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Technical Specification

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Customized Applications for Mobile network Enhanced
Logic (CAMEL) phase 3 - Stage 2
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Foreword

This Technical Specification (TS) has been produced by the 3GPP.

This TS specifies the stage 2 description for the third phase (see 3G TS 22.078 [2]) 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 this TS, it will then be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 Indicates TSG approved document under change control.
- y the second digit is incremented for changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

This Technical Specification (TS) specifies the stage 2 description for the third phase (see 3G TS 22.078 [2]) 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 GSM 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 this specification, 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.

In the third phase the CAMEL feature supports:

- mobile originated and forwarded calls;
- mobile terminating calls;
- any time interrogation;
- active location information retrieval;
- suppression of announcements;
- announcements, in band user interaction;
- charging features;
- supplementary service invocation notifications;
- USSD interaction with the gsmSCF;
- North American carrier selection;
- Mobility Management event notifications;
- change of Calling Line Identification Presentation Indicator for an MO call to restricted;
- SoLSA;
- Subscribed dialled services;
- Serving network dialled services;
- MO SMS;
- GPRS data transmission;
- Mobility management;
- Notification to CSE of change of subscriber data;
- Any Time Modification;
- Any Time Interrogation of subscription Information
- T-BCSM in the VMSC and terminating AoC;
- Interworking with Location Services;
- Multiple Subscriber Profile;
- Active Location Retrieval;

- Call Gapping.

Note that CAMEL is not applicable to Emergency Setup (TS 12), i.e., in case an Emergency call has been requested the gsmSSF shall not be invoked.

The mechanism described in this standard 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 this standard. 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 this standard.

2 Normative 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.
 - A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
 - [2] 3G TS 22.078: "Digital cellular telecommunications system (Phase 2+); Customized Applications for Mobile network Enhanced Logic (CAMEL) - Phase 3. Service description. Stage 1
 - [3] 3G TS 23.018: "Digital cellular telecommunications system (Phase 2+); Basic call handling ; Technical realisation".
 - [4] 3G TS 29.002: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".
 - [5] 3G TS 29.078: "Digital cellular telecommunications system (Phase 2+); CAMEL Application Part (CAP) specification - Phase 3".
 - [6] ITU-T Q.1214, May 1995: "Distributed Functional Plane for Intelligent Network CS-1"
 - [7] EN 301 070-1 (V1.1.1): "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]".
 - [8] 3G TS 23.090: "Digital cellular telecommunication system (Phase 2+); Unstructured Supplementary Service Data (USSD) - Stage 2".
 - [9] 3G TS 23.085: "Digital cellular telecommunications system (Phase 2+); Closed User Group (CUG) supplementary services - Stage 2".
 - [10] ANSI T1.113-1995 Signalling System No. 7(SS7) – Integrated Services Digital Network (ISDN) User Part.
 - [11] 3G TS 23.060: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service Description; Stage 2"
 - [12] ITU-T Q.1290, May 1998: "Glossary of terms used in the definition of intelligent networks"
 - [13] ITU-T Q.850, May 1998: "Usage of cause and location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN User Part"
 - [14] EN 300 403-1 (V1.3.?): "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified] "
 - [15] ITU-T Q.762, September 1997: "Signalling System No. 7 – ISDN user part general functions of messages and signals"
 - [16] ITU-T Q.763, December 1999: "Signalling System No. 7 – ISDN user part formats and codes"
 - [17] 3G TS 22.071: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Service description, Stage 1".

- [18] 3G TS 23.071: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Functional description, Stage 2".
- [19] 3G TS 27.001: "Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".
- [20] 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]"
- [21] 3G TS 23.040: " Digital cellular telecommunications system (Phase 2+); Technical realization of the Short Message Service (SMS); Point-to-Point (PP) (3G TS 23.040 version 7.1.0 Release 1998)".
- [22] 3G TS 22.030: "Digital cellular telecommunications system (Phase 2+); Man-Machine Interface (MMI) of the Mobile Station (MS)"
- [23] 3G TS 23.073: "Digital cellular telecommunications system (Phase 2+); Support of Localised Service Area (SoLSA); Stage 2".
- [24] 3G TS 22.002: "Bearer Services supported by a GSM PLMN (3G TS 22.002 version 3.0.0 Release 1999)".
- [25] 3G TS 22.004: "General on supplementary services (3G TS 22.004 version 3.0.0 Release 1999)".
- [26] 3G TS 23.011: "Technical realization of supplementary services - General Aspects (3G TS 23.011 version 3.0.0 Release 1999)".
- [27] 3G TS 23.082: "Call Forwarding (CF) Supplementary Services - Stage2 (3G TS 23.082 version 3.0.0 Release 1999)".
- [28] 3G TS 23.084: "Digital cellular telecommunications system; Multi Party (MPTY) supplementary services - Stage 2".
- [29] 3G TS 23.091: "Digital cellular telecommunications system; Explicit Call Transfer (ECT) supplementary service – Stage 2"
- [30] ITU-T Q.1224, May 1999: "Distributed Functional Plane for Intelligent Network Capability Set 2"
- [31] 3G TS 22.024: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Description of Charge Advice Information (CAI)"
- [32] 3G TS 23.012: "3rd Generation Partnership Project; Technical Specification Group Core Network; Location management procedures"
- [33] 3G TS 24.008: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification"
- [34] 3G TS 23.032: "3rd Generation Partnership Project; Technical Specification Group Core Network; Universal Geographical Area Description (GAD)"

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this TS, the following definitions apply:

Basic Call State Model (BCSM): The 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): The CCF is the Call Control Function in the network that provides call/service processing and control (see ITU-T Q.1214 [6]).

Detection Points (DP): The 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): The D-CSI identifies the subscriber as having originating CAMEL dialled services.

Forwarding MSC: A MSC which is either an MSC invoking a GSM standardized call forwarding or call deflection service; or an MSC invoking a Camel based call forwarding service.

Gateway MLC (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:

- location of Mobile Station

See [17] and [18] for information on the GMLC.

Geodetic Information: Information defining the location of a mobile station, coded according to [16]. 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 [34].

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

GSM Service Control Function (gsmSCF): A 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): A functional entity that interfaces the MSC/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): A functional entity which provides various specialized resources. It interfaces with the gsmSCF and with the MSC. This entity is defined in ITU-T Q.1214 ([6]) with variations defined in the specification.

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

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

NA (North American): A 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): The 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): The 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): The O-CSI identifies the subscriber as having originating CAMEL services.

Point In Association (PIA): PIAs identify MSC/VLR/ 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: The 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-CSI.

Serving MLC: functional entity that performs location information retrieval.

Short Message Service CAMEL Subscription Information (SMS-CSI): The SMS-CSI identifies the subscriber as having MO SMS CAMEL services.

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

Subscriber State: See 3G TS 22.078 [2].

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

Terminating Basic Call State Model (T-BCSM): The 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): The T-CSI identifies the subscriber as having terminating CAMEL services in the GMSC.

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

Translation Information Flag (TIF-CSI) : The 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) : The 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) : The 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 this specification are listed in GSM 01.04 [1].

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

BCSM	Basic Call State Model
CAMEL	Customized Applications for Mobile network Enhanced Logic
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
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
MLC	Mobile Location Centre
MO	Mobile Originating
MSC	Mobile service Switching Centre
MT	Mobile Terminating in GMSC
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
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
SMF	Service Management Function
SMLC	Serving MLC
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
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 GSM functionality are described. Figure 4.1 shows the functional entities involved in calls requiring CAMEL support. The architecture is applicable to the third phase of CAMEL.

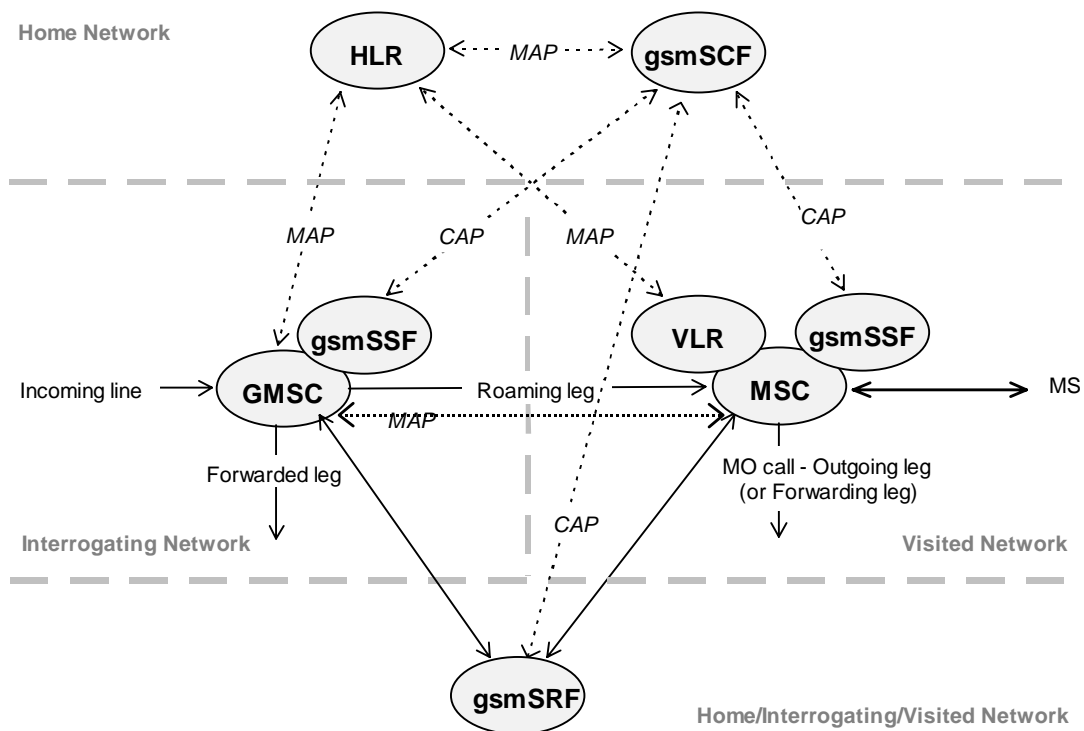


Figure 4.1: Functional architecture for support of CAMEL

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

GMSC: When processing the calls for subscribers requiring CAMEL support, the GMSC receives a O/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 a O-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. When processing an invocation of any of the supplementary services ECT, CD and MPTY, the MSC may receive a 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 O-CSI, VT-CSI, TIF-CSI and SS-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 routing information, subscriber status, location information, subscription information and suppression of announcements. The O/T-CSI 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 specification 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.

4.1.2.5 MSC - gsmSSF interface

This is an internal interface. The interface is described in the specification 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 routing.

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 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

The mechanism by which the DP is armed. A DP may be statically armed or dynamically armed.

The following arming rules apply:

- DP for mobile terminating call handling is statically armed in GMSC as result of T-CSI delivery from HLR. DP for mobile terminating call handling is statically armed in VMSC as result of VT-CSI delivery from VLR. DP for forwarding leg handling is statically armed in GMSC as result of O-CSI delivery from HLR. DP for mobile originating call or forwarded leg handling is statically armed in VMSC as result of O-CSI delivery from VLR.
- A DP is dynamically armed by the gsmSCF within the context of a CAMEL control relationship (between the gsmSSF and the gsmSCF).

The following disarming rules apply:

- A statically armed DP is disarmed when a O-CSI, T-CSI or VT-CSI 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 section 4.4.4).
- If an EDP is armed, it can be explicitly disarmed by the gsmSCF by means of the RequestReportBCSMEvent 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 an mobile originating call are checked in the originating MSC.

The criteria for an 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 RCH message 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. 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 GSM 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 case of Call Deflection), the Forwarded-to-Number retained in the VLR or the Destination Routing Address received in the Connect operation from SCF 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 operation from SCF during a Terminating CAMEL Service or on the Forwarded-to-Number received in the RCH message.

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 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 destination number is the same as the nature of address of the destination number string
- 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 or GSM call forwarding. 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 or GSM call forwarding.

4.2.1.2.2 Criteria at DP Analysed_Information

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. Reason is 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 RCH message sent to the GMSC. Reason is that 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 number plan indicator.

For MO calls, triggering at DP Analysed_Info shall be based on the number received over the access network.

Any service selection information, including * and # digits, or carrier selection information, dialled by the subscriber, shall be removed from the number before conditional triggering check takes place. No translation shall be performed on the number for triggering purposes.

Refer to 3G TS 22.030 [22] for the codes and values for service feature codes.

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 case of Call Deflection), the Forwarded-to-Number retained in the VLR, or the Destination Routing Address in the Connect operation from the SCF during a Mobile Terminated or Mobile Forwarded CAMEL Service.

Any service selection information or carrier selection information shall be removed from the number before conditional triggering check takes place. No translation shall be performed on the number for triggering purposes.

For MF calls at the GMSC, triggering at DP Analysed_Info shall be based on the Forwarded-to-Number received from HLR, on the Destination Routing Address received in the Connect operation from SCF during a Mobile Terminated or Mobile Forwarded CAMEL Service, or on the Forwarded-to-Number received in the RCH message.

Any service selection information or carrier selection information shall be removed from the number before conditional triggering check takes place. No translation shall be performed on the number for triggering purposes.

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 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.

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. Reason is that 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 RCH message sent to the GMSC. Reason is that 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.

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. 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. Reason is that 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 SRI-Ack includes the Not Reachable FTN, then 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 SRI-Ack 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 triggering check.

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

The following criteria are applicable for DP T_Busy and T_No_Answer:

- Release cause code

The trigger criteria are met if the cause code received from ISUP or MAP is equal to at least one of the cause codes in the trigger criteria list.

If trigger criteria are satisfied, either in GMSC or VMSC, then the corresponding Service Logic shall be invoked. If a T-BCSM was already invoked and there is a control relationship at that moment, then no Service Logic shall be invoked.

When a RCH message is received in the GMSC and the subscriber has T-CSI then the forwarding reason in the RCH message shall be used to perform 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 control relationship at that moment, then no Service Logic shall be invoked.

4.2.1.3 Relationship

Given that an armed DP was encountered, the gsmSSF provides an information flow via a relationship.

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 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 armed, or
 - 1 or more Call information Report outstanding, or
 - an Apply Charging Report outstanding.
- A control relationship terminates if it does not persist and does not change to a monitor relationship. 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

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

4.3.1.3 Service Key

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

4.3.1.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested in case of error in the gsmSSF to gsmSCF dialogue. A default call handling shall be associated to each Service Key.

4.3.1.5 DP criteria

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

4.3.1.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked 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 Dialed Service CAMEL Subscription Information (D-CSI)

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

4.3.2.1 DP criteria

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

4.3.2.2 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 routing.

For the D-CSI a gsmSCF address shall be associated to each DP criterion.

4.3.2.3 Service Key

The Service Key identifies to the gsmSCF the service logic.

For the D-CSI a Service Key shall be associated to 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 in case of error in the gsmSSF to gsmSCF dialogue. A default call handling shall be associated to each DP criteria.

4.3.2.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service. It shall indicate CAMEL phase 3.

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 Service CAMEL Subscription Information (N-CSI)

The N-CSI identifies services offered on a per-network basis by the serving PLMN operator for all subscribers.

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

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

4.3.4.1 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.

4.3.4.2 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 routing. Different gsmSCF addresses may be associated to different TDPs.

4.3.4.3 Service Key

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

4.3.4.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested in case of error in the gsmSSF to gsmSCF dialogue. A default call handling shall be associated to each Service Key.

4.3.4.5 DP criteria

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

4.3.4.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked 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).

4.3.4.7 CSI state

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

4.3.4.8 Notification flag

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

4.3.5 VMSC Terminating CAMEL Subscription Information (VT-CSI)

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

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

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

4.3.5.3 Service Key

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

4.3.5.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested in case of error in the gsmSSF to gsmSCF dialogue. A default call handling shall be associated to each Service Key.

4.3.5.5 DP criteria

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

4.3.5.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked 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).

4.3.5.7 CSI state

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

4.3.5.8 Notification flag

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

4.3.6 Other CAMEL data

4.3.6.1 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.

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

4.3.6.2.1 Translation Information Flag

A flag (TIF) in the CAMEL Subscriber data in the HLR 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, call barring checks (cf. 4.7.2).

If the flag is absent, this indicates that a translation is needed in the HLR and the usual procedure applies as defined in the current version of TS GSM 03.82. In particular, the interaction with barring services shall be performed by the HLR at the registration of the FTN.

A flag (TIF) in the CAMEL Subscriber data in the VLR indicates, when the subscriber registers a forwarded-to number, that the VLR shall not attempt to perform any translation, number format checks, prohibited DTN checks, call barring checks (cf. 4.7.2).

If the flag is absent, this indicates that a translation is needed in the VLR and the usual procedure applies as defined in the current version of TS GSM 03.82. In particular, the interaction with barring services shall be performed by the VLR at the registration of the DTN.

4.3.6.2.2 Notification flag

The notification flag indicates whether the change of the TIF-CSI is notified to the gsmSCF or not.

4.4 Description of CAMEL BCSMs

4.4.1 General Handling

The BCSM is used to describe the actions in an MSC/GMSC/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.

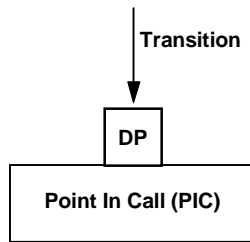


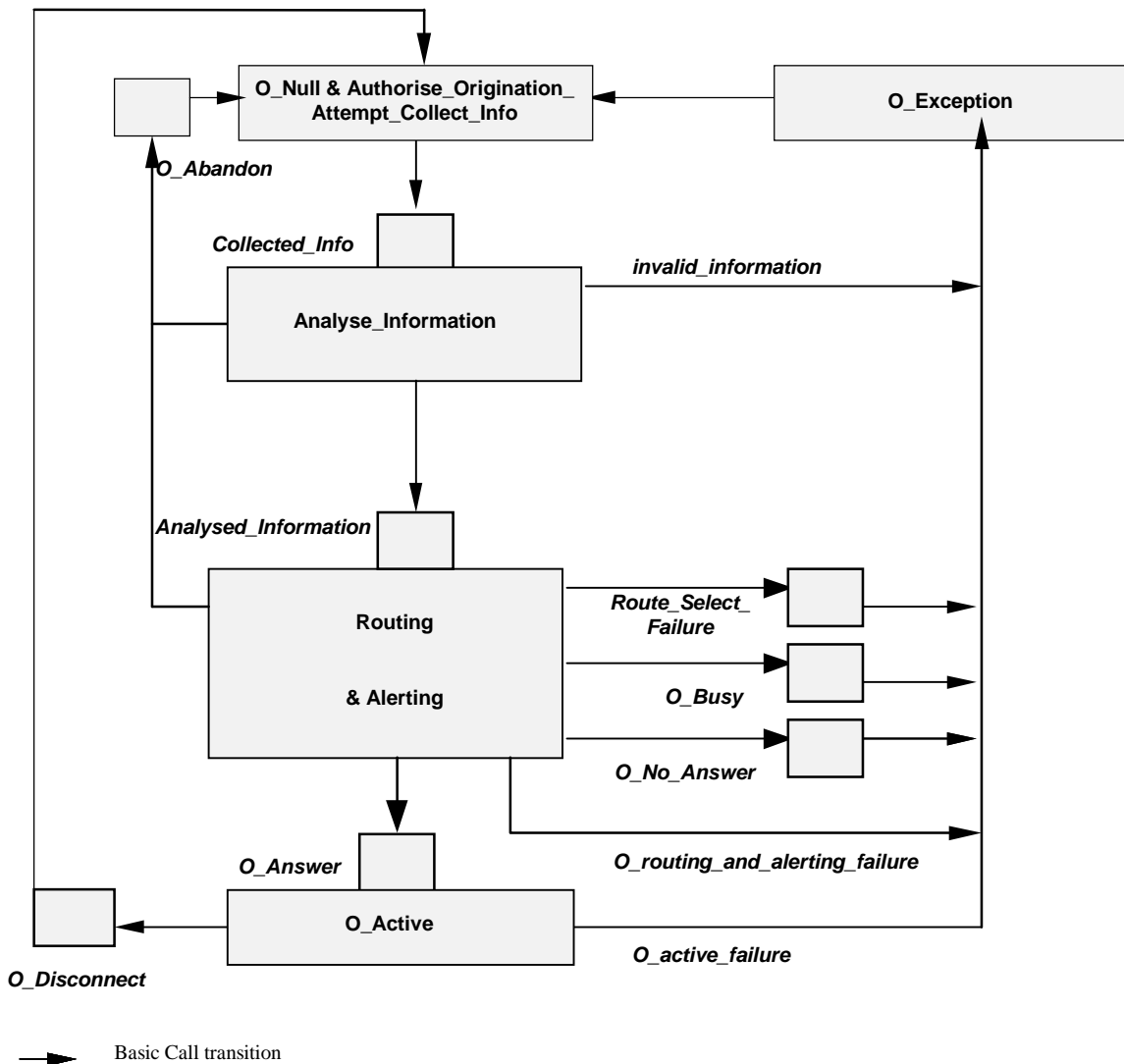
Figure 4.2: BCSM Components

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/GMSC indicates this to the gsmSSF which determines what action, if any, shall be taken in case the DP is armed.



NOTE: The *O_Busy* DP includes also the 'not reachable' case.

Figure 4.3: Originating BCSM for CAMEL

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

Table 4.1: 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. This DP is also used for gsmSCF initiated call setup. In this case the DP is neither triggered nor reported.
DP Analysed_Information	TDP-R (note 2)	Availability of routing 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 upon 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
DP O_Answer	EDP-N, EDP-R	Indication that the call is accepted and answered by the terminating party.
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 Q.1224 ([6]). 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.		

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 Q.1214 [6] 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 message 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).
- New routing information is received when Busy event, Route Select Failure event, Not Reachable event or No Answer event is reported from Routing and Alerting PIC.
- New routing information is received when Disconnect event is reported from O_Active PIC.

Actions:

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

Exit events:

- Availability of routing address and nature of address. (DP Analysed_Information)
- An exception condition is encountered (e.g. wrong number)- this leads to the O_Exception PIC.
- Calling party abandons the call- this leads to the O_Abandon DP.

4.4.2.1.1.3 Routing & Alerting

Entry events:

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

Actions:

- Information is being analysed and/or translated according to dialling plan to determine routing address.
- Routing address being interpreted.
- Originating call: Outgoing barring services and ODB categories not already applied are checked and invoked if necessary.
- Call is being processed by the terminating half BCSM. Continued processing of call setup (e.g., ringing) is taking place. Waiting for indication from terminating half BCSM that the call has been answered by terminating party.

Exit events:

- Indication from the terminating half BCSM that the call is accepted and answered by terminating party. (DP O_Answer)
- An exception condition is encountered - this leads to the O_Exception PIC.
- 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.
- Attempt to select the route for the call fails - this leads to the Route_Select_Failure DP.
- If the no reply timer expires and DP O_No_Answer is armed - this leads to the O_No_Answer DP.

4.4.2.1.1.4 O_Active

Entry events:

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

Actions:

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

Exit events:

- A disconnection indication is received from the originating party, or received from the terminating party via the terminating half BCSM. (DP9 - O_Disconnect)
- An exception condition is encountered.

4.4.2.1.1.5 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 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 / VMSC indicates this to the gsmSSF which determines what action, if any, shall be taken in case the DP is armed.

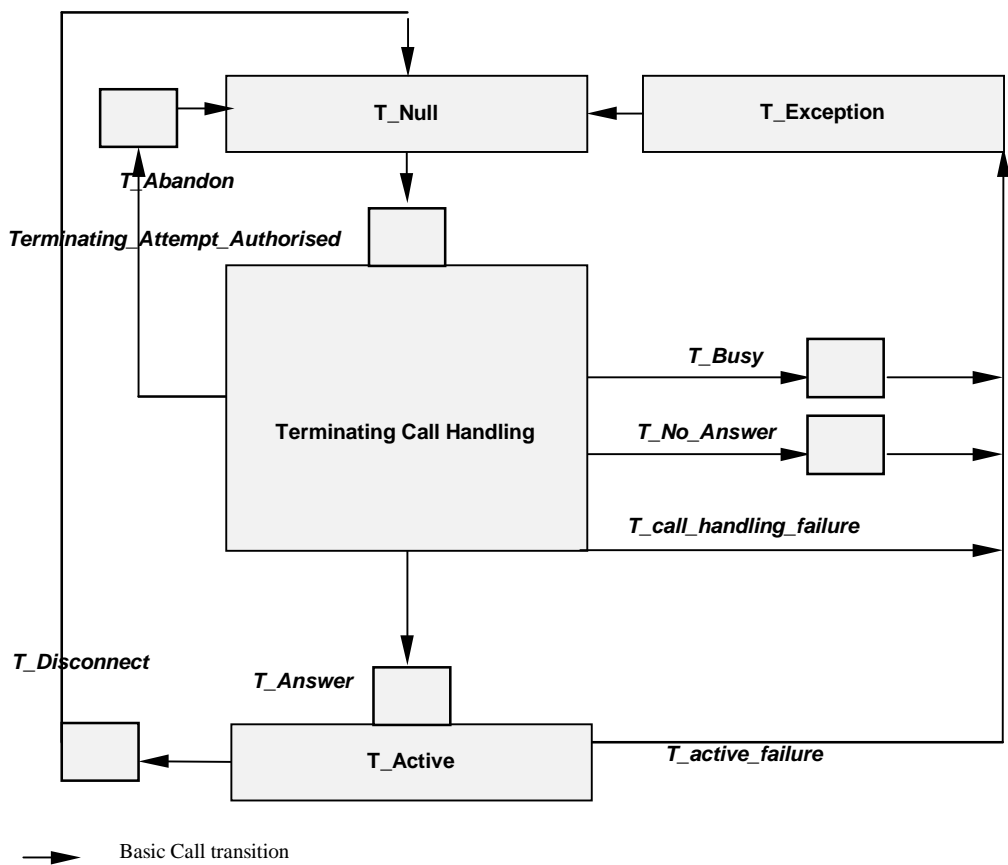


Figure 4.4: T-BCSM in the GMSC / VMSC

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

Table 4.2: Description of T-BCSM DPs in the GMSC / 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 T_Answer	EDP-N, EDP-R	Call is accepted and answered by terminating party
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 Q.1224 ([6]).		
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.		

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 Q.1224 [6] 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 / VMSC completed.
- Abandon event is reported from Terminating Call Handling PIC ;
- Exception event is reported.

Actions:

- Interface is idled.
- ISUP_IAM is received, the appropriate information is analysed.
- Send_Routeing_Info information flow is sent to HLR in case of GMSC.
- Send_Info_For_Incoming_Call information flow is sent to VLR in case of VMSC.
- In case of GMSC:
 - The supplementary services "barring of all incoming calls" and "barring of incoming calls when roaming" are checked and invoked if necessary.

- The ODB categories "barring of all incoming calls" and "barring of incoming calls when roaming" are checked and ODB is invoked if necessary.
- The supplementary service "CUG" is checked and invoked if necessary.
- T-CSI/VT-CSI is received and analysed.

Exit events:

- Response is received from HLR / 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:

- Calling party abandons call.

4.4.3.1.1.2 Terminating Call Handling

Entry events:

- Response is received from HLR / VLR and terminating CSI (if available) is analysed. (DP Terminating_Attempt_Authorised),
- New routing information is received when Busy event or No Answer event is reported from Terminating Call Handling PIC,
- New routing information is received when Disconnect event is reported from T_Active PIC.
- New routing information is received when the terminating party not reachable is reported from Terminating Call Handling 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 HLR / VLR is analysed.
- Routing address and call type being interpreted. The next route or terminating access is being selected.
- The terminating party is being alerted. Waiting for the call to be answered by terminating party.
- The GSM supplementary service call forwarding is invoked if necessary.

Exit events:

- Call is accepted and answered by terminating party.
- An exception condition is encountered - this leads to the T_Exception PIC. Example exception conditions: the call setup to the MSC/GMSC was not successful.
- 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.
- Not reachable event detected or failure of attempt to select the route for the terminating leg in GMSC or the MS cannot be reached in the VMSC - this leads to the T_Busy DP.
- If no reply timer expires and DP T_No_Answer is armed - this leads to the T_No_Answer DP.

4.4.3.1.1.3 T_Active

Entry events:

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

Actions:

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

Exit events:

- A disconnection indication is received from the terminating party, or received from the originating party via the originating half BCSM. (DP T_Disconnect)
- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure that means that the normal exit events for a PIC can not be met.

4.4.3.1.1.4 T_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 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 send an error information flow closing the relationships and indicating that any outstanding call handling instructions will not run to completion
 - The GMSC / VMSC / gsmSSF should make use of vendor-specific procedures to ensure release of resources within the GMSC / 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 completed.

4.4.4 Rules for Implicit Disarming of Event Detection Points'

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

Implicit EDP disarming rules are specified in the tables below for Originating BCSM and respectively Terminating BCSM. 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 MonitorMode (Transparent, NotifyAndContinue, or Request).

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

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

NOTE: The rules are designed for use in a Single Point of Control configuration and may require further enhancements if they were to be used in a Multiple Points of Control configuration. Enhancements to these rules in order to cover all aspects of MPC will have to be catered for in the next CAMEL Phase.

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, e.g. for follow on call.

Table 4.3: Implicit disarmed DPs in the O-BCSM

Encountered DP	Implicit disarmed DPs						
	DP4	DP 5	DP 6	DP 7	DP 9 C Leg	DP 9 P Leg	DP 10
DP4 Route_Select_Failure	X	X	X	X		X	
DP5 O_Busy	X	X	X	X		X	
DP6 O_No_Answer	X	X	X	X		X	
DP7 O_Answer	X	X	X	X			X
DP9 O_DisconnectC Leg					X		X
DP9 O_DisconnectP Leg	X	X	X	X		X	
DP10 O_Abandon					X		X

Table 4.4: Implicit disarmed DPs in the T-BCSM

Encountered DP	Implicit disarmed DPs					
	DP 13	DP 14	DP 15	DP 17 P Leg	DP 17 C Leg	DP 18
DP13 T_Busy	X	X	X		X	
DP14 T_No_Answer	X	X	X		X	
DP15 T_Answer	X	X	X			X
DP17 T_Disconnect P Leg				X		X
DP17 T_Disconnect C Leg	X	X	X		X	
DP18 T_Abandon				X		X

4.4.5 BCSM Modelling of Call Scenarios

This subclause describes how the BCSMs defined above are used to model GSM 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 logic functions shown shall not impact the modelling. This subclause describes the call scenarios without optimal routing. If optimal routing is invoked the physical configurations may be different from those shown, but the modelling is not changed.

CAMEL may be applied simultaneously and independently for each GSM 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 GSM subscribers or any other addressable subscriber.

4.4.5.1 Mobile Originated Call

The O-BCSM for the call from A to B (labelled "O(A-B)") is invoked if the A-party has an active O-CSI. A control relationship with gsmSCF (1) will be created.

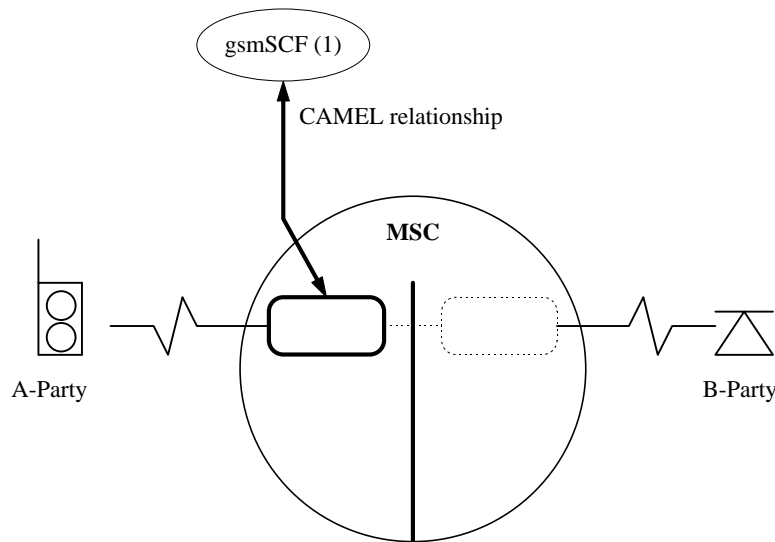


Figure 4. 5: BCSM Scenario for Mobile Originated Call

4.4.5.2 Mobile Terminated Call at the GMSC / VMSC

The T-BCSM for the call from A to B (labelled "T(A-B)") is invoked if the B-party has an active T-CSI (in GMSC) or VT-CSI (in VMSC). A control relationship with gsmSCF (1) / gsmSCF (2) will be created.

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.

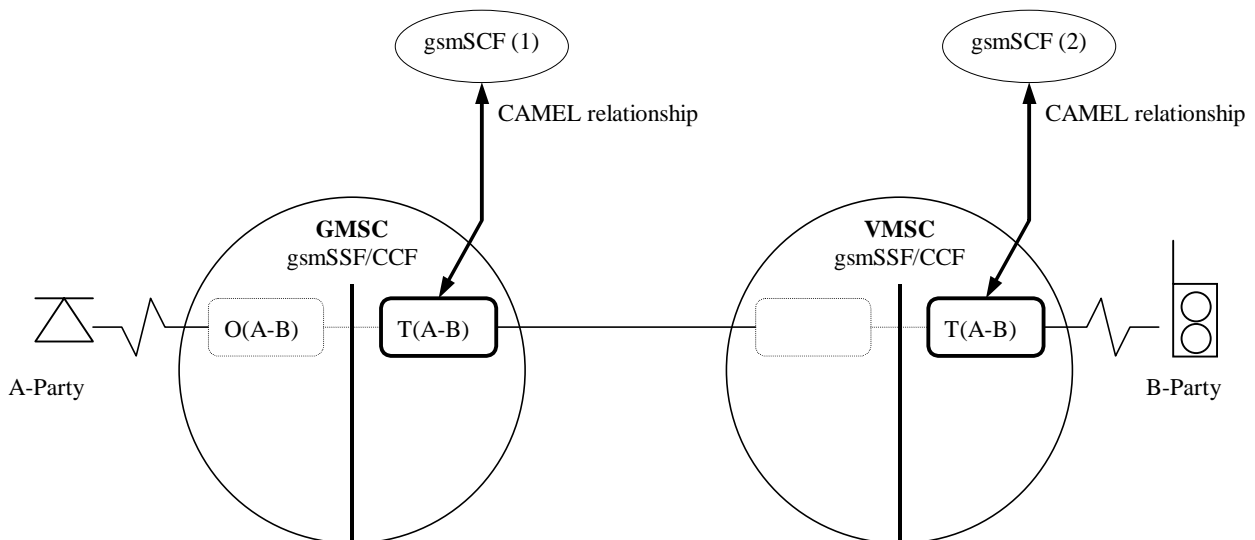


Figure 4.6: BCSM Scenario for Mobile Terminated Calls at the GMSC / VMSC

4.4.5.3 Call Forwarding at the GMSC / VMSC

The T-BCSM for the call from A to B (labelled "T(A-B)") is invoked if the B-party has an active T-CSI (in GMSC) or VT-CSI (in VMSC). A control relationship with gsmSCF (1) will be created. Following processing at the GMSC / 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 is created if:

- a GSM call forwarding supplementary service forwards the call to C. In this case O-BCSM O(B-C) is always invoked for the forwarding party if an O-CSI has been received by the GMSC from the HLR; or

- a CAMEL service in a control relationship with T(A-B) performs a CAMEL-based call forwarding by using a Connect information flow. In this case O-BCSM O(B-C) is created. The O-BCSM opens a control relationship if the following conditions are met:
 - The subscriber has an active O-CSI or there is an active N-CSI or there is an active D-CSI.
 - The triggering criteria are satisfied.
 - The last Connect operation included the "O-CSI applicable" flag. This flag affects to O-CSI only.

A control relationship with gsmSCF (2) will be created.

The relationships with gsmSCF (1) and gsmSCF(2) may exist simultaneously. The two relationships are treated independently at the GMSC. The BCSM T(A-B) and 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.

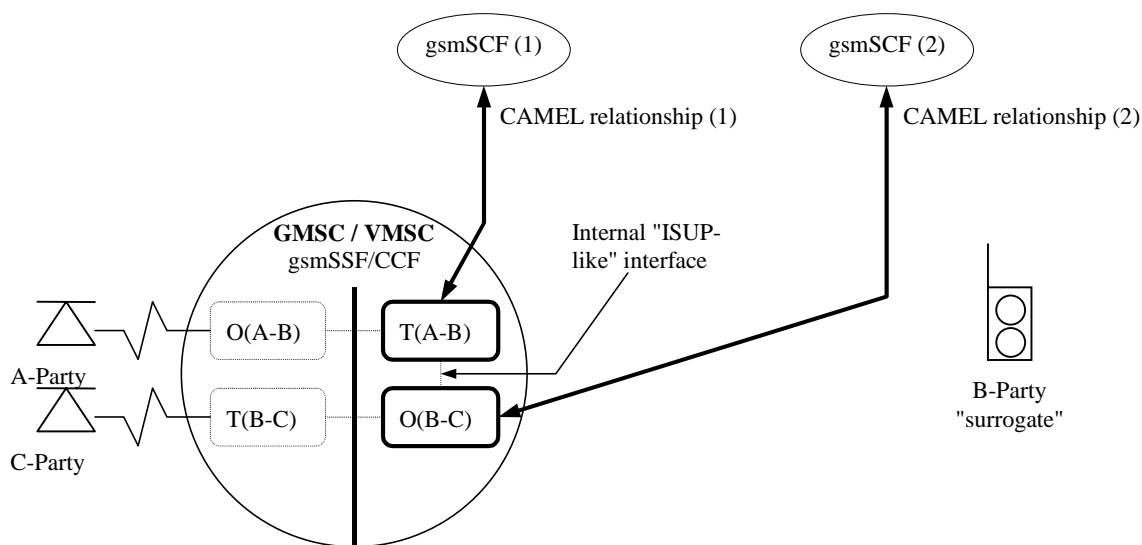


Figure 4.7: BCSM Scenario for Call Forwarding at the GMSC / VMSC

4.5 Procedures for CAMEL

The SDLs in this specification 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 3G TS 23.018 [3] apply in addition to these SDLs. For example, some inputs leading to unsuccessful call attempts are not shown on these diagrams - corresponding clauses in 3G TS 23.018 [3] apply.

Note that in some SDL processes and procedures the Release message 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 message.

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 diagram shows the overall architecture for the SDL diagrams.

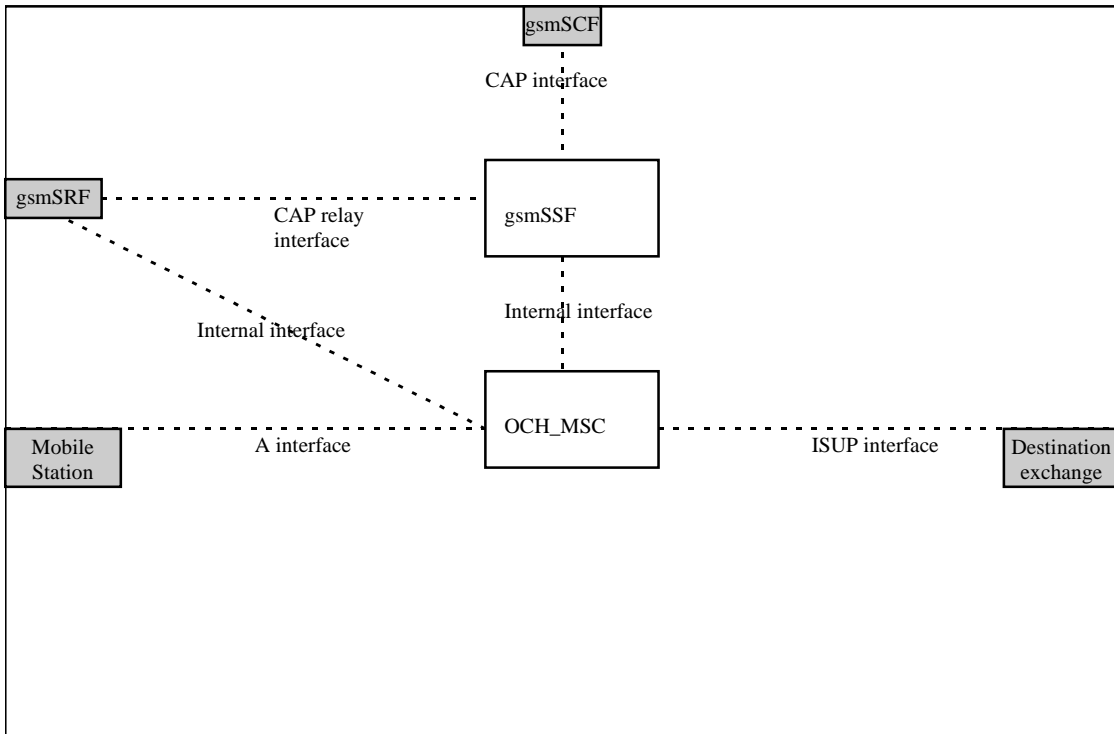


Figure 4.8a: Outgoing case (gsmSSF relay)

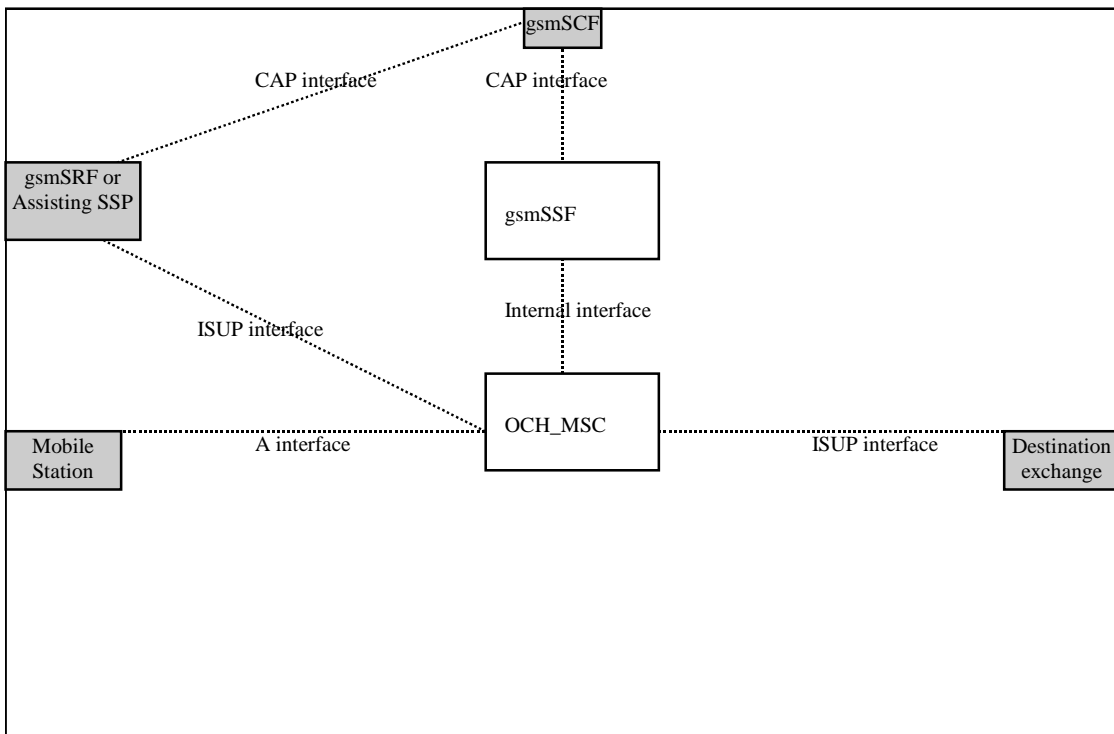


Figure 4.8b: Outgoing case (direct path gsmSCF to gsmSRF or assist with relay)

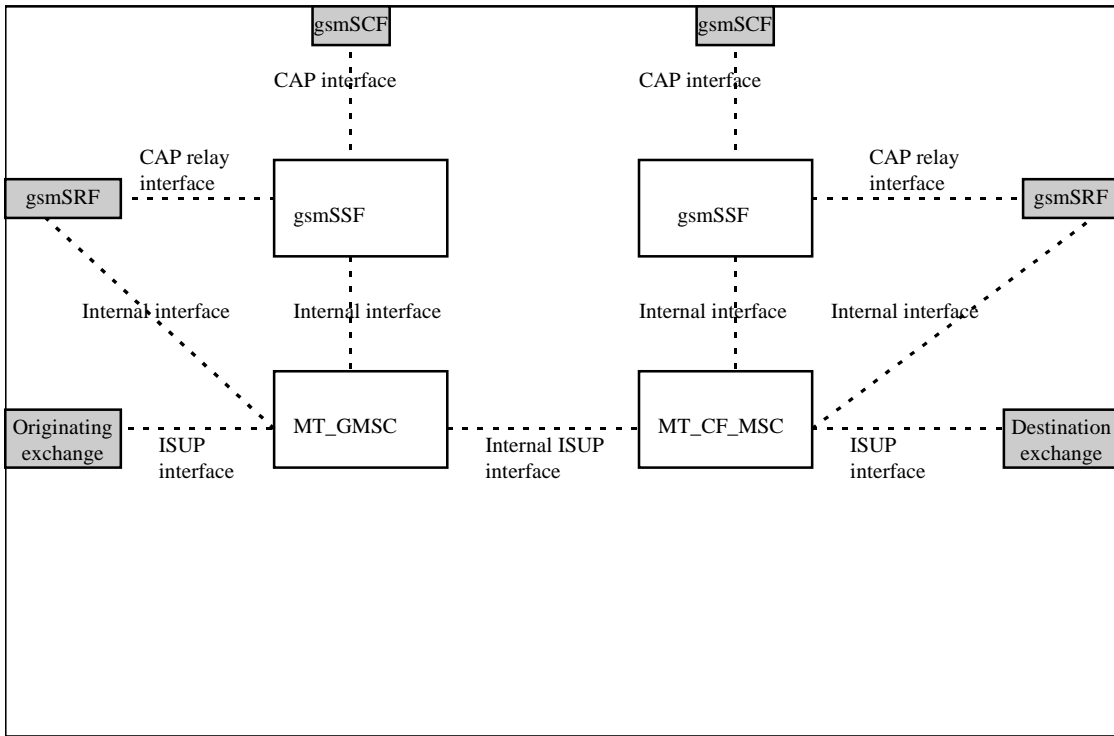


Figure 4.8c: Terminating GMSC case (gsmSSF relay)

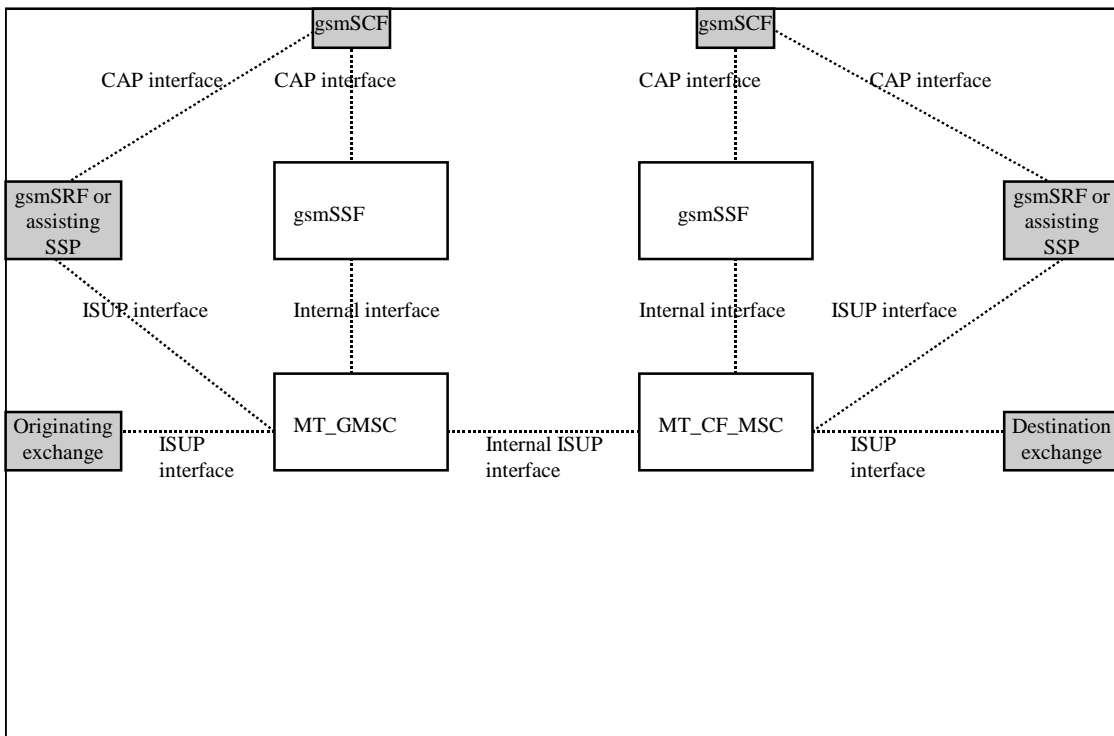
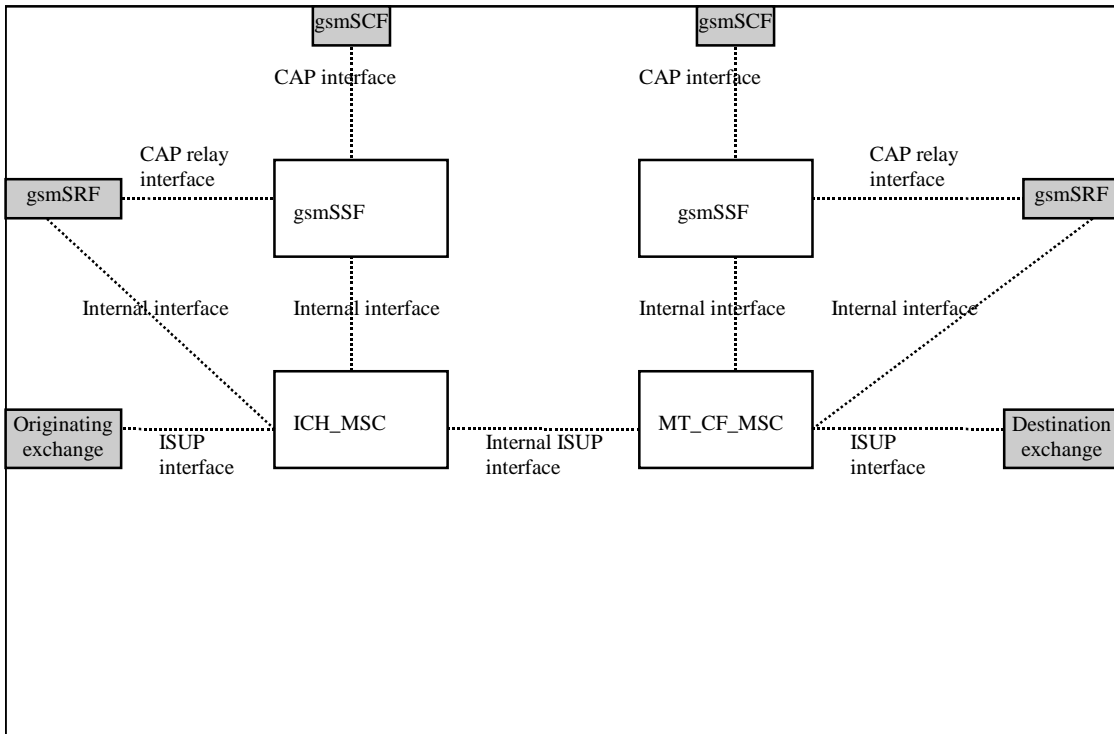
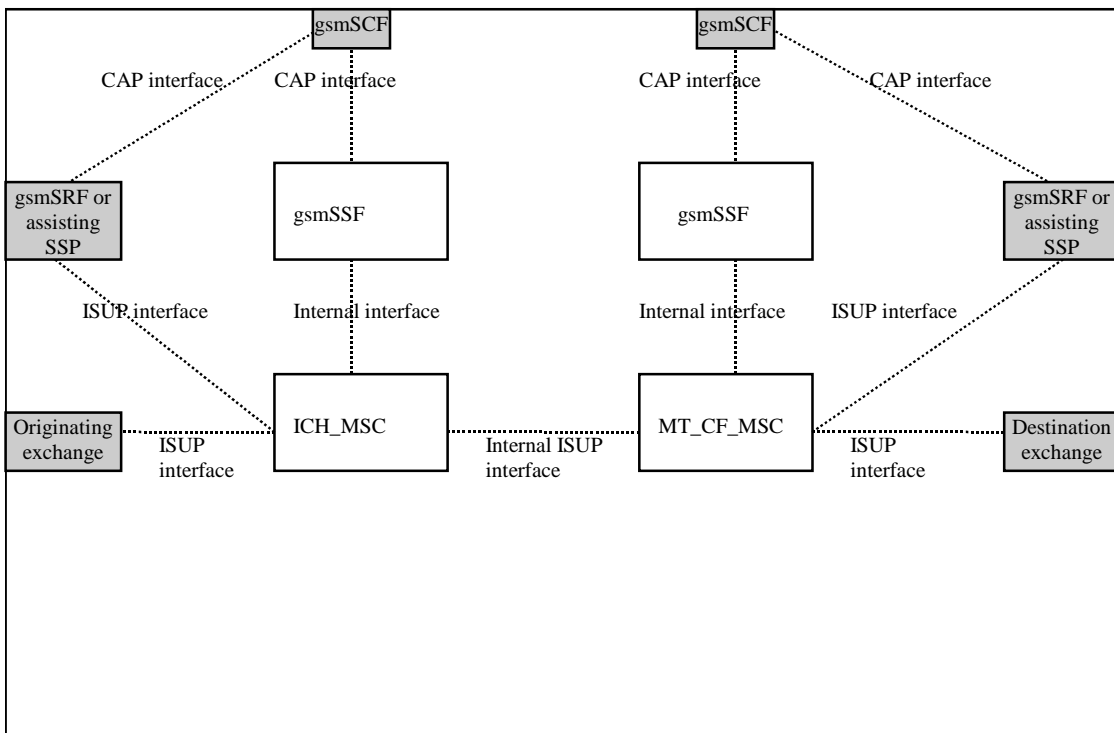


Figure 4.8d: Terminating GMSC case (direct path gsmSCF to gsmSRF or assist with relay)



NOTE: The ICH_MSC may also be connected via an A interface to the terminating Mobile Station.

Figure 4.8e: Terminating VMSC case (gsmSSF relay)



NOTE: The ICH_MSC may also be connected via an A interface to the terminating Mobile Station

Figure 4.8f: Terminating VMSC case (direct path gsmSCF to gsmSRF or assist with relay)

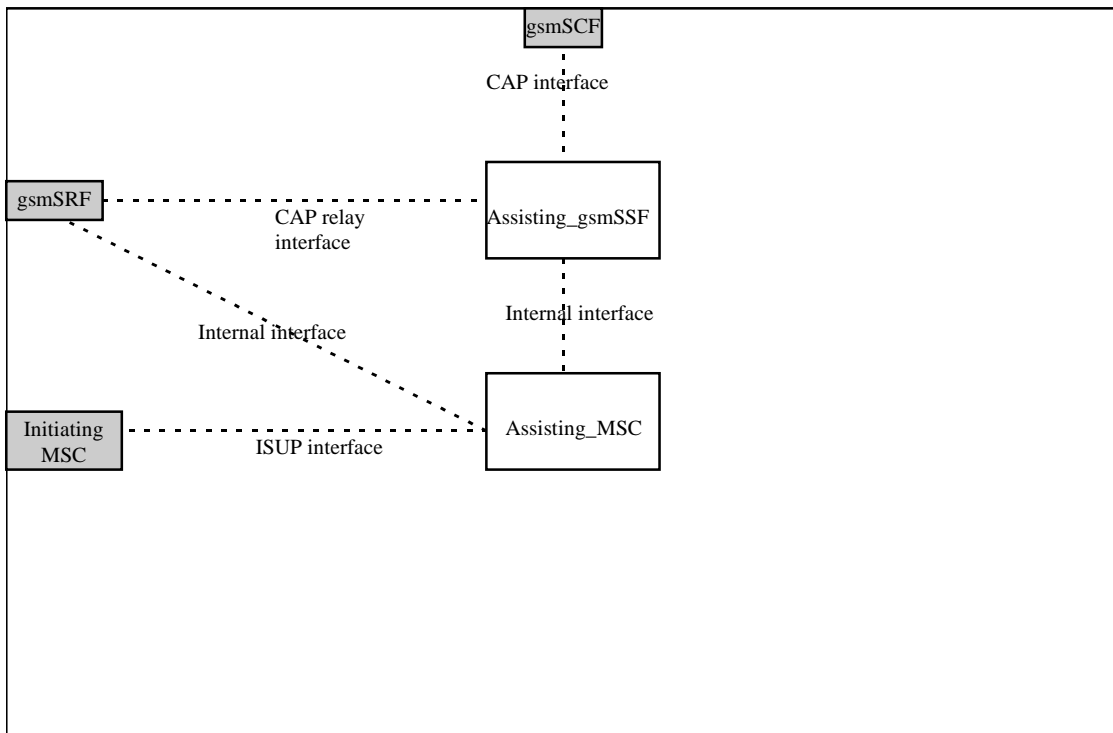


Figure 4.8g: Assisting case

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 3G TS 23.018 [3]. The procedures specific to CAMEL are specified in this subclause :

- Procedure CAMEL_OCH_MSC_INIT,
- 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_DISC4,
- Procedure CAMEL_OCH_ETC,
- Procedure CAMEL_OCH_CTR,
- Procedure CAMEL_Start_TNRy,
- Procedure CAMEL_Stop_TNRy.
- Procedure CAMEL_Store_Destination_Address

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

The following paragraphs gives details on the behaviour of the MSC in the procedure 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_Outgoing_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_Outgoing_Call 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 message. 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.

4.5.2.1.4 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 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.

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

At DP_Analysed_Information the MSC sets the O-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 is used. The MSC then releases all call resources and the procedure CAMEL_OCH_MSC_INIT ends.

4.5.2.1.6 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 message.

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

4.5.2.1.7 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".

4.5.2.1.8 Action of the MSC in procedure CAMEL_Store_Destination_Address

The Int_Store_DA message carries the value of the global variable Destination address and the parameters OR and Forwarding received in the procedure call.

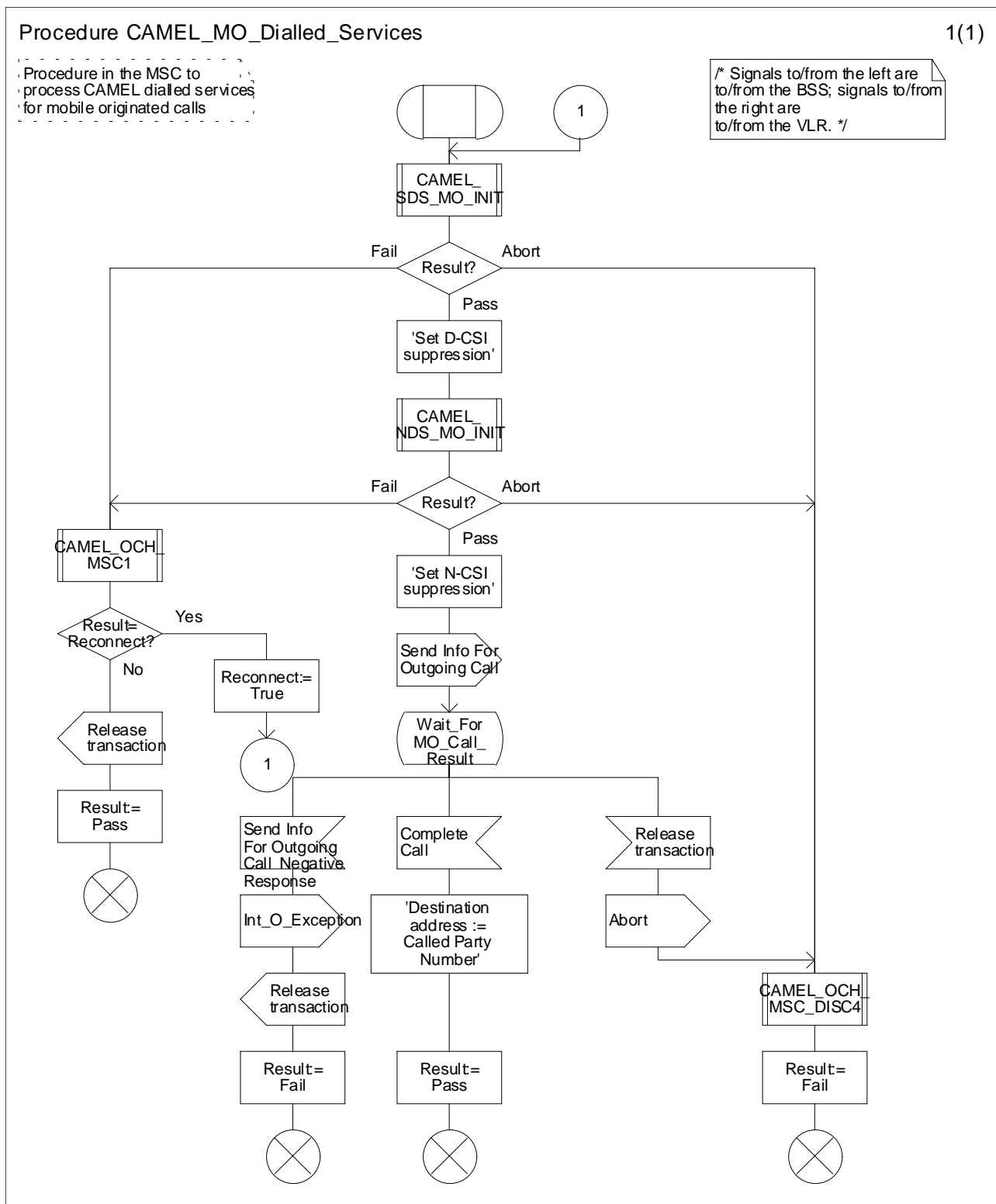


Figure 4.9a: Procedure CAMEL_MO_Dialled_Services (sheet 1)

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. */

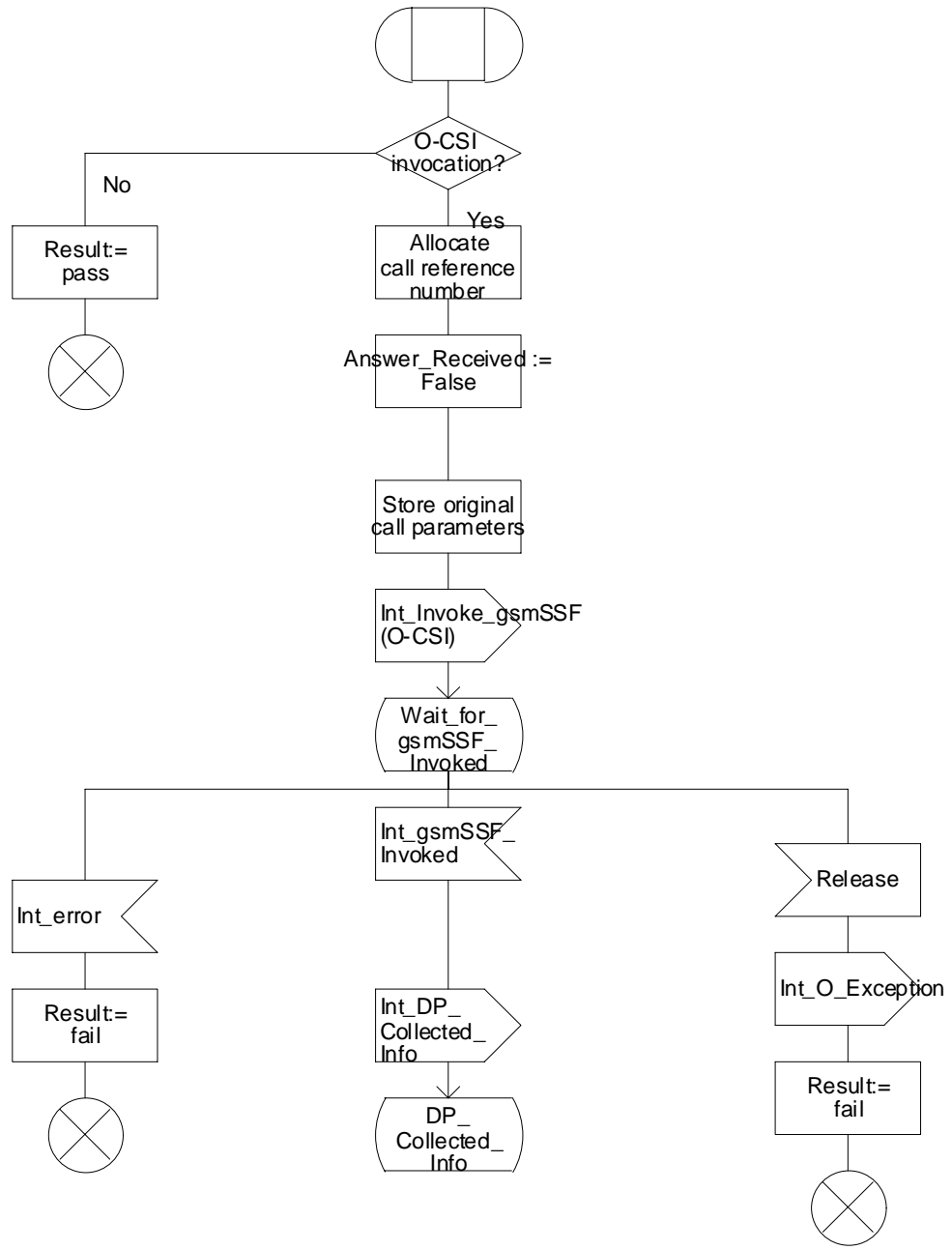


Figure 4.10a: Procedure CAMEL_OCH_MSC_INIT (sheet 1)

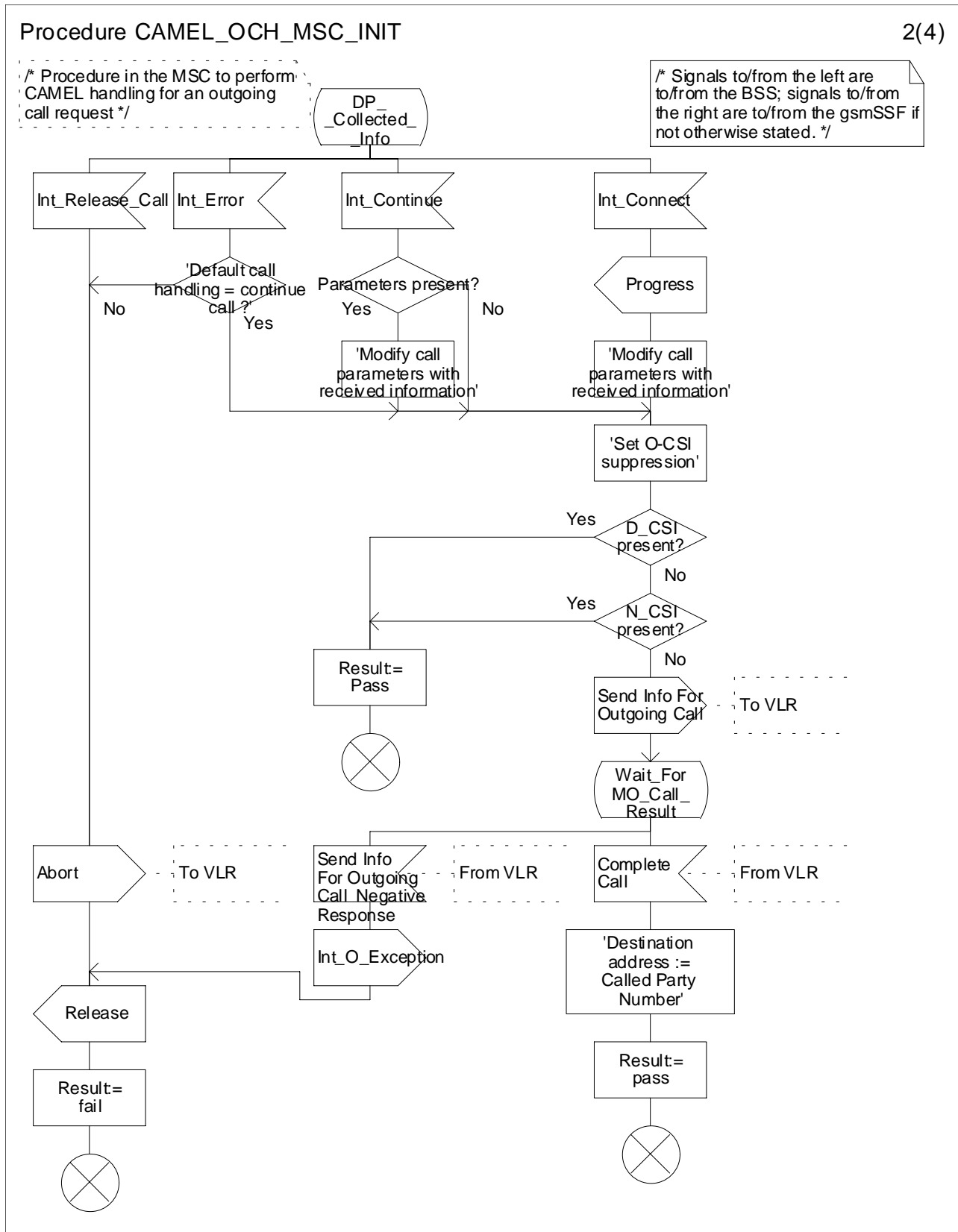


Figure 4.10b: Procedure CAMEL_OCH_MSC_INIT (sheet 2)

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. */

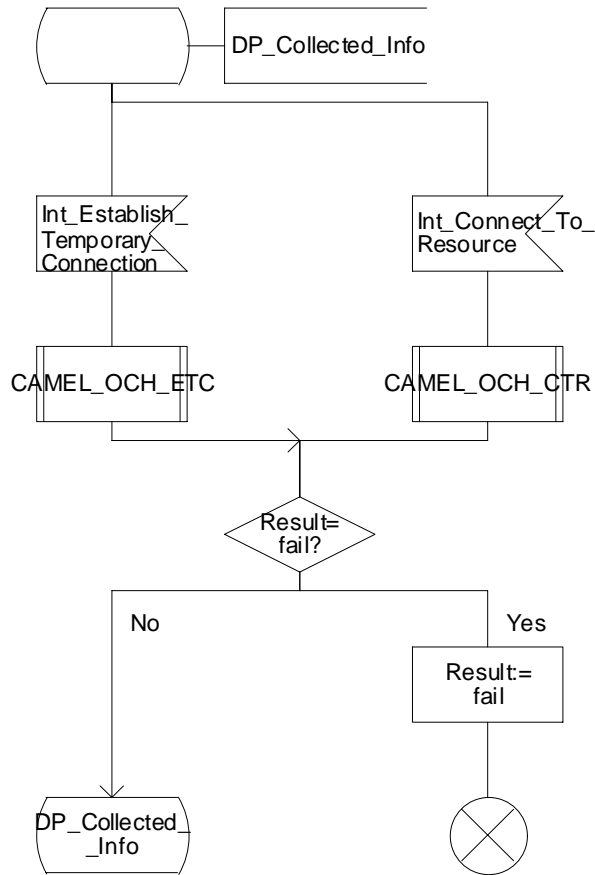


Figure 4.10d: Procedure CAMEL_OCH_MSC_INIT (sheet 3)

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. */

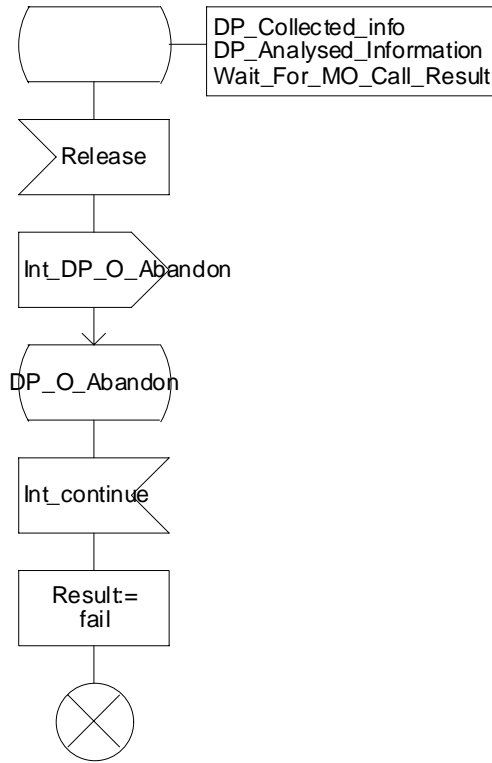


Figure 4.10e: Procedure CAMEL_OCH_MSC_INIT (sheet 4)

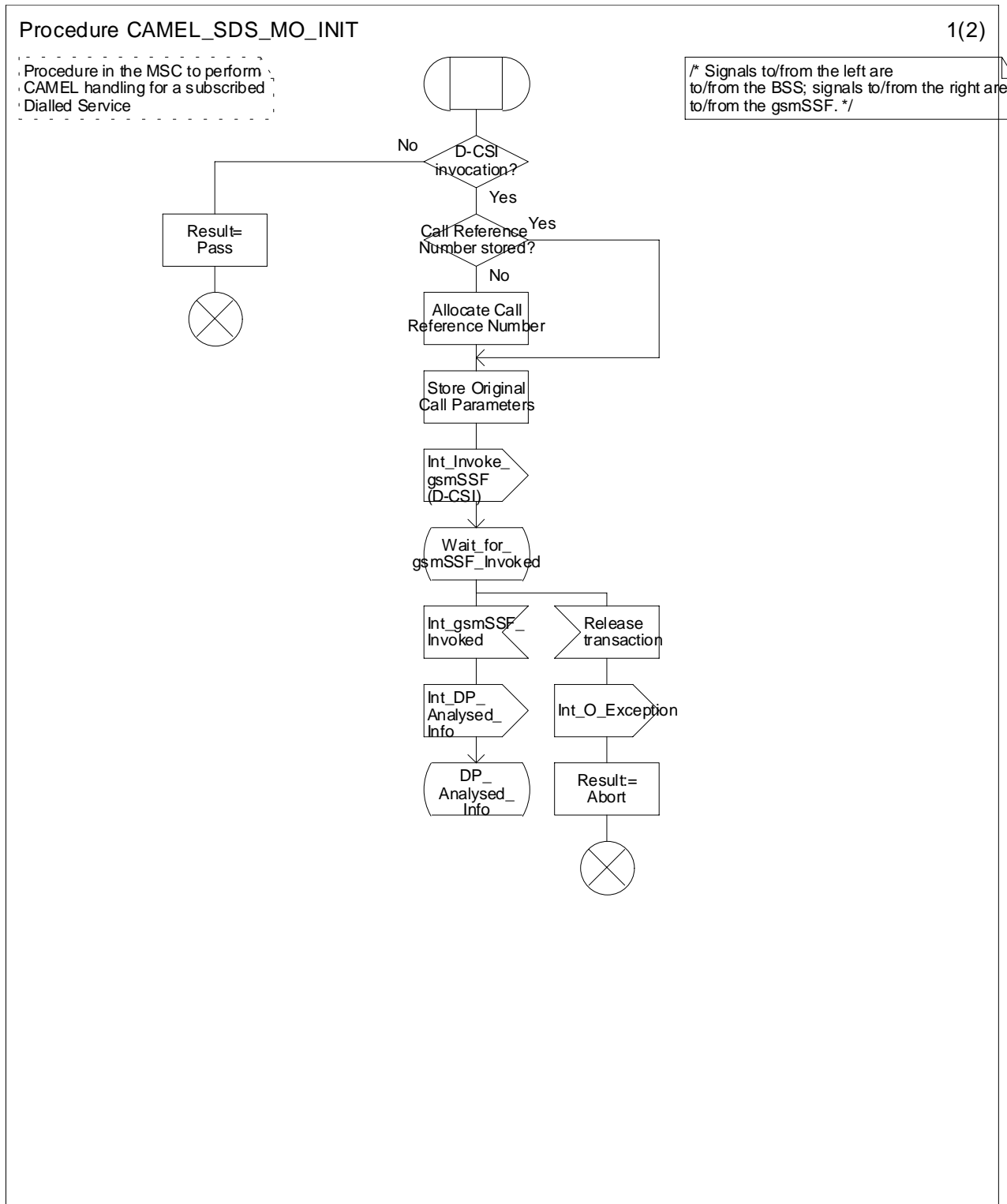


Figure 4.11a: Procedure CAMEL_SDS_MO_Init (sheet 1)

Procedure CAMEL_SDS_MO_INIT

2(2)

Procedure in the MSC to perform CAMEL handling for a subscribed Dialed Service

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

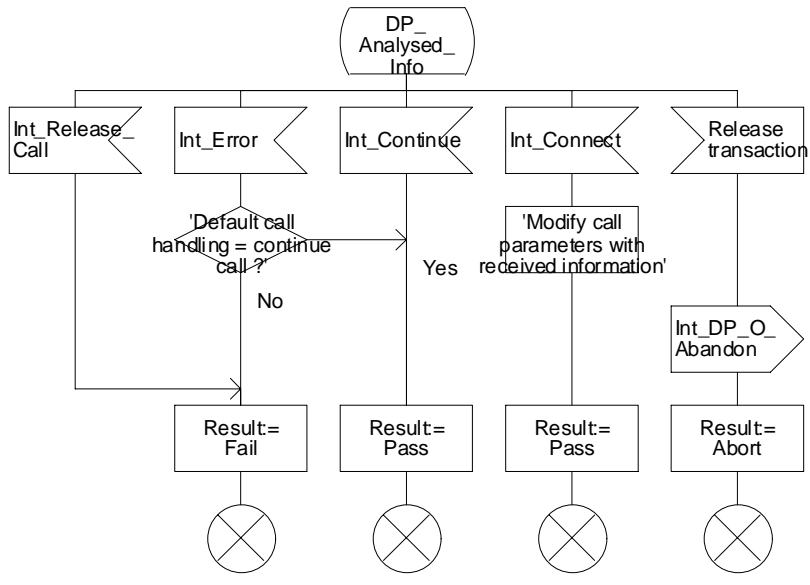


Figure 4.11b: Procedure CAMEL_SDS_MO_INIT (sheet 2)

Procedure CAMEL_NDS_MO_INIT

1(2)

Procedure in the MSC to perform CAMEL handling for a network Dialed Service for mobile originated calls

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

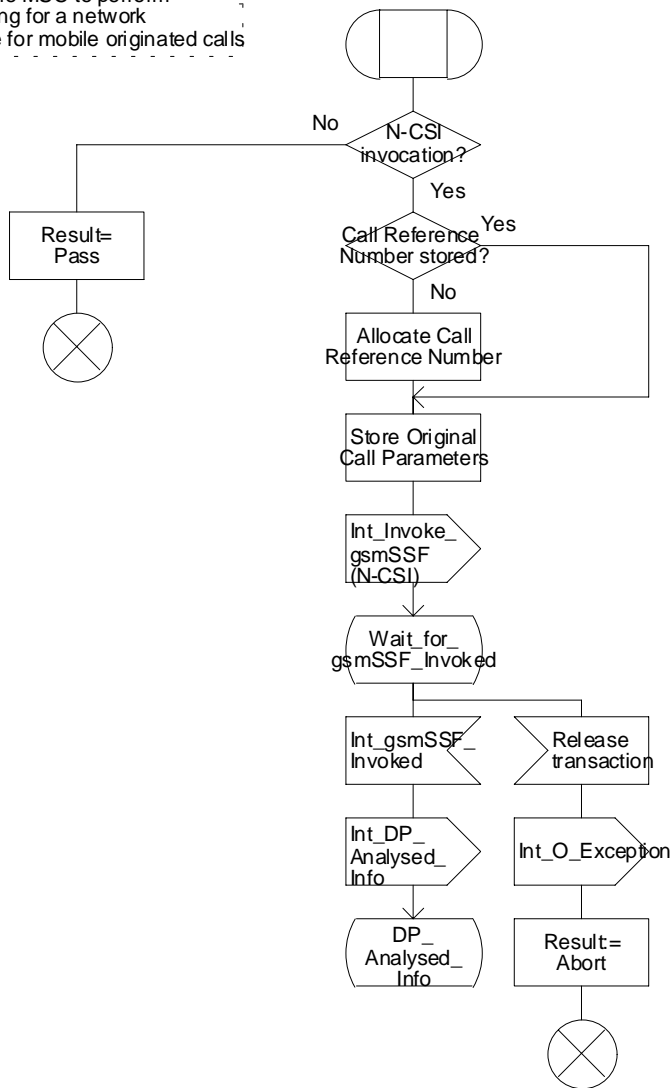


Figure 4.12a: Procedure CAMEL_NDS_MO_INIT (sheet 1)

Procedure CAMEL_NDS_MO_INIT

2(2)

Procedure in the MSC to perform CAMEL handling for a network Dialed Service for mobile originated calls

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

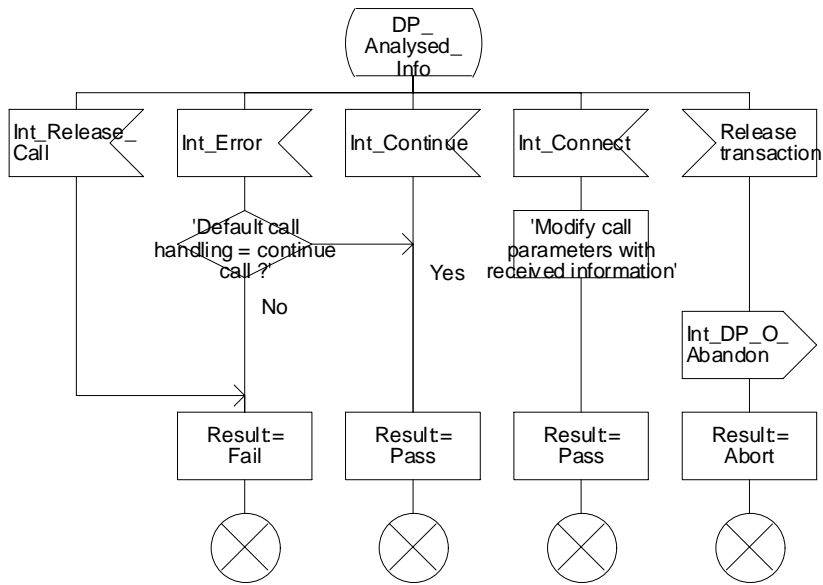


Figure 4.12b: Procedure CAMEL_NDS_MO_INIT (sheet 2)

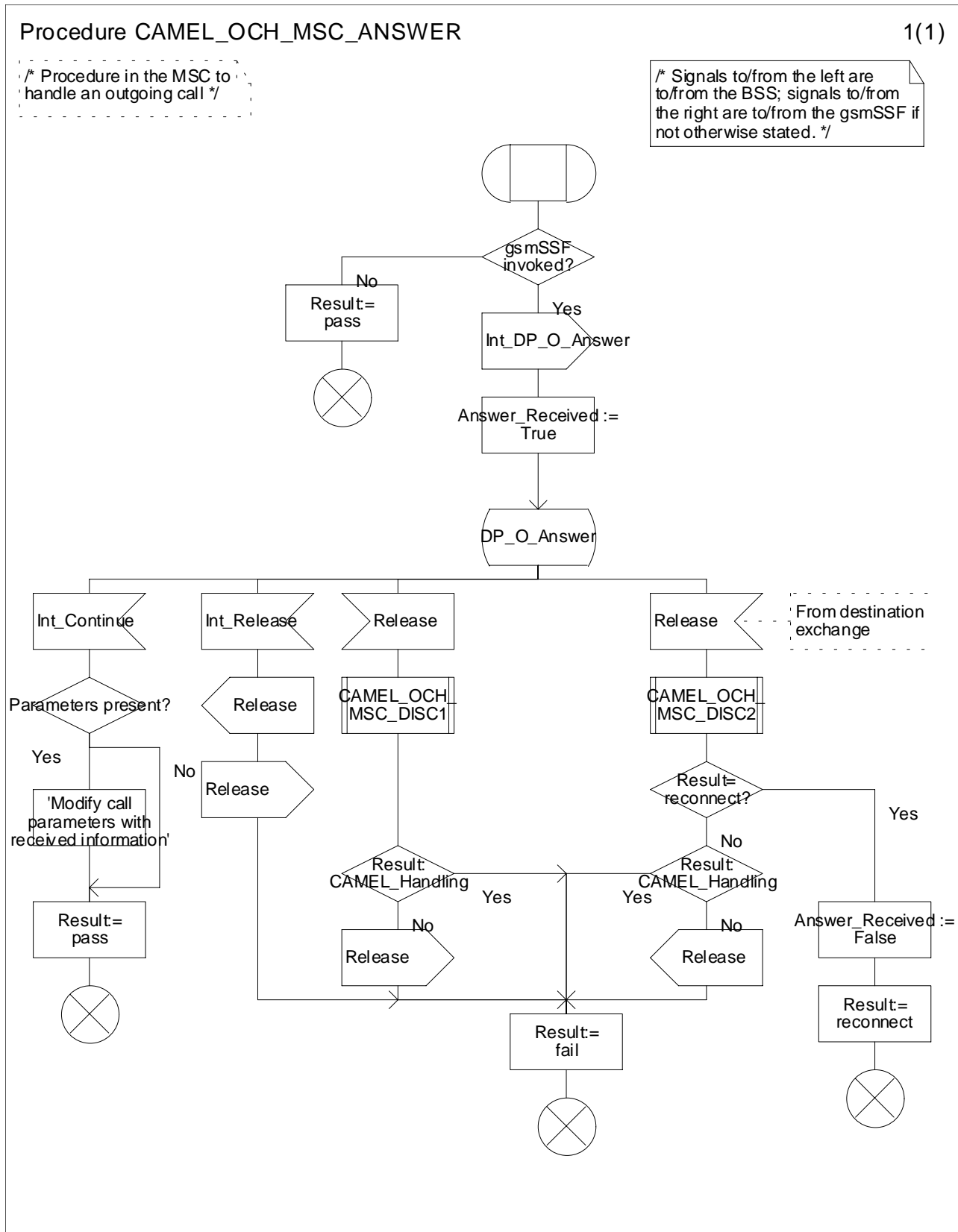


Figure 4.13a: Procedure CAMEL_OCH_MSC_ANSWER (sheet 1)

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. */

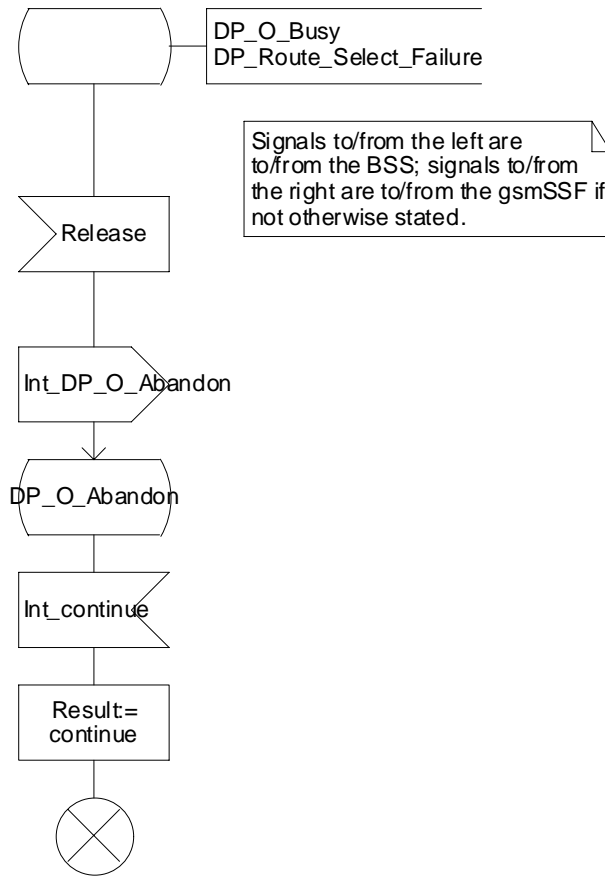


Figure 4.14b: Procedure CAMEL_OCH_MSC1 (sheet 2)

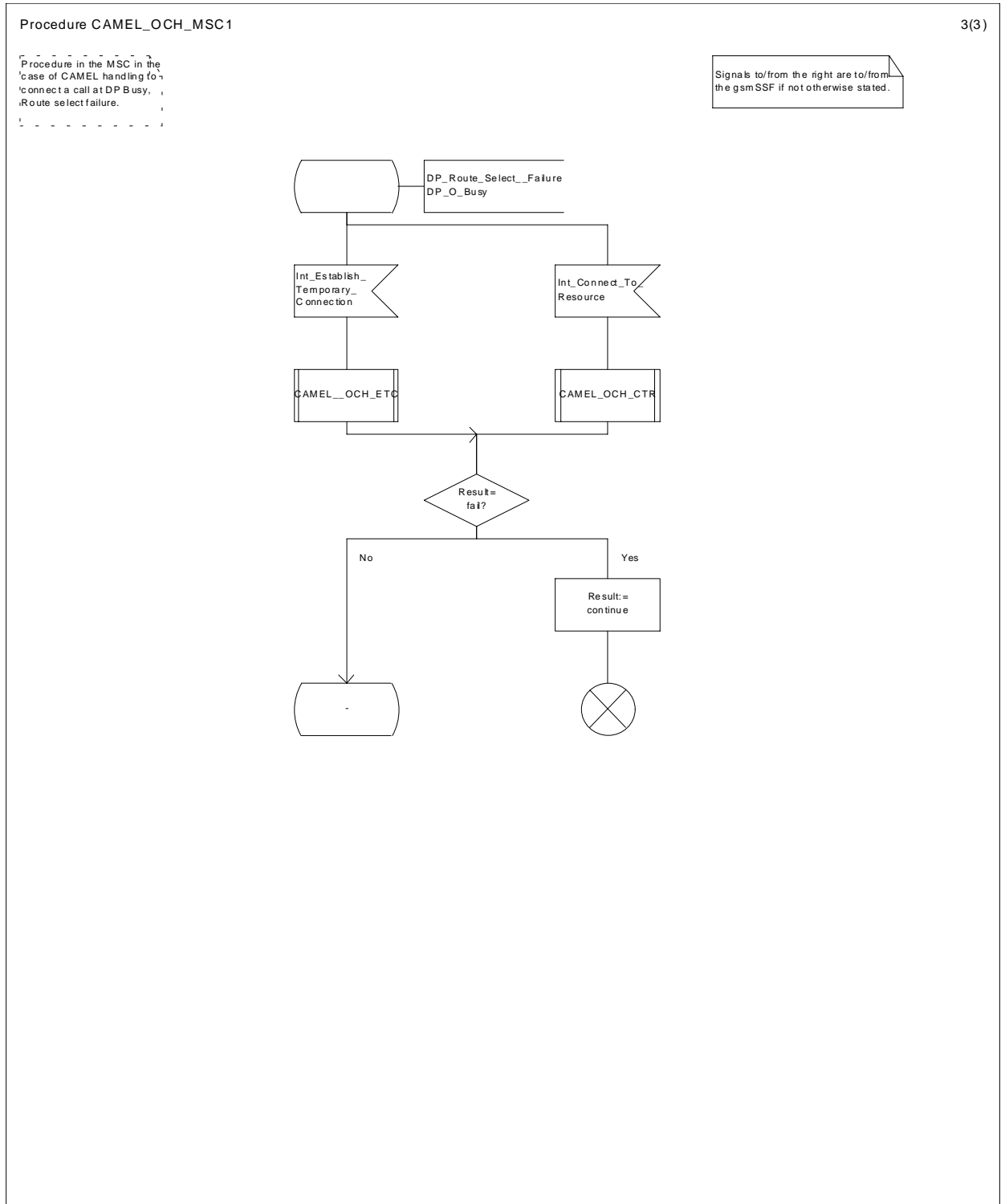


Figure 4.14c: Procedure CAMEL_OCH_MSC1 (sheet 3)

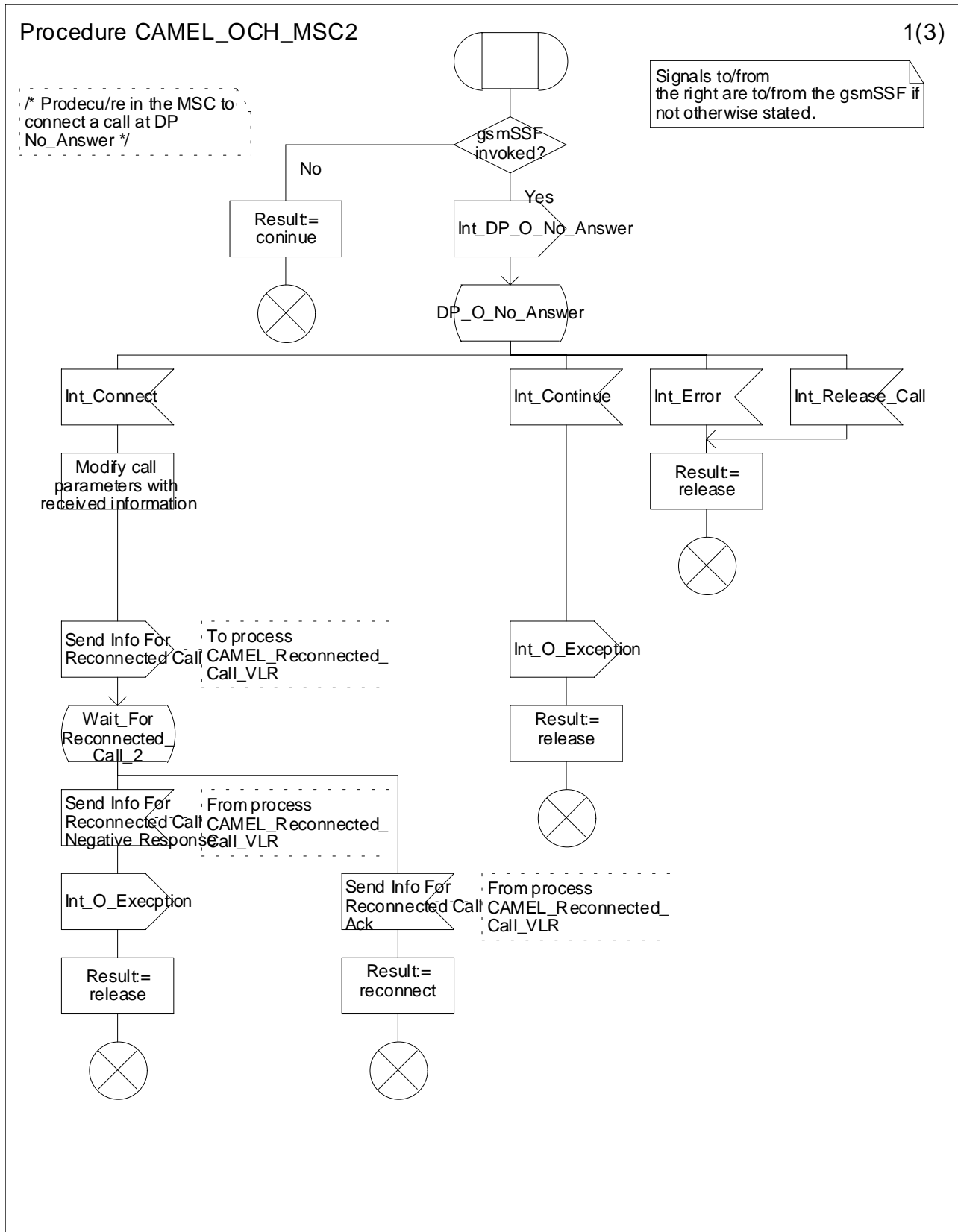


Figure 4.15a: Procedure CAMEL_OCH_MSC2 (sheet 1)

Procedure CAMEL_OCH_MSC2

2(3)

* Prodecu/re 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.

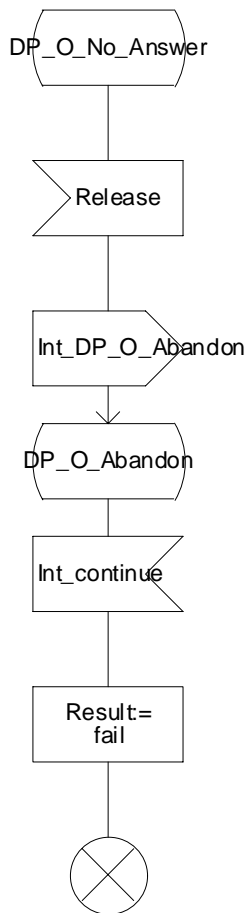


Figure 4.15b: Procedure CAMEL_OCH_MSC2 (sheet 2)

Procedure CAMEL_OCH_MSC2

3(3)

Prodecure 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.

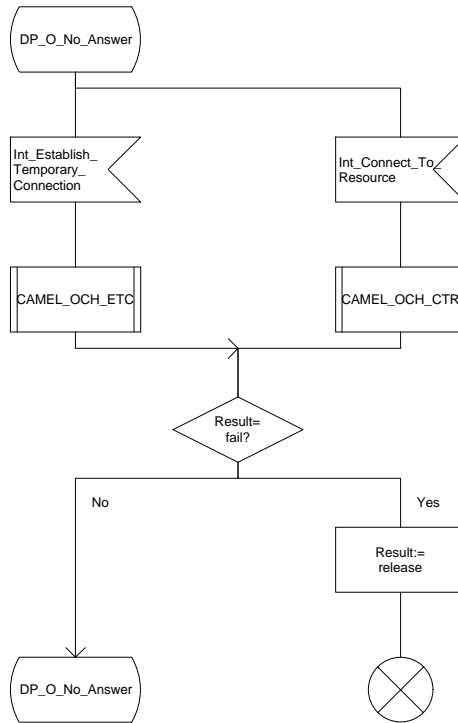


Figure 4.15c: Procedure CAMEL_OCH_MSC2 (sheet 3)

Procedure CAMEL_OCH_MSC_DISC1

1(1)

/* Procedure in the MSC performing handling for a call release */

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

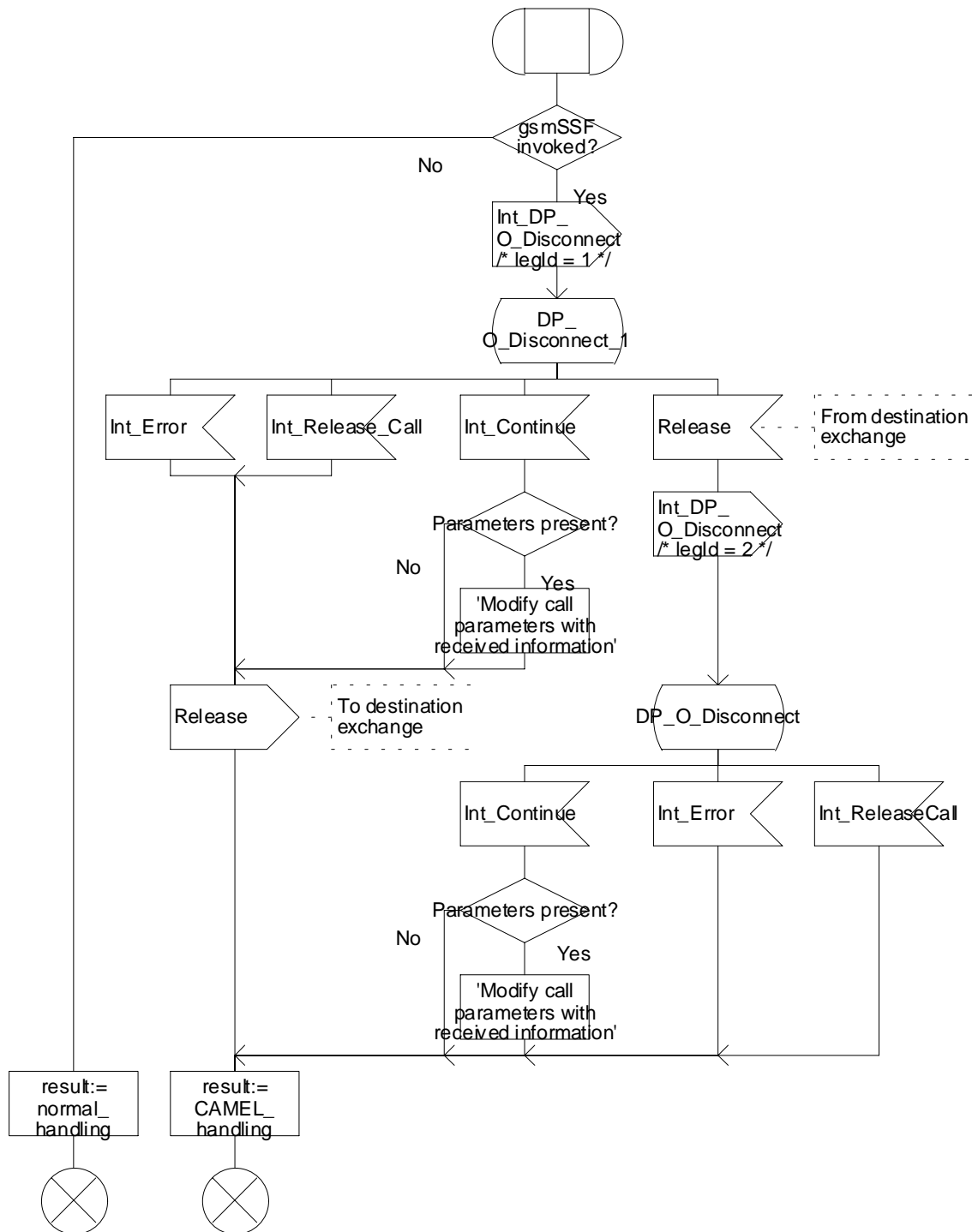


Figure 4.16a: Procedure CAMEL_OCH_MSC_DISC1 (sheet 1)

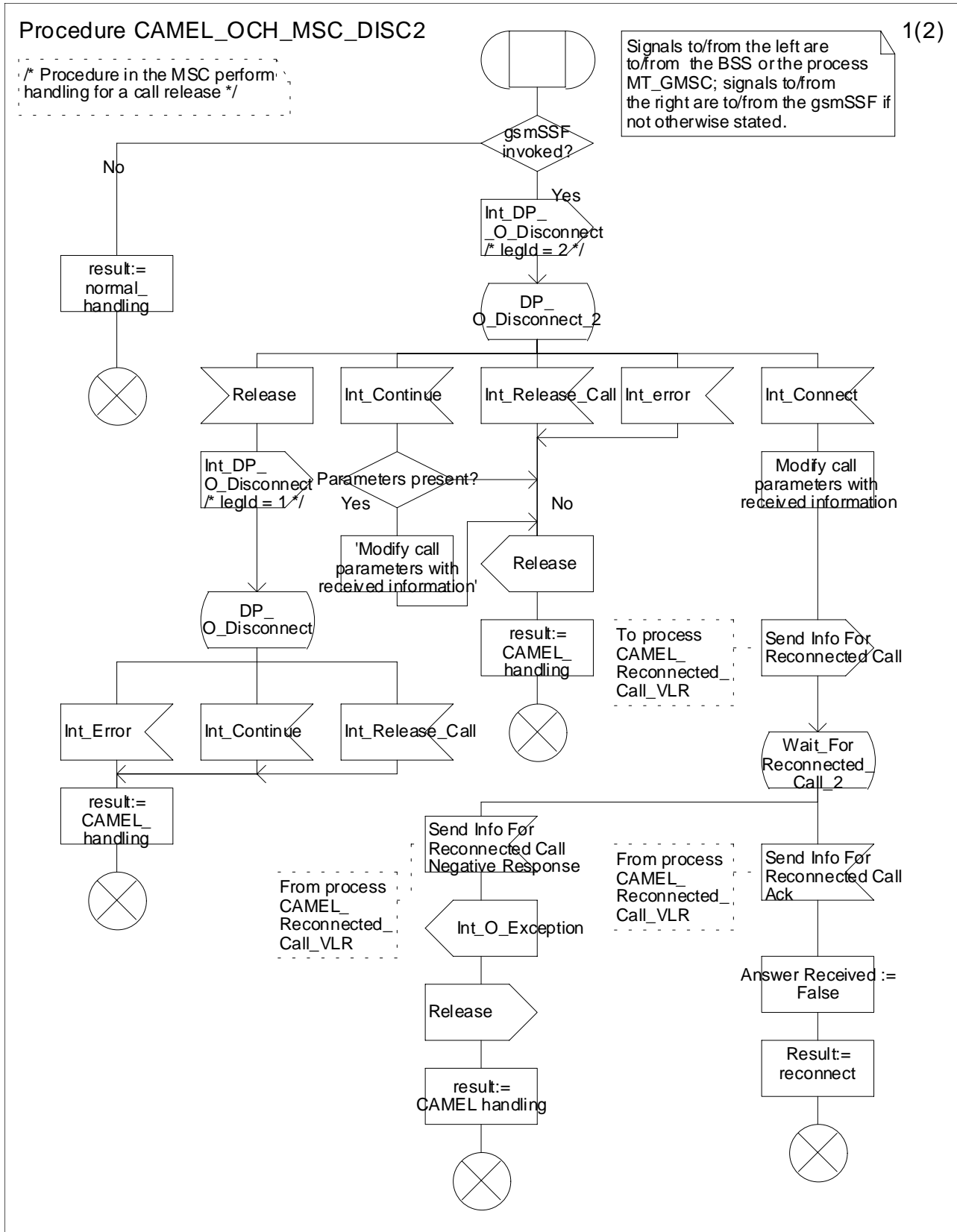


Figure 4.17a: Procedure CAMEL_OCH_MSC_DISC2 (sheet 1)

Procedure CAMEL_OCH_MSC_DISC2

2(2)

Procedure in the MSC performing handing for a call release

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

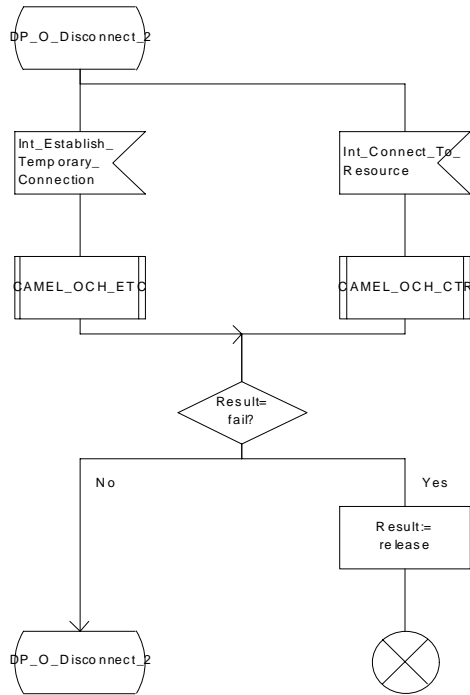


Figure 4.17b: Procedure CAMEL_OCH_MSC_DISC2 (sheet 2)

Procedure CAMEL_OCH_MSC_DISC4

1(1)

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

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

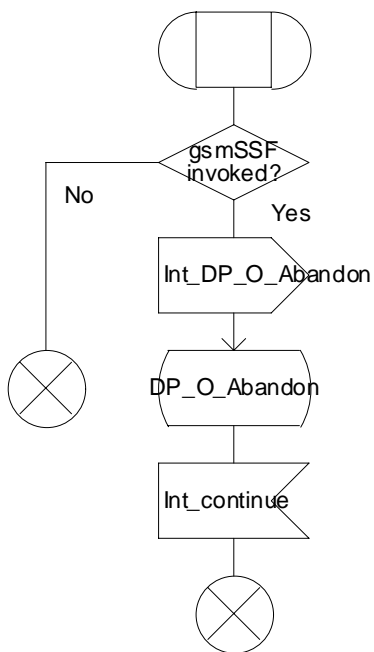


Figure 4.18a: Procedure CAMEL_OCH_MSC_DISC4 (sheet 1)

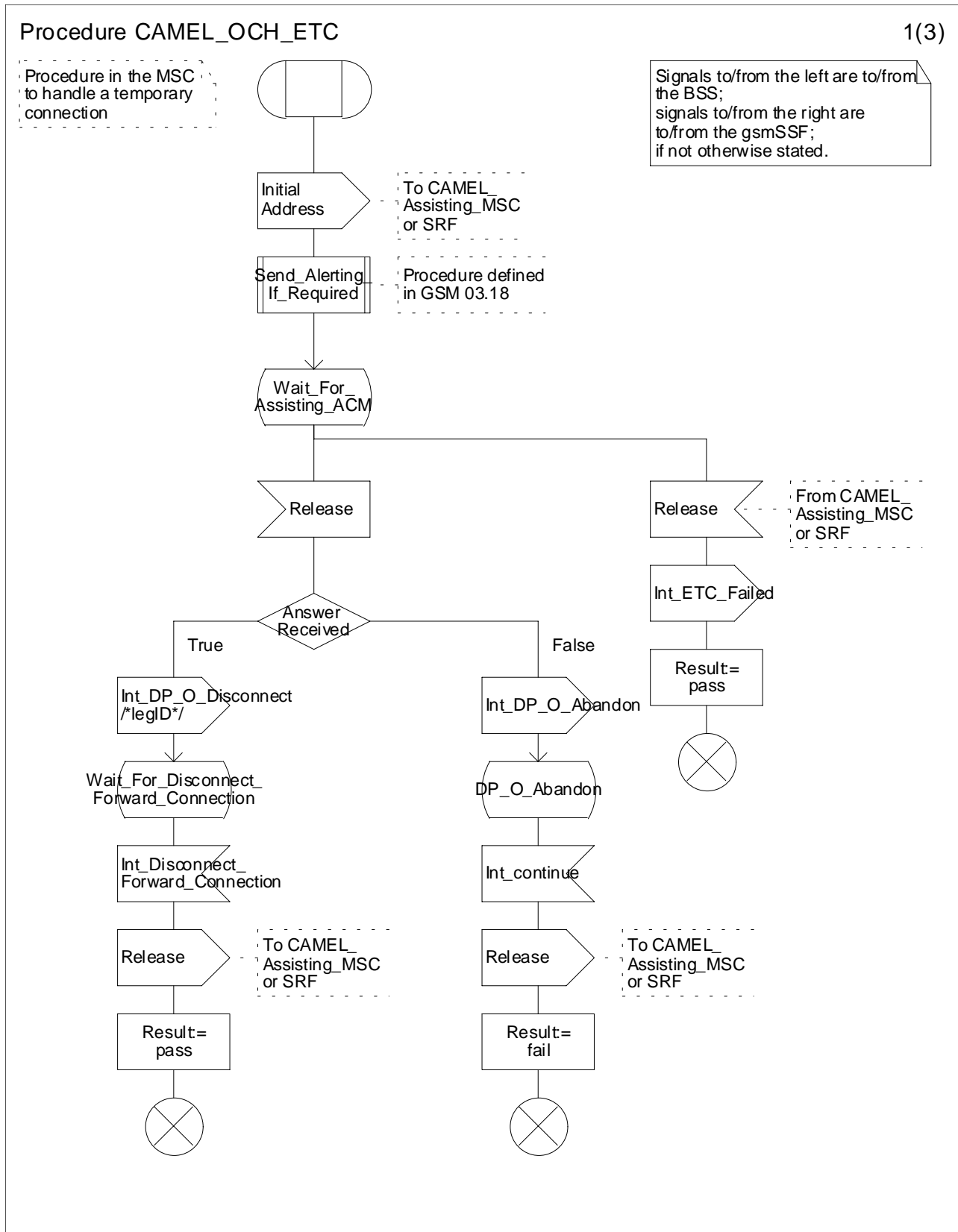


Figure 4.19a: Procedure CAMEL_OCH_ETC (sheet 1)

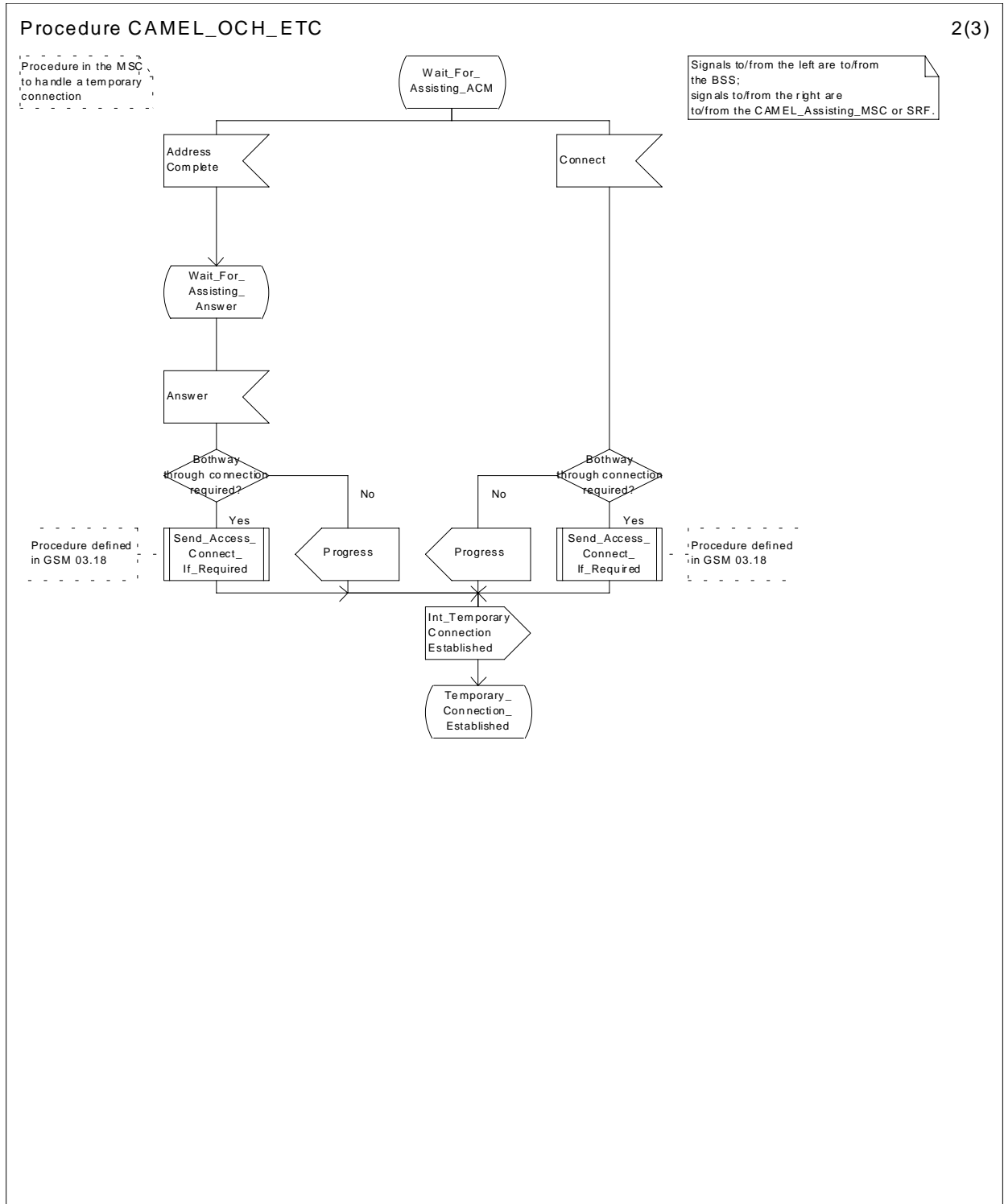


Figure 4.19b: Procedure CAMEL_OCH_ETC (sheet 2)

Procedure CAMEL_OCH_ETC

3(3)

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.

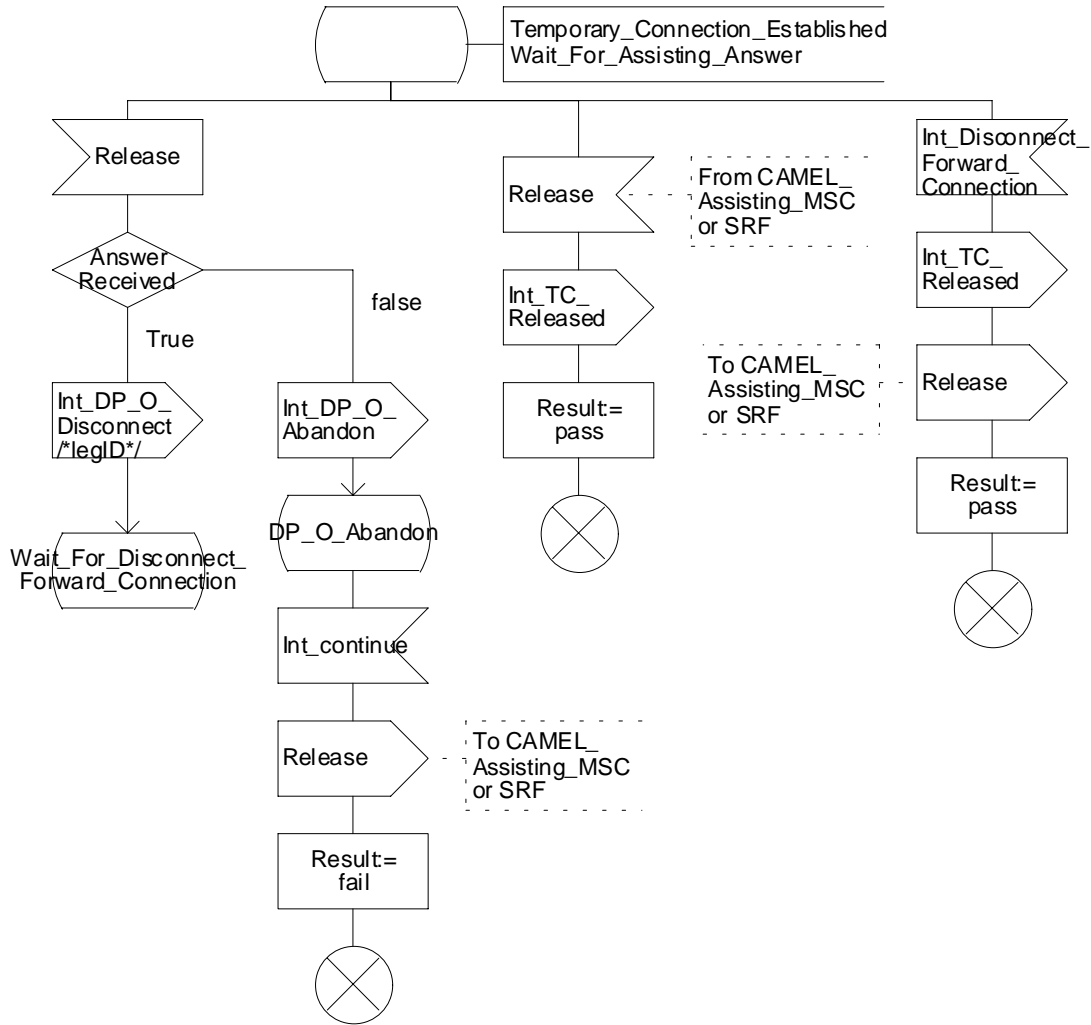


Figure 4.19c: Procedure CAMEL_OCH_ETC (sheet 3)

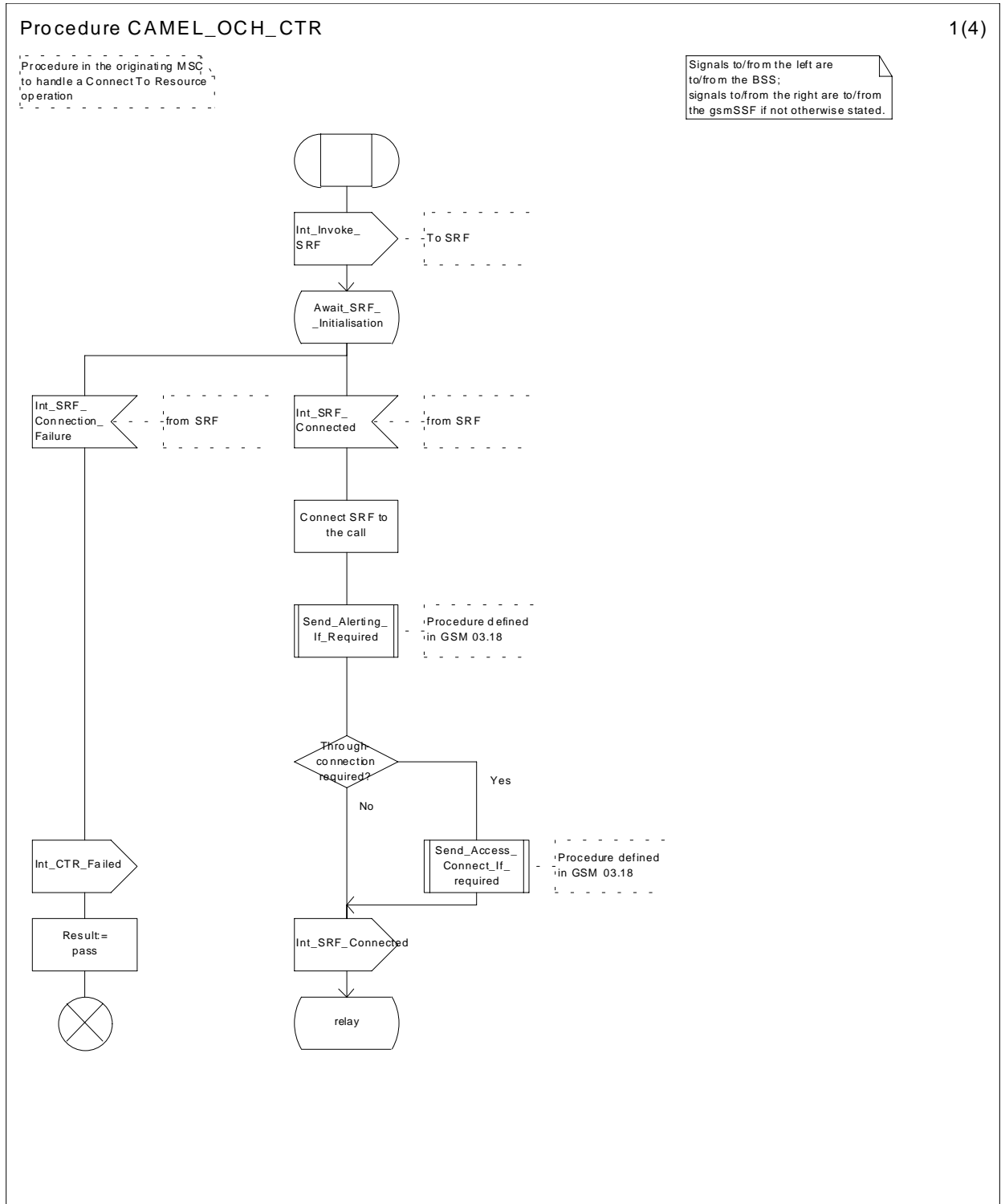


Figure 4.20a: Procedure CAMEL_OCH_CTR (sheet 1)

Procedure CAMEL_OCH_CTR

2(4)

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.

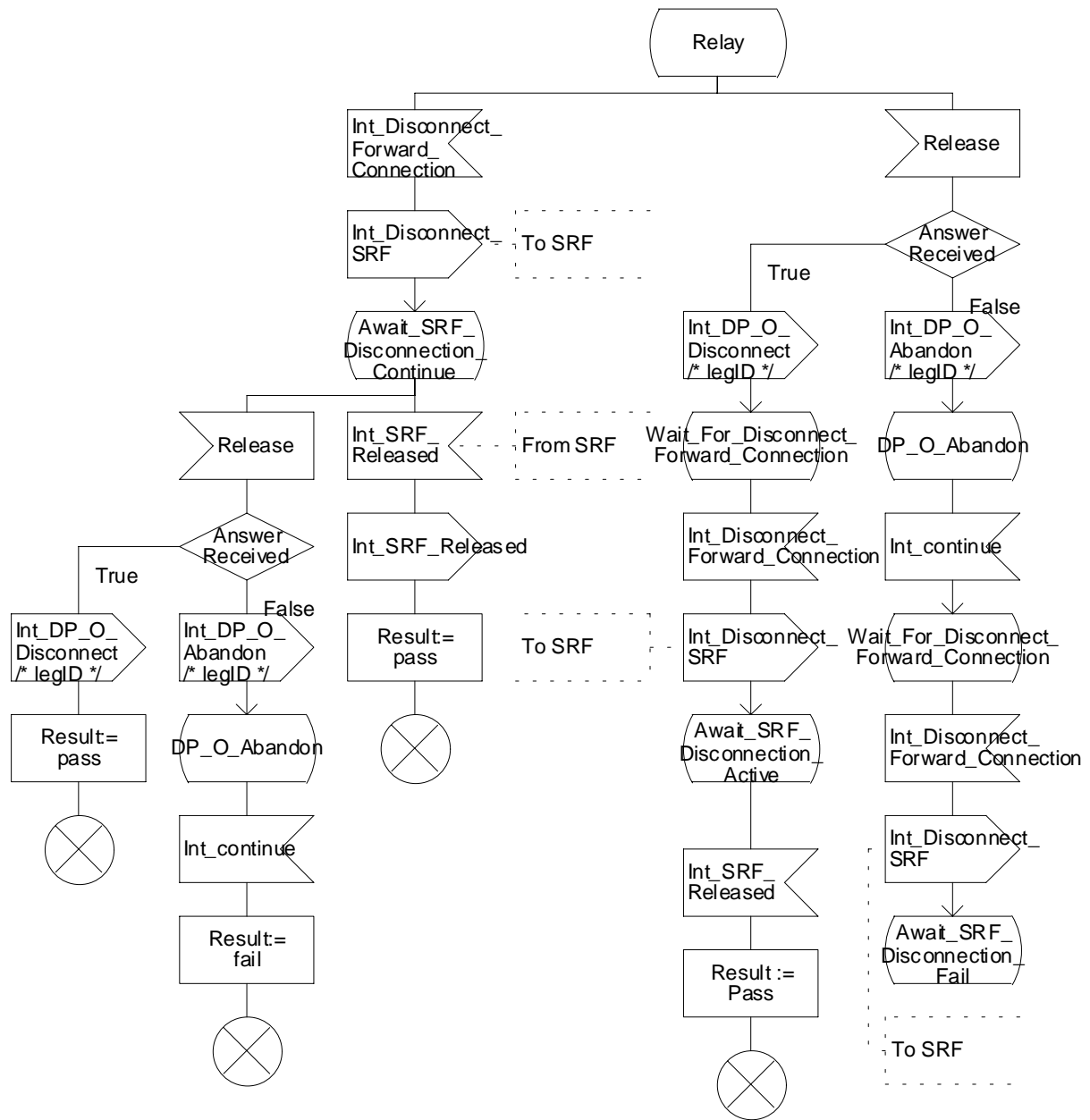


Figure 4.20b: Procedure CAMEL_OCH_CTR (sheet 2)

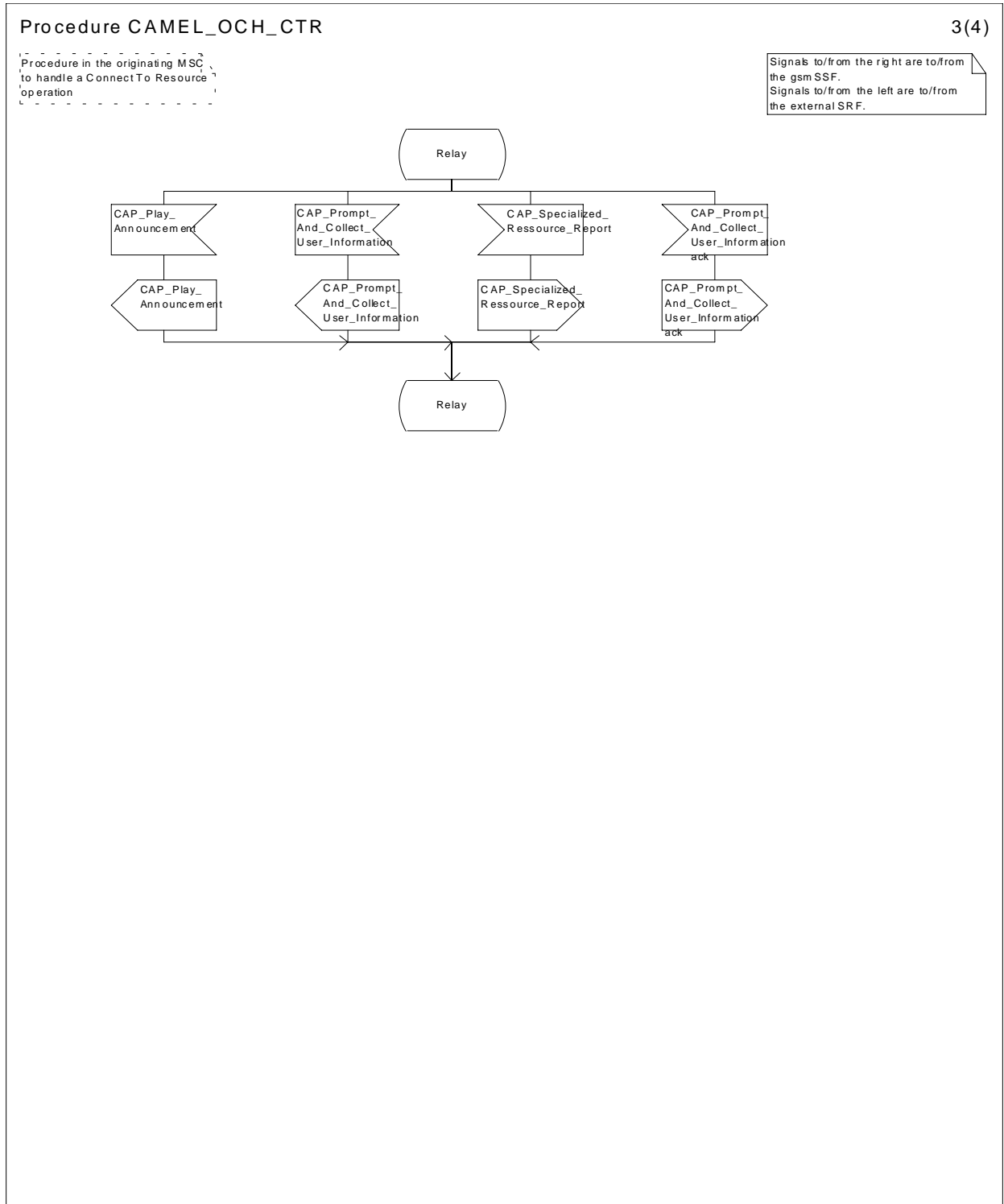


Figure 4.20c: Procedure CAMEL_OCH_CTR (sheet 3)

Procedure CAMEL_OCH_CTR

4(4)

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.

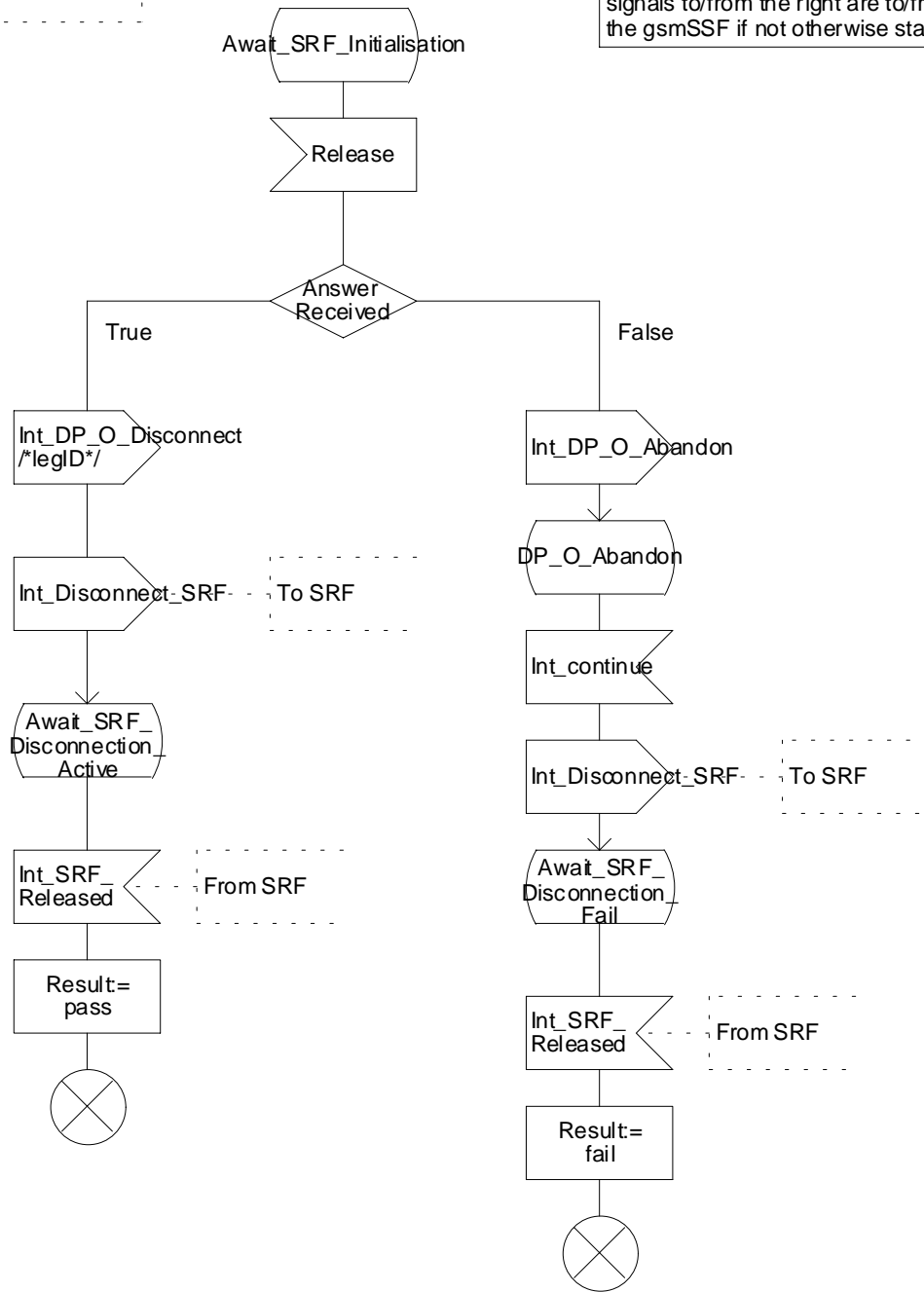


Figure 4.20d: Procedure CAMEL_OCH_CTR (sheet 4)

Procedure CAMEL_Start_TNRy

1(1)

Procedure in MSC to start the timer TNRy

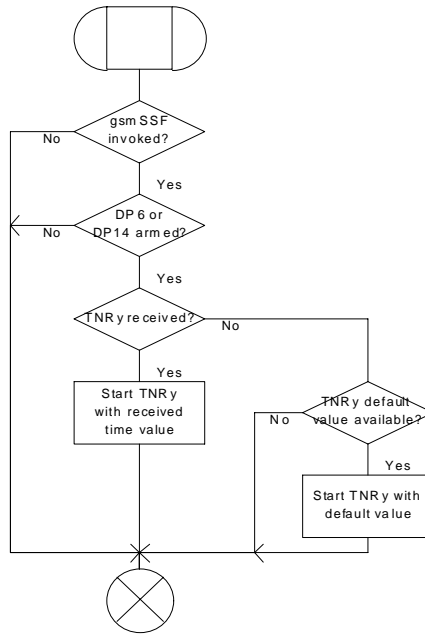


Figure 4.21a: Procedure CAMEL_Start_TNRy (sheet 1)

Procedure CAMEL_Stop_TNRy

1(1)

Procedure in the MSC₂
to stop the timer TNRy.

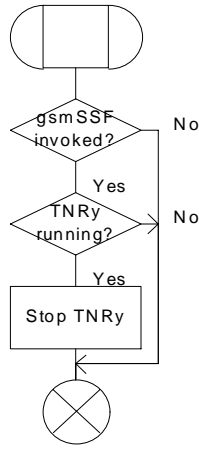


Figure 4.22a: Procedure CAMEL_Stop_TNRy (sheet 1)

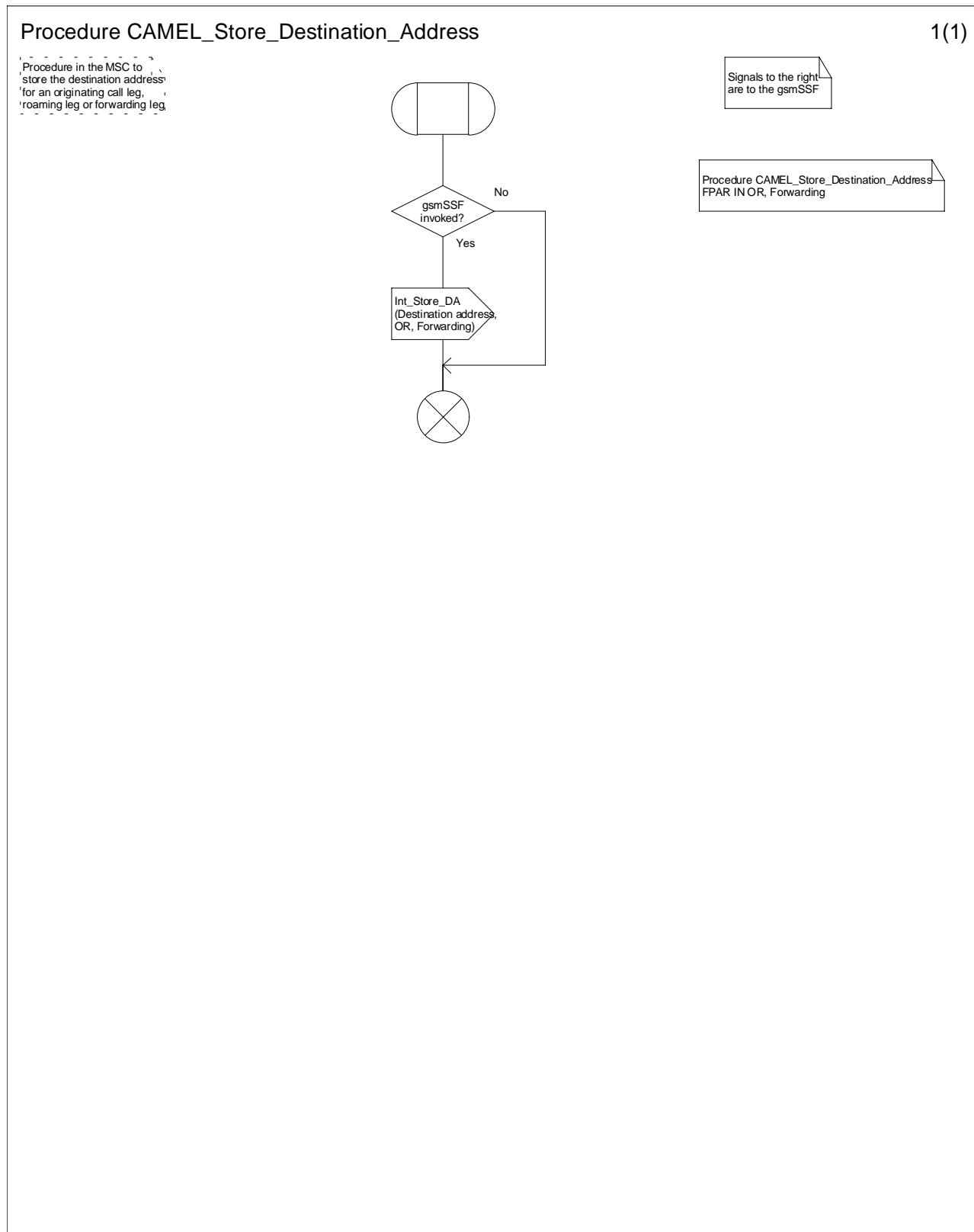


Figure 4.23a: Procedure CAMEL_Store_Destination_Address (sheet 1)

4.5.2.2 Handling of mobile originating calls in the originating VLR

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

- Procedure CAMEL_OCH_VLR

- Process CAMEL_Reconnected_Call_VLR

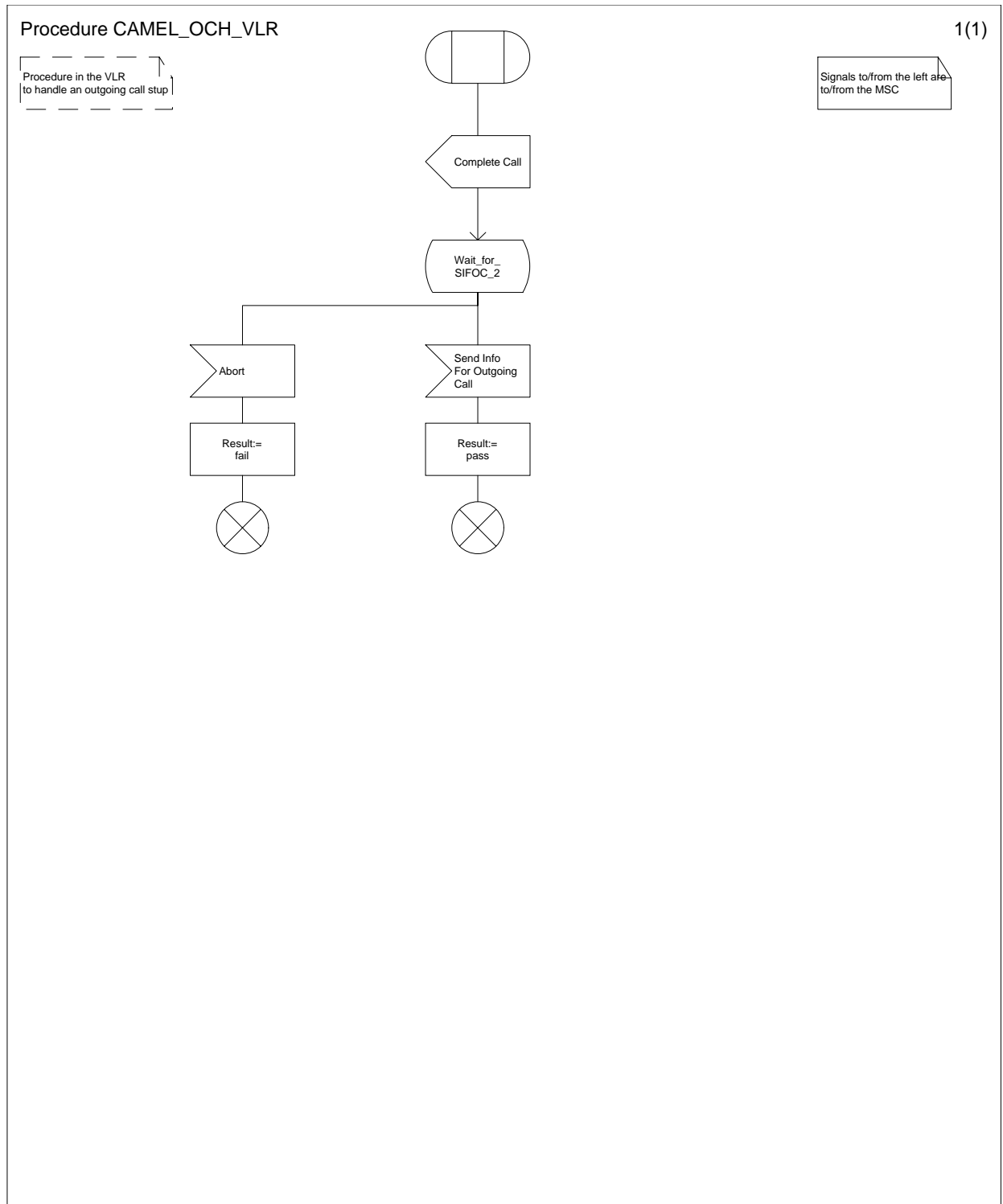


Figure 4.24a: Procedure CAMEL_OCH_VLR (sheet 1)

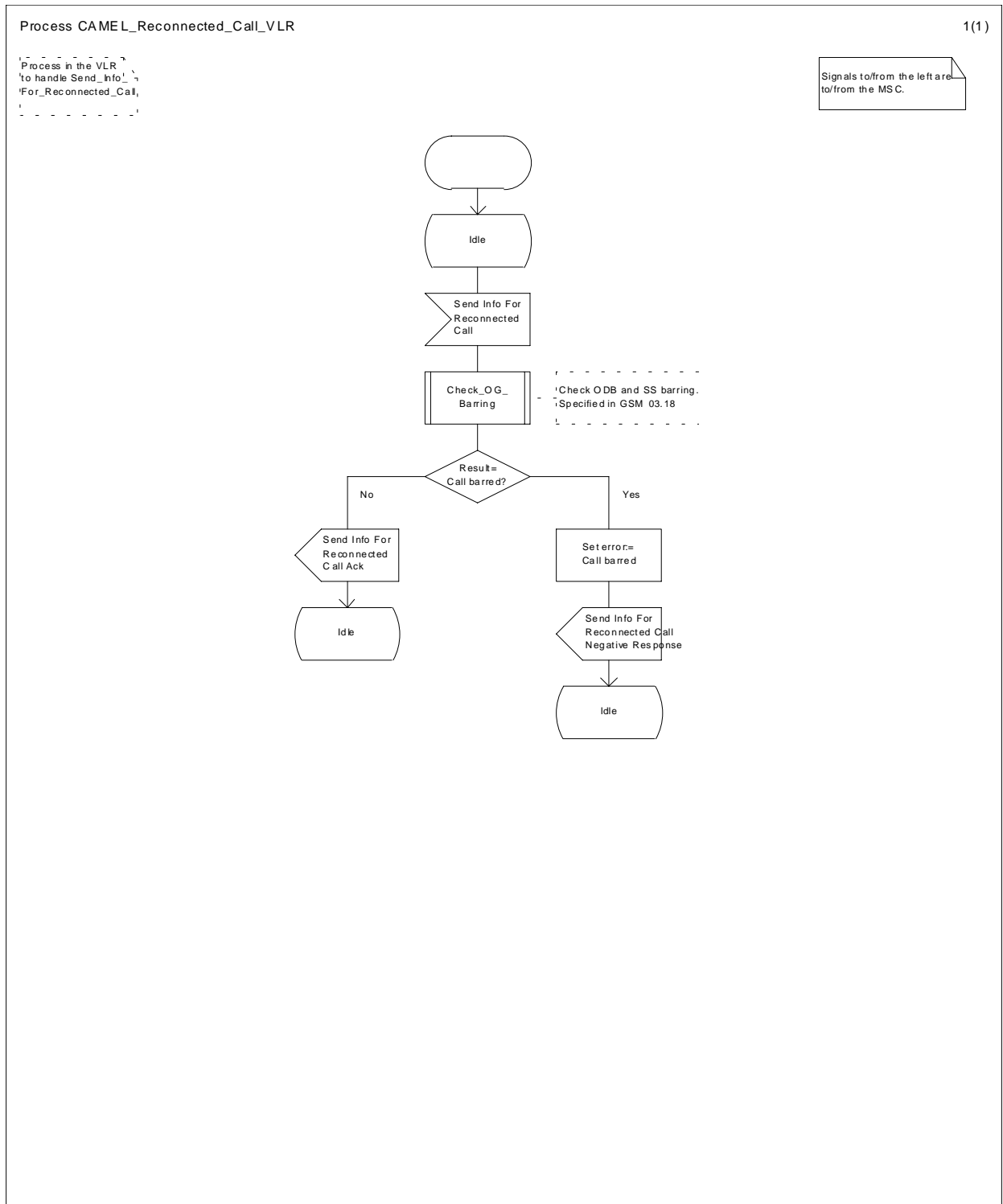


Figure 4.25a: Process CAMEL_Reconnected_Call_VLR (sheet 1)

4.5.3 Retrieval of routing information

4.5.3.1 Retrieval of routing information in the GMSC

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

- Procedure CAMEL_Set_ORA_Parameters

- Procedure CAMEL_MT_GMSC_INIT
- Procedure CAMEL_MT_GMSC_ANSWER
- Procedure CAMEL_MT_GMSC_DISC1
- Procedure CAMEL_MT_GMSC_DISC2
- 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

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

The following paragraphs gives 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 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 in T-CSI the default Call Handling parameter.

If the default call handling is release call, an ISUP_Release 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 continue call handling without CAMEL support.

4.5.3.1.3 Action of the GMSC on receipt of Int_Continue

If a FTN has been stored the information received from HLR is used to overwrite 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, a Send Routeing Info message including a T-CSI suppression parameter is sent to the HLR. The Send Routing Info includes an indication 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, the information received from HLR is used to overwrite 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, a Send Routeing Info message including a T-CSI suppression parameter is sent to the HLR. The Send Routing Info includes an indication 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 message. 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 3G TS 29.078 [5]): 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 gsmSSF, an ISUP_Release is sent to the originating exchange and all resources are released.

Otherwise the following parameters, if received, are used to overwrite the corresponding ISUP parameters (for mapping see 3G TS 29.078 [5]): Destination Number, Calling Partys Category, Generic Number, Original Called Party ID, Redirecting Party ID, Announcement Suppression Indicator, and Redirection Information. Call parameters that are not included in the Int_Connect message 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 (at state Wait_For_Routeing_Info_2)

An exception event is reported to the process 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 (at state Wait_For_Routeing_Info_2)

An ISUP_IAM with the MSRN as Called party number is constructed.

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

The information received from HLR is used to overwrite corresponding call parameters (for details see 3G TS 23.018 [3]). 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 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 FTN.

4.5.3.1.10 Action of the GMSC in procedure CAMEL_MT_ETC

In 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 (for early call forwarding) or the Resume Call Handling (for Optimal Routeing of Late Call Forwarding).

The Int_DP_T_No_Answer and Int_DP_T_Busy messages include a parameter to indicate that the call has encountered conditional call forwarding. The gsmSSF will transfer this parameter to the CAP_Event_Report_BCSM message which it sends to the gsmSCF.

Procedure CAMEL_Set_ORA_Parameters

1(1)

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

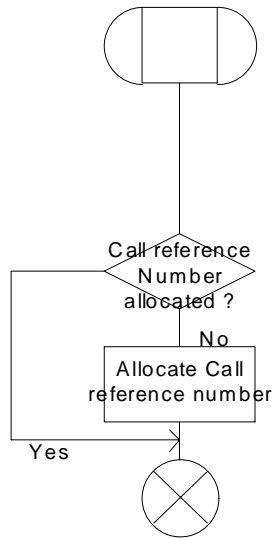


Figure 4.26a: Procedure CAMEL_Set_ORA_Parameters (sheet 1)

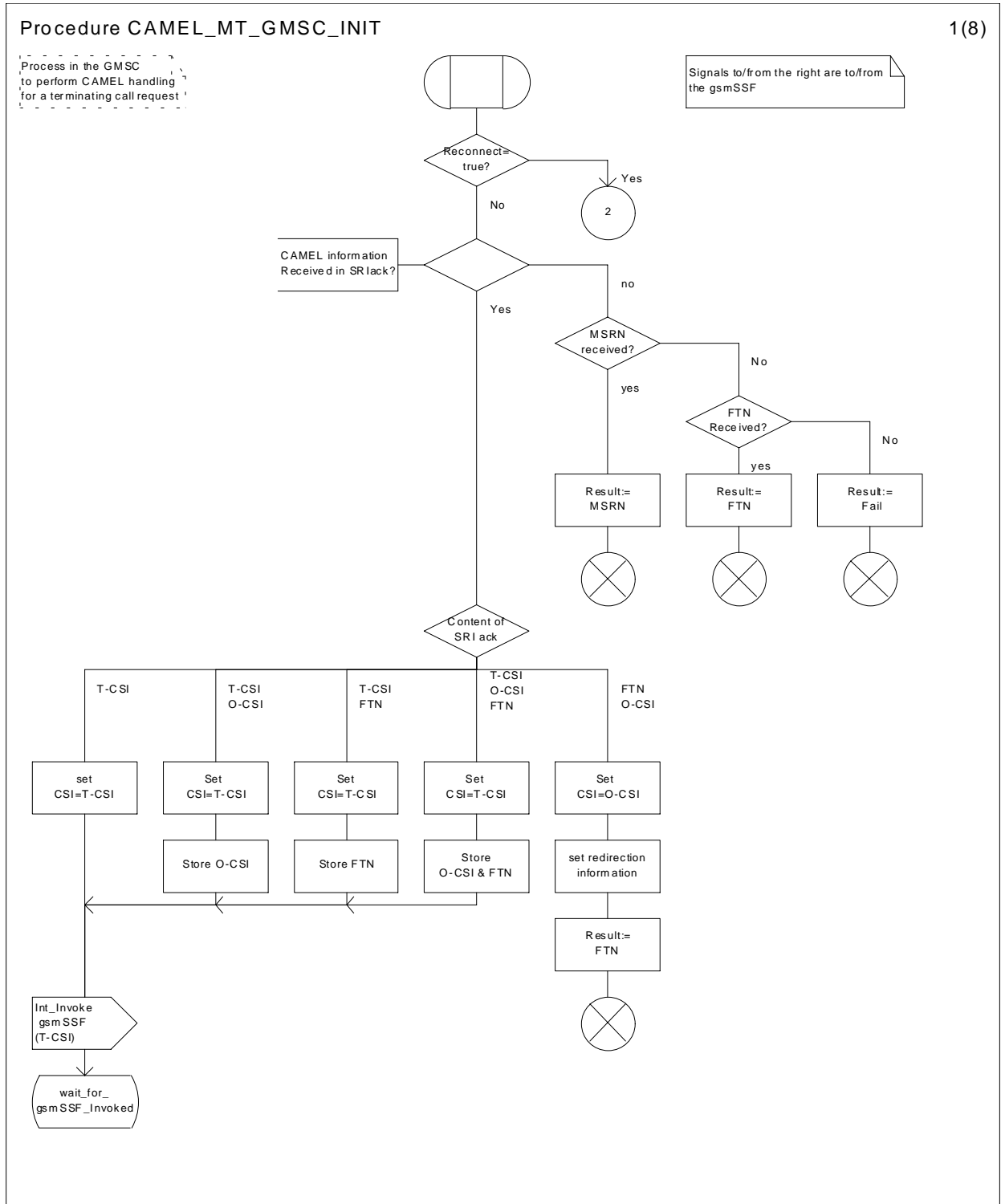


Figure 4.27a: Procedure CAMEL_MT_GMSC_INIT (sheet 1)

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 originating exchange;
signals to/from the right are to/from
the gsmSSF

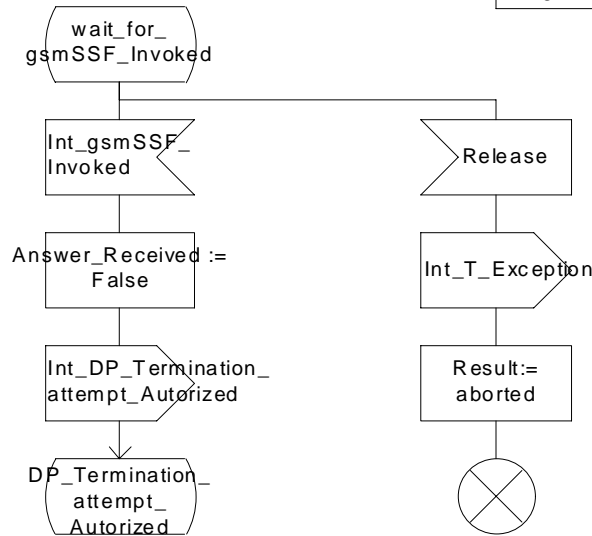


Figure 4.27b: Procedure CAMEL_MT_GMSC_INIT (sheet 2)

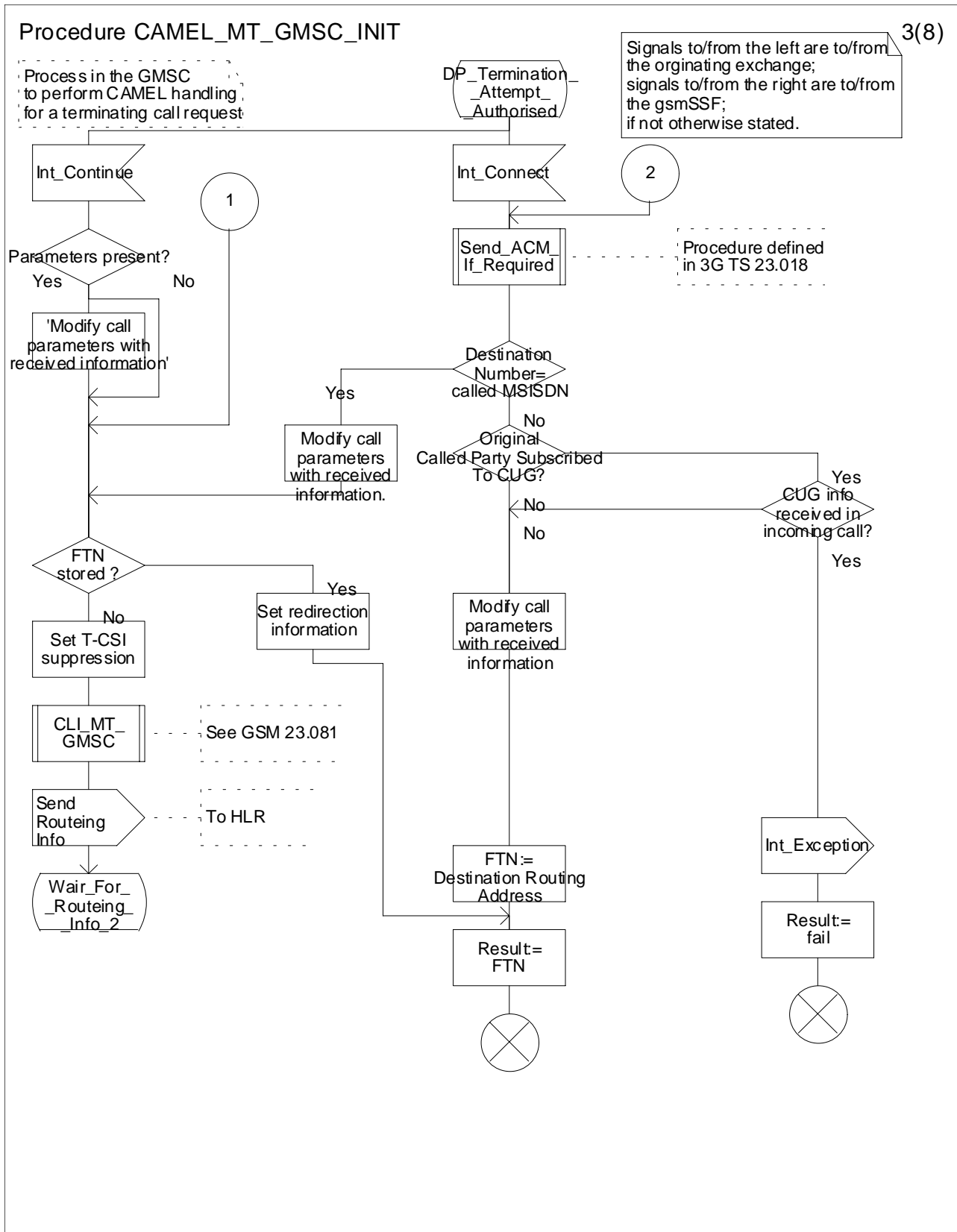


Figure 4.27c: Procedure CAMEL_MT_GMSC_INIT (sheet 3)

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.

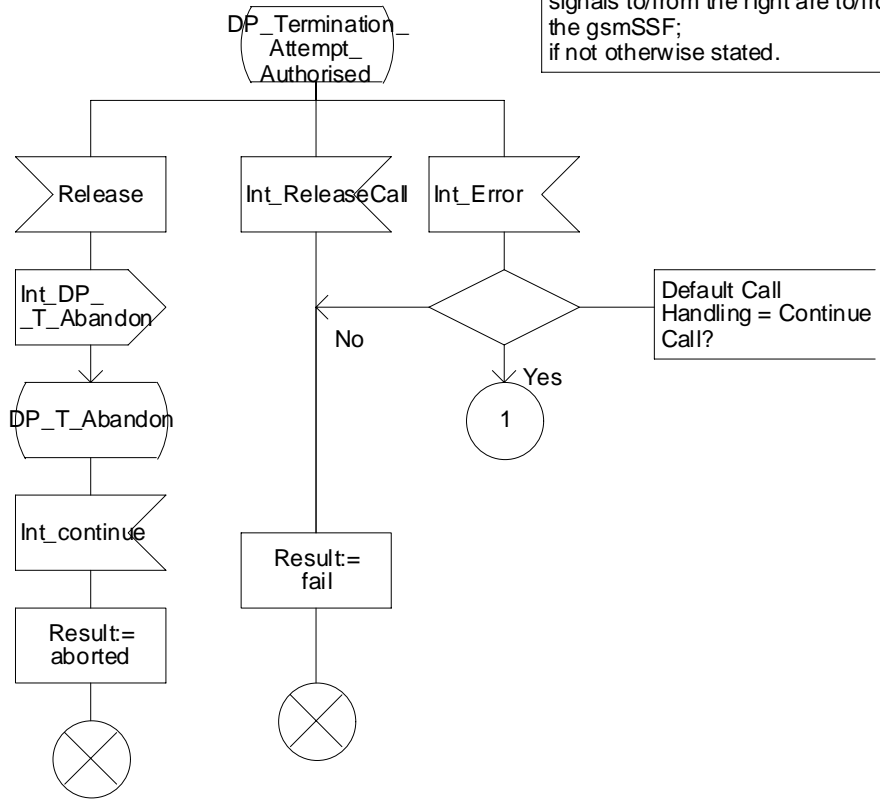


Figure 4.27d: Procedure CAMEL_MT_GMSC_INIT (sheet 4)

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.

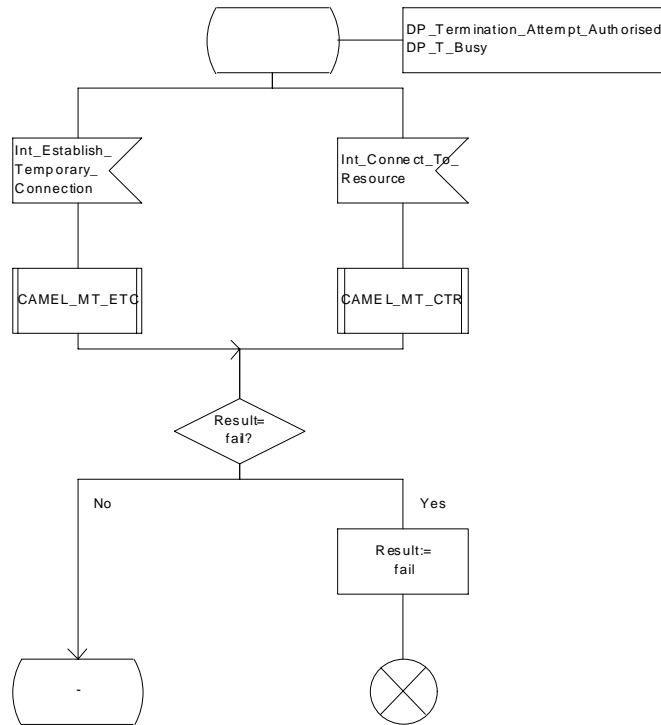


Figure 4.27e: Procedure CAMEL_MT_GMSC_INIT (sheet 5)

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.

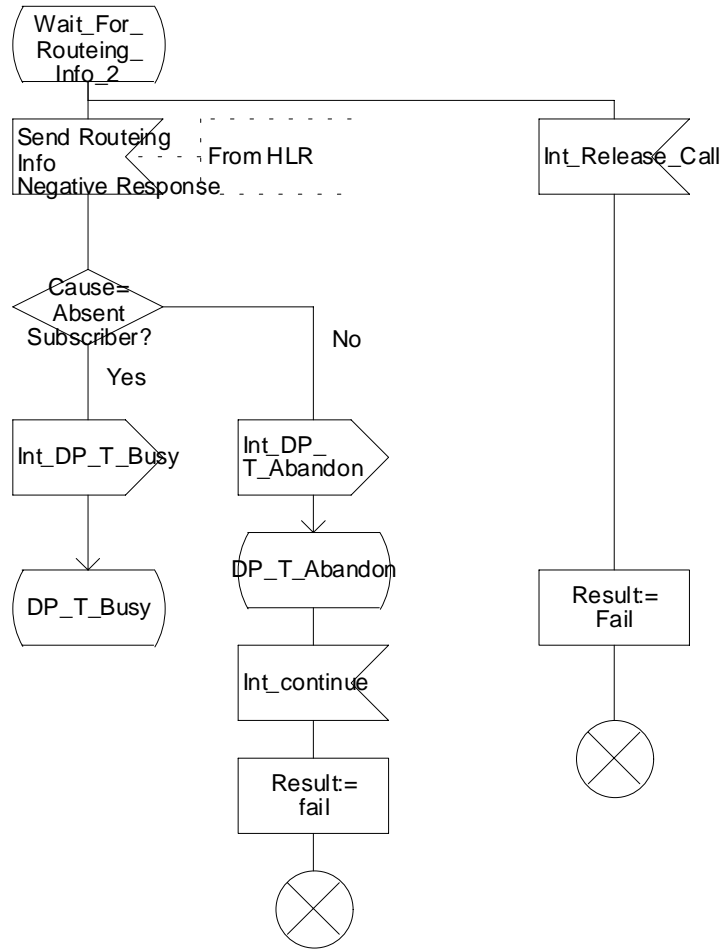


Figure 4.27f: Procedure CAMEL_MT_GMSC_INIT (sheet 6)

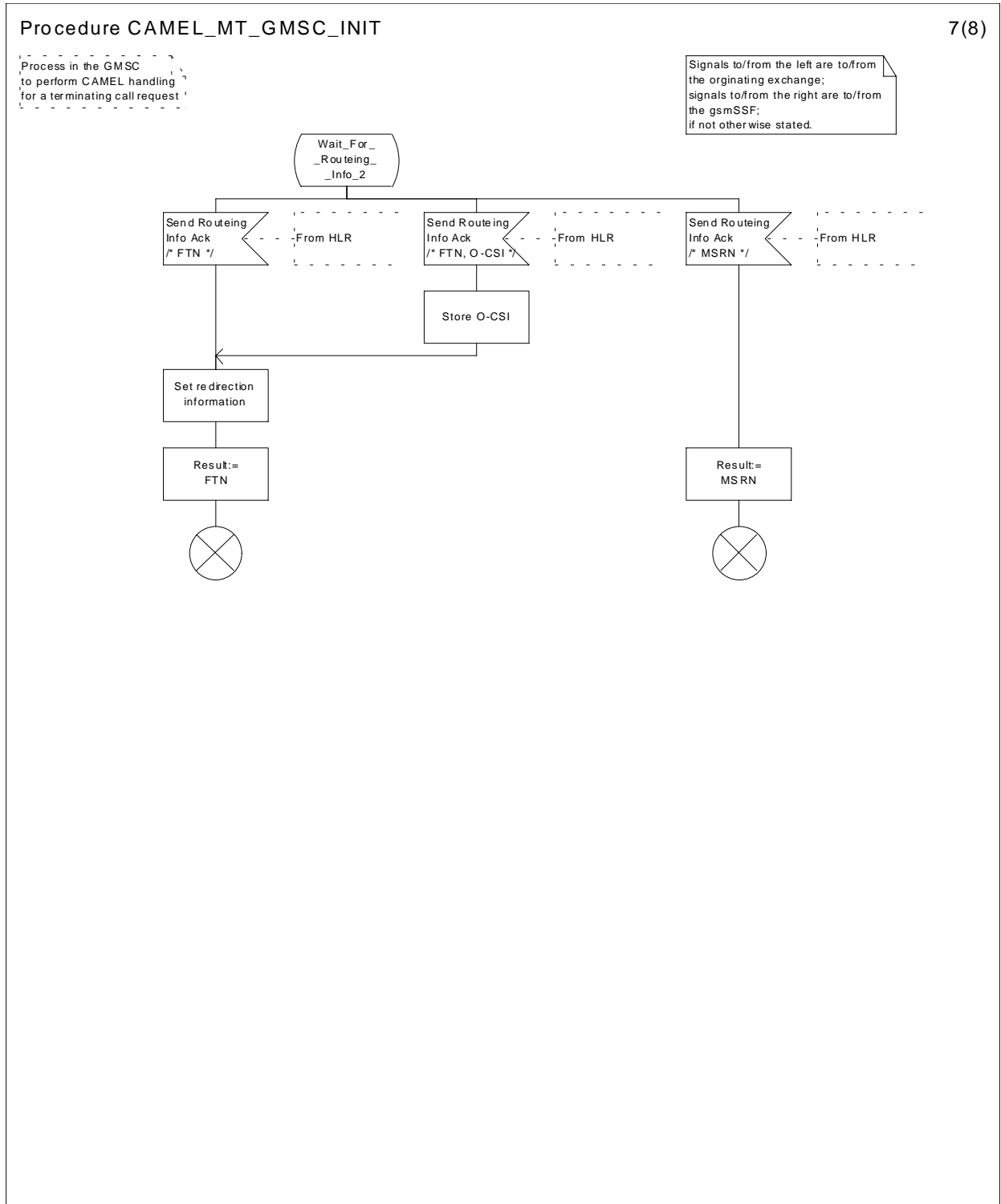


Figure 4.27g: Procedure CAMEL_MT_GMSC_INIT (sheet 7)

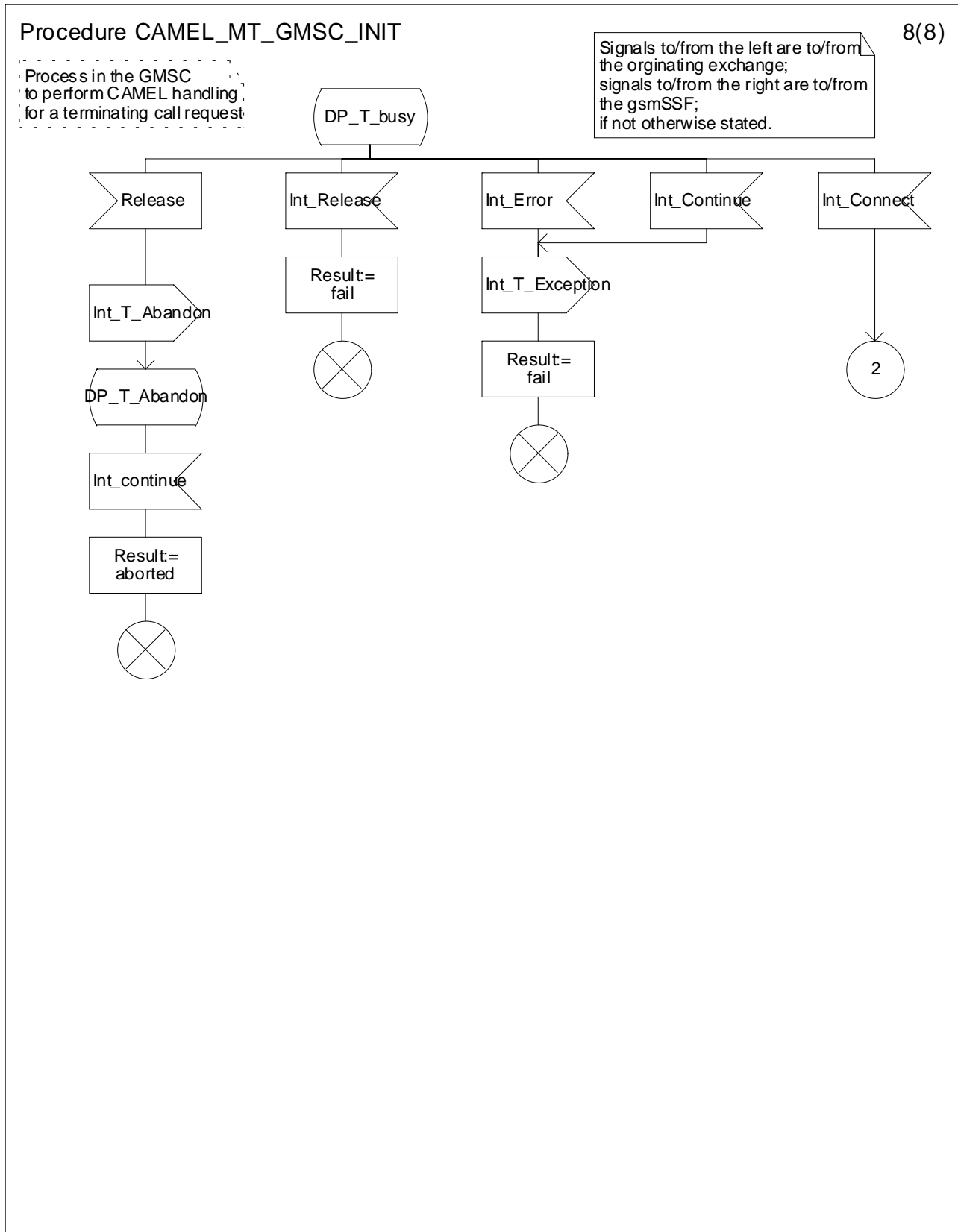


Figure 4.27h: Procedure CAMEL_MT_GMSC_INIT (sheet 8)

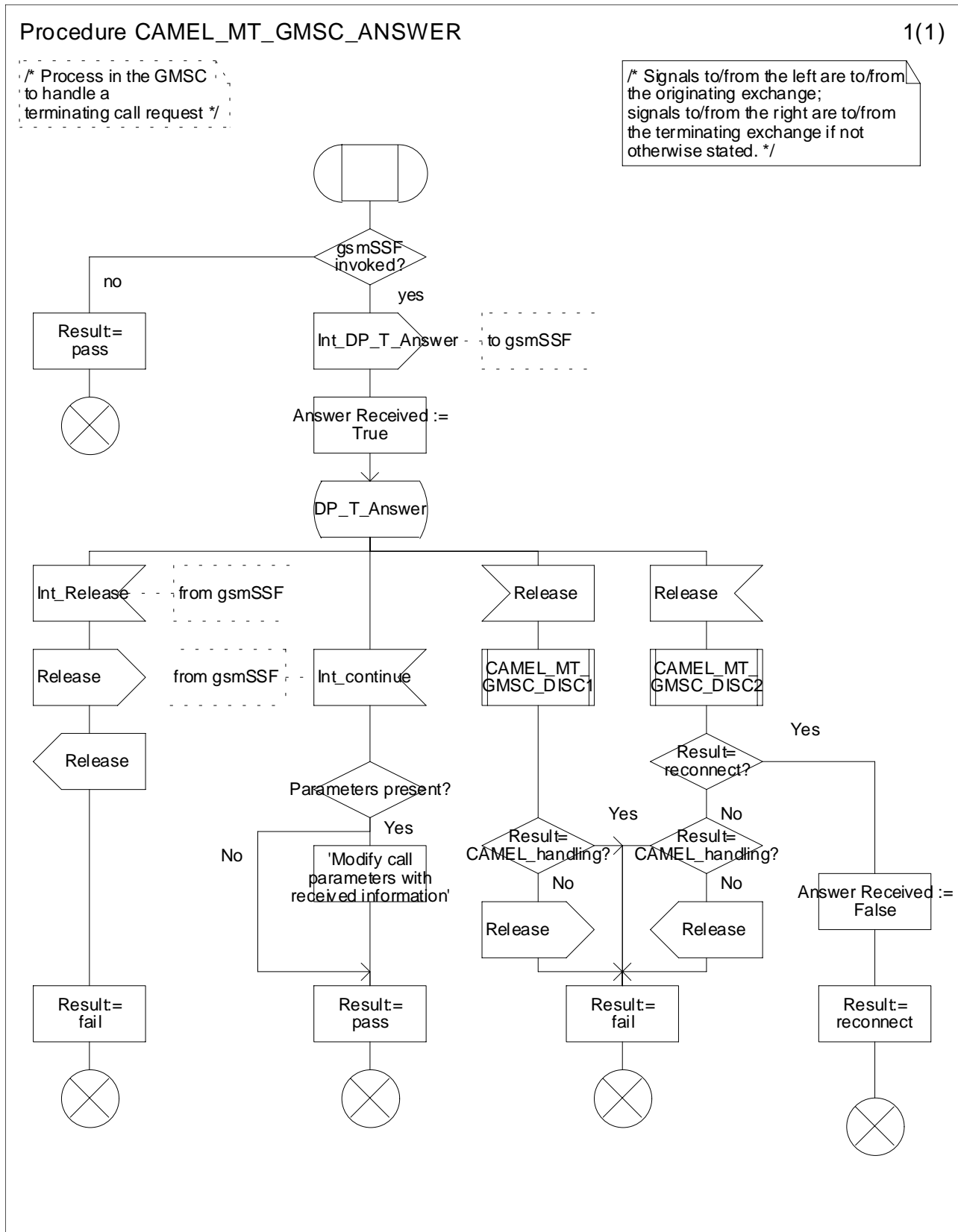


Figure 4.28a: Procedure CAMEL_MT_GMSC_ANSWER (sheet 1)

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. */

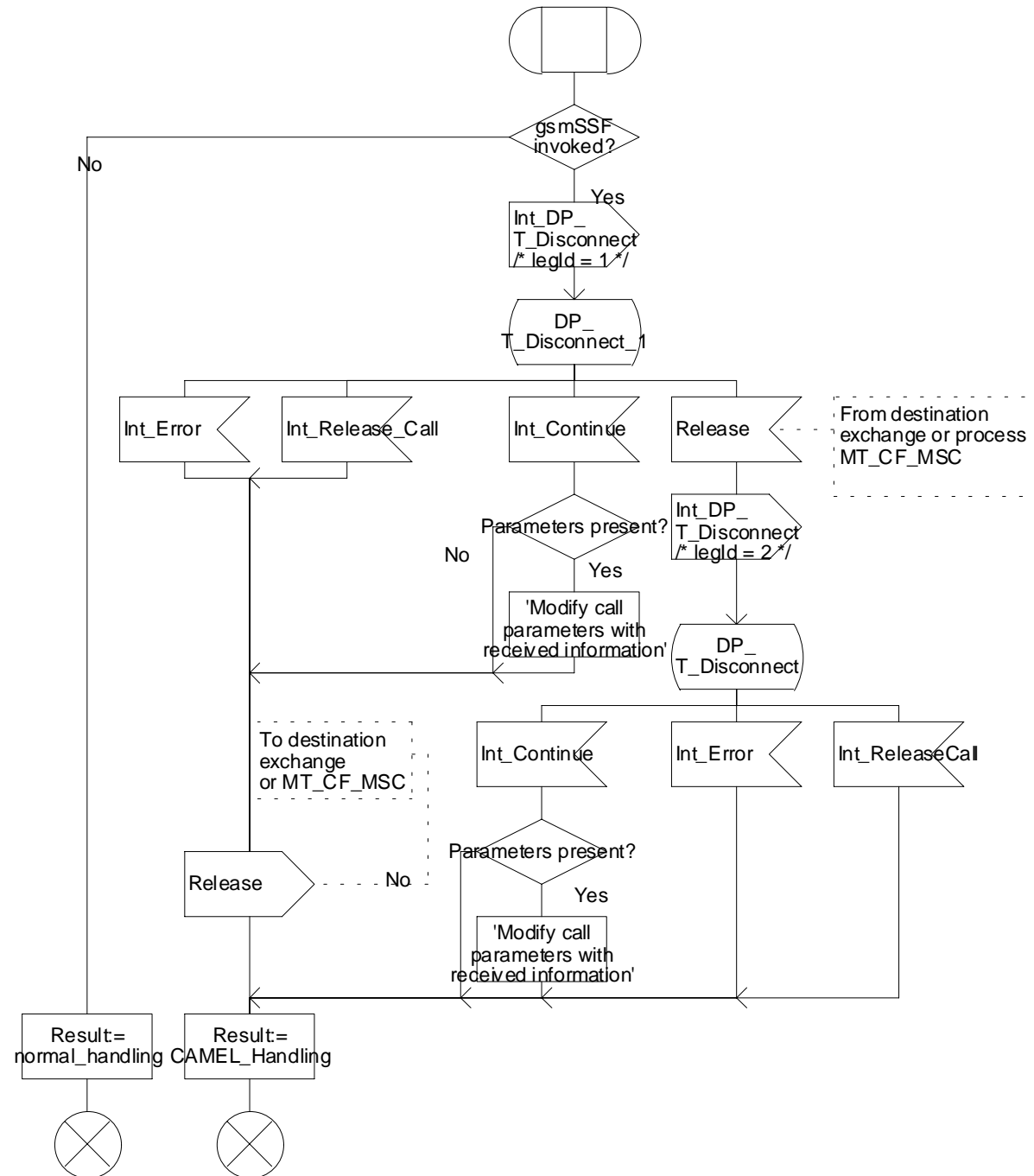


Figure 4.29a: Procedure CAMEL_MT_GMSC_DISC1 (sheet 1)

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. */

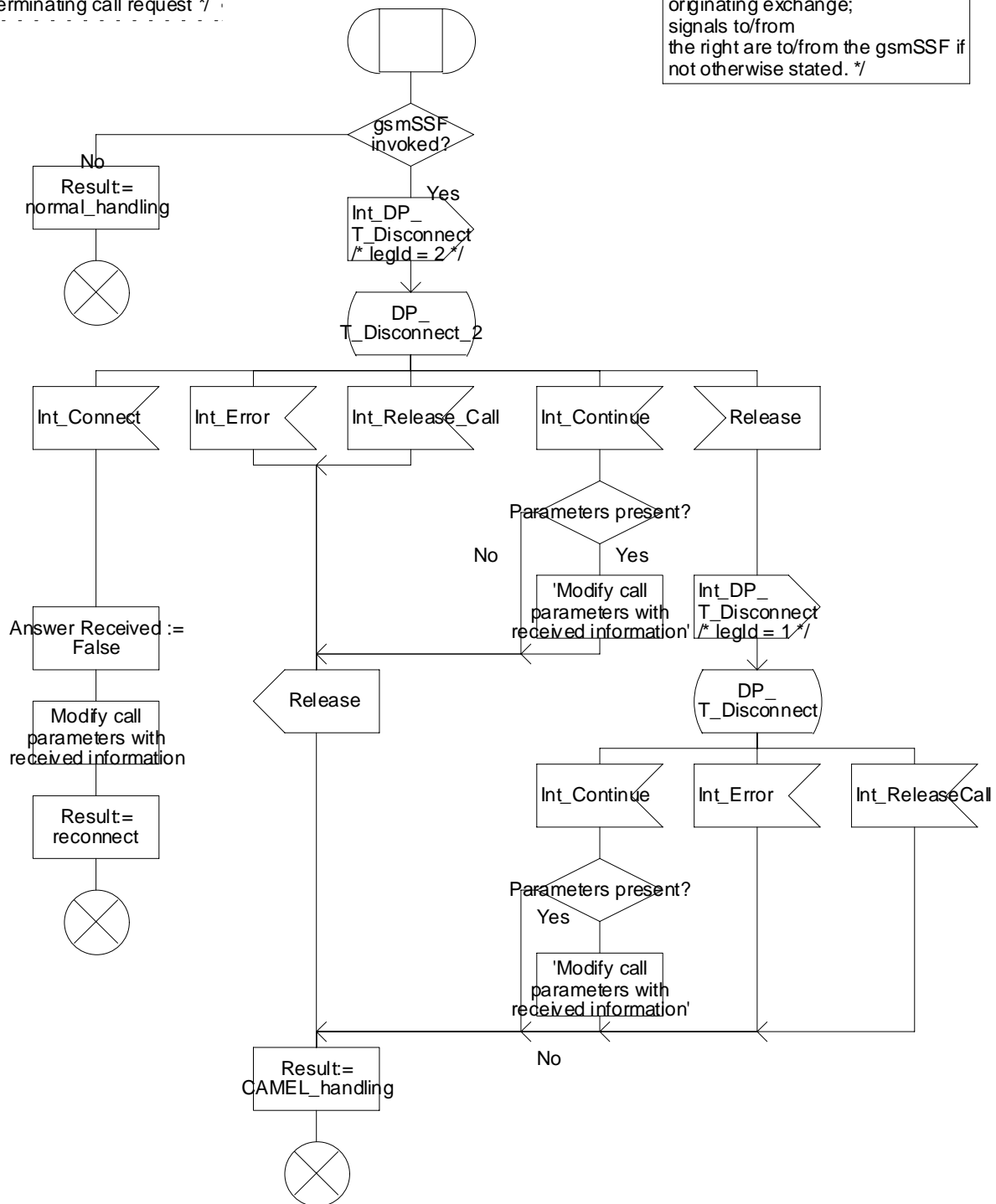


Figure 4.30a: Procedure CAMEL_MT_GMSC_DISC2 (sheet 1)

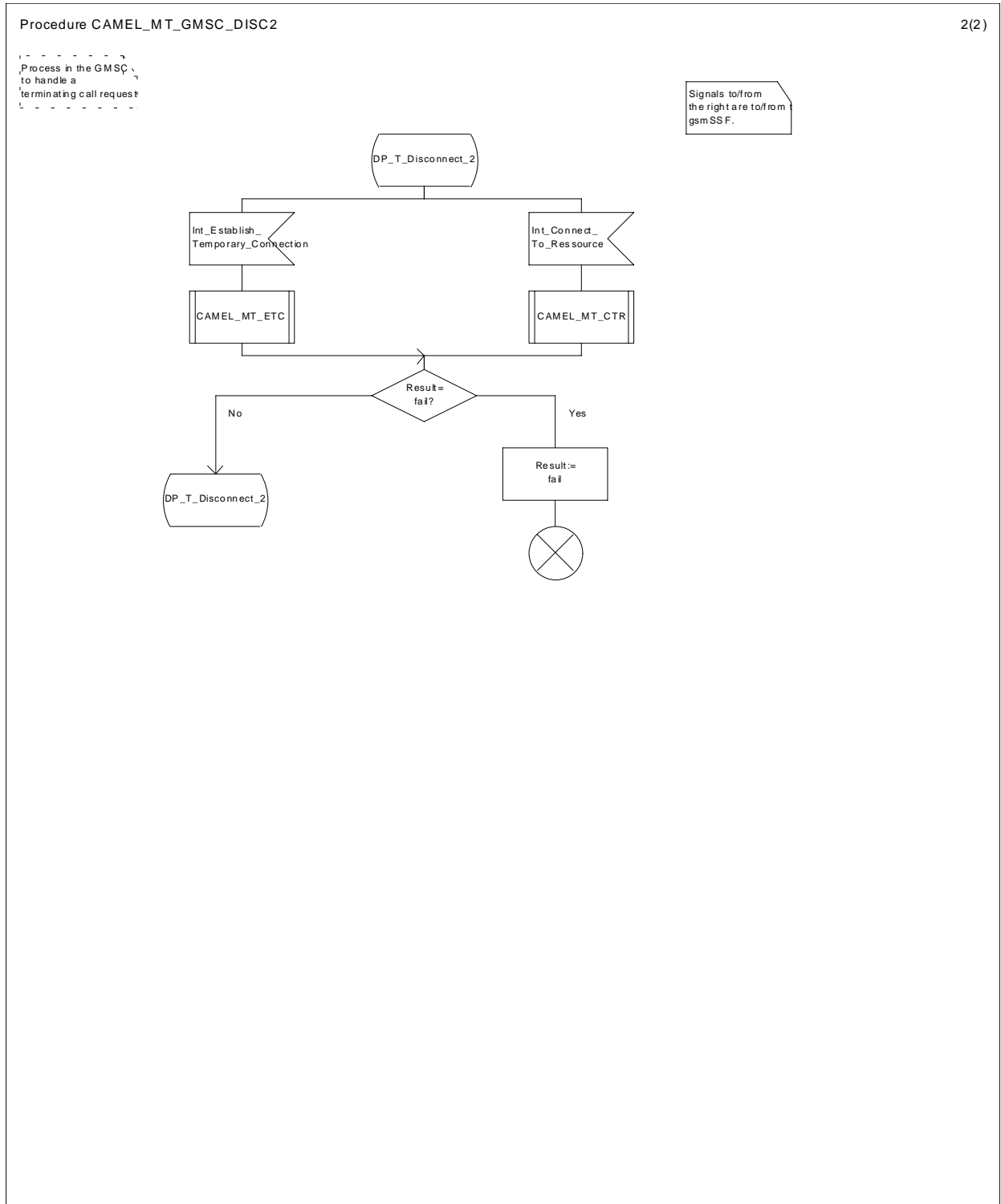


Figure 4.30b: Procedure CAMEL_MT_GMSC_DISC2 (sheet 2)

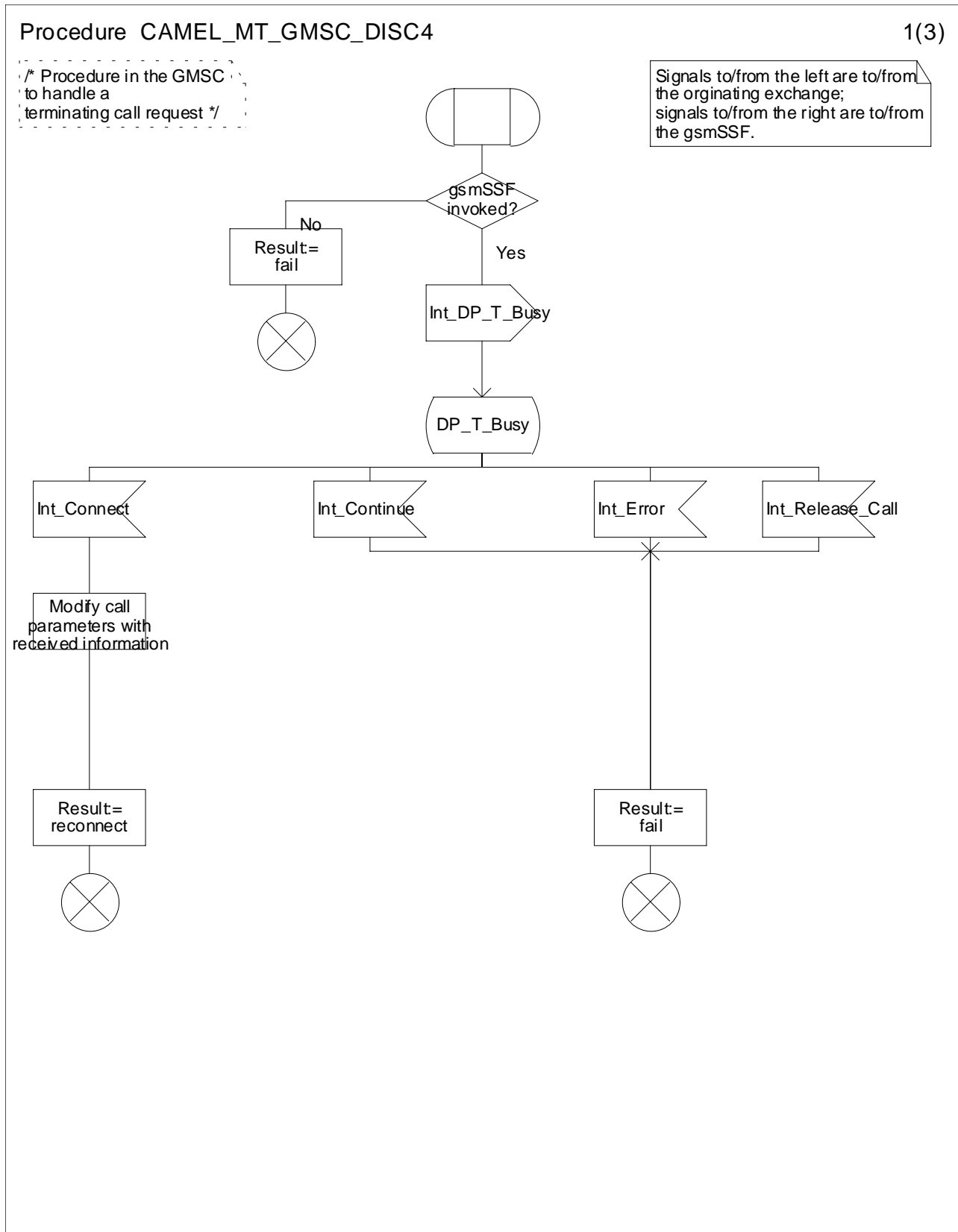


Figure 4.31a: Procedure CAMEL_MT_GMSC_DISC4 (sheet 1)

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.

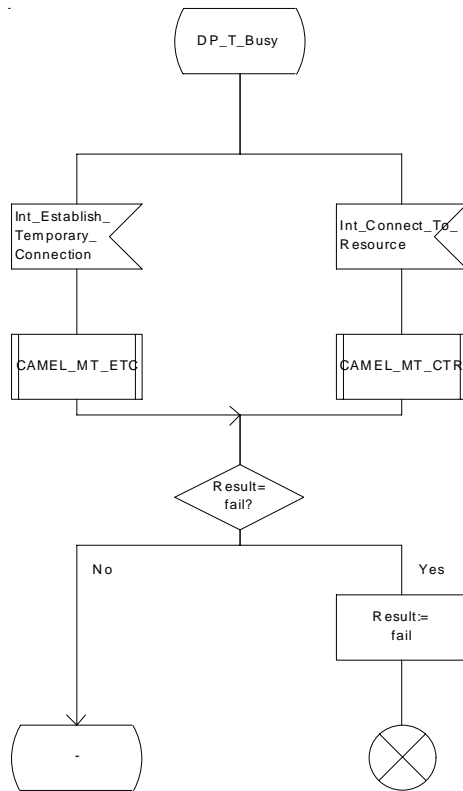


Figure 4.31b: Procedure CAMEL_MT_GMSC_DISC4 (sheet 2)

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 originating exchange; signals to/from the right are to/from the gsmSSF.

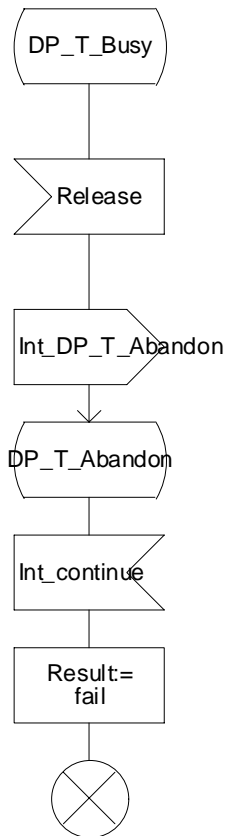


Figure 4.31c: Procedure CAMEL_MT_GMSC_DISC4 (sheet 3)

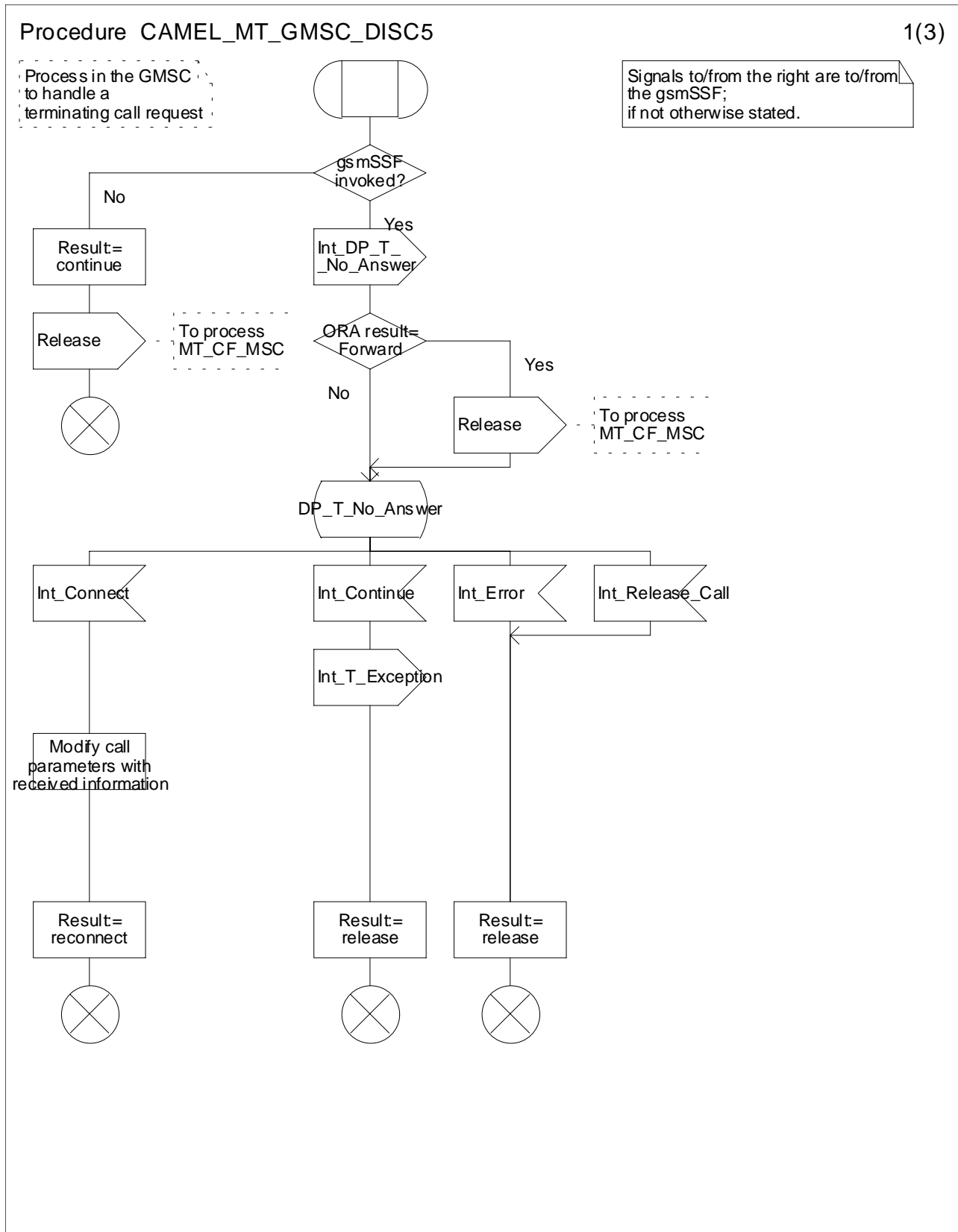


Figure 4.32a: Procedure CAMEL_MT_GMSC_DISC5 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC5

2(3)

Process in the GMSQ to handle a terminating call request

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

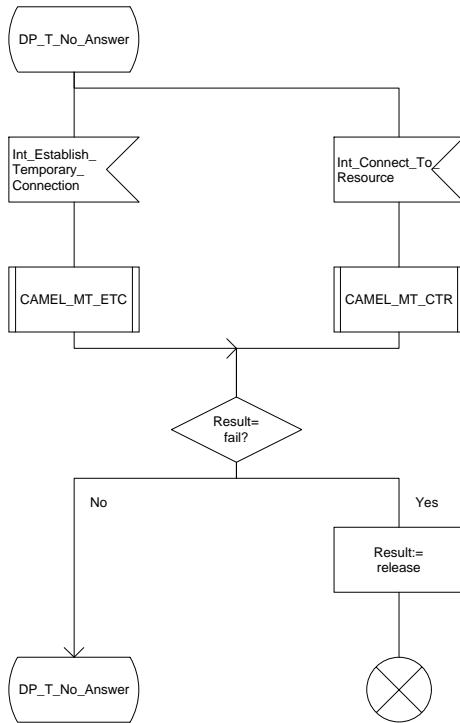


Figure 4.32b: Procedure CAMEL_MT_GMSC_DISC5 (sheet 2)

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

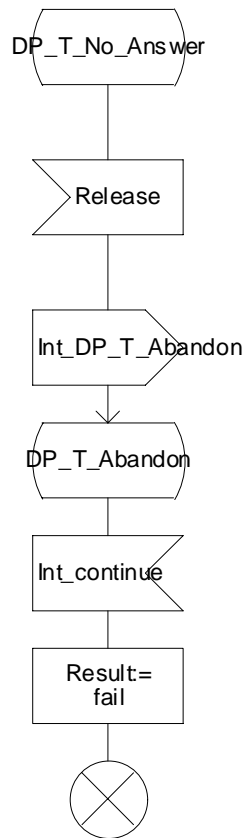


Figure 4.32c: Procedure CAMEL_MT_GMSC_DISC5 (sheet 3)

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. */

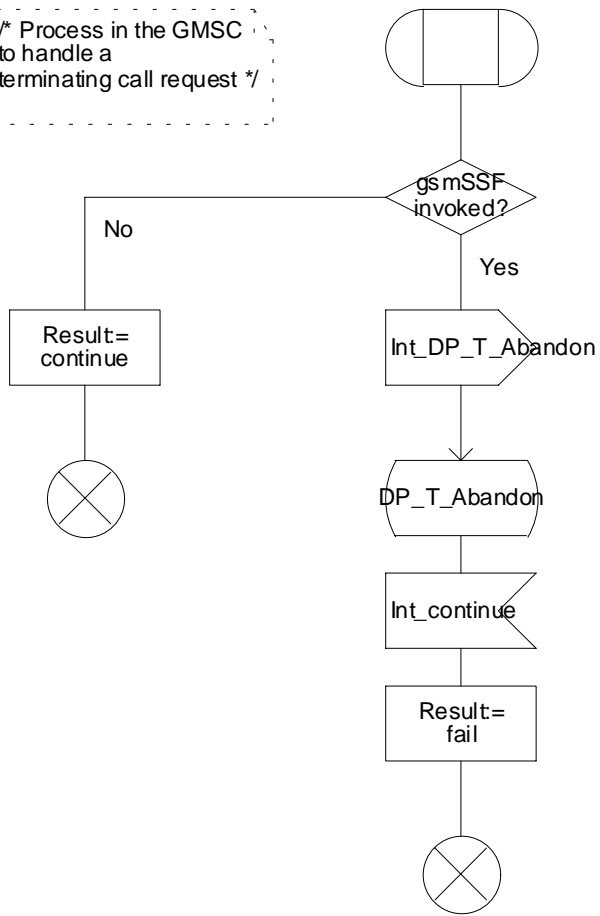


Figure 4.33a: Procedure CAMEL_MT_GMSC_DISC6 (sheet 1)

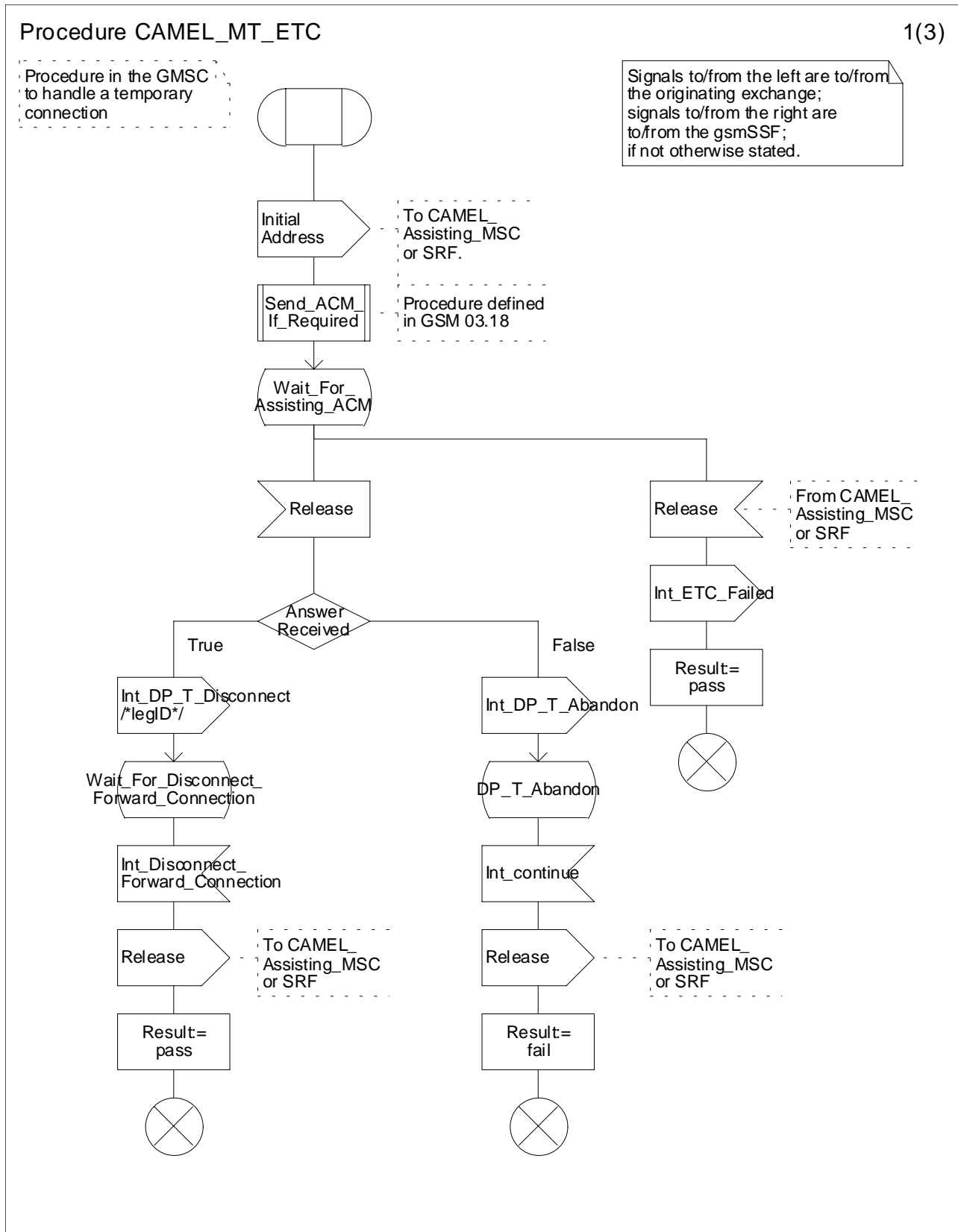


Figure 4.34a: Procedure CAMEL_MT_ETC (sheet 1)

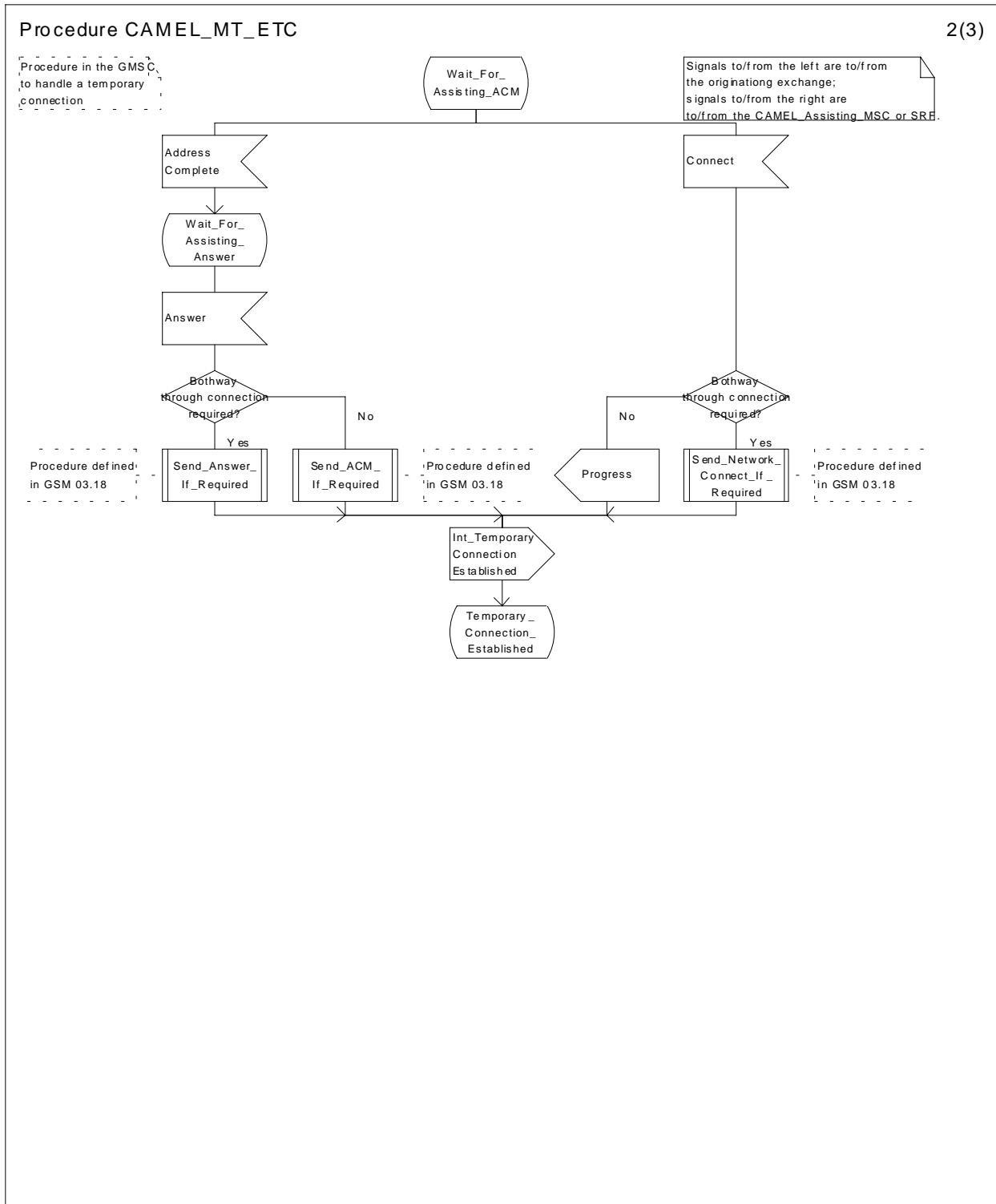


Figure 4.34b: Procedure CAMEL_MT_ETC (sheet 2)

Procedure CAMEL_MT_ETC

3(3)

Procedure in the GMSC to handle a temporary connection

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.

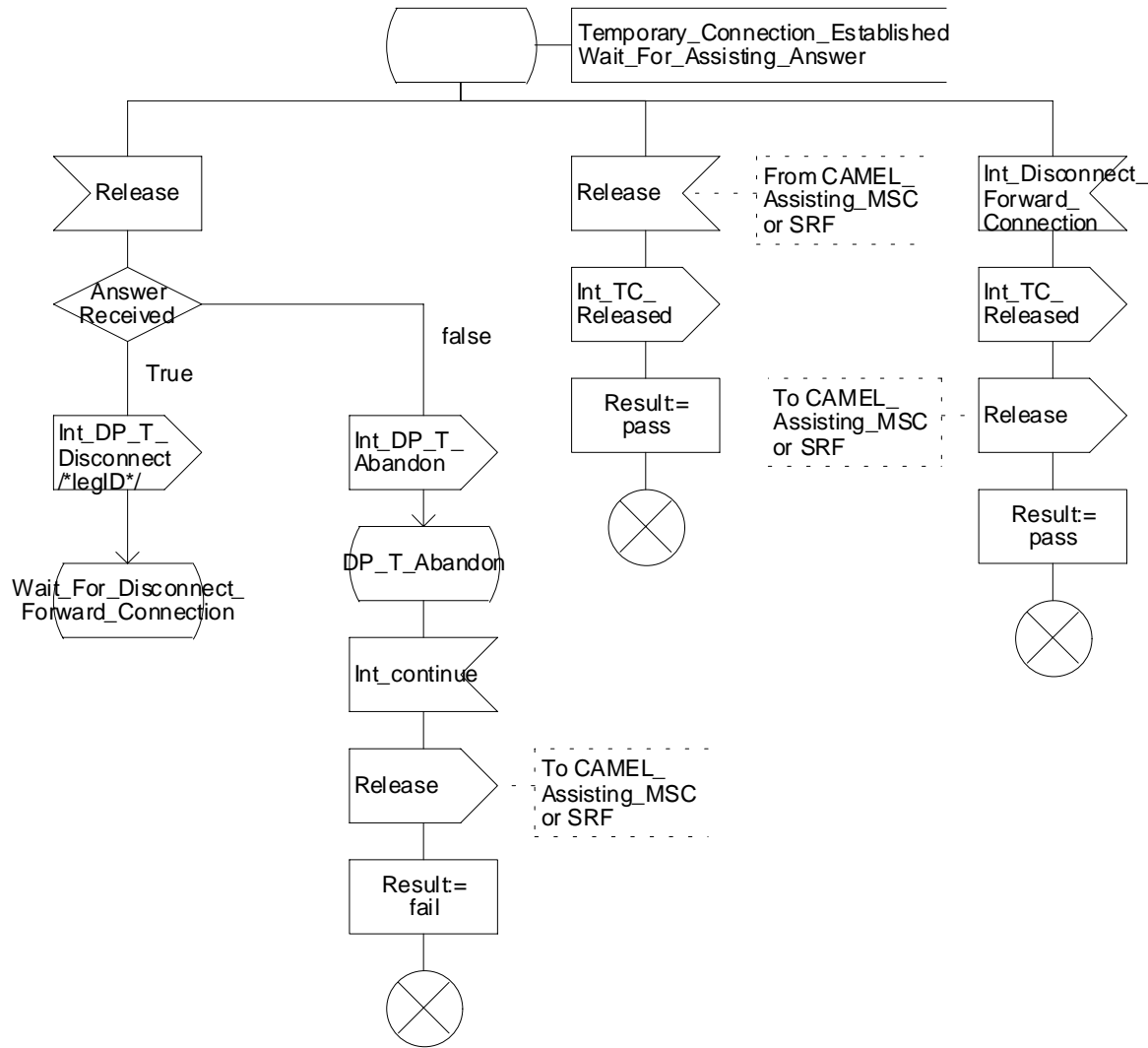


Figure 4.34c: Procedure CAMEL_MT_ETC (sheet 3)

Procedure CAMEL_MT_CTR

1(4)

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

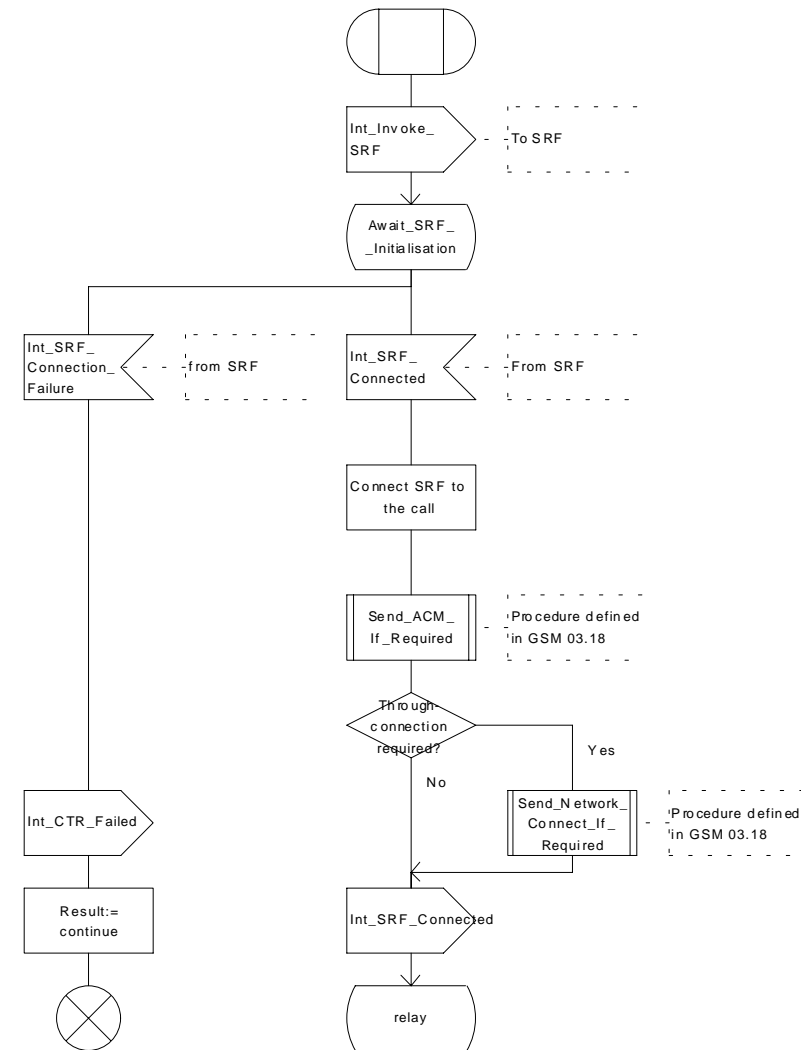


Figure 4.35a: Procedure CAMEL_MT_CTR (sheet 1)

Procedure CAMEL_MT_CTR

2(4)

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.

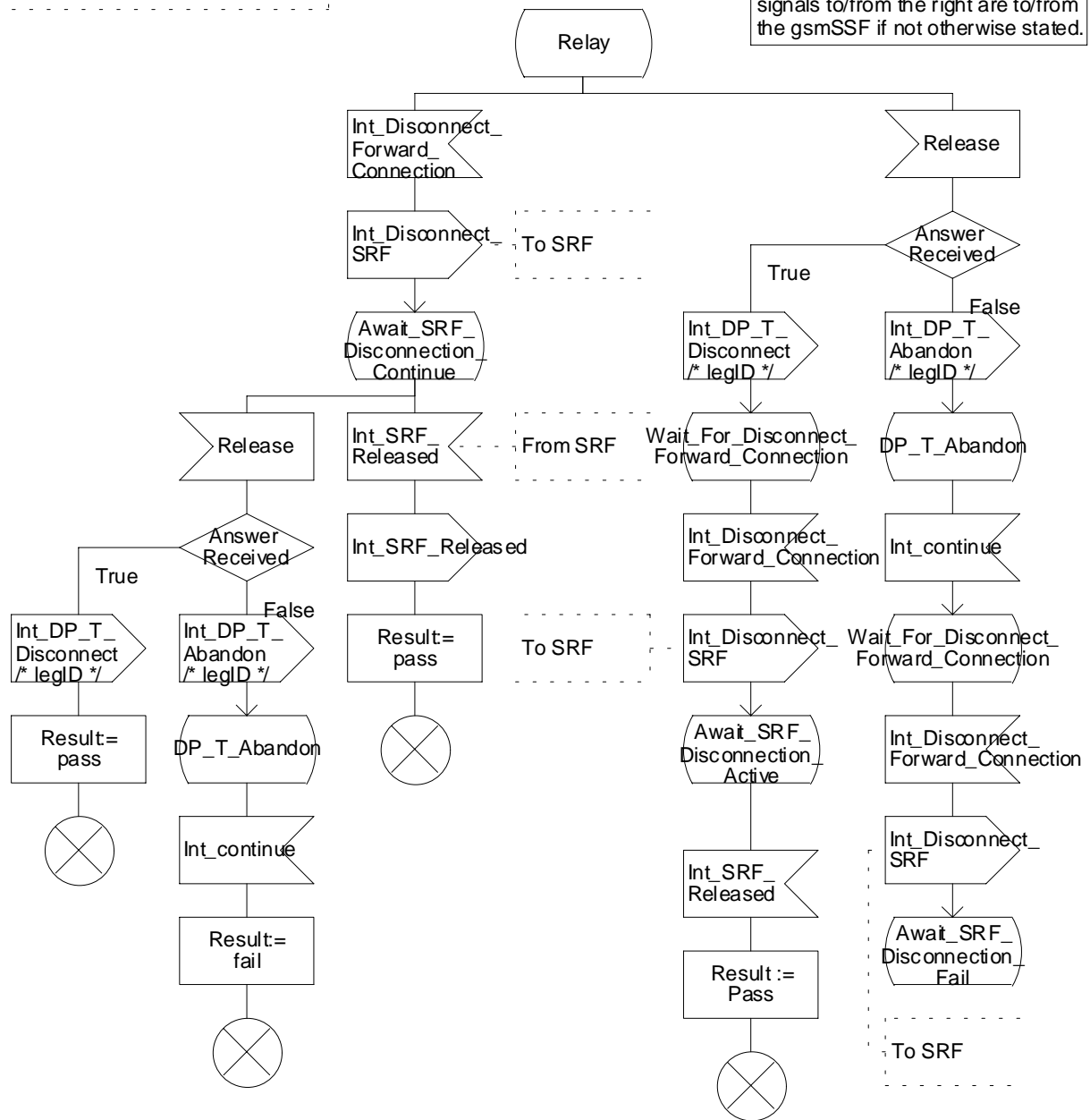


Figure 4.35b: Procedure CAMEL_MT_CTR (sheet 2)

Procedure CAMEL_MT_CTR

3(4)

Procedure in the GMSC to handle
a Connect To Resource operation

Signals to/from the right are to/from
the gmSSF.
Signals to/from the left are to/from
the external SRF.

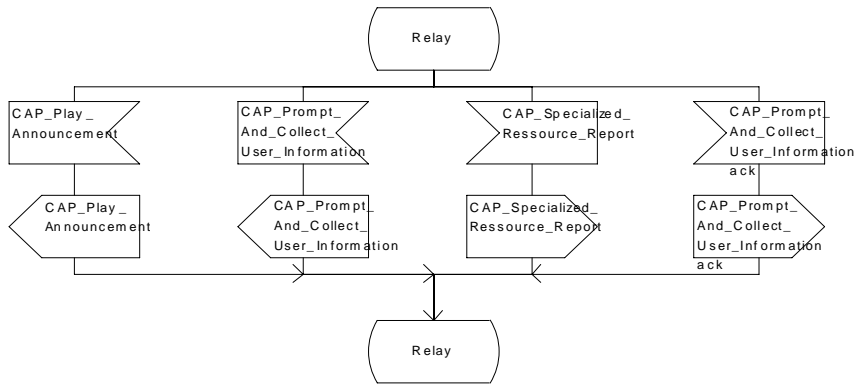


Figure 4.35c: Procedure CAMEL_MT_CTR (sheet 3)

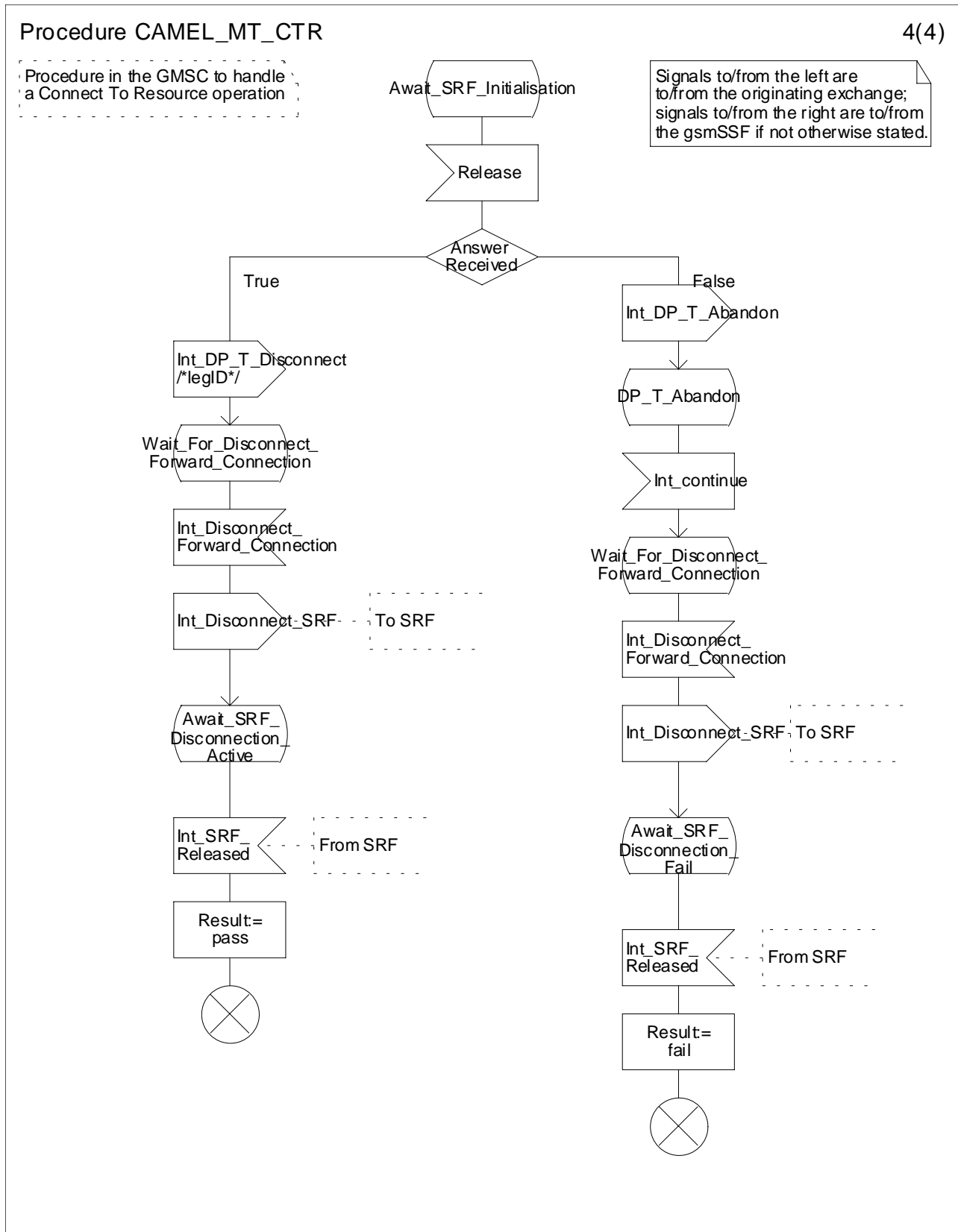


Figure 4.35d: Procedure CAMEL_MT_CTR (sheet 4)

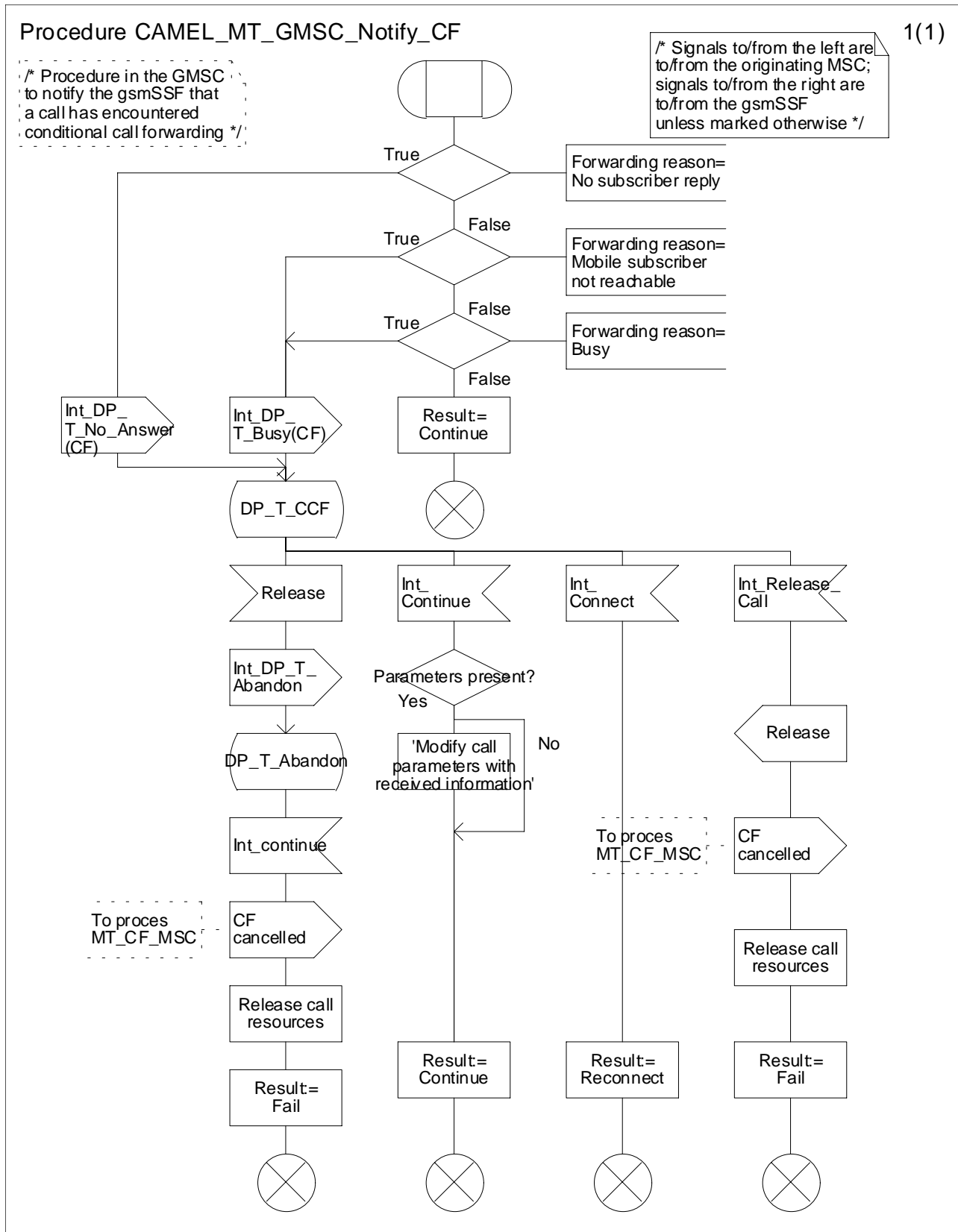


Figure 4.36: Procedure CAMEL_MT_GMSC_Notify_CF (sheet 1)

4.5.3.2 Retrieval of routing information in the HLR

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

- CAMEL_HLR_INIT,
- CAMEL_CSI_Check_HLR,
- CAMEL_O_CSI_CHECK_HLR,
- CAMEL_T_CSI_CHECK_HLR,

The procedure CAMEL_Provide_Subscriber_Info is specified in subclause 4.5.8.

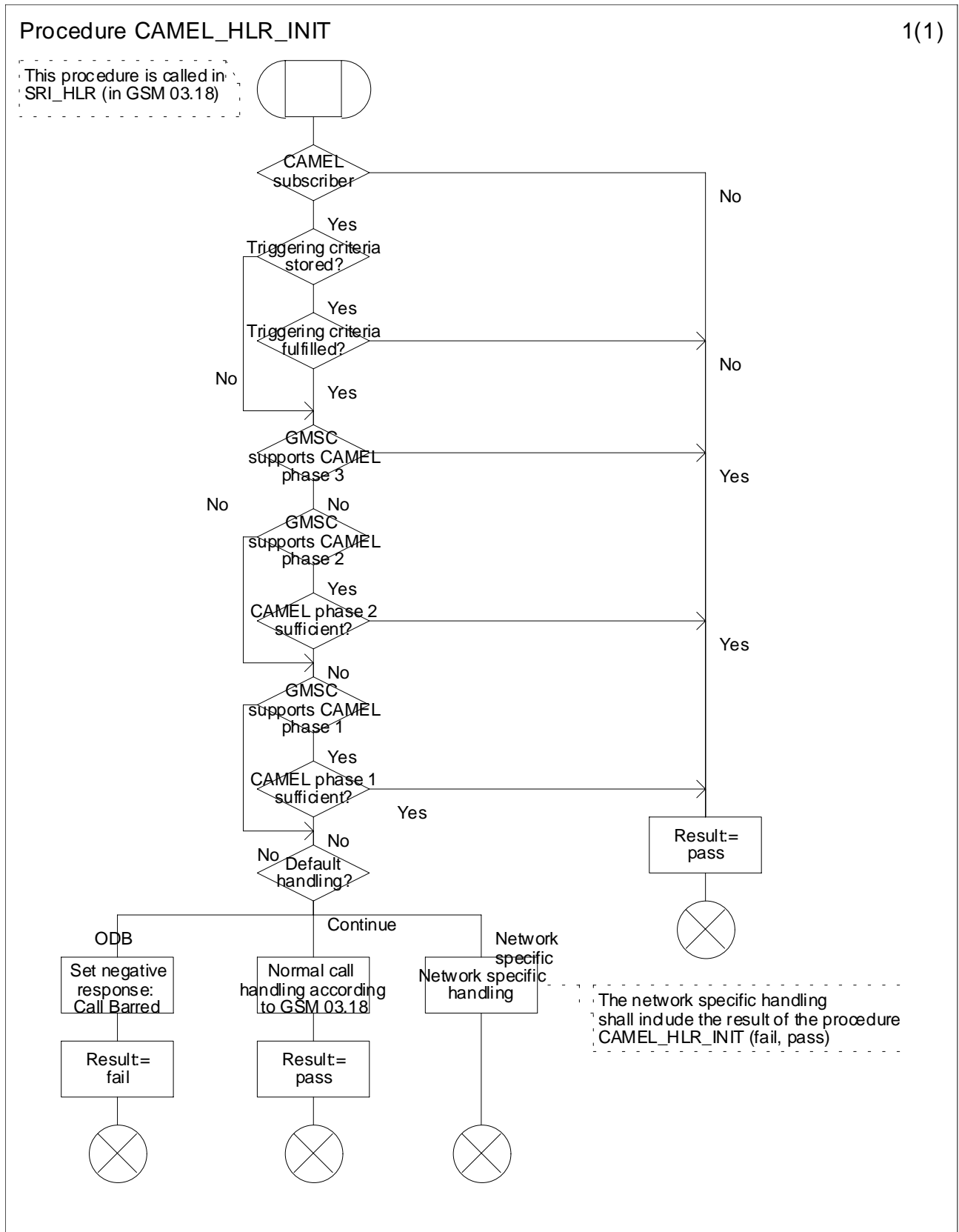


Figure 4.37a: Procedure CAMEL_HLR_INIT (sheet 1)

Procedure CAMEL_CSI_Check_HLR

1(1)

/* This procedure in the HLR to perform the handling for a forwarded CAMEL call. */

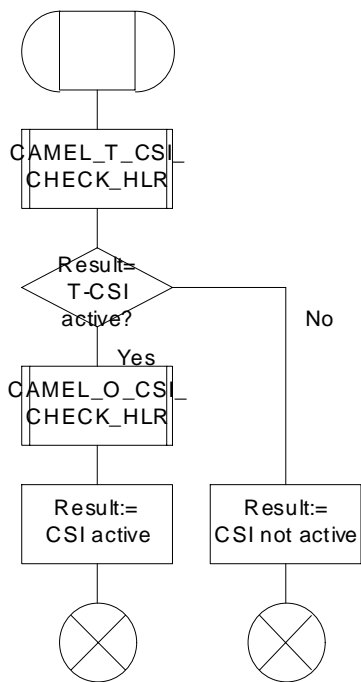


Figure 4.38a: Procedure CAMEL_CSI_Check_HLR (sheet 1)

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.

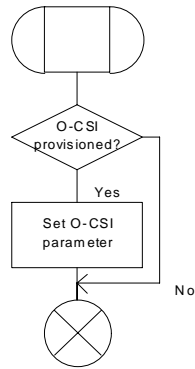


Figure 4.39a: Procedure CAMEL_O_CSI_CHECK_HLR (sheet 1)

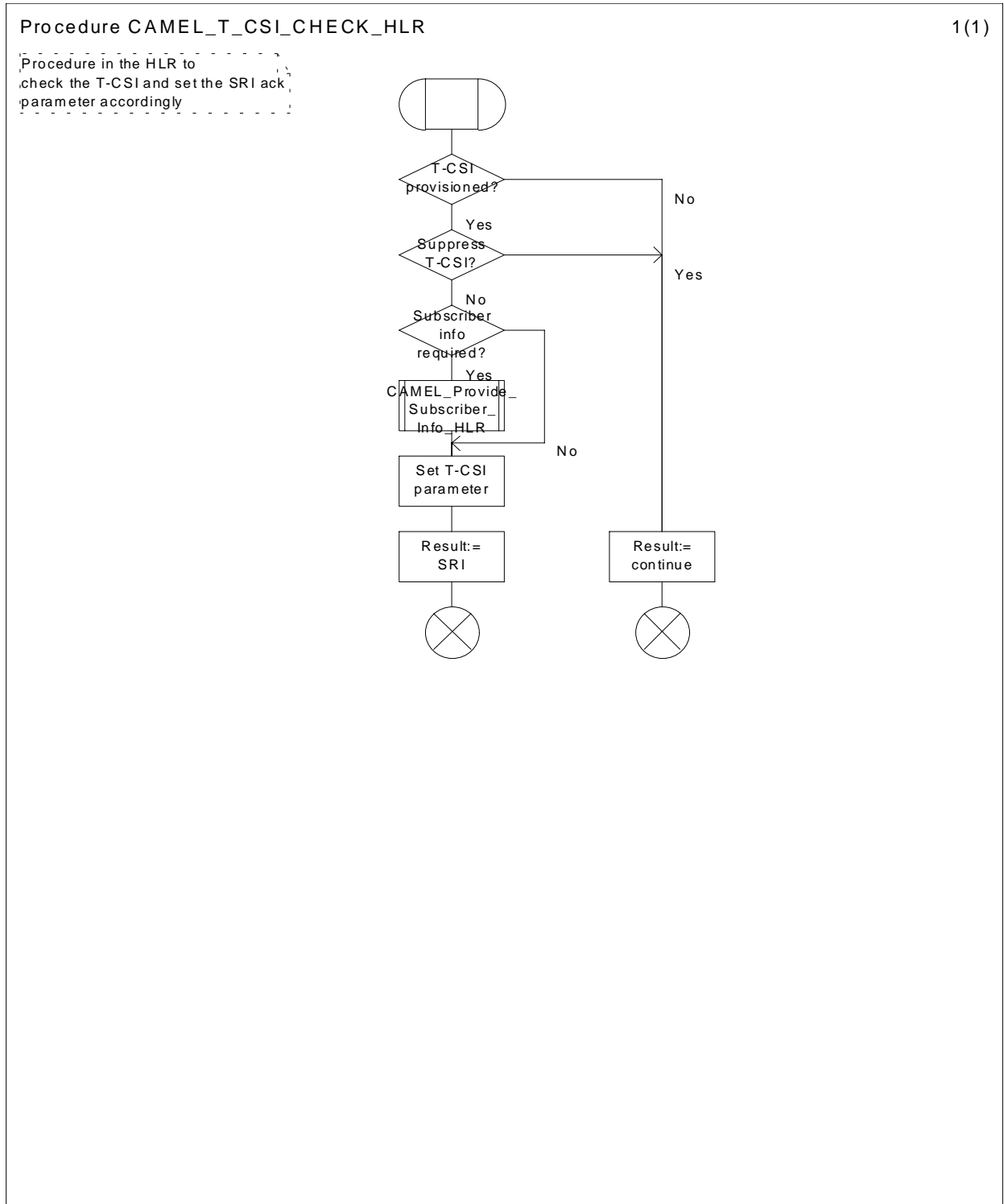


Figure 4.40a: Procedure CAMEL_T_CSI_CHECK_HLR (sheet 1)

4.5.3.3 Handling of provide roaming number request in the VLR

The functional behaviour of the VLR is specified in GSM 03.18 [3]. The procedure specific to CAMEL is specified in this subclause :

- CAMEL_SET_SOA.

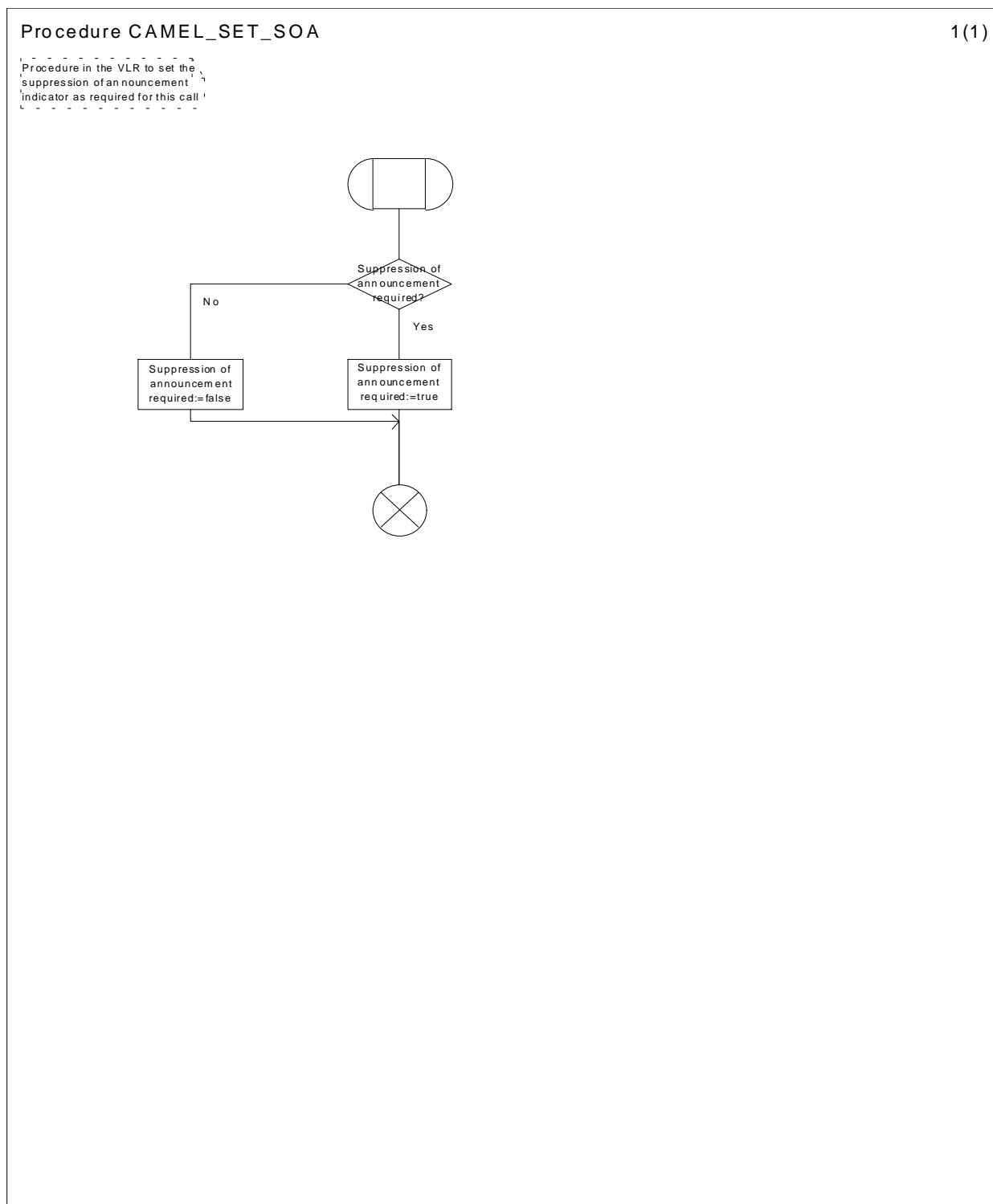


Figure 4.41a: Procedure CAMEL_SET_SOA (sheet 1)

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 3G TS 23.018 [3].

The behaviour specific to CAMEL is:

- the inclusion of the O-CSI parameter in the Perform Call Forwarding message sent to the process MT_CF_MSC if it was received in the Send Info For Incoming Call ack;
- 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.

The procedures specific to CAMEL are specified in this subclause :

- Procedure CAMEL_ICH_VLR
- Procedure CAMEL_O_CSI_Check_VLR
- Procedure CAMEL_T_CSI_Check_VLR
- Procedure CAMEL_ICH_MSC_INIT
- Procedure CAMEL_MT_VMSC_Notify_CF

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 message from the VLR.

The Int_DP_T_No_Answer and Int_DP_T_Busy messages include a parameter to indicate that the call has encountered conditional call forwarding. The gsmSSF will transfer this parameter to the CAP_Event_Report_BCSM message which it sends to the gsmSCF.

Procedure CAMEL_ICH_VLR

1(1)

/* This procedure is called in ICH_VLR (in GSM 03.18) */

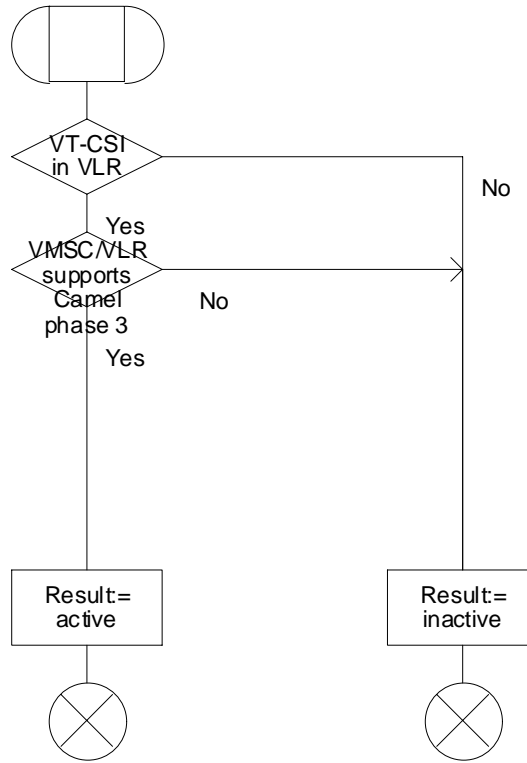


Figure 4.42: Procedure CAMEL_ICH_VLR (sheet 1)

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.

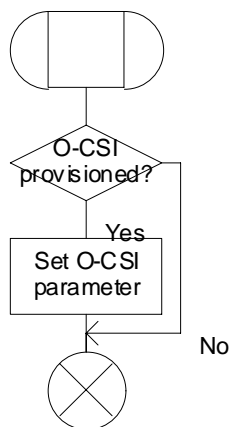


Figure 4.43: Procedure CAMEL_O_CSI_Check_VLR (sheet 1)

Procedure CAMEL_T_CSI_CHECK_VLR

1(1)

/* Procedure in the VLR to check the VT-CSI and set the SIFIC ack parameter accordingly */

- Check basic service code criteria
- Check VT-CSI in VMSC-B

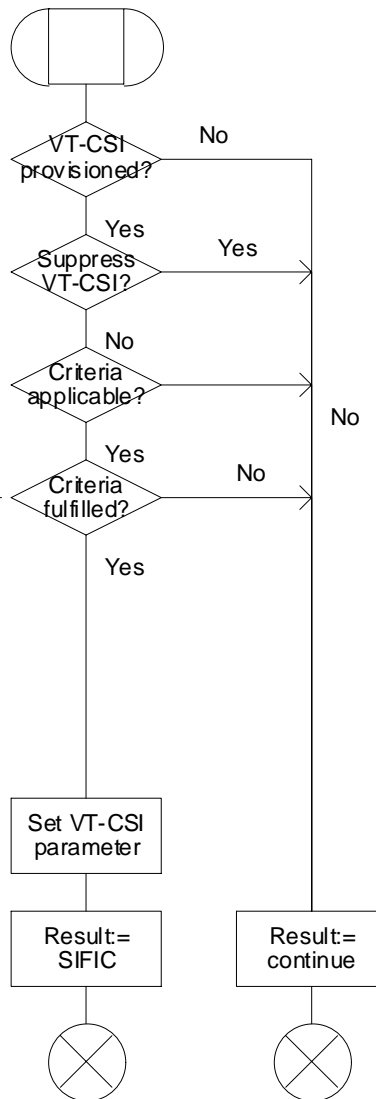


Figure 4.44: Procedure CAMEL_T_CSI_Check_VLR (sheet 1)

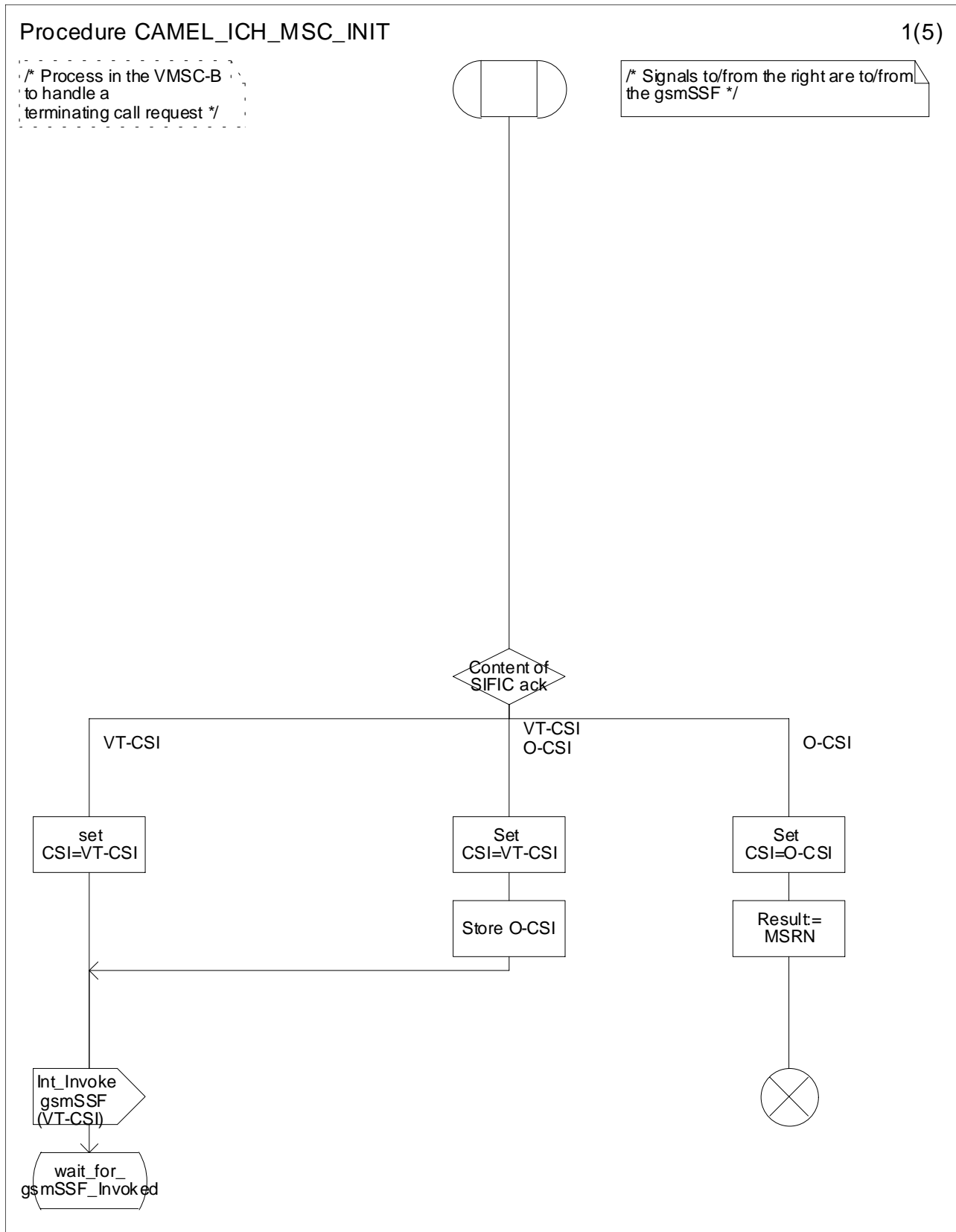


Figure 4.45a: Procedure CAMEL_ICH_MSC_INIT (sheet 1)

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 originating exchange; signals to/from the right are to/from the gsmSSF */

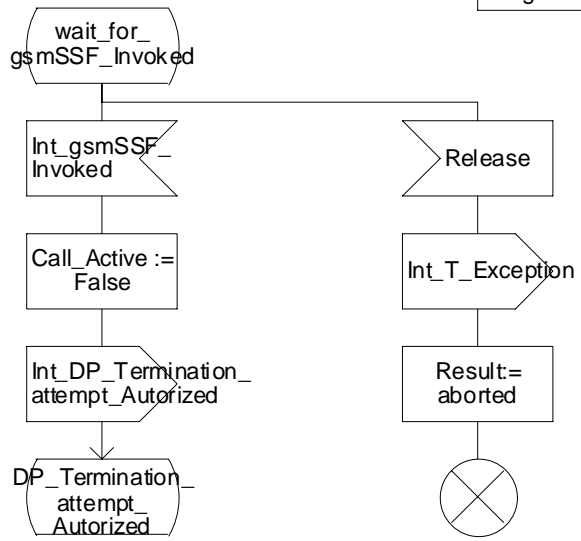


Figure 4.45b: Procedure CAMEL_ICH_MSC_INIT (sheet 2)

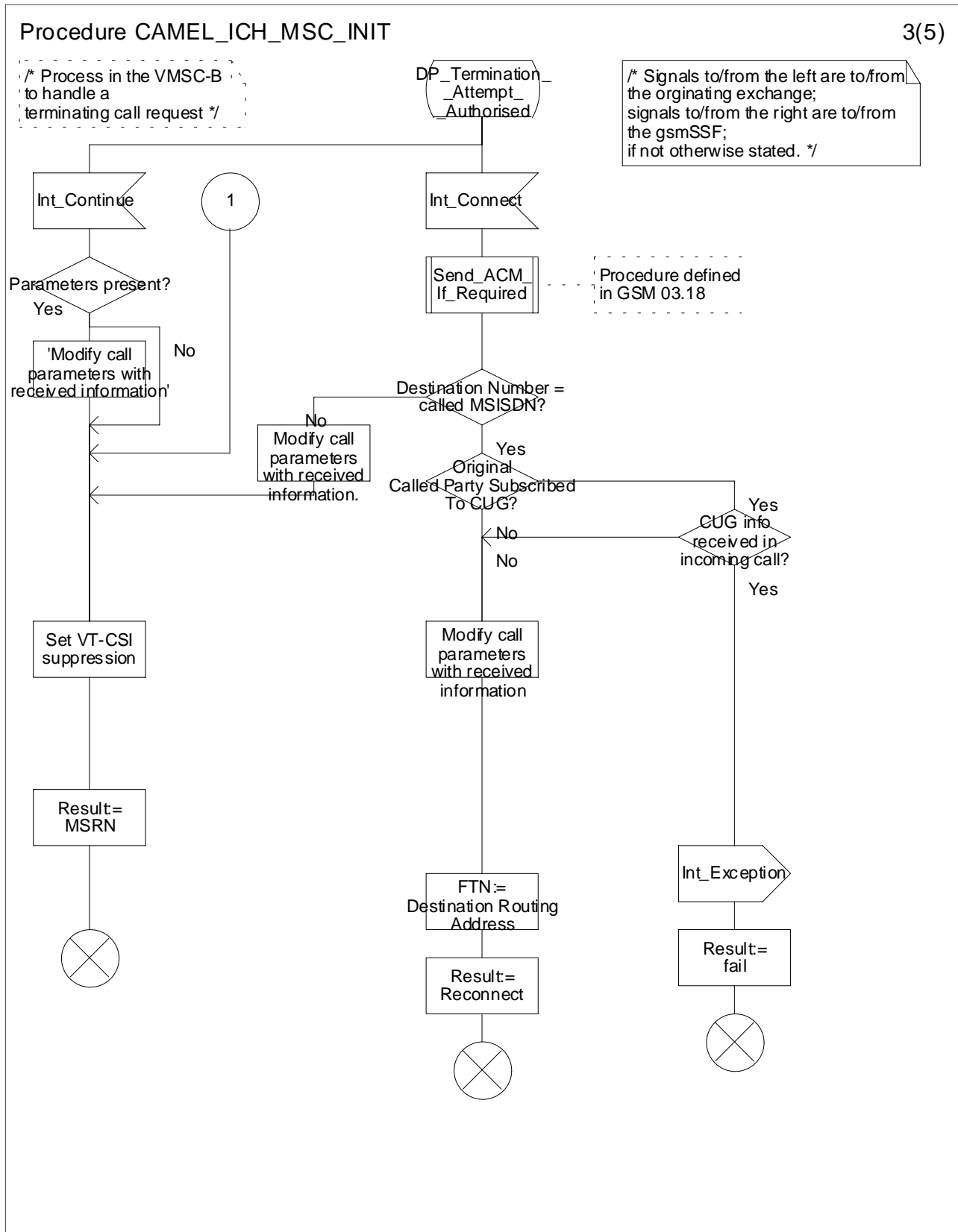


Figure 4.45c: Procedure CAMEL_ICH_MSC_INIT (sheet 3)

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

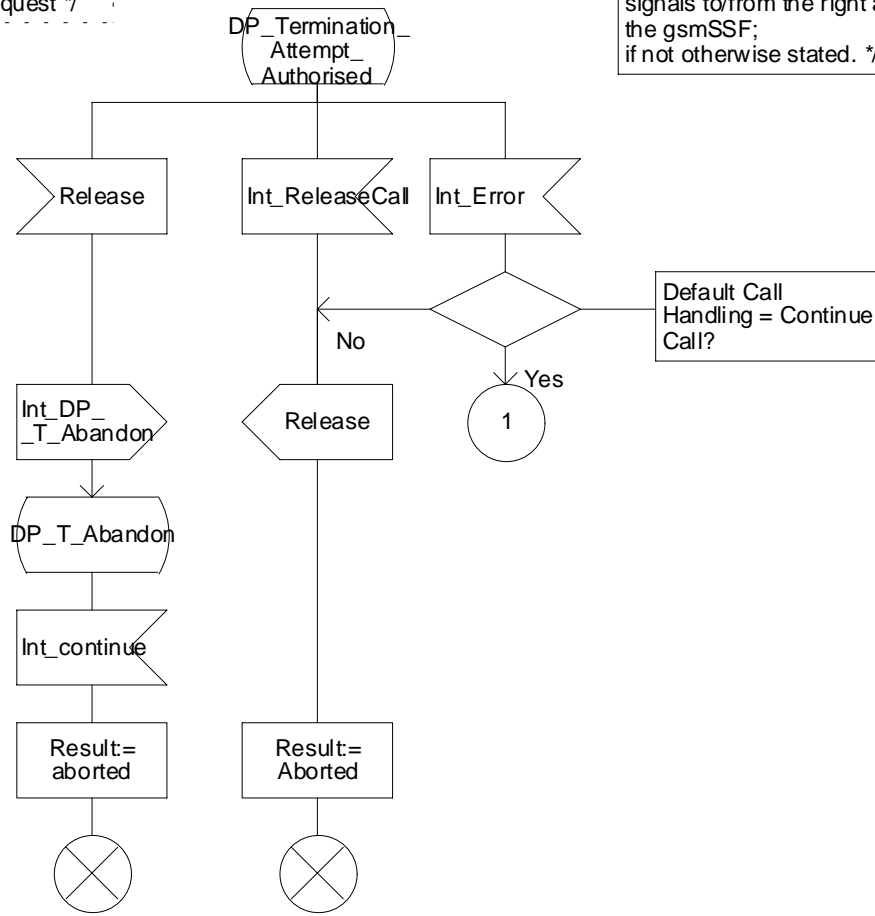


Figure 4.45d: Procedure CAMEL_ICH_MSC_INIT (sheet 4)

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. */

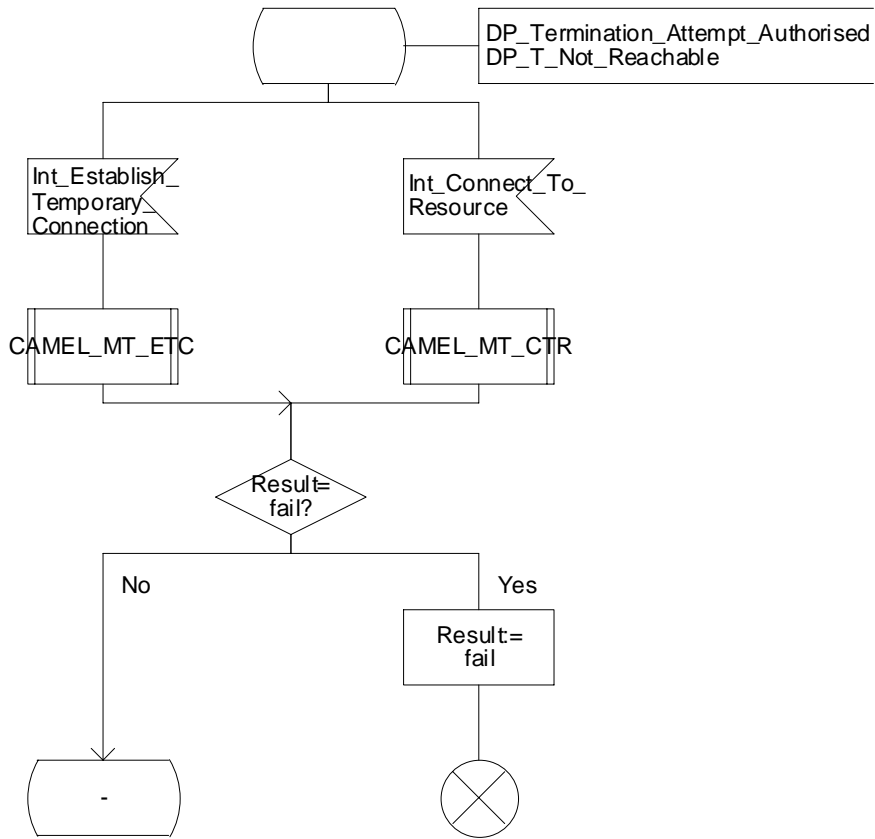


Figure 4.45e: Procedure CAMEL_ICH_MSC_INIT (sheet 5)

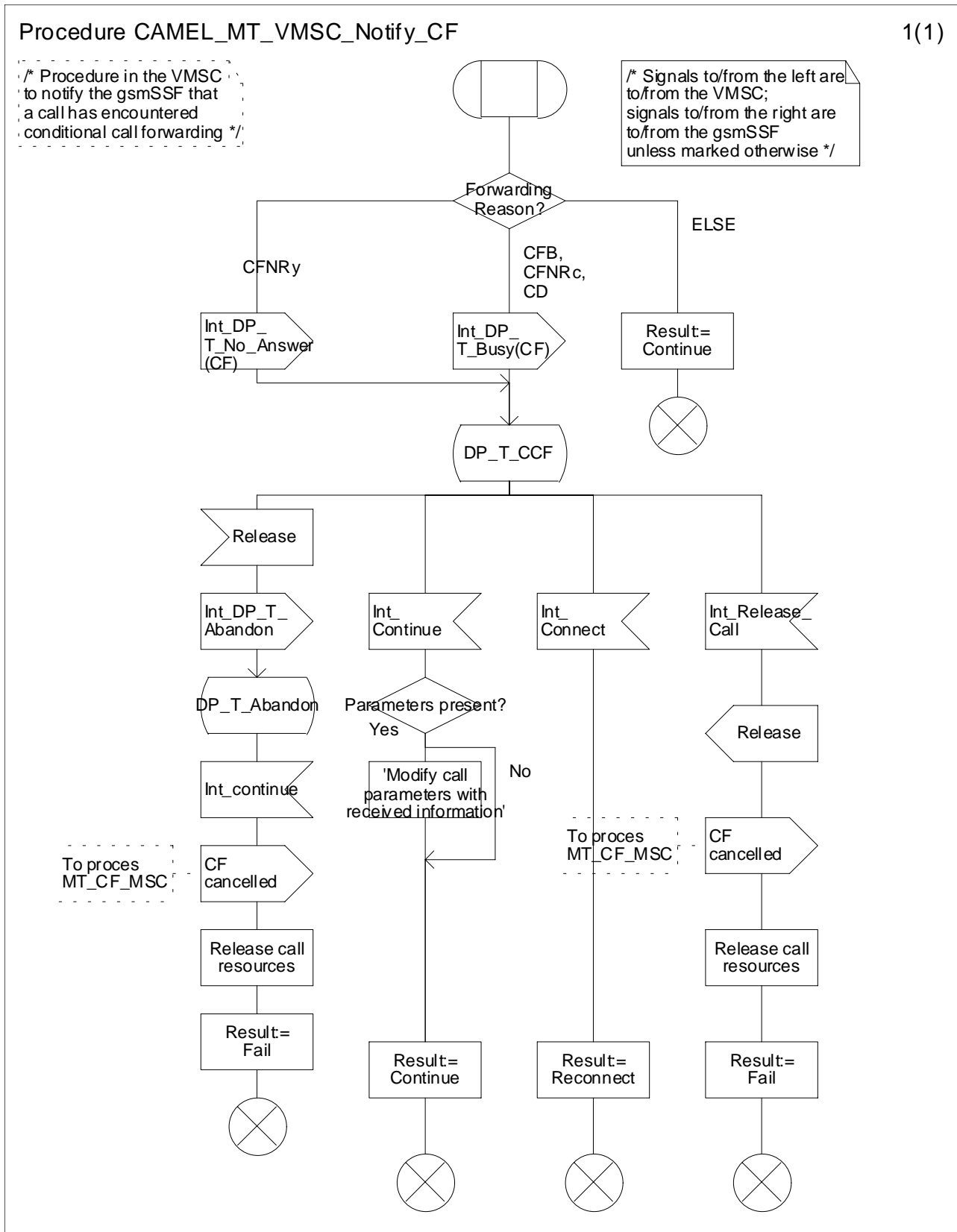


Figure 4.46: Procedure CAMEL_MT_VMSC_Notify_CF (sheet 1)

4.5.4.2 Handling of mobile terminating calls in the VLR

The functional behaviour of the terminating VLR is specified in 3G TS 23.018 [3]. The process specific to CAMEL is specified in this subclass :

- Process Reconnected_MT_Call_VLR

The behaviour specific to CAMEL is:

- the inclusion of the O-CSI parameter in the Send Info For Incoming Call ack if the call is to be forwarded and O-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 if it was received in the Provide Roaming Number.

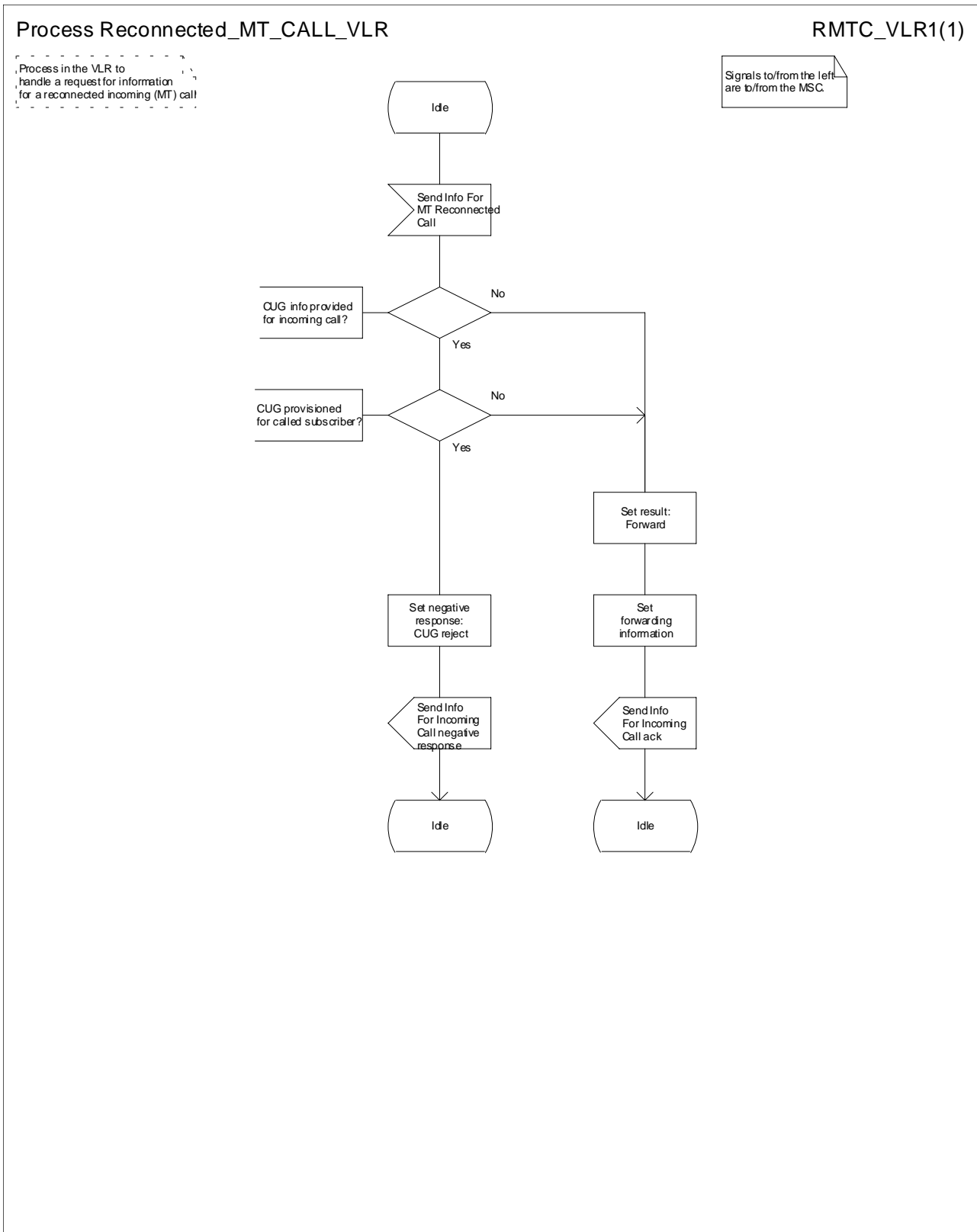


Figure 4.47: Process Reconnected_MT_Call_VLR (sheet 1)

4.5.5 Handling of forwarded calls

The handling of forwarded calls in the GMSC or the terminating VMSC is specified in 3G TS 23.018 [3]. The procedures specific to CAMEL are specified in this subclause.

- Procedure CAMEL_Check_ORLFCF_VMSC
- Procedure CAMEL_CF_MSC_INIT,
- Procedure CAMEL_CF_MSC_ANSWER
- Procedure CAMEL_CF_ETC,
- Procedure CAMEL_CF_CTR.

A mobile terminated call can be forwarded either in the GMSC (indicated by provision of Forwarded-To-Number from HLR or gsmSCF) or in the MSC (indicated by provisioning of Forwarded-To-Number from 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 3G TS 29.078 [5]). 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.

4.5.5.2 Procedure CAMEL_CF_MSC_INIT : handling of Int_Connect

The received parameters are used to overwrite the corresponding ISUP parameters (for mapping see 3G TS 29.078 [5]). Call parameters which are not included in the Int_Connect message are unchanged.

An 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 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 Connect message, the MSC relays the destination address to the gsmSSF in the Int_DP_O_Answer message.

4.5.5.4 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).

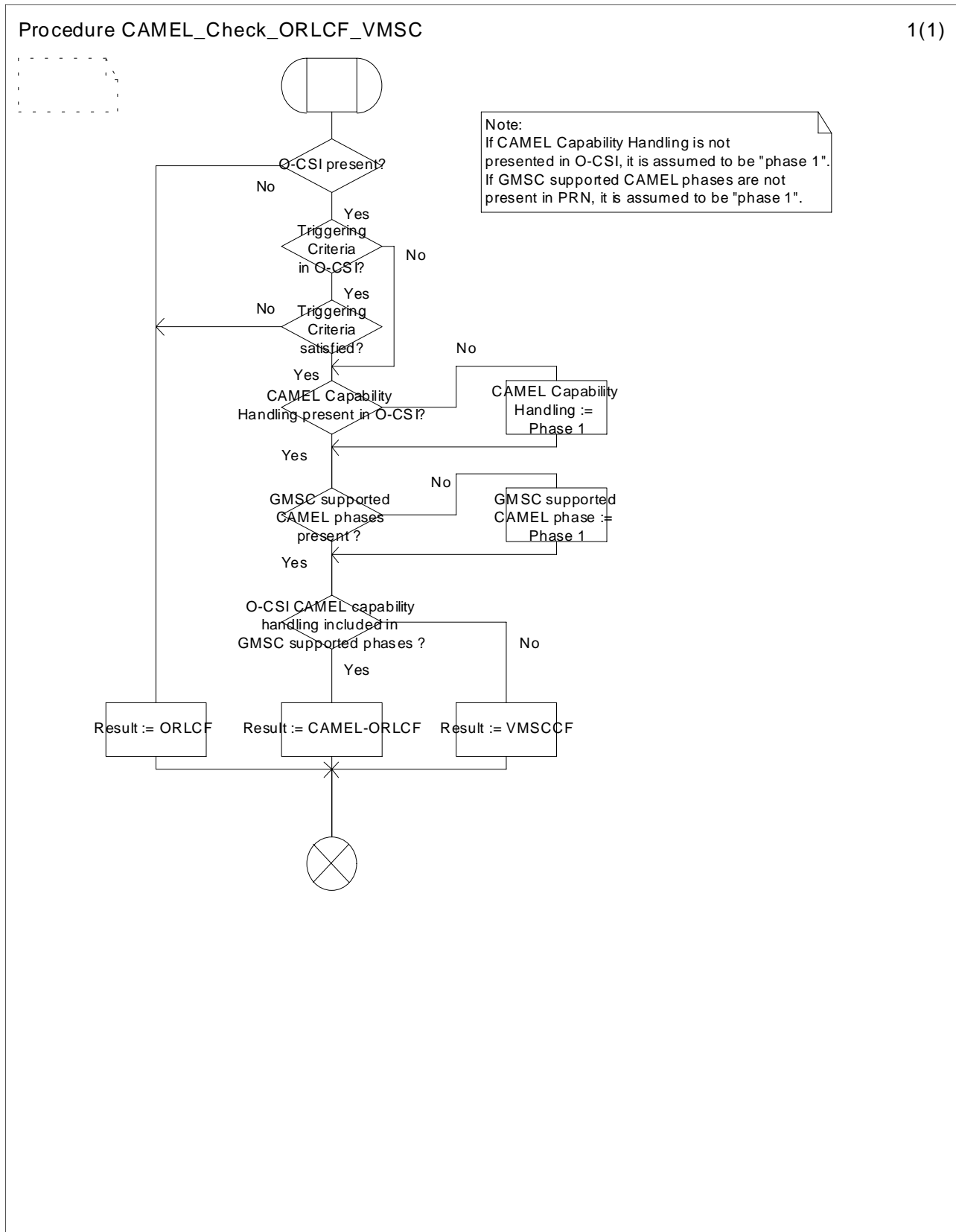


Figure 4.48a: Procedure CAMEL_Check_ORLCF_VMSC (sheet 1)

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. */

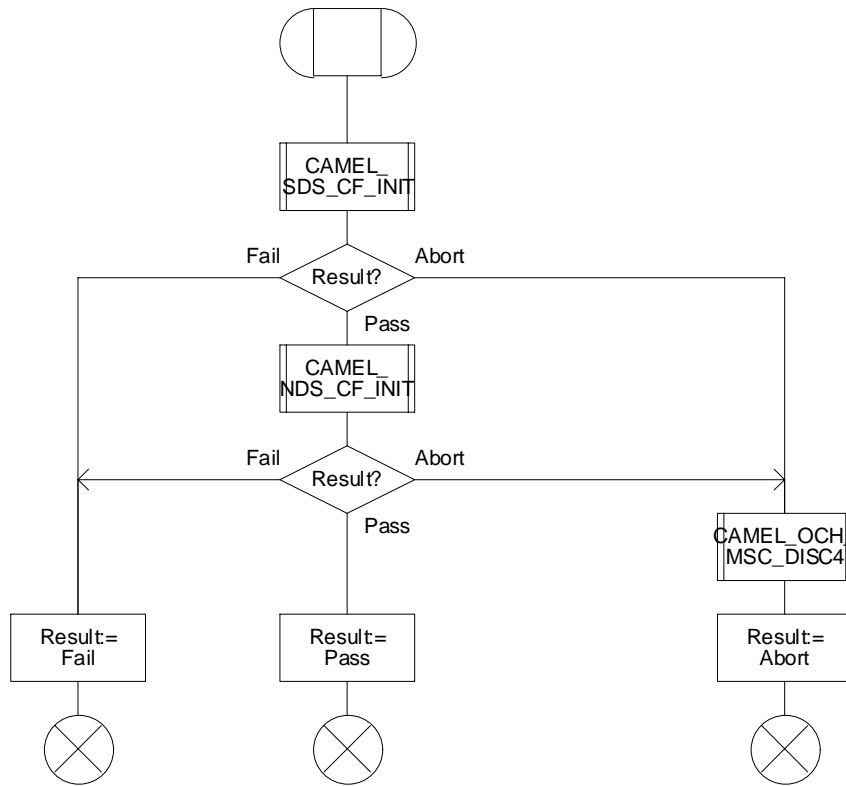


Figure 4.49a: Procedure CAMEL_CF_Dialled_Services (sheet 1)

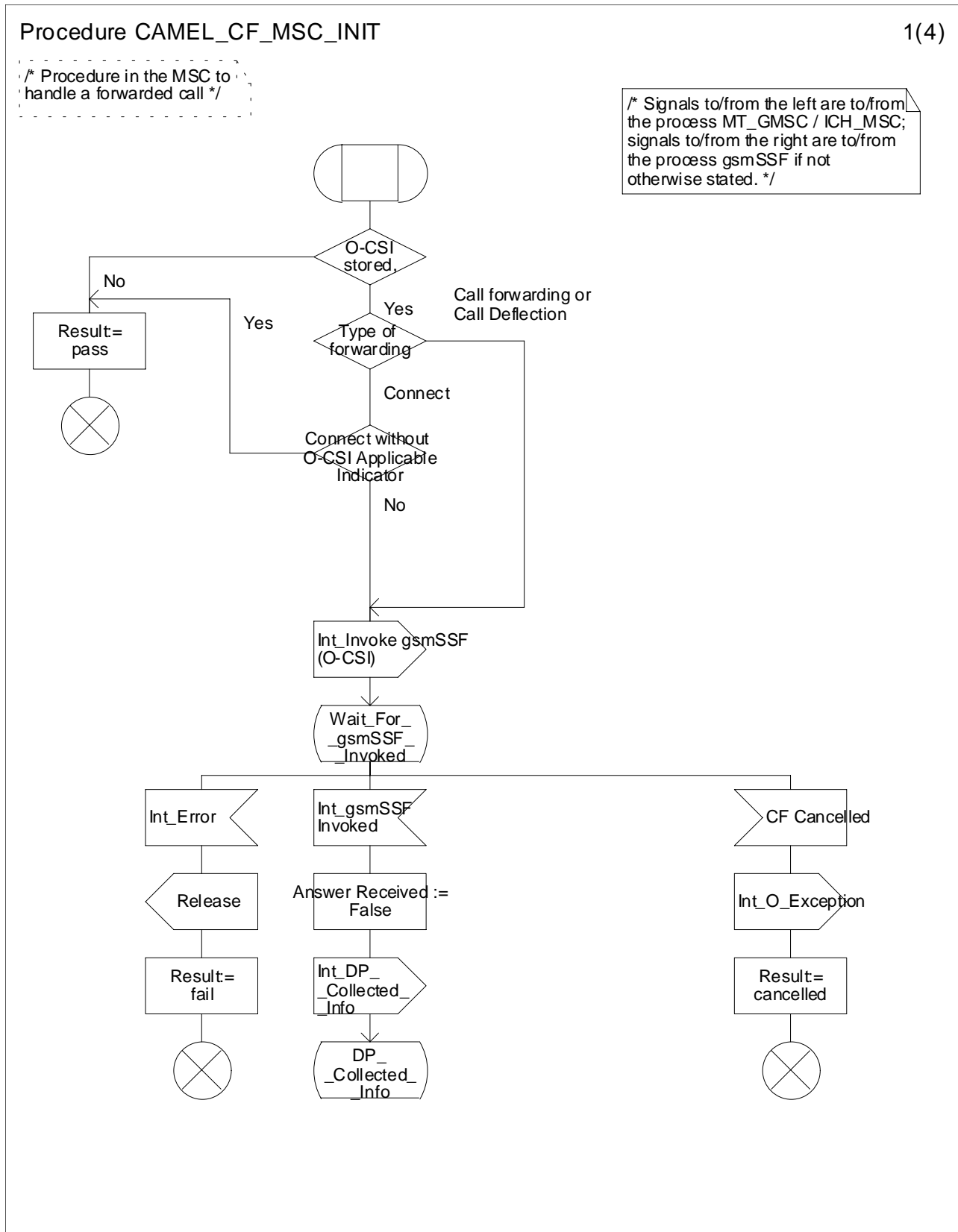


Figure 4.50a: Procedure CAMEL_CF_MSC_INIT (sheet 1)

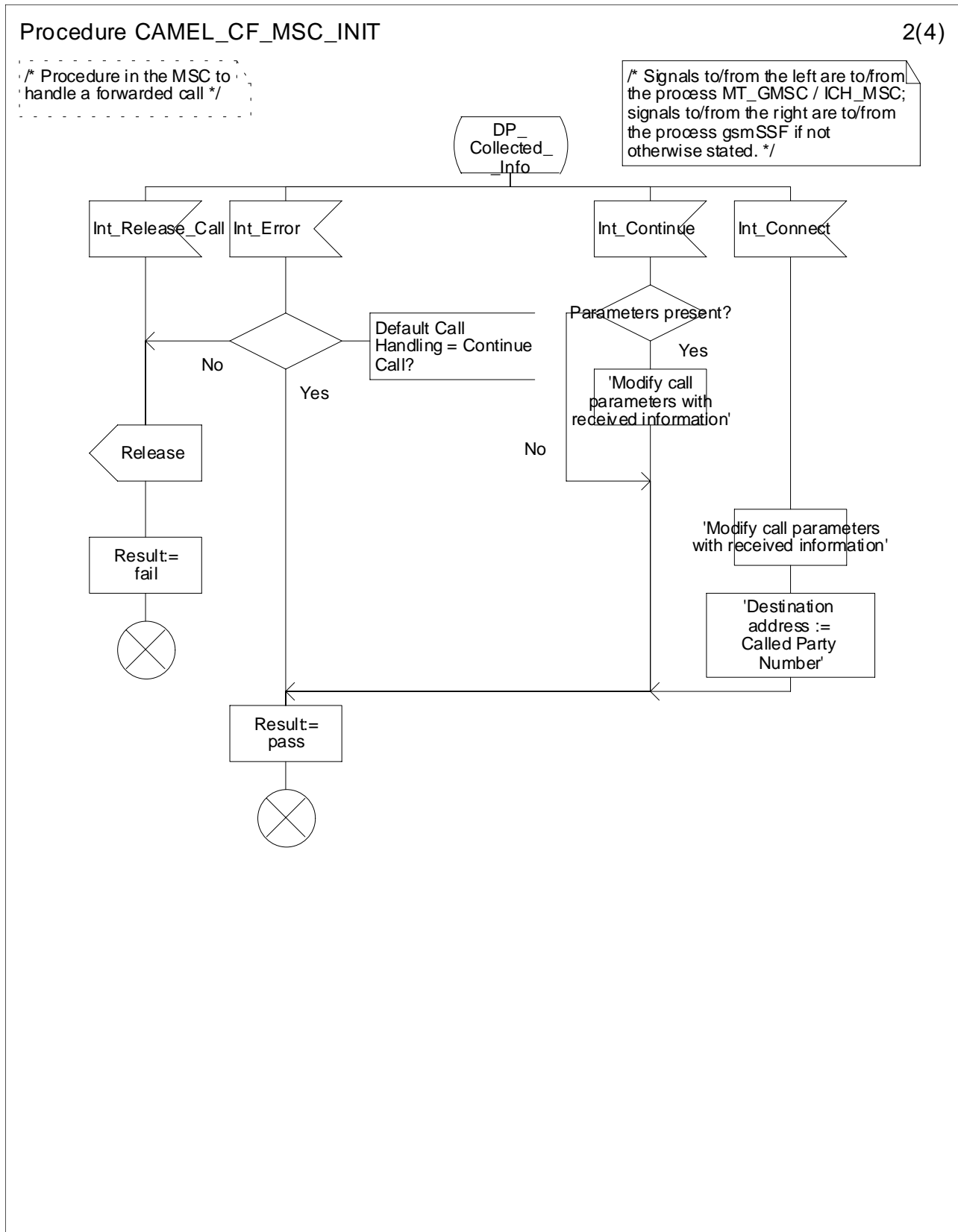


Figure 4.50b: Procedure CAMEL_CF_MSC_INIT (sheet 2)

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. */

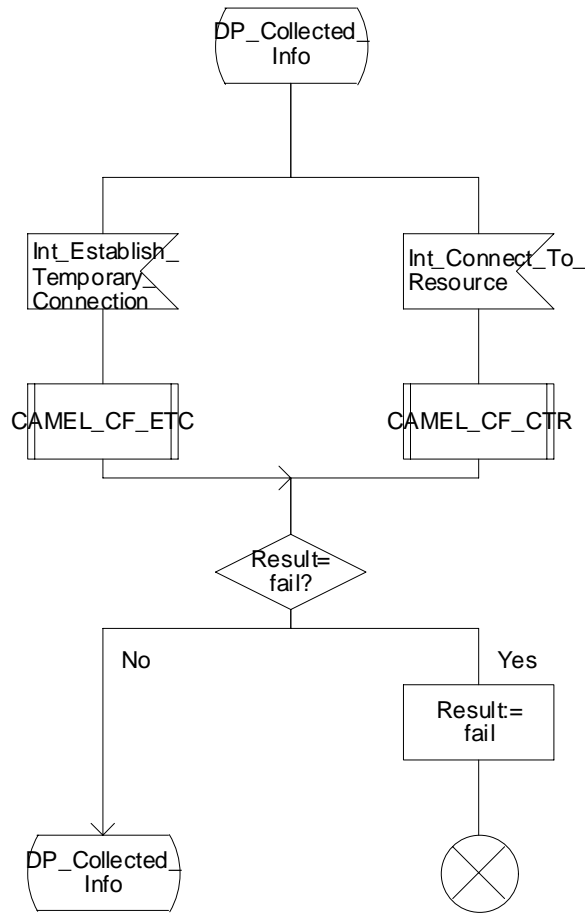


Figure 4.50c: Procedure CAMEL_CF_MSC_INIT (sheet 3)

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. */

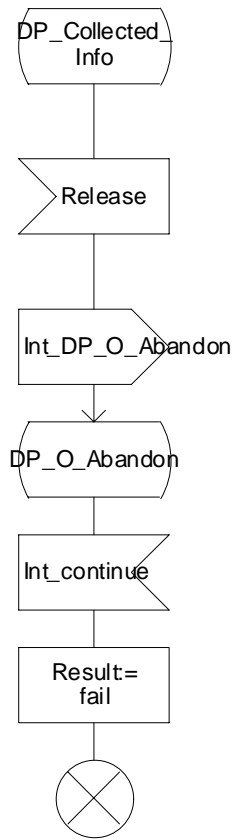


Figure 4.50d: Procedure CAMEL_CF_MSC_INIT (sheet 4)

Procedure CAMEL_SDS_CF_INIT

1(2)

Procedure in the MSC to perform CAMEL handling for a subscribed Dialed Service

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

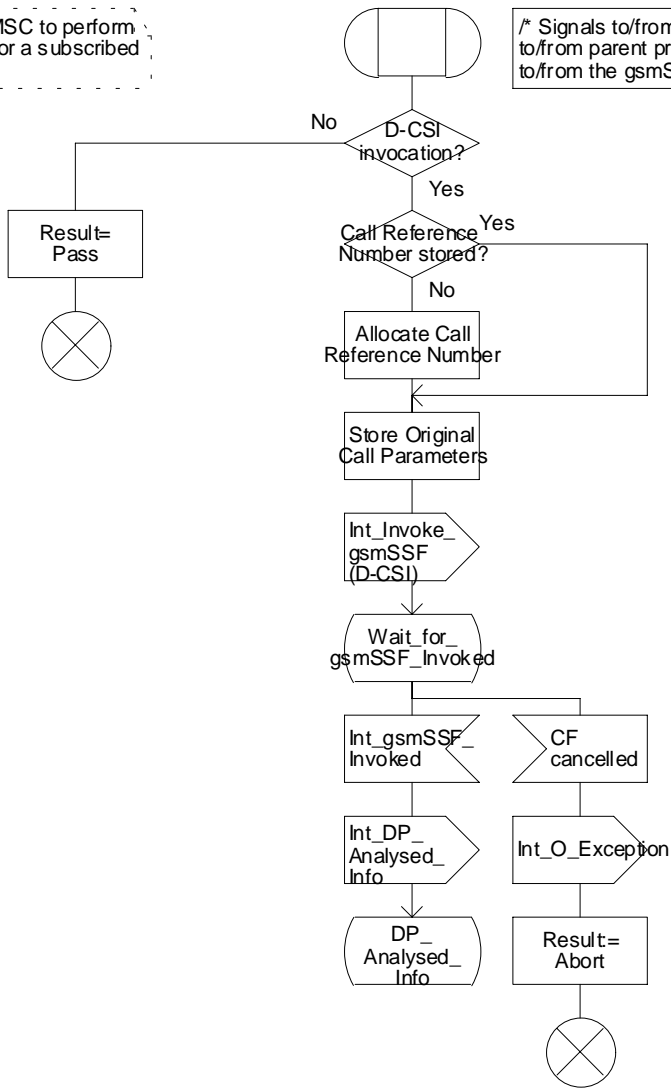


Figure 4.51a: Procedure CAMEL_SDS_CF_INIT (sheet 1)

Procedure CAMEL_SDS_CF_INIT

2(2)

Procedure in the MSC to perform CAMEL handling for a subscribed Dialed Service

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

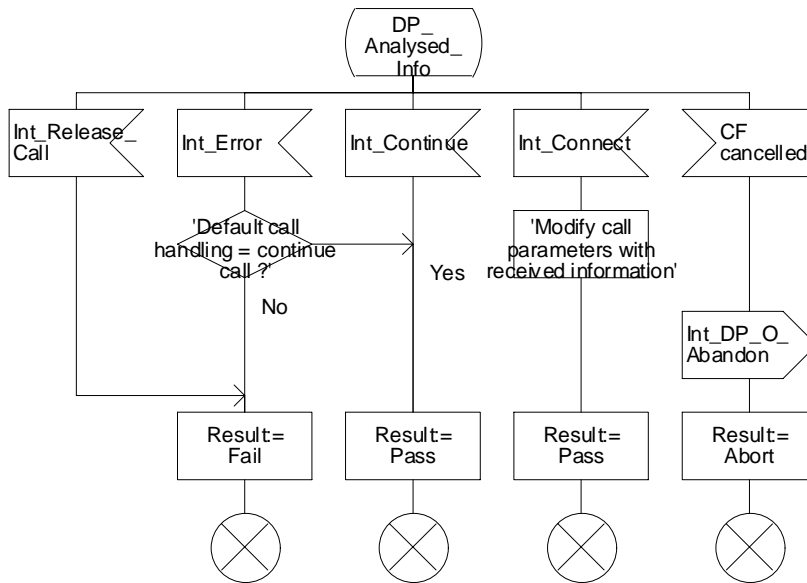


Figure 4.51b: Procedure CAMEL_SDS_CF_INIT (sheet 2)

Procedure CAMEL_NDS_CF_INIT

1(2)

Procedure in the MSC to perform CAMEL handling for a network Dialed 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. */

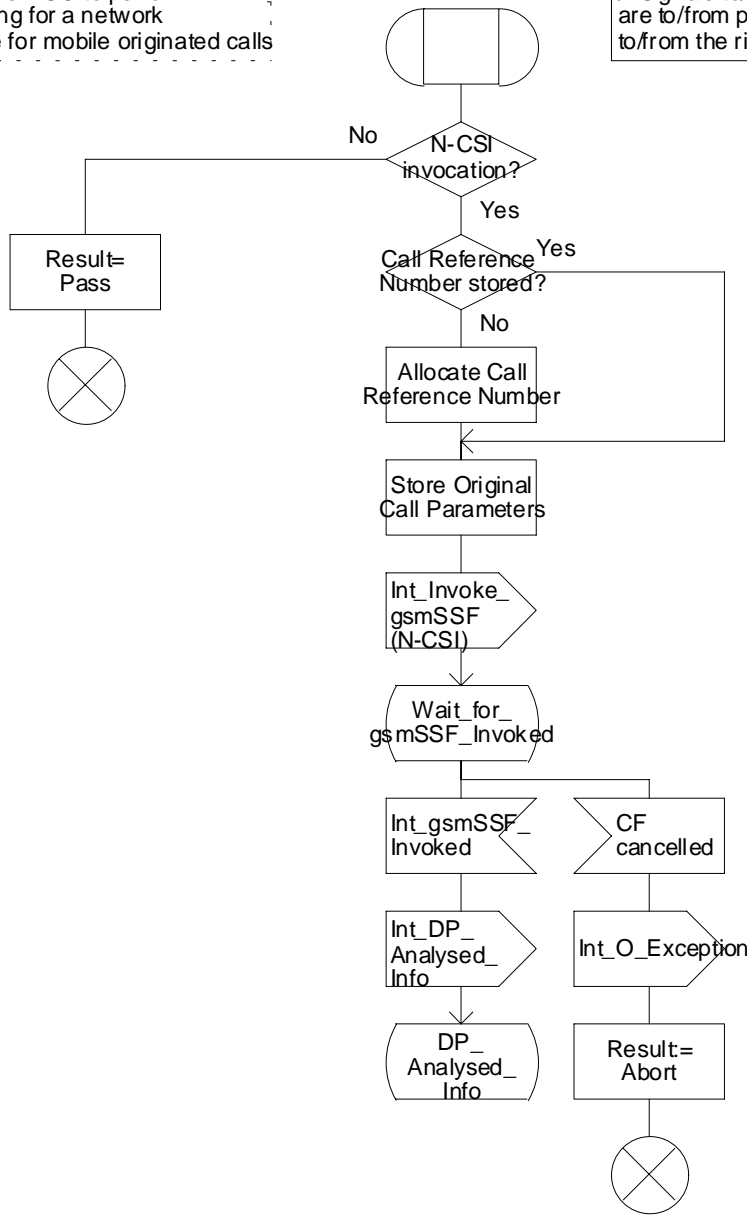


Figure 4.52a: Procedure CAMEL_NDS_CF_INIT (sheet 1)

Procedure CAMEL_NDS_CF_INIT

2(2)

Procedure in the MSC to perform CAMEL handling for a network Dialed 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. */

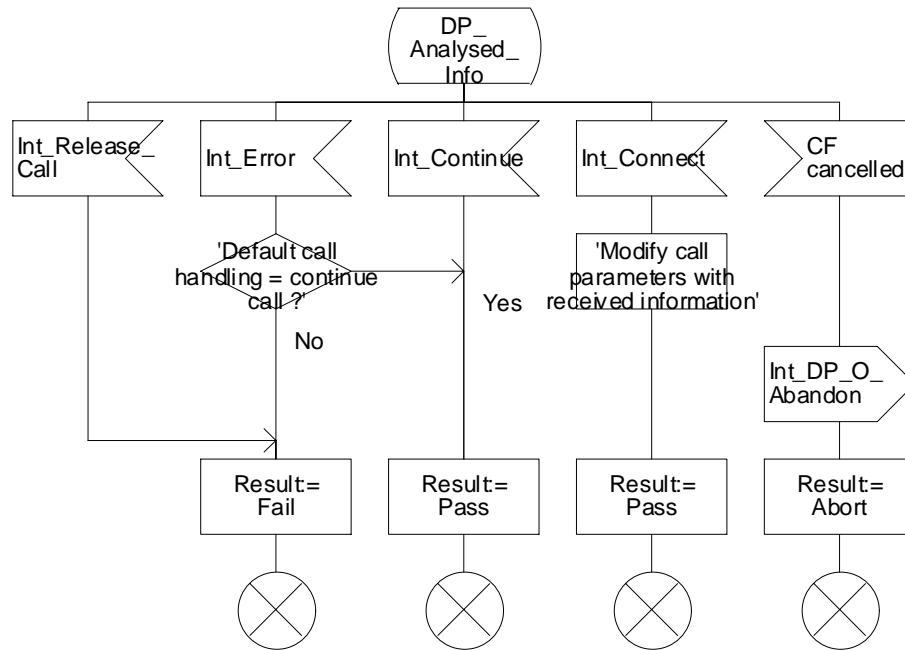


Figure 4.52b: Procedure CAMEL_NDS_CF_INIT (sheet 2)

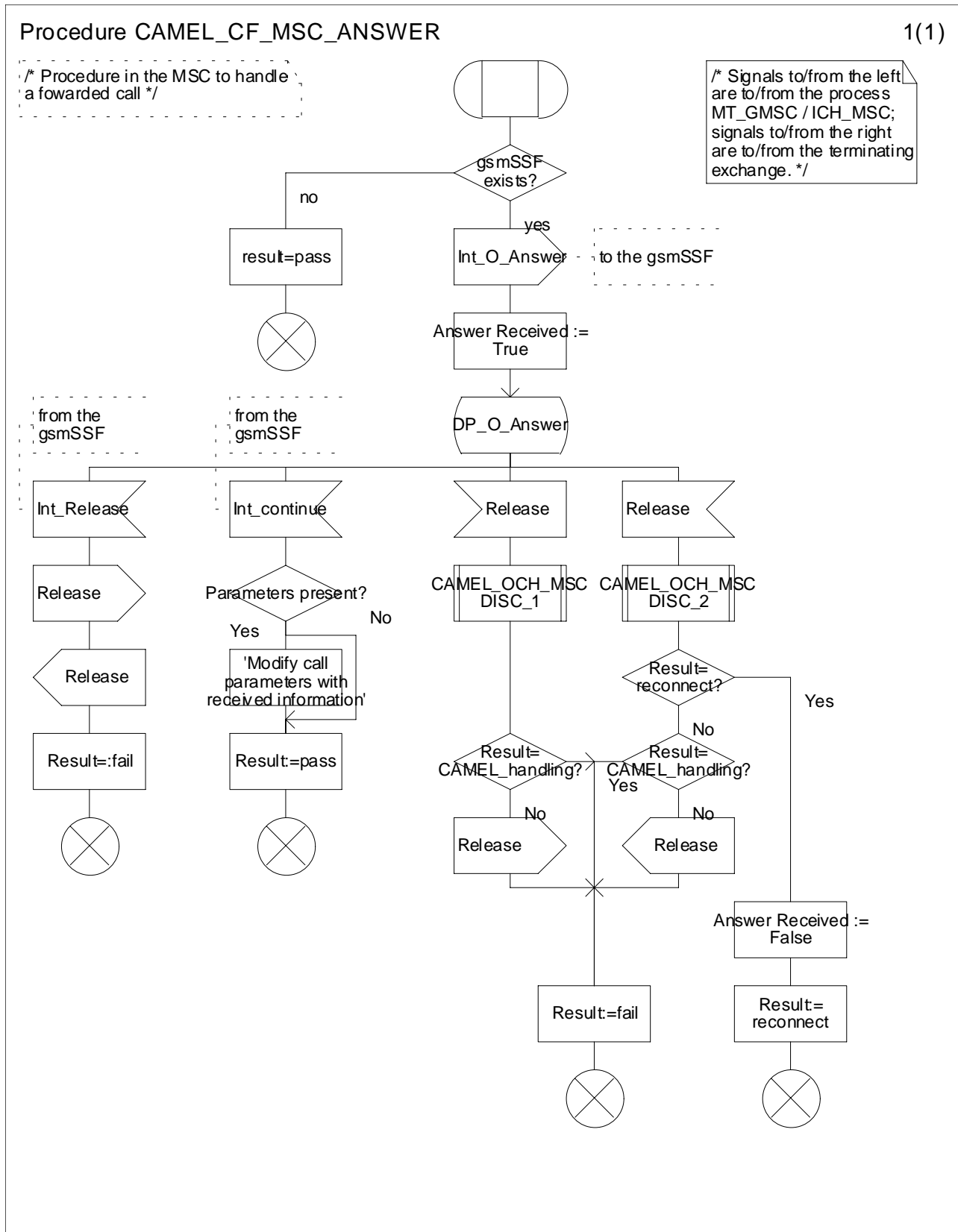


Figure 4.53a: Procedure CAMEL_CF_MSC_ANSWER (sheet 1)

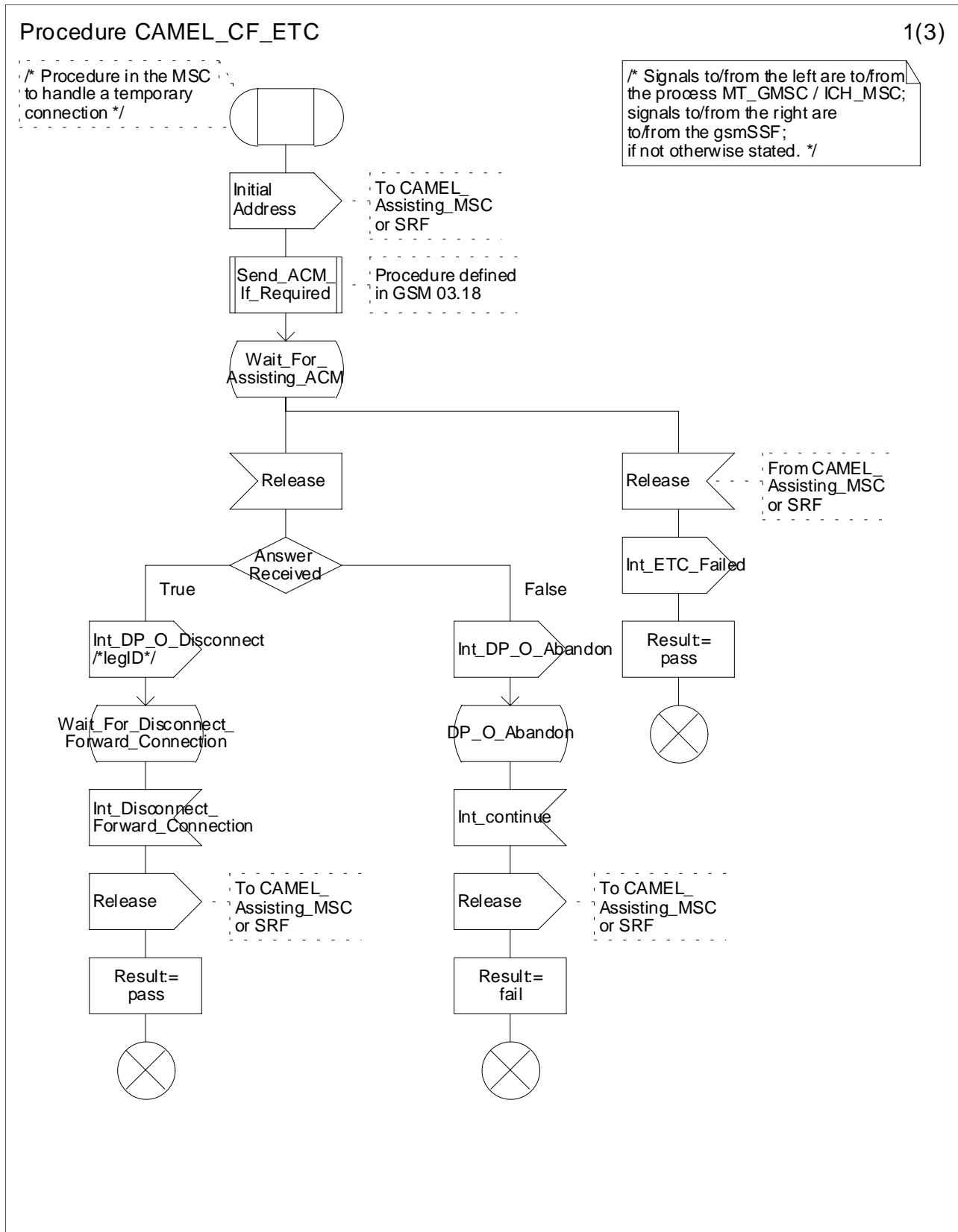


Figure 4.54a: Process CAMEL_CF_ETC (sheet 1)

Procedure CAMEL_CF_ETC

2(3)

/* 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. */

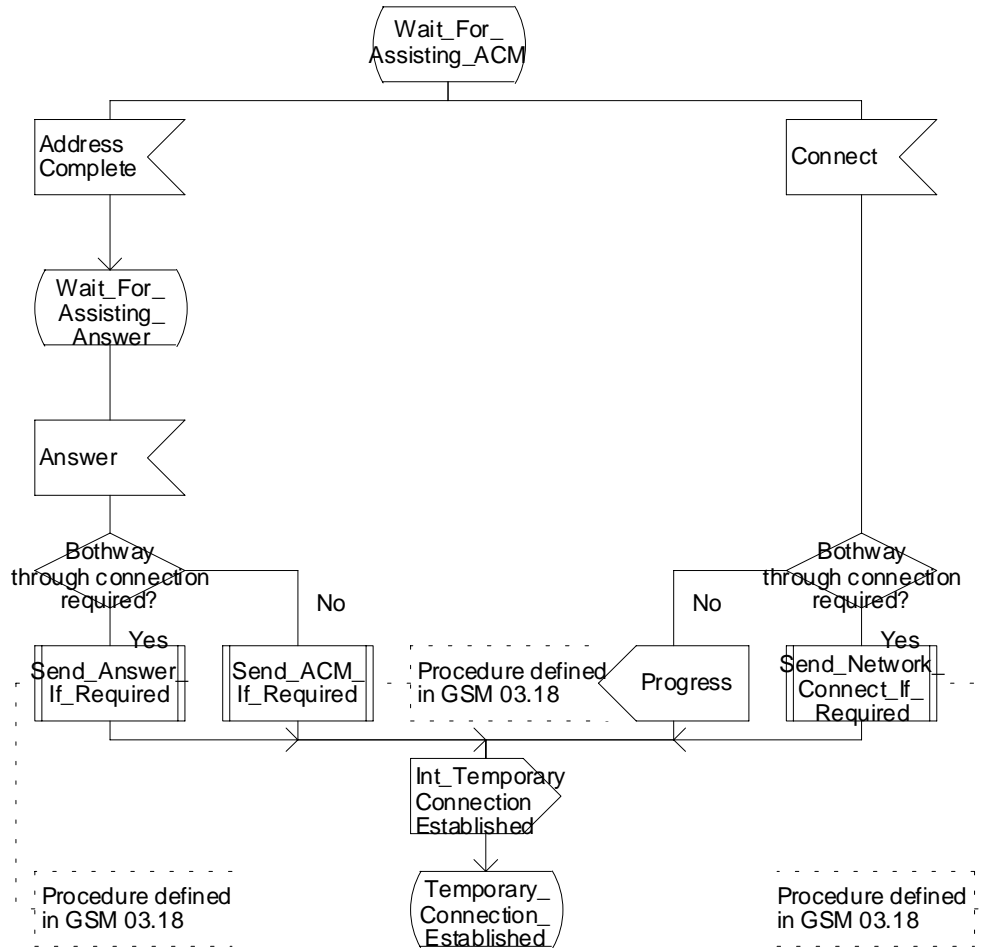


Figure 4.54b: Procedure CAMEL_CF_ETC (sheet 2)

Procedure CAMEL_CF_ETC

3(3)

/* 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. */

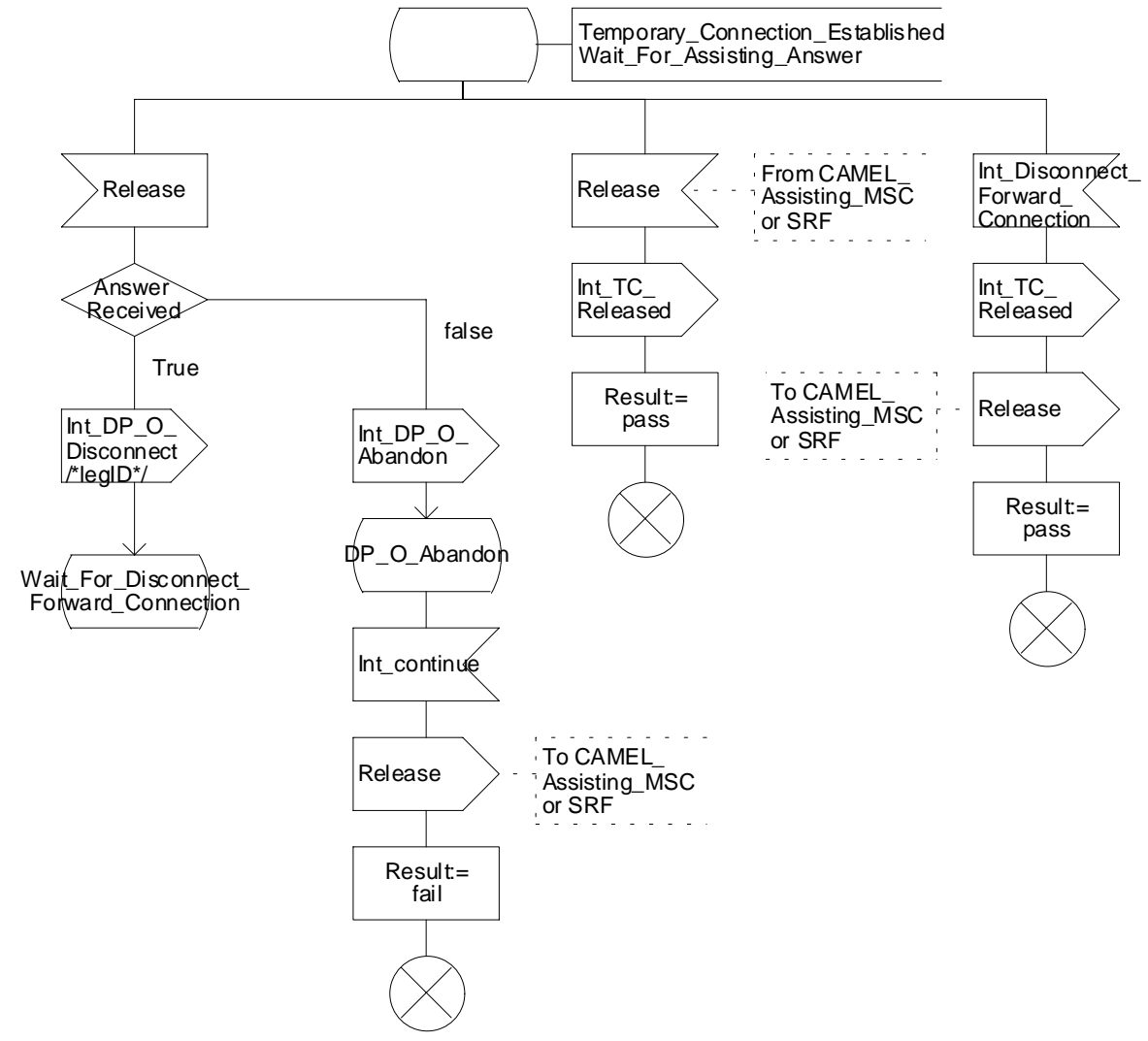


Figure 4.54c: Procedure CAMEL_CF_ETC (sheet 3)

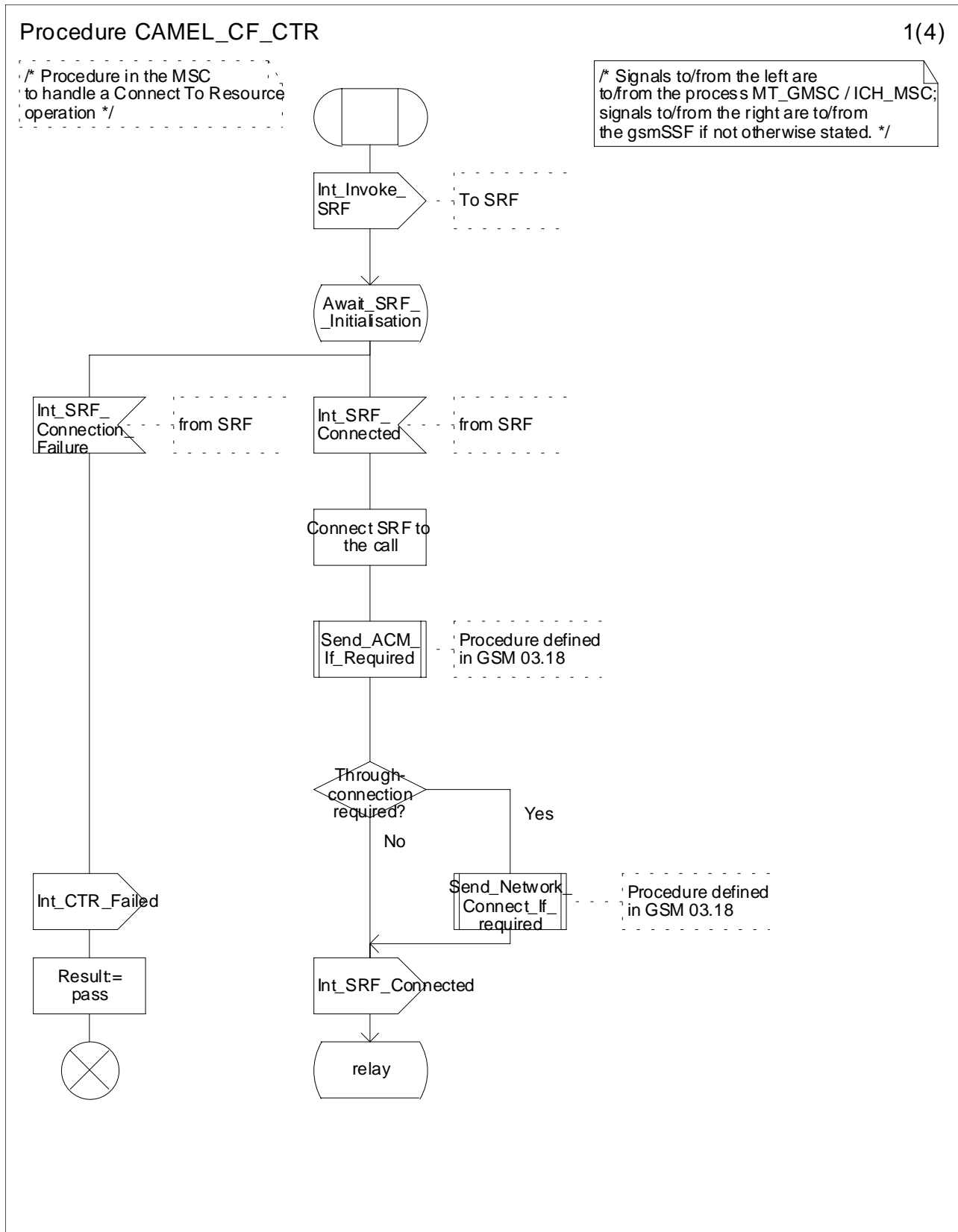


Figure 4.55a: Process CAMEL_CF_CTR (sheet 1)

Procedure CAMEL_CF_CTR

2(4)

/* 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. */

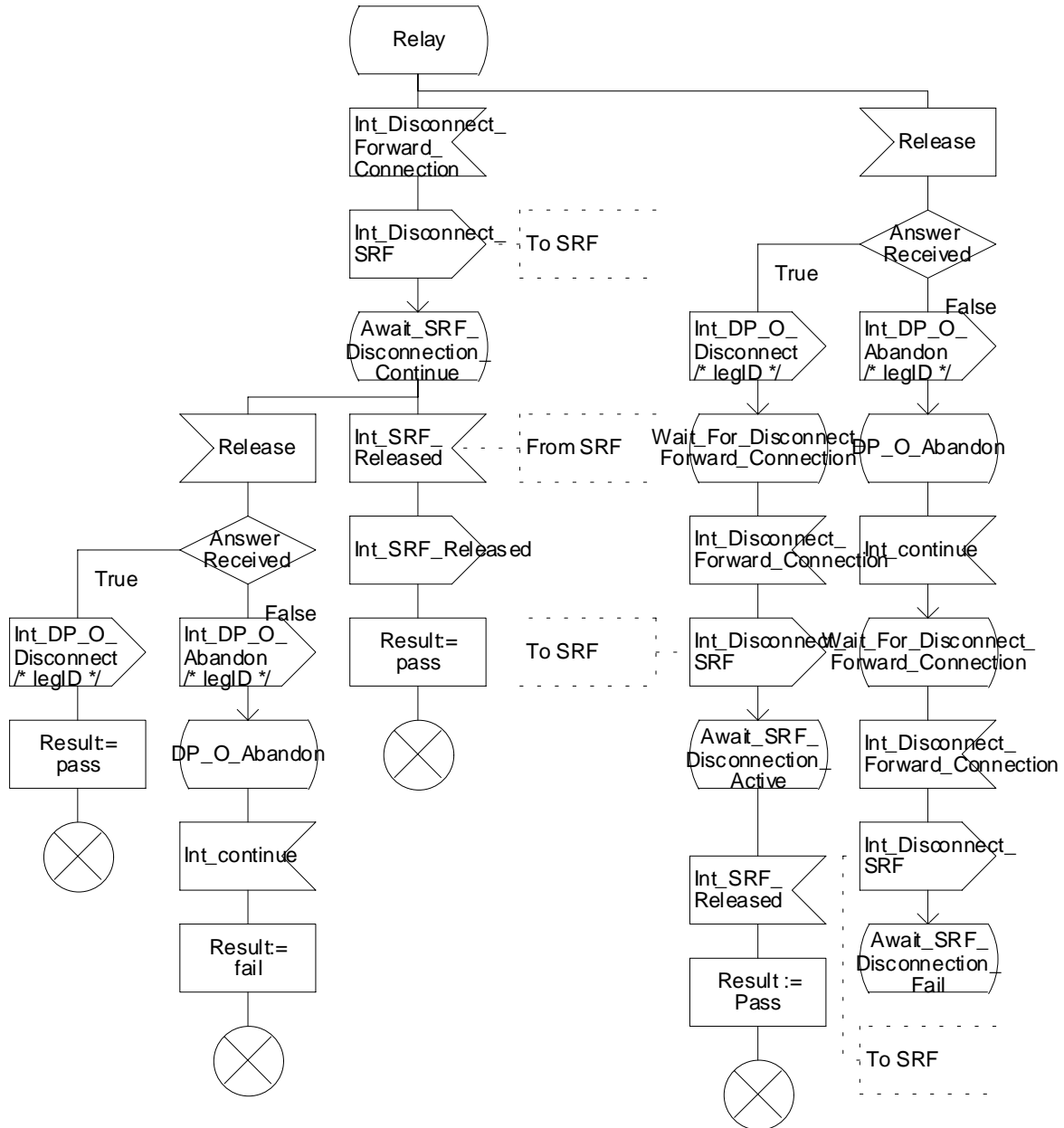


Figure 4.55b: Procedure CAMEL_CF_CTR (sheet 2)

Procedure CAMEL_CF_CTR

3(4)

/* 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 external SRF. */

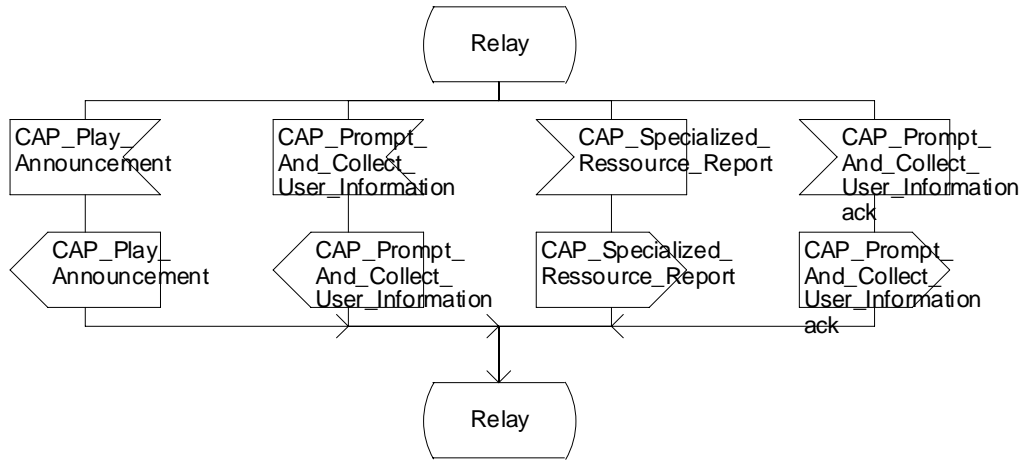


Figure 4.55c: Procedure CAMEL_CF_CTR (sheet 3)

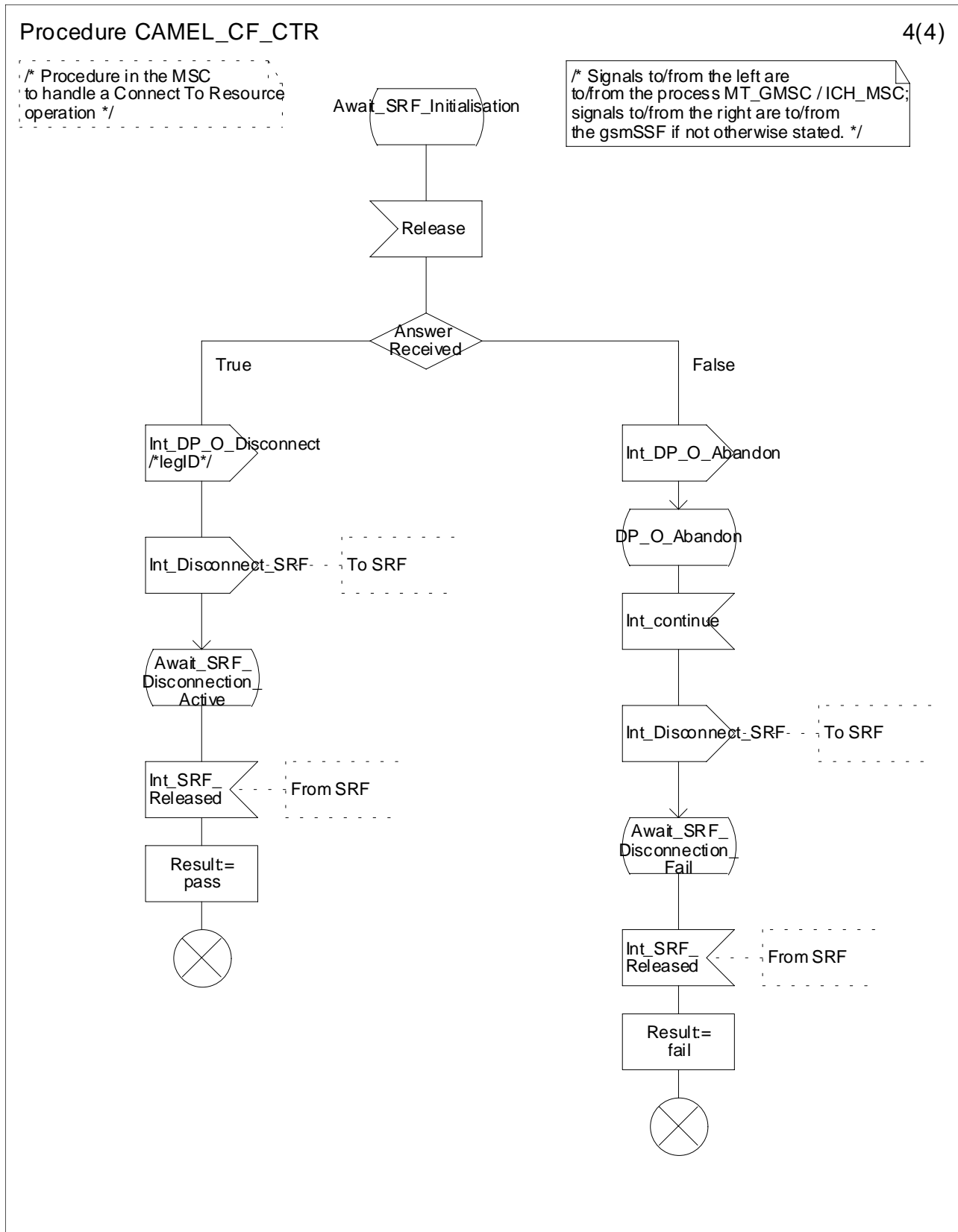


Figure 4.55d: Procedure CAMEL_CF_CTR (sheet 4)

4.5.6 Handling of mobile calls in the gsmSSF

Handling of mobile calls in the gsmSSF may involve the following process and procedures :

- gsmSSF,
- Check_Criteria.
- Connect_To_Resource,
- Handle_AC,
- Handle_ACR,
- Handle_CIR,
- Handle_CIR_leg,
- Complete_FCI_record,
- Complete_all_FCI_records,
- Handle_SCI,
- Handle_O_Answer,
- Handle_T_Answer.

The detailed error handling for the process gsmSSF and the associated procedures is specified in 3G TS 29.078 ([5]).

4.5.6.1 Information flow for call duration control

The following diagram shows the handling of the different timers that are used in the process gsmSSF and in the procedures Handle_AC, Handle_ACR, Handle_CIR. Timers Tssf, Tcp, Tsw, Tw and DELTA are defined in the process gsmSSF.

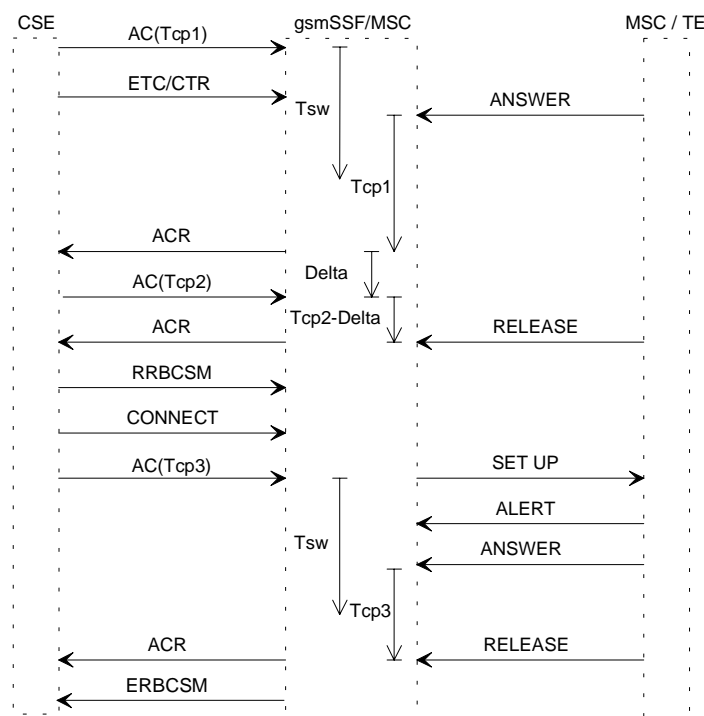


Figure 4.56: Information flow for call control duration

4.5.6.2 Behaviour of the gsmSSF in the process gsmSSF

The following paragraphs give details on the behaviour of the gsmSSF in the process gsmSSF.

4.5.6.2.1 Actions of the gsmSSF on receipt of CAP_Request_Report_BCSM_Event (at the state Waiting_For_Instructions)

The gsmSSF arms the requested EDP, if the arming rules are fulfilled and returns to state Waiting_For_Instructions.

The gsmSCF may request the monitoring for any one or more Answer, Busy, No Answer, Abandon, Route Select Failure and Disconnect Event of a party in the call.

4.5.6.2.2 Actions of the gsmSSF on receipt of CAP_Continue (at the state Waiting_For_Instructions)

An Int_Continue is sent to request the GMSC/MSC to continue call set-up as originally requested.

4.5.6.2.3 Actions of the gsmSSF on receipt of CAP_Release_Call (at 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 IF. The Release Call IF shall not be sent from the gsmSCF if only monitor relationship exists between the gsmSSF and the gsmSCF.

4.5.6.2.4 Actions of the gsmSSF on receipt of Int_DP_T_Busy or Int_DP_T_No_Answer including the parameter CF (at the state Monitoring)

If the handling of Int_DP_T_Busy or Int_DP_T_No_Answer including the parameter CF leads to the gsmSSF sending a CAP_Event_Report_BCSM to the gsmSCF, the gsmSSF shall include the parameter Call Forwarded as the Event Specific Information BCSM.

4.5.6.3 Procedure Handle_SCI

1) Precondition: before an answer event is detected and no Tsw running:

if 1 set of e-parameters received --> send to the MSC

if 2 sets 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/start Tsw/store 2nd

2) Precondition: before an answer event is detected and Tsw running and no e-parameters

if 1 set of e-parameters received --> error, no e-parameters stored

if 2 sets e-parameters received --> send 1st/store 2nd

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 an answer event is detected and Tsw running and e-parameters stored:

if 1 set of e-parameters received --> error

if 2 sets 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 an answer event is detected and no Tsw running:

if 1 set of e-parameters received --> send to the MSC

if 2 sets e-parameters received --> error

if 1 set of e-parameters and Tariff Switch received --> start Tsw/store set

if 2 sets of e-parameters and Tariff Switch received --> error

5) Precondition: after an answer event is detected and Tsw running and no e-parameters

if 1 set of e-parameters received --> store e-parameters

if 2 sets 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) Precondition: after an answer event is detected and Tsw running and e-parameters stored:

if 1 set of e-parameters received --> error

if 2 sets 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

NOTE: 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.

4.5.6.4 Process gsmSSF and procedures

Process gsmSSF

1(35)

```

/* Invocation of gsmSSF in MO,
MT, VT or CF call case. */

```

```

/* Timers used in the gsmSSF process:

```

```

Tssf: Application timer in the ssf.

```

```

Tcp: Timer for call period.

```

```

This timer measures the duration of a call period.

```

```

Tsw: Timer for tariff switch.

```

```

At the expiration of this timer, a new tariff switch shall be started.

```

```

Tw: Warning timer.

```

```

At the expiration of this timer, a warning tone shall be played to the calling party.

```

```

DELTA: time, measured in the gsmSSF, elapsed between the time an

```

```

ApplyChargingReport operation is send to the gsmSCF and an

```

```

ApplyCharging operation is received from the gsmSCF.

```

```

Tccd: Control of call duration timer.

```

```

This timer supervises if after sending of ACR a new AC is received.

```

```

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

```

```

*/

```

```

/* TASK definition:

```

```

The sending of an Application_Begin signal opens a new relationship to the gsmSCF.

```

```

The sending of an Application_End or Abort signal terminates the relationship to the gsmSCF.

```

```

*/

```

Figure 4.57a: Process gsmSSF (sheet 1)

Process gsmSSF

2(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

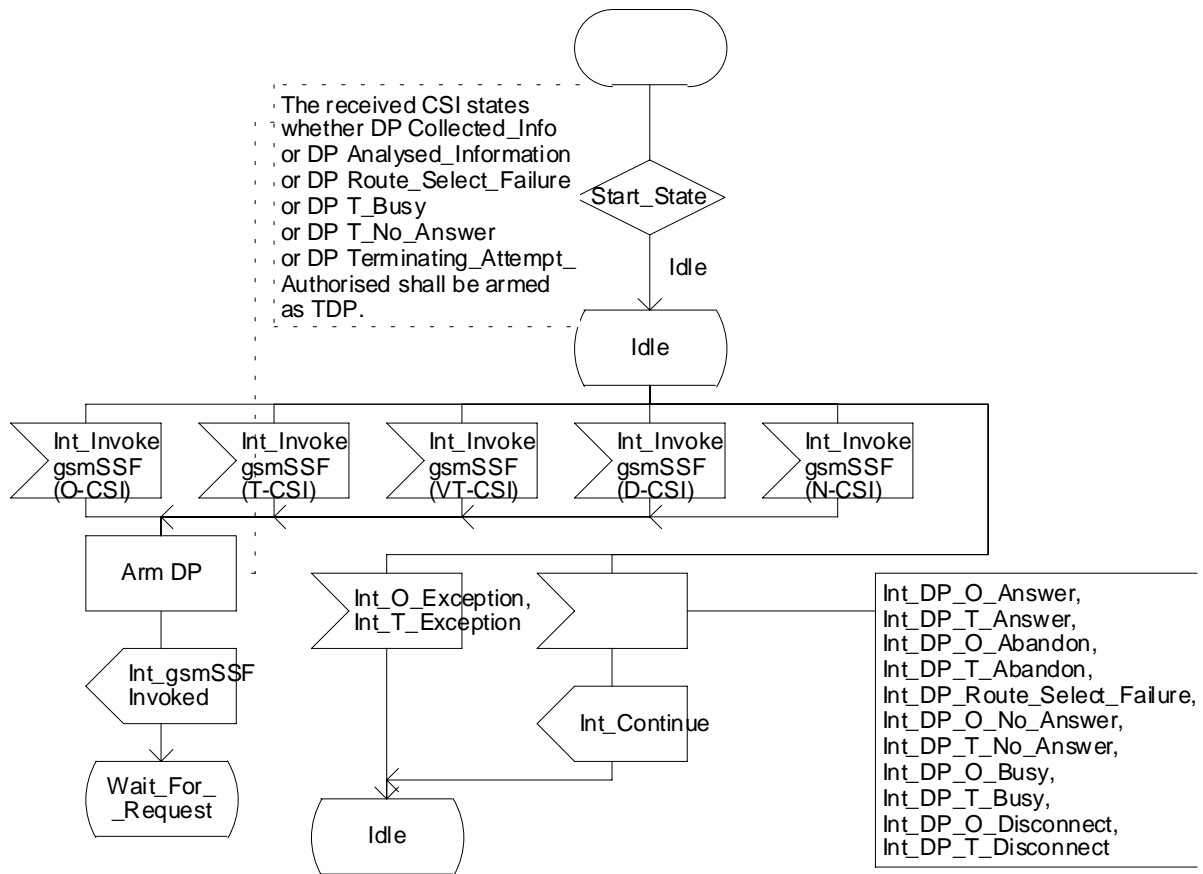


Figure 4.57b: Process gsmSSF (sheet 2)

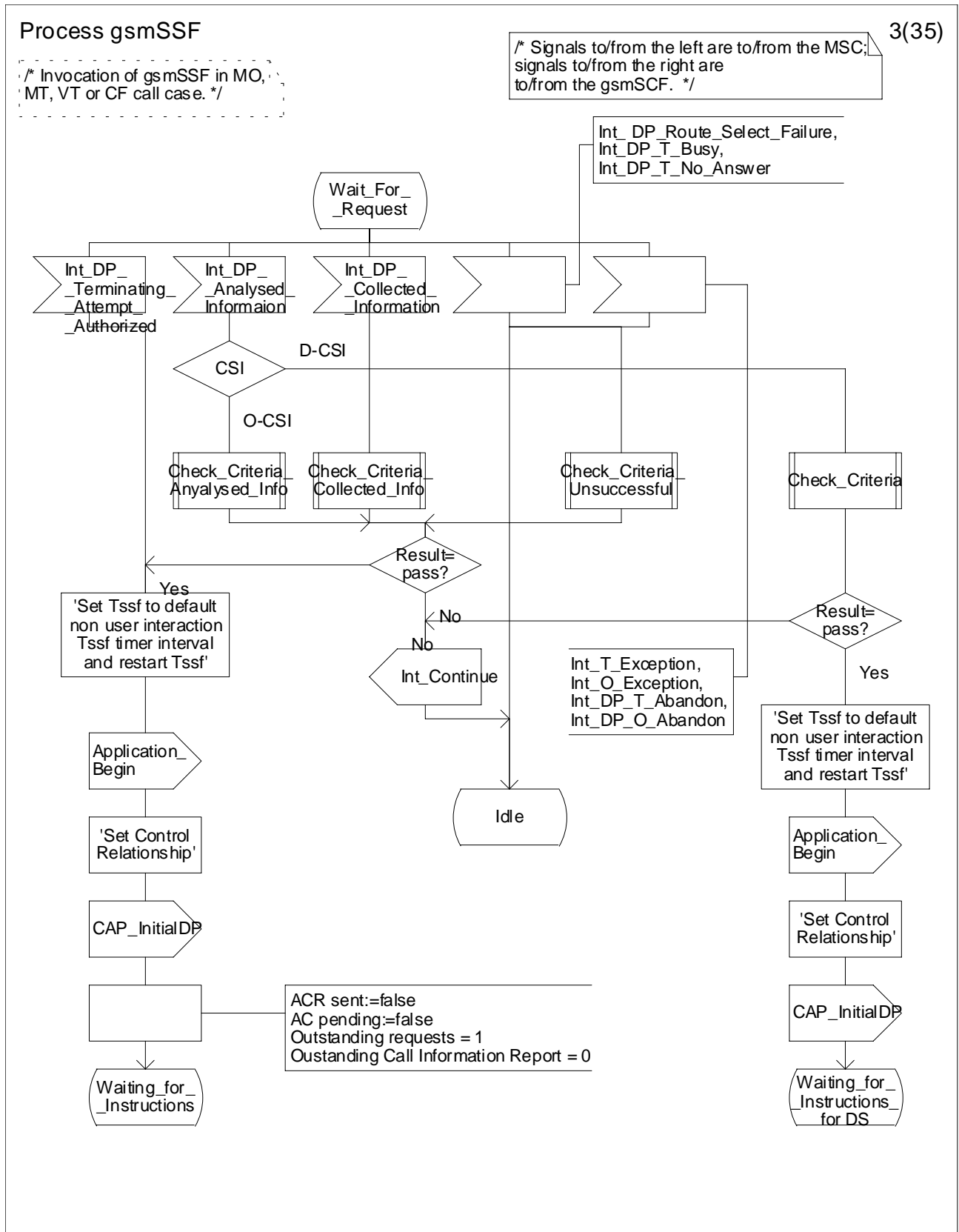


Figure 4.57c: Process gsmSSF (sheet 3)

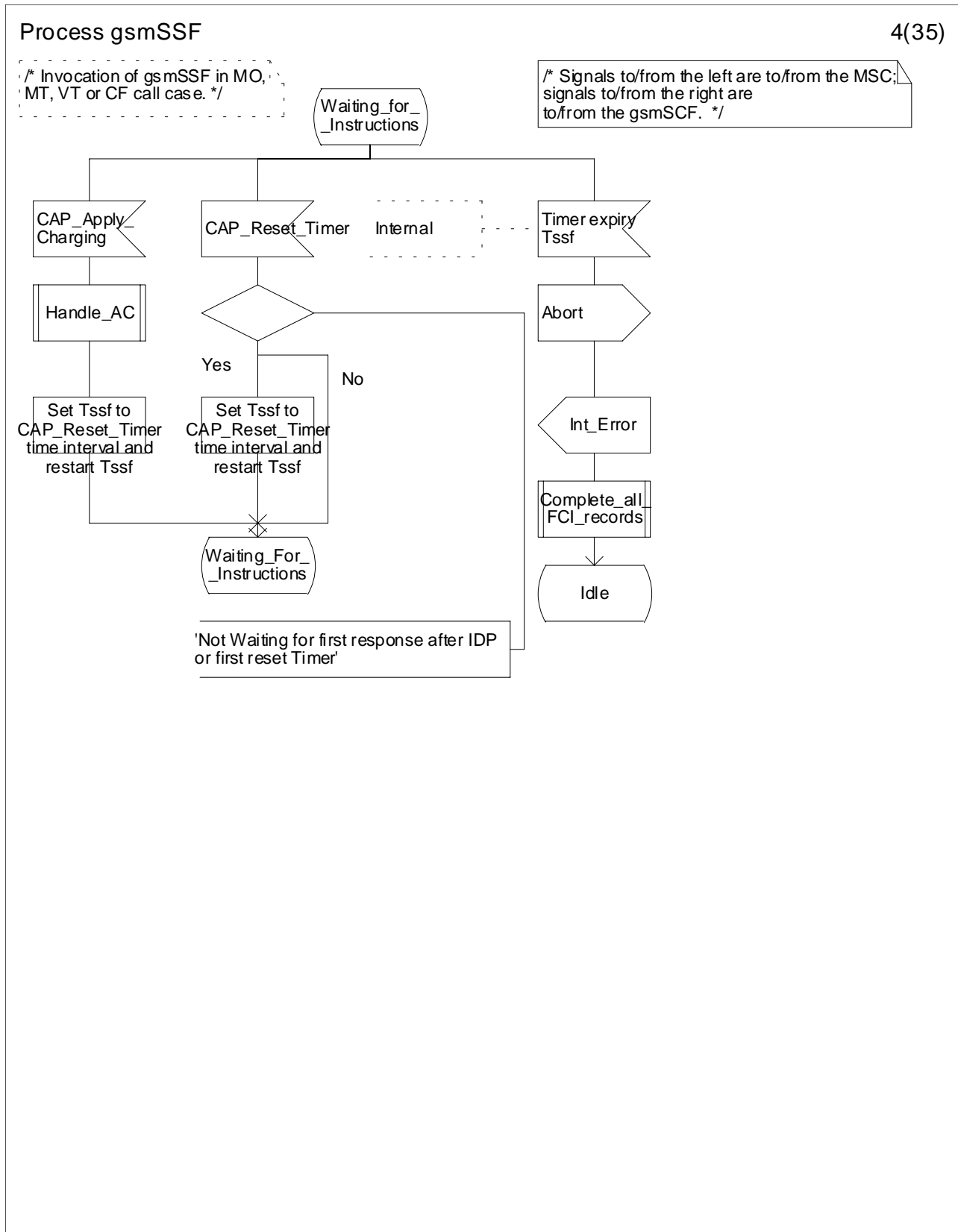


Figure 4.57d: Process gsmSSF (sheet 4)

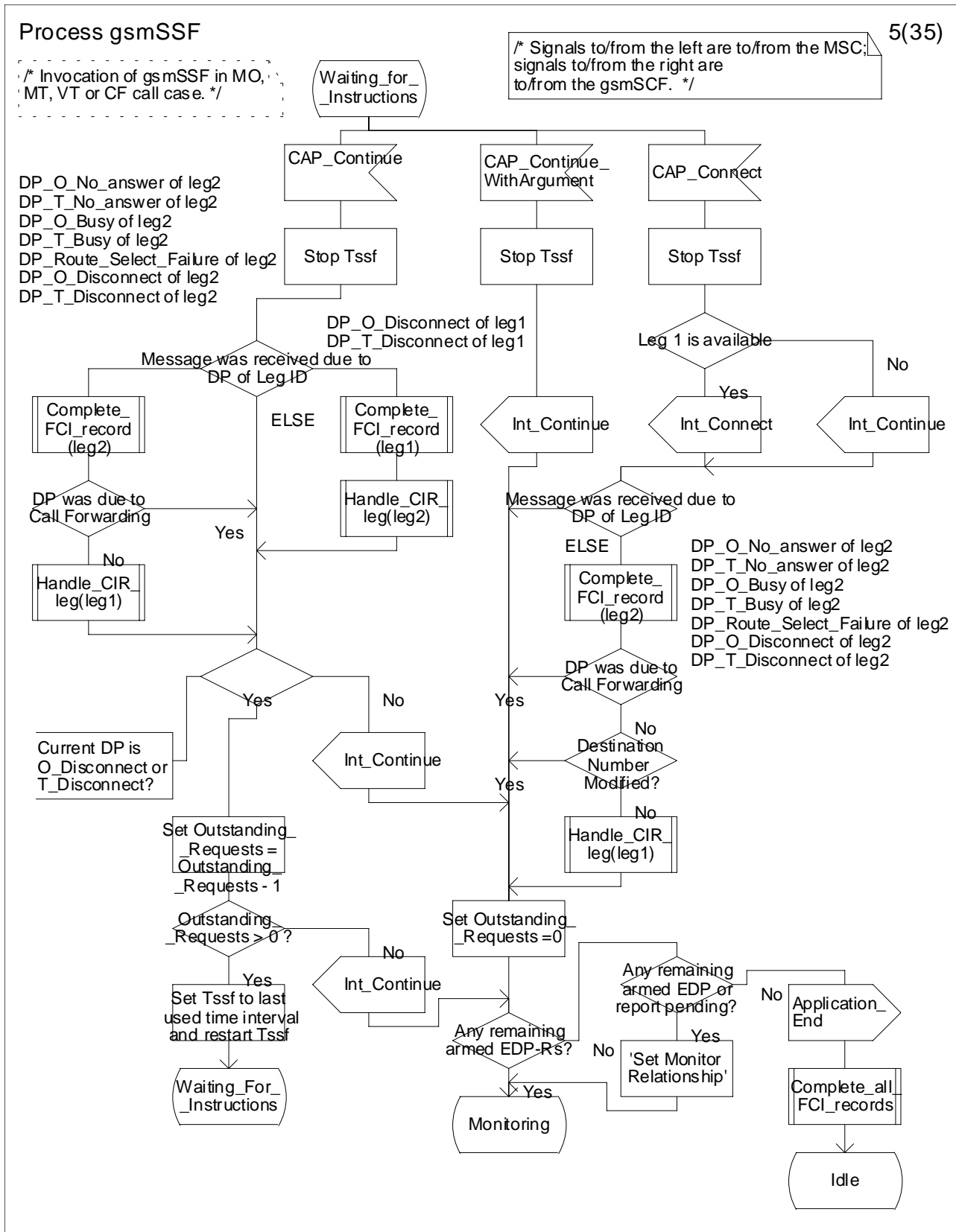


Figure 4.57e: Process gsmSSF (sheet 5)

Process gsmSSF

6(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

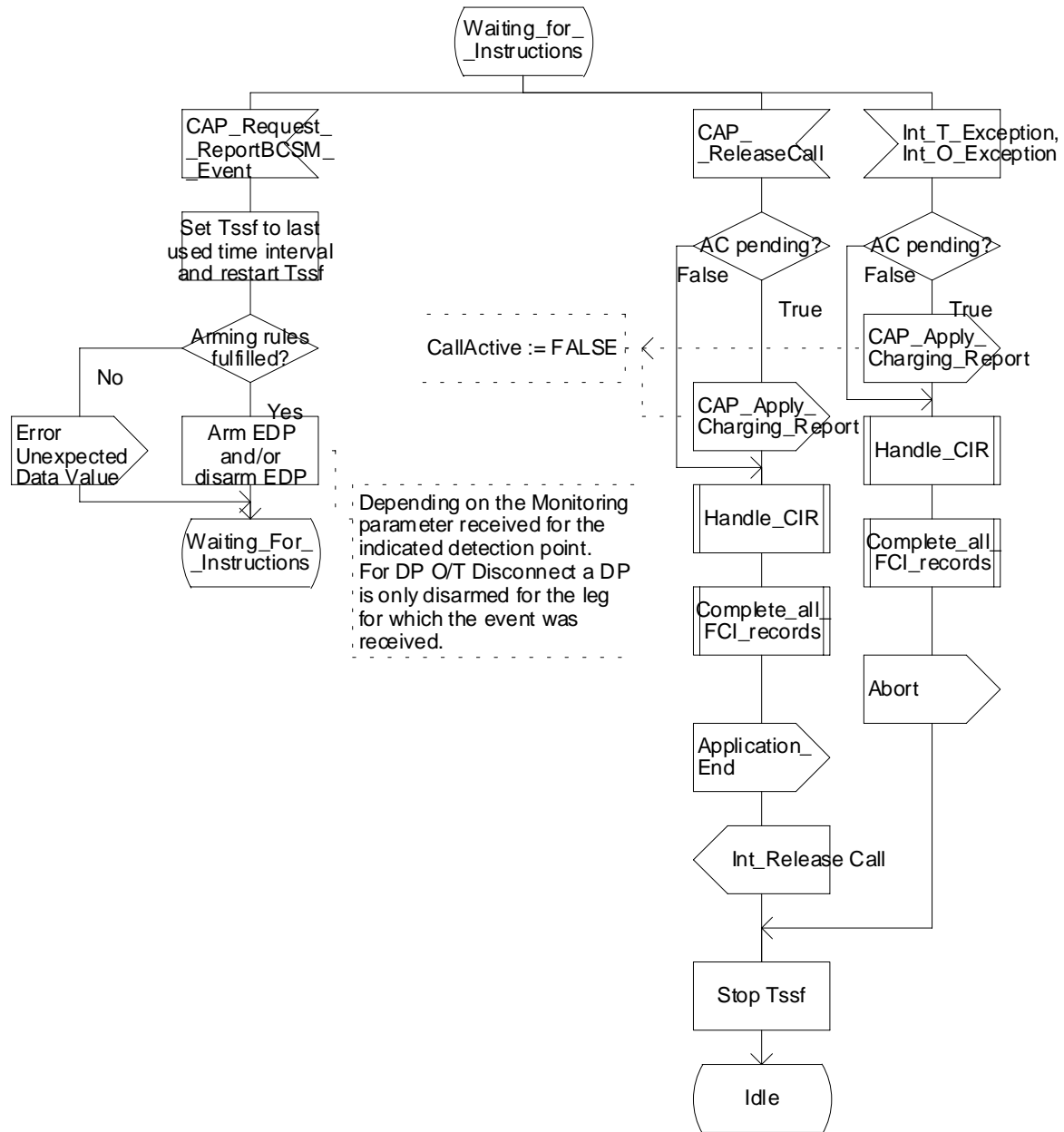


Figure 4.57f: Process gsmSSF (sheet 6)

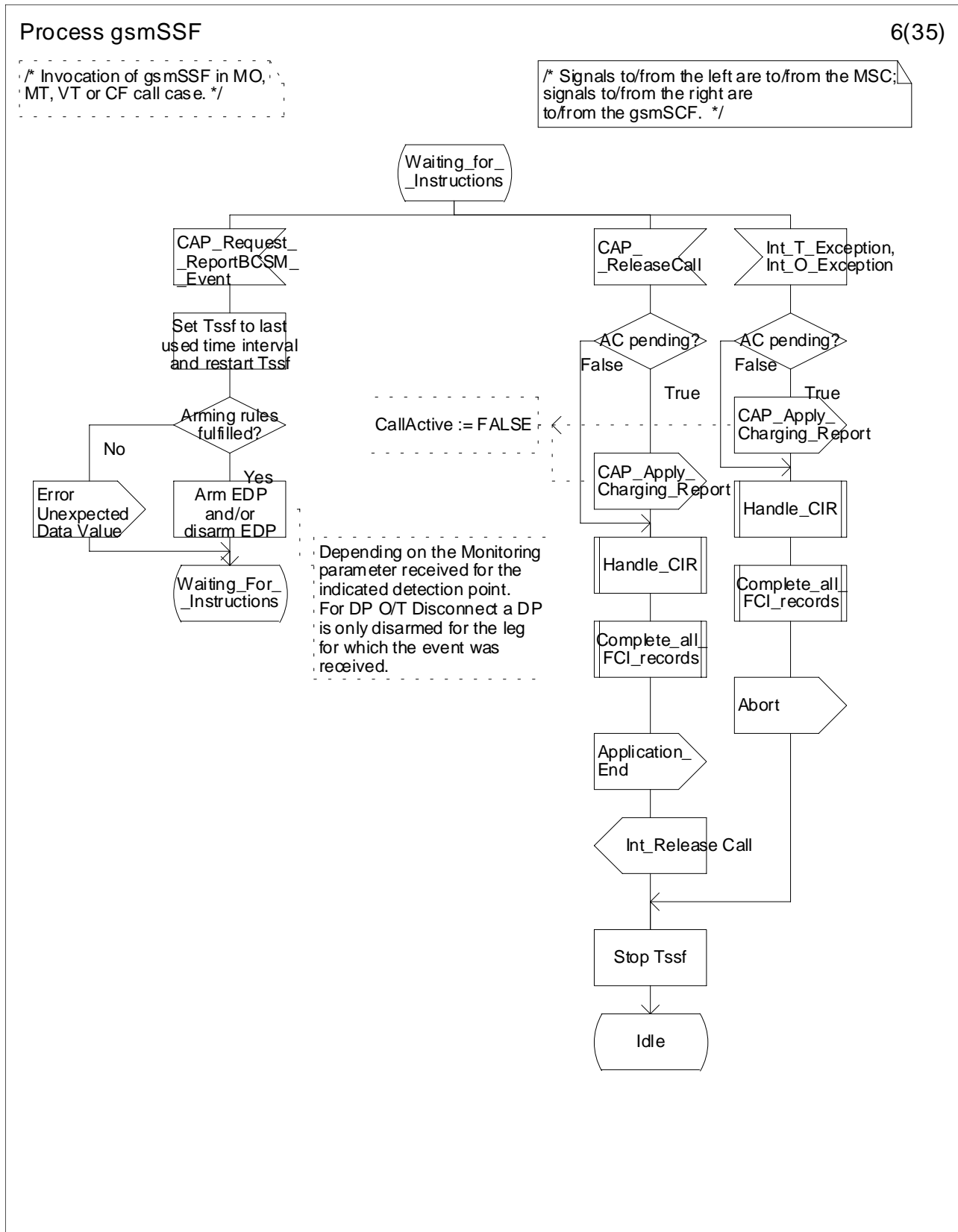


Figure 4.57g: Process gsmSSF (sheet 7)

Process gsmSSF

8(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

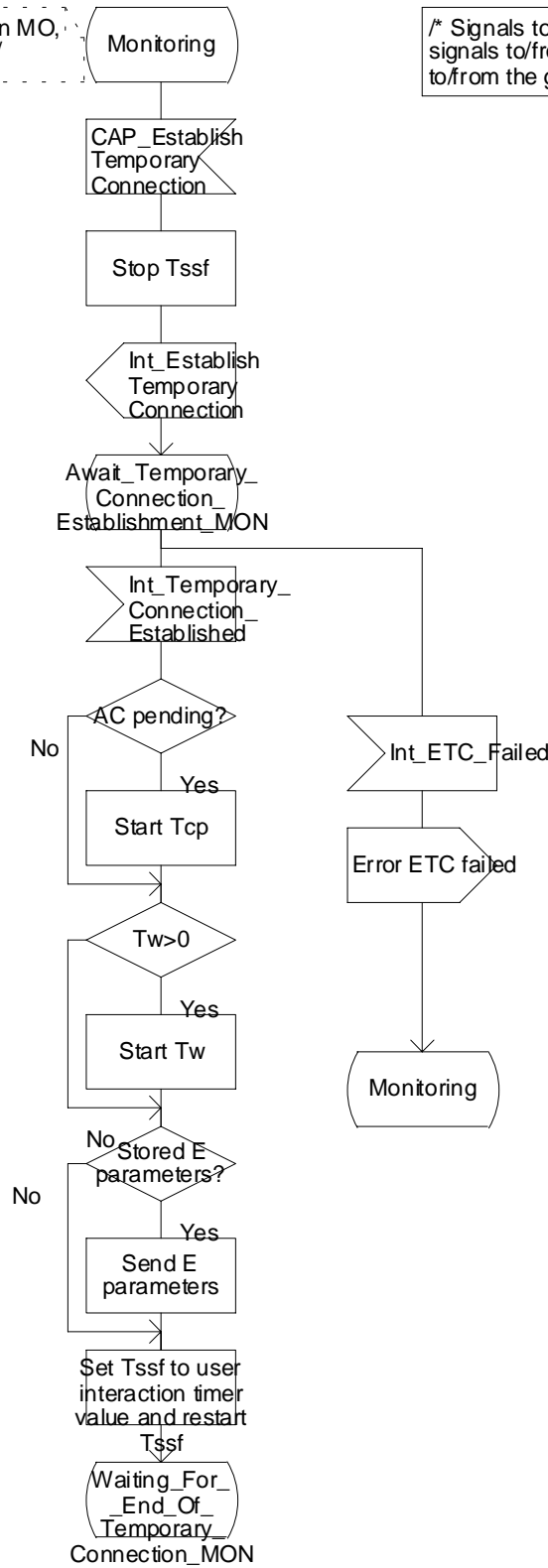


Figure 4.57h: Process gsmSSF (sheet 8)

Process gsmSSF

9(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

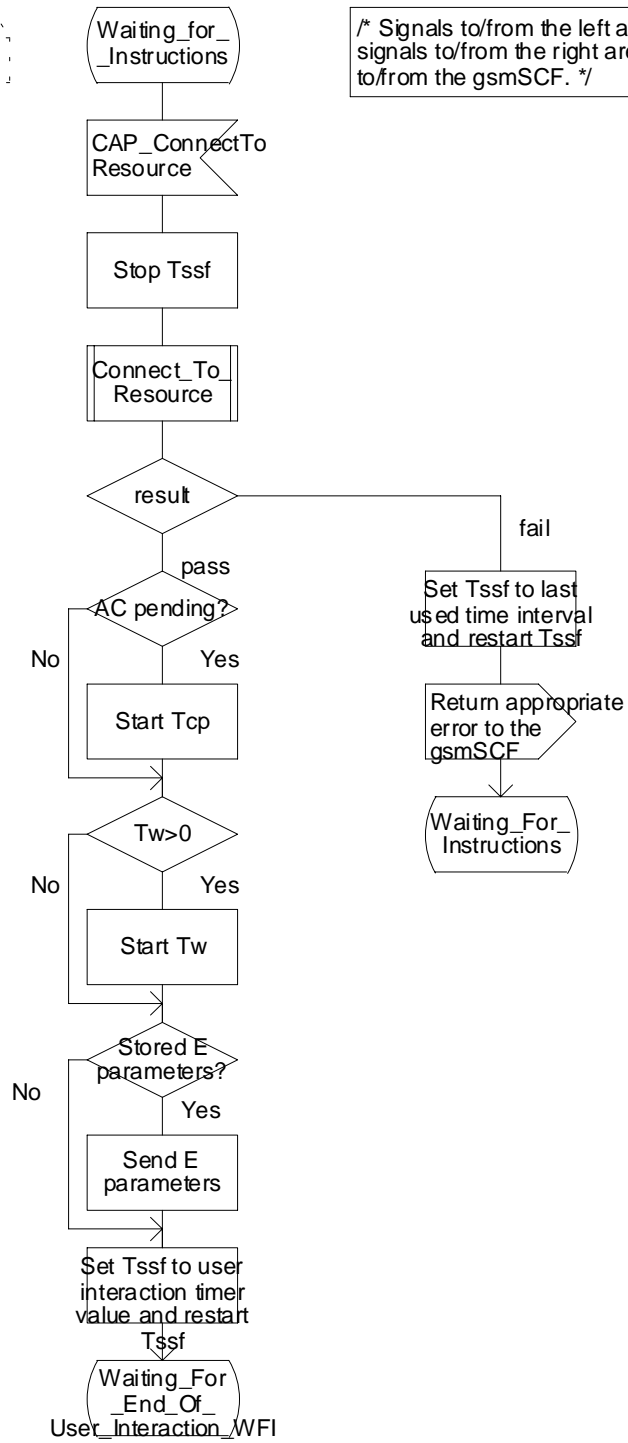


Figure 4.57i: Process gsmSSF (sheet 9)

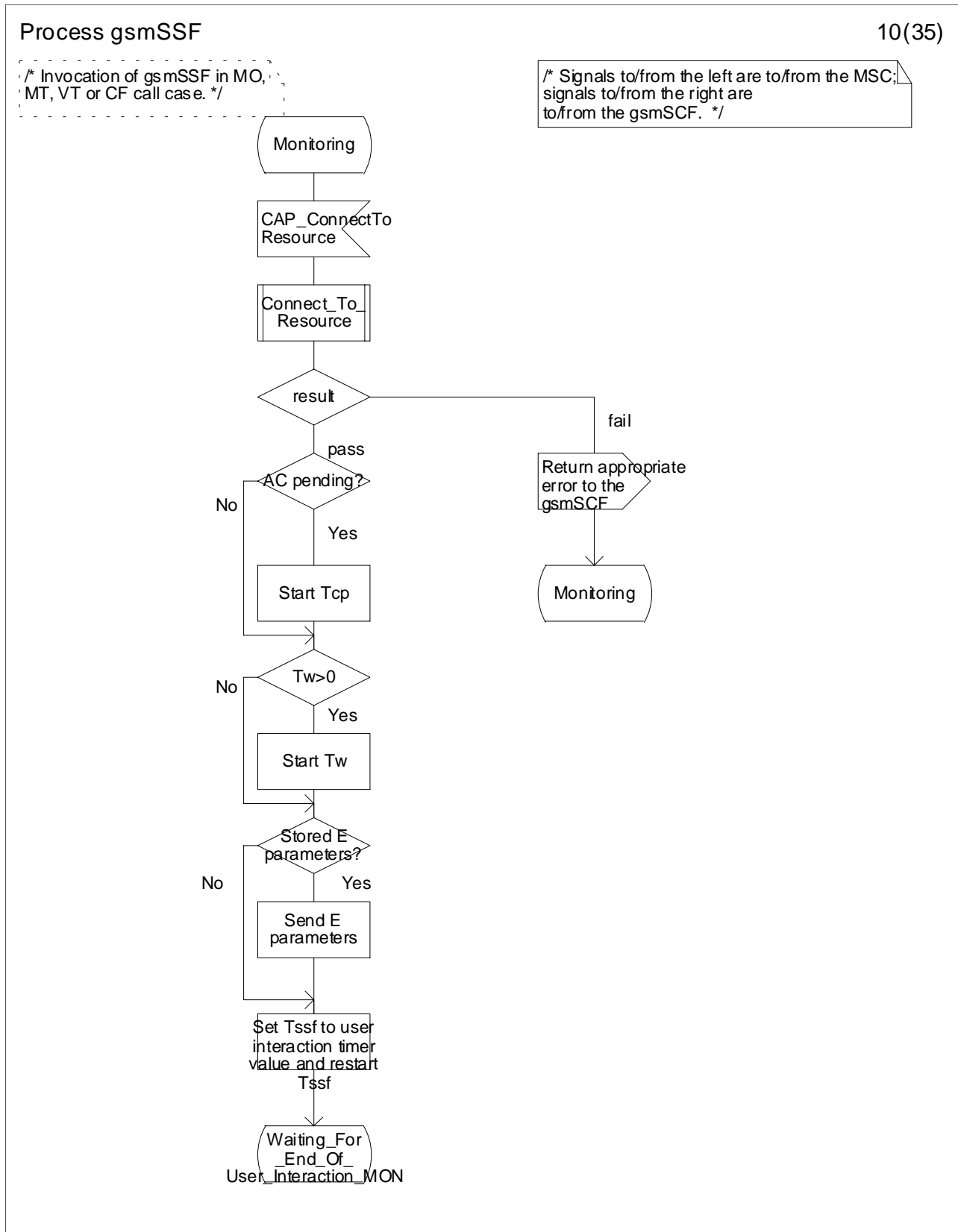


Figure 4.57j: Process gsmSSF (sheet 10)

Process gsmSSF

11 (35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

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

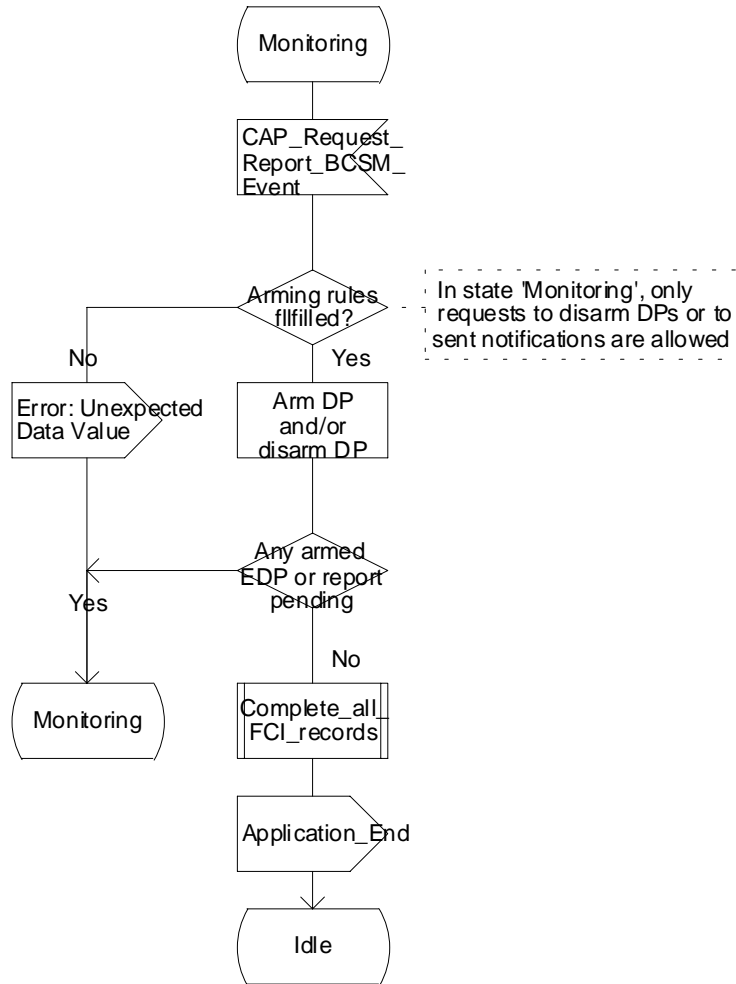


Figure 4.57k: Process gsmSSF (sheet 11)

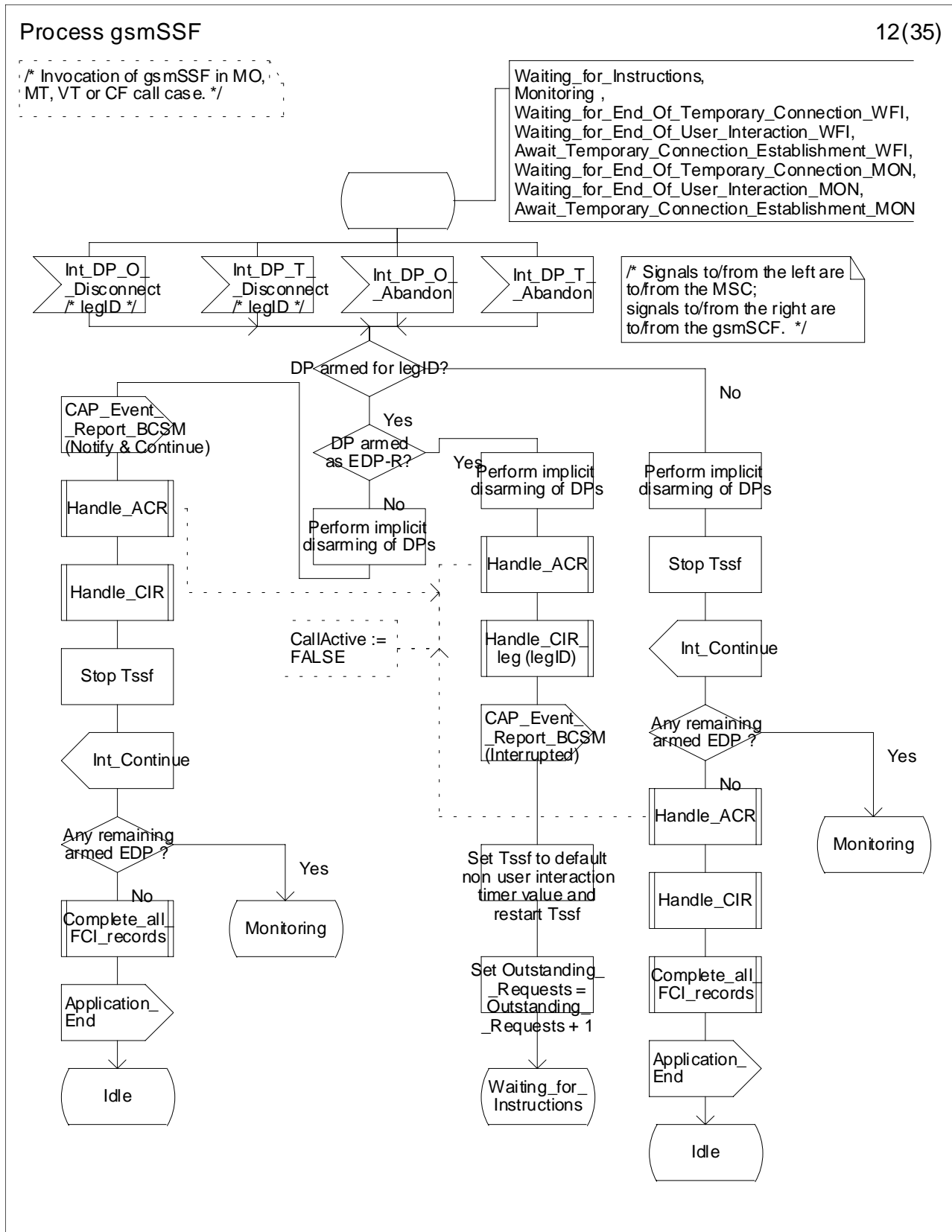


Figure 4.571: Process gsmSSF (sheet 12)

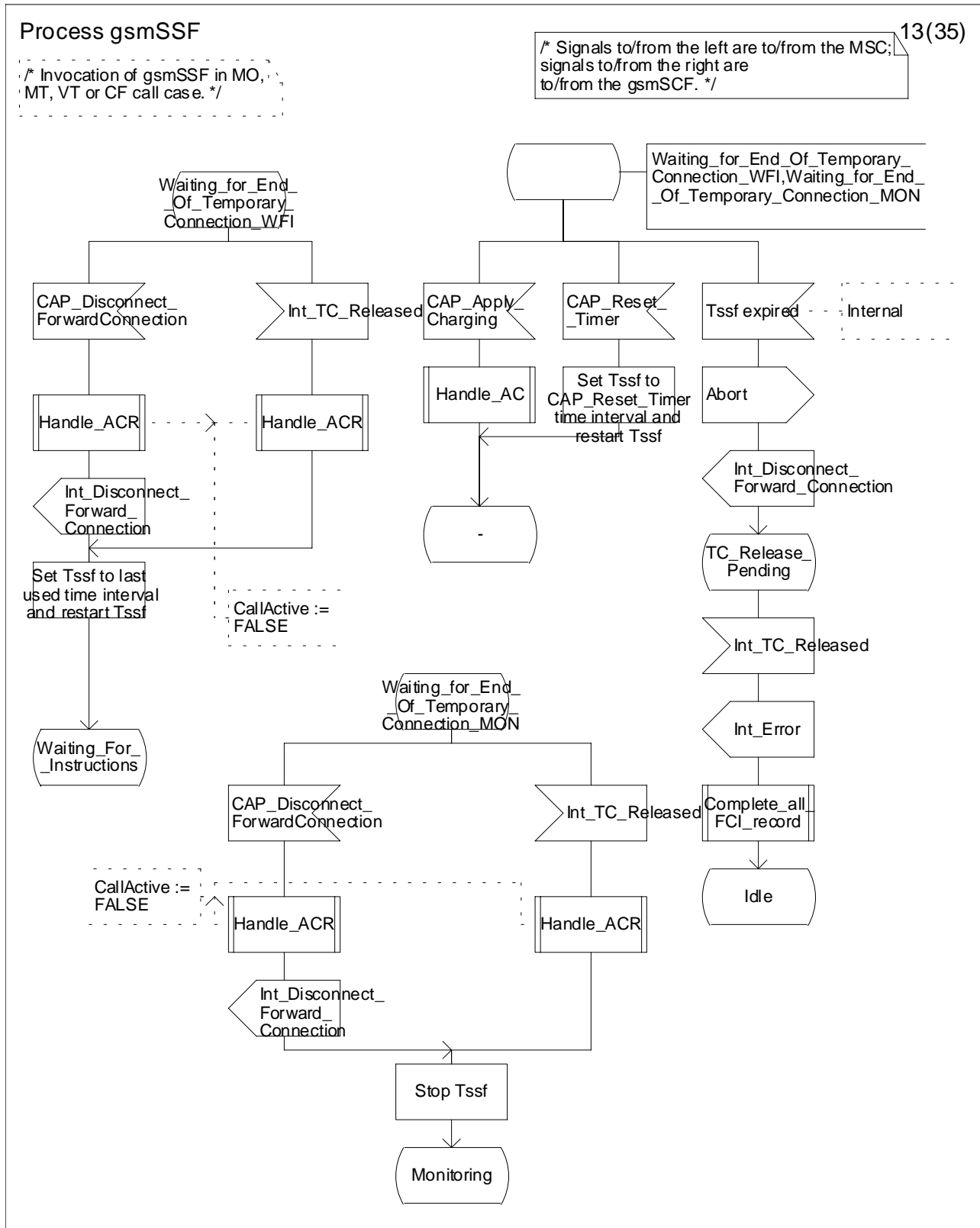


Figure 4.57m: Process gsmSSF (sheet 13)

Process gsmSSF

14(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */
 /* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

DP_O_No_answer of leg2
 DP_T_No_answer of leg2
 DP_O_Busy of leg2
 DP_T_Busy of leg2
 DP_Route_Select_Failure of leg2
 DP_O_Disconnect of leg2
 DP_T_Disconnect of leg2

DP_O_Disconnect of leg1
 DP_T_Disconnect of leg1

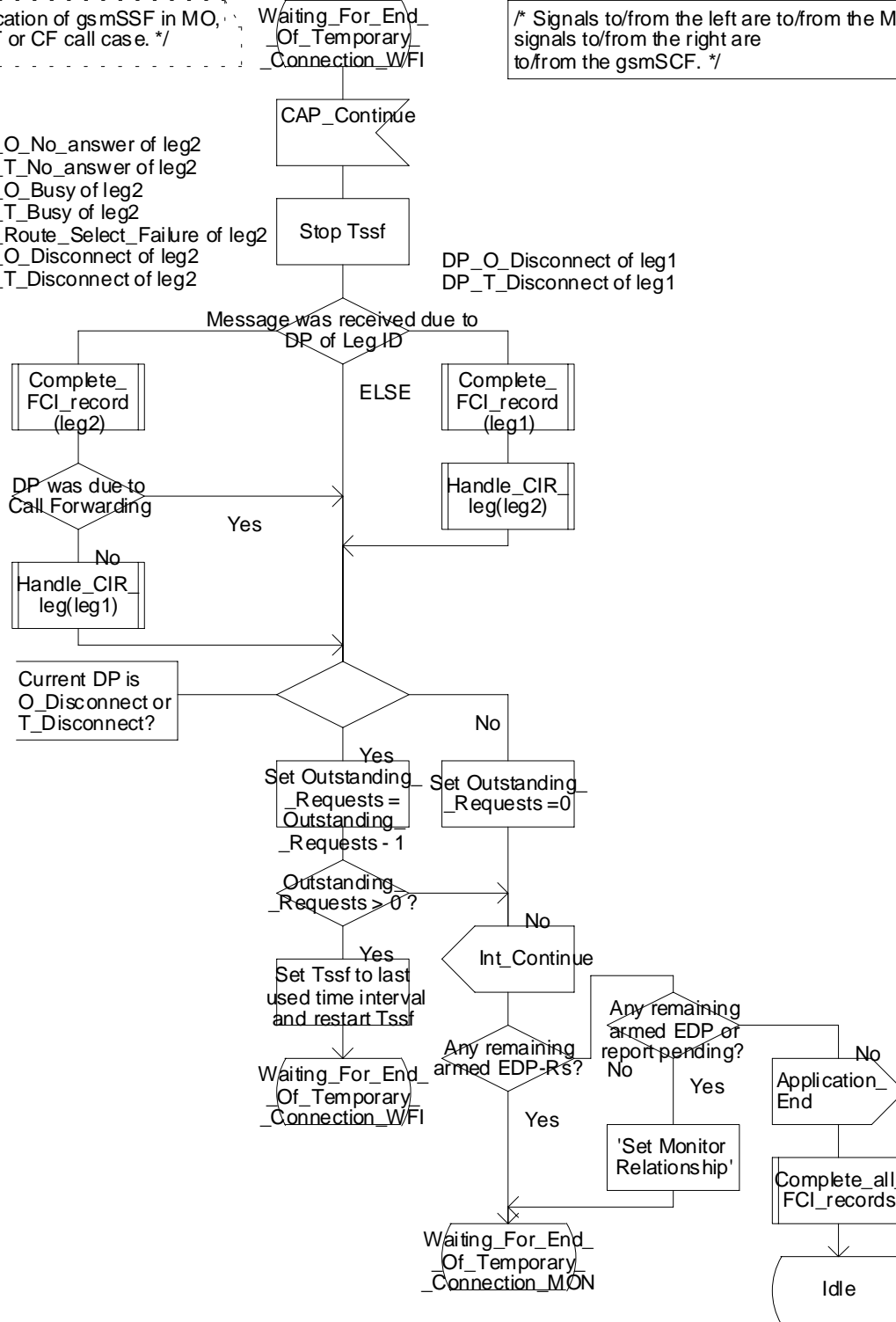


Figure 4.57n: Process gsmSSF (sheet 14)

Process gsmSSF

15(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

DP_O_No_answer of leg2
 DP_T_No_answer of leg2
 DP_O_Busy of leg2
 DP_T_Busy of leg2
 DP_Route_Select_Failure of leg2
 DP_O_Disconnect of leg2
 DP_T_Disconnect of leg2

DP_O_Disconnect of leg1
 DP_T_Disconnect of leg1

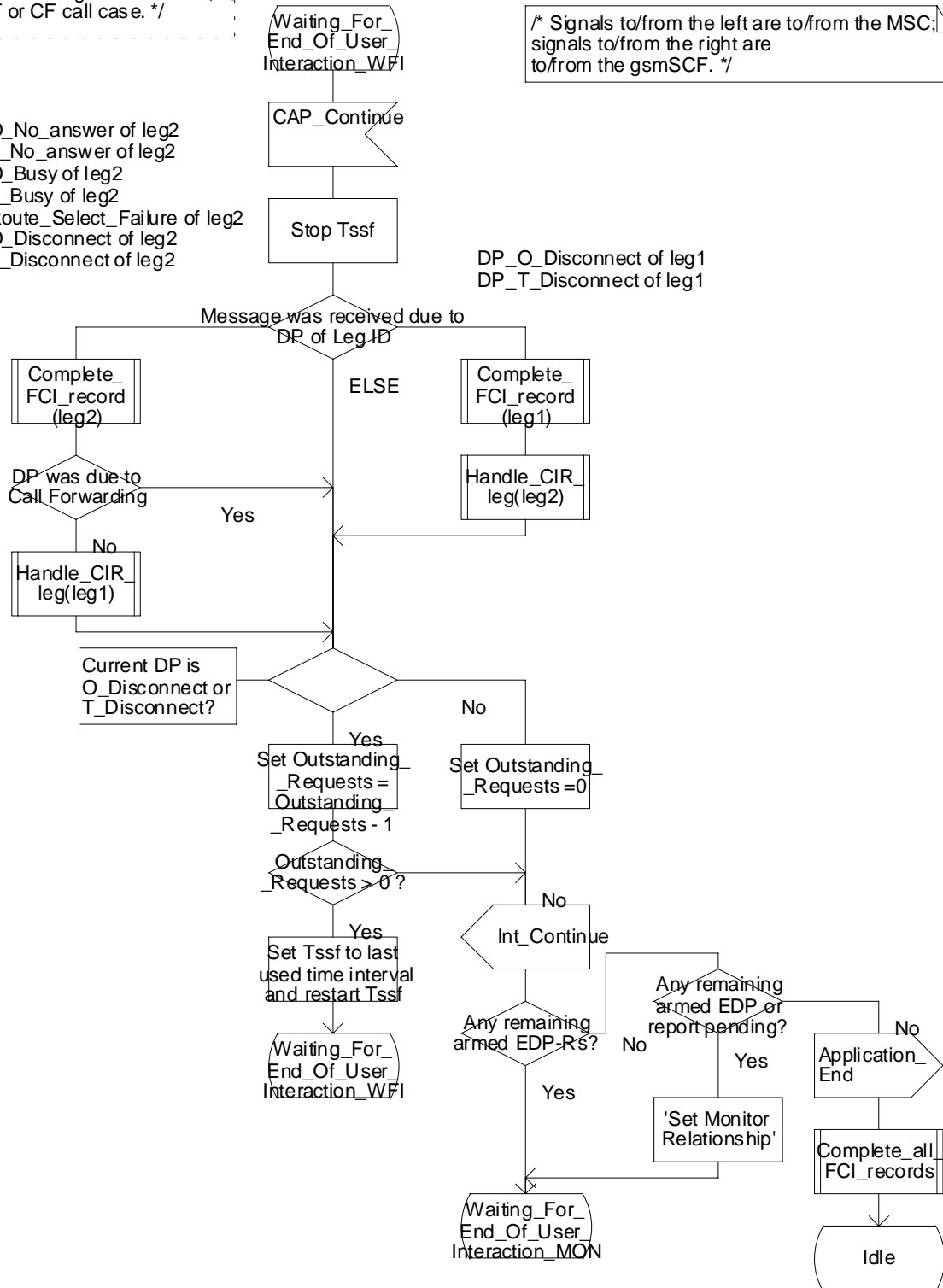


Figure 4.57o: Process gsmSSF (sheet 15)

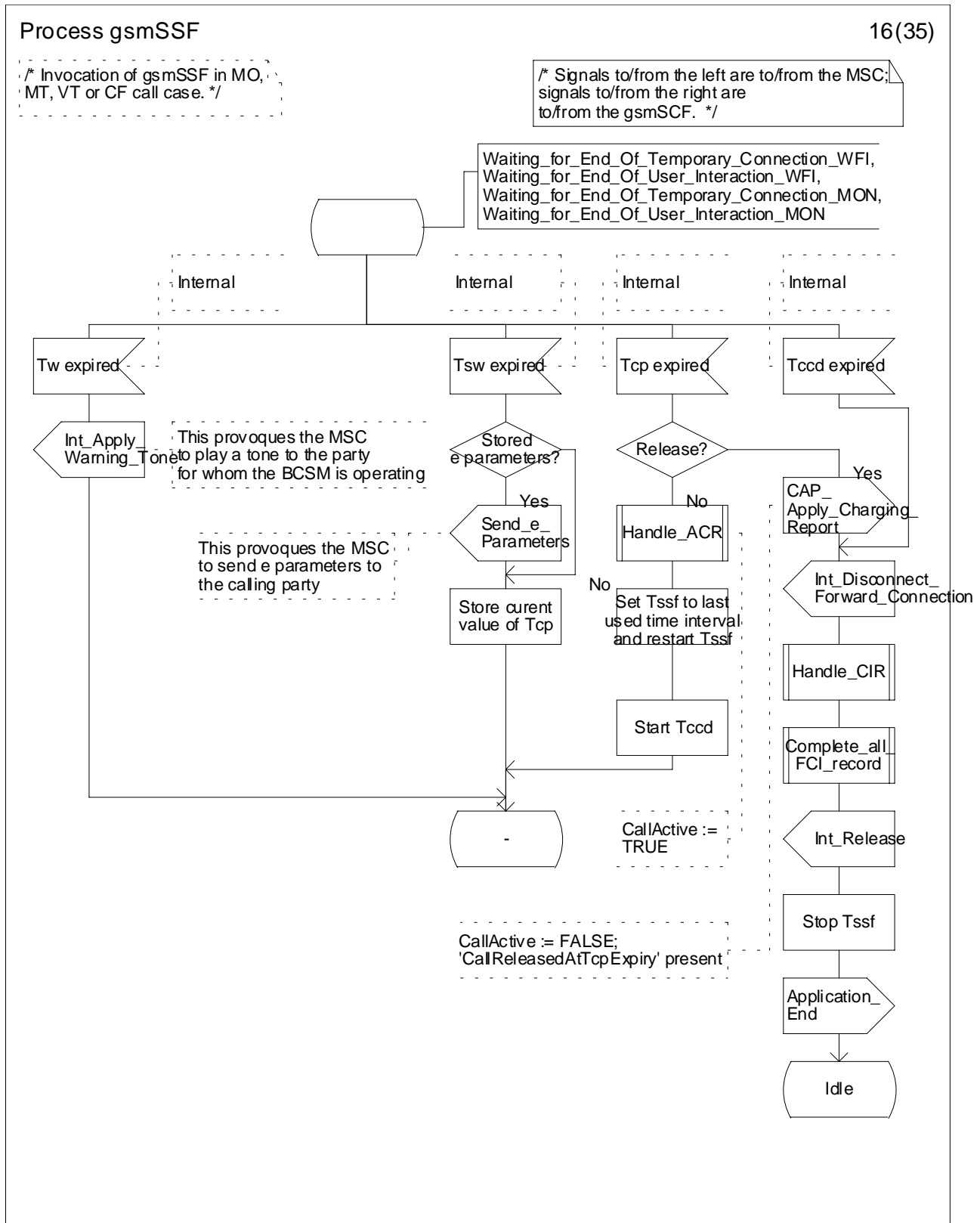


Figure 4.57p: Process gsmSSF (sheet 16)

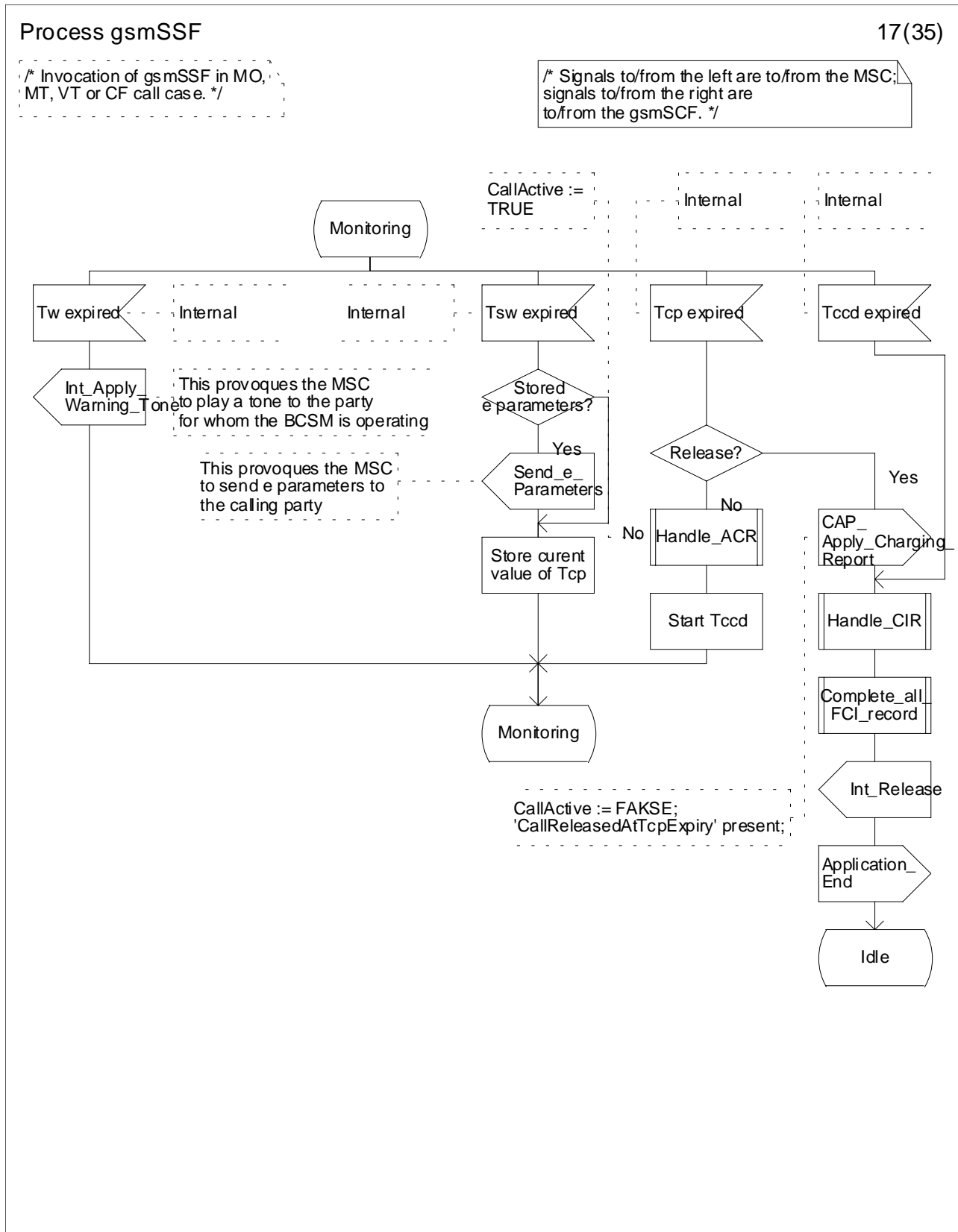


Figure 4.57q: Process gsmSSF (sheet 17)

Process gsmSSF

18(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

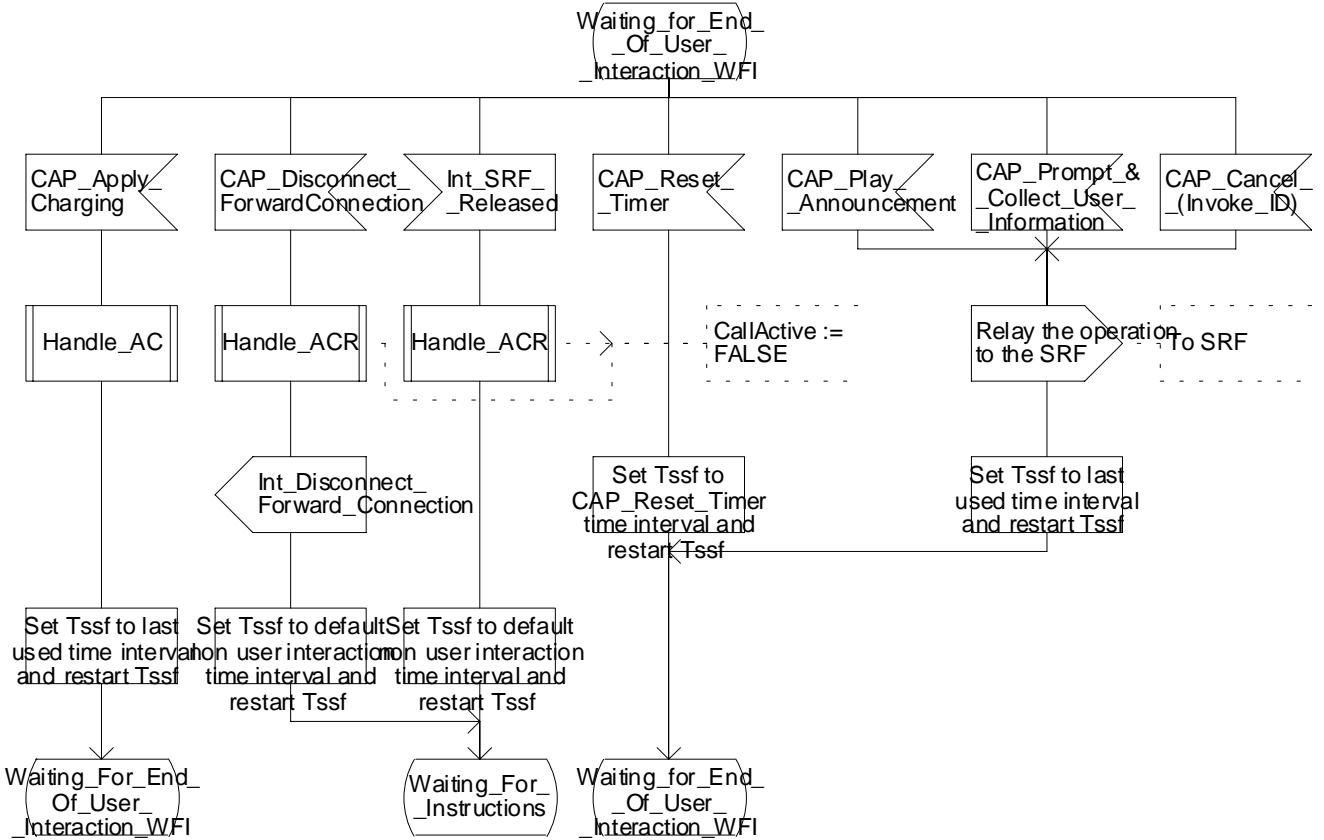


Figure 4.57r: Process gsmSSF (sheet 18)

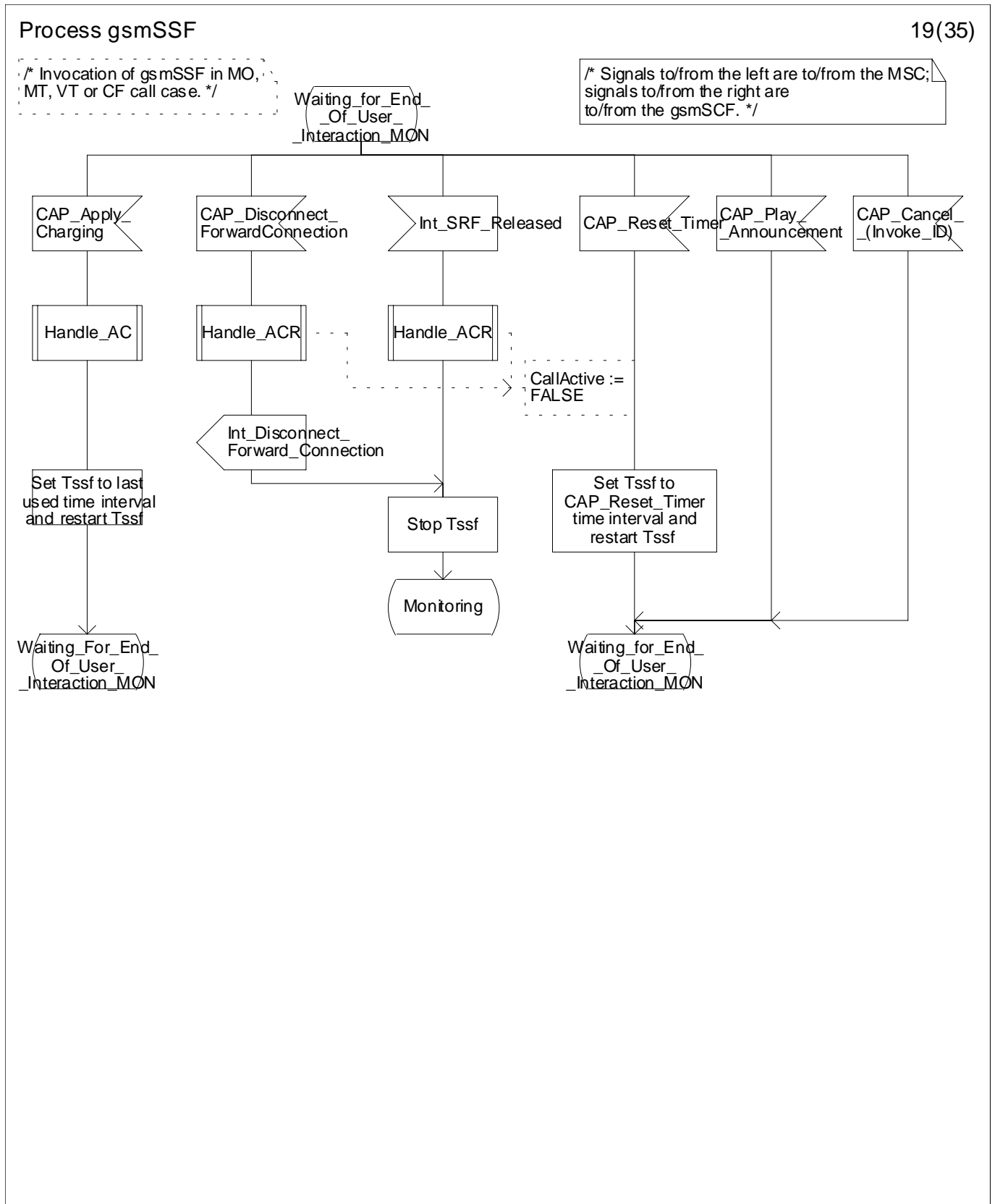


Figure 4.57s: Process gsmSSF (sheet 19)

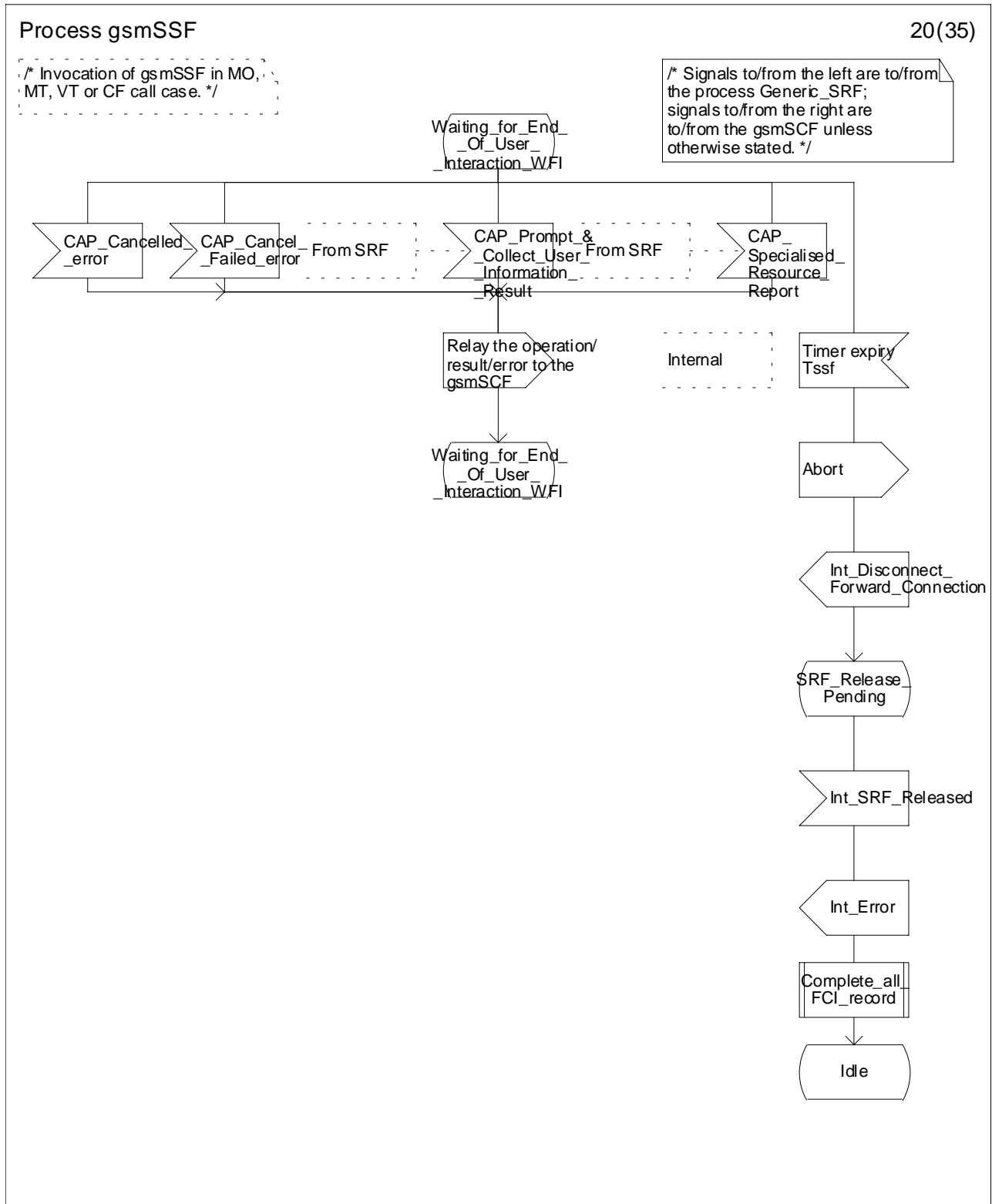


Figure 4.57t: Process gsmSSF (sheet 20)

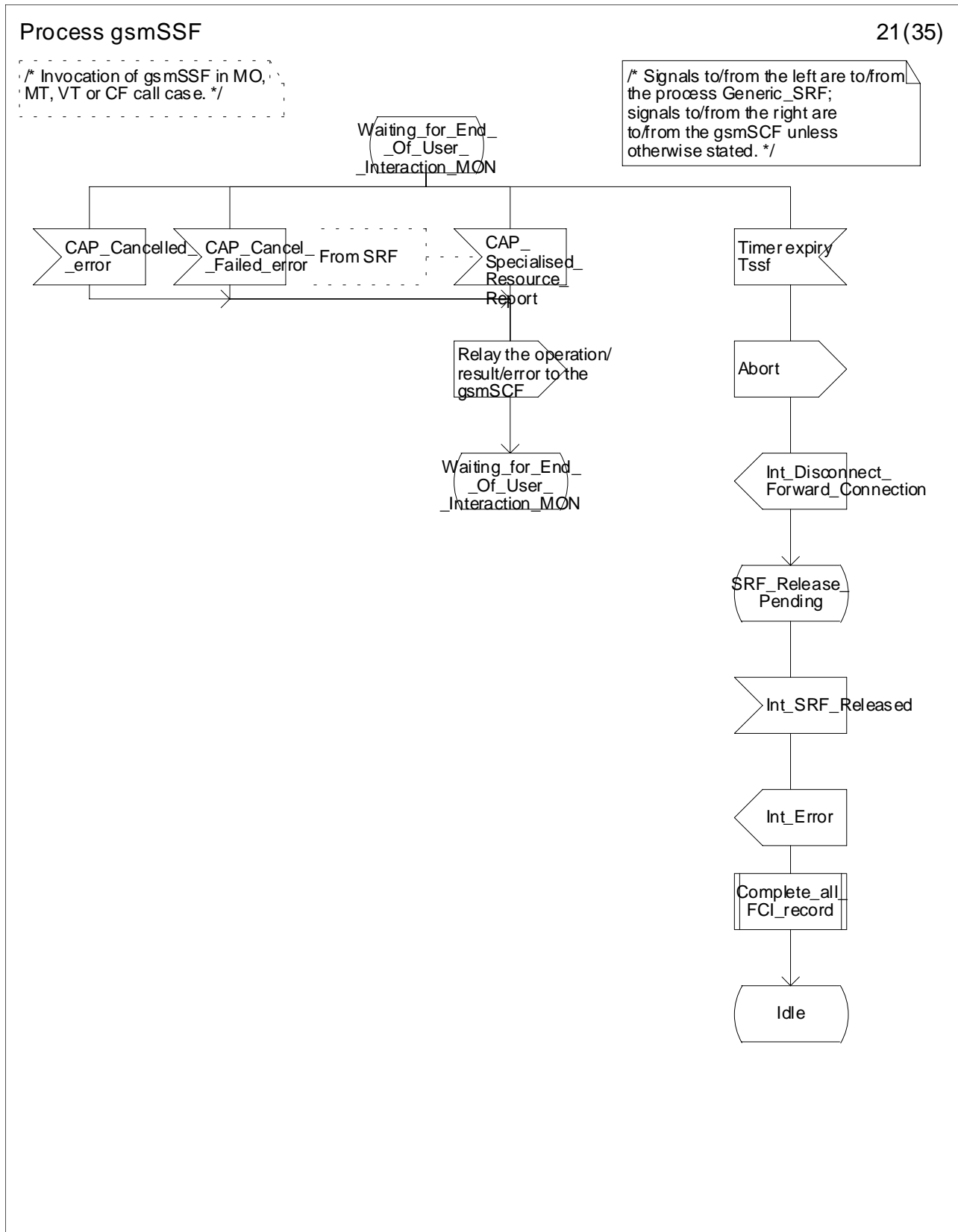


Figure 4.57u: Process gsmSSF (sheet 21)

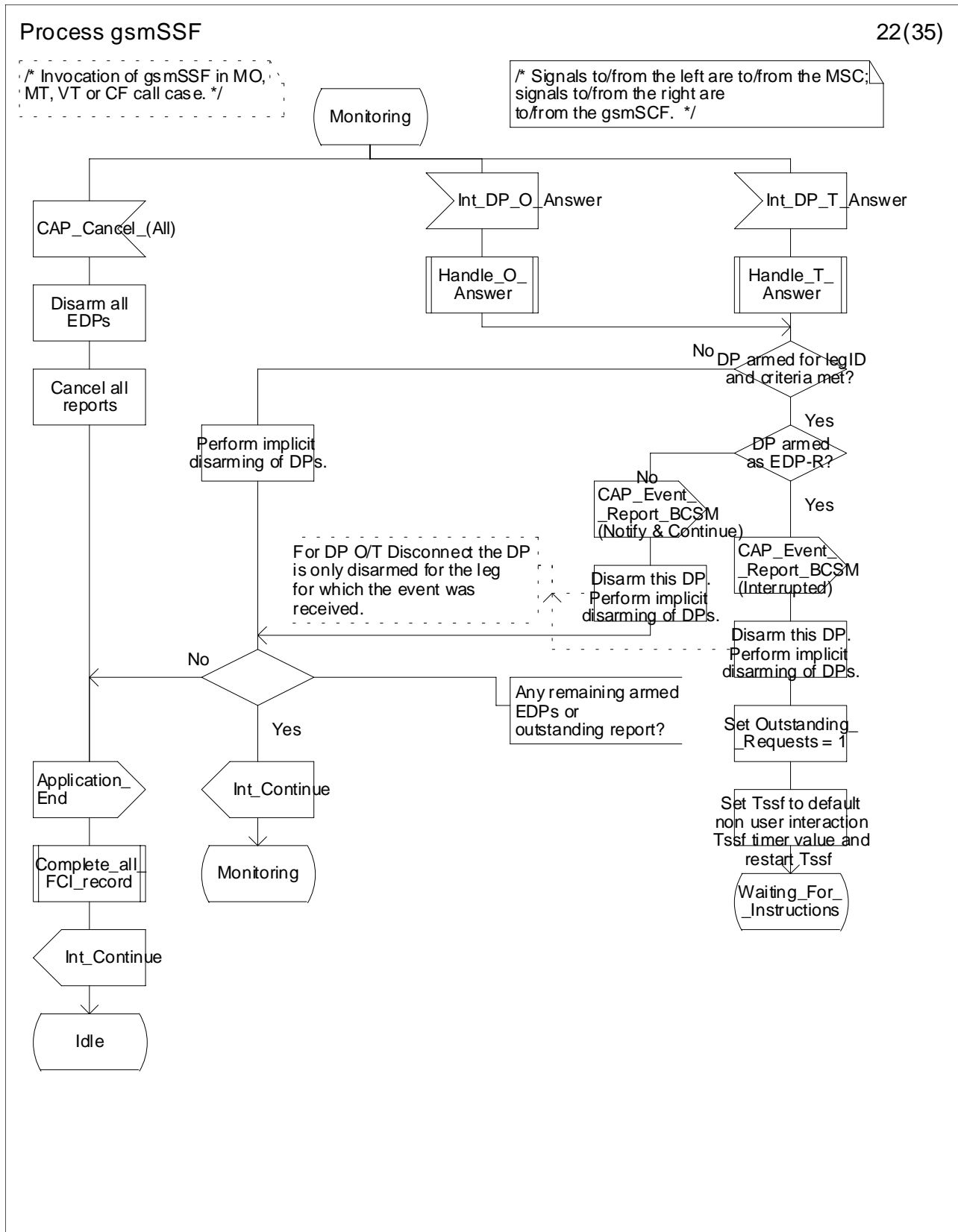


Figure 4.57v: Process gsmSSF (sheet 22)

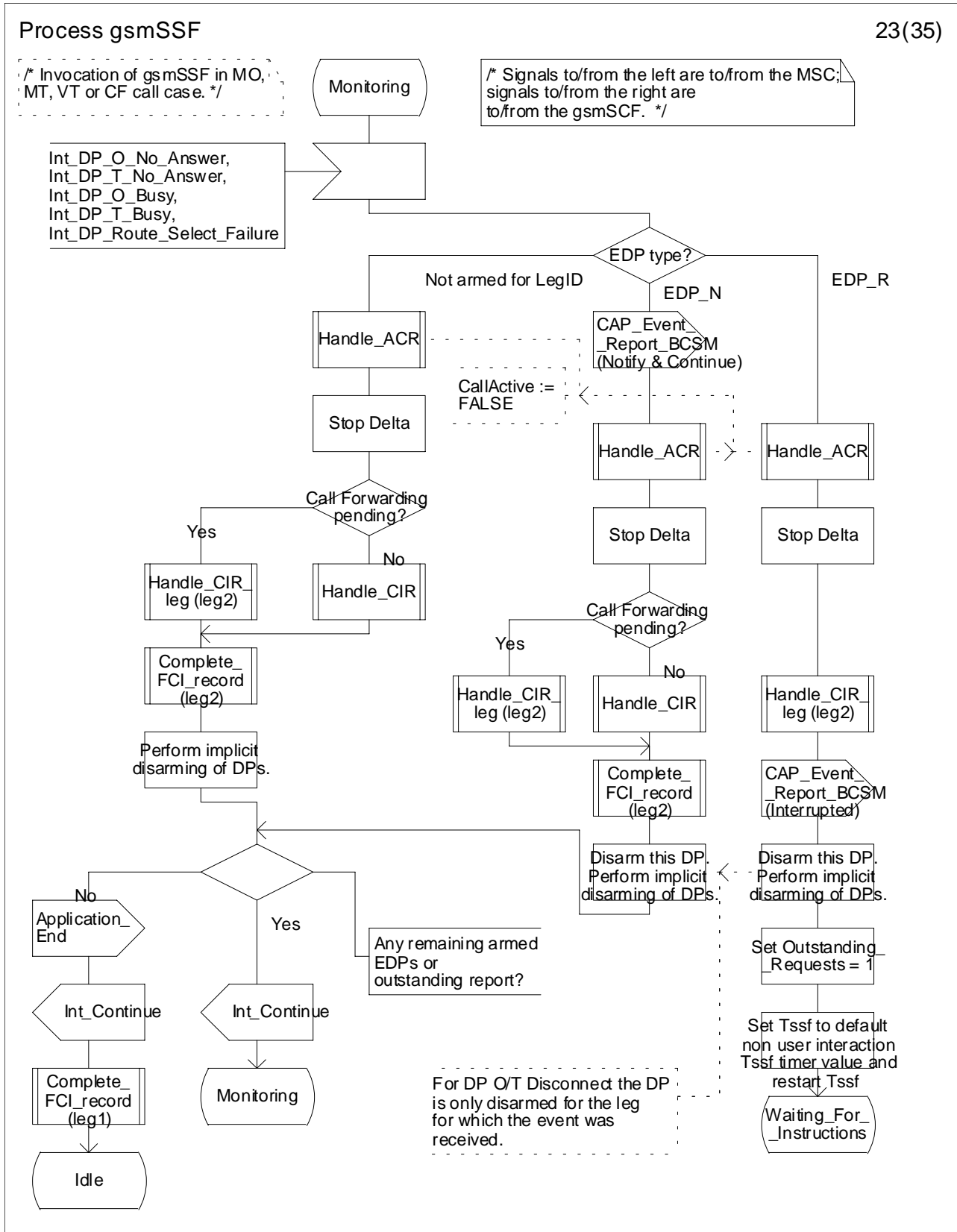


Figure 4.57w: Process gsmSSF (sheet 23)

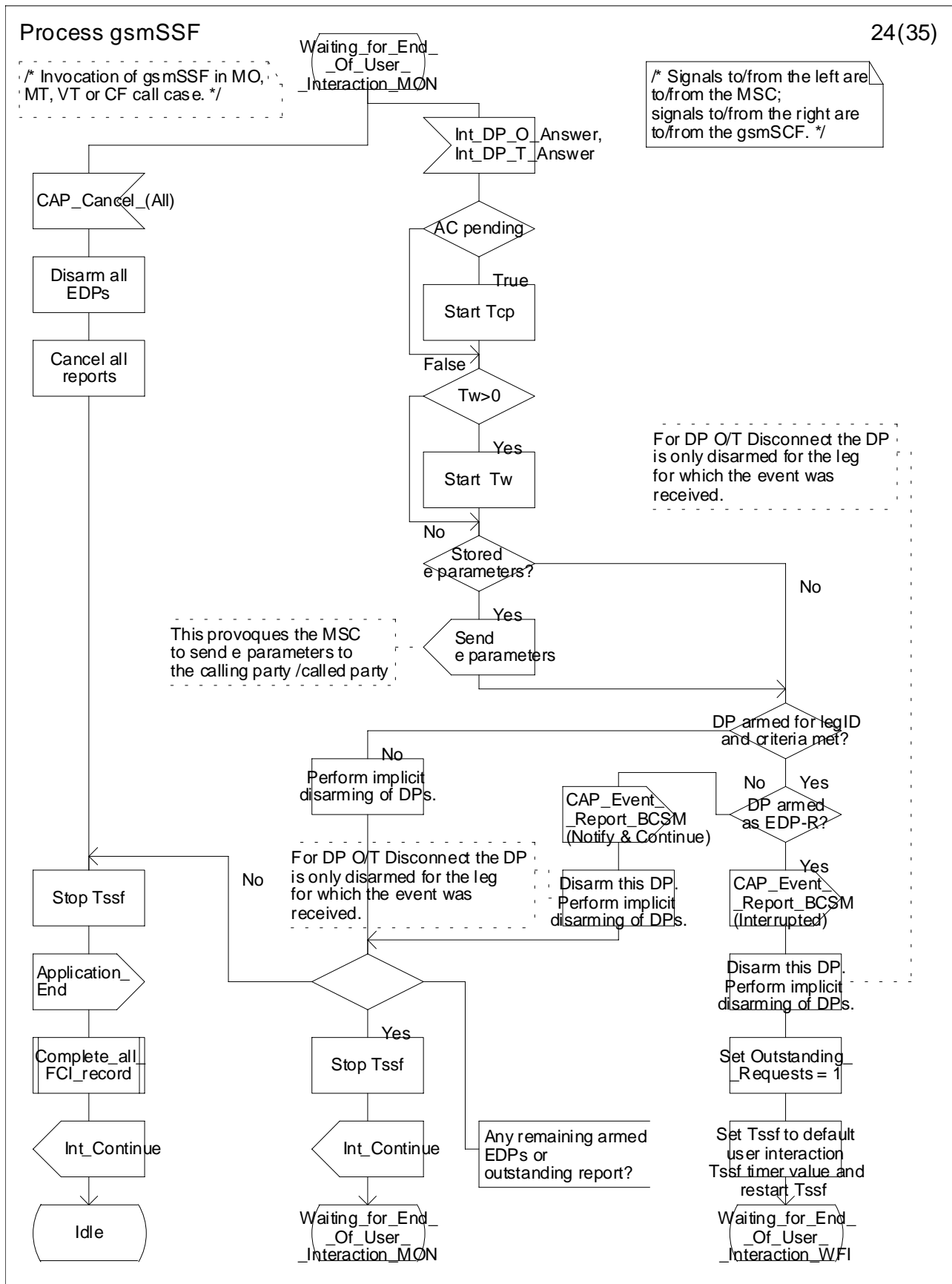


Figure 4.57x: Process gsmSSF (sheet 24)

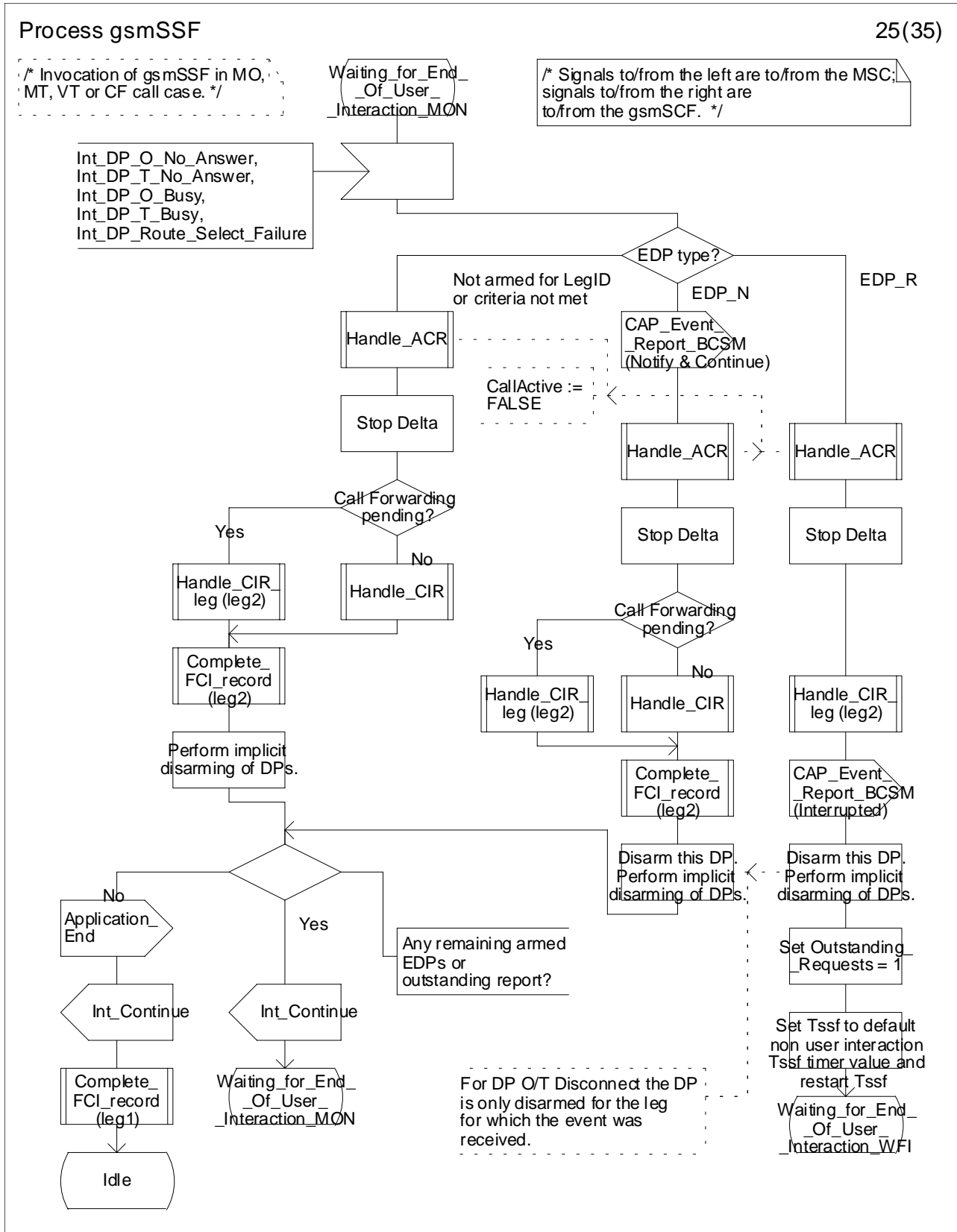


Figure 4.57y: Process gsmSSF (sheet 25)

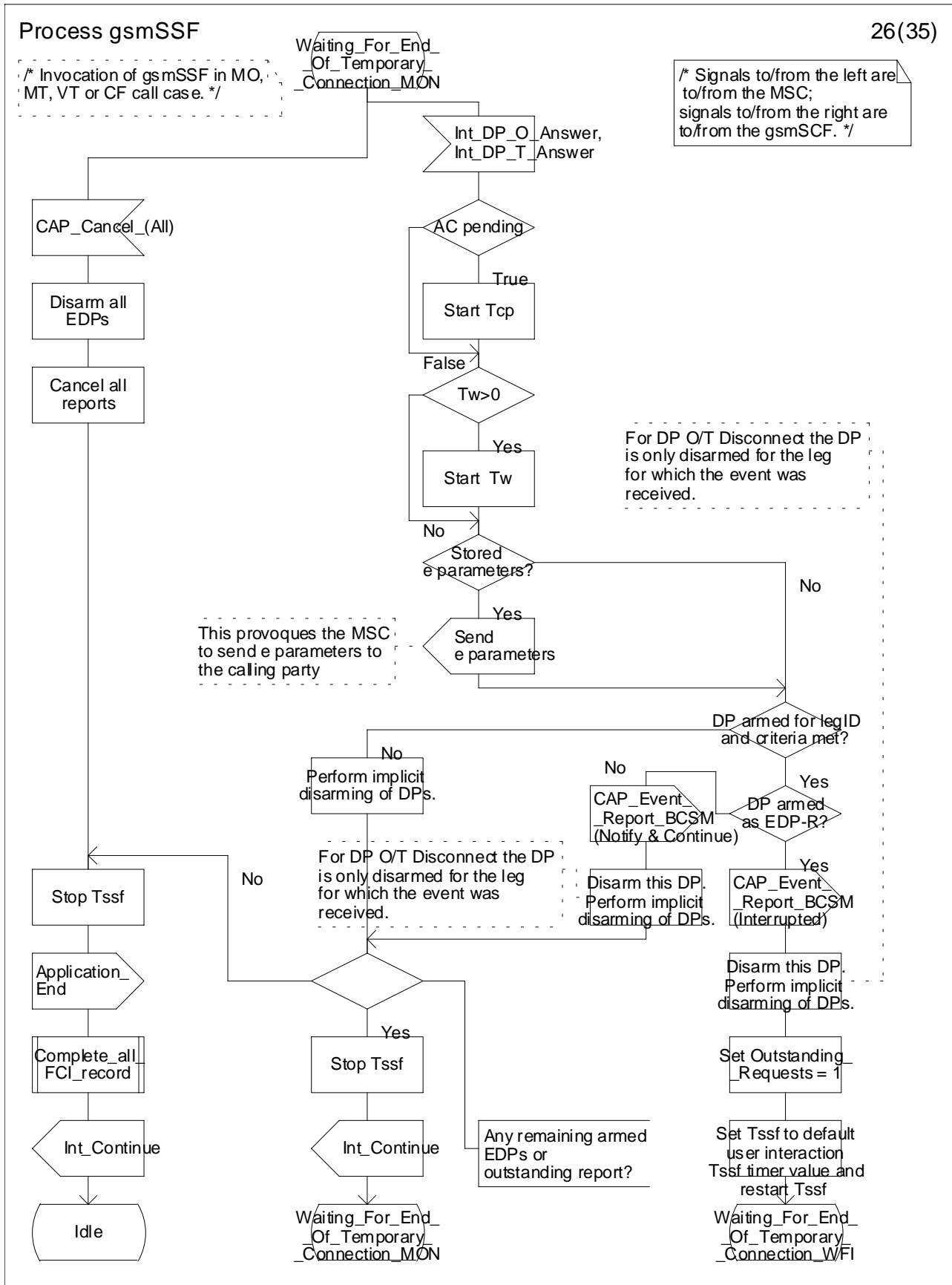


Figure 4.57z: Process gsmSSF (sheet 26)

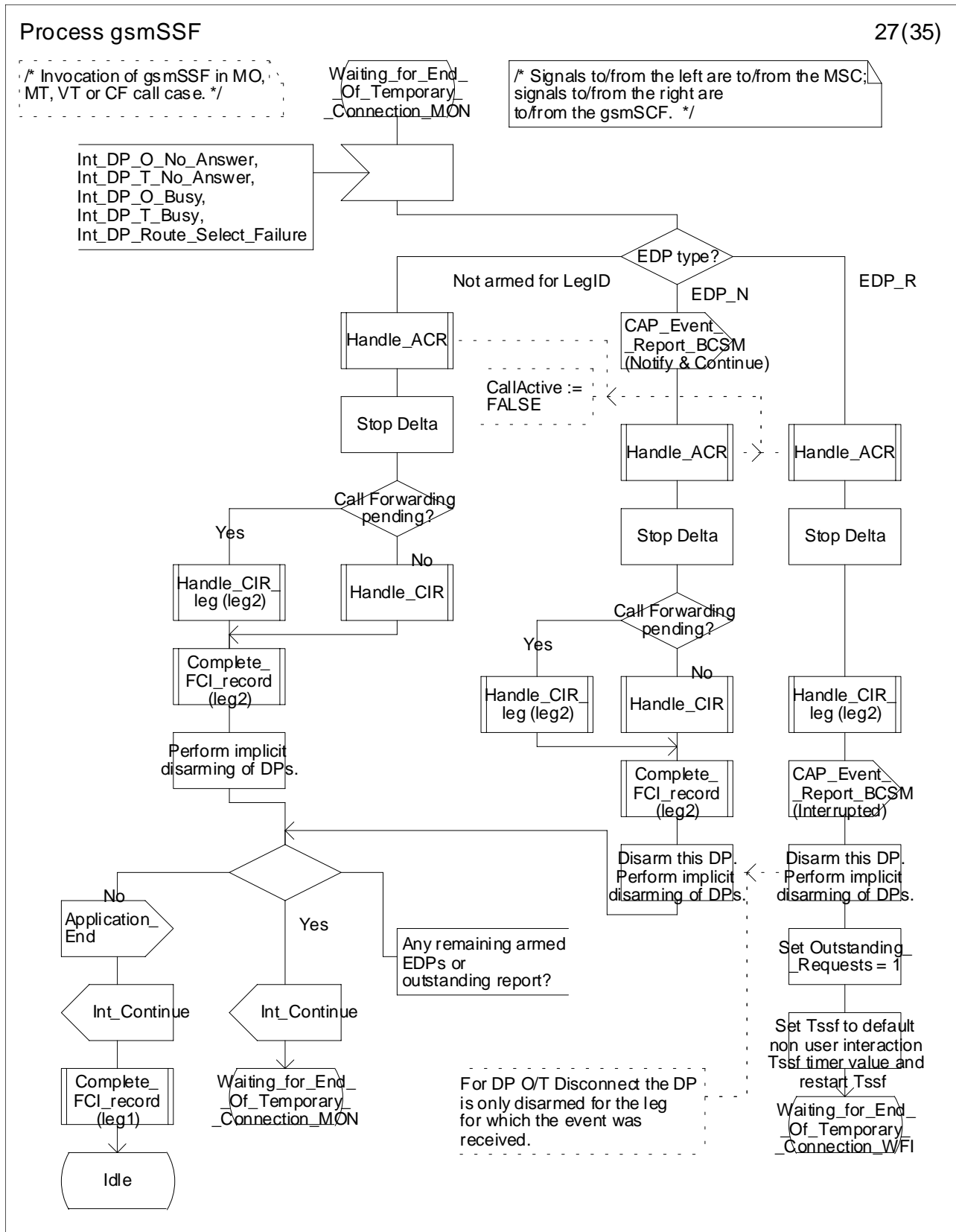


Figure 4.57aa: Process gsmSSF (sheet 27)

Process gsmSSF

28(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

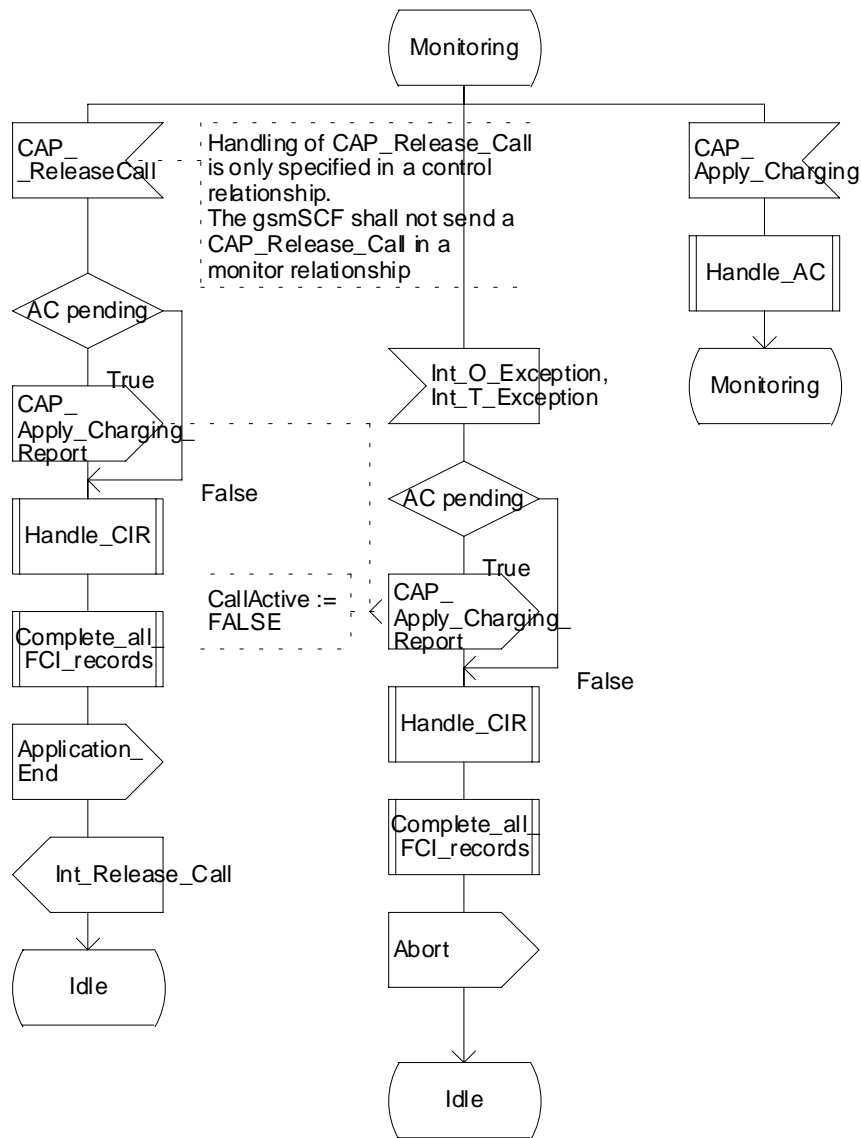


Figure 4.57bb: Process gsmSSF (sheet 28)

Process gsmSSF

29(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

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

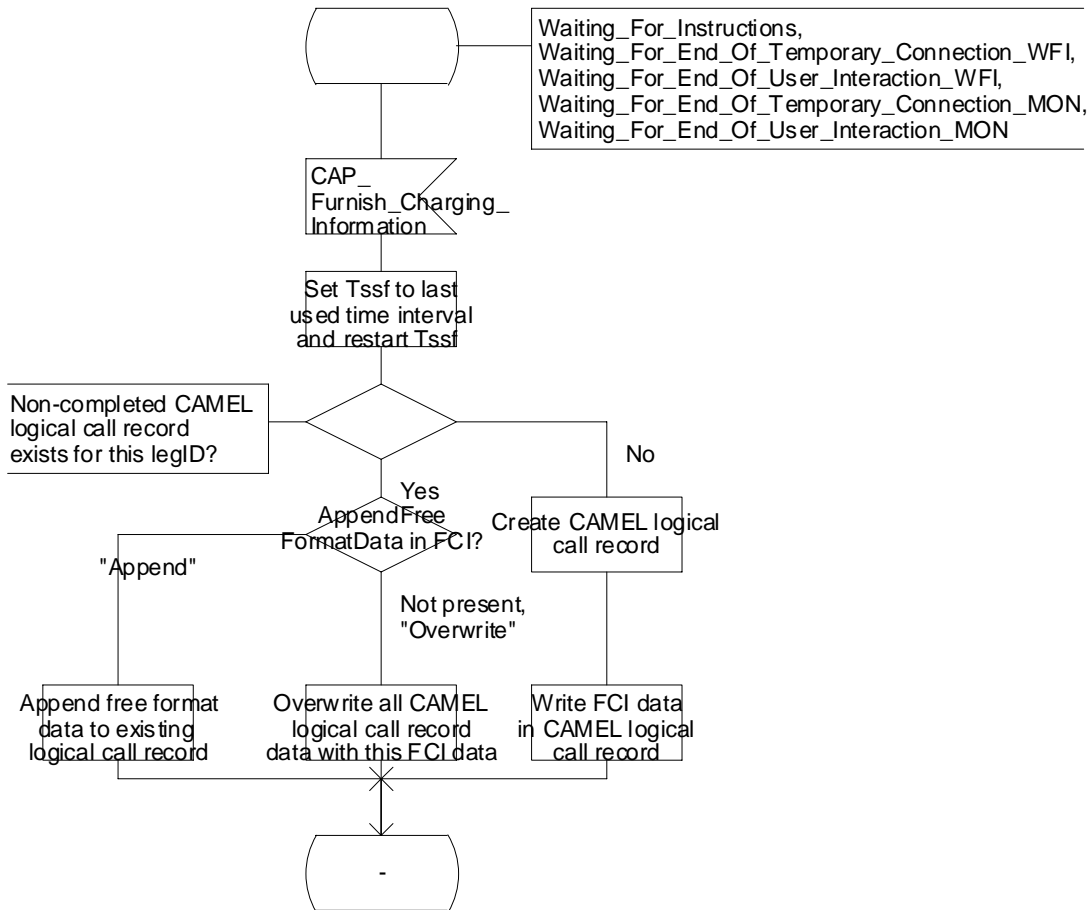


Figure 4.57cc: Process gsmSSF (sheet 29)

Process gsmSSF

30(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

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

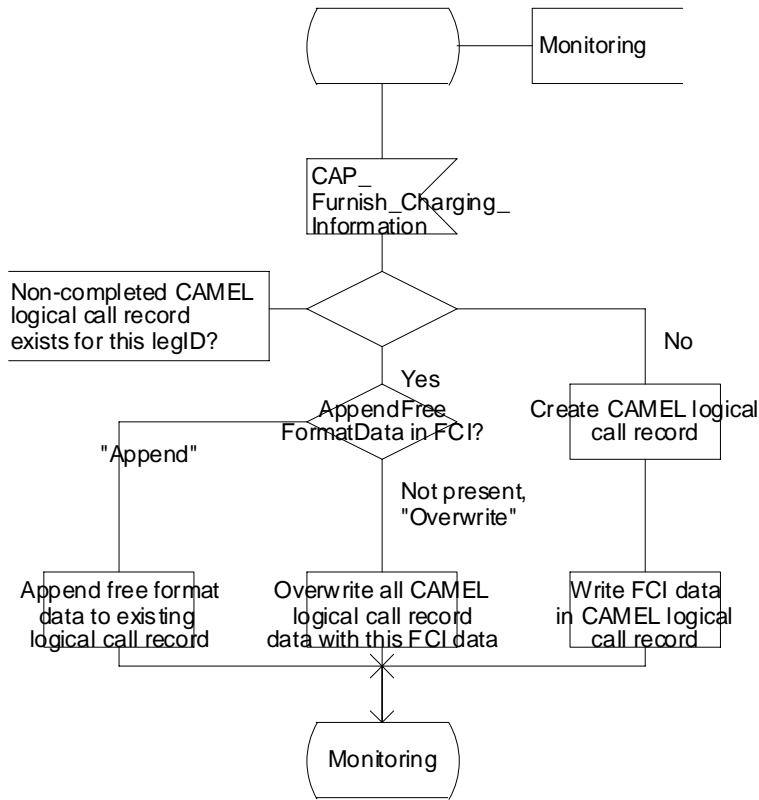


Figure 4.57dd: Process gsmSSF (sheet 30)

Process gsmSSF

31 (35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

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

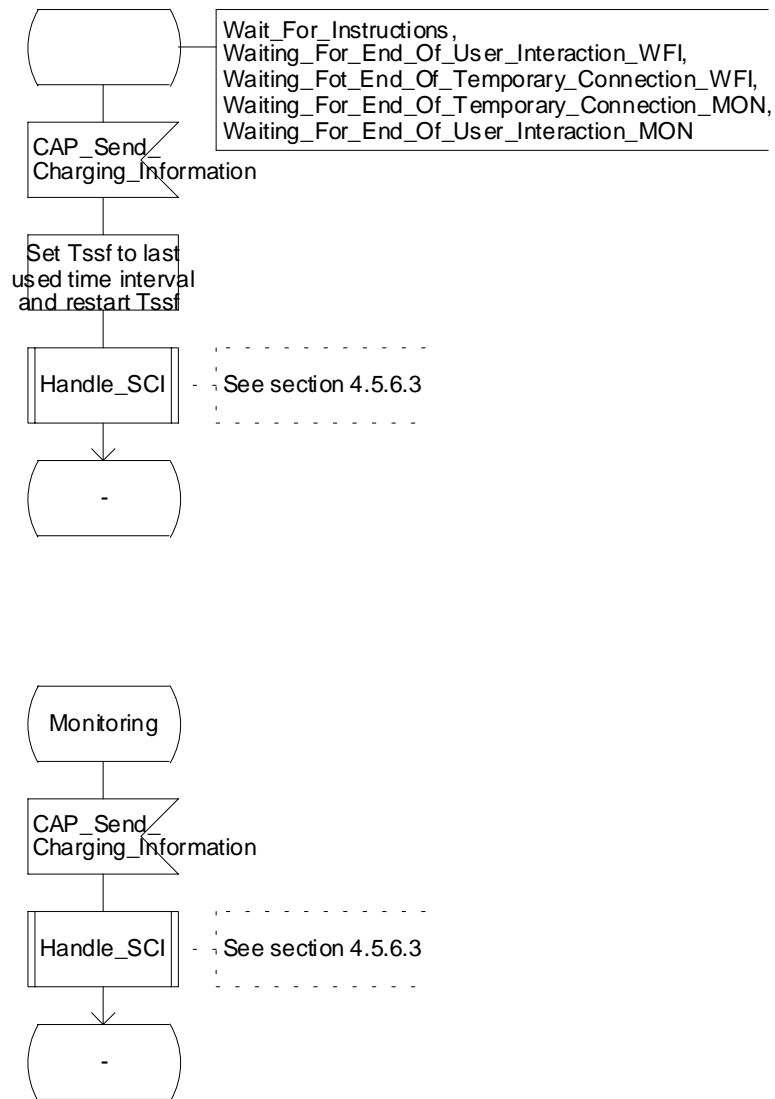


Figure 4.57ee: Process gsmSSF (sheet 31)

Process gsmSSF

32(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

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

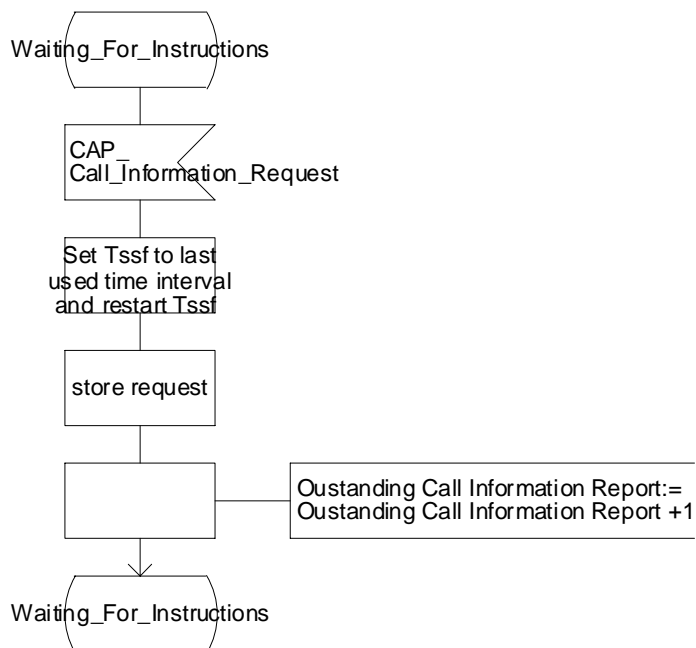


Figure 4.57ff: Process gsmSSF (sheet 32)

Process gsmSSF

33(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

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

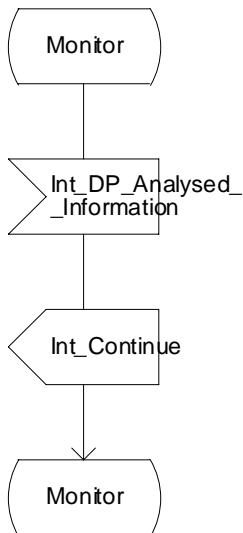


Figure 4.57gg: Process gsmSSF (sheet 33)

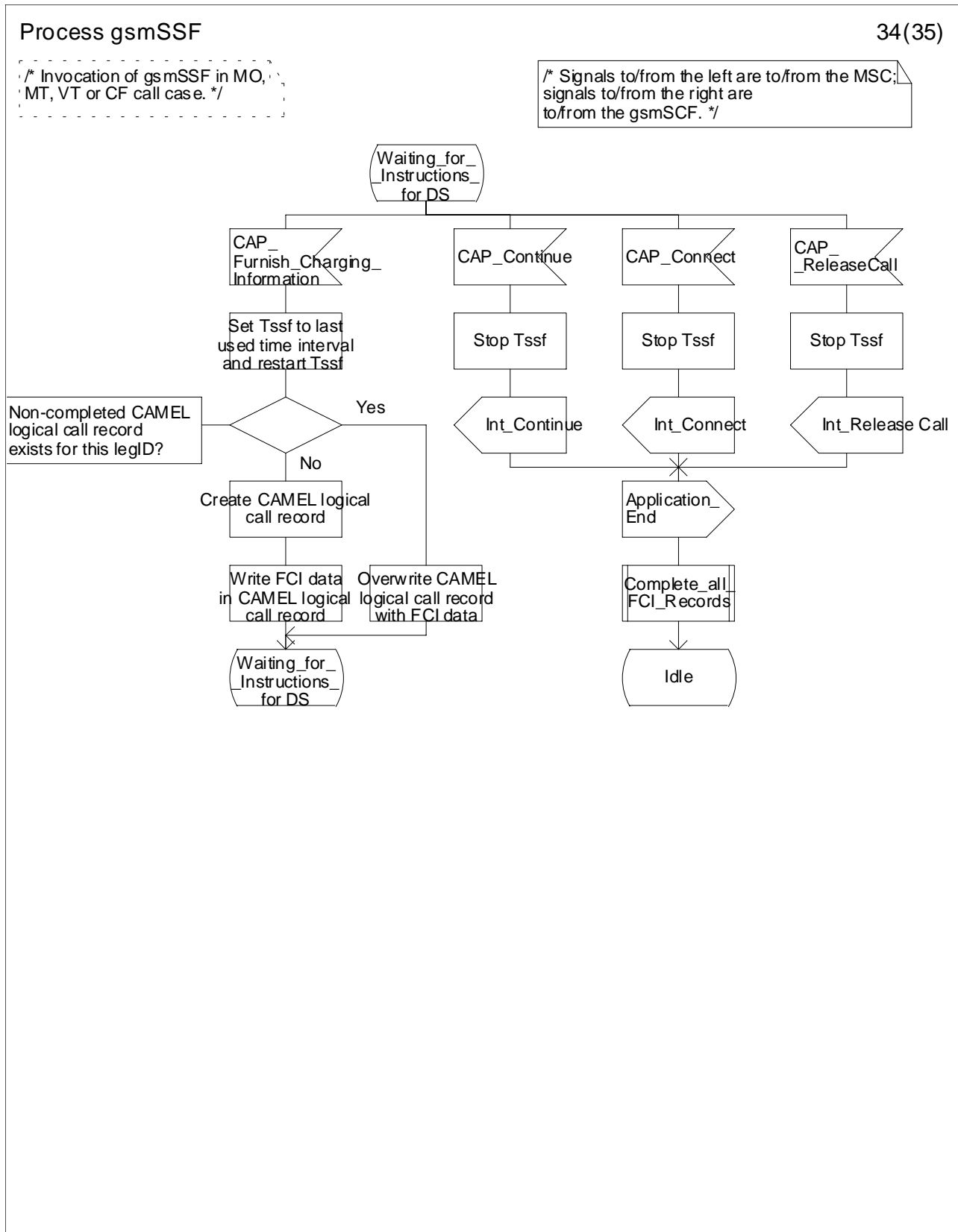


Figure 4.57hh: Process gsmSSF (sheet 34)

Process gsmSSF

35(35)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

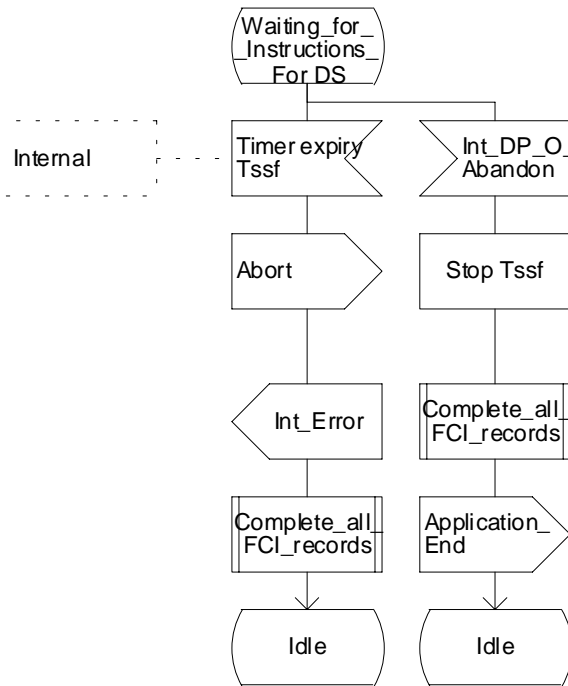


Figure 4.57ii: Process gsmSSF (sheet 35)

Procedure Check_Criteria_Collected_Info

1(1)

/* Procedure to check the criteria in the gsmSSF */

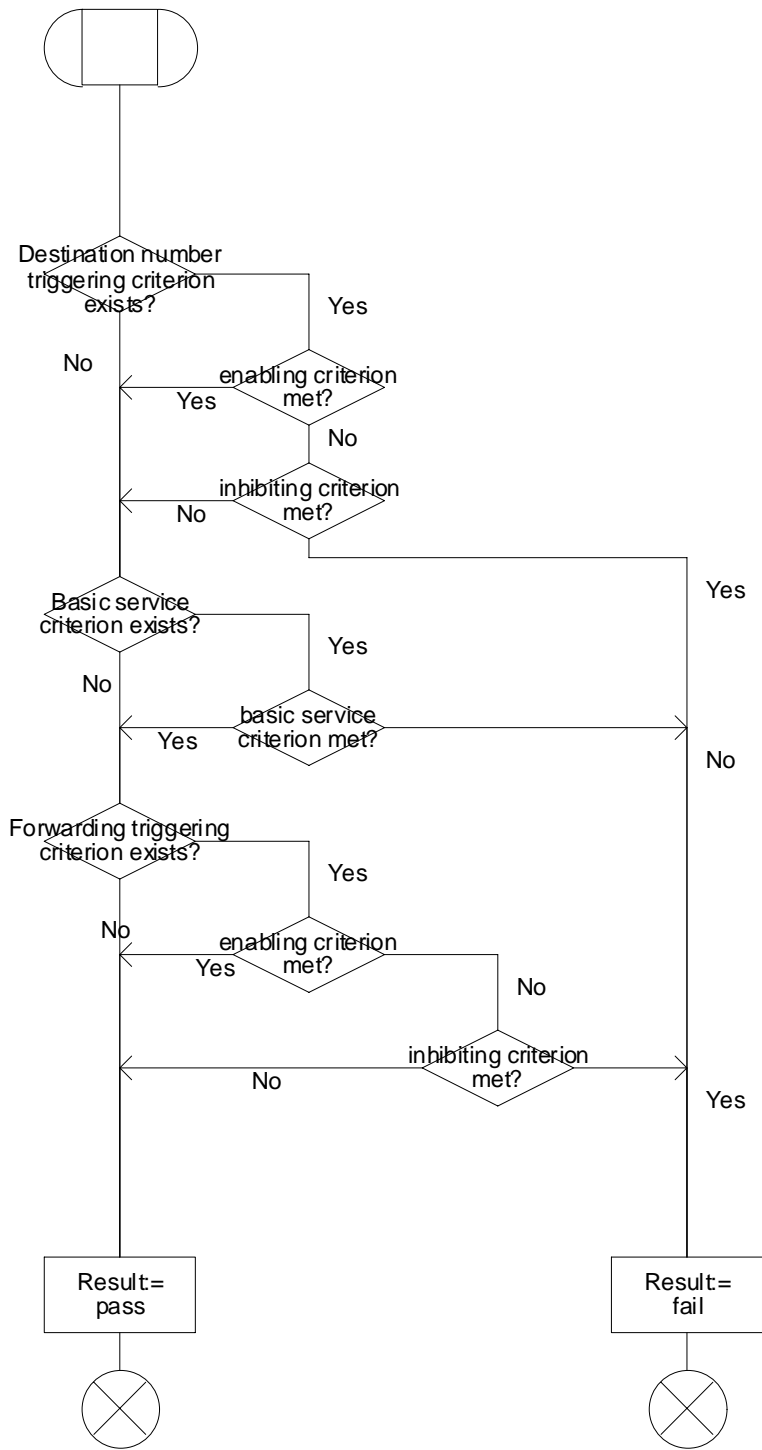


Figure 4.58a: Procedure Check_Criteria_Collected_Info(sheet 1)

Procedure Check_Criteria_Analysed_Info

1(1)

/* Procedure to check
the criteria in the gsmSSF */

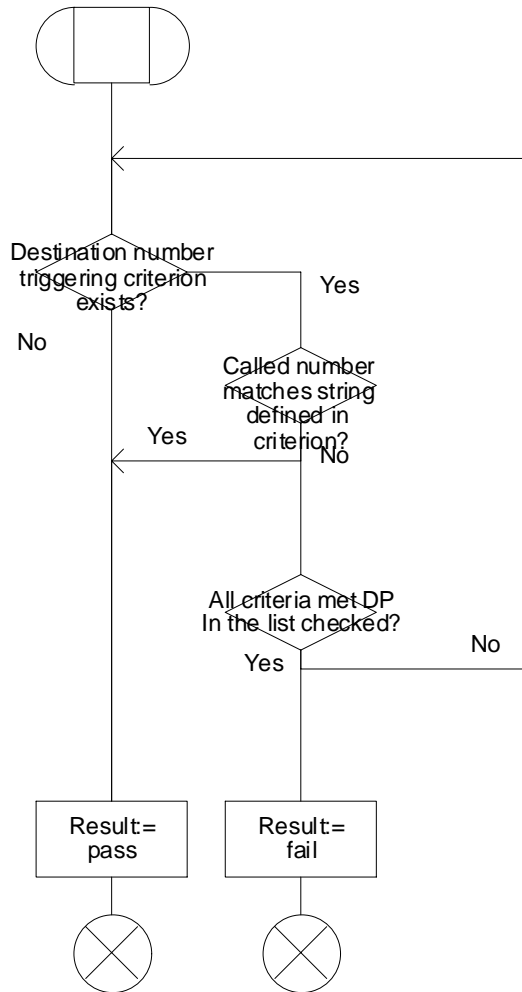


Figure 4.59a: Procedure Check_Criteria_Analysed_Info(sheet 1)

Procedure Check_Criteria_Unsuccessful

1(1)

/* Procedure to check
the criteria in the gsmSSF */

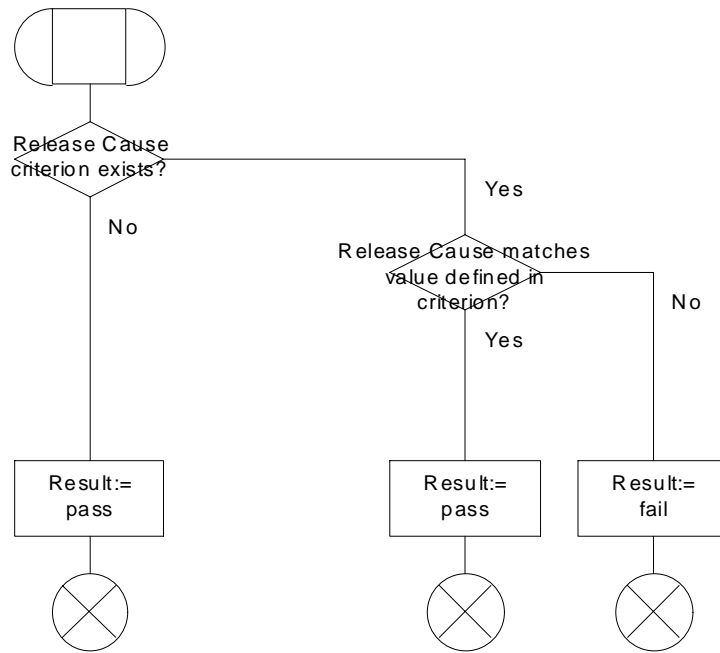


Figure 4.60a: Procedure Procedure Check_Criteria_Unsuccessful(sheet 1)

Procedure Connect_To_Resource

1(1)

This procedure is called, when the ConnectToResource request is received in Wfl or Mon state.

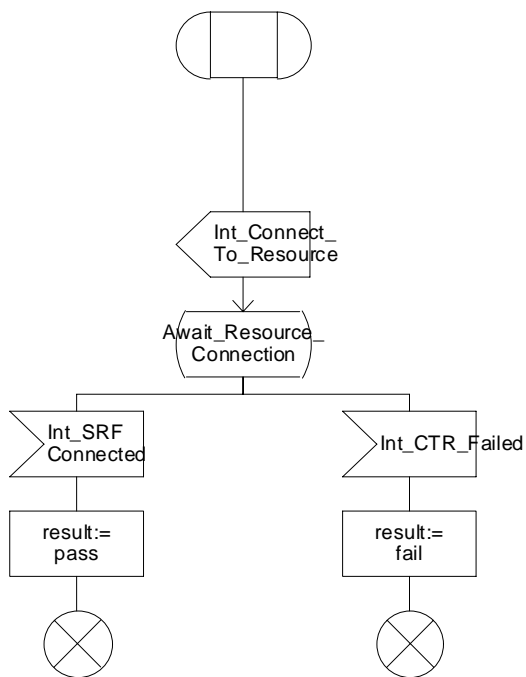


Figure 4.61a: Procedure Connect_To_Resource (sheet 1)

Procedure Handle_AC

1(1)

/* This procedure shows the handling in the gsmSSF for the operation CAP Apply Charging. */

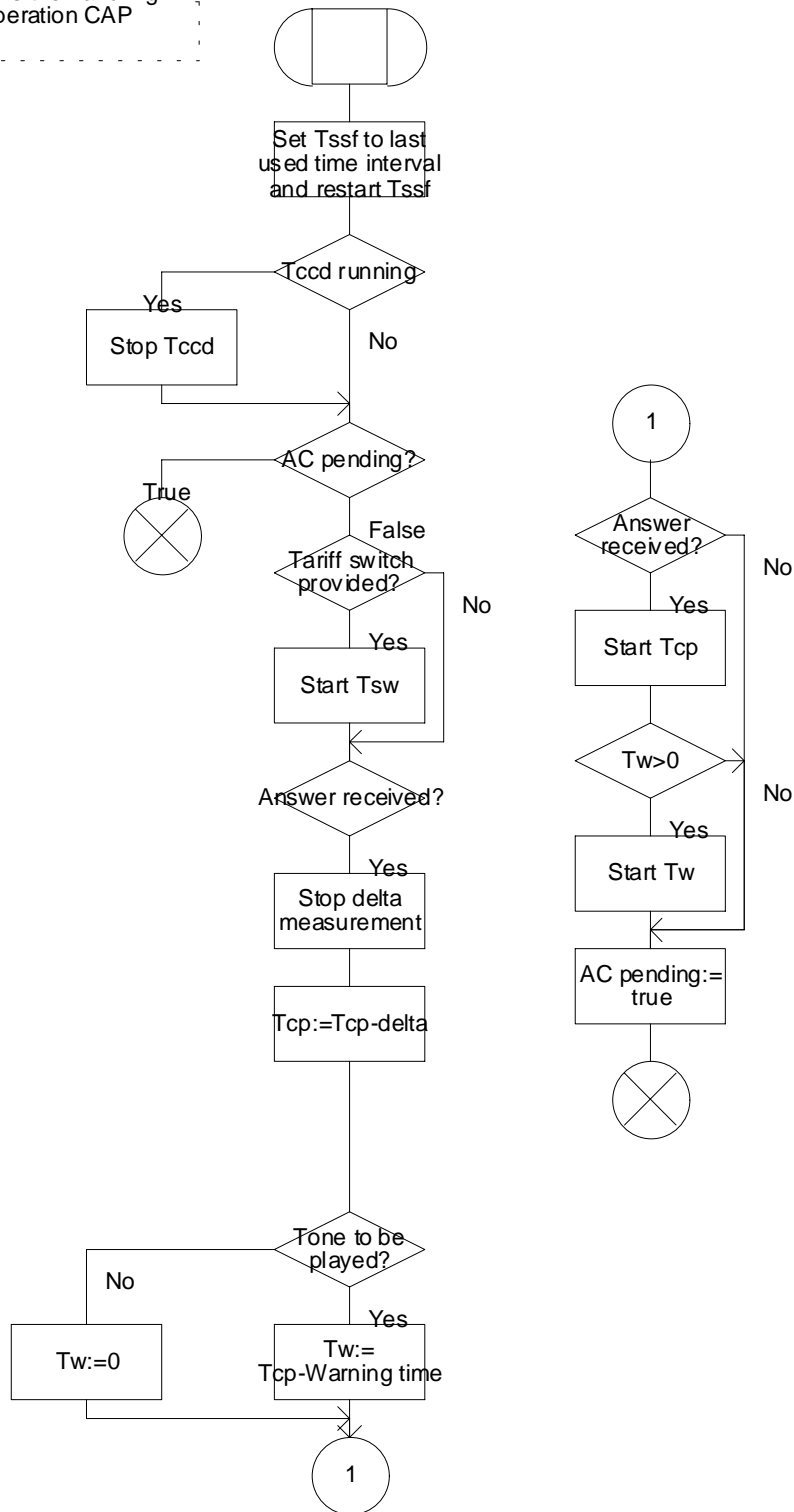


Figure 4.62a: Procedure Handle_AC (sheet 1)

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

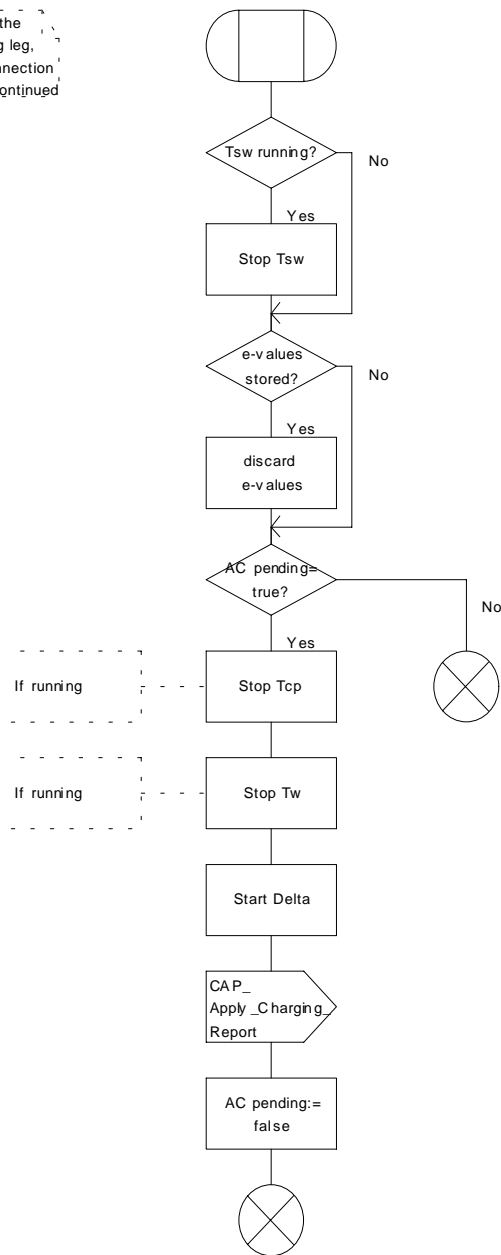


Figure 4.63a: Procedure Handle_ACR (sheet 1)

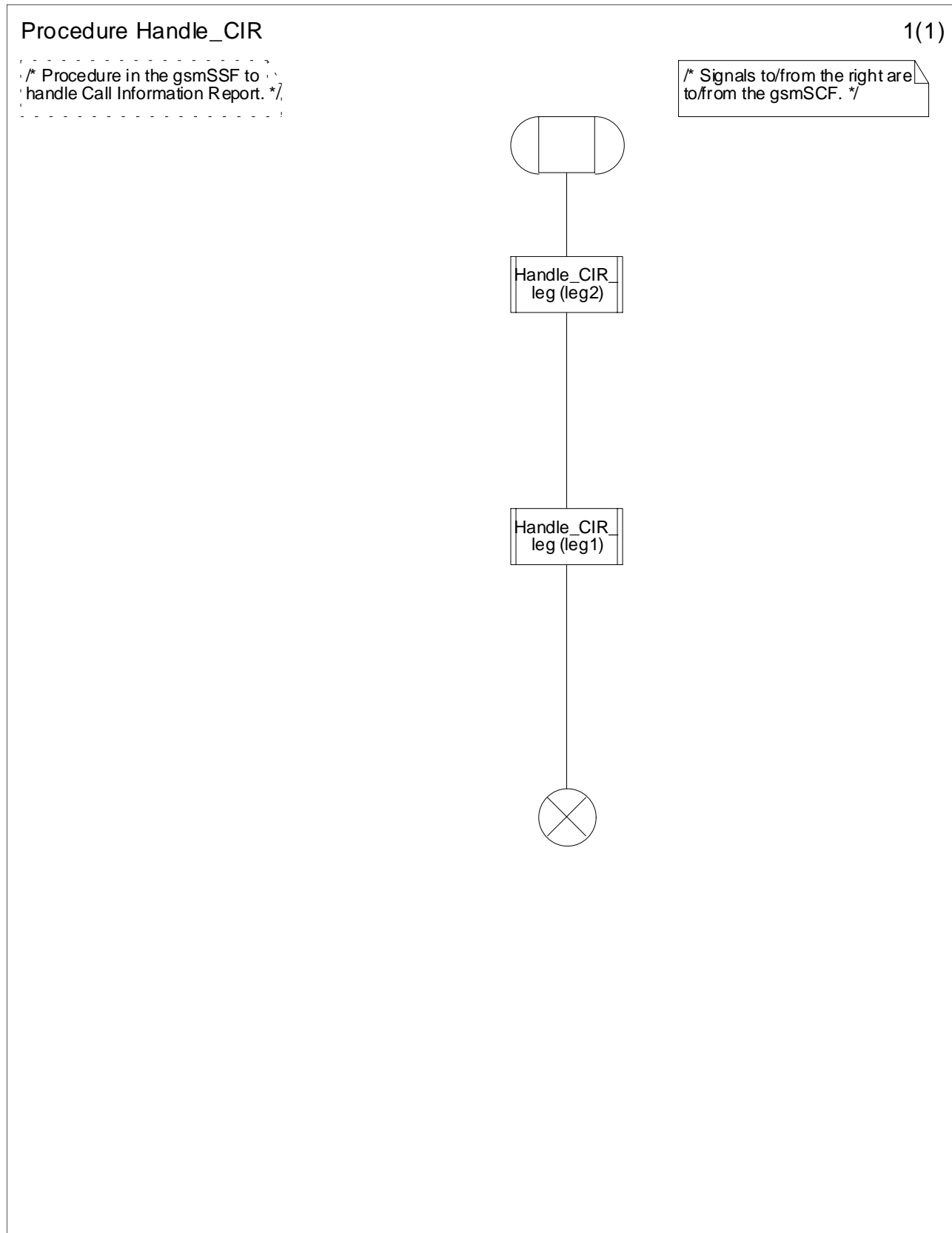


Figure 4.64a: Procedure Handle_CIR (sheet 1)

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 gsmSCF. */

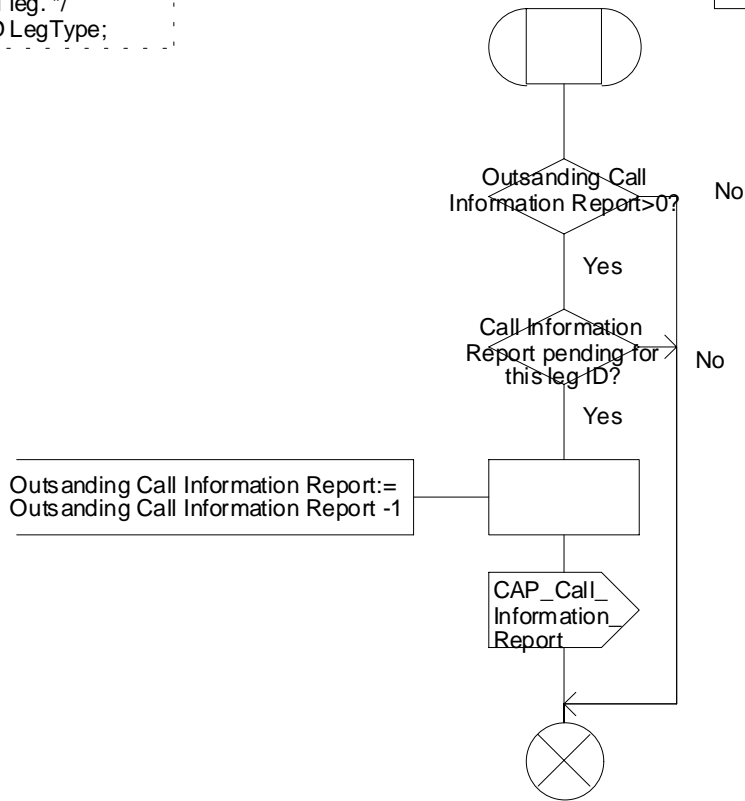


Figure 4.65a: Procedure Handle_CIR_leg (sheet 1)

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;

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

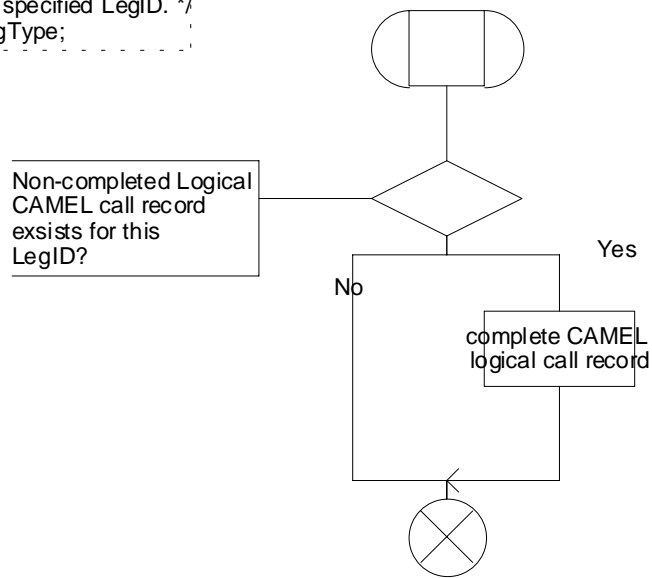


Figure 4.66a: Procedure Complete_FCI_record (sheet 1)

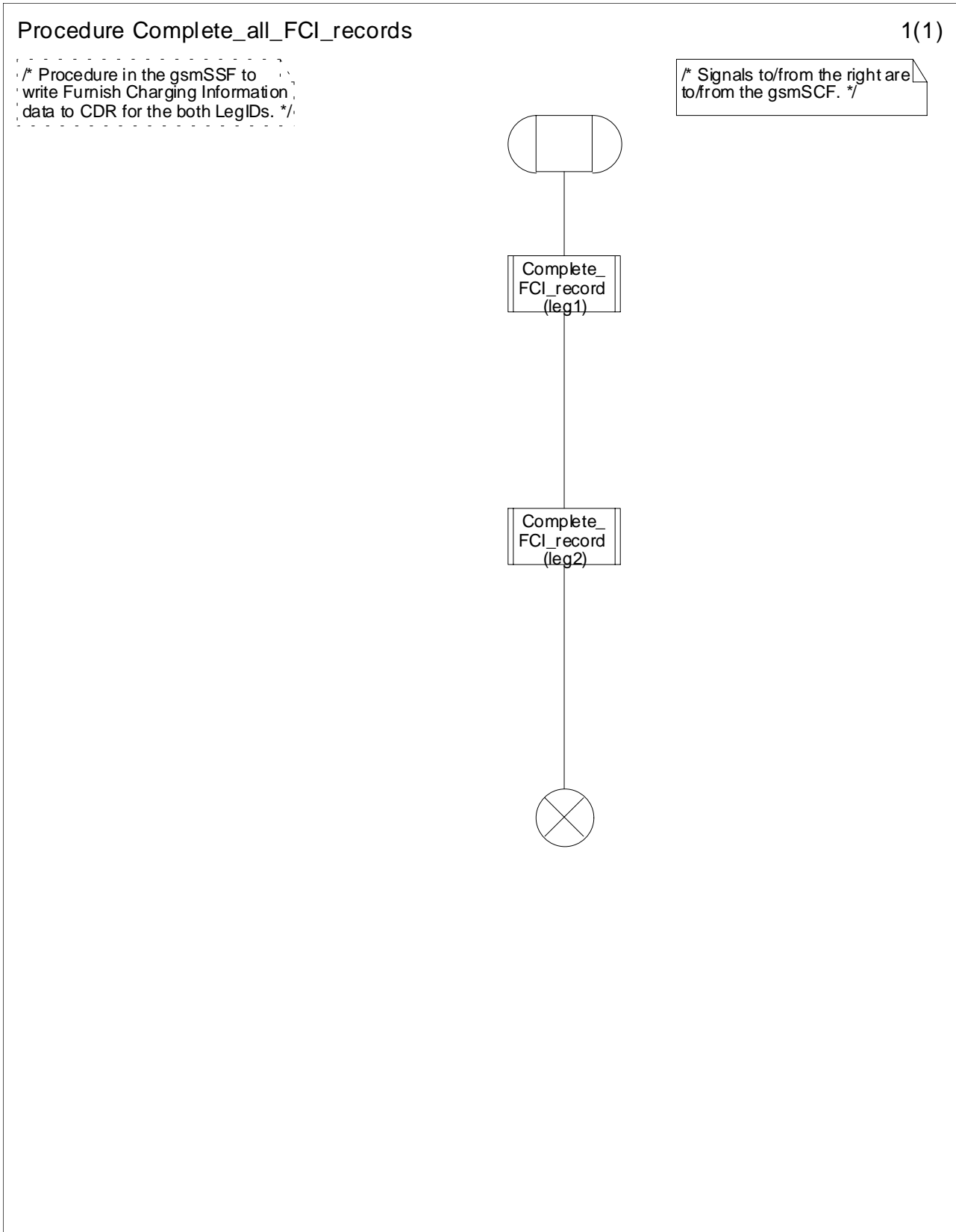


Figure 4.67a: Procedure Complete_all_FCI_records (sheet 1)

4.5.7 Assisting case

Assisting case involves the following processes :

- CAMEL_Assisting_MSC,
- Assisting_gsmSSF.

The detailed error handling for these 2 processes is specified in 3G TS 29.078 [5].

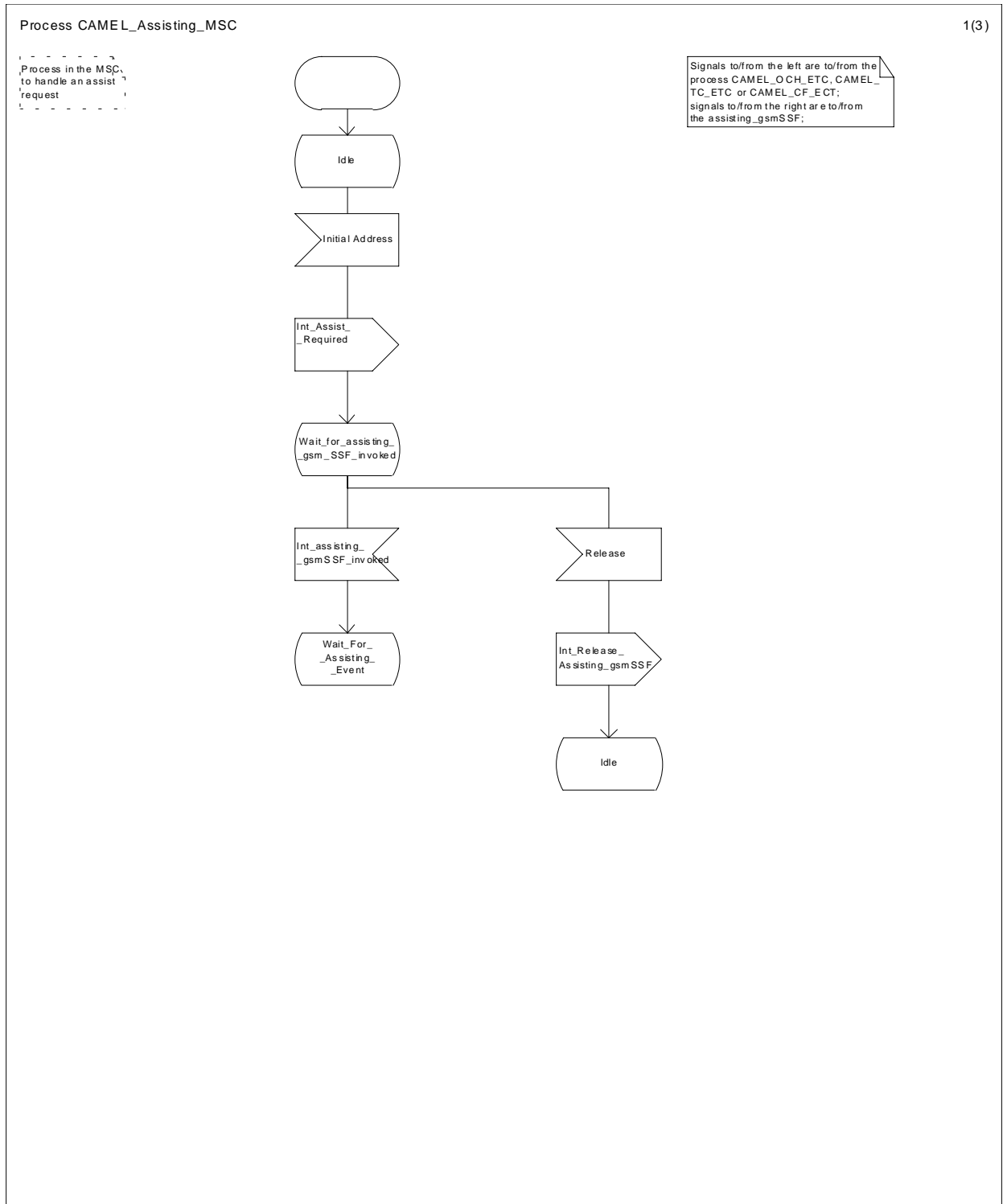


Figure 4.68a: Process CAMEL_Assisting_MSC (sheet 1)

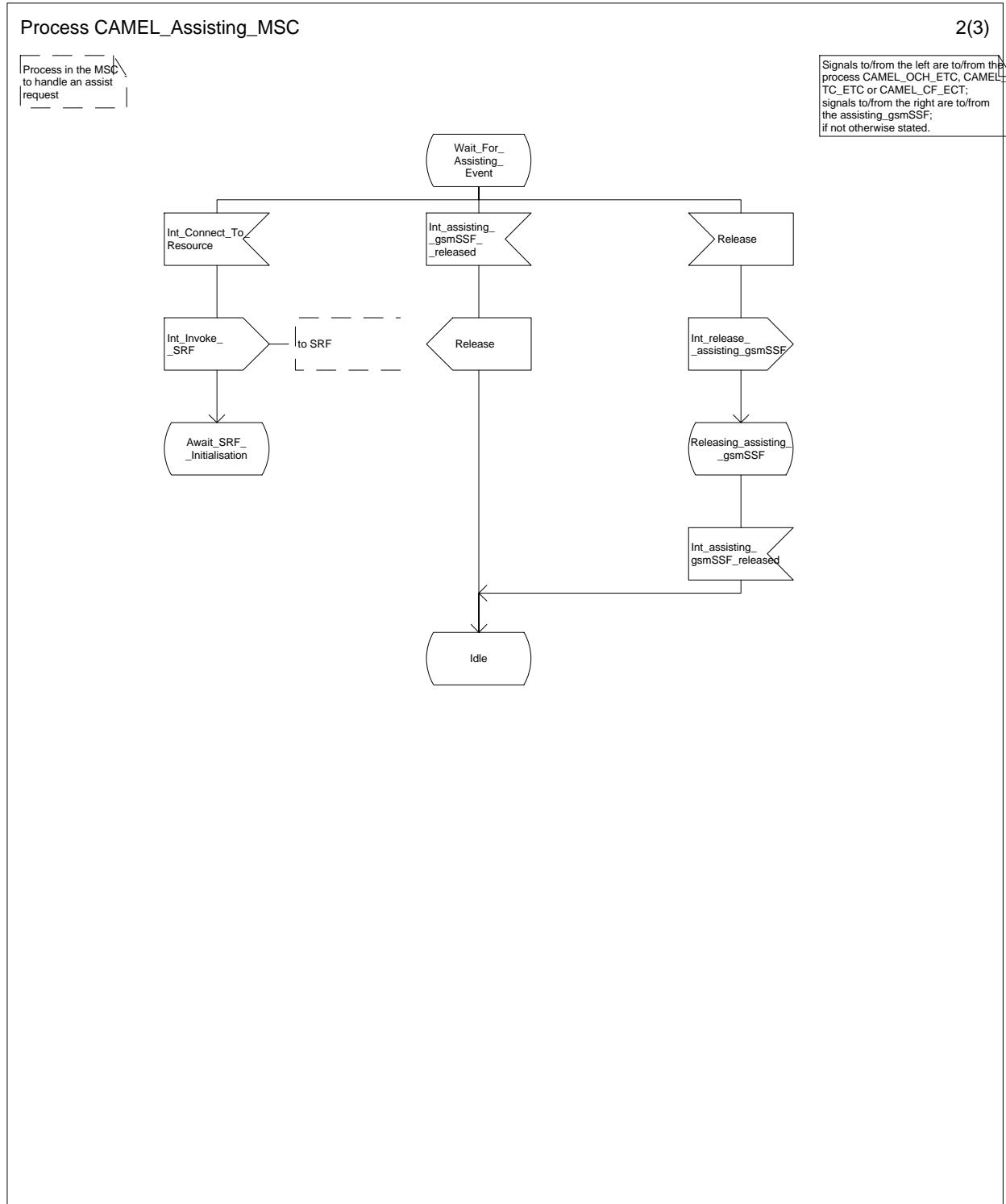


Figure 4.68b: Process CAMEL_Assisting_MSC (sheet 2)

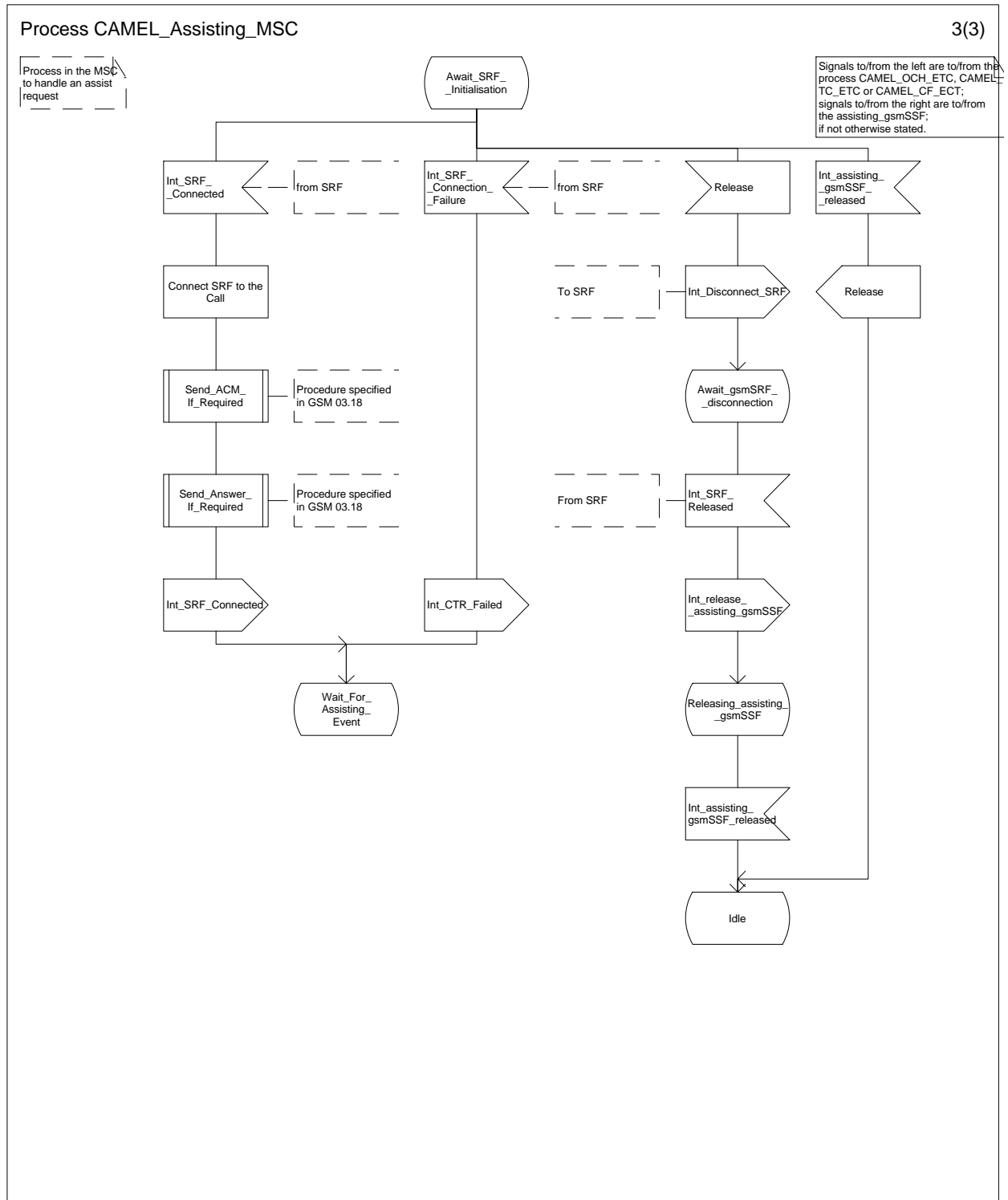


Figure 4.68c: Process CAMEL_Assisting_MSC (sheet 3)

Process assisting_gsmSSF

1(6)

/* Invocation of gsmSSF in MO, MT or CF call case. */

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
 */

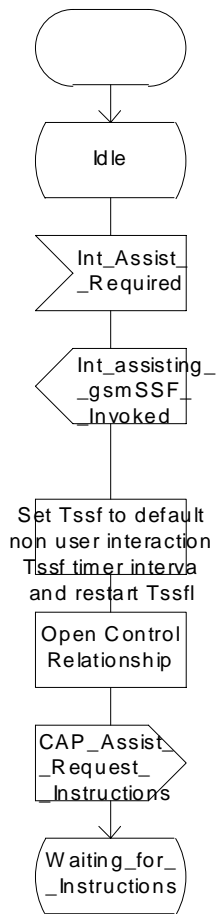


Figure 4.69a: Process Assisting_gsmSSF (sheet 1)

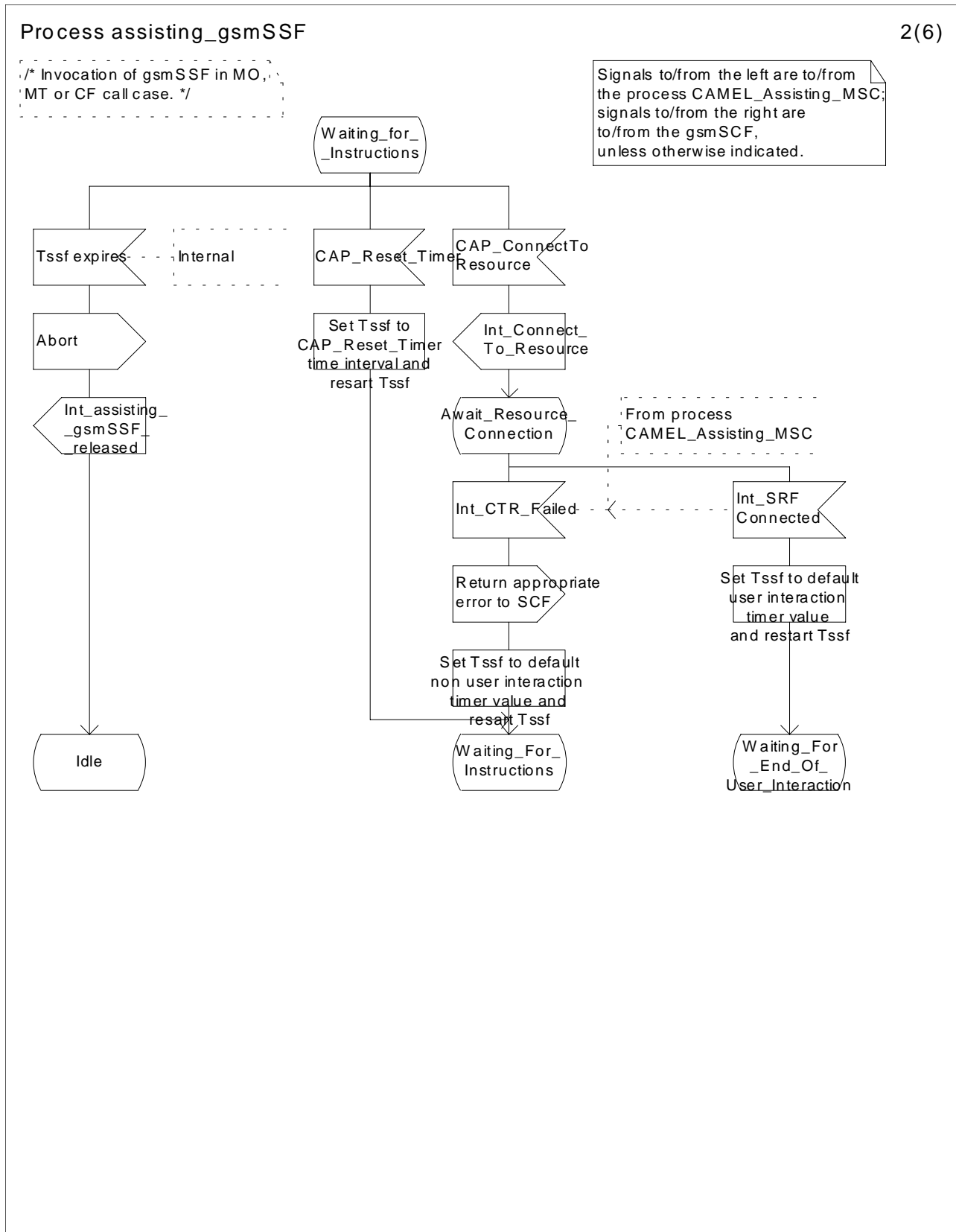


Figure 4.69b: Process Assisting_gsmSSF (sheet 2)

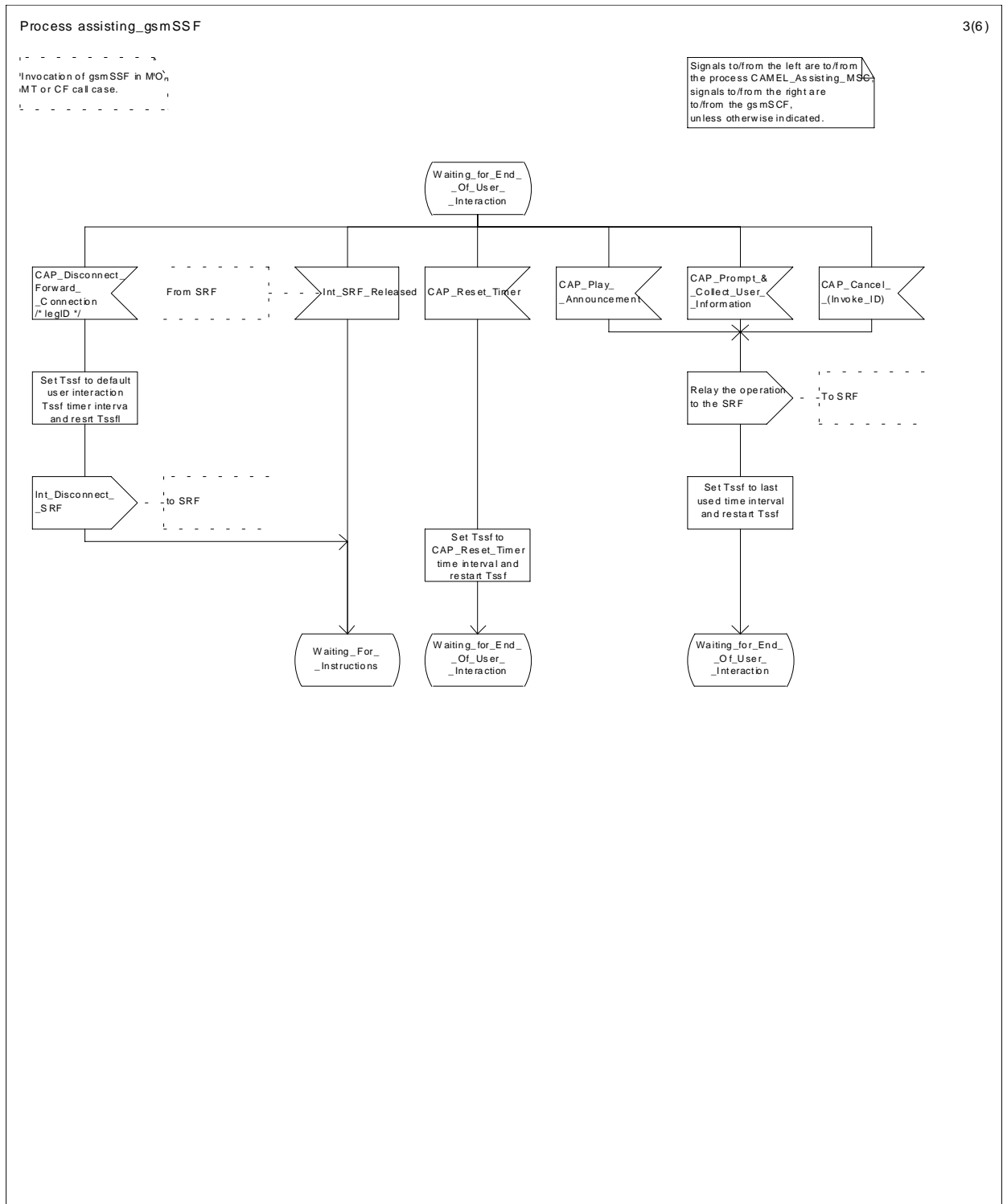


Figure 4.69c: Process Assisting_gsmSSF (sheet 3)

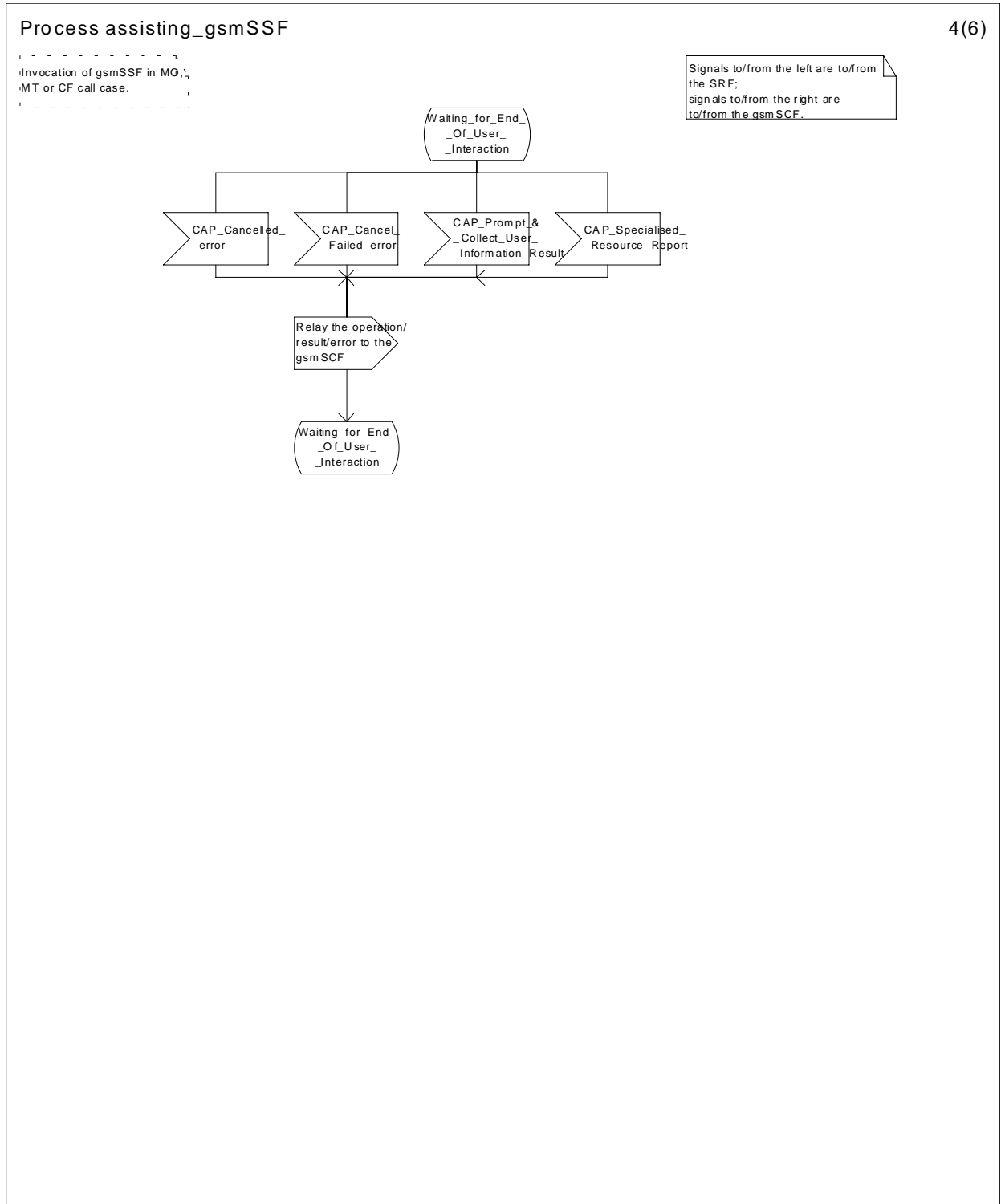


Figure 4.69d: Process Assisting_gsmSSF (sheet 4)

Process assisting_gsmSSF

5(6)

Invocation of gsmSSF in MO,
MT or CF call case.

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.

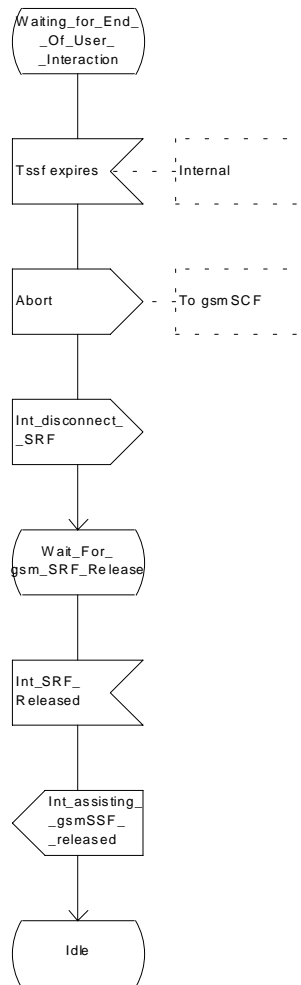


Figure 4.69e: Process Assisting_gsmSSF (sheet 5)

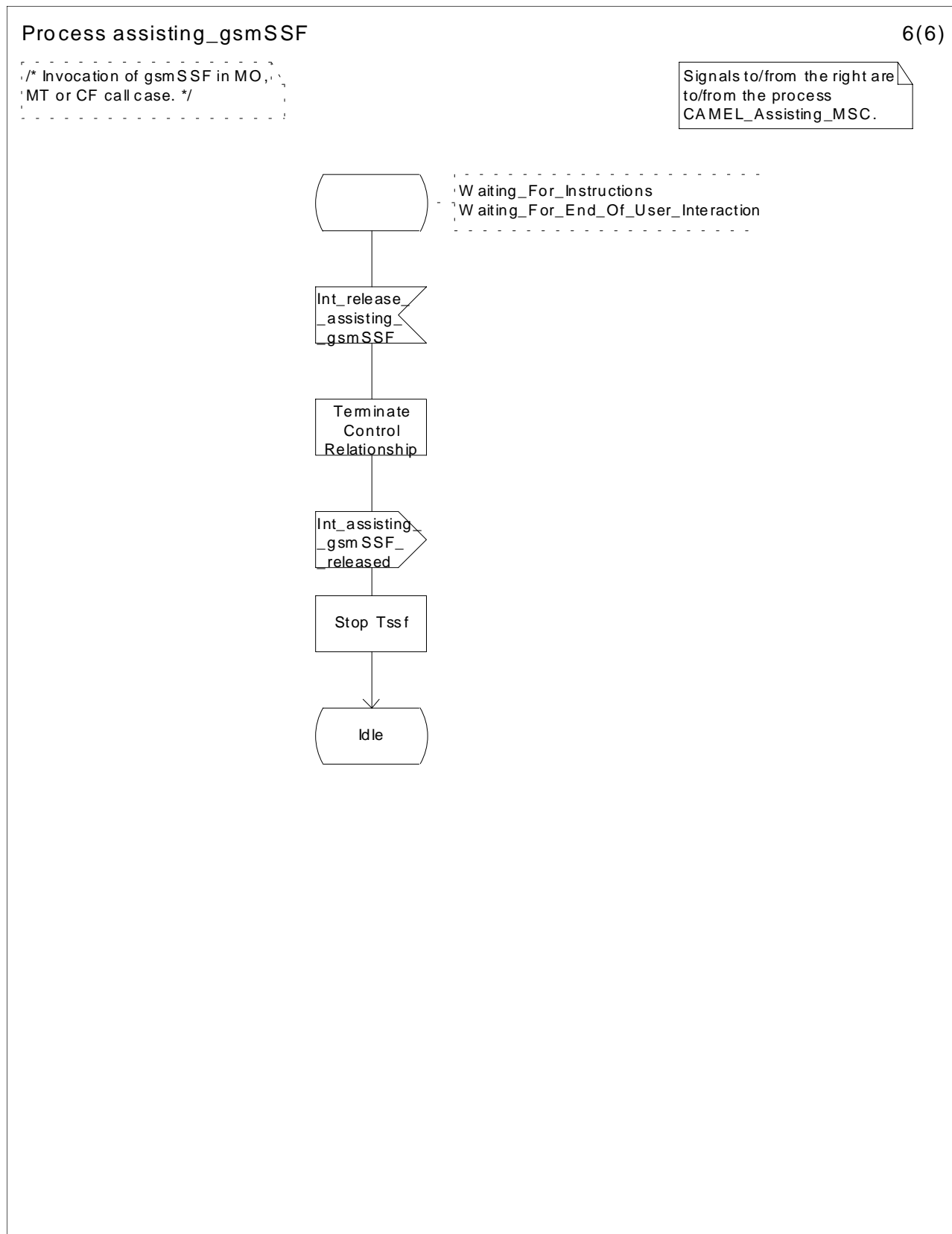


Figure 4.69f: Process Assisting_gsmSSF (sheet 6)

Procedure Handle_O_Answer

1(1)

/* Procedure in the gsmSSF to handle notification of originating answer from the MSC */

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

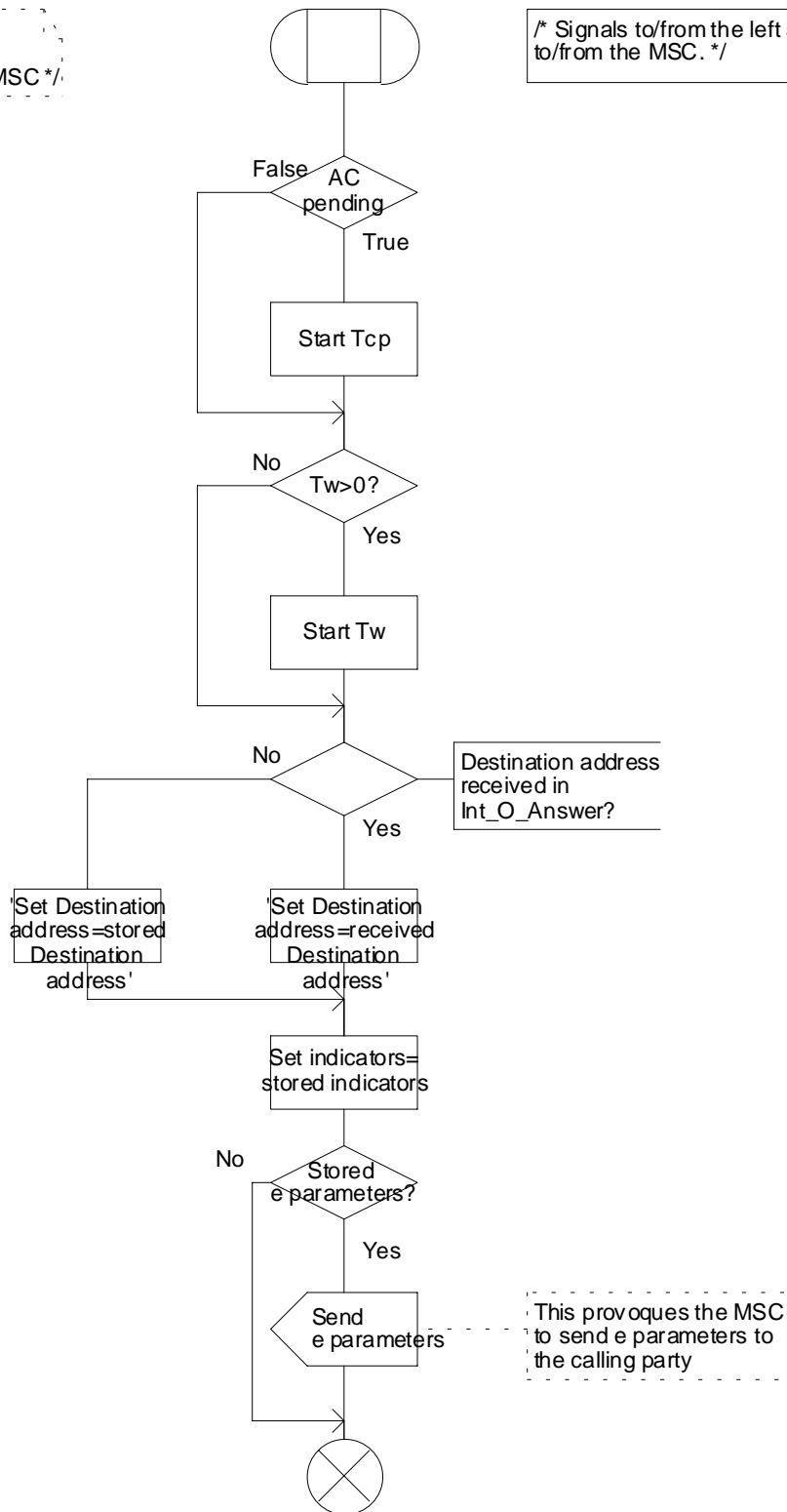


Figure 4.70a: Procedure Handle_O_Answer (sheet 1)

Procedure Handle_T_Answer

1(1)

/ Procedure in the gsmSSF to handle notification of terminating answer from the MSC */*

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

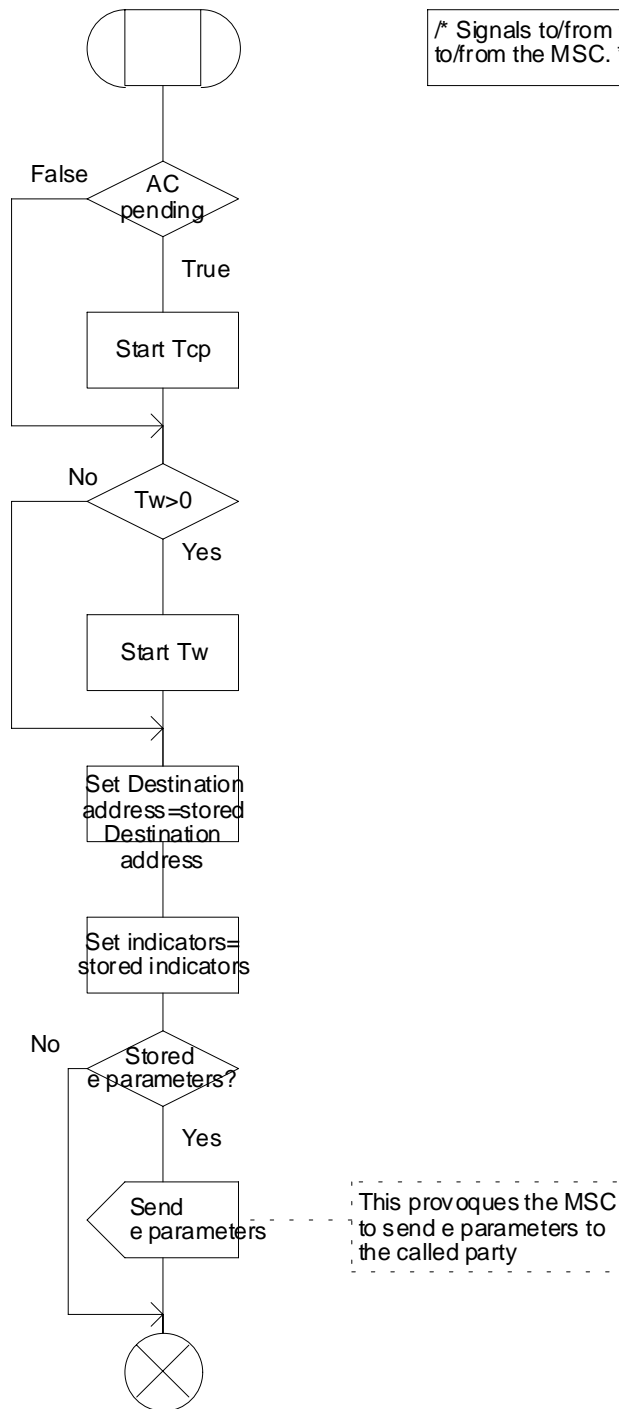


Figure 4.71a: Procedure Handle_T_Answer (sheet 1)

4.5.8 Procedure CAMEL_Provide_Subscriber_Info

4.5.8.1 MS reachable

A Provide_Subscriber_Info Request is sent to VLR and the HLR waits in state Wait_For_Information.

If the VLR returns a Provide_Subscriber_Info ack, the HLR uses the returned information to set the Subscriber Info to be returned to the gsmSCF. As a network option, the HLR may use the returned Cell Id or Location Area to derive the location number and/or Geographical Info. The mapping from cell ID and location area to location number is network-specific and outside the scope of the GSM standard.

NOTE: The handling in the VLR of Provide_Subscriber_Info Request is defined in 3G TS 23.018 [3].

4.5.8.2 MS not reachable

4.5.8.2.1 Location Information requested

If VLR number is available in the HLR, then the Location Information is set to this parameter only.

If location information is not available in the HLR, no location information is set.

4.5.8.2.2 Subscriber State requested

The Subscriber State is set to "Network determined not reachable".

4.5.8.3 Actions at state Wait_For_Information

The following actions are possible in state Wait_For_Information depending on the result of the Provide_Subscriber_Info Request sent to VLR.

4.5.8.3.1 Provide_Subscriber_Info ack

The Location Information or/and the Subscriber State are set to the received information.

4.5.8.3.2 Provide_Subscriber_Info Negative Response

If location information was requested the VLR number is provided as location information. If the subscriber state was requested the subscriber state is set to "not provided from VLR".

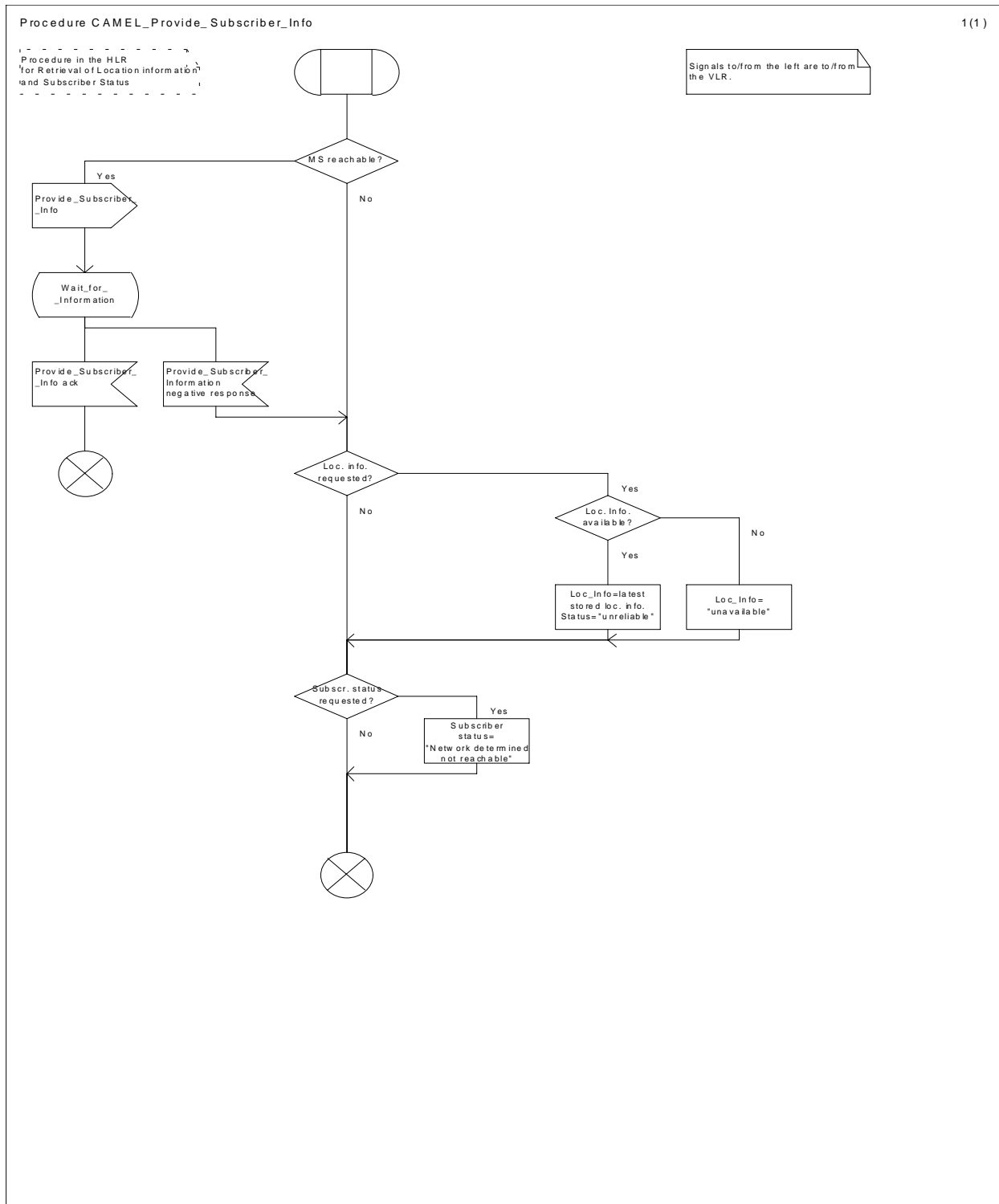


Figure 4.72a: Procedure CAMEL_Provide_Subscriber_Info (sheet 1)

4.5.9 CAMEL specific handling of location updating and data restoration

When requesting location updating or data restoration the VLR shall indicate to the HLR which CAMEL phases it supports.

The CAMEL phase 2 HLR shall then send to the VLR CAMEL subscription data for one of the CAMEL phases supported by the VLR or, if some different handling is required, data for substitute handling.

When 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 now 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.

4.5.10 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.

4.5.11 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 NA Carrier Information 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 NA 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.

Each Information Element, IE is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-) for each different traffic case, Mobile Originating call (MO), Mobile Forwarded call (MF), Mobile Terminating call in the GMSC (MT) and Mobile Terminating call in the VMSC (VT). This categorisation is a functional classification, i.e., stage 2 information and not a stage 3 classification to be used for the ASN.1 syntax of the protocol. This distinction between MO, MF, and MT and VT 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 a 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 3G TS 29.078.

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

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Call Result	M	M	M	M	This IE contains the charging information to be provided by the gsmSSF.

M Mandatory (The IE shall always be sent)

Call Result contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Time Duration Charging Result	M	M	M	M	This IE is a list defined in the next table.

M Mandatory (The IE shall always be sent)

Time Duration Charging Result contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Time Information	M	M	M	M	This IE is a choice between Time if No Tariff Switch and Time if Tariff Switch.
Party To Charge	M	M	M	M	This IE is received in the related ApplyCharging operation to correlate the result to the request. This IE shall be a copy of the corresponding IE received in the Apply Charging operation.
Call Active	M	M	M	M	This IE indicates whether the call is active or not.
Call Released at Tcp Expiry	C	C	C	C	This element is an indication that the gsmSSF has released the call and terminated the dialogue, due to Tcp expiry. It shall be present when ACR is sent due to Tcp expiry and the gsmSSF has released the call (because 'ReleaselfExceeded' was present in ACH operation). In all other circumstances, this element shall be absent.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

Time Information contains one of the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Time If No Tariff Switch	C	C	C	C	This IE will be present if no tariff switch has occurred since the detection of Answer for the connection to the Called Party, the Temporary Connection, or the SRF connection, otherwise it will be absent.
Time If Tariff Switch	C	C	C	C	This IE will be present if a tariff switch has occurred since the detection of Answer for the connection to the Called Party, the Temporary Connection, or the SRF connection, otherwise it will be absent.

C Conditional (The IE shall be sent, if available)

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 to the gsmSCF as requested from the gsmSCF in a previous Call Information Request.

4.6.1.3.2 Information Elements

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Requested Information List	M	M	M	M	This IE specifies a list of Requested information Values which are requested.
Leg ID	M	M	M	M	This IE indicates the party in the call for which information shall be collected. When absent, it indicates the 'outgoing' leg created with Connect, Continue or Continue With Argument.

M Mandatory (The IE shall always be sent)

4.6.1.4 Event Report BCSM

4.6.1.4.1 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.

4.6.1.4.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Event type BCSM	M	M	M	M	This IE specifies the type of event that is reported.
Event Specific Information BCSM	C	C	C	C	This IE indicates the call related information specific to the event.
Leg ID	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	This IE indicates the DP type.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

Event Specific Information BCSM contains the following information for the O Answer and T Answer cases:

Information element name	MO	MF	MT	VT	Description
Destination address	M	M	M	M	This IE specifies the destination address for the call leg.
OR	-	C	C	-	This IE indicates that the call was subject to basic Optimal Routeing as specified in GSM 03.79.
Forwarded call	-	M	C	C	This IE indicates that the call has been subject to GSM call forwarding.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent if its value is True, otherwise it shall not be sent)

- Not applicable

4.6.1.5 Initial DP

4.6.1.5.1 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.

4.6.1.5.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Additional Calling Party Number	-	C	C	C	The calling party number provided by the access signalling system of the calling user.
Bearer Capability	M	C	C	C	This IE indicates the type of the bearer capability connection to the user.
Called Party Number	-	M	M	M	This IE contains the number used to identify the called party in the forward direction. For the VT calls this is the MSISDN received in the Provide Roaming Number; if the MSISDN is not available, the basic MSISDN is used.
Called Party BCD Number	M	-	-	-	This IE contains the number used to identify the called party in the forward direction. 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.
Calling Party Number	M	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	Indicates the type of calling party (e.g., operator, pay phone, ordinary subscriber).

Information element name	MO	MF	MT	VT	Description
Call Reference Number	M	M	M	M	<p>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.</p> <p>For MO calls, the call reference number is set by the serving VMSC and included in the MO call record.</p> <p>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.</p> <p>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.</p> <p>For CF calls, the call reference number is set by the GMSC and included in the CF record in the forwarding MSC.</p>
Cause	C	C	C	C	<p>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 SCF to decide about the further handling of the call.</p>
Event Type BCSM	M	M	M	M	<p>This IE indicates the armed BCSM DP event, resulting in the Initial DP IF.</p>
Ext-Basic Service Code	C	C	C	C	<p>This IE indicates the type of basic service i.e., teleservice or bearer service.</p>
High Layer Compatibility	C	C	C	C	<p>This IE indicates the type of the high layer compatibility, which will be used to determine the ISDN-teleservice of a connected ISDN terminal.</p>
IMSI	M	M	M	M	<p>This IE identifies the mobile subscriber.</p>
IP SSP Capabilities	C	C	C	C	<p>This IE indicates which SRF resources are supported within the gsmSSF and are available. If this IE is absent, this indicates that no gsmSRF is attached and available.</p>
Location Information	M	-	C	M	<p>This IE is described in the next table.</p>
Location Number	M	C	C	C	<p>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 incoming ISUP signalling.</p>
MSC Address	M	M	M	M	<p>For MO calls, the MSC Address carries the international E.164 address of the serving VMSC.</p> <p>For MT calls, the MSC Address carries the international E.164 address of the GMSC.</p> <p>For VT calls, the MSC Address carries the international E.164 address of the serving VMSC.</p> <p>For CF calls, the MSC Address carries the international E.164 address of the forwarding MSC.</p>
GMSC Address	-	M	-	M	<p>For CF calls, the GMSC Address carries the international E.164 address of the GMSC.</p> <p>For VT calls, the GMSC Address carries the international E.164 address of the GMSC.</p>

Information element name	MO	MF	MT	VT	Description
NA Carrier Information	C	C	C	C	<p>The content of this IE is described in the next table.</p> <p>The IE may be sent when the VPLMN and the HPLMN of the subscriber are both North American.</p> <p>For MO calls, this IE shall contain any carrier that was dialed by the calling subscriber. If no carrier was dialed, the IE shall contain the calling subscriber's subscribed carrier.</p> <p>For MT and VT calls, the IE shall contain the carrier subscribed to by the called subscriber.</p> <p>For CF calls, the IE shall contain the carrier subscribed to by the forwarding subscriber.</p>
Original Called Party ID	-	C	C	C	This IE carries the dialed digits if the call has met call forwarding on the route to the gsmSSF.
Redirecting Party ID	-	M	C	C	This IE indicates the directory number the call was redirected from.
Redirection Information	-	M	C	C	This IE contains forwarding related information, such as redirection counter.
Service Key	M	M	M	M	This IE identifies for the gsmSCF the requested set of one or more CAMEL services. It is used to address the correct application/SLP within the gsmSCF.
Subscriber State	-	-	C	C	<p>This IE indicates the status of the MS. The states are:</p> <ul style="list-style-type: none"> - CAMELBusy: The MS is engaged on a transaction for a mobile originating or terminated circuit-switched call. - NetworkDeterminedNotReachable: The network can determine from its internal data that the MS is not reachable. - AssumedIdle: The state of the MS is neither "CAMELBusy" nor "NetworkDeterminedNotReachable". - Not provided from VLR.
Time And Timezone	M	M	M	M	This IE contains the time that the gsmSSF was triggered, and the time zone the gsmSSF resides in.
GSM Forwarding Pending	-	-	C	C	This parameter indicates that a forwarded-to-number was received and the call will be forwarded due to GSM supplementary service call forwarding in the GMSC/VMSC.
Service Interaction Indicators Two	C	C	C	C	This IE is sent if it is received in the ISUP message or due to previous CAMEL processing. The IE is described in a table below.
CUG Information	-	C	C	C	See 3G TS 23.085 [9] for details of this IE.
CUG Index	C	-	-	-	See 3G TS 23.085 [9] for details of this IE.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

- Not applicable

Location Information contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Location Number	-	-	C	C	See 3G TS 23.018 [3].
CellIdOrLAI	M	-	C	C	See 3G TS 23.018 [3].
Geographical Information	C	-	C	C	See 3G TS 23.018 [3].
Geodetic Information	C	-	C	C	See 3G TS 23.018 [3].
Age Of Location Information	M	-	C	C	See 3G TS 23.018 [3].
VLR number	M	-	C	M	See 3G TS 23.018 [3].
Selected LSA Identity	C	-	C	C	This IE indicates the LSA identity associated with the current position of the MS. Send if the LSA ID of subscription and LSA ID of the used cell matches. In the case of multiple matches the one with the highest priority is sent. See 3G TS 23.073 [23]. The IE shall only be sent, if SoLSA is supported.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available. Further conditions are in the description column.)

- Not applicable

NA Carrier Information contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
NA Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
NA Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: – dialled – subscribed

M Mandatory (The IE shall always be sent)

Service Interaction Indicators Two contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Forward Service Interaction Indicator	C	C	C	C	This IE is described in a table below.
HOLD Treatment Indicator	C	C	C	C	This IE indicates whether the CAMEL subscriber can invoke HOLD for the call.
CW Treatment Indicator	C	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	C	This IE indicates whether the call leg can become part of an ECT call initiated by the calling subscriber.
Call Completion Treatment Indicator	C	C	C	C	This IE indicates whether a CCBS request can be made for the call.

C Conditional (The IE shall be sent, if available)

- Not applicable

Forward Service Interaction Indicator contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Conference Treatment Indicator	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	This IE indicates whether the call can be forwarded using the Call Forwarding or Call Deflection Supplementary Services.

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 the 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 for interacting from the gsmSCF with the gsmSSF charging mechanisms to control the call duration.

4.6.2.2.2 Information Elements

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
ACh Billing Charging Characteristics	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	This IE shall be reflected in the corresponding IE of the Apply Charging Report operation. This IE has no effect on the charging procedures in the MSC.

M Mandatory (The IE shall always be sent)

ACh Billing Charging Characteristics contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Time Duration Charging	M	M	M	M	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

Time Duration Charging contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Max Call Period Duration	M	M	M	M	This IE indicates the maximum call period duration timer.
Tariff Switch Interval	O	O	O	O	This IE indicates the tariff switch time until the next tariff switch applies.
Release If Duration Exceeded	O	O	O	O	This IE indicates that the call shall be released when the Max call Period Duration expires, with a warning tone if the Play Tone IE is present. The cause used in the release message shall be "normal unspecified". Default is to continue the call.
Play Tone	O	-	O	O	This IE is set if a tone has to be played to the party for whom the BCSM is operating. If present, this IE indicates that 30 seconds before the Max Call Period Duration timer expires, a triple tone of 900 Hz (200 milliseconds tone, 200 milliseconds pause) shall be played.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

- Not applicable

4.6.2.3 Call Information Request

4.6.2.3.1 Description

This IF is used to request the gsmSSF to record specific information about a single call and report it to the gsmSCF (with a CallInformationReport)

4.6.2.3.2 Information Elements

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Requested Information Type List	M	M	M	M	This IE specifies a list of specific items of information which are requested.
Leg ID	M	M	M	M	This IE indicates the party in the call for which information shall be collected. When absent, it indicates the 'outgoing' leg created with Connect, Continue or Continue With Argument.

M Mandatory (The IE shall always be sent)

Requested Information Type List contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Call Attempt Elapsed Time	O	O	O	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	O	O	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	O	O	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 IDP and the release of that party
Release Cause	O	O	O	O	This IE indicates that the Release Cause is requested in the Call Information Report. Release Cause is the release cause for the call.

O Optional (Service logic dependent)

4.6.2.4 Cancel

4.6.2.4.1 Description

This IF is used by the gsmSCF to request the gsmSSF to cancel all EDPs and reports.

4.6.2.4.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
All Requests	M	M	M	M	This IE indicates that all active requests for EventReportBCSM, ApplyChargingReport and CallInformationReport shall be cancelled.

M Mandatory (The IE shall always be sent)

4.6.2.5 Connect

4.6.2.5.1 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.

4.6.2.5.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Alerting Pattern	-	-	O	O	This parameter indicates the kind of Alerting Pattern to be applied.
Calling Partys Category	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	This IE contains the called party number towards which the call is to be routed.
Generic Number	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.
NA Carrier Information	O	O	O	O	This IE is described in the next table.
NA Originating Line Information	O	O	O	O	This IE identifies the type of number in the NA Charge Number (e.g. subscriber versus PLMN operator number).
NA Charge Number	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	This IE carries the dialled digits if the call has met call forwarding on route to the gsmSSF or is forwarded by the gsmSCF.
Redirecting Party ID	O	O	O	O	This IE indicates the directory number the call was redirected from.
Redirection Information	O	O	O	O	This IE contains forwarding related information, such as redirecting counter.
Suppression Of Announcements	-	-	O	O	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed.
Service Interaction Indicators Two	O	O	O	O	This IE is described in a table below.
CUG Interlock Code	O	O	O	O	See 3G TS 23.085 [9] for details of this IE.
Outgoing Access Indicator	O	O	O	O	See 3G TS 23.085 [9] for details of this IE.

O Optional (Service logic dependent)

- Not applicable

NA Carrier Information contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
NA Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
NA Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: – dialled – subscribed

M Mandatory (The IE shall always be sent)

Service Interaction Indicators Two contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Forward Service Interaction Indicator	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 indicates whether the CAMEL subscriber can invoke HOLD for the call.
CW Treatment Indicator	O	-	-	O	This IE indicates whether CW can be applied for a call to the CAMEL subscriber whilst this call is ongoing.
ECT Treatment Indicator	O	-	-	O	This IE indicates whether the call leg can become part of an ECT call initiated by the CAMEL subscriber.
Call Completion Treatment Indicator	O	-	-	O	This IE indicates whether a CCBS request can be made for the call.

O Optional (Service logic dependent)

- Not applicable

Forward Service Interaction Indicator contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Conference Treatment Indicator	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	This IE indicates whether the call can be forwarded using the Call Forwarding or Call Deflection Supplementary Services.
Calling Party Restriction Indicator	O	-	-	-	This IE indicates whether the CLI shall be marked as Restricted by CAMEL action for the call.

O Optional (Service logic dependent)

- Not applicable

Backward Service Interaction Indicator contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
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.

O Optional (Service logic dependent)

- Not applicable

4.6.2.6 Connect To Resource

4.6.2.6.1 Description

This IF is used to connect a call from the gsmSSF to a gsmSRF.

4.6.2.6.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Service Interaction Indicators Two	O	O	O	O	This parameter indicates whether or not a bothway through connection is required between the Calling party and the gsmSRF. The handling when this IE is not present is defined in EN 301 070-1 ([7]).
Resource Address	O	O	O	O	This IE indicates the physical location of the gsmSRF.

O Optional (Service logic dependent)

Resource Address contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
IP Routing Address	C	C	C	C	This IE indicates the routing address to set up a connection towards the gsmSRF.
None	C	C	C	C	This parameter indicates that the call party is to be connected to a predefined gsmSRF.

C Conditional

4.6.2.7 Continue

4.6.2.7.1 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.

4.6.2.7.2 Information Elements

This IF contains no information elements.

4.6.2.8 Continue With Argument

4.6.2.8.1 Description

This information flow requests the gsmSSF to proceed the call processing with modified information 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) with the modified call setup information as received from the gsmSCF.

4.6.2.8.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Alerting Pattern	-	-	O	O	This parameter indicates the kind of Alerting Pattern to be applied.
Calling Partys Category	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	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.
NA Carrier Information	O	O	O	O	This IE is described in the next table.
NA Originating Line Information	O	O	O	O	This IE identifies the type of number in the NA Charge Number (e.g. subscriber versus PLMN operator number).
NA Charge Number	O	O	O	O	This IE identifies the chargeable number for the usage of a North American carrier.
Original Called Party ID	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.
Redirecting Party ID	O	O	O	O	This IE indicates the directory number the call was redirected from.
Redirection Information	O	O	O	O	This IE contains forwarding related information, such as redirecting counter.
Suppression Of Announcements	-	-	O	O	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed.
Service Interaction Indicators Two	O	O	O	O	See the Information Flow table of the Connect operation for an explanation of this parameter. For Mobile Terminated calls, this parameter may only be sent to the VMSC.
CUG Interlock Code	O	O	O	O	See 3G TS 23.085 [9] for details of this IE.
Outgoing Access Indicator	O	O	O	O	See 3G TS 23.085 [9] for details of this IE.

O Optional (Service logic dependent)

- Not applicable

NA Carrier Information contains the following information:

Information element name	MO	MF	MT	VT	Description
NA Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
NA Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: - dialled - subscribed

M Mandatory (The IE shall always be sent)

4.6.2.9 Disconnect Forward Connection

4.6.2.9.1 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 send to the initiating gsmSSF

4.6.2.9.2 Information Elements

This IF contains no information elements.

4.6.2.10 Establish Temporary Connection

4.6.2.10.1 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.

4.6.2.10.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Assisting SSP IP Routing Address	M	M	M	M	This parameter indicates the destination address of the gsmSRF or assisting gsmSSF for the assist procedure. As a network operator option, the Assisting SSP IP Routing Address may contain embedded within it, a "Correlation ID" and " Scf ID", but only if "Correlation ID" and "Scf ID" are not specified separately.
Correlation ID	O	O	O	O	This parameter 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.
NA Carrier Information	O	O	O	O	This IE is described in the next table.
NA Originating Line Information	O	O	O	O	This IE identifies the type of number in the NA Charge Number (e.g. subscriber versus PLMN operator number).
NA Charge Number	O	O	O	O	This IE identifies the chargeable number for the usage of a North American carrier.
Scf ID	O	O	O	O	This parameter indicates the gsmSCF identifier
Service Interaction Indicators Two	O	O	O	O	This parameter indicates whether or not a bothway through connection is required between the Calling party and the gsmSRF. The handling when this IE is not present is defined in EN 301 070-1 ([7]).

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

NA Carrier Information contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
NA Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
NA Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: – dialled – subscribed

M Mandatory (The IE shall always be sent)

4.6.2.11 Furnish Charging Information

4.6.2.11.1 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 FCI 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 its free format data is moved to the corresponding CDR and the logical call record is deleted.

The CSE can send multiple concatenated FCIs 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 operations. If there is non-completed free format data and new FCI operation(s) is/are received to overwrite the non-completed data, then the non-completed data is discarded and the gsmSCF can send another 160 octets per leg. The SDLs of 3GPP TS 23.078 define when Logical CDRs are completed. After the completion the gsmSCF can send another 160 octets of free format data in one or more FCI operations for the called leg.

4.6.2.11.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
FCI Billing Charging Characteristics	M	M	M	M	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

FCI Billing Charging Characteristics contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
FCIBCCAMEL Sequence 1	M	M	M	M	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

FCIBCCCAMEL Sequence 1 contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Free Format Data	M	M	M	M	This IE is a free format data to be inserted in the CAMEL logical call record.
Party To Charge	M	M	M	M	This IE indicates the party for whom a CAMEL logical call record will be created.
Append Free Format Data	O	O	O	O	<p>This IE indicates that the gsmSSF shall append the free format data to the Logical call record.</p> <ul style="list-style-type: none"> - 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 in value "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. <p>If no Logical call record exists yet for that leg of the call, then the gsmSSF shall ignore this IE.</p>

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

4.6.2.12 Release Call

4.6.2.12.1 Description

This IF is used to tear down by the gsmSCF an existing call at any phase of the call for all parties involved in the call.

4.6.2.12.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Release Cause	M	M	M	M	A number giving an indication to the gsmSSF about the reason of releasing this specific call. This may be used by MSC/GMSC for generating specific tones to the different parties in the call or to fill in the "cause" in the release message.

M Mandatory (The IE shall always be sent)

4.6.2.13 Request Report BCSM Event

4.6.2.13.1 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).

4.6.2.13.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
BCSM Event	M	M	M	M	This IE specifies the event or events of which a report is requested.

M Mandatory (The IE shall always be sent)

BCSM Event contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Event type	M	M	M	M	This IE specifies the type of event of which a report is requested.
Leg ID	C	C	C	C	This IE indicates the party in the call for which the event shall be reported.
Monitor Mode	M	M	M	M	When this IE is "interrupted", the event shall be reported as a request, if it is "notifyAndContinue", the event shall be reported as a notification, if the IE is "transparent", the event shall not be reported.
DP Specific Criteria	O	O	O	O	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

C Conditional

O Optional (Service logic dependent)

DP Specific Criteria is defined as:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Application Timer	O	O	O	O	This IE carries additional timer duration information (timer values for No Answer event) required for arming No_Answer EDPs in the gsmSSF. The TNRY timer (value defined between 10s and 40s) shall be shorter than the network no answer timer.

O Optional (Service logic dependent)

4.6.2.14 Reset Timer

4.6.2.14.1 Description

This IE is used to refresh a timer.

4.6.2.14.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Timer Value	M	M	M	M	This IE specifies the value to which the timer Tssf shall be set.
Timer ID	O	O	O	O	This IE has a default value indicating the Tssf value.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

4.6.2.15 Send Charging Information

4.6.2.15.1 Description

This IF is used to send e-parameters from the gsmSCF to the gsmSSF. If charge advice information is received from the gsmSCF, it shall replace the charge advice information which would be generated by the MSC and inhibit any further generation of CAI by the MSC. Further processing of the charge advice information by the MSC shall be in accordance with the GSM Advice of Charge Supplementary Service.

The IF is only used in the MO case or in the VT case.

NOTE: If charge advice information 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 charge advice information is sent to the gsmSSF before charge information is sent to the to the MS.

4.6.2.15.2 Information Elements

The following information elements are only used for the MO case and for the VT case:

Information element name	MO	MF	MT	VT	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 where the charging information shall be sent.

M Mandatory (The IE shall always be sent)

SCI Billing Charging Characteristics is defined as:

Information element name	MO	MF	MT	VT	Description
AOC After Answer	C	-	-	C	This IE is sent after an Answer from event has been detected from the called party, the current connected SRF or the temporary connection.
AOC Before Answer	C	-	-	C	This IE is sent before an Answer event has been detected from the called party, the current connected SRF or the temporary connection.

C Conditional (only one of these IEs may be sent)

AOC Before Answer is defined as:

Information element name	MO	MF	MT	VT	Description
AOC Initial	M	-	-	M	This IE contains CAI elements as defined in GSM 02.24.
AOC Subsequent	O	-	-	O	See definition in the next table.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

AOCSubsequent is defined as:

Information element name	MO	MF	MT	VT	Description
CAI Elements	M	-	-	M	This IE contains CAI elements as defined in GSM 02.24
Tariff Switch Interval	O	-	-	O	This IE indicates the tariff switch time until the next tariff switch applies.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

AOCAfterAnswer is defined as:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
CAI Elements	M	-	-	M	This IE contains CAI elements as defined in GSM 02.24
Tariff Switch Interval	O	-	-	O	This IE indicates the tariff switch time until the next tariff switch applies.

M Mandatory (The IE shall always be sent)

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 operation.

4.6.3.2.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Invoke ID	M	M	M	M	This IE specifies the operation to be cancelled.

M Mandatory (The IE shall always be sent)

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

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Information To Send	M	M	M	M	This IE indicates an announcement or a tone to be sent to the end user by the gsmSRF.
Disconnect From IP Forbidden	M	M	M	M	This IE indicates whether or not the gsmSRF may be disconnected from the user when all information has been sent.
Request Announcement Complete	M	M	M	M	This IE indicates whether or not a SpecializedResourceReport shall be sent to the gsmSCF when all information has been sent.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

Information To Send contains the following information:

Information element name	MO	MF	MT	VT	Description
Inband Info	O	O	O	O	This IE indicates the inband information to be sent.
Tone	O	O	O	O	This IE indicates the tone to be sent. The mapping from the code points of this IE to tones is a matter for agreement between the gsmSCF operator and the gsmSRF operator.

O Optional (Service logic dependent)

Inband Info contains the following information:

Information element name	MO	MF	MT	VT	Description
Message ID	M	M	M	M	This IE is described in the next table.
Number Of Repetitions	M	M	M	M	This IE indicates the maximum number of times the message shall be sent to the end-user.
Duration	O	O	O	O	This IE indicates the maximum duration time in seconds that the message shall be played/repeated. Zero indicates endless repetition.
Interval	O	O	O	O	This IE indicates the time interval in seconds between two repetitions.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

Message ID contains the following information:

Information element name	MO	MF	MT	VT	Description
Elementary Message ID	O	O	O	O	This IE indicates a single announcement
Text	O	O	O	O	This IE indicates a text to be sent. The text shall be transformed to inband information (speech) by the gsmSRF.
Elementary Message IDs	O	O	O	O	This IE indicates a sequence of announcements
Variable Message	O	O	O	O	This IE indicates an announcement with one or more variable parts.

O Optional (Service logic dependent)

Tone contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Tone ID	M	M	M	M	This IE indicates the tone to be sent.
Duration	O	O	O	O	This IE indicates the maximum duration time in seconds that the message shall be played/repeated. Zero indicates endless repetition.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

4.6.3.4 Prompt And Collect User Information (received 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

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Collected Info	M	M	M	M	This IE is described in the next table.
Information To Send	O	O	O	O	This IE indicates an announcement or a tone to be sent to the end user by the gsmSRF.
Disconnect From IP Forbidden	O	O	O	O	This IE indicates whether the gsmSRF should be disconnected from the user when all information has been sent.

O Optional (Service logic dependent)

Collected Info contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Collected Digits	M	M	M	M	This IE is described in the next table.

O Optional (Service logic dependent)

Collected Digits contains the following information:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Minimum Number Of Digits	M	M	M	M	This IE indicates the minimum number of valid digits to be collected.
Maximum Number Of Digits	M	M	M	M	This IE specifies the maximum number of valid digits to be collected
End Of Reply Digit	O	O	O	O	This IE indicates the digit(s) used to signal the end of input.
Cancel Digit	O	O	O	O	If this IE is present, the cancel digit can be entered by the user to request a possible retry
Start Digit	O	O	O	O	If this IE is present, the start digit(s) indicates the start of the valid digits to be collected.
First Digit Time Out	O	O	O	O	If this IE is present, the first digit shall be received before the expiration of the first digit timer expiration
Inter Digit Time Out	O	O	O	O	If this IE is present, any subsequent valid or invalid digit shall be received by the gsmSRF before the inter digit timer expires.
Error Treatment	O	O	O	O	This IE indicates what specific action shall be taken by the gsmSRF in the event of error conditions occurring.
Interruptable Ann Ind	O	O	O	O	If this IE is set to TRUE (default value) 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, the announcement will not be interrupted after the first digit is received by the gsmSRF
Voice Information	O	O	O	O	This IE is optional, where the default value is specified being FALSE. If the VoiceInformation IE is set to FALSE, all valid or invalid digits are entered by DTMF. If this IE is present and explicitly set to TRUE, calling user is required to provide all valid or invalid information by speech
Voice Back	O	O	O	O	This IE is optional, where the default value is specified being FALSE. If the VoiceBack IE is set to FALSE, no voice back information is given by the gsmSRF. If this IE is present and explicitly set to TRUE, the valid input digits received by the gsmSRF will be announced back to the calling user immediately after the end of input is received

O Optional (Service logic dependent)

InformationToSend is defined in subclause 4.6.3.3.

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

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
CorrelationID	M	M	M	M	This IE is used to associate the AssistRequestInstructions IF from an assisting gsmSSF or by a gsmSRF with the InitialDP from the initiating gsmSSF.
IP SSP Capabilities	M	M	M	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.

M Mandatory (The IE shall always be sent)

4.6.4.3 Prompt And Collect User Information ack (received information)

4.6.4.3.1 Description

This IF is used by the gsmSRF to indicate the result a Prompt And Collect User Information IF.

4.6.4.3.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>MO</u>	<u>MF</u>	<u>MT</u>	<u>VT</u>	<u>Description</u>
Digits Response	C	C	C	C	This IE indicates the digit sequence received from the end user

C Conditional (The IE shall be sent, if available)

4.6.4.4 Specialized Resource Report

4.6.4.4.1 Description

This IF is used to response to a PlayAnnouncement IF when the announcement complete indication is set.

4.6.4.4.2 Information Elements

This IF contains no information elements.

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 described in section 4.6.3.

4.6.5.3 Connect To Resource

4.6.5.3.1 Description

This IF is described in section 4.6.2.

4.6.5.4 Play Announcement

4.6.5.4.1 Description

This IF is described in section 4.6.3..

4.6.5.5 Prompt And Collect User Information

4.6.5.5.1 Description

This IF is described in section 4.6.3.

4.6.5.6 Reset Timer

4.6.5.6.1 Description

This IF is described in section 4.6.2.

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 defined in subclause 4.6.4.

4.6.6.3 Prompt And Collect User Information ack (received information)

4.6.6.3.1 Description

This IF is described in section 4.6.4.

4.6.6.4 Specialized Resource Report

4.6.6.4.1 Description

This IF is described in section 4.6.4.

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 remove certain subscriber data from a VLR if the subscription of one or more supplementary services or basic services is withdrawn. Note that this IF is not used in case of erasure or deactivation of supplementary services. This IF is specified in 3G TS 29.002 [4].

4.6.7.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR.

C Conditional (The IE shall be sent when deletion is requested)

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 3G TS 29.002 [4].

4.6.7.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
O-CSI	C	This IE identifies the subscriber as having originating CAMEL services.
VT-CSI	C	This IE identifies the subscriber as having terminating CAMEL services in the VMSC.

C Conditional (The IE shall be sent, if required)

O-CSI contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
gsmSCF Address	M	This IE is described in section 4.3.1
Service Key	M	This IE is described in section 4.3.1.
Default Call Handling	M	This IE is described in section 4.3.1.
TDP List	M	This IE is described in section 4.3.1.
DP Criteria	O	This IE is described in section 4.3.1.
CAMEL Capability Handling	C	This IE is described in section 4.3.1. If this IE is absent, this indicates that CAMEL phase 1 is asked.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent when required)

O Optional (service logic dependant)

VT-CSI contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
gsmSCF Address	M	This IE is described in section 4.3.4.
Service Key	M	This IE is described in section 4.3.4.
Default Call Handling	M	This IE is described in section 4.3.4.
TDP List	M	This IE is described in section 4.3.4.
DP Criteria	O	This IE is described in section 4.3.4.
CAMEL Capability Handling	M	This IE is described in section 4.3.4. The CAMEL Capability Handling shall indicate CAMEL phase 3 or higher.

M Mandatory

O Optional (service logic dependant)

4.6.7.3 Provide Subscriber Info

4.6.7.3.1 Description

This IF is used by the HLR to request information (subscriber state and location) from the VLR at any time.

4.6.7.3.2 Information Elements

Provide Subscriber Info contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Requested Info	M	This IE indicates the type of subscriber information to the gsmSCF. - subscriber location - subscriber state - currentLocation (currentLocation shall not be present if locationInformation is not present in the RequestedInfo parameter)
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity can be: - IMSI: The IMSI shall be accompanied by a LMSI if one was provided by the VLR.

M Mandatory (The IE shall always be sent)

4.6.7.4 Provide Roaming Number

4.6.7.4.1 Description

This IF is specified in 3G TS 23.018 [3] and 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 IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Suppression Of Announcements	C	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed.
Call Reference Number	M	This IE carries the Call Reference Number provided by the GMSC in the Send Routeing Info IF..
GMSC Address	M	This IE is the E.164 address of the GMSC
Alerting Pattern	C	This IE indicates the kind of Alerting Pattern to be applied.
GMSC CAMEL Phases	C	This IE indicates the CAMEL Phases supported in the GMSC.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if received from the GMSC 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. This IF is specified in 3G TS 29.002 [4].

4.6.8.1.2 Information Elements

Insert Subscriber Data ack contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Supported CAMEL Phases	C	This IE identifies which CAMEL phases are supported by the MSC/VLR.

C Conditional (The IE shall always be sent when a CSI has been included in the ISD)

4.6.8.2 Provide Subscriber Info ack

4.6.8.2.1 Description

This IF is used by the VLR to provide the requested information to the HLR.

4.6.8.2.2 Information Elements

Provide Subscriber Info ack contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Location Information	C	This IE indicates the location of the served subscriber. The elements contained in this IE are specified in 3G TS 23.018 ([3]).
Subscriber State	C	This IE indicates the status of the MS. The states are: <ul style="list-style-type: none"> - CAMELBusy: The MS is engaged on a transaction for a mobile originating or terminated circuit-switched call. - NetworkDeterminedNotReachable: The network can determine from its internal data that the MS is not reachable. - AssumedIdle: The state of the MS is neither "CAMELBusy" nor "NetworkDeterminedNotReachable".

C Conditional (The IE shall be sent, if requested and available)

4.6.8.3 Update Location

4.6.8.3.1 Description

This IF is used by the VLR to provide the information about supported CAMEL phases to the HLR.

4.6.8.3.2 Information Elements

Update Location contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Supported CAMEL phases	C	This IE indicates which phases of CAMEL are supported. It shall be present if a CAMEL phase different from phase 1 is supported. Otherwise may be absent.

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 IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Supported CAMEL phases	C	This IE indicates which phases of CAMEL are supported. It shall be present if a CAMEL phase different from phase 1 is supported. Otherwise may be absent.

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 3G TS 23.018 [3] and is used by the HLR to transfer the requested routing information to the GMSC.

4.6.9.1.2 Information Elements

Send Routeing Info ack contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Location Information	C	This IE indicates the location of the served subscriber.
O-CSI	C	This IE identifies the subscriber as having originating CAMEL services. Shall be sent if O-CSI is active, and CFU or CFNRc has been invoked, or if both O-CSI and T-CSI are active.
Subscriber State	C	This IE indicates the status of the MS. The possible values of the IE are: -CAMELBusy: The VLR has indicated that the MS is engaged on a transaction for a mobile originating or terminated circuit-switched call. -NetworkDeterminedNotReachable: The 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.
T-CSI	C	This IE identifies the subscriber as having terminating CAMEL services. Shall be sent if T-CSI is active and no Suppress T-CSI indicator is present in the SRI.
Basic Service Code	C	This IE indicates the type of basic service i.e., teleservice or bearer service.
CUG Subscription Flag	C	This IE indicates if the called party has a CUG subscription. It shall only be sent if the T-CSI is active and included in the Send Routing Information ack.

C Conditional (The IE shall be sent, if available)

Location Information contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Location Number	C	See 3G TS 23.018 [3]. The IE shall be sent, if available and indicated by Subscriber Information in Send Routeing Information ack indicator.
CellIdOrLAI	C	See 3G TS 23.018 [3]. The IE shall be sent, if available and indicated by Subscriber Information in Send Routeing Information ack indicator.
Geographical Information	C	See 3G TS 23.018 [3]. The IE shall be sent, if available and indicated by Subscriber Information in Send Routeing Information ack indicator.
Geodetic Information	C	See 3G TS 23.018 [3]. The IE shall be sent, if available and indicated by Subscriber Information in Send Routeing Information ack indicator.
Age Of Location Information	C	See 3G TS 23.018 [3]. The IE shall be sent, if available and indicated by Subscriber Information in Send Routeing Information ack indicator.
VLR number	C	See 3G TS 23.018 [3].
Selected LSA Identity	C	See 3G TS 23.018 [3]. The IE shall be sent, if available and indicated by Subscriber Information in Send Routeing Information ack indicator.

C Conditional (The IE shall be sent, if available. Further conditions are in the description column.)

O-CSI is defined in section 4.3.1.

T-CSI contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
gsmSCF Address	M	This IE is described in section 4.3.3.
Service Key	M	This IE is described in section 4.3.3.
Default Call Handling	M	This IE is described in section 4.3.3.
TDP List	M	This IE is described in section 4.3.3.
CAMEL Capability Handling	C	This IE is described in section 4.3.3. If this IE is absent, this indicates that CAMEL phase 1 is asked.

M Mandatory

C Conditional

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 3G TS 23.018 [3] and 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 IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Alerting Pattern	C	This IE indicates the kind of Alerting Pattern to be applied.
Suppression Of Announcement	C	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed. Shall be sent in the second interrogation if available, i.e., when it has been received from the gsmSCF.
Suppress T-CSI	C	This IE indicates that T-CSI shall be suppressed. Shall always be sent in the second interrogation
Supported CAMEL Phases	M	This IE lists the supported CAMEL phases.
Call Reference Number	M	This IE carries the Call Reference Number allocated for the call by the GMSC. Shall be allocated once per call and sent in both first and second interrogations.
GMSC Address	M	This IE is the E.164 address of the GMSC
Call Diversion Treatment Indicator	C	This IE indicates if the call can be forwarded using the Call Forwarding or Call Deflection Supplementary Services. Shall be sent if received within Forward Service Interaction Indicator in Service Interaction Indicators Two from IAM or previous CAMEL processing.

C Conditional (The IE shall be sent, if received from the gsmSCF or set by the gsmSSF)

M Mandatory (The IE shall always be sent when the GMSC supports CAMEL)

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 GSM 03.79 [4] and 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 IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
O-CSI	C	This IE contains O-CSI without triggering criteria. It indicates that CAMEL handling applies for a forwarded call. Shall be present if CAMEL handling applies; otherwise shall be absent.

C Conditional (The IE shall be sent if applicable)

4.6.12 MSC to VLR information flows

4.6.12.1 Send Info For Outgoing Call

4.6.12.1.1 Description

This IF is described in 3G TS 23.018 [3] and is used to request the VLR to provide information to handle an outgoing call.

4.6.12.1.2 Information Elements

Send Info For Outgoing Call contains the following CAMEL specific IE

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Suppress O-CSI	C	This IE indicates that O-CSI shall be suppressed. Shall always be sent in the second interrogation.

C Conditional (The IE shall be sent if applicable)

4.6.12.2 Send Info For Reconnected Call

4.6.12.2.1 Description

This IF is used to request the VLR to provide information to handle a reconnected call.

4.6.12.2.2 Information Elements

Send Info For Reconnected Call contains the following IE

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Called number	M	E.164 number of the call destination.
Bearer service	C	Bearer service required for the MO call, derived from the GSM bearer capability information received in the setup request from the MS. One of bearer service or teleservice shall be present.
Teleservice	C	Teleservice required for the MO call, derived from the GSM 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	C	For the definition of this IE, see ETS 300 546 [9]. Shall be present if it was received in the setup request from the MS.
Suppress preferential CUG	C	For the definition of this IE, see ETS 300 546 [9]. Shall be present if it was received in the setup request from the MS.
Suppress CUG outgoing access	C	For the definition of this IE, see ETS 300 546 [9]. Shall be present if it was received in the setup request from the MS.
Suppress O-CSI	C	This IE indicates that O-CSI shall be suppressed. Shall always be sent in the second interrogation.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent if applicable)

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 3G TS 23.018 [3] and 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 IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
O-CSI	C	This IE indicates that CAMEL handling applies for an MO call. Shall be present in the response to the first interrogation for an MO call if CAMEL handling applies; otherwise shall be absent. Shall be absent in the response to the second interrogation for an MO call and in the response to the interrogation for an MT call.
VT-CSI	C	This IE identifies the subscriber as having terminating CAMEL services in the VMSC.
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.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent if applicable)

4.6.13.2 Process Call Waiting

4.6.13.2.1 Description

This IF is described in GSM 03.18 [3] and is used to instruct the MSC to continue the connection of a waiting call.

4.6.13.2.2 Information Elements

Process Call Waiting contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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.

M Mandatory (The IE shall always be sent)

4.6.13.3 Send Info For Incoming Call ack

4.6.13.3.1 Description

This IF is described in 3G TS 23.018 [3] and is used to indicate that the incoming call for which the MSC requested subscription information shall be forwarded.

4.6.13.3.1 Information Elements

Send Info For Incoming Call ack contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
O-CSI	C	This IE indicates that CAMEL handling applies for a forwarded call. Shall be present if CAMEL handling applies; otherwise shall be absent.
VT-CSI	C	This IE identifies the subscriber as having terminating CAMEL services in the VMSC.
Suppression Of Announcement	C	This IE indicates that announcements or tones generated when the call is forwarded shall be suppressed. Shall be sent if it was received in the Provide Roaming Number for this call.
SS-CSI	C	This IE indicates that SS invocation notification applies for the call. This IE is described in section 8.2.1.1. Shall be present if SS invocation notification is required if Call Deflection is invoked; otherwise shall be absent.
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.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent if applicable)

4.6.13.4 Send Info For Incoming Call negative response

4.6.13.4.1 Description

This IF is described in 3G TS 23.018 [3] and is used to indicate that the incoming call for which the MSC requested subscription information shall not be connected.

4.6.13.4.2 Information Elements

Send Info For Incoming Call negative response contains the following CAMEL specific IE which may be attached as a IE to any of the negative response values defined in 3G TS 23.018 [3]:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Suppression Of Announcement	C	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed. Shall be sent if it was received in the Provide Roaming Number for this call.

C Conditional (The IE shall be sent if applicable)

4.7 Interaction with supplementary services

4.7.1 Line identification

For an MO call subject to CAMEL interactions, the gsmSCF shall have the option to include the the Calling Party Restriction Indicator parameter in the Connect message to the gsmSSF. This will be sent to the MSC and shall indicate

whether the CLI Presentation Indicator present in the Calling Party Number Parameter 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 GSM 03.82. The procedure specific to CAMEL is defined in this subclause:

- CAMEL_Check_CF_Interaction

4.7.2.2 Invocation of Call Forwarding

The functional behaviour for the invocation of the Call Forwarding supplementary service is defined in 3G TS 23.018. 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. If the Service Interaction Indicators Two parameter was included in the Initial Address Message, ContinueWithArgument or the Connect message, these shall be applied for the forwarded call.

An HLR shall not send an FTN which is not in international E.164 format to a GMSC which does not support CAMEL phase 2, i.e. if the HLR is handling a request from a GMSC for routing information and the forwarded-to number is registered a format other than international E.164, the service logic in the HLR shall behave as if the call forwarding is provisioned but not registered.

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.

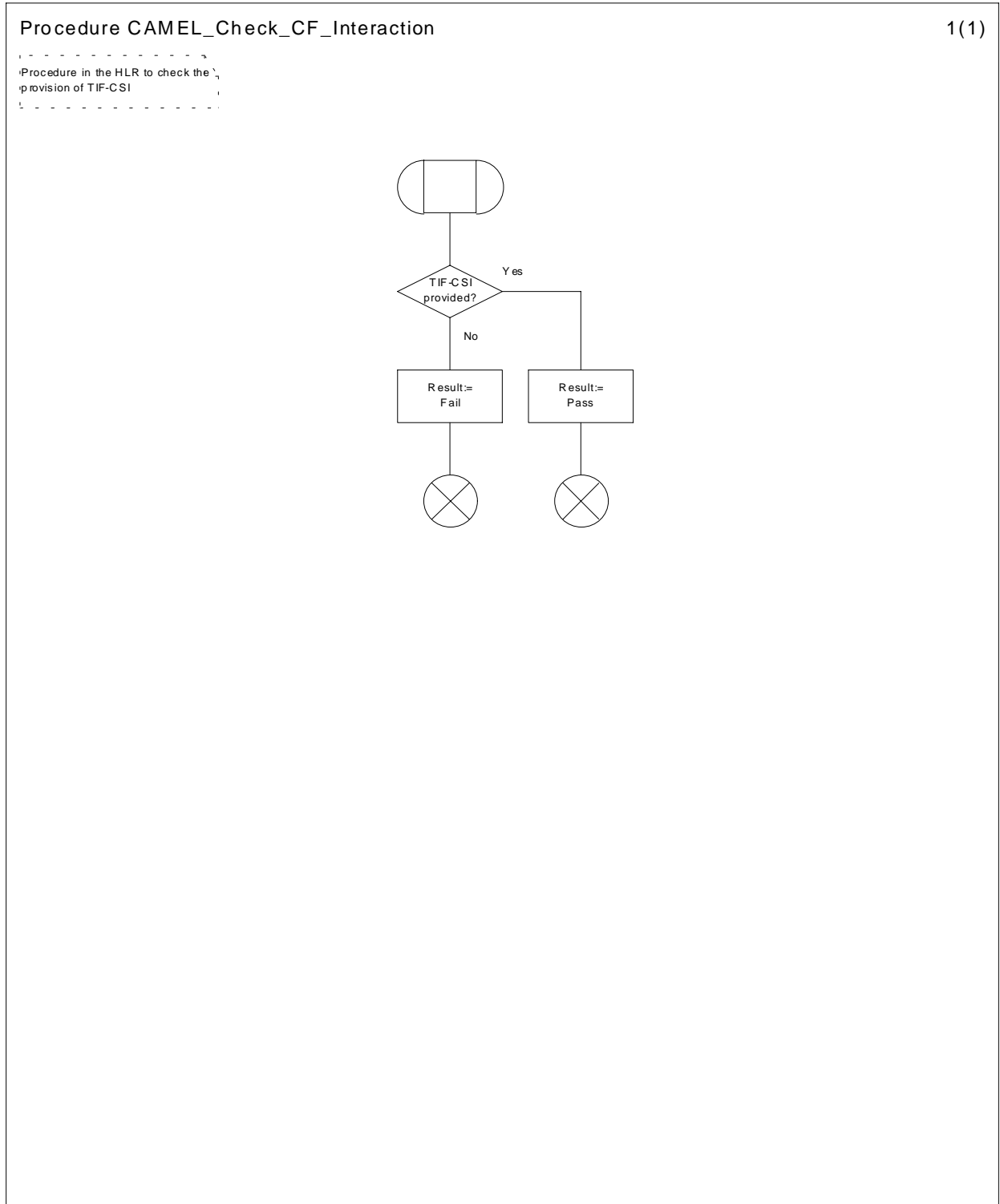


Figure 4.73: Procedure CAMEL_Check_CF_Interaction

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 3G TS 23.090 [8]. Phase 1 USSD messages 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 section.

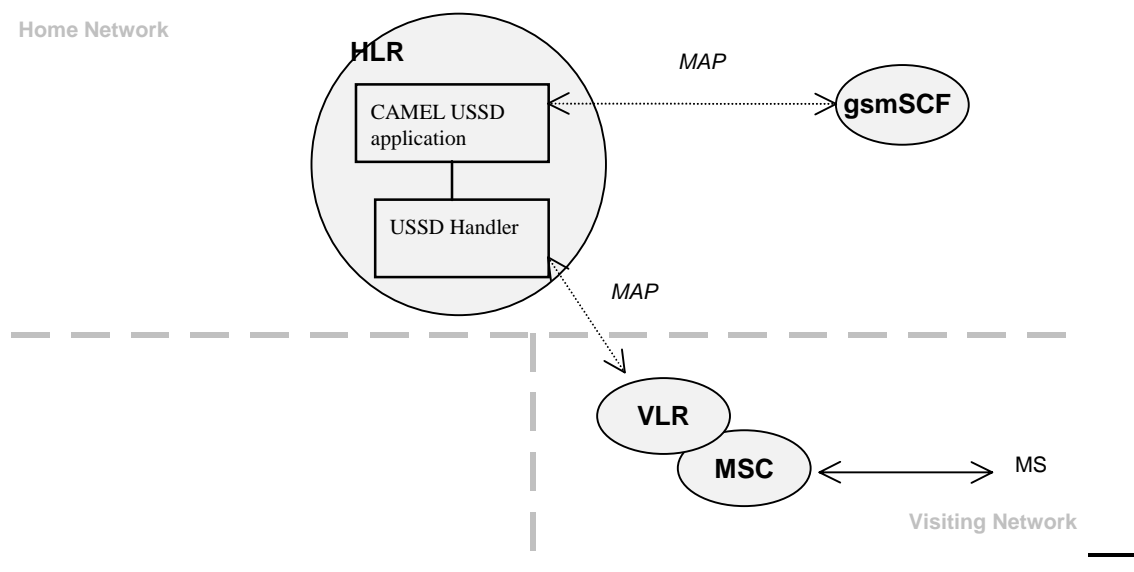


Figure 5.1: Handling of USSD to and from a CAMEL subscriber

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 CAMEL 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 HLR - VLR interface

This interface is used to send the CAMEL related subscriber data to the visited PLMN.

5.1.2.2 gsmSCF - HLR interface

This interface is used for USSD operations, both for gsmSCF-initiated dialogues and MS-initiated dialogues (relayed via HLR). It is a network operator option whether to support or not USSD operations 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 routing.

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 a particular service code. The address shall be an E.164 number to be used for routing.

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 3G TS 23.090 [8].

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 operation from the gsmSCF. If the subscriber can be contacted, the HLR shall set up a transaction to the VLR and forward the operation 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 clause contains the detailed description of the information flows used by CAMEL.

Each Information Element, IE is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorisation is a functional classification, i.e., stage 2 information and 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 a IE which it receives.

Details of errors and exceptions to these rules are specified in are specified in 3G TS 29.002.

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

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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	C	This IE identifies the subscriber for which the information is requested
Alerting Pattern	O	This IE indicates an alerting pattern to be sent to the MS.

M Mandatory (The IE shall always be sent)

C Conditional (This IE shall be sent if this IF is the first IF in a USSD dialogue)

O Optional (Service Logic dependent)

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

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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	C	This IE identifies the subscriber for which the information is requested.
Alerting Pattern	O	This IE indicates an alerting pattern to be sent to the MS.

M Mandatory (The IE shall always be sent)

C Conditional (This IE shall be sent if this IF is the first IF in a USSD dialogue)

O Optional (Service Logic dependent)

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 operation.

5.5.1.3.2 Information Elements

The following information element is required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SS User Data	C	This IE contains the string that will be sent to the MS.

C Conditional (The IE shall be sent, if requested and available)

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 operation.

5.5.1.4.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
USSD String	C	This IE contains the string that will be sent to the MS.
Data Coding Scheme	C	This IE indicates the characteristics of the USSD string

C Conditional (the presence of the IE depends on the application. Both IEs shall be sent.)

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 via the HLR send the response to the gsmSCF for the gsmSCF initiated operation.

5.5.2.1.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
USSD String	C	This IE contains the string that will be sent to the gsmSCF.
Data Coding Scheme	C	This IE indicates the characteristics of the USSD string

C Conditional (The presence of the IE depends on the application. Both IEs shall be sent.)

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 gsmSCF to request data from the MS via the HLR.

5.5.2.3.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SS User Data	M	This IE contains the string that will be sent to the MS.

M Mandatory (The IE shall always be sent)

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

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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	O	This IE contains the basic MSISDN of the subscriber who has requested the USSD operation. 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.

M Mandatory (The IE shall always be sent)

O Optional (Operator option)

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

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
<u>IMSI</u>	<u>M</u>	<u>This IE identifies the subscriber.</u>
<u>Originating Entity Number</u>	<u>M</u>	<u>This IE identifies the functional entity initiating the subscriber activity. In this case, this shall be the address of the HLR.</u>

M Mandatory (The IE shall always be sent)

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 sessions requiring CAMEL support. The architecture is applicable to the third phase of CAMEL.

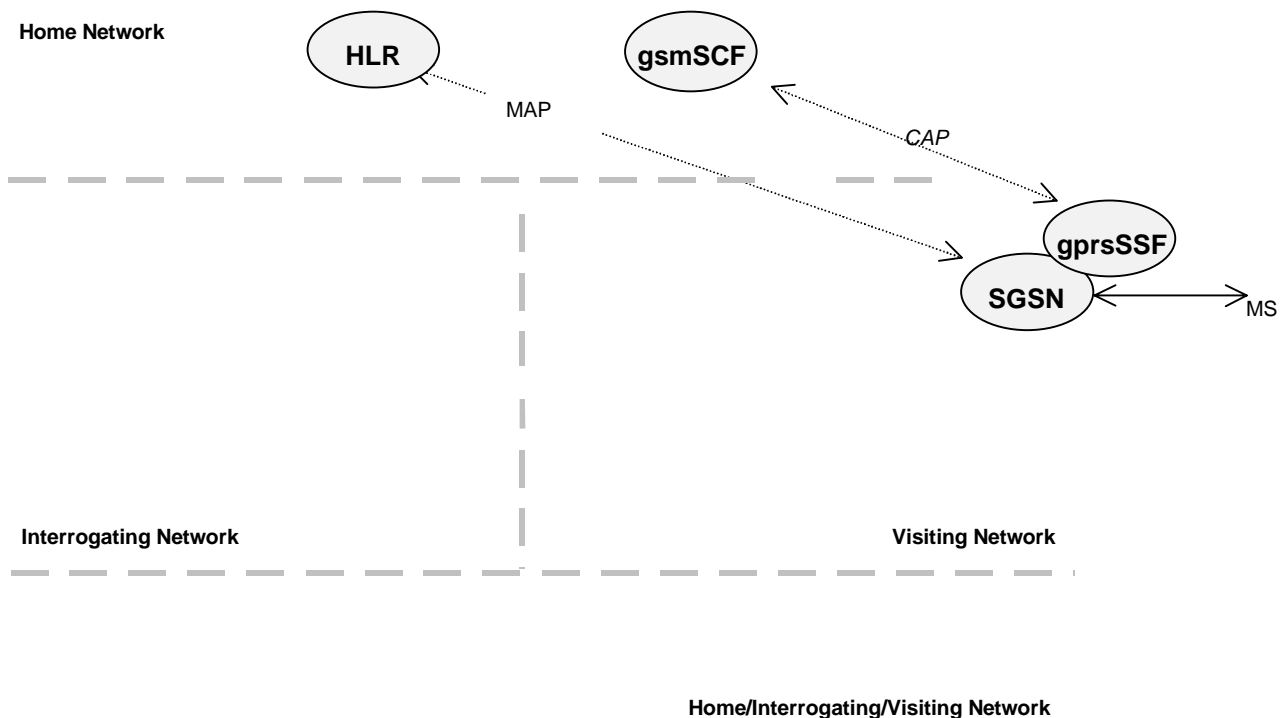


Figure 6.1 Functional architecture for support of CAMEL

HLR: The HLR stores for subscribers requiring CAMEL support the information relevant to the current subscription GPRS-CSI. The GPRS-CSI is stored in the HLR only. The HLR may provide an interface towards the gsmSCF for the Any Time Interrogation procedure.

SGSN: When processing GPRS Attach requests, PDP Context Activations 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 specification 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 an individual PDP Context in a certain gprsSSF. Relationships on this interface are opened as a result of the gprsSSF sending a request for instructions to the gsmSCF.

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)

See subclause 4.2.

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 routing.

6.3.1.2 Service Key

The Service Key identifies to the gsmSCF the service logic that shall apply.

6.3.1.3 Default Session Handling

The Default Session Handling indicates whether the session 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.

6.4 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 machines, one for the attach/detach procedures (GPRS Attach/Detach FSM) and the other for modelling individual PDP Contexts (GPRS PDP Context FSM).

6.4.1 General Handling

The GPRS SM is used to describe the actions in an SGSN during processing of GPRS sessions or PDP Contexts.

The GPRS SM 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 shows the components that have been identified to describe a GPRS SM.

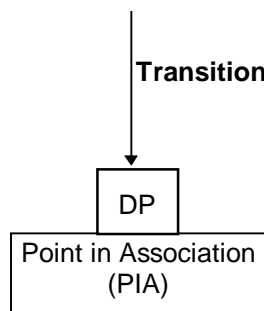


Figure 6.2: GPRS SM Components

6.4.2 GPRS Attach/Detach FSM

The GPRS Attach/Detach FSM is used to model the behaviour of the GPRS attach/detach procedures.

When encountering a DP the Attach/Detach FSM 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.

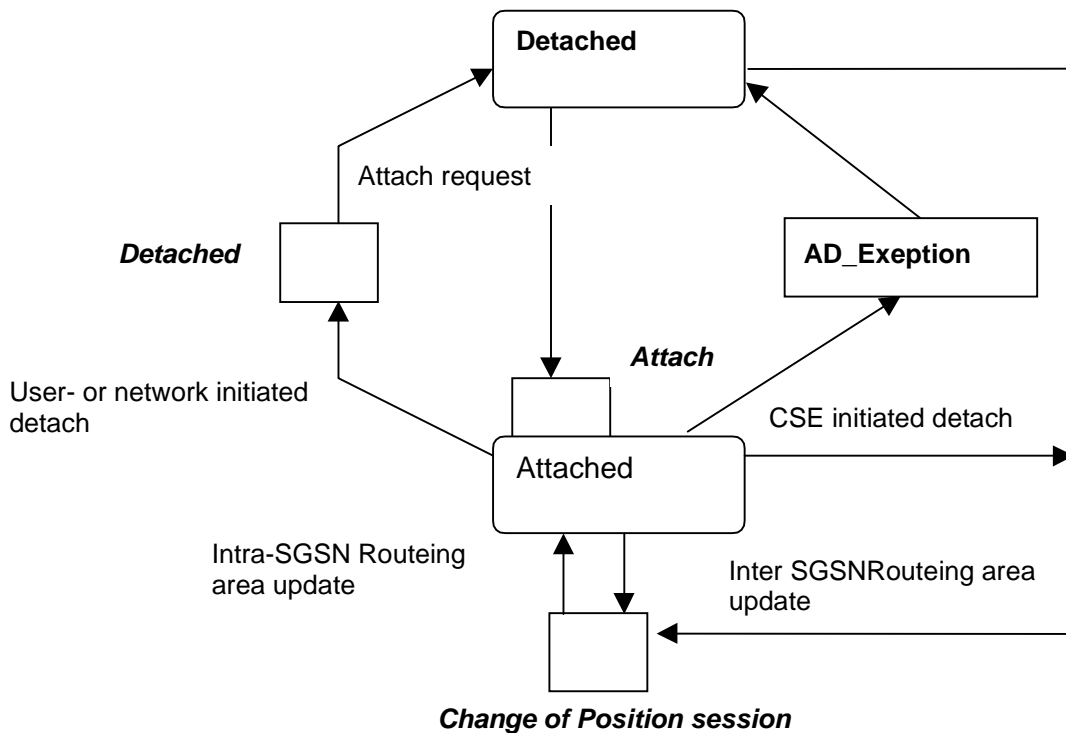


Figure 6.3: GPRS Attach/Detach FSM

Table 5: 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 session	TDP-R ¹⁾ , EDP-N, EDP-R	Routeing Area Update is accepted.
DP Detached	EDP-N, EDP-R	A detach request is received either from the MS, the SGSN or a 'Cancel Location' received from HLR.
Note 1:Change of Position 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 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 session model (PIAs)

This subclause describes the session model for the attach and detach of GPRS sessions in the SGSN. For each PIA a description can be found of the entry events, actions, information available 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, e.g. STANDBY timer expiry in the SGSN.

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).
- Information being analyzed, e.g. GPRS-CSI is analyzed.

Exit events

- GPRS-CSI is analyzed (DP Attach or DP Change of position).

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 the GGSN (DP Detach).
- Intra-SGSN Routeing Area Update is accepted (DP Change of position).
- An exception is encountered, e.g. STANDBY timer expiry.

The GPRS Attach/Detach FSM shall only have one or more GPRS PDP Context FSMs associated with it when in the Attached state. A GPRS PDP Context FSM cannot exist without its associated GPRS Attach/Detach FSM being in the Attached state. Closure of the GPRS Attach/Detach FSM via a detach will result in the idling of all associated GPRS PDP Context FSMs and the release of the associated GPRS PDP Contexts.

It shall not be necessary to trigger a relationship from the GPRS Attach/Detach FSM to the gsmSCF in order for triggering to occur in an associated GPRS PDP Context FSM. However, in this latter case a GPRS Attach/Detach FSM shall still exist at the SGSN. This is so that CSE-initiated detach events sent within a given GSM PDP Context relationship shall result in the GPRS Attach/Detach FSM transiting to the Detached state. As noted above, in this state no PDP Contexts can exist and so all associated GSM PDP Context FSMs will transit to state Idle.

6.4.3 GPRS PDP Context FSM

The GPRS PDP Context FSM is used to model the behaviour for the GPRS PDP Context procedures.

When encountering a DP the PDP Context FSM 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.

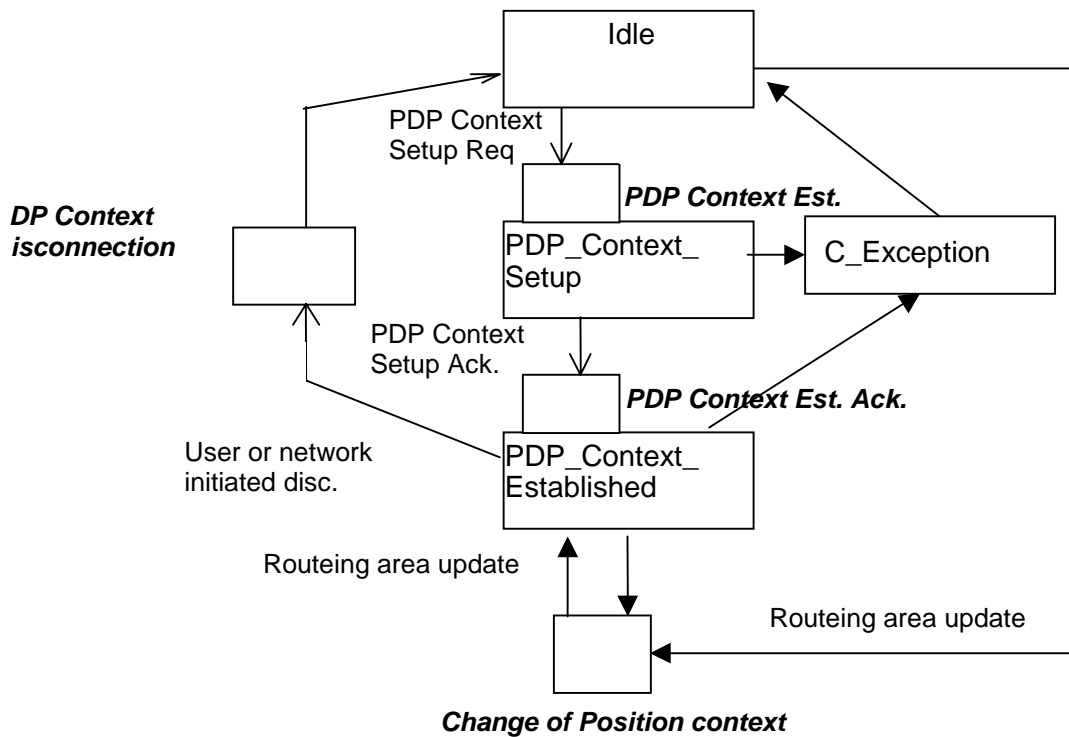


Figure 6.4: GPRS PDP Context FSM

Table 6: Description of GPRS PDP Context DPs in the SGSN

CAMEL Detection Point:	DP Type	Description:
DP PDP Context Establishment	TDP-R, EDP-R	Activate PDP Context request is received from the MS.
DP PDP Context Establishment Acknowledgement	TDP-R ¹⁾ , 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.
DP Change of position context	TDP-R ²⁾ , EDP-N, EDP-R	Routeing Area Update is accepted.
<p>NOTE 1: The PDP Context Establishment Acknowledgment shall be reported as TDP-R if there is no relationship with gsmSCF for this PDP context. Otherwise, it shall be reported as EDP-R or EDP-N if armed so.</p> <p>NOTE 2: 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). 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).</p>		

6.4.3.1 Description of the session model (PIAs)

This subclause describes the session model for PDP Context FSM in the SGSN. For each PIA a description can be found of the entry events, actions, information available 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).
- Information being analyzed, e.g. GPRS-CSI is analyzed.

Exit events

- GPRS-CSI is analyzed (DP PDP Context Establishment or DP Change of position).

6.4.3.1.2 PDP Context Setup

Entry events

- GPRS-CSI is analyzed (DP PDP Context Establishment).

Actions

- GGSN address is derived from the Access Point Name by interrogation of a DNS.
- Create PDP Context Request is sent to the GGSN.

Exit events

- Create PDP Context Response is received from the 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).

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 initiated by the SGSN via READY timer expiry (DP PDP Context disconnection).
- Intra-SGSN Routeing Area Update Request is received from the MS (DP Change of position).
- An exception is encountered.

6.4.4 Rules for Implicit Disarming of Detection Points'

The following table gives the rules for implicit disarming of event detection points.

Implicit EDP disarming rules are specified in the table below for the Attach/Detach and PDP context FSM. The 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 MonitorMode (Transparent, NotifyAndContinue, or Request).

When EDP's are armed with MonitorMode 'Request' (EDP-R's) 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 3: Implicit disarmed DPs in the Attach/Detach FSM and PDP context FSM

Encountered DP	Implicit disarmed DPs						
	DP Attach	DP Change of position session	DP Change of position context	DP Detached	DP PDP Context Establishment	DP PDP Context Establishment Acknowledgement	DP PDP Context disconnection
DP Attach	X						
DP Change of position session	X	Note	Note	Note	Note	Note	Note
DP Change of position context	X	Note	Note	Note	Note	Note	Note
DP Detached	X	X	X	X	X	X	X
DP PDP Context Establishment	X				X		
DP PDP Context Establishment Acknowledgement	X				X	X	
DP PDP Context disconnection	X						X

Note: Disarmed in case of inter SGSN Routing Area update.

6.5 Procedures for CAMEL GPRS

The functional behaviour of the SGSN is specified in 3G TS 29.002 [4]. The procedures specific to CAMEL are specified in this subclause :

- Procedure CAMEL_GPRS_Attach_Request,
- Procedure CAMEL_GPRS_Detach,
- Procedure CAMEL_GPRS_Routeing_Area_Update
- Procedure CAMEL_GPRS_SGSN_Context_Acknowledge
- Procedure CAMEL_GPRS_SGSN_Create_PDP_Context
- Procedure CAMEL_GPRS_Activate_PDP_Context
- Procedure CAMEL_GPRS_Deactivate_PDP_Context
- Procedure CAMEL_GPRS_exception_procedure
- Procedure CAMEL_GPRS_Modify_PDP_Context

Note: In the SDLs in the following subclauses, Handle_AC and Handle_ACR shall be renamed Handle_AC_GPRS and Handle_ACR_GPRS respectively, Handle_SCI shall be renamed Handle_SCI_GPRS, Complete_FCI_Record shall be renamed Complete_FCI_Record_GPRS.

6.5.1 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 Actions of the SGSN on receipt of Int_Continue

The SGSN continues processing without any modification of GPRS parameters.

6.5.3 Overall SDL Architecture

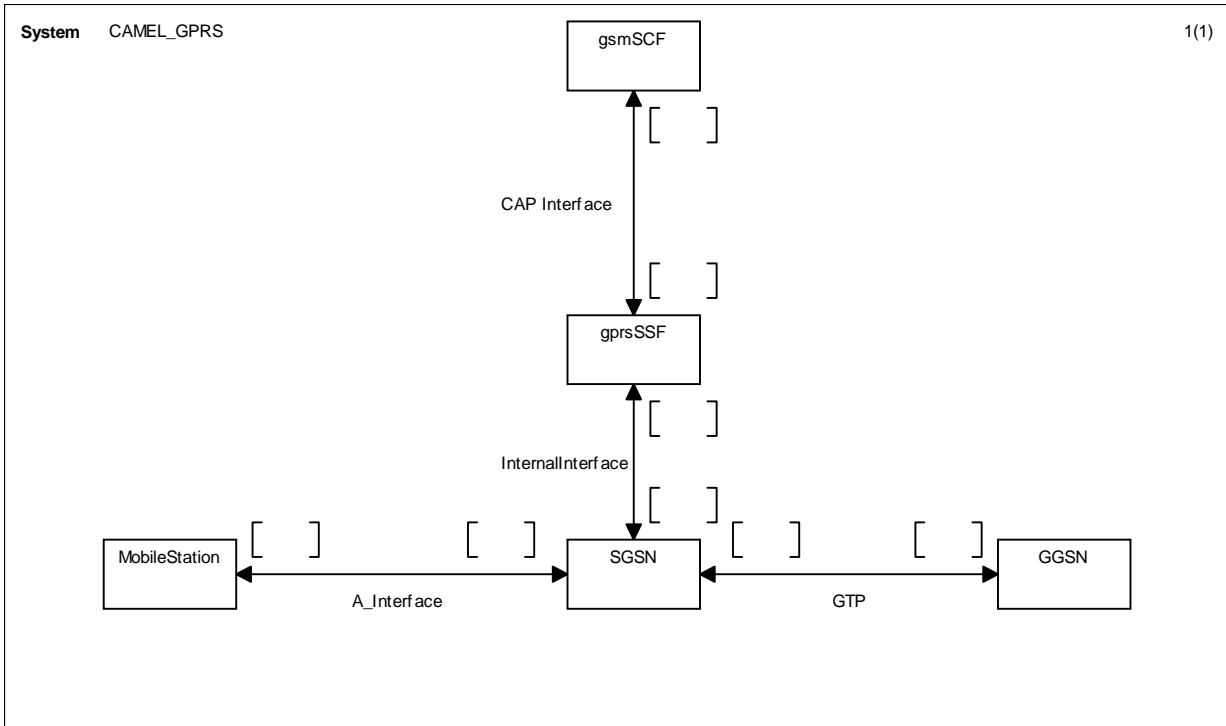


Figure 6.5: Architecture for CAMEL/GPRS interworking.

6.5.4 Handling of GPRS Attach/Detach

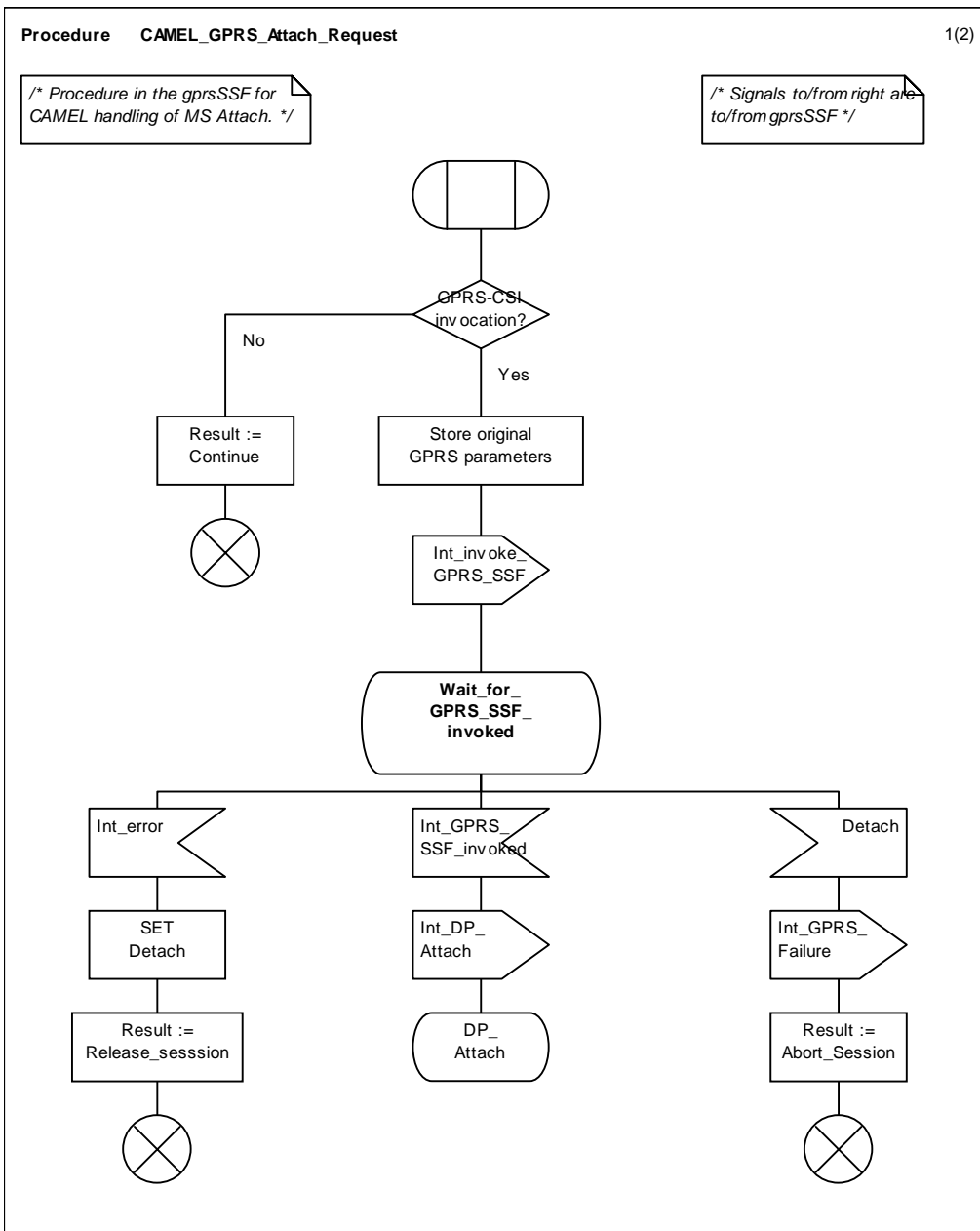


Figure 6.6 a: Procedure CAMEL_GPRS_Attach_Request (sheet 1)

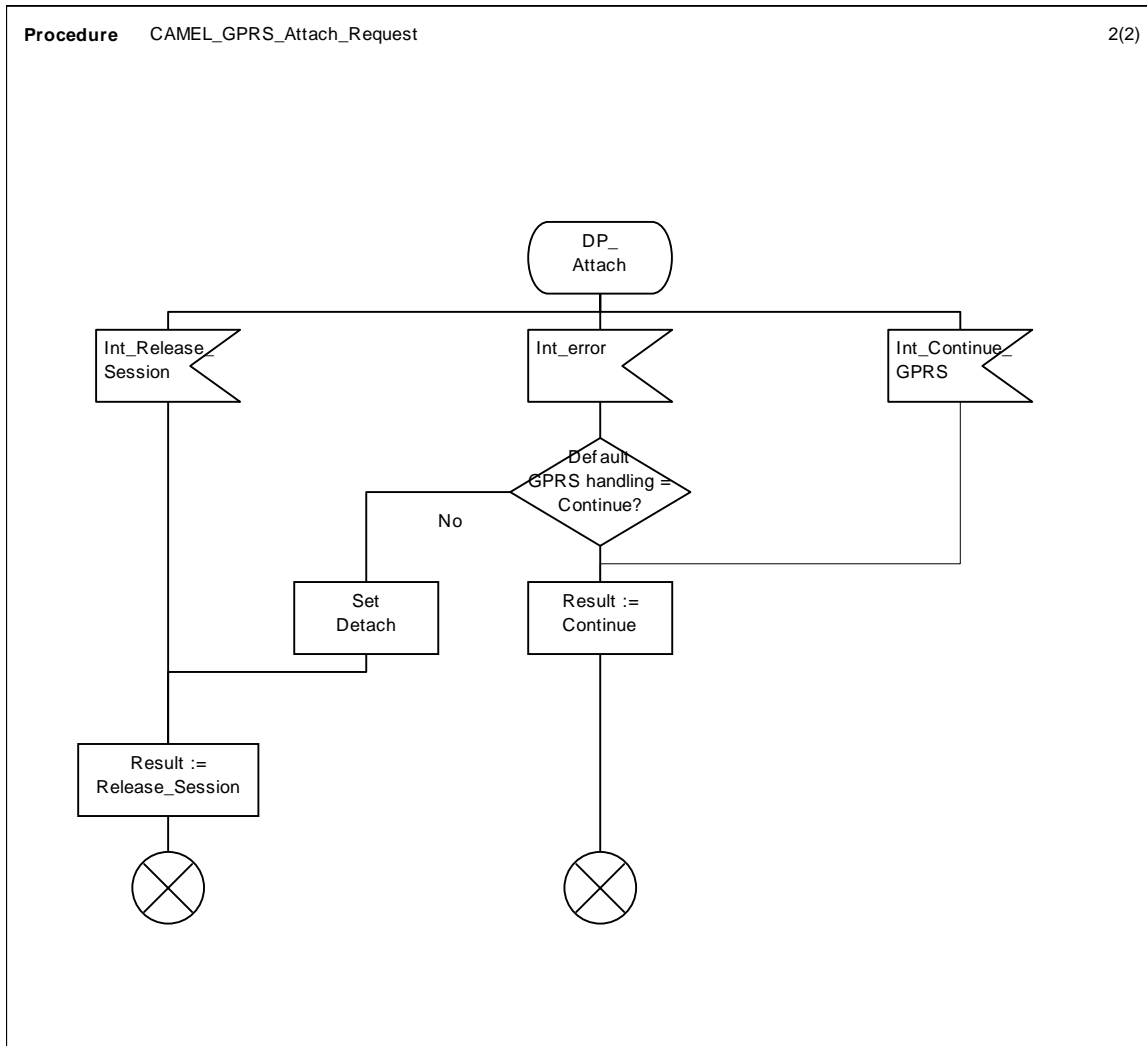


Figure 6.6 b: Procedure CAMEL_GPRS_Attach_Request (sheet 2)

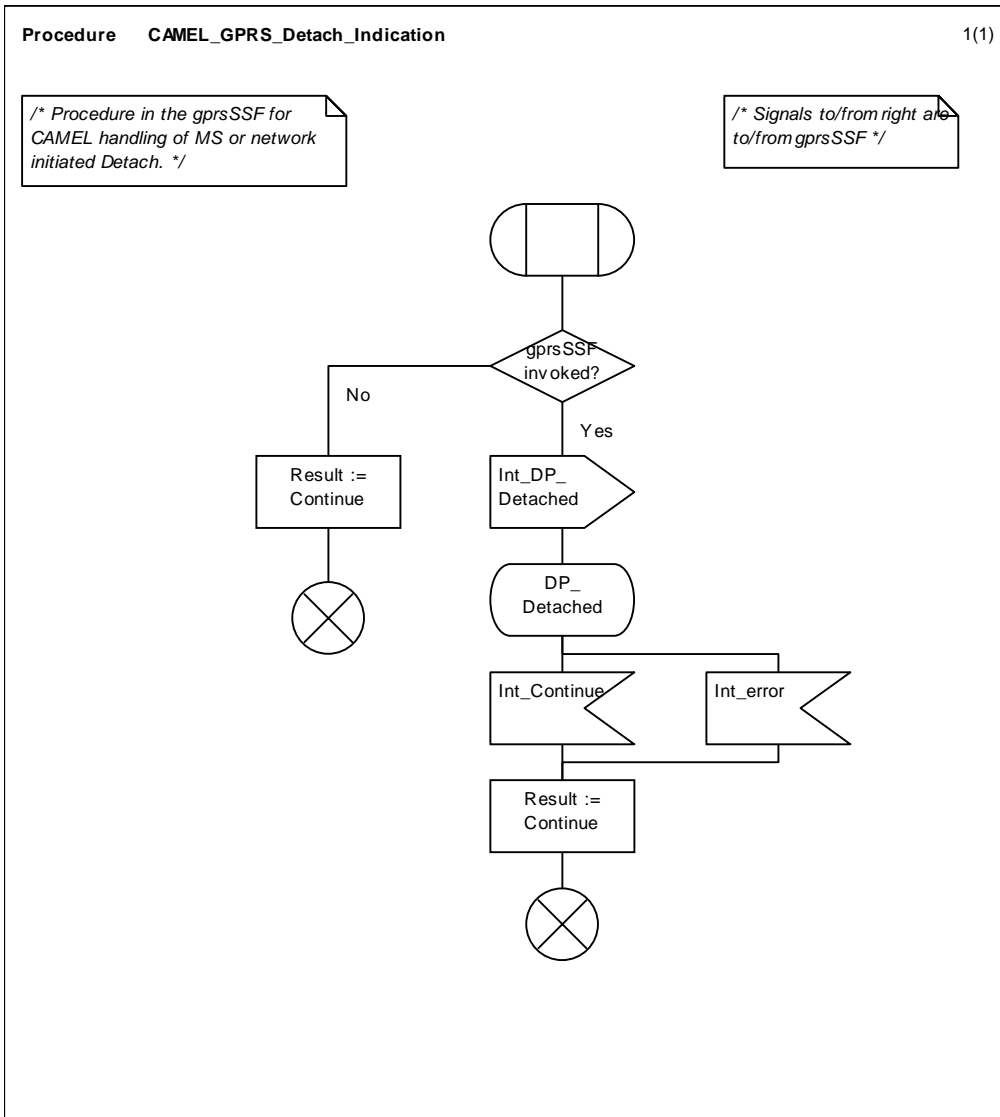


Figure 6.7: Procedure CAMEL_GPRS_Detach_Indication

6.5.5 Handling of GPRS Routing Area Update

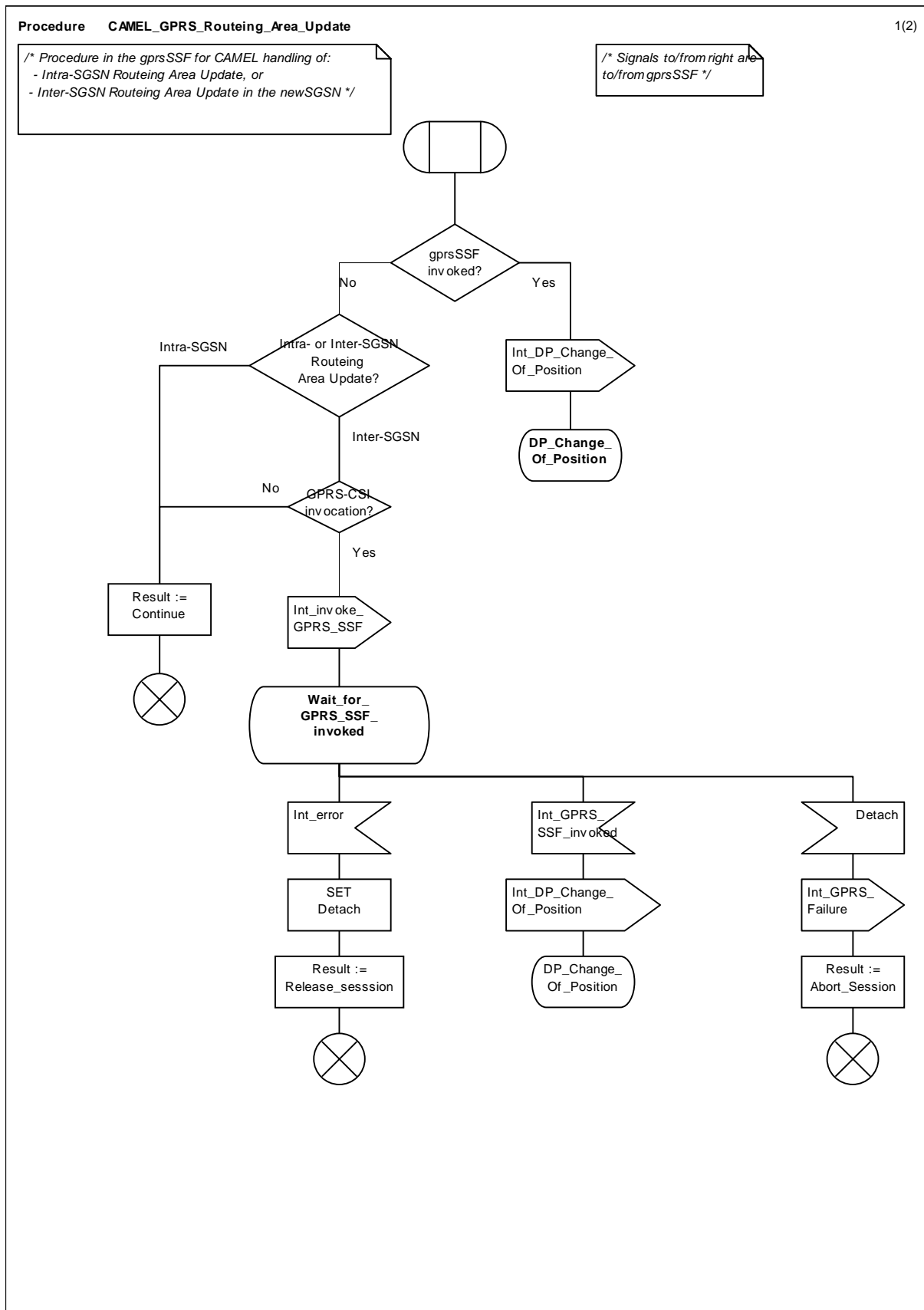


Figure 6.8 a: Procedure CAMEL_GPRS_Routeing_Area_Update (sheet 1)

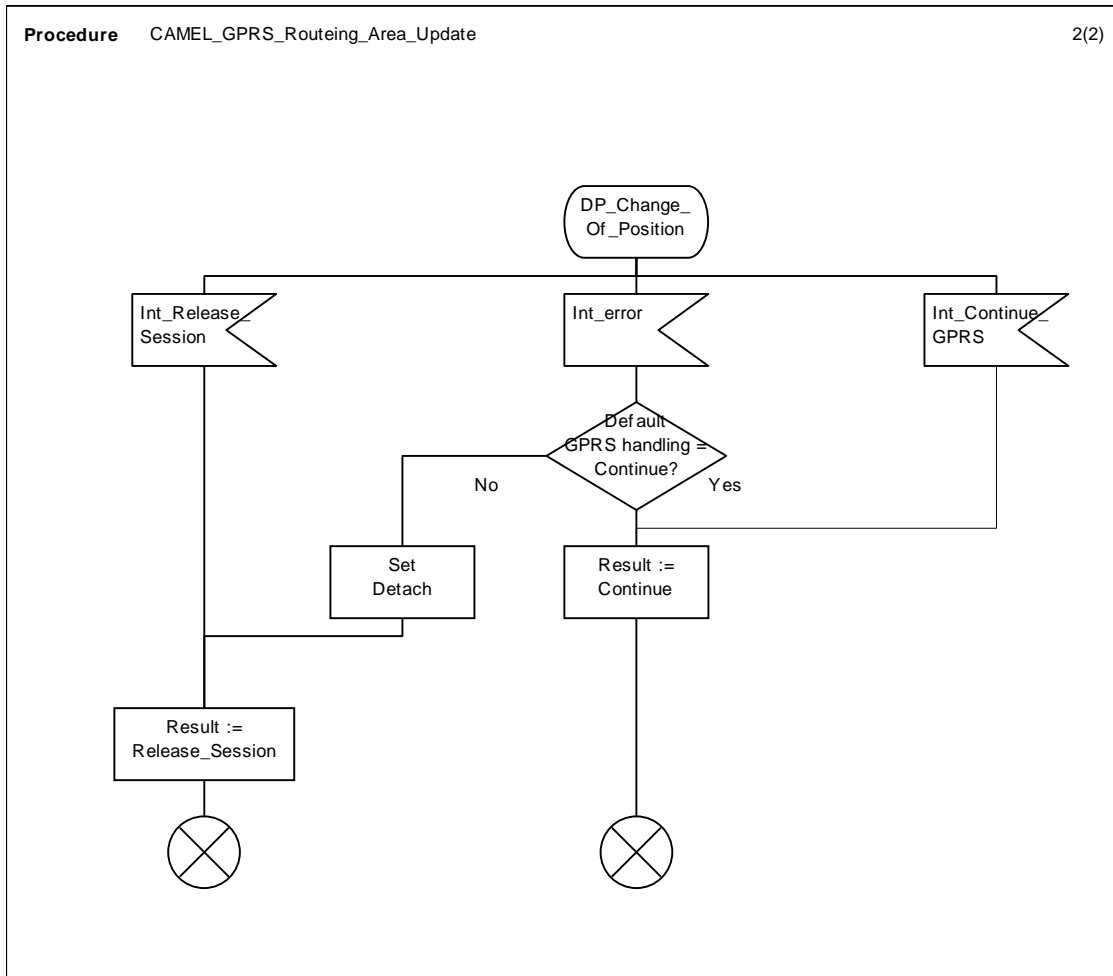


Figure 6.8 b: Procedure CAMEL_GPRS_Routeing_Area_Update (sheet 2)

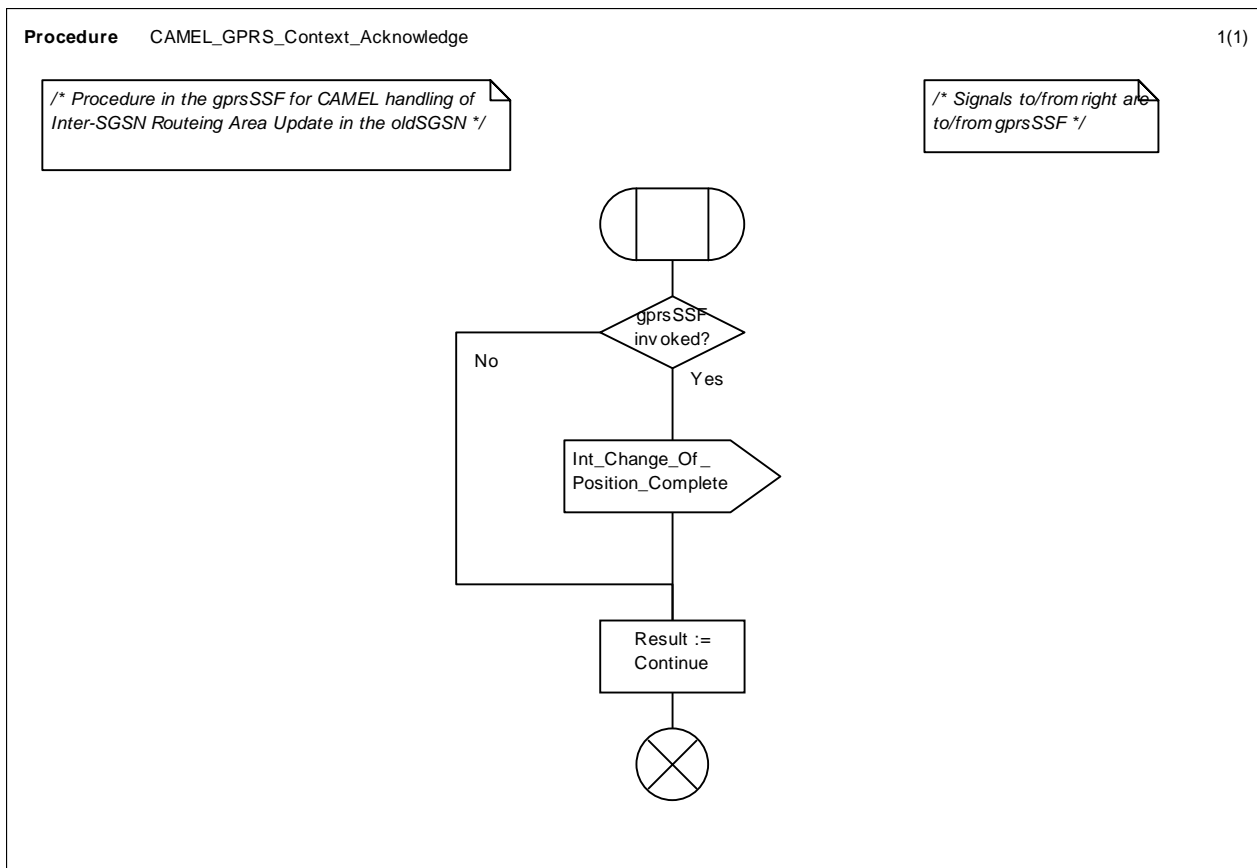


Figure 6.9: Procedure CAMEL_GPRS_Context_Acknowledge

6.5.6 Handling of PDP Context establishment and deactivation

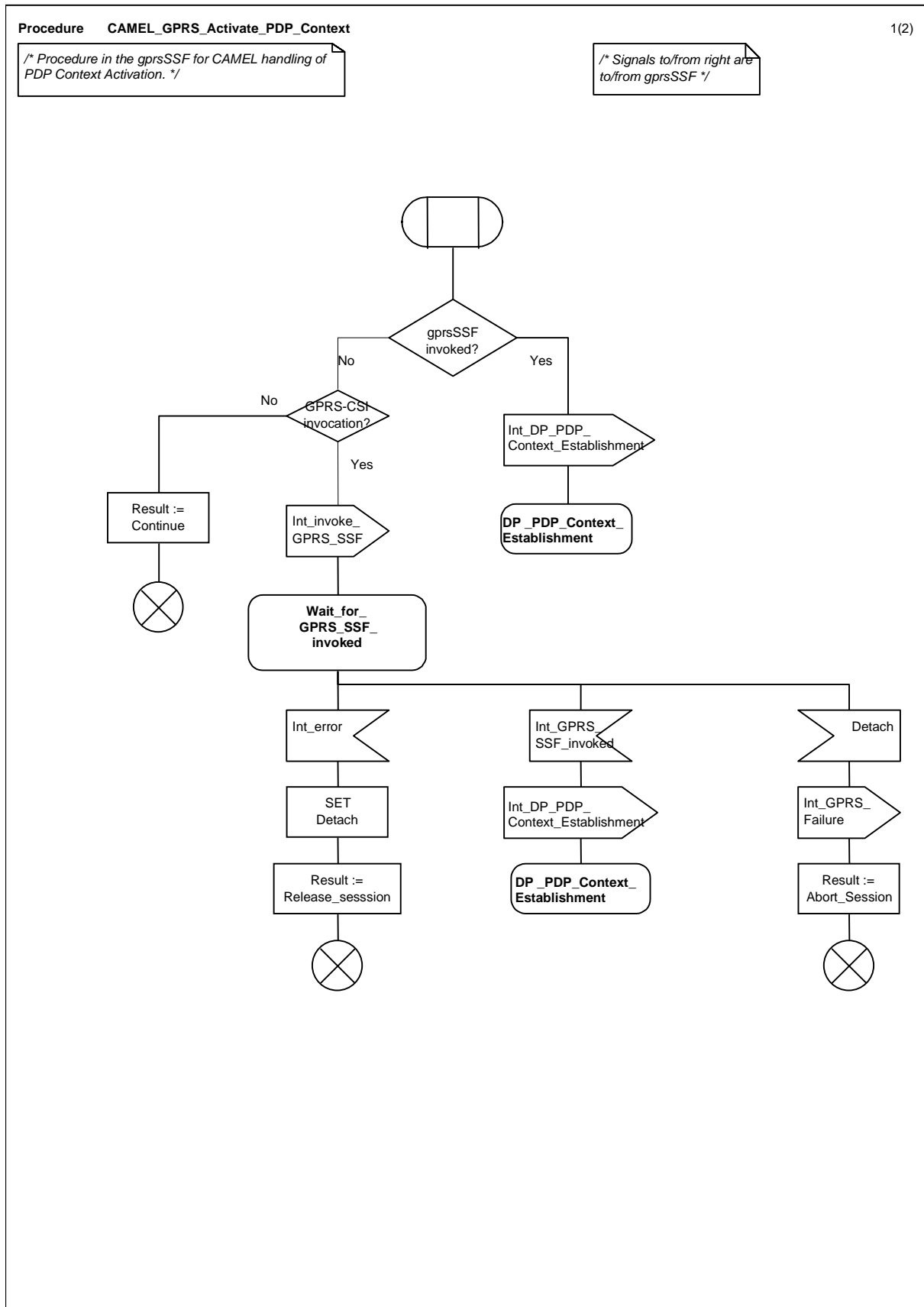


Figure 6.10 a: Procedure CAMEL_GPRS_Activate_PDP_Context (sheet 1)

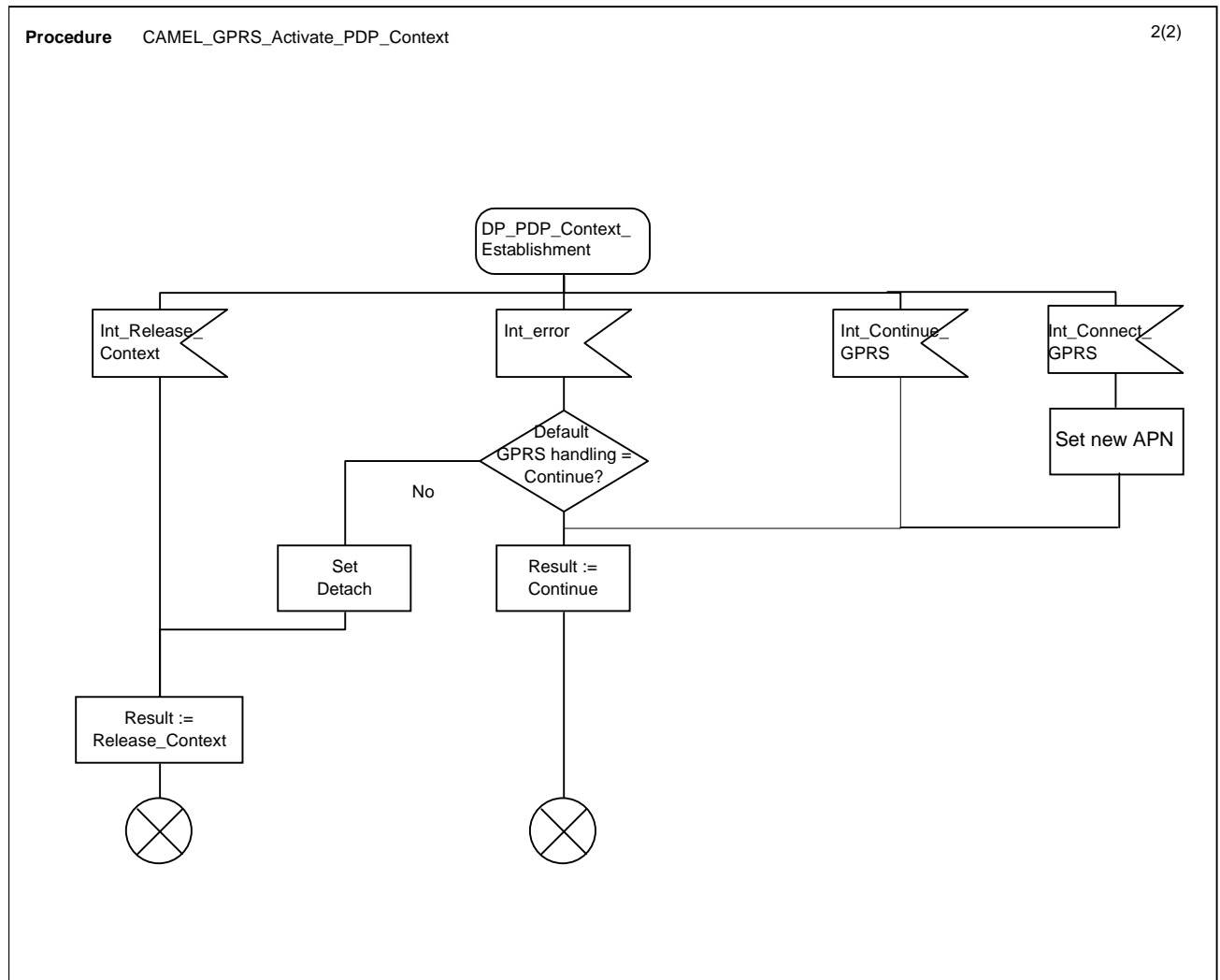


Figure 6.10 b: Procedure CAMEL_GPRS_Activate_PDP_Context (sheet 2)

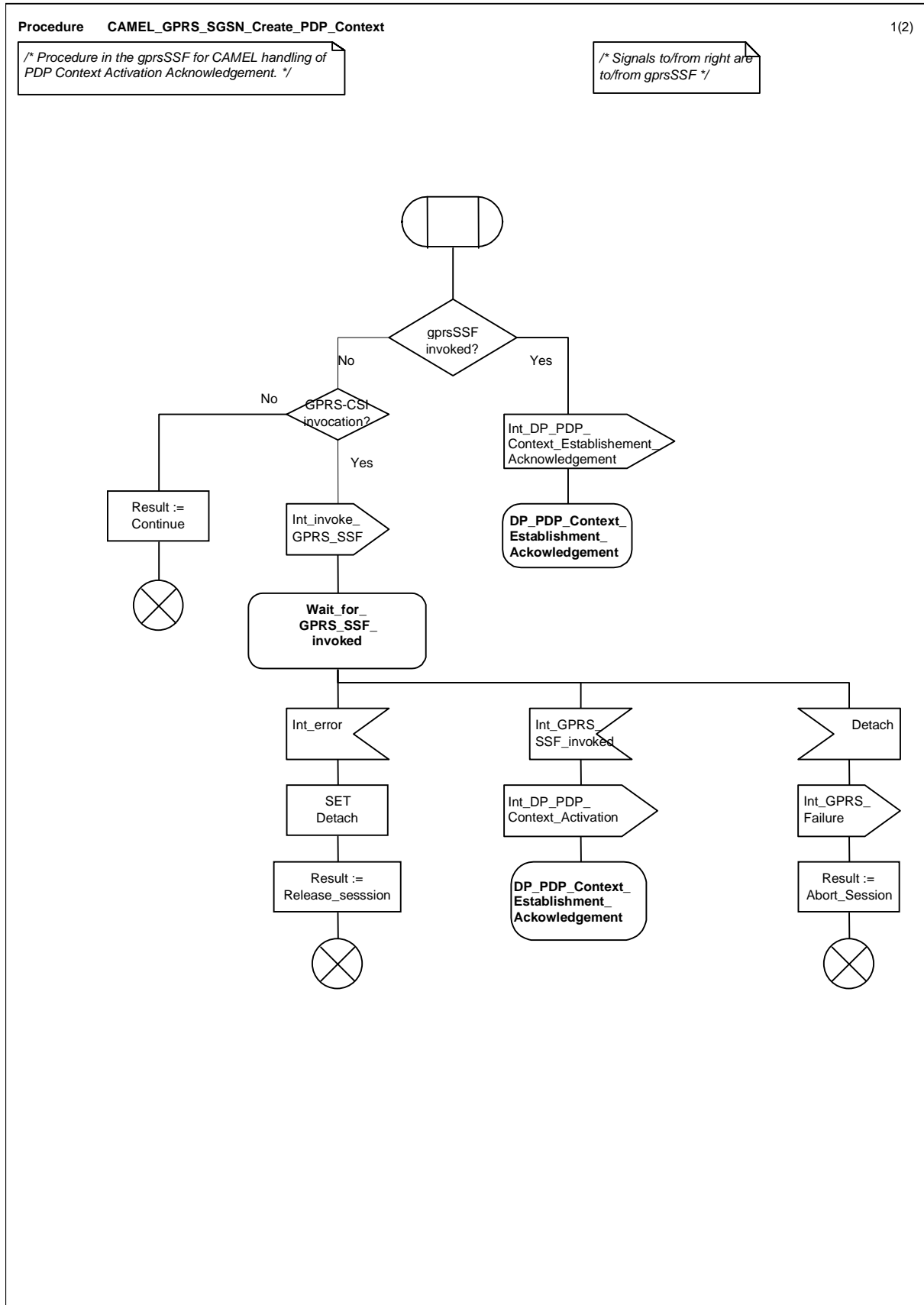


Figure 6.11 a: Procedure CAMEL_SGSN_Create_PDP_Context (sheet 1)

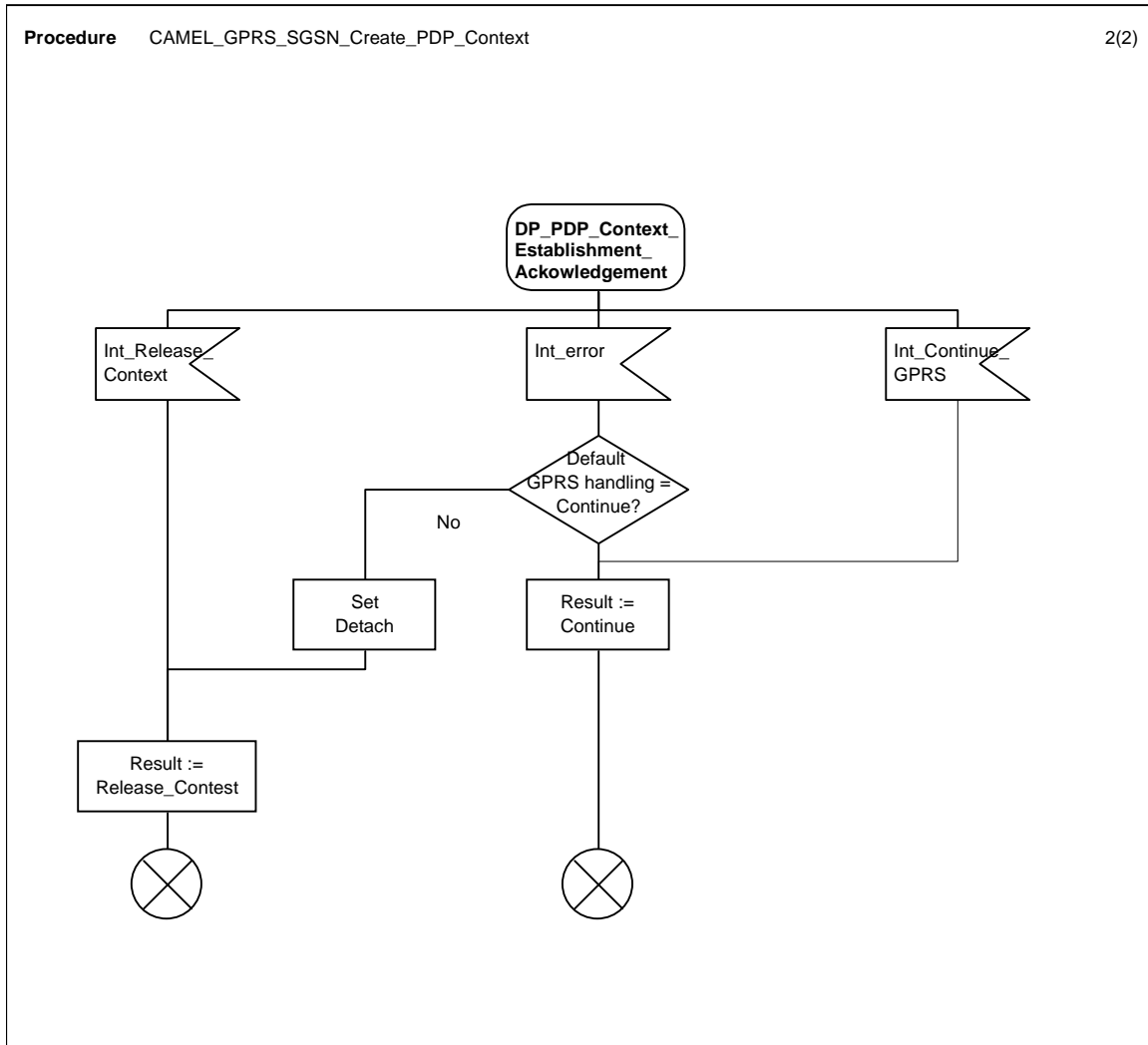


Figure 6.11 b: Procedure CAMEL_SGSN_Create_PDP_Context (sheet 2)

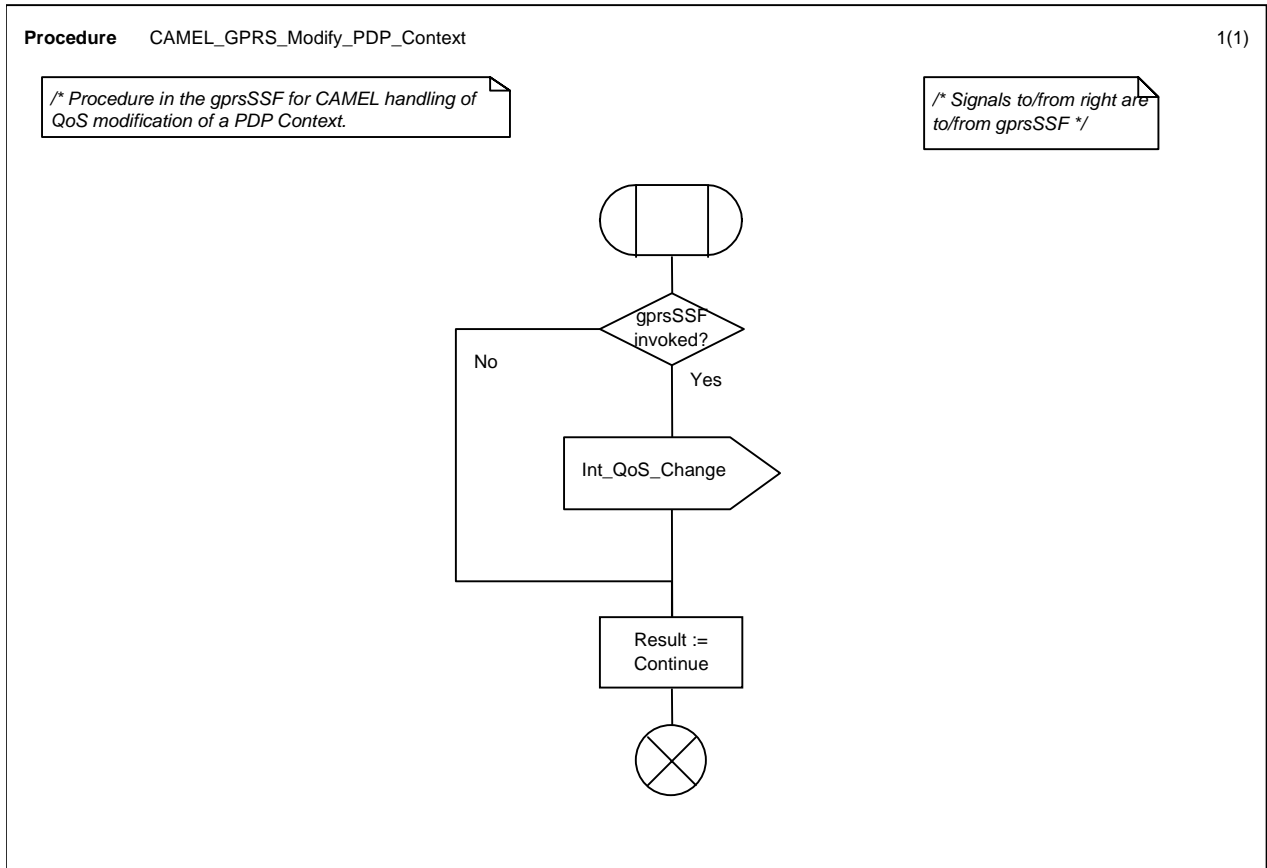


Figure 6.12: Procedure CAMEL_GPRS_Modify_PDP_Context

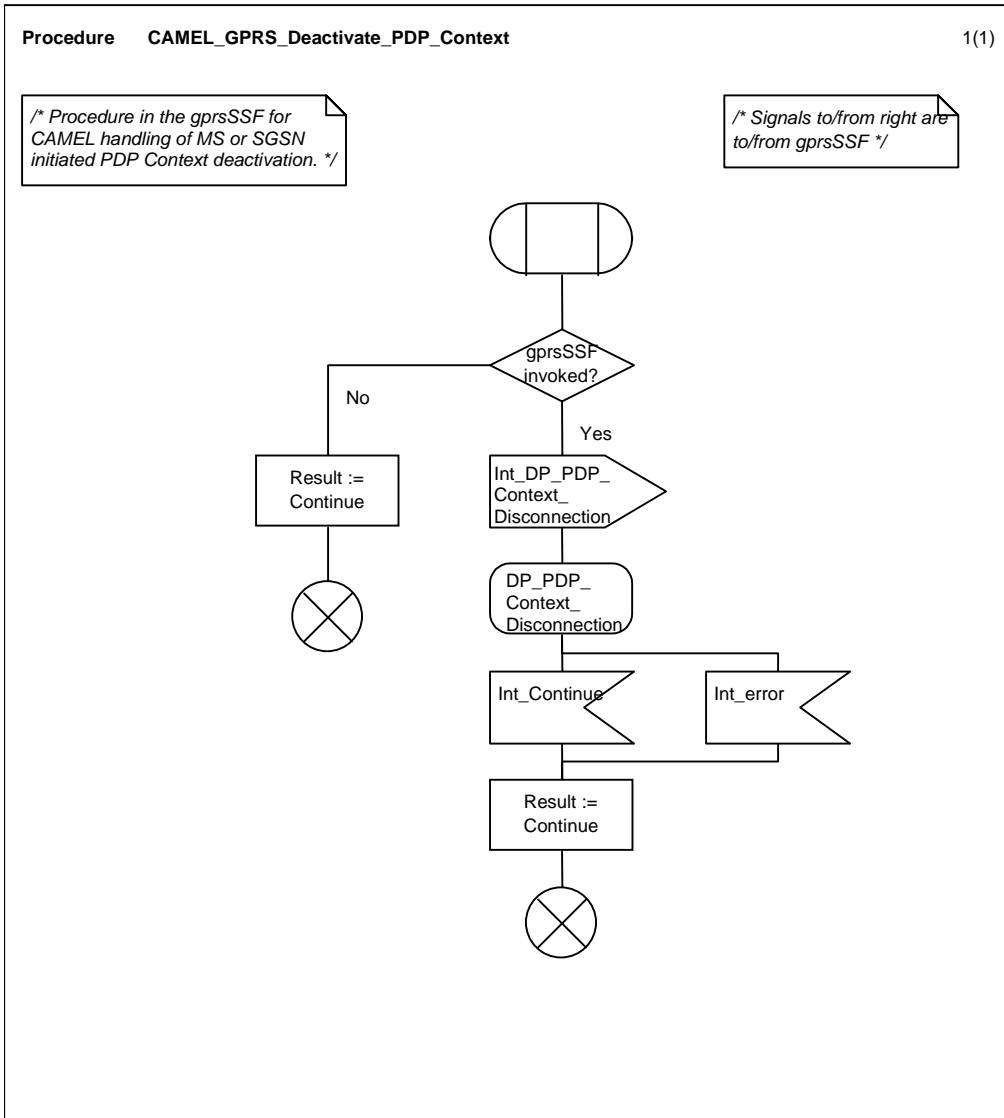


Figure 6.13: Procedure CAMEL_SGSN_Deactivate_PDP_Context

6.5.6 GPRS SSF

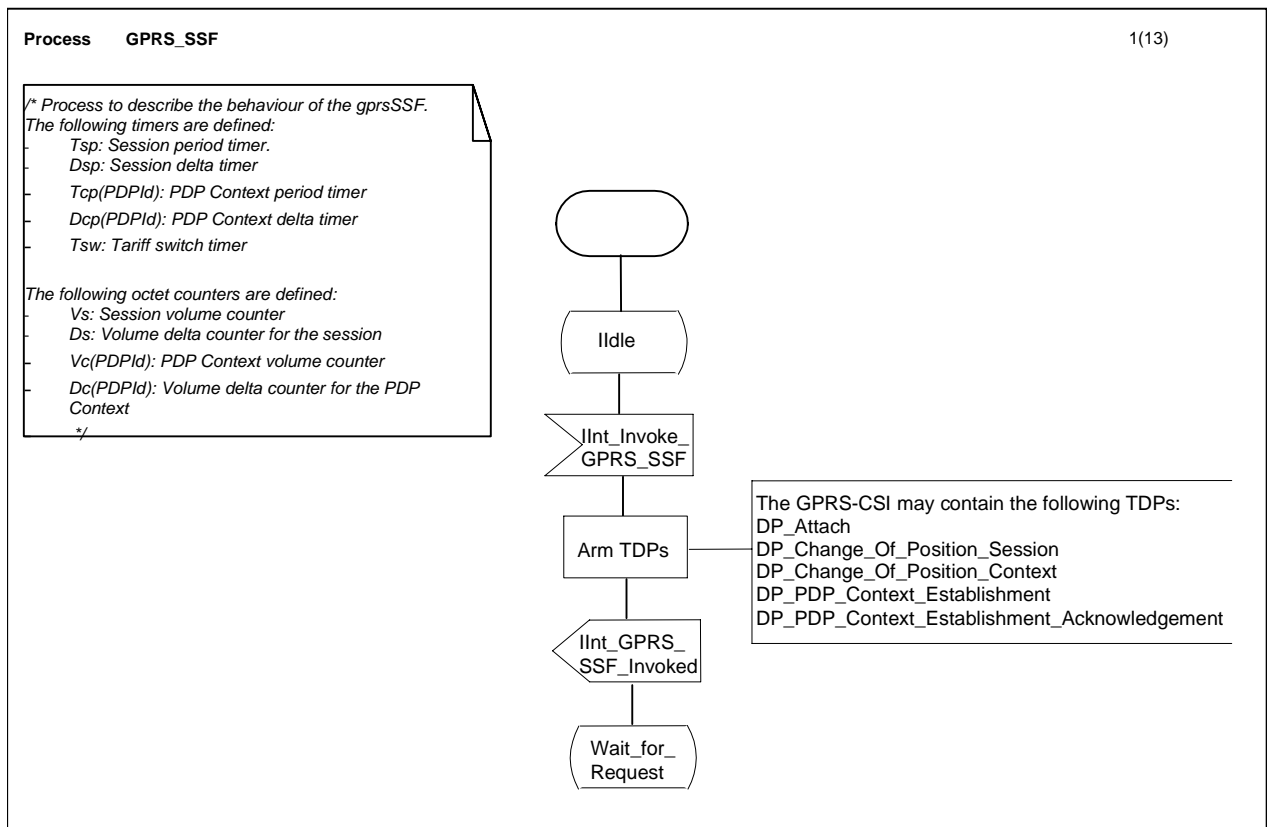


Figure 6.14 a: Process GPRS_SSF (sheet 1)

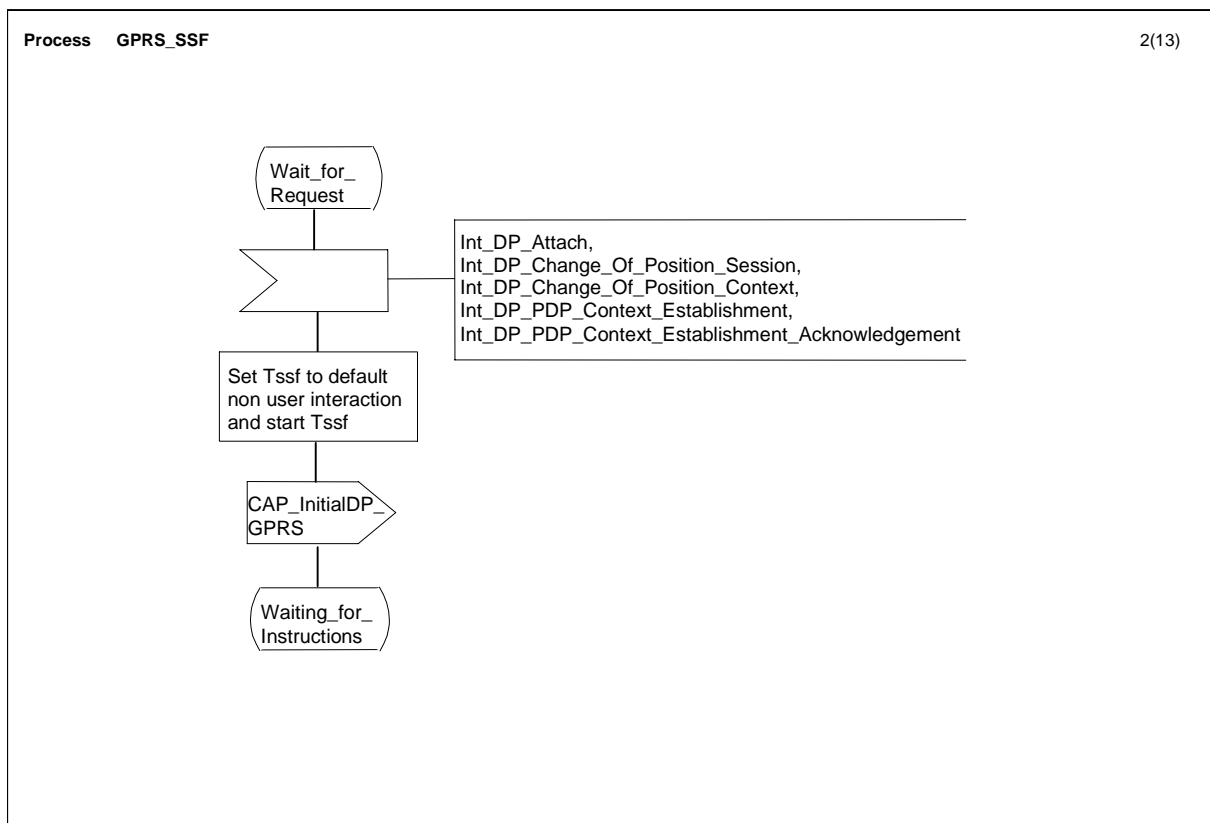


Figure 6.14 b: Process GPRS_SSF (sheet 2)

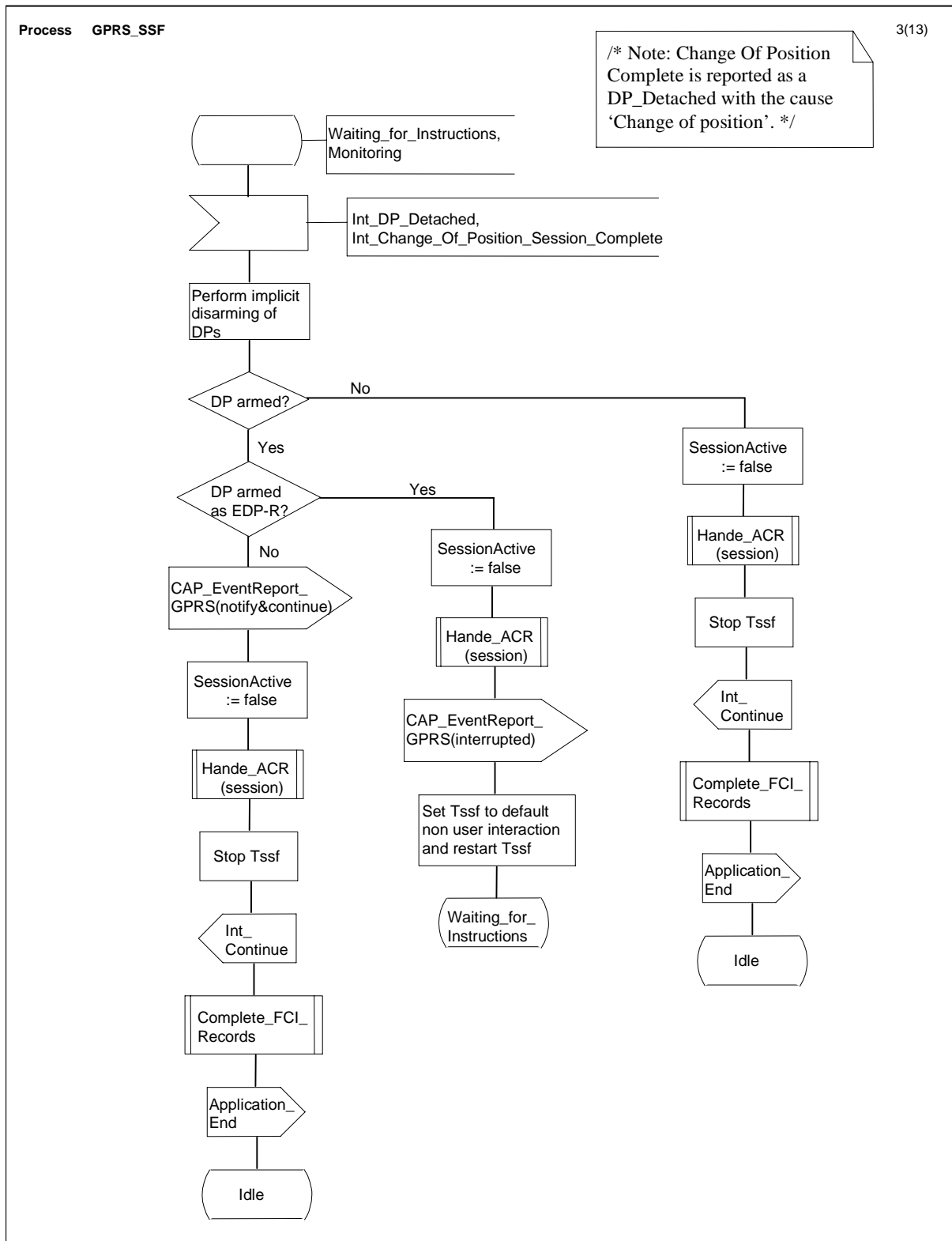


Figure 6.14 c: Process GPRS_SSF (sheet 3)

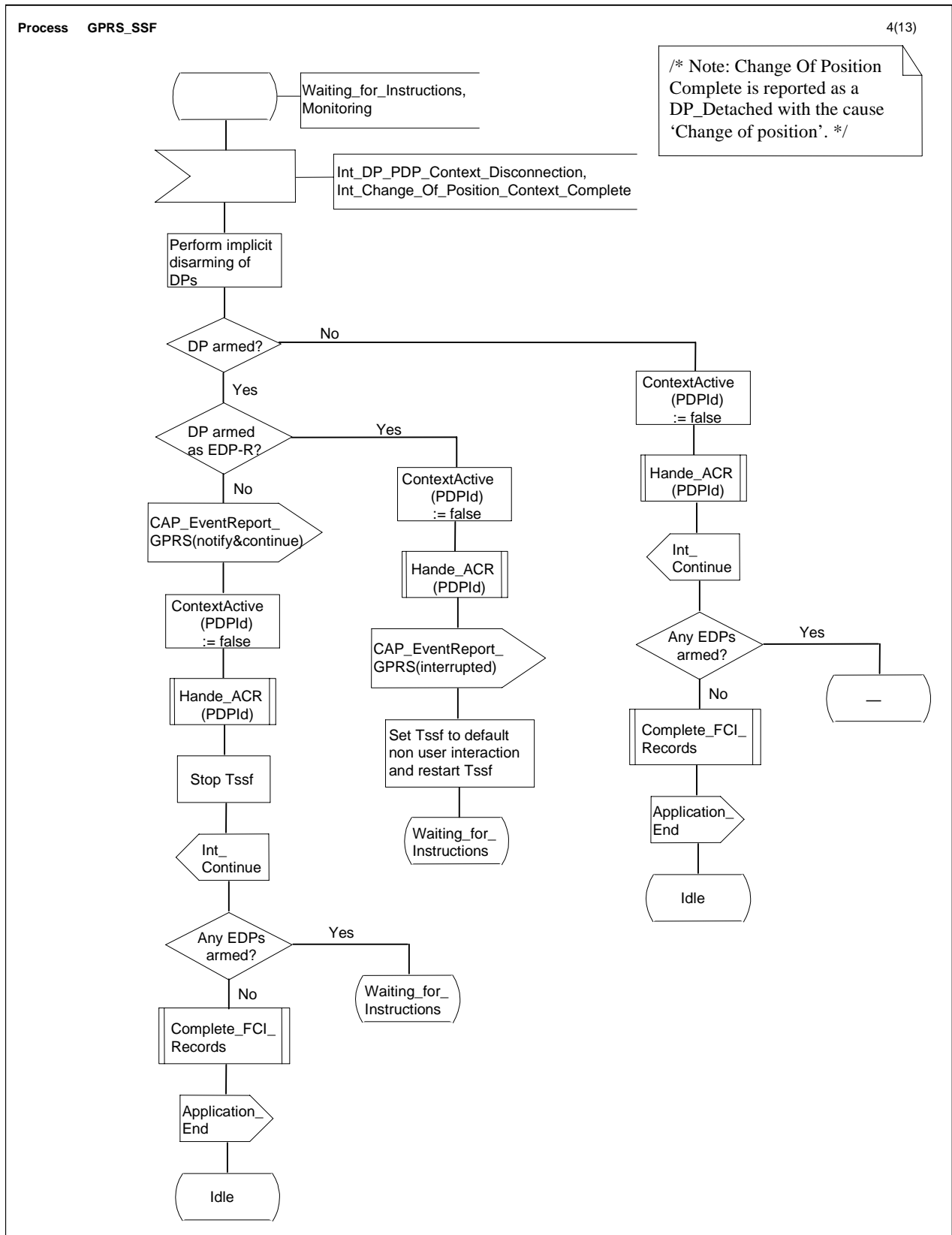


Figure 6.14 d: Process GPRS_SSF (sheet 4)

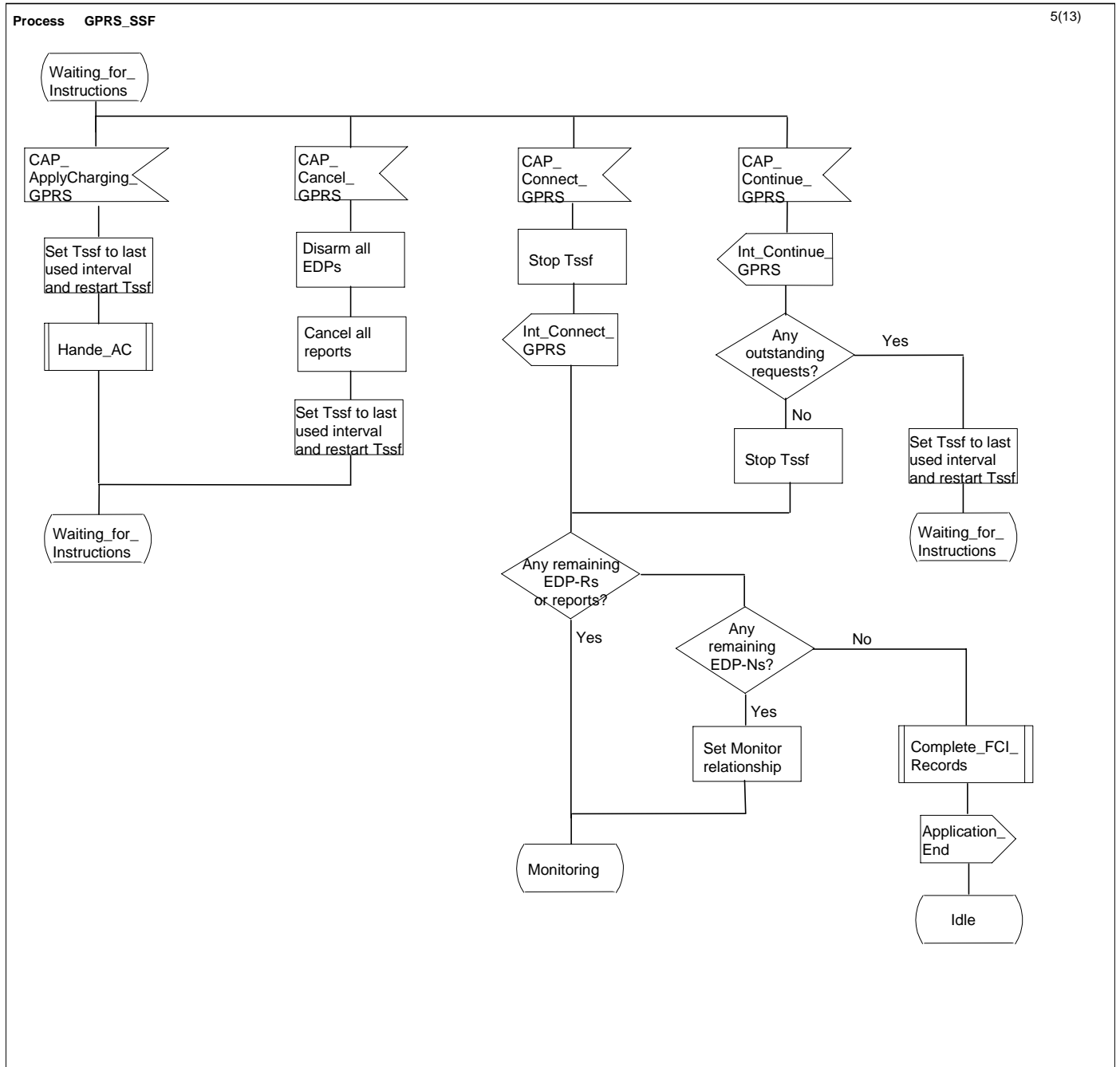


Figure 6.14 e: Process GPRS_SSF (sheet 5)

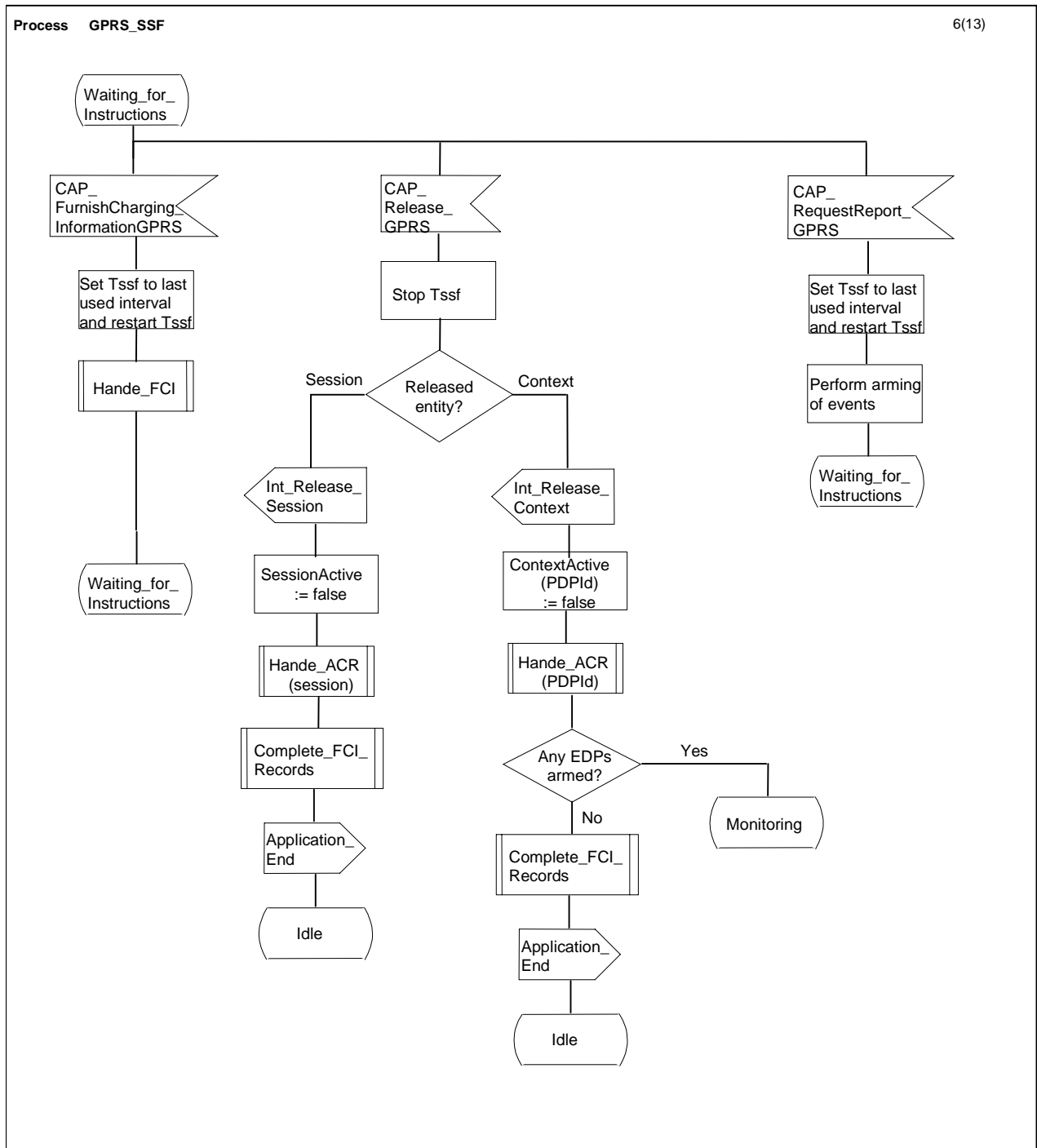


Figure 6.14 f: Process GPRS_SSF (sheet 6)

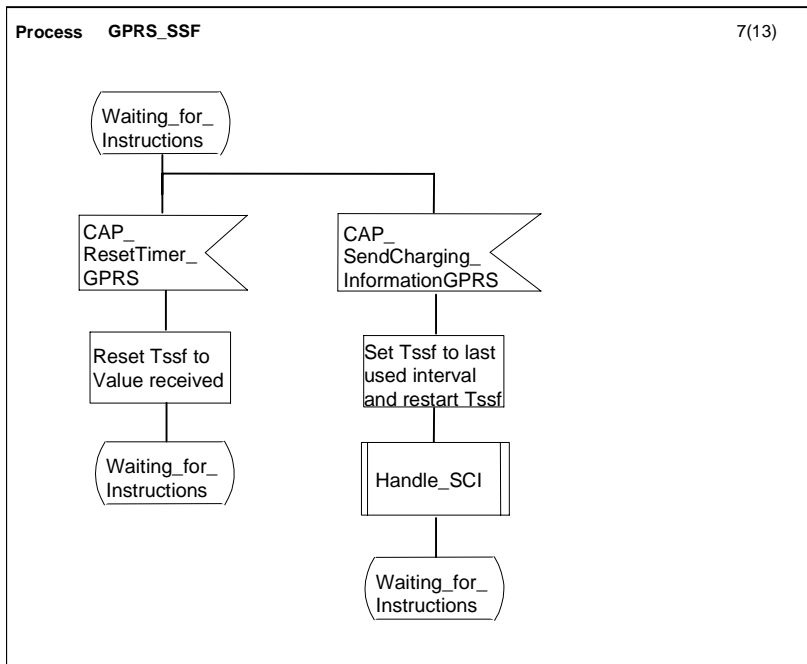


Figure 6.14 g: Process GPRS_SSF (sheet 7)

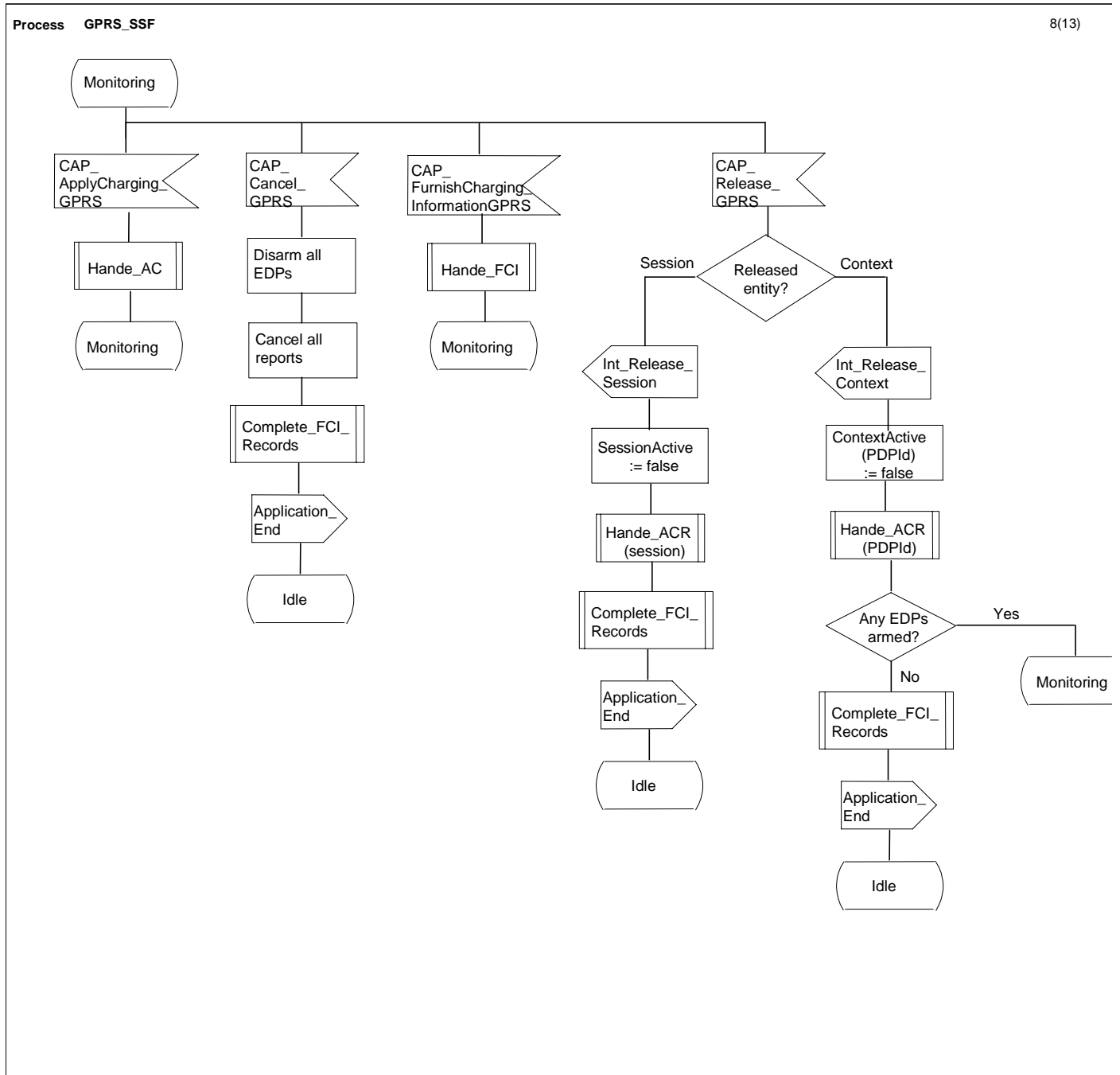


Figure 6.14 h: Process GPRS_SSF (sheet 8)

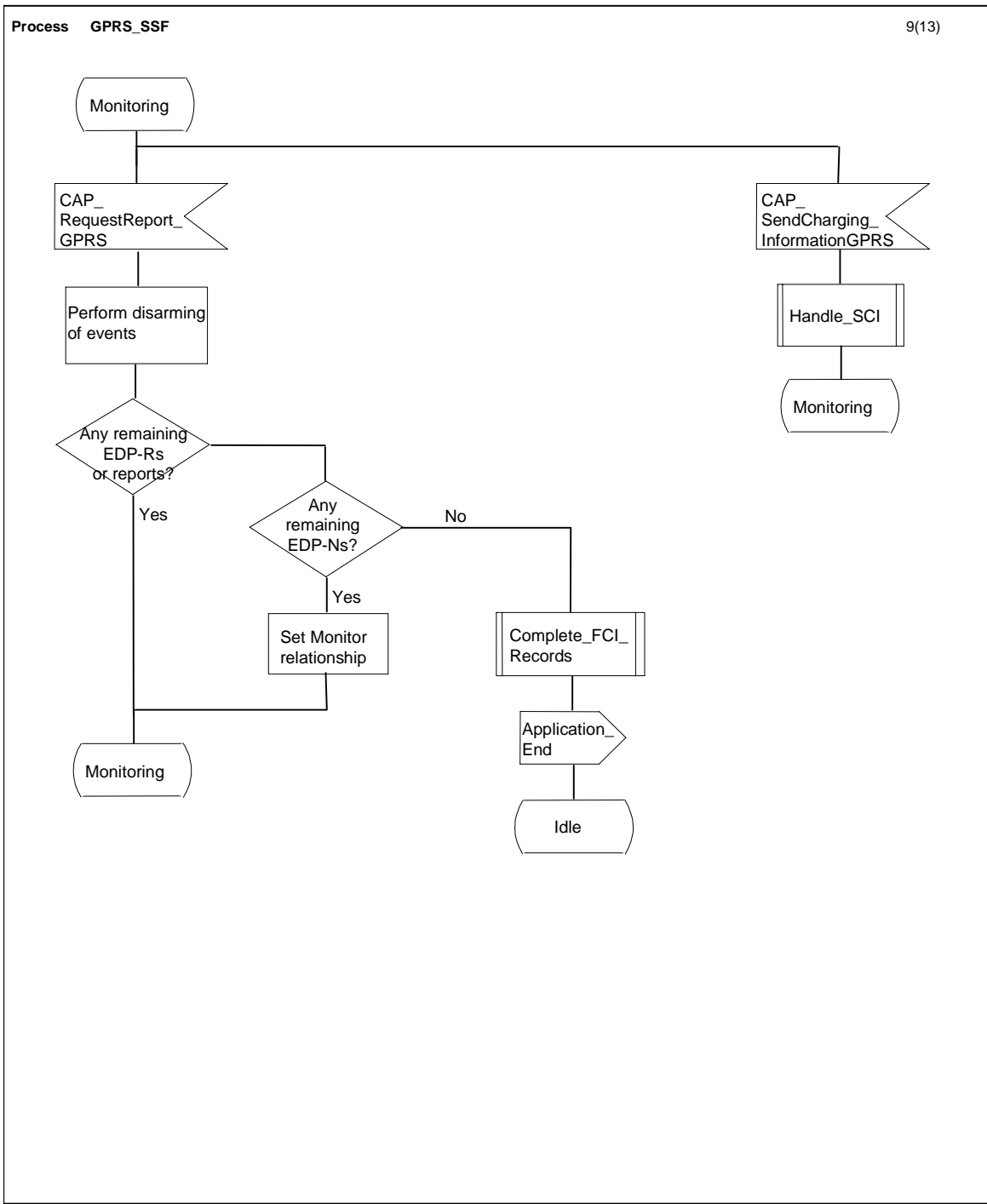


Figure 6.14 i: Process GPRS_SSF (sheet 9)

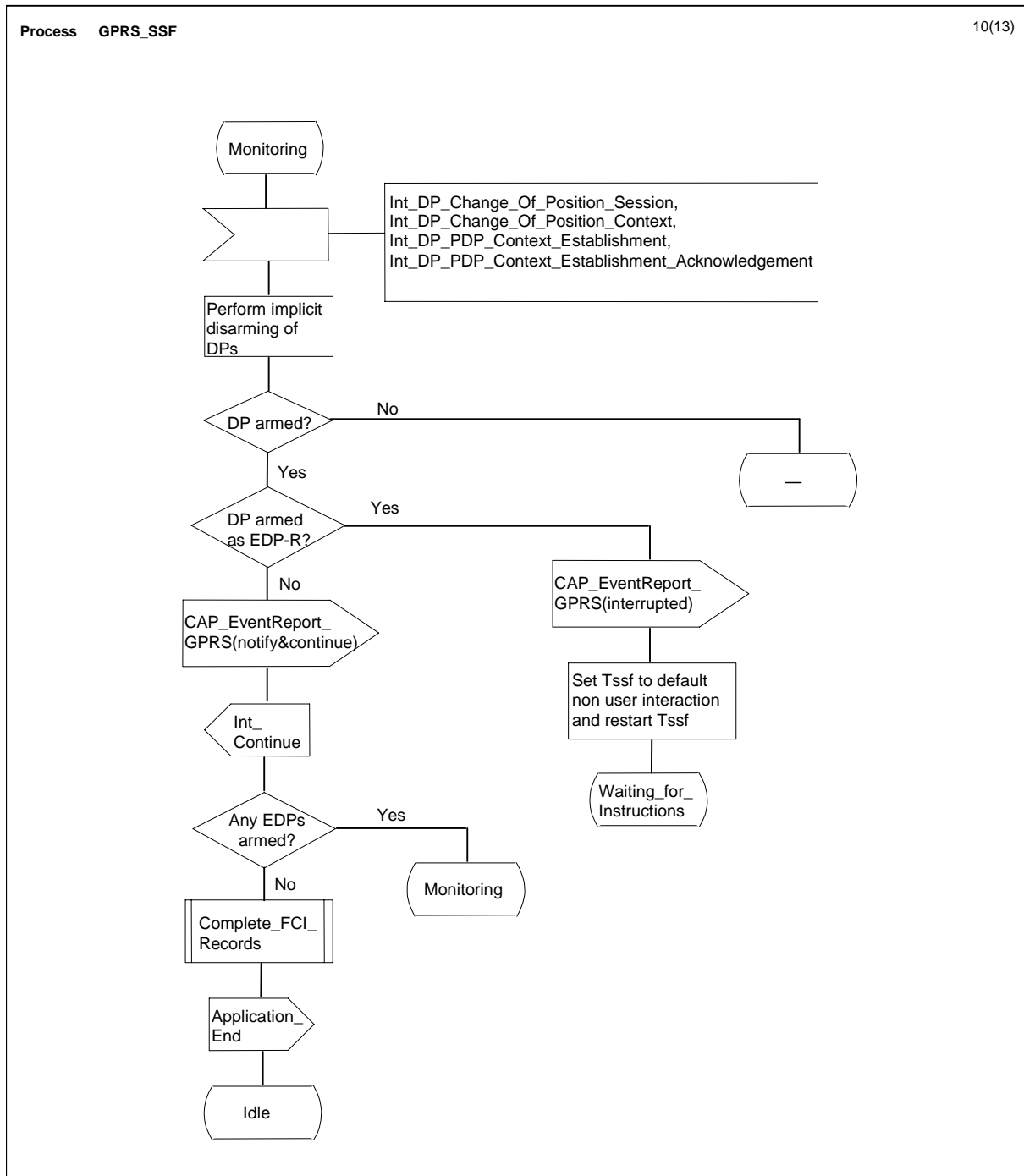


Figure 6.14 j: Process GPRS_SSF (sheet 10)

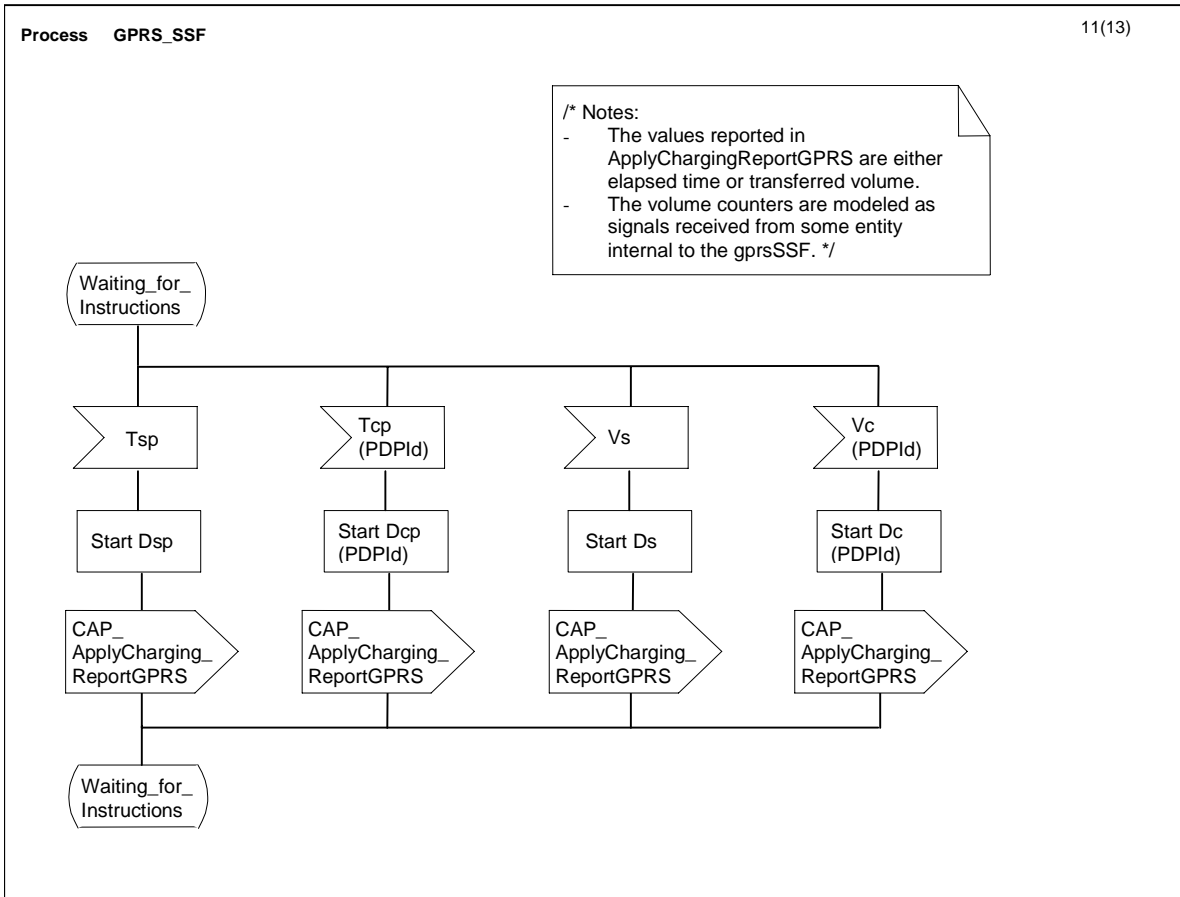


Figure 6.14 k: Process GPRS_SSF (sheet 11)

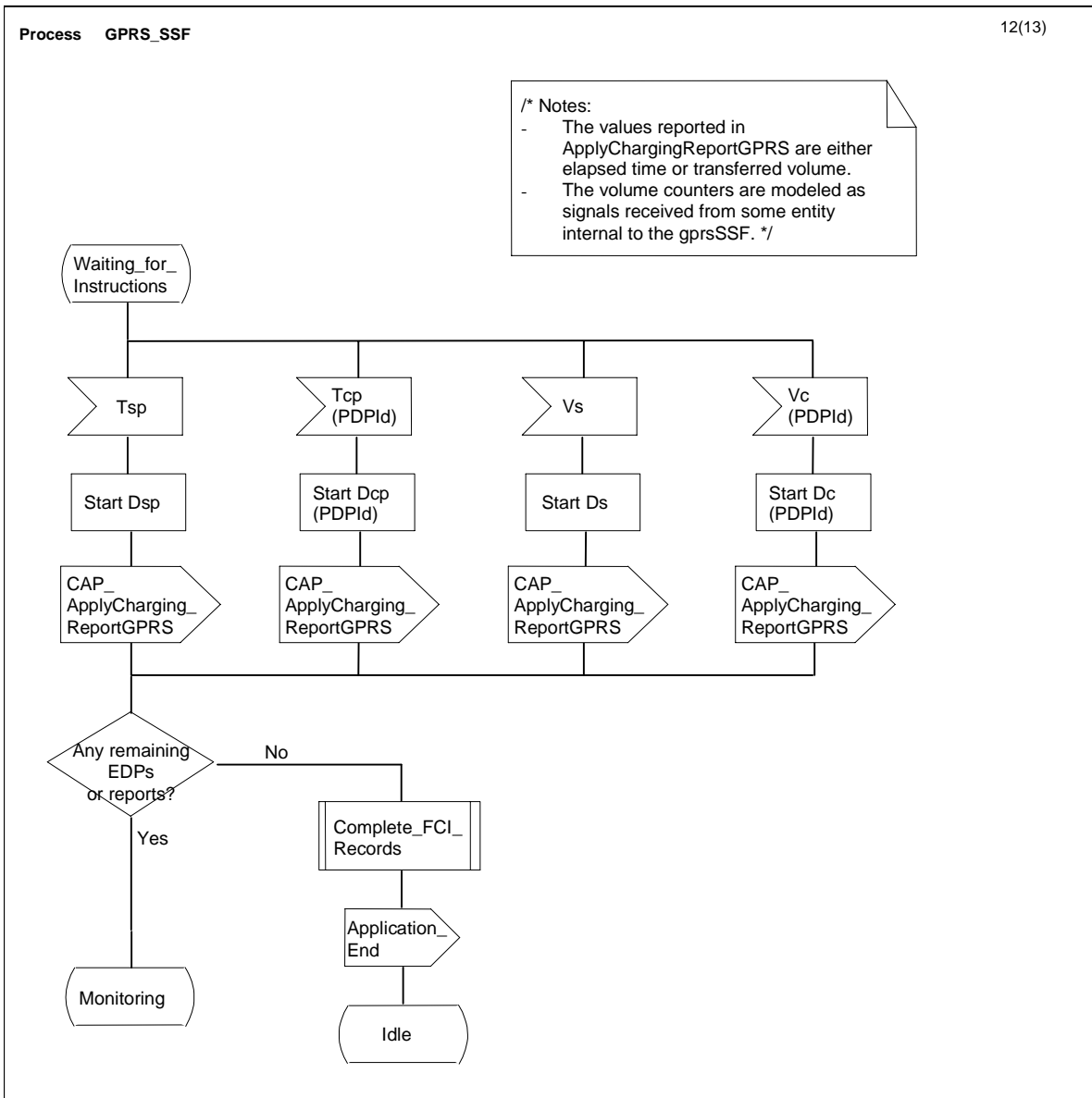


Figure 6.14 I: Process GPRS_SSF (sheet 12)

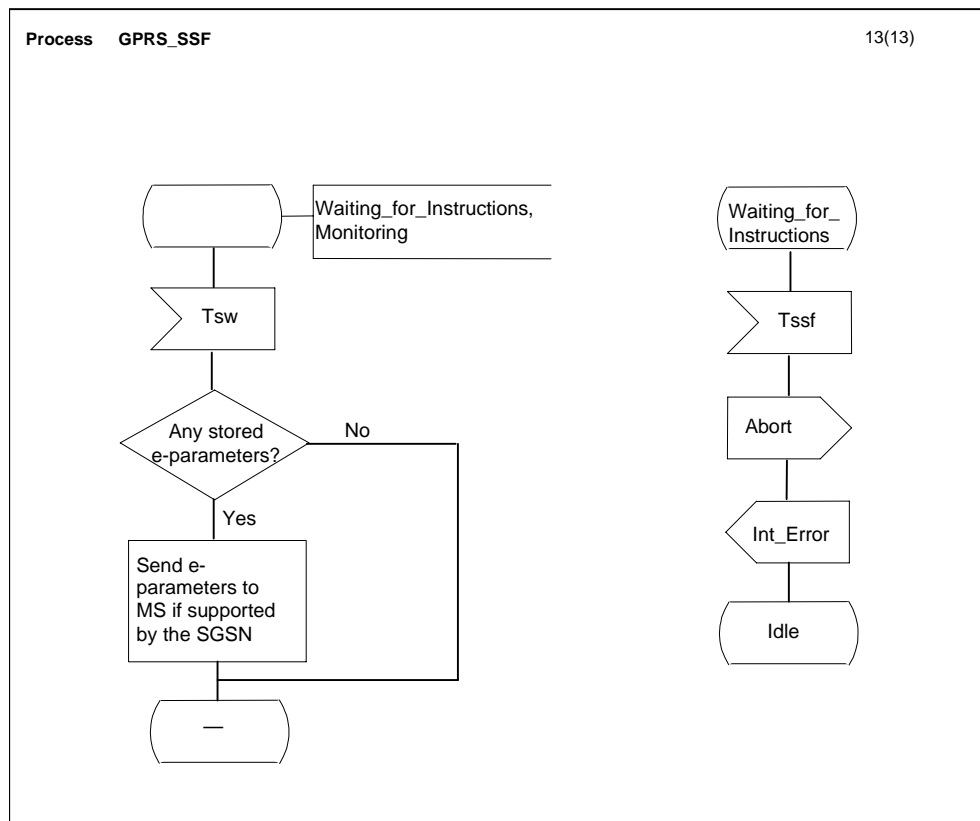


Figure 6.14 m: Process GPRS_SSF (sheet 13)

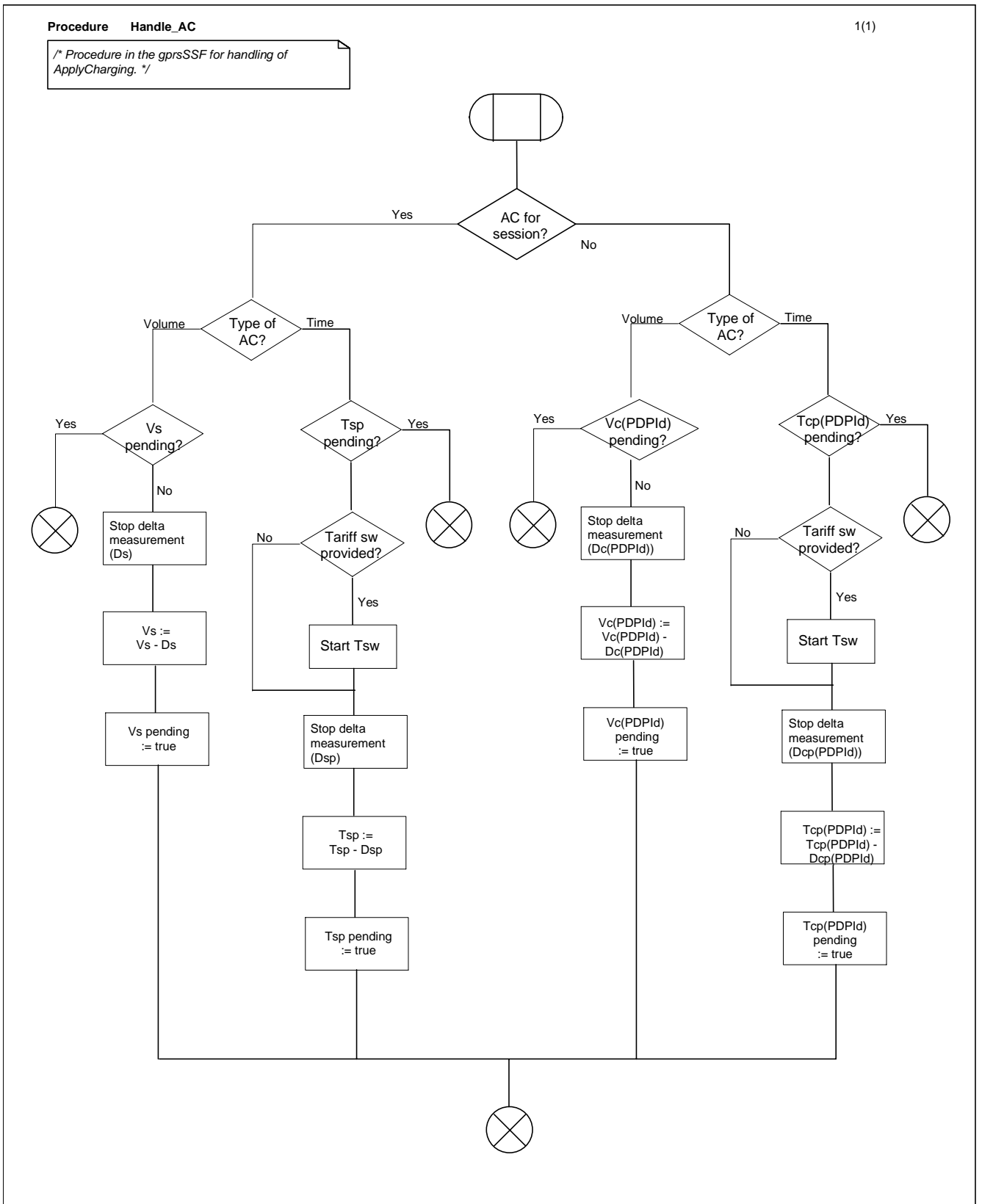


Figure 6.15: Procedure Handle_AC_GPRS

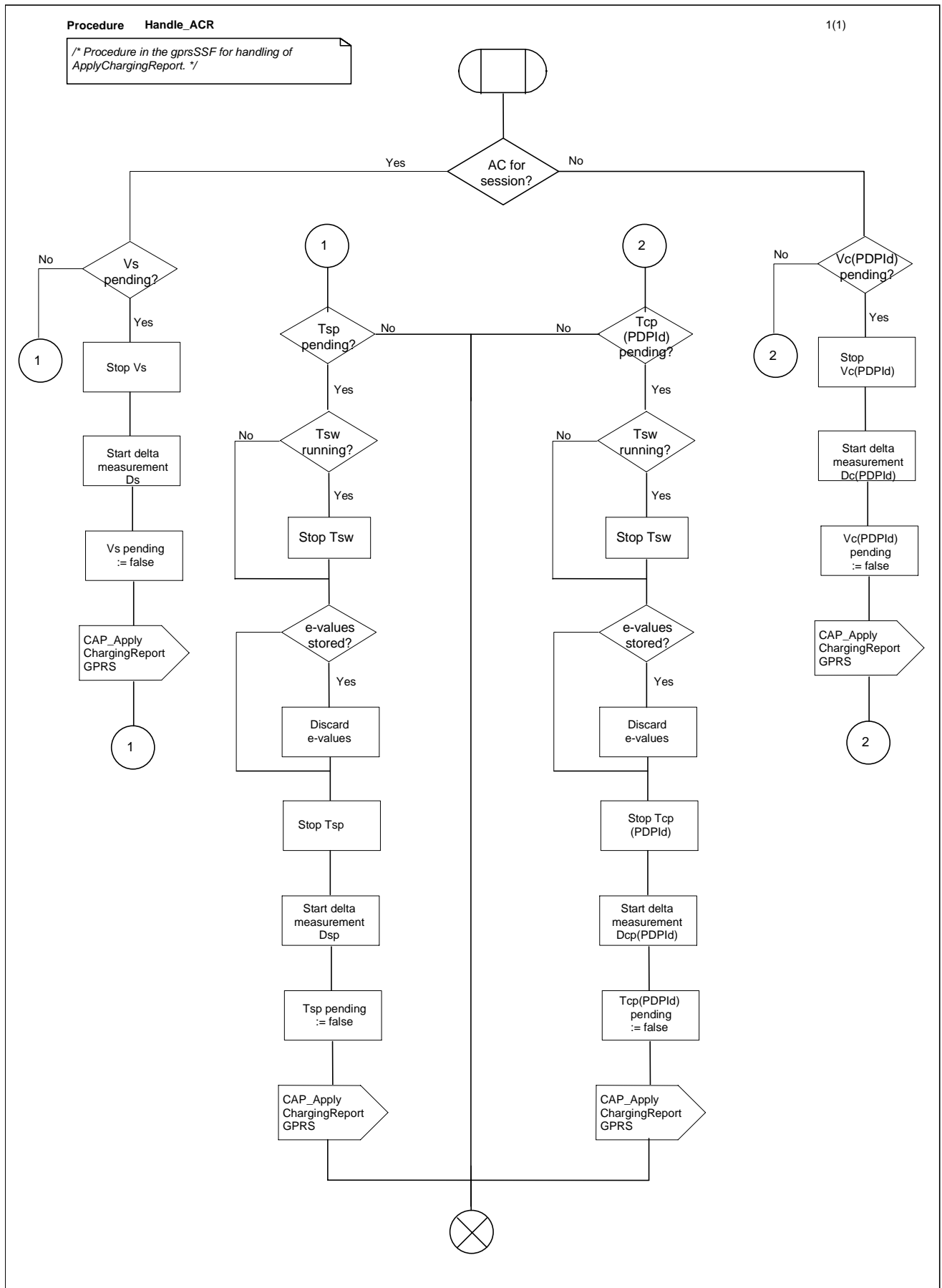


Figure 6.16: Procedure Handle_ACR_GPRS

6.6 Description of information flows

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 user initiated change in QoS. Note that there are several possible QoS profiles defined by the combinations of the different QoS attributes as defined in 3G TS 23.060, see reference [11]. 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

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Charging Result	M	This IE contains the charging information for the PDP provided by the gsmSSF. It is a choice between elapsed time and data volume.
Quality of Service	C	This IE identifies the QoS requested by the user and granted by the SGSN due to 'Modify PDP Context request. If not present the report is sent due to PDP context or GPRS session termination or Charging threshold reached.
Active	M	This IE indicates if the GPRS session or PDP context is still established e, or if it has been detached or deactivated.
PDP ID	C	This IE identifies the PDP context which the Apply Charging Report is applicable for. If not present the dialogue corresponds to the session or to one single PDP context.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

6.6.1.3 Entity Released GPRS

6.6.1.3.1 Description

This IF is used by the gprsSSF to inform the gsmSSF at any phase that a PDP context within one dialogue has been terminated abnormally by the SGSN.

6.6.1.3.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
GPRS Cause	M	This IE contains the Cause value indicating the reason for discontinuation of the PDP context.
PDP ID	M	This IE identifies the PDP context which has been terminated by the SGSN.

M Mandatory (The IE shall always be sent)

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 (e.g. Attach or Detach) previously requested by the gsmSCF in a Request Report GPRS Event IF.

6.6.1.4.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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	C	This IE contains information specific to the reported event, e.g. new routing area in case of change of position or charging id in case of PDP Context Establishment Acknowledgement.
PDP ID	C	This IE identifies the PDP context, which the Report GPRS Event is applicable for. If not present the dialogue corresponds to the Attach/Detach FSM or to one single PDP context.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

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 machines, to request instructions from the gsmSCF.

6.6.1.5.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
ServiceKey	M	This IE identifies for the gsmSCF the requested set of one or more CAMEL services. It is used to address the correct application/SLP within the gsmSCF.
GPRS Event Type	M	This IE indicates the armed GPRS DP event resulting in the Initial Data Event 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 the gprsSSF resides in.
GPRS MS Class	C	This IE contains the MS network and radio access capabilities.
PDP Type	C	This IE identifies the PDP Type, e.g. X.25 or IP.
Quality of Service	C	This IE identifies the QoS (subscribed, requested or negotiated).
Access Point Name	C	This IE identifies the address Access Point Name the MS has requested to connect to.
Routeing Area Identity	C	This IE contains the location information of the MS.
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 node to support the CAMEL interwork, e.g. support of Advice of Charge.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

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

This IF contains no information elements.

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 PDP Context.

6.6.2.2.2 Information Elements

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Charging Characteristics	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. It is a choice between granted volume and granted time for the data transfer.
Tariff Switch Interval	O	This information element specifies the time duration until the next tariff switch occurrence.
PDP ID	C	This IE identifies the PDP context, which the Apply GPRS Charging is applicable for. If not present the dialogue corresponds to the session or to one single PDP context.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent).

C Conditional (The IE shall be sent, if available)

6.6.2.3 Cancel GPRS

6.6.2.3.1 Description

This IF is used by the gsmSCF to request the gprsSSF to cancel all EDPs and reports.

6.6.2.3.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
all requests	M	This IE indicates that all active requests for EventReportGPRS and ApplyCharging shall be cancelled.
PDP ID	C	This IE identifies the PDP context which is to be cancelled. If not present the dialogue corresponds to the session or to one single PDP context.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

6.6.2.4 Connect GPRS

6.6.2.4.1 Description

This IF is used by the gsmSCF to request the gprsSSF to modify the APN used when establishing a PDP Context.

6.6.2.4.2 Information Elements

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Access Point Name	M	This IE contains the Access Point Name to be used when establishing the PDP Context.
PDP Id	C	This IE identifies the PDP Context where the new Access Point Name shall be used.

M Mandatory (The IE shall always be sent)

6.6.2.5 Continue GPRS

6.6.2.5.1 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 FSM or PDP Context FSM) without substituting new data from the gsmSCF.

6.6.2.5.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
PDP ID	C	This IE identifies the PDP context which processing shall continue for. If not present the dialogue corresponds to the session or to one single PDP context.

C Conditional (The IE shall be sent, if available)

6.6.2.6 Furnish Charging Information GPRS

6.6.2.6.1 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 FSM 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 is 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 operations. If there is non-completed free format data and new FCI operation(s) is/are received to overwrite the non-completed data, then the non-completed data is discarded and the gsmSCF can send another 160 octets per CDR.

6.6.2.6.2 Information Elements

Information element name	Required	Description
FCI GPRS Billing Charging Characteristics	M	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

FCI GPRS Billing Charging Characteristics contains the following information:

Information element name	Required	Description
FCIBCCAMEL Sequence 1	M	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

FCIBCCAMEL Sequence 1 contains the following information:

Information element name	Required	Description
Free Format Data	M	This IE is a free format data to be inserted in the CAMEL logical call record.
Append Free Format Data	O	<p>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.</p> <ul style="list-style-type: none"> 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 session or PDP Context. If this IE is absent or in value "Overwrite", then the gprsSSF shall overwrite all free format data already present in the Logical call record for that session or PDP Context, by the free format data received in this IF. <p>If no Logical call record exists yet for that session or PDP Context, then the gprsSSF shall ignore this IE.</p>

PDP Id	C	This IE identifies the PDP context's Logical call record to which the free format data shall be appended or overwritten. If not present, the free format data belong to a Logical call record for a session or a single PDP context for the dialogue.
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M Mandatory (The IE shall always be sent)

O Optimal (Service logic dependent)

C Conditional (The IE shall be sent, if available)

6.6.2.7 Release GPRS

6.6.2.7.1 Description

This IF is used by the gsmSCF to tear down an existing GPRS session or PDP Context at any phase.

6.6.2.7.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
GPRS Cause	<u>M</u>	<u>This IE contains the Cause value indicating the reason for releasing the GPRS session or PDP context.</u>
PDP ID	C	This IE identifies the PDP context which shall be released. If not present the dialogue corresponds to the session or to one single PDP context.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

6.6.2.8 Request Report GPRS Event

6.6.2.8.1 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 Data).

6.6.2.8.2 Information Elements

The following information elements are used:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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, which the Request Report GPRS Event is applicable for. If not present the dialogue corresponds to the session or to one single PDP context.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

Data Event contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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.

M Mandatory (The IE shall always be sent)

6.6.2.9 Reset Timer GPRS

6.6.2.9.1 Description

This IF is used to refresh the gprsSSF timer.

6.6.2.9.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
<u>Timer ID</u>	<u>M</u>	<u>This IE specifies the default value for the Tssf timer.</u>
Timer Value	M	This IE specifies the value to which the timer Tssf shall be set.
PDP ID	C	This IE identifies the PDP context, which the Reset of the timer is applicable for. If not present the dialogue corresponds to the session or to one single PDP context.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

6.6.2.10 Send Charging Information GPRS

6.6.2.10.1 Description

This IE 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 GSM Advice of Charge Supplementary Service.

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 MS.

6.6.2.10.2 Information Elements

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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.

M Mandatory (The IE shall always be sent)

GPRS SCI Billing Charging Characteristics is defined as:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
AOC GPRS	M	This IE is sent 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 is included if the AoC is applicable to a PDP context. If not present the AoC is applicable to the session or for a single PDP context for the dialogue.

M Mandatory (The IE shall always be sent)

C Conditional (only one of these IEs may be sent)

C Conditional (The IE shall be sent, if available)

AOC GPRS is defined as:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
AOC Initial	M	This IE contains CAI elements as defined in 3G TS 22.024 [x].
AOC Subsequent	O	See definition in the next table.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

AOC Subsequent is defined as:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
CAI Elements	M	This IE contains CAI elements as defined in 3G TS 22.024 [x].
Tariff Switch Interval	O	This IE indicates the tariff switch time until the next tariff switch applies.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

6.6.3 HLR to SGSN Information Flows

6.6.3.1 Insert Subscriber Data

6.6.3.1.1 Description

This IF is specified in 3G TS 29.002 [4] and used by the HLR to insert subscriber data in the SGSN.

6.6.3.1.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
GPRS-CSI	C	This IE identifies the subscriber as having CAMEL GPRS services.

C Conditional (The IE shall be sent, if required)

GPRS-CSI contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
GsmSCF Address	M	This IE is described in section 0
Service Key	M	This IE is described in section 0.
Default Session Handling	M	This IE is described in section 0.
TDP List	M	This IE is described in section 0.

M Mandatory (The IE shall always be sent)

6.6.4 SGSN to HLR Information Flows

6.6.4.1 Update GPRS Location

6.6.4.1.1 Description

This IF is used by the SGSN to indicate to the HLR a GPRS location update. This IF is specified in 3G TS 29.002 [4].

6.6.4.1.2 Information Elements

Update GPRS location contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Supported CAMEL Phases	C	This IE identifies which CAMEL phases are supported by the SGSN. The SGSN may indicate support of CAMEL phase 3 or higher.

C Conditional (The IE shall always be sent when the SGSN supports CAMEL.)

6.6.5 SGSN to HLR Information Flows

6.6.5.1 Insert Subscriber Data ack

See section 4.6.8.

7 Short Message Service

7.1 Architecture

7.1.1 Functional Entities used for CAMEL

This subclause describes the functional architecture needed to support MO SMS interworking for CAMEL. Figures 7.1 and 7.2 show the functional entities involved in MO SM's requiring CAMEL support. The architecture is applicable to the third phase of CAMEL.

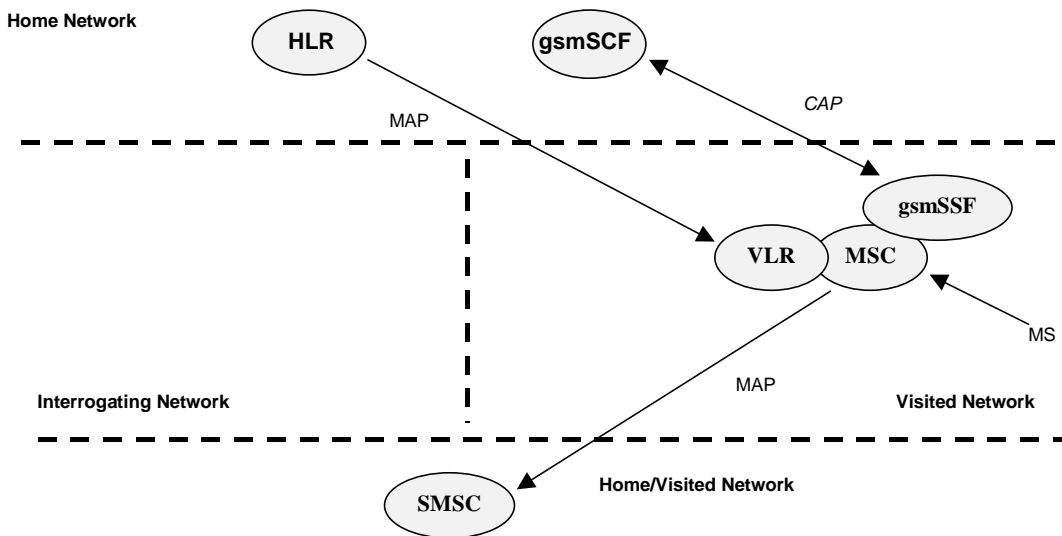


Figure 7.1: Functional architecture for support of CAMEL control of MSC switched MO SMS

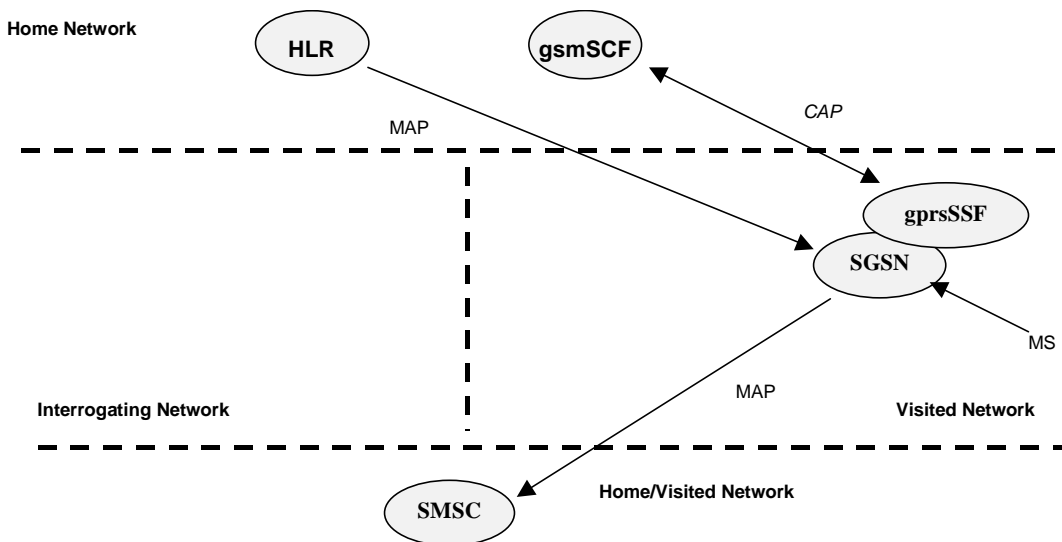


Figure 7.2: Functional architecture for support of CAMEL control of SGSN switched MO SMS

HLR: The HLR stores SMS-CSI. SMS-CSI contains subscription information for subscribers that require CAMEL support of MO SMS. SMS-CSI is transferred to the VLR or to the SGSN on Location Update and Restore Data or when SMS-CSI has changed.

VLR: The VLR receives the SMS-CSI for the subscriber from the HLR. SMS-CSI is used by the MSC to determine if a Service Logic shall be invoked for an MO SMS.

SGSN: The SGSN receives the SMS-CSI for the subscriber from the HLR. The SGSN uses the SMS-CSI to determine if a Service Logic shall be invoked for an MO SMS.

MSC: The MSC receives SMS-CSI from the VLR and uses this to determine if a Service Logic shall be invoked for an MO SMS.

gprsSSF: see subclause 4.1.

gsmSSF: see subclause 4.1.

gsmSCF: see subclause 4.1.

SMSC: Short Message Service Centre.

7.1.2 Interfaces defined for CAMEL

7.1.2.1 HLR – VLR interface

This interface is used to send CAMEL related subscriber data (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 (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 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 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 specification 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 specification 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 specification 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.

7.1.2.9 SGSN - SMSC interface

This interface is used by the SGSN to submit a SM to the SMSC.

7.2 Detection Points (DPs)

See subclause 4.2.

7.3 Description of CAMEL Subscriber Data

7.3.1 CAMEL Subscription Information for MO SMS (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 routing.

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 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.

7.3.1.6 CSI state

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

7.3.1.7 Notification flag

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

7.4 Description of SMS State Model

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 Originating State Model for SMS

7.4.2.1 Description of 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.

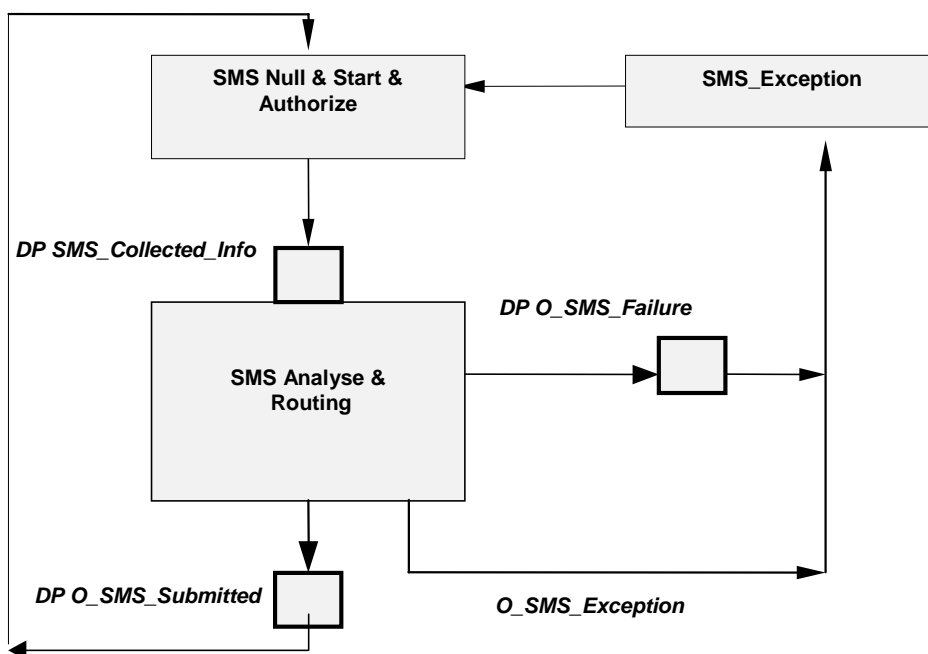


Figure 7.3: MO SMS State Model.

Table 7: 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 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 state model for SMS (PIAs)

This subclause describes the state model for originating SMS transfer. For each PIA a description can be found of the entry events, functions 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.
- Cipherring.
- 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:

- SMS-CSI is analysed.
- An exception condition is encountered

7.4.2.1.1.2 SMS Analyse & Routing

Entry events:

- SMS - CSI is analysed. (SMS_Collected_Info).

Actions:

- Information being analysed and/or translated to determine routing address of the SMSC.
- Outgoing barring services and ODB categories not already applied are checked and invoked if necessary.
- The short message is sent to the SMSC.

Exit events:

- Acknowledge from the SMSC is received. (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 (O_SMS_Failure).

A negative acknowledgement is sent to the MS.

- Negative acknowledgement from the SMSC is received (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 can not 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 Overall SDL architecture

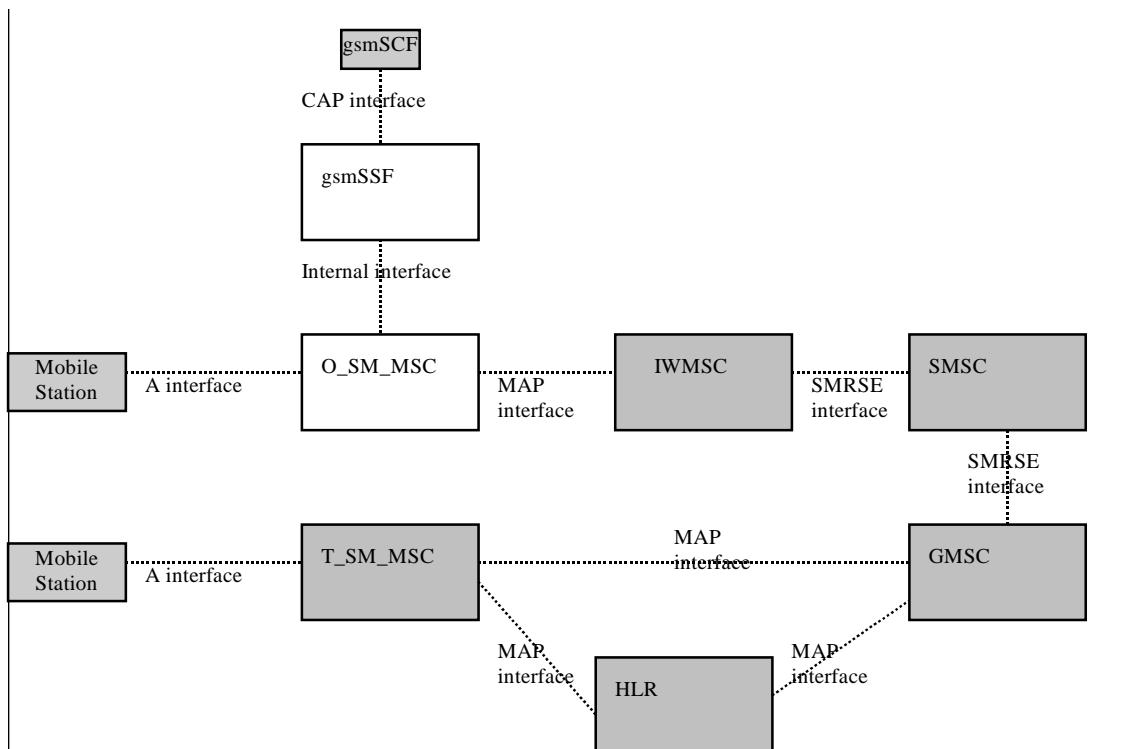


Figure 7.4: Case of MO SMS via MSC (separated IWMSC)

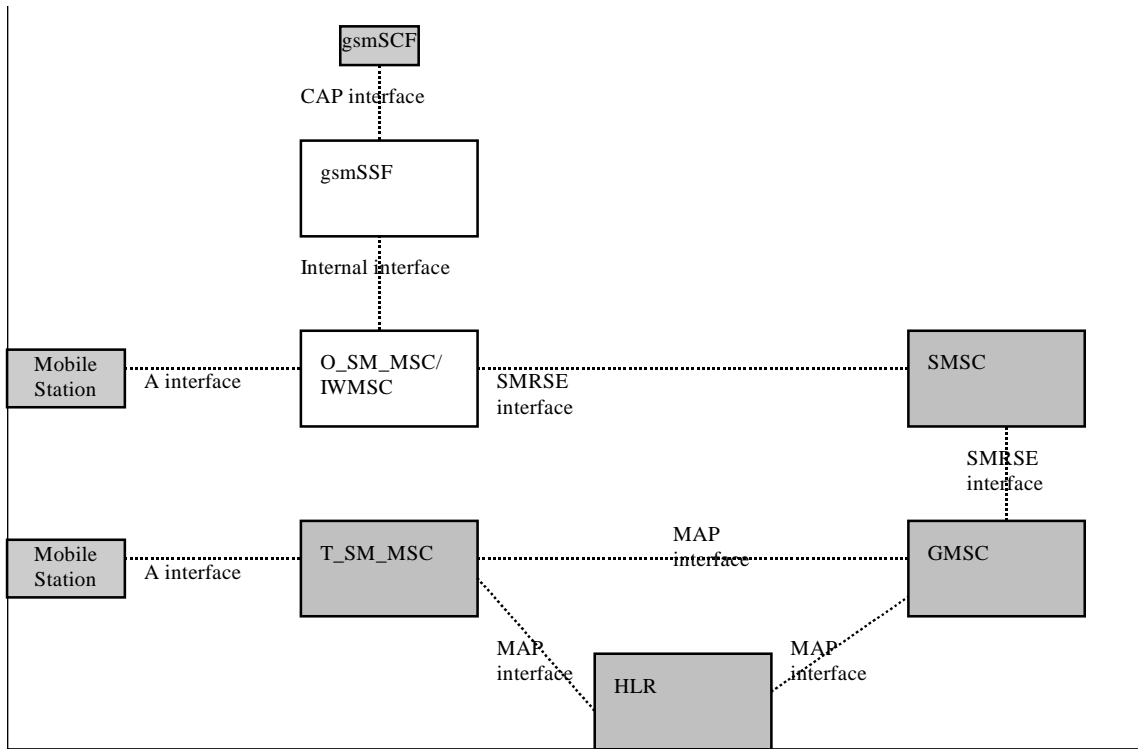


Figure 7.5: Case of MO SMS via MSC (integrated IWMSC)

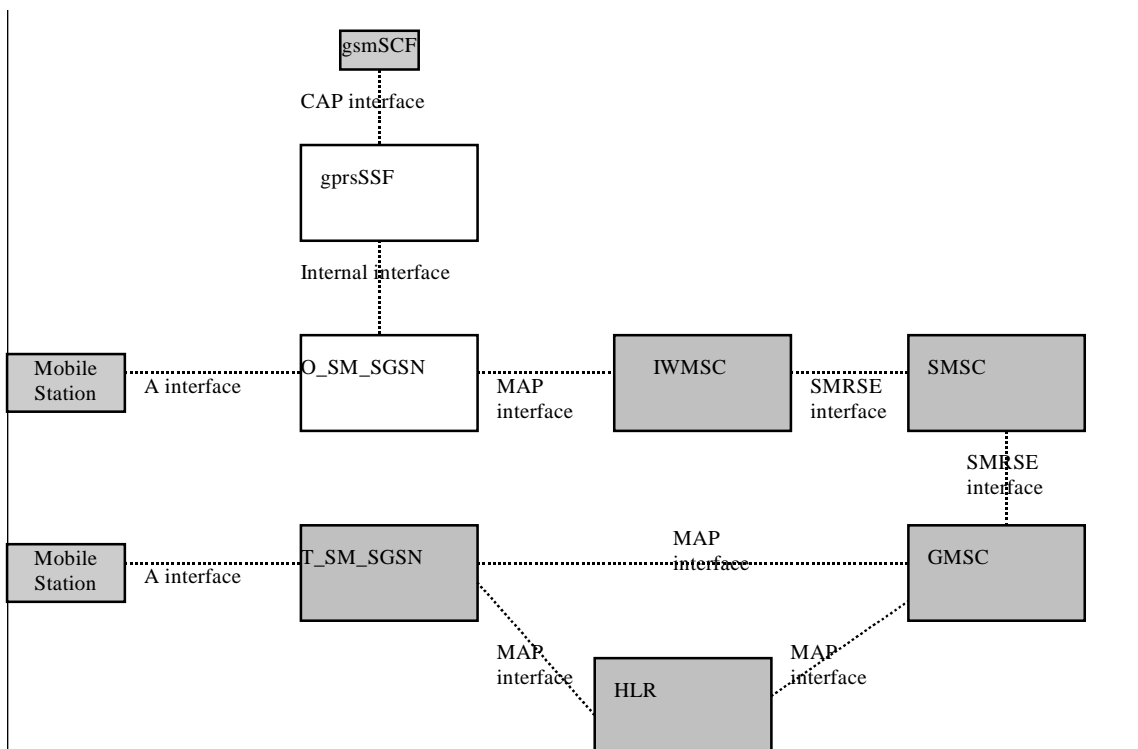


Figure 7.6: Case of MO SMS via GPRS SGSN

7.5.2 Handling of mobile originated SMS

7.5.2.1 Handling of mobile originated SMS in the originating MSC/SGSN

The functional behaviour of the originating VMSC/SGSN is specified in 3G TS 29.002 [4]. 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

7.5.2.1.1 Actions of the VMSC/SGSN on receipt of Int_Error

The MSC checks the default SMS Handling parameter in SMS-CSI.

If the default SMS handling is release SM, a A_RP_ERROR is sent to the MS. The MSC/SGSN then releases all resources and the procedure CAMEL_O_SMS_INIT ends.

If the default SMS handling is continue SMS submission, the MSC/SGSN continues processing without CAMEL support.

7.5.2.1.2 Actions of the MSC/SGSN on receipt of Int_Continue_SMS

The MSC/SGSN continues processing with modified SM parameters. The MSC/SGSN shall transparently modify the SMS parameters with the received information. Parameters which are not included in the Int_Continue_SMS message are unchanged.

7.5.2.1.3 Actions of the MSC/SGSN on receipt of Int_Connect_SMS

The MSC/SGSN continues processing with modified SM parameters. The MSC/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 message are unchanged.

7.5.2.1.4 Actions of the MSC/SGSN on receipt of Int_Release_SMS

A A_RP_ERROR is sent to the MS and SMS is deleted. The SMS cause received in the Int_Release_SMS is used. The MSC/SGSN then releases all resources and the procedure CAMEL_O_SMS_INIT ends.

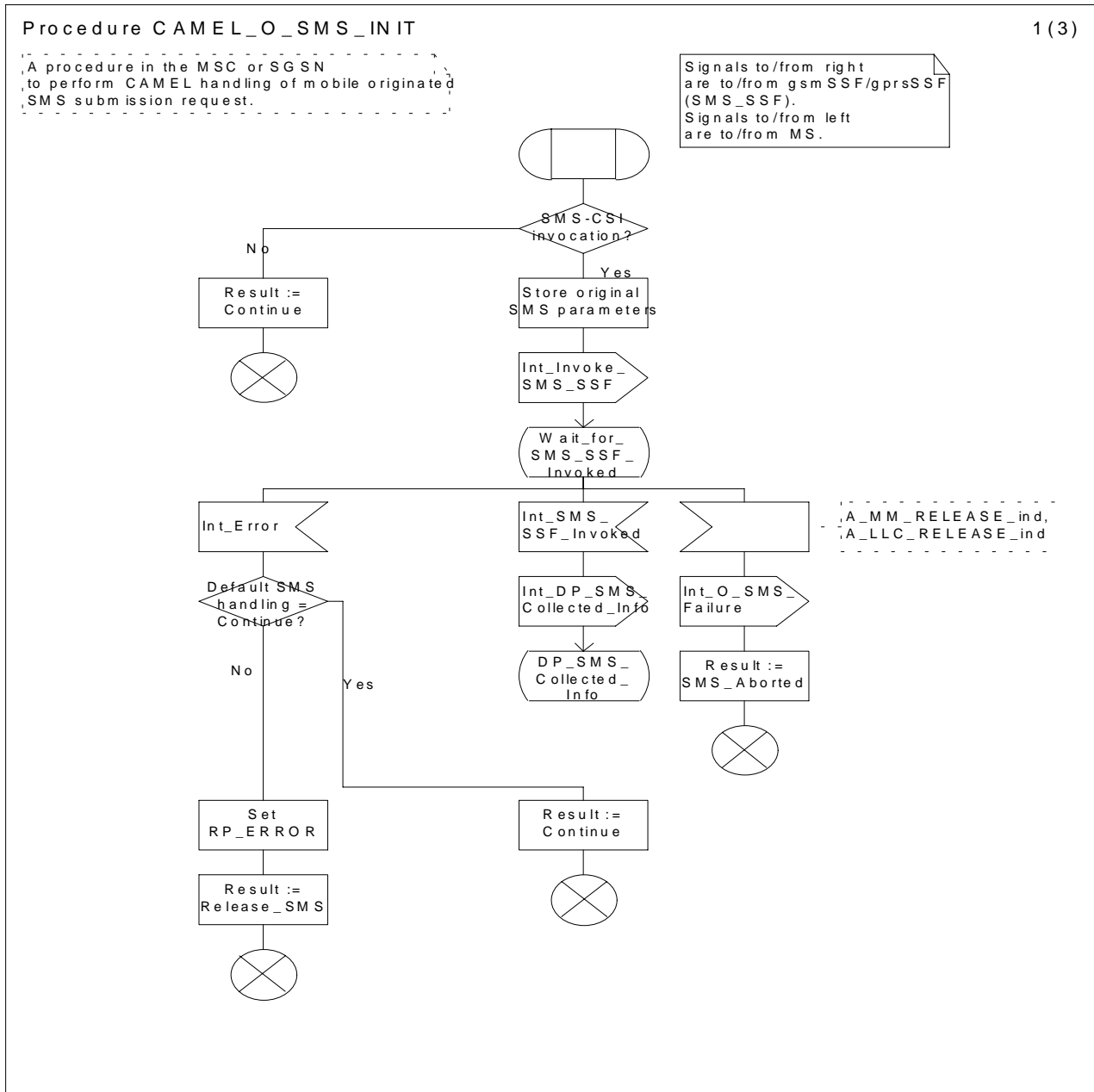


Figure 7.7 a: Procedure CAMEL_O_SMS_INIT (sheet1)

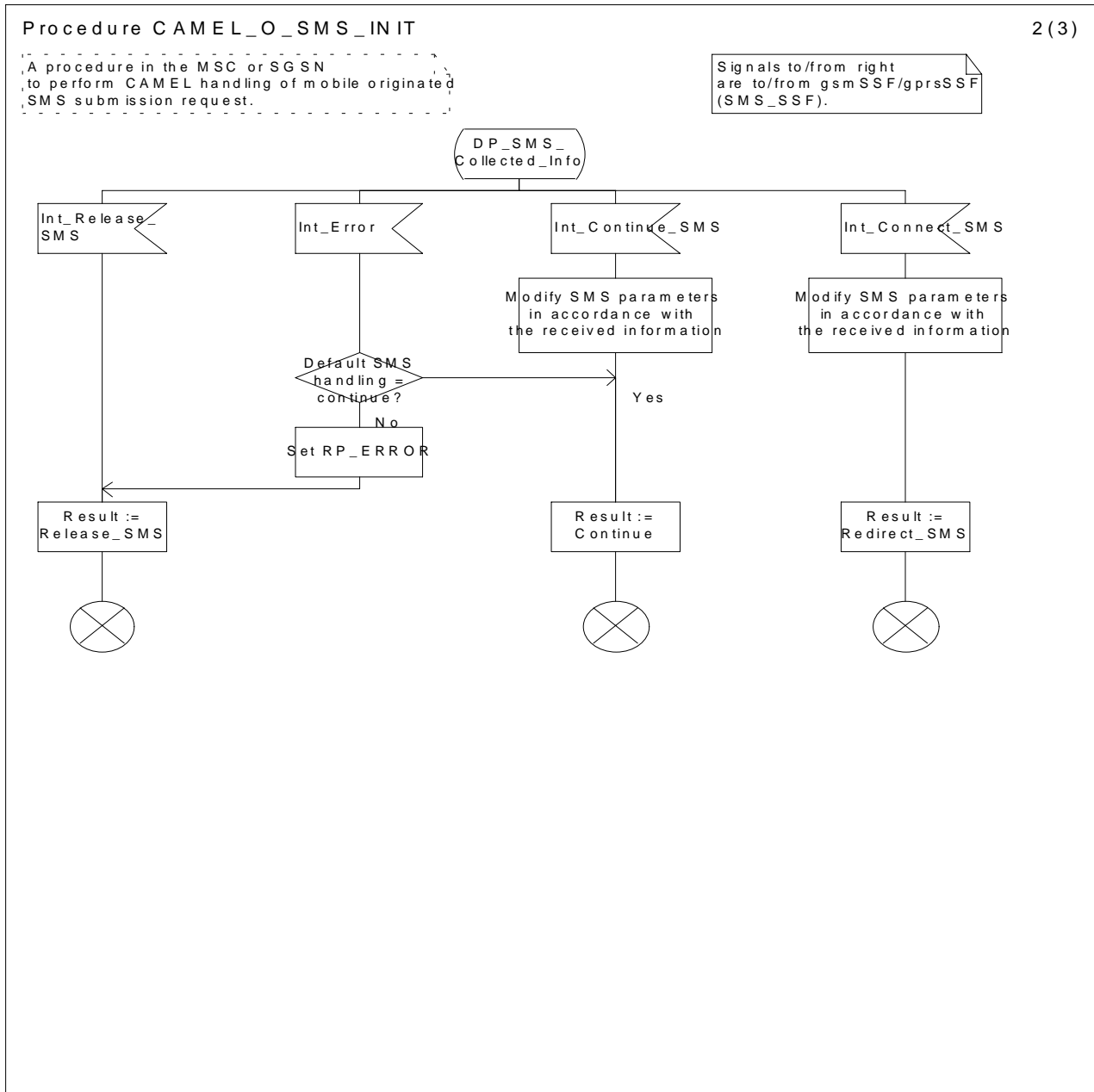


Figure 7.7 b: Procedure CAMEL_O_SMS_INIT (sheet2)

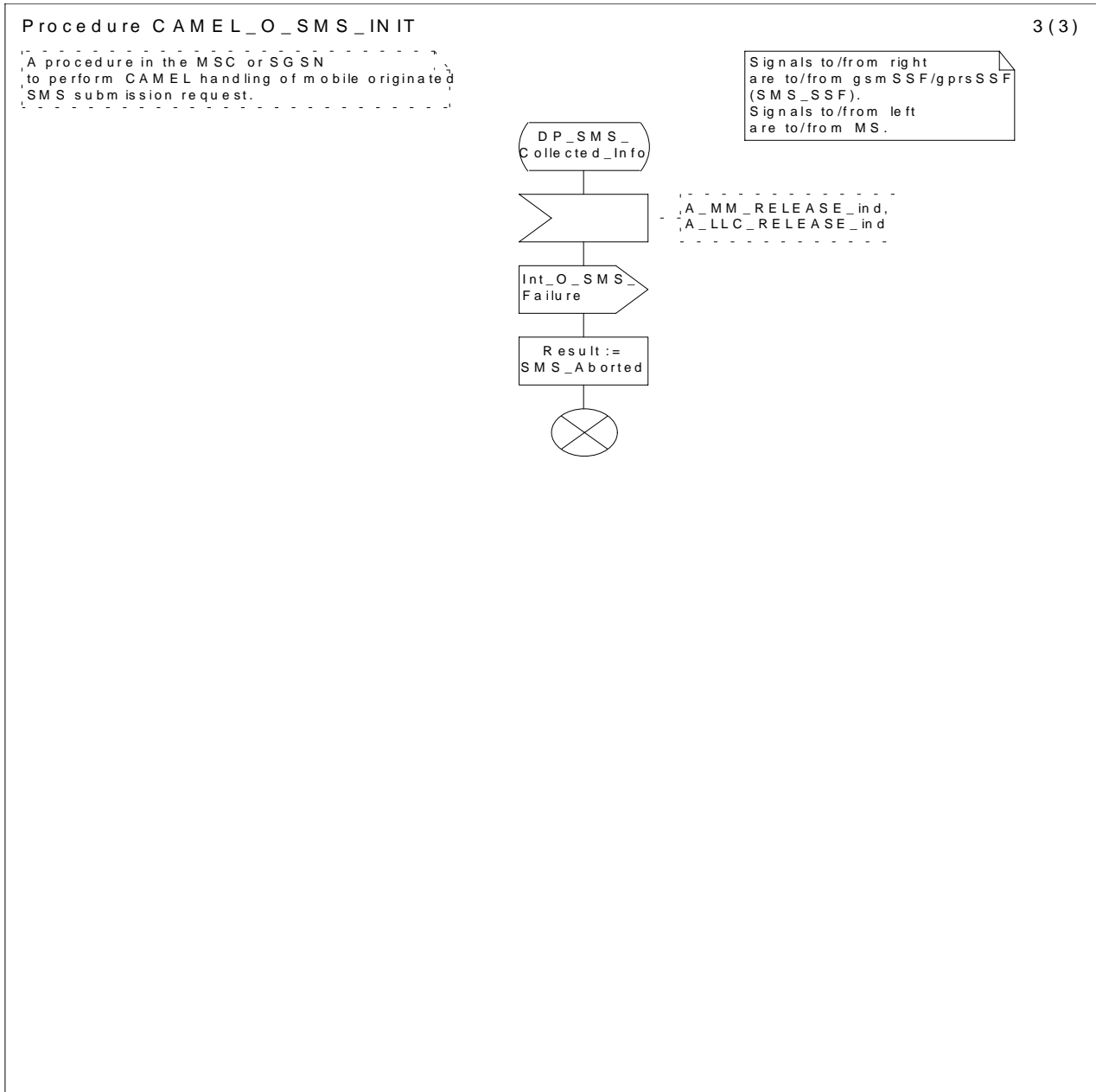


Figure 7.7 c: Procedure CAMEL_O_SMS_INIT (sheet3)

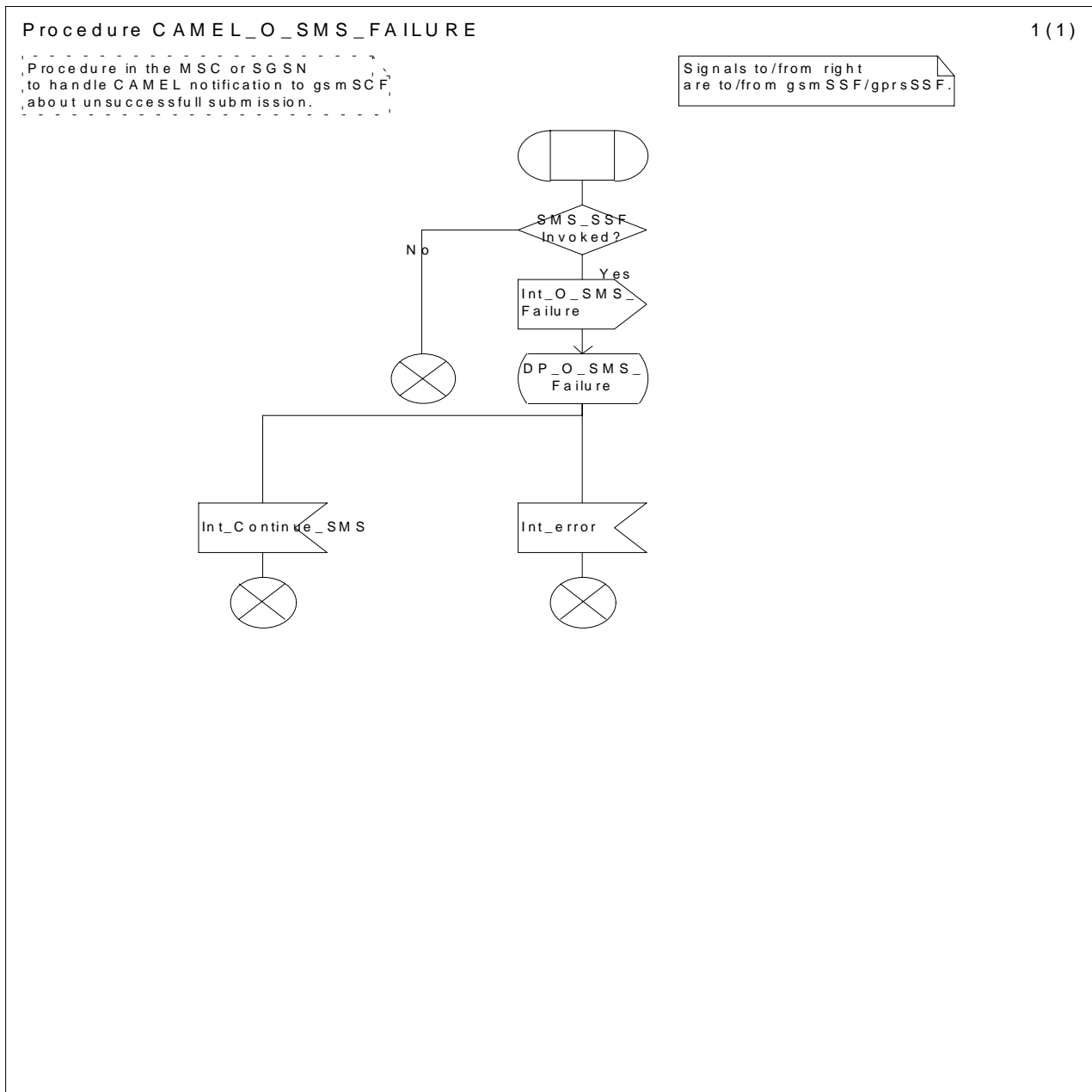


Figure 7.8: Procedure CAMEL_O_SMS_FAILURE (sheet1)

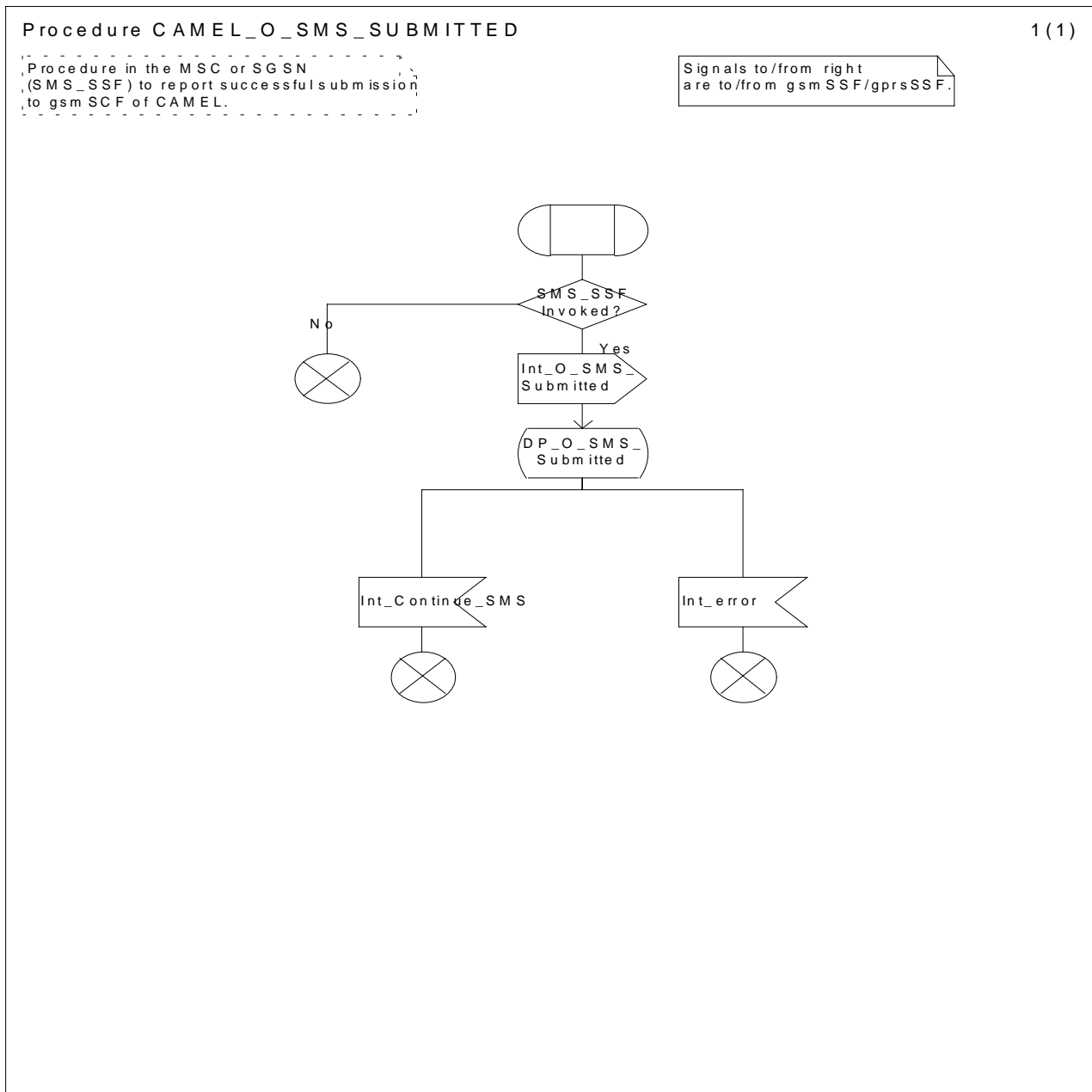


Figure 7.9: Procedure CAMEL_O_SMS_SUBMITTED (sheet1)

7.5.3 Handling of mobile originated SMS in the gsmSSF/gprsSSF

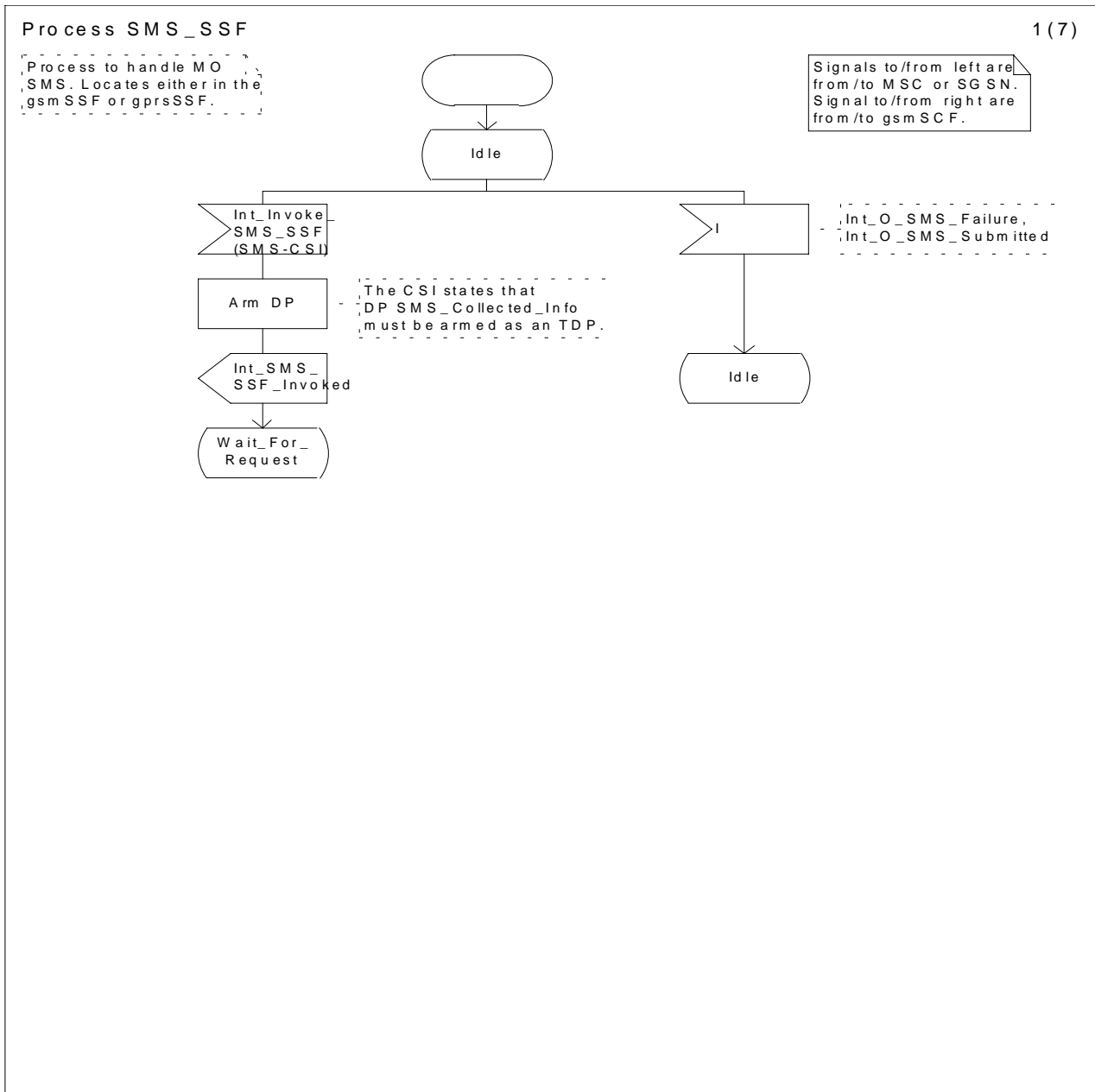


Figure 7.10 a: Process MO_SMS (sheet 1)

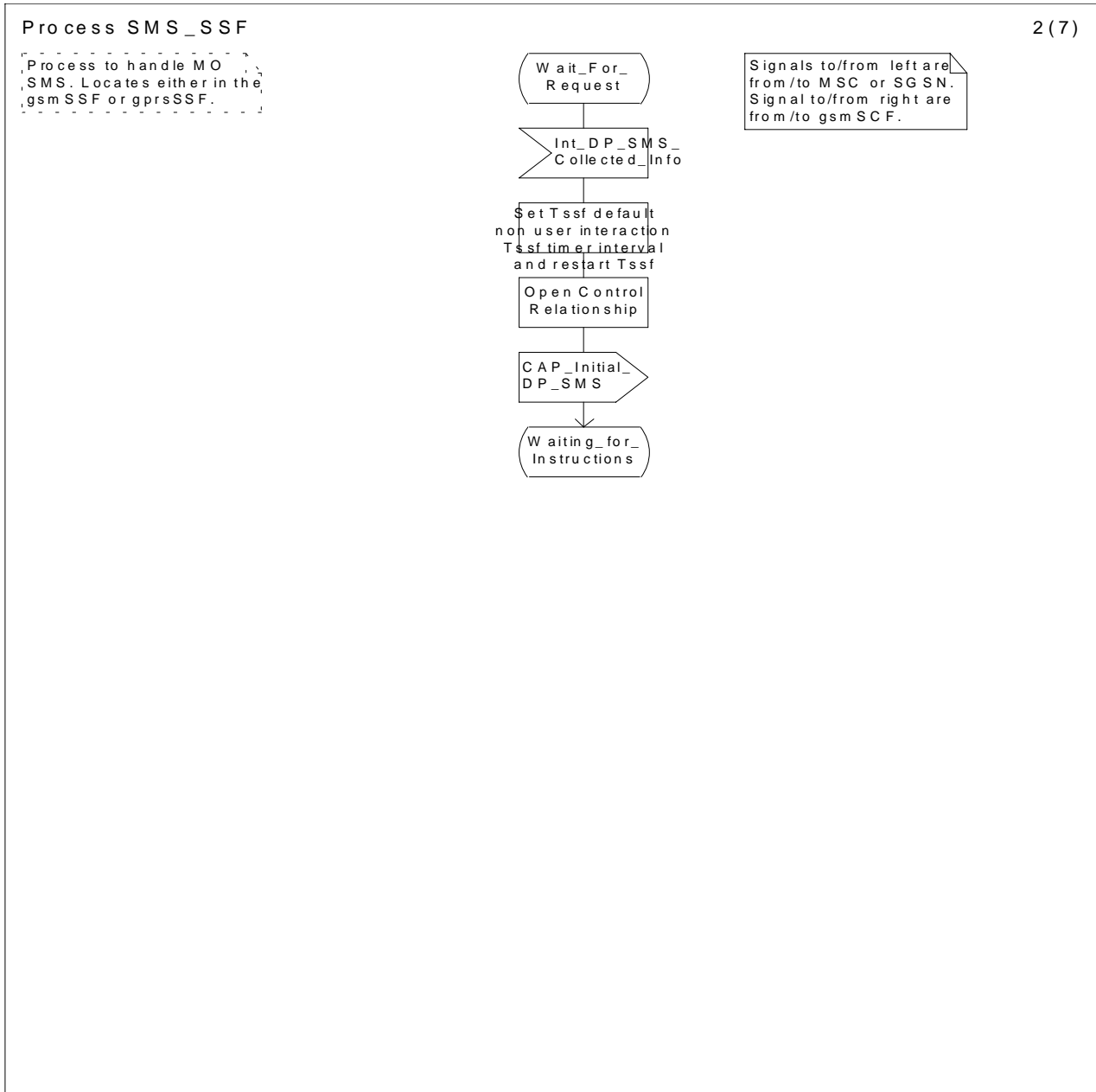


Figure 7.10 b: Process MO_SMS (sheet 2)

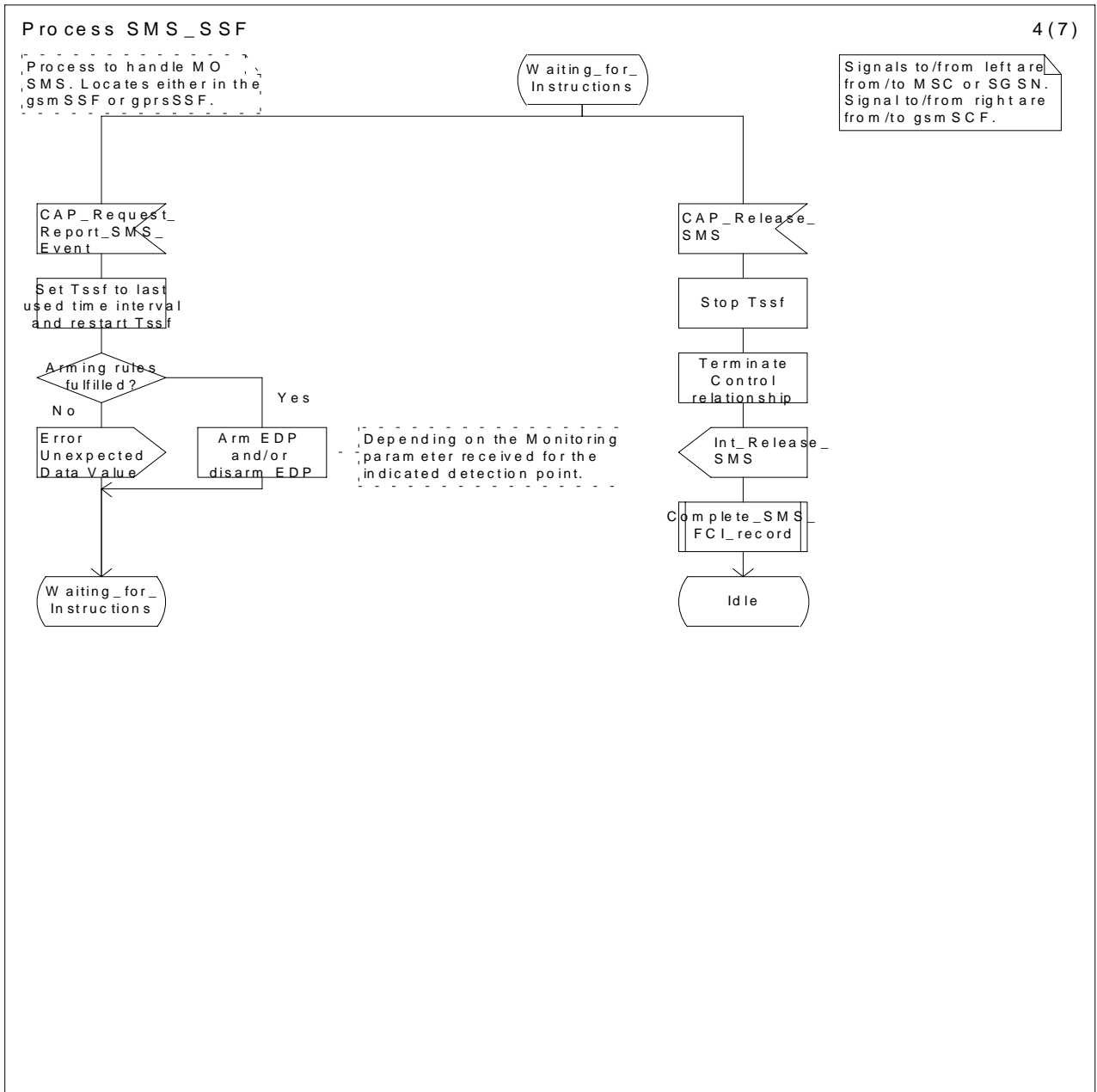


Figure 7.10 d: Process MO_SMS (sheet 4)

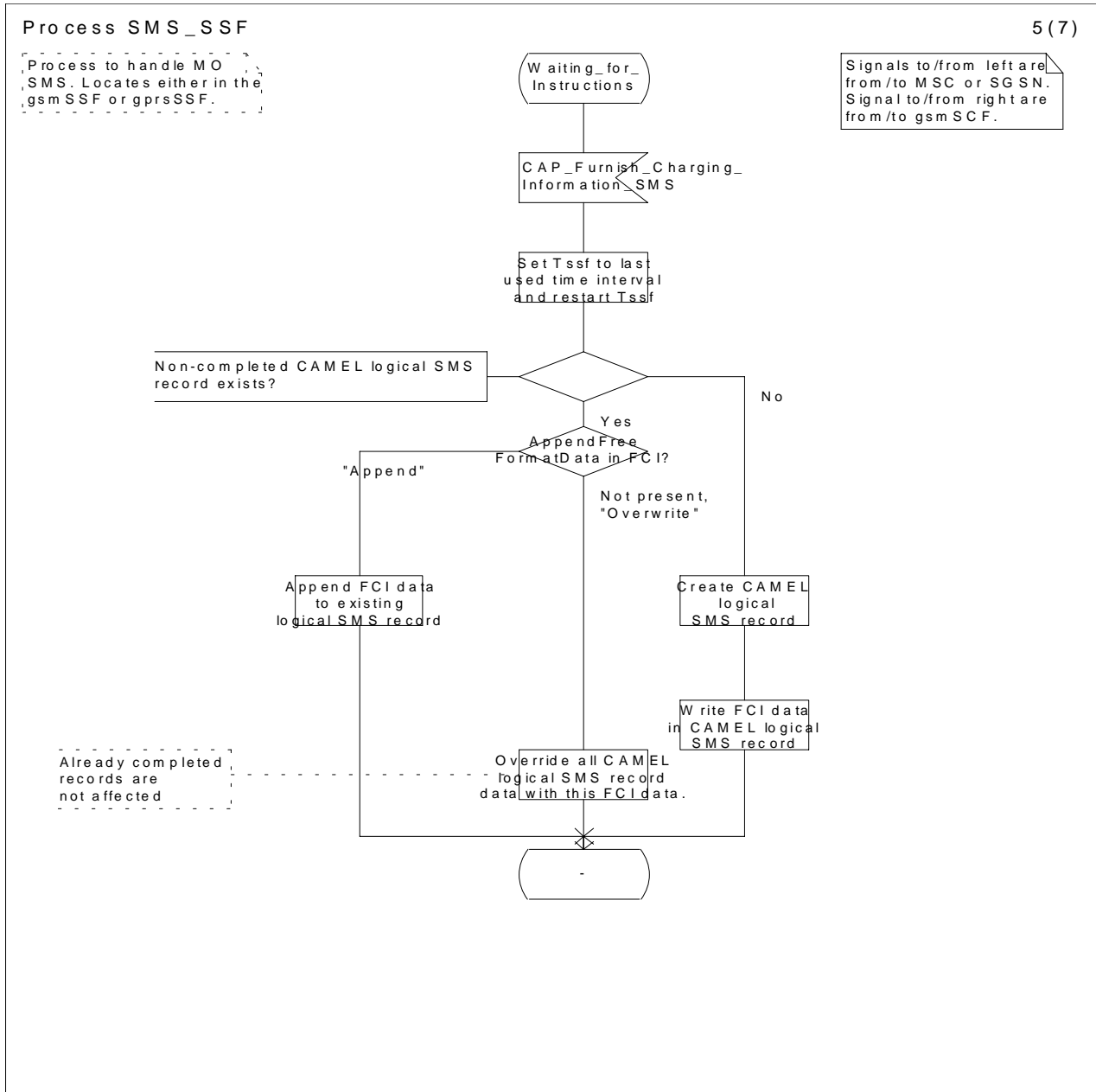


Figure 7.10 e: Process MO_SMS (sheet 5)

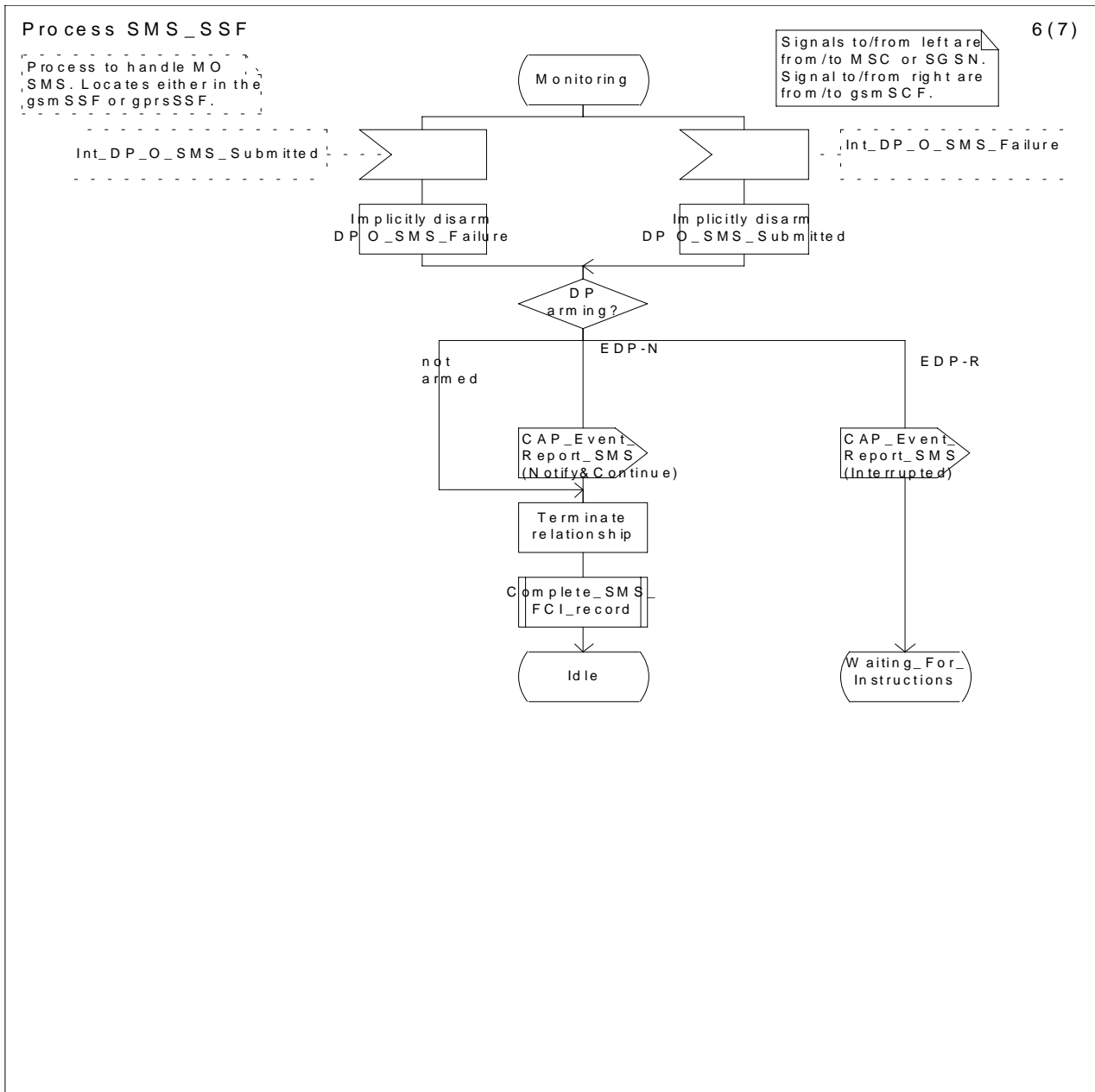


Figure 7.10 f: Process MO_SMS (sheet 6)

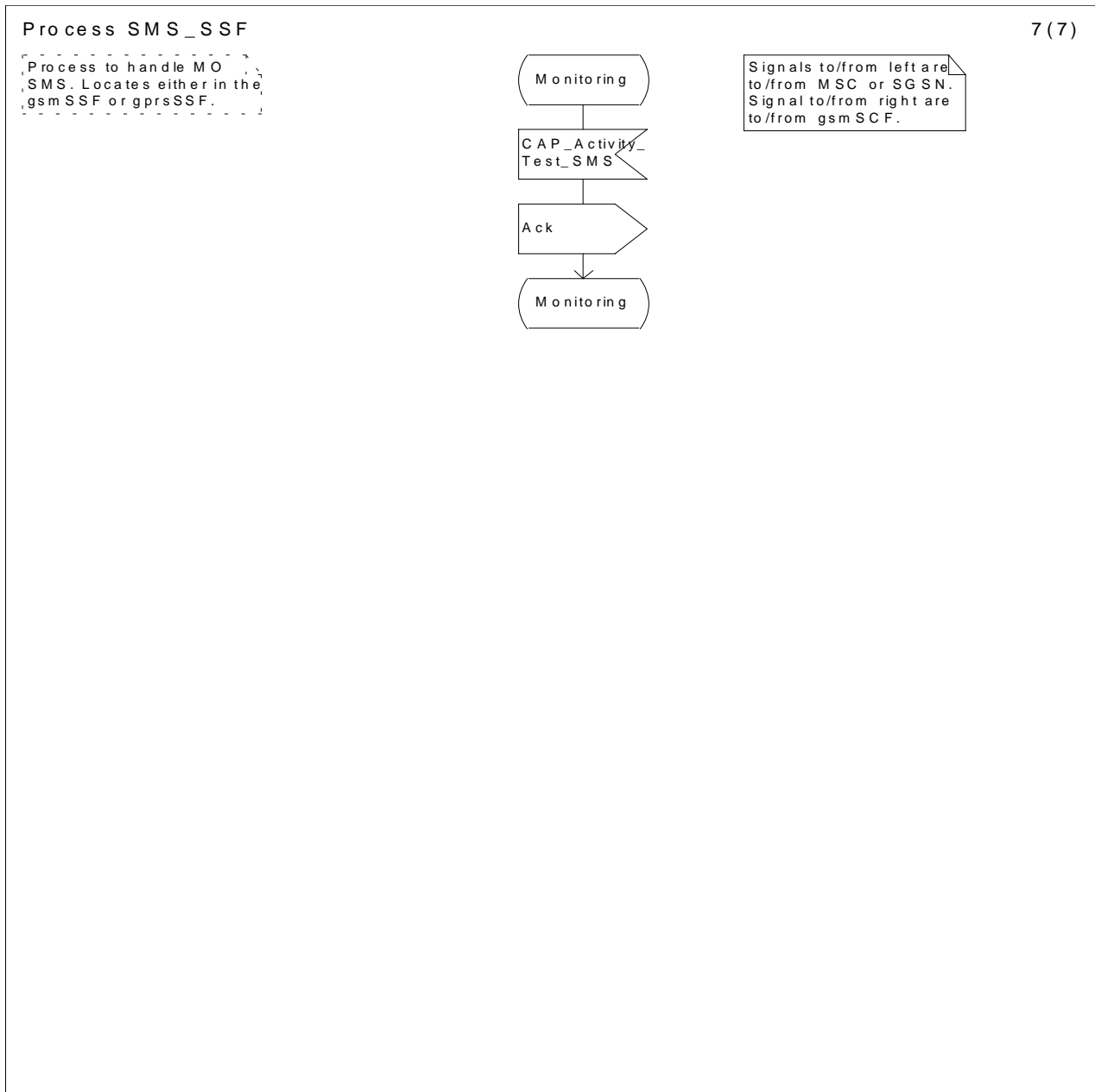


Figure 7.10 g: Process MO_SMS (sheet 7)

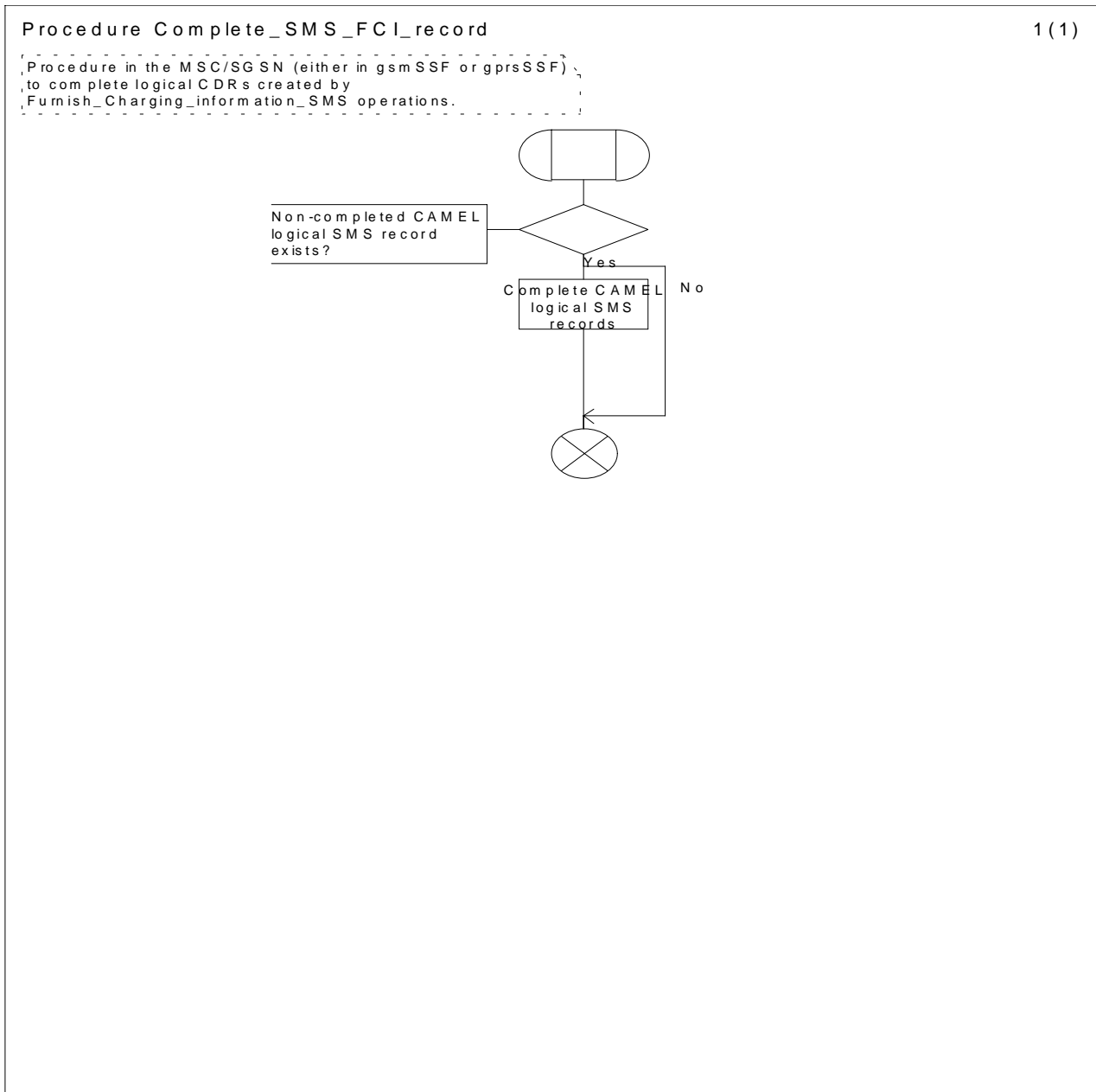


Figure 7.11: Procedure Complete_SMS_FCI_record (sheet 1)

7.6 Description of information flows

7.6.1 gsmSSF/gprsSSF to gsmSCF information flows

7.6.1.1 Activity Test SMS ack

7.6.1.1.1 Description

This IF is the response to the Activity Test sent by the gsmSCF.

7.6.1.1.2 Information Elements

This IF contains no information elements.

7.6.1.2 Event Report SMS

7.6.1.2.1 Description

This IF is used to notify the gsmSCF of an event previously requested by the gsmSCF in a Request Report SMS Event IF.

7.6.1.2.2 Information Elements

Information element name	MO SMS	Description
Event type	M	This IE specifies the type of event that is reported.
Event Specific Information	C	This IE indicates the SMS related information specific to the event.
Misc SMS Info	M	This IE indicates the DP type.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

7.6.1.3 Initial DP SMS

7.6.1.3.1 Description

This IF is generated by the gsmSSF/gprsSSF when a trigger is detected at a DP in the state model, to request instructions from the gsmSCF.

7.6.1.3.2 Information Elements

Information element name	MO SMS	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 SMS-SUBMIT TPDU which is specified in 3G TS 23.040 [21].
Calling Party Number	M	This IE carries the MSISDN of the subscriber who sent the short message.
Event Type	M	This IE indicates the armed event (i.e., <i>SMS_Collected_Info</i>) resulting in the Initial DP SMS IF.
IMSI	M	This IE identifies the mobile subscriber.
Location Information in MSC	C	This IE is described in the next table.
Location Information in SGSN	C	This IE is described in the table below.
Service Key	M	The Service Key identifies to the gsmSCF the service logic.
Time And Timezone	M	This IE contains the time that the gsmSSF/gprsSSF was triggered, and the time zone the gsmSSF/gprsSSF resides in.
TP Short Message Submission Specific Information	M	This IE contains the 1 st octet of the SMS-SUBMIT TPDU which is specified in 3G TS 23.040 [21]. The 1 st octet includes the following information: <ul style="list-style-type: none"> – Message Type Indicator – Reject Duplicates – Validity Period Format – Status Report Request – User Data Header Indicator – Reply Path
TP Protocol Identifier	M	This IE indicates the protocol used above SM-Transfer Layer. The TP Protocol Identifier shall be retrieved from the SMS-SUBMIT TPDU which is specified in 3G TS 23.040 [21].
TP Data Coding Scheme	M	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 Short Message. The TP Data Coding Scheme shall be retrieved from the SMS-SUBMIT TPDU which is specified in 3G TS 23.040 [21].
TP Validity Period	C	This IE indicates the length of the validity period or the absolute time of the validity period termination. The TP Validity Period shall be retrieved from the SMS-SUBMIT TPDU which is specified in 3G TS 23.040 [21].
SMSC Address	M	This I.E defines the address of the SMSC to which the MO short message is intended to be submitted.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

Location Information in MSC contains the following information:

Information element name	MO SMS	Description
CellIdOrLAI	M	See 3G TS 23.018 [3].
Geographical Information	C	See 3G TS 23.018 [3].
Geodetic Information	C	See 3G TS 23.018 [3].
VLR number	M	See 3G TS 23.018 [3].
Selected LSA Identity	C1	This IE indicates the LSA identity associated with the current position of the MS. Send if the LSA ID of subscription and LSA ID of the used cell matches. In the case of multiple matches the one with the highest priority is sent. See 3GPP TS 23.073[23]

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

C1 Conditional (The IE shall be sent, if available and SoLSA is supported)

Location Information in the GPRS case contains the following information:

Information element name	MO SMS	Description
CellIdOrRAI	M	See 3G TS 23.018 [3] and 3G TS 23.060 [11].
Geographical Information	C	See 3G TS 23.018 [3].
SGSN number	M	Global Title of the Serving GPRS Service Node. See 3G TS 23.060 [11].

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

7.6.2 gsmSCF to gsmSSF/gprsSSF information flows

7.6.2.1 Activity Test SMS

7.6.2.1.1 Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and gsmSSF/gprsSSF. If the relationship is still in existence, then the gsmSSF/gprsSSF will respond. If no reply is received, then the gsmSCF will assume that the gsmSSF/gprsSSF has failed in some way and will take appropriate action.

7.6.2.1.2 Information Elements

This IF contains no information elements.

7.6.2.2 Connect SMS

7.6.2.2.1 Description

This IF is used to request the gsmSSF/gprsSSF to perform the actions to route the SMS to a specific destination.

7.6.2.2.2 Information Elements

Information element name	MO SMS	Description
Calling Party's Number	O	This IE indicates the subscriber who sent the SMS; possibly changed by the gsmSCF..
Destination Subscriber Number	O	This IE identifies the Destination short message entity; possibly changed by the gsmSCF. The Destination Subscriber Number shall be placed in the header information of the TPDU.
SMSCAddress	O	Indicates the SMSC address where the MO short message shall be submitted to; possibly changed by the gsmSCF.

O Optional (Service logic dependent)

7.6.2.3 Continue SMS

7.6.2.3.1 Description

This information flow requests the gsmSSF/gprsSSF to proceed normally. The gsmSSF/gprsSSF completes DP processing, and continues SMS.

7.6.2.3.2 Information Elements

This IF contains no information elements.

7.6.2.4 Furnish Charging Information SMS

7.6.2.4.1 Description

This IF is used to request the gsmSSF/gprsSSF to include information in the CAMEL specific logical MO 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/gprsSSF. The gsmSSF/gprsSSF completes logical call records as defined in the SDLs. Once the logical call record is completed, then its free format data is moved to the corresponding CDR and the logical call record is deleted.

The CSE 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 operations. If there is non-completed free format data and new FCI operation(s) is/are received to overwrite the non-completed data, then the non-completed data is discarded and the gsmSCF can send another 160 octets per SM.

7.6.2.4.1 Information Elements

Information element name	MO SMS	Description
FCI Billing Charging Characteristics	M	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

FCI Billing Charging Characteristics contains the following information:

Information element name	MO SMS	Description
FCIBCCCAMEL Sequence 1	M	This IE is described in the next table.

M Mandatory (The IE shall always be sent)

FCIBCCCAMEL Sequence 1 contains the following information:

Information element name	MO SMS	Description
Free Format Data	M	This IE indicates that the gsmSSF/gprsSSF shall insert the free format data in the CAMEL logical SM charging record without overwriting any free format data that may already have been received for that transaction. When this IE is not present then the gsmSSF/gprsSSF shall override free format data in a non-completed CAMEL logical SM record of the previous FCI operations.
Append Free Format Data	O	<p>This IE indicates that the gsmSSF/gprsSSF shall append the free format data to the Logical MO SMS record.</p> <ul style="list-style-type: none"> • If this IE is present indicating “Append”, the gsmSSF/gprsSSF shall append the free format data received in this IF to the free format data already present in the Logical MO SMS record. • If this IE is absent or in value “Overwrite”, then the gsmSSF shall overwrite all free format data already present in the Logical MO SMS record, by the free format data received in this IF. <p>If no Logical MO SMS record exists yet, then the gsmSSF/gprsSSF shall ignore this IE.</p>

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

7.6.2.5 Release SMS

7.6.2.5.1 Description

This IF is used to tear down by the gsmSCF an existing SMS transfer.

7.6.2.5.2 Information Elements

Information element name	MO SMS	Description
Cause	M	SMS Cause. Indicates the SMS specific cause of the release. The cause is reported to the MS.

M Mandatory (The IE shall always be sent)

7.6.2.6 Request Report SMS Event

7.6.2.6.1 Description

This IF is used to request the gsmSSF/gprsSSF to monitor for an event (i.e., O_SMS_Submitted or O_SMS_Failure), then send a notification back to the gsmSCF when the event is detected (see Event Report SMS).

7.6.2.6.2 Information Elements

Information element name	MO SMS	Description
SMS Event	M	This IE specifies the event or events of which a report is requested.

M Mandatory (The IE shall always be sent)

SMS Event contains the following information:

Information element name	MO SMS	Description
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.

M Mandatory (The IE shall always be sent)

7.6.2.7 Reset Timer SMS

7.6.2.7.1 Description

This IF is used to refresh a gsmSSF/gprsSSF timer.

7.6.2.7.2 Information Elements

The following information elements are required:

Information element name	Required	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'.

M Mandatory (The IE shall always be sent)

O Optional (Service logic dependent)

7.6.3 HLR to VLR information flows

7.6.3.1 Delete Subscriber data

7.6.3.1.1 Description

This IF is specified in 3G TS 29.002 [4] and is used by the HLR to delete subscriber data in the VLR.

7.6.3.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR.

C Conditional (The IE shall be sent when deletion is requested)

7.6.3.2 Insert Subscriber Data

7.6.3.2.1 Description

This IF is specified in 3G TS 29.002 [4] and is used by the HLR to insert subscriber data in the VLR.

7.6.3.2.2 Information Elements

Insert Subscriber Data contains the following MO SMS specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SMS-CSI	C	This IE identifies the subscriber having MO SMS CAMEL services.

C Conditional (The IE shall be sent, if required)

SMS-CSI contains the following information:

Information element name	Required	Description
gsmSCF Address	M	This IE is described in section x.
Service Key	M	This IE is described in section x.
Default SMS Handling	M	This IE is described in section x
CAMEL Capability Handling	M	This IE is described in section 4.3.1.
SMS Triggers	M	This IE is described in section x. It includes the following trigger: - <i>SMS_Collected_Info</i>

M Mandatory (the IE shall always be sent)

7.6.4 VLR to HLR information flows

7.6.4.1 Insert Subscriber Data ack

See section 4.6.8.

7.6.4.2 Update Location

See section 4.6.8.3.

7.6.5 HLR – SGSN information flows

This interface is used to send CAMEL related subscriber data to a visited GPRS network, e.g. GPRS-CSI.

7.6.5.1 Delete Subscriber data

7.6.5.1.1 Description

This IF is specified in 3G TS 29.002 [4] and is used by the HLR to delete subscriber data in the SGSN.

7.6.5.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in SGSN.

C Conditional (The IE shall be sent when deletion is requested)

7.6.5.2 Insert Subscriber data

7.6.5.2.1 Description

This IF is specified in 3G TS 29.002 [4] and used by the HLR to insert subscriber data in the SGSN.

7.6.5.2.2 Information Elements

Insert Subscriber Data contains the following MO SMS specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SMS-CSI	C	This IE identifies the subscriber having MO SMS CAMEL services.

C Conditional (The IE shall be sent, if required)

SMS-CSI contains the following information:

Information element name	Required	Description
gsmSCF Address	M	This IE is described in section x.
Service Key	M	This IE is described in section x.
Default SMS Handling	M	This IE is described in section x
CAMEL Capability Handling	M	This IE is described in section 4.3.1.
SMS Triggers	M	This IE is described in section x. It includes the following trigger: - <i>SMS_Collected_Info</i>

M Mandatory (The IE shall always be sent)

7.6.6 SGSN to HLR Information Flows

7.6.6.1 Insert Subscriber Data ack

See section 4.6.8.

7.6.6.2 Update GPRS Location

See section 6.6.4.1.

7.6.7 VLR to MSC Information Flows

7.6.7.1 Send Info For MO SMS Ack

7.6.7.1.1 Description

This IF is specified in 3G TS 29.002 [4]. It is used to transport MO SMS related subscription data from the VLR to the MSC.

Send Info For MO SMS Ack contains the following information:

Information element name	Required	Description
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.

C Conditional (shall be sent if available)

8 SS Notifications

8.1 Architecture

8.1.1 Functional Entities used for CAMEL

See subclause 4.1

8.1.2 Interfaces defined for CAMEL

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

8.1.2.1 MSC - gsmSCF interface

This interface is used by the MSC to send supplementary service invocation notifications to the gsmSCF.

8.2 Description of CAMEL Subscriber Data

8.2.1 Supplementary Service Invocation Notification CAMEL Subscription Information (SS-CSI)

8.2.1.1 Content of the SS-CSI

This subclause defines the contents of the Supplementary Service Invocation Notification CAMEL Subscription Information (SS-CSI).

8.2.1.1.1 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.

8.2.1.1.2 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 routing.

8.2.1.1.3 CSI state

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

8.2.1.1.4 Notification flag

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

8.3 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 are sent.

The sending of the notification is independent of call related CAMEL processing, i.e. processing indicated by O/T/VT-CSI.

On invocation of ECT, the VLR shall include the SS-CSI in the Invoke ECT response message (see Process MAF027 in 3G TS 23.091 [29]) 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 3G TS 23.084 [28]) 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 message to the MSC if applicable to CD.

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 clause contains the detailed description of the information flows used by CAMEL.

Each Information Element, IE is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorisation is a functional classification, i.e., stage 2 information and 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 3G TS 29.002

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

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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	C	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 information element. 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.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent if applicable)

8.4.2 HLR to VLR information flows

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 3G TS 29.002 [4].

8.4.2.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific IE for SS Notifications:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SS-CSI	C	This IE identifies the subscriber as having supplementary service invocation notification services. It contains the Notification Criteria and gsmSCFAddress. This IE is described in section 8.2.1.1.

C Conditional (The IE shall be sent, if required)

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

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent if applicable)

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. Figure 9.1 shows the functional entities involved in CAMEL support of Mobility Management. The architecture is applicable to the third phase of CAMEL.

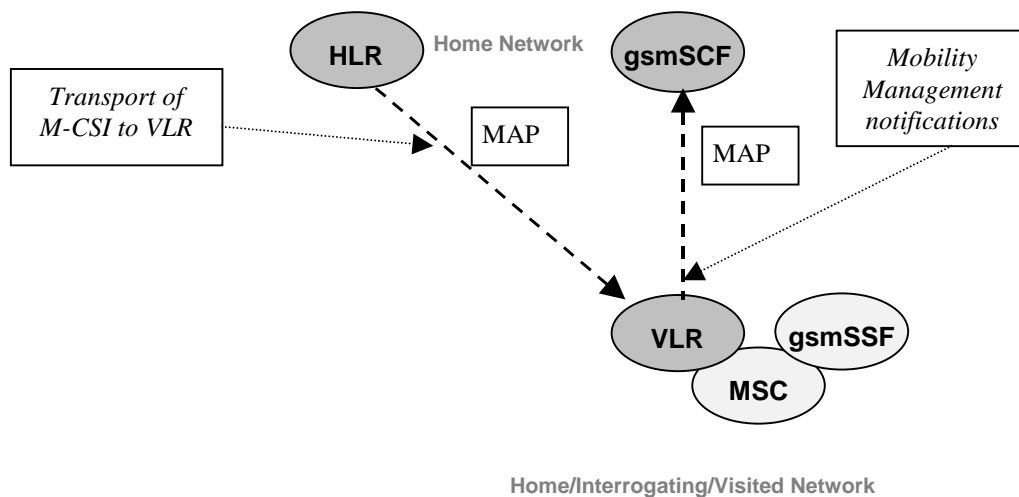


Figure 9.1: Functional architecture for support of CAMEL

gsmSCF: see subclause 4.1.

HLR: The HLR contains Mobility management CAMEL Subscription Information (M-CSI) for those subscribers that require CAMEL control (...use another word...) 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.

MS: Mobile Station (GSM terminal)

MSC: See subclause 4.1.

VLR: After having completed a Mobility Management event from a subscriber, the VLR may have to send a notification to the gsmSCF. The contents of M-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 supplementary service Mobility Management event notifications to the gsmSCF. When processing a mobility management event, the VLR may have to send a notification to the gsmSCF, depending on the presence of M-CSI for the subscriber and the contents of M-CSI.

9.2 Description of CAMEL Subscriber Data

9.2.1. Mobility Management CAMEL Subscription Information (M-CSI)

9.2.1.1 Content of the M-CSI

This subclause specifies the contents of the Mobility Management CAMEL Subscription Information (M-CSI).

9.2.1.1.1 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. One or more events may be marked per subscriber. One or more events may be marked per subscriber. The following events may be marked for a subscriber:

- 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)

9.2.1.1.2 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 routing.

9.2.1.1.3 Service Key

The Service Key is included in the notification message to the gsmSCF. It indicates to the gsmSCF which Service Logic shall be applied.

9.2.1.1.4 CSI state

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

9.2.1.1.5 Notification flag

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

9.3 Procedures for Mobility management

Figures 9.2 to 9.6 show the functional entities involved in Mobility Management event notifications.

Figure 9.2: Location Update within a single VLR Service Area. The VLR Service area may be in the HPLMN or in the VPLMN.

Figure 9.3: 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 9.4: Location Update from one PLMN to another PLMN:

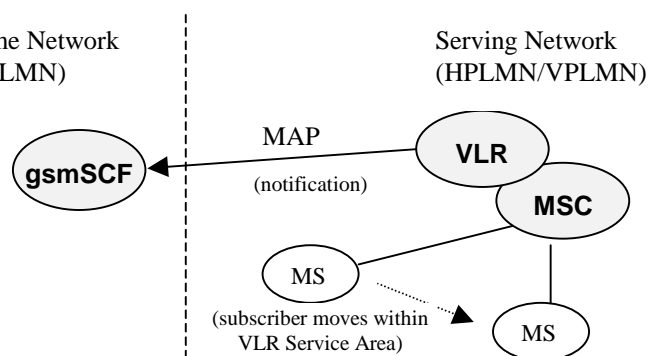
- update from HPLMN to VPLMN
- update from VPLMN to HPLMN
- update from one VPLMN to another VPLMN

Figure 9.5 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 9.6 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.)



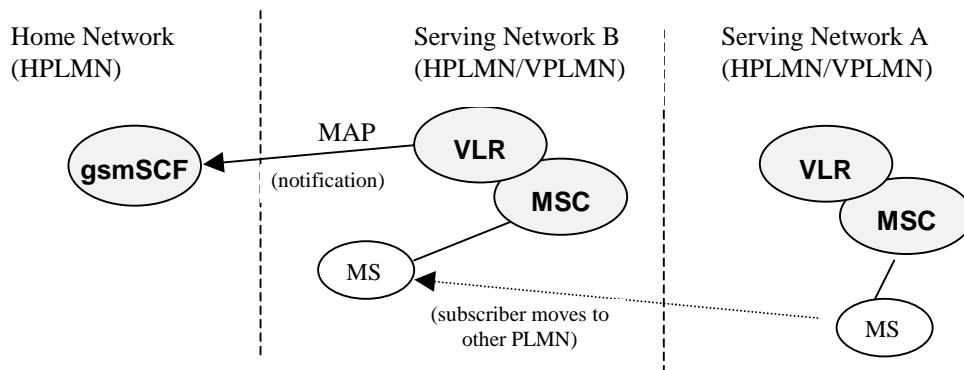
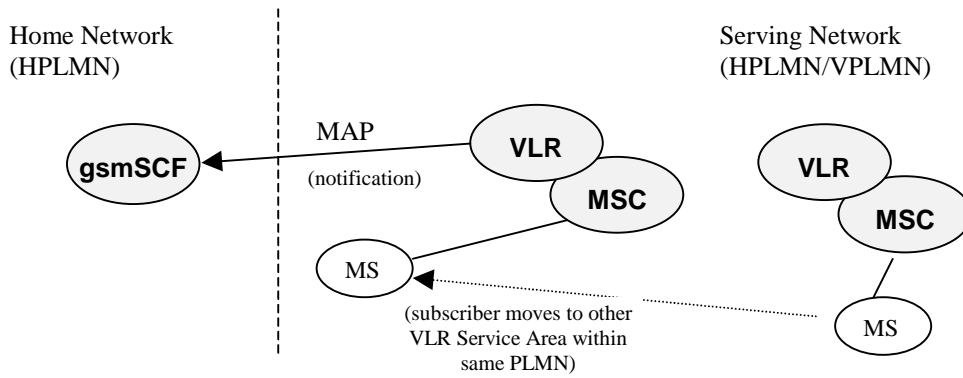


Figure 9.2: Location Update from one VLR Service Area to Another VLR Service Area; VLR Service Areas in different PLMNs.

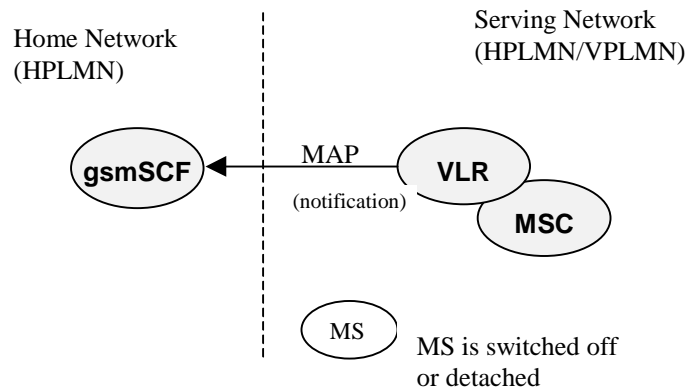


Figure 9.3: IMSI Detach (implicit/explicit)

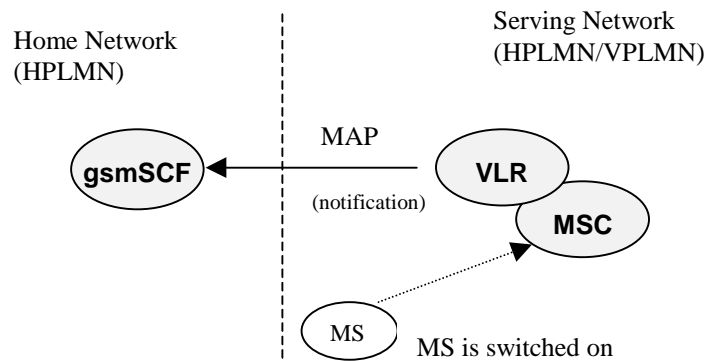


Figure 9.4: IMSI Attach

When a Mobility Management Event has taken place and the processing thereof has been completed, then the VLR may have to send a notification to the gsmSCF. The processing of the Mobility Management event in 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. Eg. a subscriber may have M-CSI without having O-CSI or VT-CSI.

The sending of a Mobility Management event notification is subscription based.

Refer to section 9.2.1.1 for a description of M-CSI and the different Mobility Management events that may lead to a notification to the gsmSCF.

9.3.1 Procedure descriptions

9.3.1.1 Procedure Set_Notification_Type

This procedure is called from process Update_Location_VLR in 3G TS 23.012 [32]. 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 3G TS 24.008 [33].

The type of Location Update that was requested by the Mobile Station, determines which Mobility Management notification message shall be sent to the gsmSCF.

The values 'Periodic Updating' and 'Reserved' shall not lead to a Mobility Management notification to the gsmSCF.

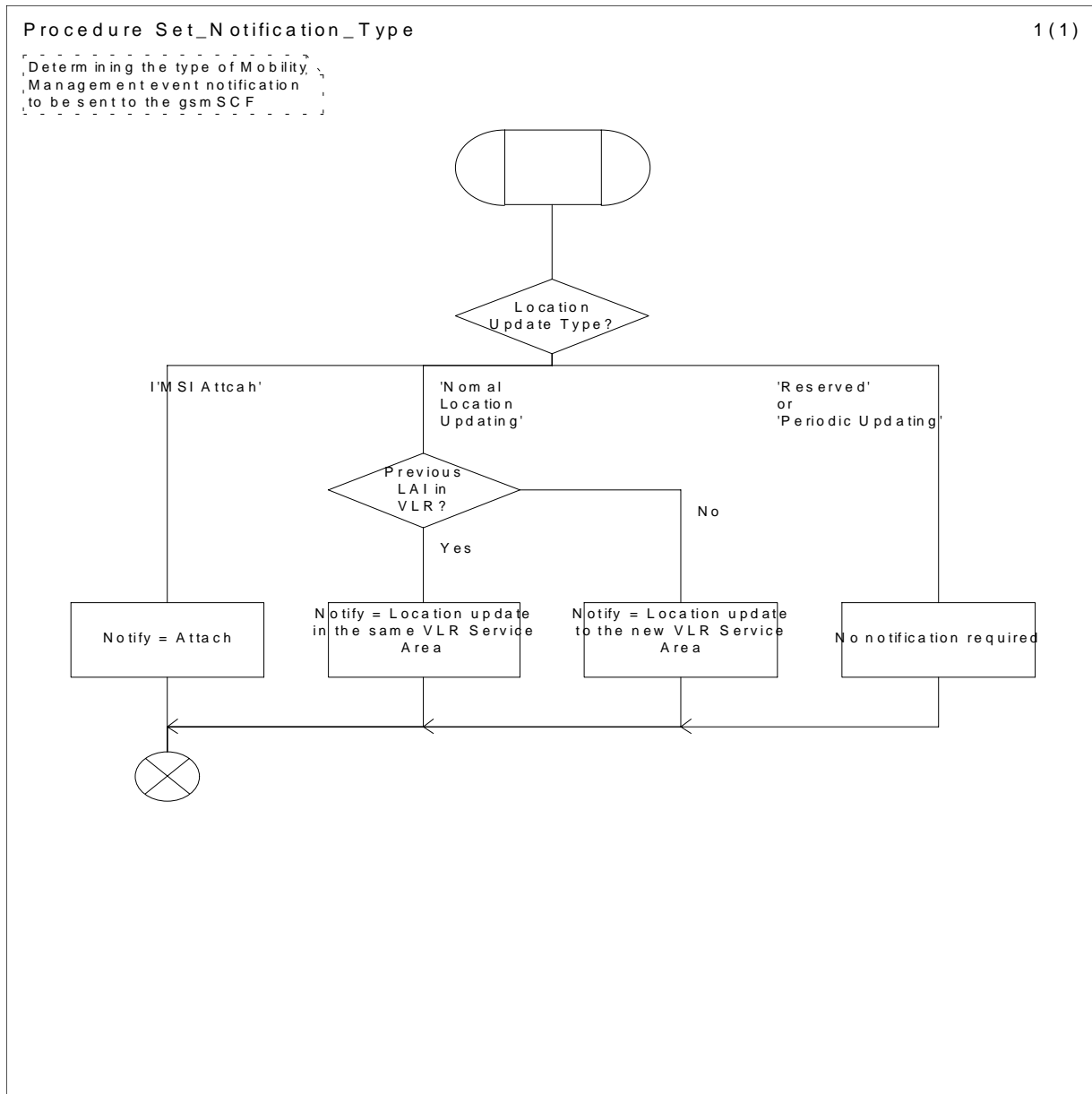


Figure 9.5: Procedure Set_Notification_Type

9.3.1.2 Procedure Notify_gsmSCF

This procedure is called from the process 'Update_Location_Area_VLR' and process 'Detach_IMSI_VLR' in 3G TS 23.012 [32].

It is also called from the process 'Update_Location_VLR' in 3G TS 29.002 [4].

The calling process passes on the variable 'Notify' to the procedure 'Notify_gsmSCF'. This variable indicates which Mobility Management notification may have 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 have 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.

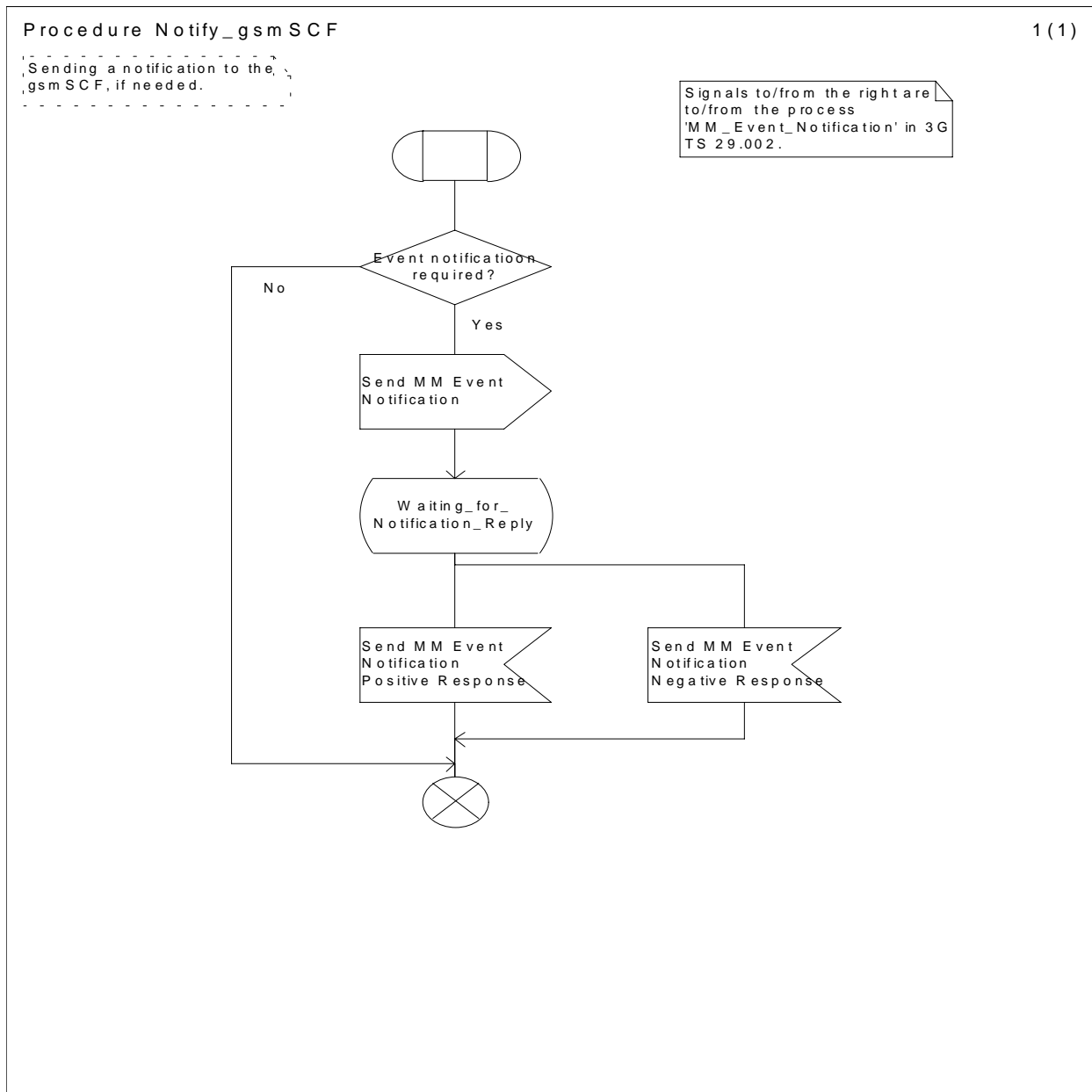


Figure 9.6: Procedure Notify_gsmSCF

9.4 Description of information flows

This clause 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), Optional (O) or Not applicable (-). This categorisation is a functional classification, i.e., stage 2 information and 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 IE's which can be sent to it.

9.4.1 VLR 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 when it shall notify the gsmSCF of a Mobility Management event.

9.4.1.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Event Met	M	This IE indicates the type of Mobility Management that lead to the notification. The value of this IE shall be one of the following. - - 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)
Service Key	M	This IE indicates the Service Logic that the gsmSCF shall apply.
IMSI	M	This IE identifies the mobile subscriber to whom the Mobility Event applies.
Basic MSISDN	M	This IE identifies the mobile subscriber to whom the Mobility Event applies.
Location Information	C	This IE indicates the current location of the MS. This IE is explained in section 4.6.1.7.
Supported CAMEL Phases	M	This IE indicates the CAMEL Phases that are supported by the MSC/VLR in which the MS is registered after the mobility management event.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

9.4.2 HLR to VLR information flows

9.4.2.1 Delete Subscriber Data

9.4.2.1.1 Description

This IF is used by an HLR to remove certain subscriber data from a VLR if the subscription of one or more supplementary services or basic services is withdrawn. Note that this IF is not used in the case of erasure or de-activation of supplementary services. This IF is specified in 3G TS 29.002 [4].

9.4.2.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR.

C Conditional (The IE shall be sent when deletion is requested)

9.4.2.2 Insert Subscriber Data

9.4.2.2.1 Description

This IF is used by an HLR to update a VLR with certain subscriber data. This IF is specified in 3G TS 29.002 [4].

9.4.2.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific IE for Mobility Management:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
M-CSI	C	This IE identifies the subscriber as having mobility management notification services. It contains the events that shall be reported, the gsmSCF Address and the Service Key.

C Conditional (The IE shall be sent, if required)

M-CSI contains the following information:

Information element name	Required	Description
GsmSCF Address	M	This IE is described in section 9.2.1.
Service Key	M	This IE is described in section 9.2.1.
Mobility Management Triggers	M	<p>This IE indicates which Mobility Management events shall be reported to the gsmSCF. It shall contain one or more of the following elements:</p> <ul style="list-style-type: none"> - 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)

M Mandatory (The IE shall always be sent)

10 Control and interrogation of subscription data

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 4.1.

HLR: The HLR may provide an interface towards the gsmSCF for the Any Time Subscription Interrogation and Any Time Modification procedure. The gsmSCF may provide an interface towards the HLR for the Notify Subscriber Data Change procedure.

10.1.2 Interfaces defined for CAMEL

This subclause describes the different 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 to notify to the gsmSCF of change of subscriber data by the HLR.

10.2 Procedures for CAMEL

10.2.1 Any Time Interrogation for Subscription Information Retrieval

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 a *Any_Time_Subscription_Interrogation_Request*. Support for this procedure is a network operator option.

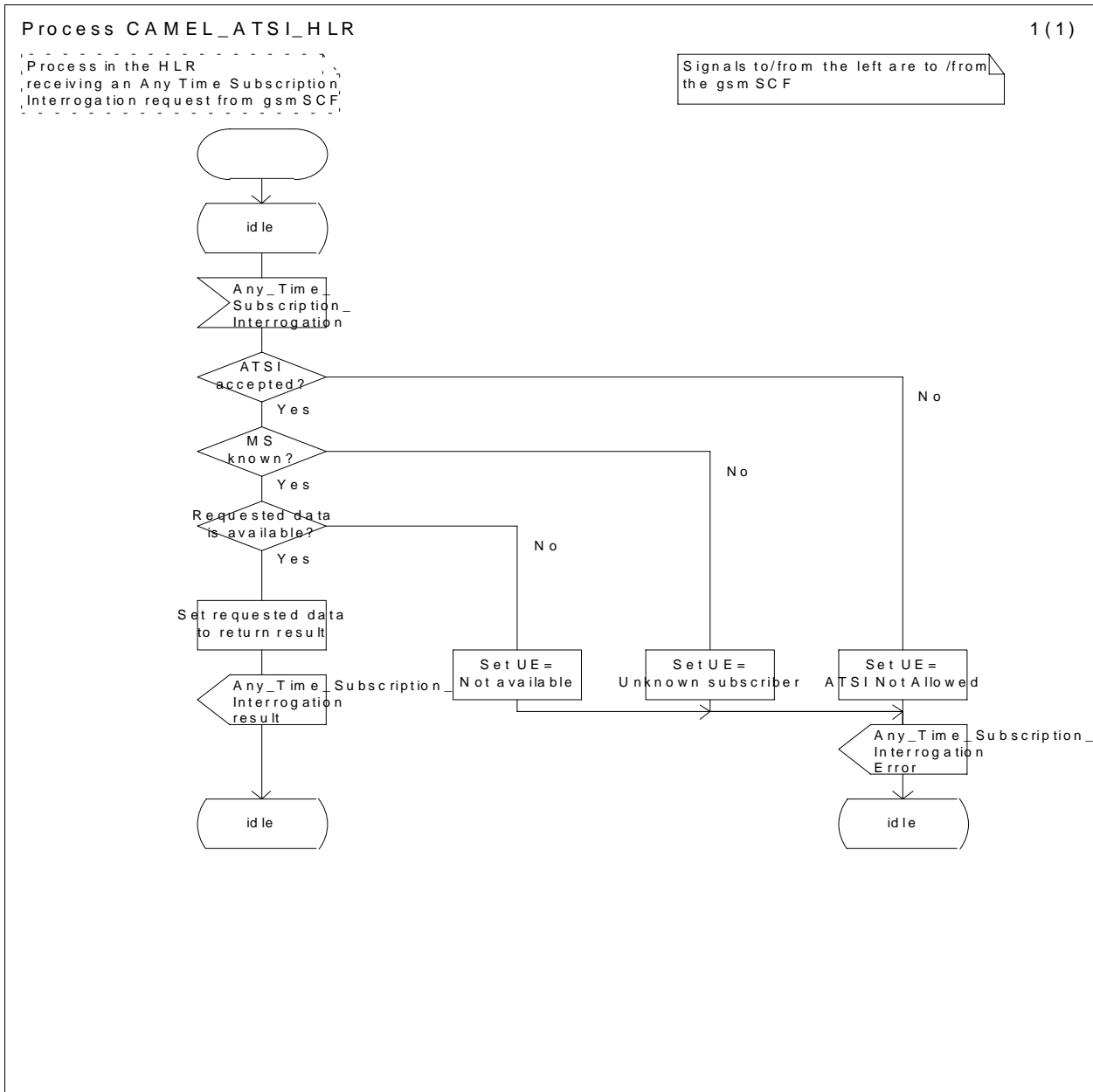


Figure 10.2: Process CAMEL_ATSI_HLR (sheet 1)

10.2.2 Any Time Modification

Handling of Any Time Modification involves the following process:

- CAMEL_ATM_HLR.

If an OSS needs to modify the Subscriber Information, the gsmSCF initiates a transaction to the HLR by sending a Any_Time_Modification Request.

When HLR receives a Any_Time_Modification Request, HLR does the procedure as follows.

- Call forwarding or call barring supplementary service data is requested
 - if only ss-code (and basic-service) is set in the Any_Time_Modification request, HLR erases the data related to the requested supplementary service.
 - if ss-code (and basic-service) and ss-status are set in the Any_Time_Modification request, HLR does the activation or deactivation of the requested supplementary service.

if ss-code (and basic-service) and “forwarded-to number”/”forwarded to subaddress”/”no reply condition time” are set in the Any_Time_Modification request, HLR modifies the requested data of the requested supplementary service.

- CSI data is requested

HLR modifies the CSI state and/or the notification flag of the requested CSI.

If a notification flag is set for the modified data, Notify_Subscriber_Data_Change is sent for the gsmSCF except for the gsmSCF which sent Any_Time_Modification Request. Support for this procedure is a network operator option.

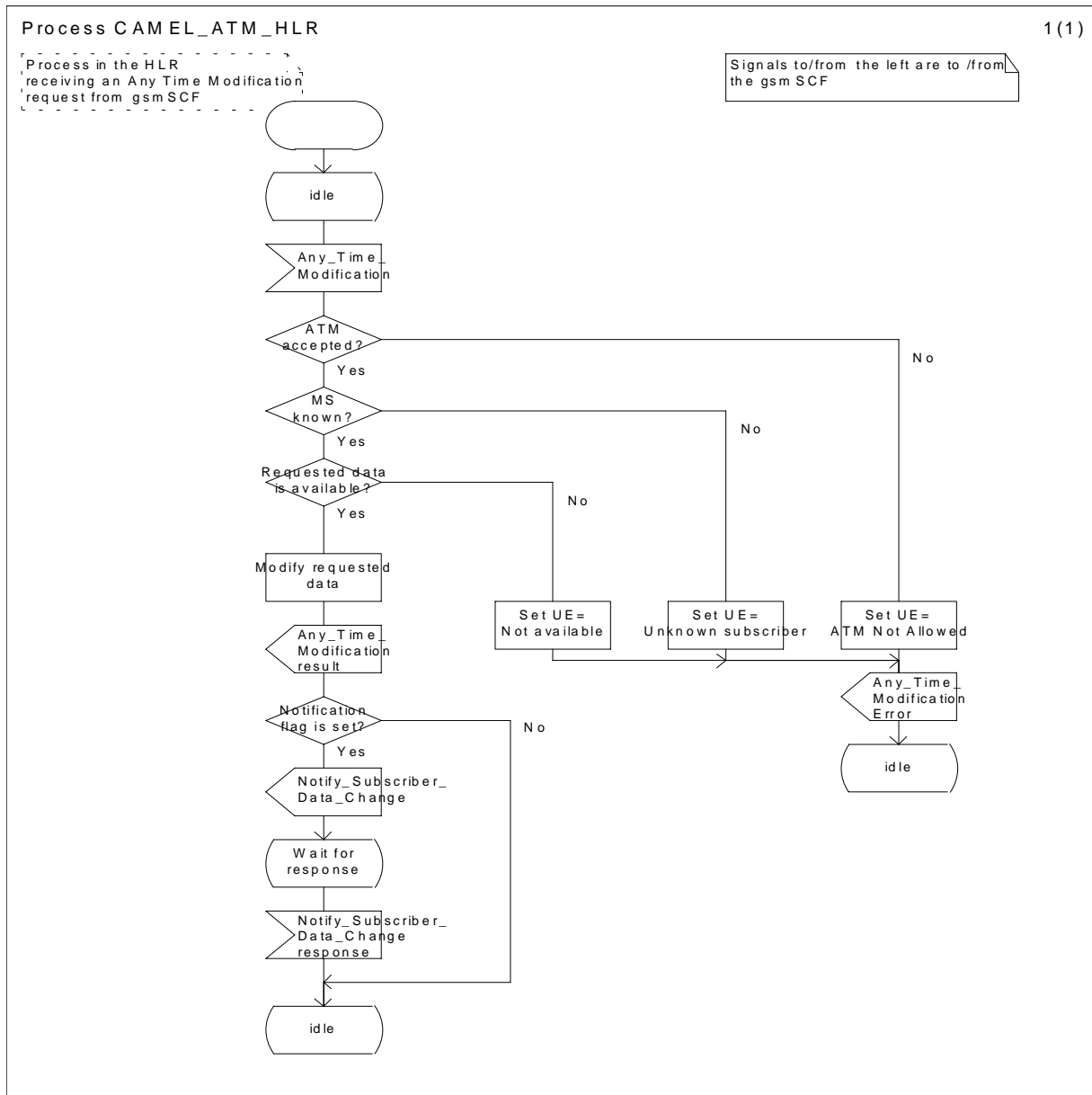


Figure 10.3: Process CAMEL_ATM_HLR (sheet 1)

10.2.3 Notify Subscriber Data Change

Changes of CSI shall be notified only if the CSI is marked with the Notification flag.

When the change of subscriber data was caused by Any Time Modification the notification of change of subscriber data shall not be sent to the gsmSCF from which this Any Time Modification was received.

Each gsmSCF shall be notified only once. Multiple occurrence of gsmSCF Address in CSIs of the subscriber shall not lead to multiple notification.

Handling of Notify subscriber data change involves the following process:

- CAMEL_NSDC_HLR.

If an OSS needs to notify to the CSE the change of subscriber data, the HLR initiates a transaction to the gsmSCF by sending Notify_Subscriber_Data_Change Request. Support for this procedure is a network operator option.

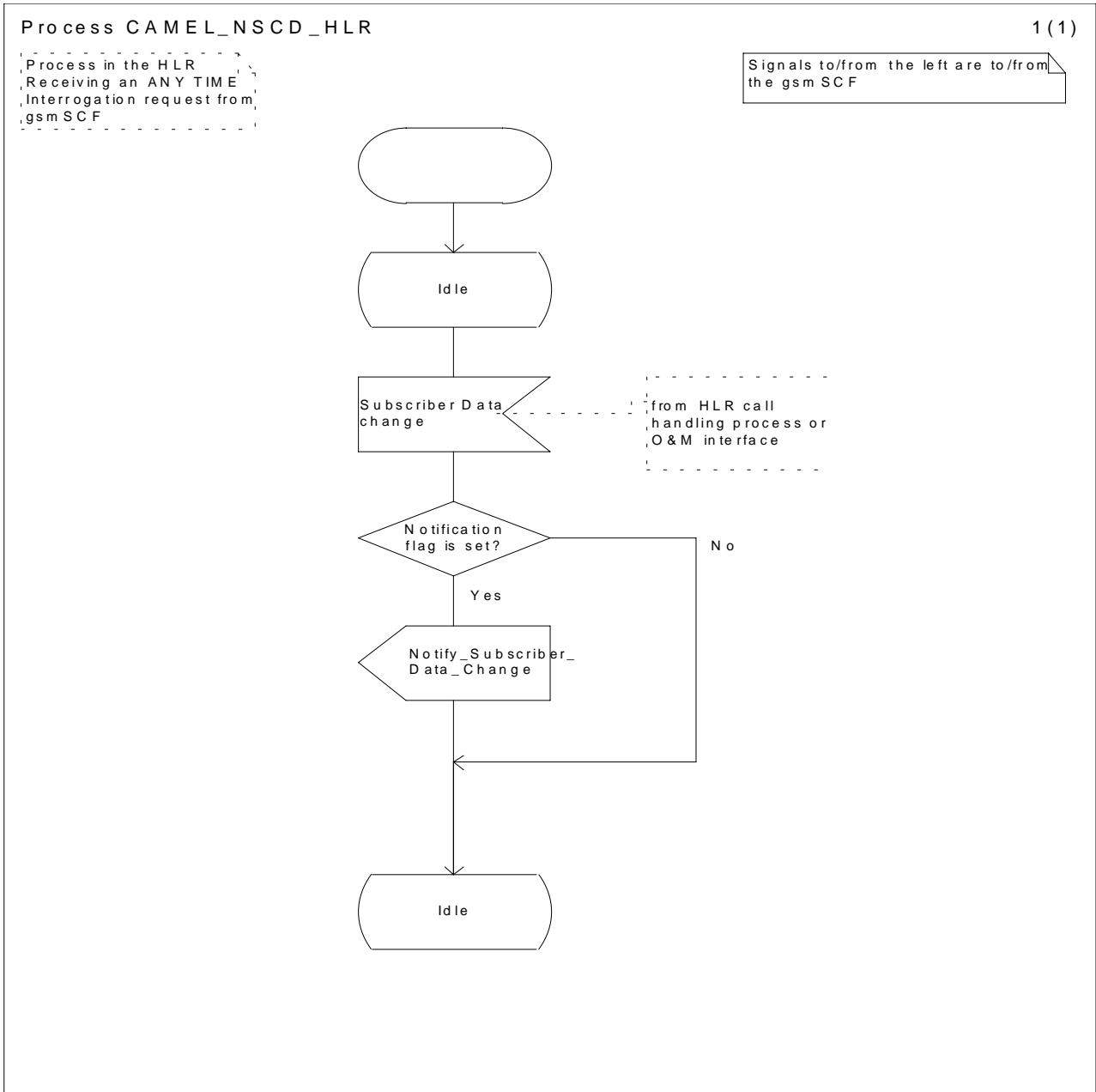


Figure 10.4: Process CAMEL_NSDC_HLR (sheet1)

10.3 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element, IE is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorisation is a functional classification, i.e., stage 2 information and 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 a IE which it receives.

Details of errors and exceptions to these rules are specified in are specified in 3G TS 29.002.

10.3.1 gsmSCF to HLR information flows

10.3.1.1 Any Time Subscription Interrogation Request

10.3.1.1.1 Description

This IF is used to request subscription information from the HLR at any time.

10.3.1.1.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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: <ul style="list-style-type: none"> - supplementary service - operator determined barring - CAMEL subscription information - supported CAMEL phases
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity can be one of: <ul style="list-style-type: none"> - IMSI - MSISDN

M Mandatory (The IE shall always be sent)

Supplementary service contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
<u>SS code</u>	<u>C</u>	This IE indicates a supplementary service or a set of supplementary services as defined in 3G TS 22.004 [25].
<u>Basic Service</u>	<u>C</u>	See 3G TS 22.002 [24].

C Conditional (The IE shall be sent, if requested and available)

CAMEL subscription information contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
CAMEL subscription information	C	This IE indicates what information about CSI is requested. It may be one or more elements of the following. - O-CSI/T-CSI/VT-CSI/TIF-CSI/GPRS-CSI/SMS-CSI/SS-CSI/M-CSI

C Conditional (The IE shall be sent, if requested and available)

10.3.1.2 Any Time Modification Request

10.3.1.2.1 Description

This IF is used to modify information in the HLR at any time.

10.3.1.2.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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 can be one of: - IMSI - MSISDN
Call forwarding SS data	C	This IE indicates the data of call forwarding.
Call barring SS data	C	This IE indicates the data of call barring.
CAMEL subscription information	C	This IE indicates the CAMEL subscription information.

M Mandatory (The IE shall always be sent)

C Conditional (The IE shall be sent, if available)

Call forwarding SS data contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SS Code	C	This IE indicates a supplementary service or a set of supplementary services as defined in 3G TS 22.004 [25].
Basic Service	C	See 3G TS 22.002 [24].
SS Status	C	See 3G TS 23.011 [26].
Forwarded-to Number	C	See 3G TS 23.082 [27].
Forwarded-to Subaddress	C	See 3G TS 23.082 [27].
No Reply Condition Time	C	See 3G TS 23.082 [27].
Notification Flag	C	This IE indicates whether the change of data of call forwarding SS is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

Call barring SS data contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SS Code	C	This IE indicates a supplementary service or a set of supplementary services as defined in 3G TS 22.004 [25].
Basic Service	C	See 3G TS 22.002 [24].
SS Status	C	See 3G TS 23.011 [26].
Password	C	See 3G TS 23.011 [26].
Wrong password attempts counter	C	See 3G TS 23.011 [26].
Notification flag	C	This IE indicates whether the change of data of call barring SS is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

CAMEL subscription information contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
O-CSI	C	This IE indicates the activation and notification status of the O-CSI.
T-CSI	C	This IE indicates the activation and notification status of the T-CSI.
VT-CSI	C	This IE indicates the activation and notification status of the TVMSC-CSI.
TIF-CSI	C	This IE indicates the activation and notification status of the TIF-CSI.
GPRS-CSI	C	This IE indicates the activation and notification status of the GPRS-CSI.
SMS-CSI	C	This IE indicates the activation and notification status of the SMS-CSI.
SS-CSI	C	This IE indicates the activation and notification status of the SS-CSI.
M-CSI	C	This IE indicates the activation and notification status of the M-CSI.

C Conditional (The IE shall be sent, if available)

O-CSI/T-CSI/VT-CSI/GPRS-CSI/SMS-CSI/SS-CSI/M-CSI contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
CSI state	C	This IE indicates whether the CSI is active or not.
Notification flag	C	This IE indicates whether the change of CSI is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

TIF-CSI contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Translation Information Flag	C	See 4.3.2.2.
Notification flag	C	This IE indicates whether the change of TIF-CSI is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

10.3.2 HLR to gsmSCF information flows

10.3.2.1 Any Time Subscription Interrogation ack

10.3.2.1.1 Description

This IF is used by the HLR to provide the requested subscription information to the gsmSCF.

10.3.2.1.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Call forwarding SS	C	This IE indicates the data related to the call forwarding.
Call barring SS data	C	This IE indicates the data related to the call barring.
Operator determined barring	C	This IE indicates the data related to the operator determined barring.
CAMEL subscription information	C	This IE indicates the data related to the CAMEL subscription information.
Supported CAMEL phases	C	This IE indicates the CAMEL phase supported at the VPLMN

C Conditional (The IE shall be sent, if requested and available)

Call forwarding SS data contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Basic Service	C	See 3G TS 22.002 [24].
SS Status	C	See 3G TS 23.011 [26].
Forwarded-to Number	C	See 3G TS 23.082 [27].
Forwarded-to Subaddress	C	See 3G TS 23.082 [27].
Subscription Options	C	See 3G TS 23.082 [27].
No Reply Condition Time	C	See 3G TS 23.082 [27].
Notification Flag	C	This IE indicates whether the change of data of call forwarding SS is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

Call barring SS data contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Basic Service	C	See 3G TS 22.002 [24].

SS Status	C	See 3G TS 23.011 [26].
Password	C	See 3G TS 23.011 [26].
Wrong password attempts counter	C	See 3G TS 23.011 [26].
Notification flag	C	This IE indicates whether the change of data of call barring SS this IE is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

Operator determined barring data contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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 flag	C	This IE indicates whether the change of data of ODB is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

CAMEL subscription information contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
O-CSI	C	See section 4.3.1.
T-CSI	C	See section 4.3.4.
VT-CSI	C	See section 4.3.5.
TIF-CSI	C	See section 4.3.6.2.
GPRS-CSI	C	See section 6.3.1.
SMS-CSI	C	See section 7.3.1.
SS-CSI	C	See section 8.2.1.1.
M-CSI	C	See section 9.2.1.1

C Conditional (The IE shall be sent, if available)

10.3.2.2 Any Time Modification ack

10.3.2.2.1 Description

This IF is used by the HLR to provide the modified information to the gsmSCF.

10.3.2.2.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Call forwarding SS data	C	This IE indicates the data related to call forwarding.
Call barring SS data	C	This IE indicates the data related to call barring.
CAMEL subscription information	C	This IE indicates the data related CAMEL subscription information.

C Conditional (The IE shall be sent, if requested and available)

Call forwarding SS data contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SS Code	C	This IE indicates a supplementary service or a set of supplementary services as defined in 3G TS 22.004 [25].
Basic Service	C	See 3G TS 22.002 [24].
SS Status	C	See 3G TS 23.011 [26].
Forwarded-to Number	C	See 3G TS 23.082 [27].
Forwarded-to Subaddress	C	See 3G TS 23.082 [27].
Subscription Options	C	See 3G TS 23.082 [27].
No Reply Condition Time	C	See 3G TS 23.082 [27].
Notification Flag	C	This IE indicates whether the change of data of call forwarding SS is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

Call barring SS data contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
SS Code	C	This IE indicates a supplementary service or a set of supplementary services as defined in 3G TS 22.004 [25].
Basic Service	C	See 3G TS 22.002 [24].
SS Status	C	See 3G TS 23.011 [26].
Password	C	See 3G TS 23.011 [26].
Wrong password attempts counter	C	See 3G TS 23.011 [26].
Notification flag	C	This IE indicates whether the change of data of call barring SS is notified to the gsmSCF or not.

C Conditional (The IE shall be sent, if available)

CAMEL subscription information contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
O-CSI	C	See section 4.3.1.
T-CSI	C	See section 4.3.4.
VT-CSI	C	See section 4.3.5.
TIF-CSI	C	See section 4.3.6.2.

GPRS-CSI	C	See section 6.3.1.
SMS-CSI	C	See section 7.3.1.
SS-CSI	C	See section 8.2.1.1.
M-CSI	C	See section 9.2.1.1

C Conditional (The IE shall be sent, if available)

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.

10.3.2.3.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity can be one of: - IMSI - MSISDN
Changed Data	M	This IE identifies the data that has changed. The data can be one of: - Call Forwarding SS Data - Call Barring SS Data - CAMEL Subscription Information

11 Location Services

Support of Location Services in CAMEL Phase 3 is a network operator option.

11.1 Architecture

11.1.1 Functional Entities used for CAMEL

This subclause describes CAMEL support of Location Services. Location Services is only supported in CAMEL Phase 3.

Figure 11.1 indicates the functional entities involved in Location Services. The interfaces between gsmSCF and GMLC and HLR are defined in this chapter.

The principle operation of Location Services is described in 3G TS 22.071 [17].

The interfaces between GMLC, HLR, MSC/VLR and SGSN are described in 3G TS 23.071 [18].

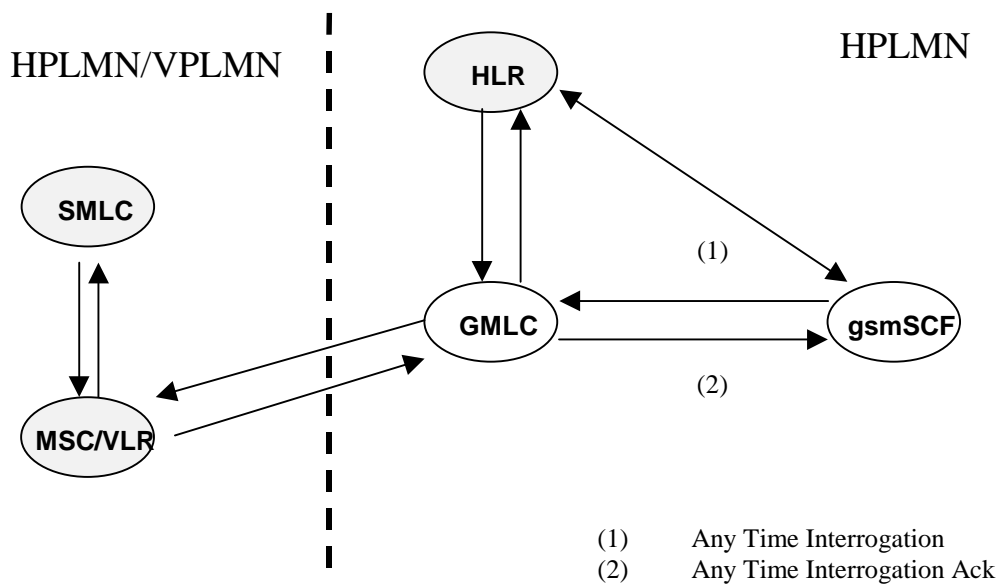


Figure 11.1: Functional architecture for support of CAMEL

gsmSCF: see subclause 4.1.

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.

SMLC: A functional entity that performs positioning activities for Mobile Stations. The SMLC interfaces with the MSC/VLR where the subscriber is currently registered.

HLR: see subclause 4.1.

MSC/VLR: see subclause 4.1.

The information flows between the GMLC and other functional entities than the gsmSCF, have not been indicated in the functional architecture as shown in figure 1. These information flows fall outside the scope of the present document.

Refer to [17] and [18] for a description of the functioning of Location Services.

11.1.2 Interfaces defined for CAMEL

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

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. The gsmSCF had requested this information via the Any Time Interrogation procedure before.

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.

11.2 Procedures for CAMEL

11.2.1 Any Time Interrogation

Handling of Any Time Interrogation 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.

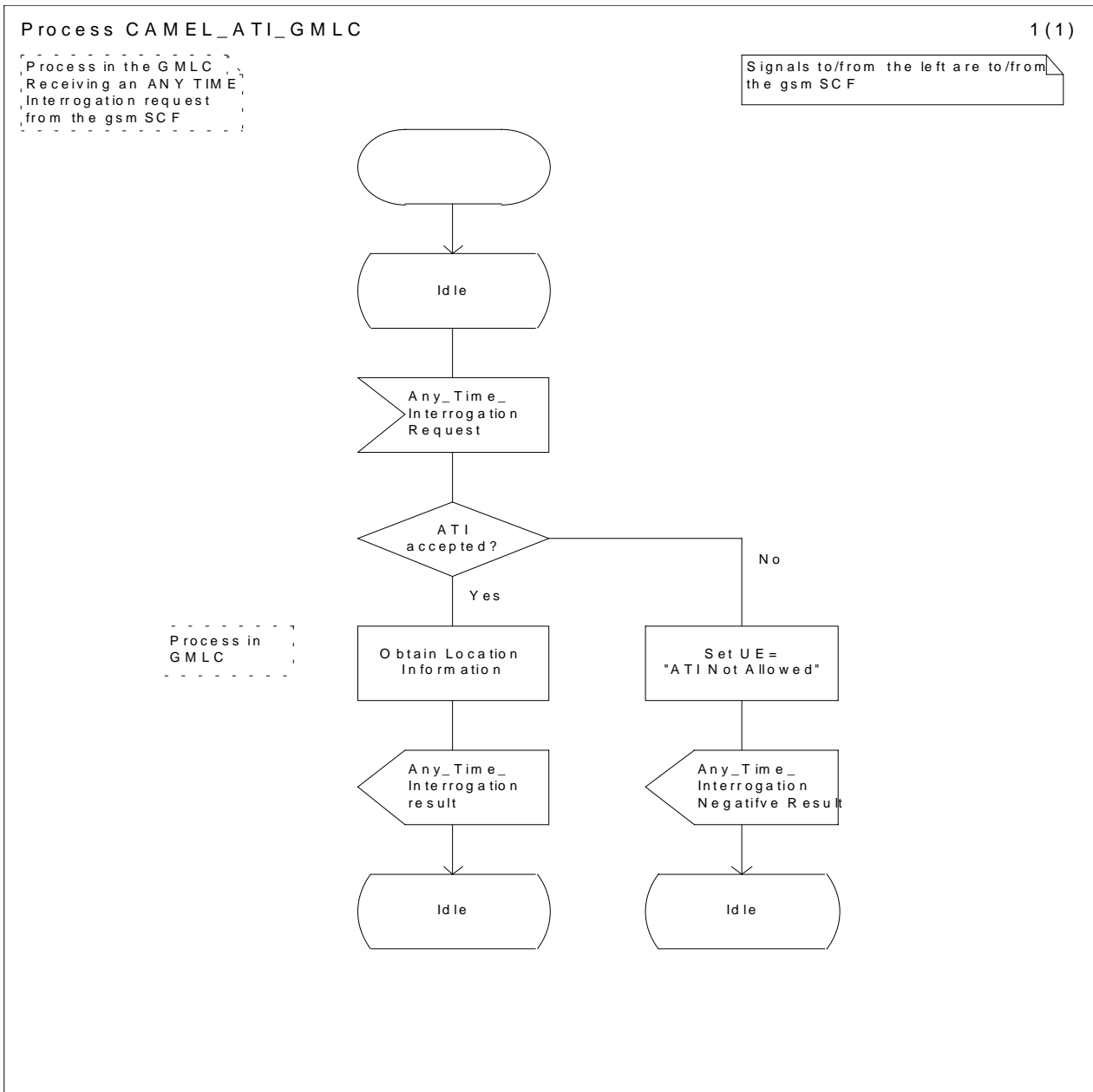


Figure 11.2: Process CAMEL_ATI_GMLC

11.2.2 Any Time Interrogation for Subscriber State and Location Information

Handling of Any Time Interrogation for 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 a Any_Time_Interrogation Request. Support for this procedure is a network operator option.

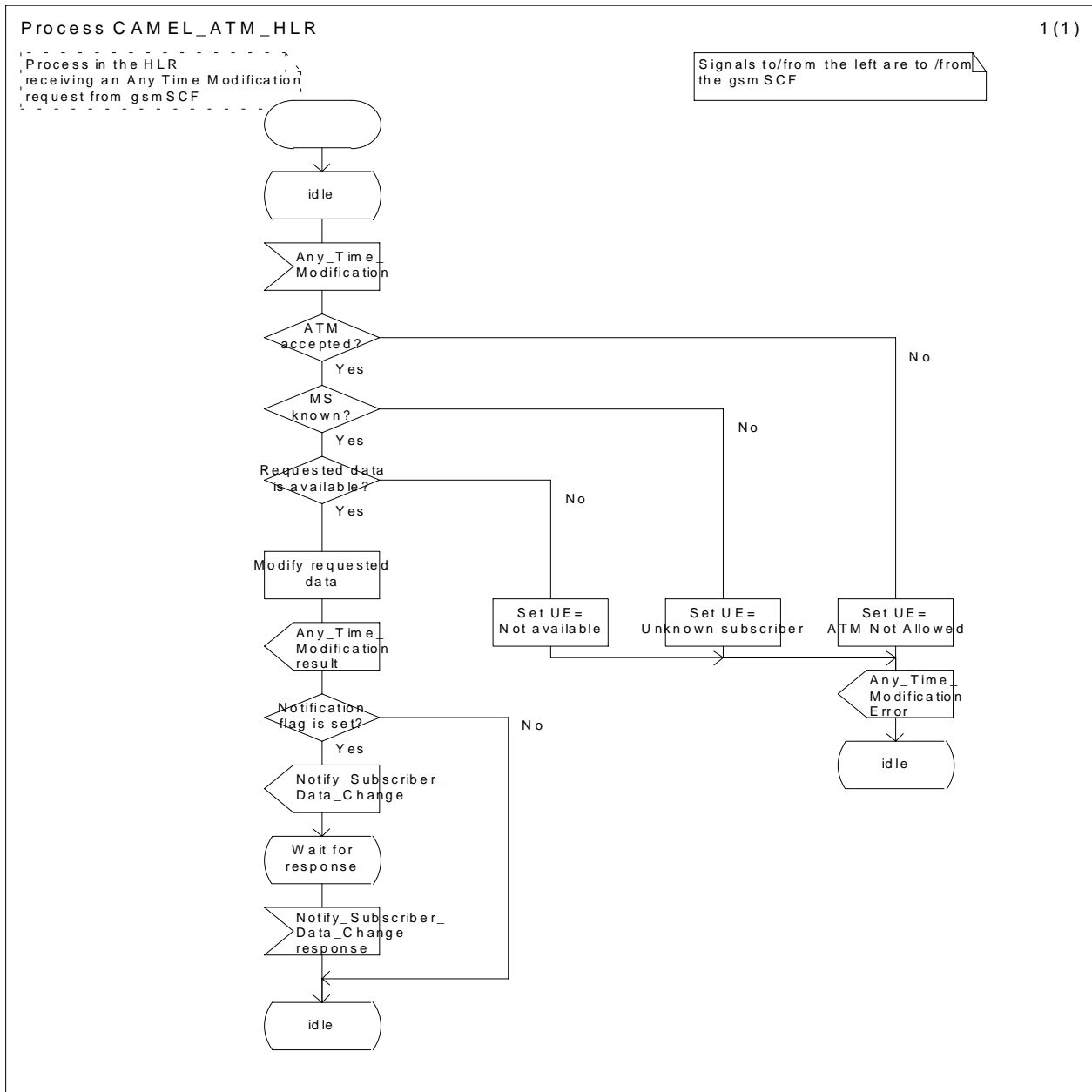


Figure 11.3: Process CAMEL_ATI_HLR

11.3 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element, IE, is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorisation is a functional classification, i.e., stage 2 information and 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 a IE which it receives.

Details of errors and exceptions to these rules are specified in are specified in 3G TS 29.002 [4].

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

The following information elements are required:

Information element name	Required	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 can be one of the following list: - IMSI - MSISDN

M Mandatory (The IE shall always be sent)

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. The gsmSCF requested the information previously with the Any Time Interrogation IF.

11.3.2.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Location Information	C	This IE indicates the location of the Mobile Station.

C Conditional (The IE shall be sent if requested and available)

Location Information contains the following information:

Information element name	Required	Description
Location Number	-	See 3G TS 23.018 [3].
CellIdOrLAI	-	See 3G TS 23.018 [3].
Geographical Information	C	See 3G TS 23.032 [x]. The GMLC receives Extended Geographical Information from the MSC. The Extended Geographical Information

		shall be converted to the Geographical Information by the GMLC.
Geodetic Information	C	See 3G TS 23.018 [3].
Age Of Location Information	C	See 3G TS 23.018 [3].
VLR number	-	See 3G TS 23.018 [3].
Selected LSA Identity	-	See 3G TS 23.018 [3].
MSC number	C	See 3G TS 23.032. [x] The GMLC receives the MSC number from the HLR in the SendRoutingInfoForLCS MAP operation.

C Conditional (The IE shall be sent, if available)

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 (subscriber state and/or location) from the HLR at any time.

11.3.3.1.2 Information Elements

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
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: <ul style="list-style-type: none"> - subscriber location - subscriber state - currentLocation (currentLocation shall not be present if locationInformation is not present in the RequestedInfo parameter)
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity can be one of: <ul style="list-style-type: none"> - IMSI - MSISDN

M Mandatory (The IE shall always be sent)

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

The following information elements are required:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Location Information	C	This IE indicates the location of the served subscriber.
Subscriber State	C	This IE indicates the status of the MS. The possible values of the IE are: <ul style="list-style-type: none"> - CAMELBusy: The VLR has indicated that the MS is engaged on a transaction for a mobile originating or terminated circuit-switched call. - NetworkDeterminedNotReachable: The 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.

C Conditional (The IE shall be sent, if requested and available)

Location Information contains the following information:

<u>Information element name</u>	<u>Required</u>	<u>Description</u>
Location Number	C	See 3G TS 23.018 [3].
CellIdOrLAI	C	See 3G TS 23.018 [3].
Geographical Information	C	See 3G TS 23.018 [3].
Geodetic Information	C	See 3G TS 23.018 [3].
Age Of Location Information	C	See 3G TS 23.018 [3].
VLR number	C	See 3G TS 23.018 [3].
Selected LSA Identity	C	See 3G TS 23.018[3]

C Conditional (The IE shall be sent, if available)

Annex A: Change history

Change history						
TSG CN#	Spec	Version	CR	<Phase>	New Version	Subject/Comment
Apr 1999	GSM 03.78	7.0.0				Transferred to 3GPP CN1
CN#03	23.078	3.0.0			3.0.0	Approved at CN#03
CN#4	23.078	3.1.0	003	R99	3.1.0	Inclusion of Subscriber Activity Information Flow
CN#4	23.078	3.1.0	004	R99	3.1.0	Inclusion of Alerting Pattern in Provide Roaming Number
CN#4	23.078	3.1.0	005	R99	3.1.0	Dialled Number String Format
CN#4	23.078	3.1.0	006	R99	3.1.0	Handling of AC/ACR in DP Busy, DP No Answer and DP
CN#4	23.078	3.1.0	007	R99	3.1.0	Inclusion of Activity Test IF between gsmSCF & gsmSRF and gsmSCF and assistSSF
CN#4	23.078	3.1.0	008	R99	3.1.0	Correction of USSD Information flows
CN#4	23.078	3.1.0	009	R99	3.1.0	Various corrections
CN#4	23.078	3.1.0	010	R99	3.1.0	Correction of CAMEL Phase interworking with Call Forwarding
CN#4	23.078	3.1.0	011	R99	3.1.0	Renaming of Call Active Variable
CN#4	23.078	3.1.0	012	R99	3.1.0	Reporting of O/T_Abandon DP when caller clears during O/T_Busy, O/T_No_Answer or Route_Select_Failure EDP-R.
CN#4	23.078	3.1.0	013	R99	3.1.0	Clarification on the scope of CAMEL Capability Handling parameter
CN#4	23.078	3.1.0	014	R99	3.1.0	Refining trigger criteria at DP2, due to the introduction of North American Equal Access
CN#4	23.078	3.1.0	015	R99	3.1.0	Introduction of MSISDN in USSD operation
CN#4	23.078	3.1.0	016	R99	3.1.0	MSC address in Initial DP
CN#4	23.078	3.1.0	017	R99	3.1.0	Correction of gsmSDL; return to idle after ACR
CN#4	23.078	3.1.0	018	R99	3.1.0	Notification of call forwarding to the gsmSCF
CN#5	23.078	3.1.0	019	R99	3.2.0	Inclusion of the SS invocation notification procedure
CN#5	23.078	3.1.0	021	R99	3.2.0	Removal of TDP criteria from resume call handling
CN#5	23.078	3.1.0	022r1	R99	3.2.0	GMSC CAMEL phases in Provide Roaming Number
CN#5	23.078	3.1.0	023r1	R99	3.2.0	Call Reference Number
CN#5	23.078	3.1.0	025	R99	3.2.0	Clarification on Call Reference Number and GMSC address
CN#5	23.078	3.1.0	027	R99	3.2.0	Value of the Active Call parameter in ACR operation
CN#5	23.078	3.1.0	028	R99	3.2.0	Correction of process gsmSSF SDL
CN#5	23.078	3.1.0	029	R99	3.2.0	Alignment of CAMEL2 FCI & handling of CIR
CN#5	23.078	3.1.0	030	R99	3.2.0	Correction of Inhibiting Triggering Criteria
CN#6	23.078	3.2.0	032r2	R99	3.3.0	23.078 revised for CAMEL Phase 3 Release 1999
CN#6	23.078	3.2.0	033	R99	3.3.0	Correction of the direction of Int_Continue after sending Int_O/T-Abandon

History

Document history		
V3.3.0	January 2000	Publication