3GPP TSG_CN#7 **NP-000079**

ETSI SMG3 Plenary Meeting #7,
Madrid, Spain
13th – 15th March 2000

Agenda item:

Source: **TSG_N WG2**

Title: **CRs to 3G Work Item TE&I**

Introduction:

This document contains **"15"** CRs on **Work Item TE&I,** that have been agreed by **TSG_N WG2,** and are forwarded to **TSG_N Plenary** meeting #7 for approval.

TDoc	SPEC	CR	REV	CAT	Rel	Old vers	New vers	SUBJECT
N2B000049	23.003	014		B	R99	3.3.0		Necessity of the function of the calculation an SGSN IP address from the target ID
N2B000121	23.003	016		B	R99	3.3.0		Definition of Service Area Identification
N2B000371	23.008	019	1	B	R99	3.2.0		Introduction of Service Area Identification
N2B000359	23.018	039	2	D	R99	3.3.0		Updating references to point to 3G specifications
N2B000359	23.079	010	1	D	R99	3.3.0		Updating references to point to 3G specifications
N2B000173	23.079	011		F	R99	3.3.0		Indication of OR capability of the GMSC to the destination MSC/VLR
N2B000144	29.002	086	1	D	R99	3.3.0		Various editorial corrections
N2B000372	29.002	101	1	B	R99	3.3.1		Introduction of Service Area Identification
N2B000281	29.002	107		D	R99	3.3.0		Removal of architectural information from clause 4
N2B000357	29.002	111		B	R99	3.3.0		Use of MAP private extensions to implement region-specific requirements
N2B000044	29.060	040		B	R99	3.3.0		Improving charging efficiency
N2B000110	29.060	041	1	B	R99	3.3.0		Subscriber and equipment trace for PS domain
N2B000048	29.060	042		B	R99	7.3.0		Necessity of the function of the calculation an SGSN IP address from the target ID
N2B000267	29.060	073		D	R99	3.3.0		Clarification to the function of the calculation an SGSN IP address from the target ID
N2B000442	29.060	083		D	R99	3.3.0		Editorial clarification of information elements in the SGSN Context Response

3GPP TSG-CN WG2 #13
Kyoto, Japan, 17-21 Jan. 2000

Document N2B000049
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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23.003	CR	014	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio		Core Network	X

Source: N2 **Date:** 2000-01-17

Subject: Necessity of the function of the calculation an SGSN IP address from the target ID

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	X
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: In UMTS, the target ID which consists of MCC, MNC and RNC ID is used as a routing information of a target RNC and a new SGSN when SRNS relocation is executed (see TS25.413 and TS23.060). It should be allowed that DNS can be used to resolve new SGSN IP addresses. Therefore an APN Network Identifier shall not start with the strings “rnc”.
This CR proposes an addition of the restriction for the format of APN Network Identifier

Clauses affected:

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	TS29.060
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

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9 Definition of Access Point Name

In the GPRS backbone, an Access Point Name (APN) is a reference to a GGSN. To support inter-PLMN roaming, the internal GPRS DNS functionality is used to translate the APN into the IP address of the GGSN.

9.1 Structure of APN

The APN is composed of two parts as follows:

- The APN Network Identifier which defines to which external network the GGSN is connected to. This part of the APN is mandatory.
- The APN Operator Identifier which defines in which PLMN GPRS backbone the GGSN is located. This part of the APN is optional.

The APN Operator Identifier is placed after the APN Network Identifier. An APN consisting of both the Network Identifier and Operator Identifier corresponds to a DNS name of a GGSN and has a maximum length of 100 octets.

The syntax of the APN shall follow the Name Syntax defined in RFC 2181 [14] and RFC 1035 [15]. The APN consists of one or more labels. Each label is coded as one octet length field followed by that number of octets coded as 8 bit ASCII characters. Following RFC 1035 [15] the labels should consist only of the alphabetic characters (A-Z and a-z), digits (0-9) and the dash (-). The case of alphabetic characters is not significant. The APN is not terminated by a length byte of zero.

NOTE: A length byte of zero is added by the SGSN at the end of the APN before interrogating a DNS server.

For the purpose of presentation, an APN is usually displayed as a string in which the labels are separated by dots (e.g. “Label1.Label2.Label3”).

9.1.1 Format of APN Network Identifier

The APN Network Identifier shall contain at least one label and shall have a maximum length of 63 octets. An APN Network Identifier shall not start with the strings “rac”, “lac”~~,~~ ~~or~~ “sgsn” or “rnc” and it shall not end in “.gprs”. It shall also not take the value “*”.

In order to guarantee uniqueness of APN Network Identifier within the GPRS PLMN(s), an APN Network Identifier containing more than one label corresponds to an Internet domain name. This name should only be allocated by the PLMN to an organisation that has officially reserved this name in the Internet domain. Other types of APN Network Identifiers are not guaranteed to be unique within the GPRS PLMN(s).

3GPP TSG-CN WG2 #13
Kyoto, Japan, 17-21 Jan. 2000

Document N2B000121
e.g. for 3GPP use the format TP-99xxx
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CHANGE REQUEST

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23.003	CR	016	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑	for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: N2 **Date:** 2000-01-18

Subject: Definition of Service Area Identification

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	X
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: In 3G network, Service Area Identity consists of LAI and SAC. It is used by Core Network to identify Service Area. For example Service Area Identity is included in initial UE message instead of CGI in 3G network.

Clauses affected:

Other specs affected:

Other 3G core specifications	X	→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments: Other specs affected are to be investigated and CRs should be created if needed.

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4.5 Location Number

A location number is a number which defines a specific location within a GSM PLMN. The Location number is formatted according to CCITT Recommendation E.164, as shown in figure 8. The Country Code (CC) and National Destination Code (NDC) fields of the location number are those which define the GSM PLMN of which the location is part.

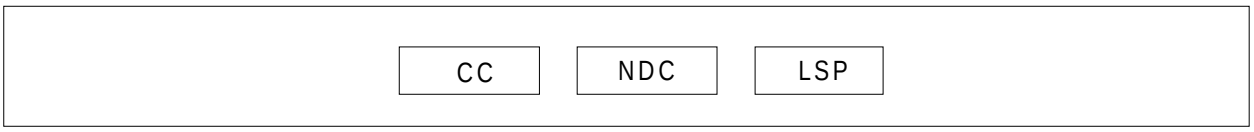

Figure 8: Location Number Structure

The structure of the locally significant part (LSP) of the location number is a matter for agreement between the PLMN operator and the national numbering authority in the PLMN's country. It is desirable that the location number can be interpreted without the need for detailed knowledge of the internal structure of the PLMN; the LSP should therefore include the national destination code in the national numbering plan for the fixed network which defines the geographic area in which the location lies.

The set of location numbers for a GSM PLMN must be chosen so that a location number can be distinguished from the MSISDN of a subscriber of the PLMN. This will allow the PLMN to trap attempts by users to dial a location number.

4.6 Composition of the Service Area Identification (SAI)

The Service Area Identification shall be composed as shown in figure 9:

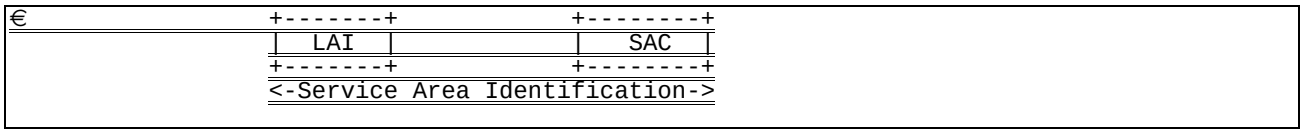

Figure 9: Structure of Service Area Identification

The SAI is composed of the following elements:

- A valid Location Area Identity (LAI) as defined in section 4.1. Invalid LAI values are used in some special cases when no valid RAI exists in the mobile station (see GSM 04.08 and GSM 11.11).
- Service Area Code (SAC) which is a fixed length code (of 2 octets) identifying a service area within a location area and it can be coded using a full hexadecimal representation. Service area consists of one or more cells.

3GPP TSG-CN WG2 B #XX
Milan, Italy, 14-16 Feb. 2000

Document N2B000371
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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23.008	CR	019r1	Current Version:	3.2.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: NTT COMMUNICATIONWARE **Date:** 2000-02-14

Subject: Introduction of Service Area Identification

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: In 3G network, Service Area Identity consists of LAI and SAC. It is used by Core Network to identify Service Area. For example Service Area Identity is included in initial UE message instead of CGI in 3G network. So the Cell ID shall be replaced to the new one that shows the Cell in GSM case and the Service Area in UMTS case.

This CR is aligning with the approved CR against 23.003 (N2B000121).

Clauses affected: 2.4.4; 2.4.16; 4

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	23.003, 23.018, 23.078, 29.002, 29.018
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments: It seems that Cell Global Identification in SGSN are duplication of Cell ID. To align with MSC, Cell global Identification in SGSN is removed.

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2.4.4 ~~Cell Global Identification~~[spare]

~~Cell Identity (CI) is defined in GSM 03.03.~~

~~CI is temporary subscriber data and is conditionally stored in the SGSN.~~

NEXT MODIFICATION

2.4.16 Cell Global ID or Service Area ID

The C~~c~~ell Global ID or Service Area ID indicates the cell global ~~cell~~ identity of the cell in GSM (see 3G TS 23.003) or the service area identification of the service area in UMTS (see 3G TS 23.003) in which the MS is currently in radio contact or in which the MS was last in radio contact. The VLR and SGSN shall update the stored ~~c~~Cell Global ID or Service Area ID at establishment of every radio connection.

The cell ID is temporary subscriber data stored in the VLR and SGSN. It is conditional data, the VLR and SGSN shall store it whenever the subscriber data is marked as confirmed by radio contact.

NEXT MODIFICATION

4 Accessing subscriber data

It shall be possible to retrieve or store subscriber data concerning a specific MS from the HLR by use of each of the following references:

- International Mobile Subscriber Identity (IMSI);
- Mobile Station ISDN Number (MSISDN)

It shall be possible to retrieve or store subscriber data concerning a specific MS from the VLR by use of each of the following references:

- International Mobile Subscriber Identity (IMSI);
- Temporary Mobile Subscriber Identity (TMSI).

It shall be possible to retrieve or store subscriber data concerning a specific MS from the SGSN by use of each of the following references:

- International Mobile Subscriber Identity (IMSI);
- Packet Temporary Mobile Subscriber identity (P-TMSI).

It shall be possible to retrieve or store subscriber data concerning a specific MS from the GGSN by use of the following reference:

- International Mobile Subscriber Identity (IMSI).

See clause 3 for explanation of M, C, T and P in table 1 and table 2.

Table 1: Overview of data stored for non-GPRS Network Access Mode

PARAMETER	SUBCLAUSE	HLR	VLR	TYPE	
IMSI	2.1.1.1	M	M	P	Note
Network Access Mode	2.1.1.2	M	-	P	Note
International MS ISDN number	2.1.2	M	M	P	
multinumbering MSISDNs	2.1.3	C	-	P	Note
Basic MSISDN indicator	2.1.3.1	C	-	P	
MSISDN-Alert indicator	2.1.3.2	C	-	P	
TMSI	2.1.4	-	C	T	
LMSI	2.1.8	C	C	T	Note
Mobile Station Category	2.2.1	M	M	P	
LMU Identifier	2.2.2	C	C	P	
RAND, SRES and Kc	2.3.1		C	T	
RAND, XRES, CK, IK and AUTN	2.3.2	M	C	T	
Ciphering Key Sequence Number	2.3.3	-	M	T	
MSRN	2.4.1	-	C	T	Note
Location Area Identity	2.4.2	-	M	T	
VLR number	2.4.5	M	-	T	Note
MSC number	2.4.6	M	C	T	
HLR number	2.4.7	-	C	T	
Subscription restriction	2.4.10	C	-	P	
RSZI lists	2.4.11.1	C	-	P	
Zone Code List	2.4.11.2	-	C	P	
MSC area restricted flag	2.4.12	M	-	T	
LA not allowed flag	2.4.13	-	M	T	
ODB-induced barring data	2.4.15.1	C	-	T	
Roaming restriction due to unsupported feature	2.4.15.2	M	M	T	
Cell Global ID or Service Area ID	2.4.16	-	C	T	
LSA Identity	2.4.17.1	C	C	P	
LSA Priority	2.4.17.2	C	C	P	
LSA Only Access Indicator	2.4.17.3	C	C	P	
LSA Active Mode Indicator	2.4.17.4	C	C	P	
VPLMN Identifier	2.4.17.5	C	-	P	
Provision of bearer service	2.5.1	M	M	P	
Provision of teleservice	2.5.2	M	M	P	
BC allocation	2.5.3	C	C	P	
IMSI detached flag	2.7.1	-	C	T	
Confirmed by Radio Contact indicator	2.7.4.1	-	M	T	
Subscriber Data Confirmed by HLR indicator	2.7.4.2	-	M	T	
Location Information Confirmed in HLR indicator	2.7.4.3	-	M	T	
Check SS indicator	2.7.4.4	M	-	T	
MS purged for non-GPRS flag	2.7.5	M	-	T	
MNRR	2.7.7	C	-	T	
Subscriber status	2.8.1	C	C	P	
Barring of outgoing calls	2.8.2.1	C	C	P	
Barring of incoming calls	2.8.2.2	C	-	P	
Barring of roaming	2.8.2.3	C	-	P	
Barring of premium rate calls	2.8.2.4	C	C	P	
Barring of supplementary service management	2.8.2.5	C	C	P	
Barring of registration of call forwarding	2.8.2.6	C	-	P	
Barring of invocation of call transfer	2.8.2.7	C	C	P	
Operator determined barring PLMN-specific data	2.8.3	C	C	P	
Handover Number	2.9.1	-	C	T	
Messages Waiting Data	2.10.1	C	-	T	
Mobile Station Not Reachable Flag	2.10.2	C	M	T	
Memory Capacity Exceeded Flag	2.10.3	C	-	T	

(continued)

Table 1 (concluded): Overview of data stored for non-GPRS Network Access Mode

PARAMETER	SUBCLAUSE	HLR	VLR	TYPE	
Trace Reference	2.11.1	C	C	P	
Trace Type	2.11.2	C	C	P	
Operations Systems Identity	2.11.3	C	C	P	
HLR Trace Type	2.11.4	C	-	P	
MAP Error On Trace	2.11.5	C	-	T	
Trace Activated in VLR	2.11.6	C	C	T	
Foreign Subscriber Registered in VLR	2.11.7	-	C	P	Note
VGCS Group Membership List	2.12.1	C	C	P	
VBS Group Membership List	2.12.2	C	C	P	
Broadcast Call Initiation Allowed List	2.12.2.1	C	C	P	
Originating CAMEL Subscription Information (O-CSI)	2.14.1.1/3.1	C	C	P	
Terminating CAMEL Subscription Information (T-CSI)	2.14.1.2	C	-	P	
VMSC Terminating CAMEL Subscription Information (VT-CSI)	2.14.1.2/3.2	C	C	P	
Location Information/Subscriber state Information	2.14.1.3	C	-	P	
USSD CAMEL subscription information(U-CSI)	2.14.1.4	C	-	P	
SS invocation notification (SS-CSI)	2.14.1.5/3.2	C	C	P	
Translation information flag(TIF-CSI)	2.14.1.6/3.6	C	C	P	
Dialled service CAMEL Subscription Information (D-CSI)	2.14.1.10/3.6	C	C	P	
USSD General CAMEL service information (UG-CSI)	2.14.2	C	-	P	
O-CSI Negotiated CAMEL Capability Handling	2.14.2.1	C		P	
SS-CSI Negotiated CAMEL Capability Handling	2.14.2.1	C		P	
VT-CSI Negotiated CAMEL Capability Handling	2.14.2.1	C		P	
SMS-CSI VLR Negotiated CAMEL Capability Handling	2.14.2.1	C		P	
M-CSI Negotiated CAMEL Capability Handling	2.14.2.1	C		P	
VLR Supported CAMEL Phases	2.14.2.3	C		P	
IST Alert Timer	2.15.1	C	C	P	
Privacy Exception List	2.16.1.1	C	C	P	
GMLC Numbers	2.16.1.2	C	C	P	
MO-LR List	2.16.1.3	C	C	P	
Age Indicator	2.17.1	C	C	T	

Table 2: Overview of data used for GPRS Network Access Mode

PARAMETER	Subclause	HLR	VLR	SGSN	GGSN	TYPE	
IMSI	2.1.1.1	M	M	M	M	P	Note
Network Access Mode	2.1.1.2	M	-	C (a)	-	P	Note
International MS ISDN number	2.1.2	M	M	M	-	T	
multinumbering MSISDNs	2.1.3	C	-	-	-	T	Note
Basic MSISDN indicator	2.1.3.1	C	-	-	-	T	.
MSISDN-Alert indicator	2.1.3.2	C	-	-	-	T	
P-TMSI	2.1.5	-	-	C	-	T	Note
TLLI	2.1.6	-	-	C	-	T	
Random TLLI	2.1.7	-	-	C	-	T	Note
IMEI	2.1.9	-	-	C	-	T	
RAND/SRES and Kc	2.3.1		-	C	-	T	
RAND, XRES, CK, IK, AUTN	2.3.2	M	-	C	-	T	
Ciphering Key Sequence Number	2.3.3	-	-	M	-	T	
Selected Ciphering Algorithm	2.3.5	-	-	M	-	T	
Current Kc	2.3.6	-	-	M	-	T	
P-TMSI Signature	2.3.7	-	-	C	-	T	
Routing Area Identity	2.4.3	-	-	M	-	T	
~~Cell Global Identification~~	~~2.4.4~~	~~-~~	~~-~~	~~C~~	~~-~~	~~T~~	
VLR Number	2.4.5	M	-	C (Gs)	-	T	
SGSN Number	2.4.8.1	M	C (Gs)	-	-	T	Note
GGSN Number	2.4.8.2	©	-	-	-	P	Note
RSZI Lists	2.4.11.1	C	-	-	-	P	
Zone Code List	2.4.11.2	-	-	C	-	P	
LA not allowed flag	2.4.13	-	-	M	-	T	
SGSN area restricted flag	2.4.14	M	-	-	-	T	
Roaming Restriction in the SGSN ..	2.4.15.2	M	-	M	-	T	
Cell Global ID or Service Area ID	2.4.16	-	-	C	-	T	
LSA Identity	2.4.17.1	C	C	C	-	P	
LSA Priority	2.4.17.2	C	C	C	-	P	
LSA Only Access Indicator	2.4.17.3	C	C	C	-	P	
LSA Active Mode Indicator	2.4.17.4	C	C	C	-	P	
VPLMN Identifier	2.4.17.5	C	-	-	-	P	
Provision of teleservice	2.5.2	C	-	C	-	P	
Transfer of SM option	2.5.4	M	-	-	-	P	
MNRG	2.7.2	M	-	M	M	T	
MM State	2.7.3	-	-	M	-	T	
Subscriber Data Confirmed by HLR Indicator	2.7.4.2	-	-	M	-	T	
Location Info Confirmed by HLR Indicator	2.7.4.3	-	-	M	-	T	
MS purged for GPRS flag	2.7.6	M	-	-	-	T	
MNRR	2.7.7	C	-	-	-	T	
Subscriber Status	2.8.1	C	-	C	-	P	
Barring of outgoing calls	2.8.2.1	C	-	C	-	P	
Barring of roaming	2.8.2.3	C	-	C	-	P	
ODB PLMN-specific data	2.8.3	C	-	C	-	P	
Trace Activated in SGSN	2.11.7	C	-	C	-	P	
PDP Type	2.13.1	C	-	C	M	P	
PDP Address	2.13.2	C	-	C	M	P	
NSAPI	2.13.3	-	-	C	C	T	
PDP State	2.13.4	-	-	C	-	T	
New SGSN Address	2.13.5	-	-	C	-	T	
Access Point Name	2.13.6	C	-	C	C	P/T	Note
GGSN Address in Use	2.13.7	-	-	C	-	T	
VPLMN Address Allowed	2.13.8	C	-	C	-	P	
Dynamic Address	2.13.9	-	-	-	C	T	
SGSN Address	2.13.10	-	-	-	M	T	
GGSN-list	2.13.11	M	-	-	-	T	

(continued)

Table 2 (concluded): Overview of data used for GPRS Network Access Mode

PARAMETER	Subclause	HLR	VLR	SGSN	GGSN	TYPE
Quality of Service Subscribed	2.13.12	C	-	C	-	P
Quality of Service Requested	2.13.13	-	-	C	-	T
Quality of Service Negotiated	2.13.14	-	-	C	M	T
SND	2.13.15	-	-	C	C	T
SNU	2.13.16	-	-	C	C	T
DRX Parameters	2.13.17	-	-	M	-	T
Compression	2.13.18	-	-	C	-	T
NGAF	2.13.19	-	-	C (Gs)	-	T
Classmark	2.13.20	-	-	M	-	T
TID	2.13.21	-	-	C	C	T
Radio Priority	2.13.22	-	-	C	-	T
Radio Priority SMS	2.13.23	-	-	C	-	T
Short Message Service CAMEL Subscription Information (SMS-CSI)	2.14.4.1/1.8	C	-	C	-	P
GPRS CAMEL Subscription Information (GPRS-CSI)	2.14.4.2/1.9	C	-	C	-	C
SMS-CSI SGSN Negotiated CAMEL Capability Handling	2.14.2.1	C	-	-	-	P
GPRS-CSI Negotiated CAMEL Capability Handling	2.14.2.1	C	-	-	-	P
SGSN Supported CAMEL Phases	2.14.2.3	C	-	-	-	P
Age Indicator	2.16.1	C	-	C	-	T

NOTE: The HLR column indicates only GPRS related use, i.e. if the HLR uses a parameter in non-GPRS Network Access Mode but not in GPRS Network Access Mode, it is not mentioned in this table 2.
(Gs): The VLR column is applicable if Gs interface is installed. It only indicates GPRS related data to be stored and is only relevant to GPRS subscribers registered in VLR.

a): This parameter is relevant in the SGSN only when the Gs interface is installed.

NOTE: For special condition of storage see in the clauses 2.x.y referred-to.
See clause 3 for explanation of M,C,T and P in table 2.

3GPP TSG-N2 SWGB
Milan, Italy, 14 - 16 Feb 2000

Tdoc 3GPP ***N2B000358***

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.018	**CR**	**039r2**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑	for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: N2 **Date:** 09/02/2000

Subject: Replacement of references to GSM with references to UMTS

Work item: Technical Enhancements & Improvements

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: As agreed by PCG, references to GSM specifications have to be replaced by references to the corresponding 3G specifications; similarly, GSM-specific material in the text has to be replaced by UMTS-specific or generic material.

Clauses affected: 1 – 7; 8.1.2; 8.1.3; 8.1.8; 8.1.22; 8.1.34; 8.1.35; 8.1.37; 8.1.39; 8.2.1; 8.2.2; 8.3.1; 8.3.2; 8.3.4; 8.3.5; 8.3.5.1; 8.3.7; 8.3.8; 8.4.1; Annex A

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments: Changes to clauses 1 – 7 are so widespread that the complete updated text of these clauses (with figures) is included.
The sequence numbers of references have been generated automatically; this process includes the deleted refrences in the sequence numbers. When the CR is incorporated into the specification, the reference numbers will be based on only the existing (not the deleted) references.

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<--------- Double-click here for help and instructions on how to create a CR.

1 Scope

This ~~ETSI~~ 3GPP Technical Specification (TS) specifies the technical realization of the handling of calls originated by a UMTS or GSM mobile subscriber and calls directed to a UMTS or GSM mobile subscriber, up to the point where the call is established. Normal release of the call after establishment is also specified.

In this specification, the term MS is used to denote a UMTS or GSM MS, as appropriate.

The handling of DTMF signalling and Off-Air Call setup (OACSU) are not described in this specification.

The details of the effects of UMTS or GSM supplementary services on the handling of a call are described in the relevant ~~GSM 0~~2x.0x, ~~GSM 0~~2x.0x and ~~GSM 0~~2x.0x series of specifications.

The specification of the handling of a request from the HLR for subscriber information is not part of basic call handling, but is required for both CAMEL (TS 23.078 [32]) and optimal routeing (~~GSM 03.~~TS 23.079 [33]). The use of the Provide Subscriber Information message flow is shown in ~~GSM 03.~~TS 23.078 [32] and ~~GSM 03.~~TS 23.079 [33].

The specification of the handling of data calls rerouted to a SIWFS is described in ~~GSM~~ TS ~~0~~2x.x54 [28].

The logical separation of the MSC and VLR (shown in clauses 4, 5 and 7), and the messages transferred between them (described in clause 8) are the basis of a model used to define the externally visible behaviour of the MSC/VLR, which is a single physical entity. They do not impose any requirement except the definition of the externally visible behaviour.

If there is any conflict between this specification and the corresponding stage 3 specifications (~~GSM~~ TS ~~0~~2x.x08 [44], TS 25.413 [45], GSM 08.08 [20] and ~~GSM~~ TS ~~0~~2x.x02 [47]), the stage 3 specification shall prevail.

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.
- For this Release 199~~8~~x document, references to ~~GSM documents~~3G Technical Specifications are for Release 199~~8~~x versions (version ~~7~~3.x.y).

~~[1] GSM 02.01: "Digital cellular telecommunications system (Phase 2+); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".~~

~~[2] GSM 03.03: " Digital cellular telecommunications system (Phase 2+); Numbering, addressing & identification".~~

[1] GSM 03.20: " Digital cellular telecommunications system (Phase 2+); Security related network functions".

~~[4] GSM 03.54 (TS 101 252) "Digital cellular telecommunications system (Phase 2+);Description for the use of a Shared Inter Working Function /SIWF) in a GSM PLMN Stage 2 ".~~

~~[5] GSM 03.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service; Service description; Stage 2".~~

~~[6] GSM 03.66: "Digital cellular telecommunications system (Phase 2+); Support of Mobile Number Portability (MNP); Technical Realization - Stage 2"~~

~~[7] GSM 03.72: " Digital cellular telecommunications system; Call Deflection (CD) supplementary service; Stage2"~~

~~[8] GSM 03.78 (TS 101 044): "Digital cellular telecommunications system (Phase 2+); Customized Applications for Mobile network Enhanced Logic (CAMEL) - Stage 2".~~

~~[9] GSM 03.78: "Digital cellular telecommunications system (Phase 2+); Customized Applications for Mobile network Enhanced Logic (CAMEL) - Phase 2; Stage 2".~~

~~[10] GSM 03.79 (TS 101 045): "Digital cellular telecommunications system (Phase 2+); Support of Optimal Routeing (SOR); Technical Realization".~~

~~[11] GSM 03.81: " Digital cellular telecommunications system (Phase 2+); Line identification supplementary services - Stage 2 ".~~

~~[12] GSM 03.82: "Digital cellular telecommunications system (Phase 2+); Call Forwarding (CF) supplementary services - Stage 2".~~

~~[13] GSM 03.83: "Digital cellular telecommunications system (Phase 2+); Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 2".~~

~~[14] GSM 03.84: "Digital cellular telecommunications system (Phase 2+); Multi Party (MPTY) supplementary services - Stage 2".~~

~~[15] GSM 03.85: "Digital cellular telecommunications system (Phase 2+); Closed User Group (CUG) supplementary services - Stage 2".~~

~~[16] GSM 03.86: "Digital cellular telecommunications system (Phase 2+); Advice of Charge (AoC) supplementary services - Stage 2".~~

~~[17] GSM 03.87: "Digital cellular telecommunications system (Phase 2+); User - to-User Signalling (UUS) Supplementary Services - Stage 2".~~

~~[18] GSM 03.88: "Digital cellular telecommunications system (Phase 2+); Call Barring (CB) supplementary services - Stage 2 (GSM 03.88)".~~

~~[19] GSM 03.93: "Digital cellular telecommunications system (Phase 2+); Technical realization of Completion of Calls to Busy Subscriber (CCBS) - Stage 2".~~

~~[20] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

~~[21] GSM 07.01: "Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".~~

[20] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile-services Switching Centre - Base Station System (MSC - BSS) interface Layer 3 specification".

~~[23] GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".~~

~~[24] GSM 09.07: "Digital cellular telecommunications system (Phase 2+); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".~~

~~[25] GSM 09.10: "Digital cellular telecommunications system (Phase 2+); Information element mapping between Mobile Station - Base Station System (MS - BSS) and Base Station System - Mobile-services Switching Centre (BSS - MSC) Signalling procedures and the Mobile Application Part (MAP) (GSM 09.10)".~~

[24] GSM 12.08: "Digital cellular telecommunications system (Phase 2+); Subscriber and equipment trace (GSM 12.08)".

[24bis] 3G TR 21.905: " Vocabulary for 3GPP Specifications ".

[25] 3G TS 23.003: "Numbering, addressing & identification".

[26] 3G TS 23.012: "Location Management Procedures".

[27] 3G TS 23.032: "Universal Geographical Area Description (GAD)".

[28] 3G TS 23.054: "Shared Inter Working Function (SIWF) - Stage 2 ".

[29] 3G TS 23.060: "General Packet Radio Service; Service description; Stage 2".

[30] 3G TS 23.066: "Support of Mobile Number Portability (MNP); Technical Realization – Stage 2"

[31] 3G~~PP~~ TS 23.072: "~~Technical Specification Group Core Network;~~ Call Deflection (CD) supplementary service; Stage2".

[32] 3G~~PP~~ TS 23.078: "~~Technical Specification Group Core Network;~~ Customized Applications for Mobile network Enhanced Logic (CAMEL) - Phase 3; Stage 2".

[33] 3G~~PP~~ TS 23.079: "~~Technical Specification Group Core Network;~~ Support of Optimal Routeing (SOR); Technical Realization".

[34] 3G TS 23.081: "Line identification Supplementary Services - Stage 2 ".

[35] 3G TS 23.082: "Call Forwarding (CF) Supplementary Services - Stage 2".

[36] 3G TS 23.083: "Call Waiting (CW) and Call Hold (HOLD) Supplementary Services - Stage 2".

[37] 3G TS 23.084: "Digital cellular telecommunications system (Phase 2+); Multi Party (MPTY) Supplementary Service - Stage 2".

[38] 3G TS 23.085: "Closed User Group (CUG) Supplementary Service - Stage 2".

[39] 3G TS 23.086: "Advice of Charge (AoC) Supplementary Service - Stage 2".

[40] 3G TS 23.087: "User –to-User Signalling (UUS) - Stage 2".

[41] 3G TS 23.088: "Call Barring (CB) Supplementary Service - Stage 2".

[42] 3G TS 23.093: "Technical realization of Completion of Calls to Busy Subscriber (CCBS) - Stage 2".

[43] 3G~~PP~~ TS 23.116: "~~3GPP; Technical Specification Group Core Network;~~ Super-Charger Technical Realization; Stage 2".

[44] 3G TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols-Stage 3".

[45] 3G TS 25.413: "UTRAN Iu Interface RANAP Signalling".

[46] 3G TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[47] 3G TS 29.002: "Mobile Application Part (MAP) specification".

[48] 3G TS 29.007: "General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[49] 3G TS 29.010: "Information element mapping between Mobile Station - Base Station System (MS - BSS) and Base Station System - Mobile-services Switching Centre (BSS - MSC) Signalling procedures and the Mobile Application Part (MAP)".

[50] 3G TS 33.102: "3G Security; Security Architecture ".

~~[51] ETS 300 356-1 (1995): "Integrated Services Digital Network (ISDN); Signalling System No. 7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services".~~

[52] ITU-T Q.761, December 1999: "Specifications of Signalling System No. 7 – Functional description of the ISDN user part of Signalling System No. 7".

[53] ITU-T Q.762, December 1999: "Specifications of Signalling System No. 7 – General function of messages and signals of the ISDN user part".

[5452] ITU-T Q.763, December 1999: "Specifications of Signalling System No. 7 – Formats and codes of the ISDN user part formats and codes".

[55] ITU-T Q.764, December 1999: "Specifications of Signalling System No. 7 – Signalling System No. 7 – ISDN user part signalling procedures".

[5653] ITU-T Recommendation Q.850 (1996): "Usage of cause and location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN User Part".

3 Definitions and abbreviations

3.1 Definitions

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

A subscriber: The calling mobile subscriber.

B subscriber: The mobile subscriber originally called by the A subscriber.

C subscriber: The subscriber to whom the B subscriber has requested that calls be forwarded. The C subscriber may be fixed or mobile.

Circuit-Switched Bearer Capability: The information transferred over the UMTS or GSM access interface to define the information transfer capabilities to be used between the MS and the network for a circuit-switched connection.

Location Information: Information to define the whereabouts of the MS, and the age of the information defining the whereabouts.

3.2 Abbreviations

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

A&O	Active & Operative
ACM	Address Complete Message
ANM	ANswer Message
AoC	Advice of Charge
BC	Bearer Capability
BOIC-exHC&BOIZC	Barring of Outgoing International Calls except those directed to the HPLMN Country & Barring of Outgoing InterZonal Calls
BOIZC	Barring of Outgoing InterZonal Calls
BOIZC-exHC	Barring of Outgoing InterZonal Calls except those directed to the HPLMN Country
CCBS	Completion of Calls to Busy Subscriber
CFB	Call Forwarding on Busy
CFNRc	Call Forwarding on mobile subscriber Not Reachable
CFNRy	Call Forwarding on No Reply
CFU	Call Forwarding Unconditional
CLIP	Calling Line Identity Presentation
CLIR	Calling Line Identity Restriction
COLP	COnnected Line identity Presentation
COLR	COnnected Line identity Restriction
CS BC	Circuit-Switched Bearer Capability
CUG	Closed User Group
CW	Call Waiting
FTN	Forwarded-To Number
FTNW	Forwarded-To NetWork
GMSCB	Gateway MSC of the B subscriber

GPRS	General Packet Radio Service
HLC	Higher Layer Compatibility
HLRB	The HLR of the B subscriber
HPLMNB	The HPLMN of the B subscriber
IAM	Initial Address Message
IPLMN	Interrogating PLMN - the PLMN containing GMSCB
IWU	Inter Working Unit
LLC	Lower Layer Compatibility
MO	Mobile Originated
MPTY	MultiParTY
MT	Mobile Terminated
NDUB	Network Determined User Busy
NRCT	No Reply Call Timer
PRN	Provide Roaming Number
SGSN	Serving GPRS support node
SIFIC	Send Information For Incoming Call
SIFOC	Send Information For Outgoing Call
SIWF	Shared Inter Working Function
SIWFS	SIWF Server. SIWFS is the entity where the used IWU is located.
SRI	Send Routeing Information
UDUB	User Determined User Busy
VLRA	The VLR of the A subscriber
VLRB	The VLR of the B subscriber
VMSCA	The Visited MSC of the A subscriber
VMSCB	The Visited MSC of the B subscriber
VPLMNA	The Visited PLMN of the A subscriber
VPLMNB	The Visited PLMN of the B subscriber

4 Architecture

Subclauses 4.1 and 4.2 show the architecture for handling a basic MO call and a basic MT call. A basic mobile-to-mobile call is treated as the concatenation of an MO call and an MT call.

4.1 Architecture for an MO call

A basic mobile originated call involves signalling between the MS and its VMSC via the BSS, between the VMSC and the VLR and between the VMSC and the destination exchange, as indicated in figure 1.

In figure 1 and throughout this specification, the term BSS is used to denote a GSM BSS or a UTRAN, as appropriate.

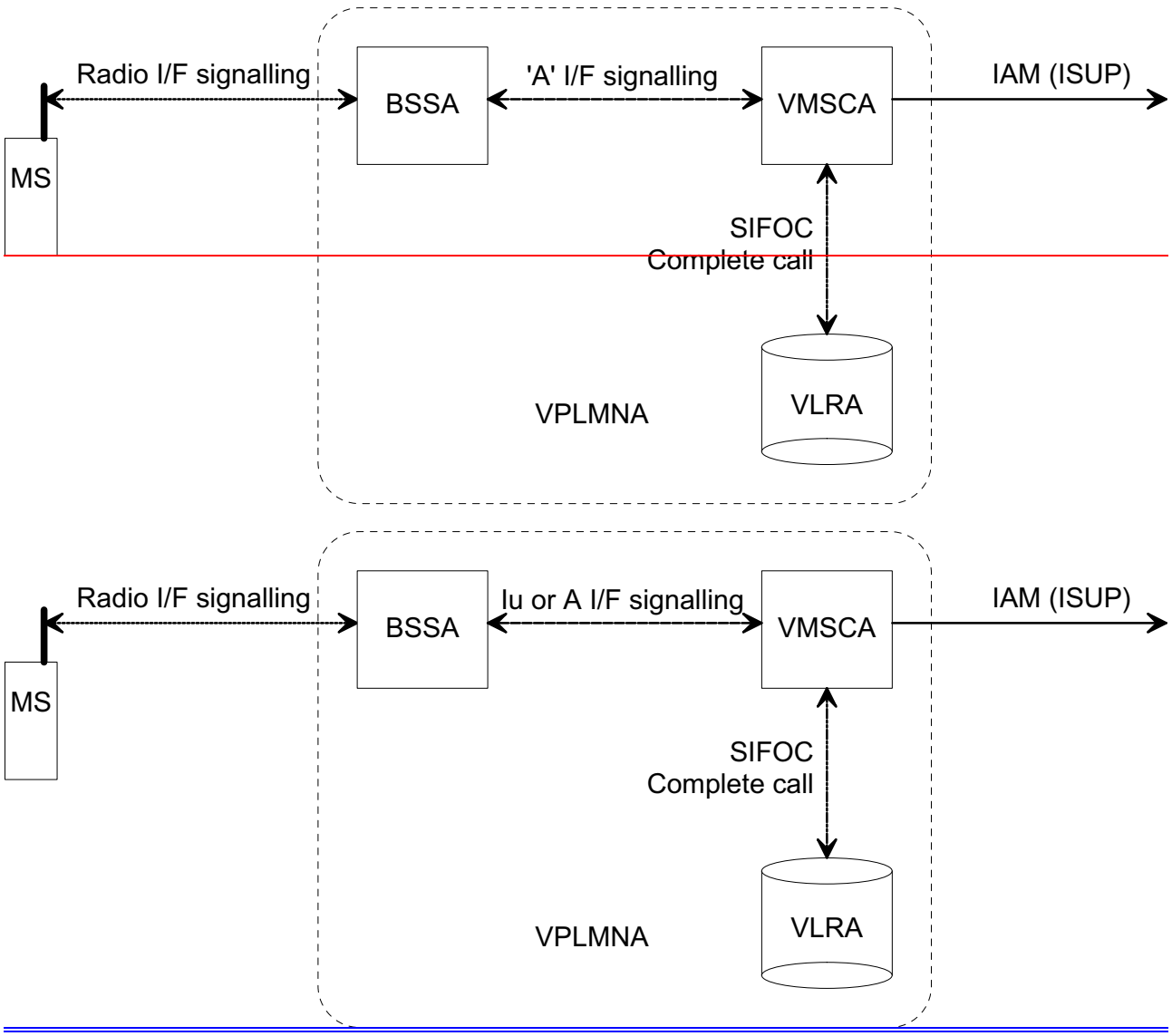


Figure 1: Architecture for a basic mobile originated call

In figure 1 and throughout this specification, the term ISUP is used to denote the telephony signalling system used between exchanges. In a given network, any telephony signalling system may be used.

When the user of an MS wishes to originate a call, the MS establishes communication with the network using radio interface signalling, and sends a message containing the address of the called party. VMSCA requests information to handle the outgoing call (SIFOC) from VLRA, over an internal interface of the MSC/VLR. If VLRA determines that the outgoing call is allowed, it responds with a Complete Call. VMSCA:

- establishes a traffic channel to the MS; and
- constructs an ISUP IAM using the called party address and sends it to the destination exchange.

NOTE: When the non-loop method is used for data calls, the IAM is sent to the SIWFS.

4.2 Architecture for an MT call

A basic mobile terminated call involves signalling as indicated in figure 2. Communication between VMSCB and the MS is via the BSS, as for the mobile originated case. If VPLMNB supports GPRS and the Gs interface between VLRB and the SGSN is implemented (see ~~GSM~~ TS ~~03.~~23.060 [29~~5~~]) and there is an association between VLRB and the SGSN for the MS, the paging signal towards the MS goes from VMSCB via VLRB and the SGSN to the BSS. The IPLMN, containing GMSCB, is in principle distinct from HPLMNB, containing HLRB, but the practice for at least the majority of current UMTS or GSM networks is that a call to an ~~GSM~~ MS will be routed to a GMSC in HPLMNB.

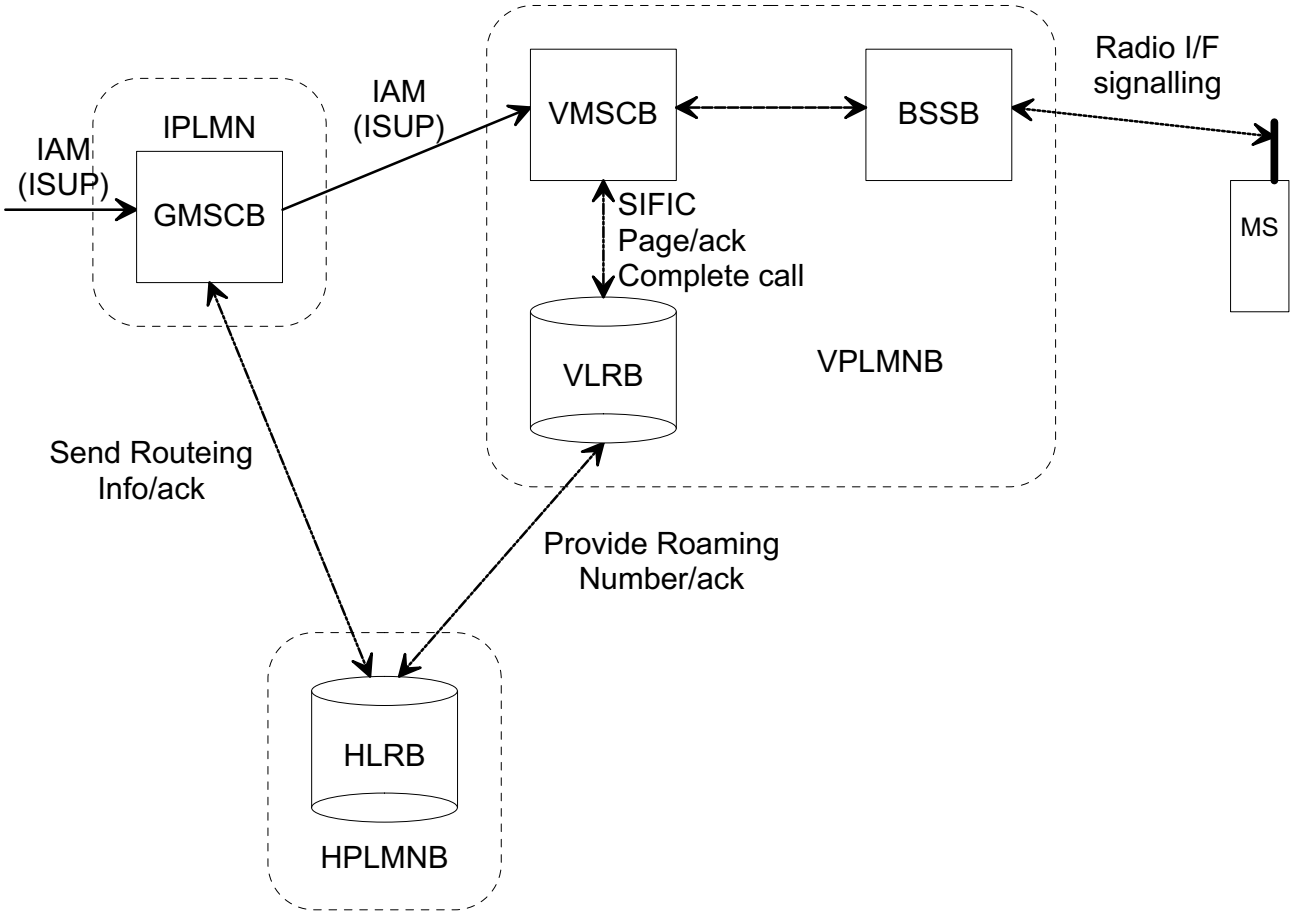


Figure 2: Architecture for a basic mobile terminated call

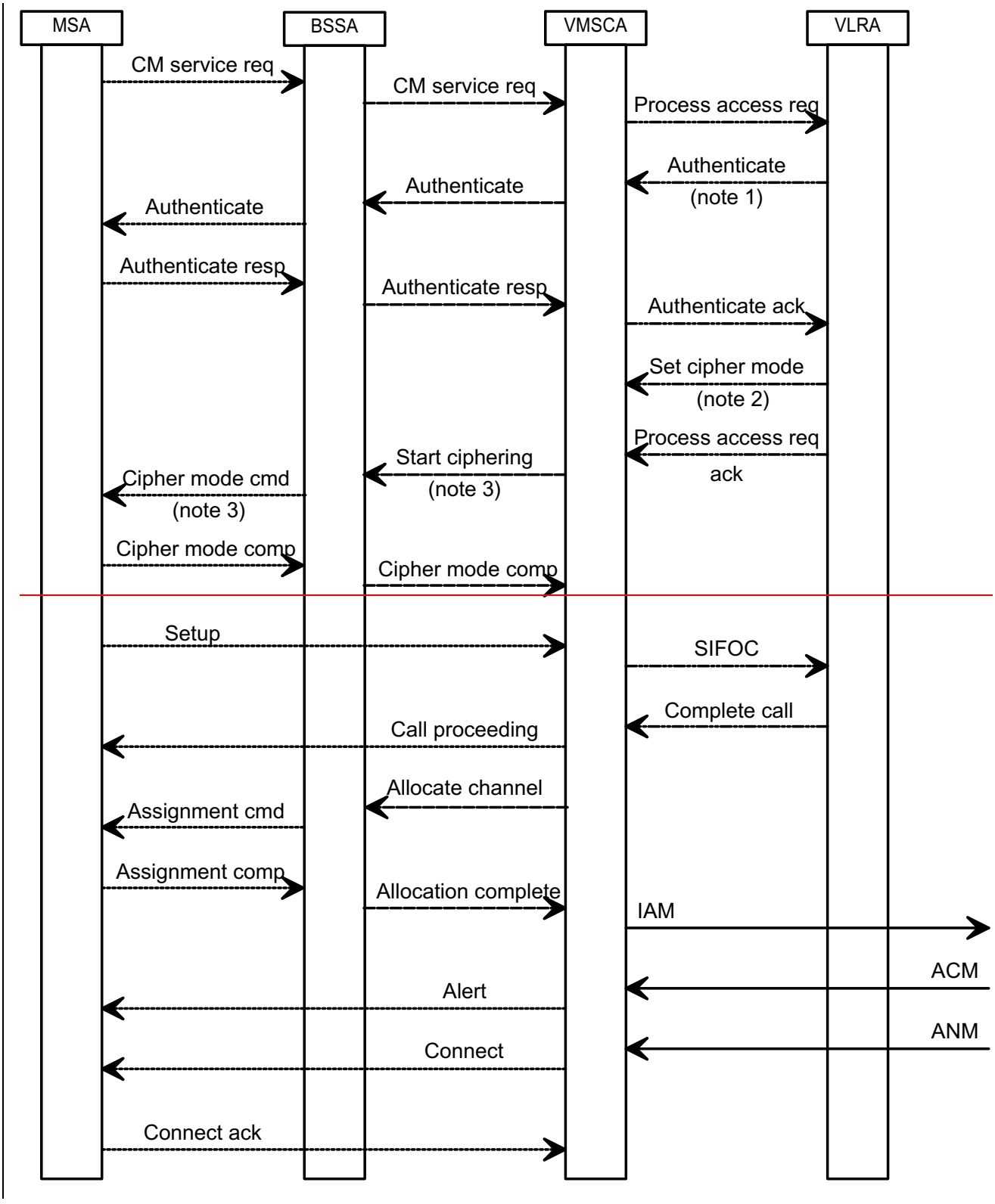
When GMSCB receives an ISUP IAM, it requests routeing information from HLRB using the MAP protocol. HLRB requests a roaming number from VLRB, also using the MAP protocol, and VLRB returns a roaming number in the Provide Roaming Number Ack. HLRB returns the roaming number to GMSCB in the Send Routeing Info ack. GMSCB uses the roaming number to construct an ISUP IAM, which it sends to VMSCB. When VMSCB receives the IAM, it requests information to handle the incoming call (SIFIC) from VLRB, over an internal interface of the MSC/VLR. If VLRB determines that the incoming call is allowed, it requests VMSCB to page the MS. VMSCB pages the MS using radio interface signalling. When the MS responds, VMSCB informs VLRB in the Page ack message. VLRB instructs VMSCB to connect the call in the Complete call, and VMSCB establishes a traffic channel to the MS.

5 Information flows

In this clause and clause 7, the terms "security procedures" and "security control" denote the UMTS ciphering and integrity protection mechanism defined in TS 33.102 [50] or the GSM ciphering mechanism defined in GSM 03.20 [1], as appropriate.

5.1 Information flow for an MO call

An example information flow for an MO call is shown in figure 3; many variations are possible. Signalling over the radio interface between MSA and BSSA or VMSCA is shown by dotted lines; signalling over the Iu interface (for UMTS) or the "A" interface (for GSM) between BSSA and VMSCA is shown by dashed lines; signalling over the B interface between VMSCA and VLRA is shown by chain lines; and ISUP signalling between VMSCA and the destination exchange is shown by solid lines.


MSA
BSSA
VMSCA
VLRA
CM service req
CM service req
Process access req
Authenticate
(note 1)
Authenticate
Authenticate
Authenticate resp
Authenticate resp
Authenticate ack
Set cipher mode
(note 2)
Process access req
ack
Start ciphering
(note 3)
Cipher mode cmd
(note 3)
Cipher mode comp
Cipher mode comp
Setup
SIFOC
Complete call
Call proceeding
Allocate channel
Assignment cmd
Assignment comp
Allocation complete
IAM
ACM
Alert
ANM
Connect
Connect ack

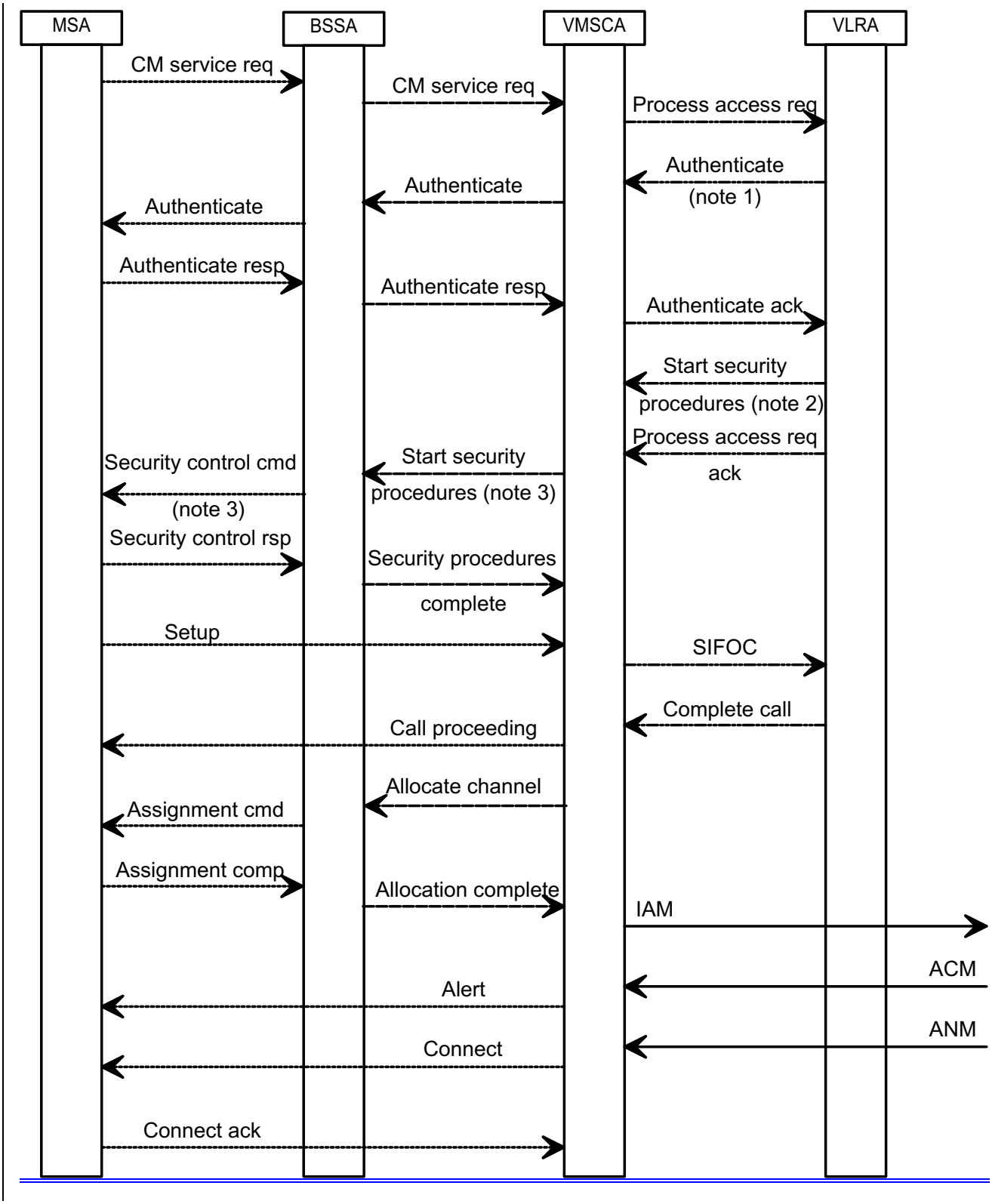


Figure 3: Information flow for a basic mobile originated call

NOTE 1: Authentication may occur at any stage during the establishment of an MO call; its position in this message flow diagram is an example.

NOTE 2: Security procedures ~~Ciphering~~ may be initiated at any stage after authentication; ~~its~~ the position in this message flow diagram is an example.

NOTE 3: If ciphering is not required for a GSM connection, the MSC may send a CM service accept towards the MS; optionally it may instead send a "start ciphering" request indicating that no ciphering is required. This option is not available for a UMTS connection [ffs].

NOTE 4: The network may request the IMEI from the MS, and may check the IMEI, at any stage during the establishment of an MO call, either as part of the procedure to start security procedures ciphering or explicitly after security procedures have ciphering has started; this is not shown in this message flow diagram.

When the user wishes to originate a call, MSA establishes a signalling connection with BSSA, and sends a Connection Management (CM) service request to BSSA, which relays it to VMSCA. VMSCA sends a Process aAccess rRequest to VLRA. VLRA may then initiate authentication, as described in TS 33.102 [50] for UMTS and GSM 03.20 [1] for GSM. VLRA may also initiate security procedures ciphering at this stage, as described in TS 33.102 [50] for UMTS GSM 03.20 [1] for GSM.

If VLRA determines that MSA is allowed service, it sends a Process aAccess rRequest ack to VMSCA. If VMSCA has received a Start security procedures Set cipher mode message from VLRA, the Process aAccess rRequest ack message triggers a Start security procedures ciphering command message towards BSSA; otherwise VMSCA sends a CM sService aAccept message towards BSSA.

If BSSA receives a Start security procedures message ciphering command from VMSCA, it initiates security procedures ciphering as described in TS 33.102 [50] for UMTS and GSM 03.20 [1] for GSM; when security procedures have been ciphering is successfully initiated, MSA interprets this in the same way as a CM sService aAccept. If security procedures are ciphering is not required at this stage, BSSA relays the CM sService aAccept to MSA.

When MSA has received the CM sService aAccept, or security procedures have ciphering has been successfully initiated, MSA sends a Setup message containing the B subscriber address via BSSA to VMSCA. MSA also uses the Setup message to indicate the bearer capability required for the call; VMSCA translates this bearer capability into a GSM basic service, and determines whether an interworking function is required. VMSCA sends to VLRA a request for information to handle the outgoing call, using a Send Info For Outgoing Call (SIFOC) message containing the B subscriber address.

If VLRA determines that the call should be connected, it sends a Complete Call message to VMSCA. VMSCA sends a Call Proceeding message via BSSA to MSA, to indicate that the call request has been accepted, and sends an Allocate channel message to BSSA, to trigger BSSA and MSA to set up a traffic channel over the radio interface. The Call Proceeding message includes bearer capability information if any of the negotiable parameters of the bearer capability has to be changed. When the traffic channel assignment process is complete (indicated by the Allocation complete message from BSSA to VMSCA), VMSCA constructs an ISUP IAM using the B subscriber address, and sends it to the destination exchange.

When the destination exchange returns an ISUP Address Complete Message (ACM), VMSCA sends an Alerting message via BSSA to MSA, to indicate to the calling user that the B subscriber is being alerted.

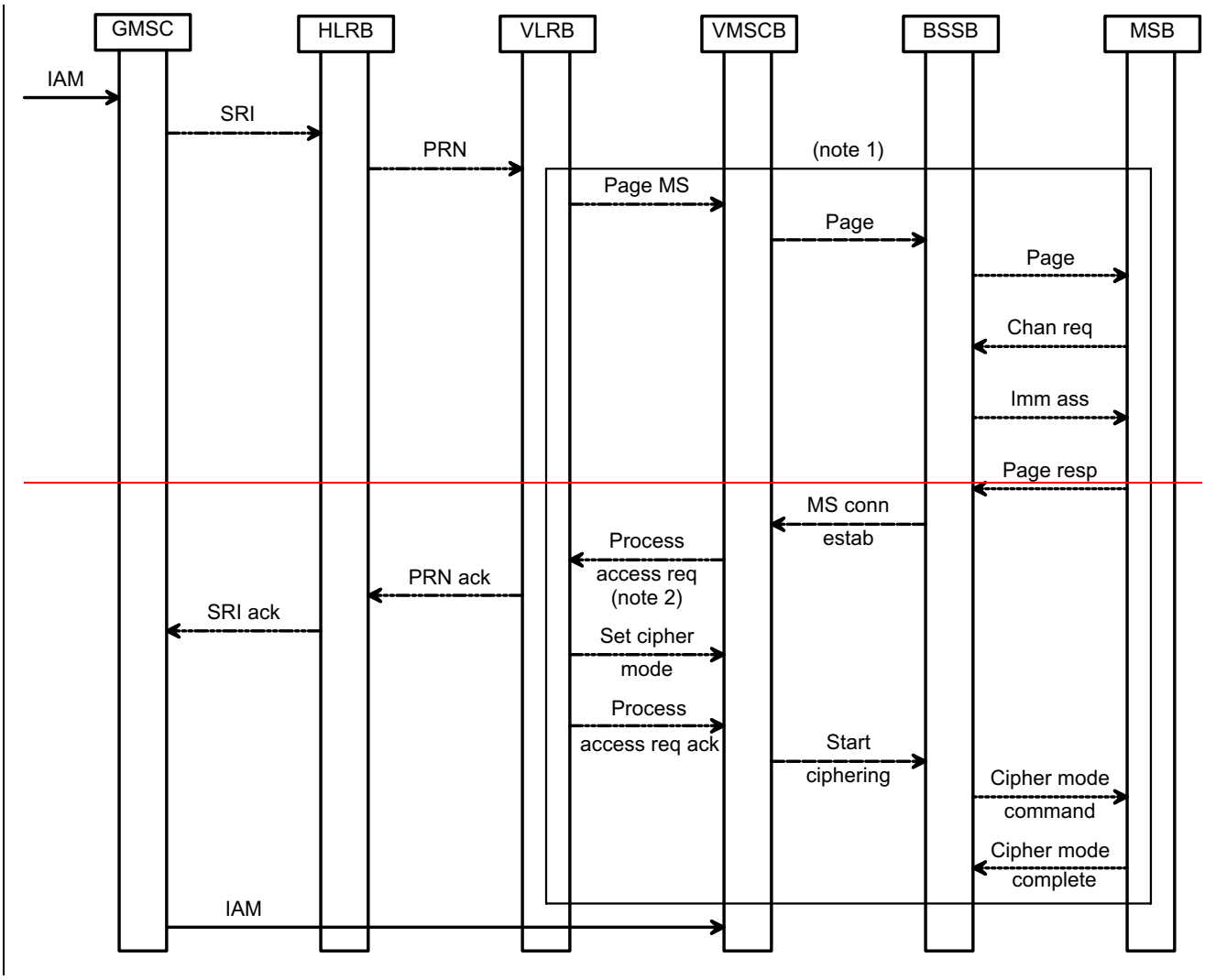
When the destination exchange returns an ISUP ANswer Message (ANM), VMSCA sends a Connect message via BSSA to MSA, to instruct MSA to connect the speech path.

The network then waits for the call to be cleared.

For an emergency call, a different CM service type (emergency call) is used, and the mobile may identify itself by an IMEI. It is a network operator option whether to allow an emergency call when the mobile identifies itself by an IMEI. Details of the handling are shown in clause 7.

5.2 Information flow for retrieval of routeing information for an MT call

The information flow for retrieval of routeing information for an MT call is shown in figure 4. ISUP signalling between the originating exchange and GMSCB, and between GMSCB and VMSCB is shown by solid lines; signalling over the MAP interfaces between GMSCB and HLRB and between HLRB and VLRB, and over the B interface between VLRB and VMSCB is shown by chain lines; signalling over the Iu interface (for UMTS) or the A interface (for GSM) between VMSCB and BSSB is shown by dashed lines; and signalling over the radio interface between BSSB and MSB is shown by dotted lines.



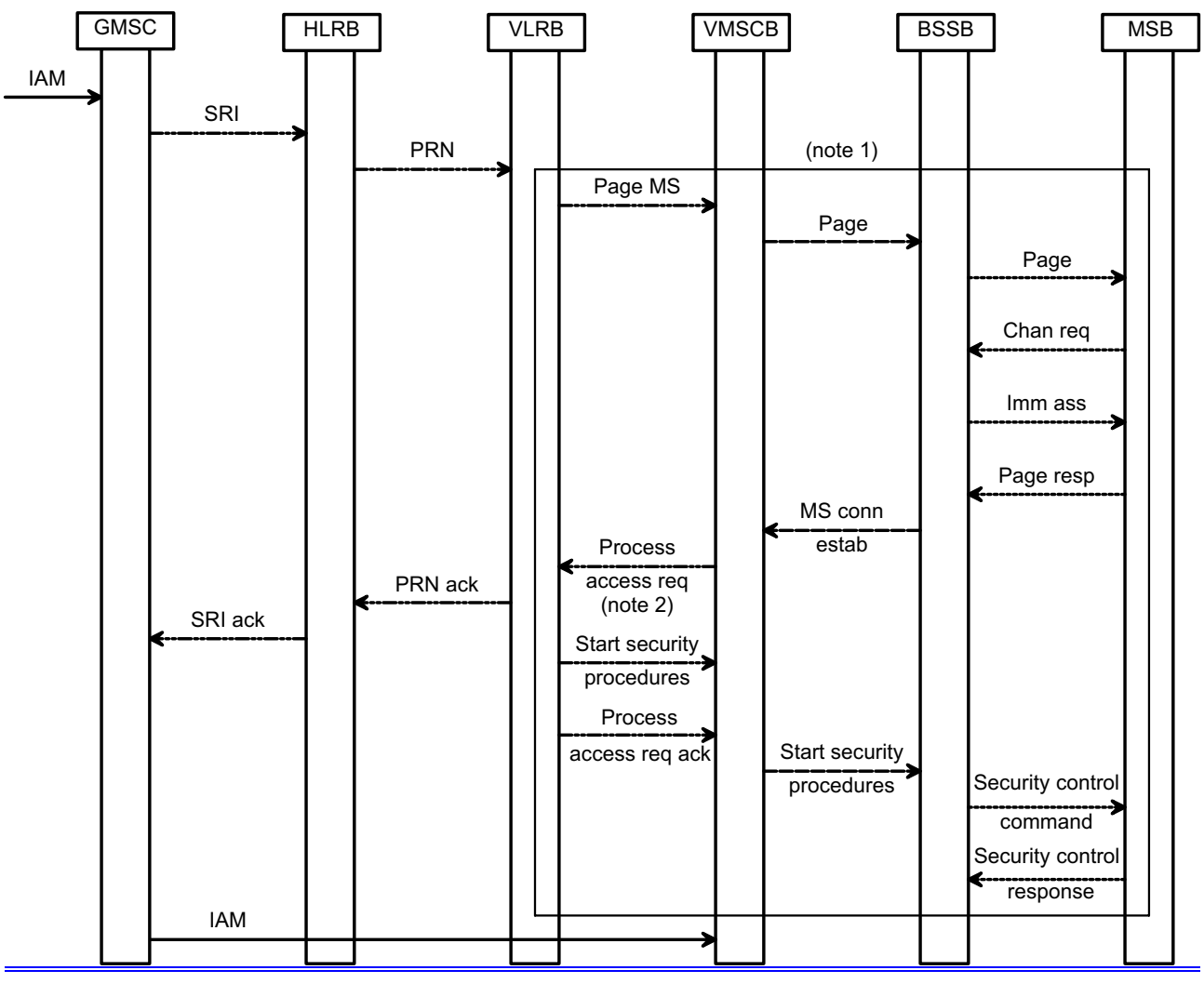


Figure 4: Information flow for retrieval of routeing information for a basic mobile terminated call

NOTE 1: If pre-paging is used, paging is initiated after VLRB has accepted the PRN message. The paging procedure is described in subclause 5.3.

NOTE 2: VMSCB starts the timer for the release of radio resources after it sends the Process Access Request message to VLRB. VMSCB releases the radio resource allocated for the MT call if the timer expires before the IAM is received.

When GMSCB receives an IAM, it analyses the called party address. If GMSCB can derive an HLR address from the B party address, it sends a request for routeing information (SRI) to HLRB. If GMSCB supports pre-paging (i.e. it is prepared to wait long enough for the SRI ack to allow pre-paging to be completed), it indicates this by an information element in the SRI message.

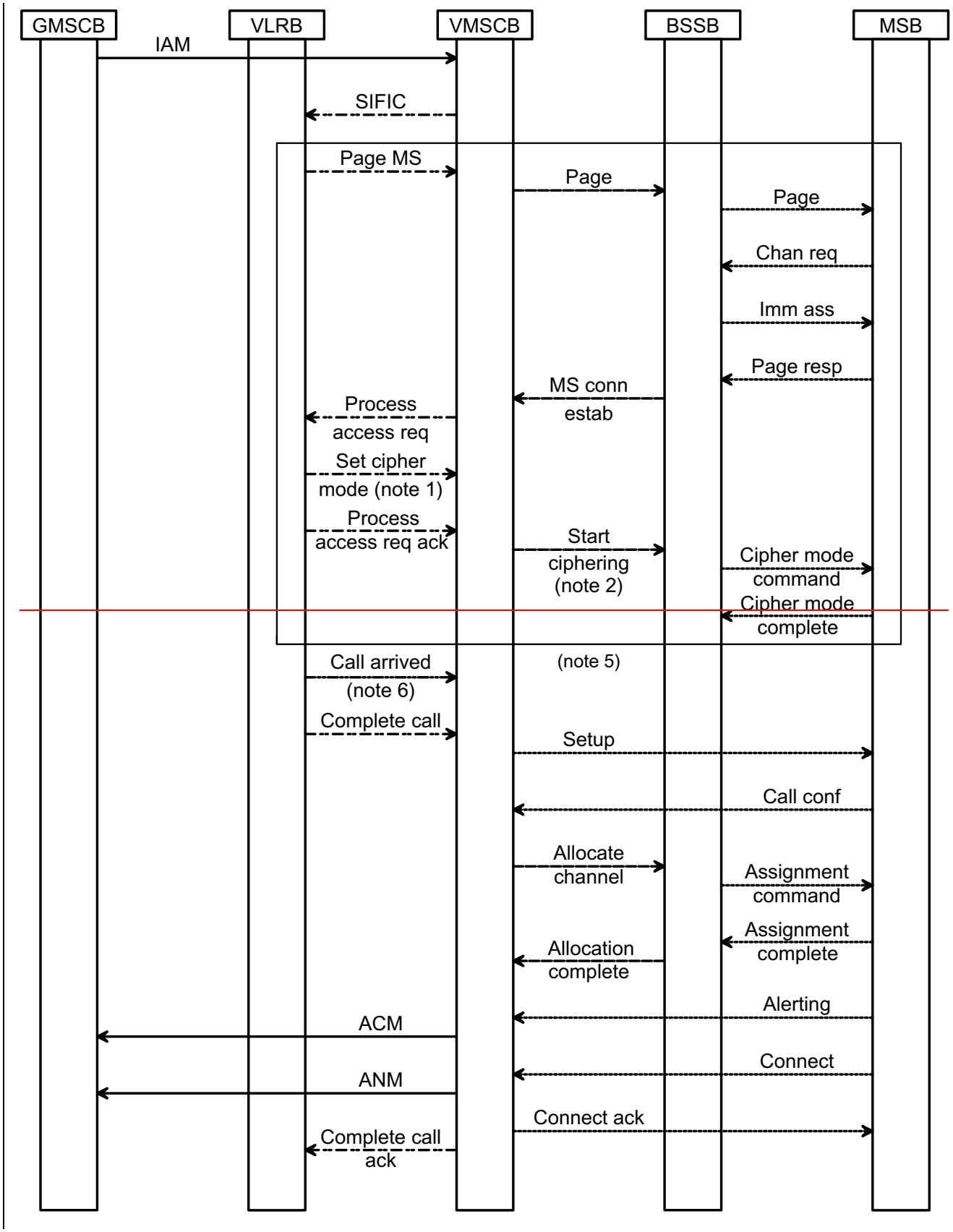
HLRB decides whether pre-paging is supported according to the following criteria:

- GMSCB has indicated that it supports pre-paging, and
- HLRB supports pre-paging (i.e. it is prepared to wait long enough for the PRN ack to allow pre-paging to be completed).

HLRB sends a request for a roaming number (PRN) to VLRB; if pre-paging is supported, it indicates this by an information element in the PRN message. VLRB returns the roaming number in the PRN ack, and HLRB relays the roaming number to GMSCB in the SRI ack. GMSCB constructs an IAM using the roaming number, and sends it to VMSCB.

5.3 Information flow for an MT call

An example information flow for an MT call is shown in figure 5; many variations are possible. ISUP signalling between GMSCB and VMSCB is shown by solid lines; signalling over the B interface between VMSCB and VLRB is shown by chain lines; signalling over the Iu interface (for UMTS) or the "A" interface (for GSM) between VMSCB and BSSB is shown by dashed lines; and signalling over the radio interface between VMSCB or BSSB and MSB is shown by dotted lines.


GMSCB
VLRB
VMSCB
BSSB
MSB
IAM
SIFIC
Page MS
Page
Page
Chan req
Imm ass
Page resp
MS conn estab
Process access req
Set cipher mode (note 1)
Process access req ack
Start ciphering (note 2)
Cipher mode command
Cipher mode complete
(note 5)
Call arrived (note 6)
Complete call
Setup
Call conf
Allocate channel
Assignment command
Assignment complete
Allocation complete
Alerting
ACM
Connect
ANM
Connect ack
Complete call ack

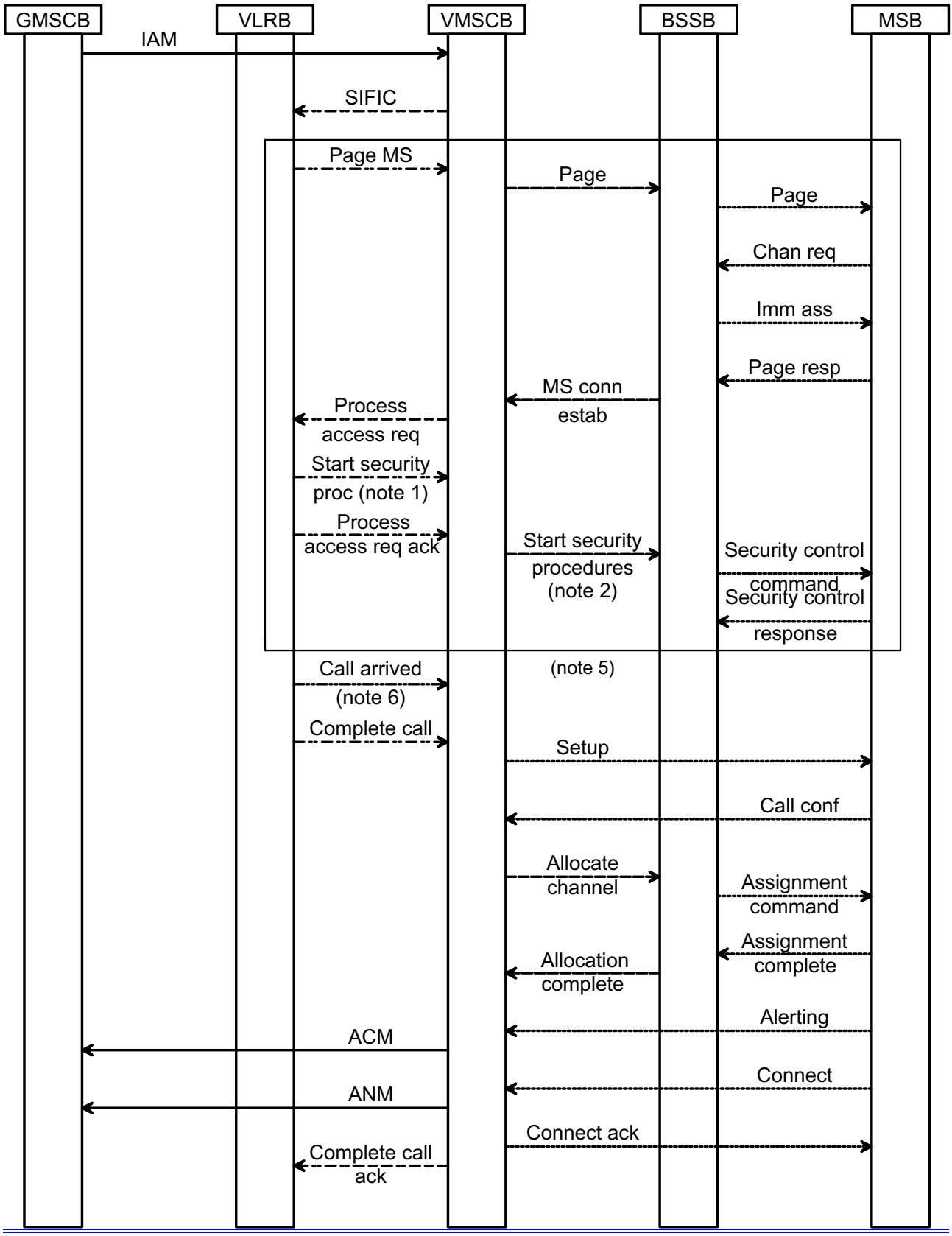


Figure 5: Information flow for a basic mobile terminated call

NOTE 1: Security procedures ~~Ciphering~~ may be initiated at any stage after the network has accepted the page response; ~~its~~ the position in this message flow diagram is an example.

NOTE 2: If Security procedures are ~~ciphering is~~ not required, the MSC may send a Start security procedures message ~~"start ciphering" request~~ indicating that no ciphering is required.

NOTE 3: This message flow diagram assumes that the MS has already been authenticated on location registration. If this is not so (for the first MT call after VLR restoration), the network may initiate authentication after the MS responds to paging.

NOTE 4: The network may request the IMEI from the MS, and may check the IMEI, at any stage after the MS responds to paging, either as part of the procedure to start security procedures ~~ciphering~~ or explicitly after security procedures have been ~~ciphering has~~ started; this is not shown in this message flow diagram.

NOTE 5: If a connection between MSCB and MSB has been established as a result of pre-paging, the paging procedure is not performed.

NOTE 6: If a connection between MSCB and MSB has been established as a result of pre-paging, VLRB sends the Call arrived message to MSCB to stop the guard timer for the release of the radio connection.

When VMSCB receives an IAM from GMSCB it sends to VLRB a request for information to handle the incoming call, using a Send Info For Incoming Call (SIFIC) message containing the roaming number received in the IAM.

If VLRB recognizes the roaming number, and MSB is allowed service, it sends a request to VMSCB to page MSB. If a radio connection between the network and MSB is already established, VMSCB responds immediately to the page request. If no radio connection exists, VMSCB sends a page request to BSSB, and BSSB broadcasts the page on the paging channel. If VPLMNB supports GPRS and the Gs interface between VLRB and the SGSN is implemented (see ~~GSM~~ TS ~~03.~~23.0~~6~~0 [29~~5~~]) and there is a valid association between VLRB and the SGSN for the MS, the paging signal towards the MS goes from VMSCB via VLRB and the SGSN to the BSS.

If MSB detects the page, it sends a channel request to BSSB, which responds with an immediate assignment command, to instruct MSB to use the specified signalling channel. MSB then sends a page response on the signalling channel; BSSB relays this to VMSCB. VMSCB sends a Process access request message to VLRB to indicate that MSB has responded to paging. VLRB may then initiate authentication, as described in TS 33.102 [50] for UMTS and GSM 03.20 [1] for GSM. VLRB may also initiate security procedures ~~ciphering~~ at this stage, as described in TS 33.102 [50] for UMTS and GSM 03.20 [1] for GSM.

If VLRB determines that MSB is allowed service, it sends a Process access request ack to VMSCB. The Process access request ack message triggers a Start security procedures ~~ciphering command~~ message towards BSSB; if VMSCB has not received a Start security procedures ~~Set cipher mode~~ message from VLRB, the Start security procedures message ~~Start ciphering command~~ indicates no ciphering.

VLRB then sends a Complete call message to VMSCB. VMSCB sends a Setup message towards MSB. The Setup message may include bearer capability information for the call.

When MSB receives the Setup message from BSSB, it responds with a Call confirmed message. The Call Confirmed message includes bearer capability information if any of the negotiable parameters of the bearer capability has to be changed. When VMSCB receives the Call confirmed message via BSSB, it sends an Allocate channel message to BSSB. BSSB instructs MSB to tune to a traffic channel by sending an Assignment command. When MSB has tuned to the specified traffic channel it responds with an Assignment complete, message, which BSSB relays to VMSCB as an Allocation complete, and sends an Alerting message to indicate that the called user is being alerted. VMSCB sends an ACM to GMSCB, which relays it to the originating exchange.

When the called user answers, MSB sends a Connect message, which BSSB relays to VMSCB. VMSCB:

- responds with a Connect ack message towards MSB;
- sends an ANM to GMSCB, which relays it to the originating exchange;
- sends a Complete call ack to VLRB.

The network then waits for the call to be cleared.

6 Principles for interactions with supplementary services

This clause specifies the principles used to describe the invocation of the GSM supplementary services which were standardized when this specification was drafted. Registration, erasure, activation, deactivation and interrogation are call-independent operations; they are therefore outside the scope of this specification. Descriptions may be found in the stage 2 specifications for each supplementary service.

In the modelling used in this specification, each supplementary service which a network entity supports is managed by a supplementary service handler, which handles data in the entity in which it runs. The call handling processes defined in this specification use the data to define the contents of messages to other entities. The basic call handling processes defined in this specification interact with the supplementary service handlers as shown in the SDL diagrams and the supporting text. If a network entity does not support a supplementary service, it bypasses the interaction with the handler for that supplementary service. Exceptions to this general principle are described later in this clause.

6.1 Call Deflection service (~~GSM~~ TS ~~03.~~23.072)

The basic call handling processes ICH_MSC and ICH_VLR interact with the CD supplementary service (~~GSM~~ TS ~~03.~~23.072) as described in subclauses 7.3.1~~7.3.1~~ and 7.3.2~~7.3.2~~ respectively.

6.2 Line identification services (~~GSM~~ TS ~~03.~~23.081)

6.2.1 Calling Line Identification Presentation (CLIP)

The basic call handling processes ICH_VLR and ICH_MSC interact with the processes CLIP_MAF001 and CLIP_MAF002 (~~GSM~~ TS ~~03.~~23.081 [34]) as described in subclauses 7.3.2 and 7.3.1.

6.2.2 Calling Line Identification Restriction (CLIR)

The basic call handling processes OCH_MSC and OCH_VLR interact with the processes CLIR_MAF004 and CLIR_MAF003 (~~GSM~~ TS ~~03.~~23.081 [34]) as described in subclauses 7.1.1 and 7.1.2.

6.2.3 Connected Line Identification Presentation (COLP)

The basic call handling processes OCH_MSC and OCH_VLR interact with the processes COLP_MAF006 and COLP_MAF005 (~~GSM~~ TS ~~03.~~23.081 [34]) as described in subclauses 7.1.1 and 7.1.2.

The basic call handling processes MT_GMSC and ICH_MSC interact with the process COLP_MAF039 [34] as described in subclauses 7.2.1 and 7.3.1.

6.2.4 Connected Line Identification Restriction (COLR)

The basic call handling processes ICH_VLR and ICH_MSC interact with the processes COLR_MAF040 and COLR_MAF041 (~~GSM~~ TS ~~03.~~23.081 [34]) as described in subclauses 7.3.2 and 7.3.1.

6.3 Call forwarding services (~~GSM~~ TS ~~03.~~23.082)

6.3.1 Call Forwarding Unconditional (CFU)

The basic call handling process SRI_HLR interacts with the process MAF007(~~GSM~~ TS ~~03.~~23.082 [35]) as described in subclause 7.2.2

6.3.2 Call Forwarding on mobile subscriber Busy (CFB)

The basic call handling process ICH_VLR interacts with the process MAF008 (~~GSM~~ TS ~~03.~~23.082 [35]) as described in subclause 7.3.2

6.3.3 Call Forwarding on No Reply (CFNRy)

The basic call handling process ICH_VLR interacts with the process MAF009 (~~GSM~~ TS ~~03.~~23.082 [35]) as described in subclause 7.3.2

6.3.4 Call Forwarding on mobile subscriber Not Reachable (CFNRc)

The basic call handling processes SRI_HLR and ICH_VLR interact with the process MAF010 (~~GSM~~ TS ~~03.~~23.082 [35]) as described in subclauses 7.2.2 and 7.3.2

6.4 Call wait (~~GSM~~ TS ~~03.~~23.083)

The basic call handling process ICH_VLR interacts with the process MAF013(~~GSM~~ TS ~~03.~~23.083 [36]) as described in subclause 7.3.2. Further details of the handling of call waiting are given in subclauses 7.3.1 & 7.3.2.

6.5 Call hold (~~GSM~~ TS ~~03.~~23.083)

Invocation of call hold before a basic call has been established will be rejected.

6.6 Multiparty (~~GSM~~ TS ~~03.~~23.084)

Invocation of multiparty before a basic call has been established will be rejected.

6.7 Closed user group (~~GSM~~ TS ~~03.~~23.085)

The basic call handling process OCH_VLR interacts with the process CUG_MAF014 (~~GSM~~ TS ~~03.~~23.085 [38]) as described in subclause 7.1.2.

The basic call handling process SRI_HLR interacts with the process CUG_MAF015 (~~GSM~~ TS ~~03.~~23.085 [38]) as described in subclause 7.2.2.

The interactions between call forwarding and CUG (~~GSM~~ TS ~~03.~~23.085 [38]) are handled as described in subclause 7.2.2.6.

6.8 Advice of charge (~~GSM~~ TS ~~03.~~23.086)

The interactions between Advice of Charge (~~GSM~~ TS ~~03.~~23.086 [39]) and MO calls are handled as described in subclauses 7.1.1 and 7.1.2.

The interactions between Advice of Charge (~~GSM~~ TS ~~03.~~23.086 [39]) and MT calls are handled as described in subclauses 7.3.1 and 7.3.2.

6.9 User-to-user signalling (GSM ~~03.~~23.087)

The basic call handling processes OCH_MSC, OCH_VLR, MT_GMSC and ICH_MSC interact with the UUS supplementary service as described in subclauses 7.1.1~~7.1.1~~, 7.1.2~~7.1.2~~, 7.2.1~~7.2.1~~ and 7.3.1~~7.3.1~~ respectively.

6.10 Call barring (~~GSM~~ TS ~~03.~~23.088)

6.10.1 Barring of outgoing calls

The basic call handling process OCH_VLR interacts with the processes MAF017, MAF018 and MAF020 (~~GSM~~ TS ~~03.~~23.088 [41]) as described in subclause 7.1.2.

6.10.2 Barring of incoming calls

The basic call handling process SRI_HLR interacts with the processes MAF022 and MAF023 (~~GSM~~ TS ~~03.~~23.088 [41]) as described in subclause 7.2.2.

6.11 Explicit Call Transfer (~~GSM~~ TS ~~03.~~23.091)

There is no interaction between Explicit Call Transfer and the basic call handling described in this specification.

6.12 Completion of Calls to Busy Subscriber (~~GSM~~ TS ~~03.~~23.093)

The basic call handling processes OCH_MSC, OCH_VLR, MT_GMSC, SRI_HLR, PRN_VLR, ICH_MSC and ICH_VLR interact with the CCBS supplementary service as described in subclauses 7.1.1, 7.1.2, 7.2.1, 7.2.2, 7.2.3, 7.3.1 & 7.3.2 respectively.

7 Functional requirements of network entities

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.

The entities described in this clause interwork with other entities over ~~three~~ four different types of interface:

- The Iu interface, used to interwork between the MSC and the UTRAN or the UMTS MS
- The A interface, used to interwork between the MSC and the GSM BSS or the GSM MS;
- The C, D & F interfaces, used to interwork between the MSC & HLR (C), VLR & HLR (D) and MSC & EIR (F);
- Telephony signalling interfaces, used to interwork between an MSC and another exchange.

The protocols used over the Iu interface are RANAP, which is specified in TS 25.413 [45], for interworking with the UTRAN and DTAP, which is specified in TS 24.008 [44], for interworking with the MS.

The protocols used over the A interface are BSSMAP, which is specified in GSM 08.08 [20], for interworking with the BSS and DTAP, which is specified in ~~GSM~~ TS ~~04.~~24.008 [44], for interworking with the MS.

The protocol used over the C, D & F interfaces is MAP, which is specified in ~~GSM~~ TS ~~09.~~29.002 [47].

For the purposes of this specification, the protocol used over telephony signalling interfaces is ISUP, which is specified in ~~ETS 300 356-1~~ITU-T Q.761 – Q.764 [52, 53, 54, 55]; other telephony signalling systems may be used instead.

This specification shows the call handling application processes interworking with a protocol handler for each of the protocols listed above. Each protocol defines supervision timers. If a supervision timer expires before a distant entity responds to a signal, the handling is as defined in the appropriate protocol specification. In general, the protocol handler reports timer expiry to the application as an error condition or negative response. Where a timer is shown in this specification, therefore, it is an **application** timer rather than a **protocol** timer. Interworking with the protocol handlers uses functional signal names which do not necessarily have a one-to-one correspondence with the names of messages used in the protocols.

An MSC which receives an IAM from an originating exchange may react in three different ways:

- It acts as a transit exchange, i.e. it relays the IAM to a destination exchange determined by analysis of the called party address, and thereafter relays other telephony signalling between the originating and destination exchange until the connection is released. This behaviour is not specific to UMTS or GSM;

- It acts as a terminating exchange, i.e. it attempts to connect the call to an MS currently registered in the service area of the MSC;

- It acts as a GMSC, i.e. it interrogates an HLR for information to route the call. If the HLR returns routeing information, the MSC uses the routeing information from the HLR to construct an IAM, which it sends to a destination exchange determined by analysis of the routeing information from the HLR.

Annex A describes the method which the MSC uses to decide how to process the IAM.

The SDL diagrams in this clause show the handling for a number of optional features and services. If the handling consists only of a call to a procedure specific to the feature or service, the procedure call is omitted if the entity does not support an optional feature or service. If the handling consists of more than a call to a procedure specific to the feature or service, the text associated with each SDL diagram specifies the handling which applies if the entity does not support an optional feature or service. For simplicity of description, it is assumed that support for Operator Determined Barring and the Call Forwarding and Call Barring supplementary services is mandatory.

~~For the entities which support CAMEL, the references to GSM 03.78 are to the version of GSM03.78 for the appropriate phase of CAMEL.~~

7.1 MO call

7.1.1 Functional requirements of serving MSC

7.1.1.1 Process OCH_MSC

The variable TCH allocated is global data, accessible to the procedure Establish_Originating_TCH_If_Required.

The procedures CCBS_Report_Not_Idle and CCBS_Check_Last_Call are specific to CCBS; they are specified in ~~GSM~~ TS ~~03.~~23.093 [42].

7.1.1.2 Procedure Process_Access_Request_MSC

Sheet 2: instead of using the explicit procedure Obtain_IMEI_MSC, the VMSC may encapsulate the request for the IMEI in the Start security procedures message~~Start ciphering request~~; the BSS relays the response in the Security procedures ~~Cipher Mode~~ complete message to the MSC.

Sheet 2: the VMSC maps the negative response received on the B interface to the appropriate reject cause according to the rules defined in ~~E~~TS ~~300 607~~29.010 [49].

Sheet 2: The Start security procedures message ~~ciphering request~~ may indicate one of several ciphering algorithms, or (for GSM only) no ciphering.

Sheet 2, sheet 3: At any stage, the MS may terminate the transaction with the network by sending a CM service abort message.

Sheet 2, sheet 3: if the VMSC receives a Setup message from the MS while the access request is being handled, the message is saved for processing after the access request has been handled.

7.1.1.3 Procedure OG_Call_Setup_MSC

Sheet 1: the variables Alerting sent, MS connected and Reconnect are global data, accessible to the procedures CCBS_Check_OG_Call, CCBS_OCH_Report_Failure, CCBS_OCH_Report_Success, CCBS_Check_If_CCBS_Possible, Send_Alerting_If_Required and Send_Access_Connect_If_Required.

Sheet 1: the VMSC converts the GSM bearer capability negotiated between the VMSC and the MS to a GSM basic service according to the rules defined in ~~GSM~~ TS ~~07.~~27.001 [].

Sheet 1: the variable UUS1 result sent is specific to UUS. This variable is accessible to all UUS specific procedures.

Sheet 1: the procedure UUS_OCH_Check_Setup is specific to UUS; it is specified in ~~GSM~~ TS ~~03.~~23.087 [40].

Sheet 1, sheet 2, sheet 5: the procedure CCBS_OCH_Report_Failure is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 1, sheet 5, sheet 6, sheet 8: at any stage after the Setup has been received, the MS may terminate the transaction with the network by sending a Release transaction request.

Sheet 2: the procedure Set_CLI_Presentation_Indicator_MSC is specific to CLIR. If the VMSC does not support CLIR, processing continues from the "Yes" exit of the test "Result=Call allowed?".

Sheet 2: the procedure CAMEL_OCH_MSC_INIT is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the VMSC does not support CAMEL, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2: the procedure CAMEL_MO_Dialled_Services is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2: the procedure CCBS_Check_OG_Call is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42]. If the VMSC does not support CCBS, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2: the procedure MOBILE_NUMBER_PORTABILITY_IN_OQoD is specific to Mobile Number Portability; it is specified in ~~GSM~~ TS ~~03.~~23.066 [**30**].

Sheet 2: the procedure UUS_OCH_Set_Info_In_IAM is specific to UUS; it is specified in ~~GSM~~ TS ~~03.~~23.087 [40].

Sheet 2: the procedure CAMEL_Store_Destination_Address is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 3: the procedure CCBS_OCH_Report_Success is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 3, sheet 6: the procedures CAMEL_Start_TNRy and CAMEL_Stop_TNRy are specific to CAMEL phase 2; they are specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**].

Sheet 3: the task "UTU2Cnt := 0" is executed only if the VMSC supports UUS

Sheet 4: the procedure CAMEL_OCH_MSC_ANSWER is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the VMSC does not support CAMEL, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 4: the procedure Set_COLP_Info_MSC is specific to COLP.

Sheet 4: the procedure Handle_AoC_MO_MSC is specific to AoC.

Sheet 4: the task "Store CW treatment indicator for this call if received in SII2" is executed only if the VMSC supports CAMEL phase 3.

Sheet 5: the procedures CCBS_Check_If_CCBS_Possible and CCBS_Activation_MSC are specific to CCBS; they are specified in ~~GSM~~ TS ~~03.~~23.093 [42]. The task "Store CCBS Result" is executed only if the VMSC supports CCBS. If the VMSC does not support CCBS, processing continues from the "CCBS Not Possible" exit of the test "CCBS Result".

Sheet 5, sheet 6: the procedures CAMEL_OCH_MSC_DISC3 and CAMEL_OCH_MSC_DISC4 are specific to CAMEL; they are specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**] respectively~~.

Sheet 5, sheet 6: the procedure CAMEL_OCH_MSC1 is specific to CAMEL phase 2; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**]. If the VMSC does not support CAMEL phase 2, processing continues from the "No" exit of the test "Result=Reconnect?"

Sheet 5, sheet 6, sheet 8: the processing in the branch beginning with the Int_Release_Call input will occur only if the MSC supports CAMEL.

Sheet 6, sheet 8: the procedure UUS_MSC_Check_UUS1_UUI is specific to UUS; it is specified in GSM ~~03.~~23.087 [40].

Sheet 7: the input signal TNRy expired and all the subsequent processing are specific to CAMEL phase 2, and will occur only if the VMSC supports CAMEL phase 2. The procedure CAMEL_OCH_MSC2 is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**].

Sheet 7: the input signal User To User is specific to UUS; it is discarded if the VMSC does not support UUS.

Sheet 7: the procedures UUS_MSC_Check_UUS2_UUI_to_MS and UUS_MSC_Check_UUS2_UUI_to_NW are specific to UUS; they are specified in GSM ~~03.~~23.087 [40].

Sheet 8: the procedure CAMEL_OCH_MSC_DISC1 is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the VMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

Sheet 8: the procedure CAMEL_OCH_MSC_DISC2 is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the VMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

7.1.1.4 Procedure Obtain_IMSI_MSC

The MS may terminate the transaction with the network while the VMSC is waiting for the MS to return its IMSI. If a CC connection has not been established, the MS uses CM Service Abort; otherwise it uses a Release, Release Complete or Disconnect. The VMSC aborts the transaction with the VLR and returns an aborted result to the parent process.

7.1.1.5 Procedure Authenticate_MSC

The MS may terminate the transaction with the network while the VMSC is waiting for the MS to respond to an authentication request. If a CC connection has not been established, the MS uses CM Service Abort; otherwise it uses a Release, Release Complete or Disconnect. The VMSC aborts the transaction with the VLR and returns an aborted result to the parent process.

7.1.1.6 Procedure Obtain_IMEI_MSC

The MS may terminate the transaction with the network while the VMSC is waiting for the MS to return its IMEI. If a CC connection has not been established, the MS uses CM Service Abort; otherwise it uses a Release, Release Complete or Disconnect. The VMSC aborts the transaction with the VLR and returns an aborted result to the parent process.

7.1.1.7 Procedure Check_IMEI_MSC

The MS may terminate the transaction with the network while the VMSC is waiting for the MS to return its IMEI. If a CC connection has not been established, the MS uses CM Service Abort; otherwise it uses a Release, Release Complete or Disconnect. The VMSC aborts the transaction with the VLR and returns an aborted result to the parent process.

The MS may terminate the transaction with the network while the VMSC is waiting for the result of the IMEI check from the EIR. If a CC connection has not been established, the MS uses CM Service Abort; otherwise it uses a Release, Release Complete or Disconnect. The VMSC aborts the transaction with the VLR and returns an aborted result to the parent process.

7.1.1.8 Procedure Establish_Originating_TCH_If_Required

7.1.1.9 Procedure Set_CLI_Presentation_Indicator_MSC

The MS may terminate the transaction with the network by sending a Release transaction message while a response is awaited from the process CLIR_MAF004. The message is saved for processing after return from the procedure.

7.1.1.10 Procedure Send_Alerting_If_Required

The test "Backward call indicator=no indication" refers to the called party's status field in the backward call indicators parameter of the ISUP Address Complete message which triggered the call of the procedure Send_Alerting_If_Required.

The procedures UUS_MSC_Check_UUS1_UUI and UUS_OCH_Set_Alert_And_Connect_Param are specific to UUS; they are specified in ~~GSM~~ TS ~~03.~~23.087 [40]. If the VMSC does not support UUS, processing continues from the "Yes" exit of the test "Result=Pass?".

If no useful information would be carried in the Progress message, it is not sent.

7.1.1.11 Procedure Set_COLP_Info_MSC

The MS may terminate the transaction with the network by sending a Release transaction message while a response is awaited from the process COLP_MAF006. The message is saved for processing after return from the procedure.

7.1.1.12 Procedure Send_Access_Connect_If_Required

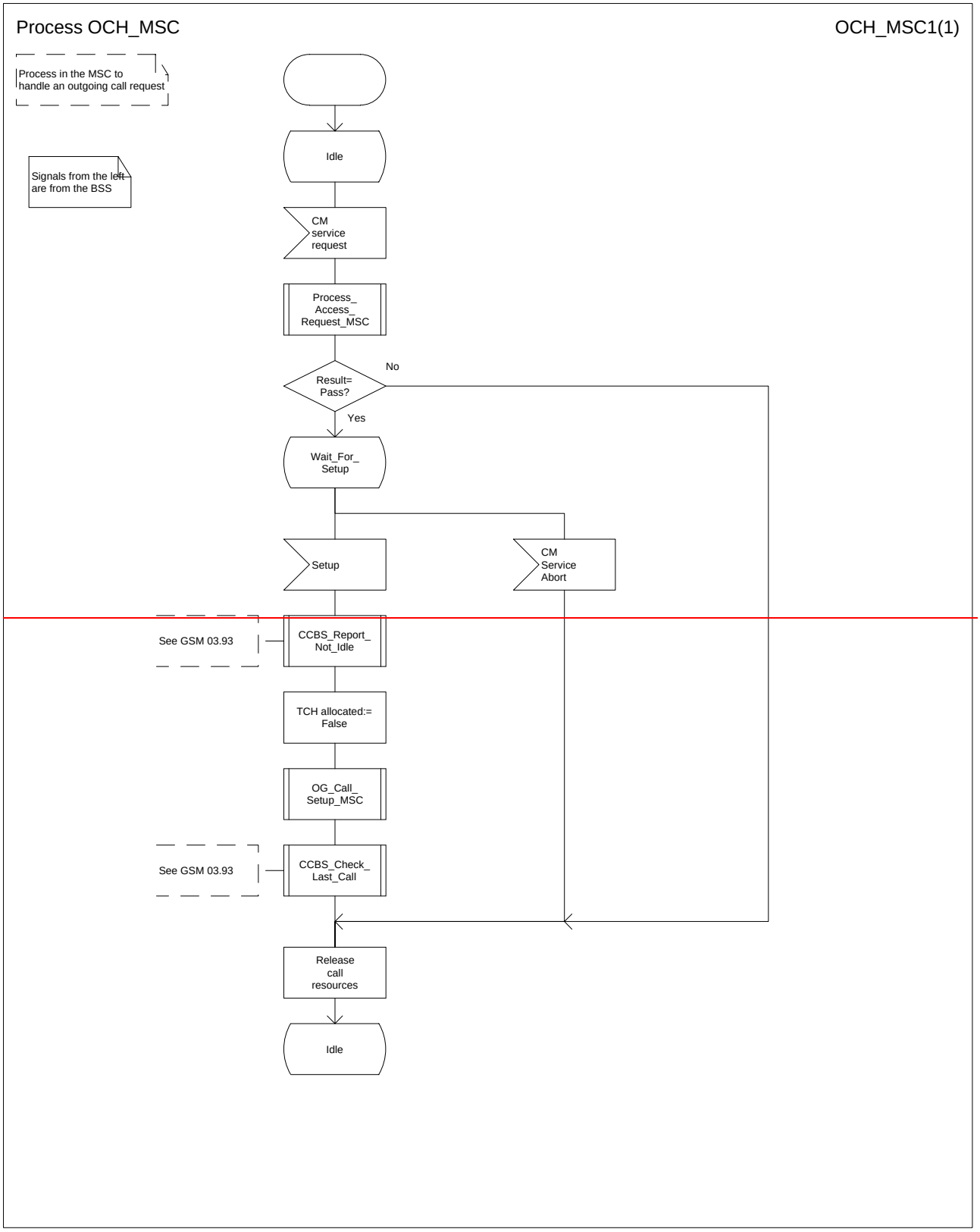
The test "Acknowledgement required" refers to the result returned by the procedure Handle_AoC_MSC. If the VMSC does not support AoC, processing continues from the "No" exit of the test "Acknowledgement required".

The procedure UUS_OCH_Set_Alert_And_Connect_Param is specific to UUS, it is specified in ~~GSM~~ TS ~~03.~~23.087 [40]. If the VMSC does not support UUS, processing continues from the "Yes" exit of the test "Result=Pass?".

If no useful information would be carried in the Facility message, it is not sent.

7.1.1.13 Procedure Handle_AoC_MO_MSC

The charging parameters and the Boolean variable Acknowledgement required are global data which can be read by the parent process.


Process OCH_MSC
OCH_MSC1(1)
Process in the MSC to handle an outgoing call request
Signals from the left are from the BSS
Idle
CM service request
Process_ Access_ Request_MSC
Result= Pass?
No
Yes
Wait_For_ Setup
Setup
CM Service Abort
See GSM 03.93
CCBS_Report_ Not_Idle
TCH allocated:= False
OG_Call_ Setup_MSC
See GSM 03.93
CCBS_Check_ Last_Call
Release call resources
Idle

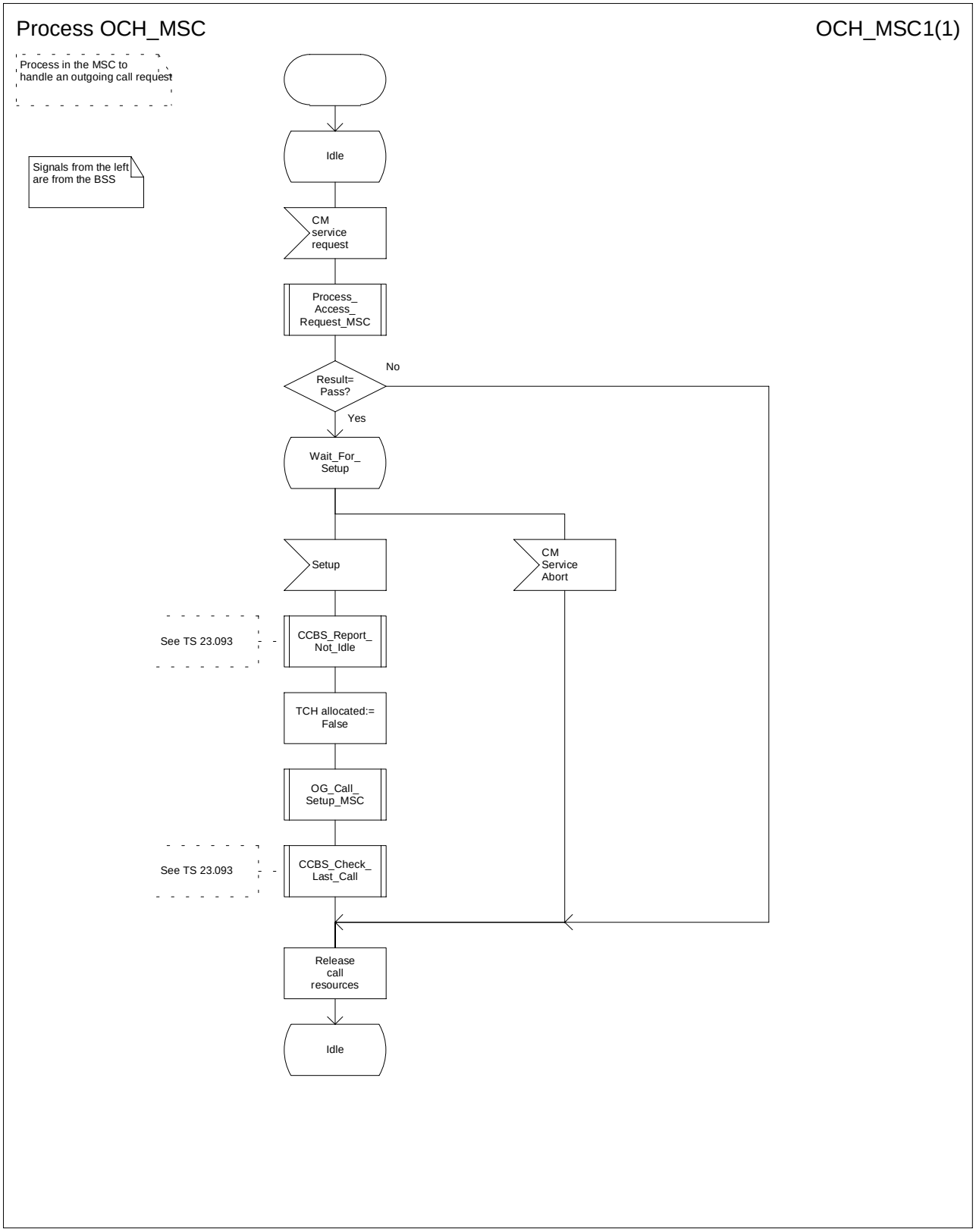
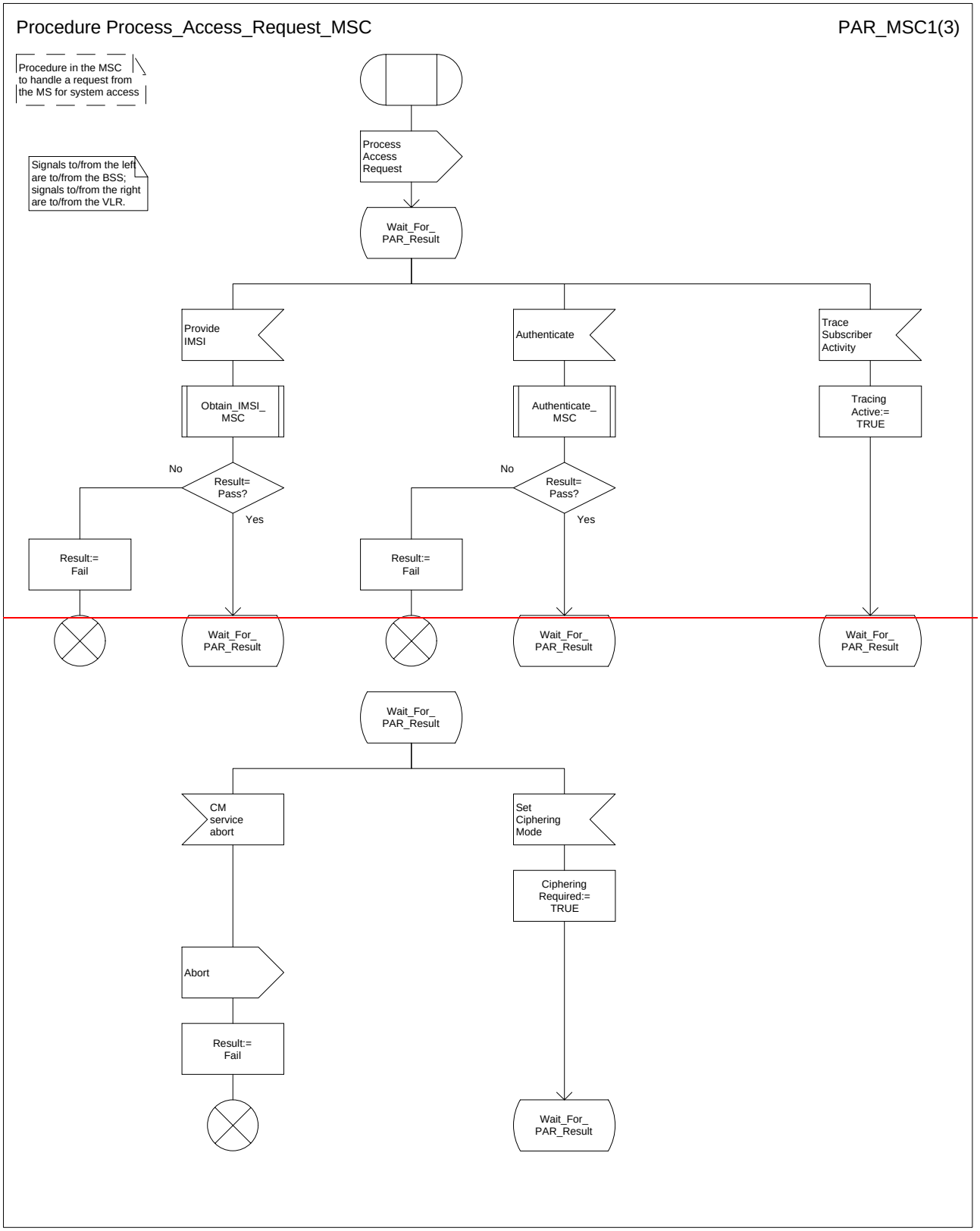


Figure 6: Process OCH_MSC


Procedure Process_Access_Request_MSC
PAR_MSC1(3)
Procedure in the MSC to handle a request from the MS for system access
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR.
Process Access Request
Wait_For_ PAR_Result
Provide IMSI
Authenticate
Trace Subscriber Activity
Obtain_IMSI_ MSC
Authenticate_ MSC
Tracing Active:= TRUE
No
Result= Pass?
Yes
No
Result= Pass?
Yes
Result:= Fail
Result:= Fail
Wait_For_ PAR_Result
Wait_For_ PAR_Result
Wait_For_ PAR_Result
Wait_For_ PAR_Result
CM service abort
Set Ciphering Mode
Ciphering Required:= TRUE
Abort
Result:= Fail
Wait_For_ PAR_Result

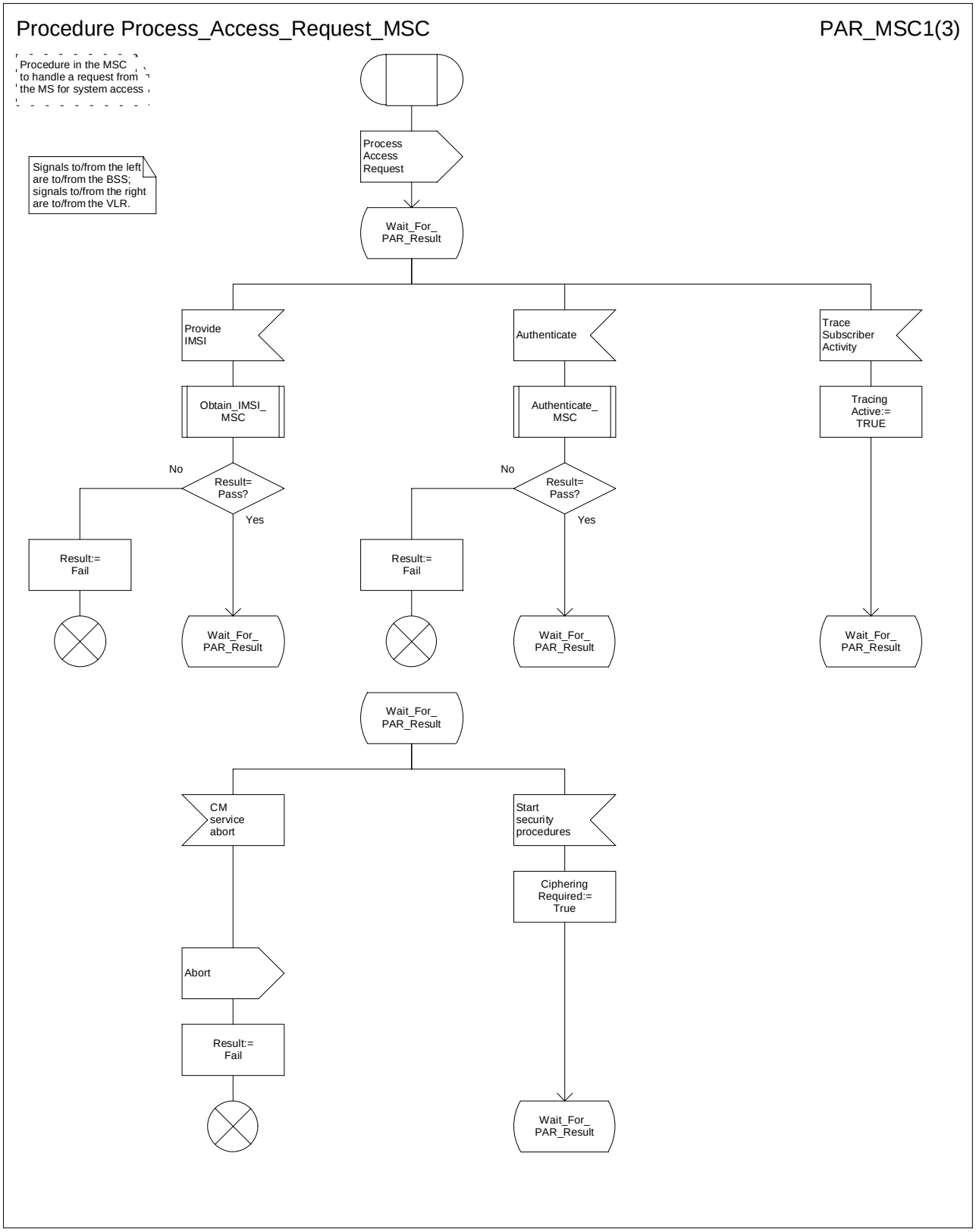
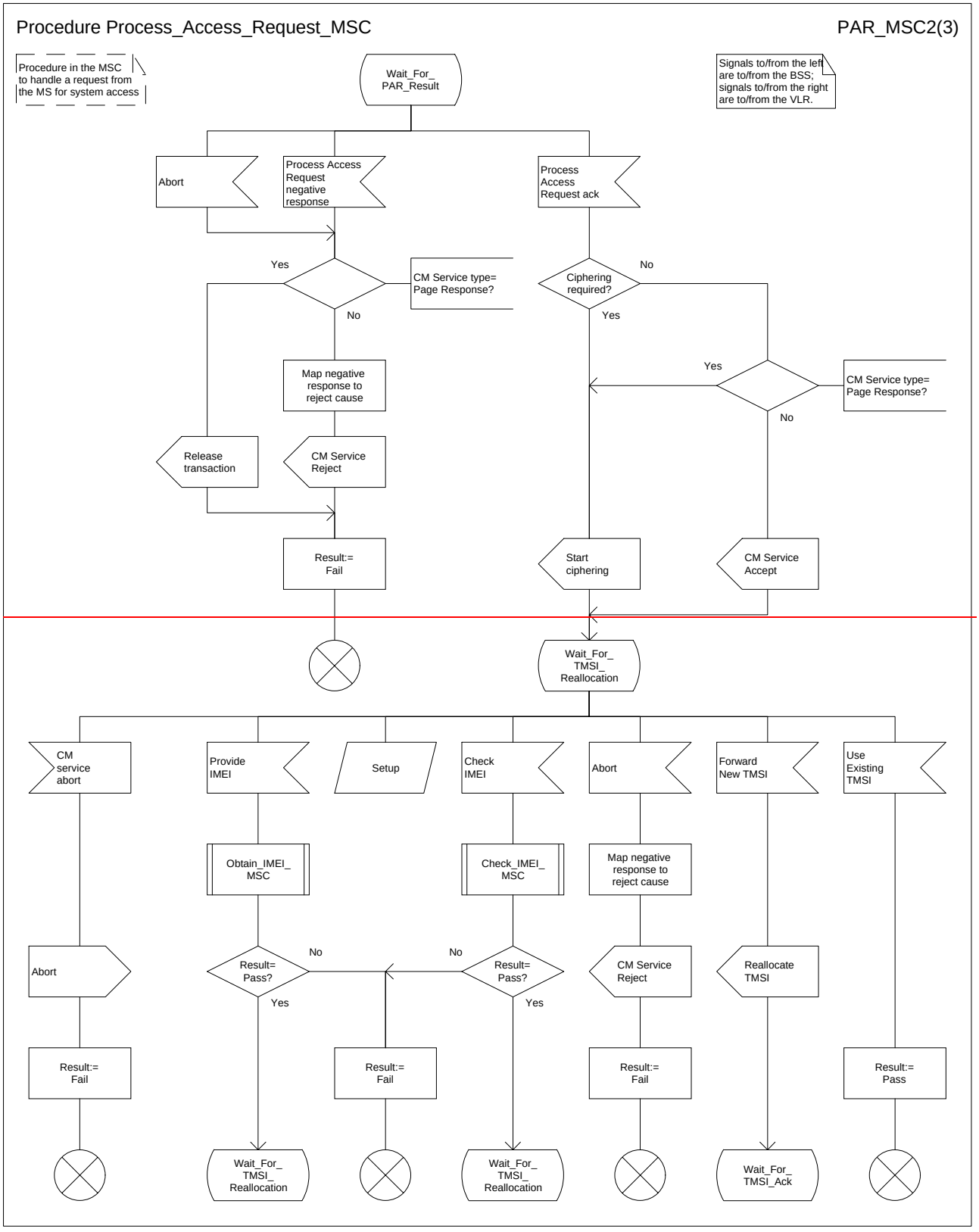


Figure 7a: Procedure Process_Access_Request_MSC (sheet 1)


Procedure Process_Access_Request_MSC
PAR_MSC2(3)
Procedure in the MSC to handle a request from the MS for system access
Wait_For_ PAR_Result
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR.
Abort
Process Access Request negative response
Process Access Request ack
Yes
CM Service type= Page Response?
No
Ciphering required?
No
Yes
Map negative response to reject cause
Yes
CM Service type= Page Response?
No
Release transaction
CM Service Reject
Result:= Fail
Start ciphering
CM Service Accept
Wait_For_ TMSI_ Reallocation
CM service abort
Provide IMEI
Setup
Check IMEI
Abort
Forward New TMSI
Use Existing TMSI
Obtain_IMEI_ MSC
Check_IMEI_ MSC
Map negative response to reject cause
Abort
Result= Pass?
No
Result= Pass?
No
CM Service Reject
Reallocate TMSI
Yes
Yes
Result:= Fail
Result:= Fail
Result:= Fail
Result:= Pass
Wait_For_ TMSI_ Reallocation
Wait_For_ TMSI_ Reallocation
Wait_For_ TMSI_Ack

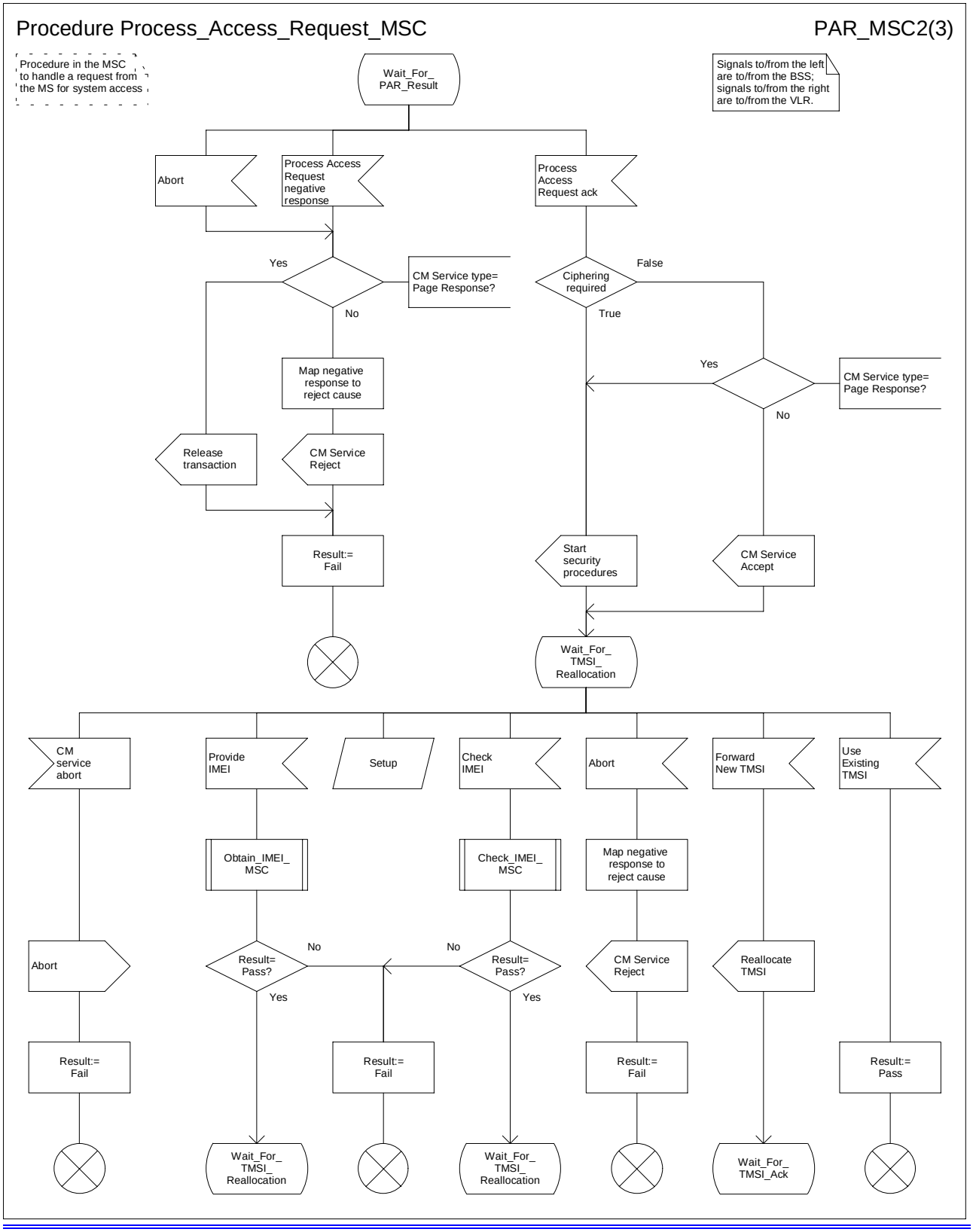


Figure 7b: Procedure Process_Access_Request_MSC (sheet 2)

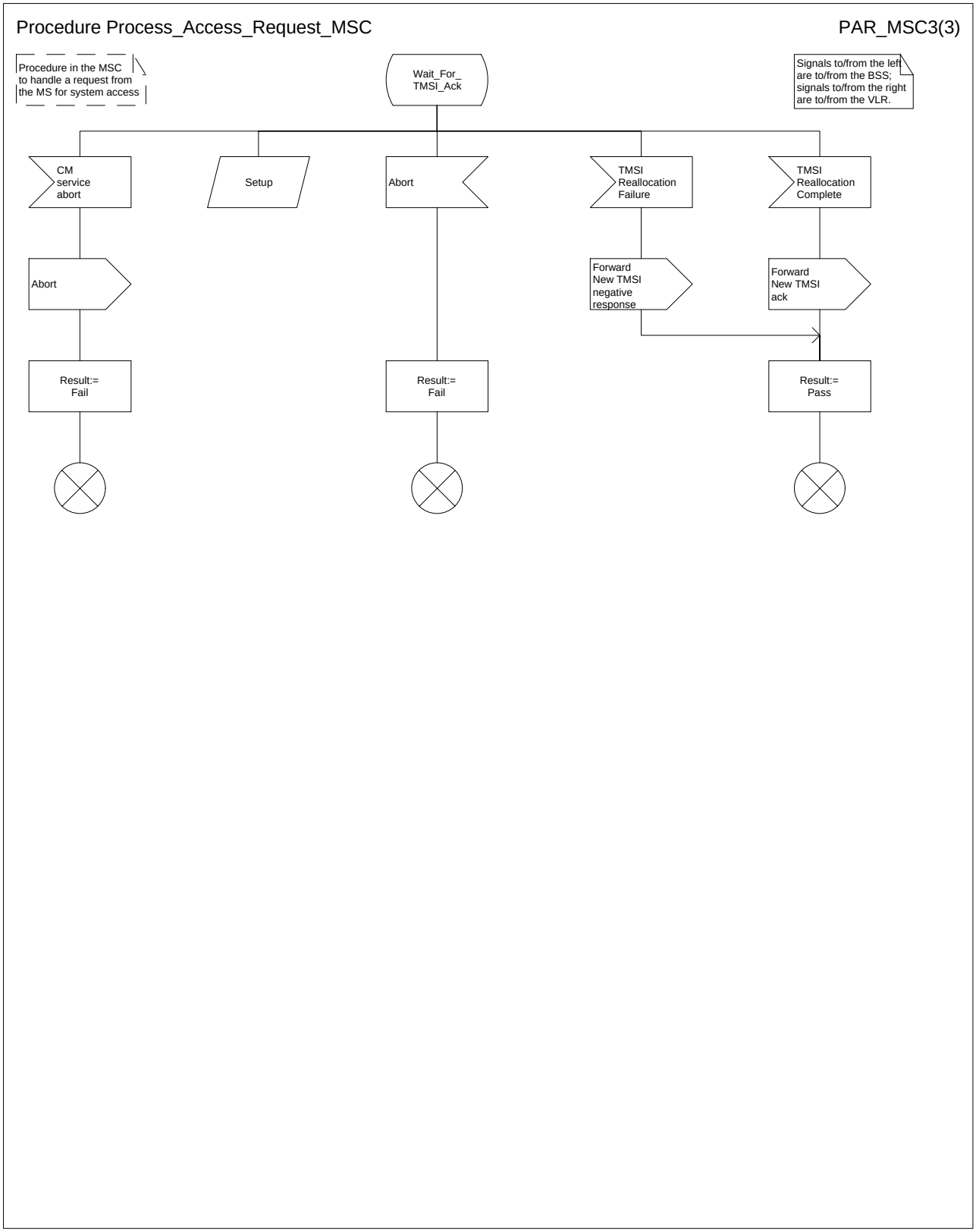
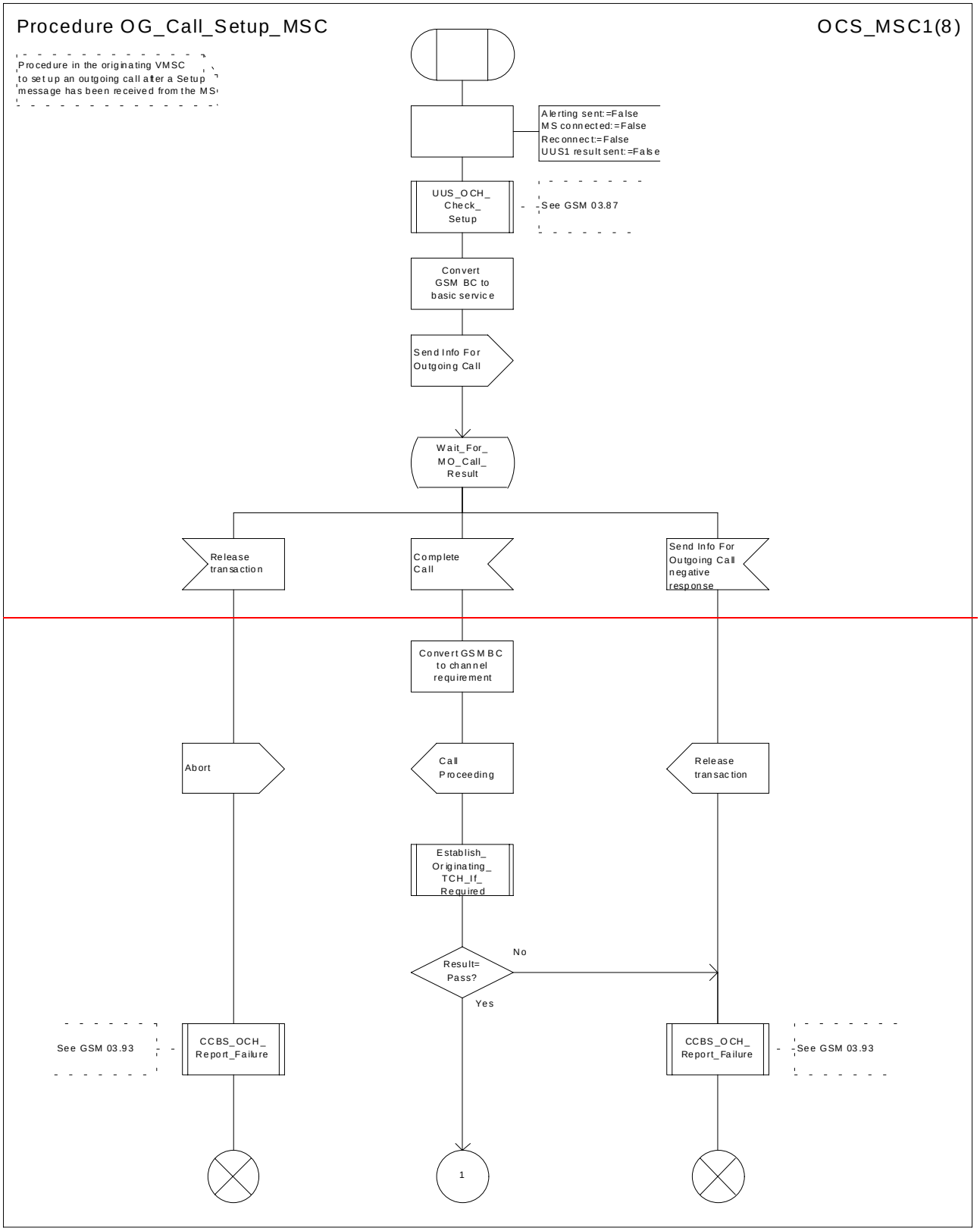


Figure 7c: Procedure Process_Access_Request_MSC (sheet 3)


Procedure OG_Call_Setup_MSC
OCS_MSC1(8)
Procedure in the originating VMSC to set up an outgoing call after a Setup message has been received from the MS
Alerting sent:=False
MS connected:=False
Reconnect:=False
UUS1 result sent:=False
UUS_OCH_ Check_ Setup
See GSM 03.87
Convert GSM BC to basic service
Send Info For Outgoing Call
Wait_For_ MO_Call_ Result
Release transaction
Complete Call
Send Info For Outgoing Call negative response
Convert GSM BC to channel requirement
Abort
Call Proceeding
Release transaction
Establish_ Originating_ TCH_If_ Required
Result= Pass?
No
Yes
See GSM 03.93
CCBS_OCH_ Report_Failure
CCBS_OCH_ Report_Failure
See GSM 03.93
1

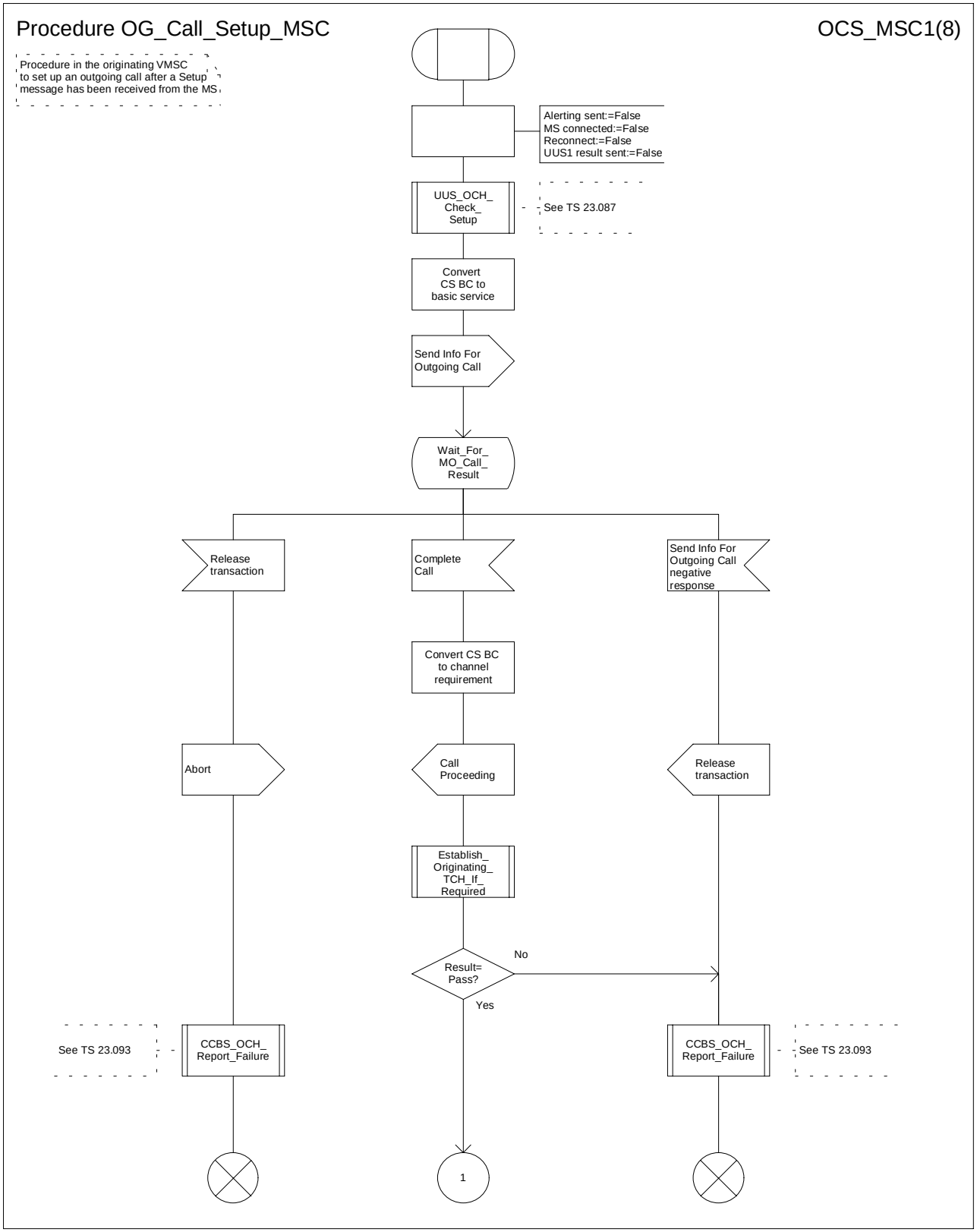
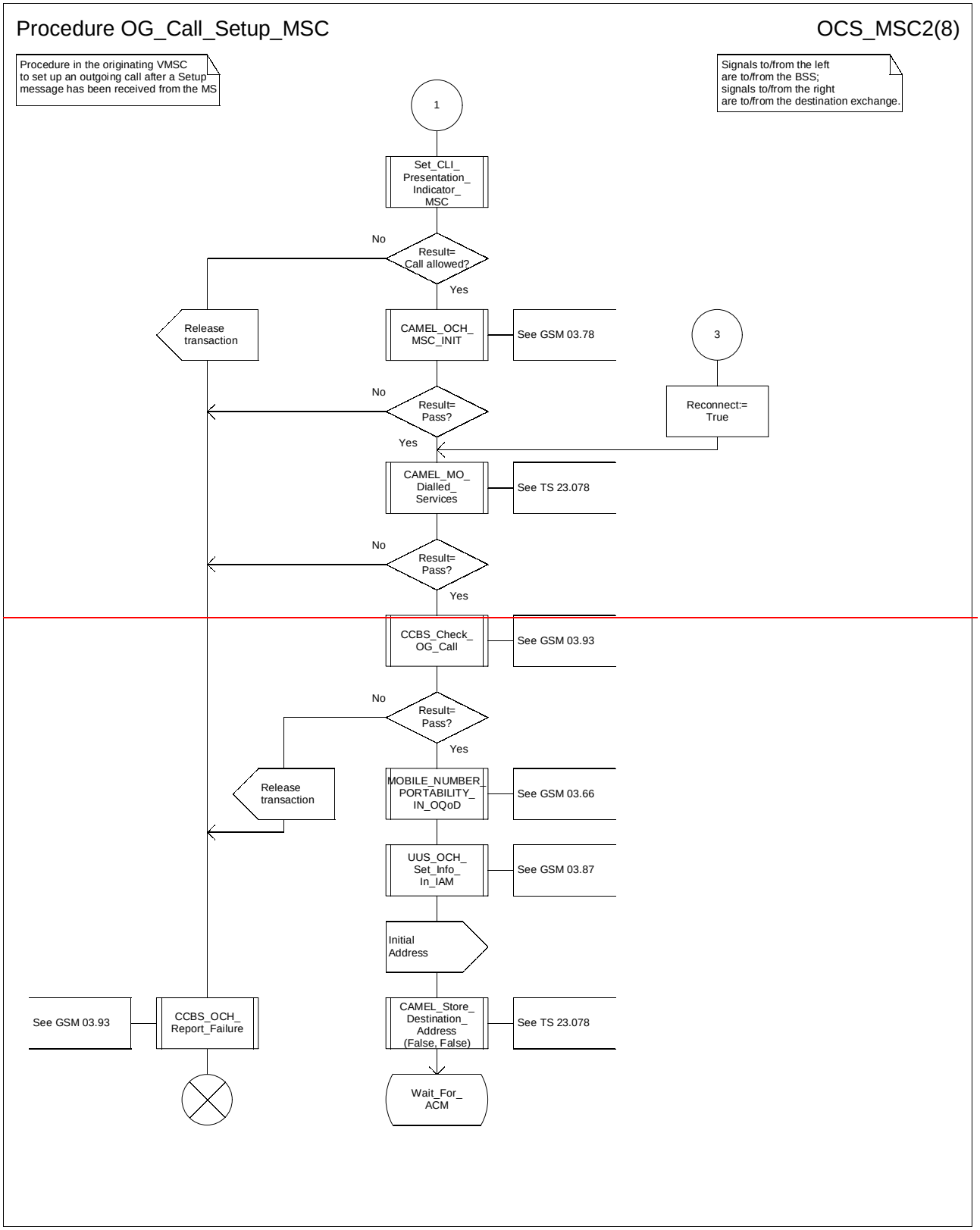


Figure 8a: Procedure Outgoing_Call_Setup_MSC (sheet 1)


Procedure OG_Call_Setup_MSC
OCS_MSC2(8)
Procedure in the originating VMSC to set up an outgoing call after a Setup message has been received from the MS
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the destination exchange.
1
Set_CLI_ Presentation_ Indicator_ MSC
No
Result= Call allowed?
Yes
Release transaction
CAMEL_OCH_ MSC_INIT
See GSM 03.78
3
No
Result= Pass?
Reconnect:= True
Yes
CAMEL_MO_ Dialled_ Services
See TS 23.078
No
Result= Pass?
Yes
CCBS_Check_ OG_Call
See GSM 03.93
No
Result= Pass?
Yes
Release transaction
MOBILE_NUMBER_ PORTABILITY_ IN_OQoD
See GSM 03.66
UUS_OCH_ Set_Info_ In_IAM
See GSM 03.87
Initial Address
See GSM 03.93
CCBS_OCH_ Report_Failure
CAMEL_Store_ Destination_ Address (False, False)
See TS 23.078
Wait_For_ ACM

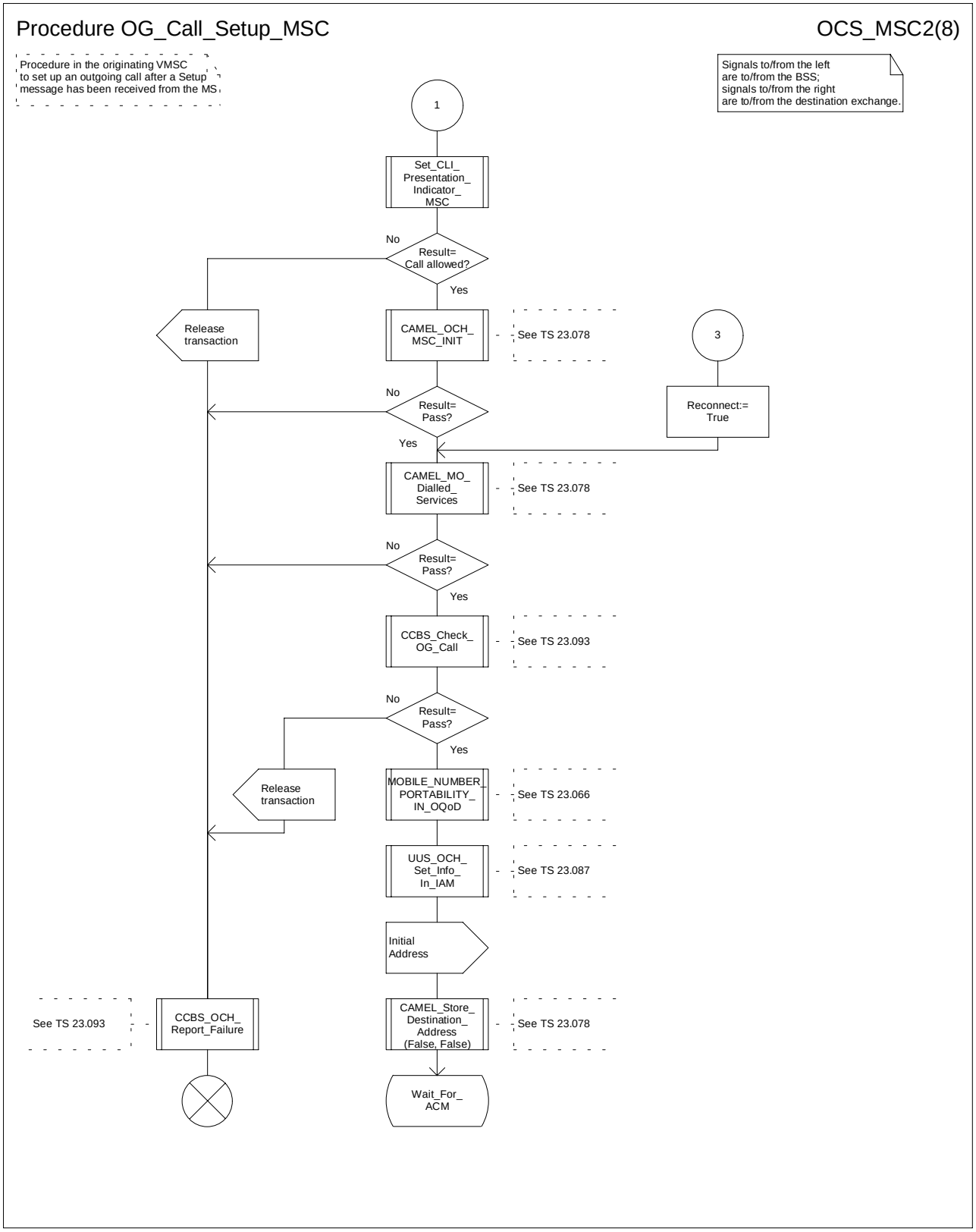
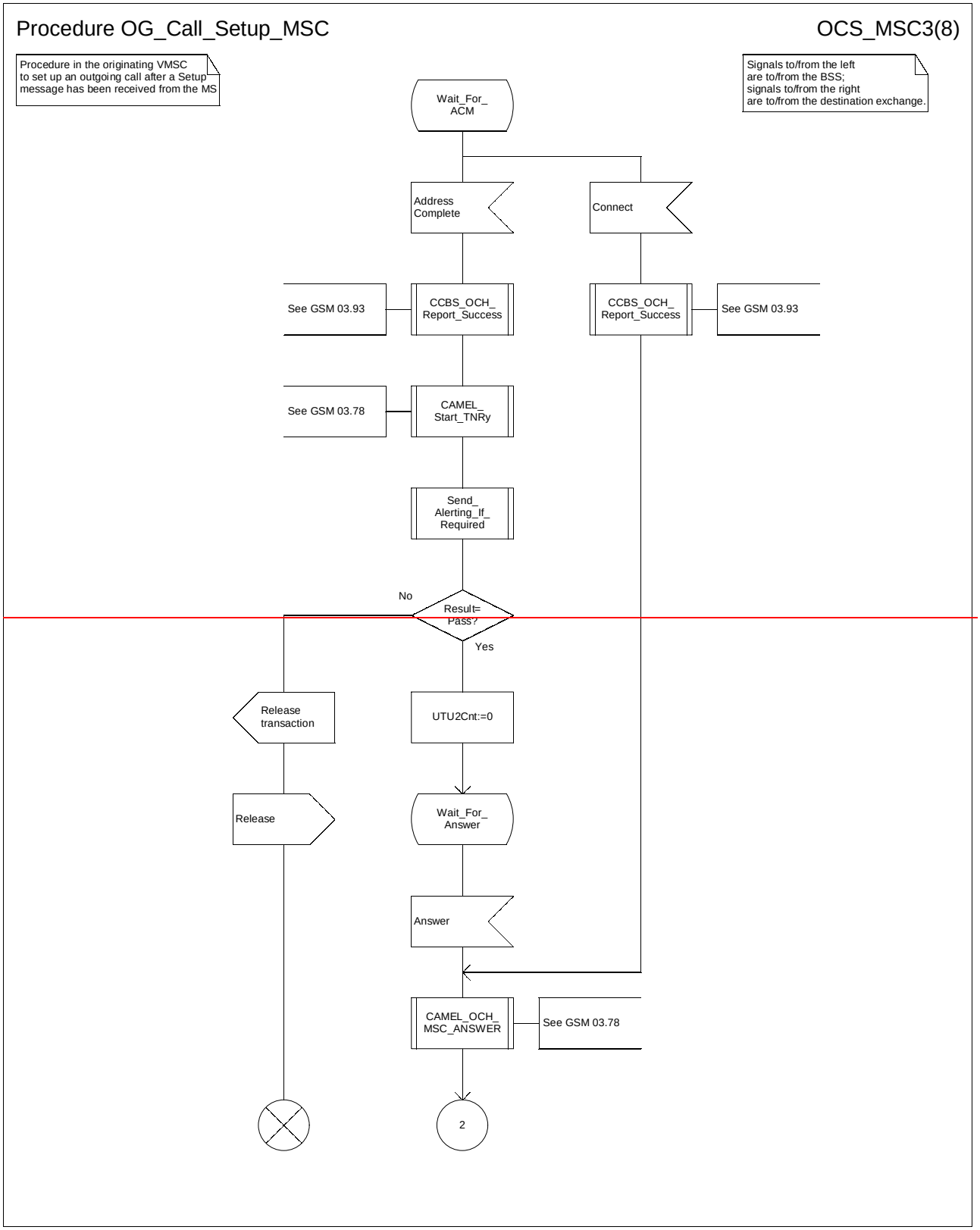


Figure 8b: Procedure Outgoing_Call_Setup _MSC (sheet 2)


Procedure OG_Call_Setup_MSC
OCS_MSC3(8)
Procedure in the originating VMSC to set up an outgoing call after a Setup message has been received from the MS
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the destination exchange.
Wait_For_ ACM
Address Complete
Connect
See GSM 03.93
CCBS_OCH_ Report_Success
CCBS_OCH_ Report_Success
See GSM 03.93
See GSM 03.78
CAMEL_ Start_TNRy
Send_ Alerting_If_ Required
No
Result= Pass?
Yes
Release transaction
UTU2Cnt:=0
Release
Wait_For_ Answer
Answer
CAMEL_OCH_ MSC_ANSWER
See GSM 03.78
2

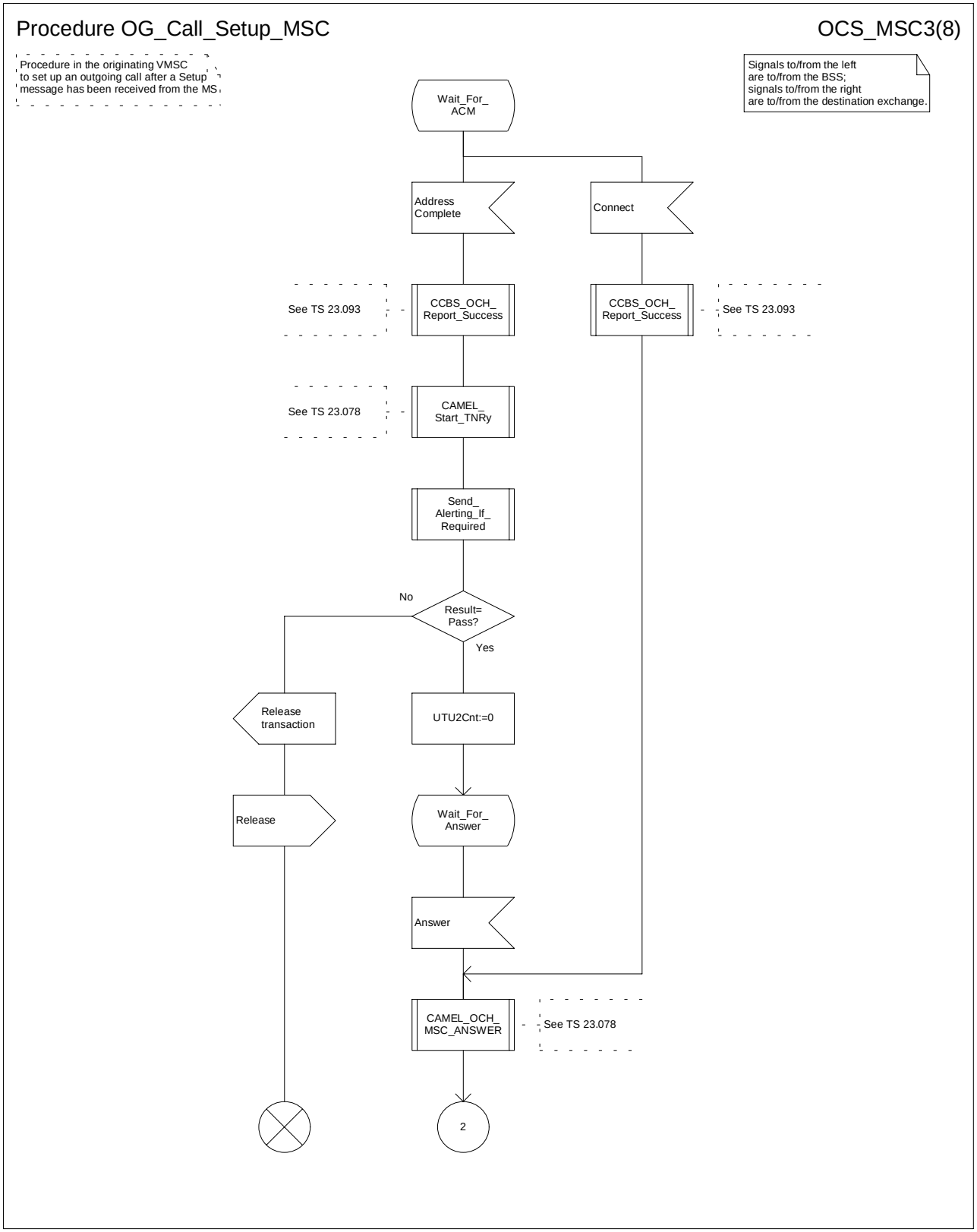


Figure 8c: Procedure Outgoing_Call_Setup _MSC (sheet 3)

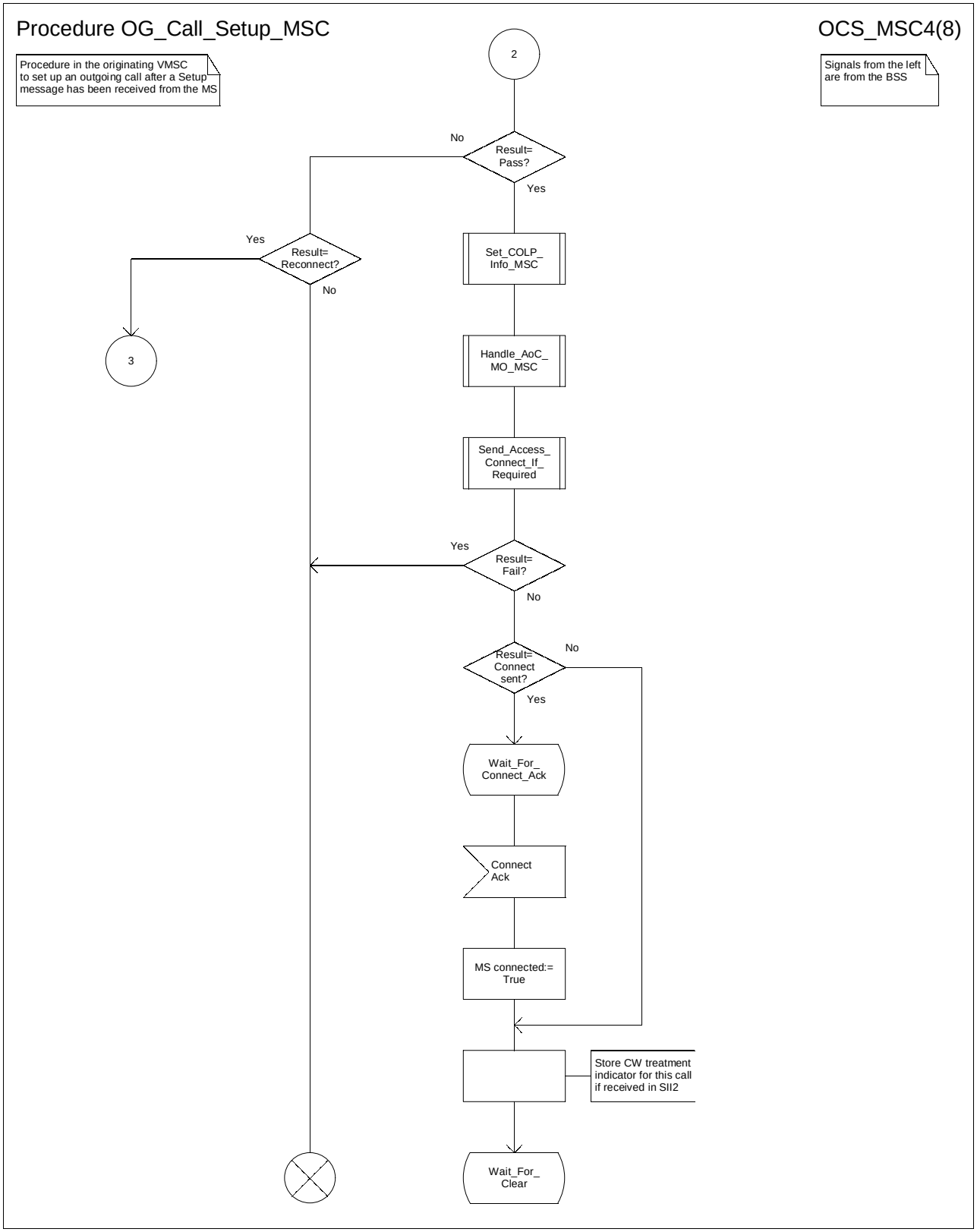
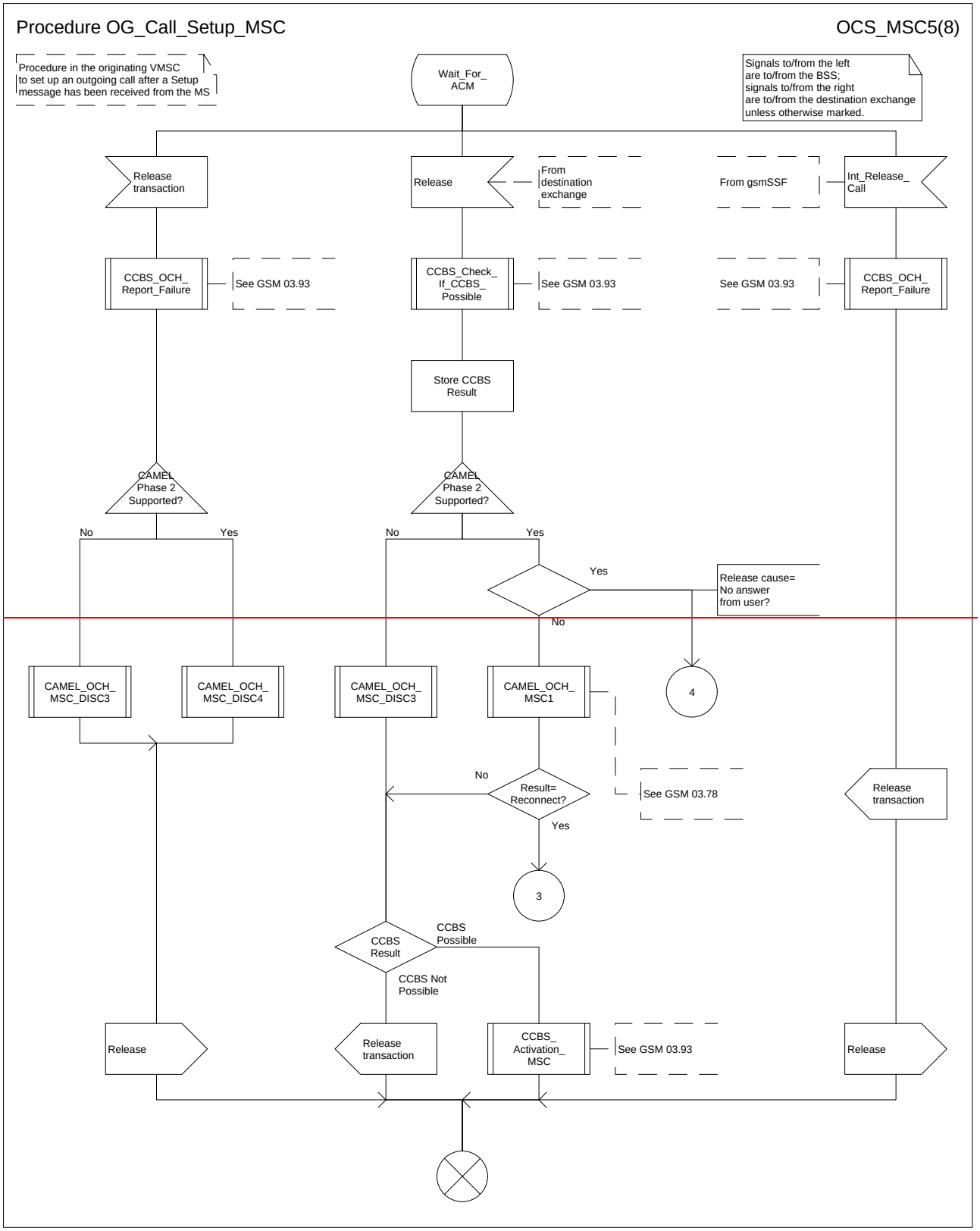


Figure 8d: Procedure Outgoing_Call_Setup _MSC (sheet 4)


Procedure OG_Call_Setup_MSC
OCS_MSC5(8)
Procedure in the originating VMSC to set up an outgoing call after a Setup message has been received from the MS
Wait_For_ ACM
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the destination exchange unless otherwise marked.
Release transaction
Release
From destination exchange
From gsmSSF
Int_Release_ Call
CCBS_OCH_ Report_Failure
See GSM 03.93
CCBS_Check_ If_CCBS_ Possible
See GSM 03.93
See GSM 03.93
CCBS_OCH_ Report_Failure
Store CCBS Result
CAMEL Phase 2 Supported?
CAMEL Phase 2 Supported?
No
Yes
No
Yes
Yes
Release cause= No answer from user?
No
CAMEL_OCH_ MSC_DISC3
CAMEL_OCH_ MSC_DISC4
CAMEL_OCH_ MSC_DISC3
CAMEL_OCH_ MSC1
4
No
Result= Reconnect?
See GSM 03.78
Release transaction
Yes
3
CCBS Result
CCBS Possible
CCBS Not Possible
Release
Release transaction
CCBS_ Activation_ MSC
See GSM 03.93
Release

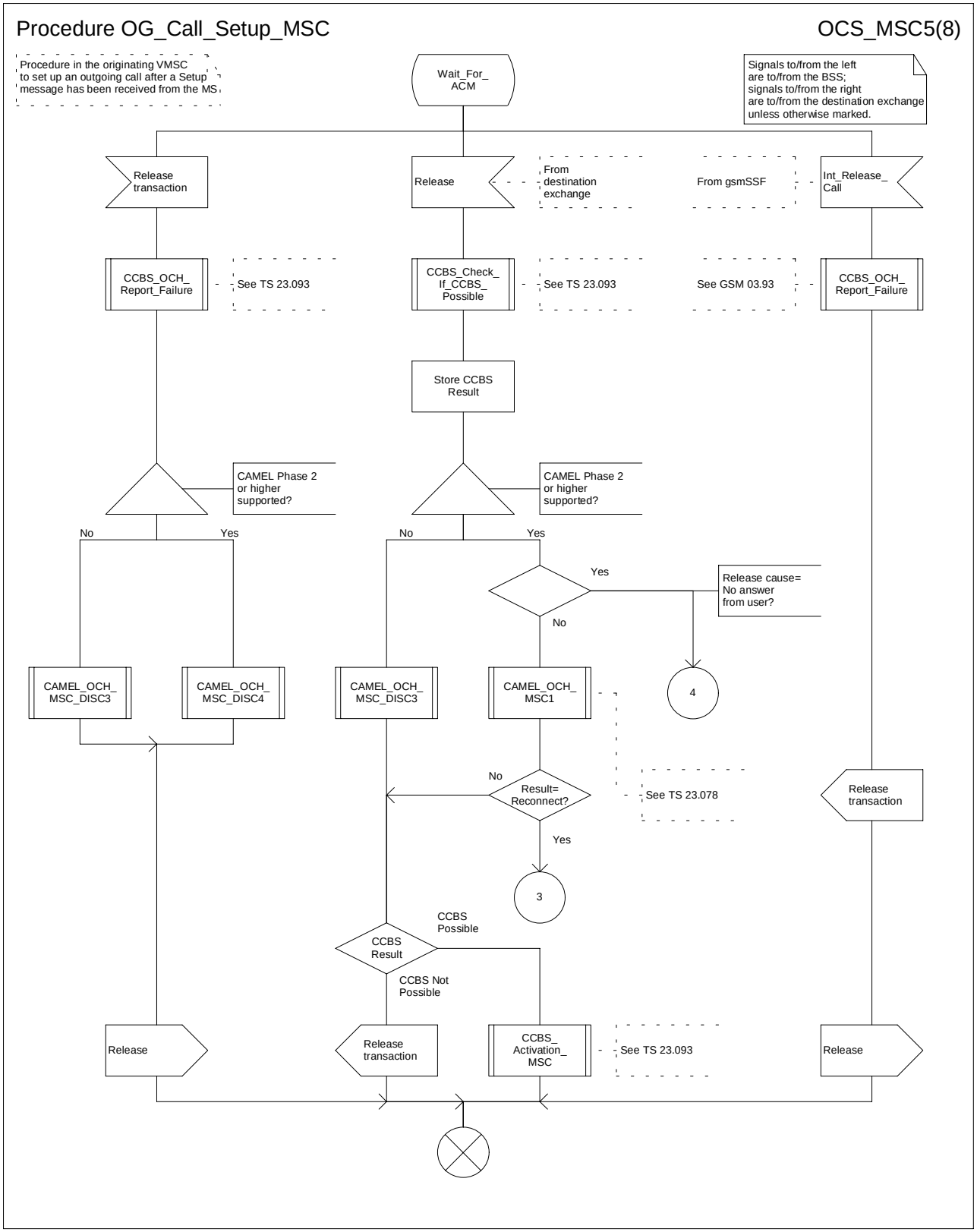
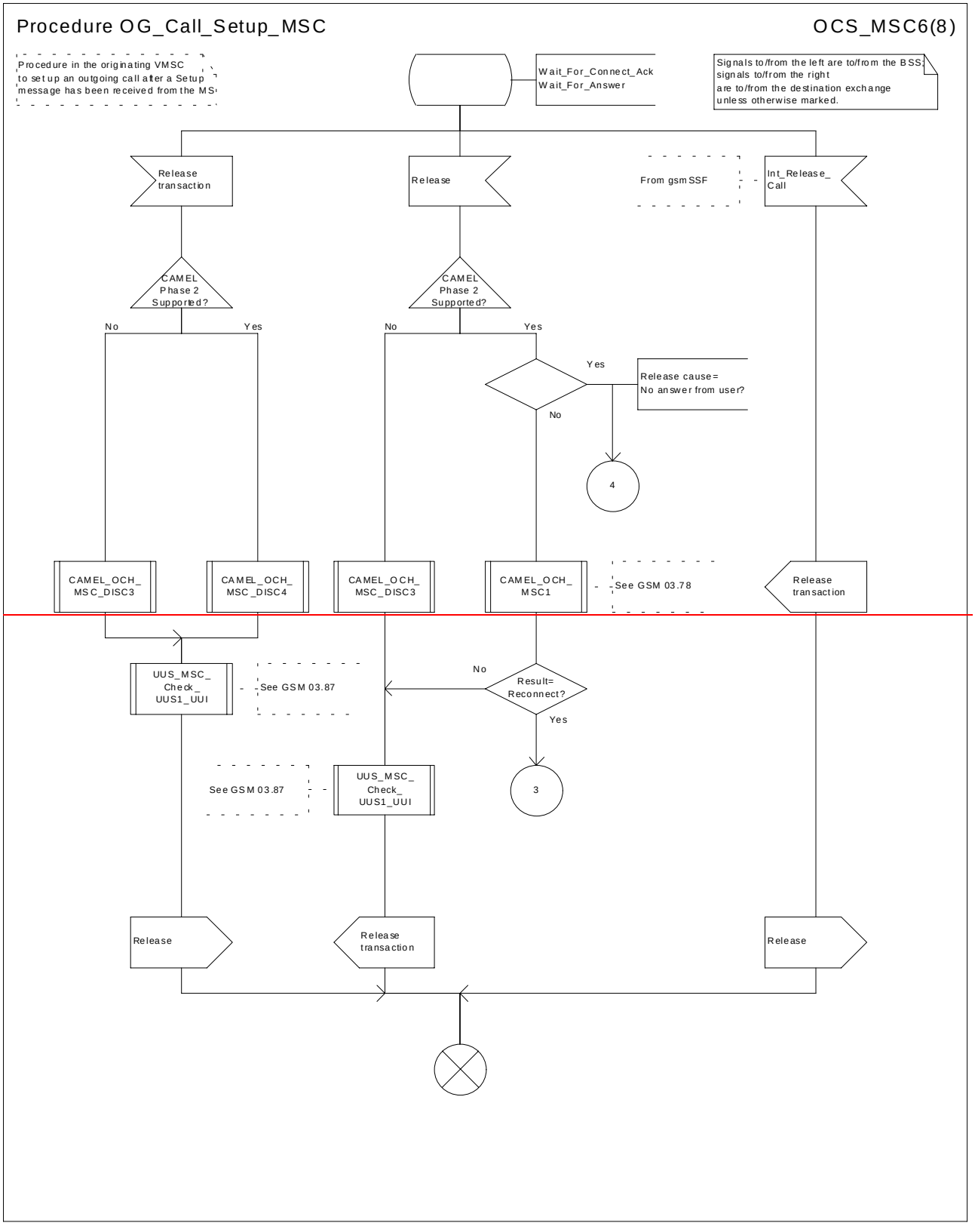


Figure 8e: Procedure Outgoing_Call_Setup _MSC (sheet 5)


Procedure OG_Call_Setup_MSC
OCS_MSC6(8)
Procedure in the originating VMSC to set up an outgoing call after a Setup message has been received from the MS
Wait_For_Connect_Ack
Wait_For_Answer
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the destination exchange unless otherwise marked.
Release transaction
Release
From gsmSSF
Int_Release_ Call
CAMEL Phase 2 Supported?
CAMEL Phase 2 Supported?
No
Yes
No
Yes
Yes
Release cause= No answer from user?
No
4
CAMEL_OCH_ MSC_DISC3
CAMEL_OCH_ MSC_DISC4
CAMEL_OCH_ MSC_DISC3
CAMEL_OCH_ MSC1
See GSM 03.78
Release transaction
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
No
Result= Reconnect?
Yes
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
3
Release
Release transaction
Release

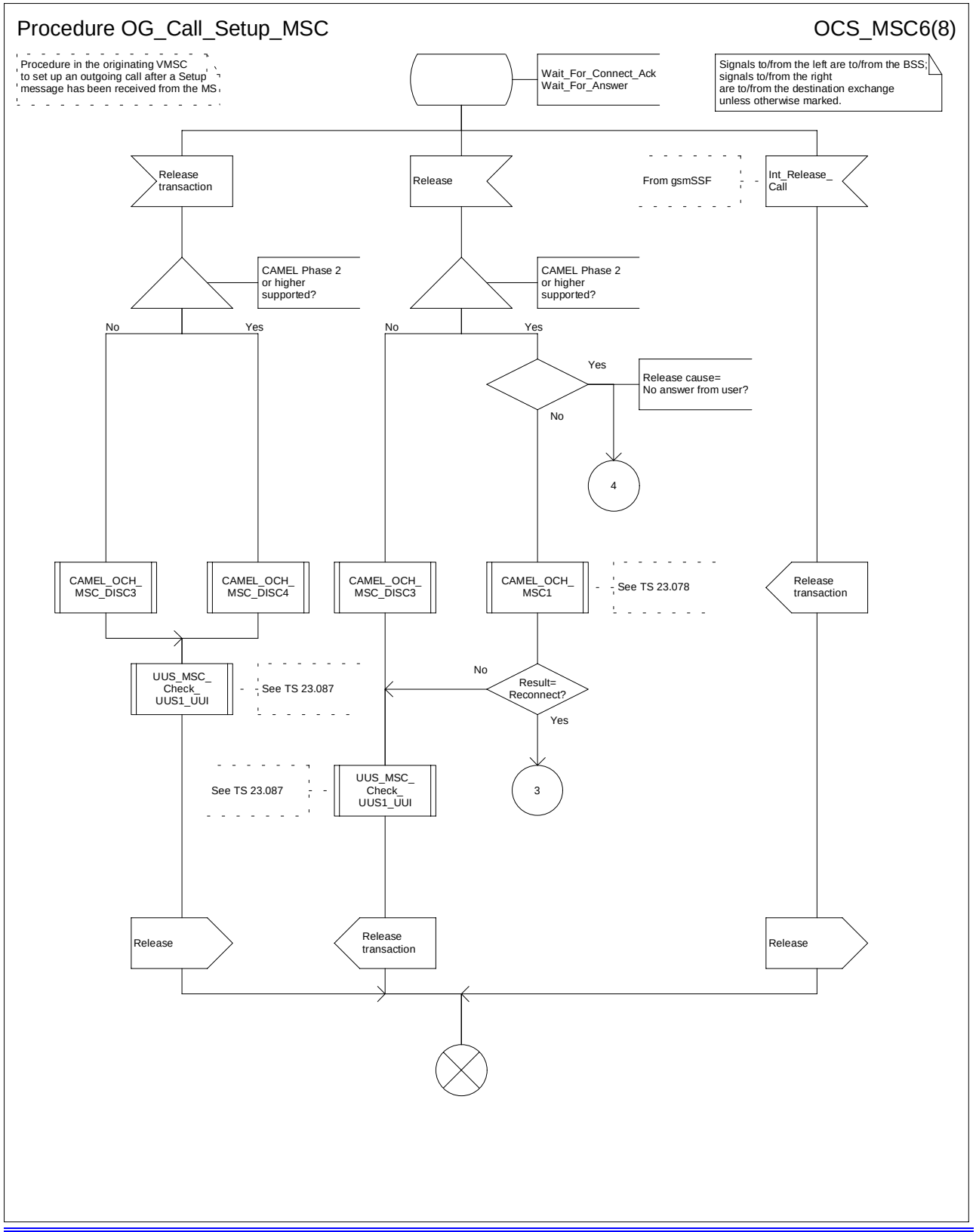
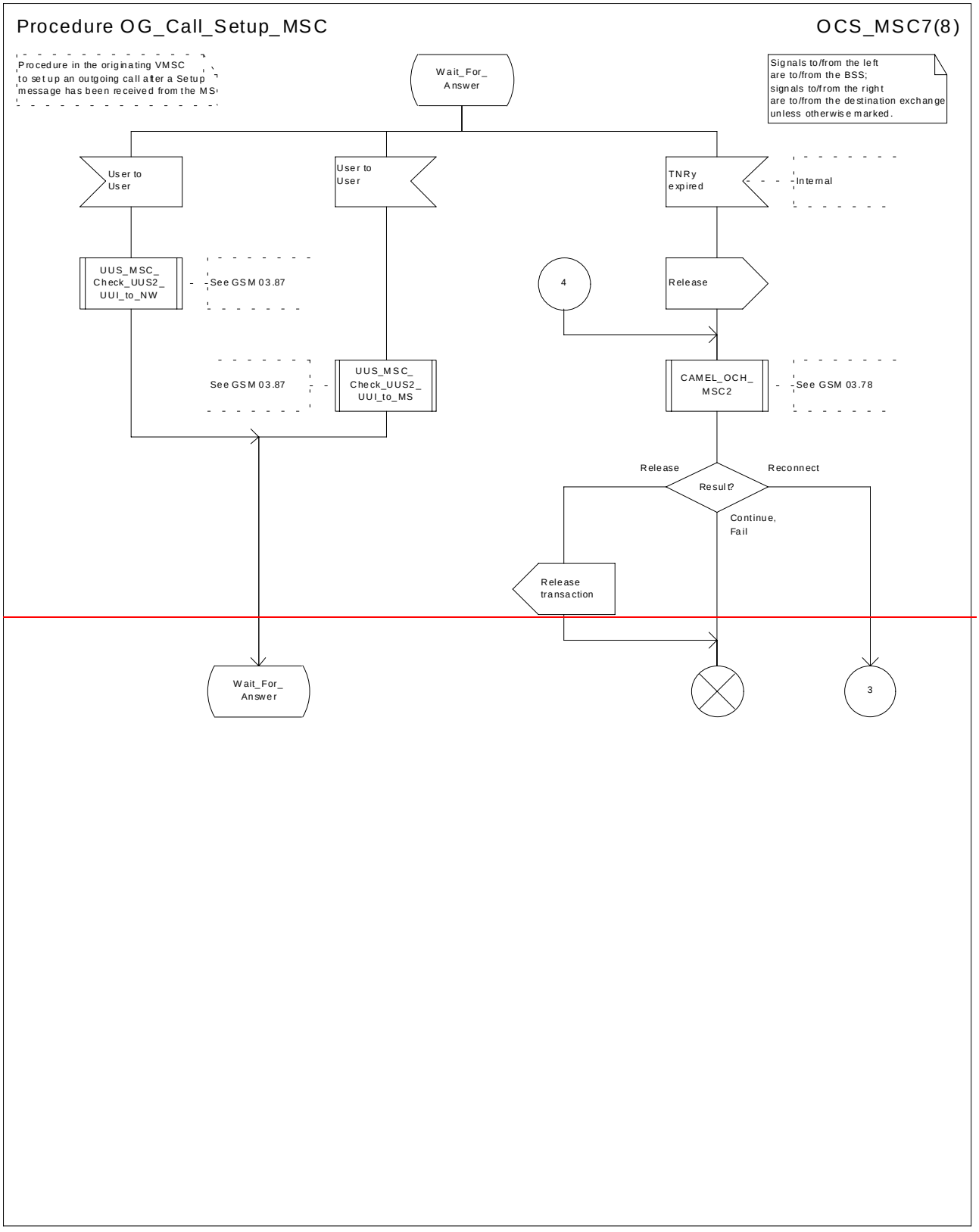


Figure 8f: Procedure Outgoing_Call_Setup _MSC (sheet 6)


Procedure OG_Call_Setup_MSC
OCS_MSC7(8)
Procedure in the originating VMSC to set up an outgoing call after a Setup message has been received from the MS
Wait_For_ Answer
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the destination exchange unless otherwise marked.
User to User
User to User
TNRy expired
Internal
UUS_MSC_ Check_UUS2_ UUI_to_NW
See GSM 03.87
4
Release
See GSM 03.87
UUS_MSC_ Check_UUS2_ UUI_to_MS
CAMEL_OCH_ MSC2
See GSM 03.78
Release
Result
Reconnect
Continue, Fail
Release transaction
Wait_For_ Answer
3

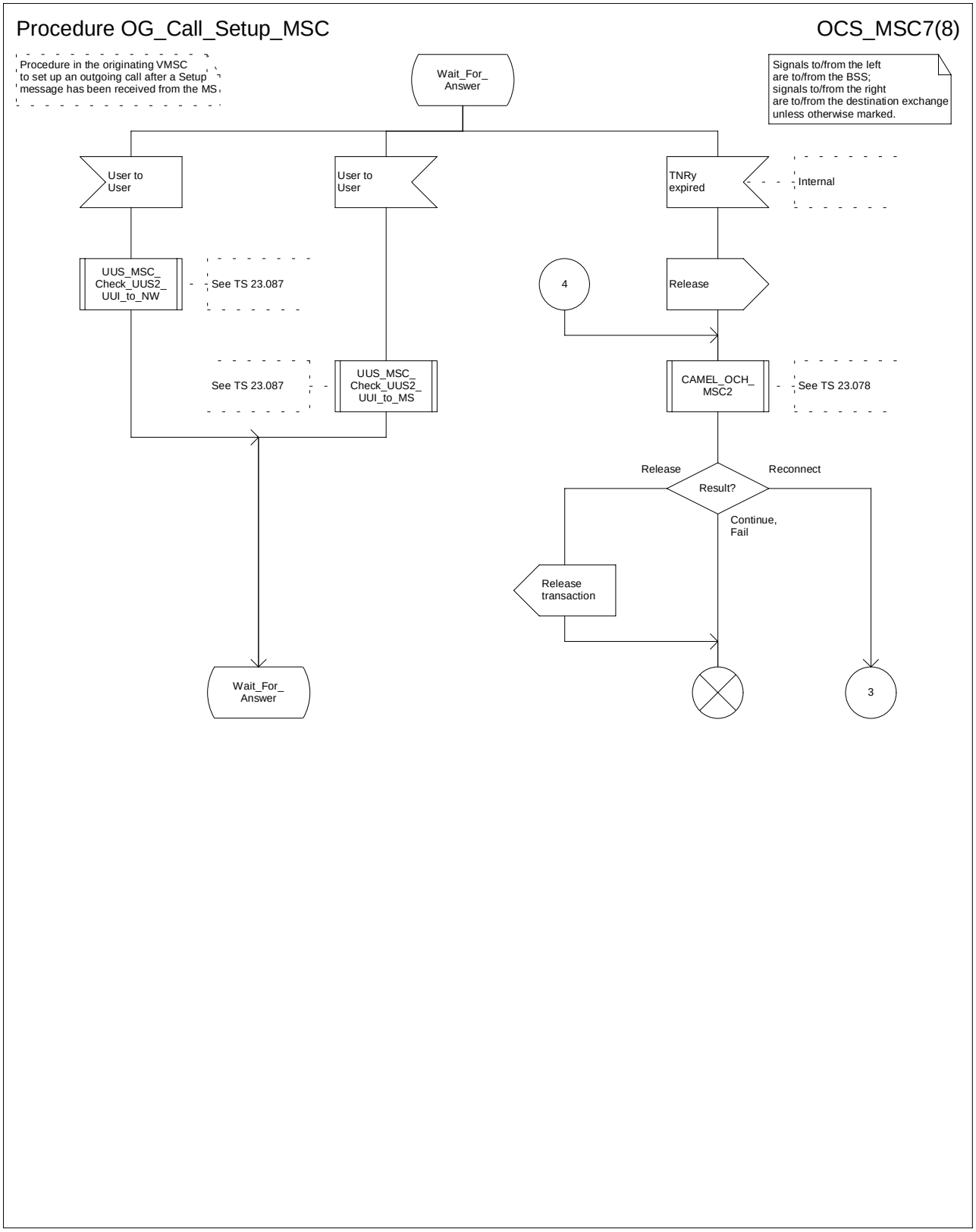
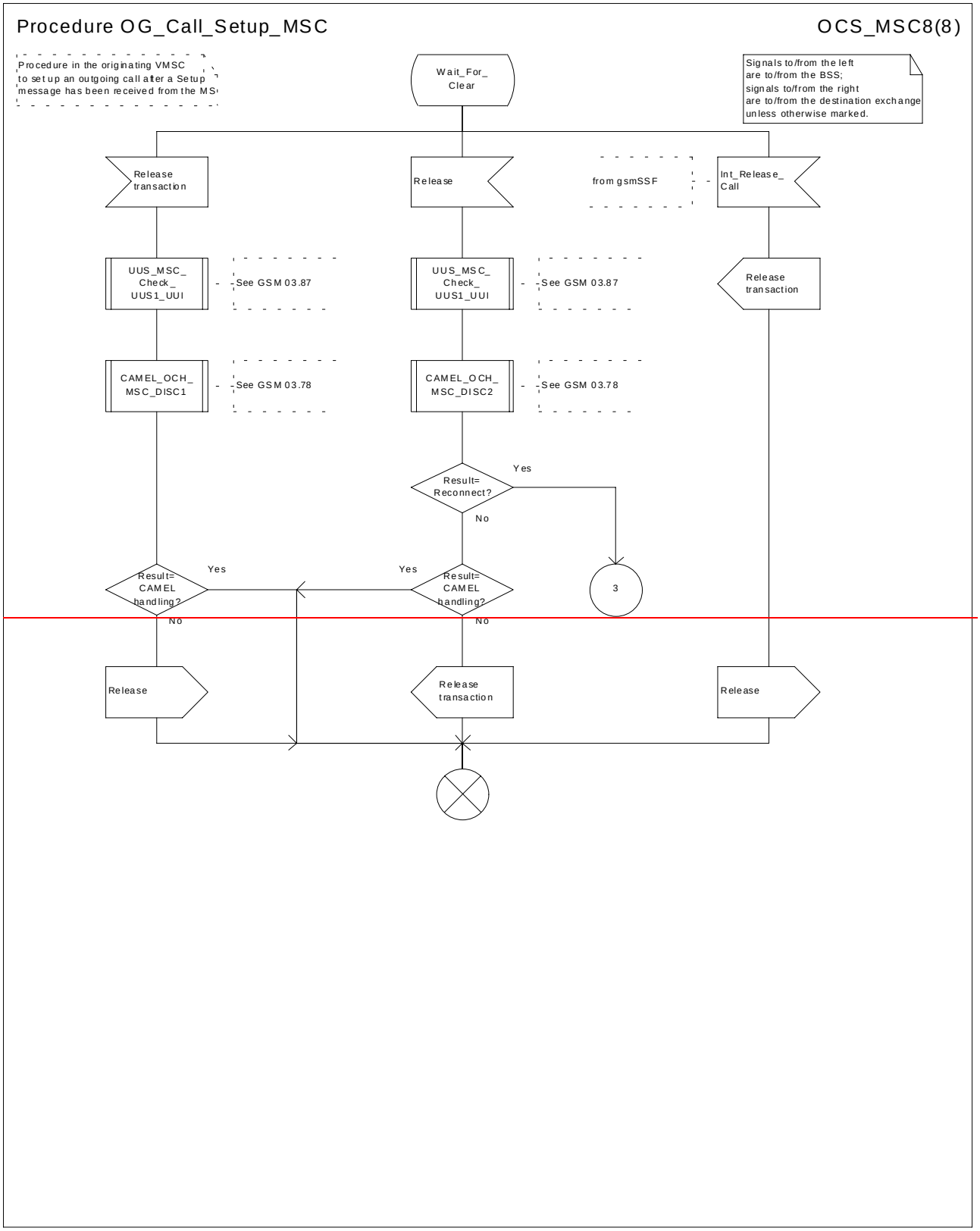


Figure 8g: Procedure Outgoing_Call_Setup _MSC (sheet 7)


Procedure OG_Call_Setup_MSC
OCS_MSC8(8)
Procedure in the originating VMSC to set up an outgoing call after a Setup message has been received from the MS
Wait_For_ Clear
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the destination exchange unless otherwise marked.
Release transaction
Release
from gsmSSF
Int_Release_ Call
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
Release transaction
CAMEL_OCH_ MSC_DISC1
See GSM 03.78
CAMEL_OCH_ MSC_DISC2
See GSM 03.78
Result= Reconnect?
Yes
No
Result= CAMEL handling?
Yes
Yes
Result= CAMEL handling?
3
No
No
Release
Release transaction
Release

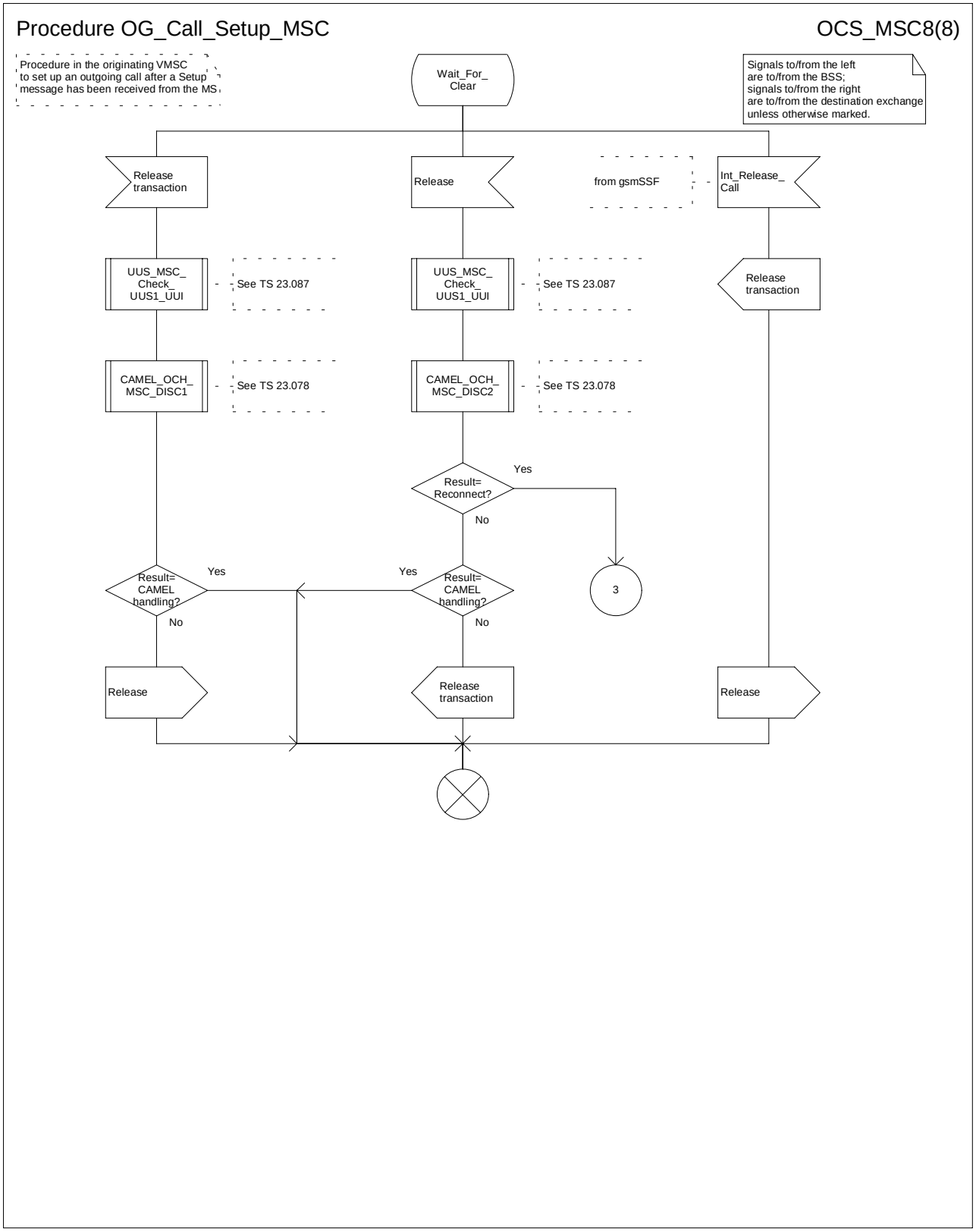


Figure 8h: Procedure Outgoing_Call_Setup _MSC (sheet 8)

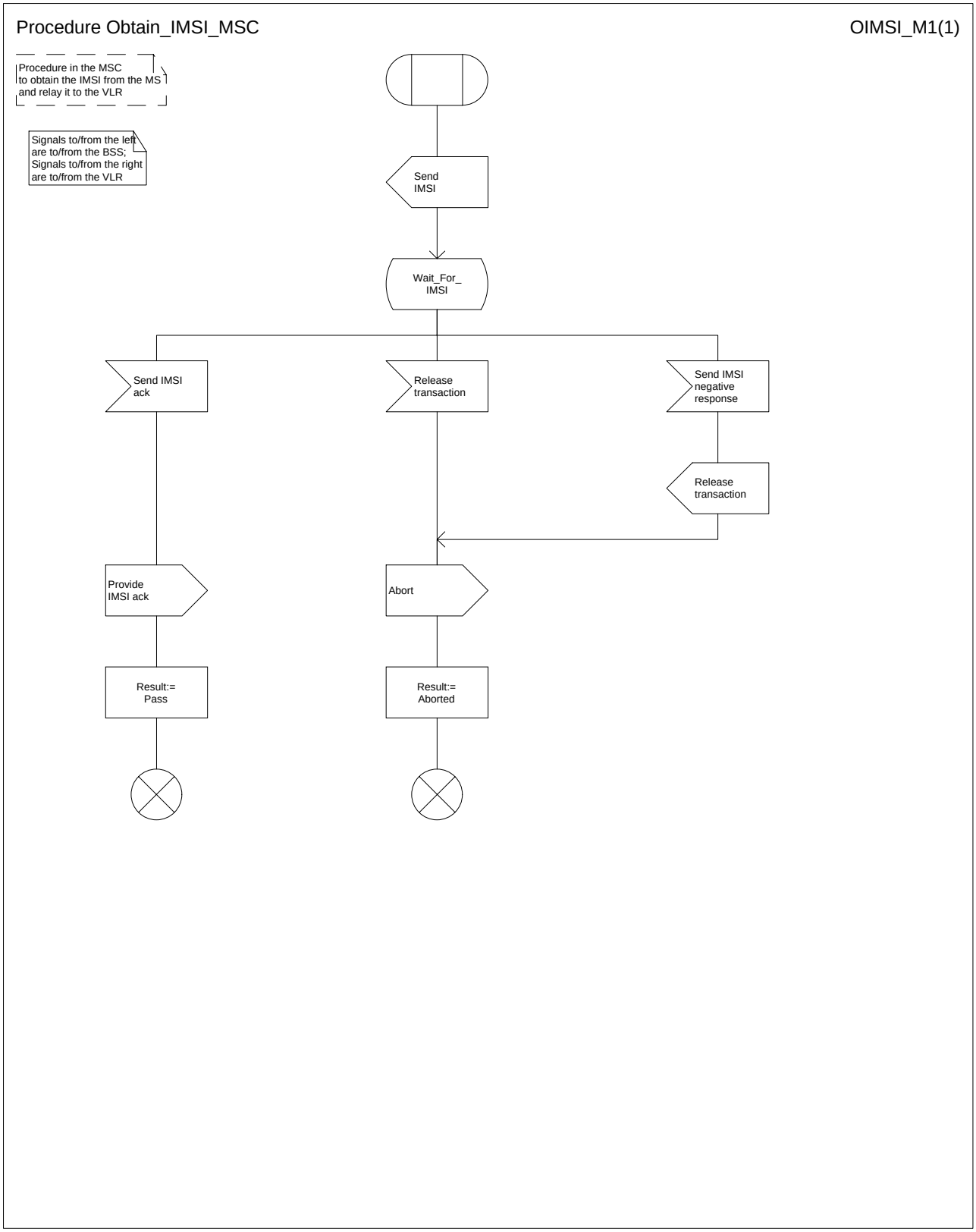


Figure 9: Procedure Obtain_IMSI_MSC

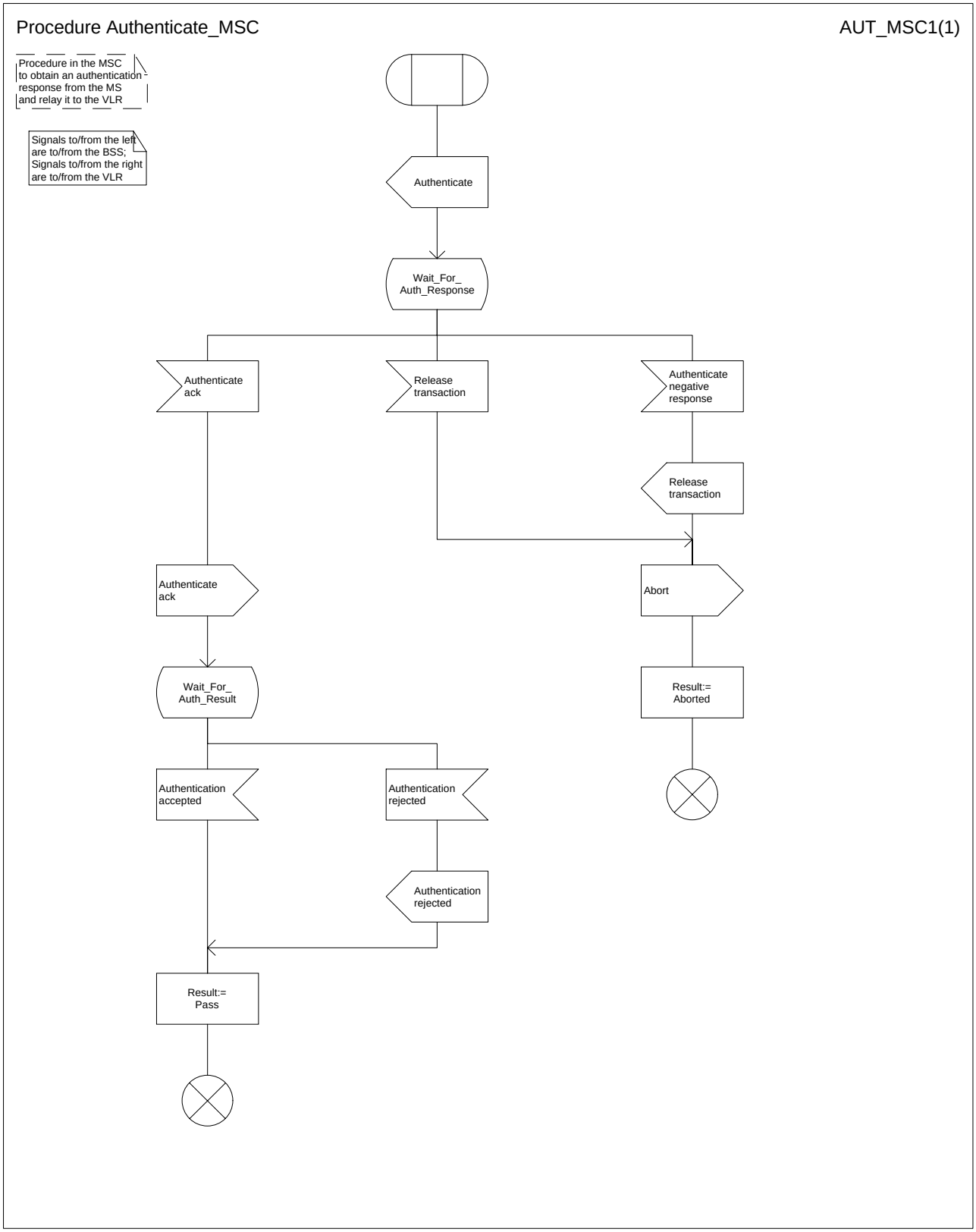


Figure 10: Procedure Authenticate_MSC

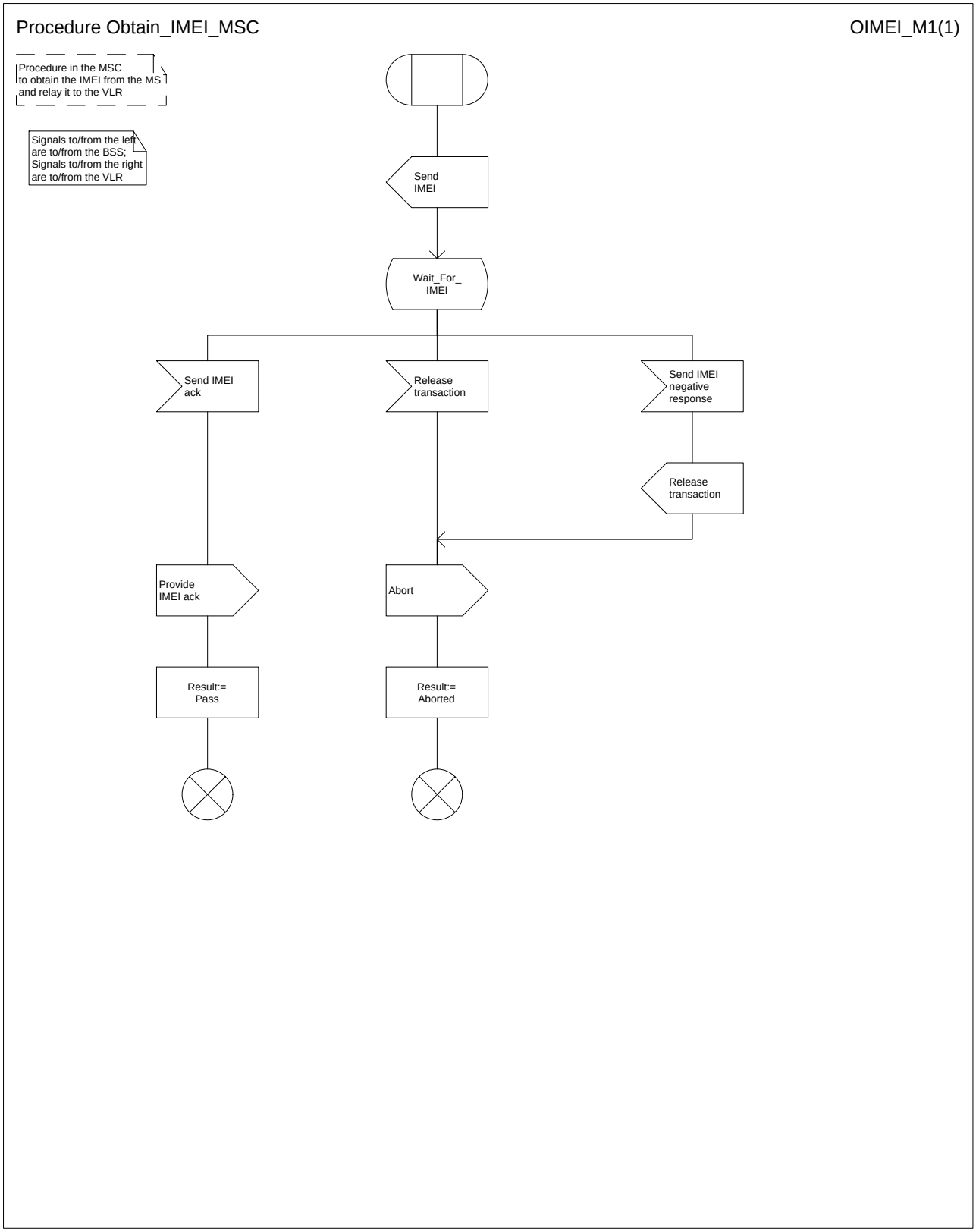


Figure 11: Procedure Obtain_IMEI_MSC

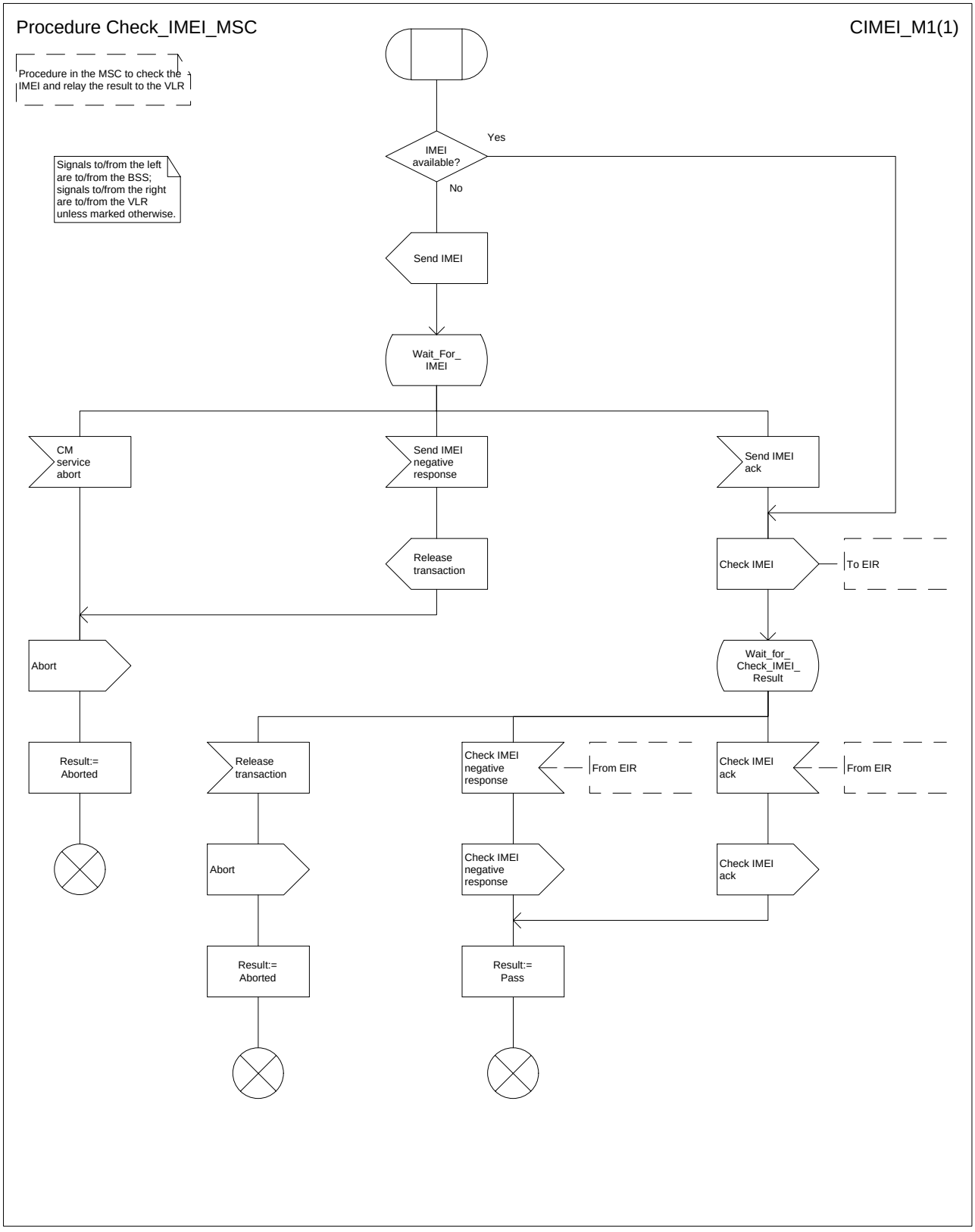


Figure 12: Procedure Check_IMEI_MSC

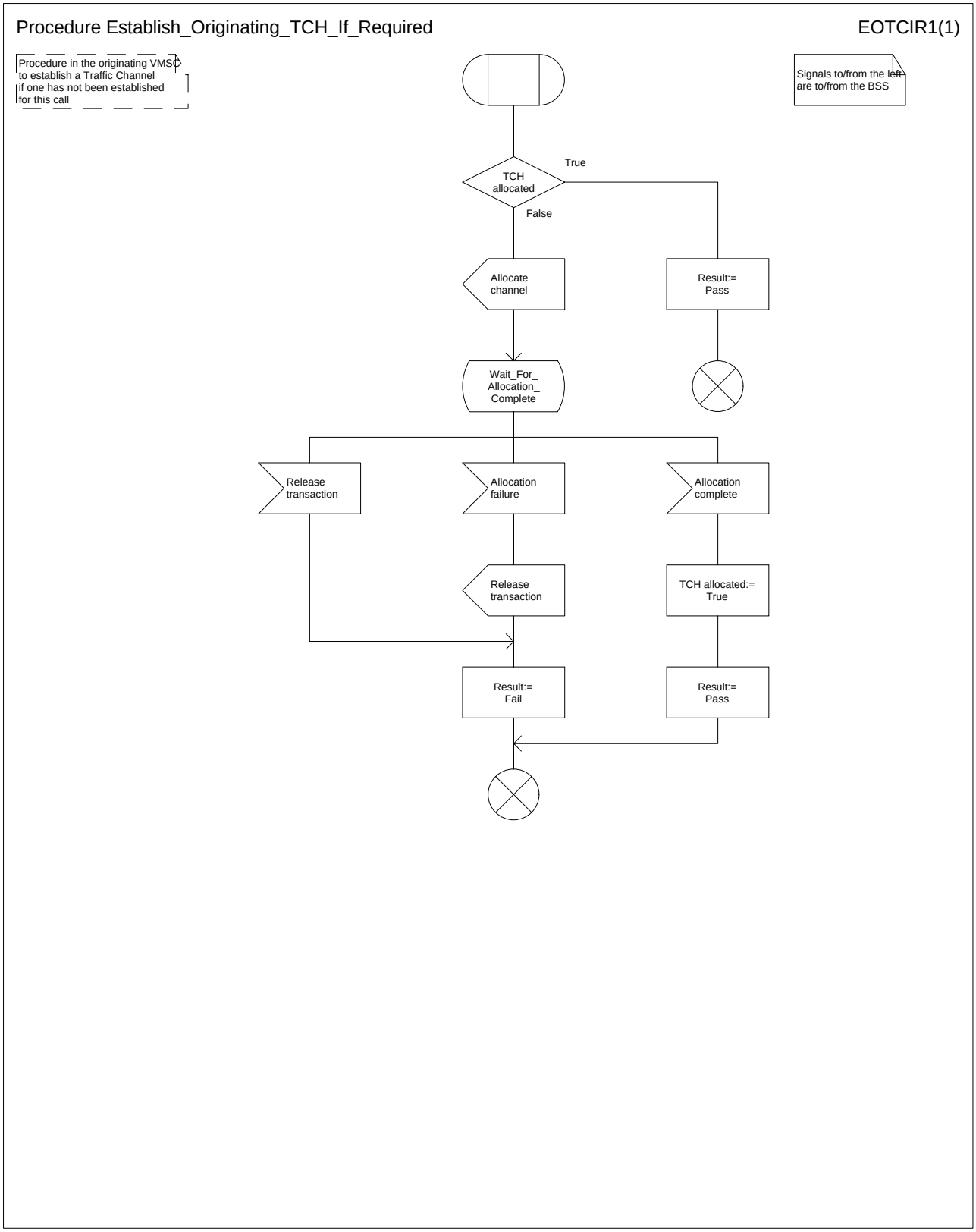


Figure 13: Procedure Establish_Originating_TCH_If_Required

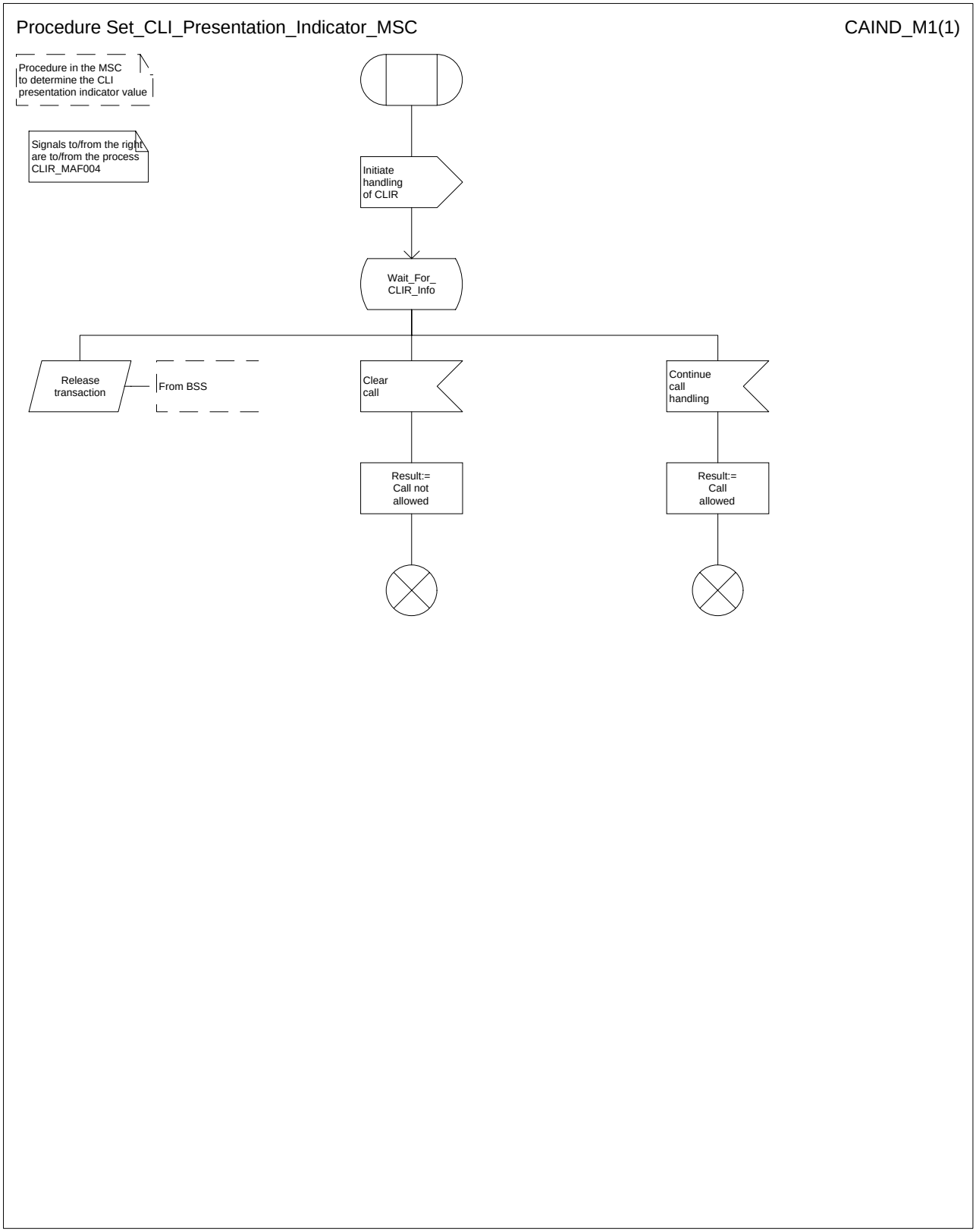
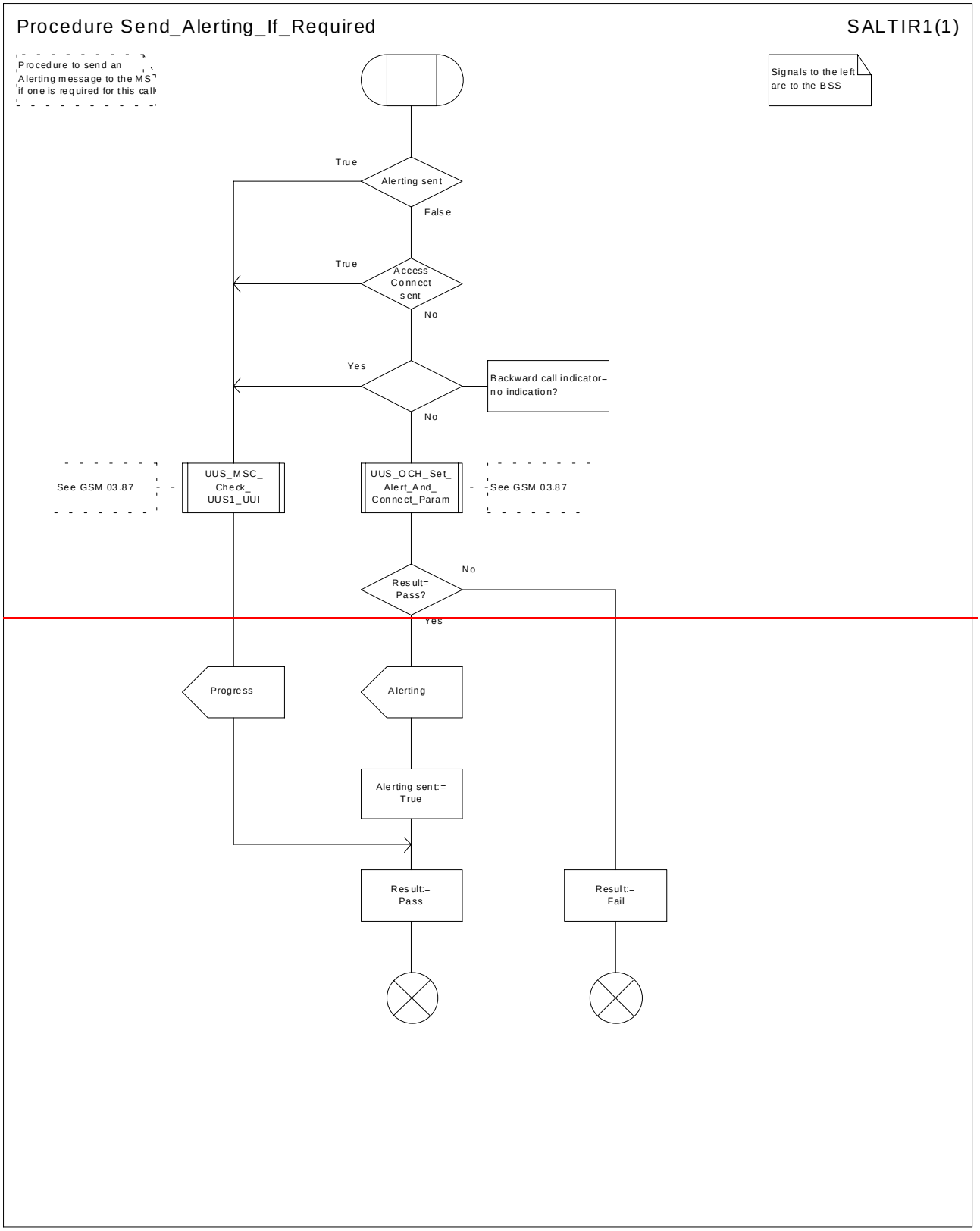


Figure 14: Procedure Set_CLI_Presentation_Indicator_MSC


Procedure Send_Alerting_If_Required
SALTIR1(1)
Procedure to send an Alerting message to the MS if one is required for this call
Signals to the left are to the BSS
Alerting sent
True
False
Access Connect sent
True
No
Yes
Backward call indicator= no indication?
No
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
UUS_OCH_Set_ Alert_And_ Connect_Param
See GSM 03.87
Result= Pass?
No
Yes
Progress
Alerting
Alerting sent:= True
Result:= Pass
Result:= Fail

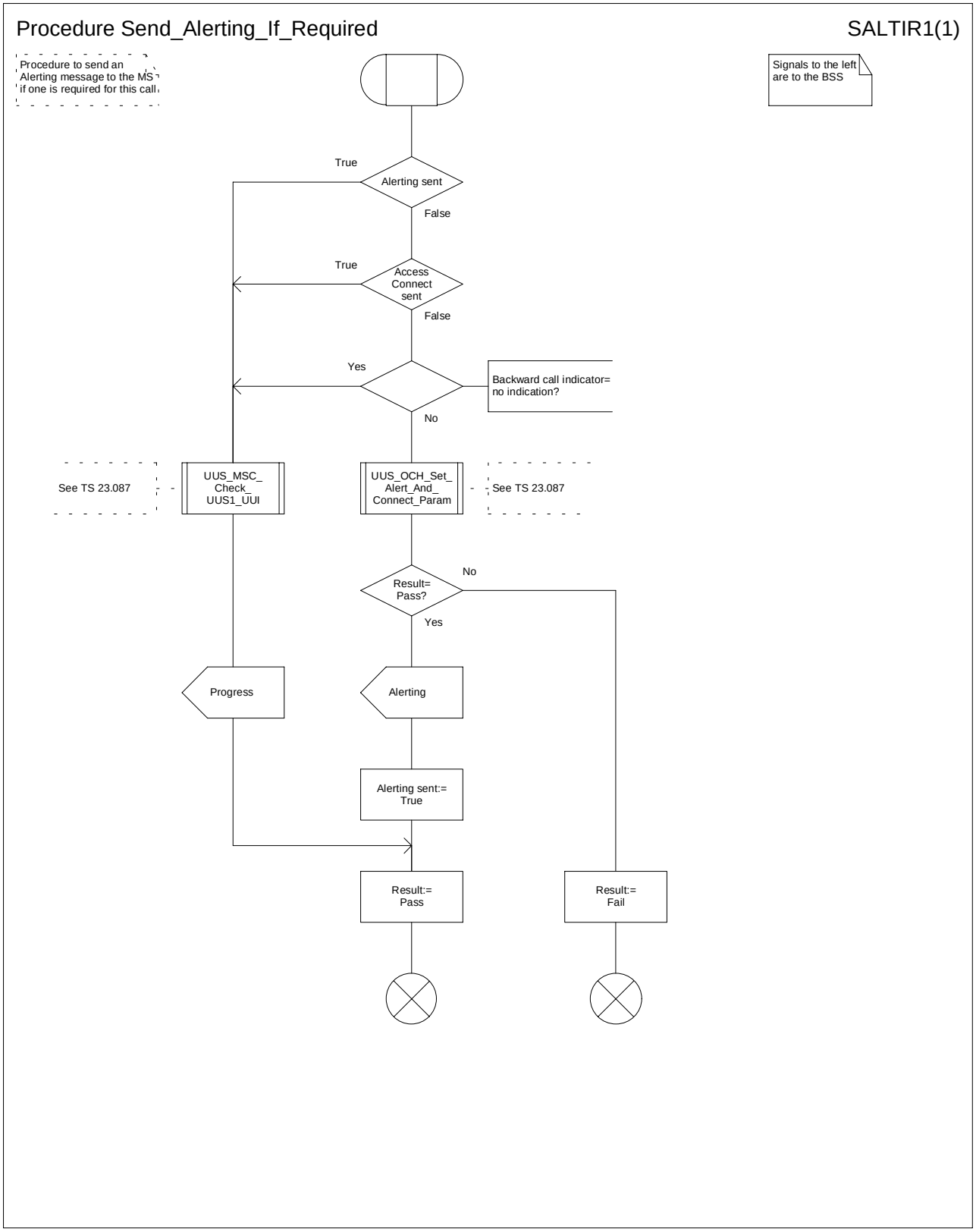


Figure 15: Procedure Send_Alerting_If_Required

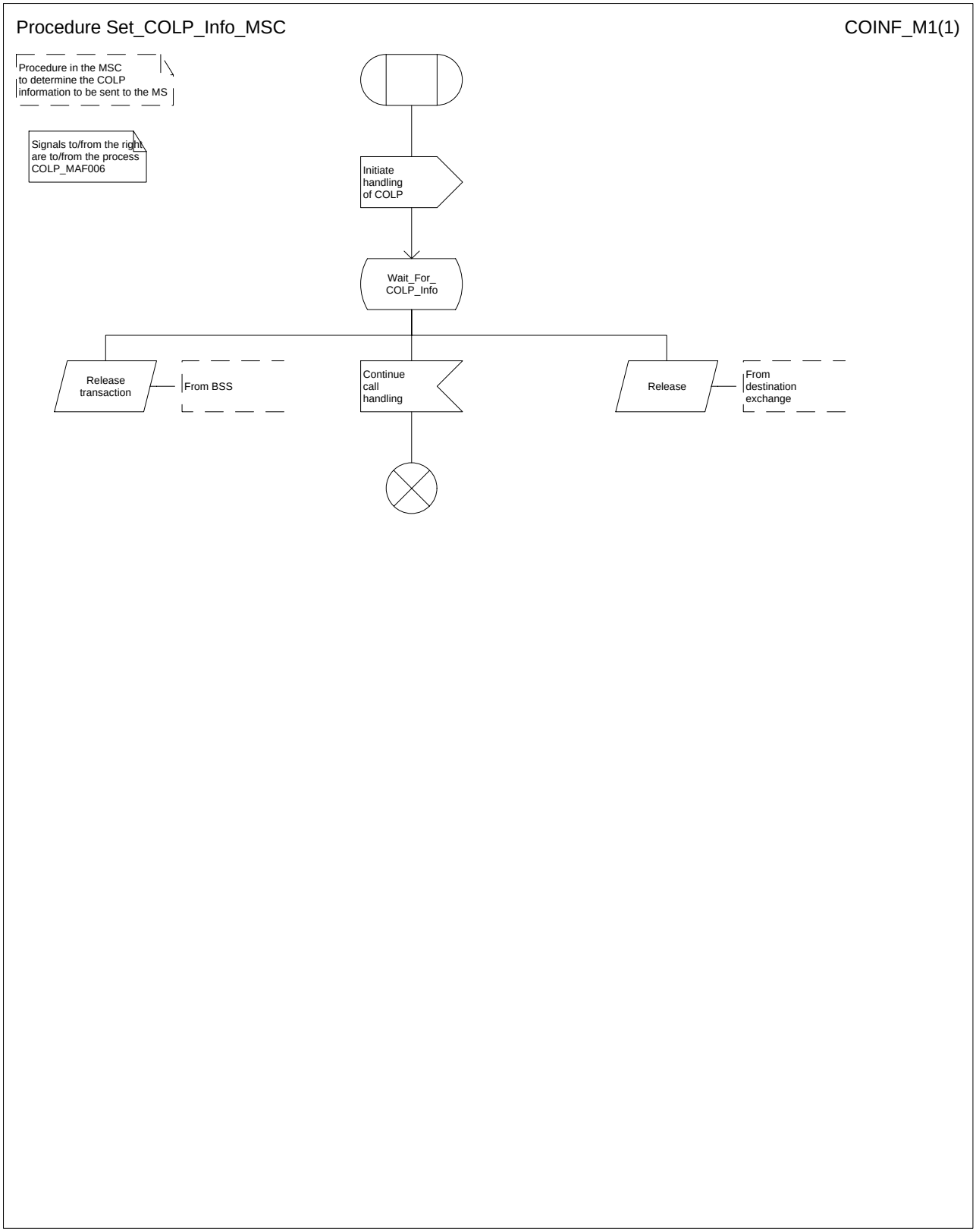


Figure 16: Procedure Set_COLP_Info_MSC

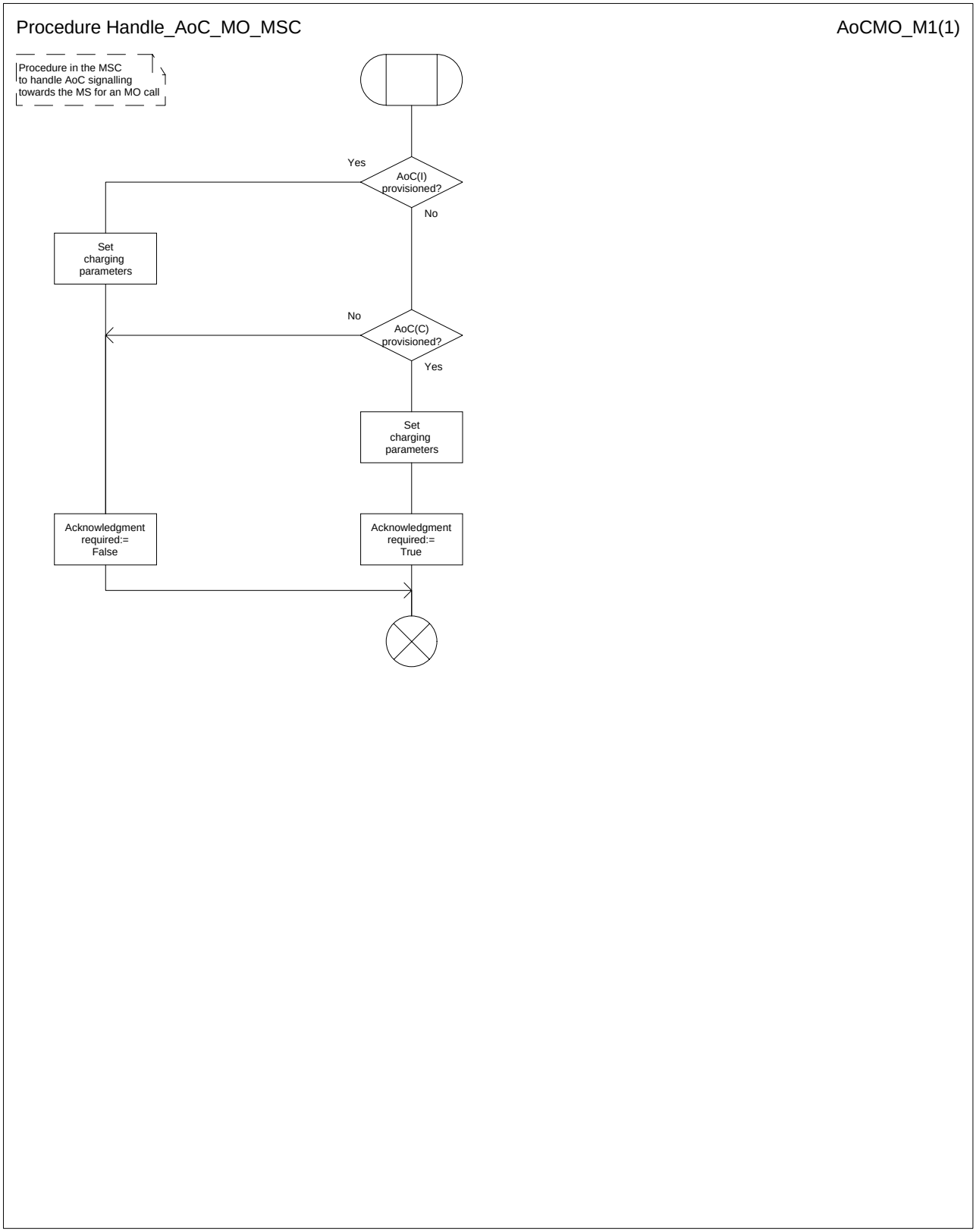
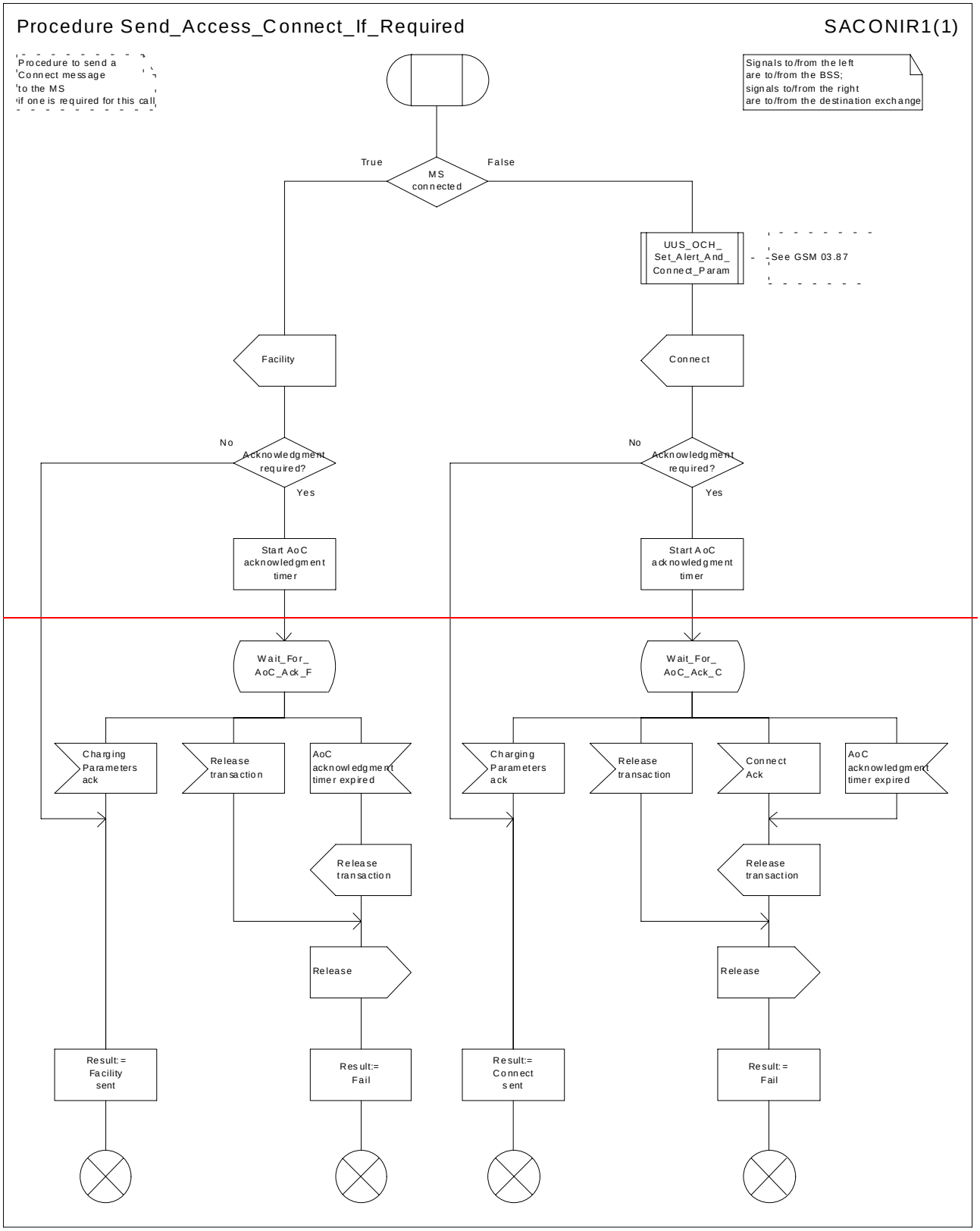


Figure 17: Procedure Handle_AoC_MO_MSC


Procedure Send_Access_Connect_If_Required
SACONIR1(1)
Procedure to send a Connect message to the MS if one is required for this call
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the destination exchange
True
False
MS connected
UUS_OCH_ Set_Alert_And_ Connect_Param
See GSM 03.87
Facility
Connect
No
Acknowledgment required?
Yes
Start AoC acknowledgment timer
Wait_For_ AoC_Ack_F
Wait_For_ AoC_Ack_C
Charging Parameters ack
Release transaction
AoC acknowledgment timer expired
Connect Ack
Release
Result:= Facility sent
Result:= Fail
Result:= Connect sent

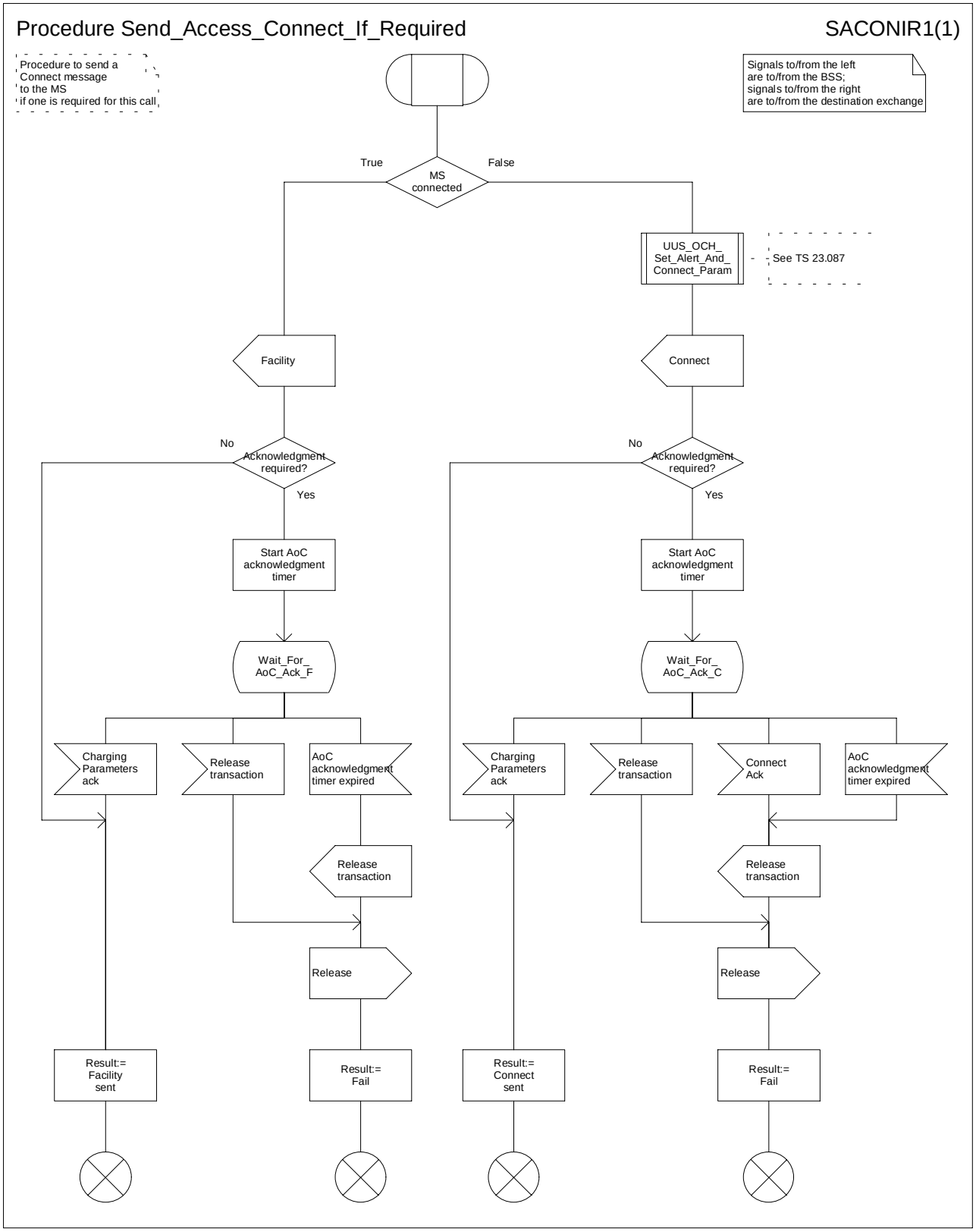


Figure 18: Procedure Send_Access_Connect_If_Required

7.1.2 Functional requirements of VLR

7.1.2.1 Process OCH_VLR

7.1.2.2 Procedure Process_Access_Request_VLR

Sheet 1: it is a network operator decision (subject to MoU requirements) how often an MS should be authenticated.

Sheet 2: the processes Update_Location_VLR and Subscriber_Present_VLR are described in ~~GSM TS 09.02~~23.012 [26].

Sheet 2: it is a network operator decision (subject to MoU requirements) whether a GSM connection should be ciphered. A UMTS connection shall always be ciphered [ffs].

Sheet 3: it is a network operator decision (subject to MoU requirements) how often an IMEI should be checked.

Sheet 3, sheet 4, sheet 5: the procedure CCBS_Report_MS_Activity is specific to CCBS; it is specified in ~~GSM TS 03.~~23.093 [42].

Sheet 5: it is a network operator decision whether emergency calls are allowed from an ME with no SIM.

7.1.2.3 Procedure OG_Call_Subscription_Check_VLR

Sheet 1: it is an implementation option to carry out the check for operator determined barring of all outgoing calls before the check on provisioning of the requested basic service.

Sheet 1: the procedure OG_CUG_Check is specific to CUG. If the VLR does not support CUG, processing continues from the "Yes" exit of the test "Result=Call allowed?".

Sheet 1: the procedure Get_LI_Subscription_Info_MO_VLR is specific to CLIR and COLP. If the VLR supports neither CLIR nor COLP, the procedure call is omitted.

Sheet 1: the procedure Get_AoC_Subscription_Info_VLR is specific to AoC.

Sheet 1: the procedure UUS_OCH_Check_Provision is specific to UUS; it is specified in ~~GSM TS 03.~~23.087 [40]. If the VMSC does not support UUS, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2: the procedure CAMEL_OCH_VLR is specific to CAMEL; it is specified in ~~GSM TS 03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the VLR does not support CAMEL, processing continues from connector 1 to the call to the procedure Check_OG_Barring.

Sheet 2: the negative response "call barred" indicates whether the reason is operator determined barring or supplementary service barring, according to the result returned by the procedure Check_OG_Barring.

7.1.2.4 Procedure Obtain_Identity_VLR

It is a network operator decision whether open (unciphered) identification of the MS by its IMSI is allowed.

7.1.2.5 Procedure Obtain_IMSI_VLR

7.1.2.6 Procedure Authenticate_VLR

Sheet 1: the number of unused authentication sets which triggers the VLR to request further authentication sets from the HLR is an operator option.

7.1.2.7 Procedure Obtain_Authentication_Sets_VLR

7.1.2.8 Procedure Start_Tracing_VLR

7.1.2.9 Procedure Check_IMEI _VLR

If the response from the EIR to a request to check an IMEI is:

- blacklisted, then service is not granted;
- greylisted, then service is granted, but the network operator may decide to initiate tracing;
- whitelisted, then service is granted.

7.1.2.10 Procedure Obtain_IMEI _VLR

7.1.2.11 Process Fetch_Authentication_Sets_VLR

7.1.2.12 Procedure Check_BAOC

Sheet 1: if the VLR receives an Abort message from the MSC while it is awaiting a response from the process MAF017, the message is saved for handling after return from the procedure.

7.1.2.13 Procedure OG_CUG_Check

If the VLR receives an Abort message from the MSC while it is awaiting a response from the process MAF014, the message is saved for handling after return from the procedure.

7.1.2.14 Procedure Get_LI_Subscription_Info_MO_VLR

If the VLR does not support CLIR, it omits the signal interchange with the process CLIR_MAF003.

If the VLR does not support COLP, it omits the signal interchange with the process COLP_MAF005.

If the VLR receives an Abort message from the MSC while it is awaiting a response from the process CLIR_MAF003 or the process COLP_MAF005, the message is saved for handling after return from the procedure.

7.1.2.15 Procedure Get_AoC_Subscription_Info_VLR

The indicator of whether or not AoC is provisioned is global data which can be read by the parent process.

7.1.2.16 Procedure Check_OG_Barring

Sheet 3: if the VLR receives an Abort message from the MSC while it is awaiting a response from the process MAF018 or MAF019, the message is saved for handling after return from the procedure.

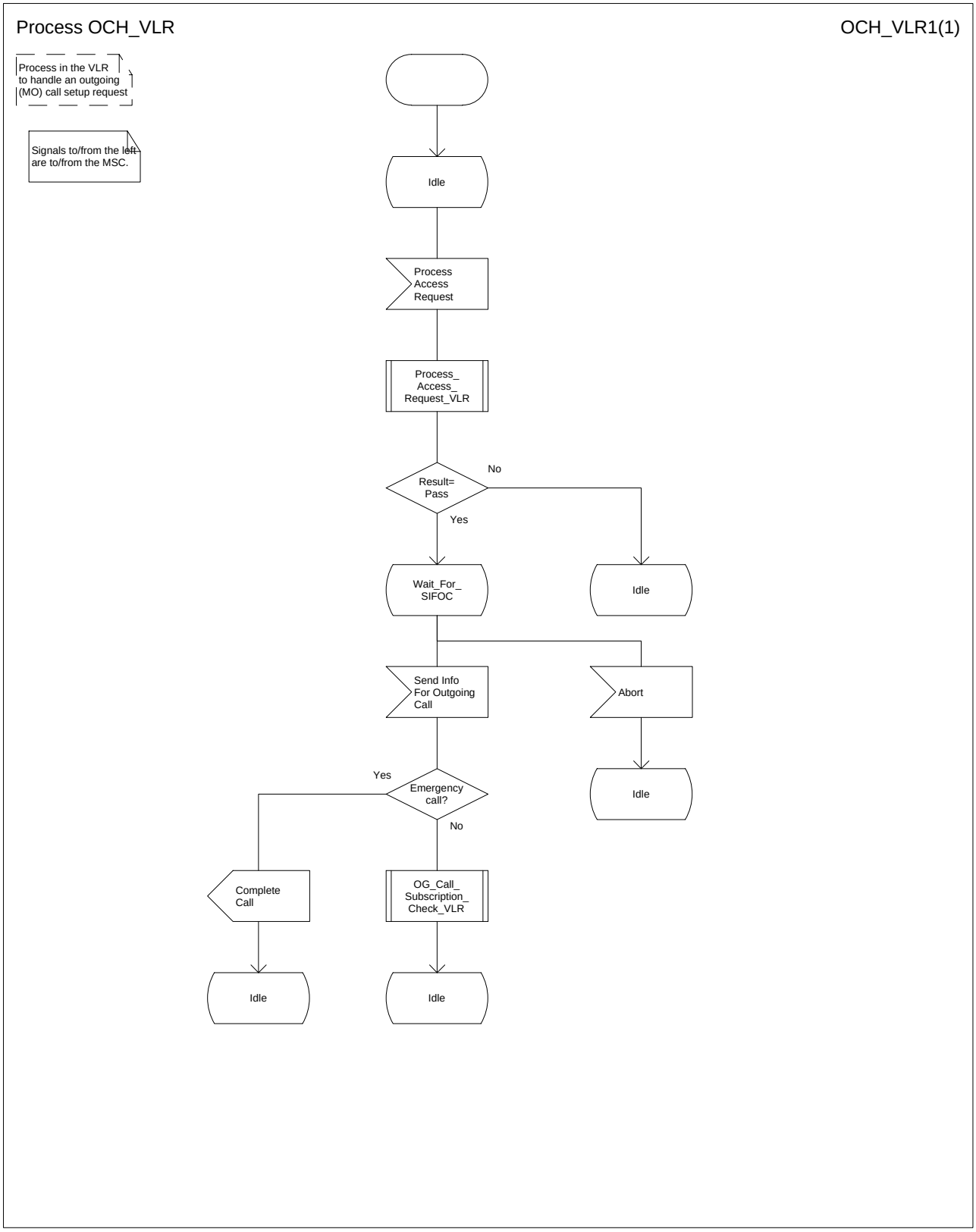


Figure 19: Process OCH_VLR

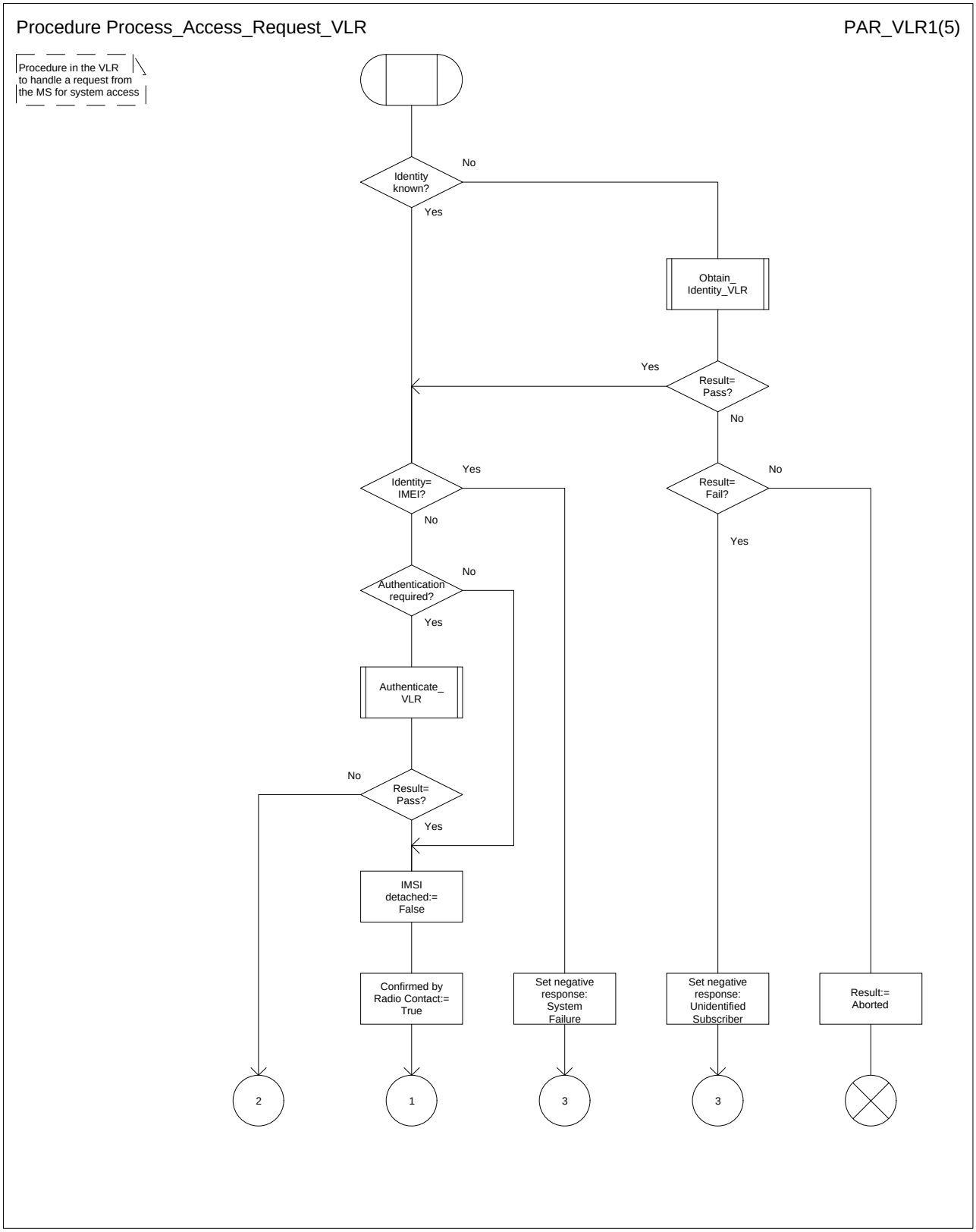
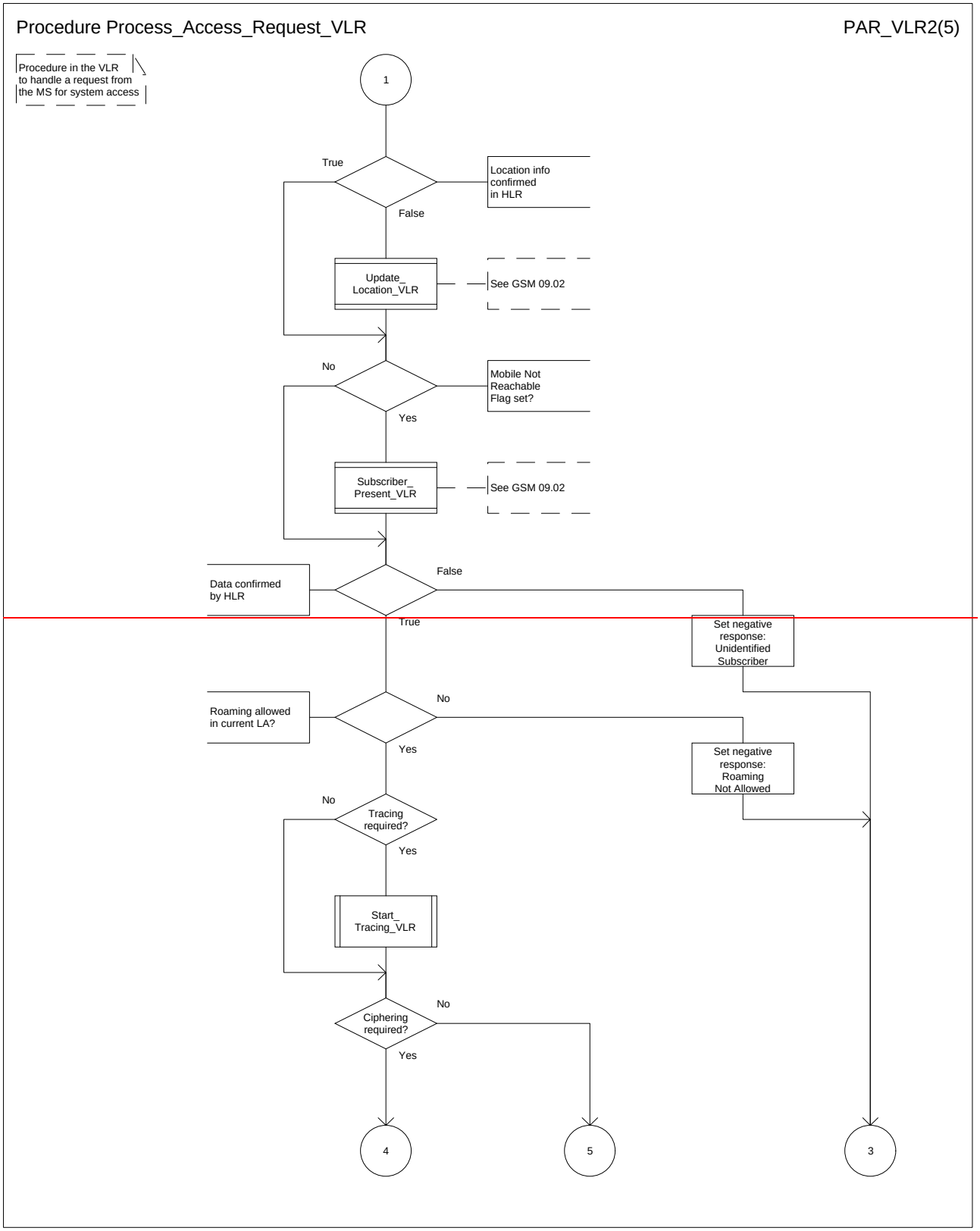


Figure 20a: Procedure Process_Access_Request_VLR (sheet 1)


Procedure Process_Access_Request_VLR
PAR_VLR2(5)
Procedure in the VLR to handle a request from the MS for system access
1
True
Location info confirmed in HLR
False
Update_ Location_VLR
See GSM 09.02
No
Mobile Not Reachable Flag set?
Yes
Subscriber_ Present_VLR
See GSM 09.02
Data confirmed by HLR
False
True
Set negative response: Unidentified Subscriber
Roaming allowed in current LA?
No
Yes
Set negative response: Roaming Not Allowed
No
Tracing required?
Yes
Start_ Tracing_VLR
No
Ciphering required?
Yes
4
5
3

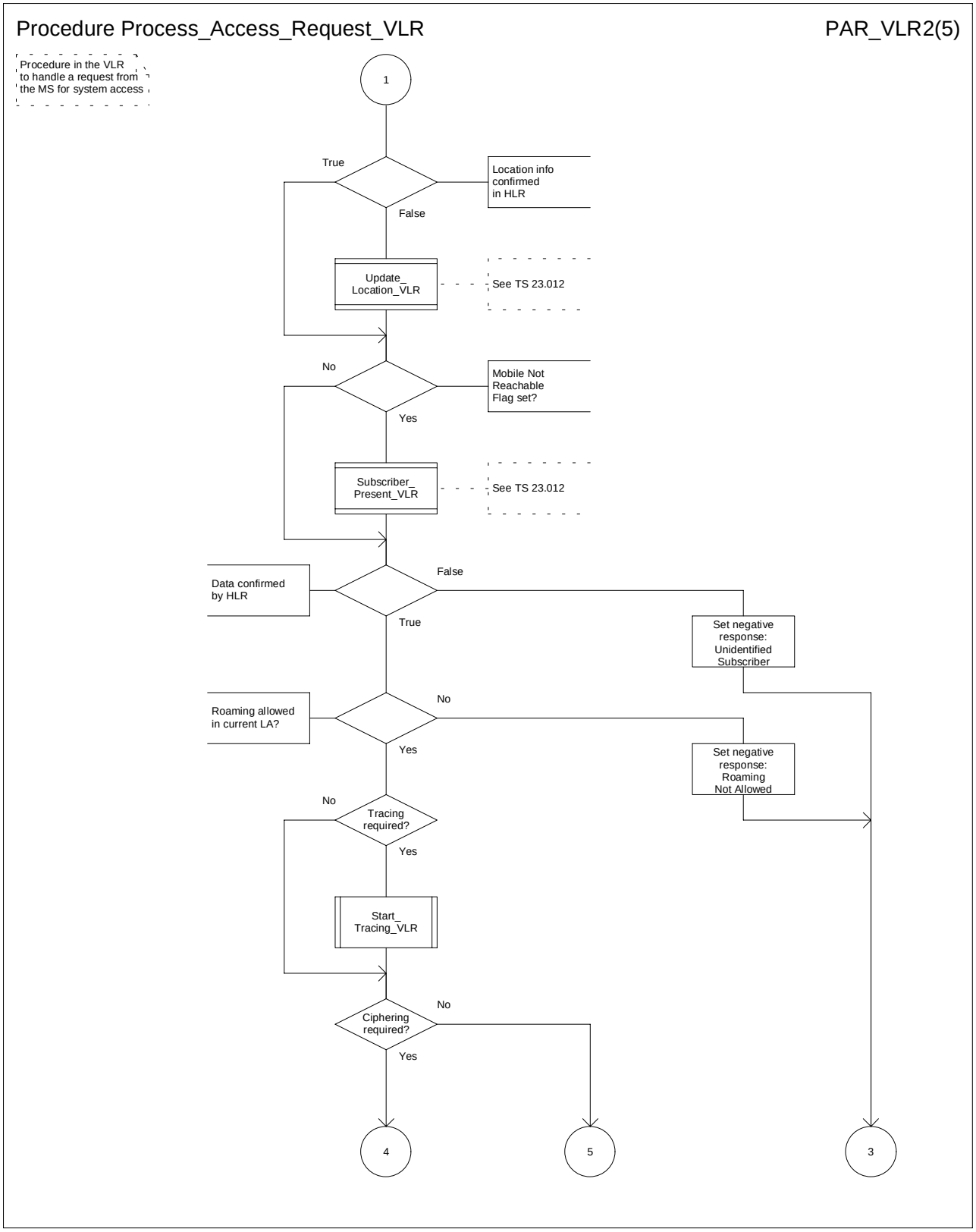
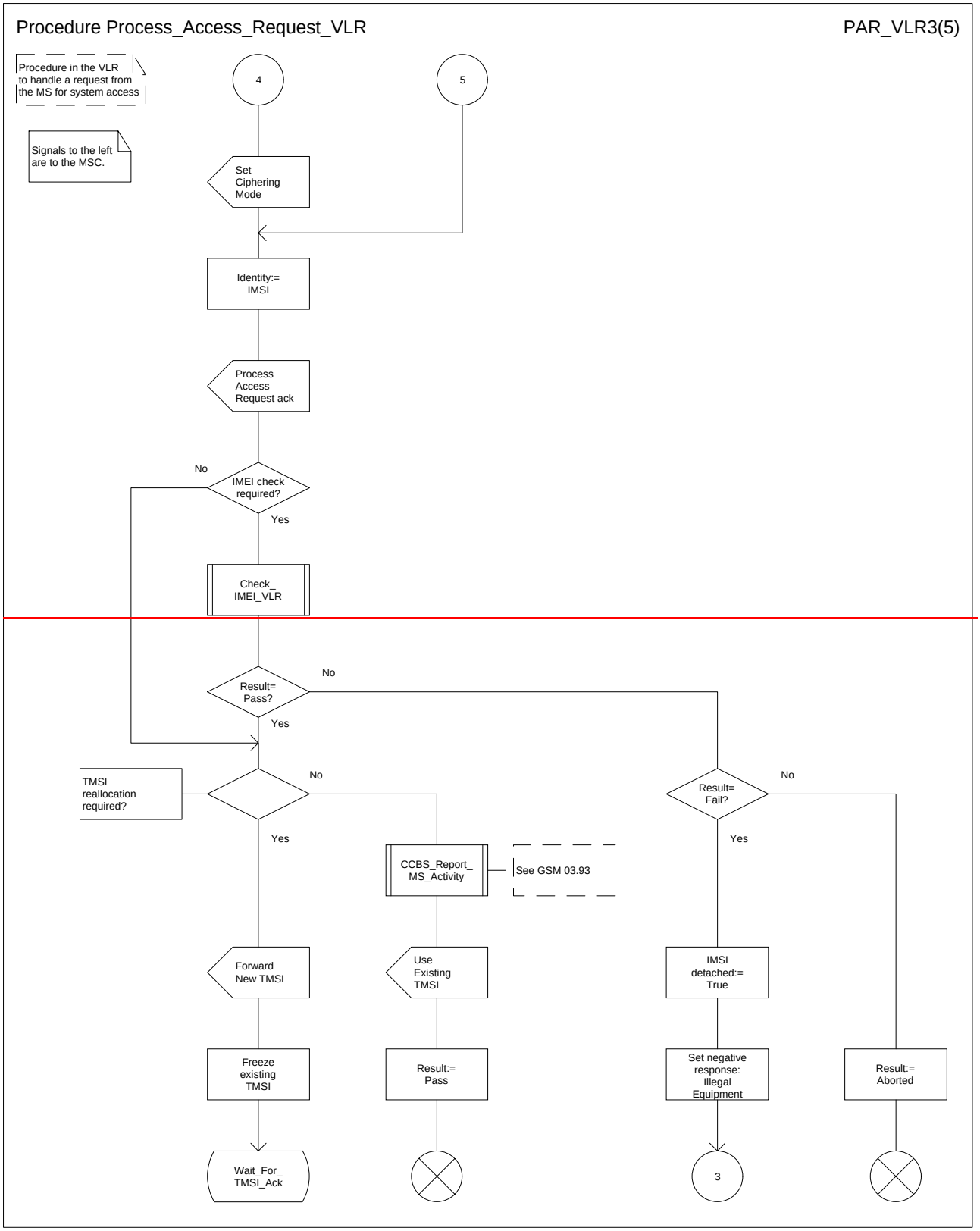


Figure 20b: Procedure Process_Access_Request_VLR (sheet 2)


Procedure Process_Access_Request_VLR
PAR_VLR3(5)
Procedure in the VLR to handle a request from the MS for system access
Signals to the left are to the MSC.
4
5
Set Ciphering Mode
Identity:= IMSI
Process Access Request ack
No
IMEI check required?
Yes
Check_ IMEI_VLR
No
Result= Pass?
Yes
TMSI reallocation required?
No
Yes
CCBS_Report_ MS_Activity
See GSM 03.93
Result= Fail?
No
Yes
Forward New TMSI
Use Existing TMSI
IMSI detached:= True
Freeze existing TMSI
Result:= Pass
Set negative response: Illegal Equipment
Result:= Aborted
Wait_For_ TMSI_Ack
3

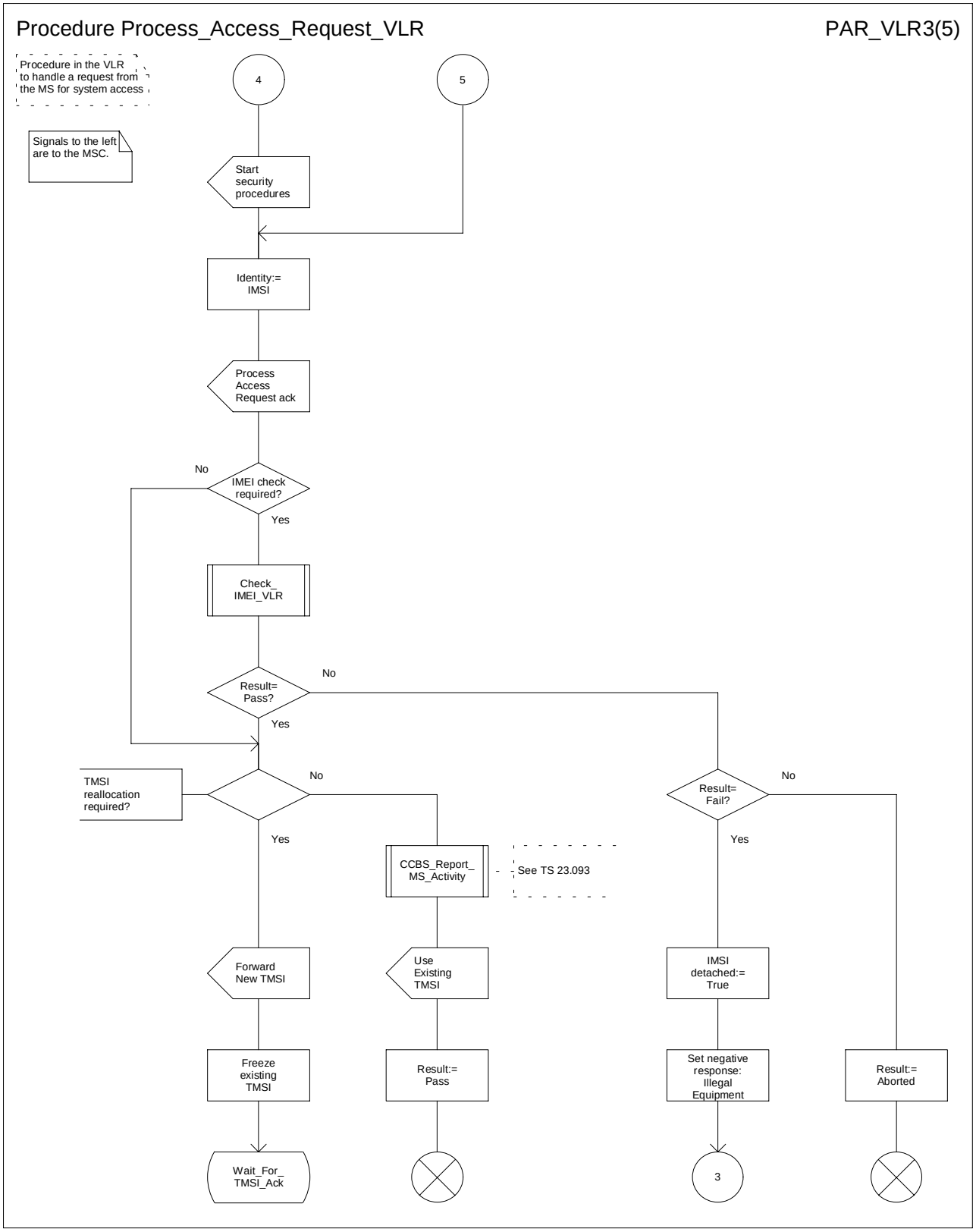
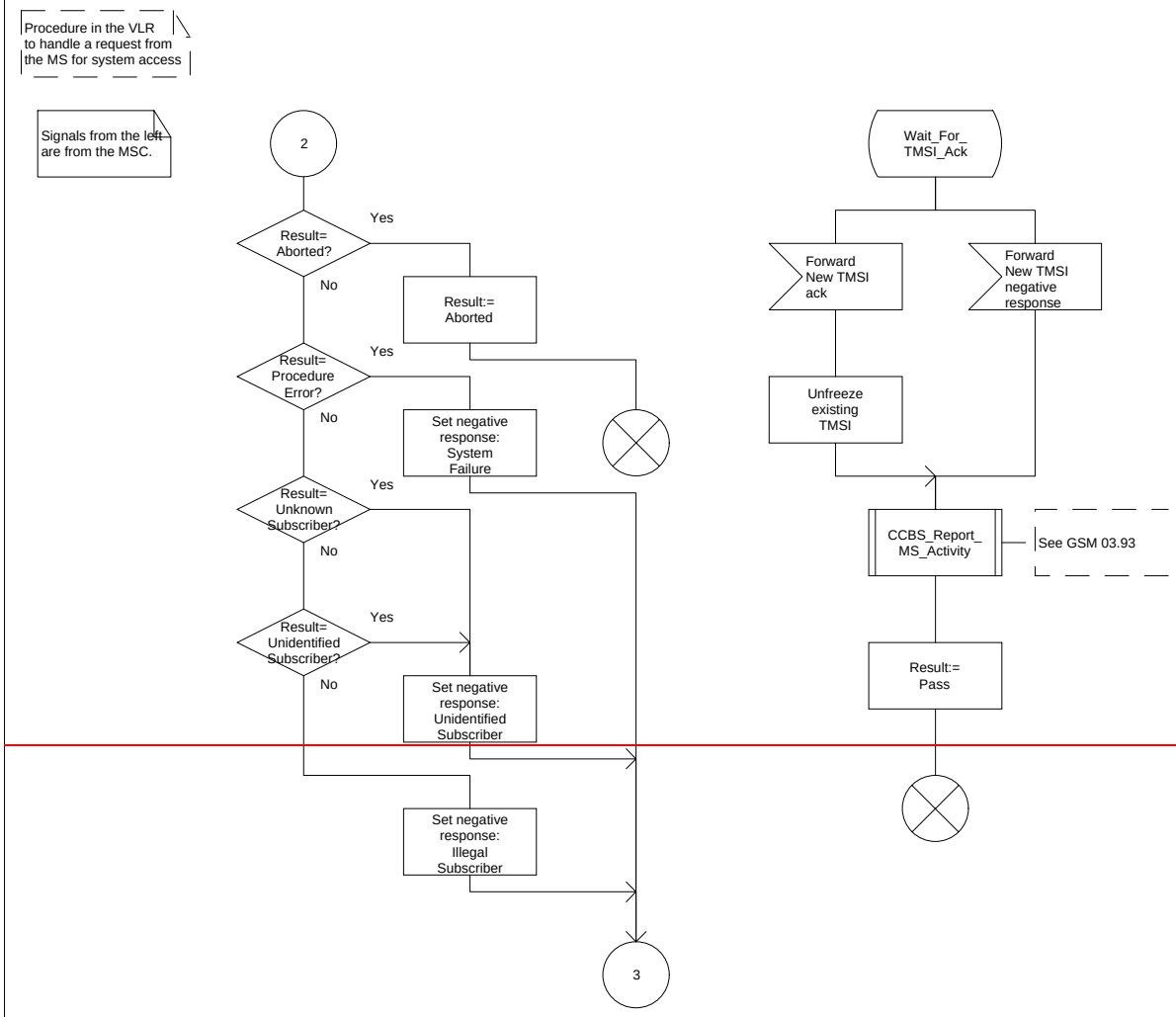


Figure 20c: Procedure Process_Access_Request_VLR (sheet 3)

Procedure Process_Access_Request_VLR PAR_VLR4(5)



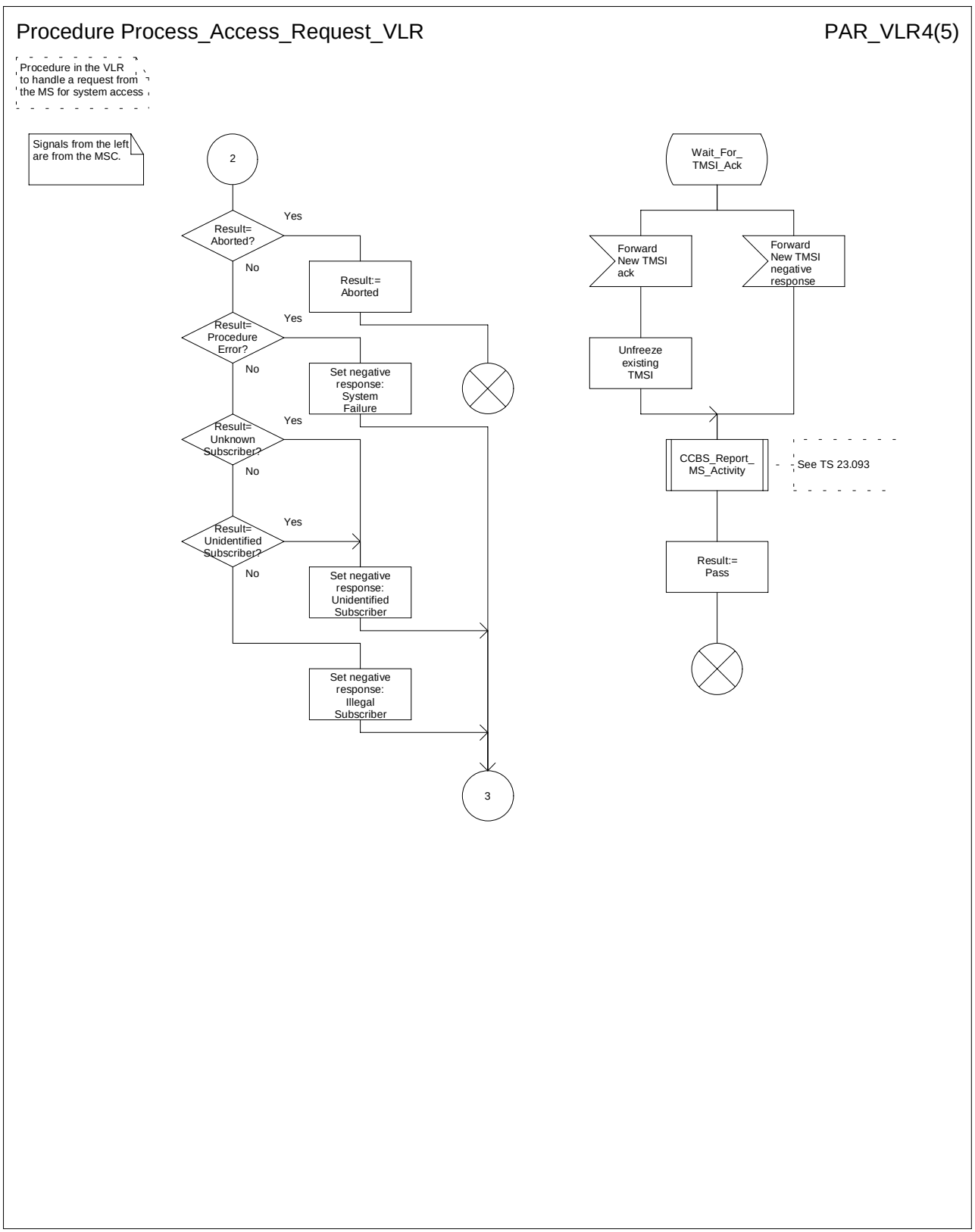
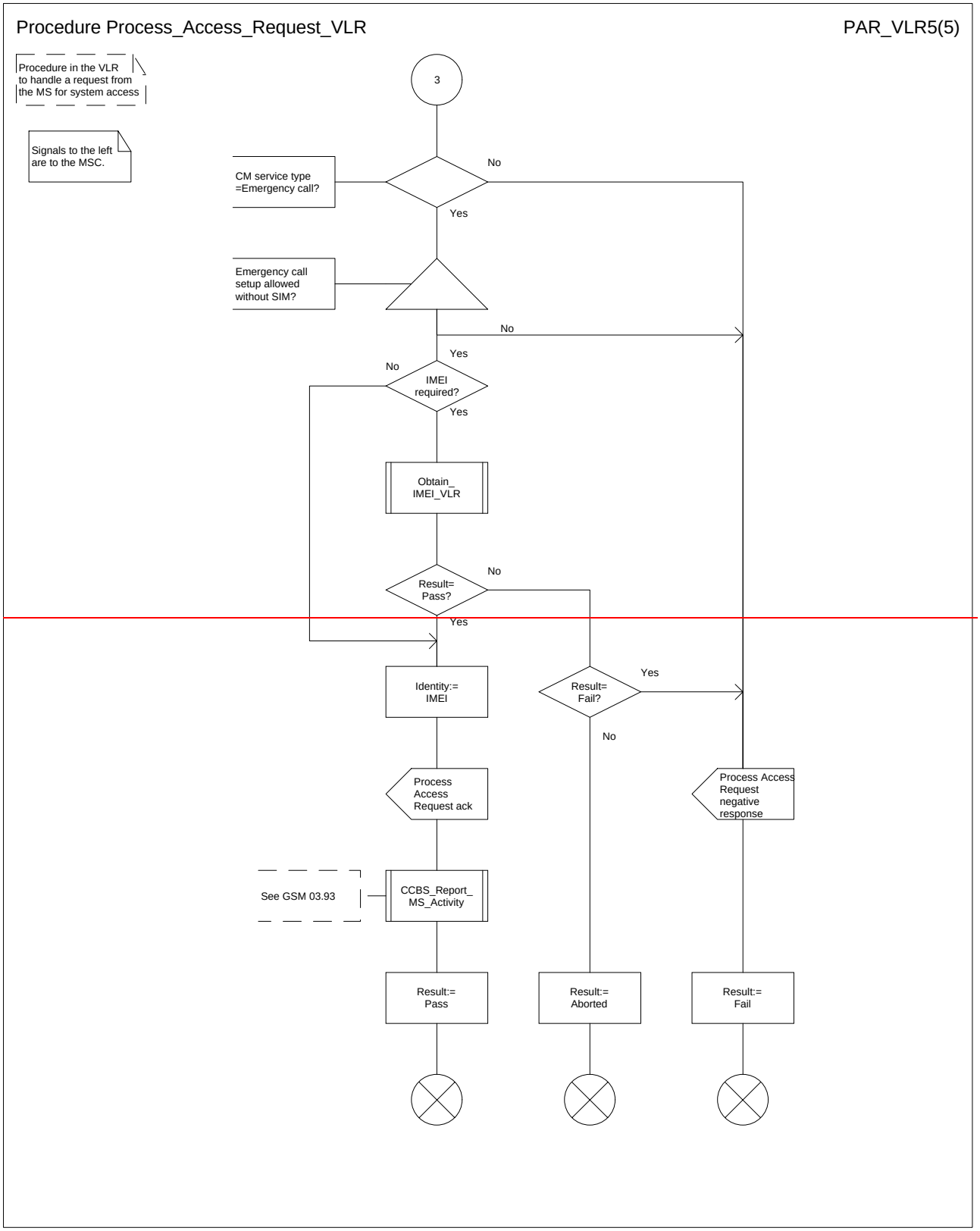


Figure 20d: Procedure Process_Access_Request_VLR (sheet 4)


Procedure Process_Access_Request_VLR
PAR_VLR5(5)
Procedure in the VLR to handle a request from the MS for system access
Signals to the left are to the MSC.
3
CM service type =Emergency call?
No
Yes
Emergency call setup allowed without SIM?
No
Yes
No
IMEI required?
Yes
Obtain_ IMEI_VLR
Result= Pass?
No
Yes
Identity:= IMEI
Result= Fail?
Yes
No
Process Access Request ack
Process Access Request negative response
See GSM 03.93
CCBS_Report_ MS_Activity
Result:= Pass
Result:= Aborted
Result:= Fail

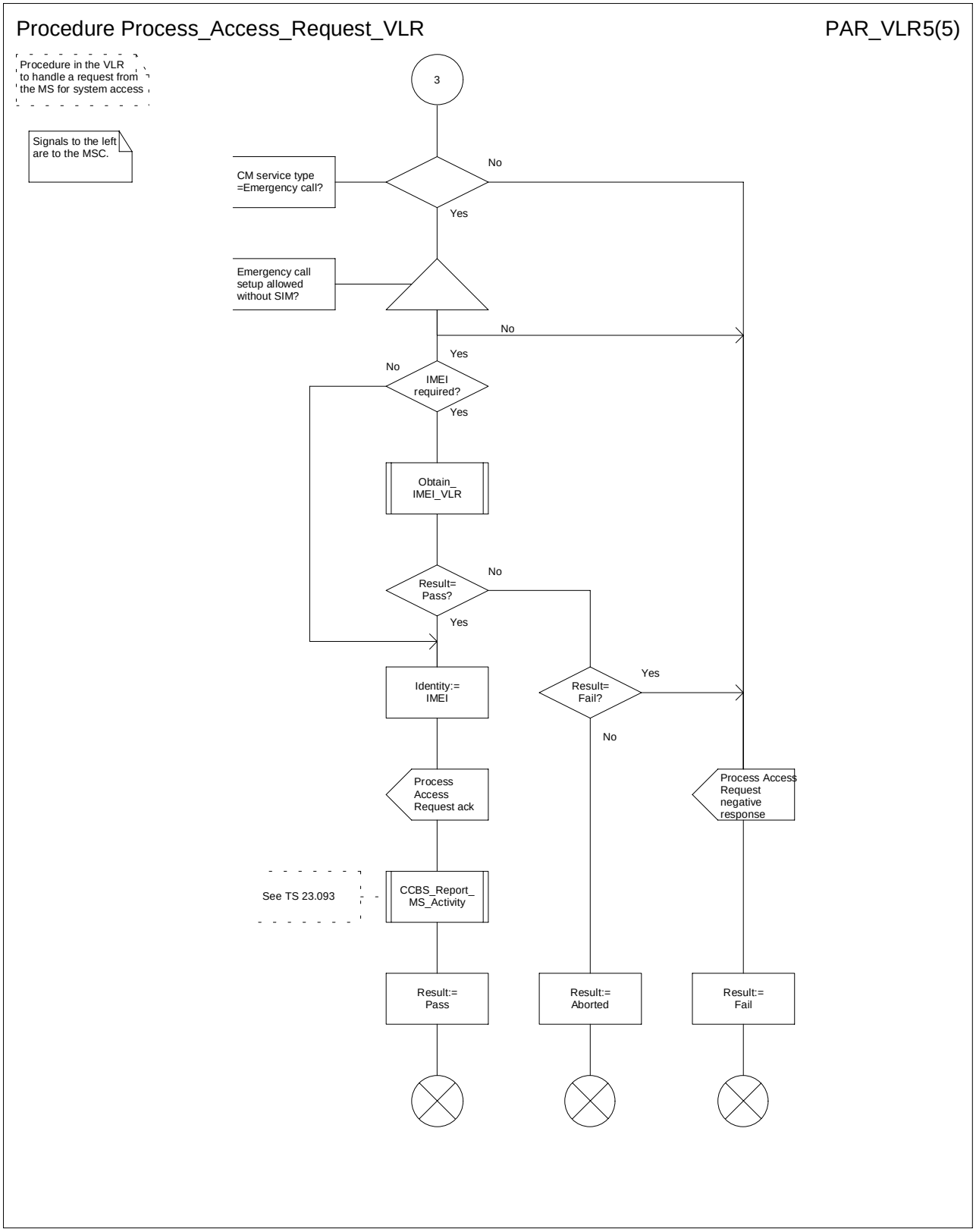


Figure 20e: Procedure Process_Access_Request_VLR (sheet 5)

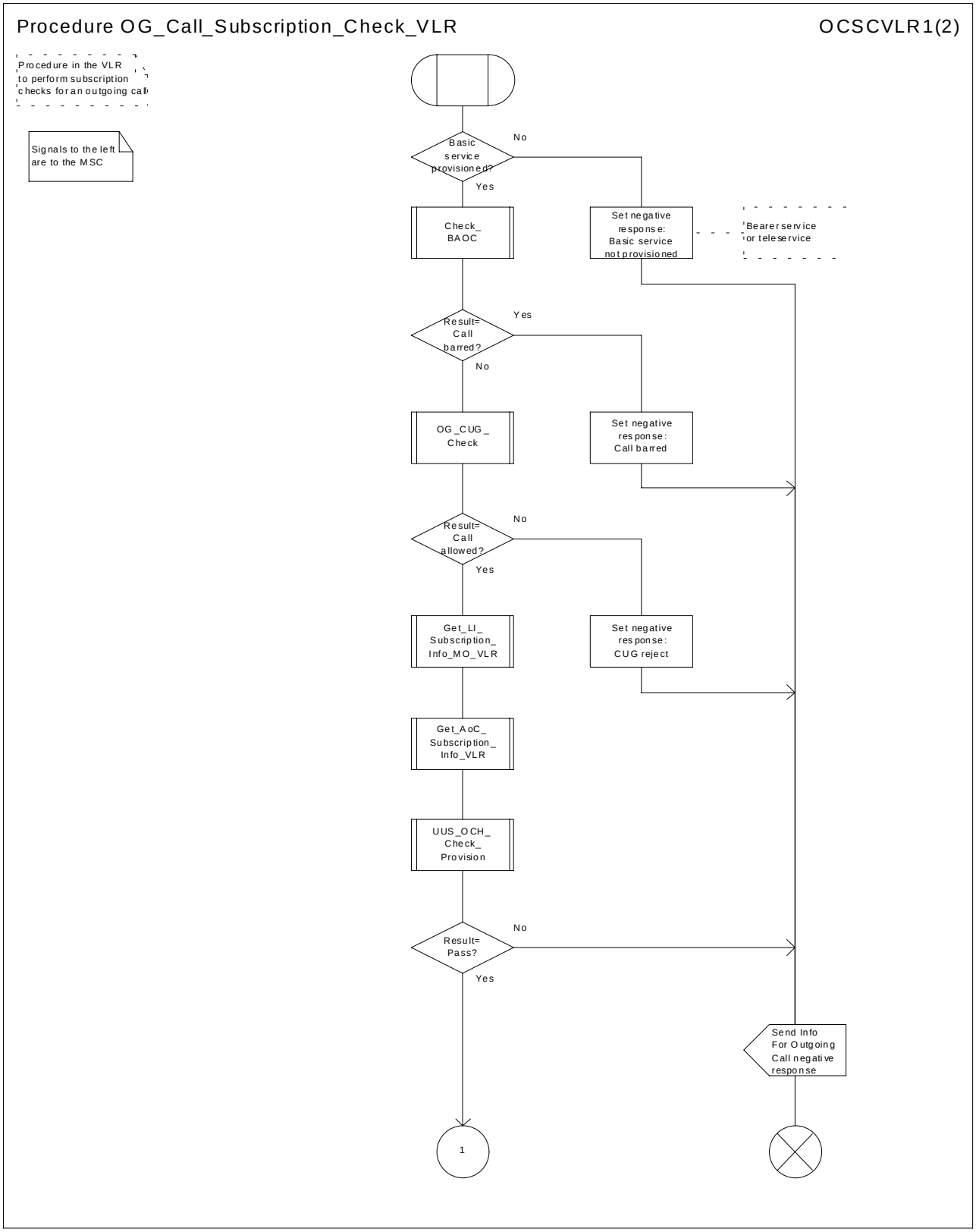
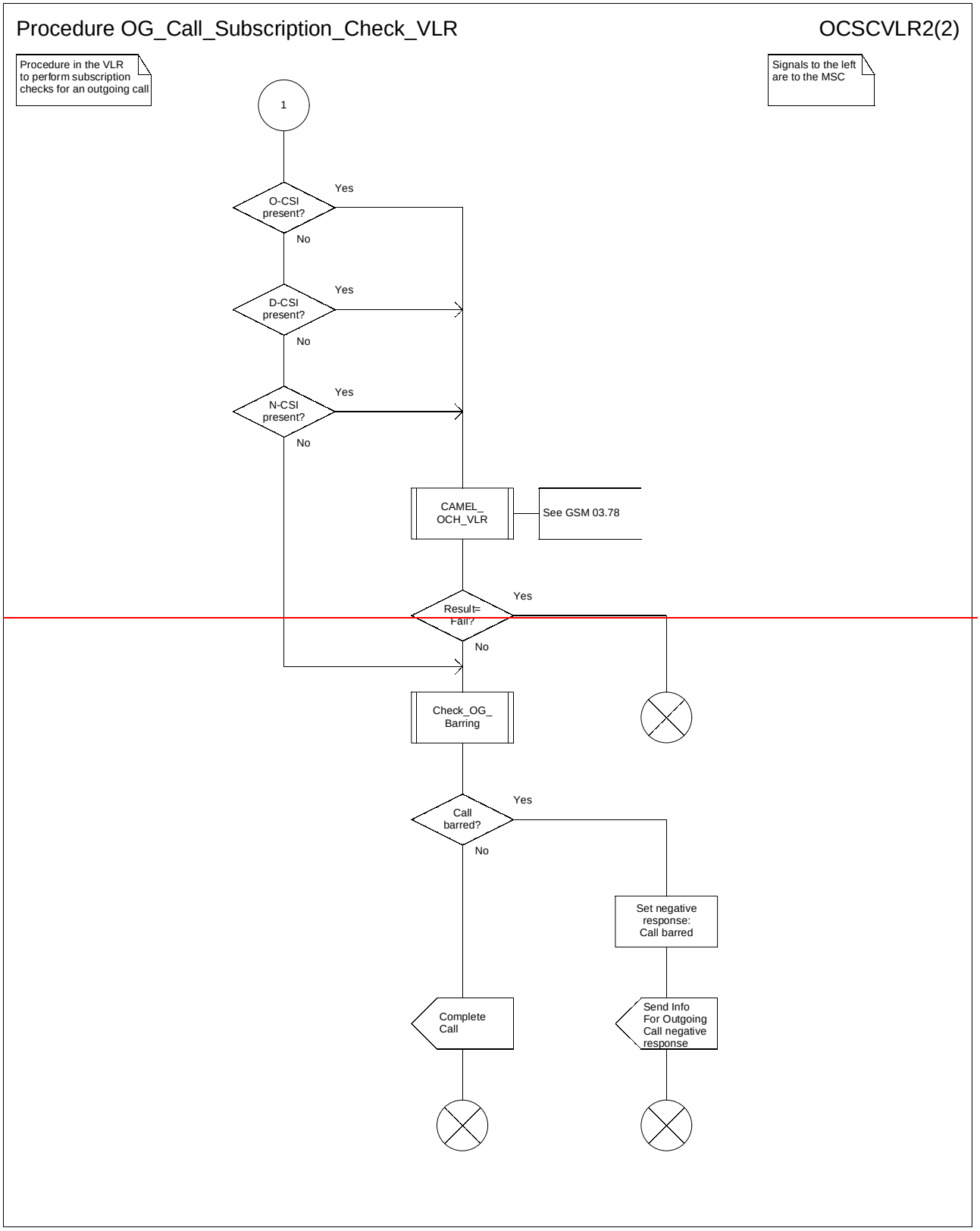


Figure 21a: Procedure OG_Call_Subscription_Check_VLR (sheet 1)


Procedure OG_Call_Subscription_Check_VLR
OCSCVLR2(2)
Procedure in the VLR to perform subscription checks for an outgoing call
Signals to the left are to the MSC
1
O-CSI present?
Yes
No
D-CSI present?
Yes
No
N-CSI present?
Yes
No
CAMEL_ OCH_VLR
See GSM 03.78
Result= Fail?
Yes
No
Check_OG_ Barring
Call barred?
Yes
No
Set negative response: Call barred
Complete Call
Send Info For Outgoing Call negative response

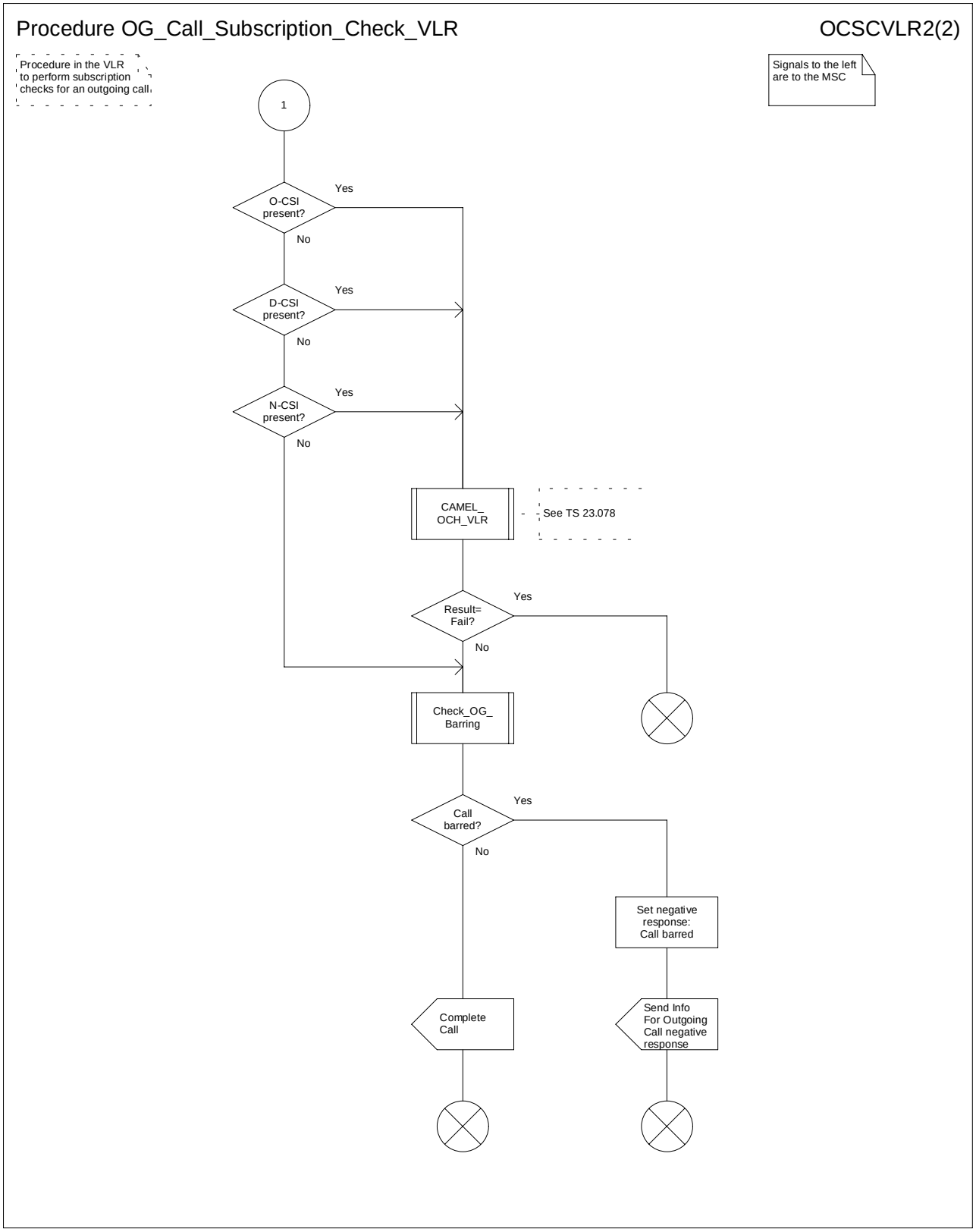


Figure 21b: Procedure OG_Call_Subscription_Check _VLR (sheet 2)

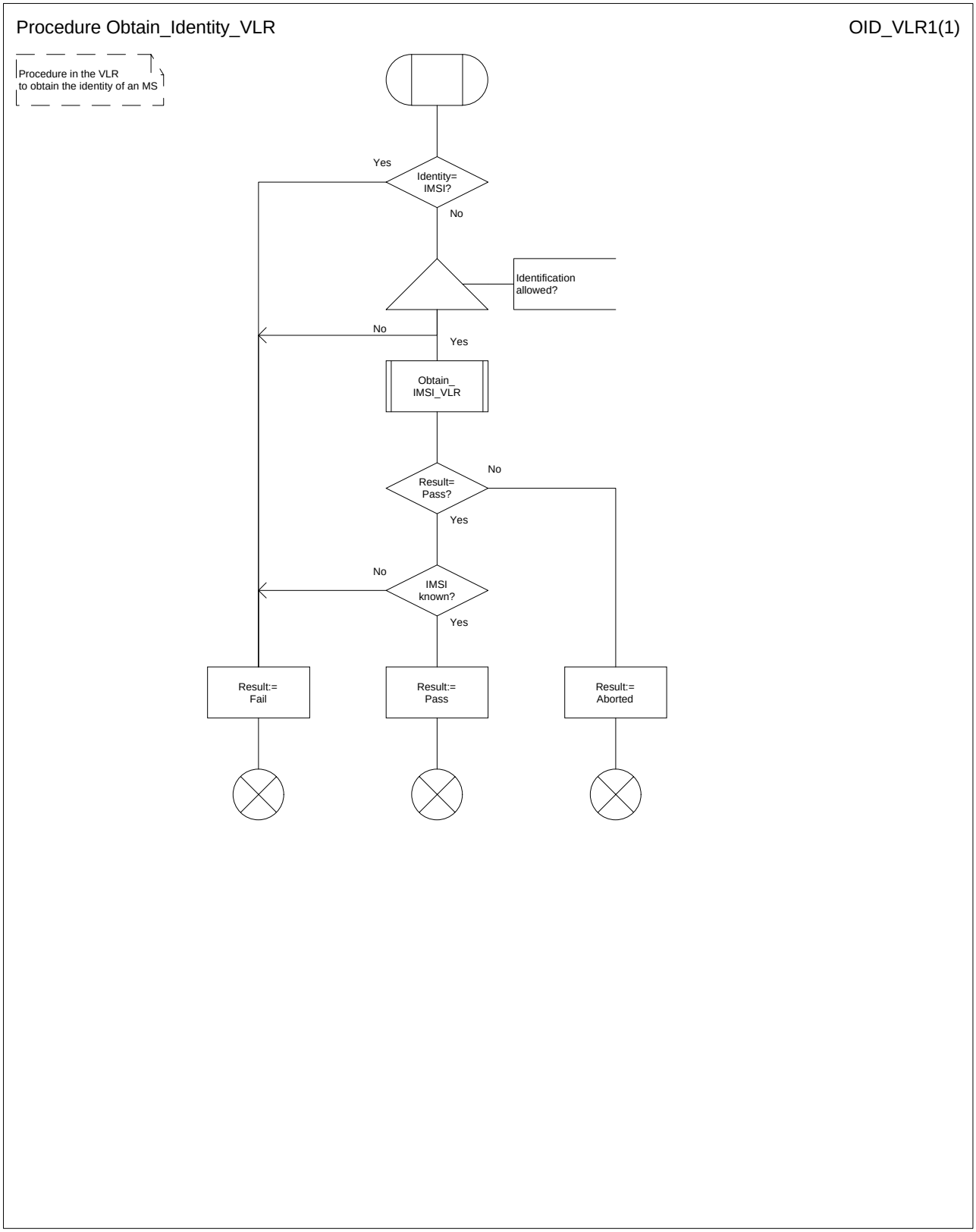


Figure 22: Procedure Obtain_Identity_VLR

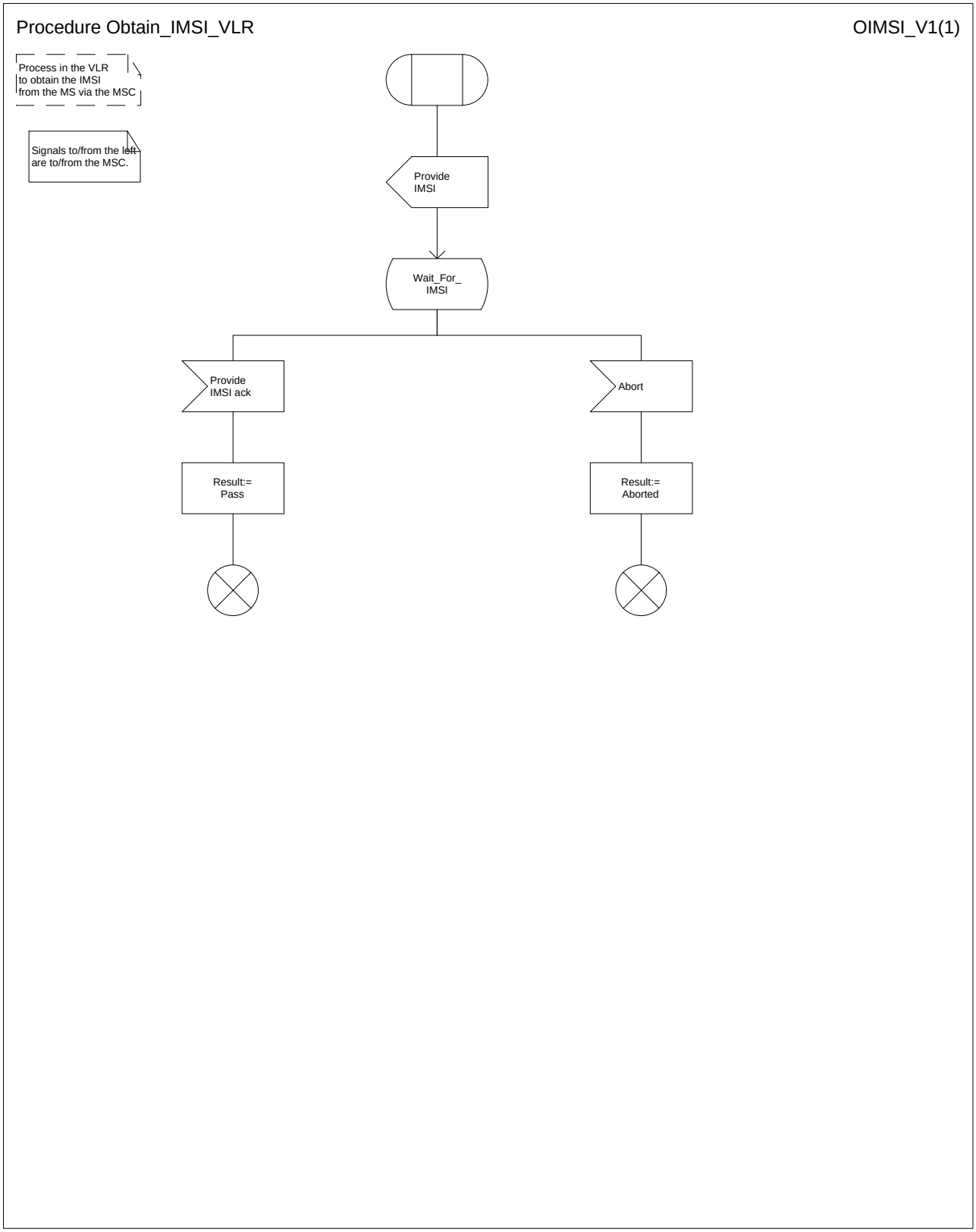


Figure 23: Procedure Obtain_IMSI_VLR

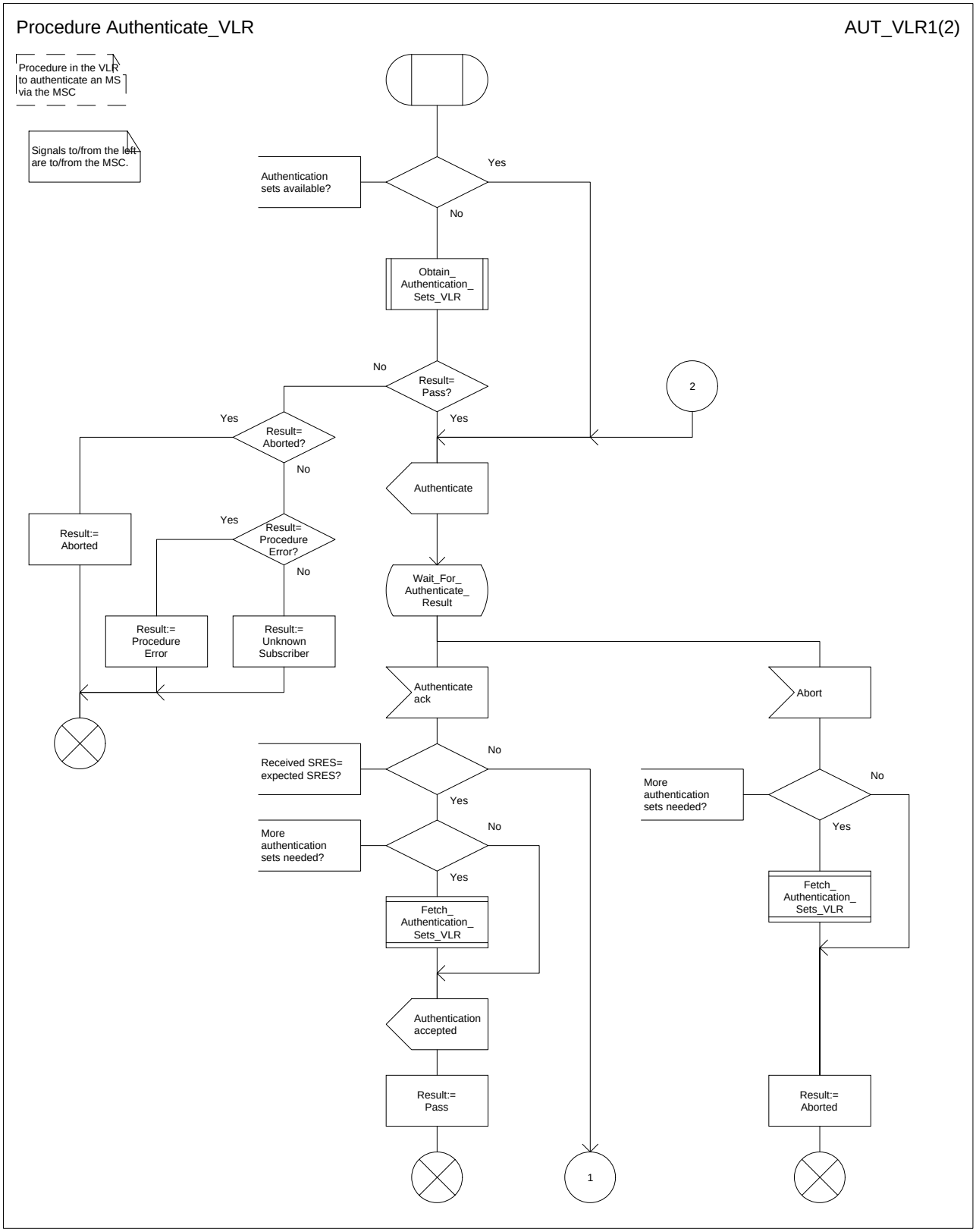


Figure 24a: Procedure Authenticate_VLR (sheet 1)

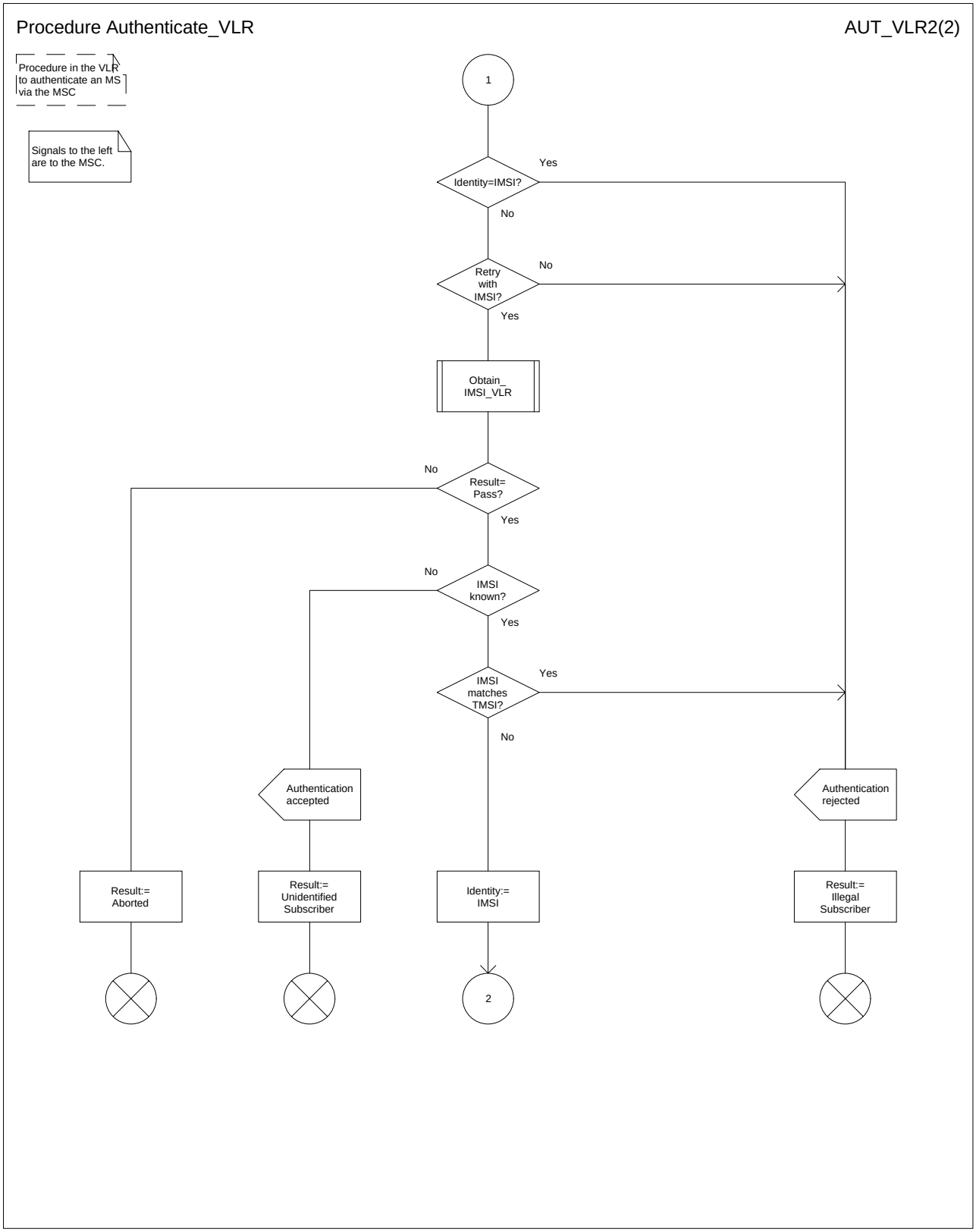


Figure 24b: Procedure Authenticate_VLR (sheet 2)

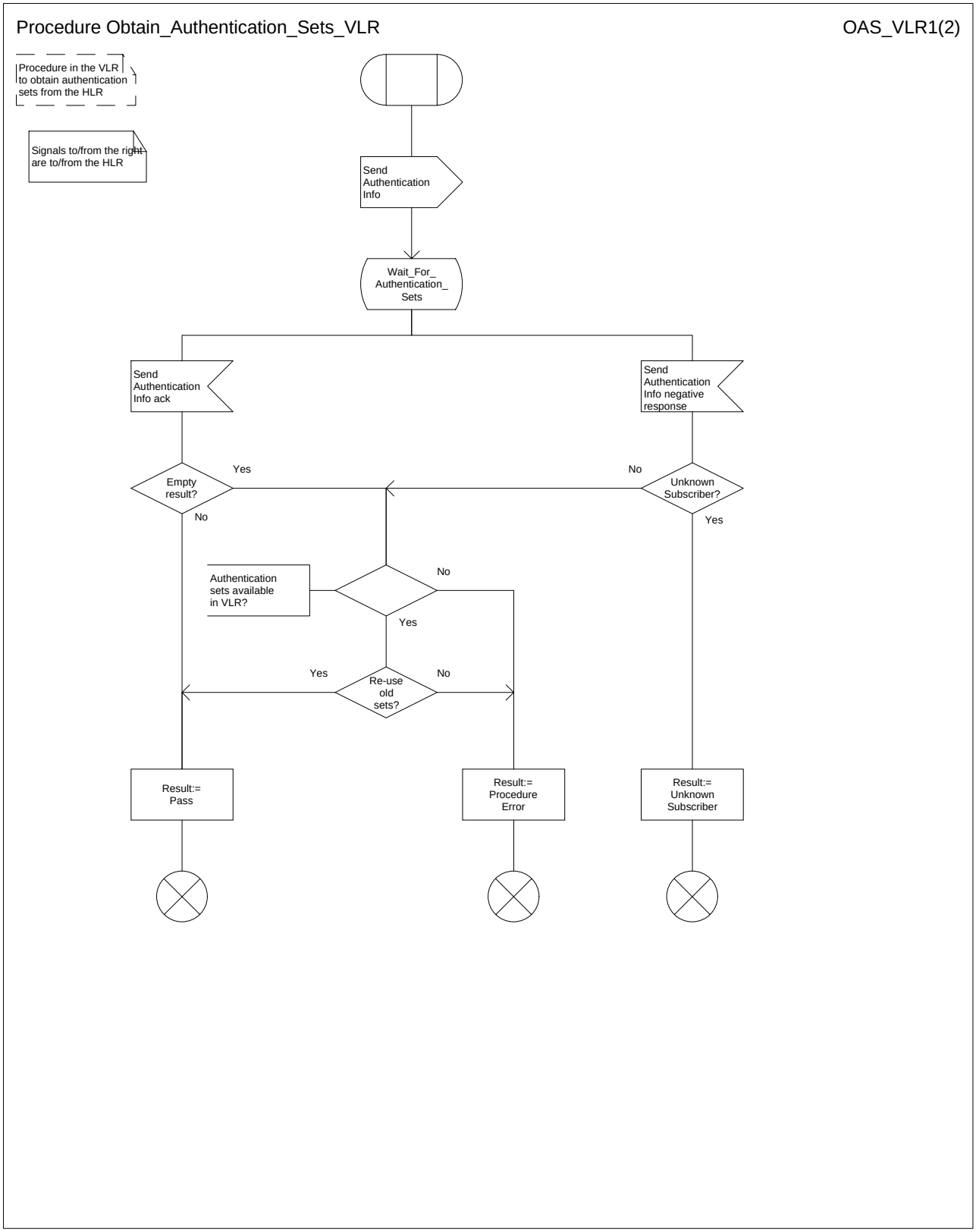


Figure 25a: Procedure Obtain_Authentication_Sets_VLR (sheet 1)

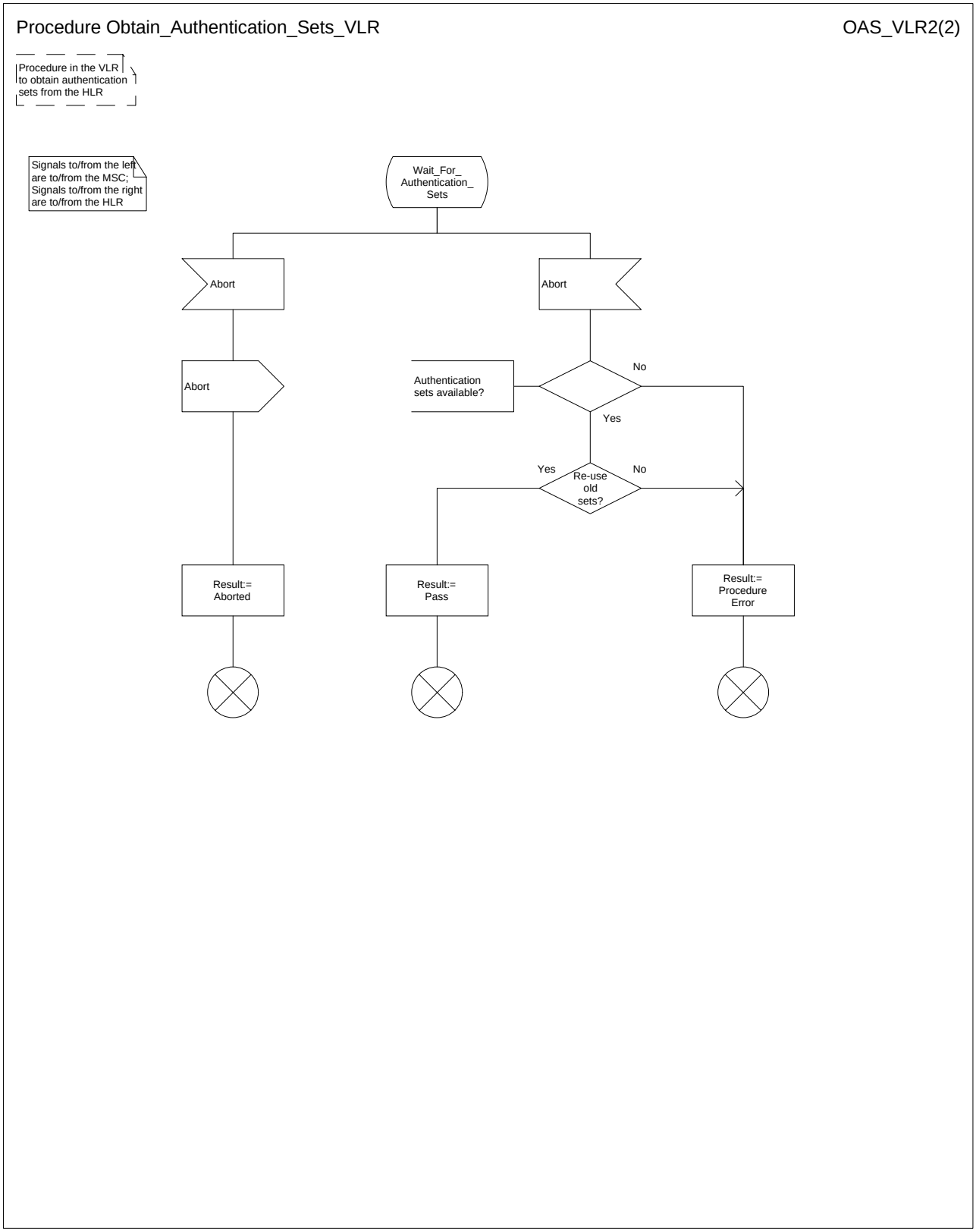


Figure 25b: Procedure Obtain_Authentication_Sets_VLR (sheet 2)

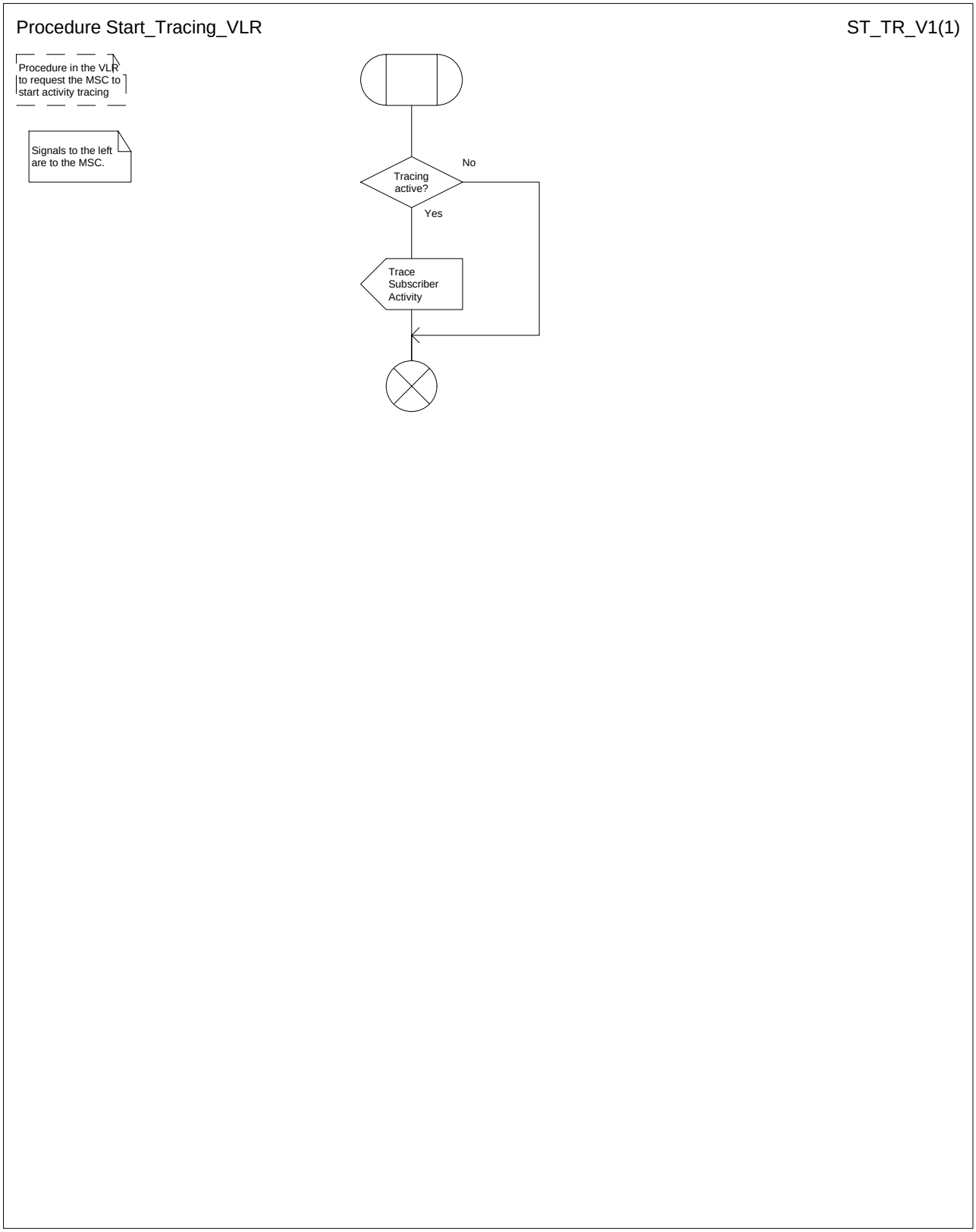


Figure 26: Procedure Start_Tracing_VLR

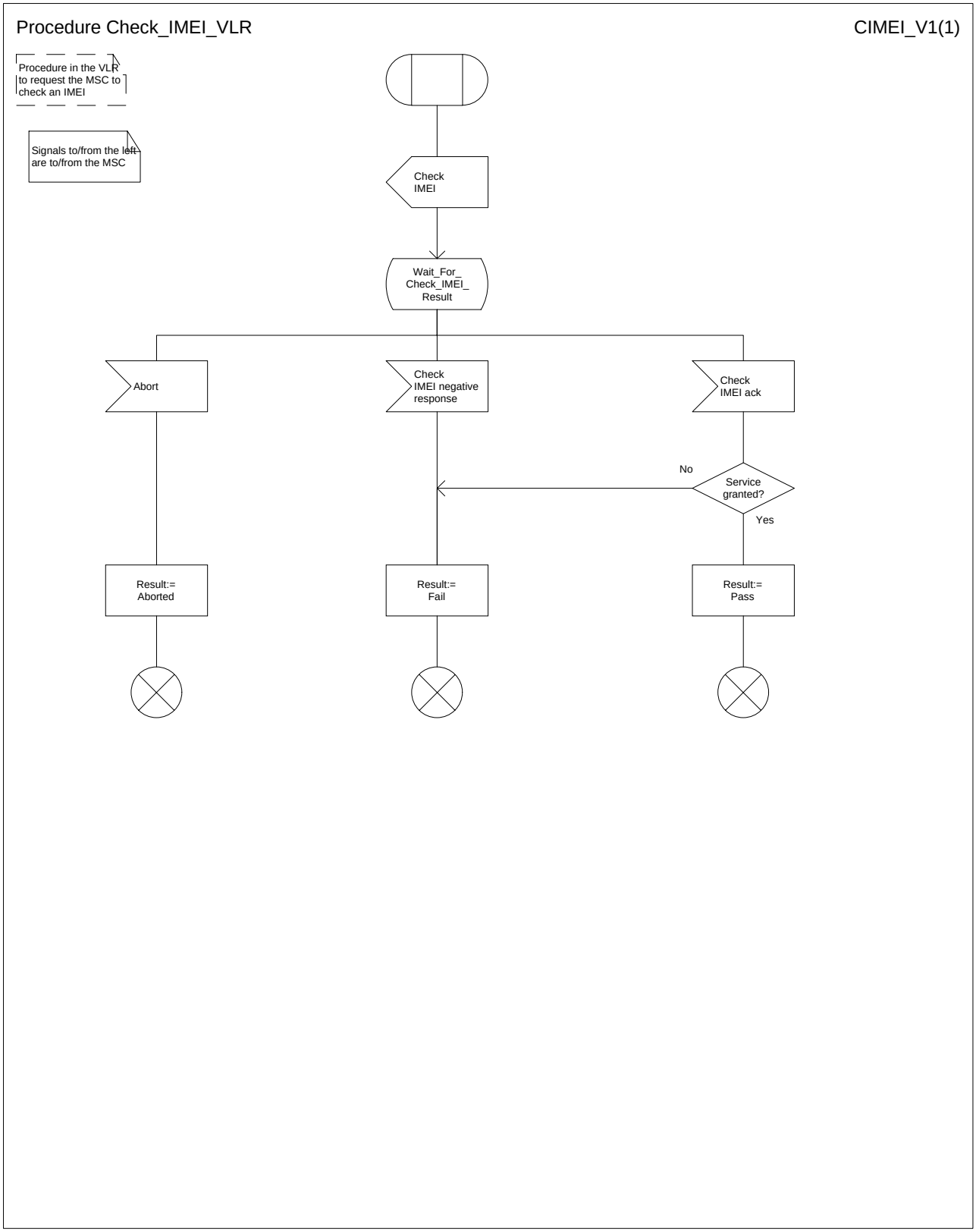


Figure 27: Procedure Check_IMEI_VLR

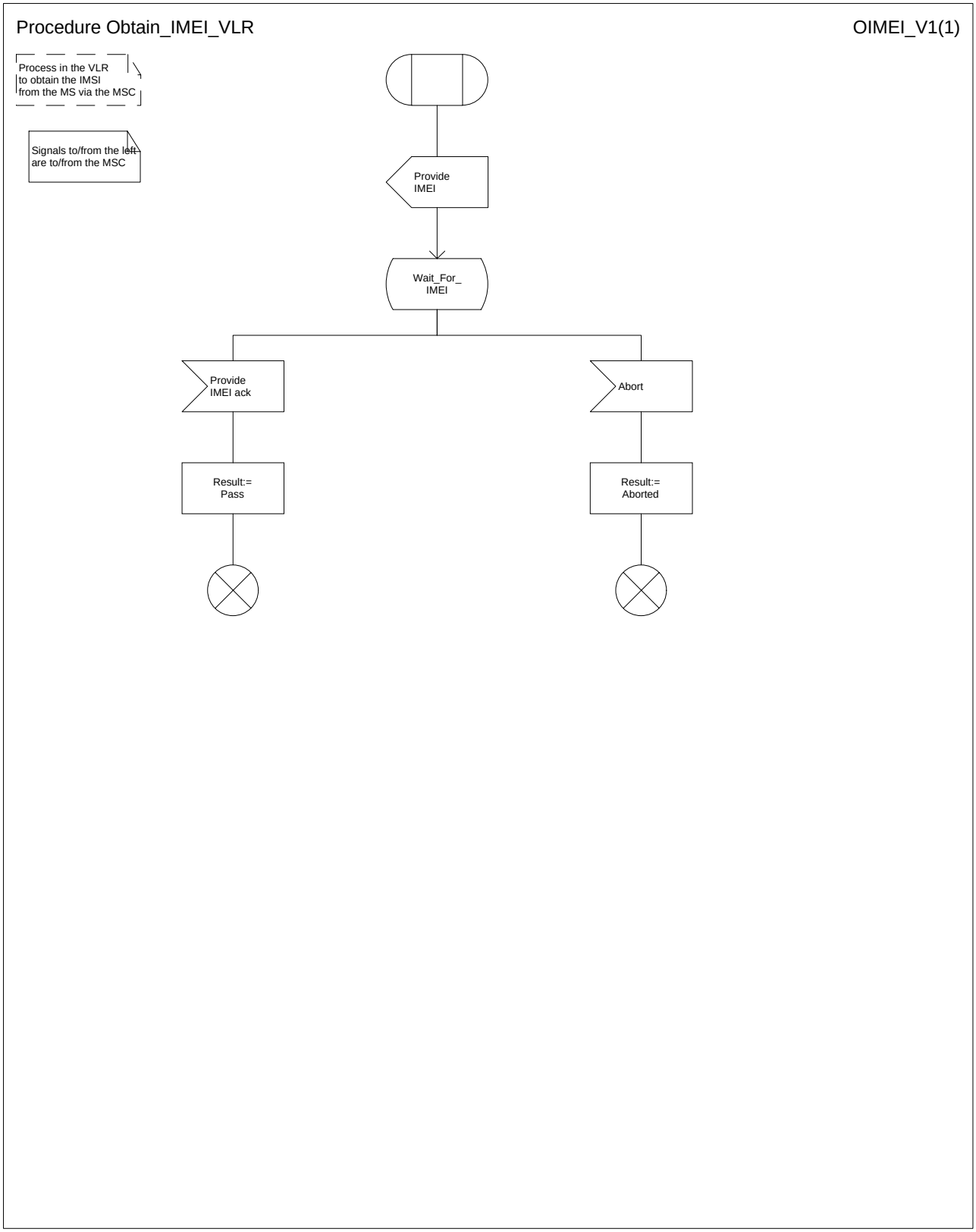


Figure 28: Procedure Obtain_IMEI _VLR

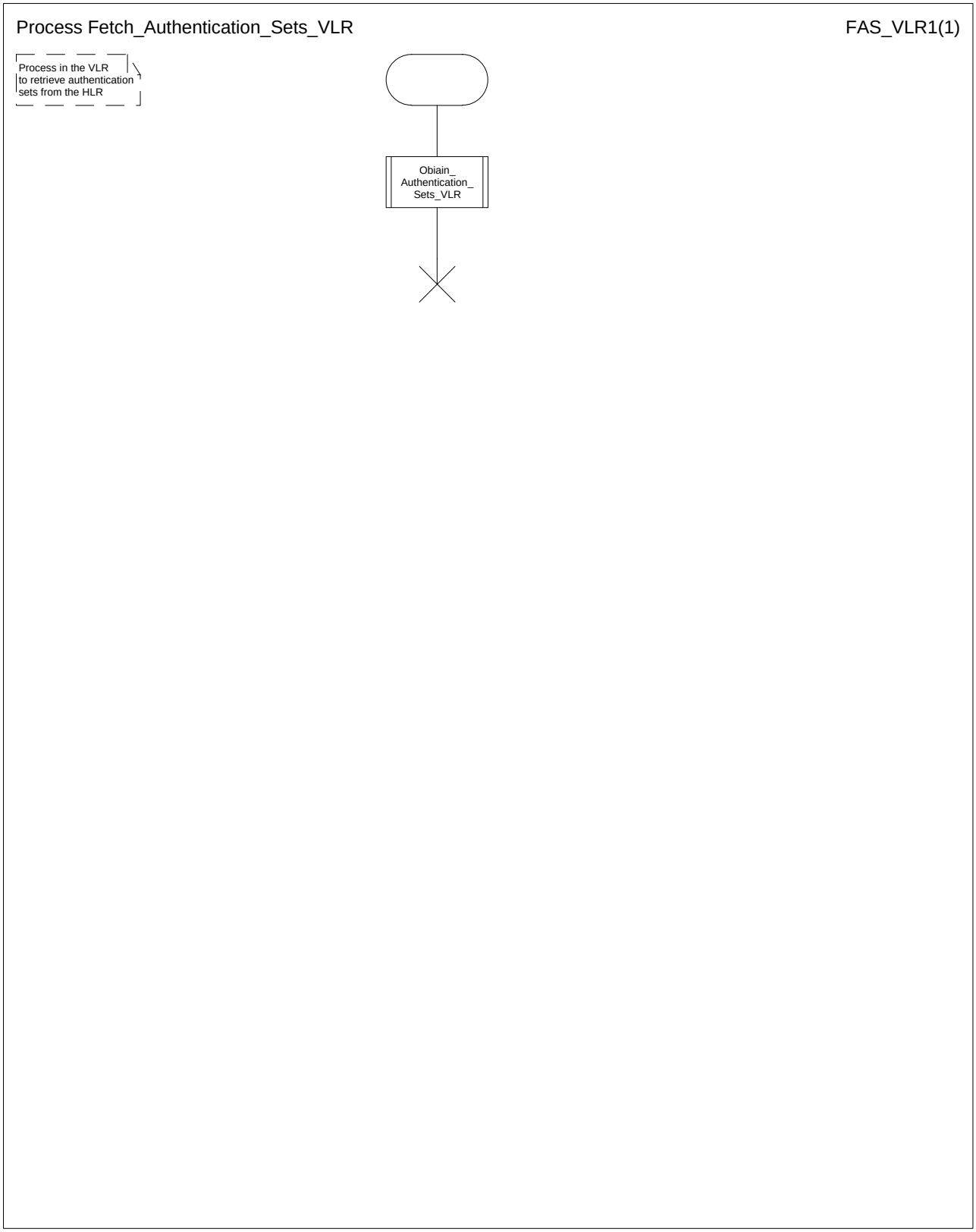


Figure 29: Process Fetch_Authentication_Sets_VLR

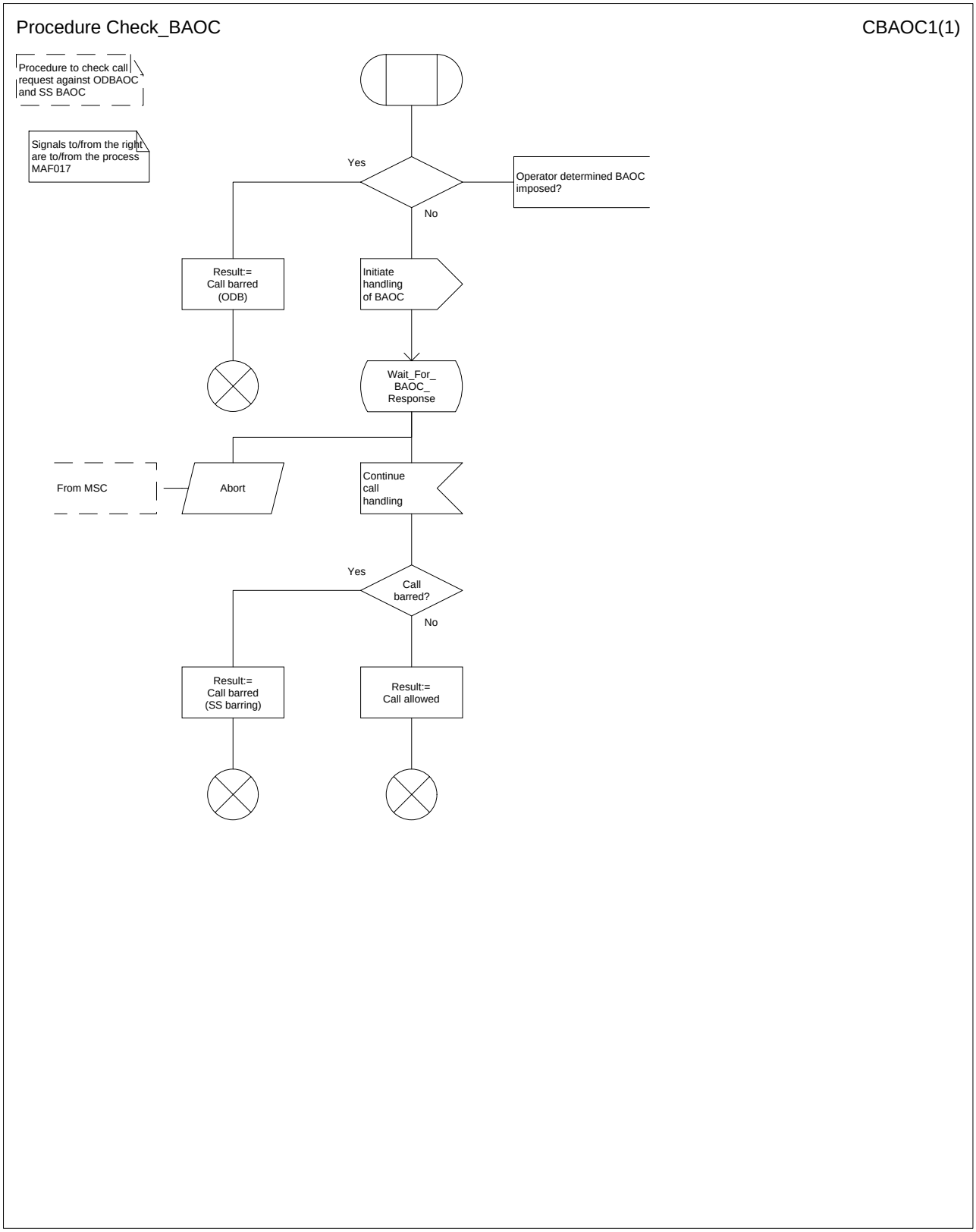


Figure 30: Procedure Check_BAOC

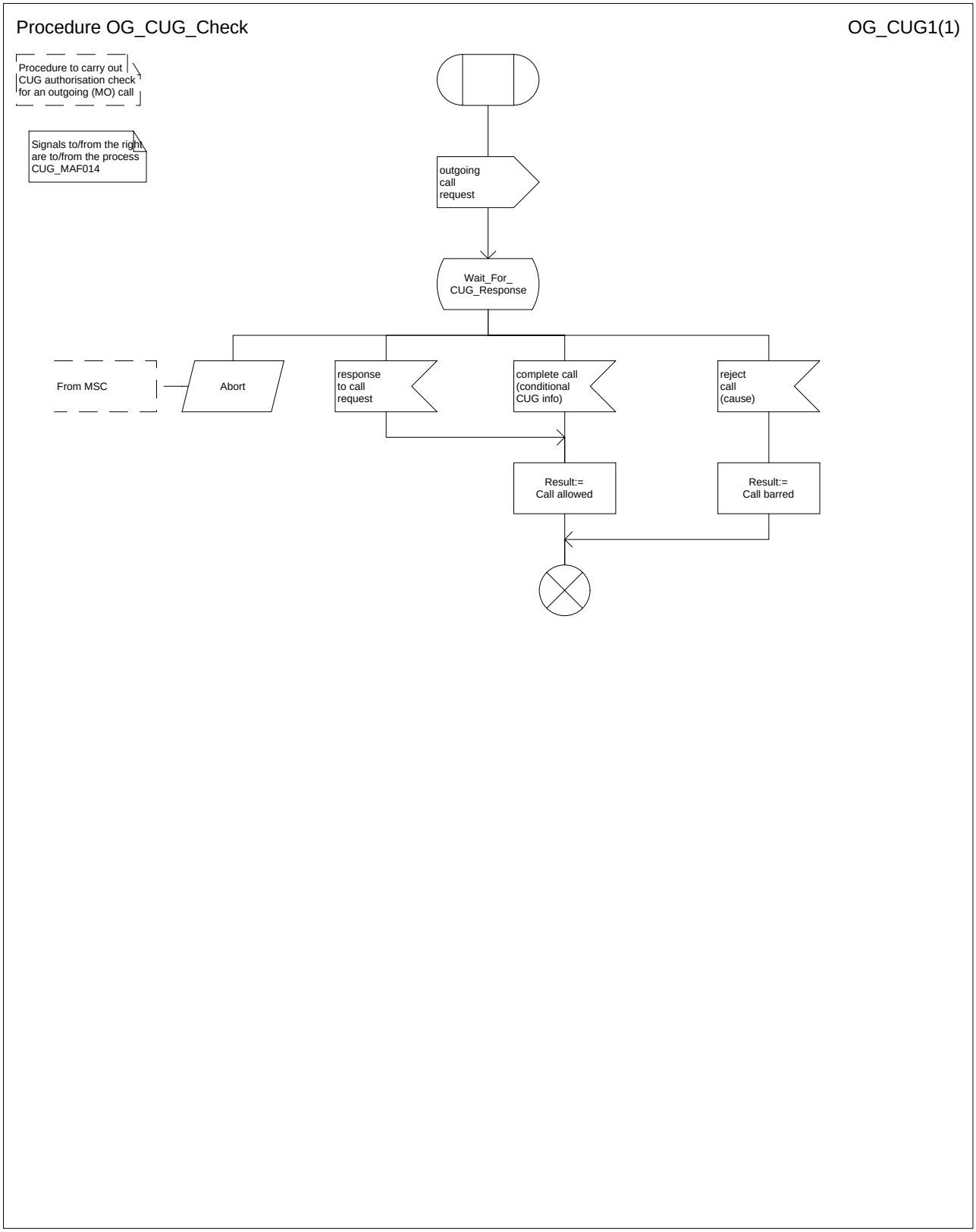


Figure 31: Procedure OG_CUG_Check

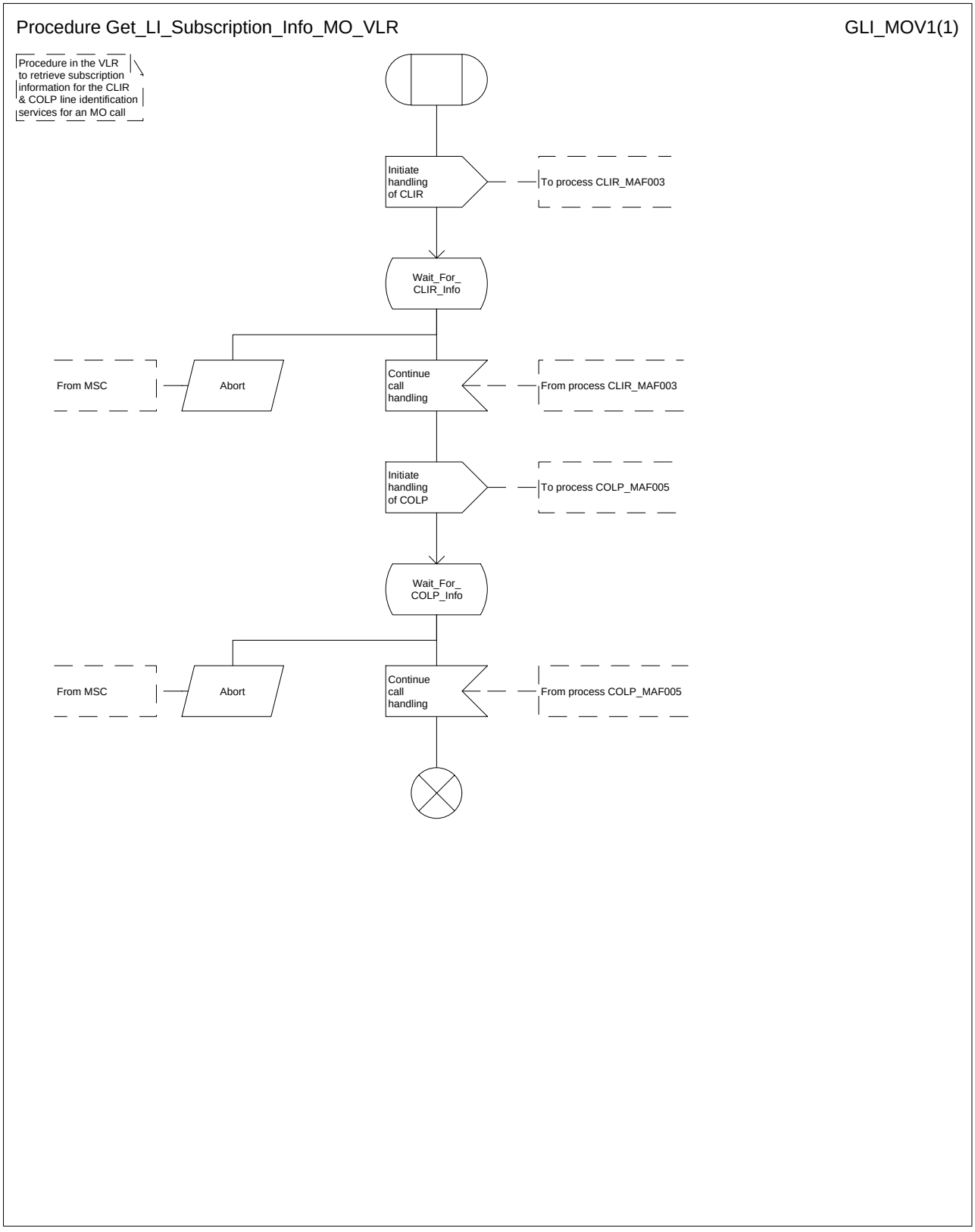


Figure 32: Procedure Get_LI_Subscription_Info_MO_VLR

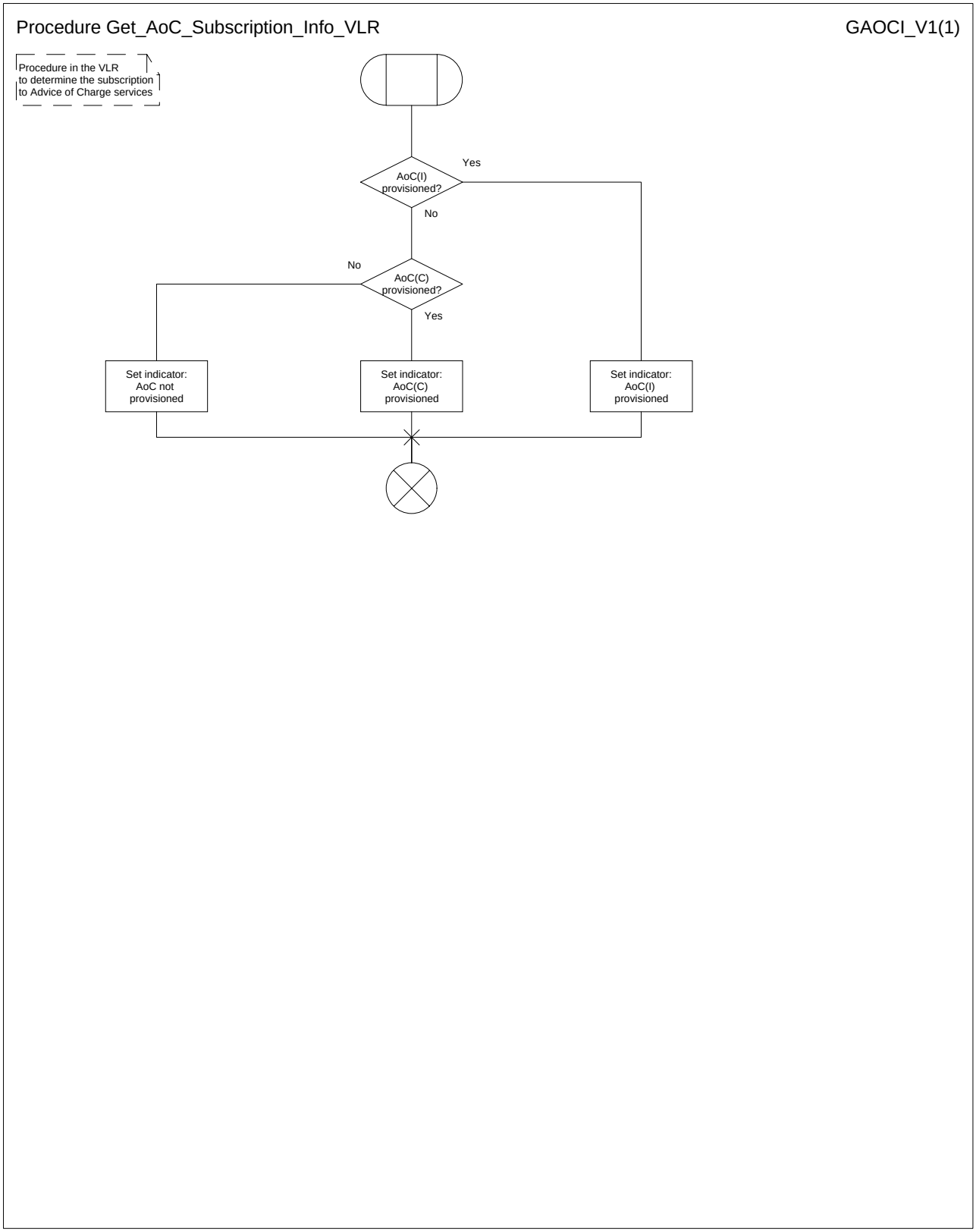


Figure 33: Procedure Get_AoC_Subscription_Info_VLR

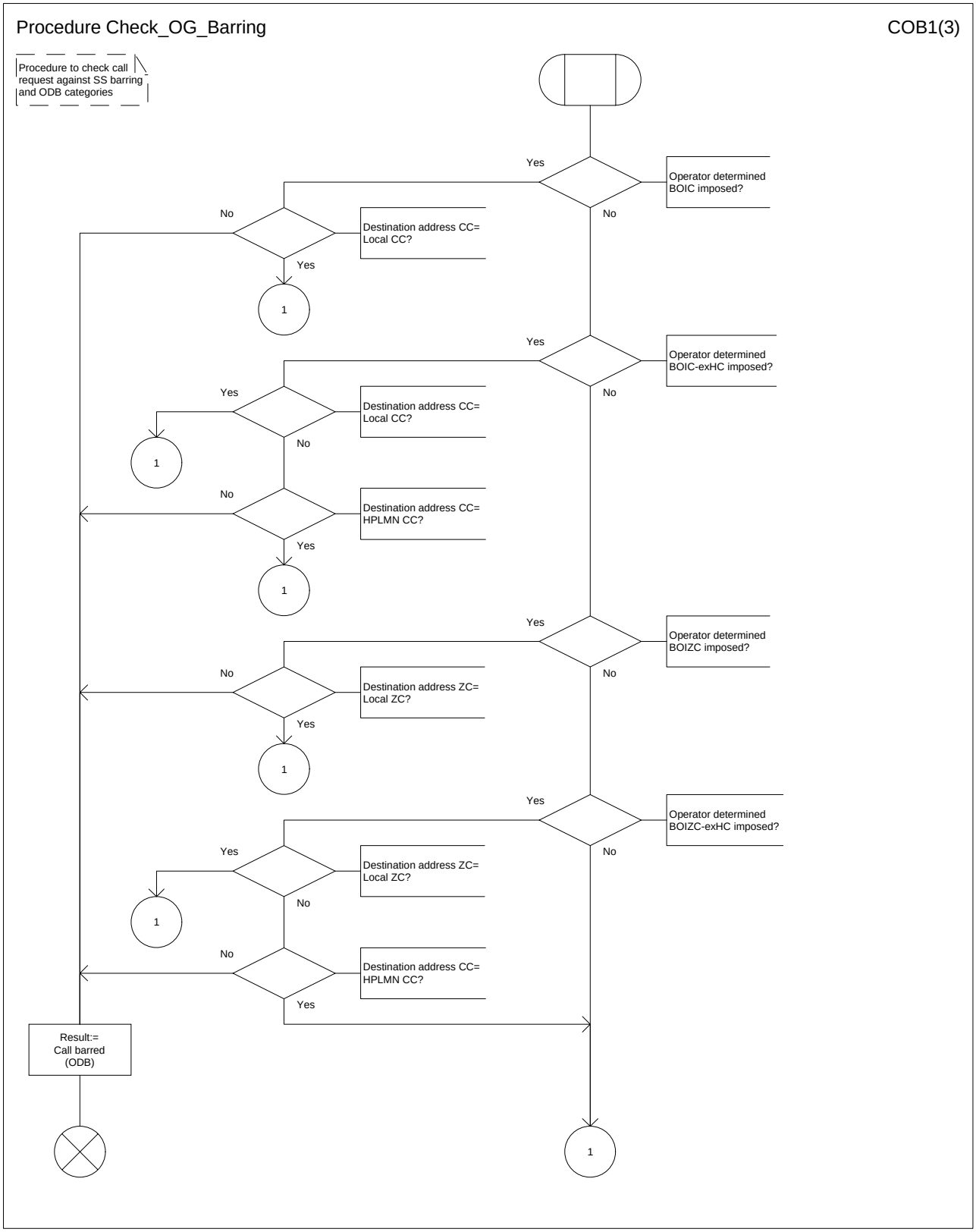


Figure 34a: Procedure Check_OG_Barring (sheet 1)

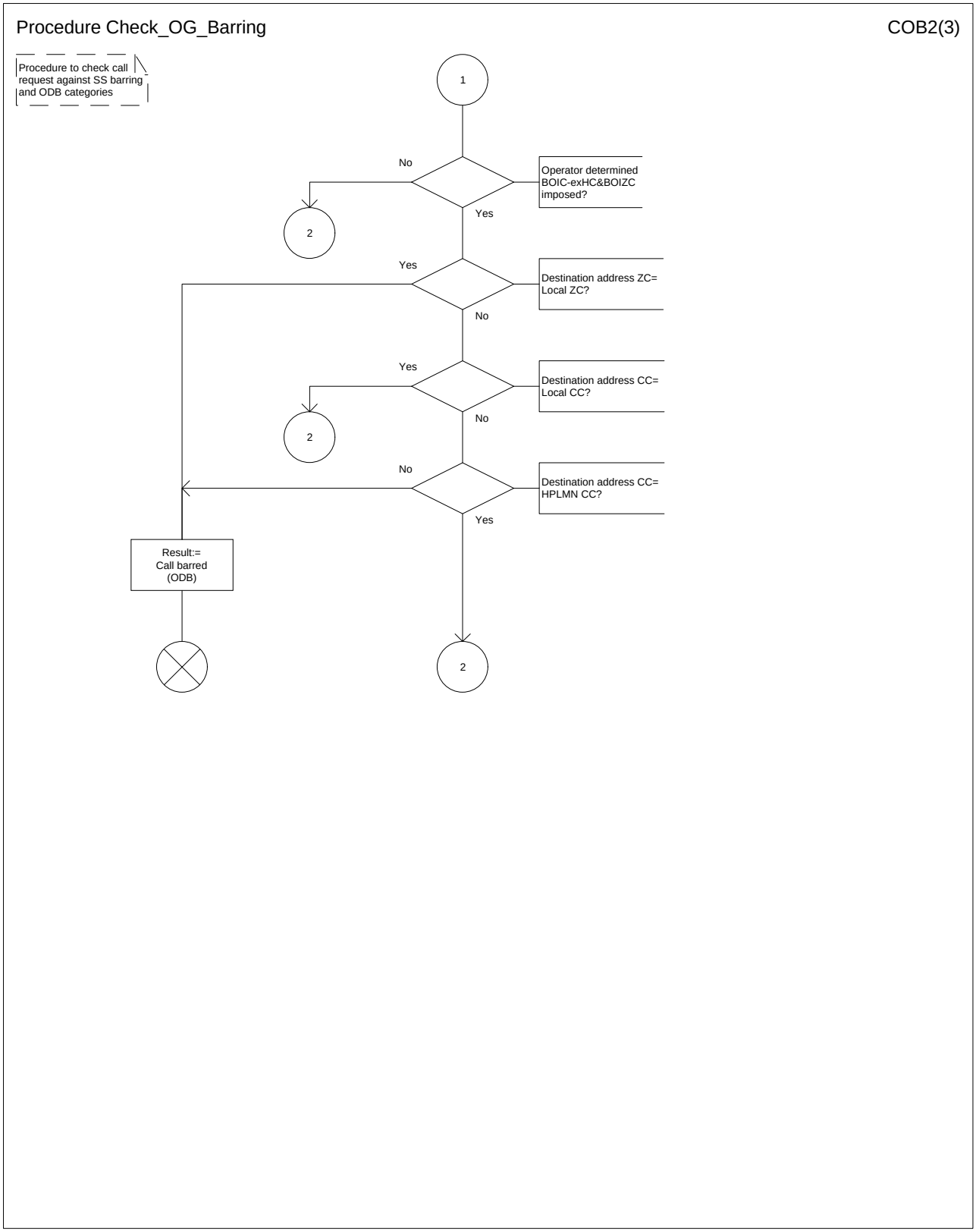


Figure 34b: Procedure Check_OG_Barring (sheet 2)

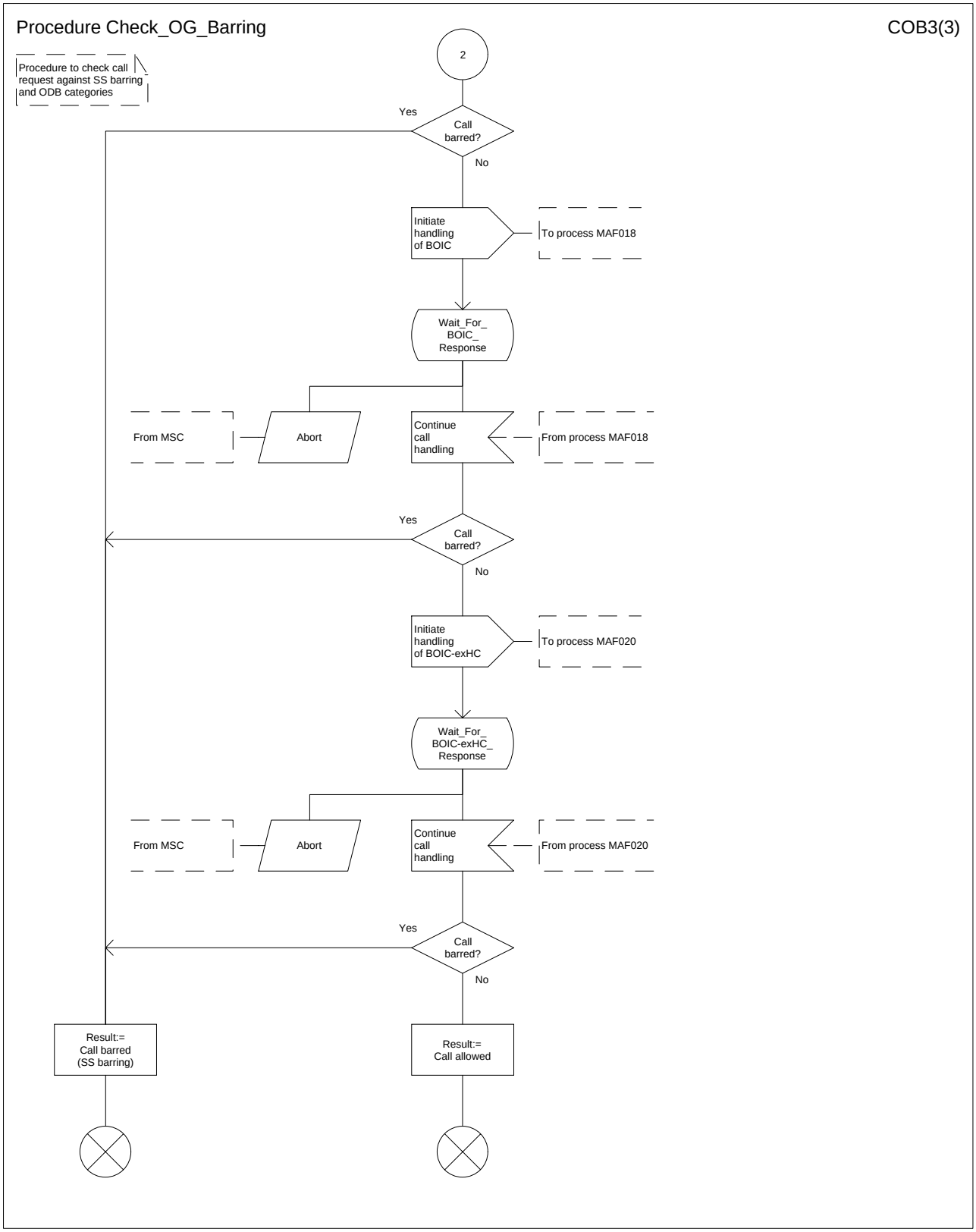


Figure 34c: Procedure Check_OG_Barring (sheet 3)

7.2 Retrieval of routeing information for MT call

7.2.1 Functional requirements of GMSC

7.2.1.1 Process MT_GMSC

Sheet 1: the variables ACM sent, Answer sent, Network connect sent, Reconnect and Resume call are global data, accessible to the procedures CCBS_MT_GMSC_Check_CCBS Possible, CCBS_Set_Diagnostic_For_Release, Obtain_Routeing_Address, Send_ACM_If_Required, Send_Answer_If_Required and Send_Network_Connect_If_Required.

Sheet 1: the variable UUS CF interaction is specific to UUS; it is accessible to all UUS specific procedures in the GMSC.

Sheet 1: the procedure OR_Set_ORA_Parameters is specific to Support of Optimal Routeing; it is specified in ~~GSM~~ TS ~~03.~~23.079 [33].

Sheet 1: the procedure CAMEL_Set_ORA_Parameters is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~.

Sheet 1: the parameters "Reference address", "OR" and "Own PLMN" are passed to the procedure Obtain_Routeing_Address only if the GMSC supports Optimal Routeing. The parameter "Destination address" is returned by the procedure Obtain_Routeing_Address only if the GMSC supports Optimal Routeing of mobile-to-mobile calls. The Send Routeing Info negative response information element received in the execution of the procedure Obtain_Routeing_Address is global data, available to the parent process.

Sheet 1: the suggested mapping from values of the Send Routeing Info negative response information element to values of the ISUP release cause (see ITU-T Recommendation Q.850 [56~~53~~]) is shown in table 1. The mapping used is a matter for the network operator, depending on the telephony signalling system used.

Table 1: Suggested mapping of Send Routeing Info (SRI) negative responses to ISUP release causes

SRI negative response	ISUP release cause number	ISUP release cause name
Absent subscriber	20	Subscriber absent
Bearer service not provisioned	57	Bearer capability not authorised
Call barred (ODB)	21	Call rejected
Call barred (SS barring)	21	Call rejected
CUG reject (Called party SS interaction violation)	21	Call rejected
CUG reject (Incoming calls barred within CUG)	55	Incoming calls barred within CUG
CUG reject (Subscriber not member of CUG)	87	User not member of CUG
CUG reject (Requested basic service violates CUG constraints)	87	User not member of CUG
Data missing	111	Protocol error, unspecified
Facility not supported	69	Requested facility not implemented
Forwarding violation	21	Call rejected
Number changed	22	Number changed
System failure	111	Protocol error, unspecified
Teleservice not provisioned	57	Bearer capability not authorised
Unexpected data value	111	Protocol error, unspecified
Unknown subscriber	1	Unallocated (unassigned) number

Sheet 1: it is an operator option whether to send an Address Complete message if the Number Portability Database returns a routeing number. If the GMSC sends an Address Complete message, it shall include the called party's status field of the Backward call indicator set to "no indication".

Sheet 1: the called party address sent in the IAM to the process MT_CF_MSC is the Forwarded-to number received in the Perform Call Forwarding ack.

Sheet 1: the procedure CAMEL_Store_Destination_Address is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 1: it is an operator option whether to send an Address Complete message if the HLR returns forwarding information. If the GMSC sends an Address Complete message, it shall include the called party's status field of the Backward call indicator set to "no indication".

Sheet 2: the procedures CAMEL_Start_TNRy and CAMEL_Stop_TNRy are specific to CAMEL phase 2; they are specified in ~~GSM~~ TS ~~03.~~23.078~~ for CAMEL Phase 2~~ [**32**].

Sheet 2, sheet 3: the procedure CAMEL_MT_GMSC_ANSWER is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078~~ for CAMEL Phase 1~~ [32]~~ and GSM 03.78 for CAMEL Phase 2 [Error! Reference source not found.]~~. If the GMSC does not support CAMEL, processing continues from the "Pass" exit of the test "Result".

Sheet 2, sheet 3: the task "Set destination address parameter" is executed only if the GMSC supports Optimal Routeing of mobile-to-mobile calls.

Sheet 3: the procedure Handle_COLP_Forwarding_Interaction is specific to COLP.

Sheet 4: the input signal Resume Call Handling and all the subsequent processing on this sheet are specific to Support of Optimal Routeing, and will occur only if the GMSC supports Optimal Routeing. The procedure OR_Handle_RCH is specified in ~~GSM~~ TS ~~03.~~23.079 [33].

Sheet 4, sheet 6: the procedure CCBS_MT_GMSC_Check_CCBS_Possible is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 5: the input signal TNRy expired and all the subsequent processing are specific to CAMEL phase 2, and will occur only if the GMSC supports CAMEL phase 2. The procedure CAMEL_MT_GMSC_DISC5 is specified in ~~GSM~~ TS ~~03.~~23.078~~ for CAMEL phase 2~~ [**32**].

Sheet 6: the procedures CAMEL_MT_GMSC_DISC3, CAMEL_MT_GMSC_DISC4 and CAMEL_MT_GMSC_DISC6 are specific to CAMEL; they are specified in ~~GSM~~ TS ~~03.~~23.078~~ for CAMEL Phase 1~~ [32]~~ (CAMEL_MT_GMSC_DISC3) and GSM 03.78 for CAMEL Phase 2 [Error! Reference source not found.] (CAMEL_MT_GMSC_DISC4 and CAMEL_MT_GMSC_DISC6).~~.

Sheet 6: the procedure CCBS_Set_Diagnostic_For_Release is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

~~Sheet 5: the procedures CAMEL_MT_GMSC_DISC1 and CAMEL_MT_GMSC_DISC2 are specific to CAMEL; they are specified in GSM 03.78 [32]. If the GMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".~~

Sheet 6, sheet 7: the processing in the branch beginning with the Int_Release_Call input will occur only if the MSC supports CAMEL.

Sheet 7: the procedure CAMEL_MT_GMSC_DISC1 is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078~~ for CAMEL Phase 1~~ [32]~~ and GSM 03.78 for CAMEL Phase 2 [Error! Reference source not found.]~~. If the GMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

Sheet 7: the procedure CAMEL_MT_GMSC_DISC2 is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078~~ for CAMEL Phase 1~~ [32]~~ and GSM 03.78 for CAMEL Phase 2 [Error! Reference source not found.]~~. If the GMSC does not support CAMEL, processing continues from the "Normal handling" exit of the test "Result?".

Sheet 7: in the upper subtree, the processing in the branch beginning with the Int_Release_Call input will occur only if the GMSC supports CAMEL.

Sheet 7: after the GMSC has sent an IAM to the destination VMSC or the forwarded-to exchange (via the process MT_CF_MSC), it acts as a relay for messages received from the originating exchange and the destination VMSC or the process MT_CF_MSC. Any message other than Address Complete, Connect, Answer or Release causes no change of state in the process MT_GMSC.

7.2.1.2 Procedure Obtain_Routeing_Address

Sheet 1: the procedure MOBILE_NUMBER_PORTABILITY_IN_TQoD is specific to Mobile Number Portability; it is specified in ~~GSM~~ TS ~~03.~~23.066 [**30**].

Sheet 1: the procedure CCBS_MT_GMSC_Check_CCBS_Call is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 1: the procedure CLI_MT_GMSC is specific to Enhanced CLI Handling. It is specified in ~~GSM~~ TS ~~03.~~23.081 [34].

Sheet 2: the procedure OR_Handle_SRI_Negative_Response is specific to Support of Optimal Routeing. It is specified in ~~GSM~~ TS ~~03.~~23.079 [33]. If the GMSC does not support Optimal Routeing, processing continues from the "No" exit of the test "Result=Pass?".

Sheet 2: the test "Error=Unknown subscriber" refers to the negative response value received from the HLR.

Sheet 2: the procedure MOBILE_NUMBER_PORTABILITY_IN_QoHR is specific to Mobile Number Portability; it is specified in ~~GSM~~ TS ~~03.~~23.066 [**30**].

Sheet 3: the procedure CAMEL_MT_GMSC_INIT is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~.

Sheet 3: the procedure CCBS_MT_GMSC_Check_CCBS_Indicators is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 2: the task "Store Forwarding Interrogation Required indicator" is executed only if the GMSC supports Optimal Routeing.

Sheet 2: The decision "MSRN contains a Routeing Number" is executed only if the SRF solution for call related MNP is used. If the SRF solution for call related MNP is not used, processing continues from the "No" exit of the test "MSRN contains a Routeing Number".

Sheet 3: the procedure CAMEL_MT_GMSC_Notify_CF is specific to CAMEL phase 2; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**]. If the GMSC does not support CAMEL, processing continues from the "Continue" exit of the test "Result".

Sheet 4: the task "BOR:=OR" is executed only if the GMSC supports Optimal Routeing of mobile-to-mobile calls.

Sheet 4: the procedures CCBS_MT_GMSC_Remove_Indicators_Store_FWT is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 4: the procedure Route_Permitted is specific to Support of Optimal Routeing. It is specified in ~~GSM~~ TS ~~03.~~23.079 [33]. If the GMSC does not support Optimal Routeing, processing continues from the "True" exit of the test "Route permitted".

Sheet 4: the procedures CAMEL_MT_MSC_DISC3 and CAMEL_MT_MSC_DISC4 are specific to CAMEL; they are specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**] respectively~~.

Sheet 4: the task "OR:= True" is executed only if the GMSC supports Optimal Routeing of mobile-to-mobile calls.

7.2.1.3 Procedure Send_ACM_If_Required

If no useful information would be carried in the Call Progress message, it is not sent.

7.2.1.4 Procedure Send_Answer_If_Required

If no useful information would be carried in the Call Progress message, it is not sent.

7.2.1.5 Procedure Send_Network_Connect_If_Required

If no useful information would be carried in the Call Progress message, it is not sent.

7.2.1.6 Procedure Handle_COLP_Forwarding_Interaction_MSC

The originating exchange or the destination exchange may release the call while a response is awaited from the process COLP_MAF039. The message is saved for processing after return from the procedure.

7.2.1.7 Procedure Activate_CF_Process

The processing in the branch beginning with the Int_Release_Call input will occur only if the MSC supports CAMEL.

7.2.1.8 Process MT_CF_MSC

Sheet 1: the procedure CAMEL_CF_MSC_INIT is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the MSC does not support CAMEL, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 1, sheet 4: the procedure CAMEL_CF_Dialled_Services is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32~~28~~]. If the MSC does not support CAMEL phase 3, processing continues from the "Pass" exit of the test "Result?".

Sheet 1, sheet 3, sheet 4: the procedure CAMEL_OCH_MSC1 is specific to CAMEL phase 2; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [32~~9~~]. If the MSC does not support CAMEL phase 2, processing continues from the "Yes" exit of the test "Result=Reconnect?".

Sheet 1: the procedure MOBILE_NUMBER_PORTABILITY_IN_OQoD is specific to Mobile Number Portability; it is specified in ~~GSM~~ TS ~~03.~~23.066 [30~~6~~].

Sheet 1: the procedure CAMEL_Store_Destination_Address is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32~~28~~].

Sheet 1: the procedures CAMEL_OCH_MSC_DISC3 and CAMEL_OCH_MSC_DISC4 are specific to CAMEL; they are specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~ ~~respectively~~.

Sheet 2: the procedures CAMEL_Start_TNRy and CAMEL_Stop TNRy are specific to CAMEL phase 2; they are specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**].

Sheet 2: the procedure CAMEL_CF_MSC_ANSWER is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the MSC does not support CAMEL, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2: the procedure UUS_MSC_Clear_UUS is specific to UUS; it is specified in GSM ~~03.~~23.087 [40].

Sheet 3: the procedures CAMEL_OCH_MSC_DISC3 and CAMEL_OCH_MSC_DISC4 are specific to CAMEL; they are specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~ ~~respectively~~.

Sheet 3: the procedure CAMEL_Stop TNRy is specific to CAMEL phase 2; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**].

Sheet 3: the processing in the branch beginning with the Int_O_Release input will occur only if the MSC supports CAMEL.

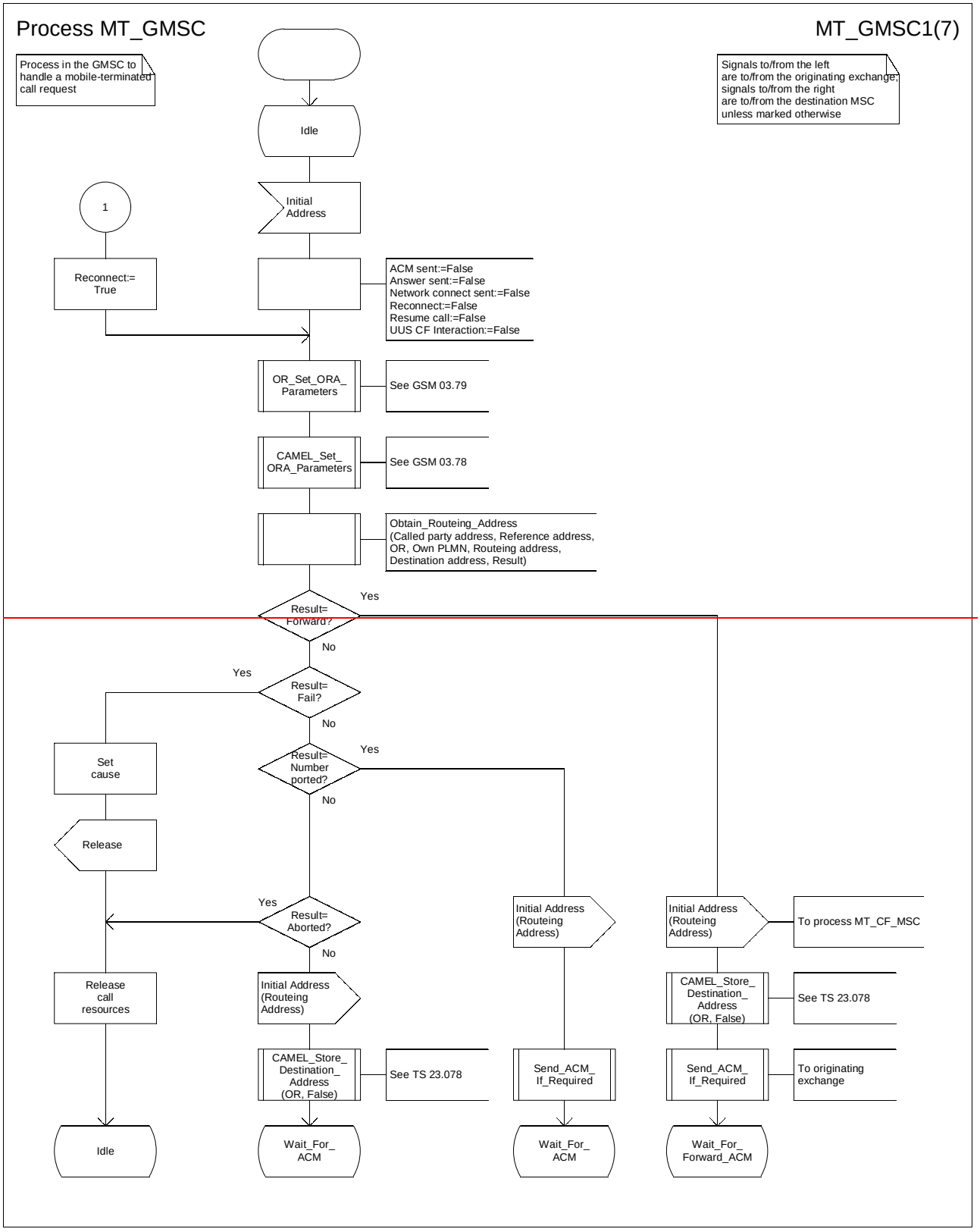
Sheet 4: the input signal TNRy expired and all the subsequent processing are specific to CAMEL phase 2, and will occur only if the GMSC supports CAMEL phase 2. The procedure CAMEL_OCH_MSC2 is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**].

Sheet 5: the procedure CAMEL_OCH_MSC_DISC1 is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the MSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

Sheet 5: the procedure CAMEL_OCH_MSC_DISC2 is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the MSC does not support CAMEL, processing continues from the "No" exit of the test "Result=Reconnect?" .

Sheet 5: the processing in the branch beginning with the Int_O_Release input will occur only if the MSC supports CAMEL.

Sheet 5: after the process MT_CF_MSC has sent an IAM to the forwarded-to exchange, it acts as a relay for messages received from the parent process and the forwarded-to exchange. Any message other than Address Complete, Connect, Answer or Release causes no change of state in the process MT_GMSC


Process MT_GMSC
MT_GMSC1(7)
Process in the GMSC to handle a mobile-terminated call request
Signals to/from the left are to/from the originating exchange, signals to/from the right are to/from the destination MSC unless marked otherwise
Idle
1
Initial Address
Reconnect:= True
ACM sent:=False
Answer sent:=False
Network connect sent:=False
Reconnect:=False
Resume call:=False
UUS CF Interaction:=False
OR_Set_ORA_ Parameters
See GSM 03.79
CAMEL_Set_ ORA_Parameters
See GSM 03.78
Obtain_Routeing_Address (Called party address, Reference address, OR, Own PLMN, Routeing address, Destination address, Result)
Result= Forward?
Yes
No
Result= Fail?
Yes
No
Set cause
Result= Number ported?
Yes
No
Release
Result= Aborted?
Yes
No
Release call resources
Initial Address (Routeing Address)
CAMEL_Store_ Destination_ Address (OR, False)
See TS 23.078
Send_ACM_ If_Required
To originating exchange
Idle
Wait_For_ ACM
Initial Address (Routeing Address)
To process MT_CF_MSC
CAMEL_Store_ Destination_ Address (OR, False)
See TS 23.078
Send_ACM_ If_Required
Wait_For_ ACM
Initial Address (Routeing Address)
CAMEL_Store_ Destination_ Address (OR, False)
See TS 23.078
Send_ACM_ If_Required
To originating exchange
Wait_For_ Forward_ACM

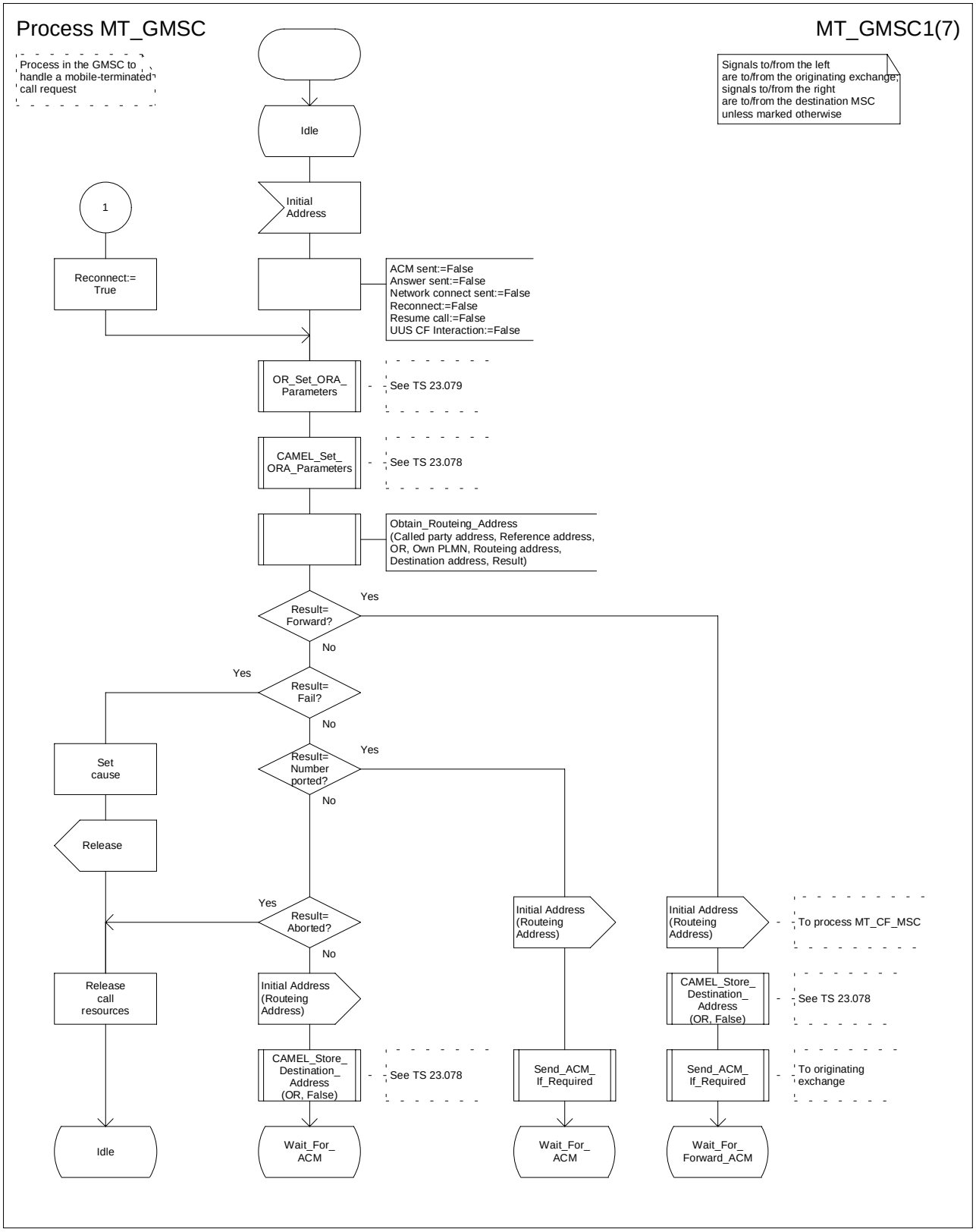
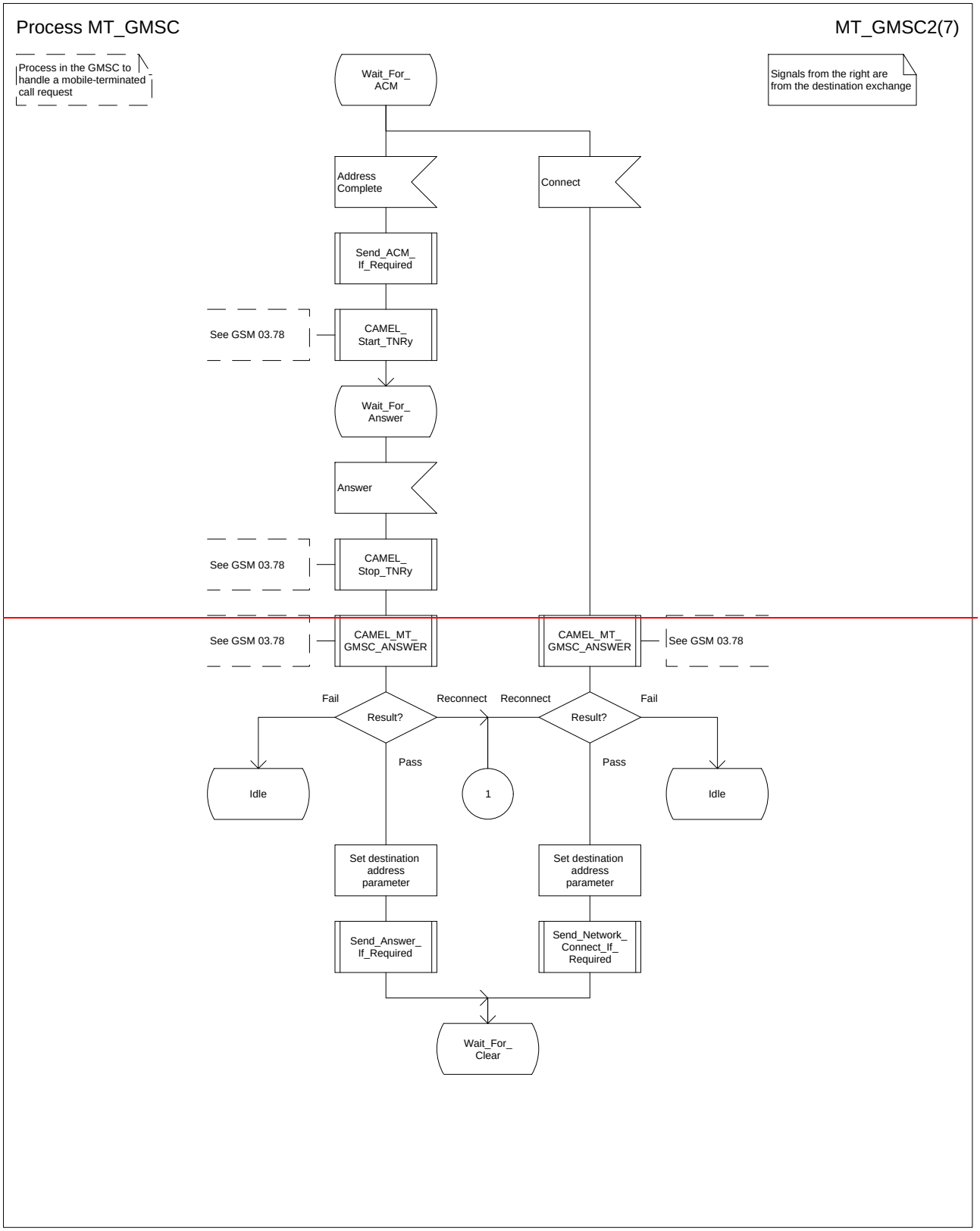


Figure 35a: Process MT_GMSC (sheet 1)


Process MT_GMSC
MT_GMSC2(7)
Process in the GMSC to handle a mobile-terminated call request
Signals from the right are from the destination exchange
Wait_For_ ACM
Address Complete
Connect
Send_ACM_ If_Required
See GSM 03.78
CAMEL_ Start_TNRy
Wait_For_ Answer
Answer
See GSM 03.78
CAMEL_ Stop_TNRy
See GSM 03.78
CAMEL_MT_ GMSC_ANSWER
CAMEL_MT_ GMSC_ANSWER
See GSM 03.78
Fail
Result?
Reconnect
Reconnect
Result?
Fail
Pass
Pass
Idle
1
Idle
Set destination address parameter
Set destination address parameter
Send_Answer_ If_Required
Send_Network_ Connect_If_ Required
Wait_For_ Clear

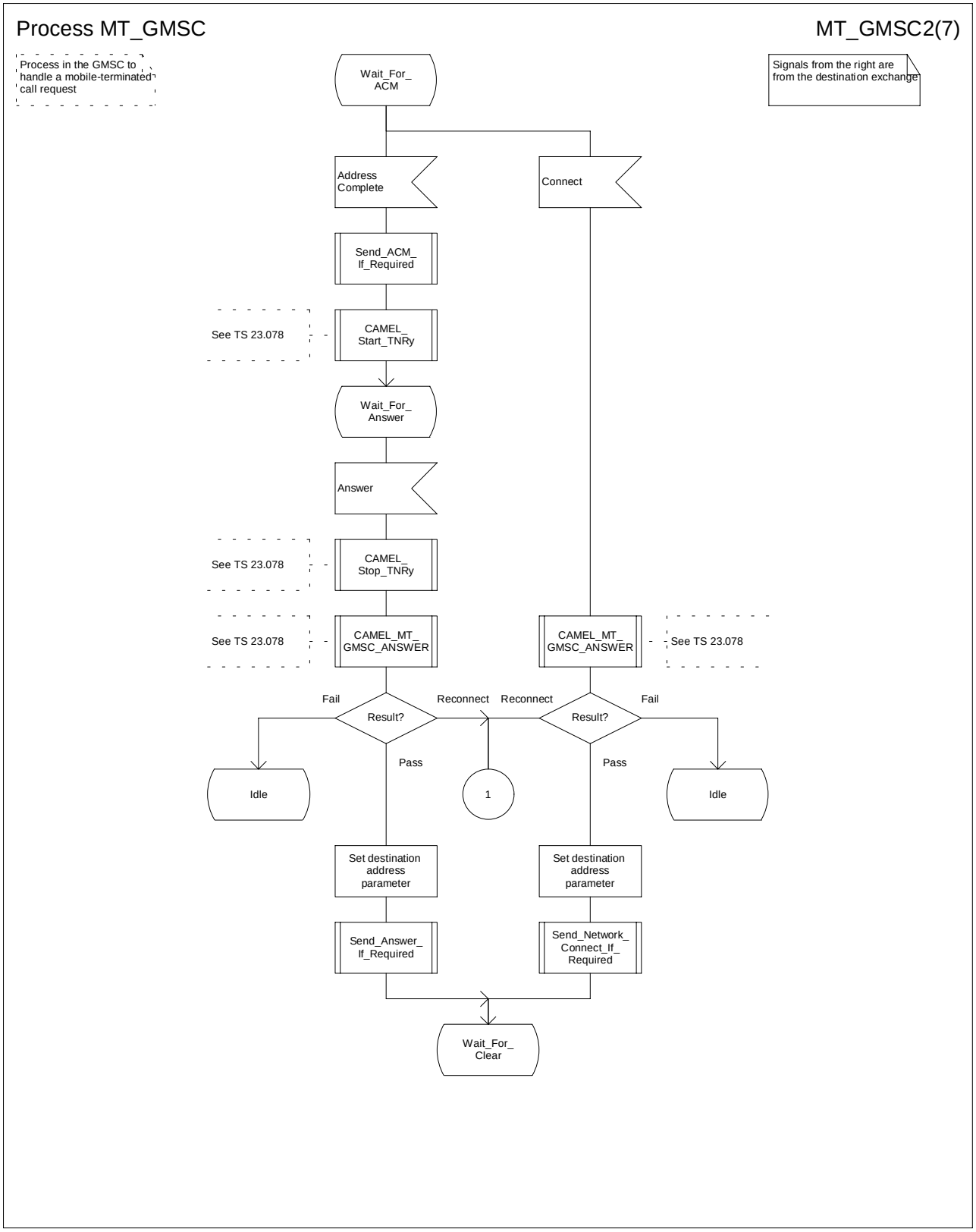
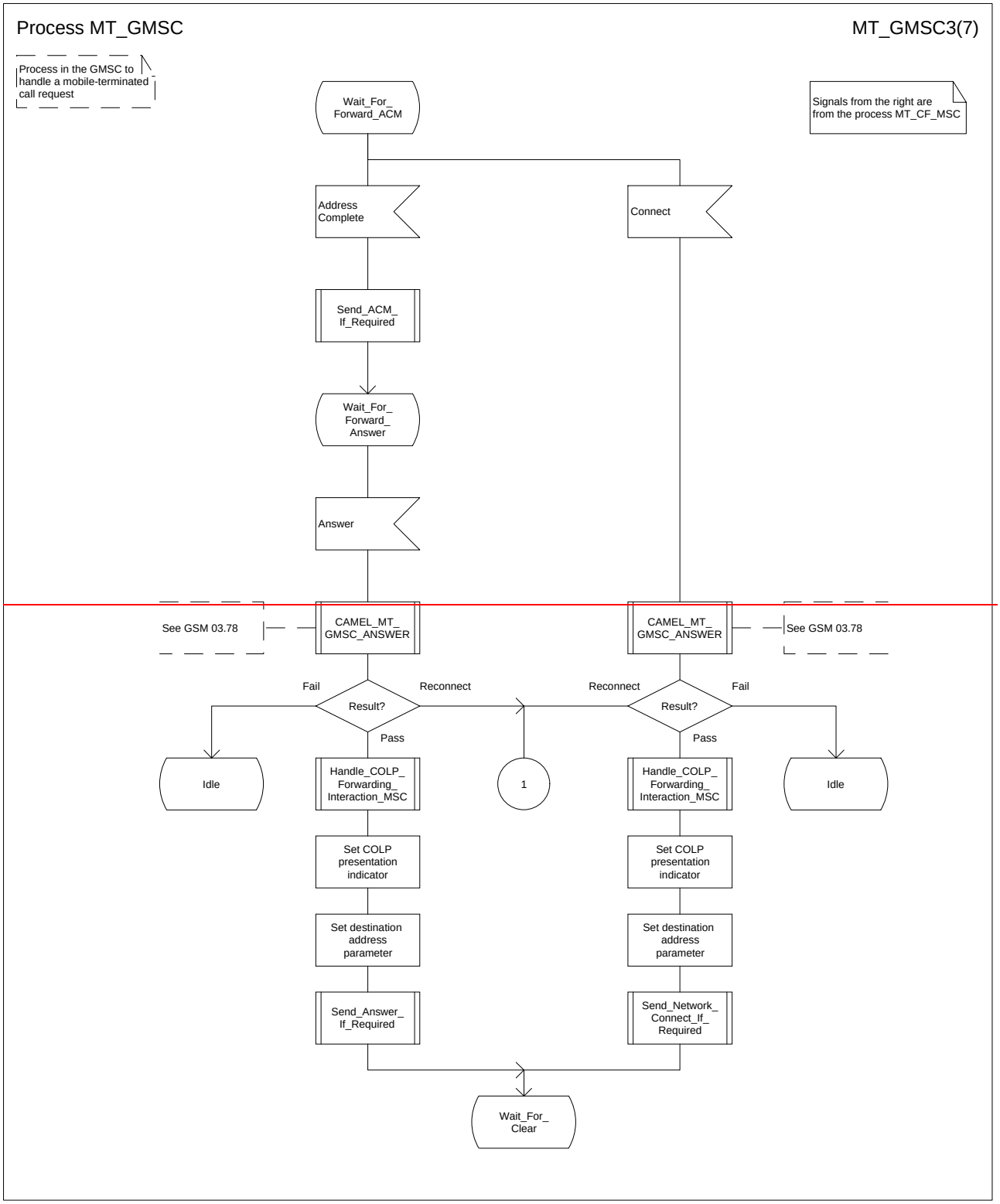


Figure 35b: Process MT_GMSC (sheet 2)


Process MT_GMSC
MT_GMSC3(7)
Process in the GMSC to handle a mobile-terminated call request
Signals from the right are from the process MT_CF_MSC
Wait_For_ Forward_ACM
Address Complete
Connect
Send_ACM_ If_Required
Wait_For_ Forward_ Answer
Answer
See GSM 03.78
CAMEL_MT_ GMSC_ANSWER
CAMEL_MT_ GMSC_ANSWER
See GSM 03.78
Fail
Result?
Reconnect
Reconnect
Result?
Fail
Pass
Pass
Idle
Handle_COLP_ Forwarding_ Interaction_MSC
1
Handle_COLP_ Forwarding_ Interaction_MSC
Idle
Set COLP presentation indicator
Set COLP presentation indicator
Set destination address parameter
Set destination address parameter
Send_Answer_ If_Required
Send_Network_ Connect_If_ Required
Wait_For_ Clear

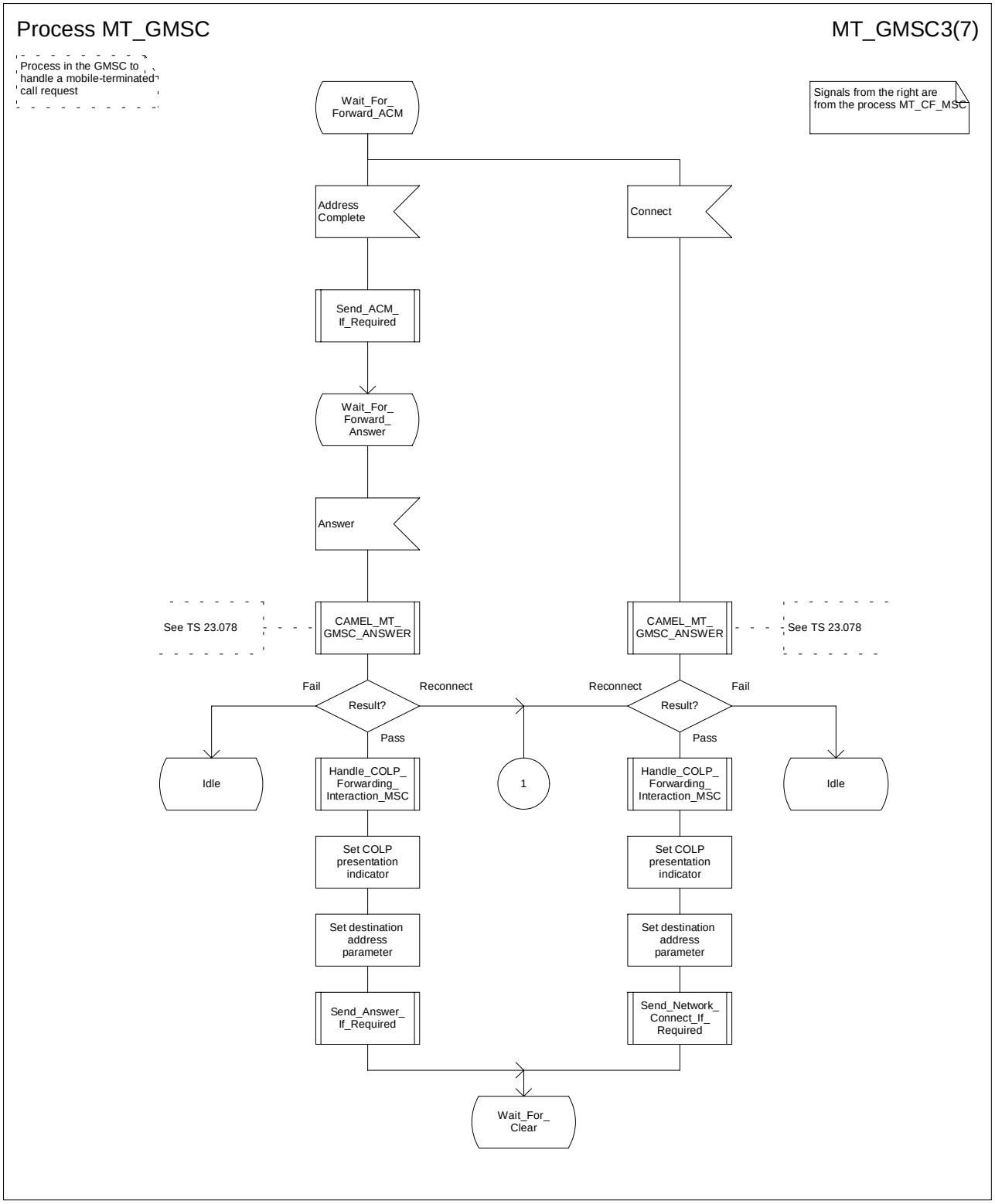
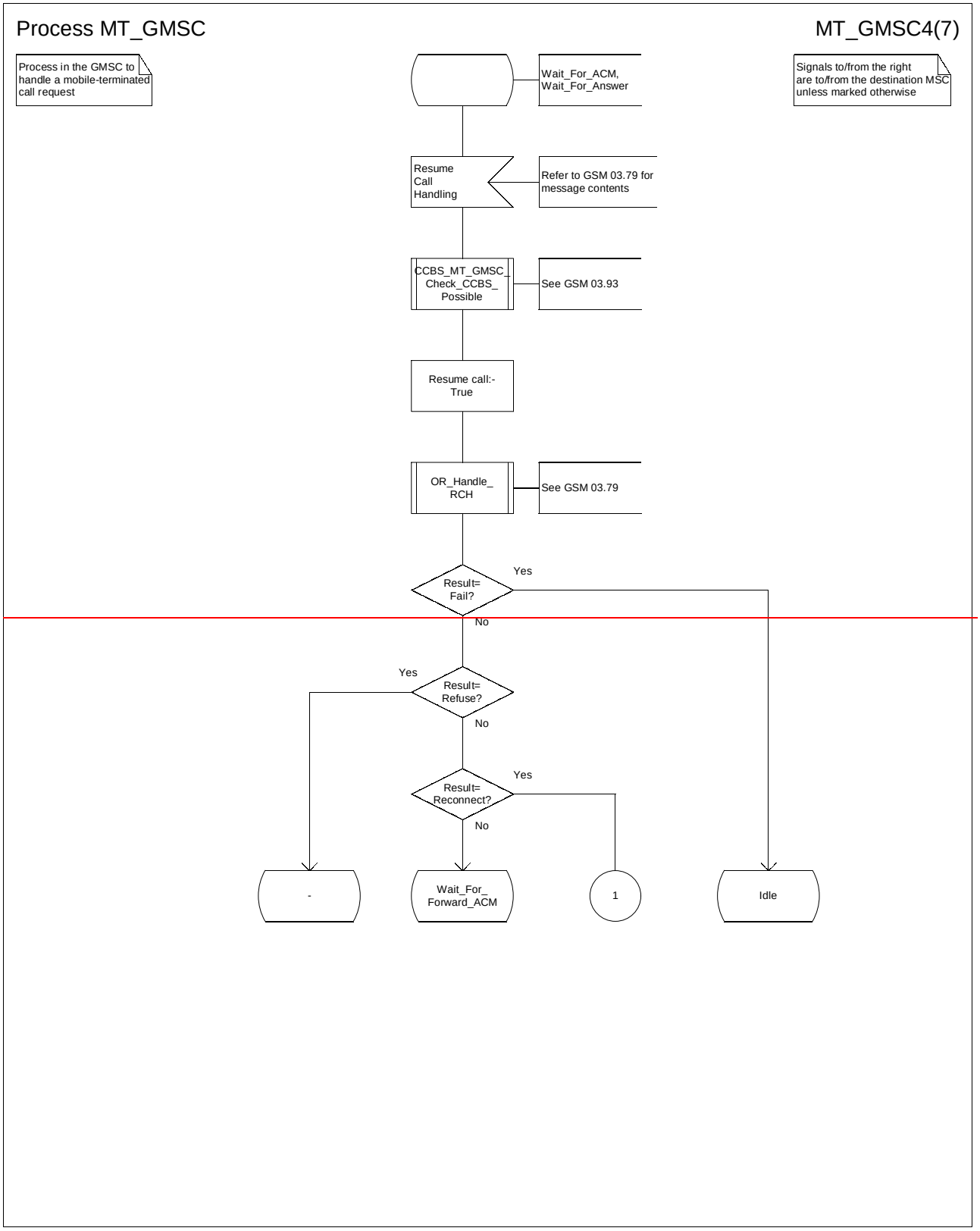


Figure 35c: Process MT_GMSC (sheet 3)


Process MT_GMSC
MT_GMSC4(7)
Process in the GMSC to handle a mobile-terminated call request
Wait_For_ACM, Wait_For_Answer
Signals to/from the right are to/from the destination MSC unless marked otherwise
Resume Call Handling
Refer to GSM 03.79 for message contents
CCBS_MT_GMSC_ Check_CCBS_ Possible
See GSM 03.93
Resume call:- True
OR_Handle_ RCH
See GSM 03.79
Result= Fail?
Yes
No
Result= Refuse?
Yes
No
Result= Reconnect?
Yes
No
-
Wait_For_ Forward_ACM
1
Idle

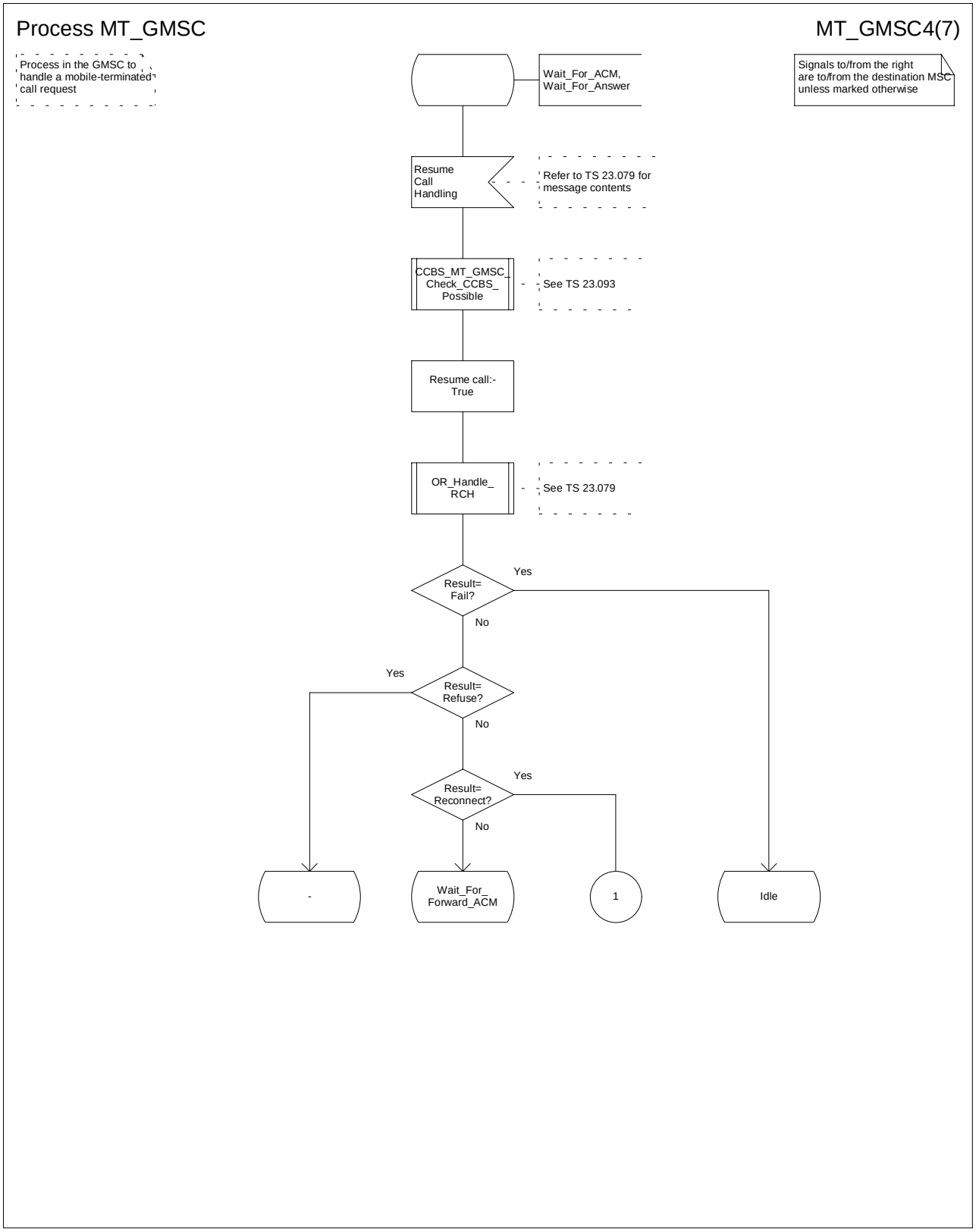
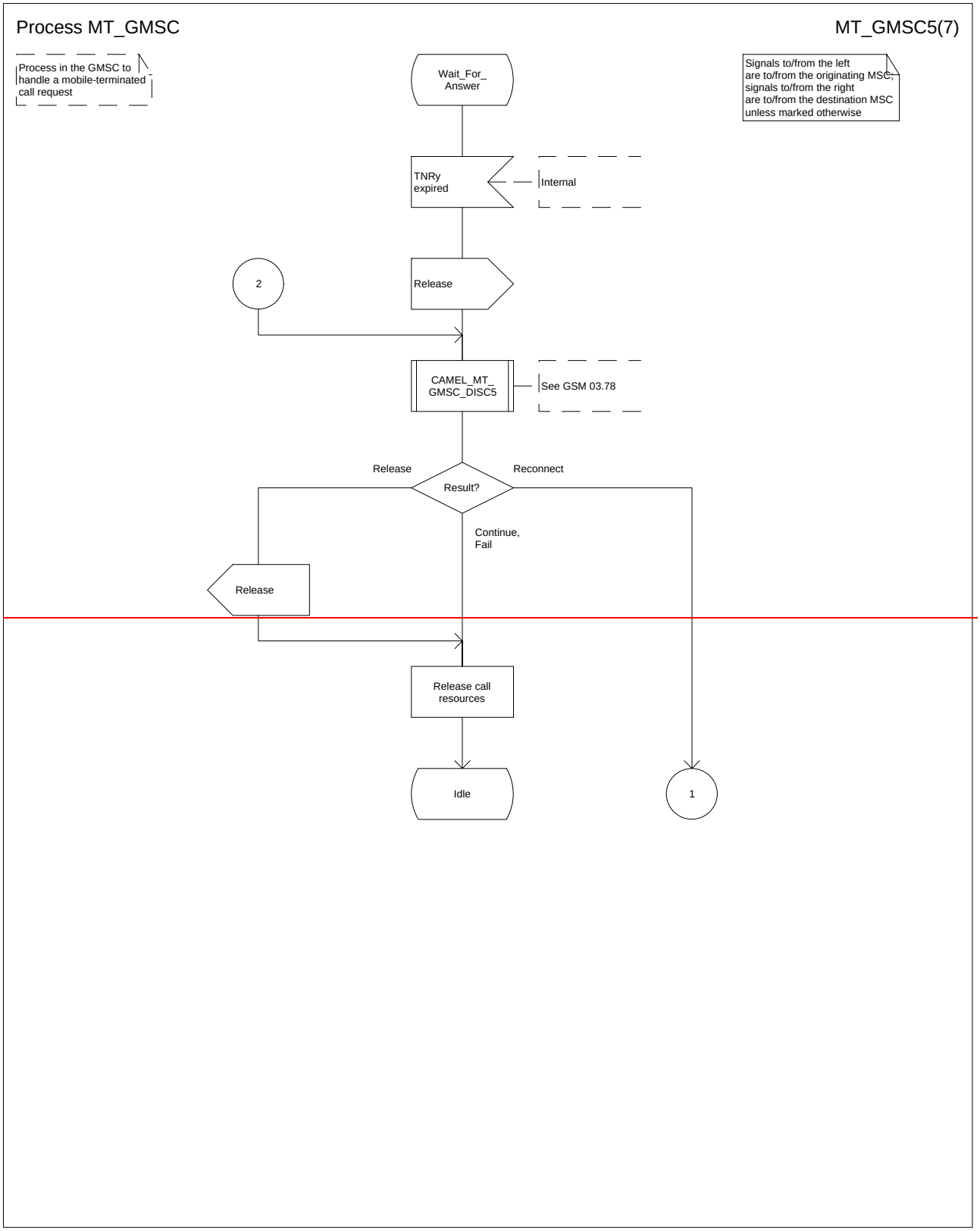


Figure 35d: Process MT_GMSC (sheet 4)


Process MT_GMSC
MT_GMSC5(7)
Process in the GMSC to handle a mobile-terminated call request
Signals to/from the left are to/from the originating MSC; signals to/from the right are to/from the destination MSC unless marked otherwise
Wait_For_ Answer
TNRy expired
Internal
2
Release
CAMEL_MT_ GMSC_DISC5
See GSM 03.78
Release
Result?
Reconnect
Continue, Fail
Release
Release call resources
Idle
1

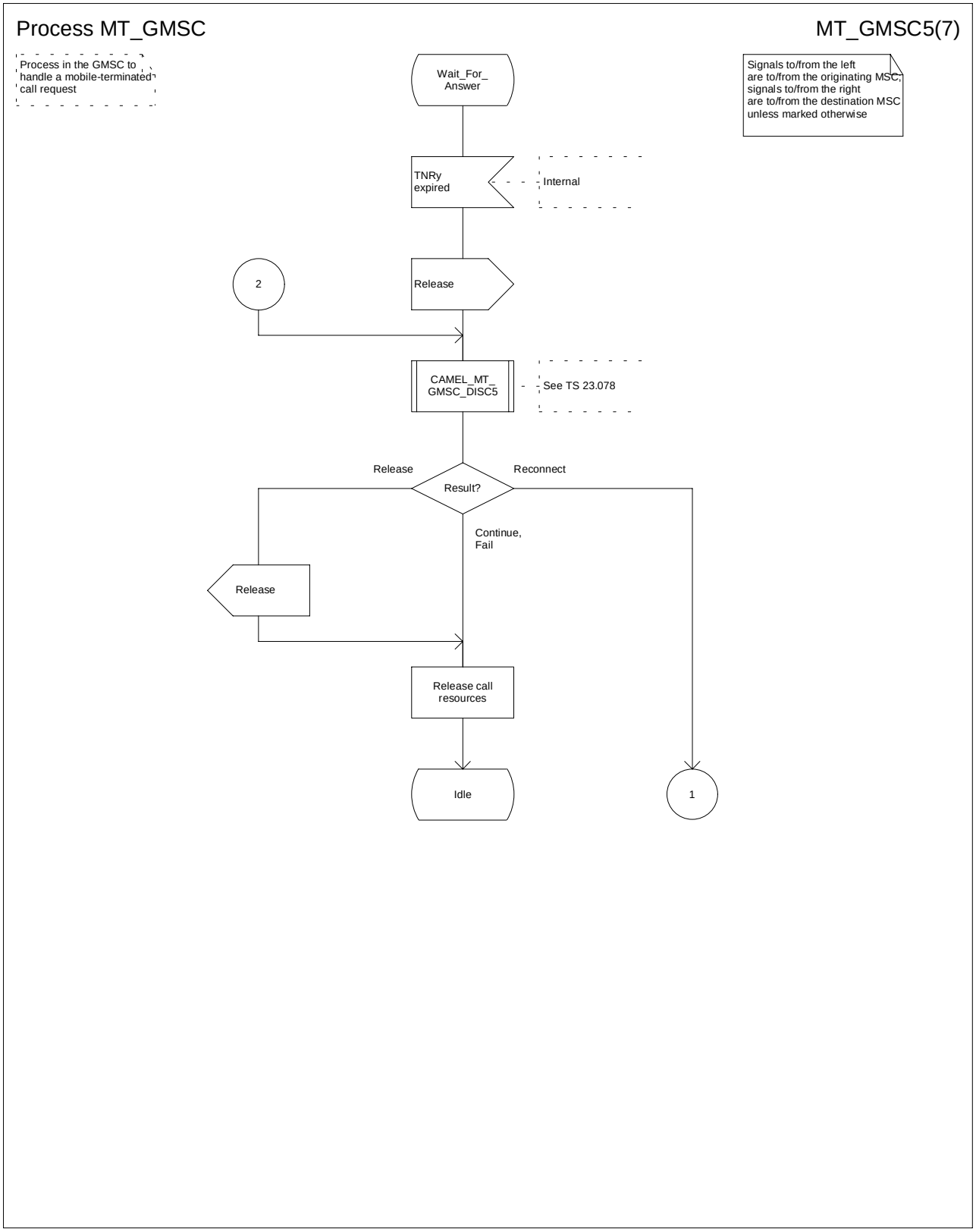
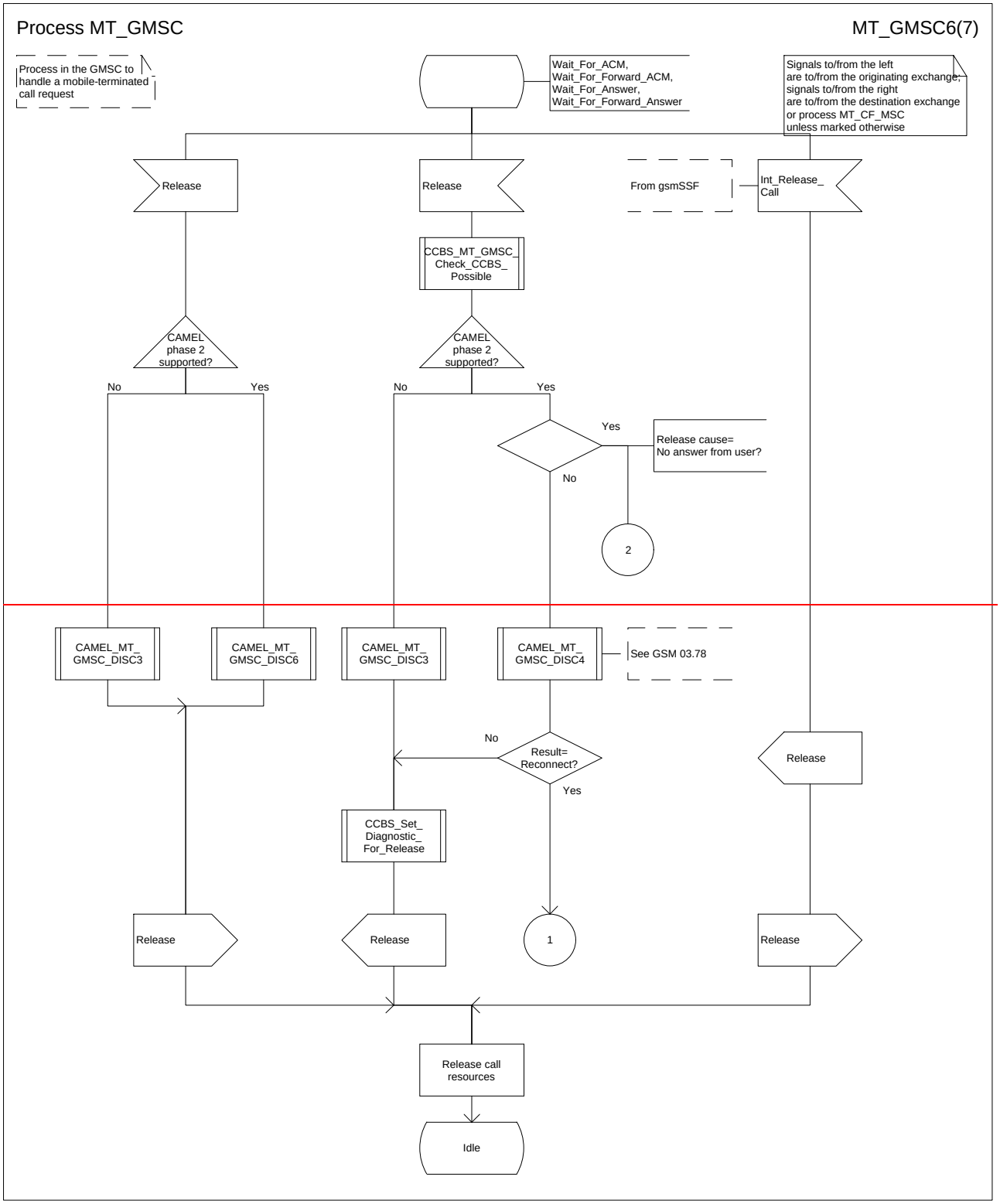


Figure 35e: Process MT_GMSC (sheet 5)


Process MT_GMSC
MT_GMSC6(7)
Process in the GMSC to handle a mobile-terminated call request
Wait_For_ACM, Wait_For_Forward_ACM, Wait_For_Answer, Wait_For_Forward_Answer
Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the destination exchange or process MT_CF_MSC unless marked otherwise
Release
Release
From gsmSSF
Int_Release_ Call
CCBS_MT_GMSC_ Check_CCBS_ Possible
CAMEL phase 2 supported?
CAMEL phase 2 supported?
No
Yes
No
Yes
Yes
Release cause= No answer from user?
No
2
CAMEL_MT_ GMSC_DISC3
CAMEL_MT_ GMSC_DISC6
CAMEL_MT_ GMSC_DISC3
CAMEL_MT_ GMSC_DISC4
See GSM 03.78
No
Result= Reconnect?
Yes
Release
CCBS_Set_ Diagnostic_ For_Release
Release
Release
1
Release
Release call resources
Idle

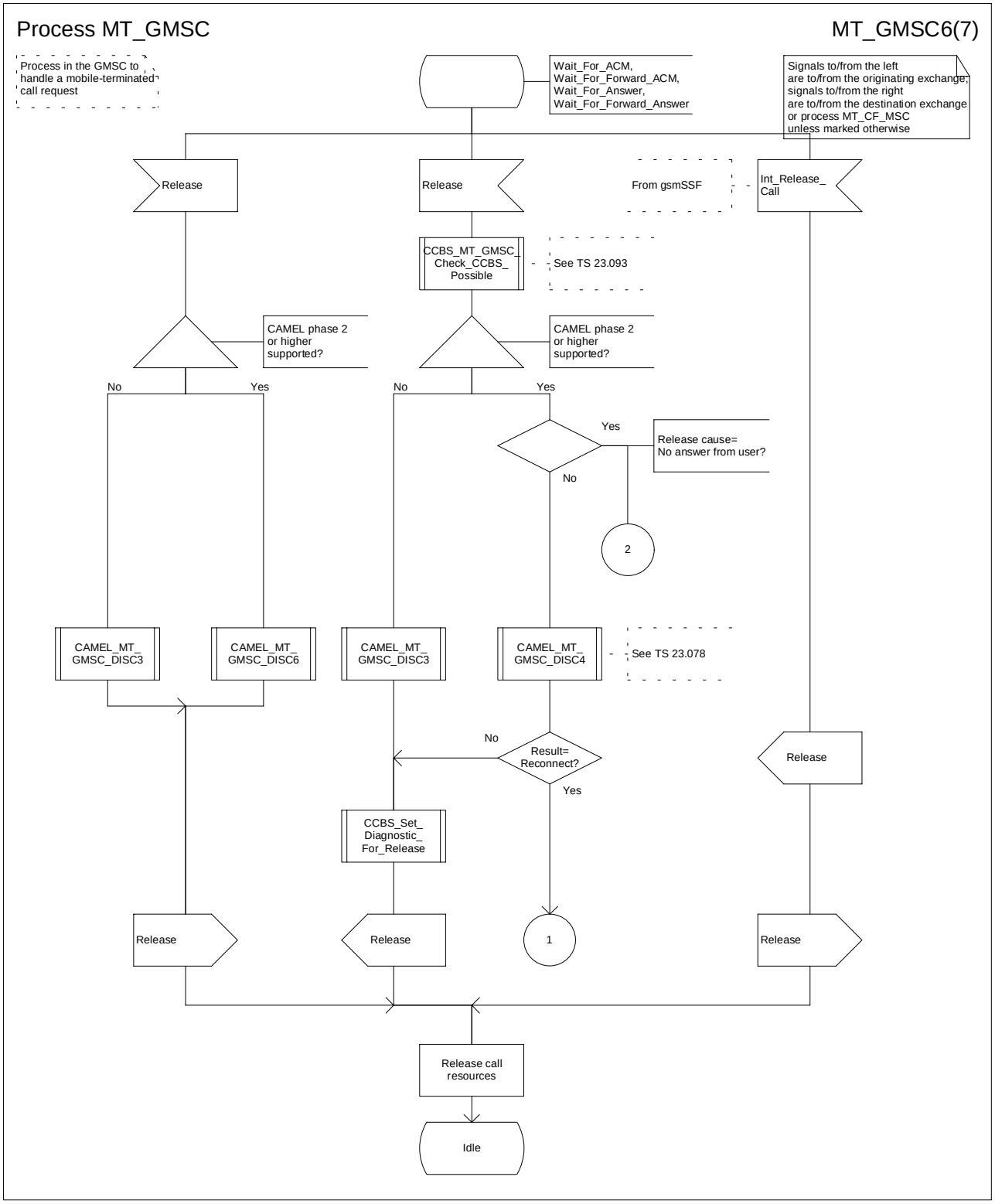
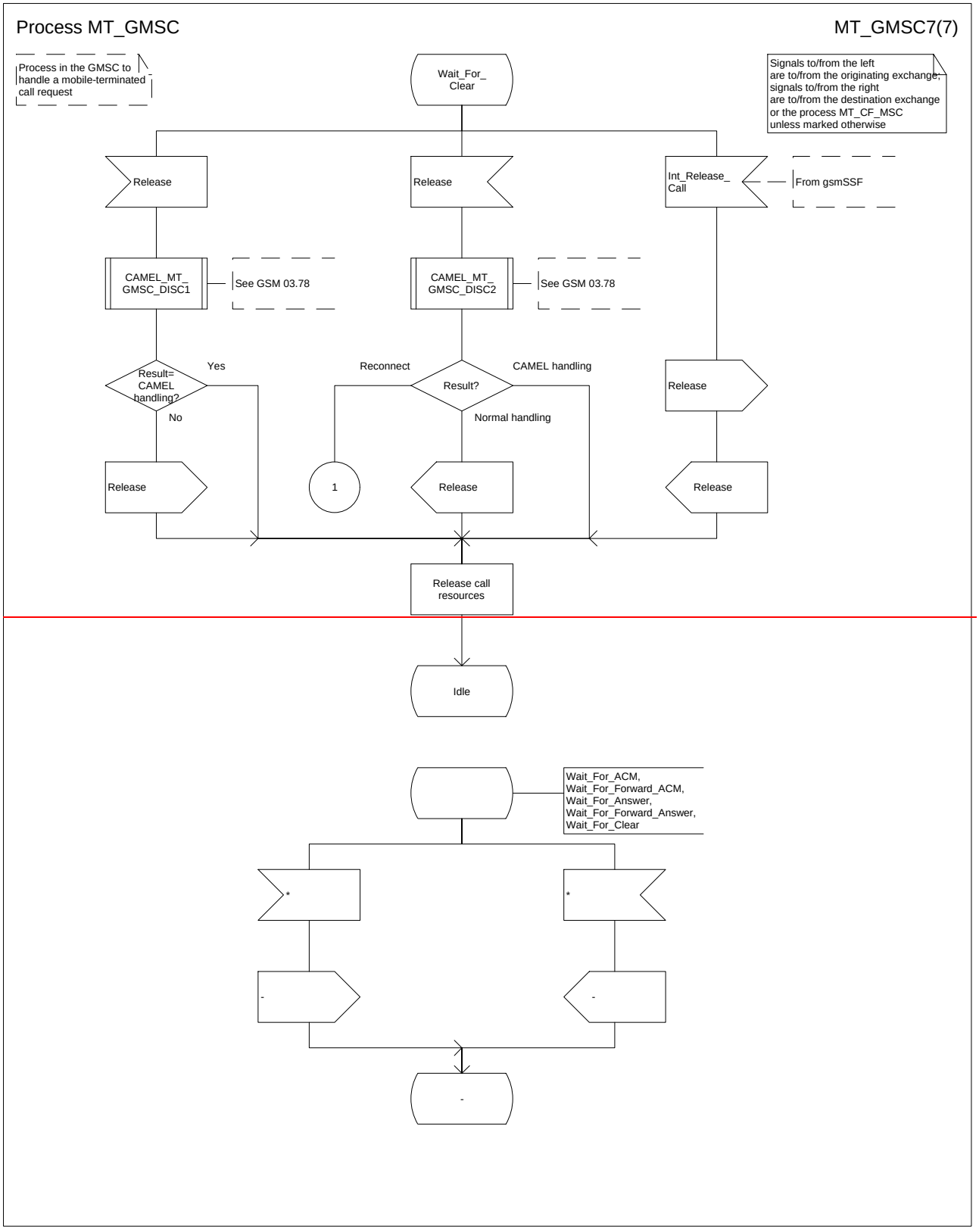


Figure 35f: Process MT_GMSC (sheet 6)


Process MT_GMSC
MT_GMSC7(7)
Process in the GMSC to handle a mobile-terminated call request
Wait_For_ Clear
Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the destination exchange or the process MT_CF_MSC unless marked otherwise
Release
Release
Int_Release_ Call
From gsmSSF
CAMEL_MT_ GMSC_DISC1
See GSM 03.78
CAMEL_MT_ GMSC_DISC2
See GSM 03.78
Result= CAMEL handling?
Yes
No
Reconnect
Result?
CAMEL handling
Normal handling
Release
Release
1
Release
Release
Release call resources
Idle
Wait_For_ACM, Wait_For_Forward_ACM, Wait_For_Answer, Wait_For_Forward_Answer, Wait_For_Clear
*
*
-
-
-

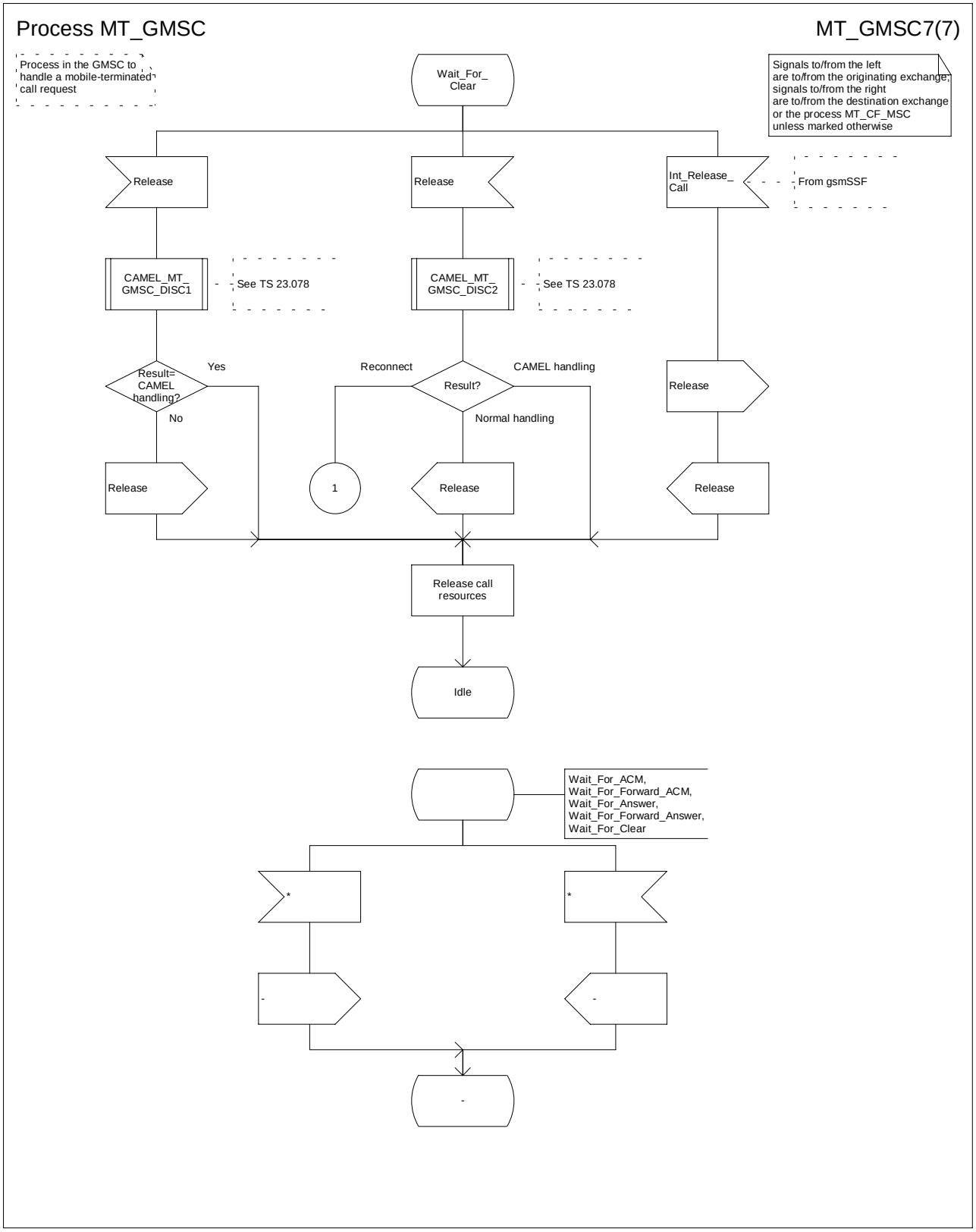
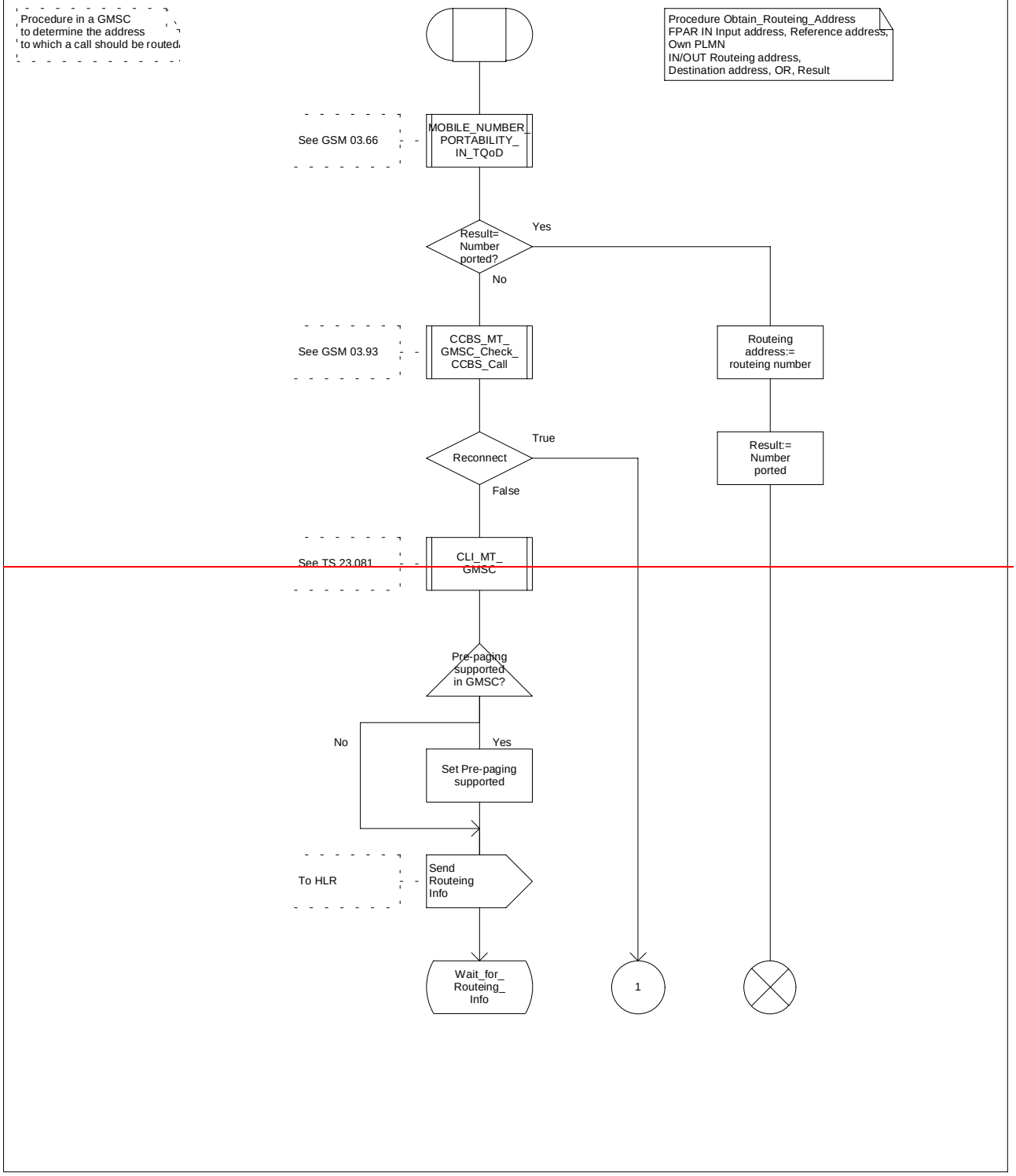


Figure 35g: Process MT_GMSC (sheet 7)

Procedure Obtain_Routeing_Address

ORA1(4)



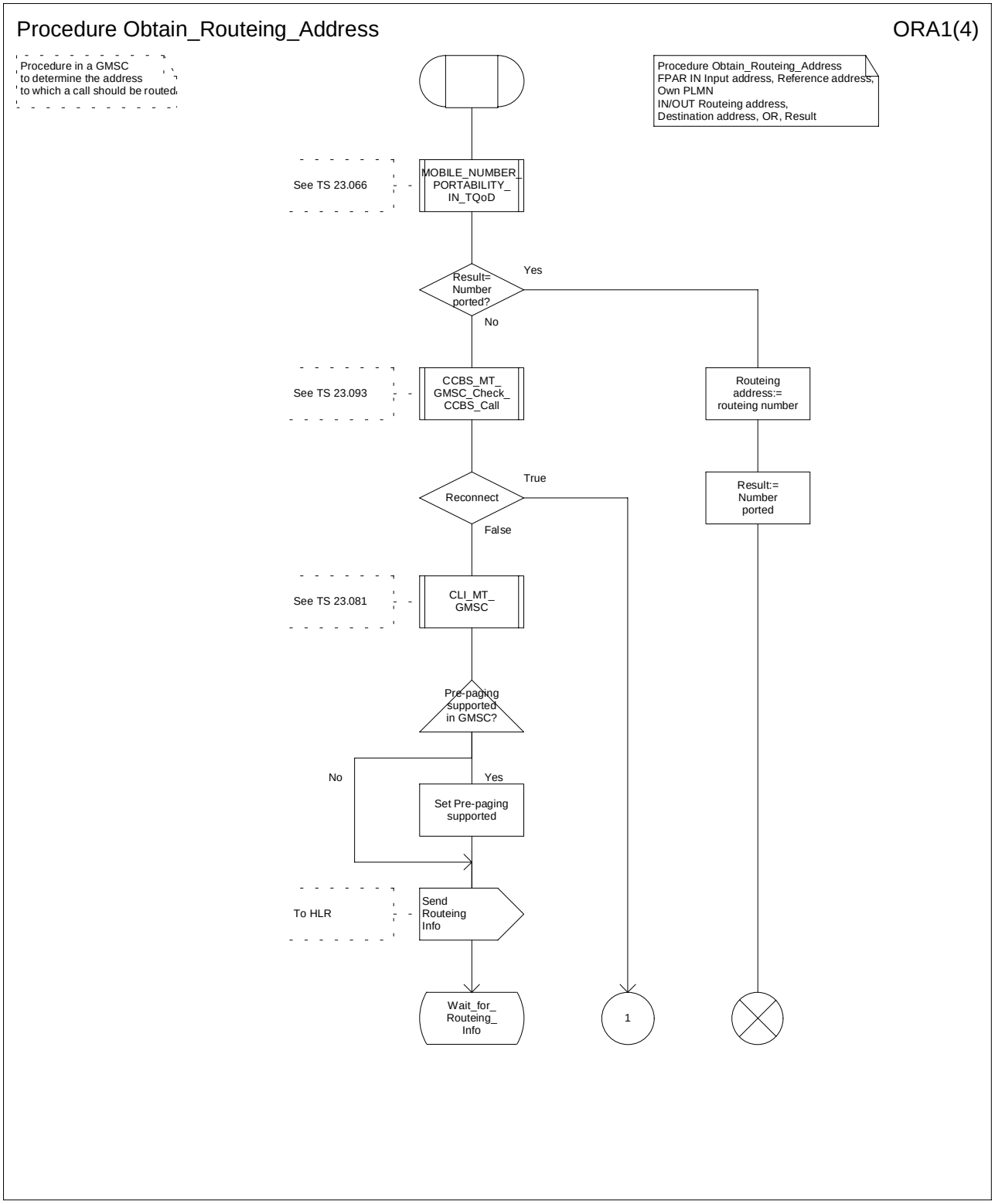
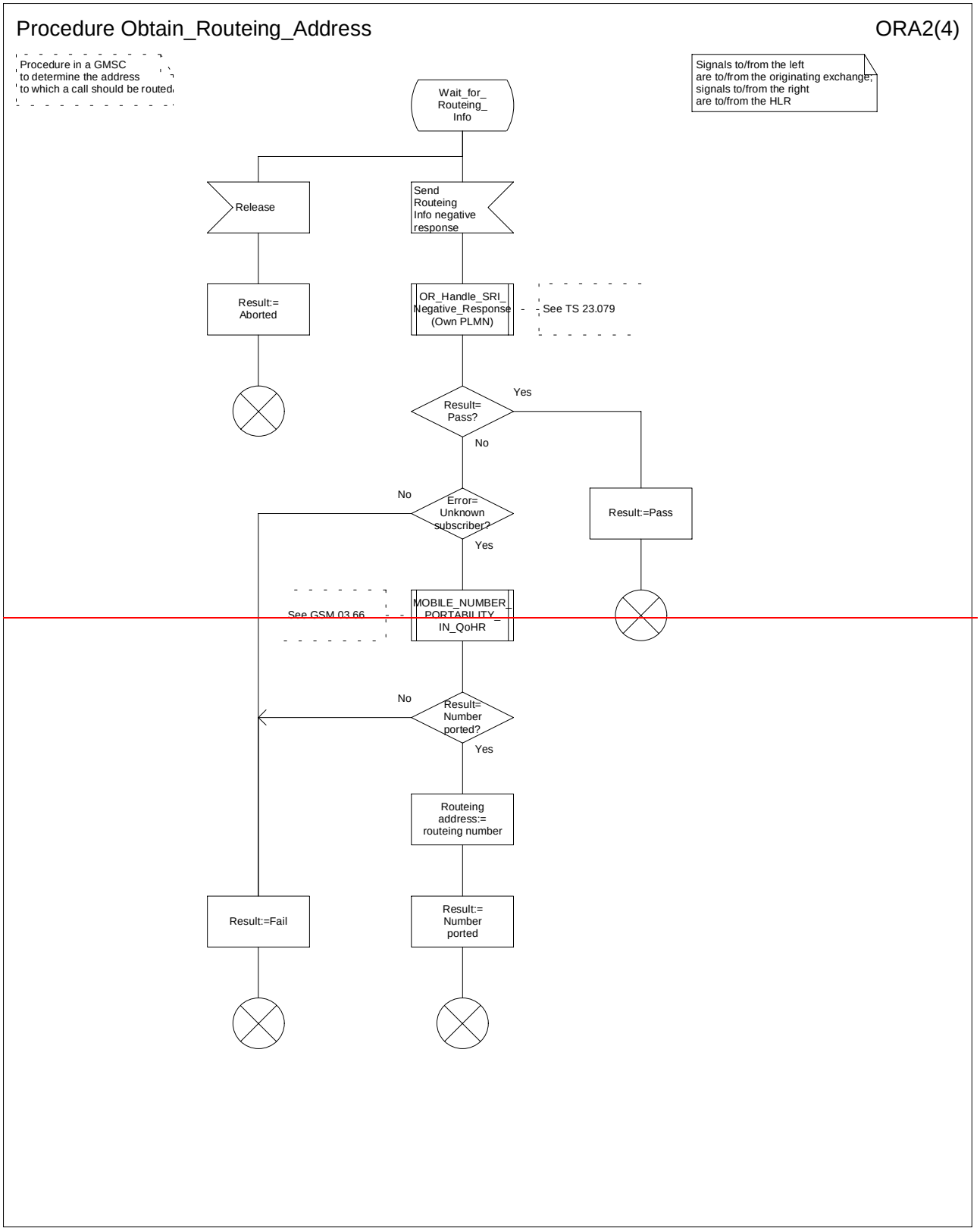


Figure 36a: Procedure Obtain_Routeing_Address (sheet 1)


Procedure Obtain_Routeing_Address
ORA2(4)
Procedure in a GMSC to determine the address to which a call should be routed
Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the HLR
Wait_for_ Routeing_ Info
Release
Send Routeing Info negative response
Result:= Aborted
OR_Handle_SRI_ Negative_Response (Own PLMN)
See TS 23.079
Result= Pass?
Yes
No
Error= Unknown subscriber?
No
Yes
Result:=Pass
See GSM 03.66
MOBILE_NUMBER_ PORTABILITY_ IN_QoHR
Result= Number ported?
No
Yes
Routeing address:= routeing number
Result:=Fail
Result:= Number ported

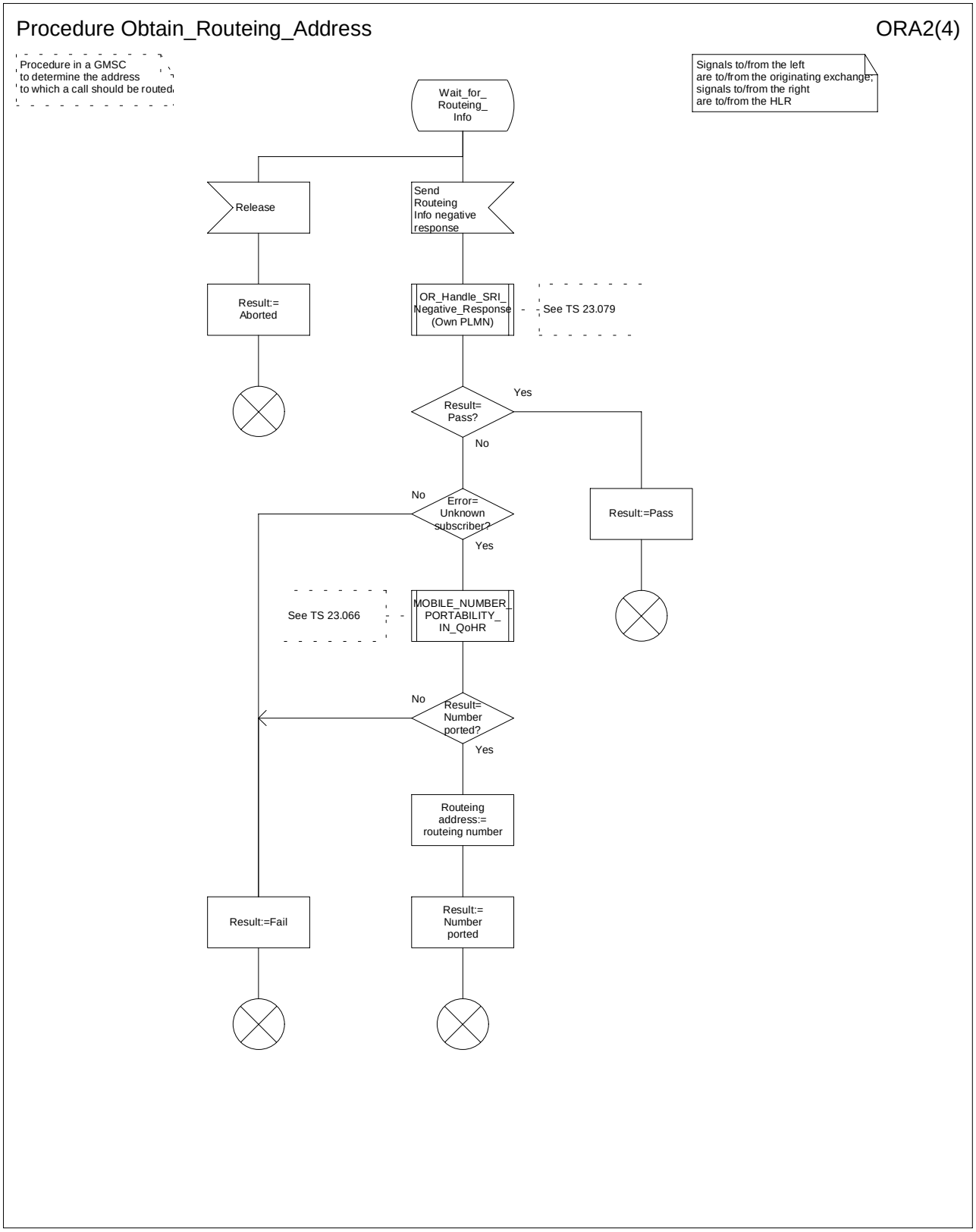
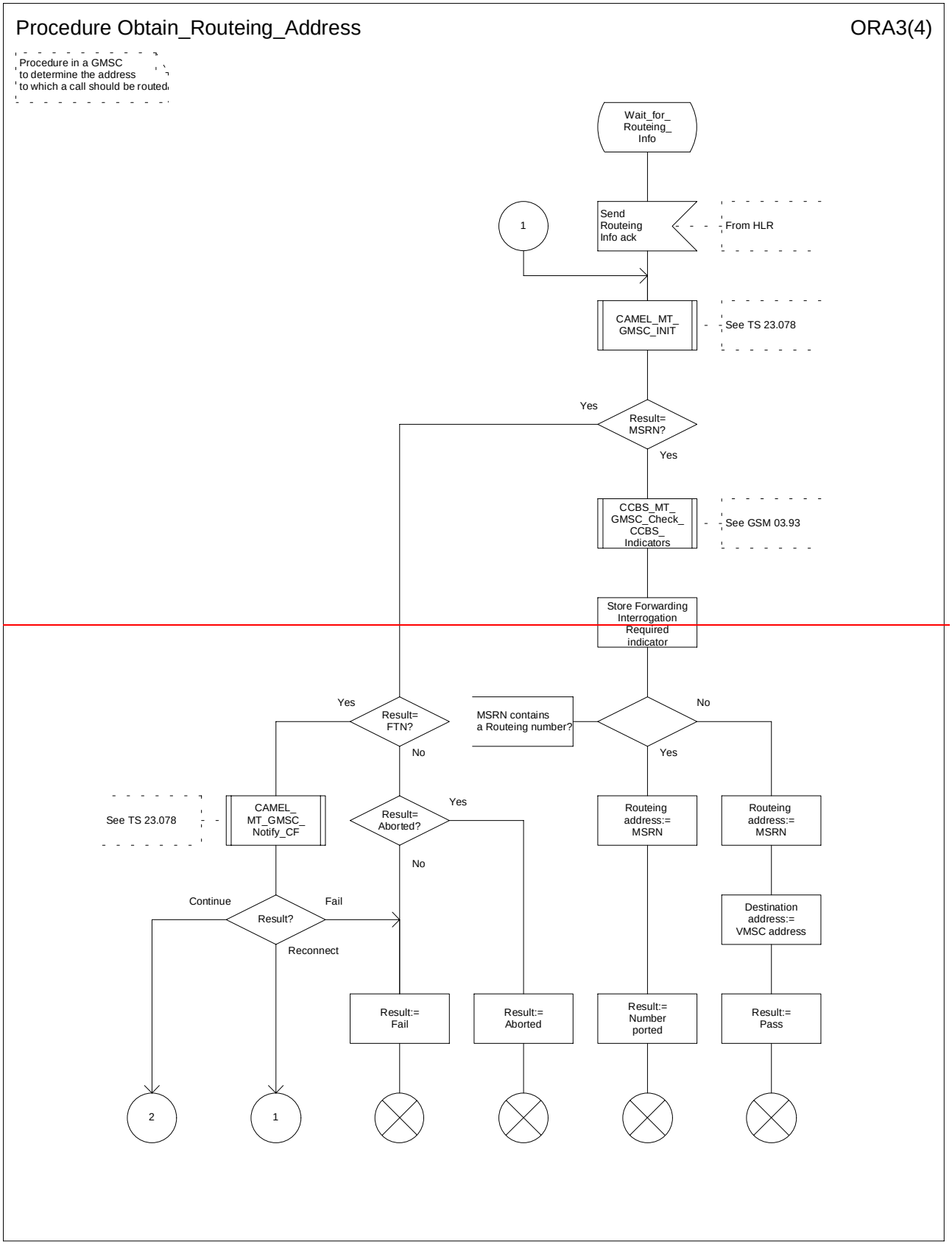


Figure 36b: Procedure Obtain_Routeing_Address (sheet 2)


Procedure Obtain_Routeing_Address
ORA3(4)
Procedure in a GMSC to determine the address to which a call should be routed
Wait_for_ Routeing_ Info
1
Send Routeing Info ack
From HLR
CAMEL_MT_ GMSC_INIT
See TS 23.078
Yes
Result= MSRN?
Yes
CCBS_MT_ GMSC_Check_ CCBS_ Indicators
See GSM 03.93
Store Forwarding Interrogation Required indicator
Yes
Result= FTN?
MSRN contains a Routeing number?
No
No
Yes
See TS 23.078
CAMEL_ MT_GMSC_ Notify_CF
Result= Aborted?
Yes
Routeing address:= MSRN
Routeing address:= MSRN
No
Continue
Result?
Fail
Reconnect
Destination address:= VMSC address
Result:= Fail
Result:= Aborted
Result:= Number ported
Result:= Pass
2
1

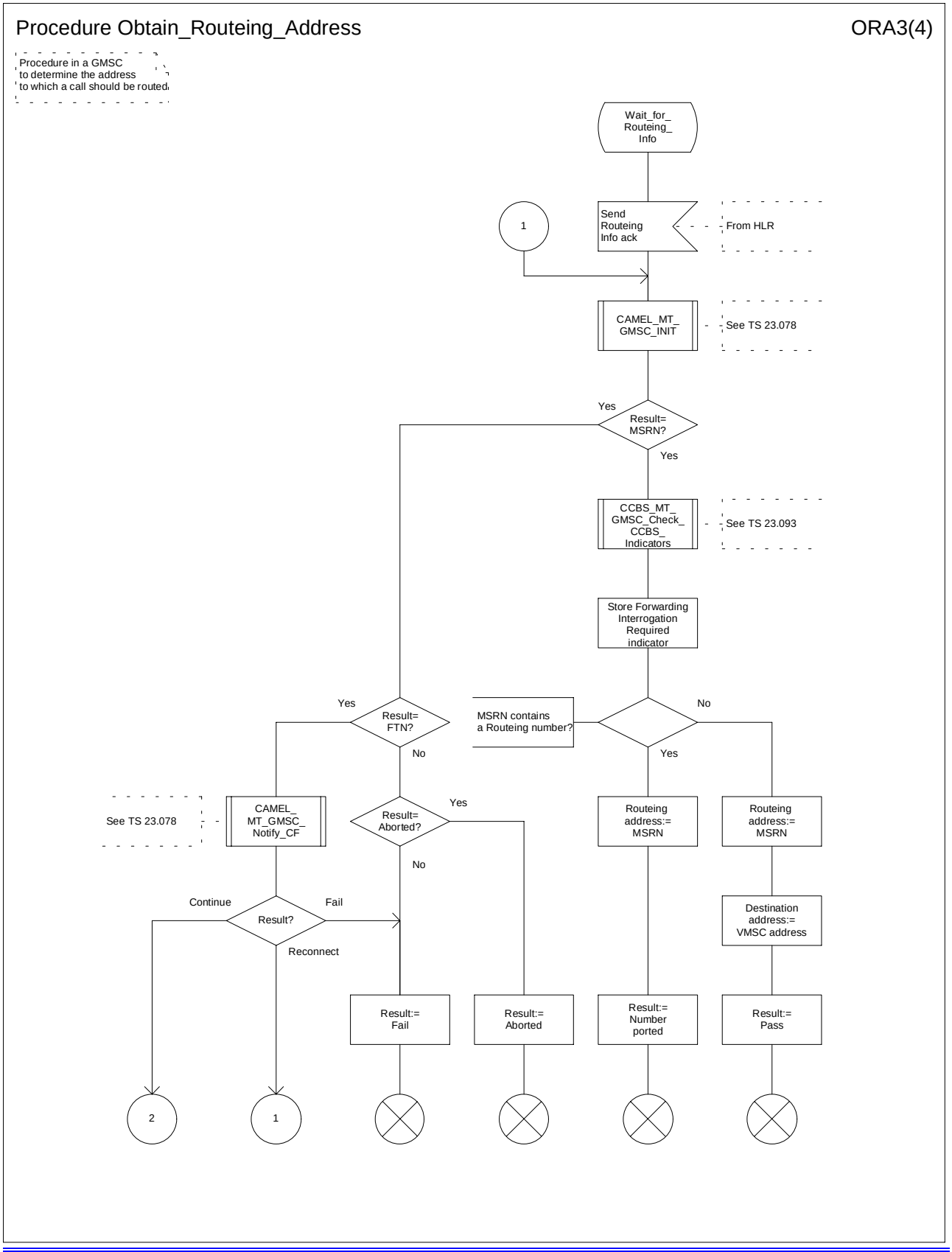
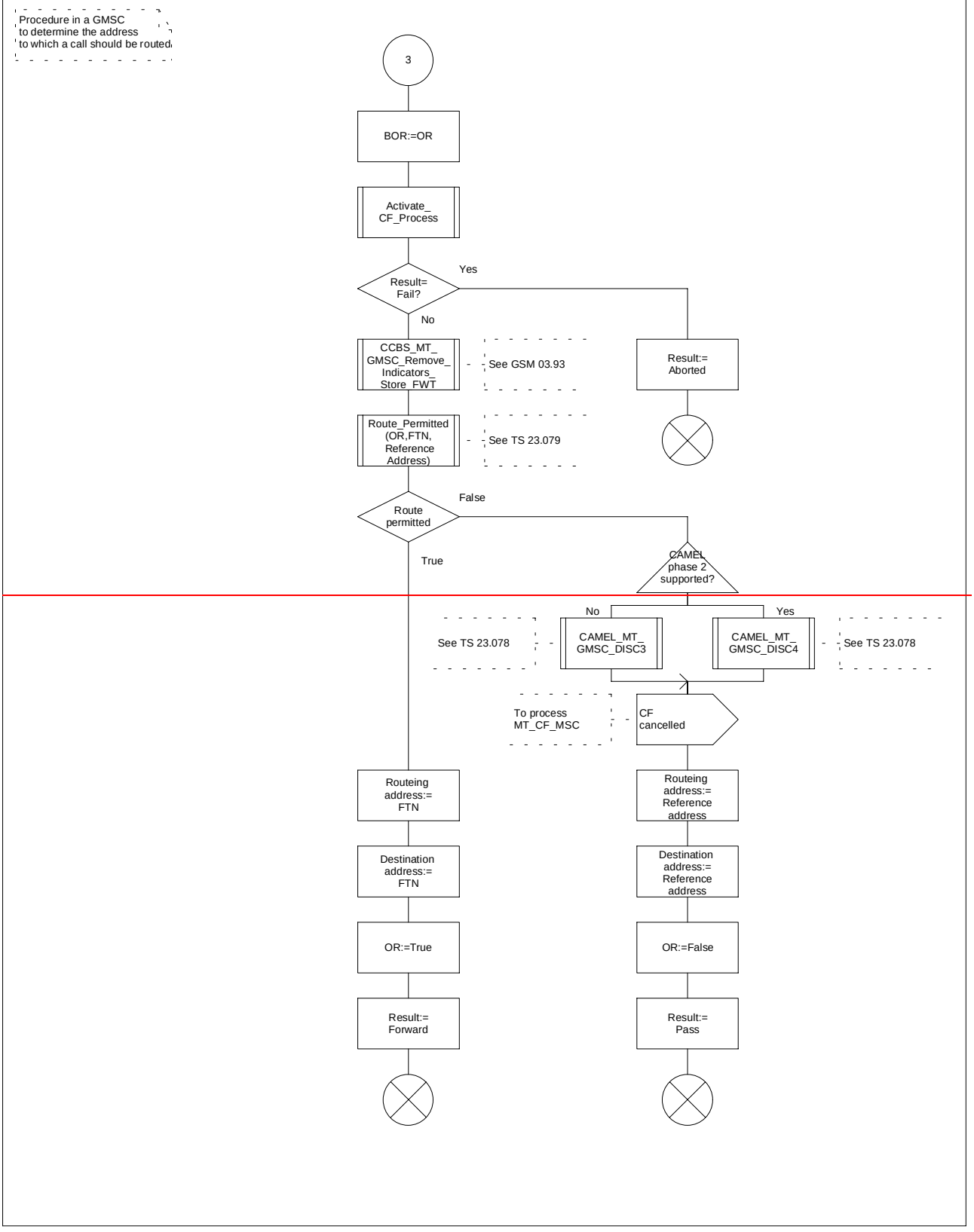


Figure 36c: Procedure Obtain_Routeing_Address (sheet 3)

Procedure Obtain_Routeing_Address ORA4(4)



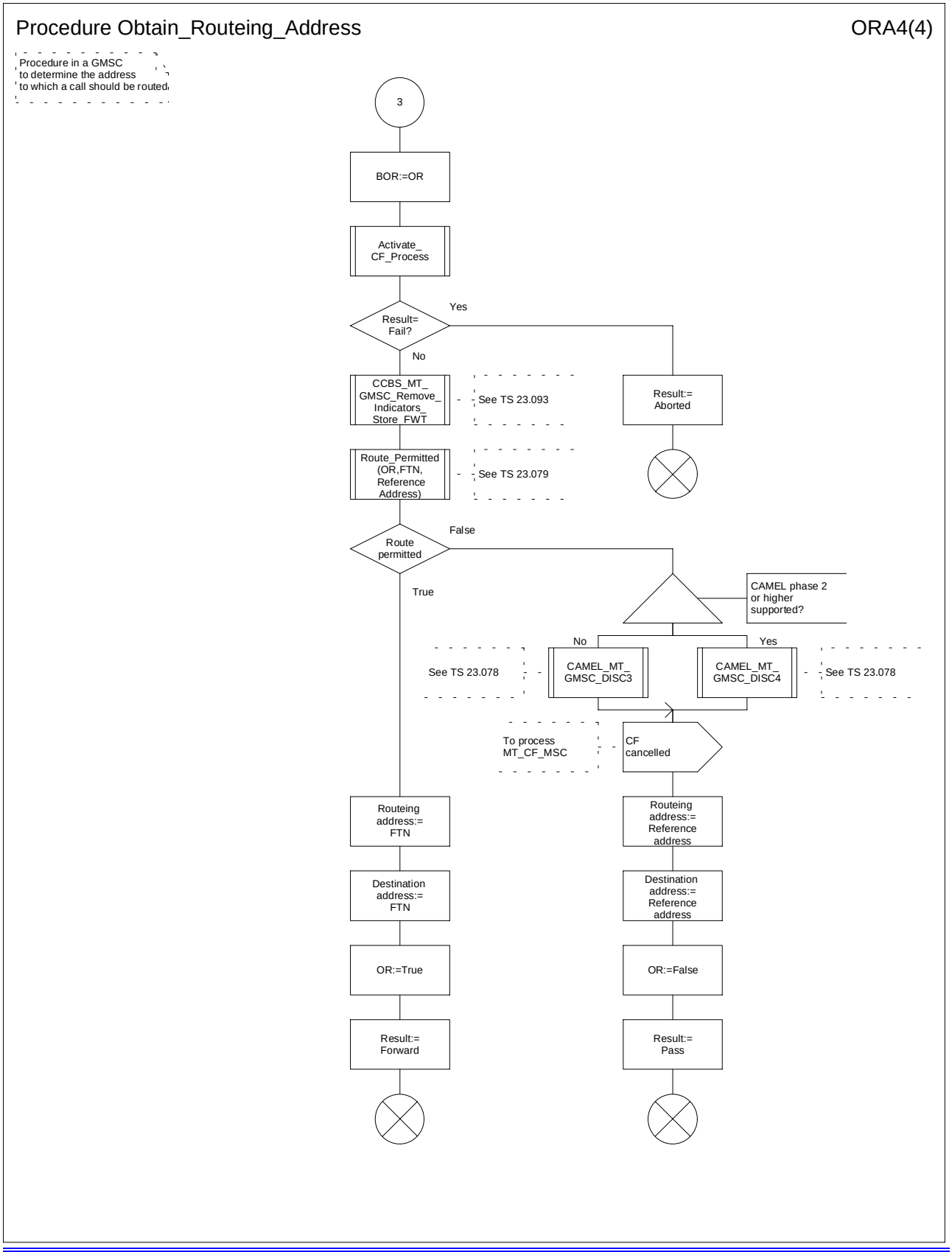


Figure 36d: Procedure Obtain_Routeing_Address (sheet 4)

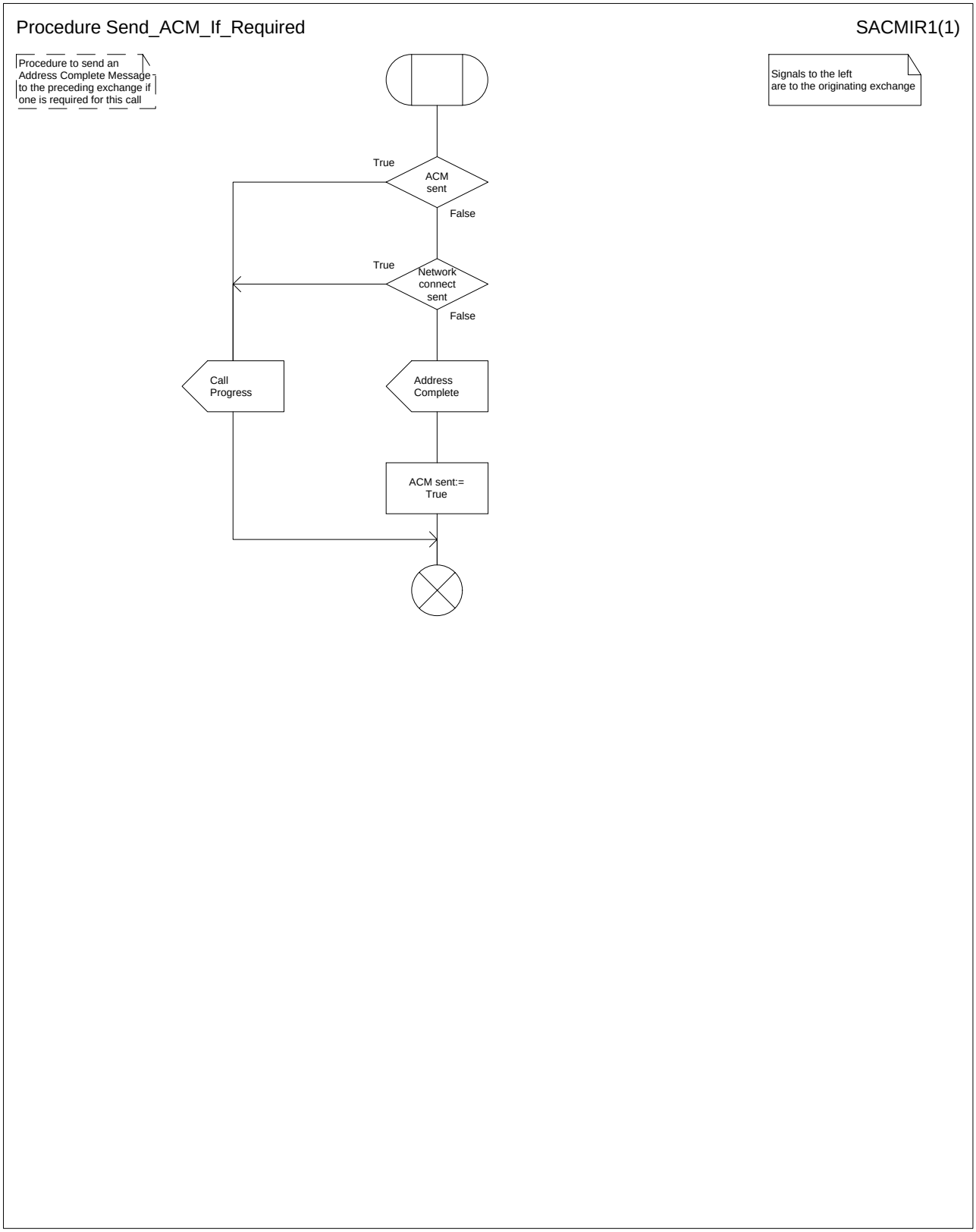


Figure 37: Procedure Send_ACM_If_Required

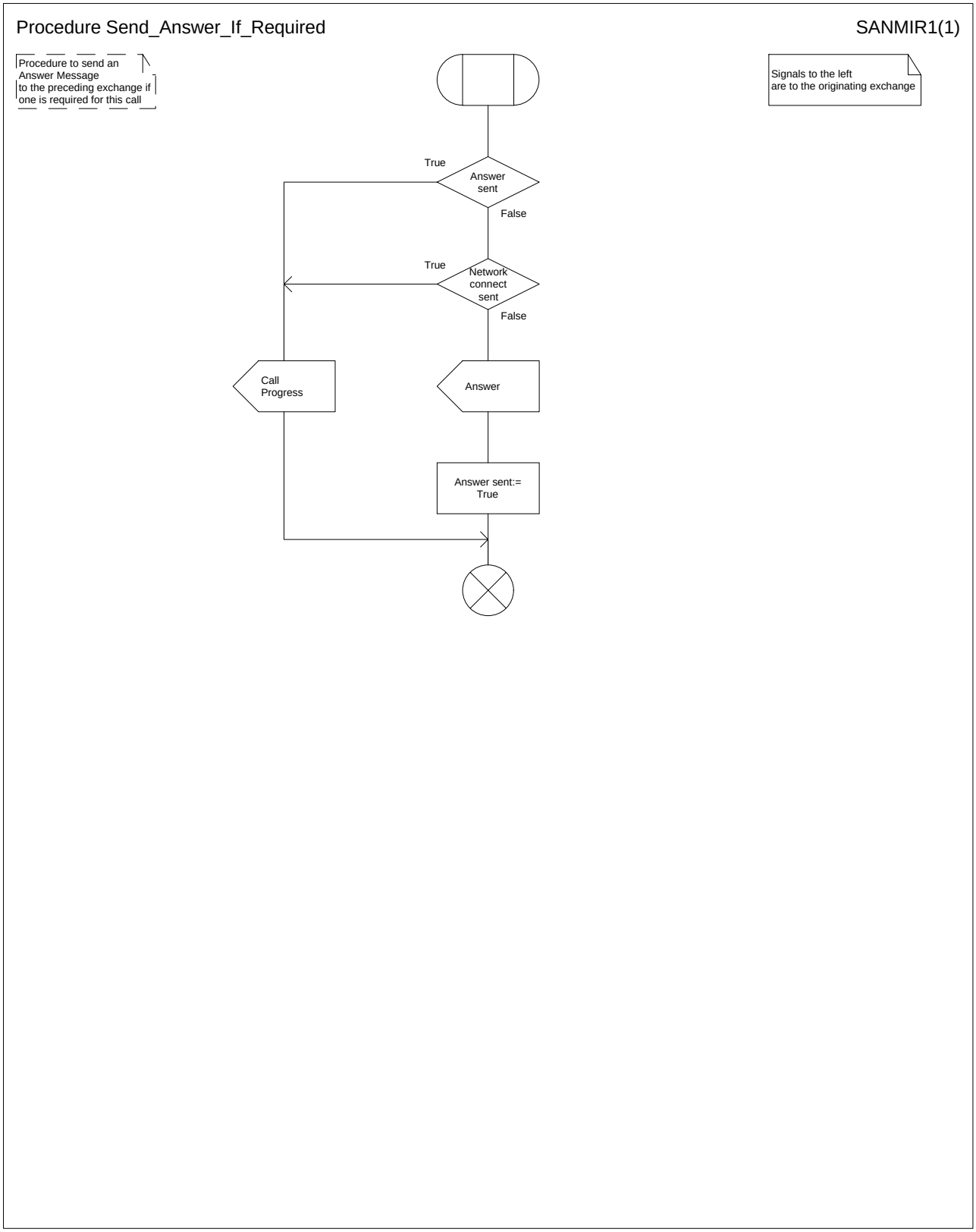


Figure 38: Procedure Send_Answer_If_Required

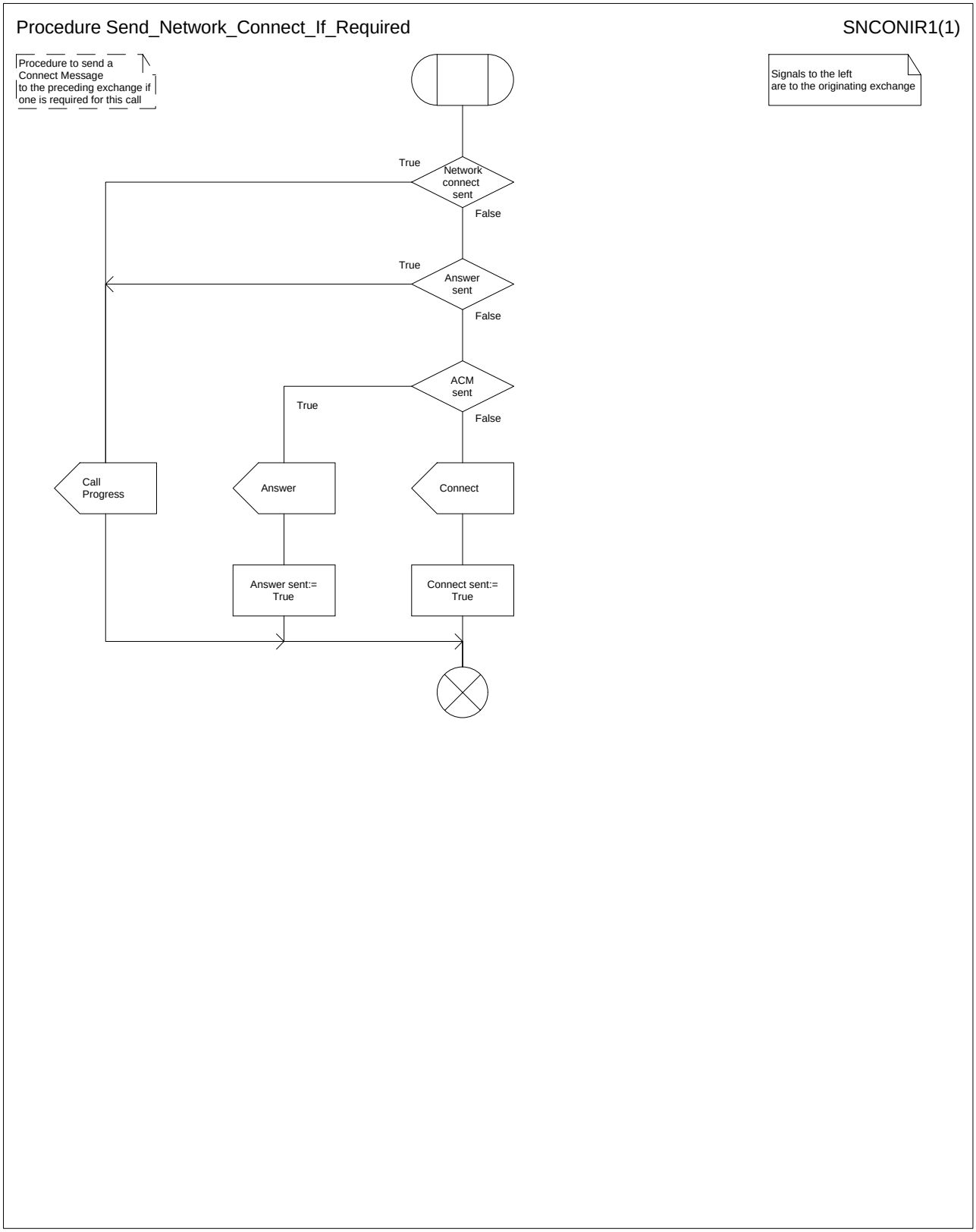


Figure 39: Procedure Send_Network_Connect_If_Required

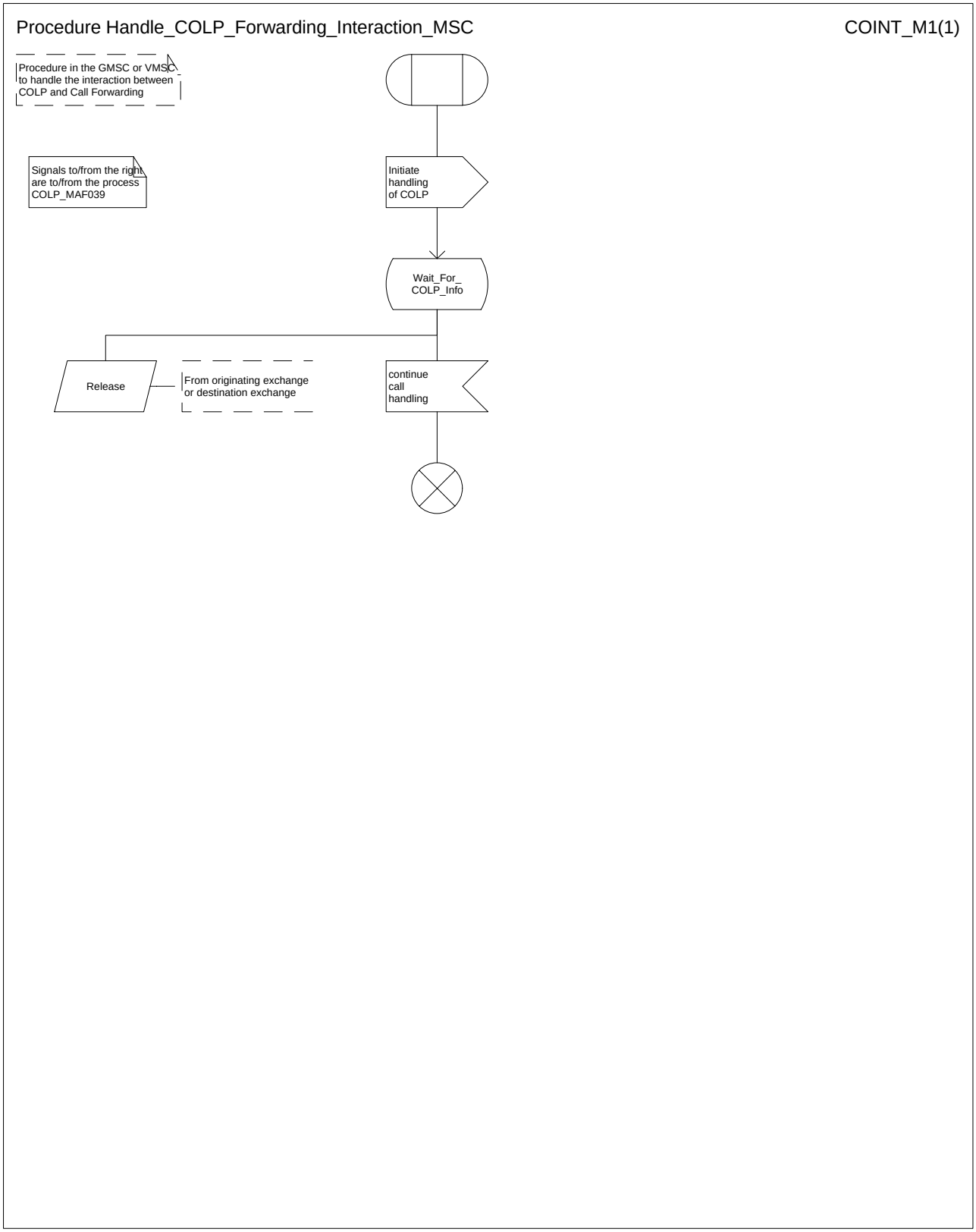


Figure 40: Procedure Handle_COLP_Forwarding_Interaction_MSC

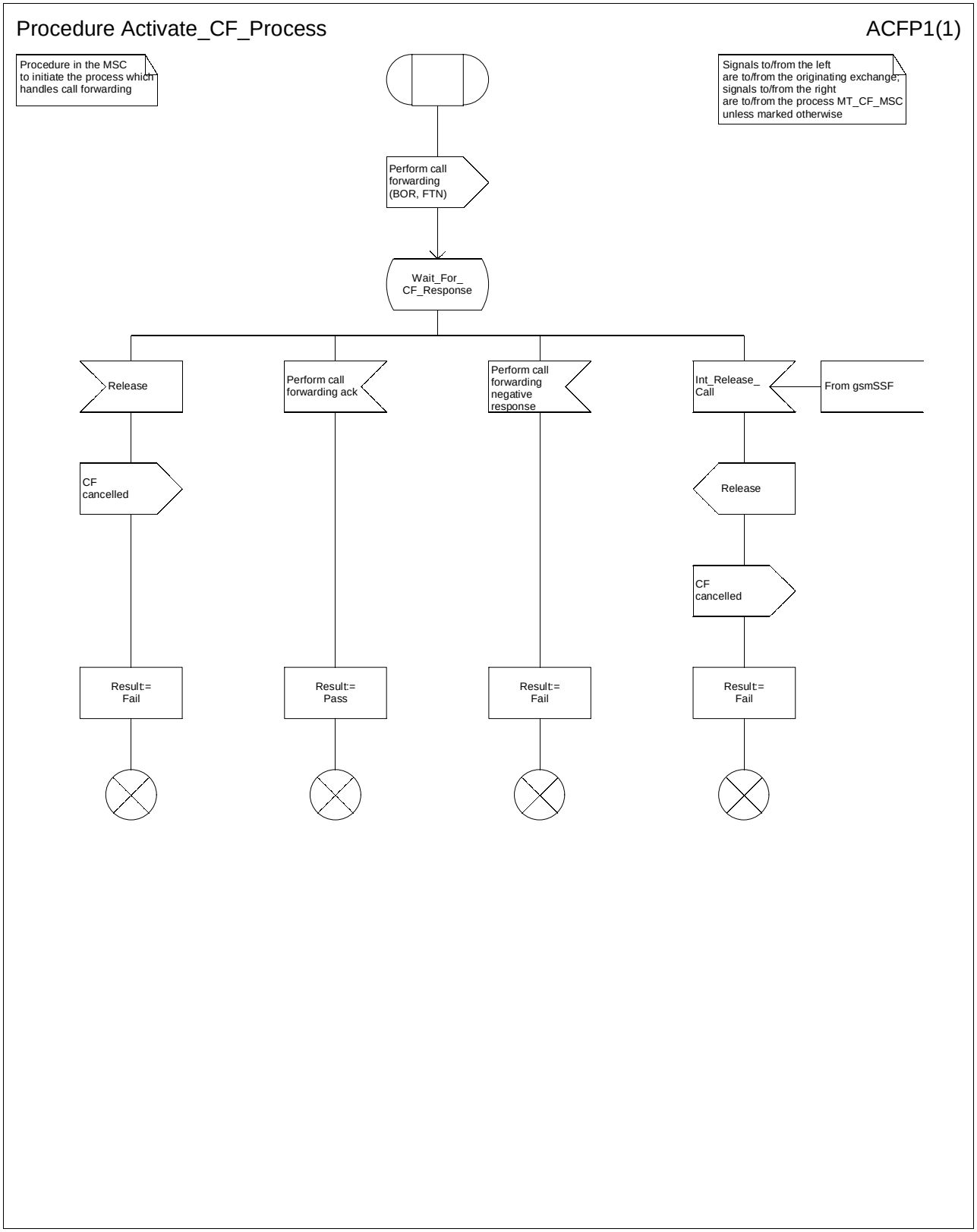
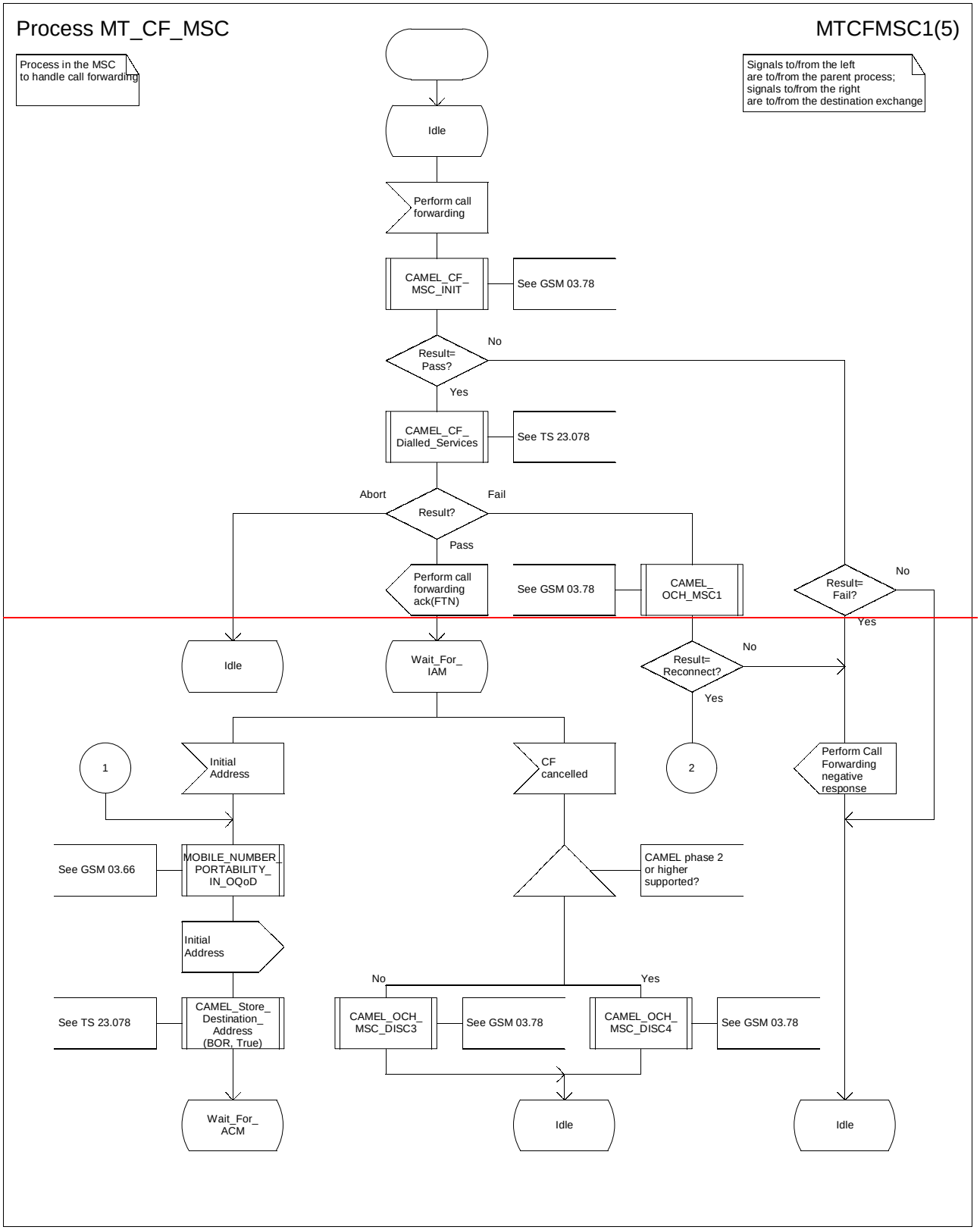


Figure 41: Procedure Activate_Call_Forwarding_Process


Process MT_CF_MSC
MTCFMSC1(5)
Process in the MSC to handle call forwarding
Signals to/from the left are to/from the parent process; signals to/from the right are to/from the destination exchange
Idle
Perform call forwarding
CAMEL_CF_ MSC_INIT
See GSM 03.78
Result= Pass?
No
Yes
CAMEL_CF_ Dialled_Services
See TS 23.078
Abort
Fail
Result?
Pass
Perform call forwarding ack(FTN)
See GSM 03.78
CAMEL_ OCH_MSC1
Result= Fail?
No
Yes
Idle
Wait_For_ IAM
Result= Reconnect?
No
Yes
1
Initial Address
CF cancelled
2
Perform Call Forwarding negative response
See GSM 03.66
MOBILE_NUMBER_ PORTABILITY_ IN_OQoD
CAMEL phase 2 or higher supported?
Initial Address
No
Yes
See TS 23.078
CAMEL_Store_ Destination_ Address (BOR, True)
CAMEL_OCH_ MSC_DISC3
See GSM 03.78
CAMEL_OCH_ MSC_DISC4
See GSM 03.78
Wait_For_ ACM
Idle
Idle

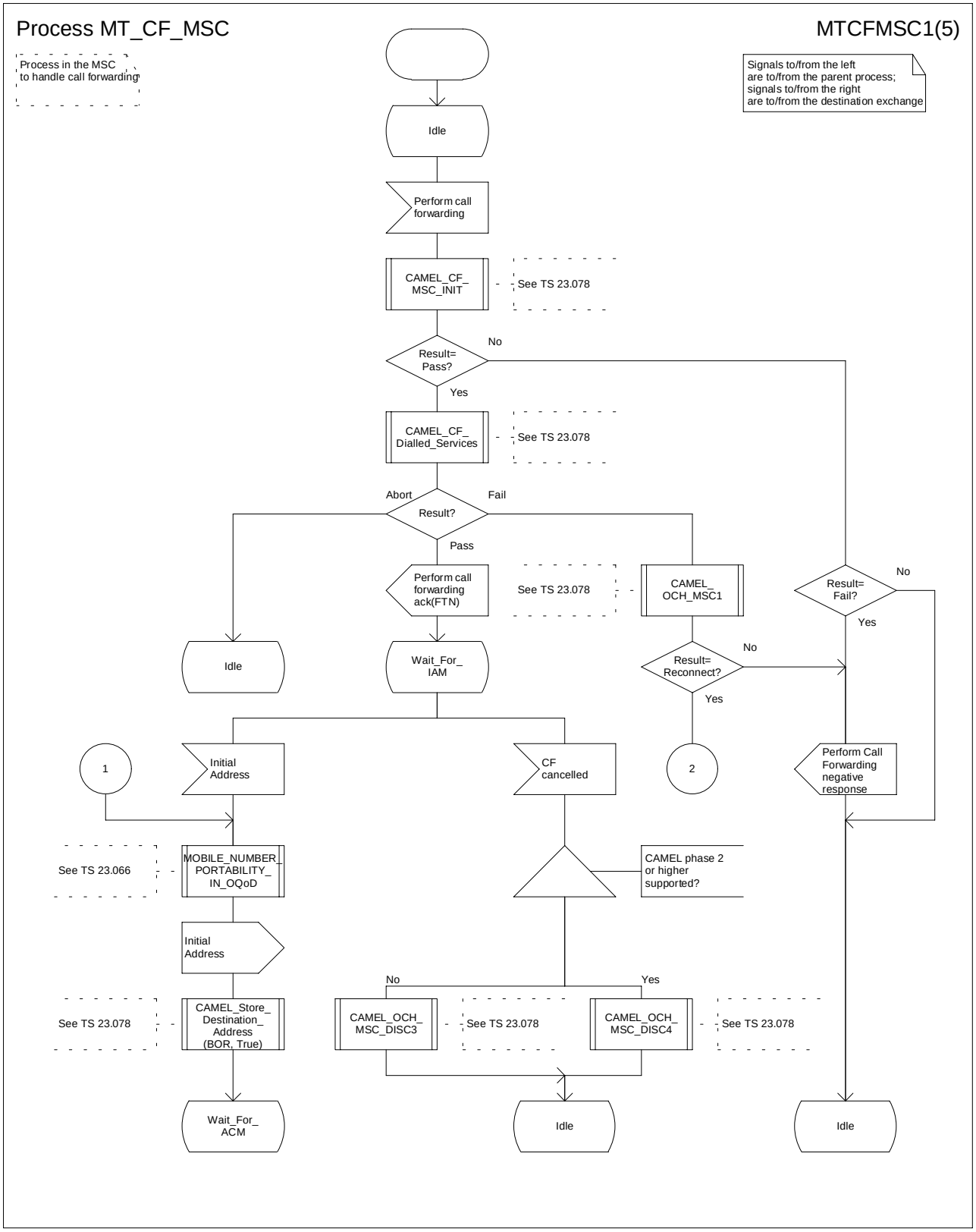
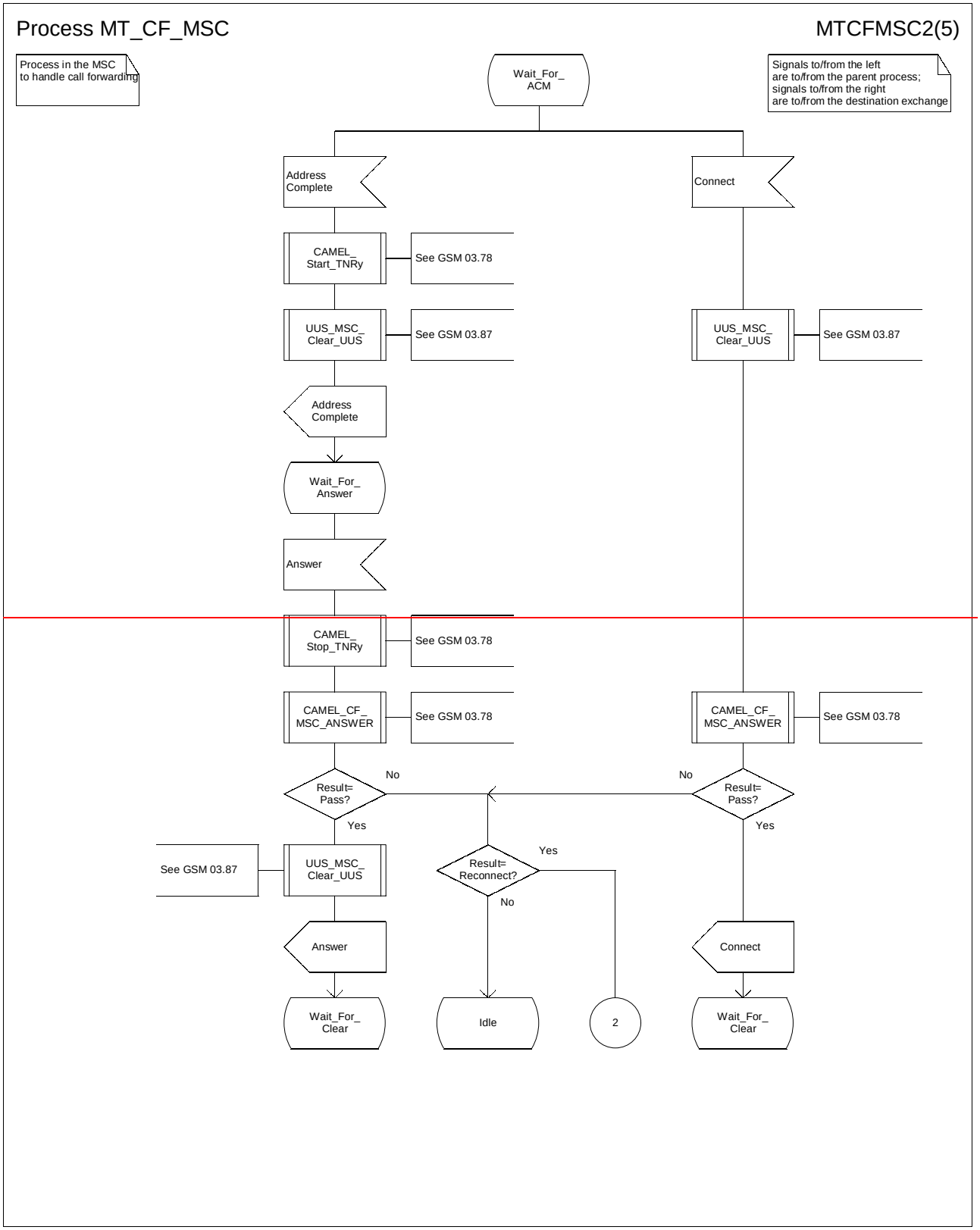


Figure 42a: Process MT_CF_MSC (sheet 1)


Process MT_CF_MSC
MTCFMSC2(5)
Process in the MSC
to handle call forwarding
Wait_For_
ACM
Signals to/from the left
are to/from the parent process;
signals to/from the right
are to/from the destination exchange
Address
Complete
Connect
CAMEL_
Start_TNRy
See GSM 03.78
UUS_MSC_
Clear_UUS
See GSM 03.87
UUS_MSC_
Clear_UUS
See GSM 03.87
Address
Complete
Wait_For_
Answer
Answer
CAMEL_
Stop_TNRy
See GSM 03.78
CAMEL_CF_
MSC_ANSWER
See GSM 03.78
CAMEL_CF_
MSC_ANSWER
See GSM 03.78
Result=
Pass?
No
No
Result=
Pass?
Yes
Yes
See GSM 03.87
UUS_MSC_
Clear_UUS
Result=
Reconnect?
Yes
No
Answer
Connect
Wait_For_
Clear
Idle
2
Wait_For_
Clear

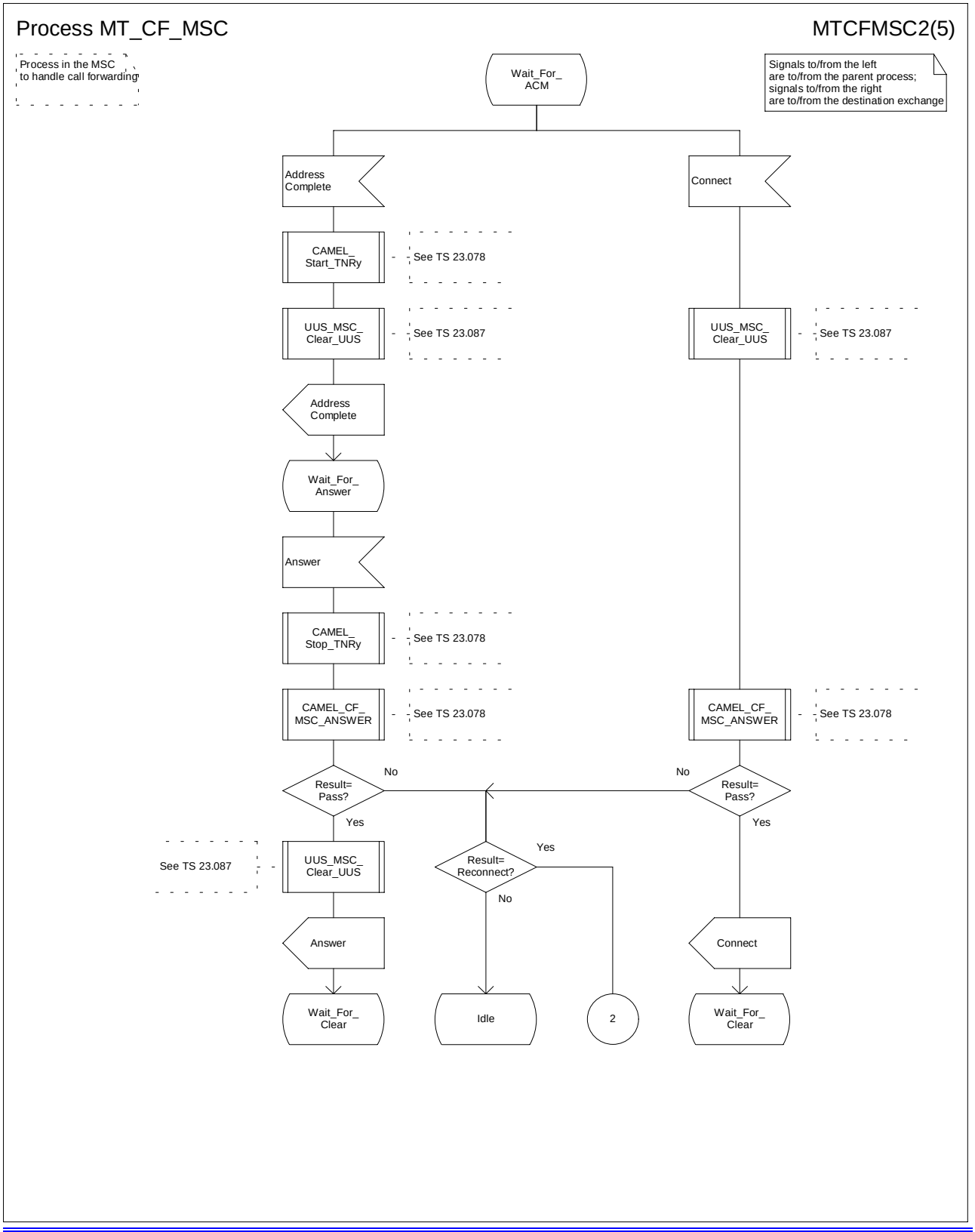
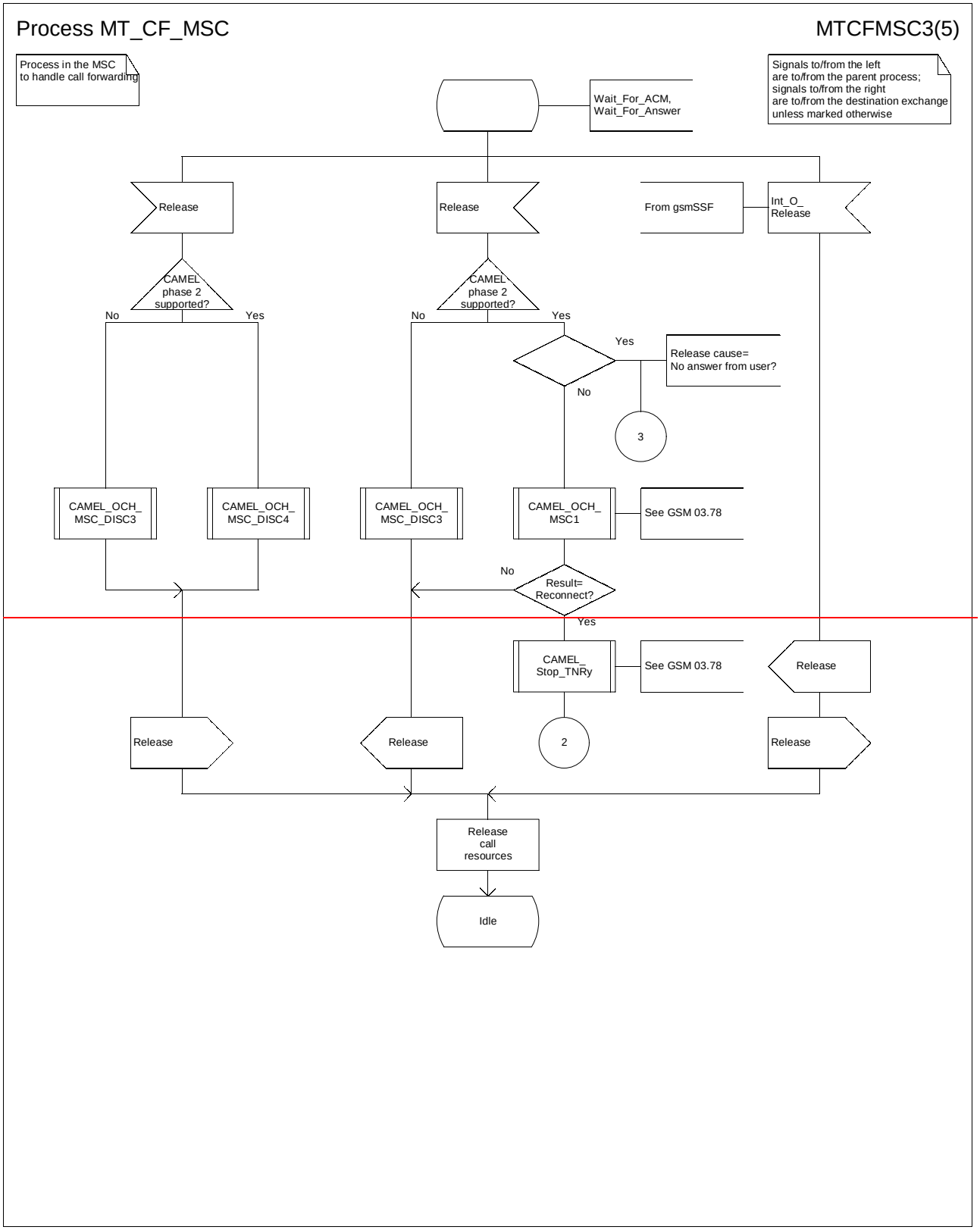


Figure 42b: Process MT_CF_MSC (sheet 2)


Process MT_CF_MSC
MTCFMSC3(5)
Process in the MSC to handle call forwarding
Signals to/from the left are to/from the parent process; signals to/from the right are to/from the destination exchange unless marked otherwise
Wait_For_ACM, Wait_For_Answer
Release
Release
From gsmSSF
Int_O_ Release
CAMEL phase 2 supported?
No
Yes
CAMEL phase 2 supported?
No
Yes
Yes
Release cause= No answer from user?
No
3
CAMEL_OCH_ MSC_DISC3
CAMEL_OCH_ MSC_DISC4
CAMEL_OCH_ MSC_DISC3
CAMEL_OCH_ MSC1
See GSM 03.78
No
Result= Reconnect?
Yes
CAMEL_ Stop_TNRy
See GSM 03.78
Release
Release
Release
2
Release
Release call resources
Idle

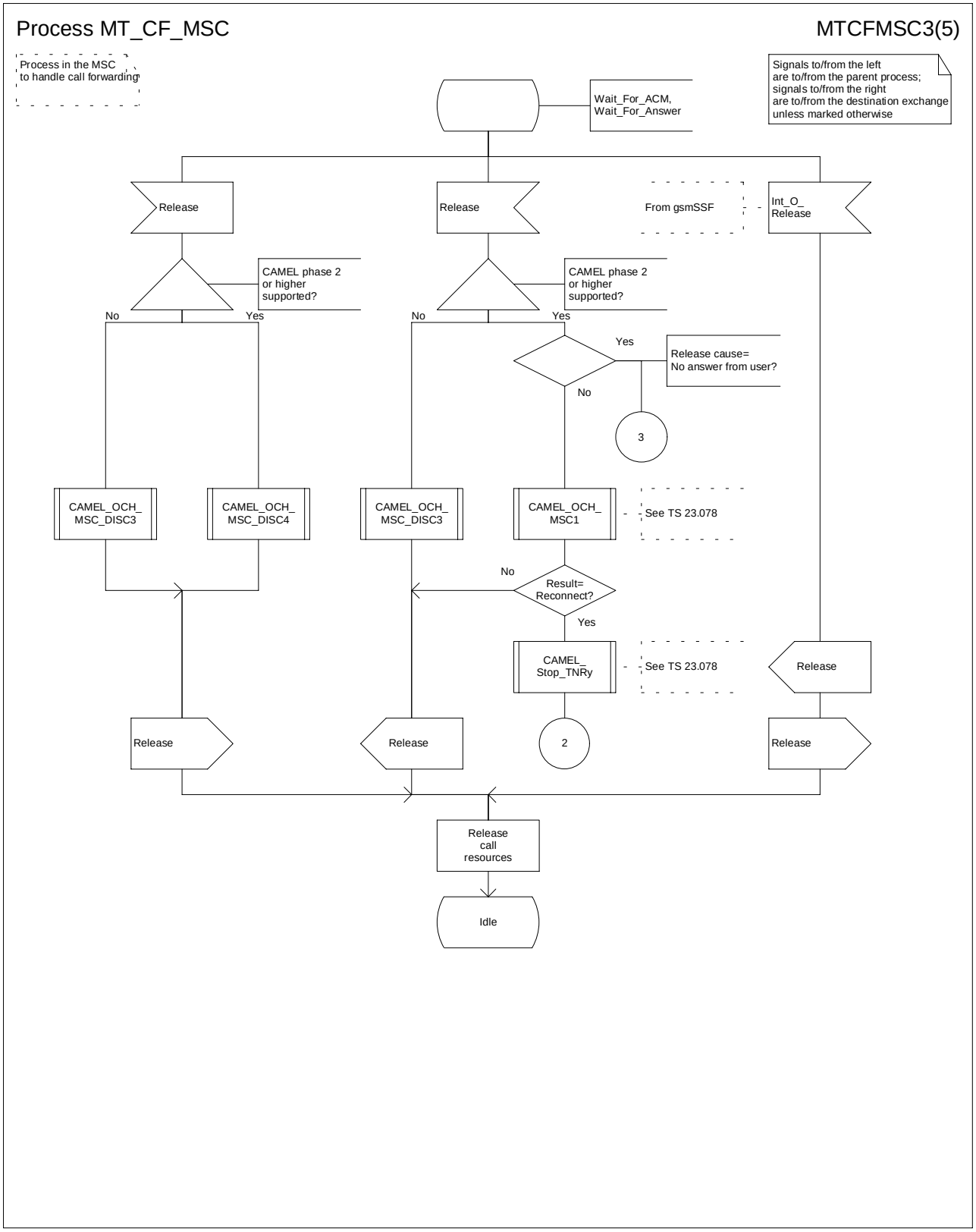
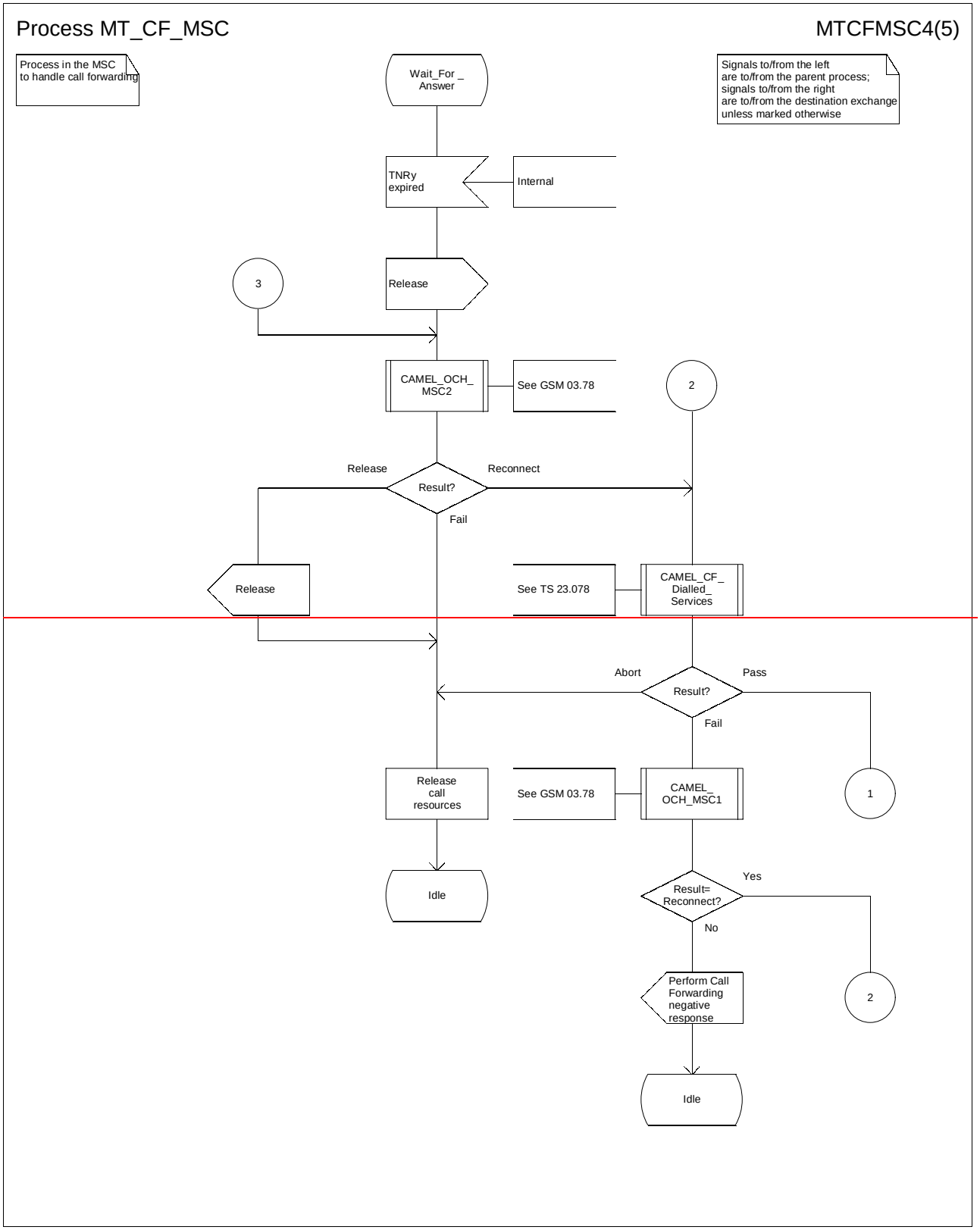


Figure 42c: Process MT_CF_MSC (sheet 3)


Process MT_CF_MSC
MTCFMSC4(5)
Process in the MSC to handle call forwarding
Signals to/from the left are to/from the parent process; signals to/from the right are to/from the destination exchange unless marked otherwise
Wait_For _ Answer
TNRy expired
Internal
3
Release
CAMEL_OCH_ MSC2
See GSM 03.78
2
Release
Result?
Reconnect
Fail
Release
See TS 23.078
CAMEL_CF_ Dialled_ Services
Abort
Result?
Pass
Fail
Release call resources
See GSM 03.78
CAMEL_ OCH_MSC1
1
Idle
Result= Reconnect?
Yes
No
Perform Call Forwarding negative response
2
Idle

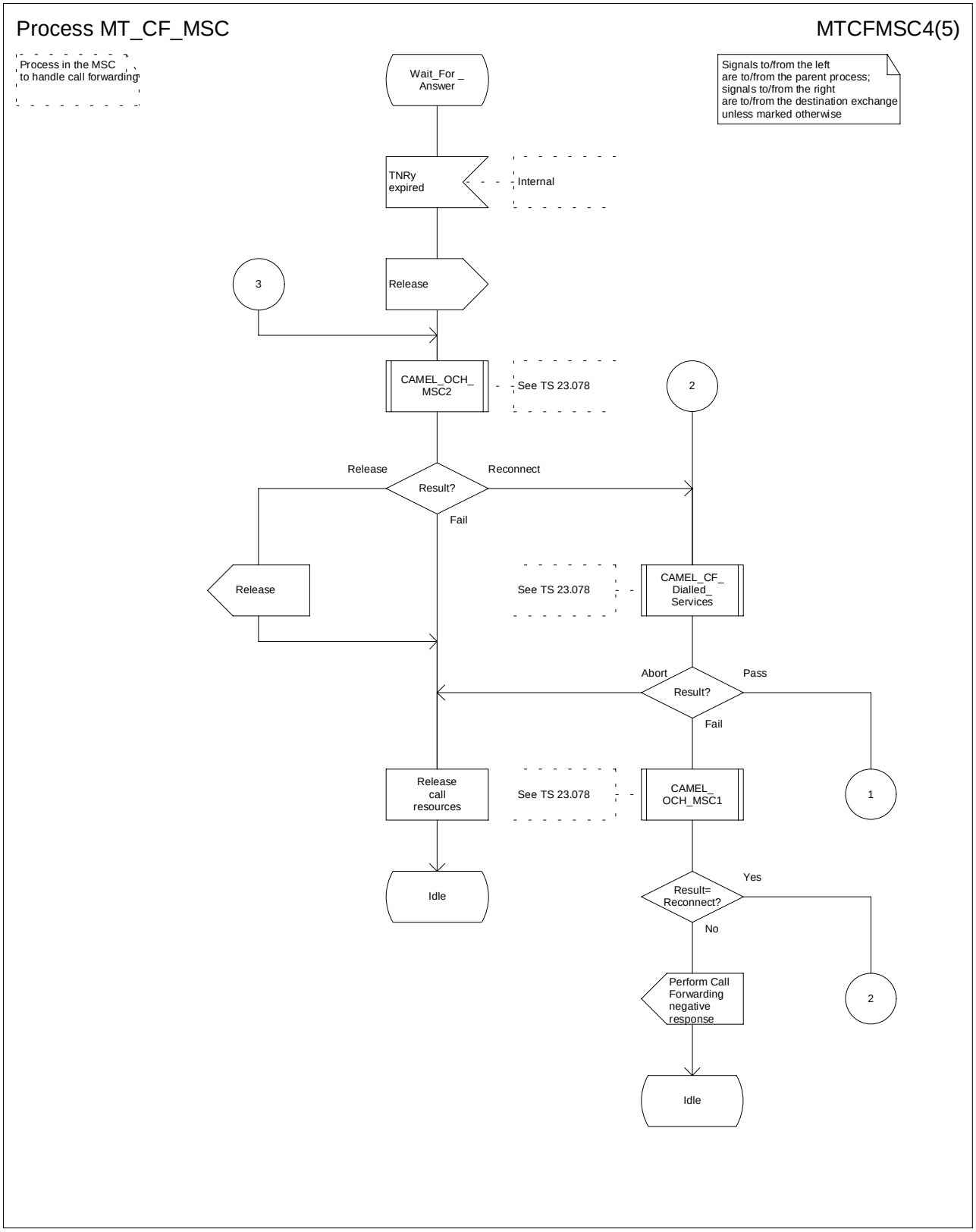
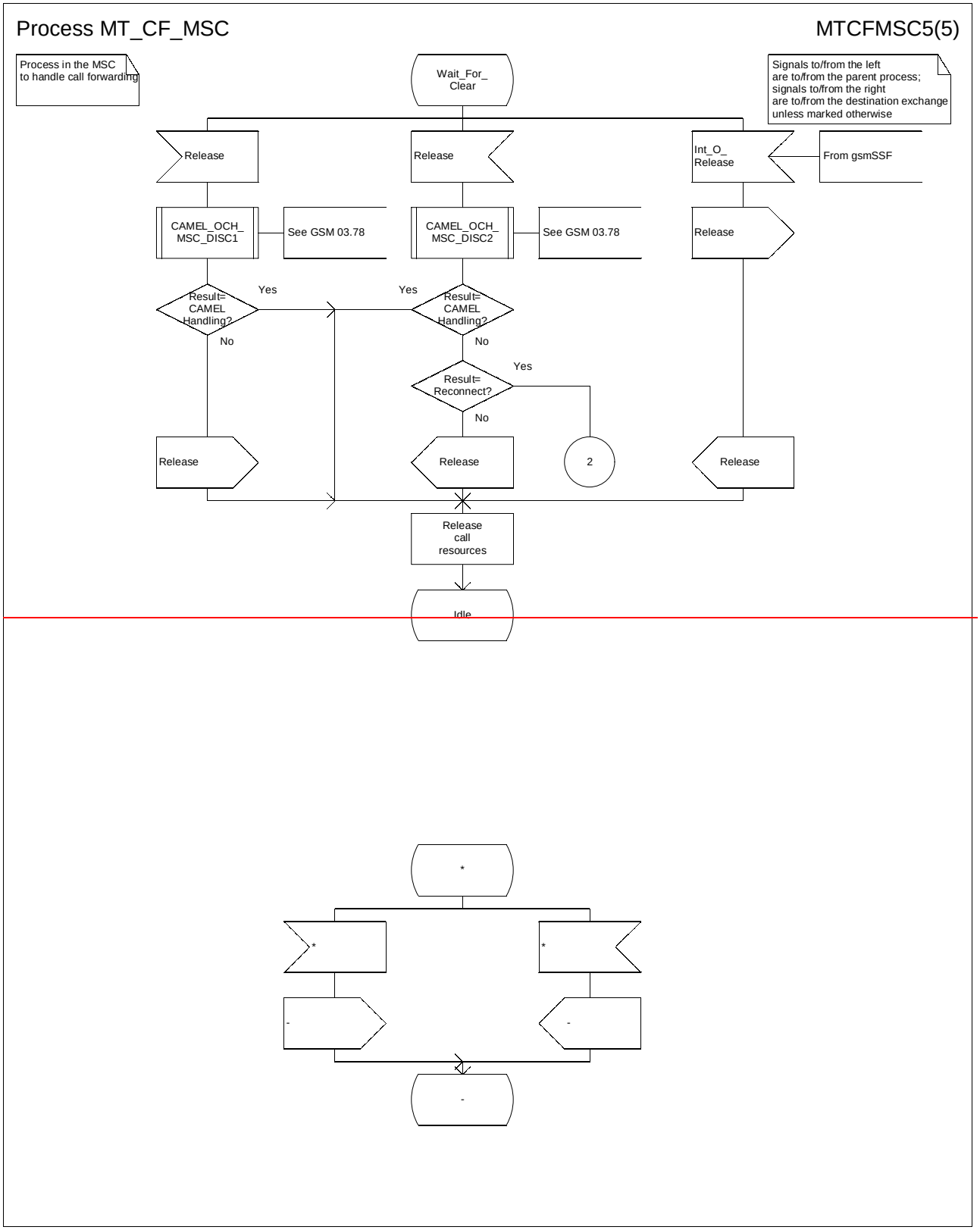


Figure 42d: Process MT_CF_MSC (sheet 4)


Process MT_CF_MSC
MTCFMSC5(5)
Process in the MSC to handle call forwarding
Wait_For_ Clear
Signals to/from the left are to/from the parent process; signals to/from the right are to/from the destination exchange unless marked otherwise
Release
Release
Int_O_ Release
From gsmSSF
CAMEL_OCH_ MSC_DISC1
See GSM 03.78
CAMEL_OCH_ MSC_DISC2
See GSM 03.78
Release
Result= CAMEL Handling?
Yes
Yes
Result= CAMEL Handling?
No
No
Result= Reconnect?
Yes
No
Release
Release
2
Release
Release call resources
Idle
*
*
*
-
-
-

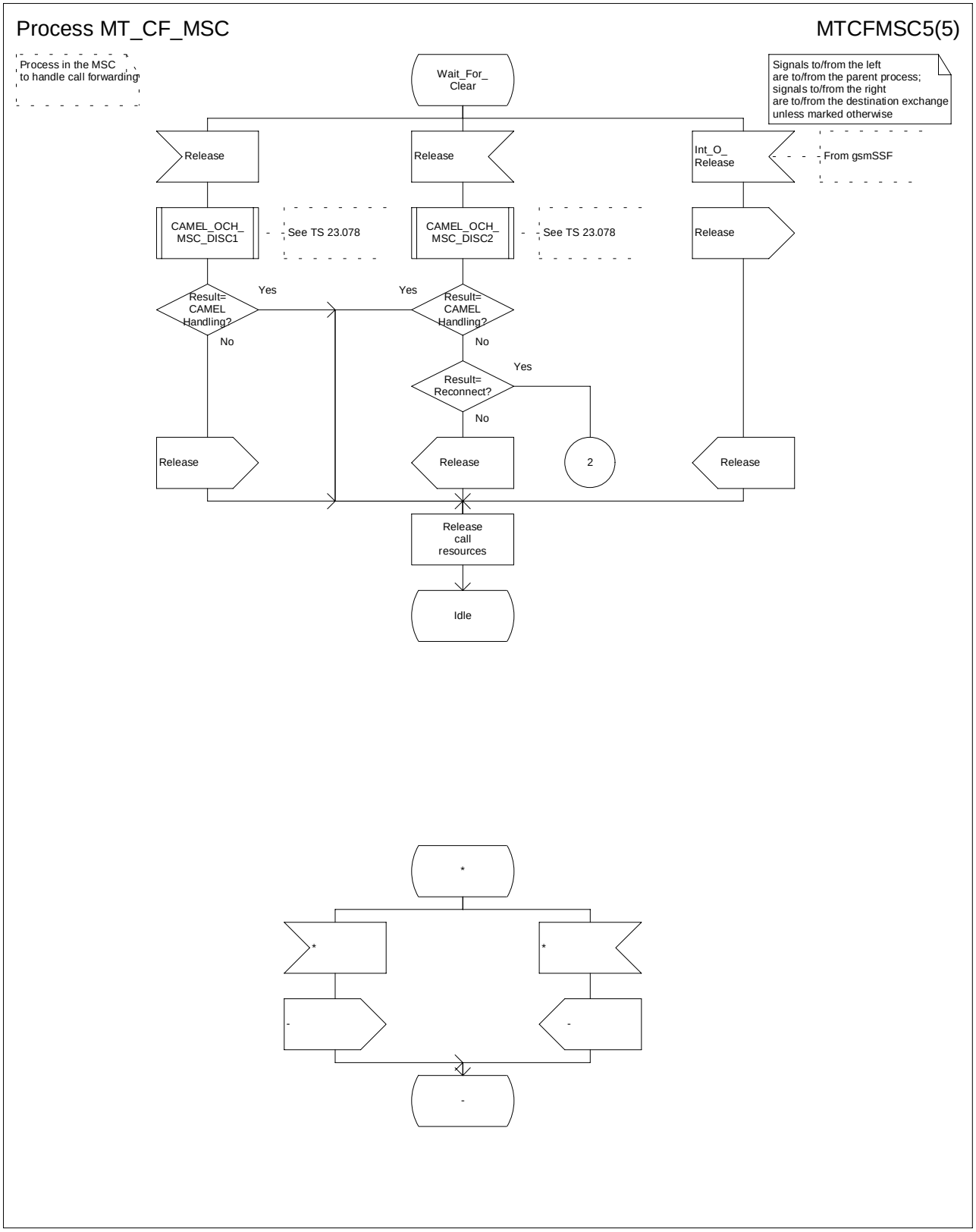


Figure 42e: Process MT_CF_MSC (sheet 5)

7.2.2 Functional requirements of HLR

7.2.2.1 Process SRI_HLR

Sheet 1: the procedures Check_Parameters, Subscription_Check_HLR, Handle_OR_HLR_CF and CAMEL_HLR_INIT can set the negative response parameter which is used by the process SRI_HLR to construct the Send Routeing Info negative response message. This negative response parameter is global data, accessible by the process SRI_HLR.

Sheet 1: the procedure Handle_OR_HLR_CF is specific to Support of Optimal Routeing; it is specified in ~~GSM~~ TS ~~03.~~23.079 [33]. If the HLR does not support Optimal Routeing, processing continues from the "No" exit of the test "Result=Forward?".

Sheet 1: the procedure CAMEL_HLR_INIT is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the HLR does not support CAMEL, processing continues from the "No" exit of the test"Result=Fail?".

Sheet 2: the procedure First_Forwarding_HLR can set the negative response parameter which is used by the process SRI_HLR to construct the Send Routeing Info negative response message. This negative response parameter is global data, accessible by the process SRI_HLR.

Sheet 2: the procedure CAMEL_CSI_Check_HLR is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the HLR does not support CAMEL, processing continues from the "No" exit of the test"Result=CSI active?".

Sheet 2: the procedure CCBS_Handling_HLR is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42]. If the HLR does not support CCBS, processing continues from the "Yes" exit of the test "Result = OK?".

Sheet 3: the procedure OR_HLR_Interrogate_VLR is specific to Optimal Routeing. It is specified in ~~GSM~~ TS ~~03.~~23.079 [33]. If the HLR does not support Optimal Routeing, processing continues from the "No" exit of the test "Result=Forward".

Sheet 3: if the HLR does not support Network Indication of Alerting, the test "Alerting pattern required" and the task "Set Alerting Pattern" are omitted.

Sheet 3: the procedure CLI_HLR_Set_CLI is specific to Enhanced CLI Handling. It is specified in ~~GSM~~ TS ~~03.~~23.081 [34].

Sheet 4: the procedure PRN_Error_HLR can set the negative response parameter which is used by the process SRI_HLR to construct the Send Routeing Info negative response message. This negative response parameter is global data, accessible by the process SRI_HLR.

Sheet 4: the procedure Forward_CUG_Check is specific to CUG. If the HLR does not support CUG, processing continues from the "Yes" exit of the test "Result=Call allowed?".

Sheet 4: the test "Forwarding enquiry" is specific to Support of Optimal Routeing. If the HLR does not support Optimal Routeing, processing continues from the "No" exit of the test.

Sheet 4: the procedure CAMEL_CSI_Check_HLR is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~. If the HLR does not support CAMEL, processing continues from the "No" exit of the test "Result=CSI active?".

Sheet 4: the procedures CAMEL_T_CSI_CHECK_HLR and CAMEL_O_CSI_CHECK_HLR are specific to CAMEL; they are specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~.

7.2.2.2 Procedure Check_Parameters

If any parameters required by the rules in clause 8 are missing from the message, the procedure sets the negative response to "Data missing". If any parameter has a value which is not in the set of values expected for the parameter, the procedure sets the negative response to "Unexpected data value".

7.2.2.3 Procedure Subscription_Check_HLR

It is an implementation option to carry out the check for operator determined barring of incoming calls before the check on provisioning of the requested basic service.

The negative response "Call barred" indicates whether the reason is operator determined barring or supplementary service barring, according to the result returned by the procedure Check_IC_Barring.

The procedure IC_CUG_Check is specific to CUG. If the HLR does not support GUG, processing continues from the "Yes" exit of the test "Result=Call allowed?".

The negative response "CUG reject" indicates whether the reason is:

- Incoming calls barred within CUG;
- Requested basic service violates CUG constraints;
- Subscriber not member of CUG

according to the cause returned by the procedure IC_CUG_Check.

7.2.2.4 Procedure First_Forwarding_HLR

The MS is not reachable if any of the following conditions is satisfied:

- The HLR has no location information for the subscriber;
- The subscriber record is marked as MS purged;
- The subscriber record is marked as MSC area restricted;
- The subscriber record is marked as Roaming Restricted due to Unsupported Feature;
- The subscriber is marked as deregistered because of subscription restrictions on roaming

7.2.2.5 Procedure PRN_Error_HLR

The procedure CCBS_Report_PRN_Failure is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42]. The procedure does not return a value; the following tests are on the value of the Provide Roaming Number negative response.

The procedure Super_Charged_SRI_Error_HLR is specific to Super-Charger; it is specified in TS 23.116 ~~[~~[43]. If the HLR does not support Super-Charger, processing continues from the "No" exit of the test "Result=Purged?".

If the HLR does not support Optimal Routeing, processing starts with the test "Negative response=Facility not supported?".

7.2.2.6 Procedure Forward_CUG_Check

7.2.2.7 Procedure Derive_Requested_Basic_Service_HLR

The rules for deriving a ~~GSM~~ Circuit-switched bearer capability from ISDN compatibility information or the MSISDN of the B subscriber are specified in ~~GSM~~ TS ~~09.~~29.007 [48]. If a GSM bearer capability cannot be derived from the ISDN compatibility information or the MSISDN of the B subscriber, the HLR applies a default basic service according to the requirements of the operator.

7.2.2.8 Procedure Check_IC_Barring

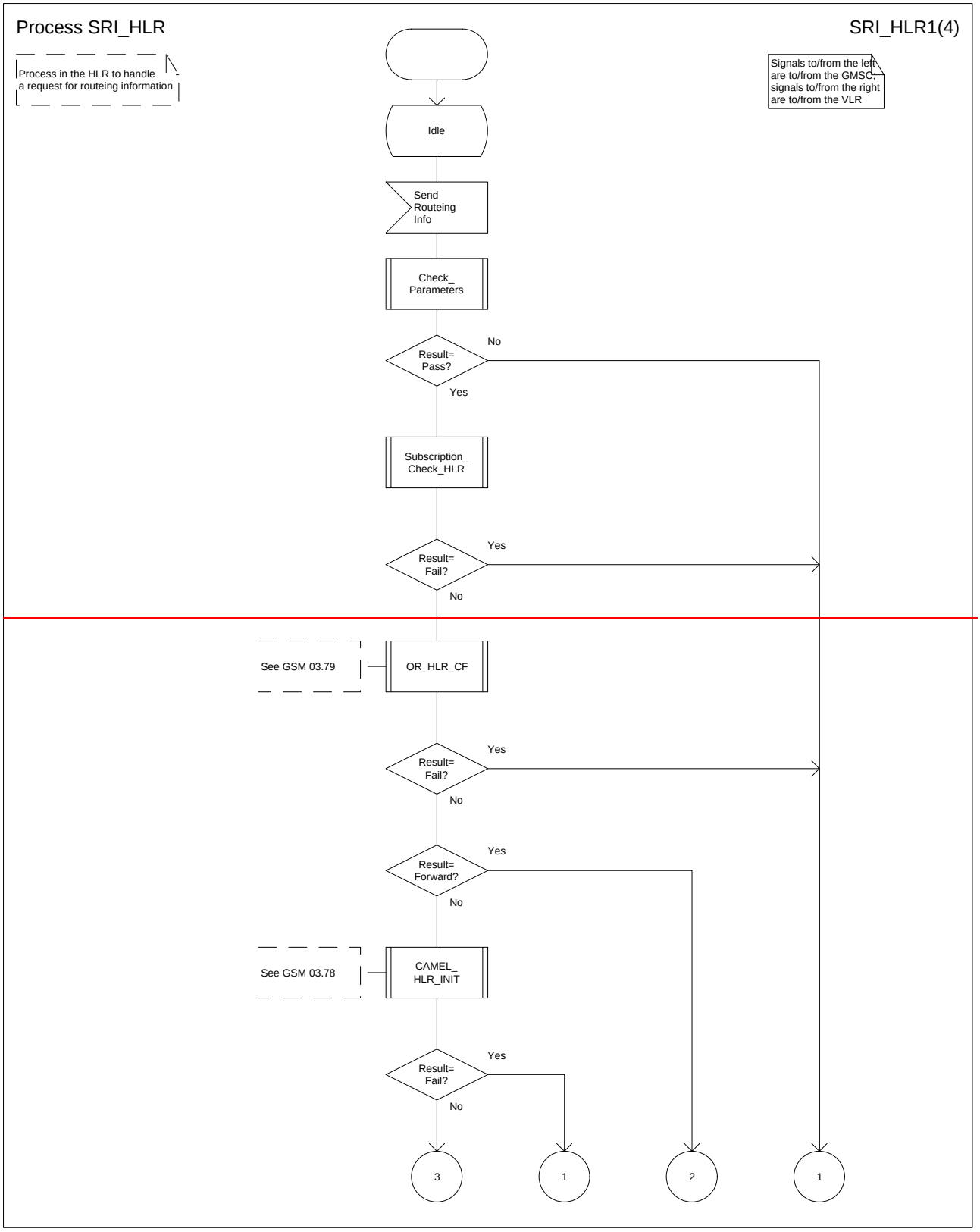
7.2.2.9 Procedure IC_CUG_Check

7.2.2.10 Procedure Handle_CFU

The test "Normal call" refers to the value of the indicator returned by the process MAF007.

7.2.2.11 Procedure Handle_CFNRc

The test "Mobile subscriber not reachable" refers to the value of the indicator returned by the process MAF010.


Process SRI_HLR
SRI_HLR1(4)
Process in the HLR to handle a request for routeing information
Signals to/from the left are to/from the GMSC, signals to/from the right are to/from the VLR
Idle
Send Routeing Info
Check_ Parameters
Result= Pass?
No
Yes
Subscription_ Check_HLR
Result= Fail?
Yes
No
See GSM 03.79
OR_HLR_CF
Result= Fail?
Yes
No
Result= Forward?
Yes
No
See GSM 03.78
CAMEL_ HLR_INIT
Result= Fail?
Yes
No
3
1
2
1

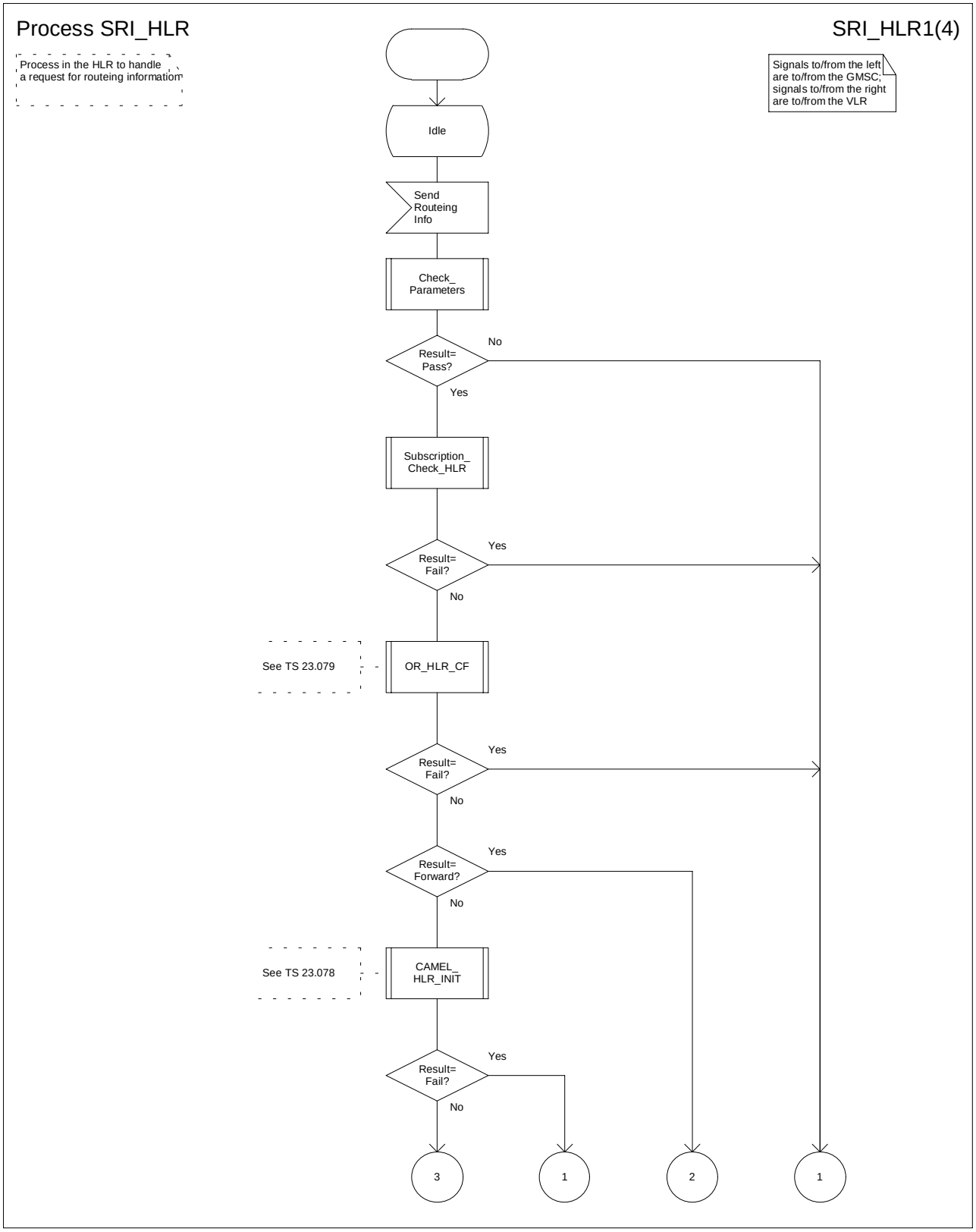
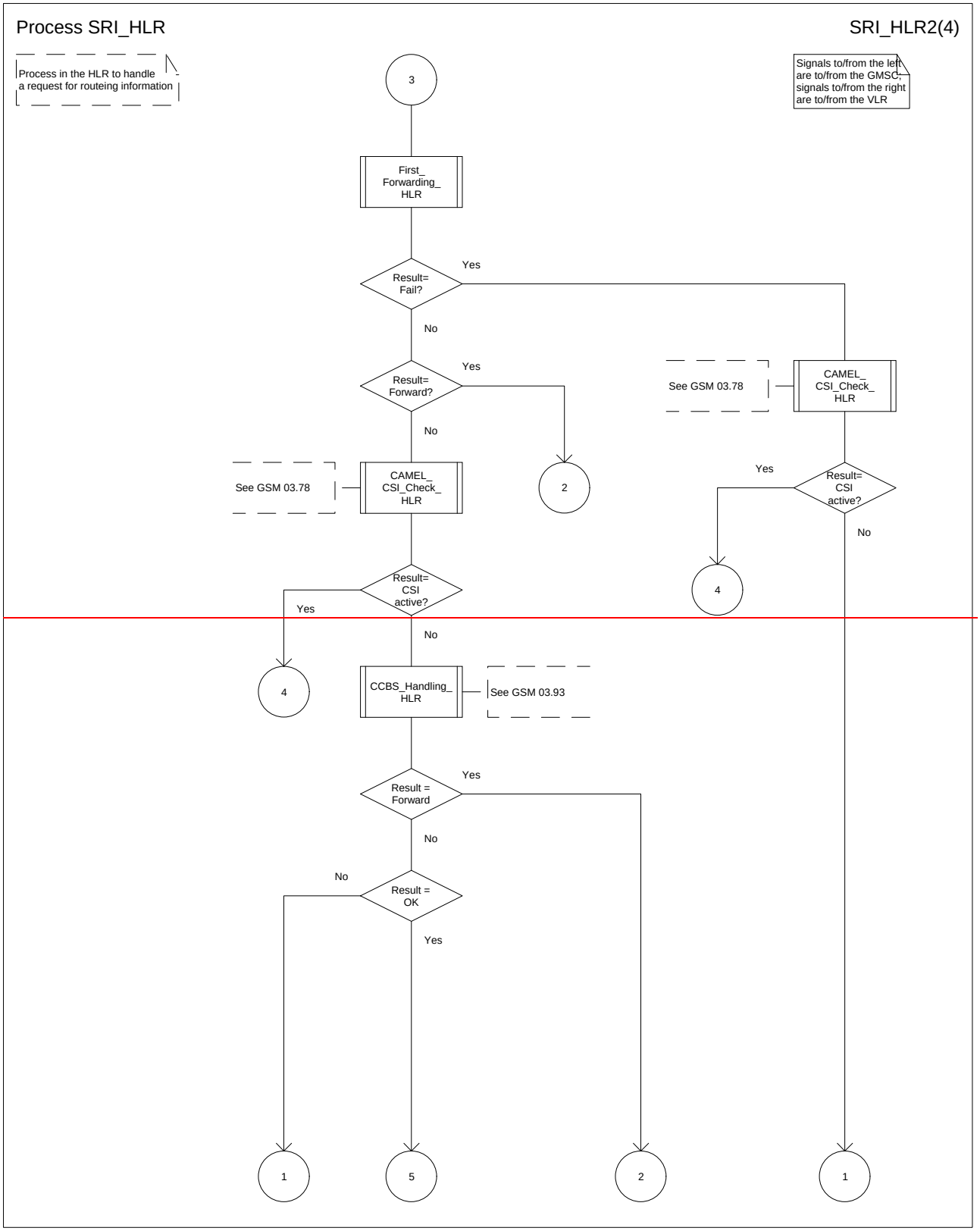


Figure 43a: Process SRI_HLR (sheet 1)


Process SRI_HLR
SRI_HLR2(4)
Process in the HLR to handle a request for routeing information
Signals to/from the left are to/from the GMSC; signals to/from the right are to/from the VLR
3
First_ Forwarding_ HLR
Result= Fail?
Yes
No
Result= Forward?
Yes
No
See GSM 03.78
CAMEL_ CSI_Check_ HLR
2
See GSM 03.78
CAMEL_ CSI_Check_ HLR
Yes
Result= CSI active?
No
4
Result= CSI active?
Yes
No
4
CCBS_Handling_ HLR
See GSM 03.93
Result = Forward
Yes
No
No
Result = OK
Yes
1
5
2
1

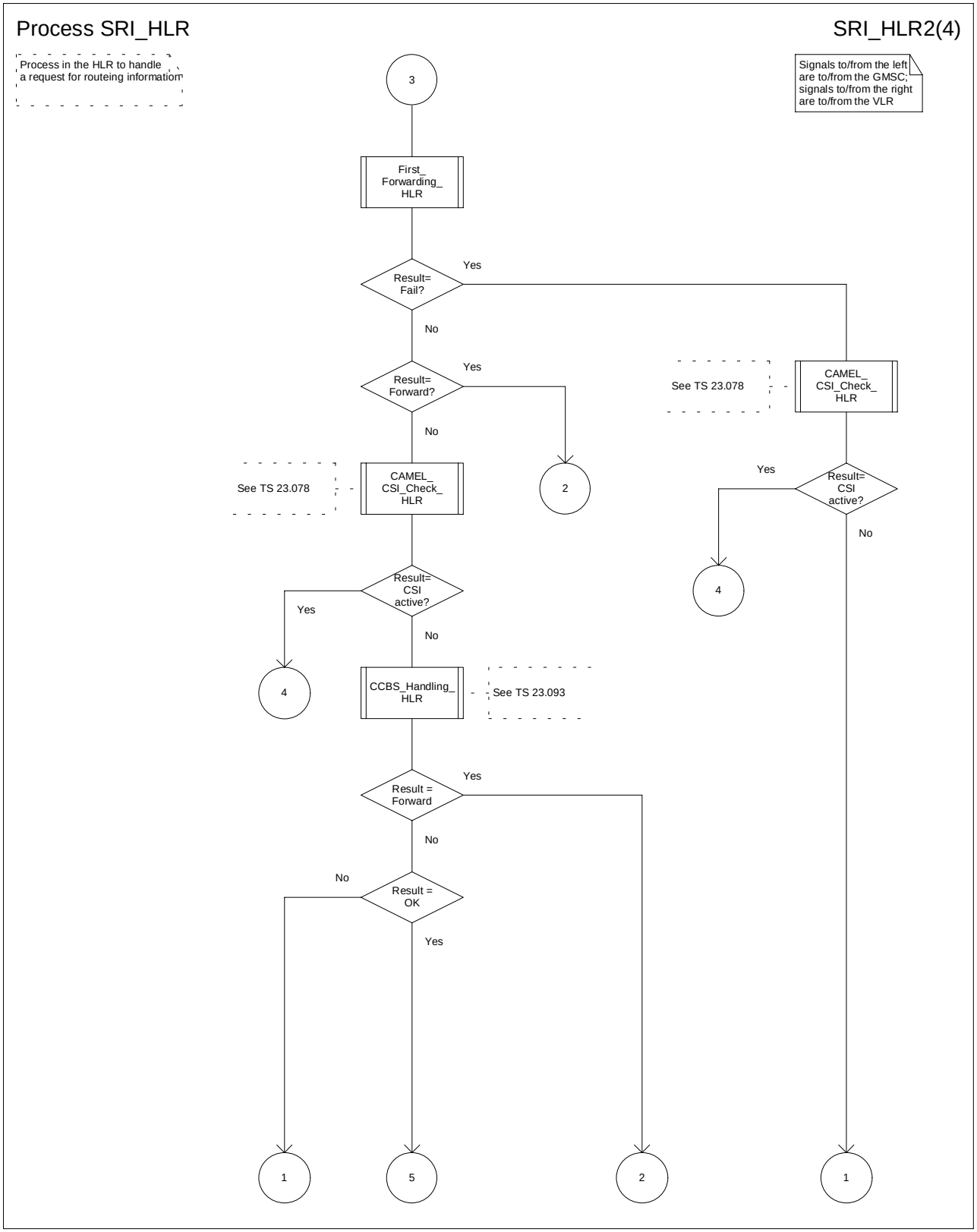
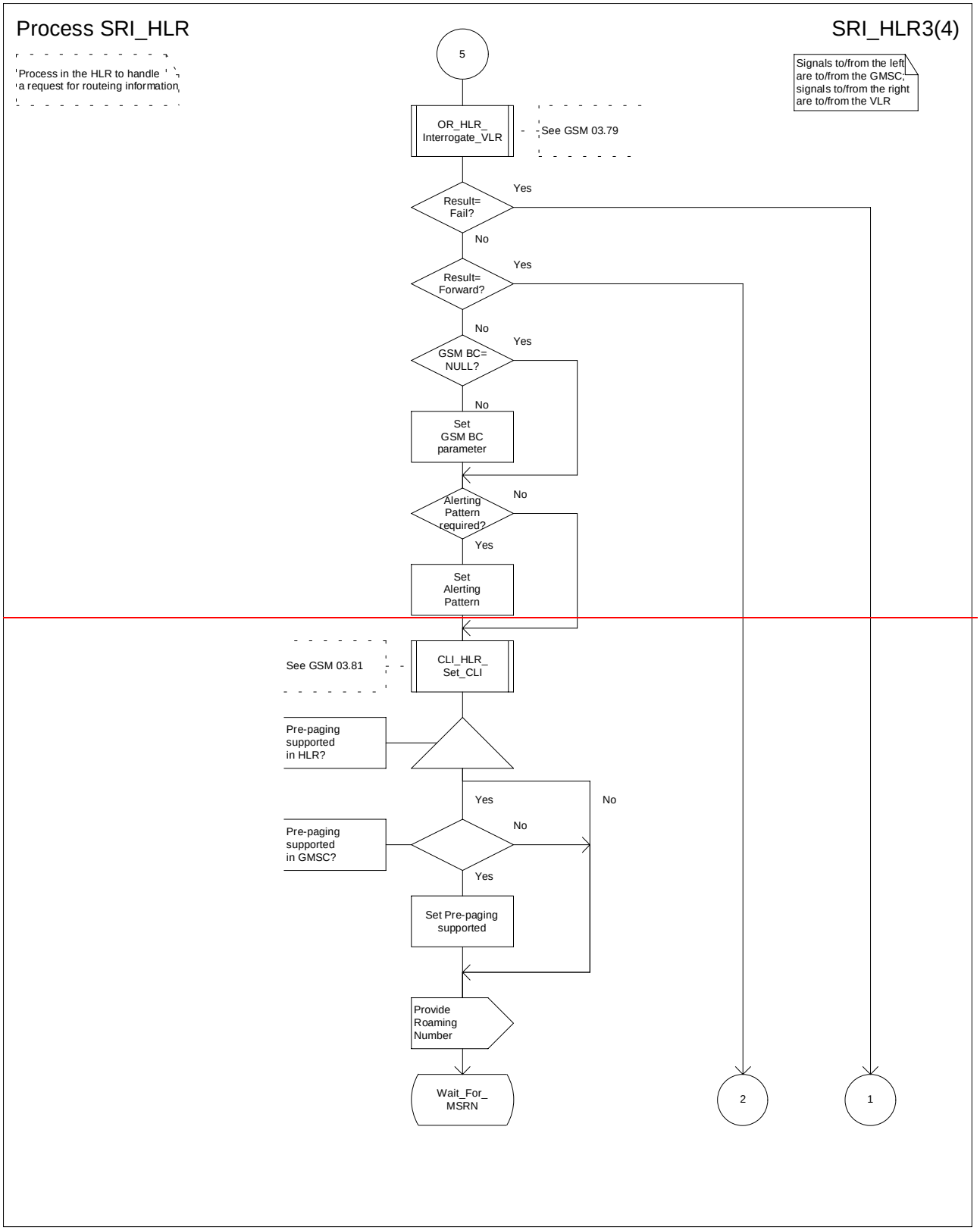


Figure 43b: Process SRI_HLR (sheet 2)


Process SRI_HLR
SRI_HLR3(4)
Process in the HLR to handle a request for routeing information
Signals to/from the left are to/from the GMSC, signals to/from the right are to/from the VLR
5
OR_HLR_ Interrogate_VLR
See GSM 03.79
Result= Fail?
Yes
No
Result= Forward?
Yes
No
GSM BC= NULL?
Yes
No
Set GSM BC parameter
Alerting Pattern required?
No
Yes
Set Alerting Pattern
See GSM 03.81
CLI_HLR_ Set_CLI
Pre-paging supported in HLR?
Yes
No
Pre-paging supported in GMSC?
No
Yes
Set Pre-paging supported
Provide Roaming Number
Wait_For_ MSRN
2
1

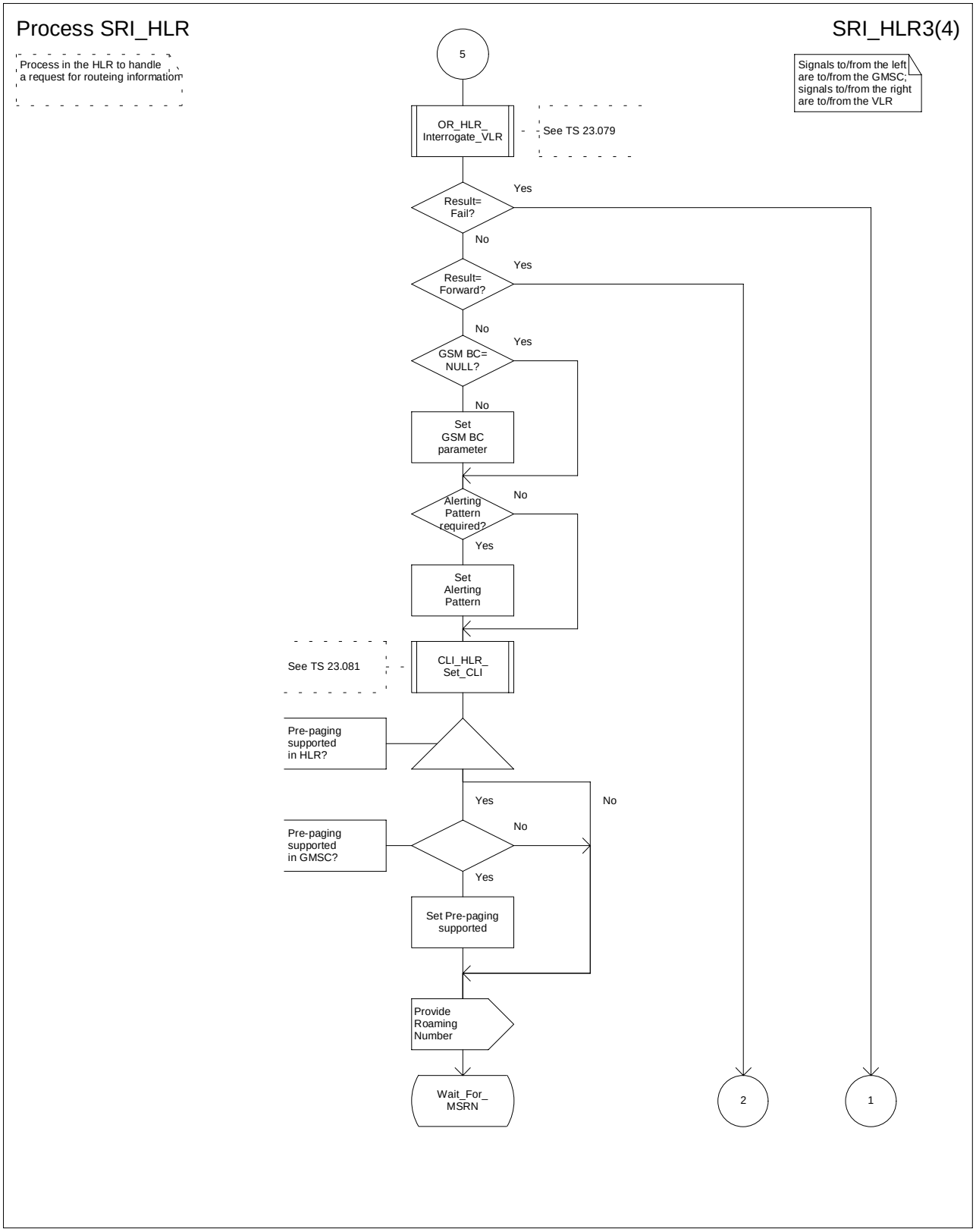
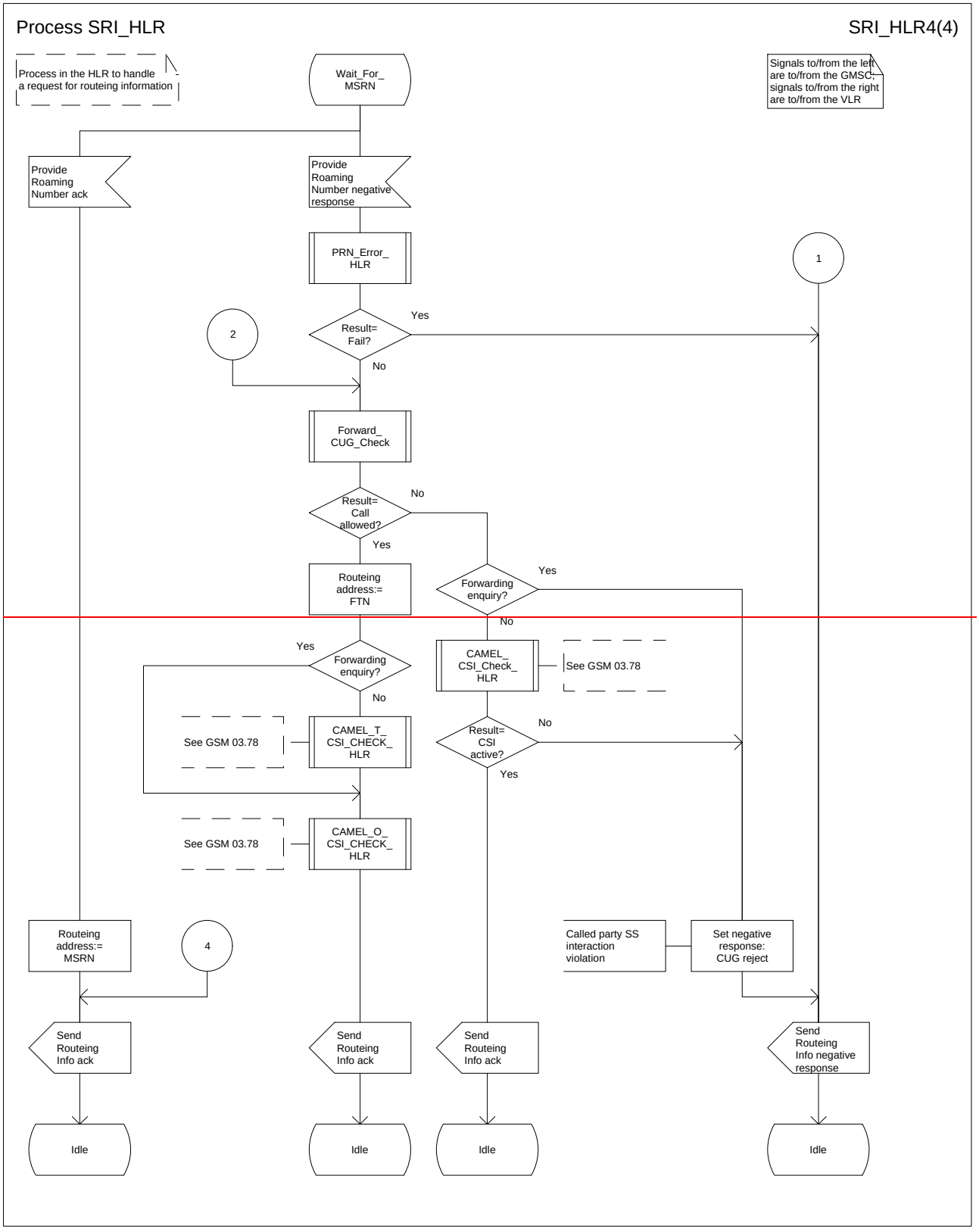


Figure 43c: Process SRI_HLR (sheet 3)


Process SRI_HLR
SRI_HLR4(4)
Process in the HLR to handle a request for routeing information
Wait_For_ MSRN
Signals to/from the left are to/from the GMSC; signals to/from the right are to/from the VLR
Provide Roaming Number ack
Provide Roaming Number negative response
PRN_Error_ HLR
1
2
Result= Fail?
Yes
No
Forward_ CUG_Check
Result= Call allowed?
No
Yes
Routeing address:= FTN
Forwarding enquiry?
Yes
No
Yes
Forwarding enquiry?
No
CAMEL_ CSI_Check_ HLR
See GSM 03.78
See GSM 03.78
CAMEL_T_ CSI_CHECK_ HLR
Result= CSI active?
No
Yes
See GSM 03.78
CAMEL_O_ CSI_CHECK_ HLR
Routeing address:= MSRN
4
Called party SS interaction violation
Set negative response: CUG reject
Send Routeing Info ack
Send Routeing Info ack
Send Routeing Info ack
Send Routeing Info negative response
Idle
Idle
Idle
Idle

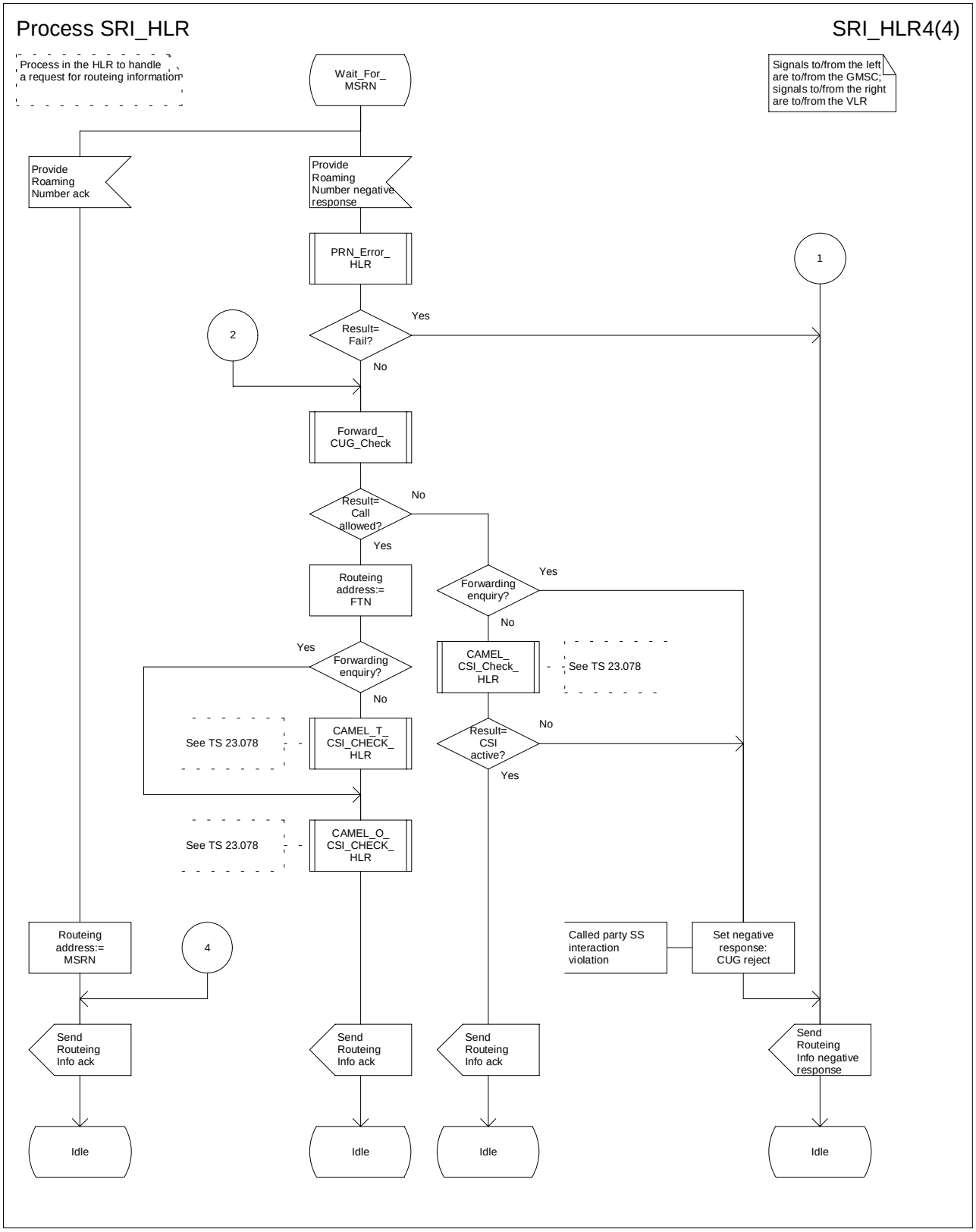


Figure 43d: Process SRI_HLR (sheet 4)

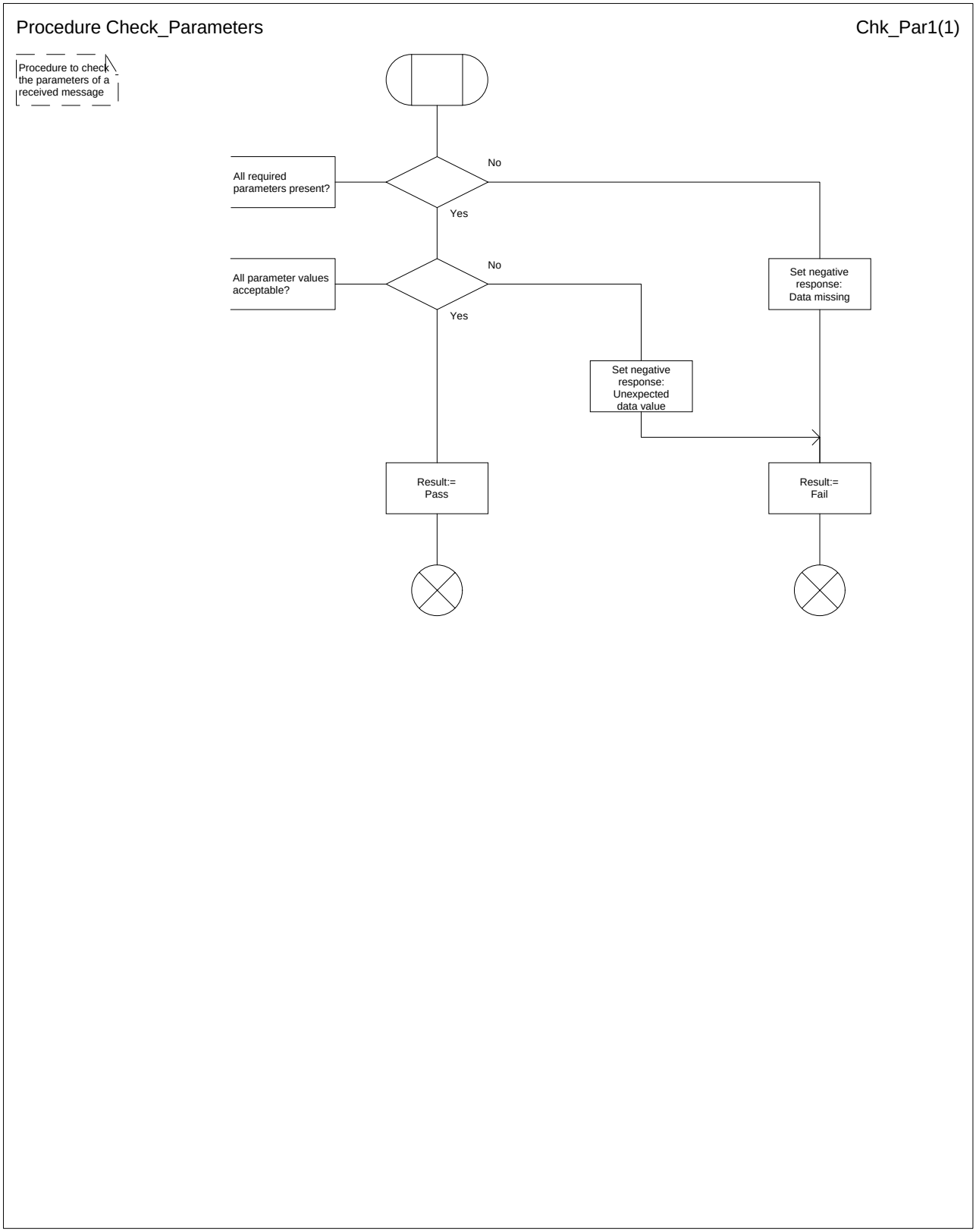


Figure 44: Procedure Check_Parameters

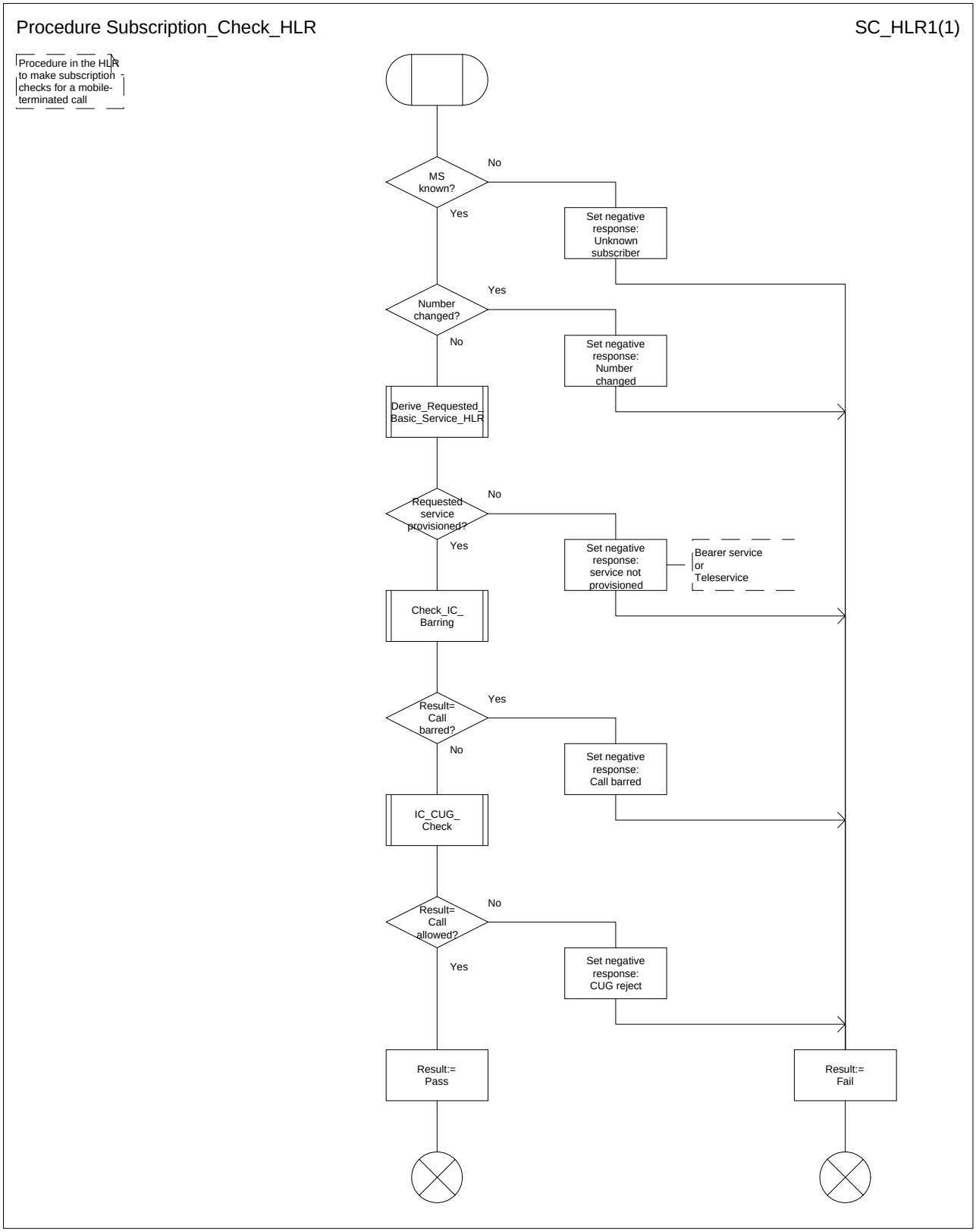


Figure 45: Procedure Subscription_Check_HLR

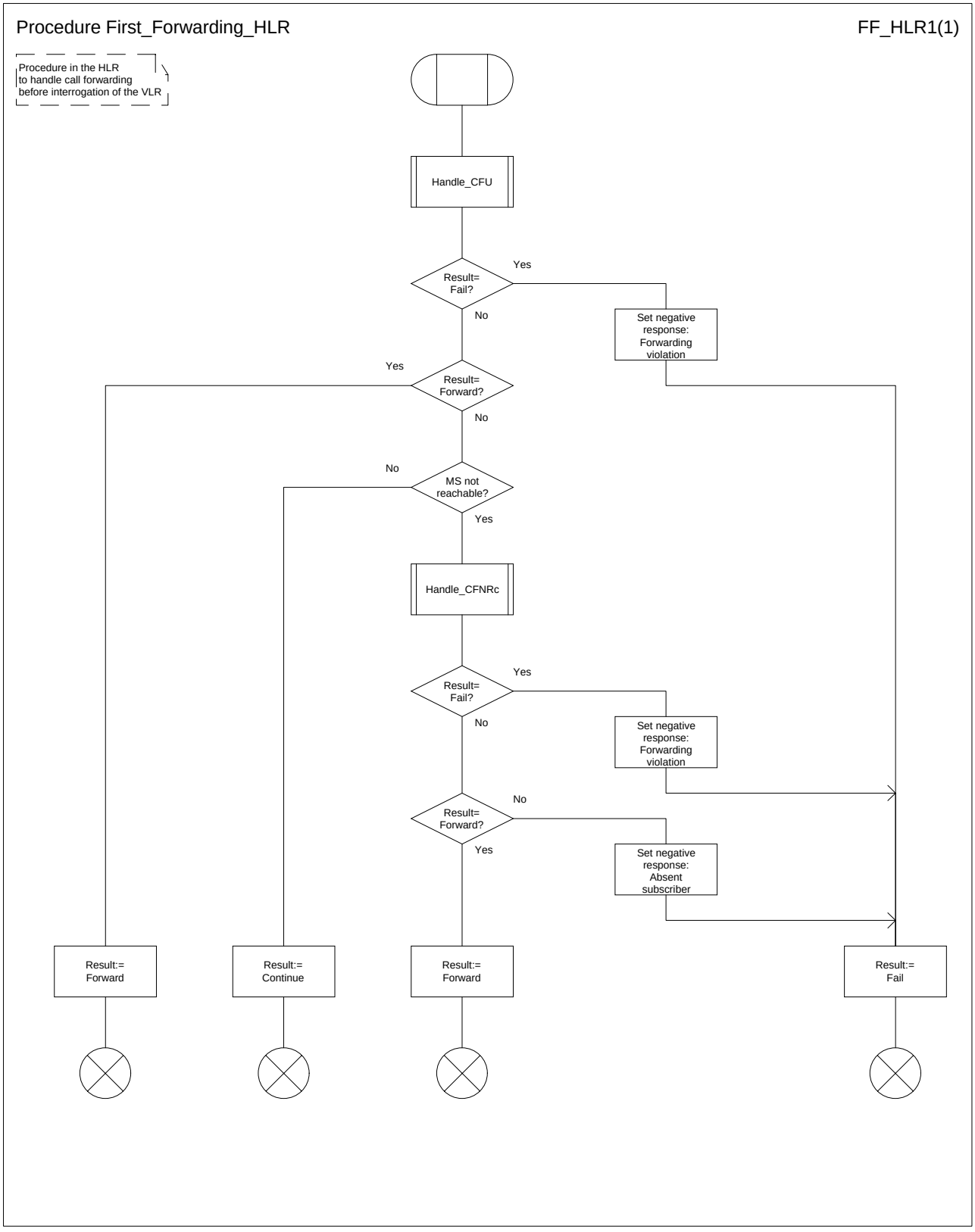
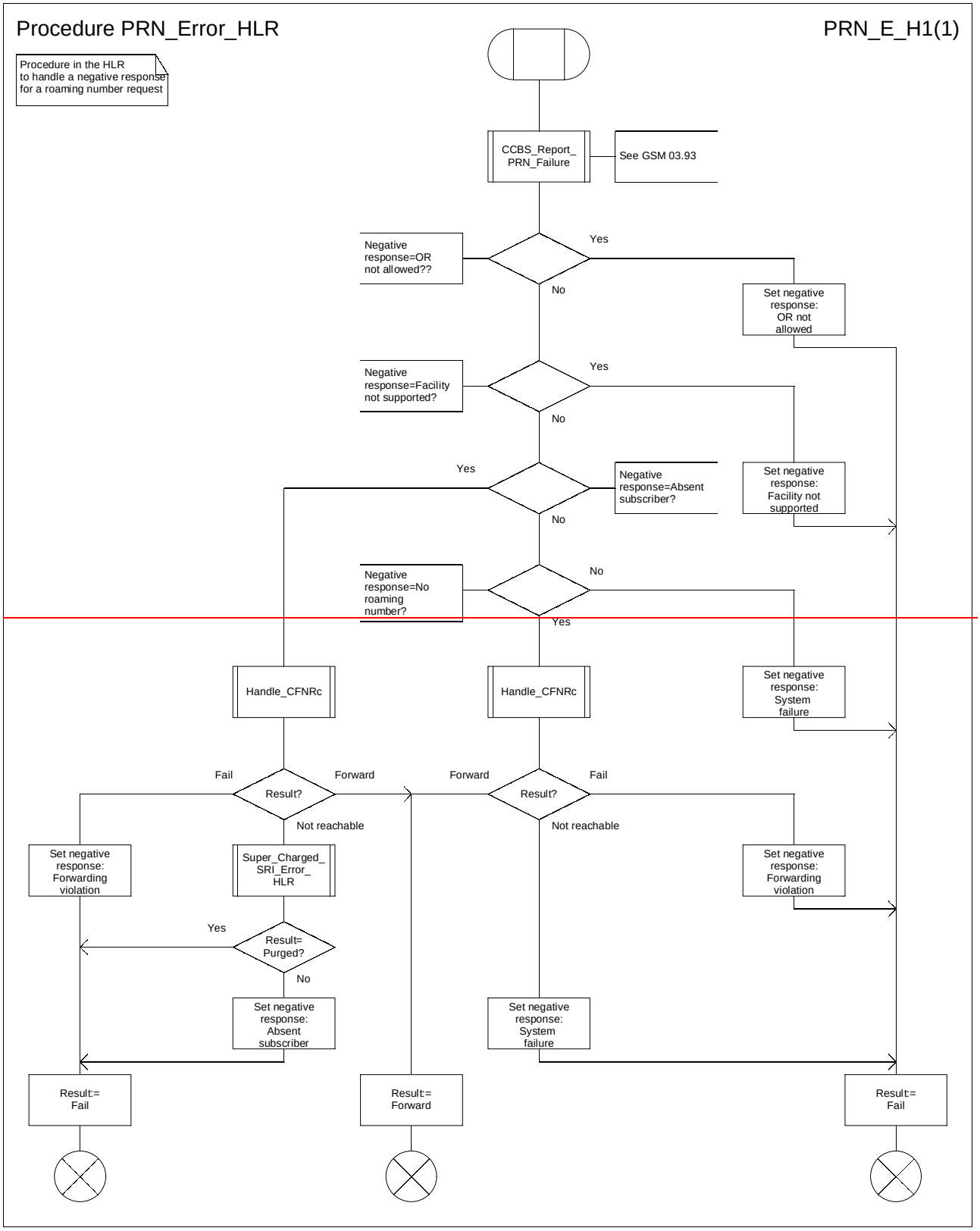


Figure 46: Procedure First_Forwarding_HLR


Procedure PRN_Error_HLR
PRN_E_H1(1)
Procedure in the HLR to handle a negative response for a roaming number request
CCBS_Report_ PRN_Failure
See GSM 03.93
Negative response=OR not allowed??
Yes
No
Set negative response: OR not allowed
Negative response=Facility not supported?
Yes
No
Yes
Negative response=Absent subscriber?
Set negative response: Facility not supported
No
Negative response=No roaming number?
No
Yes
Handle_CFNRc
Handle_CFNRc
Set negative response: System failure
Fail
Forward
Result?
Forward
Fail
Result?
Not reachable
Not reachable
Set negative response: Forwarding violation
Super_Charged_ SRI_Error_ HLR
Set negative response: Forwarding violation
Yes
Result= Purged?
No
Set negative response: Absent subscriber
Set negative response: System failure
Result= Fail
Result= Forward
Result= Fail

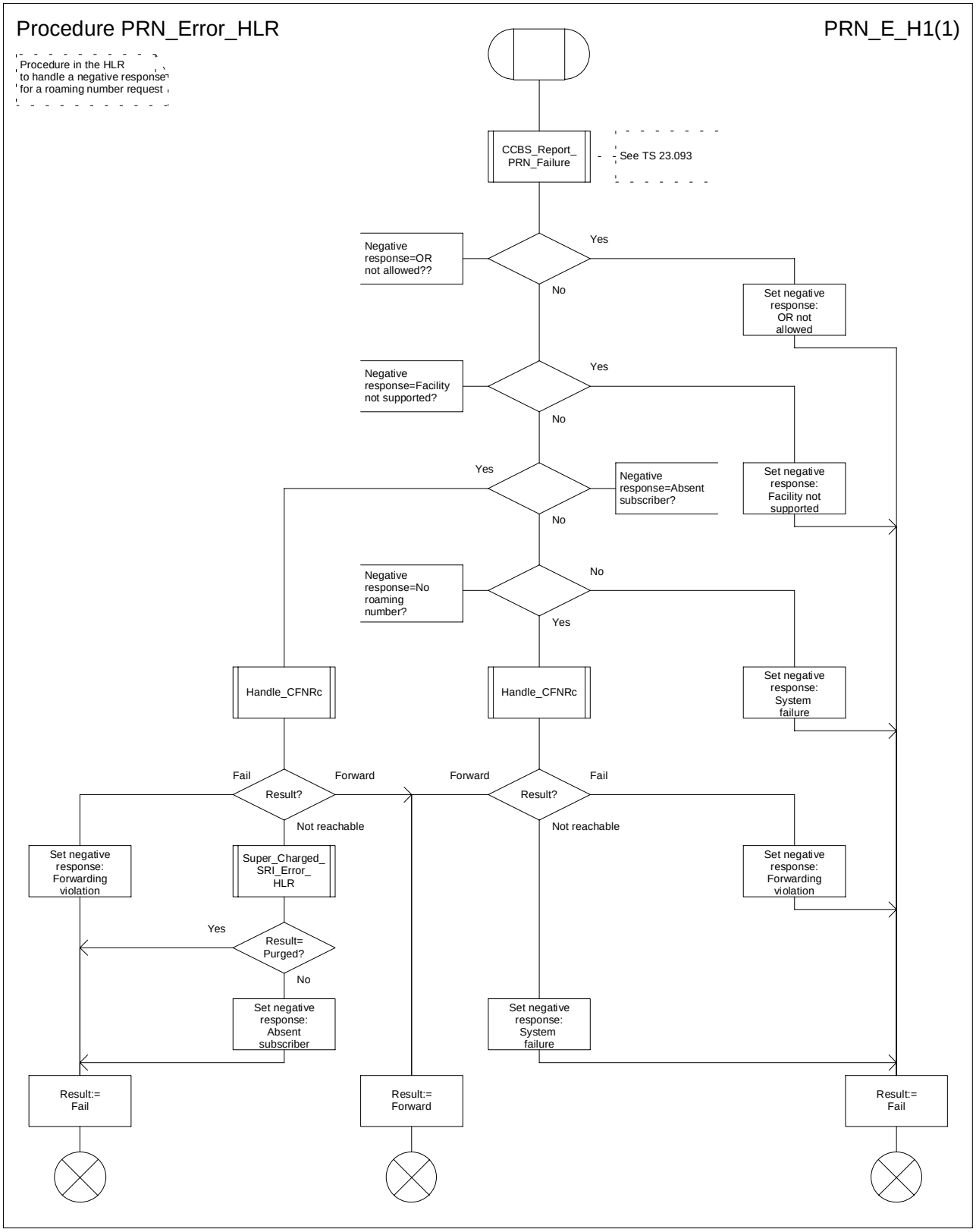
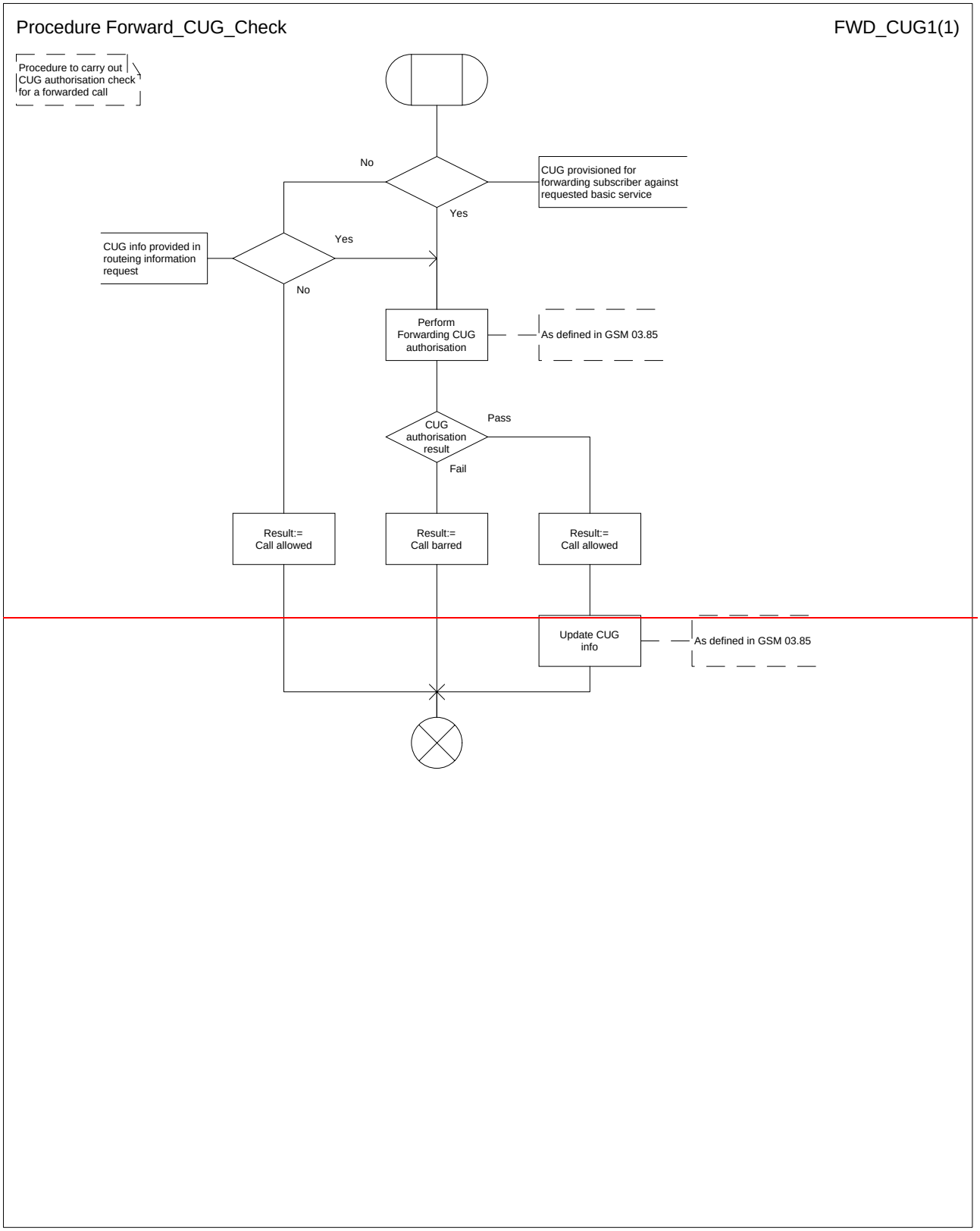


Figure 47: Procedure PRN_Error_HLR


Procedure Forward_CUG_Check
FWD_CUG1(1)
Procedure to carry out CUG authorisation check for a forwarded call
No
CUG provisioned for forwarding subscriber against requested basic service
Yes
CUG info provided in routeing information request
Yes
No
Perform Forwarding CUG authorisation
As defined in GSM 03.85
CUG authorisation result
Pass
Fail
Result:= Call allowed
Result:= Call barred
Result:= Call allowed
Update CUG info
As defined in GSM 03.85

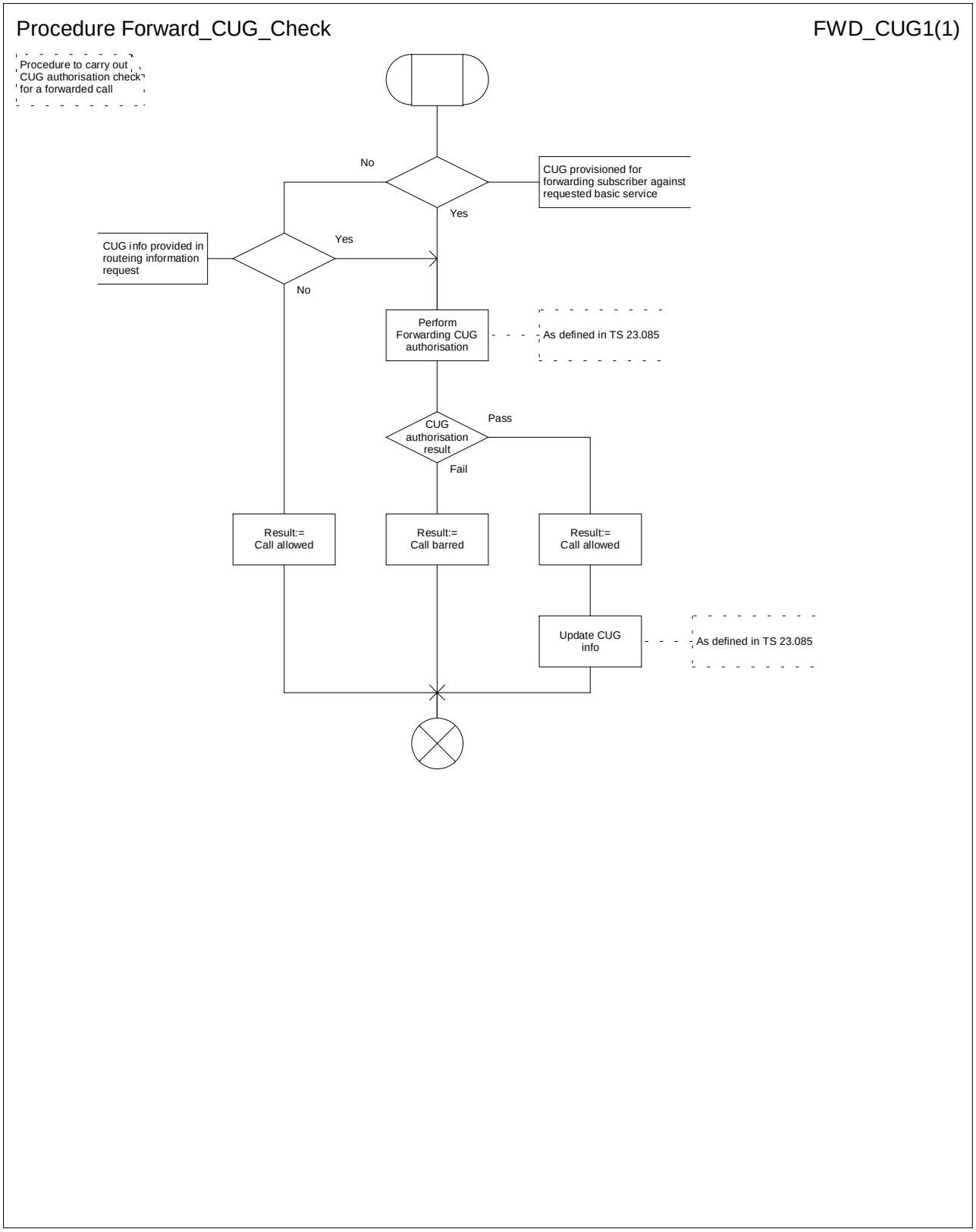


Figure 48: Procedure Forward _CUG_Check

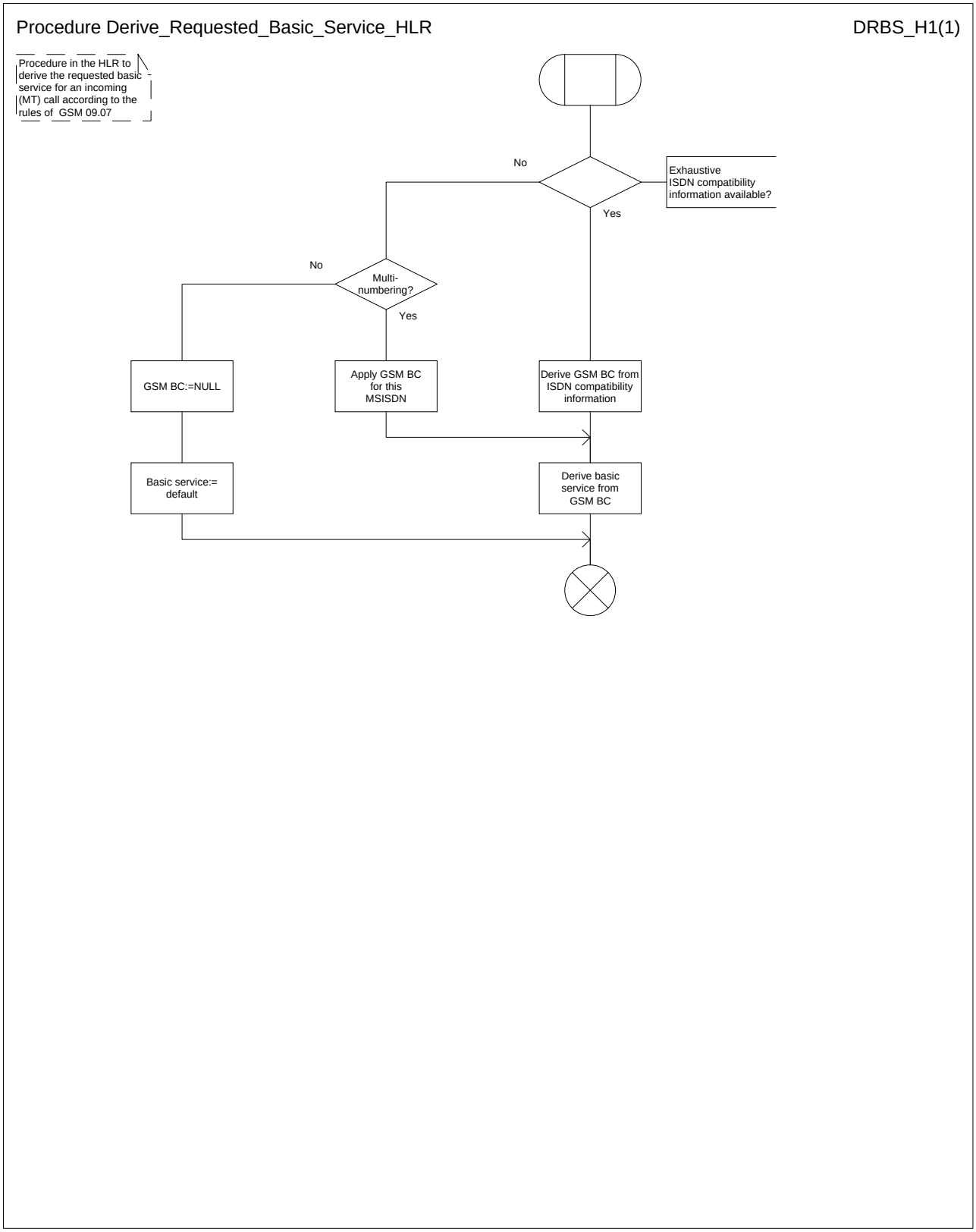


Figure 49: Procedure Derive_Requested_Basic_Service_HLR

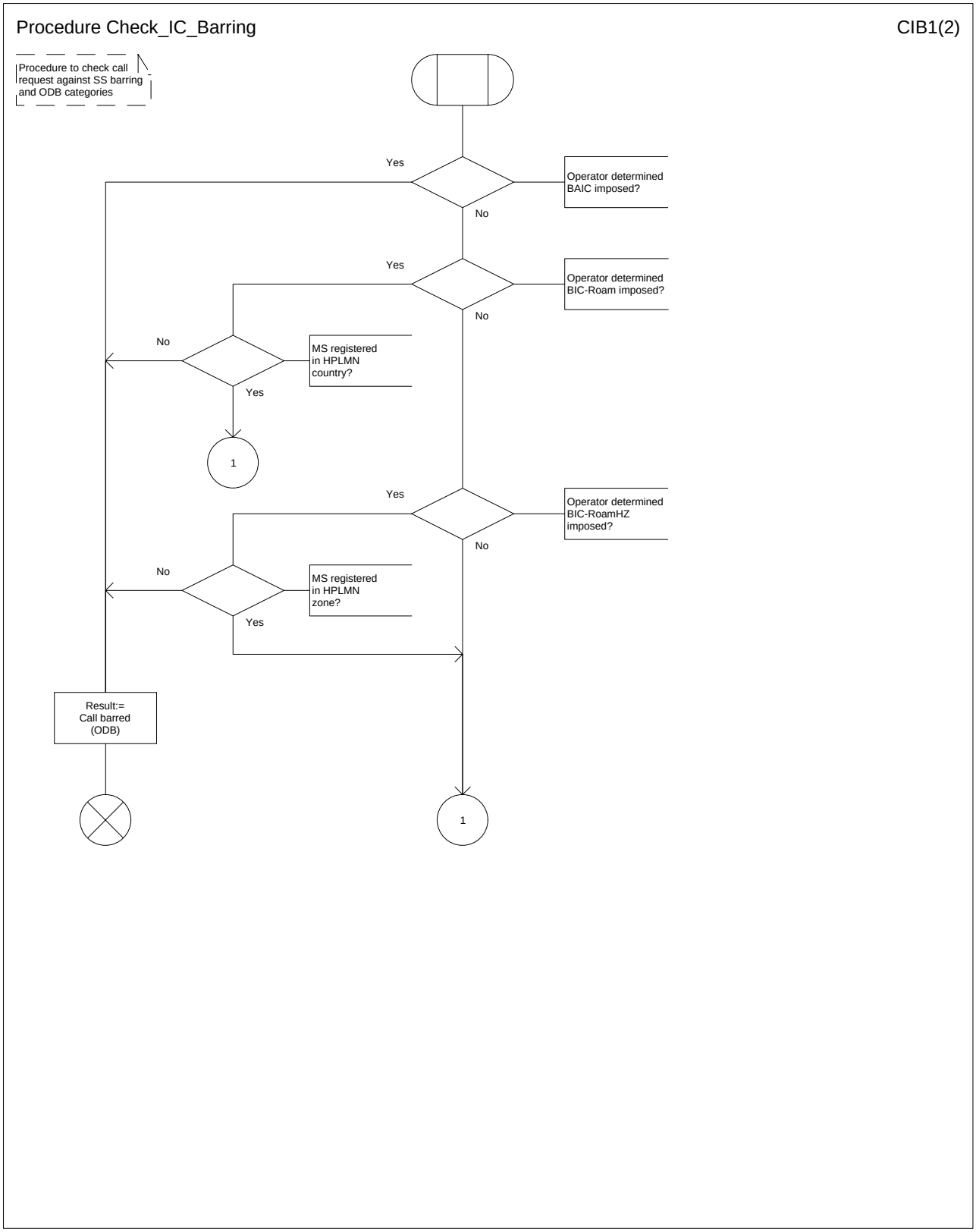


Figure 50a: Procedure Check_IC_Barring (sheet 1)

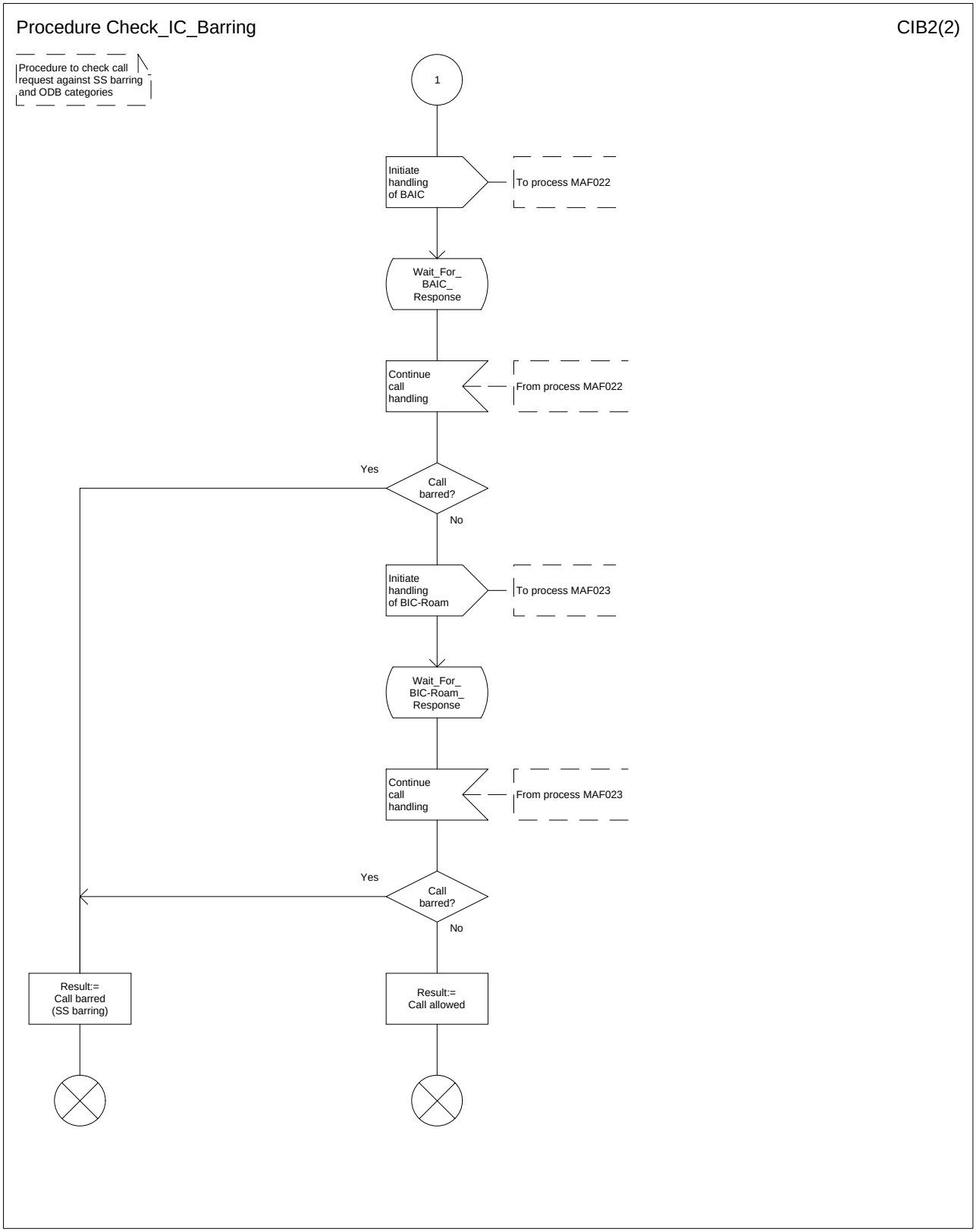


Figure 50b: Procedure Check_IC_Barring (sheet 2)

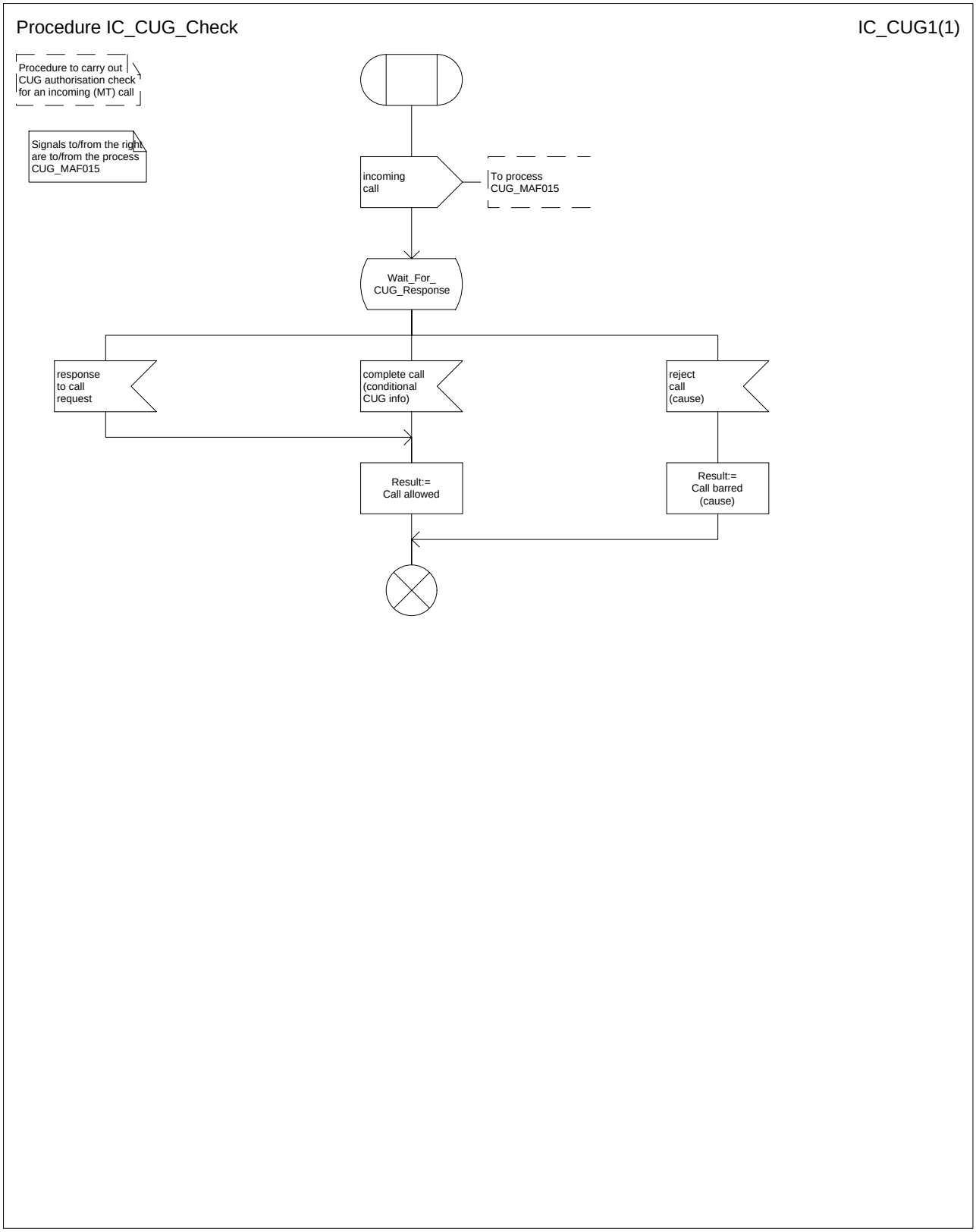


Figure 51: Procedure IC_CUG_Check

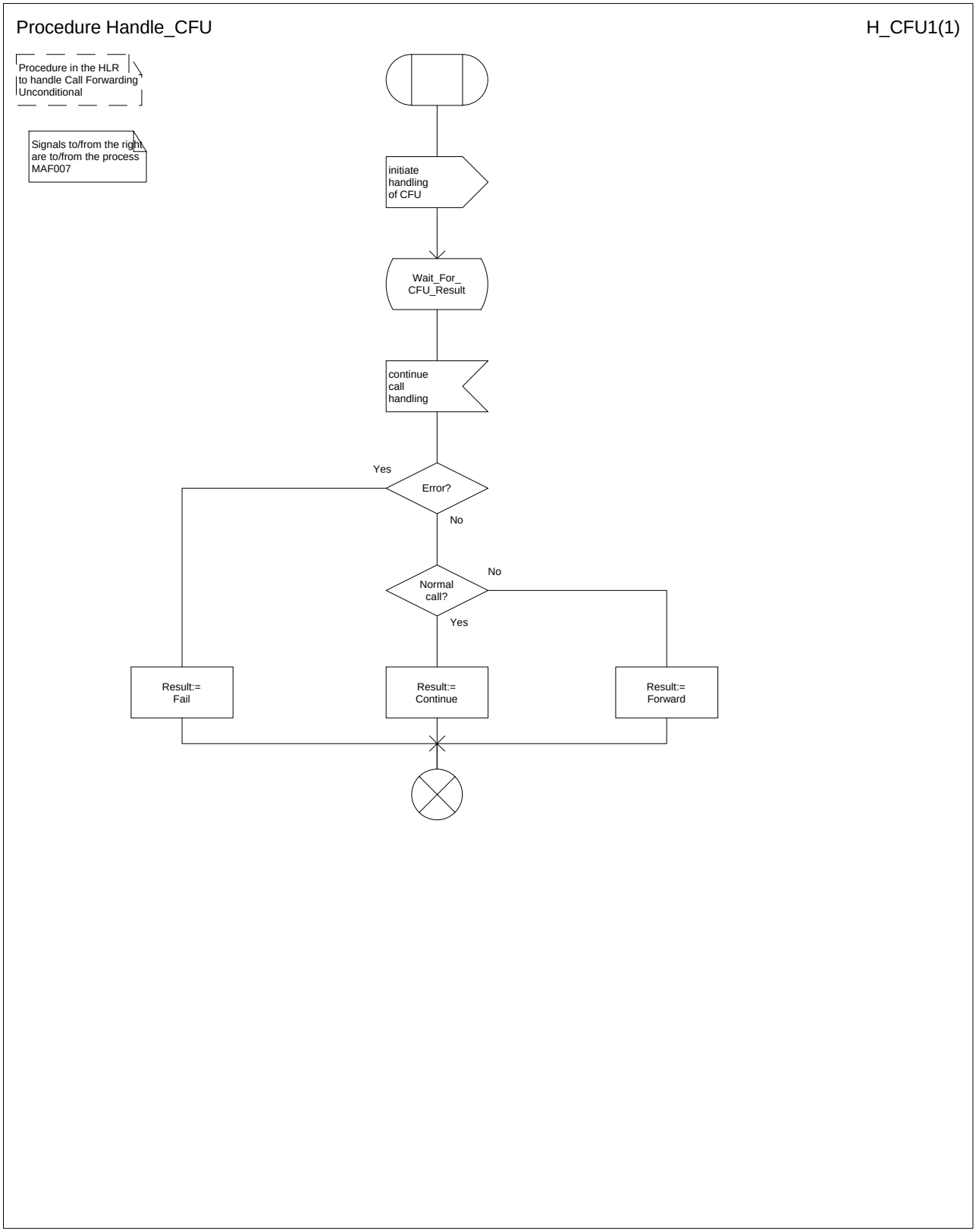


Figure 52: Procedure Handle_CFU

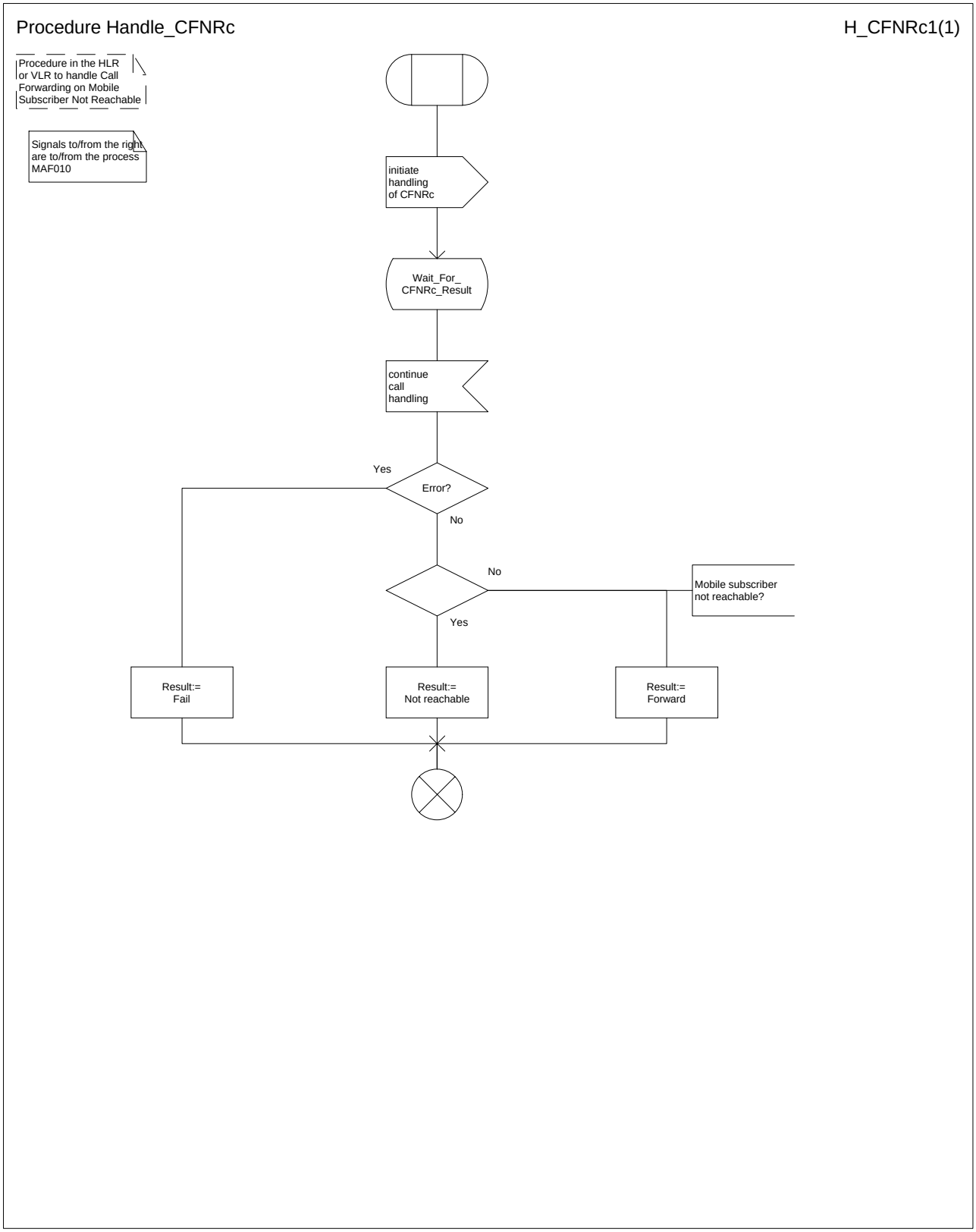


Figure 53: Procedure Handle_CFNRc

7.2.3 Functional requirements of VLR

7.2.3.1 Process PRN_VLR

Sheet 1: the procedure Check_Parameters is specified in subclause 7.2.2.2.

Sheet 1: the test "Pre-paging allowed" takes the "yes" exit if:

- the information element "Pre-paging supported" was present in the Provide Roaming Number message, or
- as an operator option, the paging procedure can be completed before the minimum timer value for the Provide Roaming Number operation timer in the HLR has elapsed.

Sheet 1: the procedure Check_Reason_In_Serving_Network_Entity is specific to Super-Charger; it is specified in TS 23.116 ~~[~~[43]. If the VLR does not support Super-Charger, processing continues from the "No" exit of the test "Result=Purged?".

Sheet 2,, sheet 3, sheet 6, sheet 7: the procedure CAMEL_SET_SOA is specific to CAMEL; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 1~~ [32] ~~and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]~~.

Sheet 2, sheet 3, sheet 6, sheet 7: the task "Store alerting pattern (if received)" is executed only if the VLR supports the feature Network Indication of Alerting.

Sheet 2, sheet 3, sheet 6, sheet 7: the procedure CLI_PRN_VLR is specific to Enhanced CLI Handling. It is specified in ~~GSM~~ TS ~~03.~~23.081 [34].

Sheet 2, sheet 3, sheet 6, sheet 7: the procedure CCBS_Handle_PRN is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 3, sheet 4: the number of unused authentication sets which triggers the VLR to request further authentication sets from the HLR is an operator option.

Sheet 3, sheet 4: the process Fetch_Authentication_Sets_VLR is specified in subclause 7.1.2.11.

Sheet 4: the procedure Search_For_MS_VLR is specified in subclause 7.3.2.3.

Sheet 4: the test "Paging via SGSN possible" takes the "yes" exit if:

- the Gs interface is implemented; and
- there is an association established for the MS between the MSC/VLR and the SGSN.

Sheet 7, sheet 8: the state variables PAR pending, PAR successful and Fatal PAR error are global data, accessible to the matching instance of the process ICH_VLR, which is linked by the MSRN.

Sheet 8: this process communicates with the matching instance of the process ICH_VLR, which is linked by the MSRN.

Sheet 8: the test " Fatal PAR error?" takes the "Yes" exit if:

- the MS failed authentication, or
- the MS failed IMEI checking, or
- the HLR returned an "Unknown subscriber" error

during the handling of the Process Access Request.

7.2.3.2 Process Restore_Subscriber_Data_VLR

7.2.3.3 Process PSI_VLR

Sheet 1: the procedure Check_Parameters is specified in subclause 7.2.2.2. If the HLR requests neither location information nor subscriber state, the VLR treats this as a missing parameter.

7.2.3.4 Procedure Retrieve_Location_Info_VLR

The test "Retrieve location info from SGSN" takes the "Yes" exit if:

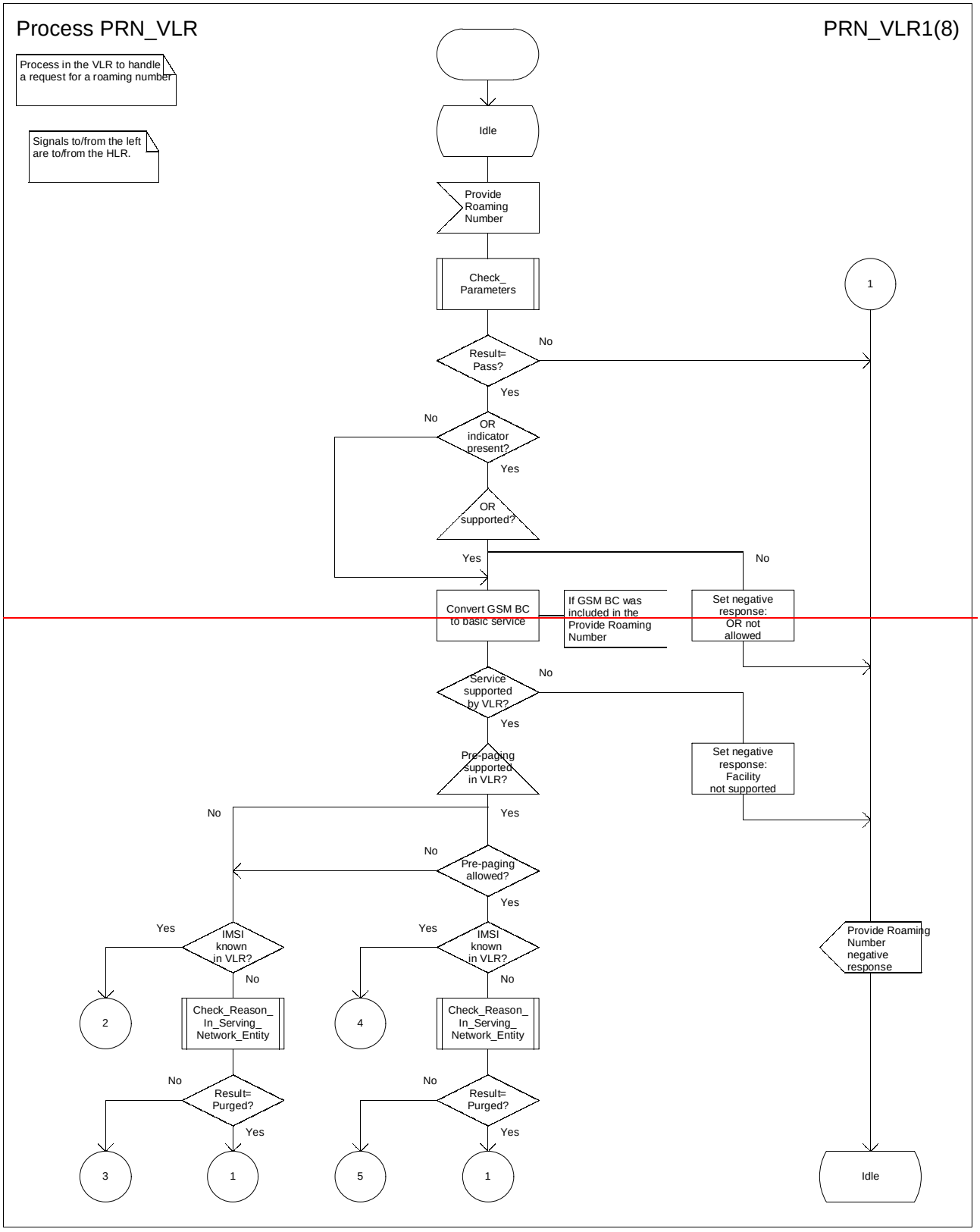
- the Gs interface is implemented; and
- there is an association established between the MSC/VLR and the SGSN.

The stored location information consists of:

- the service area ID (for UMTS) or cell ID (for GSM) of the cell in which the MS last established radio contact;
- the location number, geodetic information and geographical information derived from the service area ID or cell ID if the VLR is capable of doing so (the mapping from service area ID or cell ID to location number is network-specific and outside the scope of the UMTS and GSM standards);
- the age of the location information.

The output signal Send MS information towards the SGSN indicates that the required information is mobile location information.

The derivation of the location number, geodetic information and geographical information from the received service area ID or cell ID is a VLR operator option (the mapping from service area ID or cell ID to location number is network-specific and outside the scope of the GSM standard).


Process PRN_VLR
PRN_VLR1(8)
Process in the VLR to handle a request for a roaming number
Signals to/from the left are to/from the HLR.
Idle
Provide Roaming Number
Check_ Parameters
Result= Pass?
No
Yes
OR indicator present?
No
Yes
OR supported?
Yes
No
Convert GSM BC to basic service
If GSM BC was included in the Provide Roaming Number
Set negative response: OR not allowed
Service supported by VLR?
No
Yes
Pre-paging supported in VLR?
Set negative response: Facility not supported
No
Yes
Pre-paging allowed?
No
Yes
IMSI known in VLR?
Yes
No
Check_Reason_ In_Serving_ Network_Entity
Result= Purged?
No
Yes
2
3
1
4
5
1
1
Provide Roaming Number negative response
Idle

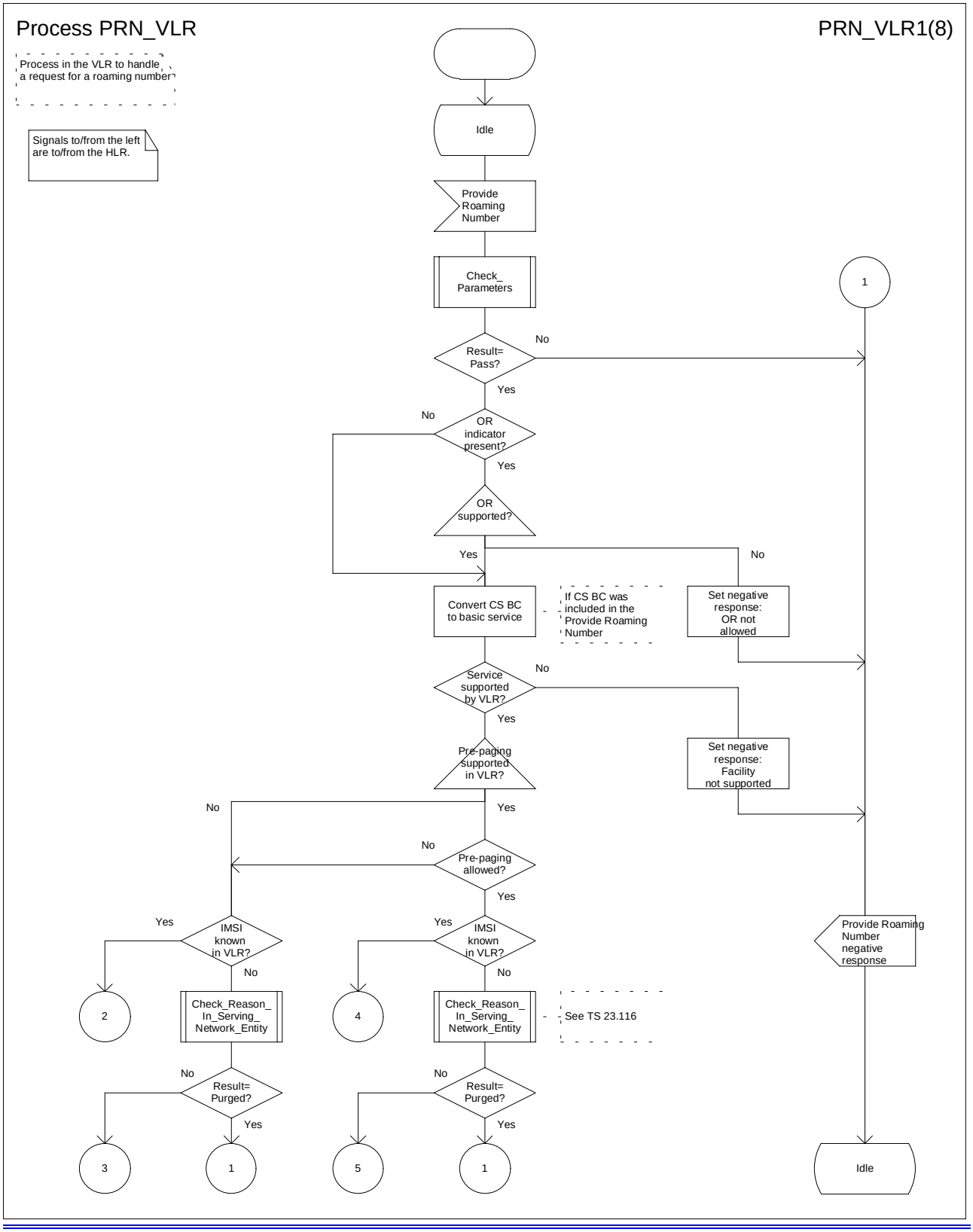
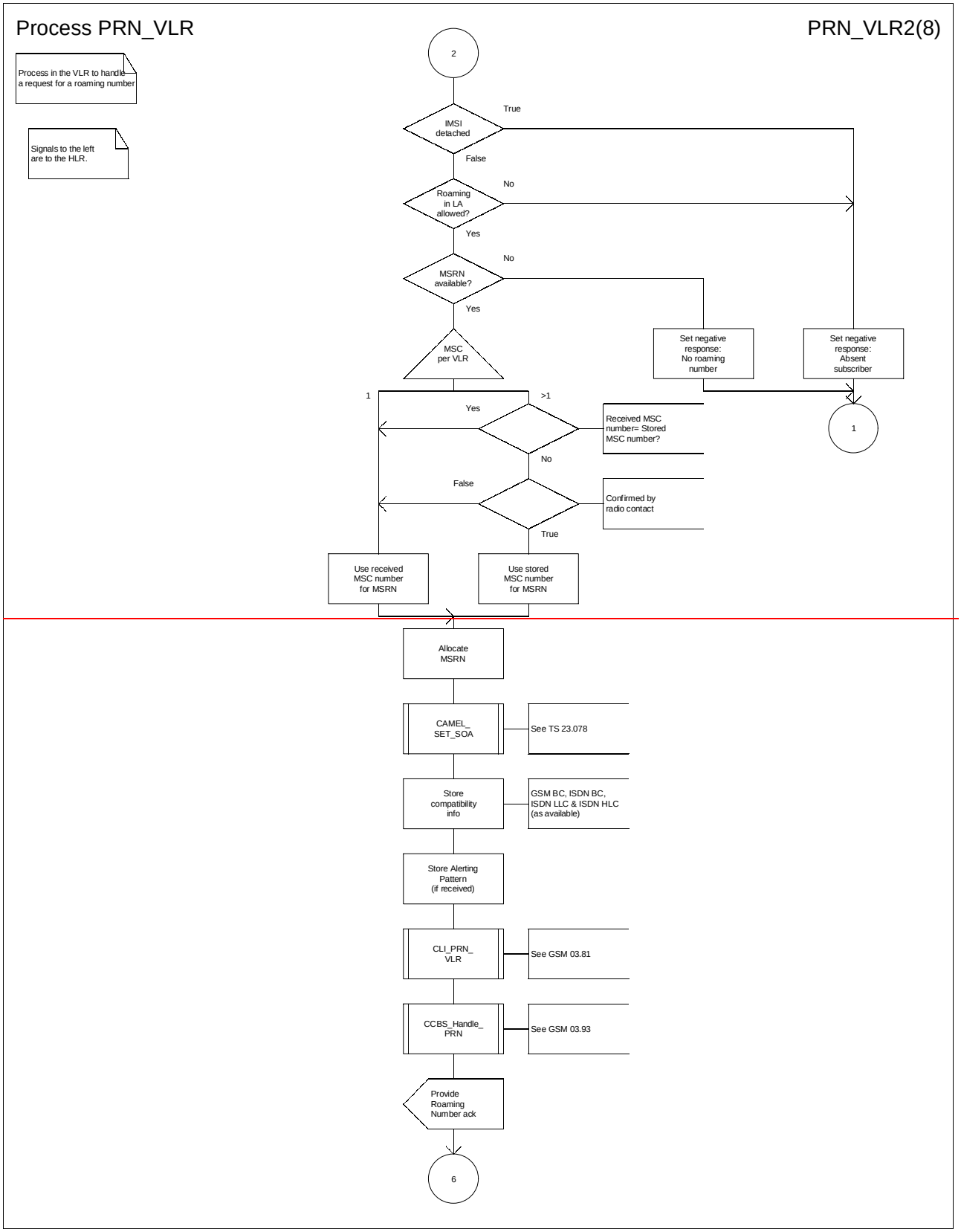


Figure 54a: Process PRN_VLR (sheet 1)


Process PRN_VLR
PRN_VLR2(8)
Process in the VLR to handle a request for a roaming number
Signals to the left are to the HLR.
2
IMSI detached
True
False
Roaming in LA allowed?
No
Yes
MSRN available?
No
Yes
MSC per VLR
Set negative response: No roaming number
Set negative response: Absent subscriber
1
1
>1
Yes
Received MSC number= Stored MSC number?
No
False
Confirmed by radio contact
True
Use received MSC number for MSRN
Use stored MSC number for MSRN
Allocate MSRN
CAMEL_ SET_SOA
See TS 23.078
Store compatibility info
GSM BC, ISDN BC, ISDN LLC & ISDN HLC (as available)
Store Alerting Pattern (if received)
CLI_PRN_ VLR
See GSM 03.81
CCBS_Handle_ PRN
See GSM 03.93
Provide Roaming Number ack
6

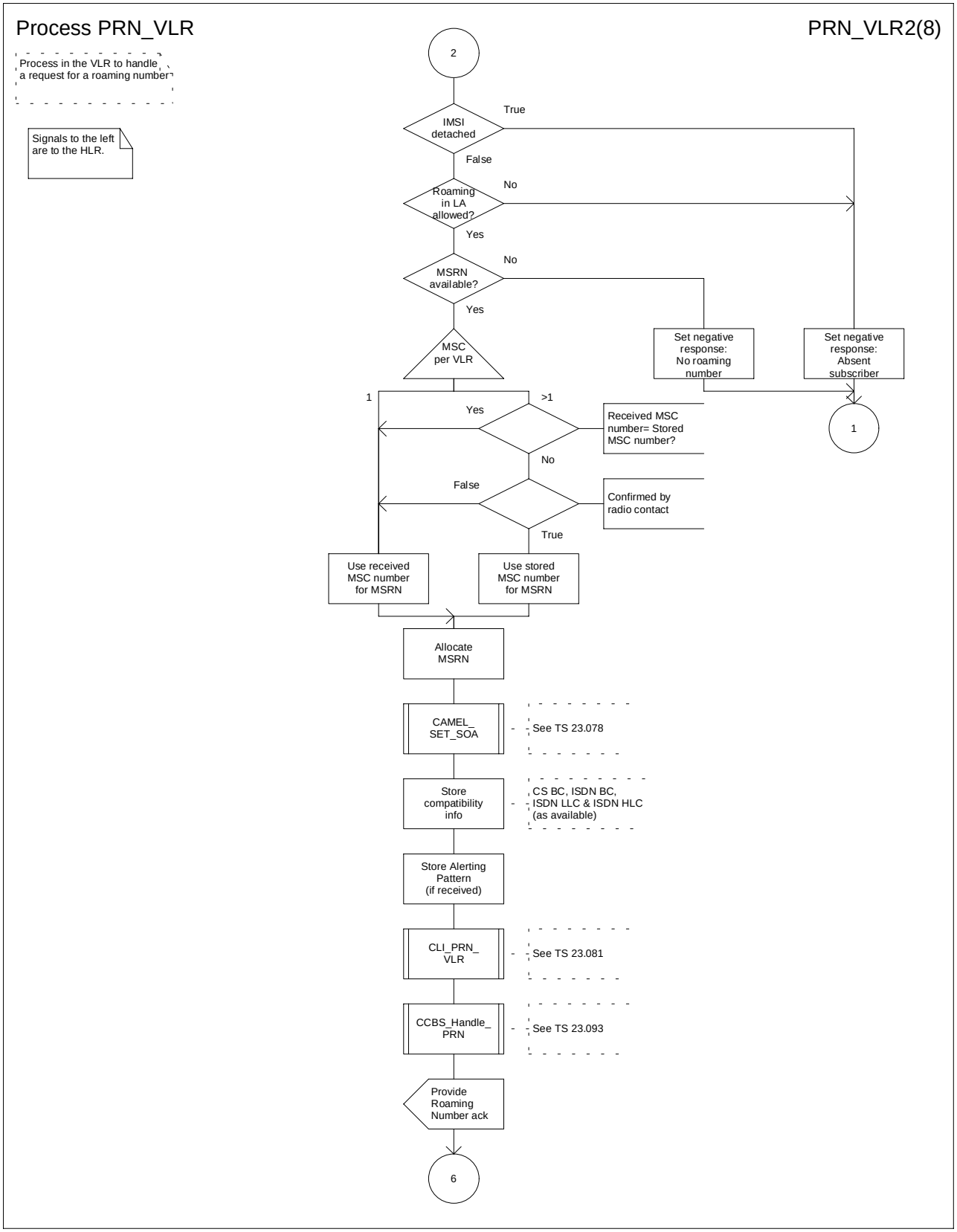
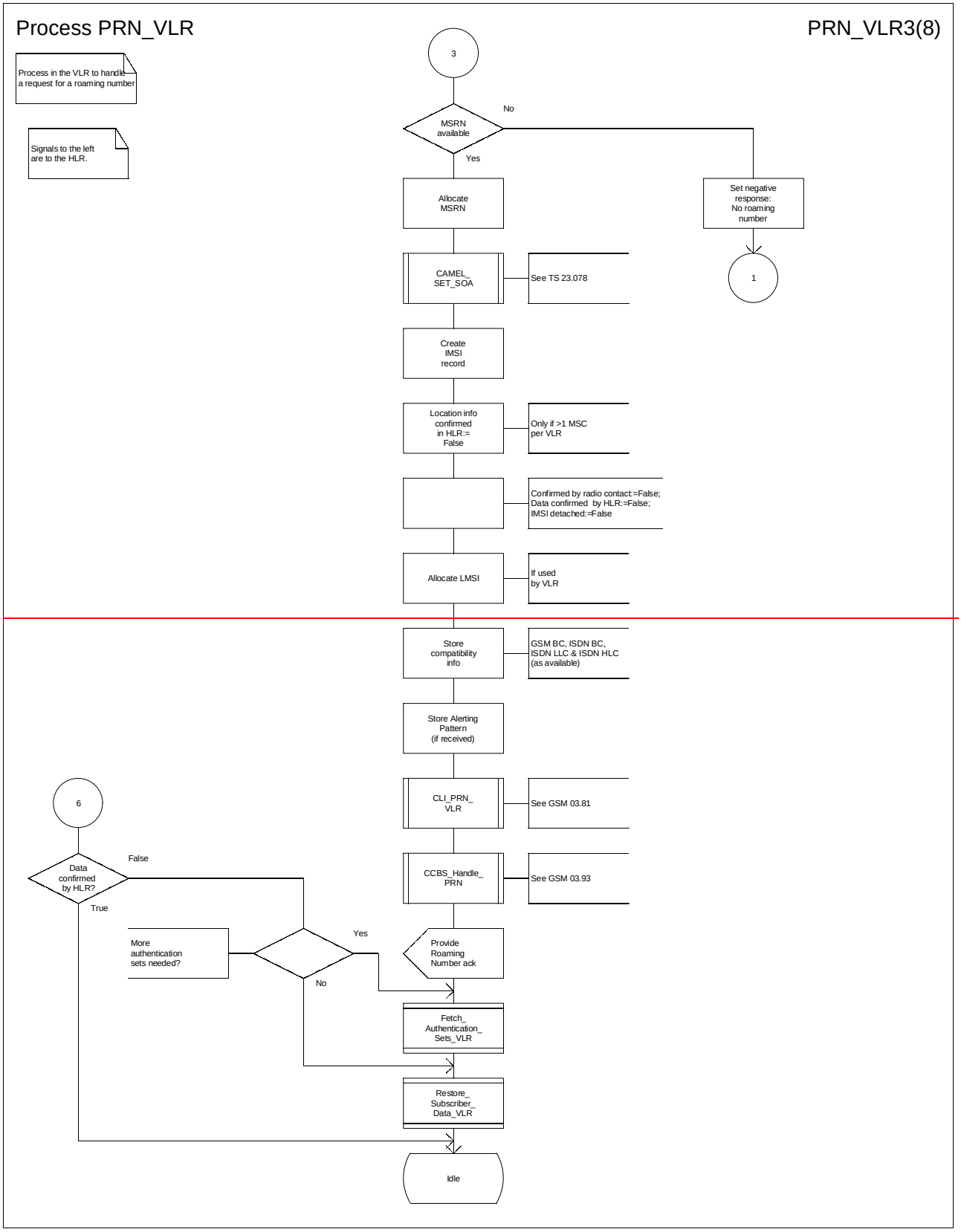


Figure 54b: Process PRN_VLR (sheet 2)


Process PRN_VLR
PRN_VLR3(8)
Process in the VLR to handle a request for a roaming number
Signals to the left are to the HLR.
3
MSRN available
No
Yes
Allocate MSRN
Set negative response: No roaming number
1
CAMEL_ SET_SOA
See TS 23.078
Create IMSI record
Location info confirmed in HLR:= False
Only if >1 MSC per VLR
Confirmed by radio contact:=False; Data confirmed by HLR:=False; IMSI detached:=False
Allocate LMSI
If used by VLR
Store compatibility info
GSM BC, ISDN BC, ISDN LLC & ISDN HLC (as available)
Store Alerting Pattern (if received)
CLI_PRN_ VLR
See GSM 03.81
CCBS_Handle_ PRN
See GSM 03.93
6
Data confirmed by HLR?
False
True
More authentication sets needed?
Yes
No
Provide Roaming Number ack
Fetch_ Authentication_ Sets_VLR
Restore_ Subscriber_ Data_VLR
Idle

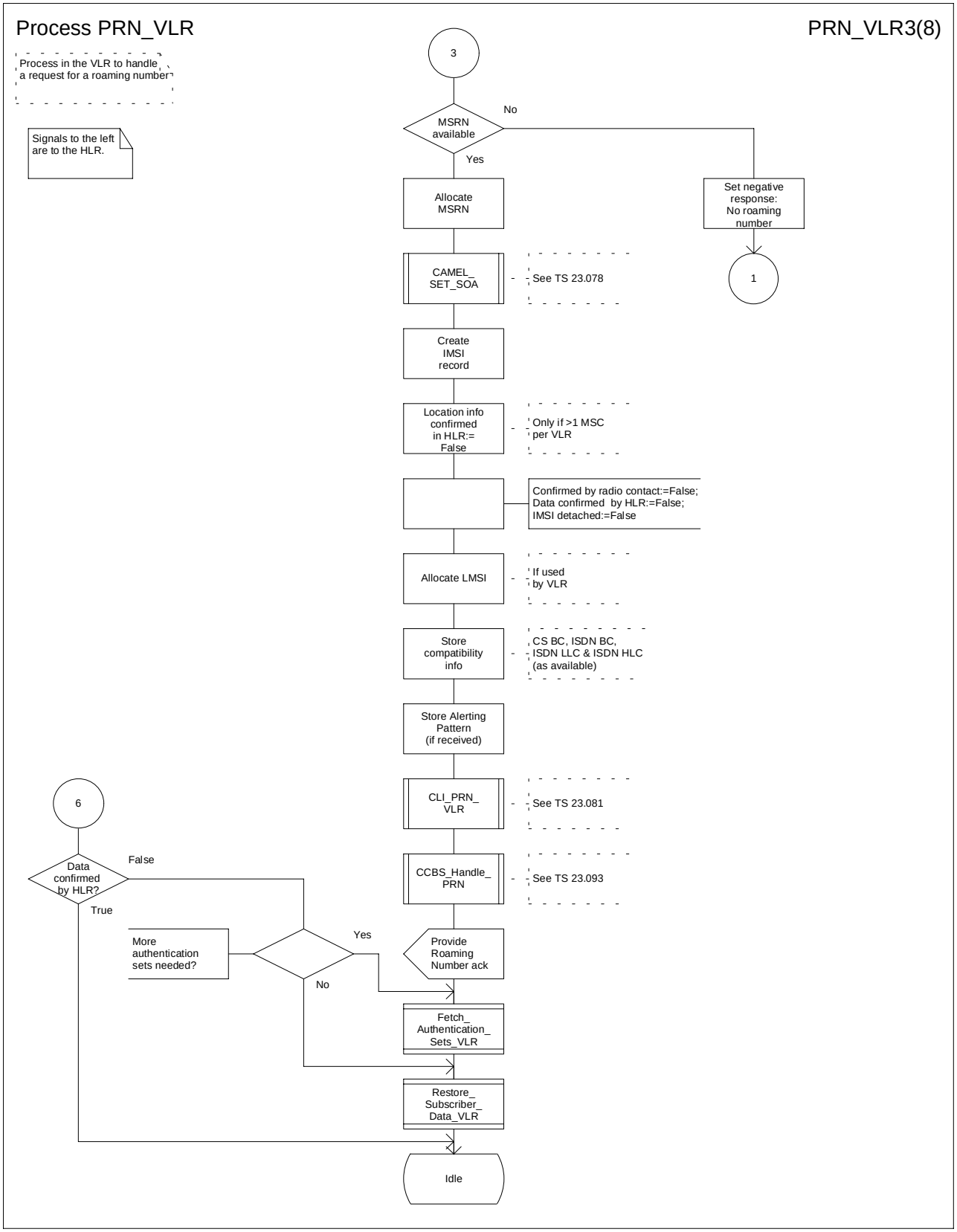


Figure 54c: Process PRN_VLR (sheet 3)

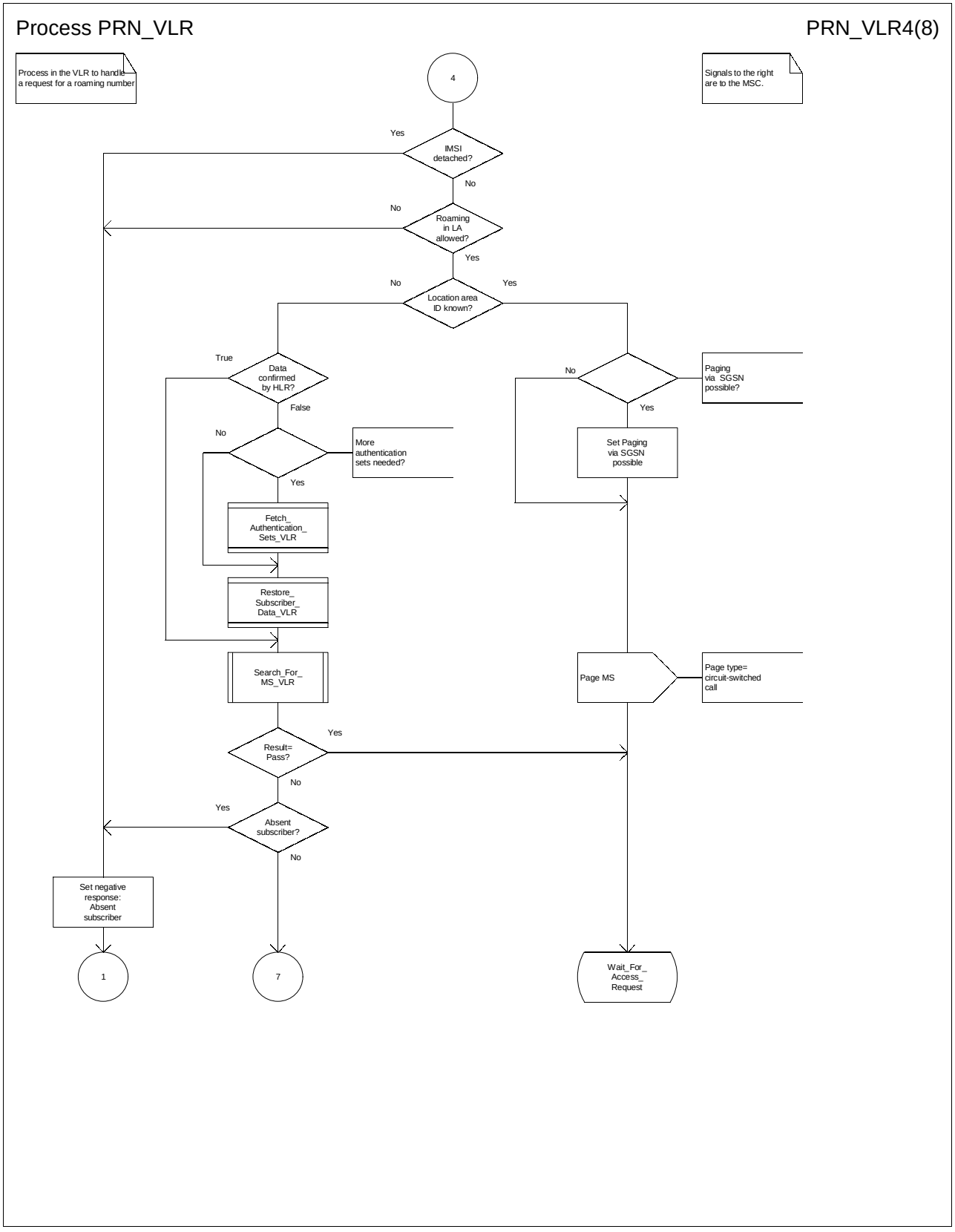
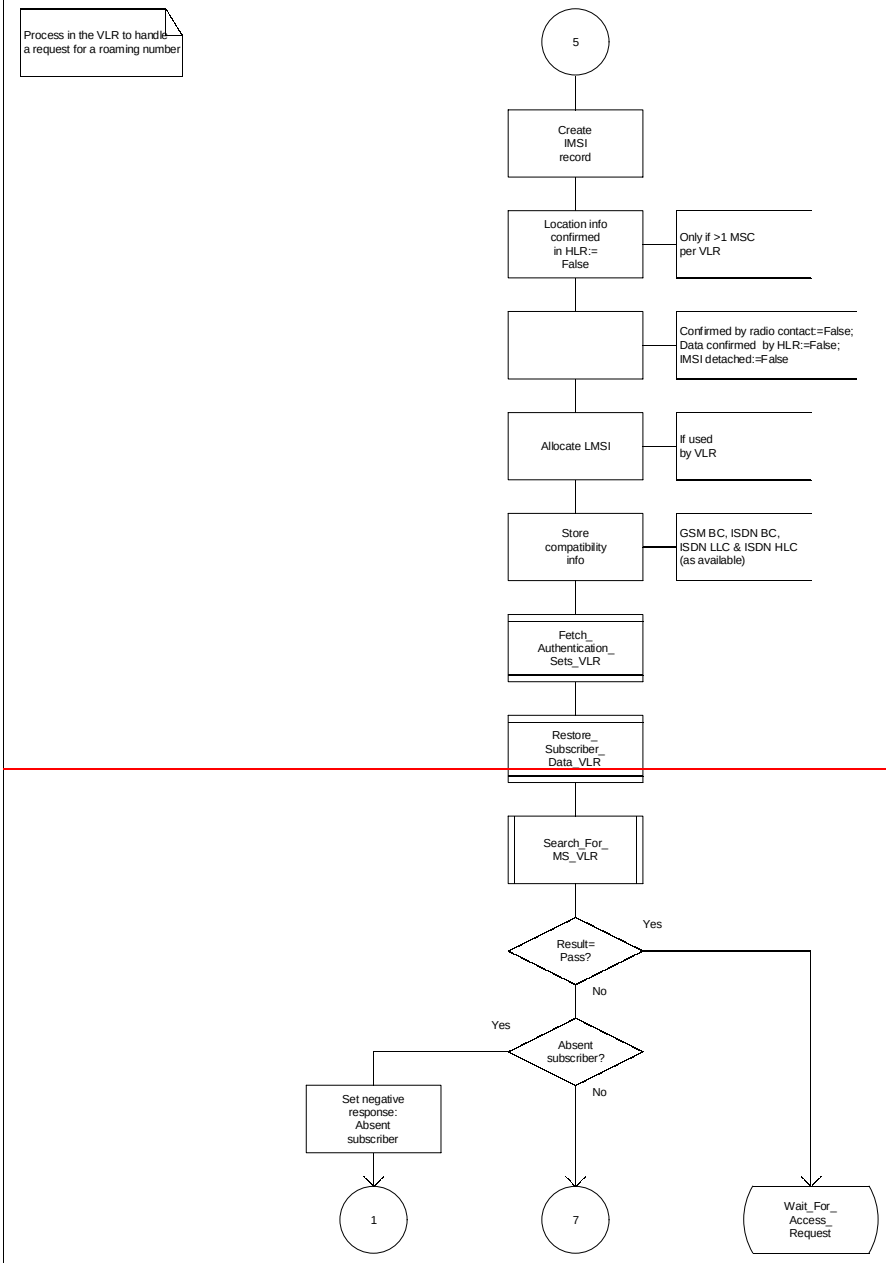


Figure 54d: Process PRN_VLR (sheet 4)

Process PRN_VLR PRN_VLR5(8)



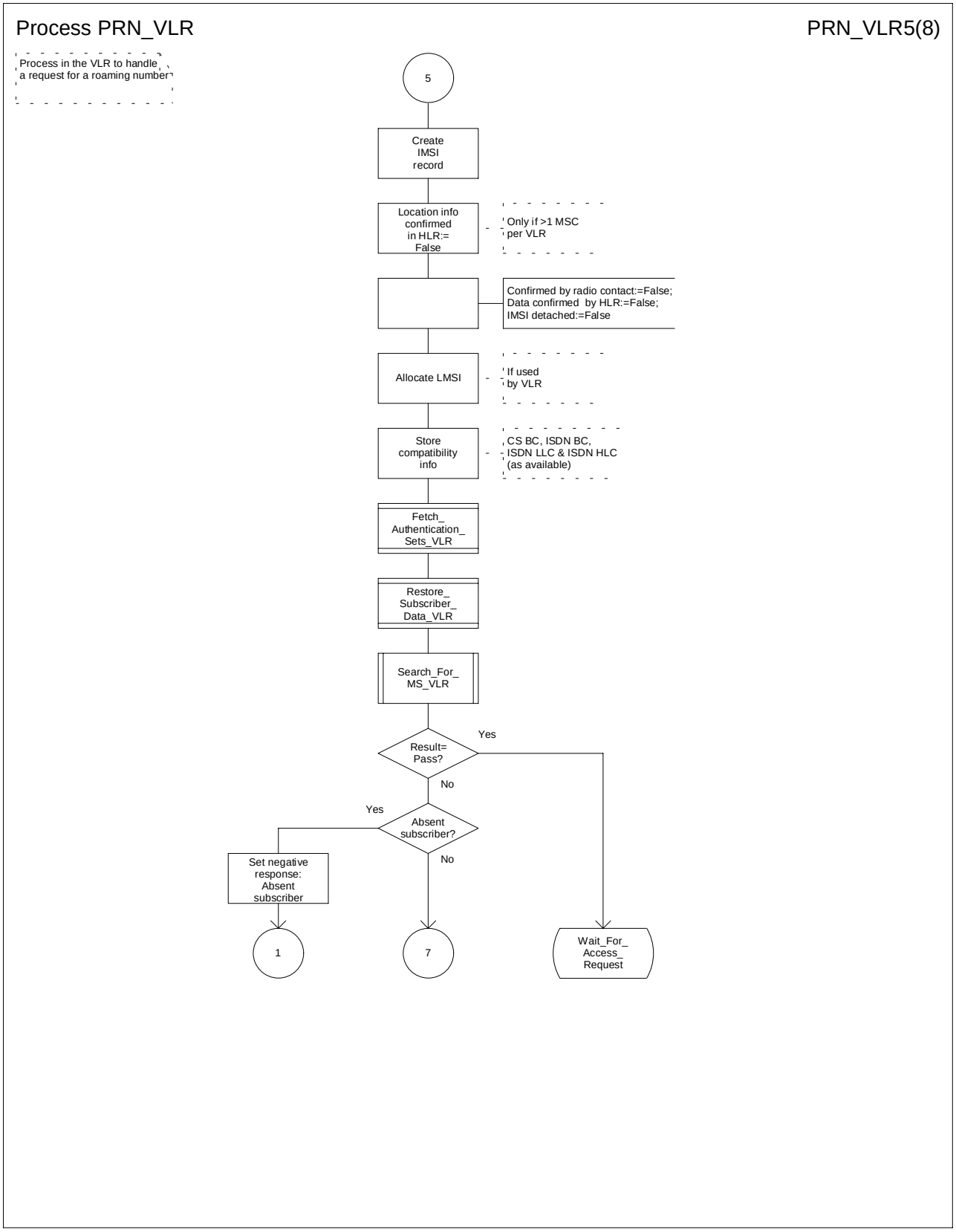
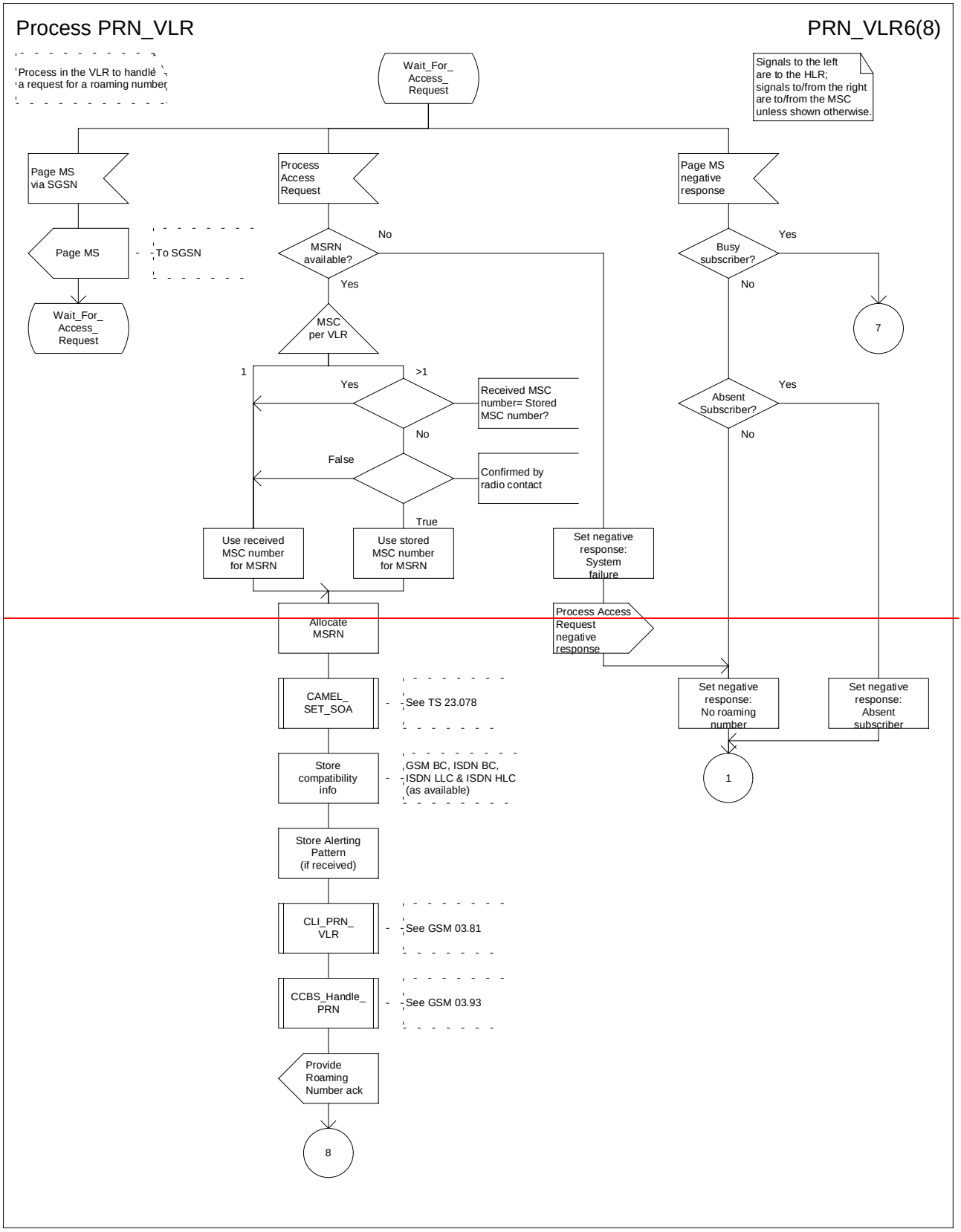


Figure 54e: Process PRN_VLR (sheet 5)


Process PRN_VLR
PRN_VLR6(8)
Process in the VLR to handle a request for a roaming number
Wait_For_ Access_ Request
Signals to the left are to the HLR; signals to/from the right are to/from the MSC unless shown otherwise.
Page MS via SGSN
Process Access Request
Page MS negative response
Page MS
To SGSN
MSRN available?
No
Yes
Busy subscriber?
Yes
No
Wait_For_ Access_ Request
MSC per VLR
7
1
>1
Yes
Received MSC number= Stored MSC number?
Absent Subscriber?
Yes
No
False
Confirmed by radio contact
No
True
Use received MSC number for MSRN
Use stored MSC number for MSRN
Set negative response: System failure
Allocate MSRN
Process Access Request negative response
CAMEL_ SET_SOA
See TS 23.078
Set negative response: No roaming number
Set negative response: Absent subscriber
Store compatibility info
GSM BC, ISDN BC, ISDN LLC & ISDN HLC (as available)
1
Store Alerting Pattern (if received)
CLI_PRN_ VLR
See GSM 03.81
CCBS_Handle_ PRN
See GSM 03.93
Provide Roaming Number ack
8

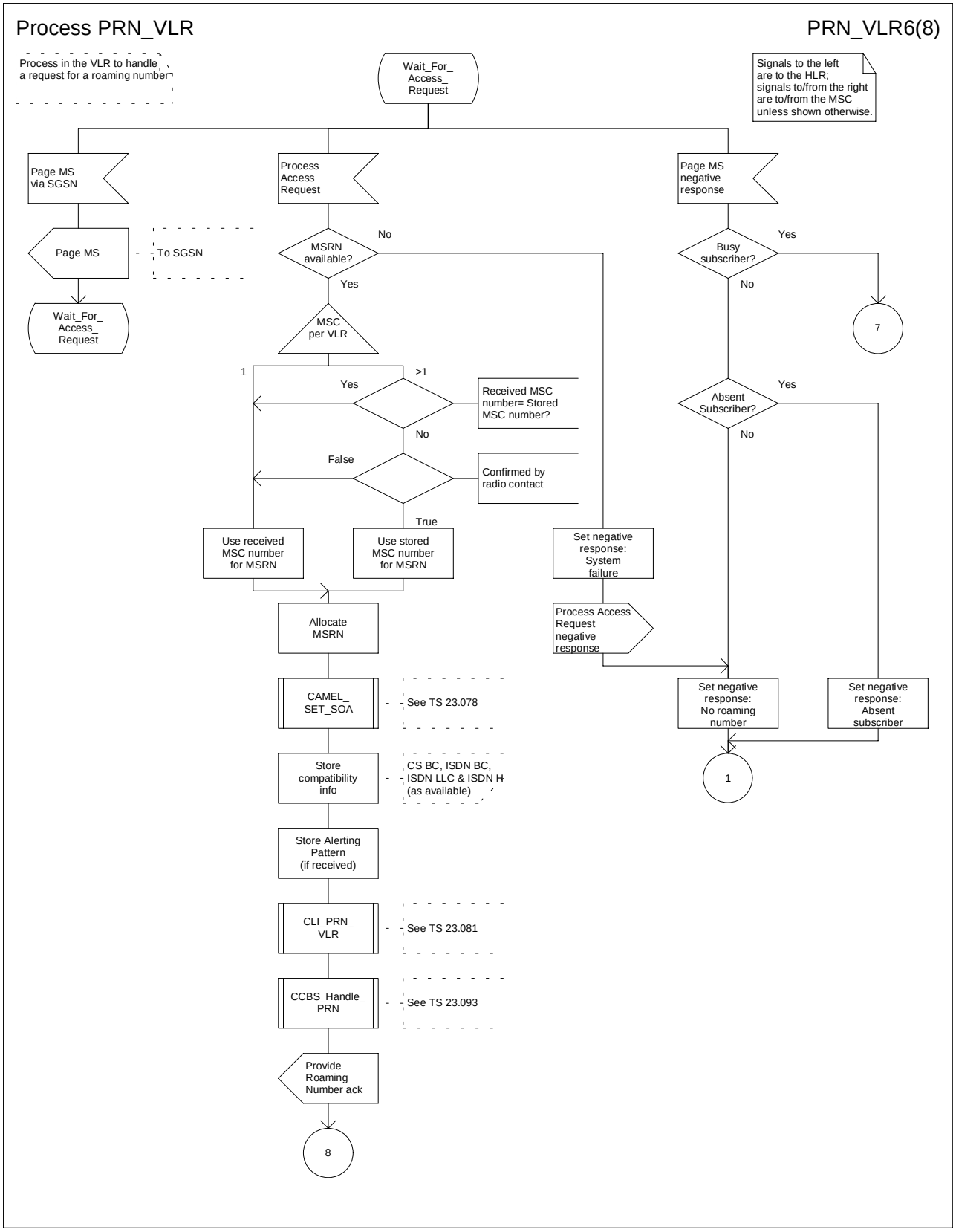
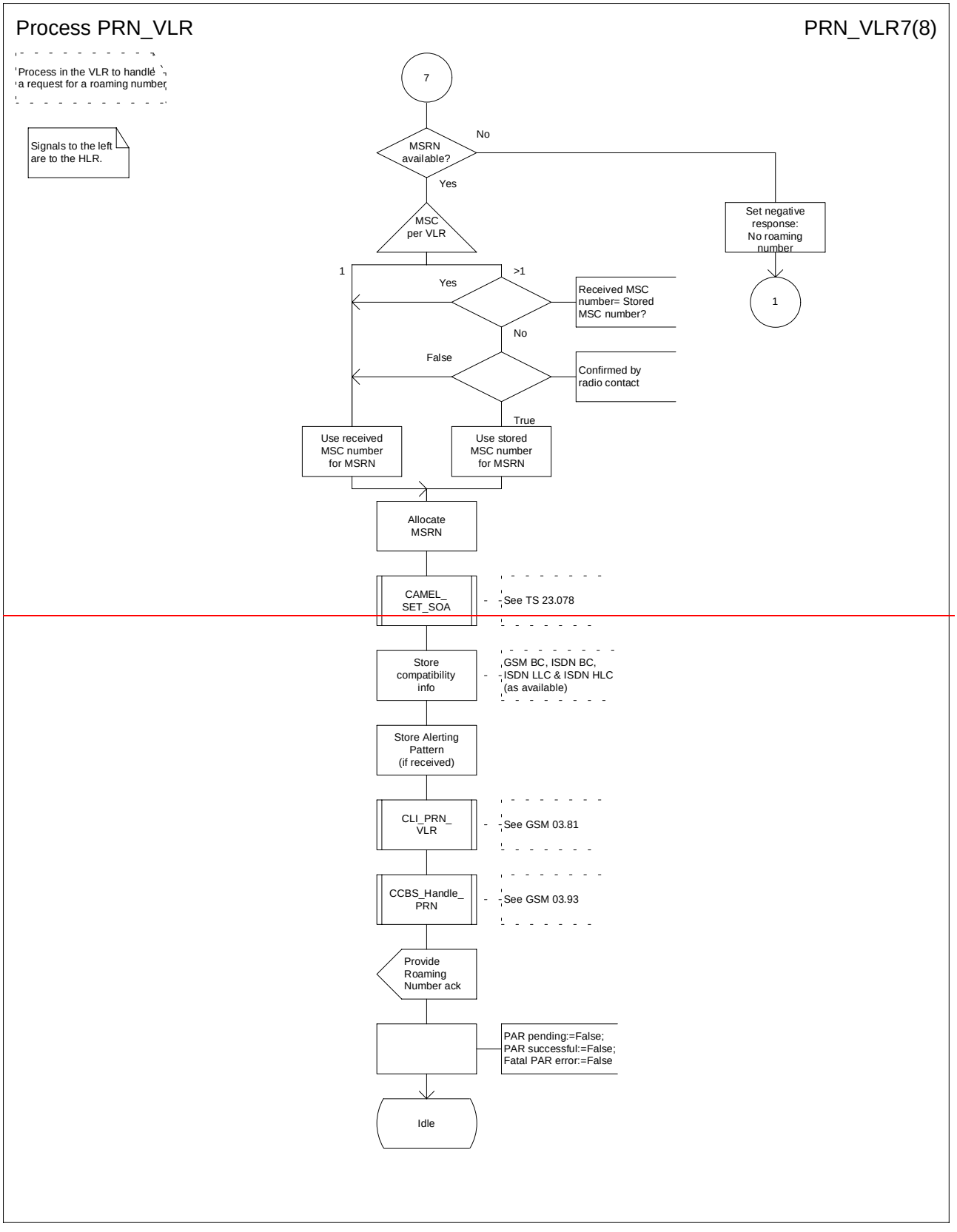


Figure 54f: Process PRN_VLR (sheet 6)


Process PRN_VLR
PRN_VLR7(8)
Process in the VLR to handle a request for a roaming number
Signals to the left are to the HLR.
7
MSRN available?
No
Yes
Set negative response: No roaming number
1
MSC per VLR
1
>1
Yes
Received MSC number= Stored MSC number?
No
False
Confirmed by radio contact
True
Use received MSC number for MSRN
Use stored MSC number for MSRN
Allocate MSRN
CAMEL_ SET_SOA
See TS 23.078
Store compatibility info
GSM BC, ISDN BC, ISDN LLC & ISDN HLC (as available)
Store Alerting Pattern (if received)
CLI_PRN_ VLR
See GSM 03.81
CCBS_Handle_ PRN
See GSM 03.93
Provide Roaming Number ack
PAR pending:=False;
PAR successful:=False;
Fatal PAR error:=False
Idle

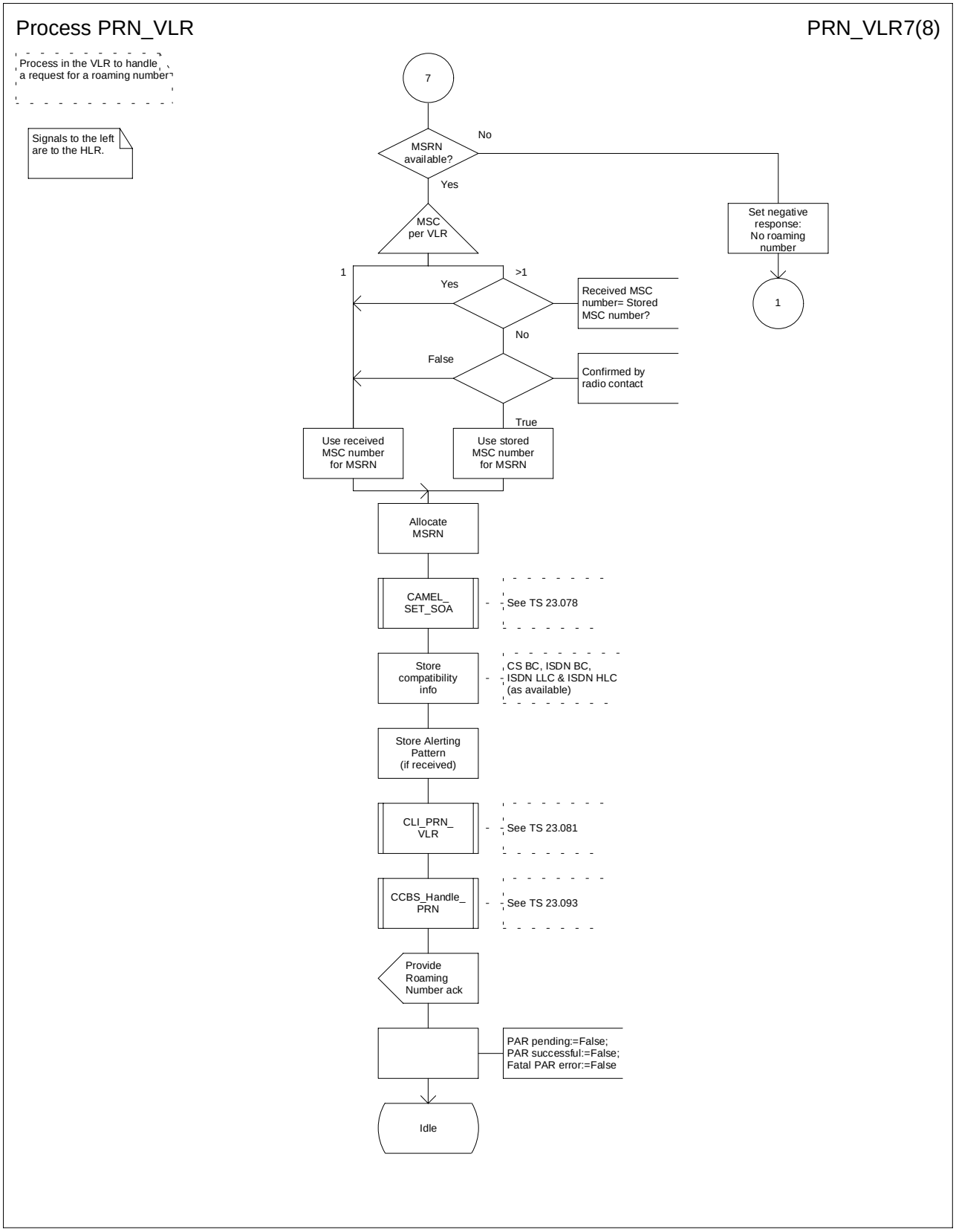


Figure 54g: Process PRN_VLR (sheet 7)

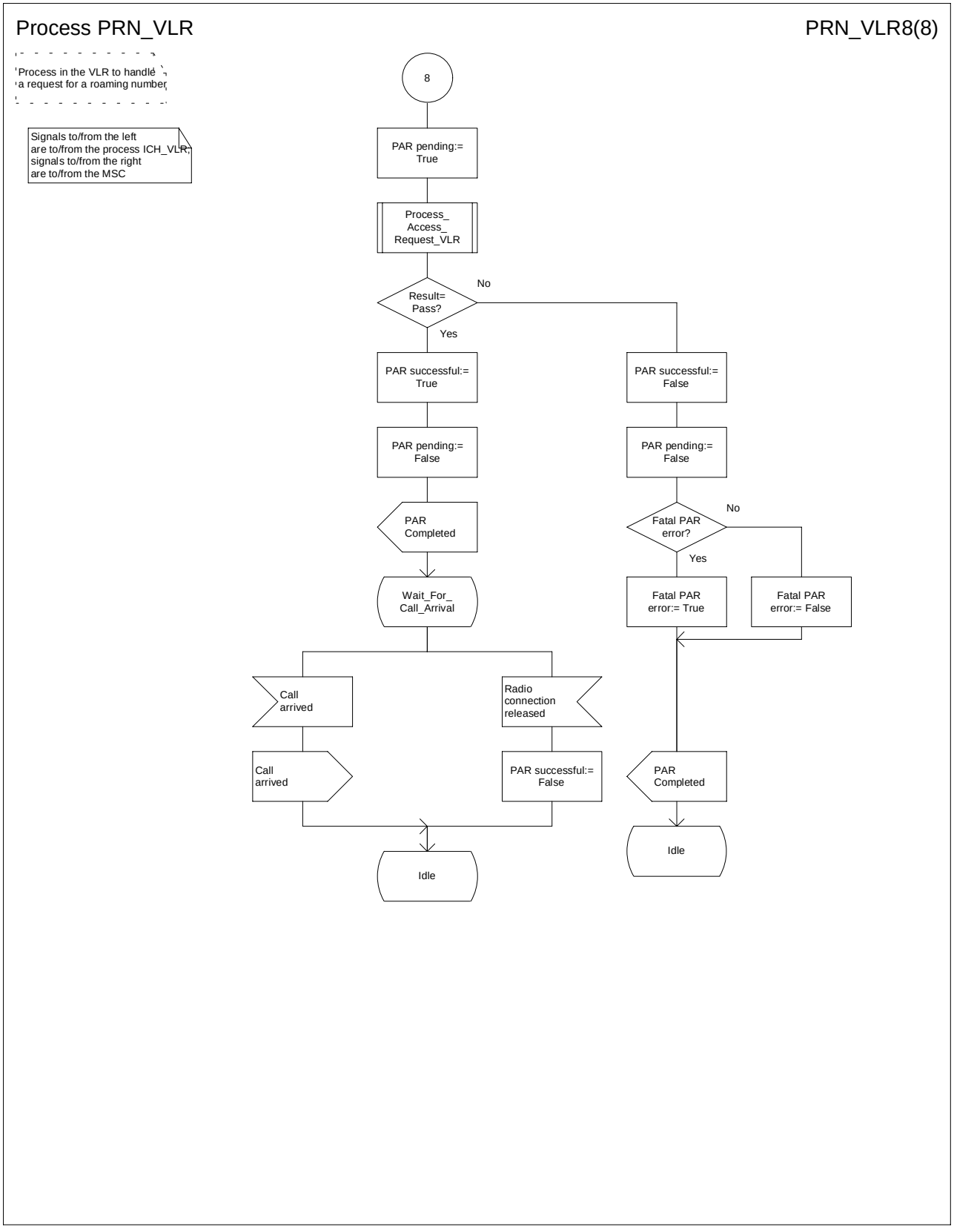


Figure 54h: Process PRN_VLR (sheet 8)

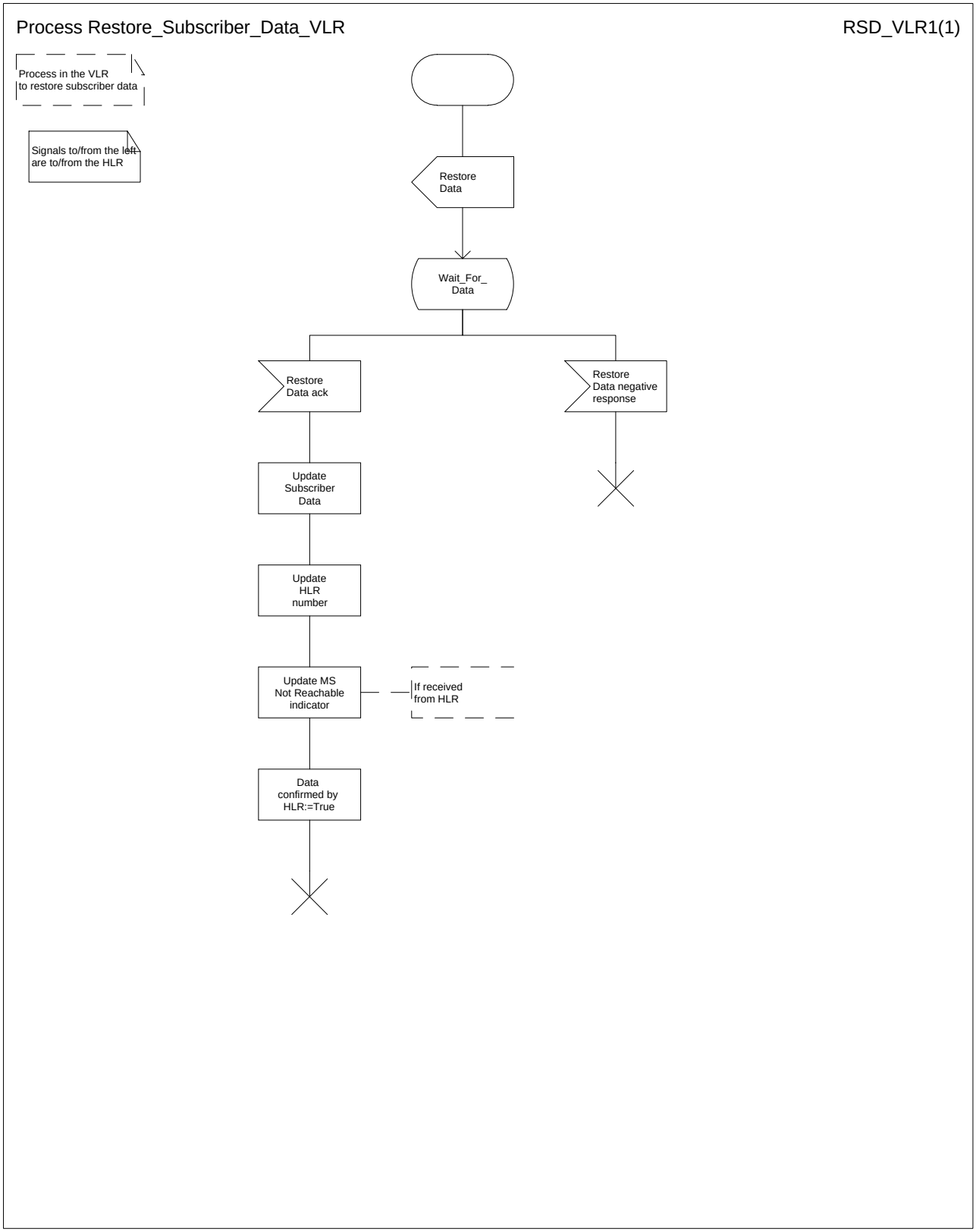


Figure 55: Process Restore_Subscriber_Data_VLR

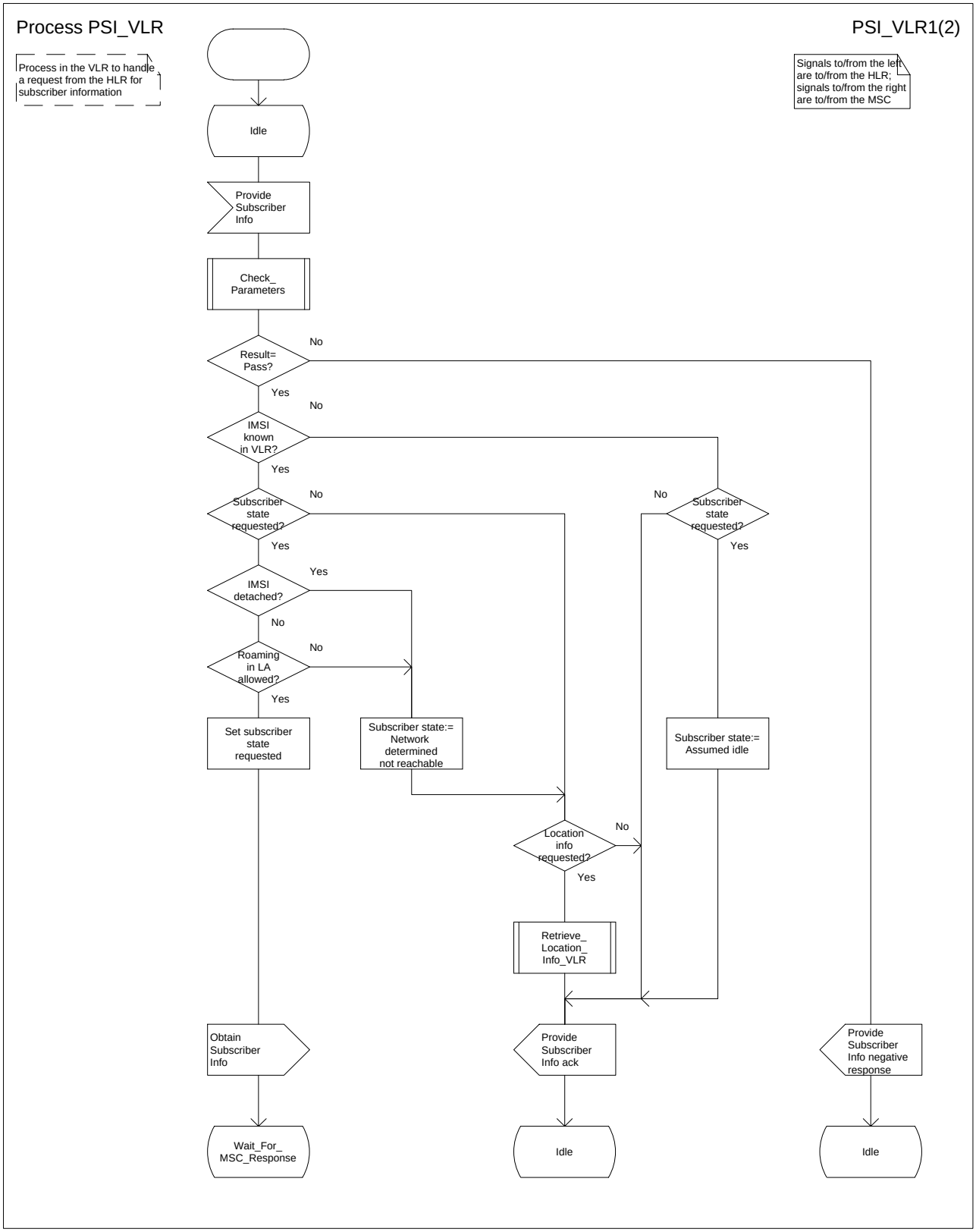


Figure 56a: Process PSI_VLR (sheet 1)

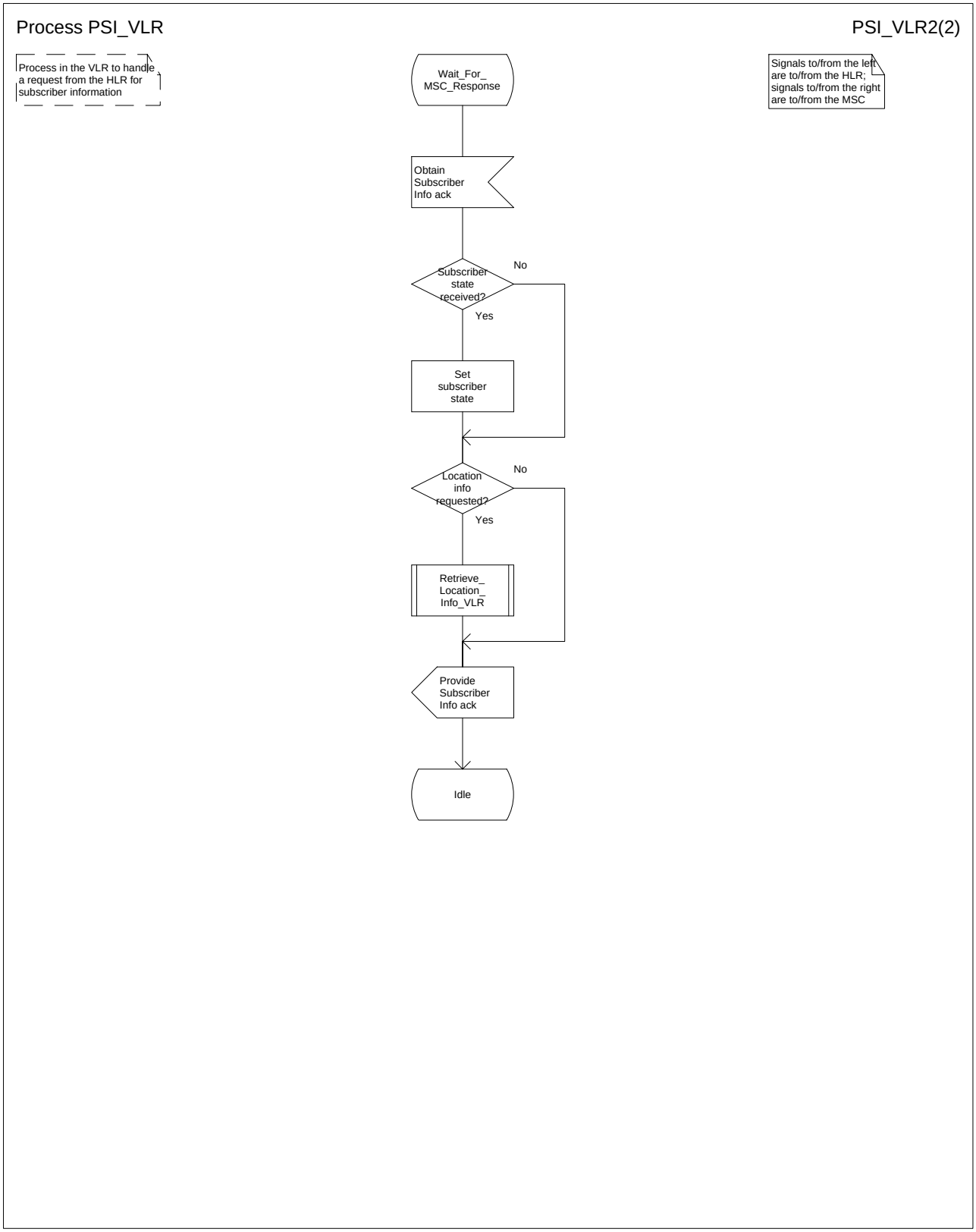
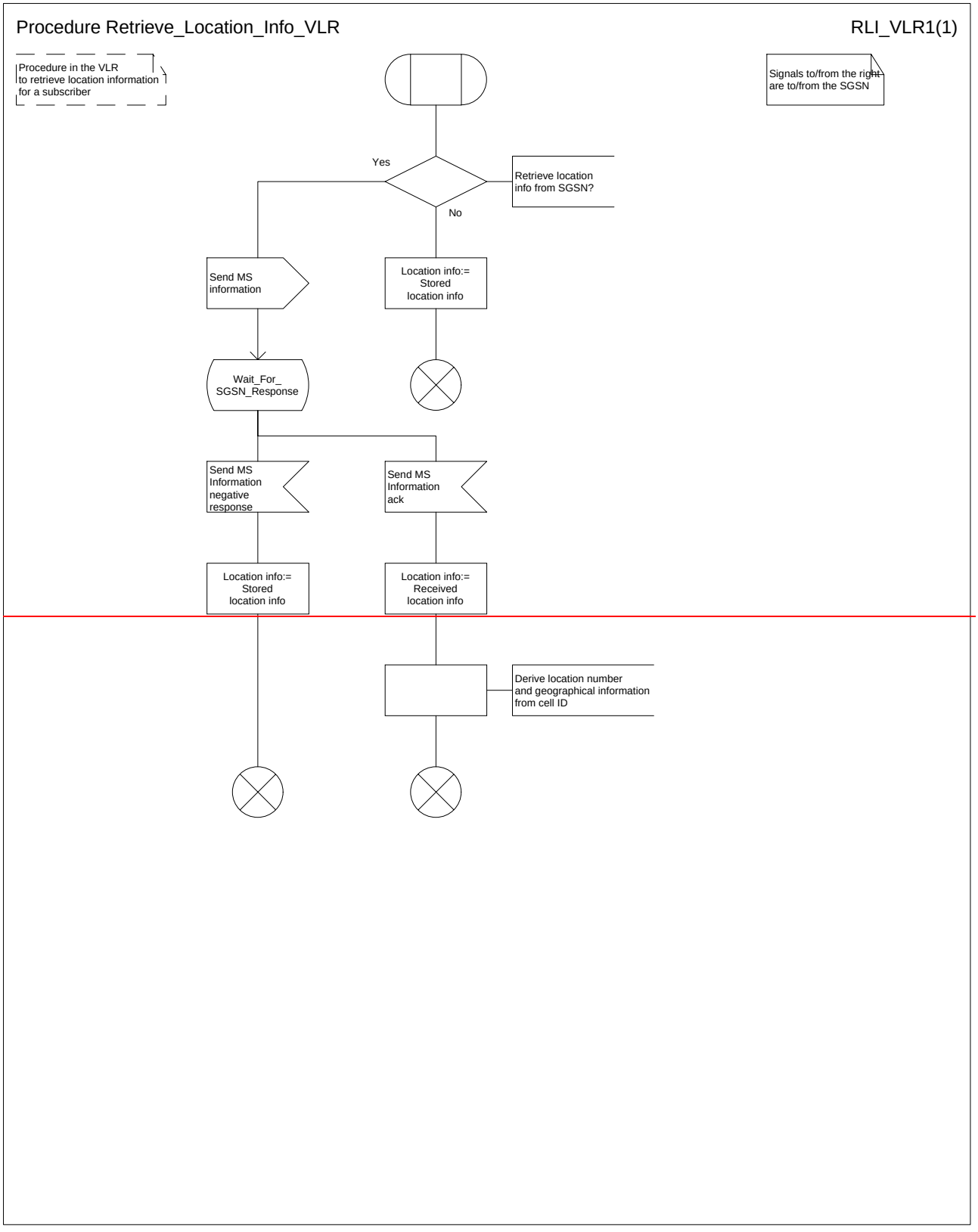


Figure 56b: Process PSI_VLR (sheet 2)


Procedure Retrieve_Location_Info_VLR
RLI_VLR1(1)
Procedure in the VLR to retrieve location information for a subscriber
Signals to/from the right are to/from the SGSN
Yes
Retrieve location info from SGSN?
No
Send MS information
Location info:= Stored location info
Wait_For_ SGSN_Response
Send MS Information negative response
Send MS Information ack
Location info:= Stored location info
Location info:= Received location info
Derive location number and geographical information from cell ID

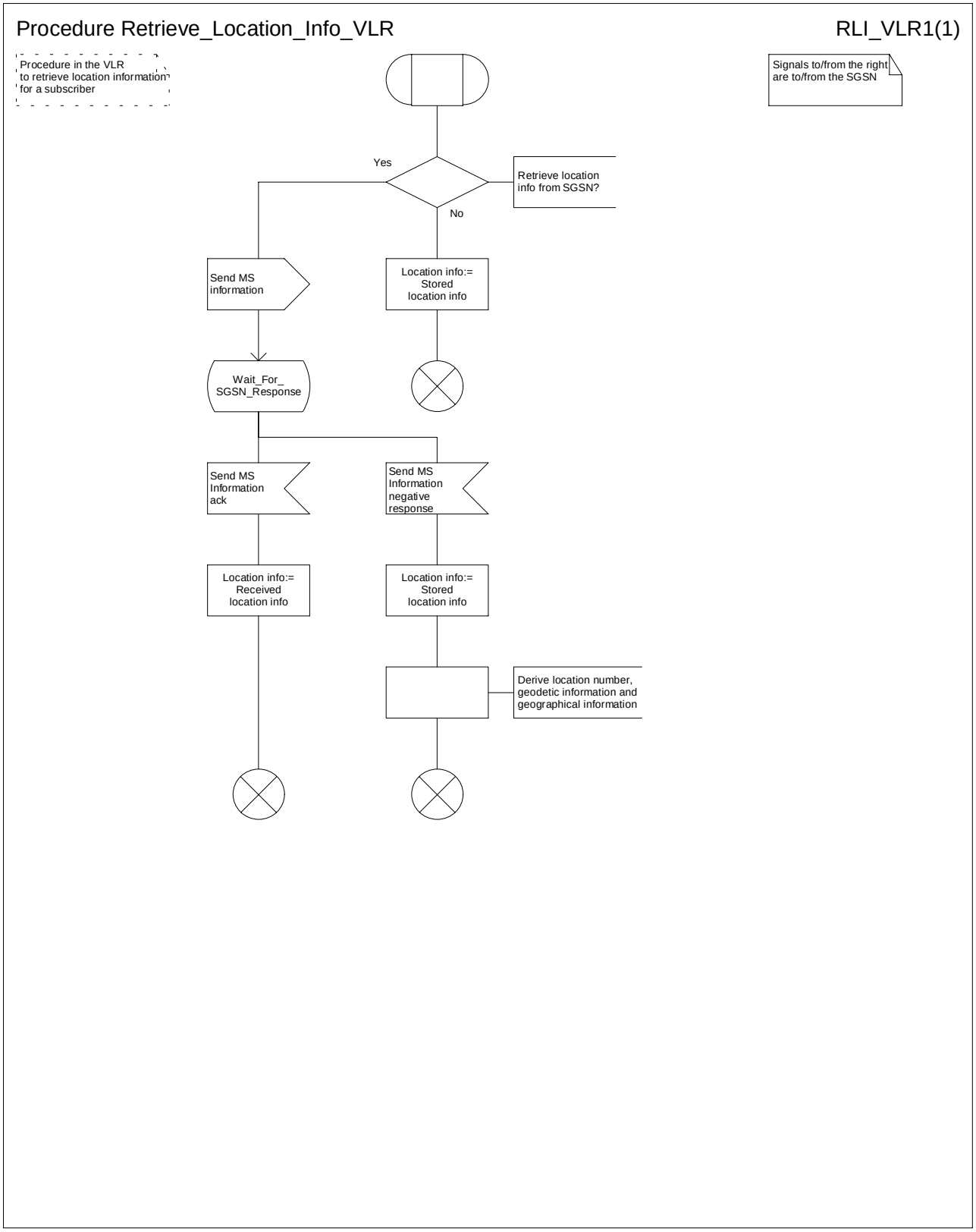


Figure 57: Procedure Retrieve_Location_Info_VLR

7.2.4 Functional requirements of MSC

7.2.4.1 Process Prepage_MSC

7.2.4.2 Procedure Prepaging_Page_MS_MSC

The test "MS connection exists" takes the "Yes" exit if there is a radio connection established between the MS and the network.

The test "MS busy" takes the "Yes" exit if the MS is engaged on a circuit-switched call.

The signal input "MS connection established" indicates that the MS has responded to paging, or sent a CM service request for anything other than a circuit-switched call, or completed the location registration procedure.

7.2.4.3 Prepaging_Search_For_MS_MSC

The test "MS connection exists" takes the "Yes" exit if there is a radio connection established between the MS and the network.

The test "MS busy" takes the "Yes" exit if the MS is engaged on a circuit-switched call.

The signal input "MS connection established" indicates that the MS has responded to paging, or sent a CM service request for anything other than a circuit-switched call, or completed the location registration procedure.

7.2.4.4 Process OSI_MSC

If the MS is engaged on a circuit-switched call, the state is busy, otherwise assumed idle.

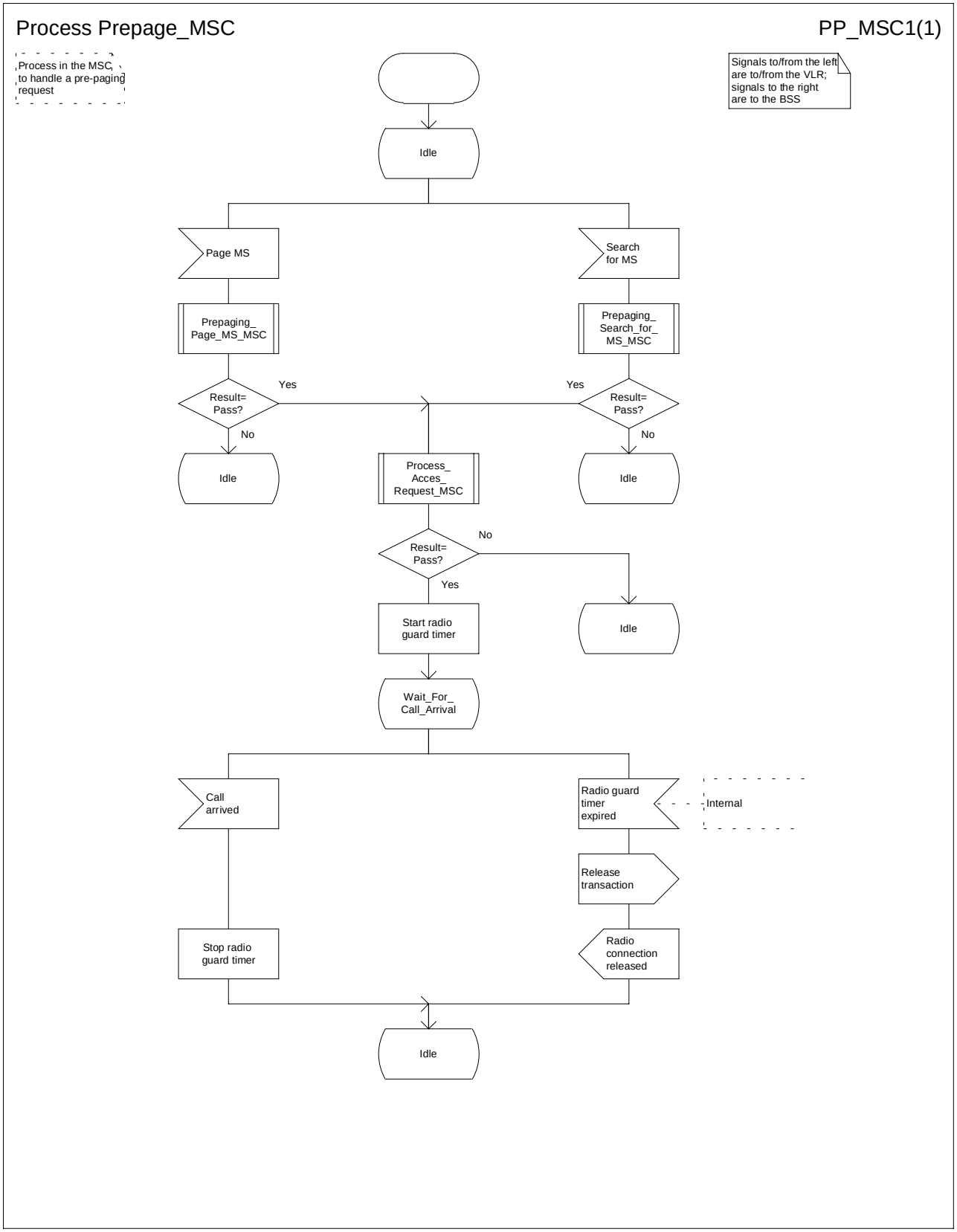


Figure 58: Process Prepage_MSC

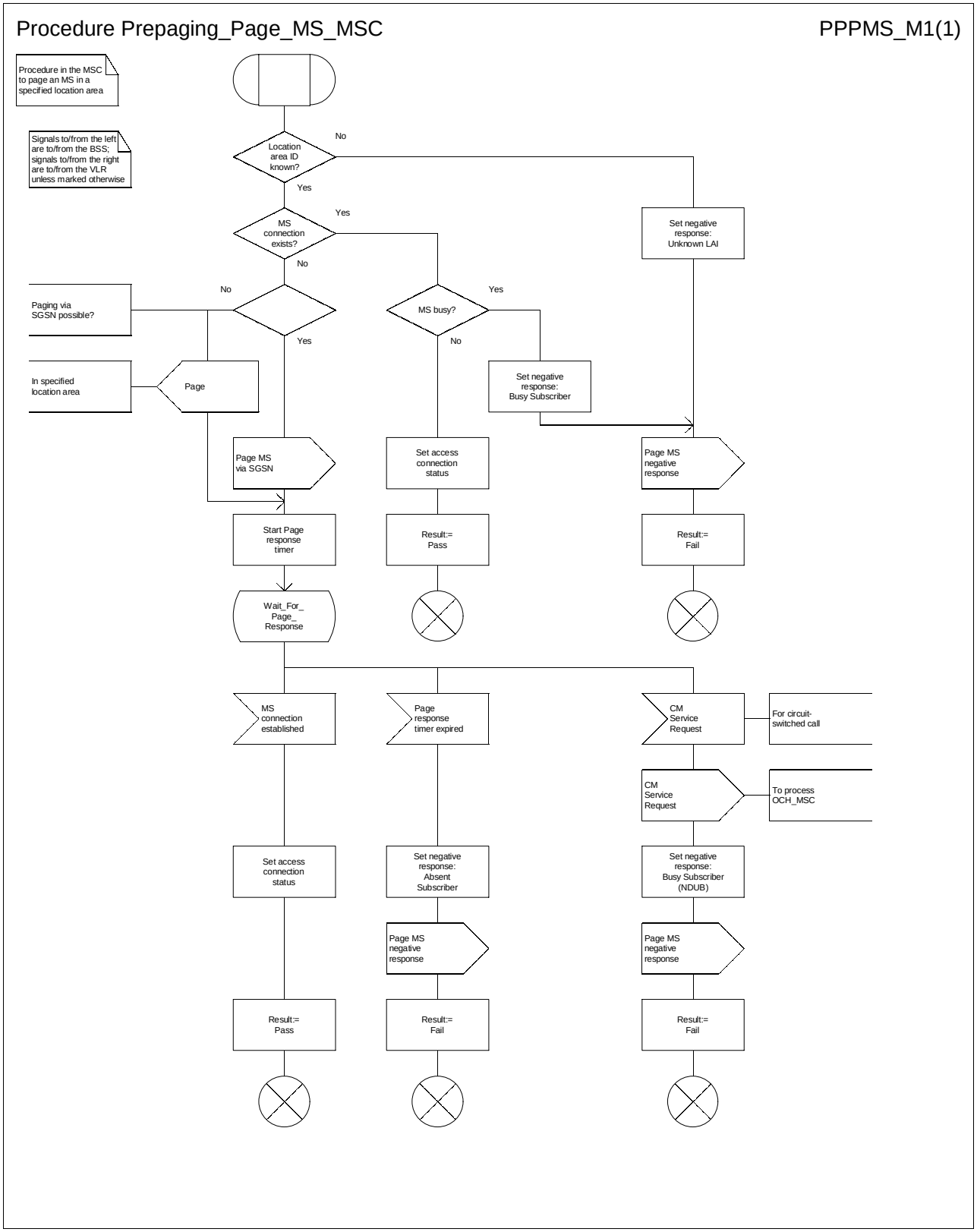


Figure 59: Procedure Prepaging_Page_MS_MSC

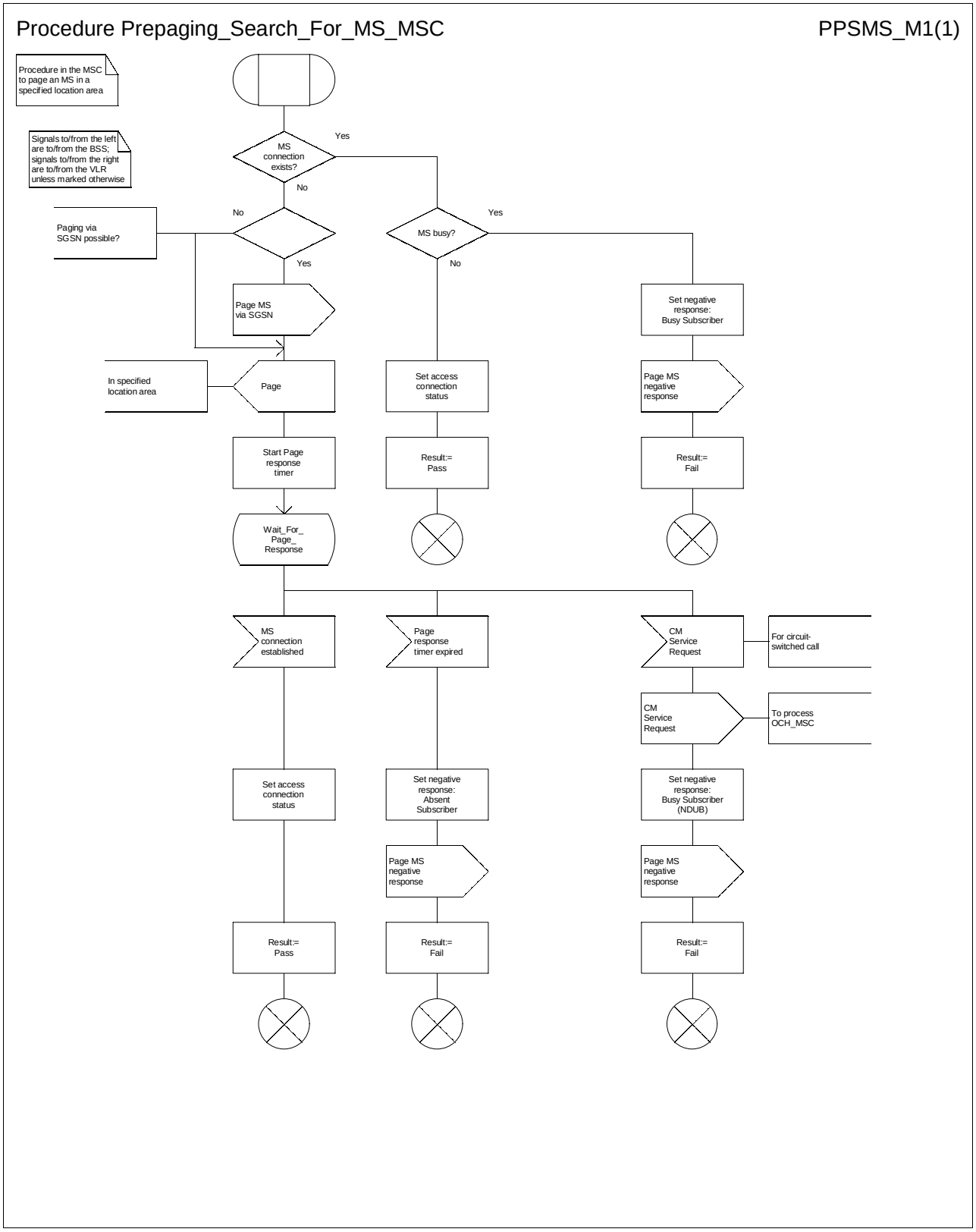


Figure 60: Procedure Prepaging_Search_For_MS_MSC

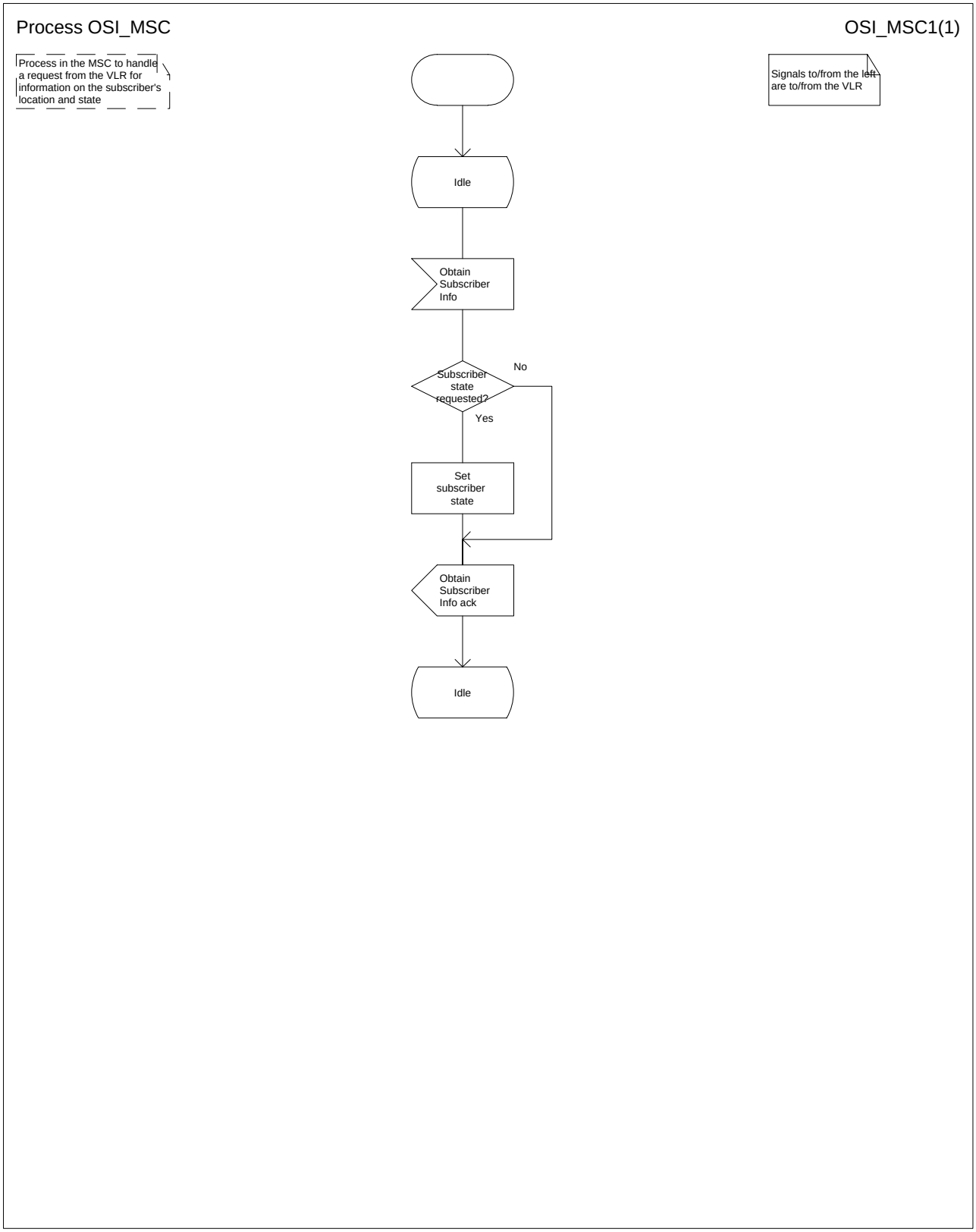


Figure 61: Process OSI_MSC

7.3 MT call

7.3.1 Functional requirements of serving MSC

7.3.1.1 Process ICH_MSC

Sheet 1: the rules for converting the ISDN BC/LLC/HLC to a ~~GSM~~ bearer service or teleservice are specified in ~~GSM~~ TS ~~09.~~29.007 [48].

Sheet 1: the task "Store UUS information (if received)" is executed only if the VMSC supports UUS.

Sheet 1: the variables TCH allocated, ACM sent, Answer sent and Network connect sent are global data, accessible to the procedures Establish_Terminating_TCH_If_Required, Send_ACM_If_Required, Send_Answer_If_Required and Send_Network_Connect_If_Required.

Sheet 1: the variables UUS result sent, UUS1 implicit active, UUS1 explicit active, UUS2 active, UUS3 active and UUS CF interaction are specific to UUS. They are accessible to all UUS specific procedures.

Sheet 1: the handling starting with the input signal "Continue CAMEL handling" is specific to CAMEL phase 3. If the VMSC does not support CAMEL phase 3, this signal will not be received from the VLR.

Sheet 1: the procedure CAMEL_ICH_MSC_INIT is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 2: the procedure Process_Access_Request_MSC is specified in subclause 7.1.1.2.

Sheet 2: the signal input Complete Call will be received in the state Wait_For_Page_Request only if the MSC/VLR supports pre-paging.

Sheet 2, sheet 3: the suggested mapping from values of the Send Info For Incoming Call negative response information element to values of the ISUP release cause (see ITU-T Recommendation Q.850 [5653]) is shown in table 2. The mapping used is a matter for the network operator, depending on the telephony signalling system used.

Table 2: Suggested mapping of Send Info For Incoming Call (SIFIC) negative responses to ISUP release causes

SIFIC negative response	ISUP release cause number	ISUP release cause name
Absent subscriber	20	Subscriber absent
Busy subscriber	17	User busy
CUG reject (Called party SS interaction violation)	21	Call rejected
Forwarding violation	21	Call rejected
Impossible call completion	111	Protocol error, unspecified
No subscriber reply	19	No answer from user (user alerted)
System failure	111	Protocol error, unspecified
Unallocated roaming number	111	Protocol error, unspecified

Sheet 2, sheet 3, sheet 5, sheet 7, sheet 8, sheet 10: the procedure CAMEL_MT_GMSC_DISC4 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=Reconnect?".

Sheet 2, sheet 4, sheet 7, sheet 8, sheet 10: the procedure CAMEL_MT_GMSC_DISC6 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 3: the procedure CAMEL_MT_GMSC_DISC5 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=Reconnect?".

Sheet 3: the task "Store CW treatment indicator for this call if received in SII2" is executed only if the VMSC supports CAMEL phase 3.

Sheet 3: If the VMSC does not support CAMEL phase 3, the procedure Complete_Call_In_MSC and the procedure Process_Call_Waiting_MSC will not return a "Reconnect" result.

Sheet 3: the processing in the branch starting with the input signal"Process Call Waiting" is specific to Call Wait. If the VMSC does not support CW this signal will not be received from the VLR.

Sheet 3, sheet 8, the procedure CD_Reject is specific to Call Deflection; it is specified in ~~GSM~~ TS ~~03.~~23.072 [31].

Sheet 3, sheet 8: the procedure CCBS_Set_Diagnostic_For_Release is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 3, sheet 4, sheet 10, sheet 11: the procedure CCBS_Check_Last_Call is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 4: the procedure UUS_ICH_Check_Support is specific to UUS; it is specified in GSM ~~03.~~23.087 [40].

Sheet 4: the procedure CAMEL_Check_ORLCF_VMSC is specific to CAMEL phase 2; it is specified in ~~GSM~~ TS ~~03.~~23.078 ~~for CAMEL Phase 2~~ [**32**]. If the VMSC does not support CAMEL, processing continues from the “ORLCF” exit of the test “Result?”

Sheet 4: the procedure Handle_ORLCF_VMSC is specific to Support of Optimal Routeing. It is specified in TS 100 045 [33]. If the VMSC does not support Optimal Routeing, processing continues from the "Continue" exit of the test "ResultForwarding Failed?".

Sheet4; the procedures CD_Failure and CD_Success are specific to Call Deflection; they are specified in ~~GSM~~ TS ~~03.~~23.0 72 [31].

Sheet 5: the procedure CAMEL_MT_VMSC_Notify_CF is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 5: If the VMSC does not support CAMEL phase 3, processing starts with the possible call of the procedure CCBS_Check_Last_Call.

Sheet 5: The task "set redirection information" includes the the mapping of the MSISDN parameter received in the Send Info For Incoming Call ack message to the redirecting number of the IAM message and the setting of the presentation indicator of the redirecting numer of the IAM message according to the value of the Redirecting presentation parameter received in the Send Info For Incoming Call ack message.

Sheet 5: it is an operator option whether to send an Address Complete message if the VLR returns forwarding information. If the VMSC sends an Address Complete message, it shall include the called party’s status field of the Backward call indicator set to "no indication".

Sheet 5, sheet 7: the procedure Send_ACM_If_Required is specified in subclause 7.2.1.3.

Sheet 5: the procedure Activate_CF_Process is specified in subclause 7.2.1.7.

Sheet 5: the procedure UUS_ICH_Set_Info_In_IAM is specific to UUS, it is specified in GSM ~~03.~~23.087 [40].

Sheet 5: the called party address sent in the IAM to the process MT_CF_MSC is the Forwarded-to number received in the Perform Call Forwarding ack.

Sheet 5: the procedure CAMEL_Store_Destination_Address is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 5; the procedure CD_Success is specific to Call Deflection; it is specified in ~~GSM~~ TS ~~03.~~23.0 72 [31].

Sheet 6: The processing on this sheet is specific to CAMEL phase 3. If the VMSC does not support CAMEL phase 3, the input signal Int_Release Call will not be received.

Sheet 7: the procedure CAMEL_MT_GMSC_ANSWER is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=Reconnect?".

Sheet 7: the procedure Handle_COLP_Forwarding_Interaction is specified in subclause 7.2.1.6.

Sheet 7: the procedure Send_Answer_If_Required is specified in subclause 7.2.1.4.

Sheet 7: the procedure Send_Network_Connect_If_Required is specified in subclause 7.2.1.5.

Sheet 8: the procedure CCBS_MT_MSC_Check_Forwarding is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42~~19~~].

Sheet 11, sheet 12: the procedure CAMEL_MT_GMSC_DISC1 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32~~28~~].

Sheet 11, sheet 12: the procedure CAMEL_MT_GMSC_ DISC2 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32~~28~~]. If the VMSC does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=Reconnect?".

Sheet 11: the procedure UUS_MSC_Check_UUS1_UUI is specific to UUS; it is specified in GSM ~~03.~~23.087 [40].

Sheet 12: after the VMSC has sent an IAM to the process MT_CF_MSC, it acts as a transparent relay for messages received from the GMSC and the process MT_CF_MSC. Any message other than Address Complete, Connect, Answer or Release causes no change of state in the process ICH_MSC.

Sheet 13: The processing on this sheet is specific to CAMEL phase 3. If the VMSC does not support CAMEL phase 3, the input signal Int_Release Call will not be received.

7.3.1.2 Procedure Page_MS_MSC

Sheet 1: the test "MS connection exists" takes the "Yes" exit if there is a radio connection established between the MS and the network.

Sheet 1: for an SMS or SS page, the test "Call still exists" takes the "Yes" exit if the SMS or SS transaction which led to the page still exists.

Sheet 1: the test "SMS or SS page" is not required for the handling of circuit-switched calls, because the VLR will always use a page type of "circuit-switched call", but the more generalized procedure Page_MS_MSC is equally applicable to paging for SMS delivery or network-initiated SS procedures.

Sheet 1: the test "MS busy" takes the "Yes" exit if the MS is engaged on a circuit-switched call.

Sheet 1: the test "Call in setup" takes the "Yes" exit if the call on which the MS is engaged has not reached the established phase (called party answer).

Sheet 1: the test Call waiting" takes the "Yes" exit if a waiting call has been offered to the subscriber but the outcome of offering the call has not been determined.

Sheet 1: the negative response Busy Subscriber (More calls possible) includes the basic service which applies for the established call.

Sheet 2: the signal input "MS connection established" indicates that the MS has responded to paging, or sent a CM service request for anything other than a circuit-switched call, or completed the location registration procedure.

7.3.1.3 Procedure Search_For_MS_MSC

Sheet 1: the test "MS connection exists" takes the "Yes" exit if there is a radio connection established between the MS and the network.

Sheet 1: for an SMS or SS page, the test "Call still exists" takes the "Yes" exit if the SMS or SS transaction which led to the page still exists.

Sheet 1: the test "SMS or SS page" is not required for the handling of circuit-switched calls, because the VLR will always use a page type of "circuit-switched call", but the more generalized procedure Search_For_MS_MSC is equally applicable to paging for SMS delivery or network-initiated SS procedures.

Sheet 1: the test "MS busy" takes the "Yes" exit if the MS is engaged on a circuit-switched call.

Sheet 1: the test "Call in setup" takes the "Yes" exit if the call on which the MS is engaged has not reached the established phase (called party answer).

Sheet 1: the test "Call waiting" takes the "Yes" exit if a waiting call has been offered to the subscriber but the outcome of offering the call has not been determined.

Sheet 1: the negative response Busy Subscriber (More calls possible) includes the basic service which applies for the established call.

Sheet 2: the signal input "MS connection established" indicates that the MS has responded to paging, or sent a CM service request for anything other than a circuit-switched call, or completed the location registration procedure.

7.3.1.4 Procedure Complete_Call_In_MSC

Sheet 1: the procedure Set_CLIP_Info_MSC is specific to CLIP.

Sheet 1: the VMSC and the MS may negotiate the bearer capability to be used for the call by the exchange of information in the Setup and Call Confirmed messages.

Sheet 1: the procedure UUS_ICH_UUS1_Implicit_Active is specific to UUS, it is specified in GSM ~~03.~~23.087 [40].

Sheet 1: the procedure CCBS_Report_Not_Idle is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 1, sheet 2, sheet 3, sheet 4: the procedure CAMEL_MT_GMSC_DISC4 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=Reconnect?".

Sheet 1, sheet 6: the procedure CAMEL_MT_GMSC_DISC6 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 1, sheet 3, sheet 6: the procedure CCBS_ICH_MSC_Report_Failure is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 2: the procedure CCBS_ICH_MSC_Report_Success is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 2, sheet 5, sheet 8: the procedure Check_CD_SII2 is specific to Call Deflection; it is specifi~~c~~ed in TS 23.072 [31]. If the VMSC does not support Call Deflection, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2: the procedure CAMEL_Start_TNRy is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 2, sheet 4: the procedure CAMEL_MT_GMSC_ANSWER is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2, sheet 4: the procedure UUS_ICH_Check_Support is specific to UUS, it is specified in GSM ~~03.~~23.087 [40]. If the VMSC does not support UUS, processing continues from the “Yes” exit of the test “Result=Pass?”.

Sheet 2: the task "UTU2Cnt:=0" is executed only if the VMSC supports UUS.

Sheet 2: the procedure Send_ACM_If_Required is specified in subclause 7.2.1.3.

Sheet 2, sheet 4: the procedure Handle_AoC_MT_MSC is specific to AoC. If the VMSC does not support AoC, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 2, sheet 4: the procedure Set_COL_Presentation_Indicator_MSC is specific to COLP.

Sheet 2: the procedure Send_Network_Connect_If_Required is specified in subclause 7.2.1.5.

Sheet 3, sheet 8: the processing in the branch starting with the input "CD Request" is specific to Call Deflection; if the VMSC does not support Call Deflection the input is discarded.

Sheet 3, sheet 8: the procedure Handling_CD_MSC is specific to Call Deflection; it is specified in ~~GSM~~ TS ~~03.~~23.072 [31].

Sheet 2: the procedure CAMEL_Stop_TNRy is specific to CAMEL phase 3; it is specified in TS 23.078 for CAMEL Phase 3 [32].

Sheet 4: the procedure Send_Answer_If_Required is specified in subclause 7.2.1.4.

Sheet 5: the input signal "CAMEL TNRy expired" will be received only if the VMSC supports CAMEL phase 3.

Sheet 5, sheet 8: the procedure UUS_ICH_Check_Forwarding is specific to UUS, it is specified in GSM 03.23.087 [40]. If the VMSC does not support UUS, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 6, sheet 7: the procedure UUS_MSC_Check_UUS1_UUI is specific to UUS; it is specified in GSM 03.23.087 [40].

Sheet 8: the procedures UUS_MSC_Check_UUS2_UUI_to MS and UUS_MSC_Check_UUS2_UUI_to NW are specific to UUS, they are specified in GSM 03.23.087 [40].

Sheet 8: the procedure CD_UUS_Interaction is specific to Call Deflection; it is specified in GSM 03.23.0 72 [31].

7.3.1.5 Procedure Process_Call_Waiting_MSC

Sheet 1: the procedure Set_CLIP_Info_MSC is specific to CLIP.

Sheet 1, sheet 2: the VMSC and the MS may negotiate the bearer capability to be used for the call by the exchange of information in the Setup and Call Confirmed messages.

Sheet 1: the procedure UUS_ICH_UUS1_Implicit_Active is specific to UUS; it is specified in GSM 03.23.087 [40].

Sheet 1: the procedure CCBS_Report_Not_Idle is specific to CCBS; it is specified in GSM TS 03.23.093 [42].

Sheet 2, sheet 3, sheet 5: the procedure UUS_ICH_Check_Support is specific to UUS; it is specified in GSM 03.23.087 [40]. If the VMSC does not support UUS, processing continues from the "Yes" exit of the test "Result=Pass?" where the test follows the procedure call.

Sheet 2: the procedure CCBS_ICH_MSC_Report_Success is specific to CCBS; it is specified in GSM TS 03.23.093 [42].

Sheet 2, sheet 8: the processing in the branch starting with the input "CD Request" is specific to Call Deflection; if the VMSC does not support Call Deflection the input is discarded.

Sheet 2, sheet 8: the procedure Handling_CD_MSC is specific to Call Deflection; it is specified in GSM TS 03.23.072 [31].

Sheet 2: the task "UTU2Cnt:=0" is executed only if the VMSC supports UUS.

Sheet 2, sheet 3, sheet 5, sheet 7: the procedure CAMEL_MT_GMSC_DISC4 is specific to CAMEL phase 3; it is specified in TS 23.078 for CAMEL Phase 3 [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=Reconnect?".

Sheet 2, sheet 3, sheet 4, sheet 8: the procedure CCBS_ICH_MSC_Report_Failure is specific to CCBS; it is specified in GSM TS 03.23.093 [42].

Sheet 2: the Call Confirmed message indicates "busy" for the successful case.

Sheet 2: the procedure CAMEL_Start_TNRy is specific to CAMEL phase 3; it is specified in TS 23.078 for CAMEL Phase 3 [32].

Sheet 2: the procedure Send_ACM_If_Required is specified in subclause 7.2.1.3.

Sheet 3, sheet 7: the Release transaction (reject) message covers all unsuccessful cases not otherwise indicated.

Sheet 4, sheet 8: the procedure CAMEL_MT_GMSC_DISC6 is specific to CAMEL phase 3; it is specified in TS 23.078 for CAMEL Phase 3 [32].

Sheet 4, sheet 7: the procedure UUS_MSC_Check_UUS1_UUI is specific to UUS; it is specified in GSM 03.23.087 [40].

Sheet 5: the procedure CAMEL_Stop_TNRy is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32].

Sheet 5: the procedure Handle_AoC_MT_MSC is specific to AoC. If the VMSC does not support AoC, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 5: the procedure CAMEL_MT_GMSC_ANSWER is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "Yes" exit of the test "Result=Pass?" on sheet 6.

Sheet 6: the procedure Set_COL_Presentation_Indicator_MSC is specific to COLP.

Sheet 6: the procedure Send_Answer_If_Required is specified in subclause 7.2.1.4.

Sheet 7: the input signal "CAMEL TNRy expired" will be received only if the VMSC supports CAMEL phase 3.

Sheet 7: the procedure CAMEL_MT_GMSC_DISC5 is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VMSC does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=Reconnect?".

Sheet 7, sheet 8: the procedure UUS_ICH_Check_Forwarding is specific to UUS; it is specified in GSM ~~03.~~23.087 [40]. If the VMSC does not support UUS, processing continues from the "Yes" exit of the test "Result=Pass?".

Sheet 8: the procedures UUS_MSC_Check_UUS2_UUI_to_MS and UUS_MSC_Check_UUS2_UUI_to_NW are specific to UUS; they are specified in GSM ~~03.~~23.087 [40].

Sheet 8: the procedure CD_UUS_Interaction is specific to Call Deflection; it is specified in GSM ~~03.~~23.0 72 [31].

7.3.1.6 Procedure Set_CLIP_Info_MSC

The originating exchange may release the call or the MS may terminate the transaction with the network by sending a Release transaction message while a response is awaited from the process CLIP_MAF002. The message is saved for processing after return from the procedure.

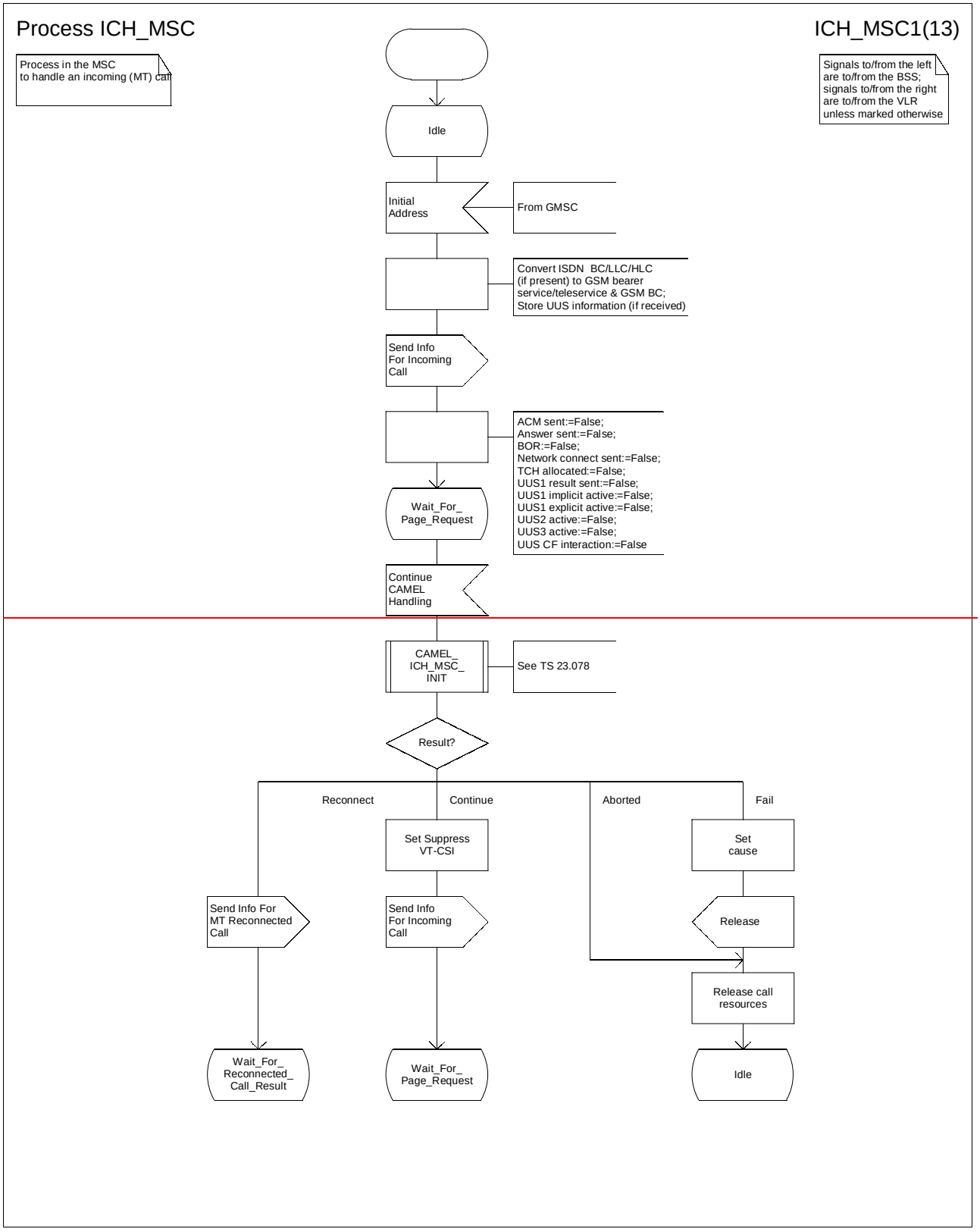
7.3.1.7 Procedure Derive_GSM_BC_MSC

7.3.1.8 Procedure Establish_Terminating_TCH_If_Required

7.3.1.9 Procedure Handle_AoC_MT_MSC

7.3.1.10 Procedure Set_COL_Presentation_Indicator_MSC

The originating exchange may release the call or the MS may terminate the transaction with the network by sending a Release transaction message while a response is awaited from the process COLP_MAF041. The message is saved for processing after return from the procedure.


Process ICH_MSC
ICH_MSC1(13)
Process in the MSC to handle an incoming (MT) call
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Idle
Initial Address
From GMSC
Convert ISDN BC/LLC/HLC (if present) to GSM bearer service/teleservice & GSM BC; Store UUS information (if received)
Send Info For Incoming Call
ACM sent:=False; Answer sent:=False; BOR:=False; Network connect sent:=False; TCH allocated:=False; UUS1 result sent:=False; UUS1 implicit active:=False; UUS1 explicit active:=False; UUS2 active:=False; UUS3 active:=False; UUS CF interaction:=False
Wait_For_ Page_Request
Continue CAMEL Handling
CAMEL_ ICH_MSC_ INIT
See TS 23.078
Result?
Reconnect
Continue
Aborted
Fail
Set Suppress VT-CSI
Set cause
Send Info For MT Reconnected Call
Send Info For Incoming Call
Release
Release call resources
Wait_For_ Reconnected_ Call_Result
Wait_For_ Page_Request
Idle

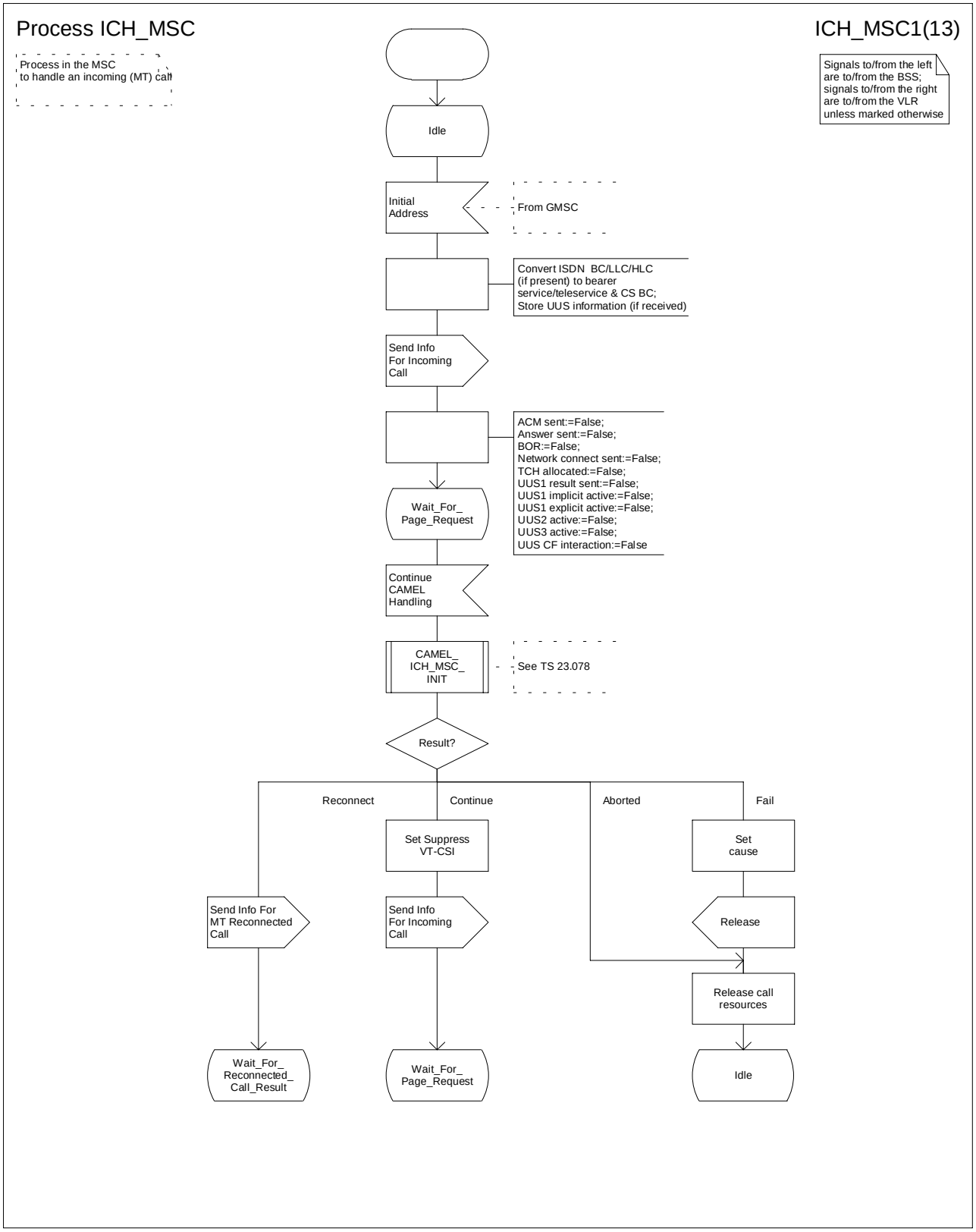


Figure 62a: Process ICH_MSC (sheet 1)

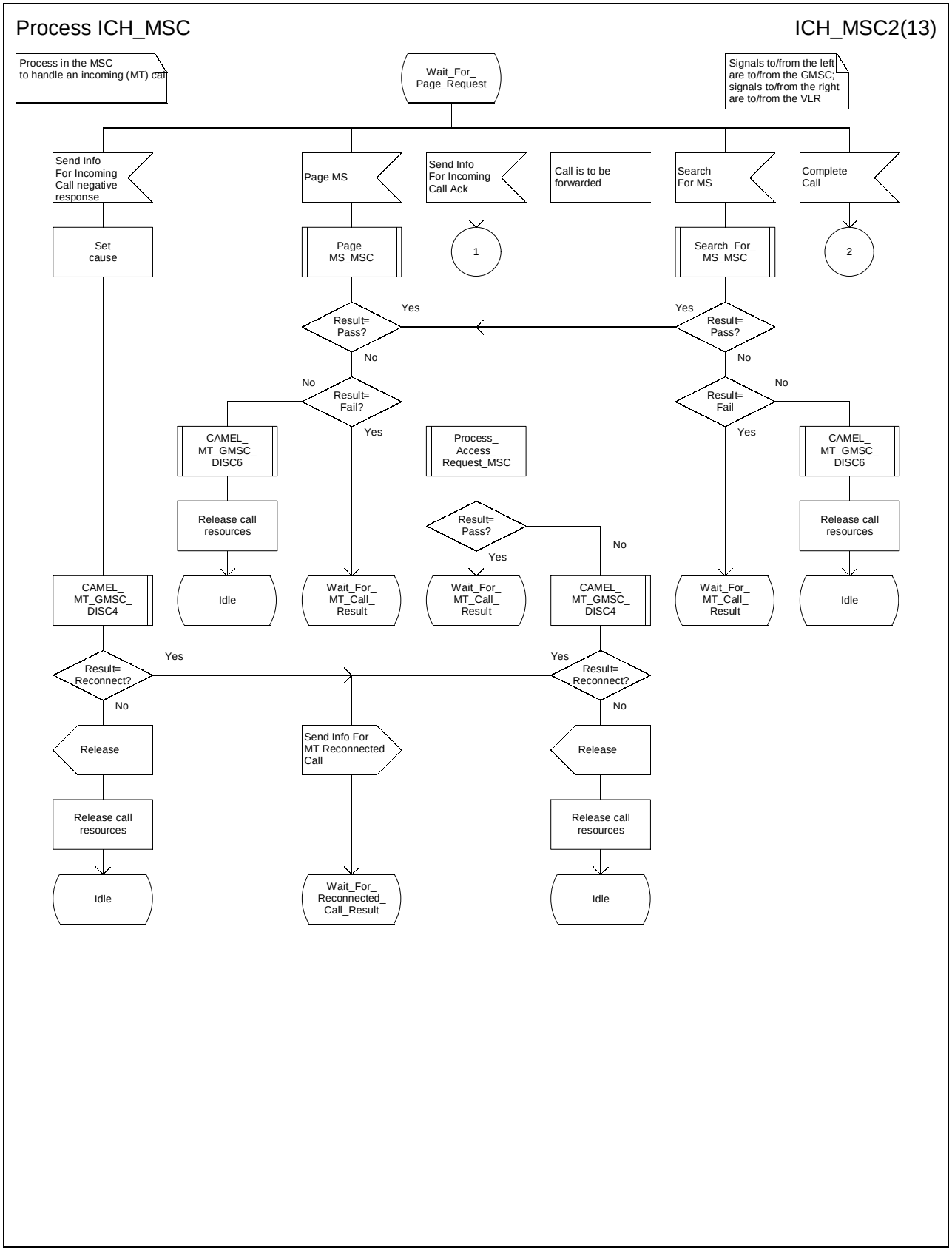
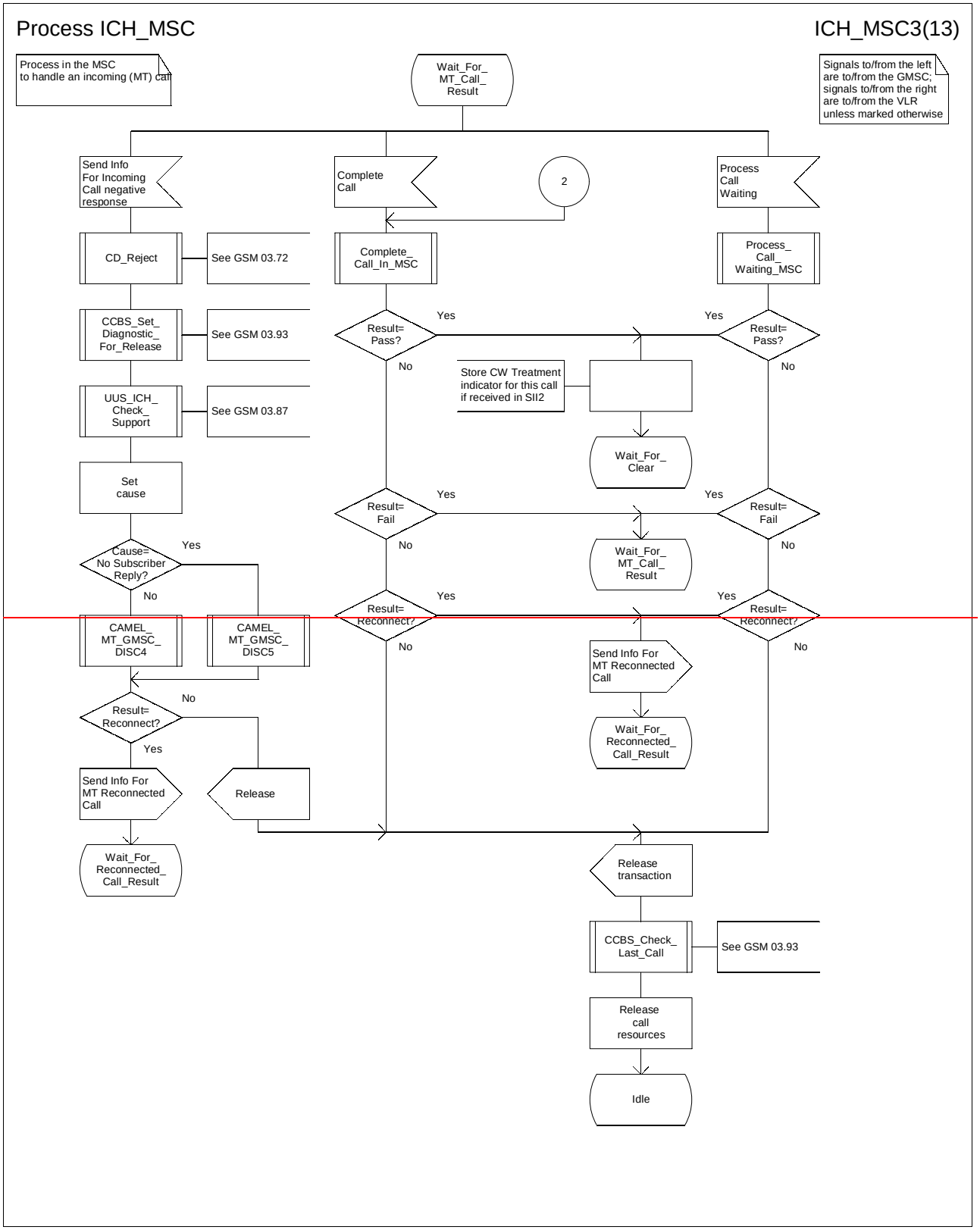


Figure 62b: Process ICH_MSC (sheet 2)


Process ICH_MSC
ICH_MSC3(13)
Process in the MSC to handle an incoming (MT) call
Wait_For_ MT_Call_ Result
Signals to/from the left are to/from the GMSC; signals to/from the right are to/from the VLR unless marked otherwise
Send Info For Incoming Call negative response
Complete Call
2
Process Call Waiting
CD_Reject
See GSM 03.72
Complete_ Call_In_MSC
Process_ Call_ Waiting_MSC
CCBS_Set_ Diagnostic_ For_Release
See GSM 03.93
Result= Pass?
Yes
No
Store CW Treatment indicator for this call if received in SII2
UUS_ICH_ Check_ Support
See GSM 03.87
Wait_For_ Clear
Set cause
Result= Fail
Cause= No Subscriber Reply?
Wait_For_ MT_Call_ Result
CAMEL_ MT_GMSC_ DISC4
CAMEL_ MT_GMSC_ DISC5
Result= Reconnect?
Send Info For MT Reconnected Call
Wait_For_ Reconnected_ Call_Result
Release
Release transaction
CCBS_Check_ Last_Call
See GSM 03.93
Release call resources
Idle

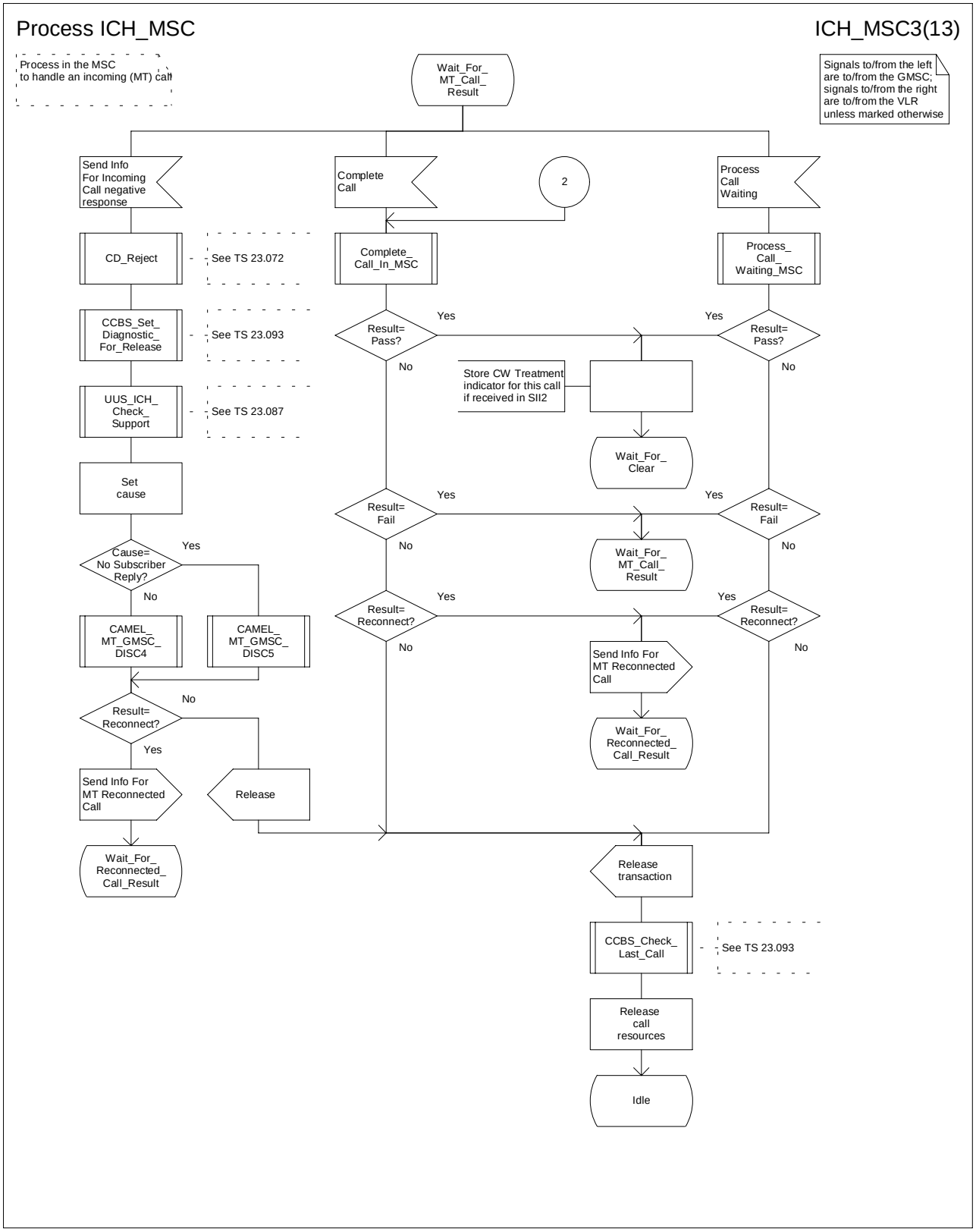
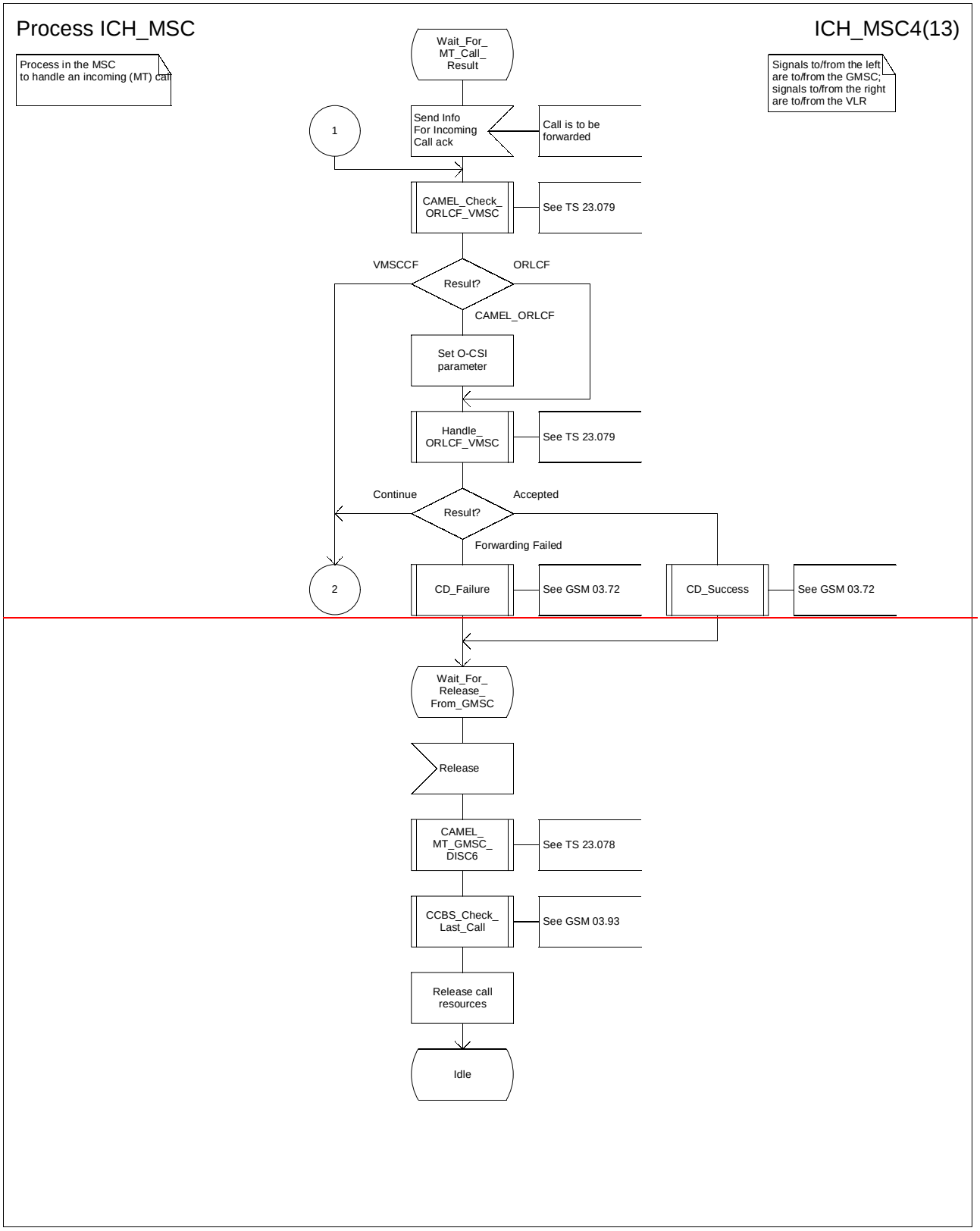


Figure 62c: Process ICH_MSC (sheet 3)


Process ICH_MSC
ICH_MSC4(13)
Process in the MSC
to handle an incoming (MT) call
Signals to/from the left
are to/from the GMSC;
signals to/from the right
are to/from the VLR
Wait_For_
MT_Call_
Result
1
Send Info
For Incoming
Call ack
Call is to be
forwarded
CAMEL_Check_
ORLCF_VMSC
See TS 23.079
VMSCCF
ORLCF
Result?
CAMEL_ORLCF
Set O-CSI
parameter
Handle_
ORLCF_VMSC
See TS 23.079
Continue
Accepted
Result?
Forwarding Failed
2
CD_Failure
See GSM 03.72
CD_Success
See GSM 03.72
Wait_For_
Release_
From_GMSC
Release
CAMEL_
MT_GMSC_
DISC6
See TS 23.078
CCBS_Check_
Last_Call
See GSM 03.93
Release call
resources
Idle

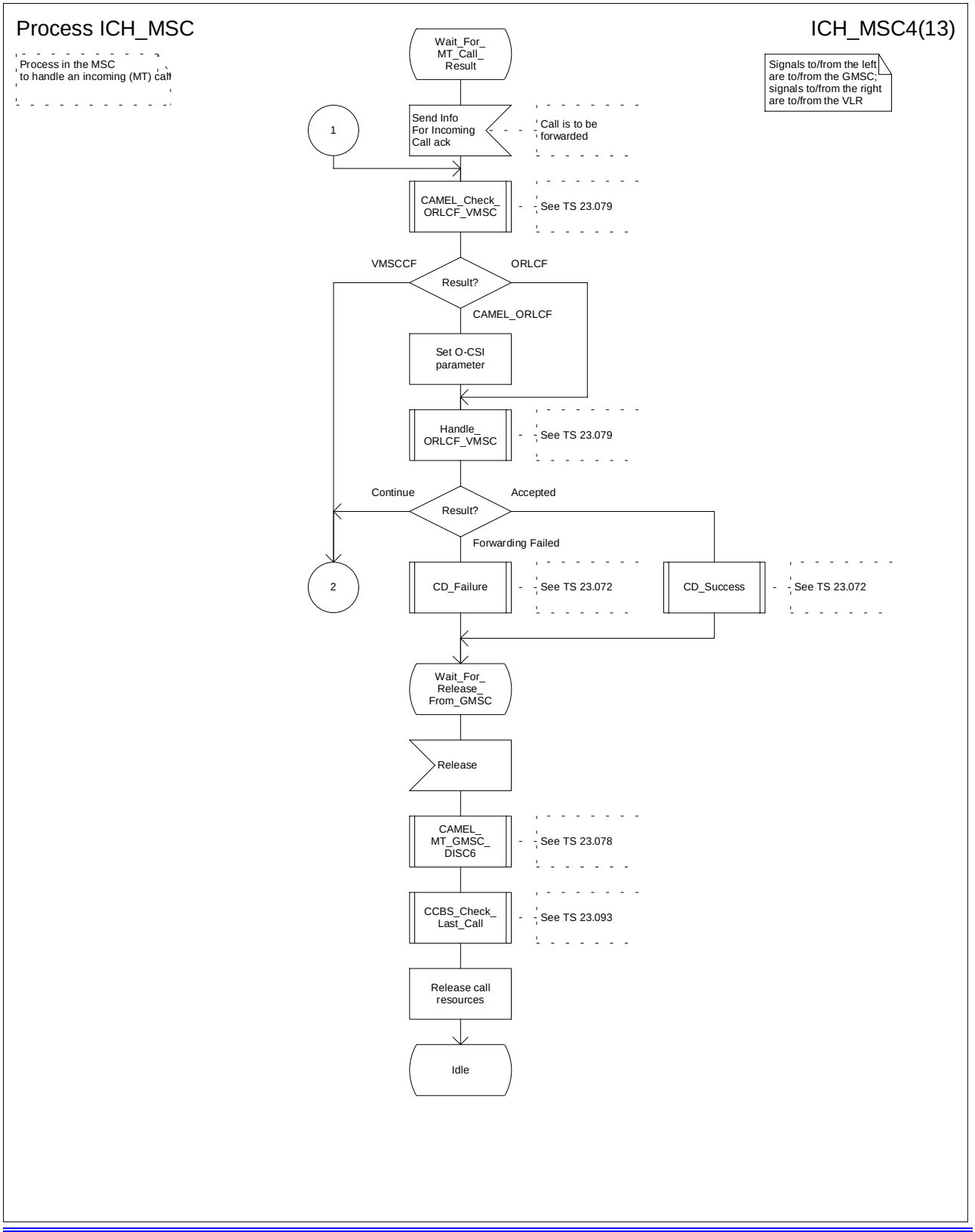
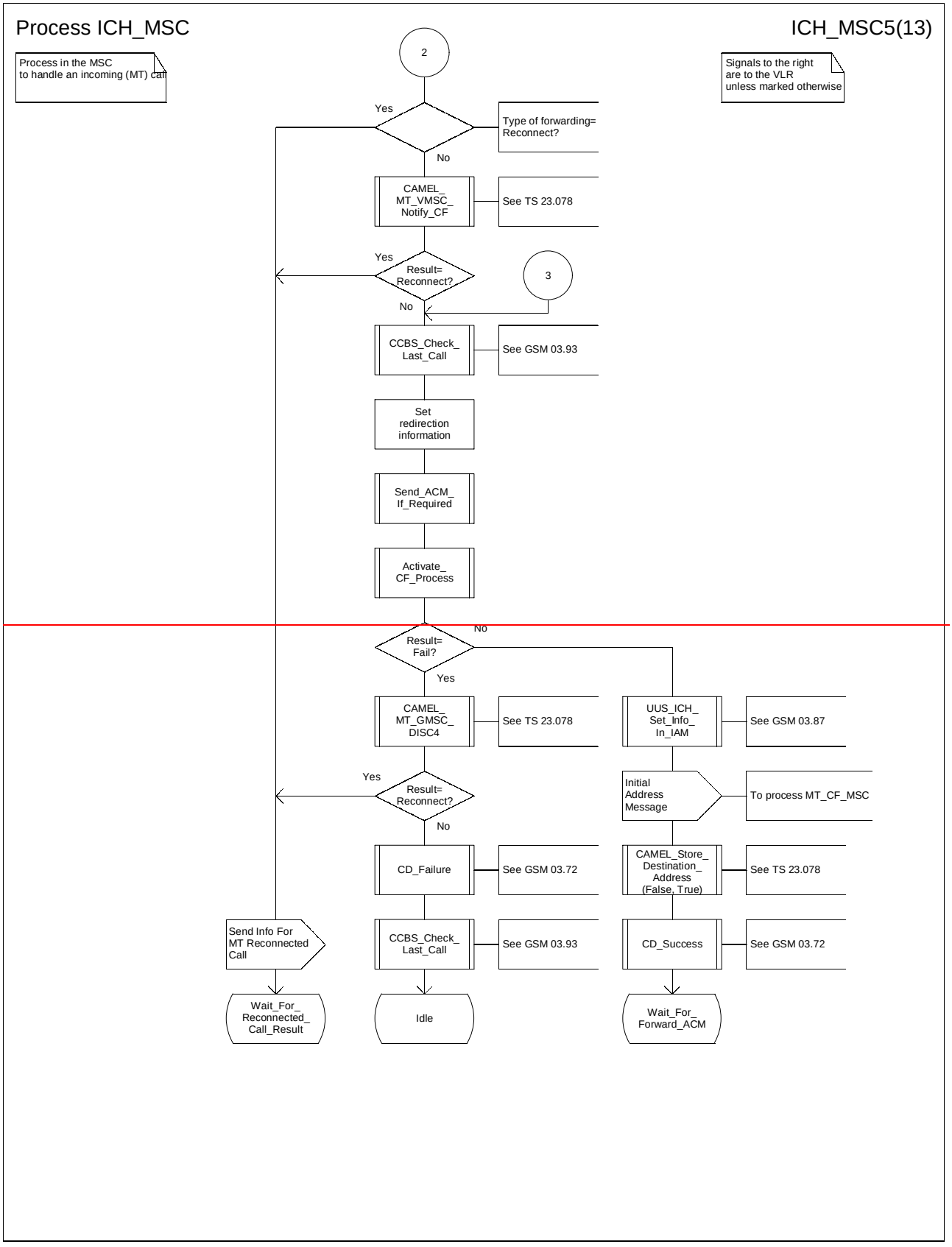


Figure 62d: Process ICH_MSC (sheet 4)


Process ICH_MSC
ICH_MSC5(13)
Process in the MSC to handle an incoming (MT) call
Signals to the right are to the VLR unless marked otherwise
2
Yes
Type of forwarding= Reconnect?
No
CAMEL_ MT_VMSC_ Notify_CF
See TS 23.078
Yes
Result= Reconnect?
3
No
CCBS_Check_ Last_Call
See GSM 03.93
Set redirection information
Send_ACM_ If_Required
Activate_ CF_Process
No
Result= Fail?
Yes
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
UUS_ICH_ Set_Info_ In_IAM
See GSM 03.87
Yes
Result= Reconnect?
Initial Address Message
To process MT_CF_MSC
No
CD_Failure
See GSM 03.72
CAMEL_Store_ Destination_ Address (False, True)
See TS 23.078
Send Info For MT Reconnected Call
CCBS_Check_ Last_Call
See GSM 03.93
CD_Success
See GSM 03.72
Wait_For_ Reconnected_ Call_Result
Idle
Wait_For_ Forward_ACM

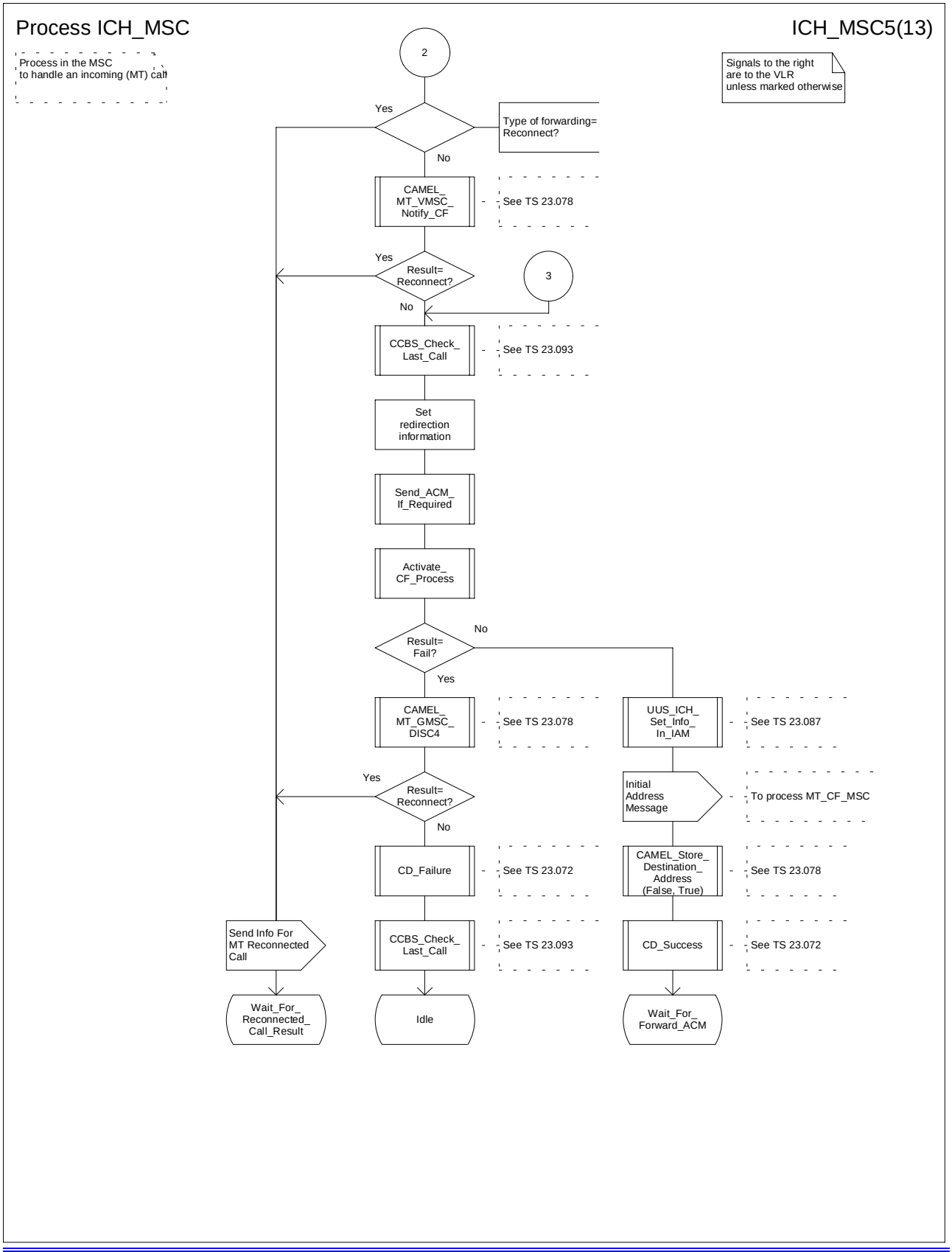


Figure 62e: Process ICH_MSC (sheet 5)

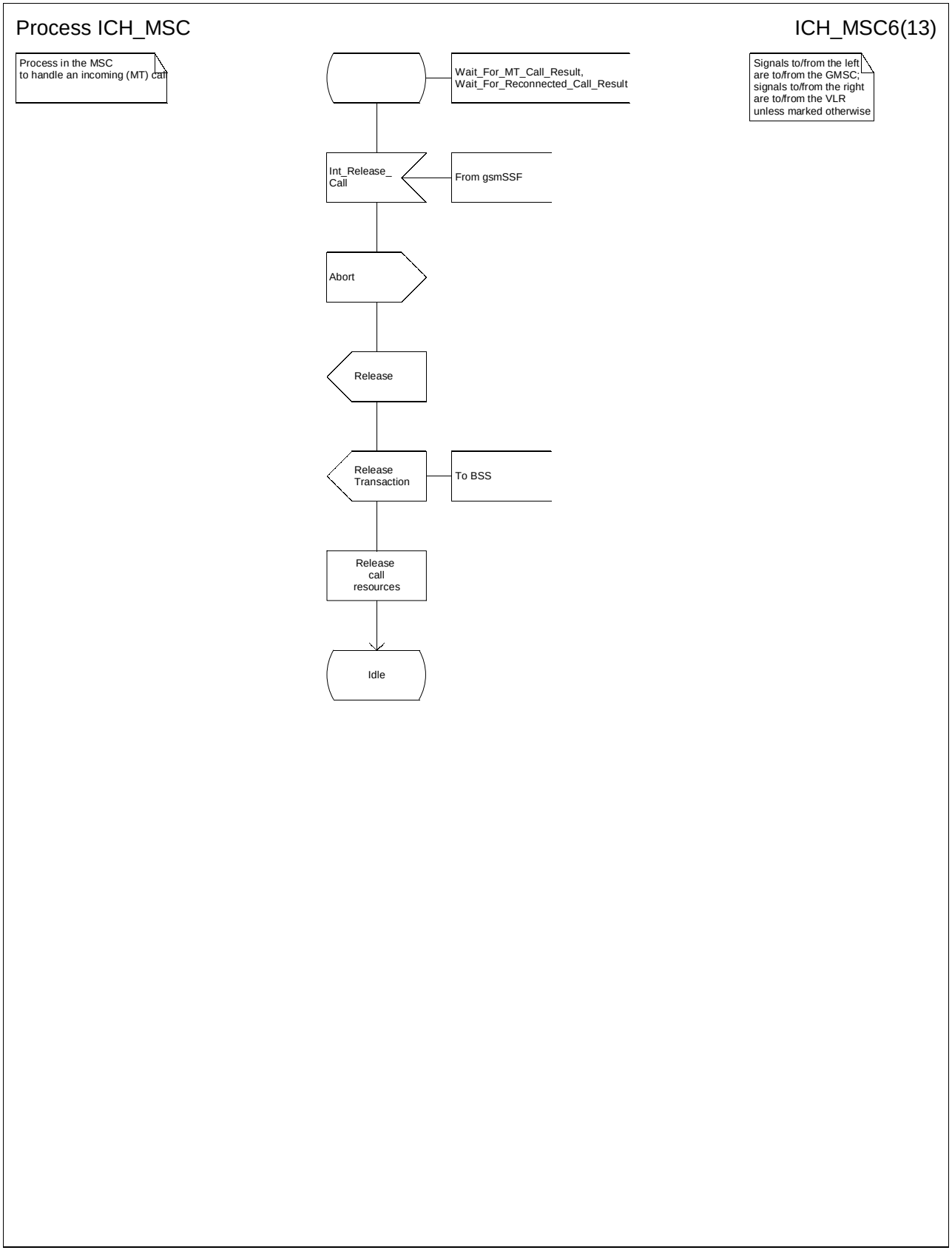


Figure 62f: Process ICH_MSC (sheet 6)

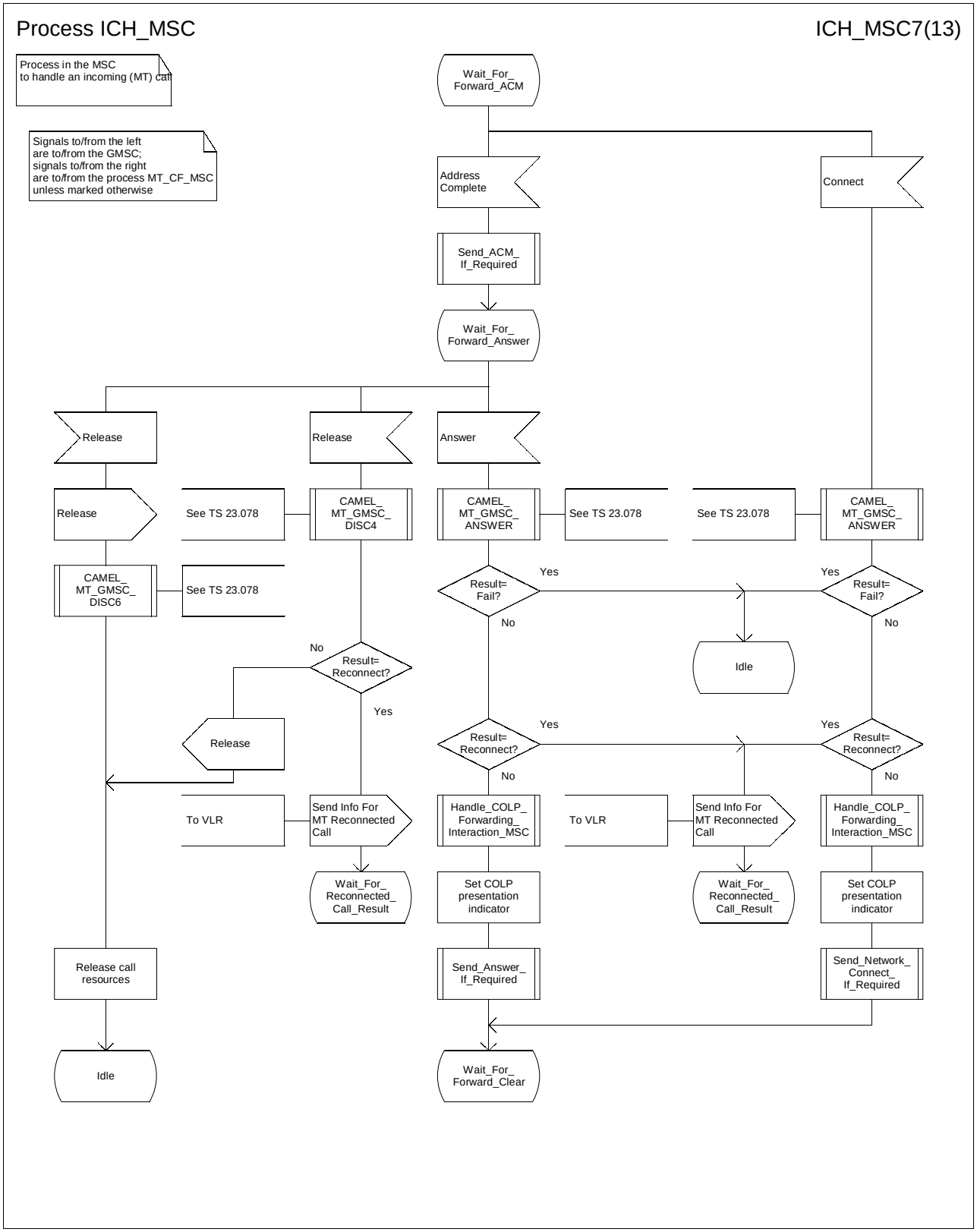
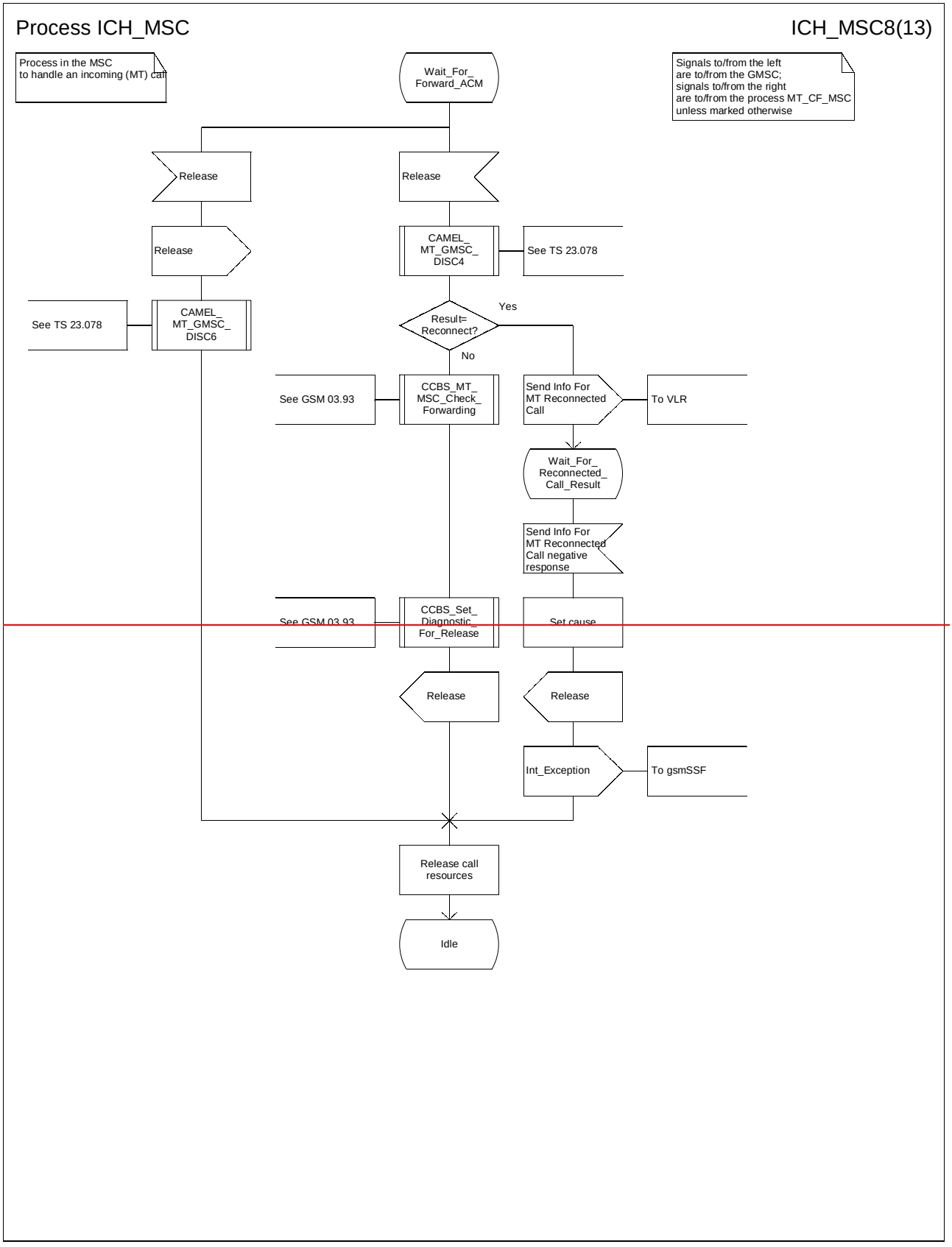


Figure 62g: Process ICH_MSC (sheet 7)


Process ICH_MSC
ICH_MSC8(13)
Process in the MSC to handle an incoming (MT) call
Wait_For_ Forward_ACM
Signals to/from the left are to/from the GMSC; signals to/from the right are to/from the process MT_CF_MSC unless marked otherwise
Release
Release
Release
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
See TS 23.078
CAMEL_ MT_GMSC_ DISC6
Result= Reconnect?
Yes
No
See GSM 03.93
CCBS_MT_ MSC_Check_ Forwarding
Send Info For MT Reconnected Call
To VLR
Wait_For_ Reconnected_ Call_Result
Send Info For MT Reconnected Call negative response
See GSM 03.93
CCBS_Set_ Diagnostic_ For_Release
Set cause
Release
Release
Int_Exception
To gsmSSF
Release call resources
Idle

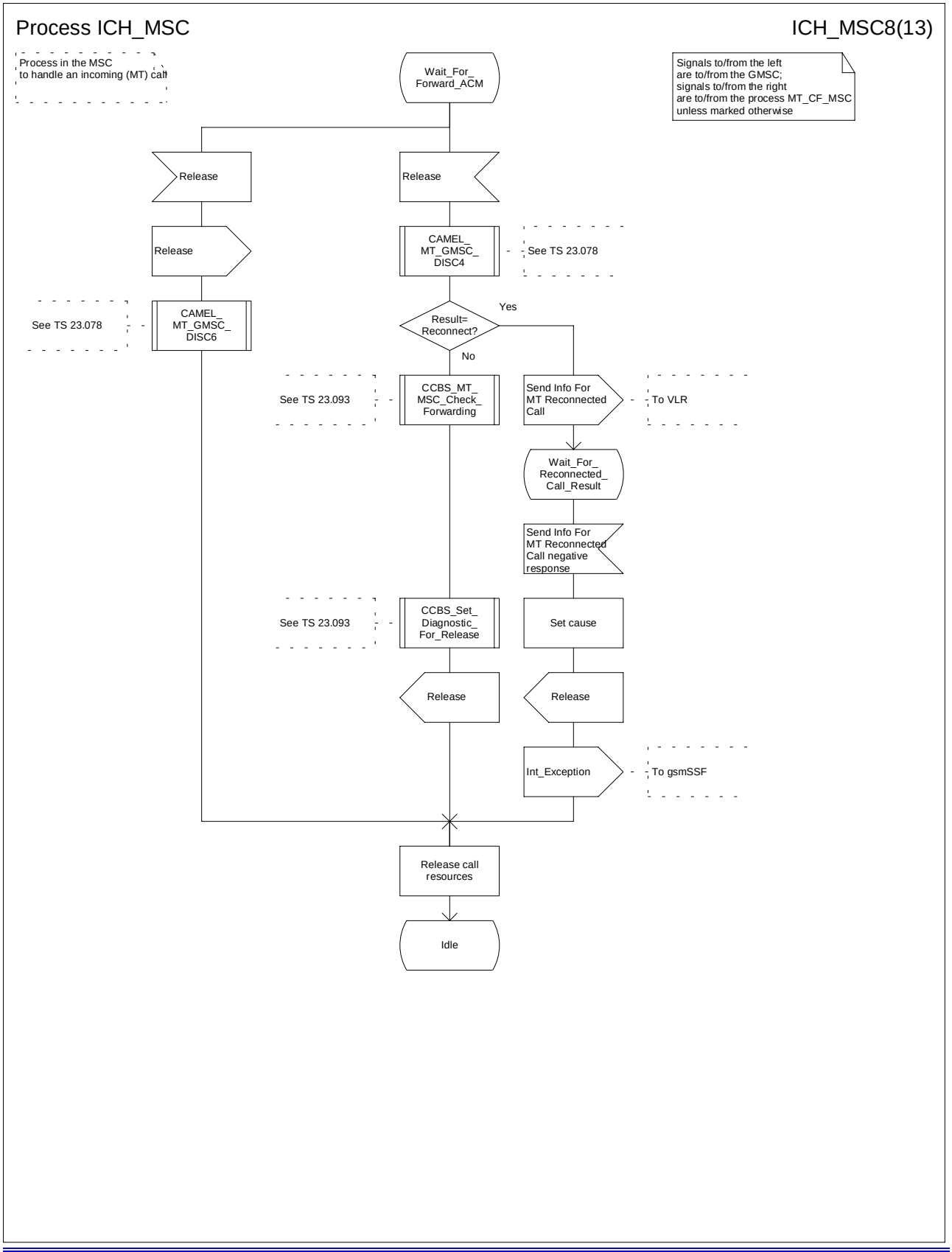
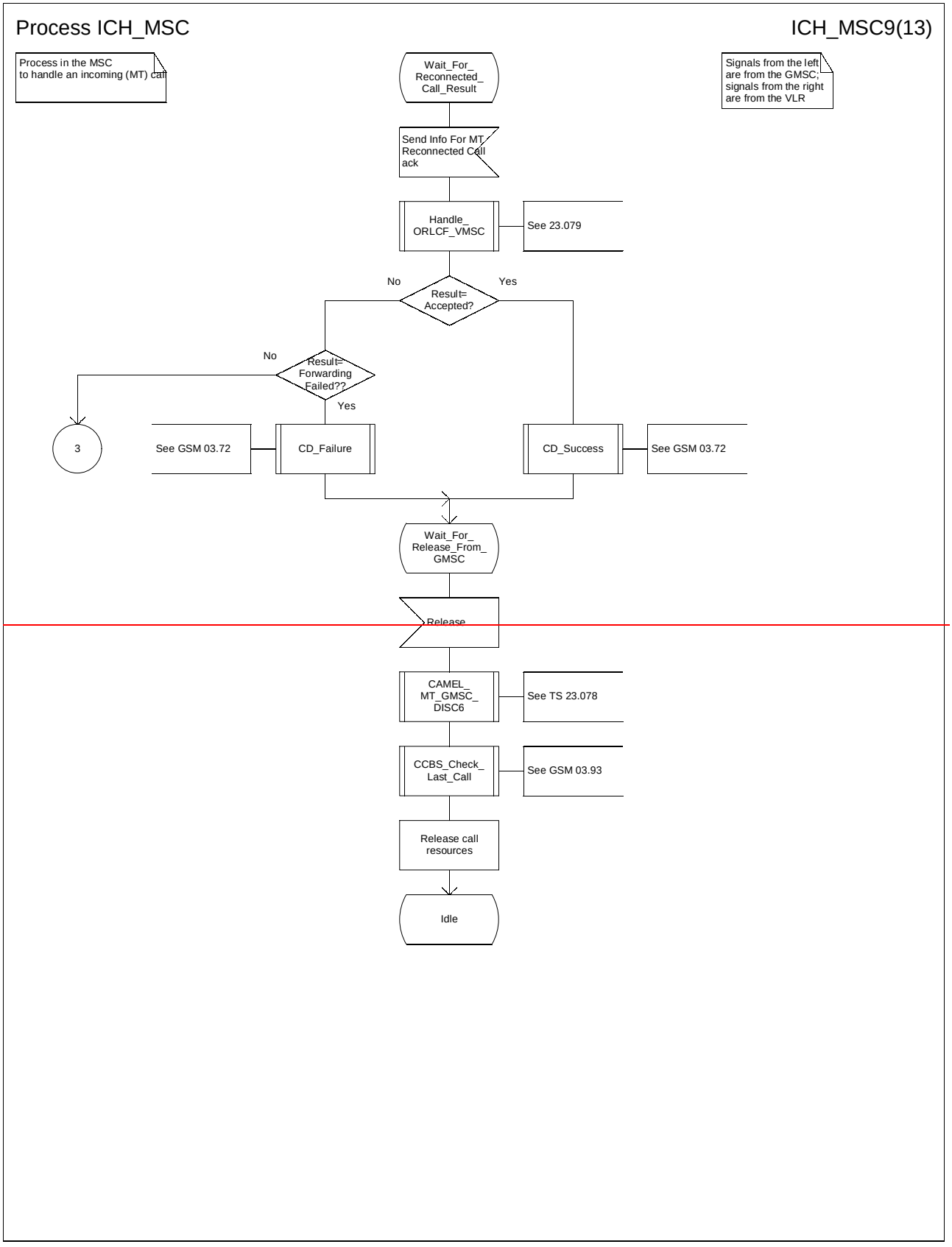


Figure 62h: Process ICH_MSC (sheet 8)


Process ICH_MSC
ICH_MSC9(13)
Process in the MSC to handle an incoming (MT) call
Wait_For_ Reconnected_ Call_Result
Signals from the left are from the GMSC; signals from the right are from the VLR
Send Info For MT Reconnected Call ack
Handle_ ORLCF_VMSC
See 23.079
No
Result= Accepted?
Yes
No
Result= Forwarding Failed??
Yes
3
See GSM 03.72
CD_Failure
CD_Success
See GSM 03.72
Wait_For_ Release_From_ GMSC
Release
CAMEL_ MT_GMSC_ DISC6
See TS 23.078
CCBS_Check_ Last_Call
See GSM 03.93
Release call resources
Idle

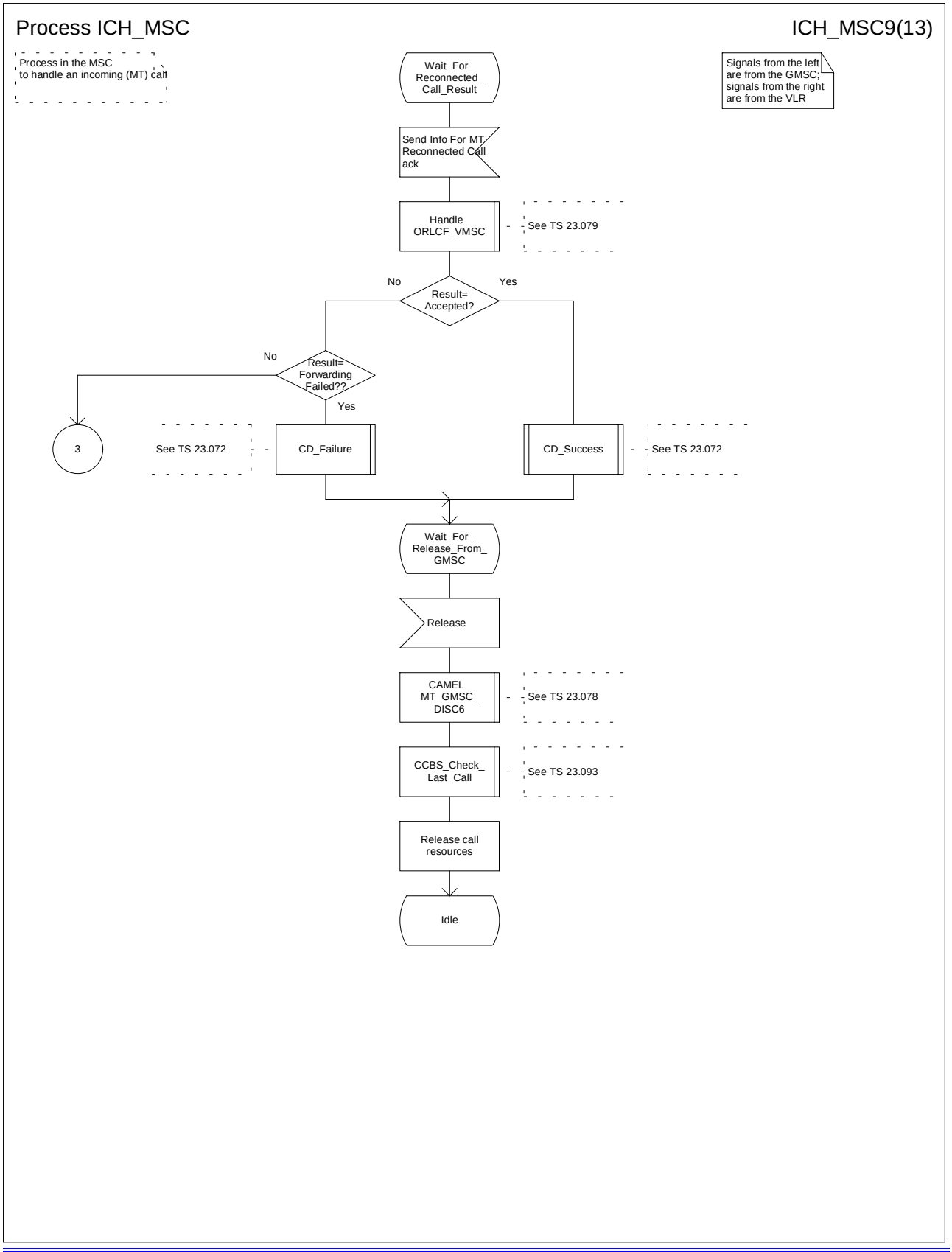
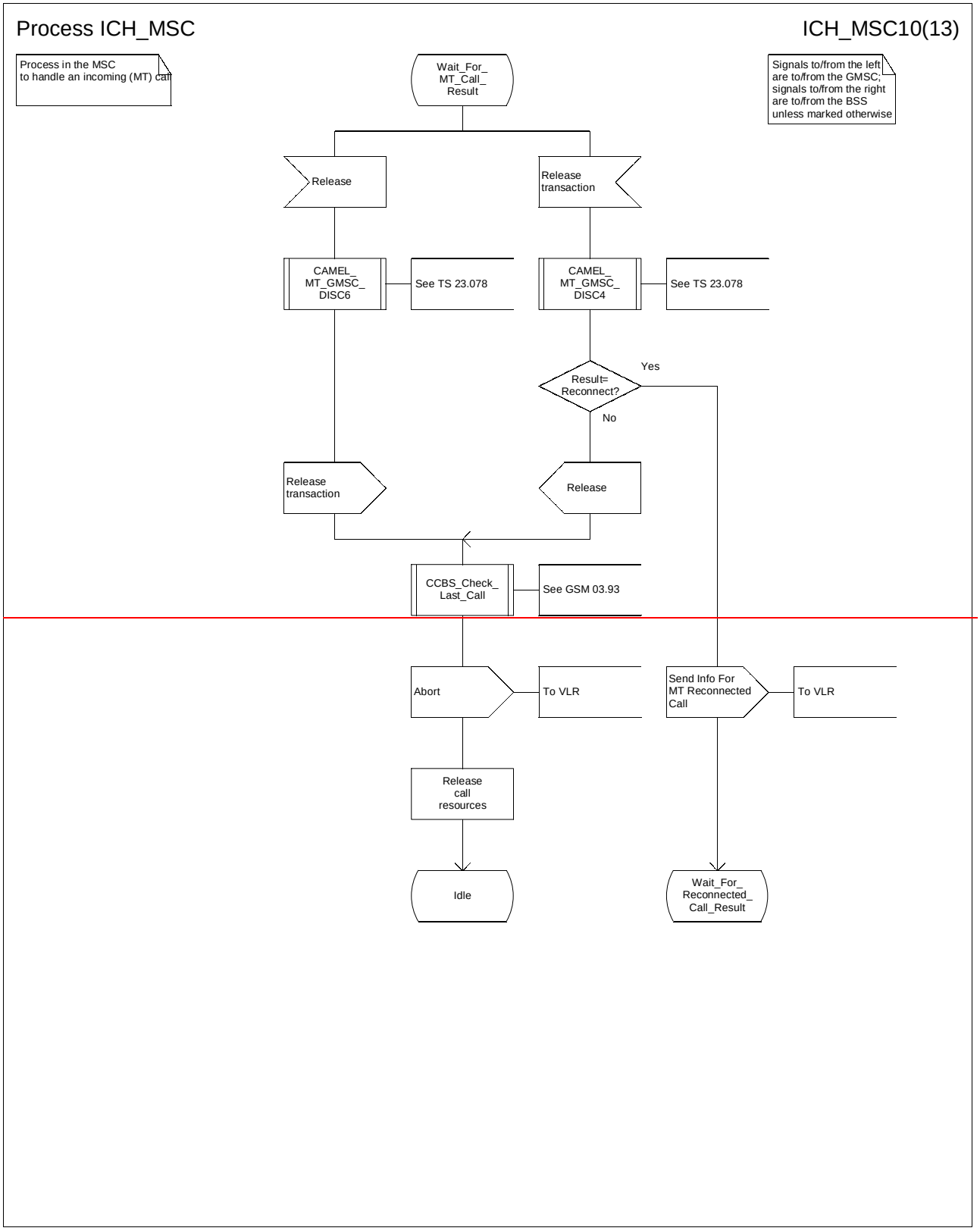


Figure 62i: Process ICH_MSC (sheet 9)


Process ICH_MSC
ICH_MSC10(13)
Process in the MSC to handle an incoming (MT) call
Wait_For_ MT_Call_ Result
Signals to/from the left are to/from the GMSC; signals to/from the right are to/from the BSS unless marked otherwise
Release
Release transaction
CAMEL_ MT_GMSC_ DISC6
See TS 23.078
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
Result= Reconnect?
Yes
No
Release transaction
Release
CCBS_Check_ Last_Call
See GSM 03.93
Abort
To VLR
Send Info For MT Reconnected Call
To VLR
Release call resources
Idle
Wait_For_ Reconnected_ Call_Result

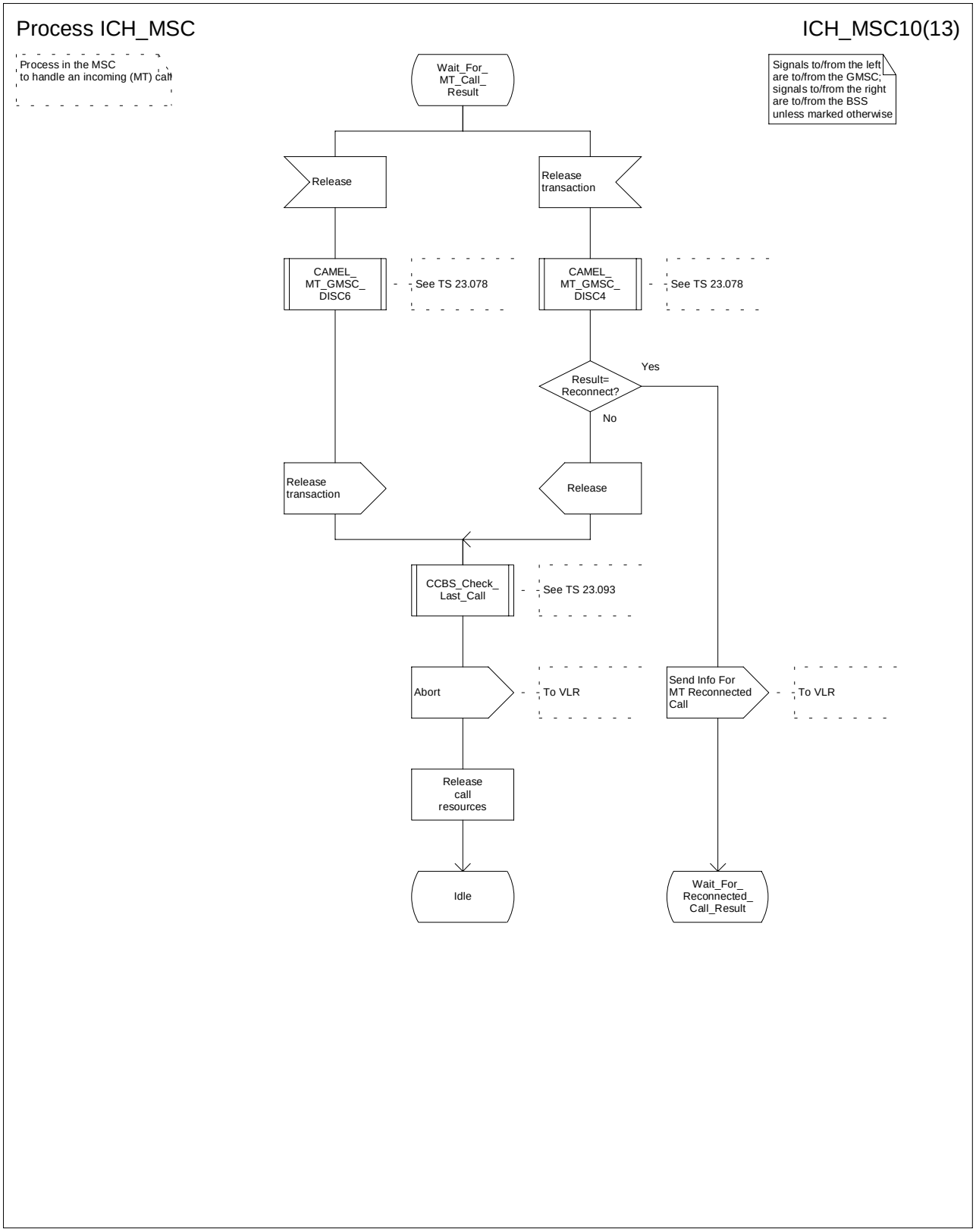
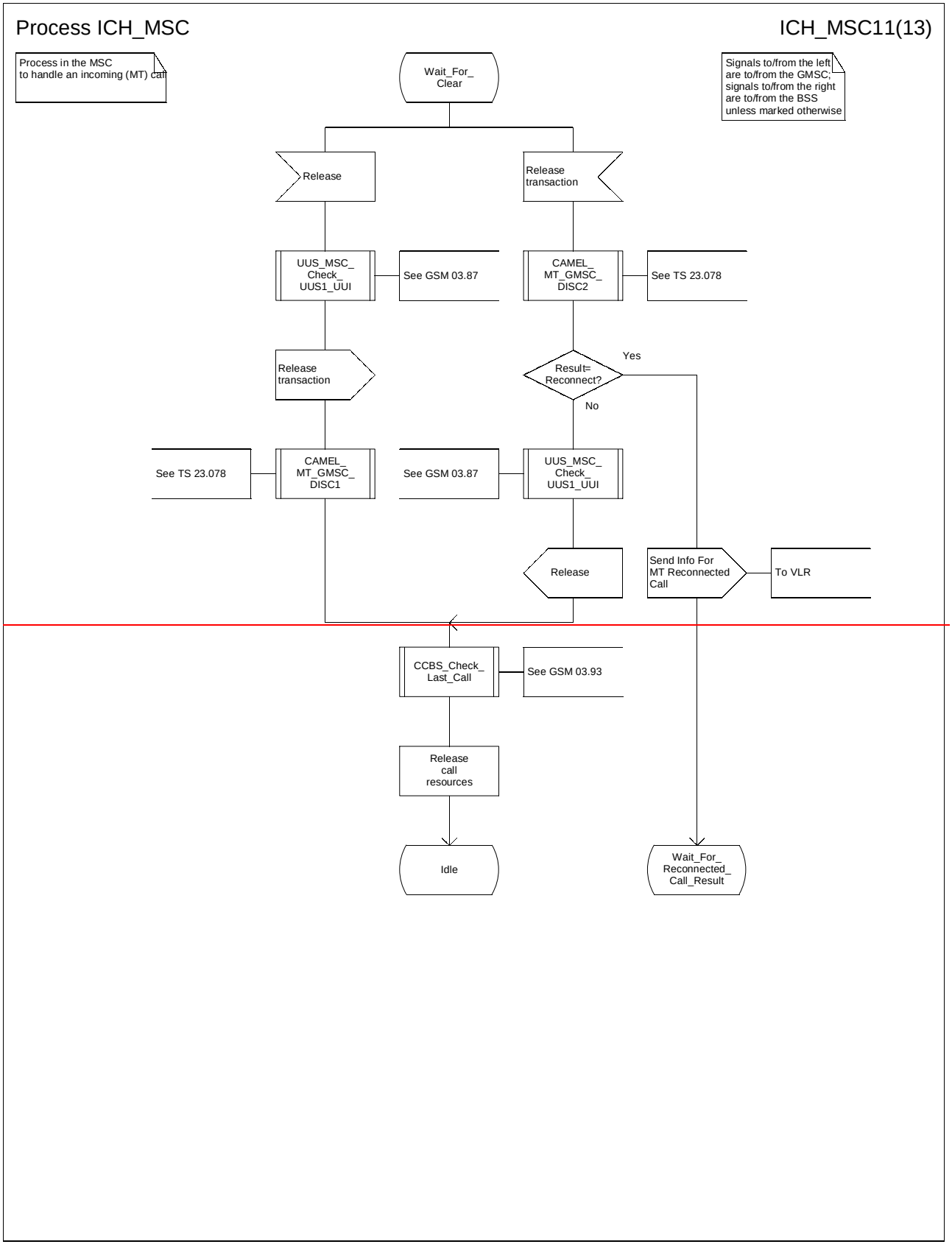


Figure 62j: Process ICH_MSC (sheet 10)


Process ICH_MSC
ICH_MSC11(13)
Process in the MSC to handle an incoming (MT) call
Wait_For_ Clear
Signals to/from the left are to/from the GMSC; signals to/from the right are to/from the BSS unless marked otherwise
Release
Release transaction
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
CAMEL_ MT_GMSC_ DISC2
See TS 23.078
Release transaction
Result= Reconnect?
Yes
No
See TS 23.078
CAMEL_ MT_GMSC_ DISC1
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
Release
Send Info For MT Reconnected Call
To VLR
CCBS_Check_ Last_Call
See GSM 03.93
Release call resources
Idle
Wait_For_ Reconnected_ Call_Result

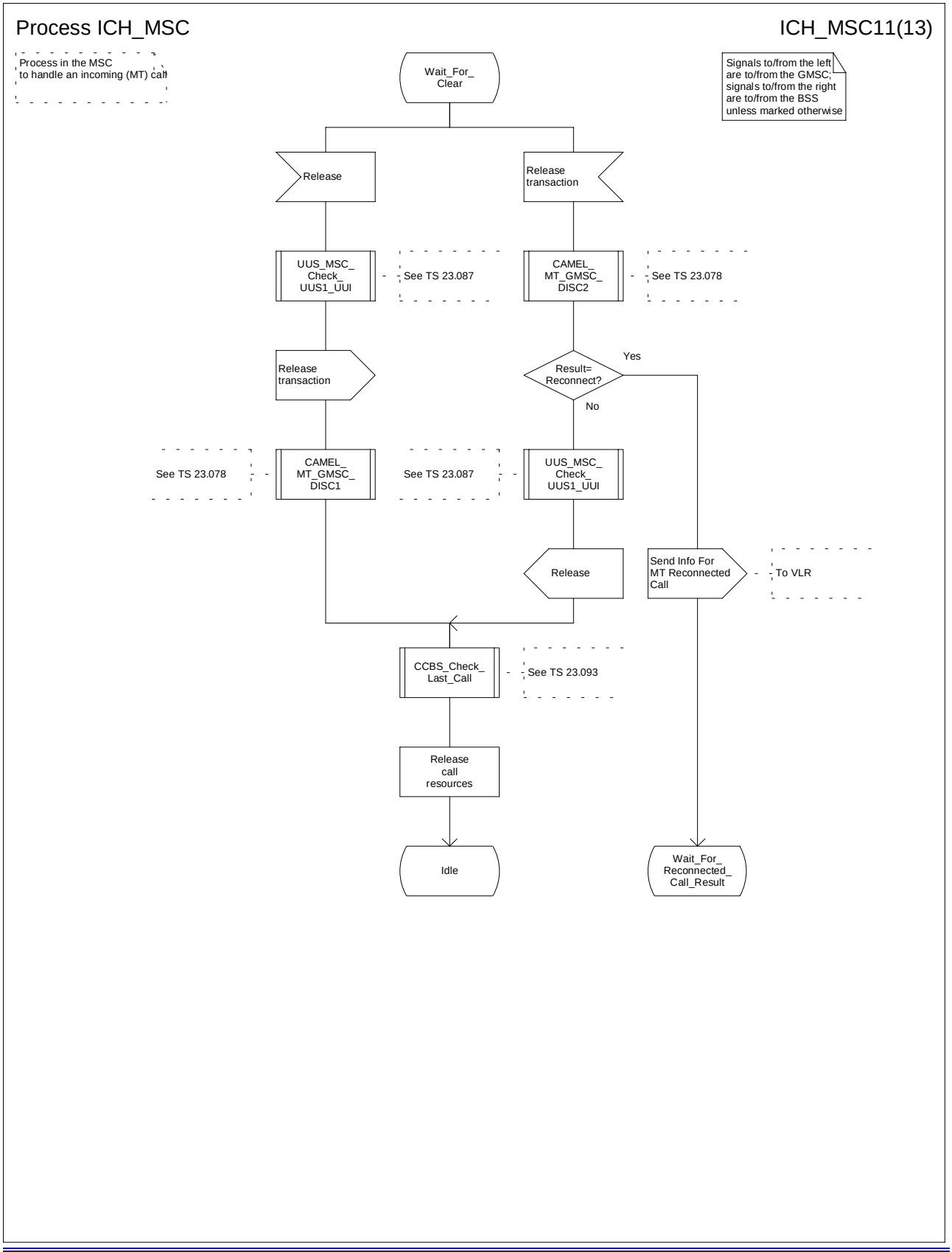


Figure 62k: Process ICH_MSC (sheet 11)

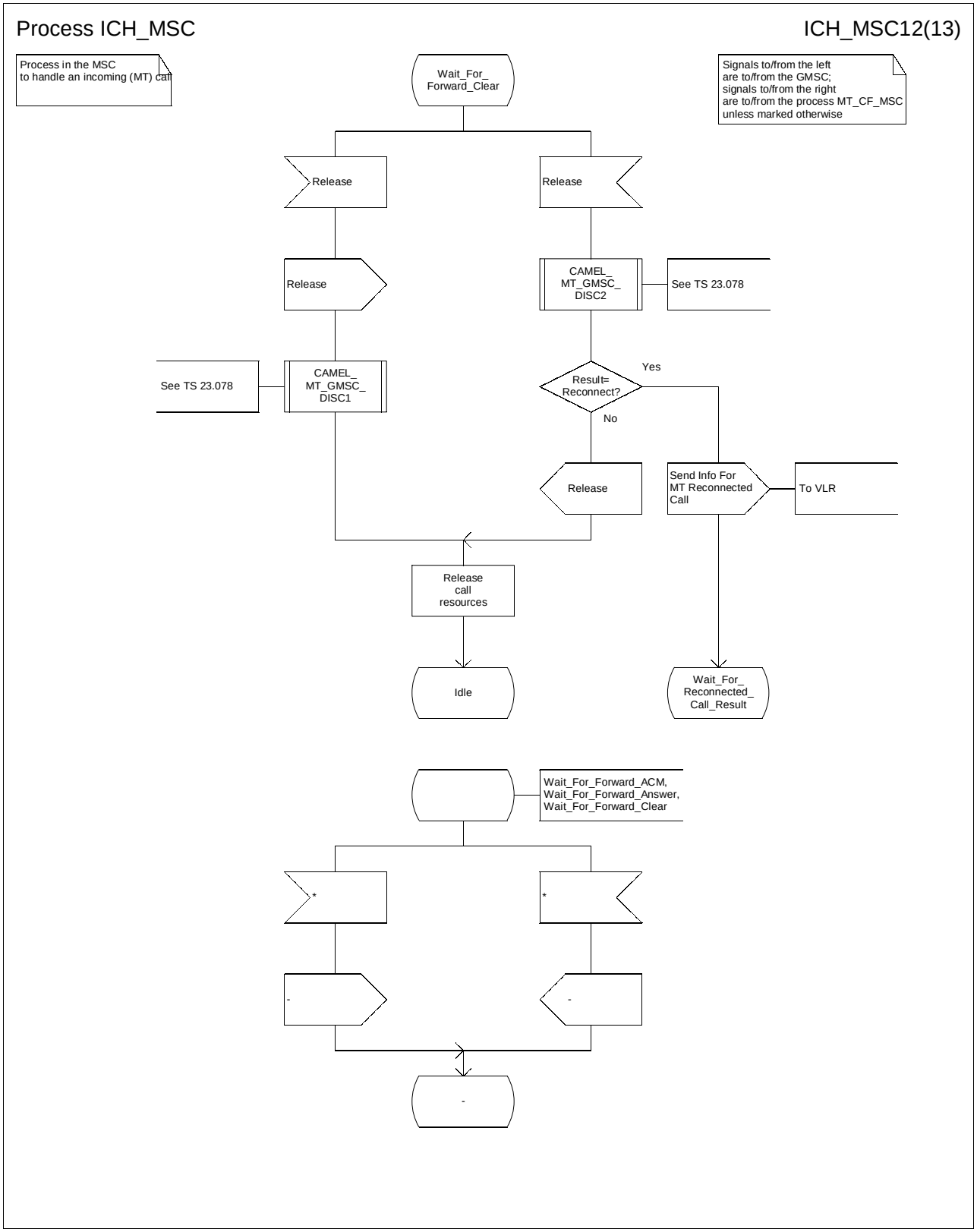


Figure 62l: Process ICH_MSC (sheet 12)

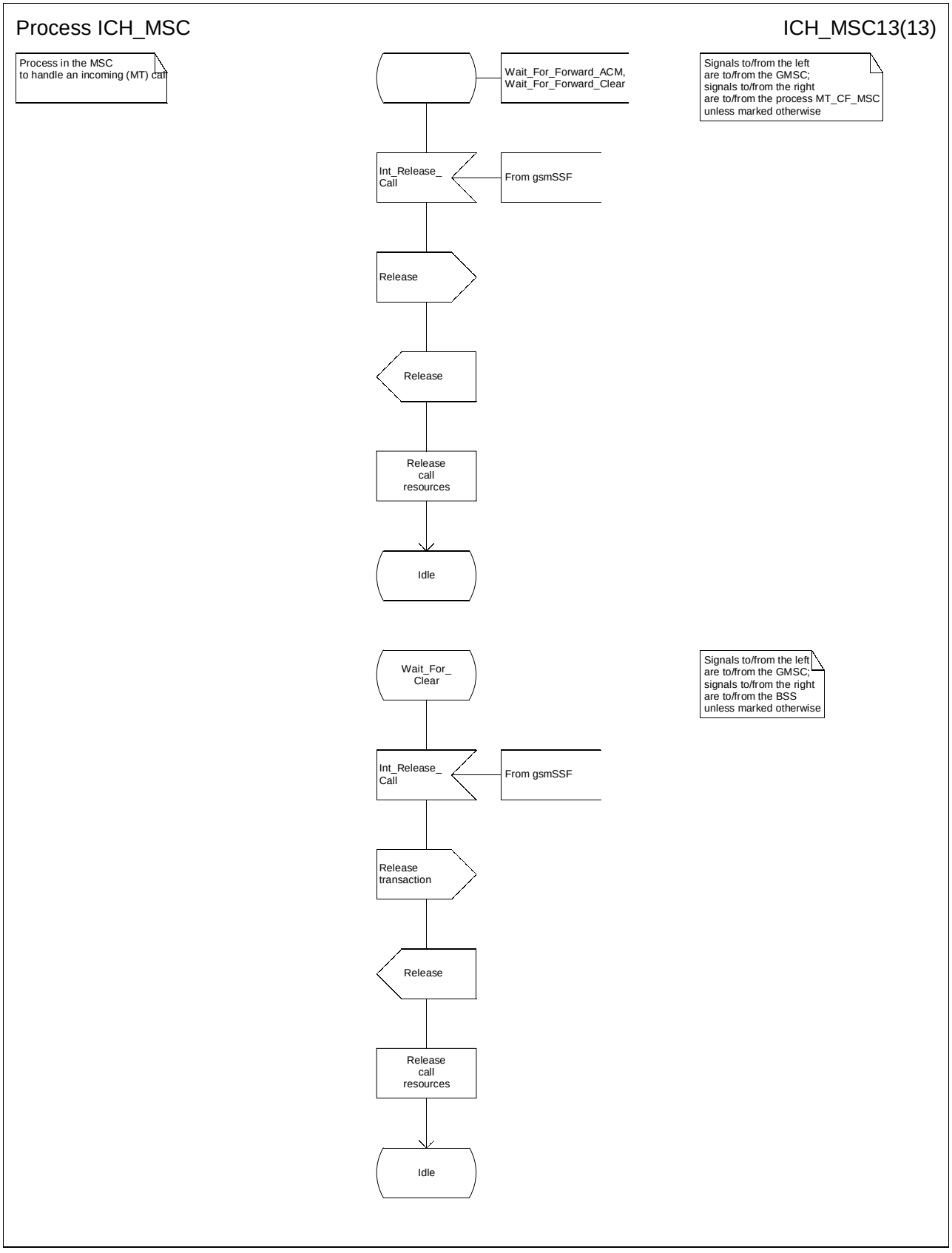


Figure 62m: Process ICH_MSC (sheet 13)

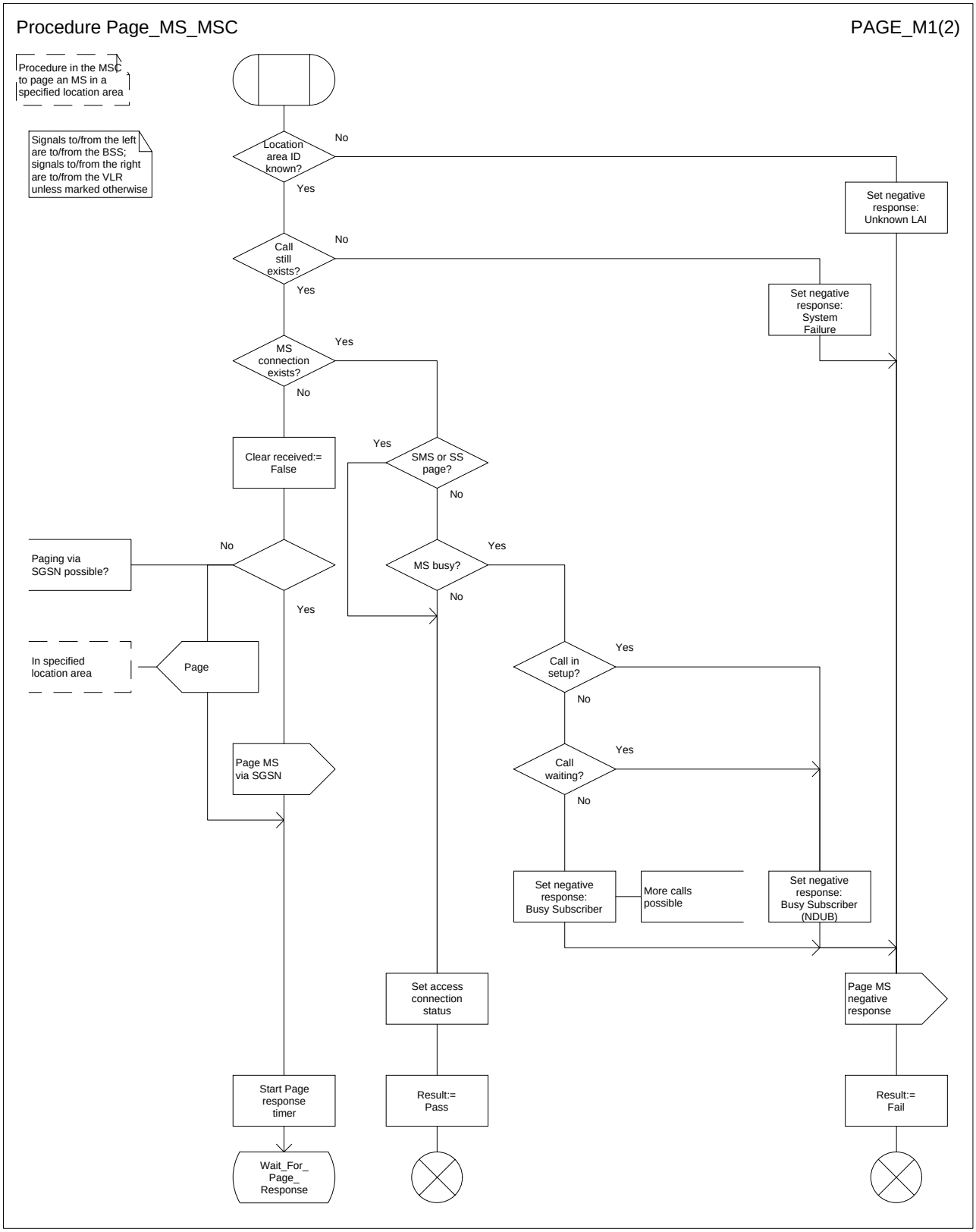


Figure 63a: Procedure Page_MS_MSC (sheet 1)

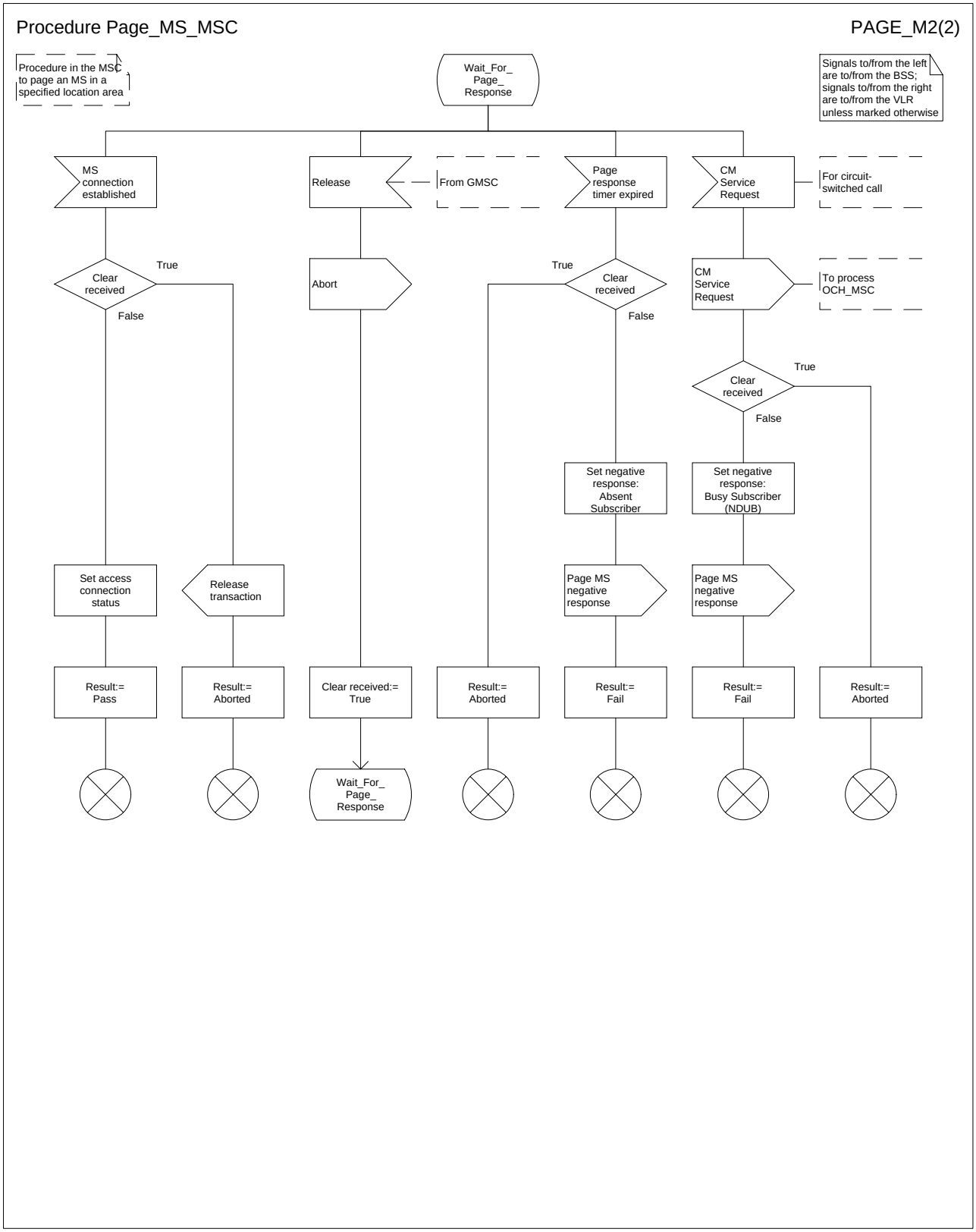


Figure 63b: Procedure Page_MS_MSC (sheet 2)

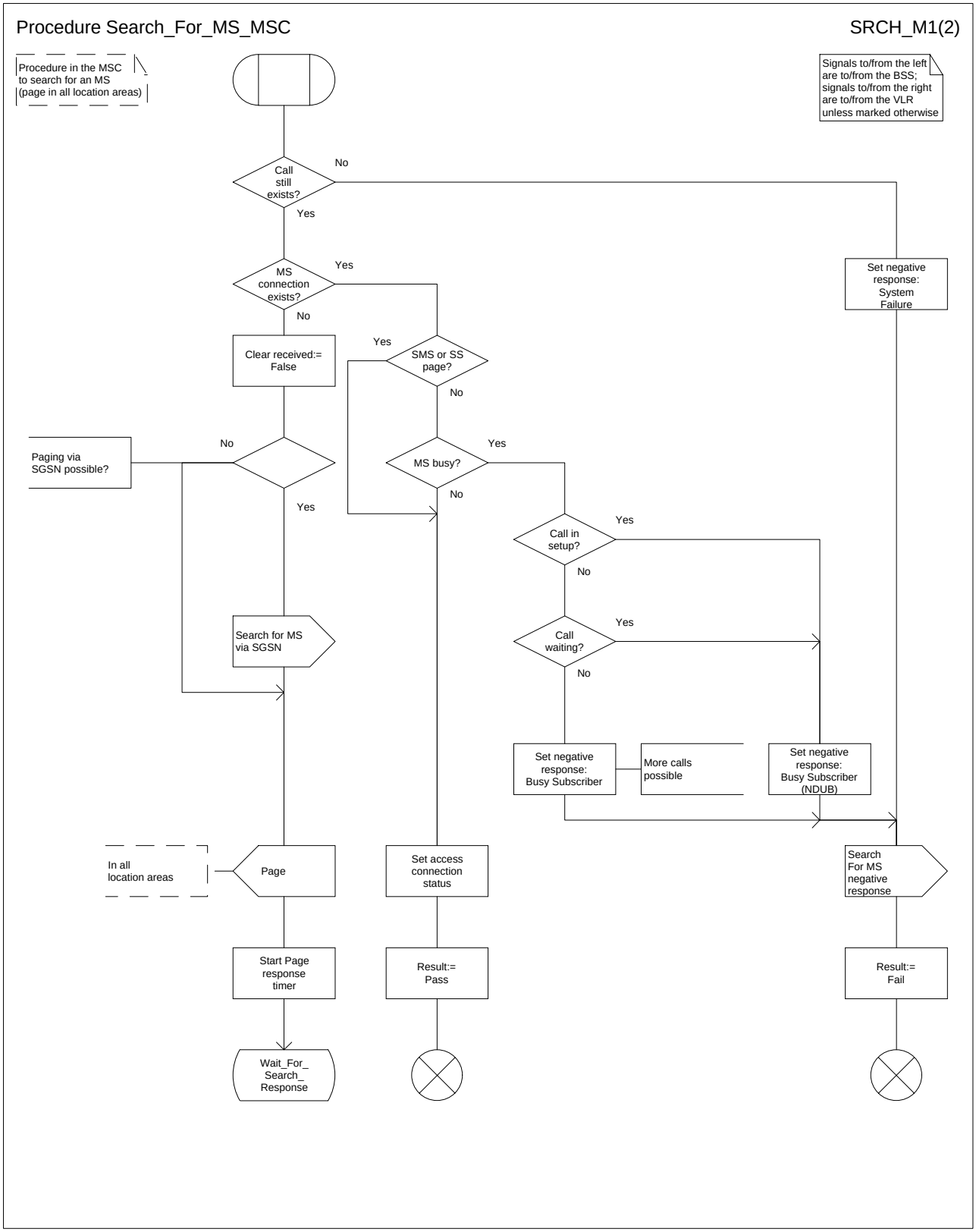


Figure 64a: Procedure Search_For_MS_MSC (sheet 1)

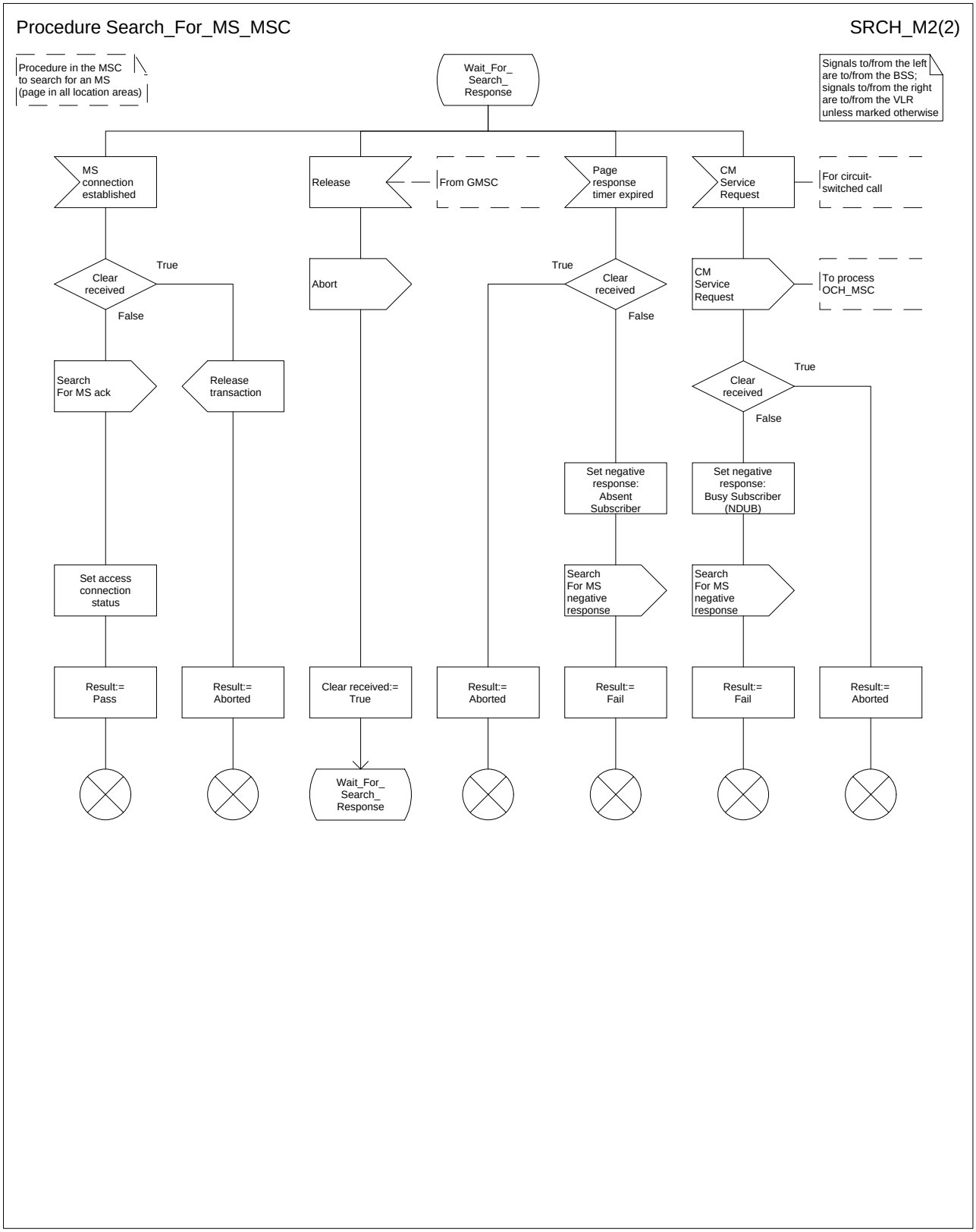
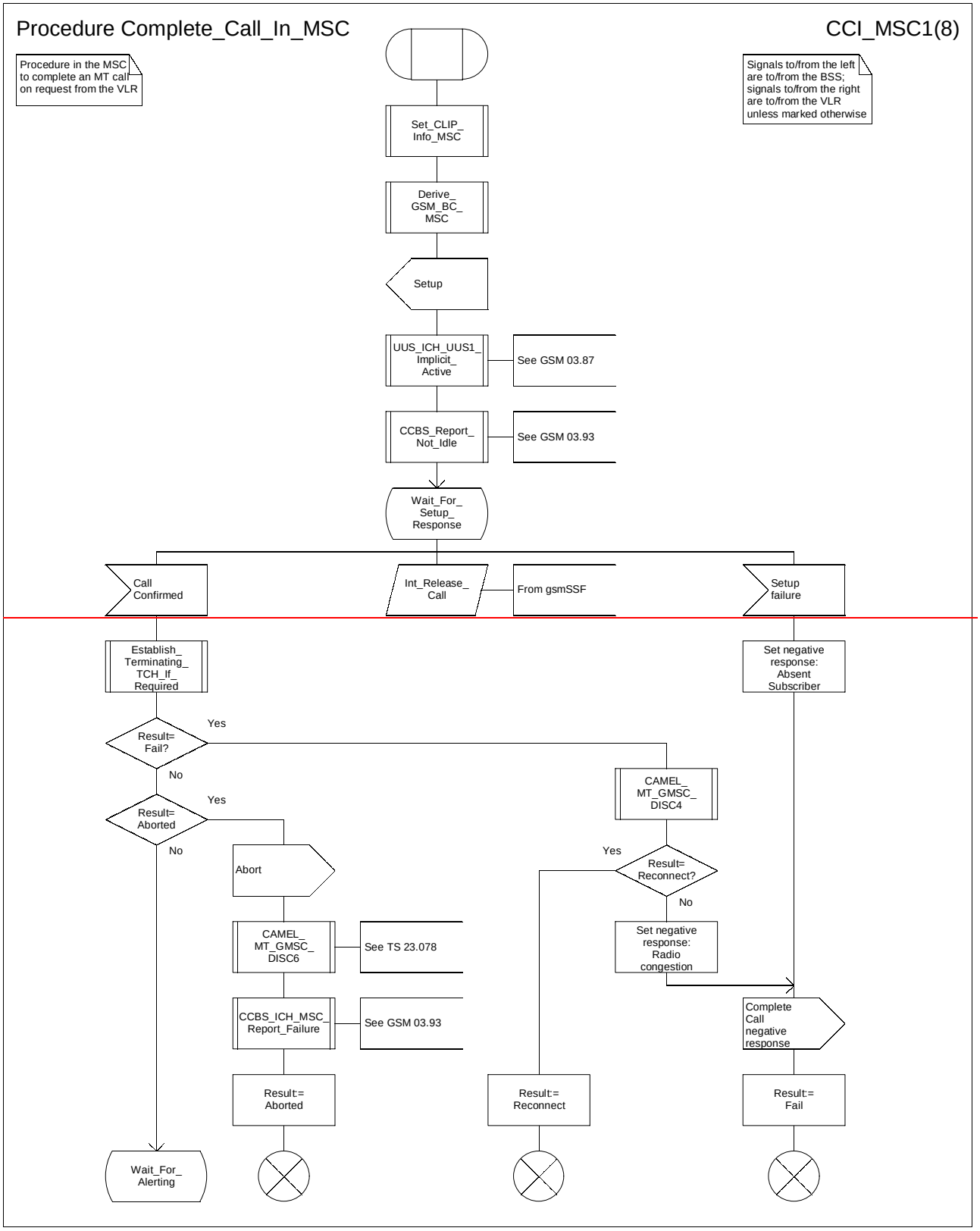


Figure 64b: Procedure Search_For_MS_MSC (sheet 2)


Procedure Complete_Call_In_MSC
CCI_MSC1(8)
Procedure in the MSC to complete an MT call on request from the VLR
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Set_CLIP_ Info_MSC
Derive_ GSM_BC_ MSC
Setup
UUS_ICH_UUS1_ Implicit_ Active
See GSM 03.87
CCBS_Report_ Not_Idle
See GSM 03.93
Wait_For_ Setup_ Response
Call Confirmed
Int_Release_ Call
From gsmSSF
Setup failure
Establish_ Terminating_ TCH_If_ Required
Result= Fail?
Yes
No
Result= Aborted
Yes
No
Abort
CAMEL_ MT_GMSC_ DISC6
See TS 23.078
CCBS_ICH_MSC_ Report_Failure
See GSM 03.93
Result= Aborted
Wait_For_ Alerting
CAMEL_ MT_GMSC_ DISC4
Yes
Result= Reconnect?
No
Result= Reconnect
Set negative response: Radio congestion
Set negative response: Absent Subscriber
Complete Call negative response
Result= Fail

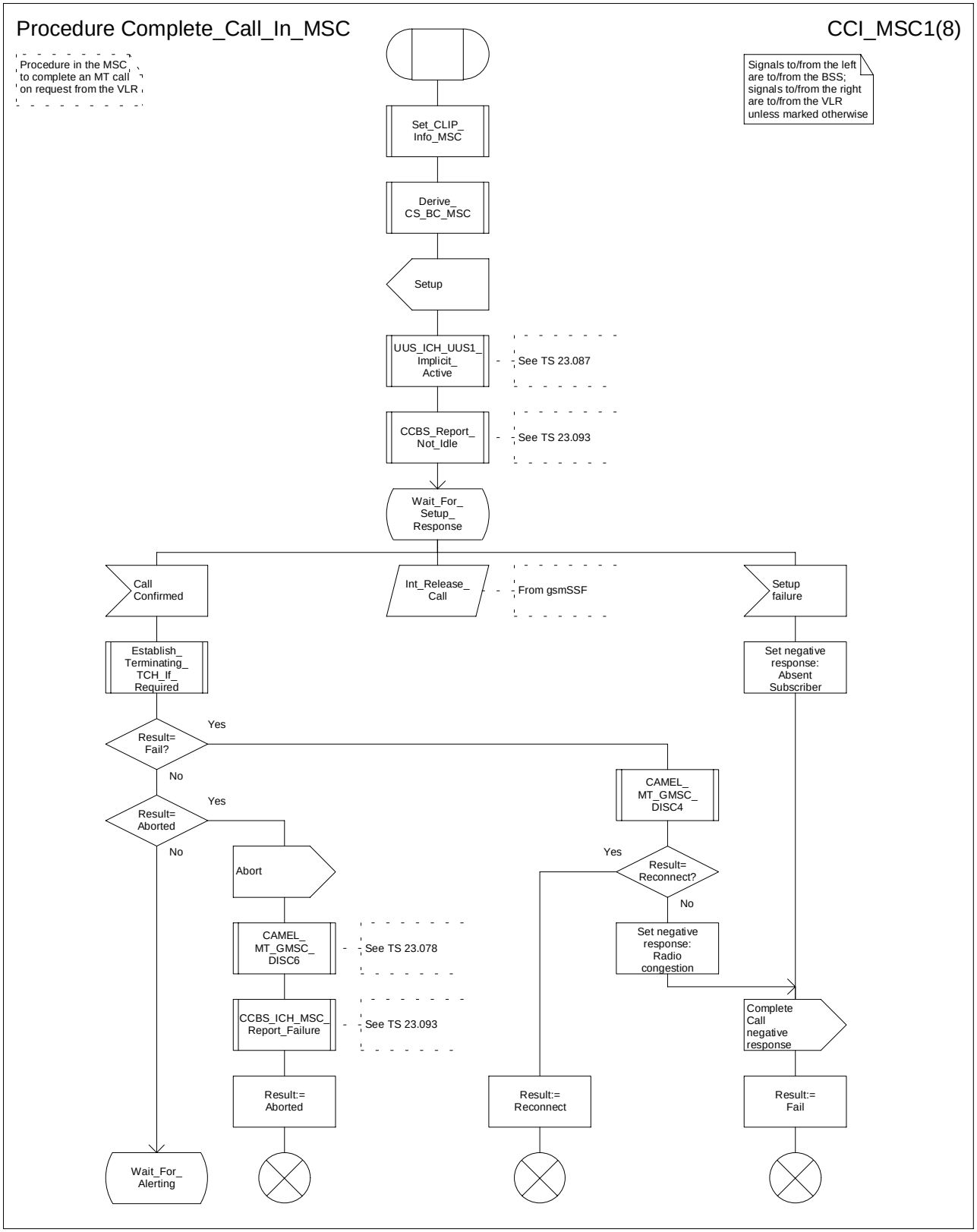
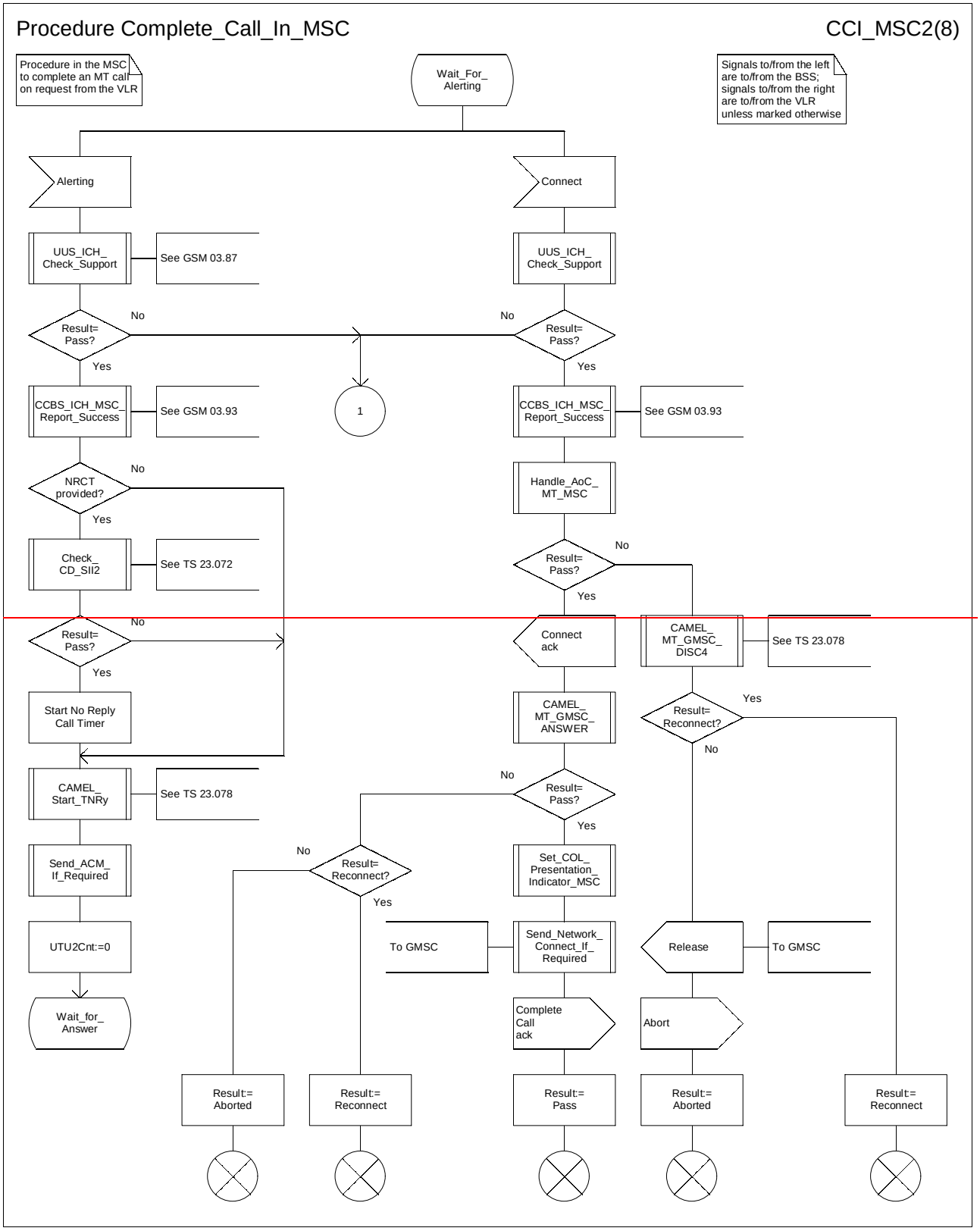


Figure 65a: Procedure Complete_Call_In_MSC (sheet 1)


Procedure Complete_Call_In_MSC
CCI_MSC2(8)
Procedure in the MSC to complete an MT call on request from the VLR
Wait_For_ Alerting
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Alerting
Connect
UUS_ICH_ Check_Support
See GSM 03.87
UUS_ICH_ Check_Support
Result= Pass?
No
Yes
Result= Pass?
No
Yes
CCBS_ICH_MSC_ Report_Success
See GSM 03.93
1
CCBS_ICH_MSC_ Report_Success
See GSM 03.93
NRCT provided?
No
Yes
Handle_AoC_ MT_MSC
Check_ CD_SII2
See TS 23.072
Result= Pass?
No
Yes
Result= Pass?
No
Yes
Connect ack
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
Start No Reply Call Timer
CAMEL_ MT_GMSC_ ANSWER
Result= Reconnect?
Yes
No
CAMEL_ Start_TNRy
See TS 23.078
Result= Pass?
No
Yes
Send_ACM_ If_Required
Result= Reconnect?
No
Yes
Set_COL_ Presentation_ Indicator_MSC
UTU2Cnt:=0
To GMSC
Send_Network_ Connect_If_ Required
Release
To GMSC
Wait_for_ Answer
Complete Call ack
Abort
Result:= Aborted
Result:= Reconnect
Result:= Pass
Result:= Aborted
Result:= Reconnect

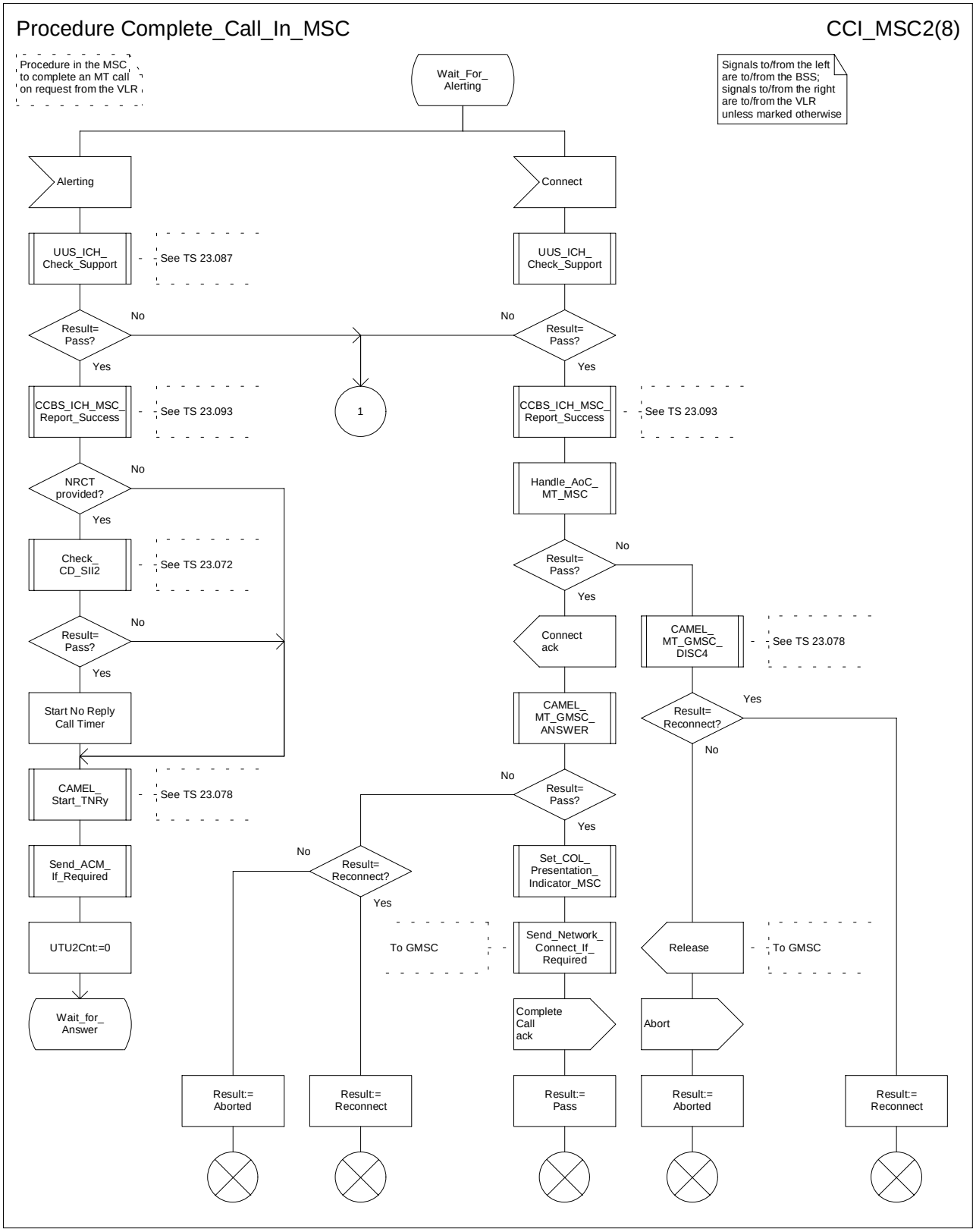
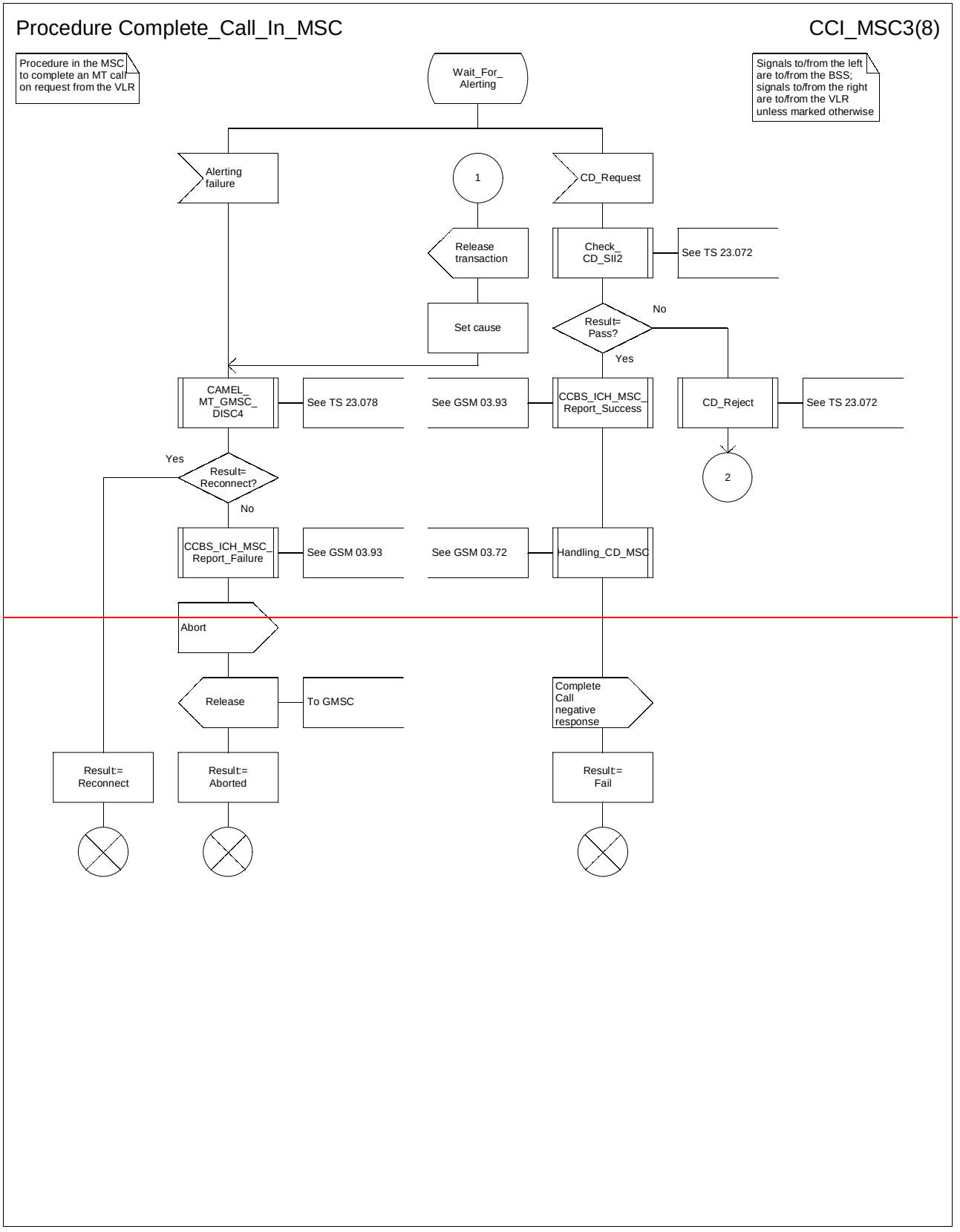


Figure 65b: Procedure Complete_Call_In_MSC (sheet 2)


Procedure Complete_Call_In_MSC
CCI_MSC3(8)
Procedure in the MSC to complete an MT call on request from the VLR
Wait_For_ Alerting
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Alerting failure
1
CD_Request
Release transaction
Check_ CD_SII2
See TS 23.072
Set cause
Result= Pass?
No
Yes
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
See GSM 03.93
CCBS_ICH_MSC_ Report_Success
CD_Reject
See TS 23.072
2
Yes
Result= Reconnect?
No
CCBS_ICH_MSC_ Report_Failure
See GSM 03.93
See GSM 03.72
Handling_CD_MSC
Abort
Release
To GMSC
Complete Call negative response
Result:= Reconnect
Result:= Aborted
Result:= Fail

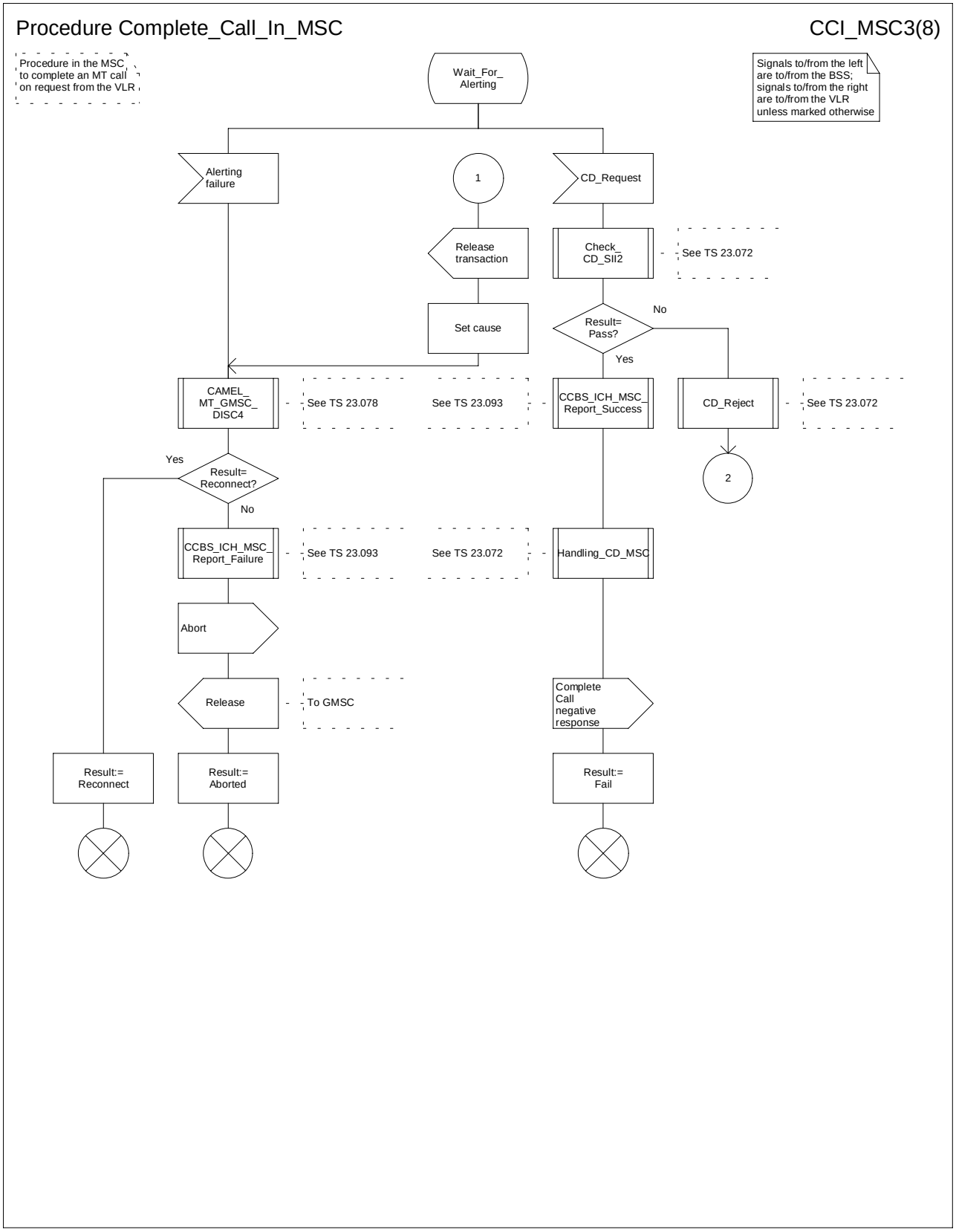
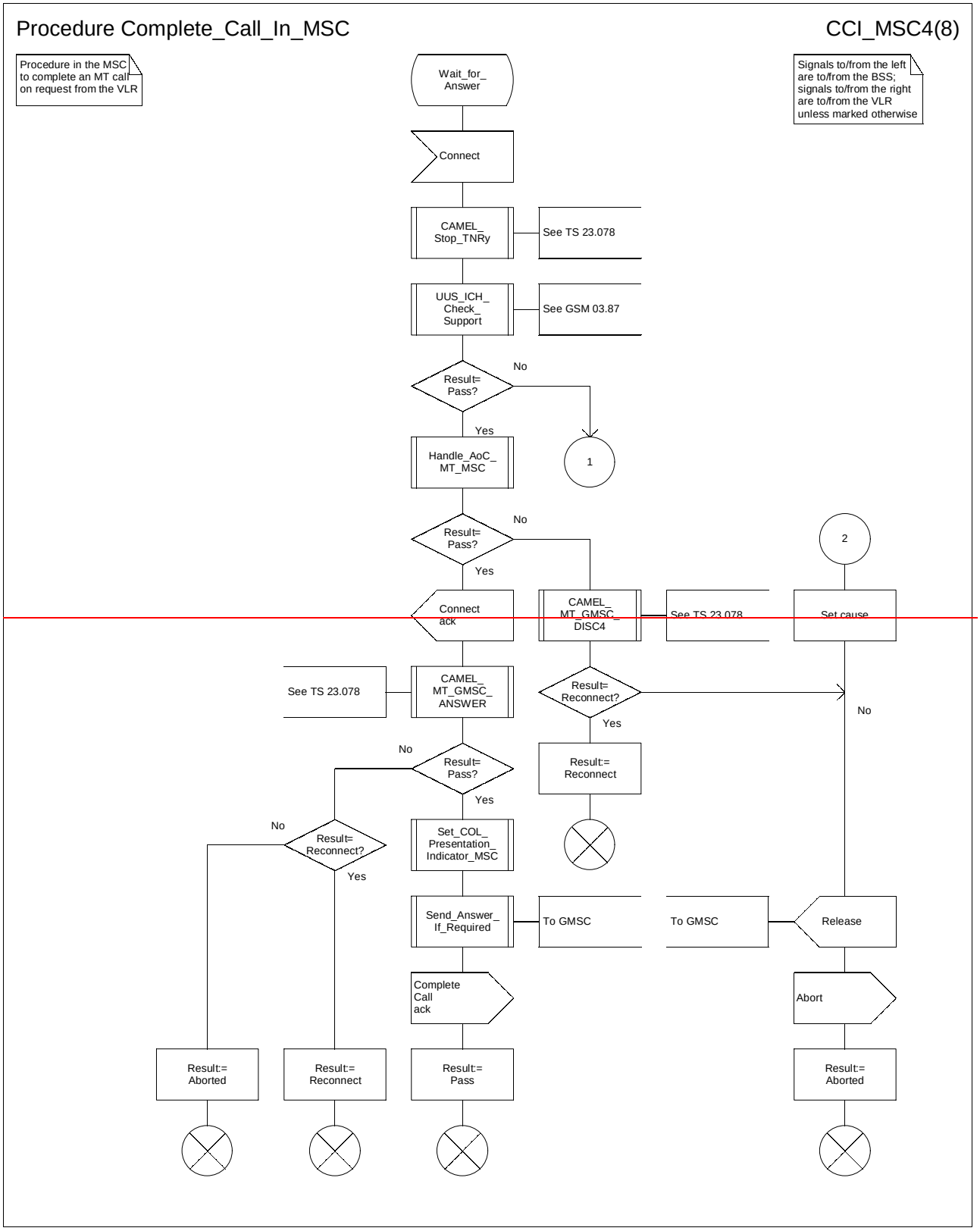


Figure 65c: Procedure Complete_Call_In_MSC (sheet 3)


Procedure Complete_Call_In_MSC
CCI_MSC4(8)
Procedure in the MSC to complete an MT call on request from the VLR
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Wait_for_ Answer
Connect
CAMEL_ Stop_TNRy
See TS 23.078
UUS_ICH_ Check_ Support
See GSM 03.87
Result= Pass?
No
Yes
1
Handle_AoC_ MT_MSC
Result= Pass?
No
Yes
2
Connect ack
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
Set cause
See TS 23.078
CAMEL_ MT_GMSC_ ANSWER
Result= Reconnect?
Yes
No
Result:= Reconnect
No
Result= Pass?
Yes
No
Result= Reconnect?
Yes
Set_COL_ Presentation_ Indicator_MSC
Send_Answer_ If_Required
To GMSC
To GMSC
Release
Complete Call ack
Abort
Result:= Aborted
Result:= Reconnect
Result:= Pass
Result:= Aborted

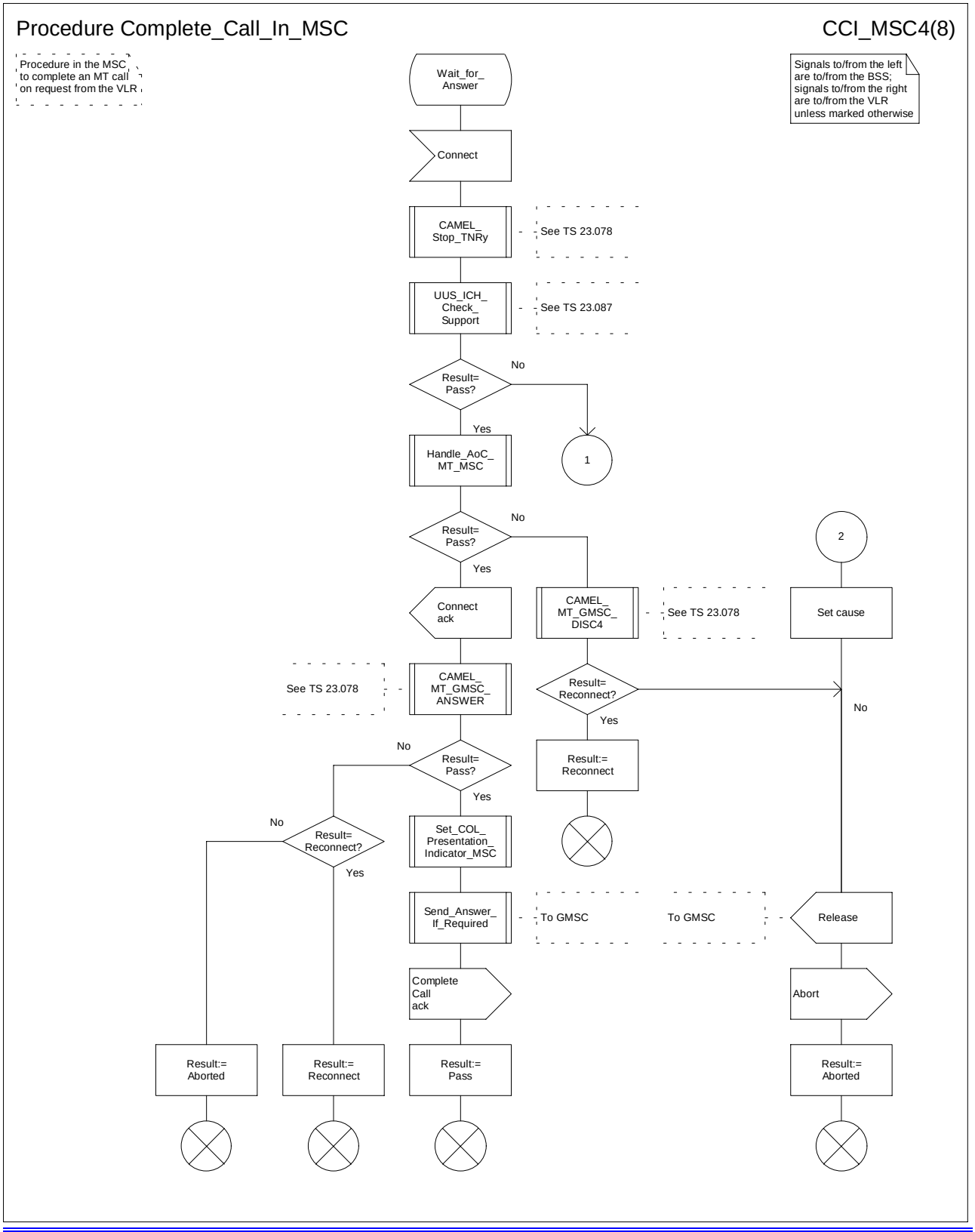
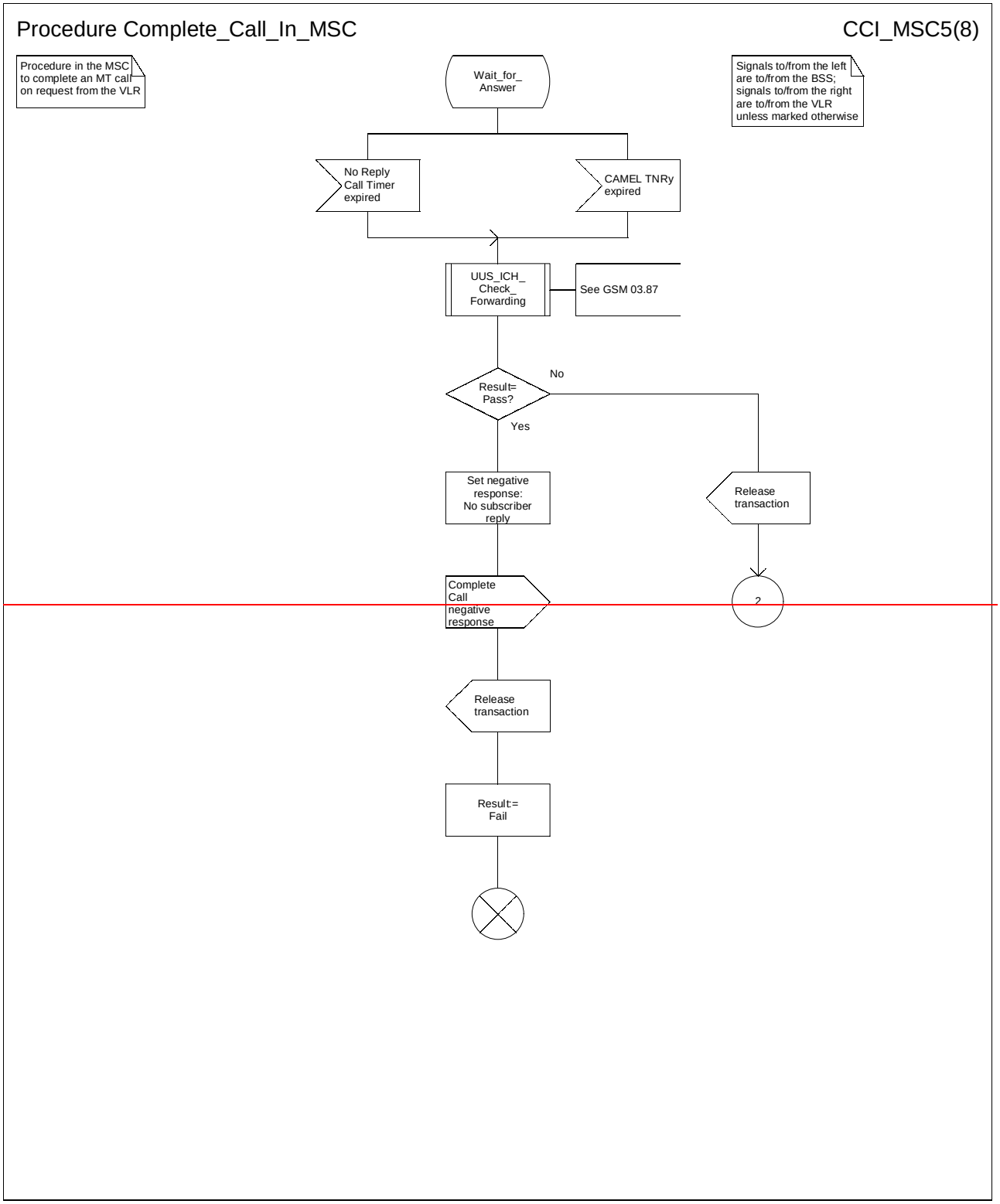


Figure 65d: Procedure Complete_Call_In_MSC (sheet 4)


Procedure Complete_Call_In_MSC
CCI_MSC5(8)
Procedure in the MSC to complete an MT call on request from the VLR
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Wait_for_ Answer
No Reply Call Timer expired
CAMEL TNRy expired
UUS_ICH_ Check_ Forwarding
See GSM 03.87
Result= Pass?
No
Yes
Set negative response: No subscriber reply
Release transaction
2
Complete Call negative response
Release transaction
Result:= Fail

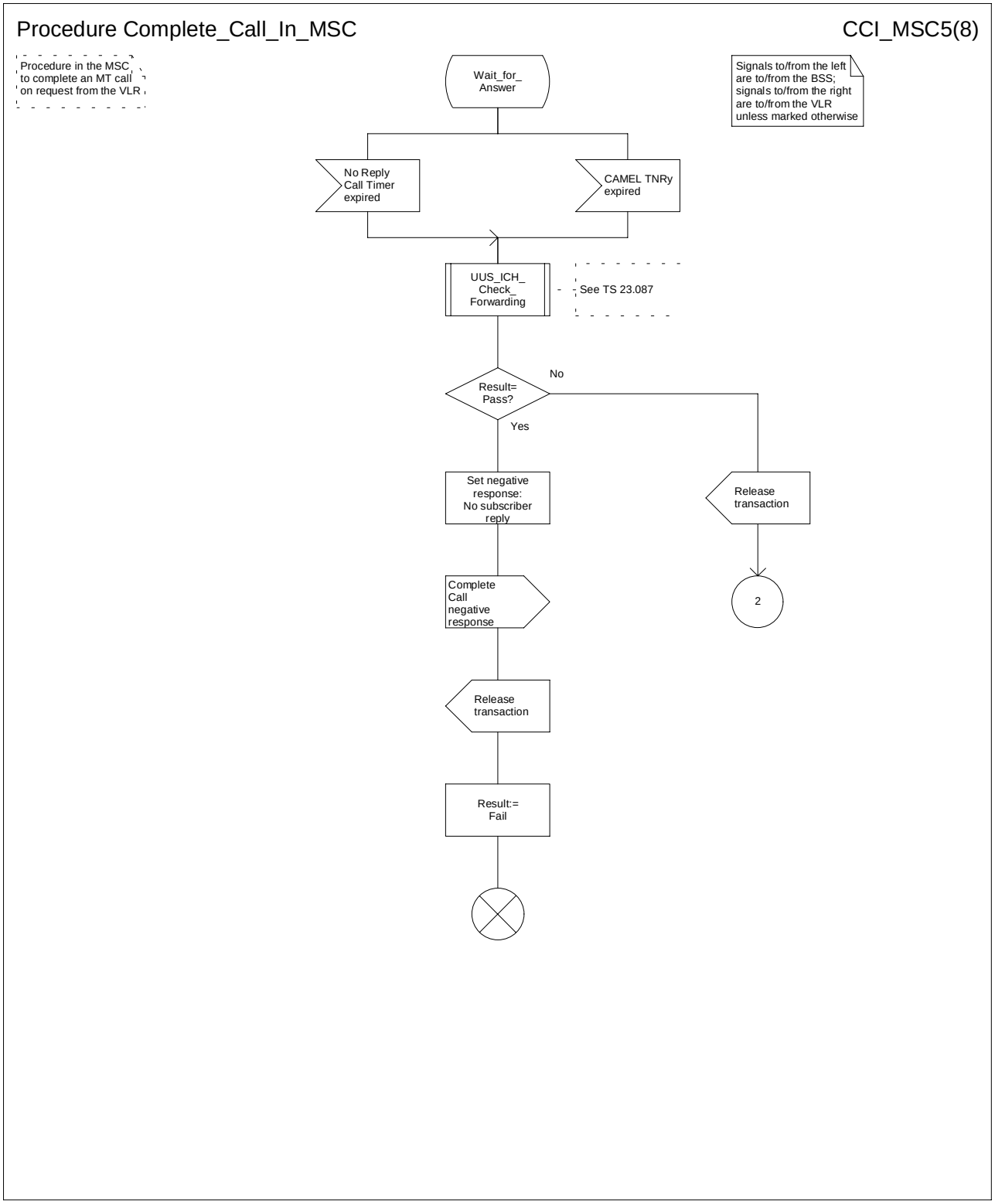
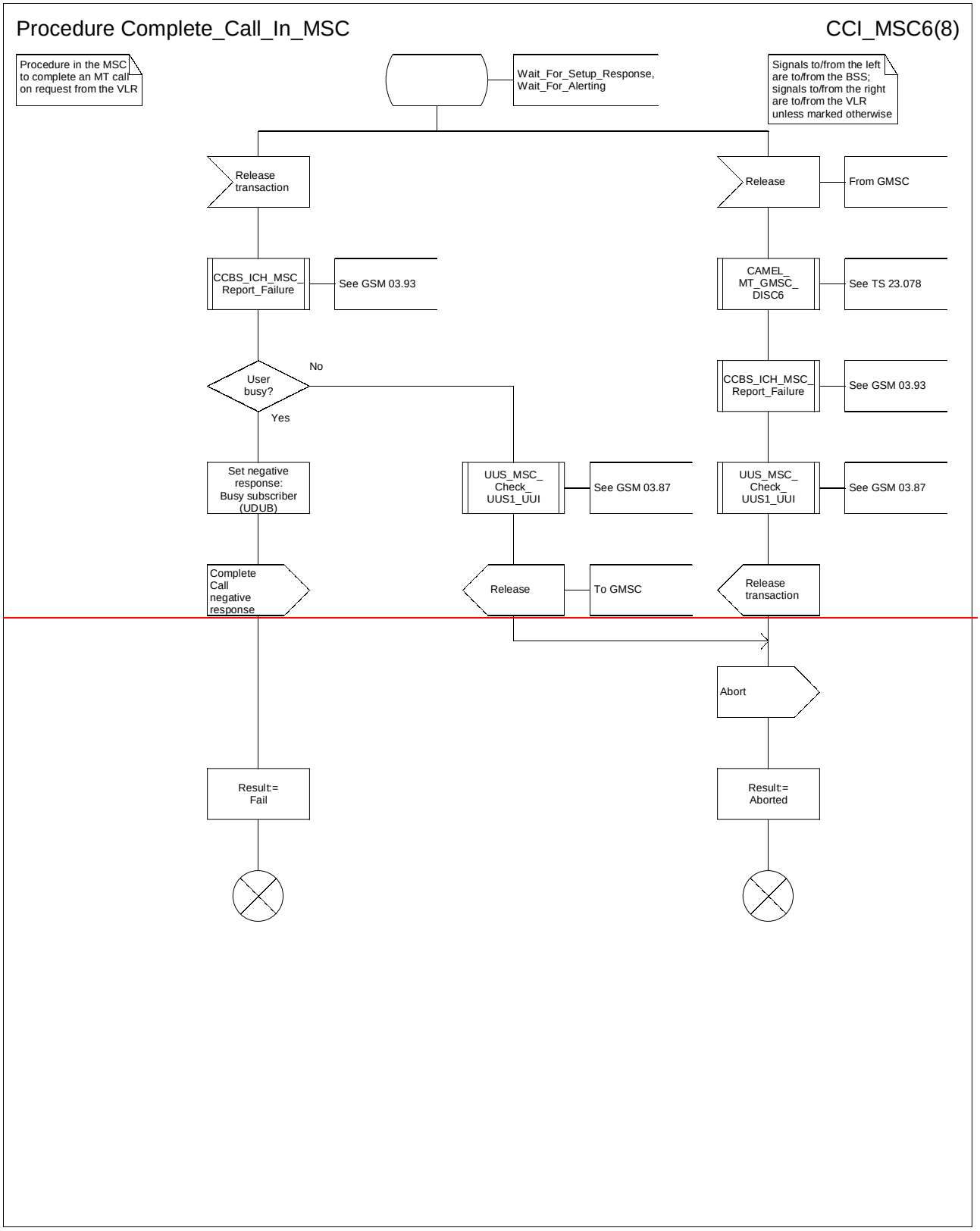


Figure 65e: Procedure Complete_Call_In_MSC (sheet 5)


Procedure Complete_Call_In_MSC
CCI_MSC6(8)
Procedure in the MSC to complete an MT call on request from the VLR
Wait_For_Setup_Response, Wait_For_Alerting
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Release transaction
Release
From GMSC
CCBS_ICH_MSC_ Report_Failure
See GSM 03.93
CAMEL_ MT_GMSC_ DISC6
See TS 23.078
User busy?
No
Yes
CCBS_ICH_MSC_ Report_Failure
See GSM 03.93
Set negative response: Busy subscriber (UDUB)
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
Complete Call negative response
Release
To GMSC
Release transaction
Abort
Result= Fail
Result= Aborted

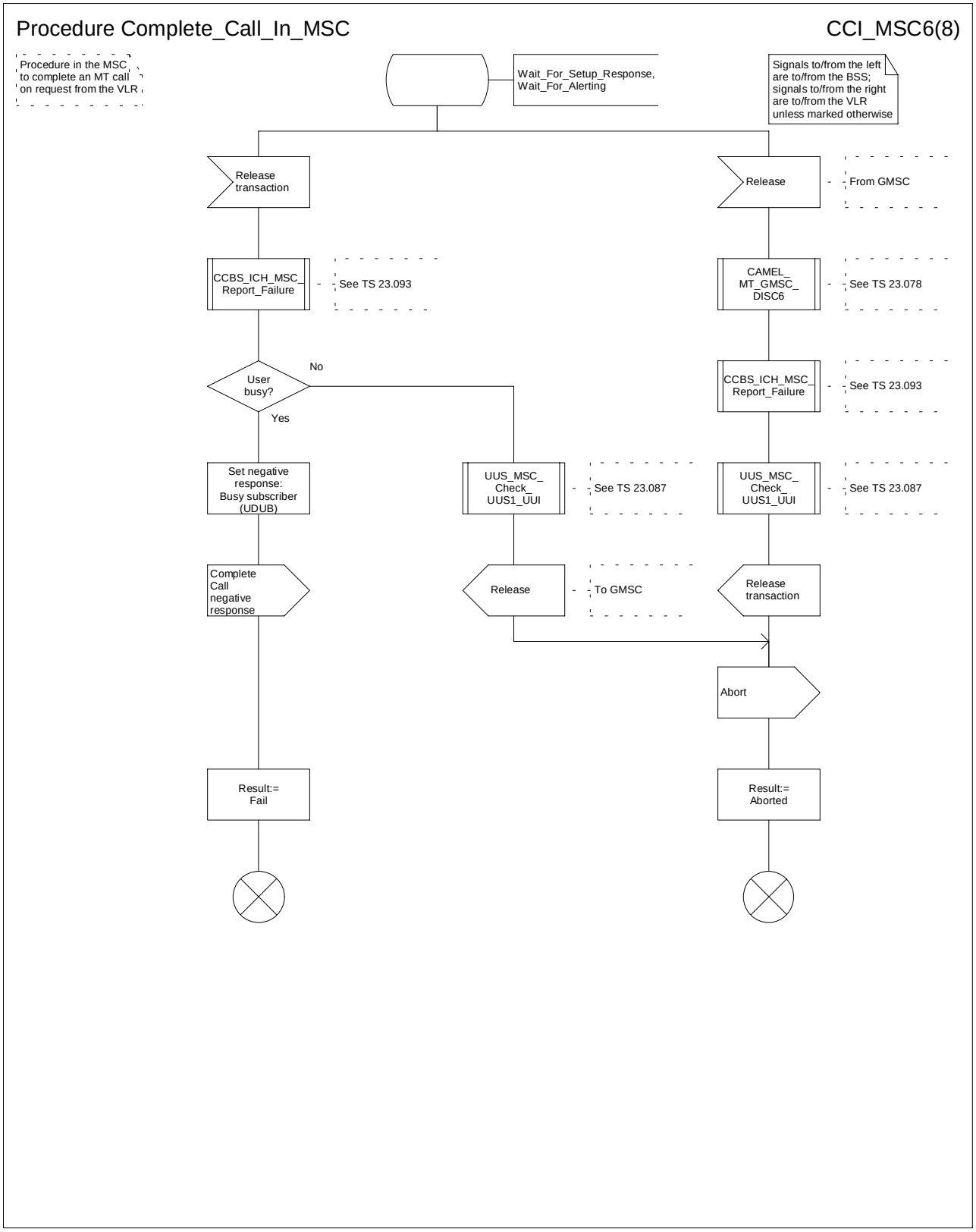
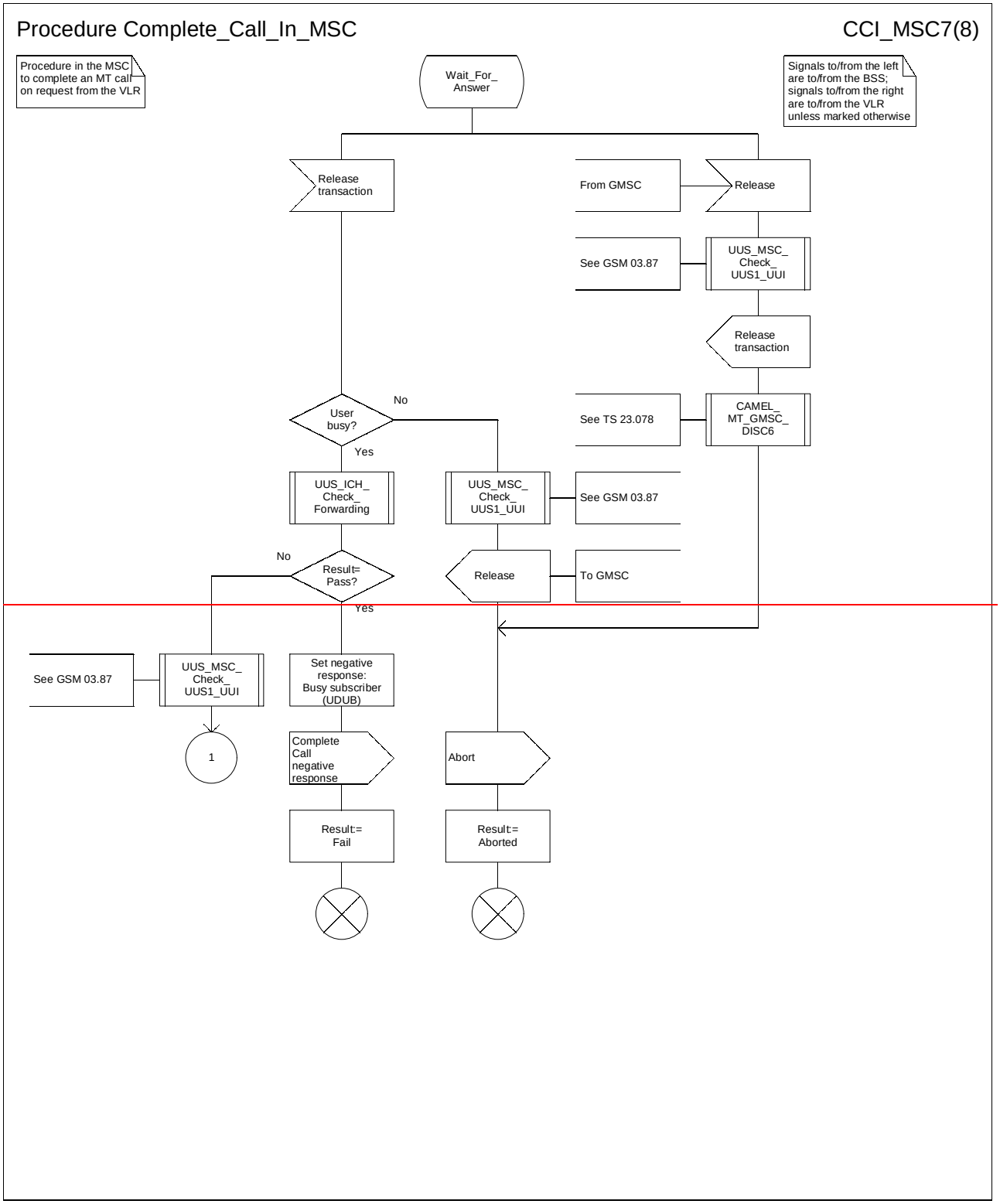


Figure 65f: Procedure Complete_Call_In_MSC (sheet 6)


Procedure Complete_Call_In_MSC
CCI_MSC7(8)
Procedure in the MSC to complete an MT call on request from the VLR
Wait_For_ Answer
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Release transaction
From GMSC
Release
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
Release transaction
User busy?
No
Yes
See TS 23.078
CAMEL_ MT_GMSC_ DISC6
UUS_ICH_ Check_ Forwarding
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
No
Result= Pass?
Release
To GMSC
Yes
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
Set negative response: Busy subscriber (UDUB)
1
Complete Call negative response
Abort
Result:= Fail
Result:= Aborted

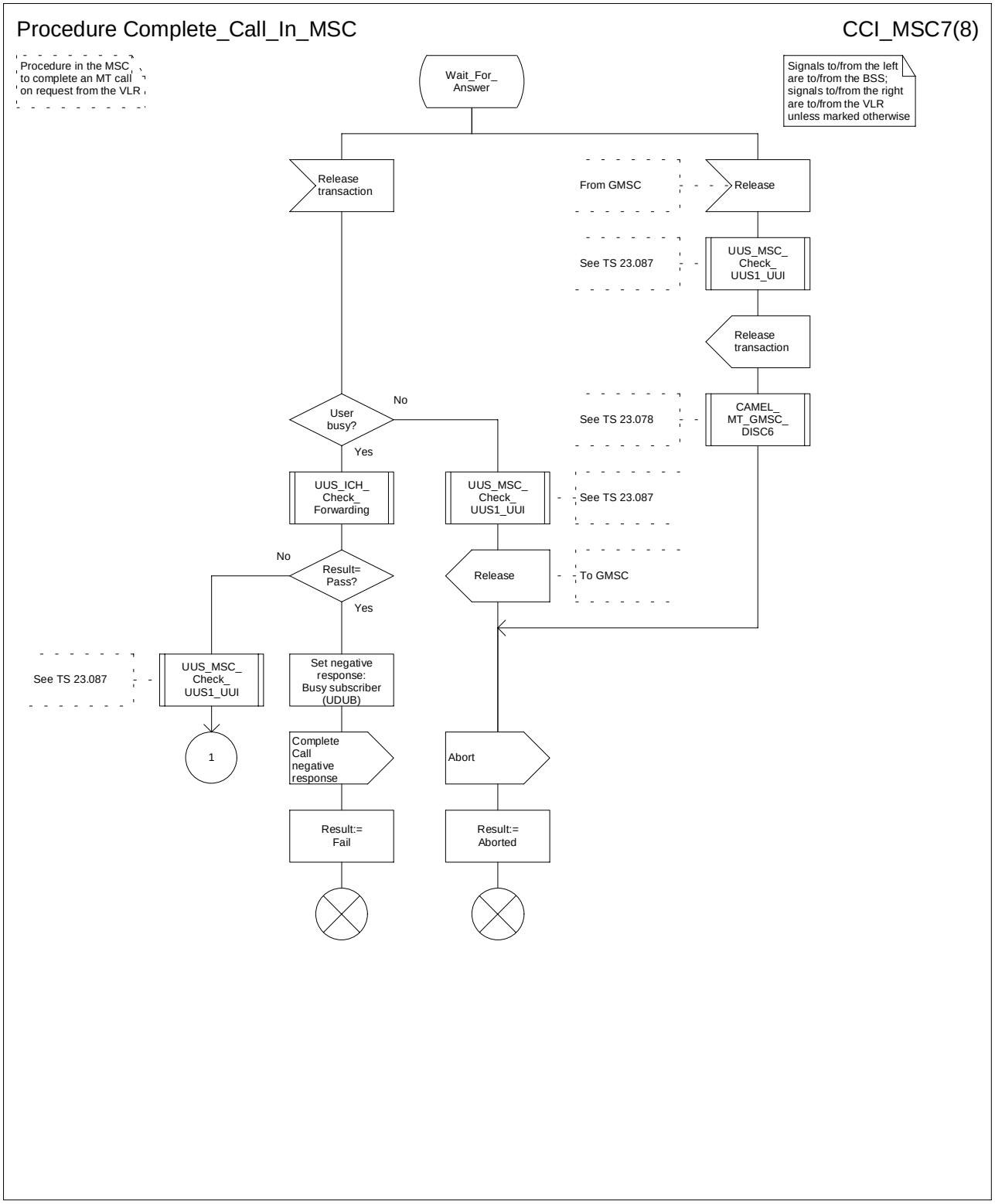
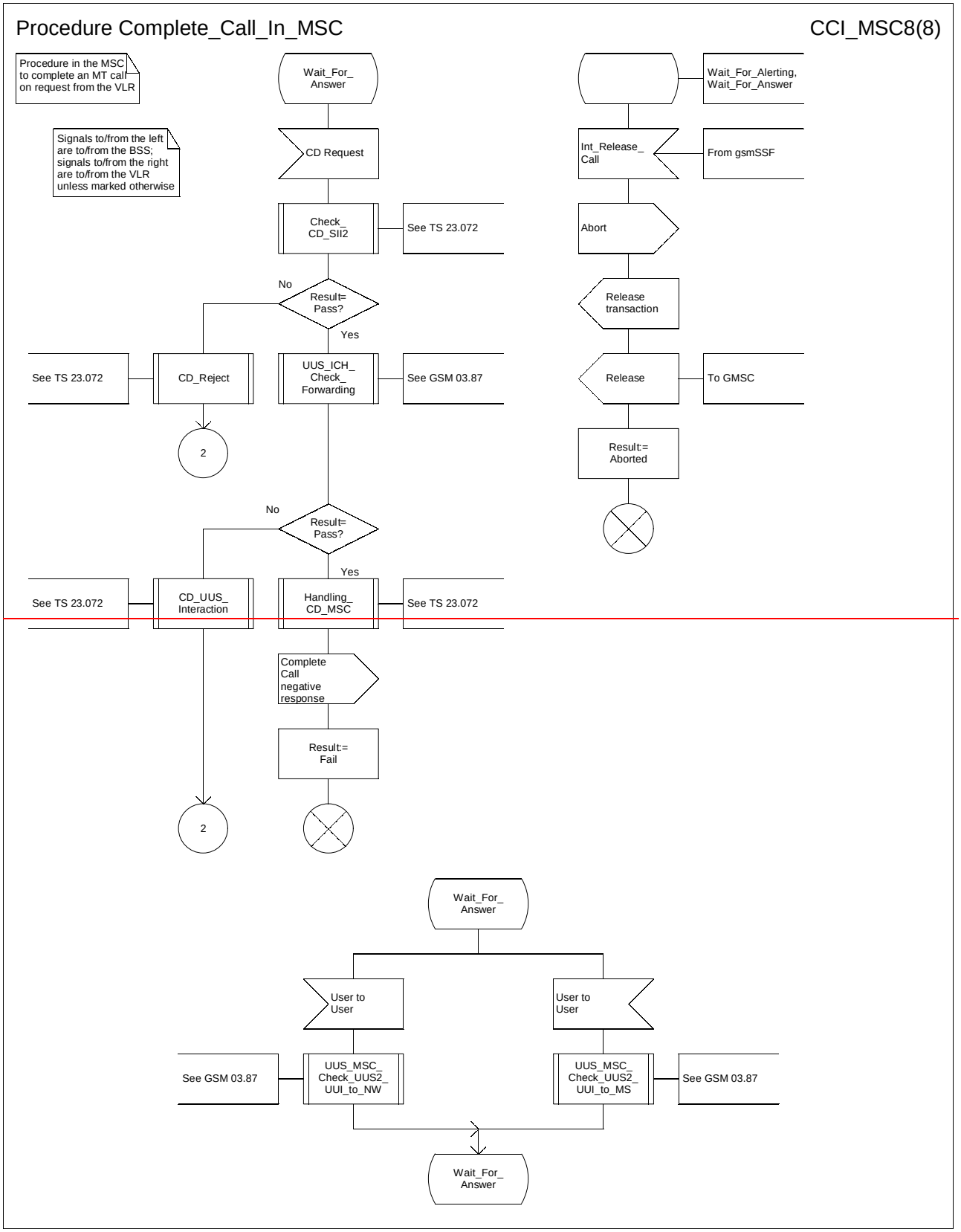


Figure 65g: Procedure Complete_Call_In_MSC (sheet 7)


Procedure Complete_Call_In_MSC
CCI_MSC8(8)
Procedure in the MSC to complete an MT call on request from the VLR
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Wait_For_ Answer
CD Request
Check_ CD_SII2
See TS 23.072
No
Result= Pass?
Yes
See TS 23.072
CD_Reject
UUS_ICH_ Check_ Forwarding
See GSM 03.87
2
No
Result= Pass?
Yes
See TS 23.072
CD_UUS_ Interaction
Handling_ CD_MSC
See TS 23.072
Complete Call negative response
Result:= Fail
2
Wait_For_Alerting, Wait_For_Answer
Int_Release_ Call
From gsmSSF
Abort
Release transaction
Release
To GMSC
Result:= Aborted
Wait_For_ Answer
User to User
User to User
See GSM 03.87
UUS_MSC_ Check_UUS2_ UUI_to_NW
UUS_MSC_ Check_UUS2_ UUI_to_MS
See GSM 03.87
Wait_For_ Answer

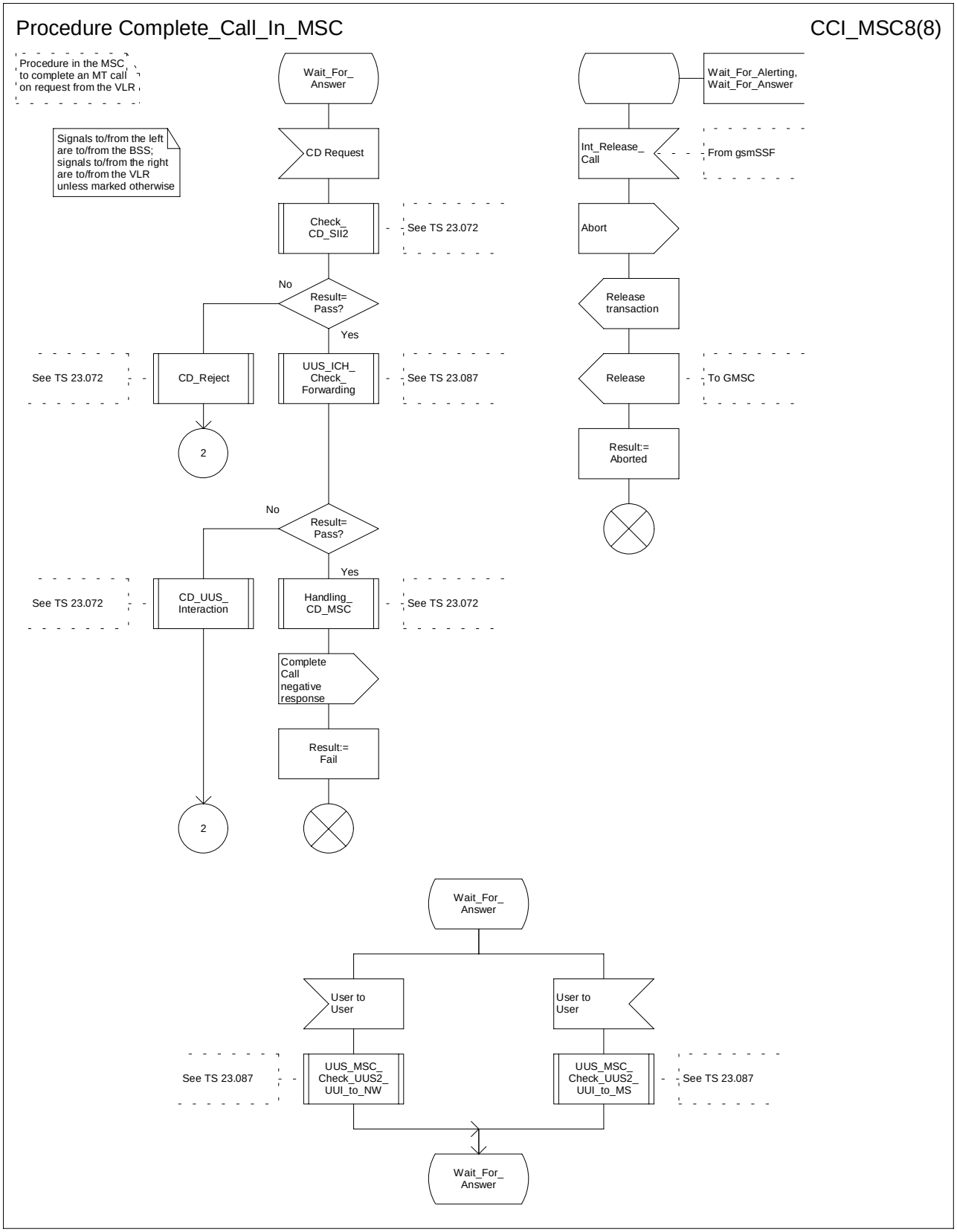
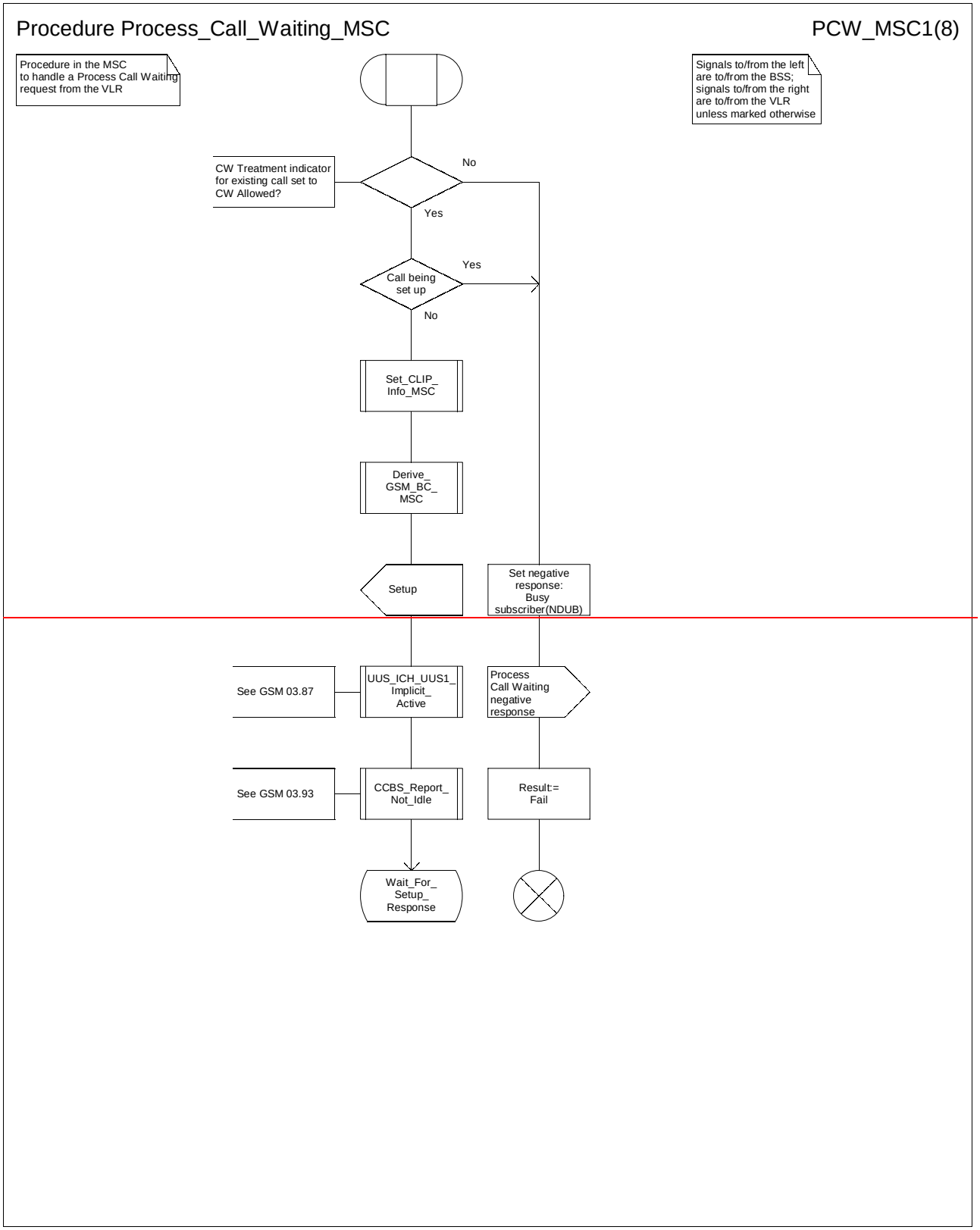


Figure 65h: Procedure Complete_Call_In_MSC (sheet 8)


Procedure Process_Call_Waiting_MSC
PCW_MSC1(8)
Procedure in the MSC to handle a Process Call Waiting request from the VLR
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
CW Treatment indicator for existing call set to CW Allowed?
No
Yes
Call being set up
Yes
No
Set_CLIP_ Info_MSC
Derive_ GSM_BC_ MSC
Setup
Set negative response: Busy subscriber(NDUB)
See GSM 03.87
UUS_ICH_UUS1_ Implicit_ Active
Process Call Waiting negative response
See GSM 03.93
CCBS_Report_ Not_Idle
Result:= Fail
Wait_For_ Setup_ Response

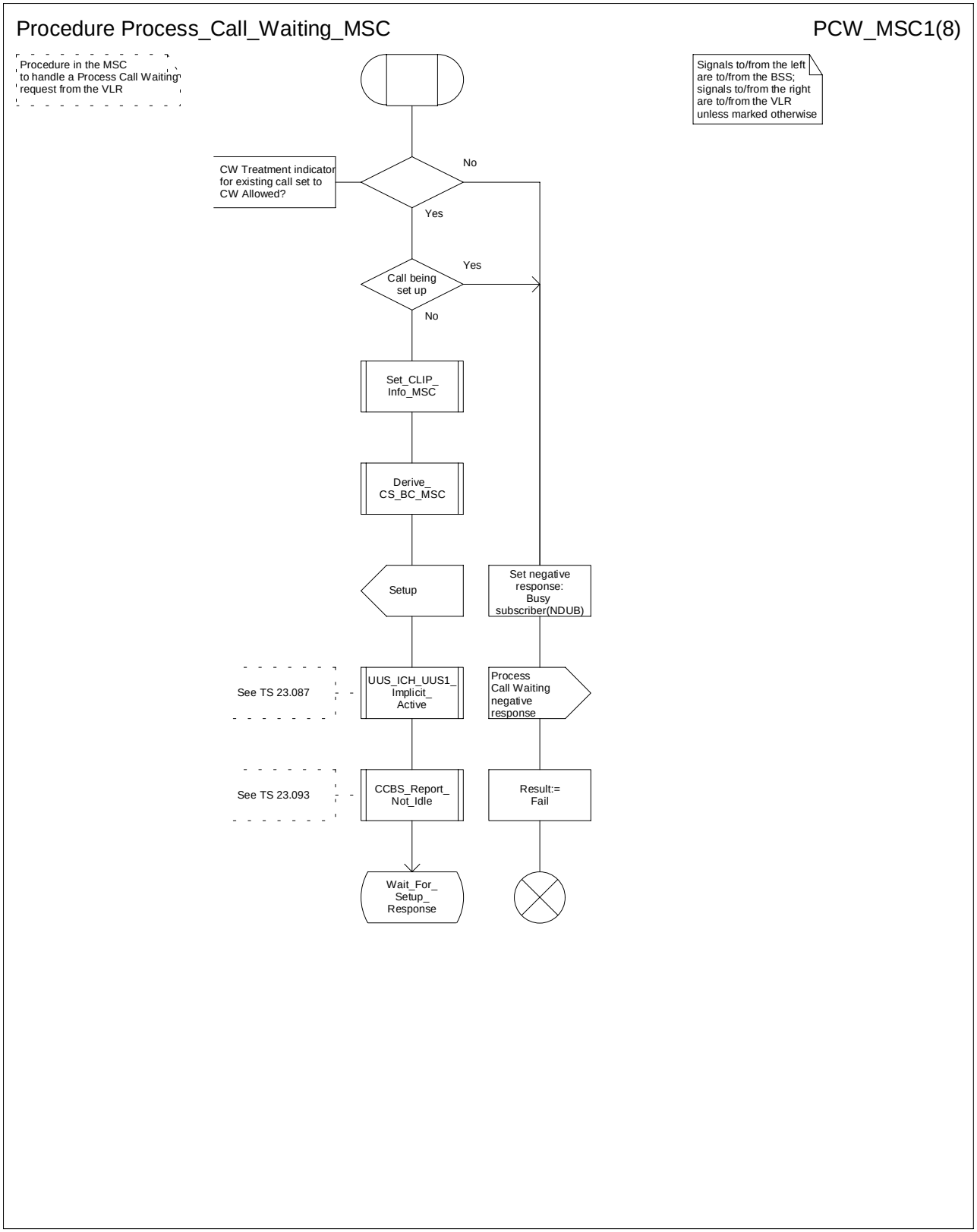
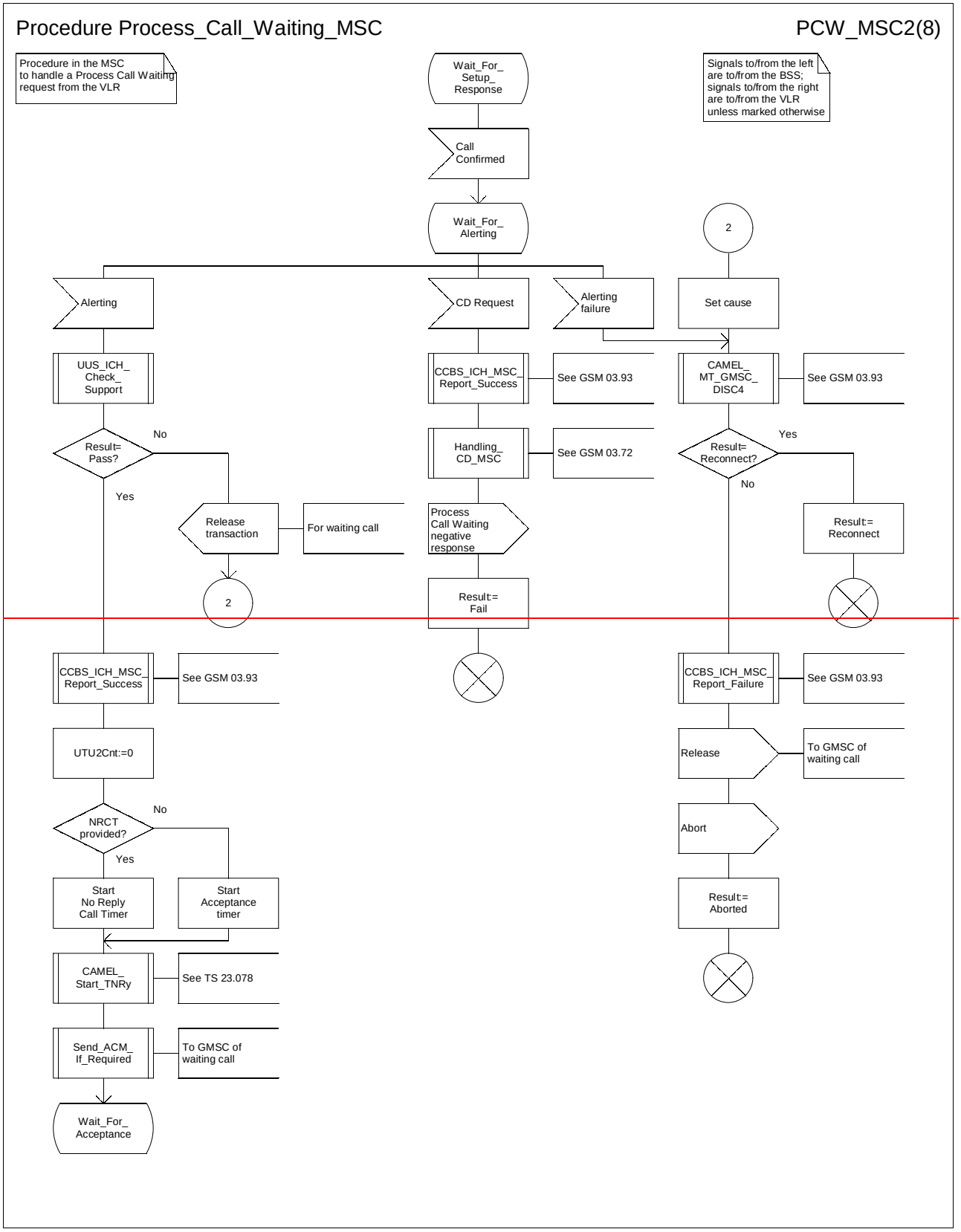


Figure 66a: Procedure Process_Call_Waiting_MSC (sheet 1)


Procedure Process_Call_Waiting_MSC
PCW_MSC2(8)
Procedure in the MSC to handle a Process Call Waiting request from the VLR
Wait_For_ Setup_ Response
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Call Confirmed
Wait_For_ Alerting
2
Alerting
CD Request
Alerting failure
Set cause
UUS_ICH_ Check_ Support
CCBS_ICH_MSC_ Report_Success
See GSM 03.93
CAMEL_ MT_GMSC_ DISC4
See GSM 03.93
Result= Pass?
No
Yes
Handling_ CD_MSC
See GSM 03.72
Result= Reconnect?
Yes
No
Release transaction
For waiting call
Process Call Waiting negative response
Result:= Reconnect
2
Result:= Fail
CCBS_ICH_MSC_ Report_Success
See GSM 03.93
CCBS_ICH_MSC_ Report_Failure
See GSM 03.93
UTU2Cnt:=0
Release
To GMSC of waiting call
NRCT provided?
No
Yes
Abort
Start No Reply Call Timer
Start Acceptance timer
Result:= Aborted
CAMEL_ Start_TNRy
See TS 23.078
Send_ACM_ If_Required
To GMSC of waiting call
Wait_For_ Acceptance

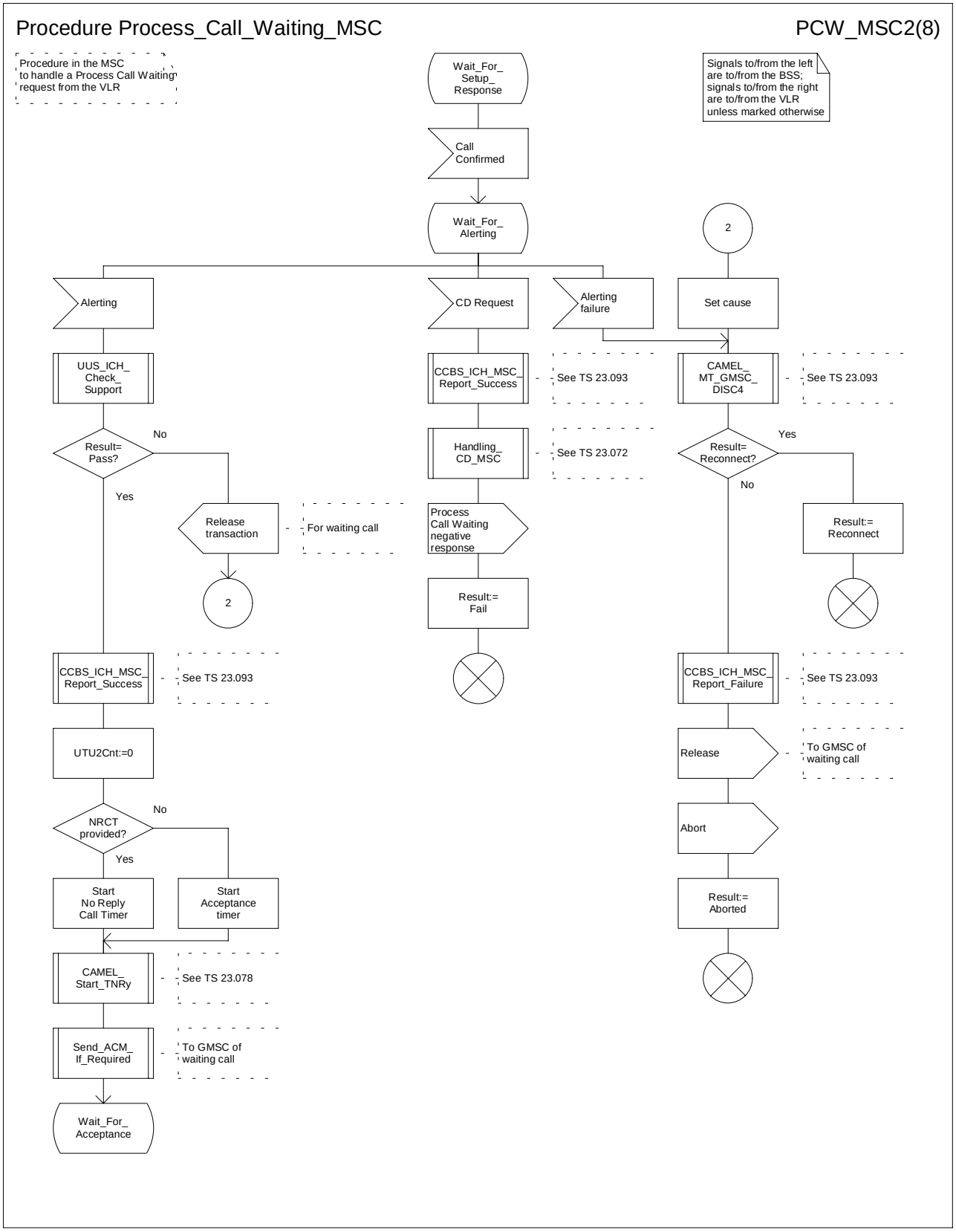
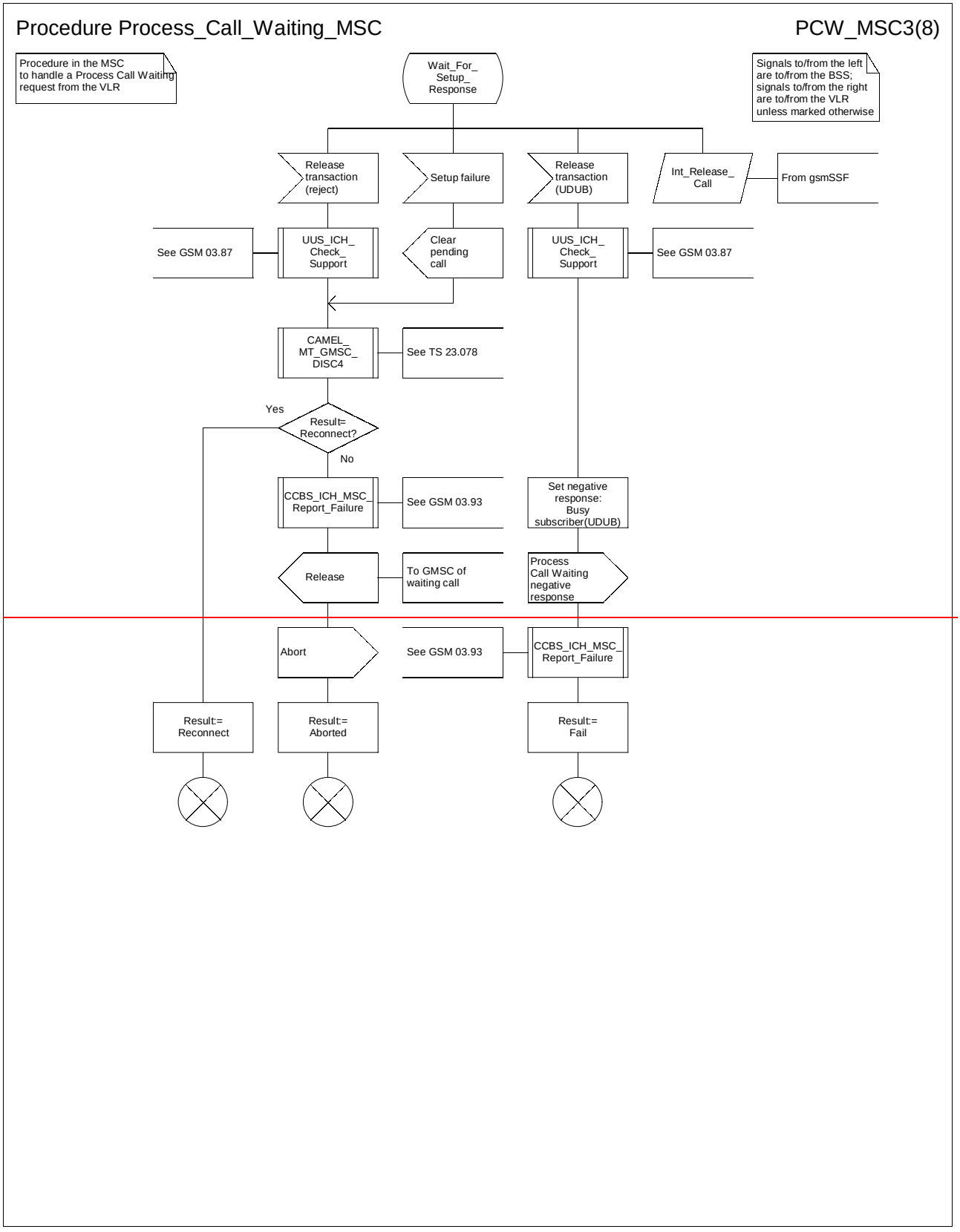


Figure 66b: Procedure Process_Call_Waiting_MSC (sheet 2)


Procedure Process_Call_Waiting_MSC
PCW_MSC3(8)
Procedure in the MSC to handle a Process Call Waiting request from the VLR
Wait_For_ Setup_ Response
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Release transaction (reject)
Setup failure
Release transaction (UDUB)
Int_Release_ Call
From gsmSSF
See GSM 03.87
UUS_ICH_ Check_ Support
Clear pending call
UUS_ICH_ Check_ Support
See GSM 03.87
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
Yes
Result= Reconnect?
No
CCBS_ICH_MSC_ Report_Failure
See GSM 03.93
Set negative response: Busy subscriber(UDUB)
Release
To GMSC of waiting call
Process Call Waiting negative response
Abort
See GSM 03.93
CCBS_ICH_MSC_ Report_Failure
Result= Reconnect
Result= Aborted
Result= Fail

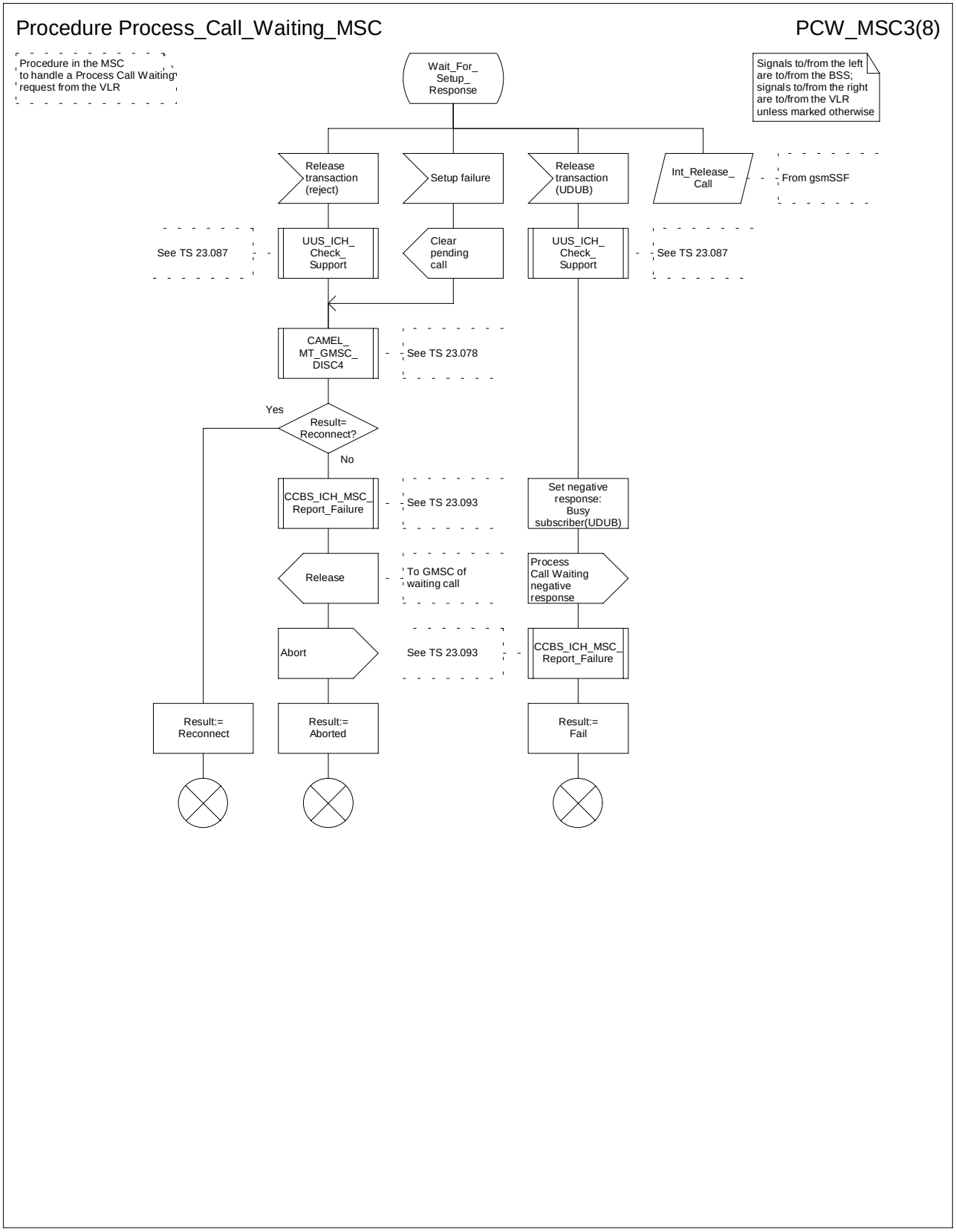
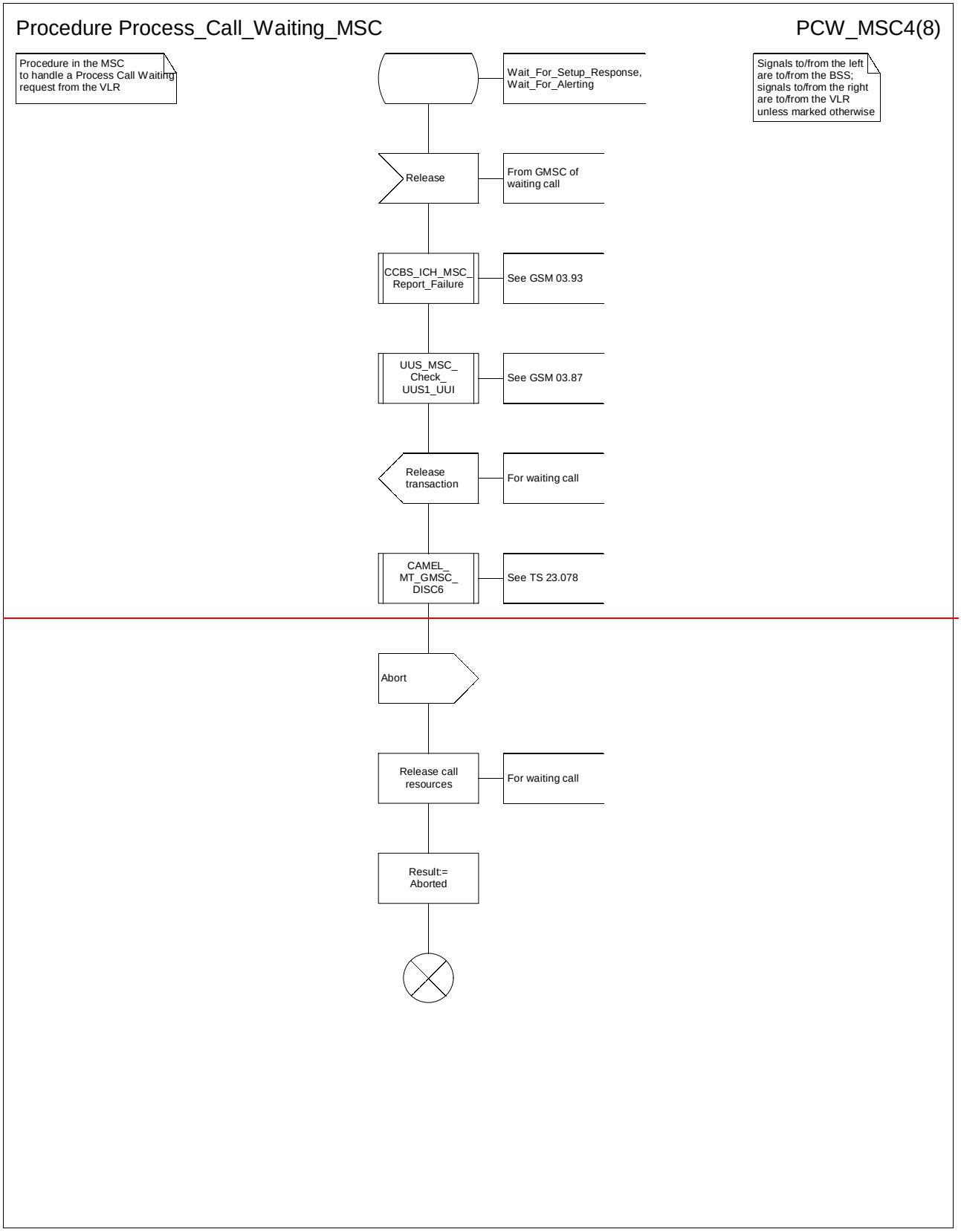


Figure 66c: Procedure Process_Call_Waiting_MSC(sheet 3)


Procedure Process_Call_Waiting_MSC
PCW_MSC4(8)
Procedure in the MSC to handle a Process Call Waiting request from the VLR
Wait_For_Setup_Response, Wait_For_Alerting
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Release
From GMSC of waiting call
CCBS_ICH_MSC_ Report_Failure
See GSM 03.93
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
Release transaction
For waiting call
CAMEL_ MT_GMSC_ DISC6
See TS 23.078
Abort
Release call resources
For waiting call
Result:= Aborted

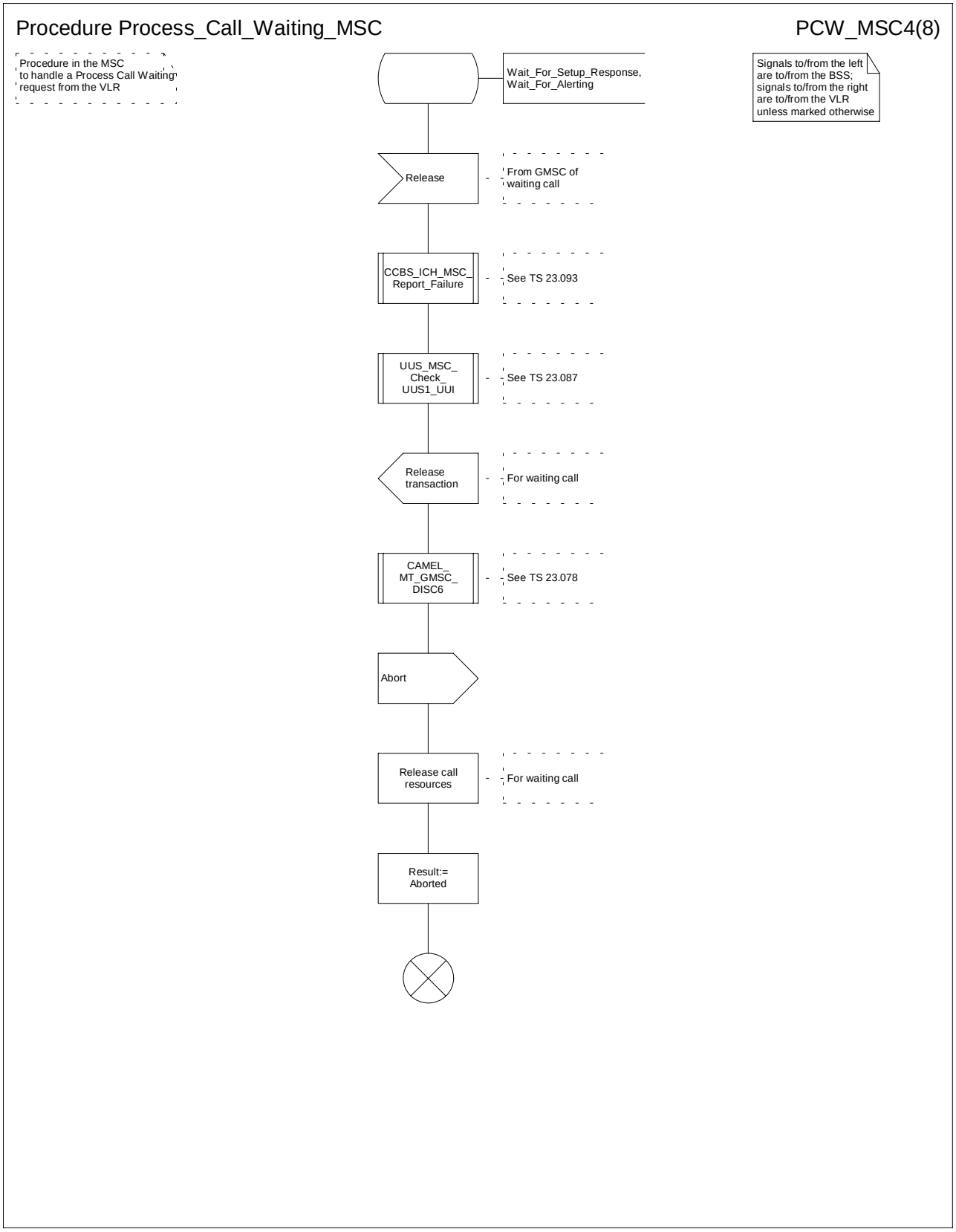
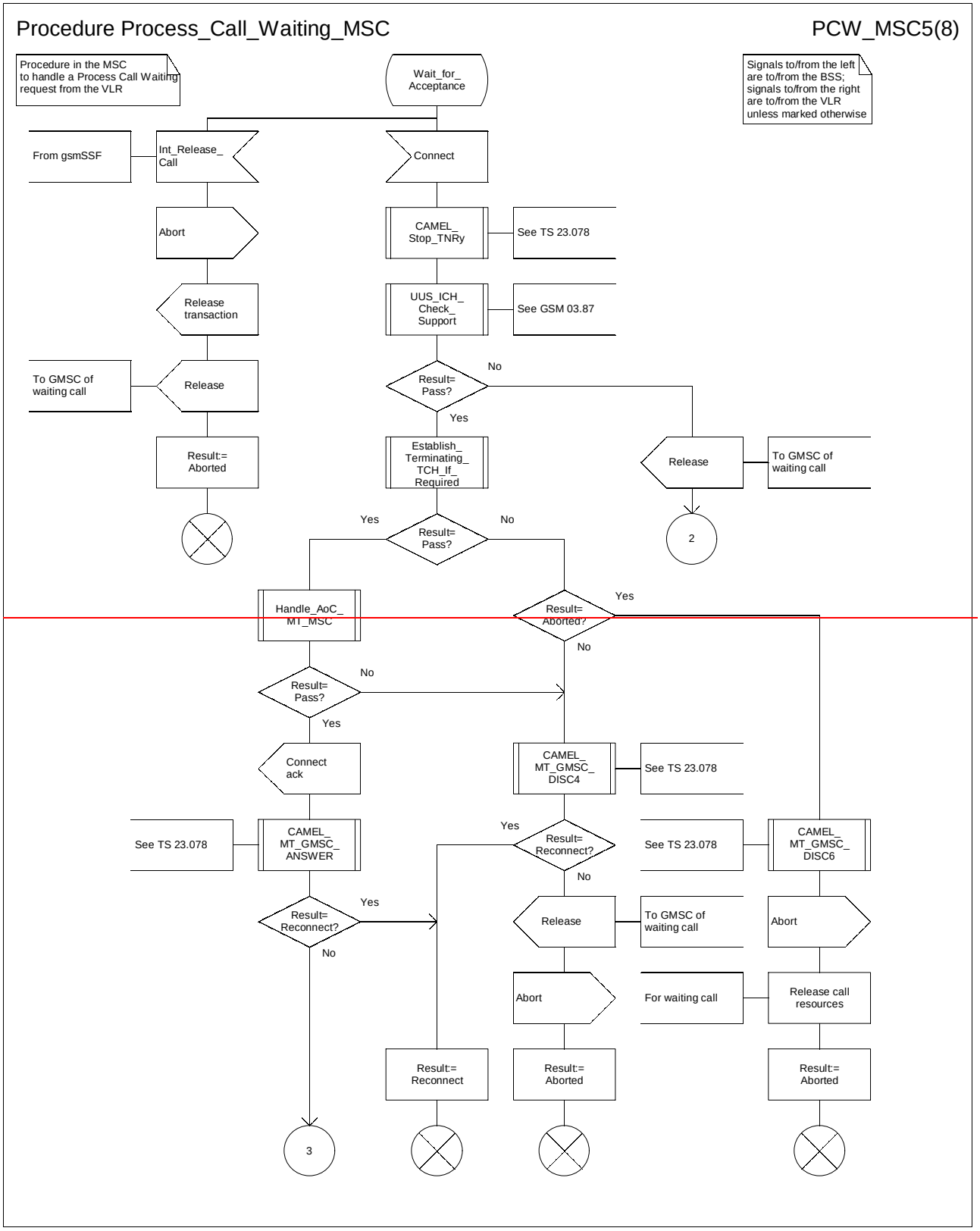


Figure 66d: Procedure Process_Call_Waiting_MSC(sheet 4)


Procedure Process_Call_Waiting_MSC
PCW_MSC5(8)
Procedure in the MSC to handle a Process Call Waiting request from the VLR
Wait_for_ Acceptance
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
From gsmSSF
Int_Release_ Call
Connect
Abort
CAMEL_ Stop_TNRy
See TS 23.078
Release transaction
UUS_ICH_ Check_ Support
See GSM 03.87
To GMSC of waiting call
Release
Result= Pass?
No
Yes
Result:= Aborted
Establish_ Terminating_ TCH_If_ Required
Release
To GMSC of waiting call
2
Yes
Result= Pass?
No
Handle_AoC_ MT_MSC
Result= Aborted?
Yes
No
Result= Pass?
No
Yes
Connect ack
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
See TS 23.078
CAMEL_ MT_GMSC_ ANSWER
Yes
Result= Reconnect?
See TS 23.078
CAMEL_ MT_GMSC_ DISC6
No
Result= Reconnect?
Yes
No
Release
To GMSC of waiting call
Abort
Abort
For waiting call
Release call resources
Result:= Reconnect
Result:= Aborted
Result:= Aborted
3

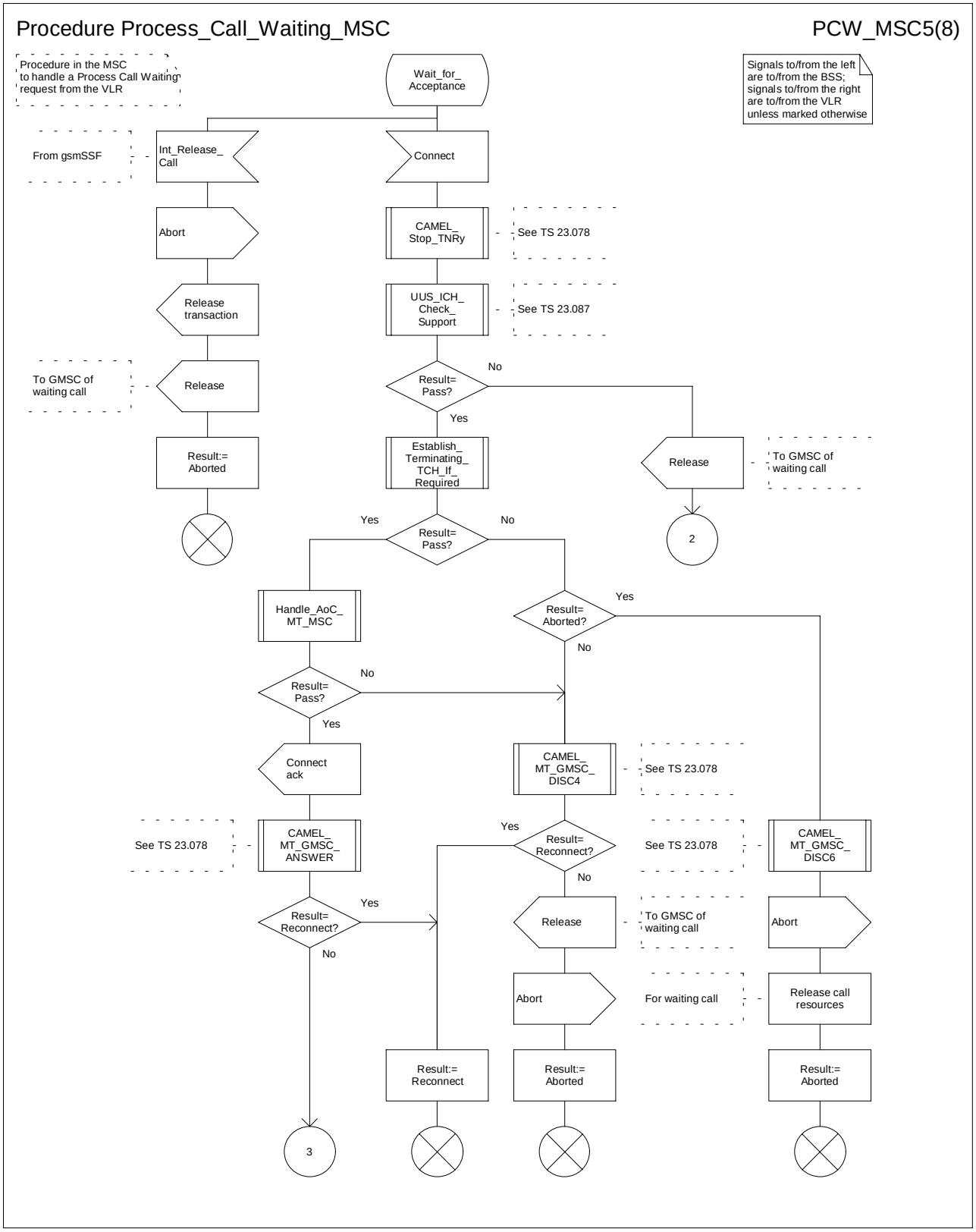


Figure 66e: Procedure Process_Call_Waiting_MSC(sheet 5)

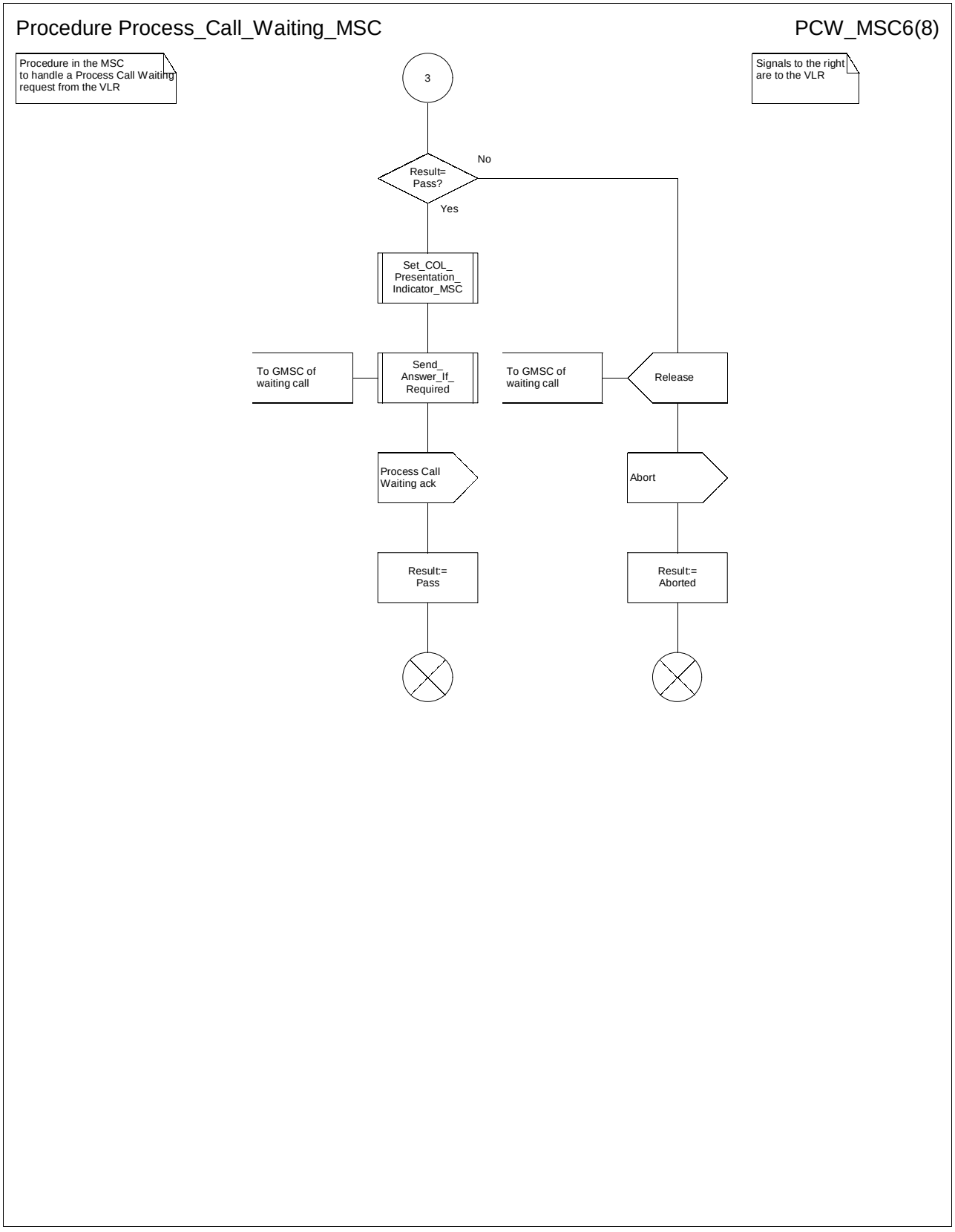
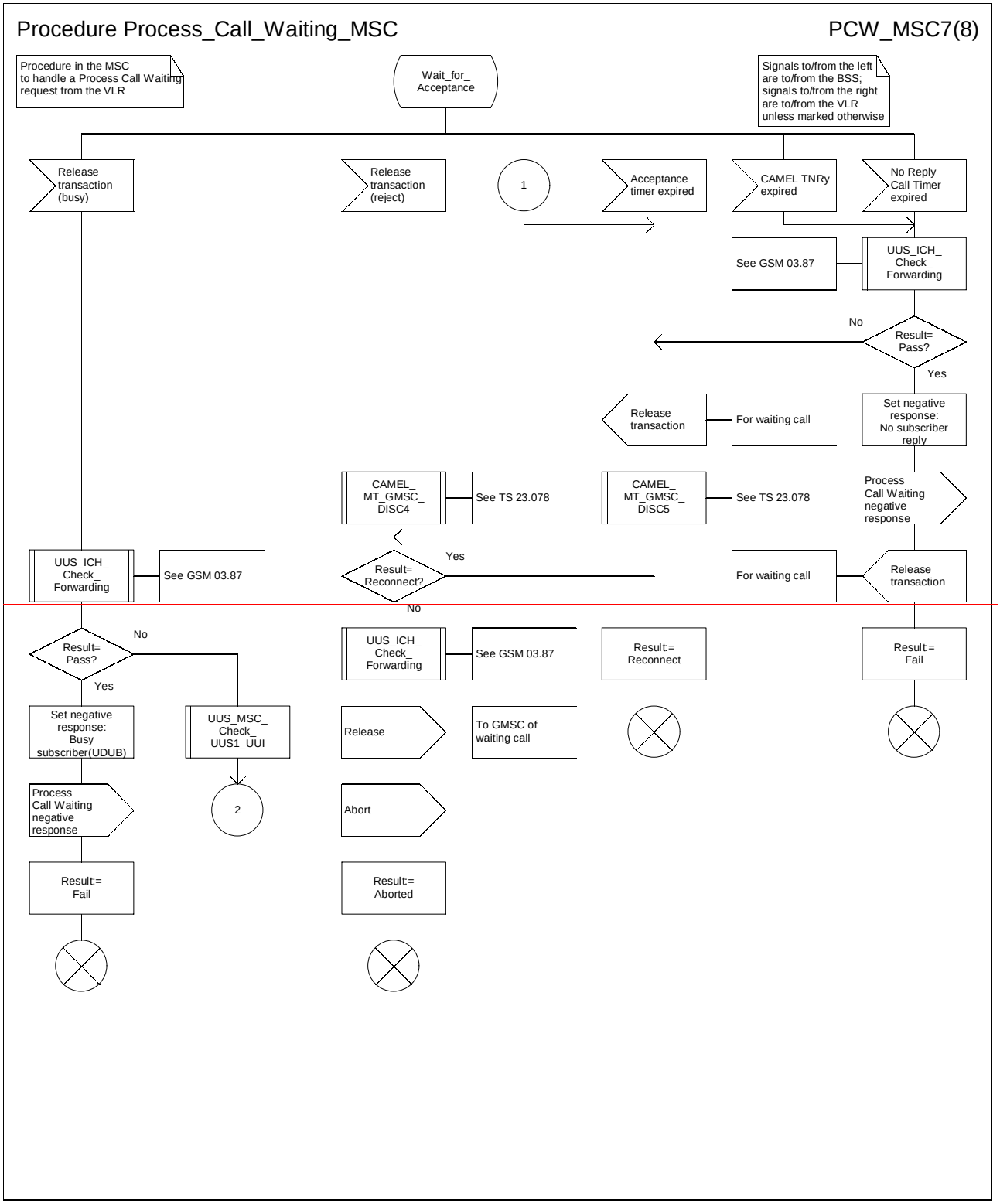


Figure 66f: Procedure Process_Call_Waiting_MSC(sheet 6)


Procedure Process_Call_Waiting_MSC
PCW_MSC7(8)
Procedure in the MSC to handle a Process Call Waiting request from the VLR
Wait_for_ Acceptance
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Release transaction (busy)
Release transaction (reject)
1
Acceptance timer expired
CAMEL TNRy expired
No Reply Call Timer expired
See GSM 03.87
UUS_ICH_ Check_ Forwarding
No
Result= Pass?
Yes
Release transaction
For waiting call
Set negative response: No subscriber reply
CAMEL_ MT_GMSC_ DISC4
See TS 23.078
CAMEL_ MT_GMSC_ DISC5
See TS 23.078
Process Call Waiting negative response
UUS_ICH_ Check_ Forwarding
See GSM 03.87
Result= Reconnect?
Yes
No
For waiting call
Release transaction
Result= Pass?
No
Yes
UUS_ICH_ Check_ Forwarding
See GSM 03.87
Result= Reconnect
Result= Fail
Set negative response: Busy subscriber(UDUB)
UUS_MSC_ Check_ UUS1_UUI
Release
To GMSC of waiting call
Process Call Waiting negative response
2
Abort
Result= Fail
Result= Aborted

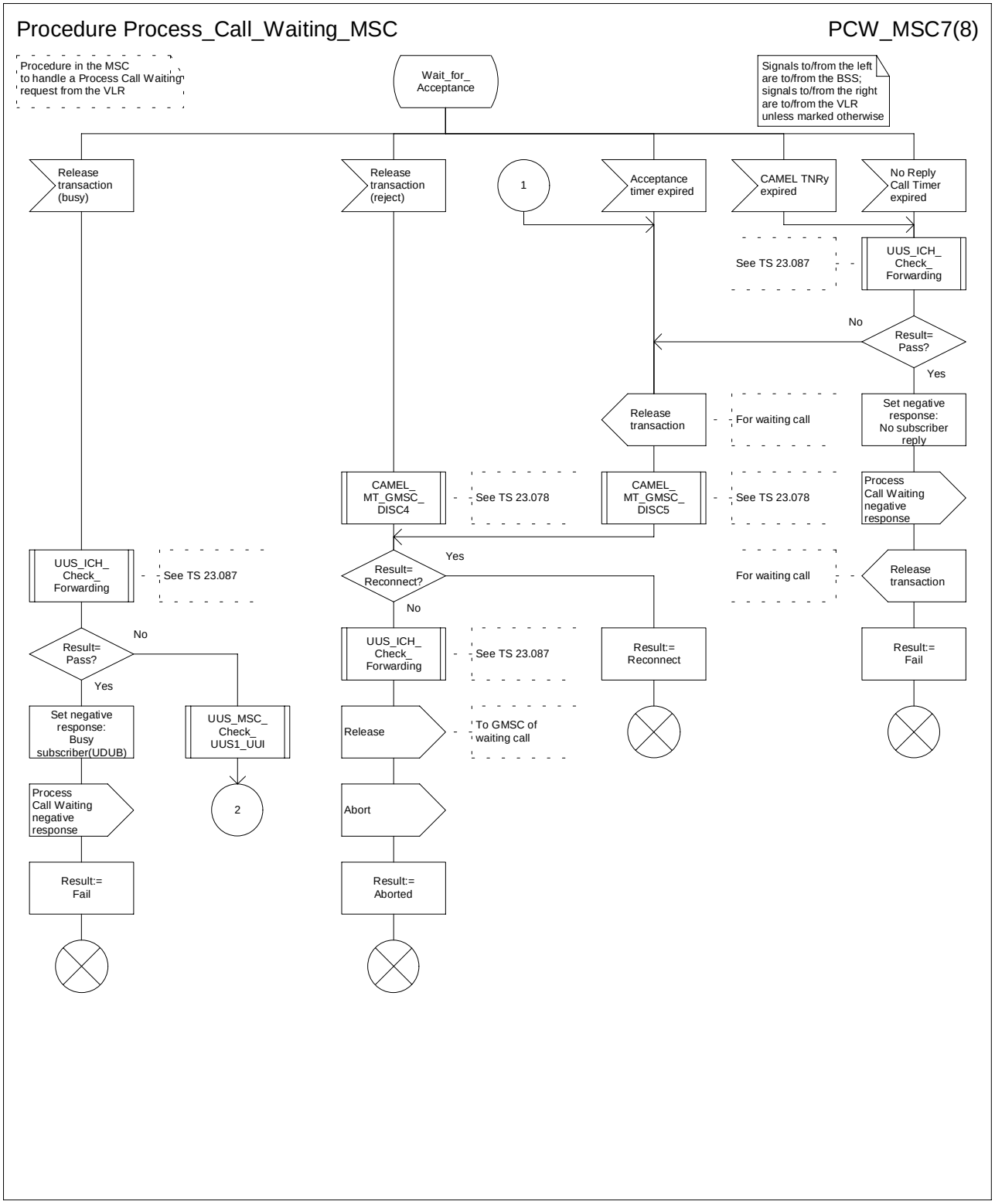
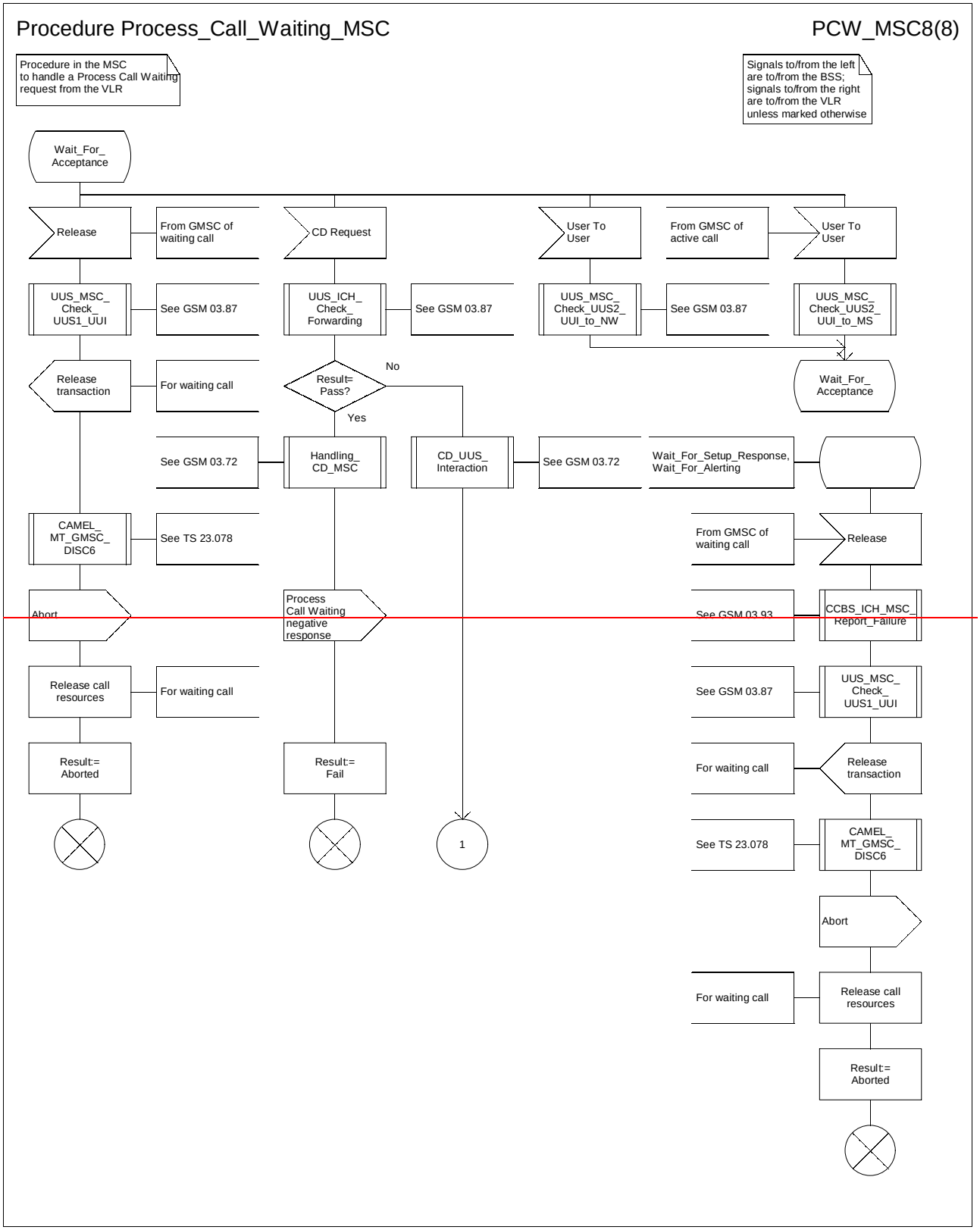


Figure 66g: Procedure Process_Call_Waiting_MSC(sheet 7)


Procedure Process_Call_Waiting_MSC
PCW_MSC8(8)
Procedure in the MSC to handle a Process Call Waiting request from the VLR
Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR unless marked otherwise
Wait_For_ Acceptance
Release
From GMSC of waiting call
CD Request
User To User
From GMSC of active call
User To User
UUS_MSC_ Check_ UUS1_UUI
See GSM 03.87
UUS_ICH_ Check_ Forwarding
See GSM 03.87
UUS_MSC_ Check_UUS2_ UUI_to_NW
See GSM 03.87
UUS_MSC_ Check_UUS2_ UUI_to_MS
Release transaction
For waiting call
Result= Pass?
No
Yes
Wait_For_ Acceptance
See GSM 03.72
Handling_ CD_MSC
CD_UUS_ Interaction
See GSM 03.72
Wait_For_Setup_Response, Wait_For_Alerting
CAMEL_ MT_GMSC_ DISC6
See TS 23.078
From GMSC of waiting call
Release
Abort
Process Call Waiting negative response
See GSM 03.93
CCBS_ICH_MSC_ Report_Failure
Release call resources
For waiting call
See GSM 03.87
UUS_MSC_ Check_ UUS1_UUI
Result:= Aborted
Result:= Fail
1
For waiting call
Release transaction
See TS 23.078
CAMEL_ MT_GMSC_ DISC6
Abort
For waiting call
Release call resources
Result:= Aborted

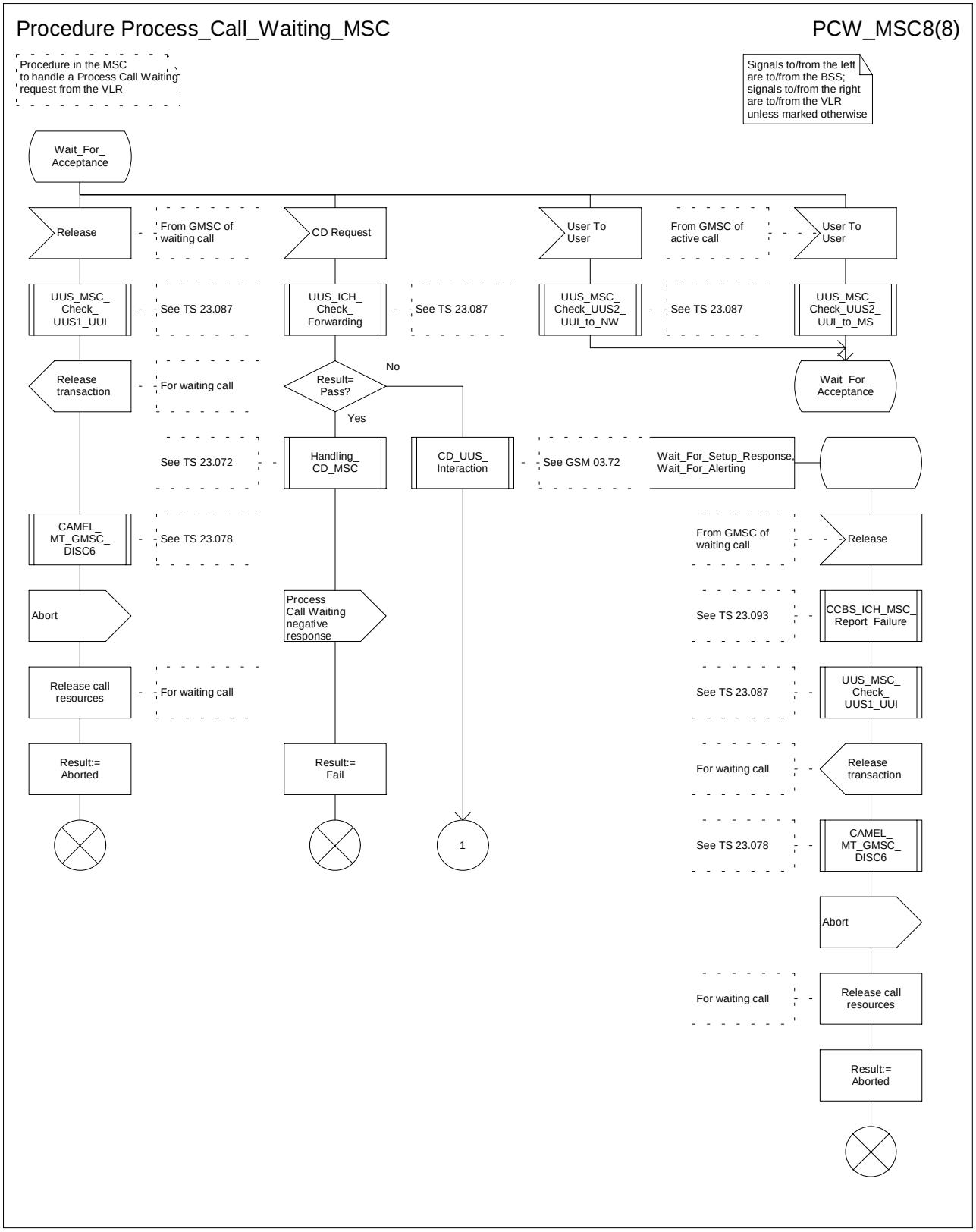


Figure 66h: Procedure Process_Call_Waiting_MSC(sheet 8)

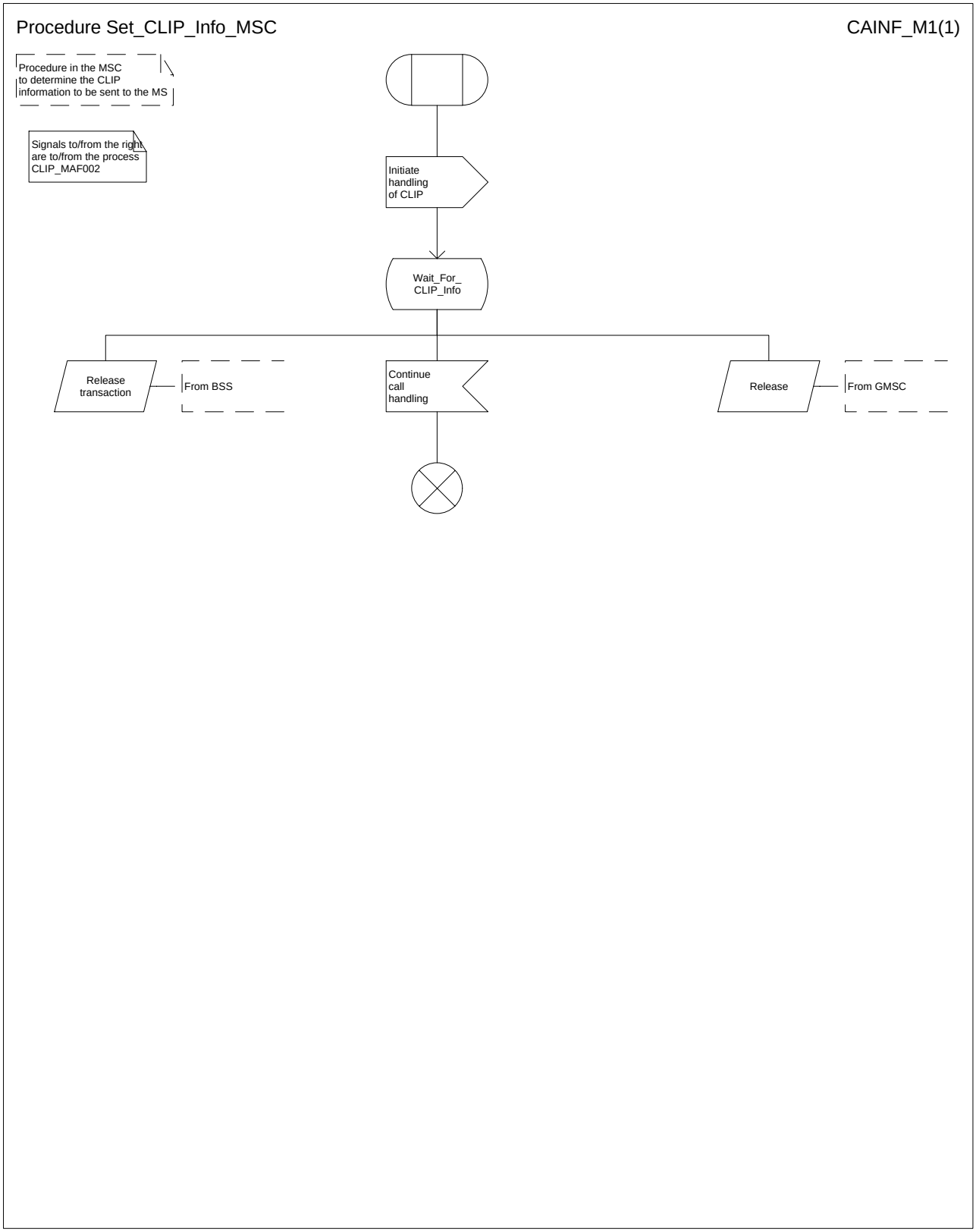
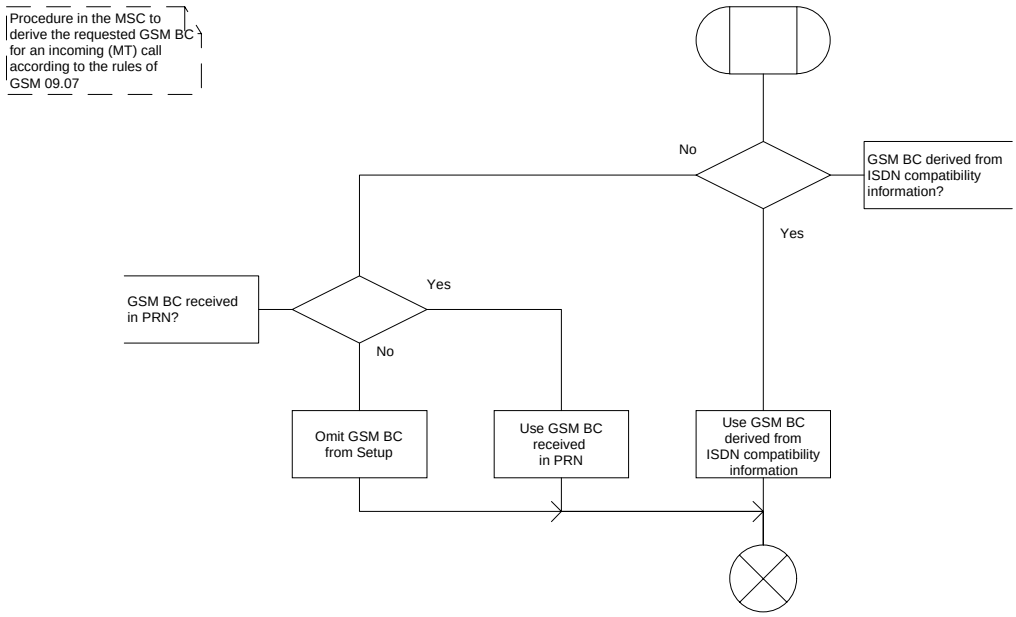


Figure 67: Procedure Set_CLIP_Info_MSC

Procedure Derive_GSM_BC_MSC DRBC_M1(1)



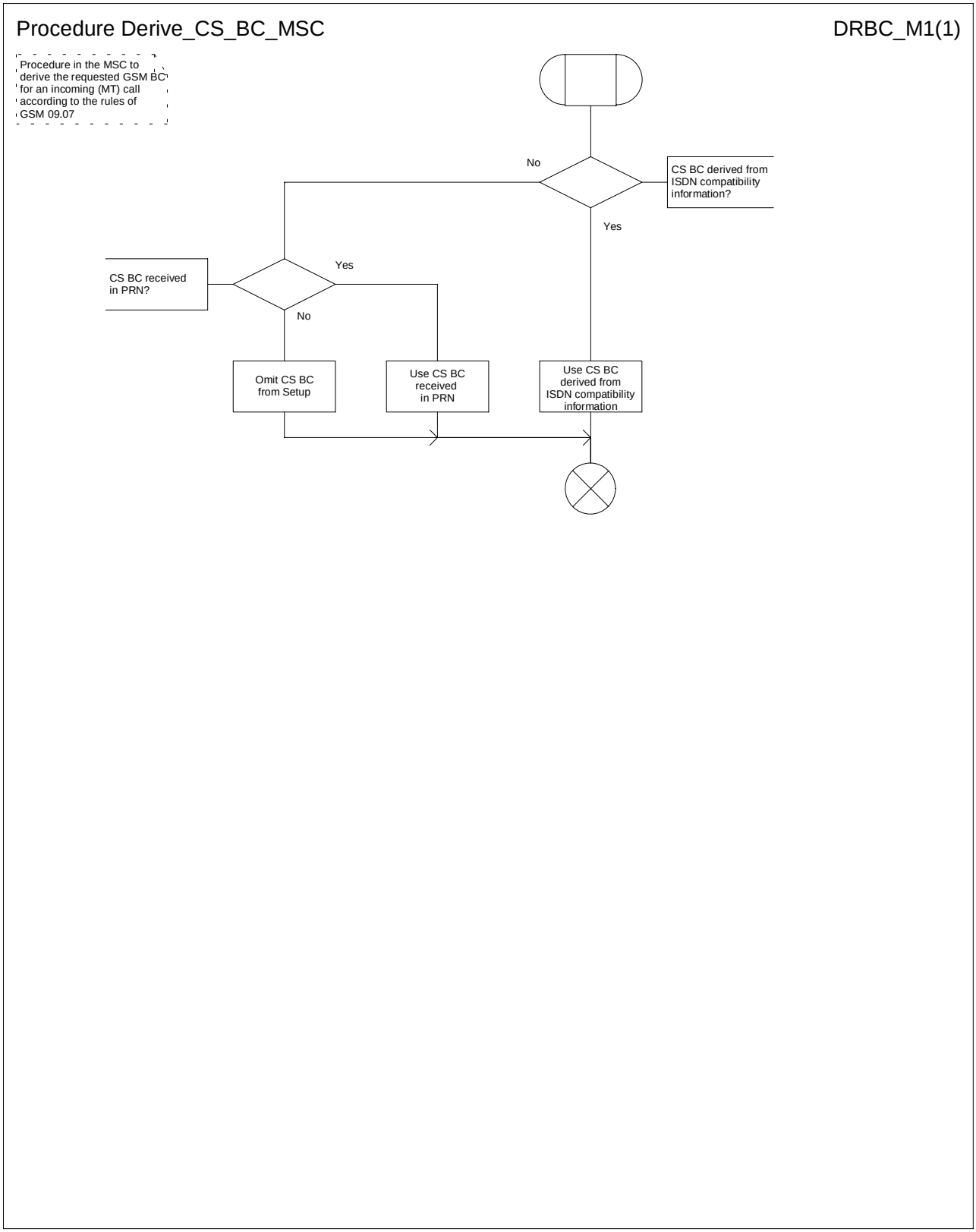


Figure 68: Derive_~~G~~CS~~M~~_BC_MSC

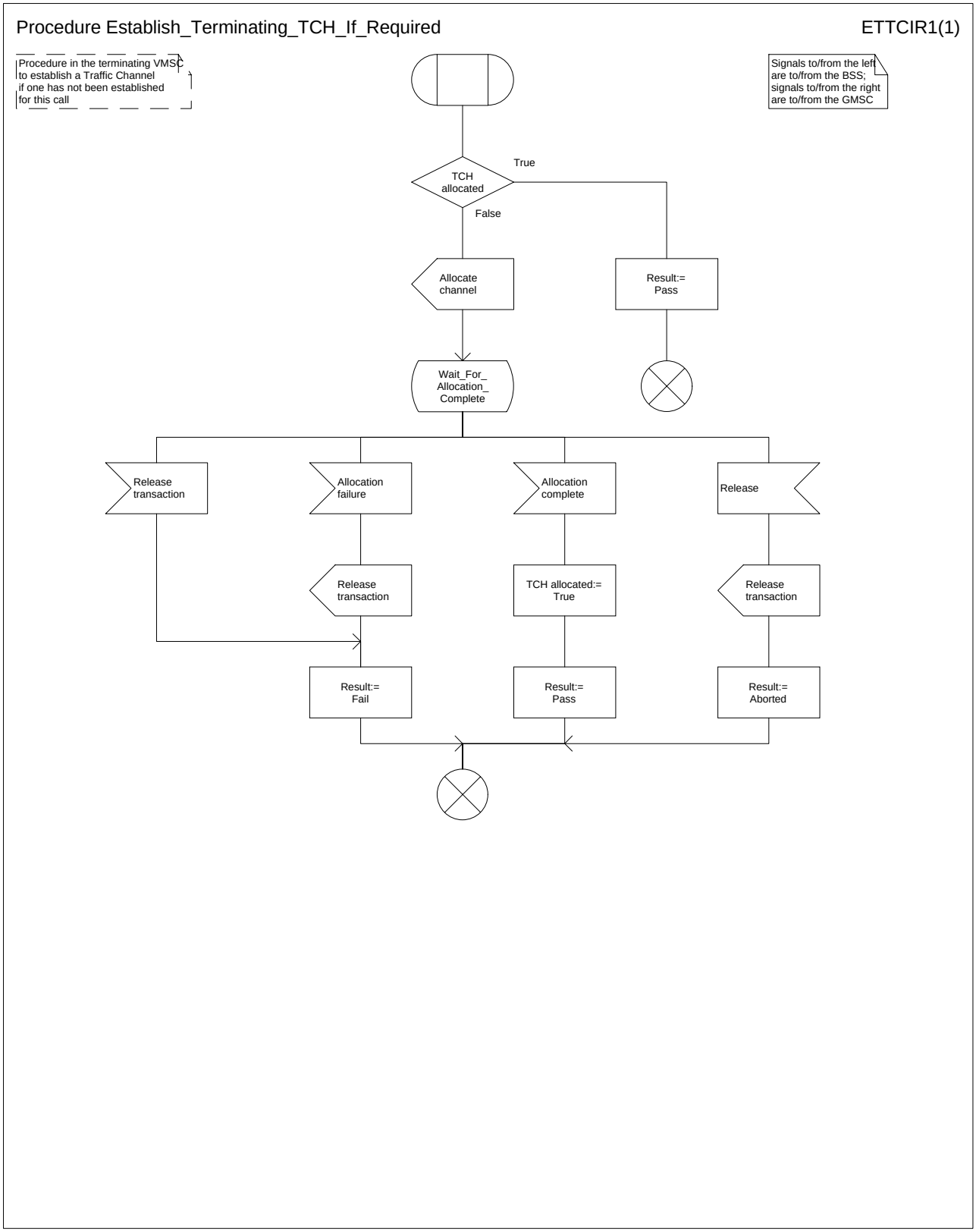


Figure 69: Procedure Establish_Terminating_TCH_If_Required

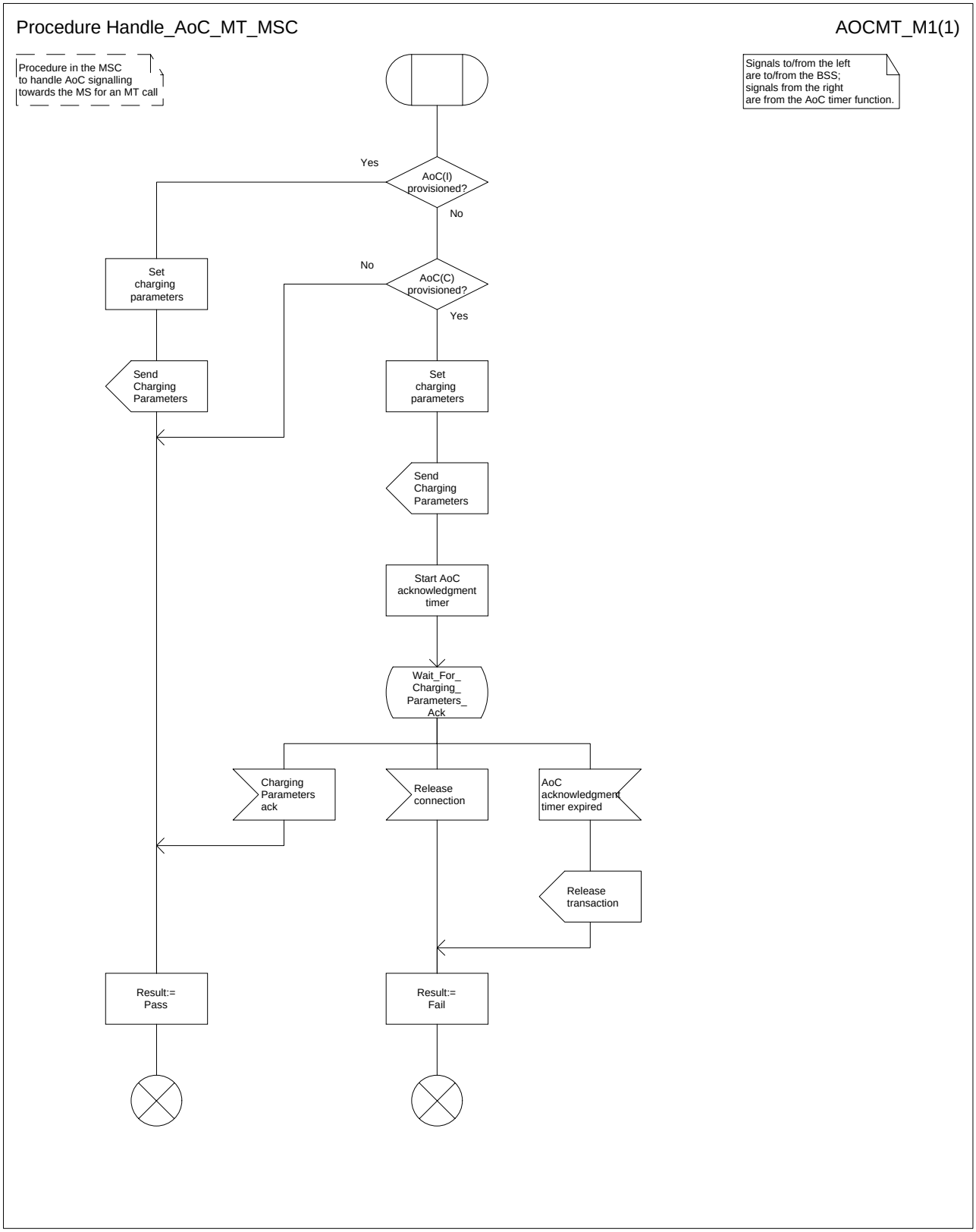


Figure 70: Procedure Handle_AoC_MT_MSC

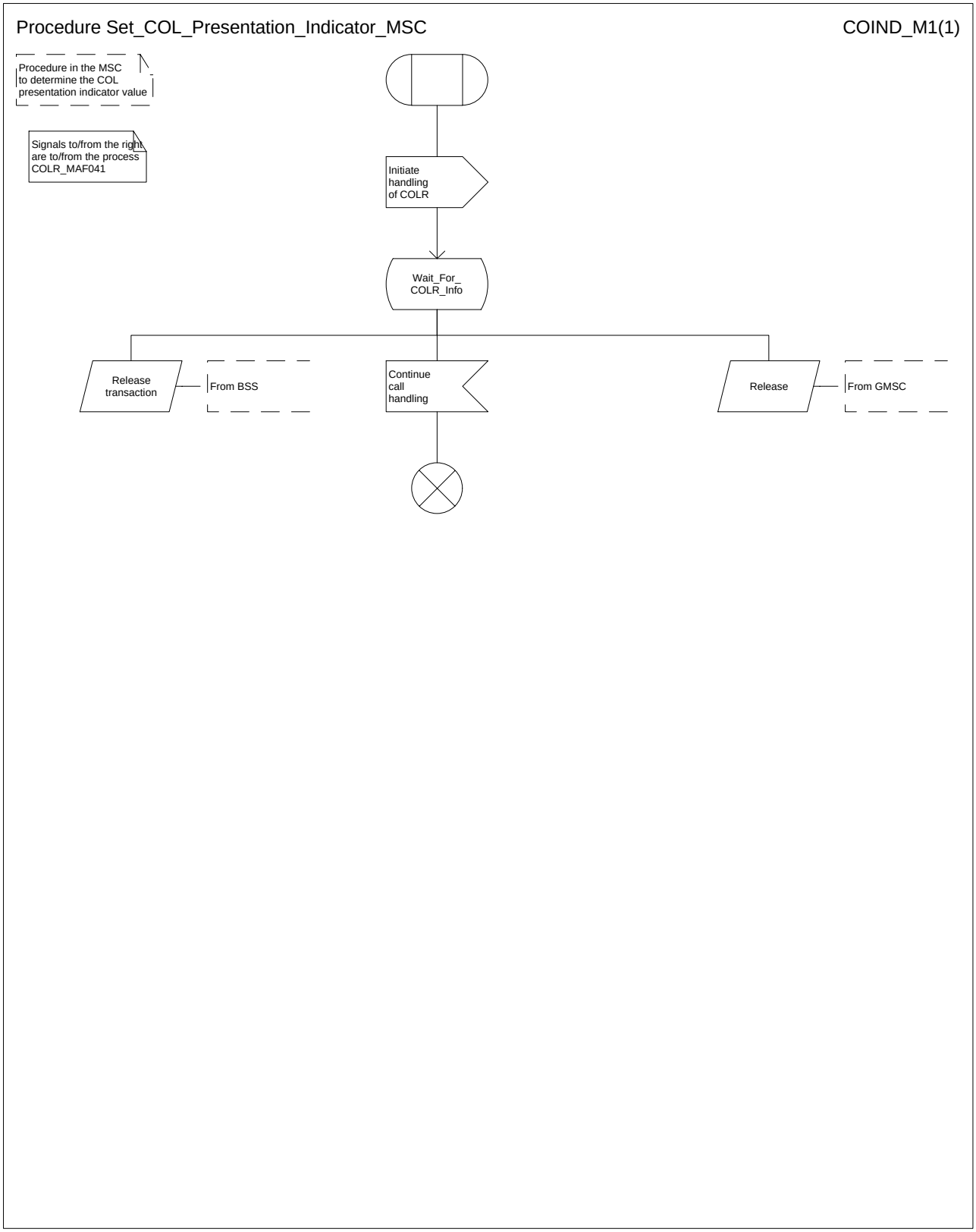


Figure 71: Procedure Set_COL_Presentation_Indicator MSC

7.3.2 Functional requirements of VLR

7.3.2.1 Process ICH_VLR

Sheet 1: if the MSRN received in the Send Info For Incoming Call is not allocated or there is no IMSI record for the IMSI identified by the MSRN, this is treated as an unknown MSRN.

Sheet 1: the procedure CAMEL_ICH_VLR is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [32]. If the VLR does not support CAMEL phase 3, processing continues from the "No" exit of the test "Result=CAMEL Active?".

Sheet 1: the procedure CCBS_ICH_Set_CCBS_Call_Indicator is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 1, sheet 2, sheet 4: the procedure CCBS_ICH_VLR_Report_Failure is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 1, sheet 3: the procedure CCBS_ICH_Report_Not_Reachable is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 2: this process communicates with the matching instance of the process PRN_VLR, which is linked by the MSRN.

Sheet 2: the test "Paging via SGSN possible" takes the "yes" exit if:

- the Gs interface is implemented; and
- there is an association established for the MS between the MSC/VLR and the SGSN.

Sheet 3: the test "NDUB?" takes the "Yes" exit if the Page MS negative response or the Search for MS negative response had the value Busy Subscriber (NDUB).

Sheet 3: the procedure Get_CW_Subscription_Info_VLR is specific to Call Waiting. If the VLR does not support Call Waiting, processing continues from the "No" exit of the test "CW available?".

Sheet 3: the VLR uses the basic service returned in the Page MS negative response or the Search for MS negative response Busy Subscriber (More calls possible) to determine whether call waiting is available.

Sheet 3: the procedure Get_LI_Subscription_Info_MT_VLR is specific to CLIP and COLR. If the VLR supports neither CLIP nor COLR, the procedure call is omitted.

Sheet3: the procedure Get_AoC_Subscription_Info_VLR is specific to AoC; it is specified in subclause 7.1.2.15.

Sheet 3 sheet 5: the procedure CLI_ICH_VLR_Add_CLI is specific to Enhanced CLI Handling. It is specified in ~~GSM~~ TS ~~03.~~23.081 [34].

Sheet 3: the procedure CCBS_ICH_Handle_NDUB is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42]. If the VLR does not support CCBS, processing continues from the "Forward" exit of the test "Result".

Sheet 3: the procedure Process_Access_Request_VLR is specified in subclause 7.1.2.2.

Sheet 3: the output signal Page MS towards the SGSN includes the Location area identity parameter.

Sheet 3: if the VLR does not support CUG, handling continues from the "No" exit of the test "CUG info present?".

Sheet 4, sheet 5: the procedure CD_Authorization is specific to Call Deflection, it is specified in ~~GSM~~ TS ~~03.~~23.072 [31]. If the VLR does not support Call Deflection, processing continues from the "Yes" exit of the test "Result=Aborted?".

Sheet 4, sheet 5: the procedure CCBS_ICH_Handle_UDUB is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 5: the test "NDUB?" is executed only if the VLR supports CCBS. If the VLR does not support CCBS, processing continues from connector 5.

Sheet 6: the procedure CCBS_ICH_Set_CCBS_Target is specific to CCBS; it is specified in ~~GSM~~ TS ~~03.~~23.093 [42].

Sheet 6: the procedure Handle_CFNRc is specified in subclause 7.2.2.11.

Sheet 7: the procedure Forward_CUG_Check is specific to CUG; it is specified in subclause 7.2.2.6. If the VLR does not support CUG, processing continues from the "Yes" exit of the test "Result=Call allowed?".

7.3.2.2 Procedure Derive_Requested_Basic_Service_VLR

If the VLR did not receive a basic service for the call in the Send Info For Incoming Call, and did not receive a GSM bearer capability in the Provide Roaming Number, it applies a default basic service according to the requirements of the operator.

7.3.2.3 Procedure Search_For_MS_VLR

The test "Paging via SGSN possible" takes the "yes" exit if:

- the Gs interface is implemented; and
- the VLR configuration requires paging via the SGSN during VLR restoration.

The output signal Page MS towards the SGSN omits the Location area identity parameter. It is sent to every SGSN to which the VLR is connected.

7.3.2.4 Procedure Get_CW_Subscription_Info_VLR

The VMSC may abort the transaction with the VLR while a response is awaited from the process MAF013. The message is saved for processing after return from the procedure.

7.3.2.5 Procedure Get_LI_Subscription_Info_MT_VLR

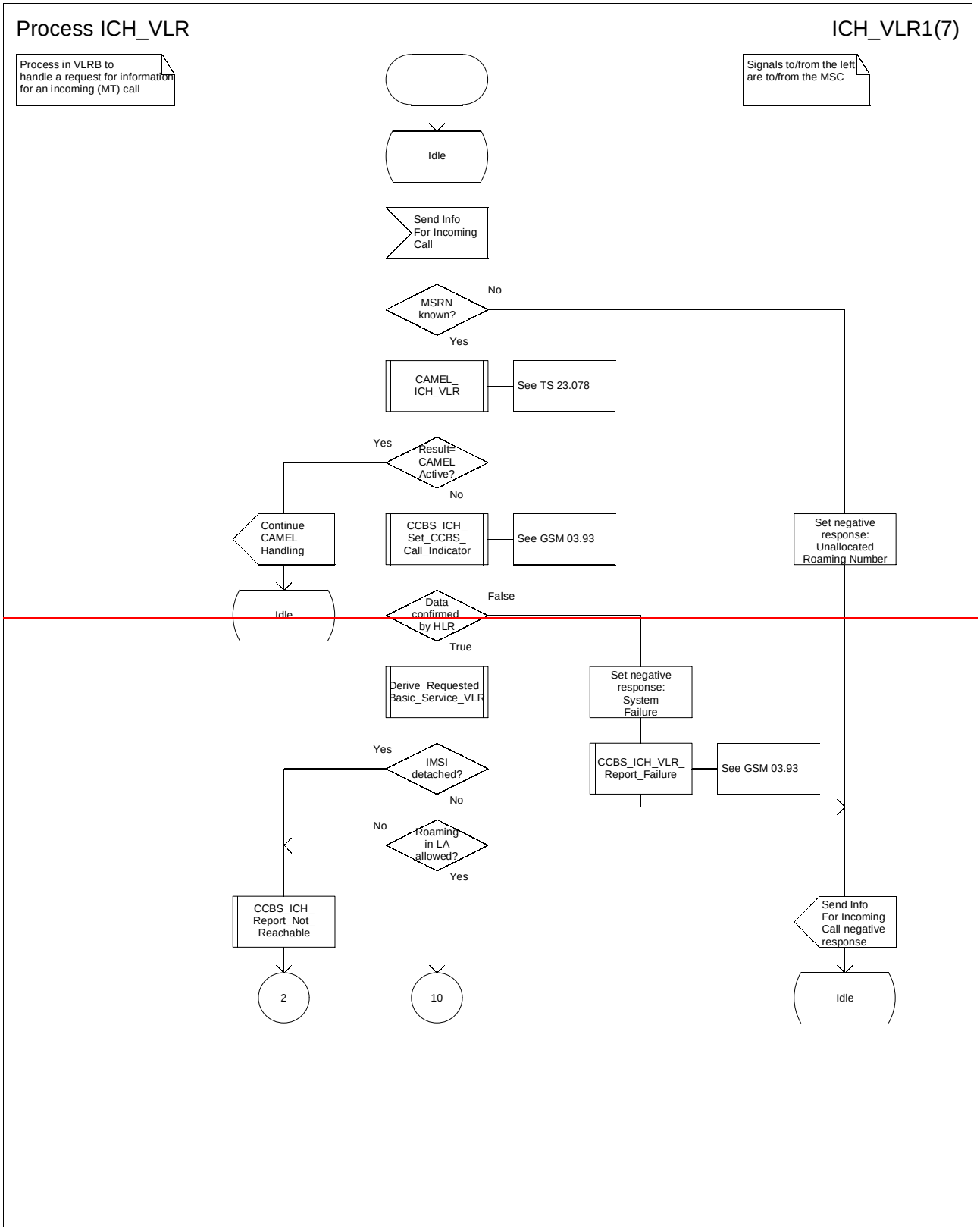
The VMSC may abort the transaction with the VLR while a response is awaited from the process CLIP_MAF001 or the process COLR_MAF040. The message is saved for processing after return from the procedure.

7.3.2.6 Procedure Handle_CFB

The test "Normal call busy" refers to the value of the indicator returned by the process MAF008.

7.3.2.7 Procedure Handle_CFNRy

The test "Normal call" refers to the value of the indicator returned by the process MAF009.


Process ICH_VLR
ICH_VLR1(7)
Process in VLRB to handle a request for information for an incoming (MT) call
Signals to/from the left are to/from the MSC
Idle
Send Info For Incoming Call
MSRN known?
No
Yes
CAMEL_ ICH_VLR
See TS 23.078
Result= CAMEL Active?
Yes
No
Continue CAMEL Handling
CCBS_ICH_ Set_CCBS_ Call_Indicator
See GSM 03.93
Set negative response: Unallocated Roaming Number
Idle
Data confirmed by HLR
False
True
Derive_Requested_ Basic_Service_VLR
Set negative response: System Failure
IMSI detached?
Yes
No
CCBS_ICH_VLR_ Report_Failure
See GSM 03.93
Roaming in LA allowed?
No
Yes
CCBS_ICH_ Report_Not_ Reachable
Send Info For Incoming Call negative response
2
10
Idle

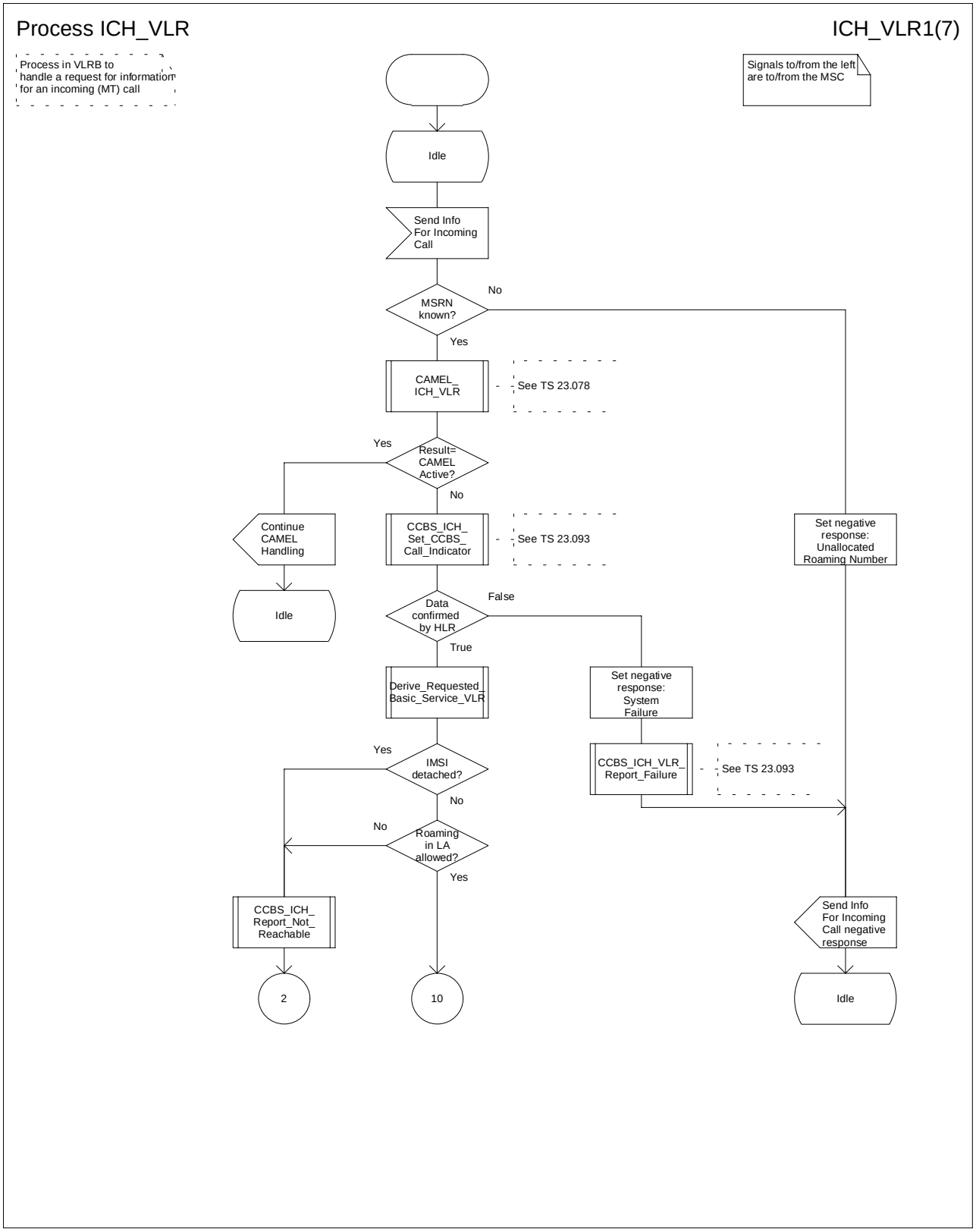
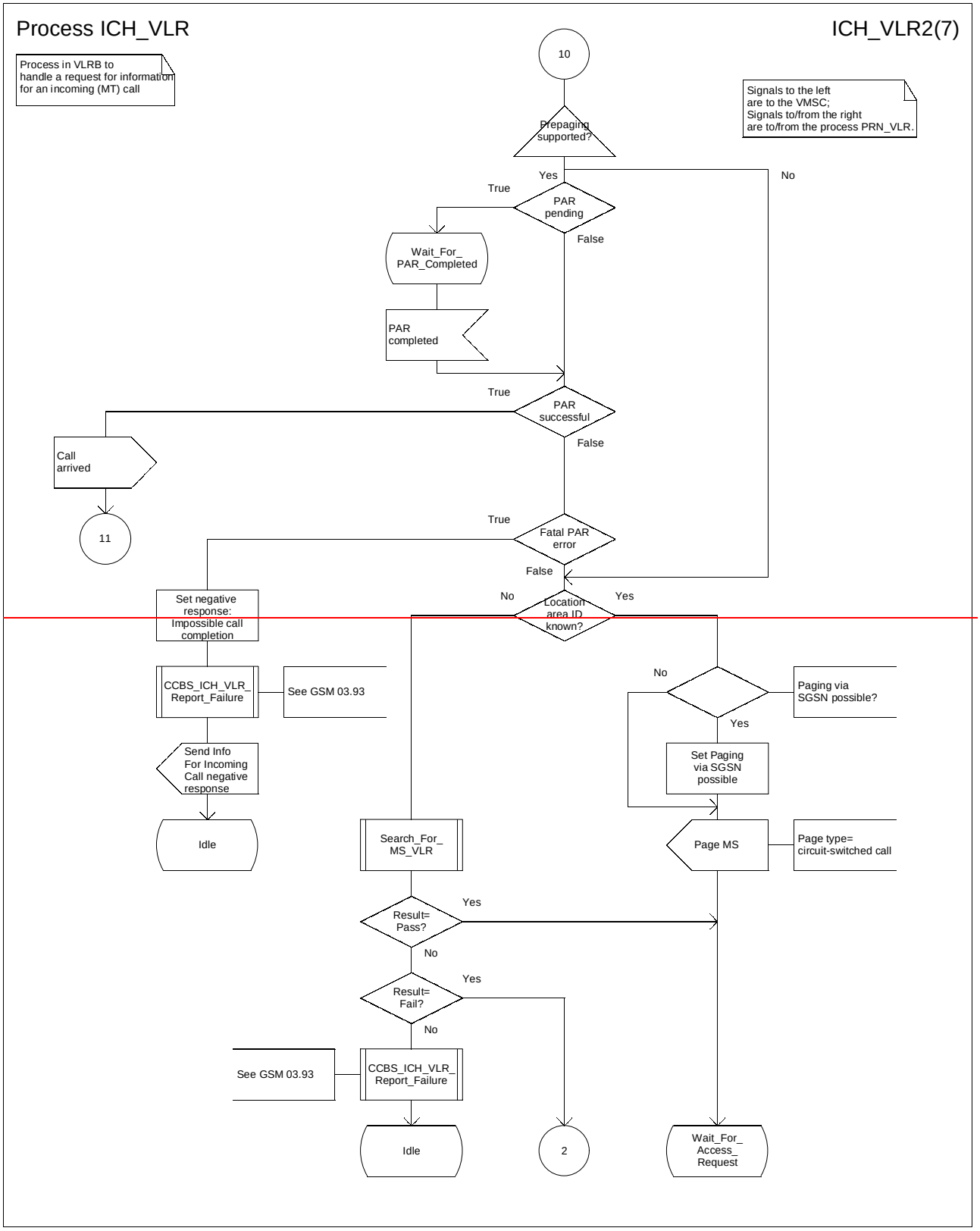


Figure 72a: Process ICH_VLR (sheet 1)


Process ICH_VLR
ICH_VLR2(7)
Process in VLRB to handle a request for information for an incoming (MT) call
Signals to the left are to the VMSC; Signals to/from the right are to/from the process PRN_VLR.
10
Prepaging supported?
Yes
No
True
PAR pending
False
Wait_For_ PAR_Completed
PAR completed
True
PAR successful
False
Call arrived
11
True
Fatal PAR error
False
No
Location area ID known?
Yes
Set negative response: Impossible call completion
CCBS_ICH_VLR_ Report_Failure
See GSM 03.93
Send Info For Incoming Call negative response
Idle
Search_For_ MS_VLR
No
Paging via SGSN possible?
Yes
Set Paging via SGSN possible
Page MS
Page type= circuit-switched call
Result= Pass?
Yes
No
Result= Fail?
Yes
No
See GSM 03.93
CCBS_ICH_VLR_ Report_Failure
Idle
2
Wait_For_ Access_ Request

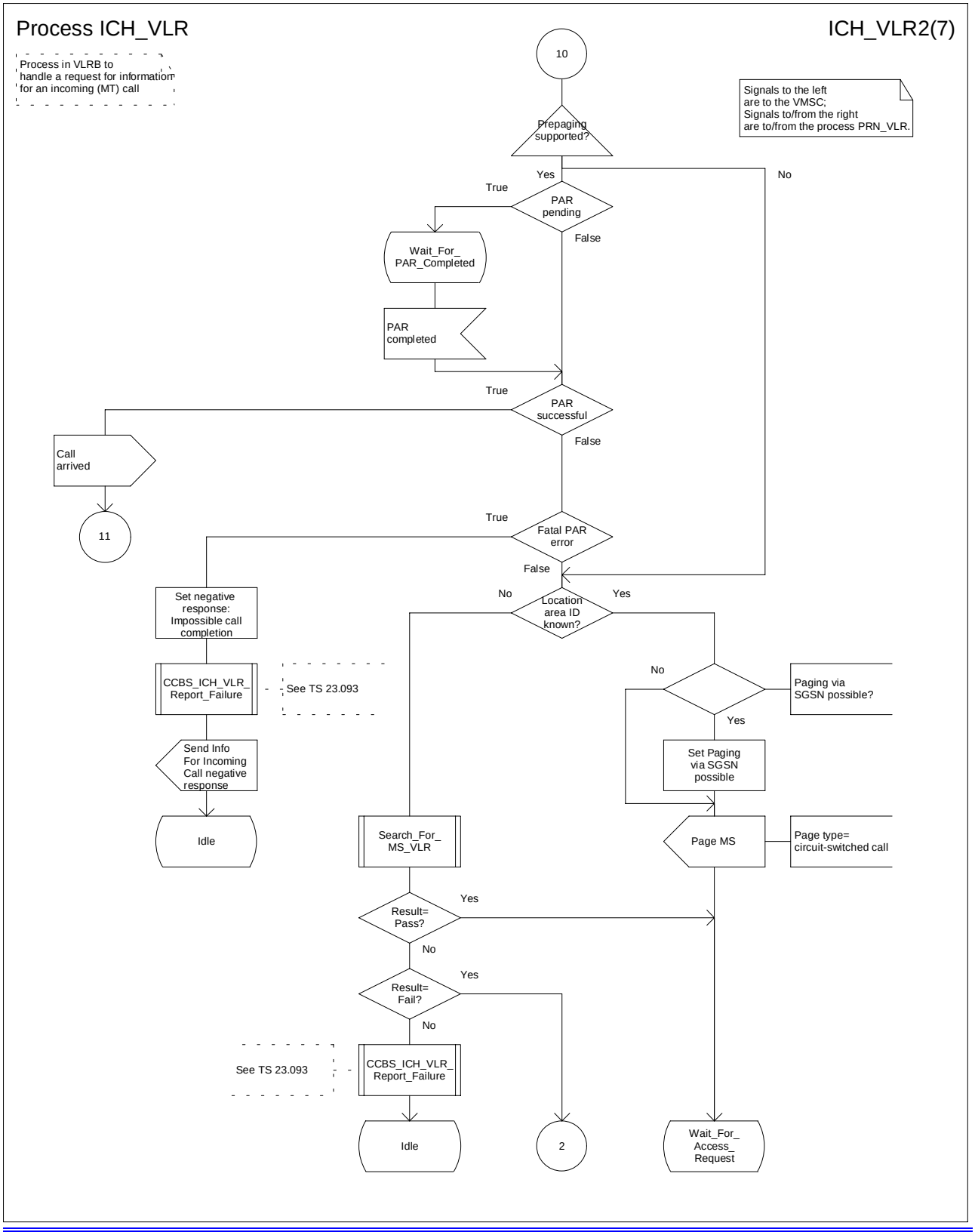
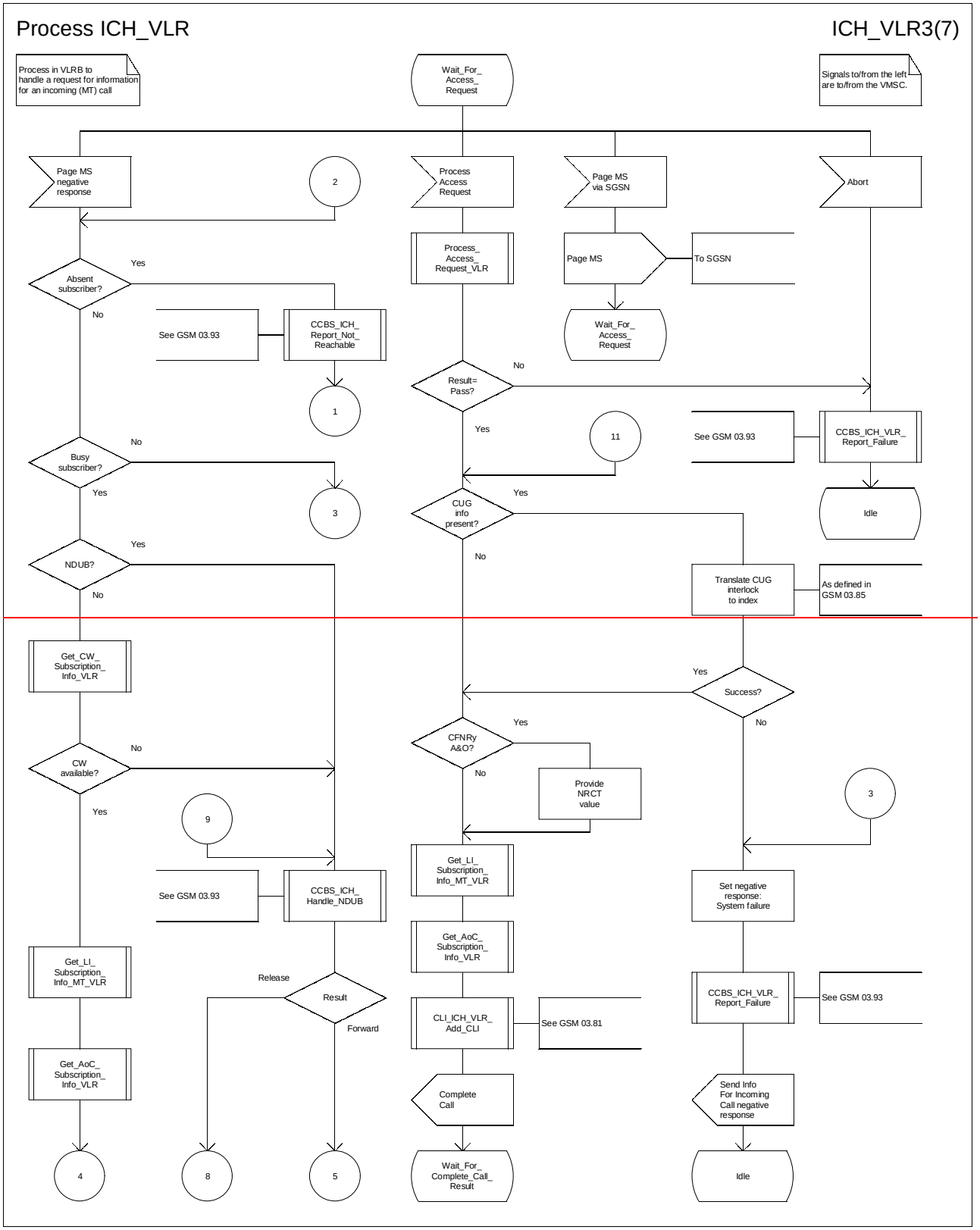


Figure 72b: Process ICH_VLR (sheet 2)


Process ICH_VLR
ICH_VLR3(7)
Process in VLRB to handle a request for information for an incoming (MT) call
Wait_For_ Access_ Request
Signals to/from the left are to/from the VMSC.
Page MS negative response
2
Process Access Request
Page MS via SGSN
Abort
Process_ Access_ Request_VLR
Page MS
To SGSN
Absent subscriber?
Yes
No
See GSM 03.93
CCBS_ICH_ Report_Not_ Reachable
Wait_For_ Access_ Request
Result= Pass?
No
1
Yes
11
See GSM 03.93
CCBS_ICH_VLR_ Report_Failure
Busy subscriber?
No
Yes
3
CUG info present?
Yes
Idle
NDUB?
Yes
No
No
Translate CUG interlock to index
As defined in GSM 03.85
Get_CW_ Subscription_ Info_VLR
Yes
Success?
No
CW available?
No
Yes
CFNRy A&O?
Yes
No
Provide NRCT value
3
9
Get_LI_ Subscription_ Info_MT_VLR
See GSM 03.93
CCBS_ICH_ Handle_NDUB
Set negative response: System failure
Get_AoC_ Subscription_ Info_VLR
Get_LI_ Subscription_ Info_MT_VLR
Release
Result
Forward
CCBS_ICH_VLR_ Report_Failure
See GSM 03.93
CLI_ICH_VLR_ Add_CLI
See GSM 03.81
Get_AoC_ Subscription_ Info_VLR
Complete Call
Send Info For Incoming Call negative response
4
8
5
Wait_For_ Complete_Call_ Result
Idle

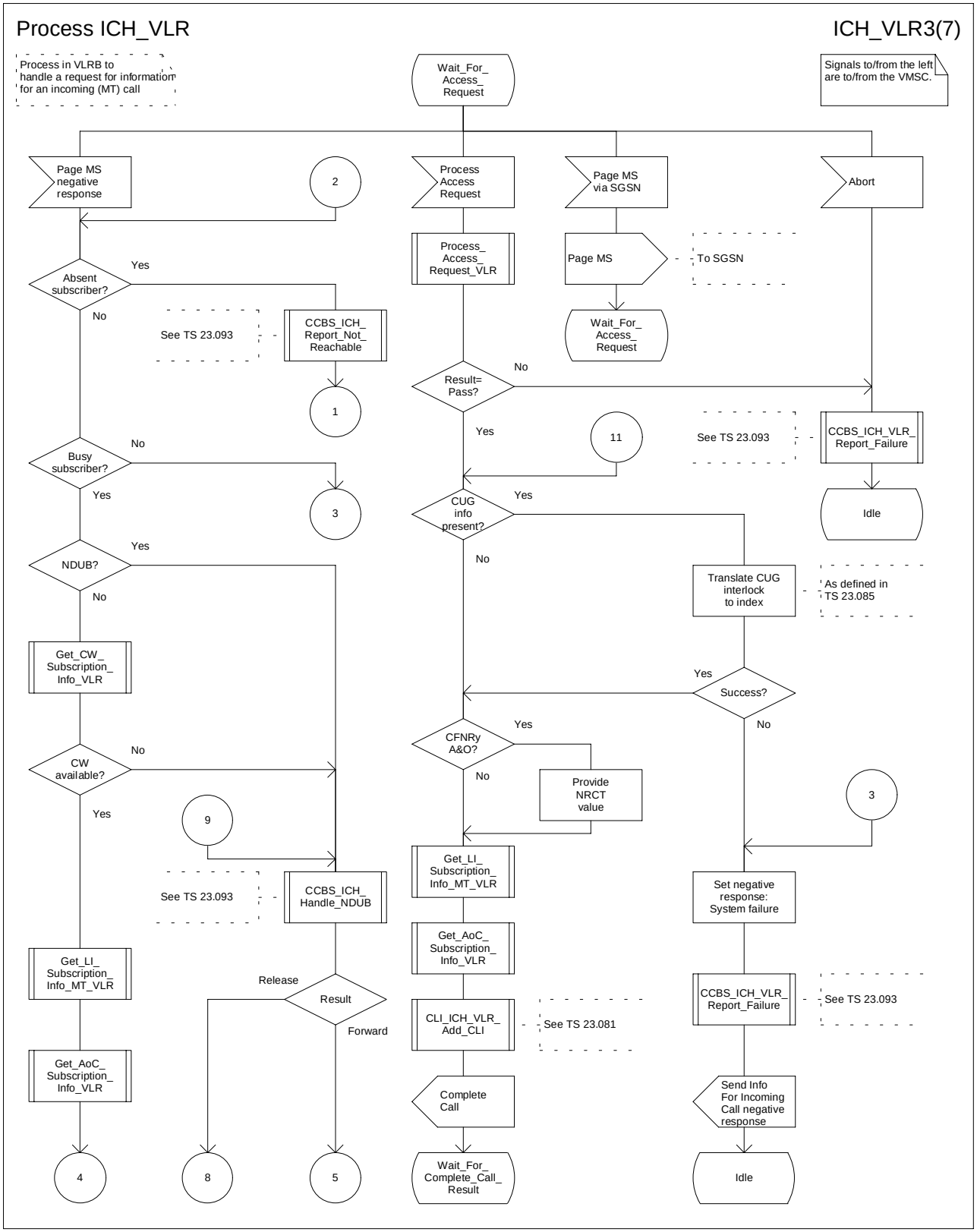
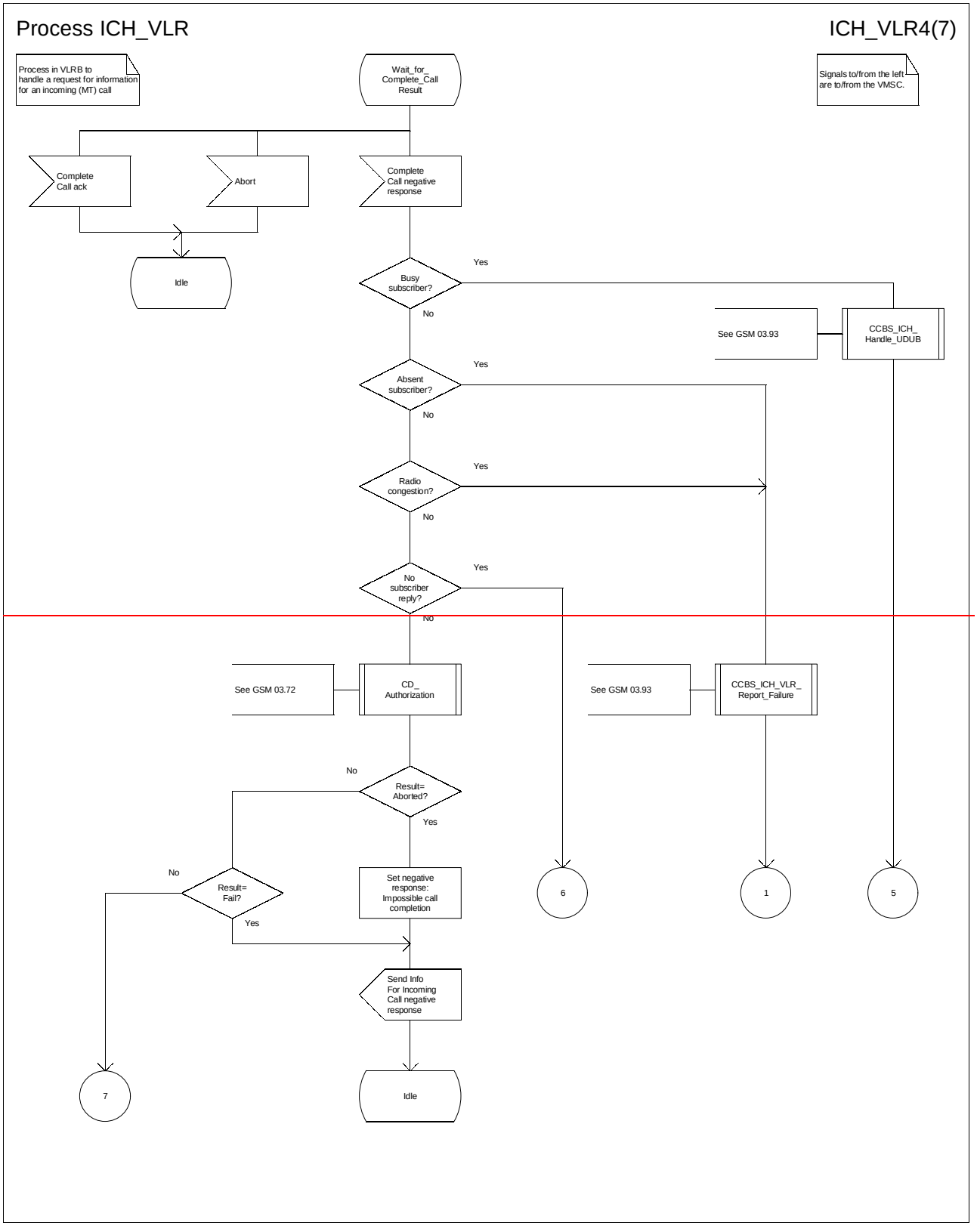


Figure 72c: Process ICH_VLR (sheet 3)


Process ICH_VLR
ICH_VLR4(7)
Process in VLRB to handle a request for information for an incoming (MT) call
Wait_for_ Complete_Call Result
Signals to/from the left are to/from the VMSC.
Complete Call ack
Abort
Complete Call negative response
Idle
Busy subscriber?
Yes
No
See GSM 03.93
CCBS_ICH_ Handle_UDUB
Absent subscriber?
Yes
No
Radio congestion?
Yes
No
No subscriber reply?
Yes
No
See GSM 03.72
CD_ Authorization
See GSM 03.93
CCBS_ICH_VLR_ Report_Failure
No
Result= Aborted?
Yes
No
Result= Fail?
Yes
Set negative response: Impossible call completion
6
1
5
Send Info For Incoming Call negative response
7
Idle

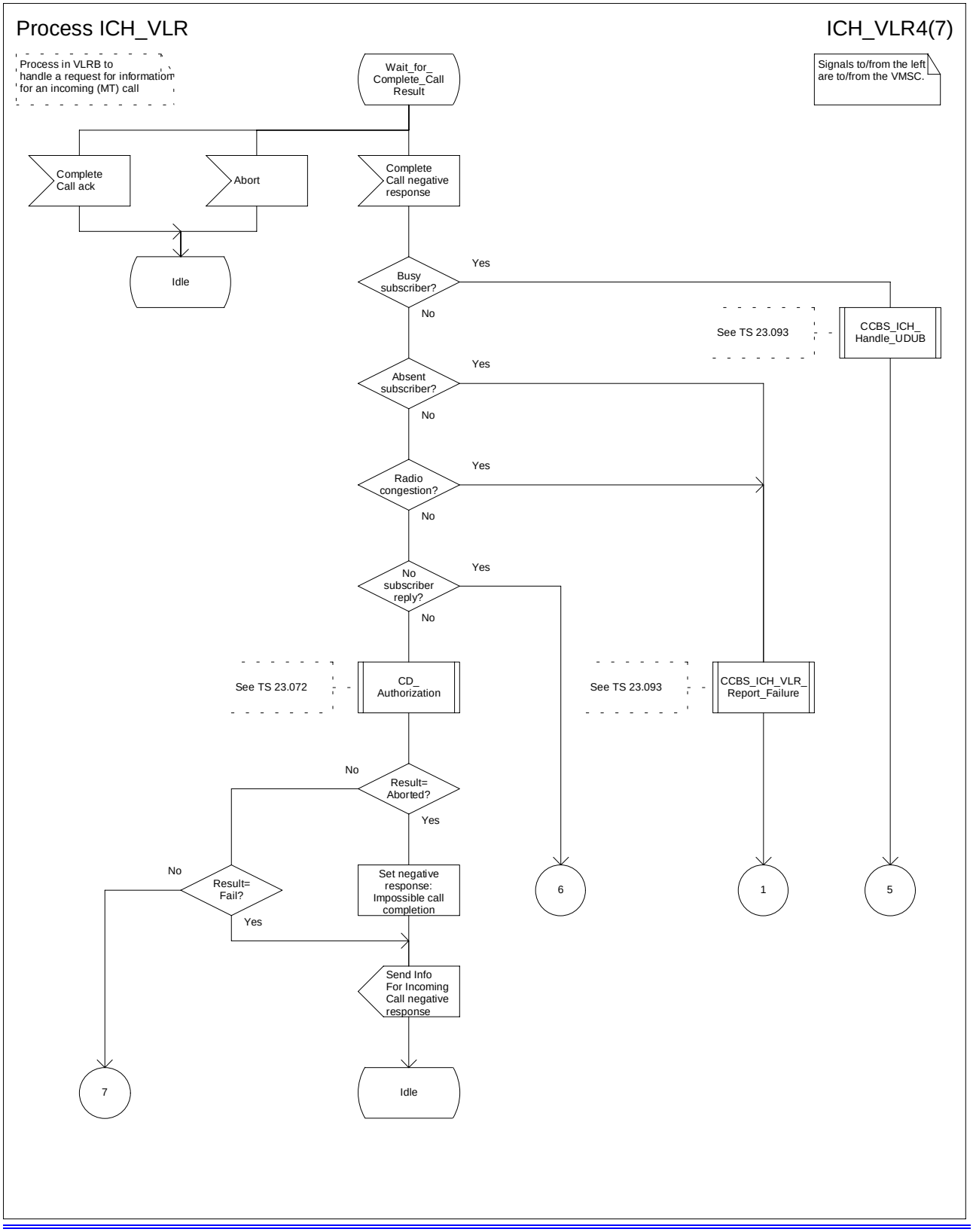
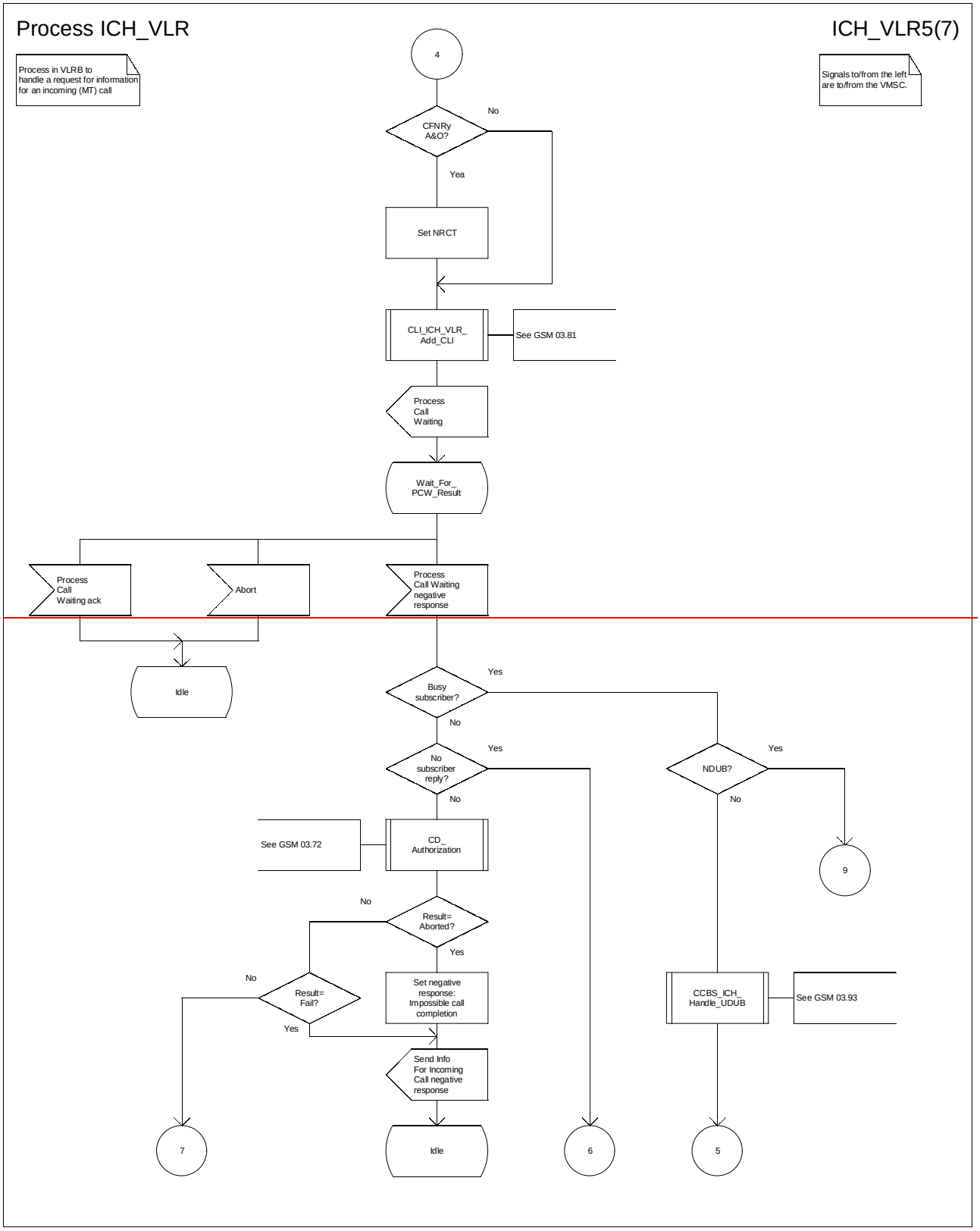


Figure 72d: Process ICH_VLR (sheet 4)


Process ICH_VLR
ICH_VLR5(7)
Process in VLRB to handle a request for information for an incoming (MT) call
Signals to/from the left are to/from the VMSC.
4
CFNRy A&O?
No
Yea
Set NRCT
CLI_ICH_VLR_ Add_CLI
See GSM 03.81
Process Call Waiting
Wait_For_ PCW_Result
Process Call Waiting ack
Abort
Process Call Waiting negative response
Idle
Busy subscriber?
Yes
No
No subscriber reply?
Yes
No
NDUB?
Yes
No
See GSM 03.72
CD_ Authorization
9
No
Result= Aborted?
Yes
No
Result= Fail?
Yes
Set negative response: Impossible call completion
CCBS_ICH_ Handle_UDUB
See GSM 03.93
Send Info For Incoming Call negative response
7
Idle
6
5

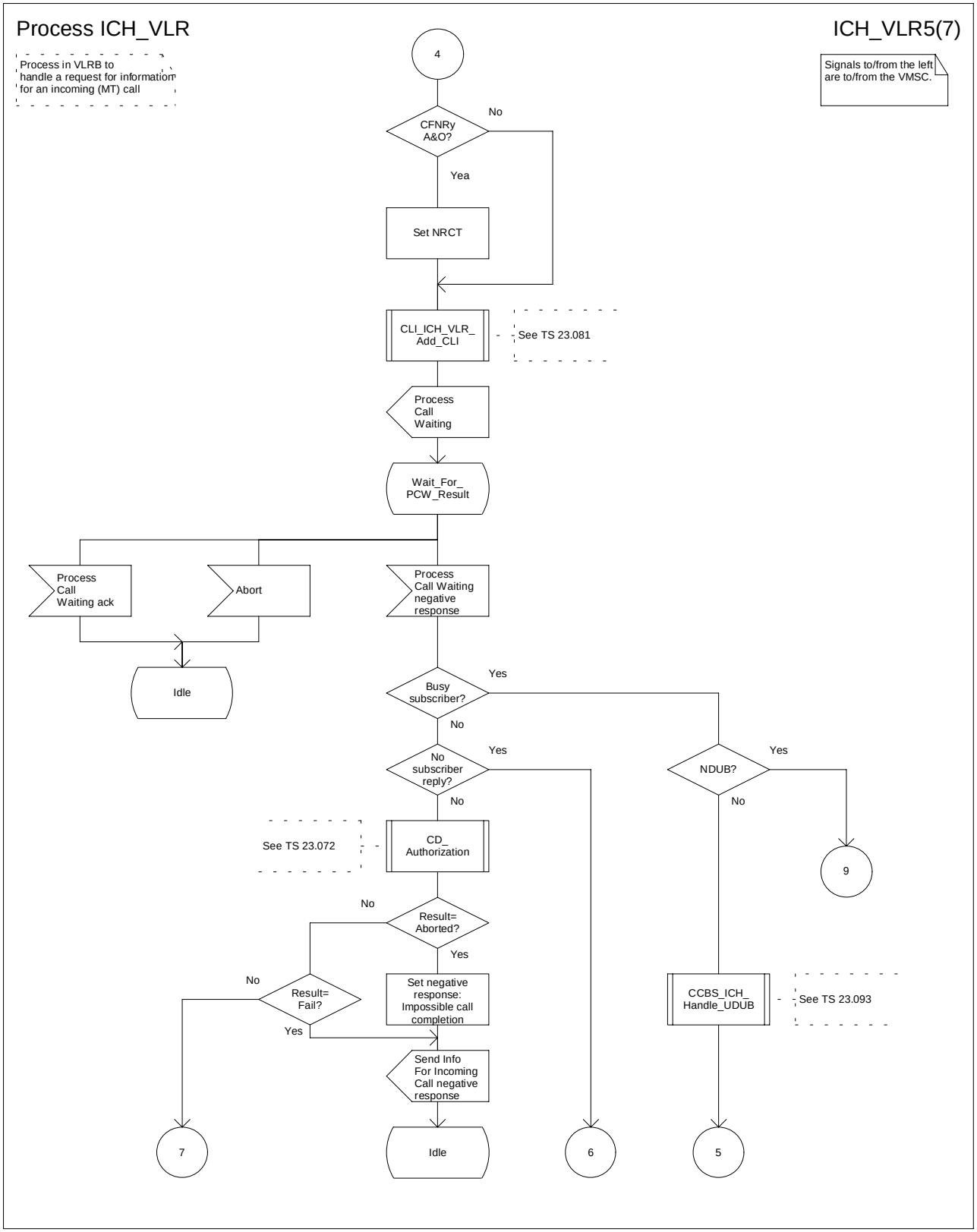
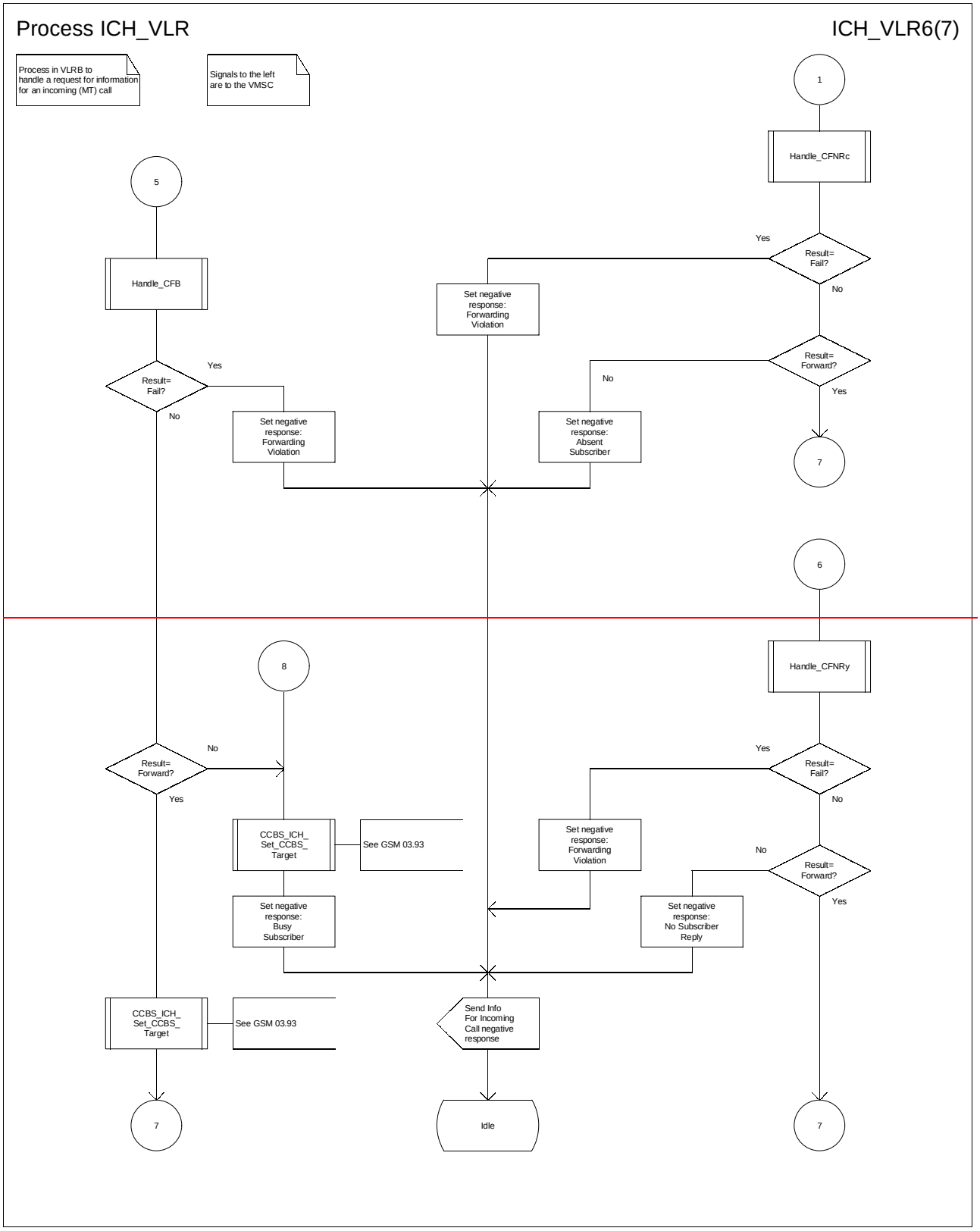


Figure 72e: Process ICH_VLR (sheet 5)


Process ICH_VLR
ICH_VLR6(7)
Process in VLRB to handle a request for information for an incoming (MT) call
Signals to the left are to the VMSC
1
Handle_CFNRc
Result= Fail?
Yes
No
Set negative response: Forwarding Violation
Result= Forward?
No
Yes
Set negative response: Absent Subscriber
7
5
Handle_CFB
Result= Fail?
Yes
No
Set negative response: Forwarding Violation
6
Handle_CFNRy
Result= Fail?
Yes
No
Set negative response: Forwarding Violation
Result= Forward?
No
Yes
Set negative response: No Subscriber Reply
7
8
Result= Forward?
No
Yes
CCBS_ICH_ Set_CCBS_ Target
See GSM 03.93
Set negative response: Busy Subscriber
CCBS_ICH_ Set_CCBS_ Target
See GSM 03.93
7
Send Info For Incoming Call negative response
Idle

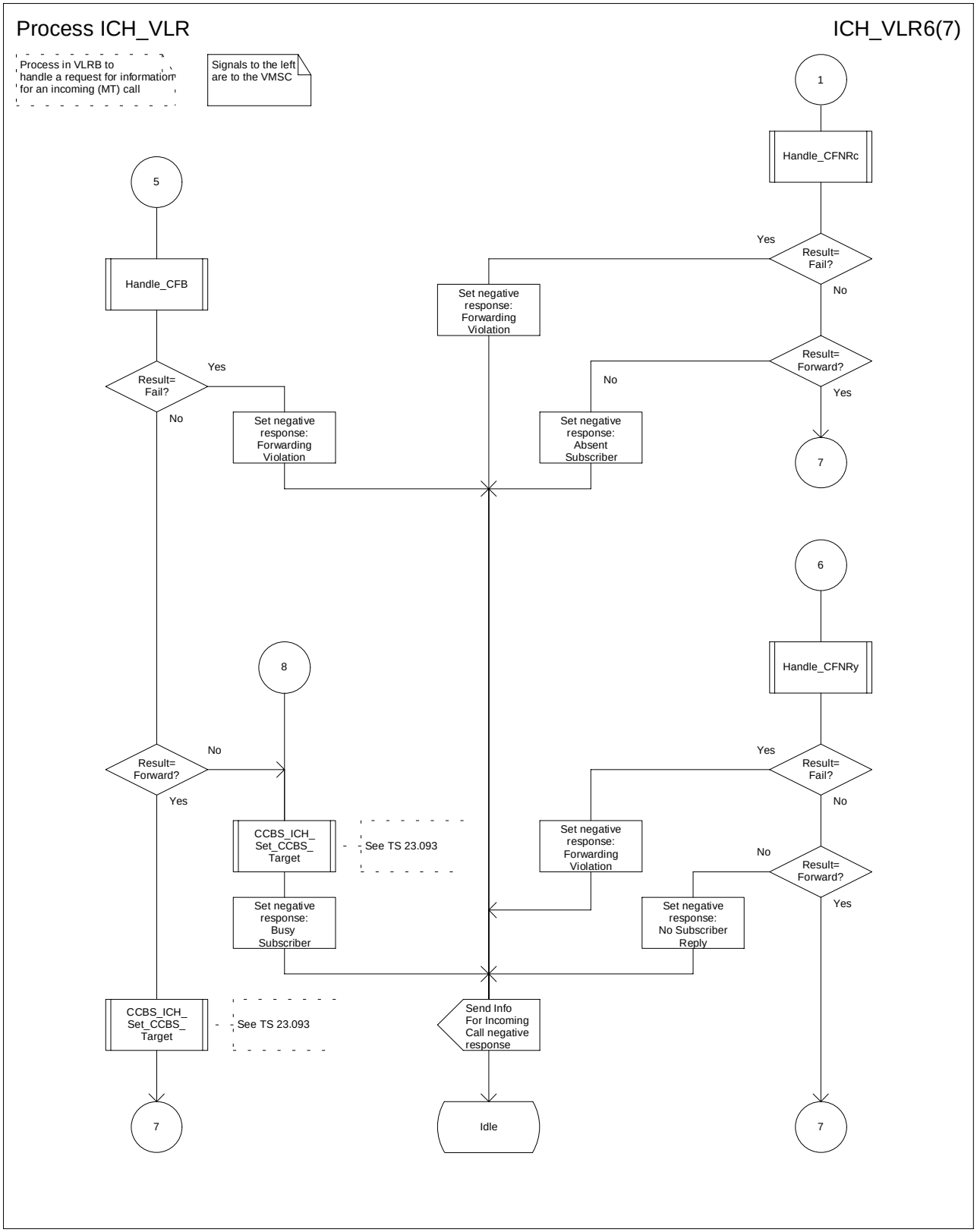


Figure 72f: Process ICH_VLR (sheet 6)

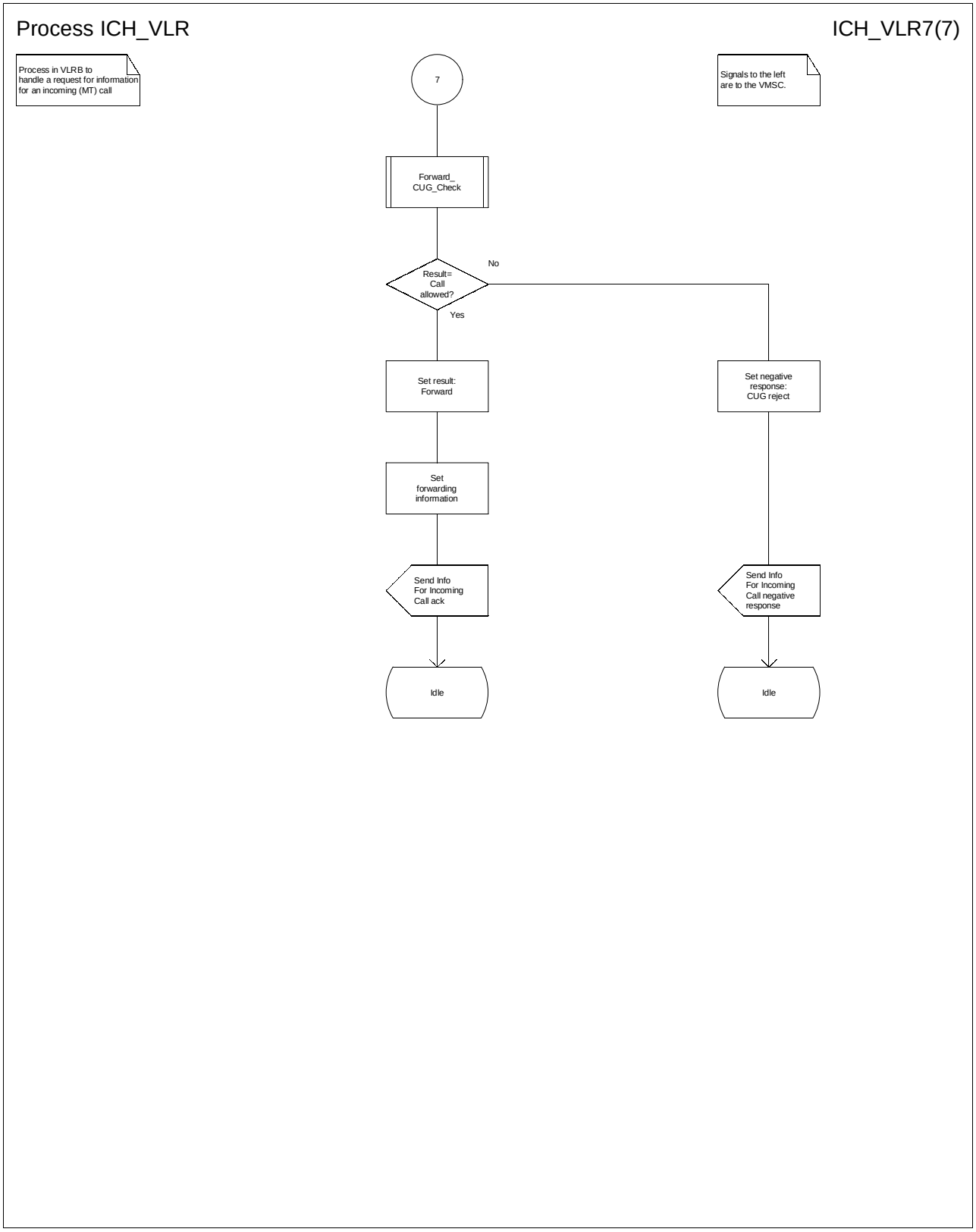
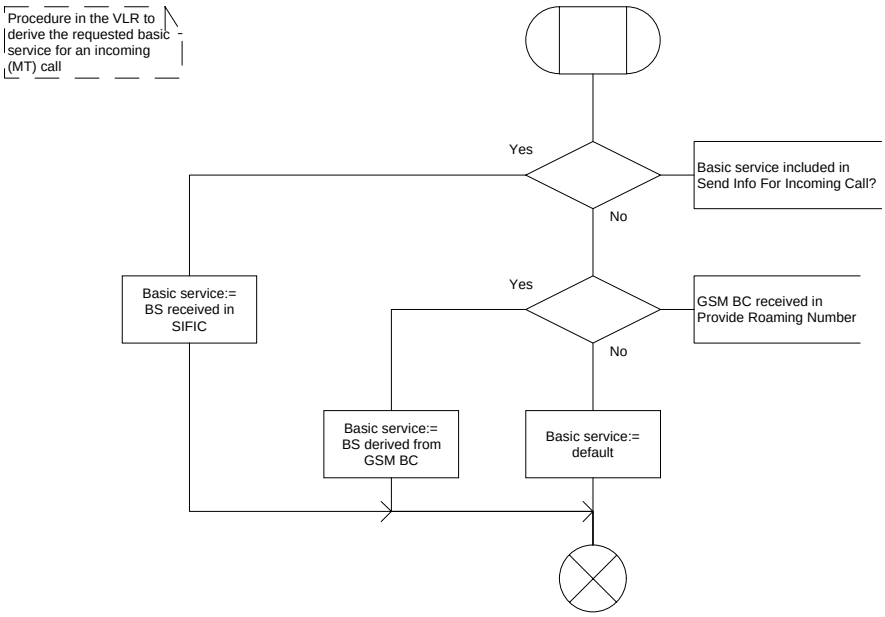


Figure 72g: Process ICH_VLR (sheet 7)

Procedure Derive_Requested_Basic_Service_VLR DRBS_V1(1)



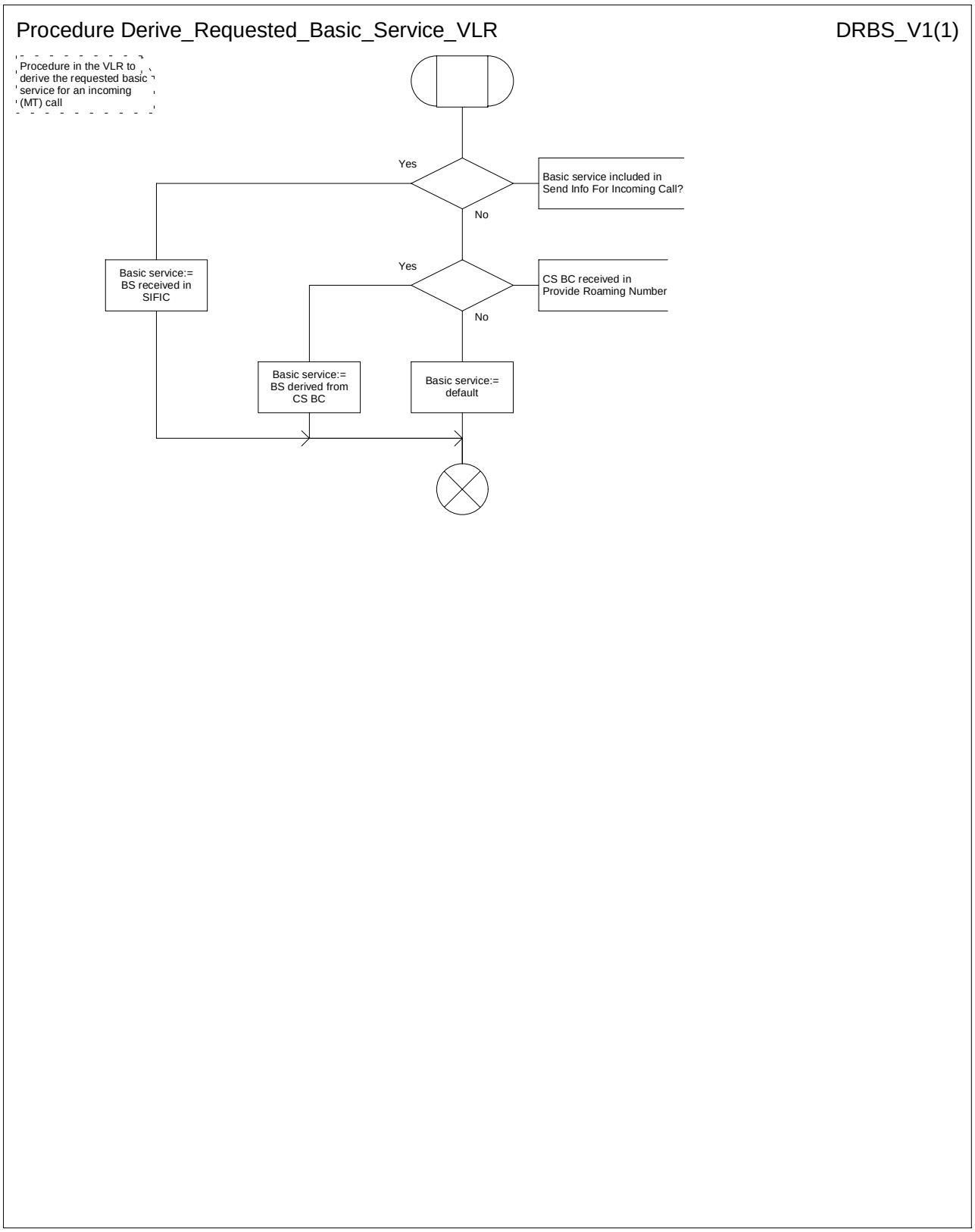


Figure 73: Procedure Derive_Requested_Basic_Service_VLR

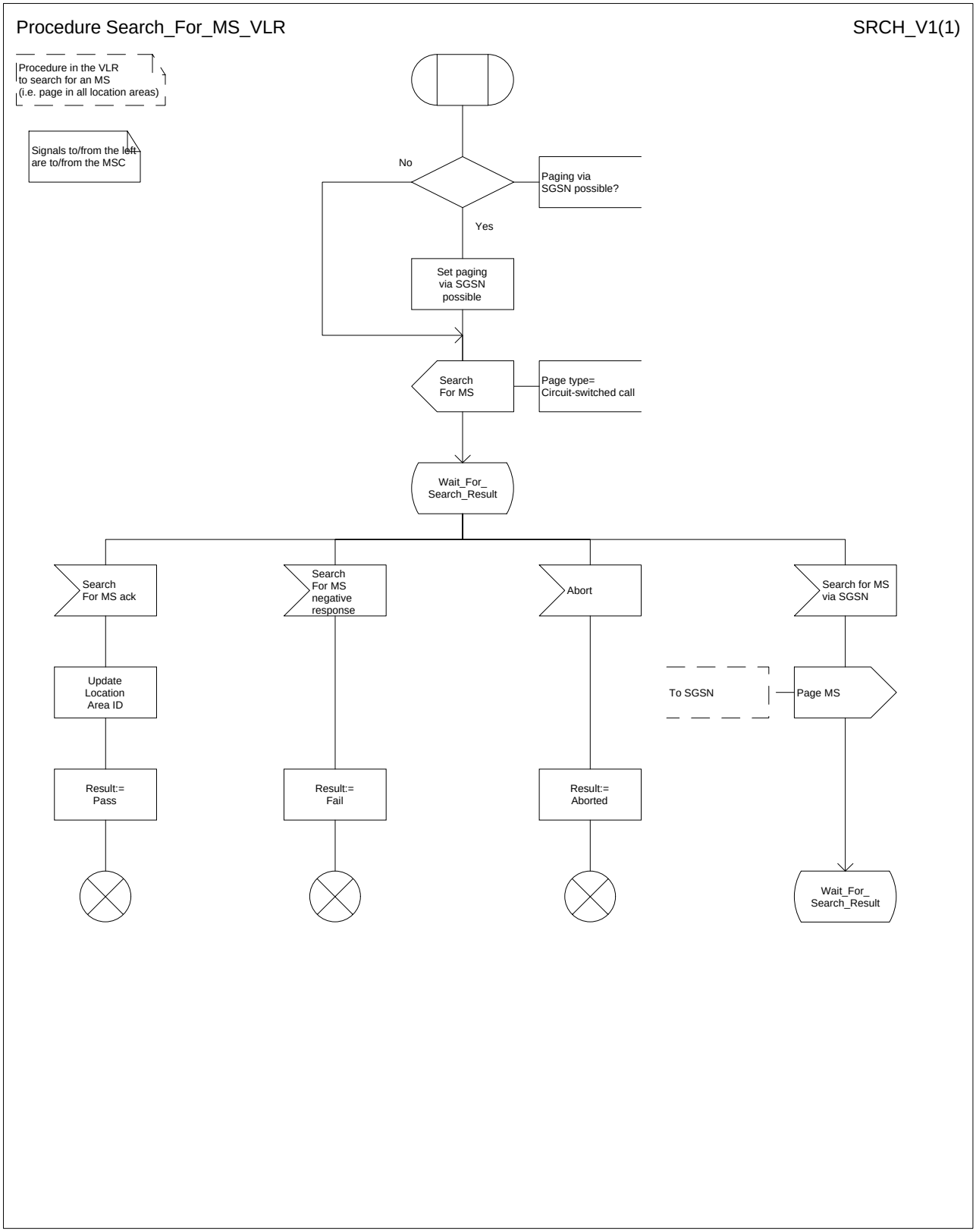


Figure 74: Procedure Search_For_MS_VLR

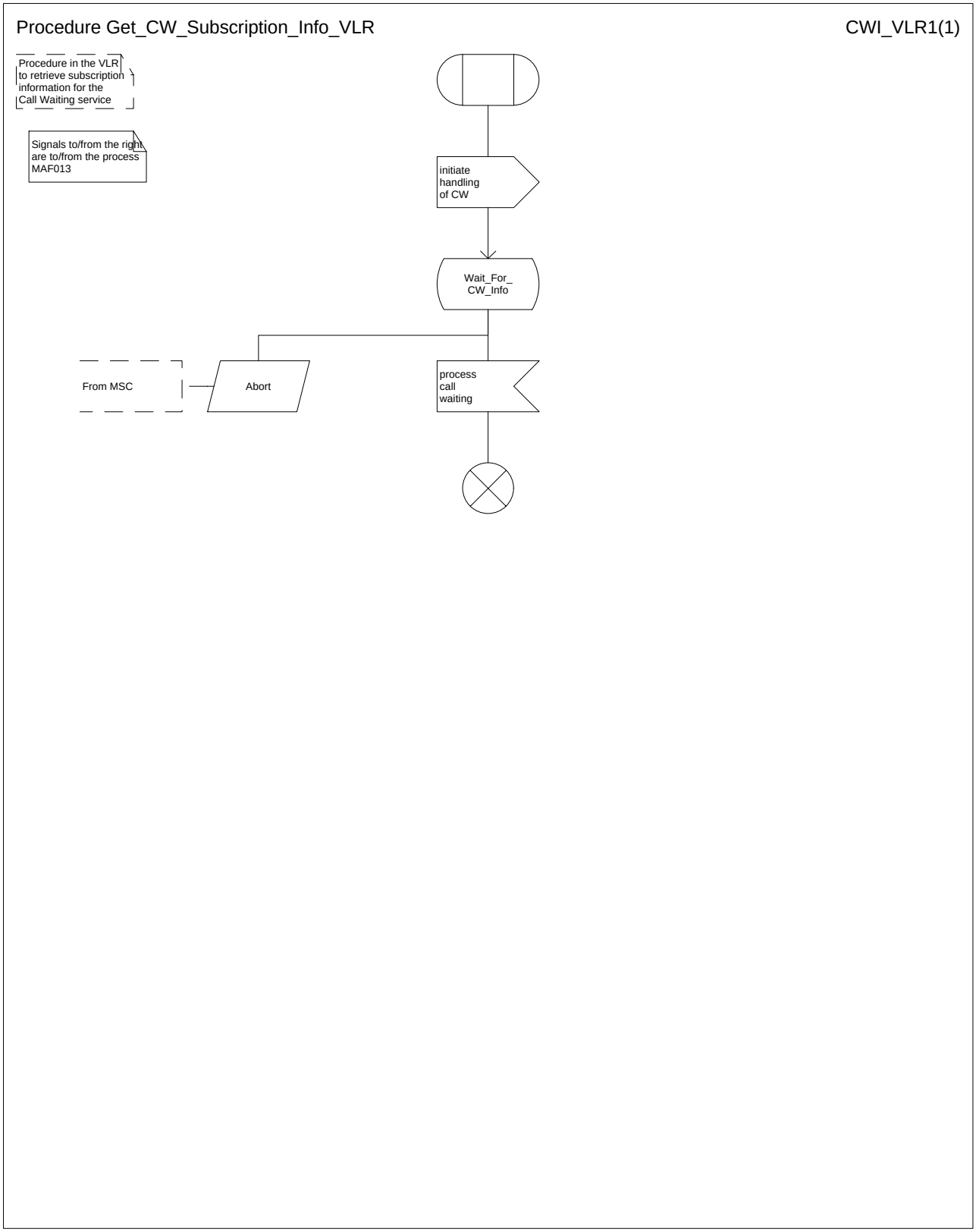


Figure 75: Procedure Get_CW_Subscription_Info_VLR

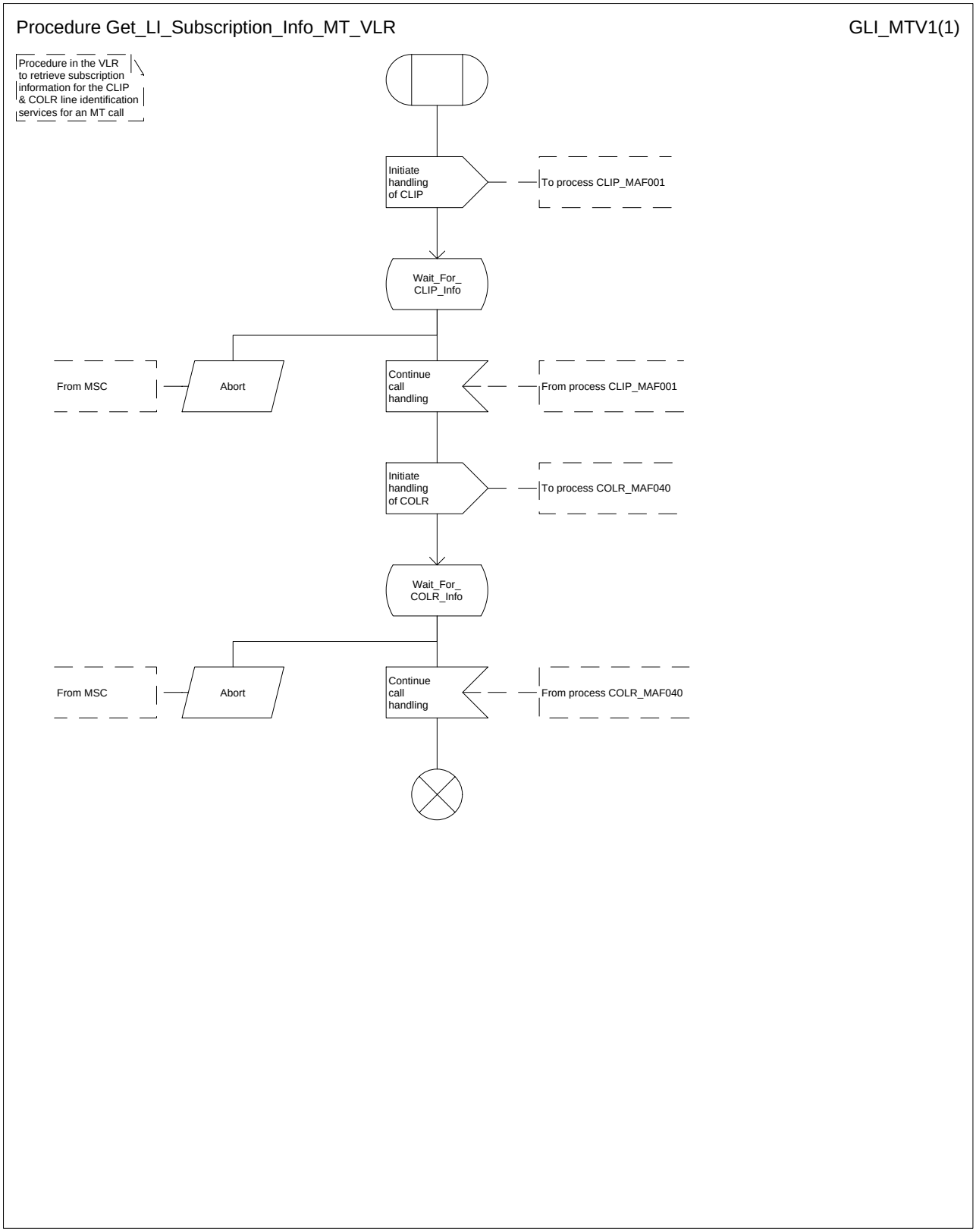


Figure 76: Procedure Get_LI_Subscription_Info_MT_VLR

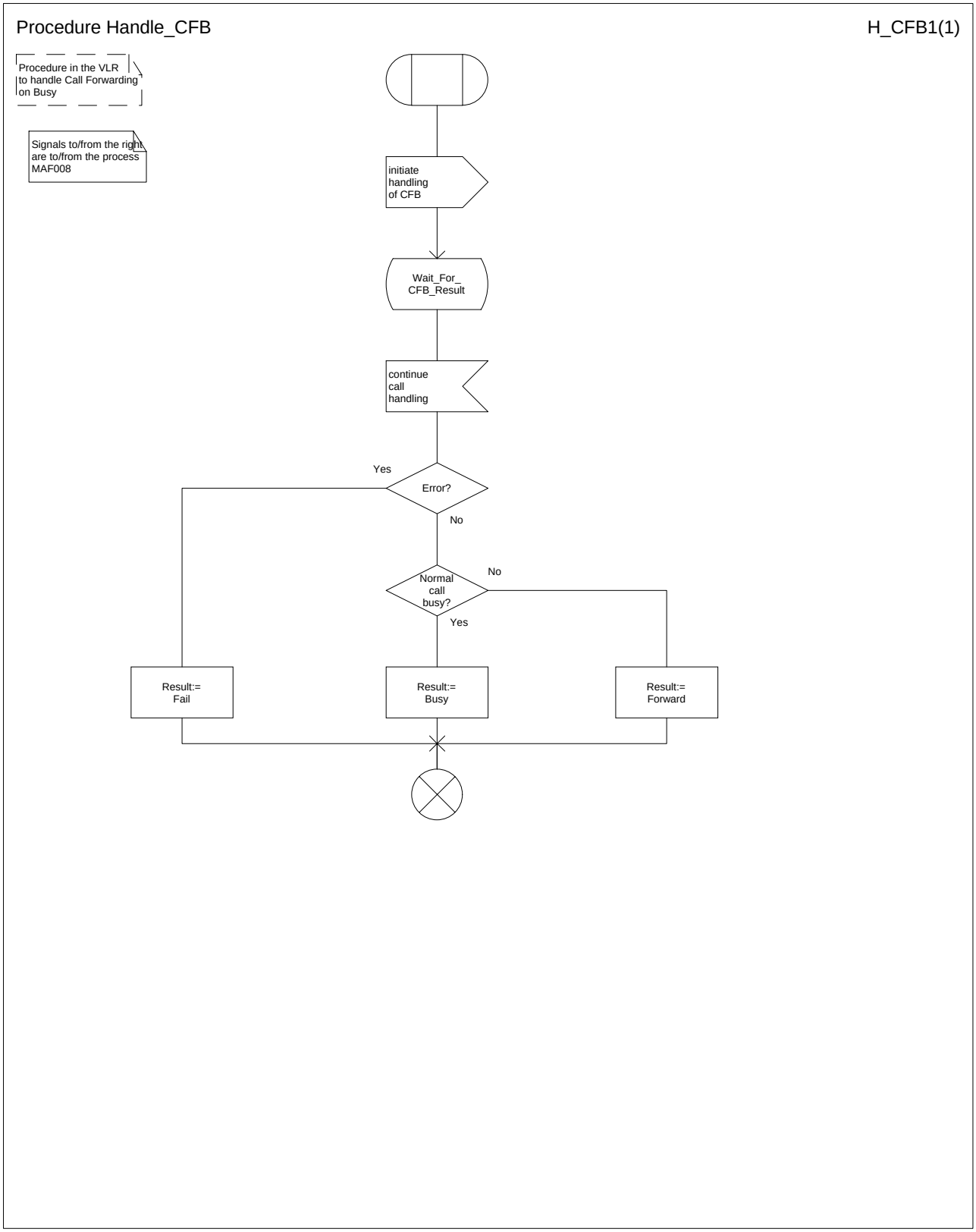


Figure 77: Procedure Handle_CFB

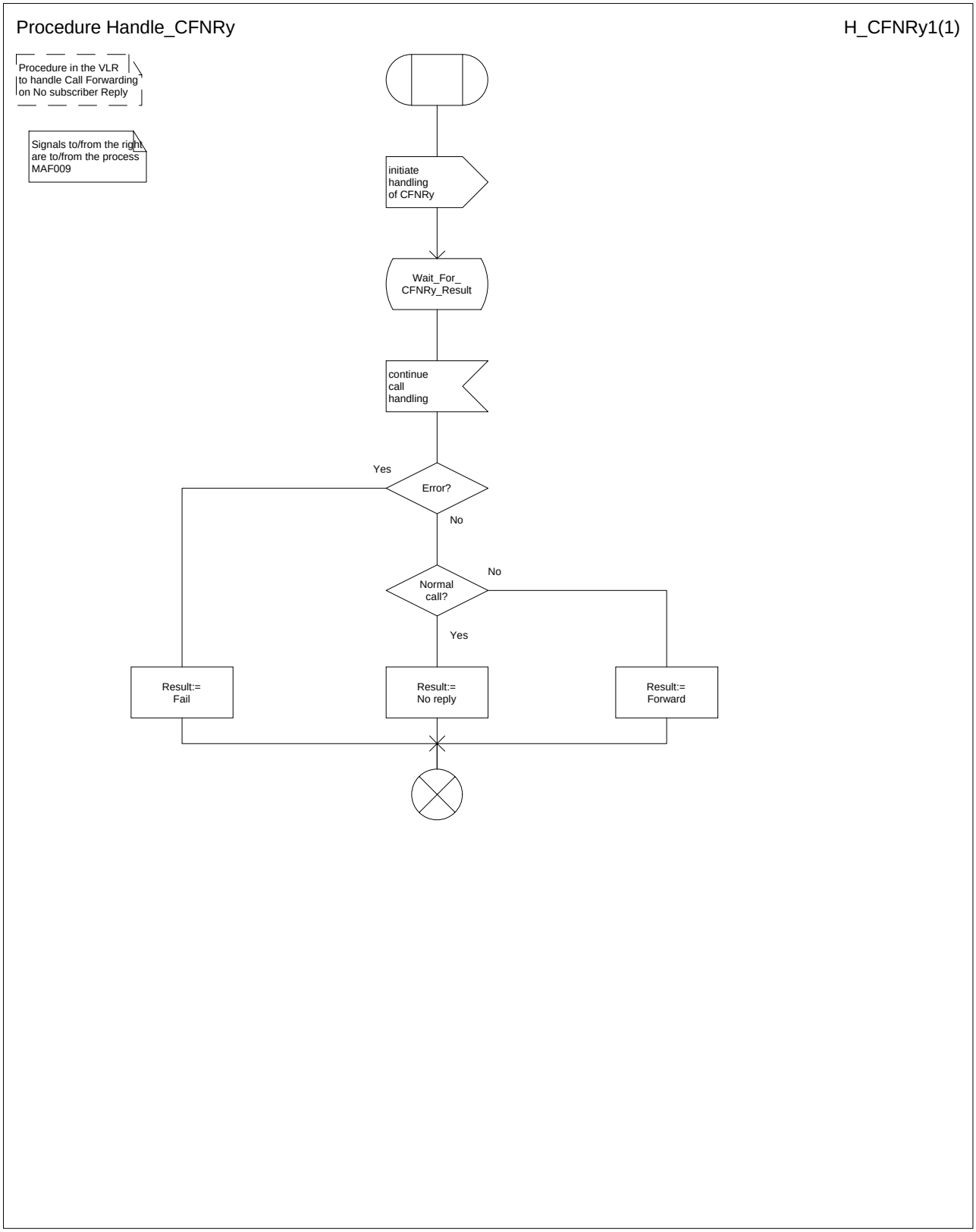


Figure 78: Procedure Handle_CFNRy

****** Next modified section ******

8.1.2 Authenticate

The following information elements are required for authentication of a UMTS MS:

Information element name	Required	Description
RAND(I)	M	Random number challenge to be sent to the MS (TS 33.102 [50])
AUTN(I)	M	Authentication token to be sent to the MS (TS 33.102 [50])

The following information elements are required for authentication of a GSM MS:

Information element name	Required	Description
RAND	M	Random number challenge to be sent to the MS (GSM 03.20 [1])
CKSN	M	Cipher key sequence number to be sent to the MS (GSM 03.20 [1])

8.1.3 Authenticate ack

The following information element is required for authentication of a UMTS MS:

Information element name	Required	Description
RES(I)	M	Result returned by the MS (TS 33.102 [50])

The following information element is required for authentication of a GSM MS:

Information element name	Required	Description
SRES	M	Signature result returned by the MS (GSM 03.20 [1])

****** Next modified section ******

8.1.8 Complete Call

The following information elements are required:

Information element name	Required	Description
MSISDN	C	MSISDN of the MS for which the Complete Call is sent. Shall be present for an ordinary MO call, for an MT call and for an emergency call when the MS is registered in the VLR; otherwise shall be absent.
IMEI	C	IMEI of the mobile for which the Complete Call is sent. Shall be present for an emergency call when the mobile is identified only by its IMEI; otherwise shall be absent.
Category	C	Category of the MS for which the Complete Call is sent. Shall be present for an ordinary MO call and for an emergency call when the MS is registered in the VLR; otherwise shall be absent.
GSM bearer capability	C	Shall be present for an MT call if it was received in the Provide Roaming Number; otherwise shall be absent.
ISDN bearer capability	C	Shall be present for an MT call if it was received in the Provide Roaming Number; otherwise shall be absent.
ISDN low layer compatibility	C	Shall be present for an MT call if it was received in the Provide Roaming Number; otherwise shall be absent.
ISDN high layer compatibility	C	Shall be present for an MT call if it was received in the Provide Roaming Number; otherwise shall be absent.
CLIP provision	C	Indicates that CLIP is provisioned. Shall be present for an MT call if CLIP is provisioned; otherwise shall be absent.

CLIR override provision	C	Indicates that the CLIR override subscription option of CLIP is provisioned. Shall be present for an MT call if CLIP is provisioned with the CLIR override subscription option and the MS is registered in the HPLMN country; otherwise shall be absent.
CLIR provision	C	Indicates that CLIR is provisioned. Shall be present for an MO call if CLIR is provisioned; otherwise shall be absent.
CLIR mode	C	Indicates the mode in which CLIR is provisioned: permanent, temporary (default presentation allowed) or temporary (default presentation restricted). Shall be present for an MO call if CLIR is provisioned; otherwise shall be absent.
COLP provision	C	Indicates that COLP is provisioned. Shall be present for an MO call if COLP is provisioned; otherwise shall be absent.
COLR override provision	C	Indicates that the COLR override subscription option of COLP is provisioned. Shall be present for an MO call if COLP is provisioned with the COLR override subscription option and the MS is registered in the HPLMN country; otherwise shall be absent.
COLR provision	C	Indicates that COLR is provisioned. Shall be present for an MT call if COLR is provisioned; otherwise shall be absent.
No Reply Condition Timer	C	Value of timer to be used to determine the No subscriber reply condition. Shall be present for an MT call if the Call Forwarding on No Reply service is active and operative; otherwise shall be absent.

(continued)

The following information elements are required (concluded):

Information element name	Required	Description
CUG index	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. May be present (as a network operator option) for an ordinary MO call if the call is a CUG call; shall be present for an MT call if the call is a CUG call; otherwise shall be absent.
CUG interlock	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present for an ordinary MO call if the call is a CUG call; otherwise shall be absent.
CUG outgoing access	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present for an ordinary MO call if the call is a CUG call with outgoing access; otherwise shall be absent.
Advice of Charge provision	C	Indicates whether Advice of Charge (Information) or Advice of Charge (Charging) is provisioned. Shall be present for an ordinary MO call or an MT call if Advice of Charge is provisioned; otherwise shall be absent.
Alerting Pattern	C	Shall be present for an MT call if it was received in the Provide Roaming Number and if the feature is supported by the MSC/VLR; otherwise shall be absent.
NAEA preferred Carrier Id	O	The preferred carrier identity identifying the carrier to be used to route the interexchange call if the call requires routing via an interexchange carrier. This parameter may be included at the discretion of the VLR operator.

****** Next modified section ******

8.1.19 Process Access Request

The following information elements are required:

Information element name	Required	Description
CM service type	M	Indicates the type of access required: normal MO call, emergency call or page response. Other values (short message service and SS request) defined for this IE are not considered in this specification.
Access connection status	M	Indicates whether or not the connection to the MS is ciphered and whether or not it is authenticated.
Current location area ID	M	Identity of the location area from which the access request was received.
Service area ID	C	Identity of the service area (for UMTS access) in use by the served subscriber. Shall be present for UMTS access; otherwise shall be absent.
Serving cell ID	C~~M~~	Identity of the cell (for GSM access) in use by the served subscriber. Shall be present for GSM access; otherwise shall be absent.
IMSI	C	IMSI of the MS requesting the access. For normal MO call or page response, one of IMSI or TMSI shall be present. For emergency call, one of IMSI, TMSI or IMEI shall be present.
TMSI	C	TMSI of the MS requesting the access. For normal MO call or page response, one of IMSI or TMSI shall be present. For emergency call, one of IMSI, TMSI or IMEI shall be present.
IMEI	C	IMEI of the MS requesting the access. For normal MO call or page response, one of IMSI or TMSI shall be present. For emergency call, one of IMSI, TMSI or IMEI shall be present.
CKSN	C	Cipher key sequence number of the MS requesting the access. Shall be present if TMSI is present; otherwise shall be absent.

****** Next modified section ******

8.1.22 Process Call Waiting

The following information elements are required:

Information element name	Required	Description
MSISDN	M	MSISDN of the MS for which the Process Call Waiting is sent.
GSM bearer capability	C	Shall be present if it was received in the Provide Roaming Number for the waiting call; otherwise shall be absent.
ISDN bearer capability	C	Shall be present if it was received in the Provide Roaming Number for the waiting call; otherwise shall be absent.
ISDN low layer compatibility	C	Shall be present if it was received in the Provide Roaming Number for the waiting call; otherwise shall be absent.
ISDN high layer compatibility	C	Shall be present if it was received in the Provide Roaming Number for the waiting call; otherwise shall be absent.
CLIP provision	C	Indicates that CLIP is provisioned. Shall be present if CLIP is provisioned; otherwise shall be absent.
CLIR override provision	C	Indicates that the CLIR override subscription option of CLIP is provisioned. Shall be present if CLIP is provisioned with the CLIR override subscription option and the MS is registered in the HPLMN country; otherwise shall be absent.
COLR provision	C	Indicates that COLR is provisioned. Shall be present if COLR is provisioned; otherwise shall be absent.
No Reply Condition Timer	C	Value of timer to be used to determine the No subscriber reply condition. Shall be present if the Call Forwarding on No Reply service is active and operative; otherwise shall be absent.
CUG index	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if the waiting call is a CUG call; otherwise shall be absent.
Advice of Charge provision	C	Indicates whether Advice of Charge (Information) or Advice of Charge (Charging) is provisioned. Shall be present if Advice of Charge is provisioned; otherwise shall be absent.

****** Next modified section ******

8.1.34 Send Info For Incoming Call

The following information elements are required:

Information element name	Required	Description
MSRN	M	Mobile Station Roaming Number received in the IAM.
Bearer service	C	GSM bearer service required for the MT call. Shall be present if the MSC was able to derive a GSM bearer service from ISDN BC/LLC/HLC information received in the IAM; otherwise shall be absent.
Teleservice	C	GSM teleservice required for the MT call. Shall be present if the MSC was able to derive a GSM teleservice from ISDN BC/LLC/HLC information received in the IAM; otherwise shall be absent.
Dialled number	C	Number dialled by the calling subscriber. Shall be present if it was received in the IAM; otherwise shall be absent.
Number of forwarding	C	Number of times the incoming call has already been forwarded. Shall be present if it was received in the IAM; otherwise shall be absent.
CUG interlock	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if it was received in the IAM; otherwise shall be absent.
CUG outgoing access	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if it was received in the IAM; otherwise shall be absent.

8.1.35 Send Info For Incoming Call ack

The following information elements are required:

Information element name	Required	Description
IMSI	M	IMSI of the B subscriber.
Forwarded-to number	M	E.164 number of the C subscriber.
Forwarding reason	M	Indication of why the call has been forwarded (on call deflection, on mobile subscriber busy, on mobile subscriber not reachable or on no subscriber reply).
Notification to calling party	M	Indication of whether the calling party is to be notified that the call has been forwarded.
Notification to forwarding party	C	Indication of whether the forwarding party is to be notified that the call has been forwarded. Shall be present if the call is to be forwarded on mobile subscriber busy or on no subscriber reply; otherwise shall be absent.
Forwarded-to subaddress	C	Subaddress of the C subscriber (see ~~GSM~~ TS ~~03.~~23.003 [25]). Shall be present if a forwarded-to subaddress is stored in the VLR in association with the forwarded-to number; otherwise shall be absent.
Redirecting presentation	C	Indication of whether the MSISDN of B subscriber shall be presented to the C subscriber. Shall be present if the call is to be forwarded, otherwise shall be absent.
MSISDN	C	E.164 number which identifies the B subscriber. It will be used to create the redirecting number presented to the C subscriber. Shall be present if the call is to be forwarded, otherwise shall be absent.
CUG interlock	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call in accordance with the rules in ~~GSM~~ TS ~~03.~~23.085 [38], otherwise shall be absent.
CUG outgoing access	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call with outgoing access in accordance with the rules in ~~GSM~~ TS ~~03.~~23.085 [38], otherwise shall be absent.
NAEA preferred Carrier Id	O	The preferred carrier identity identifying the carrier to be used to route the interexchange call if the forwarded call requires routing via an interexchange carrier. This parameter may be included at the discretion of the VLR operator.

****** Next modified section ******

8.1.37 Send Info For Outgoing Call

The following information elements are required:

Information element name	Required	Description
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 ~~GSM~~ TS ~~03.~~23.085 [38]. 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 ~~GSM~~ TS ~~03.~~23.085 [38]. 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 ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if it was received in the setup request from the MS.

****** Next modified section ******

8.1.39 S~~e~~tart security procedures~~ciphering mode~~

The following information elements are required for a UMTS connection:

Information element name	Required	Description
CK	M	Ciphering key to be used to cipher communication over the radio link (see TS 33.102 [50]).
IK	M	Integrity key to be used to verify the integrity of messages transferred over the radio link (see TS 33.102 [50]).

The following information element~~s is~~ are required:

Information element name	Required	Description
Ciphering mode	M	Indicates whether ciphering of the radio connection is required, and if so which ciphering algorithm is to be used.
Kc	C	Ciphering key to be used if ciphering of the radio connection is required. Shall be present if the ciphering mode indicates that ciphering of the radio connection is required, otherwise shall be absent.

****** Next modified section ******

8.2.1 Send Routeing Info

The following information elements are required:

Information element name	Required	Description
MSISDN	M	MSISDN of the B subscriber (see ~~GSM~~ TS ~~03.~~23.003 [25]).
Alerting Pattern	C	Shall be present if received in a Connect operation from the gsmSCF; otherwise shall be absent.
CUG interlock	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if the GMSC received it in the IAM, otherwise shall be absent.
CUG outgoing access	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if the GMSC received it in the IAM, otherwise shall be absent.
Number of forwarding	C	Number of times the incoming call has already been forwarded. Shall be present if it was received in the IAM; otherwise shall be absent.
ISDN BC	C	ISDN bearer capability. Shall be present if the GMSC received it in the IAM, otherwise shall be absent.
ISDN LLC	C	ISDN lower layer compatibility. Shall be present if the GMSC received it in the IAM, otherwise shall be absent.
ISDN HLC	C	ISDN higher layer compatibility. Shall be present if the GMSC received it in the IAM, otherwise shall be absent.
Pre-paging supported	C	Shall be present if the GMSC supports pre-paging, otherwise shall be absent.

8.2.2 Send Routeing Info ack

The following information elements are required:

Information element name	Required	Description
IMSI	M	IMSI of the B subscriber (see ~~GSM~~ TS ~~03.~~23.003 [25]).
Roaming number	C	E.164 number required to route the call to VMSCB (see ~~GSM~~ TS ~~03.~~23.003 [25]). Shall be present if the HLR received it in the Provide Roaming Number ack, otherwise shall be absent.
Forwarded-to number	C	E.164 number of the C subscriber. Shall be present if the HLR has determined that the call is to be forwarded, otherwise shall be absent.
Forwarded-to subaddress	C	Subaddress of the C subscriber (see ~~GSM~~ TS ~~03.~~23.003 [25]). Shall be present if the HLR has determined that the call is to be forwarded and a forwarded-to subaddress is stored in the HLR in association with the forwarded-to number, otherwise shall be absent.
Notification to calling party	C	Indication of whether the calling party is to be notified that the call has been forwarded. Shall be present if the HLR has determined that the call is to be forwarded, otherwise shall be absent.
Forwarding reason	C	Indication of why the call has been forwarded (unconditionally or on mobile subscriber not reachable). Shall be present if the HLR has determined that the call is to be forwarded, otherwise shall be absent.
Redirecting presentation	C	Indication of whether the MSISDN of B subscriber shall be presented to the C subscriber. Shall be present if the HLR has determined that the call is to be forwarded, otherwise shall be absent.
MSISDN	C	E.164 number which identifies the B subscriber (basic MSISDN). It will be used to create the redirecting number presented to the C subscriber. Shall be present if the HLR has determined that the call is to be forwarded, otherwise shall be absent.
CUG interlock	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if the HLR has determined that the call is to be treated as a CUG call in accordance with the rules in ~~GSM~~ TS ~~03.~~23.085 [38], otherwise shall be absent.
CUG outgoing access	C	For the definition of this IE, see ~~GSM~~ TS ~~03.~~23.085 [38]. Shall be present if the HLR has determined that the call is to be treated as a CUG call with outgoing access in accordance with the rules in ~~GSM~~ TS ~~03.~~23.085 [38], otherwise shall be absent.
NAEA preferred Carrier Id	O	The preferred carrier identity identifying the carrier to be used to route the interexchange call if the call requires routing via an interexchange carrier. This parameter may be included at the discretion of the HLR operator.

****** Next modified section ******

8.3.1 Provide Roaming Number

The following information elements are required:

Information element name	Required	Description
IMSI	M	IMSI of the B subscriber (see ~~GSM~~ TS ~~03.~~23.003 [25]).
MSC number	M	E.164 number which identifies VMSCB (see ~~GSM~~ TS ~~03.~~23.003 [25]).
MSISDN	O	E.164 number which identifies the B subscriber. May be present if the HLR requires it to be included in the call data record.
LMSI	C	Local Mobile Subscriber Identity. Shall be present if the LMSI was sent to HLRB at location updating.
GSM bearer capability	C	Information to define the GSM bearer capability required for the call. For alternate speech/fax, alternate speech/data or speech followed by data calls this information element shall contain two GSM bearer capabilities, as specified in ~~GSM~~ TS ~~04.~~24.008. May be present if the HLR can determine the required GSM bearer capability from ISDN compatibility information received in the Send Routeing Info message, or from the MSISDN if a multi-numbering scheme is used; otherwise shall be absent. If the ISDN BC and ISDN LLC IEs are present, the GSM bearer capability IE shall be absent.
ISDN BC	C	ISDN bearer capability. May be present if the HLR received it in the Send Routeing Info message, otherwise shall be absent. If the GSM bearer capability IE is present, the ISDN BC IE shall be absent.
ISDN LLC	C	ISDN lower layer compatibility. May be present if the HLR received it in the Send Routeing Info message, otherwise shall be absent. If the GSM bearer capability IE is present, the ISDN LLC IE shall be absent.
ISDN HLC	C	ISDN higher layer compatibility. Shall be present if the HLR received it in the Send Routeing Info message, otherwise shall be absent.
Alerting Pattern	C	Shall be present if the HLR has determined an alerting category or an alerting level for the MT call configuration; otherwise shall be absent.
Pre-paging supported	C	Shall be present if the HLR has determined that pre-paging is supported in the GMSC and the HLR, otherwise shall be absent.

8.3.2 Provide Roaming Number ack

The following information element is required:

Information element name	Required	Description
Roaming number	M	E.164 number required to route the call to VMSCB (see ~~GSM~~ TS ~~03.~~23.003 [25]).

****** Next modified section ******

8.3.4 Provide Subscriber Info

The following information elements are required:

Information element name	Required	Description
IMSI	M	IMSI of the subscriber for whom information is requested (see ~~GSM~~ TS ~~03.~~23.003 [25]).
LMSI	C	Local Mobile Subscriber Identity. Shall be present if the LMSI was sent to the HLR at location updating.
Requested information	M	Indicates whether the HLR requires location information, subscriber state or both location information and subscriber state.

8.3.5 Provide Subscriber Info ack

The following information elements are required:

Information element name	Required	Description
Location information	C	Information to define the location of the MS: see definition in subclause 8.3.5.1. Shall be present if location information was requested and is available; otherwise shall be absent.
Subscriber state	C	Indicates whether the MS is busy (i.e. engaged on a circuit-switched call), network determined not reachable (IMSI detached or roaming in a prohibited location area) or assumed idle. Shall be present if subscriber state was requested; otherwise shall be absent.

8.3.5.1 Location information

The compound information element Location information consists of the following subordinate information elements:

Information element name	Required	Description
Location number	C	For a definition of this information element, see ~~ETS 300 356-1~~ITU-T Q.763 [54~~51~~]. Shall be present if the VLR can derive it from the stored service area identity (for UMTS) or cell global identity (for GSM) or location area identity; otherwise shall be absent. The mapping from cell ID and location area to location number is network-specific and outside the scope of the GSM standard.
Service area ID	C	Service area identity of the cell in which the MS is currently in radio contact or in which the MS was last in radio contact. Shall be present if the MS uses UMTS radio access and the subscriber record is marked as confirmed by radio contact; otherwise shall be absent.
Cell ID	C	Cell global identity of the cell in which the MS is currently in radio contact or in which the MS was last in radio contact. Shall be present if the MS uses GSM radio access and the subscriber record is marked as confirmed by radio contact; otherwise shall be absent.
Geographical information	C	For a definition of this information element, see ~~GSM~~ TS ~~03.~~23.032 [**27**] ~~(Universal Geographical Area Description)~~. Shall be present if the VLR can derive it from the stored service area identity, cell global identity or location area identity; otherwise shall be absent.
Geodetic information	C	This information element corresponds to the Calling Geodetic Location defined in ITU-T Q.763 [54~~52~~]. Shall be present if the VLR can derive it from the stored service area identity, cell global identity or location area identity; otherwise shall be absent.
VLR number	O	E.164 number which identifies the VLR (see ~~GSM~~ TS ~~03.~~23.003 [25]). If the HLR receives it from the VLR it shall ignore it.
Age of location information	C	Measured in minutes. Shall be present if available in the MSC/VLR; otherwise shall be absent.

****** Next modified section ******

8.3.7 Restore Data

The following information elements are required:

Information element name	Required	Description
IMSI	M	IMSI of the subscriber for whom data are to be restored (see ~~GSM~~ TS ~~03.~~23.003 [25]).
LMSI	O	LMSI of the subscriber for whom data are to be restored (see ~~GSM~~ TS ~~03.~~23.003 [25]). May be included if required by the requesting VLR.

8.3.8 Restore Data ack

The following information elements are required:

Information element name	Required	Description
HLR number	M	E.164 number which identifies the HLR (see ~~GSM~~ TS ~~03.~~23.003 [25]).
MS not reachable flag	C	Indicates whether the VLR should notify the HLR when the MS next establishes radio contact. Shall be present if the corresponding indicator is set in the HLR record for the subscriber; otherwise shall be absent.

****** Next modified section ******

8.4.1 Check IMEI

The following information element is required:

Information element name	Required	Description
IMEI	M	IMEI of the ME whose status is to be checked (see ~~GSM~~ TS ~~03.~~23.003 [25]).

****** Next modified section ******

8.7.3 Send MS information ack

The following information elements are required:

Information element name	Required	Description
IMSI	M	IMSI of the MS for which information is required.
Service area ID	C	Service area ID (for UMTS access) of the cell in which the MS last established radio contact. Shall be present if the MS uses UMTS access; otherwise shall be absent.
Cell ID	~~M (note)~~C	Cell ID (for GSM access) of the cell in which the MS last established radio contact. Shall be present if the MS uses GSM access; otherwise shall be absent.
Location information age	M (note)	Time in minutes since the MS last established a radio transaction

NOTE: Although they are optional in the protocol, these IEs are mandatory in this context.

****** Next modified section ******

Annex A (informative): Handling of an IAM at an MSC

An MSC which receives an IAM from an originating exchange may react in three different ways:

- It acts as a transit exchange, i.e. it relays the IAM to a destination exchange determined by analysis of the called party address, and thereafter relays other telephony signalling between the originating and destination exchange until the connection is released. This behaviour is not specific to UMTS or GSM;

- It acts as a terminating exchange, i.e. it attempts to connect the call to an MS currently registered in the service area of the MSC;

- It acts as a GMSC, i.e. it interrogates an HLR for information to route the call. If the HLR returns routeing information, the MSC uses the routeing information from the HLR to construct an IAM, which it sends to a destination exchange determined by analysis of the routeing information from the HLR.

Sheet 1: when the MSC co-ordinating process has decided whether the MSC is to act as a terminating VMSC, a GMSC or a transit exchange, it forwards the IAM to an idle instance of the appropriate process.

Sheet 2: after the MSC co-ordinating process has sent an IAM to an instance of the process MT_GMSC or ICH_MSC, it acts as a transparent relay for messages received from the originating exchange and the process instance (denoted by "offspring"). After the MSC co-ordinating process has relayed a Release message, it returns to the idle state.

Sheet 2: after the MSC co-ordinating process has sent an IAM to a destination exchange, it acts as a transparent relay for messages received from the originating exchange and the destination exchange. After the MSC co-ordinating process has relayed a Release message, it returns to the idle state.

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Milan, Italy, 14 - 16 Feb 2000

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CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.079	**CR**	**010r1**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: CN#07 *list expected approval meeting # here ↑*

for approval [X] for information [ ]

strategic [ ] non-strategic [X] *(for SMG use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: N2 **Date:** 16/02/2000

Subject: Replacement of references to GSM with references to UMTS

Work item: Technical Enhancements & Improvements

Category: *(only one category shall be marked with an X)*

F	Correction	[X]
A	Corresponds to a correction in an earlier release	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Release:

Phase 2	[ ]
Release 96	[ ]
Release 97	[ ]
Release 98	[ ]
Release 99	[X]
Release 00	[ ]

Reason for change: As agreed by PCG, references to GSM specifications have to be replaced by references to the corresponding 3G specifications; similarly, GSM-specific material in the text has to be replaced by UMTS-specific or generic material.

Clauses affected: 1; 2; 3.2; 4.1; 4.2; 5.1; 5.2.1; 7.1; 7.2; 7.4; 7.5; 8.2; 9.1; 9.2; 9.3; 9.4; 9.4.2; Figures 7a, 7b; 9.5; 9.5.1; 9.5.2; Figures 10b, 11; 9.6.1; 9.6.2; 9.6.3; 9.7; 9.7.1; Figure 12; 10; 10.1.1; 10.1.2; 10.1.3; 10.1.4; 10.1.5; 10.1.6; 10.1.7; 10.2.1; 10.2.2; 10.2.3; 10.3.1; 10.3.2; 10.3.3; 10.3.4; 10.3.5; 10.4.1; Annex A

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

help.doc

<--------- Double-click here for help and instructions on how to create a CR.

****** Next modified section ******

1 Scope

This ~~standard~~ 3GPP Technical Specification (TS) specifies the technical realisation of the first phase of the network feature Support of Optimal Routeing (SOR). The first phase of SOR provides:

- as a network operator option, a method to route a call from one mobile subscriber directly to another mobile subscriber who is in the same country as the calling mobile subscriber or in the called mobile subscriber's home country, without needing to connect the call via the HPLMN of the called subscriber, even though the called mobile subscriber has roamed outside his HPLMN;

- a method to forward calls when a called mobile subscriber who has roamed outside his home country is busy, or is not reachable, or does not reply, to a forwarded-to destination in the HPLMN country of the called subscriber or the VPLMN country of the called subscriber, without needing to connect the forwarded call via the VPLMN of the called subscriber;

- a method to combine the optimal routeing described in the first bullet point above with the optimal routeing described in the second bullet point above.

OR of a call is permitted only if all entities involved in handling the call support OR.

Other cases of optimal routeing (e.g. calls where the calling and called subscribers are in different countries, forwarding to a mobile subscriber or multiple forwarding) will be considered for inclusion in later phases.

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.~~

- For this Release 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).

~~[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".~~

~~[2] GSM 02.79: "Digital cellular telecommunications system (Phase 2+); Support of Optimal Routeing (SOR); Service definition (Stage 1)".~~

~~[3] GSM 02.82: "Digital cellular telecommunications system (Phase 2+); Call Forwarding (CF) Supplementary Services - Stage 1".~~

~~[4] GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".~~

[1~~5~~] GSM 03.04: "Digital cellular telecommunications system (Phase 2+); Signalling requirements relating to routeing of calls to mobile subscribers".

~~[6] GSM 03.18: "Digital cellular telecommunications system (phase 2+); Basic call handling; Technical realisation".~~

~~[7] GSM 03.78: "Digital cellular telecommunications system (phase 2+); Customised Applications for Mobile network Enhanced Logic (CAMEL) - Stage 2".~~

~~[8] GSM 03.78: "Digital cellular telecommunications system (Phase 2+); Customized Applications for Mobile network Enhanced Logic (CAMEL) - Phase 2; Stage 2".~~

~~[9] GSM 03.85: "Digital cellular telecommunications system (Phase 2+); Closed User Group (CUG) supplementary services - Stage 2".~~

~~[10] GSM 03.87: "Digital cellular telecommunications system (Phase 2+); User-to-User (UUS) supplementary services - Stage 2 (GSM 03.87)".~~

[1bis] 3G TR 21.905: " Vocabulary for 3GPP Specifications ".

[2] 3G TS 22.079: " Support of Optimal Routeing (SOR); Service definition - Stage 1".

[3] 3G TS 22.082: " Call Forwarding (CF) supplementary services - Stage 1".

[4] 3G TS 23.003: "Numbering, addressing & identification".

[5] 3G TS 23.018: " Basic call handling; Technical realization ".

[6~~11~~] 3G~~PP~~ TS 23.078: "~~Technical Specification Group Core Network;~~ Customized Applications for Mobile network Enhanced Logic (CAMEL) - Phase 3; Stage 2".

[7] 3G TS 23.085: "Closed User Group (CUG) Supplementary Service - Stage 2".

[8] 3G TS 23.087: "User –to-User Signalling (UUS) - Stage 2".

****** Next modified section ******

3.2 Abbreviations

Abbreviations used in this specification are listed in ~~GSM~~ TS ~~0~~21.9~~0~~4~~5~~ [1bis~~1~~].

For the purpose of this specification the following abbreviations apply:

BOIZC	Barring of Outgoing InterZonal Calls
BOIZC-exHC	Barring of Outgoing InterZonal Calls except those directed to the HPLMN Country
CMN	CAMEL Modified Number
FTN	Forwarded-To Number
FTNW	Forwarded-To NetWork
GMSCA	The GMSC in the IPLMN, which may also be VMSCA
GMSCB	The GMSC in HPLMNB
GMSCC	The GMSC in HPLMNC
HLRB	The HLR of the B subscriber
HLRC	The HLR of the C subscriber
HPLMNB	The HPLMN of the B subscriber
HPLMNC	The HPLMN of the C subscriber
IAM	Initial Address Message
IPLMN	Interrogating PLMN
ORLCF	Optimal Routeing for Late Call Forwarding
PRN	Provide Roaming Number
PSI	Provide Subscriber Information
RCH	Resume Call Handling
SIFIC	Send Information For Incoming Call
SIFOC	Send Information For Outgoing Call
SRI(B)	Send Routeing Information (Basic call)
SRI(F)	Send Routeing Information (Forwarding information)
VLRA	The VLR of the A subscriber
VLRB	The VLR of the B subscriber
VMSCA	The VMSC of the A subscriber
VMSCB	The VMSC of the B subscriber

4 Architecture

4.1 Optimal routeing for basic mobile-to-mobile calls

It is a network operator option whether to implement optimal routeing for basic mobile-to-mobile calls.

The existing UMTS and GSM architectures support~~s~~ the primary technical requirement of optimal routeing for mobile-to-mobile calls (basic OR): that a GMSC can interrogate an HLR in a different PLMN to obtain routeing information for a mobile terminated call (see GSM 03.04 [15~~]~~). Three logically distinct PLMNs are involved in the handling of an optimally routed mobile-to-mobile call:

- the IPLMN, which is also the VPLMN of the calling mobile subscriber;
- the HPLMN of the called mobile subscriber (HPLMNB);
- the VPLMN of the called mobile subscriber (VPLMNB).

Any two or all three of these PLMNs may be identical; in figure 1 they are shown as distinct.

Figure 1 shows the communication between the IPLMN, HPLMNB and VPLMNB for an optimally routed mobile-to-mobile call.

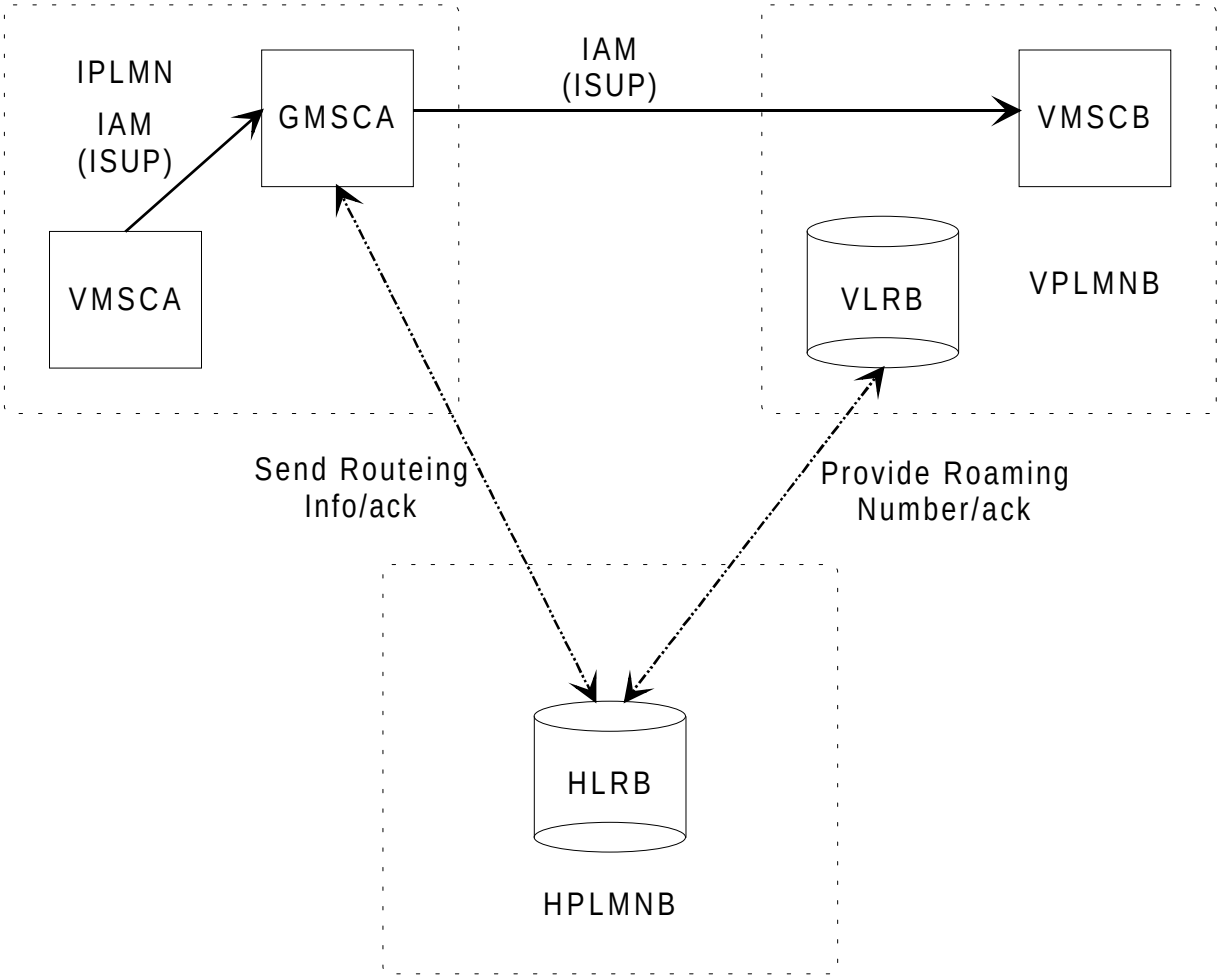


Figure 1: Architecture for optimal routeing of basic mobile-to-mobile call

In figure 1 and throughout this specification, the term ISUP is used to denote the telephony signalling system used between exchanges. In a given network, any telephony signalling system may be used; the only additional requirement is that GMSCA must be able to signal to VMSCA the destination address which it has used to route the call.

If the VMSC of the calling mobile subscriber (VMSCA) is distinct from the GMSC, it constructs an ISUP Initial Address Message (IAM) using the MSISDN of the called subscriber and sends it to the GMSC. If the GMSC, which may be distinct from the VMSC of the calling mobile subscriber but is in the VPLMN of the calling mobile subscriber, is in a different PLMN from HLRB, it requests routeing information from HLRB using the MAP protocol. If HLRB determines that the call can be routed directly from the GMSC to VMSCB without contravening the charging requirements for optimal routeing given in subclause 9.1, it requests a roaming number from VLRB using the MAP protocol, and VLRB returns a roaming number in the Provide Roaming Number ack. HLRB returns the roaming number to the GMSC in the Send Routeing Info ack. The GMSC uses the roaming number to construct an ISUP IAM, which it sends to VMSCB. The call is then handled according to the ~~existing GSM~~ procedures defined in TS 23.018 [5], except that if the call is answered GMSCA inserts in the ISUP Answer message the destination address which it used to route the call, to allow VMSCA to generate the correct charging record.

NOTE: If the GMSC returns an ISUP Answer message before it has received an Answer message from the final destination (e.g. because of an interaction with a Specialised Resource Function) an incorrect destination address (or no destination address) can be sent to VMSCA, even though the call is eventually optimally routed.

4.2 Optimal routeing for conditional call forwarding

Some cases of call forwarding on mobile subscriber not reachable (CFNRc) are handled in the IPLMN, without the call being extended to the VPLMN of the forwarding subscriber. For these cases, referred to in this specification as early call forwarding, the forwarding is already optimally routed.

When a call has been extended from the GMSC to VMSCB, the ~~current GSM~~ procedures defined in TS 23.018 [5] lead to any conditional call forwarding being routed from VMSCB to the forwarded-to destination; this is referred to in this specification as late call forwarding. Optimal routeing for late call forwarding (ORLCF) allows VMSCB to return control of the call to the GMSC, which can then route the call to the forwarded-to destination.

Figure 2 shows the architecture for ORLCF. Phase 1 of SOR does not include optimal routeing of forwarding to a mobile subscriber, so optimal routeing of the forwarding leg is not considered.

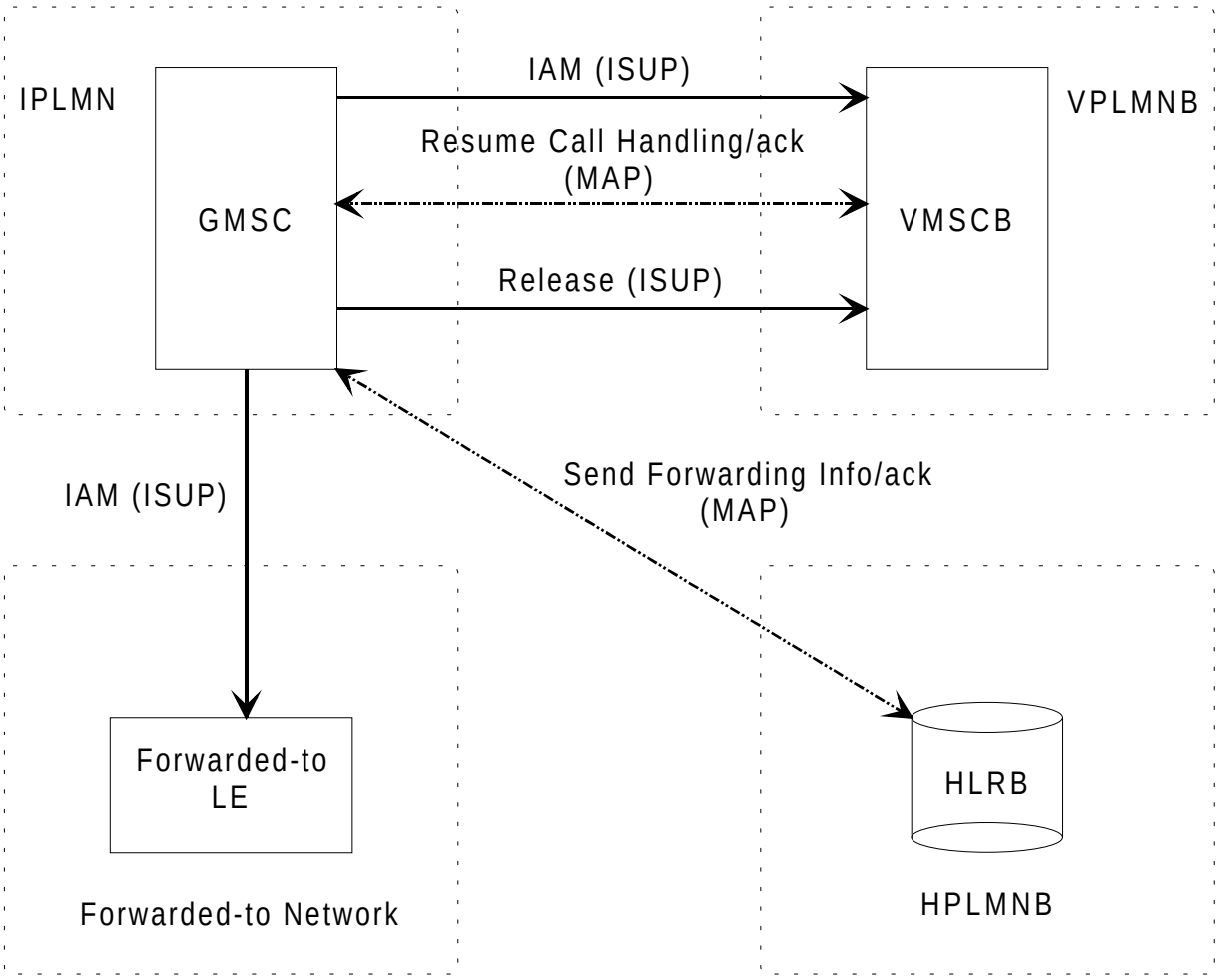


Figure 2: Architecture for optimal routeing of late call forwarding

After the call has been extended from the GMSC to VMSCB, if the VMSC/VLR determines that the call should be forwarded it requests the GMSC to resume call handling. The GMSC uses the forwarding information received in the request to resume call handling, or interrogates HLRB for forwarding information, depending on the indication received from the HLR with the roaming number. If the GMSC determines that the call can be routed directly to the forwarded-to destination without contravening the charging requirements for optimal routeing given in subclause 9.1 it acknowledges the request, clears the traffic connection to VMSCB and sends an ISUP IAM to the forwarded-to local exchange.

****** Next modified section ******

5.1 Successful outcome

When VMSCA receives a Setup message from the MS, it sends a request for information to handle the outgoing call to VLRA, according to the procedures described in ~~GSM 03.~~TS 23.018 [5~~6~~]. If VLRA determines that the MS is allowed service, it returns a positive acknowledgement. When VMSCA receives the acknowledgement, it constructs an IAM using the B subscriber address and sends it to GMSCA.

If GMSCA recognises the B subscriber address as belonging to a UMTS or GSM PLMN (decision OR1:Y), it checks the identity of HPLMNB. If GMSCA is in a different PLMN from HLRB, it then sends a request for routeing information (SRI(B)) to HLRB; this request contains an indication that it is an optimal routeing enquiry for information to route a basic call. If HLRB is prepared to accept an optimal routeing enquiry from GMSCA (decision OR2:Y), it checks whether at least one of the three conditions:

- the GMSC is in the same country as VMSCB;
- the HLR is in the same country as VMSCB;
- the GMSC is in the same PLMN as the HLR.

is met. If it is (decision OR3:Y), HLRB sends a request for a roaming number (PRN) to VLRB; the request contains an indication that it is for an optimally routed call. If VLRB supports optimal routeing (decision OR4:Y), it returns the roaming number in the PRN ack, and HLRB relays the roaming number in the SRI ack to GMSCA. GMSCA constructs an ISUP IAM using the roaming number, and sends it to VMSCB, which processes the incoming IAM according to the procedures described in ~~GSM 03.~~TS 23.018 [5~~6~~].

5.2 Unsuccessful outcome

Error situations which lead to failure of the call, rather than non-optimal routeing, are not described in this subclause.

5.2.1 B subscriber address not recognised as belonging to a UMTS or GSM PLMN

If GMSCA does not support optimal routeing for basic mobile-to-mobile calls, or does not recognise the B subscriber address as belonging to a UMTS or GSM PLMN (decision OR1:N), it constructs an IAM using the B subscriber address and sends it to GMSCB in HPLMNB. GMSCB analyses the address received in the IAM, and sends a request for routeing information (SRI(B)) to HLRB; this request contains an indication that it is not an optimal routeing enquiry. Because GMSCB is in the same PLMN as HLRB, it will always be able to derive an HLR address. HLRB sends a request for a roaming number (PRN) to VLRB. VLRB returns the roaming number in the PRN ack, and HLRB relays the roaming number in the SRI ack to GMSCB. GMSCB constructs an ISUP IAM using the roaming number, and sends it to VMSCB, which processes the incoming IAM according to the procedures described in ~~GSM 03.~~TS 23.018 [5~~6~~].

****** Next modified section ******

7 Interactions between optimal routeing and supplementary services

7.1 Call forwarding

If an optimally routed call encounters early call forwarding, GMSCA attempts to route the call to the forwarded-to destination. The forwarded-to destination is the C subscriber if the C subscriber is not a mobile subscriber, or the HPLMN of the C subscriber if the C subscriber is a mobile subscriber. If GMSCA cannot route the call to the forwarded-to destination without contravening the charging requirements for Support of Optimal Routeing given in subclause 9.1, the call is routed to a GMSC in the HPLMN of the B subscriber.

If an optimally routed call encounters late call forwarding, GMSCA attempts to route the call to the forwarded-to destination. The forwarded-to destination is the C subscriber if the C subscriber is not a mobile subscriber, or the HPLMN of the C subscriber if the C subscriber is a mobile subscriber. If GMSCA cannot route the call to the forwarded-to destination without contravening the charging requirements for Support of Optimal Routeing given in subclause 9.1, the call is routed from VMSCB to the forwarded-to destination.

The handling of call forwarding at HLRB for optimally routed calls is encapsulated in the procedures First_Forwarding_HLR, PRN_Error_HLR, Handle_CFB, Handle_CFNRc and Handle_CFNRY, which are specified in ~~GSM 03.~~TS 23.018 [~~5~~6].

7.2 Closed User Group (CUG)

The handling of CUG checking for outgoing calls at VLRA is encapsulated in the process OCH_VLR, which is specified in ~~GSM 03.~~TS 23.018 [~~5~~6].

The handling of CUG checking at HLRB is encapsulated in the procedures Subscription_Check_HLR and Forward_CUG_Check, which are specified in ~~GSM 03.~~TS 23.018 [~~5~~6].

****** Next modified section ******

7.4 Call barring

It has been accepted in principle that all supplementary service call barring programmes except for BAIC are applied for cost control reasons, and that therefore barring should be applied on the basis of the cost of the actual route taken by the call. For phase 1 of Support of Optimal Routeing, this principle does not apply. Barring of outgoing calls is applied on the basis of the B subscriber number. Barring of all incoming calls will prevent a call to the served mobile subscriber, whether or not the call is optimally routed. If Barring of Incoming Calls when roaming outside the home PLMN country is active and operative it will prevent a call to the B subscriber even if the A subscriber pays to route the call to the VMSC of the B subscriber.

The handling of barring of outgoing calls at VLRA is encapsulated in the process OCH_VLR, which is specified in ~~GSM 03.~~TS 23.018 [~~5~~6].

The handling of barring of incoming calls at HLRB is encapsulated in the procedure Subscription_Check_HLR, which is specified in ~~GSM 03.~~TS 23.018 [~~5~~6].

The interactions between barring of outgoing calls and call forwarding for phase 1 of Support of Optimal Routeing are defined in ~~GSM 02.~~TS 22.082 [~~3~~3].

The interactions between BIC-Roam and call forwarding for phase 1 of Support of Optimal Routeing are defined in ~~GSM 02.~~TS 22.082 [~~33~~].

7.5 Other supplementary services

The effects of the following supplementary services on optimally routed calls are identical to their effects on non-optimally routed calls, so they are omitted from this specification:

- CLIP, CLIR, COLP, COLR (~~GSM 03.~~TS 23.081);
- CW, HOLD (~~GSM 03.~~TS 23.083);
- MPTY (~~GSM 03.~~TS 23.084);
- ECT (~~GSM 03.~~TS 23.091).

****** Next modified section ******

8.2 CAMEL

The principles for interactions between CAMEL services and optimal routeing are specified in this subclause. The interworking between CAMEL processing and optimal routeing in the GMSC and the terminating VMSC is specified in subclause 9.4 and ~~GSM 03.~~TS 23.018 [~~56~~].

If a mobile-originating CAMEL service modifies the number entered by the A subscriber, VMSCA treats the number returned by the CAMEL server in the same way as a number received in the SETUP message, i.e. it sends an IAM containing the modified number to the associated GMSC, which analyses it to find if it is an MSISDN.

If a mobile-terminating CAMEL service modifies the number received by the GMSC, the GMSC treats the number returned by the CAMEL server in the same way as a forwarded-to number, i.e. it checks it against the optimal routeing criteria in subclause 9.1 but does not analyse it to find if it can derive an HLR address. If the number returned by the CAMEL server does not satisfy the optimal routeing criteria in subclause 9.1 and the GMSC is not in the same PLMN as HLRB, the GMSC will route the call to a GMSC in the same PLMN as HLRB. This will lead to a repetition of the mobile terminating CAMEL interaction.

If the call is to be forwarded at the GMSC (whether by a ~~GSM~~UMTS-standardised call forwarding service or by a CAMEL-based call forwarding service) and a mobile originating CAMEL service applies to the forwarding subscriber, the GMSC checks the number which results from the CAMEL service against the optimal routeing criteria in subclause 9.1. If the number returned by the CAMEL server does not satisfy the optimal routeing criteria in subclause 9.1, the GMSC will not route the call to the forwarded-to destination. For early call forwarding, the GMSC will route the call to a GMSC in the same PLMN as HLRB. This will lead to a repetition of the mobile originating CAMEL interaction. For optimal routeing of late call forwarding, the GMSC will return a Resume Call Handling negative response towards VMSCB, which will forward the call. This will lead to a repetition of the mobile originating CAMEL interaction.

9 Functional requirements of entities performing optimal routeing

9.1 Charging requirements for optimal routeing

MoU have imposed two constraints for the charging of optimally routed calls:

- No subscriber shall pay more for a call which has been optimally routed than he would do under the present routeing scheme described in GSM 03.04 [15] in the subclauses describing the call cases where the GMSC is in the same PLMN as the HLR;
- At least for the first phase of Support of Optimal Routeing, the charge for one leg of a call shall be paid for entirely by one subscriber.

These constraints mean that the direct route for a call cannot always be used. For example, if the calling mobile subscriber (the A subscriber) is in Germany, and the B subscriber's HPLMN is in Switzerland but he has roamed to Finland, the charge payable by the A subscriber to route the call by the direct route to Finland would be greater than the charge payable to route the call to HPLMNB, so the HPLMN route must be used.

In the first phase of Support of Optimal Routeing, it cannot be assumed that a GMSC is able to calculate the charge payable for the direct route and the charge payable for the HPLMN leg. The MoU requirements can be met by applying more stringent (but simpler) criteria for deciding whether the direct route may be used:

- If the country code of the destination exchange and the country code of the GMSC are the same, then the direct route may be used;
- Otherwise, for a call leg which is chargeable to the A subscriber, if the country code of the destination exchange and the country code of HPLMNB are the same, then the direct route may be used;
- Otherwise, the HPLMN route shall be used.

In certain cases, the second criterion above (equality of country codes for the HPLMN and the destination exchange) may not be enough to determine equality of the charges payable for the direct route and the HPLMN route. In these cases, analysis of the national destination code as well as the country code is required; however the principle is still that if the two numbers are the same to the depth of analysis required then the direct route may be used.

For optimal routeing of late call forwarding, the constraints are satisfied if the following criteria are applied:

- If the country code of the forwarded-to exchange and the country code of the GMSC are the same, then the forwarded call may be routed directly from the GMSC to the forwarded-to exchange;
- Otherwise, if the country code of the forwarded-to exchange and the country code of HPLMNB are the same, then the forwarded call may be routed directly from the GMSC to the forwarded-to exchange;
- Otherwise, if the country code of the forwarded-to exchange and the country code of VPLMNB are the same, then the forwarded call may be routed directly from the GMSC to the forwarded-to exchange;
- Otherwise the forwarded call shall be routed through VPLMNB.

9.2 Functional behaviour of VMSCA

The functional behaviour of VMSCA is specified in ~~GSM 03.~~TS 23.018 [56]. The only function specific to optimal routeing is the transfer of the destination address, if it is received in the ISUP Answer message, to the call data record, to allow the correct charge for the call to be made. This function is required only if VMSCA supports optimal routeing of mobile-to-mobile calls.

9.3 Functional behaviour of VLRA

The functional behaviour of VLRA is specified in ~~GSM 03.~~TS 23.018 [56].

9.4 Functional behaviour of GMSC

It should be noted that if a call is being forwarded from VMSCB rather than from the MSC which acted as GMSC for the original call then VMSCB may use the services of an associated GMSC for the forwarding leg, i.e. the associated GMSC requests routeing information from HLRC. In this case, the forwarding leg is processed in the same way as a mobile-originated call from mobile subscriber B.

The functional behaviour of a GMSC is specified in ~~GSM 03.~~TS 23.018 [~~5~~6]. The procedures specific to Support of Optimal Routeing are specified in this subclause.

9.4.1 Procedure OR_Set_ORA_Parameters

9.4.2 Procedure OR_Handle_RCH

Sheet 1: the procedure Activate_CF_Process is specified in ~~GSM 03.~~TS 23.018 [~~5~~6].

Sheet 1: if the GMSC interrogates the HLR for a Forwarded-to number, the Routeing address is the Forwarded-to number received in the Send Routeing Info ack; otherwise the Routeing address is the Forwarded-to number received in the Resume Call Handling.

Sheet 2: the procedure CAMEL_MT_GMSC_Notify_CF is specific to CAMEL phase 2 or higher; it is specified in ~~GSM 03.~~TS 23.078 ~~for CAMEL Phase 2~~ [~~6~~8]. If the GMSC does not support CAMEL phase 2 or higher, processing continues from the "Continue" exit of the test "Result".

Sheet 2: the task "Destination address:=FTN" is executed only if the GMSC supports optimal routeing of basic mobile-to-mobile calls.

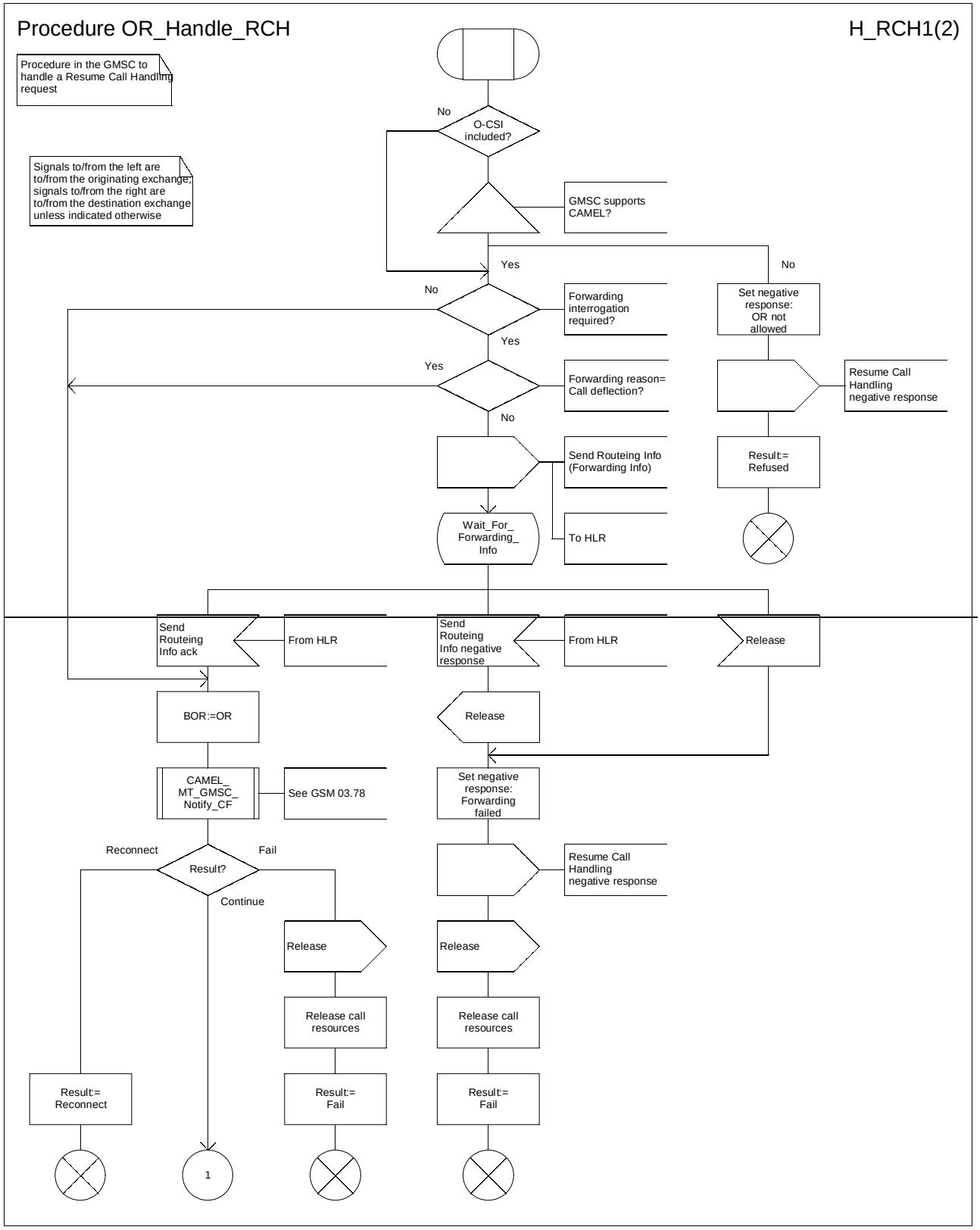
Sheet 2: the process MT_CF_MSC is specified in ~~GSM 03.~~TS 23.018 [~~5~~6].

Sheet 2: the procedure UUS_GMSC_Check_Forwarding is specific to UUS; it is specified in ~~GSM 03.~~TS 23.087 [~~8~~10].

Sheet 2: the procedure CAMEL_Store_Destination_Address is specific to CAMEL phase 3; it is specified in TS 23.078 ~~for CAMEL Phase 3~~ [~~6~~11].

Sheet 2: the called party address sent in the IAM to the process MT_CF_MSC is the Forwarded-to number received in the Perform Call Forwarding ack.

****** Next modified section ******


Procedure OR_Handle_RCH
H_RCH1(2)
Procedure in the GMSC to handle a Resume Call Handling request
Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the destination exchange unless indicated otherwise
No
O-CSI included?
GMSC supports CAMEL?
Yes
No
No
Forwarding interrogation required?
Set negative response: OR not allowed
Yes
Yes
Forwarding reason= Call deflection?
Resume Call Handling negative response
No
Send Routeing Info (Forwarding Info)
Result:= Refused
Wait_For_ Forwarding_ Info
To HLR
Send Routeing Info ack
From HLR
Send Routeing Info negative response
From HLR
Release
BOR:=OR
Release
CAMEL_ MT_GMSC_ Notify_CF
See GSM 03.78
Set negative response: Forwarding failed
Reconnect
Result?
Fail
Continue
Resume Call Handling negative response
Release
Release
Release call resources
Release call resources
Result:= Reconnect
Result:= Fail
Result:= Fail
1

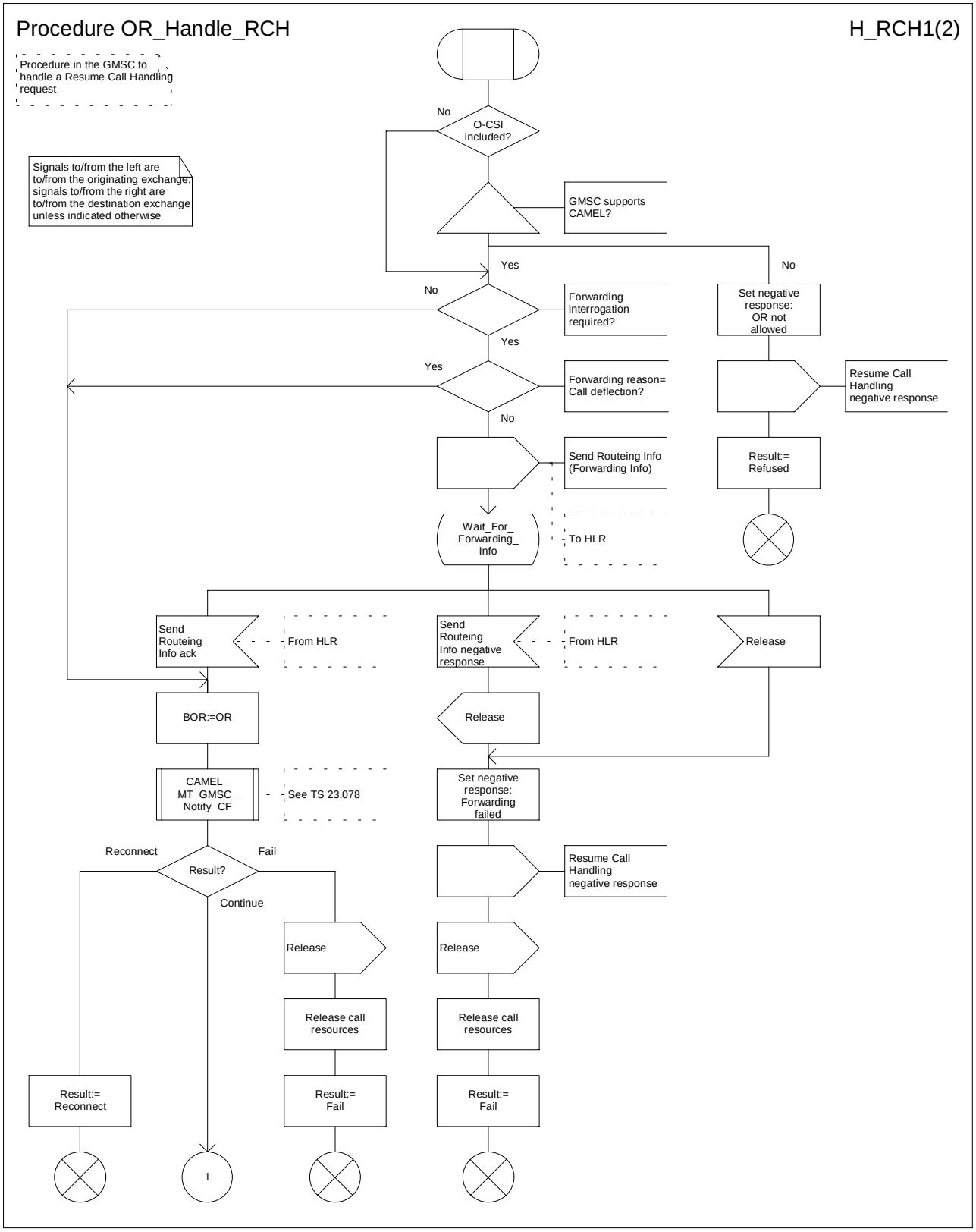
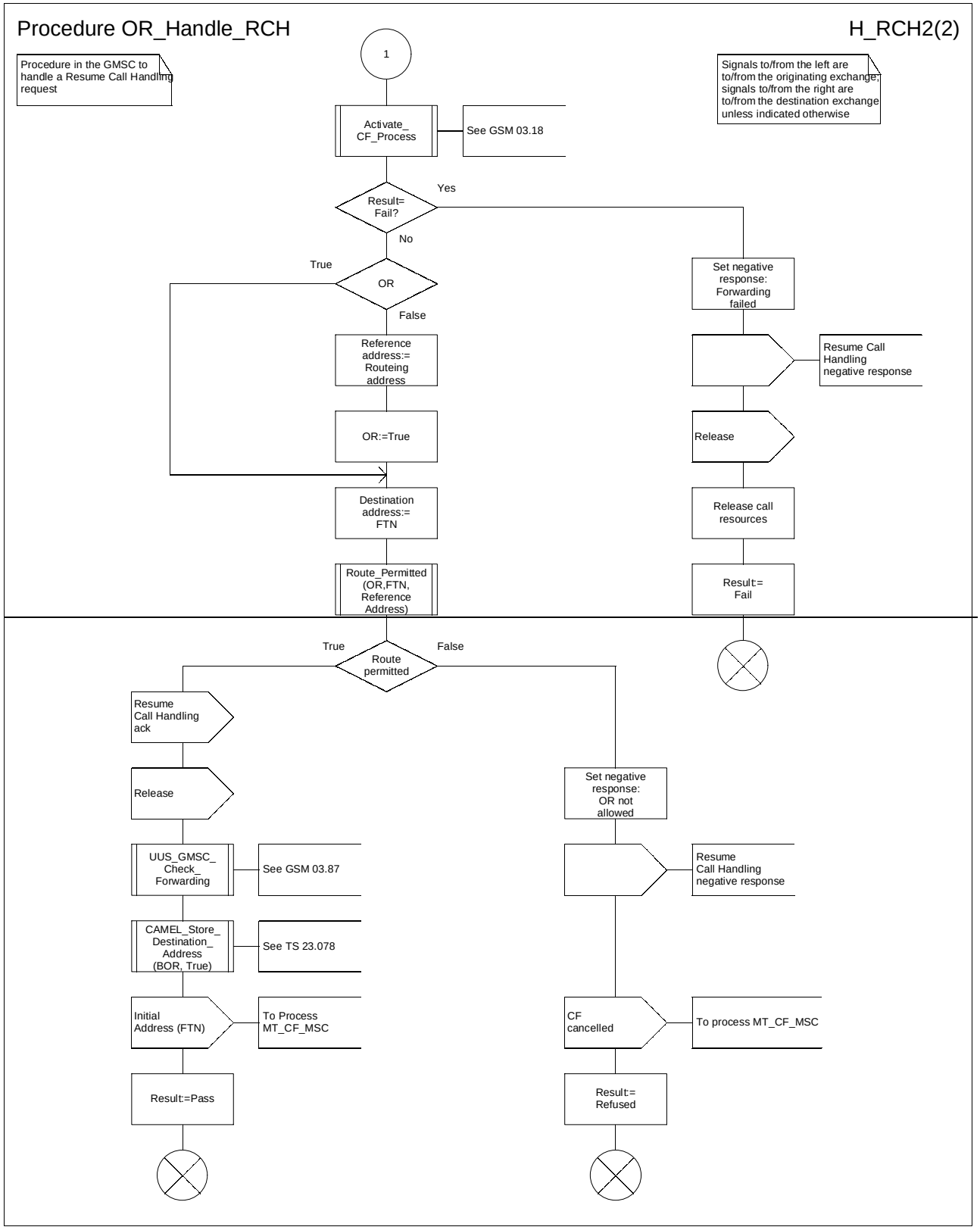


Figure 7a: Procedure OR_Handle_RCH (sheet 1)


Procedure OR_Handle_RCH
H_RCH2(2)
Procedure in the GMSC to handle a Resume Call Handling request
Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the destination exchange unless indicated otherwise
1
Activate_ CF_Process
See GSM 03.18
Result= Fail?
Yes
No
OR
True
False
Set negative response: Forwarding failed
Resume Call Handling negative response
Release
Release call resources
Result:= Fail
Reference address:= Routeing address
OR:=True
Destination address:= FTN
Route_Permitted (OR,FTN, Reference Address)
Route permitted
True
False
Resume Call Handling ack
Release
UUS_GMSC_ Check_ Forwarding
See GSM 03.87
CAMEL_Store_ Destination_ Address (BOR, True)
See TS 23.078
Initial Address (FTN)
To Process MT_CF_MSC
Result:=Pass
Set negative response: OR not allowed
Resume Call Handling negative response
CF cancelled
To process MT_CF_MSC
Result:= Refused

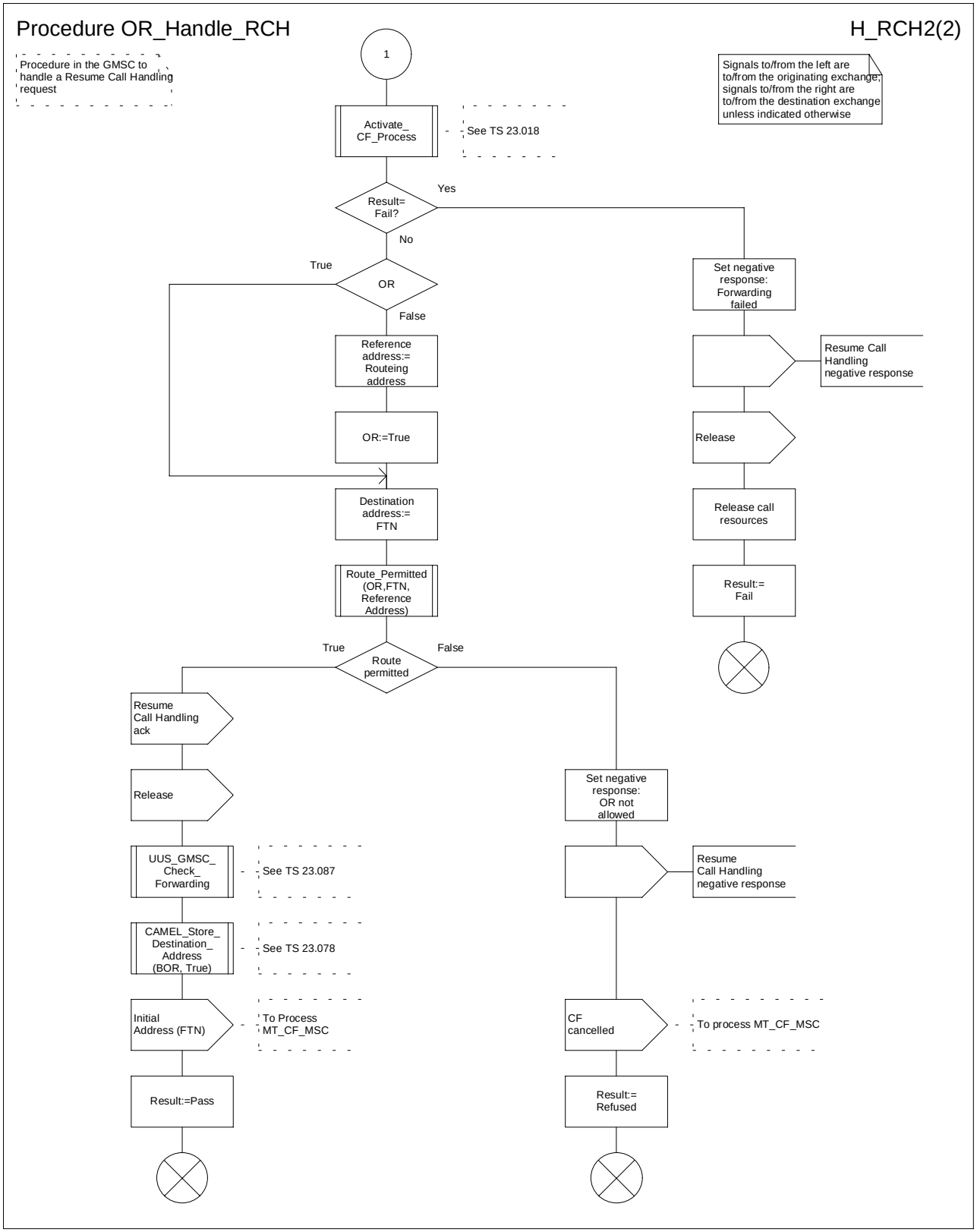


Figure 7b: Procedure OR_Handle_RCH (sheet 2)

****** Next modified section ******

9.5 Functional behaviour of HLR

The functional behaviour of an HLR is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The procedures specific to Support of Optimal Routeing are specified in this subclause.

9.5.1 Procedure OR_HLR_CF

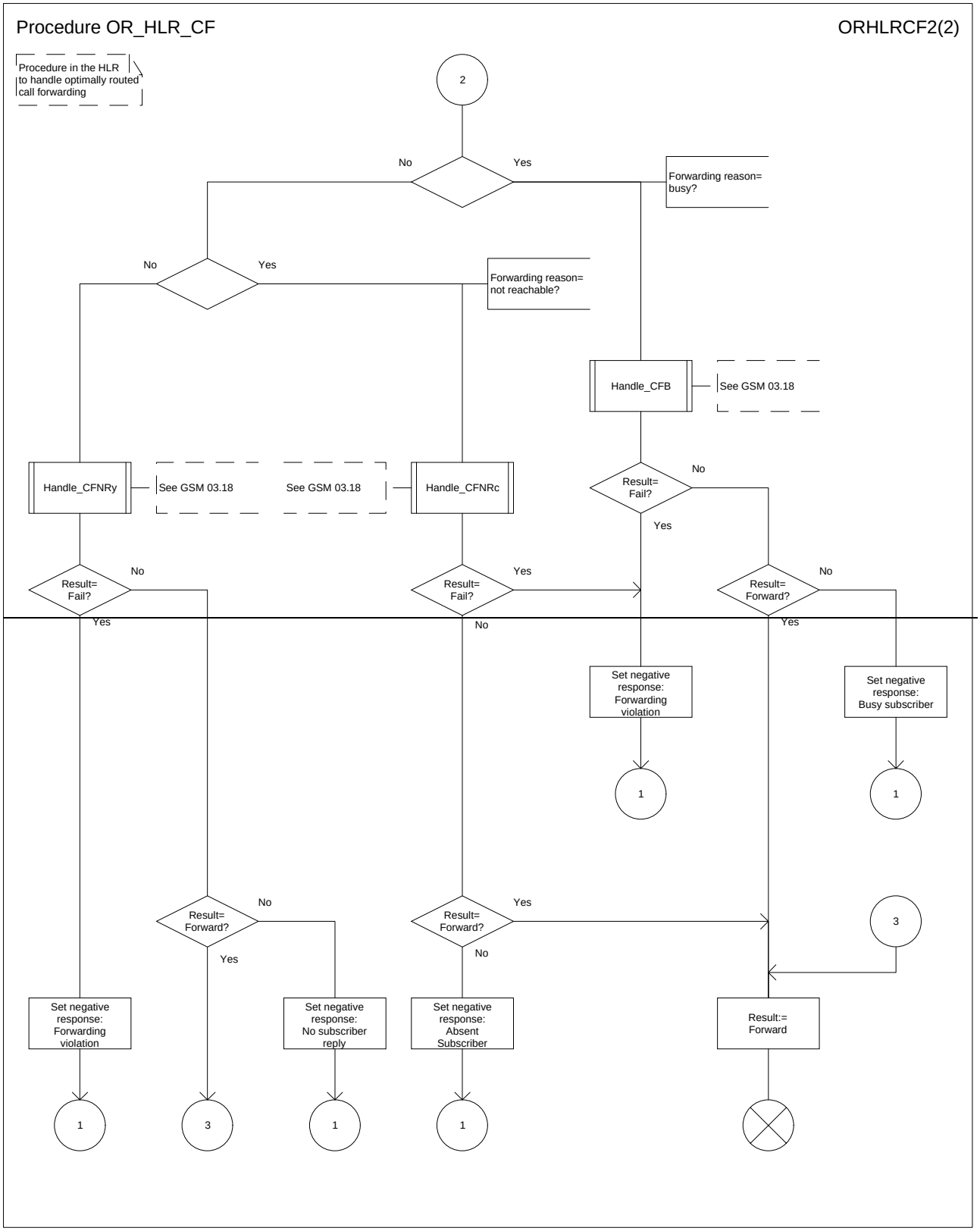
Sheet 1: if the HLR does not support optimal routeing of basic mobile-to-mobile calls, the test "Optimal routeing allowed" takes the "No" exit.

Sheet 2: the procedures Handle_CFB, Handle_CFNRc and Handle_CFNRy are specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

9.5.2 Procedure OR_HLR_Interrogate_VLR

If the HLR does not support optimal routeing of basic mobile-to-mobile calls, this procedure will be executed only if the Send Routeing Info was from a GMSC in the same PLMN as the HLR, i.e. this was not an Optimal Routeing enquiry.

The procedure Handle_CFNRc is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].


Procedure OR_HLR_CF
ORHLRCF2(2)
Procedure in the HLR to handle optimally routed call forwarding
2
No
Yes
Forwarding reason= busy?
No
Yes
Forwarding reason= not reachable?
Handle_CFB
See GSM 03.18
Handle_CFNRy
See GSM 03.18
See GSM 03.18
Handle_CFNRc
Result= Fail?
No
Yes
Result= Fail?
No
Yes
Result= Fail?
No
Yes
Result= Forward?
No
Yes
Set negative response: Forwarding violation
Set negative response: Busy subscriber
1
1
Result= Forward?
No
Yes
Result= Forward?
No
Yes
3
Set negative response: Forwarding violation
Set negative response: No subscriber reply
Set negative response: Absent Subscriber
Result:= Forward
1
3
1
1

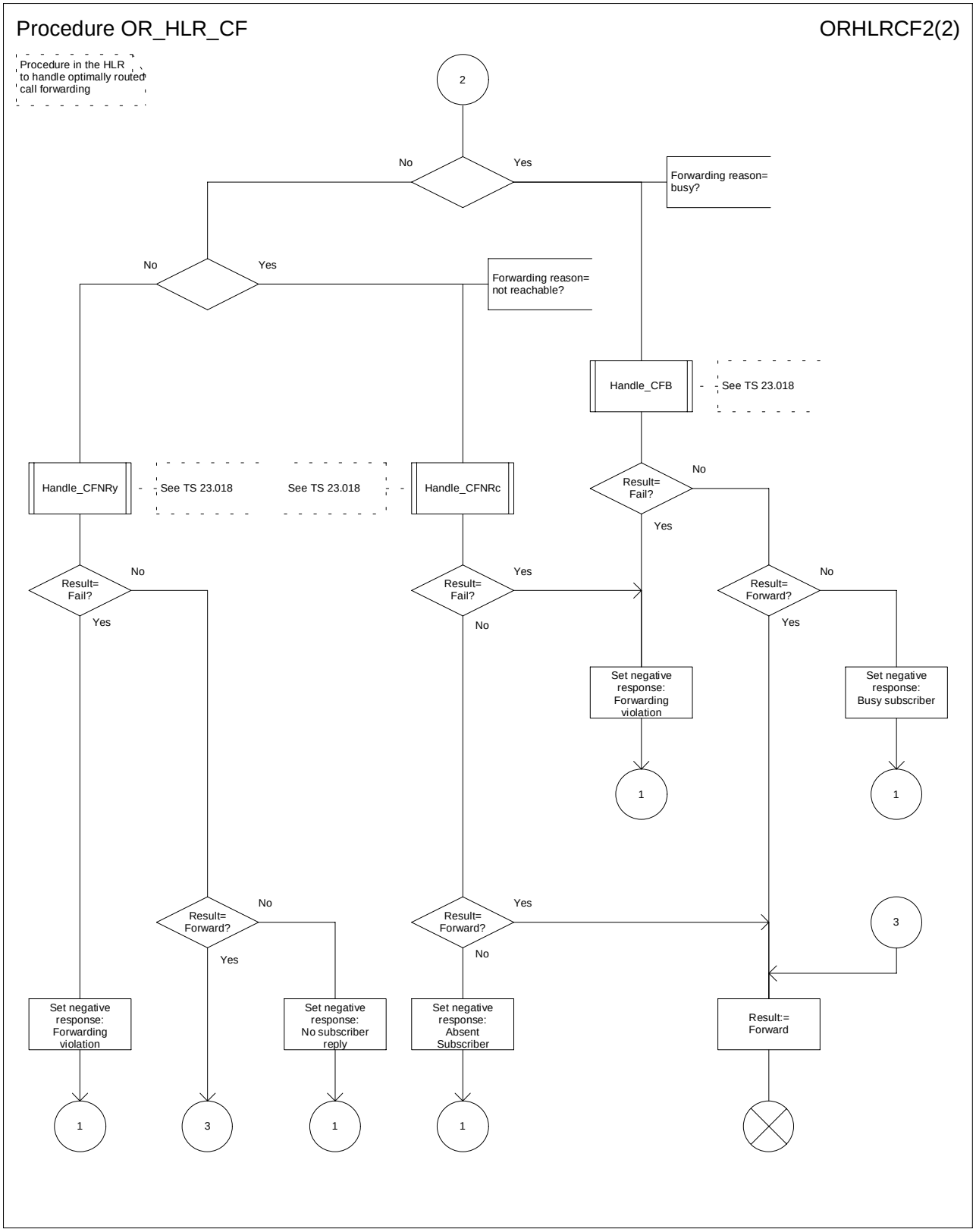
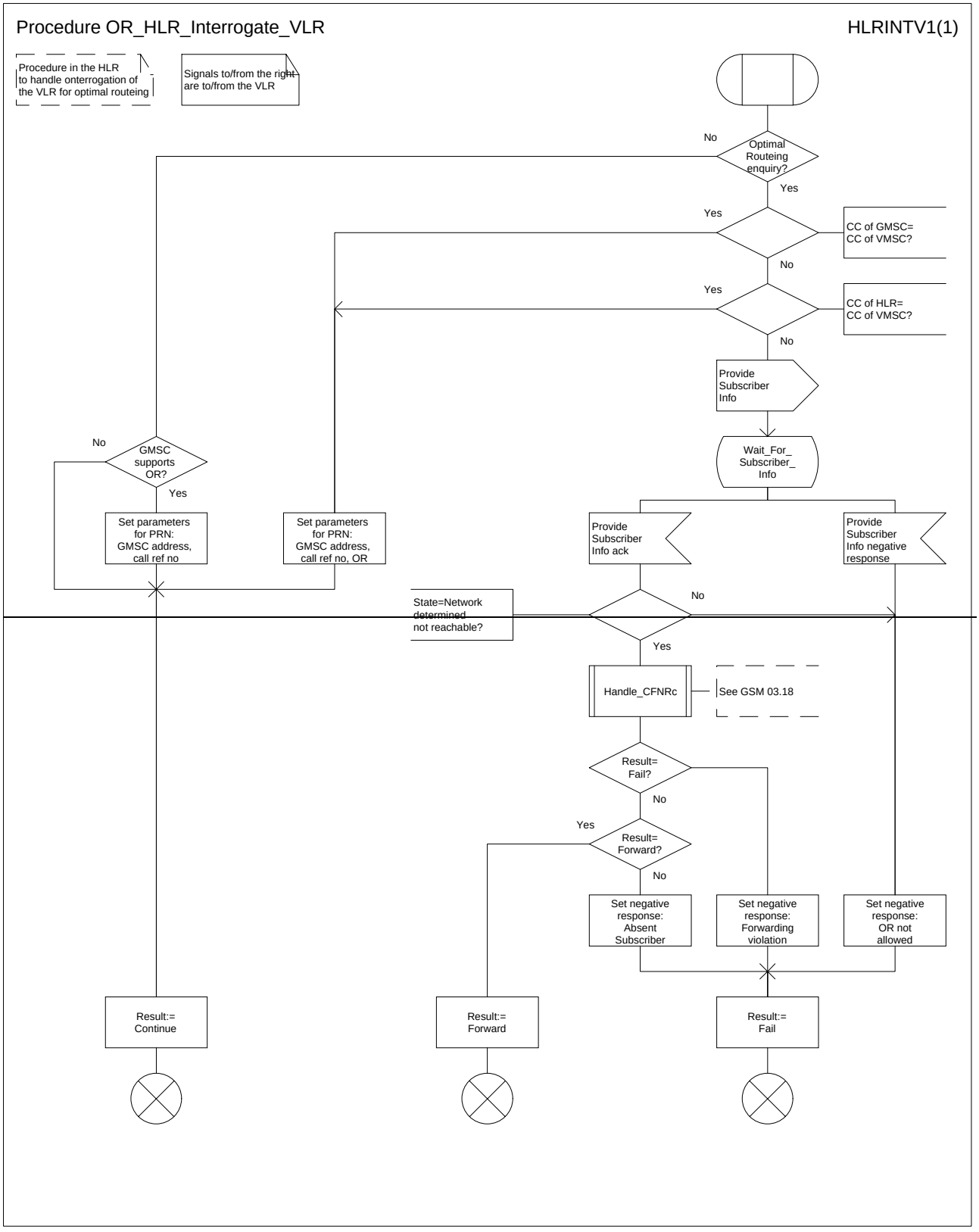


Figure 10b: Procedure OR_HLR_CF (sheet 2)


Procedure OR_HLR_Interrogate_VLR
HLRINTV1(1)
Procedure in the HLR to handle onterrogation of the VLR for optimal routeing
Signals to/from the right are to/from the VLR
Optimal Routeing enquiry?
No
Yes
CC of GMSC= CC of VMSC?
Yes
No
CC of HLR= CC of VMSC?
Yes
No
Provide Subscriber Info
Wait_For_ Subscriber_ Info
GMSC supports OR?
No
Yes
Set parameters for PRN: GMSC address, call ref no
Set parameters for PRN: GMSC address, call ref no, OR
Provide Subscriber Info ack
Provide Subscriber Info negative response
State=Network determined not reachable?
No
Yes
Handle_CFNRc
See GSM 03.18
Result= Fail?
No
Yes
Result= Forward?
No
Set negative response: Absent Subscriber
Set negative response: Forwarding violation
Set negative response: OR not allowed
Result:= Continue
Result:= Forward
Result:= Fail

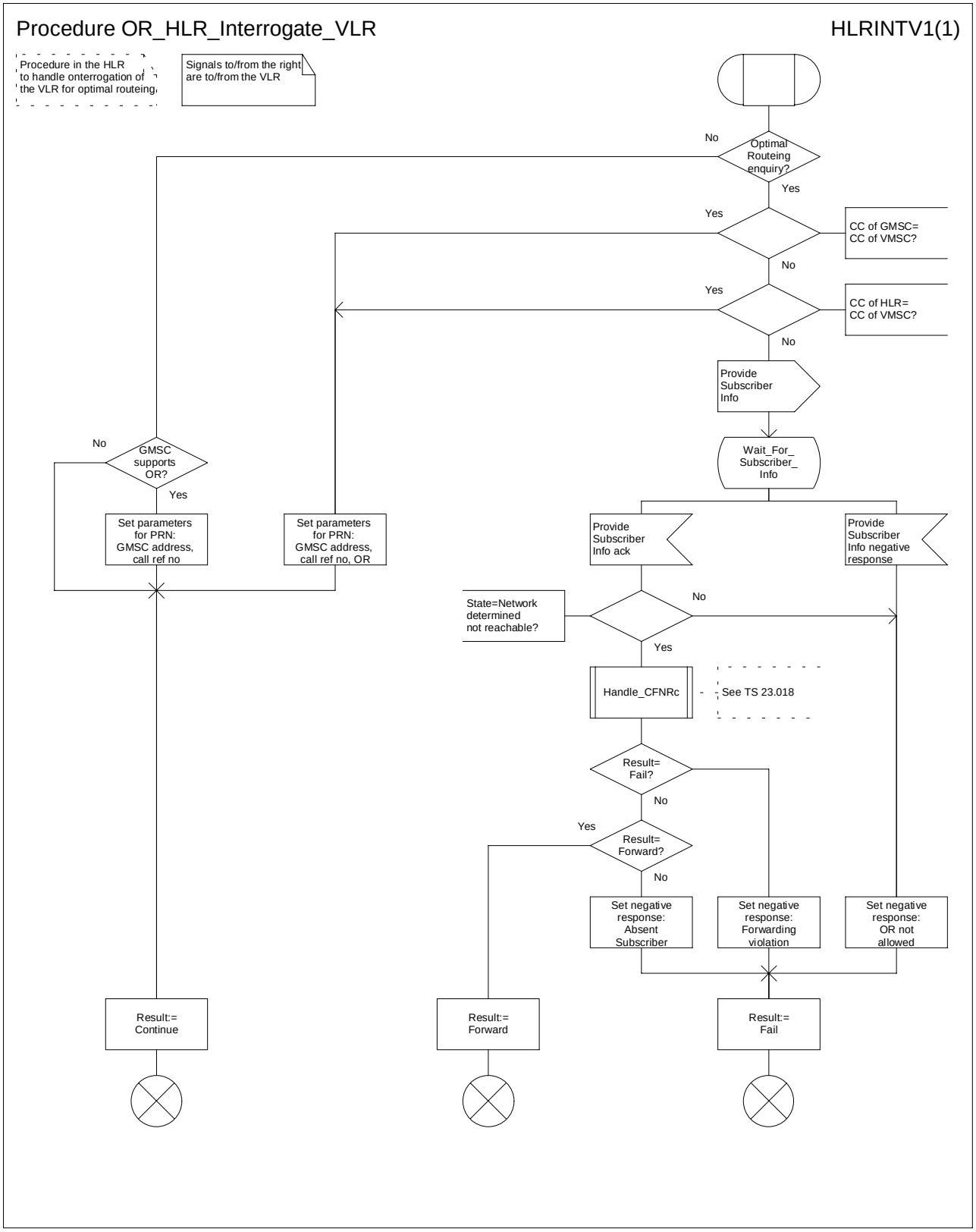


Figure 11: Procedure OR_HLR_Interrogate_VLR

9.6 Functional behaviour of VLRB

9.6.1 Functional behaviour of VLRB for provision of subscriber information

The functional behaviour of VLRB for provision of subscriber information is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

9.6.2 Functional behaviour of VLRB for roaming number allocation

The functional behaviour of VLRB for roaming number allocation is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The only function specific to Support of Optimal Routeing is the storage of the OR indicator, the GMSC address and the call reference number if VLRB receives them in the Provide Roaming Number request.

9.6.3 Functional behaviour of VLRB when handling an incoming call

The functional behaviour of VLRB when handling a request for information to handle an incoming call is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The only functions specific to Support of Optimal Routeing are:

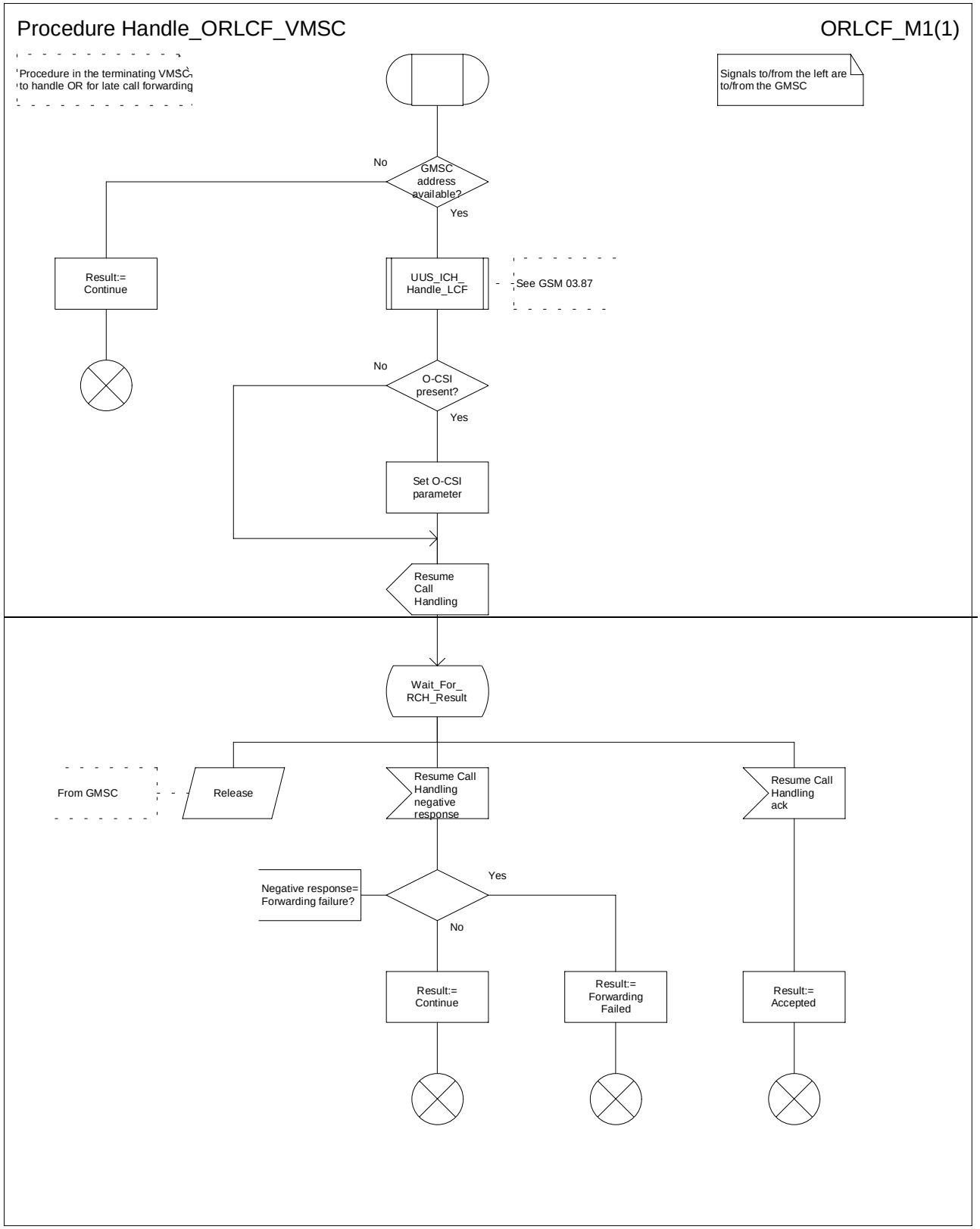
- the inclusion in the Complete Call or Process Call Waiting, if the call is to be offered to the B subscriber, of the OR indicator and the GMSC address if VLRB received them in the Provide Roaming Number request;
- the inclusion in the Send Info For Incoming Call response, if the call is to be forwarded, of:
  - the OR indicator, the GMSC address and the call reference number if VLRB received them in the Provide Roaming Number request;
  - the basic service which applies for this call.

9.7 Functional behaviour of VMSCB

The functional behaviour of VMSCB when it handles an incoming call is described in ~~GSM 03.~~TS 23.018 [5~~6~~]. The procedure specific to Support of Optimal Routeing is specified in this subclause..

9.7.1 Procedure Handle_ORLCF_VMSC

The procedure UUS_ICH_Handle_LCF is specific to UUS; it is specified in ~~GSM 03.~~TS 23.087 [8~~10~~].


Procedure Handle_ORLCF_VMSC
ORLCF_M1(1)
Procedure in the terminating VMSC to handle OR for late call forwarding
Signals to/from the left are to/from the GMSC
GMSC address available?
No
Yes
Result:= Continue
UUS_ICH_ Handle_LCF
See GSM 03.87
O-CSI present?
No
Yes
Set O-CSI parameter
Resume Call Handling
Wait_For_ RCH_Result
From GMSC
Release
Resume Call Handling negative response
Resume Call Handling ack
Negative response= Forwarding failure?
Yes
No
Result:= Continue
Result:= Forwarding Failed
Result:= Accepted

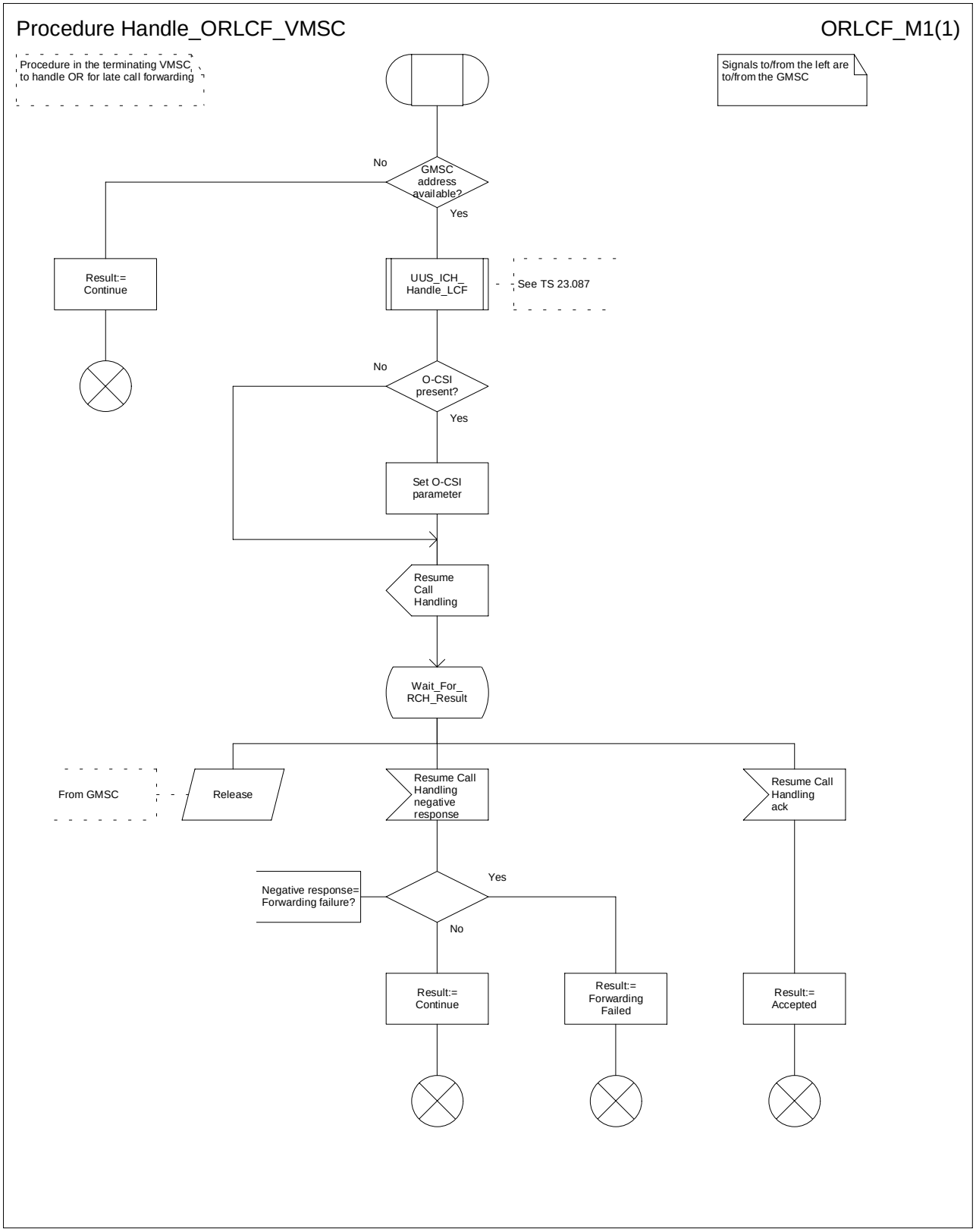


Figure 12: Procedure Handle_ORLCF_VMSC

10 Contents of messages

This clause specifies the changes to the content of each message shown in clauses 5, 6 and 9, including those messages which are already specified for ~~GSM Phase 2~~UMTS but which require changes for Optimal Routeing. It should be read as a 'delta' on the corresponding clause of ~~GSM 03.~~TS 23.018 [5]; those information elements which are the same for SOR as for the basic call without OR are not specified in this clause.

In the tables which follow, information elements are shown as mandatory (M) or conditional (C). A mandatory information element shall always be present. A conditional information element shall be present if certain conditions are fulfilled; if those conditions are not fulfilled it shall be absent.

10.1 Messages on the B interface (MSC-VLR)

10.1.1 Send Info For Outgoing Call

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.1.2 Send Info For Outgoing Call negative response

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.1.3 Send Info For Incoming Call

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.1.4 Send Info For Incoming Call ack

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The following additional information elements are required:

Information element name	Required	Description
OR indicator	C	Indicates whether the call has been routed directly from a GMSC not in the same PLMN as the HLR. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
GMSC address	C	E.164 address of the GMSC. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
Call reference number	C	Call reference number used by the GMSC for this call. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
Originating CSI	C	Originating CAMEL subscription information. Shall be present if the B subscriber has subscribed to originating CAMEL service and VMSCB supports CAMEL; otherwise shall be absent.

10.1.5 Send Info For Incoming Call negative response

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.1.6 Complete Call

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The following additional information elements are required:

Information element name	Required	Description
OR indicator	C	Indicates whether the call has been routed directly from a GMSC not in the same PLMN as the HLR. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
GMSC address	C	E.164 address of the GMSC. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.

10.1.7 Process Call Waiting

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The following additional information elements are required:

Information element name	Required	Description
OR indicator	C	Indicates whether the call has been routed directly from a GMSC not in the same PLMN as the HLR. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
GMSC address	C	E.164 address of the GMSC. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.

10.2 Messages on the C interface (MSC-HLR)

10.2.1 Send Routeing Info

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The following additional information elements are required:

Information element name	Required	Description
Interrogation type	M	Indicates the type of interrogation: basic(for routeing information for an MT call) or forwarding (when the GMSC has been asked to resume call handling for OR of late call forwarding).
OR interrogation indicator	C	Indicates that the interrogation is from a GMSC not in the same PLMN as the HLR. Shall be present if the interrogation is from a GMSC not in the same PLMN as the HLR, otherwise shall be absent.
OR capability	C	Indicates the phase of OR which the GMSC supports. Shall be present if the GMSC supports OR, otherwise shall be absent.
GMSC address	M	E.164 address of the GMSC.
Call reference number	C	Call reference number used by the GMSC for this call. Shall be present if the interrogation type=basic call, otherwise shall be absent.
Forwarding reason	C	Indicates the reason for forwarding (on busy, on no subscriber reply, or on mobile subscriber not reachable). Shall be present if the Interrogation type=forwarding, otherwise shall be absent.
Basic service group	C	Basic service group which applies for this call. Shall be present if the Interrogation type=forwarding, otherwise shall be absent.

10.2.2 Send Routeing Info ack

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. Two new information elements are required, and the condition for the presence of one existing information element is changed, as shown in the following table.

Information element name	Required	Description
Forwarding interrogation required	C	Indicates that the GMSC shall interrogate the HLR for routeing information for late call forwarding. Shall be present if the SRI ack contains an MSRN and GMSC has to interrogate the HLR for routeing information for late call forwarding, otherwise shall be absent.
VMSC address	C	E.164 address of the VMSC in whose area the B subscriber is currently registered. Shall be present in the Send Routeing Info ack if the OR interrogation indicator in the Send Routeing Info was present and the HLR supports optimal routeing of basic mobile-to-mobile calls and the HLR has not determined that the call is to be forwarded, otherwise shall be absent.
Roaming number	C	E.164 address required to route the call to the VMSC of the B party. Shall be present in the Send Routeing Info ack which is sent in response to a Send Routeing Info with Interrogation type=basic if the HLR has determined that the charging requirements for optimal routeing are not contravened and that the call is not to be forwarded, otherwise shall be absent.

10.2.3 Send Routeing Info negative response

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The negative response information element can take the following values in addition to those specified in ~~GSM 03.~~TS 23.018 [5~~6~~]:

- OR not allowed
- Busy subscriber
- No subscriber reply

10.3 Messages on the D interface (VLR-HLR)

10.3.1 Provide Roaming Number

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~]. The following additional information elements are required:

Information element name	Required	Description
GMSC address	C	E.164 address of the GMSC. Shall be present if it was received by the HLR in the Send Routeing Info, otherwise shall be absent.
Call reference number	C	Call reference number used by the GMSC for this call. Shall be present if it was received by the HLR in the Send Routeing Info, otherwise shall be absent.
OR interrogation indicator	C	Indicates that the HLR received the corresponding Send Routeing Info from a GMSC not in the same PLMN as the HLR. Shall be present if the HLR received the Send Routeing Info from a GMSC not in the same PLMN as the HLR, otherwise shall be absent.
OR Not Supported in GMSC	C	Indicates that the GMSC does not support OR, and that RCH shall not be sent. Shall be present if the HLR received the Send Routeing Info from the GMSC without or-Capability information Element, otherwise shall be absent.

10.3.2 Provide Roaming Number ack

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.3.3 Provide Roaming Number negative response

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.3.4 Provide Subscriber Information

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.3.5 Provide Subscriber Information ack

This message is specified in ~~GSM 03.~~TS 23.018 [5~~6~~].

10.4 Messages on the E interface (MSC-MSC)

10.4.1 Resume Call Handling

The following information elements are required:

Information element name	Required	Description
Call reference number	M	Call reference number used by the GMSC for this call.
Forwarding reason	M	Indicates the reason for forwarding (on call deflection, on busy, on no subscriber reply, or on mobile subscriber not reachable).
Basic service group	M	Basic service group which applies for this call.
IMSI	M	IMSI of the B subscriber.
Forwarded-to number	M	E.164 number of the C subscriber.
Notification to calling party	M	Indication of whether the calling party is to be notified that the call has been forwarded.
Forwarded-to subaddress	C	Subaddress of the C subscriber (see ~~GSM 03.~~TS 23.003 [4~~4~~]). Shall be present if a forwarded-to subaddress is stored in the VLR in association with the forwarded-to number; otherwise shall be absent.
Redirecting presentation	C	Indication of whether the MSISDN of the B subscriber shall be presented to the C subscriber. Shall be present if VMSCB supports the handling of the redirecting number, otherwise shall be absent.
MSISDN	C	E.164 number which identifies the B subscriber. It will be used to create the redirecting number presented to the C subscriber. Shall be present if VMSCB supports the handling of the redirecting number, otherwise shall be absent.
CUG interlock	C	For the definition of this IE, see ~~GSM 03.~~TS 23.085 [7~~9~~]. Shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call in accordance with the rules in ~~GSM 03.~~TS 23.085 [7~~9~~], otherwise shall be absent.
CUG outgoing access	C	For the definition of this IE, see ~~GSM 03.~~TS 23.085 [7~~9~~]. Shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call with outgoing access in accordance with the rules in ~~GSM 03.~~TS 23.085 [7~~9~~], otherwise shall be absent.
Originating CSI	C	Originating CAMEL subscription information excluding triggering criteria. Shall be present if the B subscriber has subscribed to originating CAMEL service, VMSCB supports CAMEL and the triggering criteria are satisfied for the forwarding leg; otherwise shall be absent.

****** Next modified section ******

Annex A (informative): Handling of an IAM at an MSC

An MSC which receives an IAM from an originating exchange may react in three different ways:

- It acts as a transit exchange, i.e. it relays the IAM to a destination exchange determined by analysis of the called party address, and thereafter relays other ISUP signalling between the originating and destination exchange until the connection is released. This behaviour is not specific to UMTS or GSM;

- It acts as a terminating exchange, i.e. it attempts to connect the call to an MS currently registered in the service area of the MSC;

- It acts as a GMSC, i.e. it interrogates an HLR for information to route the call. If the HLR returns routeing information, the MSC uses the routeing information from the HLR to construct an IAM, which it sends to a destination exchange determined by analysis of the routeing information from the HLR.

The method which the MSC uses to determine how to handle the IAM is described in ~~GSM 03.~~TS 23.018 [~~5~~6]. However, the number analysis required to derive the address of an HLR in a different PLMN from the MSC is much more extensive than that required to derive the address of an HLR in the same PLMN as the MSC - the MSC needs to be able to recognise the combination of country code and national destination code for every subscriber of every PLMN to which calls are to be optimally routed.

A PLMN operator may decide to implement the ability to recognise a called party address as belonging to a UMTS or GSM PLMN which is not the PLMN of the MSC in only a subset of the MSCs in his PLMN. Other MSCs will route international calls to one of the MSCs which have the capability for extra number analysis.

When a GMSC has interrogated an HLR and received an MSRN, the GMSC may need to route the call to the HPLMN of the called subscriber. If the call is routed through an MSC which has the capability to analyse an address to derive an HLR address, a method must be provided to prevent the transit MSC from performing a further interrogation of the HLR, using the MSRN as an MSISDN. The method used to prevent this further interrogation is a matter for the PLMN operator.

3GPP TSG-N2 SWGB
Milan, Italy, 14 - 16 Feb 2000

Tdoc 3GPP ***N2B000173***

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.079	**CR**	**011**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: N2 **Date:** 02/02/2000

Subject: Indication of OR capability of the GMSC to the destination MSC/VLR

Work item: Technical Enhancements & Improvements

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: CR 23.079-001, approved by TSG CN #5, introduced the information element OR not supported in GMSC to the Provide Roaming Number message, but did not fully describe the use of the information element.

Clauses affected: 6.2.2.1; Figure 11; 9.6.2; 9.6.3; Figure 12; 10.1.4; 10.3.1

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

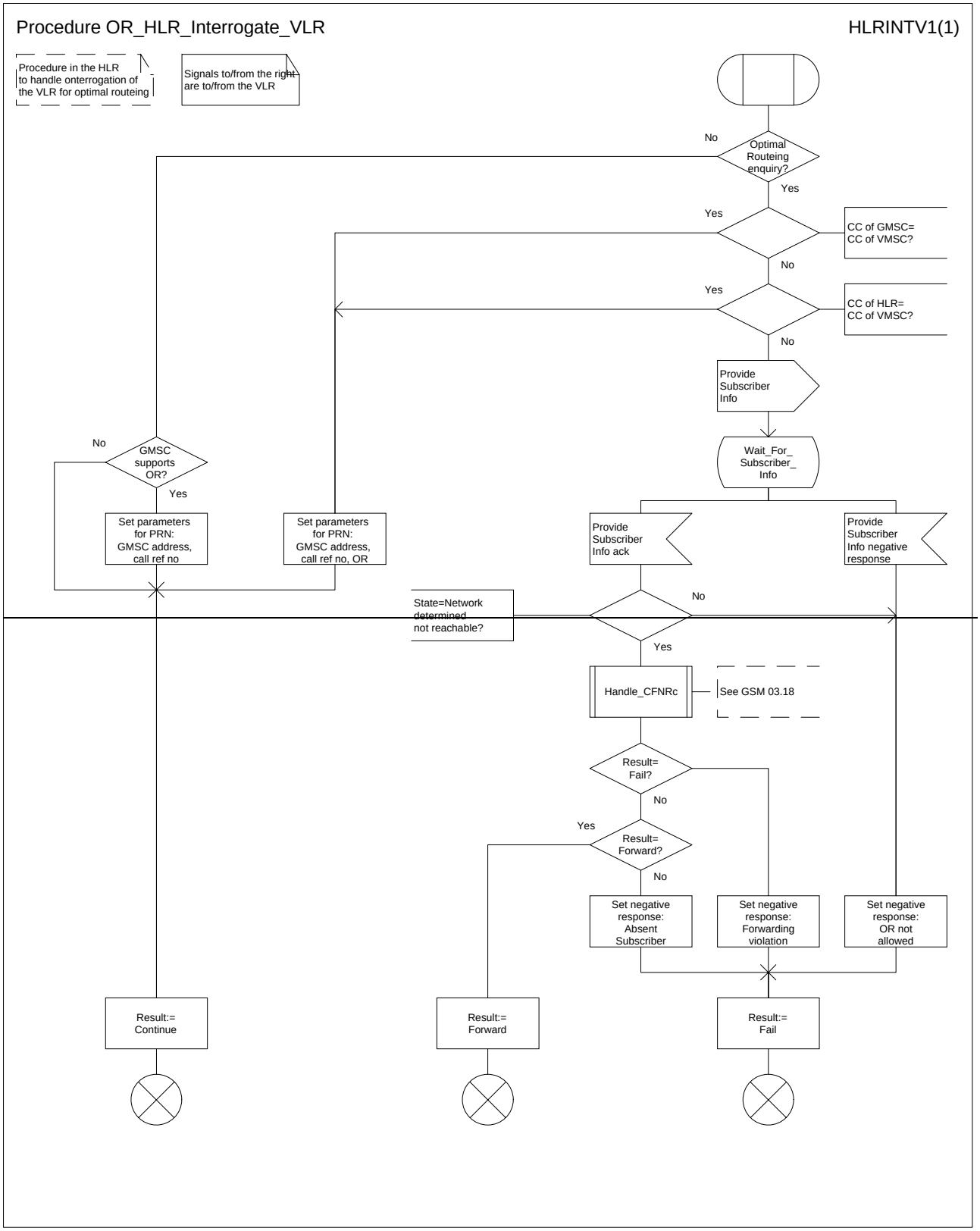
help.doc

<--------- Double-click here for help and instructions on how to create a CR.

6.2.2.1 GMSC does not support OR

If the GMSC does not support OR, it omits the 'or-capability' information element from the SRI(B) request. The HLR ~~will~~ then send~~s~~ the 'OR ~~N~~n~~o~~t~~S~~ s~~upported in GMSC' indicator ~~with~~in the PRN to ~~the~~ VLR~~/VMSC~~B. VMSCB will not send the RCH to the GMSC if the 'OR ~~N~~n~~o~~t ~~S~~s~~upported in GMSC' indicator was received in the PRN. Instead, the call will be forwarded at VMSCB.

**** Next modified section ****



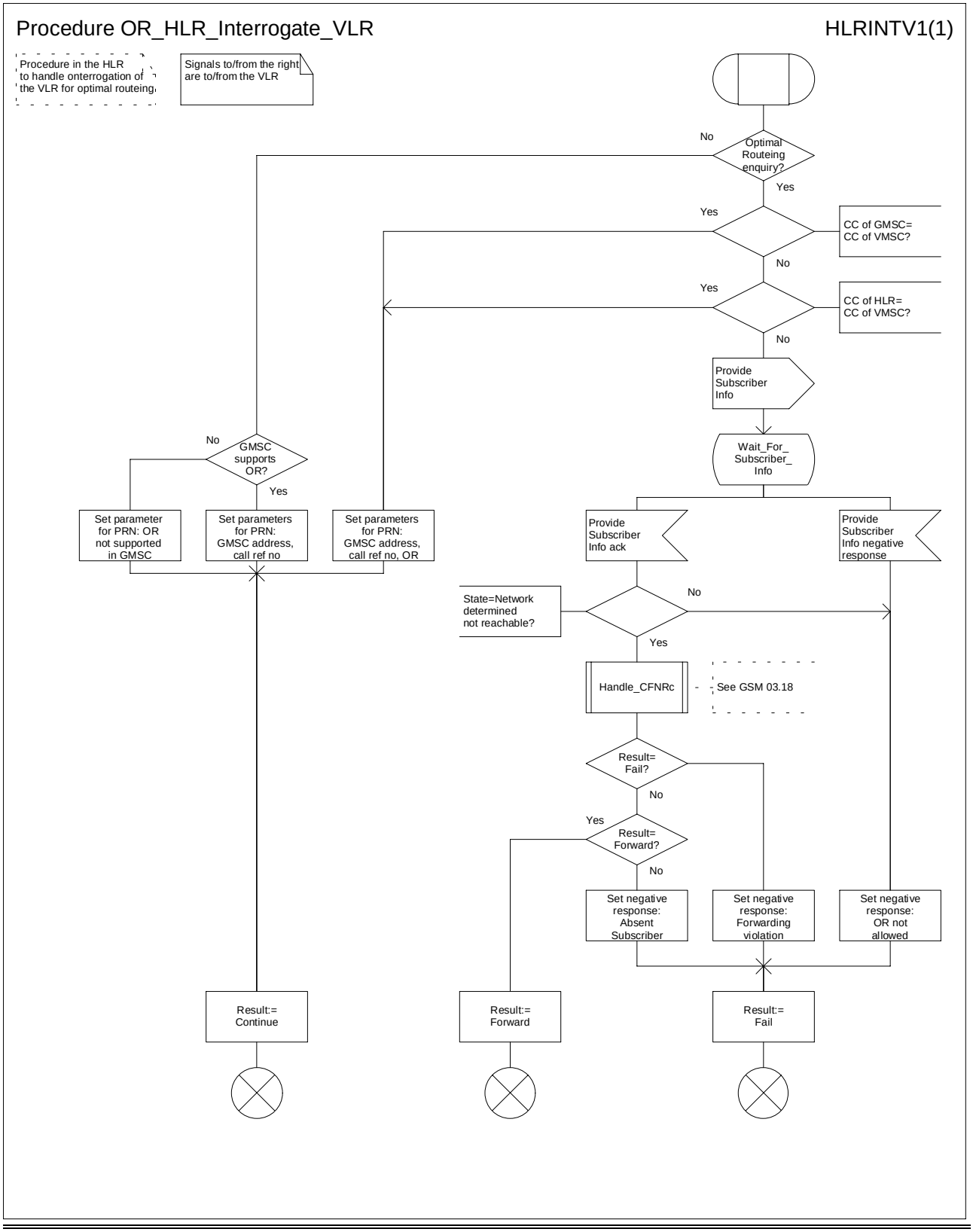


Figure 11: Procedure OR_HLR_Interrogate_VLR

****** Next modified section ******

9.6.2 Functional behaviour of VLRB for roaming number allocation

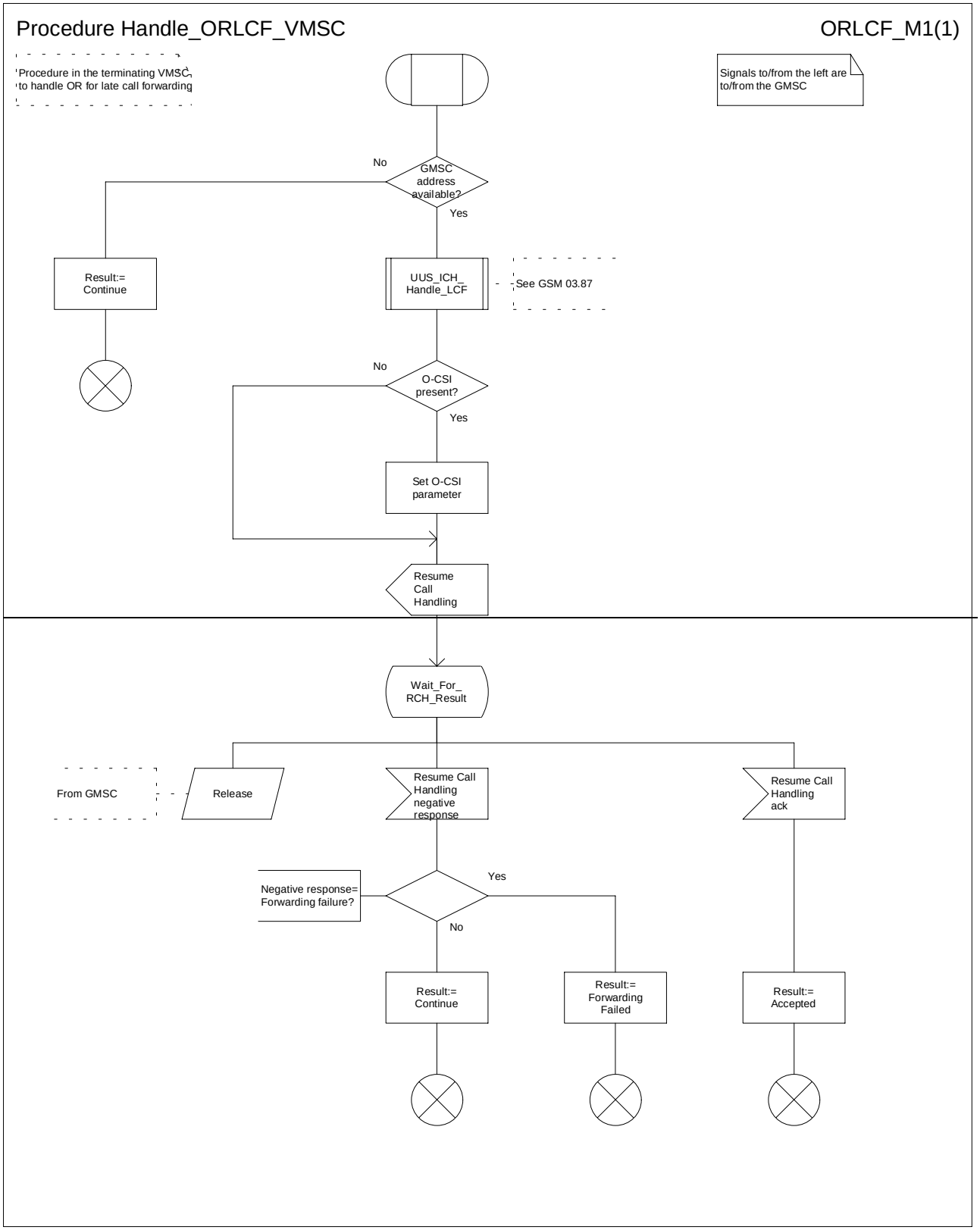
The functional behaviour of VLRB for roaming number allocation is specified in GSM 03.18 [6]. The only function specific to Support of Optimal Routeing is the storage of the OR indicator, the 'OR not supported in GMSC' indicator, the GMSC address and the call reference number if VLRB receives them in the Provide Roaming Number request.

9.6.3 Functional behaviour of VLRB when handling an incoming call

The functional behaviour of VLRB when handling a request for information to handle an incoming call is specified in GSM 03.18 [6]. The only functions specific to Support of Optimal Routeing are:

- the inclusion in the Complete Call or Process Call Waiting, if the call is to be offered to the B subscriber, of the OR indicator and the GMSC address if VLRB received them in the Provide Roaming Number request;
- the inclusion in the Send Info For Incoming Call response, if the call is to be forwarded, of:
  - the OR indicator, the 'OR not supported in GMSC' indicator, the GMSC address and the call reference number if VLRB received them in the Provide Roaming Number request;
  - the basic service which applies for this call.

****** Next modified section ******



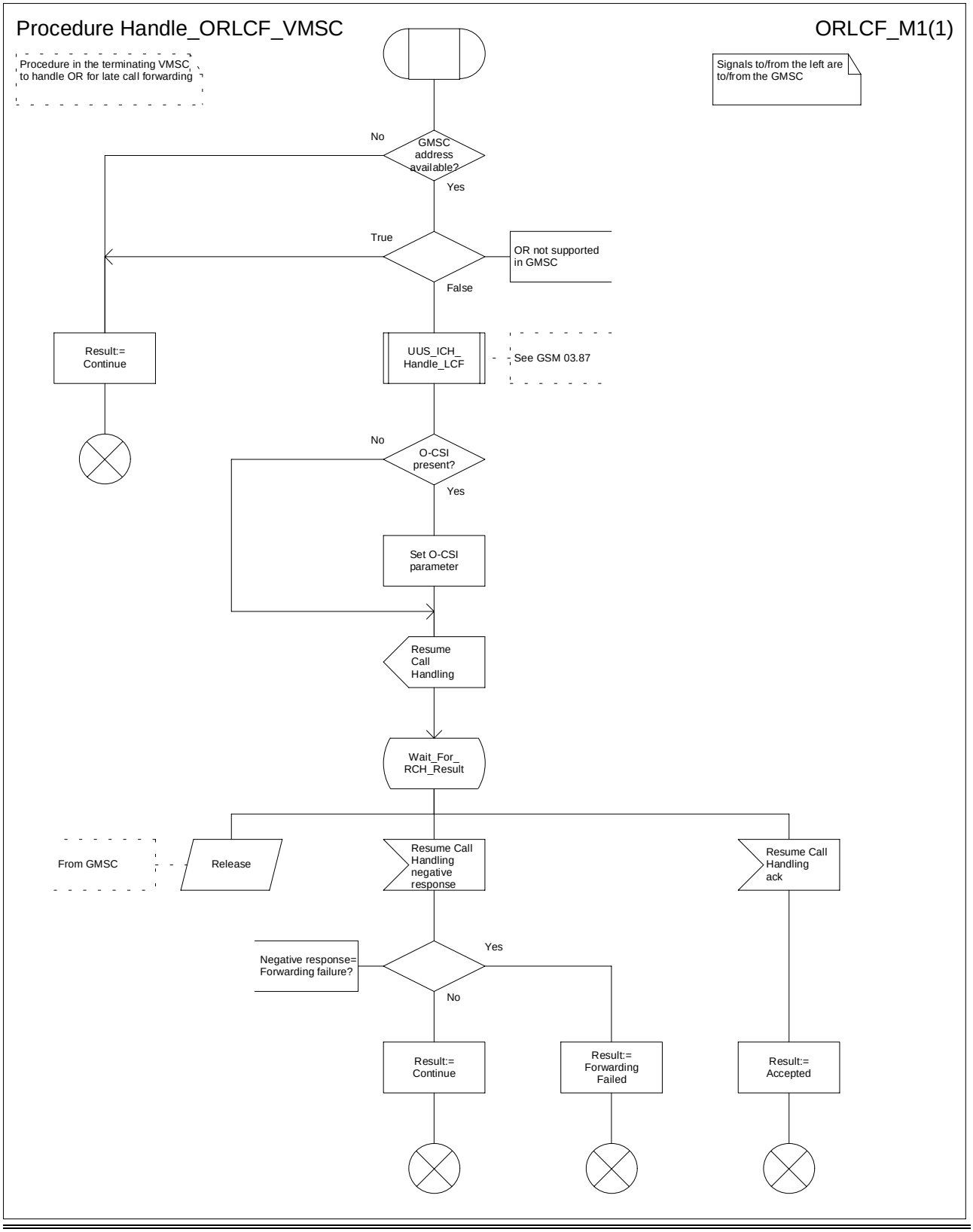


Figure 12: Procedure Handle_ORLCF_VMSC

****** Next modified section ******

10.1.4 Send Info For Incoming Call ack

This message is specified in GSM 03.18 [6]. The following additional information elements are required:

Information element name	Required	Description
OR indicator	C	Indicates whether the call has been routed directly from a GMSC not in the same PLMN as the HLR. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
GMSC address	C	E.164 address of the GMSC. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
Call reference number	C	Call reference number used by the GMSC for this call. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.
Originating CSI	C	Originating CAMEL subscription information. Shall be present if the B subscriber has subscribed to originating CAMEL service and VMSCB supports CAMEL; otherwise shall be absent.
OR not supported in GMSC	C	Indicates that the GMSC does not support Optimal Routeing. Shall be present if it was received in the Provide Roaming Number, otherwise shall be absent.

****** Next modified section ******

10.3.1 Provide Roaming Number

This message is specified in GSM 03.18 [6]. The following additional information elements are required:

Information element name	Required	Description
GMSC address	C	E.164 address of the GMSC. Shall be present if it was received by the HLR in the Send Routeing Info, otherwise shall be absent.
Call reference number	C	Call reference number used by the GMSC for this call. Shall be present if it was received by the HLR in the Send Routeing Info, otherwise shall be absent.
OR interrogation indicator	C	Indicates that the HLR received the corresponding Send Routeing Info from a GMSC not in the same PLMN as the HLR. Shall be present if the HLR received the Send Routeing Info from a GMSC not in the same PLMN as the HLR, otherwise shall be absent.
OR ~~N~~not ~~S~~supported in GMSC	C	Indicates that the GMSC does not support OR, and that RCH shall not be sent. Shall be present if the HLR received the Send Routeing Info from the GMSC without the ~~or~~OR ~~C~~capability information Element, otherwise shall be absent.

3GPP TSG-CN2 WG2
Kyoto, Japan, 17-21 Jan 2000

Document N2B000144
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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29.002	**CR**	**086r1**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME		UTRAN / Radio		Core Network	X

Source: N2 **Date:** 20-Jan-2000

Subject: Editorial cleanup of 29.002

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction		
A	Corresponds to a correction in an earlier release		
B	Addition of feature		
C	Functional modification of feature		
D	Editorial modification	X	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: There are several editorial errors including spelling mistakes, incorrect subclause references, incorrect figure numbering, etc. This CR attempts to fix a large number of these editorial errors.

Clauses affected: 1, 2, 5.2.2.2, 6.1, 6.1.2, 6.1.3.8, 6.2, 7.3.2, 7.3.5, 7.5.1, 7.6.1.2, 7.6.1.4, 7.6.2, 7.6.2.33, 7.6.2.36, 7.6.3.39, 7.6.3.40, 7.6.3.47, 7.6.5.12, 7.6.5.13, 8.1.1.3, 8.1.2.1, 8.1.2.3, 8.1.3.3, 8.4.7.2, 8.5.2.1, 8.5.2.2, 8.7.2.3, 8.8.1.1, 8.8.1.3, 8.8.2.3, 8.9.2.2, 8.10.1.3, 8.10.3.1, 8.10.3.3, 8.11.2.3, 9.2.1.1, 10.1.3, 10.2.1, 10.2.3, 10.3.3, 10.4.1, 10.4.3, 10.5.1, 10.5.3, 10.6.1, 10.6.2, 10.6.3, 10.7.2, 10.7.3, 10.8.1-3, 10.9.1-3, 10.10.2, 10.11.1-2, 10.12.2, 10.13.2, 10.14.211.1.1-2, 11.2.1-2, 11.3.1-2, 11.4.1-2, 11.8.2-3, 11.9.3, 11.10.2, 11.10.3, 11.11.2, 11.12.3, 11.13.2, 11.14.2, 12.1.2, 12.1.3, 12.2.2-3, 12.3.2-3, 12.4.1-3, 12.5.2-3, 12.6.1-3, 12.7.1-3, 12.8.2-3, 12.9.1-3, 13A.1.2-3, 13A.2.3, 13A.3.3, 13A.4.3, 13A.5.3, 13A.6.3, 13A.7.3, 13A.8.3, 13A.9.3, 14.1-2, 15.1.1, 15.6.2, 15.6.6, 15.6.8, 16.2.2.9.3, 16.3, 17.1.1-2, 17.1.2.1, 17.1.3-6, 17.2.1, 17.2.2.23, 17.2.2.39, 17.2.2.46, 17.3.1, 17.3.2.15, 17.3.2.16, 17.3.2.18, 17.3.2.26, 17.3.2.44-5, 17.4, 17.6.1, 17.6.5-8, 17.7.1, 17.7.3-4, 17.7.7, 17.7.9, 17.7.13, 18.2.2, 18.2.4, 18.3, 19.1.1.3, 20.1.1-3, 20.2, 20.2.2.3, 20.2.4, 20.3.1.2, 20.3.2, 20.3.3.2, 20.4.2, 21.1, 21.3.2, 21.4.2, 21.5.1, 22, 22.2.4, 22.6.4, 22.12.2-3, 23.1.2, 23.3.3-4, 23.4.3, 24.1.1, 24.2.1, 24.3.1, 25.1.1, 25.3.2, 25.5.4, 25.6.3, 25.7.2, 25.9.3, 25.9.4, 25.9.6

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments: This CR does not address any editorial errors which are found in the flow diagrams, SDLs or Annexes.

Note: Because version 3.3.0 of 29.002 was not available at the time of writing this CR,

the 3.2.0 version was used.

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<--------- double-click here for help and instructions on how to create a CR.

1 Scope

It is necessary to transfer between entities of a Public Land Mobile Network (PLMN) information specific to the PLMN in order to deal with the specific behaviour of roaming Mobile Stations (MS)s. The Signalling System No. 7 specified by CCITT is used to transfer this information.

This Technical Specification (TS) describes the requirements for the signalling system and the procedures needed at the application level in order to fulfil these signalling needs.

Clauses 1 to 6 are related to general aspects such as terminology, mobile network configuration and other protocols required by MAP.

MAP consists of a set of MAP services which are provided to MAP service-users by a MAP service-provider.

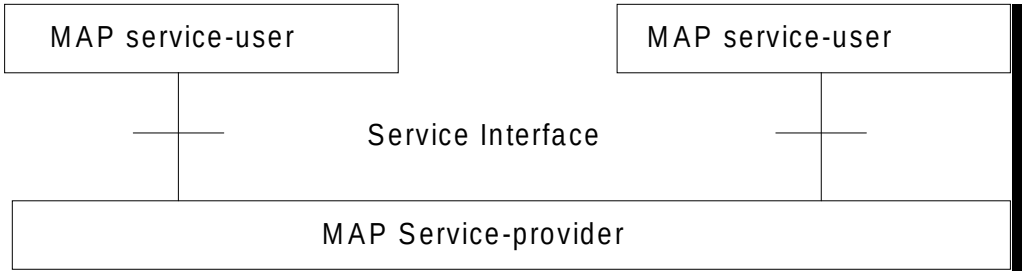


Figure 1.1/1: Modelling principles

Clauses 7 to 13A of the present document describe the MAP services.

Clauses 14 to 17 define the MAP protocol specification and the behaviour of service provider (protocol elements to be used to provide MAP services, mapping on to TC service primitives, abstract syntaxes, etc.).

Clauses 18 to 25 describe the MAP user procedures which make use of MAP services.

2 References

…

[71] CCITT Recommendation Q.699: "Interworking between the Digital Subscriber Signalling System Layer 3 protocol and the Signalling System No.7 ISDN User part".

5.2.2.2 Managing the version look-up table

WHEN it receives a MAP-OPEN ind the MAP-User determines the originating entity number either using the originating address parameter or the originating reference parameter or retrieving it from the subscriber data using the IMSI or the MSISDN.

IF the entity number is known

THEN

It updates (if required) the associated list of highest supported ACs

ELSE

It creates an entry for this entity and includes the received AC-name in the list of highest supported ACs.

WHEN starting a procedure, the originating MAP-user looks up its version control table.

IF the destination address is known and not timed-out

THEN

It retrieves the appropriate AC-name and uses it

IF the dialogue is accepted by the peer

THEN

It does not modify the version control table

ELSE (this should never occur)

It starts a new dialogue with the common highest version supported (based on information implicitly or explicitly provided by the peer).

It replaces the old AC-name by the new one in the list of associated highest AC supported.

ELSE

It uses the AC-name which corresponds to the highest version it supports.

IF the dialogue is accepted by the peer

THEN

It adds the destination node in its version control table and includes the AC-Name in the list of associated highest AC supported.

ELSE

It starts a new dialogue with the common highest version supported (based on information implicitly or explicitly provided by the peer).

IF the destination node was not known

THEN

It adds the destination node in its version control table and includes the new AC-Name in the list of associated highest AC supported.

ELSE

It replaces the old AC-name by the new one in the list of highest supported AC and reset the timer.

5.2.2.3 Optimizing the method

A table look-up may be avoided in some cases if both the HLR and the VLR or both the HLR and the SGSN store for each subscriber the version of the AC-name used at location updating. Then:

- for procedures which make use of the same application-context, the same AC-name (thus the same version) can be selected (without any table look-up) when the procedure is triggered;
- for procedures which make use of a different application-context but which includes one of the packages used by the location updating AC, the same version can be selected (without any table look-up) when the procedure is triggered;

  for HLR:

  - Subscriber data modification (stand alone);

  for VLR:

  - Data Restoration.

6 Requirements concerning the use of SCCP and TC

6.1 Use of SCCP

The Mobile Application Part makes use of the services offered by the Signalling Connection Control Part of Signalling System No. 7. CCITT Blue Book or ITU-T (03/93) Recommendations Q.711 to Q.716 should be consulted for the full specification of SCCP. In North America (World Zone 1) the national version of SCCP is used as specified in ANSI T1.112. Interworking between a PLMN in North America and a PLMN outside North America will involve an STP to translate between ANSI SCCP and ITU-T/CCITT SCCP.

6.1.1 SCCP Class

MAP will only make use of the connectionless classes (0 or 1) of the SCCP.

6.1.2 Sub-System Number (SSN)

The Application Entities (AEs) defined for MAP consist of several Application Service Elements (ASEs) and are addressed by sub-system numbers (SSNs). The SSNs for MAP are specified in GSM 03.03 [17].

6.1.3.8 The Serving GPRS Support Node (SGSN)

The HLR will initiate dialogues towards the SGSN if it is aware that one of its subscribers is in the SGSN's serving area. This means that a GPRS location updating has been successfully completed, i.e, the HLR has indicated successful completion of the GPRS location update to the SGSN. The routeing information used by the HLR is derived form the E.164 SGSN number received as parameter of the MAP message initiating the GPRS update location procedure. If the SGSN is in the same PLMN as the HLR, the SGSN may be addressed directly by an SPC derived from the E.164 SGSN number. For dialogues via the international PSTN/ISDN signalling network, the presence of the E.164 SGSN number in the Called Party Address is required.

When the GMSC initiates dialogues towards the SGSN the SGSN (MAP) SSN (See GSM 03.03) shall be included in the called party address. The routeing information used by the GMSC is derived from the E.164 SGSN number received as a parameter of the MAP message initiating the forward short message procedure. If the GMSC does not support the GPRS functionality the MSC (MAP) SSN value shall be included in the called party address.

Note: Every VMSC and SGSN shall have uniquely identifiable application using E.164 numbers, for the purpose of SMS over GPRS when the GMSC does not support the GPRS functionality.

6.2 Use of TC

The Mobile Application part makes use of the services offered by the Transaction Capabilities (TC) of Signalling System No. 7. ETS 300 287, which is based on CCITT White Book Recommendations Q.771 to Q.775, should be consulted for the full specification of TC.

7.3.2 MAP-CLOSE service

This service is used for releasing a previously established MAP dialogue. The service may be invoked by either MAP service-user depending on rules defined within the service-user. The service is an unconfirmed service with parameters as shown in table 7.3/4.

Table 7.3/4: Service-primitives for the MAP-CLOSE service

Parameters	Request	Indication
Release method	M	
Specific Information	U	C(=)

Release method:

This parameter can take the following two values:

- normal release; in this case the primitive is mapped onto the protocol and sent to the peer;
- prearranged end; in this case the primitive is not mapped onto the protocol. Prearranged end is managed independently by the two users, i.e. only the request type primitive is required in this case.

Specific information:

This parameter may be used for passing any user specific information. Establishment and processing of the Specific information is not specified by GSM and shall be performed according to operator specific requirements.

7.3.5 MAP-P-ABORT service

This service enables the MAP service-provider to abort a MAP dialogue. The service is a provider-initiated service with service-primitives as shown in table 7.3/8.

Table 7.3/8: Service-primitives for the MAP-P-ABORT service

Parameters	Indication
Provider reason	M
Source	M

7.5 General rules for mapping of services onto TC

7.5.1 Mapping of common services

Table 7.5/1 gives an overview of the mapping rules for mapping of common services onto TC-services. Table 7.5/2 gives the mapping rules for mapping of TC-services onto common services.

Protocol machine description is given in clauses 14 to 17.

Table 7.5/1: Mapping of common services onto TC services

MAP service-primitive	TC service-primitive
MAP-OPEN request (+ any user specific service primitives) + MAP-DELIMITER request	TC-BEGIN request (+ component handling primitives)
MAP-OPEN response (+ any user specific service primitives) + MAP-DELIMITER request	TC-CONTINUE request (note) (+ component handling primitives)
(any user specific service primitives) + MAP-DELIMITER request	TC-CONTINUE request (+ component handling primitives)
(any user specific service primitives) + MAP-CLOSE request	TC-END request (+ component handling primitives)
MAP-U-ABORT request	TC-U-ABORT request

NOTE: or TC-END if the MAP-CLOSE request has been received before the MAP-DELIMITER request.

Table 7.5/2: Mapping of TC services onto common service

TC service-primitive	MAP service-primitive
TC-BEGIN indication (+ component handling primitives)	MAP-OPEN indication (+ user specific service primitives) + MAP-DELIMITER indication (note 1)
TC-CONTINUE indication (+ component handling primitives)	First time: MAP-OPEN confirm (+ user specific service primitives) + MAP-DELIMITER indication (note 1) Subsequent times: (user specific service primitives) + MAP-DELIMITER indication (note 1)
TC-END indication (+ component handling primitives)	MAP-OPEN confirm (note 6) (user specific service primitives) + MAP-CLOSE indication
TC-U-ABORT indication	MAP-U-ABORT indication or MAP-P-ABORT indication (note 2) MAP-OPEN confirmation (note 3)
TC-P-ABORT indication	MAP-P-ABORT indication (note 4) MAP-OPEN confirmation (note 5)

NOTE 1: It may not be necessary to present this primitive to the user for MAP version 2 applications.

NOTE 2: The mapping depends on whether the TC-U-ABORT indication primitive contains a MAP-abort-PDU from the remote MAP service-provider or a MAP-user-abort-PDU from the remote MAP service-user.

NOTE 3: Only if the opening sequence is pending and if the "Abort Reason" in the TC-U-ABORT indication is set to "Application Context Not Supported".

NOTE 4: If the "Abort Reason" in the TC-P-ABORT indication is set to a value different from "Incorrect Transaction Portion".

NOTE 5: Only if the opening sequence is pending and if the "Abort Reason" in the TC-P-ABORT indication is set to "Incorrect Transaction Portion".

NOTE 6: Only if opening sequence is pending.

7.6.1.2 Linked Id

This parameter is used for linked services and it takes the value of the invoke Id of the service linked to.

7.6.1.4 User error

This parameter can take values as follows:

NOTE: The values are grouped in order to improve readability; the grouping has no other significance.

a) Generic error:

- system failure, i.e. a task cannot be performed because of a problem in another entity. The type of entity or network resource may be indicated by use of the network resource parameter;
- data missing, i.e. an optional parameter required by the context is missing;
- unexpected data value, i.e. the data type is formally correct but its value or presence is unexpected in the current context;
- resource limitation;
- initiating release, i.e. the receiving entity has started the release procedure;
- facility not supported, i.e. the requested facility is not supported by the PLMN;
- incompatible terminal, i.e. the requested facility is not supported by the terminal.

b) Identification or numbering problem:

- unknown subscriber, i.e. no such subscription exists;
- number changed, i.e. the subscription does not exist for that number any more;
- unknown MSC;
- unidentified subscriber, i.e. if the subscriber is not contained in the database and it has not or cannot be established whether or not a subscription exists;
- unallocated roaming number;
- unknown equipment;
- unknown location area.

c) Subscription problem:

- roaming not allowed, i.e. a location updating attempt is made in an area not covered by the subscription;
- illegal subscriber, i.e. illegality of the access has been established by use of authentication procedure;
- bearer service not provisioned;
- teleservice not provisioned;
- illegal equipment, i.e. the IMEI check procedure has shown that the IMEI is blacklisted or not whitelisted.

d) Handover problem:

- no handover number available;
- subsequent handover failure, i.e. handover to a third MSC failed for some reason.

e) Operation and maintenance problem:

- tracing buffer full, i.e. tracing cannot be performed because the tracing capacity is exceeded.

f) Call set-up problem:

- no roaming number available, i.e. a roaming number cannot be allocated because all available numbers are in use;

- absent subscriber, i.e. the subscriber has activated the detach service or the system detects the absence condition. This error may be qualified to indicate whether the subscriber was IMSI detached, in a restricted area or did not respond to paging;

- busy subscriber. This error may be qualified to indicate that the subscriber was busy due to CCBS and that CCBS is possible;

- no subscriber reply;

- forwarding violation, i.e. the call has already been forwarded the maximum number of times that is allowed;

- CUG reject, i.e. the call does not pass a CUG check; additional information may also be given in order to indicate rejection due to e.g. incoming call barred or non-CUG membership.

- call barred. Optionally, additional information may be included for indicating either that the call meets a barring condition set by the subscriber or that the call is barred for operator reasons. In case of barring of Mobile Terminating Short Message, the additional information may indicate a barring condition due to «unauthorised Message Originator».

- optimal routeing not allowed, i.e. the entity which sends the error does not support optimal routeing, or the HLR will not accept an optimal routeing interrogation from the GMSC, or the call cannot be optimally routed because it would contravene optimal routeing constraints.

- forwarding failed, i.e. the GMSC interrogated the HLR for forwarding information but the HLR returned an error.

7.6.2 Numbering and identification parameters

7.6.2.33 Group Id

This parameter is used to describe groups a subscriber can be a member of. A subscriber can partake in all group calls (VBS/VGCS) where he subscribed to the respective groups.

7.6.2.36 B-subscriber address

This parameter refers to the address used by the SIWFS to route the outgoing call from the SIWFS to either the B-subscriber in case of the non-loop method or back to the VMSC in case of the loop method.

7.6.3.39 Voice Group Call Service (VGCS) Data

This parameter refers to one or more groups a subscriber may be a member of for voice group calls.

7.6.3.40 Voice Broadcast Service (VBS) Data

This parameter refers to one or more groups a subscriber may be a member of for the voice broadcast service. Per group it is further indicated whether the subscriber is only allowed to listen to respective group calls or whether he is in addition entitled to initiate respective voice broadcast calls.

7.6.3.47 QoS-Subscribed

This parameter indicates the quality of service subscribed for a certain service. It is defined in GSM 03.60.

7.6.5.12 UU Data

This parameter includes User-To-User Data. It is defined in GSM 03.87.

7.6.5.13 UUS CF Interaction

This parameter indicates if the call forwarding or call deflection has been activated after UUS1 request has been accepted . It is defined in GSM 03.87.

8.1.1.3 Parameter definitions and use

8.1.2 MAP_UPDATE_LOCATION service

8.1.2.1 Definition

This service is used by the VLR to update the location information stored in the HLR.

The MAP_UPDATE_LOCATION service is a confirmed service using the service primitives given in table 8.1/2.

8.1.2.2 Service primitives

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
MSC Address	M	M(=)		
VLR number	M	M(=)		
LMSI	U	C(=)		
Supported CAMEL Phases	C	C(=)		
SoLSA Support Indicator	C	C(=)		
IST Support Indicator	C	C(=)	C	C(=)
HLR number				
User error			C	C(=)
Provider error				O

Table 8.1/2: MAP_UPDATE_LOCATION

8.1.2.3 Parameter definitions and use

Invoke Id

See definition in subclause 7.6.1.

IMSI

See definition in subclause 7.6.2.

MSC Address

See definition in subclause 7.6.2. The MSC address is used for short message delivery only and for each incoming call set-up attempt the MSRN will be requested from the VLR.

VLR number

See definition in subclause 7.6.2.

LMSI

See definition in subclause 7.6.2. It is an operator option to provide the LMSI from the VLR; it is mandatory for the HLR to support the LMSI handling procedures.

Supported CAMEL Phases

This parameter indicates which phases of CAMEL are supported. Must be present if a CAMEL phase different from phase 1 is supported. Otherwise may be absent.

HLR number

See definition in subclause 7.6.2. The presence of this parameter is mandatory in case of successful HLR updating.

SoLSA Support Indicator

This parameter is used by the VLR to indicate to the HLR in the Update Location indication that SoLSA is supported. If this parameter is not included in the Update Location indication and the Subscriber is marked as only allowed to roam in Subscribed LSAs, then the HLR shall reject the roaming and indicate to the VLR that roaming is not allowed to that Subscriber in the VLR.

This SoLSA Support Indicator shall be stored by the HLR per VLR where there are Subscribers roaming. If a Subscriber is marked as only allowed to roam in Subscribed LSAs while roaming in a VLR and no SoLSA Support indicator is stored for that VLR, the location status of that Subscriber shall be set to Restricted.

IST Support Indicator

This parameter is used to indicate to the HLR that the VMSC supports basic IST functionality, that is, the VMSC is able to terminate the Subscriber Call Activity that originated the IST Alert when it receives the IST alert response indicating that the call(s) shall be terminated. If this parameter is not included in the Update Location indication and the Subscriber is marked as an IST Subscriber, then the HLR may limit the service for the subscriber (by inducing an Operator Determined barring of Roaming, Incoming or Outgoing calls), or allow service assuming the associated risk of not having the basic IST mechanism available.

This parameter can also indicate that the VMSC supports the IST Command service, including the ability to terminate all calls being carried for the identified subscriber by using the IMSI as a key. If this additional capability is not included in the Update Location indication and the HLR supports the IST Command capability, then the HLR may limit the service for the subscriber (by inducing an Operator Determined barring of Roaming, Incoming or Outgoing calls), or allow service assuming the associated risk of not having the IST Command mechanism available.

User error

In case of unsuccessful updating, an error cause shall be returned by the HLR. The following error causes defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- unknown subscriber;
- roaming not allowed;

  This cause will be sent if the MS is not allowed to roam into the PLMN indicated by the VLR number. The cause is qualified by the roaming restriction reason "PLMN Not Allowed" or "Operator Determined Barring". If no qualification is received (HLR with MAP Version 1), "PLMN Not Allowed" is taken as default.
- system failure;
- unexpected data value.

Provider error

For definition of provider errors see subclause 7.6.1.

8.1.3 MAP_CANCEL_LOCATION service

8.1.3.1 Definition

This service is used between HLR and VLR to delete a subscriber record from the VLR. It may be invoked automatically when an MS moves from one VLR area to another, to remove the subscriber record from the old VLR, or by the HLR operator to enforce a location updating from the VLR to the HLR, e.g. on withdrawal of a subscription.

Also this service is used between HLR and SGSN to delete a subscriber record from the SGSN. It may be invoked automatically when an MS moves from one SGSN area to another, to remove the subscriber record from the old SGSN, or by the HLR operator to enforce a location updating from the SGSN to the HLR.

The MAP_CANCEL_LOCATION service is a confirmed service using the primitives defined in table 8.1/3.

8.1.3.2 Service primitives

Table 8.1/3: MAP_CANCEL_LOCATION

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
LMSI	C	C(=)		
Cancellation Type	C	C(=)		
User error			C	C(=)
Provider error				O

8.1.3.3 Parameter definitions and use

Invoke Id

See definition in subclause 7.6.1.

IMSI

See definition in subclause 7.6.2.

LMSI

See definition in subclause 7.6.2. The LMSI shall be included if it has been received from VLR. LMSI is not applicable between SGSN and HLR.

Value 0000 0000 can be used to indicate that the LMSI is not in use.

Cancellation Type

See definition in subclause 7.6.3. The presence of this parameter is mandatory when the Cancel Location is sent to the SGSN. If the VLR receives this parameter and do not understand it the VLR shall ignore it.

User error

If the cancellation fails, an error cause is to be returned by the VLR or by the SGSN. One of the following error causes defined in subclause 7.6.1 shall be used:

- unexpected data value;
- data missing.

Provider error

For definition of provider errors see subclause 7.6.1.

8.4.7 MAP_SEND_HANDOVER_REPORT service

8.4.7.1 Definition

This service is used between VLR and MSC-B (B-interface) to transfer the handover number to be forwarded to and used by MSC-A.

The MAP_SEND_HANDOVER_REPORT service is a confirmed service using the primitives from table 8.4/7.

8.4.7.2 Service primitives

Table 8.4/7: MAP_SEND_HANDOVER_REPORT

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
Handover Number	M	M(=)		
Linked Id	M	M(=)		
Provider error				O

8.4.7.3 Parameter use

Invoke Id

For definition of this parameter see subclause 7.6.1.

Handover Number

For definition of this parameter see subclause 7.6.2.

Linked Id

For definition of this parameter see subclause 7.6.1. This service is linked with MAP_ALLOCATE_HANDOVER_NUMBER.

Provider error

For definition of this parameter see subclause 7.6.1.

8.5.2 MAP_SEND_AUTHENTICATION_INFO service

8.5.2.1 Definition

This service is used between the VLR and the HLR for the VLR to retrieve authentication information from the HLR. The VLR requests some sets of RAND/SRES/Kc vectors.

Also this service is used between the SGSN and the HLR for the SGSN to retrieve authentication information from the HLR. The SGSN requests some sets of RAND/SRES/Kc vectors.

If the HLR cannot provide the VLR or the SGSN with triplets, an empty response is returned. The VLR or the SGSN may then re-use old authentication triplets, except where this is forbidden under the conditions specified in GSM 03.20 [24].

If the VLR or SGSN receives a MAP_Send_AUTHENTICATION_INFO response containing a User Error parameter as part of the handling of an authentication procedure, the authentication procedure in the VLR or SGSN shall fail.

Security related network functions are further described in GSM 03.20.

The service is a confirmed service and consists of four service primitives.

8.5.2.2 Service primitives

The service primitives are shown in table 8.5/2.

Table 8.5/2: MAP_SEND_AUTHENTICATION_INFO parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
AuthenticationSetList			C	C(=)
User error			C	C(=)
Provider error				O

8.5.2.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

IMSI

See subclause 7.6.2 for the use of this parameter.

AuthenticationSetList

A set of one to five authentication vectors are transferred from the HLR to the VLR or from the HLR to the SGSN, if the outcome of the service was successful.

User error

One of the following error causes defined in subclause 7.6.1 shall be sent by the user in case of unsuccessful outcome of the service, depending on the respective failure reason:

- unknown subscriber;
- unexpected data value;
- system failure;
- data missing.

Provider error

See subclause 7.6.1 for the use of this parameter.

8.7.2 MAP_OBTAIN_IMEI service

8.7.2.1 Definition

This service is used between the VLR and the MSC to request the IMEI. If the IMEI is not available in the MSC, it is requested from the MS.

The service is a confirmed service and consists of four service primitives.

8.7.2.2 Service primitives

The service primitives are shown in table 8.7/2.

Table 8.7/2: MAP_OBTAIN_IMEI parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
IMEI			C	C(=)
User error			C	C(=)
Provider error				O

8.7.2.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

IMEI

See subclause 7.6.2 for the use of this parameter. The parameter is included in the service response from the MSC to the VLR on successful outcome of the service.

User error

If the service fails, the VLR sends the user error System Failure (see subclause 7.6.1) to the MSC.

Provider error

See subclause 7.6.1 for the use of this parameter.

8.8 Subscriber management services

8.8.1 MAP-INSERT-SUBSCRIBER-DATA service

8.8.1.1 Definition

This service is used by an HLR to update a VLR with certain subscriber data in the following occasions:

- the operator has changed the subscription of one or more supplementary services, basic services or data of a subscriber. Note that in case of withdrawal of a Basic or Supplementary service this primitive shall not be used;
- the operator has applied, changed or removed Operator Determined Barring;
- the subscriber has changed data concerning one or more supplementary services by using a subscriber procedure;
- the HLR provides the VLR with subscriber parameters at location updating of a subscriber or at restoration. In this case, this service is used to indicate explicitly that a supplementary service is not provisioned, if the supplementary service specification requires it. The only supplementary services which have this requirement are the CLIR and COLR services. Network access mode is provided only in restoration.

Also this service is used by an HLR to update an SGSN with certain subscriber data in the following occasions:

- if the GPRS subscription has changed;
- if the network access mode is changed;
- the operator has applied, changed or removed Operator Determined Barring;
- the HLR provides the SGSN with subscriber parameters at GPRS location updating of a subscriber.

It is a confirmed service and consists of the primitives shown in table 8.8/1.

8.8.1.2 Service primitives

Table 8.8/1: MAP-INSERT-SUBSCRIBER-DATA

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	C	C(=)		
MSISDN	C	C(=)		
Category	C	C(=)		
Subscriber Status	C	C(=)		
Bearer service List	C	C(=)	C	C(=)
Teleservice List	C	C(=)	C	C(=)
Forwarding information List	C	C(=)		
Call barring information List	C	C(=)		
CUG information List	C	C(=)		
SS-Data List	C	C(=)		
eMLPP Subscription Data	C	C(=)		
Operator Determined Barring General data	C	C(=)	C	C(=)
Operator Determined Barring HPLMN data	C	C(=)		
Roaming Restriction Due To Unsupported Feature	C	C(=)		
Regional Subscription Data	C	C(=)		
VLR CAMEL Subscription Info	C	C(=)		
Voice Broadcast Data	C	C(=)		
Voice Group Call Data	C	C(=)		
Network access mode	C	C(=)		
GPRS Subscription Data	C	C(=)		
Roaming Restricted In SGSN Due To Unsupported Feature	C	C(=)		
North American Equal Access preferred Carrier Id List	U	C(=)		
LSA Information	C	C(=)		
IST Alert Timer	C	C(=)		
SS-Code List			C	C(=)
LMU Identifier	C	C(=)		
LCS Information	C	C(=)		
Regional Subscription Response			C	C(=)
Supported CAMEL Phases			C	C (=)
User error			U	C(=)
Provider error				O

8.8.1.3 Parameter use

All parameters are described in subclause 7.6. The following clarifications are applicable:

Network access mode

This parameter defines if the subscriber has access to MSC/VLR and/or to SGSN. This parameter is used by SGSN and MSC/VLR. In VLR, the parameter is used only as part of Restore Data Procedure and the parameter is not stored in the VLR.

IMSI

It is only included if the service is not used in an ongoing transaction (e.g. location updating). This parameter is used by the VLR and the SGSN.

MSISDN

It is included either at location updating or when it is changed. The MSISDN sent shall be the basic MSISDN. This parameter is used by the VLR and the SGSN.

Category

It is included either at location updating or when it is changed. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Subscriber Status

It is included either at location updating or when it is changed.

To apply, remove or update Operator Determined Barring Categories the Subscriber Status is set to Operator Determined Barring. In this case ODB General Data shall also be present. If the Operator Determined Barring applies and the subscriber is registered in the HPLMN and HPLMN specific Operator Determined Barring applies then ODB HPLMN Specific Data shall also be present.

To remove all Operator Determined Barring Categories the Subscriber Status shall be set to "Service Granted". This parameter is used by the VLR and the SGSN.

Bearer service List

A list of Extensible Bearer service parameters (Extensible Bearer service is defined in subclause 7.6). An Extensible Bearer service parameter must be the code for an individual Bearer service, except in the cases described below.

The codes for the Bearer service groups "allAlternateSpeech-DataCDA" and "allAlternateSpeech-DataCDS" shall, if applicable, be sent from the HLR to the VLR as a pair. The codes for the Bearer service groups "allSpeechFollowedByDataCDA" and "allSpeechFollowedByDataCDS" shall, if applicable, be sent from the HLR to the VLR as a pair.

If it is included in the Request/Indication, it includes either all Extensible Bearer services subscribed (at location updating or at restoration) or only the ones added (at subscriber data modification).

If the VLR receives an Indication containing any Extensible Bearer service parameters which it does not support/allocate it returns them in the response to the HLR and discards the unsupported Extensible Bearer services (no error is sent back), except in the cases described below.

If the VLR receives the codes for the Bearer service groups "allSpeechFollowedByDataCDA" and "allSpeechFollowedByDataCDS" and supports one or more of the circuit-switched synchronous or asynchronous data rates specified for simple data bearer services, it shall accept the bearer service codes, and not return them in the response to the HLR. If the VLR does not support any of the circuit-switched synchronous or asynchronous data rates specified for simple data bearer services, and receives the pair of codes for "allAlternateSpeech-DataCDA" and "allAlternateSpeech-DataCDS" or the pair of codes for "allSpeechFollowedByDataCDA" and "allSpeechFollowedByDataCDS", it shall reject the pair of codes by returning them in the response to the HLR. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Teleservice List

A list of Extensible Teleservice parameters (Extensible Teleservice is defined in subclause 7.6). An Extensible Teleservice parameter must be the code for an individual Teleservice.

If it is included in the Request/Indication, it contains either all Extensible Teleservices subscribed (at location updating or at restoration) or the ones added (at subscriber data modification). Only the Extensible Teleservices that are relevant to the node at which the message is received should be included in the Teleservice List.

If the VLR or the SGSN receives an Indication containing any Extensible Teleservice parameters which it does not support/allocate it returns them in the response to the HLR and discards the unsupported Extensible Teleservices (no error is sent back). This parameter is used by the VLR and the SGSN.

Forwarding information List

A list of Extensible Forwarding information parameters (Extensible Forwarding information is defined in subclause 7.6). It includes Call Forwarding services either at location updating or at restoration or when they are changed. Each Extensible Forwarding information parameter shall be treated independently of all other parameters in the primitive.

The Extensible Forwarding information shall include the SS-Code for an individual call forwarding supplementary service. The Extensible Forwarding information shall contain one or more Extensible Forwarding Features (Extensible Forwarding Feature is defined in subclause 7.6).

The Extensible Forwarding Feature may include an Extensible Basic Service Group. This shall be interpreted according to the rules in subclause 8.8.1.4.

The Extensible Forwarding Feature shall contain an Extensible SS-Status parameter.

If the Extensible SS-Status indicates that call forwarding is registered then (except for call forwarding unconditional) the Extensible Forwarding Feature shall contain a forwarded-to number and, if available, the forwarded-to subaddress. In other states the forwarded-to number and, if applicable, the forwarded-to subaddress shall not be included. For call forwarding unconditional the forwarded-to number and, if applicable, the forwarded-to subaddress shall not be included. If the VLR does not receive a forwarded-to subaddress then it shall assume that a forwarded-to subaddress has not been registered.

The Extensible Forwarding Feature shall contain the extensible forwarding options (except for call forwarding unconditional where the extensible forwarding options shall not be included). Bits 3 and 4 of the extensible forwarding options shall be ignored by the VLR, and may be set to any value by the HLR.

For call forwarding on no reply: If the extensible SS-Status indicates that call forwarding is registered then the Extensible Forwarding Feature shall contain an extensible no reply condition timer. In other states the no reply condition timer shall not be included.

For call forwarding services other than call forwarding on no reply: The Extensible Forwarding Feature shall not contain a no reply condition timer.

If the VLR receives an Indication containing any Call Forwarding service codes which it does not support/allocate it returns them to the HLR in the parameter SS-Code List and discards the unsupported Call Forwarding service codes (no error is sent back). This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Call barring information List

A list of Extensible Call barring information parameters (Extensible Call barring information is defined in subclause 7.6). It includes Call Barring services either at location updating or at restoration or when they are changed. Each Extensible Call barring information parameter shall be treated independently of all other parameters in the primitive.

The Extensible Call barring information shall include the SS-Code for an individual call barring supplementary service. The Extensible Call barring information shall contain one or more Extensible Call Barring Features (Extensible Call Barring Feature is defined in subclause 7.6).

The Extensible Call Barring Feature may include an Extensible Basic Service Group. This shall be interpreted according to the rules in subclause 8.8.1.4.

The Extensible Call Barring Feature shall contain an extensible SS-Status parameter.

If the VLR receives an Indication containing any Extensible Call Barring service codes which it does not support/allocate it returns them to the HLR in the parameter SS-Code List and discards the unsupported Extensible Call Barring service codes (no error is sent back). This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

CUG information List

A list of CUG information list parameters (CUG information is defined in subclause 7.6). It includes CUG information either at location updating or at restoration or when it is changed.

At location updating, restoration or when there is a change in CUG data, the HLR shall include the complete CUG-SubscriptionList and, if there are options per basic group, it shall also include the complete CUG-FeatureList. If there are not options per extensible basic service group the CUG-FeatureList shall not be included.

In any dialogue, the first insertSubscriberData message which contains CUG information shall include a non-empty CUG-SubscriptionList.

When the VLR receives CUG data it shall replace the stored CUG data with the received data set.

If CUG-FeatureList is omitted in the Insert Subscriber Data operation VLR shall interpret that no options per extensible basic service group exist, and then it shall apply the default values i.e. no outgoing access, no incoming access, no preferential CUG exists.

If CUG-Feature is received without preferential CUG, the VLR shall interpret that no preferential CUG applies.

If the VLR detects that there is overlapping in the information received within a dialogue, it shall send the error Unexpected Data Value.

Note that data consistency between CUG subscription data and CUG feature data is the responsibility of the HLR.

If the VLR does not support the CUG service it returns its code to the HLR in the parameter SS-Code List and discards the received information (no error is sent back). This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

SS-Data List

A list of Extensible SS-Data parameters (Extensible SS-Data is defined in subclause 7.6). It is sent for any other supplementary service than Call Forwarding, Call Barring, CUG and eMLPP either at location updating or at restoration or when they are changed. Each SS-Data parameter shall be treated independently of all other parameters in the primitive.

The Extensible SS-Data shall include the SS-Code for an individual supplementary service.

The Extensible SS-Data shall contain an Extensible SS-Status parameter and any subscription options that are applicable to the service defined by the SS-Code.

The SS-Data may include a Basic Service Group List. This shall be interpreted according to the rules in subclause 8.8.1.4.

If the VLR receives an Indication containing any supplementary service codes which it does not support/allocate it returns them to the HLR in the parameter SS-Code List and therefore discards the unsupported service codes received (no error is sent back). This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Operator Determined Barring General data

If it is included in a Request/Indication, it includes all the Operator Determined Barring categories that may be applied to a subscriber registered in any PLMN. This parameter is only included in a Request/Indication when the parameter Subscriber Status is set to the value Operator Determined Barring. Note that all General Operator Determined Barring Categories shall be set to their actual status.

If the VLR or the SGSN receives an Indication containing Operator Determined Barring General Data which shows that the subscriber is subject to barring not supported / not allocated by the VLR or by the SGSN, it returns Operator Determined Barring General Data in the response to the HLR to show the barring categories which are not supported / not allocated by the VLR or by the SGSN. This parameter is used by the VLR and the SGSN.

Operator Determined Barring HPLMN data

It includes all the Operator Determined Barring categories that may be applied only to a subscriber registered in the HPLMN. Therefore, it shall only be transferred to the VLR or to the SGSN when the subscriber is roaming into the HPLMN and when the parameter Subscriber Status is set to the value Operator Determined Barring. Note that all HPLMN Operator Determined Barring Categories shall be set to their actual status.

If Subscriber Status is set to the value Operator Determined Barring and no Operator Determined Barring HPLMN data is present then the VLR or the SGSN shall not apply any HPLMN specific ODB services to the subscriber. This parameter is used by the VLR and the SGSN.

eMLPP Subscription Data

If included in the Insert Subscriber Data request this parameter defines the priorities the subscriber might apply for a call (as defined in subclause 7.6). It contains both subparameters of eMLPP.

If the VLR does not support the eMLPP service it returns its code to the HLR in the parameter SS-Code List and therefore discards the received information (no error is sent back).

eMLPP subscription data that have been stored previously in a subscriber data record in the VLR are completely replaced by the new eMLPP subscription data received in a MAP_INSERT_SUBSCRIBER_DATA during either an Update Location or Restore Data procedure or a stand alone Insert Subscriber data procedure. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Roaming Restriction Due To Unsupported Feature

The HLR may decide to include this parameter in the request if certain services or features are indicated as not supported by the MSC/VLR (e.g. Advice of Charge Charging Level).

If this parameter is sent to the VLR the MSC area is restricted by the HLR and the VLR. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Regional Subscription Data

If included in the Insert Subscriber Data request this parameter defines the subscriber's subscription area for the addressed VLR or for the addressed SGSN (as defined in subclause 7.6). It contains the complete list of up to 10 Zone Codes that apply to a subscriber in the currently visited PLMN. The HLR shall send only those Zone Codes which are stored against the CC and NDC of the VLR or the CC and NDC of the SGSN to be updated.

NOTE: Support of this parameter is a network operator option and it will not be sent to networks which do not support Regional Subscription.

Regional subscription data that have been stored previously in a subscriber data record in the VLR or in the SGSN are completely replaced by the regional subscription data received in an Insert Subscriber Data indication during either an Update Location or Restore Data procedure or a stand alone Insert Subscriber data procedure.

After the regional subscription data are inserted the VLR or the SGSN shall derive whether its location areas are allowed or not. If the whole MSC or SGSN area is restricted it will be reported to HLR by returning the Regional Subscription Response.

The VLR or the SGSN returns a Regional Subscription Response indicating that a problem with the Zone Code has been detected in one of the following cases:

- Too Many Zone Codes: more than 10 Zone Codes are to be stored in the VLR or in the SGSN;
- Regional Subscription Not Supported by the VLR or the SGSN;
- Zone Codes Conflict: the VLR or the SGSN detects that the zone codes indicate conflicting service permission for a location area.

Zone codes which have no mapping to location areas shall be ignored.

If a sequence of MAP_INSERT_SUBSCRIBER_DATA services is used during a dialogue, Regional Subscription Data shall be accepted only in one service. Regional Subscription Data received in a subsequent service shall be rejected with the error Unexpected Data Value.

If Regional Subscription Data are not included in any MAP_INSERT_SUBSCRIBER_DATA service, there is no restriction of roaming due to Regional Subscription. This parameter is used by the VLR and the SGSN.

Voice Broadcast Data

This parameter contains a list of group id's a user might have subscribed to; (VBS-Data is defined in subclause 7.6). It includes VBS information either at location updating or at restoration or when it is changed.

At location updating, restoration or when there is a change in VBS data, the HLR shall include the complete VBS-Data.

When the VLR receives VBS-Data within a dialogue it shall replace the stored VBS-data with the received data set. All subsequent VBS-dta received within this dialogue shall be interpreted as add-on data.

If VBS-data is omitted in the Insert Subscriber Data operation the VLR shall keep the previously stored VBS data.

If the VLR detects that there is overlapping in the information received within a dialogue, it shall send the error Unexpected Data Value. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Voice Group Call Data

This parameter contains a list of group id's a user might have subscribed to; see subclause 7.6.

At location updating, restoration or when there is a change in VGCS data, the HLR shall include the complete VGCS-Data.

When the VLR receives VGCS-Data within a dialogue it shall replace the stored VGCS-Data with the received data set. All VGCS-Data received within this dialogue shall be interpreted as add-on data.

If VBCS-Data is omitted in the Insert Subsciber Data operation the VLR shall keep the previously stored VGCS-Data.

If the VLR detects that there is overlapping in the information received within a dialogue, it shall send the error Unexpected Data Value. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

North American Equal Access preferred Carrier Id List

A list of the preferred carrier identity codes that are subscribed to.

When the VLR receives this parameter from the HLR, it shall replace the previously stored preferred carrier identity codes with the received ones. It is not possible to delete all the preferred carrier identity codes from the VLR using this service. To delete all the preferred carrier identity codes from the VLR, the HLR shall use the MAP_CANCEL_LOCATION service.

LSA Information

If included in the ISD request, this parameter contains a list of localised service area identities a user might have subscribed to together with the priority of each localised service area; see subclause 7.6. The access right outside these localised service areas is also indicated. In all cases mentioned below, the LSA information shall only include LSA Data applicable to the VPLMN where the Subscriber is located. The VLR number, received in the MAP-UPDATE_LOCATION primitive, or the SGSN number, received in the MAP_UPDATE_GPRS_LOCATION primitive, can be used, alongside data stored in the HLR, to determine the LSA Data applicable to the VPLMN.

At restoration, location updating or GPRS location updating the HLR shall include the complete set of applicable LSA Information.

When there is a change in LSA data the HLR shall include at least the new and/or modified LSA data.

When there is a change in the access right outside the localised service areas the HLR shall include the LSA only access indicator.

When the SGSN or the VLR receives LSA information within a dialogue it shall check if the received data has to be considered as the entire LSA information. If so, it shall replace the stored LSA information with the received data set, otherwise it shall replace the data only for the modified LSA data (if any) and/or access right, and add the new LSA data (if any) to the stored LSA Information.

If the entire LSA information is received, it shall always include the LSA only access indicator value together with the LSA data applicable for the PLMN (if any).

If LSA Information is omitted in the Insert Subscriber Data operation the SGSN or the VLR shall keep the previously stored LSA Information.

If the SGSN or the VLR detects that there is overlapping in the information received within a dialogue, it shall send the error Unexpected Data Value. This parameter is used by the VLR and the SGSN.

IST Alert Timer

This parameter contains the IST Alert timer value that must be used to inform the HLR about the call activities that the subscriber performs.

At Location Updating, restoration, or when there is a change in the IST data defined for the Subscriber, the HLR shall include the IST Alert timer.

LMU Identifier

This parameter indicates the presence of an LMU.

LCS Information

This parameter provides the following LCS related information for an MS subscriber:

- list of GMLCs in the HPLMN
- privacy exception list

SS-Code List

The list of SS-Code parameters that are provided to a subscriber but are not supported/allocated by the VLR (SS-Code is defined in subclause 7.6). The list can only include individual SS-Codes that were sent in the service request. This parameter is used only by the VLR.

Regional Subscription Response

If included in the response this parameter indicates one of:

- MSC Area Restricted entirely because of regional subscription;
- SGSN Area Restricted entirely because of regional subscription;
- Too Many Zone Codes to be inserted;
- Zone Codes Conflict;
- Regional Subscription not Supported by the VLR or by the SGSN.

If the VLR determines after insertion of Regional Subscription Data that the entire MSC area is restricted, the VLR shall respond with a Regional Subscription Response indicating MSC Area Restricted. Otherwise MSC Area Restricted is not sent. The HLR shall check whether the current MSC area is no longer restricted.

If the SGSN determines after insertion of Regional Subscription Data that the entire SGSN area is restricted, the SGSN shall respond with a Regional Subscription Response indicating SGSN Area Restricted. Otherwise SGSN Area Restricted is not sent. The HLR shall check whether the current SGSN area is no longer restricted. This parameter is used by the VLR and by the SGSN.

VLR CAMEL Subscription Info

This parameter is sent for subscribers who have CAMEL services which are invoked in the MSC. In CAMEL phase 1 this parameter contains only the O-CSI. In CAMEL Phase 2 this parameter contains the SS-CSI and/or the O-CSI. If an O-CSI is contained, TDP-Criteria may also be present in CAMEL Phase 2. The VLR CAMEL Subscription Info is sent at location updating or when any information in the applicable CAMEL Subscription Info in the HLR has been changed. The entire set of CAMEL Subscription Info is sent within one dialogue. If a set of CAMEL Subscription Info is already stored in the VLR it is replaced by the received data. If the VLR CAMEL Subscription Info is omitted in the Insert

Subscriber Data operation the VLR shall keep the previously stored VLR CAMEL Subscription Info. Within one dialogue subsequent received data are interpreted as add-on data. If the VLR detects that there is overlapping in the information received within a dialogue, it shall send the error Unexpected Data Value. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

The VLR CAMEL Subscription Info may contain the TIF-CSI (Translation Information Flag). See GSM 03.72 for the use of this parameter and the conditions for its presence.

Supported CAMEL Phases

The use of this parameter and the requirements for its presence are specified in GSM 03.78. This parameter is used only by the VLR.

A VLR not supporting any CAMEL-Phase may omit this parameter.

GPRS Subscription Data

This parameter contains a list of PDP-contexts a user has subscribed to; see subclause 7.6.

At GPRS location updating the HLR shall include the complete GPRS Subscription Data.

When there is a change in GPRS subscriber data the HLR shall include only the new and/or modified PDP contexts.

When the SGSN receives GPRS Subscription Data within a dialogue it shall check if the received data has to be considered as the entire GPRS subscription data. If so, it shall replace the stored GPRS Subscription Data with the received data set, otherwise it shall replace the data only for the modified PDP contexts (if any) and add the new PDP contexts (if any) to the stored GPRS Subscription Data.

If GPRS Subscription Data is omitted in the Insert Subscriber Data operation the SGSN shall keep the previously stored GPRS Subscription Data.

If the SGSN detects that there is overlapping in the information received within a dialogue, it shall send the error Unexpected Data Value. This parameter is used only by the SGSN and if the VLR receives this parameter it shall ignore it.

Roaming Restricted In SGSN Due To Unsupported Feature

The HLR may decide to include this parameter in the request if certain services or features are indicated as not supported by the SGSN. This parameter is used only by the SGSN and if the VLR receives this parameter it shall ignore it.

User error

Only one of the following values is applicable:

- Unidentified subscriber;
- Data missing;
- Unexpected data value.

8.8.1.4 Basic service information related to supplementary services

A number of parameters that relate to supplementary services can be qualified by a Basic Service Group (or a Basic Service Group List). This subclause explains how this information is to be interpreted. Supplementary service parameters to which this subclause is applicable only apply to the basic service groups described in this subclause, and only those basic service groups shall be overwritten at the VLR.

The Basic Service Group (or Basic Service Group List) is optional.

If present the Basic Service Group (or the elements of the Basic Service Group List) shall be one of:

- an Elementary Basic Service Group for which the supplementary service is applicable to at least one basic service in the group; and to which the subscriber has a subscription to at least one basic service in the group;

- the group "All Teleservices" provided that the service is applicable to at least one teleservice and that the subscriber has a subscription to at least one teleservice that is in the same Elementary Basic Service Group as a teleservice to which the service is applicable;

- the group "All Bearer Services" provided that the service is applicable to at least one bearer service and that the subscriber has a subscription to at least one bearer service that is in the same Elementary Basic Service Group as a basic service to which the service is applicable.

If the Basic Service Group (or Basic Service Group List) is not present then the parameter shall apply to all Basic Service Groups.

If the basic service information is not a single Elementary Basic Service Group then the parameter shall be taken as applying individually to all the Elementary Basic Service Groups for which:

- the supplementary service is applicable to at least one basic service in the Basic Service Group; and

- the subscriber has a subscription to at least one basic service in the Basic Service Group.

The VLR is not required to store supplementary services data for Basic Service Groups that are not supported at the VLR.

8.8.2 MAP-DELETE-SUBSCRIBER-DATA service

8.8.2.1 Definition

This service 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 service is not used in case of erasure or deactivation of supplementary services.

Also this service is used by an HLR to remove GPRS subscription data from a SGSN.

It is a confirmed service and consists of the primitives shown in table 8.8/2.

8.8.2.2 Service primitives

Table 8.8/2: MAP-DELETE-SUBSCRIBER-DATA

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
Basic service List	C	C(=)		
SS-Code List	C	C(=)		
Roaming Restriction Due To Unsupported Feature	C	C(=)		
Camel Subscription Info Withdraw	C	C(=)		
Regional Subscription Data	C	C(=)		
VBS Group Indication	C	C(=)		
VGCS Group Indication	C	C(=)		
GPRS Subscription Data Withdraw	C	C(=)		
Roaming Restricted In SGSN Due To Unsupported Feature	C	C(=)		
LSA Information Withdraw	C	C(=)		
IST Information Withdraw	C	C(=)		
Regional Subscription Response			C	C(=)
User error			C	C(=)
Provider error				O

8.8.2.3 Parameter use

All parameters are described in subclause 7.6. The following clarifications are applicable:

Basic service List

A list of Extensible Basic service parameters (Extensible Basic service is defined in subclause 7.6). It is used when one, several or all basic services are to be withdrawn from the subscriber. If the VLR or the SGSN receives a value for an Extensible Basic Service which it does not support, it shall ignore that value. This parameter is used by the VLR and by the SGSN.

SS-Code List

A list of SS-Code parameters (SS-Code is defined in subclause 7.6). It is used when several or all supplementary services are to be withdrawn from the subscriber.

There are three possible options:

- deletion of basic service(s);

  The parameter Basic service List is only included.

- deletion of supplementary service(s);

  The parameter SS-Code List is only included.

- deletion of basic and supplementary services;

  Both Basic service List and SS-Code List are included.

This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Roaming Restriction Due To Unsupported Feature

This parameter is used if Roaming Restriction Due To Unsupported Feature is deleted from the subscriber data. This may occur if unsupported features or services are removed from the subscriber data in the HLR.

If this parameter is sent the VLR shall check if the current Location Area is possibly allowed now. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

CAMEL Subscription Info Withdraw

This parameter is used to indicate that CAMEL Subscription Info shall be deleted from the VLR. All CAMEL Subscription Info for the subscriber shall be deleted. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

Regional Subscription Identifier

Contains one single Zone Code (as defined in subclause 7.6) and is used if all Zone Codes shall be deleted from the subscriber data. When all the Zone Codes are deleted, the VLR or the SGSN shall check for its location areas whether they are allowed or not. If the whole MSC area is restricted, VLR will report it to HLR by returning the Regional Subscription Response "MSC Area Restricted". If the whole SGSN area is restricted, SGSN will report it to HLR by returning the Regional Subscription Response "SGSN Area Restricted".

The binary coding of the Zone Code value received in a Delete Subscriber Data request shall not be checked by the VLR or by the SGSN.

Note that support of this parameter is a network operator option and it shall not be sent to networks which do not support Regional Subscription.

If Regional Subscription is not supported by the VLR or by the SGSN, the request for deletion of Zone Codes is refused by sending the Regional Subscription Response "Regional Subscription Not Supported" to the HLR.

If no Zone Codes are stored in the respective subscriber data record, the request for deleting all Zone Code information shall be ignored and no Regional Subscription Response shall be returned. This parameter is used by the VLR and by the SGSN.

VBS Group Indication

Contains an indication (flag) which is used if all Group Ids shall be deleted from the subscriber data for the Voice Broadcast teleservice.

If VBS is not supported in the VLR or no Group Ids are stored for VBS in the respective subscriber record, the request for deletion of all Group Ids shall be ignored. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

VGCS Group Indication

Contains an indication (flag) which is used if all Group Ids shall be deleted from the subscriber data for the Voice Group Call teleservice. This parameter is used only by the VLR and if the SGSN receives this parameter it shall ignore it.

If VGCS is not supported in the VLR or no Group Ids are stored for VGCS in the respective subscriber record, the request for deletion of all Group Ids shall be ignored.

GPRS Subscription Data Withdraw

This parameter is used to indicate whether all GPRS Subscription Data for the subscriber shall be deleted or if only a subset of the stored GPRS Subscription Data for the subscriber shall be deleted. In the latter case only those PDP contexts whose identifiers are included in the subsequent identifier list will be deleted. This parameter is used only by the SGSN and if the VLR receives this parameter it shall ignore it.

Roaming Restricted In SGSN Due To Unsupported Feature

This parameter is used if Roaming Restricted In SGSN Due To Unsupported Feature is deleted from the GPRS subscriber data. This may occur if unsupported features or services are removed from the GPRS subscriber data in the HLR.

If this parameter is sent the SGSN shall check if the current Location Area is possibly allowed now. This parameter is used only by the SGSN and if the VLR receives this parameter it shall ignore it.

LSA Information Withdraw

This parameter is used to indicate whether all LSA Information for the subscriber shall be deleted or if only a subset of the stored LSA Information for the subscriber shall be deleted. In the latter case only the LSA data whose LSA identities are included in the subsequent LSA data list will be deleted. This parameter is used by the VLR and the SGSN.

IST Information Withdraw

This parameter is used to indicate that the IST condition has been removed for the subscriber. See GSM 03.35 for the use of this parameter.

Regional Subscription Response

If included in the Delete Subscriber Data response this parameter indicates one of:

- MSC Area Restricted
- SGSN Area Restricted;
- Regional Subscription Not Supported.

This parameter is used by the VLR and by the SGSN.

User error

Only one of the following values is applicable:

- Unidentified subscriber;
- Data missing;
- Unexpected data value.

8.9.2 MAP-FORWARD-NEW-TMSI service

8.9.2.1 Definition

This service is used by a VLR to allocate, via MSC, a new TMSI to a subscriber during an ongoing transaction (e.g. call set-up, location updating or supplementary services operation).

It is a confirmed service and consists of the primitives shown in table 8.9/2.

8.9.2.2 Service primitives

Table 8.9/2: MAP-FORWARD-NEW-TMSI

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
TMSI	M	M(=)		
Provider error				O

8.9.2.3 Parameter use

The parameter TMSI is described in subclause 7.6.

8.10 Fault recovery services

8.10.1 MAP_RESET service

8.10.1.1 Definition

This service is used by the HLR, after a restart, to indicate to a list of VLRs or SGSNs that a failure occurred.

The MAP_RESET service is a non-confirmed service using the service primitives defined in table 8.10/1

8.10.1.2 Service primitives

Table 8.10/1: MAP_RESET

Parameter name	Request	Indication
Invoke Id	M	M(=)
HLR number	M	M(=)
HLR Id LIST	U	C(=)

8.10.1.3 Parameter definition and use

Invoke Id

See definition in subclause 7.6.1.

HLR number

See definition in subclause 7.6.2.

HLR Id LIST

The HLR Id List is a list of HLR Ids. If the parameter is present in the indication, the VLR or SGSN may base the retrieval of subscribers to be restored on their IMSI: the subscribers affected by the reset are those whose IMSI leading

digits are equal to one of these numbers. If the parameter is absent, subscribers to be restored are those for which the OriginatingEntityNumber received at location updating time matches the equivalent parameter of the Reset Indication.

8.10.3 MAP_RESTORE_DATA service

8.10.3.1 Definition

This service is invoked by the VLR on receipt of a MAP_PROVIDE_ROAMING_NUMBER indication for an unknown IMSI, or for a known IMSI with the indicator "Confirmed by HLR" set to "Not confirmed". The service is used to update the LMSI in the HLR, if provided, and to request the HLR to send all data to the VLR that are to be stored in the subscriber's IMSI record.

The MAP_RESTORE_DATA service is a confirmed service using the service primitives defined in table 8.10/3.

8.10.3.2 Service primitives

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
LMSI	U	C(=)		
Supported CAMEL phases	C	C(=)		
HLR number			C	C(=)
MS Not Reachable Flag			C	C(=)
User error			C	C(=)
Provider error				O

Table 8.10/3: MAP_RESTORE_DATA

8.10.3.3 Parameter definitions and use

Invoke Id

See definition in subclause 7.6.1.

IMSI

See definition in subclause 7.6.2.

LMSI

See definition in subclause 7.6.2. It is an operator option to provide the LMSI from the VLR; it is mandatory for the HLR to support the LMSI handling procedures.

Supported CAMEL Phases

This parameter indicates which phases of CAMEL are supported. Must be present if a CAMEL phase different from phase 1 is supported. Otherwise may be absent.

HLR number

See definition in subclause 7.6.2. The presence of this parameter is mandatory in case of successful outcome of the service.

MS Not Reachable Flag

See definition in subclause 7.6.8. This parameter shall be present in case of successful outcome of the service, if the "MS Not Reachable flag" was set in the HLR.

User error

In case of unsuccessful outcome of the service, an error cause shall be returned by the HLR. The following error causes defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- unknown subscriber;
- system failure;
- unexpected data value;
- data missing.

Provider error

For definition of provider errors see subclause 7.6.1.

8.11 Subscriber Information services

8.11.1 MAP-ANY-TIME-INTERROGATION service

8.11.1.1 Definition

This service is used by the gsmSCF, to request information (e.g. subscriber state and location) from the HLR at any time.

8.11.1.2 Service primitives

Table 8.11/1: Any_Time_Interrogation

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
Requested Info	M	M(=)		
gsmSCF-Address	M	M(=)		
IMSI	C	C(=)		
MSISDN	C	C(=)		
Location Information			C	C(=)
Subscriber State			C	C(=)
User error			C	C(=)
Provider error				O

8.11.1.3 Parameter definition and use

All parameters are described in subclause 7.6.

The HLR may be able to use the value of the parameter gsmSCF-address to screen an MAP_Any_Time_Interrogation indication.

The use of the parameters and the requirements for their presence are specified in GSM 03.78.

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- System Failure;
- Any Time Interrogation Not Allowed;
- Data Missing;
- Unexpected Data Value;

- Unknown Subscriber.

Provider error

These are defined in subclause 7.6.1.

8.11.2 MAP-PROVIDE-SUBSCRIBER-Info service

8.11.2.1 Definition

This service is used to request information (e.g. subscriber state and location) from the VLR at any time.

8.11.2.2 Service primitives

Table 8.11/2: Provide_Subscriber_Information

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
Requested Info	M	M(=)		
IMSI	M	M(=)		
LMSI	U	O		
Location Information			C	C(=)
Subscriber State			C	C(=)
User error			C	C(=)
Provider error				O

8.11.2.3 Parameter definition and use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.18

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- Data Missing;
- Unexpected Data Value.

Provider error

These are defined in subclause 7.6.1.

9.2 Other operation and maintenance services

9.2.1 MAP-SEND-IMSI service

9.2.1.1 Definition

This service is used by a VLR in order to fetch the IMSI of a subscriber in case of some Operation & Maintenance procedure where subscriber data are needed in the Visited PLMN and MSISDN is the only subscriber's identity known.

It is a confirmed service and consists of the primitives shown in figure 9.2/1.

10.1.3 Parameter use

See subclause 7.6 for a definition of the parameters used in addition to the following. Note that:

- a conditional parameter whose use is defined only in GSM 03.78 shall be absent if the sending entity does not support CAMEL;
- a conditional parameter whose use is defined only in GSM 03.79 shall be absent if the sending entity does not support optimal routeing;
- a conditional parameter whose use is defined only in GSM 03.78 & GSM 03.79 shall be absent if the sending entity supports neither CAMEL nor optimal routeing.

Interrogation Type

See GSM 03.79 [99] for the use of this parameter.

GMSC address

The E.164 address of the GMSC.

MSISDN

This is the Mobile Subscriber ISDN number assigned to the called subscriber. In the Request & Indication it is the number received by the GMSC in the IAM. If the call is to be forwarded and the HLR supports determination of the redirecting number, the HLR inserts the basic MSISDN in the Response.

See GSM 03.66 [108] for the use of this parameter and the conditions for its presence in the response.

OR Interrogation

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

OR Capability

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

CUG Interlock

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

CUG Outgoing Access

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

Number of Forwarding

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

Network Signal Info

See GSM 03.18 [97] for the conditions for the presence of the components of this parameter.

Supported CAMEL Phases

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

T-CSI Suppression

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

Suppression Of Announcement

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

Call Reference Number

The use of this parameter and the conditions for its presence are specified in GSM 03.78 [98] and GSM 03.79 [99].

Forwarding Reason

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

Basic Service Group

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

Alerting Pattern

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

CCBS Call

See GSM 03.93 [107] for the use of this parameter and the conditions for its presence.

Supported CCBS Phase

This parameter indicates by its presence that CCBS is supported and the phase of CCBS which is supported.

Additional Signal Info

See GSM 03.81 [27] for the conditions for the presence of the components of this parameter.

IST Support Indicator

This parameter is used to indicate to the HLR that the GMSC supports basic IST functionality, that is, the GMSC is able to terminate the subscriber call activity that originated the IST Alert when it receives the IST Alert response indicating that the call(s) shall be terminated. If this parameter is not included in the Send Routing Information indication and the subscriber is marked as an IST subscriber, then the HLR may limit the service for the call (by barring the incoming call if it is not subject to forwarding, or suppressing Call Forwarding from the GMSC), or allow the call assuming the associated risk of not having the basic IST mechanism available.

This parameter can also indicate that the GMSC supports the IST Command, including the ability to terminate all calls being carried for the identified subscriber by using the IMSI as a key. If this additional capability is not included in the Send Routing Information indication and the subscriber is marked as an IST subscriber, then the HLR may limit the service for the subscriber (by barring the incoming calls if they are not subject to forwarding, or suppressing Call Forwarding from the GMSC), or allow the incoming calls assuming the associated risk of not having the IST Command mechanism available.

Pre-paging supported

See 3G 23.018 for the use of this parameter and the conditions for its presence.

IMSI

See GSM 03.18 [97] and GSM 03.66 [108] for the use of this parameter and the conditions for its presence.

MSRN

See GSM 03.18 [97], GSM 03.66 [108] and GSM 03.79 [99] for the use of this parameter and the conditions for its presence. If the NPLR returns only the MSISDN-number without Routeing Number to the GMSC, the MSISDN-number shall be returned as MSRN.

Forwarding Data

This parameter includes the forwarded-to number, the forwarding reason and the forwarding options Notification to calling party and Redirecting presentation , and can include the forwarded-to subaddress. See GSM 03.18 [97] and GSM 03.79 [99] for the conditions for the presence of its components.

Forwarding Interrogation Required

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

VMSC address

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

GMSC CAMEL Subscription Info

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

Location Information

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

Subscriber State

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

CUG Subscription Flag

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

North American Equal Access preferred Carrier Id

This parameter is returned to indicate the preferred carrier identity to be used to setup the call (i.e. forwarding the call or establishing the roaming leg).

SS-List

This parameter includes SS-codes and will be returned as an operator option. The HLR shall not send PLMN-specific SS-codes across PLMN boundaries. However if the GMSC receives PLMN-specific SS-codes from a foreign PLMN's HLR the GMSC may ignore it. If the GMSC attempts to process the PLMN-specific SS-codes, this may lead to unpredictable behaviour but the GMSC shall continue call processing.

Basic Service Code

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

If the CAMEL service is not involved, this parameter includes the basic service code and will be returned as an operator option. The HLR shall not send a PLMN-specific Basic Service Code across PLMN boundaries. However if the GMSC receives a PLMN-specific Basic Service Code from a foreign PLMN's HLR the GMSC may ignore it. If the GMSC attempts to process the PLMN specific Basic Service codes, this may lead to unpredictable behaviour but the GMSC shall continue call processing.

CCBS Target

See GSM 03.93 for the use of this parameter and the conditions for its presence.

Keep CCBS Call Indicator

See GSM 03.93 for the use of this parameter and the conditions for its presence.

IST Alert Timer

It includes the IST Alert timer value that must be used to inform the HLR about the call activities that the subscriber performs. This parameter is only sent to the GMSC in response to a Send Routing Information request which indicates the the GMSC supports IST.

Number Portability Status

This parameter indicates the number portability status of the subscriber. This parameter may be present if the sender of SRIack is NPLR.

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- Unknown Subscriber;
- Number changed;
- Call Barred;

  This error will indicate that either incoming calls are barred for this MS or that calls are barred due to Operator Determined Barring (see GSM 02.41 for a definition of this network feature).

- CUG Reject;

  The value of this error cause will indicate the reason for CUG Reject.

- Bearer Service Not Provisioned;
- Teleservice Not Provisioned;

  A subscription check has been performed and the call has not passed the check due to incompatibility with regard to the requested service. Depending on the nature of the incompatibility, either of these messages will be returned.

- Facility Not Supported;
- Absent Subscriber;

  This indicates that the location of the MS is not known (either the station is not registered and there is no location information available or the Provide Roaming Number procedure fails due to IMSI detached flag being set), or the GMSC requested forwarding information with a forwarding reason of not reachable, and the call forwarding on MS not reachable service is not active.

- Busy Subscriber;

  This indicates that Call Forwarding on Busy was not active for the specified basic service group when the GMSC requested forwarding information with a forwarding reason of busy.

  The error may also indicate that the subscriber is busy due to an outstanding CCBS recall. In the error data it may then be specified that CCBS is possible for the busy encountered call.

- No Subscriber Reply;

  This indicates that Call Forwarding on No Reply was not active for the specified basic service group when the GMSC requested forwarding information with a forwarding reason of no reply.

- OR Not Allowed;

  This indicates that the HLR is not prepared to accept an OR interrogation from the GMSC, or that calls to the specified subscriber are not allowed to be optimally routed.

- Forwarding Violation;
- System Failure;
- Data Missing;
- Unexpected Data Value.

See subclause 7.6 for a definition of these errors.

Provider error

These are defined in subclause 7.6.

10.2 MAP_PROVIDE_ROAMING_NUMBER service

10.2.1 Definition

This service is used between the HLR and VLR. The service is invoked by the HLR to request a VLR to send back a roaming number to enable the HLR to instruct the GMSC to route an incoming call to the called MS.

This is a confirmed service which uses the primitives described in table 10.2/1.

10.2.2 Service primitives

Table 10.2/1: MAP_PROVIDE_ROAMING_NUMBER parameters

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
MSC Number	M	M(=)		
MSISDN	U	C(=)		
LMSI	C	C(=)		
GSM Bearer Capability	C	C(=)		
Network Signal Info	C	C(=)		
Suppression Of Announcement	C	C(=)		
Call Reference Number	C	C(=)		
GMSC Address	C	C(=)		
OR Interrogation	C	C(=)		
OR Not Supported in GMSC	C	C(=)		
Alerting Pattern	C	C(=)		
CCBS Call	C	C(=)		
Supported CAMEL Phases in GMSC	C	C(=)		
Additional Signal Info	C	C(=)		
Pre-paging supported	C	C(=)		
Roaming Number			C	C(=)
User error			C	C(=)
Provider error				O

10.2.3 Parameter use

See subclause 7.6 for a definition of the parameters used, in addition to the following. Note that:

- a conditional parameter whose use is defined only in GSM 03.78 shall be absent if the sending entity does not support CAMEL;
- a conditional parameter whose use is defined only in GSM 03.79 shall be absent if the sending entity does not support optimal routeing;
- a conditional parameter whose use is defined only in GSM 03.78 & GSM 03.79 shall be absent if the sending entity supports neither CAMEL nor optimal routeing.

IMSI

This is the IMSI of the called Subscriber.

MSC Number

This is the ISDN number assigned to the MSC currently serving the MS. The MSC number will have been stored in the HLR as provided at location updating.

MSISDN

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

LMSI

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

GSM Bearer Capability

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

This information is passed according to the rules specified in TS GSM 09.07.

There may be two GSM Bearer Capabilities supplied.

Network Signal Info

See GSM 03.18 [97] for the conditions for the presence of the components of this parameter.

Suppression Of Announcement

The use of this parameter and the requirements for its presence are specified in GSM 03.78.

Call Reference Number

The use of this parameter and the conditions for its presence are specified in GSM 03.78 [98] and GSM 03.79 [99].

GMSC Address

The use of this parameter and the conditions for its presence are specified in GSM 03.78 [98] and GSM 03.79 [99].

OR Interrogation

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

OR Not Supported in GMSC

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

Supported CAMEL Phases in GMSC

See GSM 03.78 [98] for the use of this parameter and the conditions for its presence.

Alerting Pattern

See GSM 03.78 [98] for the use of this parameter and the conditions for its presence.

CCBS Call

See GSM 03.93 [xx] for the use of this parameter and the conditions for its presence.

Additional Signal Info

See GSM 03.81 [xx] for the conditions for the presence of the components of this parameter.

Pre-paging supported

See 3G 23.018 for the use of this parameter and the conditions for its presence.

Roaming Number

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- Absent Subscriber;

  This error will be returned if the IMSI detach flag is set.

- No Roaming Number Available;
- OR Not Allowed;

  This indicates that the MAP_PROVIDE_ROAMING_NUMBER indication included the OR interrogation indicator, but the VLR does not support optimal routeing.
- Facility Not Supported;
- System Failure;
- Data Missing;
- Unexpected Data Value.

See subclause 7.6 for a definition of these reasons.

Provider error

These are defined in subclause 7.6.

10.3.3 Parameter use

Information received in subsequent segment of a segmented dialogue shall not overwrite information received in an earlier segment.

See subclause 7.6 for a definition of the parameters used, in addition to the following.

Call Reference Number

See GSM 03.79 [99] for the use of this parameter. This parameter shall be present in a first segment of the dialogue.

Basic Service Group

See GSM 03.79 [99] for the use of this parameter. This parameter shall be present in a first segment of the dialogue.

IMSI

This is the IMSI of the forwarding Subscriber. This parameter shall be present in a first segment of the dialogue.

Forwarding Data

This parameter includes the forwarded-to number, the forwarding reason and the forwarding options Notification to calling party and Redirecting presentation, and can include the forwarded-to subaddress. See GSM 03.79 [99] for the conditions for the presence of its components. This parameter shall be present in a first segment of the dialogue.

CUG Interlock

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

CUG Outgoing Access

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

O-CSI

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

For CAMEL phases 1 & 2, the O-CSI shall contain only one set of O-BCSM TDP data.

CCBS Target

See GSM 03.93 [107] for the use of this parameter and the conditions for its presence.

UU Data

See GSM 03.87 for the use of this parameter and the conditions for its presence.

UUS CF Interaction

See GSM 03.87 for the use of this parameter and the conditions for its presence.

All Information Sent

This parameter is set when the VMSC has sent all information to GMSC.

MSISDN

This parameter is the basic MSISDN of the forwarding subscriber. It shall be present if the VMSC supports determination of the redirecting number.

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- Optimal Routeing not allowed;
- Forwarding failed;

- Unexpected Data Value;
- Data Missing.

Provider error

These are defined in subclause 7.6.

10.4 MAP_PREPARE_GROUP_CALL service

10.4.1 Definition

This service is used by the Anchor_MSC to inform the Relay_MSC about a group call setup.

The MAP_PREPARE_GROUP_CALL service is a confirmed service using the service primitives given in table 10.4/1.

10.4.2 Service primitives

Table 10.4/1: MAP_PREPARE_GROUP_CALL service

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
Teleservice	M	M(=)		
ASCI Call Reference	M	M(=)		
Ciphering Algorithm	M	M(=)		
Group Key Number	C	C(=)		
Group Key	C	C(=)		
Priority	C	C(=)		
CODEC-Information	M	M(=)		
Uplink Free Indicator	M	M(=)		
Group Call Number			M	M(=)
User Error			C	C(=)
Provider Error				O

10.4.3 Parameter definitions and use

Invoke Id

See definition in subclause 7.6.1.

Teleservice

Voice Broadcast Service or Voice Group Call Service.

ASCI Call Reference

Broadcast call reference or group call reference. This item is used to access the VBS-GCR or VGCS-GCR within the Relay_MSC.

Ciphering Algorithm

The ciphering algorithm to be used for the group call.

Group Key Number

This number has to be broadcasted and is used by the mobile station to select the chosen group key.

Shall be present if the ciphering applies.

Group Key

This key is used for ciphering on the radio interface.

Shall be present if the ciphering applies.

Priority

Default priority level related to the call if eMLPP applies.

CODEC-Information

Information on the codecs allowed for this call.

Uplink Free Indicator

A flag indicating whether the call is initiated from a dispatcher.

Group Call Number

This temporary allocated E.164 number is used for routing the call from the Anchor MSC to the Relay MSC.

User Error

For definition of this parameter see subclause 7.6.1 The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- No Group Call Number available

- System Failure

- Unexpected Data Value

Provider Error

See definition of provider error in subclause 7.6.1.

10.5 MAP_PROCESS_GROUP CALL_SIGNALLING service

10.5.1 Definitions

This service is used between Relay MSC and Anchor MSC for transmission of Group Call notifications.

The MAP_PROCESS_GROUP_CALL_SIGNALLING service is a non-confirmed service using the service primitives given in table 10.5/1.

10.5.2 Service primitives

Table 10.5/1: MAP_PROCESS_GROUP_CALL_SIGNALLING service

Parameter name	Request	Indication
Invoke Id	M	M(=)
Uplink Request	C	C(=)
Uplink Release Indication	C	C(=)
Release Group Call	C	C(=)

10.5.3 Parameter definitions and use

Invoke Id

See definition in subclause 7.6.1.

Uplink Request

This information element indicates to the anchor MSC that a service subscriber roaming in the relay MSC area requests access to the uplink.

Uplink Release Indication

This information element if included by the Relay MSC indicates to the Anchor MSC that the uplink has become free.

Release Group Call

This information element if included by the Relay MSC indicates to the Anchor MSC that the service subscriber who has initiated the call and who currently has access to the uplink terminates the call.

10.6 MAP_FORWARD_GROUP_CALL_SIGNALLING service

10.6.1 Definitions

This service is used between Anchor MSC and Relay MSC for transmission of Group Call notifications.

The MAP_FORWARD_GROUP_CALL_SIGNALLING service is a non-confirmed service using the service primitives given in table 10.6/1.

10.6.2 Service primitives

Table 10.6/1: MAP_FORWARD_GROUP_CALL_SIGNALLING service

Parameter name	Request	Indication
Invoke Id	M	M(=)
IMSI	C	C(=)
Uplink Request Acknowledgement	C	C(=)
Uplink Release Indication	C	C(=)
Uplink Reject Command	C	C(=)
Uplink Seized Command	C	C(=)
Uplink Release Command	C	C(=)

10.6.3 Parameter definitions and use

IMSI

Identity of the service subscriber who has established the call and who is allowed to terminate the call.

Invoke Id

See definition in subclause 7.6.1.

Uplink Request Acknowledgement

This information element is used for positive acknowledgement of an uplink request.

Uplink Release Indication

This information element if included by the Anchor MSC indicates to the Relay MSC that the uplink has become free.

Uplink Reject Command

This information element is used for negative acknowledgement of an uplink request.

Uplink Seized Command

This information element if included by the Anchor MSC indicates to the Relay MSC that the uplink is no longer free.

Uplink Release Command

This information element if included by the Anchor MSC indicates to the Relay MSC that the uplink which is granted to a MS in the relay MSC area shall be released.

10.7 MAP_SEND_GROUP_CALL_END_SIGNAL service

10.7.1 Definitions

This service is used between the Relay MSC and the Anchor MSC indicating that VGCS / VBS channels have been established in the Relay MSC area. The response is used by the Anchor MSC to inform the Relay MSC that all resources for the call can be released in the Relay MSC because the call has been released in the Anchor MSC.

The MAP_SEND_GROUP_CALL_END_SIGNAL service is a confirmed service using the service primitives given in table 10.7/1.

10.7.2 Service primitives

Table 10.7/1: MAP_SEND_GROUP_CALL_END_SIGNAL service

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	C	C(=)		
Provider Error				O

10.7.3 Parameter definitions and use

IMSI

Identity of the service subscriber who has established the call and who is allowed to terminate the call.

Shall be present if the call was established by a service subscriber roaming in the relay MSC area.

Invoke Id

See definition in subclause 7.6.1.

Provider Error

See definition of provider error in subclause 7.6.1.

10.8 MAP_Provide_SIWFS_Number

10.8.1 Definition

This service is used between an MSC and SIWFS. It is invoked by an MSC receiving an incoming call (call to or from MS) to request the SIWFS to allocate IWU resources. The service is defined in GSM 03.54.

This is a confirmed service using the primitives described in table 10.8/1.

10.8.2 Service primitive

Table 10.8/1: MAP_Provide_SIWFS_Number service

Parameter name	Request	Indication	Response	Confirm
Invoke ID	M	M(=)	M(=)	M(=)
GSM Bearer Capability	M	M(=)		
ISDN Bearer Capability	M	M(=)		
Call Direction	M	M(=)		
B-subscriber address	M	M(=)		
Chosen Channel	M	M(=)		
Lower Layer Compatibility	C	C(=)		
High Layer Compatibility	C	C(=)		
SIWFS number			C	C(=)
User error			C	C(=)
Provider error				O

10.8.3 Parameter use

See subclause 7.6 for a definition of the parameters used, in addition to the following.

GSM Bearer Capability

This information is the result from the negotiation with the mobile station. The information is sent from the MSC to the SIWFS to allocate the correct IWU.

ISDN Bearer Capability

This parameter refers to the ISDN Bearer Capability information element. For the MTC this parameter is received in the ISUP User Service Information parameter. For the MOC call this parameter is mapped from the GSM BC parameter according to GSM 09.07. The parameter is used by the SIWFS to route the call and to allocate the outgoing circuit.

Call Direction

This parameter indicates the direction of the call (mobile originated or mobile terminated) at call set-up.

B-subscriber address

This parameter is sent from the MSC to the SIWFS to inform the SIWFS where to route the call i.e. where to send the IAM. If the loop method is used this parameter will indicate the address to the VMSC. This address is allocated by the VMSC in the same way as a MSRN and is used to correlate the incoming IAM to the corresponding MAP dialogue. If the non-loop method is used this parameter will indicate the address to the B-subscriber.

Chosen Channel

This parameter is sent from the MSC to the SIWFS to adjust the interworking unit to the assigned radio resources. This parameter is defined in GSM 08.08.

Lower Layer Compatibility

This parameter is sent from the MSC to the SIWF to allow the interworking unit to perform a compatibility check. This parameter is handled as specified in GSM 09.07. This parameter is defined in GSM 04.08.

High Layer Compatibility

This parameter is sent from the MSC to the SIWF to allow the interworking unit to perform a compatibility check. This parameter is handled as specified in GSM 09.07. This parameter is defined in GSM 04.08.

SIWFS number

This parameter is sent from the SIWFS to the MSC. This address is used by the visited MSC to route the call, i.e. the IAM to the SIWFS (similar to MSRN) and will be used by the SIWFS to correlate the incoming IAM to the corresponding MAP message. This parameter must always be sent from the SIWFS when a successful allocation of SIWFS resources has been made.

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- Resource limitation;
- Facility Not Supported;
- Unexpected Data Value;
- System Failure.

See subclause 7.6 for a definition of these reasons.

Provider error

These are defined in subclause 7.6.

10.9 MAP_SIWFS_Signalling_Modify

10.9.1 Definition

This service is used to transport signalling information between an MSC and an SIWFS in the case of a request to modify the configuration (e.g. HSCSD). It is invoked either by an MSC or by the SIWFS. The service is defined in GSM 03.54.

This is a confirmed service using the primitives described in table 10.9/1.

10.9.2 Service primitive

Table 10.9/1: MAP_SIWFS_Signalling_Modify service

Parameter name	Request	Indication	Response	Confirm
Invoke ID	M	M(=)	M(=)	M(=)
Channel Type	C	C(=)		
Chosen Channel	C	C(=)	C(=)	C(=)
User error			C	C(=)
Provider error				O

10.9.3 Parameter use

See subclause 7.6 for a definition of the parameter used, in addition to the following.

Channel Type

This parameter is the result of a Channel Mode Modification for TS61/62. It contains the changed Air Interface User Rate. The information is sent from the SIWFS to the MSC to assign the correct radio resource. This parameter is defined in GSM 08.08.

Chosen Channel

This parameter is sent from the MSC to the SIWFS to adjust the interworking unit to the assigned radio resources. This parameter is defined in GSM 08.08.

User error

This parameter is sent by the responder when an error is detected and if present , takes one of the following values:

- Resource limitation;
- Facility Not Supported;
- Data Missing;
- Unexpected Data Value;
- System Failure.

See subclause 7.6 for a definition of these reasons.

Provider error

These are defined in subclause 7.6.

10.10 MAP_SET_REPORTING_STATE service

10.10.1 Definition

This service is used between the HLR and the VLR to set the reporting state for a requested service. It is a confirmed service using the service primitives shown in table 10.10/1.

10.10.2 Service primitives

Table 10.10/1: MAP_SET_REPORTING_STATE parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
IMSI	C	C(=)		
LMSI	C	C(=)		
CCBS Monitoring	C	C(=)		
CCBS Subscriber Status			C	C(=)
User error			C	C(=)
Provider error				O

10.10.3 Parameter use

See subclause 7.6 for a definition of the parameters used, in addition to the following.

IMSI

The IMSI is a mandatory parameter if the service is used as the only one in a dialogue.

CCBS Monitoring

This parameter indicates whether monitoring for CCBS shall be started or stopped. If it indicates that monitoring shall be started this service corresponds to the message 'Start Reporting' in GSM 03.93; if it indicates that monitoring shall be stopped this service corresponds to the message 'Stop Reporting' in GSM 03.93.

CCBS Subscriber Status

See GSM 03.93 for the use of this parameter and the conditions for its presence.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values defined in subclause 7.6.1:

- System Failure;
- Unidentified Subscriber;
- Unexpected Data Value;
- Data Missing;
- Resource Limitation;
- Facility Not Supported.

NOTE: This error is reserved for future use.

Provider error

These are defined in subclause 7.6.

10.11 MAP_STATUS_REPORT service

10.11.1 Definition

This service is used by the VLR to report an event or call outcome to the HLR. It is a confirmed service using the service primitives shown in table 10.11/1.

10.11.2 Service primitives

Table 10.11/1: MAP_STATUS_REPORT parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
CCBS Subscriber Status	C	C(=)		
Monitoring Mode	C	C(=)		
Call Outcome	C	C(=)		
User error			C	C(=)
Provider error				O

10.11.3 Parameter use

See subclause 7.6 for a definition of the parameters used, in addition to the following.

CCBS Subscriber Status

If this parameter is present without Monitoring Mode and Call Outcome this service corresponds to the message 'Event Report' in GSM 03.93 [107]. See GSM 03.93 [107] for the use of this parameter and the conditions for its presence.

Monitoring Mode

If this parameter is present with CCBS Call Outcome this service corresponds to the message 'CCBS Call Report' in GSM 03.93. See GSM 03.93 for the use of this parameter and the conditions for its presence.

Call Outcome

See GSM 03.93 for the use of this parameter and the conditions for its presence.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values defined in subclause 7.6.1:

- Unknown Subscriber ;
- System Failure;
- Unexpected Data Value;
- Data Missing.

Provider error

These are defined in subclause 7.6.

10.12 MAP_REMOTE_USER_FREE service

10.12.1 Definition

This service is used between the HLR and the VLR to report that the B subscriber is now idle and that the A subscriber can be notified. It is a confirmed service using the service primitives shown in table 10.12/1.

10.12.2 Service primitives

Table 10.12/1: MAP_REMOTE_USER_FREE parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
Call Info	M	M(=)		
CCBS Feature	M	M(=)		
Translated B Number	M	M(=)		
Replace B Number	C	C(=)		
Alerting Pattern	C	C(=)		
RUF Outcome			C	C(=)
User error			C	C(=)
Provider error				O

10.12.3 Parameter use

See subclause 7.6 for a definition of the parameters used, in addition to the following.

Call Info

See GSM 03.93 for the use of this parameter.

CCBS Feature

See GSM 03.93 for the conditions for the presence of the parameters included in the CCBS feature.

Translated B Number

See GSM 03.93 for the use of this parameter.

Replace B Number

See GSM 03.93 for the use of this parameter and the conditions for its presence.

Alerting Pattern

See GSM 03.93 for the use of this parameter and the conditions for its presence.

RUF Outcome

See GSM 03.93 for the use of this parameter and the conditions for its presence.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values defined in subclause 7.6.1:

- Unexpected Data Value;
- Data Missing;
- Incompatible Terminal;

  This error is returned by the responder when the terminal used for CCBS activation is not compatible with the terminal used for the CCBS recall. For details refer to GSM 04.08.

- Absent Subscriber (IMSI Detach; Restricted Area; No Page Response);
- System Failure;
- Busy Subscriber (CCBS Busy).

Provider error

These are defined in subclause 7.6.

10.13 MAP_IST_ALERT service

10.13.1 Definition

This service is used between the MSC (Visited MSC or Gateway MSC) and the HLR, to report that the IST timer running for a call for the Subscriber has expired. It is a confirmed service using the service primitives shown in table 10.13/1.

10.13.2 Service primitives

Table 10.13/1: MAP_IST_ALERT parameters

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
IST Alert Timer			C	C(=)
IST Information Withdraw			C	C(=)
Call termination Indicator			C	C(=)
User error			C	C(=)
Provider error				O

10.13.3 Parameter use

All parameters are described in subclause 7.6. The following clarifications are applicable:

IST Alert Timer

If included in the IST Alert response, it includes the new IST Alert timer value that must be used to inform the HLR about the call activities that the subscriber performs.

IST Information Withdraw

If included in the IST Alert response, this parameter is used to indicate that the IST condition has been removed for the subscriber. When the MSC receives this parameter, IST control for that call shall be terminated.

Call termination Indicator

If included in the IST Alert response, this parameter is used to indicate whether the MSC shall terminate the call activity that had previously triggered the IST Alert procedure, or it shall also release all other call activities for the specified subscriber (outgoing call activities if the IST Alert is initiated by the VMSC, or incoming call activities if the IST Alert is initiated by the GMSC). Release of all other call activities is possible only if the MSC has the capability to link the call activities for the Subscriber by using the IMSI as key.

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- System Failure;
- Unexpected Data Value;
- Resource Limitation;
- Facility Not Supported;
- Unknown Subscriber.

10.14 MAP_IST_COMMAND service

10.14.1 Definition

This service is used by the HLR to instruct the MSC (Visited MSC or Gateway MSC) to terminate ongoing call activities for a specific subscriber. It is a confirmed service using the service primitives shown in table 10.14/1.

10.14.2 Service primitives

Table 10.14/1: MAP_IST_COMMAND parameters

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
User error			C	C(=)
Provider error				O

10.14.3 Parameter use

All parameters are described in subclause 7.6. The following clarifications are applicable:

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- System Failure;
- Unexpected Data Value;
- Resource Limitation;
- Facility Not Supported;
- Unknown Subscriber.

11 Supplementary services related services

11.1 MAP_REGISTER_SS service

11.1.1 Definition

This service is used between the MSC and the VLR and between the VLR and the HLR to register data related to a supplementary service. The VLR will relay the message to the HLR.

The service is a confirmed service and uses the service primitives shown in table 11.1./1.

11.1.2 Service primitives

Table 11.1/1: MAP_REGISTER_SS parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
SS-Code	M	M(=)		
Basic service	C	C(=)		
Forwarded-to number with subaddress	C	C(=)		
No reply condition time	C	C(=)		
EMLPP default priority	C	C(=)	C	C(=)
Forwarding information			C	C(=)
User error			C	C(=)
Provider error				O

11.1.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

SS-Code

This parameter indicates the supplementary service which the mobile subscriber wants to register.

Basic service

This parameter indicates for which basic service group the supplementary service is to be registered. If it is not included, the registration request applies to all basic services.

Forwarded-to number with subaddress

This parameter is obligatory if the registration applies to one or more call forwarding supplementary services. It can optionally include a sub-address.

No reply condition time

This parameter is included if the registration applies to the Call Forwarding on No Reply supplementary service (or a superset of this service) and the mobile subscriber supplies a value for this time.

EMLPP default priority

This parameter is sent by the initiator to register the eMLPP default priority level and is returned by the responder at successful outcome of the service.

Forwarding information

This parameter is returned by the responder at successful outcome of the service, if the registration request concerned one or a group of Call Forwarding supplementary services.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values defined in subclause 7.6.1:

- System failure;
- Data missing;
- Unexpected data value;
- Call Barred;
- Bearer service not provisioned;

  This error is returned only if not even a subset of the requested bearer service group has been subscribed to.
- Teleservice not provisioned;

  This error is returned only if not even a subset of the requested teleservice group has been subscribed to.
- Illegal SS operation;
- SS error status;
- SS incompatibility.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.2 MAP_ERASE_SS service

11.2.1 Definition

This service is used between the MSC and the VLR and between the VLR and the HLR to erase data related to a supplementary service. The VLR will relay the message to the HLR.

The service is a confirmed service and uses the service primitives shown in table 11.2/1.

11.2.2 Service primitives

Table 11.2/1: MAP_ERASE_SS parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
SS-Code	M	M(=)		
Basic service	C	C(=)		
Forwarding information			C	C(=)
User error			C	C(=)
Provider error				O

11.2.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

SS-Code

This parameter indicates the supplementary service which the mobile subscriber wants to erase.

Basic service

This parameter indicates for which basic service group the supplementary service should be erased. If it is not included, the erasure request applies to all basic services.

Forwarding information

This parameter is returned by the responder at successful outcome of the service, if the erasure request concerned one or a group of Call Forwarding supplementary services.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values, defined in subclause 7.6.1:

- System failure;
- Data Missing;
- Unexpected data value;
- Bearer service not provisioned;

  This error is returned only if not even a subset of the requested bearer service group has been subscribed to.
- Teleservice not provisioned;

  This error is returned only if not even a subset of the requested teleservice group has been subscribed to.
- Call Barred;
- Illegal SS operation;
- SS error status.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.3 MAP_ACTIVATE_SS service

11.3.1 Definition

This service is used between the MSC and the VLR and between the VLR and the HLR to activate a supplementary service. The VLR will relay the message to the HLR.

The service is a confirmed service and uses the service primitives shown in table 11.3/1.

11.3.2 Service primitives

Table 11.3/1: MAP_ACTIVATE_SS parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
SS-Code	M	M(=)		
Basic service	C	C(=)		
Forwarding information			C	C(=)
Call barring information			C	C(=)
SS-Data			C	C(=)
User error			C	C(=)
Provider error				O

11.3.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

SS-Code

This parameter indicates the supplementary service which the mobile subscriber wants to activate.

Basic service

This parameter indicates for which basic service groups the requested supplementary service(s) should be activated. If it is not included, the activation request applies to all basic services.

Forwarding information

This parameter is returned by the responder at successful outcome of the service, if the activation request concerned Call Forwarding.

Call barring information

This parameter is returned by the responder at successful outcome of the service, if the activation request concerned Call Barring.

SS-Data

This parameter is returned by the responder at successful outcome of the service, if the activation request concerned for example Call Waiting.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values, defined in subclause 7.6.1:

- System failure;
- Data Missing;

- Unexpected data value;
- Bearer service not provisioned;

  This error is returned only if not even a subset of the requested bearer service group has been subscribed to.
- Teleservice not provisioned;

  This error is returned only if not even a subset of the requested teleservice group has been subscribed to.
- Call Barred;
- Illegal SS operation;
- SS error status;
- SS subscription violation;
- SS incompatibility;
- Negative PW check;
- Number Of PW Attempts Violation.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.4 MAP_DEACTIVATE_SS service

11.4.1 Definitions

This service is used between the MSC and the VLR and between the VLR and the HLR to deactivate a supplementary service. The VLR will relay the message to the HLR.

The service is a confirmed service and uses the service primitives shown in table 11.4/1.

11.4.2 Service primitives

Table 11.4/1: MAP_DEACTIVATE_SS parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
SS-Code	M	M(=)		
Basic service	C	C(=)		
Forwarding information			C	C(=)
Call barring information			C	C(=)
SS-Data			C	C(=)
User error			C	C(=)
Provider error				O

11.4.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

SS-Code

This parameter indicates the supplementary service which the mobile subscriber wants to deactivate.

Basic service

This parameter indicates for which basic service group the requested supplementary service(s) should be deactivated. If it is not included the deactivation request applies to all basic services.

Forwarding information

This parameter is returned by the responder at successful outcome of the service, if the deactivation request concerned one or a group of Call Forwarding supplementary services.

Call barring information

This parameter is returned by the responder at successful outcome of the service, if the activation request concerned one or a group of Call Barring supplementary services.

SS-Data

This parameter is returned by the responder at successful outcome of the service, for example if the deactivation request concerned the Call Waiting supplementary service.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values, defined in subclause 7.6.1:

- System failure;
- Data Missing;
- Unexpected data value;
- Bearer service not provisioned;

  This error is returned only if not even a subset of the requested bearer service group has been subscribed to.
- Teleservice not provisioned;

  This error is returned only if not even a subset of the requested teleservice group has been subscribed to.
- Call Barred;
- Illegal SS operation;
- SS error status;
- SS subscription violation;
- Negative PW check;
- Number Of PW Attempts Violation.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.8 MAP_GET_PASSWORD service

11.8.1 Definitions

This service is used between the HLR and the VLR and between the VLR and the MSC when the HLR receives a request from the mobile subscriber for an operation on a supplementary service which requires a password from the subscriber. The VLR will relay the message to the MSC.

The service is a confirmed service and uses the service primitives shown in table 11.8/1.

11.8.2 Service primitives

Table 11.8/1: MAP_GET_PASSWORD parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
Linked id	C	C(=)		
Guidance info	M	M(=)		
Current password			M	M(=)
Provider error				O

11.8.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

Linked Id

See subclause 7.6.1 for the use of this parameter. If the MAP_GET_PASSWORD service is used in conjunction with the MAP_REGISTER_PASSWORD service, this parameter must be present; otherwise it must be absent.

Guidance info

See subclause 7.6.4 for the use of this parameter.

Current password

See subclause 7.6.4 for the use of this parameter.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.9 MAP_PROCESS_UNSTRUCTURED_SS_REQUEST service

11.9.1 Definitions

This service is used between the MSC and the VLR, between the VLR and the HLR and between the HLR and gsmSCF to relay information in order to allow unstructured supplementary service operation.

The MAP_PROCESS_UNSTRUCTURED_SS_REQUEST service is a confirmed service using the primitives from table 11.9/1.

11.9.2 Service primitives

Table 11.9/1: MAP_PROCESS_UNSTRUCTURED_SS_REQUEST parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
USSD Data Coding Scheme	M	M(=)	C	C(=)
USSD String	M	M(=)	C	C(=)
MSISDN	U	C(=)		
User error			C	C(=)
Provider error				O

11.9.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

USSD Data Coding Scheme

See subclause 7.6.4 for the use of this parameter. The presence of the parameter in the response is dependent on the unstructured supplementary service application. If this parameter is present, then the USSD String parameter has to be present.

USSD String

See subclause 7.6.1 for the use of this parameter. The presence of the parameter in the response is dependent on the unstructured supplementary service application. If this parameter is present, then the USSD Data Coding Scheme parameter has to be present.

MSISDN

The subscriber's basic MSISDN.

See definition in subclause 7.6.2. The MSISDN is included as an operator option, e.g. to allow addressing the subscriber's data in the gsmSCF with the MSISDN.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values defined in subclause 7.6.1:

- System failure;
- Data missing;
- Unexpected data value;

  This error is returned by the responder if it is not able to deal with the contents of the USSD string.
- Call Barred;
- Unknown Alphabet.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.10 MAP_UNSTRUCTURED_SS_REQUEST service

11.10.1 Definitions

This service is used between the gsmSCF and the HLR, the HLR and the VLR and between the VLR and the MSC when the invoking entity requires information from the mobile user, in connection with unstructured supplementary service handling.

The MAP_UNSTRUCTURED_SS_REQUEST service is a confirmed service using the primitives from table 11.10/1.

11.10.2 Service primitives

Table 11.10/1: MAP_UNSTRUCTURED_SS_REQUEST parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
USSD Data Coding Scheme	M	M(=)	C	C(=)
USSD String	M	M(=)	C	C(=)
Alerting Pattern	C	C(=)		
User error			C	C(=)
Provider error				O

11.10.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

USSD Data Coding Scheme

See subclause 7.6.4 for the use of this parameter. The presence of the parameter in the response is dependent on the mobile user's MMI input. If this parameter is present, then the USSD String parameter has to be present.

USSD String

See subclause 7.6.1 for the use of this parameter. The presence of the parameter in the response is dependent on the mobile user's MMI input. If this parameter is present, then the USSD Data Coding Scheme parameter has to be present.

Alerting Pattern

See subclause 7.6.3 for the use of this parameter.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values defined in subclause 7.6.1:

- System failure;
- Data missing;
- Unexpected data value;

  This error is returned by the responder if it is not able to deal with the contents of the USSD string.

- Absent Subscriber;
- Illegal Subscriber;

  This error indicates that delivery of the unstructured supplementary service data failed because the MS failed authentication.

- Illegal Equipment;
- USSD Busy;
- Unknown Alphabet.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.11 MAP_UNSTRUCTURED_SS_NOTIFY service

11.11.1 Definitions

This service is used between the gsmSCF and the HLR, the HLR and the VLR and between the VLR and the MSC when the invoking entity requires a notification to be sent to the mobile user, in connection with unstructured supplementary services handling.

The MAP_UNSTRUCTURED_SS_NOTIFY service is a confirmed service using the primitives from table 11.11/1.

11.11.2 Service primitives

Table 11.11/1: MAP_UNSTRUCTURED_SS_NOTIFY parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
USSD Data Coding Scheme	M	M(=)		
USSD String	M	M(=)		
Alerting Pattern	C	C(=)		
User error			C	C(=)
Provider error				O

11.11.3 Parameter use

Invoke id

See subclause 7.6.1 for the use of this parameter.

USSD Data Coding Scheme:

See subclause 7.6.4 for the use of this parameter.

USSD String:

See subclause 7.6.1 for the use of this parameter.

Alerting Pattern

See subclause 7.6.3 for the use of this parameter.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values defined in subclause 7.6.1:

- System failure;
- Data missing;
- Unexpected data value;

This error is returned by the responder if it is not able to deal with the contents of the USSD string.

- Absent Subscriber;
- Illegal Subscriber;

  This error indicates that delivery of the unstructured supplementary service data failed because the MS failed authentication.

- Illegal Equipment;
- USSD Busy;
- Unknown Alphabet.

Provider error

See subclause 7.6.1 for the use of this parameter.

11.12 MAP_SS_INVOCATION_NOTIFY

11.12.1 Definition

This service is used between the MSC and the gsmSCF when the subscriber invokes one of the following supplementary services; CD, ECT or MPTY.

11.12.2 Service primitives

The service primitives are shown in table 11.12/1.

Table 11.12/1: SS_INVOCATION_NOTIFY parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
MSISDN	M	M(=)		
IMSI	M	M(=)		
SS- event	M	M(=)		
SS- event data	C	C(=)		
User error			C	C(=)
Provider error				O

11.12.3 Parameter use

All parameters are described in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.78.

User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- Data Missing;
- Unexpected Data Value;
- Unknown Subscriber.

Provider error

This is defined in subclause 7.6.1.

11.13 MAP_REGISTER_CC_ENTRY service

11.13.1 Definition

This service is used between the MSC and the VLR and between the VLR and the HLR to register data for a requested call completion supplementary service. The VLR will relay the message to the HLR.

The service is a confirmed service and uses the service primitives shown in table 11.13/1.

11.13.2 Service primitives

Table 11.13/1: MAP_REGISTER_CC_ENTRY parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
SS Code	M	M(=)		
CCBS Feature	C	C(=)	C	C(=)
Translated B number	C	C(=)		
Service Indicator	C	C(=)		
Call Info	C	C(=)		
Network Signal Info	C	C(=)		
User error			C	C(=)
Provider error				O

11.13.3 Parameter use

See subclause 7.6 for a definition of the parameters used, in addition to the following.

SS-Code

This parameter indicates the call completion supplementary service for which the mobile subscriber wants to register an entry.

CCBS Feature

See GSM 03.93 for the conditions for the presence of the parameters included in the CCBS feature.

Translated B Number

See GSM 03.93 for the use of this parameter and the conditions for its presence.

Service Indicator

This parameter corresponds to the parameters 'Presentation Indicator' and 'CAMEL Invoked' in GSM 03.93 [107]. It indicates which services have been invoked for the original call (e.g. CLIR, Camel). See GSM 03.93 [107] for the use of this parameter and the conditions for its presence.

Call Info

See GSM 03.93 [107] for the use of this parameter and the conditions for its presence.

Network Signal Info

See GSM 03.93 [107] for the use of this parameter and the conditions for its presence.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values, defined in subclause 7.6.1:

- System failure;
- Data missing;
- Unexpected data value;
- Call Barred;
- Illegal SS operation;
- SS error status;
- SS incompatibility.
- Short Term Denial;
- Long Term Denial;
- Facility Not Supported;

  Note: This error is reserved for future use.

Private Extensions shall not be sent with these user errors for this operation.

Provider error

See subclause 7.6.1 for the use of this parameter**.**

11.14 MAP_ERASE_CC_ENTRY service

11.14.1 Definition

This service is used between the MSC and the VLR and between the VLR and the HLR to erase data related to a call completion supplementary service. The VLR will relay the message to the HLR.

The service is a confirmed service and uses the service primitives shown in table 11.14/1.

11.14.2 Service primitives

Table 11.14/1: MAP_ERASE_CC_ENTRY parameters

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
SS-Code	M	M(=)	C(=)	C(=)
CCBS Index	C	C(=)		
SS-Status			C	C(=)
User error			C	C(=)
Provider error				O

11.14.3 Parameter use

See subclause 7.6 for a definition of the parameters used, in addition to the following.

SS-Code

This parameter indicates the call completion supplementary service for which the mobile subscriber wants to erase an entry/entries.

CCBS Index

See GSM 03.93 for the use of this parameter and the condition for its presence.

SS-Status

Depending on the outcome of the service request this parameter may indicate either provisioned and active or not provisioned.

User error

This parameter is sent by the responder upon unsuccessful outcome of the service, and then takes one of the following values, defined in subclause 7.6.1:

- System failure;
- Data Missing;
- Unexpected data value;
- Call Barred;
- Illegal SS operation;
- SS error status.

Private Extensions shall not be sent with these user errors for this operation.

Provider error

See subclause 7.6.1 for the use of this parameter.

12 Short message service management services

12.1 MAP-SEND-ROUTING-INFO-FOR-SM service

12.1.1 Definition

This service is used between the gateway MSC and the HLR to retrieve the routing information needed for routing the short message to the servicing MSC.

The MAP-SEND-ROUTING-INFO-FOR-SM is a confirmed service using the primitives from table 12.1/1.

12.1.2 Service primitives

Table 12.1/1: MAP-SEND-ROUTING-INFO-FOR-SM

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
MSISDN	M	M(=)		
SM-RP-PRI	M	M(=)		
Service Centre Address	M	M(=)		
SM-RP-MTI	C	C(=)		
SM-RP-SMEA	C	C(=)		
GPRS Support Indicator	C	C(=)		
IMSI			C	C(=)
Network Node Number			C	C(=)
LMSI			C	C(=)
GPRS Node Indicator			C	C(=)
Additional Number			C	C(=)
User error			C	C(=)
Provider error				O

12.1.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

MSISDN

See definition in subclause 7.6.2.

SM-RP-PRI

See definition in subclause 7.6.8.

Service Centre Address

See definition in subclause 7.6.2.

SM-RP-MTI

See definition in subclause 7.6.8. This parameter shall be present when the feature « SM filtering by the HPLMN » is supported by the SMS-GMSC and when the equivalent parameter is received from the short message service relay sub-layer protocol.

SM-RP-SMEA

See definition in subclause 7.6.8. This parameter shall be present when the feature « SM filtering by the HPLMN » is supported by the SMS-GMSC and when the equivalent parameter is received from the short message service relay sub-layer protocol.

GPRS Support Indicator

See definition in subclause 7.6.8. The presence of this parameter is mandatory if the SMS-GMSC supports receiving of the two numbers from the HLR.

IMSI

See definition in subclause 7.6.2. The presence of this parameter is mandatory in a successful case.

Network Node Number

See definition in subclause 7.6.2. This parameter is provided in a successful response.

LMSI

See definition in subclause 7.6.2. It is an operator option to provide this parameter from the VLR; it is mandatory for the HLR to include the LMSI in a successful response, if the VLR has used the LMSI.

GPRS Node Indicator

See definition in subclause 7.6.8. The presence of this parameter is mandatory if only the SGSN number is sent in the Network Node Number.

Additional Number

See definition in subclause 7.6.2. This parameter is provided in a successful response.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Unknown subscriber;
- Call Barred;
- Teleservice Not Provisioned;
- Absent Subscriber_SM;
- Facility Not Supported;
- System failure;
- Unexpected Data Value;
- Data missing.

Provider error

For definition of provider errors see subclause 7.6.1.

12.2 MAP-MO-FORWARD-SHORT-MESSAGE service

12.2.1 Definition

This service is used between the serving MSC or the SGSN and the gateway MSC to forward mobile originated short messages.

The MAP-MO-FORWARD-SHORT-MESSAGE service is a confirmed service using the service primitives given in table 12.2/1.

12.2.2 Service primitives

Table 12.2/1: MAP-MO-FORWARD-SHORT-MESSAGE

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
SM RP DA	M	M(=)		
SM RP OA	M	M(=)		
SM RP UI	M	M(=)	C	C(=)
IMSI	C	C(=)		
User error			C	C(=)
Provider error				O

12.2.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

SM RP DA

See definition in subclause 7.6.8.

In the mobile originated SM transfer this parameter contains the Service Centre address received from the mobile station.

SM RP OA

See definition in subclause 7.6.8.

The MSISDN received from the VLR or from the SGSN is inserted in this parameter in the mobile originated SM transfer.

SM RP UI

See definition in subclause 7.6.8. The short message transfer protocol data unit received from the Service Centre is inserted in this parameter.

IMSI

See definition in subclause 7.6.2.1. The IMSI of the originating subscriber is inserted in this parameter in the mobile originated SM transfer.

This parameter shall be included if the sending entity, whether MSC or SGSN, supports mobile number portability.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Facility Not Supported;
- System Failure;
- SM Delivery Failure;
    - The reason of the SM Delivery Failure can be one of the following in the mobile originated SM:
        - unknown Service Centre address;
        - Service Centre congestion;
        - invalid Short Message Entity address;
        - subscriber not Service Centre subscriber;
        - protocol error.
- Unexpected Data Value.

Provider error

For definition of provider errors see subclause 7.6.1.

12.3 MAP-REPORT-SM-DELIVERY-STATUS service

12.3.1 Definition

This service is used between the gateway MSC and the HLR. The MAP-REPORT-SM-DELIVERY-STATUS service is used to set the Message Waiting Data into the HLR or to inform the HLR of successful SM transfer after polling. This service is invoked by the gateway MSC.

The MAP-REPORT-SM-DELIVERY-STATUS service is a confirmed service using the service primitives given in table 12.3/1.

12.3.2 Service primitives

Table 12.3/1: MAP-REPORT-SM-DELIVERY-STATUS

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
MSISDN	M	M(=)		
Service Centre Address	M	M(=)		
SM Delivery Outcome	M	M(=)		
Absent Subscriber Diagnostic SM	C	C(=)		
GPRS Support Indicator	C	C(=)		
Delivery Outcome Indicator	C	C(=)		
Additional SM Delivery Outcome	C	C(=)		
Additional Absent Subscriber Diagnostic SM	C	C(=)		
MSIsdn-Alert			C	C(=)
User error			C	C(=)
Provider error				O

12.3.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

MSISDN

See definition in subclause 7.6.2.

Service Centre Address

See definition in subclause 7.6.2.

SM Delivery Outcome

See definition in subclause 7.6.8. This parameter indicates the status of the mobile terminated SM delivery.

Absent Subscriber Diagnostic SM

See definition in subclause 7.6.8.

GPRS Support Indicator

See definition in subclause 7.6.8. The presence of this parameter is mandatory if the SMS-GMSC supports handling of two delivery outcomes.

Delivery Outcome Indicator

See definition in subclause 7.6.8.

Additional SM Delivery Outcome

See definition in subclause 7.6.8.

Additional Absent Subscriber Diagnostic SM

See definition in subclause 7.6.8.

MSIsdn-Alert

See definition in subclause 7.6.2. This parameter shall be present in case of unsuccessful delivery, when the MSISDN received in the operation is different from the stored MSIsdn-Alert; the stored MSIsdn-Alert is the value that is returned to the gateway MSC.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Unknown Subscriber;
- Message Waiting List Full;
- Unexpected Data Value;
- Data missing.

Provider error

For definition of provider errors see subclause 7.6.1.

12.4 MAP-READY-FOR-SM service

12.4.1 Definition

This service is used between the MSC and VLR and as well as between the VLR and the HLR. The MSC initiates this service if a subscriber indicates memory available situation. The VLR uses the service to indicate this to the HLR.

The VLR initiates this service if a subscriber, whose message waiting flag is active in the VLR, has radio contact in the MSC.

Also this service is used between the SGSN and the HLR. The SGSN initiates this service if a subscriber indicates memory available situation. The SGSN uses the service to indicate this to the HLR.

The SGSN initiates this service if a subscriber, whose message waiting flag is active in the SGSN, has radio contact in the GPRS.

The MAP-READY-FOR-SM service is a confirmed service using the primitives from table 12.4/1.

12.4.2 Service primitives

Table 12.4/1: MAP-READY-FOR-SM

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
IMSI	C	C(=)		
TMSI	C	C(=)		
Alert Reason	M	M(=)		
Alert Reason Indicator	C	C(=)		
User error			C	C(=)
Provider error				O

12.4.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

IMSI

See definition in subclause 7.6.2. The IMSI is used always between the VLR and the HLR and between the SGSN and the HLR. Between the MSC and the VLR the identification can be either IMSI or TMSI.

TMSI

See definition in subclause 7.6.2. The identification can be either IMSI or TMSI between MSC and VLR.

Alert Reason

See definition in subclause 7.6.8. This parameter indicates if the mobile subscriber is present or the MS has memory available.

Alert Reason Indicator

See definition in subclause 7.6.8.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Unknown Subscriber;
- Facility Not Supported:
- System Failure;
- Unexpected Data Value;
- Data missing;

Provider error

For definition of provider errors see subclause 7.6.1.

12.5 MAP-ALERT-SERVICE-CENTRE service

12.5.1 Definition

This service is used between the HLR and the interworking MSC. The HLR initiates this service, if the HLR detects that a subscriber, whose MSISDN is in the Message Waiting Data file, is active or the MS has memory available.

The MAP-ALERT-SERVICE-CENTRE service is a confirmed service using the primitives from table 12.5/1.

12.5.2 Service primitives

Table 12.5/1: MAP-ALERT-SERVICE-CENTRE

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
MSIsdn-Alert	M	M(=)		
Service Centre Address	M	M(=)		
User error			C	C(=)
Provider error				O

12.5.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

MSIsdn-Alert

See definition in subclause 7.6.2. The provided MSISDN shall be the one which is stored in the Message Waiting Data file.

Service Centre Address

See definition in subclause 7.6.2.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- System Failure;
- Unexpected Data Value;
- Data missing.

Provider error

For definition of provider errors see subclause 7.6.1.

12.6 MAP-INFORM-SERVICE-CENTRE service

12.6.1 Definition

This service is used between the HLR and the gateway MSC to inform the Service Centre which MSISDN number is stored in the Message Waiting Data file. If the stored MSISDN number is not the same as the one received from the gateway MSC in the MAP-SEND-ROUTING-INFO-FOR-SM service primitive the stored MSISDN number is included in the message.

Additionally the status of MCEF, MNRF and MNRG flags and the inclusion of the particular Service Centre address in the Message Waiting Data list is informed to the gateway MSC when appropriate.

The MAP-INFORM-SERVICE-CENTRE service is a non-confirmed service using the primitives from table 12.6/1.

12.6.2 Service primitives

Table 12.6/1: MAP-INFORM-SERVICE-CENTRE

Parameter name	Request	Indication
Invoke Id	M	M(=)
MSIsdn-Alert	C	C(=)
MWD Status	C	C(=)

12.6.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

MSIsdn-Alert

See definition in subclause 7.6.2 This parameter refers to the MSISDN stored in a Message Waiting Data file in the HLR.

MWD Status

See definition in subclause 7.6.8. This parameter indicates the status of the MCEF, MNRF and MNRG flags and the status of the particular SC address presence in the Message Waiting Data list.

12.7 MAP-SEND-INFO-FOR-MT-SMS service

12.7.1 Definition

This service is used between the MSC and the VLR. The service is invoked by the MSC receiving a mobile terminated short message to request subscriber related information from the VLR.

The MAP-SEND-INFO-FOR-MT-SMS service is a confirmed service using the primitives from table 12.7/1.

12.7.2 Service primitives

Table 12.7/1: MAP-SEND-INFO-FOR-MT-SMS

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
SM RP DA	M	M(=)		
MSISDN			C	C(=)
User error			C	C(=)
Provider error				O

12.7.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

SM RP DA

See definition in subclause 7.6.8. This parameter shall contain either an IMSI or a LMSI.

MSISDN

See definition in subclause 7.6.2.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Unknown subscriber;
- Unidentified Subscriber;
- Absent subscriber;
- Unexpected Data Value;
- Data Missing;
- Illegal subscriber;

- Illegal equipment;
- Subscriber busy for MT SMS;
- System Failure.

Provider error

For definition of provider errors see subclause 7.6.1.

12.8 MAP-SEND-INFO-FOR-MO-SMS service

12.8.1 Definition

This service is used between the MSC and the VLR. The service is invoked by the MSC which has to handle a mobile originated short message request to request the subscriber related information from the VLR.

The MAP-SEND-INFO-FOR-MO-SMS service is a confirmed service using the primitives from table 12.8/1.

12.8.2 Service primitives

Table 12.8/1: MAP-SEND-INFO-FOR-MO-SMS

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
Service Centre Address	M	M(=)		
MSISDN			C	C(=)
User error			C	C(=)
Provider error				O

12.8.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

Service Centre Address

See definition in subclause 7.6.2.

MSISDN

See definition in subclause 7.6.2.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Teleservice Not Provisioned;
- Call Barred;
- Unexpected Data Value;
- Data Missing.

Provider error

For definition of provider errors see subclause 7.6.1.

12.9 MAP-MT-FORWARD-SHORT-MESSAGE service

12.9.1 Definition

This service is used between the gateway MSC and the servicing MSC or the SGSN to forward mobile terminated short messages.

The MAP-MT-FORWARD-SHORT-MESSAGE service is a confirmed service using the service primitives given in table 12.9/1.

12.9.2 Service primitives

Table 12.9/1: MAP-MT-FORWARD-SHORT-MESSAGE

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
SM RP DA	M	M(=)		
SM RP OA	M	M(=)		
SM RP UI	M	M(=)	C	C(=)
More Messages To Send	C	C(=)		
User error			C	C(=)
Provider error				O

12.9.3 Parameter use

Invoke id

See definition in subclause 7.6.1.

SM RP DA

See definition in subclause 7.6.8. This parameter can contain either an IMSI or a LMSI. The use of the LMSI is an operator option. The LMSI can be provided if it is received from the HLR. The IMSI is used if the use of the LMSI is not available.

This parameter is omitted in the mobile terminated subsequent SM transfers.

SM RP OA

See definition in subclause 7.6.8. The Service Centre address received from the originating Service Centre is inserted in this parameter.

This parameter is omitted in the mobile terminated subsequent SM transfers.

SM RP UI

See definition in subclause 7.6.8. The short message transfer protocol data unit received from the Service Centre is inserted in this parameter. A short message transfer protocol data unit may also be inserted in this parameter in the message delivery acknowledgement from the MSC or from the SGSN to the Service Centre.

More Messages To Send

See definition in subclause 7.6.8. The information from the MMS indication received from the Service Centre is inserted in this parameter.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Unidentified subscriber;
- Absent Subscriber_SM;
- Subscriber busy for MT SMS;
- Facility Not Supported;
- Illegal Subscriber indicates that delivery of the mobile terminated short message failed because the mobile station failed authentication;
- Illegal equipment indicates that delivery of the mobile terminated short message failed because an IMEI check failed, i.e. the IMEI was blacklisted or not white-listed;
- System Failure;
- SM Delivery Failure;
    - The reason of the SM Delivery Failure can be one of the following in the mobile terminated SM:
        - memory capacity exceeded in the mobile equipment;
        - protocol error;
        - mobile equipment does not support the mobile terminated short message service.
- Unexpected Data Value;
- Data Missing.

Provider error

For definition of provider errors see subclause 7.6.1.

13A Location Service Management Services

13A.1 MAP-SEND-ROUTING-INFO-FOR-LCS Service

13A.1.1 Definition

This service is used between the GMLC and the HLR to retrieve the routing information needed for routing a location service request to the servicing VMSC. The MAP-SEND-ROUTING-INFO-FOR-LCS is a confirmed service using the primitives from table 13A.1/1.

13A.1.2 Service Primitives

Table 13A.1/1: MAP-SEND-ROUTING-INFO-FOR-LCS

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
MLC Number	M	M(=)		
MSISDN	C	C(=)	C	C(=)
IMSI	C	C(=)	C	C(=)
LMSI			C	C(=)
MSC Number			C	C(=)
User error			C	C(=)
Provider error				O

13A.1.3 Parameter Use

Invoke id

See definition in subclause 7.6.1.

MLC Number

See definition in subclause 7.6.2.

MSISDN

See definition in subclause 7.6.2. The request shall carry either the IMSI or MSISDN. The response shall carry whichever of these was not included in the request (see GSM 03.71 for details).

IMSI

See definition in subclause 7.6.2.

LMSI

See definition in subclause 7.6.2. It is an operator option to provide this parameter from the VLR; it is mandatory for the HLR to include the LMSI in a successful response, if the VLR has used the LMSI.

MSC Number

See definition in subclause 7.6.2. This parameter is provided in a successful response.

User error

The following errors defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- Unknown subscriber;
- Absent Subscriber;
- Facility Not Supported;
- System failure;
- Unexpected Data Value;
- Data missing;
- Unauthorized requesting network.

Provider error

For definition of provider errors see subclause 7.6.1.

13A.2 MAP-PROVIDE-SUBSCRIBER-LOCATION Service

13A.2.1 Definition

This service is used by a GMLC to request the location of a target MS from the visited MSC at any time. This is a confirmed service using the primitives from table 13A.2/1.

13A.2.2 Service Primitives

Table 13A.2/1: Provide_Subscriber_Location

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
Location Type	M	M(=)		
MLC Number	M	M(=)		
LCS Client ID	M	M(=)		
Privacy Override	U	C(=)		
IMSI	C	C(=)		
MSISDN	C	C(=)		
LMSI	C	C(=)		
LCS Priority	C	C(=)		
LCS QoS	C	C(=)		
NA-ESRK	C	C(=)		
IMEI	C	C(=)		
Location Estimate			M	M(=)

Age of Location Estimate			C	C(=)
User error			C	C(=)
Provider error				O

13A.2.3 Parameter Definition and Use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

Location Type

This parameter identifies the type of location requested

MLC Number

This is the E.164 number of the requesting GMLC.

LCS Client ID

This parameter provides information related to the identity of an LCS client.

Privacy Override

This parameter indicates if MS privacy is overridden by the LCS client when the GMLC and VMSC for an MR-LR are in the same country.

IMSI

The IMSI is provided to identify the target MS. At least one of the IMSI, MSISDN or NA-ESRK is mandatory.

MSISDN

The MSISDN is provided to identify the target MS. At least one of the IMSI, MSISDN or NA-ESRK is mandatory.

LMSI

The LMSI shall be provided if previously supplied by the HLR.

LCS Priority

This parameter indicates the priority of the location request.

LCS QoS

This parameter indicates the required quality of service in terms of response time and accuracy.

NA-ESRK

This parameter only applies to North America and provides a North American Emergency Service Routing Key.

IMEI

The IMEI shall be provided if available when the target MS is identified by an NA-ESRK.

Location Estimate

This parameter provides the location estimate.

Age of Location Estimate

This parameter indicates how long ago the location estimate was obtained.

User error

This parameter is sent by the responder when the location request has failed or cannot proceed and if present, takes one of the following values defined in subclause 7.6.1.

- Data Missing;
- Unexpected Data Value;
- Unknown Subscriber;
- Absent Subscriber (diagnostic information may also be provided);- Unauthorized requesting network;
- Unauthorized LCS Client with detailed reason;
- Position method failure with detailed reason.

Provider error

These are defined in subclause 7.6.1.

13A.3 MAP-SUBSCRIBER-LOCATION-REPORT Service

13A.3.1 Definition

This service is used by a VMSC to provide the location of a target MS to a GMLC when a request for location is either implicitly administered or made at some earlier time. This is a confirmed service using the primitives from table 13A.3/1.

13A.3.2 Service Primitives

Table 13A.3/1: Subscriber_Location_Report

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
LCS Event	M	M(=)		
LCS Client ID	M	M(=)		
IMSI	C	C(=)		
MSISDN	C	C(=)		
NA-ESRD	C	C(=)		
NA-ESRK	C	C(=)		
IMEI	C	C(=)		
Location Estimate	C	C(=)		
Age of Location Estimate	C	C(=)		
User error			C	C(=)
Provider error				O

13A.3.3 Parameter Definition and Use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

LCS Event

This parameter indicates the event that triggered the Subscriber Location Report.

LCS Client ID

This parameter provides information related to the identity of the recipient LCS client.

IMSI

The IMSI shall be provided if available to the VMSC.

MSISDN

The MSISDN shall be provided if available to the VMSC.

NA-ESRD

If the target MS has originated an emergency service call in North America, the NA-ESRD shall be provided by the VMSC.

NA-ESRK

If the target MS has originated an emergency service call in North America, the NA-ESRK may be provided by the VMSC if available.

IMEI

If the target MS has originated an emergency service call in North America, the IMEI may be provided by the VMSCV.

Location Estimate

This parameter provides the location estimate. The absence of this parameter implies that a location estimate was not available or could not be successfully obtained.

Age of Location Estimate

This parameter indicates how long ago the location estimate was obtained.

User error

This parameter is sent by the responder when the received message contains an error, cannot be forwarded or stored for an LCS client or cannot be accepted for some other reason and if present, takes one of the following values defined in subclause 7.6.1.

- Data Missing;
- Unexpected Data Value;
- Unknown Subscriber;
- Unauthorized requesting network;
- Unknown or unreachable LCS Client.

Provider error

These are defined in subclause 7.6.1.

13A.4 MAP-PERFORM -LOCATION Service

13A.4.1 Definition

This service is used by a serving MSC to request location information from an SMLC for a target MS. This is a confirmed service using the primitives from table 13A.4/1.

13A.4.2 Service Primitives

Table 13A.4/1: Perform_Location

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
Global cell Id	M	M(=)		
Radio Channel Type	C	C(=)		
LCS Priority	C	C(=)		
LCS QoS	C	C(=)		
LCS-APDU	C	C(=)		
Location Estimate			C	C(=)
Positioning Data			C	C(=)
User error			C	C(=)
Provider error				O

13A.4.3 Parameter Definition and Use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

Global cell Id

This is the current cell location of the MS being located.

Radio Channel Type

This parameter gives the type of radio channel currently assigned to the MS.

LCS Priority

This parameter indicates the priority of the location request.

LCS QoS

This is the Quality of Service required for the location request in terms of response time and accuracy.

LCS-APDU

This parameter contains LCS related information (e.g. Timing Advance) received from the BSC.

Location Estimate

This parameter gives an estimate of the MS location and the accuracy of the estimate.

Positioning Data

This parameter provides data on the positioning process including the result and resources used.

User error

This parameter is sent by the SMLC when the location request has failed or cannot proceed and if present, takes one of the following values defined in subclause 7.6.1.

- System Failure
- Data Missing;
- Unexpected Data Value;
- Position method failure with detailed reason (restart not allowed);
- Position method failure with restart allowed.

Provider error

These are defined in subclause 7.6.1.

13A.5 MAP-LCS-Registration Service

13A.5.1 Definition

This service is used by a VLR to register or deregister an LMU in an SMLC. This is a confirmed service using the primitives from table 13A.5/1.

13A.5.2 Service Primitives

Table 13A.5/1: LCS Registration

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
IMSI	M	M(=)		
LMSI	U	C(=)		
Registration Type	M	M(=)		
MSC Number	C	C(=)		
User error			C	C(=)
Provider error				O

13A.5.3 Parameter Definition and Use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

IMSI

This is the E.212 IMSI identity of the LMU.

LMSI

The LMSI of the LMU shall be provided by the MSC if assigned in the VLR and if the registration type indicates registration.

Registration Type

The registration type distinguishes registration and deregistration.

MSC Number

This is the E.164 number of the MSC serving the LMU. Inclusion of the MSC number is mandatory if the registration type indicates registration.

User error

This parameter is sent by the SMLC when the registration procedure has failed and, if present, takes one of the following values defined in subclause 7.6.1.

- LMU unknown or offline;
- system failure;
- unexpected Data Value;
- Data Missing.

Provider error

These are defined in subclause 7.6.1.

13A.6 MAP-LCS-INFORMATION-REQUEST Service

13A.6.1 Definition

This service is used by an SMLC to transfer LCS related data to an MSC for onward transfer to an LMU or serving BSC. This is an unconfirmed service using the primitives from table 13A.6/1.

13A.6.2 Service Primitives

Table 13A.6/1: LCS Information Request

Parameter name	Request	Indication
Invoke id	M	M(=)
IMSI	C	C(=)
LMSI	C	C(=)
MLC Number	U	C(=)
Release Forbidden	U	C(=)
Report Error Indication	U	C(=)
LCS-APDU	C	C(=)

13A.6.3 Parameter Definition and Use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

IMSI

This is the E.212 IMSI identity of an LMU. Inclusion of the IMSI is mandatory when the destination for the LCS data is

an LMU, For other destinations, an IMSI shall not be included.

LMSI

When the destination is an LMU, the LMSI of the LMU shall be provided by the SMLC if previously supplied by the MSC.

MLC Number

This parameter contains the E.164 address for the SMLC. The inclusion of this parameter is optional.

Release Forbidden

This parameter is applicable only when the destination is an LMU. It indicates if an LMU is forbidden to release a signaling channel to the MSC.

Report Error Indication

If present, this parameter requests an LCS Information Report error message from the serving MSC if the LCS Information Request message cannot be transferred to the required destination.

LCS-APDU

This parameter contains the LCS data to be sent on by the MSC to the required destination. For transfer to an LMU, the content of the data is defined in GSM 04.71 For transfer to a BSC, it is defined in GSM 08.71.

13A.7 MAP-LCS-INFORMATION-REPORT Service

13A.7.1 Definition

This service is used by an MSC to transfer LCS related data to an SMLC that was received from or intended for an LMU or BSC. This is an unconfirmed service using the primitives from table 13A.7/1. The message shall be transferred to the SMLC using SCCP class 1.

13A.7.2 Service Primitives

Table 13A.7/1: LCS Information Report

Parameter name	Request	Indication
Invoke id	M	M(=)
IMSI	C	C(=)
LMSI	U	C(=)
LCS Cause	C	C(=)
LCS-APDU	C	C(=)

13A.7.3 Parameter Definition and Use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

IMSI

This is the E.212 IMSI identity of the LMU. Inclusion of the IMSI is mandatory for data transfer related to an LMU. An IMSI shall not be included for other types of data transfer.

LMSI

For data transfer related to an LMU, the MSC may include the LMSI if available in the VLR.

LCS Cause

This parameter contains the reason why LCS data received by the MSC in an LCS Information Request could not be transferred to its intended destination. This parameter shall be included if and only if the MSC is returning LCS data to the SMLC that could not be transferred to the intended destination.

LCS-APDU

This parameter contains the LCS data received from or intended for an LMU or BSC. The content of this parameter is defined in GSM 04.71 for an LMU and in GSM 08.71 for a BSC.

13A.8 MAP-LCS-RESET Service

13A.8.1 Definition

This service is used by an SMLC after either a restart or discovery of inconsistent data to request that a VLR instigate a reset for either all LMUs that are served by the VLR or just certain specific LMUs. This is an unconfirmed service using the primitives from table 13A.8/1.

13A.8.2 Service Primitives

Table 13A.8/1: LCS Reset

Parameter name	Request	Indication
Invoke id	M	M(=)
MLC number	M	M(=)
LMU List	U	C(=)

13A.8.3 Parameter Definition and Use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

MLC

This is the E.164 address for the SMLC.

LMU List

This is a list of LMUs sharing the same SMLC.

13A.9 MAP-LCS-ASSIGN-TRAFFIC-CHANNEL Service

13A.9.1 Definition

This service is used by an SMLC to request assignment of a traffic channel to the target MS by the visited MSC. This is a confirmed service using the primitives from table 13A.9/1.

13A.9.2 Service primitives

Table 13A.9/1: LCS Assign Traffic Channel

Parameter name	Request	Indication	Response	Confirm
Invoke id	M	M(=)	M(=)	M(=)
Radio Channel Type	M	M(=)		
User error			C	C(=)
Provider error				O

13A.9.3 Parameter definition and use

All parameters are defined in subclause 7.6. The use of these parameters and the requirements for their presence are specified in GSM 03.71.

Radio Channel Type

This parameter defines the type of traffic channel to be assigned.

User error

This parameter is sent by the MSC when the required type of traffic channel cannot be assigned and, if present, takes one of the following values defined in subclause 7.6.1.

- Traffic channel establishment failure;
- system failure;
- unexpected Data Value;
- data missing.

Provider error

These are defined in subclause 7.6.1.

14 General

14.1 Overview

Clauses 14 to 17 specify the protocol elements to be used to provide the MAP services described in clause 7.

Clause 15 specifies the elements of procedures for the MAP protocol. Clause 16 specifies the mapping onto TC service primitives. Clause 17 specifies the application contexts, operation packages and abstract syntaxes for the MAP protocol as well as the encoding rules to be applied.

14.2 Underlying services

The MAP protocol relies on the services provided by the Transaction Capabilities (TC) of Signalling System No. 7, as referenced in clause 6.

14.3 Model

The MAP Protocol Machine (MAP PM) can be modelled as a collection of service state machines (SSMs) - one per MAP specific service invoked - coordinated by a MAP dialogue control function with its one state machine: MAP dialogue state machine (DSM). There are two types of Service State Machines: Requesting Service State Machines (RSM) and Performing Service State Machines (PSM).

A new invocation of a MAP PM is employed on the receipt of a MAP-OPEN request primitive or a TC-BEGIN indication primitive. Each invocation controls exactly one MAP dialogue. For each MAP specific service invoked during a dialogue, a MAP RSM is created at the requestor's side and a MAP PSM is created at the performer's side.

This modelling is used only to facilitate understanding and the MAP behaviour descriptions and is not intended to suggest any implementation. SDL descriptions are organized according to this model.

How the MAP-service-user and the MAP refer to a MAP dialogue (i.e. a MAP PM invocation) is a local implementation matter.

How TC dialogue identifiers are assigned to a MAP PM invocation is also a local implementation matter.

14.4 Conventions

The behaviour of the MAP PM depends on the application-context-name associated with the dialogue. One major difference is that the MAP requests the transfer of the application-context-name by TC only for those contexts which do not belong to the so-called "version one context set".

The "version one context set" is a set of application-contexts which model the behaviour of a MAP V1 implementation according to the latest phase 1 version of GSM 09.02. This set is defined in clause 15.

The procedures described in clause 15 are used when the application-context-name does not refer to a dialogue between an MSC and its VLR. When the application-context-name refers to a dialogue between an MSC and its VLR the MAP PM procedures are a local implementation matter.

15 Elements of procedure

15.1 Dialogue establishment

The establishment of a MAP dialogue involves two MAP-service-users, one that is the dialogue-initiator and one that is the dialogue-responder.

This procedure is driven by the following signals:

- a MAP-OPEN request primitive from the dialogue-initiator;
- a TC-BEGIN indication primitive occurring at the responding side;
- a MAP-OPEN response primitive from the dialogue-responder;
- the first TC-CONTINUE indication primitive occurring at the initiating side;

and under specific conditions:

- a TC-END indication primitive occurring at the initiating side;
- a TC-U-ABORT indication primitive occurring at the initiating side;
- a TC-P-ABORT indication primitive occurring at the initiating side.

15.1.1 Handling of unknown operations

Unknown operations (i.e. a standard operation introduced in a later version of 09.02 or a private operation) can be introduced in MAP in a backwards compatible way. This means, that the receiver of an unknown operation shall, if the dialogue state allows it, send a TC-REJECT component to the sender of the operation indicating 'unrecognised operation' and continue with the processing of further components or messages exchanged within the dialogue as if the unknown operation had not been received.

The standardised structure of a MAP dialogue shall not be affected by the invocation of unknown operations, i.e. if a dialogue uses only a TC-BEGIN message which is acknowledged by a TC-END message, a TC-CONTINUE message shall not be used to invoke an unknown operation. However the standardised structure of a MAP dialogue may be affected by the rejection of unknown operations, i.e. if a dialogue uses only a TC-BEGIN message which is acknowledged by a TC-END message, a TC-CONTINUE message followed by a TC-END message may be used to carry the rejection of an unknown operation and the response to the standardised operation. The entity which initiated a dialogue whose standardised structure is a TC-BEGIN message which is acknowledged by a TC-END message shall not send any messages in that dialogue after the TC-BEGIN.Note that if the dialogue structure is affected as described in this paragraph the TC-CONTINUE shall include the dialogue portion required to confirm the acceptance of the dialogue.

Unknown operations can be invoked in the following types of messages (there is no restriction as to how many unknown operations can be invoked in a message):

- TC-BEGIN the component to invoke the unknown operation shall follow the component of the standard operation that is included in this message.

- TC-CONTINUE: the component to invoke the unknown operation may be transported as the only component in a stand-alone message or can be grouped with existing operations. In the latter case a specific sequencing of components is not required.

- TC-END: if the component to invoke the unknown operation is grouped with an existing operation a specific sequencing of components is not required

The TC-REJECT component may be sent in the following messages:

- TC-CONTINUE or TC-END: either as the only component of the message or grouped with an existing component. The choice is up to the MAP-Service User.

  If the received message contains only unknown operations the MAP-Service User shall send the TC-REJECT components in a TC-CONTINUE message to the peer entity, if the dialogue state allows it.

  If the received message contains unknown operations and standard operations and the standardised structure of the dialogue requires the response to the standard operation to be sent within a TC-END message, then the MAP-Service User may send the response to the standard operations and the TC-REJECT components for the unknown operations in a TC-CONTINUE message followed by a TC-END message. A specific distribution of the components to the TC messages or a specific sequencing of components is not required.

Note that SDLs of chapters 19 - 25 do not show the report to the MAP-Service User about the reception of the unknown operation. This has been done for the sake of simplicity of description; the MAP PM may inform the MAP-Service User.

The sender of the unknown operation shall ensure that there is enough room in the used message for the unknown operation.

15.6.2 Service invocation receipt

On receipt of a TC-INVOKE indication primitive, the MAP PM shall:

- if the invoke ID is already in use by an active service, request the transfer of a reject component using the TC-U-REJECT request primitive with the appropriate problem code (duplicated invokeID) and issue a MAP-NOTICE indication primitive with a diagnostic parameter set to "abnormal event received from the peer";

- if the operation code does not correspond to an operation supported by the application-context, request the transfer of a reject component using the TC-U-REJECT request primitive, with the appropriate problem code (unrecognized operation), and ,if the dialogue version is lower than 3, issue a MAP-NOTICE indication primitive with a diagnostic parameter set to "abnormal event received from the peer";

- if a linked ID is included, perform the following checks: If the operation referred to by the linked ID does not allow linked operations or if the operation code does not correspond to a permitted linked operation, issue a TC-U-REJECT request primitive with the appropriate problem code (linked response unexpected or unexpected linked operation);

- if the type of the argument is not the one defined for the operation, request the transfer of a reject component using the TC-U-REJECT request primitive, with the appropriate problem code (mistyped parameter), and issue a MAP-NOTICE indication primitive with a diagnostic parameter set to "abnormal event from the peer";

- if the type of the argument is correct but the values of the information elements it contains do not permit the type of MAP service being invoked to be determined, request the transfer of an error component using the TC-U-ERROR request primitive with an error code set to "unexpected data value" and issue a MAP-NOTICE indication primitive with a diagnostic parameter set to "abnormal event from the peer";

NOTE 1: These checks are only relevant when there is not a one-to-one mapping between a service and an operation.

- if the type of the argument is correct but information elements required for the service being invoked are missing, request the transfer of an error component using the TC-U-ERROR request primitive with an error code set to "data missing" and issue a MAP-NOTICE indication primitive with a diagnostic parameter set to "abnormal event from the peer";

NOTE 2: These checks are only relevant when there is not a one-to-one mapping between a service and an operation.

- if the type of the argument is correct but contains information elements which are not relevant for the type of MAP service being invoked, request the transfer of an error component using the TC-U-ERROR request primitive with an error code set to "unexpected data value" and issue a MAP-NOTICE indication primitive with a diagnostic parameter set to "abnormal event from the peer";

NOTE 3: These checks are only relevant when there is not a one-to-one mapping between a service and an operation.

- Otherwise, issue the relevant MAP indication primitive to the MAP-service-user. If the service is to be user confirmed, the MAP PM waits for the corresponding response primitive.

15.6.6 Parameter checks

As described in the previous subclauses, the MAP PM performs a set of checks to ensure the correctness of the information elements received; these are:

- check if the syntax and encoding (note) of the operation argument, result or error parameter are correct.

NOTE: Depending on the implementation, encoding problems on the TC user portion may be detected at TC level or by the MAP user. In the second case the problem is reported in a similar manner to a syntactical problem.

The syntax shall be considered incorrect if a mandatory information element is missing in any constructed element or if the value of an information element is out of the range defined for the type it is supposed to belong to;

- if there is not a one-to-one mapping between a service and an operation:

  i) check if the value of the information elements (generally a single one) permits the MAP PM to determine the service associated with the operation invocation;

  ii) check that there are no information elements which are irrelevant for the indication or a confirm primitive to be issued;

- check if all the information elements required to build an indication or a confirm primitive are available.

However some additional checks may have to be performed by the MAP user (see clause 18).

15.6.7 Returning state machines to idle

Unlike TC invocation state machines, service state machines exist at both requestor and performer side.

A service state machine at the requestor side is returned to idle when the MAP-specific confirm primitive is issued or when the dialogue terminates.

A service state machine at the performer side is returned to idle on receipt of a MAP-specific response primitive from the MAP user, when the dialogue terminates or at expiry of an implementation dependent watch-dog timer which is started when the state machine is created.

15.6.8 Load control

As stated in the previous subclauses, before issuing a MAP-OPEN indication primitive the MAP PM performs a check to verify if there are sufficient resources to open the dialogue taking into account possible overload conditions.

The decision is based on the priority allocated to the application-context whose name is explicitly included in the TC-BEGIN indication primitive or implied by the first operation invocation when V1 contexts are in use. How a V1 application-context-name is derived from an operation code is described in table 15.1/1.

The priority level allocated to each application-context is described in clause 5 tables 5.1/1 and 5.1/2.

16.2.2.9.3 Mapping to diagnostic parameter

The following values of the problem code parameter of the TC-R-REJECT and TC-U-REJECT primitive are mapped to values of the diagnostic parameter of the MAP-NOTICE indication primitive as follows:

Table 16.2/5: Mapping of TC problem code of TC-R-REJECT and TC-U-REJECT on to diagnostic parameter

TC problem code	MAP diagnostic
General problem	- abnormal event detected by the peer
Invoke problem	
- unrecognized linked ID	- abnormal event detected by the peer
- linked response unexpected	- response rejected by the peer
- unexpected linked operation	- response rejected by the peer
Return result problem	
- unrecognized invoke ID	- response rejected by the peer
- return result unexpected	- response rejected by the peer
- mistyped parameter	- response rejected by the peer
Return error problem	
- unrecognized invoke ID	- response rejected by the peer
- return error unexpected	- response rejected by the peer
- unrecognized error	- response rejected by the peer
- unexpected error	- response rejected by the peer
- mistyped parameter	- response rejected by the peer

The following values of the problem code parameter of the TC-L-REJECT primitive are mapped to values of the diagnostic parameter of the MAP-NOTICE indication primitive as follows:

Table 16.2/6: Mapping of TC problem code of TC-L-REJECT on to diagnostic parameter

TC problem code	MAP diagnostic
General problems	- abnormal event received from the peer
Invoke problem	
- unrecognized linked ID	- abnormal event received from the peer
Return result problem	
- unrecognized invoke ID	- abnormal event received from the peer
Return error problem	
- unrecognized invoke ID	- abnormal event received from the peer

16.3 SDL descriptions

The following SDL specification describes a system which includes three blocks: MAP-user, MAP-provider and TC.

Such a system resides in each network component supporting MAP and communicates with its peers via the lower layers of the signalling network which are part of the environment.

Only the MAP-provider is fully described in this subclause. The various types of processes which form the MAP-User block and the TC block are described respectively in clauses 18 to 25 of the present document and in CCITT Recommendation Q.774.

The MAP-Provider block communicates with the MAP_USER via two channels U1 and U2. Via U1 the MAP-provider receives the MAP request and response primitives. Via U2 it sends the MAP indication and confirm primitives.

The MAP-Provider block communicates with TC via two channels P1 and P2. Via P1 the MAP-Provider sends all the TC request primitives. Via P2 it receives all the TC indication primitives.

The MAP-Provider block is composed of the four following types of processes:

a) MAP_DSM: This type of process handles a dialogue. There exists one process instance per MAP dialogue.

b) LOAD_CTRL: This type of process is in charge of load control. There is only one instance of this process in each system.

c) PERFORMING_MAP_SSM: This type of process handles a MAP service performed during a dialogue. An instance of this process is created by the instance of the MAP_DSM process for each MAP-service to be performed.

d) REQUESTING_MAP_SSM: This type of process handles a MAP service requested during a dialogue. An instance of this process is created by the instance of the MAP_DSM process for each requested MAP-service.

A process MAP_DSM exchanges external signals with other blocks as well as internal signals with the other processes of the MAP-Provider block. The external signals are either MAP service primitives or TC service primitives.

The signal routes used by the various processes are organized as follows:

a) A process MAP_DSM receives and sends events from/to the MAP_user via signal route User1/User2. These routes use respectively channel U1 and U2.

b) A process MAP_DSM receives and sends events from/to the TC via signal route Tc1/Tc2. These routes use respectively channel P1 and P2.

c) A process MAP_DSM receives and sends events from/to the LOAD_CTRL process via signal route Load1/Load2. These routes are internal.

d) A process MAP_DSM sends events to the PERFORMING_MAP_SSM processes via signal route Intern1. This route is internal.

e) A process MAP_DSM sends events to the REQUESTING_MAP_SSM processes via signal route Intern2. This route is internal.

f) A process MAP_PERFORMING_SSM sends events to the MAP_USER via signal route User4. This route uses channel U2.

g) A process MAP_PERFORMING_SSM sends events to TC via signal route Tc3. This route uses channel P1.

h) A process MAP_REQUESTING_SSM sends events to the MAP_USER via signal route User5. This route uses channel U2.

j) A process MAP_REQUESTING_SSM sends events to TC via signal route Tc4. This route uses channel P1.

17.1.1 Encoding rules

The encoding rules which are applicable to the defined Abstract Syntaxes are the Basic Encoding Rules for Abstract Syntax Notation One, defined in CCITT Recommendation X.690 with the same exceptions as in CCITT Recommendation Q.773 section 4 Message Representation.

When the definite form is used for length encoding, a data value of length less than 128 octets must have the length encoded in the short form.

When the long form is employed to code a length, the minimum number of octets shall be used to code the length field.

OCTET STRING values and BIT STRING values must be encoded in a primitive form.

There is no restriction to the use of empty constructors (e.g. an empty SEQUENCE type). That is, the encoding of the content of any data value shall consist of zero, one or more octets.

17.1.2 Use of TC

The mapping of OPERATION and ERROR to TC components is defined in ETS 300 287 (version 2) which is based on CCITT Recommendation Q.773 (1992).

NOTE 1: The class of an operation is not stated explicitly but is specified as well in the ASN.1 operation type definition.

Class 1: RESULT and ERROR appear in ASN.1 operation type definition.

Class 2: only ERROR appears in ASN.1 operation type definition.

Class 3: only RESULT appears in ASN.1 operation type definition.

Class 4: both RESULT and ERROR do not appear in ASN.1 operation type definition.

The ASN.1 data type which follows the keywords "ARGUMENT", "PARAMETER" or "RESULT" (for OPERATION and ERROR) is always optional from a syntactic point of view. However, except when specifically mentioned with the ASN.1 comment «-- optional» , the «parameter» part of a component has to be considered as mandatory from a semantic point of view.

When an optional element is missing in an invoke component or in an inner data structure while it is required by the context, an error component is returned if specified in the operation type; the associated type of error is DataMissing. This holds also when the entire parameter of an invoke component is missing while it is required by the context.

NOTE 2: When a mandatory element is missing in the parameter or inner data structure of any component, a reject component is returned (if the dialogue still exists). The problem code to be used is "Mistyped parameter".

The Timer Values used in the operation type definitions are indicated as ASN.1 comments. The Timer Value Ranges are:

s = from 3 seconds to 10 seconds;

m = from 15 seconds to 30 seconds;

ml = from 1 minute to 10 minutes;

l = from 28 hours to 38 hours.

17.1.2.1 Use of Global Operation and Error codes defined outside MAP

An entity supporting an application context greater than 2 shall be capable of receiving an operation or error code, within an application context defined in GSM 09.02, encoded as either an Object Identifier (as defined in CCITT Recommendation X.690 (1994)) or an integer value (as defined in section 17.5). Related restrictions regarding the use of Object Identiers are as follows:

- The length of the Object Identifier shall not exceed 16 octets and the number of components of the Object Identifier shall not exceed 16.
- Object Identifiers shall be used only for operations or errors defined outside of GSM 09.02.
- Global error codes may be sent only in response to a global operation. If a standard operation is received then a global error code shall not be sent in response.

Handling of an unknown operation codes by the receiving entity is defined in section 15.1.1.

17.1.3 Use of information elements defined outside MAP

An information element or a set of information elements (messages) transparently carried in the Mobile Application Part but defined in other recommendations/technical specifications are handled in one of the following ways:

i) The contents of each information element (without the octets encoding the identifier and the length in the recommendation/technical specification where it is defined) is carried as the value of an ASN.1 NamedType derived from the OCTET STRING data type. Additionally, the internal structure may be explained by means of comments. In case of misalignment the referred to recommendation/technical specification takes precedence.

ii) The complete information element (including the octets encoding the identifier and the length in the recommendation/technical specification where it is defined) or set of information elements and the identity of the associated protocol are carried as the value of the ExternalSignalInfo data type defined in the present document. Where more than one information element is carried, the information elements are sent contiguously with no filler octets between them.

17.1.4 Compatibility considerations

The following ASN.1 modules conform to CCITT Recommendation X.208 (1988) or X.680 (1994) (the only module which makes use of X.680 is MAP-ExtensionDataTypes), but in addition Ellipsis Notation ("..." - notation) is used as described in ITU-T Recommendation X.680 Amendment 1 (1995) wherever future protocol extensions are foreseen.

The "..." construct applies only to SEQUENCE and ENUMERATED data types. An entity supporting a version greater than 1 shall not reject an unsupported extension following "..." of that SEQUENCE or ENUMERATED data type. The Encoding Rules from subclause 17.1.1 apply to every element of the whole Transfer Syntax especially to the ASN.1 type EXTERNAL.

Private extensions shall:

1) if included in operations of an AC of V2, follow the extension marker and be tagged using PRIVATE tags up to and including 29.

NOTE: This type of extension is in most cases used only within a PLMN.

2) if included in operations of an AC of V3 or higher: be included only in the Private Extension Container that is defined in the specification.

NOTE: This type of extension can be used between PLMNs.

Private extensions shall not be included in v2 supplementary service operations.

Private extensions shall not be included within user error for RegisterCCEntry and EraseCCEntry operations.

PCS extensions shall be included in the PCS Extension Container that is defined in this specification.

In order to improve extensibility, a few error parameters have been defined as a CHOICE between the version 2 description and a SEQUENCE including the version 2 description and an extension container. Operations used in a v2-application-context must consider only the first alternative while operations used in a vn-application-context (n>2) must consider only the second alternative.

17.1.5 Structure of the Abstract Syntax of MAP

For each MAP parameter which has to be transferred by a MAP Protocol Data Unit (MAP message), there is a PDU field (an ASN.1 NamedType) whose ASN.1 identifier has the same name as the corresponding parameter, except for the differences required by the ASN.1 notation (blanks between words are removed or replaced by hyphen, the first letter of the first word is lower-case and the first letter of the following words are capitalized, e.g. "no reply condition time" is mapped to "noReplyConditionTime"). Additionally some words may be abbreviated as follows:

bs	basic service
ch	call handling
cug	closed user group
ho	handover
ic	incoming call
id	identity
info	information
lcs	location services
ms	mobile service
oc	outgoing call
om	operation & maintenance
pw	Password
sm	short message service
ss	supplementary service

The MAP protocol is composed of several ASN.1 modules dealing with either operations, errors, data types, and, if applicable, split into those dealing with mobile services, call handling services, supplementary services and short message services. For operations and errors no values are assigned, but only the operation and error types in order to allow use of the defined types also by other protocols (e.g. TS GSM 04.80). The values (operation codes and error codes) are defined in a separate module. The ASN.1 source lines are preceded by line-numbers at the left margin in order to enable the usage of the cross-reference in annex A.

The module containing the definition of the operation packages for MAP is:

1. MAP-OperationPackages.

The module containing the definition of the application contexts for MAP is:

2. MAP-ApplicationContexts.

The module containing the data types for the Abstract Syntax to be used for TCAPMessages.DialoguePortion for MAP is:

3. MAP-DialogueInformation.

The module containing the operation codes and error codes for MAP is:

4. MAP-Protocol.

The modules containing all operation type definitions for MAP are:

5. MAP-MobileServiceOperations;
6. MAP-OperationAndMaintenanceOperations;
7. MAP-CallHandlingOperations;
8. MAP-SupplementaryServiceOperations;
9. MAP-ShortMessageServiceOperations;
10. MAP-Group-Call-Operations.
11. MAP-LocationServiceOperations

The module containing all error type definitions for MAP is:

12. MAP-Errors.

Modules containing all data type definitions for MAP are:

13. MAP-MS-DataTypes;
14. MAP-OM-DataTypes;
15. MAP-CH-DataTypes;
16. MAP-SS-DataTypes;
17. MAP-SS-Code;
18. MAP-SM-DataTypes;
19. MAP-ER-DataTypes;
20. MAP-CommonDataTypes;
21. MAP-TS-Code;
22. MAP-BS-Code;
23. MAP-ExtensionDataTypes;
24. MAP-GR-DataTypes;
25. MAP-LCS-DataTypes.

References are made also to modules defined outside of the present document. They are defined in the technical specification Mobile Services Domain and technical specification Transaction Capability respectively:

MobileDomainDefinitions;

TCAPMessages;

DialoguePDUs.

17.1.6 Application Contexts

The following informative table lists the latest versions of the Application Contexts used in this specification, with the operations used by them and, where applicable, whether or not the operation description is exactly the same as for previous versions. Information in 17.6 & 17.7 relates only to the ACs in this table.

AC Name	AC Version	Operations Used	Comments *
locationCancellationContext	v3	cancelLocation	
equipmentMngtContext	v2	checkIMEI	
imsiRetrievalContext	v2	sendIMSI	
infoRetrievalContext	v2	sendAuthenticationInfo	
interVlrInfoRetrievalContext	v2	sendIdentification	
handoverControlContext	v2	prepareHandover forwardAccessSignalling sendEndSignal processAccessSignalling prepareSubsequentHandover	
mwdMngtContext	v3	readyForSM	
msPurgingContext	v3	purgeMS	
shortMsgAlertContext	v2	alertServiceCentre	
resetContext	v2	reset	
networkUnstructuredSsContext	v2	processUnstructuredSS-Request unstructuredSS-Request unstructuredSS-Notify	
tracingContext	v3	activateTraceMode deactivateTraceMode	
networkFunctionalSsContext	v2	registerSS eraseSS activateSS deactivateSS registerPassword interrogateSS getPassword	
shortMsgMO-RelayContext	v3	mo-forwardSM	
shortMsgMT-RelayContext	v3	mt-forwardSM	
shortMsgGatewayContext	v3	sendRoutingInfoForSM reportSM-DeliveryStatus InformServiceCentre	the syntax of this operation has been extended in comparison with release 96 version
networkLocUpContext	v3	updateLocation forwardCheckSs-Indication restoreData insertSubscriberData activateTraceMode	the syntax is the same in v1 & v2
gprsLocationUpdateContext	v3	updateGprsLocation insertSubscriberData activateTraceMode	
subscriberDataMngtContext	v3	insertSubscriberData deleteSubscriberData	
roamingNumberEnquiryContext	v3	provideRoamingNumber	
locationInfoRetrievalContext	v3	sendRoutingInfo	
gprsNotifyContext	v3	noteMsPresentForGprs	
gprsLocationInfoRetrievalContext	v3	sendRoutingInfoForGprs	
failureReportContext	v3	failureReport	
callControlTransferContext	v4	resumeCallHandling	
subscriberInfoEnquiryContext	v3	provideSubscriberInfo	
anyTimeEnquiryContext	v3	anyTimeInterrogation	
ss-InvocationNotificationContext	v3	ss-InvocationNotification	
sIWFSAllocationContext	v3	provideSIWFSNumber sIWFSSignallingModify	
groupCallControlContext	v3	prepareGroupCall processGroupCallSignalling forwardGroupCallSignalling sendGroupCallEndSignal	
reportingContext	v3	setReportingState statusReport remoteUserFree	

callCompletionContext	v3	registerCC-Entry eraseCC-Entry	
istAlertingContext	v3	istAlert	
ImmediateTerminationContest	v3	istCommand	
locationSvcLMUControlContext	v3	lcsRegistrationlcsReset	
locationSvcDataTransferContext	v3	lcsInformationRequest lcsInformationReport	
locationSvcEnquiryContext	v3	provideSubscriberLocation subscriberLocationReport	
locationSvcGatewayContext	v3	sendRoutingInfoForLCS	
locationSvcPositioningContext	v3	lcsAssignTrafficChannel lcsInformationRequest lcsInformationReport performLocation	

NOTE (*): The syntax of the operations is not the same as in previous versions unless explicitly stated

17.2 Operation packages

17.2.1 General aspects

This subclause describes the operation-packages which are used to build the application-contexts defined in subclause 17.3.

Each operation-package is a specification of the roles of a pair of communicating objects (i.e. a pair of MAP-Providers), in terms of operations which they can invoke of each other.

The grouping of operations into one or several packages does not necessarily imply any grouping in terms of Application Service Elements.

The following ASN.1 MACRO is used to describe operation-packages in this subclause:

```
OPERATION-PACKAGE MACRO ::=

BEGIN

TYPE NOTATION ::= Symmetric | ConsumerInvokes SupplierInvokes |
empty

VALUE NOTATION ::= value(VALUE OBJECT IDENTIFIER)
Symmetric ::= "OPERATIONS" "{" OperationList "}"
ConsumerInvokes ::= "CONSUMER INVOKES" "{" OperationList "}"
SupplierInvokes ::= "SUPPLIER INVOKES" "{" OperationList "}" | empty
OperationList ::= Operation | OperationList "," Operation
Operation ::= value(OPERATION)

END
```

Since the application-context definitions provided in subclause 17.3 use only an informal description technique, only the type notation is used in the following subclauses to define operation-packages.

The following definitions are used throughout this subclause (n>=2):

- v1-only operation: An operation which shall be used only in v1 application-contexts;
- vn-only operation: An operation which shall be used only in vn application-contexts;
- v(n-1)-operation: An operation whose specification has not been modified since the MAP v(n-1) specifications or if the modifications are considered as not affecting v(n-1) implementations;
- v(n-1)-equivalent operation: The version of an operation which excludes all the information elements and errors which have been added since the MAP v(n-1) specification;
- vn-only package: An operation package which contains only vn-only operations;

- v(n-1)-package: An operation package which contains only v(n-1)- operations.

The names of vn-packages are suffixed by "-vn" where n>=2.

For each operation package which is not vn-only (n>=2) and which does not include only v(n-1)-operations, there is a v(n-1)-equivalent package. Except when a definition is explicitly provided in the following subclauses, the v(n-1)-equivalent package includes the v(n-1)-equivalent operations of the operations which belong to this package.

17.2.2.23 Short message gateway services

This operation package includes the operations required for short message service gateway procedures between MSC and HLR.

```
ShortMsgGatewayPackage-v3 ::= OPERATION-PACKAGE
     -- Supplier is HLR if Consumer is GMSC
     CONSUMER INVOKES {
          sendRoutingInfoForSM,
          reportSM-DeliveryStatus}
     SUPPLIER INVOKES {
          informServiceCentre}
```

The v2-equivalent package can be determined according to the rules described in subclause 17.2.1.

The v1-equivalent package is defined as follows:

```
ShortMsgGatewayPackage-v1 ::= OPERATION-PACKAGE
     -- Supplier is HLR if Consumer is GMSC
     CONSUMER INVOKES {
          SendRoutingInfoForSM,
          reportSMDeliveryStatus}
```

17.2.2.39 Supplementary Service invocation notification

This operation package includes the operations required for Supplementary Service invocation notification procedures between MSC and gsmSCF.

```
SS-InvocationNotificationPackage-v3 ::= OPERATION-PACKAGE
     -- Supplier is gsmSCF if Consumer is MSC
     CONSUMER INVOKES {
          ss-InvocationNotification}
```

This package is v3 only.

17.2.2.46 Location service Positioning

This operation package includes the operations required for the location service positioning procedures between MSC and SMLC.

```
LocationSvcPositioningPackage-v3 ::= OPERATION-PACKAGE
     -- Supplier is SMLC if Consumer is MSC
     CONSUMER INVOKES {
          performLocation,
          lcsInformationReport}
     SUPPLIER INVOKES {
          lcsAssignTrafficChannel,
          lcsInformationRequest}
```

This package is v3 only.

17.2.2.47 Location service LMU Control

This operation package includes the operations required for the location service LMU control procedures between MSC and SMLC.

```
LocationSvcLMUControlPackage-v3 ::= OPERATION-PACKAGE
     -- Supplier is SMLC if Consumer is VLR
     CONSUMER INVOKES {
          lcsRegistration }
     SUPPLIER INVOKES {
          LcsReset}
```

This package is v3 only.

17.2.2.48 Location service Data Transfer

This operation package includes the operations required for the location service data transfer procedures between MSC and SMLC when performed in stand alone mode.

```
LocationSvcDataTransferPackage-v3 ::= OPERATION-PACKAGE
     -- Supplier is MSC if Consumer is SMLC
     CONSUMER INVOKES {
          lcsInformationRequest}
     SUPPLIER INVOKES {
          lcsInformationReport}
```

This package is v3 only.

17.2.2.49 IST Alerting

This operation package includes the operation required for alerting procedures between the MSC (Visited MSC or Gateway MSC) and HLR.

```
IST-AlertingPackage-v3 ::= OPERATION-PACKAGE
     -- Supplier is HLR if Consumer is VMSC
     -- Supplier is HLR if Consumer is GMSC
     CONSUMER INVOKES {
          istAlert}
```

This package is v3 only.

17.2.2.50 Service Termination

This operation package includes the operation required for immediate service termination procedures between the HLR and the Visited MSC or between the HLR and the Gateway MSC.

```
ServiceTerminationPackage-v3 ::= OPERATION-PACKAGE
    -- Supplier is VMSC or GMSC if Consumer is HLR
    CONSUMER INVOKES {
        istCommand}
```

This package is v3 only.

17.3 Application contexts

17.3.1 General aspects

An application-context is assigned for each dialogue established by a MAP-user. In the present document each application-context is assigned a name which is supplied in the MAP-OPEN Req primitive by the MAP-User and transmitted to the peer under certain circumstances.

The following ASN.1 MACRO is used to describe the main aspects of application-contexts in the following subclauses:

```
APPLICATION-CONTEXT MACRO ::=

BEGIN

TYPE NOTATION ::= Symmetric | InitiatorConsumerOf
ResponderConsumerOf | empty

VALUE NOTATION ::= value(VALUE OBJECT IDENTIFIER)

Symmetric ::= "OPERATIONS OF" "{" PackageList "}"

InitiatorConsumerOf ::= "INITIATOR CONSUMER OF" "{" PackageList "}"

ResponderConsumerOf ::= "RESPONDER CONSUMER OF" "{" PackageList "}"
         | empty

PackageList ::= Package | PackageList "," Package

Package ::= value(OPERATION-PACKAGE)
         | type -- shall reference a package type

END
```

The following definitions are used throughout this subclause:

- v1-application-context: An application-context which contains only v1-packages and uses only TC v1 facilities;
- v1 context set: the set of v1-application-contexts defined in the present document.
- vn-application-context (n>=2): An application-context which contains only vn-packages;

The names of v1-application-contexts are suffixed by "-v1" while other names are suffixed by "-vn" where n>=2.

Application-contexts which do not belong to the v1 context set use v2 TC facilities.

The last component of each application-context-name (i.e. the last component of the object identifier value) assigned to an application-context which belongs to the v1 context set indicates explicitly "version1".

For each application-context which does not belong to the "v1 context set" there is a v1-equivalent application context. This is a v1-application-context which includes the v1-equivalents of the packages included in the original context.

Each application-context uses the abstract-syntax associated with the operation-packages it includes and uses the transfer-syntax derived from it by applying the encoding rules defined in subclause 17.1.1.

ACs which do not belong to the v1 context set require the support of the abstract-syntax identified by the object identifier value: MAP-DialogueInformation.map-Dialogue-AS defined in subclause 17.4.

17.3.2.15 Information retrieval

This application context is used for authentication information retrieval between HLR and VLR or between HLR and SGSN. For the HLR - SGSN interface version 1 and version 2 of this application context are applicable.

```
infoRetrievalContext-v2 APPLICATION-CONTEXT
     -- Responder is HLR if Initiator is VLR
     -- Responder is HLR if Initiator is SGSN
     INITIATOR CONSUMER OF {
          InfoRetrievalPackage-v2}
::= {map-ac infoRetrieval(14) version2(2)}
```

The following application-context-name is assigned to the v1-equivalent application-context:

```
{map-ac infoRetrieval(14) version1(1)}
```

17.3.2.16 Inter-VLR information retrieval

This application context is used for information retrieval between VLRs.

```
interVlrInfoRetrievalContext-v2 APPLICATION-CONTEXT
     -- Responder is VLR if Initiator is VLR
     INITIATOR CONSUMER OF {
          InterVlrInfoRetrievalPackage-v2}
::= {map-ac interVlrInfoRetrieval(15) version2(2)}
```

The v1-equivalent application-context is:

```
{map-ac infoRetrieval(14) version1(1)}
```

17.3.2.17 Stand Alone Subscriber Data Management

This application context is used for stand alone subscriber data management between HLR and VLR or between HLR and SGSN. For the HLR - SGSN interface only version 3 of this application context is applicable:

```
subscriberDataMngtContext-v3 APPLICATION-CONTEXT
     -- Responder is VLR or SGSN if Initiator is HLR
     INITIATOR CONSUMER OF {
          SubscriberDataMngtStandAlonePackage-v3}
::= {map-ac subscriberDataMngt(16) version3(3)}
```

The following application-context-name is assigned to the v2-equivalent application-context:

```
{map-ac subscriberDataMngt(16) version2(2)}
```

The following application-context-name is assigned to the v1-equivalent application-context:

```
{map-ac subscriberDataMngt(16) version1(1)}
```

17.3.2.18 Tracing

This application context is used between HLR and VLR or between HLR and SGSN for stand alone tracing control procedures. For the HLR - SGSN interface version 1, version 2 and version 3 of this application context are applicable.

```
tracingContext-v3 APPLICATION-CONTEXT
     -- Responder is VLR or SGSN if Initiator is HLR
     INITIATOR CONSUMER OF {
          TracingStandAlonePackage-v3}
::= {map-ac tracing(17) version3(3)}
```

The following application-context-name is assigned to the v2-equivalent application-context:

```
{map-ac tracing(17) version2(2)}
```

The following application-context-name is assigned to the v1-equivalent application-context:

```
{map-ac tracing(17) version1(1)}
```

17.3.2.26 Mobile terminating Short Message Relay

This application context is used between GMSC and MSC or between GMSC and SGSN for mobile terminating short message relay procedures. For the GMSC - SGSN interface version 2 and version 3 of this application context and the equivalent version 1 application context are applicable.

```
shortMsgMT-RelayContext-v3 APPLICATION-CONTEXT
     -- Responder is MSC or SGSN if Initiator is GMSC
     INITIATOR CONSUMER OF {
          MTShortMsgRelayPackage-v3}
::= {map-ac shortMsgMT-Relay(25) version3(3)}
```

The following application-context-name is assigned to the v2-equivalent application-context:

```
{map-ac shortMsgMT-Relay(25) version2(2)}
```

The following application-context-name is assigned to the v1-equivalent application-context:

```
{map-ac shortMsgMO-Relay(21) version1(1)}
```

17.3.2.44 IST Alerting

This application context is used between MSC (Visited MSC or Gateway MSC) and HLR for alerting services within IST procedures.

```
istAlertingContext-v3 APPLICATION-CONTEXT
     -- Responder is HLR if Initiator is VMSC
     -- Responder is HLR if Initiator is GMSC
     INITIATOR CONSUMER OF {
          IST-AlertingPackage-v3}
::= {map-ac alerting(4) version3(3)}
```

This application-context is v3 only.

17.3.2.45 Service Termination

This application context is used between HLR and MSC (Visited MSC or Gateway MSC) for service termination services within IST procedures.

```
serviceTerminationContext-v3 APPLICATION-CONTEXT
     -- Responder is VMSC or GMSC if Initiator is HLR
     INITIATOR CONSUMER OF {
          ServiceTerminationPackage-v3}
::= {map-ac serviceTermination(9) version3(3)}
```

This application-context is v3 only.

17.4 MAP Dialogue Information

```
MAP-DialogueInformation {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-DialogueInformation (3) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN

EXPORTS
   map-DialogueAS,
   MAP-DialoguePDU
;

IMPORTS
   gsm-NetworkId,
   as-Id
FROM MobileDomainDefinitions {
   ccitt (0) identified-organization (4) etsi (0) mobileDomain (0)
   mobileDomainDefinitions (0) version1 (1)}

   AddressString
FROM MAP-CommonDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network(1) modules (3) map-CommonDataTypes (18) version6 (6)}

   ExtensionContainer
FROM MAP-ExtensionDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}

;


-- abstract syntax name for MAP-DialoguePDU

map-DialogueAS  OBJECT IDENTIFIER ::=
     {gsm-NetworkId as-Id map-DialoguePDU (1) version1 (1)}
```

```
MAP-DialoguePDU ::= CHOICE {
     map-open                          [0] MAP-OpenInfo,
     map-accept                        [1] MAP-AcceptInfo,
     map-close                         [2] MAP-CloseInfo,
     map-refuse                        [3] MAP-RefuseInfo,
     map-userAbort                     [4] MAP-UserAbortInfo,
     map-providerAbort                 [5] MAP-ProviderAbortInfo}

MAP-OpenInfo ::= SEQUENCE {
     destinationReference              [0] AddressString               OPTIONAL,
     originationReference              [1] AddressString               OPTIONAL,
     ...,
     extensionContainer                ExtensionContainer              OPTIONAL
     -- extensionContainer must not be used in version 2
     }

MAP-AcceptInfo ::= SEQUENCE {
     ...,
     extensionContainer                ExtensionContainer              OPTIONAL
     -- extensionContainer must not be used in version 2
     }

MAP-CloseInfo ::= SEQUENCE {
     ...,
     extensionContainer                ExtensionContainer              OPTIONAL
     -- extensionContainer must not be used in version 2
     }

MAP-RefuseInfo ::= SEQUENCE {
     reason    Reason,
     ...,
     extensionContainer                ExtensionContainer              OPTIONAL
     -- extensionContainer must not be used in version 2
     }

Reason ::= ENUMERATED {
     noReasonGiven  (0),
     invalidDestinationReference  (1),
     invalidOriginatingReference  (2)}

MAP-UserAbortInfo ::= SEQUENCE {
     map-UserAbortChoice               MAP-UserAbortChoice,
     ...,
     extensionContainer                ExtensionContainer              OPTIONAL
     -- extensionContainer must not be used in version 2
     }

MAP-UserAbortChoice ::= CHOICE {
     userSpecificReason                [0] NULL,
     userResourceLimitation            [1] NULL,
     resourceUnavailable               [2] ResourceUnavailableReason,
     applicationProcedureCancellation  [3] ProcedureCancellationReason}

ResourceUnavailableReason ::= ENUMERATED {
     shortTermResourceLimitation  (0),
     longTermResourceLimitation  (1)}

ProcedureCancellationReason ::= ENUMERATED {
     handoverCancellation  (0),
     radioChannelRelease  (1),
     networkPathRelease  (2),
     callRelease  (3),
     associatedProcedureFailure  (4),
     tandemDialogueRelease  (5),
     remoteOperationsFailure  (6)}

MAP-ProviderAbortInfo ::= SEQUENCE {
     map-ProviderAbortReason           MAP-ProviderAbortReason,
     ...,
     extensionContainer                ExtensionContainer              OPTIONAL
     -- extensionContainer must not be used in version 2
     }

MAP-ProviderAbortReason ::= ENUMERATED {
     abnormalDialogue  (0),
     invalidPDU  (1)}
```

```
END
```

17.6 MAP operation and error types

17.6.1 Mobile Service Operations

```
MAP-MobileServiceOperations {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-MobileServiceOperations (5)
   version6 (6)}

DEFINITIONS

::=

BEGIN

EXPORTS

   -- location registration operations
   UpdateLocation,
   CancelLocation,
   PurgeMS,
   SendIdentification,

   -- gprs location registration operations
   UpdateGprsLocation,

   -- subscriber information enquiry operations
   ProvideSubscriberInfo,

   -- any time information enquiry operations
   AnyTimeInterrogation,

   -- handover operations
   PrepareHandover,
   SendEndSignal,
   ProcessAccessSignalling,
   ForwardAccessSignalling,
   PrepareSubsequentHandover,

   -- authentication management operations
   SendAuthenticationInfo,

   -- IMEI management operations
   CheckIMEI,

   -- subscriber management operations
   InsertSubscriberData,
   DeleteSubscriberData,

   -- fault recovery operations
   Reset,
   ForwardCheckSS-Indication,
   RestoreData,

-- gprs location information retrieval operations
   SendRoutingInfoForGprs,

   -- failure reporting operations
   FailureReport,

   -- gprs notification operations
   NoteMsPresentForGprs



;

IMPORTS
   OPERATION
FROM TCAPMessages {
```

```
   ccitt recommendation q 773 modules (2) messages (1) version2 (2)}

   SystemFailure,
   DataMissing,
   UnexpectedDataValue,
   UnknownSubscriber,
   UnknownMSC,
   UnidentifiedSubscriber,
   UnknownEquipment,
   RoamingNotAllowed,
   ATI-NotAllowed,
   NoHandoverNumberAvailable,
   SubsequentHandoverFailure,
   AbsentSubscriber

FROM MAP-Errors {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-Errors (10) version6 (6)}

   UpdateLocationArg,
   UpdateLocationRes,
   CancelLocationArg,
   CancelLocationRes,
   PurgeMS-Arg,
   PurgeMS-Res,
   SendIdentificationRes,
   UpdateGprsLocationArg,
   UpdateGprsLocationRes,
   PrepareHO-Arg,
   PrepareHO-Res,
   PrepareSubsequentHO-Arg,
   SendAuthenticationInfoArg,
   SendAuthenticationInfoRes,
   EquipmentStatus,
   InsertSubscriberDataArg,
   InsertSubscriberDataRes,
   DeleteSubscriberDataArg,
   DeleteSubscriberDataRes,
   ResetArg,
   RestoreDataArg,
   RestoreDataRes,
   ProvideSubscriberInfoArg,
   ProvideSubscriberInfoRes,
   AnyTimeInterrogationArg,
   AnyTimeInterrogationRes,
   SendRoutingInfoForGprsArg,
   SendRoutingInfoForGprsRes,
   FailureReportArg,
   FailureReportRes,
   NoteMsPresentForGprsArg,
   NoteMsPresentForGprsRes

FROM MAP-MS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-MS-DataTypes (11) version6 (6)}

   ExternalSignalInfo,
   TMSI,
   IMEI
FROM MAP-CommonDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}
;


-- location registration operations

UpdateLocation ::= OPERATION                                          --Timer m
    ARGUMENT
         updateLocationArg              UpdateLocationArg
    RESULT
         updateLocationRes              UpdateLocationRes
    ERRORS {
         SystemFailure,
         DataMissing,
         UnexpectedDataValue,
         UnknownSubscriber,
         RoamingNotAllowed}
```

```
CancelLocation ::= OPERATION                                          --Timer m
     ARGUMENT
          cancelLocationArg              CancelLocationArg
     RESULT
          cancelLocationRes              CancelLocationRes
               -- optional
     ERRORS {
          DataMissing,
          UnexpectedDataValue}
```

```
PurgeMS ::= OPERATION                                                 --Timer m
     ARGUMENT
          purgeMS-Arg                    PurgeMS-Arg
     RESULT
          purgeMS-Res                    PurgeMS-Res
               -- optional
     ERRORS{
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber}
```

```
SendIdentification ::= OPERATION                                      --Timer s
     ARGUMENT
          tmsi                           TMSI
     RESULT
          sendIdentificationRes          SendIdentificationRes
     ERRORS {
          DataMissing,
          UnidentifiedSubscriber}
```

```
-- gprs location registration operations
```

```
UpdateGprsLocation ::= OPERATION                                      --Timer m
     ARGUMENT
          updateGprsLocationArg          UpdateGprsLocationArg
     RESULT
          updateGprsLocationRes          UpdateGprsLocationRes
     ERRORS {
          SystemFailure,
          UnexpectedDataValue,
          UnknownSubscriber,
          RoamingNotAllowed}
```

```
-- subscriber information enquiry operations
```

```
ProvideSubscriberInfo ::= OPERATION                                   --Timer m
     ARGUMENT
          provideSubscriberInfoArg       ProvideSubscriberInfoArg
     RESULT
          provideSubscriberInfoRes       ProvideSubscriberInfoRes
     ERRORS {
          DataMissing,
          UnexpectedDataValue}
```

```
-- any time information enquiry operations
```

```
AnyTimeInterrogation ::= OPERATION                                    --Timer m
     ARGUMENT
          anyTimeInterrogationArg        AnyTimeInterrogationArg
     RESULT
          anyTimeInterrogationRes        AnyTimeInterrogationRes
     ERRORS {
          SystemFailure,
          ATI-NotAllowed,
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber}
```

```
-- handover operations
```

```
PrepareHandover ::= OPERATION                                          --Timer m
     ARGUMENT
          prepareHO-Arg                  PrepareHO-Arg
     RESULT
          prepareHO-Res                  PrepareHO-Res
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          NoHandoverNumberAvailable}

SendEndSignal ::= OPERATION                                            --Timer l
     ARGUMENT
          bss-APDU                       ExternalSignalInfo
     RESULT

ProcessAccessSignalling ::= OPERATION                                  --Timer s
     ARGUMENT
          bss-APDU                       ExternalSignalInfo

ForwardAccessSignalling ::= OPERATION                                  --Timer s
     ARGUMENT
          bss-APDU                       ExternalSignalInfo

PrepareSubsequentHandover ::= OPERATION                                --Timer m
     ARGUMENT
          prepareSubsequentHO-Arg        PrepareSubsequentHO-Arg
     RESULT
          bss-APDU                       ExternalSignalInfo
     ERRORS {
          UnexpectedDataValue,
          DataMissing,
          UnknownMSC,
          SubsequentHandoverFailure}

-- authentication management operations

SendAuthenticationInfo ::= OPERATION                                   --Timer m
     ARGUMENT
          sendAuthenticationInfoArg      SendAuthenticationInfoArg
     RESULT
          sendAuthenticationInfoRes      SendAuthenticationInfoRes
          -- optional
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber}

-- IMEI management operations

CheckIMEI ::= OPERATION                                                --Timer m
     ARGUMENT
          imei                           IMEI
     RESULT
          equipmentStatus                EquipmentStatus
     ERRORS {
          SystemFailure,
          DataMissing,
          UnknownEquipment}

-- subscriber management operations

InsertSubscriberData ::= OPERATION                                     --Timer m
     ARGUMENT
          insertSubscriberDataArg        InsertSubscriberDataArg
     RESULT
          insertSubscriberDataRes        InsertSubscriberDataRes
          -- optional
     ERRORS {
          DataMissing,
          UnexpectedDataValue,
          UnidentifiedSubscriber}
```

```
DeleteSubscriberData ::= OPERATION                                          --Timer m
     ARGUMENT
          deleteSubscriberDataArg         DeleteSubscriberDataArg
     RESULT
          deleteSubscriberDataRes         DeleteSubscriberDataRes
          -- optional
     ERRORS {
          DataMissing,
          UnexpectedDataValue,
          UnidentifiedSubscriber}

-- fault recovery operations

Reset ::= OPERATION                                                         --Timer m
     ARGUMENT
          resetArg                        ResetArg

ForwardCheckSS-Indication ::= OPERATION            --Timer s

RestoreData ::= OPERATION                                                   --Timer m
     ARGUMENT
          restoreDataArg                  RestoreDataArg
     RESULT
          restoreDataRes                  RestoreDataRes
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber}

-- gprs location information retrieval operations

SendRoutingInfoForGprs ::= OPERATION                                        --Timer m
     ARGUMENT
          sendRoutingInfoForGprsArg       SendRoutingInfoForGprsArg
     RESULT
          sendRoutingInfoForGprsRes       SendRoutingInfoForGprsRes
     ERRORS {
          AbsentSubscriber,
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber}

-- failure reporting operations

FailureReport ::= OPERATION                                                 --Timer m
     ARGUMENT
          failureReportArg                FailureReportArg
     RESULT
          failureReportRes                FailureReportRes
               -- optional
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber}

-- gprs notification operations

NoteMsPresentForGprs ::= OPERATION                                          --Timer m
     ARGUMENT
          noteMsPresentForGprsArg         NoteMsPresentForGprsArg
     RESULT
          noteMsPresentForGprsRes         NoteMsPresentForGprsRes
               -- optional
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber}


END
```

17.6.5 Short message service operations

```
MAP-ShortMessageServiceOperations {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ShortMessageServiceOperations (9)
   version6 (6)}

DEFINITIONS

::=

BEGIN

EXPORTS
   SendRoutingInfoForSM,
   MO-ForwardSM,
   MT-ForwardSM,
   ReportSM-DeliveryStatus,
   AlertServiceCentre,
   InformServiceCentre,
   ReadyForSM
;

IMPORTS
   OPERATION
FROM TCAPMessages {
   ccitt recommendation q 773 modules (2) messages (1) version2 (2)}

   SystemFailure,
   DataMissing,
   UnexpectedDataValue,
   FacilityNotSupported,
   UnknownSubscriber,
   UnidentifiedSubscriber,
   IllegalSubscriber,
   IllegalEquipment,
   TeleserviceNotProvisioned,
   AbsentSubscriber,
   CallBarred,
   SubscriberBusyForMT-SMS,
   SM-DeliveryFailure,
   MessageWaitingListFull,
   AbsentSubscriberSM
FROM MAP-Errors {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-Errors (10) version6 (6)}

   RoutingInfoForSM-Arg,
   RoutingInfoForSM-Res,
   MO-ForwardSM-Arg,
   MO-ForwardSM-Res,
   MT-ForwardSM-Arg,
   MT-ForwardSM-Res,
   ReportSM-DeliveryStatusArg,
   ReportSM-DeliveryStatusRes,
   AlertServiceCentreArg,
   InformServiceCentreArg,
   ReadyForSM-Arg,
   ReadyForSM-Res
FROM MAP-SM-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-SM-DataTypes (16) version6 (6)}



;

```

```
SendRoutingInfoForSM ::= OPERATION                                    --Timer m
     ARGUMENT
          routingInfoForSM-Arg            RoutingInfoForSM-Arg
     RESULT
          routingInfoForSM-Res            RoutingInfoForSM-Res
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          FacilityNotSupported,
          UnknownSubscriber,
          TeleserviceNotProvisioned,
          CallBarred,
          AbsentSubscriberSM}

MO-ForwardSM ::= OPERATION                                            --Timer ml
     ARGUMENT
          mo-forwardSM-Arg                MO-ForwardSM-Arg
     RESULT
          mo-forwardSM-Res                MO-ForwardSM-Res
          -- optional
     ERRORS {
          SystemFailure,
          UnexpectedDataValue,
          FacilityNotSupported,
          SM-DeliveryFailure}

MT-ForwardSM ::= OPERATION                                            --Timer ml
     ARGUMENT
          mt-forwardSM-Arg                MT-ForwardSM-Arg
     RESULT
          mt-forwardSM-Res                MT-ForwardSM-Res
          -- optional
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          FacilityNotSupported,
          UnidentifiedSubscriber,
          IllegalSubscriber,
          IllegalEquipment,
          SubscriberBusyForMT-SMS,
          SM-DeliveryFailure,
          AbsentSubscriberSM}

ReportSM-DeliveryStatus ::= OPERATION              --Timer s
     ARGUMENT
          reportSM-DeliveryStatusArg      ReportSM-DeliveryStatusArg
     RESULT
          reportSM-DeliveryStatusRes      ReportSM-DeliveryStatusRes
          -- optional
     ERRORS {
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber,
          MessageWaitingListFull}

AlertServiceCentre ::= OPERATION                                      --Timer s
     ARGUMENT
          alertServiceCentreArg           AlertServiceCentreArg
     RESULT
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue}

InformServiceCentre ::= OPERATION                                     --Timer s
     ARGUMENT
          informServiceCentreArg          InformServiceCentreArg
```

```
ReadyForSM ::= OPERATION                                                --Timer m
     ARGUMENT
          readyForSM-Arg                  ReadyForSM-Arg
     RESULT
          readyForSM-Res                  ReadyForSM-Res
          -- optional
     ERRORS {
          DataMissing,
          UnexpectedDataValue,
          FacilityNotSupported,
          UnknownSubscriber}

END
```

17.6.6 Errors

```
MAP-Errors {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-Errors (10) version6 (6)}

DEFINITIONS

::=

BEGIN

EXPORTS

   -- generic errors
   SystemFailure,
   DataMissing,
   UnexpectedDataValue,
   FacilityNotSupported,
   IncompatibleTerminal,
   ResourceLimitation,

   -- identification and numbering errors
   UnknownSubscriber,
   NumberChanged,
   UnknownMSC,
   UnidentifiedSubscriber,
   UnknownEquipment,

   -- subscription errors
   RoamingNotAllowed,
   IllegalSubscriber,
   IllegalEquipment,
   BearerServiceNotProvisioned,
   TeleserviceNotProvisioned,

   -- handover errors
   NoHandoverNumberAvailable,
   SubsequentHandoverFailure,

   -- operation and maintenance errors
   TracingBufferFull,

   -- call handling errors
   OR-NotAllowed,
   NoRoamingNumberAvailable,
   BusySubscriber,
   NoSubscriberReply,
   AbsentSubscriber,
   CallBarred,
   ForwardingViolation,
   ForwardingFailed,
   CUG-Reject,

   -- any time interrogation errors
   ATI-NotAllowed,

   -- supplementary service errors
   IllegalSS-Operation,
   SS-ErrorStatus,
   SS-NotAvailable,
   SS-SubscriptionViolation,
   SS-Incompatibility,
   UnknownAlphabet,
```

```
   USSD-Busy,
   PW-RegistrationFailure,
   NegativePW-Check,
   NumberOfPW-AttemptsViolation,
   ShortTermDenial,
   LongTermDenial,

   -- short message service errors
   SubscriberBusyForMT-SMS,
   SM-DeliveryFailure,
   MessageWaitingListFull,
   AbsentSubscriberSM,

   -- Group Call errors
   NoGroupCallNumberAvailable,

   -- location service errors
   UnauthorizedRequestingNetwork,
   UnauthorizedLCSClient,
   PositionMethodFailure,
   PositionMethodFailureWithRestart,
   LMUUnknownOrOffline,
   TrafficChannelEstablishmentFailure,
   UnknownOrUnreachableLCSClient

;

IMPORTS
   ERROR
FROM TCAPMessages {
   ccitt recommendation q 773 modules (2) messages (1) version2 (2)}

   SS-Status
FROM MAP-SS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-SS-DataTypes (14) version6 (6)}

   SS-IncompatibilityCause,
   PW-RegistrationFailureCause,
   SM-DeliveryFailureCause,
   SystemFailureParam,
   DataMissingParam,
   UnexpectedDataParam,
   FacilityNotSupParam,
   UnknownSubscriberParam,
   NumberChangedParam,
   UnidentifiedSubParam,
   RoamingNotAllowedParam,
   IllegalSubscriberParam,
   IllegalEquipmentParam,
   BearerServNotProvParam,
   TeleservNotProvParam,
   TracingBufferFullParam,
   NoRoamingNbParam,
   OR-NotAllowedParam,
   AbsentSubscriberParam,
   BusySubscriberParam,
   NoSubscriberReplyParam,
   CallBarredParam,
   ForwardingViolationParam,
   ForwardingFailedParam,
   CUG-RejectParam,
   ATI-NotAllowedParam,
   SubBusyForMT-SMS-Param,
   MessageWaitListFullParam,
   AbsentSubscriberSM-Param,
   ResourceLimitationParam,
   NoGroupCallNbParam,
   IncompatibleTerminalParam,
   ShortTermDenialParam,
   LongTermDenialParam,
   UnauthorizedRequestingNetwork-Param,
   UnauthorizedLCSClient-Param,
   PositionMethodFailure-Param,
   PositionMethodFailureWithRestart-Param,
   LMUUnknownOrOffline-Param,
   TrafficChannelEstablishmentFailure-Param,
   UnknownOrUnreachableLCSClient-Param

```

```
FROM MAP-ER-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ER-DataTypes (17) version6 (6)}
;


-- generic errors

SystemFailure ::= ERROR
     PARAMETER
          systemFailureParam              SystemFailureParam
          -- optional

DataMissing ::= ERROR
     PARAMETER
          dataMissingParam                DataMissingParam
          -- optional
          -- dataMissingParam must not be used in version <3

UnexpectedDataValue ::= ERROR
     PARAMETER
          unexpectedDataParam             UnexpectedDataParam
          -- optional
          -- unexpectedDataParam must not be used in version <3

FacilityNotSupported ::= ERROR
     PARAMETER
          facilityNotSupParam             FacilityNotSupParam
          -- optional
          -- facilityNotSupParam must not be used in version <3

IncompatibleTerminal ::= ERROR
     PARAMETER
          incompatibleTerminalParam       IncompatibleTerminalParam
          -- optional

ResourceLimitation ::= ERROR
     PARAMETER
          resourceLimitationParam         ResourceLimitationParam
          -- optional

-- identification and numbering errors

UnknownSubscriber ::= ERROR
     PARAMETER
          unknownSubscriberParam          UnknownSubscriberParam
          -- optional
          -- unknownSubscriberParam must not be used in version <3

NumberChanged ::= ERROR
     PARAMETER
          numberChangedParam              NumberChangedParam
          -- optional

UnknownMSC ::= ERROR

UnidentifiedSubscriber ::= ERROR
     PARAMETER
          unidentifiedSubParam            UnidentifiedSubParam
          -- optional
          -- unidentifiedSubParam must not be used in version <3

UnknownEquipment ::= ERROR


-- subscription errors

RoamingNotAllowed ::= ERROR
     PARAMETER
          roamingNotAllowedParam          RoamingNotAllowedParam

IllegalSubscriber ::= ERROR
     PARAMETER
          illegalSubscriberParam          IllegalSubscriberParam
          -- optional
          -- illegalSubscriberParam must not be used in version <3
```

```
IllegalEquipment ::= ERROR
    PARAMETER
        illegalEquipmentParam           IllegalEquipmentParam
        -- optional
        -- illegalEquipmentParam must not be used in version <3

BearerServiceNotProvisioned ::= ERROR
    PARAMETER
        bearerServNotProvParam          BearerServNotProvParam
        -- optional
        -- bearerServNotProvParam must not be used in version <3

TeleserviceNotProvisioned ::= ERROR
    PARAMETER
        teleservNotProvParam            TeleservNotProvParam
        -- optional
        -- teleservNotProvParam must not be used in version <3


-- handover errors

NoHandoverNumberAvailable ::= ERROR

SubsequentHandoverFailure ::= ERROR


-- operation and maintenance errors

TracingBufferFull ::= ERROR
    PARAMETER
        tracingBufferFullParam          TracingBufferFullParam
        -- optional


-- call handling errors

NoRoamingNumberAvailable ::= ERROR
    PARAMETER
        noRoamingNbParam                NoRoamingNbParam
        -- optional

AbsentSubscriber ::= ERROR
    PARAMETER
        absentSubscriberParam           AbsentSubscriberParam
        -- optional
        -- absentSubscriberParam must not be used in version <3


BusySubscriber ::= ERROR
    PARAMETER
        busySubscriberParam             BusySubscriberParam
        -- optional

NoSubscriberReply ::= ERROR
    PARAMETER
        noSubscriberReplyParam          NoSubscriberReplyParam
        -- optional

CallBarred ::= ERROR
    PARAMETER
        callBarredParam                 CallBarredParam
        -- optional

ForwardingViolation ::= ERROR
    PARAMETER
        forwardingViolationParam        ForwardingViolationParam
        -- optional

ForwardingFailed ::= ERROR
    PARAMETER
        forwardingFailedParam           ForwardingFailedParam
        -- optional
```

```
CUG-Reject ::= ERROR
     PARAMETER
          cug-RejectParam                 CUG-RejectParam
          -- optional
```

```
OR-NotAllowed ::= ERROR
     PARAMETER
          or-NotAllowedParam              OR-NotAllowedParam
          -- optional
```

```
-- any time interrogation errors
ATI-NotAllowed ::= ERROR
     PARAMETER
          ati-NotAllowedParam             ATI-NotAllowedParam
          -- optional
```

```
-- supplementary service errors
```

```
IllegalSS-Operation ::= ERROR
```

```
SS-ErrorStatus ::= ERROR
     PARAMETER
          ss-Status                       SS-Status
          -- optional
```

```
SS-NotAvailable ::= ERROR
```

```
SS-SubscriptionViolation ::= ERROR
```

```
SS-Incompatibility ::= ERROR
     PARAMETER
          ss-IncompatibilityCause         SS-IncompatibilityCause
          -- optional
```

```
UnknownAlphabet ::= ERROR
```

```
USSD-Busy ::= ERROR
```

```
PW-RegistrationFailure ::= ERROR
     PARAMETER
          pw-RegistrationFailureCause     PW-RegistrationFailureCause
```

```
NegativePW-Check ::= ERROR
```

```
NumberOfPW-AttemptsViolation ::= ERROR
```

```
ShortTermDenial ::= ERROR
     PARAMETER
          shortTermDenialParam                ShortTermDenialParam
          -- optional
```

```
LongTermDenial ::= ERROR
     PARAMETER
          longTermDenialParam                 LongTermDenialParam
          -- optional
```

```
-- short message service errors
```

```
SubscriberBusyForMT-SMS ::= ERROR
     PARAMETER
          subBusyForMT-SMS-Param          SubBusyForMT-SMS-Param
          -- optional
```

```
SM-DeliveryFailure ::= ERROR
     PARAMETER
          sm-DeliveryFailureCause         SM-DeliveryFailureCause
```

```
MessageWaitingListFull ::= ERROR
     PARAMETER
          messageWaitListFullParam        MessageWaitListFullParam
          -- optional
```

```
AbsentSubscriberSM ::= ERROR
     PARAMETER
          absentSubscriberSM-Param        AbsentSubscriberSM-Param
          -- optional

-- Group Call errors

NoGroupCallNumberAvailable ::= ERROR
     PARAMETER
          noGroupCallNbParam              NoGroupCallNbParam
          -- optional

-- location service errors

UnauthorizedRequestingNetwork ::= ERROR
     PARAMETER
          unauthorizedRequestingNetwork-Param  UnauthorizedRequestingNetwork-Param
          -- optional

UnauthorizedLCSClient ::= ERROR
     PARAMETER
          unauthorizedLCSClient-Param     UnauthorizedLCSClient-Param
          -- optional

PositionMethodFailure ::= ERROR
     PARAMETER
          positionMethodFailure-Param     PositionMethodFailure-Param
          -- optional

PositionMethodFailureWithRestart ::= ERROR
     PARAMETER
          positionMethodFailureWithRestart-Param   PositionMethodFailureWithRestart-Param
          -- optional

LMUUnknownOrOffline ::= ERROR
     PARAMETER
          lmuUnknownOrOffline-Param       LMUUnknownOrOffline-Param
          -- optional

TrafficChannelEstablishmentFailure ::= ERROR
     PARAMETER
          trafficChannelEstablishmentFailure   TrafficChannelEstablishmentFailure-Param
          -- optional

UnknownOrUnreachableLCSClient ::= ERROR
     PARAMETER
          unknownOrUnreachableLCSClient-Param   UnknownOrUnreachableLCSClient-Param
          -- optional

END
```

17.6.7 Group Call operations

```
MAP-Group-Call-Operations {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-Group-Call-Operations (22)
   version6 (6)}

DEFINITIONS

::=

BEGIN

EXPORTS
   PrepareGroupCall,
   SendGroupCallEndSignal,
   ForwardGroupCallSignalling,
   ProcessGroupCallSignalling
;

IMPORTS
   OPERATION
FROM TCAPMessages {
   ccitt recommendation q 773 modules (2) messages (1) version2 (2)}

   SystemFailure,
```

```
   UnexpectedDataValue,
   NoGroupCallNumberAvailable
FROM MAP-Errors {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-Errors (10) version6 (6)}

   PrepareGroupCallArg,
   PrepareGroupCallRes,
   SendGroupCallEndSignalArg,
   SendGroupCallEndSignalRes,
   ForwardGroupCallSignallingArg,
   ProcessGroupCallSignallingArg
FROM MAP-GR-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-GR-DataTypes (23) version6 (6)}



;


PrepareGroupCall ::= OPERATION                                          --Timer m
     ARGUMENT
          prepareGroupCallArg             PrepareGroupCallArg
     RESULT
          prepareGroupCallRes             PrepareGroupCallRes
     ERRORS {
          SystemFailure,
          NoGroupCallNumberAvailable,
          UnexpectedDataValue}

SendGroupCallEndSignal ::= OPERATION                                    --Timer l
     ARGUMENT
          sendGroupCallEndSignalArg       SendGroupCallEndSignalArg
     RESULT
          sendGroupCallEndSignalRes       SendGroupCallEndSignalRes


ProcessGroupCallSignalling ::= OPERATION                                --Timer s
     ARGUMENT
          processGroupCallSignallingArg   ProcessGroupCallSignallingArg

ForwardGroupCallSignalling ::= OPERATION                                --Timer s
     ARGUMENT
          forwardGroupCallSignallingArg   ForwardGroupCallSignallingArg

END
```

17.6.8 Location service operations

```
MAP-LocationServiceOperations {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-LocationServiceOperations (24)
   version6 (6)}

DEFINITIONS

::=

BEGIN

EXPORTS
   LCSAssignTrafficChannel,
   LCSInformationReport,
   LCSInformationRequest,
   LCSRegistration,
   LCSReset,
   ProvideSubscriberLocation,
   PerformLocation,
   SendRoutingInfoForLCS,
   SubscriberLocationReport
;

```

```
IMPORTS
   OPERATION
FROM TCAPMessages {
   ccitt recommendation q 773 modules (2) messages (1) version2 (2)}

   SystemFailure,
   DataMissing,
   UnexpectedDataValue,
   FacilityNotSupported,
   UnknownSubscriber,
   AbsentSubscriber,
   UnauthorizedRequestingNetwork,
   UnauthorizedLCSClient,
   PositionMethodFailure,
   PositionMethodFailureWithRestart,
   LMUUnknownOrOffline,
   TrafficChannelEstablishmentFailure,
   UnknownOrUnreachableLCSClient
FROM MAP-Errors {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-Errors (10) version6 (6)}

   LCSAssignTrafficChannel-Arg,
   LCSAssignTrafficChannel-Res,
   LCSInformationReport-Arg,
   LCSInformationRequest-Arg,
   LCSRegistration-Arg,
   LCSRegistration-Res,
   LCSReset-Arg,
   RoutingInfoForLCS-Arg,
   RoutingInfoForLCS-Res,
   ProvideSubscriberLocation-Arg,
   ProvideSubscriberLocation-Res,
   PerformLocation-Arg,
   PerformLocation-Res,
   SubscriberLocationReport-Arg,
   SubscriberLocationReport-Res
FROM MAP-LCS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-LCS-DataTypes (25) version6 (6)}
;

SendRoutingInfoForLCS ::= OPERATION                                    --Timer m
    ARGUMENT
         routingInfoForLCS-Arg          RoutingInfoForLCS-Arg
    RESULT
         routingInfoForLCS-Res          RoutingInfoForLCS-Res
    ERRORS {
         SystemFailure,
         DataMissing,
         UnexpectedDataValue,
         FacilityNotSupported,
         UnknownSubscriber,
         AbsentSubscriber,
         UnauthorizedRequestingNetwork }

ProvideSubscriberLocation ::= OPERATION                                --Timer ml
    ARGUMENT
         provideSubscriberLocation-Arg   ProvideSubscriberLocation-Arg
    RESULT
         provideSubscriberLocation-Res   ProvideSubscriberLocation-Res
    ERRORS {
         DataMissing,
         UnexpectedDataValue,
         UnknownSubscriber,
         AbsentSubscriber,
         UnauthorizedRequestingNetwork,
         UnauthorizedLCSClient,
         PositionMethodFailure }
```

```
SubscriberLocationReport ::= OPERATION                                    --Timer m
     ARGUMENT
          subscriberLocationReport-Arg    SubscriberLocationReport-Arg
     RESULT
          subscriberLocationReport-Res    SubscriberLocationReport-Res
     ERRORS {
          DataMissing,
          UnexpectedDataValue,
          UnknownSubscriber,
          UnauthorizedRequestingNetwork,
          UnknownOrUnreachableLCSClient}

PerformLocation ::= OPERATION                                             --Timer ml
     ARGUMENT
          performLocation-Arg             PerformLocation-Arg
     RESULT
          performLocation-Res             PerformLocation-Res
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          PositionMethodFailure,
          PositionMethodFailureWithRestart }

LCSRegistration ::= OPERATION                                             --Timer m
     ARGUMENT
          lcsRegistration-Arg             LCSRegistration-Arg
     RESULT
          lcsRegistration-Res             LCSRegistration-Res
     ERRORS {
          SystemFailure,
          LMUUnknownOrOffline,
          DataMissing,
          UnexpectedDataValue }

LCSInformationRequest ::= OPERATION                                       --Timer s
     ARGUMENT
          lcsInformationRequest-Arg       LCSInformationRequest-Arg

LCSInformationReport ::= OPERATION                                        --Timer s
     ARGUMENT
          lcsInformationReport-Arg        LCSInformationReport-Arg

LCSReset ::= OPERATION                                                    --Timer s
     ARGUMENT
          lcsReset-Arg                    LCSReset-Arg

LCSAssignTrafficChannel ::= OPERATION                                     --Timer m
     ARGUMENT
          lcsAssignTrafficChannel-Arg     LCSAssignTrafficChannel-Arg
     RESULT
          lcsAssignTrafficChannel-Res     LCSAssignTrafficChannel-Res
     ERRORS {
          SystemFailure,
          DataMissing,
          UnexpectedDataValue,
          TrafficChannelEstablishmentFailure }

END
```

17.7 MAP constants and data types

17.7.1 Mobile Service data types

```
MAP-MS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-MS-DataTypes (11) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN
```

```
EXPORTS

   -- location registration types
   UpdateLocationArg,
   UpdateLocationRes,
   CancelLocationArg,
   CancelLocationRes,
   PurgeMS-Arg,
   PurgeMS-Res,
   SendIdentificationRes,
   UpdateGprsLocationArg,
   UpdateGprsLocationRes,
   IST-SupportIndicator,


   -- handover types
   PrepareHO-Arg,
   PrepareHO-Res,
   PrepareSubsequentHO-Arg,

   -- authentication management types
   SendAuthenticationInfoArg,
   SendAuthenticationInfoRes,

   -- security management types
   EquipmentStatus,
   Kc,

   -- subscriber management types
   InsertSubscriberDataArg,
   InsertSubscriberDataRes,
   DeleteSubscriberDataArg,
   DeleteSubscriberDataRes,
   SubscriberData,
   ODB-Data,
   SubscriberStatus,
   ZoneCodeList,
   maxNumOfZoneCodes,
   O-CSI,
   O-BcsmCamelTDPCriteriaList,
   SS-CSI,
   ServiceKey,
   DefaultCallHandling,
   CamelCapabilityHandling,
   BasicServiceCriteria,
   SupportedCamelPhases,
   maxNumOfCamelTDPData,
   CUG-Index,
   CUG-Interlock,
   InterCUG-Restrictions,
   IntraCUG-Options,
   IST-AlertTimerValue,


   -- fault recovery types
   ResetArg,
   RestoreDataArg,
   RestoreDataRes,

   -- subscriber information enquiry types
   ProvideSubscriberInfoArg,
   ProvideSubscriberInfoRes,
   SubscriberInfo,
   LocationInformation,
   SubscriberState,

   -- any time information enquiry types
   AnyTimeInterrogationArg,
   AnyTimeInterrogationRes,

   -- gprs location information retrieval types
   SendRoutingInfoForGprsArg,
   SendRoutingInfoForGprsRes,

   -- failure reporting types
   FailureReportArg,
   FailureReportRes,
```

```
90
91      -- gprs notification types
92      NoteMsPresentForGprsArg,
93      NoteMsPresentForGprsRes
94
95
96  ;
97
98  IMPORTS
99      IST-SupportIndicator,
100     IST-AlertTimerValue
101 FROM MAP-CH-DataTypes {
102     ccitt identified-organization (4) etsi (0) mobileDomain (0)
103     gsm-Network (1) modules (3) map-CH-DataTypes (13) version5 (5) }
104     maxNumOfSS,
105     SS-SubscriptionOption,
106     SS-List
107 FROM MAP-SS-DataTypes {
108     ccitt identified-organization (4) etsi (0) mobileDomain (0)
109     gsm-Network (1) modules (3) map-SS-DataTypes (14) version6 (6)}
110
111     SS-Code
112 FROM MAP-SS-Code {
113     ccitt identified-organization (4) etsi (0) mobileDomain (0)
114     gsm-Network (1) modules (3) map-SS-Code (15) version6 (6)}
115
116     Ext-BearerServiceCode
117 FROM MAP-BS-Code {
118     ccitt identified-organization (4) etsi (0) mobileDomain (0)
119     gsm-Network (1) modules (3) map-BS-Code (20) version6 (6)}
120
121     Ext-TeleserviceCode
122 FROM MAP-TS-Code {
123     ccitt identified-organization (4) etsi (0) mobileDomain (0)
124     gsm-Network (1) modules (3) map-TS-Code (19) version6 (6)}
125
126
127     ISDN-AddressString,
128     maxISDN-AddressLength,
129     ISDN-SubaddressString,
130     ExternalSignalInfo,
131     IMSI,
132     HLR-List,
133     LMSI,
134     Identity,
135     GlobalCellId,
136     CellIdOrLAI,
137     Ext-BasicServiceCode,
138     NAEA-PreferredCI,
139     EMLPP-Info,
140     SubscriberIdentity,
141     AgeOfLocationInformation,
142     LCSClientExternalID,
143     LCSClientInternalID
144
145
146
147 FROM MAP-CommonDataTypes {
148     ccitt identified-organization (4) etsi (0) mobileDomain (0)
149     gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}
150
151     ExtensionContainer
152 FROM MAP-ExtensionDataTypes {
153     ccitt identified-organization (4) etsi (0) mobileDomain (0)
154     gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}
155
156     AbsentSubscriberDiagnosticSM
157 FROM MAP-ER-DataTypes {
158     ccitt identified-organization (4) etsi (0) mobileDomain (0)
159     gsm-Network (1) modules (3) map-ER-DataTypes (17) version6 (6)}
160
161
162 ;
163
164
165 -- location registration types
166
```

```
UpdateLocationArg ::= SEQUENCE {
    imsi                            IMSI,

    msc-Number                      [1] ISDN-AddressString,
    vlr-Number                      ISDN-AddressString,
    lmsi                            [10] LMSI OPTIONAL,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ... ,
    vlr-Capability                  [6] VLR-Capability              OPTIONAL }
```

```
VLR-Capability ::= SEQUENCE{
    supportedCamelPhases            [0] SupportedCamelPhases        OPTIONAL,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ... ,
    solsaSupportIndicator           [2] NULL                        OPTIONAL,
    istSupportIndicator             [1] IST-SupportIndicator        OPTIONAL }
```

```
IST-SupportIndicator ::=  ENUMERATED {
    basicISTSupported               (0),
    istCommandSupported             (1),
    ...}
-- exception handling:
-- reception of values > 1 shall be mapped to ' istCommandSupported '
```

```
UpdateLocationRes ::= SEQUENCE {
    hlr-Number                      ISDN-AddressString,

    extensionContainer              ExtensionContainer              OPTIONAL,
    ... }
```

```
CancelLocationArg ::= [3] SEQUENCE {
    identity                        Identity,
    cancellationType                CancellationType                OPTIONAL,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}
```

```
CancellationType ::= ENUMERATED {
    updateProcedure                 (0),
    subscriptionWithdraw            (1),
    ...}
    -- The HLR shall not send values other than listed above
```

```
CancelLocationRes ::= SEQUENCE {
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}
```

```
PurgeMS-Arg ::= [3] SEQUENCE {
    imsi                            IMSI,
    vlr-Number                      [0] ISDN-AddressString          OPTIONAL,
    sgsn-Number                     [1]  ISDN-AddressString         OPTIONAL,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}
```

```
PurgeMS-Res ::= SEQUENCE {
    freezeTMSI                      [0]  NULL                       OPTIONAL,
    freezeP-TMSI                    [1]  NULL                       OPTIONAL,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}
```

```
SendIdentificationRes ::= SEQUENCE {
    imsi                            IMSI,
    authenticationSetList           AuthenticationSetList           OPTIONAL,
    ...}
```

```
AuthenticationSetList ::= SEQUENCE SIZE (1..5) OF
                                    AuthenticationSet
```

```
AuthenticationSet ::= SEQUENCE {
    rand                            RAND,
    sres                            SRES,
    kc                              Kc,
    ...}
```

```
RAND ::= OCTET STRING (SIZE (16))
```

```
SRES ::= OCTET STRING (SIZE (4))

Kc ::= OCTET STRING (SIZE (8))

-- gprs location registration types

UpdateGprsLocationArg ::= SEQUENCE {
    imsi                            IMSI,
    sgsn-Number                     ISDN-AddressString,
    sgsn-Address                    GSN-Address,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ... ,
    sgsn-Capability                 [0] SGSN-Capability             OPTIONAL }

SGSN-Capability ::= SEQUENCE{
    solsaSupportIndicator           NULL                            OPTIONAL,
    extensionContainer              [1] ExtensionContainer          OPTIONAL,
    ... }

GSN-Address ::= OCTET STRING (SIZE (5..17))
    -- Octets are coded according to TS GSM 03.03

UpdateGprsLocationRes ::= SEQUENCE {
    hlr-Number                      ISDN-AddressString,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}

-- handover types

PrepareHO-Arg ::= SEQUENCE {
    targetCellId                    GlobalCellId                    OPTIONAL,
    ho-NumberNotRequired            NULL                            OPTIONAL,
    bss-APDU                        ExternalSignalInfo              OPTIONAL,
    ...}

PrepareHO-Res ::= SEQUENCE {
    handoverNumber                  ISDN-AddressString              OPTIONAL,
    bss-APDU                        ExternalSignalInfo              OPTIONAL,
    ...}

PrepareSubsequentHO-Arg ::= SEQUENCE {
    targetCellId                    GlobalCellId,
    targetMSC-Number                ISDN-AddressString,
    bss-APDU                        ExternalSignalInfo,
    ...}

-- authentication management types

SendAuthenticationInfoArg ::= IMSI

SendAuthenticationInfoRes ::= AuthenticationSetList


-- security management types

EquipmentStatus ::= ENUMERATED {
    whiteListed  (0),
    blackListed  (1),
    greyListed  (2)}


-- subscriber management types
```

```
InsertSubscriberDataArg ::= SEQUENCE {
    imsi                                [0] IMSI                            OPTIONAL,
    COMPONENTS OF                       SubscriberData,
    extensionContainer                  [14] ExtensionContainer             OPTIONAL,
    ... ,
    naea-PreferredCI                    [15] NAEA-PreferredCI               OPTIONAL,
    -- naea-PreferredCI is included at the discretion of the HLR operator.
    gprsSubscriptionData                [16] GPRSSubscriptionData           OPTIONAL,
    roamingRestrictedInSgsnDueToUnsupportedFeature [23]                     NULL
                                                                            OPTIONAL,
    networkAccessMode                   [24] NetworkAccessMode              OPTIONAL,
    lsaInformation                      [25] LSAInformation                 OPTIONAL,
    lmu-Indicator                       [21] NULL                           OPTIONAL,
    lcsInformation                      [22] LCSInformation                 OPTIONAL,
    istAlertTimer                       [26] IST-AlertTimerValue            OPTIONAL
     }
    -- If the Network Access Mode parameter is sent, it shall be present only in
    -- the first sequence if segmentation is used

IST-AlertTimerValue ::= INTEGER (15..255)

LCSInformation ::= SEQUENCE {
    hplmn-GMLC-List                     [0]  HPLMN-GMLC-List                OPTIONAL,
    lcs-PrivacyExceptionList            [1]  LCS-PrivacyExceptionList       OPTIONAL,
    ...}

HPLMN-GMLC-List ::= SEQUENCE SIZE (1..maxNumOfGMLC) OF
                                        ISDN-AddressString

maxNumOfGMLC  INTEGER ::= 5


NetworkAccessMode ::= ENUMERATED {
    bothMSCAndSGSN                      (0),
    onlyMSC                             (1),
    onlySGSN                            (2),
    ...}
    -- if unknown values are received in NetworkAccessMode
    -- they shall be discarded.

GPRSDataList ::= SEQUENCE SIZE (1..maxNumOfPDP-Contexts) OF
                                        PDP-Context

maxNumOfPDP-Contexts  INTEGER ::= 50

PDP-Context ::= SEQUENCE {
    pdp-ContextId                       ContextId,
    pdp-Type                            [16] PDP-Type,
    pdp-Address                         [17] PDP-Address                    OPTIONAL,
    qos-Subscribed                      [18] QoS-Subscribed,
    vplmnAddressAllowed                 [19] NULL OPTIONAL,
    apn                                 [20] APN,
    extensionContainer                  [21] ExtensionContainer             OPTIONAL,
    ...}

ContextId ::= INTEGER (1..maxNumOfPDP-Contexts)


GPRSSubscriptionData ::= SEQUENCE {
    completeDataListIncluded            NULL                                OPTIONAL,

         -- If segmentation is used, completeDataListIncluded may only be present in the
         -- first segment.
    gprsDataList                        [1]  GPRSDataList,
    extensionContainer                  [2] ExtensionContainer              OPTIONAL,
    ...}


APN ::=  OCTET STRING (SIZE (2..63))
    -- Octets are coded according to TS GSM 03.03


PDP-Type ::= OCTET STRING (SIZE (2))
    -- Octets are coded according to TS GSM 09.60
```

```
PDP-Address ::= OCTET STRING (SIZE (1..16))
    -- Octets are coded according to TS GSM 09.60

    -- The possible size values are:
    -- 1-7 octets  X.25 address type
    --  4  octets  IPv4 address type
    -- 16  octets  Ipv6 address type
```

```
QoS-Subscribed ::= OCTET STRING (SIZE (3))
    -- Octets are coded according to TS GSM 04.08.
```

```
LSAOnlyAccessIndicator ::= ENUMERATED {
    accessOutsideLSAsAllowed  (0),
    accessOutsideLSAsRestricted (1)}
```

```
LSADataList ::= SEQUENCE SIZE (1..maxNumOfLSAs) OF
                                    LSAData
```

```
maxNumOfLSAs  INTEGER ::= 20
```

```
LSAData ::= SEQUENCE {
    lsaIdentity                     [0] LSAIdentity,
    lsaPriority                     [1] LSAPriority,
    lsaActiveModeIndicator          [2] NULL                        OPTIONAL,
    lsaActiveModeSupportIndicator   [3] NULL                        OPTIONAL,
    extensionContainer              [4] ExtensionContainer          OPTIONAL,
    ...}
```

```
LSAInformation ::= SEQUENCE {
    completeDataListIncluded        NULL                            OPTIONAL,

        -- If segmentation is used, completeDataListIncluded may only be present in the
        -- first segment.
    lsaOnlyAccessIndicator          [1]  LSAOnlyAccessIndicator     OPTIONAL,
    lsaDataList                     [2]  LSADataList                OPTIONAL,
    extensionContainer              [3] ExtensionContainer          OPTIONAL,
    ...}
```

```
LSAIdentity ::= OCTET STRING (SIZE (3))
    -- Octets are coded according to TS GSM 03.03
```

```
LSAPriority ::= OCTET STRING (SIZE (1))
    -- Octets are coded according to TS GSM 08.08
```

```
SubscriberData ::= SEQUENCE {
    msisdn                          [1] ISDN-AddressString          OPTIONAL,
    category                        [2] Category                    OPTIONAL,
    subscriberStatus                [3] SubscriberStatus            OPTIONAL,
    bearerServiceList               [4] BearerServiceList           OPTIONAL,
    -- The exception handling for reception of unsupported / not allocated
    -- bearerServiceCodes is defined in section 8.8.1
    teleserviceList                 [6] TeleserviceList             OPTIONAL,
    -- The exception handling for reception of unsupported / not allocated
    -- teleserviceCodes is defined in section 8.8.1
    provisionedSS                   [7] Ext-SS-InfoList             OPTIONAL,
    odb-Data                        [8] ODB-Data                    OPTIONAL,
    roamingRestrictionDueToUnsupportedFeature  [9] NULL             OPTIONAL,
    regionalSubscriptionData        [10] ZoneCodeList               OPTIONAL,
    vbsSubscriptionData             [11] VBSDataList                OPTIONAL,
    vgcsSubscriptionData            [12] VGCSDataList               OPTIONAL,
    vlrCamelSubscriptionInfo        [13] VlrCamelSubscriptionInfo   OPTIONAL
    }
```

```
Category ::= OCTET STRING (SIZE (1))
    -- The internal structure is defined in CCITT Rec Q.763.
```

```
SubscriberStatus ::= ENUMERATED {
    serviceGranted  (0),
    operatorDeterminedBarring  (1)}
```

```
BearerServiceList ::= SEQUENCE SIZE (1..maxNumOfBearerServices) OF
                                    Ext-BearerServiceCode
```

```
maxNumOfBearerServices  INTEGER ::= 50
```

```
TeleserviceList ::= SEQUENCE SIZE (1..maxNumOfTeleservices) OF
                                        Ext-TeleserviceCode

maxNumOfTeleservices  INTEGER ::= 20

ODB-Data ::= SEQUENCE {
    odb-GeneralData                     ODB-GeneralData,
    odb-HPLMN-Data                      ODB-HPLMN-Data                  OPTIONAL,
    extensionContainer                  ExtensionContainer              OPTIONAL,
    ...}

ODB-GeneralData ::= BIT STRING {
    allOG-CallsBarred  (0),
    internationalOGCallsBarred  (1),
    internationalOGCallsNotToHPLMN-CountryBarred  (2),
    interzonalOGCallsBarred (6),
    interzonalOGCallsNotToHPLMN-CountryBarred (7),
    interzonalOGCallsAndInternationalOGCallsNotToHPLMN-CountryBarred (8),
    premiumRateInformationOGCallsBarred  (3),
    premiumRateEntertainementOGCallsBarred  (4),
    ss-AccessBarred  (5),
    allECT-Barred (9),
    chargeableECT-Barred (10),
    internationalECT-Barred (11),
    interzonalECT-Barred (12),
    doublyChargeableECT-Barred (13),
    multipleECT-Barred (14)} (SIZE (15..32))
    -- exception handling: reception of unknown bit assignments in the
    -- ODB-GeneralData type shall be treated like unsupported ODB-GeneralData

ODB-HPLMN-Data ::= BIT STRING {
    plmn-SpecificBarringType1  (0),
    plmn-SpecificBarringType2  (1),
    plmn-SpecificBarringType3  (2),
    plmn-SpecificBarringType4  (3)} (SIZE (4..32))
    -- exception handling: reception of unknown bit assignments in the
    -- ODB-HPLMN-Data type shall be treated like unsupported ODB-HPLMN-Data

Ext-SS-InfoList ::= SEQUENCE SIZE (1..maxNumOfSS) OF
                                        Ext-SS-Info

Ext-SS-Info ::= CHOICE {
    forwardingInfo                      [0] Ext-ForwInfo,
    callBarringInfo                     [1] Ext-CallBarInfo,
    cug-Info                            [2] CUG-Info,
    ss-Data                             [3] Ext-SS-Data,
    emlpp-Info                          [4] EMLPP-Info}


Ext-ForwInfo ::= SEQUENCE {
    ss-Code                             SS-Code,
    forwardingFeatureList               Ext-ForwFeatureList,
    extensionContainer                  [0] ExtensionContainer          OPTIONAL,
    ...}

Ext-ForwFeatureList ::= SEQUENCE SIZE (1..maxNumOfExt-BasicServiceGroups) OF
                                        Ext-ForwFeature

Ext-ForwFeature ::= SEQUENCE {
    basicService                        Ext-BasicServiceCode            OPTIONAL,
    ss-Status [4] Ext-SS-Status,
    forwardedToNumber                   [5] ISDN-AddressString          OPTIONAL,
    -- When this data type is sent from an HLR which supports CAMEL Phase 2
    -- to a VLR that supports CAMEL Phase 2 the VLR shall not check the
    -- format of the number
    forwardedToSubaddress               [8] ISDN-SubaddressString       OPTIONAL,
    forwardingOptions                   [6] Ext-ForwOptions             OPTIONAL,
    noReplyConditionTime                [7] Ext-NoRepCondTime           OPTIONAL,
    extensionContainer                  [9] ExtensionContainer          OPTIONAL,
    ...}
```

```
Ext-SS-Status ::= OCTET STRING (SIZE (1..5))

    -- OCTET 1:
    --
    -- bits 8765: 0000 (unused)
    -- bits 4321: Used to convey the "P bit","R bit","A bit" and "Q bit",
    --            representing supplementary service state information
    --            as defined in TS GSM 03.11

    -- bit 4: "Q bit"

    -- bit 3: "P bit"

    -- bit 2: "R bit"

    -- bit 1: "A bit"

    -- OCTETS 2-5: reserved for future use. They shall be discarded if
    -- received and not understood.
```

```
Ext-ForwOptions ::= OCTET STRING (SIZE (1..5))

    -- OCTET 1:

    --  bit 8: notification to forwarding party
    --   0  no notification
    --   1  notification

    --  bit 7: redirecting presentation
    --   0 no presentation
    --   1  presentation

    --  bit 6: notification to calling party
    --   0  no notification
    --   1  notification

    --  bit 5: 0 (unused)

    --  bits 43: forwarding reason
    --   00  ms not reachable
    --   01  ms busy
    --   10  no reply
    --   11  unconditional

    -- bits 21: 00 (unused)

    -- OCTETS 2-5: reserved for future use. They shall be discarded if
    -- received and not understood.
```

```
Ext-NoRepCondTime ::= INTEGER (1..100)
    -- Only values 5-30 are used.
    -- Values in the ranges 1-4 and 31-100 are reserved for future use
    -- If received:
    --       values 1-4 shall be mapped on to value 5
    --       values 31-100 shall be mapped on to value 30
```

```
Ext-CallBarInfo ::= SEQUENCE {
    ss-Code                         SS-Code,
    callBarringFeatureList          Ext-CallBarFeatureList,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}
```

```
Ext-CallBarFeatureList ::= SEQUENCE SIZE (1..maxNumOfExt-BasicServiceGroups) OF
                                    Ext-CallBarringFeature
```

```
Ext-CallBarringFeature ::= SEQUENCE {
    basicService                    Ext-BasicServiceCode            OPTIONAL,
    ss-Status [4] Ext-SS-Status,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}
```

```
CUG-Info ::= SEQUENCE {
    cug-SubscriptionList            CUG-SubscriptionList,
    cug-FeatureList                 CUG-FeatureList                 OPTIONAL,
    extensionContainer              [0] ExtensionContainer          OPTIONAL,
    ...}
```

```
CUG-SubscriptionList ::= SEQUENCE SIZE (0..maxNumOfCUG) OF
                                        CUG-Subscription

CUG-Subscription ::= SEQUENCE {
    cug-Index CUG-Index,
    cug-Interlock                       CUG-Interlock,
    intraCUG-Options                    IntraCUG-Options,
    basicServiceGroupList               Ext-BasicServiceGroupList         OPTIONAL,
    extensionContainer                  [0] ExtensionContainer            OPTIONAL,
    ...}

CUG-Index ::= INTEGER (0..32767)
    -- The internal structure is defined in ETS 300 138.

CUG-Interlock ::= OCTET STRING (SIZE (4))

IntraCUG-Options ::= ENUMERATED {
    noCUG-Restrictions  (0),
    cugIC-CallBarred  (1),
    cugOG-CallBarred  (2)}

maxNumOfCUG  INTEGER ::= 10

CUG-FeatureList ::= SEQUENCE SIZE (1..maxNumOfExt-BasicServiceGroups) OF
                                        CUG-Feature

Ext-BasicServiceGroupList ::= SEQUENCE SIZE (1..maxNumOfExt-BasicServiceGroups) OF
                                        Ext-BasicServiceCode

maxNumOfExt-BasicServiceGroups  INTEGER ::= 32

CUG-Feature ::= SEQUENCE {
    basicService                        Ext-BasicServiceCode              OPTIONAL,
    preferentialCUG-Indicator           CUG-Index OPTIONAL,
    interCUG-Restrictions               InterCUG-Restrictions,
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

InterCUG-Restrictions ::= OCTET STRING (SIZE (1))

    -- bits 876543: 000000 (unused)
    -- Exception handling:
    -- bits 876543 shall be ignored if received and not understood

    -- bits 21
    --   00  CUG only facilities
    --   01  CUG with outgoing access
    --   10  CUG with incoming access
    --   11  CUG with both outgoing and incoming access

Ext-SS-Data ::= SEQUENCE {
    ss-Code                             SS-Code,
    ss-Status [4] Ext-SS-Status,
    ss-SubscriptionOption               SS-SubscriptionOption             OPTIONAL,
    basicServiceGroupList               Ext-BasicServiceGroupList         OPTIONAL,
    extensionContainer                  [5] ExtensionContainer            OPTIONAL,
    ...}

LCS-PrivacyExceptionList ::= SEQUENCE SIZE (1..maxNumOfPrivacyClass) OF
                                        LCS-PrivacyClass

maxNumOfPrivacyClass  INTEGER ::= 4
```

```
LCS-PrivacyClass ::= SEQUENCE {
    ss-Code                         SS-Code,
    ss-Status                       Ext-SS-Status,
    externalClientList              [0] ExternalClientList          OPTIONAL,
    -- externalClientList is expected only for SS-code = callunrelated
    plmnClientList                  [1] PLMNClientList              OPTIONAL,
    -- plmnClientList is expected only for SS-code - plmn
    extensionContainer              [2] ExtensionContainer          OPTIONAL,
    ...}

ExternalClientList ::= SEQUENCE SIZE (1..maxNumOfExternalClient) OF
                                    ExternalClient

maxNumOfExternalClient  INTEGER ::= 5

PLMNClientList ::= SEQUENCE SIZE (1..maxNumOfPLMNClient) OF
                                    LCSClientInternalID

maxNumOfPLMNClient  INTEGER ::= 5

ExternalClient ::= SEQUENCE {
    clientIdentity                  LCSClientExternalID,
    gmlc-Restriction                [0] GMLC-Restriction            OPTIONAL,
    extensionContainer              [1] ExtensionContainer          OPTIONAL,
    ... }

GMLC-Restriction ::= ENUMERATED {
    hplmn                           (0),
    home-Country                    (1)}

ZoneCodeList ::= SEQUENCE SIZE (1..maxNumOfZoneCodes)
                                    OF ZoneCode

ZoneCode ::= OCTET STRING (SIZE (2))
    -- internal structure is defined in TS GSM 03.03

maxNumOfZoneCodes  INTEGER ::= 10

InsertSubscriberDataRes ::= SEQUENCE {
    teleserviceList                 [1] TeleserviceList             OPTIONAL,
    bearerServiceList               [2] BearerServiceList           OPTIONAL,
    ss-List                         [3] SS-List                     OPTIONAL,
    odb-GeneralData                 [4] ODB-GeneralData             OPTIONAL,
    regionalSubscriptionResponse    [5] RegionalSubscriptionResponse  OPTIONAL,
    supportedCamelPhases            [6] SupportedCamelPhases        OPTIONAL,
    extensionContainer              [7] ExtensionContainer          OPTIONAL,
    ...}

RegionalSubscriptionResponse ::= ENUMERATED {
    networkNode-AreaRestricted      (0),
    tooManyZoneCodes                (1),
    zoneCodesConflict               (2),
    regionalSubscNotSupported       (3)}

DeleteSubscriberDataArg ::= SEQUENCE {
    imsi                            [0] IMSI,
    basicServiceList                [1] BasicServiceList            OPTIONAL,
    -- The exception handling for reception of unsupported/not allocated
    -- basicServiceCodes is defined in section 6.8.2
    ss-List                         [2] SS-List                     OPTIONAL,
    roamingRestrictionDueToUnsupportedFeature [4] NULL              OPTIONAL,
    regionalSubscriptionIdentifier  [5] ZoneCode                    OPTIONAL,
    vbsGroupIndication              [7] NULL                        OPTIONAL,
    vgcsGroupIndication             [8] NULL   OPTIONAL,
    camelSubscriptionInfoWithdraw   [9] NULL   OPTIONAL,
    extensionContainer              [6] ExtensionContainer OPTIONAL,
    ...,
    gprsSubscriptionDataWithdraw    [10] GPRSSubscriptionDataWithdraw OPTIONAL,
    roamingRestrictedInSgsnDueToUnsuppportedFeature [11] NULL       OPTIONAL,
    lsaInformationWithdraw          [12] LSAInformationWithdraw     OPTIONAL,
    istInformationWithdraw          [13] NULL                       OPTIONAL }

GPRSSubscriptionDataWithdraw ::= CHOICE {
    allGPRSData                     NULL,
    contextIdList                   ContextIdList}
```

```
ContextIdList ::= SEQUENCE SIZE (1..maxNumOfPDP-Contexts) OF
                                        ContextId

LSAInformationWithdraw ::= CHOICE {
    allLSAData                          NULL,
    lsaIdentityList                     LSAIdentityList }

LSAIdentityList ::= SEQUENCE SIZE (1..maxNumOfLSAs) OF
                                        LSAIdentity

BasicServiceList ::= SEQUENCE SIZE (1..maxNumOfBasicServices) OF
                                        Ext-BasicServiceCode

maxNumOfBasicServices  INTEGER ::= 70

DeleteSubscriberDataRes ::= SEQUENCE {
    regionalSubscriptionResponse        [0] RegionalSubscriptionResponse  OPTIONAL,
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

VlrCamelSubscriptionInfo ::= SEQUENCE {
    o-CSI                               [0] O-CSI                         OPTIONAL,
    extensionContainer                  [1] ExtensionContainer            OPTIONAL,
    ...,
    ss-CSI                              [2] SS-CSI                        OPTIONAL,
    o-BcsmCamelTDP-CriteriaList         [4] O-BcsmCamelTDPCriteriaList    OPTIONAL,
    tif-CSI                             [3] NULL                          OPTIONAL}

SS-CSI ::= SEQUENCE {
    ss-CamelData                        SS-CamelData,
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

SS-CamelData  ::= SEQUENCE {
    ss-EventList                        SS-EventList,
    gsmSCF-Address                      ISDN-AddressString,
    extensionContainer                  [0] ExtensionContainer            OPTIONAL,
    ... }

SS-EventList  ::= SEQUENCE SIZE (1..maxNumOfCamelSSEvents) OF SS-Code
    -- Actions for the following SS-Code values are defined in CAMEL Phase 2:
    -- ect                              SS-Code ::= '00110001'B
    -- multiPTY                         SS-Code ::= '01010001'B
    -- cd                               SS-Code ::= '00100100'B
    -- all other SS codes shall be ignored

maxNumOfCamelSSEvents INTEGER ::= 10

O-CSI ::= SEQUENCE {
    o-BcsmCamelTDPDataList              O-BcsmCamelTDPDataList,
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...,
    camelCapabilityHandling             [0] CamelCapabilityHandling       OPTIONAL}

O-BcsmCamelTDPDataList ::= SEQUENCE SIZE (1..maxNumOfCamelTDPData) OF
    O-BcsmCamelTDPData
    --- O-BcsmCamelTDPDataList shall not contain more than one instance of
    --- O-BcsmCamelTDPData containing the same value for o-BcsmTriggerDetectionPoint.
    --- For CAMEL Phase 2, this means that only one instance of O-BcsmCamelTDPData is allowed
    --- with o-BcsmTriggerDetectionPoint being equal to DP2.

maxNumOfCamelTDPData  INTEGER ::= 10

O-BcsmCamelTDPData ::= SEQUENCE {
    o-BcsmTriggerDetectionPoint         O-BcsmTriggerDetectionPoint,
    serviceKey                          ServiceKey,
    gsmSCF-Address                      [0] ISDN-AddressString,
    defaultCallHandling                 [1] DefaultCallHandling,
    extensionContainer                  [2] ExtensionContainer            OPTIONAL,
    ... }

ServiceKey ::= INTEGER (0..2147483647)
```

```
O-BcsmTriggerDetectionPoint ::= ENUMERATED {
    collectedInfo (2),
    ...}
    -- exception handling:
    -- For O-BcsmCamelTDPData sequences containing this parameter with any
    -- other value than the ones listed the receiver shall ignore the whole
    -- O-BcsmCamelTDPDatasequence.
    -- For O-BcsmCamelTDP-Criteria sequences containing this parameter with any
    -- other value than the ones listed the receiver shall ignore the whole
    -- O-BcsmCamelTDP-Criteria sequence.

O-BcsmCamelTDPCriteriaList ::= SEQUENCE SIZE (1..maxNumOfCamelTDPData) OF
    O-BcsmCamelTDP-Criteria

O-BcsmCamelTDP-Criteria ::= SEQUENCE {
    o-BcsmTriggerDetectionPoint          O-BcsmTriggerDetectionPoint,
    destinationNumberCriteria            [0] DestinationNumberCriteria     OPTIONAL,
    basicServiceCriteria                 [1] BasicServiceCriteria          OPTIONAL,
    callTypeCriteria                     [2] CallTypeCriteria              OPTIONAL,
    ...}

DestinationNumberCriteria  ::= SEQUENCE {
    matchType                            [0] MatchType,
    destinationNumberList                [1] DestinationNumberList         OPTIONAL,
    destinationNumberLengthList          [2] DestinationNumberLengthList   OPTIONAL,
    -- one or both of destinationNumberList and destinationNumberLengthList
    -- shall be present
    ...}

DestinationNumberList  ::= SEQUENCE SIZE (1..maxNumOfCamelDestinationNumbers) OF
                                         ISDN-AddressString
    -- The receiving entity shall not check the format of a number in
    -- the dialled number list

DestinationNumberLengthList  ::= SEQUENCE SIZE (1..maxNumOfCamelDestinationNumberLengths) OF
                                             INTEGER(1..maxNumOfISDN-AddressDigits)

BasicServiceCriteria   ::= SEQUENCE SIZE(1..maxNumOfCamelBasicServiceCriteria) OF
    Ext-BasicServiceCode

maxNumOfISDN-AddressDigits  INTEGER ::= 15

maxNumOfCamelDestinationNumbers  INTEGER ::= 10

maxNumOfCamelDestinationNumberLengths  INTEGER ::= 3

maxNumOfCamelBasicServiceCriteria  INTEGER ::= 5

CallTypeCriteria       ::= ENUMERATED {
    forwarded                            (0),
    notForwarded                         (1)}

MatchType       ::= ENUMERATED {
    inhibiting                           (0),
    enabling                             (1)}


DefaultCallHandling ::= ENUMERATED {
    continueCall (0) ,
    releaseCall (1) ,
    ...}
    -- exception handling:
    -- reception of values in range 2-31 shall be treated as "continueCall"
    -- reception of values greater than 31 shall be treated as "releaseCall"

CamelCapabilityHandling ::= INTEGER(1..16)
    -- value 1 = CAMEL phase 1,
    -- value 2 = CAMEL phase 2:
    -- reception of values greater than 2 shall be treated as CAMEL phase 2

SupportedCamelPhases ::= BIT STRING {
    phase1 (0),
    phase2 (1) } (SIZE (1..16))
```

```
-- gprs location information retrieval types

SendRoutingInfoForGprsArg ::= SEQUENCE {
     imsi                                  [0] IMSI,
     ggsn-Address                          [1] GSN-Address             OPTIONAL,
     extensionContainer                    [2] ExtensionContainer      OPTIONAL,
     ...}

SendRoutingInfoForGprsRes ::= SEQUENCE {
     sgsn-Address                          [0] GSN-Address,
     ggsn-Address                          [1]  GSN-Address            OPTIONAL,
     mobileNotReachableReason              [2]  AbsentSubscriberDiagnosticSM    OPTIONAL,
     extensionContainer                    [3] ExtensionContainer      OPTIONAL,
     ...}

-- failure report types

FailureReportArg ::= SEQUENCE {
     imsi                                  [0] IMSI,
     ggsn-Number                           [1] ISDN-AddressString      ,
     ggsn-Address                          [2] GSN-Address             OPTIONAL,
     extensionContainer                    [3] ExtensionContainer      OPTIONAL,
     ...}

FailureReportRes ::= SEQUENCE {
     ggsn-Address                          [0] GSN-Address             OPTIONAL,
     extensionContainer                    [1] ExtensionContainer      OPTIONAL,
     ...}

-- gprs notification types

NoteMsPresentForGprsArg ::= SEQUENCE {
     imsi                                  [0] IMSI,
     sgsn-Address                          [1] GSN-Address,
     ggsn-Address                          [2] GSN-Address             OPTIONAL,
     extensionContainer                    [3] ExtensionContainer      OPTIONAL,
     ...}

NoteMsPresentForGprsRes ::= SEQUENCE {
     extensionContainer                    [0] ExtensionContainer      OPTIONAL,
     ...}


-- fault recovery types

ResetArg ::= SEQUENCE {
     hlr-Number                       ISDN-AddressString,
     hlr-List                         HLR-List                    OPTIONAL,
     ...}

RestoreDataArg ::= SEQUENCE {
     imsi                             IMSI,
     lmsi                             LMSI                        OPTIONAL,
     extensionContainer               ExtensionContainer          OPTIONAL,
     ... ,
     vlr-Capability                   [6] VLR-Capability          OPTIONAL }

RestoreDataRes ::= SEQUENCE {
     hlr-Number                       ISDN-AddressString,
     msNotReachable                   NULL                        OPTIONAL,
     extensionContainer               ExtensionContainer          OPTIONAL,
     ...}

-- VBS/VGCS types
VBSDataList ::= SEQUENCE SIZE (1..maxNumOfVBSGroupIds) OF
                                      VoiceBroadcastData

VGCSDataList ::= SEQUENCE SIZE (1..maxNumOfVGCSGroupIds) OF
                                      VoiceGroupCallData

maxNumOfVBSGroupIds  INTEGER ::= 50

maxNumOfVGCSGroupIds  INTEGER ::= 50
```

```
VoiceGroupCallData  ::= SEQUENCE {
    groupId                         GroupId,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}

VoiceBroadcastData ::= SEQUENCE {
    groupid                         GroupId,
    broadcastInitEntitlement        NULL                            OPTIONAL,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}

GroupId  ::= OCTET STRING (SIZE (3))
    -- Refers to the Group Identification as specified in GSM TS 03.03
    -- and 03.68/ 03.69

-- provide subscriber info types

ProvideSubscriberInfoArg ::= SEQUENCE {
    imsi     [0] IMSI,
    lmsi     [1] LMSI               OPTIONAL,
    requestedInfo                   [2] RequestedInfo,
    extensionContainer              [3] ExtensionContainer          OPTIONAL,
    ...}

ProvideSubscriberInfoRes ::= SEQUENCE {
    subscriberInfo                  SubscriberInfo,
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}

SubscriberInfo ::= SEQUENCE {
    locationInformation             [0] LocationInformation         OPTIONAL,
    subscriberState                 [1] SubscriberState             OPTIONAL,
    extensionContainer              [2] ExtensionContainer          OPTIONAL,
    ...}

RequestedInfo ::= SEQUENCE {
    locationInformation             [0] NULL                        OPTIONAL,
    subscriberState                 [1] NULL                        OPTIONAL,
    extensionContainer              [2] ExtensionContainer          OPTIONAL,
    ...}

LocationInformation ::= SEQUENCE {
    ageOfLocationInformation        AgeOfLocationInformation        OPTIONAL,
    geographicalInformation         [0] GeographicalInformation     OPTIONAL,
    vlr-number                      [1] ISDN-AddressString          OPTIONAL,
    locationNumber                  [2] LocationNumber              OPTIONAL,
    cellIdOrLAI                     [3] CellIdOrLAI                 OPTIONAL,
    extensionContainer              [4] ExtensionContainer          OPTIONAL,
    ...}

GeographicalInformation ::= OCTET STRING (SIZE (8))
    -- Refers to geographical Information defined in GSM 03.32.
    -- Only the description of an ellipsoid point with uncertainty circle
    -- as specified in GSM 03.32 is allowed to be used
    -- The internal structure according to GSM 03.32 is as follows:
    --       Type of shape (ellipsoid point with uncertainty circle)    1 octet
    --       Degrees of Latitude                                        3 octets
    --       Degrees of Longitude                                       3 octets
    --       Uncertainty code                                           1 octet

LocationNumber ::= OCTET STRING (SIZE (2..10))
    -- the internal structure is defined in CCITT Rec Q.763

SubscriberState ::= CHOICE {
    assumedIdle                     [0] NULL,
    camelBusy [1] NULL,
    netDetNotReachable              NotReachableReason,
    notProvidedFromVLR              [2] NULL}

NotReachableReason ::= ENUMERATED {
    msPurged (0),
    imsiDetached (1),
    restrictedArea (2),
    notRegistered (3)}

-- any time interrogation info types
```

```
AnyTimeInterrogationArg ::= SEQUENCE {
    subscriberIdentity                  [0] SubscriberIdentity,
    requestedInfo                       [1] RequestedInfo,
    gsmSCF-Address                      [3] ISDN-AddressString,
    extensionContainer                  [2] ExtensionContainer          OPTIONAL,
    ...}
```

```
AnyTimeInterrogationRes ::= SEQUENCE {
    subscriberInfo                      SubscriberInfo,
    extensionContainer                  ExtensionContainer              OPTIONAL,
    ...}
```

```
END
```

17.7.2 Operation and maintenance data types

```
MAP-OM-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-OM-DataTypes (12) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN

EXPORTS
   ActivateTraceModeArg,
   ActivateTraceModeRes,
   DeactivateTraceModeArg,
   DeactivateTraceModeRes
;

IMPORTS
   AddressString,
   IMSI
FROM MAP-CommonDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}

   ExtensionContainer
FROM MAP-ExtensionDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}


;

ActivateTraceModeArg ::= SEQUENCE {
    imsi                                [0] IMSI                        OPTIONAL,
    traceReference                      [1] TraceReference,
    traceType [2] TraceType,
    omc-Id                              [3] AddressString               OPTIONAL,
    extensionContainer                  [4] ExtensionContainer          OPTIONAL,
    ...}

TraceReference ::= OCTET STRING (SIZE (1..2))

TraceType ::= INTEGER
    (0..255)
    -- Trace types are fully defined in TS GSM 12.08.

ActivateTraceModeRes ::= SEQUENCE {
    extensionContainer                  [0] ExtensionContainer          OPTIONAL,
    ...}

DeactivateTraceModeArg ::= SEQUENCE {
    imsi                                [0] IMSI                        OPTIONAL,
    traceReference                      [1] TraceReference,
    extensionContainer                  [2] ExtensionContainer          OPTIONAL,
    ...}
```

```
DeactivateTraceModeRes ::= SEQUENCE {
     extensionContainer                  [0] ExtensionContainer            OPTIONAL,
     ...}

END
```

17.7.3 Call handling data types

```
MAP-CH-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-CH-DataTypes (13) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN

EXPORTS
   SendRoutingInfoArg,
   SendRoutingInfoRes,
   ProvideRoamingNumberArg,
   ProvideRoamingNumberRes,
   ResumeCallHandlingArg,
   ResumeCallHandlingRes,
   NumberOfForwarding,
   SuppressionOfAnnouncement,
   CallReferenceNumber,
   ProvideSIWFSNumberArg,
   ProvideSIWFSNumberRes,
   SIWFSSignallingModifyArg,
   SIWFSSignallingModifyRes,
   SetReportingStateArg,
   SetReportingStateRes,
   StatusReportArg,
   StatusReportRes,
   RemoteUserFreeArg,
   RemoteUserFreeRes,
   IST-AlertArg,
   IST-AlertRes,
   IST-CommandArg,
   IST-CommandRes
   IST-SupportIndicator,
   IST-AlertTimerValue
;

IMPORTS
   maxNumOfCamelTDPData,
   SubscriberInfo,
   ServiceKey,
   DefaultCallHandling,
   SupportedCamelPhases,
   CamelCapabilityHandling,
   BasicServiceCriteria,
   CUG-Interlock,
   O-CSI,
   O-BcsmCamelTDPCriteriaList,


FROM MAP-MS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-MS-DataTypes (11) version6 (6)}

   ForwardingOptions,
   SS-List,
   CCBS-Feature
FROM MAP-SS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-SS-DataTypes (14) version6 (6)}

   ISDN-AddressString,
   ISDN-SubaddressString,
   ExternalSignalInfo,
   Ext-ExternalSignalInfo,
   IMSI,
   LMSI,
```

```
   Ext-BasicServiceCode,
   AlertingPattern,
   NAEA-PreferredCI


FROM MAP-CommonDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}

   ExtensionContainer
FROM MAP-ExtensionDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}
;


CUG-CheckInfo ::= SEQUENCE {
     cug-Interlock                    CUG-Interlock,
     cug-OutgoingAccess               NULL                              OPTIONAL,
     extensionContainer               ExtensionContainer                OPTIONAL,
     ...}

NumberOfForwarding ::= INTEGER (1..5)

SendRoutingInfoArg ::= SEQUENCE {
     msisdn                           [0] ISDN-AddressString,
     cug-CheckInfo                    [1] CUG-CheckInfo                 OPTIONAL,
     numberOfForwarding               [2] NumberOfForwarding            OPTIONAL,
     interrogationType                [3] InterrogationType,
     or-Interrogation                 [4] NULL                          OPTIONAL,
     or-Capability                    [5] OR-Phase                      OPTIONAL,
     gmsc-Address                     [6] ISDN-AddressString,
     callReferenceNumber              [7] CallReferenceNumber           OPTIONAL,
     forwardingReason                 [8] ForwardingReason              OPTIONAL,
     basicServiceGroup                [9] Ext-BasicServiceCode          OPTIONAL,
     networkSignalInfo                [10] ExternalSignalInfo           OPTIONAL,
     camelInfo                        [11] CamelInfo                    OPTIONAL,
     suppressionOfAnnouncement        [12] SuppressionOfAnnouncement    OPTIONAL,
     extensionContainer               [13] ExtensionContainer           OPTIONAL,
     ...,
     alertingPattern                  [14] AlertingPattern              OPTIONAL,
     ccbs-Call                        [15] NULL                          OPTIONAL,
     supportedCCBS-Phase              [16]  SupportedCCBS-Phase         OPTIONAL,
     additionalSignalInfo             [17] Ext-ExternalSignalInfo       OPTIONAL,
     istSupportIndicator              [18] IST-SupportIndicator         OPTIONAL,
     pre-pagingSupported              [19] NULL                         OPTIONAL }

SuppressionOfAnnouncement ::= NULL

InterrogationType ::= ENUMERATED {
     basicCall  (0),
     forwarding  (1)}

OR-Phase ::= INTEGER (1..127)

CallReferenceNumber ::= OCTET STRING (SIZE (1..8))

ForwardingReason ::= ENUMERATED {
     notReachable  (0),
     busy  (1),
     noReply  (2)}

SupportedCCBS-Phase ::= INTEGER (1..127)
-- exception handling:
-- Only value 1 is used.
-- Values in the ranges 2-127 are reserved for future use.
-- If received values 2-127 shall be mapped on to value 1.
```

```
SendRoutingInfoRes ::= [3] SEQUENCE {
    imsi                                [9] IMSI                                OPTIONAL,
    -- IMSI must be present if SendRoutingInfoRes is not segmented.
    -- If the TC-Result-NL segmentation option is taken the IMSI must be
    -- present in one segmented transmission of SendRoutingInfoRes.
    extendedRoutingInfo                 ExtendedRoutingInfo                 OPTIONAL,
    cug-CheckInfo                       [3] CUG-CheckInfo                   OPTIONAL,
    cugSubscriptionFlag                 [6] NULL                            OPTIONAL,
    subscriberInfo                      [7] SubscriberInfo                  OPTIONAL,
    ss-List                             [1] SS-List                         OPTIONAL,
    basicService                        [5] Ext-BasicServiceCode            OPTIONAL,
    forwardingInterrogationRequired     [4] NULL                            OPTIONAL,
    vmsc-Address                        [2] ISDN-AddressString              OPTIONAL,
    extensionContainer                  [0] ExtensionContainer              OPTIONAL,
    ... ,
    naea-PreferredCI                    [10] NAEA-PreferredCI               OPTIONAL,
    -- naea-PreferredCI is included at the discretion of the HLR operator.
    ccbs-Indicators                     [11] CCBS-Indicators                OPTIONAL,
    msisdn                              [12] ISDN-AddressString             OPTIONAL,
    numberPortabilityStatus             [13] NumberPortabilityStatus        OPTIONAL,
    istAlertTimer                       [14] IST-AlertTimerValue            OPTIONAL
    }

NumberPortabilityStatus ::= ENUMERATED {
    notKnownToBePorted                  (0),
    ownNumberPortedOut                  (1),
    foreignNumberPortedToForeignNetwork (2),
    ...}
    --   exception handling:
    --  reception of other values than the ones listed the receiver shall ignore the
    --  whole NumberPortabilityStatus

CCBS-Indicators ::= SEQUENCE {
    ccbs-Possible                       [0]  NULL                           OPTIONAL,
    keepCCBS-CallIndicator              [1]  NULL                           OPTIONAL,
    extensionContainer                  [2]  ExtensionContainer             OPTIONAL,
    ...}

RoutingInfo ::= CHOICE {
    roamingNumber                       ISDN-AddressString,
    forwardingData                      ForwardingData}

ForwardingData ::= SEQUENCE {
    forwardedToNumber                   [5] ISDN-AddressString              OPTIONAL,
    -- When this datatype is sent from an HLR which supports CAMEL Phase 2
    -- to a GMSC which supports CAMEL Phase 2 the GMSC shall not check the
    -- format of the number
    forwardedToSubaddress               [4] ISDN-SubaddressString           OPTIONAL,
    forwardingOptions                   [6] ForwardingOptions               OPTIONAL,
    extensionContainer                  [7] ExtensionContainer              OPTIONAL,
    ...}

ProvideRoamingNumberArg ::= SEQUENCE {
    imsi                                [0] IMSI,
    msc-Number                          [1] ISDN-AddressString,
    msisdn                              [2] ISDN-AddressString              OPTIONAL,
    lmsi                                [4] LMSI                            OPTIONAL,
    gsm-BearerCapability                [5] ExternalSignalInfo              OPTIONAL,
    networkSignalInfo                   [6] ExternalSignalInfo              OPTIONAL,
    suppressionOfAnnouncement           [7] SuppressionOfAnnouncement       OPTIONAL,
    gmsc-Address                        [8] ISDN-AddressString              OPTIONAL,
    callReferenceNumber                 [9] CallReferenceNumber             OPTIONAL,
    or-Interrogation                    [10] NULL                           OPTIONAL,
    extensionContainer                  [11] ExtensionContainer             OPTIONAL,
    ... ,
    alertingPattern                     [12] AlertingPattern                OPTIONAL,
    ccbs-Call                           [13] NULL                           OPTIONAL,
    supportedCamelPhasesInGMSC          [15] SupportedCamelPhases           OPTIONAL,
    additionalSignalInfo                [14] Ext-ExternalSignalInfo         OPTIONAL,
    orNotSupportedInGMSC                [16] NULL                           OPTIONAL,
    pre-pagingSupported                 [17] NULL                           OPTIONAL }

ProvideRoamingNumberRes ::= SEQUENCE {
    roamingNumber                       ISDN-AddressString,
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}
```

```
ResumeCallHandlingArg ::= SEQUENCE {
    callReferenceNumber                 [0] CallReferenceNumber          OPTIONAL,
    basicServiceGroup                   [1] Ext-BasicServiceCode         OPTIONAL,
    forwardingData                      [2] ForwardingData               OPTIONAL,
    imsi                                [3] IMSI                         OPTIONAL,
    cug-CheckInfo                       [4] CUG-CheckInfo                OPTIONAL,
    o-CSI                               [5] O-CSI                        OPTIONAL,
    extensionContainer                  [7] ExtensionContainer           OPTIONAL,
    ccbs-Possible                       [8]  NULL                        OPTIONAL,
    msisdn                              [9]  ISDN-AddressString          OPTIONAL,
    uu-Data                             [10] UU-Data                     OPTIONAL,
    allInformationSent                  [11] NULL                        OPTIONAL,
    ...}

UU-Data ::= SEQUENCE {
    uuIndicator                         [0] UUIndicator                  OPTIONAL,
    uui                                 [1] UUI                          OPTIONAL,
    uusCFInteraction                    [2] NULL                         OPTIONAL,
    extensionContainer                  [3] ExtensionContainer           OPTIONAL,
    ...}

UUIndicator ::= OCTET STRING (SIZE (1))
    -- Octets are coded according to ETS 300 356

UUI  ::= OCTET STRING (SIZE (1..131))
    -- Octets are coded according to ETS 300 356

ResumeCallHandlingRes ::= SEQUENCE {
    extensionContainer                  ExtensionContainer               OPTIONAL,
    ...}

CamelInfo ::= SEQUENCE {
    supportedCamelPhases                SupportedCamelPhases,
    suppress-T-CSI                      NULL                             OPTIONAL,
    extensionContainer                  ExtensionContainer               OPTIONAL,
    ...}

ExtendedRoutingInfo ::= CHOICE {
    routingInfo                         RoutingInfo,
    camelRoutingInfo                    [8] CamelRoutingInfo}

CamelRoutingInfo ::= SEQUENCE {
    forwardingData                      ForwardingData                   OPTIONAL,
    gmscCamelSubscriptionInfo           [0] GmscCamelSubscriptionInfo,
    extensionContainer                  [1] ExtensionContainer           OPTIONAL,
    ...}

GmscCamelSubscriptionInfo ::= SEQUENCE {
    t-CSI                               [0] T-CSI OPTIONAL,
    o-CSI                               [1] O-CSI OPTIONAL,
    extensionContainer                  [2] ExtensionContainer           OPTIONAL,
    ...,
    o-BcsmCamelTDP-CriteriaList         [3] O-BcsmCamelTDPCriteriaList   OPTIONAL}

T-CSI ::= SEQUENCE {
    t-BcsmCamelTDPDataList              T-BcsmCamelTDPDataList,
    extensionContainer                  ExtensionContainer               OPTIONAL,
    ...,
    camelCapabilityHandling             [0] CamelCapabilityHandling      OPTIONAL}

T-BcsmCamelTDPDataList ::= SEQUENCE SIZE (1..maxNumOfCamelTDPData) OF
    T-BcsmCamelTDPData
    --- T-BcsmCamelTDPDataList shall not contain more than one instance of
    --- T-BcsmCamelTDPData containing the same value for t-BcsmTriggerDetectionPoint.
    --- For CAMEL Phase 2, this means that only one instance of T-BcsmCamelTDPData is allowed
    --- with t-BcsmTriggerDetectionPoint being equal to DP12.

T-BcsmCamelTDPData ::= SEQUENCE {
    t-BcsmTriggerDetectionPoint         T-BcsmTriggerDetectionPoint,
    serviceKey                          ServiceKey,
    gsmSCF-Address                      [0] ISDN-AddressString,
    defaultCallHandling                 [1] DefaultCallHandling,
    extensionContainer                  [2] ExtensionContainer           OPTIONAL,
    ...}
```

```
T-BcsmTriggerDetectionPoint ::= ENUMERATED {
    termAttemptAuthorized(12),
    ...}
    -- exception handling:
    -- For T-BcsmCamelTDPData sequences containing this parameter with any other
    -- value thanthe ones listed the receiver shall ignore the whole
    -- T-BcsmCamelTDPData sequence.

ProvideSIWFSNumberArg ::= SEQUENCE {
    gsm-BearerCapability                [0] ExternalSignalInfo,
    isdn-BearerCapability               [1] ExternalSignalInfo,
    call-Direction                      [2] CallDirection,
    b-Subscriber-Address                [3] ISDN-AddressString,
    chosenChannel                       [4] ExternalSignalInfo,
    lowerLayerCompatibility             [5] ExternalSignalInfo          OPTIONAL,
    highLayerCompatibility              [6] ExternalSignalInfo          OPTIONAL,
    extensionContainer                  [7] ExtensionContainer          OPTIONAL,
    ...}

CallDirection ::= OCTET STRING (SIZE (1))
    -- OCTET 1

    -- bit 1 (direction of call)
    -- 0  Mobile Originated Call (MOC)
    -- 1  Mobile Terminated Call (MTC)

ProvideSIWFSNumberRes ::= SEQUENCE {
    sIWFSNumber                         [0] ISDN-AddressString,
    extensionContainer                  [1] ExtensionContainer          OPTIONAL,
    ...}

SIWFSSignallingModifyArg ::= SEQUENCE {
    channelType                         [0] ExternalSignalInfo          OPTIONAL,
    chosenChannel                       [1] ExternalSignalInfo          OPTIONAL,
    extensionContainer                  [2] ExtensionContainer          OPTIONAL,
    ...}

SIWFSSignallingModifyRes ::= SEQUENCE {
    chosenChannel                       [0] ExternalSignalInfo          OPTIONAL,
    extensionContainer                  [1] ExtensionContainer          OPTIONAL,
    ...}

SetReportingStateArg ::= SEQUENCE {
    imsi                                [0]  IMSI                       OPTIONAL,
    lmsi                                [1]  LMSI                       OPTIONAL,
    ccbs-Monitoring                     [2]  ReportingState             OPTIONAL,
    extensionContainer                  [3]  ExtensionContainer         OPTIONAL,
    ...}

ReportingState ::= ENUMERATED {
    stopMonitoring                      (0),
    startMonitoring                     (1),
    ...}
    -- exception handling:
    -- reception of values 2-10 shall be mapped to 'stopMonitoring'
    -- reception of values > 10 shall be mapped to 'startMonitoring'

SetReportingStateRes ::= SEQUENCE{
    ccbs-SubscriberStatus               [0]  CCBS-SubscriberStatus      OPTIONAL,
    extensionContainer                  [1]  ExtensionContainer         OPTIONAL,
    ...}

CCBS-SubscriberStatus ::= ENUMERATED {
    ccbsNotIdle                         (0),
    ccbsIdle                            (1),
    ccbsNotReachable                    (2),
    ...}
    --  exception handling:
    --  reception of values 3-10 shall be mapped to 'ccbsNotIdle'
    --  reception of values 11-20 shall be mapped to 'ccbsIdle'
    --  reception of values > 20 shall be mapped to 'ccbsNotReachable'
```

```
StatusReportArg ::= SEQUENCE{
    imsi                            [0]  IMSI,
    eventReportData                 [1]  EventReportData            OPTIONAL,
    callReportdata                  [2]  CallReportData             OPTIONAL,
    extensionContainer              [3]  ExtensionContainer         OPTIONAL,
    ...}

EventReportData ::= SEQUENCE{
    ccbs-SubscriberStatus           [0]  CCBS-SubscriberStatus      OPTIONAL,
    extensionContainer              [1]  ExtensionContainer         OPTIONAL,
    ...}

CallReportData ::= SEQUENCE{
    monitoringMode                  [0]  MonitoringMode             OPTIONAL,
    callOutcome                     [1]  CallOutcome                OPTIONAL,
    extensionContainer              [2]  ExtensionContainer         OPTIONAL,
    ...}

MonitoringMode ::= ENUMERATED {
    a-side                          (0),
    b-side                          (1),
    ...}
    --   exception handling:
    --  reception of values 2-10 shall be mapped 'a-side'
    --  reception of values > 10 shall be mapped to 'b-side'

CallOutcome ::= ENUMERATED {
    success                         (0),
    failure                         (1),
    busy                            (2),
    ...}
    --   exception handling:
    --  reception of values 3-10 shall be mapped to 'success'
    --  reception of values 11-20 shall be mapped to 'failure'
    --  reception of values > 20 shall be mapped to 'busy'

StatusReportRes ::= SEQUENCE {
    extensionContainer              [0]  ExtensionContainer         OPTIONAL,
    ...}

RemoteUserFreeArg ::= SEQUENCE{
    imsi                            [0]  IMSI,
    callInfo                        [1]  ExternalSignalInfo,
    ccbs-Feature                    [2]  CCBS-Feature,
    translatedB-Number              [3]  ISDN-AddressString,
    replaceB-Number                 [4]  NULL                       OPTIONAL,
    alertingPattern                 [5]  AlertingPattern            OPTIONAL,
    extensionContainer              [6]  ExtensionContainer         OPTIONAL,
    ...}

RemoteUserFreeRes ::= SEQUENCE{
    ruf-Outcome                     [0]  RUF-Outcome,
    extensionContainer              [1]  ExtensionContainer         OPTIONAL,
    ...}

RUF-Outcome ::= ENUMERATED{
    accepted (0),
    rejected (1),
    noResponseFromFreeMS (2), -- T4 Expiry
    noResponseFromBusyMS (3), -- T10 Expiry
    udubFromFreeMS (4),
    udubFromBusyMS (5),
    ...}
    -- exception handling:
    -- reception of values 6-20 shall be mapped to 'accepted'
    -- reception of values 21-30 shall be mapped to 'rejected'
    -- reception of values 31-40 shall be mapped to 'noResponseFromFreeMS'
    -- reception of values 41-50 shall be mapped to 'noResponseFromBusyMS'
    -- reception of values 51-60 shall be mapped to 'udubFromFreeMS'
    -- reception of values > 60 shall be mapped to 'udubFromBusyMS'

IST-AlertArg ::= SEQUENCE{
    imsi                            [0]  IMSI,
    extensionContainer              [1]  ExtensionContainer         OPTIONAL,
    ...}
```

```
IST-AlertRes ::= SEQUENCE{
     istAlertTimer                      [0]  IST-AlertTimerValue          OPTIONAL,
     istInformationWithdraw             [1]  NULL                         OPTIONAL,
     callTerminationIndicator           [2]  CallTerminationIndicator     OPTIONAL,
     extensionContainer                 [3]  ExtensionContainer           OPTIONAL,
     ...}
```

```
IST-CommandArg ::= SEQUENCE{
     imsi                               [0]  IMSI,
     extensionContainer                 [1]  ExtensionContainer           OPTIONAL,
     ...}
```

```
IST-CommandRes ::= SEQUENCE{
     extensionContainer                 ExtensionContainer                OPTIONAL,
     ...}
```

```
CallTerminationIndicator ::= ENUMERATED {
     terminateCallActivityReferred       (0),
     terminateAllCallActivities          (1),
     ...}
     -- exception handling:
     -- reception of values 2-10 shall be mapped to ' terminateCallActivityReferred '
     -- reception of values > 10 shall be mapped to ' terminateAllCallActivities '

     -- In MSCs not supporting linkage of all call activities, any value received shall
     -- be interpreted as ' terminateCallActivityReferred '
```

```
END
```

17.7.4 Supplementary service data types

```
MAP-SS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-SS-DataTypes (14) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN

EXPORTS
   RegisterSS-Arg,
   SS-Info,
   SS-Status,
   SS-SubscriptionOption,
   SS-ForBS-Code,
   InterrogateSS-Res,
   USSD-Arg,
   USSD-Res,
   Password,
   GuidanceInfo,
   SS-List,
   SS-InfoList,
   OverrideCategory,
   CliRestrictionOption,
   NoReplyConditionTime,
   ForwardingOptions,
   maxNumOfSS,
   SS-Data,
   SS-InvocationNotificationArg,
   SS-InvocationNotificationRes,
   CCBS-Feature,
   RegisterCC-EntryArg,
   RegisterCC-EntryRes,
   EraseCC-EntryArg,
   EraseCC-EntryRes
;

IMPORTS
   AddressString,
   ISDN-AddressString,
   ISDN-SubaddressString,
   IMSI,
   BasicServiceCode,
   AlertingPattern,
```

```
   EMLPP-Priority,
   ExternalSignalInfo

FROM MAP-CommonDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}

   ExtensionContainer
FROM MAP-ExtensionDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}

   SS-Code
FROM MAP-SS-Code {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-SS-Code (15) version6 (6)}
;


RegisterSS-Arg ::= SEQUENCE {
     ss-Code                          SS-Code,
     basicService                     BasicServiceCode                 OPTIONAL,
     forwardedToNumber                [4] AddressString                OPTIONAL,
     forwardedToSubaddress            [6] ISDN-SubaddressString        OPTIONAL,
     noReplyConditionTime             [5] NoReplyConditionTime         OPTIONAL,
     ...,
     defaultPriority                  [7] EMLPP-Priority               OPTIONAL }

NoReplyConditionTime ::= INTEGER (5..30)

SS-Info ::= CHOICE {
     forwardingInfo                   [0] ForwardingInfo,
     callBarringInfo                  [1] CallBarringInfo,
     ss-Data                          [3] SS-Data}

ForwardingInfo ::= SEQUENCE {
     ss-Code                          SS-Code                          OPTIONAL,
     forwardingFeatureList            ForwardingFeatureList,
     ...}

ForwardingFeatureList ::=
     SEQUENCE SIZE (1..maxNumOfBasicServiceGroups) OF
                                      ForwardingFeature

ForwardingFeature ::= SEQUENCE {
     basicService                     BasicServiceCode                 OPTIONAL,
     ss-Status[4] SS-Status           OPTIONAL,
     forwardedToNumber                [5] ISDN-AddressString           OPTIONAL,
     forwardedToSubaddress            [8] ISDN-SubaddressString        OPTIONAL,
     forwardingOptions                [6] ForwardingOptions            OPTIONAL,
     noReplyConditionTime             [7] NoReplyConditionTime         OPTIONAL,
     ...}

SS-Status ::= OCTET STRING (SIZE (1))

     -- bits 8765: 0000 (unused)
     -- bits 4321: Used to convey the "P bit","R bit","A bit" and "Q bit",
     --            representing supplementary service state information
     --            as defined in TS GSM 03.11

     -- bit 4: "Q bit"

     -- bit 3: "P bit"

     -- bit 2: "R bit"

     -- bit 1: "A bit"
```

```
ForwardingOptions ::= OCTET STRING (SIZE (1))

    -- bit 8: notification to forwarding party
    --   0  no notification
    --   1  notification

    -- bit 7: redirecting presentation
    --   0 no presentation
    --   1  presentation

    -- bit 6: notification to calling party
    --   0  no notification
    --   1  notification

    -- bit 5: 0 (unused)

    -- bits 43: forwarding reason
    --   00  ms not reachable
    --   01  ms busy
    --   10  no reply
    --   11  unconditional when used in a SRI Result,
    --       or call deflection when used in a RCH Argument
    -- bits 21: 00 (unused)
```

```
CallBarringInfo ::= SEQUENCE {
    ss-Code                         SS-Code                         OPTIONAL,
    callBarringFeatureList          CallBarringFeatureList,
    ...}
```

```
CallBarringFeatureList ::= SEQUENCE SIZE (1..maxNumOfBasicServiceGroups) OF
                                    CallBarringFeature
```

```
CallBarringFeature ::= SEQUENCE {
    basicService                    BasicServiceCode                OPTIONAL,
    ss-Status [4] SS-Status         OPTIONAL,
    ...}
```

```
SS-Data ::= SEQUENCE {
    ss-Code                         SS-Code                         OPTIONAL,
    ss-Status [4] SS-Status         OPTIONAL,
    ss-SubscriptionOption           SS-SubscriptionOption           OPTIONAL,
    basicServiceGroupList           BasicServiceGroupList           OPTIONAL,
    ...,
    defaultPriority                 EMLPP-Priority                  OPTIONAL
    }
```

```
SS-SubscriptionOption ::= CHOICE {
    cliRestrictionOption            [2] CliRestrictionOption,
    overrideCategory                [1] OverrideCategory}
```

```
CliRestrictionOption ::= ENUMERATED {
    permanent  (0),
    temporaryDefaultRestricted  (1),
    temporaryDefaultAllowed  (2)}
```

```
OverrideCategory ::= ENUMERATED {
    overrideEnabled  (0),
    overrideDisabled  (1)}
```

```
SS-ForBS-Code ::= SEQUENCE {
    ss-Code                         SS-Code,
    basicService                    BasicServiceCode                OPTIONAL,
    ...}
```

```
GenericServiceInfo ::= SEQUENCE {
    ss-Status SS-Status,
    cliRestrictionOption            CliRestrictionOption            OPTIONAL,
    ...,
    maximumEntitledPriority         [0] EMLPP-Priority              OPTIONAL,
    defaultPriority                 [1] EMLPP-Priority              OPTIONAL,
    ccbs-FeatureList                [2] CCBS-FeatureList            OPTIONAL }
```

```
CCBS-FeatureList ::= SEQUENCE SIZE (1..maxNumOfCCBS-Requests) OF
                                    CCBS-Feature
```

```
maxNumOfCCBS-Requests  INTEGER ::= 5
```

```
CCBS-Feature ::= SEQUENCE {
    ccbs-Index                      [0] CCBS-Index                  OPTIONAL,
    b-subscriberNumber              [1] ISDN-AddressString          OPTIONAL,
    b-subscriberSubaddress          [2] ISDN-SubaddressString       OPTIONAL,
    basicServiceGroup               [3] BasicServiceCode            OPTIONAL,
    ...}

CCBS-Index  ::= INTEGER (1..maxNumOfCCBS-Requests)

InterrogateSS-Res ::= CHOICE {
    ss-Status [0] SS-Status,
    basicServiceGroupList           [2] BasicServiceGroupList,
    forwardingFeatureList           [3] ForwardingFeatureList,
    genericServiceInfo              [4]  GenericServiceInfo }

USSD-Arg ::= SEQUENCE {
    ussd-DataCodingScheme           USSD-DataCodingScheme,
    ussd-String                     USSD-String,
    ... ,
    alertingPattern                 AlertingPattern                 OPTIONAL,
    msisdn                          [0] ISDN-AddressString          OPTIONAL }

USSD-Res ::= SEQUENCE {
    ussd-DataCodingScheme           USSD-DataCodingScheme,
    ussd-String                     USSD-String,
    ...}

USSD-DataCodingScheme ::= OCTET STRING (SIZE (1))
    -- The structure of the USSD-DataCodingScheme is defined by
    -- the Cell Broadcast Data Coding Scheme as described in
    -- TS GSM 03.38

USSD-String ::= OCTET STRING (SIZE (1..maxUSSD-StringLength))
    -- The structure of the contents of the USSD-String is dependent
    -- on the USSD-DataCodingScheme as described in TS GSM 03.38.

maxUSSD-StringLength  INTEGER ::= 160

Password ::= NumericString
    (FROM ("0"|"1"|"2"|"3"|"4"|"5"|"6"|"7"|"8"|"9"))
    (SIZE (4))

GuidanceInfo ::= ENUMERATED {
    enterPW  (0),
    enterNewPW  (1),
    enterNewPW-Again  (2)}
    -- How this information is really delivered to the subscriber
    -- (display, announcement, ...) is not part of this
    -- specification.

SS-List ::= SEQUENCE SIZE (1..maxNumOfSS) OF
                                    SS-Code

maxNumOfSS  INTEGER ::= 30

SS-InfoList ::= SEQUENCE SIZE (1..maxNumOfSS) OF
                                    SS-Info

BasicServiceGroupList ::= SEQUENCE SIZE (1..maxNumOfBasicServiceGroups) OF
                                    BasicServiceCode

maxNumOfBasicServiceGroups  INTEGER ::= 13

SS-InvocationNotificationArg ::= SEQUENCE {
    imsi                            [0] IMSI,
    msisdn                          [1] ISDN-AddressString,
    ss-Event                        [2] SS-Code,
    -- The following SS-Code values are allowed :
    -- ect                          SS-Code ::= '00110001'B
    -- multiPTY                     SS-Code ::= '01010001'B
    -- cd                           SS-Code ::= '00100100'B
    ss-EventSpecification           [3] SS-EventSpecification       OPTIONAL,
    extensionContainer              [4] ExtensionContainer          OPTIONAL,
    ...}
```

```
SS-InvocationNotificationRes ::= SEQUENCE {
     extensionContainer                  ExtensionContainer                OPTIONAL,
     ...
     }

SS-EventSpecification ::= SEQUENCE SIZE (1..maxEventSpecification) OF
                                         AddressString

maxEventSpecification  INTEGER ::= 2

RegisterCC-EntryArg ::= SEQUENCE {
     ss-Code                             [0]  SS-Code,
     ccbs-Data                           [1]  CCBS-Data                    OPTIONAL,
     ...}

CCBS-Data ::= SEQUENCE {
     ccbs-Feature                        [0]  CCBS-Feature,
     translatedB-Number                  [1]  ISDN-AddressString,
     serviceIndicator                    [2]  ServiceIndicator             OPTIONAL,
     callInfo                            [3]  ExternalSignalInfo,
     networkSignalInfo                   [4]  ExternalSignalInfo,
     ...}

ServiceIndicator ::= BIT STRING {
     clir-invoked (0),
     camel-invoked (1)} (SIZE(2..32))
     -- exception handling:
     -- bits 2 to 31 shall be ignored if received and not understood

RegisterCC-EntryRes ::= SEQUENCE {
     ccbs-Feature                        [0] CCBS-Feature                  OPTIONAL,
     ...}

EraseCC-EntryArg ::= SEQUENCE {
     ss-Code                             [0]  SS-Code,
     ccbs-Index                          [1]  CCBS-Index                   OPTIONAL,
     ...}

EraseCC-EntryRes ::= SEQUENCE {
     ss-Code                             [0]  SS-Code,
     ss-Status                           [1] SS-Status                     OPTIONAL,
     ...}

END
```

17.7.7 Error data types

```
MAP-ER-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ER-DataTypes (17) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN

EXPORTS
   RoamingNotAllowedParam,
   CallBarredParam,
   CUG-RejectParam,
   SS-IncompatibilityCause,
   PW-RegistrationFailureCause,
   SM-DeliveryFailureCause,
   SystemFailureParam,
   DataMissingParam,
   UnexpectedDataParam,
   FacilityNotSupParam,
   OR-NotAllowedParam,
   UnknownSubscriberParam,
   NumberChangedParam,
   UnidentifiedSubParam,
```

```
   IllegalSubscriberParam,
   IllegalEquipmentParam,
   BearerServNotProvParam,
   TeleservNotProvParam,
   TracingBufferFullParam,
   NoRoamingNbParam,
   AbsentSubscriberParam,
   BusySubscriberParam,
   NoSubscriberReplyParam,
   ForwardingViolationParam,
   ForwardingFailedParam,
   ATI-NotAllowedParam,
   SubBusyForMT-SMS-Param,
   MessageWaitListFullParam,
   AbsentSubscriberSM-Param,
   AbsentSubscriberDiagnosticSM,
   ResourceLimitationParam,
   NoGroupCallNbParam,
   IncompatibleTerminalParam,
   ShortTermDenialParam,
   LongTermDenialParam,
   UnauthorizedRequestingNetwork-Param,
   UnauthorizedLCSClient-Param,
   PositionMethodFailure-Param,
   PositionMethodFailureWithRestart-Param,
   LMUUnknownOrOffline-Param,
   TrafficChannelEstablishmentFailure-Param,
   UnknownOrUnreachableLCSClient-Param


;

IMPORTS
   SS-Status
FROM MAP-SS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-SS-DataTypes (14) version6 (6)}

   SignalInfo,
   BasicServiceCode,
   NetworkResource
FROM MAP-CommonDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}

   SS-Code
FROM MAP-SS-Code {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-SS-Code (15) version6 (6)}

   ExtensionContainer
FROM MAP-ExtensionDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}
;

RoamingNotAllowedParam ::= SEQUENCE {
     roamingNotAllowedCause              RoamingNotAllowedCause,
     extensionContainer                  ExtensionContainer               OPTIONAL,
     ...}

RoamingNotAllowedCause ::= ENUMERATED {
     plmnRoamingNotAllowed  (0),
     operatorDeterminedBarring  (3)}

CallBarredParam ::= CHOICE {
     callBarringCause                    CallBarringCause,
     -- call BarringCause must not be used in version 3
     extensibleCallBarredParam           ExtensibleCallBarredParam
     -- extensibleCallBarredParam must not be used in version <3
     }

CallBarringCause ::= ENUMERATED {
     barringServiceActive  (0),
     operatorBarring  (1)}
```

```
ExtensibleCallBarredParam ::= SEQUENCE {
    callBarringCause                    CallBarringCause                    OPTIONAL,
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ... ,
    unauthorisedMessageOriginator       [1] NULL                            OPTIONAL }

CUG-RejectParam ::= SEQUENCE {
    cug-RejectCause                     CUG-RejectCause                     OPTIONAL,
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

CUG-RejectCause ::= ENUMERATED {
    incomingCallsBarredWithinCUG  (0),
    subscriberNotMemberOfCUG  (1),
    requestedBasicServiceViolatesCUG-Constraints  (5),
    calledPartySS-InteractionViolation  (7)}

SS-IncompatibilityCause ::= SEQUENCE {
    ss-Code                             [1] SS-Code                         OPTIONAL,
    basicService                        BasicServiceCode                    OPTIONAL,
    ss-Status                           [4] SS-Status                       OPTIONAL,
    ...}

PW-RegistrationFailureCause ::= ENUMERATED {
    undetermined  (0),
    invalidFormat  (1),
    newPasswordsMismatch  (2)}


SM-EnumeratedDeliveryFailureCause ::= ENUMERATED {
    memoryCapacityExceeded  (0),
    equipmentProtocolError  (1),
    equipmentNotSM-Equipped  (2),
    unknownServiceCentre  (3),
    sc-Congestion  (4),
    invalidSME-Address  (5),
    subscriberNotSC-Subscriber  (6)}

SM-DeliveryFailureCause ::= SEQUENCE {
    sm-EnumeratedDeliveryFailureCause   SM-EnumeratedDeliveryFailureCause,
    diagnosticInfo                      SignalInfo                          OPTIONAL,
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

AbsentSubscriberSM-Param ::= SEQUENCE {
    absentSubscriberDiagnosticSM        AbsentSubscriberDiagnosticSM        OPTIONAL,
    -- AbsentSubscriberDiagnosticSM can be either for non-GPRS
    -- or for GPRS
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...,
    additionalAbsentSubscriberDiagnosticSM   [0]  AbsentSubscriberDiagnosticSM OPTIONAL }
    -- if received, additionalAbsentSubscriberDiagnosticSM
    -- is for GPRS and absentSubscriberDiagnosticSM is
    -- for non-GPRS

AbsentSubscriberDiagnosticSM ::= INTEGER (0..255)
    -- AbsentSubscriberDiagnosticSM values are defined in ETS 300 536 (GSM 03.40)

SystemFailureParam ::= CHOICE {
    networkResource                     NetworkResource,
    -- networkResource must not be used in version 3
    extensibleSystemFailureParam        ExtensibleSystemFailureParam
    -- extensibleSystemFailureParam must not be used in version <3
    }

ExtensibleSystemFailureParam ::= SEQUENCE {
    networkResource                     NetworkResource                     OPTIONAL,
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

DataMissingParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}
```

```
UnexpectedDataParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

FacilityNotSupParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

OR-NotAllowedParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

UnknownSubscriberParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...,
    unknownSubscriberDiagnostic         UnknownSubscriberDiagnostic         OPTIONAL}

UnknownSubscriberDiagnostic ::= ENUMERATED {
    imsiUnknown  (0),
    gprsSubscriptionUnknown  (1),
    ...}
    -- if unknown values are received in
    -- unknownSubscriberDiagnostic they shall be discarded


NumberChangedParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

UnidentifiedSubParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

IllegalSubscriberParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

IllegalEquipmentParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

BearerServNotProvParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

TeleservNotProvParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

TracingBufferFullParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

NoRoamingNbParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...}

AbsentSubscriberParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...,
    absentSubscriberReason              [0] AbsentSubscriberReason          OPTIONAL}

AbsentSubscriberReason ::= ENUMERATED {
    imsiDetach (0),
    restrictedArea (1),
    noPageResponse (2),
    ...}
-- exception handling: at reception of other values than the ones listed the
-- AbsentSubscriberReason shall be ignored.

BusySubscriberParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                  OPTIONAL,
    ...,
    ccbs-Possible                       [0] NULL                            OPTIONAL,
    ccbs-Busy                           [1] NULL                            OPTIONAL}
```

```
NoSubscriberReplyParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

ForwardingViolationParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

ForwardingFailedParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

ATI-NotAllowedParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

SubBusyForMT-SMS-Param ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ... ,
    gprsConnectionSuspended                 NULL                          OPTIONAL }
    -- If GprsConnectionSuspended is not understood it shall
    -- be discarded

MessageWaitListFullParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

ResourceLimitationParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

NoGroupCallNbParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

IncompatibleTerminalParam ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

ShortTermDenialParam ::= SEQUENCE {
    ...}

LongTermDenialParam ::= SEQUENCE {
    ...}

UnauthorizedRequestingNetwork-Param ::= SEQUENCE {
    extensionContainer                  ExtensionContainer                OPTIONAL,
    ...}

UnauthorizedLCSClient-Param ::= SEQUENCE {
    unauthorizedLCSClient-Diagnostic    [0] UnauthorizedLCSClient-Diagnostic  OPTIONAL,
    extensionContainer                  [1] ExtensionContainer                OPTIONAL,
    ... }

UnauthorizedLCSClient-Diagnostic ::= ENUMERATED {
    noAdditionalInformation (0),
    clientNotInMSPrivacyExceptionList (1),
    callToClientNotSetup (2),
    privacyOverrideNotApplicable (3),
    disallowedByLocalRegulatoryRequirements (4),
    ... }
--  exception handling:
--  any unrecognized value shall be ignored

PositionMethodFailure-Param ::= SEQUENCE {
    positionMethodFailure-Diagnostic    [0] PositionMethodFailure-Diagnostic  OPTIONAL,
    extensionContainer                  [1] ExtensionContainer                OPTIONAL,
    ... }
```

```
PositionMethodFailure-Diagnostic ::= ENUMERATED {
     congestion  (0),
     insufficientResources  (1),
     insufficientMeasurementData  (2),
     inconsistentMeasurementData  (3),
     locationProcedureNotCompleted  (4),
     locationProcedureNotSupportedByTargetMS  (5),
     qoSNotAttainable  (6),
     ... }
--   exception handling:
--   any unrecognized value shall be ignored

PositionMethodFailureWithRestart-Param ::= SEQUENCE {
     extensionContainer                  ExtensionContainer                    OPTIONAL,
     ... }

LMUUnknownOrOffline-Param ::= SEQUENCE {
     extensionContainer                  ExtensionContainer                OPTIONAL,
     ...}

TrafficChannelEstablishmentFailure-Param ::= SEQUENCE {
     extensionContainer                  ExtensionContainer                OPTIONAL,
     ...}

UnknownOrUnreachableLCSClient-Param ::= SEQUENCE {
     extensionContainer                  ExtensionContainer                OPTIONAL,
     ...}


END
```

17.7.9 Teleservice Codes

```
MAP-TS-Code {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-TS-Code (19) version6 (6)}

DEFINITIONS

::=

BEGIN

TeleserviceCode ::= OCTET STRING (SIZE (1))
     -- This type is used to represent the code identifying a single
     -- teleservice, a group of teleservices, or all teleservices. The
     -- services are defined in TS GSM 02.03.
     -- The internal structure is defined as follows:

     -- bits 87654321: group (bits 8765) and specific service
     -- (bits 4321)

Ext-TeleserviceCode ::= OCTET STRING (SIZE (1..5))
     -- This type is used to represent the code identifying a single
     -- teleservice, a group of teleservices, or all teleservices. The
     -- services are defined in TS GSM 02.03.
     -- The internal structure is defined as follows:

     -- OCTET 1:
     -- bits 87654321: group (bits 8765) and specific service
     -- (bits 4321)

     -- OCTETS 2-5: reserved for future use. If received the
    -- Ext-TeleserviceCode shall be
     -- treated according to the exception handling defined for the
     -- operation that uses this type.

     -- Ext-TeleserviceCode includes all values defined for TeleserviceCode.


allTeleservices                         TeleserviceCode ::= '00000000'B

```

```
allSpeechTransmissionServices               TeleserviceCode ::= '00010000'B
telephony                                   TeleserviceCode ::= '00010001'B
emergencyCalls                              TeleserviceCode ::= '00010010'B

allShortMessageServices                     TeleserviceCode ::= '00100000'B
shortMessageMT-PP                           TeleserviceCode ::= '00100001'B
shortMessageMO-PP                           TeleserviceCode ::= '00100010'B

allFacsimileTransmissionServices            TeleserviceCode ::= '01100000'B
facsimileGroup3AndAlterSpeech               TeleserviceCode ::= '01100001'B
automaticFacsimileGroup3                    TeleserviceCode ::= '01100010'B
facsimileGroup4                             TeleserviceCode ::= '01100011'B

-- The following non-hierarchical Compound Teleservice Groups
-- are defined in TS GSM 02.30:
allDataTeleservices                         TeleserviceCode ::= '01110000'B
     -- covers Teleservice Groups 'allFacsimileTransmissionServices'
     -- and 'allShortMessageServices'
allTeleservices-ExeptSMS                    TeleserviceCode ::= '10000000'B
     -- covers Teleservice Groups 'allSpeechTransmissionServices' and
     -- 'allFacsimileTransmissionServices'
--
-- Compound Teleservice Group Codes are only used in call
-- independent supplementary service operations, i.e. they
-- are not used in InsertSubscriberData or in
-- DeleteSubscriberData messages.

allVoiceGroupCallServices                   TeleserviceCode ::= '10010000'B
voiceGroupCall                              TeleserviceCode ::= '10010001'B
voiceBroadcastCall                          TeleserviceCode ::= '10010010'B

allPLMN-specificTS                          TeleserviceCode ::= '11010000'B
plmn-specificTS-1                           TeleserviceCode ::= '11010001'B
plmn-specificTS-2                           TeleserviceCode ::= '11010010'B
plmn-specificTS-3                           TeleserviceCode ::= '11010011'B
plmn-specificTS-4                           TeleserviceCode ::= '11010100'B
plmn-specificTS-5                           TeleserviceCode ::= '11010101'B
plmn-specificTS-6                           TeleserviceCode ::= '11010110'B
plmn-specificTS-7                           TeleserviceCode ::= '11010111'B
plmn-specificTS-8                           TeleserviceCode ::= '11011000'B
plmn-specificTS-9                           TeleserviceCode ::= '11011001'B
plmn-specificTS-A                           TeleserviceCode ::= '11011010'B
plmn-specificTS-B                           TeleserviceCode ::= '11011011'B
plmn-specificTS-C                           TeleserviceCode ::= '11011100'B
plmn-specificTS-D                           TeleserviceCode ::= '11011101'B
plmn-specificTS-E                           TeleserviceCode ::= '11011110'B
plmn-specificTS-F                           TeleserviceCode ::= '11011111'B

END
```

17.7.13 Location service data types

```
MAP-LCS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-LCS-DataTypes (25) version6 (6)}

DEFINITIONS
IMPLICIT TAGS
::=
BEGIN

```

```
EXPORTS
   RoutingInfoForLCS-Arg,
   RoutingInfoForLCS-Res,
   ProvideSubscriberLocation-Arg,
   ProvideSubscriberLocation-Res,
   SubscriberLocationReport-Arg,
   SubscriberLocationReport-Res,
   PerformLocation-Arg,
   PerformLocation-Res,
   LCSRegistration-Arg,
   LCSRegistration-Res,
   LCSInformationRequest-Arg,
   LCSInformationReport-Arg,
   LCSReset-Arg,
   LCSAssignTrafficChannel-Arg,
   LCSAssignTrafficChannel-Res
;

IMPORTS
   AddressString,
   ISDN-AddressString,
   IMEI,
   IMSI,
   LMSI,
   Identity,
   SubscriberIdentity,
   GlobalCellId,
   Ext-ExternalSignalInfo,
   AgeOfLocationInformation,  LCSClientExternalID,
   LCSClientInternalID
FROM MAP-CommonDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}

   ExtensionContainer
FROM MAP-ExtensionDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}
;


RoutingInfoForLCS-Arg ::= SEQUENCE {
     mlcNumber                          [0] ISDN-AddressString,
     targetMS                           [1] SubscriberIdentity,
     extensionContainer                 [2] ExtensionContainer          OPTIONAL,
     ...}

RoutingInfoForLCS-Res ::= SEQUENCE {
     targetMS                           [0] SubscriberIdentity,
     lcsLocationInfo                    [1] LCSLocationInfo,
     extensionContainer                 [2] ExtensionContainer          OPTIONAL,
     ...}

LCSLocationInfo ::= SEQUENCE {
     msc-Number                         ISDN-AddressString,
     lmsi                               [0] LMSI                        OPTIONAL,
     extensionContainer                 [1] ExtensionContainer          OPTIONAL,
     ...}

ProvideSubscriberLocation-Arg ::= SEQUENCE {
     locationType                       LocationType,
     mlc-Number                         ISDN-AddressString,
     lcs-ClientID                       [0] LCS-ClientID                OPTIONAL,
     privacyOverride                    [1] NULL                        OPTIONAL,
     imsi                               [2] IMSI                        OPTIONAL,
     msisdn                             [3] ISDN-AddressString          OPTIONAL,
     lmsi                               [4] LMSI                        OPTIONAL,
     imei                               [5] IMEI                        OPTIONAL,
     na-ESRK                            [6] ISDN-AddressString          OPTIONAL,
     lcs-Priority                       [7] LCS-Priority                OPTIONAL,
     lcs-QoS                            [8] LCS-QoS                     OPTIONAL,
     extensionContainer                 [9] ExtensionContainer          OPTIONAL,
     ...}

     -- one of imsi, msisdn or na-ESRK is mandatory
     -- na-ESRK is applicable only to North American PLMNs
```

```
LocationType ::= ENUMERATED {
    currentLocation                     (0),
    currentOrLastKnownLocation          (1),
    initialLocation                     (2),
    ... }
    --   exception handling:
    --   a ProvideSubscriberLocation-Arg containing an unrecognized LocationType
    --   shall be rejected by the receiver with a return error cause of unexpected data value

LCS-ClientID ::= SEQUENCE {
    lcsClientType                       [0] LCSClientType,
    lcsClientExternalID                 [1] LCSClientExternalID          OPTIONAL,
    lcsClientDialedByMS                 [2] AddressString                OPTIONAL,
    lcsClientInternalID                 [3] LCSClientInternalID          OPTIONAL,
    ... }

LCSClientType ::= ENUMERATED {
    emergencyServices                   (0),
    valueAddedServices                  (1),
    plmnOperatorServices                (2),
    lawfulInterceptServices             (3),
    ... }
    --   exception handling:
    --   unrecognized values may be ignored if the LCS client uses the privacy override
    --   otherwise, an unrecognized value shall be treated as unexpected data by a receiver
    --   a return error shall then be returned if received in a MAP invoke

LCS-Priority ::= OCTET STRING (SIZE (1))
    -- 0 = highest priority
    -- 1 = normal priority
    -- all other values treated as 1

LCS-QoS ::= SEQUENCE {
    horizontal-accuracy                 [0] Horizontal-Accuracy          OPTIONAL,
    responseTime                        [1] ResponseTime                 OPTIONAL,
    extensionContainer                  [2] ExtensionContainer           OPTIONAL,
    ...}

Horizontal-Accuracy ::= OCTET STRING (SIZE (1))
    -- bit 8 = 0
    -- bits 7-1 = 7 bit Uncertainty Code defined in GSM 03.32

ResponseTime ::= ENUMERATED {
    nodelay  (0),
    lowdelay  (1),
    delaytolerant  (2),
    ... }
--   exception handling:
--   an unrecognized value shall be treated the same as value 2 (delaytolerant)

ProvideSubscriberLocation-Res ::= SEQUENCE {
    locationEstimate                    Ext-GeographicalInformation,
    ageOfLocationEstimate               [0] AgeOfLocationInformation     OPTIONAL,
    extensionContainer                  [1] ExtensionContainer           OPTIONAL,
    ...}
```

```
Ext-GeographicalInformation ::= OCTET STRING (SIZE (1..maxExt-GeographicalInformation))
    -- Refers to geographical Information defined in GSM 03.32.
    -- This is composed of 1 or more octets with an internal structure according to GSM 03.32
    -- Octet 1: Type of shape, only the following shapes in GSM 03.32 are allowed:
    --       (a) Ellipsoid point with uncertainty circle
    --       (b) Ellipsoid point with uncertainty ellipse
    -- Any other value in octet 1 shall be treated as invalid
    -- Octets 2 to 8 for case (a) – Ellipsoid point with uncertainty circle
    --       Degrees of Latitude                                    3 octets
    --       Degrees of Longitude                                   3 octets
    --       Uncertainty code                                       1 octet
    -- Octets 2 to 10 for case (b) – Ellipsoid point with uncertainty ellipse:
    --       Degrees of Latitude                                    3 octets
    --       Degrees of Longitude                                   3 octets
    --       Uncertainty semi-major axis                            1 octet
    --       Uncertainty semi-minor axis                            1 octet
    --       Angle of major axis                                    1 octet
    --
    -- An Ext-GeographicalInformation parameter containing any other shape or an incorrect
number
    -- of octets or coding according to GSM 03.32 shall be treated as invalid data by a
    -- receiver
```

```
maxExt-GeographicalInformation  INTEGER ::= 20
    -- the maximum length allows for further shapes in GSM 03.32 to be included in later
    -- versions of GSM 09.02
```

```
SubscriberLocationReport-Arg ::= SEQUENCE {
    lcs-Event                       LCS-Event,
    lcs-ClientID                    LCS-ClientID,
    msisdn                          [0] ISDN-AddressString          OPTIONAL,
    imsi                            [1] IMSI                        OPTIONAL,
    imei                            [2] IMEI                        OPTIONAL,
    na-ESRD                         [3] ISDN-AddressString          OPTIONAL,
    na-ESRK                         [4] ISDN-AddressString          OPTIONAL,
    locationEstimate                [5] Ext-GeographicalInformation OPTIONAL,
    ageOfLocationEstimate           [6] AgeOfLocationInformation    OPTIONAL,
    extensionContainer              [7] ExtensionContainer          OPTIONAL,
    ...}

    -- one of msisdn, imsi, or na-ESRK is mandatory
    -- in North America, the na-ESRD is mandatory
```

```
LCS-Event ::= ENUMERATED {
    emergencyCallOrigination  (0),
    emergencyCallRelease  (1),
    ... }
    --   exception handling:
    --   a SubscriberLocationReport-Arg containing an unrecognized LCS-Event
    --   shall be rejected by a receiver with a return error cause of unexpected data value
```

```
SubscriberLocationReport-Res ::= SEQUENCE {
    extensionContainer              ExtensionContainer              OPTIONAL,
    ...}
```

```
PerformLocation-Arg ::= SEQUENCE {
    globalCellId                    GlobalCellId,
    radioChannelType                [0] RadioChannelType            OPTIONAL,
    lcs-Priority                    [1] LCS-Priority                OPTIONAL,
    lcs-QoS                         [2] LCS-QoS                     OPTIONAL,
    lcs-APDU                        [3] Ext-ExternalSignalInfo      OPTIONAL,
    extensionContainer              [4] ExtensionContainer          OPTIONAL,
    ...}
```

```
RadioChannelType ::= ENUMERATED {
    sdcch  (0),
    tch-fr (1),
    tch-hr (2),
    ... }
    --   exception handling
    --   an unrecognized value shall be treated as unexpected data
    --   a return error shall be returned if received in a MAP invoke
```

```
PerformLocation-Res ::= SEQUENCE {
    locationEstimate                    Ext-GeographicalInformation,
    positioningData                     [0] PositioningDataList          OPTIONAL,
    extensionContainer                  [1] ExtensionContainer           OPTIONAL,
    ... }
```

```
PositioningDataList ::= SEQUENCE SIZE (1..maxNumOfPositionAttempts) OF
                                        PositioningData
    -- list of positioning data for each positioning attempt
    -- first in list = first attempt, last in list = last attempt
```

```
maxNumOfPositionAttempts  INTEGER ::= 5
```

```
PositioningData ::= SEQUENCE {
    positionMethod                      PositionMethod,
    positionResult                      PositionResult,
    duration                            [0] Duration                     OPTIONAL,
    toa-LMU-data                        [1] TOA-LMU-Data                 OPTIONAL,
    extensionContainer                  [2] ExtensionContainer           OPTIONAL,
    ...}

    -- Positioning data need not be provided to an LCS client but may be useful to the PLMN
    -- for billing, accounting and statistical purposes
```

```
PositionMethod ::= ENUMERATED {
    timingAdvance  (0),
    toa (1),
    ... }
    --   exception handling:
    --   an unrecognized value may be stored in billing or accounting records
    --   an unrecognized value shall not cause rejection of any associated location estimate
```

```
PositionResult ::= ENUMERATED {
    failure (0),
    success-NoDeliveryToClient (1),
    success-DeliveryToClient  (2) }
```

```
Duration  ::= INTEGER (0..250)
    -- duration of location attempt in units of 100ms
    -- 250 : duration >= 25 seconds
```

```
TOA-LMU-Data ::= SEQUENCE {
    numberOfAssignedLMUs                INTEGER (0..12),
    numberOfLMUsWithValidMeasurements   INTEGER (0..12),
    extensionContainer                  [0] ExtensionContainer           OPTIONAL,
    ... }
```

```
LCSRegistration-Arg ::= SEQUENCE {
    lmuIdentity                         Identity,
    registrationType                    RegistrationType,
    mscNumber                           [0] ISDN-AddressString           OPTIONAL,
    extensionContainer                  [1] ExtensionContainer           OPTIONAL,
    ...}
```

```
RegistrationType ::= ENUMERATED {
    registration                            (0),
    deRegistration                          (1)}
```

```
LCSRegistration-Res ::= SEQUENCE {
    extensionContainer                  ExtensionContainer               OPTIONAL,
    ...}
```

```
LCSInformationRequest-Arg ::= SEQUENCE {
     lcs-Entity                          LCS-Entity,
     mlcNumber                           [0] ISDN-AddressString            OPTIONAL,
     release-forbidden                   [1] NULL                          OPTIONAL,
     reportError-request                 [2] NULL                          OPTIONAL,
     lcs-apdu                            [3] Ext-ExternalSignalInfo        OPTIONAL,
     -- lcs-apdu carries either the Facility Information Element defined in GSM 04.71
     -- or the Location Information parameter defined in GSM 08.71
     extensionContainer                  [4] ExtensionContainer            OPTIONAL,
     ...}

LCS-Entity ::= SEQUENCE {
     entityType                          EntityType,
     entityIdentity                      [0] EntityIdentity                OPTIONAL,
     ...}

EntityType ::= ENUMERATED {
     lmu (0),
     serving-BSC (1),
     ... }
     --   Exception handling:
     --   an unrecognized value for the Entity Type shall cause any associated LCS APDU to be
     --   discarded; the Report Error procedure in GSM 03.71 may also be invoked if requested
--   in an LCSInformationRequest-Arg.

EntityIdentity ::= SEQUENCE {
     lmuIdentity                         Identity                          OPTIONAL,
     ...}

LCSInformationReport-Arg ::= SEQUENCE {
     lcs-Entity                          LCS-Entity,
     lcsCause                            [0] LCSCause                       OPTIONAL,
     -- lcsCause is included if and only if the MSC is returning an lcs-apdu to the SMLC
     -- that could not be successfully transferred to its destination LCS entity.
     lcs-apdu                            [1] Ext-ExternalSignalInfo        OPTIONAL,
     -- lcs-apdu carries either the Facility Information Element defined in GSM 04.71
     -- or the Location Information parameter defined in GSM 08.71
     extensionContainer                  [2] ExtensionContainer            OPTIONAL,
     ...}

LCSCause ::= ENUMERATED {
     undefined                           (0),
     unknownLCSEntity                    (1),
     noPagingResponse                    (2),
     errorInAuthentication               (3),
     errorInServingMSC                   (4),
     ... }
     --   exception handling:
     --   an unrecognized value shall be treated the same as value 0 (undefined)

LCSReset-Arg ::= SEQUENCE {
     mlcNumber                           ISDN-AddressString,
     lmu-List                            [0] LMU-List                      OPTIONAL,
     extensionContainer                  [1] ExtensionContainer            OPTIONAL,
     ...}

LMU-Id ::= IMSI
     -- leading digits of IMSI, i.e. (MCC, MNC, leading digits of
     -- MSIN) defining a set of LMUs sharing the same SMLC

LMU-List ::= SEQUENCE SIZE (1..maxNumOfLMU-Id) OF
                                         LMU-Id

maxNumOfLMU-Id  INTEGER ::= 10

LCSAssignTrafficChannel-Arg ::= SEQUENCE {
     radioChannelType                    RadioChannelType,
     extensionContainer                  [0] ExtensionContainer            OPTIONAL,
     ...}

LCSAssignTrafficChannel-Res ::= SEQUENCE {
     extensionContainer                  ExtensionContainer                OPTIONAL,
     ...}


END
```

18 General on MAP user procedures

18.1 Introduction

Clauses 18 to 25 describe the use of MAP services for GSM signalling procedures. GSM signalling procedures may involve one or several interfaces running one or several application protocols. The present document addresses only the signalling procedures which require at least the use of one MAP service.

When a signalling procedure takes place in the network, an application process invocation is created in each system component involved. Part of the application process invocation acts as a MAP user and handles one or several MAP dialogues. For each dialogue it employs an instance of the MAP service provider. It may also use other communication services to exchange information on other interfaces, but detailed description of these aspects is outside the scope of the present document.

18.2 Common aspects of user procedure descriptions

18.2.1 General conventions

For each signalling procedure the present document provides a brief textual overview accompanied by a flow diagram which represent the functional interactions between system components. Functional interactions are labelled using the MAP service name when the interaction results from a service request or by this service name followed by the symbol "ack" when this interaction results from a service response.

For each of the system components involved, the present document also provides a detailed textual description of the application process behaviour as well as an SDL diagram. SDL diagrams describe the sequence of events, as seen by the MAP-User, which occurs at MAP service provider boundaries as well as external events which occur at other interfaces and which impact on the previous sequence.

External events do not necessarily correspond to the messages of other protocols used in the system component. The MAP-user procedures are described as if a set of interworking functions (IWF) between the MAP-user and the other protocol entities was implemented (see figure 18.2/1). Such interworking functions are assumed to perform either an identity mapping or some processing or translation as required to eliminate information irrelevant to the MAP-user.

The mapping of service primitives on to protocol elements is described in clauses 14 to 17.

GSM signalling procedures are built from one or more sub-procedures (e.g. authentication, ciphering, ...). Sub-procedures from which signalling procedures are built are represented using SDL MACRO descriptions.

In case of any discrepancy between the textual descriptions and the SDL descriptions, the latter take precedence.

18.2.2 Naming conventions

Events related to MAP are represented by MAP service primitives. The signal names used in the SDL diagrams are derived from the service primitive names defined in clauses 7 to 12, with some lexical transformations for readability and parsability purposes (blanks between words are replaced by underscores, the first letter of each word is capitalized).

Events received and sent on other interfaces are named by appending the message or signal name to a symbol representing the interface type, with some lexical transformations for readability and parsability purposes (blanks between words are replaced by underscores, the first letter of each word is capitalized).

The following symbols are used to represent the interface types:

"I": For interfaces to the fixed network. "I" stands for ISUP interface.

"A": For interfaces to BSS (i.e. A-interfaces);

"OM": For network management interfaces (communication with OMC, MML interface, ...);

"SC": For interfaces to a Service Centre;

"HO_CA": For internal interfaces to the Handover Control Application.

"US": For a local USSD application.

These naming conventions can be summarized by the following BNF description:

<Event_Name> ::= <MAP_Primitive> | <External_Event>

<MAP_Primitive> ::= <MAP_Open> | <MAP_Close> | <MAP_U_Abort> | <MAP_P_Abort> |
<MAP_Specific> | <MAP_Notice>

<MAP_Open> ::= MAP_Open_Req | MAP_Open_Ind | MAP_Open_Rsp | MAP_Open_Cnf

<MAP_Close> ::= MAP_Close_Req | MAP_Close_Ind

<MAP_U_Abort> ::= MAP_U_Abort_Req | MAP_U_Abort_Ind

<MAP_P_Abort> ::= MAP_P_Abort_Ind

<MAP_Notice> ::= MAP_Notice_Ind

<MAP_Specific> ::= <MAP_Req> | <MAP_Ind> | <MAP_Rsp> | <MAP_Cnf>

<MAP_Req> ::= MAP_<Service_Name>_Req

<MAP_Ind> ::= MAP_<Service_Name>_Ind

<MAP_Rsp> ::= MAP_<Service_Name>_Rsp

<MAP_Cnf> ::= MAP_<Service_Name>_Cnf

<External_Event> ::= <Interface_Type>_<External_Signal>

<Interface_Type> ::= I | A | OM | SC | HO AC | US

<External_Signal> ::= <Lexical_Unit>

<Service_Name> ::= <Lexical_Unit>

<Lexical_Unit> ::= <Lexical_Component> | <Lexical_Unit>_ <Lexical_Component>

<Lexical_Component> ::= <Upper_Case_Letter><Letter_Or_Digit_List>

<Letter_Or_Digit_List> ::= <Letter_Or_Digit> | <Letter_Or_Digit_List><Letter_Or_Digit>

<Letter_Or_Digit> ::= <Letter> | <Digit>

<Letter> ::= <Lower_Case_Letter> | <Upper_Case_Letter>

<Upper_Case_Letter> ::= A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|Z

<Lower_Case_Letter> ::= a|b|c|d|e|f|g|h|i|j|k|l|m|n|o|p|q|r|s|t|u|v|w|x|y|z

<Digit> ::= 1|2|3|4|5|6|7|8|9|0

Figure 18.2/1: Interfaces applicable to the MAP-User

18.2.3 Convention on primitives parameters

18.2.3.1 Open service

When the originating and destination reference parameters shall be included in the MAP-OPEN request primitive, their value are indicated as a comment to the signal which represents this primitive.

18.2.3.2 Close service

When a pre-arranged released is requested, a comment is attached to the signal which represents the MAP-CLOSE request primitive. In the absence of comment, a normal release is assumed.

18.2.4 Version handling at dialogue establishment

Unless explicitly indicated in subsequent subclauses, the following principles regarding version handling procedures at dialogue establishment are applied by the MAP-user:

18.2.4.1 Behaviour at the initiating side

When a MAP user signalling procedure has to be executed, the MAP-user issues a MAP-OPEN request primitive with an appropriate application-context-name. If several names are supported (i.e. several versions) a suitable one is selected using the procedures described in clause 5.

If version 2 is selected and a MAP-CLOSE Confirm primitive in response to the MAP-OPEN request is received with a result parameter set to "refused" and a diagnostic parameter indicating "application-context-not-supported" or "potential incompatibility problem", the MAP-User issues a new MAP-OPEN request primitive with the equivalent version one context. This is informally represented in the SDL diagrams by a task symbol indicating "Perform Vr procedure".

If version 3 is selected and a MAP-CLOSE Confirm primitive in response to the MAP-OPEN request is received with a result parameter set to "refused" and a diagnostic parameter indicating "application-context-not-supported" or "potential incompatibility problem", the MAP-User issues a new MAP-OPEN request primitive with the equivalent version one or version two context. This is informally represented in the SDL diagrams by task symbols indicating "Perform Vr procedure".

18.2.4.2 Behaviour at the responding side

On receipt of a MAP-OPEN indication primitive, the MAP-User analyses the application-context-name.

If it refers to a version one context, the associated V1 procedure is executed; if it refers to a version two context, the associated V2 procedure is executed, otherwise the associated V3 procedure is executed.

18.2.5 Abort Handling

Unless explicitly indicated in subsequent subclauses, the following principles are applied by the MAP-user regarding abort handling procedures:

On receipt of a MAP-P-ABORT indication or MAP-U-ABORT Indication primitive from any MAP-provider invocation, the MAP-User issues a MAP-U-ABORT Request primitive to each MAP-provider invocation associated with the same user procedure.

If applicable a decision is made to decide if the affected user procedure has to be retried or not.

18.2.6 SDL conventions

The MAP SDLs make use of a number of SDL concepts and conventions, where not all of them may be widely known. Therefore, this subclause outlines the use of a few concepts and conventions to improve understanding of the MAP SDLs.

The MAP User SDLs make use of SDL Processes, Procedures and Macros. Processes are independent from each other even if one process starts another one: The actions of both of them have no ordering in time. SDL Procedures and Macros are just used to ease writing of the specification: They contain parts of a behaviour used in several places, and the corresponding Procedure/Macro definition has to be expanded at the position of the Procedure/Macro call.

All Processes are started at system initialization and live forever, unless process creation/termination is indicated explicitly (i.e. a process is created by some other process).

The direction of Input/Output Signals in the SDL graphs is used to indicate the entity to which/from which communication is directed. If a process A communicates in parallel with processes B and C, all Inputs/Outputs to/from B are directed to one side, whereas communication with C is directed to the other side. However, there has been no formal convention used that communication to a certain entity (e.g. a HLR) will always be directed to a certain side (e.g. right).

In each state all those Input Signals are listed, which result in an action and/or state change. If an Input Signal is not listed in a state, receipt of this input should lead to an implicit consumption without any action or state change (according to the SDL rules). This implicit consumption is mainly used for receipt of the MAP DELIMITER indication and for receipt of a MAP CLOSE indication, except for a premature MAP CLOSE.

18.3 Interaction between MAP Provider and MAP Users

Each MAP User is defined by at least one SDL process. On the dialogue initiating side, the MAP User will create a new instance of a MAP Provider implicit by issuing a MAP-OPEN request. This instance corresponds to a TC Dialogue and lives as long as the dialogue exists (see also subclause 14.3). There is a fixed relationship between MAP User and this Provider instance, i.e. all MAP service primitives from the MAP User for this dialogue are sent to this instance and all TC components received by this MAP Provider are mapped onto service primitives sent to this MAP User.

On the receiving side a MAP Provider instance is created implicit by receipt of a TC BEGIN indication. The corresponding MAP User is determined by the Application Context name included in this primitive, i.e. each Application Context is associated with one and only one MAP User. An instance of this User will be created implicitly by receiving a MAP-OPEN indication. Note that in some cases there exist several SDL Processes for one MAP User (Application Context), e.g. the processes Register_SS_HLR, Erase_SS_HLR, Activate_SS_HLR, Deactivate_SS_HLR, Interrogate_SS_HLR, and Register_Password for the AC Network_Functional_SS_Handling. In these cases, a coordinator process is introduced acting as a MAP User, which in turn starts a sub-process depending on the first MAP service primitive received.

19.1.1.3 Detailed procedure in the VLR

Figure 19.1.1/6 shows the process for location updating in the VLR. The following general macros are used:

Receive_Open_Ind	subclause 25.1;
Receive_Open_Cnf	subclause 25.1;
Authenticate_VLR	subclause 25.5;
Check_IMEI_VLR	subclause 25.6;
Insert_Subscriber_Data_VLR	subclause 25.7;
Obtain_IMSI_VLR to request the IMSI for the subscriber	subclause 25.8;
Activate_Tracing_VLR and Trace_Subscriber_Activity_VLR	subclause 25.9,
Subscriber_Present_VLR	subclause 25.10.

Additionally, the process specific macro

Location_Update_Completion_VLR, for optional initiation of Ciphering and TMSI reallocation as for acknowledgement of the MAP_UPDATE_LOCATION_AREA service, see figure 19.1.1/7,

and the optional process specific macro

VLR_Update_HLR to update the HLR and download subscriber data from there, see figure 19.1.1/8,

are invoked by this process.

Process Initiation

The location area updating process will be activated by receiving a MAP_UPDATE_LOCATION_AREA indication from the MSC. If there are parameter errors in the indication, the process is terminated with the appropriate error sent in the MAP_UPDATE_LOCATION_AREA response to the MSC. Else, The behaviour will depend on the subscriber identity received, either an IMSI or an TMSI.

Updating using IMSI

If the subscriber identity is an IMSI, the VLR checks whether the subscriber is unknown (i.e. no IMSI record). If so, the indicator "Location Information Confirmed in HLR" is set to "Not Confirmed" to initiate HLR updating later on. If the IMSI is known, the VLR checks whether the previous location area identification (LAI) provided in the primitive received from the MSC belongs to this VLR. If it does not, the indicator "Location Information Confirmed in HLR" is set to "Not Confirmed" to initiate HLR updating later on. The process may continue in both cases with the authentication check (see below).

Updating using TMSI

If the subscriber identity is a TMSI, the VLR checks whether the previous location area identification (LAI) provided in the primitive received from MSC belongs to an area of this VLR:

- if so, the TMSI will be checked. In case of location area change within a VLR, the TMSI should be known and the process may continue with the authentication check. Additionally, the indicator "Location Information Confirmed in HLR" is set to "Not confirmed" and the trace activity status is checked in case the target Location Area Id belongs to a new MSC.

- if the TMSI is not known or the subscriber data stored are incomplete, e.g. because the new LA belongs to a different VLR or due to VLR restoration, the indicator "Confirmed by VLR" is set to "Not Confirmed" to initiate HLR updating later on.

If the subscriber has not already been registered in the VLR, i.e. the previous LAI belongs to a different VLR, the indicators "Confirmed by HLR" and "Location Information Confirmed in HLR" are set to "Not Confirmed" and the VLR checks whether the identity of the Previous VLR (PVLR) is derivable from the previous LAI:

- if so, the IMSI and authentication parameters are requested from that VLR using the MAP_SEND_IDENTIFICATION service (see sheet 3 of figure 19.1.1/6), containing the subscriber's TMSI.

- if the dialogue is rejected by the PVLR, the process continues requesting the IMSI from the MS. In case the PVLR reverts to the MAP version Vr dialogue, the VLR will perform the respective procedure of version Vr, too, with outcomes as for the current MAP version dialogue. Else, the process waits the for the respective MAP_SEND_IDENTIFICATION response from the PVLR:

    - if the IMSI is received in that primitive, the process continues with the authentication check;

    - if the IMSI is not received from the previous VLR for any reason, the dialogue to the PVLR is terminated and the IMSI will be requested from the MS;

    - if a MAP_NOTICE indication is received from the PVLR, the dialogue will be terminated by sending a MAP_CLOSE indication, and the process continues requesting the IMSI from the MS;

    - if a MAP_P_ABORT or MAP_U_ABORT indication is received from the MSC while waiting for the MAP_SEND_IDENTIFICATION response, the process is terminated;

    - if a MAP_NOTICE indication is received from the MSC while waiting for the MAP_SEND_IDENTIFICATION response, the dialogue with the PVLR will be aborted by sending a MAP_U_ABORT indication (Remote Operations Failure), the dialogue with the MSC will be terminated by sending a MAP_CLOSE and the process terminates;

- if the identity of the previous VLR cannot be derived, the process continues by requesting the IMSI from the MS.

Requesting IMSI from the MS

For requesting the IMSI from the MS, the macro Obtain_IMSI_VLR described in subclause 25.8 is invoked (see figure 19.1.1/6 sheet 3). The outcome will be:

- OK, i.e. receipt of IMSI, in which case the process continues with the authentication check described below; or

- receipt of an Absent Subscriber error, indicating that the MS did not respond. In this case the System Failure error is reported in the MAP_UPDATE_LOCATION_AREA response towards the MSC and the updating process is terminated;

- aborted, i.e. the MSC dialogue has been released while waiting for the IMSI. In this case the updating process is terminated, too.

Authentication check

After a subscriber identity has been received, either in the service indication or by an explicit request procedure, the VLR checks whether authentication of this identity is required (see figure 19.1.1/6 sheet 2). If so, the authentication macro described in subclause 25.5 is invoked. The outcome of this macro can be:

- OK, i.e. the subscriber has been authenticated successfully, in which case the process is continued by setting the indicator "Confirmed by Radio Contact" to "Confirmed" and updating the location information held in the register. Thereafter,

    - if one or both of the indicators "Confirmed by HLR" and "Location Information Confirmed in HLR" is set to "Not Confirmed", HLR updating is invoked first;

    - otherwise the process continues with the Location Update Completion VLR macro described below, and the register is updated after successful completion of this macro.

- Illegal subscriber, i.e. there was a mismatch between expected and received SRES. The VLR checks whether authentication had been performed using the TMSI, in which case a new authentication attempt with IMSI may be started (VLR operator option).

  - if so, the process continues by requesting the IMSI from the MS;

  - else, the Illegal Subscriber error is reported in the MAP_UPDATE_LOCATION_AREA response.

- Unknown Subscriber, i.e. the IMSI given is unknown in the HLR. In this case, the subscriber data are deleted in the VLR and the same error is returned in the MAP_UPDATE_LOCATION_AREA response.

- Procedure error, i.e. the authentication process was unsuccessful for some other reason, e.g. because of a failure while requesting authentication information from the HLR. In this case the System Failure error is reported in the MAP_UPDATE_LOCATION_AREA response.

- Null, indicating impossible dialogue continuation (e.g. termination of the radio path), and leading to procedure termination without any further action.

Updating the HLR

If the HLR is to be updated, the VLR_Update_HLR macro described below is performed, with one of the following results (see sheet 4 of figure 19.1.1/6):

- OK, if HLR updating has been completed successfully. The response will contain the HLR number as parameter. Next, the Location_Update_Completion VLR macro is invoked (checking amongst others the roaming restrictions and regional subscription data), and upon successful outcome of this macro the register is updated and the process terminates.

- Roaming Not Allowed, qualified by PLMN Roaming Not Allowed if the location information indicates a PLMN for which the subscriber has no subscription or if the subscribers HLR cannot be reached (e.g. SS7 links to the subscribers HPLMN do not yet exist). In this case, the error Roaming Not Allowed qualified by PLMN Roaming Not Allowed is sent in the MAP_UPDATE_LOCATION_AREA response. The Subscriber Data are deleted in the VLR.

- if Roaming Not Allowed was qualified by the parameter Operator Determined Barring, the same value is sent in the MAP_UPDATE_LOCATION_AREA response to the MSC. The subscriber data are deleted in the VLR.

- Unknown Subscriber, if the subscriber is not known in the HLR. In this case, the subscriber data are deleted in the VLR, and the same error is sent in the MAP_UPDATE_LOCATION_AREA response.

- Procedure error, if there occurs some other error during HLR updating (e.g. abort of the connection to HLR):

  - if the VLR can proceed in stand alone mode (VLR operator option), the Location Update Completion VLR macro is invoked to complete the VLR updating, and the indicator "Confirmed by HLR" remains unchanged;

  - otherwise, the System Failure error is sent in the MAP_UPDATE_LOCATION_AREA response.

- Aborted, indicating that during HLR updating the MSC dialogue has been terminated. In this case, the updating process terminates without any further action.

The macro Location Update Completion VLR

This macro completes the VLR updating process. First, the VLR checks whether there is a roaming restriction for the subscriber (see figure 19.1.1/7):

- if the target LA is not allowed for the subscriber due to national roaming restrictions, the error Roaming Not Allowed with cause National Roaming Not Allowed is returned in the MAP_UPDATE_LOCATION_AREA response towards the MSC.

  The subscriber data are not deleted from VLR, to avoid unnecessary HLR updating when roaming into other LAs of the same MSC. An indication that the subscriber is not allowed to roam is set in the VLR (LA Not Allowed Flag set to not allowed). As a consequence the subscriber is not reachable (checked for MTC, SMS and MT USSD) and cannot perform outgoing actions (checked in Access Management).

- if the target LA is not allowed for the subscriber because of Roaming Restriction Due To Unsupported Feature stored in the VLR, the error Roaming Not Allowed with cause National Roaming Not Allowed is returned towards the MSC in the MAP_UPDATE_LOCATION_AREA response.

  Also in this case the subscriber data are not deleted from VLR, to avoid unnecessary HLR updating when roaming into other LAs of the same MSC. The LA Not Allowed Flag is set to not allowed in the VLR.

- if the target LA is not allowed for the subscriber because of regional subscription data (Zone Code List) stored in the VLR, the error Roaming Not Allowed with cause Location Area Not Allowed is returned towards the MSC in the MAP_UPDATE_LOCATION_AREA response.

  Also in this case the subscriber data are not deleted from VLR, to avoid unnecessary HLR updating when roaming into other LAs of the same MSC. The LA Not Allowed Flag is set to not allowed in the VLR.

- if, after check of possible roaming restrictions, the subscriber is allowed to roam in the target LA, the LA Not Allowed Flag is set to allowed (if necessary), the IMSI Detached Flag is set to attached and the process SUBSCRIBER_PRESENT_VLR is started; this may inform the HLR that the subscriber is present again to retry an SMS delivery (see subclause 19.1.1.7). Thereafter, the VLR checks whether TMSI reallocation is required.

  - if so, the VLR sends a MAP_SET_CIPHERING_MODE request containing:

    - Ciphering Mode (version 1 GSM); and

    - Kc, the cipher key to be used.

- if IMEI checking is required by the operator, the VLR will invoke the CHECK_IMEI_VLR macro (see subclause 25.6) to initiate both requesting IMEI from the MS and checking of this IMEI towards the EIR. As result either the service is granted, with process continuation as given below, or the service is rejected, in which case the VLR marks the subscriber as detached and returns an Illegal Equipment error in the MAP_UPDATE_LOCATION_AREA response before the process terminates.

  - the VLR then sends a MAP_FORWARD_NEW_TMSI request containing the new TMSI, and the MAP_UPDATE_LOCATION_AREA response containing no parameters. The process will thereafter wait for the MAP_FORWARD_NEW_TMSI confirm. If this indicates a negative outcome, or if a MAP_P_ABORT or a MAP_U_ABORT primitive is received, the old TMSI is frozen. Subsequent accesses of the MS shall be accepted with both old or new TMSI.

- if TMSI reallocation is not required, the VLR invokes the CHECK_IMEI_VLR macro (see subclause 25.6) to initiate both requesting IMEI from the MS and checking of this IMEI towards the EIR, if IMEI Checking is required by the operator. As a result, either the service is granted, in which case the MAP_UPDATE_LOCATION_AREA response is sent without any parameters, or the service is rejected, in which case an Illegal Equipment error is returned in the MAP_UPDATE_LOCATION_AREA response, before the process terminates.

In all cases where the VLR sends a MAP_UPDATE_LOCATION_AREA response to the MSC, the dialogue towards the MSC is terminated by a MAP_CLOSE request with parameter Release Method indicating Normal Release.

The macro VLR Update HLR

This macro is invoked by the VLR process for location updating or by some other process handling the first subscriber access to the network after a register failure in order to perform HLR updating. If the VLR does not know the subscribers HLR (e.g. no IMSI translation exists as there are not yet any SS7 links to the subscribers HPLMN), the error Roaming Not Allowed with cause PLMN Roaming Not Allowed is returned.

If the subscribers HLR can be reached, the VLR opens a dialogue towards the HLR (see figure 19.1.1/8) by sending a MAP_OPEN request without any user specific parameters, together with a MAP_UPDATE_LOCATION request containing the parameters

- IMSI, identifying the subscriber;

- Location Info, containing the MSC number;

- VLR Number, the E.164 address of the VLR, to be used by the HLR when addressing the VLR henceforth (e.g. when requesting an MSRN);

- the LMSI as an VLR operator option; this is a subscriber identification local to the VLR, used for fast database access.

In case the HLR rejects dialogue opening (see subclause 25.1), the VLR will terminate the procedure indicating Procedure error. If the HLR indicates version Vr protocol to be used, the VLR will revert to the version Vr procedure concerning the dialogue with the HLR, with outcomes as for the current MAP version procedure.

If the HLR accepts the dialogue, the HLR will respond with:

- a MAP_INSERT_SUBSCRIBER_DATA indication, handled by the macro Insert_Subs_Data_VLR defined in subclause 25.7;

NOTE: The HLR may repeat this service several times depending on the amount of data to be transferred to the VLR and to replace subscription data in case they are not supported by the VLR.

- a MAP_ACTIVATE_TRACE_MODE indication, handled by the macro Activate_Tracing_VLR defined in subclause 25.9;

- a MAP_FORWARD_CHECK_SS_INDICATION_ind. This indication will be relayed to the MSC without any change of the current state.

- the MAP_UPDATE_LOCATION confirmation:

  - if this confirmation contains the HLR Number, this indicates that the HLR has passed all information and that updating has been successfully completed. The VLR is updated using the parameters provided in the service and needed by the VLR. If certain parameters are not needed in the VLR, e.g. because some service is not supported, the corresponding data may be discarded. The VLR sets the "Confirmed by HLR" and "Location information confirmed in HLR" indicators to "Confirmed" to indicate successful subscriber data updating;

  - if the confirmation contains an User error cause (Unknown Subscriber, Roaming Not Allowed or some other), the process calling the macro continues accordingly. In the last case, the subscriber data are marked as incomplete by setting the indicators "Confirmed by HLR" and "Location information confirmed in HLR" to "Not Confirmed". The same holds if there is a Provider error or a Data error in the confirmation;

- a MAP_P_ABORT, MAP_U_ABORT, or MAP_CLOSE indication. In these cases, the subscriber data are marked to be incomplete and the process continues as in the case of an error reported by the HLR;

- a MAP_NOTICE indication. Then, the dialogue towards the HLR is terminated, the subscriber data are marked to be incomplete and the process continues as in the case of an error reported by the HLR;

- if during HLR updating the VLR receives a MAP_P_ABORT, MAP_U_ABORT or a MAP_CLOSE indication concerning the MSC dialogue, the process is terminated by sending a MAP_U_ABORT request towards the HLR, and subscriber data are marked to be incomplete;

- if during HLR updating the VLR receives a MAP_NOTICE indication concerning the MSC dialogue, the dialogue with the MSC is terminated by sending a MAP_CLOSE, the dialogue with the HLR is terminated by sending a MAP_U_ABORT, subscriber data are marked to be incomplete and the process is terminated.

20.1.1 Tracing Co-ordinator for the VLR

The MAP_OPEN indication opens the dialogue for the stand-alone tracing procedure when the application context tracingContext is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP_ACTIVATE_TRACE_MODE indication is received, the process ATM_VLR_Standalone is created;
- if the MAP_DEACTIVATE_TRACE_MODE indication is received, the process DTM_VLR_Standalone is created.

After creation of the user process the Co-ordinator relays the messages between the MAP_PM and the invoked process until a request or an indication for dialogue termination is received.

The Tracing Co-ordinator is shown in the figure 20.1/1.

20.1.2 Subscriber Data Management Co-ordinator for the VLR

The MAP_OPEN indication opens the dialogue for the stand-alone subscriber data management procedure when the application context subscriberDataManagementContex is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP_INSERT_SUBSCRIBER_DATA indication is received, the process INS_SUBS_DATA_VLR is created;

- if the MAP_DELETE_SUBSCRIBER_DATA indication is received, the process Delete_Subscriber_Data_VLR is created.

After creation of the user process the Co-ordinator relays the messages between the MAP_PM and the invoked process until a request or an indication for dialogue termination is received.

The Subscriber_Data_Management Co-ordinator is shown in the figure 20.1/2.

20.1.3 Tracing Co-ordinator for the SGSN

The MAP_OPEN indication opens the dialogue for the stand-alone tracing procedure when the application context tracingContext is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP_ACTIVATE_TRACE_MODE indication is received, the process ATM_SGSN_Standalone is created;
- if the MAP_DEACTIVATE_TRACE_MODE indication is received, the process DTM_SGSN_Standalone is created.

After creation of the user process the Co-ordinator relays the messages between the MAP_PM and the invoked process until a request or an indication for dialogue termination is received.

The Tracing Co-ordinator for the SGSN is shown in the figure 20.1/3.

20.2 Tracing procedures

Three types of tracing procedures exist:

i) Subscriber tracing management procedures;

ii) Subscriber tracing procedures;

iii) Event tracing procedures.

20.2.2.3 Subscriber tracing procedure

When the VLR receives a MAP_PROCESS_ACCESS_REQUEST or MAP_UPDATE_LOCATION_AREA indication related to any subscriber activity from the MSC, the subscriber tracing procedure may be carried out. The macro Trace_Subscriber_Activity_VLR is shown in figure 25.9/2.

20.2.3 Procedures in the MSC

The MSC is involved in the following tracing procedure:

i) Subscriber tracing procedure.

20.2.3.1 Subscriber tracing procedure

When receiving the MAP_TRACE_SUBSCRIBER_ACTIVITY indication from the VLR, the MSC stores trace reference, trace type and the identity of the OMC in charge of the trace, and the MSC starts to collect the trace information. The MSC will send the trace record to the OMC.

The macro Trace_Subscriber_Activity_MSC is shown in figure 25.9/1.

20.2.4 Procedures in the SGSN

The SGSN is involved in the following tracing procedures:

i) Subscriber tracing activation procedure;

ii) Subscriber tracing deactivation procedure;

20.2.4.1 Subscriber tracing activation procedure

When receiving a MAP_ACTIVATE_TRACE_MODE indication, the SGSN will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known, the tracing facility is supported and the tracing capacity is not exceeded, the successful report is sent in the MAP_ACTIVATE_TRACE_MODE response primitive.

The MAP_ACTIVATE_TRACE_MODE indication primitive may be received during a location updating or data restoration procedure, so the location updating or restore data process shall use the macro Activate_Tracing_SGSN (see figure 25.9/7).

The subscriber tracing activation process in the SGSN is shown in figure 20.2/16.

20.3.1.2 Subscriber data modification procedure

The OMC can modify the subscriber data in several different ways. The modifications can be categorized in following groups:

a) no effect in the VLR;

b) data shall be modified in both the HLR and the VLR;

c) withdrawal of a basic service or a supplementary service requiring change to VLR data;

d) modification affects on the roaming of the subscriber and the subscriber shall be removed from the VLR database;

e) authentication algorithm or authentication key of the subscriber is modified;

f) no effect in the SGSN;

g) data shall be modified in both the HLR and the SGSN;

h) withdrawal of a GPRS subscription data or a basic service or both requiring change to SGSN data;

i) modification affects on the roaming of the subscriber and the subscriber shall be removed from the SGSN database;

j) withdrawal of GPRS Subscription related to Network Access Mode;

k) withdrawal of non-GPRS Subscription related to Network Access Mode;

In case "b" and “g” the MAP_INSERT_SUBSCRIBER_DATA service is initiated in the HLR.

In case "c" and “h” the MAP_DELETE_SUBSCRIBER_DATA service is initiated in the HLR.

In cases "d", "e", “i”, “j” and “k” the MAP_CANCEL_LOCATION service is initiated in the HLR.

If the result of a primitive received from the VLR or from the SGSN is unsuccessful, the HLR may initiate re-attempts; the number of repeat attempts and the time in between are HLR operator options, depending on the error returned by the VLR or by the SGSN.

The subscriber data modification procedure in the HLR is shown in the figures 20.3/4, 20.3/5 and 25.7/2.

20.3.2 Procedures in the VLR

20.3.2.1 Subscriber deletion procedure

The subscriber deletion procedure in the VLR is described in the subclause 19.1.

20.3.2.2 Subscriber data modification procedure

When receiving either the MAP_INSERT_SUBSCRIBER_DATA indication or the MAP_DELETE_SUBSCRIBER_DATA indication, the VLR checks the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

After receiving the first MAP_INSERT_SUBSCRIBER_DATA indication, the VLR will check the IMSI that is included in the primitive. If the IMSI is unknown, the error "Unidentified subscriber" is returned.

If the VLR does not support received basic or supplementary services or the network feature Operator Determined Barring, or there is a problem with Regional Subscription Data then it reports it to the HLR.

If the entire MSC area is restricted due to regional subscription, this is reported to the HLR.

If the updating of the subscriber data is not possible, the VLR will initiate the MAP_U_ABORT request primitive. If the updating is successful, the MAP_CLOSE indication is received from the HLR.

The subscriber data modification procedure in the VLR is shown in the figures 20.3/6, 20.3/7 and 25.7/1.

20.3.3 Procedures in the SGSN

20.3.3.1 Subscriber deletion procedure

The subscriber deletion procedure in the SGSN is described in the subclause 19.1.

20.3.3.2 Subscriber data modification procedure

When receiving either the MAP_INSERT_SUBSCRIBER_DATA indication or the MAP_DELETE_SUBSCRIBER_DATA indication, the SGSN checks the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

After receiving the first MAP_INSERT_SUBSCRIBER_DATA indication, the SGSN will check the IMSI that is included in the primitive. If the IMSI is unknown, the error "Unidentified subscriber" is returned.

If the SGSN does not support received basic services or the network feature Operator Determined Barring, or there is a problem with Regional Subscription Data then it reports it to the HLR.

If the entire SGSN area is restricted due to regional subscription, this is reported to the HLR.

If the updating of the subscriber data is not possible, the SGSN will initiate the MAP_U_ABORT request primitive. If the updating is successful, the MAP_CLOSE indication is received from the HLR.

The subscriber data modification procedure in the SGSN is shown in the figures 20.3/11, 20.3/12 and 25.7/5.

20.4.2 Subscriber identity procedure in the VLR

When the IMSI request is received from the OMC, the VLR will send the MAP_SEND_IMSI request to the HLR. The contents of the response are sent to the OMC.

The subscriber identity procedure in the VLR is shown in figure 20.4/3.

21 Call handling procedures

21.1 General

The MAP call handling procedures are used:

- to retrieve routeing information to handle a mobile terminating call;
- to transfer control of a call back to the GMSC if the call is to be forwarded;
- to retrieve and transfer information between anchor MSC and relay MSC for inter MSC group calls / broadcast calls;
- to allocate resources in an SIWFS;
- to handle the reporting of MS status for call completion services;
- to handle the notification of remote user free for CCBS;
- to handle the alerting and termination of ongoing call activities for a specific subscriber.

The procedures to handle a mobile originating call and a mobile terminating call after the call has arrived at the destination MSC do not require any signalling over a MAP interface. These procedures are specified in GSM 03.18 [97].

The stage 2 specification for the retrieval of routeing information to handle a mobile terminating call is in GSM 03.18 [97]; modifications to this procedure for CAMEL are specified in GSM 03.78 [98], for optimal routeing of a basic mobile-to-mobile call in GSM 03.79 [99] and for CCBS in GSM 03.93. The interworking between the MAP signalling procedures and the call handling procedures for each entity (GMSC, HLR and VLR) is shown by the transfer of signals between these procedures.

The stage 2 specification for the transfer of control of a call back to the GMSC if the call is to be forwarded is in GSM 03.79 [99]. The interworking between the MAP signalling procedures and the call handling procedures for each entity (VMSC and GMSC) is shown by the transfer of signals between these procedures.

The stage 2 specifications for inter MSC group calls / broadcast calls are in GSM 03.68 and GSM 03.69. The interworking between the MAP signalling procedures and the group call /broadcast call procedures for each entity (Anchor MSC and Relay MSC) is shown by the transfer of signals between these procedures.

The stage 2 specification for the allocation of resources in an SIWFS is in GSM 03.54. The interworking between the MAP signalling procedures and the call handling procedures for each entity (VMSC and SIWFS) is shown by the transfer of signals between these procedures.

The interworking between the call handling procedures and signalling protocols other than MAP is shown in GSM 03.18, GSM 03.78 and GSM 03.79.

The stage 2 specification for the handling of reporting of MS status for call completion services and notification of remote user free for CCBS is in GSM 03.93.

21.3.2 Process in the VMSC

The MAP process in the VMSC to retrieve routeing information for a mobile terminating call is shown in figure 21.3/2. The MAP process invokes macros not defined in this subclause; the definitions of these macros can be found as follows:

Receive_Open_Cnf see subclause 25.1.2;

Check_Confirmation see subclause 25.2.2.

Successful Outcome

When the MAP process receives a Resume Call Handling request from the call handling process in the VMSC, it requests a dialogue with the GMSC whose identity is contained in the Resume Call Handling request by sending a MAP_OPEN service request, requests routeing information using a MAP_RESUME_CALL_HANDLING service request and invokes the macro Receive_Open_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the GMSC. VMSC shall not send any duplicate data to the GMSC.

If the VMSC notices after receiving a Resume Call Handling request that the segmentation is needed the VMSC does not set the “All Information Sent” indicator. Otherwise the indicator is set and the process returns to the Wait For GMSC Response state.

If the MAP process receives a MAP_RESUME_CALL_HANDLING service confirm from the GMSC, the MAP process invokes the macro Check_Confirmation to check the content of the confirm.

If the macro Check_Confirmation takes the OK exit, the MAP process checks if the “All Information Sent” indicator is set. If it is set the MAP process sends a Resume Call Handling ack to the call handling process in the VMSC and returns to the idle state. If the “All Information Sent” indicator is not set the MAP process checks if further segmentation is needed. If segmentation is needed the VMSC does not set the indicator and sends MAP_RESUME_CALL_HANDLING service request to the GMSC. Otherwise the indicator is set and the MAP_RESUME_CALL_HANDLING service request is sent to the GMSC.

Dialogue opening failure

If the macro Receive_Open_Cnf indicates that the dialogue with the GMSC could not be opened or that the dialogue can be opened only at an earlier version, the MAP process sends an Resume Call Handling negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

Error in MAP_RESUME_CALL_HANDLING confirm

If the MAP_RESUME_CALL_HANDLING service confirm contains a user error or a provider error, the MAP process sends a Resume Call Handling negative response to the call handling process in the VMSC and returns to the idle state.

NOTE: the 'Data Error' exit from the macro Check_Confirmation is shown for formal completeness; the result is empty, so the MAP_PROVIDE_SUBSCRIBER_INFO_cnf primitive cannot contain a data error.

Abort of GMSC dialogue

After the dialogue with the GMSC has been established, the MAP service provider may abort the dialogue by issuing a MAP_P_ABORT indication, or the GMSC may send a MAP_CLOSE indication. In either of these cases, the MAP process sends a Resume Call Handling negative response to the call handling process in the GMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP_NOTICE indication, the MAP process closes the dialogue with the GMSC, sends a Resume Call Handling negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

21.4.2 Process in the Anchor MSC

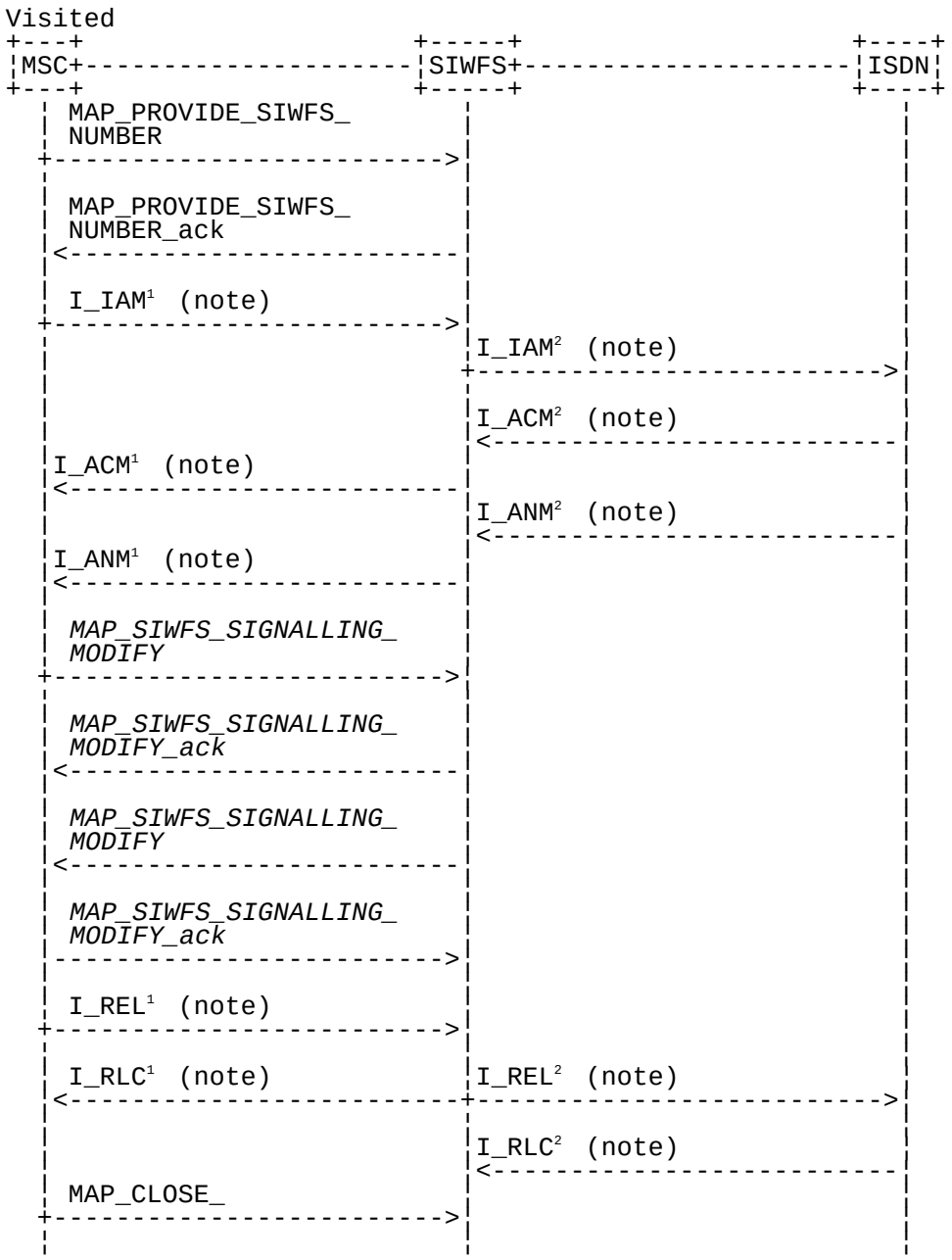
The MAP process in the Anchor MSC to retrieve and transfer information from / to the Relay MSC for VBS and VGCS calls is shown in figure 21.4/2. The MAP process invokes macros not defined in this subclause; the definitions of these macros can be found as follows:

Receive_Open_Cnf	see subclause 25.1.2;
Check_Indication	see subclause 25.2.1;
Check_Confirmation	see subclause 25.2.2.

21.5 Allocation and modifications of resources in an SIWFS

21.5.1 General

The message flow for successful allocation and modification of resources in an SIWFS is shown in figure 21.5/1 (mobile originating call non-loop method), 21.5/2 (mobile originating call loop method) and 21.5/3 (mobile terminating call loop method).



Notes: *xxx = Optional Procedure*

TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. The Release message can be initiated either by the calling or called subscriber. For further details on the TUP and ISUP procedures refer to the following CCITT Recommendations & ETSI specification:

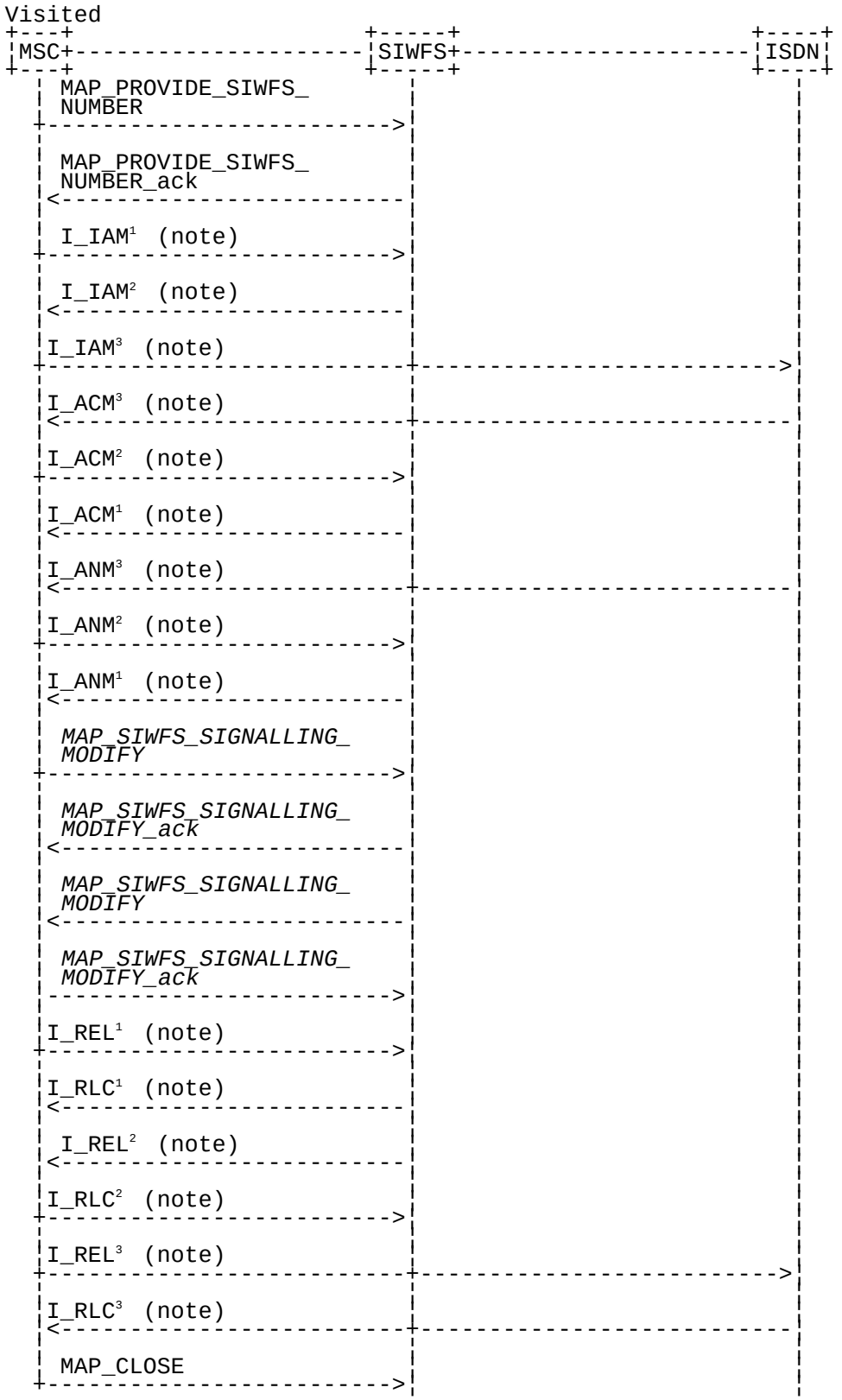
Q.721-725 - Telephone User Part (TUP);

ETS 300 356-1 - Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.

The number on the ISUP messages have been added to link the messages to respective signalling sequence.

The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

Figure 21.5/1: Message flow for mobile originating call non-loop method



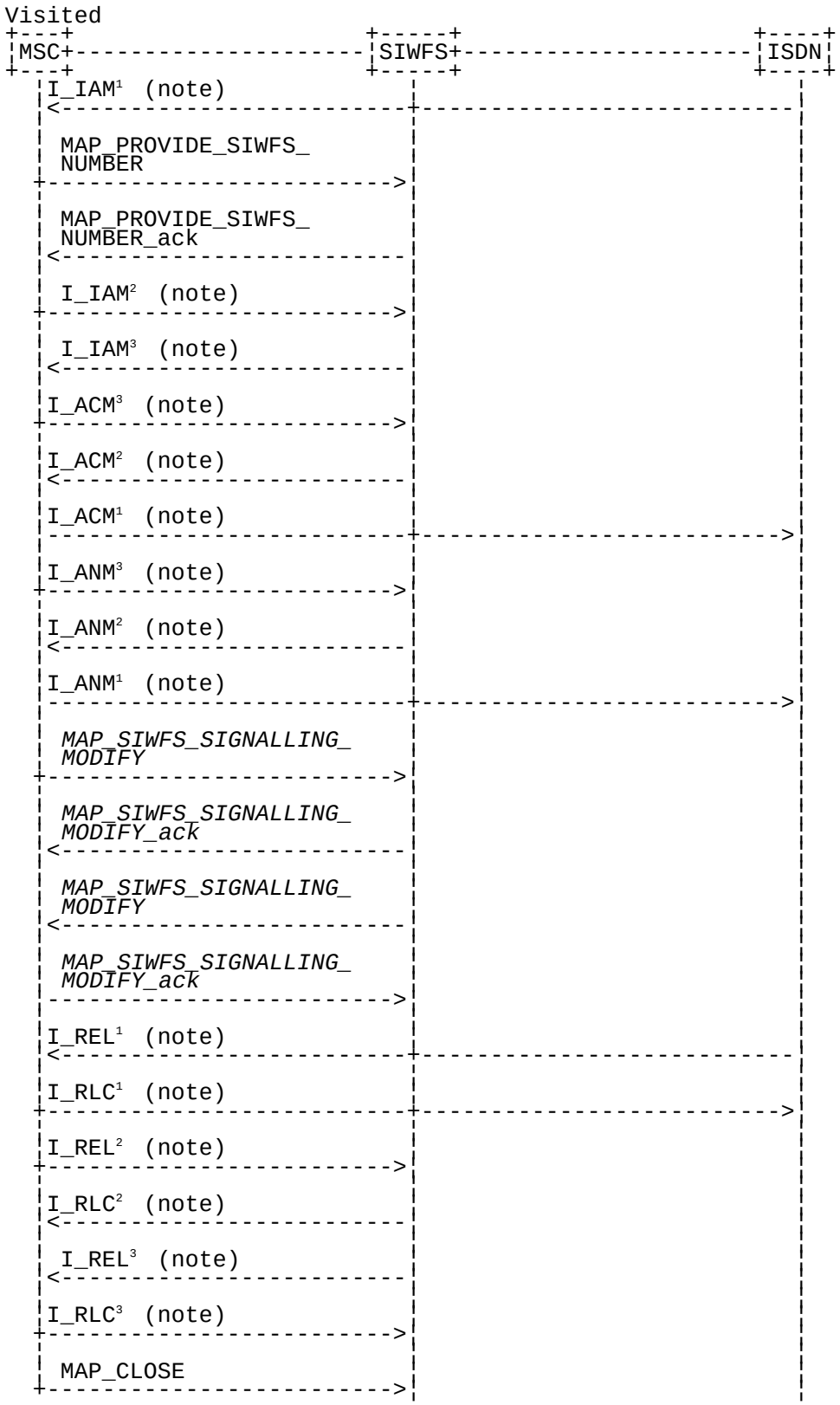
Notes:

xxx = Optional Procedure

TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. The Release message can be initiated either by calling or called subscriber. For further details on the TUP and ISUP procedures refer to the following CCITT Recommendations & ETSI specification:
Q.721-725 - Telephone User Part (TUP);
ETS 300 356-1 - Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.

The number on the ISUP messages have been added to link the messages to respective signalling sequence.
The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

Figure 21.5/2: Message flow for mobile originating call loop method



Notes:

xxx = Optional Procedure

TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. The Release message can be initiated either by calling or called subscriber. For further details on the TUP and ISUP procedures refer to the following CCITT Recommendations & ETSI specification:
Q.721-725 - Telephone User Part (TUP);
ETS 300 356-1 - Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.
The number on the ISUP messages have been added to link the messages to respective signalling sequence.
The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

Figure 21.5/3: Message flow for mobile terminating call loop method

The following MAP servcies are used to allocate resources in an SIWFS:

MAP_PROVIDE_SIWFS_NUMBER see subclause 10.8.

The following MAP services are used to modify resources in an SIWFS:

MAP_SIWFS_SIGNALLING_MODIFY see subclause 10.9.

22 Supplementary services procedures

The following application contexts exist for handling of supplementary services:

- accessUnstructuredSsContext;
- accessFunctionalSsContext.

The accessUnstructuredSsContext refers to a simple MAP user, for which the corresponding MAP process can be identified by the MAP-Provider directly.

However, the accessFunctionalSsContext refers to a complex MAP-User consisting of several processes. For this user, a process co-ordinator is defined for each network entity, in order to identify the correct process to invoke. These processes open and validate the dialogue, then invoke the necessary operation-specific process. These processes are described below.

22.2.4 Procedures in the HLR

The procedure in the HLR is initiated when it receives a MAP_REGISTER_SS indication.

The HLR acts as follows:

- if the operator has barred the subscriber from access to supplementary services, the Call Barred error should be returned to the VLR. The parameter "operatorBarring" shall be included with the error.

The supplementary service request shall then be processed according to GSM 03.11 and the 03.8x and 03.9x-series of technical specifications. This handling may lead to either a successful result, a partially successful result, or an error being returned.

For call independent SS operations, each message shall only contain a single component. Messages which contain more than one component will be stopped at the air interface (as specified in GSM 09.11):

- if the VLR is to be updated after the supplementary service registration, the MAP_INSERT_SUBS_DATA_HLR process shall be initiated;

- if at any time during this procedure a MAP_P_ABORT, MAP_U_ABORT or MAP_CLOSE indication concerning the process is received from the VLR, the process is terminated. If a MAP_NOTICE indication is received, a MAP_CLOSE request is sent towards the VLR.

The registration procedure in the HLR is shown in figure 22.2.4/1.

22.6.4 Procedures in the HLR

When receiving the MAP_INTERROGATE_SS indication, the MAP user acts as follows:

- if the operator has barred the subscriber from access to supplementary services, the error Call Barred is returned to the MSC. The parameter "operatorBarring" shall be included with the error;

- if the supplementary service is not supported in the HLR the error Unexpected Data Value is returned to the VLR.

The interrogation is either answered by the VLR or by the HLR, depending on the service interrogated.

a) Interrogation to be handled by the VLR

If the interrogation procedure should have been answered by the VLR, then the HLR assumes that the VLR does not support the interrogated supplementary service, and returns the SS Not Available error to the VLR.

b) Interrogation to be handled by HLR

The supplementary service request shall be processed according to GSM 03.11 and the 03.8x and 03.9x-series of technical specifications. This handling may lead to either a successful result or an error being returned.

For call independent SS operations, each message shall only contain a single component.

22.12.2 Procedures in the MSC

The supplementary service invocation notification procedure in the MSC is triggered when the requested supplementary service is invoked at the MSC. The MSC notifies the gsmSCF of a supplementary service invocation via the MAP-SUPPLEMENTARY-SERVICE-INVOCATION-NOTIFICATION service. This is sent in a TCAP TC-BEGIN primitive. The MSC then awaits a positive or negative acknowledgement from the gsmSCF to the MAP-SUPPLEMENTARY-SERVICE-INVOCATION-NOTIFICATION. This is received in a TCAP TC-END primitive, and upon receipt the relationship between the MSC and the gsmSCF is terminated. Similarly, the relationship is terminated at the MSC by the sending of or receipt of a TCAP P-ABORT primitive. This is illustrated in Figure 22.12.2/1.

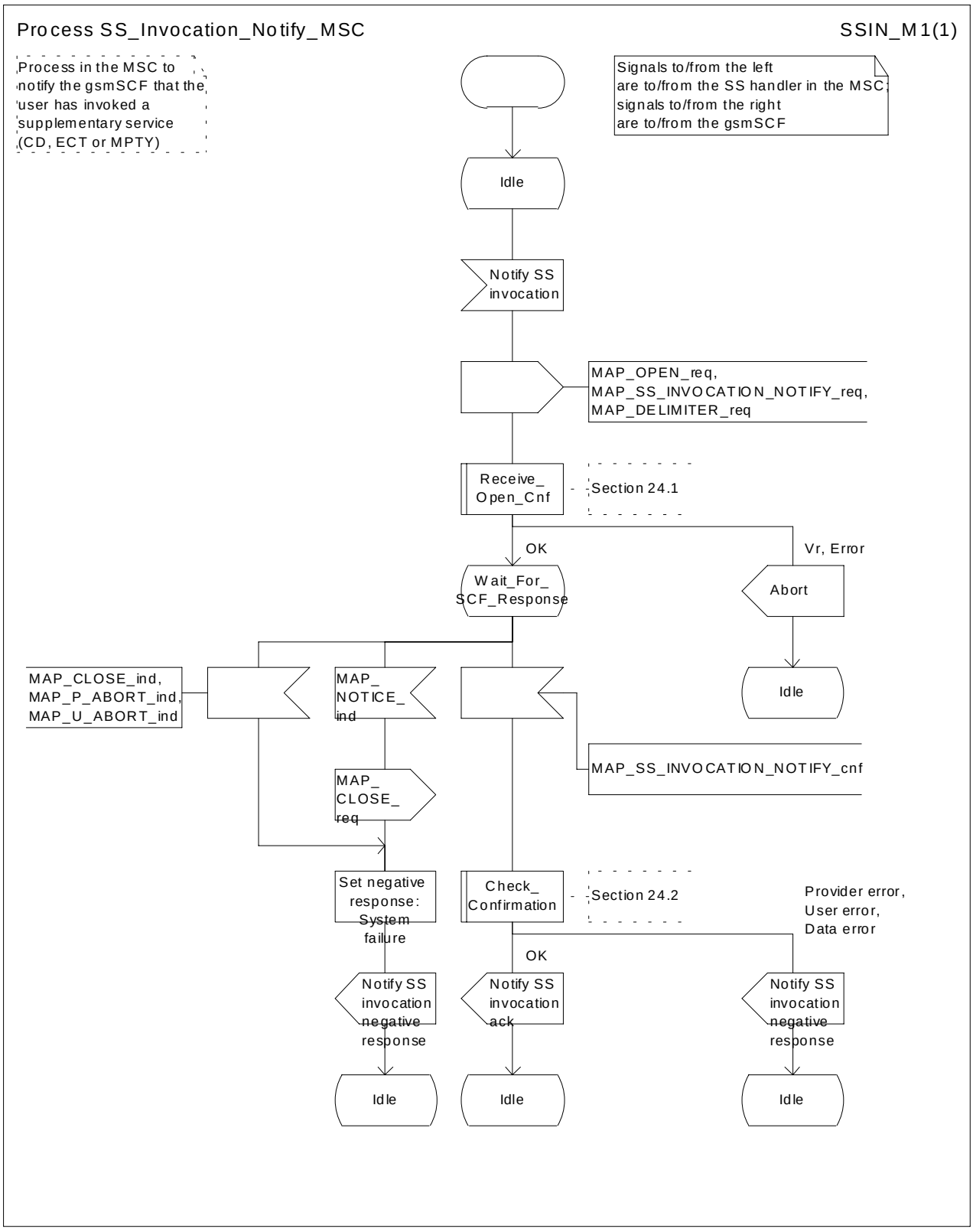


Figure 22.12.2/1 Process SS_Invocation_Notify_MSC (sheet 1 of 1)

22.12.3 Procedures in the gsmSCF

Upon receiving notification of the supplementary service invocation via the MAP-SUPPLEMENTARY-SERVICE-INVOCATION-NOTIFICATION service, the gsmSCF analyses the received information. If the gsmSCF understands the information sent via the the MAP-SUPPLEMENTARY-SERVICE-INVOCATION-NOTIFICATION service then it returns a positive acknowledgement to the MAP-SUPPLEMENTARY-SERVICE-INVOCATION-NOTIFICATION, indicating the success of the service. This is returned in a TCAP TC-END primitive, using the basic end procedure.

Otherwise, a negative acknowledgement to the MAP-SUPPLEMENTARY-SERVICE-INVOCATION-NOTIFICATION is returned. This is also returned in a TCAP TC-END primitive, again using the basic end procedure. The gsmSCF TCAP service may also choose to abort the relationship to the MSC by sending a TCAP P-ABORT primitive. It will immediately terminate processing of a MAP-SUPPLEMENTARY-SERVICE-INVOCATION-NOTIFICATION should a TCAP P-ABORTprimitive be received from the MSC. This is illustrated in Figure 22.12.3/1.

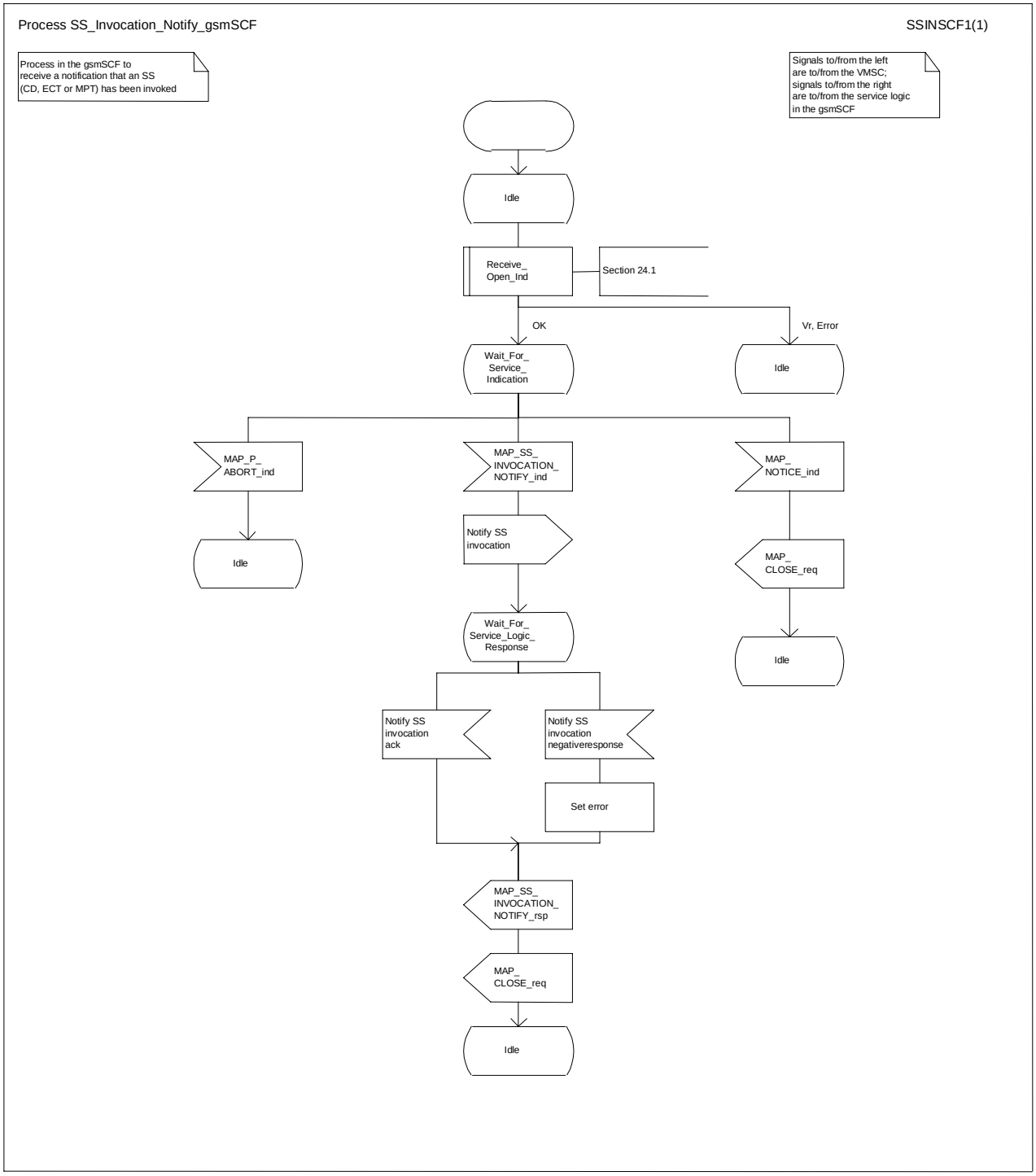


Figure 22.12.3/1 Process SS_Invocation_Notify_gsmSCF (sheet 1 of 1)

23.1.2 Short message Gateway Co-ordinator for the HLR

The MAP_OPEN indication opens a dialogue for the short message procedure between the gateway MSC and the HLR when the application context shortMessageGatewayContext is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP_SEND_ROUTING_INFO_FOR_SM indication is received, the process Mobile_Terminated_SM_HLR is created;

- if the MAP_REPORT_SM_DELIVERY_STATUS indication is received, the process Report_SM_delivery_stat_HLR is created.

After creation of the user processs the Co-ordinator relays the messages between the MAP_PM and the invoked process until a request or an indication for dialogue termination is received.

The SM Gateway Co-ordinator is shown in the figure 23.1/2.

If the Receive_Open_Ind macro takes the Vr exit then HLR shall perform the MAP Vr dialogue. But based on the subscriber data, handling at the MAP user application level may be performed as described in release 97 :

- If the subscriber is not a GPRS subscriber then the behaviour of the HLR shall be the same as described in the corresponding MAP Vr release.

- If the subscriber is a GPRS subscriber and a non-GPRS subscriber with the option « transfer of SM via the MSC when GPRS is not supported in the GMSC » then the behaviour of the HLR shall be the same as described in the corresponding MAP Vr release.

- If the subscriber is a GPRS subscriber and a non-GPRS subscriber with the option « transfer of SM via the SGSN when GPRS is not supported in the GMSC » or if the subscriber is a GPRS subscriber only then the behaviour of the HLR shall be the same as for the case transfer over GPRS described in MAP release 97, with the following precision: because GMSC does not support MAP release 97, the previous MAP protocol release is used. When the HLR sends the MAP_SEND_ROUTING_INFO_FOR_SM_Resp, the SGSN number is mapped to the MAP parameter « MSC number ». When the HLR sends the MAP_INFORM_SERVICE_CENTRE_resp, the MNRG status shall be mapped to the MAP parameter « mnrf-set ». When the HLR receives the MAP_REPORT_SM_DELIVERY_STATUS_Ind, it shall interpret the delivery outcome as a GPRS delivery outcome.

23.3.3 Procedures in the HLR

The MAP_SEND_ROUTING_INFO_FOR_SM indication is received from the GMSC. The following error cases are reported to the GMSC in the MAP_SEND_ROUTING_INFO_FOR_SM response as an unsuccessful outcome of the procedure:

- if the necessary parameters and data are not present in the primitive or they are badly formatted, the data missing or unexpected data value error is returned;

- if the mobile subscriber is unknown, i.e. it cannot be identified from the MSISDN given, an unknown subscriber error is returned;

- if the short message transfer would contravene operator determined barring, the call barred error with cause operator barring is returned;

- if the short message transfer would contravene the « SM filtering by the HPLMN » function criteria, the call barred error with cause unauthorised Message Originator is returned (the definition of the filtering function is out of the scope of GSM specification. Filtering may be based on SM-RP-SMEA information element if received from the GMSC) ;

- if the mobile subscription identified by the given MSISDN number does not include the short message service, the teleservice not provisioned error is returned;

- if the GMSC does not support the GPRS functionality, the behaviour of the HLR depends on the following conditions:

    - If the subscriber is not a GPRS subscriber then the behaviour of the HLR shall be the same as for a subscriber only registered as non GPRS and for SMS delivery.

    - If the subscriber is a GPRS subscriber and a non-GPRS subscriber with the option « transfer of SM via the MSC when GPRS is not supported in the GMSC » then the behaviour of the HLR shall be the same as for a subscriber only registered as non GPRS and for SMS delivery.

    - If the subscriber is a GPRS subscriber and a non-GPRS subscriber with the option « transfer of SM via the SGSN when GPRS is not supported in the GMSC » or if the subscriber is a GPRS subscriber only then the behaviour of the HLR shall be the same as for the case transfer over GPRS described in MAP release 97, with the following precision: because GMSC does not support MAP release 97, the previous MAP protocol release is used. When the HLR sends the MAP_SEND_ROUTING_INFO_FOR_SM_Resp, the SGSN number is mapped to the MAP parameter « MSC number ». When the HLR sends the MAP_INFORM_SERVICE_CENTRE_resp, the MNRG status shall be mapped to the MAP parameter « mnrf-set ».

The HLR may send the MSC, SGSN or both numbers as routing information to SMS-GMSC based on the following:

A) The subscriber may only be registered as non GPRS and for SMS delivery:

    - if the short message transfer would contravene the supplementary service barring, the call barred error with cause barring service active is returned;

    - if the location registration of the mobile subscriber shows that the VLR in the visited PLMN does not support the MT short message service, the facility not supported error is returned;

- if no MSC identity is stored for the mobile subscriber or the "MSC Area Restricted Flag" is set or the "MS purged for non GPRS" flag is set, i.e. the MS is not reachable, the MSISDN-Alert and the SC address are included in the MWD (if possible), the flag MNRF is set and the "Absent Subscriber_SM" error is returned with the appropriate absent subscriber diagnostic indication, i.e. 'Deregistered in HLR for non GPRS ', 'Roaming Restricted' or 'MS-Purged for non GPRS '.

The priority parameter (SM_RP_PRI) is processed as follows:

- if the priority is low (SM_RP_PRI = False) and the mobile station not reachable flag (MNRF) is set, an absent subscriber_SM error is returned. If a reason for the subscriber's absence for non GPRS is stored in the mobile not reachable reason (MNRR) in the subscriber data, then this is returned with the absent subscriber_SM error. The SC-address given in the request will be included in the MWD if possible. The service MAP_INFORM_SERVICE_CENTRE including the parameter MW Status is invoked to indicate whether or not the SC address has been included in the MWD list.

- if the priority is low (SM_RP_PRI = False), and the MNRF is clear, the routing information with MSC number is retrieved as described below;

- if the priority is high (SM_RP_PRI = True) and the MNRF is set, the HLR will send the acknowledge primitive containing the routing information with MSC number to the gateway MSC. In addition the service MAP_INFORM_SERVICE_CENTRE including the parameter MW Status is invoked to indicate whether or not the SC address is already included in the MWD list.

B) The subscriber may only be registered as GPRS and for SMS delivery:

- if the location registration of the mobile subscriber shows that the SGSN in the visited PLMN does not support the MT short message service, the facility not supported error is returned;

- if no SGSN identity is stored for the mobile subscriber or the "SGSN Area Restricted Flag" is set or the "MS purged for GPRS" flag is set, i.e. the MS is not reachable, the MSISDN-Alert and the SC address are included in the MWD (if possible), the flag MNRG is set and the "Absent Subscriber_SM" error is returned with the appropriate absent subscriber diagnostic indication, i.e. 'Deregistered in HLR for GPRS', 'Roaming Restricted' or 'MS-Purged for GPRS '.

The priority parameter (SM_RP_PRI) is processed as follows:

- if the priority is low (SM_RP_PRI = False) and the mobile station not reachable for GPRS (MNRG) flag is set, an absent subscriber_SM error is returned. If a reason for the subscriber's absence for GPRS is stored in the mobile not reachable reason (MNRR) in the subscriber data, then this is returned with the absent subscriber_SM error. The SC-address given in the request will be included in the MWD if possible. The service MAP_INFORM_SERVICE_CENTRE including the parameter MW Status is invoked to indicate whether or not the SC address has been included in the MWD list.

- if the priority is low (SM_RP_PRI = False), and the MNRG is clear, the routing information with SGSN number is retrieved as described below;

- if the priority is high (SM_RP_PRI = True) and the MNRG is set, the HLR will send the acknowledge primitive containing the routing information with SGSN number to the gateway MSC. In addition the service MAP_INFORM_SERVICE_CENTRE including the parameter MW Status is invoked to indicate whether or not the SC address is already included in the MWD list.

C) The subscriber may be registered as non GPRS and GPRS and for SMS Delivery:

- if the short message transfer would contravene the supplementary service barring, the behaviour is the same as for a subcriber only registered for GPRS and SMS delivery.

- if the location registration of the mobile subscriber shows that the VLR in the visited PLMN does not support the MT short message service, the behaviour is the same as for a subcriber only registered for GPRS and SMS delivery;

- if the location registration of the mobile subscriber shows that the SGSN in the visited PLMN does not support the MT short message service, the behaviour is the same as for a subcriber only registered for non GPRS and SMS delivery;

- if no MSC and SGSN identities are stored for the mobile subscriber or the "MSC and SGSN Area Restricted Flags" are set or the "MS purged for non GPRS and GPRS" flags are set or a combination of these errors for non GPRS and GPRS are used, i.e. the MS is not reachable, the MSISDN-Alert and the SC address are included in the MWD (if possible), the flags MNRF and MNRG are set and the "Absent Subscriber_SM" error is returned with the appropriate absent subscriber diagnostic indication, i.e. 'Deregistered in HLR for non GPRS or GPRS', 'Roaming Restricted', 'MS-Purged for non GPRS or GPRS' or both.

The priority parameter (SM_RP_PRI) is processed as follows:

- if the priority is low (SM_RP_PRI = False), the MNRF and MNRG are set, an absent subscriber_SM error is returned. If reasons for the subscriber's absence for non GPRS and GPRS are stored in MNRR in the subscriber data, then this is returned with the absent subscriber_SM error. The SC-address given in the request will be included in the MWD if possible. The service MAP_INFORM_SERVICE_CENTRE including the parameter MW Status is invoked to indicate whether or not the SC address has been included in the MWD list.

- if the priority is low (SM_RP_PRI = False), and the MNRF is clear and MNRG is set, the routing information with MSC number is retrieved as described below;

- if the priority is low (SM_RP_PRI = False), and the MNRF is set and MNRG is clear, the routing information with SGSN number is retrieved as described below;

- if the priority is low (SM_RP_PRI = False), and the MNRF and MNRG are clear, the routing information with MSC and SGSN numbers is retrieved as described below;

- if the priority is high (SM_RP_PRI = True) and the MNRF, the MNRG or both are set, the HLR will send the acknowledge primitive containing the routing information with both MSC and SGSN numbers to the gateway MSC. In addition the service MAP_INFORM_SERVICE_CENTRE including the parameter MW Status is invoked to indicate whether or not the SC address is already included in the MWD list.

If the MSISDN-Alert number of the mobile subscriber stored in the MWD is not the same as that received in the MAP_SEND_ROUTING_INFO_FOR_SM indication, the HLR will include in the MAP_INFORM_SERVICE_CENTRE request to the GMSC the MSISDN-Alert number stored.

The MAP_INFORM_SERVICE_CENTRE request is sent also when the MCEF, MNRF, MNRG or both are set but the routing information is still sent to the GMSC. The status of the flags is indicated in the parameter MW Status.

The routing information is included in a MAP_SEND_ROUTING_INFO_FOR_SM response as follows:

- the IMSI will be returned to the GMSC together with the MSC, SGSN or both numbers and may be optionally accompanied by the LMSI.

- an indication specifying which number belongs the MSC and the SGSN will be returned to the GSMC.

LMSI shall not be used in case only the SGSN number is sent by HLR.

The mobile terminated short message transfer procedure in the HLR is shown in figure 23.3/6.

23.3.4 Procedures in the gateway MSC

The short message handling function of the GMSC will request routing information when a mobile terminated short message is received from a Service Centre. The GMSC sends the MAP_SEND_ROUTING_INFO_FOR_SM request to the HLR containing the subscriber data of the mobile subscriber and the indication that the SMS-GMSC supports the GPRS functionality.

As an outcome of the procedure the MAP_SEND_ROUTING_INFO_FOR_SM confirmation is received indicating:

- an unsuccessful event indication containing an error;

  The mapping between the MAP error causes and the RP_ERROR causes is explained in TS GSM 03.40.

- a successful event indication containing following parameters:

  - an IMSI optionally accompanied by an LMSI; and

  - routing addresses (servicing MSC, SGSN or both numbers).

The LMSI shall not be used in case the short message is routed towards the SGSN.

The GMSC may also receive a MAP_INFORM_SERVICE_CENTRE indication after the MAP_SEND_ROUTING_INFO_FOR_SM confirmation. The parameter MW Status in the message indicates whether or not the Service Centre address is stored in the Message Waiting Data. It also indicates the status of the MCEF , MNRF and MNRG flags in the HLR.

If the MSISDN-Alert stored in the MWD data is not the same as the one sent to the HLR, the MSISDN-Alert is received in the MAP_INFORM_SERVICE_CENTRE indication. This MSISDN number shall be transferred in a delivery failure report to the SC.

In the abnormal end or in the provider error case the system failure error is provided to the SC.

The forward short message procedure is initiated when the GMSC has obtained the routing information needed to forward a mobile terminated short message to the servicing MSC or SGSN.

If both numbers MSC and SGSN are received from HLR as routing information, the SMS-GMSC may choose which path (SGSN or MSC) first the SMS is to be transfered.

If an LMSI has been provided in the MAP_SEND_ROUTING_INFO_FOR_SM confirmation, it can be included in the sm-RP-DA information field of the first MAP_MT_FORWARD_SHORT_MESSAGE request sent to the servicing MSC. In this case, the IMSI must be included in the Destination Reference of the MAP_OPEN request. If the LMSI is not sent by the SMS Gateway MSC, the sm-RP-DA information field in the first MAP_MT_FORWARD_SHORT_MESSAGE request sent to the servicing MSC or SGSN shall contain the IMSI and the Destination Reference in the MAP_OPEN request shall not be present. The Service Centre address is sent in the parameter SM_RP_OA. The More Messages To Send flag is set to TRUE or FALSE depending on the information received from the Service Centre.

If the GMSC is the servicing MSC then the MAP service is not initiated. The procedure in the Servicing MSC is described in subclause 23.3.1 and in the figure 23.3/4.

If the grouping of MAP_OPEN request and MAP_MT_FORWARD_SHORT_MESSAGE request together would need segmenting, these primitives must not be grouped together. The MAP_OPEN request primitive is sent first without any associated MAP service request primitive and the dialogue confirmation must be received before the MAP_MT_FORWARD_SHORT_MESSAGE request is sent.

As a response to the procedure, the GMSC will receive the MAP_MT_FORWARD_SHORT_MESSAGE confirmation indicating:

- a successful forwarding of the short message. This indication is passed to the SC;
- unsuccessful forwarding of the short message:

  In case only one number (MSC or SGSN) was received from HLR as routing information,the mapping of the MAP error causes and the RP_ERROR causes is explained in TS GSM 03.40. The appropriate error indication is sent to the SC.

  In case both numbers (MSC and SGSN) were received from HLR as routing information, the transfer of SMS is re-attempted towards the second path only when one of the following errors is received from the unsuccessful transfer over the first path:

    Facility Not Supported

    Unidentified Subscriber

    Absent Subscriber with indication: GPRS or IMSI Detach

    Unexpected Data Value

    System failure

    Data Missing

    Subscriber Busy for MT SMS: GPRS Connection Suspended,

  otherwise, the mapping of the MAP error causes and the RP_ERROR causes is performed (see TS GSM 03.40) and the appropriate error indication is sent to the SC.

  If second forwarding of short message is unsuccessful, the mapping of the MAP error causes and the RP_ERROR causes is explained in TS GSM 03.40. The appropriate error indications are sent to the SC.

  If second forwarding of short message is successful, the successful indication is passed to the SC.

A provider error is indicated as a system failure error to the SC.

The GMSC invokes the procedure MAP_REPORT_SM_DELIVERY_STATUS, if an absent subscriber_SM, an unidentified subscriber or SM delivery failure with error cause MS memory capacity exceeded indication is received from the servicing MSC, SGSN or both, and the corresponding flags received in the MAP_INFORM_SC are not already set or the SC address is not yet included in the MWD set.

If absent subscriber diagnostic information (see GSM 03.40) is included with the absent subscriber_SM error indication then this information is relayed to the HLR using the procedure MAP_REPORT_SM_DELIVERY_STATUS.

In case the SMS was attempted to be delivered towards the MSC and the SGSN, and both delivery failed with causes described above, the two unsuccessful SMS delivery outcomes for GPRS and non GPRS are sent to the HLR.

In case the SMS was attempted to be deliverd towards the MSC and the SGSN, and the first delivery failed with causes described above and the second delivery succeeded, the unsuccessful and successful SMS delivery outcomes for GPRS and non GPRS are sent to HLR.

The gateway MSC may also invoke the procedure when the first SMS delivery was successful towards MSC, if the MNRF, MCEF flags or both were set in the HLR.

The gateway MSC may also invoke the procedure when the fisrt SMS delivery was successful towards SGSN, if the MNRG, MCEF flags or both were set in the HLR.

This procedure is described in detail in subclause 23.5.

Unexpected data value, system failure errors are indicated as a system failure to the SC. Other errors are indicated using appropriate cause values and diagnostic information between the GMSC and the SC as described in TS GSM 03.40 and GSM 04.11.

The unidentified subscriber error is indicated to the SC as absent subscriber with diagnostic information set to 'Unidentified subscriber' as described in TS GSM 03.40.

Note that the indication, on which number belongs the SGSN and MSC, received from the HLR at routing information result (see subclause 23.3.3) will enable the GMSC to map the causes received from the SGSN, MSC or both into the appropriate causes for non GPRS, GPRS or both, and send them to the SC and HLR.

If there are more short messages to send in the Service Centre and the previous short message transfer succeeded, then the gateway MSC awaits the next short message.

When receiving the next short message from the SC, the gateway MSC sets the More Messages To Send flag according to the information received and starts the service MAP_MT_FORWARD_SHORT_MESSAGE again.

If the gateway MSC is the servicing MSC, then the short message transfer to mobile subscriber is started as described in the subclause 23.3.1.

The mobile terminated short message transfer procedure in the gateway MSC is shown in figure 23.3/7.

23.4.3 Procedures in the HLR

When receiving the MAP_READY_FOR_SM indication, the HLR will check the contents. Data errors are reported to the VLR as an unexpected data value or a data missing error depending on the error. If the HLR does not support the MNRF or MNRG, MCEF, and MWD a facility not supported error is reported to the VLR or SGSN. If the IMSI is unknown an unknown subscriber error is reported to the VLR or SGSN. Otherwise an acknowledgement is returned to the VLR or SGSN.

If neither the MS not reachable flag (MNRF) or the MS not reachable for GPRS (MNRG) flag, nor the memory capacity exceeded flag (MCEF) are set, and MAP_READY_FOR_SM is received from the VLR or SGSN, the HLR sets a timer and waits for it to expire. This ensures that in the race situation the MAP_REPORT_SM_DELIVERY_STATUS service (as described in the subclause 23.6) for the same subscriber can be carried out when delayed in the GMSC.

If the Alert Reason indicates the mobile present for non GPRS situation, or when the update location procedure has been successfully completed or Supplementary Service Control request is received, the MS not reachable flag (MNRF) is cleared and the service centre alert procedure is initiated. If the memory capacity exceeded flag is set, the MS not reachable flag is cleared and stored reason for absence for non GPRS are cleared but the alert procedure is not started.

If the Alert Reason indicates the mobile present for GPRS situation, or when the Update GPRS location procedure has been successfully completed, the MS not reachable for GPRS (MNRG) flag is cleared and the service centre alert procedure is initiated. If the memory capacity exceeded flag is set, the MS detach for GPRS flag is cleared and stored reason for absence for GPRS are cleared but the alert procedure is not started.

If the Alert Reason indicates the memory available for non GPRS situation, the HLR initiates the alert procedure. The MS not reachable and memory capacity available flags are cleared.

If the Alert Reason indicates the memory available for GPRS situation, the HLR initiates the alert procedure. The MS detach for GPRS and memory capacity available flags are cleared.

If the MAP_REPORT_SM_DELIVERY_STATUS indication is received and it indicates the successful transfer of the mobile terminated short message for non GPRS, the HLR initiates the alert procedure described in the subclause 25.10 and clears MCEF and MNRF flags and stored reason for absence for non GPRS are cleared.

If the MAP_REPORT_SM_DELIVERY_STATUS indication is received and it indicates the successful transfer of the mobile terminated short message for GPRS, the HLR initiates the alert procedure described in the subclause 25.10 and clears MCEF and MNRG flags and stored reason for absence for GPRS are cleared.

The short message alert procedure in the HLR is shown in figures 23.4/6 and 25.10/2.

24 GPRS process description

24.1 General

The MAP GPRS procedures are used for the Network Requested PDP-Context Activation procedures.

The stage 2 specification for General Packet Radio Service (GPRS) is in GSM 03.60 [100].

24.1.1 Process in the HLR for Send Routing Information for GPRS

The MAP process in the HLR to provide routing information for a network-requested PDP context activation is shown in figure 24.1/1. The MAP process invokes macros not defined in this subclause; the definition of these macros can be found as follows:

Receive_Open_Ind	see subclause 25.1.1;
Check_Indication	see subclause 25.2.1.

Successful outcome

When the MAP process receives a MAP_OPEN indication with the application context gprsLocationInfoRetrieval, it checks it by invoking the macro Receive_Open_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP_SEND_ROUTING_INFO_FOR_GPRS service indication is received, the HLR sends a Send Routing Info For Gprs request to the GPRS application process in the HLR, and waits for a response. The Send Routing Info For Gprs request contains the parameter received in the MAP_SEND_ROUTING_INFO_FOR_GPRS service indication.

If the GPRS application process in the HLR returns a positive response containing the routing information, the MAP process constructs a MAP_SEND_ROUTING_INFO_FOR_GPRS service response containing the routing info, constructs a MAP_CLOSE service request, sends them to the GGSN and returns to the idle state.

Negative response from HLR GPRS application process

If the GPRS application process in the HLR returns a negative response, the MAP process constructs a MAP_SEND_ROUTING_INFO_FOR_GPRS service response containing the appropriate error, constructs a MAP_CLOSE service request, sends them to the GGSN and returns to the idle state.

Failure of dialogue opening with the GGSN

If the macro Receive_Open_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP_P_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP_CLOSE request to terminate the dialogue and returns to the idle state.

24.2.1 Process in the HLR for Failure Report

The MAP process in the HLR to set the MNRG (Mobile station Not Reachable for GPRS) flag for the subcriber is shown in figure 24.2/1. The MAP process invokes macros not defined in this subclause; the definition of these macros can be found as follows:

Receive_Open_Ind	see subclause 25.1.1;
Check Indication	see subclause 25.2.1.

Successful outcome

When the MAP process receives a MAP_OPEN indication with the application context failureReport, it checks it by invoking the macro Receive_Open_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP_FAILURE_REPORT service indication is received, the HLR sends a Failure Report request to the GPRS application process in the HLR, and waits for a response. The Failure Report request contains the parameter received in the MAP_FAILURE_REPORT service indication.

If a positive response is received, the MAP process constructs a MAP_FAILURE_REPORT service response, constructs a MAP_CLOSE service request, sends them to the GGSN and returns to the idle state.

Negative response from HLR GPRS application process

If the GPRS application process in the HLR returns a negative response, the MAP process constructs a MAP_FAILURE_REPORT service response containing the appropriate error, constructs a MAP_CLOSE service request, sends them to the GGSN and returns to the idle state.

Failure of dialogue opening with the GGSN

If the macro Receive_Open_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP_P_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP_CLOSE request to terminate the dialogue and returns to the idle state.

24.3.1 Process in the GGSN for Note Ms Present For Gprs

The MAP process in the GGSN to inform that the subscriber is present for GPRS again is shown in figure 24.3/1. The MAP process invokes macros not defined in this subclause; the definition of these macros can be found as follows:

Receive_Open_Ind	see subclause 25.1.1;
Check_Indication	see subclause 25.2.1.

Successful outcome

When the MAP process receives a MAP_OPEN indication with the application context gprsNotify, it checks it by invoking the macro Receive_Open_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP_NOTE_MS_PRESENT_FOR_GPRS service indication is received, the GGSN sends a Note Ms Present For Gprs request to the GPRS application process in the GGSN, and waits for a response. The Note Ms Present For Gprs request contains the parameter received in the MAP_NOTE_MS_PRESENT_FOR_GPRS service indication.

If the GPRS application process in the GGSN returns a positive response, the MAP process constructs a MAP_NOTE_MS_PRESENT_FOR_GPRS service response, constructs a MAP_CLOSE service request, sends them to the HLR and returns to the idle state.

Negative response from GGSN GPRS application process

If the GPRS application process in the GGSN returns a negative response, the MAP process constructs a MAP_NOTE_MS_PRESENT_FOR_GPRS service response containing the appropriate error, constructs a MAP_CLOSE service request, sends them to the HLR and returns to the idle state.

Failure of dialogue opening with the HLR

If the macro Receive_Open_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP_P_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP_CLOSE request to terminate the dialogue and returns to the idle state.

25 General macro description

25.1 MAP open macros

25.1.1 Macro Receive_Open_Ind

This macro is used by a MAP service-user procedure when a peer entity requests opening of a dialogue.

If the application context received in the MAP-OPEN indication primitive indicates a context name of the MAP version one context set, the macro takes the Vr exit..

If an application-context different from version 1 is received, the presence of MAP_OPEN information is checked. If no MAP_OPEN information has been received, the MAP_OPEN response with:

- Result set to Dialogue Accepted; and
- Application Context Name set to the received value,

is returned.

If the received version (Vr) is the one described in this version of MAP, the macro takes the OK exit, otherwise it takes the Vr exit.

If MAP_OPEN information is received, the macro "CHECK_REFERENCE" is called in order to check whether the received values for Destination Reference and Originating Reference correspond with the requirements of the received application-context-name. If the outcome of this check is an error, the MAP_OPEN response with:

- Result set to Dialogue Refused;
- Refuse Reason set to Invalid Destination Reference or Invalid Originating Reference;
- Application Context Name set to the highest version supported,

is returned and the macro takes the error exit.

If the data values received for Destination Reference and Originating Reference are accepted for the associated application-context-name it is checked whether the Destination Reference is known if this check is required by the process that calls the macro.

If the Destination Reference (e.g. a subscribers IMSI) is unknown, the MAP_OPEN response with

- Result set to Dialogue Refused;
- Refuse Reason set to Invalid Destination Reference;
- Application Context Name set to the highest version supported,

is returned and the macro takes the error exit.

Else, if the Destination Reference is accepted or if no check is required, the MAP_OPEN response with

- Result set to Dialogue Accepted; and
- Application Context Name set to the received value,

is returned and

If the received version (Vr) is the one described in this version of MAP, the macro takes the OK exit, otherwise it takes the Vr exit.

25.3.2 Macro Search_For_MS_MSC

This macro (see figure 25.3/2) is called if a mobile terminating call set-up, an unstructured SS notification, a network-initiated unstructured SS request or a mobile terminating short message is to be delivered to the MS and the current location area identity of the MS is not known in VLR.

25.5.4 Macro Obtain_Authent_Para_VLR

This macro is used by the VLR to request authentication triplets from the HLR. The macro proceeds as follows:

- a connection is opened, and a MAP_SEND_AUTHENTICATION_INFO request sent to the HLR;
- if the HLR indicates that a MAP version 1 dialogue is to be used, the VLR performs the equivalent MAP version 1 dialogue which can return a positive result containing authentication sets, an empty positive result, or an error;
- if the dialogue opening fails, the "Procedure Error" exit is used. Otherwise, the VLR waits for the response from the HLR;
- if a MAP_SEND_AUTHENTICATION_INFO confirmation is received from the HLR, the VLR checks the received data.

One of the following positive responses may be received from a MAP version 1 or MAP version 2 dialogue with the HLR:

- Authentication triplets, in which case the outcome is successful;
- Empty response, in which case the VLR may re-use old triplets, if allowed by the PLMN operator.

If the VLR cannot re-use old triplets (or no such triplets are available) then the "Procedure Error" exit is used.

If the outcome was successful or re-use of old parameters in the VLR is allowed, then the "OK" exit is used.

If an "Unknown Subscriber" error is included in the MAP_SEND_AUTHENTICATION_INFO confirm or is returned by the MAP version 1 dialogue, then the "Unknown Subscriber" exit is used.

- if a MAP-U-ABORT, MAP_P_ABORT, MAP_NOTICE or unexpected MAP_CLOSE service indication is received from the MSC, then open connections are terminated, and the macro takes the "Null" exit;
- if a MAP-U-ABORT, MAP_P_ABORT or unexpected MAP_CLOSE service indication is received from the HLR, then the VLR checks whether old authentication parameters can be re-used. If old parameters cannot be re-used the macro takes the "Procedure Error" exit; otherwise it takes the "OK" exit;
- if a MAP_NOTICE service indication is received from the HLR, then the dialogue with the HLR is closed. The VLR then checks whether old authentication parameters can be re-used. If old parameters cannot be re-used the macro takes the "Procedure Error" exit; otherwise it takes the "OK" exit.

The macro is described in figure 25.5/4.

25.6.3 Process Check_IMEI_EIR

This process is used by the EIR to obtain the status of a piece of mobile equipment, upon request from the MSC or from the SGSN. The process acts as follows:

- a MAP_OPEN service indication is received (macro Receive_Open_Ind, subclause 25.1.1). If the dialogue opening fails, the process terminates;
- otherwise, a MAP_CHECK_IMEI indication is received by the EIR, containing the IMEI to be checked;
- the EIR checks the service indication for errors. If there are any, they are reported to the MSC or to the SGSN in the MAP_CHECK_IMEI response. If no errors are detected, the EIR database function is interrogated for the status of the given equipment. Further details are found in GSM 02.16;
- the status of the equipment (white-listed, grey-listed, black-listed or unknown) is returned to the MSC or to the SGSN in the MAP_CHECK_IMEI service response;
- if a MAP_U_ABORT, MAP_P_ABORT, MAP_NOTICE or MAP_CLOSE indication is received from the MSC or from the SGSN at any time during this process, the process in the EIR terminates.

The process is described in figure 25.6/3.

25.7.2 Process Insert_Subs_Data_Stand_Alone_HLR

This process is used by HLR to transfer subscriber data to VLR or to SGSN in a stand alone mode, i.e. in its own dialogue. This is done whenever a change of subscriber data is performed either by the operator or by the subscriber and this change has to be reported to VLR or to SGSN.

25.9.3 Macro Activate_Tracing_VLR

The Activate_Tracing_VLR macro is invoked, when the MAP_ACTIVATE_TRACE_MODE indication is received from the HLR. The primitive is processed in the VLR as follows:

- if the data contains errors, a data missing or unexpected data value indication is returned to the HLR;
- if the tracing is not supported, a facility not supported indication is returned to the HLR;
- if the tracing buffer does not have any space left for the data, a tracing buffer full indication is returned to the HLR;
- if no errors are detected, the tracing is set active and a positive acknowledge is returned to the HLR.

The Activate_Tracing_VLR macro is described in the figure 25.9/3.

25.9.4 Macro Control_Tracing_HLR

The Control_Tracing_HLR macro may be invoked in the HLR, if subscriber related activity is detected. If the tracing is active in the HLR and not active in the VLR or in the SGSN, the MAP_ACTIVATE_TRACE_MODE request is sent to the VLR or to the SGSN.

The MAP_ACTIVATE_TRACE_MODE confirmation from the VLR or from the SGSN is processed as follows:

- if the primitive contains a successful acknowledge, the tracing in VLR or in the SGSN is set active;
- if the primitive contains errors, the tracing in VLR or in SGSN is set deactive.

The Control_Tracing_HLR macro between HLR and VLR is shown in the figure 25.9/4.

The Control_Tracing_HLR_with_SGSN macro between HLR and SGSN is shown in the figure 25.9/5.

25.9.6 Macro Activate_Tracing_SGSN

The Activate_Tracing_SGSN macro is invoked, when the MAP_ACTIVATE_TRACE_MODE indication is received from the HLR. The primitive is processed in the SGSN as follows:

- if the data contains errors, a data missing or unexpected data value indication is returned to the HLR;
- if the tracing is not supported, a facility not supported indication is returned to the HLR;
- if the tracing buffer does not have any space left for the data, a tracing buffer full indication is returned to the HLR;
- if no errors are detected, the tracing is set active and a positive acknowledge is returned to the HLR.

The Activate_Tracing_SGSN macro is described in the figure 25.9/7.

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29.002	**CR**	**101r1**	Current Version:	3.3.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: NTT COMMUNICATIONWARE **Date:** 2000-02-14

Subject: Introduction of Service Area Identification

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	X
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: In 3G network, Service Area Identity consists of LAI and SAC. It is used by Core Network to identify Service Area. For example Service Area Identity is included in initial UE message instead of CGI in 3G network. So the Cell ID shall be replaced to the new one that shows the Cell in GSM case and the Service Area in UMTS case.

This CR is aligning with approved CR against 23.003 (N2B000121).

Clauses affected: 7.6.2.37; 17.7.1; 17.7.8.

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	23.003, 23.008, 23.018, 23.078, 29.018
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments: The target Cell Id in the handover procedure means an actual GSM cell and it is not replaced to the Service Area Id but to the target RNC Id in the case of UMTS.

help.doc

<--------- double-click here for help and instructions on how to create a CR

7.6 Definition of parameters

7.6.2 Numbering and identification parameter

7.6.2.37 Serving cell global Id or service area Id

This parameter indicates the cell or the service area currently being used by the served subscriber.

NEXT MODIFICATION

17 Abstract syntax of the MAP protocol

17.7 MAP constants and data types

17.7.1 Mobile Service data types

```
MAP-MS-DataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-MS-DataTypes (11) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN

EXPORTS

[omitted]

-- provide subscriber info types

ProvideSubscriberInfoArg ::= SEQUENCE {
     imsi     [0] IMSI,
     lmsi     [1] LMSI                  OPTIONAL,
     requestedInfo                      [2] RequestedInfo,
     extensionContainer                 [3] ExtensionContainer          OPTIONAL,
     ...}

ProvideSubscriberInfoRes ::= SEQUENCE {
     subscriberInfo                     SubscriberInfo,
     extensionContainer                 ExtensionContainer              OPTIONAL,
     ...}

SubscriberInfo ::= SEQUENCE {
     locationInformation                [0] LocationInformation         OPTIONAL,
     subscriberState                    [1] SubscriberState             OPTIONAL,
     extensionContainer                 [2] ExtensionContainer          OPTIONAL,
     ...}

RequestedInfo ::= SEQUENCE {
     locationInformation                [0] NULL                        OPTIONAL,
     subscriberState                    [1] NULL                        OPTIONAL,
     extensionContainer                 [2] ExtensionContainer          OPTIONAL,
     ...}
```

```
LocationInformation ::= SEQUENCE {
     ageOfLocationInformation            AgeOfLocationInformation          OPTIONAL,
     geographicalInformation             [0] GeographicalInformation       OPTIONAL,
     vlr-number                          [1] ISDN-AddressString            OPTIONAL,
     locationNumber                      [2] LocationNumber                OPTIONAL,
     cellGlobalIdOrServiceAreaIdOrLAI    [3] CellGlobalIdOrServiceAreaIdOrLAI  OPTIONAL,
     extensionContainer                  [4] ExtensionContainer            OPTIONAL,
     ... ,
     selectedLSA-Id                      [5] LSAIdentity                   OPTIONAL,
     msc-Number                          [6] ISDN-AddressString            OPTIONAL,
     geodeticInformation                 [7] GeodeticInformation           OPTIONAL }
```

```
GeographicalInformation ::= OCTET STRING (SIZE (8))
--   Refers to geographical Information defined in GSM 03.32.
--   Only the description of an ellipsoid point with uncertainty circle
--   as specified in GSM 03.32 is allowed to be used
--   The internal structure according to GSM 03.32 is as follows:
--        Type of shape (ellipsoid point with uncertainty circle)          1 octet
--        Degrees of Latitude                                              3 octets
--        Degrees of Longitude                                             3 octets
--        Uncertainty code                                                 1 octet
```

```
GeodeticInformation ::= OCTET STRING (SIZE (10))
--   Refers to Calling Geodetic Location defined in Q.763 (1999).
--   Only the description of an ellipsoid point with uncertainty circle
--   as specified in Q.763 (1999) is allowed to be used
--   The internal structure according to Q.763 (1999) is as follows:
--        Screening and presentation indicators                            1 octet
--        Type of shape (ellipsoid point with uncertainty circle)          1 octet
--        Degrees of Latitude                                              3 octets
--        Degrees of Longitude                                             3 octets
--        Uncertainty code                                                 1 octet
--        Confidence                                                       1 octet
```

```
LocationNumber ::= OCTET STRING (SIZE (2..10))
     -- the internal structure is defined in CCITT Rec Q.763
```

```
SubscriberState ::= CHOICE {
     assumedIdle                         [0] NULL,
     camelBusy [1] NULL,
     netDetNotReachable                  NotReachableReason,
     notProvidedFromVLR                  [2] NULL}
```

```
NotReachableReason ::= ENUMERATED {
     msPurged (0),
     imsiDetached (1),
     restrictedArea (2),
     notRegistered (3)}
```

```
[omitted]

END
```

NEXT MODIFICATION

17.7.8 Common data types

```
1  MAP-CommonDataTypes {
2     ccitt identified-organization (4) etsi (0) mobileDomain (0)
3     gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}
4
5  DEFINITIONS
6
7  IMPLICIT TAGS
8
9  ::=
10
11 BEGIN
12
13 EXPORTS
14
15    -- general data types and values
16    AddressString,
17    ISDN-AddressString,
18    maxISDN-AddressLength,
19    ISDN-SubaddressString,
20    ExternalSignalInfo,
```

```
   Ext-ExternalSignalInfo,
   SignalInfo,
   maxSignalInfoLength,
   AlertingPattern,

   -- data types for numbering and identification
   IMSI,
   TMSI,
   Identity,
   SubscriberId,
   IMEI,
   HLR-List,
   LMSI,
   GlobalCellId,
   NetworkResource,
   NAEA-PreferredCI,
   NAEA-CIC,
   ASCI-CallReference,
   SubscriberIdentity,

   -- data types for CAMEL
   CellGlobalIdOrServiceAreaIdOrLAI,

   -- data types for subscriber management
   BasicServiceCode,
   Ext-BasicServiceCode,
   EMLPP-Info,
   EMLPP-Priority,

   -- data types for geographic location
   AgeOfLocationInformation,
   LCSClientExternalID,
   LCSClientInternalID
;

IMPORTS
   TeleserviceCode,
   Ext-TeleserviceCode
FROM MAP-TS-Code {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-TS-Code (19) version6 (6)}

   BearerServiceCode,
   Ext-BearerServiceCode
FROM MAP-BS-Code {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-BS-Code (20) version6 (6)}

   ExtensionContainer
FROM MAP-ExtensionDataTypes {
   ccitt identified-organization (4) etsi (0) mobileDomain (0)
   gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}
;

[omitted]

-- data types for CAMEL

CellGlobalIdOrServiceAreaIdOrLAI ::= CHOICE {
     cellGlobalIdOrServiceAreaIdFixedLength   [0] CellGlobalIdOrServiceAreaIdFixedLength,
     laiFixedLength                           [1] LAIFixedLength}

CellGlobalIdOrServiceAreaIdFixedLength ::= OCTET STRING (SIZE (7))
     -- Refers to Cell Global Identification or Service Are Identification
     -- defined in 3G TS GSM 03.0323.003.
     -- The internal structure is defined as follows:
     -- octet 1 bits 4321                Mobile Country Code 1st digit
     --         bits 8765                Mobile Country Code 2nd digit
     -- octet 2 bits 4321                Mobile Country Code 3rd digit
     --         bits 8765                Mobile Network Code 3rd digit
     --                                  or filler (1111) for 2 digit MNCs
     -- octet 3 bits 4321                Mobile Network Code 1st digit
     --         bits 8765                Mobile Network Code 2nd digit
     -- octets 4 and 5                   Location Area Code according to 3G TS GSM 04.0824.008
     -- octets 6 and 7                   Cell Identity (CI) value or
     --                                  Service Area Code (SAC) value
     --                                  according to 3G TS GSM 04.0823.003
```

```
LAIFixedLength ::= OCTET STRING (SIZE (5))
     -- Refers to Location Area Identification defined in TS GSM 03.03.
     -- The internal structure is defined as follows:
     -- octet 1 bits 4321                Mobile Country Code 1st digit
     --         bits 8765                Mobile Country Code 2nd digit
     -- octet 2 bits 4321                Mobile Country Code 3rd digit
     --         bits 8765                Mobile Network Code 3rd digit
     --                                  or filler (1111) for 2 digit MNCs
     -- octet 3 bits 4321                Mobile Network Code 1st digit
     --         bits 8765                Mobile Network Code 2nd digit
     -- octets 4 and 5                   Location Area Code according to TS GSM 04.08

[omitted]

END
```

3GPP TSG-N2 SWG B
Milan, ITALY, 14 – 16 Feb 2000

Tdoc 3GPP ***N2B000281***

CHANGE REQUEST

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29.002	**CR**	**107**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME		UTRAN / Radio		Core Network	X

Source: N2 **Date:** 11/02/2000

Subject: Removal of architectural information from clause 4

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification	X		Release 99	X
				Release 00	

Reason for change: S2 have agreed to the request from N2 to move the architectural information from clause 4 of TS 29.002 to TS 23.002

Clauses affected: 2; 4

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	CR 23.002-???
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- Double-click here for help and instructions on how to create a CR.

2 References

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

.

.

.

[117] 3G TS 23.002: "Network architecture".

4 Configuration of the mobile network

The configuration of the mobile network is specified in 3G TS 23.002 [117].

~~4.1 The entities of the mobile system~~

~~To provide the mobile service as it is defined, it is necessary to introduce some specific functions. These functional entities can be implemented in different equipments or integrated. In any case, exchanges of data occur between these entities.~~

~~4.1.1 The Home Location Register (HLR)~~

~~This functional entity is a data base in charge of the management of mobile subscribers. A PLMN may contain one or several HLRs; it depends on the number of mobile subscribers, on the capacity of the equipment and on the organization of the network. All subscription data are stored there. The main information stored there concerns the location of each MS in order to be able to route calls to the mobile subscribers managed by each HLR. All management interventions occur on this data base. The HLRs have no direct control of MSCs.~~

~~Two numbers attached to each mobile subscription are stored in the HLR:~~

- ~~IMSI;~~
- ~~MSISDN.~~

~~The data base contains other information such as:~~

- ~~location information (VLR number);~~
- ~~basic telecommunication services subscription information;~~
- ~~service restrictions (e.g. roaming limitation);~~
- ~~supplementary services; the tables contain the parameters attached to these services.~~
- ~~GPRS subscription data and routeing information.~~

~~The organization of the subscriber data is detailed in GSM 03.08.~~

4.1.2 The Visitor Location Register (VLR)

An MS roaming in an MSC area is controlled by the Visitor Location Register in charge of this area. When an MS appears in a location area it starts a location updating procedure. The MSC in charge of that area notices this registration and transfers to the Visitor Location Register the identity of the location area where the MS is situated. A VLR may be in charge of one or several MSC areas.

The VLR also contains the information needed to handle the calls set up or received by the MSs registered in its data base (in some cases the VLR may have to obtain additional information from the HLR); the following elements can be found in its tables:

- the IMSI;
- the MSISDN;
- the TMSI, if applicable;
- the location area where the MS has been registered. This will be used to call the station;
- supplementary service parameters.

The information is passed between VLR and HLR by the procedures described in GSM 03.12.

The organization of the subscriber data is detailed in GSM 03.08.

4.1.3 The Mobile-services Switching Centre (MSC)

The Mobile-services Switching Centre is an exchange which performs all the switching functions for MSs located in a geographical area designated as the MSC area. The main difference between an MSC and an exchange in a fixed network is that the MSC has to take into account the impact of the allocation of radio resources and the mobile nature of the subscribers and has to perform, for example, the following procedures:

- procedures required for the location registration (see GSM 03.12);
- procedures required for hand-over (see GSM 03.09).

4.1.4 The Base Station System (BSS)

The BSS is the sub-system of Base Station equipment (transceivers, controllers, etc...) which is viewed

- by the MSC through an interface (A interface) with the functionality described in GSM 08.02;
- by the SGSN through an interface (Gb interface) with the functionality described in GSM 03.60.

4.1.5 The Gateway MSC (GMSC)

In the case of incoming calls to the PLMN, if the fixed network is unable to interrogate the HLR, the call is routed to an MSC. This MSC will interrogate the appropriate HLR and then route the call to the MSC where the MS is located. The MSC which then performs the routing function to the actual location of the mobile is called the Gateway MSC.

The choice of which MSCs can act as Gateway MSCs is a network operator matter (e.g. all MSCs or some designated MSCs).

If the call is a voice group/broadcast call it is routed directly from the GMSC to the VBS/VGCS Anchor MSC, based on information (VBS/VGCS call reference) contained in the dialled number. See also GTSs 03.68 and 03.69.

See also GSM 03.04.

4.1.6 The SMS Gateway MSC

The SMS GMSC is the interface between the Mobile Network and the network which provides access to the Short Message Service Centre, for short messages to be delivered to MSs.

The choice of which MSCs can act as SMS Gateway MSCs is a network operator matter (e.g. all MSCs or some designated MSCs).

4.1.7 The SMS Interworking MSC

The SMS IWMSC is the interface between the Mobile Network and the network which provides access to the Short Message Service Centre, for short messages submitted by MSs.

The choice of which MSCs can act as SMS Interworking MSCs is a network operator matter (e.g. all MSCs or some designated MSCs).

4.1.8 The VBS/VGCS Anchor MSC

The voice broadcast/group call anchor MSC obtains from the associated GCR all relevant attributes and controls in turn all cells in its area, VBS/VGCS Relay MSCs and dispatchers belonging to a given group call.

4.1.9 The Equipment Identity Register (EIR)

This functional unit is a data base in charge of the management of the equipment identities of the MSs; see also GSM 02.16.

4.1.10 The GSM Service Control Function (gsmSCF)

This functional entity contains the CAMEL service logic to implement OSS. It interfaces with the gsmSSF, gprsSSF, the HLR, VLR and MSC; see also 3G TS 23.078.

4.1.11 The VBS/VGCS Relay MSC

The voice broadcast/group call relay MSC obtains from the associated anchor MSC all relevant attributes and controls in turn all cells in its area belonging to a given group call.

4.1.12 The Group Call Register (GCR)

This functional unit is a data base in charge of the management of attributes related to the establishment of Voice Broadcast Calls and Voice Group Calls

4.1.13 The Shared InterWorking Function Server (SIWFS)

A Shared Inter Working Function is a network function that may be used by any MSC in the same PLMN to provide interworking for a data/fax call. Whereas an IWF can only be used by its MSC, the SIWF can be used by several other network nodes e.g. any MSC within the same PLMN (the concept is not limited to a certain number of MSCs). SIWF is applied to data services in GSM Phase 2 and GSM Phase 2+ (as defined in GSM 02.02, GSM 02.03 and GSM 02.34).

The usage of an SIWF requires no additional manipulation at the MS.

An IWF provides specific functions associated with the visited MSC for the interworking with other networks. It comprises signalling and traffic channel related functions. The traffic channel related functions are provided by an Inter Working Unit (IWU).

The SIWF concept is that it provides specific functions for the interworking with other networks. It comprises signalling and traffic channel related functions. Whereas the signalling related functions are associated with the visited MSC, the IWU providing the traffic channel related functions has another physical location.

The entity that contains all additional functions needed in the visited MSC to provide the SIWF is called SIWF Controller (SIWFC). The entity where the IWU is located is called SIWF Server (SIWFS). The Interface between a visited MSC and a SIWFS is called the K Interface.

SIWFS can be provided by a MSC (MSC/SIWFS) or by another network entity (stand alone SIWFS).

4.1.14 The Serving GPRS Support Node (SGSN)

This functional unit keeps track of the individual MSs' location and performs security functions and access control; see also GSM 03.60.

4.1.15 The Gateway GPRS Support Node (GGSN)

This functional unit provides interworking with external packet switched networks, network screens and routing of the Network Requested PDP context activation;see also GSM 03.60.4.2 "Configuration of a Public Land Mobile Network (PLMN)".

The basic configuration of a Public Land Mobile Network is presented in figure 2.2/1. In this figure the most general solution is described in order to define all the possible interfaces which can be found in any PLMN. The specific implementation in each network may be different: some particular functions may be implemented in the same equipment and then some interfaces may become internal interfaces. In any case the configuration of a PLMN must have no impact on the relationship with the other PLMNs.

In this configuration, all the functions are considered implemented in different equipments. Therefore, all the interfaces are external and need the support of the Mobile Application Part of the Signalling System No. 7 to exchange the data necessary to support the mobile service. From this configuration, all the possible PLMN organizations can be deduced.

4.1.16 The Number Portability Location Register (NPLR)

This functional unit provides routing information necessary in some Mobile Number Portability environments in order to route calls for ported mobile subscribers. For details see also GSM 03.66 [108].

4.1.17 The Serving Mobile Location Center (SMLC)

An SMLC is a database and processing entity that manages the procedures for obtaining the geographic location of a target MS in the coverage area served by the SMLC. In managing the location procedures, the SMLC chooses the positioning method and provides data and instructions to the LMUs or target MS that perform the actual location measurements associated with the chosen method. The SMLC also verifies any location estimate computed by the target MS or computes a location itself from measurements provided to it by the target MS or LMUs.

An SMLC also manages a set of LMUs in its coverage area whose purpose is to provide location measurements and location assistance data to the SMLC to compute, or assist in computing, location estimates for target MSs. Management functions performed by an SMLC on behalf of its LMUs include maintaining the status and current serving MSC of each LMU and supporting O&M procedures,

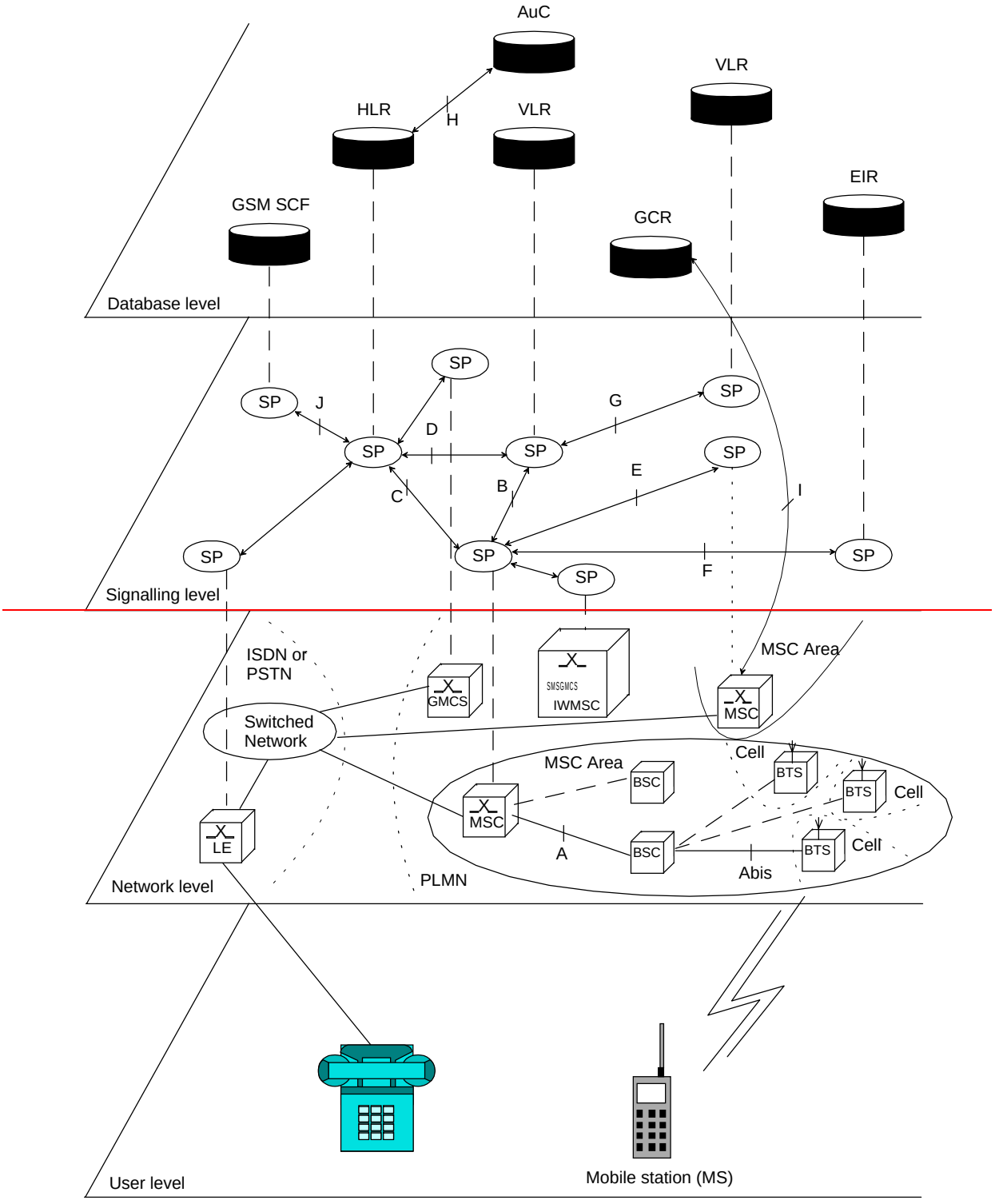
The database in an SMLC contains data necessary for choosing an appropriate position method and any parameters associated with this method for a target MS in any serving cell, for computing or verifying location estimates and for managing its LMUs.

4.1.18 The Gateway Mobile Location Center (GMLC)

The GMLC provides access to location services (LCS) for LCS clients external to a PLMN. A GMLC may also support access to location services from LCS clients internal to its own PLMN. The GMLC allows an LCS client to issue location requests for certain target MSs; it then conveys these requests to the VMSC currently serving each target MS and passes back the location results to the LCSclient. Any target MS whose location is requested may belong to either the GMLC's own PLMN or another PLMN and may currently be served by either the GMLC's own PLMN or another PLMN.

4.1.19 The Location Measurement Unit (LMU)

The LMU is the logical network entity that performs location measurements in the VPLMN in order to either position a target MS or provide assistance data to be used in conjunction with other location measurements. An LMU is controlled by an SMLC in the VPLMN from which location commands can be received and to which any location measurements are returned.



~~Figure 4.2/1: Configuration of a PLMN~~

4.3 Interconnection between PLMNs

Since the configuration of a PLMN does not have any impact on other PLMNs, the signalling interfaces specified can be implemented both between the entities within a PLMN and between different PLMNs.

4.4 The interfaces within the mobile service

4.4.1 Interface between the HLR and the VLR (D-interface)

This interface is used to exchange the data related to the location of the MS and to the management of the subscriber. The main service provided to the mobile subscriber is the capability to set up or to receive calls within the whole service area. To support that purpose the location registers have to exchange data. The VLR informs the HLR on the registration of a MS managed by the latter and provides it with the relevant location information. The HLR sends to the VLR all the data needed to support the service to the MS. The HLR then calls the previous VLR to inform it that it can cancel the location registration of this station because of the roaming of the mobile.

Exchanges of data may also occur when the mobile subscriber requires a particular service, when he wants to change some data attached to his subscription or when some parameters of the subscription are modified by administrative means.

4.4.2 Interface between the HLR and the gsmSCF (J-interface)

This interface is used by the gsmSCF to request information from the HLR (via the Any-time Interrogation function) or to allow call independent related network- or user-initiated interaction between an MS and the gsmSCF (via the USSD function). Support of the gsmSCF-HLR interface is a network operator option. As a network operator option, the HLR may refuse to provide the information requested by the gsmSCF.

4.4.3 Interface between the VLR and its associated MSC(s) (B-interface)

The VLR is the location and management data base for the MSs roaming in the area controlled by the associated MSC(s). Whenever the MSC needs data related to a given MS currently located in its area, it interrogates the VLR. When a MS initiates a location updating procedure with an MSC, the MSC informs its VLR which stores the relevant information in its tables. This procedure occurs whenever a mobile roams to another location area. Also, for instance when a subscriber activates a specific supplementary service or modifies some data attached to a service, the MSC transfers (via the VLR) the request to the HLR, which stores these modifications and updates the VLR if required.

However, this interface is not fully operational specified. It is strongly recommended not to implement the B-interface as an external interface.

4.4.4 Interface between VLRs (G-interface)

When an MS initiates a location updating using TMSI, the VLR can fetch the IMSI and authentication set from the previous VLR.

4.4.5 Interface between the HLR and the MSC (C-interface)

When the fixed network is not able to perform the interrogation procedure needed to set up a call to a mobile subscriber, the Gateway MSC has to interrogate the HLR of the called subscriber to obtain the roaming number of the called MS (see GSM 03.04).

To forward a short message to a mobile subscriber, the SMS Gateway MSC has to interrogate the HLR to obtain the MSC number where the MS is located.

4.4.6 Interface between the MSC and the gsmSCF (L-interface)

When one of the following Supplementary Services, CD, ECT or MPTY, is invoked in the MSC a notification shall be sent towards the gsmSCF.

4.4.6A Interface between the VLR and the gsmSCF (M-interface)

This interface is used by the VLR to notify the gsmSCF about the occurrence of a Mobility Management event.

4.4.7 Interface between MSCs (E-interface)

When a MS moves from one MSC area to another during a call, a handover procedure has to be performed in order to continue the communication. For that purpose the MSCs involved have to exchange data to initiate and then to realize the operation.

This interface is also used to forward short messages, to perform location for a target MS for which handover has occurred on an established call and to transfer LCS messages to and from an LMU for which handover of a signalling channel has occurred.

This interface is also used to transfer information for inter-MSC VBS/VGCS calls .

4.4.8 Interface between the MSC and Base Station Systems (A-interface)

The description of this interface is contained in the GSM 08-series of MSs.

The BSS-MSC interface carries information concerning:

- BSS management;
- call handling;
- location management.

4.4.9 Interface between MSC and EIR (F-interface)

This interface is used when an MSC wants to check an IMEI.

4.4. 10 Interface between VBS/VGCS Anchor MSC and GCR (I-interface)

This is an internal interface.

4.4.11 Interface between the MSC and the SIWF server (K-interface)

When a MSC detects that it can not provide the requested IW function, resources from an SIWF server can be used. This interface is used to allocate resources in that SIWF server and establish required physical connections to that server.

4.4.12 Interface between SGSN and HLR (Gr-interface)

The description of this interface is contained in the GSM 03.60.

4.4.13 Interface between SGSN and SMS-GMSC or SMS-IWMSC (Gd-interface)

The description of this interface is contained in the GSM 03.60.

4.4.14 Interface between GGSN and HLR (Gc-interface)

The description of this interface is contained in the GSM 03.60.

4.4.15 Interface between SGSN and EIR (Gf-interface)

The description of this interface is contained in the GSM 03.60.

4.4.16 Interface between SGSN and BSC (Gb-interface)

The description of this interface is contained in the GSM 03.60.

4.4.17 Interface between SGSN and MSC/VLR (Gs-interface)

The description of this interface is contained in the GSM 09.18.

4.4.18 Interface between SMLC and MSC (Ls interface)

This interface is used by the MSC to request either the initiation of location procedures or the retrieval of location assistance data for a particular target MS in the coverage area served by the SMLC. The interface is also used to transfer LCS measurement and O&M information between an SMLC and LMU or BSC via the MSC.

4.4.19 Interface between SMLC and VLR (Lv interface)

This interface is used by the VLR to register or deregister an LMU in the SMLC.

4.4.20 Interface between GMLC and HLR (Lh interface)

This interface is used by the GMLC to request the address of the visited MSC for a particular target MS whose location has been requested.

4.4.21 Interface between GMLC and MSC (Lg interface)

This interface is used by the GMLC to convey a location request to the MSC currently serving a particular target MS whose location was requested. The interface is used by the MSC to return location results to the GMLC.

4.4.22 Interface between LCS Client and GMLC (Le interface)

This interface is used by a client of the Location Services (LCS) to request location information from a GMLC for certain target MSs. The interface is used by the GMLC to provide location information to an LCS client. This interface is external to a PLMN and is not defined within GSM.

4.4.23 Interface between the gsmSCF and the GMLC (Lc-interface)

This interface is used by the gsmSCF to request information from the GMLC (via the Any-time Interrogation function).

As a network operator option, the GMLC may refuse to provide the information requested by the gsmSCF.

4.5 Splitting of the data storage

The data attached to each MS management, operation and location are stored in the Location Registers. Some data are duplicated in the HLR and in the VLR, but others may be stored only in one place.

The data associated with any client that uses a particular GMLC to access location services is stored in the GMLC.

A detailed description of the data organization can be found in GSM 03.08.

3GPP TSG CN WG2 SWGB Meeting #4
Milan, Italy, 14-16 Feb 2000

Document* *N2B000357
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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29.002	**CR**	**111**	Current Version:	3.3.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-CN#07	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: N2 **Date:** 15 Feb 2000

Subject: Use of MAP private extensions to implement region-specific requirements

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	X
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: A TTC extension container is necessary to transport TTC specific charging parameters.

Clauses affected: 17.1.4

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

17.1.4 Compatibility considerations

The following ASN.1 modules conform to CCITT Recommendation X.208 (1988) or X.680 (1994) (the only module which makes use of X.680 is MAP-ExtensionDataTypes), but in addition Ellipsis Notation ("..." - notation) is used as described in ITU-T Recommendation X.680 Amendment 1 (1995) wherever future protocol extensions are foreseen.

The "..." construct applies only to SEQUENCE and ENUMERATED data types. An entity supporting a version greater than 1 shall not reject an unsupported extension following "..." of that SEQUENCE or ENUMERATED data type. The Encoding Rules from subclause 17.1.1 apply to every element of the whole Transfer Syntax especially to the ASN.1 type EXTERNAL.

The extension container "privateExtensionList" is defined in this specification in order to carry extensions which are defined outside this specification. Private extensions can be defined by, for example, network operators, manufacturers, and regional standardisation bodies.

Private extensions shall:

1) if included in operations of an AC of V2, follow the extension marker and be tagged using PRIVATE tags up to and including 29.

NOTE: This type of extension is in most cases used only within a PLMN.

2) if included in operations of an AC of V3 or higher: be included only in the Private Extension Container that is defined in the specification.

NOTE: This type of extension can be used between PLMNs.

Private extensions shall not be included in v2 supplementary service operations.

Private extensions shall not be included within user error for RegisterCCEntry and EraseCCEntry operations.

PCS extensions shall be included in the PCS Extension Container that is defined in this specification.

In order to improve extensibility, a few error parameters have been defined as a CHOICE between the version 2 description and a SEQUENCE including the version 2 description and an extension container. Operations used in a v2-application-context must consider only the first alternative while operations used in a vn-application-context (n>2) must consider only the second alternative.

3GPP TSG CN WG2
Kyoto, Japan, 17-21 Jan 2000

Document N2B0000
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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29.060	CR	040	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: N2 **Date:** 5.1.2000

Subject: Improving charging efficiency

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

Normally, the SGSN and the GGSN collect charging information on MSs which they are serving. The SGSN collects charging information for each attached MS and for each active PDP context. The GGSN collects charging information for each active PDP context.

Alternative charging mechanisms, such as prepaid or flat rate billing, do not require generating charging information (CDRs) in the SGSN and in the GGSN. Sending CDRs for such MSs and/or PDP contexts to Charging Gateway Functionality increases load in the communication channel.

This CR introduces a method of decreasing the load in the communication channel. CDRs may not be sent for MSs and/or PDP contexts which are not liable for charging. If the feature is not supported in the SGSN and in the GGSN, the SGSN and the GGSN will send CDRs normally. It is operator-specific whether charging information is collected for those MSs and/or PDP contexts which are not liable for charging. For roaming subscribers, CDRs should be generated.

At attach or at inter-SGSN routing area update, the packet domain subscription data is transferred to the SGSN. The packet domain subscription data includes the subscribed charging characteristics. When creating a PDP context, the SGSN copies the charging characteristics of the PDP context from the subscribed charging characteristics if the information is present in the packet domain subscription data.

Clauses affected:

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	23.060, 29.002
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

7.5.1 Create PDP Context Request

A Create PDP Context Request shall be sent from a SGSN node to a GGSN node as a part of the GPRS PDP Context Activation procedure. The GGSN IP address where the SGSN sends the Create PDP Context Request is the first IP address in the list of IP addresses provided by the DNS server. After sending the Create PDP Context Request message, the SGSN marks the PDP context as 'waiting for response'. In this state the SGSN shall accept G-PDUs from the GGSN but shall not send these G-PDUs to the MS. A valid request initiates the creation of a tunnel between a PDP Context in a SGSN and a PDP Context in a GGSN. If the procedure is not successfully completed, the SGSN repeats the Create PDP Context Request message to the next GGSN address in the list of IP addresses, if there is one. If the list is exhausted the activation procedure fails.

The Tunnel Endpoint Identifier Data I field specifies a downlink Tunnel Endpoint Identifier for G-PDUs which is chosen by the SGSN. The GGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent downlink G-PDUs which are related to the requested PDP context.

The Tunnel Endpoint Identifier Signalling field specifies a downlink Tunnel Endpoint Identifier for signalling messages which is chosen by the SGSN. The GGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent downlink signalling messages which are related to the requested PDP context.

The MSISDN of the MS is passed to the GGSN inside the Create PDP Context Request; This additional information can be used when a secure access to a remote application residing on a server is needed. The GGSN would be in fact able to provide the user identity (i. e. the MSISDN) to the remote application server, providing it with the level of trust granted to users through successfully performing the GPRS authentication procedures, without having to re-authenticate the user at the application level.

If the MS requests a dynamic PDP address and a dynamic PDP address is allowed, then the PDP Address field in the End User Address information element shall be empty. If the MS requests a static PDP Address then the PDP Address field in the End User Address information element shall contain the static PDP Address. In case the PDP addresses carried in the End User Address and optionally in the Protocol Configuration Option information element contain contradicting information, the PDP address carried in the End User Address information element takes the higher precedence. The Quality of Service Profile information element shall be the QoS values to be negotiated between the MS and the SGSN at PDP Context activation.

The SGSN shall include an SGSN Address for signalling and an SGSN address for user traffic, which may differ from that provided by the underlying network service (e.g. IP). The GGSN shall store these SGSN Addresses and use them when sending signalling on this GTP tunnel or G-PDUs to the SGSN for the MS.

The SGSN shall include a Recovery information element into the Create PDP Context Request if the SGSN is in contact with the GGSN for the very first time or if the SGSN has restarted recently and the new Restart Counter value has not yet been indicated to the GGSN. The GGSN that receives a Recovery information element in the Create PDP Context Request message element shall handle it in the same way as when receiving an Echo Response message. The Create PDP Context Request message shall be considered as a valid activation request for the PDP context included in the message.

The SGSN shall include either the MS provided APN, a subscribed APN or an SGSN selected APN in the message; the Access Point Name may be used by the GGSN to differentiate accesses to different external networks.
The Selection Mode information element shall indicate the origin of the APN in the message.

For secondary PDP contexts the SGSN shall include the NSAPI of the primary PDP context to associate the secondary PDP context with and a TFT to be used for packet filtering by GGSN. When creating a secondary PDP context, the Selection mode, MSISDN, End User Address, Access Point Name and Protocol Configuration Options information elements shall not be included in the message.

The optional Protocol Configuration Options information element is applicable for the end user protocol 'IP' only.

The SGSN shall select one GGSN based on the user provided or SGSN selected APN. The GGSN may have a logical name that is converted to an address. The conversion may be performed with any name-to-address function. The converted address shall be stored in the "GGSN Address in Use" field in the PDP context and be used during the entire lifetime of the PDP context.

NOTE: A DNS query may be used as the name-to-IP address mapping of the GGSN. The IP address returned in the DNS response is then stored in the "GGSN Address in Use" field in the PDP context.

The IMSI information element together with the NSAPI information element uniquely identifies the PDP context to be created.

The SGSN may send a Create PDP Context Request even if the PDP context is already active.

The GGSN shall check if the PDP context already exists for the MS. The existing parameters in the PDP context shall then be replaced with the parameters in the Create PDP Context Request message. If a dynamic PDP address has already been allocated for the existing context, this address should be used and copied to the Create PDP Context Response message.

If the GGSN uses the MNRG flag and the flag is set, the GGSN should treat the Create PDP Context Request as a Note MS Present Request and clear the MNRG flag.

The SGSN shall copy Charging Characteristics from the Subscribed Charging Characteristics if the information is present in the Packet Domain Subscription Data.

The optional Private Extension contains vendor or operator specific information.

Table 4: Information elements in a Create PDP Context Request

Information element	Presence requirement	Reference
IMSI	Conditional	7.7.2
Recovery	Optional	7.7.11
Selection mode	Mandatory	7.7.12
Tunnel Endpoint Identifier Data I	Mandatory	7.7.13
Tunnel Endpoint Identifier Signalling	Mandatory	7.7.14
End User Address	Conditional	7.7.17
Access Point Name	Conditional	7.7.20
Protocol Configuration Options	Conditional	7.7.21
SGSN Address for signalling	Mandatory	GSN Address 7.7.22
SGSN Address for user traffic	Mandatory	GSN Address 7.7.22
MSISDN	Conditional	7.7.23
Quality of Service Profile	Mandatory	7.7.25
Private Extension	Optional	7.7.26
TFT	Conditional	7.7.28
NSAPI	Mandatory	7.7.30
Primary NSAPI	Conditional	7.7.30
Charging Characteristics	Optional	7.7.XX

< next modified section>

7.7.XX Charging Characteristics

The Charging Characteristics information element indicates which kind of charging a PDP context is liable for. The N flag indicates normal charging, the P flag indicates prepaid charging, the F flag indicates flat rate charging and the H flag indicates charging by hot billing. One or more of the flags shall be set according to the subscribed charging characteristics received from the HLR as part of the packet domain subscription data.

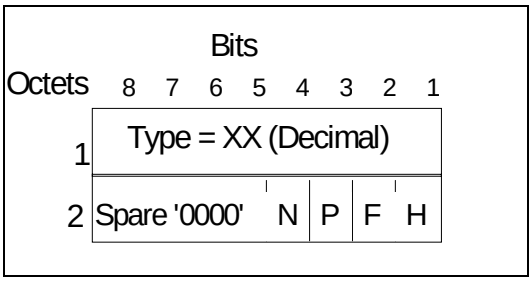

Figure XX: Charging Characteristics information element

3GPP TSG CN WG2
Kyoto, Japan, 17-21 Jan 2000

Document N2B000110
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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29.060	**CR**	**041r1**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: N2 **Date:** 18.1.2000

Subject: Subscriber and equipment trace for PS domain

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	X
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change:

The trace facility enables subscriber administration and network management to trace the activities of various entities when specific events occur within the PLMN. The facility may be used for subscriber observation, e.g. following a customer complaint, or on suspicion of equipment malfunction by the operator, or at the request of the police.

According to TS 29.002, trace information is sent at trace activation from the HLR to the SGSN. To enable GGSN trace, the SGSN shall send the trace information to the GGSN. The trace information is sent in the Create PDP Context Request or in the Update PDP Context Request from the SGSN to the GGSN.

Clauses affected:

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	23.060
Other GSM core specifications	X	→ List of CRs:	12.08
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

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7.5.1 Create PDP Context Request

A Create PDP Context Request shall be sent from a SGSN node to a GGSN node as a part of the GPRS PDP Context Activation procedure. The GGSN IP address where the SGSN sends the Create PDP Context Request is the first IP address in the list of IP addresses provided by the DNS server. After sending the Create PDP Context Request message, the SGSN marks the PDP context as 'waiting for response'. In this state the SGSN shall accept G-PDUs from the GGSN but shall not send these G-PDUs to the MS. A valid request initiates the creation of a tunnel between a PDP Context in a SGSN and a PDP Context in a GGSN. If the procedure is not successfully completed, the SGSN repeats the Create PDP Context Request message to the next GGSN address in the list of IP addresses, if there is one. If the list is exhausted the activation procedure fails.

The Tunnel Endpoint Identifier Data I field specifies a downlink Tunnel Endpoint Identifier for G-PDUs which is chosen by the SGSN. The GGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent downlink G-PDUs which are related to the requested PDP context.

The Tunnel Endpoint Identifier Signalling field specifies a downlink Tunnel Endpoint Identifier for signalling messages which is chosen by the SGSN. The GGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent downlink signalling messages which are related to the requested PDP context.

The MSISDN of the MS is passed to the GGSN inside the Create PDP Context Request; This additional information can be used when a secure access to a remote application residing on a server is needed. The GGSN would be in fact able to provide the user identity (i. e. the MSISDN) to the remote application server, providing it with the level of trust granted to users through successfully performing the GPRS authentication procedures, without having to re-authenticate the user at the application level.

If the MS requests a dynamic PDP address and a dynamic PDP address is allowed, then the PDP Address field in the End User Address information element shall be empty. If the MS requests a static PDP Address then the PDP Address field in the End User Address information element shall contain the static PDP Address. In case the PDP addresses carried in the End User Address and optionally in the Protocol Configuration Option information element contain contradicting information, the PDP address carried in the End User Address information element takes the higher precedence. The Quality of Service Profile information element shall be the QoS values to be negotiated between the MS and the SGSN at PDP Context activation.

The SGSN shall include an SGSN Address for signalling and an SGSN address for user traffic, which may differ from that provided by the underlying network service (e.g. IP). The GGSN shall store these SGSN Addresses and use them when sending signalling on this GTP tunnel or G-PDUs to the SGSN for the MS.

The SGSN shall include a Recovery information element into the Create PDP Context Request if the SGSN is in contact with the GGSN for the very first time or if the SGSN has restarted recently and the new Restart Counter value has not yet been indicated to the GGSN. The GGSN that receives a Recovery information element in the Create PDP Context Request message element shall handle it in the same way as when receiving an Echo Response message. The Create PDP Context Request message shall be considered as a valid activation request for the PDP context included in the message.

The SGSN shall include either the MS provided APN, a subscribed APN or an SGSN selected APN in the message; the Access Point Name may be used by the GGSN to differentiate accesses to different external networks.
The Selection Mode information element shall indicate the origin of the APN in the message.

For secondary PDP contexts the SGSN shall include the NSAPI of the primary PDP context to associate the secondary PDP context with and a TFT to be used for packet filtering by GGSN. When creating a secondary PDP context, the Selection mode, MSISDN, End User Address, Access Point Name and Protocol Configuration Options information elements shall not be included in the message.

The optional Protocol Configuration Options information element is applicable for the end user protocol 'IP' only.

The SGSN shall select one GGSN based on the user provided or SGSN selected APN. The GGSN may have a logical name that is converted to an address. The conversion may be performed with any name-to-address function. The converted address shall be stored in the "GGSN Address in Use" field in the PDP context and be used during the entire lifetime of the PDP context.

NOTE: A DNS query may be used as the name-to-IP address mapping of the GGSN. The IP address returned in the DNS response is then stored in the "GGSN Address in Use" field in the PDP context.

The IMSI information element together with the NSAPI information element uniquely identifies the PDP context to be created.

The SGSN may send a Create PDP Context Request even if the PDP context is already active.

The GGSN shall check if the PDP context already exists for the MS. The existing parameters in the PDP context shall then be replaced with the parameters in the Create PDP Context Request message. If a dynamic PDP address has already been allocated for the existing context, this address should be used and copied to the Create PDP Context Response message.

If the GGSN uses the MNRG flag and the flag is set, the GGSN should treat the Create PDP Context Request as a Note MS Present Request and clear the MNRG flag.

The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity in the message if GGSN trace is activated. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace request received from the HLR or OMC.

The optional Private Extension contains vendor or operator specific information.

Table 4: Information elements in a Create PDP Context Request

Information element	Presence requirement	Reference
IMSI	Conditional	7.7.2
Recovery	Optional	7.7.11
Selection mode	Mandatory	7.7.12
Tunnel Endpoint Identifier Data I	Mandatory	7.7.13
Tunnel Endpoint Identifier Signalling	Mandatory	7.7.14
End User Address	Conditional	7.7.17
Access Point Name	Conditional	7.7.20
Protocol Configuration Options	Conditional	7.7.21
SGSN Address for signalling	Mandatory	GSN Address 7.7.22
SGSN Address for user traffic	Mandatory	GSN Address 7.7.22
MSISDN	Conditional	7.7.23
Quality of Service Profile	Mandatory	7.7.25
Private Extension	Optional	7.7.26
TFT	Conditional	7.7.28
NSAPI	Mandatory	7.7.30
Primary NSAPI	Conditional	7.7.30
Trace Reference	Optional	7.7.XX
Trace Type	Optional	7.7.XX
Trigger Id	Optional	7.7.XX
OMC Identity	Optional	7.7.XX

< next modified section>

7.5.3 Update PDP Context Request

An Update PDP Context Request message shall be sent from a SGSN to a GGSN as part of the GPRS Inter SGSN Routeing Update procedure or the PDP Context Modification procedure or to redistribute contexts due to load sharing. It shall be used to change the QoS and the path. The message shall be sent by the new SGSN at the Inter SGSN Routeing Update procedure.

The NSAPI information element together with the Tunnel Endpoint Identifier in the GTP header unambiguously identifies a PDP Context in the GGSN.

The Tunnel Endpoint Identifier Data I field specifies a downlink Tunnel Endpoint Identifier for G-PDUs which is chosen by the SGSN. The GGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent downlink G-PDUs which are related to the requested PDP context.

The Tunnel Endpoint Identifier Signalling field specifies a downlink Tunnel Endpoint Identifier for signalling messages which is chosen by the SGSN. The GGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent downlink signalling messages which are related to the requested PDP context.

The Quality of Service Profile information element shall include the QoS negotiated between the MS and SGSN at PDP Context activation or the new QoS negotiated in the PDP Context Modification procedure.

The SGSN shall include an SGSN Address for signalling and an SGSN address for user traffic, which may differ from that provided by the underlying network service (e.g. IP). The GGSN shall store these SGSN Addresses and use them when sending subsequent signalling on this GTP tunnel or G-PDUs to the SGSN for the MS. When active contexts are being redistributed due to load sharing, G-PDUs that are in transit across the Gn-interface are in an undetermined state and may be lost.

The SGSN shall include a Recovery information element into the Update PDP Context Request if the SGSN is in contact with the GGSN for the very first time or if the SGSN has restarted recently and the new Restart Counter value has not yet been indicated to the GGSN. The GGSN that receives a Recovery information element in the Update PDP Context Request message element shall handle it in the same way as when receiving an Echo Response message. The Update PDP Context Request message shall be considered as a valid update request for the PDP context indicated in the message.

The Traffic Flow Template (TFT) is used to distinguish between different user traffic flows.

The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity in the message if GGSN trace is activated while the PDP context is active. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace request received from the HLR or OMC.

The optional Private Extension contains vendor or operator specific information.

Table 6: Information elements in an SGSN-initiated Update PDP Context Request

Information element	Presence requirement	Reference
Recovery	Optional	7.7.11
Tunnel Endpoint Identifier Data I	Mandatory	7.7.13
Tunnel Endpoint Identifier Signalling	Mandatory	7.7.14
SGSN Address for signalling	Mandatory	GSN Address 7.7.22
SGSN Address for user traffic	Mandatory	GSN Address 7.7.22
Quality of Service Profile	Mandatory	7.7.25
Private Extension	Optional	7.7.26
TFT	Optional	7.7.28
NSAPI	Mandatory	7.7.30
Trace Reference	Optional	7.7.XX
Trace Type	Optional	7.7.XX
Trigger Id	Optional	7.7.XX
OMC Identity	Optional	7.7.XX

< next modified section>

7.7.XX Trace Reference

The Trace Reference information element identifies a record or a collection of records for a particular trace. The Trace Reference is allocated by the triggering entity.

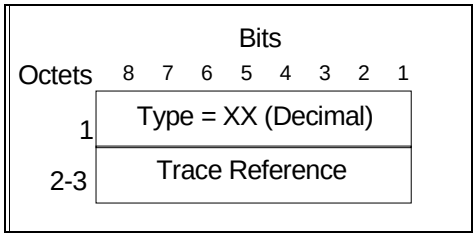

Figure XX: Trace Reference information element

7.7.XX Trace Type

The Trace Type information element indicates the type of the trace.

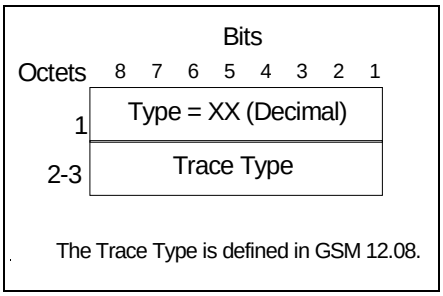

Figure XX: Trace Type information element

The Trace Type value 0 (Decimal) and the Trace Type value which is not understood by the receiver shall be treated as a basic trace type.

7.7.XX Trigger Id

The Trigger Id information element identifies the entity which triggered the trace.

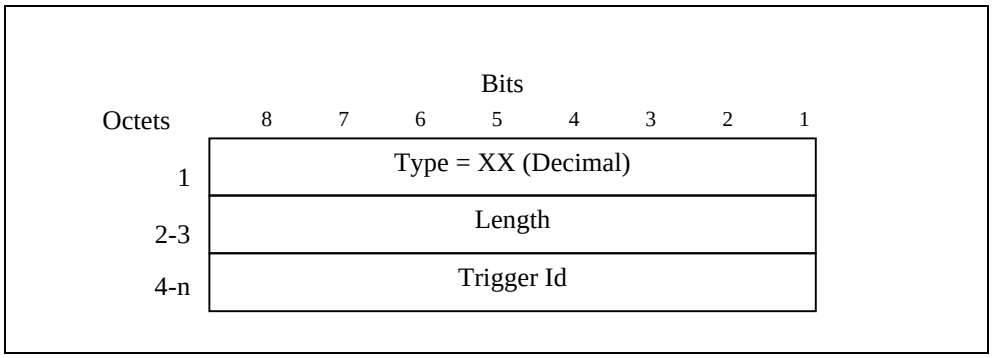

Figure XX: Trigger Id information element

7.7.XX OMC Identity

The OMC Identity information element identifies the OMC that shall receive the trace record(s).

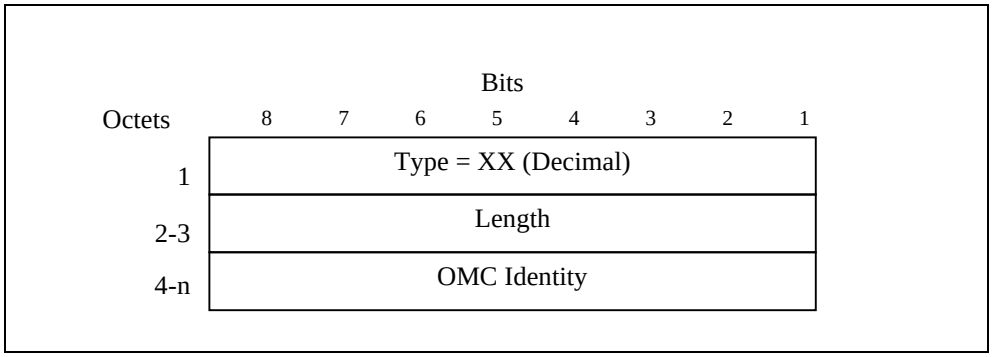

Figure XX: OMC Identity information element

3GPP TSG-CN WG2 #13
Kyoto, Japan, 17-21 Jan. 2000

Document N2B000048
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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29.060	**CR**	**042**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME		UTRAN / Radio		Core Network	X

Source: N2 **Date:** 2000-01-17

Subject: Necessity of the function of the calculation an SGSN IP address from the target ID

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	X
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: In UMTS, the target ID which consists of MCC, MNC and RNC ID is used as a routing information of a target RNC and a new SGSN when SRNS relocation is executed (see TS25.413 and TS23.060). It should be allowed that DNS can be used to resolve new SGSN IP addresses.
This CR proposes a naming convention for the target ID.

Clauses affected:

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	TS23.003
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

Annex A (Informative): Naming convention

A naming convention that will make it possible for DNS servers to translate logical names for GSNs and RAs to physical IP addresses is described in this informative annex. The use of logical names is optional, but if the option is used, it shall comply with the naming convention described in this annex.

A.1 Routing Area Identities

A possible way to support inter-PLMN roaming is discussed very briefly in this sub-section.

When an MS roams between two SGSNs within the same PLMN, the new SGSN finds the address to the old SGSN by the association old RA - old SGSN. Thus, each SGSN knows the address to every other SGSN in the PLMN.

When an MS roams from an SGSN to an SGSN in another PLMN, the new SGSN may not itself have access to the address to the old SGSN. Instead, the SGSN transforms the old RA information to a logical name of the form:

RACxxxx.LACyyyy.MNCzzzz.MCCwwww.GPRS; x,y,z and w shall be Hex coded digits.

The SGSN may then acquire the IP address of the old SGSN from a DNS server, using the logical address. Every PLMN should include one DNS server each. Note that these DNS servers are GPRS internal entities, unknown outside the GPRS system.

The above implies that at least MCC + MNC + RAC + LAC (= RAI) is sent as RA parameter over the radio when an MS roams to another RA.

If the new SGSN for any reason fails to obtain the address of the old SGSN, the same actions as when the corresponding event occurs within one PLMN are taken.

Introducing the DNS concept in GPRS gives a general possibility to use logical names instead of IP addresses when referring to e.g. GSNs, thus providing flexibility in addressing of PLMN nodes.

Another way to support seamless inter-PLMN roaming is to store the SGSN IP addresses in HLR and request them when necessary.

A.2 GPRS Support Nodes

In this sub-section a naming convention for GSNs is described.

It shall be possible to refer to a GSN by a logical name that shall then be translated into a physical IP address. Here a GSN naming convention is proposed which would make it possible for an internal GPRS DNS server to make the translation.

An example of how a logical name of a SGSN could look like is:

SGSNxxxx.MNCyyyy.MCCzzzz.GPRS; x,y and z shall be Hex coded digits.

A.x Target ID

In this sub-section a possible way to support SRNS relocation is described.

In UMTS, when an SRNS relocation is executed, a target ID which consists of MCC, MNC and RNC ID is used as a routeing information to route to the target RNC via the new SGSN. An old SGSN shall resolve a new SGSN IP address by a target ID to send a Forward Relocation Request message to the new SGSN.

It shall be possible to refer to a target ID by a logical name that shall be translated into an SGSN IP address for taking the inter-PLMN handover into account. The old SGSN transforms the target ID information to a logical name of the form;

RNCxxxx.MNCyyyy.MCCzzzz.GPRS; x,y and z shall be Hex coded digits.

3GPP TSG-CN SWG2B
Milan, Italy, 14-16 Feb. 2000

Document N2B000267
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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29.060	CR	073	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: N2 **Date:** 2000-02-08

Subject: Clarification to the function of the calculation an SGSN IP address from the target ID

Work item: TEI

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	X

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change:

In UMTS, the target ID which consists of MCC, MNC and RNC ID is used as a routing information of a target RNC and a new SGSN when SRNS relocation is executed (see TS25.413 and TS23.060). It should be allowed that DNS can be used to resolve new SGSN IP addresses. A CR proposing a naming convention for the target ID was approved at the N2 meeting in Kyoto in January (CR 046).

This CR gives some clarification to how the logical address can be translated to an SGSN IP address by a DNS server.

Clauses affected:

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	TS23.003
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

Annex A (Informative): Naming convention

A naming convention that will make it possible for DNS servers to translate logical names for GSNs and RAs to physical IP addresses is described in this informative annex. The use of logical names is optional, but if the option is used, it shall comply with the naming convention described in this annex.

A.x Target ID

In this sub-section a possible way to support SRNS relocation is described.

In UMTS, when a SRNS relocation is executed, a target ID which consists of MCC, MNC and RNC ID is used as a routing information to route to target RNC via new SGSN. An old SGSN shall resolve a new SGSN IP address by a target ID to send Forward Relocation Request message to the new SGSN.

It shall be possible to refer to a target ID by a logical name that shall be translated into a SGSN IP address for taking the inter-PLMN handover into account. The old SGSN transforms the target ID information to a logical name of the form;

RNCxxxx.MNCyyyy.MCCzzzz.GPRS; x,y and z shall be Hex coded digits.

Then, for example a DNS server is used to translate the logical name to a SGSN IP address.

3GPP TSG CN2B
Kista, Sweden, 2-3 Mar 2000

Document N2B000442
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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29.060	CR	083	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#07	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME		UTRAN / Radio		Core Network	X

Source: N2 **Date:** 2 Mar 2000

Subject: Editorial clarification of information elements in the SGSN Context Response

Work item: Technical Enhancements and improvements

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification	X		Release 99	X
				Release 00	

Reason for change: The condition for the inclusion of information elements in the SGSN context response is unclear

Clauses affected: 7.5.4

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

7.5.4 SGSN Context Response

The old SGSN shall send an SGSN Context Response to the new SGSN as a response to a previous SGSN Context Request.

Possible Cause values are:

- 'Request Accepted'
- 'IMSI not known'
- 'System failure'
- 'Mandatory IE incorrect'
- 'Mandatory IE missing'
- 'Optional IE incorrect'
- 'Invalid message format'
- 'Version not supported'
- 'P-TMSI Signature mismatch'

Only the Cause information element shall be included in the response if the Cause contains another value than 'Request accepted'.

If the Cause contains the value 'Request accepted', ~~A~~all information elements are mandatory, except PDP Context~~,~~ and Private Extension~~, if the Cause contains the value 'Request accepted'~~.

The Tunnel Endpoint Identifier Signalling field specifies a Tunnel Endpoint Identifier which is chosen by the old SGSN. The new SGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent signalling messages which are sent from the new SGSN to the old SGSN and related to the PDP context(s) requested.

The IMSI information element contains the IMSI matching the TLLI or P-TMSI (for GSM or UMTS respectively) and RAI in the SGSN Context Request.

One or several Receive State Variable information elements may be included in the message.

The MM Context contains necessary mobility management and security parameters.

All active PDP contexts in the old SGSN shall be included as PDP Context information elements.

If there is at least one active PDP context, the old SGSN shall start the T3-TUNNEL timer and store the address of the new SGSN in the "New SGSN Address" field of the MM context. The old SGSN shall wait for SGSN Context Acknowledge before sending T-PDUs to the new SGSN. If the old SGSN has one or more active PDP contexts for the subscriber and SGSN Context Acknowledge message is not received within a time defined by T3-RESPONSE, the old SGSN shall retransmit the SGSN Context Response to the new SGSN for as long as the total number of attempts is less than N3-REQUESTS. After N3-REQUESTS unsuccessfully attempts, the old SGSN shall proceed as described in section 'Reliable delivery of signalling messages' in case the transmission of a signalling message fails N3-REQUESTS times.

The optional Private Extension contains vendor or operator specific information.

Table 30: Information elements in a SGSN Context Response

Information element	Presence requirement	Reference
Cause	Mandatory	7.7.1
IMSI	Conditional	7.7.2
Tunnel Endpoint Identifier Signalling	Conditional	7.7.14
MM Context	Conditional	7.7.19
PDP Context	Conditional	7.7.19
Private Extension	Optional	7.7.26