

**3GPP TSG\_CN#6**

**NP-99501**

**Nice, France**

**13<sup>th</sup> – 15<sup>th</sup> December 1999**

---

**Agenda item:**

**Source: TSG\_N WG2**

**Title: CRs to 3G TS 23.012, 29.002 (Work Item TE&I)**

---

**Introduction:**

This document contains **3 CRs on Work Item Technical Enhancements and Improvements** agreed by **TSG\_N WG2** and forwarded to **TSG\_N Plenary** meeting #6 for approval.

<b>TDoc</b>	<b>Spec</b>	<b>CR</b>	<b>Rev</b>	<b>Ph.</b>	<b>Cat</b>	<b>Old v.</b>	<b>New v.</b>	<b>Subject</b>
N2-99J50	23.012	001	1	R99	D	3.0.0	3.0.0	MAP Location Management Restructuring
N2-99G18	29.002	032	2	R99	C	3.2.0	3.3.0	Introduction of White Book SCCP in MAP
N2-99J52	29.002	074		R99	D	3.2.0	3.3.0	Restructuring of MAP Location Management Procedures for the Circuit Switched Domain

# CHANGE REQUEST

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

**23.012 CR 001r1**

Current Version: **3.0.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN#06**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (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:** (U)SIM  ME  UTRAN / Radio  Core Network   
(at least one should be marked with an X)

**Source:** TSG N2 **Date:** 15 Nov. 1999

**Subject:** Restructuring of MAP Location Management Procedures, Stage 2

**Work item:** TEI

<b>Category:</b> (only one category shall be marked with an X)	F Correction	<input type="checkbox"/>	<b>Release:</b>	Phase 2	<input type="checkbox"/>
	A Corresponds to a correction in an earlier release	<input type="checkbox"/>		Release 96	<input type="checkbox"/>
	B Addition of feature	<input type="checkbox"/>		Release 97	<input type="checkbox"/>
	C Functional modification of feature	<input type="checkbox"/>		Release 98	<input type="checkbox"/>
	D Editorial modification	<input checked="" type="checkbox"/>		Release 99	<input checked="" type="checkbox"/>
			Release 00	<input type="checkbox"/>	

**Reason for change:** Currently, stage 2 and stage 3 descriptions of location management procedures are mixed together in chapter 19 of TS 29.002. This CR imports the stage 2 descriptions which are to be removed from chapter 19 of 29.002.

**Clauses affected:** all

<b>Other specs affected:</b>	Other 3G core specifications	<input checked="" type="checkbox"/>	→ List of CRs:	29.002-0xx
	Other GSM core specifications	<input type="checkbox"/>	→ List of CRs:	
	MS test specifications	<input type="checkbox"/>	→ List of CRs:	
	BSS test specifications	<input type="checkbox"/>	→ List of CRs:	
	O&M specifications	<input type="checkbox"/>	→ List of CRs:	

**Other comments:**

# 3G TS 23.012 ~~V3.0.0 (1999-05)~~

*Technical Specification*

**3rd Generation Partnership Project;  
Technical Specification Group Core Network;  
Location ~~registration~~Management proceduresProcedures  
(3G TS 23.012 ~~version 3.0.0~~)**



Reference

---

DTS/TSGN-0123012U

Keywords

---

3GPP, CN

**3GPP**

Postal address

---

3GPP support office address

650 Route des Lucioles - Sophia Antipolis  
Valbonne - FRANCE  
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

---

<http://www.3gpp.org>

# Contents

Foreword.....	998
1 Scope.....	101010
1.1 References.....	101011
1.2 Abbreviations.....	111113
2 Definitions.....	111113
2.1 Location management.....	111113
2.2 Location area and MSC area.....	111114
2.3 Location area identification.....	111114
2.4 IMSI detach/attach operation.....	111114
2.4.1 Explicit IMSI detach/attach.....	121215
2.4.2 Implicit IMSI detach.....	121215
2.5 Use of the term mobile station (MS) in the present document.....	121215
3 General Procedures in the network related to Location Management.....	121216
3.1 Procedures in the MSC related to Location Updating.....	121216
3.2 Procedures in the VLR related to Location Updating.....	121216
3.3 Procedures in the HLR related to Location Updating.....	121216
3.4 Normal location updating and IMSI detach/attach operation.....	121217
3.5 IMSI enquiry procedure.....	121217
3.6 Information transfer between visitor and home location registers.....	131317
3.6.1 Procedures for location management.....	131317
3.6.1.1 Location updating procedure.....	131318
3.6.1.2 Downloading of subscriber parameters to the VLR.....	131318
3.6.1.3 Location cancellation procedure.....	131319
3.6.1.4 Mobile subscriber purging procedure.....	131319
4 Detailed Procedures in the network related to Location Management.....	141420
4.1 Location Updating.....	141421
4.1.1 Detailed procedure in the MSC.....	141421
4.1.1.1 Process Update Location Area MSC.....	141421
4.1.1.2 Procedure Authenticate MSC.....	191930
4.1.2 Detailed procedure in the VLR.....	202032
4.1.2.1 Process Update Location Area VLR.....	202032
4.1.2.2 Procedure Authenticate VLR.....	272746
4.1.2.3 Procedure Location Update Completion VLR.....	313151
4.1.2.4 Process Update HLR VLR.....	343457
4.1.2.5 Process Insert Subs Data VLR.....	353559
4.1.2.6 Process Activate Tracing VLR.....	363662
4.1.2.7 Process Send Identification PVLR.....	373765
4.1.2.8 Process Trace Subscriber Activity VLR.....	383868
4.1.3 Detailed procedure in the HLR.....	404070
4.1.3.1 Process Update Location HLR.....	404070
4.1.3.2 Procedure Insert Subscriber Data HLR.....	454578
4.1.3.3 Process Subscriber Present HLR.....	484883
4.1.3.4 Procedure Control Tracing HLR.....	505087
4.2 Location Cancellation.....	525291
4.2.1 Detailed procedure in the VLR.....	525291
4.2.1.1 Process Cancel Location VLR.....	535392
4.2.2 Detailed procedure in the HLR.....	545494
4.2.2.1 Process Cancel Location HLR.....	545494
4.3 Detach IMSI.....	565697
4.3.1 Detailed procedure in the MSC.....	565697
4.3.1.1 Process Detach IMSI MSC.....	565698
4.3.2 Detailed procedure in the VLR.....	585899
4.3.2.1 Process Detach IMSI VLR.....	5858100

4.4	Purge MS .....	6161102
4.4.1	Detailed procedure in the VLR .....	6161103
4.4.1.1	Procedure Purge MS VLR .....	6161104
4.4.2.1	Procedure Purge MS HLR .....	6262105
<b>Annex A: Change history .....</b>		<b>6565109</b>
History .....		66
Foreword .....		
1 Scope .....		
1.1	References .....	
1.2	Abbreviations .....	
2 Definitions .....		
2.1	Location management .....	
2.2	Location area and MSC area .....	
2.3	Location area identification .....	
2.4	IMSI detach/attach operation .....	
2.4.1	Explicit IMSI detach/attach .....	
2.4.2	Implicit IMSI detach .....	
2.5	Use of the term mobile station (MS) in the present document .....	
3 General Procedures in the network related to Location Management .....		
3.1	Procedures in the MSC related to Location Updating .....	
3.2	Procedures in the VLR related to Location Updating .....	
3.3	Procedures in the HLR related to Location Updating .....	
3.4	Normal location updating and IMSI detach/attach operation .....	
3.5	IMSI enquiry procedure .....	
3.6	Information transfer between visitor and home location registers .....	
3.6.1	Procedures for location management .....	
3.6.1.1	Location updating procedure .....	
3.6.1.2	Downloading of subscriber parameters to the VLR .....	
3.6.1.3	Location cancellation procedure .....	
3.6.1.4	Mobile subscriber purging procedure .....	
4 Detailed Procedures in the network related to Location Management .....		
4.1	Location Updating .....	
4.1.1	Detailed procedure in the MSC .....	
4.1.1.1	Process Update_Location Area_MSC .....	
4.1.1.2	Procedure Authenticate_MSC .....	
4.1.2	Detailed procedure in the VLR .....	
4.1.2.1	Process Update_Location Area_VLR .....	
4.1.2.2	Procedure Authenticate_VLR .....	
4.1.2.3	Procedure Location_Update_Completion_VLR .....	
4.1.2.4	Process Update_HLR_VLR .....	
4.1.2.5	Process Insert_Subscriber_Data_VLR .....	
4.1.2.6	Process Activate_Tracing_VLR .....	29
4.1.2.7	Process Send_Identifier_PVLR .....	30
4.1.2.8	Process Trace_Subscriber_Activity_VLR .....	31
4.1.3	Detailed procedure in the HLR .....	32
4.1.3.1	Process Update_Location_HLR .....	32
4.1.3.2	Procedure Insert_Subscriber_Data_HLR .....	36
4.1.3.3	Process Subscriber_Present_HLR .....	39
4.1.3.4	Procedure Control_Tracing_HLR .....	41
4.2	Location Cancellation .....	43
4.2.1	Detailed procedure in the VLR .....	43
4.2.1.1	Process Cancel_Location_VLR .....	44
4.2.2	Detailed procedure in the HLR .....	45
4.2.2.1	Process Cancel_Location_HLR .....	45
4.3	Detach IMSI .....	47
4.3.1	Detailed procedure in the MSC .....	47

4.3.1.1	Process Detach IMSI_MSC	47
4.3.2	Detailed procedure in the VLR	49
4.3.2.1	Process Detach IMSI_VLR	49
4.4	Purge MS	51
4.4.1	Detailed procedure in the VLR	51
4.4.1.1	Procedure Purge_MS_VLR	51
4.4.2	Detailed procedure in the HLR	53
4.4.2.1	Procedure Purge_MS_HLR	53
<b>Annex A: Change history</b>		<b>56</b>
History		57
Foreword		7
1	Scope	8
1.1	References	8
1.2	Abbreviations	9
2	Definitions	9
2.1	Location management	9
2.2	Location area and MSC area	9
2.3	Location area identification	9
2.4	IMSI detach/attach operation	9
2.4.1	Explicit IMSI detach/attach	10
2.4.2	Implicit IMSI detach	10
2.5	Use of the term mobile station (MS) in the present document	10
3	General Procedures in the network related to Location Management	10
3.1	Procedures in the MSC related to Location Updating	10
3.2	Procedures in the VLR related to Location Updating	10
3.3	Procedures in the HLR related to Location Updating	10
3.4	Normal location updating and IMSI detach/attach operation	10
3.5	IMSI enquiry procedure	11
3.6	Information transfer between visitor and home location registers	11
3.5.1	Procedures for location management	11
3.5.1.1	Location updating procedure	11
3.5.1.2	Downloading of subscriber parameters to the VLR	11
3.5.1.3	Location cancellation procedure	11
3.5.1.5	Mobile subscriber purging procedure	11
4	Detailed Procedures in the network related to Location Management	12
4.1	Location Updating	12
4.1.1	Detailed procedure in the MSC	12
4.1.1.1	Process Update_Location_Area_MSC	12
4.1.1.2	Procedure Authenticate_MSC	18
4.1.2	Detailed procedure in the VLR	19
4.1.2.1	Process Update_Location_Area_VLR	19
4.1.2.2	Procedure Location_Update_Completion_VLR	25
4.1.2.3	Process Update_HLR_VLR	28
4.1.2.4	Process Insert_Subscriber_Data_VLR	30
4.1.2.5	Process Activate_Tracing_VLR	31
4.1.2.6	Process Send_Identifier_P_VLR	33
4.1.3	Detailed procedure in the HLR	34
4.1.3.1	Process Update_Location_HLR	34
4.1.3.2	Procedure Insert_Subscriber_Data_HLR	38
4.1.3.3	Process Subscriber_Present_HLR	41
4.1.3.4	Procedure Control_Tracing_HLR	43
4.2	Location Cancellation	45
4.2.1	Detailed procedure in the VLR	45
4.2.1.1	Process Cancel_Location_VLR	46
4.2.2	Detailed procedure in the HLR	48
4.2.2.1	Process Cancel_Location_HLR	48

4.3	Detach IMSI .....	50
4.3.1	Detailed procedure in the MSC .....	50
4.3.1.1	Process Detach IMSI MSC .....	50
4.3.2	Detailed procedure in the VLR .....	52
4.3.2.1	Process Detach IMSI VLR .....	52
4.4	Purge MS .....	54
4.4.1	Detailed procedure in the VLR .....	54
4.4.1.1	Procedure Purge MS VLR .....	54
4.4.2	Detailed procedure in the HLR .....	56
4.4.2.1	Procedure Purge MS HLR .....	56
<b>Annex A: Change history .....</b>		<b>59</b>
History .....		60
Foreword .....		5
1	Scope .....	6
1.1	References .....	6
1.2	Abbreviations .....	7
2	Definitions .....	7
2.1	Location management .....	7
2.2	Location area and MSC area .....	7
2.3	Location area identification .....	7
2.4	IMSI detach/attach operation .....	7
2.4.1	Explicit IMSI detach/attach .....	8
2.4.2	Implicit IMSI detach .....	8
2.5	Use of the term mobile station (MS) in the present document .....	8
3	General Procedures in the network related to Location Management .....	8
3.1	Procedures in the MSC related to Location Updating .....	8
3.2	Procedures in the BSC related to Location Updating .....	8
3.3	Normal location updating and IMSI detach/attach operation .....	8
3.4	IMSI enquiry procedure .....	8
3.5	Information transfer between visitor and home location registers .....	9
3.5.1	Procedures for location management .....	9
3.5.1.1	Location updating procedure .....	9
3.5.1.2	Downloading of subscriber parameters to the VLR .....	9
3.5.1.3	Location cancellation procedure .....	9
3.5.1.4	Subscriber parameter request procedure .....	9
3.5.1.5	Mobile subscriber purging procedure .....	9
3.5.1.6	Recovery procedures .....	10
4	Detailed Procedures in the network related to Location Management .....	10
4.1	Location Updating .....	10
4.1.1	Detailed procedure in the MSC .....	10
4.1.1.1	Process Update Location Area MSC .....	10
4.1.1.2	Procedure Check IMEI MSC .....	13
4.1.1.3	Procedure Authenticate MSC .....	15
4.1.1.4	Procedure Obtain IMSI MSC .....	16
4.1.2	Detailed procedure in the VLR .....	17
4.1.2.1	Process Update Location Area VLR .....	17
4.1.2.2	Process Location Update Completion VLR .....	22
4.1.2.3	Process Update HLR VLR .....	25
4.1.2.4	Process Insert Subs Data VLR .....	27
4.1.2.5	Process Activate Tracing VLR .....	28
4.1.2.6	Process Send Identification PVLR .....	29
4.1.3	Detailed procedure in the HLR .....	30
4.1.3.1	Process Update Location HLR .....	30
4.1.3.2	Process Insert Subscriber Data HLR .....	34
4.1.3.3	Process Subscriber Present HLR .....	37
4.2	Location Cancellation .....	39



4.2.1	Detailed procedure in the VLR .....	39
4.2.1.1	Process Cancel Location VLR.....	39
4.2.2	Detailed procedure in the HLR .....	41
4.2.2.1	Process Cancel Location HLR.....	41
4.3	Detach IMSI .....	43
4.3.1	Detailed procedure in the MSC.....	43
4.3.1.1	Process Detach IMSI MSC.....	43
4.3.2	Detailed procedure in the VLR .....	45
4.3.2.1	Process Detach IMSI VLR .....	45
4.4	Purge MS .....	47
4.4.1	Detailed procedure in the VLR .....	47
4.4.1.1	Procedure Purge MS VLR.....	47
4.4.2	Detailed procedure in the HLR .....	49
4.4.2.1	Procedure Purge MS HLR.....	49
5	Authentication .....	51
<b>Annex A: Change history .....</b>		<b>52</b>
History.....		53
Foreword.....		4
1	Scope.....	5
1.1	References.....	5
1.2	Abbreviations.....	5
2	Definitions .....	6
2.1	Location registration.....	6
2.2	Location area and MSC area.....	6
2.3	Location area identification .....	6
2.4	IMSI detach/attach operation.....	6
2.4.1	Explicit IMSI detach/attach.....	6
2.4.2	Implicit IMSI detach .....	6
2.5	Use of the term mobile station (MS) in the present document.....	7
3	Procedures in the network related to location updating .....	7
3.1	Procedures in the MSC related to Location Updating.....	7
3.2	Procedures in the BSC related to Location Updating .....	7
3.3	Normal location updating and IMSI detach/attach operation .....	7
3.4	IMSI enquiry procedure.....	7
3.5	Information transfer between visitor and home location registers .....	7
3.5.1	Procedures for location registration .....	7
3.5.1.1	Location updating procedure.....	7
3.5.1.2	Downloading of subscriber parameters to the VLR.....	8
3.5.1.3	Location cancellation procedure.....	8
3.5.1.4	Subscriber parameter request procedure.....	8
3.5.1.5	Mobile subscriber purging procedure.....	8
3.5.1.6	Recovery procedures .....	8
4	Authentication .....	8
<b>Annex A: Change history.....</b>		<b>9</b>
History.....		10

---

# Foreword

This Technical Specification has been produced by the 3GPP.

This TS defines the location registration-management procedures within the 3GPP system.

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

Version x3.y.z

where:

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

# 1 Scope

The present document describes the procedures in the network related to location registration management procedures for the circuit switched domain, with respect to the application level functional behaviour. This is to be distinguished from the corresponding protocol handling behaviour, which is specified in 3G TS 29.002. They include: The following location management procedures are included:

- location updating;
- location cancellation;
- MS purging;
- periodic location updating;
- IMSI attach/detach.

The procedures in the Mobile Station (MS) are described in GSM 03.22. The procedures between MSC, VLR and HLR utilise the Mobile Application Part (MAP) and details concerning the exchange of information-protocol handling are contained in GSM 09.023G TS 29.002.

The present document excludes location management procedures for the packet switched domain, which are covered in 3G TS 23.060.

The descriptions herein depict a logical separation between the MSC and VLR. This logical separation, as well as the messages transferred between the two logical entities are the basis of a model used to define the externally visible behaviour of the MSC/VLR, which may be a single physical entity. They do not impose any requirement except the definition of the externally visible behaviour.

## 1.1 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 03.02: "Digital cellular telecommunication system (Phase 2+); Network architecture".
- [3] GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".
- [4] GSM 03.07: "Digital cellular telecommunication system (Phase 2+); Restoration procedures".
- [5] GSM 03.08: "Digital cellular telecommunication system (Phase 2+); Organization of subscriber data".
- [6] GSM 03.20: "Digital cellular telecommunication system (Phase 2+); Security related network functions".
- [7] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".

- [8] GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".
- [9] 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)".

## 1.2 Abbreviations

Abbreviations are listed in GSM 01.04.

---

## 2 Definitions

### 2.1 Location ~~registration~~management

Location ~~registration~~management means that the PLMNs keep track of where the MSs are located in the system area. The location information for each MS is stored in functional units called location registers. Functionally, there are two types of location registers:

- the home location register where all subscriber parameters of a MS are permanently stored, and where the current location may be stored;
- the visitor location register where all relevant data concerning a MS are stored as long as the station is within the area controlled by that visitor location register.

See also GSM 03.02 where the network architecture is described, and GSM 03.08 where the data stored in the location registers are described.

The action taken by a MS in order to provide location information to the PLMN will be referred to as location updating.

### 2.2 Location area and MSC area

The MSC area is composed of the area covered by all base stations controlled by the MSC. A MSC area may consist of several location areas. A location area is an area in which, ~~after having performed a location update once,~~ MSs may roam without ~~updating the location registers~~being required to perform subsequent location updates for reason of location change. A location area consists of one or more cells.

~~The paging procedure is used by the MSC to determine the cell in which the MS is located.~~

For further details of the network architecture, see GSM 03.02.

### 2.3 Location area identification

The Location Area Identification (LAI) plan is part of the base station identification plan. The base stations are identified uniquely (see GSM 03.03). ~~The Location Area Identification is included in messages sent in the BCCH.~~

### 2.4 IMSI detach/attach operation

The support of IMSI detach/attach operation is mandatory in MSs. The facility is optional in the fixed infrastructure of the PLMN.

## 2.4.1 Explicit IMSI detach/attach

Explicit IMSI detach operation is the action taken by an MS to indicate to the PLMN that the station has entered an inactive state (e.g. the station is powered down). Explicit IMSI attach operation is the action taken by an MS to indicate that the station has re-entered an active state (e.g. the station is powered up).

## 2.4.2 Implicit IMSI detach

Implicit IMSI detach operation is the action taken by the VLR to mark an MS as detached when there has been no successful contact between the MS and the network for a time determined by the implicit detach timer. The value of the implicit detach timer is derived from the periodic location updating timer. During an established radio contact, the implicit detach timer shall be prevented from triggering implicit detach. At the release of the radio connection, the implicit detach timer shall be reset and restarted. Implicit IMSI detach shall also be performed in the case of a negative response to an IMEI check.

## 2.5 Use of the term mobile station (MS) in the present document

In order to simplify the text the term Mobile Station (MS) as used in relation to location registrationmanagement refers to the entity where the IMSI is stored, i.e., in card operated MSs the term Mobile Station (MS) refers to the card.

# 3 General Procedures in the network related to location updating Location Management

## 3.1 Procedures in the MSC related to Location Updating

The MSC shall pass messages related to location updating between the MS and the VLR.

## ~~3.2 Procedures in the BSC related to Location Updating~~

~~The BSC shall insert the Location Area Identification, periodic location updating time out value and IMSI detach/attach supported information on the BCCH.~~

## 3.2 Procedures in the VLR related to Location Updating

## 3.3 Procedures in the HLR related to Location Updating

## ~~3.34~~ 3.4 Normal location updating and IMSI detach/attach operation

When receiving a Location Updating Request or an IMSI detach/attach message from an MS, the MSC shall convey the message to its associated visitor location register. Any response from the location register shall similarly be conveyed to the MS.

## ~~3.45~~ 3.5 IMSI enquiry procedure

The MS shall identify itself by either the IMSI or the TMSI plus Location Area Identification of the previous VLR. In the latter case the new VLR shall attempt to request the IMSI and authentication parameters from the previous VLR by the methods defined in GSM 09.02.

If this procedure fails, or if the TMSI is not allocated, the VLR shall request that the MS identifies itself by use of the IMSI.

## 3.56 Information transfer between visitor and home location registers

### 3.56.1 Procedures for location registration management

Detailed procedures for exchange of and location updating information between visitor and home location registers are given in GSM 09.02. Below follows an overview of these procedures.

#### 3.56.1.1 Location updating procedure

This procedure is used when an MS registers with a visitor location register.

The ~~visitor location register~~VLR provides ~~routing information~~ its address to the ~~home location register~~HLR. ~~This information consists, for instance, of VLR address used for routing of MAP messages.~~

The VLR may also allocate an optional identity for the MS at location updating: the Local Mobile Station Identity: see GSM 03.03.

#### 3.56.1.2 Downloading of subscriber parameters to the VLR

As a part of the location updating procedure, the home location register will convey the subscriber parameters of the MS which need to be known by the visitor location register for proper call handling. This procedure is also used whenever there is a change in the subscriber parameters that need to be conveyed to the VLR (e.g. change in subscription, a change in supplementary services activation status).

If the HPLMN applies the multinumbring option, different MSISDNs are allocated for different Basic Services (see GSM 09.07) and stored in the HLR. Among these MSISDNs, the Basic MSISDN Indicator as part of the HLR subscriber data (see GSM 03.08) marks the 'Basic MSISDN' to be sent to the VLR at location update. It is used in the VLR for call handling as calling party and as line identity.

#### 3.56.1.3 Location cancellation procedure

The procedure is used by the home location register to remove a MS from a visitor location register. The procedure will normally be used when the MS has moved to an area controlled by a different location register. The procedure can also be used in other cases, e.g. an MS ceases to be a subscriber of the home PLMN.

#### ~~3.5.1.4 Subscriber parameter request procedure~~

~~This procedure enables a visitor location register to request the HLR (at any time) to provide subscriber parameters for a specified MS (e.g. after a restart).~~

#### 3.56.1.54 Mobile subscriber purging procedure

A VLR may purge the subscriber data for an MS which has not established radio contact for a period determined by the network operator. Purging means to delete the subscriber data and to "freeze" the TMSI that has been allocated to the purged MS in order to avoid TMSI double allocation. The VLR shall inform the HLR of the purging.

When the HLR is informed of the purging, it shall set the flag "MS purged" in the IMSI record of the MS concerned. Presence of the "MS purged" flag will cause any request for routing information for a call or short message to the MS to be treated as if the MS were not reachable.

In the VLR, the "frozen" TMSI is freed for usage in the TMSI allocation procedure by location updating for the purged MS in the same VLR, location cancellation for the purged MS or, in exceptional cases, by O&M.

In the HLR, the "MS purged" flag is reset by the location updating procedure and after reload of data from the non-volatile back-up that is performed when the HLR restarts after a failure.

### 3.5.1.6 Recovery procedures

Recovery and restoration procedures for location registers are defined in Technical Specifications GSM 03.07 and 09.02.

Recovery arrangements should be such that MSs with a valid subscription are not deleted from the HLR as a result of HLR failure. The worst result of an HLR failure will thus be that some MSs are stored with errors in the temporary subscriber data.

---

## 4 Detailed Procedures in the network related to Location Management

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.

This specification shows the location management application processes interworking with the MAP protocol handler, which is specified in 3G TS 29.002. The MAP protocol defines supervision timers. If a supervision timer expires before a distant entity responds to a signal, the handling is as defined in 3G TS 29.002. 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 MAP protocols.

### 4.1 Location Updating

#### 4.1.1 Detailed procedure in the MSC

##### 4.1.1.1 Process Update Location Area MSC

NEC====> Drafted Sheet 1: the MSC receives an A-LU-REQUEST because of normal location updating, periodic location updating or IMSI attach.

Sheet 1: Location Update corresponds to a Location Registration Request indicating any of the following:

- Normal location update;
- Periodic location update;
- IMSI attach.

Sheet 2: When the MSC receives a Set Ciphering Mode request from the VLR, it sends a Start ciphering request towards the MS. After that, the Forward new TMSI and Update Location Area ack may be received in any order. The MSC will upon receipt of a MAP\_SET\_CIPHERING\_MODE request send a ciphering command towards BSS/MS. Thereafter, the MAP\_FORWARD\_NEW\_TMSI indication and the MAP\_UPDATE\_LOCATION\_AREA confirmation are received in arbitrary order.

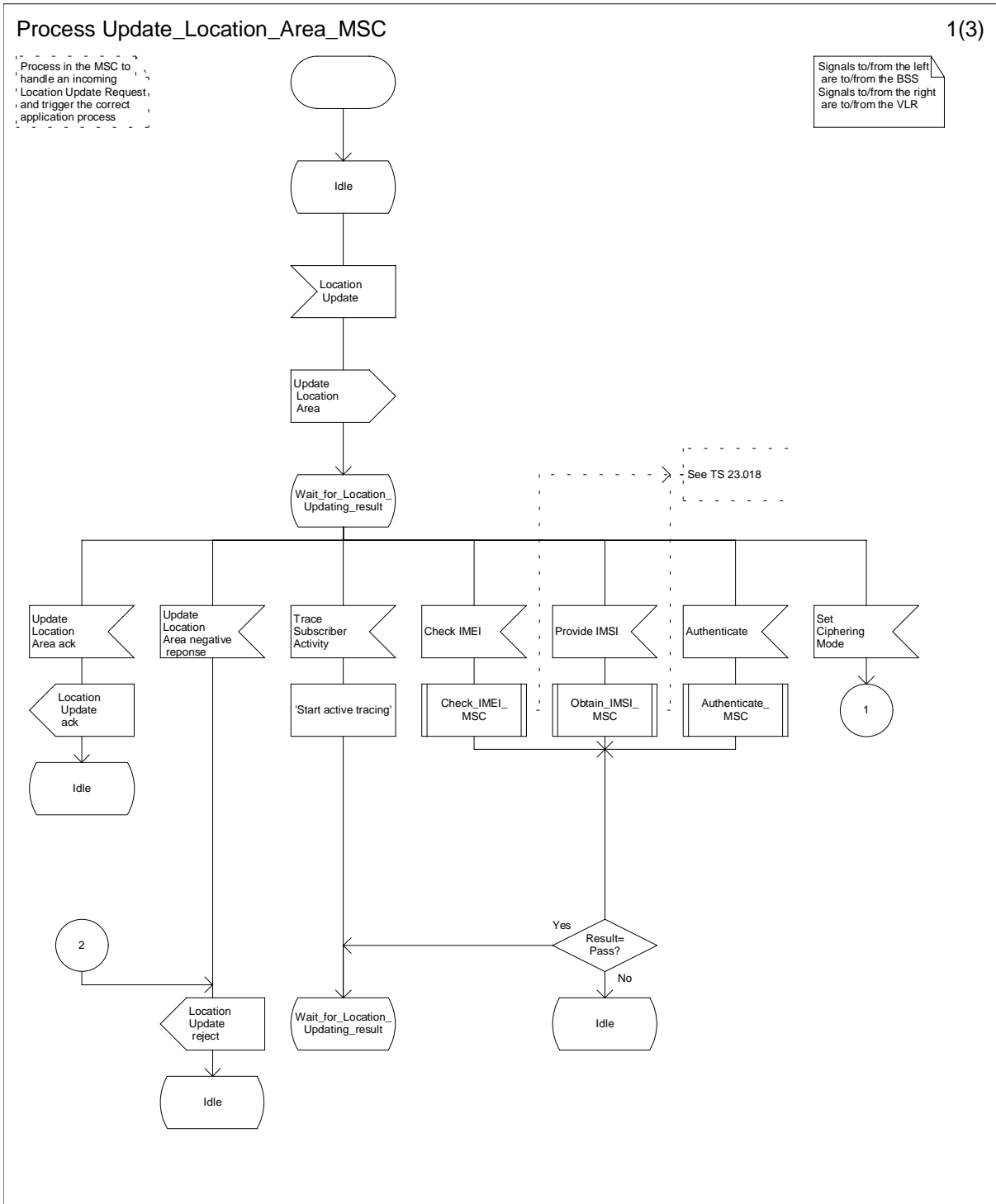


Figure 4.1.1.1 (sheet 1 of 3): Process Update\_Location\_Area\_MSC



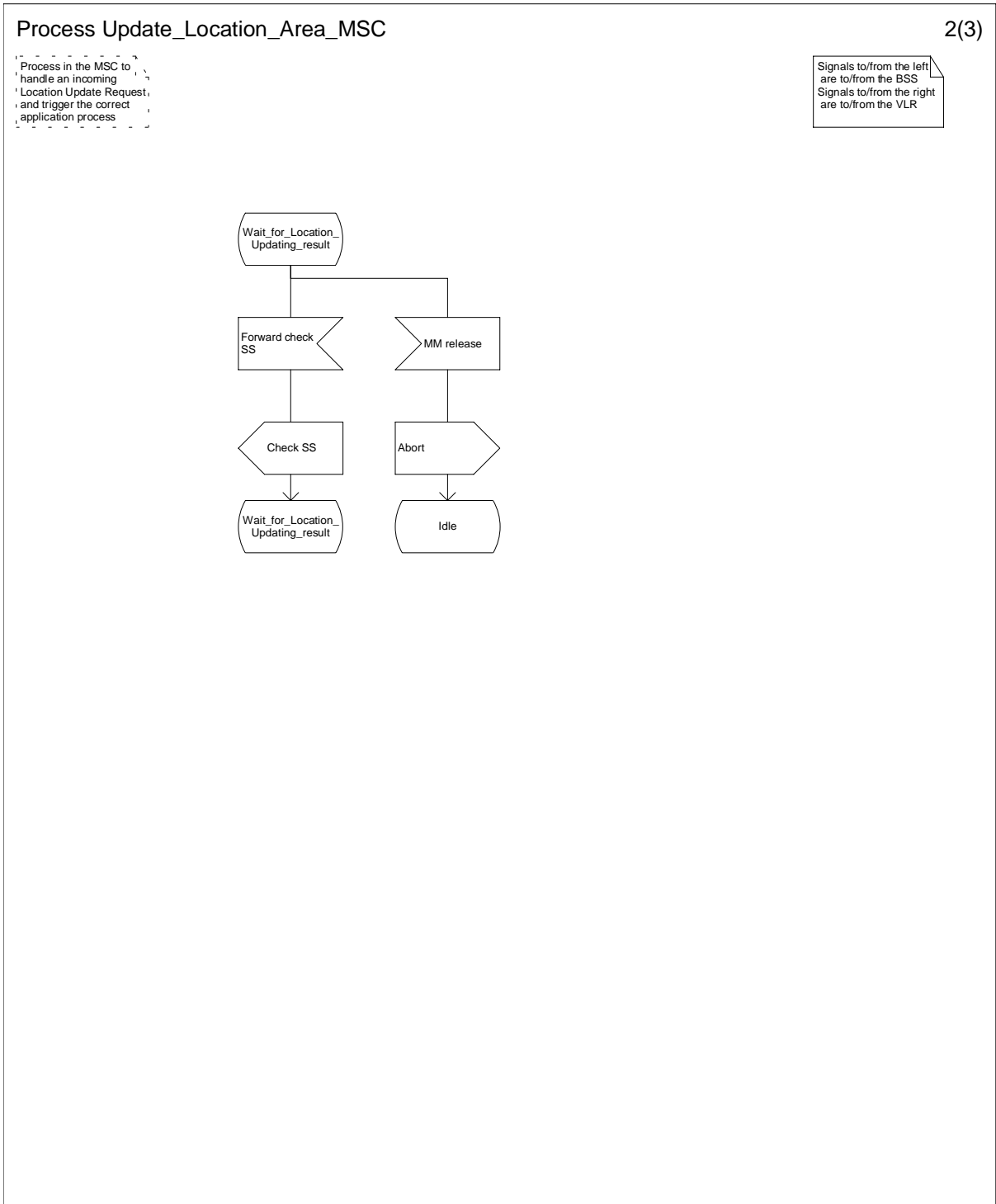


Figure 4.1.1.1 (sheet 2 of 3): Process Update\_Location\_Area\_MSC

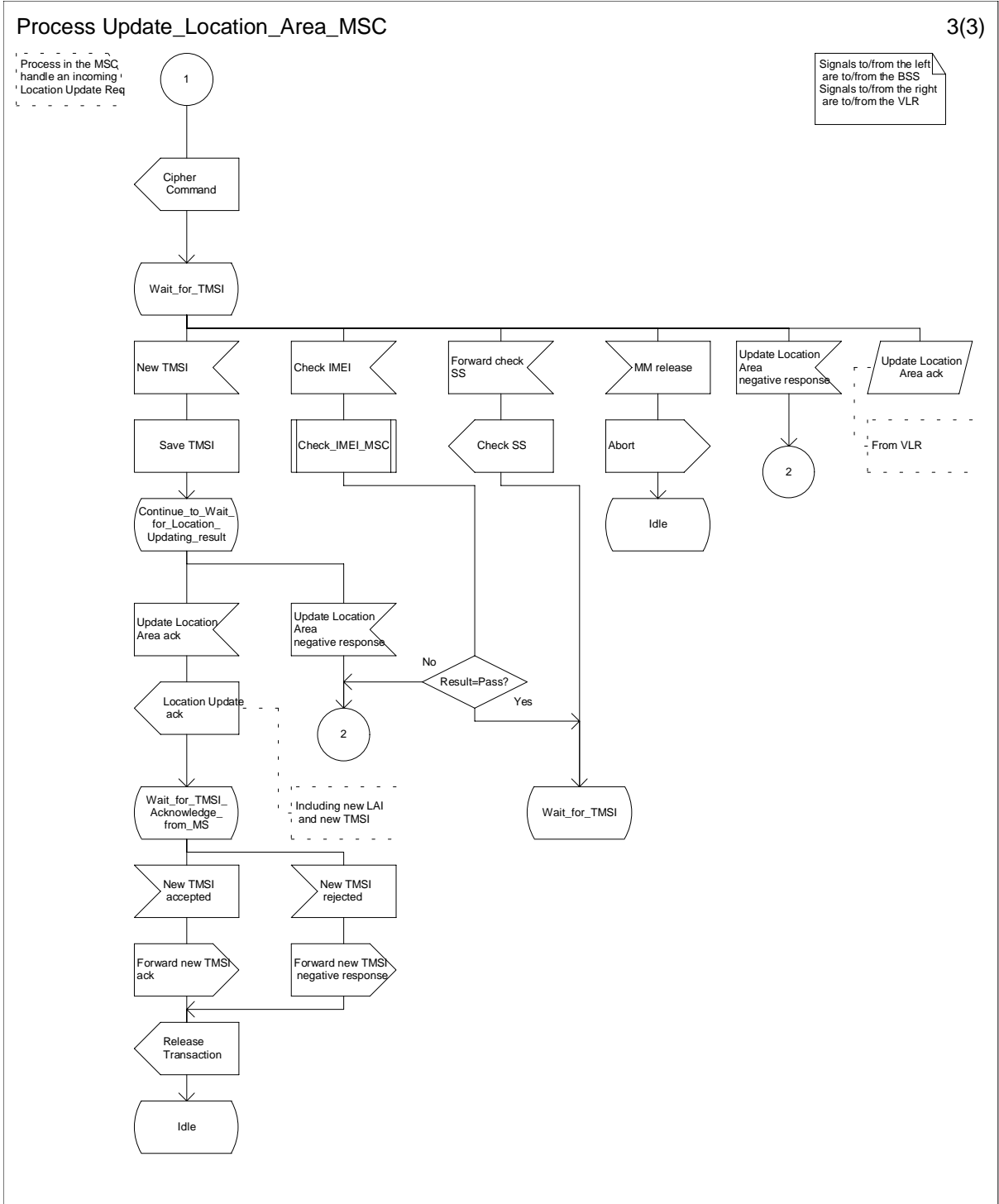


Figure 4.1.1.1 (sheet 3 of 3): Process Update Location Area MSC

4.1.1.2

NEC====>Drafted

### 4.1.1.32 Procedure Authenticate\_MSC

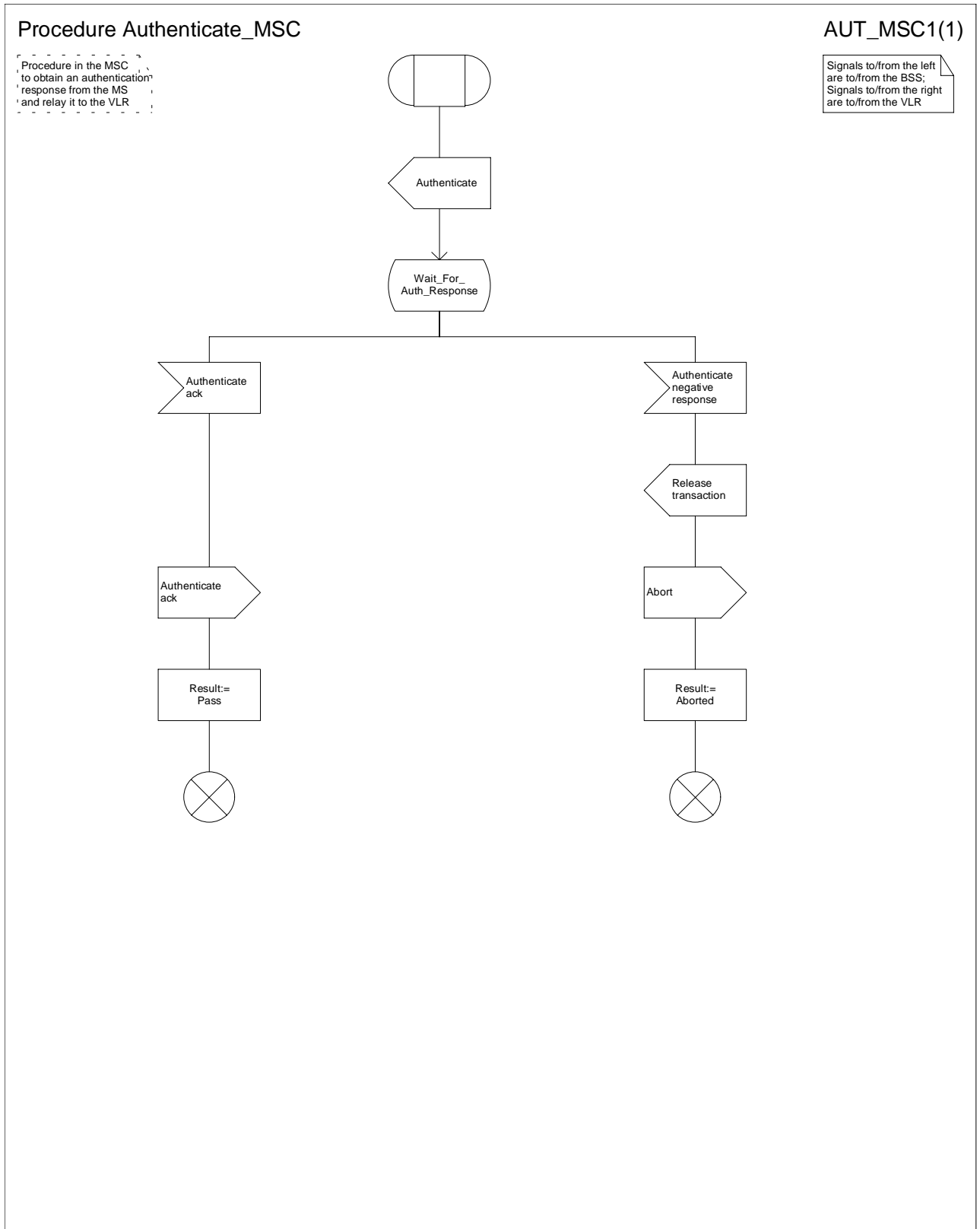


Figure 4.1.1.2 (sheet 1 of 1): Procedure Authenticate\_MSC ~~No specific annotation needed.~~

~~No specific annotation needed.~~

4NEC=====> Drafted

No specific annotation needed NEC=====> Drafted.

#### 4.1.2 Detailed procedure in the VLR.1.2 Detailed procedure in the VLR

##### 4.1.2.1 Process Update Location Area VLR

General comment: At any stage in the location updating process the MSC may receive an indication from the BSS that the MM transaction has been released. The MSC then sends an Abort signal to the VLR. Upon receipt of this message, the VLR shall follow one of two possible courses of action.

The two possible courses of action and the conditions determining which course shall be taken are as follows:

-1) If a successfully authenticated radio connection is already established before the Abort message is received, the VLR shall ignore the message.

-2) If a successfully authenticated radio connection has not been established before the Abort message is received, the VLR shall abort the Update Location Area process and return to the idle state.

NEC=====> Drafted Sheet 1: The location area updating process will be activated by receiving an MAP\_UPDATE\_LOCATION\_AREA 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 Update Location Area response to the MSC. Else, The behaviour will depend on the subscriber identity received, either an IMSI or an TMSI.

Sheet 2: At the decision "HLR updating required?" the "True" branch shall be taken if and only if one or more of the following conditions is true: (1) Location Info Confirmed in HLR is false. (2) Data Confirmed by HLR is false.

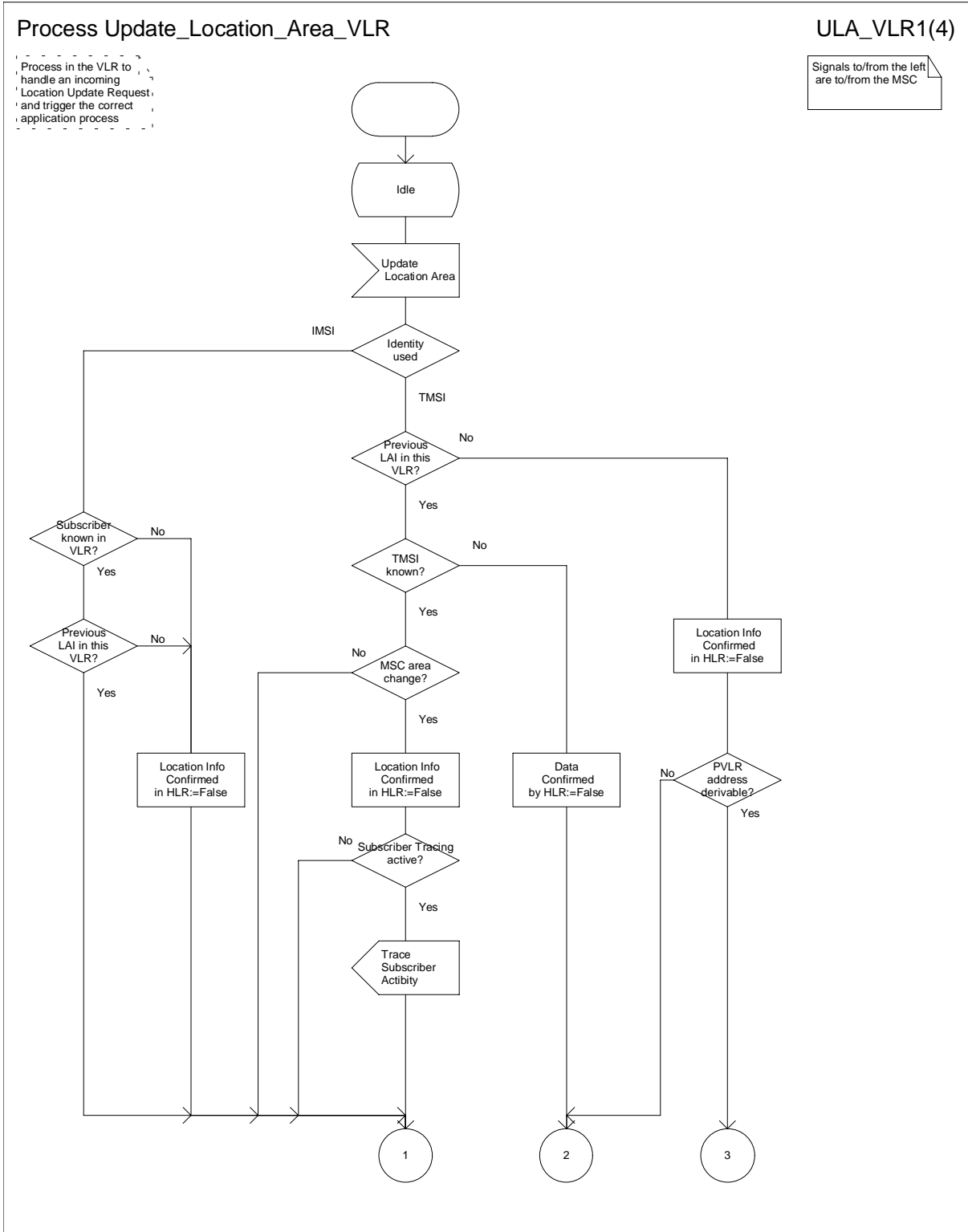


Figure 4.1.2.1 (sheet 1 of 4): Process Update Location Area VLR

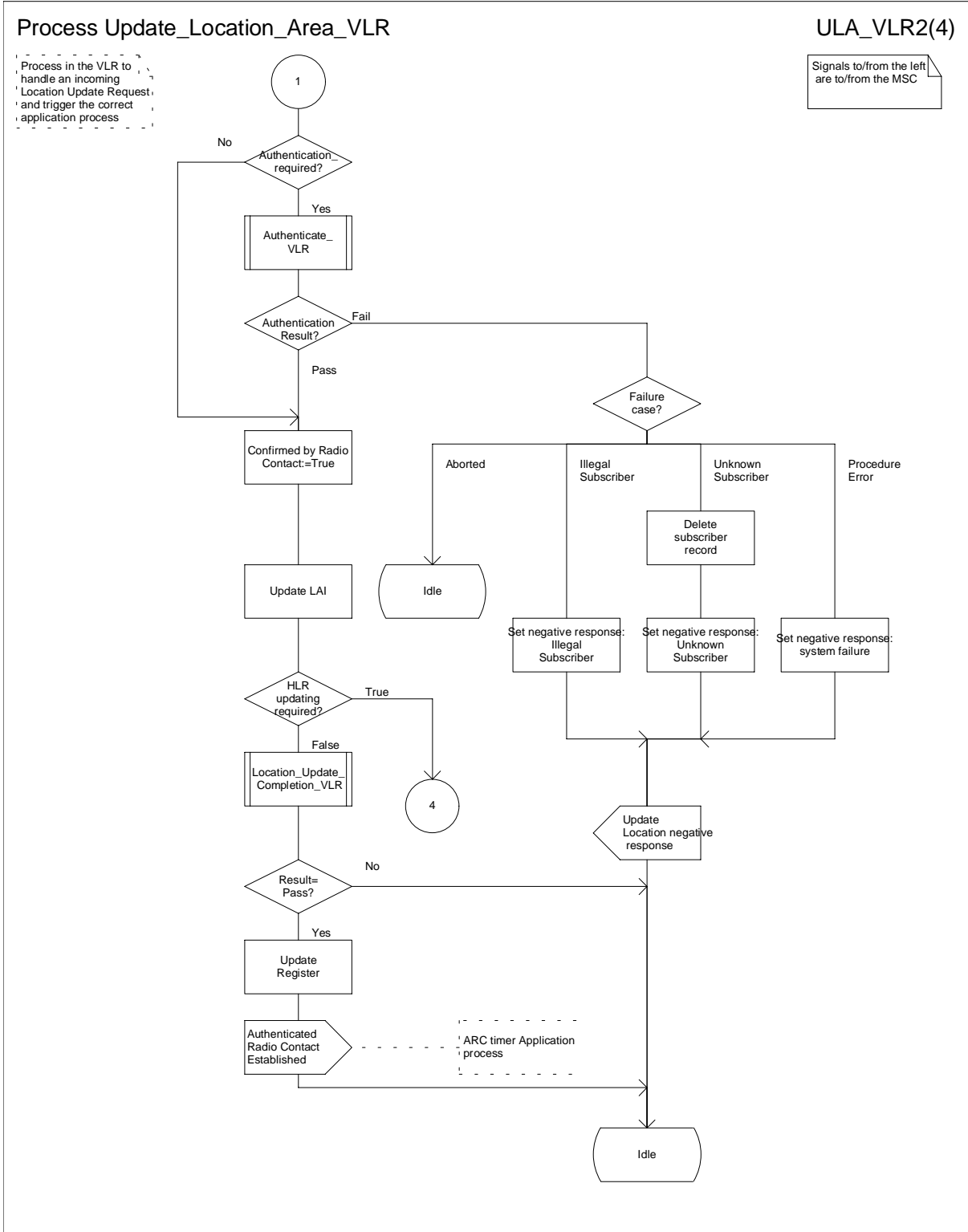


Figure 4.1.2.1 (sheet 2 of 4): Process Update Location Area VLR





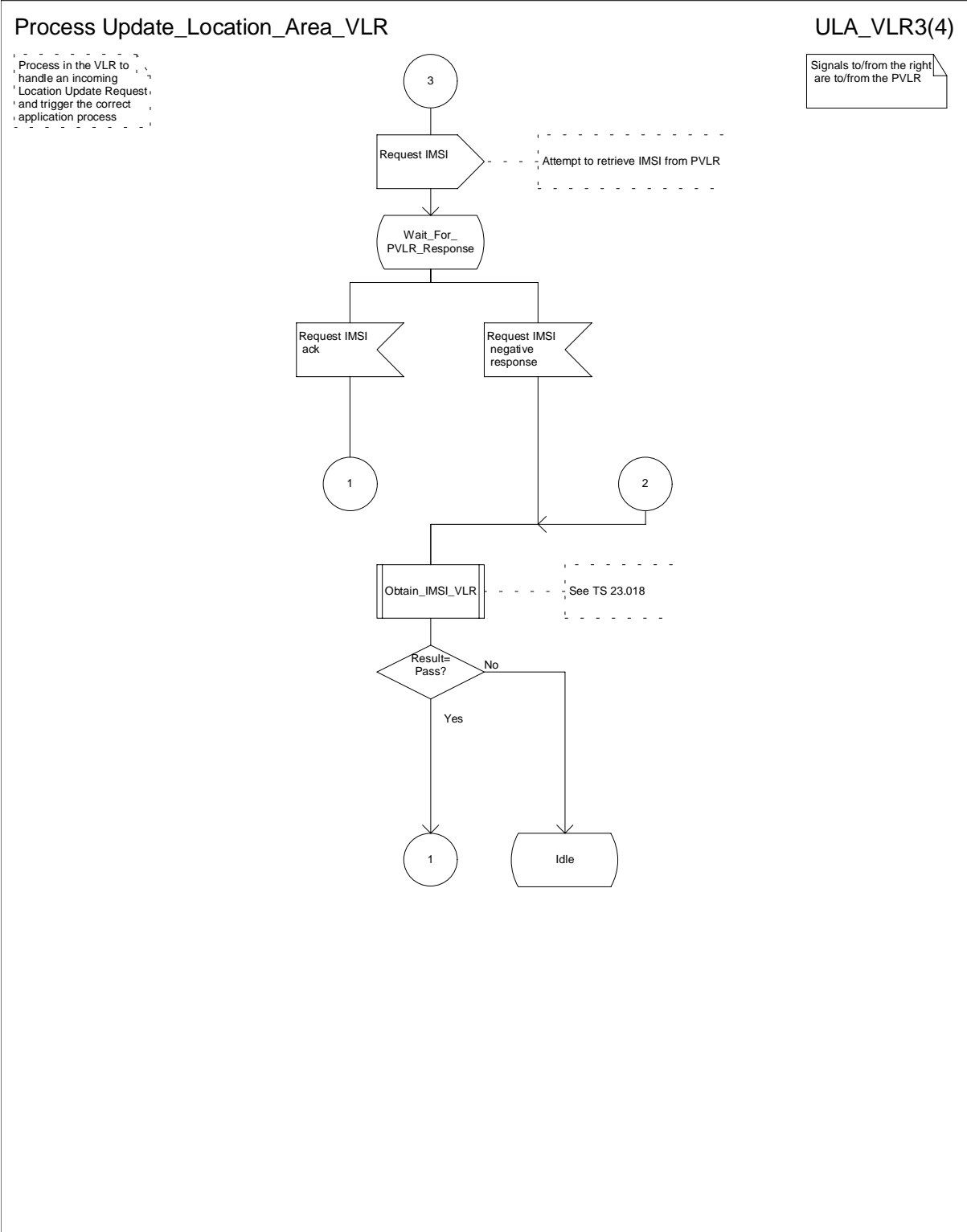


Figure 4.1.2.1 (sheet 3 of 4): Process Update Location Area VLR

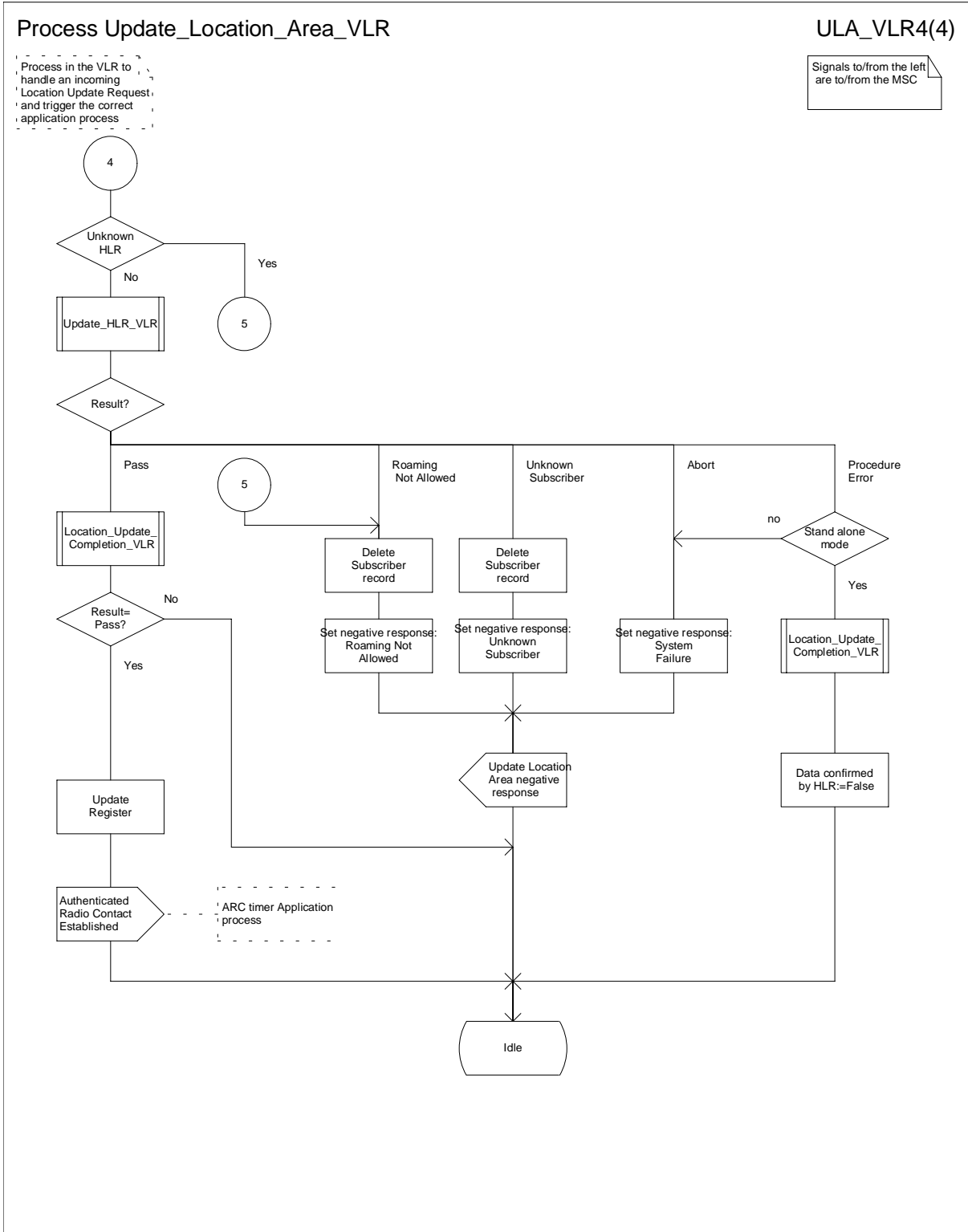


Figure 4.1.2.1 (sheet 4 of 4): Process Update Location Area VLR



### 4.1.2.2 Procedure Authenticate\_VLR

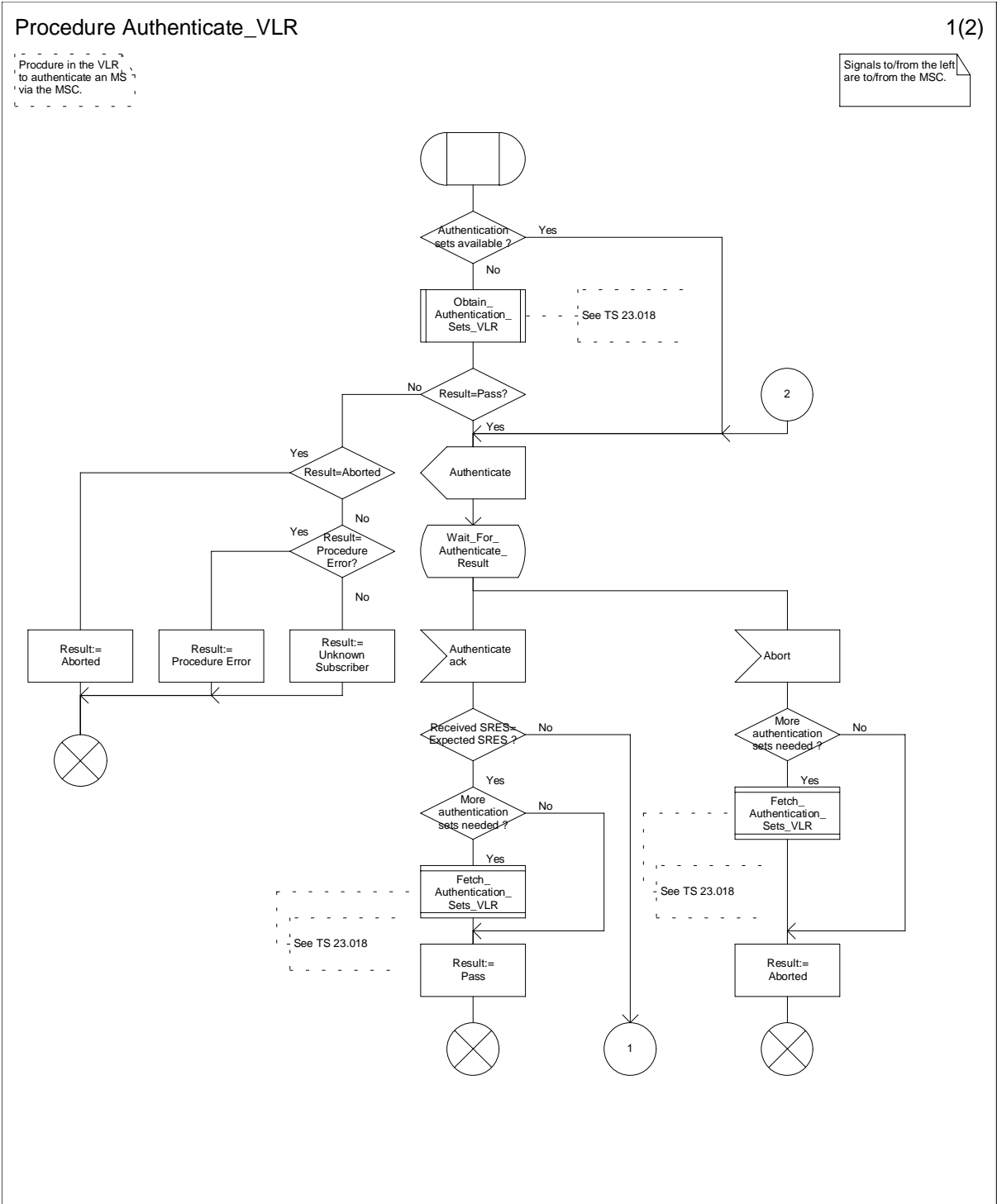


Figure 4.1.2.2 (sheet 1 of 2): Procedure Authenticate\_VLR

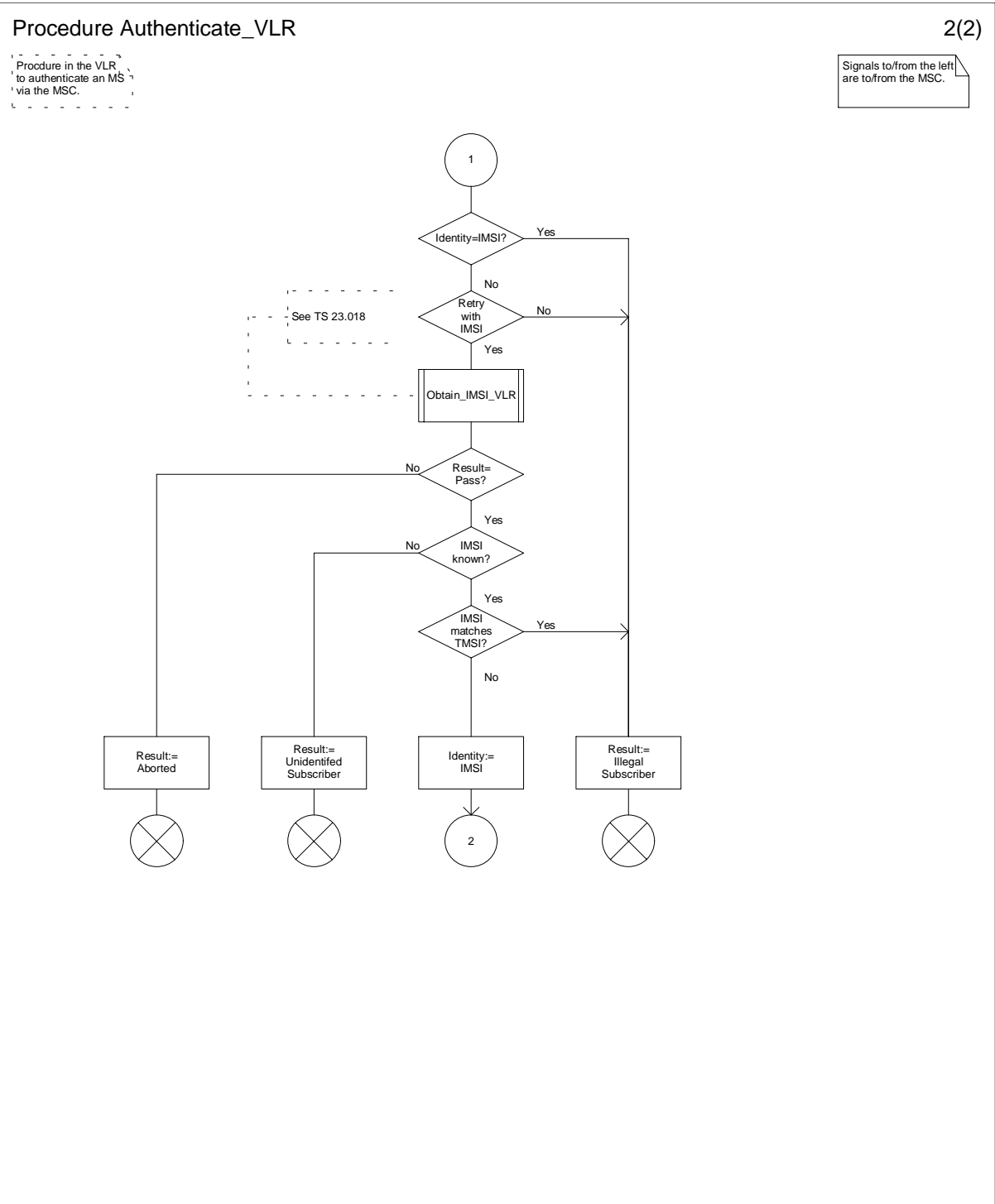


Figure 4.1.2.2 (sheet 2 of 2): Procedure Authenticate\_VLR



4.1.2.2 Process Update\_HLR\_VLR

NEC====>Drafted

#### 4.1.2.323 Procedure Location Update Completion VLR

No specific annotation needed. NEC====> Drafted

Sheet 1: Decision "National Roaming Restrictions Exist?" distinguishes whether or not the subscriber is allowed service in the target LA, based on the current location of the MS and the VLR's knowledge of other networks. The "Yes" branch results in the sending of "Update Location Area Negative Response" toward the MSC (and the MS), with cause "National Roaming Not Allowed." However, subscriber data shall not be deleted from the VLR. This is to avoid unnecessary HLR updating should the subscriber be allowed subsequently to roam in other LAs of the same MSC.

Sheet 1: Decision "Roaming restriction due to Unsupported Feature received in subscriber data?" distinguishes whether or not the subscriber data received from the HLR indicates "roaming restriction due to unsupported feature." The "Yes" branch results in the sending of "Update Location Area Negative Response" toward the MSC (and the MS), with cause "National Roaming Not Allowed." However, subscriber data shall not be deleted from the VLR. This is to avoid unnecessary HLR updating should the subscriber be allowed subsequently to roam in other LAs of the same MSC.

Sheet 1: Decision "Regional subscription restriction" distinguishes whether or not the subscriber is allowed service in the target LA, which the VLR deduces based on regional subscription information received from the HLR. The "Yes" branch results in the sending of "Update Location Area Negative Response" toward the MSC (and the MS), with cause "location area not allowed." However, subscriber data shall not be deleted from the VLR. This is to avoid unnecessary HLR updating should the subscriber be allowed subsequently to roam in other LAs of the same MSC.



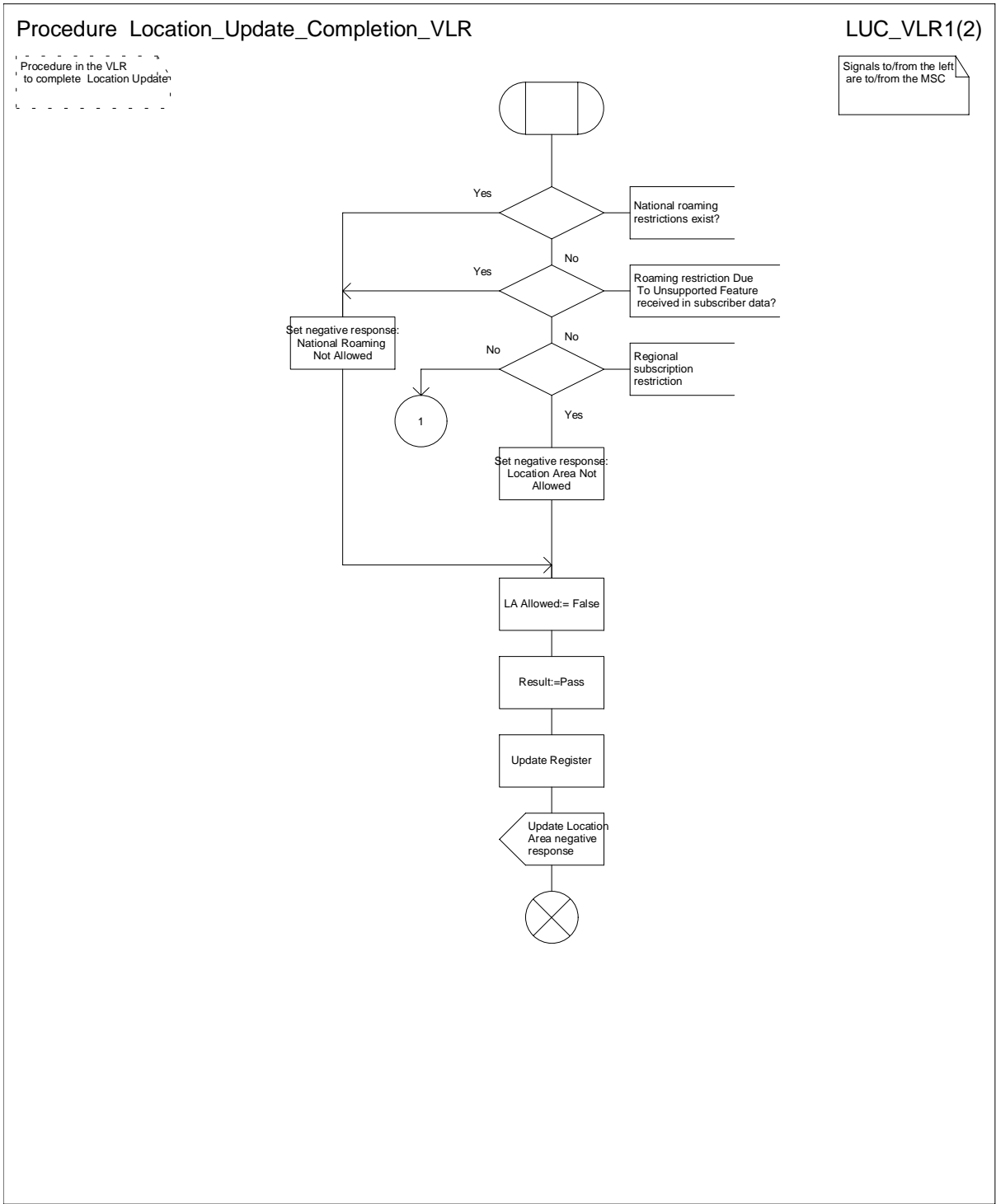


Figure 4.1.2.3 (sheet 1 of 2): Procedure Location Update Completion VLR

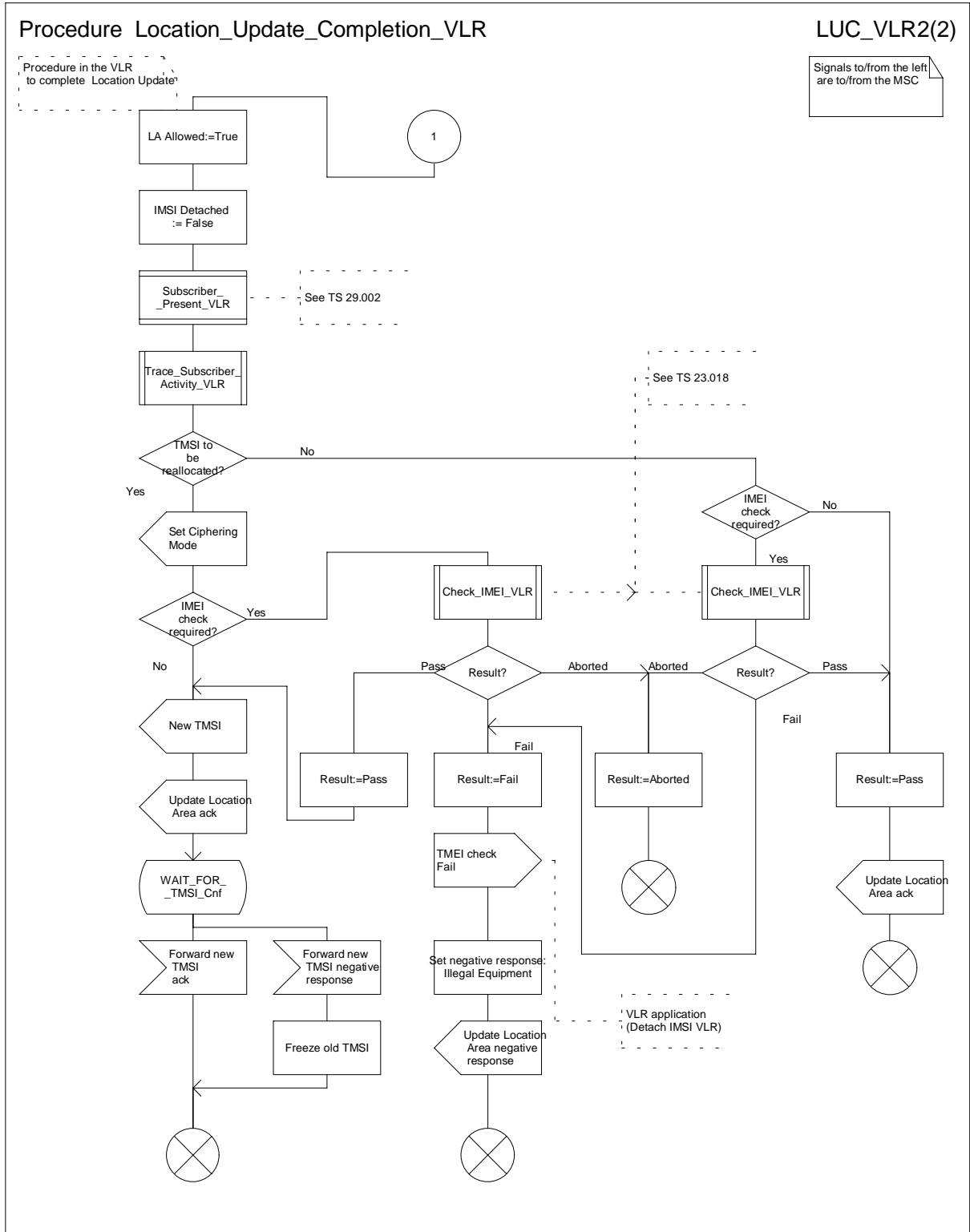


Figure 4.1.2.3 (sheet 2 of 2): Procedure Location Update Completion VLR

4.1.2.34 Process Update\_HLR\_VLR

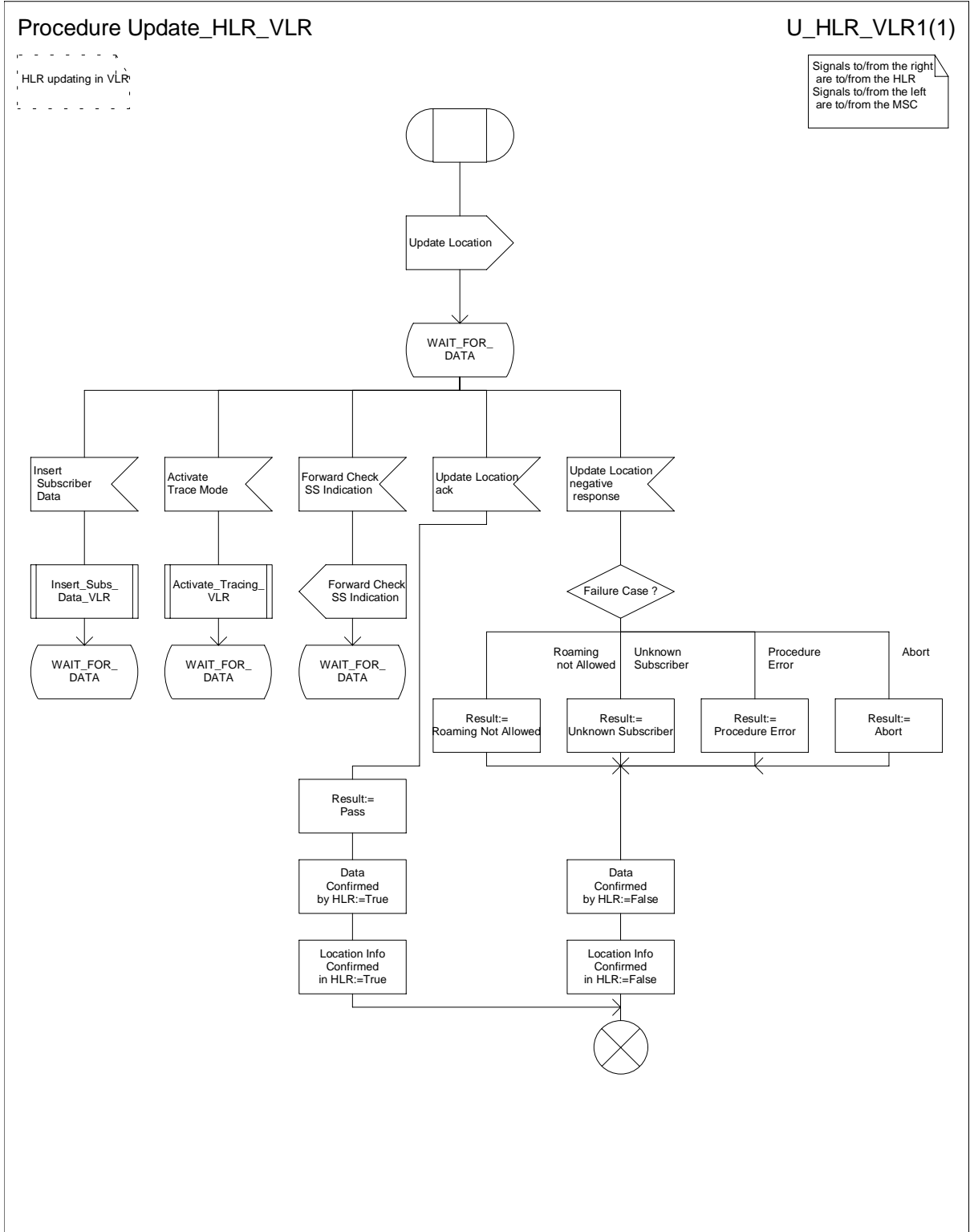


Figure 4.1.2.4 (sheet 1 of 1): Process Update\_HLR\_VLR ~~No specific annotation needed.~~

4.1.2.45 Process Insert Subs Data VLR

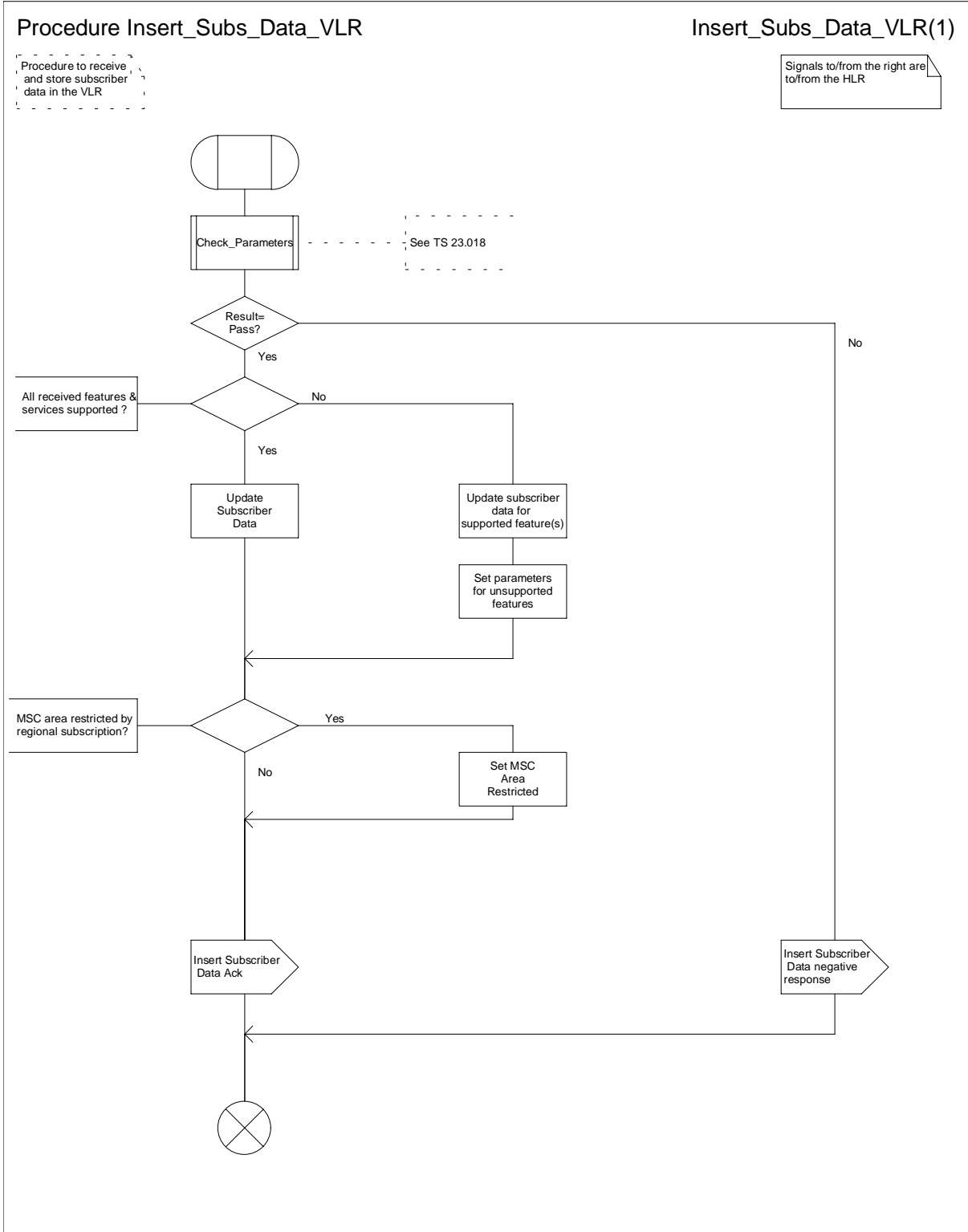


Figure 4.1.2.5 (sheet 1 of 1): Process Insert Subs Data VLR No specific annotation needed.

NEC====> Drafted

### 4.1.2.56 Process Send Identification PVLR Activate Tracing VLR

NEC====> Drafted

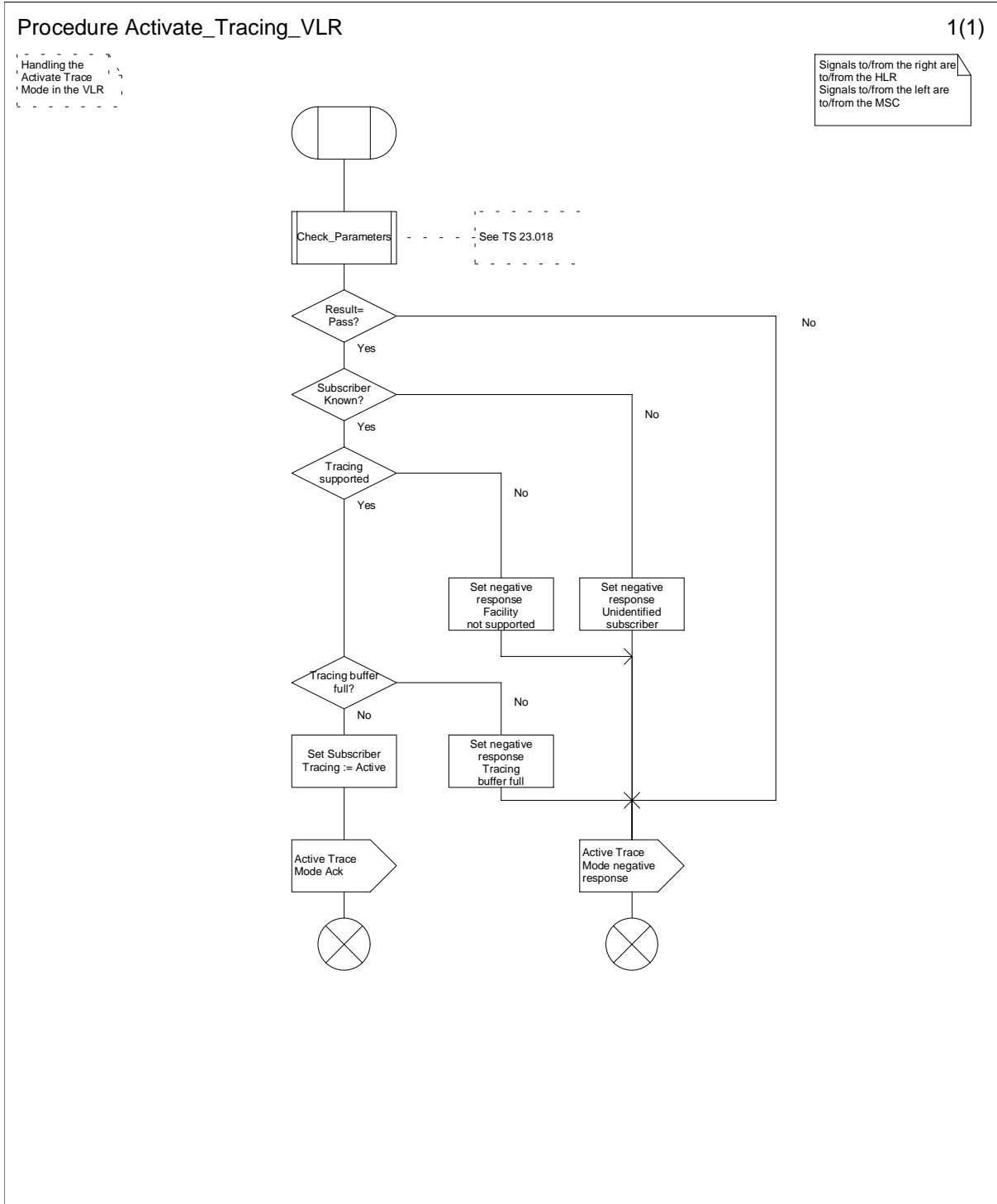


Figure 4.1.2.6 (sheet 1 of 1): Process Activate Tracing VLR

4.1.2.67 Process Send Identification PVLR

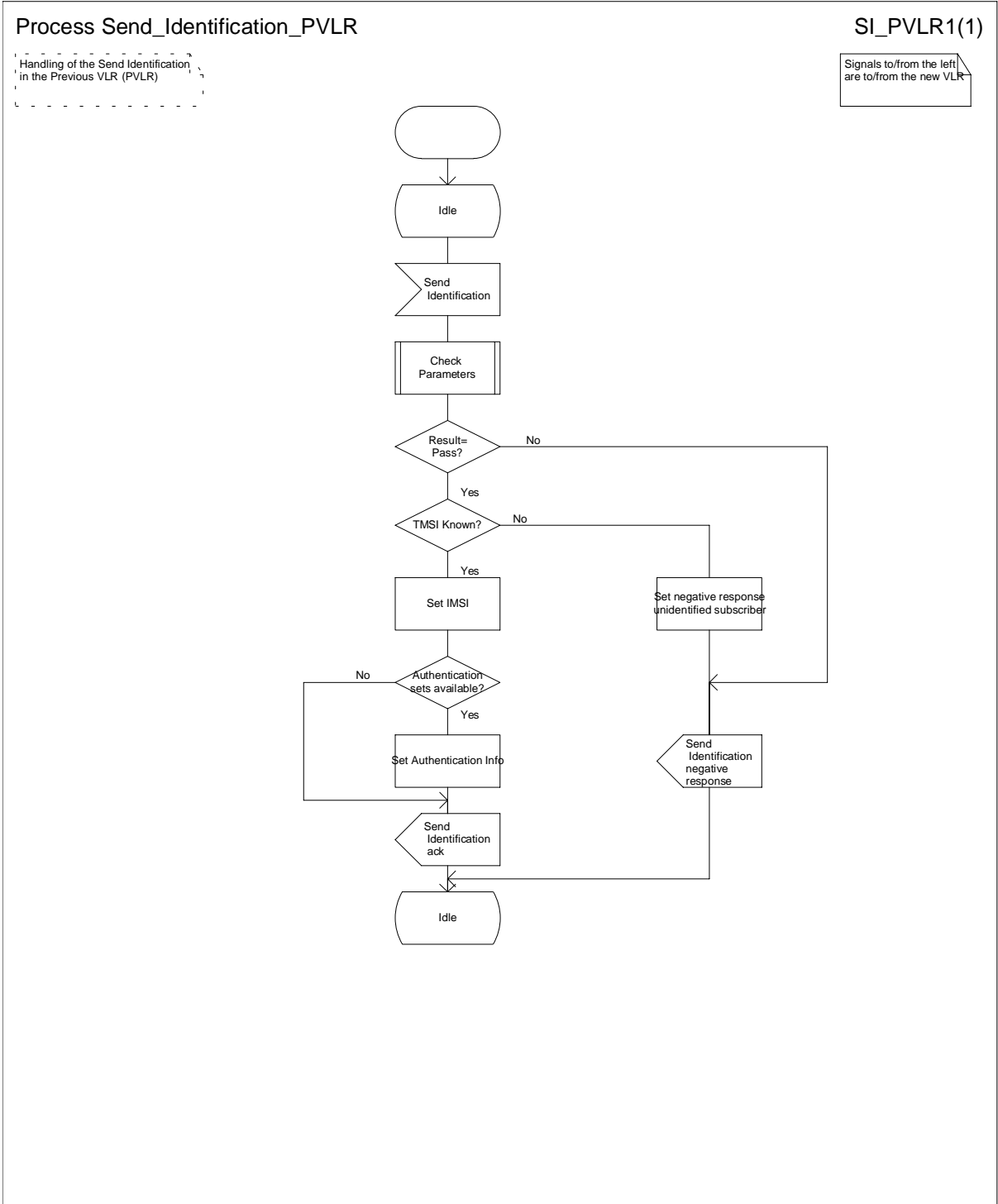


Figure 4.1.2.7 (sheet 1 of 1): Process Send Identification PVLR No specific annotation needed.

### 4.1.2.8 Process Trace Subscriber Activity VLR

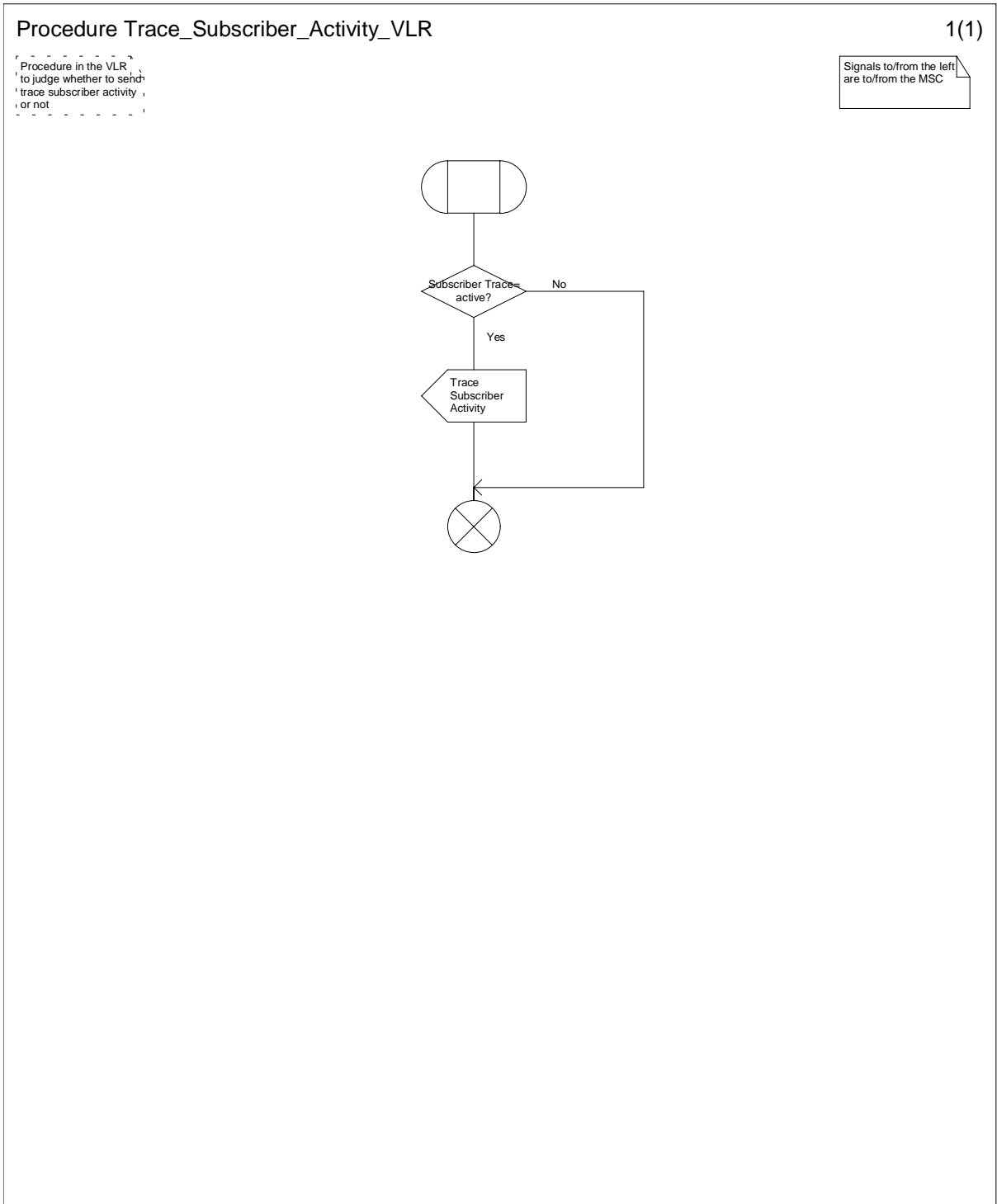


Figure 4.1.2.8 (sheet 1 of 1): Process Trace\_Subscriber\_Activity\_VLR





### 4.1.3 Detailed procedure in the HLR

#### 4.1.3.1 Process Update\_Location\_HLR

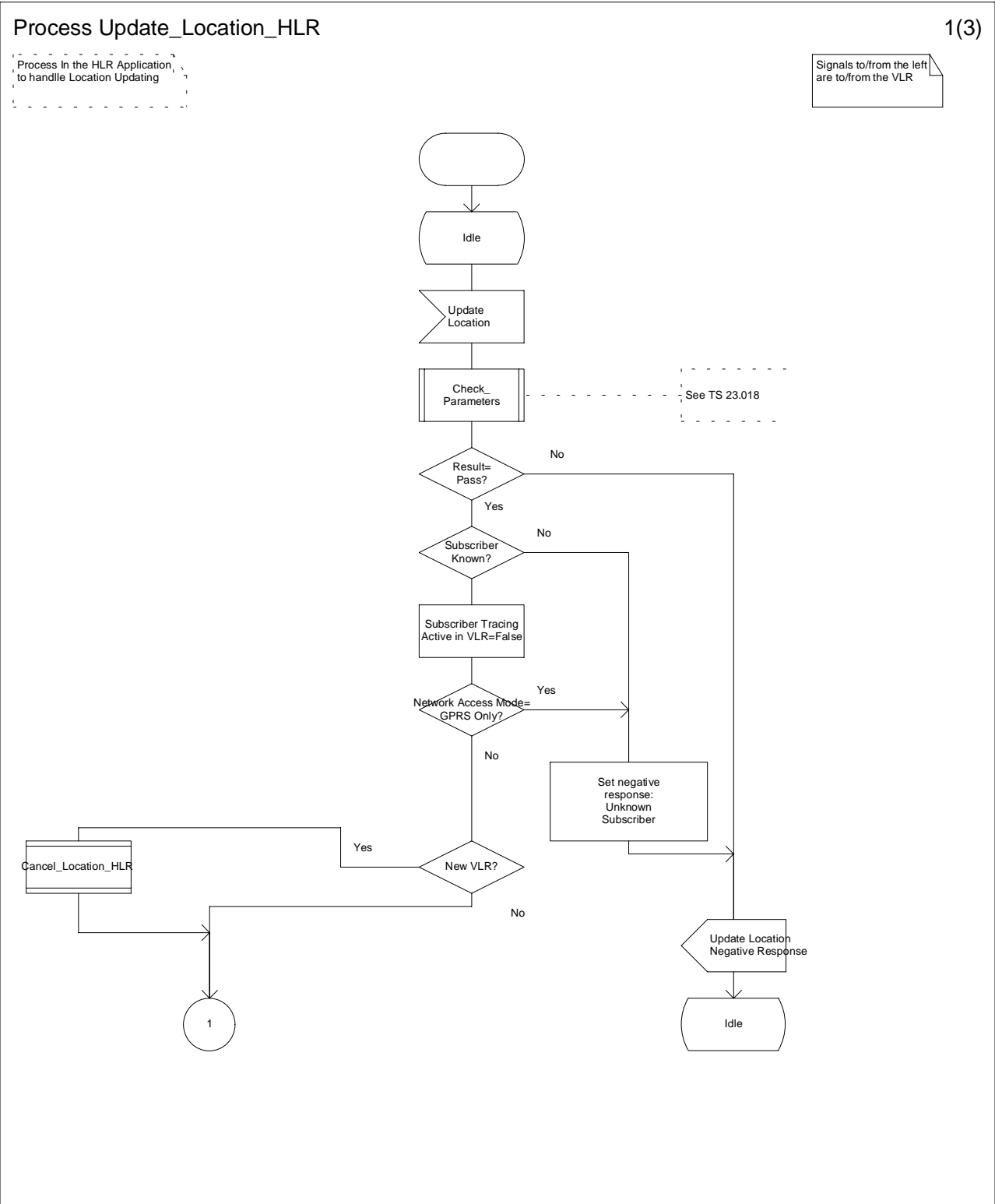


Figure 4.1.3.1 (sheet 1 of 3): Process Update Location HLR

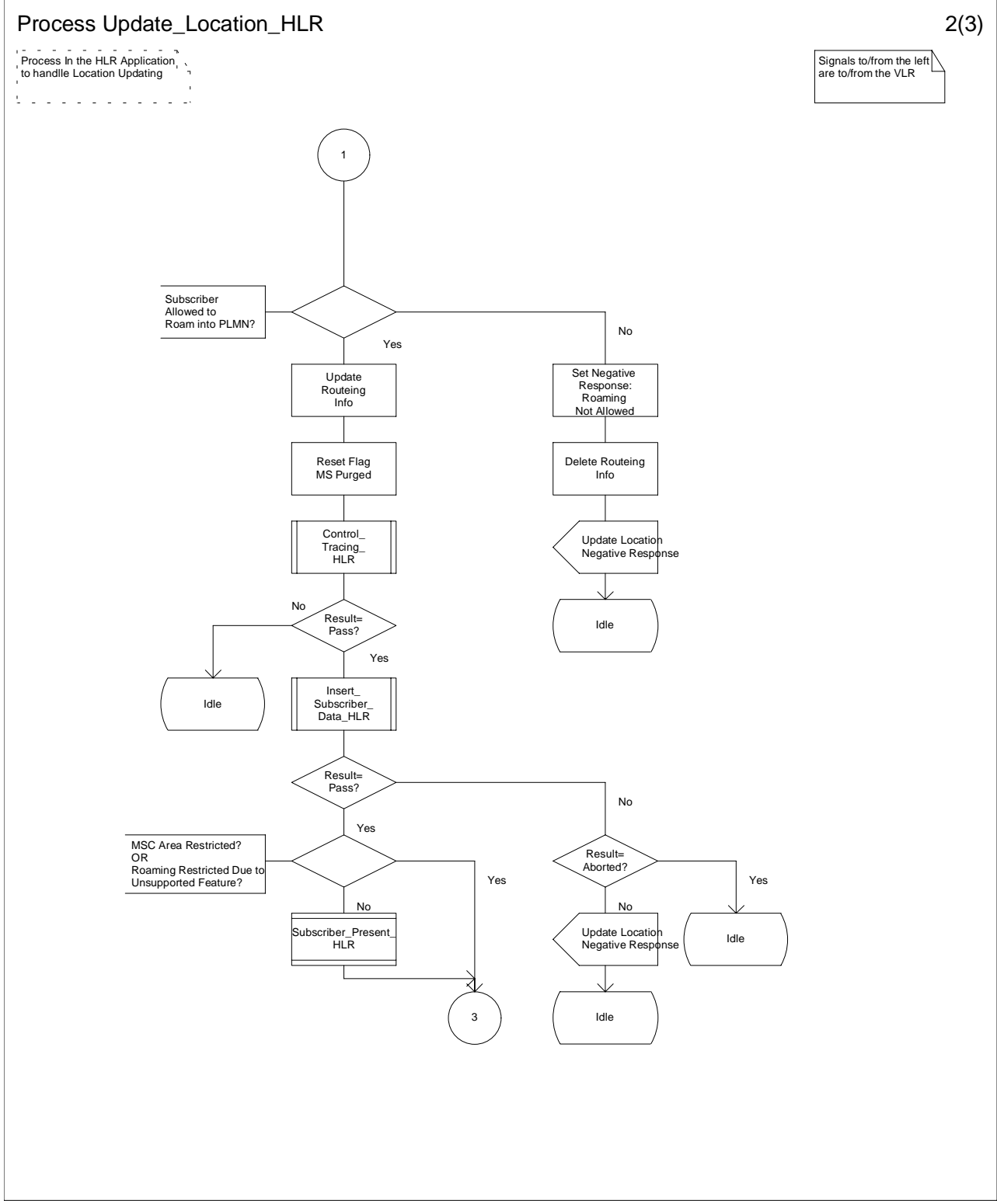


Figure 4.1.3.1 (sheet 2 of 3): Process Update Location HLR

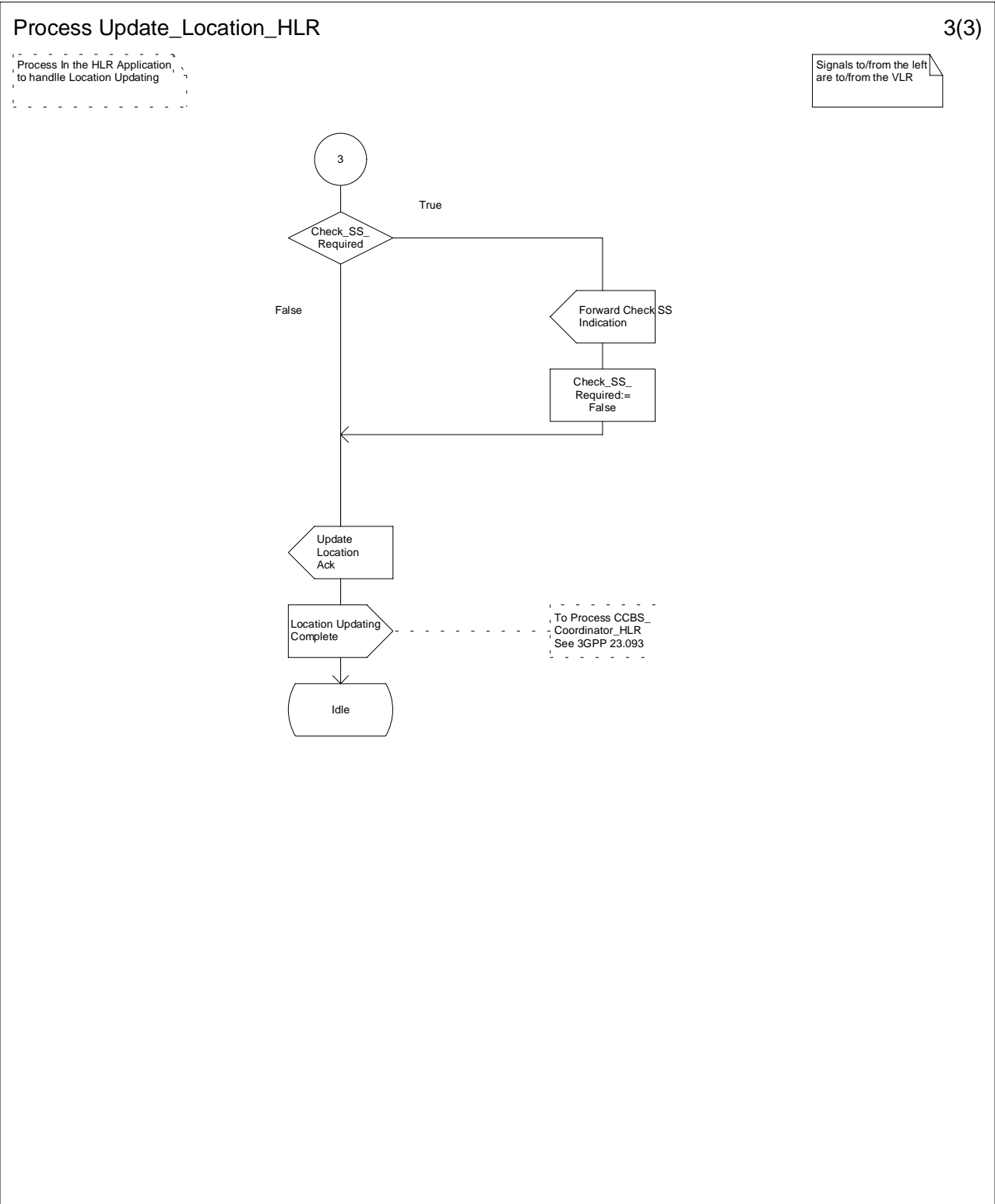


Figure 4.1.3.1 (sheet 3 of 3): Process Update Location HLR



#### 4.1.3.2 Procedure Insert Subscriber Data HLR

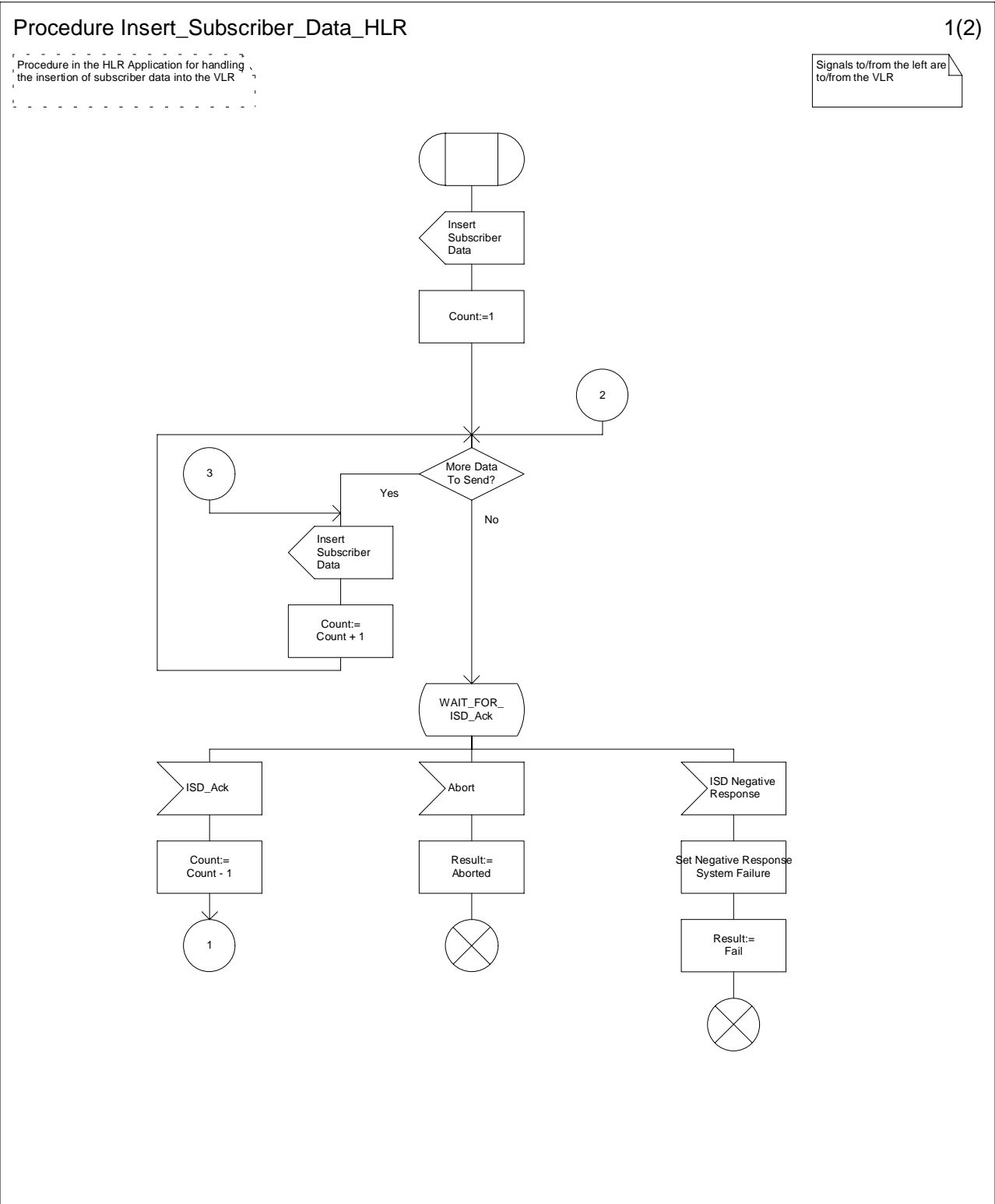


Figure 4.1.3.2 (sheet 1 of 2): Procedure Insert Subscriber Data HLR

Procedure Insert\_Subscriber\_Data\_HLR

2(2)

Procedure in the HLR Application for handling the insertion of subscriber data into the VLR

Signals to/from the left are to/from the VLR

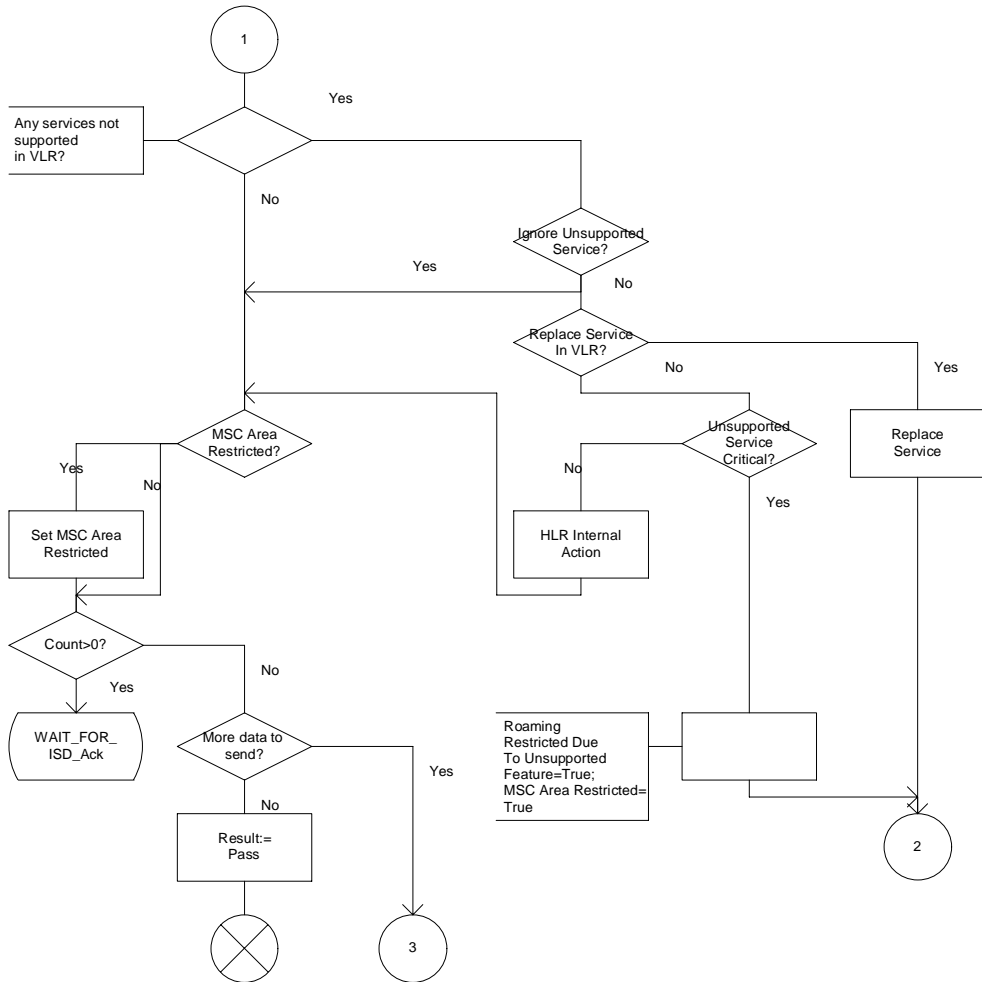


Figure 4.1.3.2 (sheet 2 of 2): Procedure Insert Subscriber Data HLR



### 4.1.3.3 Process Subscriber Present HLR

### Process Subscriber\_Present\_HLR

1(1)

Process in the HLR Application to perform actions required for short message alerting

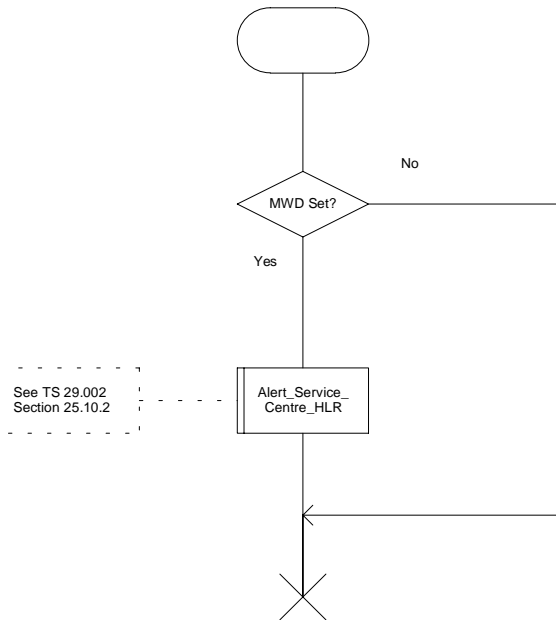


Figure 4.1.3.3: Process Subscriber Present HLR



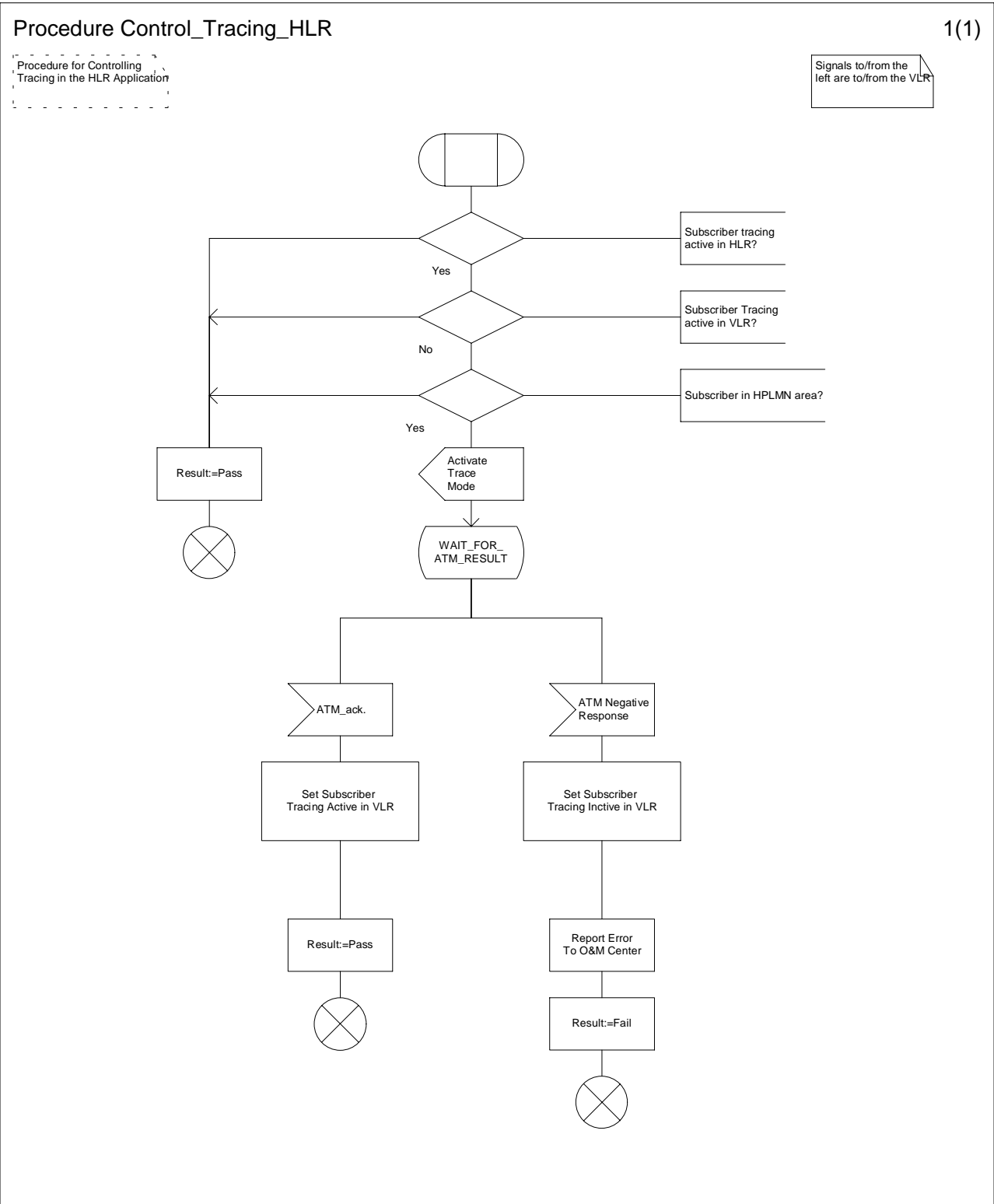


Figure 4.1.3.4 (sheet 1 of 1): Procedure Control Tracing\_HLR







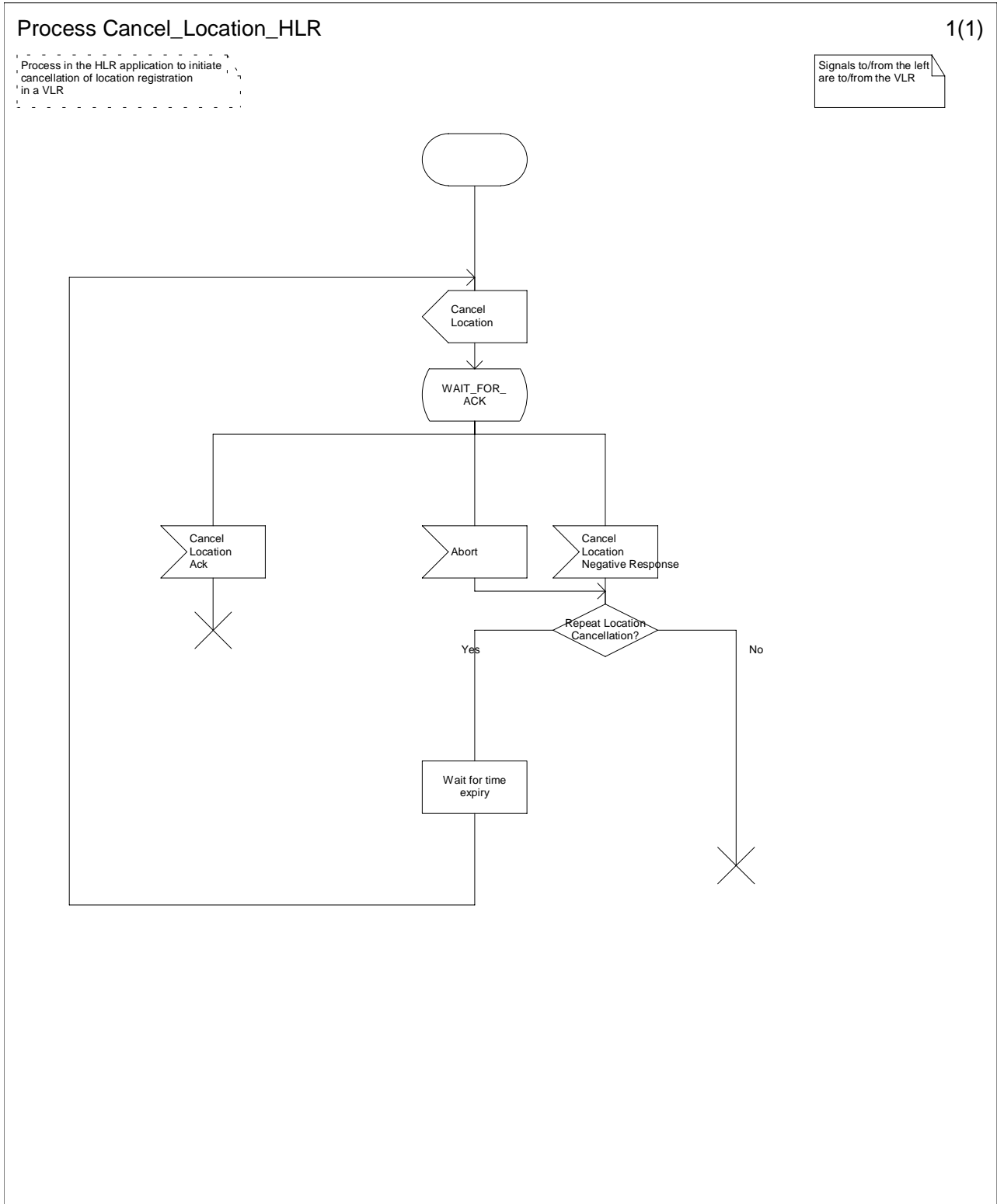


Figure 4.2.2.1: Process Cancel Location HLR



## 4.3 Detach IMSI

### 4.3.1 Detailed procedure in the MSC

#### 4.3.1.1 Process Detach\_IMSI\_MSC

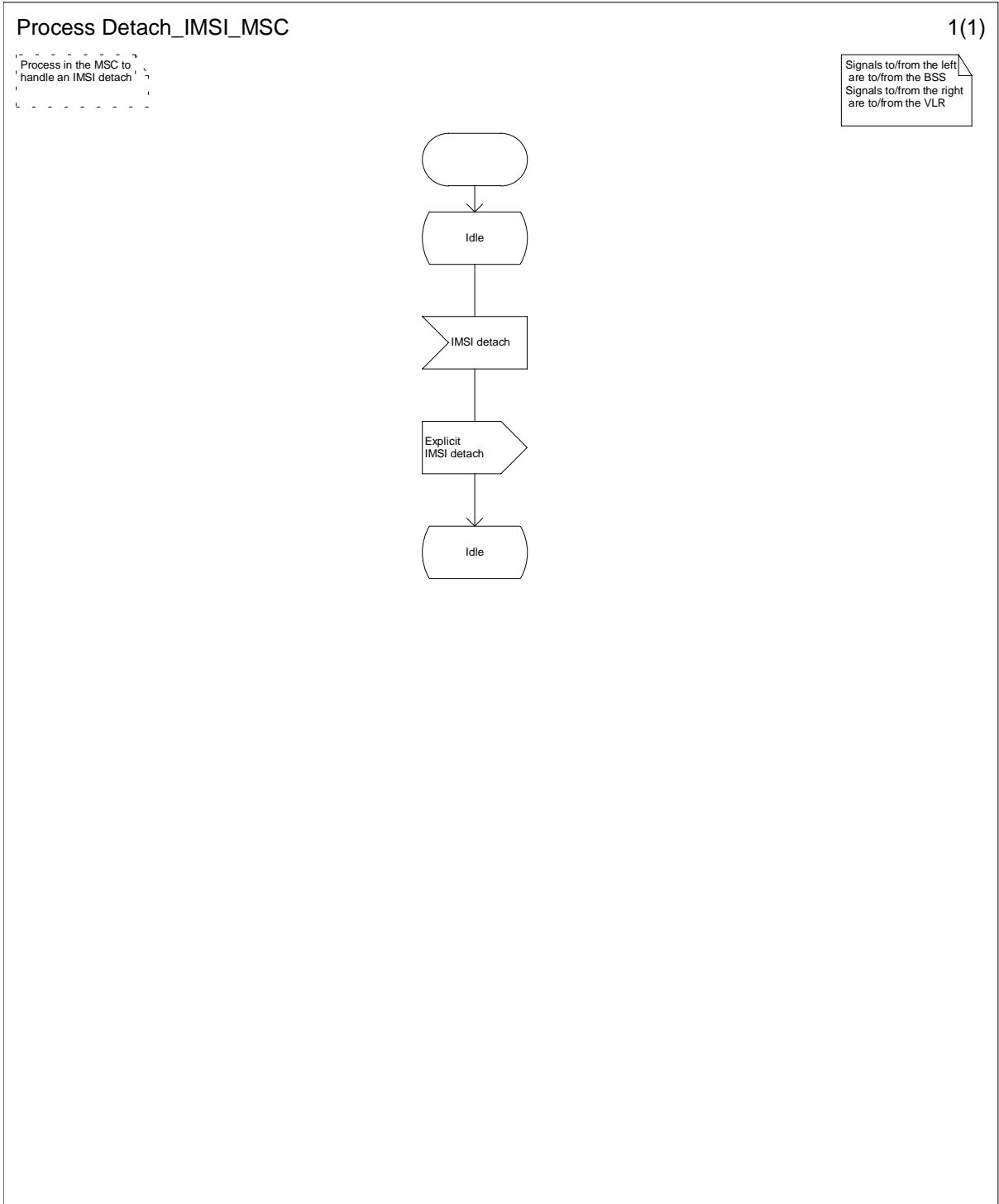


Figure 4.3.1.1. (Sheet 1 of 1): Process Detach IMSI MSC No specific annotation needed.

NEC====> Pending

## 4.3.2 Detailed procedure in the VLR

### 4.3.2.1 Process Detach IMSI VLR

Sheet 1: The signal "Authenticated Radio Contact Terminated" is sent to Process Detach IMSI VLR from RR handling in the MSC whenever authenticated radio contact is terminated, e.g. at the release of a call.

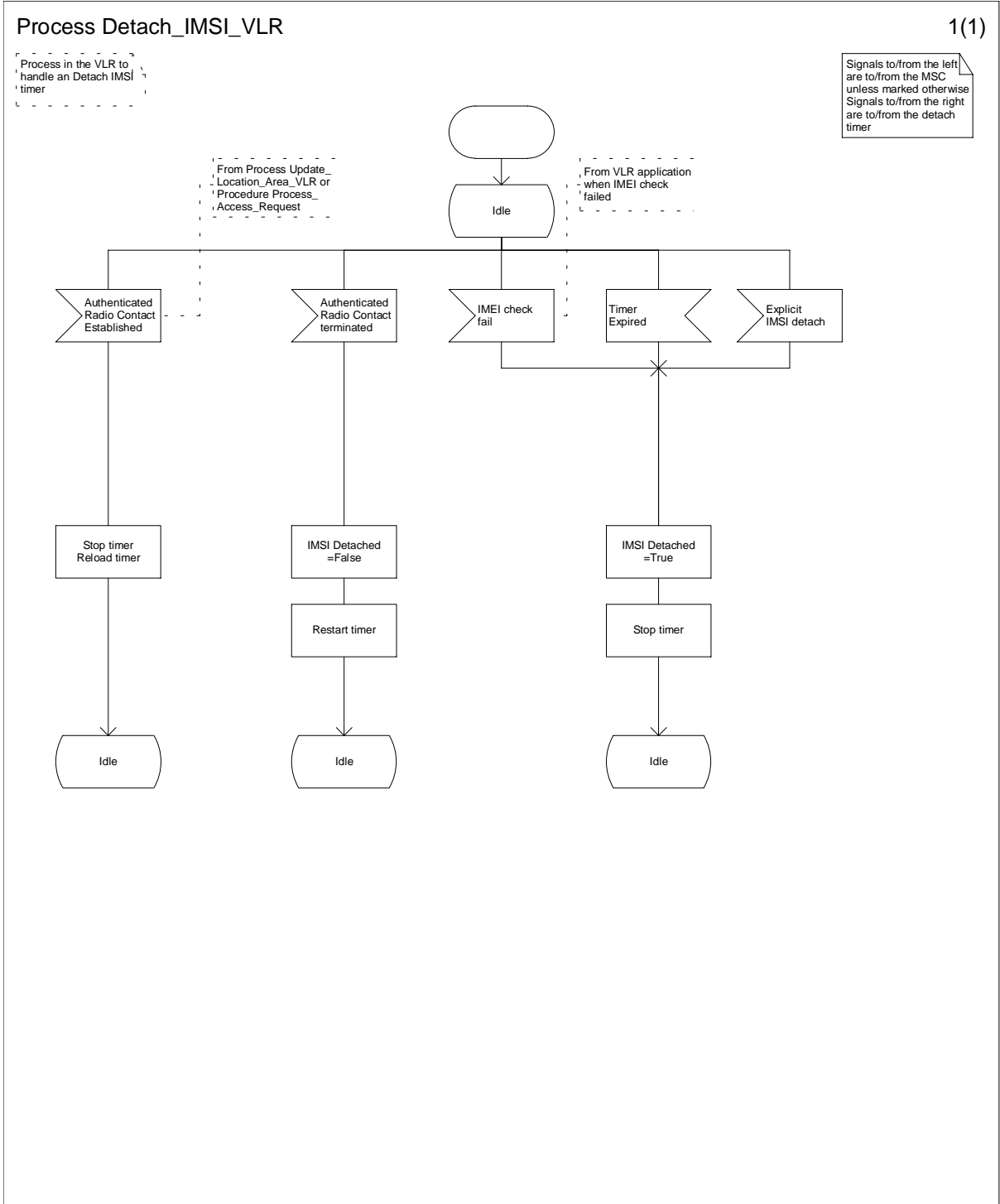


Figure 4.3.1.1. (Sheet 1 of 1): Process Detach IMSI VLR

No specific annotation needed.

NEC====> Pending

## 4.4 Purge MS

### 4.4.1 Detailed procedure in the VLR

#### 4.4.1.1 Procedure Purge\_MS\_VLR

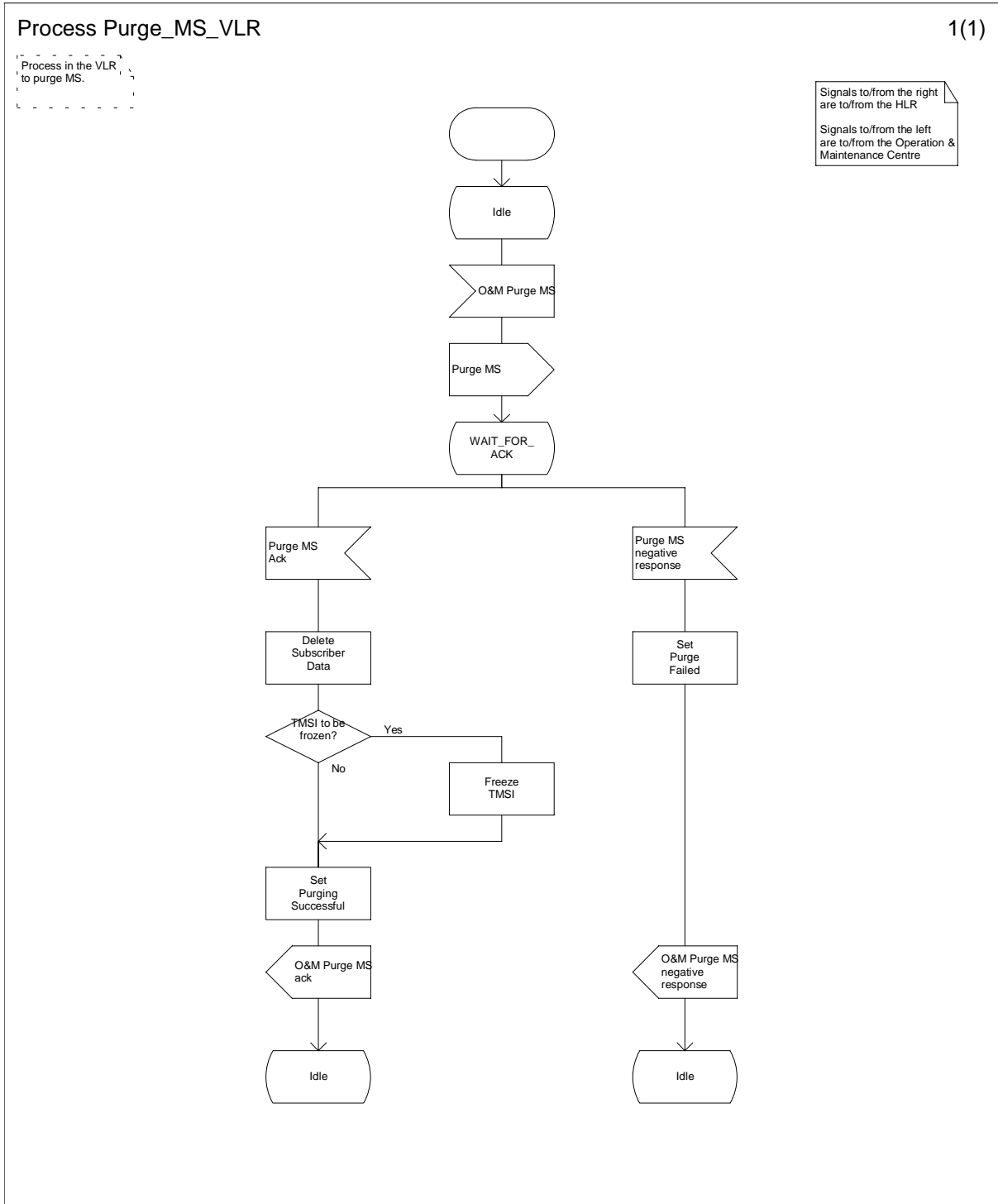


Figure 4.4.1.1. (Sheet 1 of 1): Procedure Purge\_MS\_VLR ~~No specific annotation needed.~~

NEC====> Pending

## 4.4.2 Detailed procedure in the HLR

### 4.4.2.1 Procedure Purge MS HLR

Sheet 1: If the received VLR number and the stored VLR number do not match, the HLR sends Purge MS ack containing an empty result to indicate successful outcome. Since the MS is known by the HLR to be in a different VLR area, it is not appropriate to block mobile terminated calls or short messages to the MS, but the VLR which initiated the purging procedure can safely purge its record for the MS without freezing the TMSI.

Sheet 1: If the received SGSN number and the stored SGSN number do not match, the HLR sends a Purge MS ack containing an empty result to indicate successful outcome. Since the MS is known by the HLR to be in a different SGSN area, it is not appropriate to block short messages to the MS, but the SGSN which initiated the purging procedure can safely purge its record for the MS without freezing the P-TMSI.

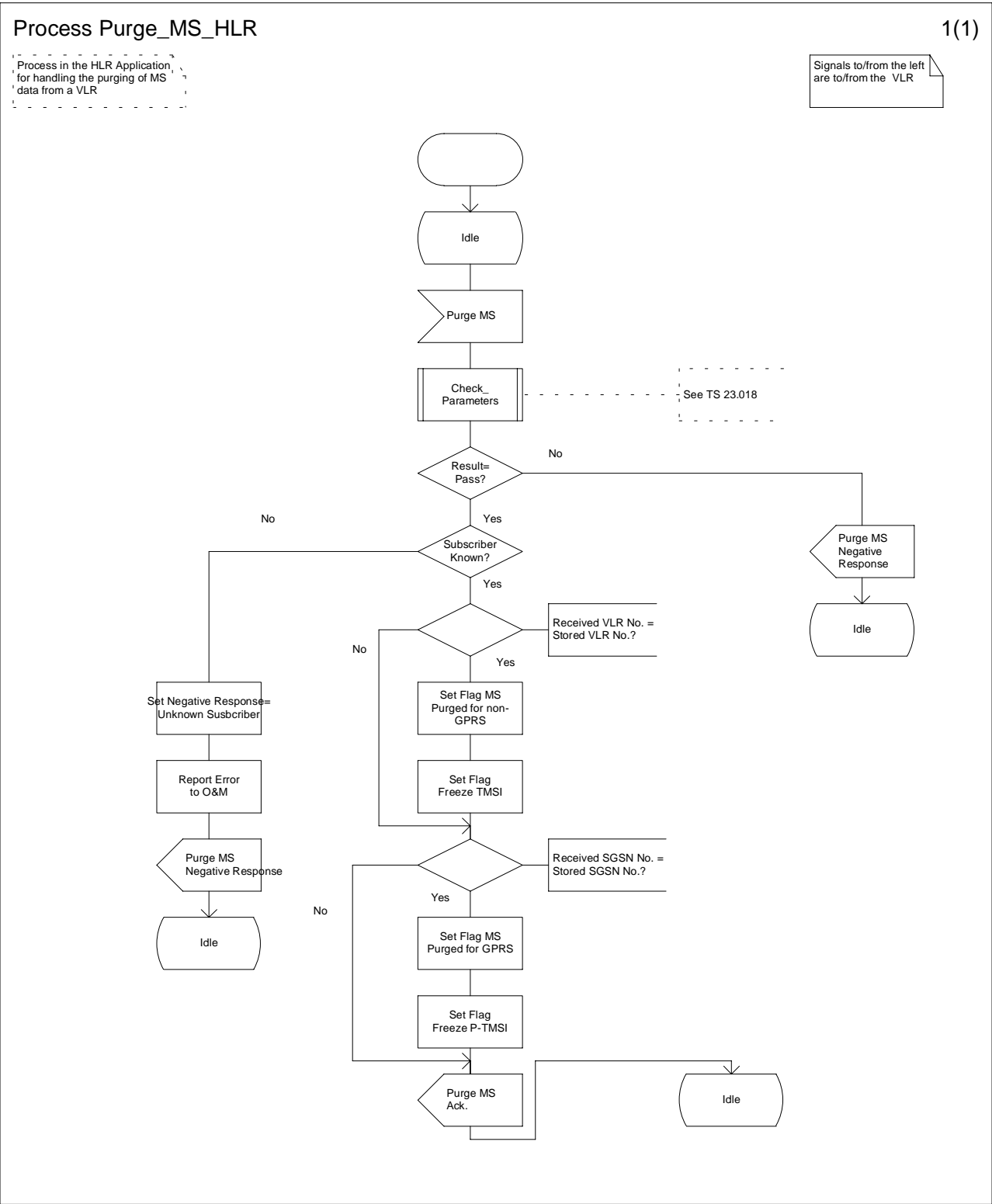


Figure 4.4.2.1, (Page 1 of 1): Procedure Purge\_MS\_HLR



## ~~4 Authentication~~

~~Authentication at location updating and IMSI attach shall be in accordance with GSM 03.20.~~

## Annex A: Change history

Change history						
TSG CN#	Spec	Version	CR	<Phase>	New Version	Subject/Comment
Apr 1999	GSM 03.12	6.0.0				Transferred to 3GPP CN1
CN#03	23.012				3.0.0	Approved at CN#03

---

## History

Document history		
V3.0.0	May 1999	Approved at TSGN #3. Under TSG TSG CN Change Control.

### 3G CHANGE REQUEST

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

**29.002 CR 032r2**

Current Version: **3.2.0**

3G specification number ↑

↑ CR number as allocated by 3G support team

For submission to TSG **CN#06**  
*list TSG meeting no. here ↑*

for approval  (only one box should  
for information  be marked with an X)

Form: 3G CR cover sheet, version 1.0 The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf>

**Proposed change affects:**  
*(at least one should be marked with an X)*

USIM

ME

UTRAN

Core Network

**Source:** TSG N2

**Date:** 10.08.99

**Subject:** Introduction of White Book SCCP in MAP

**3G Work item:** TEI

**Category:**

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

- F Correction
- A Corresponds to a correction in a 2G specification
- B Addition of feature
- C Functional modification of feature
- D Editorial modification

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

**Reason for change:**

The evolution of MAP has resulted in ever increasing message lengths.

Segmentation is greatly simplified if White Book SCCP is used. White Book SCCP is a mature protocol that is already supported by a number of vendors. White Book SCCP is capable of performing segmentation and reassembly, which removes the need to use application layer segmentation. Furthermore, since the SCCP layer is responsible the reconstruction of the segmented user data the use of White Book SCCP should eliminate the possibility of segments being presented to the application layer out of order.

**Clauses affected:** 2, 6.1

**Other specs affected:**

- |                              |                          |                |
|------------------------------|--------------------------|----------------|
| Other 3G core specifications | <input type="checkbox"/> | → List of CRs: |
| Other 2G core specifications | <input type="checkbox"/> | → List of CRs: |
| MS test specifications       | <input type="checkbox"/> | → List of CRs: |
| BSS test specifications      | <input type="checkbox"/> | → List of CRs: |
| O&M specifications           | <input type="checkbox"/> | → List of CRs: |

**Other comments:**

## 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- 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".

....

[xxx] ITU-T Recommendation Q.711: "Specifications of Signalling System No.7; Signalling System No. 7 – Functional Description of the Signalling Connection Control Part".

[xxx] ITU-T Recommendation Q.712: "Specifications of Signalling System No.7; Signalling System No. 7 – Definition and Function of SCCP Messages".

[xxx] ITU-T Recommendation Q.713: "Specifications of Signalling System No.7; Signalling System No. 7 – SCCP formats and codes".

[xxx] ITU-T Recommendation Q.714: "Specifications of Signalling System No.7; Signalling System No. 7 – Signalling Connection Control Part Procedures".

[xxx] ITU-T Recommendation Q.716: "Specifications of Signalling System No.7; Signalling System No. 7 – Signalling Connection Control Part (SCCP) Performance".

....

### 6.1 Use of SCCP

The Mobile Application Part (MAP) makes use of the services offered by the Signalling Connection Control Part (SCCP).

MAP supports the following SCCP versions:

- Signalling Connection Control Part , Signalling System no. 7 CCITT ('Blue Book SCCP')
- Signalling Connection Control Part , Signalling System no. 7 ITU-T Recommendation (07/96) Q.711 to Q.716 ('White Book SCCP'). Support of White Book SCCP at the receiving side shall be mandated from 00:01hrs, 1st July 2002(UTC).

A White Book SCCP message will fail if any signalling point used in the transfer of the message does not support White Book SCCP. Therefore it is recommended that the originator of the White Book SCCP message supports a drop

back mechanism or route capability determination mechanism to interwork with signalling points that are beyond the control of GSM/UMTS network operators.

~~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.

# CHANGE REQUEST

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

**29.002 CR 074**

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#06**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (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:** (U)SIM  ME  UTRAN / Radio  Core Network   
(at least one should be marked with an X)

**Source:** TSG N2 **Date:** 15 Nov. 1999

**Subject:** Restructuring of MAP Location Management Procedures for the Circuit Switched 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   
C Functional modification of feature   
D Editorial modification

**Release:**  
Phase 2   
Release 96   
Release 97   
Release 98   
Release 99   
Release 00

**Reason for change:**  
-Currently, Stage 2 and Stage 3 descriptions of location management procedures are mixed together in Chapter 19 of TS 29.002. This CR is to reformulate the description of Location Management procedures for the Circuit Switched Domain as pure Stage 3, i.e. describing only the protocol handling, while removing the descriptions of application level logic, which belong in TS 23.012.  
-This CR also removes references in Chapter 8 to services exclusive to the B interface, since the MAP protocol is not used on this interface.

**Clauses affected:** 8, 19

**Other specs affected:**  
Other 3G core specifications  → List of CRs: 23.012-001  
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:**  
To MCC, please accept the followings requests.  
1. Please realign chapter numbers (indicated as 19.1.1.X) as needed.  
2. Please synchronize the references to the new chapter numbers in chapter 19.1 Location management Procedures and in the 19.1.1.5.2 Detailed procedure in the VLR.  
3. Likewise, some figures still remain un-numbered. Please assign the appropriate figure numbers as required.



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

# 3G TS 29.002 ~~v3.1.0~~ (1999-09)

*Technical Specificati*

## **3rd Generation Partnership Project Technical Specification Group Core Network Mobile Application Part (MAP) specificatio**

**(3G TS 29.002 version ~~3.1.0~~)**



The present document has been developed within the 3<sup>rd</sup> Generation Partnership Project (3GPP™) and may be further elaborated for the purposes of 3GPP. The present document has not been subject to any approval process by the 3GPP Organisational Partners and shall not be implemented. This Specification is provided for future development work within 3GPP only. The Organisational Partners accept no liability for any use of this Specification. Specifications and reports for implementation of the 3GPP™ system should be obtained via the 3GPP Organisational Partners' Publications Offices.



Reference

---

DTS/TSGN-0229002U

Keywords

---

3GPP, CN

**3GPP**

Postal address

---

3GPP support office address

---

650 Route des Lucioles - Sophia Antipolis  
Valbonne - FRANCE  
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

---

<http://www.3gpp.org>

---

## 8 Mobility services

### 8.1 Location management services

#### 8.1.1 ~~MAP\_UPDATE\_LOCATION\_AREA service~~

##### 8.1.1.1 ~~Definition~~

This service is used between MSC and VLR to update location information in the network. It is initiated by an MS when changing the location area or at first registration. The detailed conditions are given in GSM 03.12.

The ~~MAP\_UPDATE\_LOCATION\_AREA service~~ is a confirmed service using the primitives from table 8.1/1.

##### 8.1.1.2 ~~Service primitives~~

**Table 8.1/1: MAP\_UPDATE\_LOCATION\_AREA**

Parameter name	Request	Indication	Response	Confirm
Invoke Id	M	M(=)	M(=)	M(=)
Target location area Id	M	M(=)		
Serving cell Id	M	M(=)		
Location update type	M	M(=)		
IMSI	C	C(=)		
TMSI	C	C(=)		
Previous location area Id	C	C(=)		
CKSN	C	C(=)		
User error			C	C(=)
Provider error				Ø

##### 8.1.1.3 ~~parameter definitions and use~~

###### Invoke Id

See definition in subclause 7.6.1.

###### Target location area Id

See definition in subclause 7.6.2.

###### Serving cell Id

See definition in subclause 7.6.2.

###### Location update type

See definition in subclause 7.6.9.

###### IMSI

See definition in subclause 7.6.2. It is up to the MS to provide either IMSI or TMSI, but one shall be present.

###### TMSI

See definition in subclause 7.6.2. It is up to the MS to provide either IMSI or TMSI, but one shall be present.

###### Previous location area Id

See definition in subclause 7.6.2. This parameter is provided if the updating is not a first registration.

### CKSN

See definition in subclause 7.6.7. The CKSN is given if TMSI is used.

### User error

One of the following error causes defined in subclause 7.6.1 is sent by the user in case of location area updating failures, depending on the failure reason:

- unknown subscriber;
  - This cause is used if the subscriber is not known in the VLR and even a correlated request to the subscriber's HLR gives a negative result (i.e. the IMSI is not allocated to a subscriber).
- unknown location area;
  - This cause is used if the target location area identity given is not known in the VLR.
- roaming not allowed;
  - This cause is used if the MS is not allowed to roam into the target location area indicated in the MAP\_UPDATE\_LOCATION\_AREA Req. The cause will be qualified according to the roaming restriction reason, i.e. one of "National Roaming Not Allowed", "PLMN Not Allowed", "Location Area Not Allowed", or "Operator Determined Barring".
- illegal subscriber;
  - This error is sent if a correlated authentication procedure has not authenticated the subscriber.
- illegal equipment;
  - This error is sent if an IMEI check failed, i.e. the IMEI is blacklisted or not white listed.
- system failure;
- unexpected data value.

### Provider error

For definition of provider errors see subclause 7.6.1.

## 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 6.1/2.

This parameter is mandatory if the service fails. The following error cause defined in subclause 7.6.1 may be used, depending on the nature of the fault:

- unidentified subscriber.

#### Provider error

For definition of provider errors see subclause 7.6.1.

## 8.1.5 ~~MAP\_DETACH\_IMSI~~ service

### 8.1.5.1 ~~Definition~~

The ~~MAP\_DETACH\_IMSI~~ service is used by the MSC to indicate to the VLR that an MS is no longer reachable. The network needs this information e.g. to reject an incoming call without initiating paging on the radio path.

~~The MAP\_DETACH\_IMSI service is a non-confirmed service using the service primitives defined in table 8.1/5.~~

### 8.1.5.2 ~~Service primitives~~

**Table 8.1/5: ~~MAP\_DETACH\_IMSI~~**

<b>Parameter name</b>	<b>Request</b>	<b>Indication</b>
Invoke Id	M	M(⇒)
Serving cell id	M	M(⇒)
IMSI	C	C(⇒)
TMSI	C	C(⇒)

### 8.1.5.3 ~~Parameter definitions and use~~

#### Invoke Id

See definition in subclause 7.6.1.

#### Serving cell id

See definition in subclause 7.6.2.

#### IMSI

See definition in subclause 7.6.2. It is up to the MS to provide either IMSI or TMSI as subscriber identity, but one shall be present.

#### TMSI

See definition in subclause 7.6.2. It is up to the MS to provide either IMSI or TMSI as subscriber identity, but one shall be present.

## 8.1.6 MAP\_PURGE\_MS service

### 8.1.6.1 Definition

This service is used between the VLR and the HLR to cause the HLR to mark its data for an MS so that any request for routing information for a mobile terminated call or a mobile terminated short message will be treated as if the MS is not reachable. It is invoked when the subscriber record for the MS is to be deleted in the VLR, either by MMI interaction or automatically, e.g. because the MS has been inactive for several days.

Also this service is used between the SGSN and the HLR to cause the HLR to mark its data for an MS so that any request for routing information for a mobile terminated short message or a network requested PDP-context activation

will be treated as if the MS is not reachable. It is invoked when the subscriber record for the MS is to be deleted in the SGSN, either by MMI interaction or automatically, e.g. because the MS has been inactive for several days.

The MAP\_PURGE\_MS service is a confirmed service using the primitives defined in table 8.1/6.

## 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 fix relation 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 implicit 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 Mobility procedures

## 19.1 Location management Procedures

For non-GPRS subscribers, this subclause comprises a number of processes to handle the mobile nature of the subscriber. The processes will be addressed by SCCP Sub-System Number (MSC, VLR or HLR) and the Application Context. The following processes are defined in this subclause:

Process Update Location Area:

~~Initiator: Update\_Location\_Area\_MSC, subclause 19.1.1.2;~~

~~Responder: Update\_Location\_Area\_VLR, subclause 19.1.1.3;~~

Process Update Location:

Initiator: Update\_Location\_Area\_VLR, subclause 19.1.1.3, ~~or~~

~~Update\_Location\_VLR, subclause 19.1.1.6;~~

Responder: Update\_Location\_HLR, subclause 19.1.1.4;

Process Send Identification:

Initiator: ~~Update\_Location\_Area\_VLR~~Send\_Identification\_VLR, subclause 19.1.1.3~~;~~

Responder: Send\_Identification\_PVLR, subclause 19.1.1.5;

~~Process Subscriber Present HLR:~~

~~Initiator: Subscriber\_Present\_HLR, subclause 19.1.1.7;~~

~~Responder: Short\_Message\_Alert\_IWMSC, subclause 23.4.3;~~

Process Cancel Location:

Initiator: Cancel\_Location\_HLR, subclause 19.1.2.2;

Responder: Cancel\_Location\_VLR, subclause 19.1.2.3;

Process Detach IMSI:

Initiator: Detach\_IMSI\_MSC, subclause 19.1.3.2;

Responder: Detach\_IMSI\_VLR, subclause 19.1.3.3.

Process Purge MS:

Initiator: Purge\_MS\_VLR, subclause 19.1.4.2;

Responder: Purge\_MS\_HLR, subclause 19.1.4.3.

For GPRS subscribers, this subclause comprises a number of other processes to handle the mobile nature of the subscriber. The processes will be addressed by SCCP Sub-System Number (SGSN or HLR) and the Application Context. The following processes are defined in this subclause:

Process GPRS Update Location:

Initiator: GPRS Update Location Area VLR, subclause 19.1.1.3, or

SGSN Update HLR, subclause 19.1.1.8,

Responder: Update GPRS Location HLR, subclause 19.1.1.4;

Process Cancel Location:

Initiator: Cancel GPRS Location HLR, subclause 19.1.2.2;

Responder: Cancel Location SGSN, subclause 19.1.2.4;

Process Purge MS:

Initiator: Purge MS SGSN, subclause 19.1.4.4;

Responder: Purge MS HLR, subclause 19.1.4.3.

The following existing process is also used for GPRS subscribers :

Process Subscriber Present HLR:

Initiator: Subscriber Present HLR, subclause 19.1.1.7;

Responder: Short Message Alert IW MSC, subclause 23.4.3;

As both the Update Location Area and the Detach IMSI processes use the same application context name, the MAP Provider cannot distinguish between them. Therefore, a Location Management Coordinator Process will act as one user for this application context. This process (one in MSC, one in VLR) will create the Update Location Area or the Detach IMSI process, depending on the first service primitive received in the respective dialogue.

Additionally, a Location Management Coordinator process in the HLR coordinates the two application processes "Update Location HLR" (subclause 19.1.1.4) and "RESTORE\_DATA\_HLR" (subclause 19.3.3) that are addressed by the same application context.

**Location Management Coordinator MSC**

On receipt of a request for location updating from the A interface, the Location Management Coordinator in the MSC will:

- create the process Update\_Location\_Area\_MSC in case the updating type indicated in the A interface primitive indicates normal updating, periodic updating or IMSI Attach;
- create the process Detach\_IMSI\_MSC in case the updating type indicated in the A interface primitive indicates IMSI Detach.

The respective primitive is then forwarded to the created process. Henceforth, the coordinator will relay all service primitives from provider to the user and vice versa, until a request or indication for dialogue termination is received. This last primitive will be relayed, too, before the Coordinator process returns to idle state.



**Location Management Coordinator VLR**

On receipt of a dialogue request for the Location Management Application Context (see `Receive_Open_Ind` macro in subclause 25.1), the `Location_Management_Coordinator` will:

- terminate the procedure in case of parameter problems or if the MSC indicated version `Vr` protocol; or
- continue as below, if the dialogue is accepted.

Depending on the first service primitive received from the MAP Provider in this dialogue, the user process is created:

- `Update_Location_Area_VLR` in case the primitive is a `MAP_UPDATE_LOCATION_AREA` indication;
- `Detach_IMSI_VLR` in case the primitive is a `MAP_DETACH_IMSI` indication.

In case a `MAP_U_ABORT`, `MAP_P_ABORT` or a premature `MAP_CLOSE` indication is received instead, the process returns to idle state. If a `MAP_NOTICE` indication is received, the dialogue towards the MSC is aborted and the process returns to idle state.

After creation of the user process the service primitive received from the provider is passed to the user process. Henceforth, the coordinator will relay all service primitives from provider to the user and vice versa, until a request or indication for dialogue termination is received. This last primitive will be relayed, too, before the Coordinator process returns to idle state.

**Location Management Coordinator HLR**

On receipt of a dialogue request for the Location Management Application Context (see `Receive_Open_Ind` macro in subclause 25.1), the `Location_Management_Coordinator` will:

- terminate the process in case of parameter problems; or
- revert to MAP version `Vr` protocol if the VLR requests version `Vr` protocol; or
- continue as described in the following, if the dialogue is accepted.

The user process is created depending on the first service primitive received from the MAP service provider within this dialogue:

- `Update_Location_HLR` if the primitive is a `MAP_UPDATE_LOCATION` indication;
- `RESTORE_DATA_HLR` if the primitive is a `MAP_RESTORE_DATA` indication.

If a `MAP_NOTICE` indication is received instead, the dialogue towards the MSC is terminated and the process returns to idle state.

Sheet 1: After creation of the user process the service primitive received from the MAP service-provider is passed to the user process. Henceforth, the coordinator will relay all service primitives from MAP service-provider to the MAP service-user and vice versa, until a request or indication for dialogue termination is received. This last primitive will be relayed, too, before the Coordinator process returns to idle state.

For GPRS subscribers, this subclause comprises a number of other processes to handle the mobile nature of the subscriber. The processes will be addressed by SCCP Sub System Number (SGSN or HLR) and the Application Context. The following processes are defined in this subclause:

**Process GPRS Update Location:**

- Initiator: — `GPRS_Update_Location_Area_VLR`, subclause 19.1.1.3, or
- `SGSN_Update_HLR`, subclause 19.1.1.8;
- Responder: — `Update_GPRS_Location_HLR`, subclause 19.1.1.4;

~~Process Cancel Location:~~

~~Initiator: — Cancel\_GPRS\_Location\_HLR, subclause 19.1.2.2;~~

~~Responder: — Cancel\_Location\_SGSN, subclause 19.1.2.4;~~

~~Process Purge MS:~~

~~Initiator: — Purge\_MS\_SGSN, subclause 19.1.4.4;~~

~~Responder: — Purge\_MS\_HLR, subclause 19.1.4.3.~~

~~The following existing process is also used for GPRS subscribers:~~

~~Process Subscriber Present HLR:~~

~~Initiator: — Subscriber\_Present\_HLR, subclause 19.1.1.7;~~

~~Responder: — Short\_Message\_Alert\_IWMSC, subclause 23.4.3;~~

Process Location\_Management\_Coordinator\_MSC

19.1\_1(1)

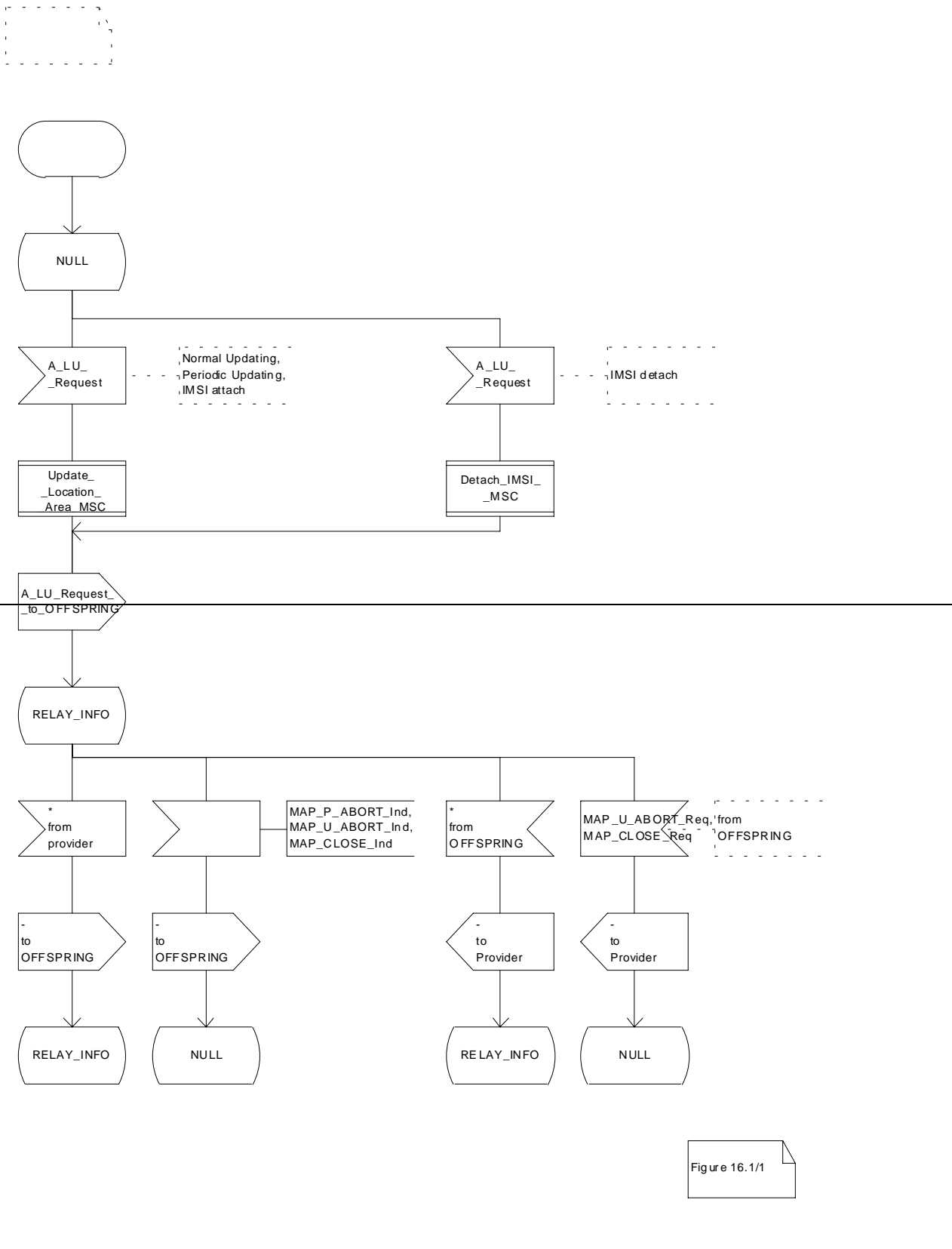


Figure 19.1/1: Process Location\_Management\_Coordinator\_MSC

Process Location\_Management\_Coordinator\_VLR

19.1\_2(1)

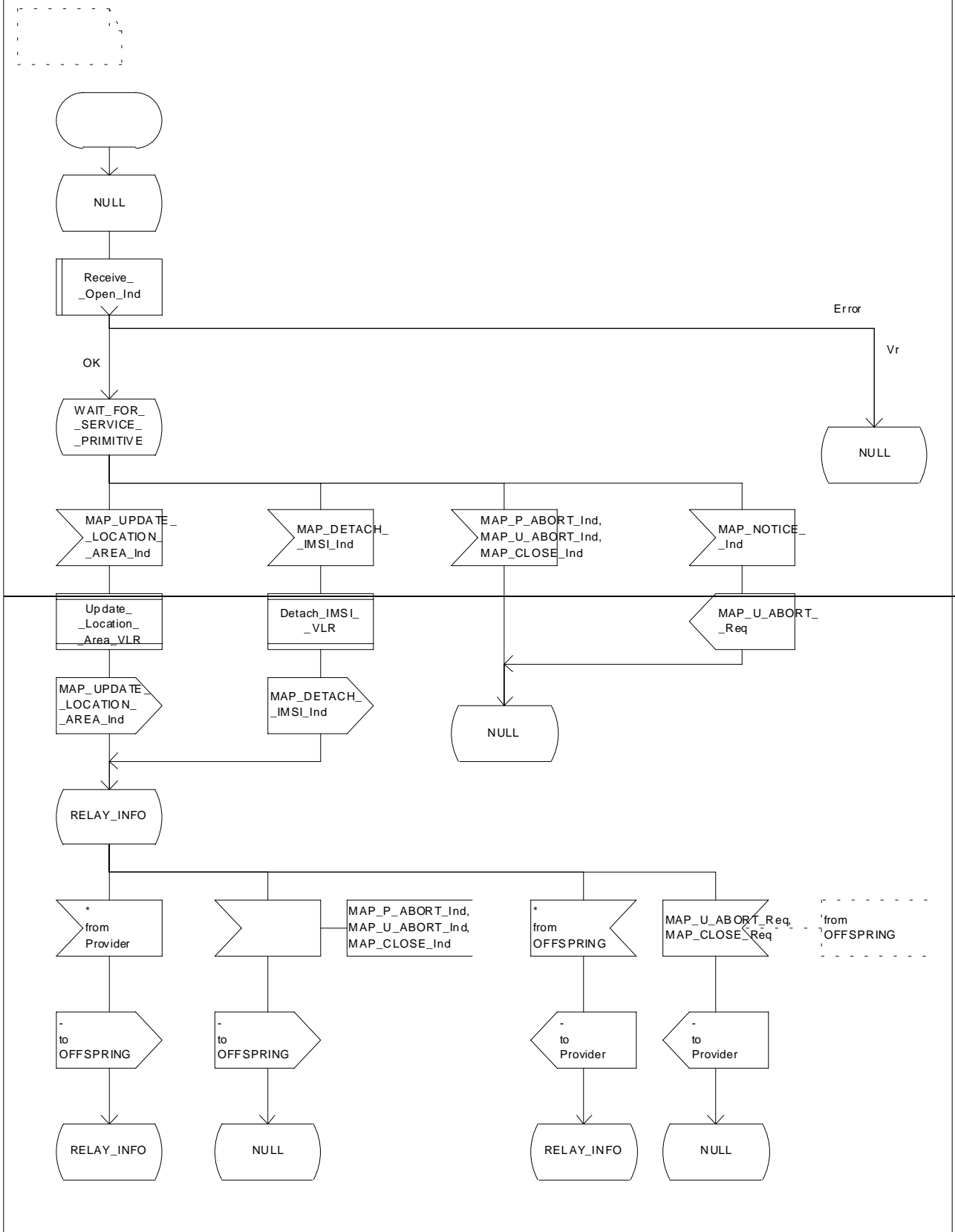


Figure 19.1/2: Process Location\_Management\_Coordinator\_VLR

Process Location\_Management\_Coordinator\_HLR

19.1\_3(1)

Figure 19.1/3  
Location management coordination process in the HLR

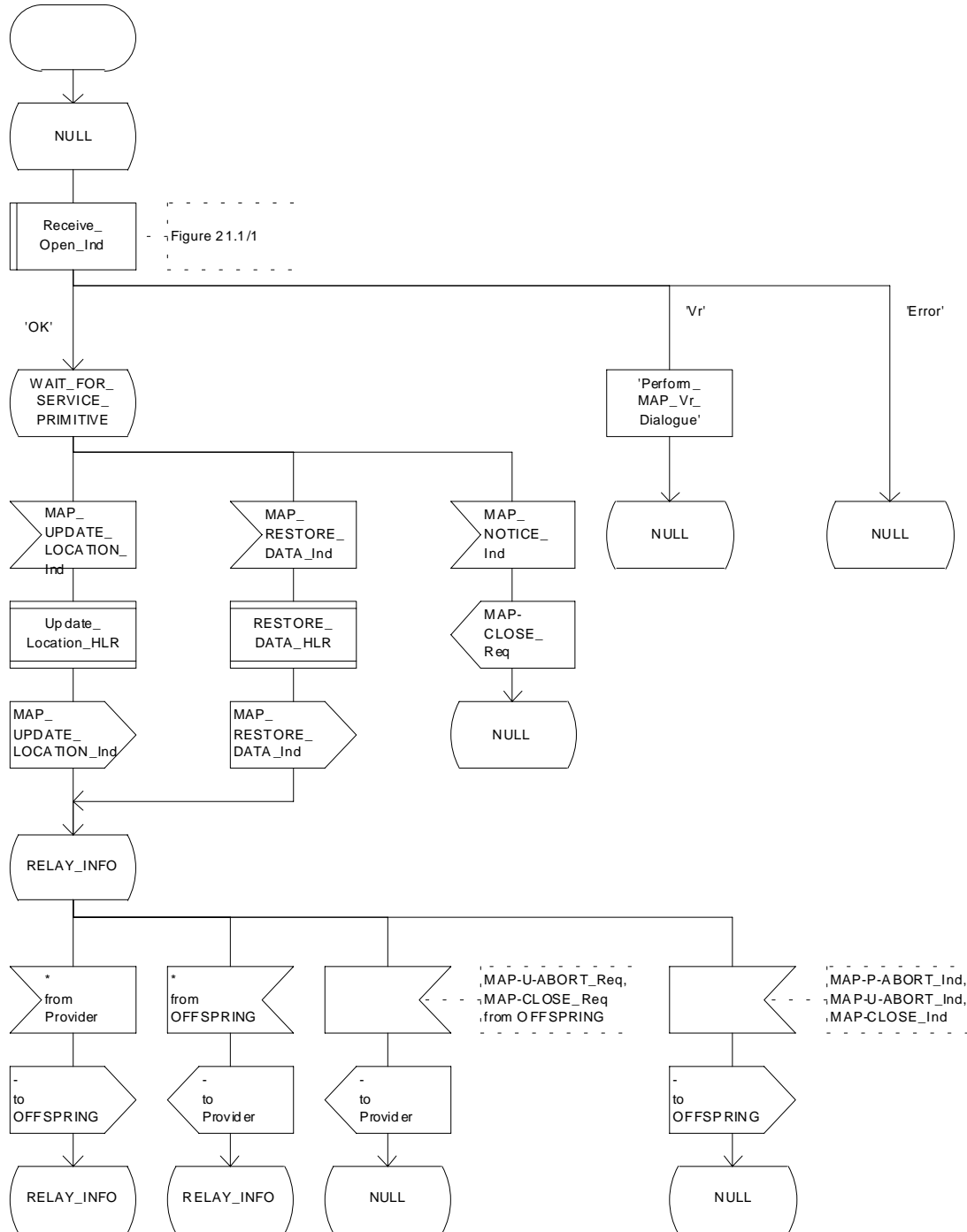


Figure 19.1/3: Process Location\_Management\_Coordinator\_HLR

## 19.1.1 Location updating

### 19.1.1.1 General

The location updating procedure is used to update the location information held in the network. For GPRS subscribers, this procedure describes also updating of the SGSN and, if Gs interface is installed, updating of the VLR in combination with an attach/routing area updating in the SGSN. This location information is used to route incoming calls, packet data, short messages and unstructured supplementary service data to the roaming subscriber. Additionally, this procedure is used to provide the VLR and/or the SGSN with the information that a subscriber already registered, but being detached, is reachable again (IMSI Attach and/or GPRS Attach, see GSM 03.12 and GSM 03.60). The use of the IMSI Detach / Attach feature is optional for the network operator.

To minimize the updates of the subscriber's HLR, the HLR holds only information about the VLR and MSC the subscriber is attached to and, for GPRS subscribers, the SGSN the subscriber is attached to. The VLR and the SGSN contain more detailed location information, i.e. the location area the subscriber is actually roaming in (for the VLR) and the routing area (RA) where the GPRS subscriber is located (for SGSN). Therefore, the VLR needs to be updated at each location area change (see figure 19.1.1/1 for this procedure) and the SGSN needs to be updated at each routing area change. The HLR needs updating only in the following cases:

- when the subscriber registers in a new VLR or SGSN, i.e. the VLR or SGSN has no data for that subscriber;
- when the subscriber registers in a new location area of the same VLR and new routing information is to be provided to the HLR (change of MSC area);
- if the indicator "Confirmed by HLR" or the indicator "Location Information Confirmed in HLR" is set to "Not Confirmed" because of HLR, VLR or SGSN restoration, and the VLR or SGSN receives an indication that the subscriber is present.

If a mobile subscriber registers in a visitor location register (VLR) not holding any information about this subscriber and is identified by a temporary mobile subscriber identity (TMSI) allocated by a previous visitor location register (PVLR), if the PVLR identity can be derived from LAI the new VLR must obtain the IMSI from PVLR to identify the HLR to be updated (see figure 19.1.1/2). If the IMSI cannot be retrieved from PVLR, it is requested from the MS (see figure 19.1.1/3).

The stage 2 specification for GPRS is in GSM 03.60. The interworking between the MAP signalling procedures and the GPRS procedures in the SGSN is shown by the transfer of signals between these procedures (see subclause 19.1.1.8).

The message flow for successful GPRS Attach/ RA update procedure (with Gs interface not installed) is shown in figure 19.1.1/4.

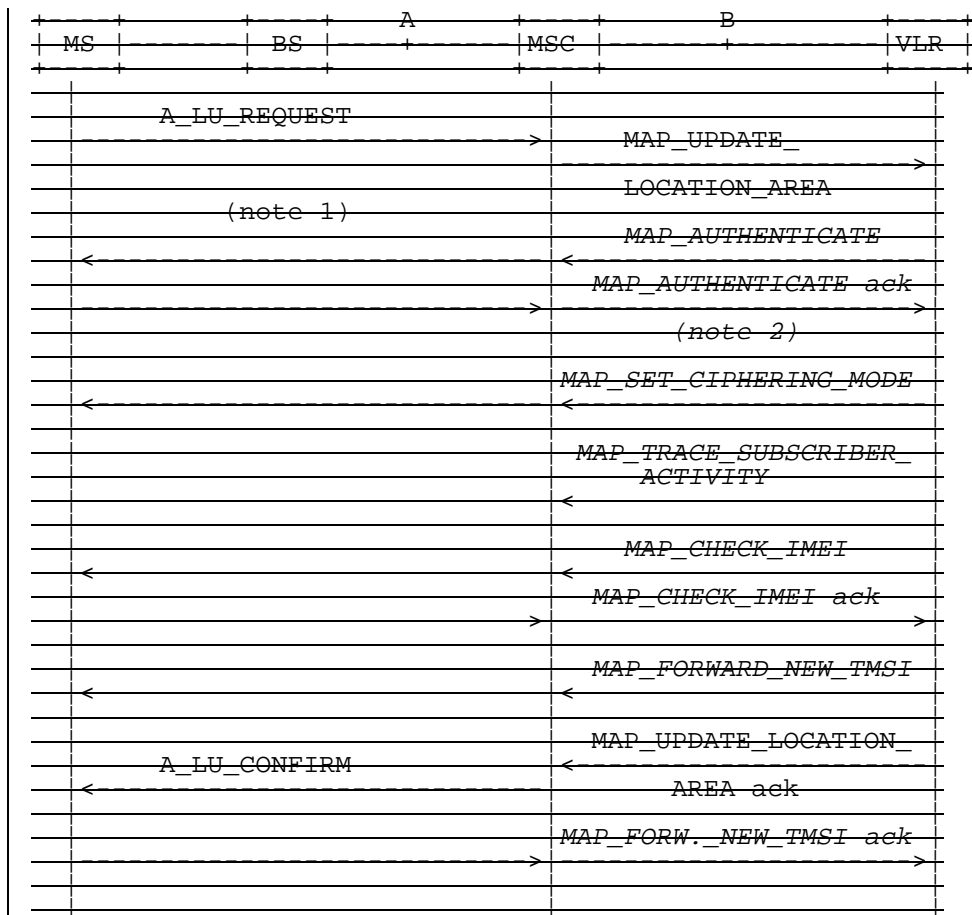
The message flow for successful GPRS Attach/ RA update procedure combined with a successful VLR location updating (Gs interface installed) is shown in figure 19.1.1/5.

The following MAP services are invoked by the location update procedure:

MAP\_UPDATE\_LOCATION\_AREA (see subclause 8.1);(\*\*)  
MAP\_UPDATE\_LOCATION (see subclause 8.1);(\*\*)  
MAP\_UPDATE\_GPRS\_LOCATION (see subclause 8.1) (\*);  
MAP\_CANCEL\_LOCATION (see subclause 8.1);  
MAP\_INSERT\_SUBSCRIBER\_DATA (see subclause 8.8);  
MAP\_SEND\_IDENTIFICATION (see subclause 8.1) (\*\*);  
MAP\_PROVIDE\_IMSI (see subclause 8.9) (\*\*);  
MAP\_AUTHENTICATE (see subclause 8.5) (\*\*);  
MAP\_SET\_CIPHERING\_MODE (see subclause 8.6) (\*\*);  
MAP\_FORWARD\_NEW\_TMSI (see subclause 8.9) (\*\*);  
MAP\_CHECK\_IMEI (see subclause 8.7) (\*\*);  
MAP\_ACTIVATE\_TRACE\_MODE (see subclause 9.2);  
MAP\_TRACE\_SUBSCRIBER\_ACTIVITY (see subclause 9.2) (\*\*).

(\*): only used in SGSN and HLR for GPRS

(\*\*): not used in SGSN

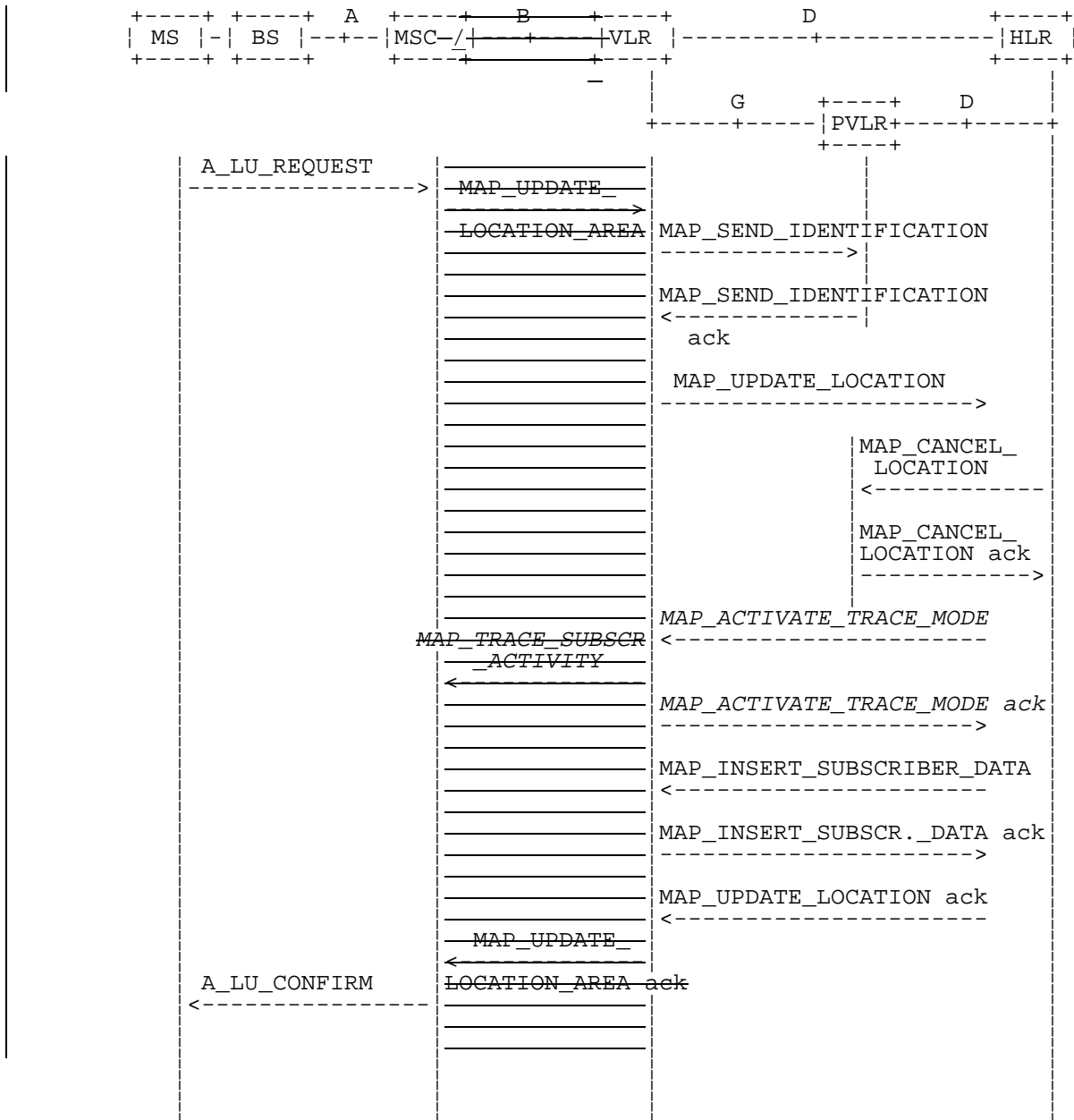


NOTE 1: For details of the procedure on the radio path, see GSM 04.08. The services shown in dotted lines indicate the trigger provided by the signalling on the radio path, and the signalling triggered on the radio path.

NOTE 2: Optional services are printed in *italics*.

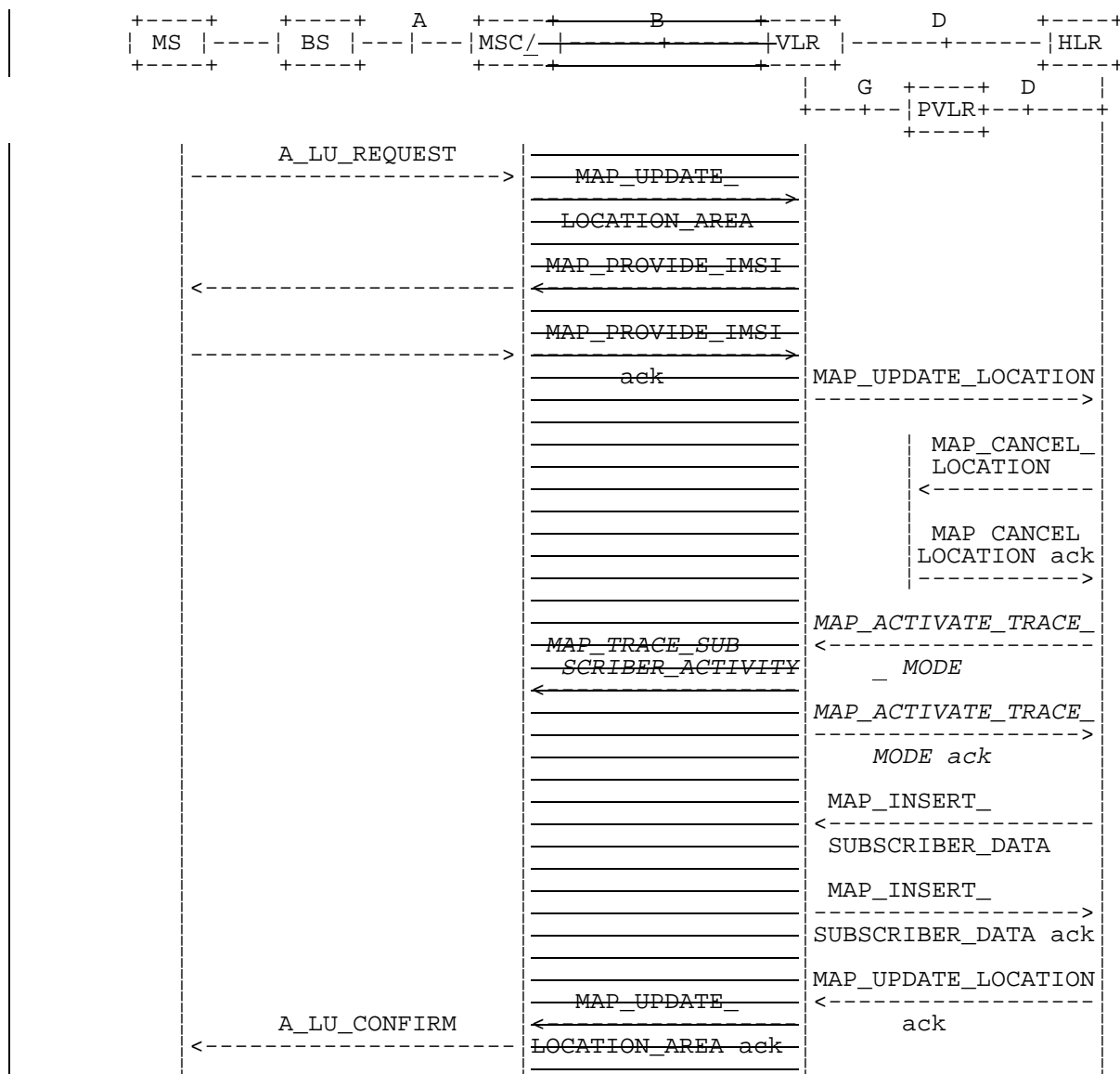
**Figure 19.1.1/1: Interface and services for location updating when roaming within a visitor location registers area (without need to update HLR)**





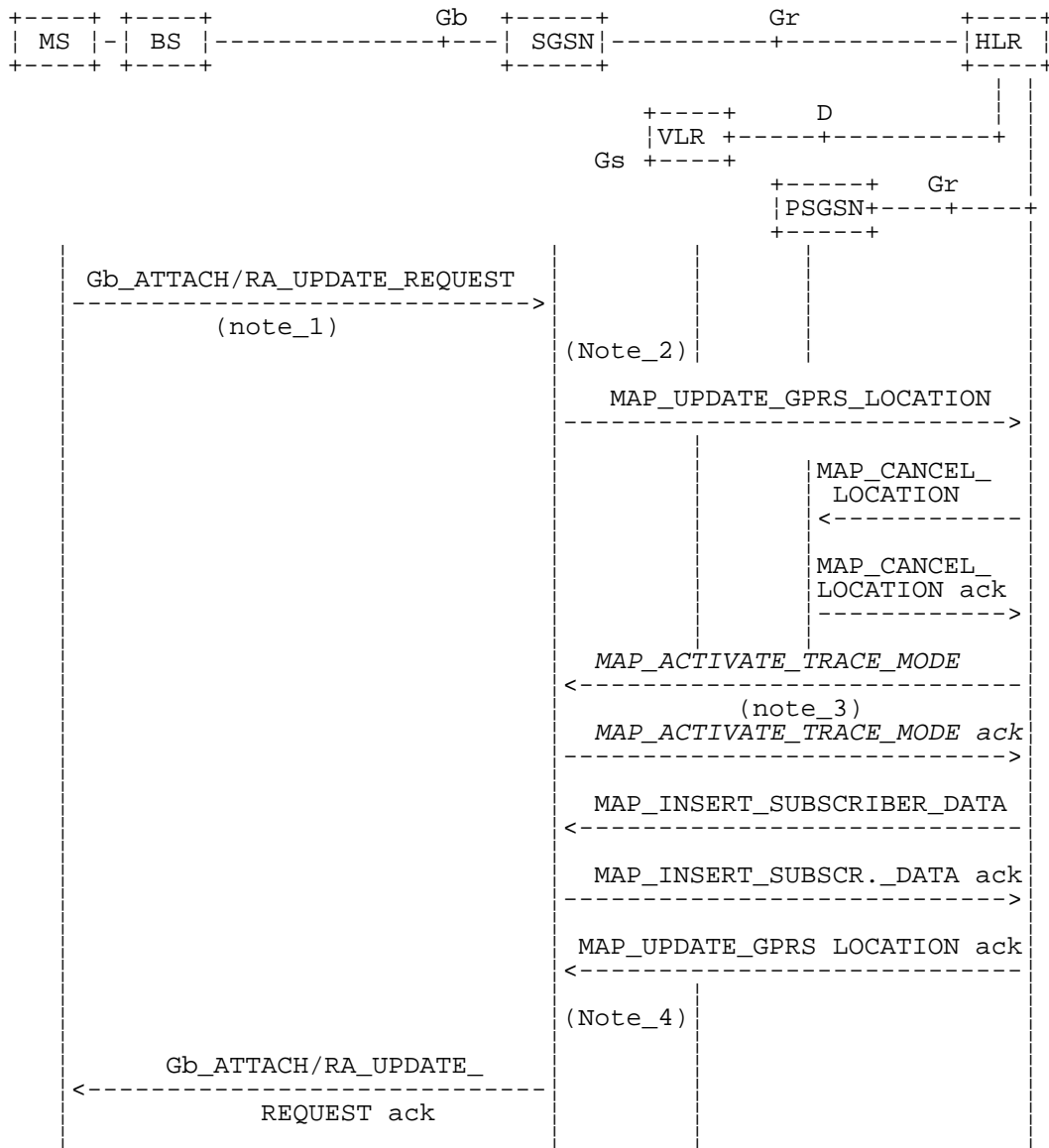
NOTE: The optional procedures in figure 19.1.1/1 apply here respectively. Procedures shown in italics are optional.

**Figure 19.1.1/2: Interface and services for location updating when changing the VLR area**



NOTE: Procedures shown in italics are optional. The optional procedures in figure 19.1.1/1 apply here respectively.

**Figure 19.1.1/3: Interface and services for location updating involving both a VLR and an HLR, when IMSI can not be retrieved from the previous VLR**



PSGSN = Previous SGSN

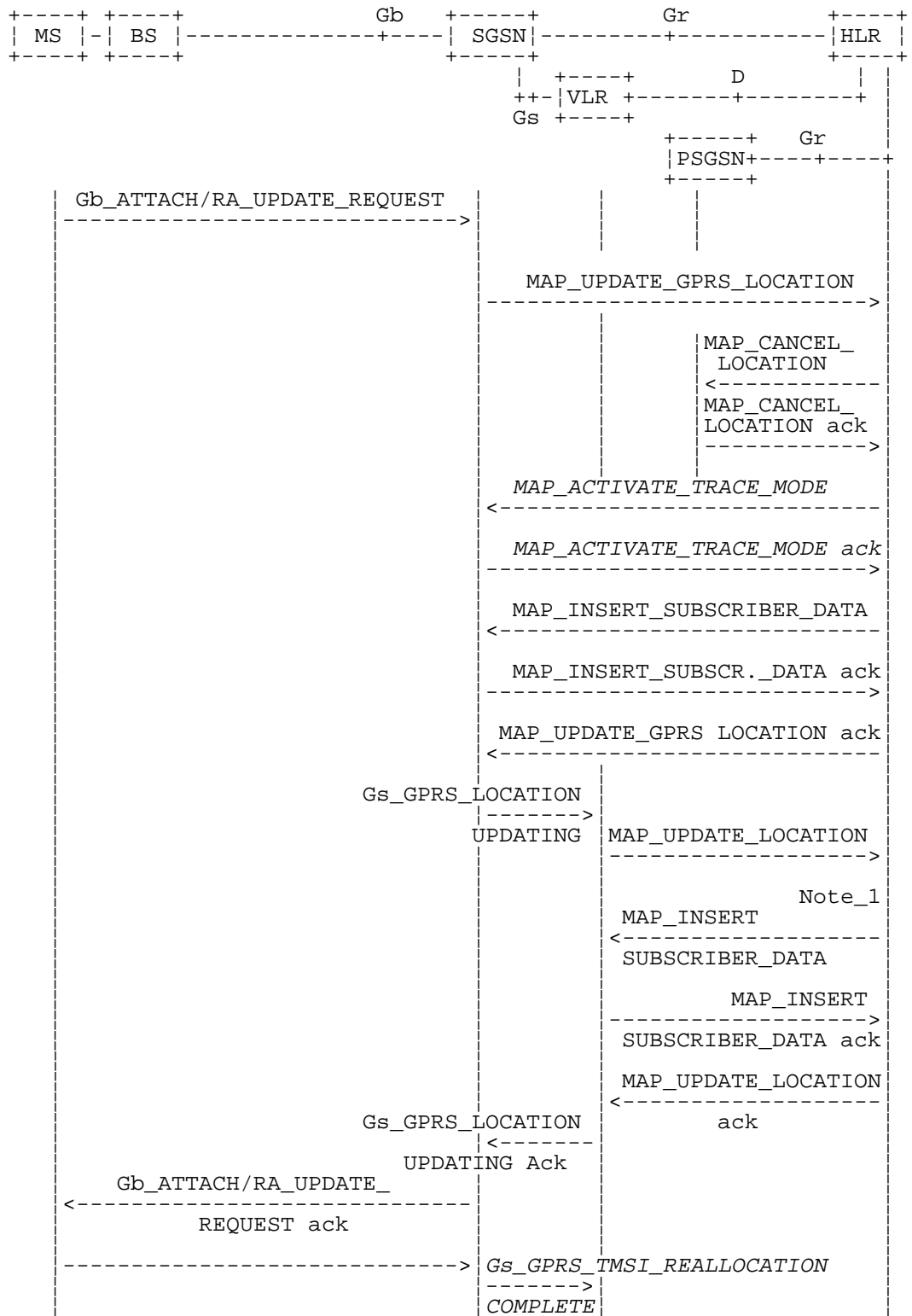
NOTE 1: For details of the procedure on the radio path, see GSM 08.18. The services shown in dotted lines indicate the trigger provided by the signalling on the radio path, and the signalling triggered on the radio path.

NOTE 2: For security functions (authentication, ciphering, IMEI check) triggering refer to GSM 03.60. MAP processes invoked for those procedures are described in section 25.

NOTE 3: Optional services are printed in *italics*.

NOTE 4: Refer to GSM 03.60 for termination of the procedure and triggering of the signalling on the Gb interface.

**Figure 19.1.1/14: Interface and services for GPRS location updating (Gs-interface not installed)**



NOTE: The optional procedures in figure 19.1.1/14 apply here respectively. For details of the procedure on the Gs-interface, see GSM 09.18.

NOTE 1: Location Cancellation procedure toward the old VLR and optional tracing activation toward the new VLR are not represented on this figure.

**Figure 19.1.1/15: Interface and services for GPRS location updating (Gs-interface installed)**

### 19.1.1.2 Detailed procedure in the MSC

Figure 19.1.1/4 shows the MSC process for location register updating, containing macro calls for:

- Receive\_Open\_Cnf — subclause 25.1;
- Authenticate\_MSC — subclause 25.5;
- Check\_IMEI\_MSC — subclause 25.6;
- Obtain\_IMSI\_MSC — subclause 25.8;
- Trace\_Subscriber\_Activity\_MSC — subclause 25.9.

For structuring purposes, the second part of the process is placed into the macro Update Location Completion MSC, which is specific to this process (see figure 19.1.1/5).

When the MSC receives an A\_LU\_REQUEST (normal location updating, periodic location updating or IMSI attach) for a subscriber via the radio path, the MSC opens a dialogue to the VLR (MAP\_OPEN request without any user specific parameters) and sends a MAP\_UPDATE\_LOCATION\_AREA request, containing the parameters provided in the A\_LU\_REQUEST by the MS or BSS (for the parameter mapping see GSM 09.10).

If the dialogue is rejected or the VLR indicates a fallback to the version Vr procedure (see Receive\_Open\_Cnf macro in subclause 25.1), the MSC will send an A\_LU\_Rej towards the MS and terminate the procedure.

If the dialogue is accepted, the VLR will process this updating request, invoking optionally the MAP\_PROVIDE\_IMSI, MAP\_TRACE\_SUBSCRIBER\_ACTIVITY, MAP\_CHECK\_IMEI or the MAP\_AUTHENTICATE services first (see subclause 19.1.1.3 for initiation conditions, clause 25 for macros defining the handling of services in the MSC). For these macros there are two possible outcomes:

- a positive outcome, in which case the process continues waiting for the MAP\_UPDATE\_LOCATION\_AREA confirmation; or
- an error is reported, in which case the process terminates (not applicable for Trace\_Subscriber\_Activity\_MSC, which has only a positive outcome).

After receiving the MAP\_UPDATE\_LOCATION\_AREA indication and handling these optional services, the VLR will decide whether a new TMSI need to be allocated to the subscriber or not.

#### Updating without TMSI reallocation

If the VLR does not reallocate the TMSI, the MSC will receive a MAP\_UPDATE\_LOCATION\_AREA confirmation next (figure 19.1.1/4).

- if there are no parameters with this primitive, updating was successful and a confirmation will be sent to the MS;
- if there is an error cause contained in the received primitive, this cause will be mapped to the corresponding cause in the confirmation sent to the MS (see GSM 09.10 for the mapping of messages and causes).

#### Updating including TMSI reallocation

This case is covered by the macro Update Location Completion MSC given in figure 19.1.1/5. The MSC will upon receipt of a MAP\_SET\_CIPHERING\_MODE request send a ciphering command towards BSS/MS. Thereafter, the MAP\_FORWARD\_NEW\_TMSI indication and the MAP\_UPDATE\_LOCATION\_AREA confirmation are received in arbitrary order, causing a confirmation on the radio path containing both new LAI and new TMSI. If the MAP\_UPDATE\_LOCATION\_AREA confirmation contains any error, the updating request is rejected towards the MS:

- the MS will confirm receipt of the new TMSI, resulting in an empty MAP\_FORWARD\_NEW\_TMSI response terminating the dialogue;
- if there is no confirmation received from the A-interface, the dialogue is terminated locally.

Before receiving a MAP\_UPDATE\_LOCATION\_AREA confirmation, the MSC may receive a MAP\_CHECK\_IMEI indication. Handling of this indication, comprising IMEI request towards the MS and IMEI checking request towards the EIR, is given in the macro description in subclause 25.6. The result may either be to return to the state Wait for TMSI or to return to terminate.

#### **Forwarding the Check SS Indication**

When the VLR receives a MAP\_FORWARD\_CHECK\_SS\_INDICATION\_Ind during the Update LOCATION Area process, this indication is relayed to the MS (see GSM 09.11 for detailed interworking) and the MSC remains in the current state.

#### **Abort handling**

If the VLR receives a MAP\_U\_ABORT, a MAP\_P\_ABORT or a premature MAP\_CLOSE indication from the VLR during the location update process, the MSC terminates the process by sending an A\_LU\_CONFIRM containing the error cause Updating Failure to the MS. If the MSC had already confirmed the location update towards the MS, the process terminates without notification towards the A interface.

If the MSC receives a MAP\_NOTICE indication, it issues a MAP\_CLOSE and terminates the A interface dialogue, and the process terminates.

When the procedure is terminated abnormally on the radio path, the dialogue towards the VLR is aborted with the appropriate diagnostic information, and the procedure terminates.

Process Update\_Location\_Area\_MSC

19.1.1\_4(1)

Figure 19.1.1/4: Location Updating in MSC

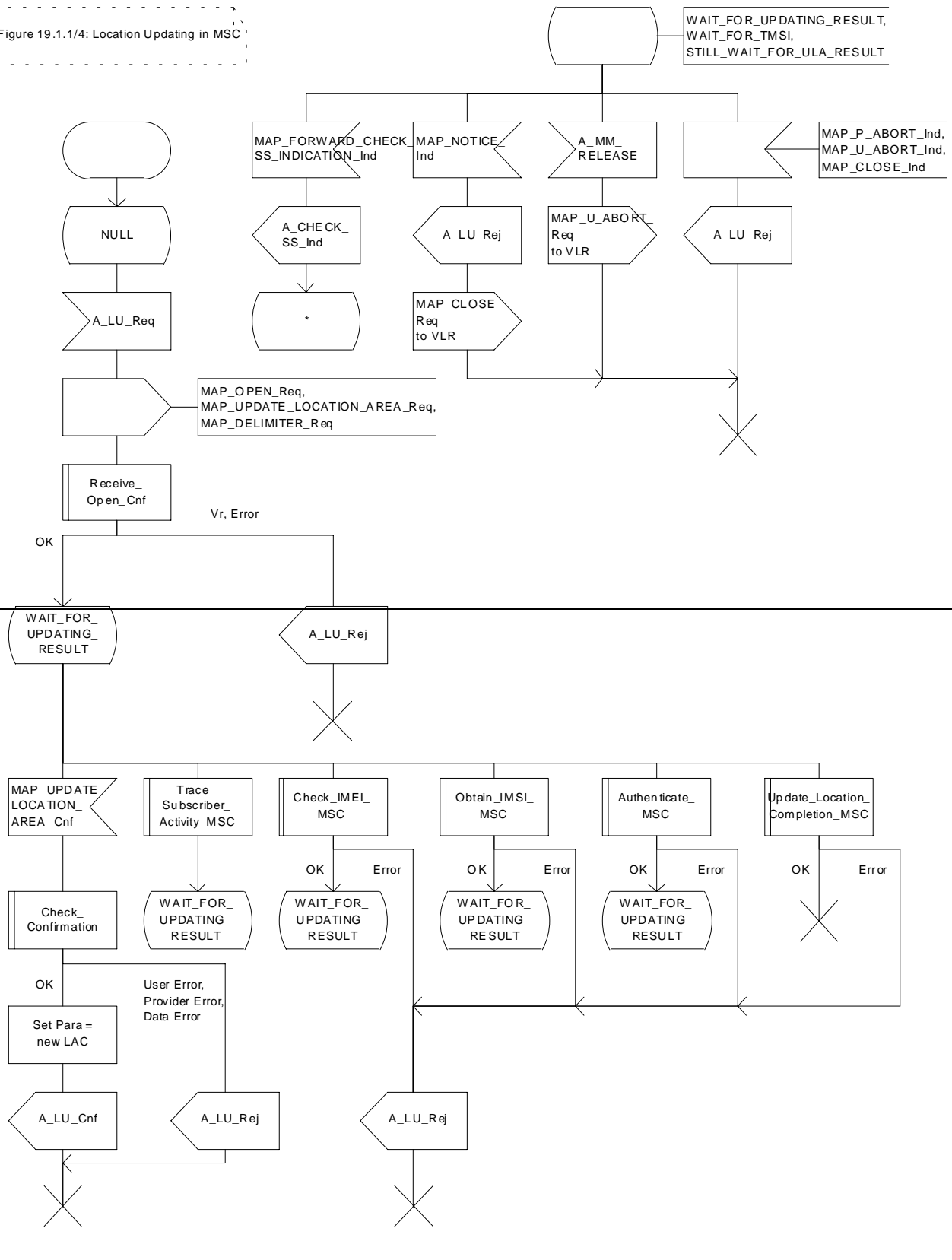


Figure 19.1.1/4: Process Update\_Location\_Area\_MSC

Macrodefinition Update\_Location\_Completion\_MSC

19.1.1\_5(1)

Figure 19.1.1/5: Macro used for Location Updating in MSC

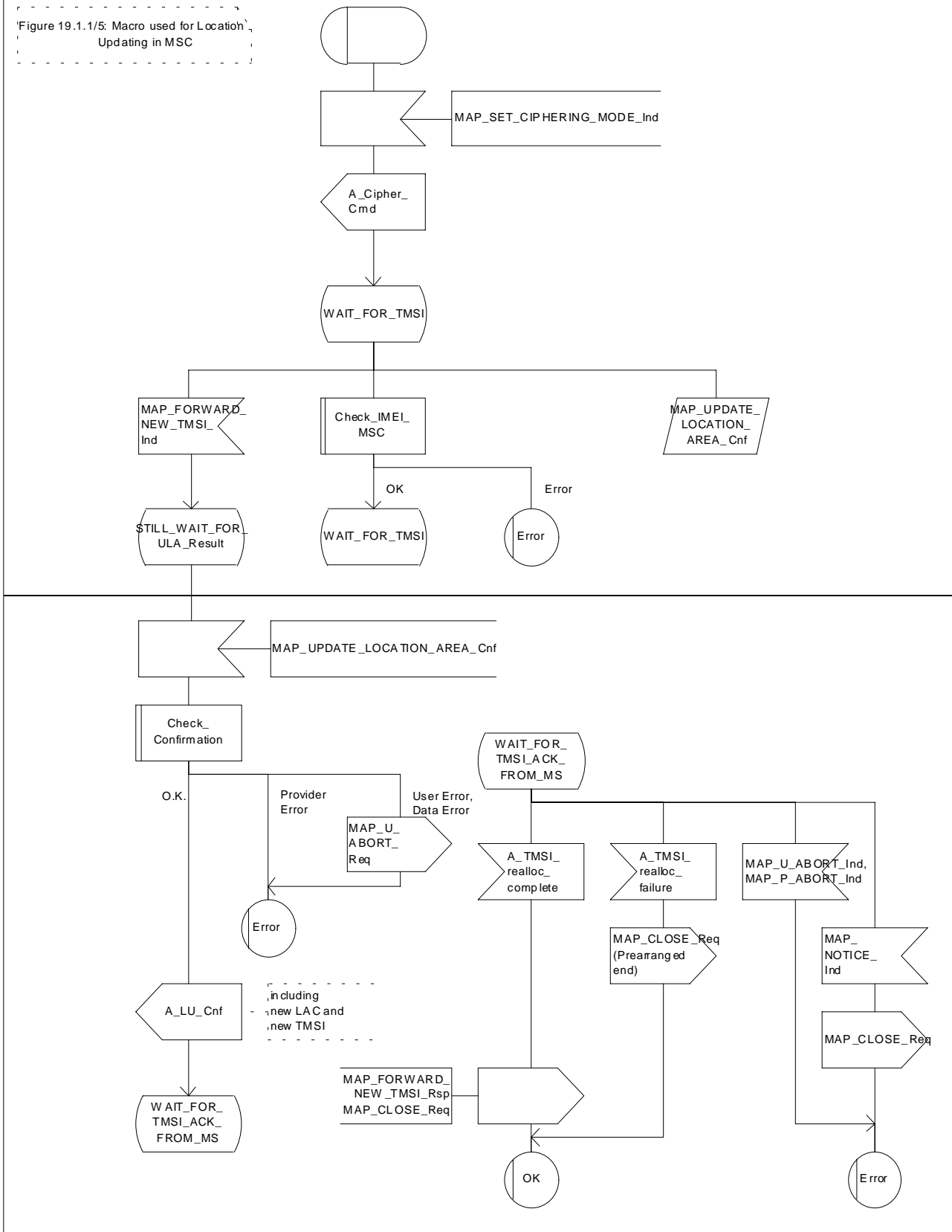


Figure 19.1.1/5: Macro Update\_Location\_Completion\_MSC



### 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 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 regional subscription data (Zone Code List) or Roaming Restriction Due To Unsupported Feature 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 data base 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.

### Abort Handling

If the VLR receives a MAP\_NOTICE indication from the MSC while waiting for a MAP service primitive, the VLR will terminate the MSC dialogue by sending a MAP\_CLOSE and any pending HLR dialogue by sending a MAP\_U\_ABORT (Remote Operations Failure), and the process is terminated.

### Updating request via the Gs interface (optional for GPRS)

If Gs-interface is installed, the VLR may receive the Gs\_GPRS\_LOCATION\_UPDATING\_Request message from the SGSN for triggering an IMSI Attach or Location Updating procedure (see GSM 03.60 and 09.18).

Figure 19.1.1/16 shows the process for handling this Gs interface message.

The process specific macro

« GPRS\_Location\_Update\_Completion\_VLR » for optional initiation of TMSI reallocation as for acknowledgement of the Gs\_GPRS\_LOCATION\_UPDATING\_Request message (see figure 19.1.1/17),

and the optional process specific macro

« VLR\_Update\_GPRS\_HLR » to update the HLR and download subscriber data from there (see figure 19.1.1/18), are invoked by this process.

On receipt of the Gs\_GPRS\_LOCATION\_UPDATING\_Request message, 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. The indicator "Confirmed by Radio Contact" is set to "Confirmed" and the location information held in the register is updated. If no VLR/SGSN association exists it is created (storage of SGSN address received) otherwise it is updated.

If the HLR is to be updated, the VLR\_Update\_GPRS\_HLR macro described below is performed, with one of the following results (see sheet 2 of figure 19.1.1/18):

- OK, if HLR updating has been completed successfully. The response will contain the HLR number as parameter. Next, the GPRS\_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 appropriate error (see GSM 09.18) is sent to the SGSN in the Gs\_GPRS\_LOCATION\_UPDATING Reject. The Subscriber Data are deleted in the VLR.
- if Roaming Not Allowed was qualified by the parameter Operator Determined Barring, the appropriate error (see GSM 09.18) is sent in the Gs\_GPRS\_LOCATION\_UPDATING Reject to the SGSN. 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 appropriate error (see GSM 09.18) is sent in the Gs\_GPRS\_LOCATION\_UPDATING Reject.
- Procedure error, if there occurs some other error during HLR updating (e.g. abort of the connection to HLR). In this case the appropriate error (see GSM 09.18) is sent in the Gs\_GPRS\_LOCATION\_UPDATING Reject.

#### **The macro GPRS 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 19.1.1/17):

- if the target LA is not allowed for the subscriber due to national roaming restrictions, the appropriate error (see GSM 09.18) is sent in the Gs\_GPRS\_LOCATION\_UPDATING Reject towards the SGSN.

The subscriber data are not deleted from VLR, to avoid unnecessary HLR updating when roaming into other LAs of the same MSC/VLR. 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 regional subscription data (Zone Code List) or Roaming Restriction Due To Unsupported Feature stored in the VLR, the appropriate error (see GSM 09.18) is returned to the SGSN in the Gs\_GPRS\_LOCATION\_UPDATING Reject.

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 the TMSI within the Gs\_GPRS\_LOCATION\_UPDATING Accept message and Gs\_GPRS\_TMSI\_REALLOCATION\_Complete is expected.
- if TMSI reallocation is not required, the VLR sends the Gs\_GPRS\_LOCATION\_UPDATING Accept message to the SGSN.

#### **The macro VLR Update GPRS HLR**

This macro is invoked by the VLR process for location updating (see GSM 03.60). 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 19.1.1/18) 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 data base 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 not be relayed to the SGSN.
- 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.

Process Update\_Location\_Area\_VLR

19.1.1\_6.1(4)

Figure 19.1.1/6: Location updating in VLR

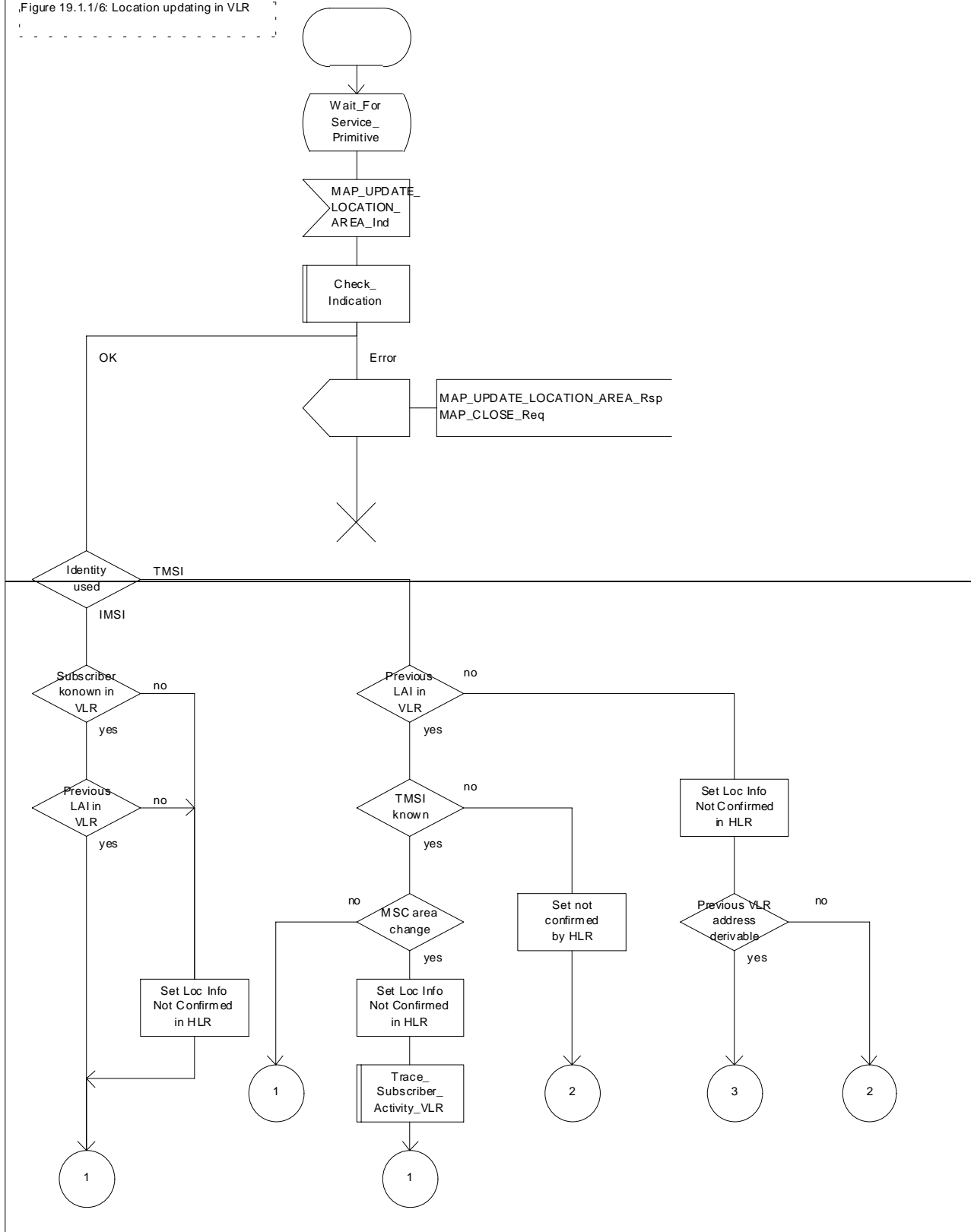


Figure 19.1.1/6 (sheet 1 of 4): Process Update\_Location\_Area\_VLR



Process Update\_Location\_Area\_VLR

19.1.1\_6.2(4)

Figure 19.1.1/6: Location updating in VLR

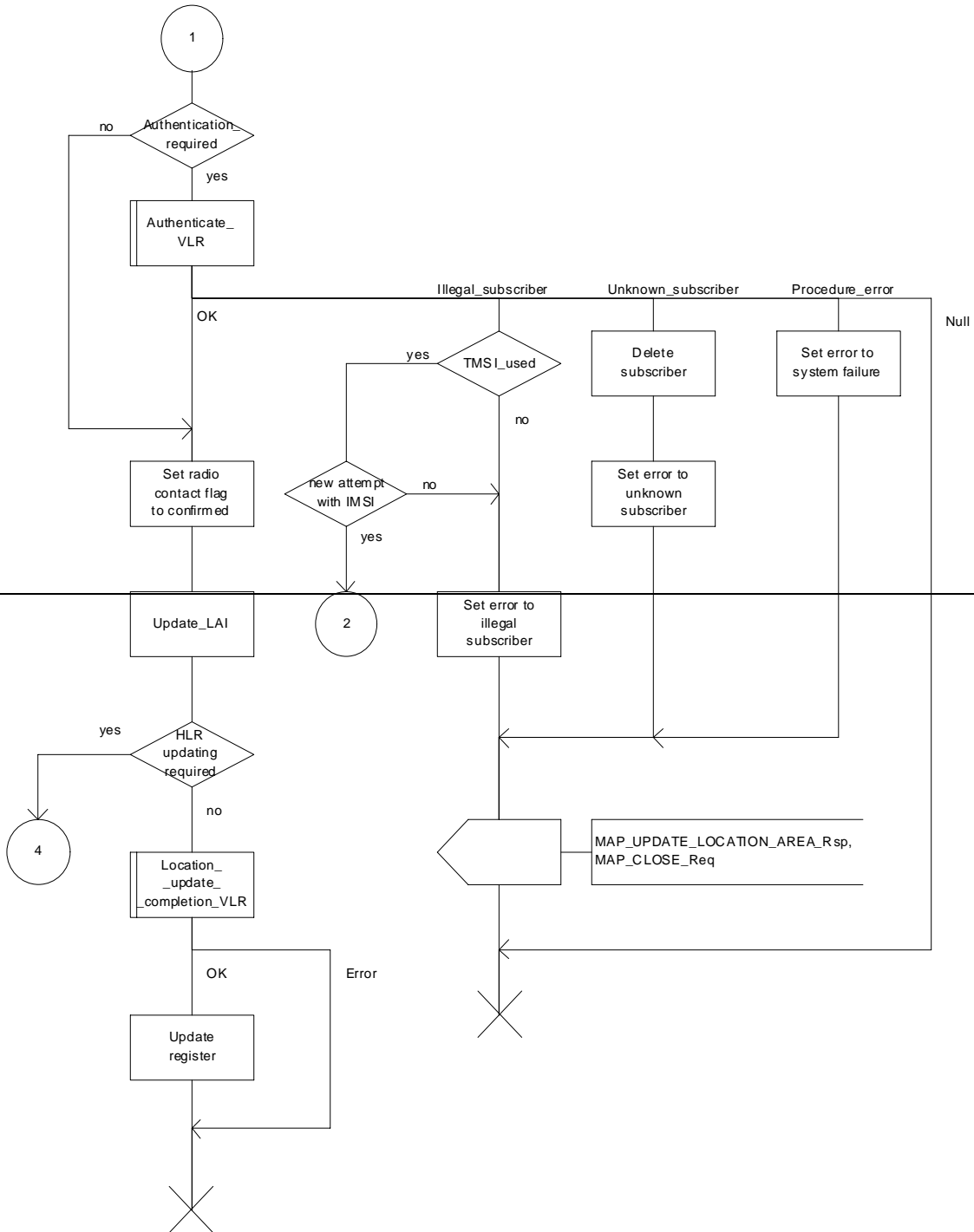


Figure 19.1.1/6 (sheet 2 of 4): Process Update\_Location\_Area\_VLR

Process Update\_Location\_Area\_VLR

19.1.1\_6.3(4)

Figure 19.1.1/6: Location updating in VLR

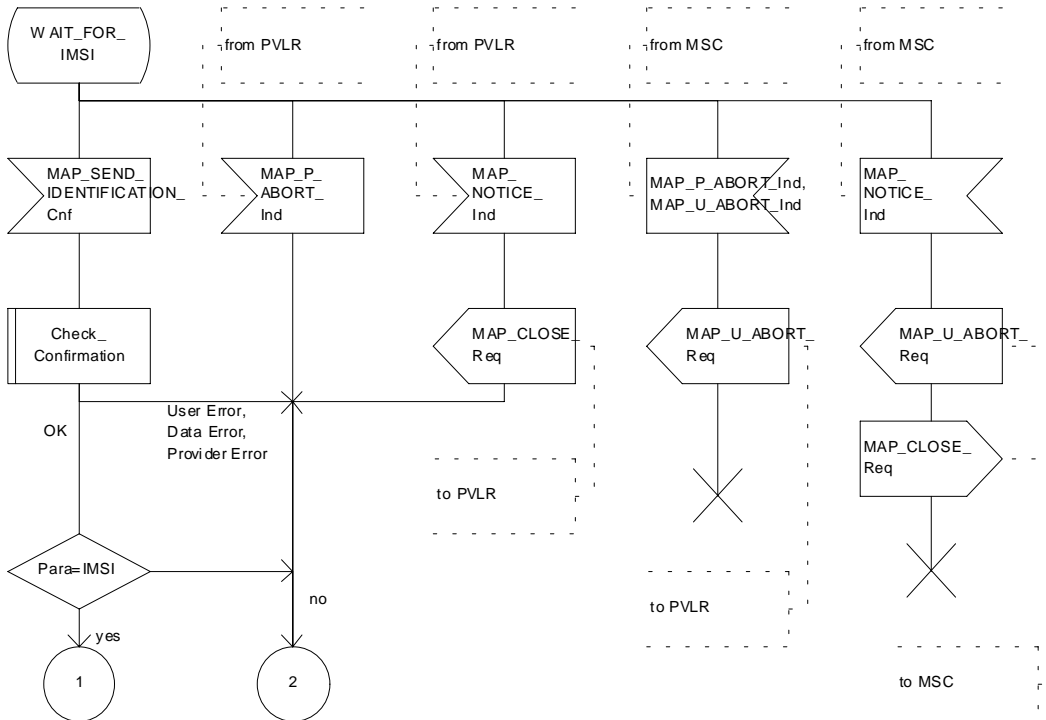
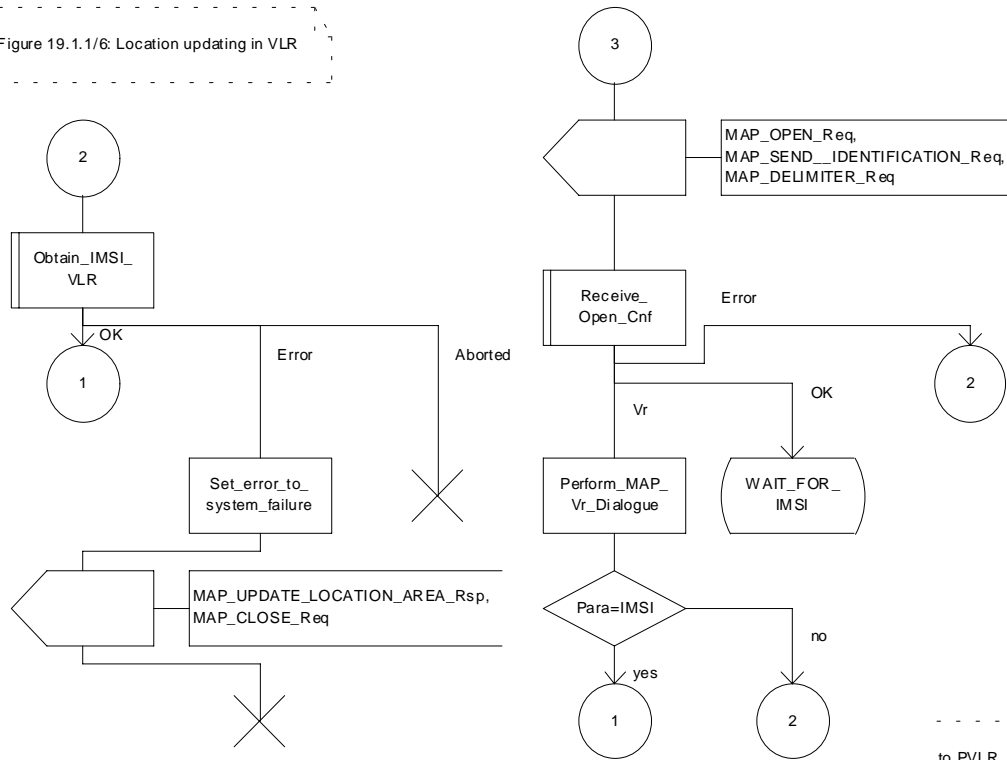


Figure 19.1.1/6 (sheet 3 of 4): Process Update\_Location\_Area\_VLR

### Process Update\_Location\_Area\_VLR

19.1.1\_6.4(4)

Figure 19.1.1/6: Location updating in VLR

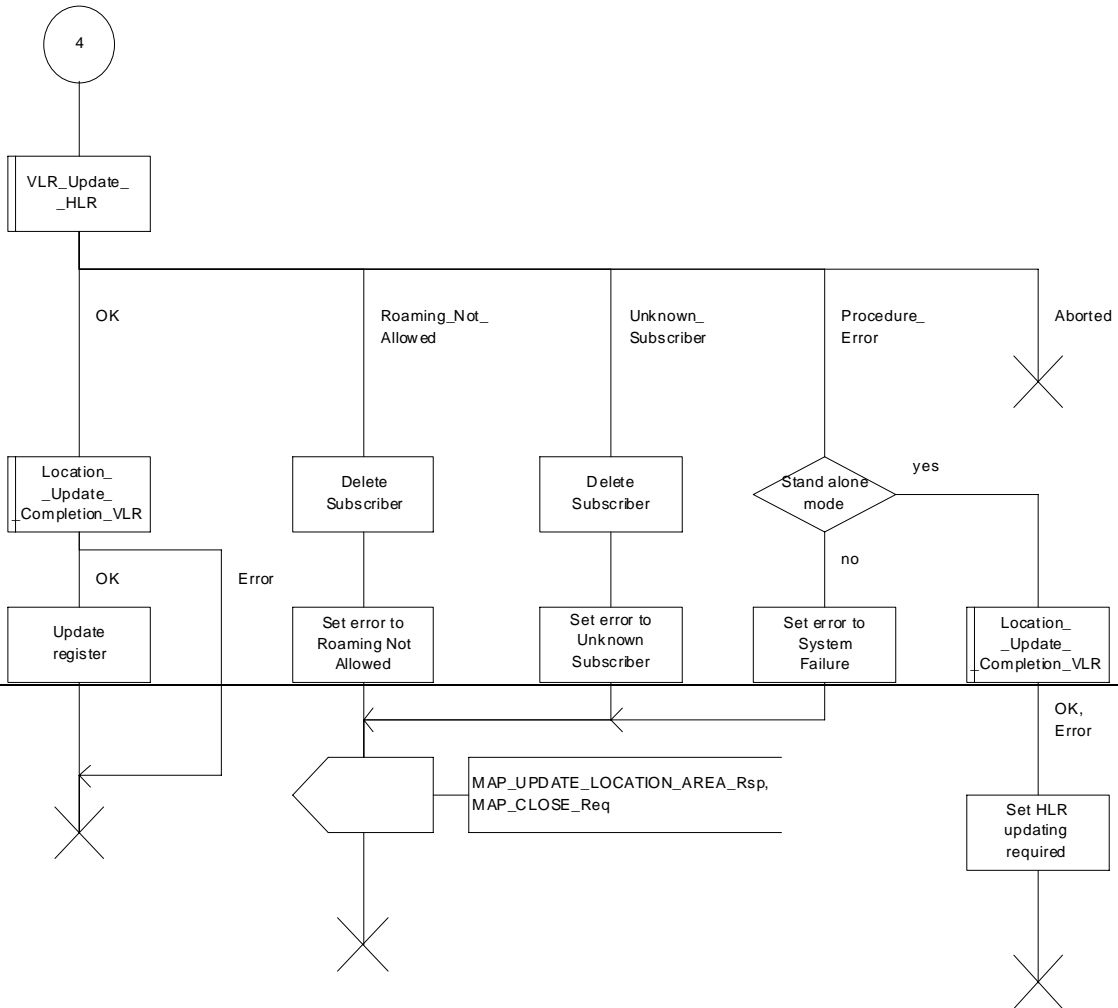
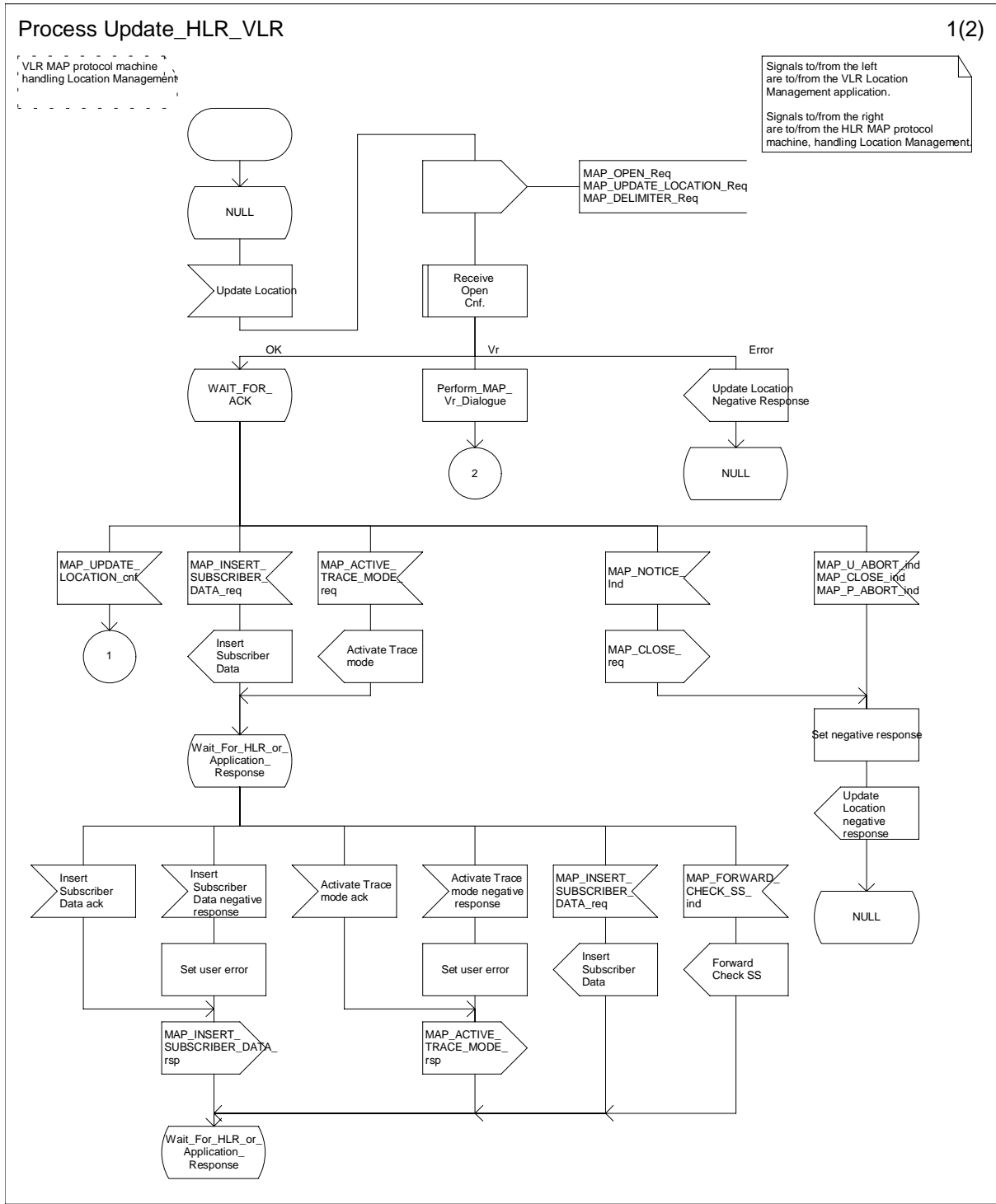


Figure 19.1.1/6 (sheet 4 of 4): Process Update\_Location\_Area\_VLR



**Figure 19.1.1/XX (sheet 1 of 2): Process Update HLR VLR**

Process Update\_HLR\_VLR

2(2)

VLR MAP protocol machine  
handling Location Management

Signals to/from the left  
are to/from the VLR Location  
Management application.  
Signals to/from the right  
are to/from the HLR MAP protocol  
machine, handling Location Management.

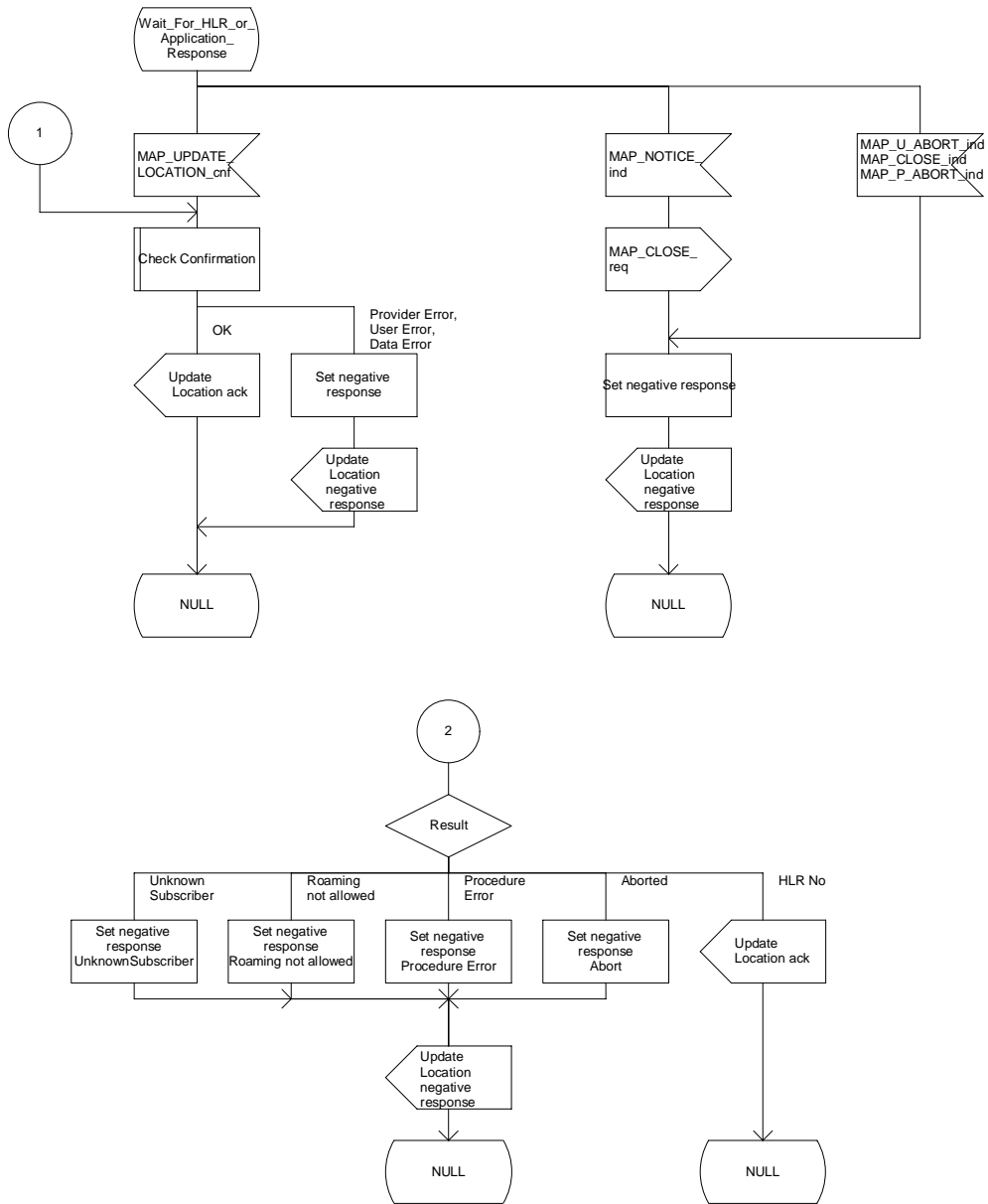
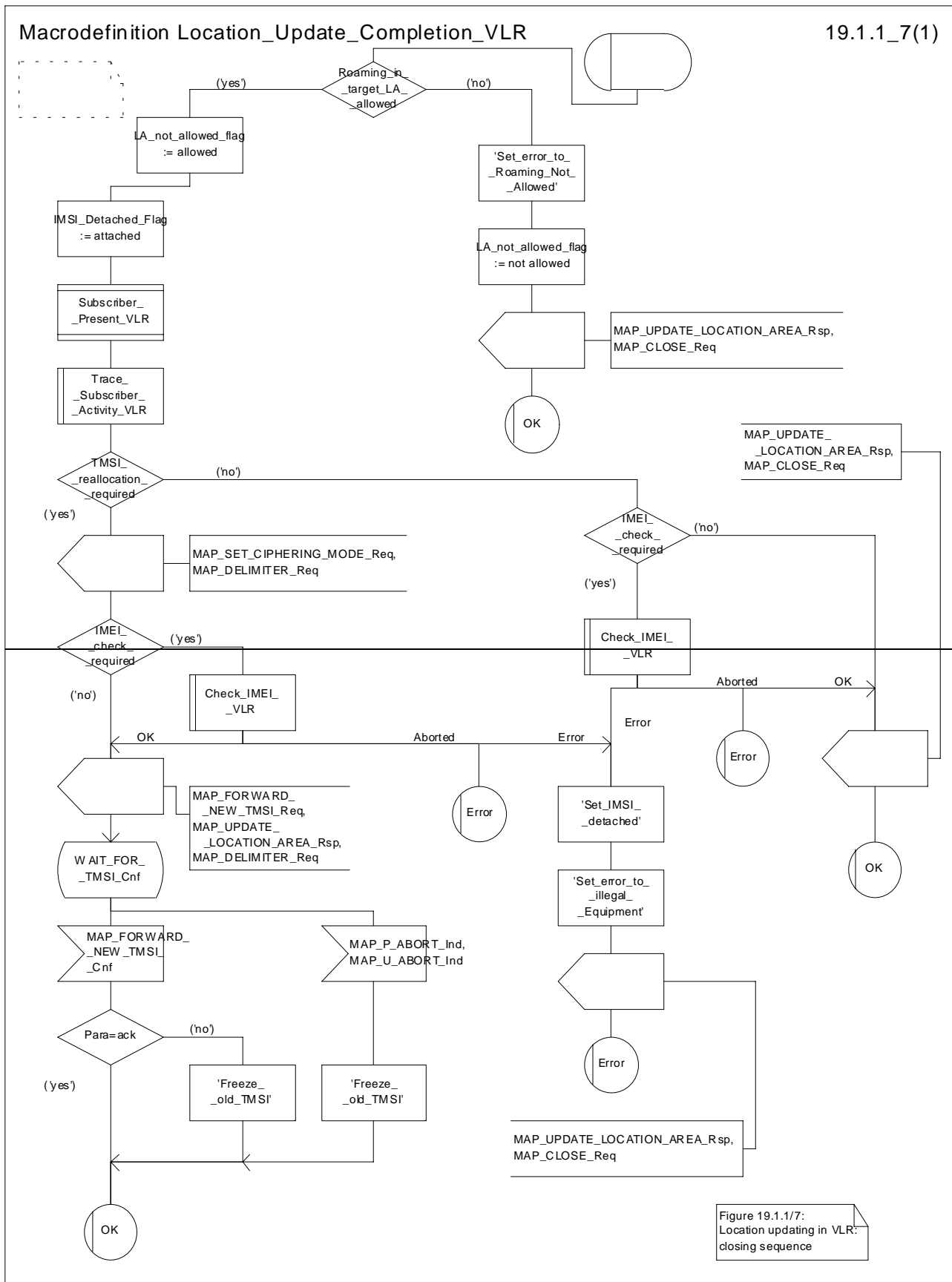


Figure 19.1.1/XX (sheet 2 of 2): Process Update\_HLR\_VLR



**Figure 19.1.1/7: Macro Location\_Update\_Completion\_VLR**

Macrodefinition VLR\_Update\_HLR

19.1.1\_8.1(2)

Figure 19.1.1/8:  
HLR updating in VLR

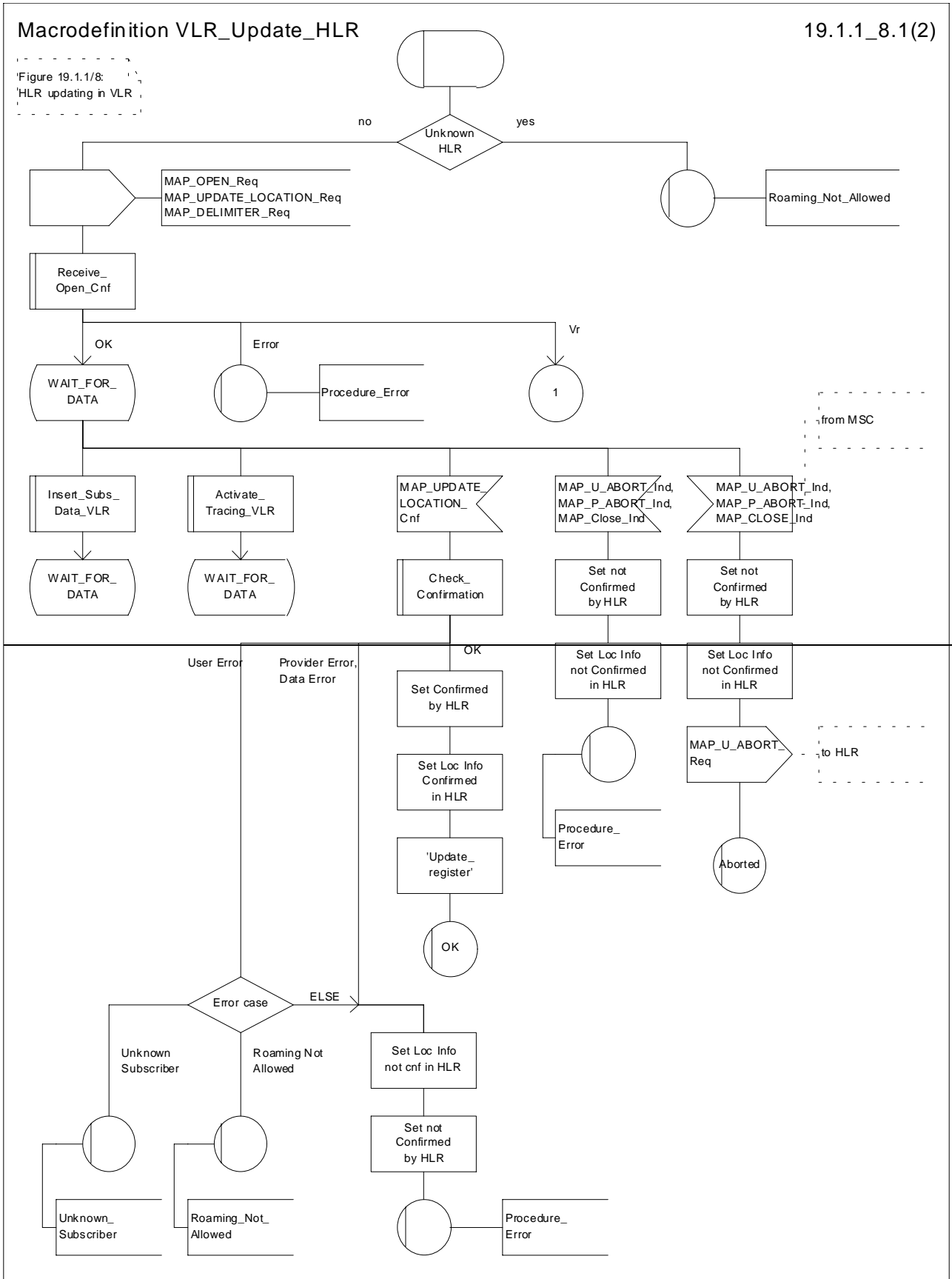


Figure 19.1.1/8 (sheet 1 of 2): Macro VLR\_Update\_HLR

Macrodefinition VLR\_Update\_HLR

19.1.1\_8.2(2)

Figure 19.1.1/8:  
HLR updating in VLR

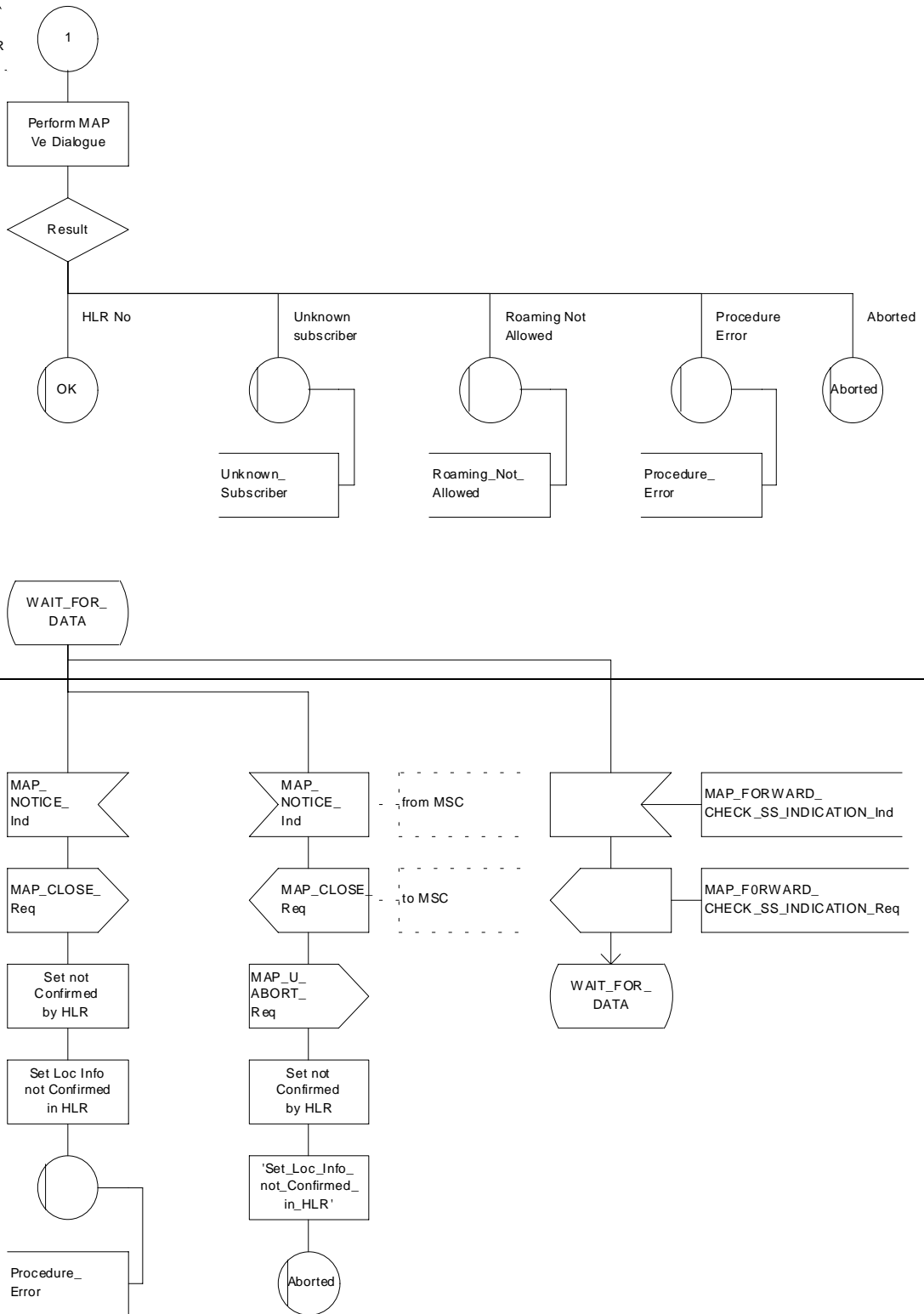


Figure 19.1.1/8 (sheet 2 of 2): Macro VLR\_Update\_HLR



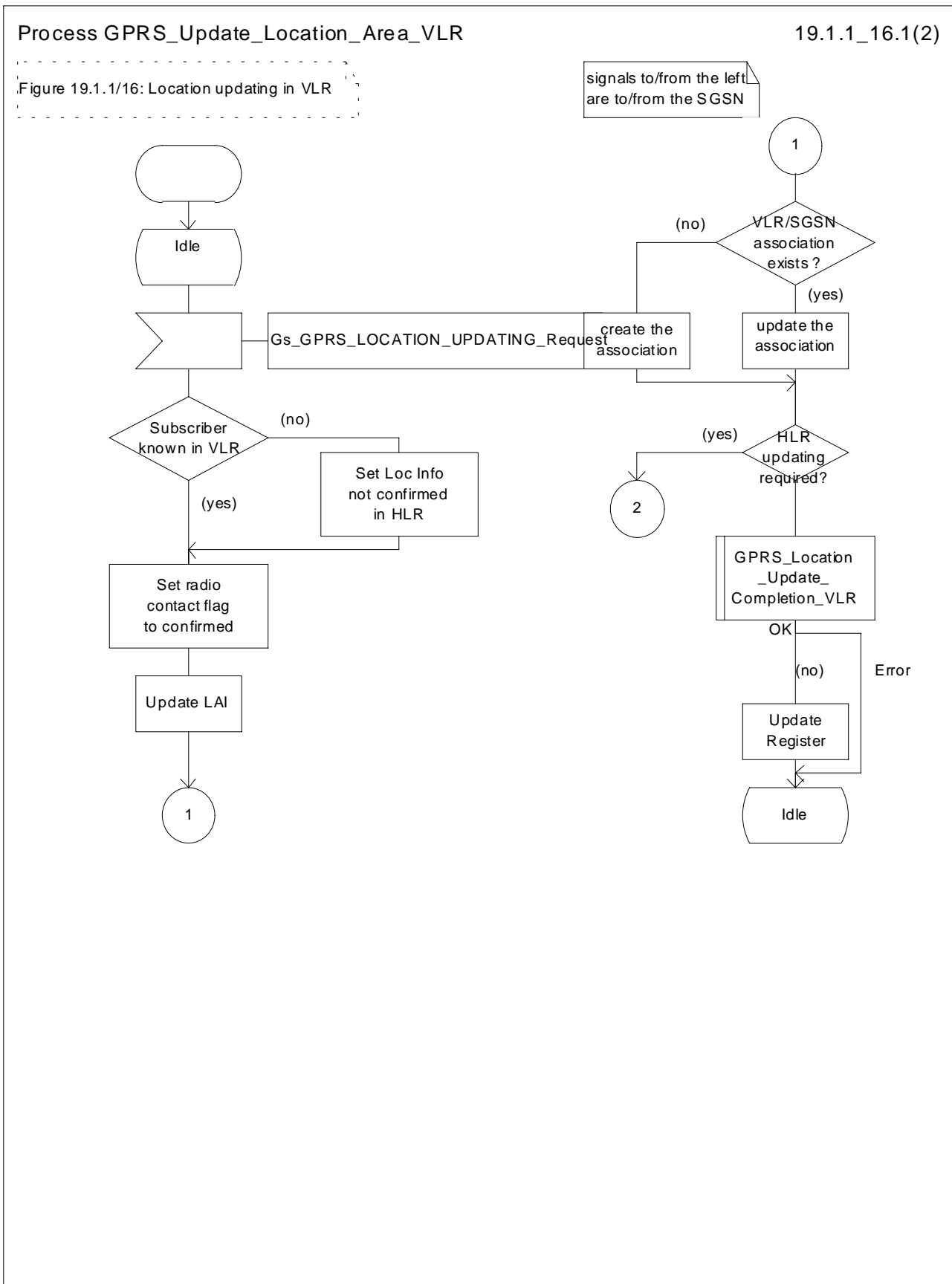


Figure 19.1.1/16 (sheet 1 of 2): Process GPRS\_Update\_Location\_Area\_VLR

Process GPRS\_Update\_Location\_Area\_VLR

19.1.1\_16.2(2)

Figure 19.1.1/16: Location updating in VLR

Signals to/from the left are to/from the SGSN

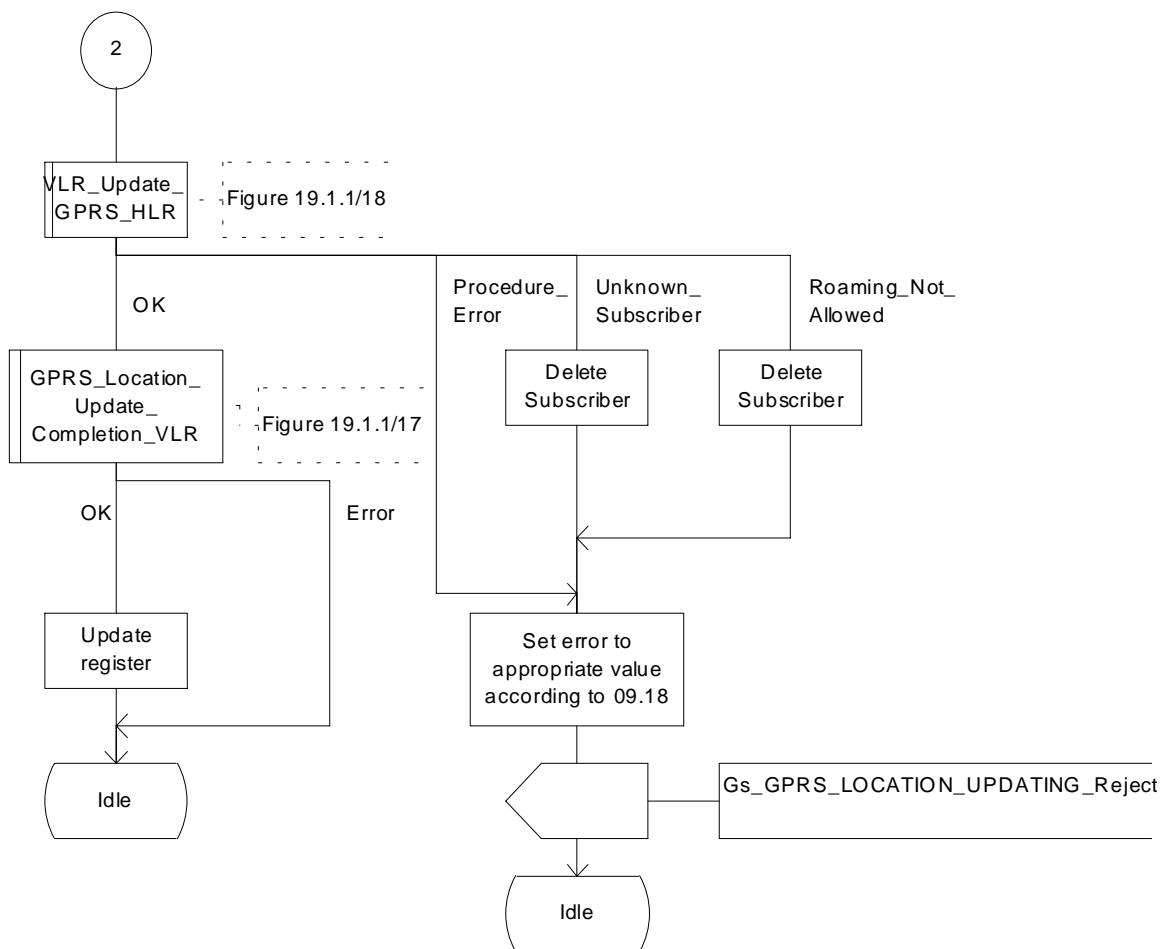


Figure 19.1.1/16 (sheet 2 of 2): Process GPRS\_Update\_Location\_Area\_VLR

Macrodefinition GPRS\_Location\_Update\_Completion\_VLR

19.1.1\_17(1)

Figure 19.1.1/17:  
'Location updating in VLR for GPRS;  
closing sequence

Signals to/from the left  
are to/from the SGSN

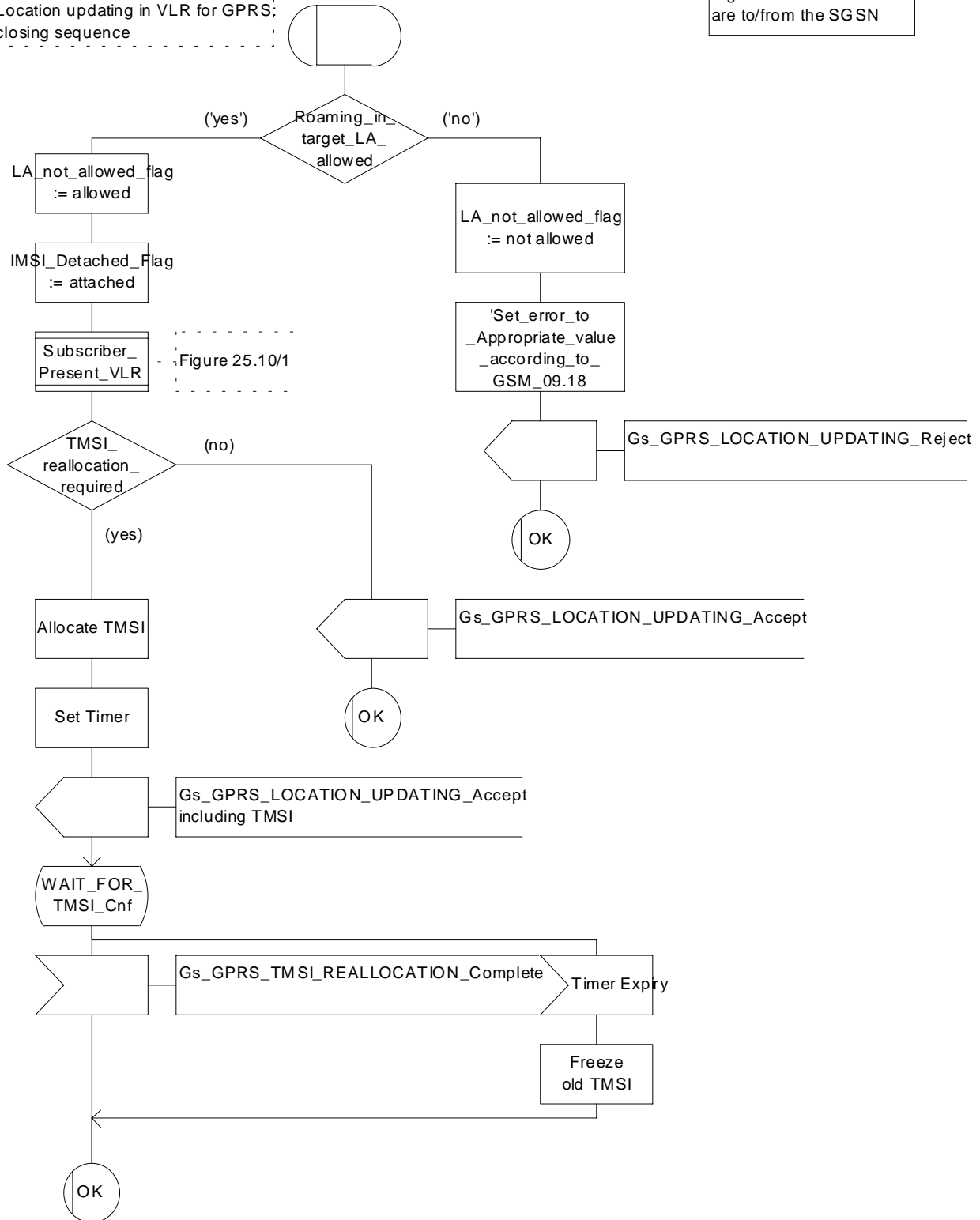


Figure 19.1.1/17: Macro GPRS\_Location\_Update\_Completion\_VLR

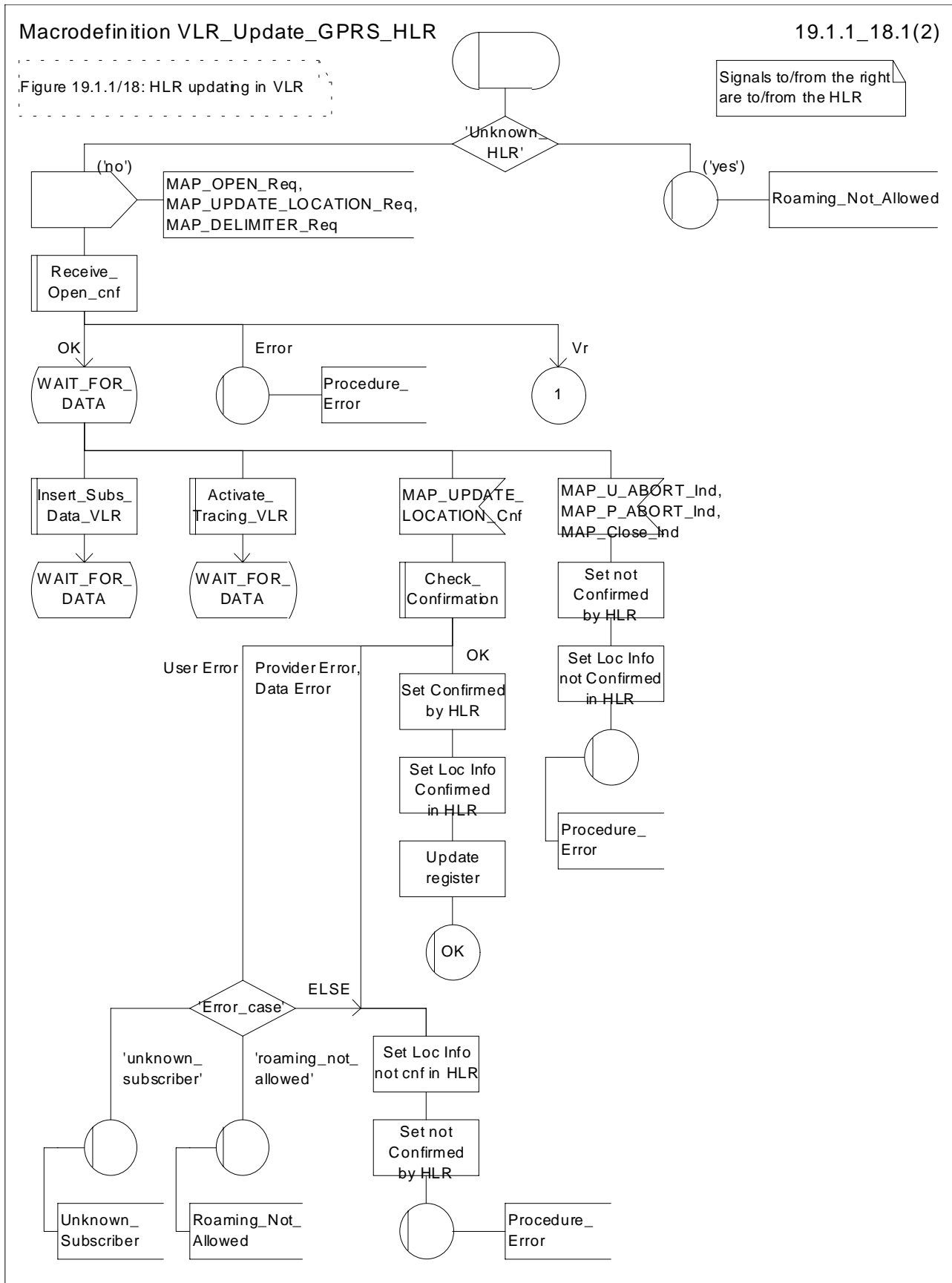


Figure 19.1.1/18 (sheet 1 of 2): Macro VLR\_Update\_GPRS\_HLR

Macrodefinition VLR\_Update\_GPRS\_HLR

19.1.1\_18.2(2)

Figure 19.1.1/18: HLR updating in VLR

Signals to/from the right are to/from the HLR

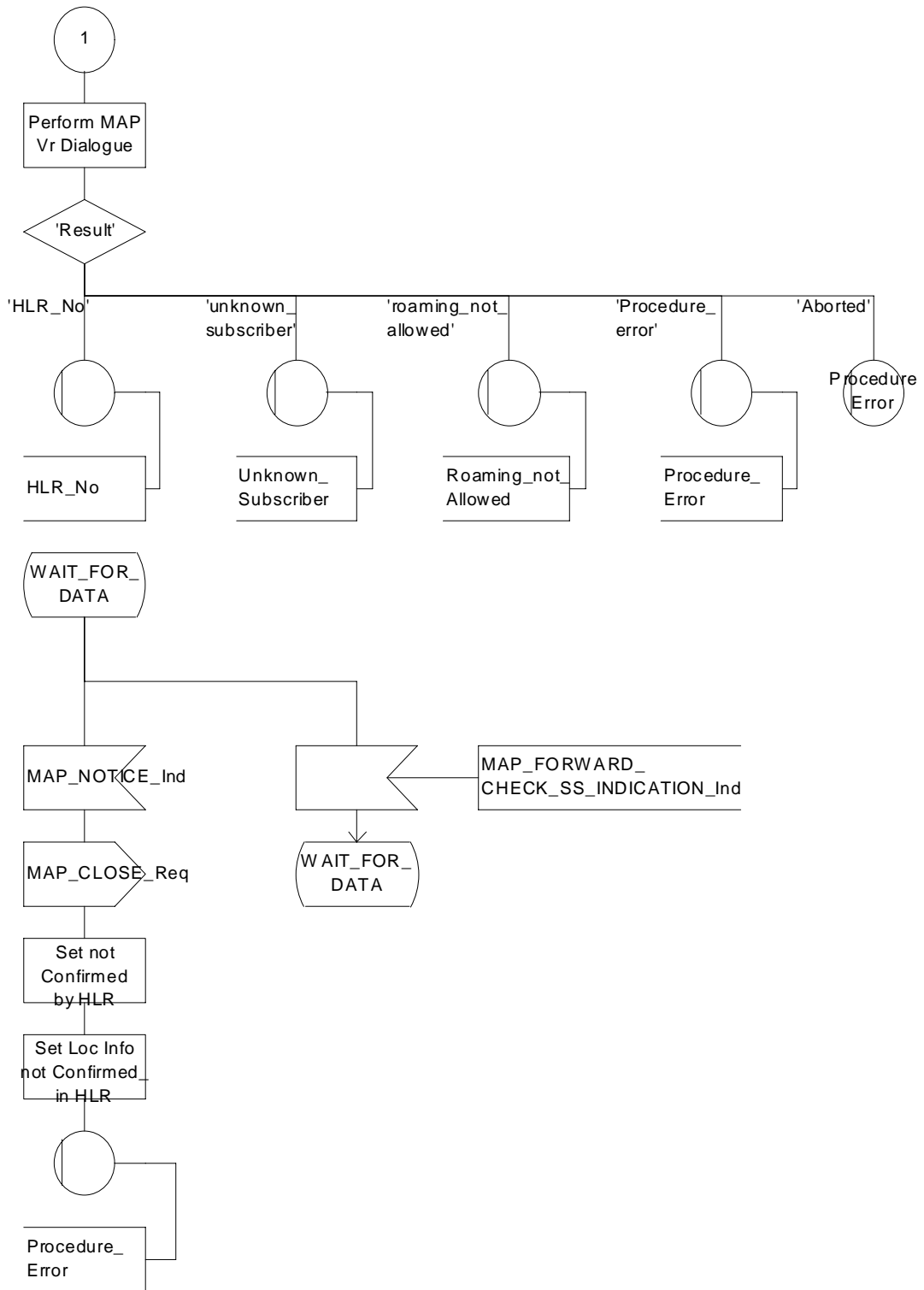


Figure 19.1.1/18 (sheet 2 of 2): Macro VLR\_Update\_GPRS\_HLR

#### 19.1.1.4 Detailed procedure in the HLR

When addressed by the VLR, the following macros are used by the process `Update_Location_HLR`:

- `Receive_Open_Ind`, defined in subclause 25.1;
- `Check_indication`, defined in subclause 25.2;
- `Insert_Subs_Data_Framed_HLR`, described in subclause 19.4.1;
- `Control_Tracing_HLR`, described in subclause 25.9;

and the processes `Cancel_Location_HLR` (see subclause 19.1.2) and `Subscriber_Present_HLR` (see subclause 19.1.1.7) are invoked.

The location updating process in the HLR is activated by receipt of a `MAP_UPDATE_LOCATION` indication (see figure 19.1.1/9):

- if there is a parameter problem in the indication, the error `Unexpected Data Value` is returned in the `MAP_UPDATE_LOCATION` response (see `Check_indication` macro defined in subclause 25.2); if the subscriber is not known in the HLR, the error `Unknown Subscriber` is returned in the response. In either case the process terminates;
- if `Network Access Mode` is set to "GPRS only" the error `Unknown Subscriber` is returned in the response. The process terminates;
- tracing shall be set to deactivate in the VLR
- if the VLR address received in the `MAP_UPDATE_LOCATION` indication differs from the one actually stored against the subscriber, the `Cancel_Location_HLR` process is started to cancel the subscriber data in the stored VLR (see subclause 19.1.2).

The next action will be to check whether the subscriber is allowed to roam into the PLMN indicated by the VLR Number given in the `MAP_UPDATE_LOCATION` indication:

- if the subscriber is not allowed to roam into the PLMN, the error `Roaming not Allowed with cause PLMN Roaming Not Allowed` is returned in the `MAP_UPDATE_LOCATION` response, and the routing information stored (VLR number, MSC Number, LMSI) is deleted (deregistration);
- otherwise the HLR database will be updated with information received in the indication. The HLR sets the "MS purged for non GPRS" flag to False and checks whether tracing is required for that subscriber. This is handled by the macro `Control_Tracing_HLR` described in subclause 25.9.

Thereafter, the macro `Insert_Subs_Data_Framed_HLR` described in subclause 19.4.1 is invoked. The outcome of this macro may be:

- aborted, in which case the process terminates;
- error, in which case the error `System Failure` is returned in the `MAP_UPDATE_LOCATION` response and the process terminates;
- OK, indicating successful outcome of downloading the subscriber data to the VLR.

The `SUBSCRIBER_PRESENT_HLR` process is then started to alert the Short Message Service Centre, if required (see subclause 19.1.7). Additionally, the `MAP_FORWARD_CHECK_SS_INDICATION` request is sent to inform the subscriber about an uncertain state of his SS Data if this is needed due to previous HLR restoration (use of this service may be omitted as an HLR operator option).

The HLR number is then returned in the `MAP_UPDATE_LOCATION` response.

In all cases where the HLR sends a `MAP_UPDATE_LOCATION` response to the VLR, the dialogue towards the VLR is terminated by a `MAP_CLOSE` request with parameter `Release Method` indicating `Normal Release`.

Finally the process `Update_Location_HLR` sends a "Location updating complete" message to the process `CCBS_Coordinator_HLR` (specified in GSM 03.93 [107]) and the process terminates.

When addressed by the SGSN, the following macros are used by the process Update\_GPRS\_Location\_HLR:

- Receive\_Open\_indication, defined in subclause 25.1;
- Check\_indication, defined in subclause 25.2;
- Insert\_Subs\_Data\_In\_SGSN\_Framed\_HLR, described in subclause 19.4.x;
- Control\_Tracing\_HLR\_with\_SGSN, described in subclause 25.9;

and the processes Cancel\_Location\_HLR (see subclause 19.1.2) and Subscriber\_Present\_HLR (see subclause 19.1.1.7) are invoked.

The location updating process in the HLR is activated by receipt of a MAP\_UPDATE\_GPRS\_LOCATION indication (see figure 19.1.1/19):

- if there is a parameter problem in the indication, the error Unexpected Data Value is returned in the MAP\_UPDATE\_LOCATION response (see Check\_indication macro defined in subclause 25.2); if the subscriber is not known in the HLR, the error Unknown Subscriber (with diagnostic value set to "Imsi Unknown") is returned in the response. In either case the process terminates;
- if Network Access Mode is set to "non-GPRS only" the error Unknown Subscriber (with diagnostic value set to "Gprs Subscription Unknown") is returned in the response. The process terminates;
- tracing shall be set to deactivate in the SGSN.
- if the SGSN number received in the MAP\_UPDATE\_GPRS\_LOCATION indication differs from the one actually stored against the subscriber, the Cancel\_Location\_HLR process is started to cancel the subscriber data in the stored SGSN (see subclause 19.1.2).

The next action will be to check whether the subscriber is allowed to roam into the PLMN indicated by the SGSN Number given in the MAP\_UPDATE\_GPRS\_LOCATION indication:

- if the subscriber is not allowed to roam into the PLMN, the error Roaming not Allowed with cause PLMN Roaming Not Allowed or 'Operator determined Barring', depending on the case, is returned in the MAP\_UPDATE\_GPRS\_LOCATION response, and the routing information stored (SGSN number) is deleted (deregistration);
- otherwise the HLR database will be updated with information received in the indication. The HLR sets the "MS purged for GPRS" flag to False and checks whether tracing is required for that subscriber. This is handled by the macro Control\_Tracing\_HLR-with\_SGSN described in subclause 25.9.

Thereafter, the macro Insert\_Subs\_Data\_In\_SGSN\_Framed\_HLR described in subclause 19.4.x is invoked. The outcome of this macro may be:

- aborted, in which case the process terminates;
- error, in which case the error System Failure is returned in the MAP\_UPDATE\_GPRS\_LOCATION response and the process terminates;
- OK, indicating successful outcome of downloading the subscriber data to the SGSN.

The SUBSCRIBER\_PRESENT\_HLR process is then started to alert the Short Message Service Centre, if required (see subclause 19.1.7).

Finally the HLR number is returned in the MAP\_UPDATE\_GPRS\_LOCATION response.

In all cases where the HLR sends a MAP\_UPDATE\_GPRS\_LOCATION response to the SGSN, the dialogue towards the SGSN is terminated by a MAP\_CLOSE request with parameter Release Method indicating Normal Release.

Process Update\_Location\_HLR

19.1.1\_9.1(2)

Figure 19.1.1/9:  
Location Updating in the HLR

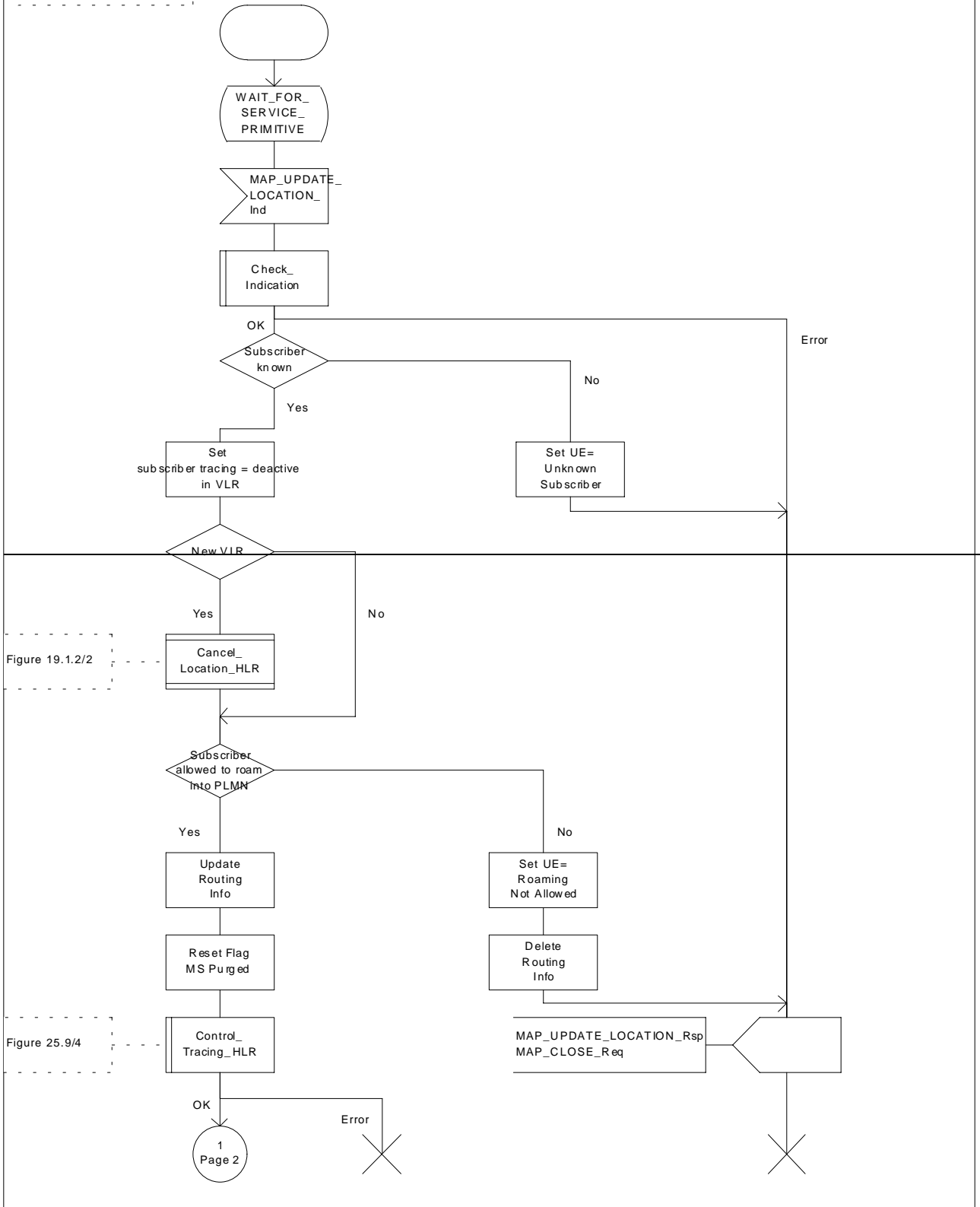


Figure 19.1.1/9 (sheet 1 of 2): Process Update\_Location\_HLR



Process Update\_Location\_HLR

19.1.1\_9.2(2)

Figure 19.1.1/9:  
Location Updating in the HLR

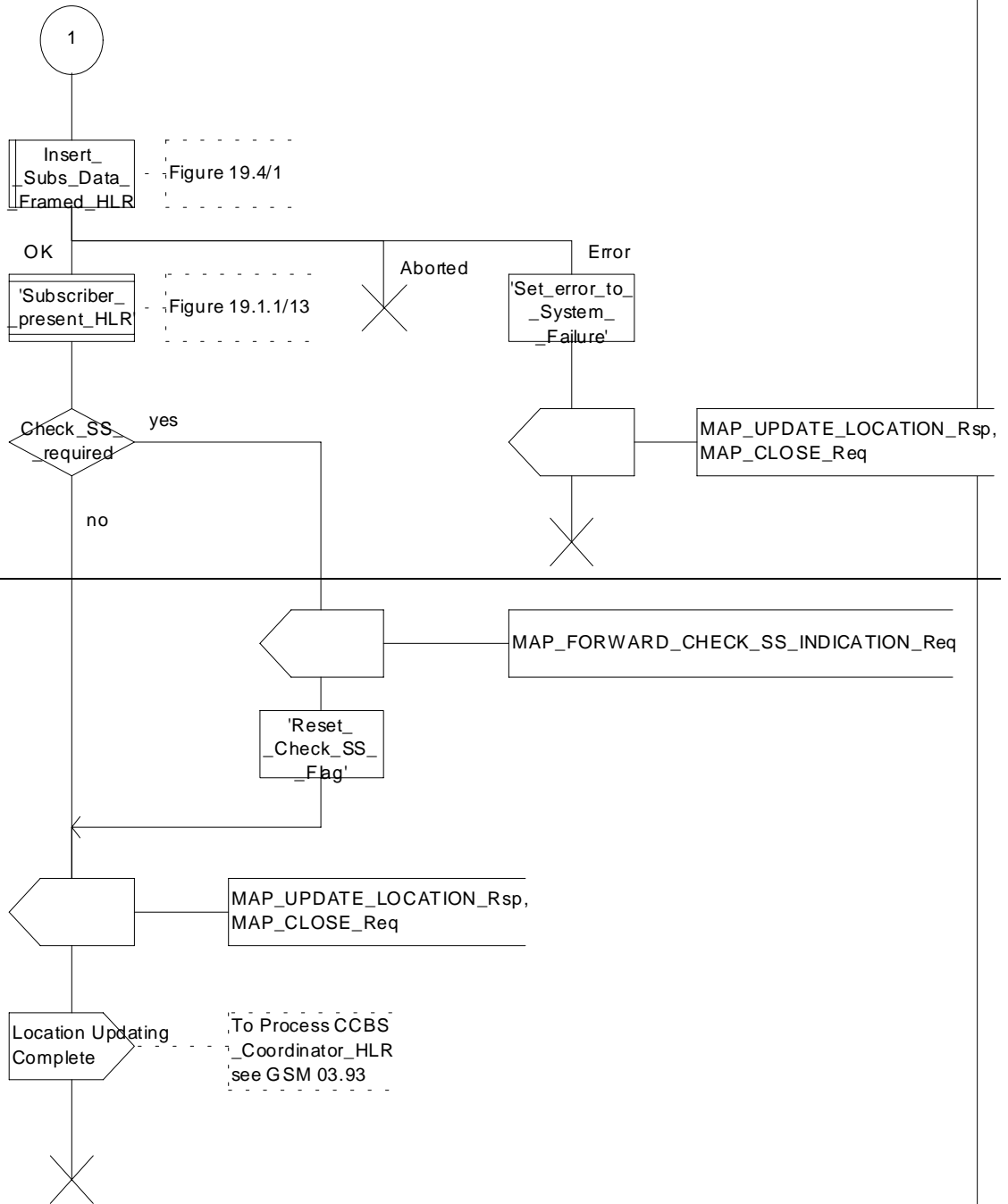
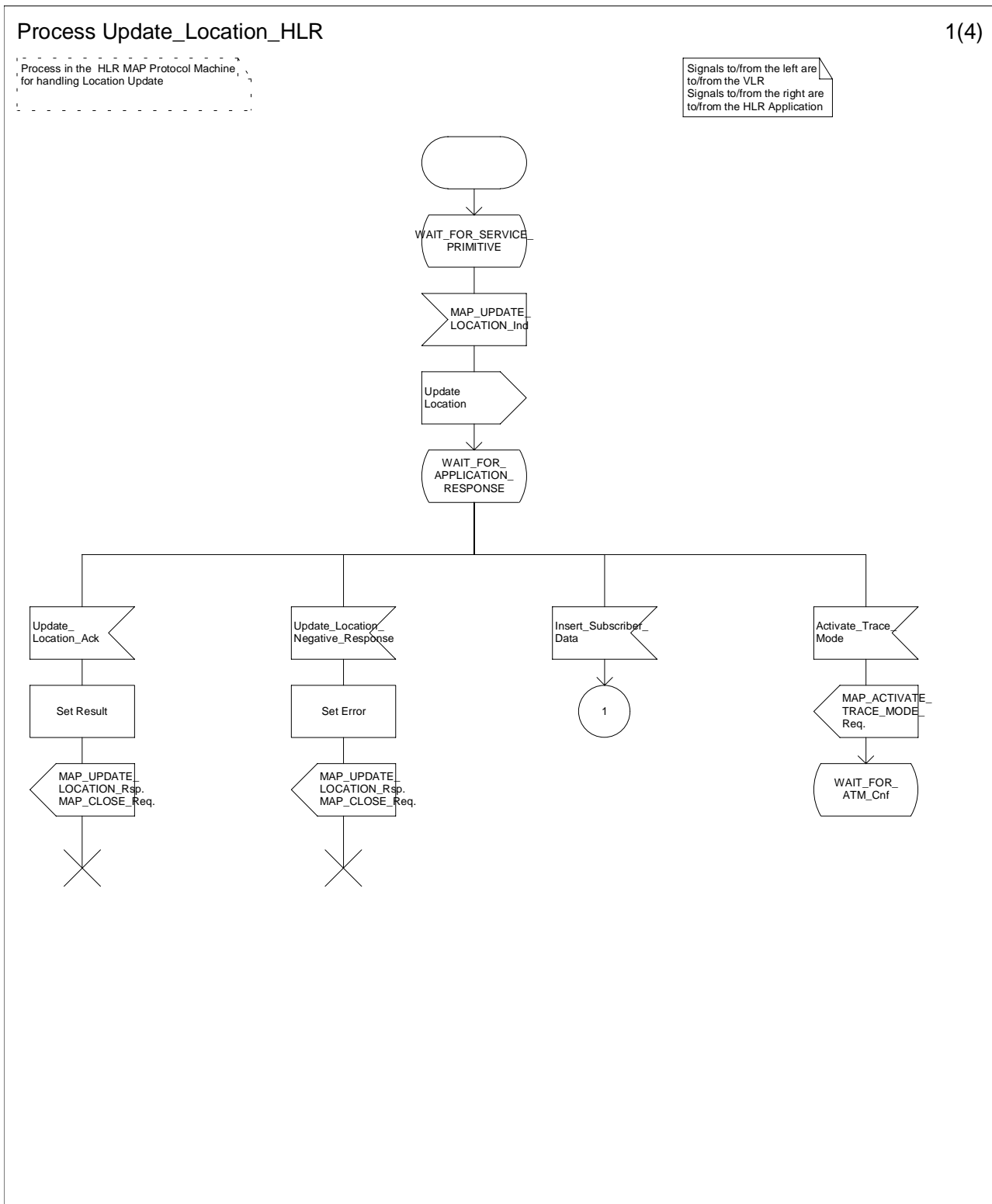


Figure 19.1.1/9 (sheet 2 of 2): Process Update\_Location\_HLR



**Figure 19.1.1/9 (sheet 1 of 4): Process Update Location\_HLR**

### Process Update\_Location\_HLR

Process in the HLR MAP Protocol Machine, for handling Location Update

Signals to/from the left are to/from the VLR  
Signals to/from the right are to/from the HLR Application

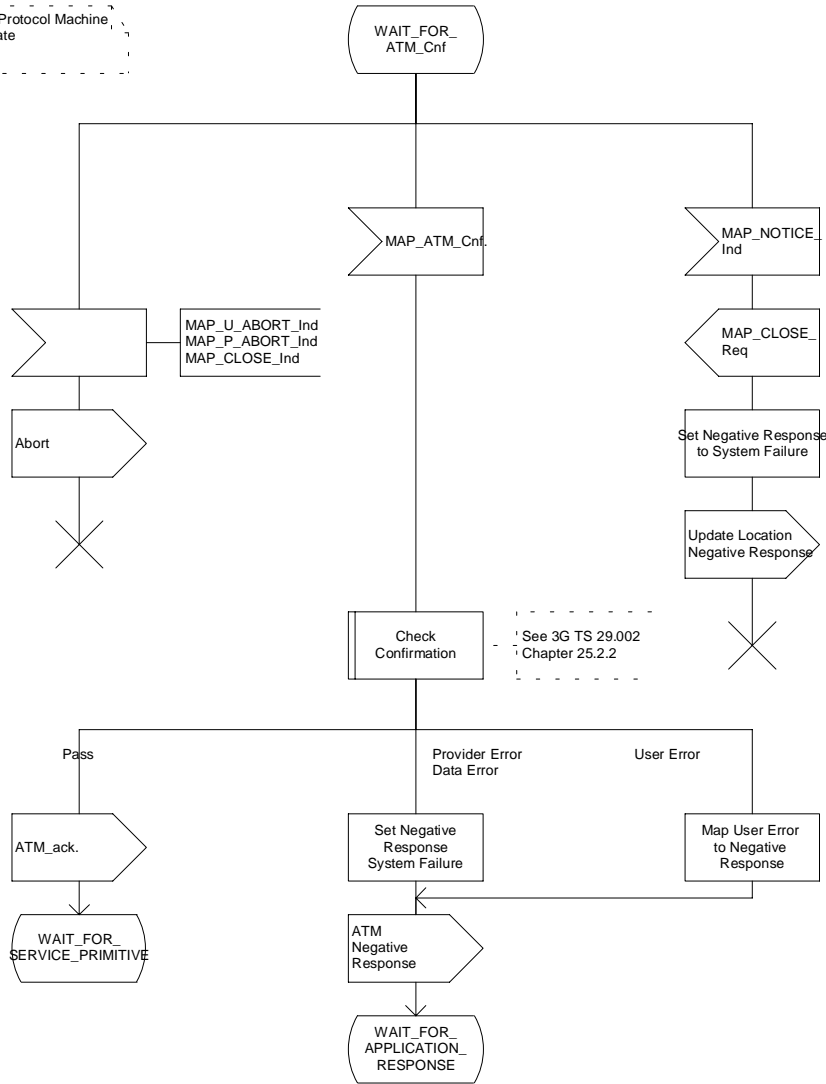


Figure 19.1.1/9 (sheet 2 of 4): Process Update Location HLR

### Process Update\_Location\_HLR

3(4)

Process in the HLR MAP Protocol Machine, for handling Location Update

Signals to/from the left are to/from the VLR  
Signals to/from the right are to/from the HLR Application

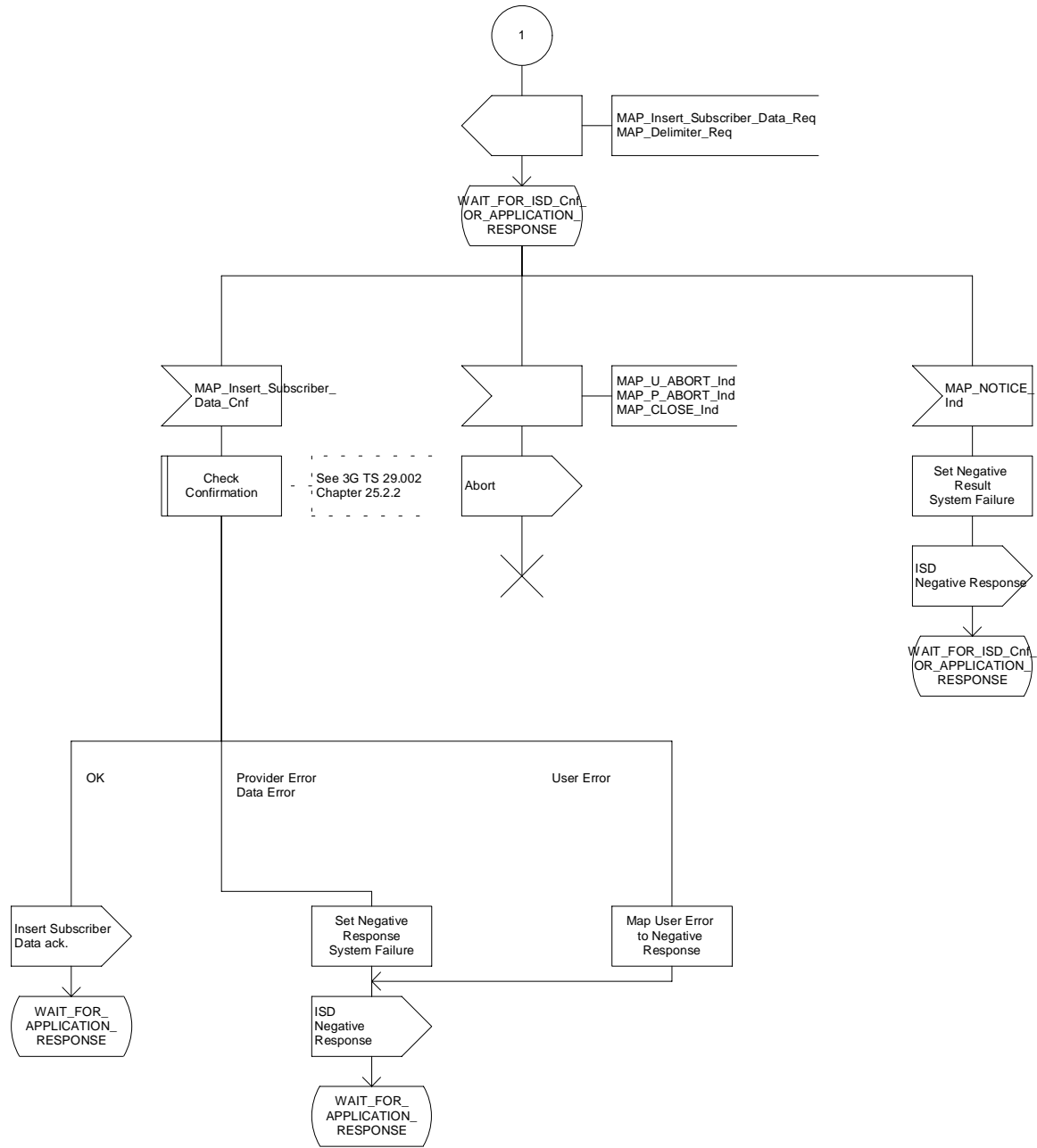


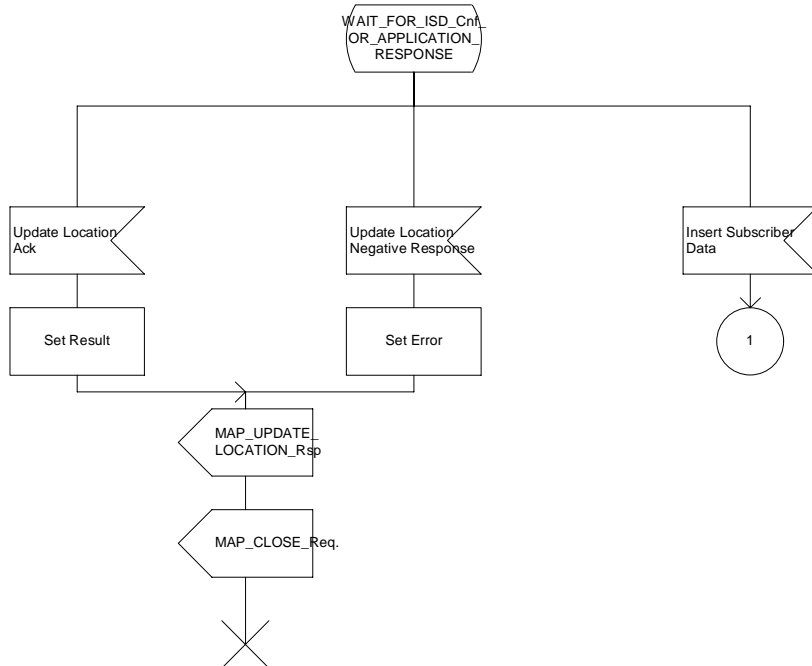
Figure 19.1.1/9 (sheet 3 of 4): Process Update\_Location\_HLR

### Process Update\_Location\_HLR

4(4)

Process in the HLR MAP Protocol Machine for handling Location Update

Signals to/from the left are to/from the VLR  
Signals to/from the right are to/from the HLR Application



**Figure 19.1.1/9 (sheet 4 of 4): Process Update Location\_HLR**

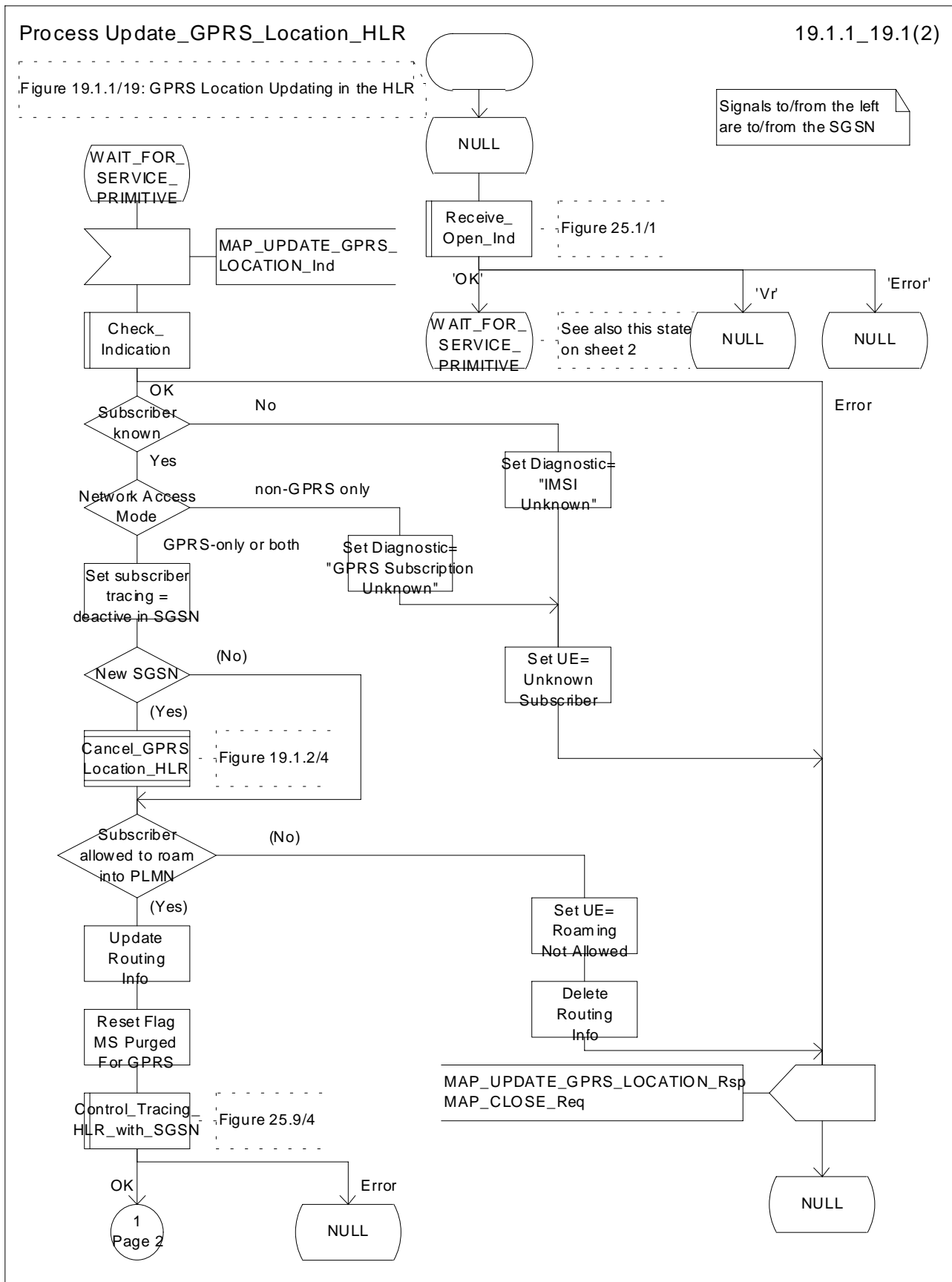


Figure 19.1.1/19 (sheet 1 of 2): Process Update\_GPRS\_Location\_HLR

Process Update\_GPRS\_Location\_HLR

19.1.1\_19.2(2)

Figure 19.1.1/19: GPRS Location Updating in the HLR

Signals to/from the left are to/from the HLR

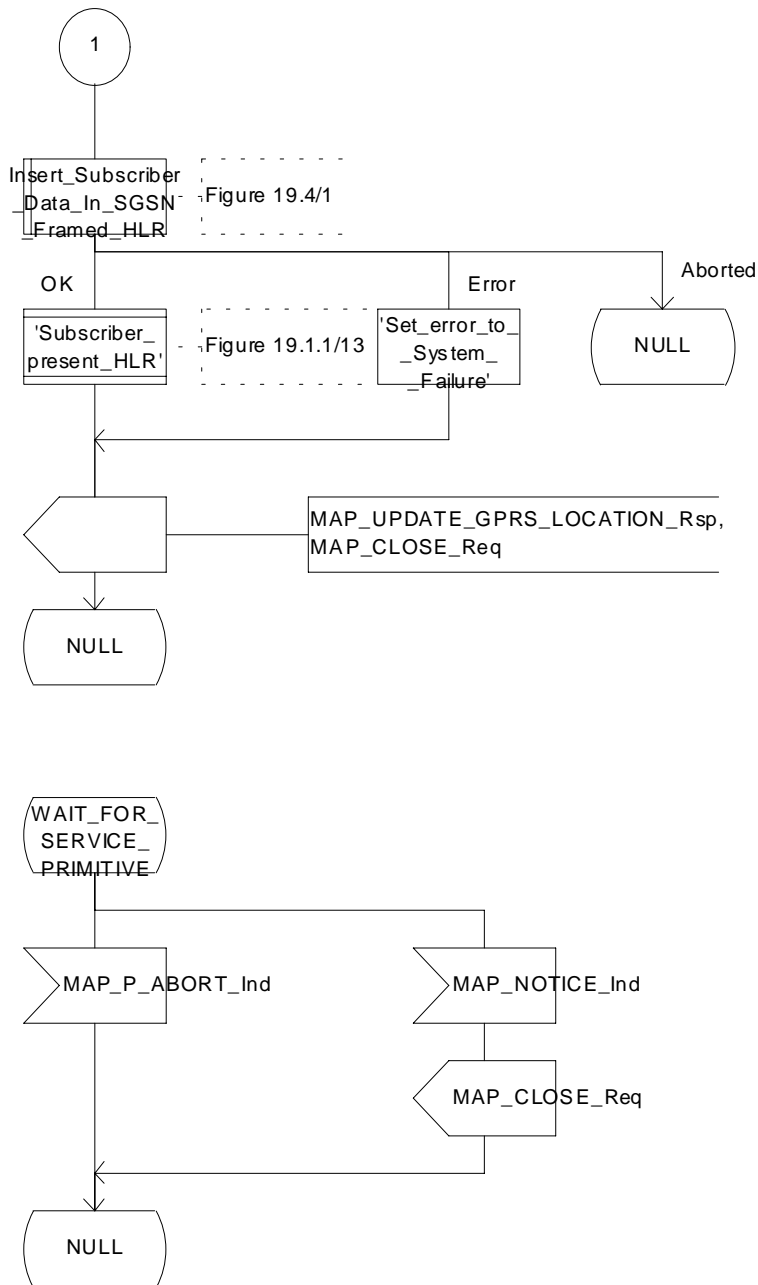
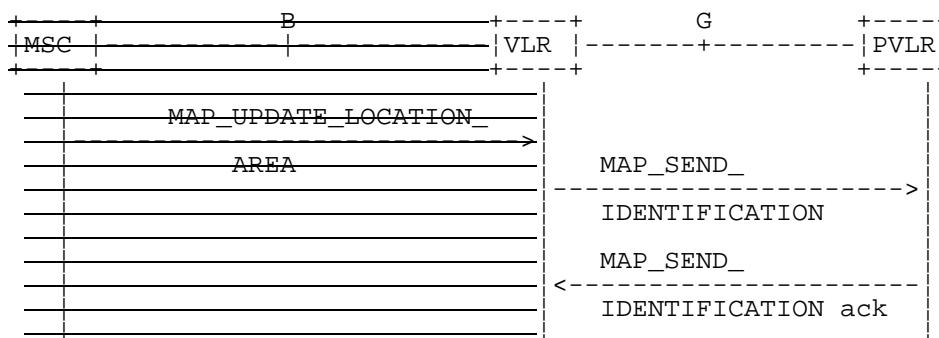


Figure 19.1.1/19 (sheet 2 of 2): Process Update\_GPRS\_Location\_HLR

## 19.1.1.5 Send Identification

### 19.1.1.5.1 General

This service is invoked by the VLR when it receives Update location MAP\_UPDATE\_LOCATION\_AREA from the MSC indication containing a LAI indicating that the subscriber was registered in a different VLR (henceforth called the Previous VLR, PVLR). If the identity of the PVLR is derivable for the VLR (usually if both are within the same network), the IMSI and authentication sets are requested from the PVLR (see subclause 19.1.1.3), using the service described in subclause 8.1.4.



NOTE: The service shown in dotted lines indicates the trigger provided by other MAP signalling.

**Figure 19.1.1/10: Interface and services for Send Identification**

### 19.1.1.5.2 Detailed procedure in the VLR

The VLR procedure is part of the location area updating process described in subclause 19.1.1.X3, see also figure 19.1.1/6 sheet 3.

### 19.1.1.5.3 Detailed procedure in the PVLR

On receipt of a dialogue request for the Send Identification procedure, (see Receive\_Open\_Ind macro in subclause 25.1), the PVLR will:

- terminate the procedure in case of parameter problems;
- revert to the MAP version Vr procedure in case the VLR indicated version Vr protocol; or
- continue as below, if the dialogue is accepted.

If the PVLR process receives a MAP\_NOTICE indication, it terminates the dialogue by sending a MAP\_CLOSE request.

If the PVLR process receives a MAP\_SEND\_IDENTIFICATION indication from the VLR (see figure 19.1.1/11), it checks whether the subscriber identity provided is known:

- if so, the IMSI and - if available - authentication parameters for the subscriber are returned in the MAP\_SEND\_IDENTIFICATION response;
- if not, the error Unidentified Subscriber is returned in the MAP\_SEND\_IDENTIFICATION response.

In all cases where the PVLR sends a MAP\_SEND\_IDENTIFICATION response to the VLR, the dialogue towards the VLR is terminated by a MAP\_CLOSE request with parameter Release Method indicating Normal Release.



Process Send\_Identification\_PVLR

19.1.1\_11(1)

Figure 19.1.1/11: Process in the Previous VLR to handle an identification request

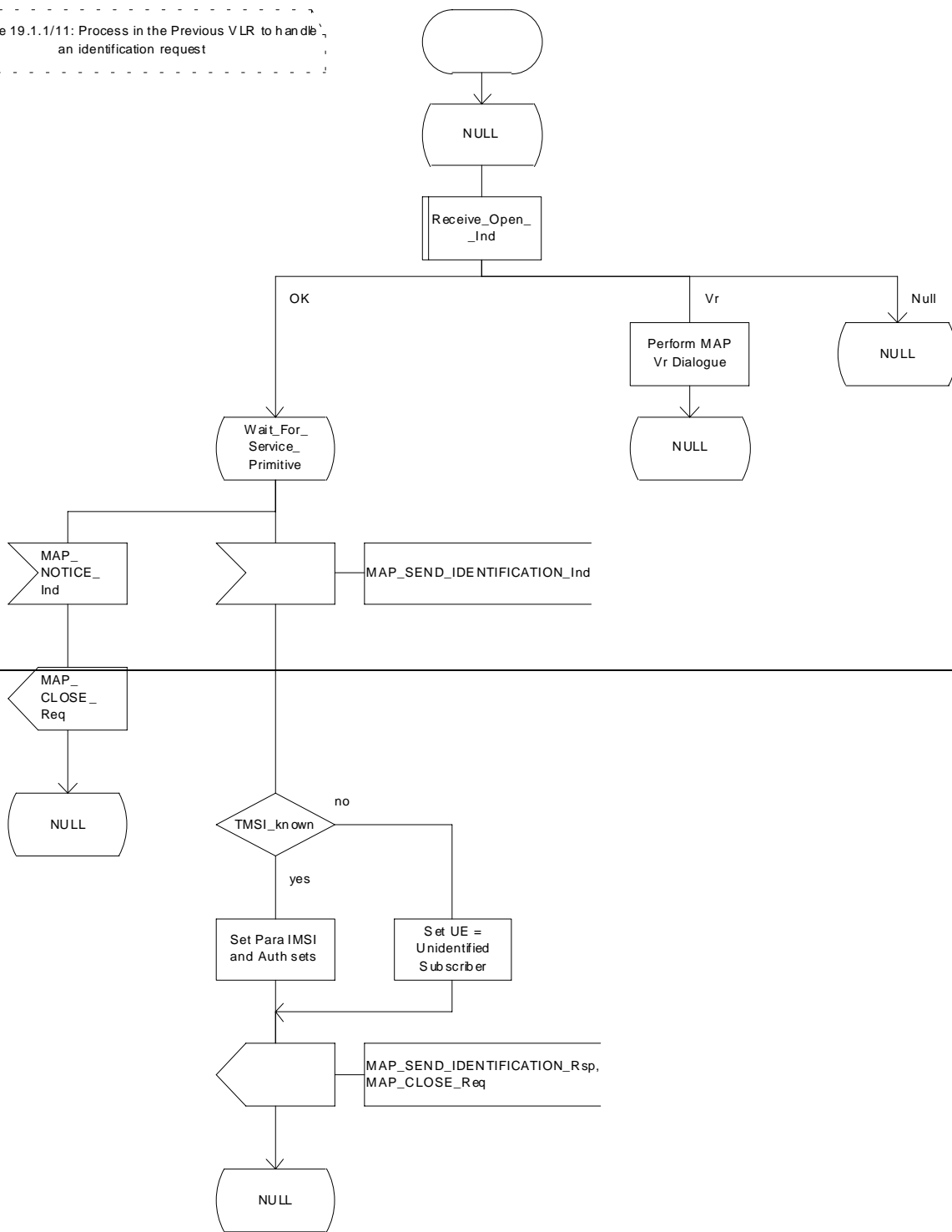
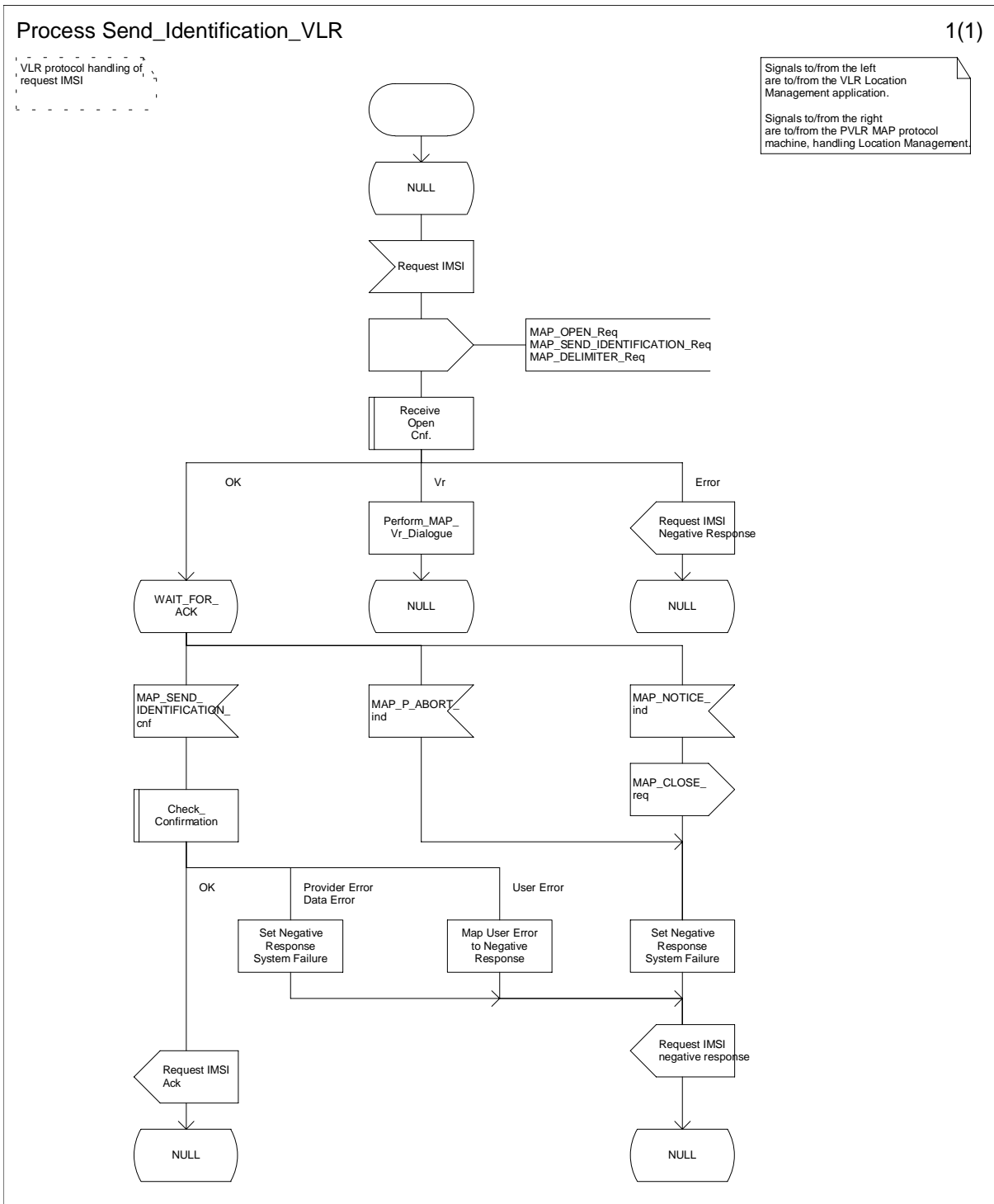
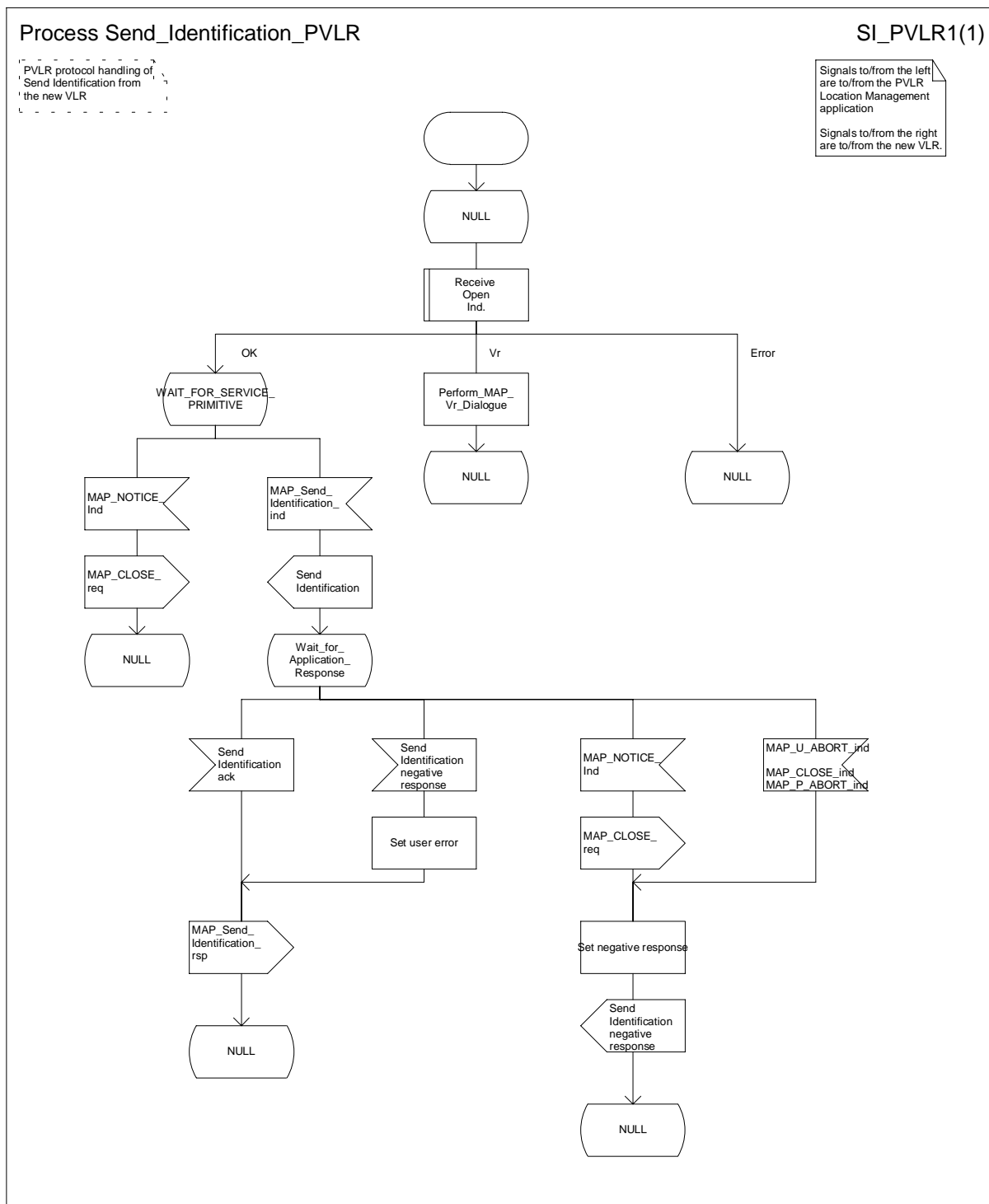


Figure 19.1.1/11: Process Send\_Identification\_PVLR



**Figure 19.1.1/XX (sheet 1 of 1): Process Send Identification VLR**



**Figure 19.1/XX (sheet 1 of 1): Process Send Identification PVLR**

### 19.1.1.6 The Process Update Location VLR

This process is started by some other MAP user process in case the HLR need to be updated due to previous network failure. It is invoked when the subscriber accesses the network, e.g. for mobile originated call set-up, response to paging or supplementary services handling. Here, location updating consists only of invoking the macro VLR\_Update\_HLR described above (see subclause 19.1.1.3), which performs HLR updating and downloading of subscriber data.

If updating is successful (OK) the HLR Number is received in the MAP\_UPDATE\_LOCATION confirm primitive and the process terminates.

If one of the errors Roaming not Allowed or Unknown Subscriber is received instead, all subscriber data are deleted from the VLR before the process terminates.

In case some other error occurs during HLR updating, the process simply terminates. Note, in all error cases the initiating restoration flags in VLR remain false, therefore a new HLR updating attempt will be started later on.

NOTE: This process will be performed independent from the calling process, no coordination is required.

Process UL\_VLR

19.1.1\_12(1)

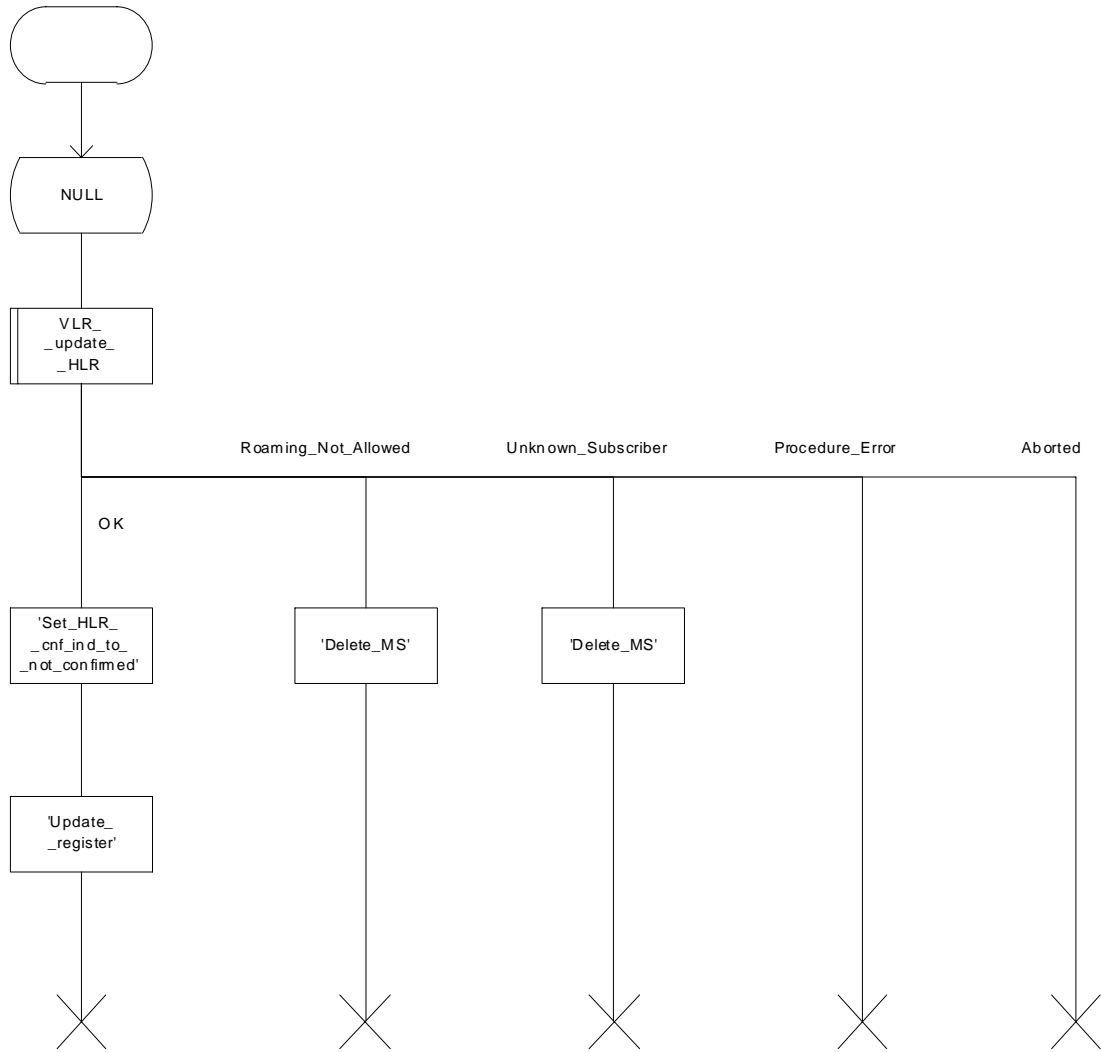


Figure 19.1.1/12:  
Location updating initiated  
by VLR: VLR process

Process UL\_VLR

19.1.1\_12(1)

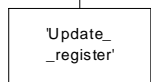
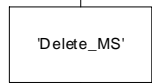
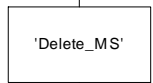
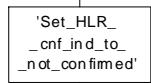
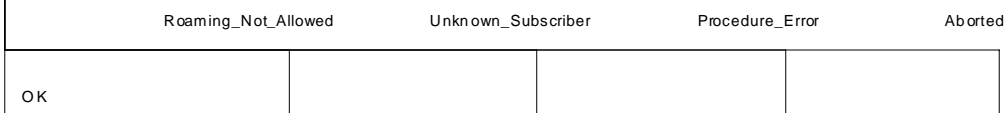
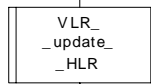
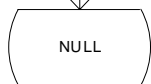
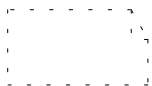


Figure 19.1.1/12: Location updating initiated by VLR: VLR process

Figure 19.1.1/12: Process UL\_VLR

#### ~~19.1.1.7 The Process Subscriber Present HLR~~

~~The process Subscriber Present HLR is started by the location updating process in HLR to perform actions required for short message alerting. The process checks the Message Waiting Data flag, and if this is set, the macro Alert\_Service\_Centre\_HLR defined in subclause 25.10 is invoked. This macro will alert all service centres from which there are short messages waiting for this subscriber.~~

Process Subscriber\_Present\_HLR

19.1.1\_13(1)

Figure 19.1.1/13: Process Subscriber\_Present\_HLR

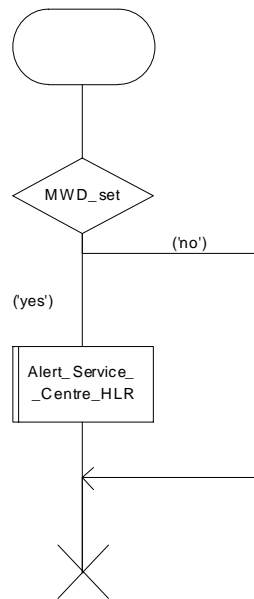


Figure 19.1.1/13: Process Subscriber\_Present\_HLR



### 19.1.1.8 Detailed procedure in the SGSN

Figure 19.1.1/20 shows the MAP process for updating of the SGSN. The following general macros are used:

Receive_Open_Cnf	subclause 25.1;
Insert_Subscriber_Data_SGSN	subclause 25.7;
Activate_Tracing_SGSN	subclause 25.9;

#### The location updating process

The MAP process receives an « Update HLR request » from the relevant process in the SGSN (see GSM 03.60) to perform HLR updating. If the SGSN 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 « Update HLR negative response » with error Roaming Not Allowed (cause PLMN Roaming Not Allowed) is returned to the requesting process.

If the subscribers HLR can be reached, the SGSN opens a dialogue towards the HLR by sending a MAP\_OPEN request without any user specific parameters, together with a MAP\_UPDATE\_GPRS\_LOCATION request containing the parameters

- IMSI, identifying the subscriber;
- SGSN Address and SGSN number;

In case the HLR rejects dialogue opening (see subclause 25.1) or indicates version Vr protocol to be used, the SGSN will terminate the process indicating « Update HLR negative response » to the requesting process.

If the HLR accepts the dialogue, the HLR will respond with:

- a MAP\_INSERT\_SUBSCRIBER\_DATA indication, handled by the macro Insert\_Subs\_Data\_SGSN 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 SGSN and to replace subscription data in case they are not supported by the SGSN.

- a MAP\_ACTIVATE\_TRACE\_MODE indication, handled by the macro Activate\_Tracing\_SGSN defined in subclause 25.9;
- the MAP\_UPDATE\_GPRS\_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 « Update HLR response » message is returned to the requesting process for completion of the SGSN updating (see GSM 03.60).
  - if the confirmation contains an User error cause (Unknown Subscriber, Roaming Not Allowed or some other), the corresponding error is returned to the requesting process in the « Update HLR negative response ».
- a MAP\_P\_ABORT, MAP\_U\_ABORT, or MAP\_CLOSE indication. In these cases, the corresponding error is returned to the requesting process in the « Update HLR negative response ».
- a MAP\_NOTICE indication. Then, the dialogue towards the HLR is terminated, and the « HLR Update negative response » with the appropriate error is returned to the requesting process.

Process SGSN\_Update\_HLR

19.1.1\_20.1(2)

Figure 19.1.1/20: HLR updating in SGSN

Signals from/to the left are from/to requesting process in SGSN  
 Signals to/from the right are to/from the HLR

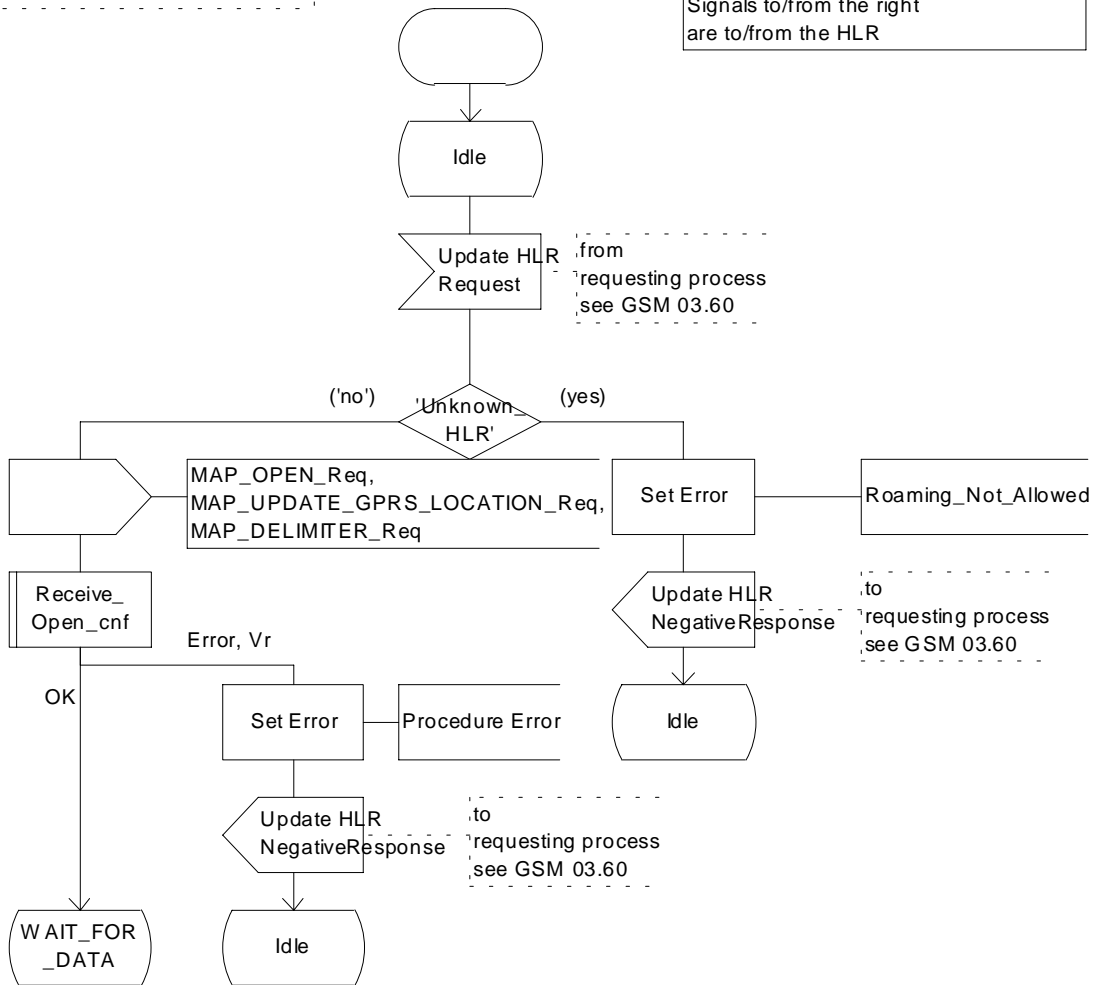


Figure 19.1.1/20 (sheet 1 of 2): Process SGSN\_Update\_HLR

Process SGSN\_Update\_HLR

19.1.1\_20.2(2)

Figure 19.1.1/20: HLR updating in SGSN

Signal from/to the left are from/to requesting process in SGSN  
 Signals to/from the right are to/from the HLR

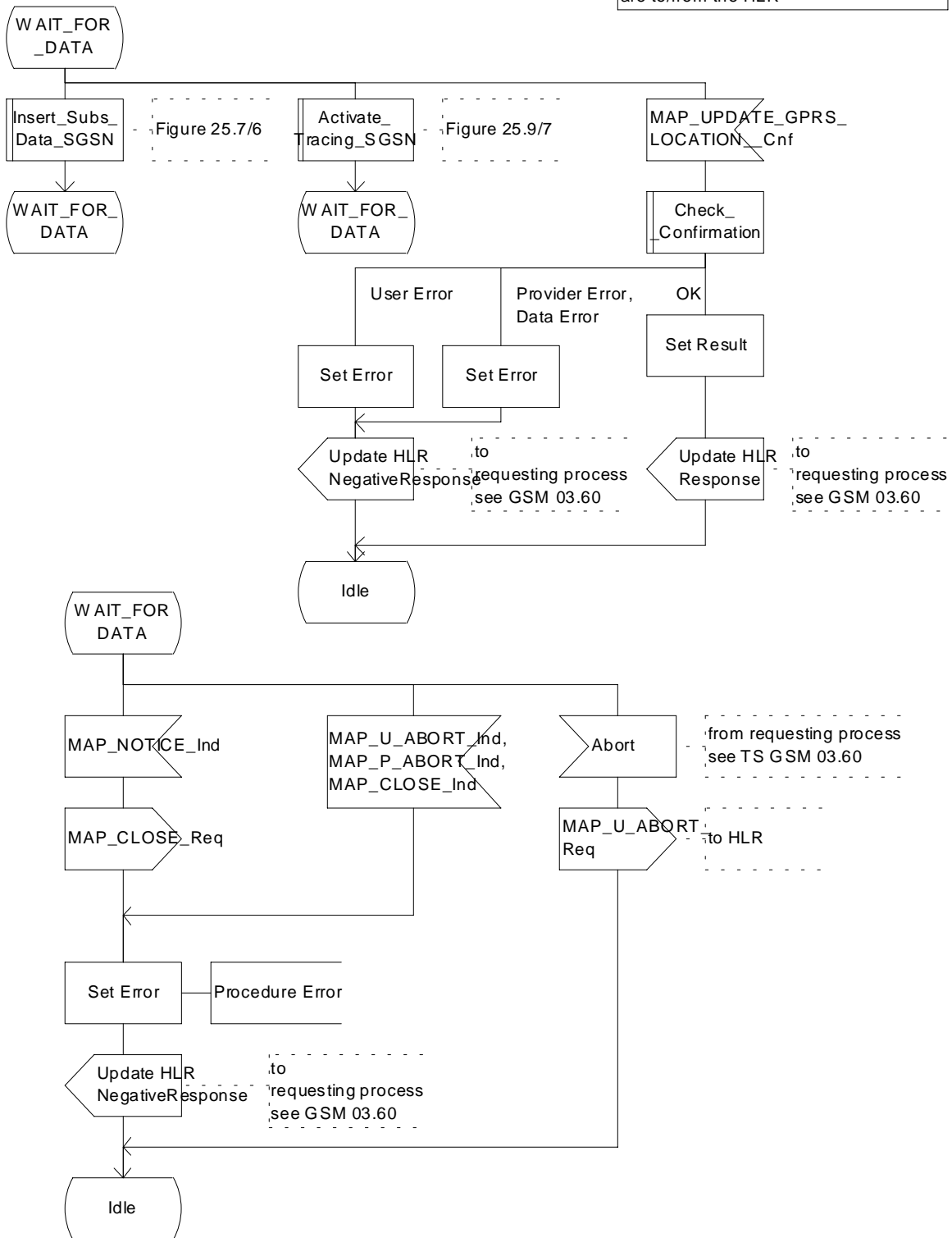


Figure 19.1.1/20 (sheet 2 of 2): Process SGSN\_Update\_HLR

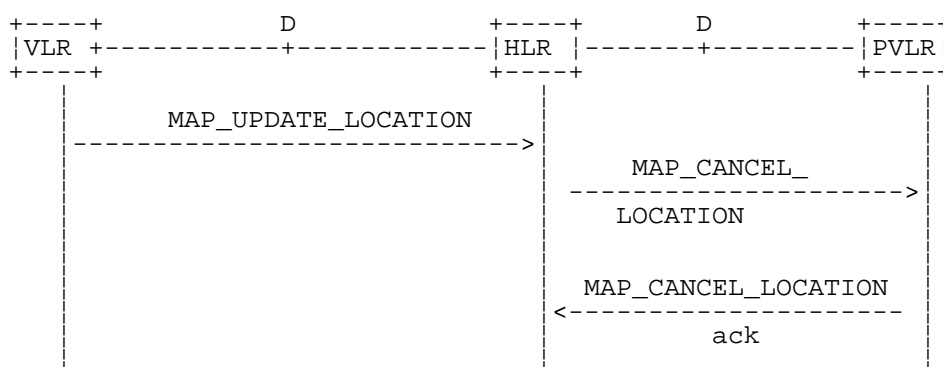
## 19.1.2 Location Cancellation

### 19.1.2.1 General

The purpose of this process is to delete a subscriber's record from a previous visitor location register after she has registered with a new visitor location register. Also this process is used to delete a subscriber's record from a old SGSN after she has registered with a SGSN. The procedure may also be used if the subscriber's record is to be deleted for other operator determined purposes, e.g. withdrawal of subscription, imposition of roaming restrictions or modifications to the subscription which result in roaming restrictions. Location cancellation can be used to enforce location updating including updating of subscriber data in the VLR or in the SGSN at the next subscriber access.

In all cases, the process is performed independently of the invoking process (e.g. Location Updating).

The service as described in subclause 8.1.3 is invoked when an HLR receives a MAP\_UPDATE\_LOCATION indication from a VLR other than that stored in its table for this subscriber. Also the MAP\_CANCEL\_LOCATION service is invoked when the HLR receives a MAP\_UPDATE\_GPRS\_LOCATION indication from a SGSN other than stored in its table for this subscriber. Additionally the service may be invoked by operator intervention. The MAP\_CANCEL\_LOCATION service is in any case invoked towards the VLR or the SGSN whose identity is contained in the HLR table.



NOTE: The service shown in dotted lines indicates the trigger provided by other MAP signalling.

**Figure 19.1.2/1: Interface and services for Location Cancellation**

NOTE: The service shown in dotted lines indicates the trigger provided by other MAP signalling.

**Figure 19.1.2/6: Interface and services for Location Cancellation in GPRS**

### 19.1.2.2 Detailed procedure in the HLR

The location cancellation process is started by an external process as stated above. The HLR opens a dialogue with the VLR or with the SGSN whose identity is contained in the HLR table (MAP\_OPEN request without any user specific parameters), sending the MAP\_CANCEL\_LOCATION request primitive (see figures 16.1.2/2 and 16.1.2/4), containing the parameters:

- IMSI, to identify the subscriber to be deleted from that VLR or SGSN;
- LMSI, which is included if available in the HLR. LMSI is not applicable between HLR and SGSN;
- Cancellation Type if the Cancel Location is sent to SGSN. Cancellation Type is not applicable between HLR and VLR. If the VLR receives this parameter and do not understand it this parameter shall be ignored.

The HLR then waits for the MAP\_OPEN confirmation (see macro Receive\_Open\_Cnf, subclause 21.1), indicating either:

- reject of the dialogue (process terminates);
- reversion to version Vr when the operation is sent to SGSN (process terminates);
- reversion to version Vr when the operation is sent to VLR (process will be performed according to MAP version Vr); or
- dialogue acceptance.

When the VLR or the SGSN accepts the dialogue, it will return a MAP\_CANCEL\_LOCATION confirmation, containing:

- no parameter, indicating successful outcome of the procedure;
- a user error, provider error or a data error indicating unsuccessful outcome of the procedure.

In case of unsuccessful outcome or if a MAP\_P\_ABORT indication has been received, the HLR may repeat the MAP\_CANCEL\_LOCATION request later, where the number of repeat attempts and time in between are HLR operator options, depending on the error returned by the VLR or the SGSN.

### 19.1.2.3 Detailed procedure in the VLR

Opening of the dialogue is described in the macro Receive\_Open\_Ind in subclause 25.1, with outcomes:

- reversion to version Vr procedure;
- procedure termination; or
- dialogue acceptance, with processing as below.

If the VLR process receives a MAP\_NOTICE indication, it terminates the dialogue by sending a MAP\_CLOSE request.

If the VLR process receives a MAP\_CANCEL\_LOCATION indication from the HLR (see figure 19.1.2/3), the parameters are checked first (macro Check\_Indication, see subclause 25.2). In case of parameter problems the appropriate error is sent in the MAP\_CANCEL\_LOCATION response.

If the MAP\_CANCEL\_LOCATION indication contains both the IMSI and the LMSI, the VLR checks whether the stored IMSI matches the received IMSI. If it does not, the VLR attempts to process the request using the IMSI received from the HLR to define the subscriber record to be deleted.

Thereafter the VLR checks whether the subscriber identity provided is known in the VLR:

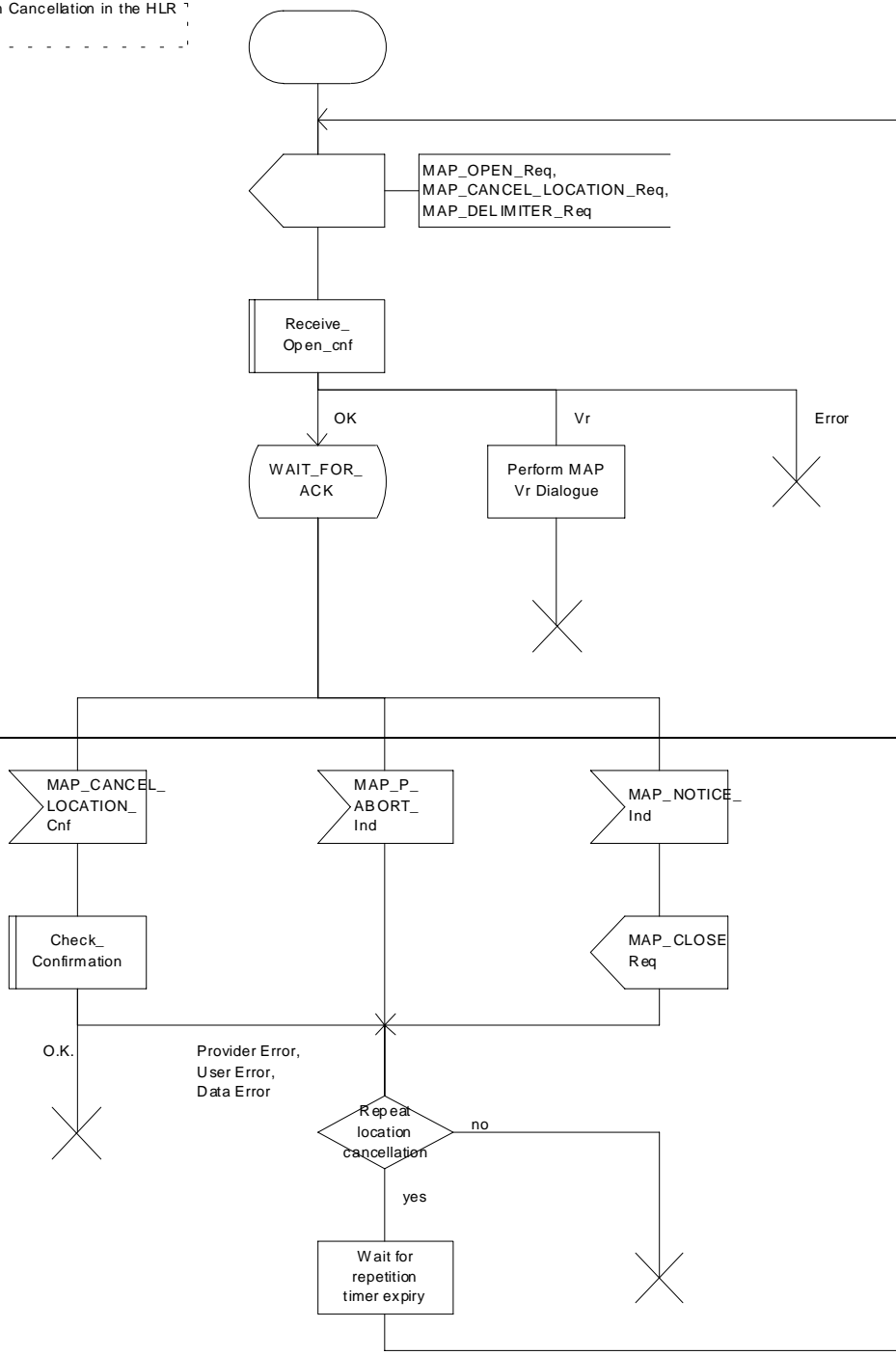
- if so, the data of the subscriber are deleted from VLR table and a MAP\_CANCEL\_LOCATION response is returned without any parameters;
- if not, location cancellation is regarded as being successful, too, and the MAP\_CANCEL\_LOCATION response is returned without any parameters.

In either case, after sending the MAP\_CANCEL\_LOCATION response the VLR process releases any TMSI which may be associated with the IMSI of the subscriber, terminates the dialogue (MAP\_CLOSE with Release Method Normal Release) and returns to the idle state.

### Process Cancel\_Location\_HLR

19.1.2\_2(1)

Figure 19.1.2/2: Location Cancellation in the HLR



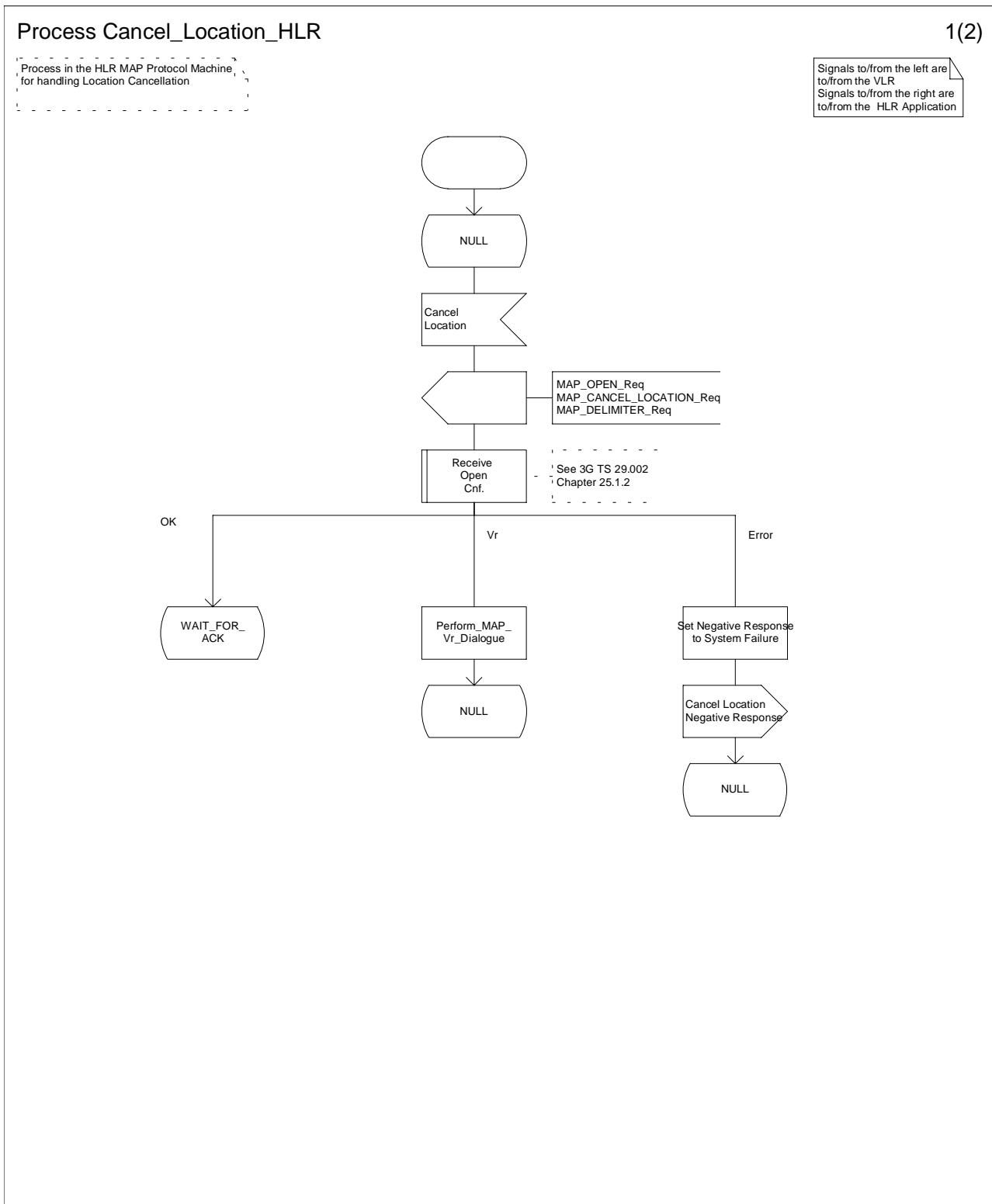


Figure 19.1.2/2 (Sheet 1 of 2): Process Cancel\_Location\_HLR

Process Cancel\_Location\_HLR

2(2)

Process in the HLR MAP Protocol Machine, for handling Location Cancellation

Signals to/from the left are to/from the VLR  
Signals to/from the right are to/from the HLR Application

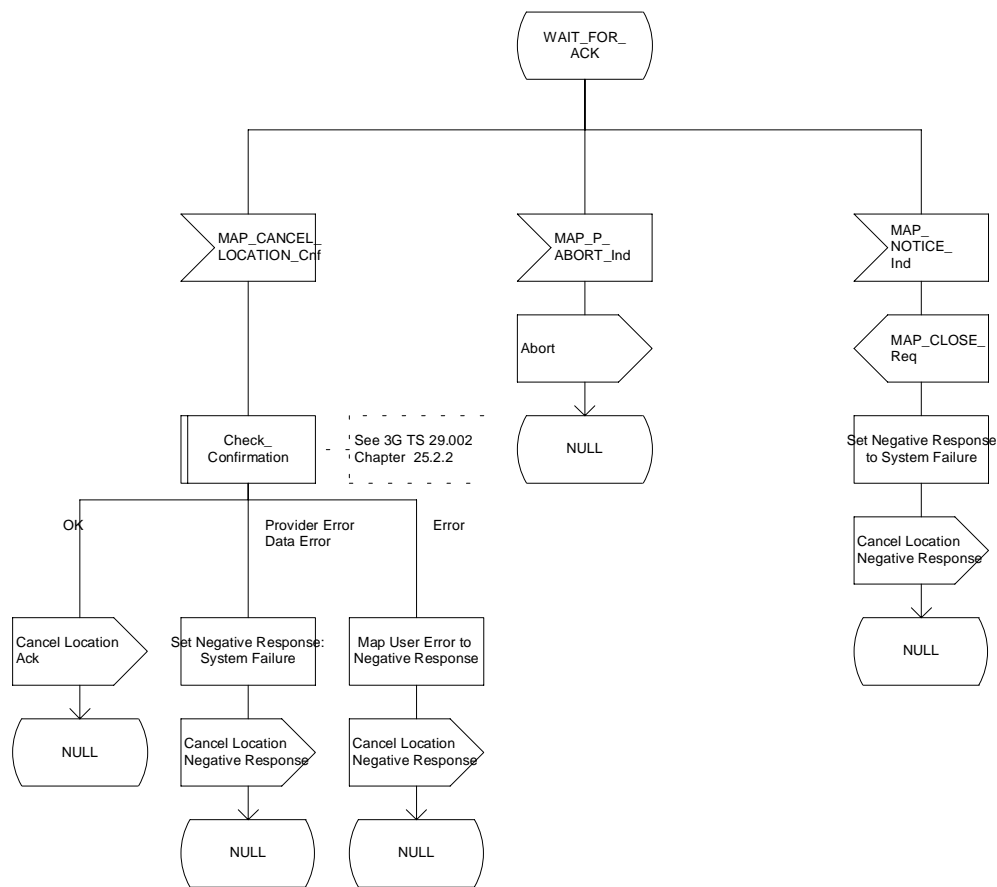


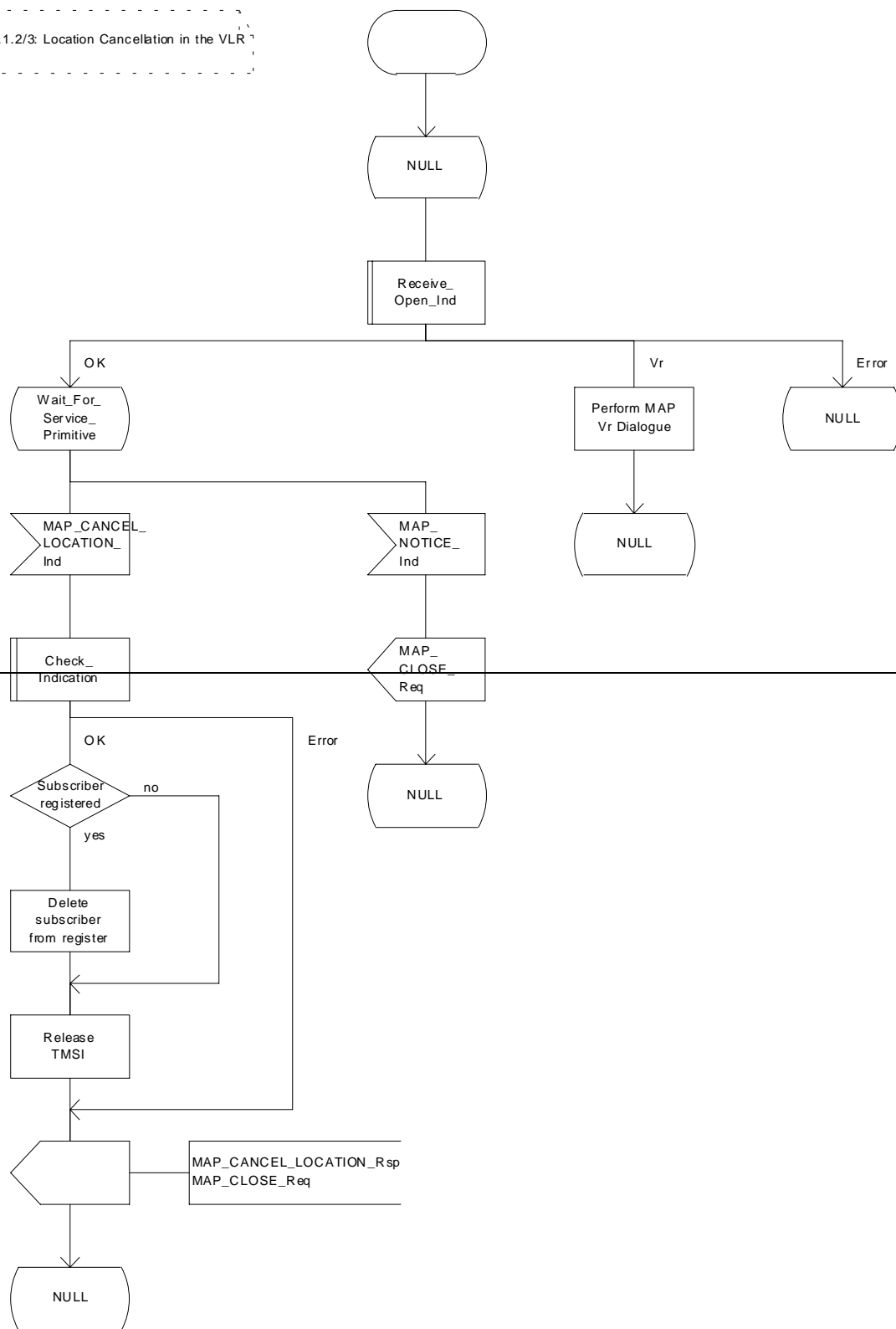
Figure 19.1.2/2 (Sheet 2 of 2): Process Cancel Location HLR



Process Cancel\_Location\_VLR

19.1.2\_3(1)

Figure 19.1.2/3: Location Cancellation in the VLR



Process Cancel\_Location\_VLR

1(1)

Process in the VLR for handling the Cancel location

Signals to/from the left are to/from Location Management application  
 Signals to/from the right are to/from the HLR MAP protocol machine.

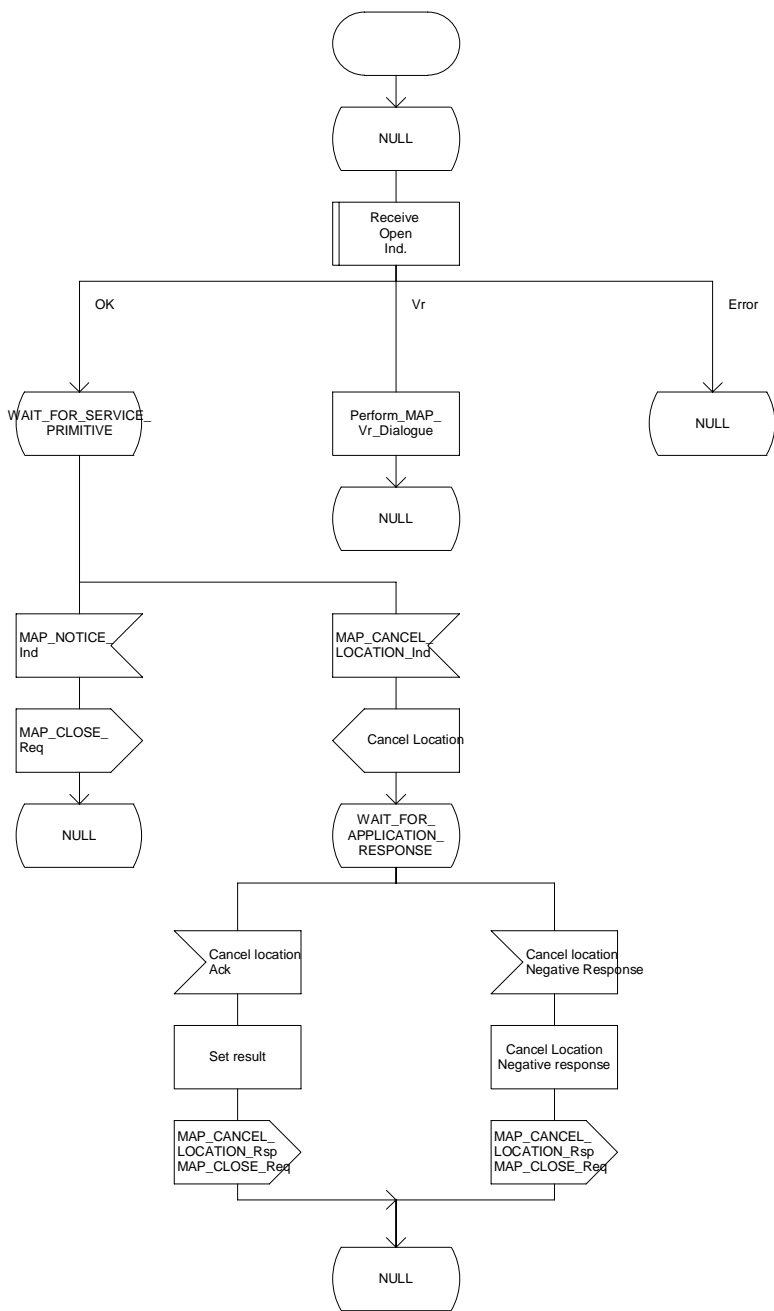


Figure 19.1.2/3: Process Cancel\_Location\_VLR

#### 19.1.2.4 Detailed procedure in the SGSN

Opening of the dialogue is described in the macro Receive\_Open\_Ind in subclause 25.1, with outcomes:

- procedure termination; or
- dialogue acceptance, with processing as below.

If the SGSN process receives a MAP\_NOTICE indication, it terminates the dialogue by sending a MAP\_CLOSE request.

If the SGSN process receives a MAP\_CANCEL\_LOCATION indication from the HLR (see figure 19.1.2/4), the parameters are checked first (macro Check\_Indication, see subclause 25.2). In case of parameter problems the appropriate error is sent in the MAP\_CANCEL\_LOCATION response.

Thereafter the SGSN checks whether the subscriber identity provided is known in the SGSN:

- if so, the data of the subscriber are deleted from SGSN table and a MAP\_CANCEL\_LOCATION response is returned without any parameters;
- if not, location cancellation is regarded as being successful, too, and the MAP\_CANCEL\_LOCATION response is returned without any parameters.

In either case, after sending the MAP\_CANCEL\_LOCATION response the SGSN process releases any P-TMSI which may be associated with the IMSI of the subscriber, terminates the dialogue (MAP\_CLOSE with Release Method Normal Release) and returns to the idle state.

Process Cancel\_GPRS\_Location\_HLR

19.1.2\_4(1)

Figure 19.1.2/4: Location Cancellation in the HLR for GPRS

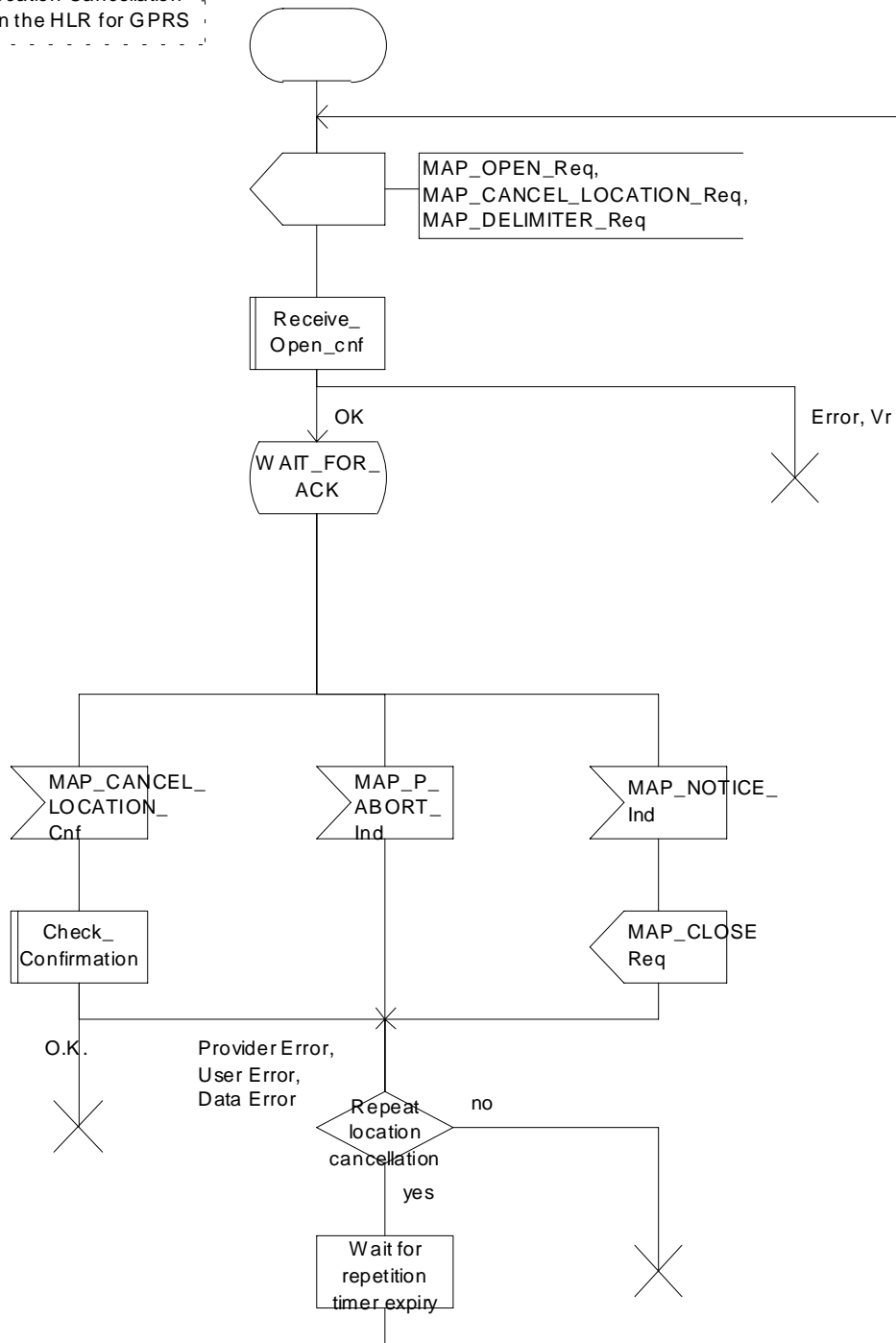


Figure 19.1.2/4: Process Cancel\_GPRS\_Location\_HLR

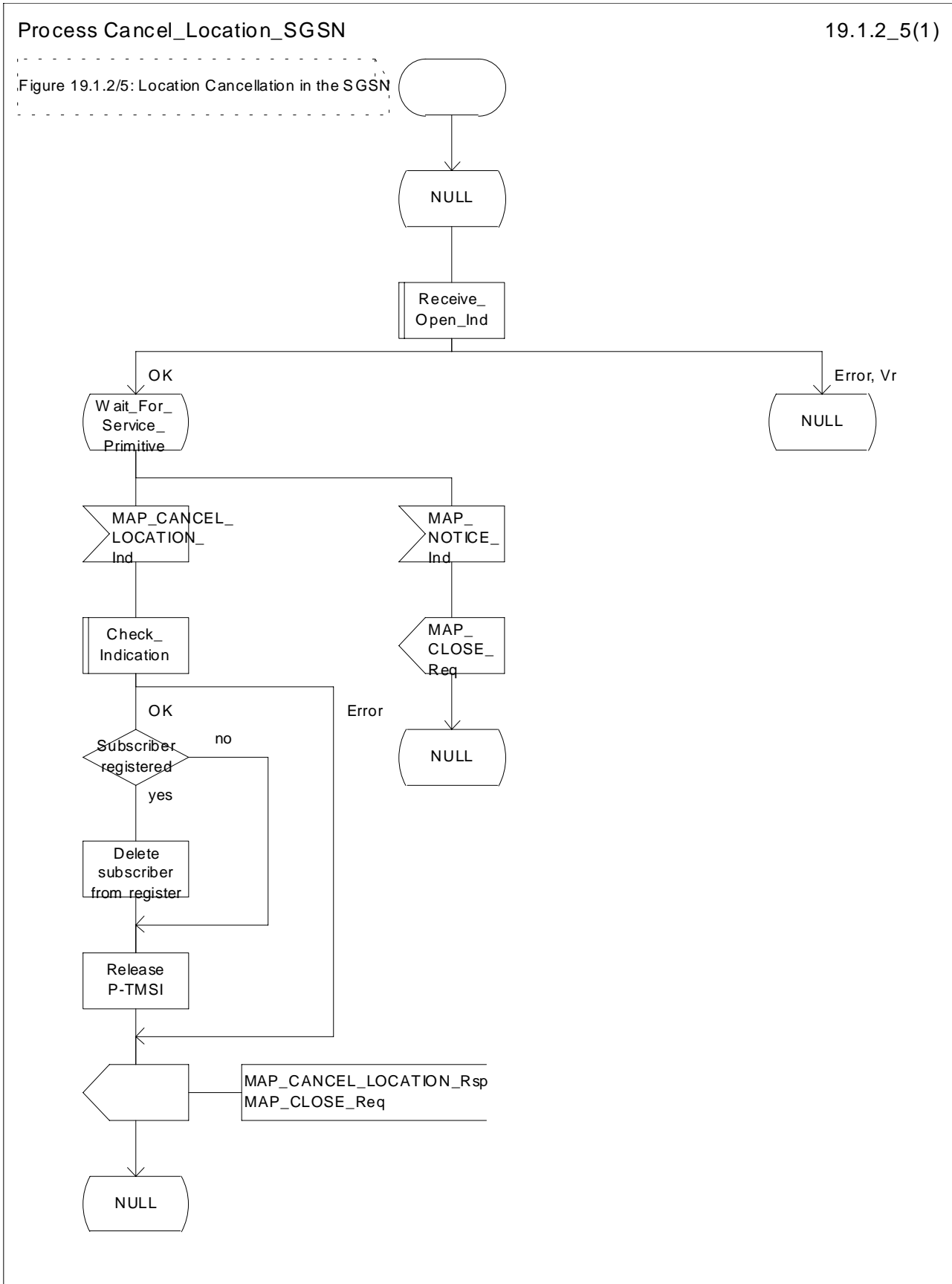


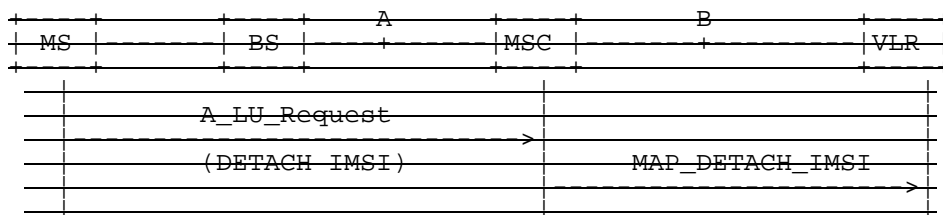
Figure 19.1.2/5: Process Cancel\_Location\_SGSN

### 19.1.3 Detach IMSI

#### 19.1.3.1 General

On receipt of an A\_LU\_REQUEST (DETACH IMSI) indication from the radio interface this procedure invokes the MAP\_DETACH\_IMSI service described in subclause 8.1.5 in order to inform the visitor location register that a subscriber is no longer reachable (see figure 19.1.3/1), e.g. due to switched-off station. This information is used by the VLR to reject mobile terminating calls or short messages without sending page messages on the radio path. The service is unconfirmed as it is likely that the MS is switched off before receiving a confirmation.

The detach IMSI feature is optional for the network operator. The MS is informed by the network whether detach IMSI is to be used or not.



NOTE: The service shown in dotted lines indicates the trigger provided by the radio interface (see GSM 09.10).

**Figure 19.1.3/1: Interface and services for MAP\_DETACH\_IMSI**

If the Gs interface is installed, the procedures to handle an IMSI Detach or a GPRS Detach request from the SGSN via the Gs interface do not require any signalling over the MAP interface. These procedures are specified in GSM 03.60 and 09.18.

#### 19.1.3.2 Detailed procedure in the MSC

The MAP\_DETACH\_IMSI service is invoked by the MSC when receiving an A\_LU\_Request (DETACH IMSI) for a subscriber (see figure 19.1.3/2).

The MSC will open the dialogue to the VLR with a MAP\_OPEN request containing no user specific parameters. The MAP\_DETACH\_IMSI request will contain the following parameter received from the radio side (for the mapping see GSM 09.10):

— Subscriber Id, being either a TMSI or an IMSI.

The MSC then waits for the MAP\_OPEN confirmation (see macro Receive\_Open\_Cnf, subclause 25.1), indicating either:

- reject of dialogue (process terminates);
- reversion to version Vr (process terminates); or
- dialogue acceptance.

Thereafter, the dialogue is terminated locally by the MSC (MAP\_CLOSE request with Release Method Prearranged End).

#### 19.1.3.3 Detailed procedure in the VLR

When the VLR receives a MAP\_DETACH\_IMSI indication (see figure 19.1.3/3), it first checks the indication data (macro Check\_Indication, see subclause 25.2). Thereafter it is checked whether the subscriber is known:

- if the subscriber is unknown the VLR ignores the indication;
- if the subscriber is known in the VLR, the IMSI detached flag is set.

The VLR process will terminate the dialogue locally (MAP\_CLOSE request with Release Method Prearranged End).

Process Detach\_IMSI\_MSC

19.1.3\_2(1)

Figure 19.1.3/2:  
Detach IMSI in MSC

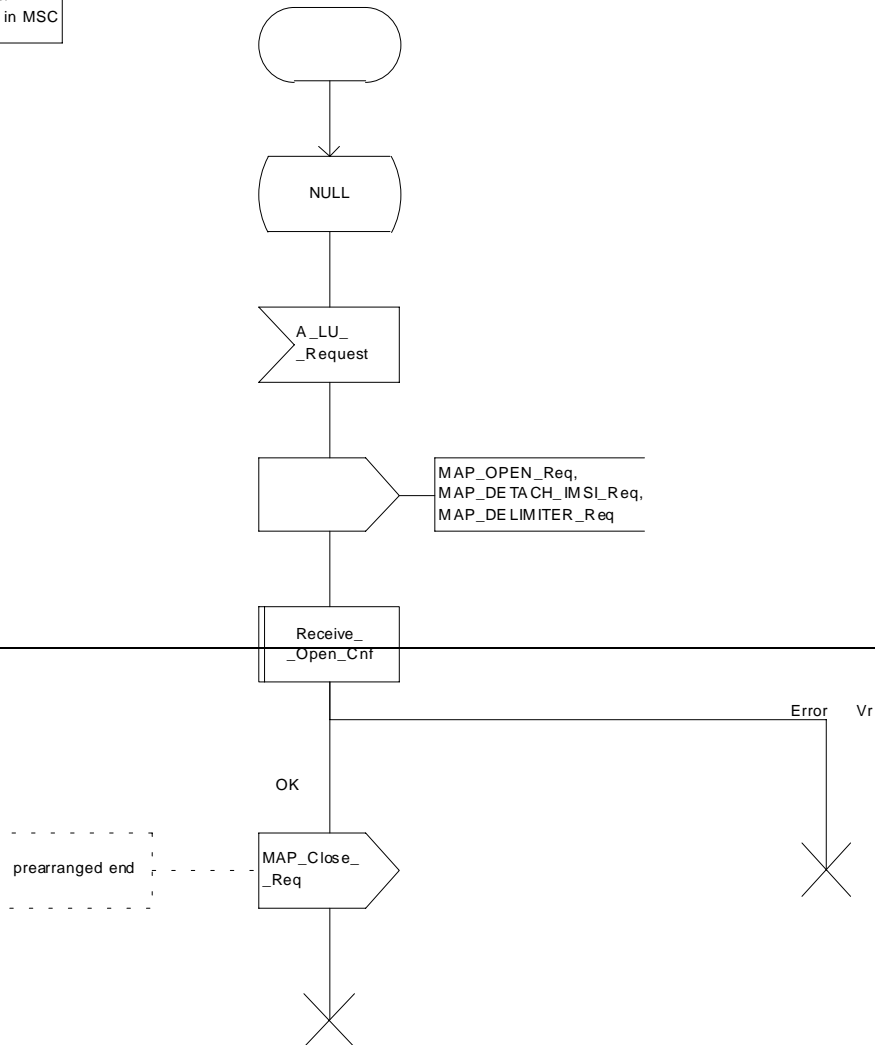


Figure 19.1.3/2: Process Detach\_IMSI\_MSC

Process Detach\_IMSI\_VLR

19.1.3\_3(1)

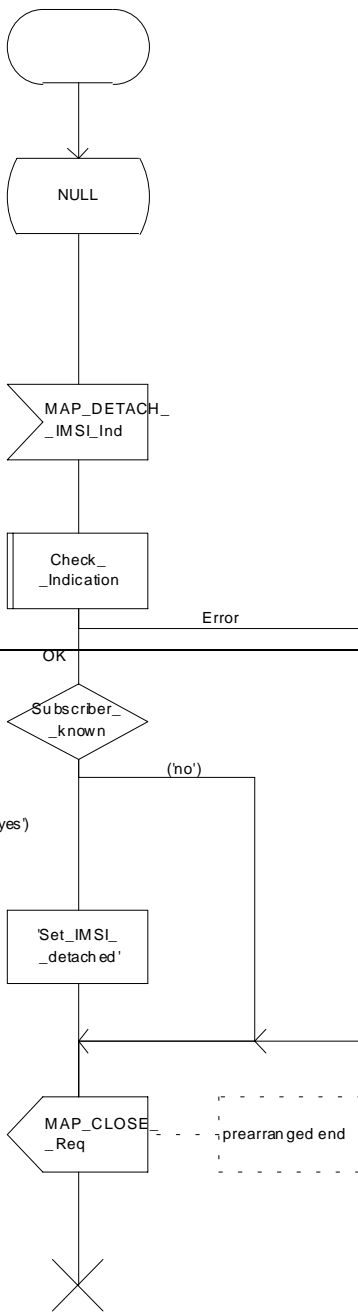
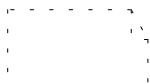


Figure 19.1.3/3:  
Detach IMSI in VLR

Figure 19.1.3/3: Process Detach\_IMSI\_VLR



## 19.1.4 Purge MS

### 19.1.4.1 General

When the VLR or the SGSN receives an indication on the O&M interface that the MS record is to be purged (either because of administrative action or because the MS has been inactive for an extended period), this procedure invokes the MAP\_PURGE\_MS service described in subclause 8.1.6 to request the HLR to set the "MS purged for non-GPRS" or the "MS purged for GPRS" flag for the MS so that any request for routing information for a mobile terminated call or a mobile terminated short message will be treated as if the MS is not reachable. The message flows are shown in figures 19.1.4/1 and 19.1.4/5.

It is optional for the network operator to delete MS records from the VLR or from the SGSN, but if the option is used the VLR or the SGSN shall notify the HLR when a record has been deleted.

The O&M process in the VLR or in the SGSN must ensure that during the MS purging procedure any other attempt to access the MS record is blocked, to maintain consistency of data.

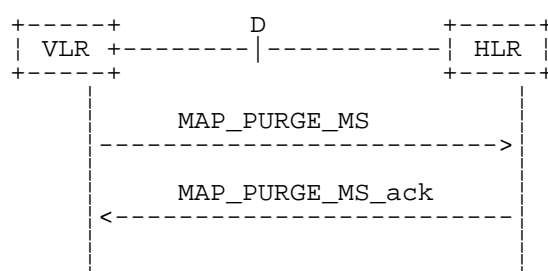


Figure 19.1.4/1: MAP-D Interface and services for MAP\_PURGE\_MS

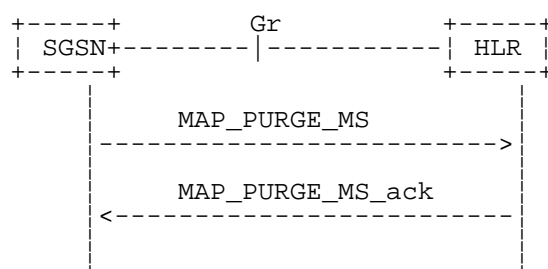


Figure 19.1.4/5: Gr Interface and services for MAP\_PURGE\_MS

### 19.1.4.2 Detailed procedure in the VLR

When the VLR receives an indication from O&M that an MS record is to be purged, it invokes the MAP\_PURGE\_MS service (see figure 19.1.4/2).

The VLR opens the dialogue to the HLR with a MAP\_OPEN request containing no user specific parameters. The MAP\_PURGE\_MS request contains the IMSI of the MS which is to be purged and the VLR number.

The VLR then waits for the MAP\_OPEN confirmation (see macro Receive\_Open\_Cnf, subclause 25.1), indicating one of:

- rejection of the dialogue (process terminates);
- reversion to version one (process terminates);
- dialogue acceptance.

If the HLR accepts the dialogue it returns a MAP\_PURGE\_MS confirmation, containing no parameter, indicating successful outcome of the procedure.

If a MAP\_PURGE\_MS confirmation containing a provider error, data error or user error, or a MAP\_P\_ABORT, MAP\_NOTICE or premature MAP\_CLOSE indication, has been received, the failure is reported to the O&M interface. Successful outcome of the procedure leads to deletion of the subscriber data and freezing of the TMSI if so requested by the HLR, and is reported to the O&M interface.

#### 19.1.4.3 Detailed procedure in the HLR

Opening of the dialogue is described in the macro Receive\_Open\_Ind in subclause 25.1. The possible outcomes are:

- termination of the procedure if the AC indicates a version 1 dialogue, as this procedure is not defined for version 1;
- termination of the procedure if there is an error;
- dialogue acceptance, in which case the procedure is as described below.

If the HLR receives a MAP\_NOTICE indication, it terminates the dialogue by sending a MAP\_CLOSE request.

If the HLR receives a MAP\_PURGE\_MS indication (see figure 19.1.4/3), it first checks the indication data (macro Check\_Indication, see subclause 25.2). If there is a parameter error the HLR terminates the dialogue by sending an appropriate error in the MAP\_PURGE\_MS response in a MAP\_CLOSE request. If there is no parameter error the HLR then checks whether the subscriber is known.

- if the subscriber is unknown, the HLR reports an error to the O&M interface, the error Unknown Subscriber is returned in the MAP\_PURGE\_MS response and the dialogue is terminated by sending a MAP\_CLOSE request;
- if the subscriber is known, the HLR checks whether the purging notification came from the VLR or SGSN where the MS was last registered:
  - if the received VLR number and the stored VLR number match, the HLR sets the "MS purged for non GPRS" flag for the subscriber and sends a MAP\_PURGE\_MS response containing a freeze TMSI indicator to indicate successful outcome;
  - if the received VLR number and the stored VLR number do not match, the HLR sends a MAP\_PURGE\_MS response containing an empty result to indicate successful outcome. Since the MS is known by the HLR to be in a different VLR area, it is not appropriate to block mobile terminated calls or short messages to the MS, but the VLR which initiated the purging procedure can safely purge its record for the MS without freezing the TMSI.
  - if the received SGSN number and the stored SGSN number match, the HLR sets the "MS purged for GPRS" flag for the subscriber and sends a MAP\_PURGE\_MS response containing a freeze P-TMSI indicator to indicate successful outcome;
  - if the received SGSN number and the stored SGSN number do not match, the HLR sends a MAP\_PURGE\_MS response containing an empty result to indicate successful outcome. Since the MS is known by the HLR to be in a different SGSN area, it is not appropriate to block short messages to the MS, but the SGSN which initiated the purging procedure can safely purge its record for the MS without freezing the P-TMSI.

In either cases of successful termination the HLR terminates the dialogue by sending a MAP\_CLOSE request.

#### 19.1.4.4 Detailed procedure in the SGSN

When the SGSN receives an indication from O&M that an MS record is to be purged, it invokes the MAP\_PURGE\_MS service (see figure 19.1.4/4).

The SGSN opens the dialogue to the HLR with a MAP\_OPEN request containing no user specific parameters. The MAP\_PURGE\_MS request contains the IMSI of the MS which is to be purged and the SGSN number.

The SGSN then waits for the MAP\_OPEN confirmation (see macro Receive\_Open\_Cnf, subclause 25.1), indicating one of:

- rejection of the dialogue (process terminates);
- reversion to Vr (process terminates);
- dialogue acceptance.

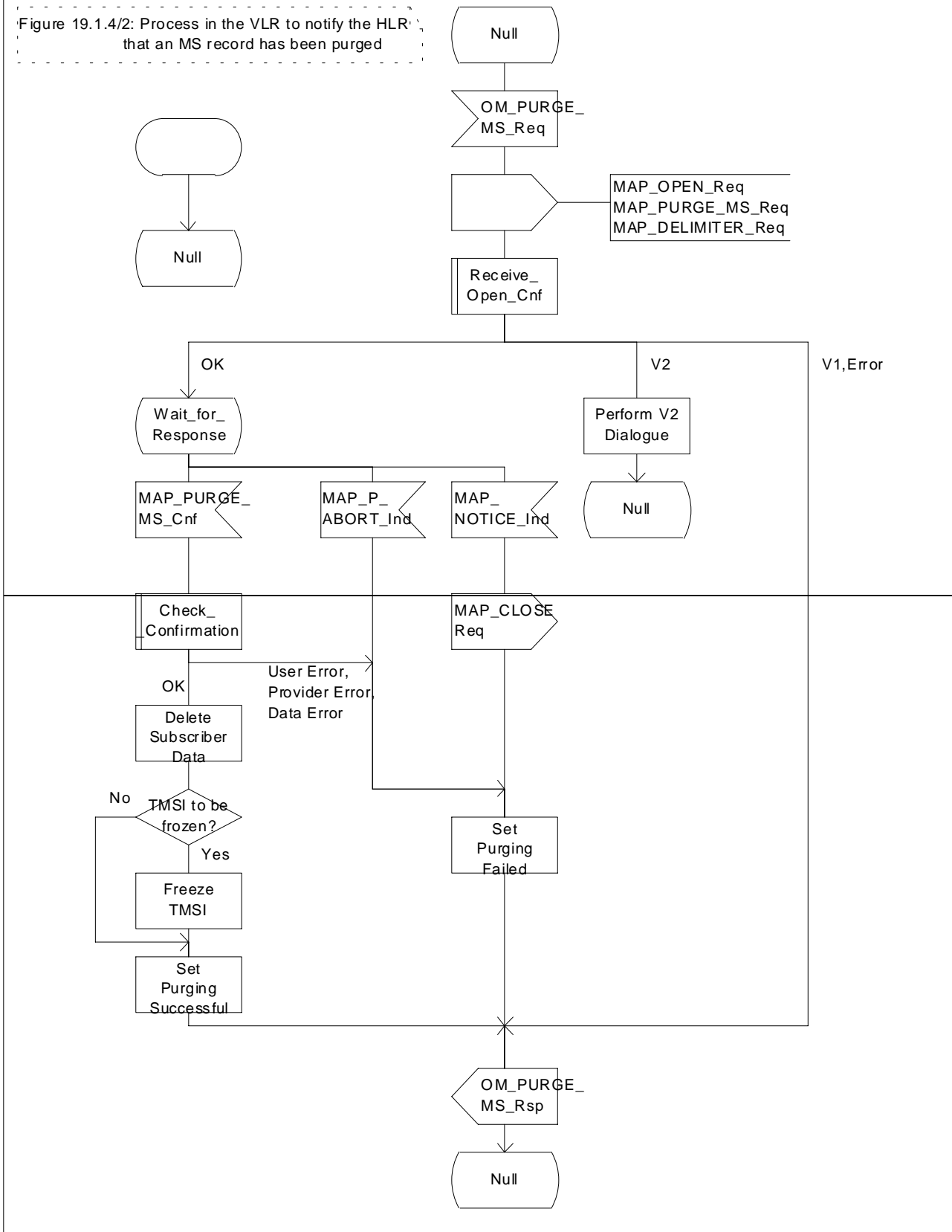
If the HLR accepts the dialogue it returns a MAP\_PURGE\_MS confirmation, containing no parameter, indicating successful outcome of the procedure.

If a MAP\_PURGE\_MS confirmation containing a provider error, data error or user error, or a MAP\_P\_ABORT, MAP\_NOTICE or premature MAP\_CLOSE indication, has been received, the failure is reported to the O&M interface. Successful outcome of the procedure leads to deletion of the subscriber data and freezing of the P-TMSI if so requested by the HLR, and is reported to the O&M interface.

Process Purge\_MS\_VLR

19.1.4\_2(1)

Figure 19.1.4/2: Process in the VLR to notify the HLR that an MS record has been purged



Process Purge\_MS\_VLR

1(1)

Process in the VLR for handling purge MS

Signals to/from the left are to/from Location Management application  
 Signals to/from the right are to/from the HLR MAP protocol machine.

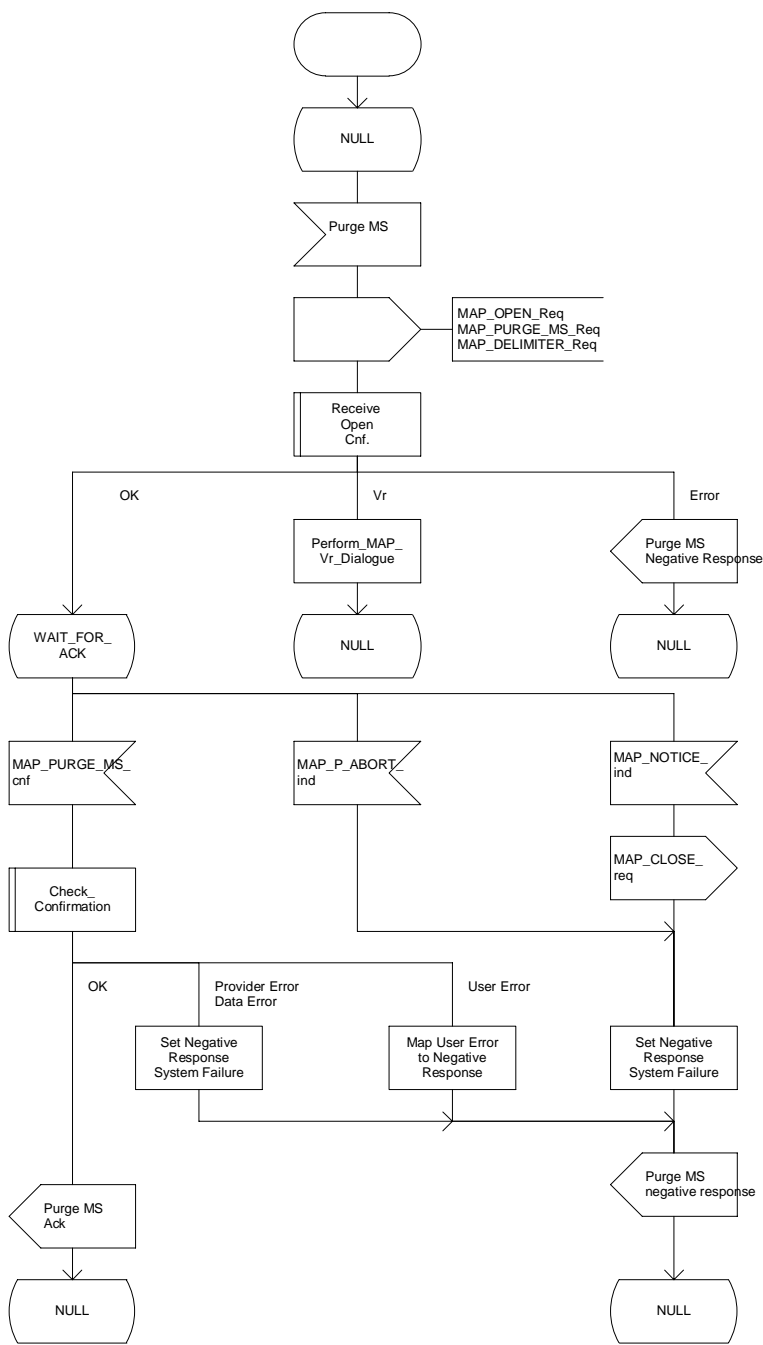


Figure 19.1.4/2: Process Purge\_MS\_VLR

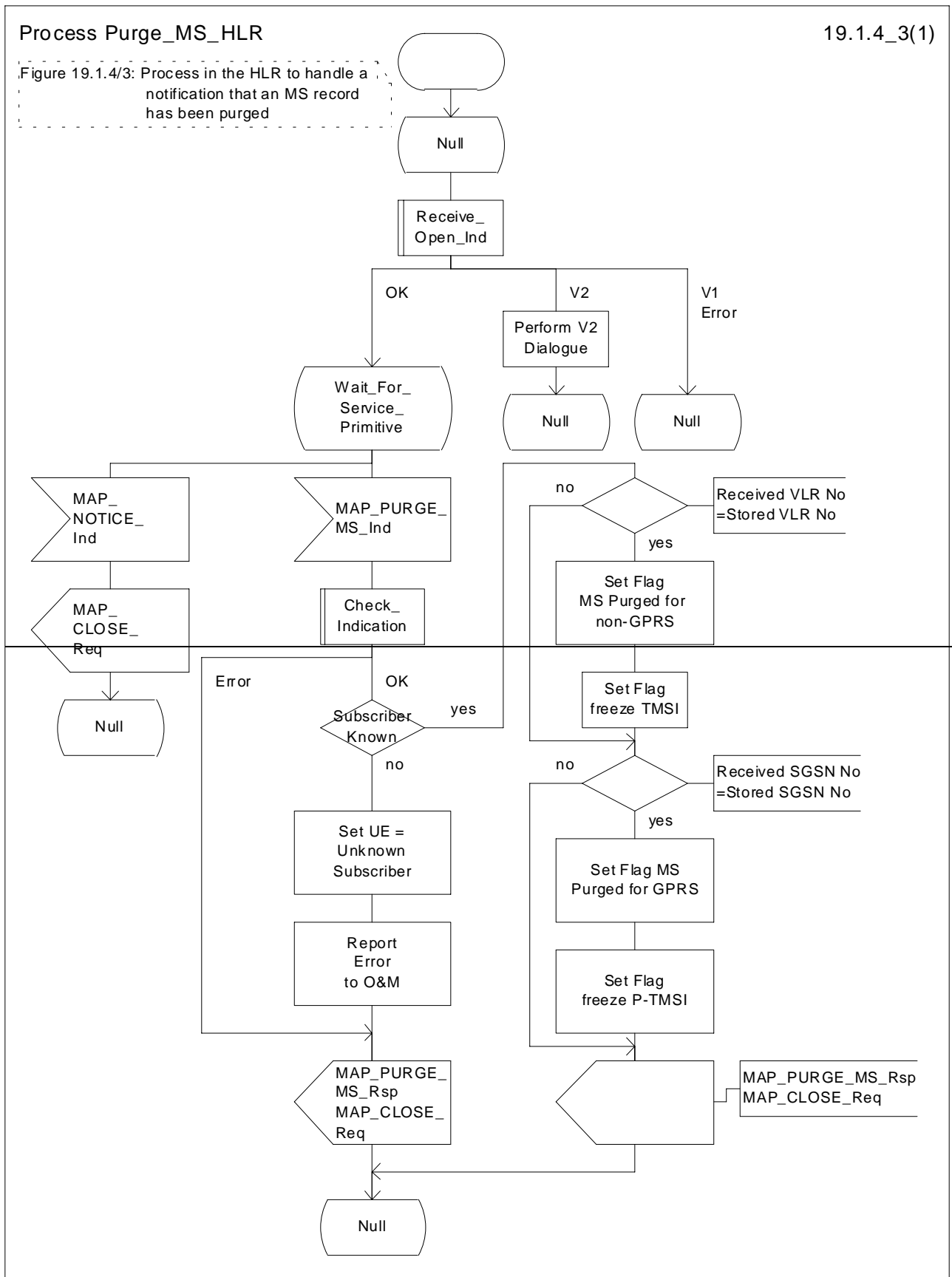


Figure 19.1.4/3: Process Purge\_MS\_HLR

Process Purge\_MS\_HLR

1(2)

Process in the HLR MAP Protocol Machine for handling the Purging of an MS

Signals to/from the left are to/from the VLR  
Signals to/from the right are to/from the HLR Application

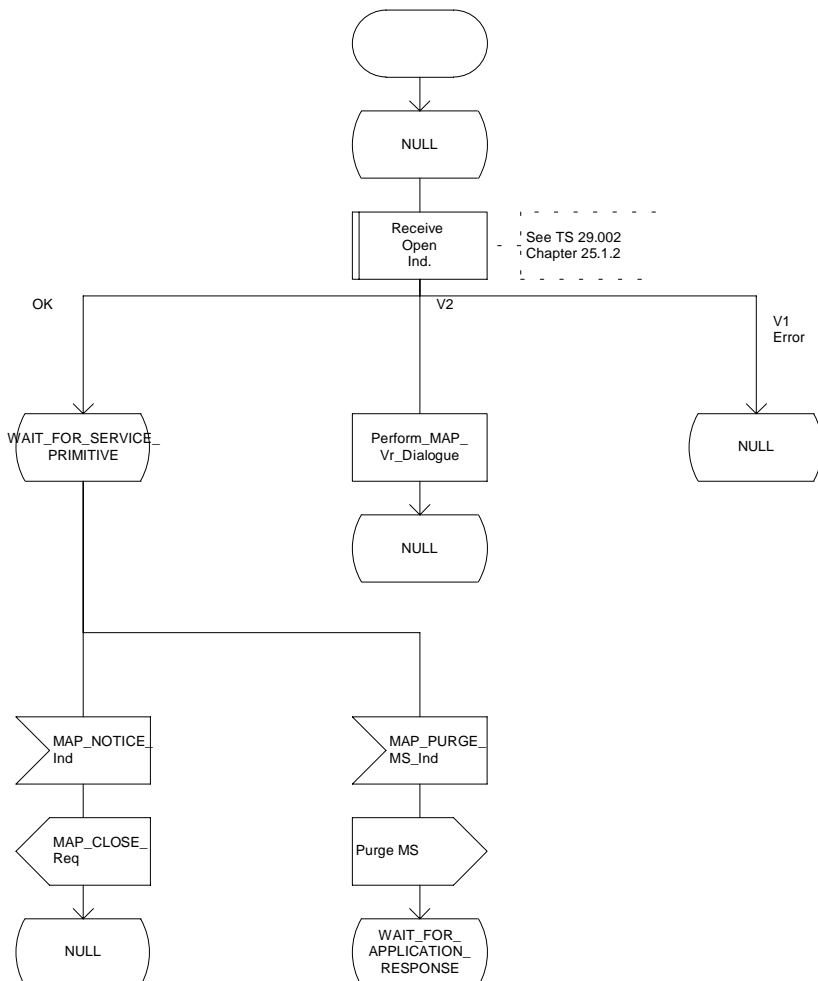


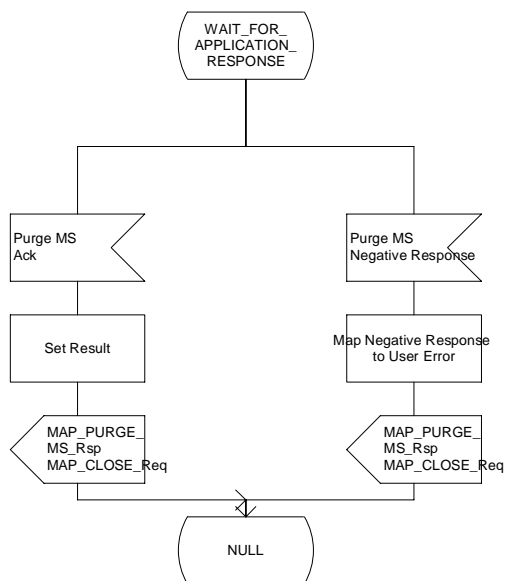
Figure 19.1.4/3 (Sheet 1 of 2): Process Purge MS HLR

### Process Purge\_MS\_HLR

2(2)

Process in the HLR MAP Protocol Machine, for handling the Purging of an MS

Signals to/from the left are to/from the VLR  
Signals to/from the right are to/from the HLR Application



**Figure 19.1.4/3 (Sheet 2 of 2): Process Purge\_MS\_HLR**



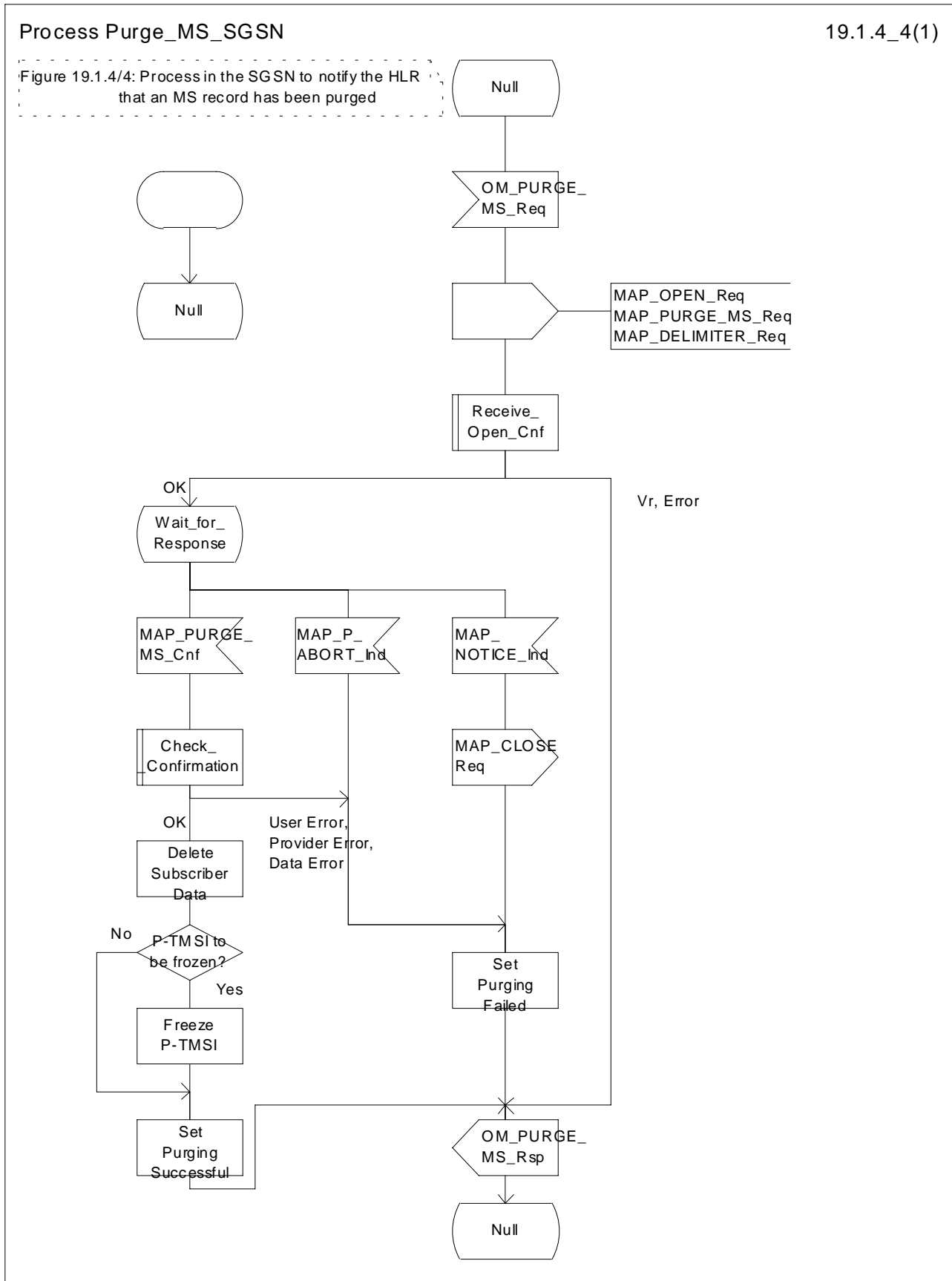


Figure 19.1.4/4: Process Purge\_MS\_SGSN