38)

Process CS_gsmSSF 39(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_
_Of_Temporary_
Connection

Int_Disconnect_
ForwardConnection

Int_Disconnect
Forward Connection
With Argument

Handle_ACR
(srfID)

Handle_ACR
(srfID)

LegActive := FALSE

Int_Disconnect_
Forward_
Connection

Int_Disconnect
Forward Connection
With Argument

TC_Release_
_Pending_2

Int_TC_
Released

Set Tssf to default
non-user interaction
Tssf timer value and
restart Tssf

Waiting_For_
_Instructions
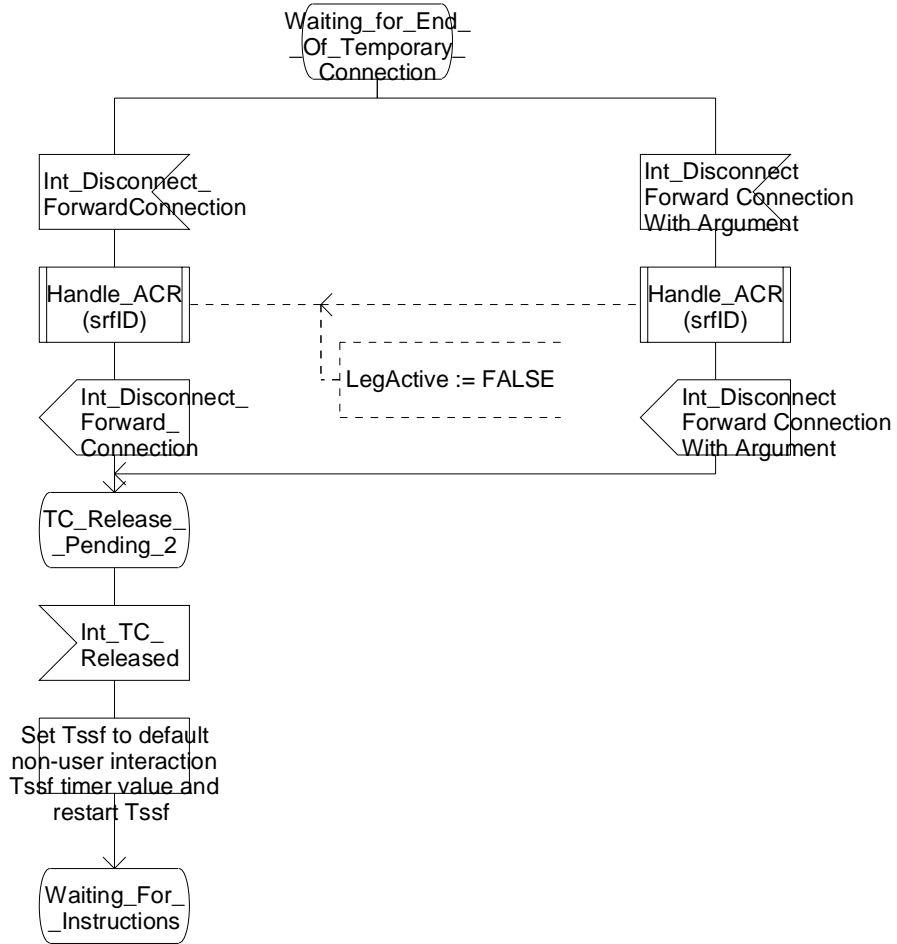
Figure 4.96-39: Process CS_gsmSSF (sheet 39)

Process CS_gsmSSF 40(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_
_Of_User_
_Interaction

Int_Apply_
Charging

Int_Disconnect_
ForwardConnection

Int_Disconnect_
Forward_Connection_
With_Argument

Int_SRF_
_Released

LegActive := FALSE

Handle_AC
(pty)

Handle_ACR
(srfID)

Handle_ACR
(srfID)

Handle_ACR
(srfID)

Int_Disconnect_
Forward_
Connection

Int_Disconnect_
Forward_Connection_
With_Argument

Set Tssf to last
used time interval
and restart Tssf

SRF_Release_
Pending_2

Waiting_For_End_
Of_User_
_Interaction

Int_SRF_
_Released

Set Tssf to default
non user interaction
time interval and
restart Tssf

Set Tssf to default
non user interaction
time interval and
restart Tssf

Waiting_For_
_Instructions

Figure 4.96-40: Process CS_gsmSSF (sheet 40)

Process CS_gsmSSF   41(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_
_Of_User_
_Interaction

Int_Cancel_
_(Invoke_ID)

Int_Play_
_Announcement

Int_Prompt_&
_Collect_User_
_Information

Int_Reset_
_Timer

Relay the operation
to the SRF

To SRF

Set Tssf to last
used time interval
and restart Tssf

Set Tssf to
Int_Reset_Timer
time interval and
restart Tssf

Waiting_for_End_
_Of_User_
_Interaction
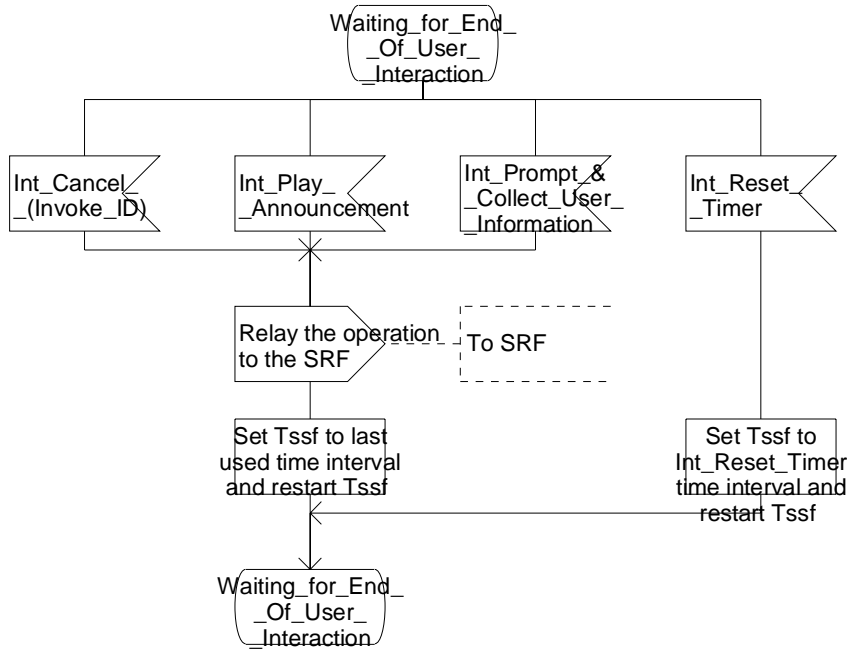
Figure 4.96-41: Process CS_gsmSSF (sheet 41)

Process CS_gsmSSF 42(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the process Generic_SRF; signals to/from the right are to/from the Process CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_
_Of_User_
_Interaction

Int_Cancelled_
_error

Int_Cancel_
_Failed_error

Int_Prompt_&
_Collect_User_
Information
_Result

Int_
Specialised_
Resource_
Report

Timer expiry
Tssf

Relay the operation/
result/error to the
CSA_gsmSCF

Internal

Abort

From SRF

Int_Disconnect_
Forward_Connection

Waiting_for_End_
_Of_User_
_Interaction

SRF_Release_
Pending

Int_SRF_Released

Int_Error

Complete_all_
FCI_record

No

'Default call
handling = continue
call?'

Yes

No

'armed TDPs
for this CSI?'

Yes

Idle

Wait_For_
_Request

Figure 4.96-42: Process CS_gsmSSF (sheet 42)
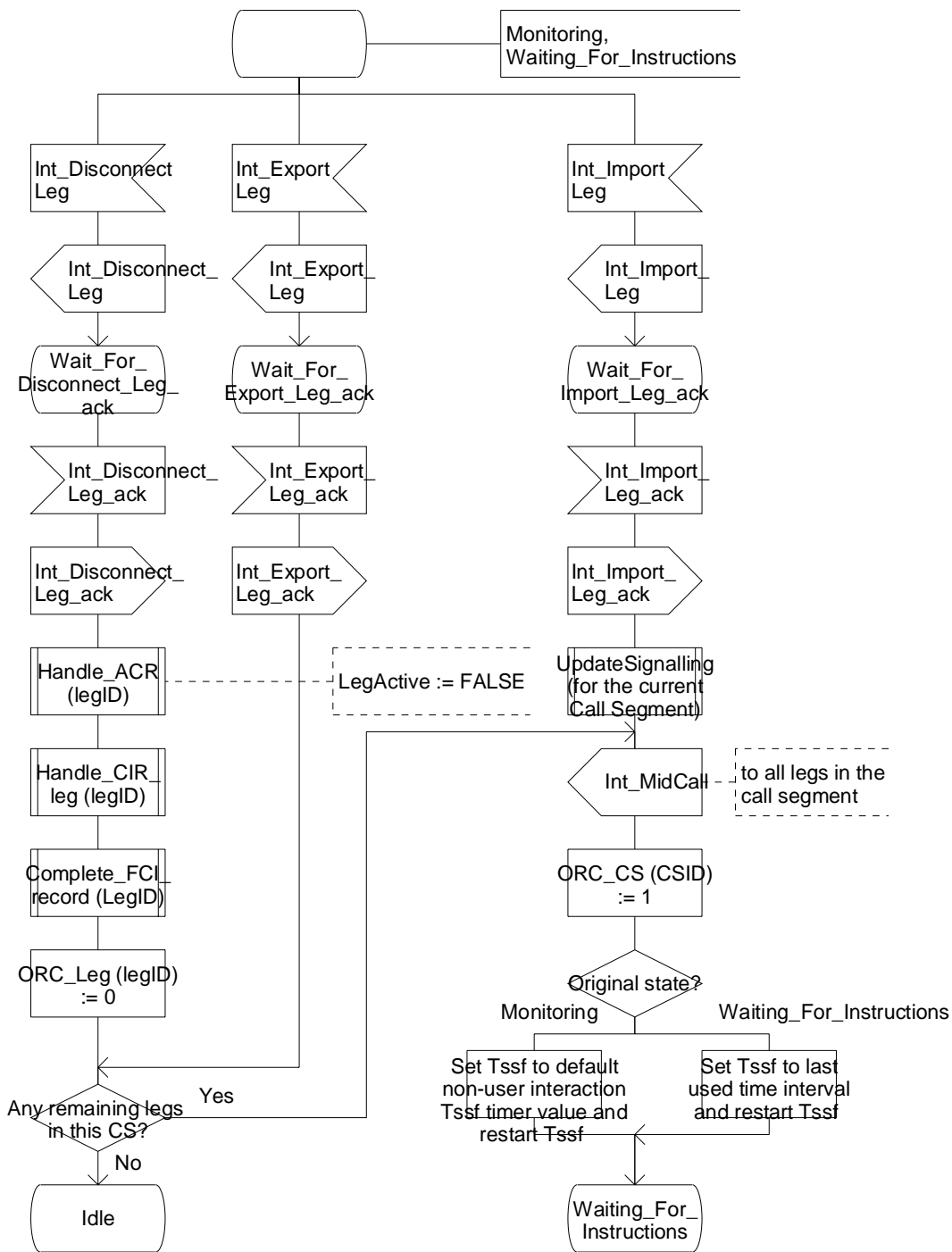
Figure 4.96-43: Process CS_gsmSSF (sheet 43)
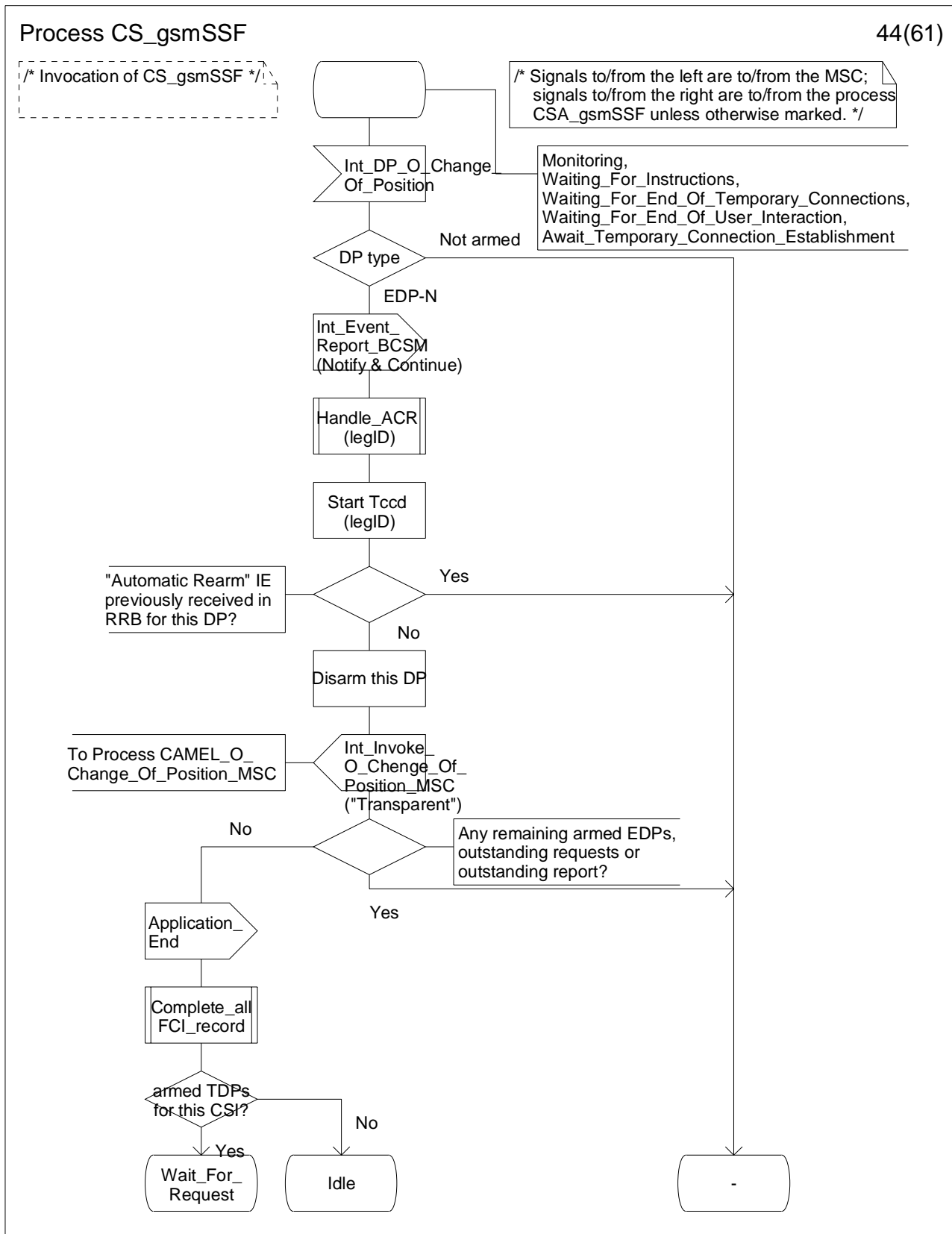
Figure 4.96-44: Process CS_gsmSSF (sheet 44)
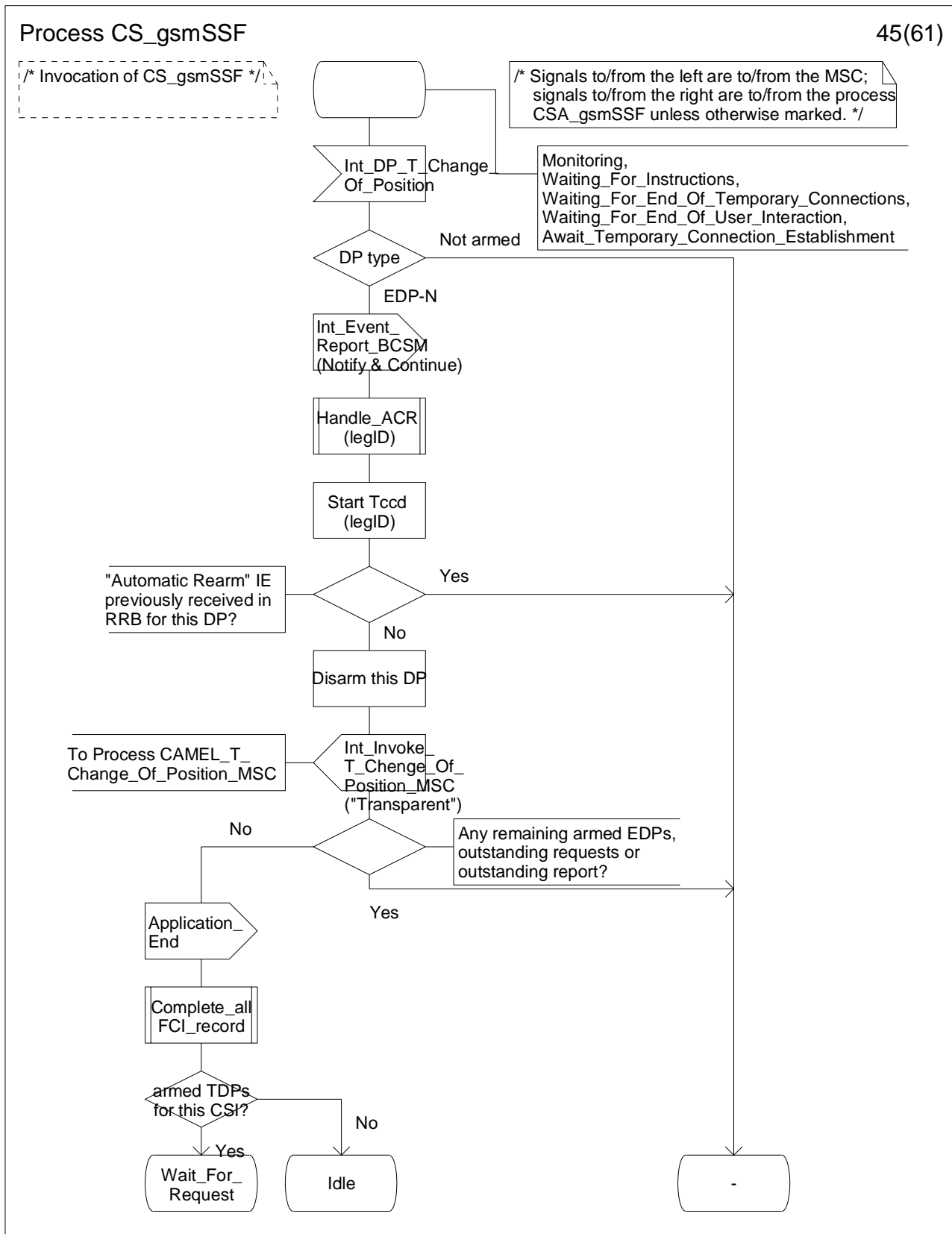
Figure 4.96-45: Process CS_gsmSSF (sheet 45)
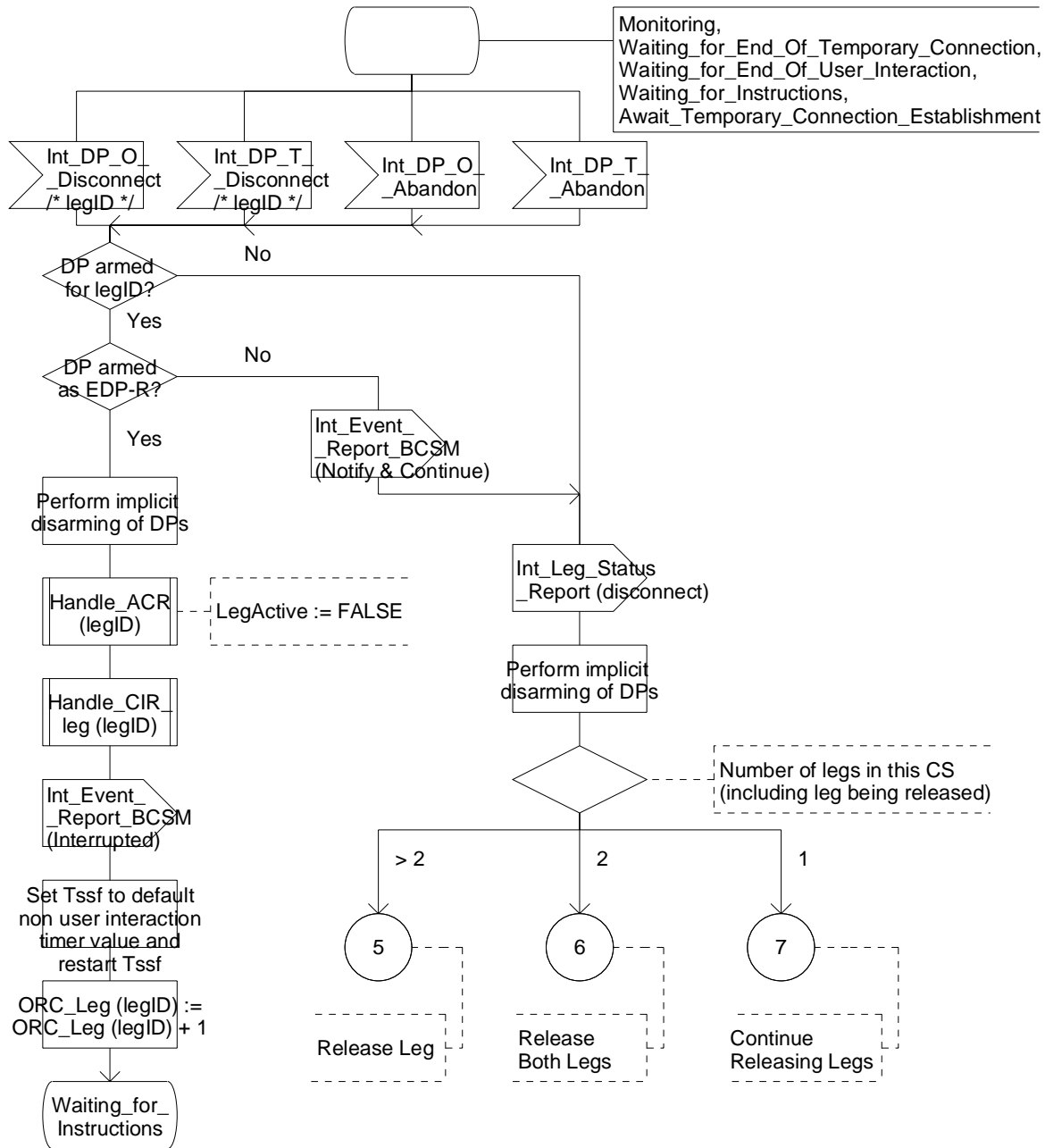
Figure 4.96-46: Process CS_gsmSSF (sheet 46)

Process CS_gsmSSF 47(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */
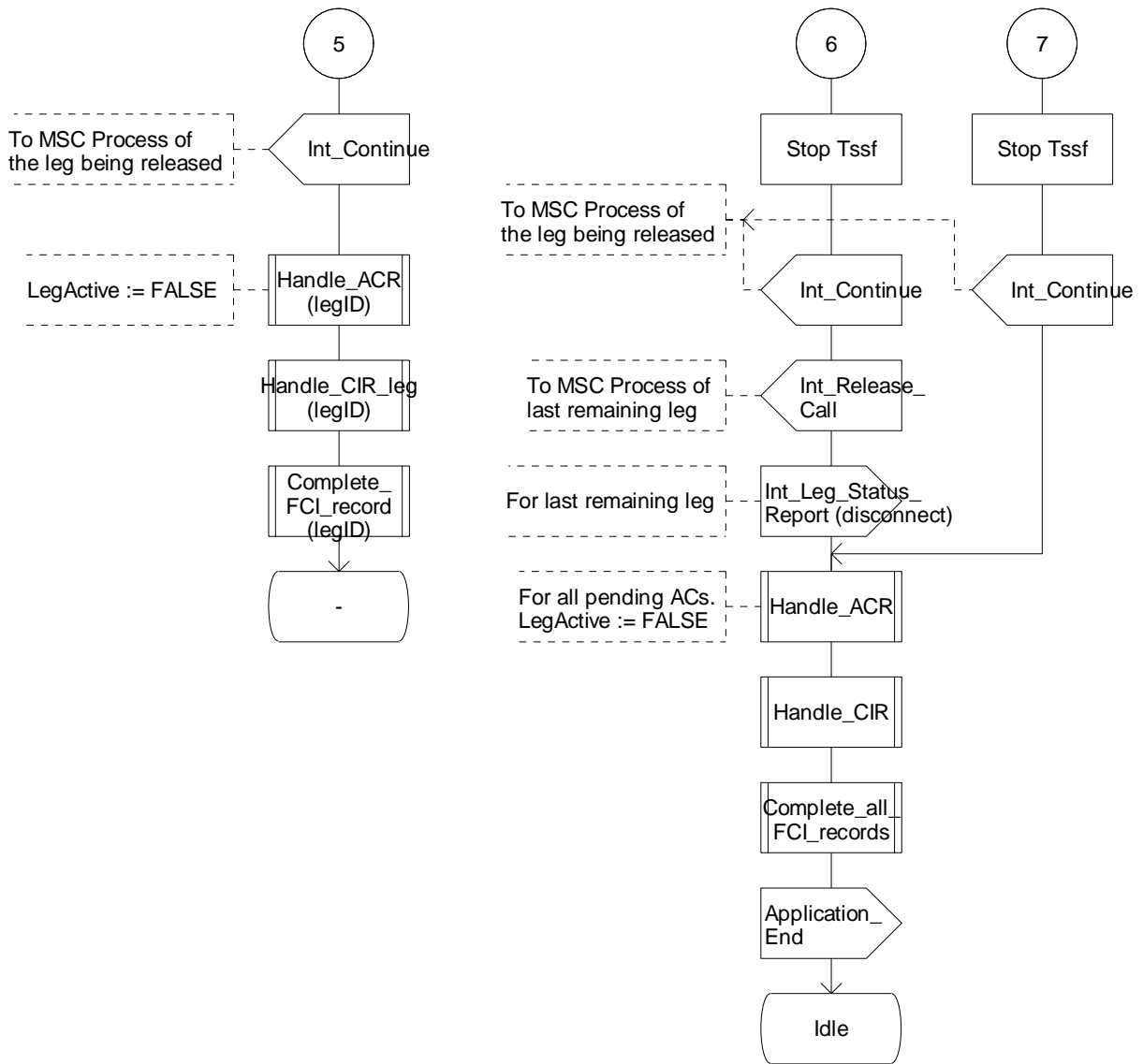
Figure 4.96-47: Process CS_gsmSSF (sheet 47)

Process CS_gsmSSF   48(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

Waiting_For_Instructions,
Waiting_For_End_Of_Temporary_Connection,
Waiting_For_End_Of_User_Interaction,
Waiting_For_Instructions_For_DS,
Waiting_For_End_Of_Temporary_Connection_For_DS,
Waiting_For_End_Of_User_Interaction_For_DS.

Int_
Furnish_Charging_
Information

Set Tssf to last
used time interval
and restart Tssf

Non-completed CAMEL
logical call record
exists for this legID?

No

Yes

AppendFree
FormatData in FCI?

Create CAMEL logical
call record

"Append"

Not present,
"Overwrite"

Append free format
data to existing
logical call record

Overwrite all CAMEL
logical call record
data with this FCI data

Write FCI data
in CAMEL logical
call record

-

Figure 4.96-48: Process CS_gsmSSF (sheet 48)

Process CS_gsmSSF   49(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Waiting_For_Instructions,
Waiting_For_Instructions_for_DS,
Waiting_For_End_Of_User_Interaction,
Waiting_For_End_Of_Temporary_Connection

Int_Send_
Charging_Information

Set Tssf to last
used time interval
and restart Tssf

Handle_SCI ----- See subclause 4.5.7.2

-
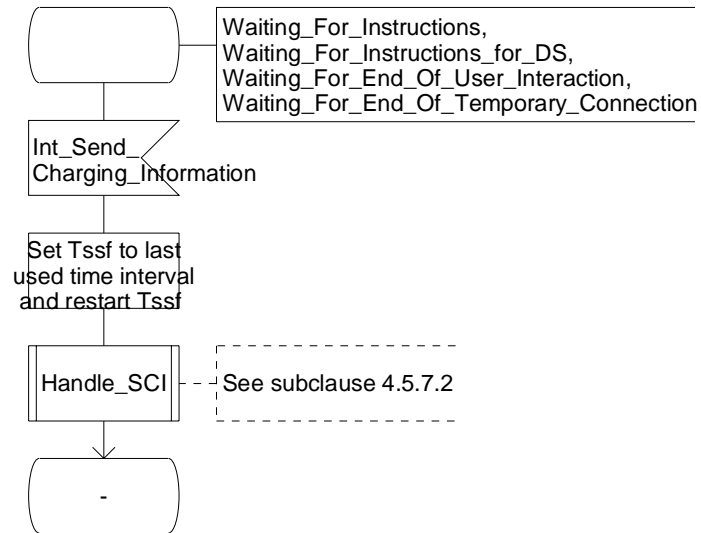
Figure 4.96-49: Process CS_gsmSSF (sheet 49)

ETSI

Process CS_gsmSSF   50(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Monitoring

Int_PlayTone

Int_Apply_
Warning_Tone

This provokes the MSC to playing tones
to the indicated call segment or leg.
See subclause 4.5.2.1.7.

-

Waiting_For_Instructions

Int_PlayTone

Int_Apply_
Warning_Tone

This provokes the MSC to playing tones
to the indicated call segment or leg.
See subclause 4.5.2.1.7.

Set Tssf to last
used time interval
and restart Tssf

-
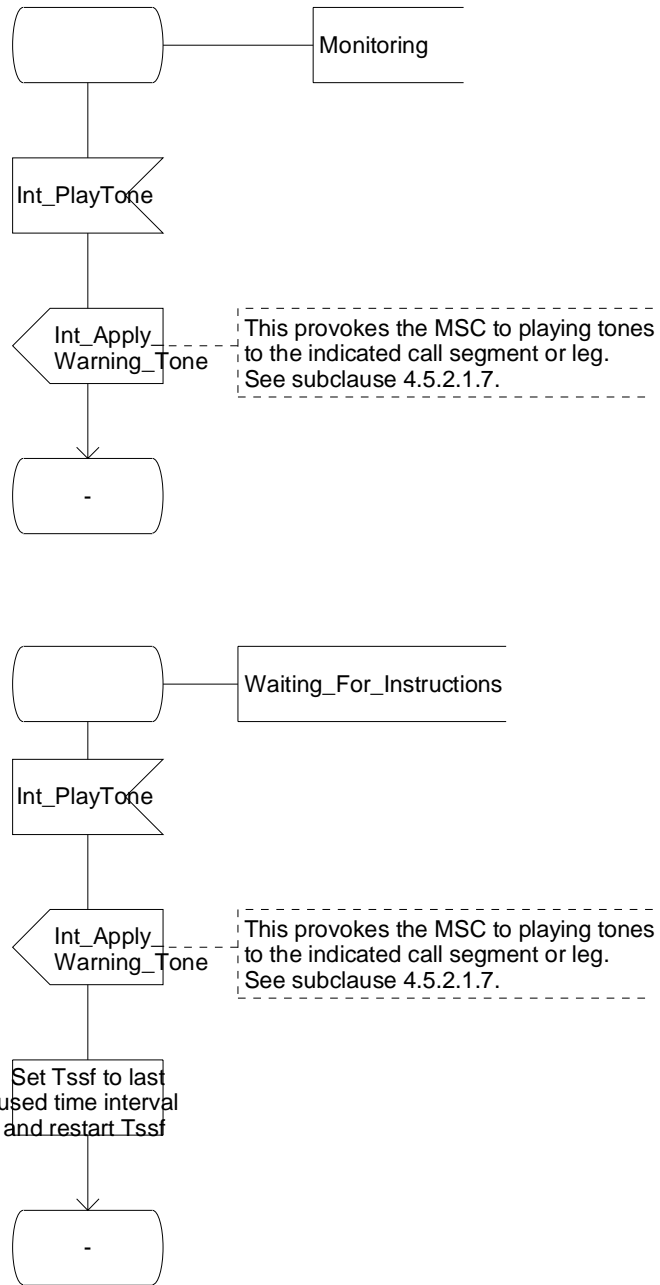
Figure 4.96-50: Process CS_gsmSSF (sheet 50)

Process CS_gsmSSF 51(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_Of_Temporary_Connection,
Waiting_for_End_Of_User_Interaction

Tccd(pty) expired

Tw(pty) expired

Int_Apply_ Warning_Tone (legID)

Int_Disconnect_ Forward_ Connections

Internal

Int_Apply_ Warning_Tone (pty)

Int_Apply_ Warning_Tone (legID)

Handle_CIR

-

This provokes the MSC to play a tone. See subclause 4.5.2.1.7.

Complete_all_ FCI_record

Int_Release

To all MSC processes associated with this call segment

Stop Tssf

Application_ End

CS_Failure

Idle
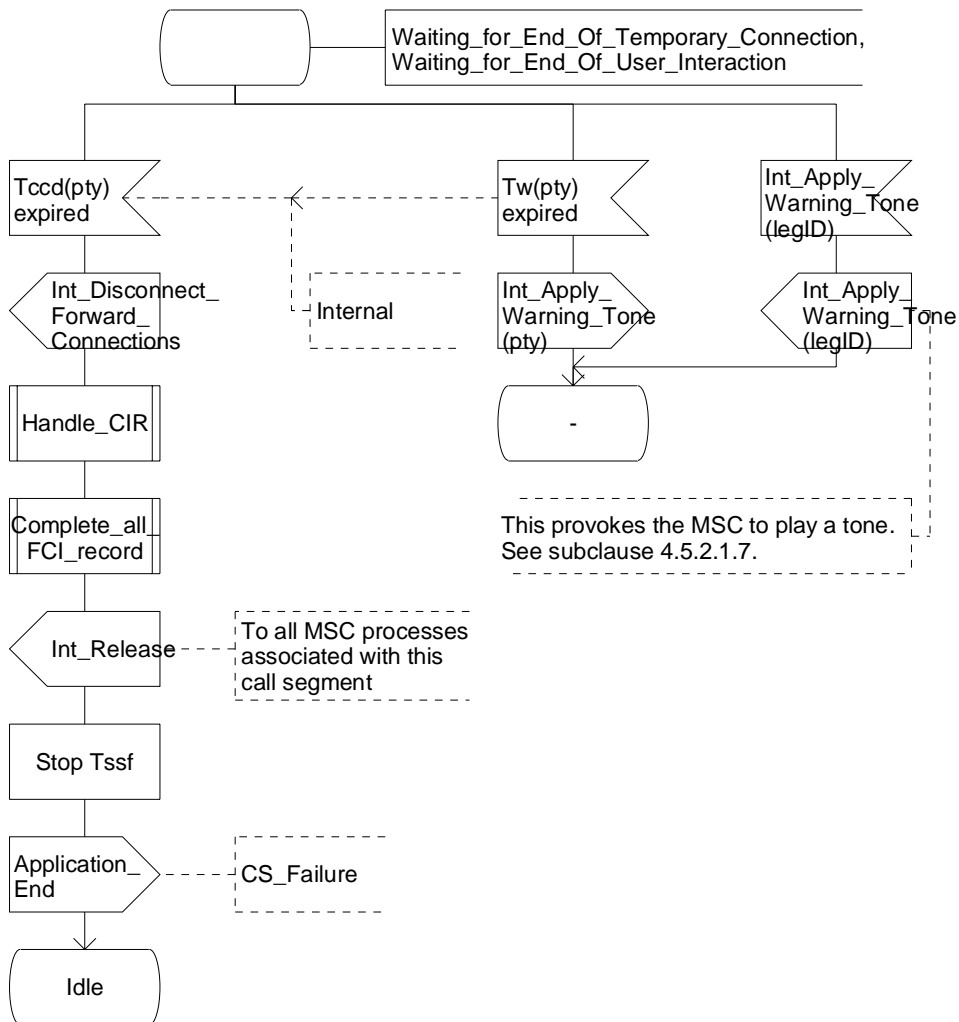
Figure 4.96-51: Process CS_gsmSSF (sheet 51)

Process CS_gsmSSF 52(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */
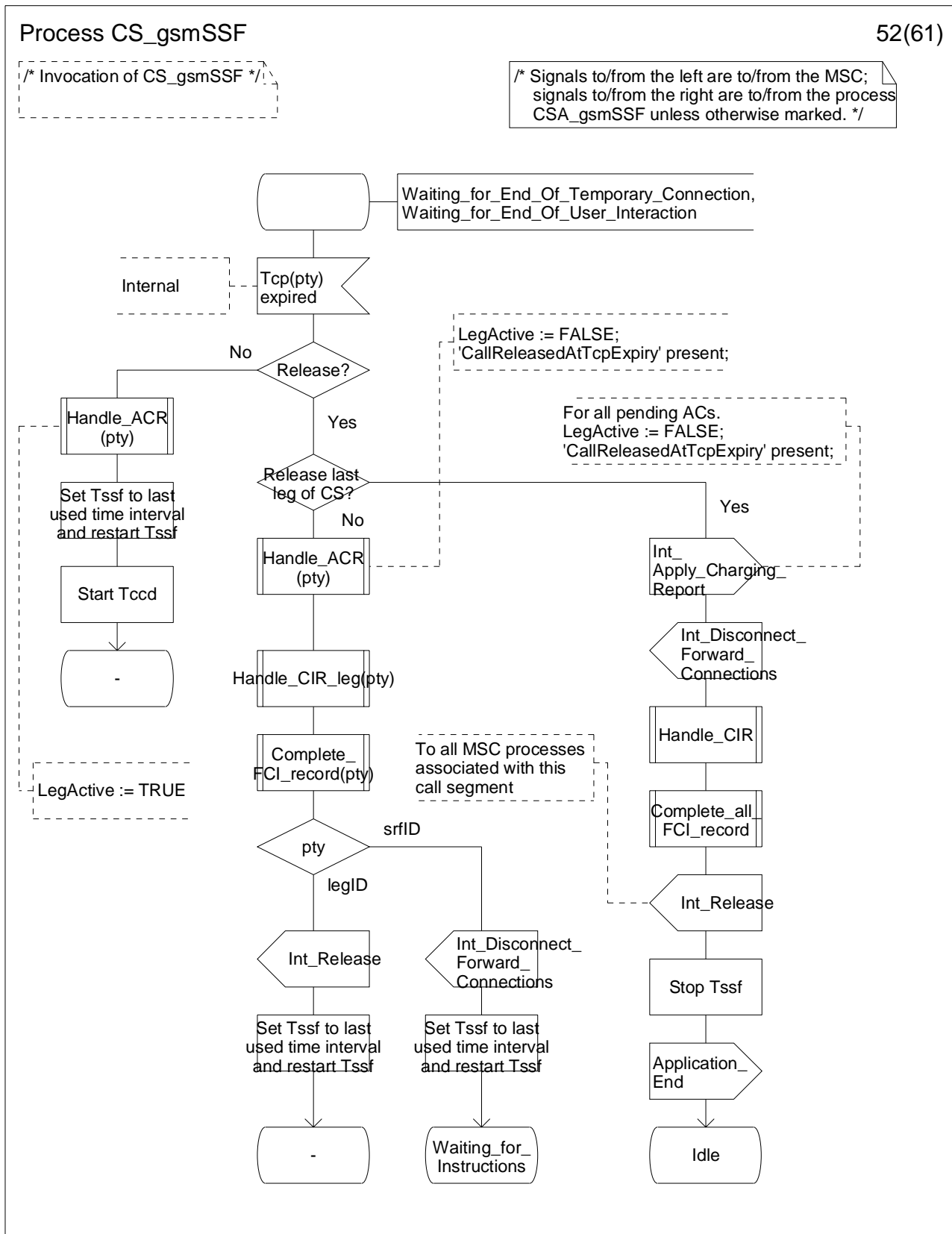
Figure 4.96-52: Process CS_gsmSSF (sheet 52)

Process CS_gsmSSF   53(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_Of_Temporary_Connection,
Waiting_for_End_Of_User_Interaction

Tsw(pty)
expired   Internal

Store curent
value of Tcp(pty)

-
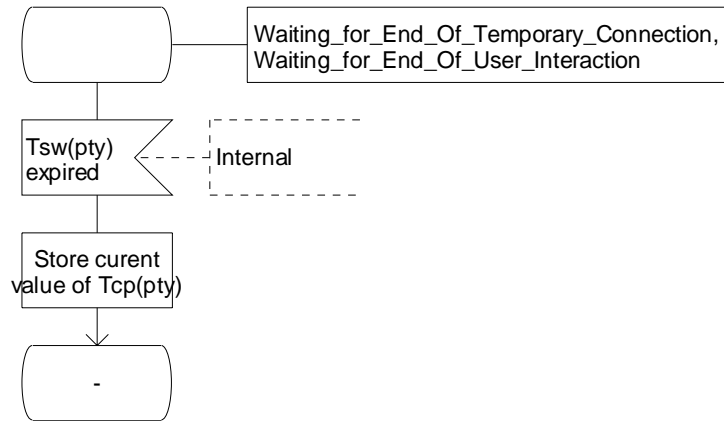
Figure 4.96-53: Process CS_gsmSSF (sheet 53)

Process CS_gsmSSF   54(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Waiting_for_
Instructions
for DS

Int_Connect	Int_Continue	Int_Continue_ _With_ _Argument	Int_ _ReleaseCall
Stop Tssf	Stop Tssf	Stop Tssf	Stop Tssf
Int_Connect	Int_Continue	Int_Continue_ _With_ _Argument	Int_Release Call

Application_
End

Complete_all_
FCI_Records

Idle
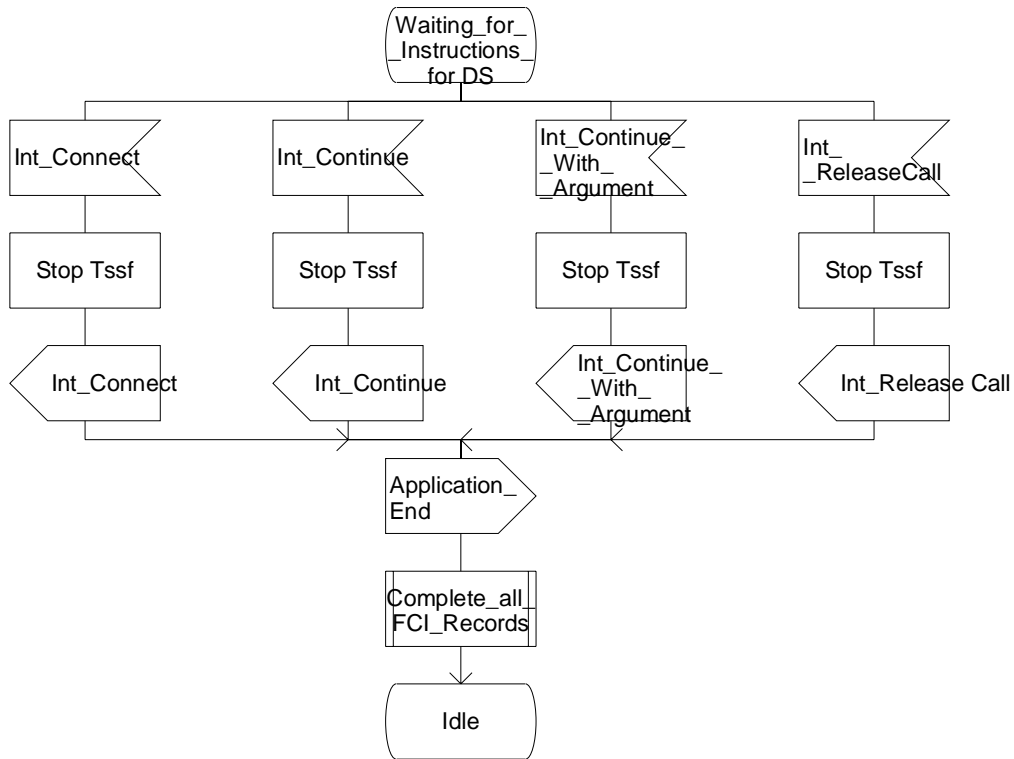
Figure 4.96-54: Process CS_gsmSSF (sheet 54)

Process CS_gsmSSF   55(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_ _Instructions_ for DS

Int_ConnectTo Resource

Stop Tssf

Connect_To_ Resource

result — fail

pass

Set Tssf to user interaction timer value and restart Tssf

Waiting_For _End_Of_ User_Interaction_For_DS

Set Tssf to last used time interval and restart Tssf

Return appropriate error to the CSA_gsmSSF

Waiting_For_ Instructions_For_DS

Int_Establish Temporary Connection

Stop Tssf

Int_Establish Temporary Connection

Await_Temporary_ Connection_ Establishment_DS

Int_Temporary_ Connection_ Established

Int_ETC_Failed

Set Tssf to user interaction timer value and restart Tssf

Error ETC failed

Waiting_For_ _End_Of_ Temporary_ Connection_For_DS

Set Tssf to last used time interval and restart Tssf

Waiting_For_ Instructions_For_DS

Figure 4.96-55: Process CS_gsmSSF (sheet 55)

Process CS_gsmSSF   56(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
   signals to/from the right are to/from the process
   CSA_gsmSSF unless otherwise marked. */

Waiting_for_
Instructions
For DS

Internal - - - - - Timer expiry
Tssf

Int_DP_O_
Abandon

Abort

Stop Tssf

Int_Error

Complete_all_
FCI_records

Complete_all_
FCI_records

Application_
End

Idle
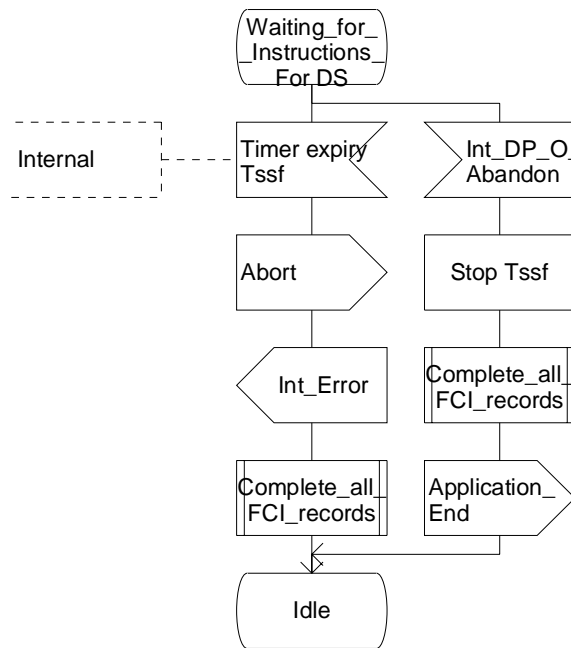
Figure 4.96-56: Process CS_gsmSSF (sheet 56)

Process CS_gsmSSF 57(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_ _Of_User_ _Interaction_For_DS

Int_Disconnect_ ForwardConnection

Int_SRF_ _Released

Int_Play_ _Announcement

Int_Prompt_& _Collect_User_ _Information

Int_Cancel _(Invoke_ID)

Int_Reset_ _Timer

Int_Disconnect_ Forward_Connection

Relay the operation to the SRF

to SRF

SRF_Release_ Pending_DS_2

Set Tssf to last used time interval and restart Tssf

Set Tssf to Int_Reset_Timer time interval and restart Tssf

Int_SRF_ _Released

Waiting_for_End_ _Of_User_ _Interaction_For_DS

Set Tssf to default non user interaction time interval and restart Tssf

Waiting_For_ _Instructions_For_DS

Figure 4.96-57: Process CS_gsmSSF (sheet 57)
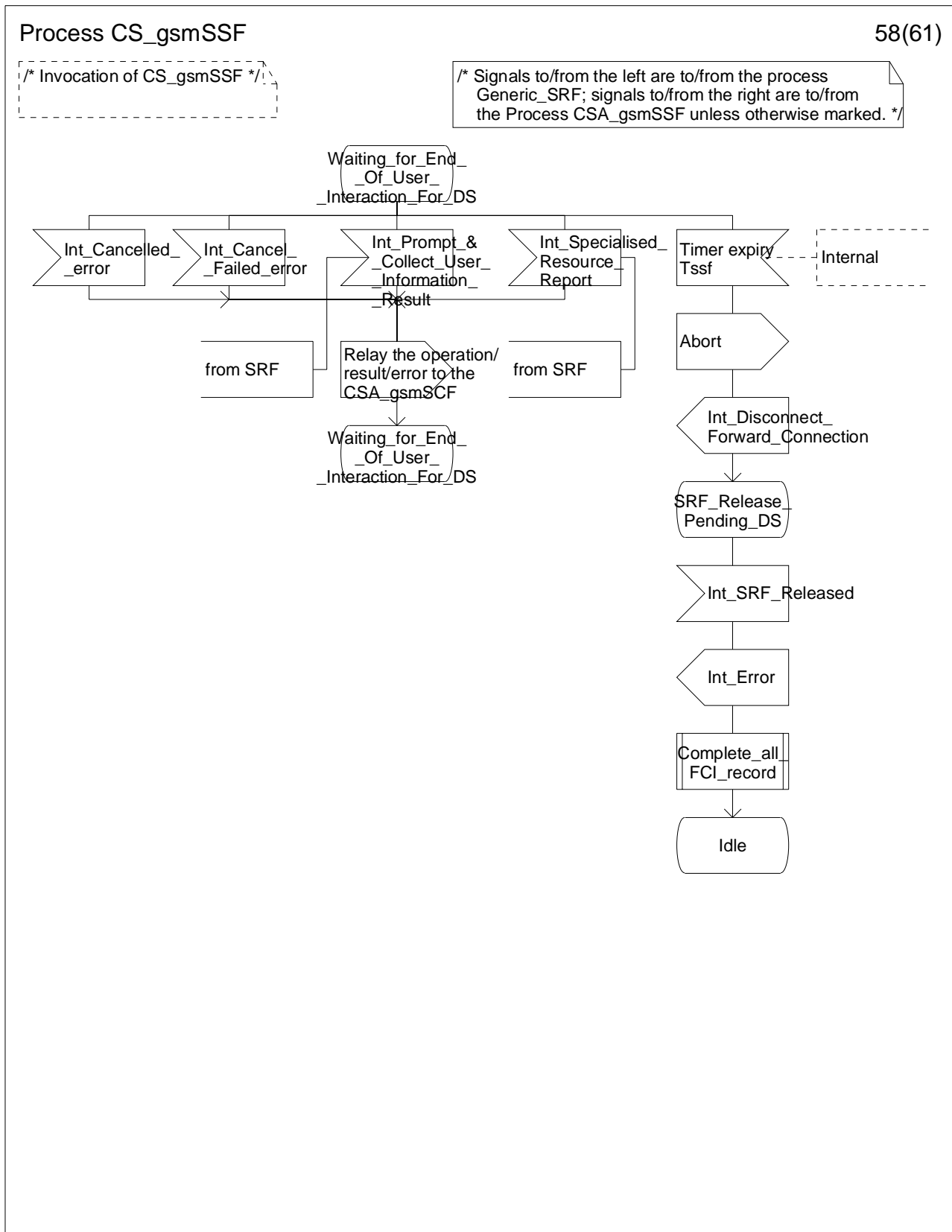
Figure 4.96-58: Process CS_gsmSSF (sheet 58)

Process CS_gsmSSF 59(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_ _Of_Temporary_ Connection_For_DS

Int_TC_Released

Int_Disconnect_ ForwardConnection

Int_Reset_ _Timer

Tssf expired - - - Internal

Int_Disconnect_ Forward_ Connection

Set Tssf to Int_Reset_Timer time interval and restart Tssf

Abort

TC_Release_ Pending_DS_2

Int_Disconnect_ Forward_Connection

Int_TC_Released

-

TC_Release_ Pending_DS

Set Tssf to default non-user interaction Tssf timer value and restart Tssf

Int_TC_Released

Waiting_For_ _Instructions_For_DS

Int_Error

Complete_all FCI_record

Idle
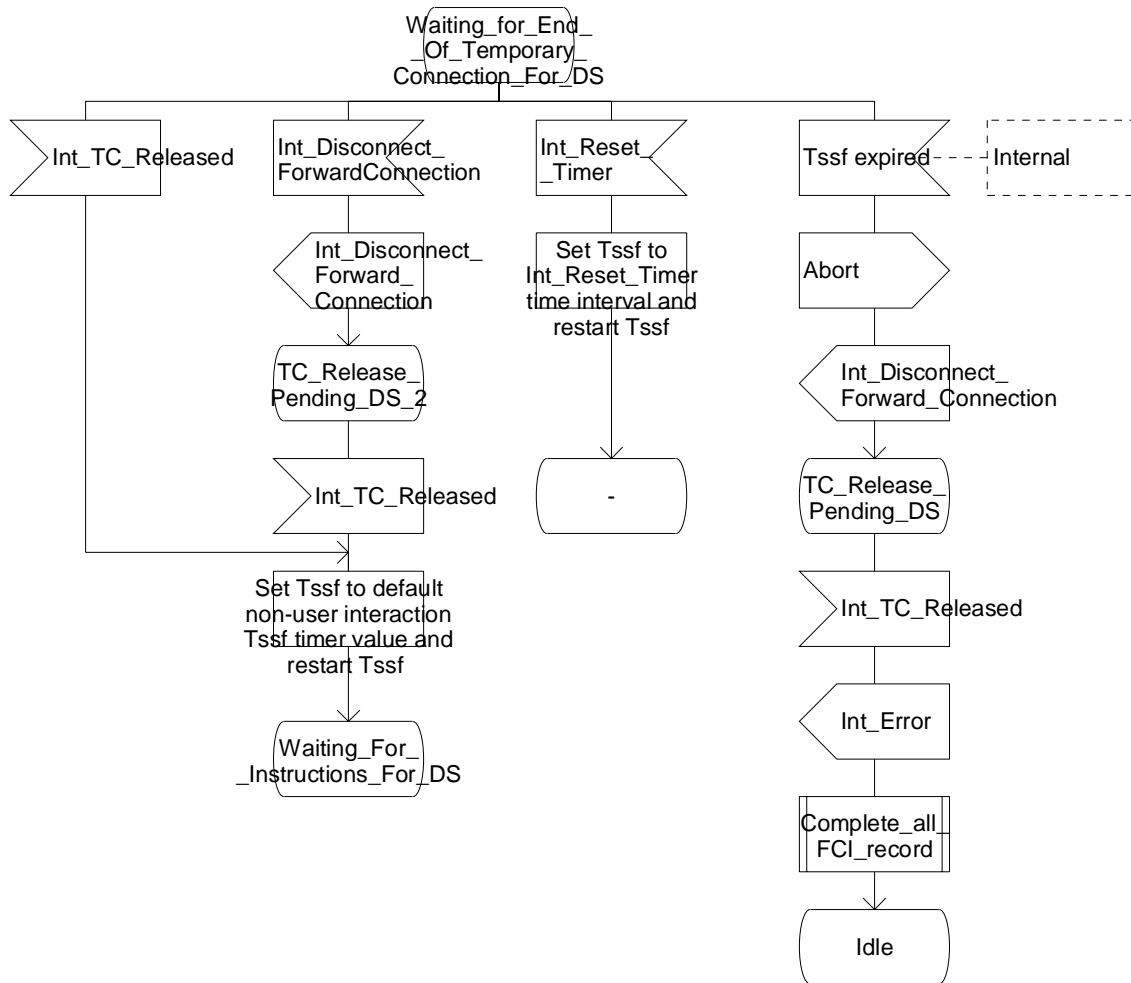
Figure 4.96-59: Process CS_gsmSSF (sheet 59)

Process CS_gsmSSF 60(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are to/from the process
CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_Of_Temporary_Connection_For_DS,
Waiting_for_End_Of_User_Interaction_For_DS

Int_DP_O_
_Abandon

Stop Tssf

Complete_all_
FCI_records

Application_
End

Idle
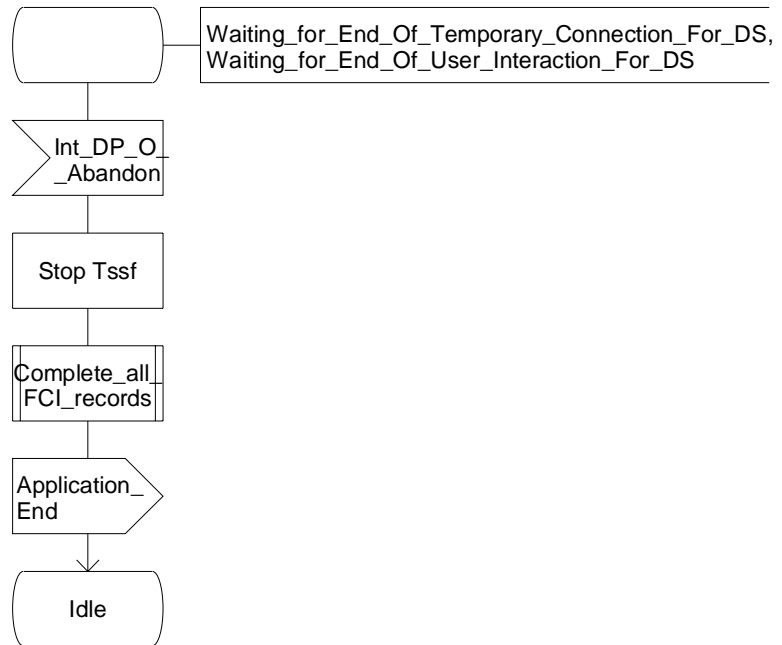
Figure 4.96-60: Process CS_gsmSSF (sheet 60)

Process CS_gsmSSF 61(61)

/* Invocation of CS_gsmSSF */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the process CSA_gsmSSF unless otherwise marked. */

Waiting_for_End_Of_Temporary_Connection,
Waiting_for_End_Of_User_Interaction,
SRF_release pending,
Await_Temporary_Connection_Establishment

Int_Request_ML

Int_Request_SL

Int_Request_DL

Int_Error_Not_Allowed_Due_To User_Interaction

-

Monitoring,
Wait_For_Request,
Waiting _For_Instructions

Int_Request_ML

Int_Request_SL

Int_Request_DL

Int_Allowed_No_User_Interaction

-
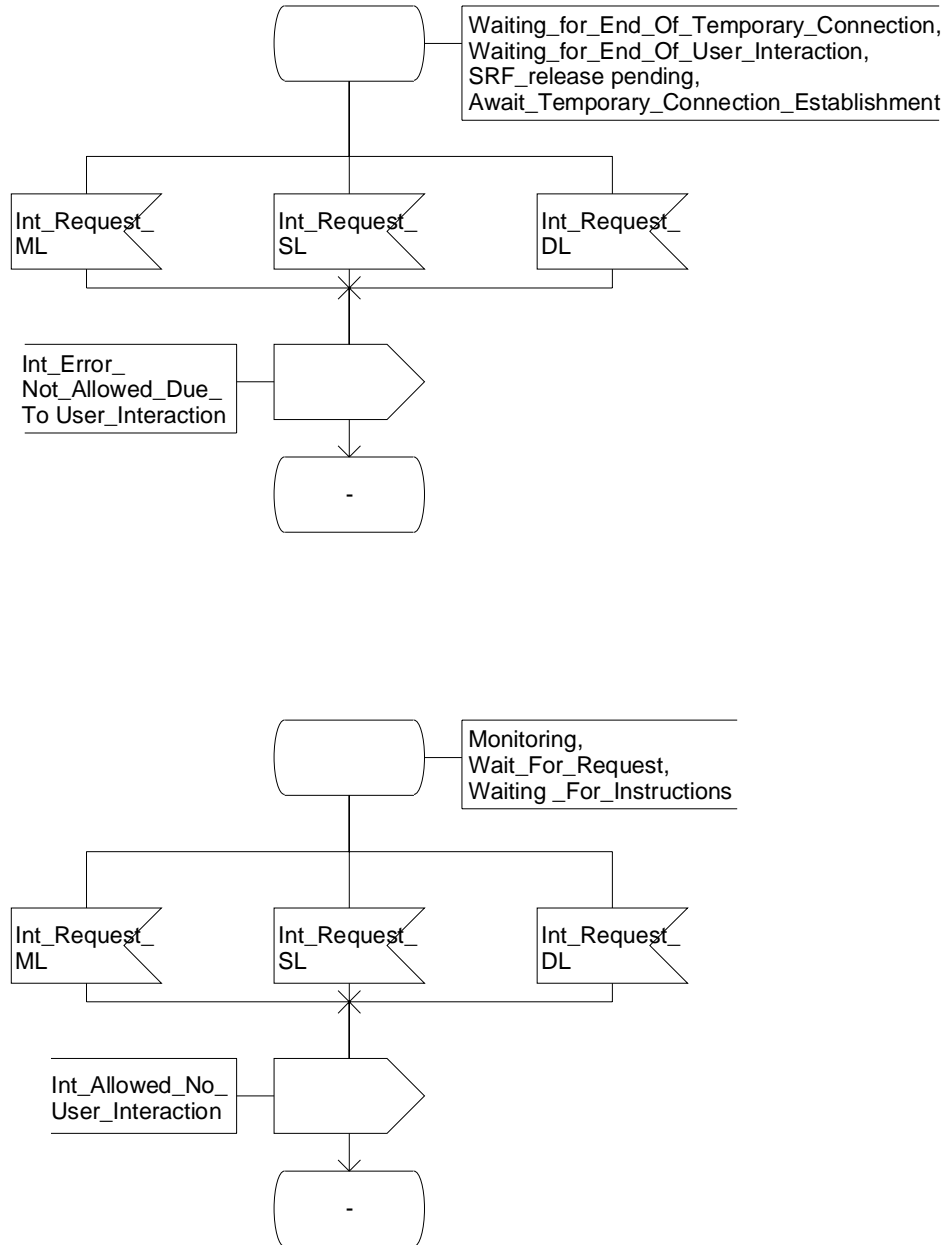
Figure 4.96-61: Process CS_gsmSSF (sheet 61)

Figure 4.97-1: Procedure Check_Criteria_Collected_Info (sheet 1)

Procedure Check_Criteria_Analysed_Info 1(1)

/* Procedure to check
the criteria in the gsmSSF */

Called number matches
string defined in criterion?

Yes

No

All criteria met
DP in the list
checked?

No

Yes

Result:=
pass

Result:=
fail
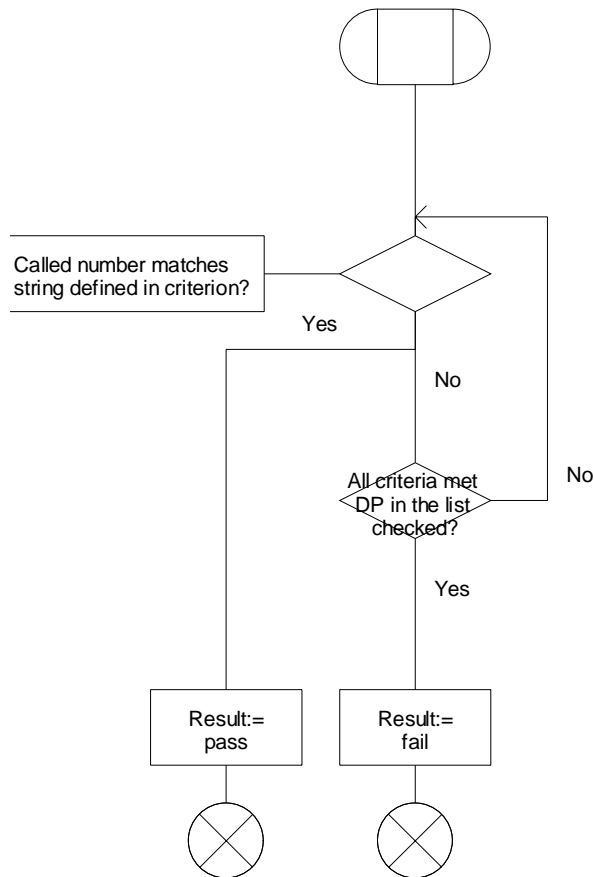
Figure 4.98-1: Procedure Check_Criteria_Analysed_Info (sheet 1)

Procedure Check_Criteria_Unsuccessful   1(1)

/* Procedure to check
the criteria in the gsmSSF */

Int_DP_Route_Select_Failure,
Int_DP_T_Busy,
Int_DP_T_No_Answer

Indicated
DP armed?   No

Yes

Release Cause
criterion exists?   Yes

No

Release Cause matches
value defined in
criterion?   No

Yes

Result:=
pass

Result:=
pass

Result:=
fail
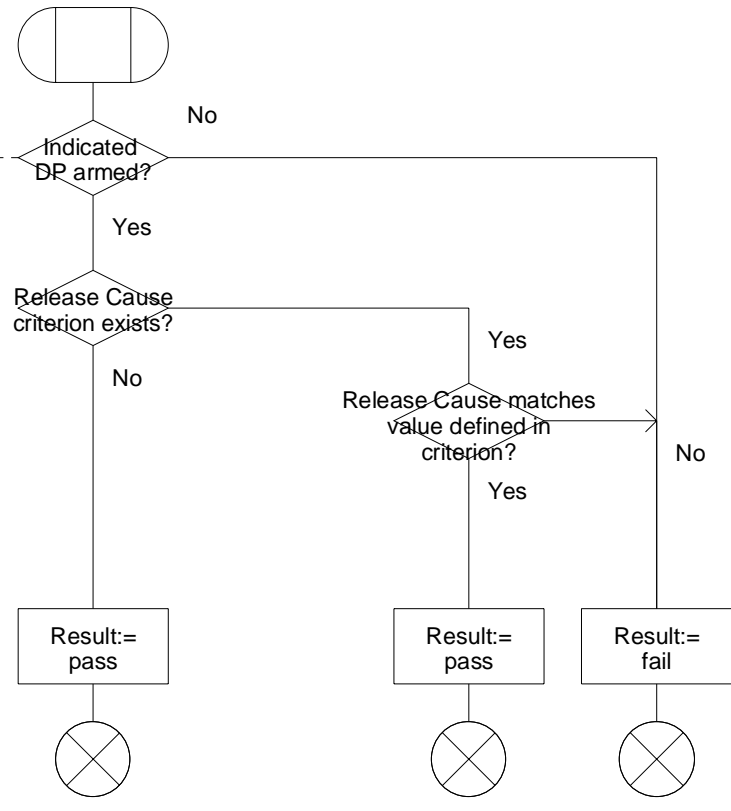
Figure 4.99-1: Procedure Check_Criteria_Unsuccessful (sheet 1)

Procedure Connect_To_Resource 1(1)

This procedure is called, when the ConnectToResource request is received.

/* Signals to/from the left are to from the Call Control Function in the MSC. */

Int_Connect_ To_Resource

Await_Resource_ Connection

Int_SRF Connected

Int_CTR_Failed

result:= pass

result:= fail
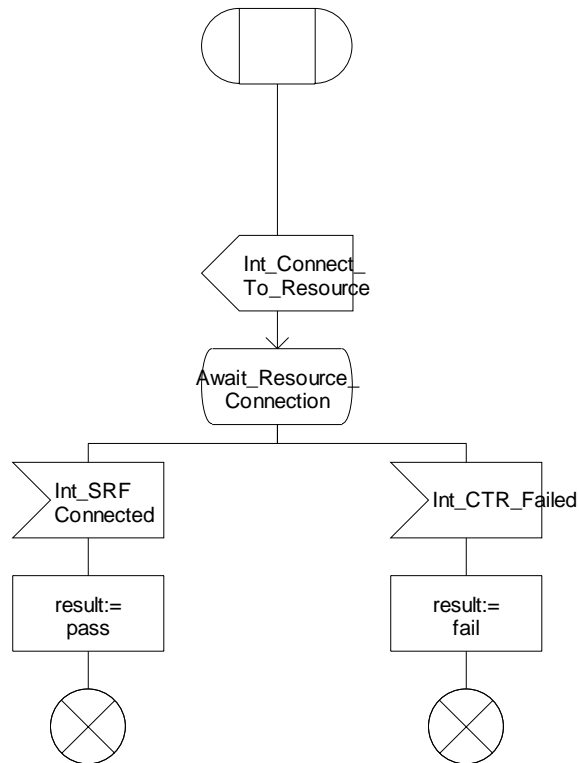
Figure 4.100-1: Procedure Connect_To_Resource (sheet 1)

Procedure Handle_AC 1(1)

/* This procedure shows the handling in
the gsmSSF for the operation CAP
Apply Charging. */
FPAR IN pty LegID_or_srfID

Yes — Tccd(pty) running

Stop Tccd(pty)

No

True — AC(pty) pending?

False

Tariff switch provided?

No

Yes

Start Tsw(pty)

Answer received?

No

Yes

Stop delta(pty) measurement

Tcp(pty):= Tcp(pty)-delta(pty)

No — Tone to be played?

Yes

Tw(pty):=0

Tw(pty):= Tcp-Warning time

1

1

Answer received?

No

Yes

Start Tcp(pty)

Tw(pty)>0

No

Yes

Start Tw(pty)

AC(pty) pending:= true
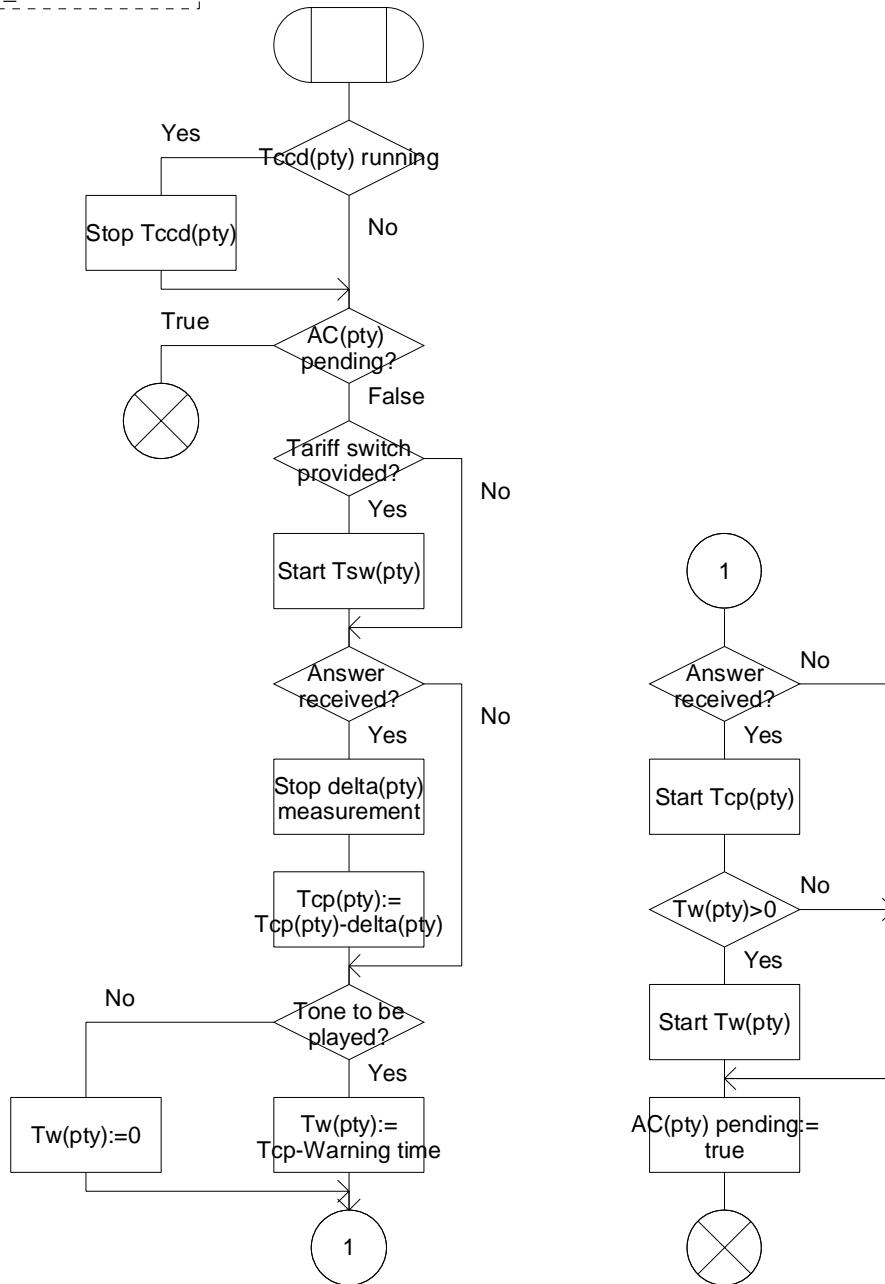
Figure 4.101-1: Procedure Handle_AC (sheet 1)

Procedure Handle_ACR   1(1)

/*This procedure is only called at the
end of connection to an outgoing leg,
a temporary connection or a connection
to a SRF when the call can be continued*/
FPAR IN pty LegID_or_srfID

/* Signals to/from the right are to/from
the Process CSA_gsmSSF. */

Tsw (pty) running? —— No

Yes

If running ---- Stop Tsw(pty)

Stop Tccd(pty)

If running ---- Stop Delta(pty)

AC(pty) pending= true? —— No ⊗

Yes

If running ---- Stop Tcp(pty)

If running ---- Stop Tw(pty)

LegActive? —— FALSE

TRUE

Start Delta(pty)

Int_
Apply_Charging_
Report

Value of LegActive in ACR is
defined in the calling process
(process 'gsmSSF').

AC (pty) pending:=
false

⊗
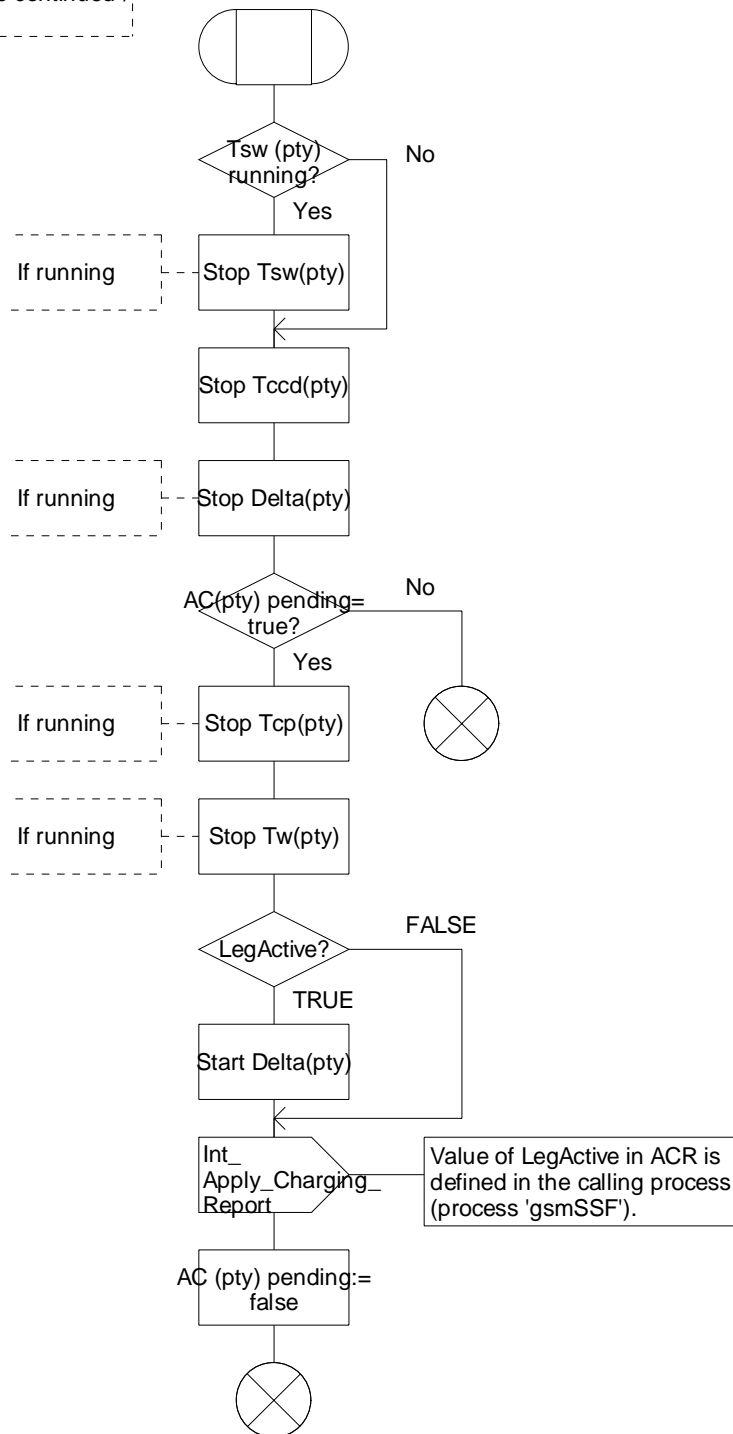
Figure 4.102-1: Procedure Handle_ACR (sheet 1)

Procedure Handle_CIR   1(1)

/* Procedure in the gsmSSF to
handle Call Information Report. */

legID := 1

1

legID in
this CS?   No

Yes

Handle_CIR_
leg (leg<legID>)

No   leg > legID
in this CS?

Yes

legID :=
legID + 1

⊗   1
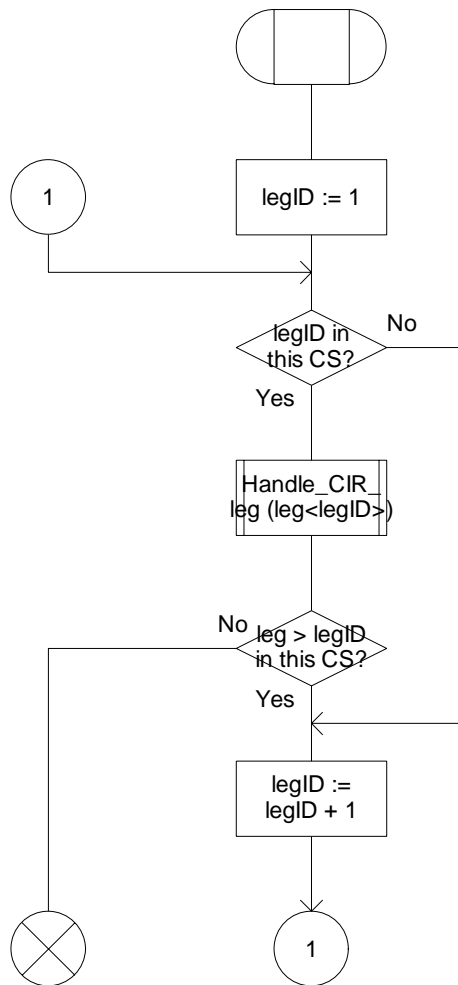
Figure 4.103-1: Procedure Handle_CIR (sheet 1)

Procedure Handle_CIR_leg 1(1)

/* Procedure in the gsmSSF to
handle Call Information Report
for the specified leg. */
;FPAR IN LegID LegType;

/* Signals to/from the right are to/from
the Process CSA_gsmSCF. */

Outsanding Call
Information Report>0?   No

Yes

Call Information
Report pending for   No
this leg ID?

Yes

Outsanding Call Information Report:=
Outsanding Call Information Report -1

Int_Call_
Information_
Report
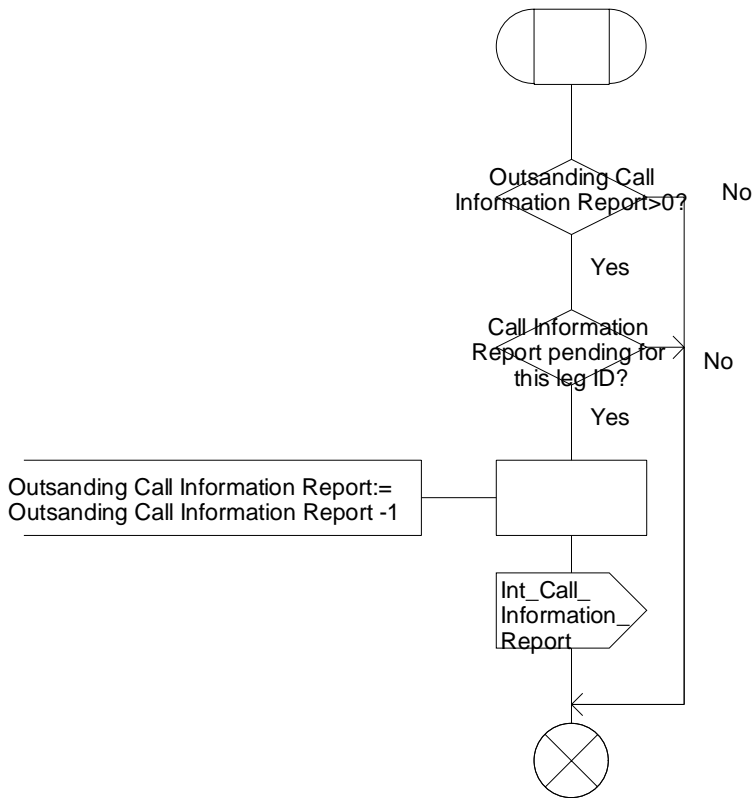
Figure 4.104-1: Procedure Handle_CIR_leg (sheet 1)

Procedure Complete_FCI_record   1(1)

/* Procedure in the gsmSSF to
write Furnish Charging Information
data to CDR for the specified LegID. */
;FPAR IN LegID LegType;

Non-completed Logical
CAMEL call record
exists for this LegID?

No   Yes

complete CAMEL
logical call record
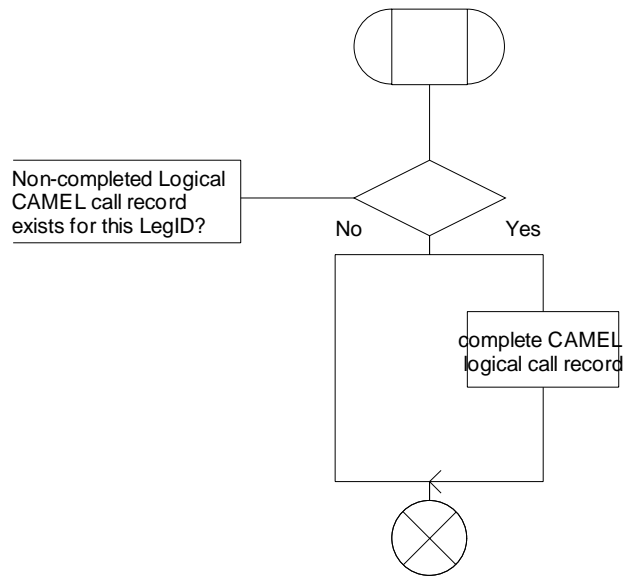
Figure 4.105-1: Procedure Complete_FCI_record (sheet 1)

Procedure Complete_all_FCI_records   1(1)

/* Procedure in the gsmSSF to
write Furnish Charging Information
data to CDR for all LegIDs in this CS. */

legID := 1

1

legID in this CS?   No

Yes

Complete_
FCI_record
(leg<legID>)

No   leg > legID
in this CS?

Yes

legID :=
legID + 1

⊗   1
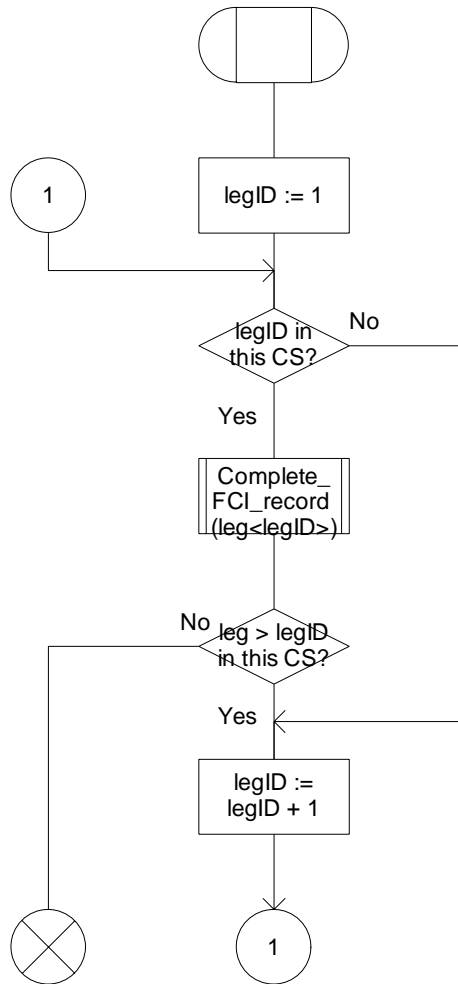
Figure 4.106-1: Procedure Complete_all_FCI_records (sheet 1)

Procedure Handle_O_Answer   1(1)

/* Procedure in the gsmSSF
to handle notification of
originating answer from the MSC */
FPAR IN legId LegType

False ─── AC(legID) pending

True

Start Tcp(legID)

Tw(legID)>0?

Yes

Start Tw(legID)

'Set Destination
address=stored
Destination
address'

Set indicators=
stored indicators

⊗
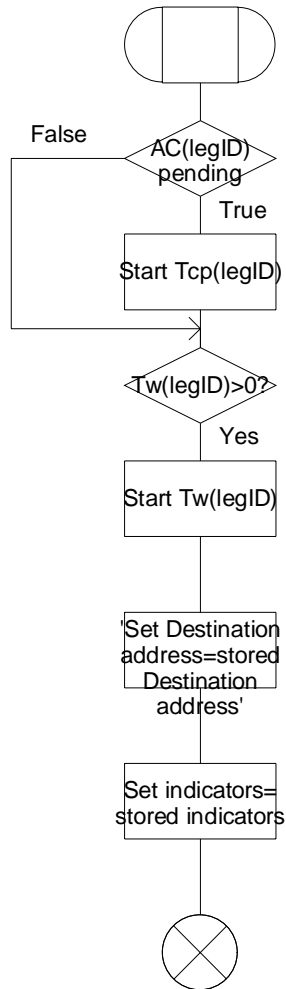
Figure 4.107-1: Procedure Handle_O_Answer (sheet 1)

Procedure Handle_T_Answer 1(1)

/* Procedure in the gsmSSF
to handle notification of
terminating answer from the MSC */
FPAR IN legId LegType

/* Signals to/from the left are
to/from the MSC. */

False ◇ AC(legID)
pending

True

Start Tcp(legID)

No ◇ Tw(legID)>0

Yes

Start Tw(legID)

Set Destination
address=stored
Destination
address

Set indicators=
stored indicators

⊗
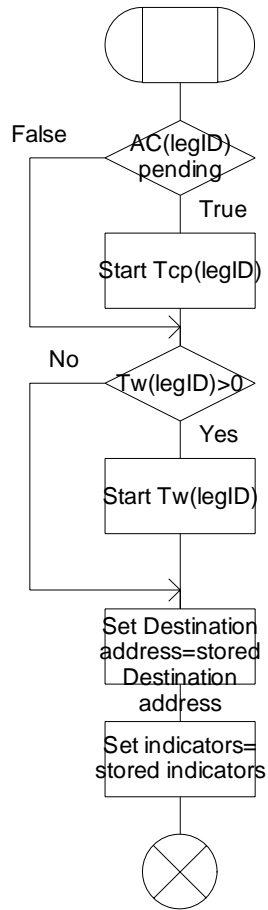
Figure 4.108-1: Procedure Handle_T_Answer (sheet 1)

ETSI

Procedure UpdateSignalling 1(1)

/* This procedure updates the signalling
status of the incoming leg (Leg 1), if available
to be at least in the status of any other
outgoing leg in this CS.
This procedure is called after the
successful move of a leg or on receipt
of an Alerting or Active DP.*/

/* Signals to the left are to the MSC process
which handles Leg 1. */

Leg status:
set-up: Initial Address sent (ISUP) or Setup send and Call confirmed received (access).
alerting: Address Complete or Alerting sent or received on this leg
active: Answer, Connect (ISUP) or Connect (access) sent or received
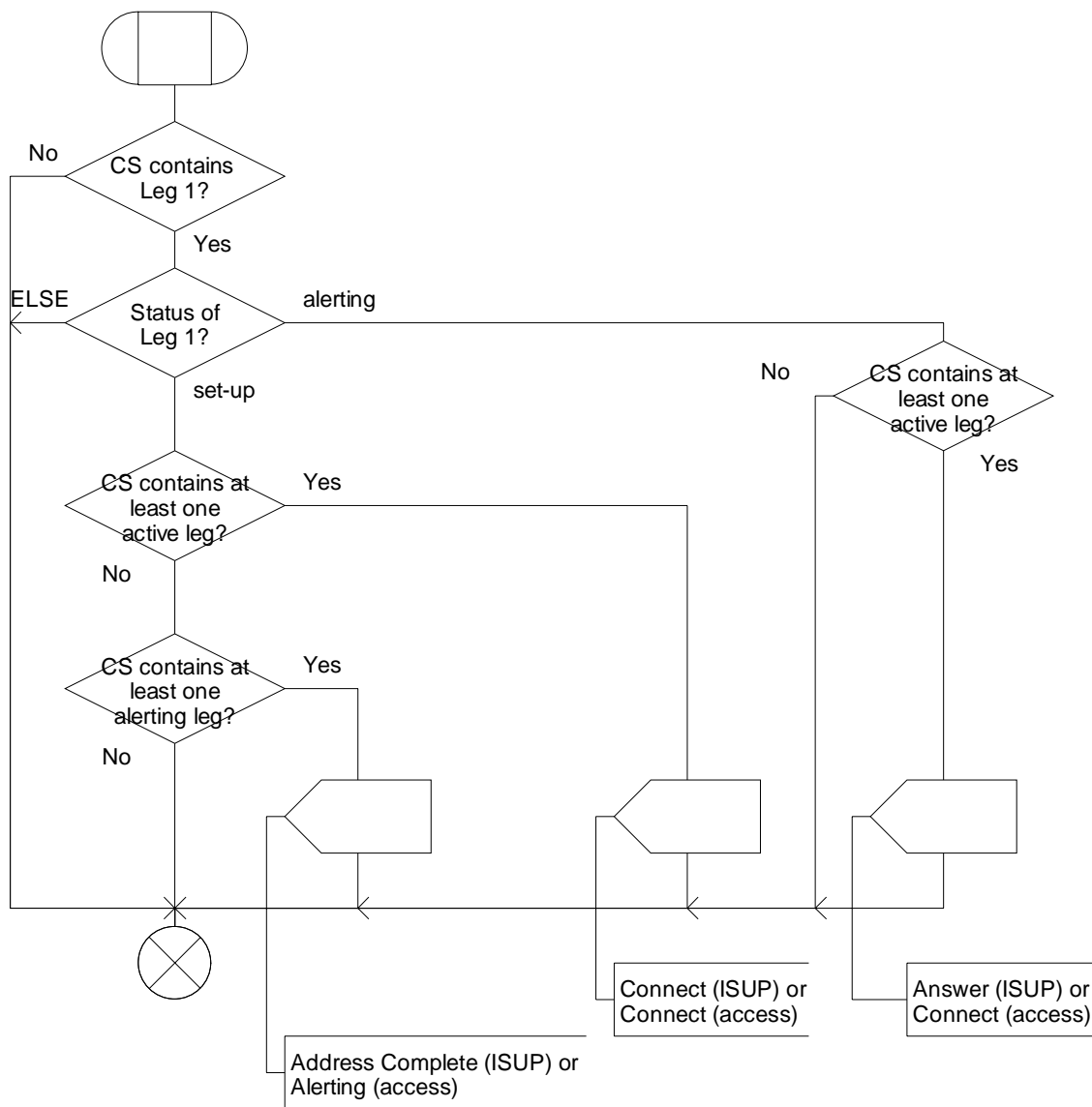
Figure 4.109-1: Procedure UpdateSignalling (sheet 1)

4.5.7.6 Process gsmSSF_SSME_FSM and procedures

One process is instantiated for each Call Gap information flow received from a gsmSCF.
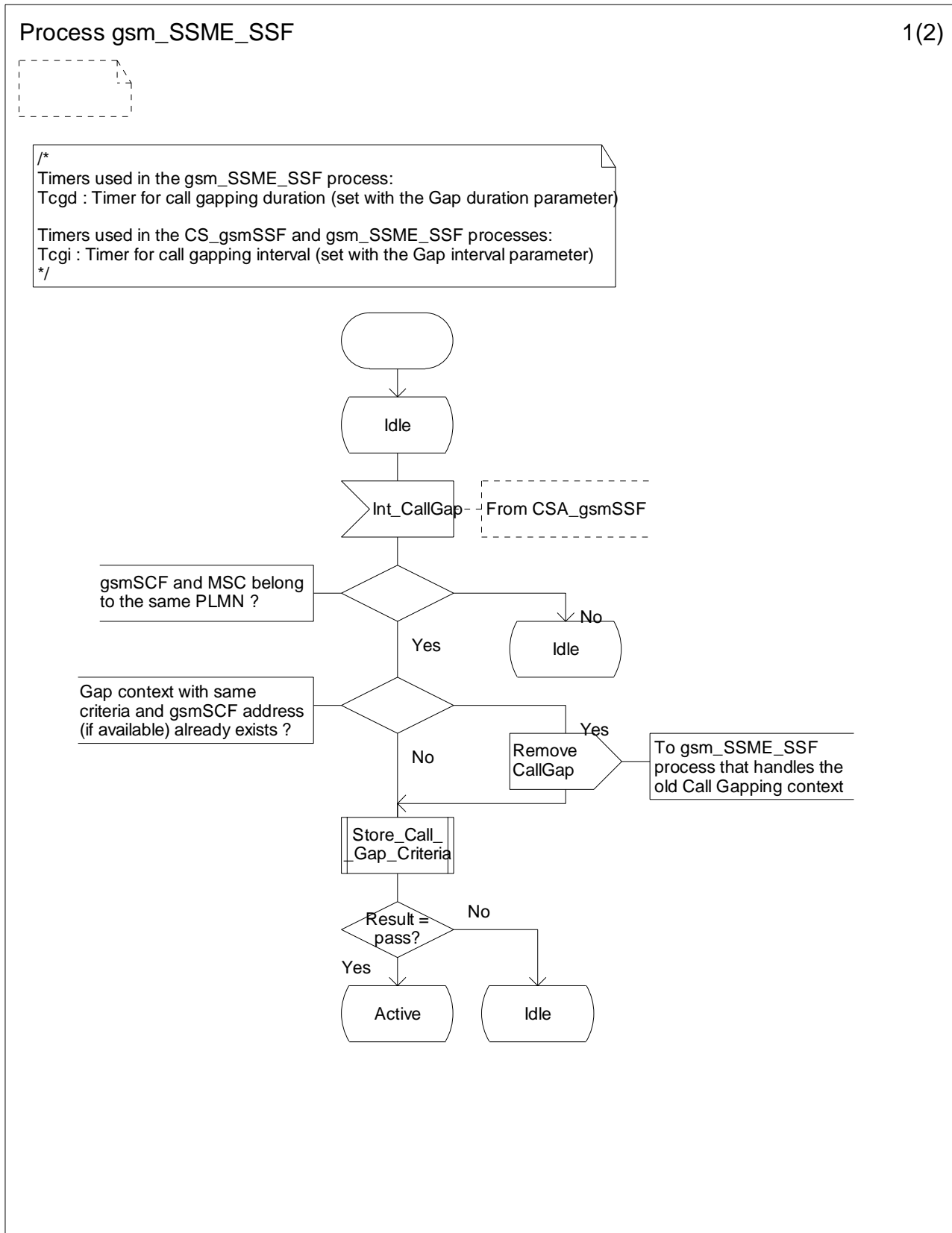
Figure 4.110-1: Process gsm_SSME_SSF (sheet 1)

Process gsm_SSME_SSF   2(2)

```
+- - - -+
|       |
+- - - -+

   Internal           Active        From CS_gsmSSF        Internal

  Tcgi              Trigger          Tcgd               Remove
  expiry            Tcgi             expiry             CallGap

  CG Reject :=      Start Tcgi       Clear Call Gapping
  False                              Context (i.e. remove
                                     timers and criteria)

                    CG Reject :=
                    True                Idle

       Active
```

NOTE: The timer Tcgi is started for the
first time after the first call encountering
the call gapping criteria is met.
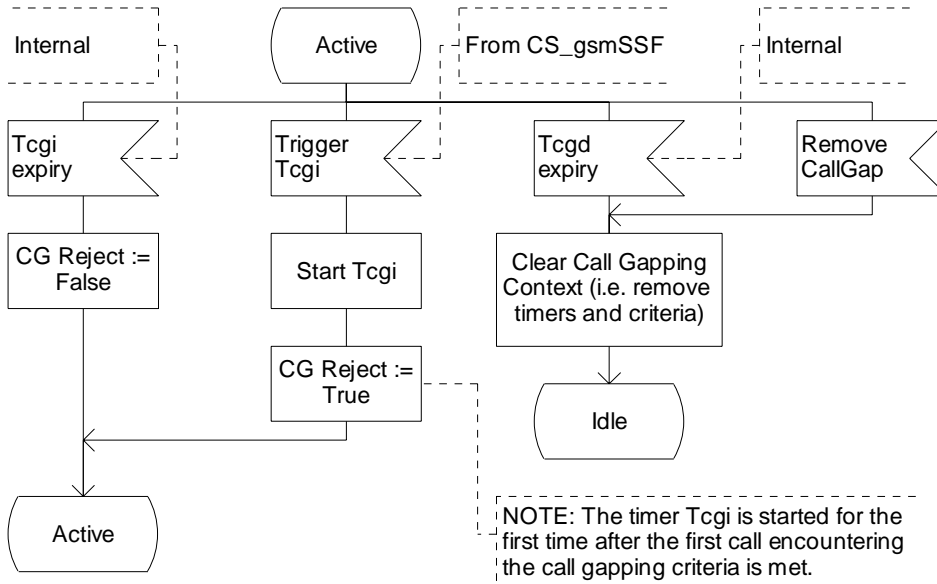
Figure 4.110-2: Process gsm_SSME_SSF (sheet 2)

Procedure Store_Call_Gap_Criteria 1(1)

/* Store parameters received in the CallGap operation */

CG Duration value — See subclause 4.6.2. for the exact use of this parameter

0 -2 else

Set Tcgd with network specific value | Set Tcgd with received value

Start Tcgd

CG Interval value — See subclause 4.6.2. for the exact use of this parameter

0 1 else

CG Int := false
CG Reject := false

CG Int := false
CG Reject := true

CG Int := true
CG Reject := false

Set Tcgi with received value

store Gap Criteria, gsmSCF address (if present) and Gap Treatment

Result := Fail

Result := Pass

NOTE: CG Int and CG Reject internal variables are initiated with False value.

Figure 4.111-1: Procedure Store_Gap_Criteria (sheet 1)

ETSI

Procedure Check_Gap_Criteria   1(1)

/* Check if the Call Gap is applicable. */

/* Signals to the right are to the gsm_SSME_SSF. */

One Call Gapping context active? — No

Yes

V/IPLMN is the subscriber's HPLMN? — No

Yes

gsmSCF address of the CSI is the same as the gsmSCF address stored along the Gap Criteria? (note) — No

Yes

Call parameters match with Call Gap criteria? — No

Yes

CG Reject = True ? — No

Yes

CG Int = true? — No

Yes

Trigger Tcgi
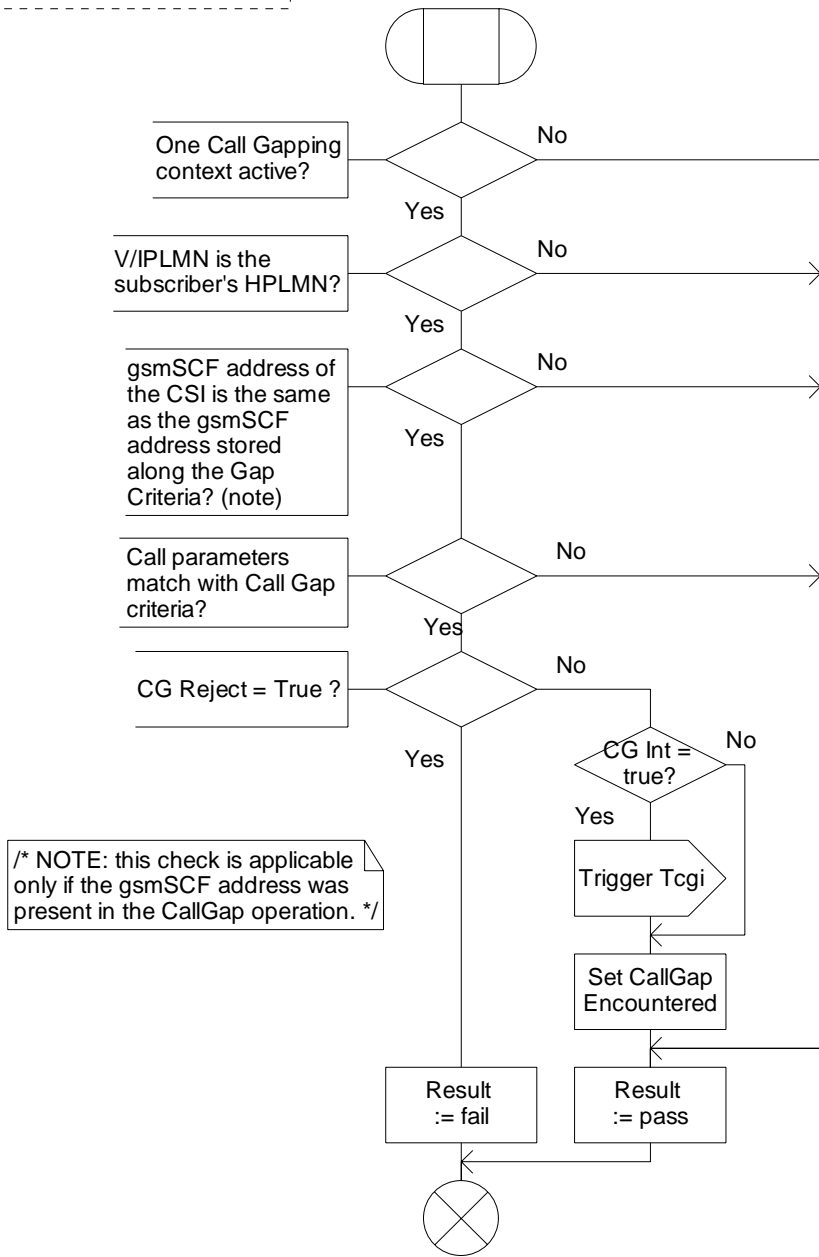
/* NOTE: this check is applicable only if the gsmSCF address was present in the CallGap operation. */

Set CallGap Encountered

Result := fail

Result := pass

Figure 4.112-1: Procedure Check_Gap_Criteria (sheet 1)

4.5.7.7 Process CSA_gsmSSF and procedures

The call gap information flow can only be received for an opened transaction between the CSA_gsmSSF and the gsmSCF.

Process CSA_gsmSSF   1(23)

/* A process in the gsmSSF to
co-ordinate the Call Segments
for a call. */

/* Signals to/from the left are to/from
one or more instances of the process
CS_gsmSSF; signals to/from the right
are to/from the gsmSCF. */

/* TASK definition:
The Application_Begin signal opens a new relationship with the gsmSCF.
The Application_End or Abort signal terminates the relationship with the gsmSCF.
*/

/* TASK definition:
The relay of operation and signals implies a "CAP_..." <-> "Int_..." conversion.
"CAP_..." operations are used between the CSA_gsmSSF process and the gsmSCF.
"Int_..." signals are used between the CSA_gsmSSF process and the CS_gsmSSF process.
*/
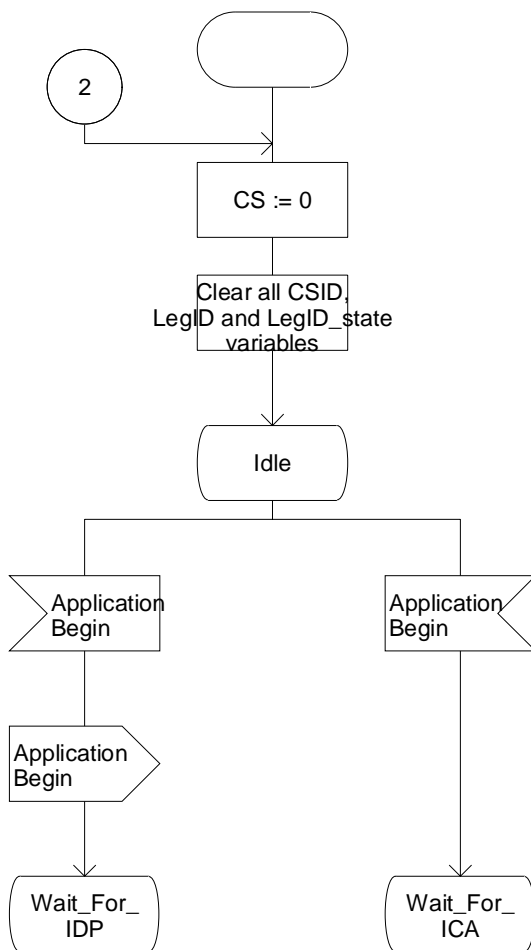
Figure 4.113-1: Process CSA_gsmSSF (sheet 1)

Process CSA_gsmSSF   2(23)

/* A process in the gsmSSF to
co-ordinate the Call Segments
for a call. */

/* Signals to/from the left are to/from
one or more instances of the process
CS_gsmSSF; signals to/from the right
are to/from the gsmSCF. */

Wait_For_
IDP

Int_Initial_
DP

Move_Leg_Allowed
:= False

Assign LegID1
to originating
party

LegID1_state
:= Set-up

Assign LegID2
to terminating
party

LegID2_state
:= Set-up

Add LegID1
and LegID2
to CSID1

CS := 1

CAP_InitalDP

One_CS

Wait_For_
ICA

CAP_Initiate_
Call_Attempt

Move_Leg_Allowed
:= True

1
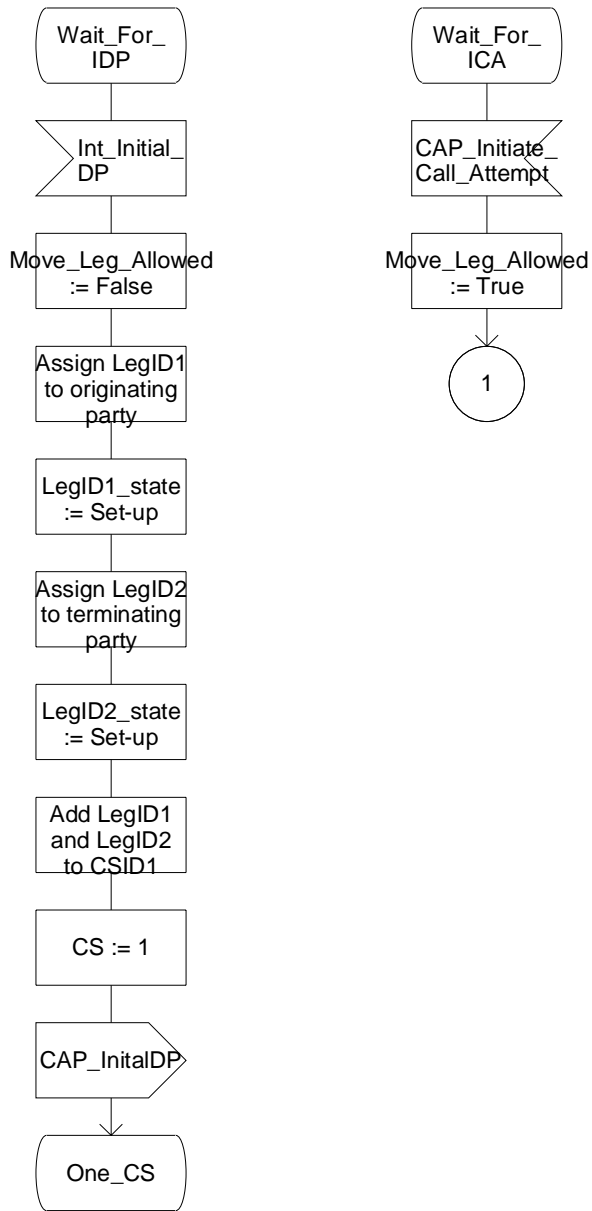
Figure 4.113-2: Process CSA_gsmSSF (sheet 2)

Process CSA_gsmSSF   3(23)

/* A process in the gsmSSF to
co-ordinate the Call Segments
for a call. */

/* Signals to/from the left are to/from
one or more instances of the process
CS_gsmSSF; signals to/from the right
are to/from the gsmSCF. */

One_CS

CAP_Continue

CAP_Disconnect_
Forward_
Connection

-     Relay the
      operation

One_CS
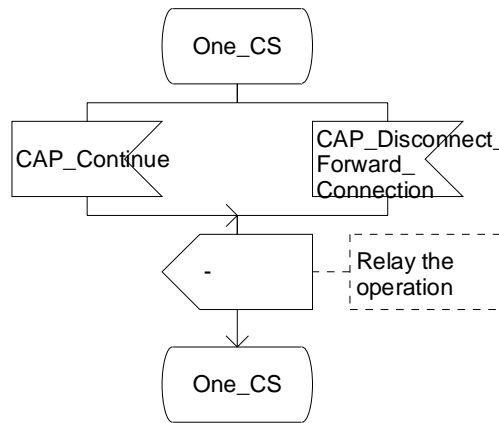
Figure 4.113-3: Process CSA_gsmSSF (sheet 3)

Process CSA_gsmSSF 4(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS

Abort

Application End

Application End

CSID already cleared?

Yes

No

CSID1 exists?

No

Yes

No

Yes

Abort

Application End

One_CS

To current Call Segment

Int_Release_ Call

Idle

2

CSID1 contains more than one leg?
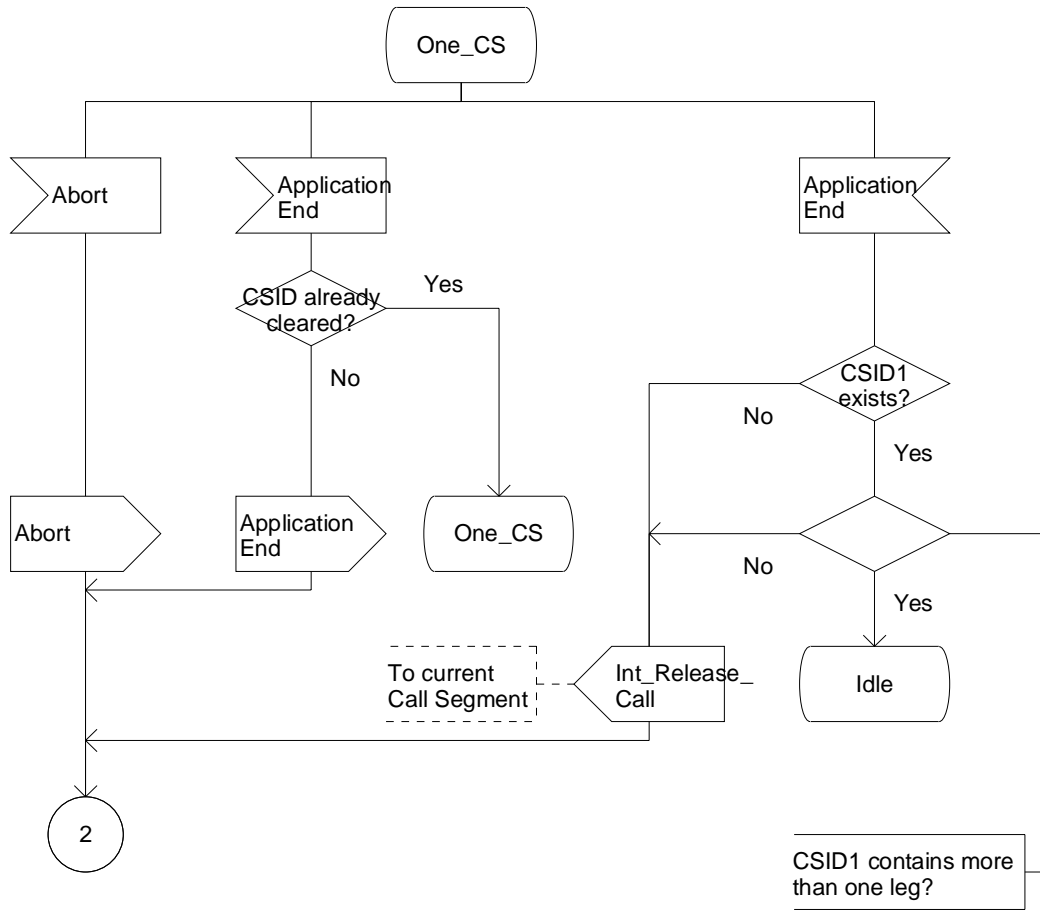
Figure 4.113-4: Process CSA_gsmSSF (sheet 4)

Process CSA_gsmSSF 5(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

CAP_ConnectToResource,
CAP_DisconnectForwardConnectionWithArgument,
CAP_EstablishTemporaryConnection,
CAP_PlayAnnouncement,
CAP_Prompt&CollectUserInformation,
CAP_ResetTimer

CSID valid? — No

Yes

Relay the operation to the Process CS_gsmSSF for the indicated CS ID

-

CAP_Error

-

One_CS, Multiple_CS

CAP_CallInformationRequest,
CAP_FurnishChargingInformation,
CAP_RequestReportBCSMEvent,
CAP_SendChargingInformation

LegID present? — Yes

No

Apply default LegID

Or Party To Charge

LegID valid? — No

Yes

Relay the operation to the Process CS_gsmSSF for the CS containing the indicated LegID

-

CAP_Error

-
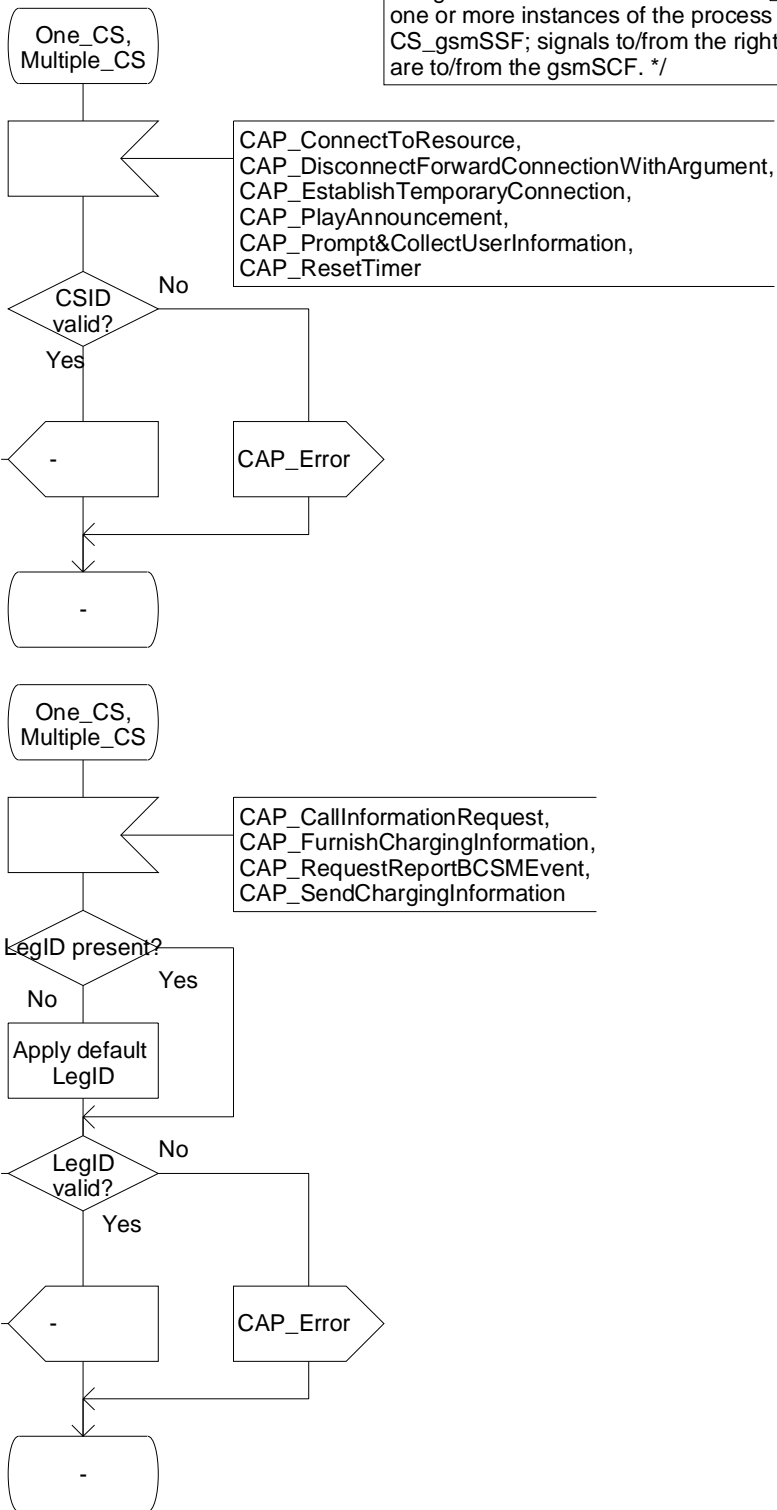
Figure 4.113-5: Process CSA_gsmSSF (sheet 5)

ETSI

Process CSA_gsmSSF 6(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

CAP_Continue_ With_Argument

Operation contains

Is "no LegID" allowed ? /* See subclause 4.6.2.9 Continue With Argument */

Neither LegID nor CSID

LegID

CSID

LegID valid?

No

No

CSID valid?

Yes

No

Yes

Yes

CAP_Continue_ With_Argument

CAP_Error

CAP_Continue_ With_Argument

CAP_Error

CAP_Continue_ With_Argument

-

Relay the operation to the Process CS_gsmSSF for the single CS

Relay the operation to the Process CS_gsmSSF for the CS containing the indicated LegID

Relay the operation to the Process CS_gsmSSF for the indicated CS ID
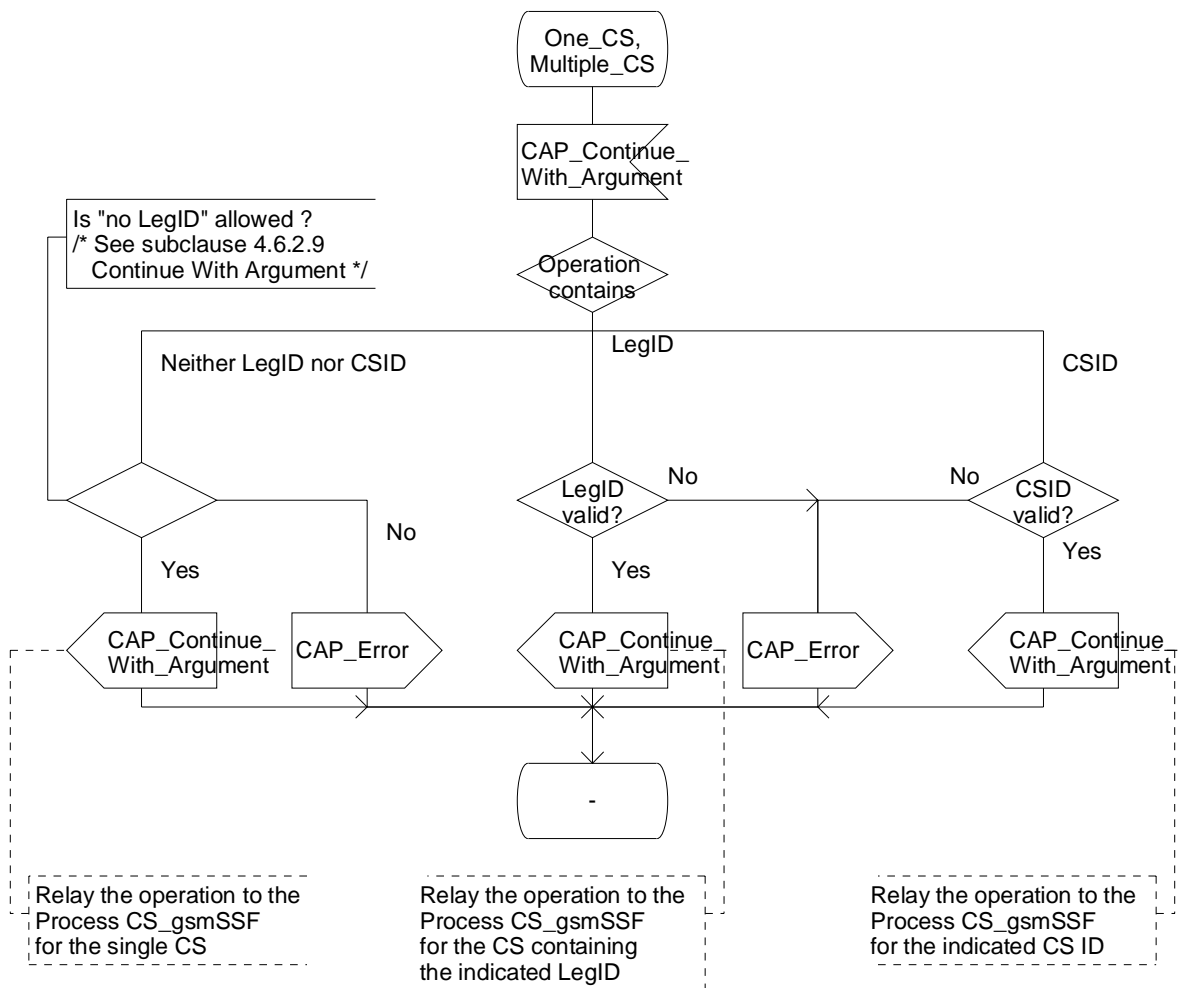
Figure 4.113-6: Process CSA_gsmSSF (sheet 6)

Process CSA_gsmSSF 7(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

CAP_ PlayTone

LegID — Operation contains — CSID

LegID valid? — No ...... No — CSID valid?

Yes ...... Yes

CAP_ PlayTone ...... CAP_Error ...... CAP_ PlayTone

Relay the operation to the Process CS_gsmSSF for the CS containing the indicated LegID

-

Relay the operation to the Process CS_gsmSSF for the indicated CS ID
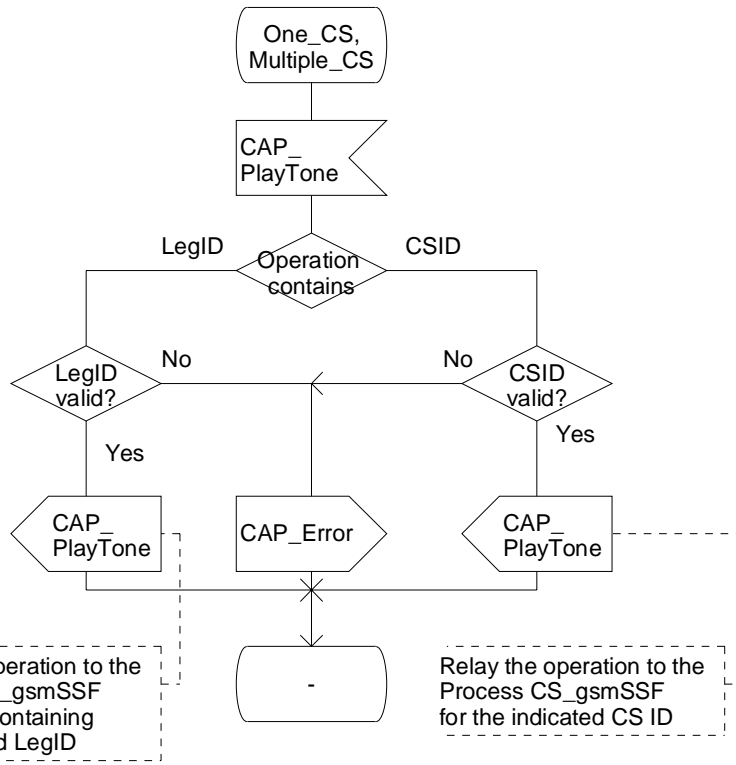
Figure 4.113-7: Process CSA_gsmSSF (sheet 7)

Process CSA_gsmSSF 8(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

CAP_ApplyCharging

CAP_CallGap

LegID or SRF Connection IE valid?

No

Yes

Relay the operation to the Process CS_gsmSSF for the CS containing the indicated LegID or SRF Connection

-

CAP_Error

Int_CallGap

-

To gsm_SSME_SSF
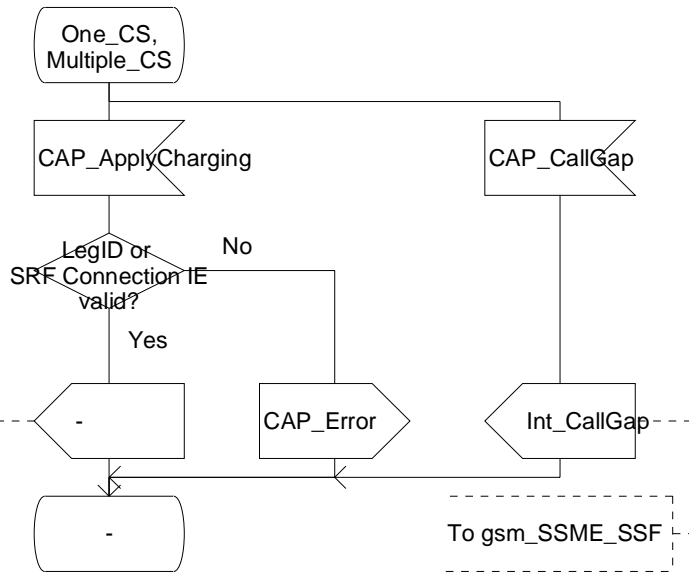
Figure 4.113-8: Process CSA_gsmSSF (sheet 8)

Process CSA_gsmSSF   9(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

CAP_Connect

No Leg To Be Connected

Operation contains

Leg To Be Connected

LegID valid?

No

Is "no Leg To Be Connected" allowed ?
/* See subclause 4.6.2.6 Connect */

Yes

Yes

No

CAP_Error

Update LegIDx_state to Set-up

Int_Connect

CAP_Error

-

Relay the operation to the Process CS_gsmSSF for the CS containing the indicated LegID, or to the single call segment if no Leg To Be Connected was indicated.

If no Leg To Be Connected is included in the operation, then LegID2 is assumed.
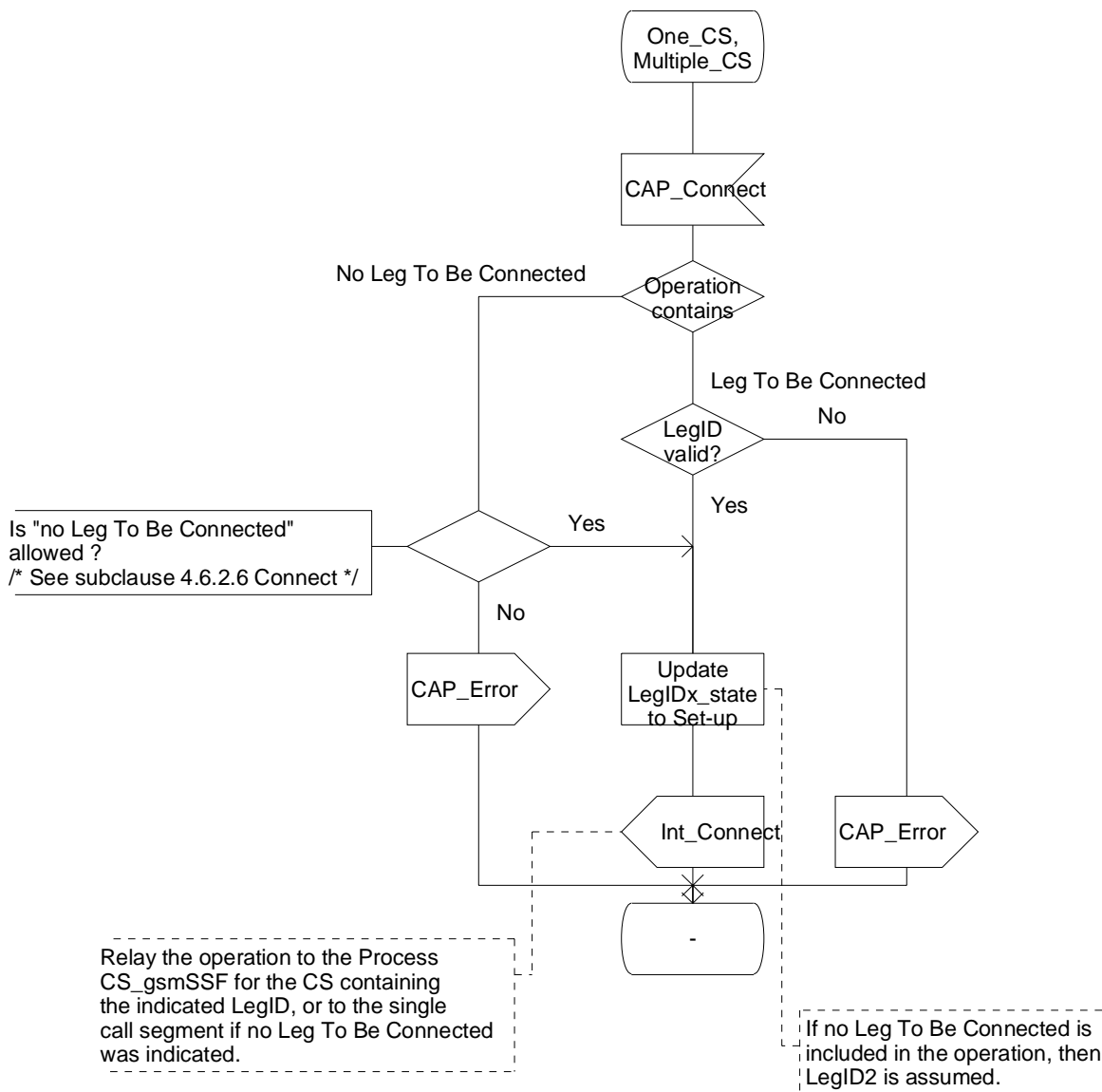
Figure 4.113-9: Process CSA_gsmSSF (sheet 9)

Process CSA_gsmSSF   10(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

One_CS, Multiple_CS

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

CAP_Initiate_ Call_Attempt

LegID in use? — Yes

No

CSID in use? — Yes

1

No

To new CS ⋯ Int_Invoke gsmSSF

CAP_Error

Wait_For _Invoked

-

Int_gsmSSF Invoked

*

Assign legIDx to terminating party

legIDx_state := Set-up

Add new leg to new CSID record

CS := CS + 1

Int_Initiate Call Attempt

No — CS = 1?

Yes

Multiple_CS   One_CS
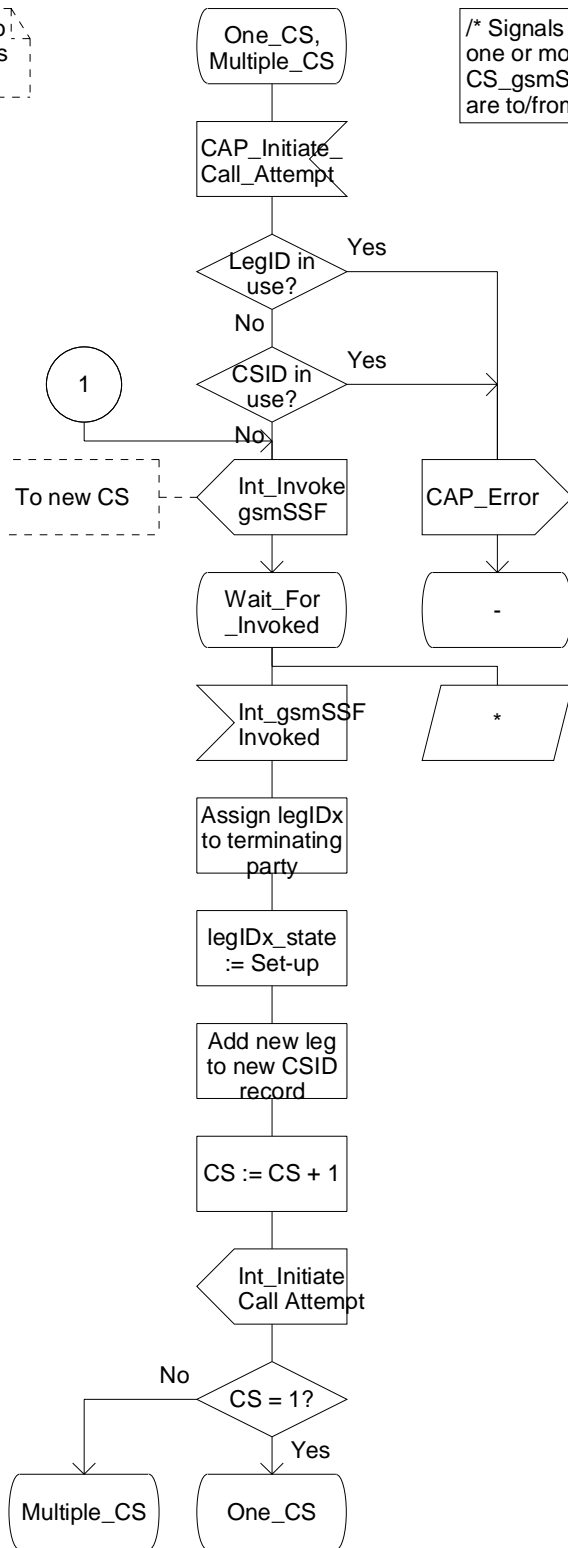
ModifiedFigure 4.113-10: Process CSA_gsmSSF (sheet 10)

Process CSA_gsmSSF 11(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

CAP_Disconnect_ Leg

Int_Request _DL

Wait_For_ User_Interaction _Response_SL

Int_Allowed_No_ User_Interaction

*

Int_Error_Not_ Allowed_due_To _User_Interaction

CAP_Error

Disconnect Leg is for Leg ID 2?

No

Yes

Move_Leg_Allowed := True

CS = 1?

Yes

No

Int_Disconnect Leg

To CS containing leg to be disconnected

One_CS

Multiple_CS

Wait_For_ DL_ack

Int_Disconnect Leg ack

*

CAP_Disconnect Leg ack

3
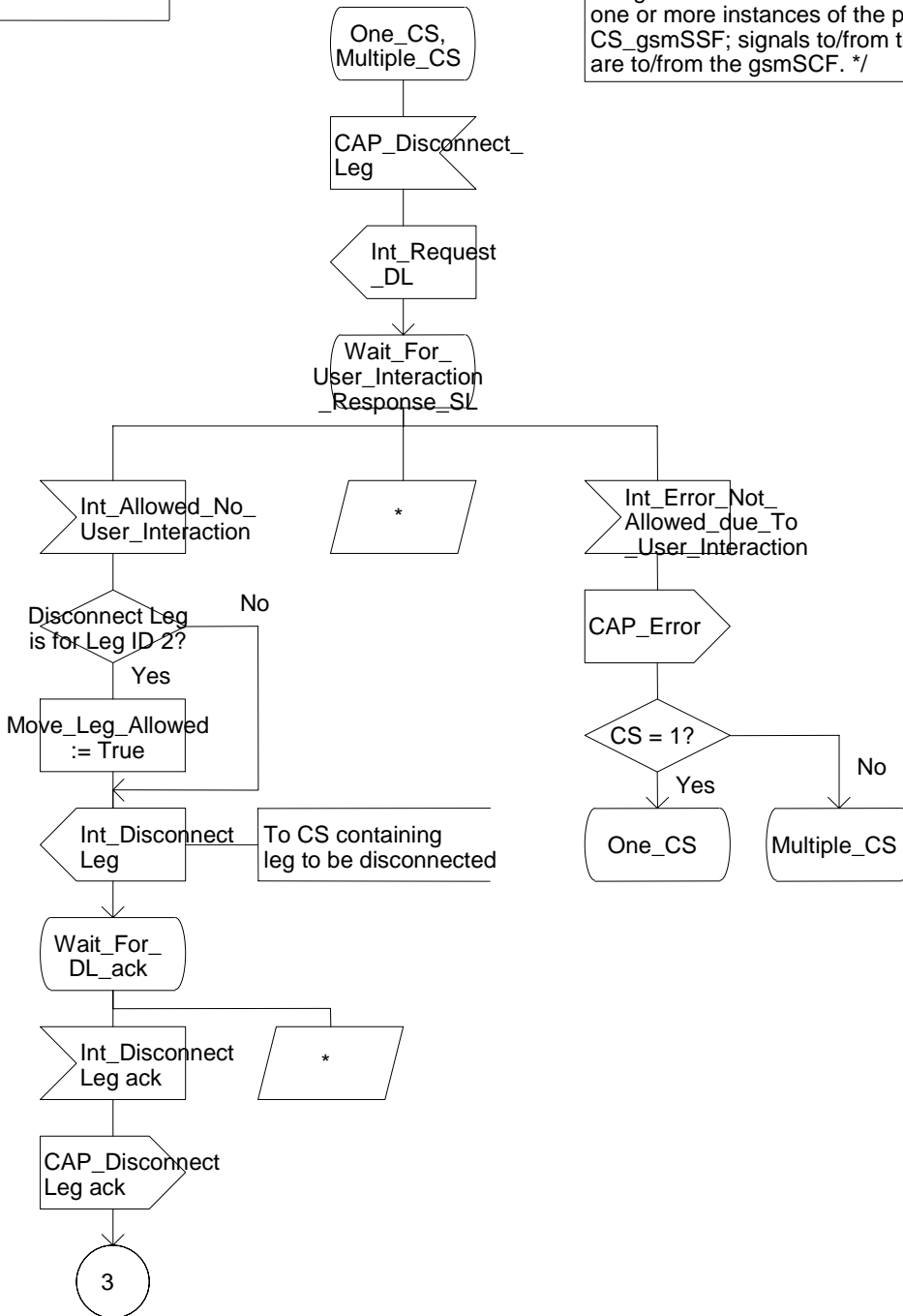
Figure 4.113-11: Process CSA_gsmSSF (sheet 11)

ETSI

Process CSA_gsmSSF 12(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

CAP_Release_Call

CAP_Cancel

No — Includes CSID?

To all current CSs — Int_Release Call

Yes

CSID valid? — No

To all CS — Int_Cancel

-

Yes

CAP_Error

-

Relay the operation to the Process CS_gsmSSF for the indicated CSID
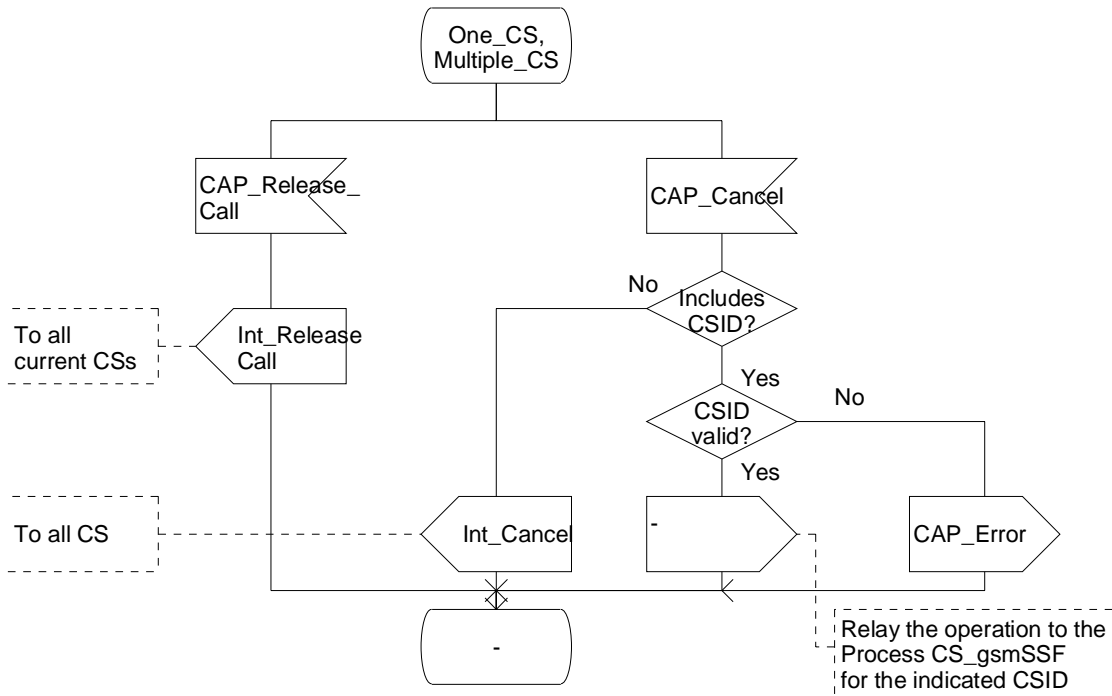
Figure 4.113-12: Process CSA_gsmSSF (sheet 12)

Process CSA_gsmSSF 13(23)

/* A process in the gsmSSF to
co-ordinate the Call Segments
for a call. */

/* Signals to/from the left are to/from
one or more instances of the process
CS_gsmSSF; signals to/from the right
are to/from the gsmSCF. */

One_CS,
Multiple_CS

CAP_Split Leg
(Leg to be split, new CS)

Leg to be split
in CSID1?
Yes   No

New CS is
CSID1?
Yes   No

Leg to be split
in active phase?
Yes

Leg to be split
in alerting or in
active phase?
No   No

CAP_Error
No

-

New CS
in use?
Yes

CS =
CS_max?
Yes

CAP_Error

-

To source CS ---- Int_Request
_SL

Wait_For_
User_Interaction
_Response_SL

*

Int_Error_Not_
Allowed_due_To
_User_Interaction

Int_Allowed_No_
User_Interaction

CAP_Error

4

CS = 1?
No

Yes

One_CS

Multiple_CS
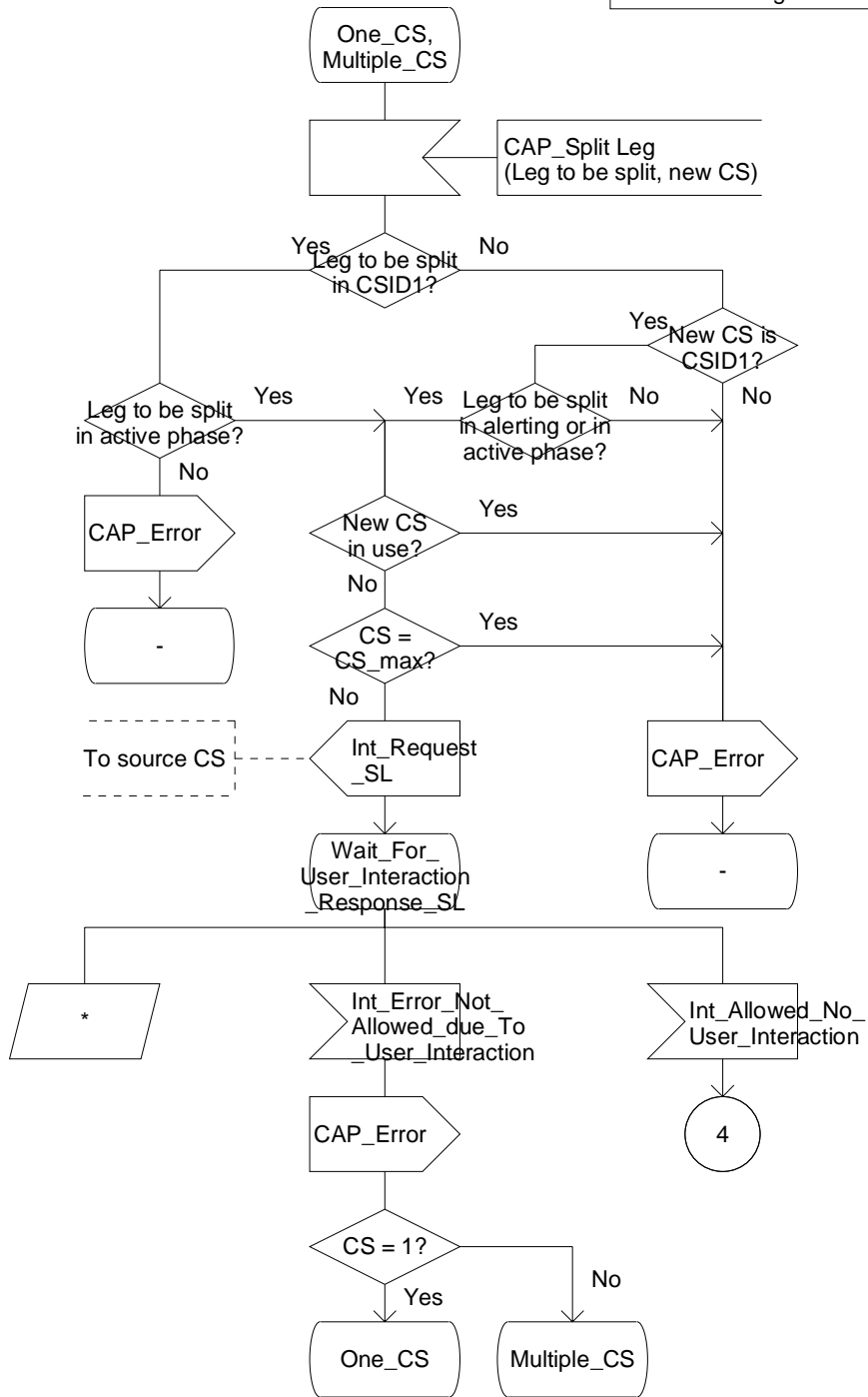
Figure 4.113-13: Process CSA_gsmSSF (sheet 13)

Process CSA_gsmSSF 14(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

4

To target CS ----- Int_Invoke gsmSSF

Wait_For _invoke

From target CS -----> Int_gsmSSF Invoked   *

To source CS ----- Int_Export_ Leg

To target CS ----- Int_Import_ Leg

Wait_For_ Import_ack_SL
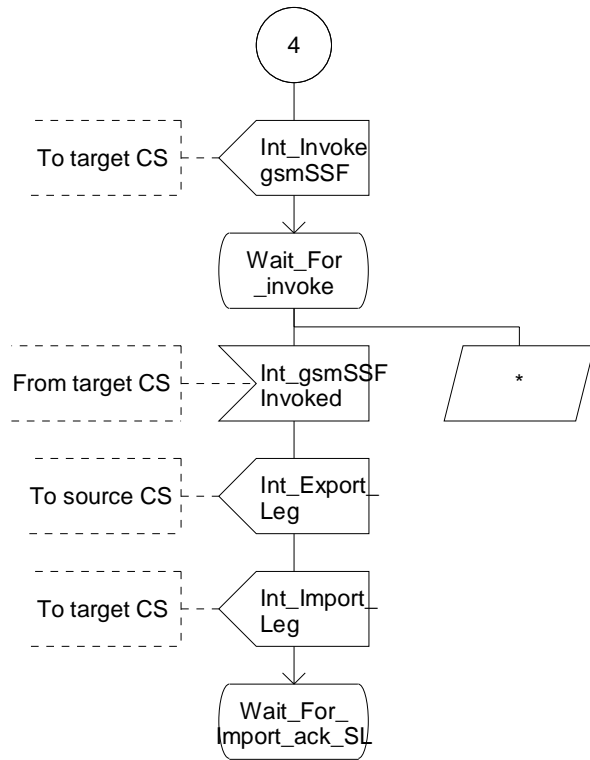
Figure 4.113-14: Process CSA_gsmSSF (sheet 14)

Process CSA_gsmSSF 15(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS,
Multiple_CS

Abort

Int_Cancel (All) — To all Call Segments

CSID1 exists? — No

Yes

CSID1 contains more than one leg? — No

Yes

Default Call Handling = Continue Call ? — No

Yes

To all Call Segments except CSID1 — Int_Release_ Call

Int_Release_ Call — To all Call Segments

To CSID1 — Int_Continue

2
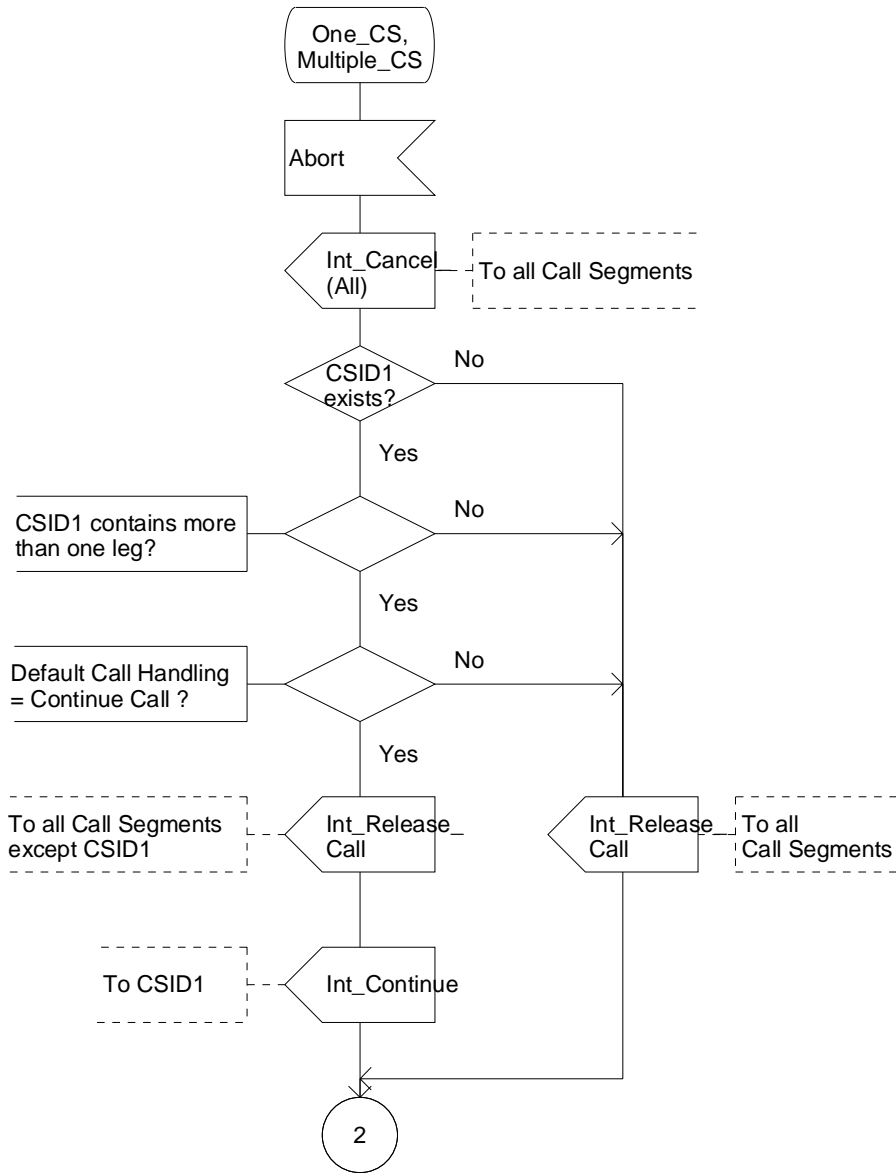
Figure 4.113-15: Process CSA_gsmSSF (sheet 15)

ETSI

Process CSA_gsmSSF 16(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

Int_Apply_Warning_Tone (pty)

Int_Apply_Charging_Report

Int_Call_Information_Report

Int_Cancel_Failed error

No

Yes

Int_Apply_Warning_Tone (legID)

CAP_Apply_Charging_Report

CAP_Call_Information_Report

CAP_Cancel_Failed error

-

To the CS_gsmSSF of the party (legID) which receives the warning tone.
This is the CAMEL subscriber. In the NC case the first party created will receive the warning tone.

Does the party which receives the warning tone exist and is this leg active?

One_CS, Multiple_CS

Int_Cancelled error

Int_Error

Int_Error ETC failed

Int_Error Unexpected Data Value

CAP_Cancelled error

CAP_Error

CAP_Error ETC failed

CAP_Error Unexpected Data Value

-

Figure 4.113-16: Process CSA_gsmSSF (sheet 16)

Process CSA_gsmSSF 17(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

One_CS, Multiple_CS

| Int_Event_ Report_ BCSM | Int_Initiate Call Attempt ack | Int_Prompt_ &_Collect_User_ Information Result | Int_Specialised_ Resource_ Report |

| CAP_Event_ Report_ BCSM | CAP_Initiate Call Attempt ack | CAP_Prompt_ &_Collect_User_ Information Result | CAP_Specialised_ Resource_ Report |

-
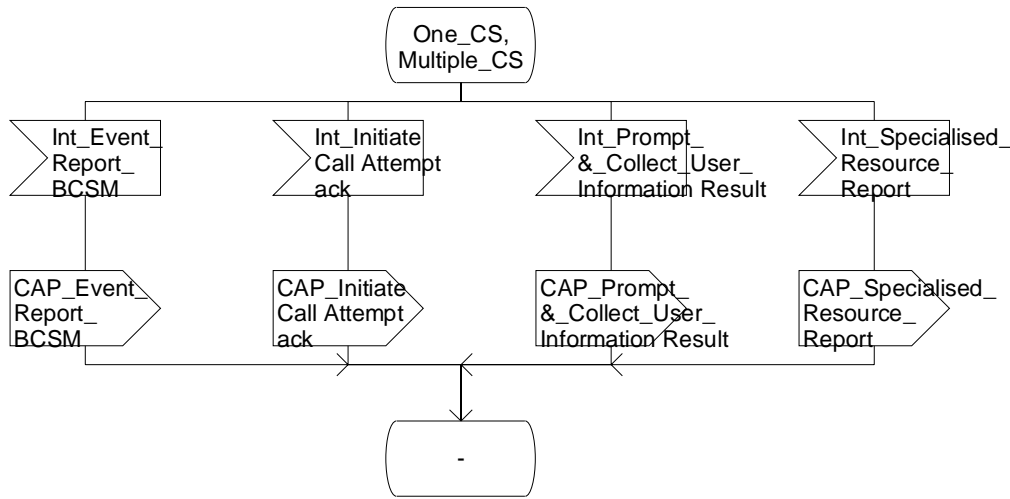
Figure 4.113-17: Process CSA_gsmSSF (sheet 17)
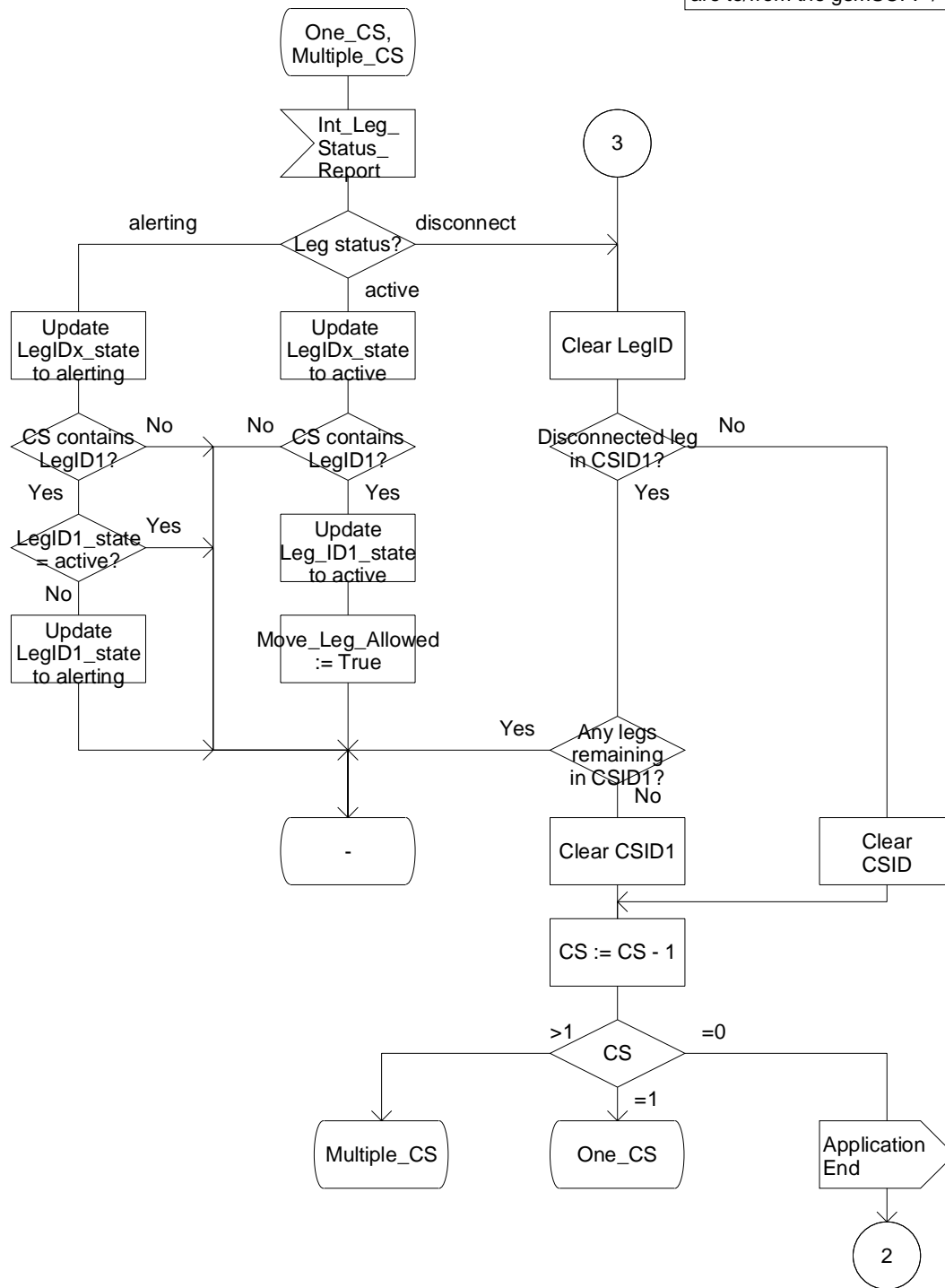
Figure 4.113-18: Process CSA_gsmSSF (sheet 18)

Process CSA_gsmSSF 19(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

Multiple_CS

CAP_Move_Leg (LegID)

CSID1 exists? — No

Yes

Move_Leg_Allowed? — False

True

Leg to be moved in CSID1? — Yes

No

Leg to be moved in alerting or active phase? — No

Yes

CSID1 contains max number of legs? — Yes

No

To Source CS ---- Int_Request _ML

CAP_Error

Wait_for_Request _ML_Response_1

Multiple_CS
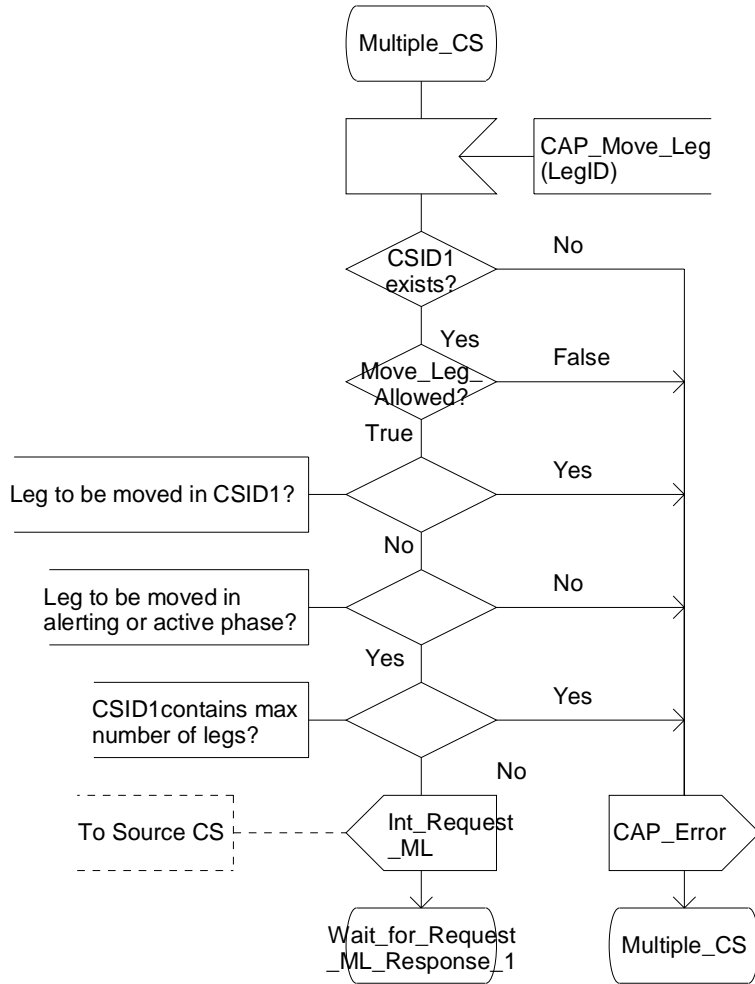
Figure 4.113-19: Process CSA_gsmSSF (sheet 19)
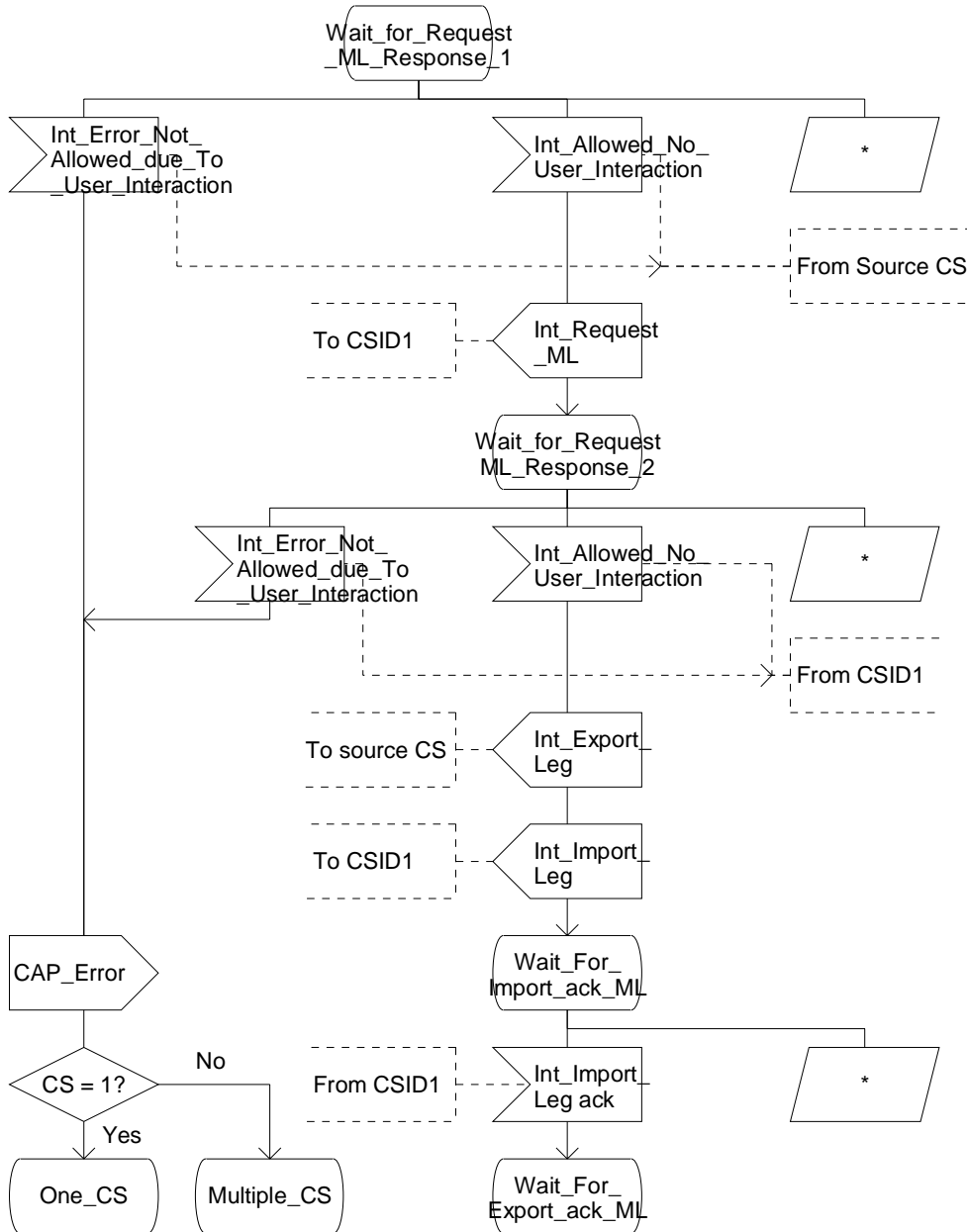
Figure 4.113-20: Process CSA_gsmSSF (sheet 20)

Process CSA_gsmSSF   21(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

Multiple_CS

Abort

Application End

Yes ← Application End with CS_Failure?

No

CAP_Entity_ Released

CSID already cleared?

Yes →

No

Clear LegIDs within this CS

If the CS_gsmSSF is gone to Idle or Wait_for_Request, the 'CS Failure' IE is used.

Clear CSID - - → CS from which message was received

CS := CS - 1

CS = 1?   No →

Yes

One_CS

Multiple_CS
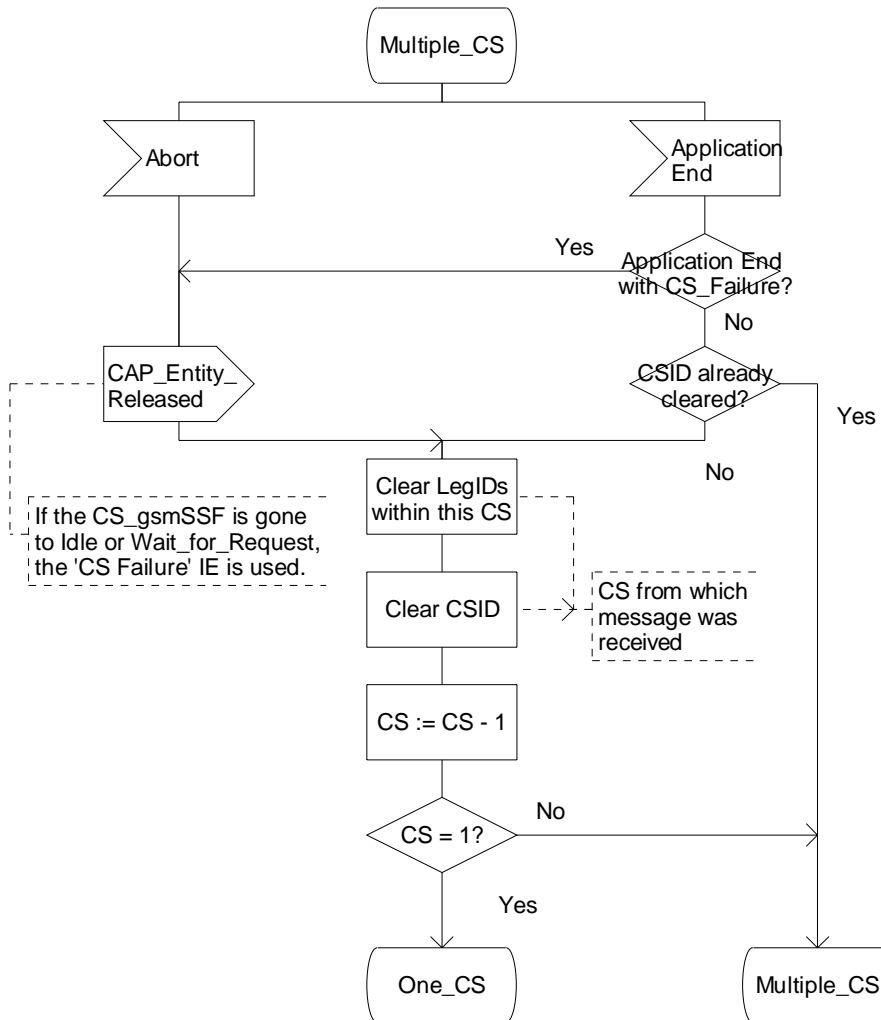
Figure 4.113-21: Process CSA_gsmSSF (sheet 21)

ETSI

Process CSA_gsmSSF   22(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */

Wait_For_
Export_ack_ML

From source CS ----> Int_Export_
Leg ack   *

Remove source
CSID

Add leg to be
moved to
CSID1

CS := CS - 1

CSID1 contains
LegID1?   No

Yes

LegID1_state
= active?   Yes

No

Moved Leg
status?   Alerting

Active

Update
Leg_ID1_state
to active

Update
LegID1_state
to alerting

CAP_Move_
Leg ack

CS = 1?   Yes

No

One_CS   Multiple_CS
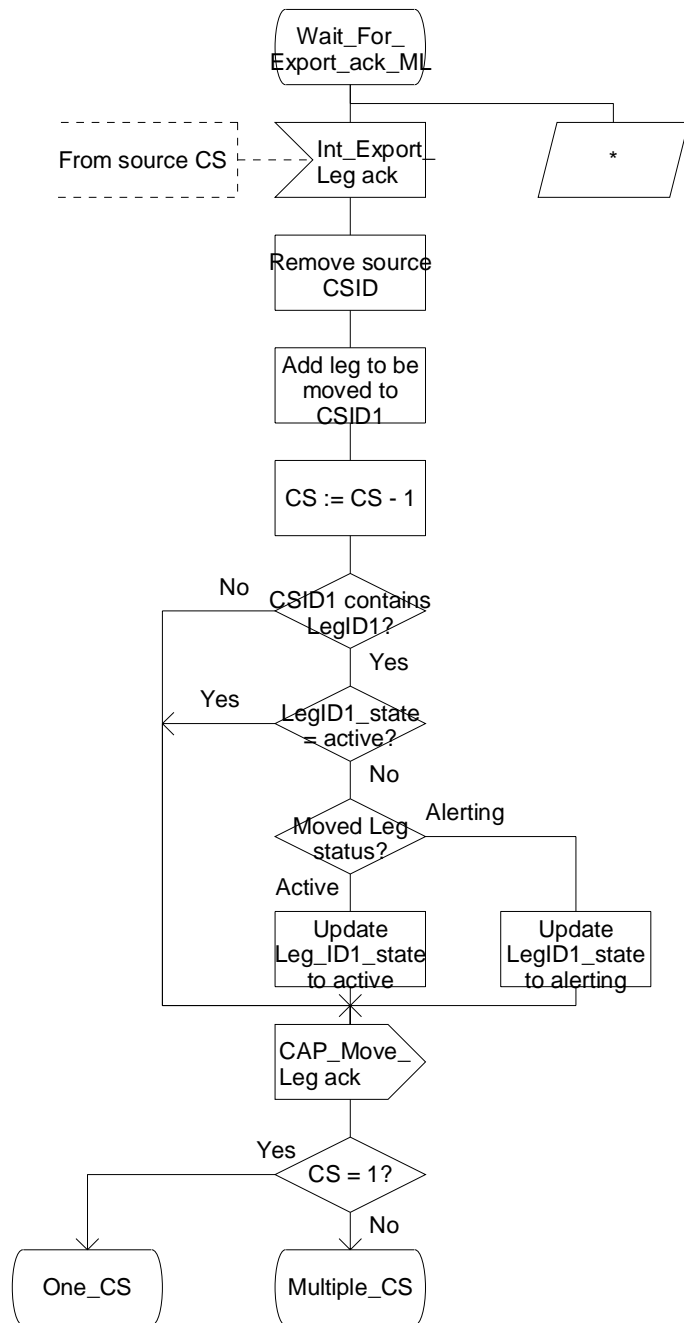
Figure 4.113-22: Process CSA_gsmSSF (sheet 22)

ETSI

Process CSA_gsmSSF 23(23)

/* A process in the gsmSSF to co-ordinate the Call Segments for a call. */

/* Signals to/from the left are to/from one or more instances of the process CS_gsmSSF; signals to/from the right are to/from the gsmSCF. */
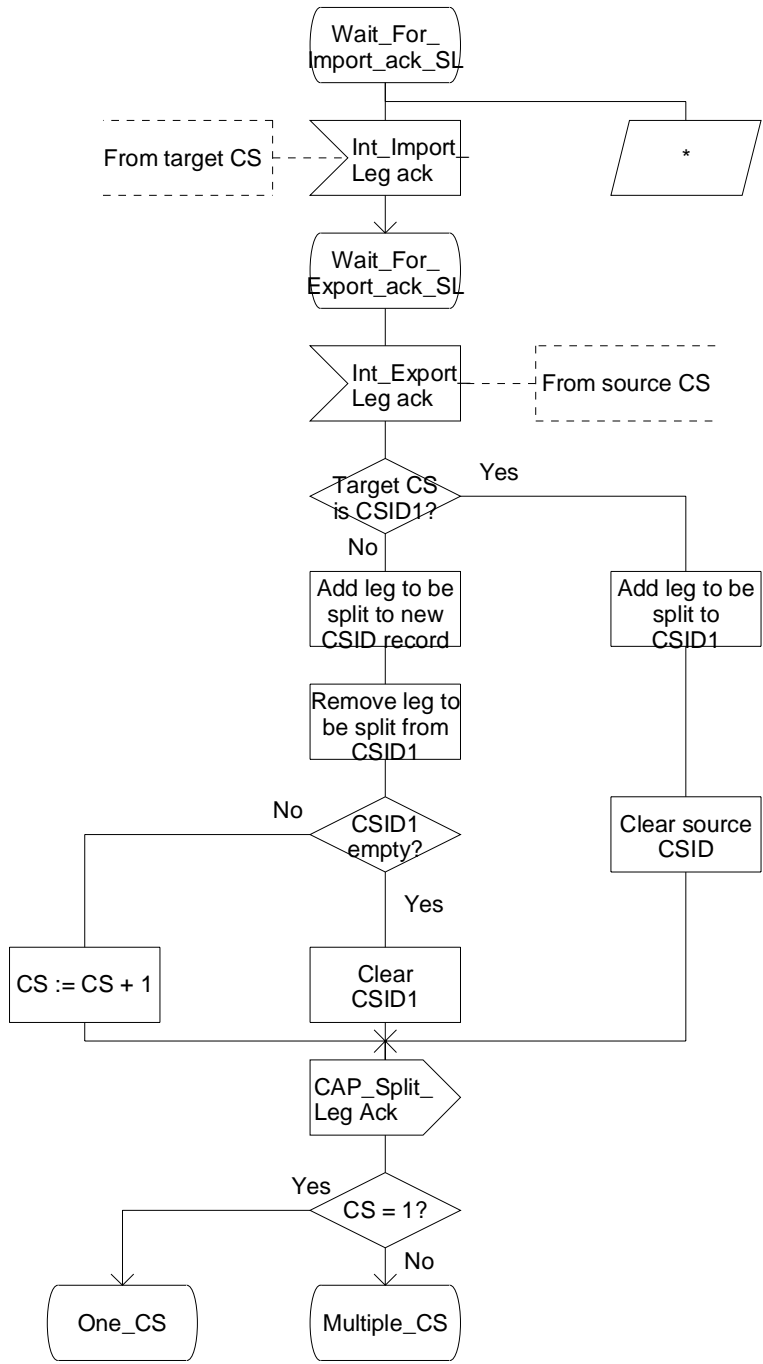
Figure 4.113-23: Process CSA_gsmSSF (sheet 23)

4.5.8   Assisting case

Assisting case involves the following processes:

- CAMEL_Assisting_MSC,

- Assisting_gsmSSF.

The detailed error handling for these 2 processes is specified in 3GPP TS 29.078 [36].

Process CAMEL_Assisting_MSC 1(3)

Process in the MSC to handle an assist request

Signals to/from the left are to/from the process CAMEL_OCH_ETC, CAMEL_TC_ETC or CAMEL_CF_ECT; signals to/from the right are to/from the assisting_gsmSSF;

Idle

Initial Address

Int_Assist_ _Required

Wait_for_assisting_ _gsm_SSF_invoked

Int_assisting_ _gsmSSF_invoked

Release

Wait_For_ _Assisting_ _Event

Int_Release_ Assisting_gsmSSF

Idle
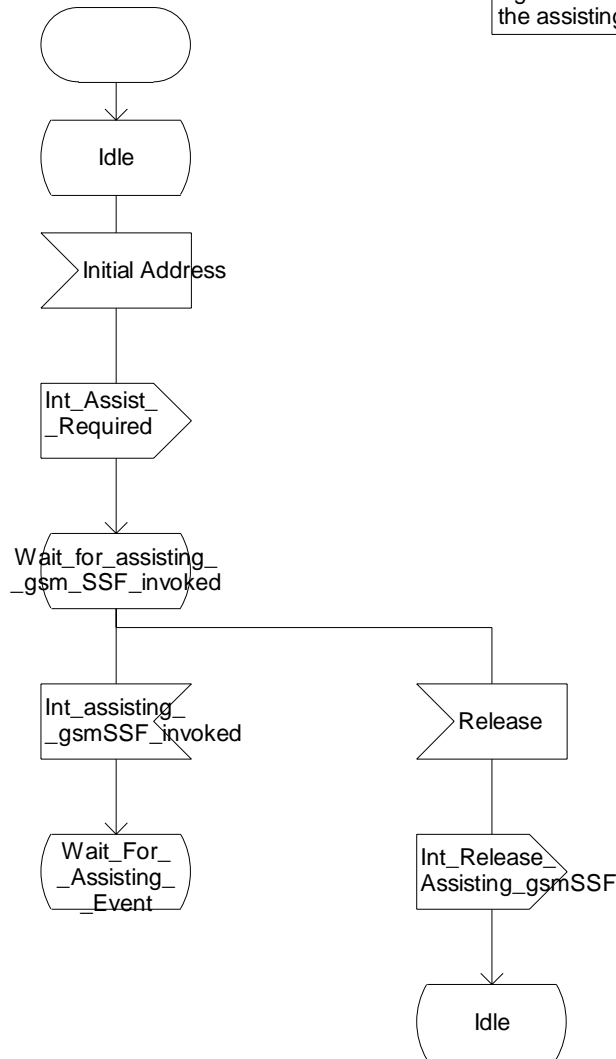
Figure 4.114-1: Process CAMEL_Assisting_MSC (sheet 1)

Process CAMEL_Assisting_MSC 2(3)

Process in the MSC
to handle an assist
request

Signals to/from the left are to/from the
process CAMEL_OCH_ETC, CAMEL_
TC_ETC or CAMEL_CF_ECT;
signals to/from the right are to/from
the assisting_gsmSSF;
if not otherwise stated.

Wait_For_
Assisting_
Event

Int_Connect_To_
Resource

Int_assisting_
gsmSSF
_released

Release

Int_Invoke_
_SRF — to SRF

Release

Int_release_
_assisting_gsmSSF

Await_SRF_
_Initialisation

Releasing_assisting_
_gsmSSF

Int_assisting_
gsmSSF_released

Idle
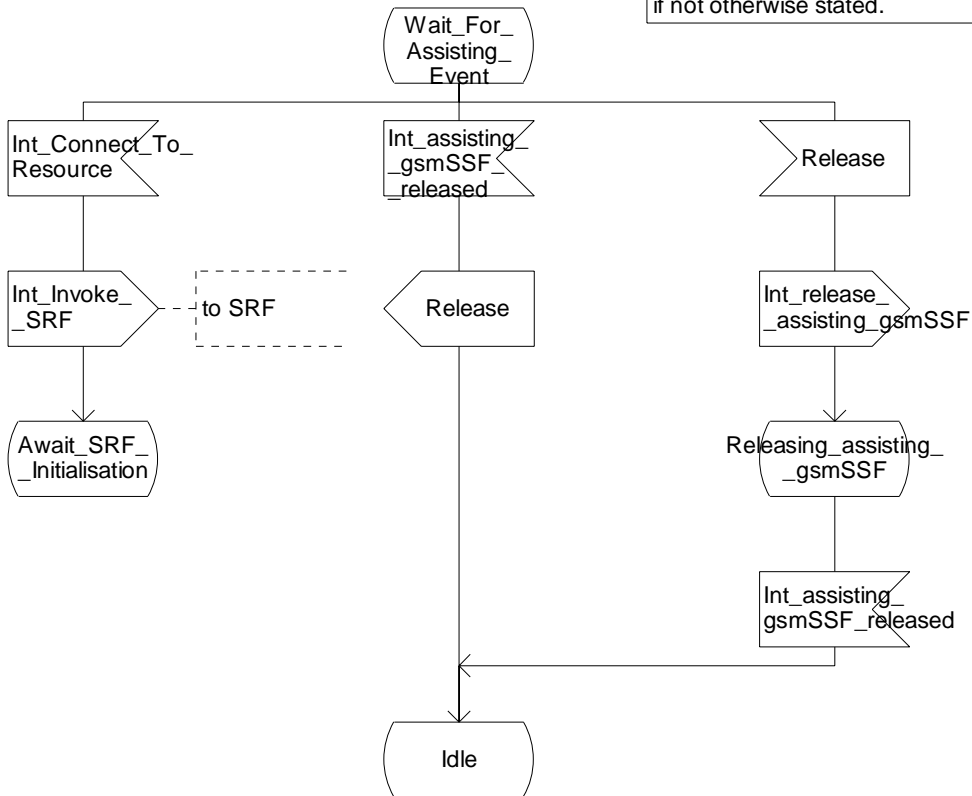
Figure 4.114-2: Process CAMEL_Assisting_MSC (sheet 2)
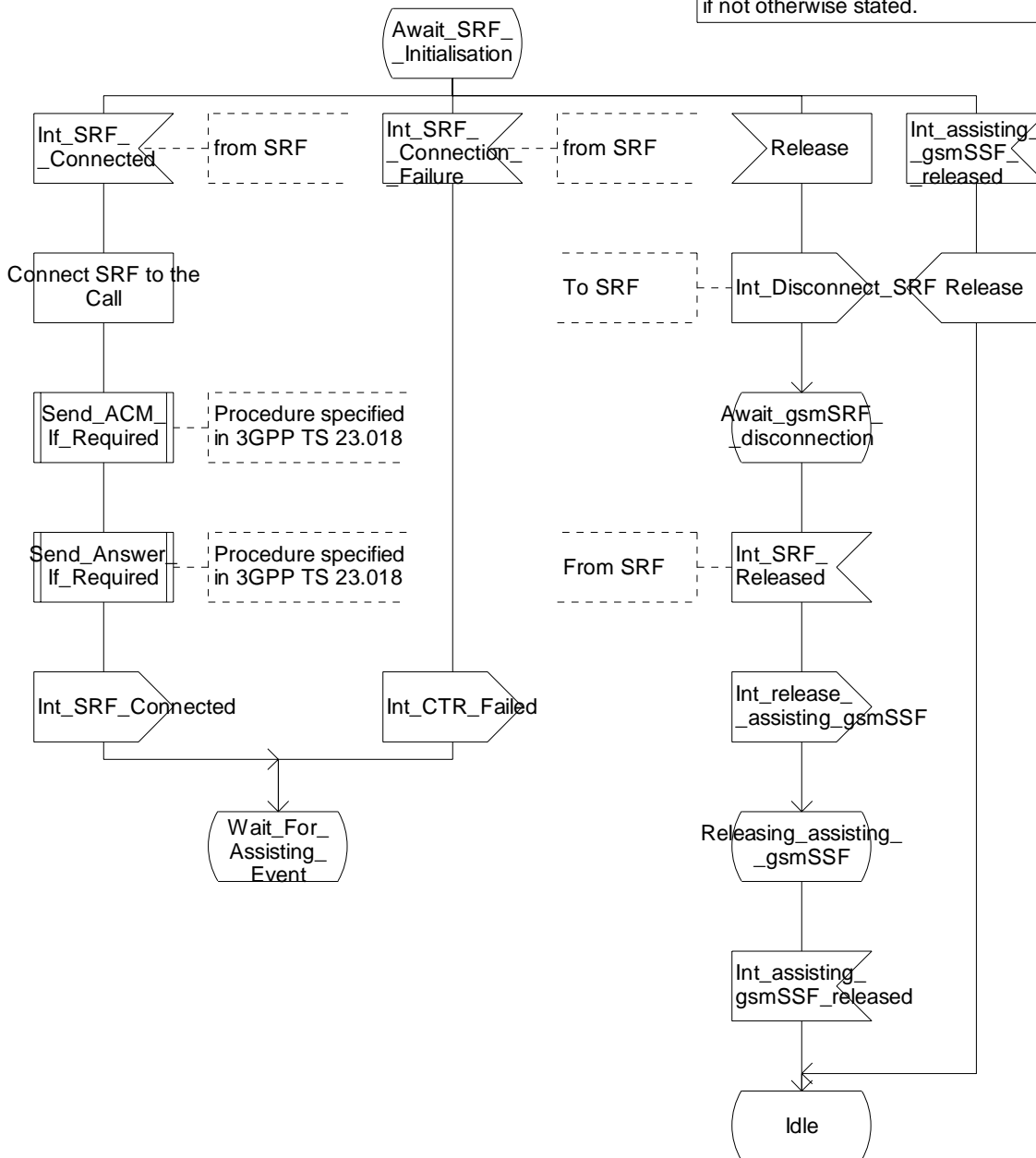
Figure 4.114-3: Process CAMEL_Assisting_MSC (sheet 3)

Process assisting_gsmSSF   1(6)

/* Invocation of assisting gsmSSF */

Signals to/from the left are to/from
the process CAMEL_Assisting_MSC;
signals to/from the right are
to/from the gsmSCF,
unless otherwise indicated.

/* Timers used in the assisting gsmSSF process:
Tssf: Application timer in the ssf.
Ranges for the default values for Tssf.
- non user interaction Tssf timer value: 1 second to 20 seconds
- user interaction Tssf timer value: 1 minute to 30 minutes
*/

Idle

Int_Assist_
_Required

Int_assisting_
gsmSSF
_Invoked

Set Tssf to default
non user interaction
Tssf timer interva
and restart Tssfl

Open Control
Relationship

CAP_Assist_
Request
_Instructions

Waiting_for_
_Instructions
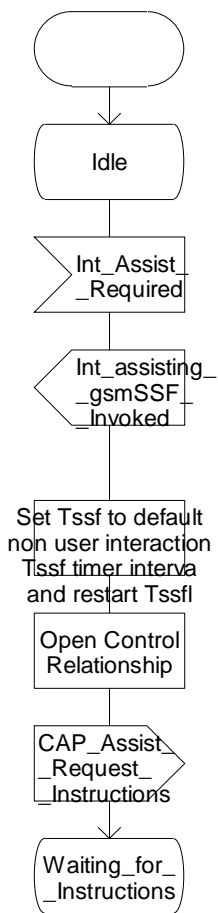
Figure 4.115-1: Process Assisting_gsmSSF (sheet 1)

Process assisting_gsmSSF 2(6)

/* Invocation of assisting gsmSSF */

Signals to/from the left are to/from the process CAMEL_Assisting_MSC; signals to/from the right are to/from the gsmSCF, unless otherwise indicated.

Waiting_for_ _Instructions

Tssf expires ← Internal

CAP_Reset_Timer

CAP_ConnectTo Resource

Abort

Set Tssf to CAP_Reset_Timer time interval and resart Tssf

Int_Connect_ To_Resource

Int_assisting_ _gsmSSF_ _released

Await_Resource_ Connection

From process CAMEL_Assisting_MSC

Idle

Int_CTR_Failed ← ← Int_SRF Connected

Return appropriate error to SCF

Set Tssf to default user interaction timer value and restart Tssf

Set Tssf to default non user interaction timer value and resart Tssf

Waiting_For_ Instructions

Waiting_For _End_Of_ User_Interaction

Figure 4.115-2: Process Assisting_gsmSSF (sheet 2)
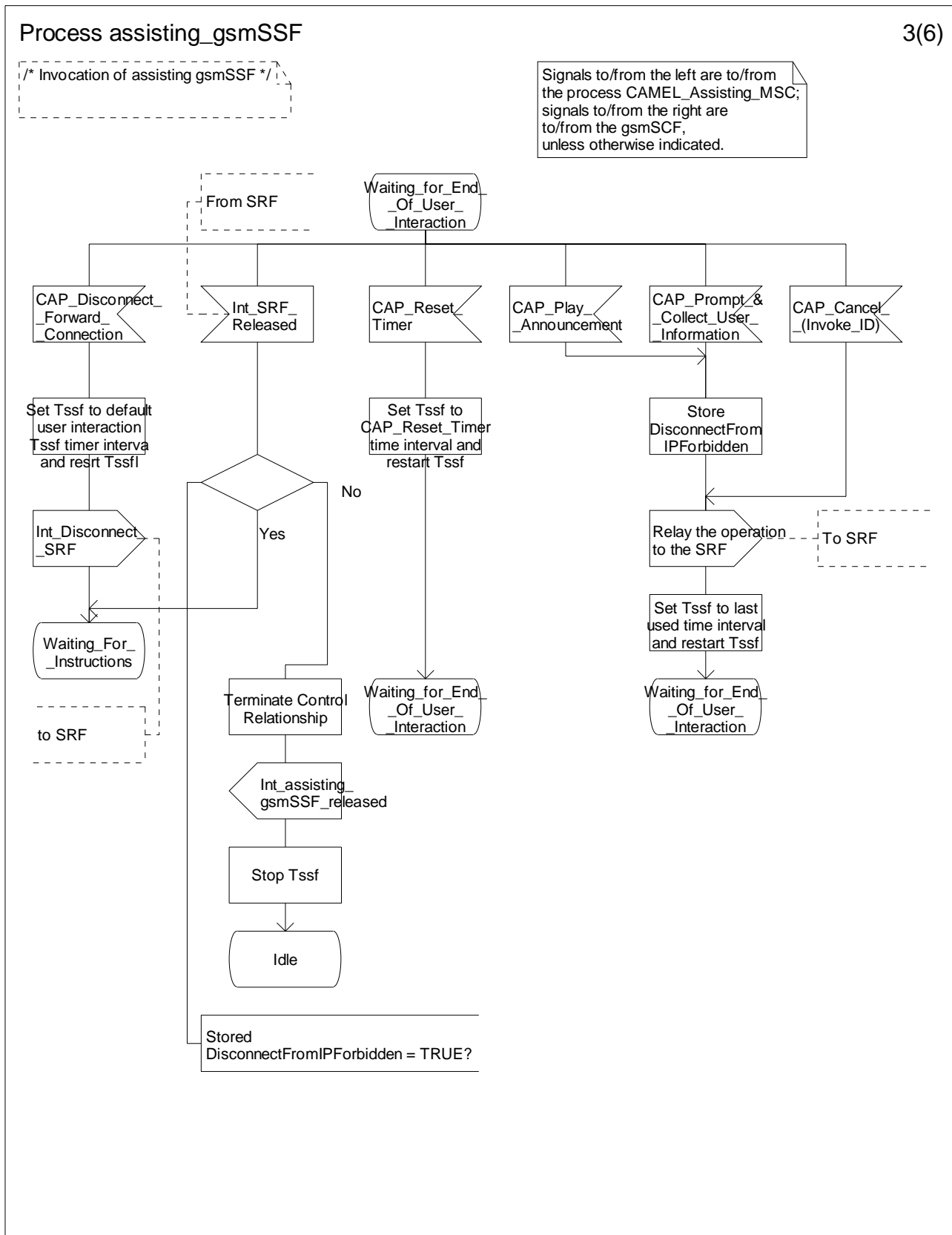
Figure 4.115-3: Process Assisting_gsmSSF (sheet 3)

Process assisting_gsmSSF 4(6)

/* Invocation of assisting gsmSSF */

Signals to/from the left are to/from the SRF;
signals to/from the right are to/from the gsmSCF.

Waiting_for_End_
_Of_User_
_Interaction

Int_Cancelled_
_error

Int_Cancel_
_Failed_error

Int_Prompt_&
_Collect_User_
_Information_Result

Int_Specialised_
_Resource_Report

Relay the operation/
result/error to the
gsmSCF

The signal "Int_..." will be relayed as "CAP_..." operation.

Waiting_for_End_
_Of_User_
_Interaction
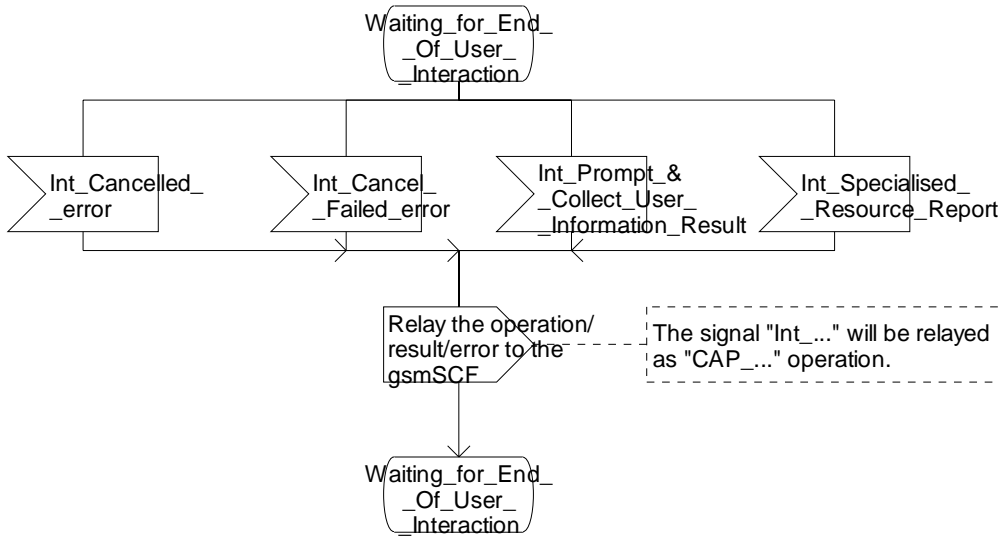
Figure 4.115-4: Process Assisting_gsmSSF (sheet 4)

Process assisting_gsmSSF   5(6)

```
/* Invocation of assisting gsmSSF */
```

Signals to/from the left are to/from
the process CAMEL_Assisting_MSC;
signals to/from the right are
to/from the SRF,
unless otherwise indicated.

Waiting_for_End_
_Of_User_
_Interaction

Tssf expires - - - - Internal

Abort - - - To gsmSCF

Int_disconnect_
_SRF

Wait_For_
gsm_SRF_Release

Int_SRF_
Released

Int_assisting_
gsmSSF
_released

Idle
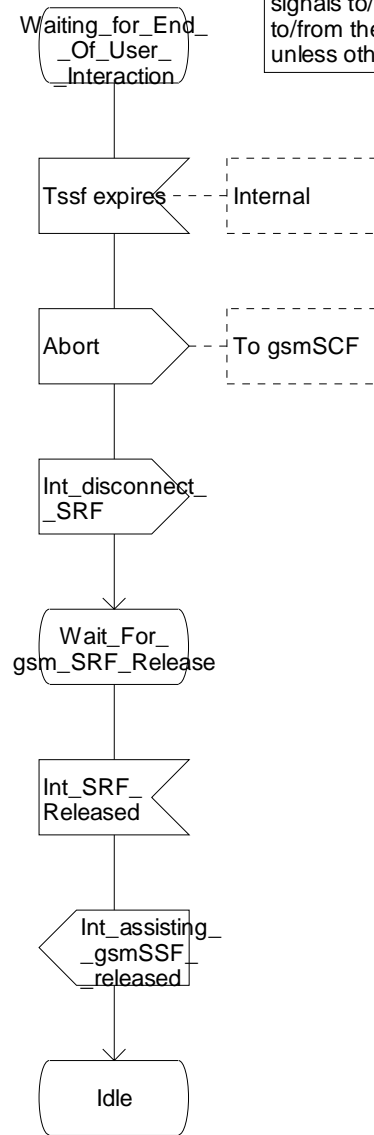
Figure 4.115-5: Process Assisting_gsmSSF (sheet 5)

ETSI

Process assisting_gsmSSF   6(6)

/* Invocation of assisting gsmSSF */

Signals to/from the right are to/from the process CAMEL_Assisting_MSC.

Waiting_For_Instructions
Waiting_For_End_Of_User_Interaction

Int_release_assisting_gsmSSF

Terminate Control Relationship

Int_assisting_gsmSSF_released

Stop Tssf

Idle
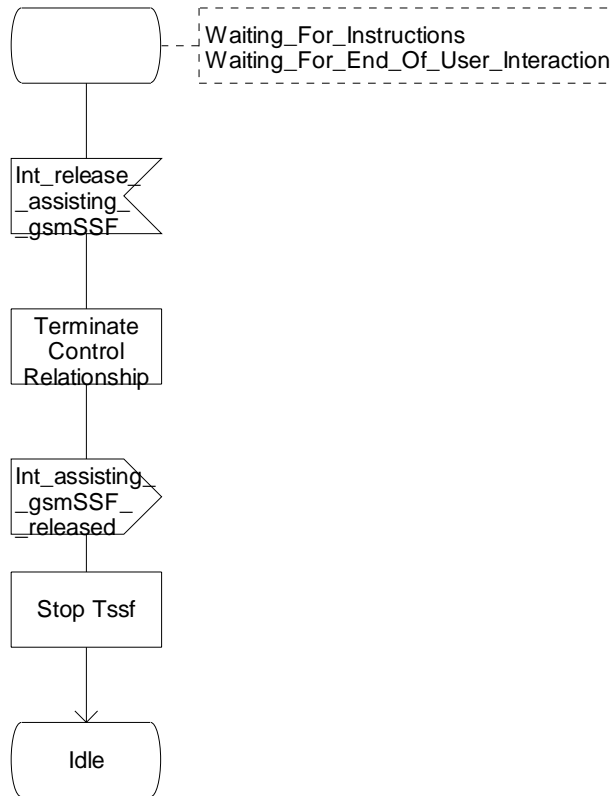
Figure 4.115-6: Process Assisting_gsmSSF (sheet 6)

4.5.9 Procedure CAMEL_Provide_Subscriber_Info

The procedure CAMEL_Provide_Subscriber_Info is called either during Retrieval of routeing information in the HLR or as a result of reception of the Any Time Interrogation information flow from the gsmSCF.

The HLR sends a Provide Subscriber Info information flow to the VLR or SGSN dependent on the setting of the parameter "requested domain" received from the calling process.

If the VLR or SGSN returns a Provide Subscriber Info ack information flow, then the HLR uses the received information to set the Subscriber Info to be returned to the calling process.

As a network option, the HLR may use the information received from the VLR, such as Cell Id, Location Area Id or Service Area Id, to derive the Location Number and/or Geographical Information. The HLR may use the information received from the SGSN, such as Cell Id, Location Area Id, Service Area Id or Routeing Area Identity, to derive the Location Number and/or Geographical Information. This mapping is network-specific and outside the scope of the present document.

NOTE: The handling in the VLR of Provide Subscriber Info is defined in 3GPP TS 23.018 [12]. The handling in the SGSN of Provide Subscriber Info is defined in clause 11.
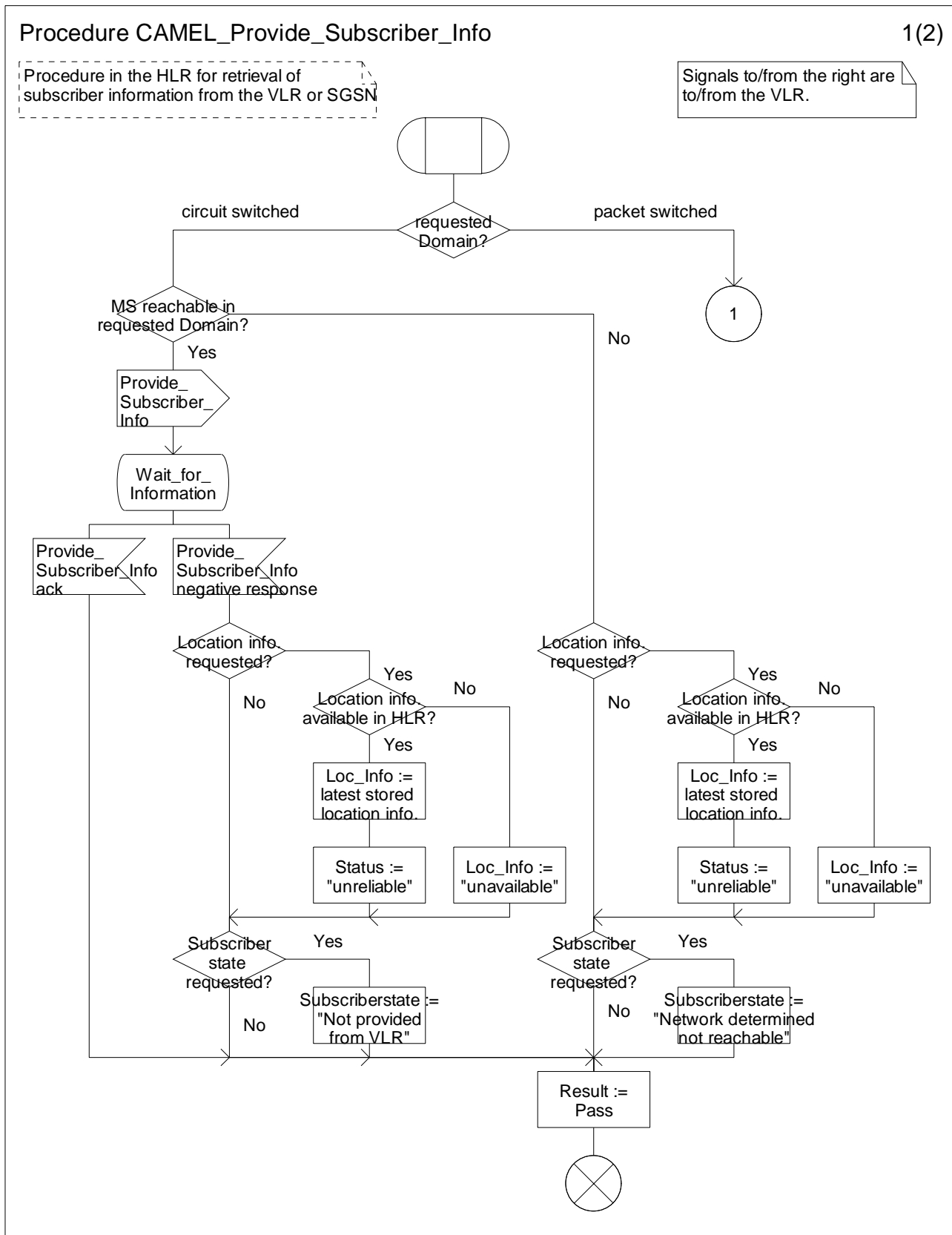
Figure 4.116-1: Procedure CAMEL_Provide_Subscriber_Info (sheet 1)
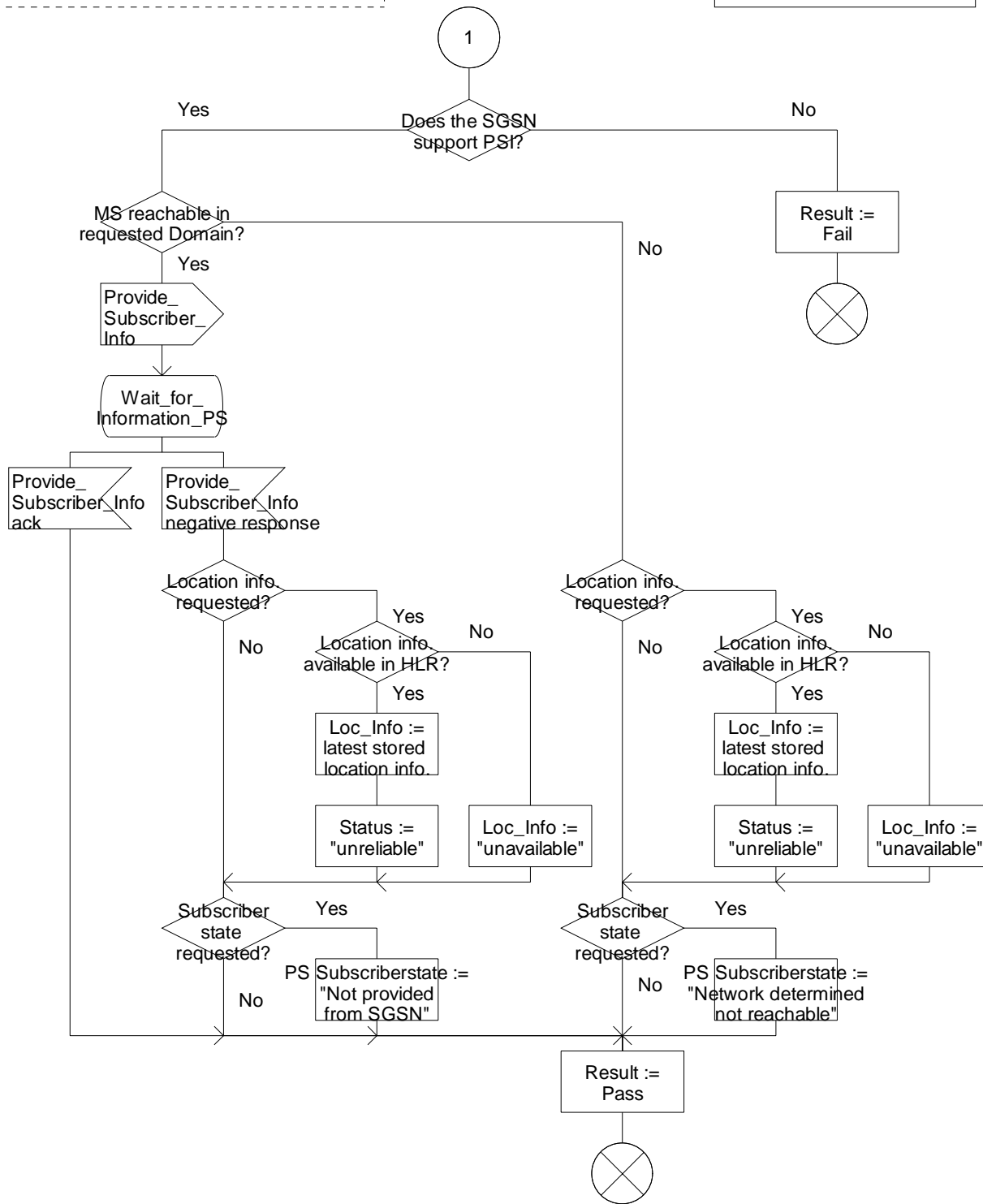
Figure 4.116-2: Procedure CAMEL_Provide_Subscriber_Info (sheet 2)

4.5.10 CAMEL specific handling of location updating and data restoration

When requesting a location update or data restoration the VLR shall indicate to the HLR which CAMEL phases it supports and which CAMEL phase 4 CSIs can be downloaded.

The HLR may then send CAMEL subscription data to the VLR or, if some different handling is required, data for substitute handling. The CAMEL subscription data sent by the HLR shall comply with the indication of supported CAMEL phases and supported CAMEL phase 4 CSIs as received from the VLR.

When the location update has been completed, the MSC/VLR in which the subscriber is registered after the location update shall check the M-CSI. If a Mobility Management notification to the gsmSCF is required for this subscriber, then the MSC/VLR shall send the notification to the gsmSCF.

Refer to subclause 9.2.1 for a description of M-CSI and the conditions under which a notification shall be sent.

4.5.11 Cross phase compatibility

To avoid a case by case fallback between the gsmSSF and the gsmSCF, the gsmSSF shall use the CAP phase corresponding to the CAMEL phase negotiated on the HLR-VLR interface when it opens a dialogue with the gsmSCF. The HLR-VLR negotiation of CAMEL phase is per subscriber.

4.5.12 Handling of North American Carrier Information

The following procedures apply only when the HPLMN of the CAMEL subscriber and either the VPLMN (for a mobile originated or forwarded call) or the IPLMN (for a mobile terminated call or forwarded call) are both North American. A gsmSCF may then provide the gsmSSF with any of the following North American (NA) carrier related information items.

- NA Carrier Information;

- NA Originating Line Information;

- NA Charge Number.

A gsmSSF shall use the received information items both to select any long distance carrier needed for the call and to provide certain information needed by this carrier. Any required information items not received shall be defaulted to those that would normally apply to the call in the absence of an interaction with a gsmSCF.

If any NA information item received from the gsmSCF is found to be invalid, the gsmSSF may either, as an operator option, release the call or behave as if the invalid information item had not been sent.

If the carrier specified in the Carrier parameter is not supported in the VPLMN or IPLMN, the gsmSSF may either, as an operator option, release the call or substitute for the unsupported carrier a preferred carrier of the VPLMN or IPLMN.

Support of the NA Originating Line Information and Charge Number parameters is an operator option in a VPLMN based on roaming agreements with the operators of other PLMNs, A gsmSSF may ignore these items when received from certain or all gsmSCFs located in other PLMNs and replace them with the corresponding default items for an MO, MF, MT or VT call.

4.6 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL for Circuit Switched call control.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Specific conditions (S), mutually Exclusive (E), Optional (O) or not applicable (-) for each different traffic case applicable to the following CSI:

- MO   Mobile Originating call in the VMSC (O-CSI, D-CSI or N-CSI dialogue);

- MF   Mobile Forwarded call in the VMSC or the GMSC as in figure 4.7 (O-CSI, D-CSI or N-CSI dialogue);

- MT   Mobile Terminating call in the GMSC (T-CSI dialogue);

- VT   Mobile Terminating call in the VMSC (VT-CSI dialogue);

- NC   gsmSCF initiated new call;

- NP   gsmSCF initiated new party in an existing call.

If the IEs in one table apply in all the possible cases listed above or no distinction is needed, then the IEs are marked in the "Status" column.

An 'M' IE shall always be included for the corresponding traffic case. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. When a set of 'E' IEs is shown in the definition of an Information Flow or compound IE, only one of those IEs may be included. An 'O' IE may be included or omitted as required by the service logic. A '-' IE shall always be omitted for the corresponding traffic case. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. it is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The distinction between MO, MF, MT, VT, NC and NP calls is not applicable to all Information Flows.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSSF shall functionally support all IEs which can be sent to it.

- The gsmSCF may silently discard any IE which it does not functionally support.

- The gsmSRF shall return an error if it does not functionally support an IE which it receives.

- The HLR may silently discard any IE which it does not functionally support.

Details of errors and exceptions to these rules are specified in are specified in 3GPP TS 29.078 [36].

4.6.1   gsmSSF to gsmSCF information flows

4.6.1.1   Activity Test ack

4.6.1.1.1   Description

This IF is the response to the Activity Test.

4.6.1.1.2   Information Elements

This IF contains no information elements.

4.6.1.2   Apply Charging Report

4.6.1.2.1   Description

This IF is used by the gsmSSF to report to the gsmSCF the information requested in the Apply Charging IF.

4.6.1.2.2   Information Elements

Information element name	Status	Description
Call Result	M	This IE contains the charging information provided by the gsmSSF.

Call Result contains the following information elements:

Information element name	Status	Description
Time Duration Charging Result	M	This IE is described in a table below.

Time Duration Charging Result contains the following information elements:

Information element name	Status	Description
Time Information	M	This IE is described in a table below.
Party To Charge	M	This IE is received in the related Apply Charging IF to correlate the result to the request. This IE shall be a copy of the corresponding IE received in the Apply Charging IF.
ACh Charging Address	M	This IE identifies the call party to which the Apply Charging Report IF applies. This IE is described in a table below.
Leg Active	M	This IE indicates whether the call leg is active or not.
Call Leg Released At Tcp Expiry	S	This IE is an indication that the gsmSSF has released the call leg or the Temporary Connection or SRF Connection, due to Tcp expiry. It shall be present when Apply Charging Report is sent due to Tcp expiry and the gsmSSF has released the call leg or the Temporary Connection or SRF Connection (because 'Release If Duration Exceeded' was present in the Apply Charging IF). In all other cases, this IE shall be absent.

Time Information contains the following information elements:

Information element name	Status	Description
Time If No Tariff Switch	S,E	This IE shall be present if no tariff switch has occurred since the reception of the first Apply Charging IF for the connection to the Called Party, the Temporary Connection, or the gsmSRF connection, otherwise it shall be absent. If Answer was detected for the connection to the Called Party, the Temporary Connection or the gsmSRF connection, then the elapsed time since detection of Answer shall be reported. If answer was not detected, it shall be set to "0".
Time If Tariff Switch	S,E	This IE shall be present if a tariff switch has occurred since the reception of the first Apply Charging IF for the connection to the Called Party, the Temporary Connection, or the gsmSRF connection, otherwise it shall be absent.

ACh Charging Address contains the following information elements:

Information element name	Status	Description
Leg ID	E	This IE indicates that the Apply Charging Report IF applies to the specified leg.
SRF Connection	E	This IE indicates that the Apply Charging Report IF applies to the Temporary Connection or SRF Connection

4.6.1.3 Call Information Report

4.6.1.3.1 Description

This IF is used to send specific call information for a single call party to the gsmSCF as requested by the gsmSCF in a previous Call Information Request IF.

4.6.1.3.2 Information Elements

Information element name	Status	Description
Requested Information List	M	This IE specifies the requested information.
Leg ID	M	This IE indicates the party in the call for which information shall be collected.

4.6.1.4 Disconnect Leg ack

4.6.1.4.1 Description

This IF is the successful response to the Disconnect Leg IF.

4.6.1.4.2 Information Elements

This IF contains no information elements.

4.6.1.5 Entity Released

4.6.1.5.1 Description

This IF is used to inform the gsmSCF about the release of a logical entity (CS or BCSM) caused by exception or errors. It is sent by the CSA FSM if this information cannot be conveyed within an TC_ABORT or TC_END because the TC dialogue has to be kept because of other existing logical entities (CS or BCSM) in this CSA which are not affected by this error/exception. This IF is not sent if the last CS was released.

The IF Entity Released is not used if the release of the entity can be reported through other IFs, e.g. Event Report BCSM, Call Information Report.

4.6.1.5.2 Information Elements

Information element name	Status	Description
CS Failure	E	This IE indicates that an CS has been released.
BCSM Failure	E	This IE indicates that a leg has been released.

CS Failure contains the following information elements:

Information element name	Status	Description
Call Segment ID	M	This IE identifies the released CS.
Cause	C	This IE indicates the cause for releasing the CS. The Cause may be used by the gsmSCF to decide how to continue the call handling.

BCSM Failure contains the following information elements:

Information element name	Status	Description
Leg ID	M	This IE identifies the released leg.
Cause	C	This IE indicates the cause for releasing the leg. The cause may be used by the gsmSCF to decide handling.

4.6.1.6 Event Report BCSM

4.6.1.6.1 Description

This IF is used to notify the gsmSCF of a call-related event (i.e. BCSM events as answer and disconnect) previously requested by the gsmSCF in a Request Report BCSM Event IF.

4.6.1.6.2 Information Elements

Information element name	MO	MF	MT	VT	NC	NP	Description
Event Type BCSM	M	M	M	M	M	M	This IE specifies the type of event that is reported.
Event Specific Information BCSM	C	C	C	C	C	C	This IE indicates the call related information specific to the event.
Leg ID	M	M	M	M	M	M	This IE indicates the party in the call for which the event is reported.
Misc Call Info	M	M	M	M	M	M	This IE indicates the DP type.

If the Event Type BCSM IE contains either O_Answer or T_Answer, then the Event Specific Information BCSM IE contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Destination Address	M	M	M	M	M	M	This IE specifies the destination address for the call leg. The *NatureOfAddress indicator* may contain a national-specific value. For some national-specific *NatureOfAddress indicator* values the length of the digit part of destination address may be zero.
OR	-	C	C	-	-	-	This IE indicates that the call was subject to basic Optimal Routeing as specified in 3GPP TS 23.079 [19].
Forwarded Call	-	M	C	C	-	-	This IE indicates that the call has been subject to a Call Forwarding supplementary service.
Charge Indicator	S	S	S	S	S	S	This IE specifies the value which will be stored in the Call Data Record. See ITU-T Recommendation Q.763 [43].
Ext-Basic Service Code	S	S	S	S	-	-	This IE is used for SCUDIF calls. It indicates the type of basic service, i.e. teleservice or bearer service. It indicates the service active at answer for the SCUDIF call (as defined in 3GPP TS 23.172 [27]).
Ext-Basic Service Code 2	S	S	S	S	-	-	This IE is used for SCUDIF calls. It indicates the type of basic service, i.e. teleservice or bearer service. It indicates the service which is not active at answer for the SCUDIF call (as defined in 3GPP TS 23.172 [27]). It shall be present if the negotiation of the SCUDIF services resulted in both basic services for the SCUDIF call. Otherwise shall be absent.

If the Event Type BCSM IE contains either O_Mid_Call or T_Mid_Call, then the Event Specific Information BCSM IE contains the following information element:

Information element name	MO	MF	MT	VT	NC	NP	Description
Midcall Info	M	-	-	M	-	-	This IE is described in a table below.

MidCall Info contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
DTMF Digits Completed	S,E	-	-	S,E	-	-	This IE contains the detected mid-call digits. This IE shall be present when triggering takes place after the minimum number of digits has been detected.
DTMF Digits Timeout	S,E	-	-	S,E	-	-	This IE contains the detected mid-call digits. This IE shall be present when triggering takes place before the minimum number of digits has been detected.

If the Event Type BCSM IE contains one of Route_Select_Failure, O_Busy, O_Disconnect or T_Disconnect, then the Event Specific Information BCSM IE contains the following information element:

Information element name	MO	MF	MT	VT	NC	NP	Description
Cause	C	C	C	C	C	C	This IE indicates the cause.

If the Event Type BCSM IE contains T_Busy, then the Event Specific Information BCSM IE contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Cause	C	C	C	C	-	-	This IE indicates the cause.
Call forwarded	-	-	C	C	-	-	This IE indicates that the call may be forwarded by the appropriate Call Forwarding supplementary service or Call Deflection supplementary service. If T_Busy is reported from the GMSC, then this IE shall be present in the following cases: - The event is triggered by the reception of an FTN in the 2nd Send Routeing Info ack from the HLR; - The event is triggered by the reception of the Resume Call Handling information flow from the VMSC. If T_Busy is reported from the VMSC, then this IE shall be present in the following cases: - The event is triggered by the invocation of conditional call forwarding (Busy or Not_Reachable); - The event notification is triggered by the invocation of Call Deflection.
Route Not permitted	-	-	S	-	-	-	This IE indicates that the further call setup will not take place in this GMSC due to the rules of basic optimal routeing. See 3GPP TS 23.079 [19].
Forwarding Destination Number	-	-	C	C	-	-	This IE contains the Forwarded-to-Number or the Deflected-to-Number. It shall be present if the Call Forwarded IE is present. Otherwise, it shall be absent.

If the Event Type BCSM IE contains T_No_Answer, then the Event Specific Information BCSM IE contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Call Forwarded	-	-	C	C	-	-	This IE indicates that the call may be forwarded by the appropriate Call Forwarding supplementary service. If T_No_Answer is reported from the GMSC, then this IE shall be present in the following cases: - The event is triggered by the reception of the Resume Call Handling information flow from the VMSC. If the T_No_Answer is reported from the VMSC, then this IE shall be present in the following cases: - The event is triggered by the invocation of conditional call forwarding (No_Answer).
Forwarding Destination Number	-	-	C	C	-	-	This IE contains the Forwarded-to-Number or the Deflected-to-Number. It shall be present if the Call Forwarded IE is present. Otherwise, it shall be absent.

If the Event Type BCSM IE contains Call_Accepted, O_Term_Seized, O_Change_Of_Position or T_Change_Of_Position, then the Event Specific Information BCSM IE contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Location Information	C	-	-	C	-	-	See subclause 4.6.1.8 with VLR Number IE as '- (not applicable)'.

NOTE   If gsmSCF does not arm DP O_Change_Of_Position, then the Location Information reported at DP O_Term_Seized may be the same as the Location Information reported at DP Collected Information, even when the subscriber has changed location between DP Collected Information and DP O_Term_Seized.

If the Event Type BCSM IE contains O_Abandon, then the Event Specific Information BCSM IE contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Route Not Permitted	-	S	-	-	-	-	This IE indicates that the further call setup will not take place in this MSC due to the rules of basic optimal routeing. See 3GPP TS 23.079 [19].

If the Event Type BCSM IE contains O_No_Answer, then the Event Specific Information BCSM IE is not included.

4.6.1.7   Initiate Call Attempt ack

4.6.1.7.1   Description

This IF is the successful response to the Initiate Call Attempt IF.

4.6.1.7.2   Information Elements

Information element name	NC	NP	Description
Supported CAMEL Phases	M	M	This IE indicates the CAMEL Phases supported.
Offered CAMEL4 Functionalities	M	M	This IE is described in subclause 4.6.1.8. This IE indicates the CAMEL phase 4 functionalities offered.

4.6.1.8   Initial DP

4.6.1.8.1   Description

This IF is generated by the gsmSSF when a trigger is detected at a DP in the BCSM, to request instructions from the gsmSCF.

4.6.1.8.2   Information Elements

(Note: IEs in the NC columns in this IF may need further study.)

Information element name	MO	MF	MT	VT	NC	NP	Description
Additional Calling Party Number	C	C	C	C	-	C	This IE contains the calling party number provided by the access signalling system of the calling user or received from the gsmSCF due to the previous CAMEL processing.

Information element name	MO	MF	MT	VT	NC	NP	Description
Called Party Number	C	M	M	M	-	M	This IE contains the number used to identify the called party in the forward direction. For MO and MF calls this IE is used in the case of TDP Route_Select_Failure (this is the destination number used to route the call) and in the case of TDP Busy and TDP No Reply (this is the MSISDN when the destination number used for the call is an MSRN, or in the case of unsuccessful call establishment received from the HLR via the MAP interface, otherwise it is the number used to route the call). For VT calls when there is no forwarding pending this is the MSISDN received in the Provide Roaming Number; if the MSISDN is not available, the basic MSISDN is used. For the MT and VT call case when there is call forwarding or call deflection pending, this is the MSISDN, i.e. not the forwarded-to or deflected-to number. If the Initial DP IF is sent at TDP Route_Select_Failure or TDP Analysed_Information then the *NatureOfAddress indicator* may contain a national-specific value. For some national-specific *NatureOfAddress indicator* values the length of the digit part of the destination address may be zero.
Called Party BCD Number	C	-	-	-	-	-	This IE contains the number used to identify the called party in the forward direction. It is used for an MO call in all cases except in the case of TDP Route_Select_Failure. For the TDP Collected_Information, the number contained in this IE shall be identical to the number received over the access network. It may e.g. include service selection information, such as ∗ and # digits, or carrier selection information dialled by the subscriber. For the TDP Analysed_Information, the number contained in this IE shall be the dialled number received over the network access or received from a gsmSCF in a Connect IF, Service selection information, such as * and # digits may be present (see subclause 4.2.1.2.2); carrier selection information dialled by the subscriber is not present.
Calling Party Number	M	C	C	C	-	C	This IE carries the calling party number to identify the calling party or the origin of the call.
Calling Partys Category	M	C	C	C	-	C	This IE indicates the type of calling party (e.g., operator, pay phone, ordinary subscriber).
CallGap Encountered	C	C	C	C	-	C	This IE indicates the type of gapping which has been applied to the related call. This IE shall be present only if a call gapping context is applicable to the Initial DP IF.

Information element name	MO	MF	MT	VT	NC	NP	Description
Call Reference Number	M	M	M	M	-	M	This IE may be used by the gsmSCF for inclusion in a network optional gsmSCF call record. It has to be coupled with the identity of the MSC which allocated it in order to define unambiguously the identity of the call. For MO calls, the call reference number is set by the serving VMSC and included in the MO call record. For MT calls, the call reference number is set by the GMSC and included in the RCF call record in the GMSC and in the MT call record in the terminating MSC. For VT calls, the call reference number is set by the GMSC and included in the RCF call record in the GMSC and in the MT call record in the terminating MSC. For MF calls, the call reference number is set by the GMSC and included in the CF record in the forwarding MSC. For the setting of the Call Reference Number for NP calls, see the corresponding call case above (MO, MT, VT or MF).
Cause	C	C	C	C	-	-	This IE indicates the cause specific to the armed BCSM DP event. This IE is applicable to DP Route_Select_Failure and DP T_Busy. The cause may be used by the gsmSCF to decide how to continue the call handling.
Event Type BCSM	M	M	M	M	-	M	This IE indicates the armed BCSM DP event, resulting in the Initial DP IF.
IMSI	M	M	M	M	-	S	This IE identifies the mobile subscriber. For the NP case, the IMSI is mandatory if the new party is initiated in an MO, MF, MT, or VT call, otherwise it shall be absent.
IP SSP Capabilities	C	C	C	C	-	C	This IE indicates which SRF resources are supported within the gsmSSF and are available. If this IE is absent, it indicates that no gsmSRF is attached and available.
Location Information	M	-	C	M	-	-	This IE is described in a table below.
Location Number	M	C	C	C	-	-	For mobile originated calls this IE represents the location of the calling party. For all other call scenarios this IE contains the location number received in the incoming ISUP signalling.
MSC Address	M	M	M	M	-	M	For MO calls, the MSC Address carries the international E.164 address of the serving VMSC. For MT calls, the MSC Address carries the international E.164 address of the GMSC. For VT calls, the MSC Address carries the international E.164 address of the serving VMSC. For MF calls, the MSC Address carries the international E.164 address of the forwarding MSC. For NP calls, see the corresponding call case above (MO, MT, VT or MF).
GMSC Address	-	M	-	M	-	S	For MF calls, the GMSC Address carries the international E.164 address of the GMSC. For VT calls, the GMSC Address carries the international E.164 address of the GMSC. For NPcalls, the GMSC Address is mandatory if the new party is initiated in an MF call or in a VT call, otherwise it shall be absent. The GMSC Address carries the international E.164 address of the GMSC.

Information element name	MO	MF	MT	VT	NC	NP	Description
Carrier	S	S	S	S	-	S	This IE is described in a table below. This IE may be present when the VPLMN and the HPLMN of the subscriber are both North American. For MO calls, this IE shall identify any carrier that was explicitly selected by the calling subscriber. If no carrier was explicitly selected, this IE shall contain the calling subscriber's subscribed carrier. For MT and VT calls, the IE shall contain the carrier subscribed to by the called subscriber. For MF calls, the IE shall contain the carrier subscribed to by the forwarding subscriber.
Original Called Party ID	C	C	C	C	-	-	This IE carries the dialled digits if the call has met call forwarding on the route to the gsmSSF. This IE shall also be sent if it was received from the gsmSCF due to previous CAMEL processing.
Redirecting Party ID	C	C	C	C	-	-	This IE indicates the directory number the call was redirected from. This IE shall also be sent if it was received from the gsmSCF due to previous CAMEL processing.
Redirection Information	C	C	C	C	-	-	This IE contains forwarding related information, such as the redirection counter.
Service Key	M	M	M	M	-	M	This IE indicates to the gsmSCF the requested CAMEL Service. It is used to address the required application within the gsmSCF.
Subscriber State	-	-	C	C	-	-	This IE indicates the status of the MS. The states are: - CAMEL Busy: The MS is engaged on a transaction for a mobile originating or terminated circuit-switched call. - Network Determined Not Reachable: The network can determine from its internal data that the MS is not reachable. - Assumed Idle: The state of the MS is neither "CAMEL Busy" nor "Network Determined Not Reachable". - Not provided from VLR.
Time And Timezone	M	M	M	M	-	M	This IE contains the time that the gsmSSF was triggered, and the time zone in which gsmSSF resides.
Call Forwarding SS Pending	-	-	C	C	-	-	If the Initial DP IF is sent from the GMSC, then this IE shall be present in the following cases: - The GMSC has received an FTN in the 1st Send Routeing Info ack IF from the HLR. - The GMSC has received an FTN in the 2nd Send Routeing Info ack IF from the HLR and no relationship with the gsmSCF exists at that moment. - The GMSC has received the Resume Call Handling IF from the VMSC and no relationship with the gsmSCF exists at that moment. If the Initial DP IF is sent from the VMSC, then this IE shall be present in the following cases: - Conditional call forwarding is invoked and no relationship with the gsmSCF exists at that moment. - Call Deflection is invoked and no relationship with the gsmSCF exists at that moment.

Information element name	MO	MF	MT	VT	NC	NP	Description
Forwarding Destination Number	-	-	C	C	-	-	This IE contains the Forwarded-to-Number or the Deflected-to-Number. It shall be present if the Call Forwarding SS Pending IE is present, otherwise it shall be absent.
Service Interaction Indicators Two	C	C	C	C	-	C	The IE is described in a table below. This IE is present if it is received in the ISUP message or due to previous CAMEL processing.
CUG Index	C	-	-	-	-	C	See 3GPP TS 23.085 [22] for details of this IE.
CUG Interlock Code	C	C	C	C	-	C	This IE shall be set according to 3GPP TS 23.085 [22] unless modified by the gsmSCF via the Connect or Continue With Argument IFs.
Outgoing Access Indicator	C	C	C	C	-	C	This IE shall be set according to the 3GPP TS 23.085 [22] unless modified by the gsmSCF via the Connect or Continue With Argument IFs.
MS Classmark 2	C	-	-	-	-	-	This IE contains the MS classmark 2, which is sent by the MS when it requests access to setup the MO call or responds to paging in the CS domain.
IMEI (with software version)	C	-	-	-	-	-	This IE contains the IMEISV (as defined in 3GPP TS 23.003 [7]) of the ME in use by the served subscriber.
Supported CAMEL Phases	M	M	M	M	M	M	This IE indicates the CAMEL Phases supported by the GMSC or the VMSC.
Offered CAMEL4 Functionalities	M	M	M	M	M	M	This IE is described in a table below. This IE indicates the CAMEL phase 4 functionalities offered by the GMSC or the VMSC.
Bearer Capability	M	C	C	C	-	C	This IE indicates the bearer capability connection to the user. For a SCUDIF call (as defined in 3GPP TS 23.172 [27]) this IE indicates the Bearer Capability of the preferred service.
Bearer Capability 2	C	C	C	C	-	-	This IE indicates the bearer capability of the less preferred service for a SCUDIF call.
Ext-Basic Service Code	C	C	C	C	-	C	This IE indicates the basic service, i.e. teleservice or bearer service. For a SCUDIF call this IE indicates the basic service of the preferred service.
Ext-Basic Service Code 2	C	C	C	C	-	-	This IE indicates the basic service of the less preferred service for a SCUDIF call.
High Layer Compatibility	C	C	C	C	-	C	This IE indicates the high layer compatibility, which will be used to determine the ISDN-teleservice of a connected ISDN terminal. For a SCUDIF call this IE indicates the high layer compatibility of the preferred service.
High Layer Compatibility 2	C	C	C	C	-	C	This IE indicates the high layer compatibility of the less preferred service for a SCUDIF call.
Low Layer Compatibility	C	C	C	C	-	C	This IE indicates the low layer compatibility, which will be used to determine the ISDN bearer capability of a connected ISDN terminal. For a SCUDIF call this IE indicates the Low Layer Compatibility of the preferred service.
Low Layer Compatibility 2	C	C	C	C	-	C	This IE indicates the low layer compatibility of the less preferred service for a SCUDIF call.

Offered CAMEL4 Functionalities contains the following information elements:

Information element name	Status	Description

Information element name	Status	Description
Initiate Call Attempt	S	This IE indicates that the gsmSCF may send to the gsmSSF the Initiate Call Attempt IF.
Split Leg	S	This IE indicates that the gsmSCF may send to the gsmSSF the Split Leg IF.
Move Leg	S	This IE indicates that the gsmSCF may send to the gsmSSF the Move Leg IF.
Disconnect Leg	S	This IE indicates that the gsmSCF may send to the gsmSSF the Disconnect Leg IF.
Entity Released	S	This IE indicates that the gsmSSF will send to the gsmSCF the Entity Released IF, when appropriate.
DFC With Argument	S	This IE indicates that the gsmSCF may send to the gsmSSF the Disconnect Forward Connection With Argument IF.
Play Tone	S	This IE indicates that the gsmSCF may send to the gsmSSF the Play Tone IF.
DTMF Mid Call	S	This IE indicates that the gsmSCF may instruct the gsmSSF to arm the O_MidCall or T_MidCall DP. The gsmSCF may instruct the gsmSSF to automatically re-arm the DP, when encountered.
Charging Indicator	S	This IE indicates that the Charge Indicator IE may be present in the Event Report BCSM IF reporting the O_Answer or T_Answer DP.
Alerting DP	S	This IE indicates that the gsmSCF may instruct the gsmSSF to arm the O_Term_Seized or Call_Accepted DP.
Location At Alerting	S	This IE indicates that the Location Information IE shall be present (if available) in the Event Report BCSM IF reporting the O_Term_Seized or Call_Accepted DP.
Change Of Position DP	S	This IE indicates that the gsmSCF may instruct the gsmSSF to arm the O_Change_Of_Position or T_Change_Of_Position DPs. The gsmSCF may instruct the gsmSSF to automatically re-arm the DP, when encountered.
OR Interactions	S	This IE indicates that the gsmSCF may send to the gsmSSF the Basic OR Interrogation Requested IE in the Connect or Continue With Argument IF. This IE indicates that the Route Not Permitted IE may be present in the Event Report BCSM IF reporting the O_Abandon DP.
Warning Tone Enhancements	S	This IE indicates that the gsmSCF may send to the gsmSSF the Burstlist IE (within the Audible Indicator IE) in an Apply Charging IF.
CF Enhancements	S	This IE indicates that the Forwarding Destination Number IE may be present in the Event Report BCSM IF reporting the T_Busy or T_No_Answer DP.

Location Information is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	MO	MF	MT	VT	NC	NP	Description
Location Number	-	-	C	C	-	-	See 3GPP TS 23.018 [12].
Service area ID	C,E	-	C,E	C,E	-	-	See 3GPP TS 23.018 [12].
Cell ID	C,E	-	C,E	C,E	-	-	See 3GPP TS 23.018 [12].
Geographical information	C	-	C	C	-	-	See 3GPP TS 23.018 [12].
Geodetic information	C	-	C	C	-	-	See 3GPP TS 23.018 [12].
VLR number	M	-	C	M	-	-	See 3GPP TS 23.018 [12].
Age Of location information	M	-	C	C	-	-	See 3GPP TS 23.018 [12].
Current Location Retrieved	-	-	-	-	-	-	Not applicable
Location area ID	C,E	-	C,E	C,E	-	-	See 3GPP TS 23.003 [7].
Selected LSA Identity	S	-	S	S	-	-	This IE indicates the LSA identity associated with the current position of the MS. It shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority shall be present. See 3GPP TS 23.073 [18]. This IE shall be present if available and SoLSA is supported, otherwise it shall be absent.

Carrier contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Carrier Identification Code	M	M	M	M	-	M	This IE uniquely identifies a North American long distance carrier.
Carrier Selection Information	M	M	M	M	-	M	This IE indicates the way the carrier was selected, i.e.: - dialled - subscribed

Service Interaction Indicators Two contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Forward Service Interaction Indicator	C	C	C	C	-	C	This IE is described in a table below.
HOLD Treatment Indicator	C	-	-	C	-	C	This IE indicates whether the CAMEL subscriber can invoke HOLD for the call.
CW Treatment Indicator	C	-	-	C	-	C	This IE indicates whether CW can be applied for a call to the CAMEL subscriber whilst this call is ongoing.
ECT Treatment Indicator	C	-	-	C	-	C	This IE indicates whether the call leg can become part of an ECT call initiated by the CAMEL subscriber.

Forward Service Interaction Indicator contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Conference Treatment Indicator	C	C	C	C	-	C	This IE indicates whether the call leg can become part of a MPTY call initiated by the called subscriber.
Call Diversion Treatment Indicator	C	C	C	C	-	C	This IE indicates whether the call can be forwarded using the Call Forwarding or Call Deflection supplementary services.

4.6.1.9 Move Leg ack

4.6.1.9.1 Description

This IF is the successful response to the Move Leg IF.

4.6.1.9.2 Information Elements

This IF contains no information elements.

4.6.1.10 Split Leg ack

4.6.1.10.1 Description

This IF is the successful response to the Split Leg IF.

4.6.1.10.2 Information Elements

This IF contains no information elements.

4.6.2 gsmSCF to gsmSSF information flows

4.6.2.1 Activity Test

4.6.2.1.1 Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and gsmSSF. If the relationship is still in existence, then the gsmSSF will respond. If no reply is received, then the gsmSCF will assume that the gsmSSF has failed in some way and will take appropriate action.

4.6.2.1.2 Information Elements

This IF contains no information elements.

4.6.2.2 Apply Charging

4.6.2.2.1 Description

This IF is used to instruct the gsmSSF to apply charging mechanisms to control the call duration.

4.6.2.2.2 Information Elements

Information element name	MO	MF	MT	VT	NC	NP	Description
ACh Billing Charging Characteristics	M	M	M	M	M	M	This IE specifies the charging related information to be provided by the gsmSSF and the conditions on which this information has to be provided back to the gsmSCF.
Party To Charge	M	M	M	M	M	M	This IE shall be reflected in the corresponding IE of the Apply Charging Report IF. This IE has no effect on the charging procedures in the MSC.
ACh Charging Address	M	M	M	M	M	M	This IE identifies the call party to which the Apply Charging IF applies. This IE is described in a table below.

ACh Billing Charging Characteristics contains the following information element:

Information element name	MO	MF	MT	VT	NC	NP	Description
Time Duration Charging	M	M	M	M	M	M	This IE is described in a table below.

Time Duration Charging contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Max Call Period Duration	M	M	M	M	M	M	This IE indicates the maximum call period duration timer.
Tariff Switch Interval	O	O	O	O	O	O	This IE indicates the tariff switch time until the next tariff switch applies for this call leg.
Release If Duration Exceeded	O	O	O	O	O	O	This IE indicates that the call leg, SRF connection or Temporary connection shall be released when the Max call Period Duration expires. The cause used in the Release IF shall be "normal unspecified". The default handling is to continue the call.
Audible Indicator	O	-	O	O	O	O	This IE is described in a table below.

Audible Indicator IE contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Tone	E	-	E	E	E	E	This IE indicates that a fixed sequence of tones shall be played to the CAMEL

							subscriber. In the NC case, the first party created will receive the warning tone. If present, this IE indicates that 30 seconds before the Max Call Period Duration timer expires, a fixed sequence of tones consisting of 3 tones of 900 Hz, with a 200 milliseconds tone duration and a 200 milliseconds intertone duration shall be played.
Burstlist	E	-	E	E	E	E	This IE is described in the table below. This IE indicates a variable sequence of bursts that shall be played during the call period to the CAMEL subscriber. In the NC case, the first party created will receive the warning tone.

Burstlist IE contains the following information elements:

Information element name	Status	Description
Warning Period	M	This IE indicates the time, before the Max Call Period Duration timer expires, when the Play Burst List IE shall start.
Number Of Bursts	M	This IE indicates the number of bursts to be played. There may be up to three bursts.
Burst Interval	M	This IE indicates the time interval between successive bursts.
Number Of Tones In Burst	M	This IE indicates the number of tones to be played in each burst. There may be up to three tones per burst. The tone is fixed to 900 Hz.
Tone Duration	M	This IE indicates the duration of a tone in a burst.
Tone Interval	M	This IE indicates the time interval between successive tones in a burst.

NOTE Service logic designers should note that the total duration of the Burst List should not exceed the WarningPeriod IE, otherwise an incomplete Burst List will be played to the served party.

ACh Charging Address contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Leg ID	E	E	E	E	E	E	This IE indicates that the Apply Charging IF applies to the specified leg.
SRF Connection	E	E	E	E	E	E	This IE indicates that the Apply Charging IF applies to the Temporary Connection or SRF Connection

4.6.2.3 Call Gap

4.6.2.3.1 Description

This IF is used to activate/modify/remove a call gap mechanism in the gsmSSF. The call gap mechanism is used to reduce the rate at which specific service requests are sent to a gsmSCF.

A Call Gap IF can only be sent on an opened dialogue between a gsmSCF and a gsmSSF.

It is possible to have several call gapping conditions applicable to the same gsmSSF (i.e. each conditions was activated for a defined Service (identified by the service Key) by a defined gsmSCF (identified by the gsmSCF address).

4.6.2.3.2 Information Elements

Information element name	Status	Description
Gap Criteria	M	This IE specifies the criteria for a call to be subject to call gapping.
Gap Indicators	M	This IE indicates the gapping characteristics.
Control Type	O	This IE indicates the reason for activating call gapping. The value "gsmSCF Overloaded" indicates that an automatic congestion detection and control mechanism in the gsmSCF has detected a congestion situation.

Information element name	Status	Description
		The value "Manually Initiated" indicates that the service and/or network/service management centre has detected a congestion situation, or any other situation that requires manually initiated controls. The Control Type "Manually Initiated" will have priority over a "gsmSCF Overloaded" call gap. Note that Non-IN controlled traffic control mechanism can also apply to an exchange with the gsmSSF functionality. As the non-IN controlled traffic control is within the MSC, this traffic control has implicit priority over the IN controlled traffic control. The non-IN controlled traffic control may also have some influence on the IN call. Therefore it is recommended to take measures to coordinate several traffic control mechanisms. The non-IN controlled traffic control and co-ordination of several traffic control mechanisms are out of the scope of the present document.
Gap Treatment	O	This IE indicates how calls that were rejected due to the call gapping condition and have Default Call Handling as "Release Call" shall be treated.

Gap Criteria contains one of the following information elements:

Information element name	Status	Description
Basic Gap Criteria	O,E	This IE is a choice of various basic criteria.
Compound Gap Criteria	O,E	This IE is a choice of various criteria including a gsmSCF ID.

Compound Gap Criteria contains the following information elements:

Information element name	Status	Description
Basic Gap Criteria	M	This IE is a choice of various criteria.
gsmSCF ID	O	This IE contains the address of the gsmSCF which initiated the Call Gapping.

Basic Gap Criteria contains one of the following information elements:

Information element name	Status	Description
Called Address	O,E	This IE contains a string of digits. For each call attempt where the leading digits of the dialled number match this specific value, the call gapping treatment shall be applied to the call.
Service	O,E	This IE contains a service key value. For each call attempt where the service key match this specific value, the call gapping treatment shall be applied to the call.
Called Address And Service	O,E	This IE contains a specific string of digits and a service key value. For each call attempt where the leading digits of the dialled number and the service key of a call match these specific values, the call gapping treatment shall be applied to the call.
Calling Address And Service	O,E	This IE contains a specific string of digits and a service key value. For each call attempt where the leading digits of the calling party number and the service key match these specific values, the call gapping treatment shall be applied to the call.

Gap Indicators contains the following information elements:

Information element name	Status	Description
Duration	M	This IE specifies the total time interval during which call gapping for the specified gap criteria will be active. A duration of 0 indicates that gapping is to be removed. A duration of -2 indicates a network specific duration. Other values indicate the duration in seconds.
Interval	M	This IE specifies the minimum time between calls being allowed through. An interval of 0 indicates that calls meeting the gap criteria are not to be rejected. An interval of -1 indicates that all calls meeting the gap criteria are to be rejected. Other values indicate the interval in milliseconds.

Gap Treatment contains one of the following elements:

Information element name	Status	Description
Information To Send	O,E	This IE indicates an announcement or a tone to be sent to the calling party. At the tone or announcement, the call shall be released.
Release Cause	O,E	If the call is to be released, this IE indicates the specific cause value to be sent in the Release IF. See ETSI EN 300 356-1 [40] for the coding.

Information To Send contains one of the following elements:

Information element name	Status	Description
In-band Info	O,E	This IE specifies the in-band information to be sent.
Tone	O,E	This IE specifies a tone to be sent to the end-user.

In-band Info contains the following information elements:

Information element name	Status	Description
Message ID	M	This IE is described in a table below. This IE indicates the message(s) to be sent.
Message Duration	O	This parameter indicates the maximum time in seconds that the message shall be played/repeated. ZERO indicates endless repetition.

Message Id contains the following element:

Information element name	Status	Description
Elementary Message ID	O	This IE indicates a single announcement.

4.6.2.4 Call Information Request

4.6.2.4.1 Description

This IF is used to request the gsmSSF to record specific information about a single call party and report it to the gsmSCF (with a Call Information Report IF).

4.6.2.4.2 Information Elements

Information element name	Status	Description
Requested Information Type List	M	This IE is described in a table below. This IE specifies a list of specific items of information which are requested.
Leg ID	M	This IE indicates the party in the call for which the information shall be collected.

Requested Information Type List contains the following information elements:

Information element name	Status	Description
Call Attempt Elapsed Time	O	This IE indicates that the Call Attempt Elapsed Time is requested in the Call Information Report. Call Attempt Elapsed Time is the duration between the end of the CAMEL processing initiating call setup (Connect, Continue or Continue With Argument IF) and the received answer indication from the called party side. For the Calling Party, the value of Call Attempt Elapsed Time in the Call Information Report shall be set to 0.
Call Stop Time	O	This IE indicates that the Call Stop Time is requested in the Call Information Report. Call Stop Time is the time stamp when the connection is released.
Call Connected Elapsed Time	O	This IE indicates that the Call Connected Elapsed Time is requested in the Call Information Report. Call Connected Elapsed Time is the duration between the received answer indication from the called party side and the release of the connection. For a Calling Party, it indicates the duration between the sending of the Initial

Information element name	Status	Description
		DP IF and the release of that party.
Release Cause	O	This IE indicates that the Release Cause for the call party is requested in the Call Information Report.

4.6.2.5 Cancel

4.6.2.5.1 Description

This IF is used by the gsmSCF to request the gsmSSF to cancel all EDPs and reports.

4.6.2.5.2 Information Elements

Information element name	Status	Description
All Requests	M	This IE indicates that all active requests for the Event Report BCSM, Apply Charging Report and Call Information Report IFs shall be cancelled.

4.6.2.6 Connect

4.6.2.6.1 Description

This IF is used to request the gsmSSF to perform the call processing actions to route a call to a specific destination. To do so, the gsmSSF may use destination information from the calling party and existing call set-up information depending on the information provided by the gsmSCF.

The gsmSCF shall not send this IF when there is a CSA with a single call segment which includes only leg 1.

4.6.2.6.2 Information Elements

Information element name	MO	MF	MT	VT	NC	NP	Description
Alerting Pattern	-	-	O	O	-	-	This IE indicates the kind of Alerting Pattern to be applied.
Calling Partys Category	O	O	O	O	O	O	This IE indicates the type of calling party (e.g., operator, pay phone, ordinary subscriber).
Destination Routing Address	M	M	M	M	M	M	This IE contains the called party number towards which the call is to be routed. The NatureOfAddress indicator may contain a national-specific value. For some national-specific *NatureOfAddress indicator* values the length of the digit part of the destination address may be zero. The gsmSCF may use national-specific *NatureOfAddress indicator* values of the gsmSSF country.
Generic Number	O	O	O	O	O	O	This IE contains the generic number. Its used to convey the additional calling party number, which e.g. could be used to modify the calling line ID presented to the called user.
Carrier	O	O	O	O	O	O	This IE is described in a table below.
NA Originating Line Information	O	O	O	O	O	O	This IE identifies the type of number in the Charge Number (e.g. subscriber versus PLMN operator number).
Charge Number	O	O	O	O	O	O	This IE identifies the chargeable number for the usage of a North American carrier.
O-CSI Applicable	-	-	O	O	-	-	This IE indicates that the O-CSI, if present shall be applied on the outgoing leg.
Original Called Party ID	O	O	O	O	O	O	This IE carries the dialled digits if the call has met call forwarding on route to the gsmSSF or is forwarded by the gsmSCF.

Information element name	MO	MF	MT	VT	NC	NP	Description

Leg To Be Connected	S	S	S	S	S	S	This IE indicates the leg to which the Connect IF applies.
							The gsmSCF shall include this IE if:
							- The CSA has more than one call segment, or
							- The CSA has a single call segment, which contains:
							  - one leg, which is not leg 2; or
							  - two legs, which are not leg 1 and leg 2, or
							  - more than two legs.
							Otherwise this IE may be present or absent as required by the service logic.
							This IE shall not indicate leg1.

Redirecting Party ID	O	O	O	O	O	O	This IE indicates the directory number the call was redirected from.
Redirection Information	O	O	O	O	O	O	This IE contains forwarding related information, such as redirecting counter.
Suppression Of Announcements	-	-	O	O	O	O	This IE indicates that announcements or tones generated as a result of unsuccessful call establishment shall be suppressed.
Service Interaction Indicators Two	O	O	O	O	O	O	This IE is described in a table below.
CUG Interlock Code	O	O	O	O	O	O	See 3GPP TS 23.085 [22] for details of this IE.
Outgoing Access Indicator	O	O	O	O	O	O	See 3GPP TS 23.085 [22] for details of this IE.
Basic OR interrogation requested	O	O	-	-	O	O	This IE indicates that a Basic Optimal Routeing interrogation is requested for the call. If Basic Optimal Routeing is successful, this will be reported to the gsmSCF in the Answer event report. This IE shall be ignored if the VMSC associated with the gsmSSF does not support Basic Optimal Routeing. This IE shall be ignored if it is received in a gsmSSF which is handling the MF call case in the GMSC function of the forwarding subscriber.

Carrier contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Carrier Identification Code	M	M	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
Carrier Selection Information	M	M	M	M	M	M	This IE indicates the way the carrier was selected e.g.: - dialled; - subscribed.

Service Interaction Indicators Two contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Forward Service Interaction Indicator	O	O	O	O	O	O	This IE is described in a table below.
Backward Service Interaction Indicator	O	O	O	O	-	-	This IE is described in a table below.
HOLD Treatment Indicator	O	-	-	O	-	-	This IE allows the gsmSCF to disallow the invocation of HOLD by the CAMEL subscriber.
CW Treatment Indicator	O	-	-	O	-	-	This IE allows the gsmSCF to disallow the invocation of CW for a call to the CAMEL subscriber whilst this call is ongoing.
ECT Treatment Indicator	O	-	-	O	-	-	This IE allows the gsmSCF to disallow the

Information element name	MO	MF	MT	VT	NC	NP	Description
							call leg to become part of an ECT call initiated by the CAMEL subscriber.
Connected number treatment indicator	O	O	O	O	-	-	This IE indicates the treatment of the connected number at the originating side.
Non-CUG Call	O	O	O	O	O	O	This IE indicates that no parameters for CUG should be used for the call (i.e. the call should be a non-CUG call). Shall be absent if one or more of CUG Interlock Code and Outgoing Access Indicator is present in the IF.

Forward Service Interaction Indicator contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Conference Treatment Indicator	O	O	O	O	O	-	This IE allows the gsmSCF to disallow the call leg to become part of a MPTY call initiated by the CAMEL subscriber.
Call Diversion Treatment Indicator	O	O	O	O	O	-	This IE allows the gsmSCF to disallow the Call Forwarding or Call Deflection supplementary services for this call.
Calling Party Restriction Indicator	O	O	O	O	O	O	This IE allows the gsmSCF to mark the CLI as Restricted for the call.

Backward Service Interaction Indicator contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Conference Treatment Indicator	O	O	O	O	-	O	This IE allows the gsmSCF to disallow the call leg to become part of a MPTY call initiated by the calling subscriber.
Call Completion Treatment Indicator	O	O	O	O	-	O	This IE allows the gsmSCF to disallow a CCBS request to be made for the call. See also 3GPP TS 23.093 [26] for description.

4.6.2.7 Connect To Resource

4.6.2.7.1 Description

This IF is used to connect a call from the gsmSSF to a gsmSRF.

4.6.2.7.2 Information Elements

Information element name	Status	Description
Resource Address	M	This IE indicates the address of the gsmSRF to which the connection shall be established. It is described in a table below.
Service Interaction Indicators Two	O	This IE indicates whether or not a bothway through connection is required between the call segment and thecalling party. When there is no calling party connected to the call segment, then the gsmSSF shall ignore this IE, if received. The handling when this IE is not present is defined in ETSI EN 301 070-1 ([41]).
Call Segment ID	M	This IE indicates the call segment to be connected to the resource. The subsequent user interaction shall apply to all parties connected to the call segment.

Resource Address contains the following information elements:

Information element name	Status	Description
IP Routing Address	E	This IE indicates the routeing address to set up a connection between the call segment and the gsmSRF.
None	E	This IE indicates that the call segment shall be connected to a predefined gsmSRF.

4.6.2.8 Continue

4.6.2.8.1 Description

This IF requests the gsmSSF to proceed with call processing at the DP at which it previously suspended call processing to await gsmSCF instructions. The gsmSSF completes DP processing, and continues basic call processing (i.e. proceeds to the next point in call in the BCSM) without substituting new data from the gsmSCF.

The gsmSCF may send this operation only when there is a CSA with a single call segment which includes:

- only leg 1, or

- only leg 2, or

- leg 1 and leg 2 but no other legs.

4.6.2.8.2 Information Elements

This IF contains no information elements.

4.6.2.9 Continue With Argument

4.6.2.9.1 Description

This IF requests the gsmSSF to continue the call processing with modified information at the DP at which it previously suspended call processing to await gsmSCF instructions or to continue call processing after a Call Party Handling IF was received. The gsmSSF completes DP processing if necessary, and continues basic call processing (i.e. proceeds to the next point in call in the BCSM) with the modified call setup information as received from the gsmSCF.

This IF may also be used to continue call processing after an Initiate Call Attempt IF and Call Party Handling IF.

The gsmSCF can send modified call information at DP Collected_Info and at DP Analysed_Info, as listed in the MO and MF columns in subclause 4.6.2.9.2.

The gsmSCF can send modified call information at DP Termination_Attempt_Authorised, as listed in the MT and VT columns in subclause 4.6.2.9.2.

The gsmSCF can send modified call information immediately after sending an Initiate Call Attempt IF, as listed in the NC and NP columns in subclause 4.6.2.9.2.

In all other cases, Continue With Argument shall contain no other IE than Leg ID or Call Segment ID.

When this IF is used to resume the processing of an Initiate Call Attempt IF, then a Leg ID shall be included and Call Segment ID shall be absent.

When this IF is used to resume the processing of a Call Party Handling IF, then a Call Segment ID shall be included and Leg ID shall be absent.

When this IF is used to resume processing after an EDP-R or TDP-R, then a Leg ID shall be included and Call Segment ID shall be absent. The following exception exists: if this IF is used to resume processing after an EDP-R or TDP-R in one of the following scenarios:

- the CSA has one Call Segment only, which includes leg 1 only;

- the CSA has one Call Segment only, which includes leg 2 only;

- the CSA has one Call Segment only, which includes leg 1 and leg 2, but no other legs;

then, the Leg ID may be present or absent, as required by the Service Logic.

4.6.2.9.2 Information Elements

Information element name	MO	MF	MT	VT	NC	NP	Description
Alerting Pattern	-	-	O	O	O	-	This IE indicates the kind of Alerting Pattern to be applied.
Calling Partys Category	O	O	O	O	O	O	This IE indicates the type of calling party (e.g., operator, pay phone, ordinary subscriber).
Generic Number	O	O	O	O	O	O	This IE contains the generic number. It is used to convey the additional calling party number, which e.g. could be used to modify the calling line ID presented to the called user.
Carrier	O	O	O	O	O	O	This IE is described in a table below.
NA Originating Line Information	O	O	O	O	O	O	This IE identifies the type of number in the Charge Number (e.g. subscriber versus PLMN operator number).
Charge Number	O	O	O	O	O	O	This IE identifies the chargeable number for the usage of a North American carrier.
Suppression Of Announcements	-	-	O	O	O	O	This IE indicates that announcements or tones generated as a result of unsuccessful call establishment shall be suppressed.
Service Interaction Indicators Two	O	O	O	O	O	O	This IE is described in a table below.
CUG Interlock Code	O	O	-	-	O	O	See 3GPP TS 23.085 [22] for details of this IE.
Outgoing Access Indicator	O	O	-	-	O	O	See 3GPP TS 23.085 [22] for details of this IE.
Basic OR Interrogation Requested	O	O	-	-	O	O,S	This IE indicates that a Basic Optimal Routeing interrogation is requested for the call. If Basic Optimal Routeing is successful, this will be reported to the gsmSCF in the Answer event report. This IE shall be ignored if the VMSC associated with the gsmSSF does not support Basic Optimal Routeing. This IE shall be ignored if it is received in a gsmSSF which is handling the MF call case in the GMSC function of the forwarding subscriber. For an NP call leg, this IE can only be included if the original call was an MO or NC call.
Leg ID	O,E	O,E	O,E	O,E	O,E	O,E	This IE indicates the party for which call processing is to be resumed.
Call Segment ID	O,E	O,E	O,E	O,E	O,E	O,E	This IE indicates the call segment for which call processing is to be resumed.
Suppress O-CSI	-	-	O	O	-	-	This IE indicates that O-CSI shall be suppressed for the forwarding leg or deflecting leg.
Suppress D-CSI	-	-	-	-	-	O	This IE indicates that D-CSI shall be suppressed for the new call leg. This IE can only be included if this IE is sent to the VMSC or GMSC of the CAMEL subscriber.
Suppress N-CSI	-	-	-	-	O	O	This IE indicates that N-CSI shall be suppressed for the new call leg.
Suppress Outgoing Call Barring	-	-	-	-	-	O	This IE indicates that Outgoing Call Barrings for the created leg shall be suppressed. This IE can only be included if the Initiate Call Attempt IF is sent to the VMSC of the CAMEL subscriber.

Carrier contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Carrier Identification Code	M	M	M	M	M	M	This IE uniquely identifies a North American

Information element name	MO	MF	MT	VT	NC	NP	Description
							long distance carrier.
Carrier Selection Information	M	M	M	M	M	M	This IE indicates the way the carrier was selected, i.e.: - dialled - subscribed

Service Interaction Indicators Two contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Forward Service Interaction Indicator	O	O	O	O	O	O	This IE is described in a table below.
Backward Service Interaction Indicator	O	O	O	O	-	-	This IE is described in a table below.
HOLD Treatment Indicator	O	-	-	O	-	-	This IE allows the gsmSCF to disallow the invocation of HOLD by the CAMEL subscriber.
CW Treatment Indicator	O	-	-	O	-	-	This IE allows the gsmSCF to disallow the invocation of CW for a call to the CAMEL subscriber whilst this call is ongoing.
ECT Treatment Indicator	O	-	-	O	-	-	This IE allows the gsmSCF to disallow the call leg to become part of an ECT call initiated by the CAMEL subscriber.
Connected Number Treatment Indicator	O	O	O	O	-	-	This IE indicates the treatment of the connected number at the originating side.
Non-CUG Call	O	O	-	-	-	O	This IE indicates that no parameters for CUG should be used for the call (i.e. the call should be a non-CUG call). This IE shall be absent if one or more of CUG Interlock Code and Outgoing Access Indicator are present in the IF.

Forward Service Interaction Indicator contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Conference Treatment Indicator	O	O	O	O	O	O	This IE indicates whether the call leg can become part of a MPTY call initiated by the called subscriber.
Call Diversion Treatment Indicator	O	O	O	O	O	O	This IE indicates whether the call can be forwarded using the Call Forwarding or Call Deflection supplementary services.
Calling Party Restriction Indicator	O	O	O	O	O	O	This IE allows the gsmSCF to mark the CLI as Restricted for the call.

Backward Service Interaction Indicator contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Conference Treatment Indicator	O	O	O	O	-	-	This IE indicates if the call leg can become part of a MPTY call initiated by the calling subscriber.
Call Completion Treatment Indicator	O	O	O	O	-	-	This IE indicates whether a CCBS request can be made for the call. See also 3GPP TS 23.093 [26] for description.

4.6.2.10 Disconnect Forward Connection

4.6.2.10.1 Description

This IF is used:

- to disconnect a connection with a gsmSRF previously established with a Connect To Resource IF;

- to disconnect an initiating gsmSSF from an assisting gsmSSF and its associated gsmSRF. The IF is sent to the initiating gsmSSF.

4.6.2.10.2 Information Elements

This IF contains no information elements.

4.6.2.11 Disconnect Forward Connection With Argument

4.6.2.11.1 Description

This IF is used in the following two cases:

1) To clear a connection to a gsmSRF: This IF is used to explicitly disconnect a connection to a resource (gsmSRF) established previously with a Connect To Resource or an Establish Temporary Connection IF. It is used for a forward disconnection from the gsmSSF.

2) To clear a connection to an assisting SSF: This IF is sent to the non-assisting SSF of a pair of SSFs involved in an assist procedure. It is used to disconnect the temporary connection between the initiating SSF and the assisting SSF.

4.6.2.11.2 Information Elements

Information element name	Status	Description
Call Segment ID	M	This IE indicates the call segment in the call to be disconnected from the resource or the temporary connection.

4.6.2.12 Disconnect Leg

4.6.2.12.1 Description

This IF is used to request the gsmSSF to release a specific leg associated with the call at any phase. All other legs in this call are retained. If the last leg of the call segment is disconnected, then the call segment is deleted.

4.6.2.12.2 Information Elements

Information element name	Status	Description
Leg To Be Released	M	This IE indicates the party in the call to be released.
Release Cause	O	This IE indicates to the gsmSSF the reason for releasing the identified party. This may be used by the MSC or GMSC for generating specific tones to the party to be released or to fill in the "cause" IE in the Release IF.

4.6.2.13 Establish Temporary Connection

4.6.2.13.1 Description

This IF is used to create a connection between an initiating gsmSSF and an assisting gsmSSF as a part of the assist procedure. It can also be used to create a connection between a gsmSSF and a gsmSRF.

4.6.2.13.2 Information Elements

Information element name	Status	Description
Assisting SSP IP Routing Address	M	This IE indicates the destination address of the gsmSRF or assisting gsmSSF for the assist procedure. As a network operator option, the Assisting gsmSSF IP Routing Address may contain embedded within it, a "Correlation ID" and "gsmSCF ID", but only if "Correlation ID" and "gsmSCF ID" are not specified separately.
Correlation ID	O	This IE is used for: - the correlation of dialogues from the initiating gsmSSF-> gsmSCF with dialogues from gsmSRF -> gsmSCF; - the correlation of dialogues from the initiating gsmSSF-> gsmSCF with dialogues from assisting gsmSSF -> gsmSCF.
Carrier	O	This IE is described in a table below.
NA Originating Line Information	O	This IE identifies the type of number in the Charge Number (e.g. subscriber versus PLMN operator number).
Charge Number	O	This IE identifies the chargeable number for the usage of a North American carrier.
gsmSCF ID	O	This IE indicates the gsmSCF identifier.
Service Interaction Indicators Two	O	This IE indicates whether or not a bothway through connection is required between the call segment and the calling party. When there is no calling party connected to the call segment, then the gsmSSF shall ignore this IE, if received. The handling when this IE is not present is defined in ETSI EN 301 070-1 [41].
Call Segment ID	M	This IE indicates the call segment to be connected to the resource. The subsequent user interaction shall apply to all parties connected to the call segment.

Carrier contains the following information elements:

Information element name	Status	Description
Carrier Identification Code	M	This IE uniquely identifies a North American long distance carrier.
Carrier Selection Information	M	This IE indicates the way the carrier was selected, i.e.: - dialled; - subscribed.

4.6.2.14 Furnish Charging Information

4.6.2.14.1 Description

This IF is used to request the gsmSSF to include call related information in the CAMEL specific logical call record. The logical call record is created when the Furnish Charging Information IF is received and a logical call record for that leg does not exist. For modelling purposes the logical call record is buffered in the gsmSSF. The gsmSSF completes logical call records as defined in the SDLs. Once the logical call record is completed, then the free format data are moved to the corresponding CDR and the logical call record is deleted.

The gsmSCF can send multiple concatenated Furnish Charging Information IFs per leg for completion. The total maximum of free format data is 160 octets per leg. The 160 octets may be sent in one or more FCI IFs. If there are incomplete free format data and new Furnish Charging Information IF(s) is/are received to overwrite the non-completed data, then the non-complete data are discarded and the gsmSCF can send another 160 octets per leg. The SDLs of the present document define when logical call records are completed. After the completion the gsmSCF can send another 160 octets of the free format data in one or more Furnish Charging Information IFs for the called leg.

4.6.2.14.2 Information Elements

Information element name	Status	Description
FCI Billing Charging Characteristics	M	This IE is described in a table below.

FCI Billing Charging Characteristics contains the following information element:

Information element name	Status	Description
FCIBCCCAMEL Sequence 1	M	This IE is described in a table below.

FCIBCCCAMEL Sequence 1 contains the following information elements:

Information element name	Status	Description
Free Format Data	M	This IE contains the free format data to be inserted in the CAMEL logical call record.
Party To Charge	M	This IE indicates the party for whom a CAMEL logical call record will be created.
Append Free Format Data	O	This IE indicates that the gsmSSF shall append the free format data to the logical call record. - If this IE is present and indicates "Append", the gsmSSF shall append the free format data received in this IF to the free format data already present in the logical call record for that leg of the call. - If this IE is absent or indicates "Overwrite", then the gsmSSF shall overwrite all free format data already present in the logical call record for that leg of the call, by the free format data received in this IF. If no logical call record exists for that leg of the call, then the gsmSSF shall ignore this IE.

4.6.2.15 Initiate Call Attempt

4.6.2.15.1 Description

This IF is used to request the gsmSSF to create a new party in an existing call (NP), or to create a completely new call (NC). The created leg is an originating call. The address information provided by the gsmSCF is used.

4.6.2.15.2 Information Elements

Information element name	NC	NP	Description
Destination Routeing Address	M	M	This IE contains the called party number towards which the call is to be routed. For calls to an MS this can e.g. be (but shall not be limited to) the MSISDN (for routeing via a GMSC) or the MSRN received from the HLR (for routeing direct to the VMSC).
Calling Party Number	M	-	This IE identifies which number shall be regarded as the calling party for the created call.
Leg To Be Created	M	M	This IE indicates the legID to be assigned to the newly created party. The leg ID shall be 3 or higher.
New Call Segment	M	M	This IE indicates the CS ID to be assigned to the newly created call segment.
Call Reference Number	M	-	This IE may be used by the gsmSCF for inclusion in a network optional gsmSCF call record. The call reference number is included by the MSC in the call record.
gsmSCF Address	M	-	This IE contains the address of the gsmSCF which initiated the new call. This IE is required for a unique Call Reference.
Suppress T-CSI	O	O	This IE indicates that T-CSI shall be suppressed on the terminating leg.

4.6.2.16 Move Leg

4.6.2.16.1 Description

This IF requests the gsmSSF to move a leg to CSID1. After the move the source call segment is deleted.

In moving the specified leg, the conditions of the leg: the armed EDPs, the Apply Charging Report pending, the Stored e-parameters, the Non-completed CAMEL logical call records, and the Call Information Report pending, are also applied for the same leg after the move.

4.6.2.16.2 Information Elements

Information element name	Status	Description
Leg ID To Move	M	This IE indicates the leg that shall be moved.

4.6.2.17 Play Tone

4.6.2.17.1 Description

This IF is used to play a variable sequence of tones to a particular leg or call segment using the MSC's tone generator. Refer to subclause 4.5.7.1.2 for a graphical representation of the variable sequence of tones.

In order to avoid tone bursts being played in close succession to the same party or group of parties, the gsmSCF is responsible for careful use of this IF especially when warning tones have been scheduled using the Apply Charging IF.

4.6.4.17.2 Information Elements

Information element name	Status	Description
Leg or Call Segment	M	This IE is described in a table below. This IE indicates the leg or call segment.
Burst List	M	This IE is described in a table below. This IE indicates a variable sequence of bursts.

Leg or Call Segment contains the following information elements:

Information element name	Status	Description
Call Segment ID	E	This IE indicates the call segment to which tones shall be played.
Leg ID	E	This IE indicates the leg to which tones shall be played.

Burst List contains the following information elements:

Information element name	Status	Description
Number of bursts	M	This IE indicates the number of bursts to be played. There may be up to three bursts.
Burst interval	M	This IE indicates the time interval between successive bursts.
Number of tones in burst	M	This IE indicates the number of tones to be played in each burst. There may be up to three tones per burst. The tone is fixed to 900 Hz.
Tone Duration	M	This IE indicates the duration of each tone in a burst.
Tone Interval	M	This IE indicates the time interval between successive tones in a burst.

4.6.2.18 Release Call

4.6.2.18.1 Description

This IF is used by the gsmSCF to tear down an existing call at any phase of the call for all parties involved in the call.

4.6.2.18.2 Information Elements

Information element name	Status	Description
Release Cause	M	This IE indicates the Release Cause for the call. This may be used by the MSC or GMSC for generating specific tones to the different parties in the call or to fill in the "cause" in the Release IF.

4.6.2.19 Request Report BCSM Event

4.6.2.19.1 Description

This IF is used to request the gsmSSF to monitor for a call-related event, then send a notification back to the gsmSCF when the event is detected (see Event Report BCSM).

4.6.2.19.2 Information Elements

Information element name	MO	MF	MT	VT	NC	NP	Description
BCSM Event	M	M	M	M	M	M	This IE specifies the event or events for which a report is requested.

BCSM Event contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Event type	M	M	M	M	M	M	This IE specifies the type of event for which a report is requested.
Leg ID	C	C	C	C	C	M	This IE indicates the party in the call for which the event shall be armed or disarmed.
Monitor Mode	M	M	M	M	M	M	If this IE is "interrupted" then the event shall be reported as a request, if this IE is "notify and continue" then the event shall be reported as a notification, if this IE is "transparent" then the event shall not be reported.
DP Specific Criteria	O	O	O	O	O	O	This IE is described in a table below.
Automatic Rearm	O	-	-	O	-	-	This IE indicates that the detection point shall be automatically rearmed by the gsmSSF when it is encountered. This IE may be present only if the Event Type is O_Mid_Call, T_Mid_Call, O_Change_Of_Position or T_Change_Of_Position and the Monitor Mode is "notify and continue".

DP Specific Criteria contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Application Timer	O	O	O	O	O	O	This IE carries additional timer duration information (timer values for No_Answer event) required for arming the No_Answer EDPs in the gsmSSF. The TNRy timer (value defined between 10 seconds and 40 seconds) shall be shorter than the network no answer timer.
Mid Call Control Info	O	-	-	O	-	-	This IE is described in a table below. This IE carries the criterion for the detection and reporting of the mid-call event. If this IE is absent, then mid-call triggering shall take place when the first digit has been entered by the user.
NOTE If a Request Report BCSM Event information flow overwrites previous Request Report BCSM Event information flow which contained Application Timer IE for No_Answer DP, the behaviour of the gsmSSF is unpredictable.							

Mid Call Control Info contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
Minimum Number Of Digits	M	-	-	M	-	-	This IE indicates the minimum number of digits to be collected. The value of this IE includes the length of the Start digit string, if

Information element name	MO	MF	MT	VT	NC	NP	Description
							present, and the length of the End of reply digit string, if present.
Maximum Number Of Digits	M	-	-	M	-	-	This IE indicates the maximum number of digits to be collected. The value of this IE includes the length of the Start digit string, if present, and the length of the End of reply digit string, if present. If triggering takes place due to the detection of the maximum number of digits and the End of reply digit string, if present, is partially detected, then the partially detected End of reply digit string shall be included in the digit string to be reported to the gsmSCF.
End of Reply Digit String	O	-	-	O	-	-	This IE, if present, indicates the digit string that denotes the end of the digits to be collected. If triggering takes place due to the detection of the End of reply digit string, then this string shall be included in the digit string to be reported to the gsmSCF. If the interdigit timeout expires when the Start Digit String, if present, is complete and the Minimum Number Of Digits has been detected and the End Digit String, if present, has been partially detected then triggering shall take place. The partially detected End Of Reply Digit String shall be included in the string to be reported to the gsmSCF.
Cancel Digit String	O	-	-	O	-	-	This IE, if present, indicates the digit string that indicates that the input shall be erased and that digit collection, including the start digit string, if present, shall start afresh.
Start Digit String	O	-	-	O	-	-	This IE, if present, indicates the digit string that denotes the start of the digits to be collected. If this IE is absent, then the first digit entered forms part of the digits to be collected. When triggering takes place, then the Start digit string shall be included in the digit string to be reported to the gsmSCF.
Inter Digit Timeout	M	-	-	M	-	-	This IE indicates the maximum duration allowed between receipt of successive digits from the MS

4.6.2.20 Reset Timer

4.6.2.20.1 Description

This IF is used to reset a timer.

4.6.2.20.2 Information Elements

Information element name	Status	Description
Timer Value	M	This IE specifies the value to which the indicated timer shall be set.
Timer ID	O	This IE indicates which timer shall be reset. It shall be set to 'Tssf'.
Call Segment ID	M	This IE indicates for which Call Segment in the gsmSSF the timer shall be reset.

4.6.2.21 Send Charging Information

4.6.2.21.1 Description

This IF is used to send e-parameters from the gsmSCF to the gsmSSF. If Charge Advice Information (CAI) is received from the gsmSCF, it shall replace the CAI which would be generated by the MSC and inhibit any further generation of CAI by the MSC. Further processing of the CAI by the MSC shall be in accordance with the Advice of Charge supplementary service. If the subscriber is not provisioned with the Advice of Charge supplementary service or if the VPLMN does not support this service, then no e-parameters shall be sent to the MS and no error due to this fact shall be sent back to the gsmSCF.

The IF is only used in the MO case or in the VT case.

NOTE: If CAI is received from the gsmSCF after charge information has been generated by the MSC and sent to the MS, the behaviour of the service may be unpredictable or incorrect; the service designer should therefore ensure that the first set of CAI is sent to the gsmSSF before charge information is sent to the MS.

4.6.2.21.2 Information Elements

Information element name	MO	MF	MT	VT	NC	NP	Description
SCI Billing Charging Characteristics	M	-	-	M	-	-	This IE defines the Advice Of Charge related information to be provided to the Mobile Station.
Leg ID	M	-	-	M	-	-	This IE indicates the leg to which the charging information shall be sent.

SCI Billing Charging Characteristics contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
AoC After Answer	S,E	-	-	S,E	-	-	This IE is described in a table below. This IE is present after an Answer event has been detected from the called party, the current connected SRF or the temporary connection.
AoC Before Answer	S,E	-	-	S,E	-	-	This IE is described in a table below. This IE is present before an Answer event has been detected from the called party, the current connected SRF or the temporary connection.

AoC Before Answer contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
AoC Initial	M	-	-	M	-	-	This IE contains CAI elements as defined in 3GPP TS 22.024 [3].
AoC Subsequent	O	-	-	O	-	-	This IE is described in a table below.

AoC Subsequent contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
CAI Elements	M	-	-	M	-	-	This IE contains CAI elements as defined in 3GPP TS 22.024 [3].
Tariff Switch Interval	O	-	-	O	-	-	This IE indicates the tariff switch time until the next tariff switch applies.

AoC After Answer contains the following information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
CAI Elements	M	-	-	M	-	-	This IE contains CAI elements as defined in 3GPP TS 22.024 [3].
Tariff Switch Interval	O	-	-	O	-	-	This IE indicates the tariff switch time until the next tariff switch applies.

4.6.2.22   Split Leg

4.6.2.22.1   Description

This IF is used to request the gsmSSF to separate a leg from CSID1 and move it to a new call segment.

If CSID1 does not exist, then this IF is used to request the gsmSSF to move a leg into a newly created CSID1.

In splitting the specified leg, the conditions of the leg: the armed EDPs, the Apply Charging Report pending, the Stored e-parameters, the Non-completed CAMEL logical call records, and the Call Information Report pending, are also applied for the same leg after split.

4.6.2.22.2   Information Elements

Information element name	Status	Description
Leg To Be Split	M	This IE indicates the leg in the call to be split.
New Call Segment	M	This IE indicates the Call Segment ID to be assigned to the new call segment.

4.6.3   Optional (Service logic dependent) gsmSCF to gsmSRF information flows

4.6.3.1   Activity Test

4.6.3.1.1   Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and gsmSRF. If the relationship is still in existence, then the gsmSRF will respond. If no reply is received, then the gsmSCF will assume that the gsmSRF has failed in some way and will take the appropriate action.

4.6.3.1.2   Information Elements

This IF contains no information elements.

4.6.3.2   Cancel

4.6.3.2.1   Description

This IF is used by the gsmSCF to request the gsmSRF to cancel a correlated previous IF.

4.6.3.2.2   Information Elements

Information element name	Status	Description
Invoke ID	E	This IE specifies the IF to be cancelled. This IE may be used when the Cancel IF is used in a single call segment CSA or when the Cancel IF is sent by the gsmSCF to an Intelligent Peripheral.
Call Segment To Cancel	E	This IE may be used when the Cancel IF is used in a single call segment CSA or in a multi call segment CSA. This IE is described in a table below. This IE shall not be used when the Cancel IF is sent by the gsmSCF to an Intelligent Peripheral.

Call Segment To Cancel contains the following information elements:

Information element name	Status	Description
Invoke ID	M	This IE specifies the IF to be cancelled.
Call Segment ID	M	This IE specifies to which call segment the cancellation of the user interaction IF shall apply.

4.6.3.3 Play Announcement

4.6.3.3.1 Description

This IF is used for inband interaction.

4.6.3.3.2 Information Elements

Information element name	Status	Description
Information To Send	M	This IE is described in a table below.
Disconnect From IP Forbidden	M	This IE indicates whether or not the gsmSRF may be disconnected from the user when all information has been sent.
Request Announcement Complete Notification	M	This IE indicates whether or not a Specialized Resource Report shall be sent to the gsmSCF when all information has been sent.
Request Announcement Started Notification	M	This IE indicates whether or not a Specialized Resource Report shall be sent to the gsmSCF when the first announcement or tone starts.
Call Segment ID	S	This IE indicates the call segment to which the user interaction shall apply. This IE shall be absent if this IF is sent by the gsmSCF to an Intelligent Peripheral.

Information To Send contains the following information elements:

Information element name	Status	Description
Inband Info	E	This IE is described in a table below.
Tone	E	This IE is described in a table below.

Inband Info contains the following information elements:

Information element name	Status	Description
Message ID	M	This IE is described in a table below.
Number Of Repetitions	M	This IE indicates the maximum number of times the message shall be sent to the end-user.
Duration	O	This IE indicates the maximum duration time in seconds that the message shall be played/repeated. Zero indicates endless repetition.
Interval	O	This IE indicates the time interval in seconds between two repetitions.

Message ID contains the following information elements:

Information element name	Status	Description
Elementary Message ID	E	This IE indicates a single announcement
Text	E	This IE indicates a text to be sent. The text shall be transformed to inband information (speech) by the gsmSRF.
Elementary Message IDs	E	This IE indicates a sequence of announcements
Variable Message	E	This IE indicates an announcement with one or more variable parts.

Tone contains the following information elements:

Information element name	Status	Description
Tone ID	M	This IE indicates the tone to be sent.
Duration	O	This IE indicates the maximum duration in seconds that the message shall be

Information element name	Status	Description
		played/repeated. Zero indicates endless repetition.

4.6.3.4 Prompt And Collect User Information

4.6.3.4.1 Description

This IF is used to interact with a call party in order to collect information.

4.6.3.4.2 Information Elements

Information element name	Status	Description
Collected Info	M	This IE is described in a table below.
Information To Send	O	This IE is described in subclause 4.6.3.3.2. This IE indicates an announcement or a tone to be sent to the end user by the gsmSRF.
Disconnect From IP Forbidden	M	This IE indicates whether the gsmSRF may be disconnected from the user when all information has been sent.
Request Announcement Started Notification	M	This IE indicates whether or not a Specialized Resource Report shall be sent to the gsmSCF when the first announcement or tone starts.
Call Segment ID	S	This IE indicates the call segment to which the user interaction shall apply. This IE shall be absent if this IF is sent by the gsmSCF to an Intelligent Peripheral.

Collected Info contains the following information element:

Information element name	Status	Description
Collected Digits	M	This IE is described in a table below.

Collected Digits contains the following information elements:

Information element name	Status	Description
Minimum Number Of Digits	M	This IE indicates the minimum number of valid digits to be collected. The value of this IE includes the length of the Start digit string, if present, and the length of the End of reply digit string, if present.
Maximum Number Of Digits	M	This IE specifies the maximum number of valid digits to be collected. The value of this IE includes the length of the Start digit string, if present, and the length of the End of reply digit string, if present.
End Of Reply Digit	O	This IE indicates the digit(s) used to signal the end of input.
Cancel Digit	O	If this IE is present then the cancel digit can be entered by the user to request a possible retry.
Start Digit	O	If this IE is present then the start digit(s) indicates the start of the valid digits to be collected.
First Digit Time Out	O	If this IE is present then the first digit shall be received before the expiration of the first digit timer expiration.
Inter Digit Time Out	O	If this IE is present then any subsequent valid or invalid digit shall be received by the gsmSRF before the inter digit timer expires.
Error Treatment	O	This IE indicates what specific action shall be taken by the gsmSRF in the event of error conditions occurring.
Interruptable Ann Ind	O	If this IE is set to TRUE (default value) then the announcement is interrupted after the first valid or invalid digit received by the gsmSRF. If this IE is present and explicitly set to FALSE then the announcement will not be interrupted after the first digit is received by the gsmSRF.
Voice Information	O	If this IE is set to FALSE (default value) then all valid or invalid digits are entered by DTMF. If this IE is set to TRUE then the calling user is required to provide all valid or invalid information by speech.
Voice Back	O	If this IE is set to FALSE (default value) then no voice back information is given by the gsmSRF. If this IE is set to TRUE then the valid input digits received by the gsmSRF will be announced back to the calling user immediately after the end of input is received.

4.6.4 gsmSRF to gsmSCF information flows

4.6.4.1 Activity Test ack

4.6.4.1.1 Description

This IF is the response to the Activity Test.

4.6.4.1.2 Information Elements

This IF contains no information elements.

4.6.4.2 Assist Request Instructions

4.6.4.2.1 Description

This IF is sent to the gsmSCF by a gsmSSF which is acting as the assisting gsmSSF or by a gsmSRF.

4.6.4.2.2 Information Elements

Information element name	Status	Description
Correlation ID	M	This IE is used to associate the Assist Request Instructions IF from an assisting gsmSSF or by a gsmSRF with the Initial DP IF from the initiating gsmSSF.
IP SSP Capabilities	M	This IE indicates which SRF resources are attached, available and supported within the MSC where the gsmSSF resides or the IP in which the gsmSRF resides.

4.6.4.3 Prompt And Collect User Information ack

4.6.4.3.1 Description

This IF is used by the gsmSRF to indicate the result of a Prompt And Collect User Information IF.

4.6.4.3.2 Information Elements

Information element name	Status	Description
Digits Response	C	This IE indicates the digit sequence received from the end user.

4.6.4.4 Specialized Resource Report

4.6.4.4.1 Description

This IF is used when a Specialized Resource Report was requested in a Play Announcement IF or in a Prompt and Collect User Information IF.

4.6.4.4.2 Information Elements

Information element name	Status	Description
All Announcements Complete	E	This IE indicates that all the announcements and tones are complete.
First Announcement Started	E	This IE indicates that the first announcement or tone has started.

4.6.5 gsmSCF to Assisting SSF information flows

4.6.5.1 Activity Test

4.6.5.1.1 Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and assistSSF. If the relationship is still in existence, then the assistSSF will respond. If no reply is received, then the gsmSCF will assume that the assistSSF has failed in some way and will take the appropriate action.

4.6.5.1.2 Information Elements

This IF contains no information elements.

4.6.5.2 Cancel

4.6.5.2.1 Description

This IF is used by the gsmSCF to request the assisting gsmSSF to cancel a correlated previous IF.

4.6.5.2.2 Information Elements

Information element name	Status	Description
Invoke ID	M	This IE specifies the IF to be cancelled.

4.6.5.3 Connect To Resource

4.6.5.3.1 Description

This IF is described in subclause 4.6.2.7. The following difference applies:

- The Call Segment ID information element is not used.

4.6.5.4 Disconnect Forward Connection

4.6.5.4.1 Description

This IF is used to disconnect a connection with a gsmSRF previously established with a Connect To Resource IF.

4.6.5.4.2 Information Elements

This IF contains no information elements.

4.6.5.5 Play Announcement

4.6.5.5.1 Description

This IF is described in subclause 4.6.3.3. The following difference applies:

- The Call Segment ID information element is not used.

4.6.5.6 Prompt And Collect User Information

4.6.5.6.1 Description

This IF is described in subclause 4.6.3.4. The following difference applies:

- The Call Segment ID information element is not used.

4.6.5.7 Reset Timer

4.6.5.7.1 Description

This IF is described in subclause 4.6.2.20. The following difference applies:

- The Call Segment ID information element is not used.

4.6.6 Assisting SSF to gsmSCF information flows

4.6.6.1 Activity Test ack

4.6.6.1.1 Description

This IF is the response to the Activity Test.

4.6.6.1.2 Information Elements

This IF contains no information elements.

4.6.6.2 Assist Request Instructions

4.6.6.2.1 Description

This IF is described in subclause 4.6.4.2.

4.6.6.3 Prompt And Collect User Information ack (received information)

4.6.6.3.1 Description

This IF is described in subclause 4.6.4.3.

4.6.6.4 Specialized Resource Report

4.6.6.4.1 Description

This IF is described in subclause 4.6.4.4.

4.6.7 HLR to VLR information flows

4.6.7.1 Delete Subscriber Data

4.6.7.1.1 Description

This IF is used by an HLR to delete CAMEL subscription data from a VLR. It is specified in 3GPP TS 29.002 [34].

4.6.7.1.2 Information Elements

The Delete Subscriber Data IF contains the following CAMEL specific information elements:

Information element name	Status	Description
CAMEL Subscription Info Withdraw	O,E	This IE identifies that all CSIs shall be deleted from the subscriber data in the VLR.
Specific CSI Withdraw	O,E	This IE indicates that one or more specific elements of CAMEL Subscription Info shall be deleted from the VLR. The specific elements of CAMEL Subscription Info which may be deleted are: - O-CSI with TDP criteria for O-CSI; - TIF-CSI; - D-CSI; - VT-CSI with TDP criteria for VT-CSI. This IE should not be present when CAMEL Subscription Info Withdraw is present.

4.6.7.2 Insert Subscriber Data

4.6.7.2.1 Description

This IF is used by an HLR to update a VLR with certain subscriber data. This IF is specified in 3GPP TS 29.002 [34].

4.6.7.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific information elements for circuit switched call control:

Information element name	Status	Description
O-CSI	O	This IE is described in a table below. This IE identifies the subscriber as having originating CAMEL services.
D-CSI	O	This IE is described in a table below. This IE identifies the subscriber as having originating CAMEL dialled services.
VT-CSI	O	This IE is described in a table below. This IE identifies the subscriber as having terminating CAMEL services in the VMSC.
TIF-CSI	O	See 3GPP TS 23.072 [16].

O-CSI contains the following information elements:

Information element name	Status	Description
gsmSCF Address	M	This IE is described in subclause 4.3.1
Service Key	M	This IE is described in subclause 4.3.1.
Default Call Handling	M	This IE is described in subclause 4.3.1.
TDP List	M	This IE is described in subclause 4.3.1.
DP Criteria	O	This IE is described in subclause 4.3.1.
CAMEL Capability Handling	C	This IE is described in subclause 4.3.1. If this IE is absent, this indicates that CAMEL phase 1 support is requested.

D-CSI contains the following information elements:

Information element name	Status	Description
gsmSCF Address	M	This IE is described in subclause 4.3.2.
Service Key	M	This IE is described in subclause 4.3.2.
Default Call Handling	M	This IE is described in subclause 4.3.2.
DP Criteria	M	This IE is described in subclause 4.3.2.
CAMEL Capability Handling	M	This IE is described in subclause 4.3.2. The CAMEL Capability Handling shall indicate CAMEL phase 3 or higher.

VT-CSI contains the following information elements:

Information element name	Status	Description
gsmSCF Address	M	This IE is described in subclause 4.3.6.
Service Key	M	This IE is described in subclause 4.3.6.
Default Call Handling	M	This IE is described in subclause 4.3.6.
TDP List	M	This IE is described in subclause 4.3.6.
DP Criteria	O	This IE is described in subclause 4.3.6.
CAMEL Capability Handling	M	This IE is described in subclause 4.3.6. The CAMEL Capability Handling shall indicate CAMEL phase 3 or higher.

4.6.7.3 Provide Subscriber Info

4.6.7.3.1 Description

This IF is described in TS 23.018 [12]; it is used by the HLR to request information (any one or more of subscriber state, subscriber location, IMEI & software version and MS classmark information for the CS domain) from the VLR at any time.

4.6.7.4 Provide Roaming Number

4.6.7.4.1 Description

This IF is specified in 3GPP TS 23.018 [12]; it is used by the HLR to request a roaming number from the VLR.

4.6.7.4.2 Information Elements

Provide Roaming Number contains the following CAMEL specific information elements:

Information element name	Status	Description
Suppression Of Announcements	S	This IE indicates that announcements or tones generated as a result of unsuccessful call establishment shall be suppressed. It shall be present if the HLR received it in the Send Routeing Info IF.
Call Reference Number	M	This IE carries the Call Reference Number provided by the GMSC or the gsmSCF in the Send Routeing Info IF.
GMSC Or gsmSCF Address	M	This IE is the E.164 address of the GMSC for an MT call or the E.164 address of the gsmSCF for a gsmSCF initiated call.
Alerting Pattern	S	This IE indicates the kind of Alerting Pattern to be applied. It shall be present if the HLR received it from the GMSC or the gsmSCF in the Send Routeing Info IF.
Supported CAMEL Phases in Interrogating Node	S	This IE indicates the CAMEL Phases supported in the GMSC or the gsmSCF. It shall be present if the HLR received it from the GMSC or the gsmSCF in the Send Routeing Info.
Offered CAMEL4 CSIs in Interrogating Node	S	This IE indicates the CAMEL phase 4 CSIs offered in the GMSC or the gsmSCF. It shall be present if the HLR received it from the GMSC or the gsmSCF in the Send Routeing Info. This IE is described in a table below.
Suppress VT-CSI	S	This IE indicates that VT-CSI shall be suppressed for the called party. This IE shall be present if the HLR received it in the Send Routeing Info IF.
OR not Supported In GMSC	S	This IE indicates that the VMSC should not attempt to invoke Optimal Routeing of late call forwarding. It shall be present if this IF was triggered by a Send Routeing IF for a gsmSCF initiated call.

Offered CAMEL4 CSIs in Interrogating Node contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI. It shall be present if the HLR received it from the GMSC or the gsmSCF in the Send Routeing Info.
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI. It shall be present if the HLR received it from the GMSC or the gsmSCF in the Send Routeing Info.
T-CSI	S	This IE indicates the offer of CAMEL phase 4 T-CSI. It shall be present if the

Information element name	Status	Description
		HLR received it from the GMSC or the gsmSCF in the Send Routeing Info.

4.6.8 VLR to HLR information flows

4.6.8.1 Insert Subscriber Data ack

4.6.8.1.1 Description

This IF is used by the VLR to indicate to the HLR the result of the Insert Subscriber Data IF. It is specified in 3GPP TS 29.002 [34].

4.6.8.1.2 Information Elements

Insert Subscriber Data ack contains the following CAMEL specific information elements:

Information element name	Status	Description
Supported CAMEL Phases	S	This IE identifies which CAMEL phases are supported by the VMSC/VLR. It shall be present when a CSI has been included in the Insert Subscriber Data IF.
Offered CAMEL4 CSIs	S	This IE indicates the CAMEL phase 4 CSIs offered in the VMSC/VLR. It shall be present if a CSI has been included in the Insert Subscriber Data IF and the 'Supported CAMEL Phases' IE indicates support of CAMEL phase 4.

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI.
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI.
VT-CSI	S	This IE indicates the offer of CAMEL phase 4 VT-CSI.
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI.

4.6.8.2 Provide Subscriber Info ack

4.6.8.2.1 Description

This IF is described in TS 23.018 [12]; it is used by the VLR to provide the requested information to the HLR.

4.6.8.3 Update Location

4.6.8.3.1 Description

This IF is used by the VLR to provide information about supported CAMEL phases to the HLR.

4.6.8.3.2 Information Elements

Update Location contains the following CAMEL specific information element:

Information element name	Status	Description
Supported CAMEL Phases	S	This IE indicates which phases of CAMEL are supported. It shall be present if a CAMEL phase higher than phase 1 is supported. Otherwise may be absent.
Offered CAMEL4 CSIs	S	This IE indicates the CAMEL phase 4 CSIs offered in the VMSC/VLR. It shall be present if the "Supported CAMEL Phases" IE indicates support of CAMEL phase 4.

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI.
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI.
VT-CSI	S	This IE indicates the offer of CAMEL phase 4 VT-CSI.
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI.

4.6.8.4 Restore Data

4.6.8.4.1 Description

This IF is used by the VLR to provide the information about supported CAMEL phases to the HLR.

4.6.8.4.2 Information Elements

Restore Data contains the following CAMEL specific information element:

Information element name	Status	Description
Supported CAMEL Phases	S	This IE indicates which phases of CAMEL are supported. It shall be present if a CAMEL phase higher than phase 1 is supported. Otherwise may be absent.
Offered CAMEL4 CSIs	S	This IE indicates the CAMEL phase 4 CSIs offered in the VMSC/VLR. It shall be present if the "Supported CAMEL Phases" IE indicates support of CAMEL phase 4.

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI
VT-CSI	S	This IE indicates the offer of CAMEL phase 4 VT-CSI
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI

4.6.9 HLR to GMSC information flows

4.6.9.1 Send Routeing Info ack

4.6.9.1.1 Description

This IF is specified in 3GPP TS 23.018 [12]; it is used by the HLR to transfer the requested routeing information to the GMSC.

4.6.9.1.2 Information Elements

Send Routeing Info ack contains the following CAMEL specific information elements:

Information element name	Status	Description
Location Information	C	This IE indicates the location of the served subscriber.
O-CSI	S	O-CSI is defined in subclause 4.3.1. This IE identifies the subscriber as having originating CAMEL services. It shall be present if O-CSI is active, and CFU or CFNRc has been invoked, or if both O-CSI and T-CSI are active.
D-CSI	S	D-CSI is defined in subclause 4.3.2. This IE identifies the subscriber as having originating CAMEL dialled services. It shall be present if D-CSI is active, and CFU or CFNRc has been invoked, or if both D-CSI and T-CSI are active.
Subscriber State	C	This IE indicates the state of the MS. The possible values of the IE are: - CAMEL Busy: The VLR has indicated that the MS is engaged in a transaction for a mobile originating or terminated circuit-switched call. - Network Determined Not Reachable: The HLR or VLR has indicated that the network can determine from its internal data that the MS is not reachable. - Assumed Idle: The VLR has indicated that the state of the MS is neither "CAMEL Busy" nor "Network Determined Not Reachable". - Not Provided From VLR: The VLR did not provide any information on subscriber state even though it was requested.
T-CSI	S	This IE is described in a table below. This IE identifies the subscriber as having terminating CAMEL services. It shall be present if T-CSI is active and no Suppress T-CSI indicator is present in the Send Routeing Info IF.
Basic Service Code	C	This IE indicates the type of basic service, i.e. teleservice or bearer service.
CUG Subscription Flag	S	This IE indicates if the called party has a CUG subscription. It shall be present only if the T-CSI is active and included in the Send Routing Information ack IF.
Supported CAMEL Phases In VMSC	S	This IE indicates the supported CAMEL phases of the VLR. It shall be present if known by the HLR, otherwise it shall be absent.
Offered CAMEL4 CSIs In VMSC	S	This IE indicates the CAMEL phase 4 CSIs offered in the VMSC. It shall be present if known by the HLR, otherwise it shall be absent.
VMSC Address	M	This IE indicates the E.164 address of the VMSC in whose area the B subscriber is currently registered.

Location Information is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	Status	Description
Service area ID	C,E	See 3GPP TS 23.018 [12].
Cell ID	C,E	See 3GPP TS 23.018 [12].
VLR Number	C	See 3GPP TS 23.018 [12]. The HLR shall include the internally stored VLR Number.
Current Location Retrieved	-	Not applicable
Location area ID	C,E	See 3GPP TS 23.003 [7].
Selected LSA Identity	S	This IE indicates the LSA identity associated with the current position of the MS. Shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. If there are multiple matches the LSA ID with the highest priority shall be sent. See 3GPP TS 23.073 [18].

T-CSI contains the following information elements:

Information element name	Status	Description
gsmSCF Address	M	This IE is described in subclause 4.3.5.
Service Key	M	This IE is described in subclause 4.3.5.
Default Call Handling	M	This IE is described in subclause 4.3.5.
TDP List	M	This IE is described in subclause 4.3.5.
DP Criteria	S	This IE is described in subclause 4.3.5. The HLR shall send only the criteria associated with DP T_Busy or DP T_No_Answer, if available.
CAMEL Capability Handling	C	This IE is described in subclause 4.3.5. If this IE is absent then this indicates that CAMEL phase 1 support is requested.

Offered CAMEL4 CSIs In VMSC contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI. It shall be present if known by the HLR, otherwise it shall be absent.
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI. It shall be present if known by the HLR, otherwise it shall be absent.
VT-CSI	S	This IE indicates the offer of CAMEL phase 4 VT-CSI. It shall be present if known by the HLR, otherwise it shall be absent.
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI. It shall be present if known by the HLR, otherwise it shall be absent.

4.6.10 GMSC to HLR information flows

4.6.10.1 Send Routeing Info

4.6.10.1.1 Description

This IF is described in 3GPP TS 23.018 [12]; it is used to request information from the HLR to route an MT call.

4.6.10.1.2 Information Elements

Send Routeing Info contains the following CAMEL specific information elements:

Information element name	Status	Description
Alerting Pattern	S	This IE indicates the kind of Alerting Pattern to be applied. It shall be present if it was received from the gsmSCF or set by the gsmSSF.
Suppression Of Announcement	S	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed. It shall be present in the interrogation if available, i.e. when it has been received from the gsmSCF.
Suppress T-CSI	S	This IE indicates that T-CSI shall be suppressed. It shall always be present in the second interrogation or if it was received from the gsmSCF due to an Initiate Call Attempt IF.
Supported CAMEL Phases	M	This IE lists the supported CAMEL phases in the GMSC.
Offered CAMEL4 CSIs	M	This IE indicates the CAMEL phase 4 CSIs offered in the GMSC. This IE is described in a table below.
Call Reference Number	M	This IE carries the Call Reference Number allocated for the call by the GMSC. It shall be allocated once per call and present in both first and second interrogations.
GMSC Address	M	This IE is the E.164 address of the GMSC.
Call Diversion Treatment Indicator	S	This IE indicates whether or not the call can be forwarded using the Call Forwarding or Call Deflection supplementary services. It shall be present if it was received within Forward Service Interaction Indicator in Service Interaction Indicators Two from the ISUP Initial Address Message or previous CAMEL processing.

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI.
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI.
T-CSI	S	This IE indicates the offer of CAMEL phase 4 T-CSI.

4.6.11   VMSC to GMSC information flows

4.6.11.1   Resume Call Handling

4.6.11.1.1   Description

This IF is described in 3GPP TS 23.079 [19], it is used to request the GMSC to take over handling the call so that it can be forwarded from the GMSC.

4.6.11.1.2   Information Elements

Resume Call Handling contains the following CAMEL specific information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates that CAMEL handling applies for an optimally routed late forwarded call. This IE shall be present if CAMEL handling applies; otherwise it shall be absent. Trigger criteria for DP Collected_Information, if present, shall be omitted from this IF. Trigger criteria for DP Route_Select_Failure, if present, shall be included in this IF.
D-CSI	S	This IE indicates that CAMEL handling applies for an optimally routed late forwarded call. This IE shall be present if CAMEL handling applies; otherwise it shall be absent.

4.6.12   MSC to VLR information flows

4.6.12.1   Send Info For ICA

4.6.12.1.1   Description

This IF is used to request the VLR to provide information to handle an outgoing call leg created by the gsmSCF.

4.6.12.1.2   Information Elements

Information element name	NP	Description
Called Number	M	This IE indicates the E.164 number of the call leg destination.
IMSI	M	This IE is the IMSI of the served CAMEL subscriber.
CUG Index	C	For the definition of this IE, see 3GPP TS 23.085 [22].
Suppress Preferential CUG	C	For the definition of this IE, see 3GPP TS 23.085 [22].
Suppress CUG Outgoing Access	C	For the definition of this IE, see 3GPP TS 23.085 [22].
Suppress Outgoing Call Barring	C	This IE indicates that outgoing call barrings shall be suppressed for the call leg.
Suppress D-CSI	S	This IE indicates that D-CSI shall be suppressed. It shall always be present in the second interrogation.
N-CSI Available	S	This IE indicates that N-CSI is available in MSC. It shall be present in the first interrogation if N-CSI is available in the MSC.
Non-CUG Call	S	This IE indicates that no parameters for CUG should be used for the call. It shall be present if received from gsmSCF.
CUG Interlock Code	S	For the definition of this IE, see 3GPP TS 23.085 [22]. It shall be present if received from gsmSCF.
Outgoing Access	S	For the definition of this IE, see 3GPP TS 23.085 [22]. It shall be present if received from gsmSCF.

4.6.12.2 Send Info For Incoming Call

4.6.12.2.1 Description

This IF is described in 3GPP TS 23.018 [12]; it is used to request the VLR to provide information to handle an incoming call.

4.6.12.2.2 Information Elements

Send Info For Incoming Call contains the following CAMEL specific information elements:

Information element name	Status	Description
Suppress VT-CSI	S	This IE indicates that VT-CSI shall be suppressed. It shall never be present in the first interrogation; it shall always be present in the second interrogation.
Call Diversion Treatment Indicator	S	This IE indicates whether or not the call can be forwarded using the Call Forwarding or Call Deflection supplementary services. It shall be present if received within the Forward Service Interaction Indicator in the Service Interaction Indicators Two from the IAM or previous CAMEL processing.

4.6.12.3 Send Info For MT Reconnected Call

4.6.12.3.1 Description

This IF is used to request the VLR to provide information to handle a reconnected MT call.

4.6.12.3.2 Information Elements

Information element name	Required	Description
Called Number	M	E.164 number of the call destination.

4.6.12.4 Send Info For Outgoing Call

4.6.12.4.1 Description

This IF is described in 3GPP TS 23.018 [12]; it is used to request the VLR to provide information to handle an outgoing call.

4.6.12.4.2 Information Elements

Send Info For Outgoing Call contains the following CAMEL specific information elements:

Information element name	Status	Description
Suppress O-CSI	S	This IE indicates that O-CSI shall be suppressed. It shall always be present in the second interrogation.
Suppress D-CSI	S	This IE indicates that D-CSI shall be suppressed. It shall always be present in the second interrogation.
N-CSI Available	S	This IE indicates that N-CSI is available in MSC. It shall be present in the first interrogation if N-CSI is available in the MSC.

4.6.12.5 Send Info For Reconnected Call

4.6.12.5.1 Description

This IF is used to request the VLR to provide information to handle a reconnected MO call.

4.6.12.5.2   Information Elements

Information element name	Status	Description
Called Number	M	This IE indicates the E.164 number of the call destination.
Bearer Service	S,E	This IE indicates the bearer service required for the MO call, derived from the CS bearer capability information received in the setup request from the MS. One of bearer service or teleservice shall be present.
Teleservice	S,E	This IE indicates the teleservice required for the MO call, derived from the CS bearer capability information received in the setup request from the MS or from the emergency setup request from the MS. One of bearer service or teleservice shall be present.
CUG Index	S	For the definition of this IE, see 3GPP TS 23.085 [22]. It shall be present if it was received in the setup request from the MS.
Suppress Preferential CUG	S	For the definition of this IE, see 3GPP TS 23.085 [22]. It shall be present if it was received in the setup request from the MS.
Suppress CUG Outgoing Access	S	For the definition of this IE, see 3GPP TS 23.085 [22]. It shall be present if it was received in the setup request from the MS.
Suppress O-CSI	S	This IE indicates that O-CSI shall be suppressed. It shall always be present in the second interrogation.

4.6.13   VLR to MSC information flows

4.6.13.1   Complete Call

4.6.13.1.1   Description

This IF is described in 3GPP TS 23.018 [12]; it is used to instruct the MSC to continue the connection of a call.

4.6.13.1.2   Information Elements

Complete Call contains the following CAMEL specific information elements:

Information element name	MO	MF	MT	VT	NC	NP	Description
O-CSI	S	-	-	-	-	-	This IE indicates that CAMEL handling applies for an MO call. It shall be present in the response to the first interrogation for an MO call if CAMEL handling applies; otherwise it shall be absent. It shall be absent from the response to the second interrogation for an MO call.
D-CSI	C	-	-	-	-	C	This IE identifies the subscriber as having originating CAMEL dialled services.
Call Reference Number	-	-	-	M	-	-	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
GMSC Address	-	-	-	M	-	-	This IE is the E.164 address of the GMSC.

4.6.13.2   Continue CAMEL Handling

4.6.13.2.1   Description

This IF is used to instruct the MSC to continue the CAMEL specific handling.

4.6.13.2.2 Information Elements

Information element name	Status	Description
VT-CSI	M	This IE identifies the subscriber as having terminating CAMEL services in the VMSC.
IMSI	M	This IE contains the IMSI of the B subscriber.
MSISDN	S	This IE contains the E.164 number of the B subscriber. It will be used to create the redirecting number presented to the C subscriber. It shall be present if the call is to be forwarded or if it has been provided by the HLR in the Provide Roaming Number IF, otherwise it shall be absent.
CUG Interlock	S	For the definition of this IE, see 3GPP TS 23.085 [22]. It shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call in accordance with the rules in 3GPP TS 23.085 [22], otherwise it shall be absent.
CUG Outgoing Access	S	For the definition of this IE, see 3GPP TS 23.085 [22]. It shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call with outgoing access in accordance with the rules in 3GPP TS 23.085 [22], otherwise it shall be absent.
Location Information	S	This IE contains the information to define the location of the MS: see definition in 3GPP TS 23.018 [12]. It shall be present if location information was requested and is available; otherwise it shall be absent.
GMSC-Address	M	This IE is the E.164 address of the GMSC which was received in the Provide Roaming Number.
Call Reference Number	M	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
ExtBasic Service Code	M	This IE indicates the type of basic service, i.e. teleservice or bearer service.

4.6.13.3 Process Call Waiting

4.6.13.3.1 Description

This IF is described in 3GPP TS 23.018 [12]; it is used to instruct the MSC to continue the connection of a waiting call.

4.6.13.3.2 Information Elements

Process Call Waiting contains the following CAMEL specific information elements:

Information element name	Status	Description
Call Reference Number	M	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
GMSC Address	M	This IE is the E.164 address of the GMSC.

4.6.13.4 Send Info For ICA negative response

4.6.13.4.1 Description

This IF is used to indicate that the outgoing call leg for which the MSC requested subscription information shall not be connected.

4.6.13.4.2 Information Elements

The negative response information elements can take the following values:

- Bearer service not provisioned;

- Call barred (Operator determined barring);

- Call barred (Supplementary service barring);

- CUG reject (Inconsistent access information - index incompatible with basic service);

- CUG reject (Inconsistent access information - no CUG selected);

- CUG reject (Outgoing calls barred within the CUG);

- CUG reject (Unknown CUG index);

- Teleservice not provisioned.

4.6.13.5 Send Info For Incoming Call ack

4.6.13.5.1 Description

This IF is described in 3GPP TS 23.018 [12]; it is used to indicate that the incoming call for which the MSC requested subscription information shall be forwarded.

4.6.13.5.1 Information Elements

Send Info For Incoming Call ack contains the following CAMEL specific information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates that originating CAMEL service handling applies for a forwarded call. It shall be present if originating CAMEL service handling applies; otherwise it shall be absent.
D-CSI	S	This IE indicates that originating CAMEL dialled service handling applies for a forwarded call. It shall be present if originating CAMEL dialled service handling applies; otherwise it shall be absent.
Suppression Of Announcement	S	This IE indicates that announcements or tones generated when the call is forwarded shall be suppressed. It shall be present if it was received in the Provide Roaming Number for this call.
Call Reference Number	M	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
GMSC Address	M	This IE is the E.164 address of the GMSC.

4.6.13.6 Send Info For Incoming Call negative response

4.6.13.6.1 Description

This IF is described in 3GPP TS 23.018 [12]; it is used to indicate that the incoming call for which the MSC requested subscription information shall not be connected.

4.6.13.6.2 Information Elements

Send Info For Incoming Call negative response contains the following CAMEL specific information element which may be attached as an IE to any of the negative response values defined in 3GPP TS 23.018 [12]:

Information element name	Status	Description
Suppression Of Announcement	S	This IE indicates that announcements or tones generated as a result of unsuccessful call establishment shall be suppressed. It shall be present if it was received in the Provide Roaming Number for this call.

4.6.13.7 Send Info For MT Reconnected Call ack

4.6.13.7.1 Description

This IF is used to instruct the MSC to continue the connection of a reconnected MT call.

4.6.13.7.2 Information Elements

Information element name	Required	Description
O-CSI	S	This IE indicates that originating CAMEL service handling applies for the reconnected call. It shall be present if originating CAMEL service handling applies; otherwise it shall be absent.
D-CSI	S	This IE indicates that originating CAMEL dialled service handling applies for the reconnected call. It shall be present if originating CAMEL dialled service handling applies; otherwise it shall be absent.

4.6.13.8 Send Info For MT Reconnected Call negative response

4.6.13.8.1 Description

This IF is used to indicate that the reconnected MT call for which the MSC requested subscription information shall not be connected.

4.6.13.8.2 Information Elements

The negative response information element can take the following value:

- CUG reject

4.6.13.9 Send Info For Reconnected Call ack

4.6.13.9.1 Description

This IF is used to instruct the MSC to continue the connection of a reconnected MO call.

4.6.13.9.2 Information Elements

Send Info For Reconnected Call ack does not contain any information elements.

4.6.13.10 Send Info For Reconnected Call negative response

4.6.13.10.1 Description

This IF is used to indicate that the reconnected MO call for which the MSC requested subscription information shall not be connected.

4.6.13.10.2 Information Elements

The negative response information element can take the following value:

- Call barred (Operator determined barring);

- Call barred (Supplementary service barring).

4.6.14 Internal MSC information flows

4.6.14.1 Perform Call Forwarding ack

4.6.14.1.1 Description

This IF is defined in 3GPP TS 23.018 [12]; it is used to inform the MSC that Call Forwarding is taking place.

4.6.14.1.2 Information Elements

Perform Call Forwarding ack is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	Status	Description
Forwarded-to Number	M	If the Forwarded-to Number is not available due to CAMEL handling (a Disconnect Leg IF has been received for Leg 2), then the MSC shall populate this parameter with a dummy number.

4.6.15 gsmSCF to HLR information flows

4.6.15.1 Send Routeing Info

4.6.15.1.1 Description

This IF is defined in 3GPP TS 23.018 [12] and subclause 4.6.10.1; it is used to request information from the HLR to route a gsmSCF initiated call.

Refer to 3GPP TS 29.007 [35] for the usage of ISDN BC, ISDN LLC, ISDN HLC and MSISDN for the selection of the PLMN Basic Service.

4.6.15.1.2 Information Elements

Send Routeing Info from the gsmSCF contains the following information elements:

Information element name	Status	Description
MSISDN	M	This IE indicates the MSISDN of the called subscriber.
Alerting Pattern	O	This IE indicates the kind of Alerting Pattern to be applied.
CUG Interlock	O	For the definition of this IE, see 3GPP TS 23.085 [22].
CUG Outgoing Access	O	For the definition of this IE, see 3GPP TS 23.085 [22].
Suppression Of Announcement	O	This IE indicates that announcements or tones generated as a result of unsuccessful call establishment shall be suppressed.
Suppress T-CSI	M	This IE indicates that CAMEL subscription information should not be returned in the first Send Routeing Info ack (to avoid the need for a second interrogation).
Supported CAMEL Phases	M	This IE indicates the CAMEL Phases supported by the gsmSCF.
Offered CAMEL4 CSIs	S	This IE indicates the CAMEL phase 4 CSIs offered by the gsmSCF. This IE shall be present when the Supported CAMEL Phases IE indicates support of CAMEL Phase 4. This IE is described in a table below.
Call Reference Number	M	This IE carries the Call Reference Number allocated for the call by the gsmSCF.
GMSC Or gsmSCF Address	M	This IE is the E.164 address of the gsmSCF.
Call Diversion Treatment Indicator	O	This IE indicates whether or not the call is allowed to be forwarded on behalf of the called party using the Call Forwarding supplementary service.
Pre-paging Supported	S	This IE shall be present if the gsmSCF supports pre-paging, otherwise it shall be absent.
Interrogation Type	M	This IE shall contain the value "Basic Call".
Long FTN Supported	O	This IE indicates that the gsmSCF supports Long Forwarded to Numbers.
gsmSCF Initiated Call	M	This IE indicates that the IF was originated by a gsmSCF.
Suppress Incoming Call Barring	O	This IE indicates that Incoming Call Barrings shall be suppressed for the called party.
Suppress VT-CSI	O	This IE indicates that VT-CSI shall be suppressed.
ISDN BC	O	ISDN bearer capability. See 3GPP TS 23.018 [12].
ISDN LLC	O	ISDN lower layer compatibility. See 3GPP TS 23.018 [12].
ISDN HLC	O	ISDN higher layer compatibility. See 3GPP TS 23.018 [12].

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI.
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI.
T-CSI	S	This IE indicates the offer of CAMEL phase 4 T-CSI.

4.6.16   HLR to gsmSCF information flows

4.6.16.1   Send Routeing Info ack

4.6.16.1.1   Description

This IF is described in subclause 4.6.9.1; it is used by the HLR to transfer the requested routeing information to the gsmSCF.

4.6.16.2   Send Routeing Info negative response

4.6.16.2.1   Description

This IF is described in 3GPP TS 23.018 [12]; it is used by the HLR to indicate that the routeing information is not available.

4.7   Interaction with supplementary services

4.7.1   Line identification

For a call subject to CAMEL control, the gsmSCF shall have the option to send the Calling Party Restriction Indicator to the gsmSSF. This information element will be sent to the MSC and shall indicate whether the CLI Presentation Indicator present in the Calling Party Number shall be set by CAMEL action to Restricted.

4.7.2   Call forwarding services

4.7.2.1   Registration of Call Forwarding

The functional behaviour for the registration of the Call Forwarding supplementary service is defined in 3GPP TS 23.082 [20]. The procedure specific to CAMEL is defined in this subclause:

- CAMEL_Check_CF_Interaction.

Procedure CAMEL_Check_CF_Interaction 1(1)

Procedure in the HLR to check the provision of TIF-CSI.

```
                    ┌──────────┐
                    │          │
                    └──────────┘

                      ◇ TIF-CSI
                      ◇ provided? ◇──────────┐ No
                                             │
                      Yes                    │
                 ┌──────────┐          ┌──────────┐
                 │ Result:= │          │ Result:= │
                 │   pass   │          │   fail   │
                 └──────────┘          └──────────┘
                      │                     │
                      ⊗                     ⊗
```
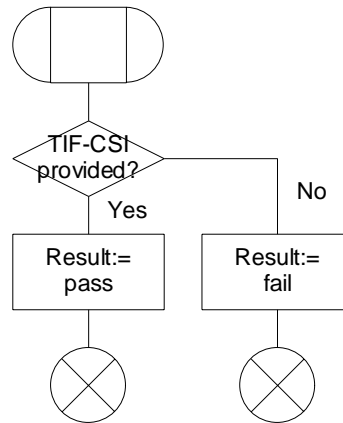
Figure 4.117-1: Procedure CAMEL_Check_CF_Interaction (sheet 1)

4.7.2.2 Invocation of Call Forwarding

The functional behaviour for the invocation of the Call Forwarding supplementary service is defined in 3GPP TS 23.018 [12] and 3GPP TS 23.082 [20]. The following additional requirements apply.

When Call Forwarding is invoked for a CAMEL subscriber with O-CSI, the gsmSSF shall send the FTN to the gsmSCF in the format in which it was received from the HLR. When Call Forwarding is invoked for a CAMEL subscriber with D-CSI or if an N-CSI is present in the forwarding MSC, then the FTN shall be treated as defined in subclause 4.2.1.2.2.

If the Service Interaction Indicators Two parameter was included in the Initial Address Message, the Continue With Argument information flow or the Connect message, the appropriate indicator shall be applied for the forwarded call.

An HLR shall not send an FTN which is not in international format to a GMSC which does not support CAMEL phase 2, i.e. if the HLR is handling a request from a GMSC for routeing information and the forwarded-to number is registered in a format other than international, the service logic in the HLR shall behave as if the call forwarding is provisioned but not registered.

4.7.2.3 Invocation of Call Deflection

The functional behaviour for the invocation of the Call Deflection supplementary service is defined in 3GPP TS 23.018 [12] and 3GPP TS 23.072 [16]. The following additional requirements apply.

When Call Deflection is invoked by a CAMEL subscriber with O-CSI, the gsmSSF shall send the DTN to the gsmSCF in the format in which it was received from the MS. When Call Deflection is invoked by a CAMEL subscriber with D-CSI or if a N-CSI is present in the VMSC, then the DTN shall be treated as defined in subclause 4.2.1.2.2.

If the Service Interaction Indicators Two parameter was included in the Initial Address Message, the Continue With Argument information flow or the Connect information flow, the appropriate indicator shall be applied for the deflected call.

4.7.3 Call Barring services

When a CAMEL subscriber with O-CSI and TIF-CSI attempts to activate a conditional call barring service (BOIC,BOIC-exHC), the HLR shall not check the interactions with call forwarding.

When the gsmSCF initiates a call to a subscriber, the gsmSCF can indicate to the HLR that incoming call barrings shall be suppressed for this call.

When the gsmSCF creates an additional call leg in an existing call, the gsmSCF can indicate to the VLR (via the gsmSSF and MSC) that outgoing call barrings shall be suppressed for this call leg.

4.7.4 Closed User Group

For a CUG subscriber with CAMEL services:

- The HLR shall store (and transfer to the VLR) the necessary subscriber data to ensure that the served subscriber is not unnecessarily prevented by CUG constraints from originating calls.

- The HLR shall store the necessary subscriber data to ensure that the served subscriber is not unnecessarily prevented by CUG constraints from receiving calls.

For an MO or MF call, the CUG information for that call shall be sent to the gsmSCF in the Initial DP information flow.

If the gsmSCF returns a Continue information flow, the call shall continue with the original CUG information unchanged.

If the gsmSCF returns a Connect or Continue With Argument information flow, the CUG handling in table 4.7 applies.

Table 4.7: CUG handling on receipt of Connect or Continue With Argument for an MO or MF call

CUG parameters in information flow	Handling
Non-CUG call (note 1)	Remove CUG information for the call and continue as a non-CUG call
CUG information (note 2)	Call shall continue with modified CUG information
No CUG information	Call shall continue with original CUG information
NOTE 1: Received in Service Interaction Indicators Two IE. NOTE 2: CUG information consists of at least one of CUG Interlock Code and Outgoing Access Indicator.	

For an MT call which is to be routed to the terminating subscriber, the CUG information shall be extracted from the Send Routeing Information ack and sent to the gsmSCF in the Initial DP, but the gsmSCF shall not have the ability to change the CUG information for the call.

For an VT call which is to be routed to the terminating subscriber, the CUG information shall be extracted from the incoming ISUP IAM and sent to the gsmSCF in the Initial DP, but the gsmSCF shall not have the ability to change the CUG information for the call.

For an MT or VT call which is subject to CAMEL forwarding, the gsmSCF shall return a Connect information flow and the CUG handling in table 4.7 applies.

5 USSD to/from gsmSCF

5.1 Architecture

5.1.1 Functional Entities used for CAMEL

This subclause describes the functional architecture needed to support CAMEL handling of USSD to/from gsmSCF. The functional model of USSD in an HLR that supports CAMEL is shown in figure 5.1. The phase 2 USSD handler is defined in 3GPP TS 23.090 [24]. Phase 1 USSD information flows may be relayed from the HLR to the gsmSCF. CAMEL introduces a "CAMEL USSD application" which is invoked by the USSD handler. The CAMEL USSD functional entities and application behaviour is specified in this subclause.
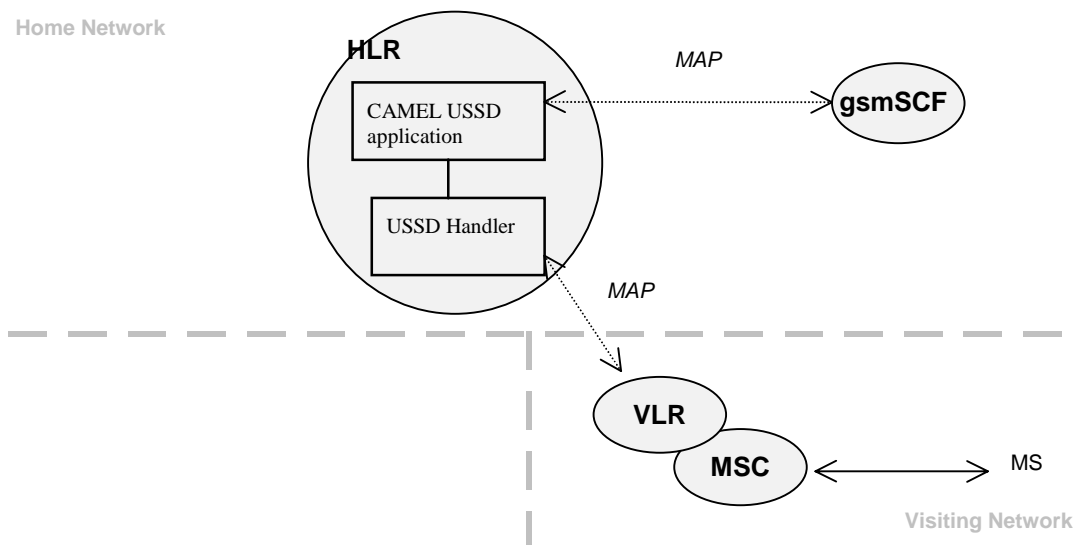
Figure 5.1: Handling of USSD to and from a CAMEL subscriber

HLR: The HLR stores for subscribers requiring CAMEL support the information relevant to the current subscription regarding U-CSI. The UG-CSI is stored as global data applicable to all subscribers. The U-CSI and the UG-CSI are stored in the HLR only.

gsmSCF: see subclause 3.1.

5.1.2 Interfaces defined for CAMEL

This subclause describes the different interfaces applicable to CAMEL. It specifies on a high level the functions specific to CAMEL.

5.1.2.1 gsmSCF - HLR interface

This interface is used for USSD information flows, both for gsmSCF-initiated dialogues and MS-initiated dialogues (relayed via HLR). It is a network operator option whether to support or not USSD information flows on this interface.

5.2 Description of CAMEL Subscriber Data

5.2.1 USSD CAMEL Subscription Information (U-CSI)

The subscription information specified in this subclause is for information only.

This subclause defines the contents of the USSD CAMEL Subscription Information (U-CSI). The U-CSI consists of a list of pairs of the following two parameters.

5.2.1.1 Service Code

Service code for a specific application in a gsmSCF which interacts with the user by USSD.

5.2.1.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber and a particular service code. The address shall be an E.164 number to be used for routeing.

5.3 Content of the USSD General CAMEL Service Information (UG-CSI)

The service information specified in this subclause is for information only.

This subclause defines the contents of the USSD General CAMEL Service Information (UG-CSI). The allocation of the UG-CSI is independent from a particular subscriber.

The UG-CSI consists of a list of pairs of the following two parameters.

5.3.1 Service Code

Service code for a specific application in a gsmSCF which interacts with the user by USSD.

5.3.2 gsmSCF address

Address to be used to access the gsmSCF for a particular service code. The address shall be an E.164 number to be used for routeing.

5.4 Procedures

5.4.1 MS Initiated USSD

For the behaviour of the USSD handler in HLR when receiving a MS initiated USSD see 3GPP TS 23.090 [24].

When the USSD handler has determined that the service code present in the received USSD does not indicate that an USSD application in the HLR shall be invoked it shall route the USSD to the USSD application specific for CAMEL, i.e. the CAMEL USSD application.

The procedure at the CAMEL USSD application at the HLR is implementation dependent. The following text describes a recommended procedure.

The CAMEL USSD application shall check the U-CSI data assigned to the specific subscriber. If the service code is present in the U-CSI the USSD is routed to the gsmSCF given by the gsmSCF address stored against the service code in the U-CSI.

If the service code is not present in the U-CSI (or the subscriber does not have U-CSI defined) then the CAMEL USSD application shall check the UG-CSI data assigned to the HLR. If the service code is present in the UG-CSI then the USSD is routed to the gsmSCF given by the gsmSCF address stored against the service code in the UG-CSI.

If the service code is not present in U-CSI or UG-CSI an error (unknown application) is returned to the USSD handler.

5.4.2 gsmSCF Initiated USSD

The HLR may at any time receive a USSD information flow from the gsmSCF. If the subscriber can be contacted, the HLR shall set up a transaction to the VLR and forward the information flow unchanged. Any further information exchange between the gsmSCF and MSC shall be transparent to the VLR and the HLR. When one transaction is released, the HLR shall release the other. If an error is received from the MSC, the VLR shall release the transaction to the HLR and the HLR shall release the transaction to the gsmSCF.

5.5 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for USSD handling.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Specific conditions (S) or Optional (O) in the "Status" column.

An 'M' IE shall always be included. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. An 'O' IE may be included or omitted as required by the service logic. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The HLR shall return an error if it does not functionally support an IE which it receives.

Details of errors and exceptions to these rules are specified in are specified in 3GPP TS 29.002 [34].

5.5.1 gsmSCF to HLR information flows

5.5.1.1 Unstructured SS Request

5.5.1.1.1 Description

This IF is used for the gsmSCF to request data from the MS via the HLR.

5.5.1.1.2 Information Elements

Information element name	Status	Description
USSD String	M	This IE contains the string that will be sent to the MS.
Data Coding Scheme	M	This IE indicates the characteristics of the USSD string.
IMSI	S,E	This IE identifies the subscriber for which the information is requested. It shall be present if this IF is the first IF in a USSD dialogue, otherwise it shall be absent.
MSISDN	S,E	This IE identifies the subscriber for which the information is requested. It shall be present if this IF is the first IF in a USSD dialogue, otherwise it shall be absent.
Alerting Pattern	O	This IE indicates an alerting pattern to be sent to the MS.

5.5.1.2 Unstructured SS Notify

5.5.1.2.1 Description

This IF is used for the gsmSCF to send data to the MS via the HLR.

5.5.1.2.2 Information Elements

Information element name	Status	Description
USSD String	M	This IE contains the string that will be sent to the MS.
Data Coding Scheme	M	This IE indicates the characteristics of the USSD string.
IMSI	S,E	This IE identifies the subscriber for which the information is requested. It shall be present if this IF is the first IF in a USSD dialogue, otherwise it shall be absent.
MSISDN	S,E	This IE identifies the subscriber for which the information is requested. It shall be present if this IF is the first IF in a USSD dialogue, otherwise it shall be absent.
Alerting Pattern	O	This IE indicates an alerting pattern to be sent to the MS.

5.5.1.3 Process Unstructured SS Data ack

5.5.1.3.1 Description

This IF is used for the gsmSCF to send the response to the MS via the HLR for the MS initiated IF.

5.5.1.3.2 Information Elements

The following information element is required:

Information element name	Status	Description
SS User Data	C	This IE contains the string that will be sent to the MS.

5.5.1.4 Process Unstructured SS Request ack

5.5.1.4.1 Description

This IF is used for the gsmSCF to send the response to the MS via the HLR for the MS initiated IF.

5.5.1.4.2 Information Elements

Information element name	Status	Description
USSD String	S	This IE contains the string that will be sent to the MS. It shall be present if the Data Coding Scheme is present; otherwise it shall be absent.
Data Coding Scheme	S	This IE indicates the characteristics of the USSD string. It shall be present if the Data Coding Scheme is present; otherwise it shall be absent.

5.5.2 HLR to gsmSCF information flows

5.5.2.1 Unstructured SS Request ack

5.5.2.1.1 Description

This IF is used for the MS to send to the gsmSCF via the HLR for the gsmSCF initiated IF.

5.5.2.1.2 Information Elements

Information element name	Status	Description
USSD String	C	This IE contains the string that will be sent to the gsmSCF. It shall be present if the Data Coding Scheme is present; otherwise it shall be absent.
Data Coding Scheme	C	This IE indicates the characteristics of the USSD string. It shall be present if the Data Coding Scheme is present; otherwise it shall be absent.

5.5.2.2 Unstructured SS Notify ack

5.5.2.2.1 Description

This IF is used for the MS to via the HLR acknowledge to the gsmSCF that the notification was received.

5.5.2.2.2 Information Elements

This IE contains no information element.

5.5.2.3 Process Unstructured SS Data

5.5.2.3.1 Description

This IF is used for the MS to request data from gsmSCF via the HLR.

5.5.2.3.2 Information Elements

Information element name	Status	Description
SS User Data	M	This IE contains the string that was received from the MS.

5.5.2.4 Process Unstructured SS Request

5.5.2.4.1 Description

This IF is used for the MS to request data from the gsmSCF via the HLR.

5.5.2.4.2 Information Elements

Information element name	Status	Description
USSD String	M	This IE contains the string that will be sent to the gsmSCF, including the Service Code.
Data Coding Scheme	M	This IE indicates the characteristics of the USSD string
IMSI	M	This IE identifies the subscriber.
MSISDN	S	This IE contains the basic MSISDN of the subscriber who has requested the USSD IF. This IE is used as an operator option.
Originating Entity Number	M	This IE identifies the functional entity initiating the information flow. In this case, this shall be the address of the HLR.

5.5.2.5 Begin Subscriber Activity

5.5.2.5.1 Description

This IF is used by the HLR to start subscriber activity towards the gsmSCF for USSD purposes.

5.5.2.5.2 Information Elements

Information element name	Status	Description
IMSI	M	This IE identifies the subscriber.
Originating Entity Number	M	This IE identifies the functional entity initiating the subscriber activity. In this case, this shall be the address of the HLR.

6 GPRS interworking

6.1 Architecture

6.1.1 Functional Entities used for CAMEL

This subclause describes the functional architecture needed to support GPRS interworking for CAMEL. Figure 6.1 shows the functional entities involved in a GPRS session requiring CAMEL support. The architecture is applicable to the third phase of CAMEL or higher.

Home/Interrogating/Visiting Network
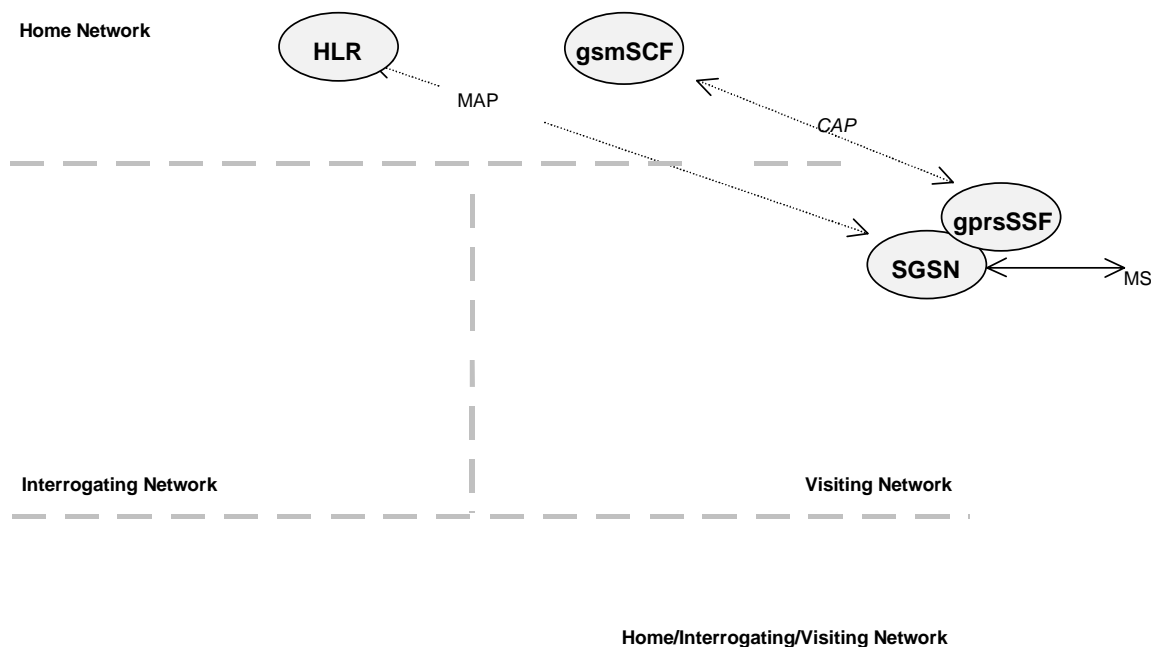
Figure 6.1: Functional architecture for support of CAMEL

HLR: For subscribers requiring CAMEL support, the HLR stores the information relevant to the current subscription GPRS-CSI.

SGSN: When processing GPRS Attach requests or Inter-SGSN Routeing Area Updates for subscribers requiring CAMEL support, the SGSN receives a GPRS-CSI from the HLR, indicating the SGSN to request instructions from the gprsSSF. The SGSN monitors on request the GPRS events and informs the gprsSSF of these events during processing, enabling the gprsSSF to control the execution of the GPRS session or individual PDP contexts in the SGSN.

gprsSSF: see subclause 3.1.

gsmSCF: see subclause 3.1.

6.1.2   Interfaces defined for CAMEL

6.1.2.1   SGSN - gprsSSF interface

This is an internal interface. The interface is described in the present document to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

6.1.2.2   gprsSSF - gsmSCF interface

This interface is used by the gsmSCF to control a GPRS session or individual PDP Context in a certain gprsSSF. GPRS dialogues between the gprsSSF and the gsmSCF on this interface are opened as a result of the gprsSSF sending a request for instructions to the gsmSCF. A GPRS dialogue is composed of a sequence of TC dialogues linked together by the same reference. The GPRS dialogue handler allows the TC dialogue handling.

6.1.2.3   HLR - SGSN interface

This interface is used to send CAMEL related subscriber data to a visited GPRS network, e.g. GPRS-CSI.

6.2   Detection Points (DPs)

6.2.1   Definition and description

GPRS events may be made visible to the gsmSCF. The DPs are the points in association at which these events are detected. The DPs for GPRS Session and PDP Context are described in subclause 6.4.2 and subclause 6.4.3.

A DP can be armed in order to notify the gsmSCF that the GPRS event was encountered, and to allow the gsmSCF to influence subsequent handling of the GPRS Session, or the PDP Context. If the DP is not armed, the processing entity continues the processing without gsmSCF involvement at this DP.

Three different types of DPs are identified:

- Trigger Detection Point-Request (TDP-R): This detection point is statically armed and may initiate a CAMEL control relationship. This CAMEL control relationship is within a new GPRS dialogue. When the GPRS event is encountered and reported, processing is suspended.

- Event Detection Point- Request (EDP-R): This detection point is dynamically armed within the context of a CAMEL control relationship. When the GPRS event is encountered, and reported, processing is suspended and the gprsSSF waits for instructions from the gsmSCF.

- Event Detection Point-Notification (EDP-N): This detection point is dynamically armed within the context of a CAMEL control relationship. When the GPRS event is encountered and reported, processing is not suspended.

Arming/disarming mechanism:

A DP may be statically armed or dynamically armed. The following arming rules apply:

- DPs for GPRS Session and PDP Context are statically armed as a result of the GPRS-CSI analysis in the SGSN.

- DPs may be dynamically armed by the gsmSCF within the context of a CAMEL control relationship. In scenario 1 which is described in the subclause 6.4.4.1, PDP context related DPs may be armed as generic DP or as non-generic DP.

The following disarming rules apply:

- A statically armed DP is disarmed when the GPRS-CSI is withdrawn in the HLR. Only TDP-Rs can be disarmed using this mechanism.

- If the GPRS Session is released, then all EDPs related to the GPRS Session are disarmed.

- If a PDP context is released, then all non-generically armed EDPs related to that PDP context are disarmed.

- If a non-generically armed EDP is met, then EDPs for the GPRS Session or that PDP Context are disarmed, in accordance with the implicit disarming rule (see subclause 6.4.6).

- Armed EDPs may be explicitly disarmed by the gsmSCF by means of the Request Report BCSM Event information flow.

6.2.2 Relationship, DP processing rules and GPRS dialogue

A relationship between the State Models (in the gprsSSF) and the gsmSCF for the purpose of operator specific service processing is considered to be a CAMEL relationship. There are two types of CAMEL relationships: monitor relationship and control relationship.

- A CAMEL control relationship: the gsmSCF is able to influence the GPRS Session/PDP Context via the relationship for the given state model.

- A CAMEL monitor relationship: the gsmSCF is not able to influence the GPRS Session/PDP Context via the relationship for the given state model.

A control relationship persists as long as there is one or more EDP-R armed for this instance of the state model, or if the gprsSSF is in the state Waiting For Instruction for this instance of state model.

A control relationship changes to a monitor relationship if the conditions for a control relationship are no longer fulfilled and one or more EDP-N is armed or one or more Apply Charging Report GPRS is outstanding for this instance of the state model. If no EDP-Ns are armed and no Apply Charging Reports GPRS are outstanding for this instance of the state model, the relationship terminates.

A GPRS dialogue exists between gprsSSF and gsmSCF if at least one of the following conditions is fulfilled:

- There is at least one EDP armed,

- At least one report is pending,

- gprsSSF is in state Waiting_For_Instructions.

6.3 Description of CAMEL Subscriber Data

6.3.1 GPRS CAMEL Subscription Information (GPRS-CSI)

This subclause defines the contents of the GPRS CAMEL Subscription Information.

6.3.1.1 gsmSCF Address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

6.3.1.2 Service Key

The Service Key identifies to the gsmSCF the service logic that shall apply.

6.3.1.3 Default GPRS Handling

The Default GPRS Handling indicates whether the GPRS session or PDP context shall be released or continued as requested in case of error in the gprsSSF to gsmSCF dialogue.

6.3.1.4 TDP List

The TDP List indicates on which detection point triggering shall take place.

6.3.1.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

6.3.1.6 CSI state

The CSI state indicates whether the GPRS-CSI is active or not.

6.3.1.7 Notification flag

The notification flag indicates whether the change of the GPRS-CSI shall trigger Notification on Change of Subscriber Data or not.

6.3.2 gsmSCF address list for CSI

The gsmSCF address list contains a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

6.4 Description of CAMEL State Models

GPRS can support multiple PDP contexts simultaneously for an attached subscriber, requiring the behaviour of a GPRS session to be modelled by two state models, one for the attach/detach procedures (GPRS Attach/Detach State Model) and the other for modelling individual PDP Contexts (GPRS PDP Context State Model).

6.4.1 General Handling

The GPRS State Model is used to describe the actions in an SGSN during processing of a GPRS session or PDP Contexts.

The GPRS State Model identifies the points in basic GPRS processing when Operator Specific Service (OSS) logic instances (accessed through the gsmSCF) are permitted to interact with basic GPRS control capabilities.

Figure 6.2 shows the components that have been identified to describe a GPRS State Model.
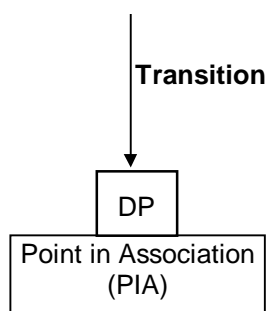
Figure 6.2: GPRS State Model Components

6.4.2 GPRS Attach/Detach State Model

The GPRS Attach/Detach State Model is used to model the behaviour of the GPRS attach/detach procedures.

When encountering a DP the Attach/Detach State Model processing is suspended at the DP and the SGSN indicates this to the gprsSSF which determines what action, if any, shall be taken in case the DP is armed.
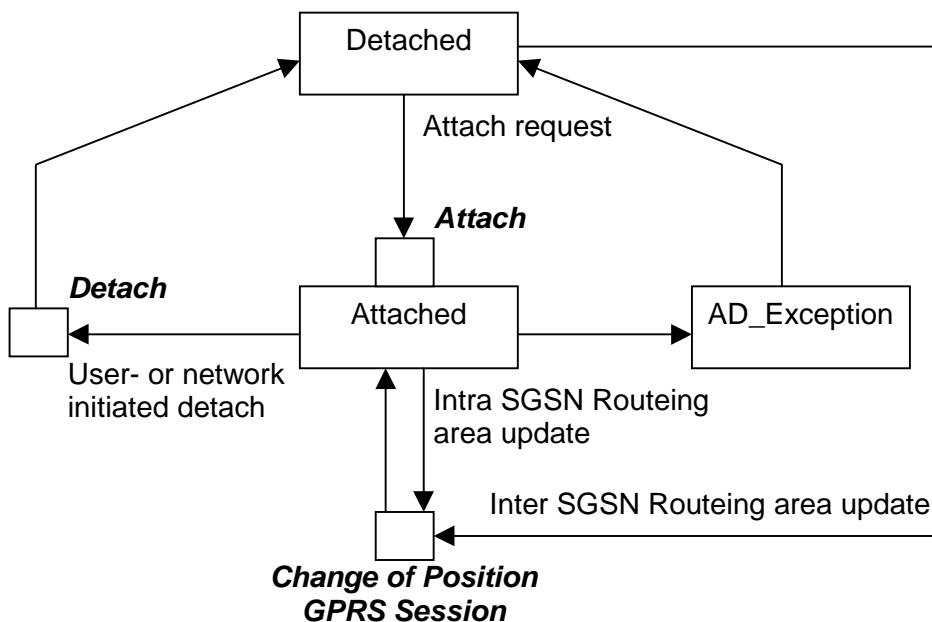
Figure 6.3: GPRS Attach/Detach State Model

Table 6.1: Description of GPRS Attach/Detach DPs in the SGSN

CAMEL Detection Point	DP Type	Description
DP Attach	TDP-R	A request to attach is received.
DP Change of Position GPRS Session	TDP-R[1)], EDP-N	Routeing Area Update is accepted.
DP Detach	EDP-N, EDP-R	A detach request is received either from the MS, the SGSN or a 'Cancel Location' received from HLR or Inter SGSN Routeing update occurred in the old SGSN.
Note 1: Change of Position GPRS Session is reported as TDP-R in the case of Inter-SGSN Routeing Area Update (provided that this DP is statically armed in GPRS-CSI). Change of Position GPRS Session is reported as EDP-N in the case of Intra-SGSN Routeing Area Update (provided that this DP is dynamically armed by the Service Logic).		

6.4.2.1 Description of the Attach/Detach model (PIAs)

This subclause describes the model for the attach and detach a GPRS session in the SGSN. For each PIA a description can be found of the entry events, actions and exit events.

6.4.2.1.1 Detached

Entry events:

- Detach (user or network initiated) and clearing of a previous GPRS session.

- Processing of exceptional conditions.

Actions:

- Interface is idled.

- Attach request is received from MS containing the IMSI/P-TMSI and the type of attach requested and, the identity of the MS is established (IMSI) (DP Attach), or Inter-SGSN Routeing Area Update Request is accepted (DP Change of Position GPRS Session).

- Information being analyzed, e.g. GPRS-CSI is analyzed.

Exit events:

- GPRS-CSI is analyzed (DP Attach or DP Change of Position GPRS Session).

6.4.2.1.2 Attached

Entry events:

- GPRS-CSI is analyzed (DP Attach).

Actions:

- MM contexts are established at the MS and the SGSN.

Exit events:

- A GPRS Detach request is received from the MS or from the network (DP Detach).

- Intra-SGSN Routeing Area Update is accepted (DP Change of Position GPRS Session).

- An exception is encountered.

The GPRS Attach/Detach State Model shall only have one or more GPRS PDP Context State Models associated with it when in the Attached state. A GPRS PDP Context State Model cannot exist without its associated GPRS Attach/Detach State Model being in the Attached state. Closure of the GPRS Attach/Detach State Model via a detach will result in the idling of all associated GPRS PDP Context State Models and the release of the associated GPRS PDP Contexts.

It shall not be necessary to trigger a relationship from the GPRS Attach/Detach State Model to the gsmSCF in order for triggering to occur in an associated GPRS PDP Context State Model. However, in this latter case a GPRS Attach/Detach State Model shall still exist at the SGSN. This is so that CSE-initiated detach events sent within a given GPRS PDP Context relationship shall result in the GPRS Attach/Detach State Model transiting to the Detached state. As noted above, in this state no PDP Contexts can exist and so all associated GPRS PDP Context State Models will transit to state Idle.

6.4.3 GPRS PDP Context State Model

The GPRS PDP Context State Model is used to model the behaviour for the GPRS PDP Context procedures. There is one PDP Context State Model per GPRS PDP context.

When encountering a DP the PDP Context State Model processing is suspended at the DP and the SGSN indicates this to the gprsSSF which determines what action, if any, shall be taken in case the DP is armed.
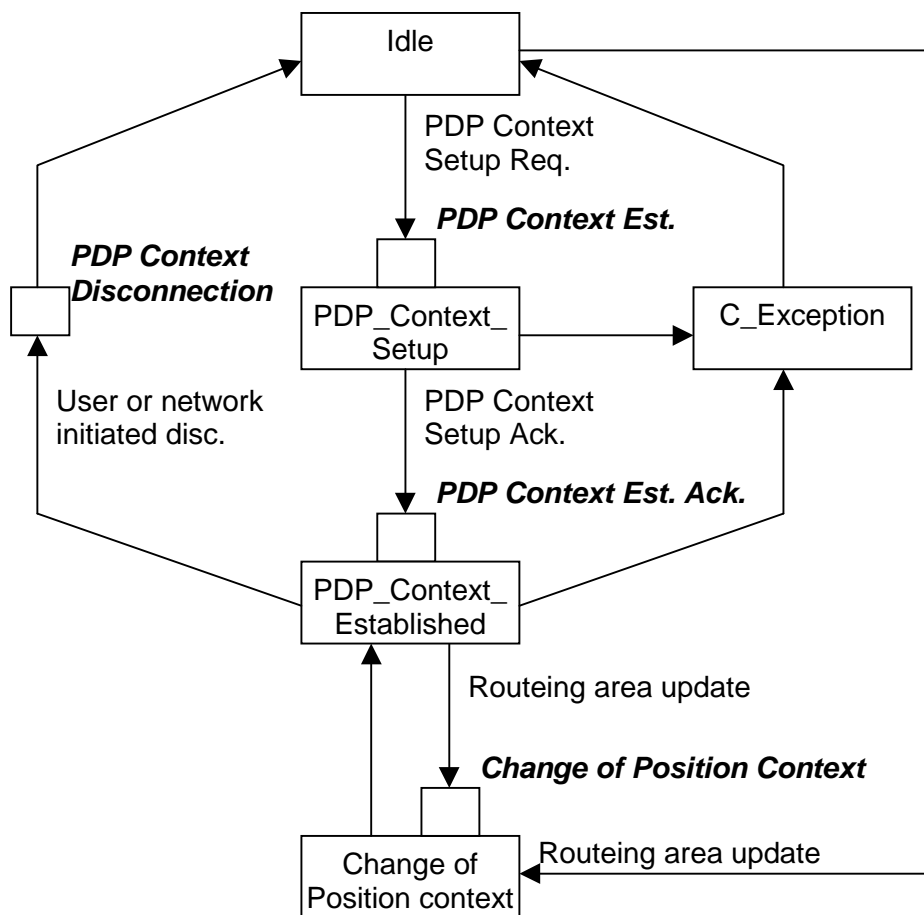
Figure 6.4: GPRS PDP Context State Model

Table 6.2: Description of GPRS PDP Context DPs in the SGSN

CAMEL Detection Point	DP Type	Description
DP PDP Context Establishment	TDP-R[1]), EDP-R, EDP-N	Activate PDP Context request is received from the MS.
DP PDP Context Establishment Acknowledgement	TDP-R[2]), EDP-R, EDP-N	Create PDP Context response is received from the GGSN.
DP PDP Context Disconnection	EDP-N, EDP-R	Deactivate PDP Context Request is received from the MS, Delete PDP Context request is received from the GGSN. Inter SGSN Routeing update occurred in old SGSN.
DP Change of Position Context	TDP-R[3]), EDP-N, EDP-R	Routeing Area Update is accepted.
NOTE 1: The PDP Context Establishment shall be reported as TDP-R (provided that this DP is statically armed in GPRS-CSI) if there is no relationship with the gsmSCF. If there is a relationship with the gsmSCF it shall be reported as EDP-R or EDP-N if armed so.		
NOTE 2: The PDP Context Establishment Acknowledgement shall be reported as TDP-R (provided that this DP is statically armed in GPRS-CSI) if there is no relationship with gsmSCF. If there is a relationship with the gsmSCF, it shall be reported as EDP-R or EDP-N if armed so.		
NOTE 3: Change of Position Context is reported as TDP-R in the case of Inter-SGSN Routeing Area Update (provided that this DP is statically armed in GPRS-CSI) if there is no relationship with the gsmSCF. Change of Position Context is reported as EDP-N or EDP-R in the case of Inter-SGSN Routeing Area Update (provided that this DP is armed as generic EDP) if there is a relationship with the gsmSCF. Change of Position Context is reported as EDP-N in the case of Intra-SGSN Routeing Area Update (provided that this DP is dynamically armed by the Service Logic).		

6.4.3.1   Description of the PDP Context model (PIAs)

This subclause describes the model for PDP Context State Model in the SGSN. For each PIA a description can be found of the entry events, actions and exit events.

6.4.3.1.1   Idle

Entry events:

- Deactivation (user or network initiated) and clearing of a previous PDP Context.

- Processing of exceptional conditions.

Actions:

- Interface is idled.

- Activate PDP Context request is received from MS (containing NSAPI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options), or Inter-SGSN Routeing Area Update is accepted (DP Change of Position Context).

- Information being analyzed, e.g. GPRS-CSI is analyzed.

Exit events:

- GPRS-CSI is analyzed (DP PDP Context Establishment or DP Change of Position Context, new SGSN).

6.4.3.1.2   PDP Context Setup

Entry events:

- GPRS-CSI is analyzed (DP PDP Context Establishment).

Actions:

- APN and GGSN selection procedure is performed for a primary PDP context as specified in Annex A of 3GPP TS 23.060 [15]. APN and GGSN selection procedure is not performed for a secondary PDP context.

- Access Point Name is verified against the subscription. If the gsmSCF has provided an Access Point Name then the Access Point Name provided by the gsmSCF is checked against the subscription. For details refer to 3GPP TS 23.060 [15] Annex A.

- The operator determined barring category "Barring of all Packet Oriented Services " is checked and invoked if necessary.

- The operator determined barring category "Barring of Packet Oriented Services from access points that are within the HPLMN whilst the subscriber is roaming in a VPLMN" is checked and invoked if necessary.

- The operator determined barring category "Barring of Packet Oriented Services from access points that are within the roamed to VPLMN" is checked and invoked if necessary.

- The SGSN ensures that an already active PDP context is not reactivated.

- GGSN address is derived from the Access Point Name by interrogation of a DNS. The Access Point Name consists of a Network Identifier and an Operator Identifier.

- Create PDP Context Request is sent to the GGSN.

Exit events:

- Create PDP Context Response is received from the GGSN (DP PDP Context Establishment Acknowledgement).

- An exception is encountered.

6.4.3.1.3   PDP Context Established

Entry events:

- GPRS-CSI is analyzed (DP PDP Context Establishment Acknowledgement or DP Change of Position Context).

Actions:

- PDP context is established at the MS and the SGSN.

Exit events:

- Deactivation of the PDP Context is received from the MS or the GGSN, or is due to an inter SGSN routing area update (DP PDP Context Disconnection, old SGSN).

- Intra-SGSN Routeing Area Update Request is received from the MS (DP Change of Position Context).

- Inter-SGSN Routeing Area Update (DP Change of Position Context, new SGSN).

- An exception is encountered.

6.4.3.1.4 Change of Position Context

Entry events:

- Inter SGSN Routing Area update accepted (new SGSN).

- Intra SGSN Routeing Area update request received from the MS.

Actions:

- PDP Context (containing NSAPI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) is reestablished in case of Inter-SGSN Routeing Area update accepted (new SGSN).

- Intra SGSN Routeing Area updated.

Exit events:

- reestablishement of the PDP context at the new SGSN and return to PDP context established in case of inter SGSN Routeing Area update accepted in new SGSN (PIA PDP context established).

- Routeing Area update completed in case of intra SGSN Routeing Area update (PIA PDP context established).

6.4.4 GPRS CAMEL Scenarios

Two different scenarios are applicable for CAMEL control of GPRS.

Scenario 1:
Scenario 1 allows CAMEL control of the GPRS session and of multiple PDP contexts related to this session within a single GPRS dialogue.

Scenario 2:
Scenario 2 allows CAMEL control of single PDP contexts. Multiple PDP contexts are controlled in this scenario via multiple GPRS dialogues.

Scenario 1 and scenario 2 are mutually exclusive, i.e. it is not possible to use both for one GPRS session at the same time in one SGSN. A GPRS session is involved in GPRS CAMEL at one moment in time either by using scenario 1 or by using possible multiple instances of scenario 2. GPRS sessions in different SGSNs are independent from a CAMEL perspective.

6.4.4.1 GPRS CAMEL Scenario 1

Scenario 1 allows CAMEL control of the GPRS session and of multiple PDP contexts related to this session within a single GPRS dialogue (Session dialogue).
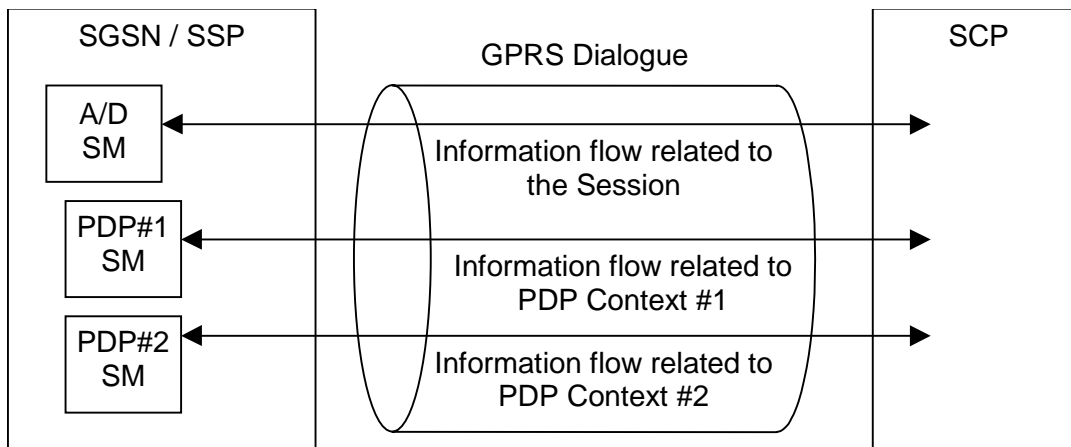
Figure 6.5: GPRS CAMEL Scenario 1

A GPRS dialogue in scenario 1 always consists of one GPRS Attach/Detach State Model and optionally of additional multiple GPRS PDP Context State Models related to the Attach/Detach State Model for the GPRS session. There is at most one GPRS Attach/Detach State Model per non idle GPRS session in one SGSN and at most one PDP Context State Model per active GPRS PDP context in one SGSN. The various PDP Context State Models are treated independently of each other.

The GPRS dialogue and the relationship between the GPRS Attach/Detach State Model and the gsmSCF are always initiated using the TDPs of the GPRS Attach/Detach State Model.

The gsmSCf requests further control or monitoring of individual GPRS PDP contexts using the Request Report GPRS Event information flow. To be informed about new individual PDP contexts the gsmSCF arms the DP 'PDP Context Establishment' or the DP 'PDP Context Establishment Acknowledgement' generically, i.e. without a PDP ID, as an EDP. To be informed about the handed over PDP contexts the gsmSCF arms the DP 'Change of Position Context' generically as an EDP-N or EDP-R.

Each GPRS PDP context is identified by a PDP ID. The PDP ID is assigned by the SGSN during PDP context establishment. The PDP ID is unique within one GPRS dialogue. The Request Report GPRS Event information flows to control new or handed over PDP contexts do not include a PDP ID. There is no 'PDP ID' related to the GPRS Attach/Detach State Model.

The PDP Id is reported to the gsmSCF in the first event notification for that PDP context.

6.4.4.2   GPRS CAMEL Scenario 2

Scenario 2 allows CAMEL control of single PDP contexts. Multiple PDP contexts are controlled in this scenario via multiple GPRS dialogues (PDP Context dialogues).
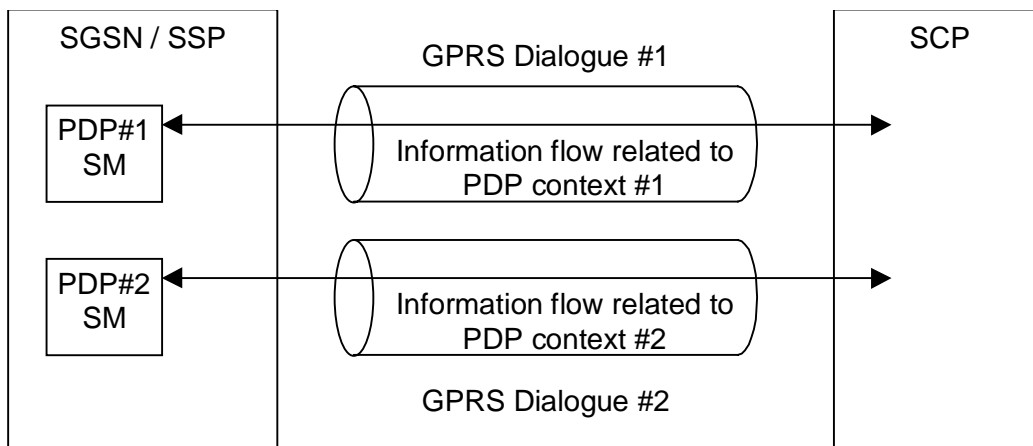
Figure 6.6: GPRS CAMEL Scenario 2

A GPRS dialogue in scenario 2 consists of a single GPRS PDP Context State Model. There is no GPRS Attach/Detach State Model involved in this scenario. There is at most one PDP Context State Model per active GPRS PDP context in one SGSN.

There might be multiple GPRS dialogues in scenarios 2 for one GPRS session, each of the dialogues controlling a single GPRS PDP context. The various GPRS dialogues are independent of each other.

The GPRS dialogue and the relationship between the GPRS PDP Context State Model and the gsmSCF are always initiated using the TDPs for the GPRS PDP Context State Model.

Control of further individual GPRS PDP contexts in the same GPRS dialogue as in scenario 1 is not possible. There are no PDP IDs in this scenario.

6.4.5 SGSN Routeing Area Update

6.4.5.1 Intra-SGSN Routeing Area Update

Intra-SGSN Routeing Area Update will be detected via the DP 'Change of Position GPRS Session' for the session using the GPRS Attach/Detach State Model and via the DPs 'Change of Position Context' for the individual PDP contexts using the GPRS PDP Context State Models.

It will be reported via an EDP-N if the necessary EDP-N is armed.

6.4.5.2 Inter-SGSN Routeing Area Update

Inter-SGSN Routeing Area Update from the old SGSN to the new SGSN will be detected via the DP 'Change of Position GPRS Session' for the session using the GPRS Attach/Detach State Model and via the DPs 'Change of Position Context' using the GPRS PDP Context State Models for the individual PDP contexts which have been handed over.

Scenario 1:

Inter-SGSN Routeing Area Update from the old SGSN to the new SGSN will be detected in the new SGSN via the DP 'Change of Position GPRS Session' for the session using the GPRS Attach/Detach State Model and in the new SGSN via the DPs 'Change of Position Context' using the GPRS PDP Context State Models for the individual PDP contexts which have been handed over.

In this scenario the DP 'Change of Position GPRS Session' is armed as a TDP-R. If the Routeing Area Update is accepted the gprsSSF reports this TDP-R to the gsmSCF using the Initial DP GPRS information flow. To be informed about new PDP contexts the gsmSCF arms the DP 'PDP Context Establishment' or the DP 'PDP Context Establishment Acknowledgement' generically as EDP-R or EDP-N. The DPs 'Change of Position Context' for the PDP contexts which have been handed over will be reported with all necessary information to the gsmSCF when the gprsSSF is continued, i.e. it is not longer waiting for instructions. Contexts which are not continued in the new SGSN are not reported. The EDPs for new PDP contexts are reported as usual.

The Detach in the old SGSN is reported to the gsmSCF, provided this event is armed. All outstanding reports in the old SGSN are sent to the gsmSCF and all open CDRs are closed.

Scenario 2:

Inter-SGSN Routeing Area Update from the old SGSN to the new SGSN will be detected in the new SGSN via the DPs 'Change of Position Context' using the GPRS PDP Context State Models for the individual PDP contexts which have been handed over.

In this scenario the DP 'Change of Position Context' is armed as TDP-R. If the Routeing Area Update is accepted the gprsSSF reports these TDP-Rs PDP contexts which have been handed over to the gsmSCF using the Initial DP GPRS information flows in multiple GPRS dialogues.

The PDP Context Disconnection in the old SGSN is reported to the gsmSCF, provided this event is armed. All outstanding reports in the old SGSN are sent to the gsmSCF and the open CDR is closed.

6.4.6 Rules for Implicit Disarming of Detection Points

The two tables below give the rules for implicit disarming of event detection points.

Implicit EDP disarming rules are specified for the Attach/Detach State Model and PDP Context State Model. The tables specify which EDP's shall be disarmed (i.e. MonitorMode set to Transparent) if/when each EDP is encountered, irrespective of the EDP's MonitorMode (Transparent, NotifyAndContinue, or Request).

EDPs which are armed generically for GPRS PDP Context State Models shall only be implicitly disarmed at the end of the GPRS dialogue. Explicit disarming is possible.

When EDP's are armed with MonitorMode 'Request' (EDP-Rs) are encountered, any implicit EDP disarming shall take place before reporting the EDP and transiting the gprsSSF to the WFI state (if not already suspended in the WFI state).

The table entry 'X' means that if one DP occurs (independently of arming and reporting to the gsmSCF) the marked one is implicitly disarmed. It shall be possible to rearm explicitly an implicitly disarmed DP.

Table 6.3: Implicit disarming rules for Scenario 1 (the rules apply for non-generically armed DPs)

Encountered DP	Implicit disarmed DPs					
	Change of Position GPRS Session	Change of Position Context	Detach	PDP Context Establishment	PDP Context Establishment Acknowledgement	PDP Context Disconnection
Change of Position GPRS Session						
Change of Position Context						
Detach	X	X	X	X	X	X
PDP Context Establishment						
PDP Context Establishment Acknowledgement					X	
PDP Context Disconnection		X			X	X

Table 6.4: Implicit disarming rules for Scenario 2 (the rules apply for non-generically armed DPs)

Encountered DP	Implicit disarmed DPs		
	Change of Position Context	PDP Context Establishment Acknowledgement	PDP Context Disconnection
PDP Context Establishment Acknowledgement		X	
PDP Context Disconnection	X	X	X
Change of Position Context			

6.5 Procedures for CAMEL GPRS

6.5.1 Overall SDL Architecture
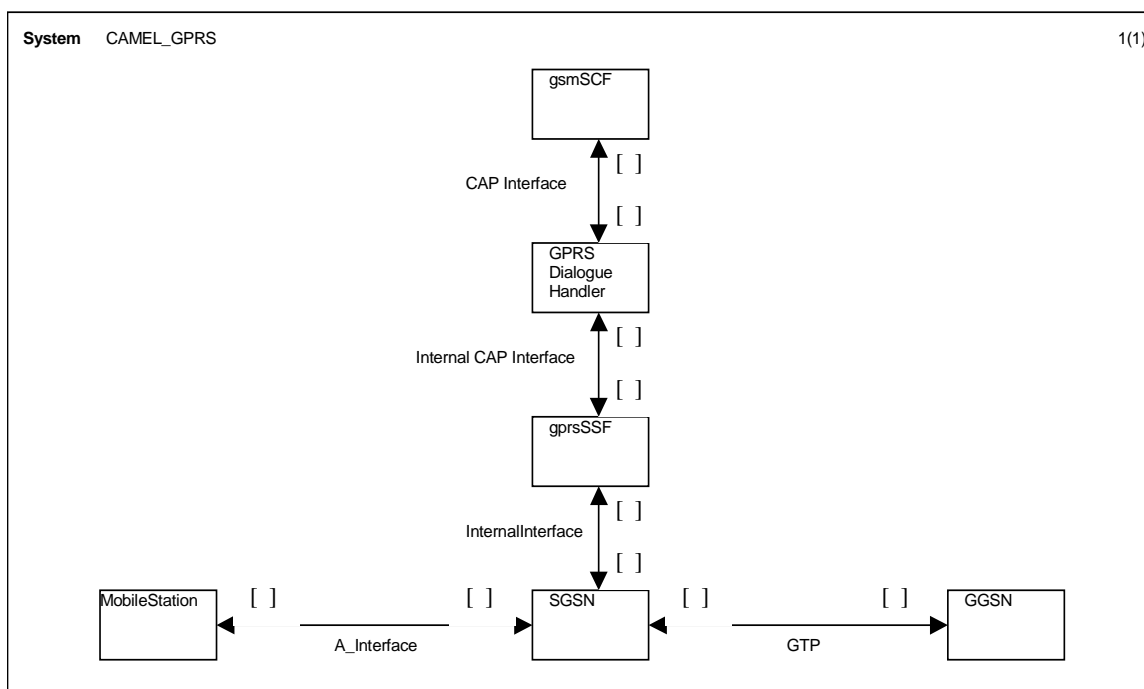
Figure 6.7: Architecture for CAMEL/GPRS interworking

6.5.2 Handling GPRS in the SGSN

The functional behaviour of the SGSN is specified in 3GPP TS 23.060 [15]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_GPRS_Attach;

- Procedure CAMEL_GPRS_Detach;

- Procedure CAMEL_GPRS_Routeing_Area_Update_Session;

- Procedure CAMEL_GPRS_Routeing_Area_Update_Context;

- Procedure CAMEL_GPRS_PDP_Context_Establishment;

- Procedure CAMEL_GPRS_Create_PDP_Context_Establishment_Acknowledgement;

- Procedure CAMEL_GPRS_Change_Of_QoS;

- Procedure CAMEL_GPRS_PDP_Context_Disconnection.

6.5.2.1 Actions of the SGSN on receipt of Int_Error

The SGSN checks the default GPRS Handling parameter in GPRS-CSI.

If the default GPRS handling is release, a Detach indication is sent to the MS. The SGSN then releases all resources and the invoked CAMEL procedure ends.

If the default GPRS handling is continue, the SGSN continues processing without CAMEL support.

6.5.2.2 Actions of the SGSN on receipt of Int_Continue

The SGSN continues processing without any modification of GPRS parameters.

6.5.2.3 Handling of GPRS Attach/Detach

Procedure CAMEL_GPRS_Attach 1(2)

/* Procedure in the SGSN for CAMEL handling of MS Attach */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network. */

GPRS-CSI invocation?

No → Result := Continue

Yes → Store original GPRS parameters

Int_invoke_GPRS_SSF

Wait_for_GPRS_SSF_invoked

Int_GPRS_SSF_Invoked

Int_DP_Attach

DP_Attach

Abort

Int_GPRS_Failure

Result := Abort_session

Figure 6.8-1: Procedure CAMEL_GPRS_Attach (sheet 1)

ETSI

Procedure CAMEL_GPRS_Attach 2(2)

/* Procedure in the SGSN for CAMEL handling of MS Attach */

/* Signals from the right are from the gprsSSF.*/

DP_Attach

Int_Release_
Session

Int_error

Int_Continue_
GPRS

No

Default GPRS handling =
Continue?

Yes

Result :=
Release_session

Result :=
Abort_session

Result :=
Continue
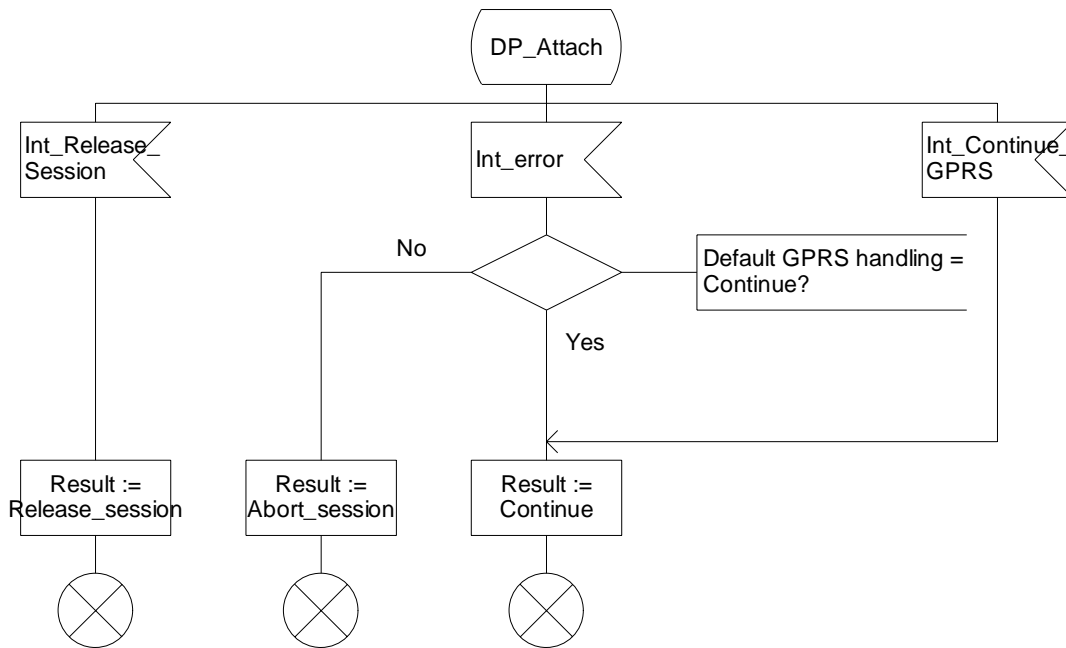
Figure 6.8-2: Procedure CAMEL_GPRS_Attach (sheet 2)

Procedure CAMEL_GPRS_Detach 1(1)

/* Procedure in the SGSN for CAMEL handling of MS or network indicated Detach */

/* Signals to/from the right are to/from the gprsSSF */

No ← gprsSSF invoked?

Yes

Result := Continue

Int_DP_Detach

DP_Detach

Int_Continue_GPRS   Int_Continue   Int_error

Result := Continue
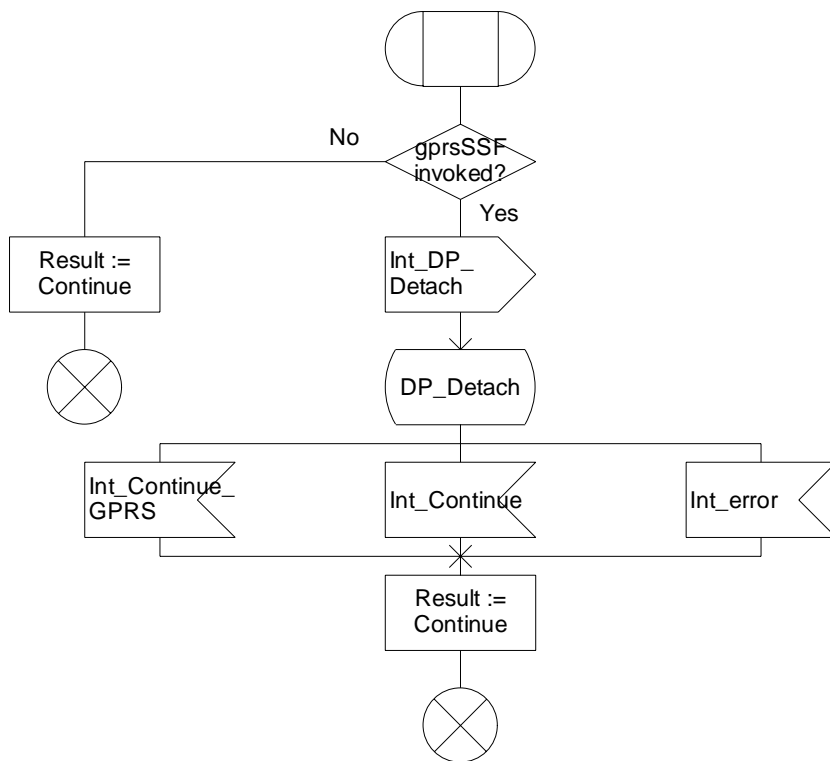
Figure 6.9-1: Procedure CAMEL_GPRS_Detach (sheet 1)

6.5.2.4 Handling of GPRS Routeing Area Update
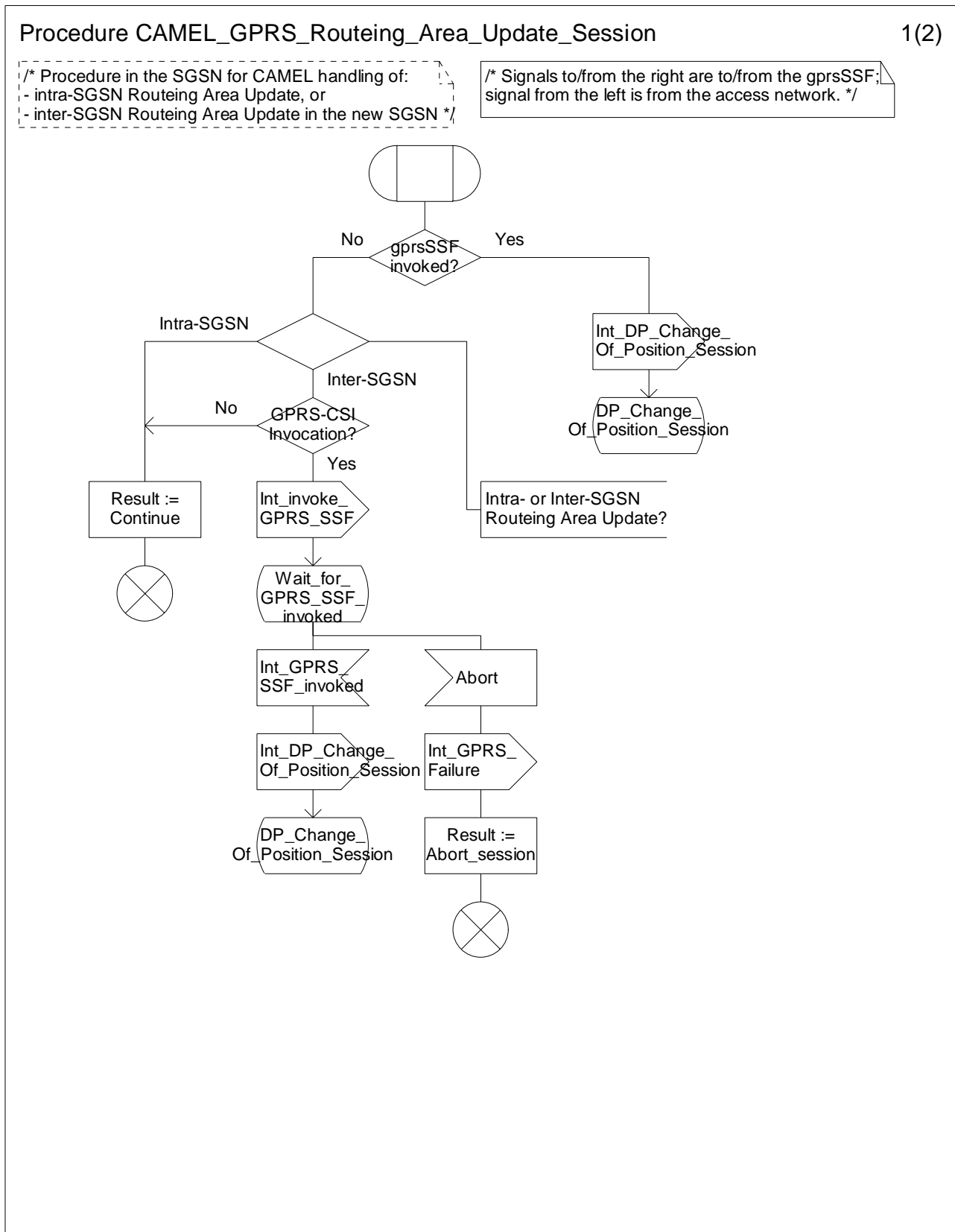
Figure 6.10-1: Procedure CAMEL_GPRS_Routeing_Area_Update_Session (sheet 1)

Procedure CAMEL_GPRS_Routeing_Area_Update_Session 2(2)

/* Procedure in the SGSN for CAMEL handling of:
- intra-SGSN Routeing Area Update, or
- inter-SGSN Routeing Area Update in the new SGSN */

/* Signals from the right are from the gprsSSF.*/

DP_Change_ Of_Position_Session

Int_Release_ Session

Int_error

Int_Continue

Int_Continue_ GPRS

Default GPRS handling = Continue?

No

Yes

Result := Release_session

Result := Abort_session

Result := Continue
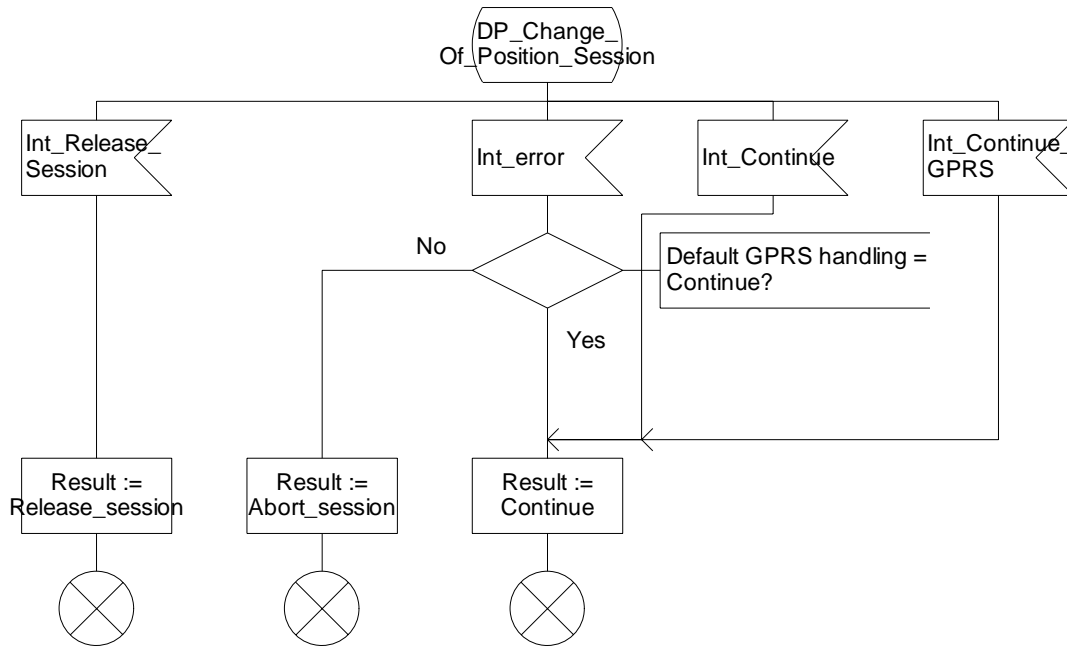
Figure 6.10-2: Procedure CAMEL_GPRS_Routeing_Area_Update_Session (sheet 2)

ETSI

Procedure CAMEL_GPRS_Routeing_Area_Update_Context 1(2)

/* Procedure in the SGSN for CAMEL handling of:
- intra-SGSN Routeing Area Update, or
- inter-SGSN Routeing Area Update in the new SGSN */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network. */

/* NOTE: See Table 7: 'Description of GPRS PDP Context DPs in the SGSN' Note 3 for further explanation whether reporting occurs within a new gprsSSF or in an existing (invoked) one. */
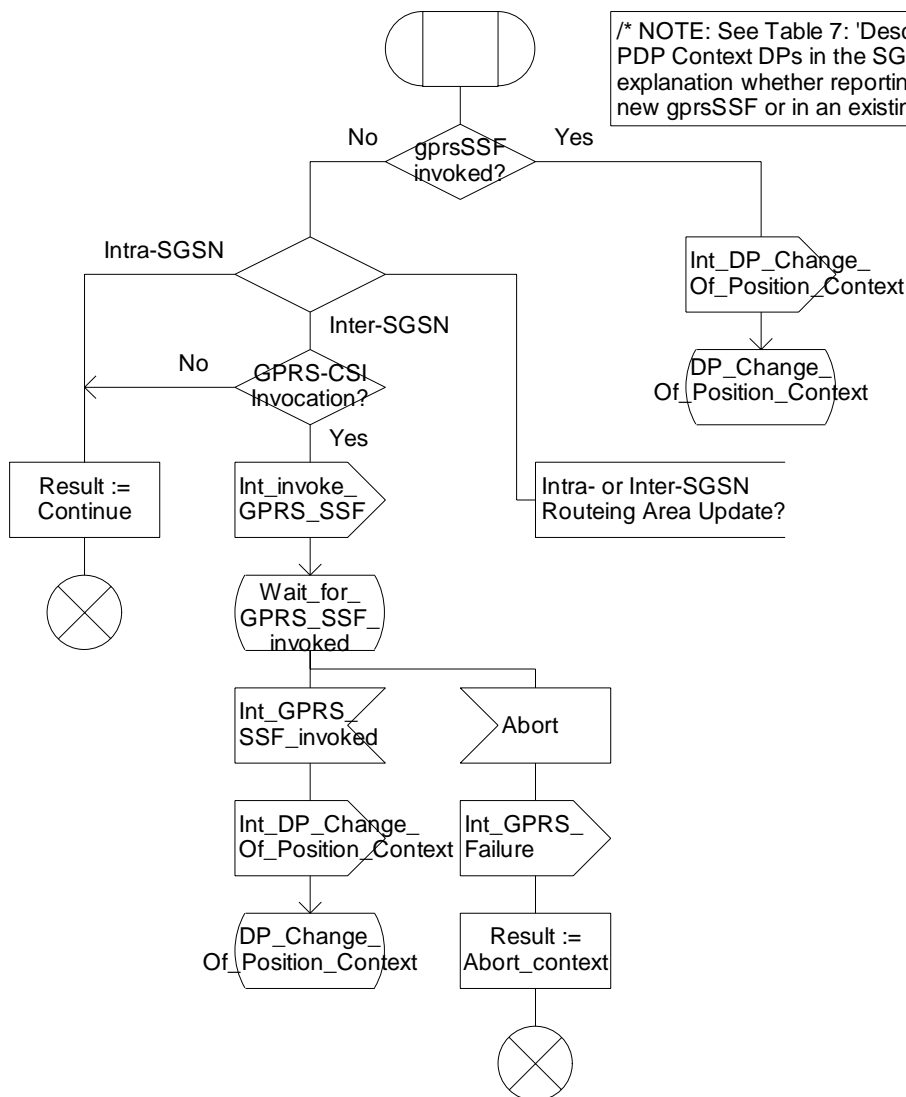
Figure 6.11-1: Procedure CAMEL_GPRS_Routeing_Area_Update_Context (sheet 1)

Procedure CAMEL_GPRS_Routeing_Area_Update_Context 2(2)

/* Procedure in the SGSN for CAMEL handling of:
- intra-SGSN Routeing Area Update, or
- inter-SGSN Routeing Area Update in the new SGSN */

/* Signals from the right are from the gprsSSF.*/

DP_Change_
Of_Position_Context

Int_Release_
Context

Int_error

Int_Continue

Int_Continue_
GPRS

No

Default GPRS handling =
Continue?

Yes

Result :=
Release_context

Result :=
Abort_context

Result :=
Continue
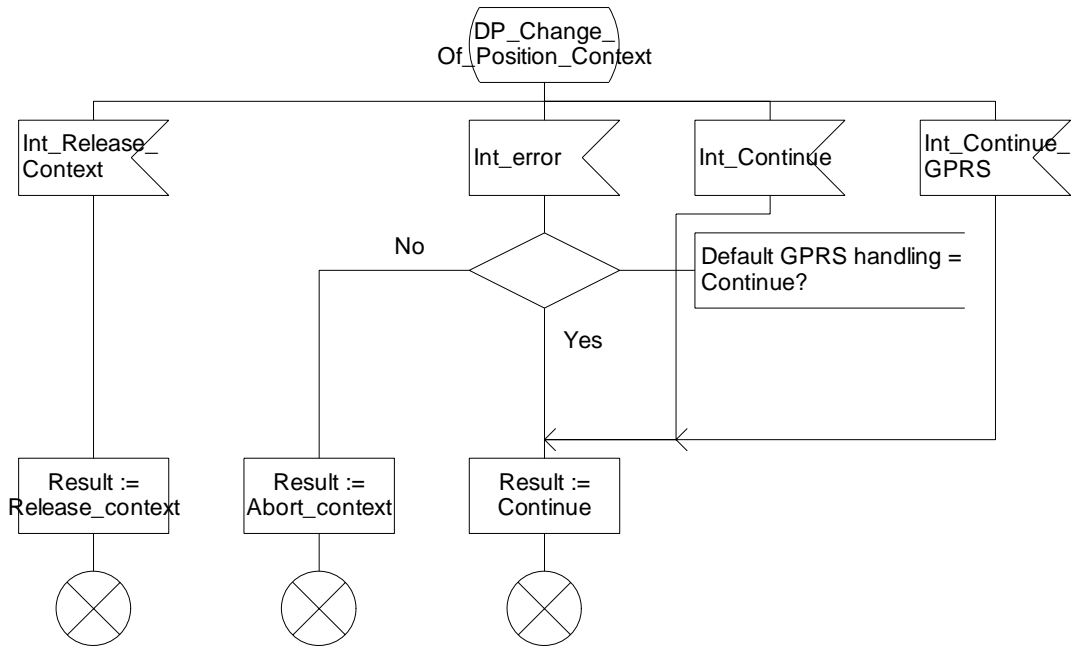
Figure 6.11-2: Procedure CAMEL_GPRS_Routeing_Area_Update_Context (sheet 2)

6.5.2.5 Handling of PDP Context establishment and deactivation
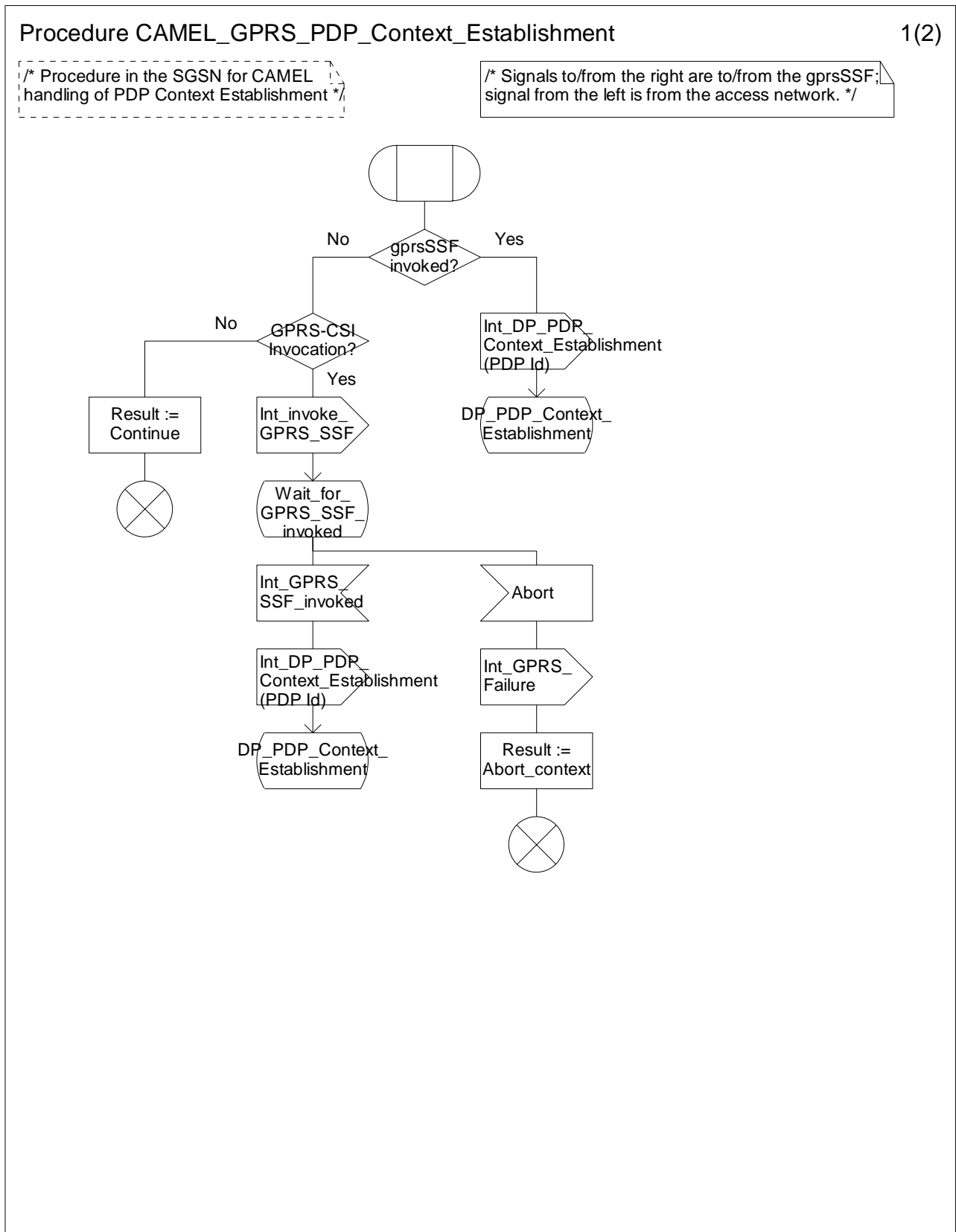
Figure 6.12-1: Procedure CAMEL_GPRS_PDP_Context_Establishment (sheet 1)

Procedure CAMEL_GPRS_PDP_Context_Establishment 2(2)

/* Procedure in the SGSN for CAMEL handling of PDP Context Establishment */

/* Signals from the right are from the gprsSSF. */

DP_PDP_Context_Establishment

Int_Release_Context

Int_error

Int_Continue

Int_Continue_GPRS

Int_Connect_GPRS

Set new APN

No

Yes

Result := Release_Context

Result := Abort_Context

Result := Continue

Default GPRS handling = Continue?
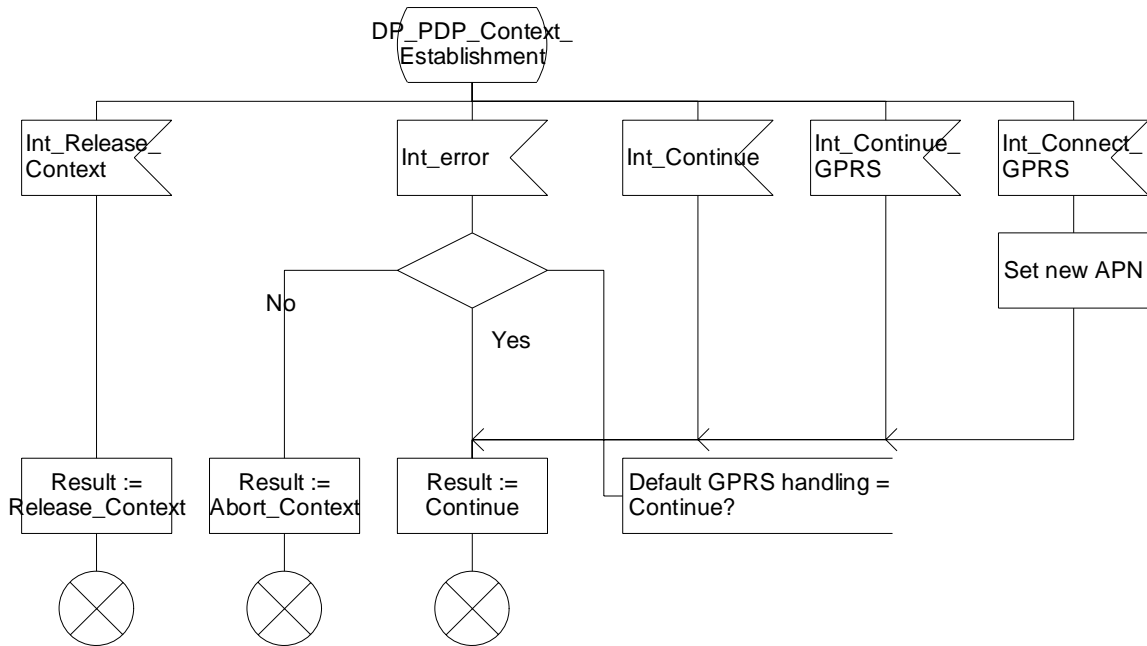
Figure 6.12-2: Procedure CAMEL_GPRS_PDP_Context_Establishment (sheet 2)

Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement   1(2)

/* Procedure in the SGSN for CAMEL handling of PDP Context Establishment Acknowledgement */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network unless otherwise stated. */
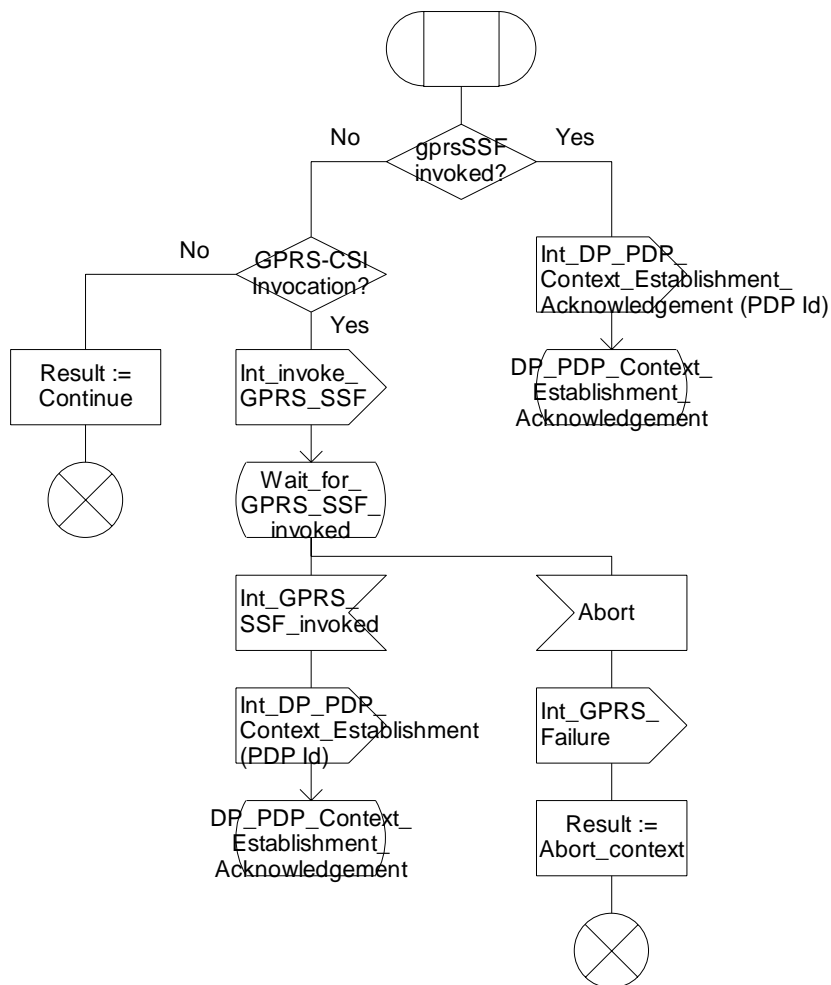
Figure 6.13-1: Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement (sheet 1)

Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement   2(2)

/* Procedure in the SGSN for CAMEL handling of PDP Context Establishment Acknowledgement */

/* Signals from the right are from the gprsSSF. */

DP_PDP_Context_ Establishment_ Acknowledgement

Int_Release_ Context

Int_error

Int_Continue

Int_Continue_ GPRS

Default GPRS handling = Continue?

No

Yes

Result := Release_Context

Result := Abort_Context

Result := Continue
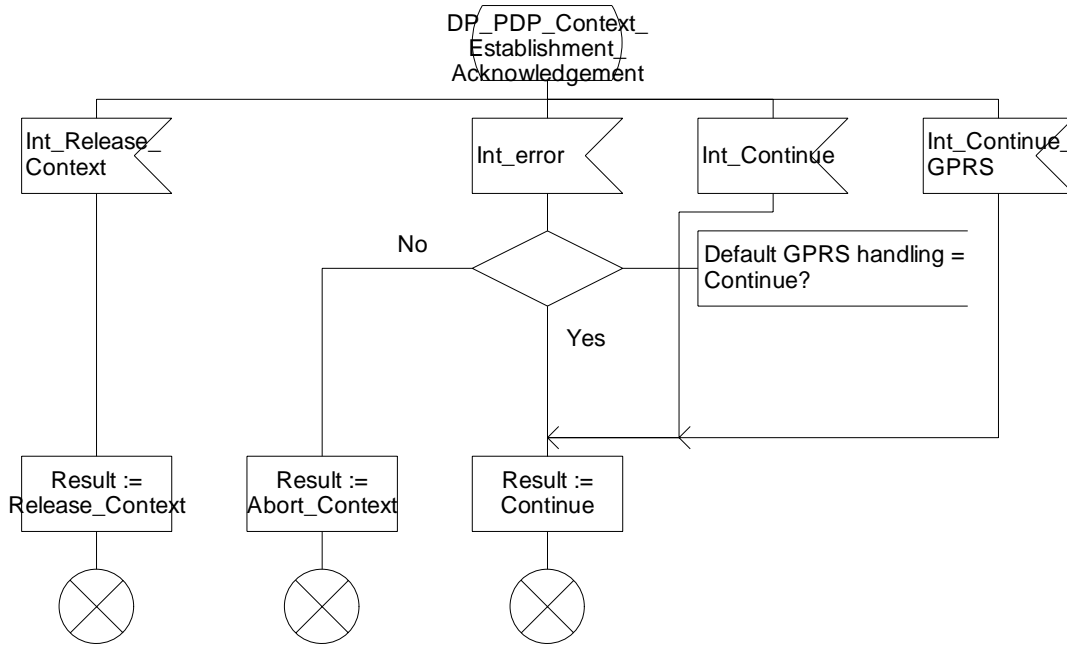
Figure 6.13-2: Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement (sheet 2)

Procedure CAMEL_GPRS_Change_of_QoS 1(1)

/* Procedure in the SGSN for CAMEL
handling a change of QoS for a PDP Context */

/* Signal to the right is to the gprsSSF */

No — gprsSSF invoked?

Yes

Int_QoS_Change
(PDP Id)

Result :=
Continue
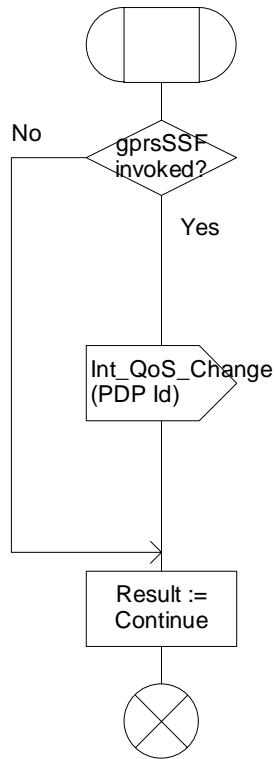
Figure 6.14-1: Procedure CAMEL_GPRS_Change_Of_QoS (sheet 1)

Procedure CAMEL_GPRS_PDP_Context_Disconnection   1(1)

/* Procedure in the SGSN for CAMEL handling of MS or network indicated PDP Context Disconnection */

/* Signals to/from the right are to/from the gprsSSF */

gprsSSF invoked?

No

Yes

Result := Continue

Int_DP_PDP_Context_Disconnection (PDP Id)

DP_PDP_Context_Disconnection

Int_Continue_GPRS

Int_Continue

Int_error

Result := Continue
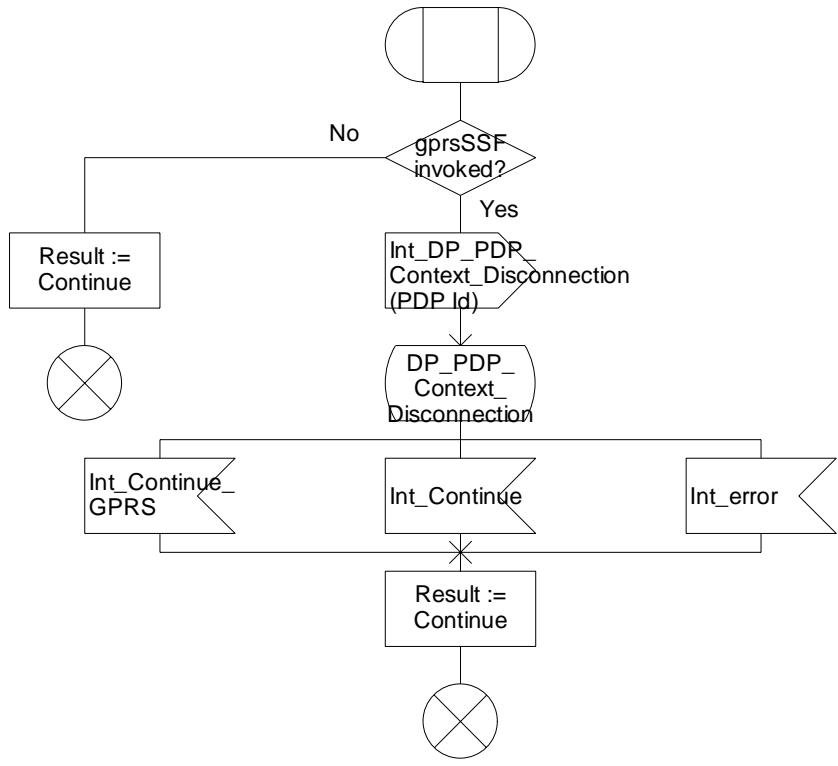
Figure 6.15-1: Procedure CAMEL_GPRS_PDP_Context_Disconnection (sheet 1)

6.5.3 Handling GPRS in the gprsSSF

6.5.3.1 Process GPRS_SSF

A relationship exists between the gsmSCF and the Attach/Detach State Model and/or between the gsmSCF and every PDP Context State Model. The relationship may be in controlling or monitoring mode. When a Continue GPRS, Connect GPRS or Request Report GPRS Event information flow is received, then the relationship between the gsmSCF and the Attach/Detach State Model, and between the gsmSCF and a PDP Context State Model may be downgraded from controlling to monitoring.

When Tssf expires, the CAMEL procedures that are waiting for an instruction from the gsmSCF shall receive an Int_Error signal. The Default GPRS Handling parameter determines the subsequent action of those CAMEL procedures.

If the Default GPRS Handling parameter is set to 'Release', then:

- if the GPRS Dialogue is controlling a GPRS Session, then the gprsSSF shall release the entire GPRS Session;

- if the GPRS Dialogue is controlling a single PDP Context, then the gprsSSF shall release the PDP Context.

The task box 'Open GPRS Dialogue' comprises all the tasks that are required for starting a GPRS dialogue. This includes, amongst others, the allocation of a GPRS Reference Number and the allocation of resources. The task box 'Terminate GPRS Dialogue' comprises all the tasks that are required for closing a GPRS dialogue.

6.5.3.2 Process GPRS_Dialogue_Handler

When process gprsSSF sends a TC_End request primitive to process GPRS_Dialogue_Handler, then the corresponding TC_End TC Message shall be sent to the gsmSCF only when the following conditions have been fulfilled:

- The gprsSSF has processed all information flows that the gprsSSF has received from the gsmSCF.

- No information flows remain to be sent from the gprsSSF to the gsmSCF.

- The gprsSSF is not waiting for a Result or Error component for any information flows that the gprsSSF has sent to the gsmSCF.

6.5.3.3 Procedure Handle_AC_GPRS

Procedure Handle_AC_GPRS is called from process gprsSSF with the following input parameters:

- 'Session'. The Apply Charging GPRS procedure shall be executed for the Session

- 'PDP Id'. The Apply Charging GPRS procedure shall be executed for the indicated PDP Context.

Sheet 3 in procedure Handle_AC_GPRS contains a check for the PDP Context duration (Tcp(PDP Id)) and PDP Context volume (Vc(PDP Id)). If the PDP Context delta timer (Dcp(PDP Id)) is equal to or larger than the duration threshold received in the Apply Charging GPRS operation or the PDP Context delta counter (Dc(PDP Id)) is equal to or larger than the volume threshold received in the Apply Charging GPRS operation, then the gprsSSF shall generate an internal signal to trigger the sending of an Apply Charging Report GPRS.

If a QoS change has occurred prior to receiving Apply Charging GPRS but after the sending Apply Charging Report GPRS, then the gprsSSF shall generate an internal signal to trigger the sending of an Apply Charging Report GPRS, including the negotiated QoS.

6.5.3.4 Procedure Handle_ACR_GPRS

Procedure Handle_ACR_GPRS is called from process gprsSSF with the following input parameters:

- 'Session'. The Apply Charging Report GPRS procedure shall be executed for the Session. This procedure checks if a Session Period report is pending and if so, sends this report to the gsmSCF.

- 'PDP Id'. The Apply Charging Report GPRS procedure shall be executed for the indicated PDP Context. This procedure checks if a Context Volume report is pending and if so, sends this report to the gsmSCF. The procedure then checks if a Context Period is pending and if so, sends this report to the gsmSCF.

- 'Session + PDPs'. The Apply Charging Report GPRS procedure shall be executed for the Session and all PDP Contexts. The sequence of checking the reports shall be as follows:

    1) The procedure checks the pending Volume and Period reports for each PDP Context.

    2) The procedure then checks the pending Period report for the Session.

When a PDP Context Volume counter or PDP context Period timer expires or an Apply Charging GPRS is received when QoS change report is pending, then the procedure Apply Charging Report GPRS procedure is called with the PDP Id as input parameter. The procedure will then check both reports for that PDP Context.

6.5.3.5 Procedure Complete_FCI_Record_GPRS

Procedure Complete_FCI_Record_GPRS is called from process gprsSSF with the following input parameters:

- 'Session'. The Complete_FCI_Record_GPRS procedure shall be executed for the Session.

- 'PDP Id'. The Complete_FCI_Record_GPRS procedure shall be executed for the indicated PDP Context.

- 'Session + PDPs'. The Complete_FCI_Record_GPRS procedure shall be executed for the Session and all PDP Contexts.

6.5.3.6 Procedure Handle_SCI_GPRS

For terminology see subclause 4.5.7.2.1.

The gsmSCF may send e-parameters to the Session and to individual PDP Contexts.

When e-parameters are sent for the Session, the SGSN will forward these e-parameters directly to the Mobile Station.

When e-parameters are sent for a PDP Context and that PDP Context is not yet acknowledged (= active), then the SGSN shall retain these parameters (pending parameters). These parameters will be sent to the Mobile Station when the PDP Context is acknowledged.

The gsmSCF may send two sets of e-parameters and a Tariff Switch for the Session or a PDP Context. The first set of e-parameters shall be sent to the SGSN and the second set of e-parameters shall be stored. This second set of e-parameters shall be sent to the SGSN when the tariff switch expires.

When the Tariff Switch for the Session expires, then the stored e-parameters for the Session shall be sent to the SGSN.

When the Tariff Switch for a PDP Context expires before that PDP Context is acknowledged, then the pending e-parameters for that PDP Context shall be replaced by the stored e-parameters for that PDP Context.

The stored e-parameters for that PDP Context shall be discarded.

When the Tariff Switch for a PDP Context expires after that PDP Context has been acknowledged, then the stored e-parameters for that PDP Context shall be sent to the SGSN.

6.5.3.6.1 Handling of SCI_GPRS for the Session

1) Precondition: no Tsw running for the Session:

   if 1 set of e-parameters received --> send e-parameters to the SGSN;

   if 2 sets of e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> send 1st set of e-parameters to the SGSN/start Tsw (Session)/store 2nd set of e-parameters.

2) Precondition: Tsw running for the Session and no e-parameters stored for the Session:

   if 1 set of e-parameters received --> error;

   if 2 sets of e-parameters received --> send 1st set of e-parameters to the SGSN/store 2nd set of e-parameters;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

3) Precondition: Tsw running for the Session and e-parameters stored for the Session:

   if 1 set of e-parameters received --> error;

   if 2 sets of e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

6.5.3.6.2 Handling of SCI_GPRS for a PDP Context

1) Precondition: before a PDP Context Establishment Acknowledgement event is detected and no Tsw running for this PDP Context:

   if 1 set of e-parameters received --> send e-parameters to the SGSN;

   if 2 sets of e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> send 1st set of e-parameters to the SGSN/start Tsw(PDP Id)/store 2nd set of e-parameters;

2) Precondition: before a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and no e-parameters stored for this PDP Context:

   if 1 set of e-parameters received --> error;

   if 2 sets of e-parameters received --> send 1st set of e-parameters to the SGSN/store 2nd set of e-parameters;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

3) Precondition: before a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and e-parameters stored for this PDP Context:

   if 1 set of e-parameters received --> error;

   if 2 sets of e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

4) Precondition: after a PDP Context Establishment Acknowledgement event is detected and no Tsw running for this PDP Context:

   if 1 set of e-parameters received --> send e-parameters to the SGSN;

   if 2 sets of e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> start Tsw(PDP Id)/store e-parameters;

   if 2 sets of e-parameters and Tariff Switch received --> send 1st set of e-parameters to the SGSN/start Tsw(PDP Id)/store 2nd set of e-parameters.

5) Precondition: after a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and no e-parameters stored for this PDP Context;

if 1 set of e-parameters received --> store e-parameters;

if 2 sets of e-parameters received --> send 1st set of e-parameters to the SGSN/store 2nd set of e-parameters;

if 1 set of e-parameters and Tariff Switch received --> error;

if 2 sets of e-parameters and Tariff Switch received --> error.

6) Precondition: after a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and e-parameters stored for this PDP Context:

if 1 set of e-parameters received --> error;

if 2 sets of e-parameters received --> error;

if 1 set of e-parameters and Tariff Switch received --> error;

if 2 sets of e-parameters and Tariff Switch received --> error.

6.5.3.7 Procedure Handle_PDP_Acknowledgement

Procedure Handle_PDP_Acknowledgement is called when an event occurs that may signal the activation (= Acknowledgement) of a PDP Context. The event signal is passed on to the Handle_PDP_Acknowledgement procedure.

6.5.3.8 GPRS duration and volume control

6.5.3.8.1 Examples of information flows for GPRS session and PDP context control
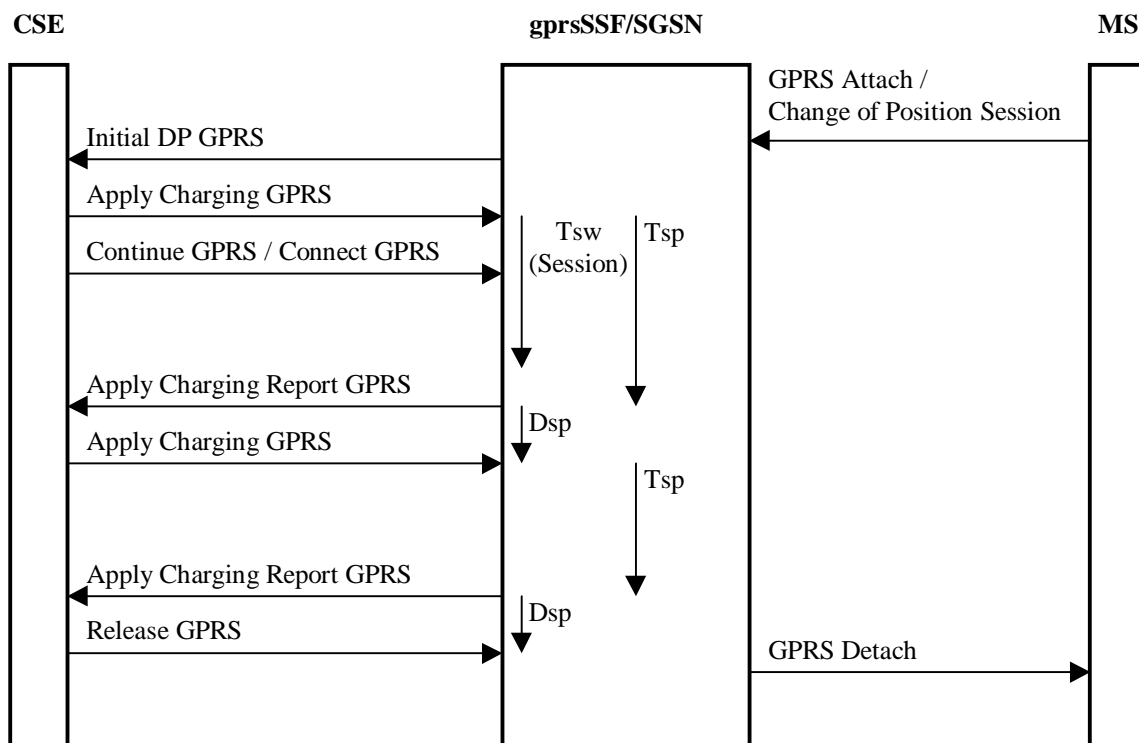
Figure 6.16-1: Example of information flows for GPRS session duration at GPRS attach and change of position session
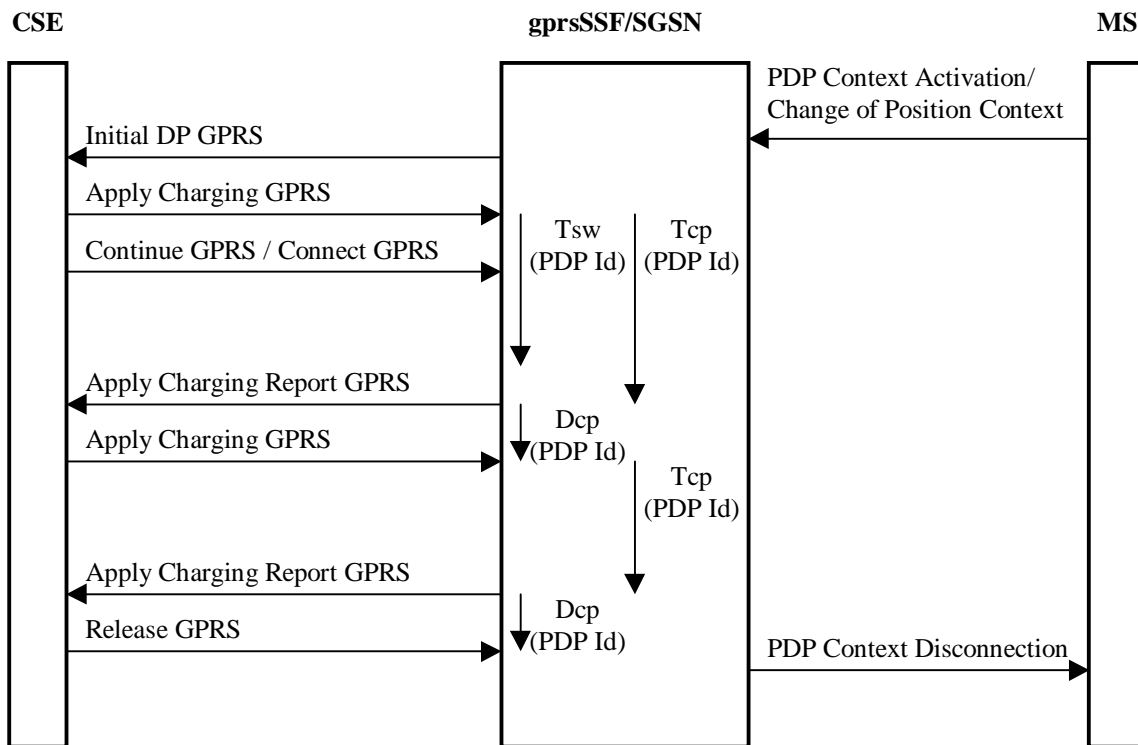
Figure 6.16-2: Example of information flows for PDP context duration control at context activation and change of position context
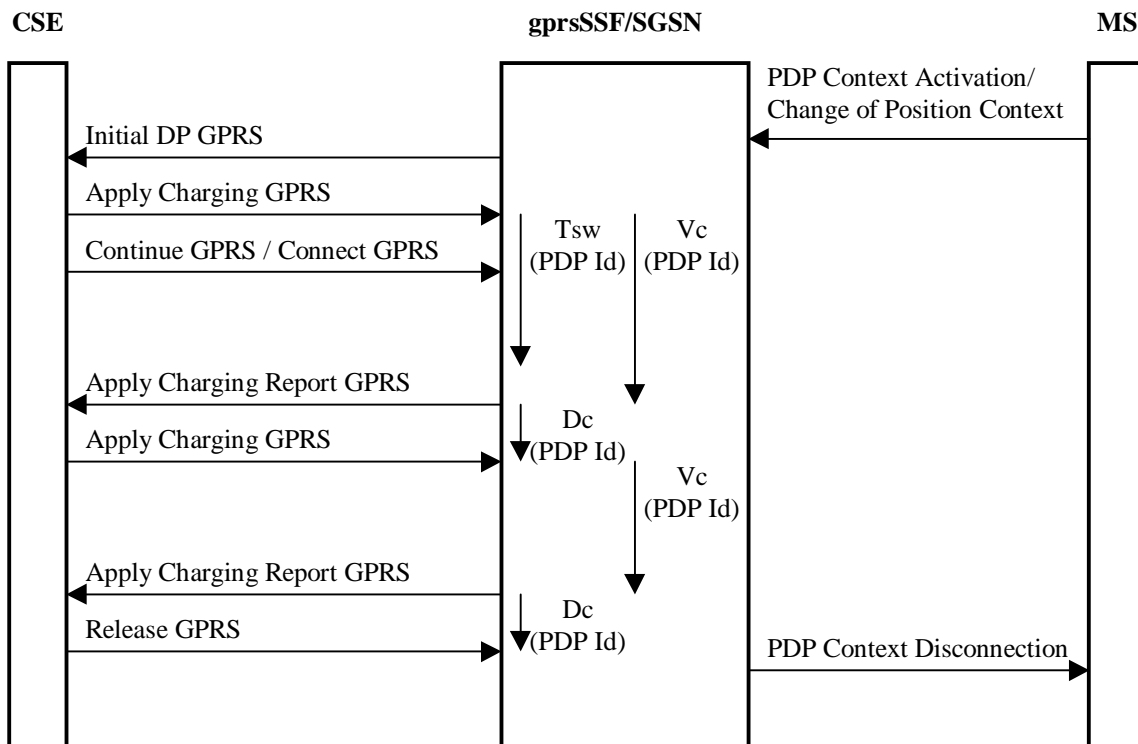
Figure 6.16-3: Example of information flows for PDP context volume control at context activation and change of position context
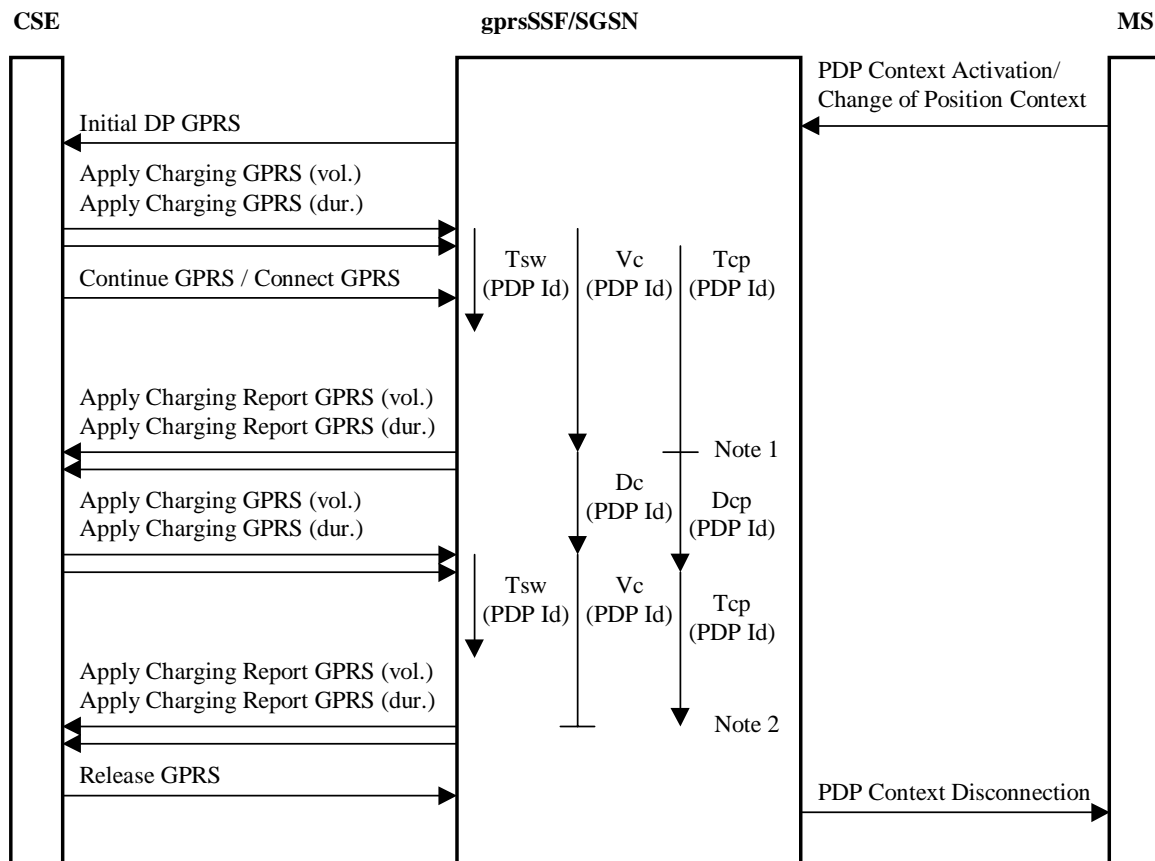
Note1: Vc threshold reached, Tcp is stopped.
Note2: Tcp time out, Vc is stopped.

Figure 6.16-4: Example of information flows for PDP context volume and duration control at context activation and change of position context

These figures 6.16-1 to 6.16-4show examples of handling of the timers that are used in the process gprsSSF and in the procedures Handle_AC_GPRS and Handle_ACR_GPRS.

Duration timers (Tsp for the GPRS session and one Tcp for each PDP context) are used if the charging is on duration of the GPRS session or a PDP context.

Tariff Switch Timers (Tsw(Session) for the GPRS session and one Tsw(PDP Id) for each PDP context) define the start point of a new Tariff. Tsw(Session) is used for charging on duration. Tsw(PDP Id) is used for both methods of charging: duration charging and volume charging. If a PDP context is charged on duration and volume, only one Tsw(PDP Id) timer will be accepted from the gsmSCF for that PDP context.

Delta timers measure the response time of the gsmSCF after an Apply Charging Report GPRS information flow:

- Dsp for the GPRS session; this delta timer is used for GPRS session period timing.

- Dcp for each PDP context; these delta timers are used for PDP context period timing.

- Dc for each PDP context; these delta counters are used for PDP context volume counting.

After the sending of Apply Charging Report GPRS, the gsmSCF may reply either with:

- Apply Charging GPRS, if the gsmSCF sends a new duration because of the expiration of the previous period or because of QOS change.

- Release GPRS, if the gsmSCF decides to release the GPRS session or PDP context.

For a more detailed example of the handling of the Apply Charging GPRS and Apply Charging Report GPRS information flows, see Annex A.

6.5.3.8.2 TC guard timer

6.5.3.8.2.1 General

When the gprsSSF sends an Apply Charging Report GPRS information flow to the gsmSCF, with SessionActive or ContextActive variable set to TRUE, then the gprsSSF shall start the TC guard timer. The gprsSSF shall also mark for the Session or PDP Context for which the Apply Charging Report GPRS was sent, that a corresponding Apply Charging GPRS information flow from the gsmSCF is expected.

When the gprsSSF receives an Apply Charging GPRS information flow or a Release GPRS information flow, then the 'Waiting-for-AC' marking(s) for the Session or PDP Context shall be removed. The gprsSSF shall then check if the TC guard timer shall be stopped (task box 'Check TC guard timer'). The TC guard timer shall be stopped if there are no more Apply Charging GPRS information flows expected for the Session and all PDP Contexts.

When an event occurs that results in the termination of a PDP Context, then the 'Waiting-for-AC' markings for that PDP Context shall be removed. The gprsSSF shall then check if the TC guard timer shall be stopped (task box 'Check TC guard timer'). The TC guard timer shall be stopped if there are no more Apply Charging GPRS information flows expected for the Session and all PDP Contexts.

When the TC guard timer expires in state Monitoring, then the gprsSSF shall close the TC dialogue, provided that all conditions for closing the TC dialogue are fulfilled, i.e. there are no information flow results expected from the gsmSCF, no information flows or errors to be sent to the gsmSCF and no information flows from the gsmSCF received and waiting to be processed.

When the TC guard timer expires in state Waiting_for_Instructions, then no action shall be taken.

Service Designers should note that there may be additional timer(s) in the gprsSSF to supervise the response from the gsmSCF on the Apply Charging Report GPRS procedure. As a result of this, if the gsmSCF does not send an Apply Charging GPRS, Release GPRS or Cancel GPRS in response to an Apply Charging Report GPRS when the gprsSSF is awaiting such response, then service behaviour may be unpredictable.

6.5.3.8.2.2 Check TC guard timer

This clause describes the actions to be taken in the task box 'Check TC guard timer'.

The tasks to be executed in the 'Check TC guard timer' box depend on the event that resulted in execution of the task box.

6.5.3.8.2.2.1 Apply Charging GPRS

If 'Check guard timer' is executed as a result of an Apply Charging GPRS information flow from the gsmSCF, then the appropriate 'Waiting-for-AC' marker shall be removed, depending on the information received in the Apply Charging GPRS information flow:

- if the Apply Charging GPRS information flow carries a Session Time threshold, then the Session-Period 'Waiting-for-AC' marker shall be removed.

- if the Apply Charging GPRS information flow carries a PDP Context Volume threshold, then the PDP Context-Volume 'Waiting-for-AC' marker shall be removed.

- if the Apply Charging GPRS information flow carries a PDP Context Time threshold, then the PDP Context - Period 'Waiting-for-AC' marker shall be removed.

The gprsSSF then checks if there is any 'Waiting-for-AC' marker for the Session or any PDP Context. If there is no 'Waiting-for-AC' marker remaining, then the TC guard timer shall be stopped.

6.5.3.8.2.2.2 Release GPRS

If 'Check TC guard timer' is executed as a result of a Release GPRS information flow from the gsmSCF, then the appropriate 'Waiting-for-AC' markers shall be removed, depending on the information received in the Release GPRS information flow:

- if the Release GPRS information flow is for the Session, then the Session 'Waiting-for-AC' markers shall be removed.

- if the Release GPRS information flow is for the PDP Context, then the PDP Context 'Waiting-for-AC' markers shall be removed.

The gprsSSF then checks if there is any 'Waiting-for-AC' marker for the Session or any PDP Context. If there is no 'Waiting-for-AC' marker remaining, then the TC guard timer shall be stopped.

6.5.3.8.2.2.3 PDP Context Disconnect

If 'Check TC guard timer' is executed as a result of a PDP Context Disconnect signal from the SGSN, then the 'Waiting-for-AC' markers for that PDP Context shall be removed.

The gprsSSF then checks if there is any 'Waiting-for-AC' marker for the Session or any PDP Context. If there is no 'Waiting-for-AC' marker remaining, then the TC guard timer shall be stopped.

6.5.3.9 SDL diagrams for process GPRS_SSF and procedures

Process GPRS_SSF 1(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN. */

/*
The following timers are defined:
- Tsp: GPRS session period timer,
- Dsp: GPRS session delta timer,
- Tcp(PDP Id): PDP Context period timer,
- Dcp(PDP Id): PDP Context delta timer,
- Tsw(Session): Tariff switch timer for the GPRS session,
- Tsw(PDP Id): Tariff switch timer for a PDP Context,
- Tssf: gprsSSF state machine timer.
   This timer has a default value range of 1 to 20 seconds.
- TC guard timer: charging guard timer.
   This timer has a value range of 1 to 20 seconds.

The following octet counters are defined:
- Vc(PDP Id): PDP Context volume counter,
- Dc(PDP Id): Volume delta counter for the PDP Context.
*/

/* Messages are sent from the gprsSSF via the
GPRS_Dialogue_Handler to the gsmSCF and
vice versa. */

Idle

Int_Invoke_
GPRS_SSF

Arm TDPs

The GPRS-CSI may contain the following TDPs:
DP_Attach,
DP_Change_Of_Position_Session,
DP_Change_Of_Position_Context,
DP_PDP_Context_Establishment,
DP_PDP_Context_Establishment_Acknowledgement

Int_GPRS_
SSF_Invoked

Wait_for_
Request

Figure 6.17-1: Process GPRS_SSF (sheet 1)

Process GPRS_SSF 2(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals from the left are from the SGSN; signal to the right is to the GPRS_Dialogue_Handler. */

Wait_for_
Request

Int_GPRS_
Failure

Idle

Int_DP_Attach,
Int_DP_Change_Of_Position_Session,
Int_DP_Change_Of_Position_Context,
Int_DP_PDP_Context_Establishment,
Int_DP_PDP_Context_Establishment_Acknowledgement

Set Tssf to
default value
and start Tssf

Open
GPRS Dialogue

CAP_InitialDP_
GPRS

Input
signal?

Int_DP_Change_Of_Position_Context,
Int_DP_PDP_Context_Establishment_Acknowledgement

Int_DP_Attach,
Int_DP_Change_Of_Position_Session

ContextActive
(PDP Id) :=true

SessionActive
:=true

Instruction_
Counter := 1

Waiting_for_
Instructions

Figure 6.17-2: Process GPRS_SSF (sheet 2)

Process GPRS_SSF 3(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the left are to the SGSN; signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Waiting_for_Instructions

CAP_Apply_Charging_GPRS

Set Tssf to last used interval and restart Tssf

Yes

No

Handle_AC_GPRS (Session/PDP Id)

Waiting_for_Instructions

GPRS Session detached or PDP Context (PDP Id) already released?

CAP_Cancel_GPRS

Set Tssf to last used interval and restart Tssf

Disarm all EDPs (Session/PDP Id)

Cancel all reports (Session/PDP Id)

CAP_Connect_GPRS

Int_Connect_GPRS (PDP Id)

Decrement Instruction_counter

Yes

No

Any armed EDP-R for the Session or this PDP Context?

Set monitor relationship for the Session or this PDP Context

CAP_Continue_GPRS

Int_Continue_GPRS (Session/PDP Id)

Instruction_counter?

0

> 0

Stop Tssf

Set Tssf to last used interval and restart Tssf

TC_End

Waiting_for_Instructions

Any EDPs armed or reports outstanding?

No

Yes

Complete_FCI_Record_GPRS (Session+PDPs)

Terminate GPRS dialogue

Monitoring

Idle

Figure 6.17-3: Process GPRS_SSF (sheet 3)

Process GPRS_SSF   4(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals from the right are from the GPRS_Dialogue_Handler. */

Waiting_for_Instructions

| CAP_FurnishCharging_InformationGPRS | CAP_RequestReport_GPRSEvent | CAP_ResetTimer_GPRS | CAP_SendCharging_InformationGPRS |

Set Tssf to last used interval and restart Tssf

Set Tssf to last used interval and restart Tssf

Reset Tssf to value received and restart Tssf

Set Tssf to last used interval and restart Tssf

Handle_FCI_GPRS (Session/PDP Id)

Perform arming/disarming of events (Session/PDP Id)

Handle_SCI_GPRS (Session/PDP Id)

Yes

No

Set monitor relationship for the Session or this PDP Context

Waiting_for_Instructions

Any armed EDP-R for the Session or this PDP Context?

Shall not be performed if the Session or PDP Context for which the operation was sent, is waiting for instructions from the gsmSCF.

Figure 6.17-4: Process GPRS_SSF (sheet 4)
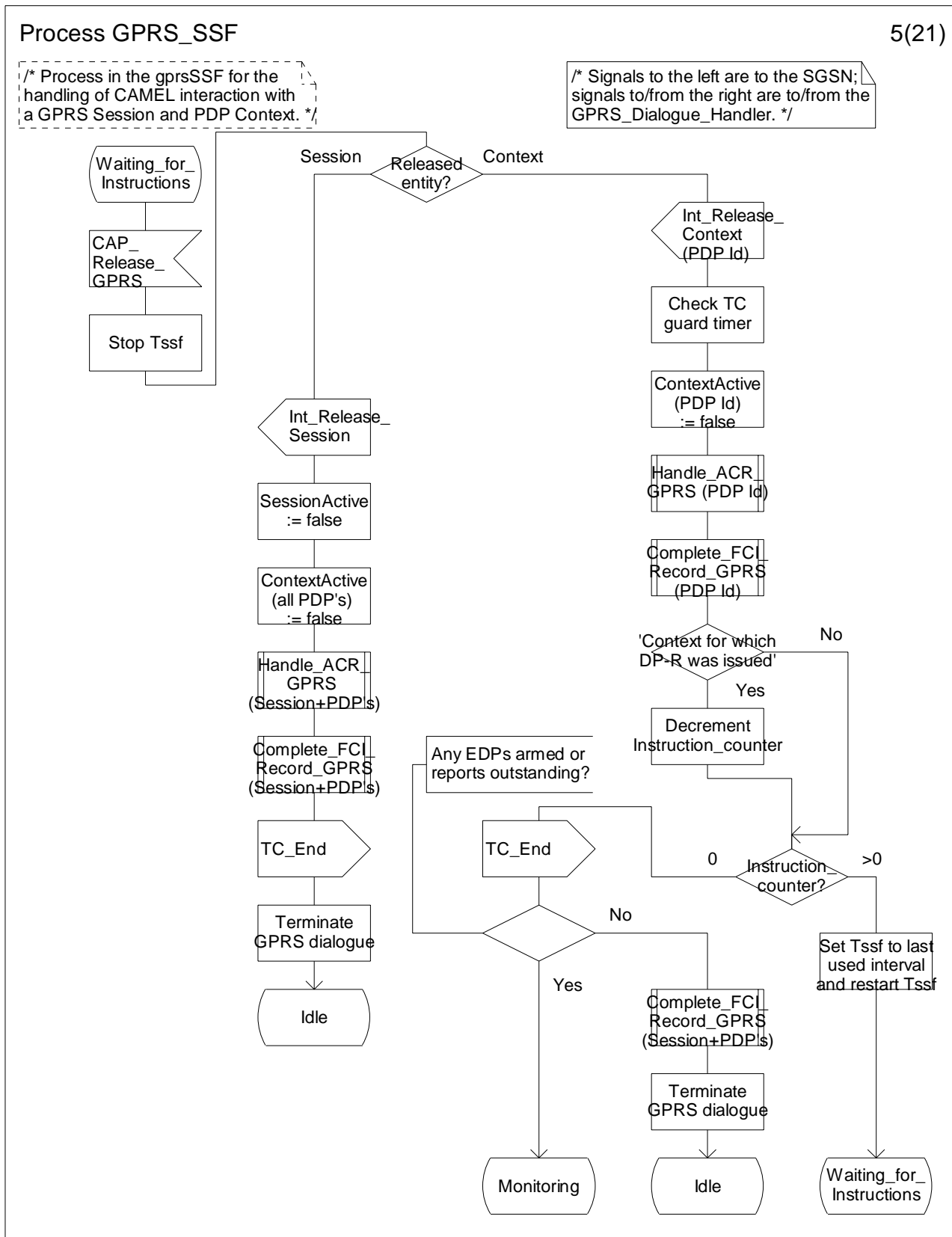
Figure 6.17-5: Process GPRS_SSF (sheet 5)

Process GPRS_SSF 6(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN;
signals to the right are to the GPRS_Dialogue_Handler. */

Waiting_for_
Instructions

Int_DP_Change_Of_Position_Session,
Int_DP_Change_Of_Position_Context,
Int_DP_PDP_Context_Establishment,
Int_DP_PDP_Context_Establishment_Acknowledgement

Perform Implicit
Disarming

Handle_PDP_
Acknowledgement
(input signal)

Was DP armed?

No | EDP-N | EDP-R

Int_Continue
(Session/PDP Id)

CAP_Event_Report_GPRS
(DP, notify & continue)

CAP_Event_Report_GPRS
(DP, interrupted)

Waiting_for_
Instructions

Set Tssf to last
used interval
and restart Tssf

Set Tssf to last
used interval
and restart Tssf

Int_Continue
(Session/PDP Id)

Increment
Instruction_counter

Waiting_for_
Instructions

Waiting_for_
Instructions

Figure 6.17-6: Process GPRS_SSF (sheet 6)

Process GPRS_SSF 7(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN; signals to the right are to the GPRS_Dialogue_Handler. */

Waiting_for_Instructions

/* Note: Change Of Position Complete is reported as a Int_DP_PDPContext_Disconnection with the cause 'Change of Position'. */

Int_DP_PDP_Context_Disconnection

Perform implicit disarming of DPs

Check TC guard timer

Was DP armed?

| No | EDP-N | EDP-R |

No:

ContextActive (PDP Id) := false

Handle_ACR_GPRS (PDP Id)

Complete_FCI_Record_GPRS (PDP Id)

Int_Continue (PDP Id)

CAP_Entity_Released_GPRS (PDP Id)

Set Tssf to last used interval and restart Tssf

EDP-N:

CAP_Event_Report_GPRS (DP, notify & continue)

ContextActive (PDP Id) := false

Handle_ACR_GPRS (PDP Id)

Set Tssf to last used interval and restart Tssf

Complete_FCI_Record_GPRS (PDP Id)

Int_Continue (PDP Id)

EDP-R:

ContextActive (PDP Id) := false

Handle_ACR_GPRS (PDP Id)

CAP_Event_Report_GPRS (DP, interrupted)

Set Tssf to last used interval and restart Tssf

Increment Instruction_counter

Waiting_for_Instructions

Figure 6.17-7: Process GPRS_SSF (sheet 7)

Process GPRS_SSF 8(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signal from the left is from the SGSN or internal GPRS_SSF.*/

Waiting_for_ Instructions

Int_QoS_Change (PDP Id)

No ◇ Any outstanding report for this PDP Context?

Yes

Waiting for Apply Charging GPRS (PDP Id) ?

No

Yes

QoS (PDP Id) Pending := True

Handle_ACR_GPRS (PDP Id)

Set Tssf to last used interval and restart Tssf

Waiting_for_ Instructions
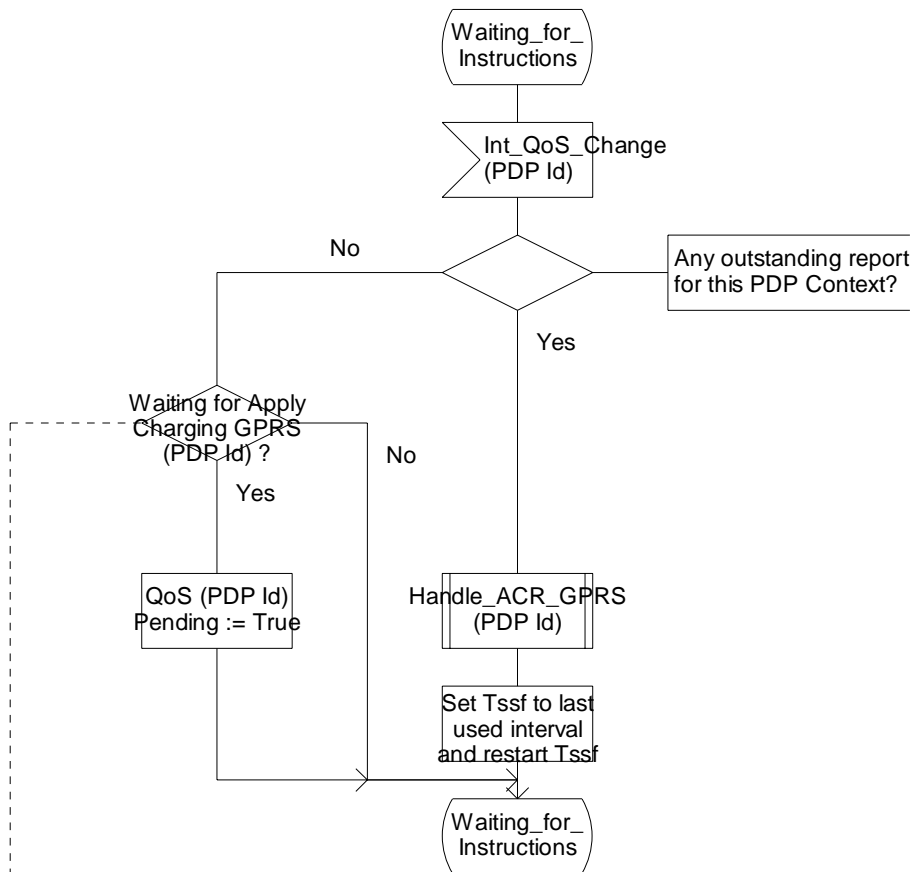
gprsSSF shall check whether it is expecting an Apply Charging GPRS for this PDP Context

Figure 6.17-8: Process GPRS_SSF (sheet 8)

Process GPRS_SSF 9(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Notes:
- The period timers are received from an entity internal to the gprsSSF when the threshold has been reached.
- The volume counters are received from an entity internal to the gprsSSF when the threshold has been reached.
*/

Internal

Waiting_for_ Instructions

Tsp | Tcp (PDP Id) | Vc (PDPId)

Handle_ACR_GPRS (Session) | Handle_ACR_GPRS (PDP Id) | Handle_ACR_GPRS (PDP Id)

Set Tssf to last used interval and restart Tssf

Waiting_for_ Instructions
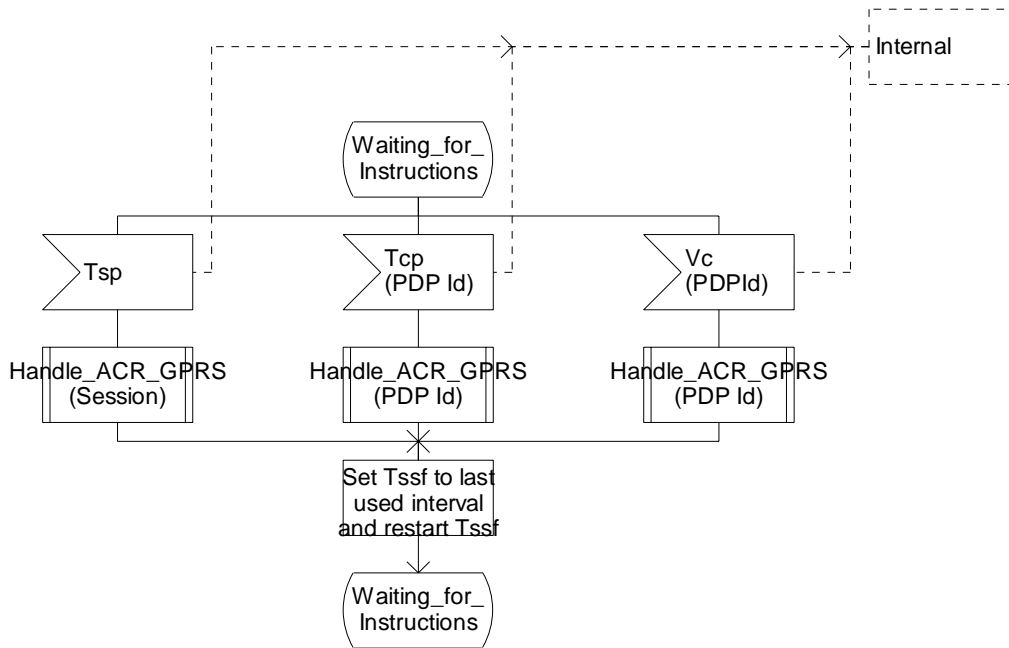
Figure 6.17-9: Process GPRS_SSF (sheet 9)

Process GPRS_SSF   10(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signal to the right is to the GPRS_Dialogue_Handler. Signals to the left are to the SGSN. */

Waiting_for_Instructions

Tssf ----- Internal

TC_Abort

Int_Error

Decrement Instruction_counter

Instruction_counter = 0?   No

Yes

Default GPRS handling?   Continue

Release

Int_Release_Session

Complete_FCI Record_GPRS (Session+PDP Id)

Terminate GPRS Dialogue

Idle
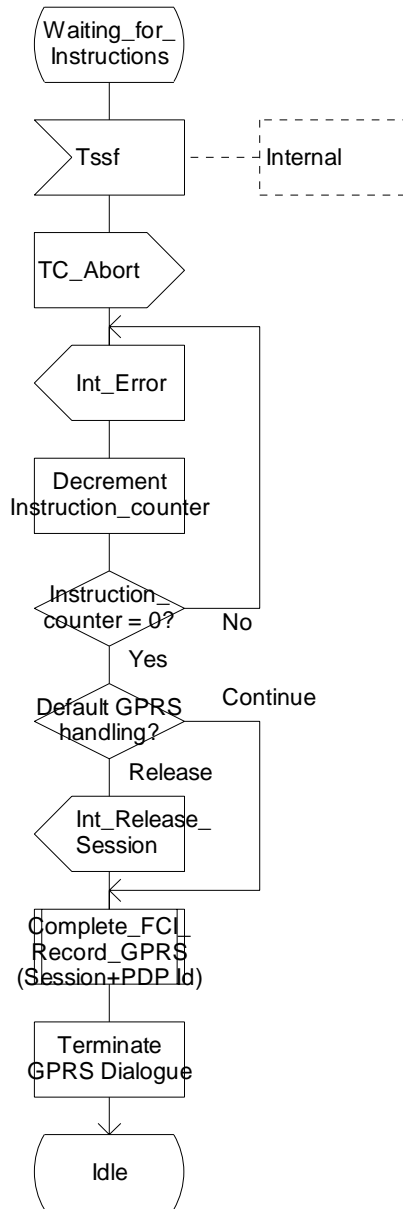
Figure 6.17-10: Process GPRS_SSF (sheet 10)

Process GPRS_SSF   11(21)

```
/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */
```

```
    ┌─────────────┐
    │ Waiting_for_│
    │ Instructions│
    └─────────────┘
           │
    ┌─────────────┐      ┌ ─ ─ ─ ─ ─ ┐
    │ TC guard    │ ─ ─ ─  Internal
    │ timer       │      └ ─ ─ ─ ─ ─ ┘
    └─────────────┘
           │
    ┌─────────────┐
    │ Waiting_for_│
    │ Instructions│
    └─────────────┘
```
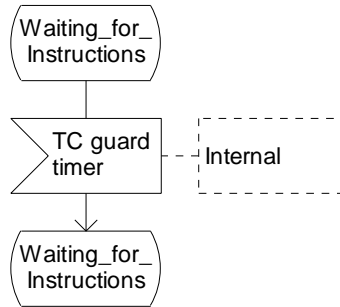
Figure 6.17-11: Process GPRS_SSF (sheet 11)

Process GPRS_SSF   12(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Monitoring

CAP_Apply_Charging_GPRS

Handle_AC_GPRS
(Session/PDP Id)

TC_End

Monitoring

CAP_Cancel_GPRS

Disarm all EDPs
(Session/PDP Id)

Cancel all reports
(Session/PDP Id)

Complete_FCI_Records_GPRS
(Session/PDP Id)

Any EDPs armed or reports outstanding?   No

Yes

TC_End

Monitoring

Complete_FCI_Record_GPRS
(Session+PDPs)

TC_End

Terminate GPRS dialogue

Idle

CAP_FurnishCharging_InformationGPRS

Handle_FCI_GPRS
(Session/PDP Id)

TC_End

Monitoring

CAP_SendCharging_InformationGPRS

Handle_SCI_GPRS
(Session/PDP Id)

TC_End

Monitoring

Figure 6.17-12: Process GPRS_SSF (sheet 12)

Process GPRS_SSF 13(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the left are to the SGSN; signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Monitoring

CAP_Release_GPRS

Released entity?

Session → Int_Release_Session

SessionActive := false

ContextActive (all PDP's) :=false

Handle_ACR_GPRS (Session+PDP's)

Complete_FCI_Record_GPRS (Session+PDP's)

TC_End

Terminate GPRS dialogue

Idle

Context → Int_Release_Context (PDP Id)

Check TC guard timer

ContextActive (PDPId) := false

Handle_ACR_GPRS (PDPId)

Complete_FCI_Record_GPRS (PDP Id)

TC_End

Any EDPs armed or reports outstanding?

No

Yes → Monitoring

Complete_FCI_Records_GPRS (Session+PDP's)

Terminate GPRS dialogue

Idle
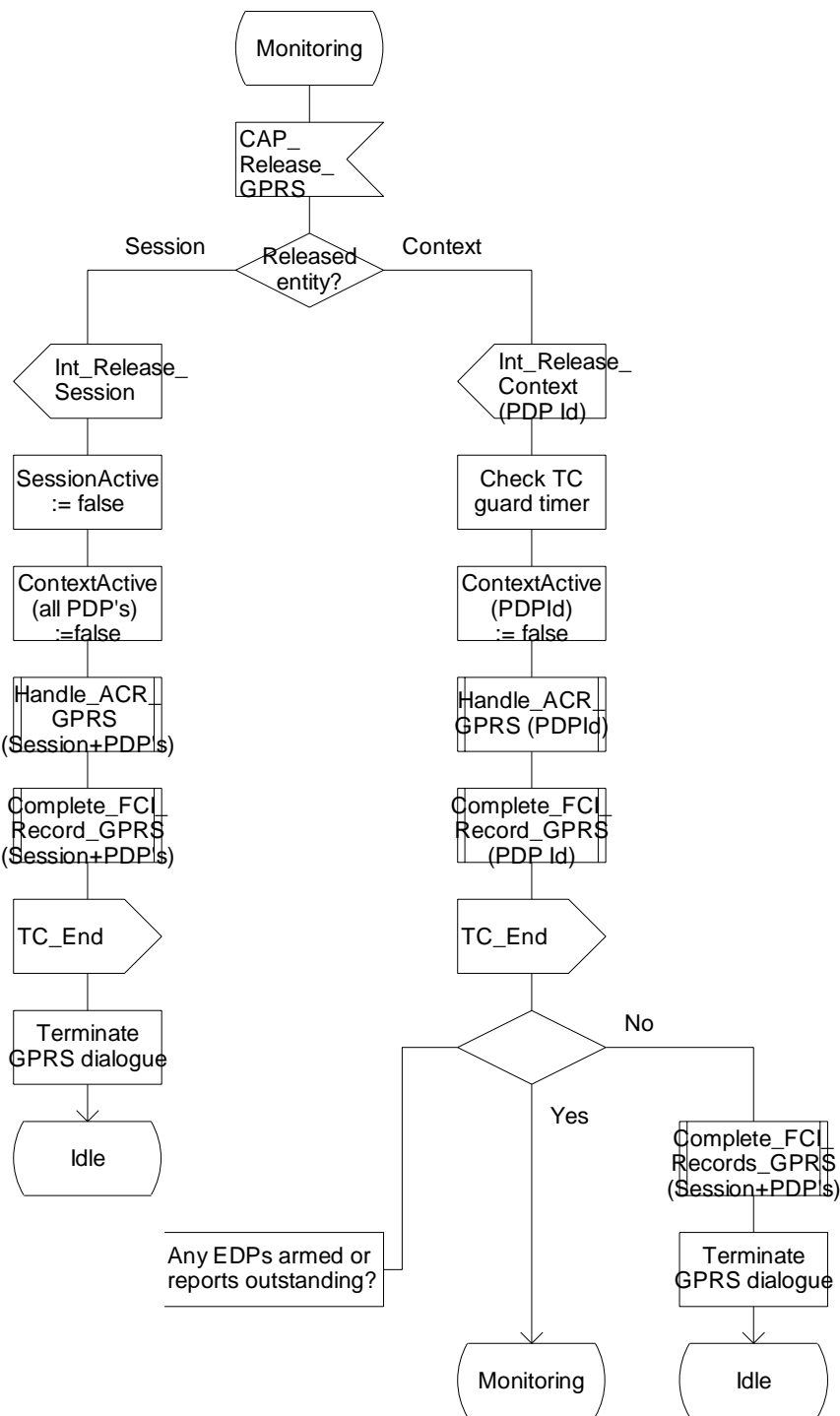
Figure 6.17-13: Process GPRS_SSF (sheet 13)

Process GPRS_SSF 14(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Monitoring

CAP_
RequestReport_
GPRSEvent

Perform disarming
of events
(Session/PDP Id)

Yes ← Any armed EDP or outstanding report for the Session or this PDP Context

No

Complete_FCI_
Record_GPRS
(Session/PDP Id)

TC_End

Yes ← Any armed EDP-R for the Session or this PDP Context?

No

Set monitor relationship
for the session or
this PDP context

Any EDPs armed or
reports outstanding? →

No

Yes

Complete_FCI_
Record_GPRS
(Session+PDPs)

Terminate
GPRS dialogue

Monitoring

Idle
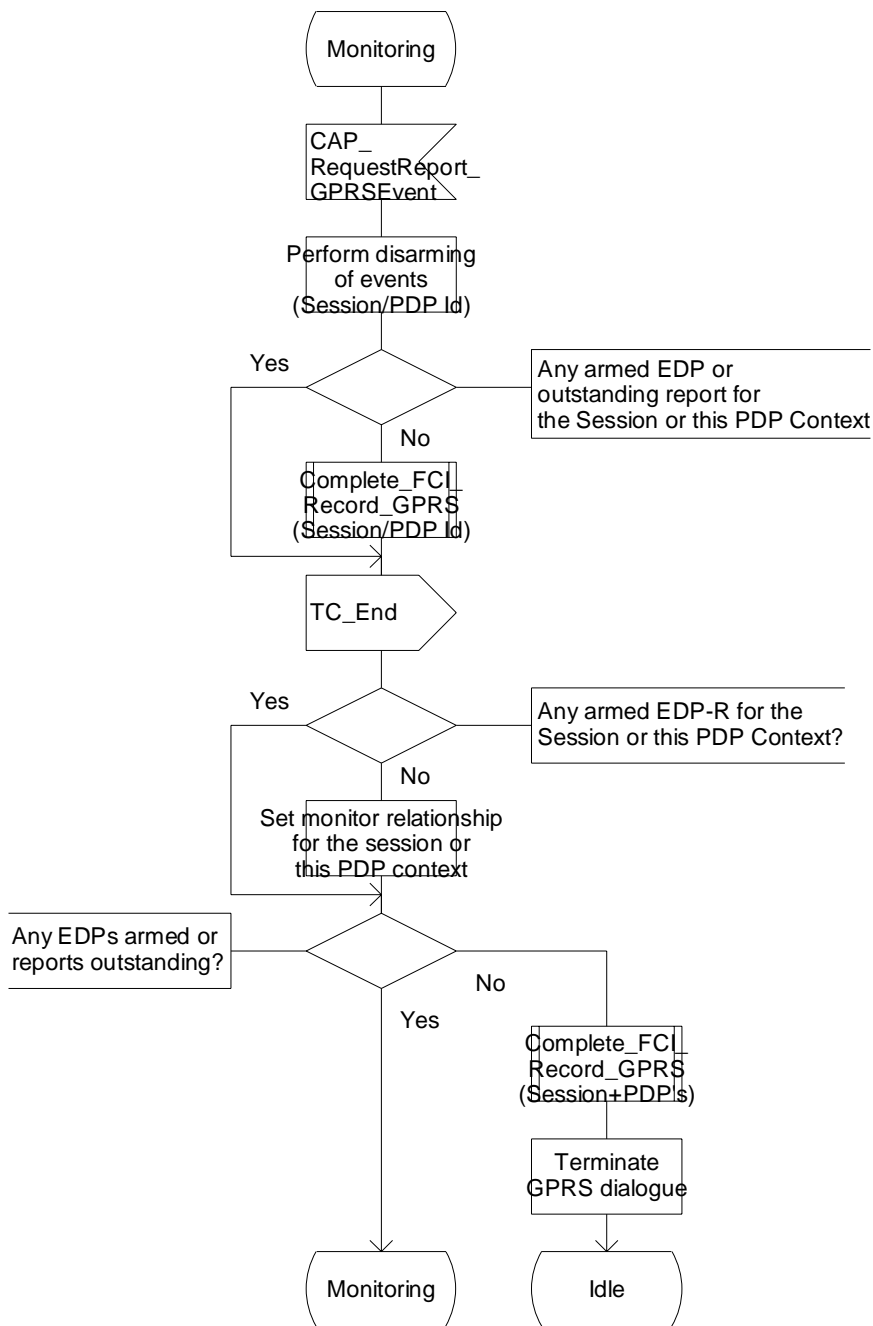
Figure 6.17-14: Process GPRS_SSF (sheet 14)

Process GPRS_SSF   15(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN; signals to the right are to the GPRS_Dialogue_Handler. */

Figure 6.17-15: Process GPRS_SSF (sheet 15)
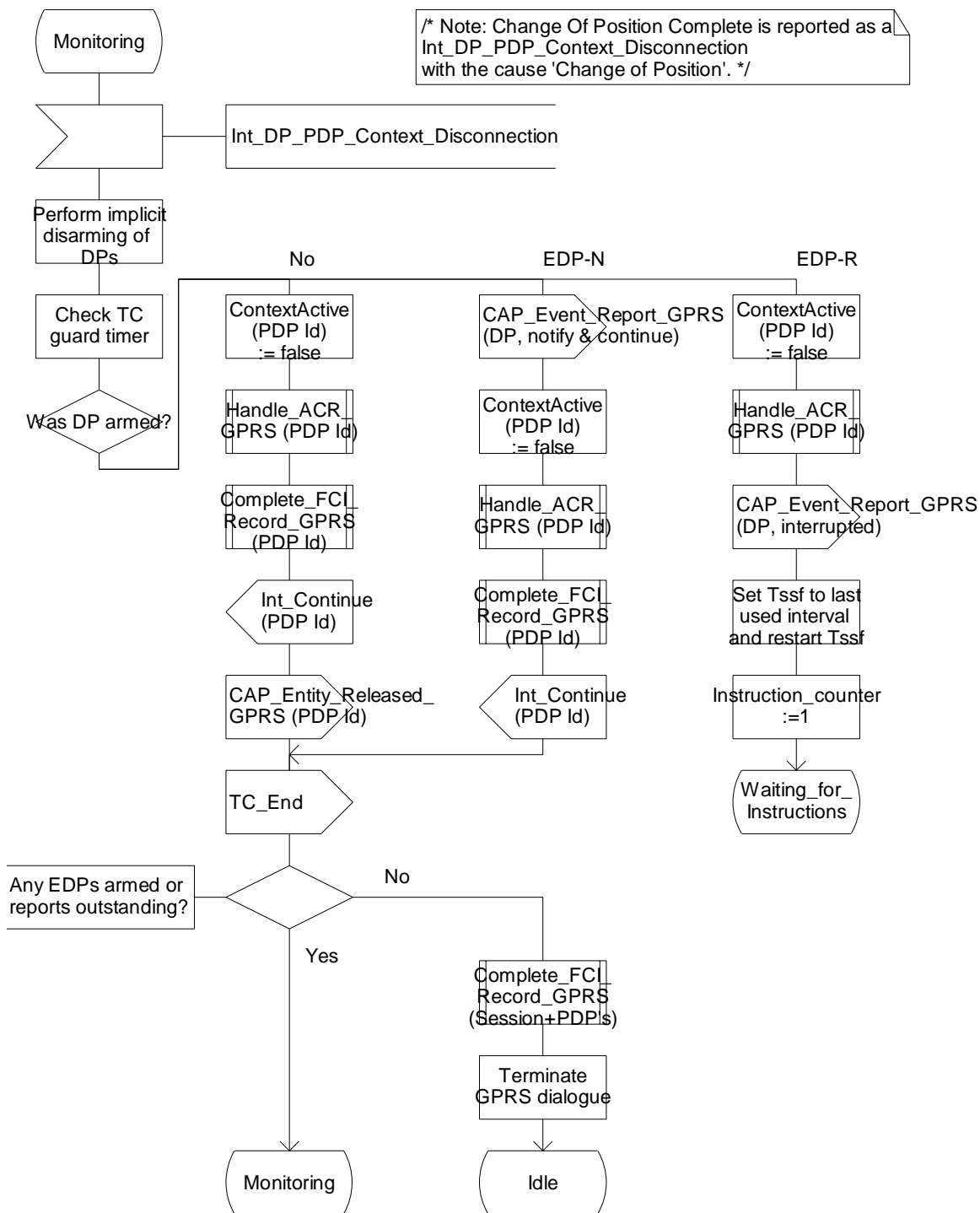
Figure 6.17-16: Process GPRS_SSF (sheet 16)

Process GPRS_SSF   17(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

/* Signal from the left is from the SGSN
or internal GPRS_SSF.*/

Monitoring

Int_QoS_Change
(PDP Id)

No ──────────────── ◇ ────── Any outstanding report
                              for this PDP Context?

                    Yes

Waiting for Apply
Charging GPRS
(PDP Id) ?   No

        Yes

QoS (PDP Id)   Handle_ACR_GPRS
Pending := True   (PDP Id)

                    Monitoring

gprsSSF shall check whether it is
expecting an Apply Charging GPRS
for this PDP Context

Figure 6.17-17: Process GPRS_SSF (sheet 17)

Process GPRS_SSF 18(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Notes:
- The period timers are received from an entity internal to the gprsSSF when the threshold has been reached.
- The volume counters are received from an entity internal to the gprsSSF when the threshold has been reached.
*/

Internal

Monitoring

Tsp

Tcp (PDP Id)

Vc (PDP Id)

Handle_ACR_GPRS (Session)

Handle_ACR_GPRS (PDP Id)

Handle_ACR_GPRS (PDP Id)

Any EDPs armed or reports outstanding?

No

Yes

Complete_FCI_ Record_GPRS (Session+PDPs)

Terminate GPRS dialogue

Monitoring

Idle
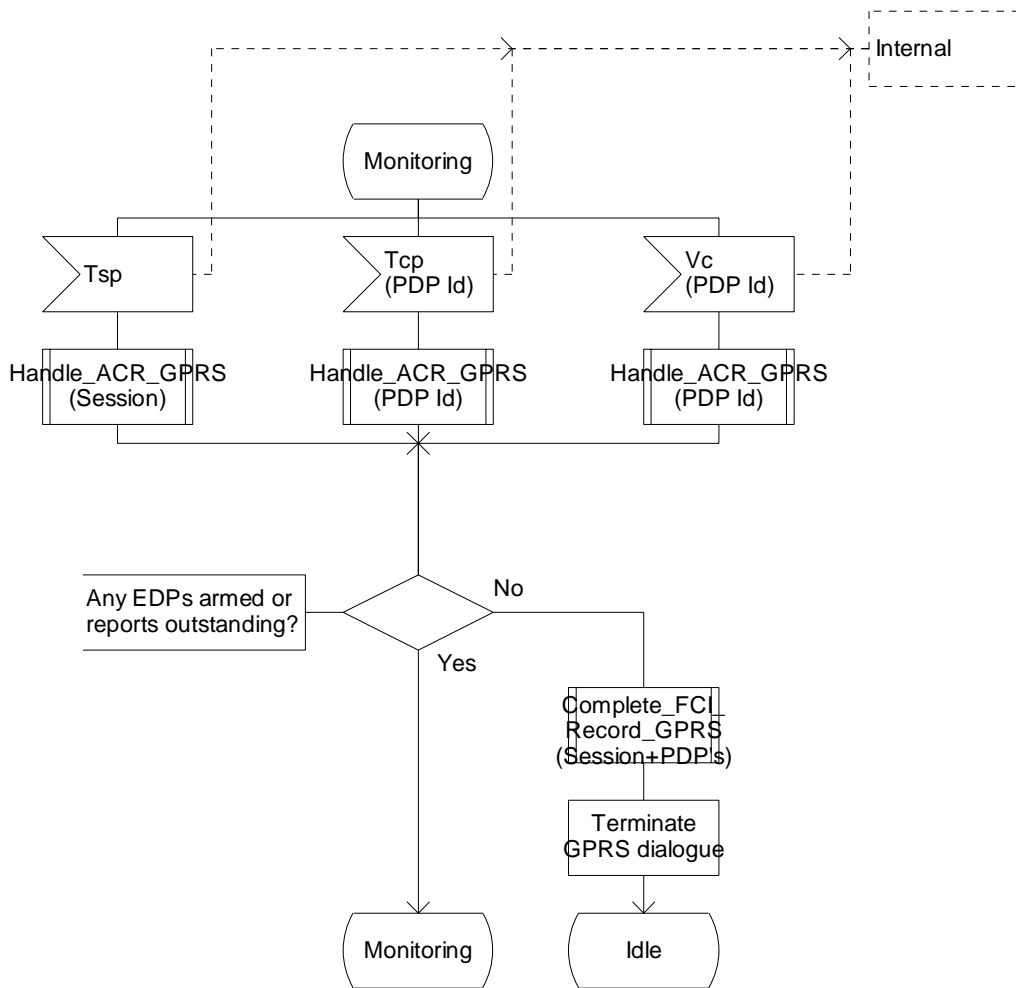
Figure 6.17-18: Process GPRS_SSF (sheet 18)

Process GPRS_SSF 19(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the right is to the GPRS_Dialogue_Handler */

Monitoring
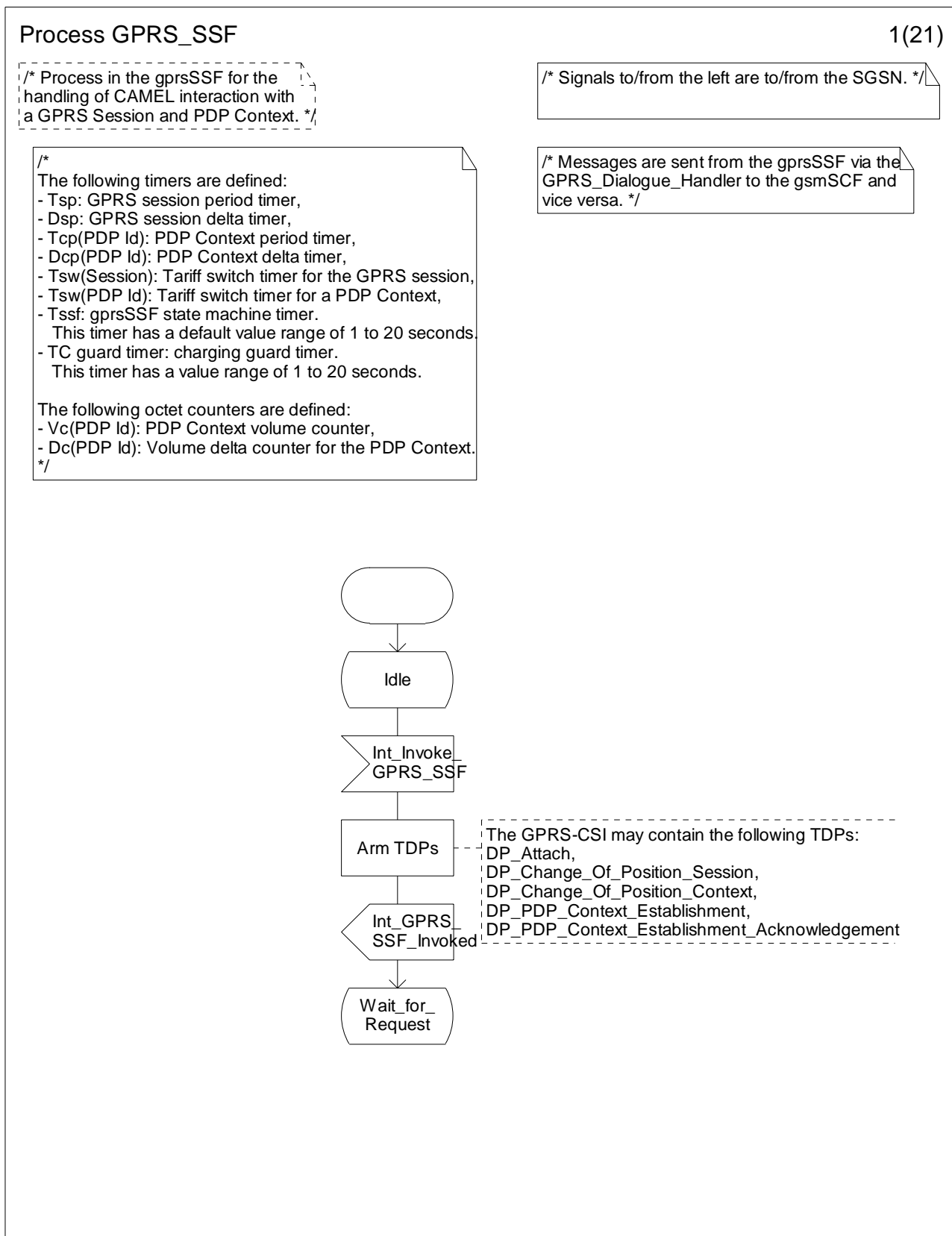
TC guard timer --- Internal

TC_End

Monitoring
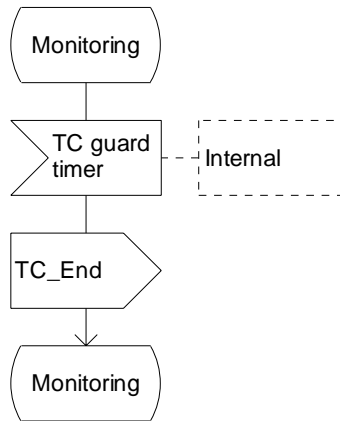
Figure 6.17-19: Process GPRS_SSF (sheet 19)

Process GPRS_SSF 20(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN; signals to the right are to the GPRS_Dialogue_Handler. */

Waiting_for_Instructions, Monitoring

/* Note: DP Change Of Position SessionComplete is signaled with Int_DP_Detach with the cause 'Change of Position'. */

Int_DP_Detach

Perform implicit disarming of DPs

Was DP armed?

No

Stop Tssf

SessionActive := false

ContextActive (all PDP's) := false

Handle_ACR_ GPRS (Session+PDP's)

Int_Continue (Session)

CAP_Entity_ Released_GPRS (Session)

Complete_FCI_ Record_GPRS (Session+PDP's)

TC_End

Terminate GPRS dialogue

Idle

EDP-N

Stop Tssf

CAP_Event_Report_GPRS (DP, notify & continue)

SessionActive := false

ContextActive (all PDP's) := false

Handle_ACR_ GPRS (Session+PDP's)

Int_Continue (Session)

Complete_FCI_ Record_GPRS (Session+PDP's)

TC_End

Terminate GPRS dialogue

Idle

EDP-R

SessionActive := false

ContextActive (all PDP's) := false

Handle_ACR_ GPRS (Session+PDP's)

CAP_Event_Report_GPRS (DP, interrupted)

Set Tssf to last used interval and restart Tssf

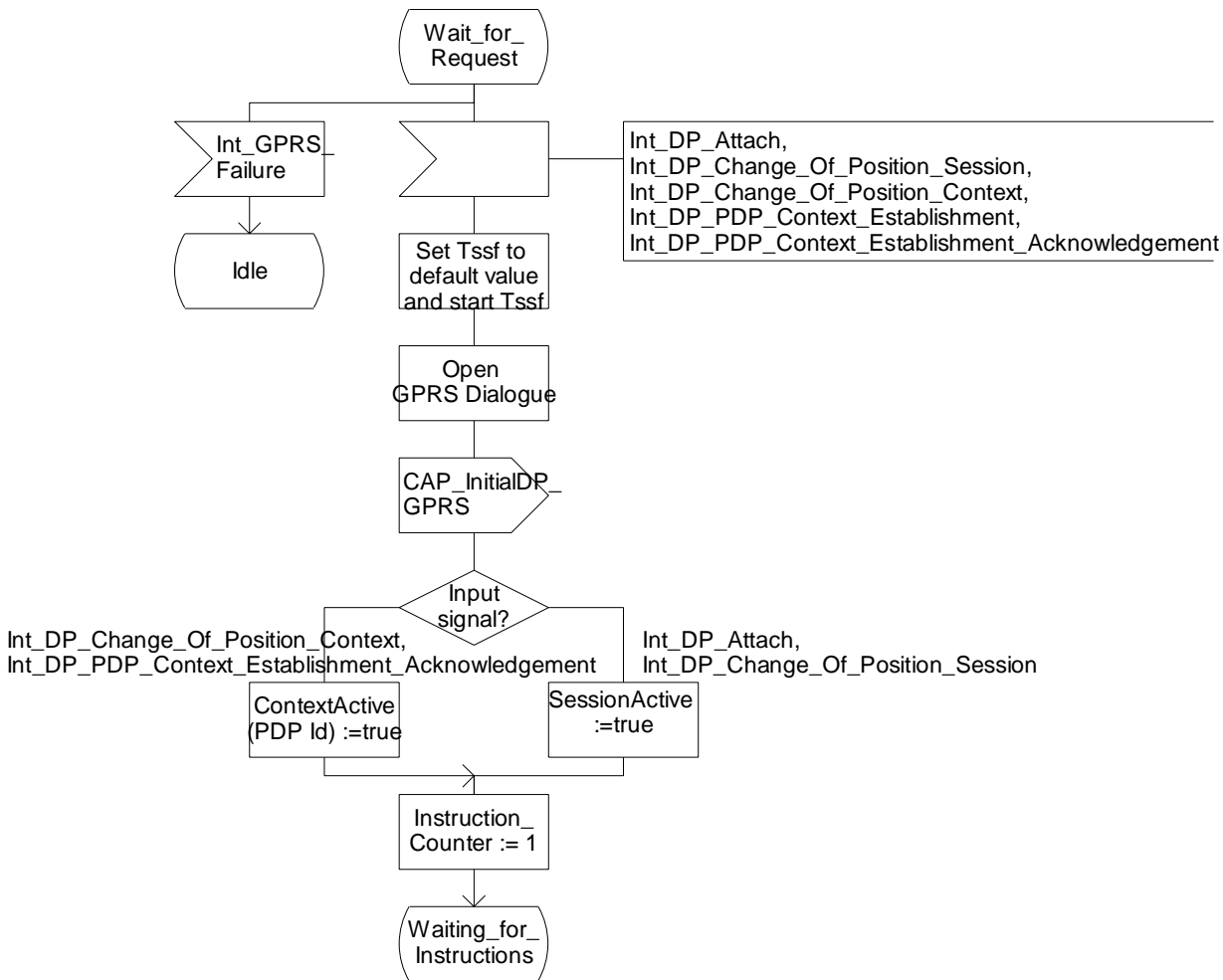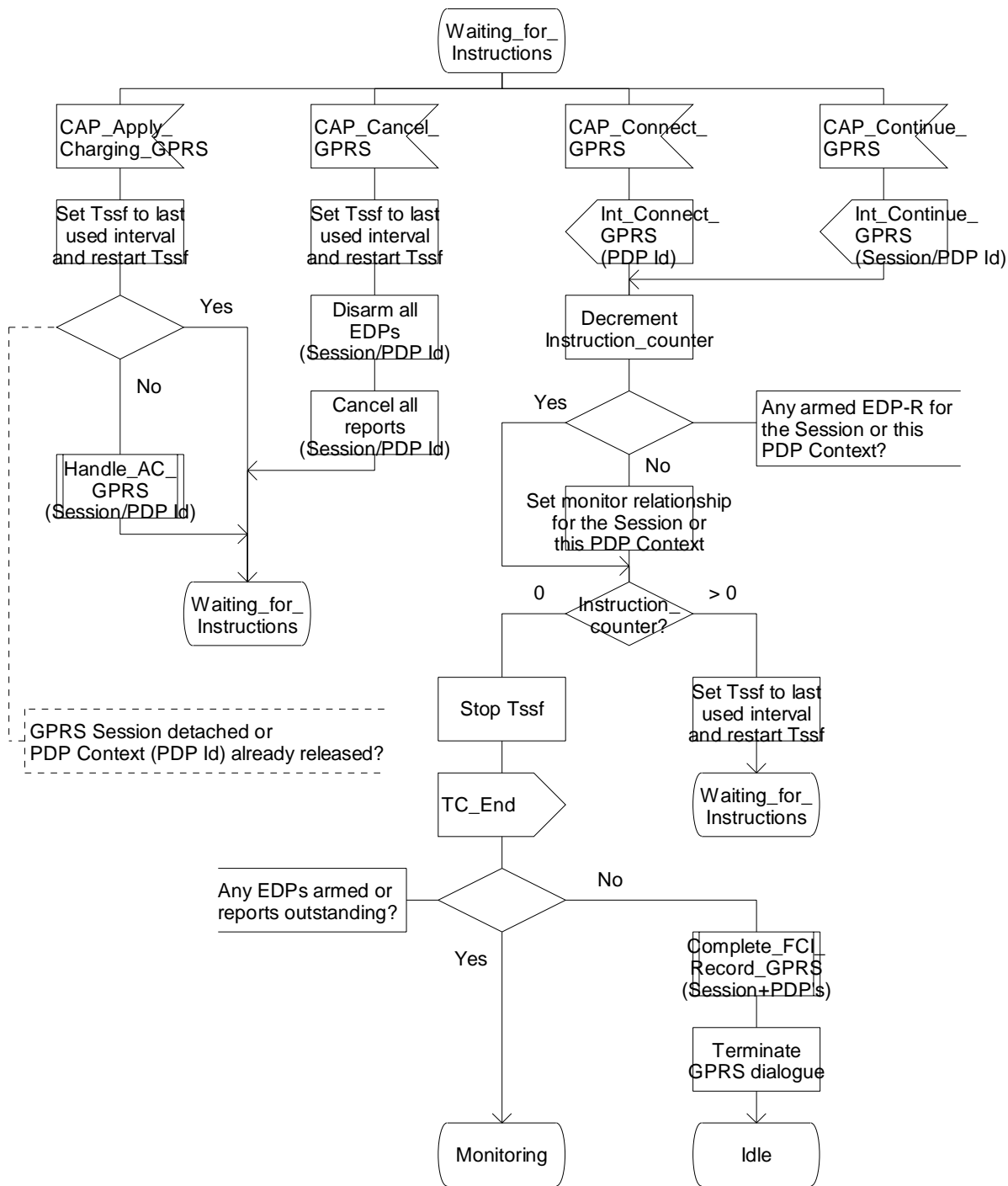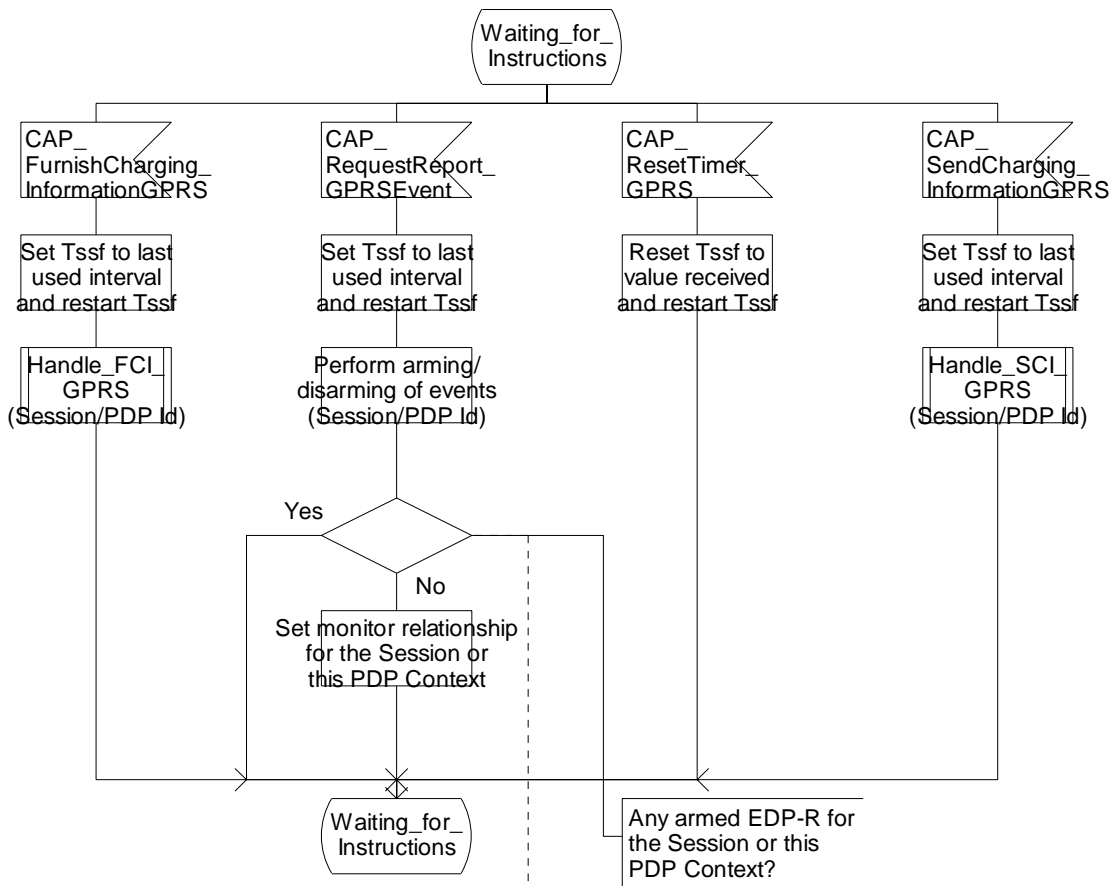Increment Instruction_counter

Waiting_for_ Instructions

Figure 6.17-20: Process GPRS_SSF (sheet 20)

Process GPRS_SSF 21(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the left are to the SGSN */

Waiting_for_instructions, Monitoring

Tsw (Session)

Tsw (PDPId)

Internal

Any stored e-parameters?

No

Yes

Set stored e-parameters as applicable

No stored e-parameters exist after this setting

Any stored e-parametes?

No

Yes

Context-Active(PDPId) = true?

No

Yes

Set stored e-parameters as applicable

Send_ e-parameters

This provokes the SGSN to send e-parameters to the MS if the AoC is supported by the SGSN

Send_ e-parameters

-

Overwrite pending e-parameters by stored e-parameters. Discard stored e-parameters.

Figure 6.17-21: Process GPRS_SSF (sheet 21)

Process GPRS_Dialogue_Handler 1(3)

/* Handling of GPRS dialogues */

/* Signals to/from the left are to/from the gprsSSF; signals to/from the right are to/from the gsmSCF. */

/* Messages are sent from the gprsSSF via the GPRS_Dialogue_Handler to the gsmSCF and vice versa. */

/* A new GPRS Dialogue is created when a CAP_InitialDP_GPRS is to be sent.
It is deleted by 'Terminate GPRS dialogue'.
The receipt of TC-End signal closes the TCAP dialogue. */

Idle

any signal

any signal

Open TCAP dialogue

Open TCAP dialogue

in TC_BEGIN
(Dialogue ID=j)

same signal

in TC_BEGIN
(Dialogue ID=j)

same signal

Opening

Active

From gprsSSF

any signal

any signal

in TC_CONTINUE
(Dialogue ID=j)

same signal

Active
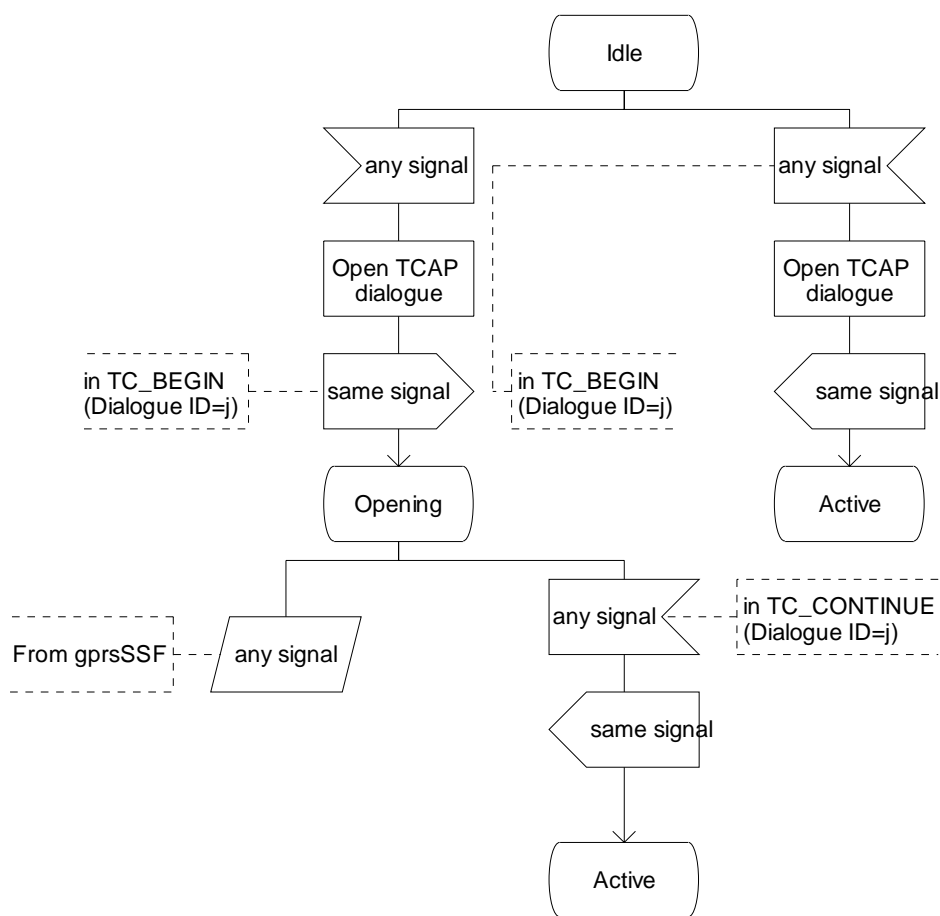
Figure 6.18-1: Process GPRS_Dialogue_Handler (sheet 1)

ETSI

Process GPRS_Dialogue_Handler 2(3)

/* Handling of GPRS dialogues */

/* Signals to/from the left are to/from the gprsSSF; signals to/from the right are to/from the gsmSCF. */

Active, Opening

TC_Abort (Dialogue ID=j)	TC_End (Dialogue ID=j)	TC_ABORT (Dialogue ID=j)	any signal	TC_BEGIN (Dialogue ID=k)

TC_ABORT (Dialogue ID=j)

Any messages buffered?

No

Yes

TC_Abort (Dialogue ID=j)

same signal

CAP-U-ABORT-REASON :=overlapping-dialogue

TC_END (Dialogue ID=j)

Refer to subclause 6.5.3.2

Discard all buffered messages

TC_ABORT (Dialogue ID=k)

Close TCAP dialogue

Close TCAP dialogue

Idle

-

Idle

-

in TC_END (Dialogue ID=j)
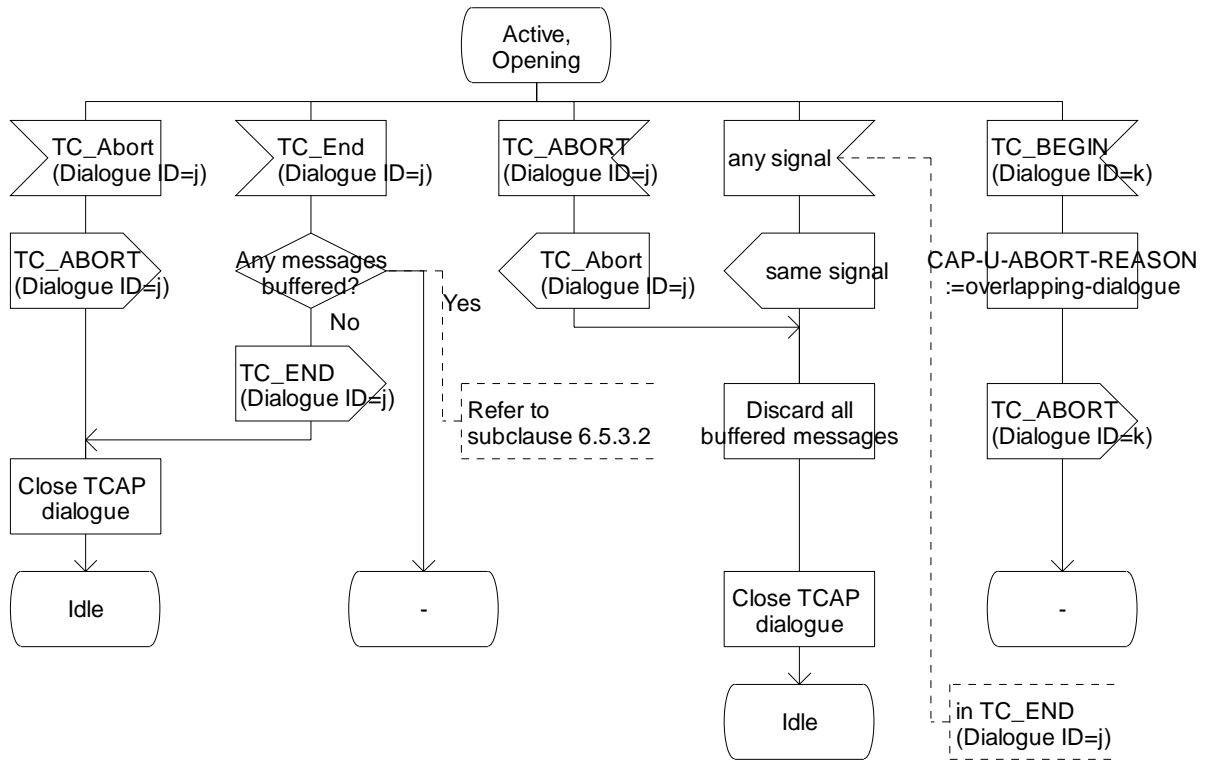
Figure 6.18-2: Process GPRS_Dialogue_Handler (sheet 2)

Process GPRS_Dialogue_Handler 3(3)

/* Handling of GPRS dialogues */

/* Signals to/from the left are to/from the gprsSSF; signals to/from the right are to/from the gsmSCF. */

Active

any signal

any signal ← in TC_CONTINUE (Dialogue ID=j)

same signal ← in TC_CONTINUE (Dialogue ID=j)

same signal

Active
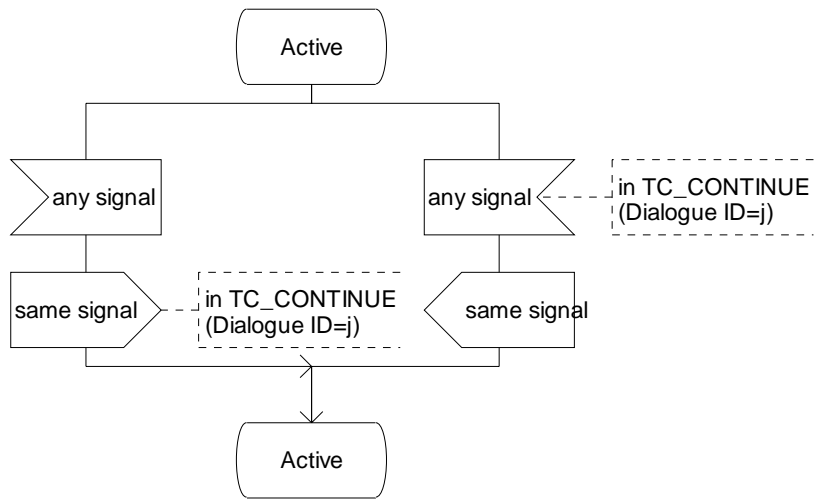
Figure 6.18-3: Process GPRS_Dialogue_Handler (sheet 3)

Procedure Handle_AC_GPRS 1(3)

/* Procedure in the gprsSSF for handling of
ApplyChargingGPRS. */

AC_GPRS
for session? —No→ (1)

Yes

Tsp pending
= true? —Yes→ ⊗

No

No← Tsw(Session)
provided?

Yes

Start
Tsw(Session)

Stop delta
measurement
(Dsp)

Tsp :=
Tsp - Dsp

Start Tsp

Tsp pending
:= true

Check TC
guard timer

⊗
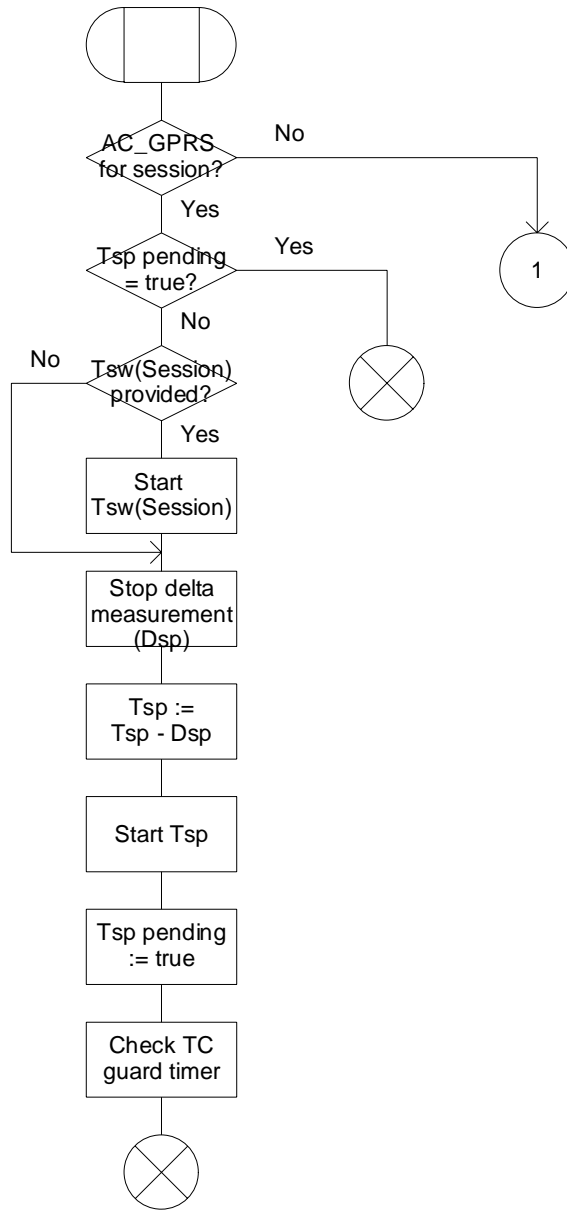
Figure 6.19-1: Procedure Handle_AC_GPRS (sheet 1)

Procedure Handle_AC_GPRS 2(3)

/* Procedure in the gprsSSF for handling of ApplyChargingGPRS. */
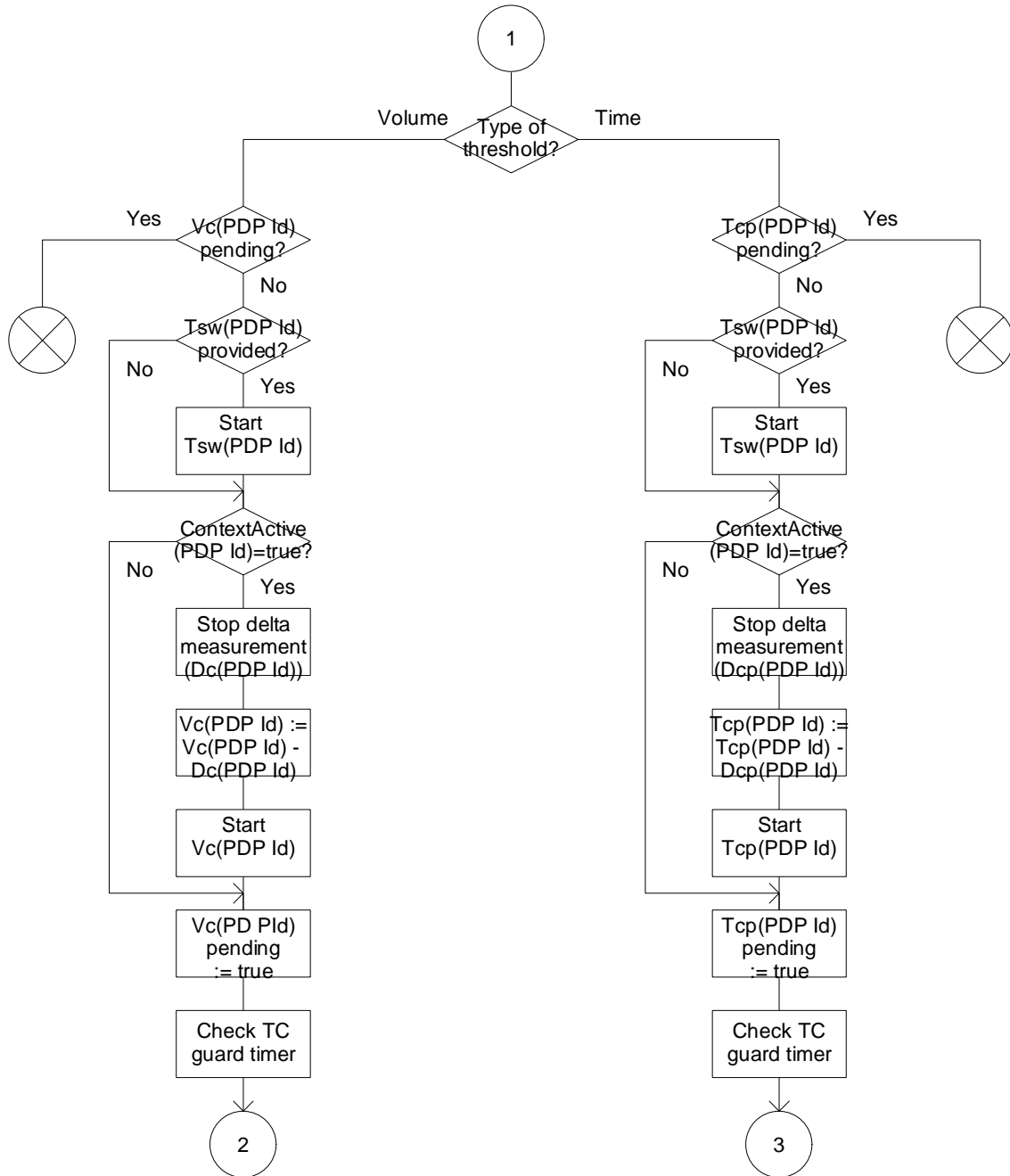
Figure 6.19-2: Procedure Handle_AC_GPRS (sheet 2)

Procedure Handle_AC_GPRS   3(3)

/* Procedure in the gprsSSF for handling of
   ApplyChargingGPRS. */
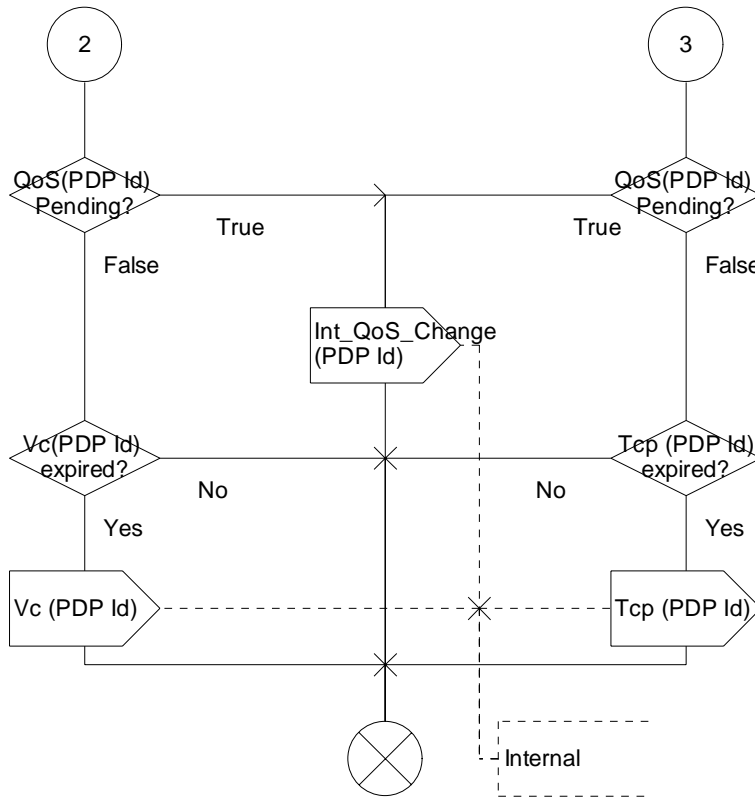
Figure 6.19-3: Procedure Handle_AC_GPRS (sheet 3)

Procedure Handle_ACR_GPRS 1(2)

/* Procedure in the gprsSSF for handling of ApplyChargingReport. */

/* Signals to the right are to the GPRS_Dialogue_Handler. */

ACR_GPRS for session?
- No → 1
- Yes

Tsw(Session) running?
- No
- Yes → Stop Tsw(Session)

e-parameters (Session) stored?
- No
- Yes → Discard e-parameters (Session)

Tsp pending = true?
- Yes → Stop Tsp → Start delta measurement Dsp → Tsp pending := false → CAP_Apply ChargingReport_ GPRS → SessionActive = true?
  - No
  - Yes → Start TC guard timer; 'AC(Tsp) expected' := true
- No
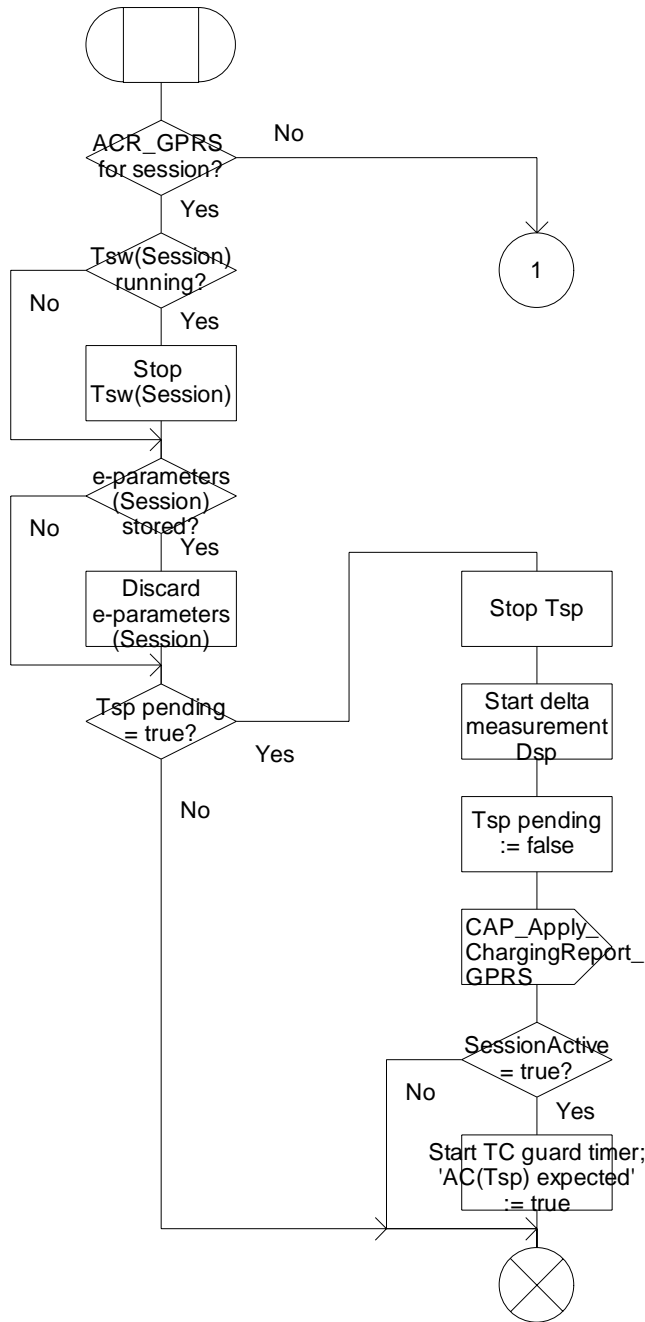
Figure 6.20-1: Procedure Handle_ACR_GPRS (sheet 1)
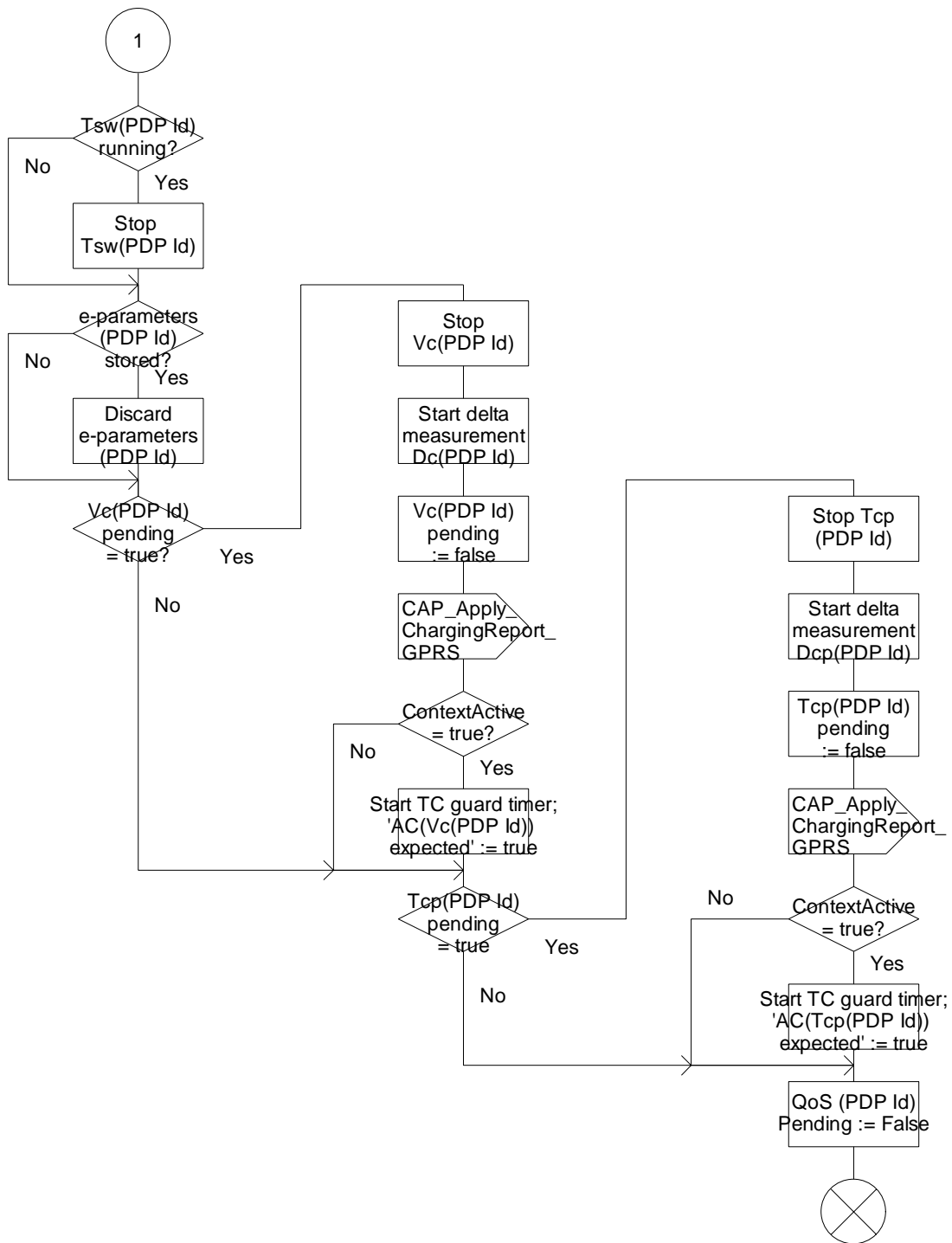
Figure 6.20-2: Procedure Handle_ACR_GPRS (sheet 2)

Procedure Handle_FCI_GPRS   1(1)

/*Procedure in the gprsSSF to handle
FurnishChargingInformationGPRS*/
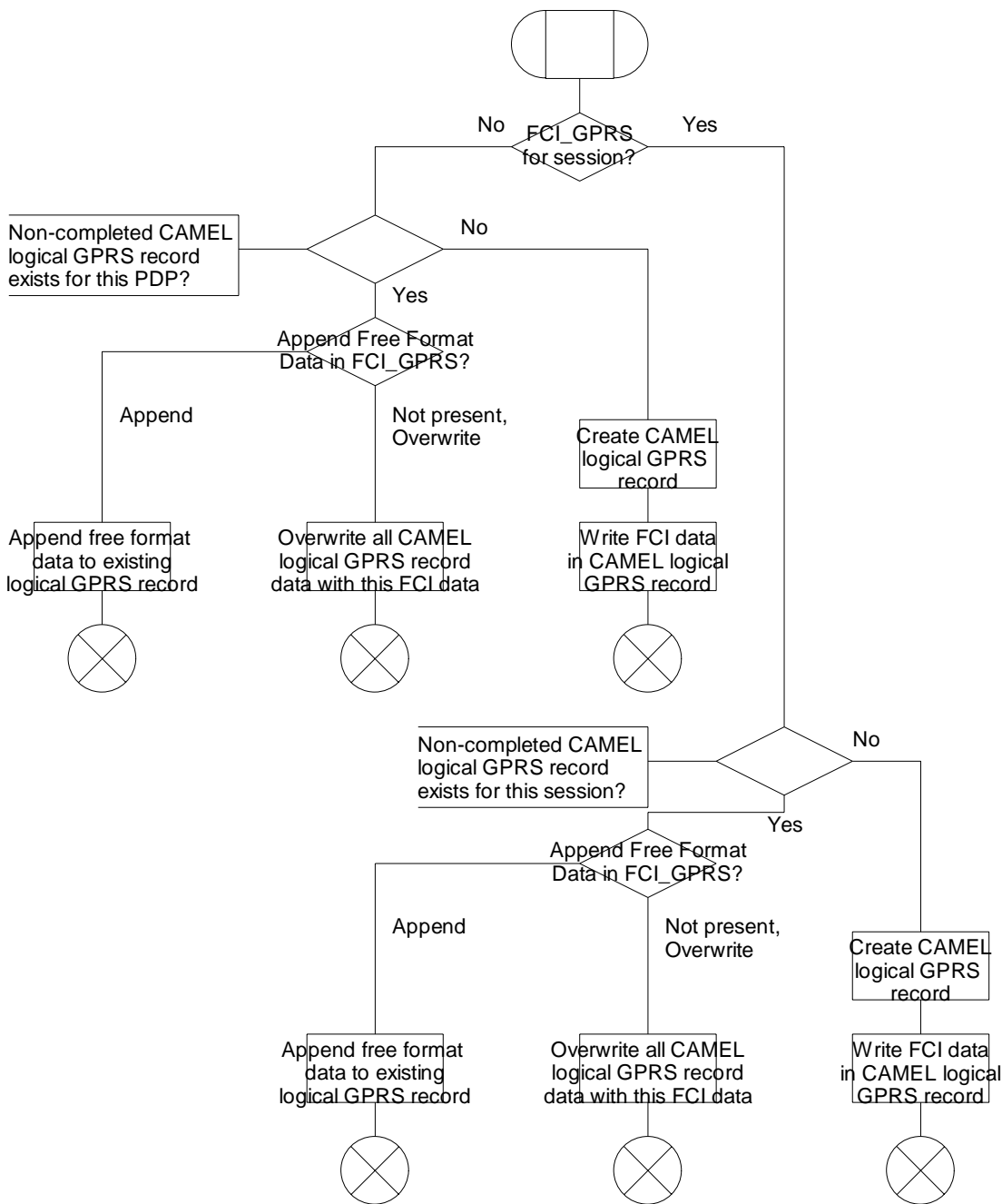
Figure 6.21-1: Procedure Handle_FCI_GPRS (sheet 1)

Procedure Complete_FCI_Record_GPRS   1(1)

/* Procedure in the gprsSSF to
write Furnish Charging Information
data to a PDP context for the specified
PDP Id, or session. */

Non-completed Logical
CAMEL record exists for   Yes
this PDP context or session?

                                                No

                                    Complete CAMEL
                                    logical GPRS
                                    record
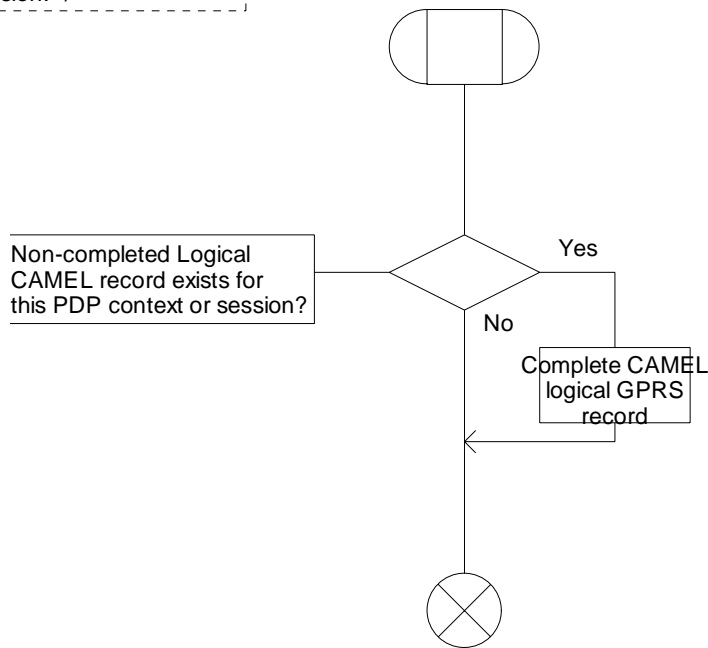
Figure 6.22-1: Procedure Complete_FCI_Record_GPRS (sheet 1)

Procedure Handle_SCI_GPRS 1(3)

/* Procedure in the gprsSSF for handling of
SendChargingInformationGPRS>
Refer also to subclause 6.5.3.6. */
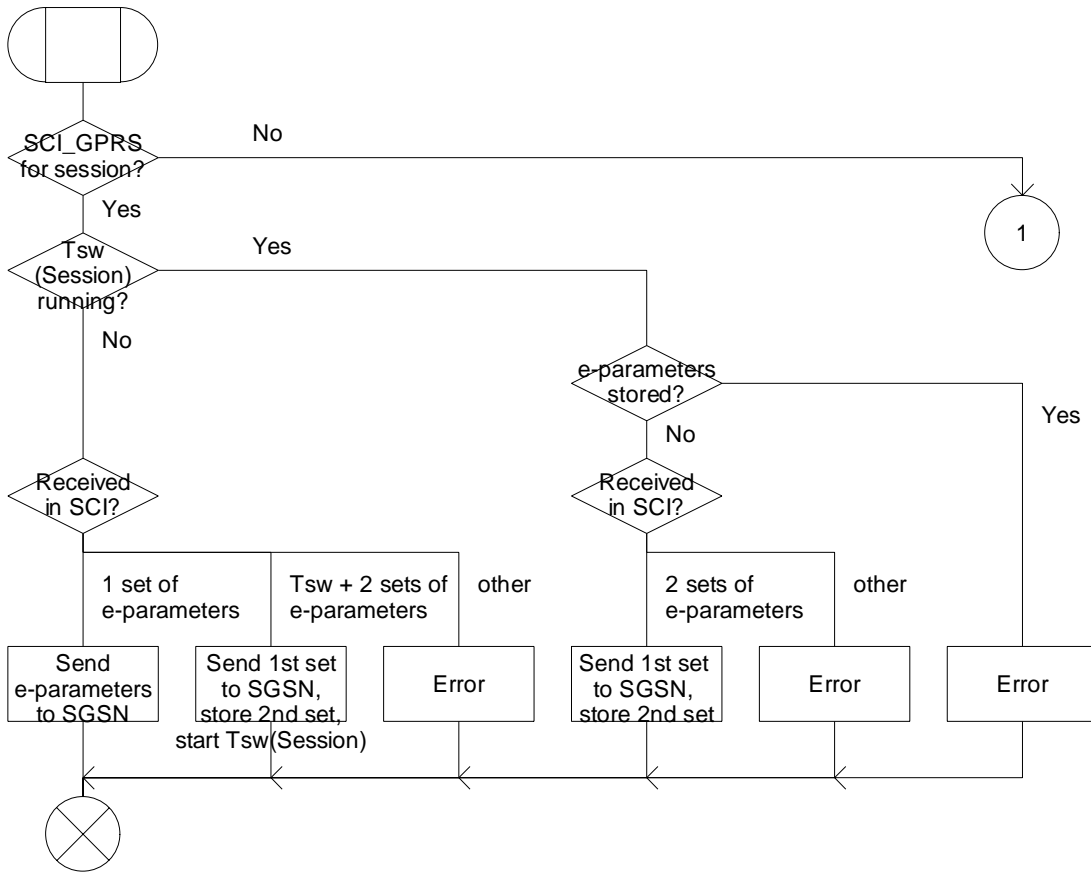
Figure 6.23-1: Procedure Handle_SCI_GPRS (sheet 1)

Procedure Handle_SCI_GPRS 2(3)

/* Procedure in the gprsSSF for handling of
SendChargingInformationGPRS>
Refer also to subclause 6.5.3.6. */
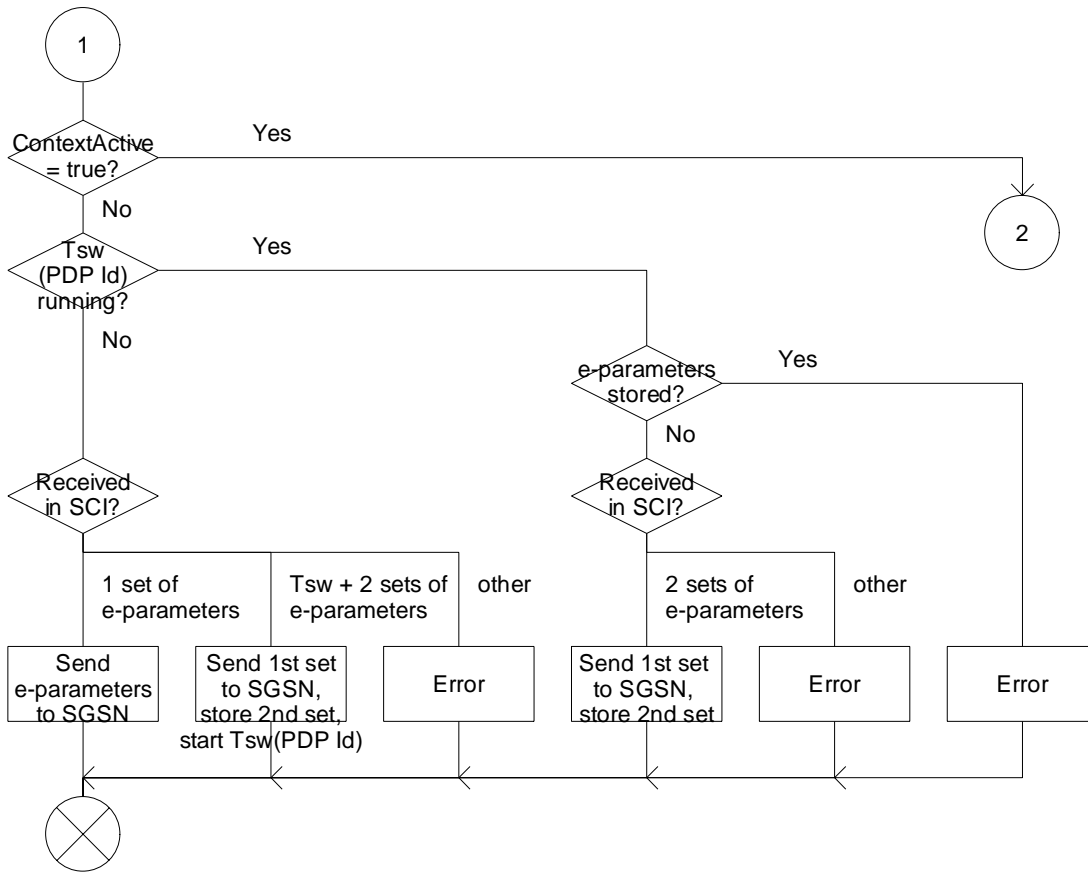
Figure 6.23-2: Procedure Handle_SCI_GPRS (sheet 2)

Procedure Handle_SCI_GPRS 3(3)

/* Procedure in the gprsSSF for handling of
SendChargingInformationGPRS>
Refer also to subclause 6.5.3.6. */
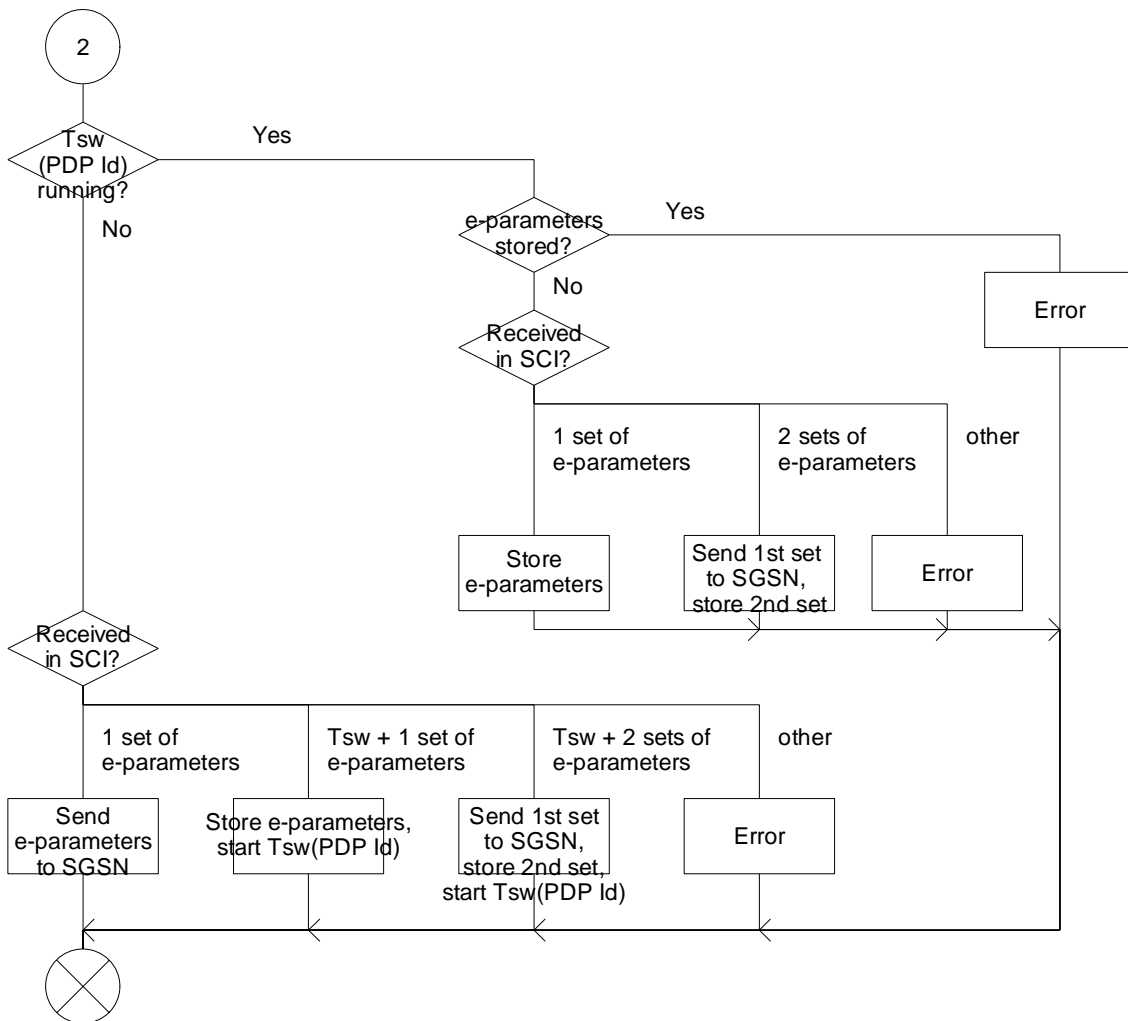
Figure 6.23-3: Procedure Handle_SCI_GPRS (sheet 3)

Procedure Handle_PDP_Acknowledgement 1(1)

/* Procedure in the gprsSSF for the handling of PDP Context Acknowledgement. */

input signal?

other

Int_DP_PDP_Context_Establishment_Acknowledgement,
Int_DP_Change_of_Position_Context

ContextActive
(PDP Id) := true

Input signal?

other

Int_DP_PDP_Context_Establishment_Acknowledgement

e-parameters
(PDP Id)
pending?

No

Yes

Send e-parameters
(PDP Id)
to SGSN

Tcp(PDP Id)
pending = true?

Yes

No

Start
Tcp(PDP Id)

Vc(PDP Id)
pending = true?

Yes

No

Start
Vc(PDP Id)
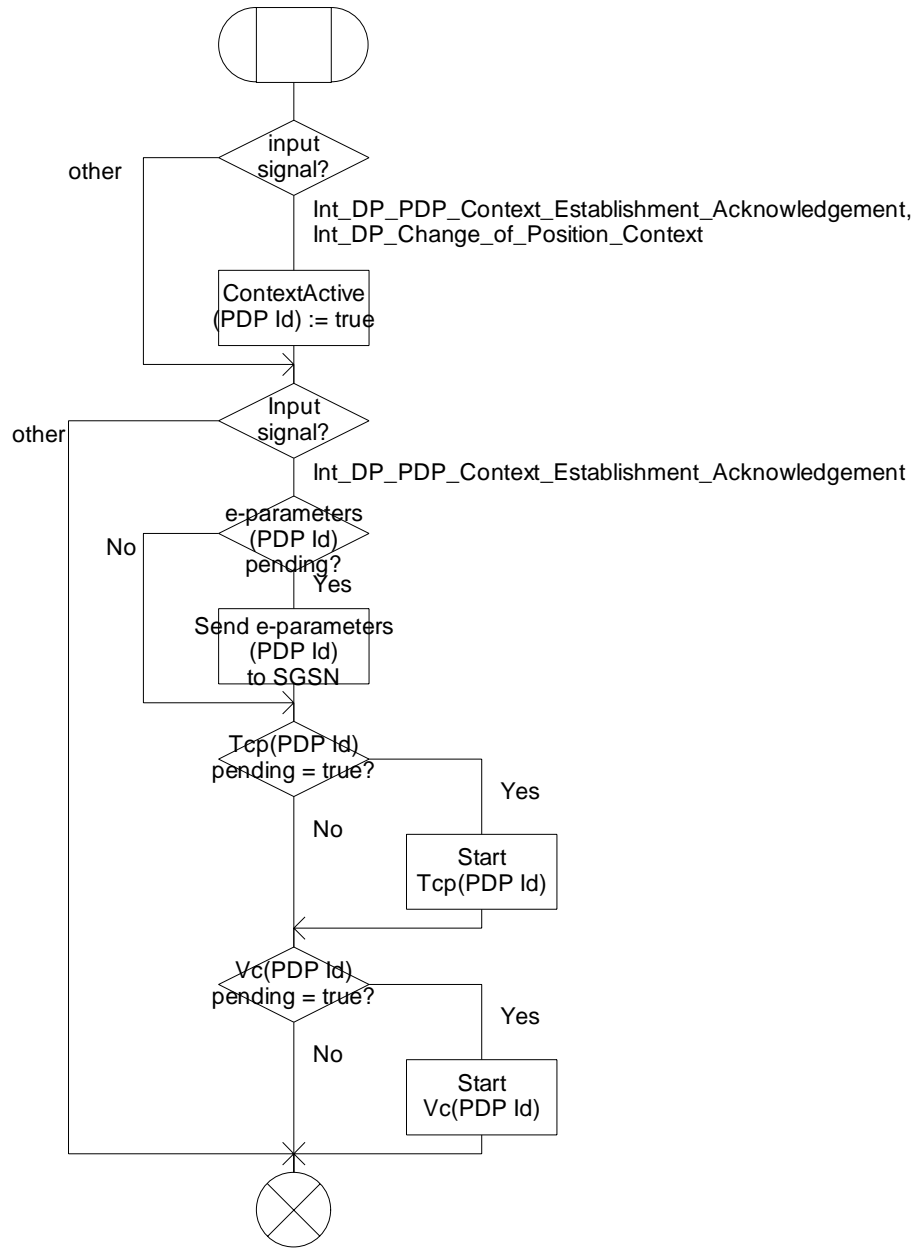
Figure 6.24-1: Procedure Handle_PDP_Acknowledgement (sheet 1)

6.6 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for GPRS control.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Specific conditions (S) or Optional (O) in the "Status" column.

An 'M' IE shall always be included. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. An 'O' IE may be included or omitted as required by the service logic. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [34] and TS 29.078 [36].

6.6.1 gprsSSF to gsmSCF Information Flows

6.6.1.1 Activity Test GPRS ack

6.6.1.1.1 Description

This IF is the response to the Activity Test GPRS.

6.6.1.1.2 Information Elements

This IF contains no information elements.

6.6.1.2 Apply Charging Report GPRS

6.6.1.2.1 Description

This IF is used by the gprsSSF to report to the gsmSCF the information requested in the Apply Charging GPRS IF. In addition, this IF is used to notify the gsmSCF of changes in QoS. Note that there are several possible QoS profiles defined by the combinations of the different QoS attributes as defined in 3GPP TS 23.060 [15]. A PLMN may only support and charge on a limited subset of those QoS. It is recommended that changes in QoS are only reported in Apply Charging Report GPRS for those QoS profiles.

6.6.1.2.2 Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [36] for the usage of this element.
Charging Result	M	This IE contains the charging information for the PDP provided by the gprsSSF. It is a choice between elapsed time and data volume.
Quality Of Service	C	This IE is described in a table below.
Active	M	This IE indicates if the GPRS session or PDP context is still established, or if it has been detached or deactivated.
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Apply Charging Report GPRS applies to the GPRS Session. If this IE is present in the IF, then the Apply Charging Report GPRS applies to the indicated PDP Context. Scenario 2: This IE is not used in the IF.
Charging Roll Over	C	This IE indicates which parameter(s) of the Charging Result have overflowed. Refer to 3GPP TS 29.078 [36] for the usage of this element.

Quality of Service contains the following information element:

Information element name	Status	Description
Negotiated QoS	C	This IE identifies the QoS which was negotiated between the user, the SGSN and the GGSN, as a result of a 'Modify PDP Context' request. This IE shall be included only if sending of the Apply Charging Report GPRS was triggered by a change in Quality of Service. This IE shall contain the negotiated QoS as on the time of sending the Apply Charging Report GPRS.
Negotiated QoS Extension	S	This IE contains a supplement to the Negotiated QoS. It shall be present if the Negotiated QoS IE is present and one or more of the following was negotiated between the MS, the SGSN and the GGSN: - Source Statistics Descriptor; - Signalling Indication; - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.

6.6.1.3   Entity Released GPRS

6.6.1.3.1   Description

This IF is used by the gprsSSF to inform the gsmSCF at any phase that a GPRS Session has been detached or a PDP Context has been disconnected without reporting any EDP.

6.6.1.3.2   Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [36] for the usage of this element.
GPRS Cause	M	This IE contains the Cause value indicating the reason for the GPRS Session Detach event or the PDP Context Disconnection event.
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Entity Released GPRS applies to the GPRS Session. If this IE is present in the IF, then the Entity Released GPRS applies to the indicated PDP Context. Scenario 2: This IE is not used in the IF.

6.6.1.4   Event Report GPRS

6.6.1.4.1   Description

This IF is used to notify the gsmSCF of a GPRS event previously requested by the gsmSCF in a Request Report GPRS Event IF.

6.6.1.4.2   Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [36] for the usage of this element.
GPRS Event Type	M	This IE specifies the type of event that is reported.
Misc GPRS Info	M	This IE indicates the DP type (EDP-N or EDP-R).
GPRS Event Specific Information	M	This IE is described in a table below. This IE contains information specific to the reported event.
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Event Report GPRS applies to the GPRS Session. If this IE is present in the IF, then the Event

Information element name	Status	Description
		Report GPRS applies to the indicated PDP Context. Scenario 2: This IE is not used in the IF.

If the *GPRS Event Type* contains DP Change of Position GPRS Session, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Status	Description
Location Information In SGSN	M	See subclause 7.6.1.2.2.

If the *GPRS Event Type* contains DP Change of Position Context, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Status	Description
Access Point Name	S	This IE identifies the Access Point Name to which the MS is connected. It shall be present, if available, at inter-SGSN routing area update. It shall be absent at intra-SGSN routing area update.
Charging ID	S	This IE contains the Charging ID received from the GGSN for the PDP context. It shall be present, if available, at inter-SGSN routing area update. It shall be absent at intra-SGSN routing area update.
Location Information In SGSN	M	See subclause 7.6.1.2.2.
End User Address	S	See subclause 6.6.1.5.2. It shall be present, if available, at inter-SGSN routing area update. It shall be absent at intra-SGSN routing area update.
Quality Of Service	S	This IE is described in a table below. It shall be present, if available, at inter-SGSN routing area update. It shall be absent at intra-SGSN routing area update.
Time And Time Zone	S	This IE contains the time that the gprsSSF met the detection point, and the time zone the gprsSSF resides in. It shall be present, if available, at inter-SGSN routing area update. It shall be absent at intra-SGSN routing area update.
GGSN Address	S	This IE contains the GGSN address for control plane to which the MS is connected, see 3GPP TS 23.003 [7]. It shall be present, if available, at inter-SGSN routing area update. It shall be absent at intra-SGSN routing area update.

If the *GPRS Event Type* contains DP Detach or DP PDP context disconnection, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Status	Description
Initiating Entity	M	This IE identifies the entity that has initiated the disconnection or detachment.
Routeing Area Update	C	This IE indicates that the Detach or Disconnection is due to inter-SGSN routeing area update.

If the *GPRS Event Type* contains DP PDP context establishment, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Status	Description
Access Point Name	C	This IE identifies the Access Point Name the MS has requested to connect to.
End User Address	C	See subclause 6.6.1.5.2.
Quality Of Service	M	This IE is described in a table below.
Location Information In SGSN	M	See subclause 7.6.1.2.2.
Time And Time Zone	M	This IE contains the time that the gprsSSF met the detection point, and the time zone the gprsSSF resides in.
PDP Initiation Type	M	This IE indicates whether a PDP context was established as a result of a network-initiated request or as a result of a subscriber request.
Secondary PDP Context	C	This IE indicates that the PDP context activation was requested for a secondary PDP context. See 3GPP TS 23.060 [15].

If the *GPRS Event Type* contains DP PDP context establishment acknowledgement, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Status	Description
Access Point Name	M	This IE identifies the Access Point Name to which the MS is connected.
Charging ID	M	This IE contains the Charging ID received from the GGSN for the PDP context.
End User Address	M	See subclause 6.6.1.5.2.
Quality Of Service	M	This IE is described in a table below.
Location Information In SGSN	M	See subclause 7.6.1.2.2.
Time And Time Zone	M	This IE contains the time that the gprsSSF met the detection point, and the time zone the gprsSSF resides in.
GGSN Address	M	This IE contains the GGSN address for control plane to which the MS is connected, see 3GPP TS 23.003 [7].

Quality of Service contains the following information elements:

Information element name	Status	Description
Requested QoS	C	This IE identifies the QoS requested by the subscriber for the PDP Context. It shall be included if the EventReportGPRS is sent at PDP Context Establishment, at PDP Context Establishment Acknowledgement and at Change of Position Context.
Subscribed QoS	C	This IE identifies the subscribed QoS. It shall be included if the EventReportGPRS is sent at PDP Context Establishment, at PDP Context Establishment Acknowledgement and at Change of Position Context.
Negotiated QoS	C	This IE identifies the QoS which was negotiated between the user, the SGSN and the GGSN. It shall be included if the EventReportGPRS is sent at PDP Context Establishment Acknowledgement and at Change of Position Context.
Requested QoS Extension	S	This IE contains a supplement to the Requested QoS IE. It shall be present if the Requested QoS IE is present and the MS requested one or more of the following for the PDP context: - Source Statistics Descriptor; - Signalling Indication; - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.
Subscribed QoS Extension	S	This IE contains a supplement to the Subscribed QoS IE. It shall be present if the Subsribed QoS IE is present and one or more of the following is part of the subscription profile in the HLR: - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.
Negotiated QoS Extension	S	This IE contains a supplement to the Negotiated QoS. It shall be present if the Negotiated QoS IE is present and one or more of the following was negotiated between the MS, the SGSN and the GGSN: - Source Statistics Descriptor; - Signalling Indication; - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.

6.6.1.5 Initial DP GPRS

6.6.1.5.1 Description

This IF is generated by the gprsSSF when a trigger is detected at a DP in the GPRS state models, to request instructions from the gsmSCF.

6.6.1.5.2 Information Elements

Information element name	Status	Description
Gprs Reference Number	M	This IE consists of a number assigned by the gprsSSF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [36] for the usage of this element.
ServiceKey	M	This IE indicates to the gsmSCF the requested CAMEL Service. It is used to address the required application/SLP within the gsmSCF.
GPRS Event Type	M	This IE indicates the armed GPRS DP event resulting in the Initial DP IF.
MSISDN	M	This IE contains the basic MSISDN of the MS.
IMSI	M	This IE identifies the mobile subscriber.
Time and Time zone	M	This IE contains the time that the gprsSSF was triggered, and the time zone in which the gprsSSF resides.
GPRS MS Class	C	This IE contains the MS network and radio access capabilities.
End User Address	C	This IE is described in a table below.
Quality of Service	C	This IE is described in a table below.
Access Point Name	C	This IE identifies the Access Point Name: - At DP Change Of Position Context contains the selected APN. - AT DP PDP Context Establishment contains the APN which the MS has requested. - AT DP PDP Context Establishment Acknowledgement contains the selected APN.
Charging ID	C	This IE contains the Charging ID received from the GGSN for the PDP context.
SGSN Capabilities	C	This IE specifies the capabilities of the SGSN to support the CAMEL interworking, e.g. support of Advice of Charge.
Location Information in SGSN	M	This IE is described in subclause 7.6.1.2.2.
PDP Initiation Type	C	This IE indicates whether a PDP context was established as a result of a network-initiated request or as a result of a subscriber request.
GGSN Address	C	This IE contains the GGSN address for control plane to which the MS is connected, see 3GPP TS 23.003 [7].
Secondary PDP context	C	This IE indicates that the PDP context activation was requested for a secondary PDP context. See 3GPP TS 23.060 [15]. This IE is not sent if this IF is initiated at DP Change of Position Context.
IMEI (with software version)	C	This IE contains the IMEISV (as defined in 3GPP TS 23.003 [7]) of the ME in use by the served subscriber.

Quality of Service contains the following information elements:

Information element name	Status	Description
Requested QoS	C	This IE identifies the QoS requested by the subscriber for a new PDP Context. It shall be included if the InitialDPGPRS is sent at PDP Context Establishment, at PDP Context Establishment Acknowledgement and at Change of Position Context.
Subscribed QoS	C	This IE identifies the subscribed QoS. It shall be included if the InitialDPGPRS is sent at PDP Context Establishment, at PDP Context Establishment Acknowledgement and at Change of Position Context.
Negotiated QoS	C	This IE identifies the QoS which was negotiated between the user, the SGSN and the GGSN. It shall be included if the Initial DP GPRS is sent at PDP Context Establishment Acknowledgement and at Change of Position Context.
Requested QoS Extension	S	This IE contains a supplement to the Requested QoS IE. It shall be present if the Requested QoS IE is present and the MS requested one or more of the following for the PDP context: - Source Statistics Descriptor; - Signalling Indication; - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.

Information element name	Status	Description
Subscribed QoS Extension	S	This IE contains a supplement to the Subscribed QoS IE. It shall be present if the Subsribed QoS IE is present and one or more of the following is part of the subscription profile in the HLR: - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.
Negotiated QoS Extension	S	This IE contains a supplement to the Negotiated QoS. It shall be present if the Negotiated QoS IE is present and one or more of the following was negotiated between the MS, the SGSN and the GGSN: - Source Statistics Descriptor; - Signalling Indication; - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.

End User Address shall be populated as follows:

- At DP Change Of Position Context in an Inter-SGSN Routeing Area Update: Initial DP GPRS and EventReportGPRS contain the selected value;

- At DP PDP Context Establishment: Initial DP GPRS and Event Report GPRS contain the value which the MS has requested;

- At DP PDP Context Establishment Acknowledgement: Initial DP GPRS and Event Report GPRS contain the selected value. Note that the PDP Address is not always available at this DP.

For details see 3GPP TS 23.060 [15].

End User Address contains the following information elements:

Information element name	Status	Description
PDP Type Organization	C	This IE identifies the PDP Type Organisation (e.g. IETF).
PDP Type Number	C	This IE identifies the PDP type, e.g. IPv4 or IPv6.
PDP Address	C	This IE identifies the address of the subscriber for a new PDP Context.

6.6.2 gsmSCF to gprsSSF Information Flows

6.6.2.1 Activity Test GPRS

6.6.2.1.1 Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and gprsSSF. If the relationship is still in existence, then the gprsSSF will respond. If no reply is received, then the gsmSCF will assume that the gprsSSF has failed in some way and will take the appropriate action.

6.6.2.1.2 Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [36] for the usage of this element.

6.6.2.2 Apply Charging GPRS

6.6.2.2.1 Description

This IF is used for interacting from the gsmSCF with the gprsSSF charging mechanisms to control the charging of a GPRS session or a PDP Context.

6.6.2.2.2   Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [36] for the usage of this element.
Charging Characteristics	M	This IE specifies the charging related information to be provided by the gprsSSF and the conditions on which this information has to be provided back to the gsmSCF. It is a choice between granted volume and granted time for the data transfer. Time charging may be applied to GPRS Session or PDP Contexts; volume charging may be applied to PDP Context only.
Tariff Switch Interval	O	This information element specifies the time until the next tariff switch occurrence.
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Apply Charging GPRS applies to the GPRS Session. If this IE is present in the IF, then the Apply Charging GPRS applies to the indicated PDP Context. Scenario 2: This IE is not used in the IF.

6.6.2.3   Apply Charging Report GPRS ack

6.6.2.3.1   Description

This IF is the response to the Apply Charging Report GPRS.

6.6.2.3.2   Information Elements

This IF contains no information elements.

6.6.2.4   Cancel GPRS

6.6.2.4.1   Description

This IF is used by the gsmSCF to request the gprsSSF to cancel all EDPs and reports.

6.6.2.4.2   Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [36] for the usage of this element.
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then all pending reports of the GPRS Session and all pending reports of the PDP Contexts shall be cancelled and all armed events of the GPRS Session, all armed events of the PDP Contexts and all generically armed events shall be disarmed. If this IE is present in the IF, then all pending reports of the indicated PDP Context shall be cancelled and all armed events of the indicated PDP Context shall be disarmed. Scenario 2: This IE is not used in the IF.

6.6.2.5   Connect GPRS

6.6.2.5.1   Description

This IF is used by the gsmSCF to request the gprsSSF to modify the APN used when establishing a PDP Context. This IF shall not be used for a secondary PDP context or for a network initiated PDP context.

6.6.2.5.2 Information Elements

Information element name	Status	Description
Access Point Name	M	This IE contains the Access Point Name (APN) to be used when establishing the PDP Context. The gsmSCF should provide an APN which is allowed by the served subscriber's subscription. The APN provided by the gsmSCF is used for selecting the primary PDP context as specified in 3GPP TS 23.060 [15]. The gsmSCF provided APN may consist of Network Identity (NI) only, or Network Identity and Operator Identity (OI). The APN provided by the gsmSCF replaces entirely the APN requested by the MS. If the gsmSCF does not provide OI in APN then the SGSN selects the OI independent of MS.
PDP Id	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: There shall always be this IE present in this IF. This IE indicates the PDP Context to which the Connect GPRS applies. Scenario 2: This IE is not used in the IF.

6.6.2.6 Continue GPRS

6.6.2.6.1 Description

This information flow requests the gprsSSF to proceed with processing at the DP at which it previously suspended processing to await gsmSCF instructions. The gprsSSF completes DP processing, and continues processing (i.e. proceeds to the next point in the Attach/Detach State Model or PDP Context State Model) without substituting new data from the gsmSCF.

6.6.2.6.2 Information Elements

Information element name	Status	Description
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Continue GPRS applies to the GPRS Session. If this IE is present in the IF, then the Continue GPRS applies to the indicated PDP Context. Scenario 2: This IE is not used in the IF.

6.6.2.7 Entity Released GPRS ack

6.6.2.7.1 Description

This IF is the response to the Entity Released GPRS.

6.6.2.7.2 Information Elements

This IF contains no information elements.

6.6.2.8 Event Report GPRS ack

6.6.2.8.1 Description

This IF is the response to the Event Report GPRS.

6.6.2.8.2 Information Elements

This IF contains no information elements.

6.6.2.9 Furnish Charging Information GPRS

6.6.2.9.1 Description

This IF is used to request the gprsSSF to include information in the CAMEL specific logical call record.

The logical call record is created when FCI-GPRS is received and a logical call record for that state model does not exist. For modelling purposes the logical call record is buffered in the gprsSSF. The gprsSSF completes logical call records as defined in the SDLs. Once the logical call record is completed, then its free format data are moved to the corresponding CDR and the logical call record is deleted.

In the SGSN there is a separate Logical call record for the attach/detach state model and for each PDP context.

The CSE can send multiple concatenated FCIs per Logical Call Record for completion. The total maximum of free format data is 160 octets per Logical Call Record. The 160 octets may be sent in one or more FCI IF. If there is incomplete free format data and one or more new FCI IFs is/are received to overwrite the incomplete data, then the incomplete data are discarded and the gsmSCF can send another 160 octets per CDR.

6.6.2.9.2 Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
FCI GPRS Billing Charging Characteristics	M	This IE is described in a table below.

FCI GPRS Billing Charging Characteristics contains the following information:

Information element name	Status	Description
FCIBCCCAMEL Sequence 1	M	This IE is described in a table below.

FCIBCCCAMEL Sequence 1 contains the following information:

Information element name	Status	Description
Free Format Data	M	This IE contains free format data to be inserted in the CAMEL logical call record.
Append Free Format Data	O	This IE indicates that the gprsSSF shall append the free format data to the Logical call record. In the SGSN there is a separate Logical call record for the attach/detach state model and for each PDP context. - If this IE is present indicating "Append", the gprsSSF shall append the free format data received in this IF to the free format data already present in the Logical call record for that GPRS session or PDP Context. - If this IE is absent or indicates "Overwrite", then the gprsSSF shall overwrite all free format data already present in the Logical call record for that GPRS session or PDP Context, by the free format data received in this IF. If no Logical call record exists yet for that GPRS session or PDP Context, then the gprsSSF shall ignore this IE.
PDP Id	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Furnish Charging Information GPRS applies to the GPRS Session. If this IE is present in the IF, then the Furnish Charging Information GPRS applies to the indicated PDP Context. Scenario 2: This IE is not used in the IF.

6.6.2.10 Release GPRS

6.6.2.10.1 Description

This IF is used by the gsmSCF to tear down an existing GPRS session or PDP Context at any time.

6.6.2.10.2 Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
GPRS Cause	M	This IE contains the Cause value indicating the reason for releasing the GPRS session or PDP context.
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Release GPRS applies to the GPRS Session, in which case the GPRS Session and all PDP Contexts shall be released. If this IE is present in the IF, then the Release GPRS applies to the indicated PDP Context, in which case the indicated PDP Context shall be released. Scenario 2: This IE is not used in the IF.

6.6.2.11 Request Report GPRS Event

6.6.2.11.1 Description

This IF is used to request the gprsSSF to monitor for an event and send a notification back to the gsmSCF when the event is detected (see Event Report GPRS IF).

6.6.2.11.2 Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
GPRS Event	M	This IE specifies the event or events of which a report is requested.
PDP ID	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IF is used to arm an event related to the GPRS Session, then this IF shall not include this IE. If this IF is used to arm an event related to a specific PDP Context, then this IF shall include this IE for that PDP Context. If this IF is used to generically arm a PDP Context related event, then this IF shall not include this IE. Scenario 2: This IE is not used in the IF.

GPRS Event contains the following information elements:

Information element name	Status	Description
GPRS Event type	M	This IE specifies the type of event of which a report is requested.
Monitor Mode	M	This IE indicates how the event shall be reported.

6.6.2.12 Reset Timer GPRS

6.6.2.12.1 Description

This IF is used to refresh the gprsSSF timer.

6.6.2.12.2 Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
Timer ID	M	This IE specifies the default value for the Tssf timer.
Timer Value	M	This IE specifies the value to which the timer Tssf shall be set.

6.6.2.13   Send Charging Information GPRS

6.6.2.13.1   Description

This IF is used to send e-parameters from the gsmSCF to the gprsSSF. If charge advice information is received from the gsmSCF, it shall replace the charge advice information which would be generated by the SGSN and inhibit any further generation of CAI by the SGSN. Further processing of the charge advice information by the SGSN shall be in accordance with the Advice of Charge supplementary service.

If the SGSN supports Advice of Charge, then the gsmSCF may use this IF to send e-parameters to the gprsSSF. However, if the subscriber is not provisioned with the Advice of Charge supplementary service, then no e-parameters shall be sent to the MS and no error due to this fact shall be sent back to the gsmSCF.

If the SGSN does not support Advice of Charge, then the gsmSCF shall not send e-parameters to the gprsSSF.

The SGSN's support of Advice of Charge is indicated in the Initial DP GPRS IF.

>   NOTE: If charge advice information is received from the gsmSCF after charge information has been generated by the SGSN and sent to the MS, the behaviour of the service may be unpredictable or incorrect; the service designer should therefore ensure that the first set of charge advice information is sent to the gprsSSF before charge information is sent to the to the MS.

6.6.2.13.2   Information Elements

Information element name	Status	Description
Gprs Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
SCI GPRS Billing ChargingCharacteristics	M	This IE defines the Advice Of Charge related information to be provided to the Mobile Station, if supported by the SGSN.

GPRS SCI Billing Charging Characteristics contains the following information elements:

Information element name	Status	Description
AOC GPRS	M	This IE is present after an Activate PDP Context Accept or Attach Accept has been received from the SGSN. This IE defines the Advice Of Charge related information to be provided to the Mobile Station, if supported by the SGSN.
PDP Id	C	This IE identifies the PDP Context to which the IF applies. Scenario 1: If this IE is not present in the IF, then the Send Charging Information GPRS applies to the GPRS Session. If this IE is present in the IF, then the Send Charging Information GPRS applies to the indicated PDP Context. Scenario 2: This IE is not used in the IF.

AOC GPRS contains the following information elements:

Information element name	Status	Description
AOC Initial	M	This IE contains CAI elements as defined in 3GPP TS 22.024 [3].
AOC Subsequent	O	This IE is described in a table below.

AOC Subsequent contains the following information elements:

Information element name	Status	Description
CAI Elements	M	This IE contains CAI elements as defined in 3GPP TS 22.024 [3].
Tariff Switch Interval	O	This IE indicates the tariff switch time until the next tariff switch applies.

6.6.3 HLR to SGSN Information Flows

6.6.3.1 Delete Subscriber Data

6.6.3.1.1 Description

This IF is used by the HLR to delete CAMEL subscription data from an SGSN. It is specified in 3GPP TS 29.002 [34].

6.6.3.1.2 Information Elements

The Delete Subscriber Data IF contains the following CAMEL specific information elements:

Information element name	Status	Description
CAMEL Subscription Info Withdraw	O	This IE identifies that all CSIs shall be deleted from the subscriber data in SGSN.
Specific CSI Withdraw	O	This IE is used to indicate that only GPRS-CSI shall be deleted from the SGSN. This IE should not be present when CAMEL Subscription Info Withdraw is present.

6.6.3.2 Insert Subscriber Data

6.6.3.2.1 Description

This IF is specified in 3GPP TS 29.002 [34] and used by the HLR to insert subscriber data in the SGSN.

6.6.3.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific information element:

Information element name	Status	Description
GPRS-CSI	O	This IE identifies the subscriber as having CAMEL GPRS services.

GPRS-CSI contains the following information elements:

Information element name	Status	Description
GsmSCF Address	M	See subclause 6.3.1.1.
Service Key	M	See subclause 6.3.1.2.
Default Session Handling	M	See subclause 6.3.1.3.
TDP List	M	See subclause 6.3.1.4.
CAMEL Capability Handling	M	See subclause 6.3.1.5.

6.6.4 SGSN to HLR Information Flows

6.6.4.1 Insert Subscriber Data ack

6.6.4.1.1 Description

This IF is used by the SGSN to indicate to the HLR the result of the Insert Subscriber Data IF. It is specified in 3GPP TS 29.002 [34].

6.6.4.1.2 Information Elements

Insert Subscriber Data ack contains the following CAMEL specific information elements:

Information element name	Status	Description
Supported CAMEL Phases	S	This IE identifies which CAMEL phases are supported by the SGSN. It shall be present when a CSI has been included in the Insert Subscriber Data IF.
Offered CAMEL4 CSIs	S	This IE indicates the CAMEL phase 4 CSIs offered in the SGSN. It shall be present if a CSI has been included in the Insert Subscriber Data IF.

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI. It shall be present if a CSI has been included in the Insert Subscriber Data IF.
MG-CSI	S	This IE indicates the offer of CAMEL phase 4 MG-CSI. It shall be present if a CSI has been included in the Insert Subscriber Data IF.
PSI Enhancements	S	This IE indicates the offer of CAMEL phase 4 Enhancements of Provide Subscriber Information.

6.6.4.2 Update GPRS Location

6.6.4.2.1 Description

This IF is used by the SGSN to indicate to the HLR the CAMEL phases supported by the SGSN. It is specified in 3GPP TS 29.002 [34].

6.6.4.2.2 Information Elements

Update GPRS location contains the following CAMEL specific information element:

Information element name	Status	Description
Supported CAMEL Phases	S	This IE identifies which CAMEL phases are supported by the SGSN. The SGSN may indicate support of CAMEL phase 3 or higher. It shall be present when the SGSN supports CAMEL.
Offered CAMEL4 CSIs		This IE indicates the CAMEL phase 4 CSIs offered in the SGSN. It shall be present if the "Supported CAMEL Phases" IE indicates support of CAMEL phase 4.

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI.
MG-CSI	S	This IE indicates the offer of CAMEL phase 4 MG-CSI.
PSI Enhancements	S	This IE indicates the offer of CAMEL phase 4 Enhancements of Provide Subscriber Information.

7 Short Message Services

7.1 Architecture

7.1.1 Functional Entities used for CAMEL

This subclause describes the functional architecture needed to support Mobile Originating Short Message Service (MO SMS) and Mobile Terminating Short Message Service (MT SMS) interworking for CAMEL. Figures 7.1-1 and 7.1-2 show the functional entities involved in MO SMS or MT SMS requiring CAMEL support. Further details of the architecture needed to support Mobile Originating Short Message Service (MO SMS) and Mobile Terminating Short Message Service (MT SMS) are given in 3GPP TS 23.040 [14].
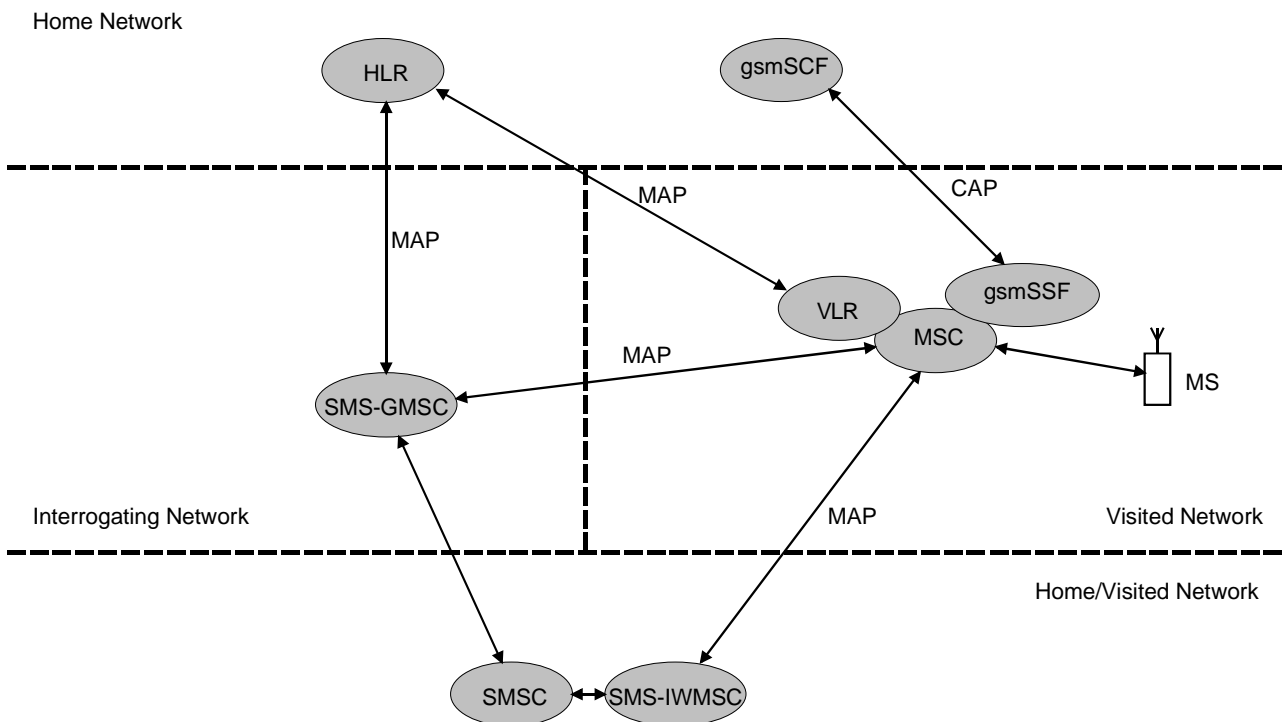
Figure 7.1-1: Functional architecture for support of CAMEL control of MSC switched MO and MT SMS

Home Network

HLR

gsmSCF

MAP

CAP

MAP

gsmSSF

SGSN

MS

SMS-GMSC

MAP

Interrogating Network

MAP

Visited Network

Home/Visited Network

SMSC

SMS-IWMSC
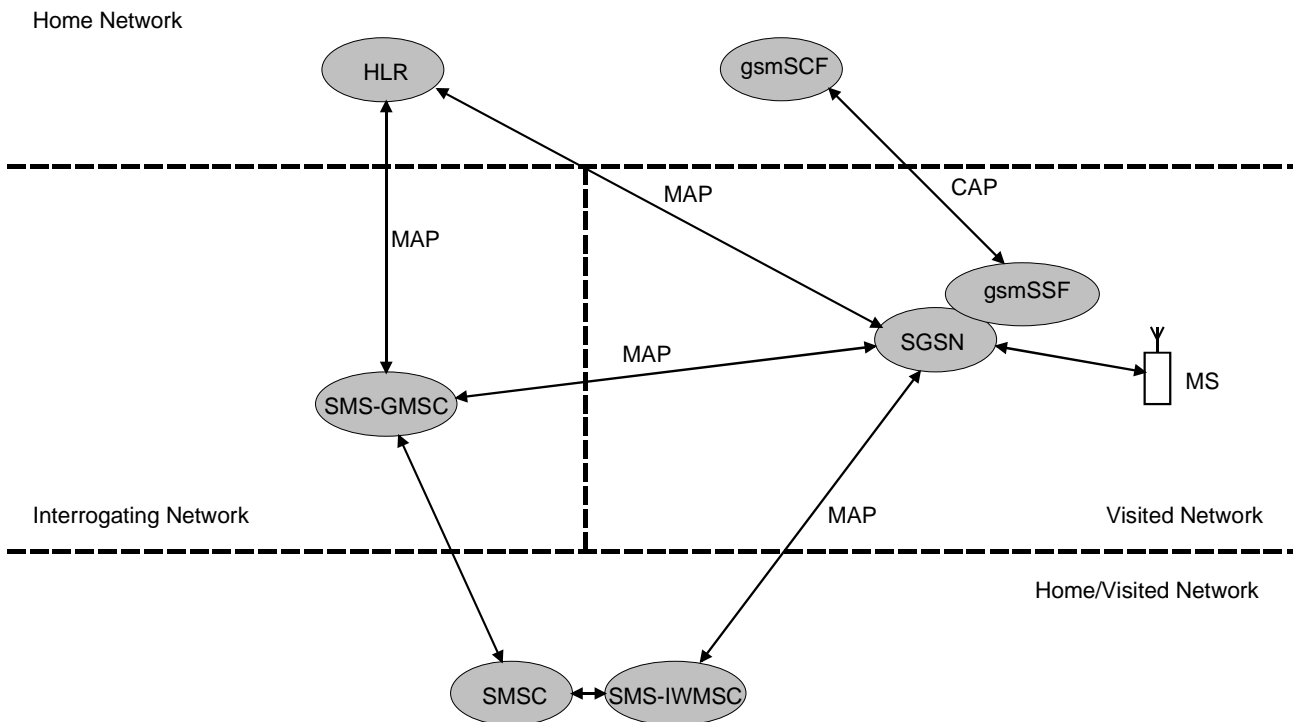
Figure 7.1-2: Functional architecture for support of CAMEL control of SGSN switched MO and MT SMS

HLR: The HLR stores MO-SMS-CSI and/or MT-SMS-CSI. MO-SMS-CSI contains subscription information for subscribers that require CAMEL support of MO SMS. MT-SMS-CSI contains subscription information for subscribers that require CAMEL support of MT SMS. One or both of MO-SMS-CSI and MT-SMS-CSI are transferred to the VLR or to the SGSN on Location Update and Restore Data or when MO-SMS-CSI or MT-SMS-CSI has changed.

VLR: The VLR receives the MO-SMS-CSI and MT-SMS-CSI for the subscriber from the HLR. MO-SMS-CSI and MT-SMS-CSI are used by the MSC to determine whether a Service Logic shall be invoked for an MO SMS submission or MT SMS delivery.

MSC: The MSC receives MO-SMS-CSI and MT-SMS-CSI from the VLR and uses this to determine whether a Service Logic shall be invoked for an MO SMS submission or MT SMS delivery.

SGSN: The SGSN receives the MO-SMS-CSI and MT-SMS-CSI for the subscriber from the HLR. The SGSN uses the MO-SMS-CSI and MT-SMS-CSI to determine whether a Service Logic shall be invoked for an MO SMS submission or MT SMS delivery.

gprsSSF: see subclause 3.1.

gsmSSF: see subclause 3.1.

gsmSCF: see subclause 3.1.

SMSC: The Short Message Service Centre accepts messages submitted by an MS or other MO short message entity, stores them and delivers them to the destination MS or other MT short message entity.

SMS-GMSC: The Short Message Service Gateway MSC receives short messages from the SMSC, interrogates the HLR for routeing information to deliver each short message and forwards each short message to the serving node (MSC or SGSN) for delivery to the destination MS. The SMS-GMSC may be physically integrated with the SMSC or with the MSC for the destination subscriber.

SMS-IWMSC: The Short Message Service InterWorking MSC terminates the MAP signalling from the MSC or the SGSN for MO short message submission, and transfers the short message to the SMSC, The SMS-IWMSC may be physically integrated with the SMSC or with the MSC for the originating subscriber.

7.1.2 Interfaces defined for CAMEL

7.1.2.1 HLR - VLR interface

This interface is used to send CAMEL related subscriber data (MO-SMS-CSI and MT-SMS-CSI) to a visited MSC/VLR or to remove CAMEL related subscriber data from a visited MSC/VLR.

7.1.2.2 HLR - SGSN interface

This interface is used to send CAMEL related subscriber data (MO-SMS-CSI and MT-SMS-CSI) to a visited SGSN or to remove CAMEL related subscriber data from a visited SGSN.

7.1.2.3 gsmSSF - gsmSCF interface

This interface is used by the gsmSCF to control the handling of MO SMS and MT SMS in the MSC. A relationship on this interface is opened as a result of the gsmSSF sending a request for instructions to the gsmSCF.

7.1.2.4 gprsSSF - gsmSCF interface

This interface is used by the gsmSCF to control the handling of MO SMS and MT SMS in the SGSN. A relationship on this interface is opened as a result of the gprsSSF sending a request for instructions to the gsmSCF.

7.1.2.5 MSC - gsmSSF interface

This is an internal interface. The interface is described in the present document to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

7.1.2.6 SGSN - gprsSSF interface

This is an internal interface. The interface is described in the present document to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

7.1.2.7 MSC - VLR interface

This is an internal interface. The interface is described in the present document to make it easier to understand the internal information flow within the MSC/VLR.

7.1.2.8 MSC - SMSC interface

This interface is used by the MSC to submit a SM to the SMSC and to deliver a SM to the MSC.

7.1.2.9 SGSN - SMSC interface

This interface is used by the SGSN to submit a SM to the SMSC and to deliver a SM to the SGSN.

7.2 Detection Points (DPs)

For the general handling of the DPs, see subclause 4.2.

7.2.1 Criteria at DP SMS Delivery Request

The HLR may store a criterion that indicates when triggering shall take place. The criterion for DP SMS_Delivery_Request consists of a list of TPDU types. Refer to 3GPP TS 23.040 [14] for the available TPDU types. When the TPDU type of the Short Message is present in the list of TPDU types, then triggering shall take place. Otherwise, triggering shall not take place.

If no criterion is defined for a subscriber, then triggering shall take place regardless of the TPDU type of the Short Message.

7.3 Description of CAMEL Subscriber Data

Note: CAMEL Phase 3 specifies SMS-CSI for MO SMS CAMEL Services. CAMEL Phase 4 specifies MO-SMS-CSI for MO SMS CAMEL Services and MT-SMS-CSI for MT SMS CAMEL Services. SMS-CSI and MO-SMS-CSI are, however, syntactically and functionally identical.

7.3.1 Mobile Originating Short Message Service CAMEL Subscription Information (MO-SMS-CSI)

This subclause defines the contents of the Short Message Service CAMEL Subscription Information.

7.3.1.1 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

7.3.1.2 Service Key

The Service Key identifies to the gsmSCF the service logic.

7.3.1.3 Default SMS Handling

The Default SMS Handling indicates whether the Short Message submission shall be released or continued as requested in the case of error in the dialogue between gsmSCF and gsmSSF or gprsSSF.

7.3.1.4 TDP List

The TDP List indicates on which detection point triggering shall take place. For MO-SMS-CSI only DP SMS_Collected_Info is used.

7.3.1.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service. This parameter shall be set to CAMEL Phase 3

7.3.1.6 CSI state

The CSI state indicates whether the MO-SMS-CSI is active or not.

7.3.1.7 Notification flag

The notification flag indicates whether the change of the MO-SMS-CSI shall trigger Notification on Change of Subscriber Data or not.

7.3.2 Mobile Terminating Short Message Service CAMEL Subscription Information (MT-SMS-CSI)

This subclause defines the contents of the Mobile Terminating Short Message Service CAMEL Subscription Information.

7.3.2.1 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

7.3.2.2   Service Key

The Service Key identifies to the gsmSCF the service logic.

7.3.2.3   Default SMS Handling

The Default SMS Handling indicates whether the Short Message delivery shall be released or continued as requested in the case of error in the dialogue between gsmSCF and gsmSSF or gprsSSF.

7.3.2.4   TDP List

The TDP List indicates on which detection point triggering shall take place. For MT-SMS-CSI only DP SMS_Delivery_Request is used.

7.3.2.5   DP criteria

The DP criteria indicate whether the SMS_SSF shall request the gsmSCF for instructions.

7.3.2.6   CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service. This parameter shall be set to CAMEL Phase 4.

7.3.2.7   CSI state

The CSI state indicates whether the MT-SMS-CSI is active or not.

7.3.2.8   Notification flag

The notification flag indicates whether the change of the MT-SMS-CSI shall trigger Notification on Change of Subscriber Data or not.

7.3.3   gsmSCF address list for CSI

The gsmSCF address list indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI's.

7.4   Description of SMS State Models

7.4.1   General Handling

See subclause 4.4.1.

The State Model for MO SMS handling contains Points in Association (PIA's) instead of Points in Call (PIC's).

7.4.2   Mobile Originating SMS State Models

7.4.2.1   Description of MO SMS state model

The MO SMS state model is used to describe the actions in an MSC and in a SGSN during Mobile Originating SMS.
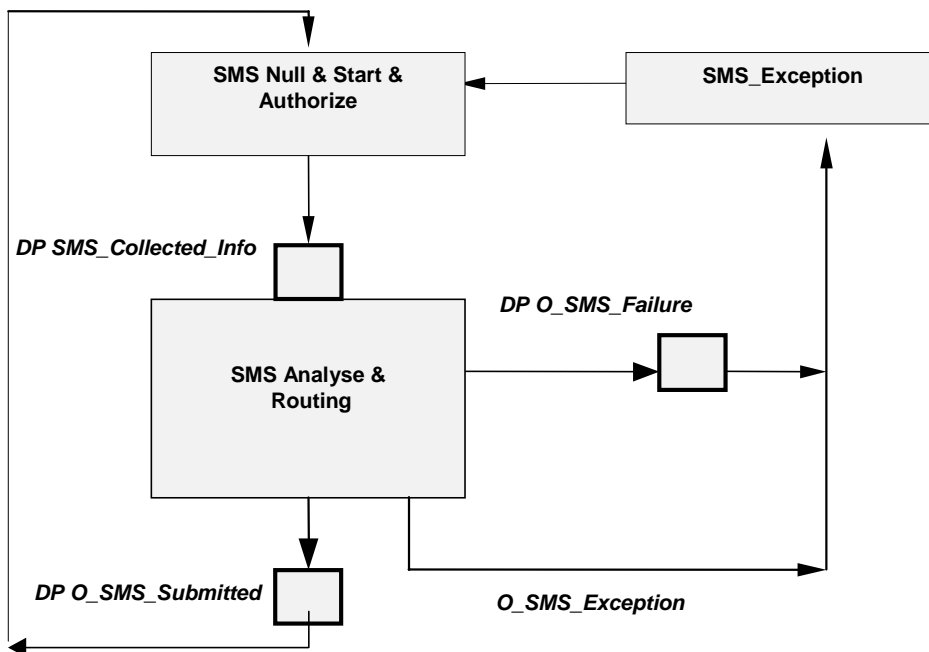
Figure 7.2: MO SMS State Model

Table 7.1: Description of MO SMS DPs in the MSC and SGSN

CAMEL Detection Point	DP Type	Description
DP SMS_Collected_Info	TDP-R	Indication that the MO-SMS-CSI is analysed and a mobile originated short message is received.
DP O_SMS_Failure	EDP-N, EDP-R	Indication that the SM submission to the Short Message Service Centre failed
DP O_SMS_Submitted	EDP-N, EDP-R	Indication that the SM has been successfully submitted to the Short Message Service Centre.

7.4.2.1.1 Description of the MO SMS state model (PIAs)

This subclause describes the state model for originating SMS transfer. For each PIA a description can be found of the entry events, actions and exit events.

7.4.2.1.1.1 SMS Null & Start & Authorize

Entry events:

- Previous MO SMS transfer to the SMSC completed (DP O_SMS_Submitted).

- Exception event is reported.

Actions:

- Interface is idled.

- Authentication.

- Ciphering.

- MO SMS subscription check.

- RP-MO-DATA message containing the User Data and the SMSC address is received from MS.

- The supplementary service "barring of all outgoing calls" is checked and invoked if necessary.

- The ODB category "barring of all outgoing calls" is checked and ODB is invoked if necessary.

Exit events:

- MO-SMS-CSI is analysed.

- An exception condition is encountered.

7.4.2.1.1.2   SMS Analyse & Routing

Entry events:

- MO-SMS-CSI is analysed (DP SMS_Collected_Info).

Actions:

- Information being analysed and/or translated to determine routeing address of the SMSC.

- Outgoing barring services and ODB categories not already applied are checked and invoked if necessary. If any of the barring services or ODB categories prevents the submission of the MO-SMS, then the MSC or SGSN shall generate the "O_SMS_Failure" event. The cause code to be used in that case shall be "sM-DeliveryFailure".

- The short message is sent to the SMSC.

Exit events:

- Acknowledge from the SMSC is received. (DP O_SMS_submitted).

A positive acknowledgement is sent to the MS.

- An exception condition is encountered - this leads to the SMS_Exception PIA.

A negative acknowledgement is sent to the MS.

- Attempt to select the route for the SMS fails (DP O_SMS_Failure).

A negative acknowledgement is sent to the MS.

- Negative acknowledgement from the SMSC is received (DP O_SMS_Failure).

A negative acknowledgement is sent to the MS.

7.4.2.1.1.3   SMS_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for a PIA cannot be met.

Actions:

- Default handling of the exception condition is applied. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

  - If a relationship exists between the gsmSCF and gsmSSF or gprsSSF send an error information flow closing the relationship and indicating that any outstanding Short Message handling instructions will not run to completion.

  - The MSC/gsmSSF or SGSN/gprsSSF shall make use of vendor-specific procedures to ensure release of internal resources.

Exit events:

- Default handling of the exception condition by MSC/gsmSSF or SGSN/gprsSSF completed.

7.4.3 Mobile Terminating SMS State Model

7.4.3.1 Description of MT SMS state model

The MT SMS state model is used to describe the actions in an MSC and in a SGSN during Mobile Terminating SMS.
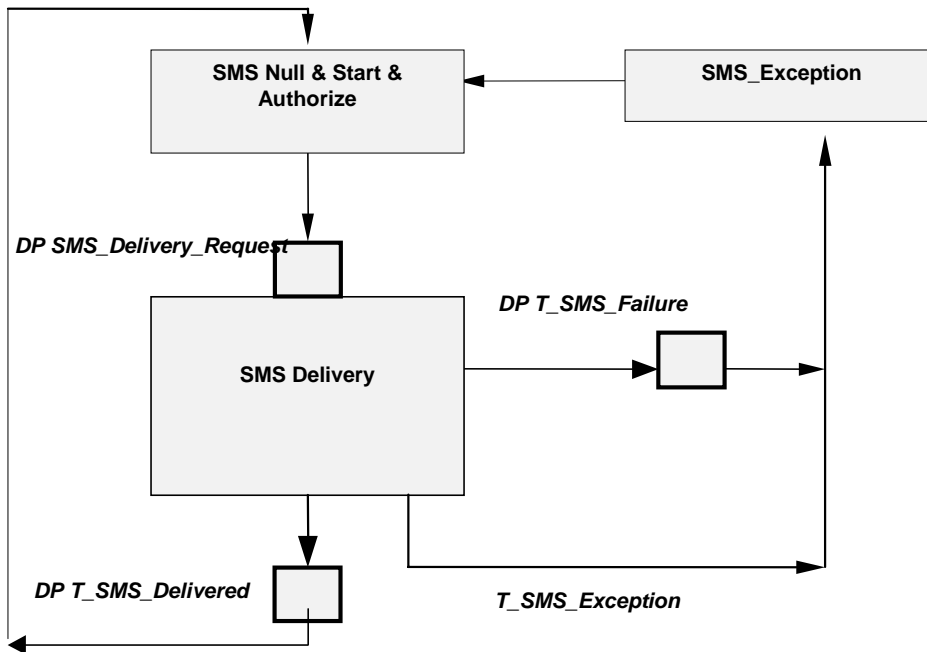
Figure 7.3: MT SMS State Model

Table 7.2: Description of MT SMS DPs in the MSC and SGSN

CAMEL Detection Point	DP Type	Description
DP SMS_Delivery_Request	TDP-R	Indication that the MT-SMS-CSI is analysed and a mobile terminating short message or status report is received.
DP T_SMS_Failure	EDP-N, EDP-R	Indication that the SM delivery to the Mobile Station has failed
DP T_SMS_Delivered	EDP-N, EDP-R	Indication that the SM has been successfully delivered to the Mobile Station.

7.4.3.1.1 Description of the MT SMS state model (PIAs)

This subclause describes the state model for terminating SMS transfer. For each PIA a description can be found of the entry events, actions and exit events.

7.4.3.1.1.1 SMS Null & Start & Authorize

Entry events:

- MAP-MT-FORWARD-SHORT-MESSAGE message is received from SMS-GMSC.

- Previous MT SMS transfer to the MS completed (DP T_SMS_Delivered).

- Exception event is reported.

Actions:

- Interface is idled.

- MT SMS subscription check.

- MT-SMS-CSI is received from the VLR (in the MSC only).

Exit events:

- MT-SMS-CSI is analysed.

- An exception condition is encountered.

7.4.3.1.1.2   SMS Delivery

Entry events:

- MT-SMS-CSI is analysed. (DP SMS_Delivery_Request).

Actions:

- Subscriber paging is performed, if required.

- The short message is delivered to the MS.

Exit events:

- Acknowledge from the MS is received. (DP T_SMS_Delivered).

  A positive acknowledgement is sent to the SMSC.

- An exception condition is encountered - this leads to the SMS_Exception PIA.

  A negative acknowledgement is sent to the SMSC.

- Negative acknowledgement from the MS is received (DP T_SMS_Failure).

  A negative acknowledgement is sent to the SMSC.

7.4.3.1.1.3   SMS_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for a PIA cannot be met.

Actions:

- Default handling of the exception condition is applied. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

  - If a relationship exists between the gsmSCF and gsmSSF or gprsSSF send an error information flow closing the relationship and indicating that any outstanding Short Message handling instructions will not run to completion.

  - The MSC/gsmSSF or SGSN/gprsSSF shall make use of vendor-specific procedures to ensure release of internal resources.

Exit events:

- Default handling of the exception condition by MSC/gsmSSF or SGSN/gprsSSF completed.

7.5 Procedures for CAMEL SMS

7.5.1 Functional architecture for CAMEL MO SMS services
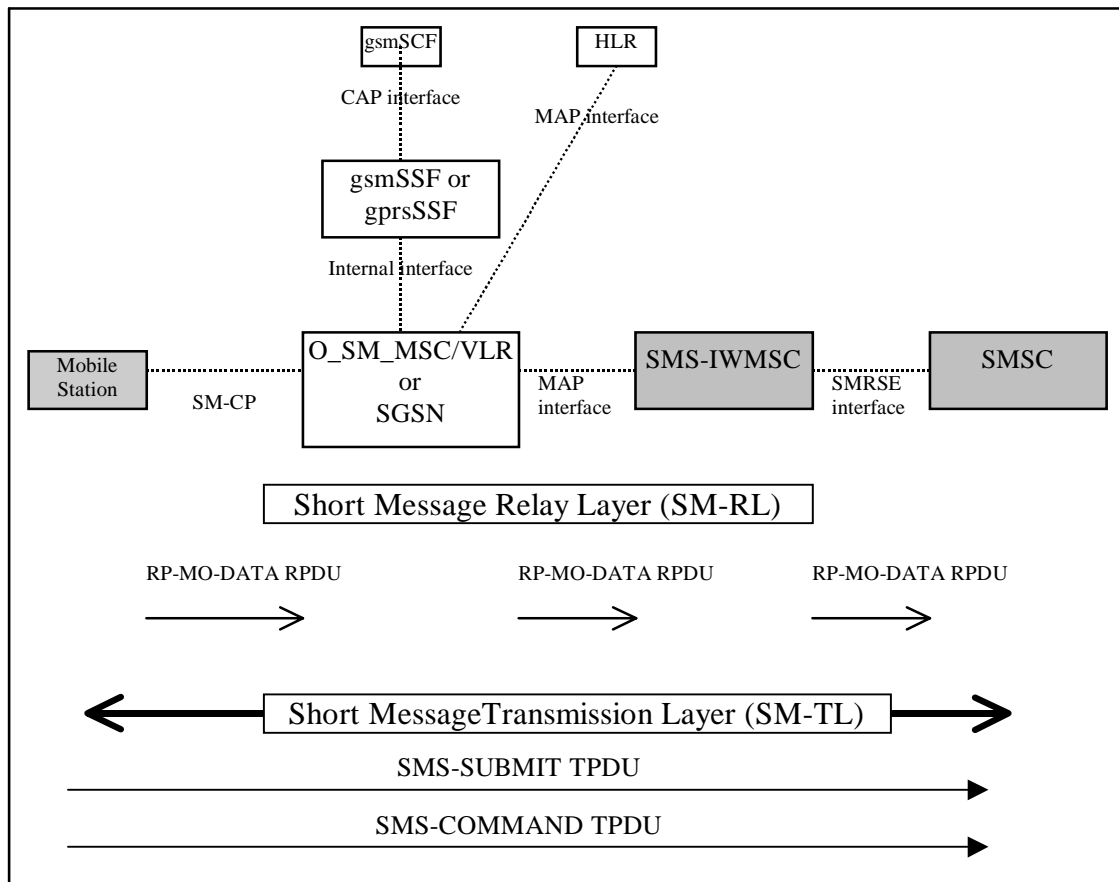
Note 1: The functional entities depicted by means of dark shaded boxes in the figure 7.4 are not affected by CAMEL interaction with MO-SMS.

Note 2: The Relay Protocol between the MS and the MSC or SGSN is described in 3GPP TS 24.011 [31]. The Relay Protocol between the MSC or SGSN and the SMS-GMSC is described in 3GPP TS 29.002 [34]. The Relay Protocol between the SMS-GMSC and the SMSC is not standardised. Examples of this protocol are described in GSM TR 03.47 [42].

Figure 7.4: MO SMS via MSC or SGSN

7.5.2 Handling of mobile originating SMS

7.5.2.1 Handling of mobile originating SMS in the originating MSC or SGSN

The functional behaviour of the originating MSC or SGSN is specified in 3GPP TS 29.002 [34] and 3GPP TS 23.060 [15]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_O_SMS_INIT;

- Procedure CAMEL_O_SMS_SUBMITTED;

- Procedure CAMEL_O_SMS_FAILURE.

A CAMEL Service may be invoked for the following Mobile Originated short message types:

- Short Message Submission (TPDU type = SMS-SUBMIT)

- Short Message Command (TPDU type = SMS-COMMAND)

Refer to 3GPP TS 23.040 [14] for a description of the various TPDU types and to 3GPP TS 24.011 [31] for a description of the protocol elements of the Short Message Relay Layer (RPDUs).

7.5.2.1.1 Actions of the MSC or SGSN on receipt of Int_Error

The MSC or SGSN checks the default SMS Handling parameter in MO-SMS-CSI.

If the default SMS handling is 'releaseTransaction', a A_RP_ERROR is sent to the MS. The MSC or SGSN then releases all resources and the procedure CAMEL_O_SMS_INIT ends.

If the default SMS handling is 'continueTransaction', the MSC or SGSN continues processing without CAMEL support.

7.5.2.1.2 Actions of the MSC or SGSN on receipt of Int_Continue_SMS

The MSC or SGSN continues processing with modified SM parameters. The MSC or SGSN shall transparently modify the SMS parameters with the received information. Parameters which are not included in the Int_Continue_SMS signal are unchanged.

7.5.2.1.3 Actions of the MSC or SGSN on receipt of Int_Connect_SMS

The MSC or SGSN continues processing with modified SM parameters. The MSC or SGSN shall transparently modify the SMS parameters with the received information. Barring is checked with the modified parameters. Parameters which are not included in the Int_Connect_SMS signal are unchanged.

7.5.2.1.4 Actions of the MSC or SGSN on receipt of Int_Release_SMS

A_RP_ERROR is sent to the MS and the Short Message is deleted. The SMS cause received in the Int_Release_SMS signal is used. The MSC or SGSN then releases all resources and the procedure CAMEL_O_SMS_INIT ends.

7.5.2.1.5 Allocation of SMS Reference Number

During the CAMEL handling of a Mobile Originated Short Message, the MSC or SGSN shall allocate an SMS Reference Number. This SMS Reference Number shall be placed in the SMS-MO Call Detail Record, together with the MSC Address or SGSN Number. This SMS Reference Number shall also be sent to the gsmSCF in the Initial DP SMS Information Flow, together with the MSC Address or SGSN Number. The combination of SMS Reference Number and MSC Address or SGSN Number forms a globally unique pair. This pair may be used for correlation of CDRs produced in the MSC or SGSN with CDRs produced in the gsmSCF.

An SMS Reference Number shall be generated and placed in the SMS-MO Call Detail Record, for every Short Message, including the case when a Short Message forms part of a set of concatenated Short Messages.

7.5.2.2 Handling of A_MM_Release and A_LLC_Release

If the radio link with the subscriber is lost during the handling of a CAMEL procedure in the MSC or SGSN, then the MSC or SGSN sends signal A_MM_Release_ind or A_LLC_Release_ind to that procedure. This results in the termination of that CAMEL procedure. (Refer to 3GPP TS 29.002 [34] for details.)

7.5.2.3 Handling of time-out from SMSC

If the MSC or SGSN does not receive a confirmation from the SMSC after submission of a Short Message, then the MSC or SGSN calls procedure CAMEL_O_SMS_FAILURE. (Refer to 3GPP TS 29.002 [34] for details.)

Procedure CAMEL_O_SMS_INIT   1(3)

/* A procedure in the MSC or SGSN
to perform CAMEL handling of mobile originated
SMS submission request.*/

/* Signals to/from the right are to/from
gsmSSF/gprsSSF (SMS_SSF).
Signals from the left are from MS,
unless otherwise stated. */

SMS-CSI invocation?

No → Result := Continue

Yes → Store original SMS parameters

Allocate SMS Reference Number

Int_Invoke_ SMS_SSF (MO-SMS-CSI)

Wait_for_ SMS_SSF_ Invoked

A_MM_RELEASE_ind, A_LLC_RELEASE_ind

Int_SMS_ SSF_Invoked

Int_SMS_ Failure

Int_DP_SMS_ Collected_Info

Result := SMS_Aborted

DP_SMS_ Collected_ Info
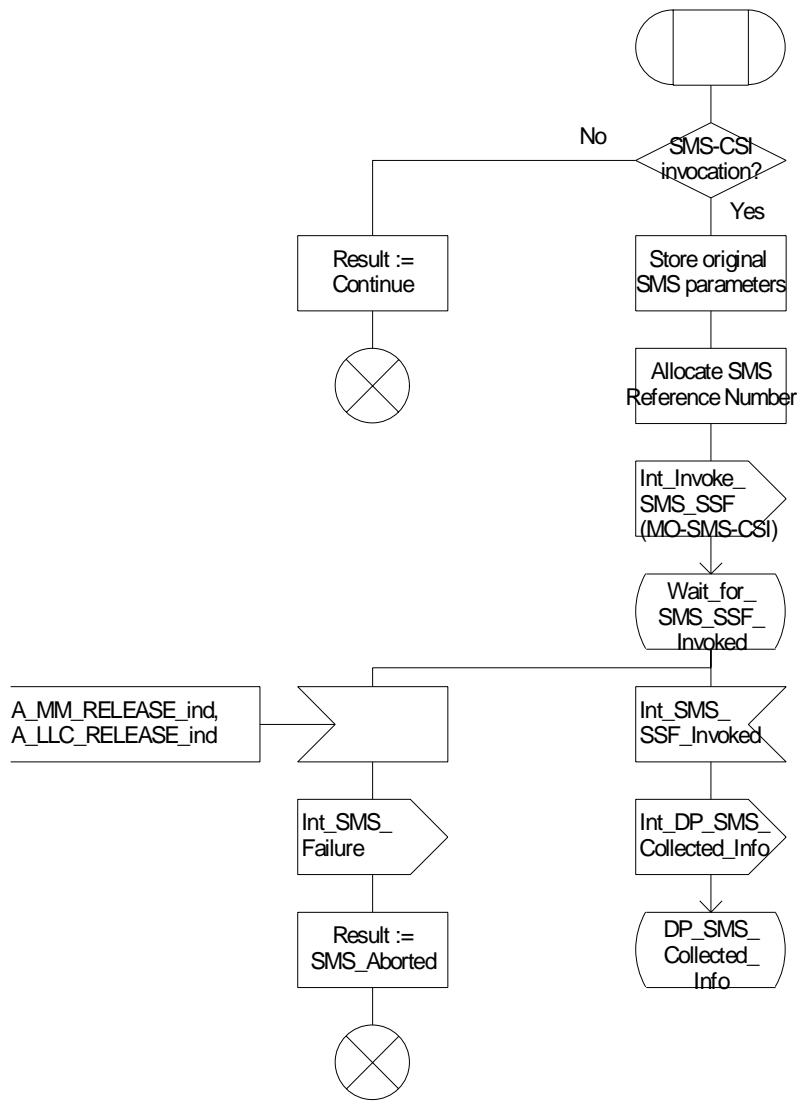
Figure 7.5-1: Procedure CAMEL_O_SMS_INIT (sheet 1)

Procedure CAMEL_O_SMS_INIT 2(3)

/* A procedure in the MSC or SGSN
to perform CAMEL handling of mobile originated
SMS submission request.*/

/* Signals from the right are from
gsmSSF/gprsSSF (SMS_SSF).*/

DP_SMS_
Collected_Info

Int_Release_
SMS

Int_Error

Int_Continue_SMS

Int_Connect_SMS

Modify SMS parameters
in accordance with
the received information

Modify SMS parameters
in accordance with
the received information

Default SMS
handling =
continue?

Yes

No

Set RP_ERROR

Result :=
Release_SMS

Result :=
Continue

Result :=
Redirect_SMS

Figure 7.5-2: Procedure CAMEL_O_SMS_INIT (sheet 2)

Procedure CAMEL_O_SMS_INIT 3(3)

/* A procedure in the MSC or SGSN
to perform CAMEL handling of mobile originated
SMS submission request.*/

/* Signal to the right is to
gsmSSF/gprsSSF (SMS_SSF).
Signals from the left are from MS.*/

DP_SMS_
Collected_Info

A_MM_RELEASE_ind,
A_LLC_RELEASE_ind

Int_SMS_
Failure

Result :=
SMS_Aborted
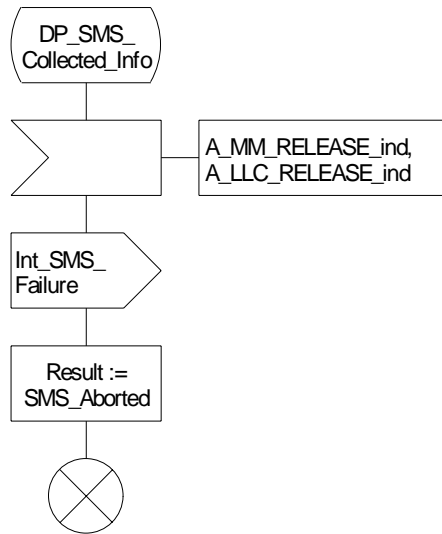
Figure 7.5-3: Procedure CAMEL_O_SMS_INIT (sheet 3)

Procedure CAMEL_O_SMS_SUBMITTED   1(1)

/* Procedure in the MSC or SGSN
(SMS_SSF) to report successful submission
to gsmSCF of CAMEL. */

/* Signals to/from the right are to/from
gsmSSF/gprsSSF (SMS_SSF). */
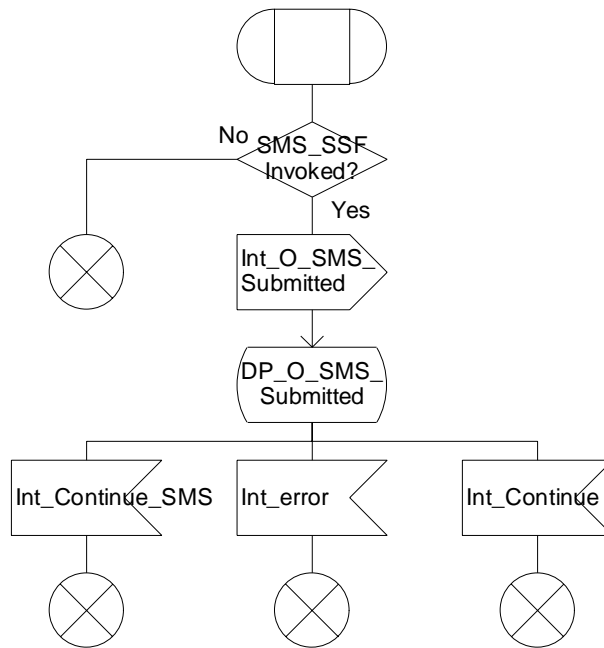
Figure 7.6-1: Procedure CAMEL_O_SMS_SUBMITTED (sheet 1)

Procedure CAMEL_O_SMS_FAILURE 1(1)

/* Procedure in the MSC or SGSN
to handle CAMEL notification to gsmSCF
about unsuccessfull submission. */

/* Signals to/from the right are to/from
gsmSSF/gprsSSF (SMS_SSF). */

SMS_SSF
Invoked?

No

Yes

Int_O_SMS_
Failure

DP_O_SMS_
Failure

Int_Continue_SMS

Int_error

Int_Continue

Figure 7.7-1: Procedure CAMEL_O_SMS_FAILURE (sheet 1)

7.5.2.4 Handling of mobile originating SMS in the VLR

The functional behaviour of the VLR is specified in 3GPP TS 29.002 [34] The handling specific to CAMEL is specified in the following procedure:

- Procedure CAMEL_MO_SMS_VLR.

Procedure CAMEL_MO_SMS_VLR   1(1)

/* Procedure called in the process
   MO_SMS_VLR (3GPP TS 29.002) */

/* Signals to/from the left are
   to/from the MSC. */

No ← MO-SMS-CSI provisioned?

Yes

Result := Pass

Set MO-SMS-CSI parameter

MAP_CONTINUE_CAMEL_
SMS_HANDLING_req

Wait_For_
SIF_MO_SMS

MAP_U_
ABORT_ind

MAP_SEND_INFO_FOR_
MO_SMS_ind

Result := Fail

Result := Pass

Figure 7.8-1: Procedure CAMEL_MO_SMS_VLR (sheet 1)

7.5.3   Functional architecture for CAMEL MT SMS services
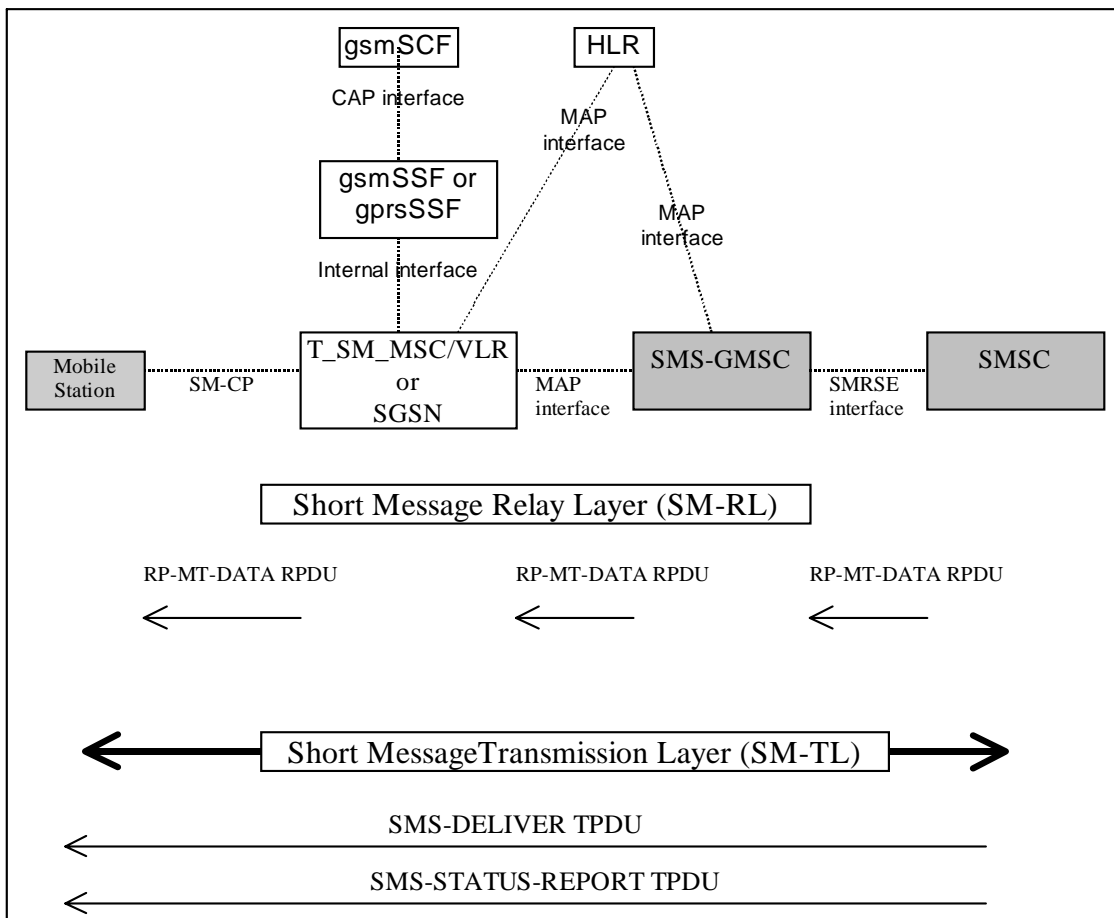
Note 1:   The functional entities depicted by means of dark shaded boxes in the figure 7.9 are not affected by CAMEL interaction with MT-SMS.

Note 2:   The Relay Protocol between the MS and the MSC or SGSN is described in 3GPP TS 24.011 [31]. The Relay Protocol between the MSC or SGSN and the SMS-GMSC is described in 3GPP TS 29.002 [34]. The Relay Protocol between the SMS-GMSC and the SMSC is not standardised. Examples of this protocol are described in GSM TR 03.47 [42].

Figure 7.9: MT SMS via MSC or SGSN

7.5.4   Handling of mobile terminating SMS

7.5.4.1   Handling of mobile terminating SMS in the terminating MSC or SGSN

A CAMEL Service may be invoked for the following Mobile Terminated short message types:

-    Short Message Delivery (TPDU type = SMS-DELIVER)

-    Short Message Status Report (TPDU type = SMS-STATUS-REPORT)

Refer to 3GPP TS 23.040 [14] for a description of the various TPDU types and to 3GPP TS 24.011 [31] for a description of the protocol elements of the Short Message Relay Layer (RPDUs).

The functional behaviour of the terminating MSC or SGSN is specified in 3GPP TS 29.002 [34]. The procedures specific to CAMEL are specified in the following subclauses:

7.5.4.1.1   Procedure CAMEL_T_SMS_INIT;

This procedure is called when a Short Message delivery attempt is received from the SMS-GMSC. If MT-SMS-CSI is present for the subscriber, then the SMS_SSF shall be invoked. Otherwise, the Short Message delivery attempt proceeds without CAMEL.

When the SMS_SSF is invoked and the SMS_SSF has requested the gsmSCF for instructions, the MSC or SGSN may receive the following responses from the SMS_SSF:

- Int_Continue_SMS

   The gsmSCF has indicated that SM delivery may proceed. It may have supplied the SMS_SSF with a modified Calling Party Number. This Calling Party Number shall replace the TP-Originating-Address in the SMS-DELIVER TPDU.

- Int_Release_SMS

   The gsmSCF has force-released SM delivery. The RP Cause received from the gsmSCF shall be conveyed to the SMS-GMSC in the RP-Cause component, in the RP-ERROR RPDU.

- Int_Error

   A Tssf time-out or an internal SMS_SSF error has occurred; the SM has not been forwarded to the Mobile Station. If Default SMS Handling equals 'Continue', the SM delivery proceeds. Otherwise, SM delivery shall be aborted. In the latter case, the RP-Cause component, in the RP-ERROR RPDU shall be set to EquipmentProtocolError, in accordance with 3GPP TS 29.002 [34].

7.5.4.1.2   Procedure CAMEL_T_SMS_DELIVERED

This procedure is called when the MSC or SGSN has detected that delivery of the SM to the Mobile Station has succeeded. No event specific information is sent to the gsmSCF.

When Short Message delivery attempt success has been reported to the gsmSCF, then the MSC or SGSN may receive the following responses from the SMS_SSF:

- Int_Continue_SMS

   The event was reported to the gsmSCF in interrupt mode. The gsmSCF has concluded CAMEL processing and has terminated the Service Logic.

- Int_Continue

   The event was not reported to the gsmSCF or was reported in notification mode.

- Int_Error

   A Tssf time-out has occurred.

In all the above cases, the SM processing in the MSC or SGSN continues.

7.5.4.1.3   Procedure CAMEL_T_SMS_FAILURE

This procedure is called when the MSC or SGSN has detected that delivery of the SM to the Mobile Station has failed. If the delivery failure is due to RP-ERROR RPDU received from the MS, then the MT SMS Cause in the event report to the gsmSCF shall be set to the RP-Cause component in the RP-ERROR-RPDU. Otherwise, if the delivery failure is due to internal failure in the MSC or SGSN, CP-ERROR from MS or time-out from the MS, then the MT SMS Cause in the event report to the gsmSCF shall be set to "Protocol error, unspecified", as defined in 3GPP TS 24.011 [31].

When Short Message delivery attempt failure has been reported to the gsmSCF, then the MSC or SGSN may receive the following responses from the SMS_SSF:

- Int_Continue_SMS

   The event was reported to the gsmSCF in interrupt mode. The gsmSCF has concluded CAMEL processing and has terminated the Service Logic.

- Int_Continue

    The event was not reported to the gsmSCF or was reported in notification mode.

- Int_Error

    A Tssf time-out has occurred.

In all the above cases, the SM processing in the MSC or SGSN continues.

7.5.4.1.4 Allocation of SMS Reference Number

During the CAMEL handling of a Mobile Terminating Short Message, the MSC or SGSN shall allocate an SMS Reference Number. This SMS Reference Number shall be placed in the SMS-MT Call Detail Record, together with the MSC Address or SGSN Number. This SMS Reference Number shall also be sent to the gsmSCF in the Initial DP SMS Information Flow, together with the MSC Address or SGSN Number. The combination of SMS Reference Number and MSC Address or SGSN Number forms a globally unique pair. This pair may be used for correlation of CDRs produced in the MSC or SGSN with CDRs produced in the gsmSCF.

An SMS Reference Number shall be generated and placed in the SMS-MT Call Detail Record, for every Short Message, including the case when a Short Message forms part of a set of concatenated Short Messages.

Procedure CAMEL_T_SMS_INIT 1(2)

/* A procedure in the MSC or SGSN to perform CAMEL handling of mobile terminated SMS delivery request.*/

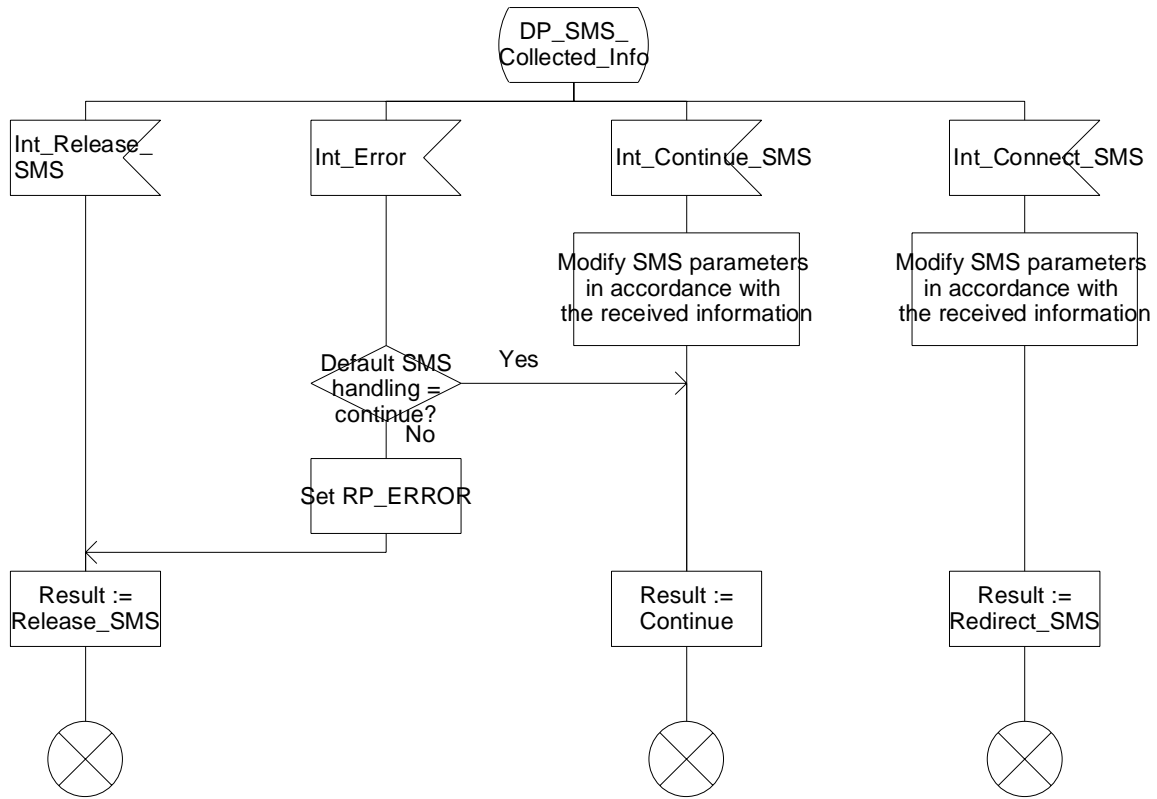/* Signals to/from the right are to/from gsmSSF/gprsSSF (SMS_SSF).*/

SMS-CSI invocation?

No

Yes

Result := Continue

Store original SMS parameters

Allocate SMS Reference Number

Int_Invoke_ SMS_SSF (MT-SMS-CSI)

Wait_for_ SMS_SSF_ Invoked

Int_SMS_ SSF_Invoked

Int_DP_SMS_ Delivery_Request

DP_SMS_ Delivery_Request
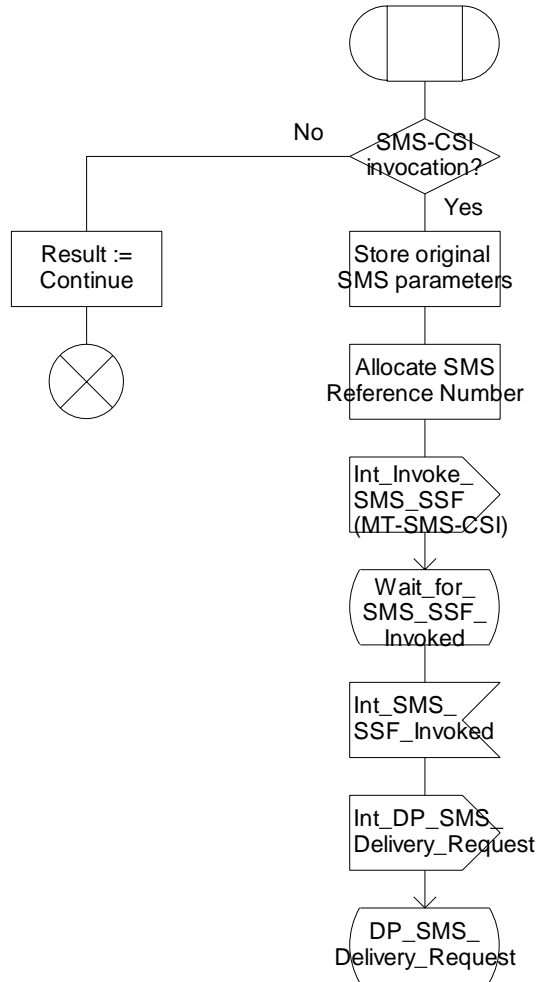
Figure 7.10-1: Procedure CAMEL_T_SMS_INIT (sheet 1)

Procedure CAMEL_T_SMS_INIT 2(2)

/* A procedure in the MSC or SGSN to perform CAMEL handling of mobile terminated SMS delivery request.*/

/* Signals from the right are from gsmSSF/gprsSSF (SMS_SSF).*/

DP_SMS_
Delivery_Request

Int_Release_
SMS

Int_Error

Int_Continue_SMS

Modify SMS parameters
in accordance with
the received information

Default SMS
handling =
continue?   Yes

No

Result :=
Release_SMS

Result :=
Continue
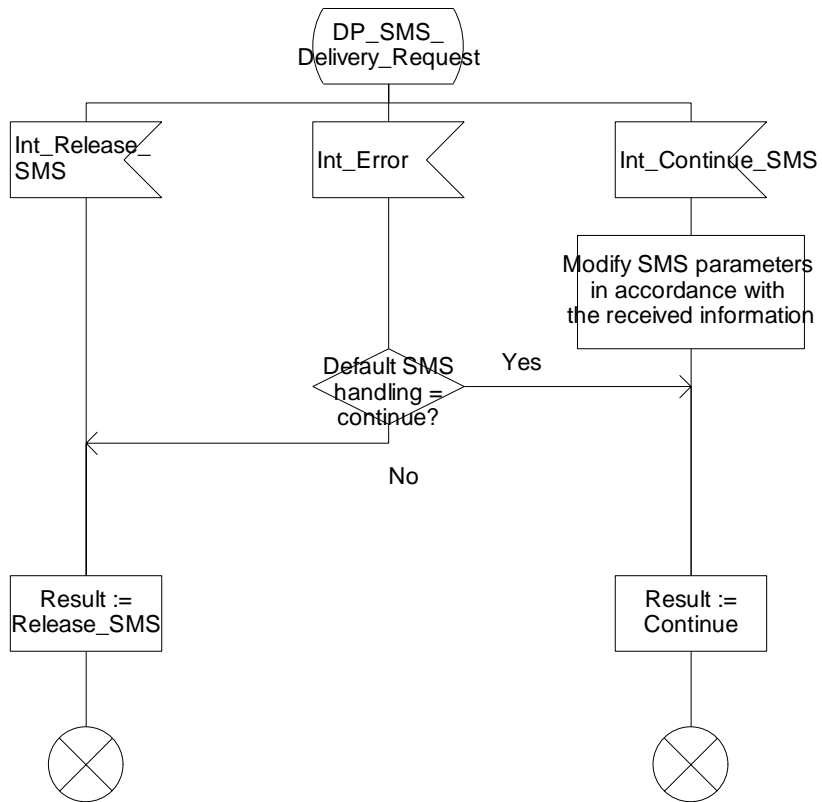
Figure 7.10-2: Procedure CAMEL_T_SMS_INIT (sheet 2)

Procedure CAMEL_T_SMS_FAILURE 1(1)

/* Procedure in the MSC or SGSN to handle CAMEL notification to gsmSCF about unsuccessfull delivery. */

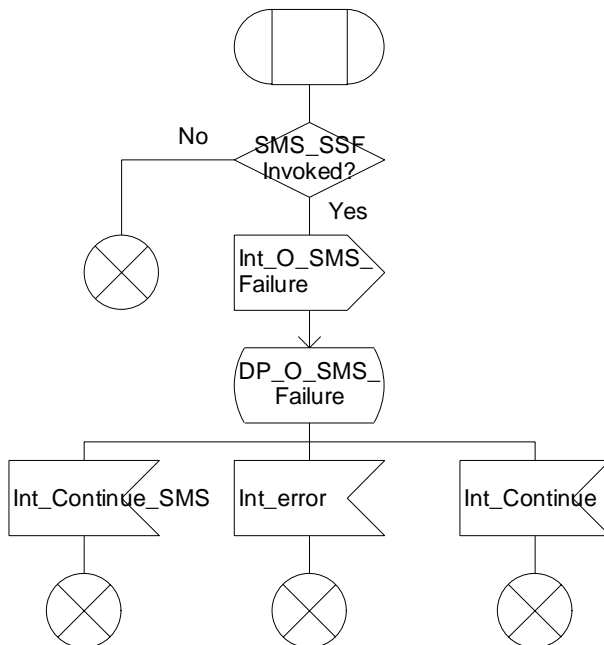/* Signals to/from the right are to/from gsmSSF/gprsSSF (SMS_SSF). */

SMS_SSF Invoked?

No

Yes

Int_T_SMS_Failure

DP_T_SMS_Failure

Int_Continue_SMS

Int_error

Int_Continue

Figure 7.11-1: Procedure CAMEL_T_SMS_FAILURE (sheet 1)

Procedure CAMEL_T_SMS_DELIVERED   1(1)

/* Procedure in the MSC or SGSN
(SMS_SSF) to handle CAMEL notification
to gsmSCF about successful delivery. */

/* Signals to/from the right are to/from
gsmSSF/gprsSSF (SMS_SSF). */

SMS_SSF
Invoked?

No

Yes

Int_T_SMS_
Delivered

DP_T_SMS_
Delivered

Int_Continue_SMS

Int_error

Int_Continue
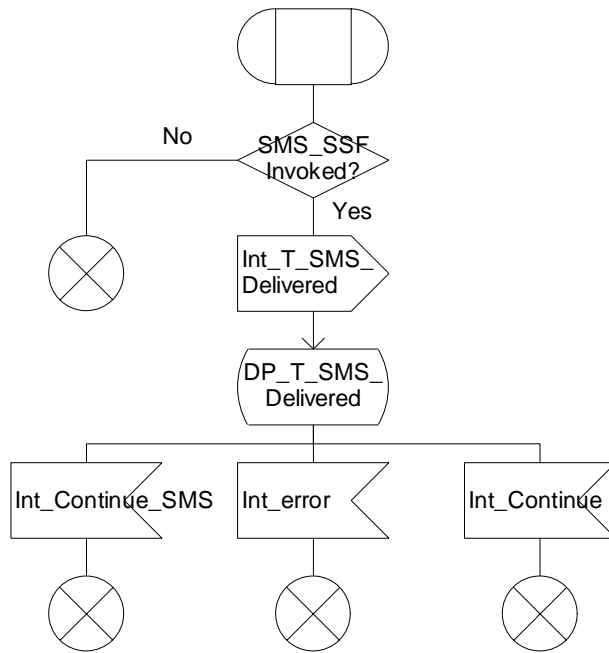
Figure 7.12-1: Procedure CAMEL_T_SMS_DELIVERED (sheet 1)

7.5.4.2 Handling of mobile terminating SMS in the VLR

The functional behaviour of the VLR is specified in 3GPP TS 29.002 [34]. The handling specific to CAMEL is specified in the following procedure:
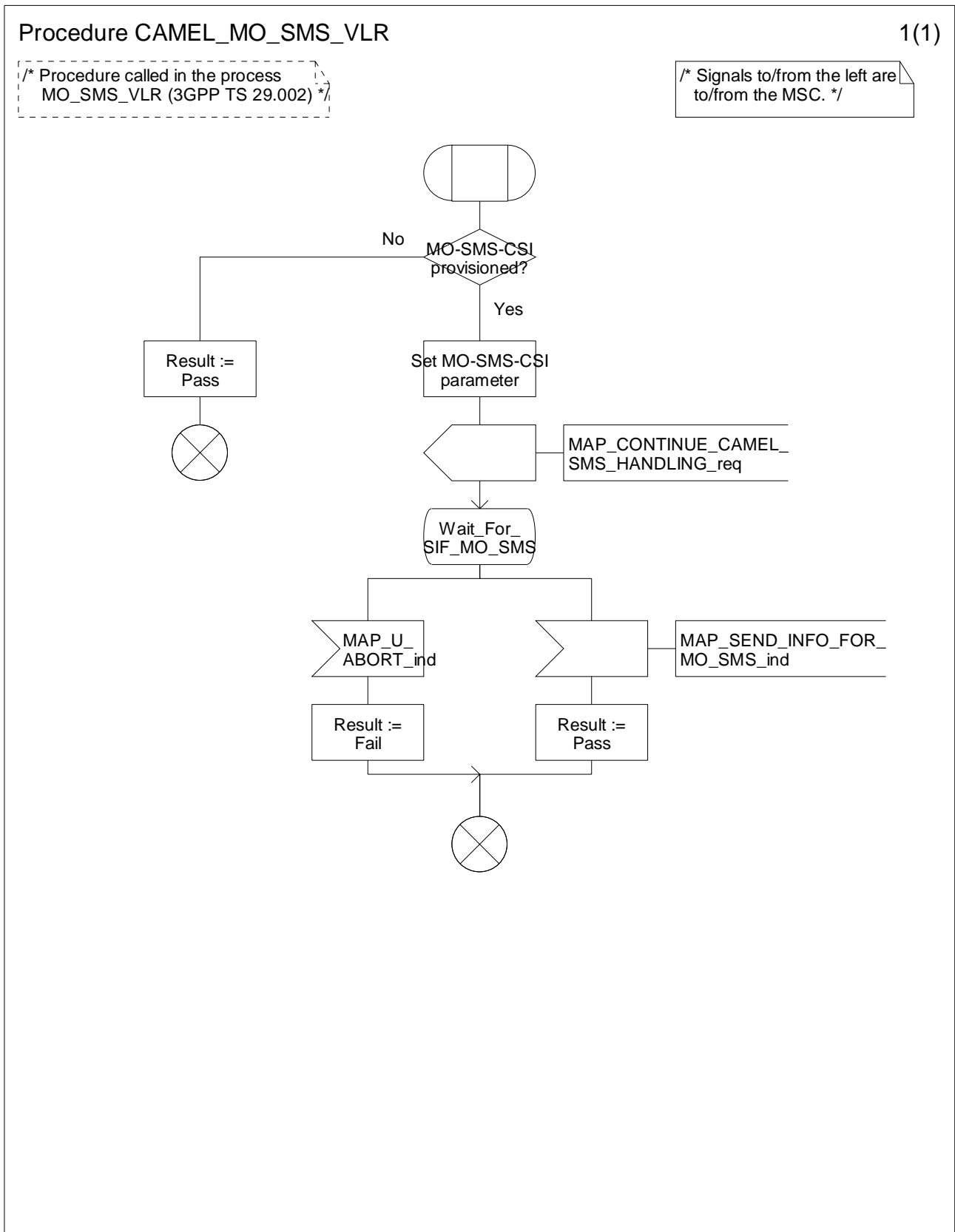
- Procedure CAMEL_MT_SMS_VLR.

Procedure CAMEL_MT_SMS_VLR   1(1)

/* Procedure called in the process
MT_SM_VLR (3GPP TS 29.002) */

/* Signals to/from the left are to/from the MSC.*/

MT-SMS-CSI
provisioned? — No

Yes

Set
MT-SMS-CSI
parameter

MAP_CONTINUE_
CAMEL SMS_
HANDLING_req

Wait_for_
SIF_MT_SMS

MAP_U_
ABORT_ind

MAP_SEND_INFO_
FOR_MT_SMS_ind

Result :=
Fail

Result :=
Pass
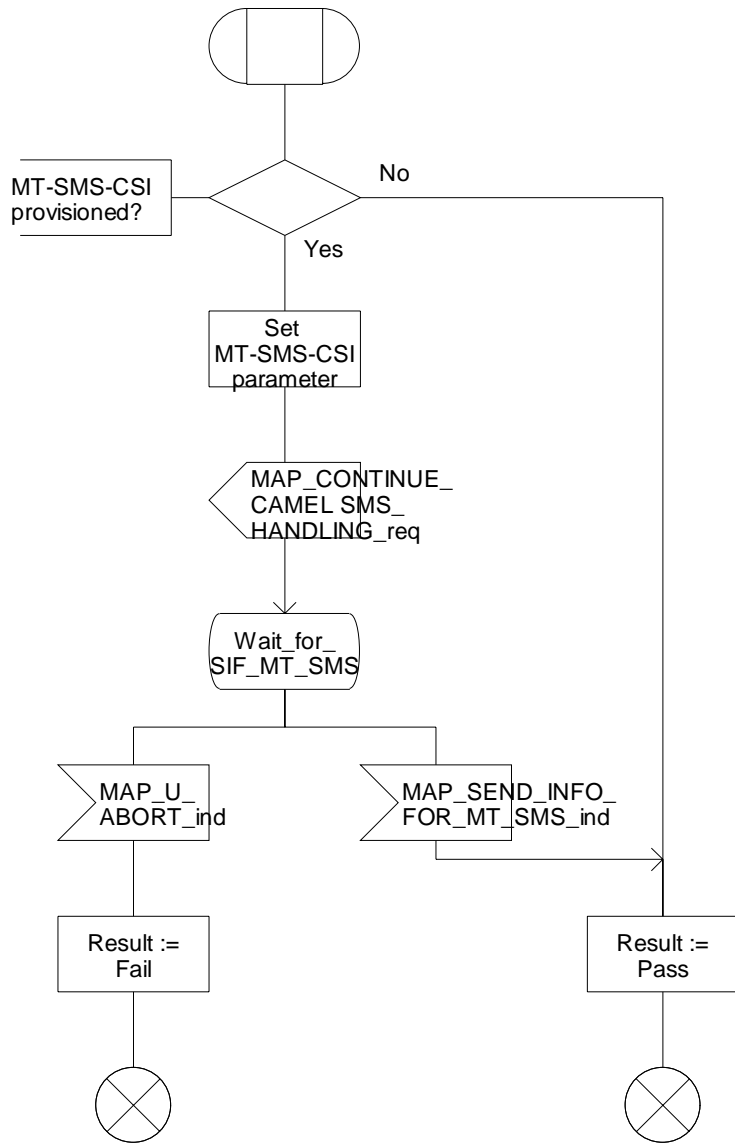
Figure 7.13-1: Procedure CAMEL_MT_SMS_VLR (sheet 1)

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7.5.4.3 CAMEL subscription check for mobile terminating SMS in the SGSN

The functional behaviour of the SGSN for delivery of MT shrt message is specified in 3GPP TS 29.002 [34]. The procedure for checking CAMEL capability and subscription information is specified in the following procedure:

- Procedure CAMEL_MT_SMS_SGSN.

Procedure CAMEL_MT_SMS_SGSN 1(1)

/* Procedure in the SGSN to check whether
a CAMEL dialogue should be opened for
MT SMS delivery. Called from the process
MT_SM_SGSN (3GPP TS 29.002) */

```
                              ┌──┬───┐
                              │  │   │
                              └──┴───┘
                                  │
                                  │
                               ╱  ╲         No
           ┌──────────┐      ╱     ╲───────────────┐
           │ MT-SMS-CSI│    ╱       ╲              │
           │provisioned?├──╲         ╱             │
           └──────────┘    ╲       ╱              │
                             ╲     ╱               │
                              ╲  ╱                 │
                               │                   │
                              Yes                  │
                               │                   │
                          ┌────────┐          ┌────────┐
                          │Result :=│         │Result :=│
                          │ CAMEL   │         │Continue │
                          │handling │         │         │
                          └────────┘          └────────┘
                               │                   │
                              ⊗                   ⊗
```
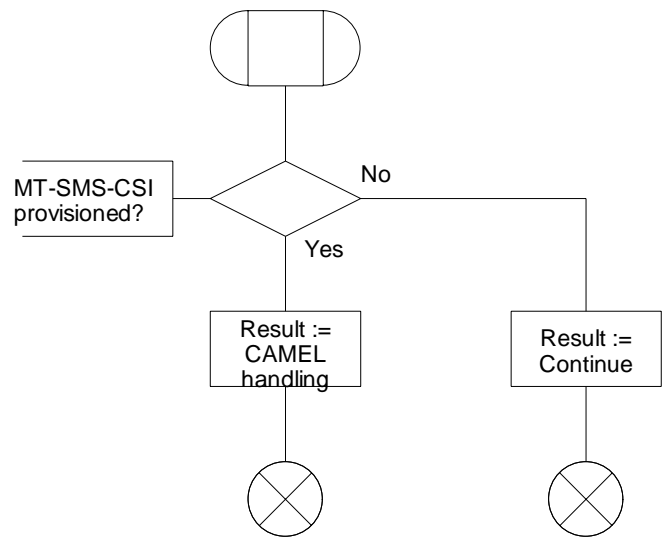
Figure 7.14-1: Procedure CAMEL_MT_SMS_SGSN (sheet 1)

7.5.5 Handling of mobile originating and mobile terminating SMS in the gsmSSF or gprsSSF

7.5.5.1 Process SMS_SSF

Sheet 1   The Int_Invoke SMS_SSF signal dictates which TDP shall be armed. For a Mobile Originated SMS service, the SMS_Collected_Info TDP shall be armed. For a Mobile Terminated SMS service, the SMS_Delivery_Request TDP shall be armed.

Sheet 2   The Int_SMS_Failure signal may be received only for a MO-SMS service. It is received when a MS detach event occurs before the SMS_SSF is invoked.

Sheet 3   The SMSC Address and Destination Subscriber Number may be received in CAP ConnectSMS only for a MO-SMS service.

Sheet 4:   For a MO-SMS service, the following events may be armed or disarmed: O_SMS_Submission, O_SMS_Failure. For a MT-SMS service, the following events may be armed or disarmed: T_SMS_Delivery, T_SMS_Failure.

Sheet 5:   For a MO-SMS service, the gsmSCF may place free-format charging data in the 'MOSMSRecord' CDR (in the MSC) or in the S-SMO-CDR (in the SGSN).

For a MT-SMS service, the gsmSCF may place free-format charging data in the 'MTSMSRecord' (in the MSC) or in the S-SMT-CDR (in the SGSN).

Refer to 3GPP TS 32.205 [37] and 3GPP TS 32.215 [38] for a description of these CDR types.

Sheet 6:   The Int_SMS_Failure signal in state Waiting_For_Instructions may be received for a MO-SMS service only. It is received when a MS detach event occurs before the gsmSCF has given instruction to continue SM processing.

Sheet 7:   When the SM submission or failure event occurs, both MO-SMS events shall be disarmed.

When the SM delivery or failure event occurs, both MT-SMS events shall be disarmed.

7.5.5.2 Process Complete_SMS_FCI_Record

Sheet 1:   For a MO-SMS service, the 'MOSMSRecord' or 'S-SMO-CDR' shall be closed. For a MT-SMS service, the 'MTSMSRecord' or 'S-SMT-CDR' shall be closed.

Process SMS_SSF 1(7)

/* Process to handle MO/MT SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or SGSN; signals to/from the right are to/from the gsmSCF, unless otherwise stated.*/

/*
The following timer is defined:
- Tssf: gsmSSF or gprsSSF state machine timer.
  This timer has a default value range of 1 to 20 seconds.
*/

Idle

Int_Invoke_
SMS_SSF

CSI?

MO-SMS-CSI   MT-SMS-CSI

Arm DP   DP SMS_Collected_Info   Arm DP   DP SMS_Delivery_Request
                shall be armed as TDP.   shall be armed as TDP.

Int_SMS_   Int_SMS_
SSF_Invoked   SSF_Invoked

Wait_For_   Wait_For_
Request   Request
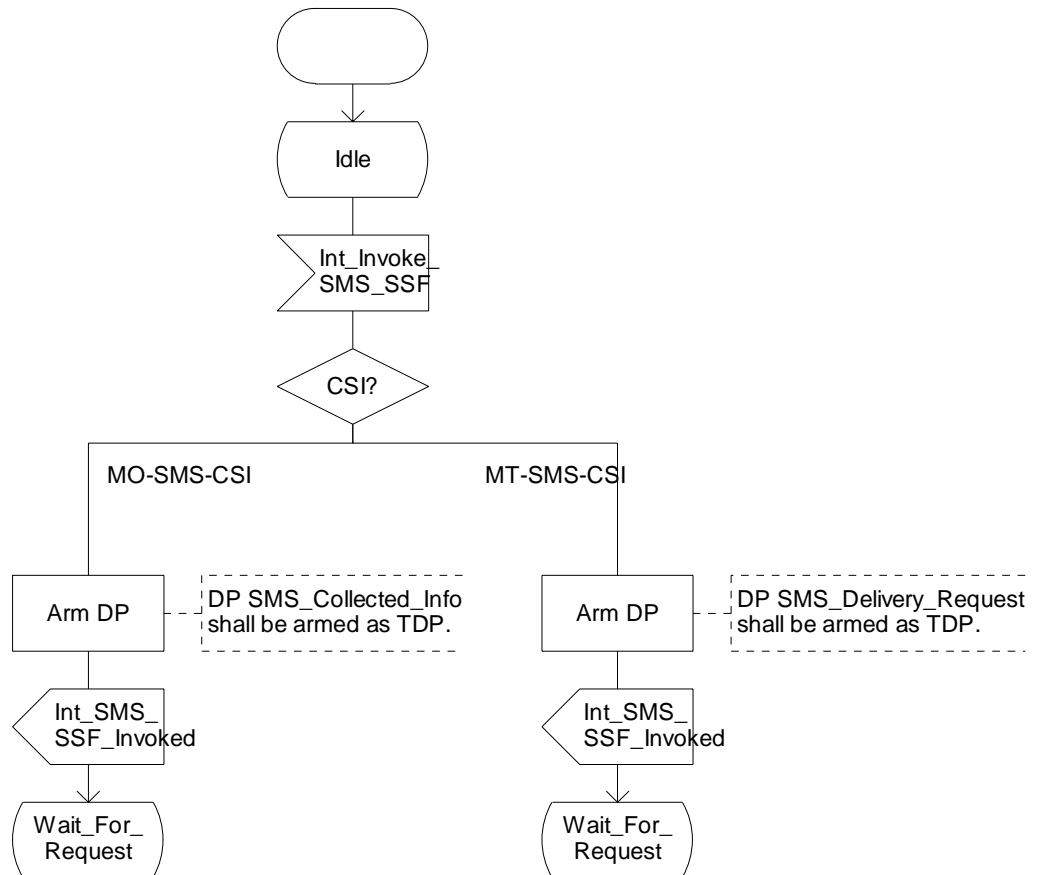
Figure 7.15-1: Process SMS_SSF (sheet 1)

Process SMS_SSF 2(7)

/* Process to handle MO/MT SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or SGSN; signals to/from the right are to/from the gsmSCF, unless otherwise stated.*/

```
                            ( Wait_For_
                                Request )

        Int_DP_SMS_         Int_DP_SMS_        Int_SMS_
        Delivery_Request    Collected_Info     Failure

        Check_Criteria_SMS_                       ( Idle )
        Delivery_Request

            / Result \ ──Yes──────────┐
            \ = pass? /                │
               │                       │
               No                      │
                                       │
        Int_Continue_          Set Tssf to
        SMS                    default value
                              and start Tssf

          ( Idle )            Open Control
                              Relationship

                              CAP_Initial_
                              DP_SMS

                            ( Waiting_for_
                               Instructions )
```
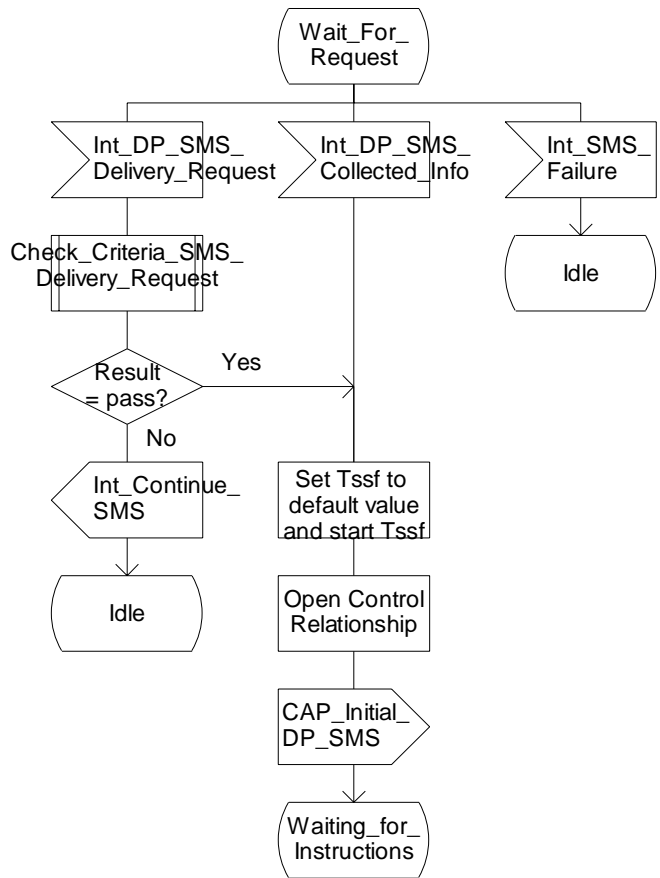
Figure 7.15-2: Process SMS_SSF (sheet 2)

Process SMS_SSF 3(7)

/* Process to handle MO/MT SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or SGSN; signals to/from the right are to/from the gsmSCF, unless otherwise stated.*/
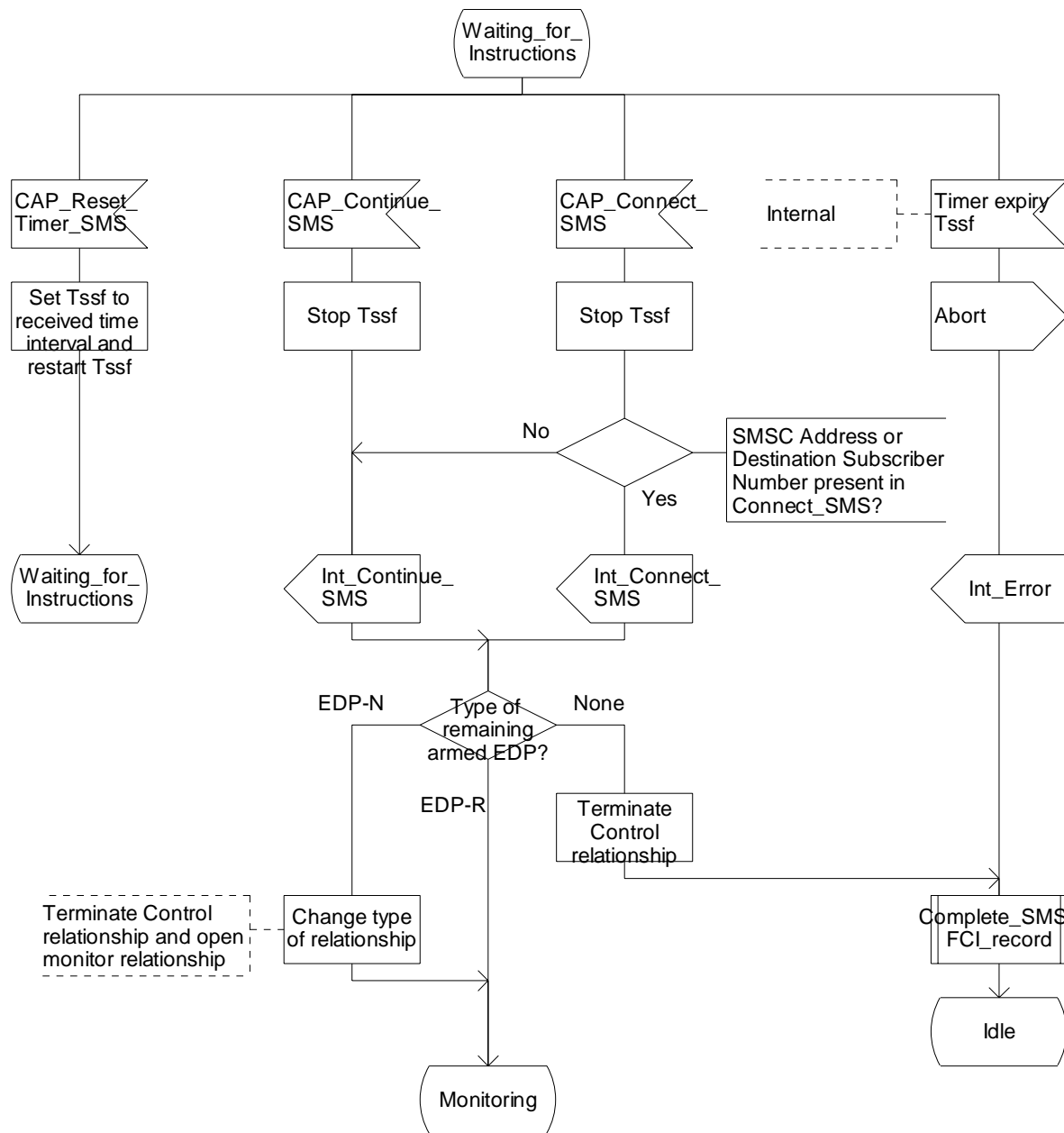
Figure 7.15-3: Process SMS_SSF (sheet 3)

Process SMS_SSF 4(7)

/* Process to handle MO/MT SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or SGSN; signals to/from the right are to/from the gsmSCF, unless otherwise stated.*/
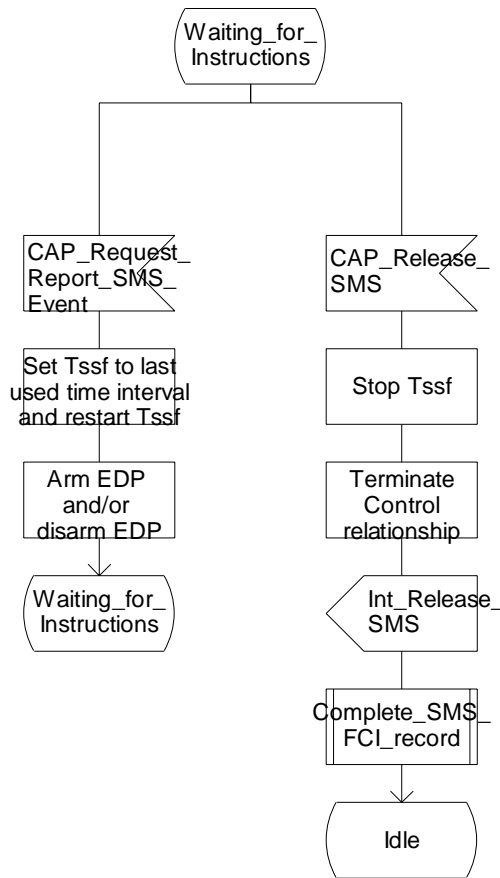
Figure 7.15-4: Process SMS_SSF (sheet 4)

Process SMS_SSF 5(7)

/* Process to handle MO/MT SMS. Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or SGSN; signals to/from the right are to/from the gsmSCF, unless otherwise stated.*/

Waiting_for_ Instructions

CAP_Furnish_Charging_ Information_SMS

Set Tssf to last used time interval and restart Tssf

Non-completed CAMEL logical SMS record exists?

No

Yes

AppendFree FormatData in FCI?

"Append"

Not present, "Overwrite"

Append FCI data to existing logical SMS record

Already completed records are not affected

Overwrite all CAMEL logical SMS record data with this FCI data.

Create CAMEL logical SMS record

Write FCI data in CAMEL logical SMS record

Waiting_for_ Instructions
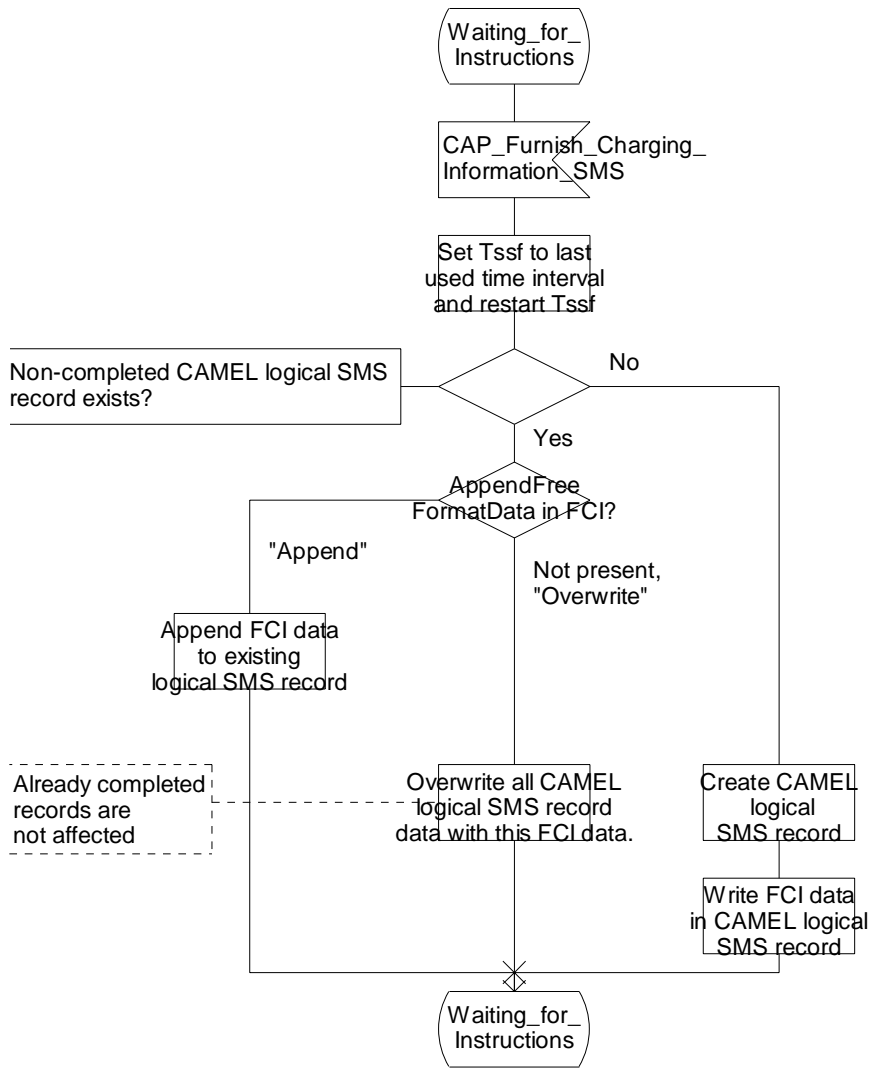
Figure 7.15-5: Process SMS_SSF (sheet 5)

Process SMS_SSF 6(7)

/* Process to handle MO/MT SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or
SGSN; signals to/from the right are to/from
the gsmSCF, unless otherwise stated.*/

Waiting_for_
Instruction

Int_SMS_
Failure

Application_
End

Complete_SMS_
FCI_record

Idle
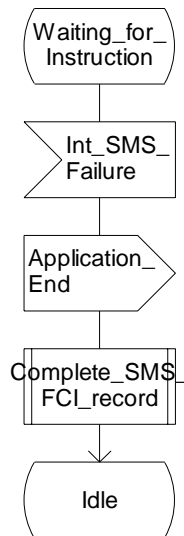
Figure 7.15-6: Process SMS_SSF (sheet 6)

Process SMS_SSF 7(7)

/* Process to handle MO/MT SMS. Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or SGSN; signals to/from the right are to/from the gsmSCF, unless otherwise stated.*/

Monitoring

Int_DP_O_SMS_Submitted

Int_DP_O_SMS_Failure

Int_DP_T_SMS_Delivered

Int_DP_T_SMS_Failure

Implicitly disarm DP O_SMS_Failure

Implicitly disarm DP O_SMS_Submitted

Implicitly disarm DP T_SMS_Failure

Implicitly disarm DP T_SMS_Delivered

DP arming?

not armed

Int_Continue

Application_End

EDP-N

Int_Continue

CAP_Event_Report_SMS (Notify&Continue)

Terminate relationship

Complete_SMS_FCI_record

Idle

EDP-R

Set Tssf to last used time interval and start Tssf

CAP_Event_Report_SMS (Interrupted)

Disarm this event

The event which occurred shall be disarmed.

Waiting_For_Instructions

Figure 7.15-7: Process SMS_SSF (sheet 7)

Procedure Check_Criteria_SMS_Delivery_Request   1(1)

/* Procedure to check the criteria for DP
SMS_Delivery_Request in the SMS_SSF. */
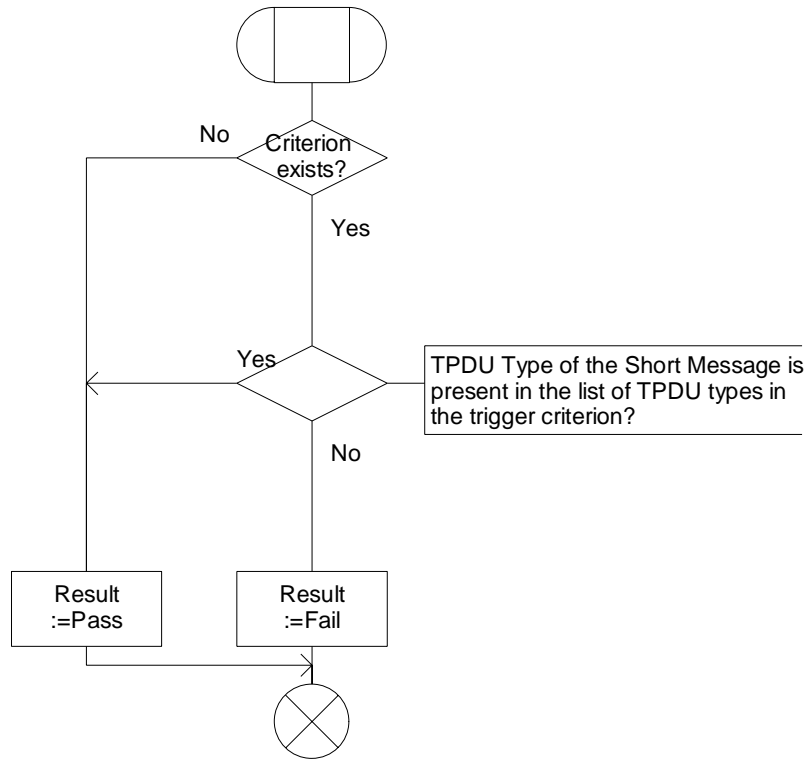
Figure 7.16-1: Procedure Check_Criteria_SMS_Delivery_Request (Sheet 1)

Procedure Complete_SMS_FCI_record 1(1)

/* Procedure in the MSC/SGSN (either in gsmSSF or gprsSSF) to complete logical CDRs created by Furnish_Charging_Information_SMS operations.*/

Non-completed CAMEL logical SMS record exists?

No

Yes

Complete CAMEL logical SMS record
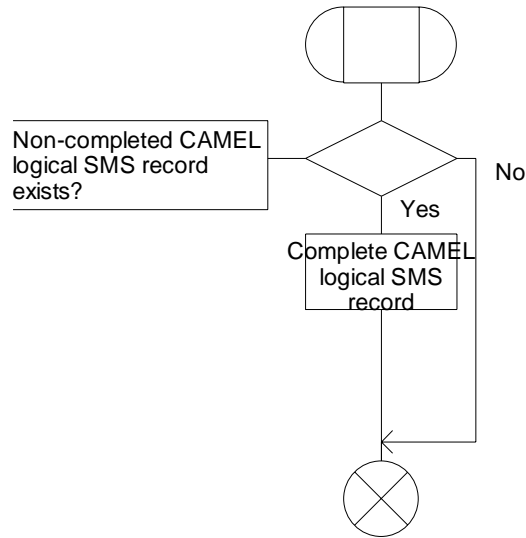
Figure 7.17-1: Procedure Complete_SMS_FCI_record (sheet 1)

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7.6 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for SMS control.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O), Specific conditions (S), mutually Exclusive (E), or not applicable (-) for each different traffic case: Mobile Originating SMS (MO) and Mobile Terminating SMS (MT). If the IEs in one table apply in both the MO and MT cases, then the IEs are marked in the "Status" column.

An 'M' IE shall always be included. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. When a set of 'E' IEs is shown in the definition of an Information Flow or compound IE, only one of those IEs may be included. An 'O' IE may be included or omitted as required by the service logic. A '-' IE shall always be omitted. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The distinction between MO and MT SMS applies only to the Information Flows between the gsmSCF and the gsmSSF or gprsSSF.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [34], TS 29.078 [36].

7.6.1 gsmSSF or gprsSSF to gsmSCF information flows

7.6.1.1 Event Report SMS

7.6.1.1.1 Description

This IF is used to notify the gsmSCF of an event previously requested by the gsmSCF in a Request Report SMS Event IF.

7.6.1.1.2 Information Elements

Information element name	MO	MT	Description
Event Type	M	M	This IE specifies the type of event that is reported.
Event Specific Information	C	C	This IE indicates the SMS related information specific to the event.
Misc SMS Info	M	M	This IE indicates the DP type.

If the Event Type IE indicates O_SMS_Failure, then the Event Specific Information contains the following information element:

Information element name	MO	MT	Description
MO_SMS Cause	M	-	This IE indicates the reason of submission failure.

If the Event Type IE indicates T_SMS_Failure, then the Event Specific Information contains the following information elements:

Information element name	MO	MT	Description
MT_SMS Cause	-	M	This IE indicates the reason of delivery failure.

If the Event Type IE indicates O_SMS_Submitted or T_SMS_Delivered, then no Event Specific Information shall be sent to the gsmSCF.

7.6.1.2 Initial DP SMS

7.6.1.2.1 Description

This IF is generated by the gsmSSF or gprsSSF when a trigger is detected at a DP in the state model, to request instructions from the gsmSCF.

7.6.1.2.2 Information Elements

Information element name	MO	MT	Description
Destination Subscriber Number	M	-	This IE contains a number to identify the Destination short message entity. The Destination Subscriber Number shall be retrieved from the TP-Destination-Address in the SMS-SUBMIT TPDU or the SMS-COMMAND TPDU.
Called Party Number	-	M	This IE contains a number to identify the subscriber for whom the Short Message is destined. The Called Party Number shall be the MSISDN of the served subscriber.
Calling Party Number	M	C	For MO SMS: This IE contains a number to identify the subscriber who requests the SM submission. The Calling Party Number shall be the MSISDN of the served subscriber. For MT SMS: This IE contains the address of the submitter of the short message. For SMS-DELIVER TPDU, the Calling Party Number shall be retrieved from the TP-Originating-Address in the SMS-DELIVER TPDU. For SMS-STATUS-REPORT TPDU, this element shall not be included in this IF.
Event Type	M	M	This IE indicates the armed event resulting in the Initial DP SMS IF.
IMSI	M	M	This IE identifies the mobile subscriber.
Location Information In MSC	C	C	This IE is described in a table below.
Location Information In SGSN	C	C	This IE is described in a table below.
Service Key	M	M	This IE indicates to the gsmSCF the requested CAMEL Service. It is used to address the required application/SLP within the gsmSCF.
Time And Timezone	M	M	This IE contains the time that the gsmSSF or gprsSSF was triggered, and the time zone the gsmSSF or gprsSSF resides in.
TP Short Message Specific Information	M	M	This IE contains the first octet of the applicable TPDU. For SMS-SUBMIT, the following elements may be included: - Message Type Indicator - Reject Duplicates - Validity Period Format - Status Report Request - User Data Header Indicator - Reply Path For SMS-COMMAND, the following elements may be included: - Message Type Indicator - User Data Header Indicator - Status Report Request For SMS-DELIVER, the following elements may be included: - Message Type Indicator - More Messages to Send - Status Report Indication - User Data Header Indicator - Reply Path For SMS-STATUS-REPORT, the following elements may be included: - Message Type Indicator - More Messages to Send - Status Report Qualifier - User Data Header Indicator Refer to 3GPP TS 23.040 [14] for an indication of which elements of this 1st octet are Mandatory and which elements are Conditional.
TP Protocol Identifier	M	C	This IE indicates the protocol used above SM-Transfer Layer. The TP Protocol Identifier shall be retrieved from the applicable TPDU. For SMS-STATUS-REPORT, the sending of this IE is Conditional, depending on its presence in the SMS-STATUS-REPORT TPDU.
TP Data Coding Scheme	C	C	This IE indicates the data coding scheme of the TP-User Data field, and may indicate a message class. The message class may indicate e.g. the originator of the Short Message. The TP Data Coding Scheme shall be retrieved from the applicable TPDU. For SMS-COMMAND, this IE shall not be included in this IF.

Information element name	MO	MT	Description
TP Validity Period	S	-	This IE indicates the length of the validity period or the absolute time of the validity period termination. This IE is used only for the SMS-SUBMIT TPDU. The TP Validity Period, if available, shall be retrieved from the SMS-SUBMIT TPDU. For other TPDU, this IE shall not be included in this IF.
SMSC Address	M	M	For MO SMS: This IE defines the address of the SMSC to which the MO short message is intended to be submitted. It shall be retrieved from the RP-Destination-Address in the RP-MO-DATA RPDU. For MT SMS: This IE identifies the address of the SMSC from which the MT short message is originating. It shall be retrieved from the RP-Originating-Address in the RP-MT-DATA RPDU.
SMS Reference Number	M	M	This IE carries the SMS Reference Number. This Reference Number is allocated by the MSC or SGSN that processes the Short Message. It may be used by the gsmSCF for inclusion in a gsmSCF SMS record.
MSC Address	S	S	This IE carries the E.164 MSC Address. This IE shall be present if the Short Message processing takes place in an MSC. Otherwise shall be absent.
SGSN Number	S	S	This IE carries the Global Title of the SGSN. See 3GPP TS 23.060 [15]. This IE shall be present if the Short Message processing takes place in an SGSN. Otherwise shall be absent.
GPRS MS Class	C	-	This IE contains the MS network and radio access capabilities if the short message is being transferred through an SGSN.
MS Classmark 2	C	-	This IE contains the MS classmark 2 if the short message is being transferred through an MSC.
IMEI (with software version)	C	-	This IE contains the IMEISV (as defined in 3GPP TS 23.003 [7]) of the ME in use by the served subscriber.
Note: Refer to 3GPP TS 23.040 [14] for a description and encoding of the various TP-DUs and RP-DUs.			

Location Information in MSC is based on the Location Information IE defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	MO	MT	Description
Location number	C	C	See 3GPP TS 23.018 [12].
VLR number	M	M	See 3GPP TS 23.018 [12].
Age of location information	-	M	See 3GPP TS 23.018 [12].
Current Location Retrieved	-	-	Not applicable
Selected LSA Identity	S	S	This IE is applicable only if SoLSA is supported by the MSC. This IE indicates the LSA identity associated with the current position of the MS. It shall be shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority shall be present. See 3GPP TS 23.073 [18].

Location Information in SGSN is based on the Location Information For GPRS IE defined in the subclause 11.3.6.1.2. The following differences and clarifications apply:

Information element name	MO	MT	Description
Service area ID	C,E	C,E	
Cell ID	C,E	C,E	
Location area ID	C,E	C,E	
Routeing area ID	C	C	
Geographical information	C	C	
Geodetic information	-	-	Not applicable
Age of location information	-	-	Not applicable
Current Location Retrieved	-	-	Not applicable

7.6.2 gsmSCF to gsmSSF or gprsSSF information flows

7.6.2.1 Connect SMS

7.6.2.1.1 Description

This IF is used to request the gsmSSF or gprsSSF to perform the actions to route the Short Message to a specific destination (for MO SMS) or to deliver the Short Message to the MS (for MT SMS).

7.6.2.1.2 Information Elements

Information element name	MO	MT	Description
Calling Partys Number	O	O	This IE indicates the subscriber who sent the SMS; possibly changed by the gsmSCF. If the Short Message type is SMS-SUBMIT or SMS-COMMAND, then this IE, if present, it shall replace the RP-Originating-Address in the RP-MO-DATA RPDU (CHOICE set to MSISDN). If the Short Message type is SMS-DELIVER, then this IE, if present, shall replace the TP-Originating-Address in the SMS-DELIVER TPDU. If the Short Message type is SMS-STATUS-REPORT, then this IE, if present, shall be ignored.
Destination Subscriber Number	O	-	This IE identifies the Destination short message entity; possibly changed by the gsmSCF. This IE, if present, shall replace the TP-Destination-Address in the SMS-SUBMIT TPDU or SMS-COMMAND-TPDU.
SMSC Address	O	-	This IE indicates the SMSC address to which the MO short message shall be submitted; possibly changed by the gsmSCF. This IE, if present, shall replace the RP-Destination-Address in the RP-MO-DATA RPDU (CHOICE set to serviceCentreAddressDA).

7.6.2.2 Continue SMS

7.6.2.2.1 Description

This information flow requests the gsmSSF or gprsSSF to proceed normally. The gsmSSF or gprsSSF completes DP processing, and continues with the SMS handling.

7.6.2.2.2 Information Elements

This IF contains no information elements.

7.6.2.3 Furnish Charging Information SMS

7.6.2.3.1 Description

This IF is used to request the gsmSSF or gprsSSF to include information in the CAMEL specific logical MO SMS or MT SMS record.

The logical call record is created when FCI-SMS is received and a logical call record for that short message does not exist. For modelling purposes the logical call record is buffered in the gsmSSF or gprsSSF. The gsmSSF or gprsSSF completes logical call records as defined in the SDLs. Once the logical call record is completed, then its free format data are moved to the corresponding CDR and the logical call record is deleted.

The gsmSCF can send multiple concatenated FCIs per Short Message for completion. The total maximum of free format data is 160 octets per SM. The 160 octets may be sent in one or more FCI IFs. If there are incomplete free format data and new FCI IFs is/are received to overwrite the incomplete data, then the incomplete data are discarded and the gsmSCF can send another 160 octets per SM.

7.6.2.3.2   Information Elements

Information element name	MO	MT	Description
FCI Billing Charging Characteristics	M	M	This IE is described in a table below.

FCI Billing Charging Characteristics contains the following information element:

Information element name	MO	MT	Description
FCIBCCCAMEL Sequence 1	M	M	This IE is described in a table below.

FCIBCCCAMEL Sequence 1 contains the following information elements:

Information element name	MO	MT	Description
Free Format Data	M	M	This IE contains free format data to be inserted in the CAMEL logical call record.
Append Free Format Data	O	O	This IE indicates that the gsmSSF or gprsSSF shall append the free format data to the Logical MO SMS or MT SMS record. - If this IE is present indicating "Append", the gsmSSF or gprsSSF shall append the free format data received in this IF to the free format data already present in the Logical MO SMS or MT SMS record. - If this IE is absent or indicates "Overwrite", then the gsmSSF shall overwrite all free format data already present in the Logical MO SMS or MT SMS record, by the free format data received in this IF. If no Logical MO SMS or MT SMS record exists yet, then the gsmSSF or gprsSSF shall ignore this IE.

7.6.2.4   Release SMS

7.6.2.4.1   Description

This IF is used to tear down by the gsmSCF an existing SMS transfer.

7.6.2.4.2   Information Elements

Information element name	MO	MT	Description
RP Cause	M	M	SMS Cause. Indicates the SMS specific cause of the release. The cause is reported to the MS (in the case of MO SMS) or SMSC (in the case of MT SMS). For MO SMS, the RP Cause value shall be used to set the RP-Cause in the RP-ERROR RPDU sent to the MS. 3GPP TS 24.011 [31] specifies which RP-Cause values may be sent to the MS. For MT SMS, the RP Cause value shall be used to set the RP-Cause in the RP-ERROR RPDU sent to the SMSC. 3GPP TS 29.002 [34] specifies which RP-Cause values may be sent to the SMSC.

7.6.2.5   Request Report SMS Event

7.6.2.5.1   Description

This IF is used to request the gsmSSF or gprsSSF to monitor for an event and to send a notification to the gsmSCF when the event is detected (see Event Report SMS IF).

7.6.2.5.2   Information Elements

Information element name	MO	MT	Description
SMS Event	M	M	This IE specifies the event or events of which a report is requested.

SMS Event contains the following information elements:

Information element name	MO	MT	Description
Event Type	M	M	This IE specifies the type of event of which a report is requested.
Monitor Mode	M	M	This IE indicates how the event shall be reported.

7.6.2.6 Reset Timer SMS

7.6.2.6.1 Description

This IF is used to refresh a gsmSSF or gprsSSF timer.

7.6.2.6.2 Information Elements

Information element name	MO	MT	Description
Timer Value	M	M	This IE specifies the value to which the indicated timer shall be set.
Timer ID	O	O	This IE indicates which timer shall be reset. It shall be set to 'Tssf'.

7.6.3 HLR to VLR or SGSN information flows

7.6.3.1 Delete Subscriber Data

7.6.3.1.1 Description

This IF is used by the HLR to delete CAMEL subscription data from a VLR or SGSN. It is specified in 3GPP TS 29.002 [34]

7.6.3.1.2 Information Elements

The Delete Subscriber Data IF contains the following CAMEL specific information elements:

Information element name	Status	Description
CAMEL Subscription Info Withdraw	O	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR or SGSN.
Specific CSI Withdraw	O	This IE is used to indicate that only MO-SMS-CSI or MT-SMS-CSI shall be deleted from the VLR or SGSN. This IE should not be present when CAMEL Subscription Info Withdraw is present.

7.6.3.2 Insert Subscriber Data

7.6.3.2.1 Description

This IF is used by the HLR to insert subscriber data in the VLR or SGSN. It is specified in 3GPP TS 29.002 [34].

7.6.3.2.2 Information Elements

The Insert Subscriber Data contains the following CAMEL specific information elements:

Information element name	Status	Description
MO-SMS-CSI	O	This IE identifies the subscriber as having MO SMS CAMEL services.
MT-SMS-CSI	O	This IE identifies the subscriber as having MT SMS CAMEL services.

MO-SMS-CSI contains the following information elements:

Information element name	Status	Description
gsmSCF Address	M	See subclause 7.3.1.1.
Service Key	M	See subclause 7.3.1.2.
Default SMS Handling	M	See subclause 7.3.1.3.
CAMEL Capability Handling	M	See subclause 7.3.1.5.
SMS Triggers	M	See subclause 7.3.1.4. It includes the following trigger: SMS_Collected_Info

MT-SMS-CSI contains the following information elements:

Information element name	Status	Description
gsmSCF Address	M	See subclause 7.3.2.1.
Service Key	M	See subclause 7.3.2.2.
Default SMS Handling	M	See subclause 7.3.2.3.
CAMEL Capability Handling	M	See subclause 7.3.2.6.
SMS Triggers	M	See subclause 7.3.2.4. It includes the following trigger: SMS_Delivery_Request.
SMS Trigger Criteria	C	See subclause 7.3.2.5.

7.6.4 VLR or SGSN to HLR information flows

7.6.4.1 Insert Subscriber Data ack

See subclause 4.6.8.1. This information flow is sent by the VLR.

7.6.4.2 Update Location

See subclause 4.6.8.3.

7.6.4.3 Update GPRS Location

7.6.4.3.1 Description

This IF is used by the SGSN to indicate to the HLR the CAMEL phases and CAMEL phase 4 CSIs offered by the SGSN. It is specified in 3GPP TS 29.002 [34].

7.6.4.3.2 Information Elements

Update GPRS location contains the following CAMEL specific information element:

Information element name	Status	Description
Supported CAMEL Phases	S	This IE indicates which CAMEL phases are supported by the SGSN. The SGSN may indicate support of CAMEL phase 3 or higher. It shall be present when the SGSN supports CAMEL.
Offered CAMEL4 CSIs	S	This IE indicates the CAMEL phase 4 CSIs offered in the SGSN. It shall be present if the "Supported CAMEL Phases" IE contains support of CAMEL phase 4.

Offered CAMEL4 CSIs contains the following information elements:

Information element name	Status	Description
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI

7.6.5 VLR to MSC Information Flows

7.6.5.1 Continue CAMEL SMS Handling

7.6.5.1.1 Description

This IF is used to instruct the MSC to continue the CAMEL specific handling.

7.6.5.1.2 Information Elements

Information element name	Status	Description
MT-SMS-CSI	M	This IE contains the CAMEL Subscription Information for MT SMS.
IMSI	M	IMSI of the served subscriber.
MSISDN	M	MSISDN of the served subscriber.

7.6.5.2 Send Info For MO SMS ack

7.6.5.2.1 Description

This IF is used to transport MO SMS related subscription data from the VLR to the MSC. It is specified in 3GPP TS 29.002 [34].

7.6.5.2.2 Information Elements

Information element name	Status	Description
MO-SMS-CSI	C	This IE contains the CAMEL Subscription Information for MO SMS.
ODB Data	C	This IE contains ODB data. This information is used to apply ODB for a reconnected Short Message, if needed.
CB SS Data	C	This IE contains CB SS data. This information is used to apply CB for a reconnected Short Message, if needed.

7.6.6 MSC to VLR Information Flows

7.6.6.1 Send Info For MT SMS

7.6.6.1.1 Description

This IF is described in 3GPP TS 29.002 [34]; it is used to request the VLR to provide information to handle an MT SMS.

7.6.6.1.2 Information Elements

Send Info For MT SMS contains the following CAMEL specific information element:

Information element name	Status	Description
Suppress MT-SMS-CSI	S	This IE indicates to the VLR that it shall not return MT-SMS-CSI to the MSC. This IE shall not be present in the first interrogation; it shall be present in the second interrogation.

8   SS Notifications

8.1   Architecture

8.1.1   Functional Entities used for CAMEL

This subclause describes the functional architecture needed to support Supplementary Service (SS) Notifications. Figure 8.1 shows the functional entities involved in sending SS Notifications. The architecture is applicable to the third phase of CAMEL or higher.
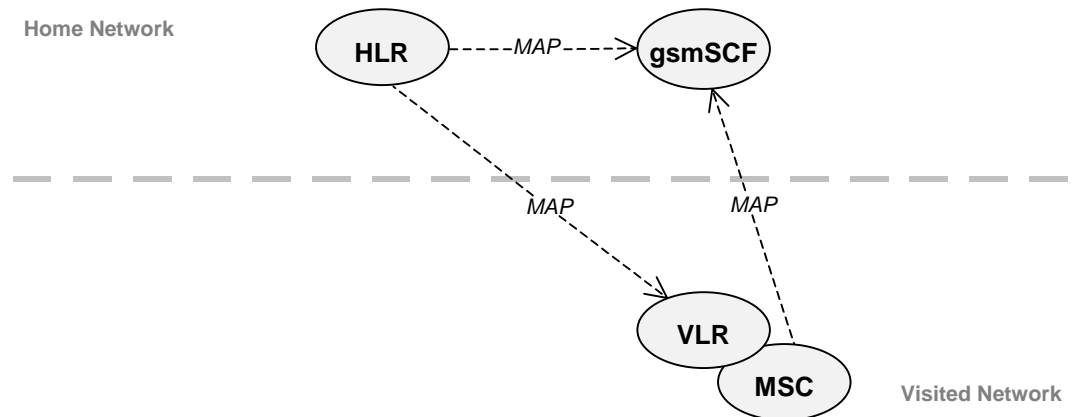
Figure 8.1: Functional architecture for support of SS Notifications

HLR: For subscribers requiring CAMEL support, the HLR stores the information relevant to the current subscription regarding SS-CSI. The SS-CSI is sent to the VLR at Location Update, on Data Restoration or if the SS-CSI is updated by administrative action. When processing an invocation of the CCBS supplementary service, the HLR shall send a notification of the invocation of the supplementary service to the gsmSCF if required by the SS-CSI.

MSC: When processing an invocation of any of the supplementary services ECT, CD and MPTY, the MSC may receive an SS-CSI from the VLR, indicating that a notification of the invocation of the supplementary service shall be sent to the gsmSCF.

VLR: The VLR stores the SS-CSI as a part of the subscriber data for subscribers roaming in the VLR area.

gsmSCF: The gsmSCF receives the SS Invocation Notification from the MSC or HLR.

8.1.2   Interfaces defined for SS Notifications

This subclause describes the different interfaces applicable to SS Notifications. It specifies on a high level the functions specific to SS Notifications.

8.1.2.1   MSC - gsmSCF interface

This interface is used by the MSC to send supplementary service invocation notifications to the gsmSCF. The SS invocations that can be notified to the gsmSCF via this interface are Call Deflection (CD), Explicit Call Transfer (ECT) and Multi Party (MPTY).

8.1.2.2   HLR - gsmSCF interface

This interface is used by the HLR to send supplementary service invocation notifications to the gsmSCF. The SS invocation that can be notified to the gsmSCF via this interface is Call Completion to Busy Subscriber (CCBS).

8.1.2.3 VLR - MSC interface

This interface is used by the VLR to transfer SS-CSI to the MSC.

8.1.2.4 HLR-VLR interface

This interface is used by the HLR to send the SS-CSI to the VLR or to remove SS-CSI from the VLR.

8.2 Description of CAMEL Subscriber Data

8.2.1 Supplementary Service Invocation Notification CAMEL Subscription Information (SS-CSI)

This subclause defines the contents of the Supplementary Service Invocation Notification CAMEL Subscription Information (SS-CSI).

8.2.1.1 Notification criteria

This data indicates for which supplementary services notifications shall be sent. The supplementary services which may be indicated are ECT, CD, CCBS and MPTY.

8.2.1.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

8.2.1.3 CSI state

The CSI state indicates whether the SS-CSI is active or not.

8.2.1.4 Notification flag

The notification flag indicates whether the change of the SS-CSI shall trigger Notification on Change of Subscriber Data or not.

8.2.2 gsmSCF address list for CSI

The gsmSCF address list indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

8.3 Procedures for CAMEL

8.3.1 Handling of Supplementary Service Invocation Notification

At the invocation of any of the services ECT, CD and MPTY the VLR checks whether the criteria for sending a notification are fulfilled, i.e. whether the subscriber is provisioned with the SS-CSI and the particular invoked supplementary service is marked in the SS-CSI. If this is the case a notification is sent to the gsmSCF given by the gsmSCF address contained in the SS-CSI. The processing of the particular SS invocation is not suspended. If the notification criteria are not fulfilled the processing of the particular supplementary service continues unchanged and no notification is sent.

The sending of the notification is independent of call related CAMEL processing, i.e. processing indicated by O/D/T/VT-CSI.

On invocation of ECT, the VLR shall include the SS-CSI in the Invoke ECT response message (see Process MAF027 in 3GPP TS 23.091 [25]) to the MSC if applicable for ECT.

On invocation of MPTY, the VLR shall include the SS-CSI in the Process MPTY message (see Process MPTY_MAF026 in 3GPP TS 23.084 [21]) to the MSC if applicable for MPTY.

On invocation of CD, the VLR shall include the SS-CSI in the Send Info For Incoming Call ack information flow to the MSC if applicable to CD (see 3GPP TS 23.072 [16]).

When a subscriber activates a CCBS request, the HLR checks whether the criteria for sending a notification are fulfilled, i.e. whether

- The subscriber is provisioned with an active SS-CSI, and

- CCBS is marked in the SS-CSI.

If the criteria are fulfilled, a notification is immediately sent to the gsmSCF given by the gsmSCF address contained in the SS-CSI and the processing of the CCBS request continues. Whenever the state of the CCBS request changes (see 3GPP TS 23.093 [26]), an additional notification is immediately sent to the gsmSCF and the processing of the CCBS request continues.

If the criteria are not fulfilled, the processing of the CCBS request continues unchanged and no notifications are sent.

At the invocation of the CCBS supplementary service, the HLR checks whether the criteria for sending a notification are fulfilled, i.e. whether the subscriber is provisioned with the SS-CSI and the particular invoked supplementary service is marked in the SS-CSI. If this is the case, a notification is sent to the gsmSCF given by the gsmSCF address contained in the SS-CSI. The processing of the SS invocation is not suspended. If the notification criteria are not fulfilled the processing of the particular supplementary service continues unchanged and no notification are sent.

8.4 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for notification of Supplementary Service invocation.

Each Information Element (IE) is marked as Mandatory (M), Specific conditions (S) or Optional (O) in the "Status" column.

An 'M' IE shall always be included. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. An 'O' IE may be included or omitted as required by the service logic. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

Details of errors and exceptions to these rules are specified in are specified in 3GPP TS 29.002 [34].

8.4.1 MSC to gsmSCF information flows

8.4.1.1 SS Invocation Notification

8.4.1.1.1 Description

This IF is generated by the MSC when it shall notify the gsmSCF of a supplementary service invocation.

8.4.1.1.2 Information Elements

Information element name	Status	Description
Notification Event	M	This IE indicates the supplementary service invocation, resulting in the SS Invocation Notification IF. Only the following supplementary services are allowed: Explicit Call Transfer, Call Deflection, Multi Party.
Notification Event Specific Information	S	In the case of ECT, the sending entity shall include the called party for each call originated by the subscriber and relevant to the ECT invocation. Note: the subscriber may have originated zero, one or two calls relevant to the ECT service. In the case of CD, the deflected to number shall be included in this IE. In the case of MPTY, this IE shall be omitted.
IMSI	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.
MSISDN	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.

8.4.2 HLR to VLR information flows

8.4.2.1 Delete Subscriber Data

8.4.2.1.1 Description

This IF is used by the HLR to delete CAMEL subscription data from a VLR. Ii is specified in 3GPP TS 29.002 [34].

8.4.2.1.2 Information Elements

The Delete Subscriber Data IF contains the following CAMEL specific information elements for SS Notifications:

Information element name	Status	Description
CAMEL Subscription Info Withdraw	O	This IE identifies that all CSIs shall be deleted from the subscriber data in the VLR.
Specific CSI Withdraw	O	This IE is used to indicate that only SS-CSI shall be deleted from the VLR. This IE should not be present when CAMEL Subscription Info Withdraw is present.

8.4.2.2 Insert Subscriber Data

8.4.2.2.1 Description

This IF is used by an HLR to update a VLR with certain subscriber data. This IF is specified in 3GPP TS 29.002 [34].

8.4.2.2.2 Information Elements

The Insert Subscriber Data contains the following CAMEL specific information element for SS Notifications:

Information element name	Status	Description
SS-CSI	O	This IE is described in subclause 8.2.1. This IE identifies the subscriber as having supplementary service invocation notification services. It contains the Notification Criteria and gsmSCFAddress. When SS-CSI is sent to the VLR, it shall not contain a marking for CCBS.

8.4.3 HLR to gsmSCF information flows

8.4.3.1 SS Invocation Notification

This IF is generated by the HLR when it shall notify the gsmSCF of a supplementary service invocation.

8.4.3.1.2   Information Elements

Information element name	Status	Description
Notification Event	M	This IE indicates the supplementary service invocation, resulting in the SS Invocation Notification IF. Only the following supplementary services are allowed: Completion of Calls to Busy Subscriber
IMSI	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.
MSISDN	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.
B-Number	M	This IE indicates the destination address of the CCBS request.
CCBS Request State	M	This IE identifies the current state of the CCBS request. It can be one of: - Request; - Recall; - Active; - Completed; - Suspended; - Frozen; - Deleted.

8.4.4   VLR to MSC information flows

8.4.4.1   Invoke SS result

8.4.4.1.1   Description

This IF is used by the VLR to send SS-CSI to the MSC. This IF is specified in 3GPP TS 29.002 [34].

8.4.4.1.2   Information Elements

The Invoke SS result contains the following CAMEL specific information element for SS Notifications:

Information element name	Status	Description
SS-CSI	C	This IE is included when it is available in the VLR and either ECT or MPTY has been successfully invoked and that supplementary service has been marked for notification.

8.4.4.2   Send Info For Incoming Call ack

8.4.4.2.1   Description

This IF is used by the VLR to send SS-CSI to the MSC. This IF is specified in 3GPP TS 23.018 [12].

8.4.4.2.2   Information Elements

The Send Info For Incoming Call ack contains the following CAMEL specific information elements for SS Notifications:

Information element name	Status	Description
SS-CSI	S	This IE is included when it is available in the VLR and CD has been successfully invoked and that supplementary service has been marked for notification.

9 Mobility Management

9.1 Architecture

9.1.1 Functional Entities used for CAMEL

This subclause describes the functional architecture required to support Mobility Management in CAMEL. Figures 9.1-1 and 9.1-2 show the functional entities involved in CAMEL support of Mobility Management. The architecture in the figure 9.1-1 is applicable to the third phase of CAMEL or higher and the architecture in the figure 9.1-2 is applicable to the fourth phase of CAMEL.
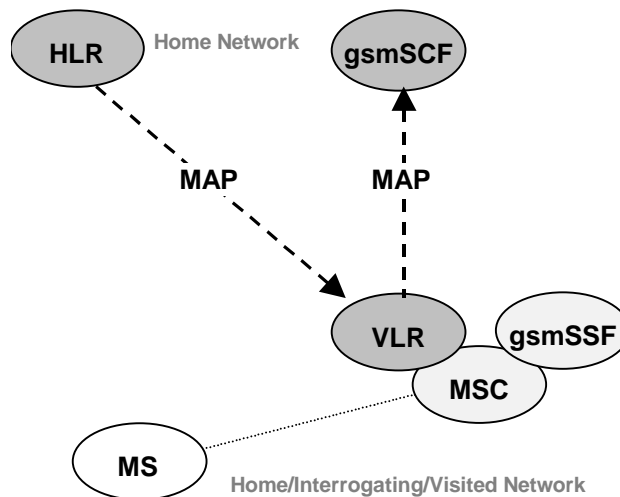
Figure 9.1-1: Functional architecture for CS subscriber support of CAMEL
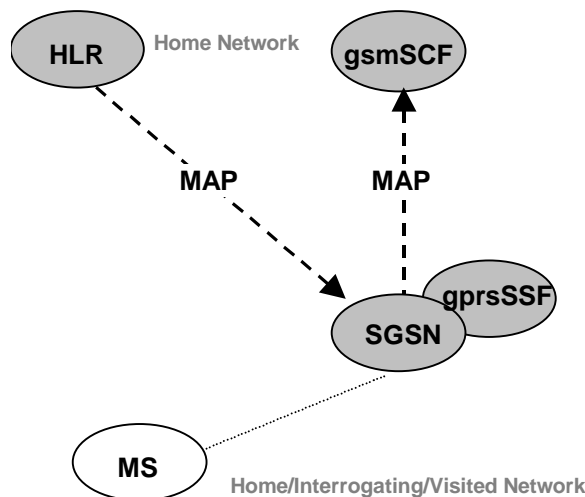
Figure 9.1-2: Functional architecture for GPRS subscriber support of CAMEL

gsmSCF: see subclause 3.1.

HLR: The HLR contains Mobility management CAMEL Subscription Information (M-CSI) for those CS subscribers that require CAMEL control of Mobility Management events and Mobility management GPRS CAMEL Subscription Information (MG-CSI) for those GPRS subscribers that require CAMEL control of Mobility Management events. M-CSI is sent to the VLR during the Location Update and Restore Data procedures or when M-CSI is modified in the HLR. The M-CSI is deleted in the VLR with the Delete Subscriber Data procedure. MG-CSI is sent to the SGSN during the GPRS Location Updating procedure or when MG-CSI is modified in the HLR. The MG-CSI is deleted in the SGSN with the Delete Subscriber Data procedure.

MS: Mobile Station.

MSC: see subclause 4.1.

VLR: After having completed a Mobility Management event from a CS subscriber, the VLR may find it necessary to send a notification to the gsmSCF. The content of M-CSI indicates which Mobility Management events shall be reported to the gsmSCF.

SGSN: After having completed a Mobility Management event from a GPRS subscriber, the SGSN may find it necessary to send a notification to the gsmSCF. The content of MG-CSI indicates which Mobility Management events shall be reported to the gsmSCF.

9.1.2 Interfaces defined for CAMEL

This subclause describes the different interfaces applicable to CAMEL control of Mobility Management events. It specifies on a high level the functions specific to CAMEL.

9.1.2.2 VLR - gsmSCF interface

This interface is used by the VLR to send Mobility Management event notifications to the gsmSCF. When processing a mobility management event, the VLR may find it necessary to send a notification to the gsmSCF, depending on the presence of M-CSI for the subscriber and the contents of M-CSI.

9.1.2.3 SGSN - gsmSCF interface

This interface is used by the SGSN to send Mobility Management event notifications to the gsmSCF. When processing a mobility management event, the SGSN may find it necessary to send a notification to the gsmSCF, depending on the presence of MG-CSI for the subscriber and the contents of MG-CSI.

9.2 Description of CAMEL Subscriber Data

9.2.1 Mobility Management CAMEL Subscription Information (M-CSI)

This subclause specifies the contents of the Mobility Management CAMEL Subscription Information (M-CSI).

9.2.1.1 Mobility Management Triggers

This data indicates which Mobility Management events shall result in a notification to the gsmSCF. One or more events may be marked per subscriber. These events are:

- Location update in the same VLR service area.

- Location update to another VLR service area.

- IMSI attach.

- MS initiated IMSI detach (explicit detach).

- Network initiated IMSI detach (implicit detach).

9.2.1.2 gsmSCF address

This is the address of the gsmSCF where the Mobility Management event notification shall be sent to. The gsmSCF address is in E.164 format.

9.2.1.3 Service Key

The Service Key is included in the notification information flow to the gsmSCF. It indicates to the gsmSCF which Service Logic shall be applied.

9.2.1.4 CSI state

The CSI state indicates whether the M-CSI is active or not.

9.2.1.5 Notification flag

The notification flag indicates whether the change of the M-CSI shall trigger Notification on Change of Subscriber Data or not.

9.2.2 Mobility Management for GPRS CAMEL Subscription Information (MG-CSI)

This subclause specifies the contents of the Mobility Management for GPRS CAMEL Subscription Information (MG-CSI).

9.2.2.1 Mobility Management Triggers

This data indicates which Mobility Management events shall result in a notification to the gsmSCF. One or more events may be marked per subscriber. These events are:

- Routeing area update of MS to a different SGSN service area (update from mew SGSN);

- Routeing area update of MS to a different SGSN service area (disconnect by detach);

- Routeing area update of MS within the same SGSN service area;

- GPRS attach (e.g. MS switched on, successful routeing area update after network initiated transfer to "MS not reachable for paging");

- MS-initiated GPRS detach (e.g. MS switched off);

- Network-initiated GPRS detach.

- Network-initiated transfer to the "not reachable for paging" state (the network has not received a periodic routeing area update from the MS and assumes that the MS is unreachable).

9.2.2.2 gsmSCF address

This is the address of the gsmSCF where the Mobility Management event notification shall be sent to. The gsmSCF address is in E.164 format.

9.2.2.3 Service Key

The Service Key is included in the notification information flow to the gsmSCF. It indicates to the gsmSCF which Service Logic shall be applied.

9.2.2.4 CSI state

The CSI state indicates whether the MG-CSI is active or not.

9.2.2.5 Notification flag

The notification flag indicates whether the change of the MG-CSI shall trigger Notification on Change of Subscriber Data or not.

9.2.3 gsmSCF address list for CSI

The gsmSCF address list indicates the gsmSCF addresses to which Notification on Change of Subscriber Data shall be sent. This list is common to all CSI.

9.3 Procedures for Mobility management

9.3.1 Procedures for Mobility management for CS subscriber

The different procedures for Mobility Management are shown in Figures 9.2-1 to 9.2-5.

Figure 9.2-1: Location Update within a single VLR Service Area. (The VLR Service area may be in the HPLMN or in the VPLMN.);

Figure 9.2-2: Location Update from one VLR Service Area to another VLR Service Area. (Both VLR Service Areas are in the HPLMN or in the same VPLMN.);

Figure 9.2-3: Location Update from one PLMN to another PLMN;

- update from HPLMN to VPLMN;

- update from VPLMN to HPLMN;

- update from one VPLMN to another VPLMN.

Figure 9.2-4: IMSI Detach (in HPLMN or in VPLMN);

- explicit detach (the MS has been switched off by the subscriber);

- implicit detach (the network has not received a periodic paging update from the MS and assumes that the MS is switched off or unreachable).

Figure 9.2-5: IMSI Attach (in HPLMN or in VPLMN);

- attach (the MS has been switched on by the subscriber - subscription data is still available in the VLR, no location update is needed).
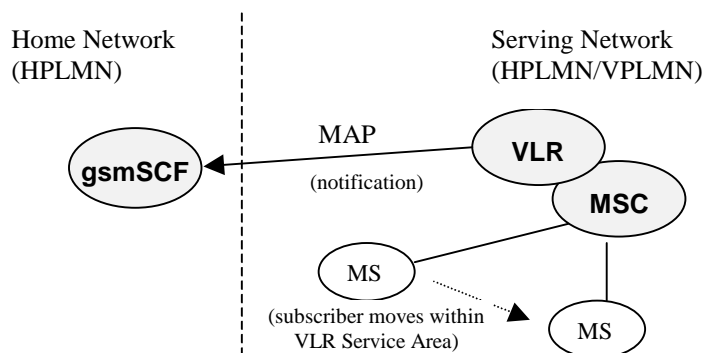
Figure 9.2-1: Location Update within a single VLR Service Area
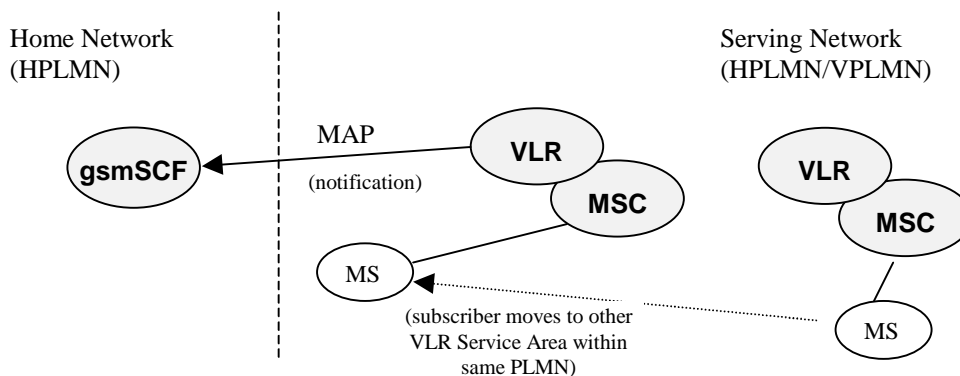
Figure 9.2-2: Location Update from one VLR Service Area to another VLR Service Area
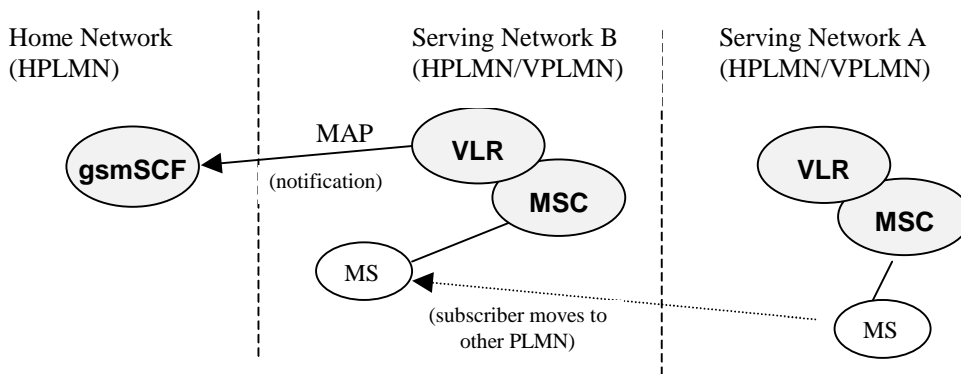
Figure 9.2-3: Location Update from one PLMN to another PLMN
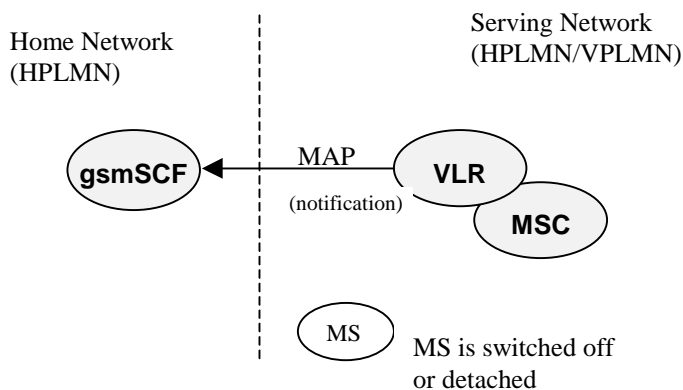
Figure 9.2-4: IMSI Detach (implicit/explicit)
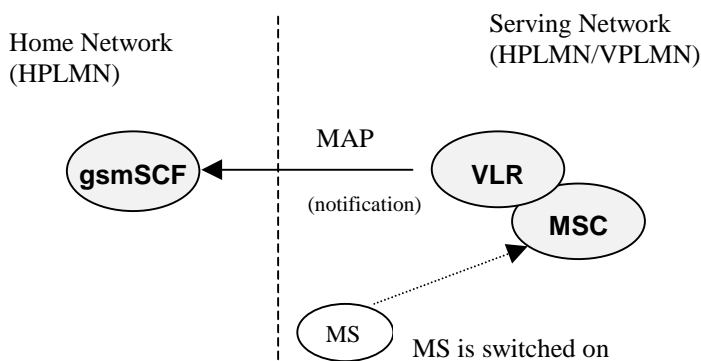
Figure 9.2-5: IMSI Attach

When a Mobility Management Event has taken place and the processing has been completed, then the VLR may find it necessary to send a notification to the gsmSCF. The processing of the Mobility Management event in the VLR is not suspended by the sending of the notification nor is it in any way affected by the notification.

The sending of a Mobility Management notification to gsmSCF is independent of other CAMEL subscription data for a subscriber. E.g. a subscriber may have M-CSI without O-CSI or VT-CSI.

The sending of a Mobility Management event notification is subscription based.

Refer to subclause 9.2.1 for a description of M-CSI and the different Mobility Management events that may lead to a notification to the gsmSCF.

9.3.1.1 Procedure descriptions

9.3.1.1.1 Procedure Set_Notification_Type

This procedure is called from process Update_Location_VLR in 3GPP TS 23.012 [10]. It checks the information element 'Location Update Type', which the VLR receives from the MSC via MAP_UPDATE_LOCATION_AREA service. This element identifies the type of Location Update requested by the mobile station.

The possible values of this parameter are specified in 3GPP TS 24.008 [30].

The type of Location Update that was requested by the mobile station determines which Mobility Management notification information flow shall be sent to the gsmSCF.

The values 'Periodic Updating' and 'Reserved' shall not lead to a Mobility Management notification to the gsmSCF.

Procedure Set_Notification_Type 1(1)

/* Determining the type of Mobility
Management event notification
to be sent to the gsmSCF. */

Location
Update Type?

'IMSI Attach'

'Nomal
Location
Updating'

'Reserved'
or
'Periodic Updating'

Previous
LAI in
VLR?

No

Yes

Notify :=
Attach

Notify := Location
update in the same
VLR Service Area

Notify := Location
update to the new
VLR Service Area

No notification
required
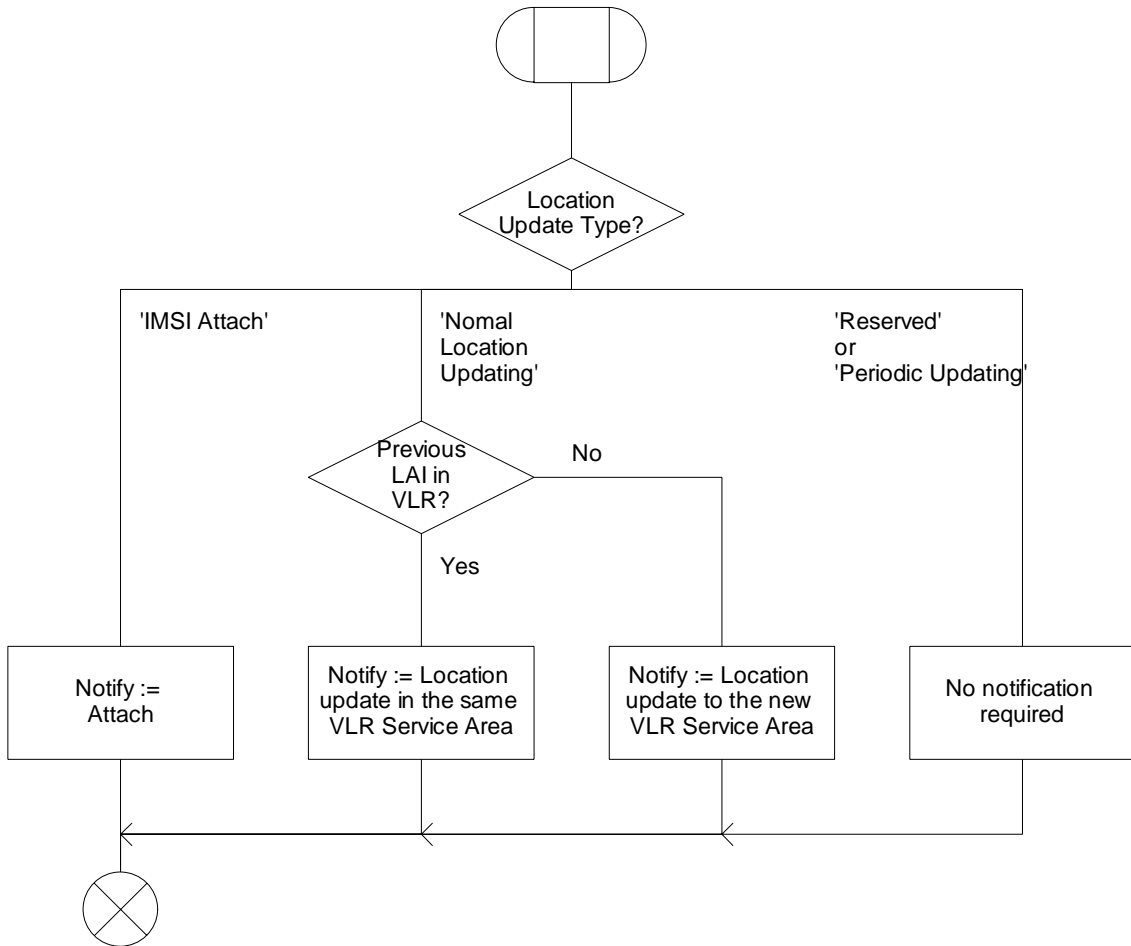
Figure 9.-1a: Procedure Set_Notification_Type (sheet 1)

9.3.1.1.2 Procedure Notify_gsmSCF

This procedure is called from the process 'Update_Location_Area_VLR' and process 'Detach_IMSI_VLR' in 3GPP TS 23.012 [10]. It is also called from the process 'Update_Location_VLR' in 3GPP TS 29.002 [34].

The calling process passes on the variable 'Notify' to the procedure 'Notify_gsmSCF'. This variable indicates which Mobility Management notification may be necessary to be sent to the gsmSCF. If this variable has a value NULL, then no notification shall be sent to the gsmSCF.

If a notification may be necessary to be sent to the gsmSCF, then the procedure checks the presence of M-CSI.

- If M-CSI is present and the Mobility Management event indicated in the variable 'Notify' is marked in M-CSI, then a notification shall be sent to the gsmSCF.

- If M-CSI is not present or the Mobility Management event indicated in the variable 'Notify' is not marked in M-CSI, then no notification shall be sent to the gsmSCF.

Procedure Notify_gsmSCF   1(1)

/* Sending a notification to the gsmSCF, if needed. */

/* Signals to/from the right are to/from the process 'MM_Event_Notification_VLR' in 3GPP TS 29.002. */

No ← Event notification required?

Yes

Send MM Event Notification

Waiting_for_ Notification_Reply

Send MM Event Notification Positive Response

Send MM Event Notification Negative Response

Figure 9.3-1: Procedure Notify_gsmSCF (sheet 1)

9.3.2 Procedures for Mobility management for GPRS subscriber

The different procedures for Mobility Management are shown in figures 9.4-1 to 9.4-5.
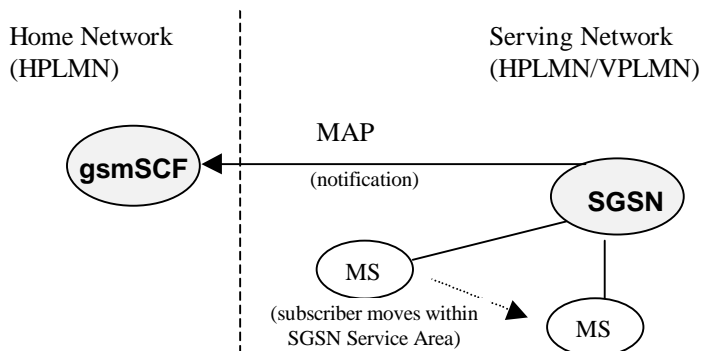
Figure 9.4-1: Routeing Area Update within SGSN Service Area
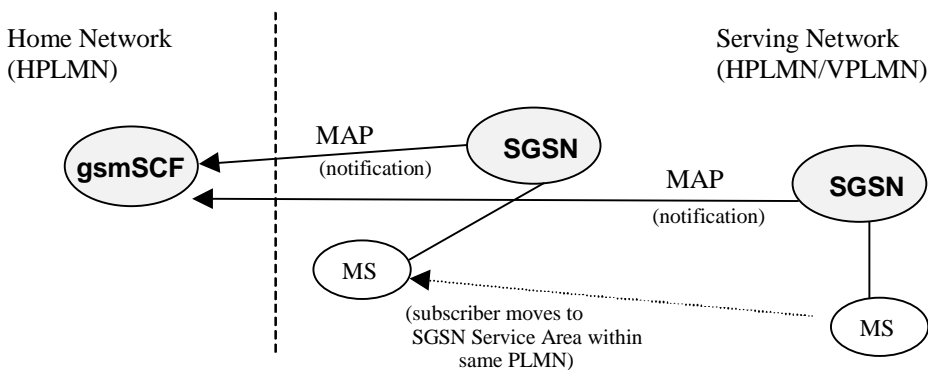
Figure 9.4-2: Routeing Area Update from one SGSN Service Area to another SGSN Service Area
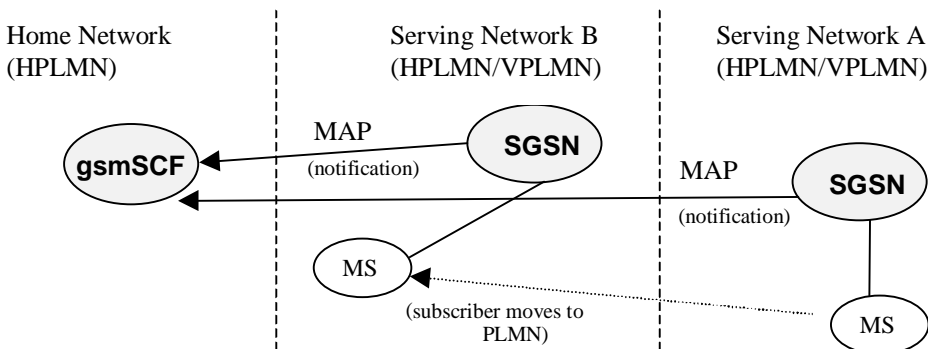
Figure 9.4-3: Routeing Area Update from one PLMN to another PLMN
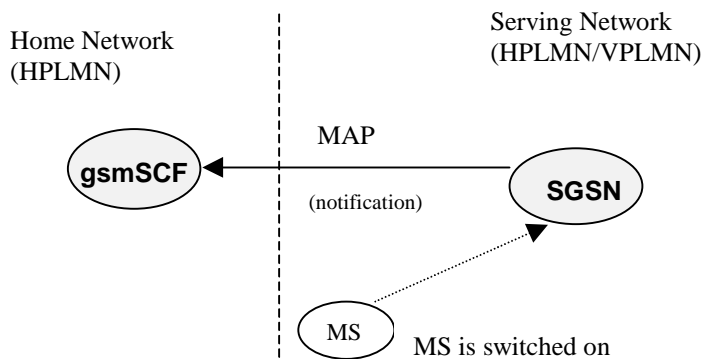
Figure 9.4-4: Attach of MS
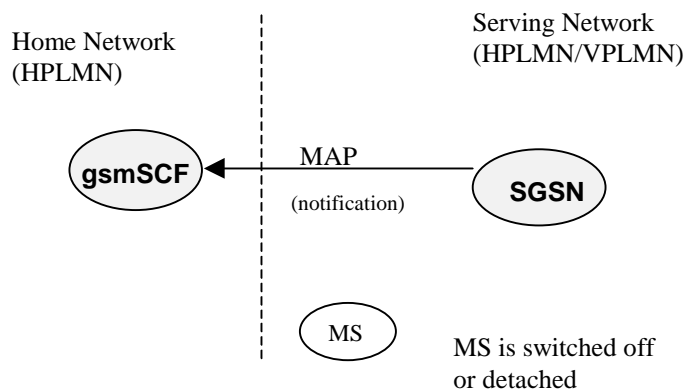
Figure 9.4-5: GPRS detach

When a Mobility Management Event has taken place and the processing has been completed, then the SGSN may have to send a notification to the gsmSCF.

The sending of a Mobility Management notification to gsmSCF is independent of other CAMEL subscription data for a subscriber. E.g. a subscriber may have MG-CSI without GPRS-CSI.

The sending of a Mobility Management event notification is subscription based.

Refer to subclause 9.2.2 for a description of MG-CSI and the different Mobility Management events that may lead to a notification to the gsmSCF.

9.3.2.1   Procedure CAMEL_PS_Notification

This procedure is called from processes in 3GPP TS 23.060 [15]. When this procedure is called, it checks the presence of MG-CSI. If there is no MG-CSI, then no notification is sent to the gsmSCF.

Procedure CAMEL_PS_Notification 1(1)

/* procedure in the SGSN for mobility management for GPRS subscriber */

MG-CSI present?

No

Yes

Set_PS_ Notification_Type

Notify_ PS_gsmSCF

Result := Continue
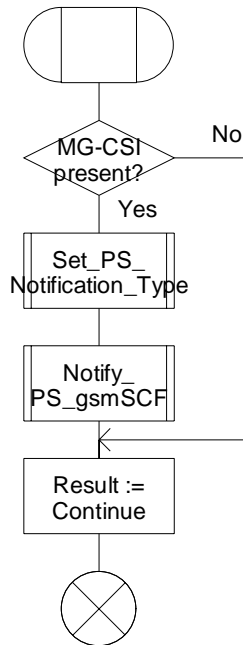
Figure 9.5-1: Procedure CAMEL_PS_Notification (sheet 1)

Procedure Set_PS_Notification_Type 1(1)

/* Determining the type of Mobility Management event notification to be sent to the gsmSCF. */

MS not reachable for paging

Event type?

Routeing area update

Routeing Area Update Type?

'Attach'

'PS Detach'

'Nomal Routeing Area Update'

Others

No notification required

Notify:=MS not reachable for paging

Due to routeing area update

Detach reason?

Other

Previous Routeing Area in this SGSN?

Yes

No

Notify := Attach

Notify:= Detach

(1)

(2)

(3)
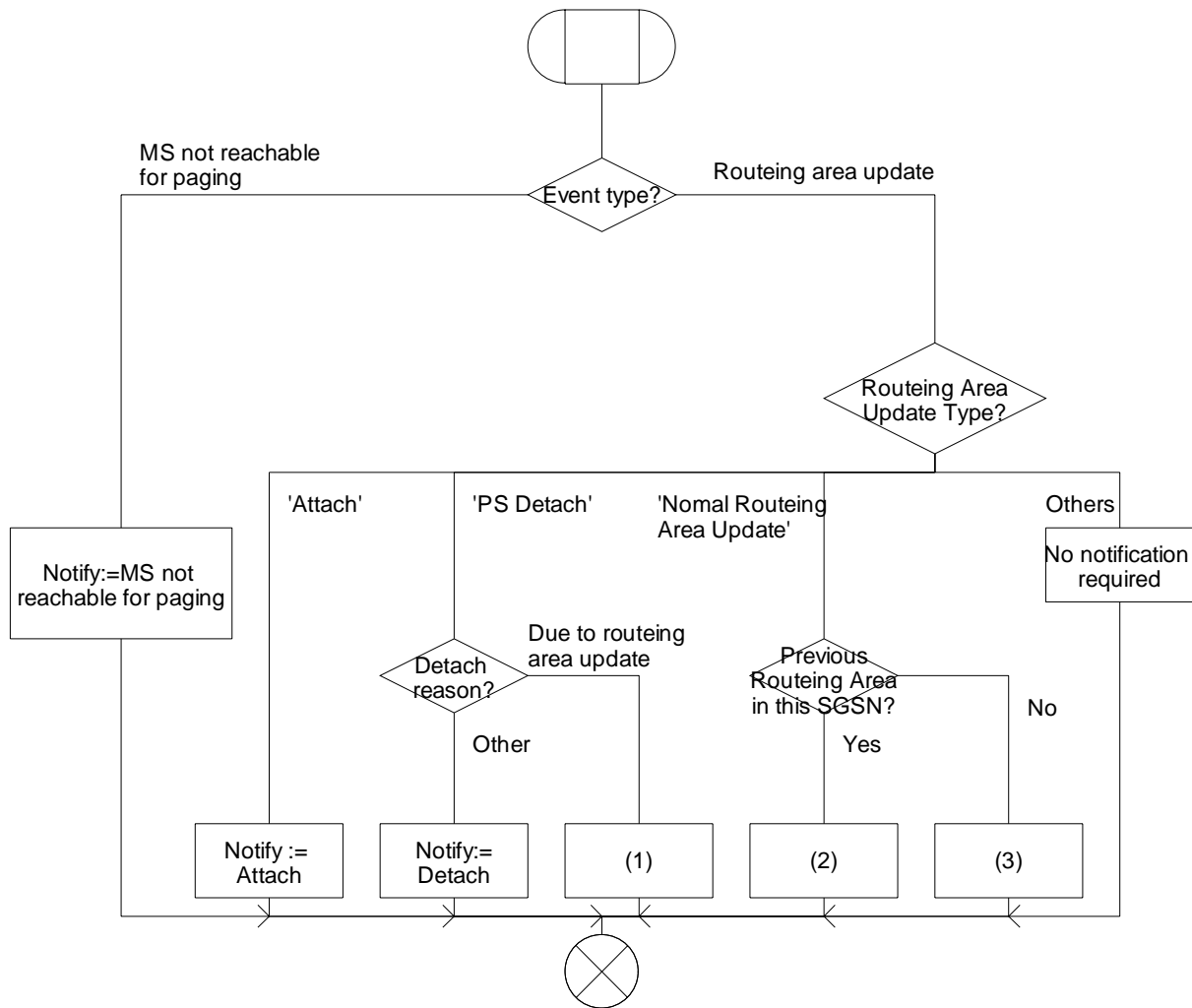
(1) Notify := Routeing Area Update to new SGSN Service Area (disconnect by detach)
(2) Nofity := Routeing Area Update in the same SGSN Service Area
(3) Nofity := Routeing Area Update to new SGSN Service Area (update from new SGSN)

Figure 9.6-1: Procedure Set_PS_Notification_Type (sheet 1)

Procedure Notify_PS_gsmSCF   1(1)

/* Sending a notification to the gsmSCF, if needed. */

/* Signals to/from the right are to/from the process 'MM_Event_Notification_VLR/SGSN' in 3GPP TS 29.002. */

No ← Event notification required?

Yes

Send MM Event Notification

Waiting_for_ Notification_Reply

Send MM Event Notification Positive Response

Send MM Event Notification Negative Response
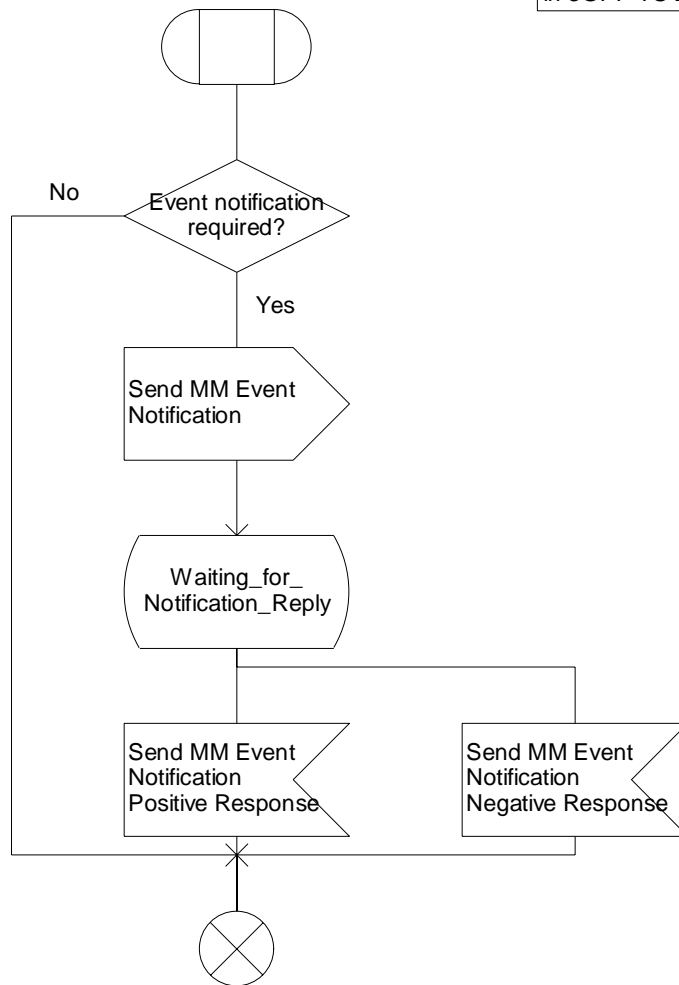
Figure 9.7-1: Procedure Notify_PS_gsmSCF (sheet 1)

9.4 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for Mobility Management control.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Specific conditions (S), mutually Exclusive (E), Optional (O) or not applicable (-) for each different entity involved: VLR (VLR) and SGSN (SGSN) where distinction is applicable. If the IEs in one table apply in both VLR and SGSN, then the IEs are marked in the "Status" column.

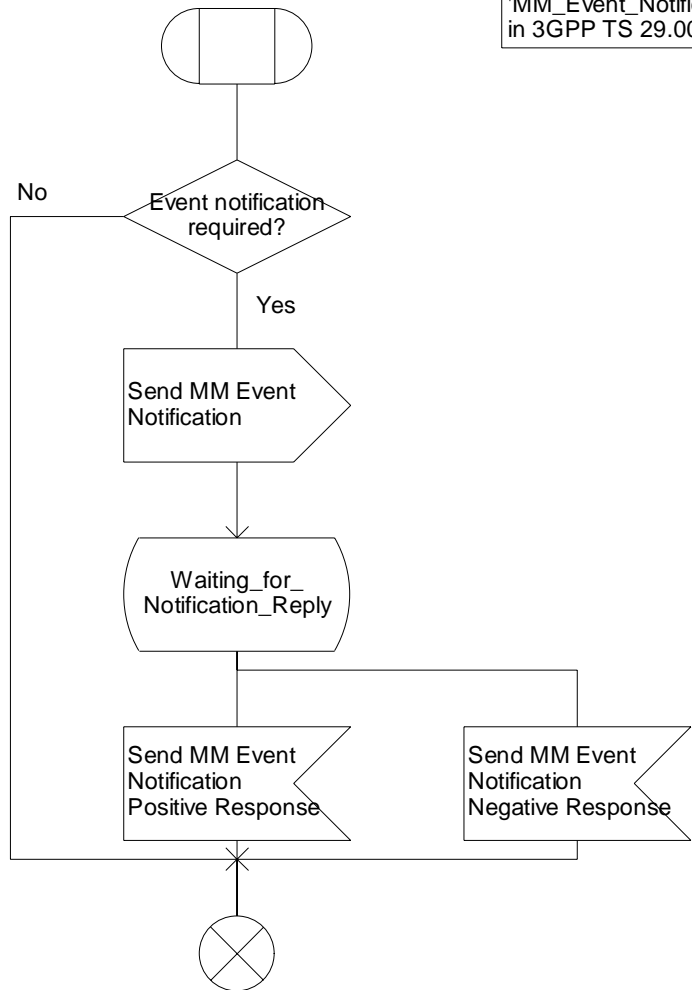An 'M' IE shall always be included. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. When a set of 'E' IEs is shown in the definition of an Information Flow or compound IE, only one of those IEs may be included. An 'O' IE may be included or omitted as required by the service logic. A '-' IE shall always be omitted. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support;

- The VLR shall functionally support all IEs which can be sent to it;

- The SGSN shall functionally support all IEs which can be sent to it.

9.4.1 VLR or SGSN to gsmSCF information flows

9.4.1.1 Mobility Management event Notification

9.4.1.1.1 Description

This IF is generated by the VLR or SGSN to notify the gsmSCF of a Mobility Management event.

9.4.1.1.2 Information Elements

Information element name	VLR	SGSN	Description
Event Met	M	M	This IE indicates the type of Mobility Management event that lead to the notification. Refer to subclause 9.2.1.1 for the CS subscriber and subclause 9.2.2.1 for the GPRS subscriber.
Service Key	M	M	This IE indicates the Service Logic that the gsmSCF shall apply.
IMSI	M	M	This IE identifies the mobile subscriber to whom the Mobility Event applies.
Basic MSISDN	M	M	This IE identifies the mobile subscriber to whom the Mobility Event applies.
Location Information for CS subscriber	C	-	This IE is described in a table below. This IE indicates the current location of the MS.
Location Information for GPRS subscriber	-	C	This IE indicates the current location of the MS which is equivalent to the location info SGSN IE in subclause 7.6.1.2.
Supported CAMEL Phases	M	M	This IE indicates the CAMEL Phases that are supported by the sending entity (VMSC/VLR or SGSN) in which the MS is registered after the mobility management event.
Offered CAMEL4 Functionalities	M	-	This IE is described in subclause 4.6.1.8. It indicates the CAMEL phase 4 functionalities offered by the VMSC/VLR.

Location Information for CS subscriber is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	Status	Description
Service area ID	C,E	See 3GPP TS 23.018 [12].
Cell ID	C,E	See 3GPP TS 23.018 [12].
VLR Number	M	See 3GPP TS 23.018 [12].
Current Location Retrieved	-	Not applicable
Location area ID	C,E	See 3GPP TS 23.003 [7].
Selected LSA Identity	S	This IE indicates the LSA identity associated with the current position of the MS. It shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority it shall be present. See 3GPP TS 23.073 [18].

9.4.2 SGSN to HLR information flows

9.4.2.1 Update GPRS Location

See subclause 6.6.4.2.

9.4.3 VLR to HLR information flows

9.4.3.1 Update Location

See subclause 4.6.8.3.

9.4.3.2 Restore Data

See subclause 4.6.8.4.

9.4.4 HLR to VLR or SGSN information flows

9.4.4.1 Delete Subscriber Data

9.4.4.1.1 Description

This IF is used by an HLR to delete CAMEL subscription data from a VLR or SGSN. It is specified in 3GPP TS 29.002 [34].

9.4.4.1.2 Information Elements

The Delete Subscriber Data IF contains the following CAMEL specific information elements for Mobility Management:

Information element name	VLR	SGSN	Description
CAMEL Subscription Info Withdraw	O	O	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR or SGSN.
Specific CSI Withdraw	O	O	This IE is used to indicate that only M-CSI or MG-CSI shall be deleted from the VLR or SGSN respectively. It should not be present when CAMEL Subscription Info Withdraw is present.

9.4.4.2 Insert Subscriber Data

9.4.4.2.1 Description

This IF is used by an HLR to update a VLR or SGSN with certain subscriber data. This IF is specified in 3GPP TS 29.002 [34].

9.4.4.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific information elements for Mobility Management:

Information element name	VLR	SGSN	Description
M-CSI	O	-	This IE identifies the CS subscriber as having mobility management notification services. It contains the events that shall be reported, the gsmSCF Address and the Service Key.
MG-CSI	-	O	This IE identifies the GPRS subscriber as having mobility management notification services. It contains the events that shall be reported, the gsmSCF Address and the Service Key.

M-CSI contains the following information elements:

Information element name	Status	Description
GsmSCF Address	M	This IE is described in subclause 9.2.1.
Service Key	M	This IE is described in subclause 9.2.1.
Mobility Management Triggers	M	This IE indicates which Mobility Management events shall be reported to the gsmSCF. It shall contain one or more of the following elements: - Location update in the same VLR service area - Location update to another VLR service area - IMSI attach - MS initiated IMSI detach (explicit detach) - Network initiated IMSI detach (implicit detach)

MG-CSI contains the following information elements:

Information element name	Status	Description
GsmSCF Address	M	This IE is described in subclause 9.2.2.
Service Key	M	This IE is described in subclause 9.2.2.
Mobility Management Triggers	M	This IE is described in subclause 9.2.2.

10 Control and interrogation of subscription data

Support of the procedures described in this clause in CAMEL Phase 4 is a network operator option.

10.1 Architecture

10.1.1 Functional Entities used for CAMEL

This subclause describes the functional architecture required to support control and interrogation of subscription data. Figure 10.1 shows the functional entities involved in CAMEL support of control and interrogation of subscription data.
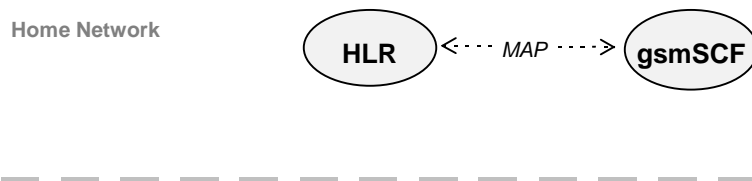
Figure 10.1: Functional architecture for support of control and interrogation of subscription data

gsmSCF: see subclause 3.1.

HLR: The HLR may provide an interface to the gsmSCF for the Any Time Subscription Interrogation and Any Time Modification procedures. The gsmSCF may provide an interface to the HLR for the Notify Subscriber Data Change procedure.

10.1.2 Interfaces defined for CAMEL

This subclause describes the interface applicable to CAMEL control of subscription data. It specifies on a high level the functions specific to CAMEL.

10.1.2.1 gsmSCF - HLR

This interface is used by the gsmSCF to interrogate or modify information in the HLR. As a network operator option, the HLR may refuse to provide or modify the information requested by the gsmSCF. This interface is also used by the HLR to notify the gsmSCF of a change of subscriber data.

10.2 Procedures for CAMEL

10.2.1 Any Time Subscription Interrogation

Handling of Any Time Interrogation for Subscription Information Retrieval involves the following process:

- CAMEL_ATSI_HLR.

If an OSS needs the Subscription Information, the gsmSCF initiates a transaction to the HLR by sending an Any Time Subscription Interrogation Request.

Process CAMEL_ATSI_HLR 1(2)

/* Process in the HLR receiving an Any Time Subscription Interrogation request from gsmSCF. */

/* Signals to/from the left are to/from the gsmSCF. */
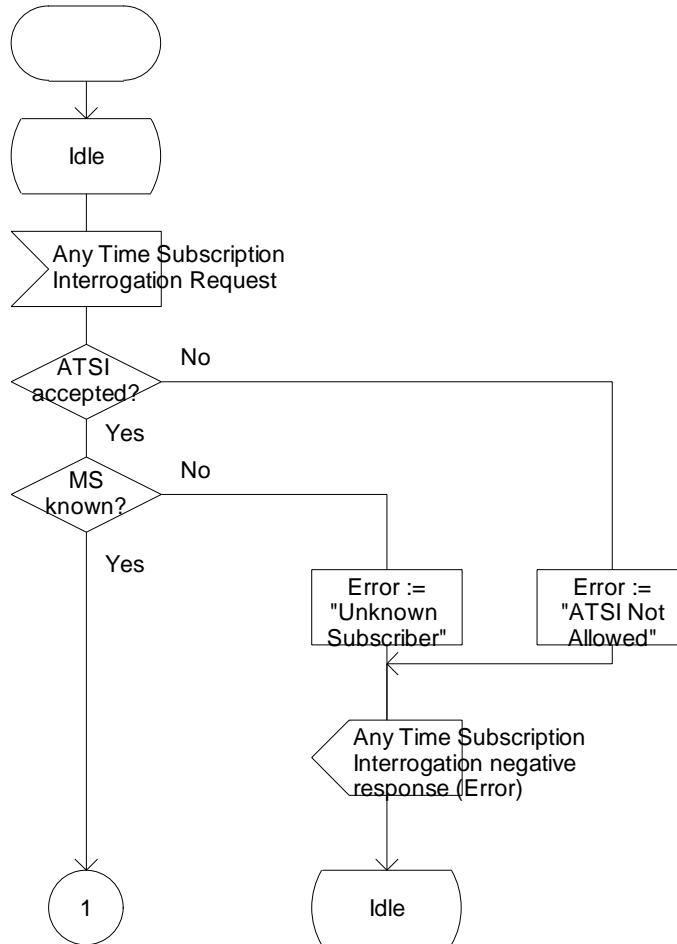
Figure 10.2-1: Process CAMEL_ATSI_HLR (sheet 1)

Process CAMEL_ATSI_HLR 2(2)

/* Process in the HLR receiving an Any Time Subscription Interrogation request from gsmSCF. */

/* Signals to/from the left are to/from the gsmSCF. */
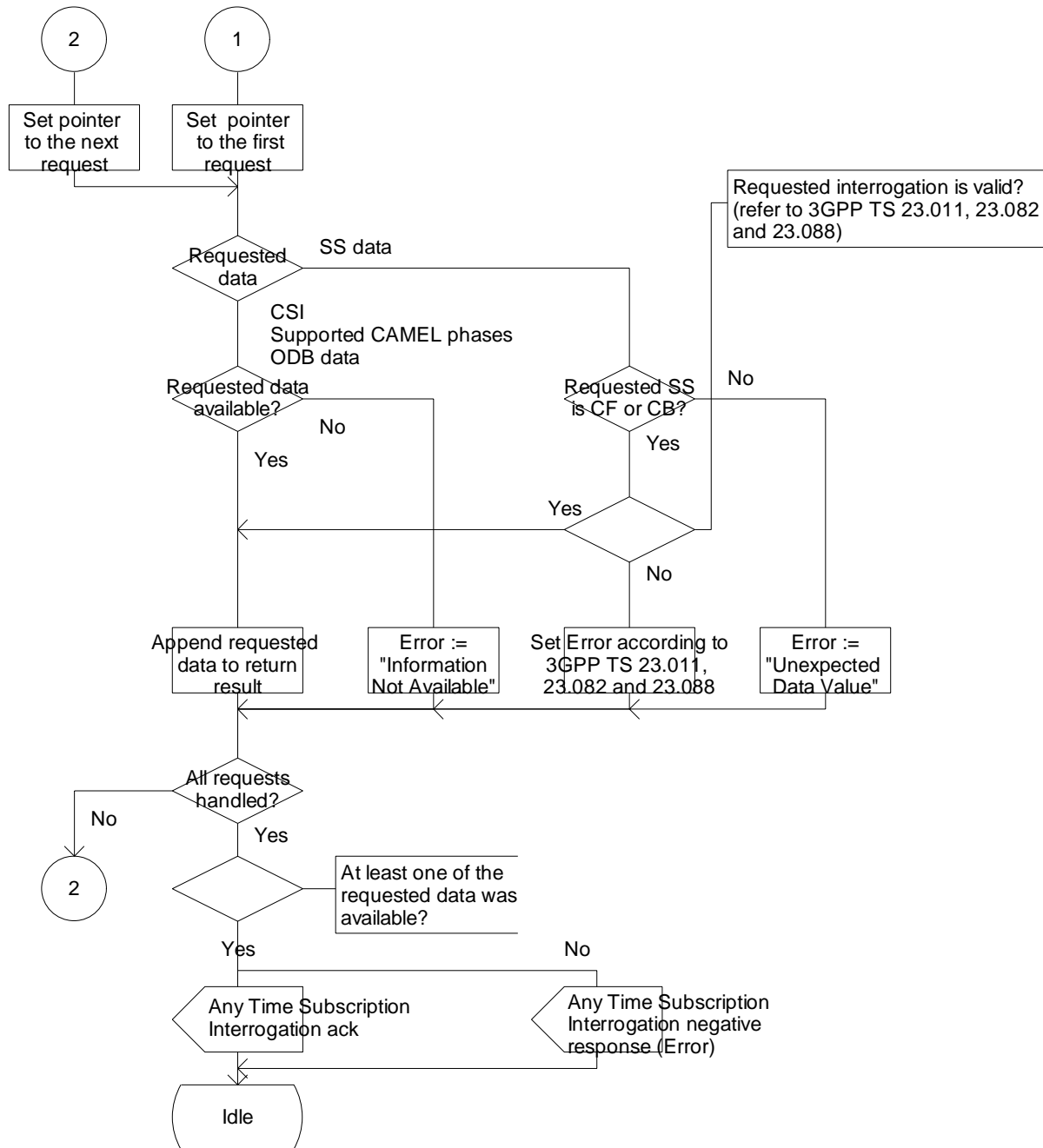
Figure 10.2-2: Process CAMEL_ATSI_HLR (sheet 2)

10.2.2   Any Time Modification

Handling of Any Time Modification involves the following process:

- CAMEL_ATM_HLR.

The following procedures are involved:

- ATM_Modify_Data
  This procedure checks which data shall be modified and calls the appropriate data modification procedure.

- ATM_Modify_CSI_Data
  If the CSI indicated in the ATM request is not available in the HLR, then an error is returned.
  Otherwise, the CSI state and/or Notification-to-CSE flag are set as instructed with the ATM request.

- ATM_Modify_CF_Data
  When only the SS-code and (optionally) a Basic Service code are present in the ATM request, then all Call Forwarding data belonging to this SS code and basic service code is erased, the associated notificationToCSE flag is unchanged and the SS-Status is amended according to the state transition model defined in 3GPP TS 23.082 [20].
  Otherwise, the behaviour is as follows:

  - If a valid SS state is present in the ATM request, then an SS state transition is performed.

  - If a valid FTN, FTN sub address or No Reply Condition Time is present in the ATM request, then the indicated variable is modified.

  - Before modification of CF data (SS state changed to 'registered', insert or change of FTN), the interaction checks between CF and ODB and between CF and CB shall be performed as described in 3GPP TS 23.015 [11] and TS 23.082 [20] respectively. The CF data shall only be modified if the changed new CF data does not conflict with the existing ODB or CB entries.

  - If an instruction to modify the notification-to-CSE flag is present in the ATM request, then the notification-to-CSE flag is modified.

  - If the modification is partially successful (e.g. succeeds for one Basic Service but fails for another Basic Service), then the operation is partially accepted by the HLR. The accepted changes are made in the HLR and the changed data is sent in the ATM acknowledgement.

- ATM_Modify_CB_Data
  When only the SS-code and (optionally) a Basic Service code are present in the ATM request, then all Call Barring belonging to this SS code and basic service code is deactivated, the associated notificationToCSE flag is unchanged and the SS-Status is amended according to the state transition model defined in 3GPP TS 23.088 [23].
  Otherwise, the behaviour is as follows:

  - If a valid SS state is present in the ATM request, then an SS state transition is performed.

  - Before modification of CB data (SS state), the interaction checks between CF and CB shall be performed as described in 3GPP TS 23.088 [23]. The CB data shall only be modified if the changed new CB data does not conflict with the existing CF entries.

  - If a valid Password or 'Wrong password attempt counter' is present in the ATM request, then the indicated variable is modified.

  - If an instruction to modify the notification-to-CSE flag is present in the ATM request, then the notification-to-CSE flag is modified.

- ATM_Modify_ODB_Data

  - If ODB data is not present in the ATM request, then it is assumed that the ODB data is not modified. When present, the modification is done by overwriting the existing ODB data.

  - If an instruction to modify the notification-to-CSE flag is present in the ATM request, then the notification-to-CSE flag is modified.

- If the modification is partially successful (e.g. succeeds for one Basic Service but fails for another Basic Service), then the operation is partially accepted by the HLR. The accepted changes are made in the HLR and the changed data is sent in the ATM acknowledgement.

After having executed the Any Time Modification instruction from the gsmSCF, the HLR calls the procedure CAMEL_NSDC_HLR, which sends notifications to gsmSCF(s), if required.

Process CAMEL_ATM_HLR 1(1)

/* Process in the HLR receiving an Any Time Subscription Modification request from gsmSCF. */

/* Signals to/from the left are to/from the gsmSCF, unless otherwise indicated.*/

Idle

Any Time Modification request

ATM accepted? — No

Yes

MS known? — No

Yes

Requested data available? — No

Yes

ATM_Modify_ Data

Set UE= "Not available"

Set UE= "Unknown subscriber"

Set UE= "ATM Not Allowed"

Result? — Fail

Pass

Set Result to modified data

Any Time Modification ack

Any Time Modification Error

CAMEL_NSDC_ HLR

Idle
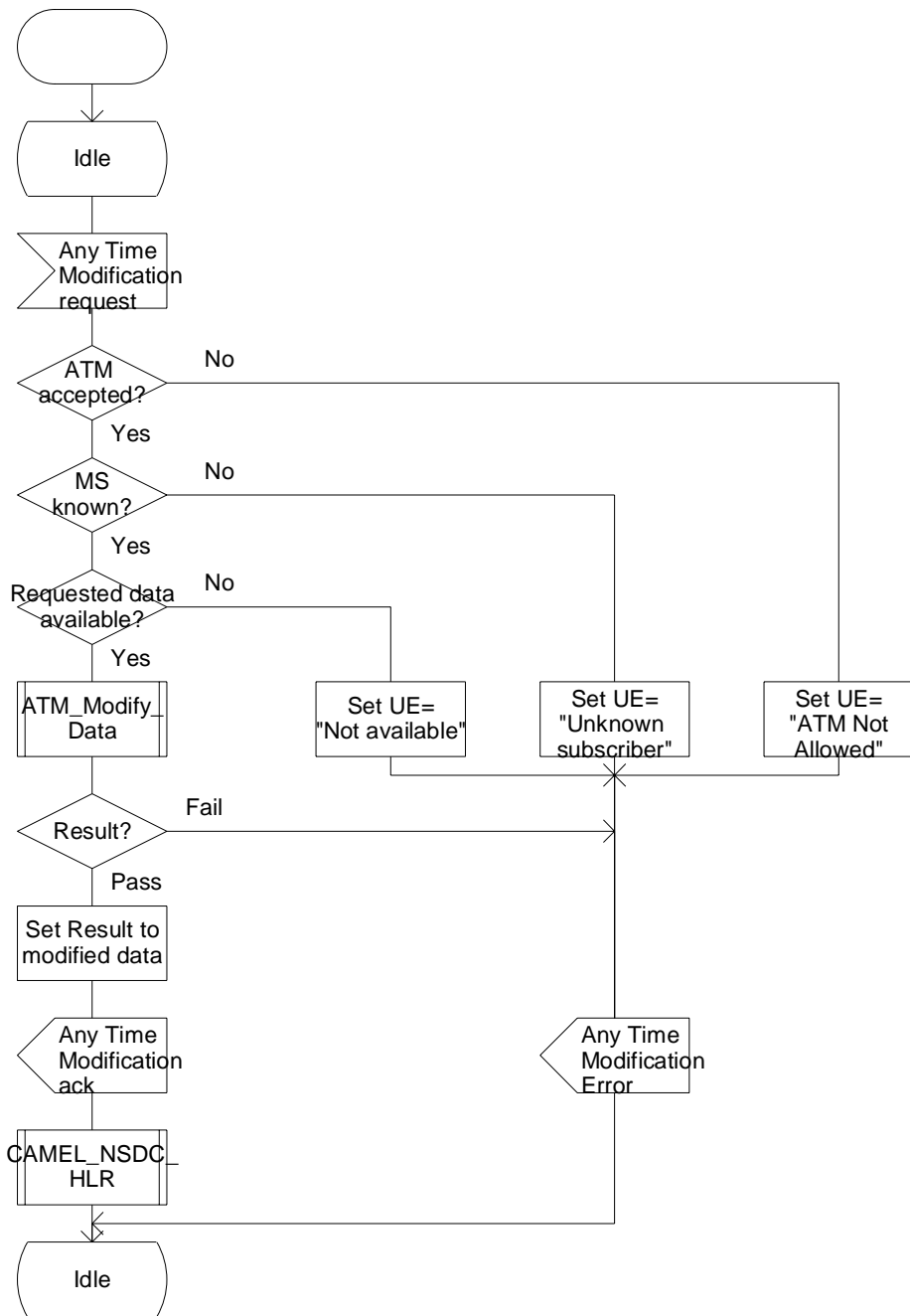
Figure 10.3-1: Process CAMEL_ATM_HLR (sheet 1)

Procedure ATM_Modify_Data 1(1)

/* Procedure in the HLR to modify subscriber
data as a result of an ATM request. */

Data to be
modified

CSI CF Data CB Data ODB Data

ATM_Modify_
CSI_Data

ATM_Modify_
CF_Data

ATM_Modify_
CB_Data

ATM_Modify_
ODB_Data

Result? Not OK

Result? Not OK

Result? Not OK

OK OK OK

Set UE:=
"InformationNot_
Available"

Set UE in accordance
with 3GPP TS 23.011
and 23.082

Set UE in accordance
with 3GPP TS 23.011
and 23.088

Set Result:=
"Pass"

Set Result:=
"Fail"
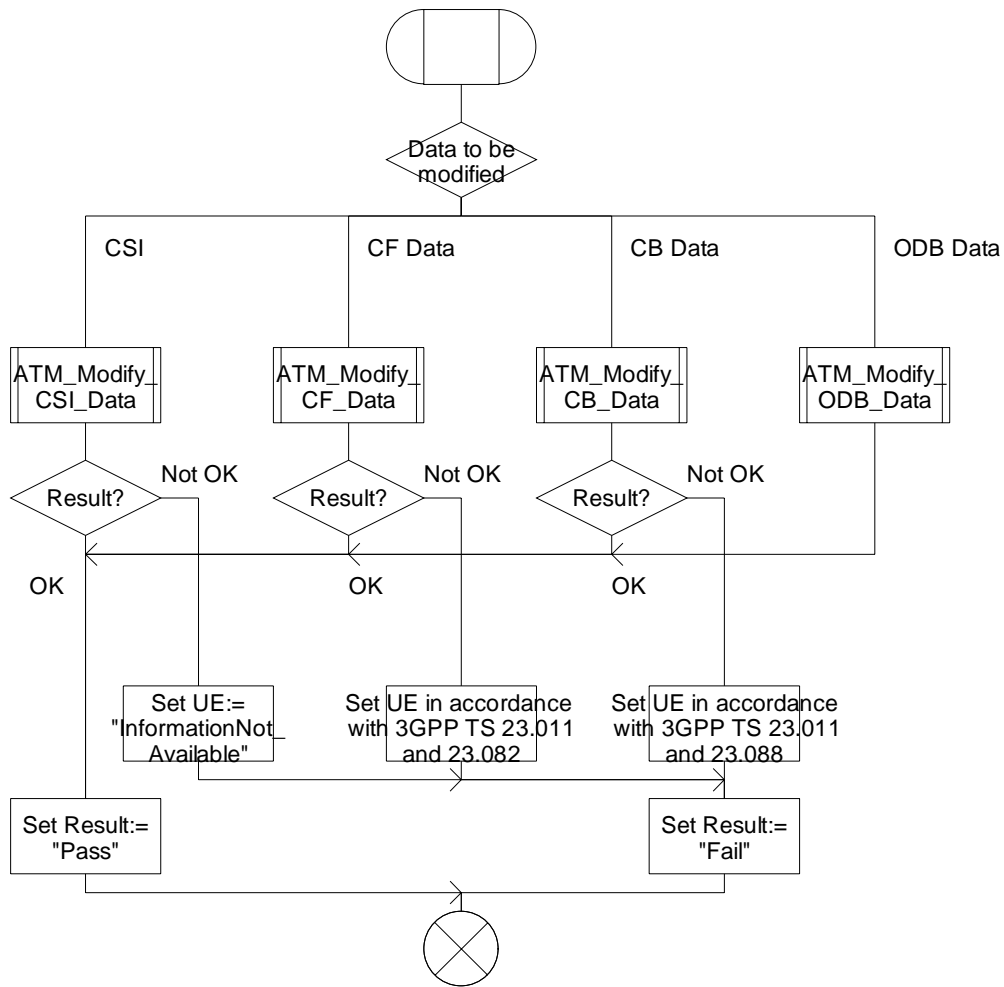
Figure 10.4-1: Procedure ATM_Modify_Data (sheet 1)

Procedure ATM_Modify_CSI_Data   1(1)

/* Procedure in the HLR to modify CSI data
as a result of an ATM request. */
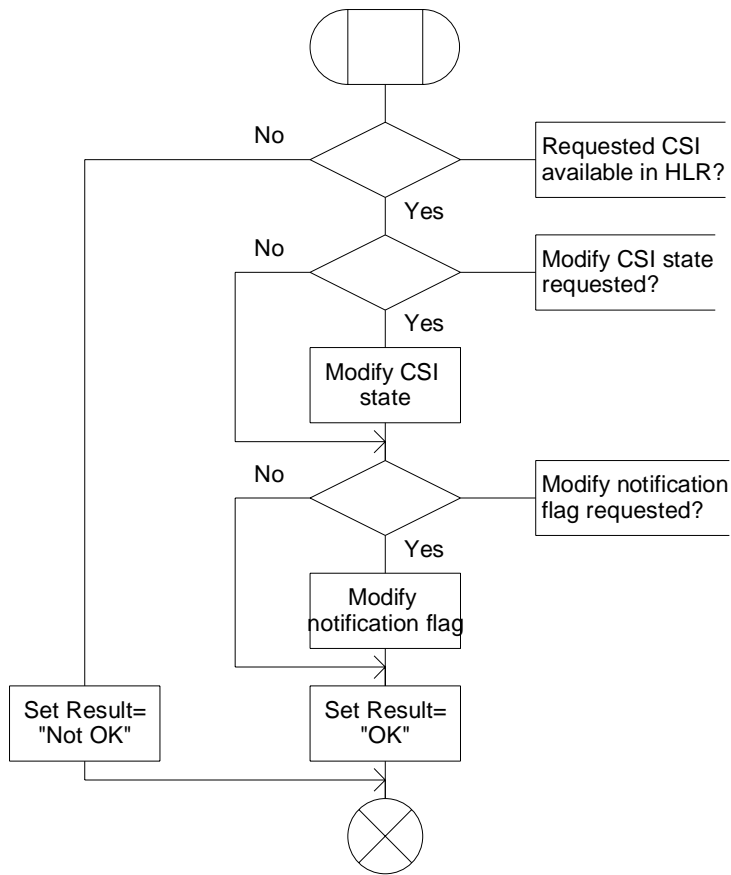
Figure 10.5-1: Procedure ATM_Modify_CSI_Data (sheet 1)

Procedure ATM_Modify_CF_Data   1(2)

/* Procedure in the HLR to modify Call Forwarding data, as a result of an ATM request. */

Set Result:= "Not OK"

Result is "OK" if anything succeeds

Only SS-code and (optionally) Basic Service present in ATM?

Notification flag instruction present in ATM?

Set notification-to-CSE flag

Basic Service code present in ATM?

Erase Call Forwarding Data

Set Call Forwarding state

Set Result:= "OK"

Compound basic service code?

Break All Basic Services into elementary group Basic Service Codes

Break compound code into elementary Basic Service group codes

2

Basic Service Codes left?

Take next/first Basic Service group

Note 1
When ATM contains "BasicService", then the changes to CF apply to that BasicService only. When ATM does not contain "BasicService", then the changes to CF apply to all BasicServices.

Note 2
Changes to Call Forwarding data shall be done in accordance with 3GPP TS 23.082 and 3GPP TS 23.011.

1

Figure 10.6-1: Procedure ATM_Modify_CF_Data (sheet 1)

Procedure ATM_Modify_CF_Data 2(2)

/* Procedure in the HLR to modify Call
Forwarding data, as a result of an
ATM request. */
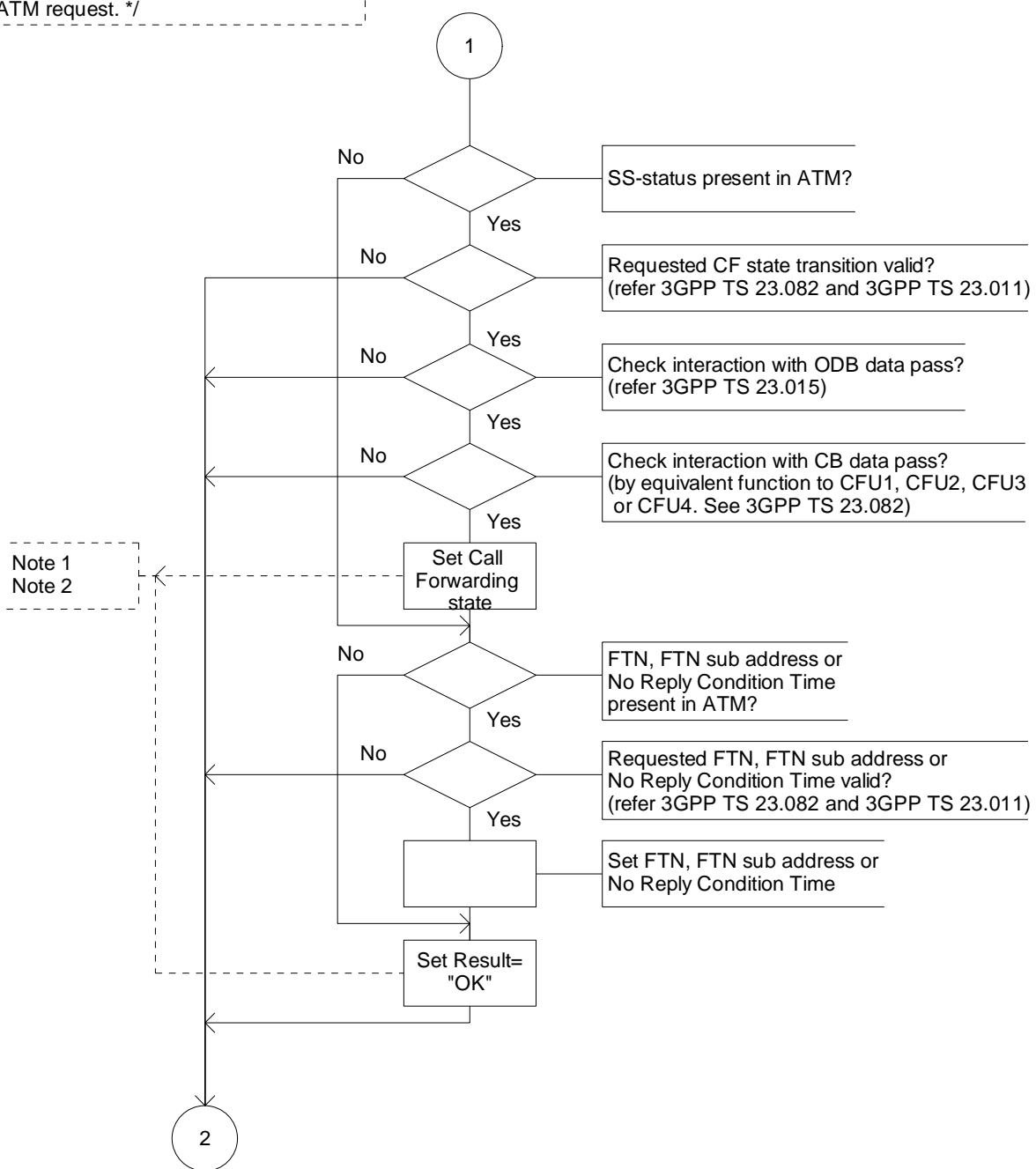
Figure 10.6-2: Procedure ATM_Modify_CF_Data (sheet 2)

Procedure ATM_Modify_CB_Data 1(2)

/* Procedure in the HLR to modify Call Barring data, as a result of an ATM request. */

Set Result:= "Not OK"

Result is "OK" if anything succeeds

Only SS-code and (optionally) Basic Service present in ATM?

Notification flag instruction present in ATM?

Erase Call Barring Data

Set notification-to-CSE flag

Basic Service code present in ATM?

Set Call Barring status

Compound basic service code?

Set Result:= "OK"

Break All Basic Services into elementary group Basic Service Codes

Break compound code into elementary Basic Service group codes

2

Basic Service Codes left?

Note 1
When ATM contains "BasicService", then the changes to CB apply to that BasicService only. When ATM does not contain "BasicService", then the changes to CF apply to all BasicServices.

Note 2
Changes to Call Barring data shall be done in accordance with 3GPP TS 23.088 and 3GPP TS 23.011.

Take next/first Basic Service group

1

Figure 10.7-1: Procedure ATM_Modify_CB_Data (sheet 1)

Procedure ATM_Modify_CB_Data   2(2)

/* Procedure in the HLR to modify Call
Barring data, as a result of an
ATM request. */

①

No ◇ SS-status present in ATM?

Yes

No ◇ Requested CB state transition valid?
(refer 3GPP TS 23.088 and 3GPP TS 23.011)

Yes

No ◇ Check interaction with CF data pass?
(by equivalent function to BO3 or BI2.
 See 3GPP TS 23.088)

Yes

Note 1
Note 2

Set Call
Barring status

No ◇ Password or 'wrong password attempt counter'
present in ATM?

Yes

No ◇ Password or 'wrong password attempt counter' valid?
(refer 3GPP TS 23.088 and 3GPP TS 23.011)

Yes

Set Password or 'wrong password attempt counter'

Set Result=
"OK"

②

Figure 10.7-2: Procedure ATM_Modify_CB_Data (sheet 2)

Procedure ATM_Modify_ODB_Data 1(1)

/* Procedure in the HLR to modify CSI data
as a result of an ATM request. */

No — Modification of ODB
Data requested?

Yes

Change
ODB Data — Overwrite the existing ODB data
with the ODB data in ATM

Re-evaluate
subscriber status — Set or reset "Subscriber Status"
See 3GPP TS 23.008

No — Modify notification
flag requested?

Yes

Modify
notification flag

Set result :=
"OK"
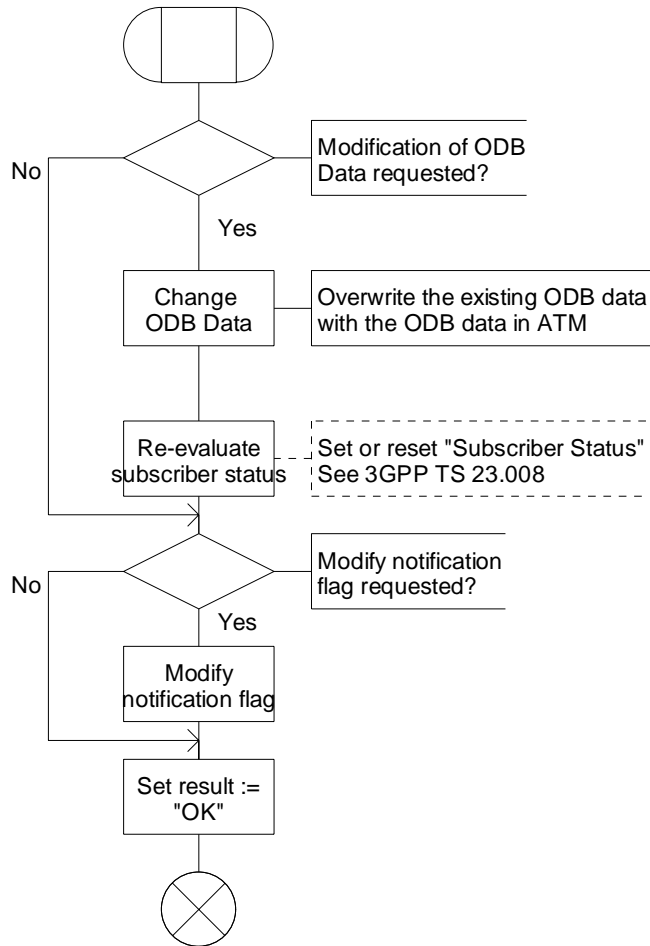
Figure 10.8-1: Procedure ATM_Modify_ODB_Data (sheet 1)

10.2.3 Notify Subscriber Data Change

Changes of CSI, Call Forwarding data, Call Barring data or ODB data shall be notified only if the CSI, Call Forwarding data, Call Barring data or ODB data is marked with the Notification-to-CSE flag.

The HLR maintains a list of gsmSCF address(es) for Call Forwarding Data, Call Barring Data, ODB and CSI. When any of these items has been modified, a notification shall be sent to each gsmSCF in the corresponding list.

The sending of a notification to the gsmSCF may be triggered by the following processes:

- subscriber data change by administrative procedure;

- subscriber data changed by subscriber;

- subscriber data changed by Any Time Modification request from gsmSCF;

- subscriber data changed due to a change of other subscriber data;

- subscriber data change due to Location Update.

When a change of subscriber data is requested by Any Time Modification, Any Time Modification acknowlegement is returned to the requesting gsmSCF confirming the status of the altered data. Separate Notifications of subscriber data change shall also be returned to the requesting gsmSCF for each other piece of altered data, but these shall not contain the requested change.

Each gsmSCF shall be notified only once. Multiple occurrence of gsmSCF Address in these lists shall not lead to multiple notification.

Handling of Notify Subscriber Data Change involves the following procedure:

- CAMEL_NSDC_HLR.

If a change of subscriber data needs to be notified to the gsmSCF, then the HLR initiates a transaction to the gsmSCF by sending Notify Subscriber Data Change information flow.

Procedure CAMEL_NSDC_HLR 1(1)

/* Procedure in the HLR to notify the gsmSCF about a change in subscriber data. */

/* Signals to/from the left are to/from the gsmSCF. */

No — Notification flag set for this data item?

Yes

Start at position 1 of gsmSCF address list associated with this data item.

Yes — End of gsmSCF address list?

No

No — Valid gsmSCF address?

Yes

Yes — Data modification requestd by ATM from this gsmSCF?

No

Nofity_Subscriber_Data_Change

Wait for response

Nofity_Subscriber_Data_Change response

Go to next position in list
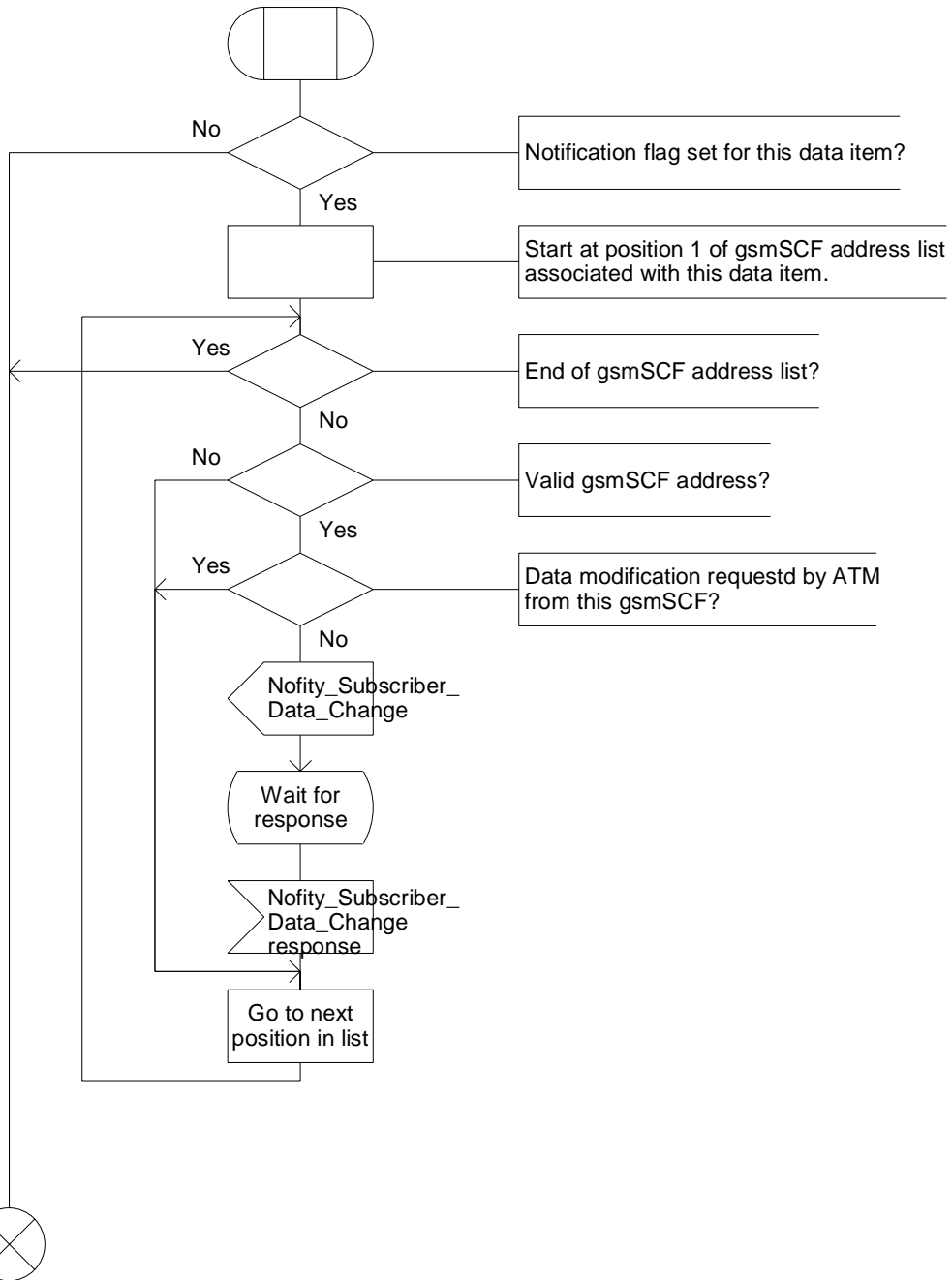
Figure 10.9-1: Procedure CAMEL_NSDC_HLR (sheet 1)

10.3 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for control and interrogation of subscription data.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Specific conditions (S), mutually Exclusive (E) or Optional (O) in the "Status" column.

An 'M' IE shall always be included. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. An 'O' IE may be included or omitted as required by the service logic. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The HLR shall return an error if it does not functionally support an IE which it receives.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [34].

10.3.1 gsmSCF to HLR information flows

10.3.1.1 Any Time Modification Request

10.3.1.1.1 Description

This IF is used to modify information in the HLR at any time.

10.3.1.1.2 Information Elements

Information element name	Status	Description
gsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity shall be either: - IMSI, or - MSISDN
Modification Request For Call Forwarding SS Data	E	This IE is described in a table below. This IE indicates the data of Call Forwarding data to be modified.
Modification Request For Call Barring SS Data	E	This IE is described in a table below. This IE indicates the data of call barring data to be modified.
Modification Request For Operator Determined Barring Data	E	This IE is described in a table below. This IE indicates the data of operator determined barring data to be used.
Modification Request For CAMEL Subscription Information	E	This IE is described in a table below. This IE indicates the Modification Request for CAMEL Subscription Information.

Modification Request For Call Forwarding SS Data contains the following information elements:

Information element name	Status	Description
SS Code	M	This IE indicates Call Forwarding supplementary service as defined in 3GPP TS 22.004 [2]. Due to a restriction of the Any Time Modification acknowledgement IF, only the following supplementary service codes are allowed for this IE; - call forwarding unconditional; - call forwarding on mobile subscriber busy; - call forwarding on no reply; - call forwarding on mobile subscriber not reachable.
Basic Service	O	See 3GPP TS 29.002 [34].
SS Status	O	See 3GPP TS 23.011 [9]. Provisioning and withdrawal are not allowed for the gsmSCF.
Forwarded-to Number	O	See 3GPP TS 23.082 [20].
Forwarded-to Subaddress	O	See 3GPP TS 29.002 [34].
No Reply Condition Time	O	See 3GPP TS 23.082 [20].
Modify Notification Flag	O	This IE contains an instruction to activate or de-activate the Notification-to-CSE flag.

Modification Request For Call Barring SS Data contains the following information elements:

Information element name	Status	Description
SS Code	M	This IE indicates Call Barring supplementary service as defined in 3GPP TS 22.004 [2]. Due to a restriction of the Any Time Modification acknowledgement IF, only the following supplementary service codes are allowed for this IE; - barring of all outgoing calls; - barring of outgoing international calls; - barring of outgoing international calls except those directed to the home PLMN; - barring of all incoming calls; - barring of incoming calls when roaming outside home PLMN Country.
Basic Service	O	See 3GPP TS 29.002 [34].
SS Status	O	See 3GPP TS 23.011 [9]. Provisioning and withdrawal are not allowed for the gsmSCF.
Password	O	See 3GPP TS 23.011 [9].
Wrong password attempts counter	O	See 3GPP TS 23.011 [9].
Modify Notification Flag	O	This IE contains an instruction to activate or de-activate the Notification-to-CSE flag.

Modification Request For Operator Determined Barring Data contains the following information elements:

Information element name	Status	Description
ODB data	O	This IE contains ODB General Data and ODB HPLMN Specific Data to be imposed by this IF.
Modify Notification Flag	O	This IE contains an instruction to activate or de-activate the Notification-to-CSE flag.

Modification Request For CAMEL Subscription Information contains the following information elements:

Information element name	Status	Description
Requested CSI	M	This IE indicates which CSI shall be modified. Only one CSI may be changed in one ATM Request.
Modify Notification Flag	O	This IE contains an instruction to activate or de-activate the Notification-to-CSE flag.
Modify CSI State	O	This IE contains an instruction to activate or de-activate the CSI.

10.3.1.2   Any Time Subscription Interrogation Request

10.3.1.2.1   Description

This IF is used to request subscription information from the HLR at any time.

10.3.1.2.2   Information Elements

Information element name	Status	Description
GsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Requested Info	M	This IE indicates the type of subscriber information being requested: This shall consist of one or more of the following list: - supplementary service; this information is described in a table below, - Operator Determined Barring; - CAMEL Subscription Information; this information is described in a table below, - supported CAMEL phases in VLR; - supported CAMEL phases in SGSN.
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity shall be either: - IMSI, or - MSISDN.

Supplementary service contains the following information elements:

Information element name	Status	Description
SS Code	M	This IE indicates a supplementary service as defined in 3GPP TS 22.004 [2]. Due to a restriction of the Any Time Subscription Interrogation acknowledgement IF, only the following supplementary service codes are allowed for this IE; - call forwarding unconditional; - call forwarding on mobile subscriber busy; - call forwarding on no reply; - call forwarding on mobile subscriber not reachable; - barring of all outgoing calls; - barring of outgoing international calls; - barring of outgoing international calls except those directed to the home PLMN; - barring of all incoming calls; - barring of incoming calls when roaming outside home PLMN Country.
Basic Service	O	See 3GPP TS 29.002 [34].

CAMEL subscription information shall contain one of the following information elements:

Information element name	Status	Description
CAMEL Subscription Info	S,E	This IE indicates which CAMEL Subscription Information is requested. It shall be one of the following elements: O-CSI/T-CSI/VT-CSI/TIF-CSI/GPRS-CSI/MO-SMS-CSI/SS-CSI/M-CSI/D-CSI.
Additional Requested CAMEL Subscription Info	S,E	This IE indicates which CAMEL Subscription Information is requested. It shall be one of the following elements: MT-SMS-CSI/ MG-CSI.

10.3.1.3   Notify Subscriber Data Change response

10.3.1.3.1   Description

This IF is used by the gsmSCF to respond to the HLR of the change of subscriber data notify.

10.3.1.3.2   Information Elements

This IF contains no information elements.

10.3.2 HLR to gsmSCF information flows

10.3.2.1 Any Time Modification ack

10.3.2.1.1 Description

This IF is used by the HLR to provide the modified information to the gsmSCF.

10.3.2.1.2 Information Elements

Information element name	Status	Description
Call Forwarding SS Data	S	This IE is described in a table below. It shall be present if it was modified.
Call Barring SS Data	S	This IE is described in a table below. It shall be present if it was modified.
Operator Determined Barring Information	S	This IE is described in a table below. It shall be present if it was modified.
CAMEL Subscription Information	S	This IE is described in a table below. It shall be present if it was modified.

Call Forwarding SS Data contains the following information elements:

Information element name	Status	Description
SS Code	S	This IE indicates Call Forwarding supplementary service as defined in 3GPP TS 22.004 [2]. Only the SS code for which the modification applies is sent.
Forwarding Feature List	S	This IE is described in a table below. If a Forwarding Feature List item is modified then all applicable fields within the item shall be sent. All modified Forwarding Feature List items shall be returned.
Notification-to-CSE Flag	S	This IE indicates whether the gsmSCF is notified of a change of Call Forwarding SS data. The IE shall be sent if it was modified.

Forwarding Feature List contains 1 to 32 items of the following information elements:

Information element name	Status	Description
Basic Service	C	See 3GPP TS 29.002 [34].
SS Status	C	See 3GPP TS 23.011 [9].
Forwarded-to Number	C	See 3GPP TS 23.082 [20].
Forwarded-to Subaddress	C	See 3GPP TS 29.002 [34].
Subscription Options	C	See 3GPP TS 23.082 [20].
No Reply Condition Timer	C	See 3GPP TS 23.082 [20].

Call Barring SS Data contains the following information elements:

Information element name	Status	Description
SS Code	S	This IE indicates Call Barring supplementary service as defined in 3GPP TS 22.004 [2]. Only the SS code for which the modification applies is sent.
Call Barring Feature List	S	This IE is described in a table below. If a Call Barring Feature List item is modified then all applicable fields within the item shall be sent. All modified Call Barring Feature List items shall be returned.
Password	S	See 3GPP TS 23.011 [9]. The IE shall be sent if it was modified.
Wrong Password Attempts Counter	S	See 3GPP TS 23.011 [9]. The IE shall be sent if it was modified.
Notification-to-CSE Flag	S	This IE indicates whether the gsmSCF is notified of a change of Call Barring SS data. The IE shall be sent if it was modified.

Call Barring Feature List contains 1 to 32 items of the following information elements:

Information element name	Status	Description
Basic Service	C	See 3GPP TS 29.002 [34].
SS Status	C	See 3GPP TS 23.011 [9].

Operator Determined Barring Information contains the following information elements:

Information element name	Status	Description
ODB Data	C	See subclause 10.3.2.3
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of ODB data.

CAMEL Subscription Information contains the following information elements:

Information element name	Status	Description
O-CSI	S	See subclause 4.3.1. It shall be present if it was modified.
D-CSI	S	See subclause 4.3.2. It shall be present if it was modified.
T-CSI	S	See subclause 4.3.5. It shall be present if it was modified.
VT-CSI	S	See subclause 4.3.6. It shall be present if it was modified.
TIF-CSI	S	See subclause 4.3.4. It shall be present if it was modified.
GPRS-CSI	S	See subclause 6.3.1. It shall be present if it was modified.
MO-SMS-CSI	S	See subclause 7.3.1. It shall be present if it was modified.
MT-SMS-CSI	S	See subclause 7.3.2. It shall be present if it was modified.
SS-CSI	S	See subclause 8.2.1. It shall be present if it was modified.
M-CSI	S	See subclause 9.2.1. It shall be present if it was modified.
MG-CSI	S	See subclause 9.2.2. It shall be present if it was modified.

10.3.2.2 Any Time Subscription Interrogation ack

10.3.2.2.1 Description

This IF is used by the HLR to provide the requested subscription information to the gsmSCF.

10.3.2.2.2 Information Elements

Information element name	Status	Description
Call Forwarding SS Data	C	This IE is described in a table below.
Call Barring SS Data	C	This IE is described in a table below.
Operator Determined Barring Data	C	This IE is described in a table below.
CAMEL Subscription Information	C	This IE is described in a table below.
Supported CAMEL Phases In VLR	C	This IE indicates the CAMEL phase supported in the VLR.
Offered CAMEL4 CSIs In VLR	S	This IE indicates the CAMEL phase 4 CSIs offered in the VMSC/VLR. It shall be present if the "Supported CAMEL Phases In VLR" IE indicates CAMEL phase 4.
Supported CAMEL Phases In SGSN	C	This IE indicates the CAMEL phase supported in the SGSN.
Offered CAMEL4 CSIs In SGSN	S	This IE indicates the CAMEL phase 4 CSIs offered in the SGSN. It shall be present if the "Supported CAMEL Phases In SGSN" IE indicates support of CAMEL phase 4.

Call Forwarding SS Data contains the following information elements:

Information element name	Status	Description
Forwarding Feature List	C	This IE is described in a table below
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Forwarding SS data.

ETSI

Forwarding Feature List contains 1 to 32 items of the following information elements:

Information element name	Status	Description
Basic Service	C	See 3GPP TS 29.002 [34].
SS Status	C	See 3GPP TS 23.011 [9].
Forwarded-to Number	C	See 3GPP TS 23.082 [20].
Forwarded-to Subaddress	C	See 3GPP TS 29.002 [34].
Subscription Options	C	See 3GPP TS 23.082 [20].
No Reply Condition Time	C	See 3GPP TS 23.082 [20].

Call Barring SS Data contains the following information elements:

Information element name	Status	Description
Call Barring Feature List	C	This IE is described in a table below.
Password	C	See 3GPP TS 23.011 [9].
Wrong Password Attempts Counter	C	See 3GPP TS 23.011 [9].
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Barring SS data.

Call Barring Feature List contains 1 to 32 items of the following information elements:

Information element name	Status	Description
Basic Service	C	See 3GPP TS 29.002 [34].
SS Status	C	See 3GPP TS 23.011 [9].

Operator Determined Barring Bata contains the following information elements:

Information element name	Status	Description
ODB General Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate.
ODB HPLMN Specific Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate only when the subscriber is registered in the HPLMN.
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of ODB data.

CAMEL Subscription Information contains the following information elements:

Information element name	Status	Description
O-CSI	C	See subclause 4.3.1.
D-CSI	C	See subclause 4.3.2.
T-CSI	C	See subclause 4.3.5.
VT-CSI	C	See subclause 4.3.6.
TIF-CSI	C	See subclause 4.3.4.
GPRS-CSI	C	See subclause 6.3.1.
MO-SMS-CSI	C	See subclause 7.3.1.
MT-SMS-CSI	C	See subclause 7.3.2.
SS-CSI	C	See subclause 8.2.1.
M-CSI	C	See subclause 9.2.1.
MG-CSI	C	See subclause 9.2.2.

Offered CAMEL4 CSIs in VLR contains the following information elements:

Information element name	Status	Description
O-CSI	S	This IE indicates the offer of CAMEL phase 4 O-CSI
D-CSI	S	This IE indicates the offer of CAMEL phase 4 D-CSI
VT-CSI	S	This IE indicates the offer of CAMEL phase 4 VT-CSI
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI

Offered CAMEL4 CSIs in SGSN contains the following information elements:

Information element name	Status	Description
MT-SMS-CSI	S	This IE indicates the offer of CAMEL phase 4 MT-SMS-CSI
MG-CSI	S	This IE indicates the offer of CAMEL phase 4 MG-CSI
PSI Enhancements	S	This IE indicates the offer of CAMEL phase 4 Enhancement of Provide Subscriber Information

10.3.2.3 Notify Subscriber Data Change

10.3.2.3.1 Description

This IF is used by the HLR to notify to the gsmSCF of the change of subscriber data. This IF is sent at each time subscriber data is changed.

10.3.2.3.2 Information Elements

Information element name	Status	Description
IMSI	M	The IMSI is used to identify the subscriber.
MSISDN	M	The MSISDN is used to identify the subscriber.
Call Forwarding SS Data	C	This IE is described in a table below.
Call Barring SS Data	C	This IE is described in a table below.
Operator Determined Barring Data	C	This IE is described in a table below.
CAMEL Subscription Information	C	This IE is described in a table below.

Call Forwarding SS data contains the following information elements:

Information element name	Status	Description
SS Code	C	This IE indicates Call Forwarding supplementary service as defined in 3GPP TS 22.004 [2].
Forwarding Feature List	C	This IE is described in a table below.
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Forwarding SS data.

Forwarding Feature List contains 1 to 32 items of the following information elements:

Information element name	Status	Description
Basic Service	C	See 3GPP TS 29.002 [34]. Compound basic service codes can also be used in this IF if the subscriber has used a compound code when modifying the SS (e.g. all bearer services compound code).
SS Status	C	See 3GPP TS 23.011 [9].
Forwarded-to Number	C	See 3GPP TS 23.082 [20].
Forwarded-to Subaddress	C	See 3GPP TS 29.002 [34].
Subscription Options	C	See 3GPP TS 23.082 [20].
No Reply Condition Timer	C	See 3GPP TS 23.082 [20].

Call Barring SS data contains the following information elements:

Information element name	Status	Description
SS Code	C	This IE indicates Call Barring supplementary service as defined in 3GPP TS 22.004 [2].
Call Barring Feature List	C	This IE is described in a table below.
Password	C	See 3GPP TS 23.011 [9].
Wrong Password Attempts Counter	C	See 3GPP TS 23.011 [9].
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Barring SS data.

Call Barring Feature List contains 1 to 32 items of the following information elements:

Information element name	Status	Description
Basic Service	C	See 3GPP TS 29.002 [34]. Compound basic service codes can also be used in this IF if the subscriber has used a compound code when modifying the SS (e.g. all bearer services compound code).
SS Status	C	See 3GPP TS 23.011 [9].

Operator Determined Barring Data contains the following information elements:

Information element name	Status	Description
ODB General Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate. When the ODB general data is removed for the subscriber, this IE indicates that the set of subscribers features is empty.
ODB HPLMN Specific Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate only when the subscriber is registered in the HPLMN. When the ODB HPLMN specific data is removed for the subscriber, this IE indicates that the set of subscribers features is empty.
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of ODB data.

CAMEL Subscription Information contains the following information elements:

Information element name	Status	Description
O-CSI	S	See subclause 4.3.1. It shall be present if it was modified.
D-CSI	S	See subclause 4.3.2. It shall be present if it was modified.
T-CSI	S	See subclause 4.3.5. It shall be present if it was modified.
VT-CSI	S	See subclause 4.3.6. It shall be present if it was modified.
TIF-CSI	S	See subclause 4.3.4. It shall be present if it was modified.
GPRS-CSI	S	See subclause 6.3.1. It shall be present if it was modified.
MO-SMS-CSI	S	See subclause 7.3.1. It shall be present if it was modified.
MT-SMS-CSI	S	See subclause 7.3.2. It shall be present if it was modified.
SS-CSI	S	See subclause 8.2.1. It shall be present if it was modified.
M-CSI	S	See subclause 9.2.1. It shall be present if it was modified.
MG-CSI	S	See subclause 9.2.2. It shall be present if it was modified.
Specific CSI Deleted List	S	This IE indicates that one or more specific elements of CAMEL Subscription Information have been deleted from the HLR. It shall indicate any of the following; - O-CSI (with TDP criteria for O-CSI); - T-CSI (with TDP criteria for T-CSI); - TIF-CSI; - D-CSI; - VT-CSI with TDP criteria for VT-CSI; - GPRS-CSI; - MO-SMS-CSI; - MT-SMS-CSI with TDP criteria for MT-SMS-CSI; - SS-CSI; - M-CSI; - MG-CSI. This IE shall be present if CSI is/are deleted.

11 Subscriber Location and State retrieval

Support of the procedures described in this clause in CAMEL Phase 4 is a network operator option.

11.1 Architecture

11.1.1 Functional Entities used for CAMEL

This subclause describes procedures for the retrieval of subscriber location and subscriber state information. Location Services is only supported in CAMEL Phase 3 and higher.

1) The gsmSCF may request location information of a mobile station from the GMLC via Location Services. The information flow of Location Services is described in 3GPP TS 23.271 [28] and 25.205 [32]. Figure 11.1-1 indicates the functional entities involved in the procedures for the retrieval of location information via location services.

2) The gsmSCF may request location information and/or subscriber state information of a mobile station from the HLR. Location information and/or subscriber state information may be requested either from the circuit switched or the packet switched domain.

 If location information and/or subscriber state information is requested by the gsmSCF, then the HLR may retrieve this information via the Provide Subscriber Information procedure from either the MSC/VLR or the SGSN. This procedure is defined in subclause 4.5.9 of the present document.

 The interface for the provision of subscriber location and state information between HLR and MSC/VLR is described in 3GPP TS 23.018 [12]. The interface for the provision of subscriber location and state information between HLR and SGSN is described in this chapter. Figure 11.1-2 indicates the functional entities involved in the procedures for the retrieval of location information and/or subscriber state information from the circuit switched or packet switched domain.
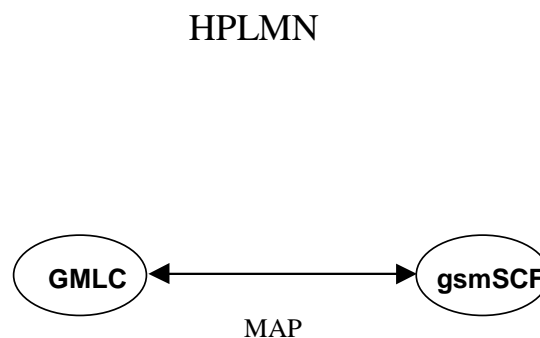
Figure 11.1-1: Functional architecture for CAMEL Support of Location Services
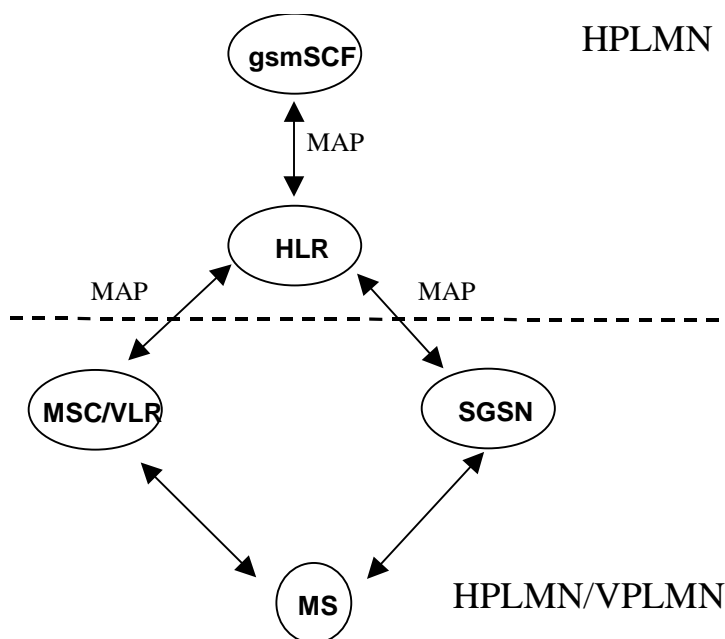
Figure 11.1-2: Functional architecture for Any Time Interrogation

gsmSCF: see subclause 3.1.

GMLC: A functional entity that allows external LCS Clients to request real-time information about a Mobile Station. The information that can be requested from the GMLC is the location of the mobile station**.**

HLR: see subclause 4.1.

MSC/VLR: see subclause 4.1.

SGSN: see subclause 6.1.1. The SGSN stores location and state information for each subscriber. Upon request this information is provided to the HLR.

The information flows between the GMLC and functional entities other than the gsmSCF, have not been indicated in the functional architecture shown in figures 11.1. These information flows are outside the scope of the present document.

11.1.2 Interfaces defined for CAMEL

This subclause describes the interfaces applicable to CAMEL. It specifies on a high level the functions specific to CAMEL.

11.1.2.1 gsmSCF - GMLC interface

This interface is used by the gsmSCF to request information (Mobile Station location) from the GMLC at any time.

11.1.2.2 GMLC - gsmSCF interface

This interface is used by the GMLC to return the requested information (Mobile Station location) to the gsmSCF as requested by the gsmSCF via the Any Time Interrogation procedure.

11.1.2.3 gsmSCF - HLR

This interface is used by the gsmSCF to interrogate the HLR. As a network operator option, the HLR may refuse to provide the information requested by the gsmSCF.

11.1.2.4   HLR - gsmSCF

This interface is used by the HLR to return the requested information (Mobile Station location and/or Mobile Station state) to the gsmSCF as requested by the gsmSCF via the Any Time Interrogation procedure.

11.1.2.5   HLR - SGSN

This interface is used by the HLR to request information (Mobile station location and/or subscriber state) from the SGSN.

11.1.2.5   SGSN - HLR

This interface is used by the SGSN to return the requested information (Mobile station location and/or subscriber state) to the HLR.

11.2   Procedures for CAMEL

11.2.1   Location Services

Handling of Any Time Interrogation to obtain Location Information involves the following process:

- CAMEL_ATI_GMLC.

If an OSS needs to retrieve the active location of a Mobile Station, the gsmSCF initiates a transaction to the GMLC by sending a Any Time Interrogation Request.

Process CAMEL_ATI_GMLC 1(1)

/* Process in the GMLC Receiving an Any Time Interrogation request from the gsmSCF. */

/* Signals to/from the left are to/from the gsmSCF. */

Idle

Any Time Interrogation Request

ATI accepted?

No

Yes

Procedure in GMLC See 3GPP TS 22.071 --- Obtain Location Information

Set UE= "ATI Not Allowed"

Any Time Interrogation ack

Any Time Interrogation Negative response

Idle

Idle
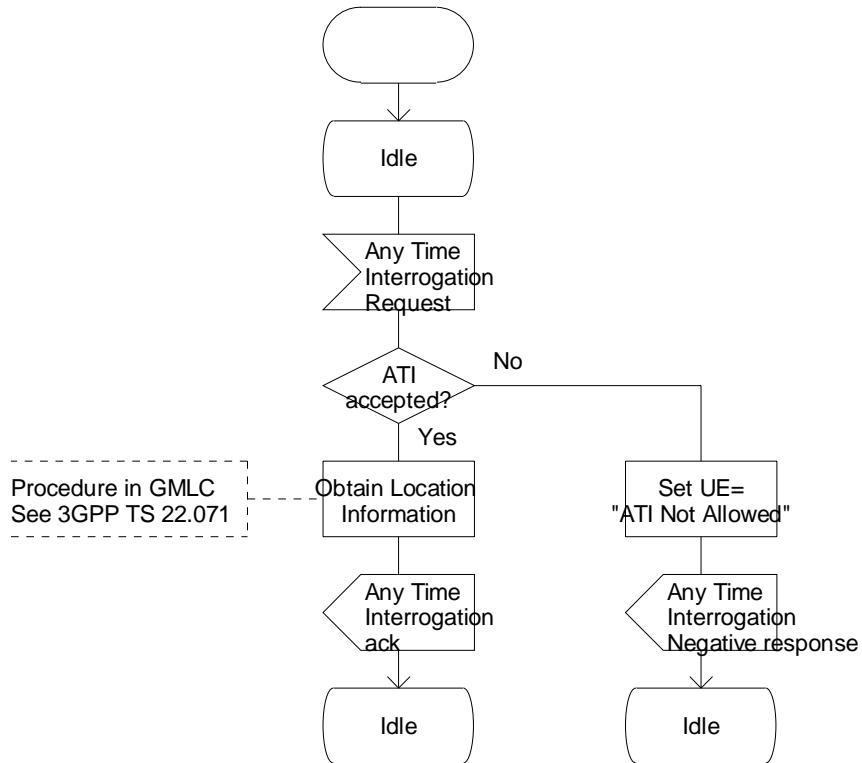
Figure 11.2-1: Process CAMEL_ATI_GMLC (sheet 1)

11.2.2   Any Time Interrogation

Handling of Any Time Interrogation to obtain Subscriber State and Location Information involves the following process:

- CAMEL_ATI_HLR.

If an OSS needs the Subscriber State and/or the Location Information, the gsmSCF initiates a transaction to the HLR by sending an Any_Time_Interrogation Request.

Process CAMEL_ATI_HLR 1(1)

/* Process in the HLR receiving an Any Time Interrogation request from gsmSCF.*/

/* Signals to/from the left are to/from the gsmSCF. */
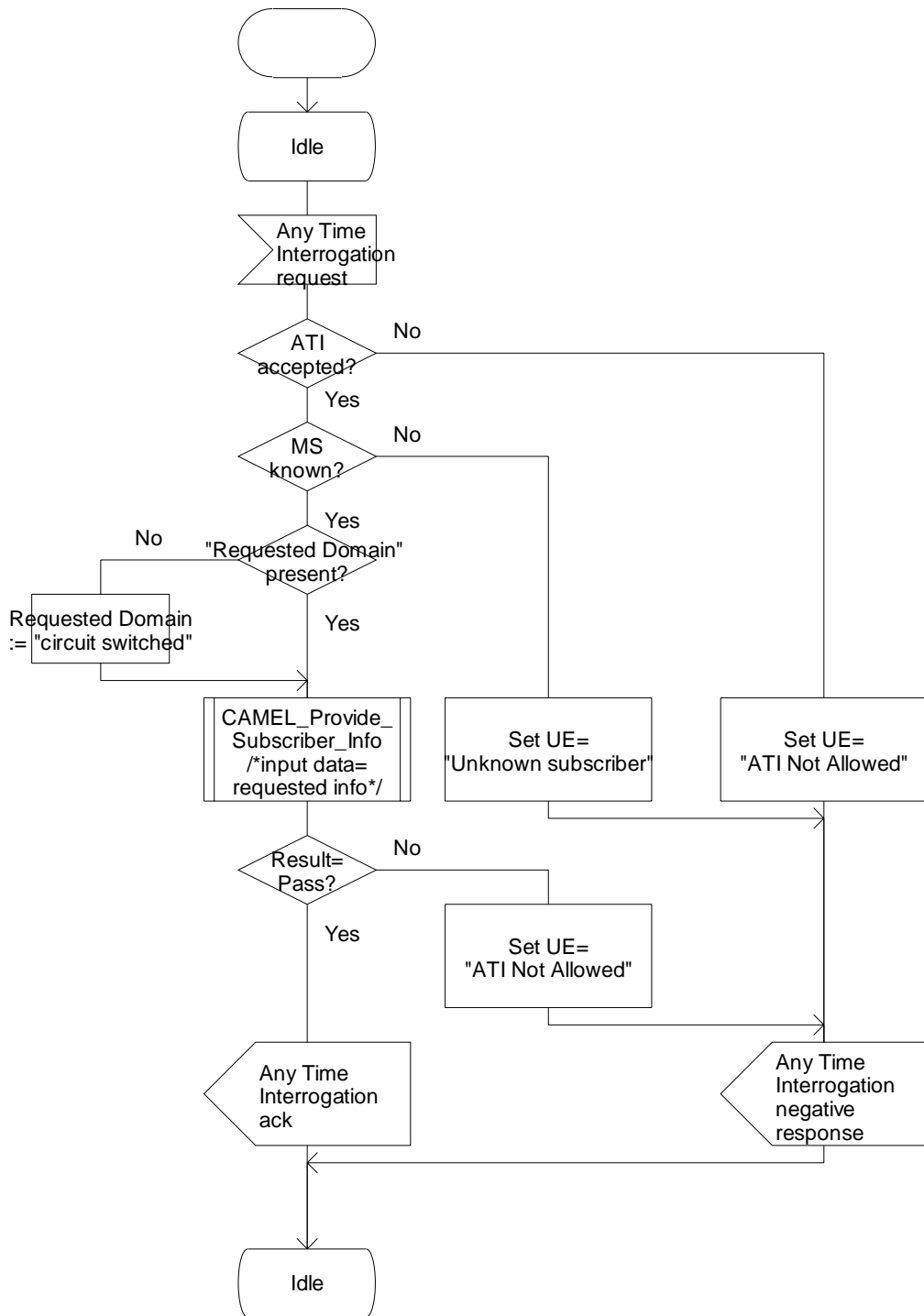
Figure 11.3-1: Process CAMEL_ATI_HLR (sheet 1)

11.2.3 Provide Subscriber Information in the SGSN

The provision of Subscriber State and Location Information involves the following process and procedures:

- CAMEL_Provide_Subscriber_Info_SGSN;

- CAMEL_Active_Info_Retrieval_SGSN;

- Retrieve_GPRS_MS_Class_If_Required;

- Retrieve_IMEI_If_Required.

11.2.3.1 Procedure CAMEL_Provide_Subscriber_Info_SGSN

If the SGSN receives a Provide Subscriber Info request, it performs procedures to obtain the requested information.

The test "Active retrieval required" takes the "Yes" exit if any one or more of current location, GPRS MS class or IMEI is indicated in the Provide Subscriber Info request.

11.2.3.2 Procedure CAMEL_Active_Info_Retrieval_SGSN

If the SGSN data show that the MS is in the "Iu Connected" state (i.e. it has an Iu connection established), the SGSN performs the Location Reporting Control procedure (Direct report) which is defined in 3GPP TS 25.413 [33].

The test "Report on change of service area" takes the "Yes" exit if the SGSN has performed the Location Reporting Control procedure with the Request Type IE set to "Change of service area".

If the SGSN data show that the MS is in the "A/Gb Ready" state (i.e. it is transferring packet data over an A/Gb access connection) then the currently stored location information is up to date, and no further action is required.

Process CAMEL_Provide_Subscriber_Info_SGSN 1(1)

/* Process in the SGSN to handle a request from the HLR for subscriber information. */

/* Signals to/from the left are to/from the HLR. */

Idle

Provide_ Subscriber_ Info

IMSI known in SGSN? — No

Active retieval required? — Yes

Location info requested? — No / Yes

Subscriber state requested? — No / Yes

CAMEL_Active_ Info_Retrieval_ SGSN

Location info:= Stored location info

Subscriber state:= "Detached"

Subscriber state requested? — No / Yes

Set subscriber state

Provide_ Subscriber_Info ack

Idle
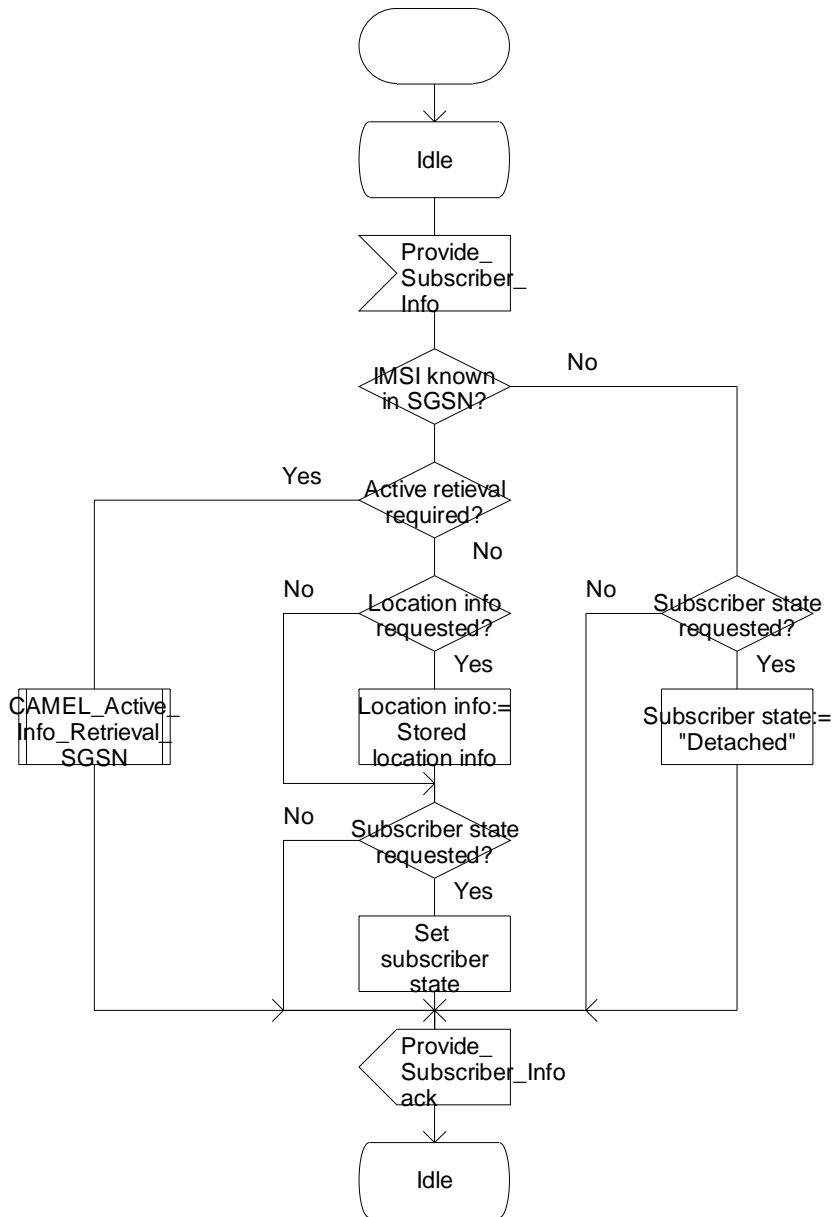
Figure 11.4-1: Process CAMEL_Provide_Subscriber_Info_SGSN (sheet 1)

ETSI

Procedure CAMEL_Active_Info_Retrieval_SGSN 1(2)

/* Procedure in the SGSN to retrieve information by establishing a connection with the MS

/* Signals to/from the left are to/from the RAN */

Current location requested?

No

Yes

MS reachable for paging?

No

Yes

1

Location info:= Stored location info

Iu Connected

MS state

Else

A/Gb Ready

Report on change of service area?

Yes

No

Page

Location Reporting Control

Wait_For_ Page_ Response

Location info:= Stored location info

Wait_For_ Location_Report

2

Location Report

MS connection established

Page response timer expired

Location undetermined?

No

Stop page response timer

Location info:= Stored location info

Yes

Location info:= Stored location info

Location info:= Retrieved location info

Location info:= Retrieved location info

Derive location number, geodetic location and geographical information

3

2

Derive location number, geodetic location and geographical information

Figure 11.5-1: Procedure CAMEL_Active_Info_Retrieval_SGSN (sheet 1)

Procedure CAMEL_Active_Info_Retrieval_SGSN 2(2)

/* Procedure in the SGSN to retrieve information by establishing a connection with the MS

/* Signals to/from the left are to/from the RAN */
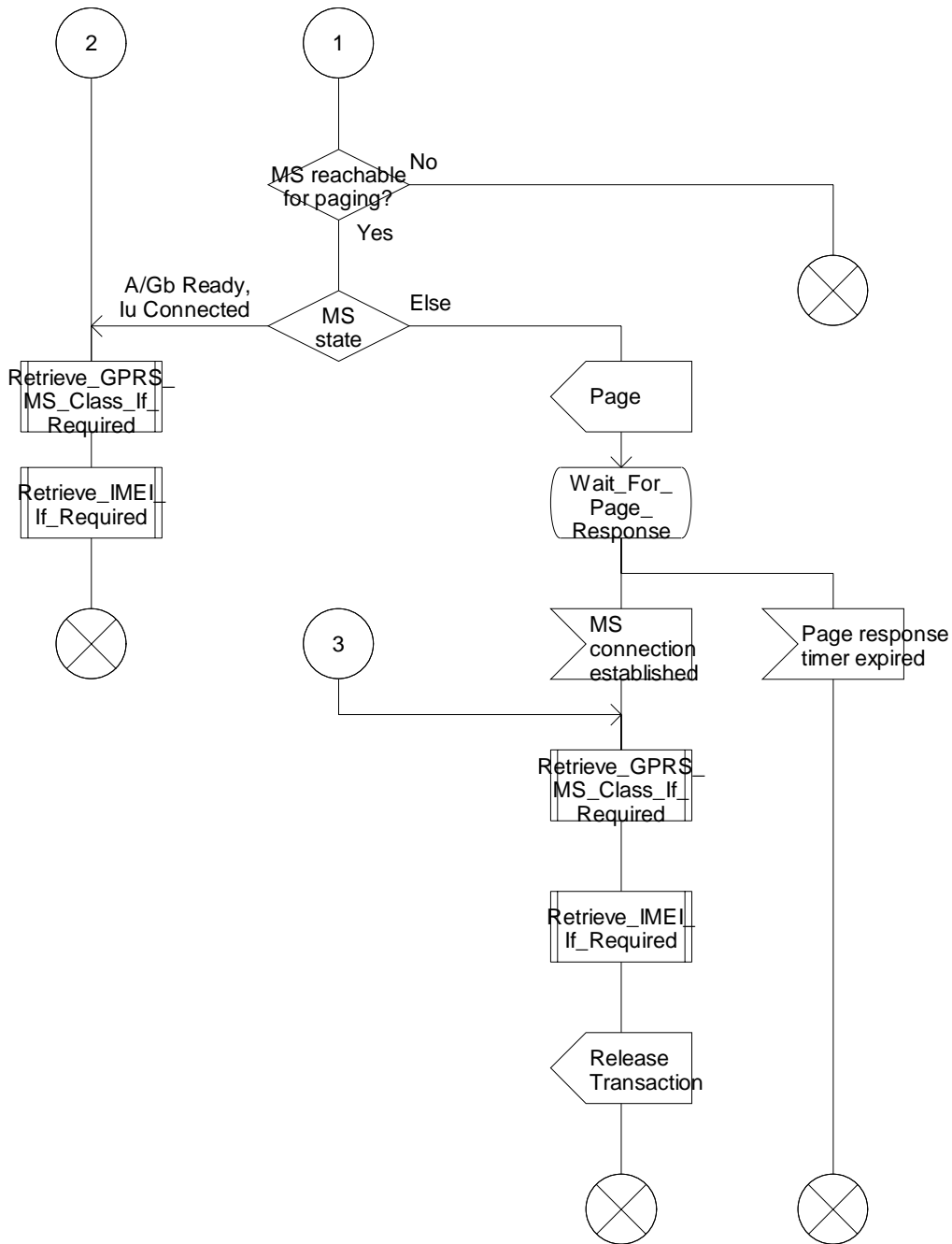
Figure 11.5-2: Procedure CAMEL_Active_Info_Retrieval_SGSN (sheet 2)

Procedure Retrieve_GPRS_MS_Class_If_Required 1(1)

Procedure in the SGSN to retrieve
GPRS classmark information if
required by the HLR

GPRS
MS class
required? No

Yes

GPRS MS class:=
Stored GPRS MS
class
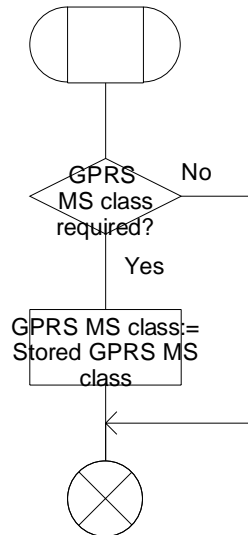
Figure 11.6-1: Procedure Retrieve_GPRS_MS_Class_If_Required (sheet 1)

Procedure Retrieve_IMEI_If_Required   1(1)

Procedure in the SGSN to retrieve
the IMEI if required by the HLR

/* Signals to/from the left
are to/from the RAN */

IMEI
required? ──── No

Yes

Send IMEI

Wait_For_IMEI

Release
transaction

IMEI

IMEI:=
Retrieved
IMEI
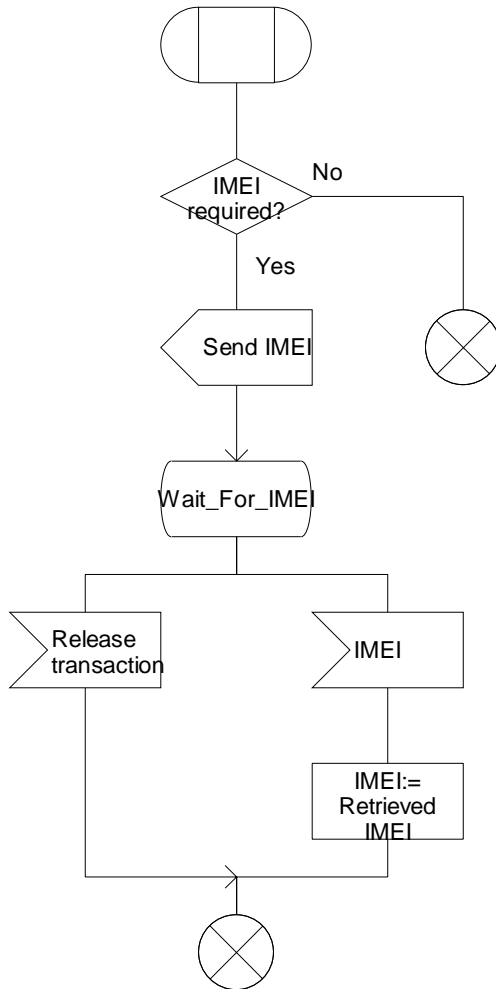
Figure 11.7-1: Procedure Retrieve_IMEI_If_Required (sheet 1)

11.3 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for the retrieval of information about the location and state of a subscriber.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Specific conditions (S), mutually Exclusive (E) or not applicable (-) in the "Status" column.

An 'M' IE shall always be included. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. When a set of 'E' IEs is shown in the definition of an Information Flow or compound IE, only one of those IEs may be included. A '-' IE shall always be omitted. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The GMLC shall return an error if it does not functionally support an IE which it receives.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [34].

11.3.1 gsmSCF to GMLC information flows

11.3.1.1 Any Time Interrogation Request

11.3.1.1.1 Description

This IF is used to request information (Mobile Station location) from the GMLC.

11.3.1.1.2 Information Elements

Information element name	Status	Description
gsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Requested Info	M	This IE indicates the type of information that is requested. It shall have the following value: - Mobile Station location
Mobile Station Identity	M	This IE identifies the Mobile Station of which the information is requested. The identity shall be either: - IMSI, or - MSISDN

11.3.2 GMLC to gsmSCF information flows

11.3.2.1 Any Time Interrogation ack

11.3.2.1.1 Description

This IF is used by the GMLC to provide the requested information to the gsmSCF.

11.3.2.1.2 Information Elements

Information element name	Status	Description
Location Information	C	This IE indicates the location of the Mobile Station.

Location Information is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	Status	Description
Location number	-	Not applicable
Service area ID	-	Not applicable
Cell ID	-	Not applicable
Geographical information	C	See 3GPP TS 23.032 [13]. The GMLC receives Extended Geographical Information from the MSC. The Extended Geographical Information shall be converted to the Geographical Information by the GMLC.
VLR number	-	Not applicable
Current Location Retrieved	-	Not applicable
MSC number	C	The GMLC receives the MSC number from the HLR in the SendRoutingInfoForLCS MAP message.
SGSN number	C	The GMLC receives the SGSN number from the HLR in the SendRoutingInfoForLCS MAP message.

11.3.3   gsmSCF to HLR information flows

11.3.3.1   Any Time Interrogation Request

11.3.3.1.1   Description

This IF is used to request information (any one or more of subscriber state, subscriber location, IMEI (with software version) and MS classmark information for the requested domain) from the HLR at any time.

11.3.3.1.2   Information Elements

Information element name	Status	Description
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity shall be either: - IMSI, or - MSISDN.
Requested Info	M	This IE indicates the type of subscriber information being requested. This IE is described in a table below.
gsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.

Requested Info contains the following information elements:

Information element name	Status	Description
Location Information	O	This IE indicates that the Location Information is requested.
Subscriber State	O	This IE indicates that the Subscriber State is requested.
Current Location	O,S	This IE indicates that the Current Location is requested. This IE shall not be present if Location Information is not present in Requested Info.
Requested Domain	M	This IE indicates for which domain the subscriber info is requested. It shall be one of the following: - circuit switched domain; - packet switched domain.
IMEI (with software version)	O	This IE indicates that the IMEI (with software version) is requested.
MS class mark information for the requested domain	O	This IE indicates that the MS classmark information for the indicated domain is requested.

Requested Info shall contain one or more of the following information elements:

- Location Information;

- Subscriber State;

- IMEI (with software version);

- MS classmark information for the requested domain.

11.3.4 HLR to gsmSCF information flows

11.3.4.1 Any Time Interrogation ack

11.3.4.1.1 Description

This IF is used by the HLR to provide the requested subscriber location and/or subscriber state information to the gsmSCF.

11.3.4.1.2 Information Elements

Information element name	Status	Description
Location Information	C, E1	This IE indicates the location of the served subscriber in the MSC/VLR. It shall be present only if requested by the gsmSCF.
Location Information For GPRS	C, E1	This IE indicates the location of the served subscriber in the SGSN. The content is defined in the subclause 11.3.6.1.2. It shall be present only if requested by the gsmSCF.
Subscriber State	S, E2	This IE indicates the state of the MS in the CS domain. It shall be present only if requested by the gsmSCF. The possible values of the IE are: - CAMELBusy: The VLR has indicated that the MS is engaged in a transaction for a mobile originating or terminated circuit-switched call. - NetworkDeterminedNotReachable: The HLR or VLR has indicated that the network can determine from its internal data that the MS is not reachable. - AssumedIdle: The VLR has indicated that the state of the MS is neither "CAMELBusy" nor "NetworkDeterminedNotReachable". - NotProvidedFromVLR: The VLR did not provide any information on subscriber state even though it was requested.
PS Domain Subscriber State	S, E2	This IE indicates the state of the MS in the PS Domain. It shall be present only if requested by the gsmSCF. The possible values of the IE are: - Detached (see subclause 11.3.5.1). - CAMEL attached, MS not reachable for paging (see subclause 11.3.5.1). - CAMEL attached, MS may be reachable for paging (see subclause 11.3.5.1). - CAMEL PDP active, MS not reachable for paging (see subclause 11.3.5.1). - CAMEL PDP active, MS may be reachable for paging (see subclause 11.3.5.1). - Not provided from SGSN: The SGSN did not provide any information on subscriber state even though it was requested. - NetworkDeterminedNotReachable: The HLR has indicated that the network can determine from its internal data that the MS is not reachable.
PDP Context Information List	C	This IE indicates the PDP context information (see the table in subclause 11.3.5.1) for each PDP context which is active for the MS. It shall be present if the PS domain Subscriber State has the value "CAMEL PDP active, MS not reachable for paging' or 'CAMEL PDP active, MS may be reachable for paging"; otherwise it shall be absent.
IMEI (with software version)	C	This IE contains the IMEISV (as defined in 3GPP TS 23.003 [7]) of the ME in use by the served subscriber. It shall be present only if requested by the gsmSCF.
MS Classmark 2	C	This IE contains the MS classmark 2, which is returned by the MS when it responds to paging in the CS domain. It shall be present only if requested by the gsmSCF.
GPRS MS Class	C	This IE contains the MS network and radio access capabilities. It shall be present only if requested by the gsmSCF.

Location Information is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	Status	Description
Service area ID	C,E	See 3GPP TS 23.018 [12].
Cell ID	C,E	See 3GPP TS 23.018 [12].
VLR Number	C	See 3GPP TS 23.018 [12]. The HLR shall include the internally stored VLR Number.
Location area ID	C,E	See 3GPP TS 23.003 [7].
Selected LSA Identity	C	This IE indicates the LSA identity associated with the current position of the MS. It shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA Id with the highest priority it shall be present. See 3GPP TS 23.073 [18].
MSC number	C	E.164 number which identifies the VMSC in whose area the subscriber is currently registered. See 3GPP TS 23.003 [7]. If the HLR receives the MSC number from the VLR in the Provide Subscriber Info ack IF then the HLR shall ignore the MSC number.

11.3.5 HLR to SGSN information flows

11.3.5.1 Provide Subscriber Info

11.3.5.1.1 Description

This IF is used by the HLR to request information (subscriber state and/or location) from the SGSN at any time.

11.3.5.1.2 Information Elements

This IF is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	Status	Description
LMSI	-	Not applicable.
Requested Info	M	This IE indicates which of the following information the HLR requires: - Subscriber location; - Subscriber state; - Current location; - IMEI & Software version; - GPRS MS classmark information.

11.3.6 SGSN to HLR information flows

11.3.6.1 Provide Subscriber Info ack

11.3.6.1.1 Description

This IF is used by the SGSN to provide the requested subscriber location and/or subscriber state information to the HLR.

11.3.6.1.2 Information Elements

This IF is defined in 3GPP TS 23.018 [12]. The following differences apply:

Information element name	Status	Description
Subscriber State	-	Not applicable.
PS domain Subscriber State	C	This IE indicates the status of the MS in the PS Domain. It shall be present only if requested by the HLR. The possible values of the IE are: - Detached: The SGSN has determined from its internal data that the MS is not attached to the network. - CAMEL attached, MS not reachable for paging: The SGSN has determined from its internal data that the MS is attached to the network, but there is no PDP Context active, and the MS is not reachable for paging. - CAMEL attached, MS may be reachable for paging: The SGSN has determined from its internal data that the MS is attached to the network, but there is no PDP Context active; the SGSN has not determined from its internal data that the MS is not reachable for paging. - CAMEL PDP active, MS not reachable for paging: The SGSN has determined from its internal data that the MS is attached to the network there is at least on PDP context active, and the MS not reachable for paging. - CAMEL PDP active, MS may be reachable for paging: The SGSN has determined from its internal data that the MS is attached to the network and there is at least one PDP context active; the SGSN has not determined from its internal data that the MS is not reachable for paging.
PDP Context Information List	S	This IE is described in a table below. This IE indicates the PDP context information for each PDP context which is active for the MS. It shall be present if the PS domain Subscriber State has the value "CAMEL PDP active, MS not reachable for paging' or 'CAMEL PDP active MS may be reachable for paging"; otherwise it shall be absent.
Location Information For GPRS	C	This IE is described in a table below. It indicates the location of the MS. It shall be present only if requested by the HLR.
IMEI (with software version)	C	This IE contains the IMEI & software version of the ME in use by the served subscriber. It shall be present only if requested by the HLR.
GPRS MS Class	C	This IE contains the MS network and radio access capabilities. It shall be present only if requested by the HLR.

PDP Context Information includes the following information elements:

Information element name	Status	Description
PDP Context Identifier	M	Index of the PDP context.
PDP State	C	Packet data protocol state, INACTIVE or ACTIVE.
PDP Type	C	PDP type, e.g., PPP or IP.
PDP Address	C	PDP address, e.g., an IP address.
APN Subscribed	C	The APN received from the HLR.
APN in Use	C	The APN currently used.
NSAPI	C	Network layer Service Access Point Identifier.
TI	C	Transaction Identifier.
TEID for Gn/Gp	C	Tunnel Endpoint Identifier for the Gn and Gp interfaces.
TEID for Iu	C	Tunnel Endpoint Identifier for the Iu interface.
GGSN Address in Use	C	The IP address of the GGSN currently used.
Subscribed QoS	C	The quality of service profile subscribed.
Requested QoS	C	The quality of service profile requested.
Negotiated QoS	C	The quality of service profile negotiated.
Charging ID	C	Charging identifier, identifies charging records generated by SGSN and GGSN.
PDP Context Charging Characteristics	C	The charging characteristics of this PDP context, e.g., normal, prepaid, flat-rate, and/or hot billing.
RNC Address In Use	C	The IP address of the RNC currently used.

Information element name	Status	Description
Requested QoS Extension	S	This IE contains a supplement to the Requested QoS IE. It shall be present if the Requested QoS IE is present and the MS requested one or more of the following for the PDP context: - Source Statistics Descriptor; - Signalling Indication; - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.
Subscribed QoS Extension	S	This IE contains a supplement to the Subscribed QoS IE. It shall be present if the Subsribed QoS IE is present and one or more of the following is part of the subscription profile in the HLR: - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.
Negotiated QoS Extension	S	This IE contains a supplement to the Negotiated QoS. It shall be present if the Negotiated QoS IE is present and one or more of the following was negotiated between the MS, the SGSN and the GGSN: - Source Statistics Descriptor; - Signalling Indication; - Maximum bit rate for downlink (extended); - Guaranteed bit rate for downlink (extended). Otherwise, it shall be absent.

Location Information For GPRS includes the following information elements:

Information element name	Status	Description
Service area ID	C,E	See 3GPP TS 23.018 [12].
Cell ID	C,E	See 3GPP TS 23.018 [12].
Location area ID	C,E	See 3GPP TS 23.018 [12].
Routeing area ID	C	See 3GPP TS 23.003 [7].
Geographical information	C	See 3GPP TS 23.032 [13].
Geodetic information	C	See ITU-T Q.763 [43].
Age of location information	C	See 3GPP TS 23.018 [12].
Current Location Retrieved	C	See 3GPP TS 23.018 [12].
SGSN number	M	Global Title of the SGSN. See 3GPP TS 23.060 [15].
Selected LSA Identity	C	This IE is applicable only if SoLSA is supported by the SGSN. This IE indicates the LSA identity associated with the current position of the MS. It shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority it shall be present. See 3GPP TS 23.073 [18]

12 Subscriber Mobile Number Portability status retrieval

Support of the procedures described in this clause in CAMEL Phase 4 is a network operator option.

12.1 Architecture

12.1.1 Functional Entities used for CAMEL

This clause describes procedures for the retrieval of subscriber Mobile Number Portability (MNP) information.

The gsmSCF may request subscriber MNP information of a mobile station from the MNP Signalling Relay Function (MNP SRF).

Figure 12.1 indicates the functional entities involved in the procedures for the retrieval of MNP information.
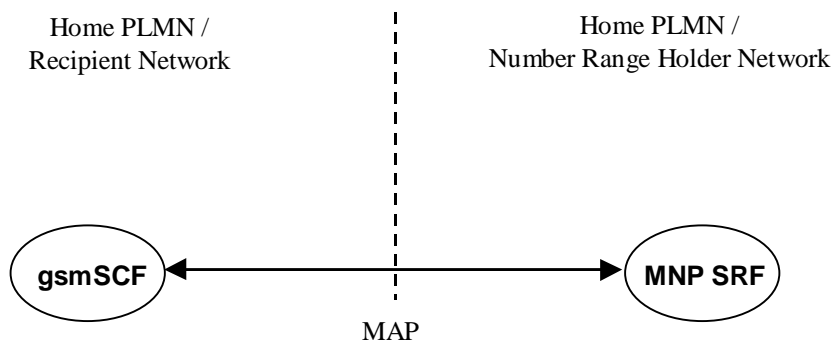
Figure 12.1: Functional architecture for CAMEL Support of providing MNP information

gsmSCF: see subclause 3.1.

MNP SRF: A functional entity that supports the mobile number portability of a mobile station, which is described in 3GPP TS 23.066 [17].

Recipient Network: Network that receives the number in the porting process. This network becomes the subscription network when the porting process is complete. See 3GPP TS 23.066 [17].

Number Range Holder Network: Network to which the number range containing the ported number has been allocated. See 3GPP TS 23.066 [17].

12.1.2   Interfaces defined for CAMEL

This subclause describes the interfaces applicable to CAMEL. It specifies on a high level the functions specific to CAMEL.

12.1.2.1   gsmSCF - MNP SRF interface

This interface is used by the gsmSCF to request MNP information from the MNP SRF at any time.

12.1.2.2   MNP SRF - gsmSCF interface

This interface is used by the MNP SRF to return the requested MNP information to the gsmSCF, as requested by the gsmSCF via the Any Time Interrogation procedure.

12.2   Procedures for CAMEL

12.2.1   Provide MNP Information

12.2.1.1   CAMEL_Provide_MNP_Info with ATI

The process for providing MNP information with Any Time Interrogation (ATI) is the following:

-    CAMEL_ATI_MNP.

Sheet 1: Details of the task box 'Query Number Portability Database' may be obtained from 3GPP TS 23.066 [17]. The task box returns an indication whether the MSISDN is known or not.

Process CAMEL_ATI_MNP 1(1)

/* Process in the MNP SRF receiving an Any Time Interrogation request from gsmSCF.*/

/* Signals to/from the left are to/from the gsmSCF. */

Idle

Any Time Interrogation request

ATI accepted? — No

Yes

Query Number Portability Database - - - Refer to 3GPP TS 23.066

MSISDN known? — No

Yes

Result := MNP Information Result

Set UE := "Unknown subscriber"

Set UE := "ATI Not Allowed"

Any Time Interrogation ack

Any Time Interrogation negative response

Idle
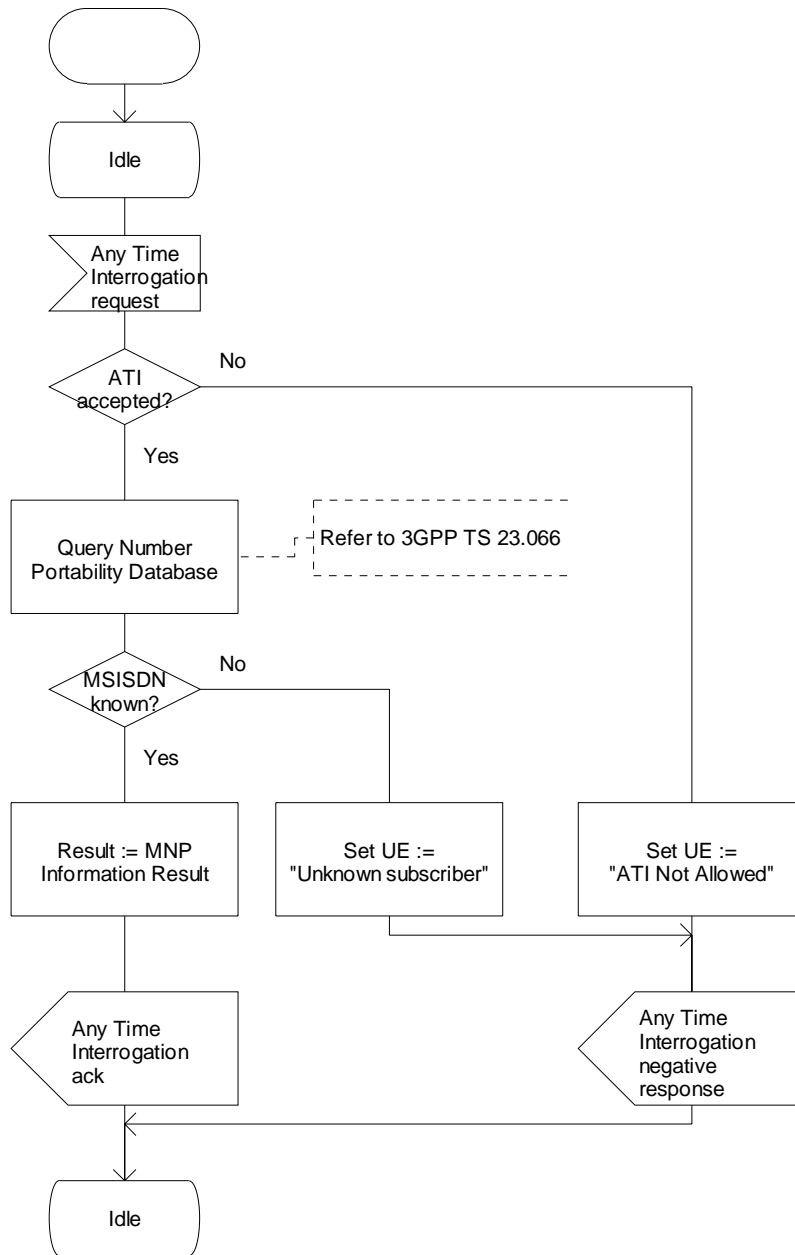
Figure 12.2-1: Process CAMEL_ATI_MNP (sheet 1)

12.3 Description of information flows

This subclause contains the detailed description of the information flows used by CAMEL for the retrieval of MNP information about a subscriber.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Specific conditions (S), mutually Exclusive (E) or not applicable (-).

An 'M' IE shall always be included. A 'C' IE shall be included if the sending entity has the necessary information to populate the IE. The conditions for the inclusion of an 'S' IE are shown in the 'Description' column of the definition table. When a set of 'E' IEs is shown in the definition of an Information Flow or compound IE, only one of those IEs may be included. A '-' IE shall always be omitted. This categorization is a functional classification, i.e. it defines the requirements for the stage 2 information. It is not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The MNP SRF shall return an error if it does not functionally support an IE which it receives.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [34].

12.3.1 gsmSCF to MNP SRF information flows

12.3.1.1 Any Time Interrogation Request

12.3.1.1.1 Description

This IF is used by the gsmSCF to request the MNP information for subscribers from the MNP SRF at any time.

12.3.1.1.2 Information Elements

Information element name	Status	Description
gsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Requested Info	M	This IE indicates the type of subscriber information that is requested. It shall have the following value: - MNP Requested Info.
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity shall be: - MSISDN.

12.3.2 MNP SRF to gsmSCF information flows

12.3.2.1 Any Time Interrogation ack

12.3.2.1.1 Description

This IF is used by the MNP SRF to provide the requested MNP information for the subscriber to the gsmSCF.

12.3.2.1.2 Information Elements

Information element name	Status	Description
MNP Information Result	M	This IE contains the MNP information for the subscriber. It is described in a table below.

MNP Information Result contains the following information:

Information element name	Status	Description
Routeing Number	C	This IE shall be present, if requested by the gsmSCF. Refer to 3GPP TS 23.066 [17].
IMSI	C	This IE shall be present, if requested by the gsmSCF. Refer to 3GPP TS 23.066 [17].
MSISDN	C	This IE shall be present, if requested by the gsmSCF. Refer to 3GPP TS 23.066 [17].
Number Portability Status	C	This IE shall be present, if requested by the gsmSCF. It may have one of the following values: - Not Known To Be Ported; - Own Number PortedOut; - Foreign Number Ported To Foreign Network; - Own Number Not Ported Out; - Foreign Number Ported In. Refer to 3GPP TS 23.066 [17].

Annex A (informative):
Handling of Apply Charging GPRS and Apply Charging Report GPRS

This Annex provides an example to demonstrate the handling of Apply Charging GPRS and Apply Charging Report GPRS.
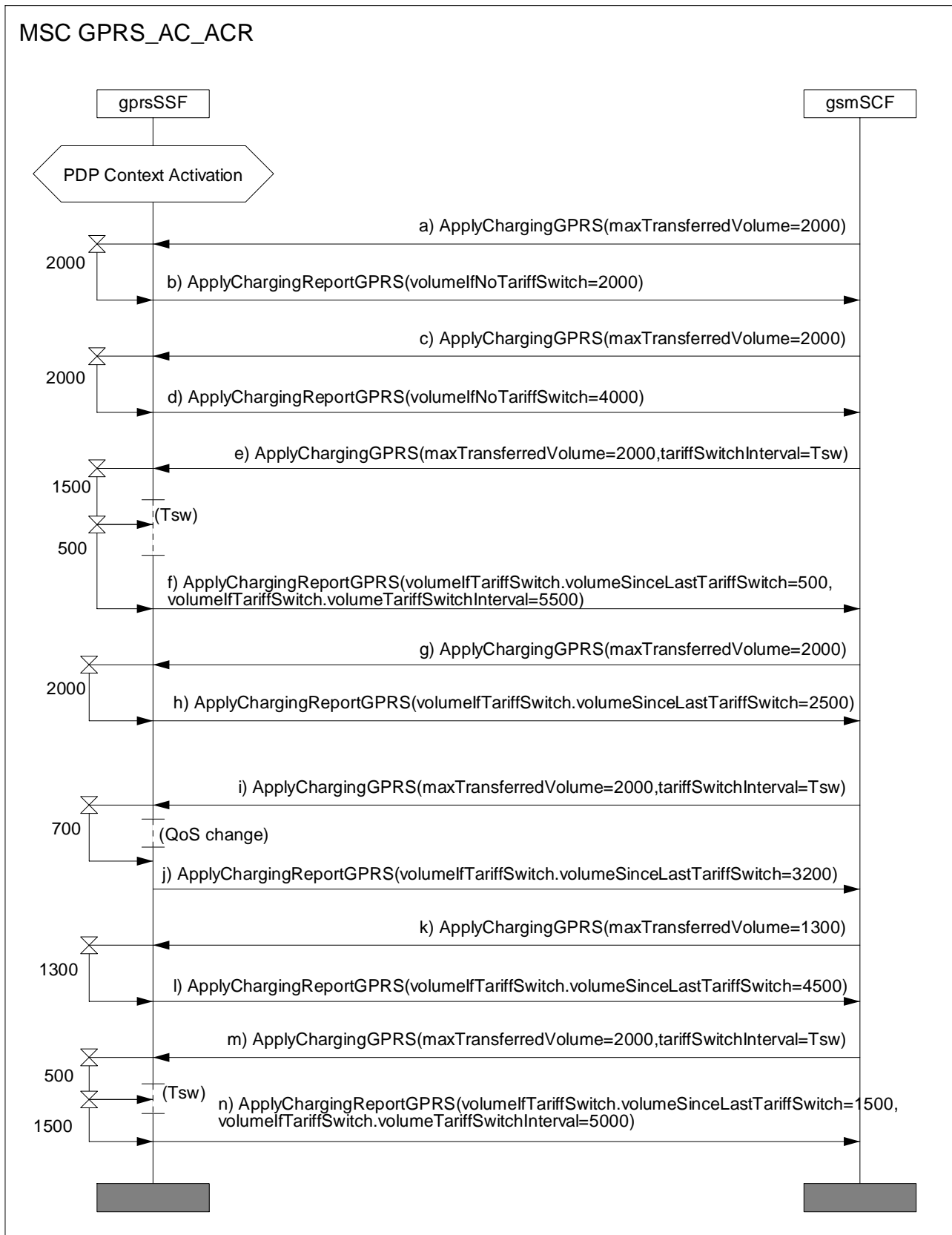
Figure A.1: Example of Handling of Apply Charging GPRS and Apply Charging Report GPRS

In Figure A.1, data volumes transferred for the active PDP context are listed on the left-hand side of diagram. The following is a description of the example:

a) Apply Charging GPRS threshold set to 2000, no tariff switch timer set.

b) After 2000 units of data have been transferred, an Apply Charging Report GPRS is sent to the gsmSCF.

c) The gsmSCF sends another Apply Charging GPRS with a 2000 unit threshold.

d) After 2000 units of data have been transferred, an Apply Charging Report GPRS is sent to the gsmSCF.

e) Another threshold (2000) is set by the gsmSCF in Apply Charging GPRS, and a tariff switch timer is set.

f) After 2000 units have been transferred, Apply Charging Report GPRS is sent to the gsmSCF, as a tariff switch timer has expired since the last Apply Charging GPRS, values for volumeTariffSwitchInterval and Volume transferred since the tariff switch are sent. The gsmSCF stores the value volumeTariffSwitchInterval.

g) The gsmSCF sends another Apply Charging GPRS with a 2000 unit threshold.

h) After 2000 units of data have been transferred, an Apply Charging Report GPRS is sent to the gsmSCF.

i) Apply Charging GPRS sets a tariff switch timer, which does not expire before the next Apply Charging Report GPRS.

j) A change in QoS is reported so Apply Charging Report GPRS is returned to the gsmSCF containing VolumeIfNoTariffSwitch as no tariff switch has occurred since the last Apply Charging Report GPRS. The gsmSCF should store this value if the volume of data transferred at each QoS level is to be calculated. The Tsw sent in the previous Apply Charging GPRS is stopped. In this example the tariff switch timer (Tsw) does not expire before this QoS change. If Tsw had expired the Apply Charging Report GPRS would report the volumeTariffSwitchInterval in the normal way.

k) An Apply Charging GPRS is sent giving a new threshold. This threshold is service logic dependent and does not rely on any previous value sent. In the example it is 'previous threshold - volume transferred since last threshold was set'.

l) The VolumeSinceLastTariffSwitch is reported in the Apply Charging Report GPRS. Note: this includes data transferred before and after the QoS change.

m) Note that a tariff switch timer is set and expires.

n) A final Apply Charging Report GPRS is returned containing the data volume transferred since the last tariff switch, and also the total volume transferred at the previous tariff.

The calculations made by the gsmSCF in this example are:

a) Total Data Volume Transferred in this example: Total of all volumeTariffSwitchInterval received + final volumeSinceLastTariff switch is (5500 + 5000) + 1500 = 12000 units of data

b) Data Volume transferred for each tariff: (periods separated by Tsw in figure A.1)

   - 1st Tariff: taken from Apply Charging Report GPRS (signal f)) volumeTariffSwitchInterval = 5500 units of data

   - 2nd Tariff: taken from Apply Charging Report GPRS (signal n)) volumeTariffSwitchInterval = 5000 units of data

   - 3rd Tariff: taken from VolumeSinceLastTariffSwitch (signal n)) volumeTariffSwitchInterval = 1500 units of data

c) Data Volume Transferred at each QoS level (One QoS Change Occurs in figure A.1)

   - 1st QoS level (up to signal 10): All volumeTariffSwitchIntervals + final VolumeSinceLastTariffSwitch at QoS change is 5500 + 3200 = 8700 units of data.

   - 2nd QoS level (from signal 10 onwards): (Value of first VolumeTariffSwitchInterval received after QoS change - VolumeNoTariffSwitch Received directly after QoS change) + Volume transferred since this tariff switch is (5000-3200) + 1500 = 3300 units of data.

Note: The volume reported to the gsmSCF in an Apply Charging Report GPRS may exceed the threshold sent in the previous Apply Charging GPRS, e.g. if the delta timer exceeds the threshold received in the subsequent Apply Charging GPRS or a data packet is transferred causing the threshold to be exceeded.

Annex B (informative): Change history

					Change history		
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2002-06	CN#16	NP-020205	394	1	Composite changes for CAMEL phase 4	4.4.0	5.0.0
2002-09	CN#17	NP-020343	412	1	CPH clarification on overall SDL architecture	5.0.0	5.1.0
2002-09	CN#17	NP-020343	414		Move Leg not allowed before Active phase of "normal" A-B call	5.0.0	5.1.0
2002-09	CN#17	NP-020343	415	1	Disconnect of penultimate leg in CSID1	5.0.0	5.1.0
2002-09	CN#17	NP-020347	416	3	Handling of partial implementations of CAMEL phase 4	5.0.0	5.1.0
2002-09	CN#17	NP-020345	417		Removal of ChargingNotification feature	5.0.0	5.1.0
2002-09	CN#17	NP-020343	419	1	No use of Call Segment ID for the direct gsmSCF - gsmSRF case	5.0.0	5.1.0
2002-09	CN#17	NP-020345	420	1	Clean-up of LocationInformation table for Call_Accepted DP	5.0.0	5.1.0
2002-09	CN#17	NP-020342	421		Correction of clause 4.3.3 N-CSI	5.0.0	5.1.0
2002-09	CN#17	NP-020342	422		Inconsistency for the negotiated Camel Capability handling of the D-CSI	5.0.0	5.1.0
2002-09	CN#17	NP-020343	423		Change "Initial Call Segment" to "CSID1"	5.0.0	5.1.0
2002-09	CN#17	NP-020343	424		Removal of DP_MidCall state from CAMEL_EXPORT_LEG_MSC	5.0.0	5.1.0
2002-09	CN#17	NP-020343	425		FtN in Perform Call Handling ack	5.0.0	5.1.0
2002-09	CN#17	NP-020476	426	1	CSA_gsmSSF: Handling signals in states such as DL_ack	5.0.0	5.1.0
2002-09	CN#17	NP-020476	429		Wrong State Name in CSA_gsmSSF	5.0.0	5.1.0
2002-09	CN#17	NP-020476	430		Change Int_Continue_Without_Leg2 to Int_Disconnect_Leg (Leg2)	5.0.0	5.1.0
2002-09	CN#17	NP-020476	431		Contents of CWA at MidCall DP	5.0.0	5.1.0
2002-09	CN#17	NP-020343	432	1	Introduction of CPH Definitions	5.0.0	5.1.0
2002-09	CN#17	NP-020340	435	1	Correction in CAMEL_MO_Dialled_Services procedure	5.0.0	5.1.0
2002-09	CN#17	NP-020340	443	1	Inconsistent description on ACR: time information	5.0.0	5.1.0
2002-09	CN#17	NP-020342	446	1	Secondary PDP context for DP change of position context	5.0.0	5.1.0
2002-09	CN#17	NP-020342	447	2	Detail description for applicability of call cases	5.0.0	5.1.0
2002-09	CN#17	NP-020341	450		CAMEL3 inter-working with Rel-4 GPRS barring	5.0.0	5.1.0
2002-12	CN#18	NP-020527	418	4	Playing of Warning Tones	5.1.0	5.2.0
2002-12	CN#18	NP-020526	427	2	Use of Release Call & Release Call Segment in gsmSSF processes	5.1.0	5.2.0
2002-12	CN#18	NP-020526	449	1	Correction of handling of MT-SMS in the SGSN	5.1.0	5.2.0
2002-12	CN#18	NP-020526	452	2	Clarification of architecture for CAMEL control of SMS	5.1.0	5.2.0
2002-12	CN#18	NP-020526	453		Correction of handling of MT-SMS in the VLR	5.1.0	5.2.0
2002-12	CN#18	NP-020526	454		Correction of IDPs in new section 4.5.1	5.1.0	5.2.0

					Change history		
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2002-12	CN#18	NP-020526	456		Add result from GPRS mobility management procedure	5.1.0	5.2.0
2002-12	CN#18	NP-020526	457	1	Detach report in inter-SGSN routeing area update	5.1.0	5.2.0
2002-12	CN#18	NP-020525	461		Correction to interaction between MO-SMS and CB / ODB	5.1.0	5.2.0
2002-12	CN#18	NP-020527	466	1	Correction to VLR Address in Location Information	5.1.0	5.2.0
2002-12	CN#18	NP-020526	470	2	Resolving of open issues on "Support of partial implementation of CAMEL"	5.1.0	5.2.0
2002-12	CN#18	NP-020523	480		Correction to QoS reporting and delta timer overflow	5.1.0	5.2.0
2002-12	CN#18	NP-020527	482		Correction on DP name	5.1.0	5.2.0
2002-12	CN#18	NP-020529	483		Figure and table numbers	5.1.0	5.2.0
2002-12	CN#18	NP-020528	484	1	Better SDL CSA_gsmSSF	5.1.0	5.2.0
2002-12	CN#18	NP-020527	485	1	Correction of "Support of partial implementation of CAMEL"	5.1.0	5.2.0
2002-12	CN#18	NP-020524	489	1	Number comparison for D-CSI	5.1.0	5.2.0
2002-12	CN#18	NP-020528	490	1	Handling of Apply Charging after gsmSCF terminates dialogue or sends 'Release Call'	5.1.0	5.2.0
2002-12	CN#18	NP-020527	494		Inconsistent description "Store destination address"	5.1.0	5.2.0
2002-12	CN#18	NP-020528	495	1	Correction to ATI handling in HLR	5.1.0	5.2.0
2002-12	CN#18	NP-020528	499	1	MSC-number in MAP Location Information	5.1.0	5.2.0
2002-12	CN#18	NP-020528	500	1	ASN default for Flexible Tone BurstInterval due to MEGACO	5.1.0	5.2.0
2002-12	CN#18	NP-020527	504		Removal of redundant information elements from Location Information	5.1.0	5.2.0
2002-12	CN#18	NP-020524	507	2	Clarification on ATM -> NSDC when status of one SS impacts another SS status	5.1.0	5.2.0
2002-12	CN#18	NP-020524	512		Correction to Dialled Services criteria	5.1.0	5.2.0
2003-03	CN#19	NP-030088	491	2	Handling of a stand alone call segment in CS_gsmSSF	5.2.0	5.3.0
2003-03	CN#19	NP-030088	513		Handling of Int_Import_Leg in CS_gsmSSF	5.2.0	5.3.0
2003-03	CN#19	NP-030088	516	2	Correction to CAMEL interaction with Line Identification	5.2.0	5.3.0
2003-03	CN#19	NP-030088	517	1	Correction to implicit disarming of DPs in CS_gsmSSF	5.2.0	5.3.0
2003-03	CN#19	NP-030088	518	3	Correction to the ATI Information Flow table structure	5.2.0	5.3.0
2003-03	CN#19	NP-030088	520	1	Correction to CTR Information Flow	5.2.0	5.3.0
2003-03	CN#19	NP-030089	526		Consistent prefix naming of 23.078 signals.	5.2.0	5.3.0
2003-03	CN#19	NP-030068	529		Correction to interactions between CAMEL control of MO SMS and barring	5.2.0	5.3.0
2003-03	CN#19	NP-030089	531		Alignment of signal names with TS 29.002	5.2.0	5.3.0
2003-03	CN#19	NP-030089	533	2	Buffering of TC messages in the SGSN while waiting for the first SCP response	5.2.0	5.3.0
2003-03	CN#19	NP-030089	534		Disallowing ACH-GPRS when PDPc already disconnected	5.2.0	5.3.0
2003-03	CN#19	NP-030089	536	1	Correction to timer expiry handling during call forwarding notification	5.2.0	5.3.0
2003-03	CN#19	NP-030089	538		Correction to Call Information Request	5.2.0	5.3.0

					Change history		
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2003-03	CN#19	NP-030085	541	1	Inconsistency in Call Information Report in Re-Connect Case	5.2.0	5.3.0
2003-03	CN#19	NP-030089	542	1	Handling of AC and ACR in GPRS	5.2.0	5.3.0
2003-03	CN#19	NP-030085	544		Correction to SRI Information Flow	5.2.0	5.3.0
2003-03	CN#19	NP-030085	546		Introduction of ResetTimer input in state WFI-DS	5.2.0	5.3.0
2003-06	CN#20	NP-030188	486	6	Implementing and handling of the Outstanding Request Counter	5.3.0	5.4.0
2003-06	CN#20	NP-030188	554	2	Correction to MAP PRN and to MAP SRI	5.3.0	5.4.0
2003-06	CN#20	NP-030188	555	1	Removal of ENC disarming from SDL	5.3.0	5.4.0
2003-06	CN#20	NP-030188	556		Correction to assisting gsmSSF	5.3.0	5.4.0
2003-06	CN#20	NP-030188	559	1	Correction to Destination Routeing Address in ICA	5.3.0	5.4.0
2003-06	CN#20	NP-030188	560	1	Default value for Domain Indicator in ATI IF	5.3.0	5.4.0
2003-06	CN#20	NP-030188	561	2	Correction to Cancel IF	5.3.0	5.4.0
2003-06	CN#20	NP-030188	562		Correction to Specialized Resource Report IF	5.3.0	5.4.0
2003-06	CN#20	NP-030188	563	1	Reference to ITU-T timer for default No_Answer timer	5.3.0	5.4.0
2003-06	CN#20	NP-030188	564	1	Correction to Reset Timer handling in CS_gsmSSF	5.3.0	5.4.0
2003-06	CN#20	NP-030189	565		TC-ABORT shall not cause "same signal" output in GPRS dialogue handler	5.3.0	5.4.0
2003-06	CN#20	NP-030189	567		Adding of TIF-CSI into CAMEL stage 2 MAP-ISD for Call Deflection	5.3.0	5.4.0
2003-06	CN#20	NP-030189	572	1	Receiving Int_CWA after reporting Abandon	5.3.0	5.4.0
2003-06	CN#20	NP-030189	576		Correction to TC Establishment procedure	5.3.0	5.4.0
2003-06	CN#20	NP-030189	585		VLR number in ERB is not needed	5.3.0	5.4.0
2003-06	CN#20	NP-030189	586		Removal of Int_CWA in Process CAMEL_T_CHANGE_OF_POSITION_MSC	5.3.0	5.4.0
2003-06	CN#20	NP-030189	587		SRI Handling and CAMEL phase 4	5.3.0	5.4.0
2003-06	CN#20	NP-030189	593		Behavior of HLR upon location updating in CAMEL Phase 4	5.3.0	5.4.0
2003-06	CN#20	NP-030189	594		Inclusion of DFC from assisting gsmSSF dialogue	5.3.0	5.4.0
2003-06	CN#20	NP-030189	596		Renaming DP numbers by names	5.3.0	5.4.0
2003-09	CN#21	NP-030362	622		Correction in handling of Start-Delta and Stop-Delta operations	5.4.0	5.5.0
2003-09	CN#21	NP-030363	584		Direction change of incoming message Answer	5.4.0	5.5.0
2003-09	CN#21	NP-030363	608		Correction to procedure Handle_O_Answer	5.4.0	5.5.0
2003-09	CN#21	NP-030363	610	1	Correction of 'pty continues' and 'LegActive' check boxes in SDL"s	5.4.0	5.5.0
2003-09	CN#21	NP-030363	612	1	Receiving Int_CWA after reporting Abandon	5.4.0	5.5.0
2003-09	CN#21	NP-030364	530	2	Using ATI for Mobile Number Portability	5.4.0	5.5.0
2003-09	CN#21	NP-030365	523	5	Handling of Connect operation with and without LegID	5.4.0	5.5.0
2003-09	CN#21	NP-030365	524	4	Handling of Information Flows with absent LegID and CS ID	5.4.0	5.5.0

					Change history		
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2003-09	CN#21	NP-030365	570	2	Update of Charging spec references	5.4.0	5.5.0
2003-09	CN#21	NP-030365	573	2	Reporting Disconnect (leg n)	5.4.0	5.5.0
2003-09	CN#21	NP-030365	575		Correction to procedure CAMEL_ICA_MSC	5.4.0	5.5.0
2003-09	CN#21	NP-030365	601		Correction of "Int_leg_Status_Report" to avoid double state changes in the CSA	5.4.0	5.5.0
2003-09	CN#21	NP-030365	609		Correction to usage of LegId in ICA Operation	5.4.0	5.5.0
2003-09	CN#21	NP-030365	611	1	Correction to Apply Charging and Apply Charging Report due to introduction of CPH	5.4.0	5.5.0
2003-09	CN#21	NP-030365	616		Allow user interaction at answer DP	5.4.0	5.5.0
2003-09	CN#21	NP-030366	603		Correction to SMS Event Disarming	5.4.0	5.5.0
2003-09	CN#21	NP-030366	604	1	Correction to SMS Error handling	5.4.0	5.5.0
2003-09	CN#21	NP-030367	605		Correction to PlayTone pre-conditions	5.4.0	5.5.0
2003-09	CN#21	NP-030367	617	3	Handling of concurrent tones	5.4.0	5.5.0
2003-09	CN#21	NP-030368	558		Correction to partial implementation of CAMEL4	5.4.0	5.5.0
2003-09	CN#21	NP-030368	602	1	Alignment of Offered CAMEL4 functionalities	5.4.0	5.5.0
2003-09	CN#21	NP-030368	614		Correction to Change of position processes	5.4.0	5.5.0
2003-09	CN#21	NP-030368	615		Correction on MG-CSI sending to the SGSN	5.4.0	5.5.0
2003-09	CN#21	NP-030369	620	1	Correction to InitialDP for SCUDIF	5.4.0	5.5.0
2003-09					Editorial correction: Deleting of unnecessary files from SDL zip file	5.5.0	5.5.1
2003-12	CN#22	NP-030522	619	3	CAMEL Leg Handling	5.5.1	5.6.0
2003-12	CN#22	NP-030522	624	1	CAMEL DP Leg Handling	5.5.1	5.6.0
2003-12	CN#22	NP-030522	627		Correction to MAP SRI between gsmSCF and HLR - Supported CAMEL Phases shall be Mandatory	5.5.1	5.6.0
2003-12	CN#22	NP-030522	628		Removal of Int_Continue from process ICA_MSC	5.5.1	5.6.0
2003-12	CN#22	NP-030522	631	2	Correction to MAP SRI between gsmSCF and HLR - HLR shall use TS11	5.5.1	5.6.0
2003-12	CN#22	NP-030522	636	1	CAMEL User interaction at alerting and MidCall	5.5.1	5.6.0
2003-12	CN#22	NP-030522	642	1	Use of Continue With Argument for gsmSCF initiated calls	5.5.1	5.6.0
2003-12	CN#22	NP-030522	644		Correction to Disconnect Leg handling - gsmSSF shall send charging reports	5.5.1	5.6.0
2003-12	CN#22	NP-030523	568	2	CLIR/CLIP interaction with CSE initiated calls	5.5.1	5.6.0
2003-12	CN#22	NP-030523	613	1	Handling AC Pending if ETC/ CTR fails	5.5.1	5.6.0
2003-12	CN#22	NP-030523	629		Remove contents table for MNP Requested Info parameter	5.5.1	5.6.0
2003-12	CN#22	NP-030523	633	1	Reporting Basic Service at DP Answer for SCUDIF calls	5.5.1	5.6.0
2003-12	CN#22	NP-030523	634	1	SDL handling of DisconnectFromIPForbidden handling in Assisting SSF case	5.5.1	5.6.0
2003-12	CN#22	NP-030523	643		Inclusion of DP O_Term_Seized in	5.5.1	5.6.0
2003-12	CN#22	NP-030524	641		Using Suppress T-CSI in ICA for NP call legs	5.5.1	5.6.0

ETSI

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2003-12	CN#22	NP-030531	646		Extension of QoS for HSDPA in GPRS CAMEL	5.5.1	5.6.0
2004-03	CN#23	NP-040137	648	1	Missing DisconnectLeg Result	5.6.0	5.7.0
2004-03	CN#23	NP-040090	655		DP Triggering without having armed the TDP	5.6.0	5.7.0
2004-03	CN#23	NP-040136	661	1	Correction to dialed services triggering for NP and NC calls	5.6.0	5.7.0
2004-03	CN#23	NP-040137	662	1	Correction to DP description tables	5.6.0	5.7.0
2004-03	CN#23	NP-040136	663		Correction to No Answer handling (CAMEL_OCH_MSC2)	5.6.0	5.7.0
2004-03	CN#23	NP-040136	666	1	Handling of DFCWA in ETC and CTR procedures	5.6.0	5.7.0
2004-03	CN#23	NP-040137	667	1	Correction to CUG handling for NP calls	5.6.0	5.7.0
2004-03	CN#23	NP-040137	668	1	Correction to CAMEL_ICA_MSC (hanging connector)	5.6.0	5.7.0
2004-03	CN#23	NP-040137	669	1	Allowing Export_leg at DP Alerting and DP Answer	5.6.0	5.7.0
2004-03	CN#23	NP-040136	670		Correction to handling of DFC in CS_gsmSSF	5.6.0	5.7.0
2004-03	CN#23	NP-040137	671	2	Correction to Request Report BCSM Event handling in CSA_gsmSSF	5.6.0	5.7.0
2004-03	CN#23	NP-040137	673	2	Correction to Split Leg handling in CSA_gsmSSF	5.6.0	5.7.0
2004-03	CN#23	NP-040136	674	1	Correction to both way through parameter for ETC and CTR	5.6.0	5.7.0
2004-03	CN#23	NP-040137	675	1	Correction to CS ID Prompt & Collect	5.6.0	5.7.0
2004-03	CN#23	NP-040136	676	1	Correction to forwarded leg handling with Suppress O-CSI	5.6.0	5.7.0
2004-03	CN#23	NP-040136	677	1	Correction to ORLCF handling for CAMEL calls in VMSC	5.6.0	5.7.0
2004-03	CN#23	NP-040136	678		Correction to Information Location at DP O_Term_Seized	5.6.0	5.7.0
2004-03	CN#23	NP-040137	679	2	Correction to Tssf timer at Apply Charging	5.6.0	5.7.0
2004-03	CN#23	NP-040137	680	1	Correction to SplitLeg preconditions	5.6.0	5.7.0
2004-03	CN#23	NP-040138	681	2	Correction to Disconnect Leg preconditions	5.6.0	5.7.0
2004-03	CN#23	NP-040096	692	4	LLC passes on the gsmSSF - gsmSCF interface	5.6.0	5.7.0
2004-03	CN#23	NP-040138	709		Starting of Timer Tccd after ACR on DP 'Change of Position'	5.6.0	5.7.0
2004-06	CN#24	NP-040207	713	2	Correction to Tssf timer	5.7.0	5.8.0
2004-06	CN#24	NP-040207	714	1	Correction to Move Leg pre-condition	5.7.0	5.8.0
2004-06	CN#24	NP-040207	717		Correction to D-CSI suppression in Continue With Argument	5.7.0	5.8.0
2004-06	CN#24	NP-040207	718	3	Correction to InitialDP IF for NP leg	5.7.0	5.8.0
2004-06	CN#24	NP-040207	719	1	Correction to Entity Released for individual call party	5.7.0	5.8.0
2004-06	CN#24	NP-040207	720	1	Correction to User Interaction before Answer	5.7.0	5.8.0
2004-12	CN#26	NP-040525	754		Clarification on Outstanding Request Counter (ORC) handling at EDP-R or TDP-R resumption	5.8.0	5.9.0

History

Document history		
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