## NP-030391

# 3GPP TSG CN Plenary Meeting #21 17<sup>th</sup> – 19<sup>th</sup> September 2003 Frankfurt, GERMANY.

Source: TSG CN WG4

Title: "Small" Technical Enhancements and Improvements for MAP

Agenda item: 8.8

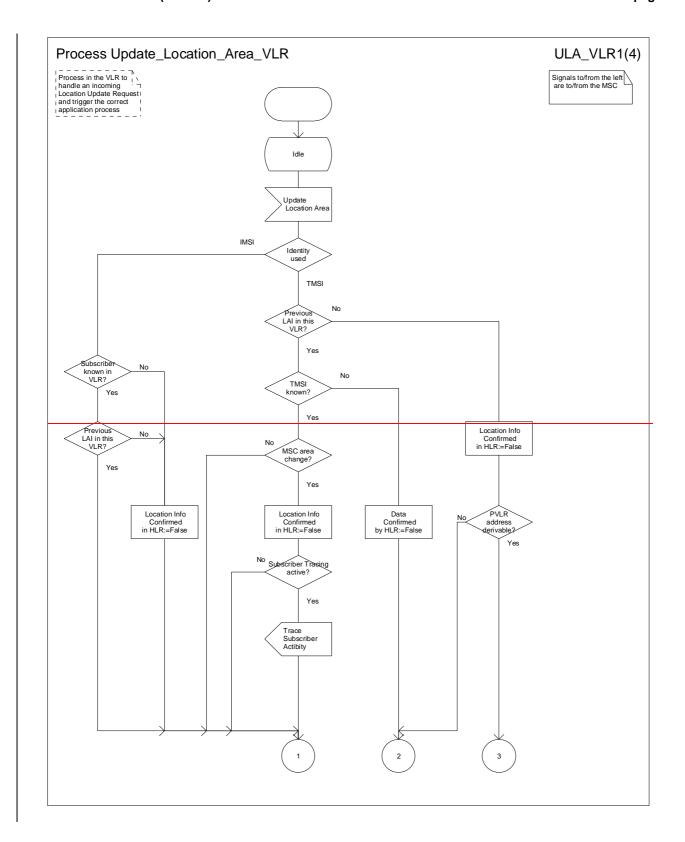
**Document for:** APPROVAL

Spec	CR	Rev	Doc-2nd-Level	Phase	Subject	Cat	Ver_C
29.002	636	2	N4-030952	Rel-5	Provision of SDL diagrams and removal of redundant text in chapter 19	F	5.6.2
29.002	637	1	N4-030953	Rel-6	Provision of SDL diagrams and removal of redundant text in chapter 19	Α	6.2.0
23.012	012		N4-030814	Rel-5	Correction of misaligned signal names between VLR and PVLR	F	5.1.0
29.002	638		N4-030744	Rel-5	Provision of SDL diagrams and removal of redundant text in chapter 20	F	5.6.2
29.002	639		N4-030745	Rel-6	Provision of SDL diagrams and removal of redundant text in chapter 20	Α	6.2.0
29.002	640		N4-030746	Rel-5	Provision of SDL diagrams and removal of redundant text in chapter 21	F	5.6.2
29.002	641		N4-030747	Rel-6	Provision of SDL diagrams and removal of redundant text in chapter 21	Α	6.2.0

# 3GPP TSG CN WG4 Meeting #20 Sophia Antipolis, FRANCE, 25<sup>th</sup> – 29<sup>th</sup> August 2003

CHANGE REQUEST				
æ	23.012 CR 012	Current version: 5.1.0 **		
For <u>HELP</u> on usi	ing this form, see bottom of this page or look at the	e pop-up text over the <b>%</b> symbols.		
Proposed change af	f <b>fects:</b> UICC apps <b>Ж</b> ME Radio Ac	ccess Network Core Network X		
Title: 第	Correction of misaligned signal names between VL	LR and PVLR		
Source: #	CN4			
Work item code: 第	TEI5	<i>Date:</i>		
	F  Jse one of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.	Release: # Rel-5  Use one of the following releases: 2 (GSM Phase 2)  ) R96 (Release 1996) R97 (Release 1997) R98 (Release 1998) R99 (Release 1999) Rel-4 (Release 4) Rel-5 (Release 5) Rel-6 (Release 6)		
Reason for change:	The names of the signals used between the Von inter-VLR location update are not aligned; "Request IMSI", but the signal received at the linked CR to 29.002 aligns the signal name with (MAP_SEND_IDENTIFICATION).  This is a non-critical change, proposed for	the signal sent from the VLR is PVLR is "Send Identification". The with the name of the MAP service		
Summary of change	-	ceived in the VLR to Send		
Consequences if not approved:	Misalignment between processes in 23.012, a	and between 23.012 and 29.002		
Clauses affected:	策 Figure 4.1.2.1			
Other specs affected:	Y N  X Other core specifications X Test specifications O&M Specifications	29.002-636		
Other comments:	No SDL source file is available for the process the complete process has been redrawn. The sheet 3.			

# \*\*\* First modified section \*\*\*



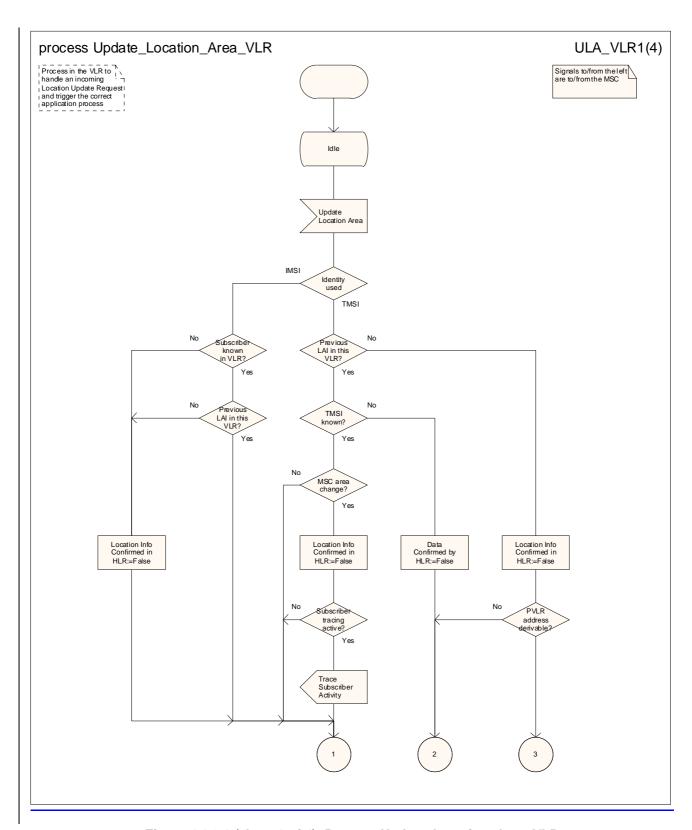
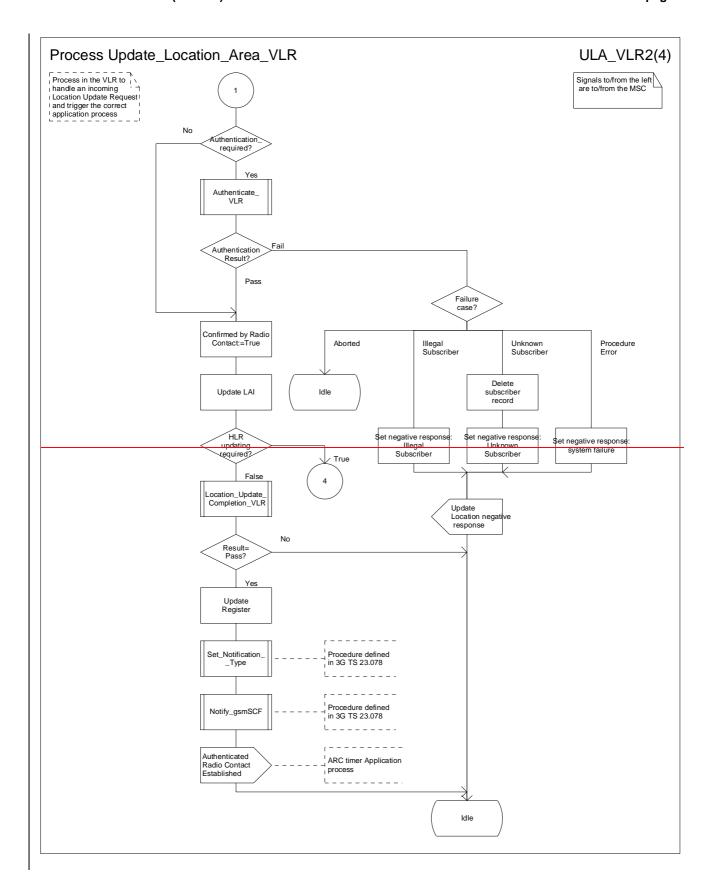


Figure 4.1.2.1 (sheet 1 of 4): Process Update\_Location\_Area\_VLR



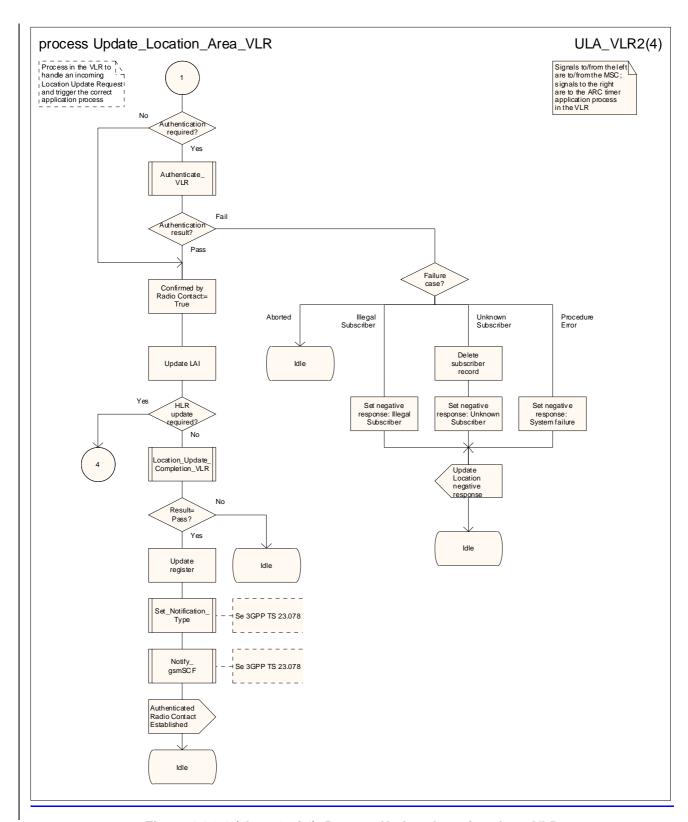
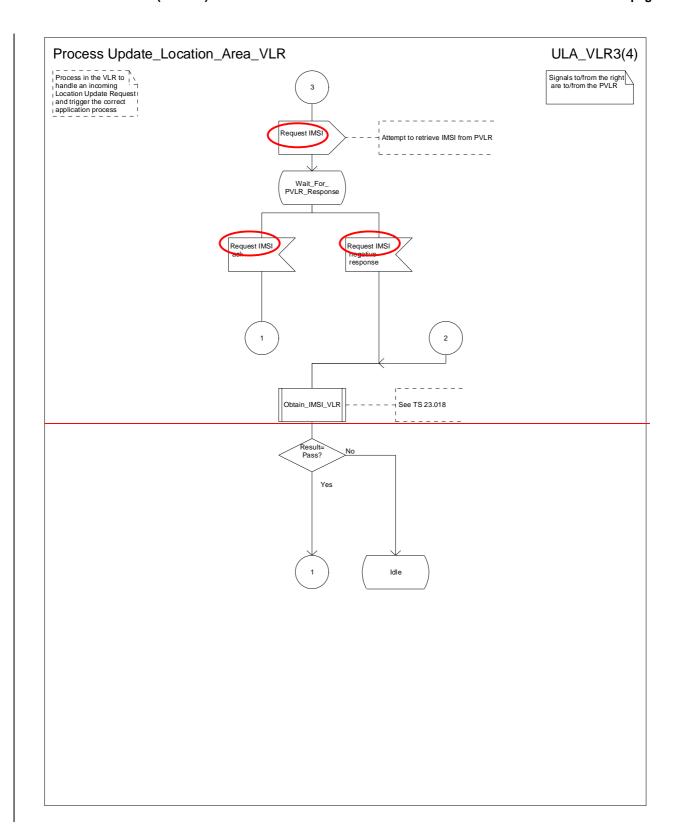


Figure 4.1.2.1 (sheet 2 of 4): Process Update\_Location\_Area\_VLR



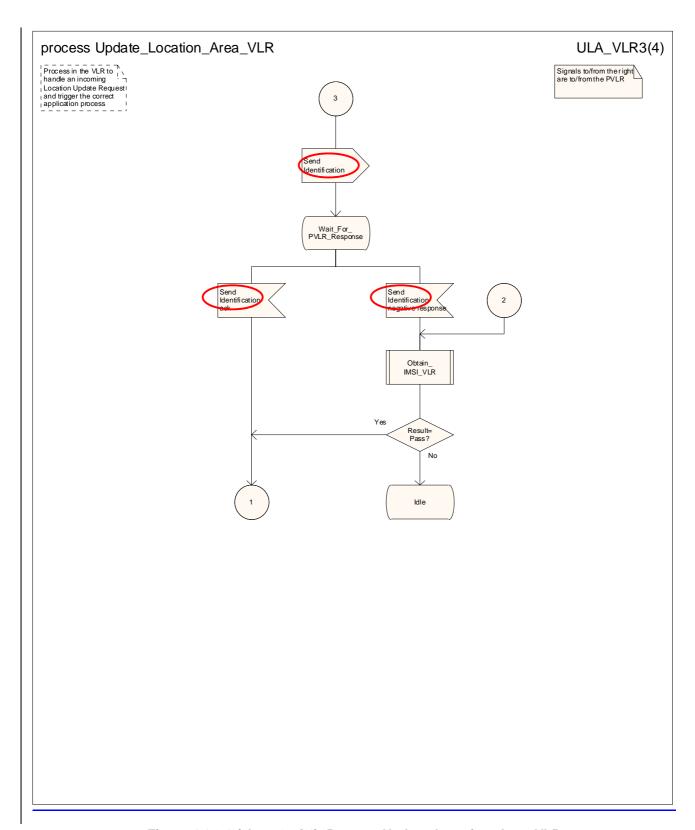
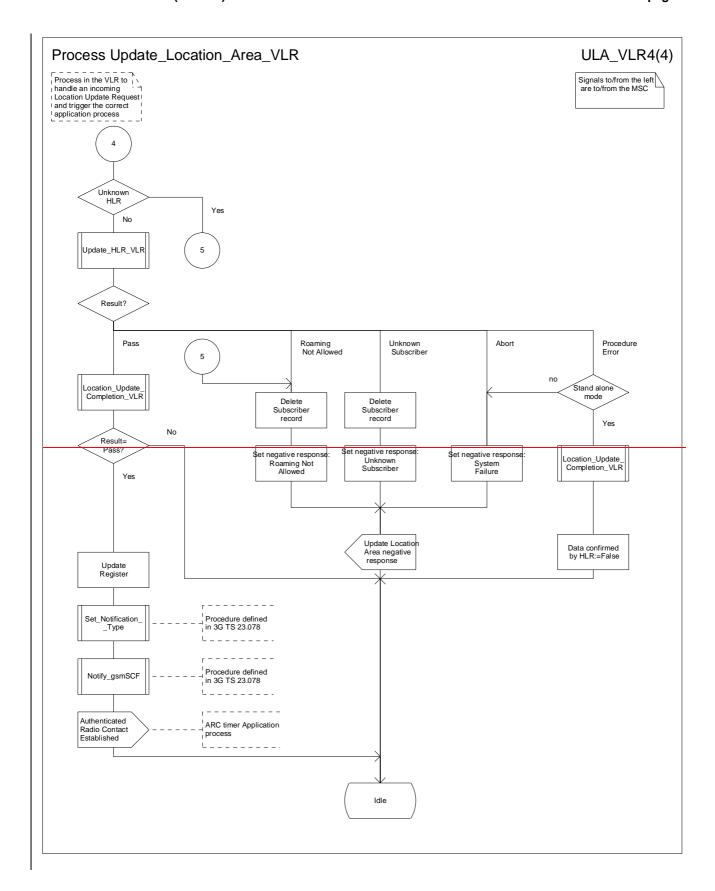


Figure 4.1.2.1 (sheet 3 of 4): Process Update\_Location\_Area\_VLR



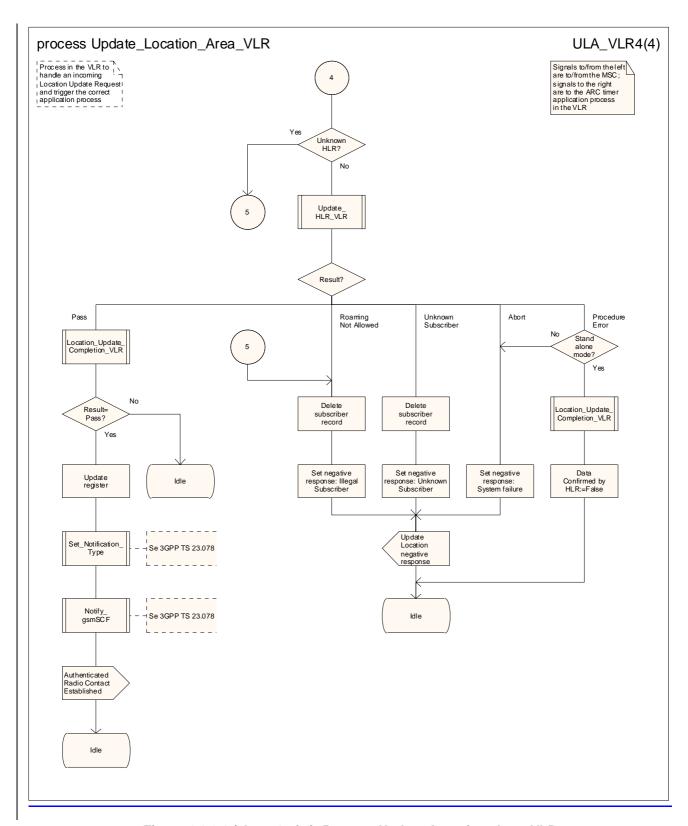


Figure 4.1.2.1 (sheet 4 of 4): Process Update\_Location\_Area\_VLR

# \*\*\* For information \*\*\*

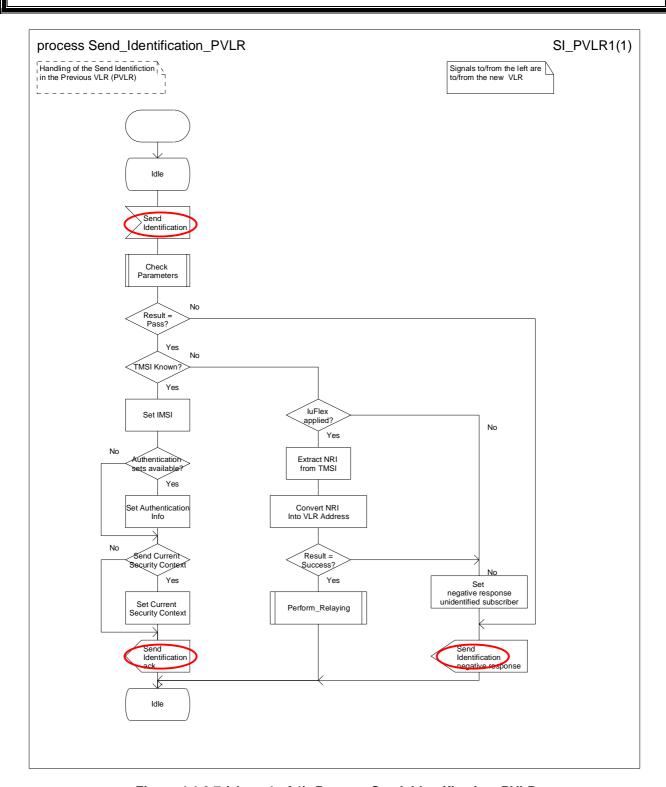


Figure 4.1.2.7 (sheet 1 of 1): Process Send\_Identification\_PVLR

# \*\*\* End of document \*\*\*

# 3GPP TSG CN WG4 Meeting #20 Sophia Antipolis, FRANCE, 25<sup>th</sup> – 29<sup>th</sup> August 2003

CR-Form-v					
ж	29.002 CR 638	Current version:	<b>5.6.2</b> **		
For <u>HELP</u> on	using this form, see bottom of this page or look at the	pop-up text ove	r the <b>%</b> symbols.		
Proposed change	e <b>affects:</b> UICC apps器 ME Radio Acc	cess Network	Core Network X		
Title:	₩ Provision of SDL diagrams and removal of redunda	ant text in chapte	er 20		
Source:	₩ CN4				
Work item code:	¥ TEI5	Date:	3/07/2003		
Category:	Use one of the following categories:  F (correction)  A (corresponds to a correction in an earlier release)  B (addition of feature),  C (functional modification of feature)  D (editorial modification)  Detailed explanations of the above categories can be found in 3GPP TR 21.900.	2 (GS R96 (Rel R97 (Rel R98 (Rel R99 (Rel Rel-4 (Rel Rel-5 (Rel	el-5 collowing releases: M Phase 2) ease 1996) ease 1997) ease 1998) ease 1999) ease 4) ease 5)		

- Reason for change: # 1. There are no source files available for the SDL diagrams in 29.002 chapter 20. Many SDL diagrams are poorly laid out.
  - 2. Some message flow diagrams are drawn using linedraw characters, which do not display correctly in Word 2000.
  - 3. Most of the text repeats the information in the SDL diagrams; the useful additional information is buried in superfluous verbiage. The principle of making the text a **supplement** to the SDL diagrams has been accepted by CN #20, with the approval of CRs to chapters 22 – 25 to remove the redundant
  - 4. Some SDL diagrams use the wrong notation for MAP and other service primitives (the correct notation is req/rsp for an output signal, ind/cnf for an input signal).
  - 5. In the processes in the HLR for activating trace mode, the text description allows a repeat attempt if the VLR or SGSN returns an error, but the SDL does not show this possibility. The text is aligned with the SDL for deactivating trace mode, so the SDL has been aligned with the text.
  - 6. In the processes in the HLR for deactivating trace mode, if the dialogue opening fails the HLR stores the trace mode in the VLR or SGSN as deactive, but it should be active.
  - 7. In the macro in the HLR to delete subscriber data from a VLR, the macro should take the Error exit if the MAP Vr dialogue does not have a successful result.
  - 8. The name of the parameter which is returned in the Delete Subscriber Data response if the whole service area of the MSC/VLR or SGSN is restricted due to regional subscription is "Network Node Area Restricted".
  - 9. In the macro Delete\_Subscriber\_Data\_HLR, if the dialogue drops back to a previous protocol version the result of the dialogue should be reflected in the exit from the macro.

- 10.In the processes INS\_SUBS\_DATA\_VLR & INS\_SUBS\_DATA\_SGSN, the setting of the "Subscriber data confirmed by HLR" flag is not completely covered.
- 11. The reference to the interworking between the MSC and the VLR for tracing during location management is redundant; this is defined in the stage 2 for location management (23.012).

This is a non-critical correction, proposed for agreement by consensus

- Summary of change: # 1. Redraw SDL diagrams to a consistent style. Redraw message flow diagrams. Remove text which replicates the information in SDL diagrams.
  - 2. Correct errors in SDL diagrams.

## Consequences if not approved:

- # 1. No SDL source files to use as the basis for future changes.
  - 2 Message flow diagrams are difficult to read.
  - 3. Useful information to supplement the SDL diagrams is buried in superfluous verbiage.
  - 4. Many minor technical errors in the SDL diagrams.
  - 5. The style of chapter 20 will be markedly different from the style of chapters 22 - 25, making the specification more difficult to use for implementers who are not aware of the history, and leading to a perception of poor quality.

Clauses affected:	<b>₩</b> 20
Other specs affected:	Y N  X Other core specifications X Test specifications O&M Specifications
Other comments:	<ol> <li>The text for each first level subclause has been grouped together, before the SDL diagrams for that subclause.</li> <li>Within each first level subclause, the description of the behaviour of network entities has been re-ordered to show the behaviour of the dialogue initiator first, then the behaviour of the dialogue responder. This change has not been revision marked, except for the changes to subclause numbers and figure numbers.</li> <li>Where a first level subclause includes descriptions of the behaviour of network entities in the CS domain and the PS domain for similar functions, the lower level subclauses have been re-ordered to group the descriptions of the behaviour in the CS and PS domain together. This change has not been revision marked, except for the changes to subclause numbers and figure numbers.</li> <li>The modelling of repeat attempts after a delay (in processes ATM_With_VLR_HLR, ATM_With_SGSN_HLR, DTM_With_VLR_HLR, DTM_With_VLR_HLR, DTM_With_VLR_HLR, DTM_With_SGSN_HLR &amp; Modify_Data_HLR) has been changed to show the timer being started, the process entering a wait state and the input of an internal signal to show timer expiry.</li> <li>In some SDL diagrams, the test "Error" is used after a confirm primitive has been received; this has been replaced with a call to the macro Check_Confirmation.</li> <li>Many process names have been changed to follow the convention that the last component of the name indicates the entity in which the process runs.</li> <li>The convention for the directions of signal inputs and outputs in some SDL diagrams has been changed to reflect the relative positions of entities in the message flow diagrams.</li> </ol>

# 20 Operation and maintenance procedures

# 20.1 General

The Operation and Maintenance procedures are <u>needed for used to support</u> operation and maintenainceing of the <u>GSM\_PLMN</u> network.

The following procedures exist for operation and maintenance purposes:

- i) Tracing procedures;
- ii) Subscriber Data Management procedures;
- iii) Subscriber Identity procedures.

The following application contexts refer to complex MAP Users consisting of several processes:

- subscriberDataManagementContext;
- tracingContext.

<u>Each of These two application contexts needs</u> a co-ordinating process in the VLR or in the SGSN as described in the following <u>sub</u>clauses.

# 20.1.1 Tracing Co-ordinator for the VLR

The MAP\_OPEN indication opens the dialogue for the stand-alone tracing procedure when the application context tracingContext is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_ACTIVATE\_TRACE\_MODE indication is received, the process ATM\_VLR\_Standalone is created;
- if the MAP\_DEACTIVATE\_TRACE\_MODE indication is received, the process DTM\_VLR\_Standalone is ereated.

After creation of the user process the Co ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Tracing Co-ordinator <u>process in the VLR</u> is shown in the figure 20.1/1. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

# 20.1.23 Tracing Co-ordinator for the SGSN

The MAP\_OPEN indication opens the dialogue for the stand-alone tracing procedure when the application context tracingContext is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_ACTIVATE\_TRACE\_MODE indication is received, the process ATM\_SGSN\_Standalone is created;
- if the MAP\_DEACTIVATE\_TRACE\_MODE indication is received, the process DTM\_SGSN\_Standalone is ereated.

After creation of the user process the Co-ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Tracing Co-ordinator <u>process in for the SGSN</u> is shown in the figure 20.1/23. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

# 20.1.32 Subscriber Data Management Co-ordinator for the VLR

The MAP\_OPEN indication opens the dialogue for the stand alone subscriber data management procedure when the application context subscriberDataManagementContex is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_INSERT\_SUBSCRIBER\_DATA indication is received, the process INS\_SUBS\_DATA\_VLR is created:
- if the MAP\_DELETE\_SUBSCRIBER\_DATA indication is received, the process Delete\_Subscriber\_Data\_VLR is created.

After creation of the user process the Co-ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Subscriber\_Data\_Management Co-ordinator <u>process in the VLR</u> is shown in the figure 20.1/32. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

# 20.1.4 Subscriber Data Management Co-ordinator for the SGSN

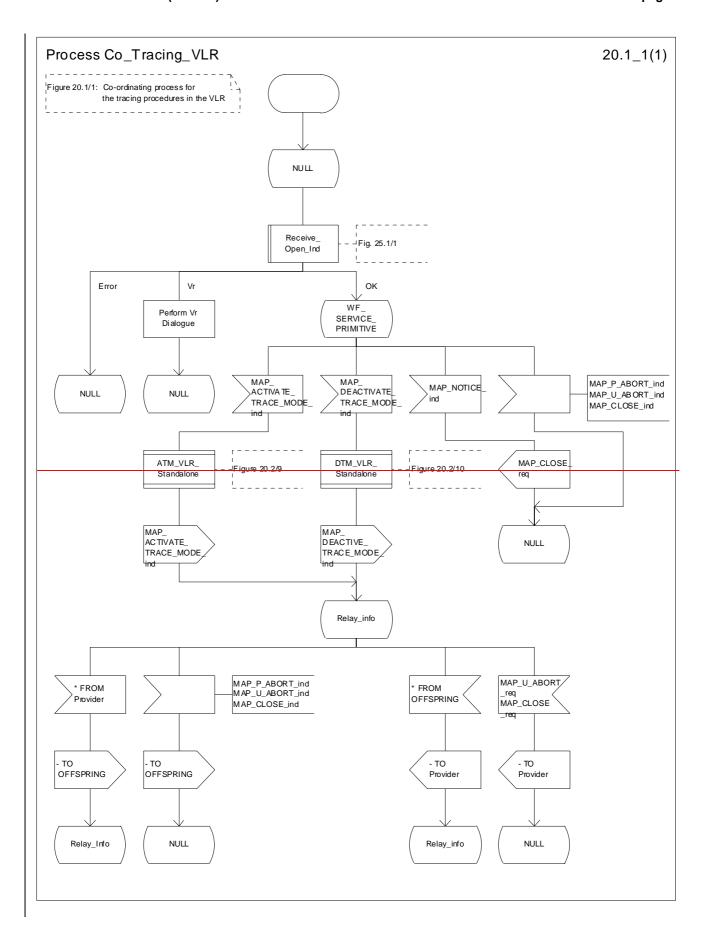
The MAP\_OPEN indication opens the dialogue for the stand alone subscriber data management procedure when the application context subscriberDataManagementContext is received. If that service is successful, the Co ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_INSERT\_SUBSCRIBER\_DATA indication is received, the process INS\_SUBS\_DATA\_SGSN is created;
- if the MAP\_DELETE\_SUBSCRIBER\_DATA indication is received, the process Delete\_Subscriber\_Data\_SGSN is created.

After creation of the user process the Co ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Subscriber\_Data\_Management Co-ordinator <u>process in the SGSN</u> is shown in <u>the figure 20.1/4</u>. <u>The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:</u>

Receive\_Open\_Ind see subclause 25.1.1.



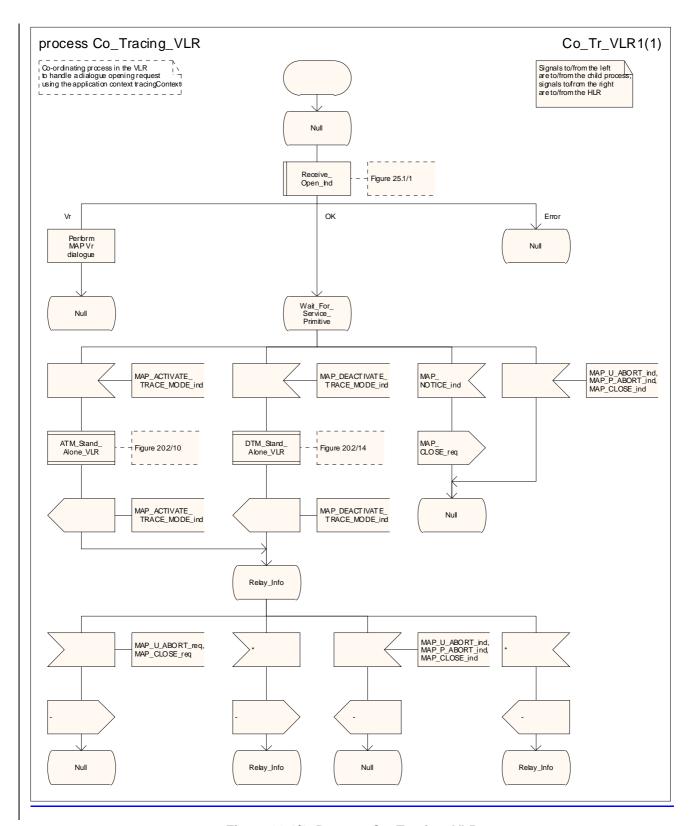
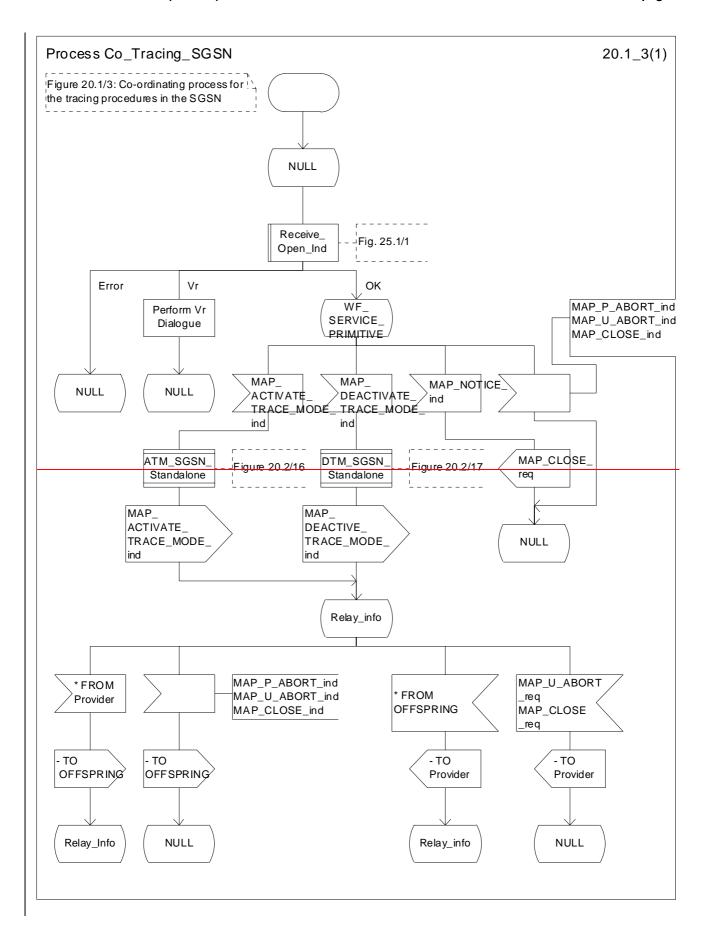


Figure 20.1/1: Process Co\_Tracing\_VLR



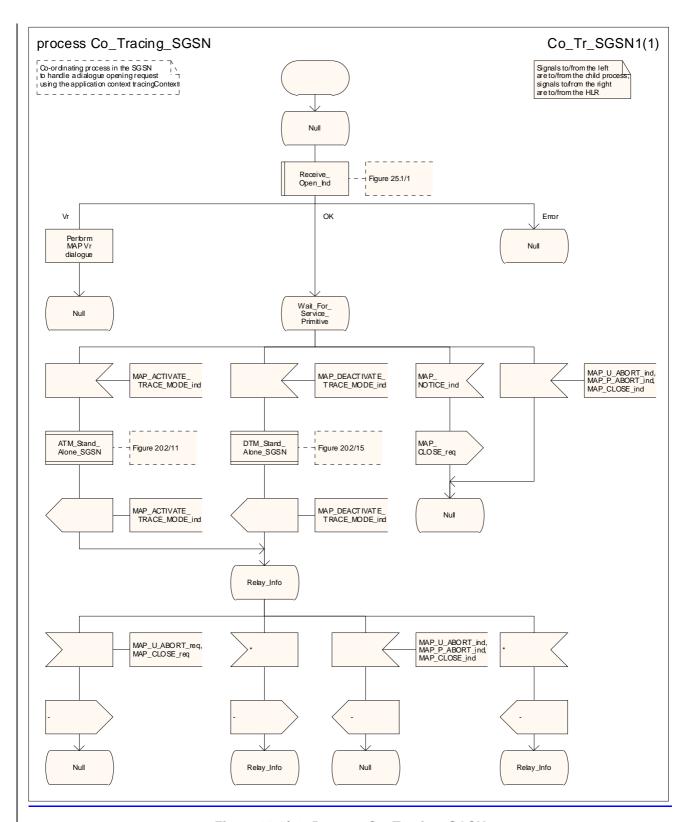
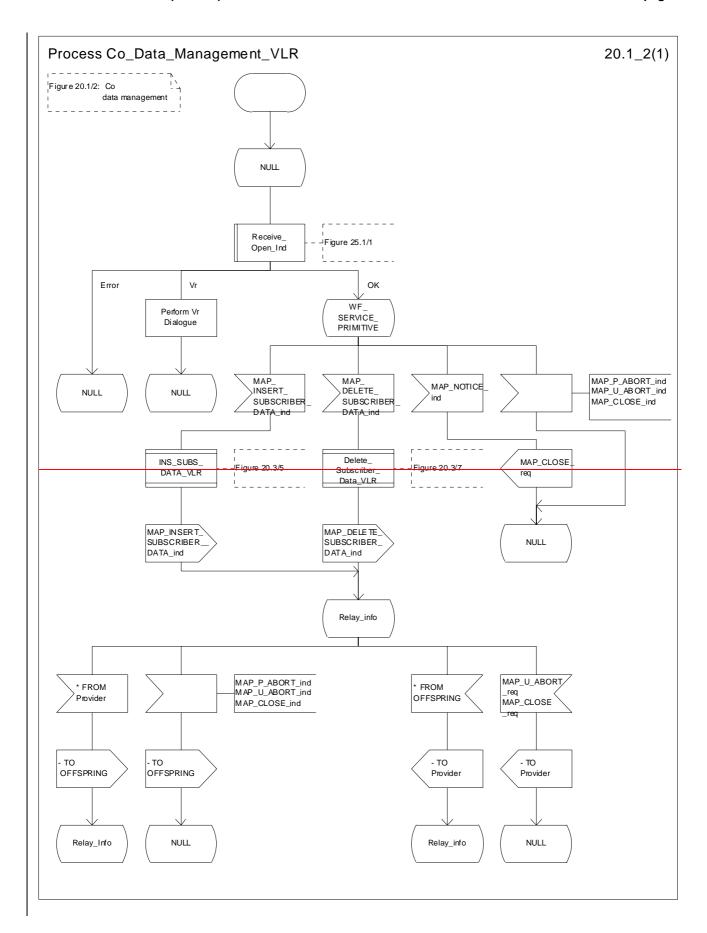


Figure 20.1/23: Process Co\_Tracing\_SGSN



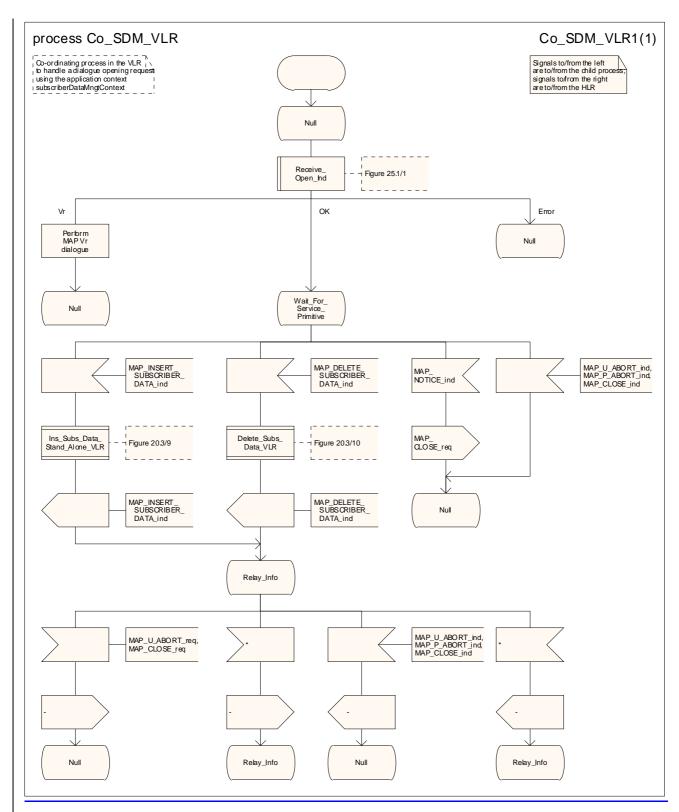
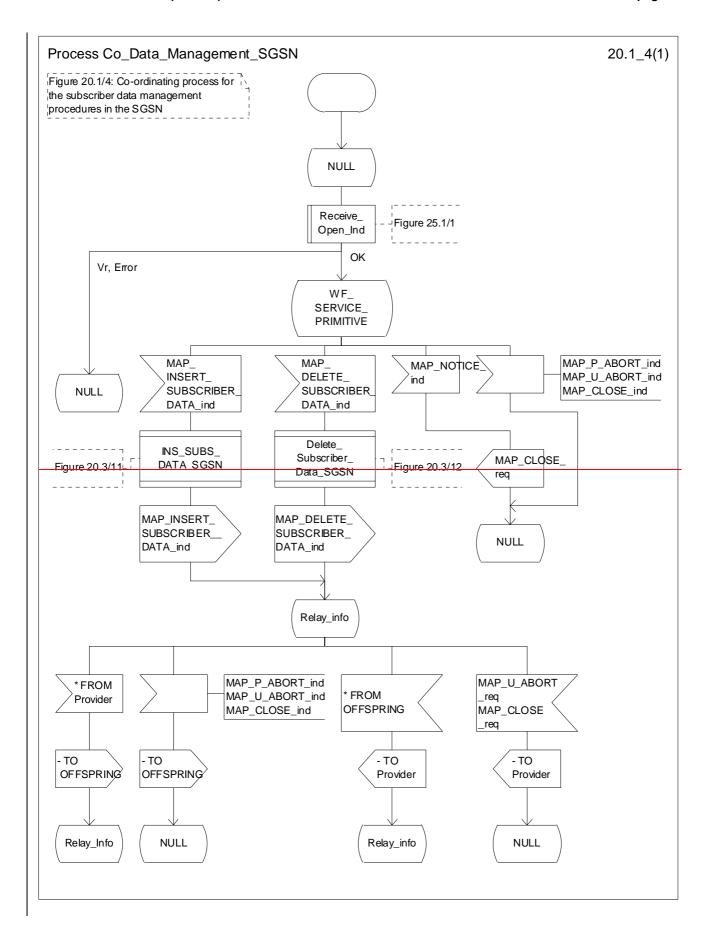


Figure 20.1/32: Process Co\_Data\_ManagementSDM\_VLR



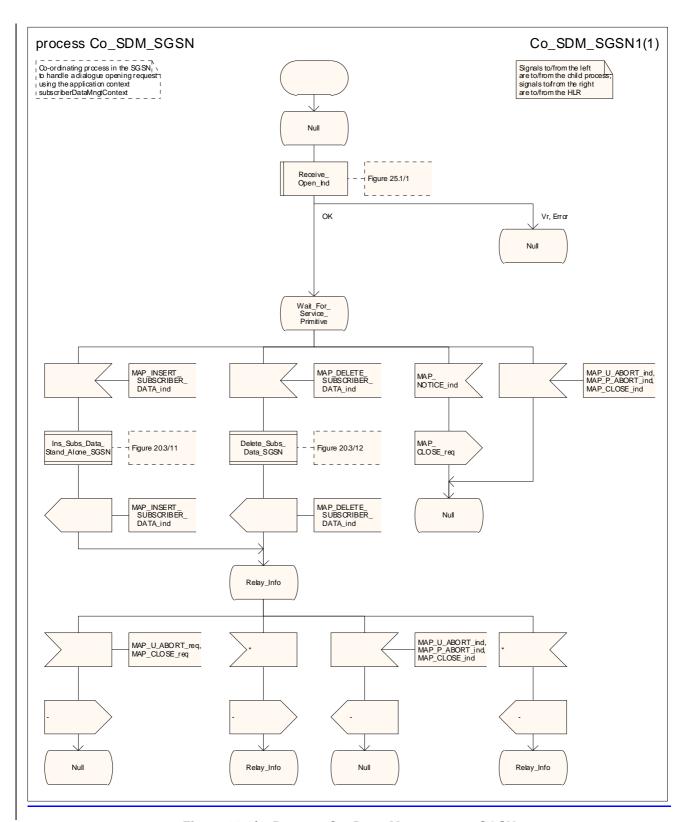


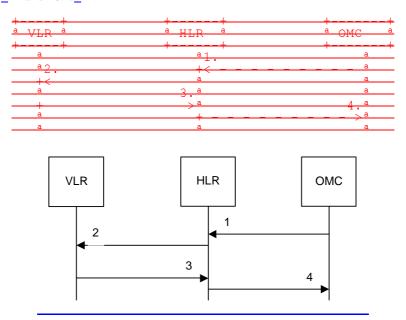
Figure 20.1/4: Process Co\_Data\_Management\_SGSN

#### 20.2 Tracing procedures

Three types of tracing procedures exist:

- i) Subscriber tracing management procedures;
- ii) Subscriber tracing procedures;
- iii) Event tracing procedures.

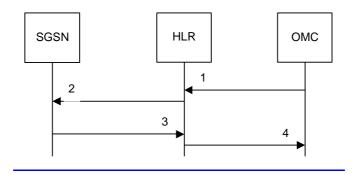
The subscriber tracing management procedures are used for to management of the status and the type of the tracing. The subscriber tracing activation procedure is used at location updating or data restoration when the trace mode of a subscriber is set active in the HLR or, as a stand-alone procedure, when the subscriber is already registered and the trace mode becomes active in the HLR. The procedures for providing a trace request to activate tracing in the VLR are shown in figures 20.2/1 and 20.2/32. The procedures for providing a trace request to activate tracing in the SGSN are shown in figures 20.2/211 and 20.2/412.



- 1) Subscriber Tracing Activation-
- 2) 3) MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Activation Accepted-

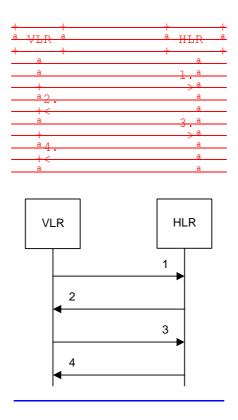
Figure 20.2/1: Stand-alone subscriber tracing activation procedure for non-GPRS





- Subscriber Tracing Activation-1)
- 2) 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Activation Accepted-

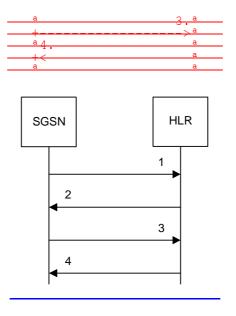
Figure 20.2/241: Stand-alone subscriber tracing activation procedure for GPRS



- MAP\_UPDATE\_LOCATION or MAP\_RESTORE\_DATA\_req/ind-1)
- 2)
- 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK. MAP\_UPDATE\_LOCATION\_ACK or MAP\_RESTORE\_DATA\_rsp/cnfACK.

Figure 20.2/32: Subscriber tracing activation procedure at location updating or data restoration

++	++
a SGSNa	a HLR a
++ a	<del>++</del>
a	1 a
	<u>a</u>
<u>a 2</u> .	a
+<	a

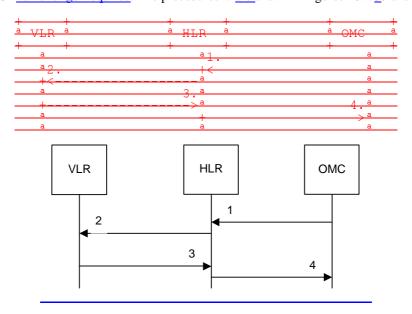


- MAP\_UPDATE\_GPRS\_LOCATION\_req/ind-1)
- 2)
- MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK. 3)
- MAP\_UPDATE\_GPRS\_LOCATION\_rsp/cnfACK.

Figure 20.2/412: Subscriber tracing activation procedure at GPRS location updating

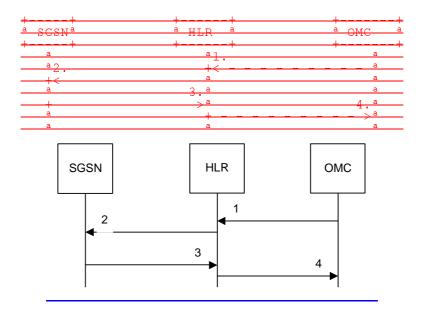
The HLR sends the trace request (IMSI, trace reference, trace type and identity of the OMC) to the VLR or to the SGSN in a MAP\_ACTIVATE\_TRACE\_MODE request includes the IMSI, trace reference, trace type and identity of the OMC. The receipt of this primitive is acknowledged. The acknowledge primitive will indicate that the trace request is accepted by the VLR or by the SGSN. If the request is not accepted, the reason will be reported to the HLR.

The subscriber tracing deactivation procedure is used when the trace requesttracing of a subscriber is to be cancelled in the VLR or in the SGSN is no longer required. The procedures is are shown in figures 20.2/53 and 20.2/613.



- Subscriber Tracing Deactivation-1)
- MAP\_DEACTIVATE\_TRACE\_MODE\_reg/ind-2)
- 3) MAP\_DEACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Deactivation Accepted-

Figure 20.2/53: Subscriber tracing deactivation procedure for non-GPRS

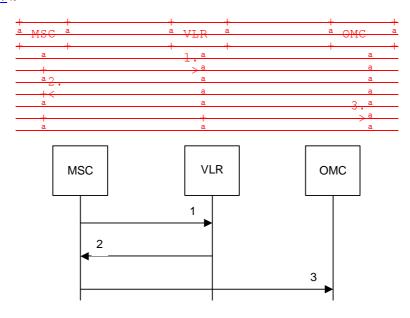


- 1) Subscriber Tracing Deactivation-
- 2) MAP\_DEACTIVATE\_TRACE\_MODE\_req/ind-
- 3) MAP\_DEACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Deactivation Accepted-

Figure 20.2/613: Subscriber tracing deactivation procedure for GPRS

The HLR sends a MAP\_DEACTIVATE\_TRACE\_MODE request to the VLR or to the SGSN. The VLR or the SGSN will acknowledge the deactivation. The acknowledge primitive will indicate that the trace request has been deleted by the VLR or by the SGSN. If the deactivation is not accepted, the reason will be reported to the HLR.

The subscriber tracing procedures are used when the VLR detects any subscriber related activity for which the trace mode is activated, e.g. <u>the VLR</u> receives <u>the a MAP\_PROCESS\_ACCESS\_REQUEST</u> indication. The procedure is shown in figure 20.2/74.



- 1) MAP\_PROCESS\_ACCESS\_REQUEST\_<u>req/ind</u>, <u>MAP\_UPDATE\_LOCATION\_AREA.</u>
- 2) MAP\_TRACE\_SUBSCRIBER\_ACTIVITY\_req/ind-
- Subscriber tracing information-

Figure 20.2/74: Subscriber tracing procedure in the servicing MSC

The VLR will generate the MAP\_TRACE\_SUBSCRIBER\_ACTIVITY indication. The receiving MSC will send the trace record to the OMC.

[Figure numbers 20.2/5 and 20.2/6 are spare.]

## 20.2.1 Procedures in the HLR

# 20.2.1.4 Subscriber tracing activation procedure

#### 20.2.1.1 Procedures in the HLR

A subscriber tracing activation request from the OMC starts the appropriate process in the HLR: ATM\_HLR\_With\_VLR if tracing is required in the MSC/VLR, ATM\_HLR\_With\_SGSN if tracing is required in the SGSN.

When receiving the subscriber tracing mode activation command for a subscriber from the OMC, the HLR will activate tracing, if the subscriber is known and registered in the HLR and the subscriber is roaming in the home PLMN area. The MAP\_ACTIVATE\_TRACE\_MODE request is sent to the VLR or to the SGSN where the subscriber is registered.

If the MAP\_ACTIVATE\_TRACE\_MODE confirmation is received indicating an error situation, the errors are mapped to the OMC interface. The activation request may also be repeated; the number of repeat attempts and the time in between are HLR operator options, depending on the error returned by the VLR or the SGSN.

If the subscriber is known in the HLR, but is deregistered or roaming outside the home PLMN area, the subscriber tracing status is activated in the HLR, but the VLR or the SGSN is not updated.

When receiving a request for location updating or data restoration while the subscriber trace mode is active, the macro Control\_Tracing\_HLR (see figure 25.9/6) shall be initiated by the location updating process in the HLR.

The subscriber tracing activation process in the HLR with VLR is shown in figure 20.2/7.

The process in the HLR to activate tracing in the VLR is shown in figure 20.2/8. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

The subscriber tracing activation process in the HLR with SGSN is shown in figure 20.2/14.

The process in the HLR to activate tracing in the SGSN is shown in figure 20.2/9. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open\_Cnf see subclause 25.1.2;
Check\_Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

#### 20.2.1.2 Procedure in the VLR

When receiving a MAP\_ACTIVATE\_TRACE\_MODE indication, the VLR will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known, the tracing facility is supported and the tracing capacity is not exceeded, the successful report is sent in the MAP\_ACTIVATE\_TRACE\_MODE response primitive.

The MAP\_ACTIVATE\_TRACE\_MODE indication primitive may be received during a location updating or data restoration procedure, so the location updating or restore data process shall use the macro-Activate\_Tracing\_VLR (see figure 25.9/4).

The subscriber tracing activation process in the VLR is shown in figure 20.2/9.

The process in the VLR to activate tracing in a stand-alone dialogue is shown in figure 20.2/10. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check Indication see subclause 25.2.1.

# 20.2.1.3 Procedure in the SGSN

When receiving a MAP\_ACTIVATE\_TRACE\_MODE indication, the SGSN will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known, the tracing facility is supported and the tracing capacity is not exceeded, the successful report is sent in the MAP\_ACTIVATE\_TRACE\_MODE response primitive.

The MAP\_ACTIVATE\_TRACE\_MODE indication primitive may be received during a location updating or data restoration procedure, so the location updating or restore data process shall use the macro Activate\_Tracing\_SGSN (see figure 25.9/5).

The subscriber tracing activation process in the SGSN is shown in figure 20.2/16.

The process in the SGSN to activate tracing in a stand-alone dialogue is shown in figure 20.2/11. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check Indication see subclause 25.2.1.

# 20.2.1.2 Subscriber tracing deactivation procedure

#### 20.2.2.1 Procedures in the HLR

A subscriber tracing deactivation request from the OMC starts the appropriate process in the HLR: DTM\_HLR\_With\_VLR if tracing is no longer required in the MSC/VLR, DTM\_HLR\_With\_SGSN if tracing is no longer required in the SGSN.

When receiving the subscriber trace mode deactivation command for a subscriber from the OMC, the HLR will send the MAP\_DEACTIVATE\_TRACE\_MODE request to the VLR or to the SGSN where the subscriber is registered, if the trace mode activation has been carried out. The subscriber tracing in HLR is set to a deactive state.

If the operation is successful, the HLR will set the subscriber tracing in VLR or in SGSN to a deactive state.

If the MAP\_DEACTIVATE\_TRACE\_MODE confirmation is received indicating an error situation, the errors are mapped to the OMC interface. The deactivation request may be also repeated; the number of repeat attempts and the time in between are HLR operator options, depending on the error returned by the VLR or by the SGSN.

The subscriber tracing deactivation procedure with VLR is shown in figure 20.2/8.

The process in the HLR to deactivate tracing in the VLR is shown in figure 20.2/12. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

The subscriber tracing deactivation procedure with SGSN is shown in figure 20.2/15.

The process in the HLR to deactivate tracing in the SGSN is shown in figure 20.2/13. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

#### 20.2.2.2 Procedures in the VLR

The VLR is involved in the following tracing procedures:

- i) Subscriber tracing activation procedure;
- ii) Subscriber tracing deactivation procedure;
- iii) Subscriber tracing procedure.

#### 20.2.2.1 Subscriber tracing activation procedure

## 20.2.2.2 Subscriber tracing deactivation procedure

When receiving a MAP\_DEACTIVATE\_TRACE\_MODE indication, the VLR will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known and the tracing facility is supported, the successful report is sent in the MAP\_DEACTIVATE\_TRACE\_MODE response primitive.

The subscriber tracing deactivation procedure in the VLR is shown in figure 20.2/10.

The process in the VLR to deactivate tracing is shown in figure 20.2/14. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check\_Indication see subclause 25.2.1.

#### 20.2.2.3 Procedure in the SGSN

When receiving a MAP\_DEACTIVATE\_TRACE\_MODE indication, the SGSN will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known and the tracing facility is supported, the successful report is sent in the MAP\_DEACTIVATE\_TRACE\_MODE response primitive.

The subscriber tracing deactivation procedure in the SGSN is shown in figure 20.2/17.

The process in the SGSN to deactivate tracing is shown in figure 20.2/15. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

<u>Check\_Indication</u> see subclause 25.2.1.

# 20.2.2.3 Subscriber tracing procedure

When the VLR receives a MAP\_PROCESS\_ACCESS\_REQUEST or MAP\_UPDATE\_LOCATION\_AREA indication related to any subscriber activity from the MSC, the subscriber tracing procedure may be carried out. The macro Trace\_Subscriber\_Activity\_VLR is shown in figure 25.9/2.

#### 20.2.3 Procedures in the MSC

The MSC is involved in the following tracing procedure:

i) Subscriber tracing procedure.

## 20.2.3.1 Subscriber tracing procedure

When receiving the MAP\_TRACE\_SUBSCRIBER\_ACTIVITY indication from the VLR, the MSC stores trace reference, trace type and the identity of the OMC in charge of the trace, and the MSC starts to collect the trace information. The MSC will send the trace record to the OMC.

The macro Trace\_Subscriber\_Activity\_MSC is shown in figure 25.9/1.

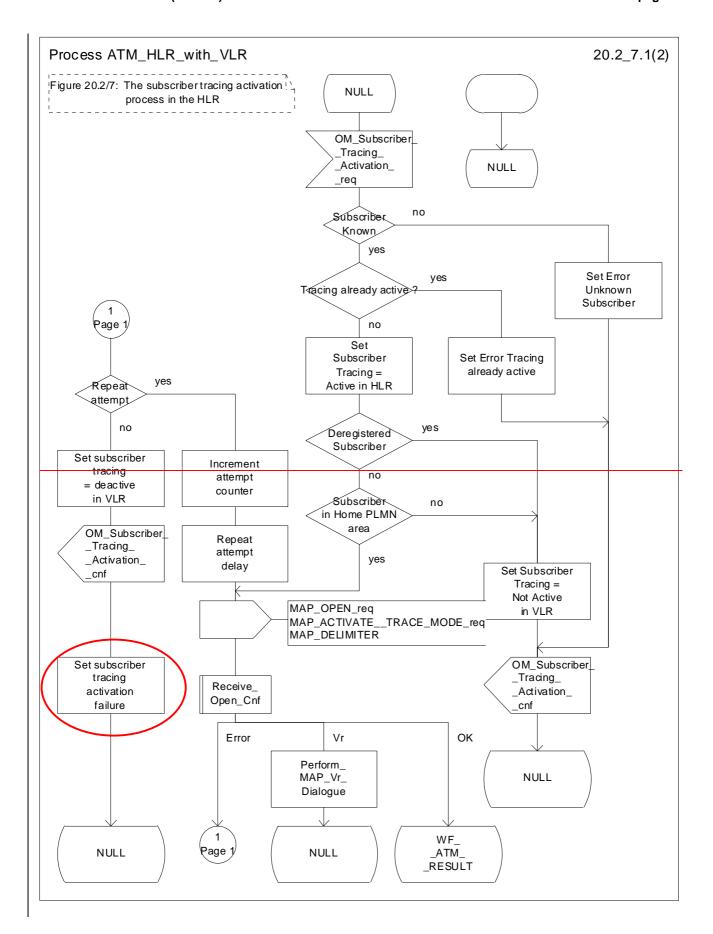
## 20.2.4 Procedures in the SGSN

The SGSN is involved in the following tracing procedures:

- i) Subscriber tracing activation procedure;
- ii) Subscriber tracing deactivation procedure.

## 20.2.4.1 Subscriber tracing activation procedure

## 20.2.4.2 Subscriber tracing deactivation procedure in SGSN



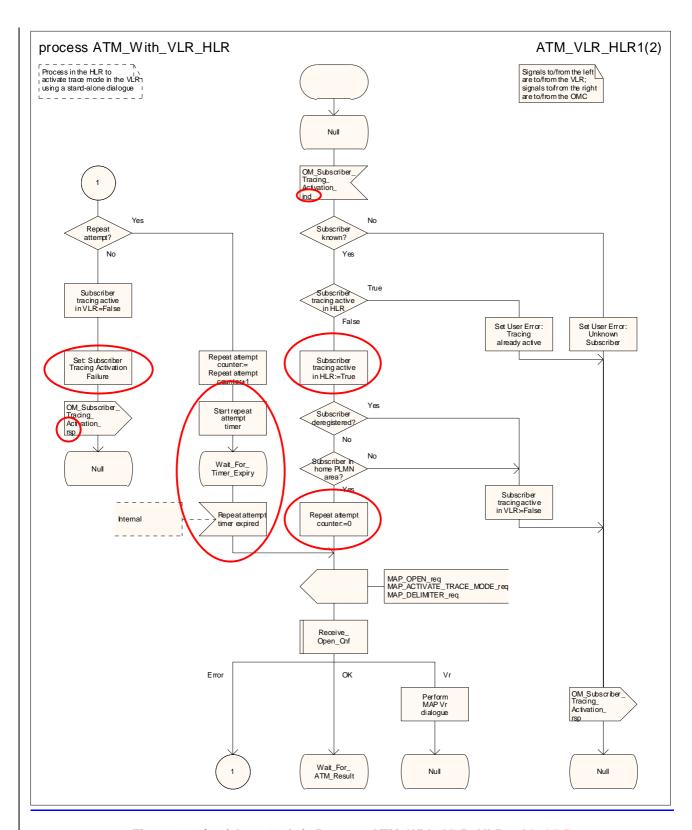
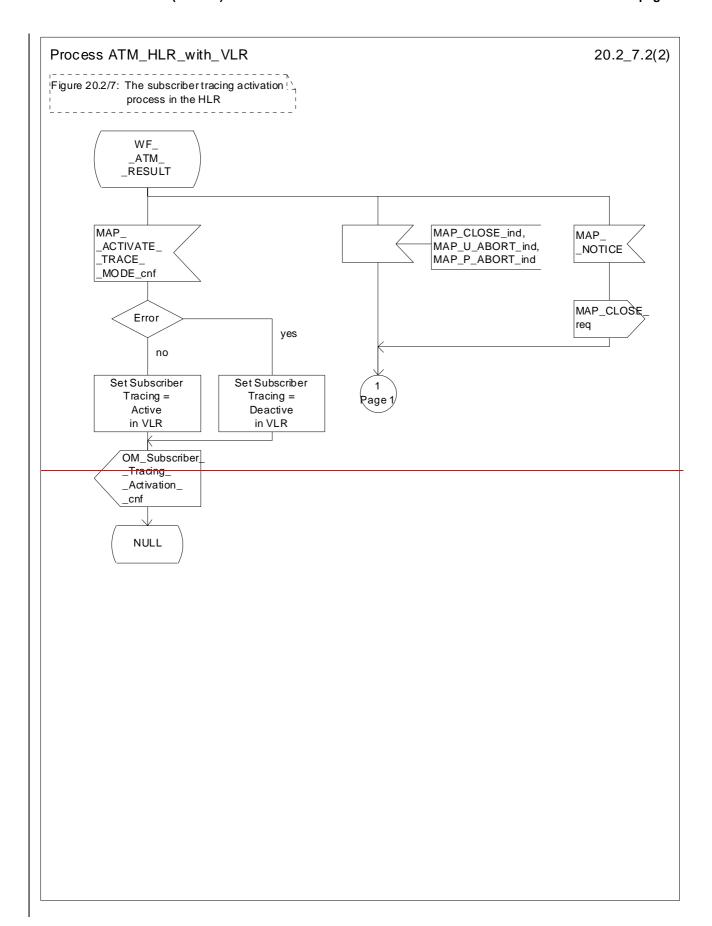


Figure 20.2/87 (sheet 1 of 2): Process ATM\_With\_VLR\_HLR\_with\_VLR



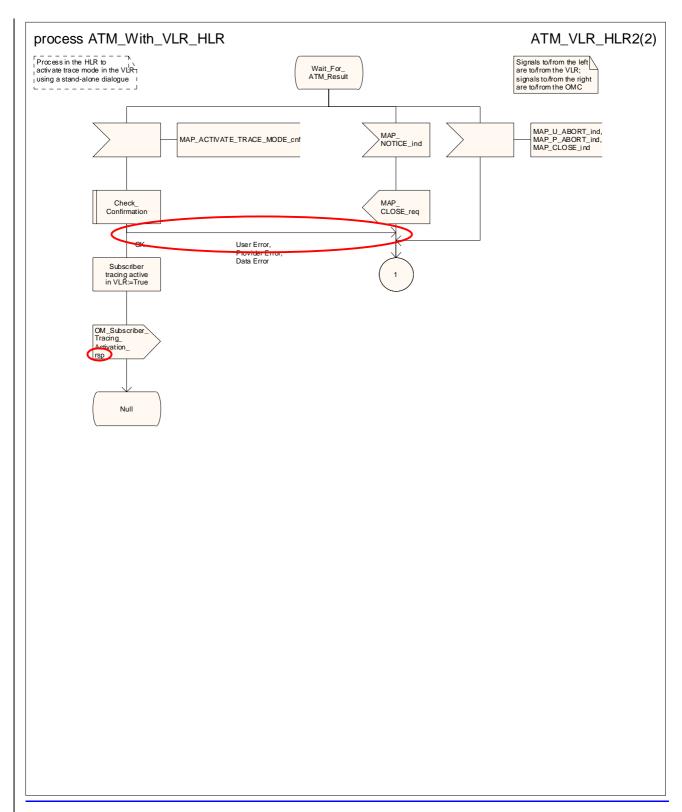
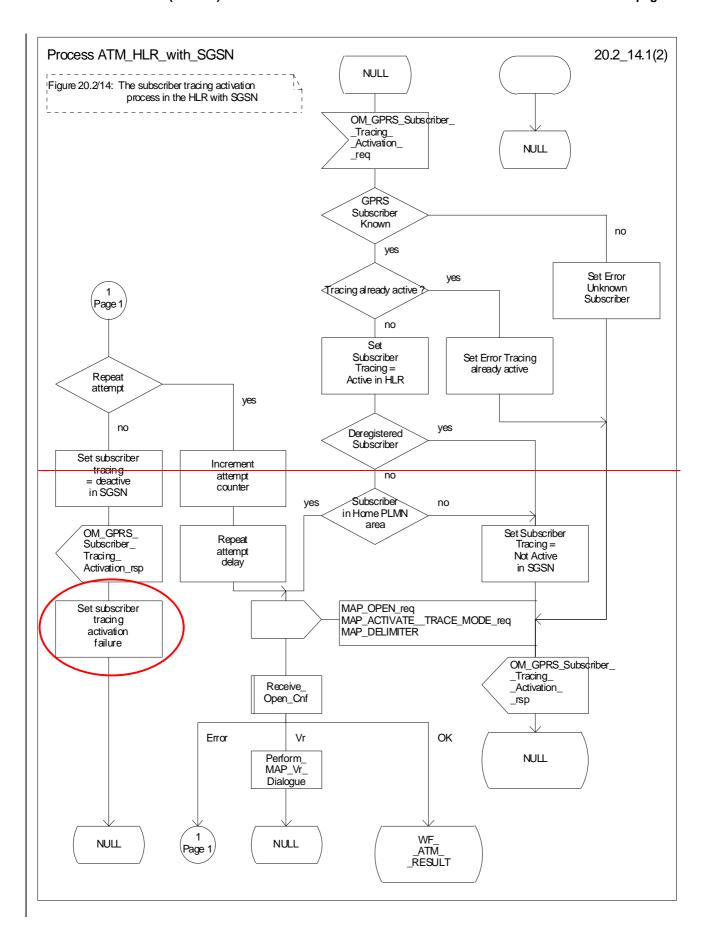


Figure 20.2/87 (sheet 2 of 2): Process ATM With VLR HLR with VLR



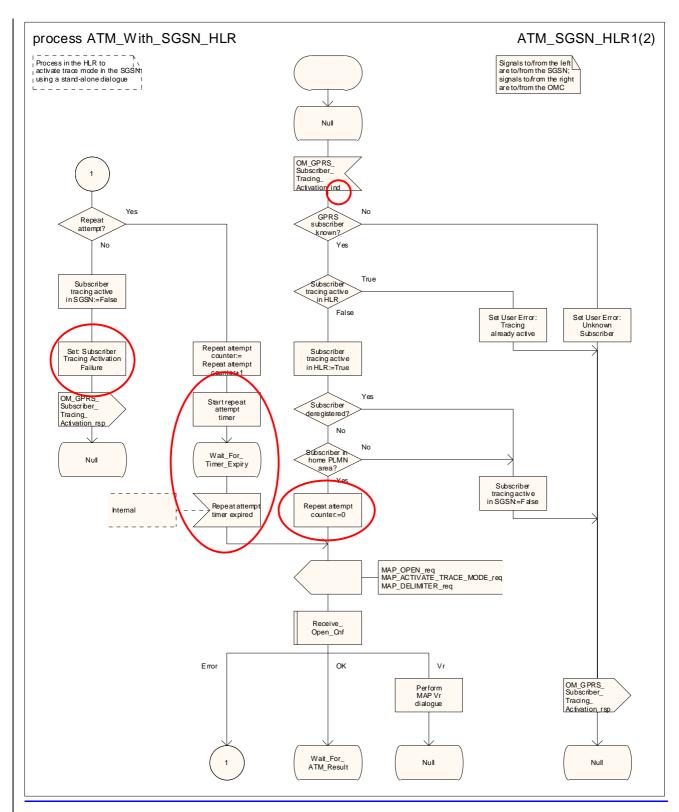
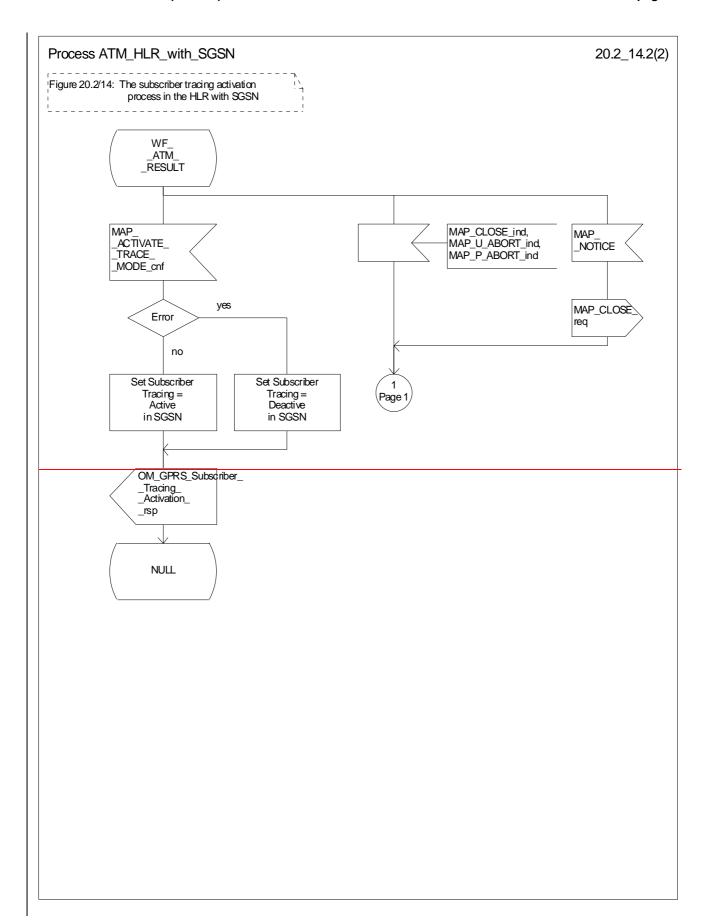


Figure 20.2/914 (sheet 1 of 2): Process ATM\_With\_SGSN\_HLR\_with\_SGSN



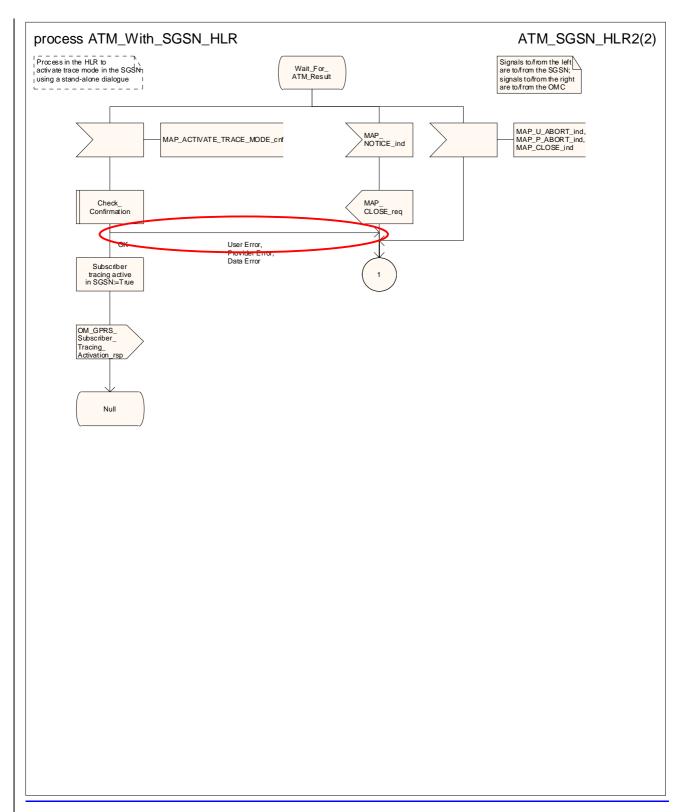
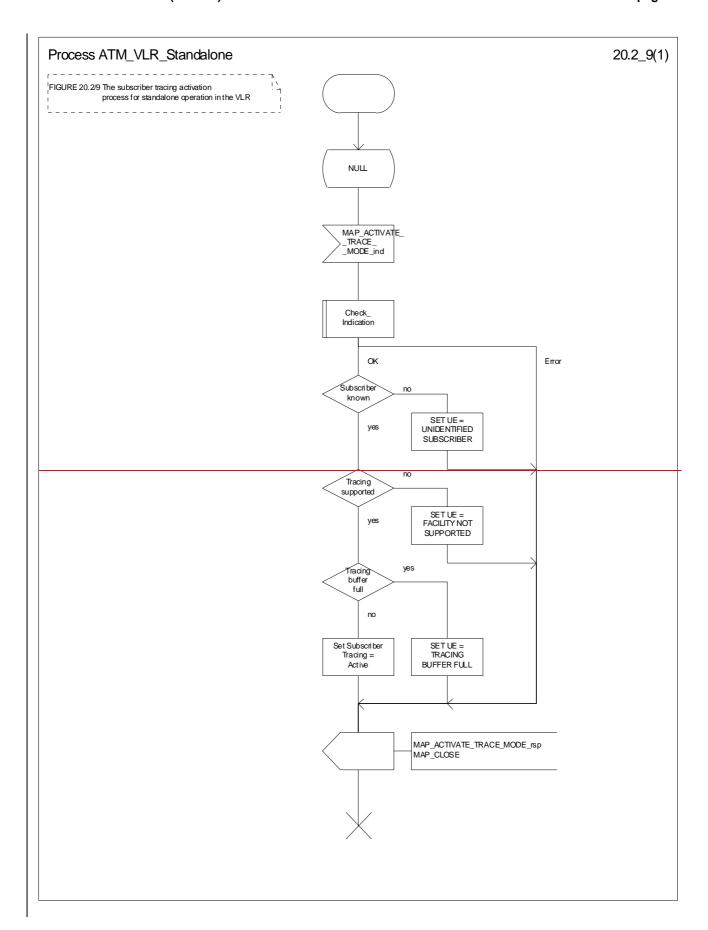


Figure 20.2/914 (sheet 2 of 2): Process ATM\_With\_SGSN\_HLR\_with\_SGSN



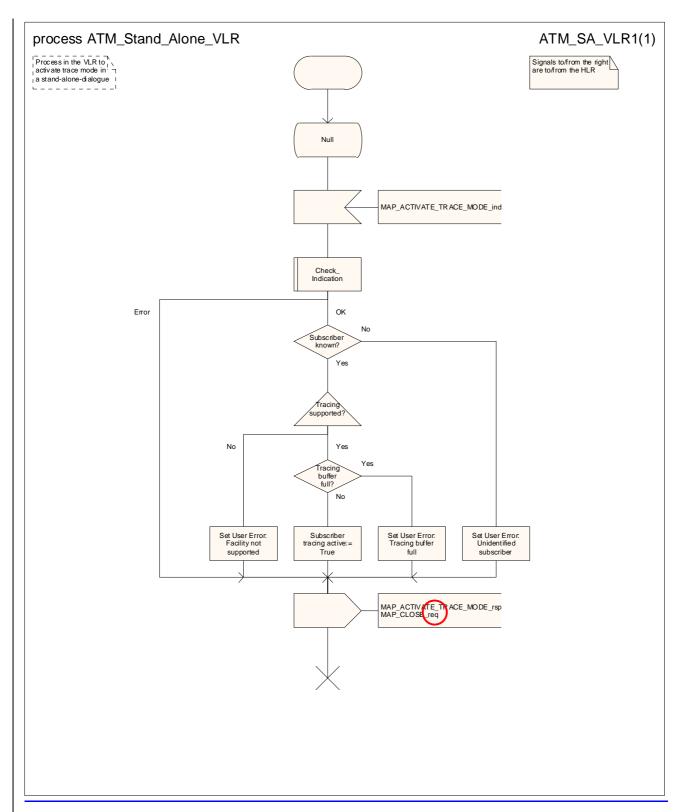
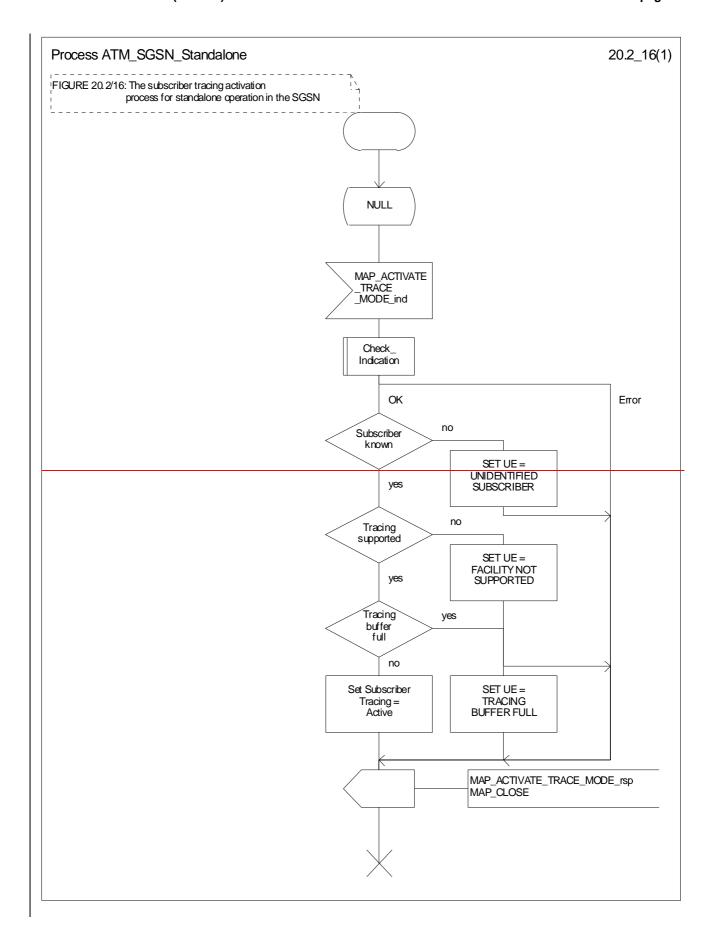


Figure 20.2/109: Process ATM\_Stand\_Alone\_VLR\_Standalone



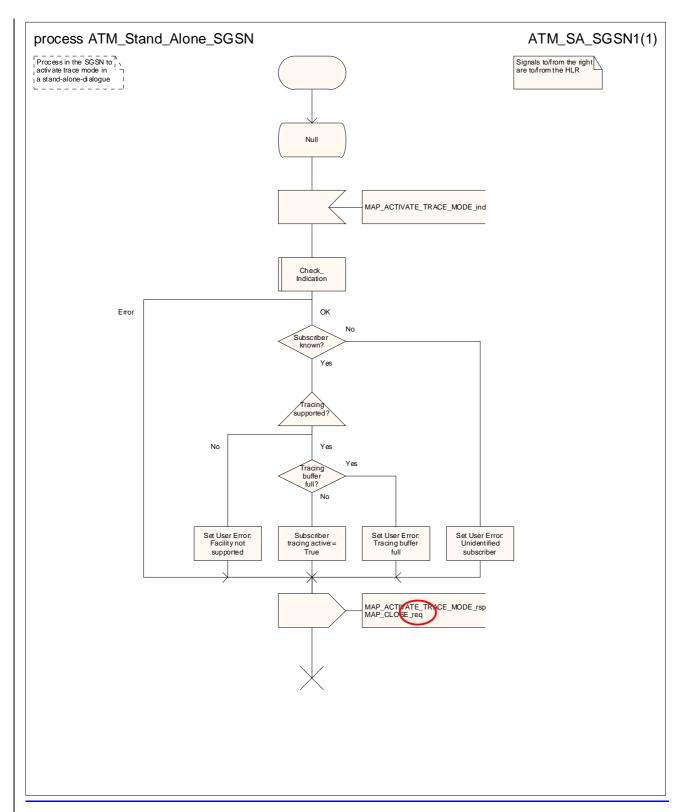
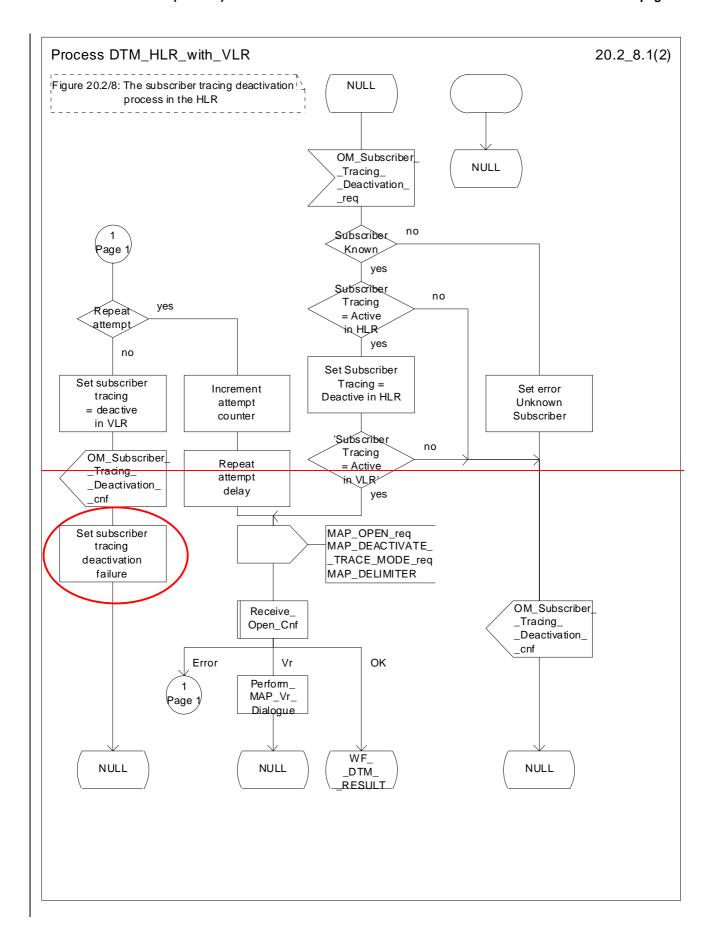


Figure 20.2/116: Process ATM Stand Alone SGSN Standalone



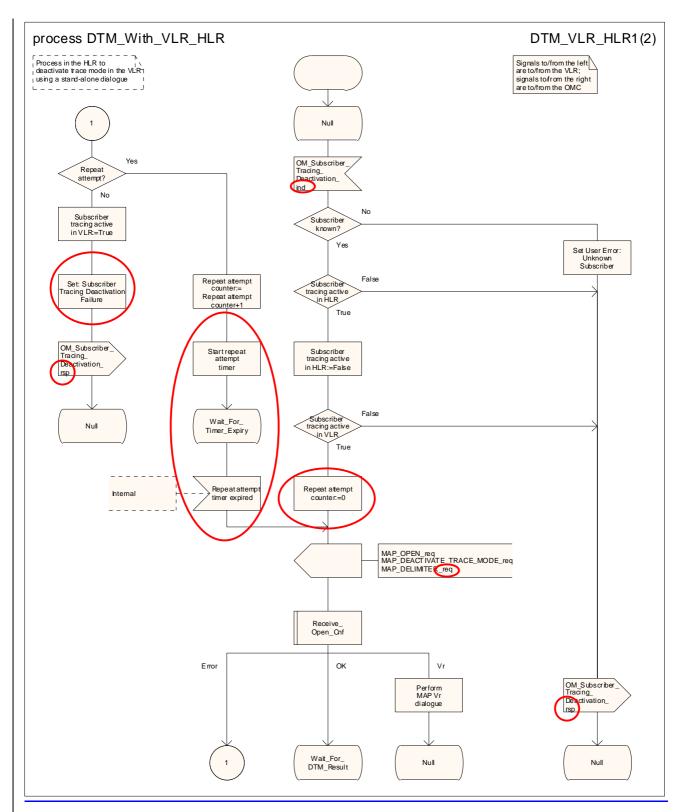
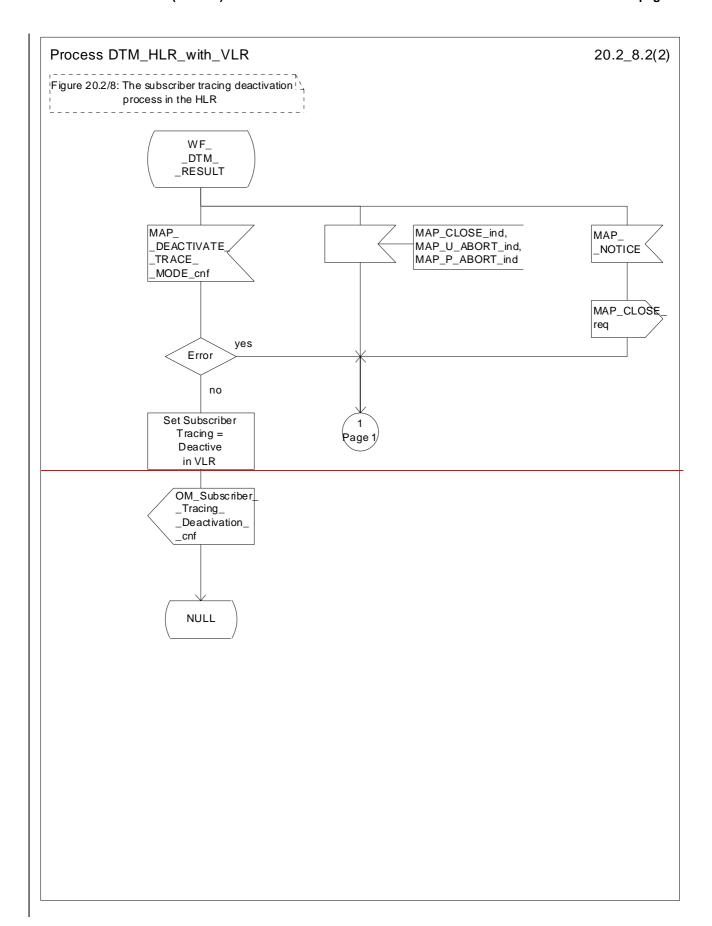


Figure 20.2/128 (sheet 1 of 2): Process DTM With VLR HLR with VLR



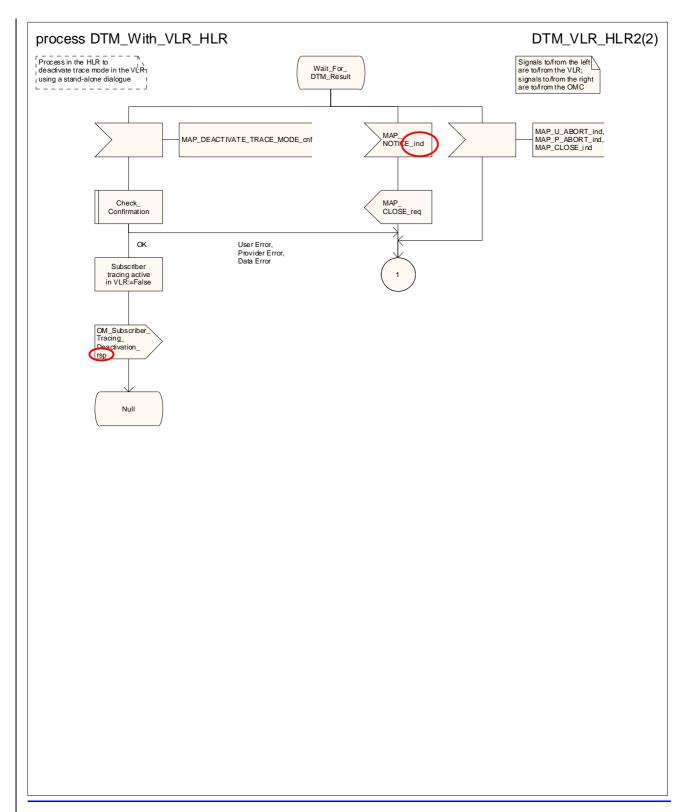
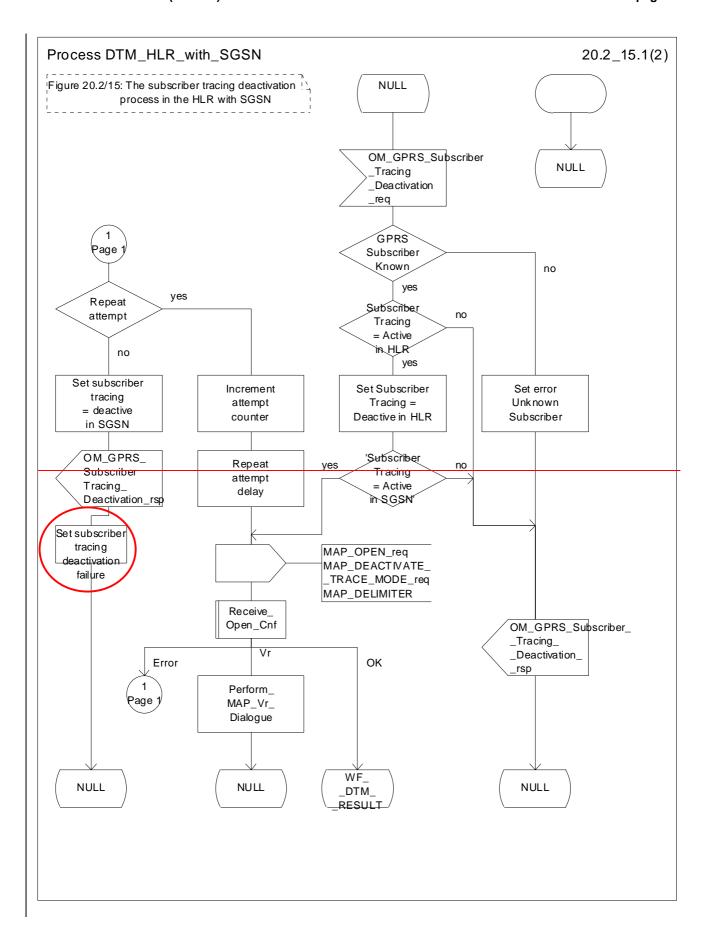


Figure 20.2/128 (sheet 2 of 2): Process DTM With VLR HLR with VLR



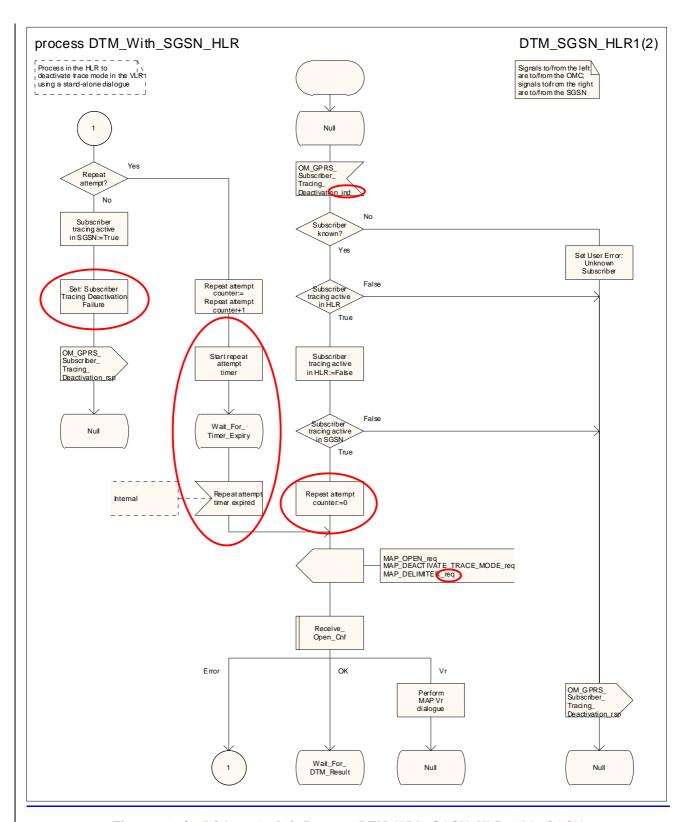
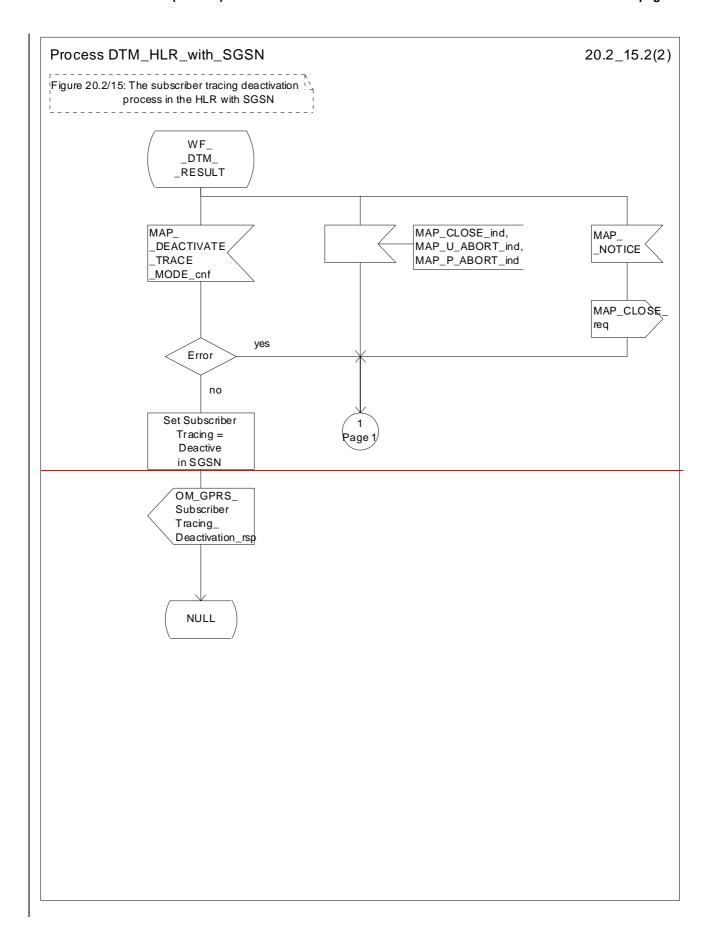


Figure 20.2/135 (sheet 1 of 2): Process DTM With SGSN\_HLR\_with\_SGSN



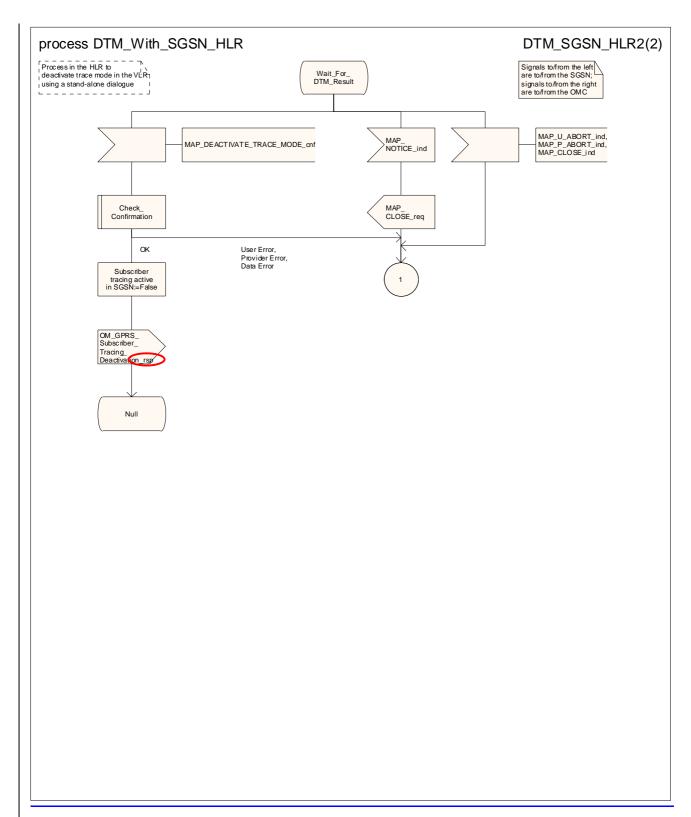
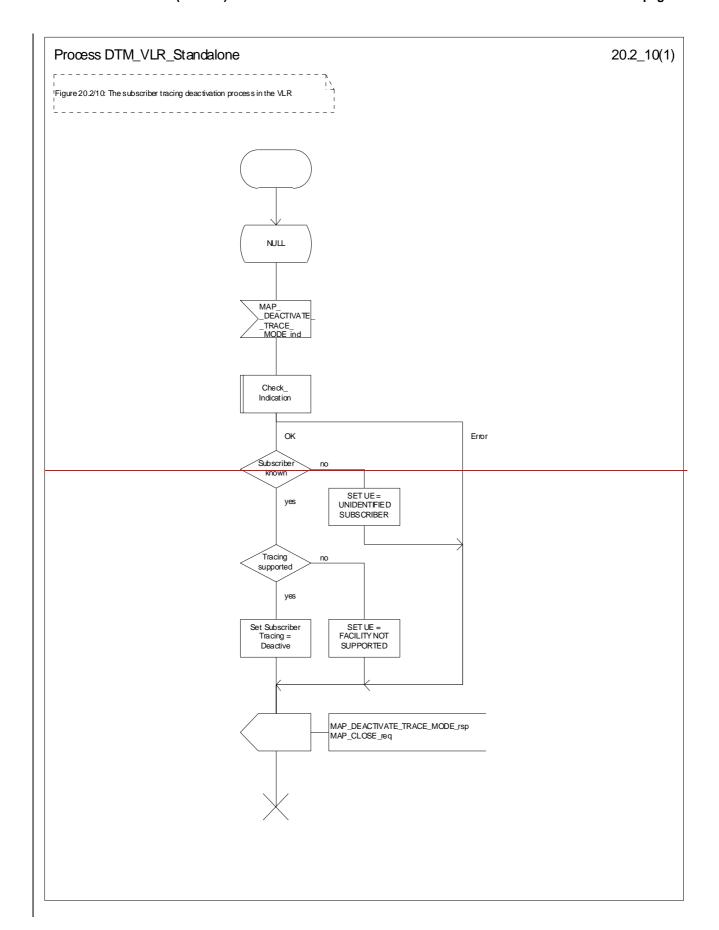


Figure 20.2/135 (sheet 2 of 2): Process DTM\_With\_SGSN\_HLR\_with\_SGSN



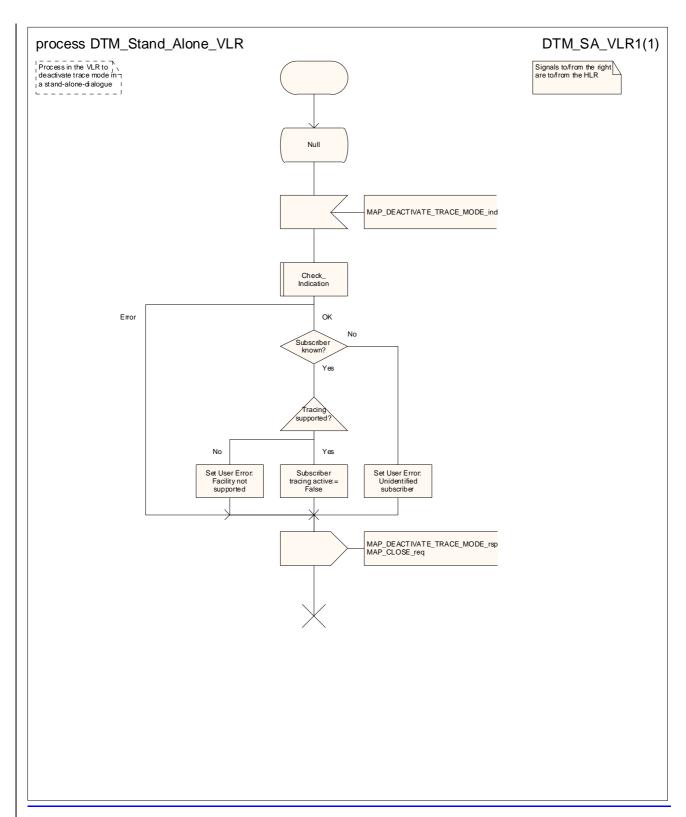
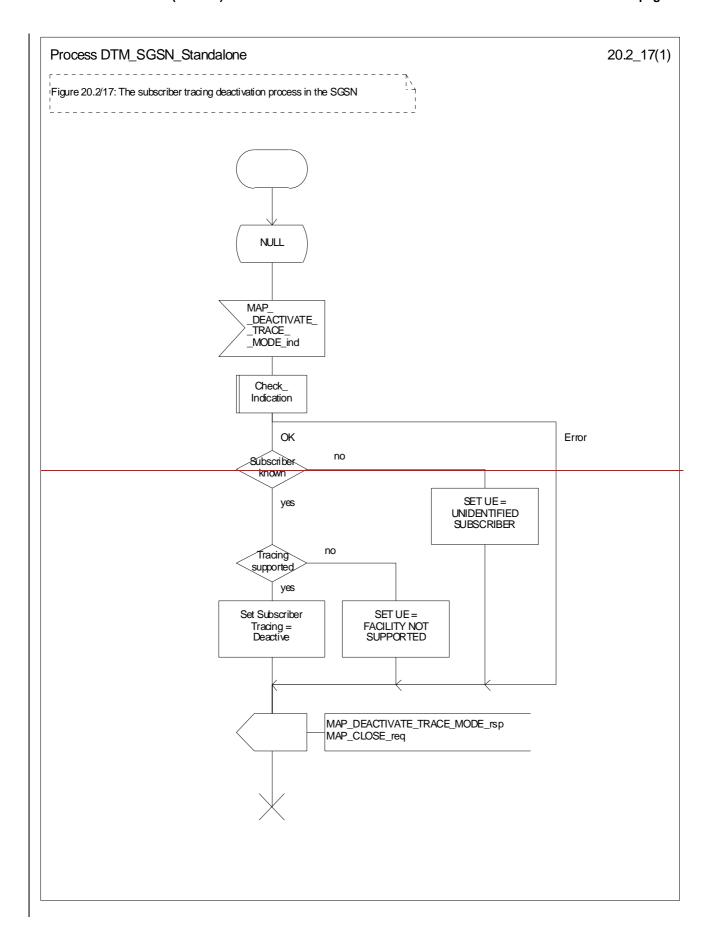


Figure 20.2/140: Process DTM Stand Alone VLR Standalone



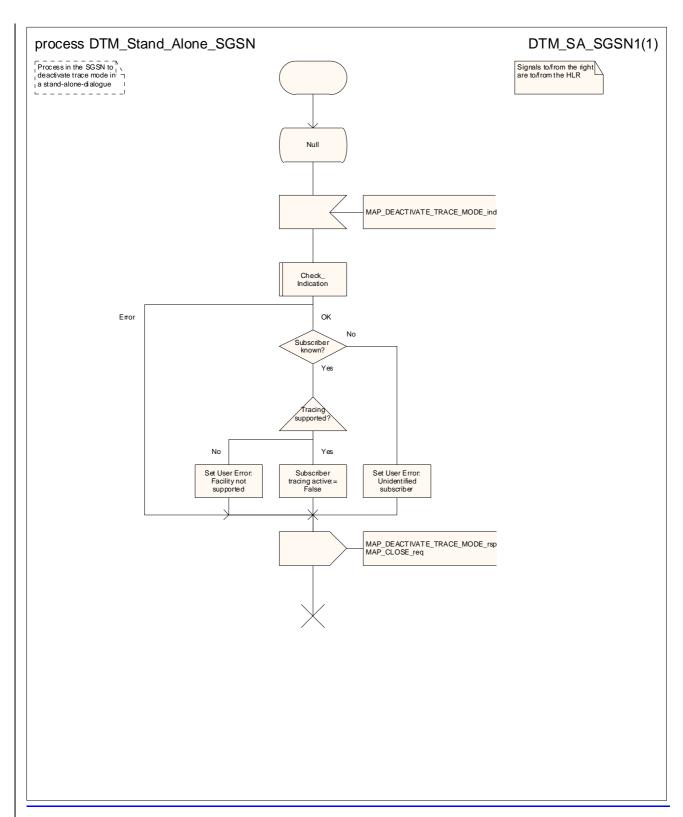


Figure 20.2/157: Process DTM Stand Alone SGSN Standalone

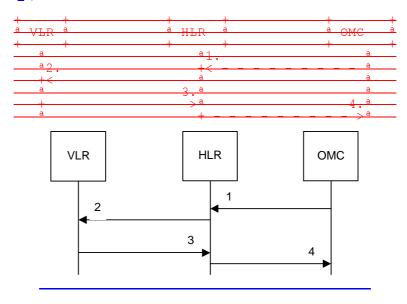
# 20.3 Subscriber data management procedures

Two types of subscriber data management procedures exist: in the Mobile Application Part

- 1i) Subscriber Deletion;
- 2#)Subscriber Data Modification.

No requirements have been identified for the Subscriber creation and subscriber data interrogation procedures.

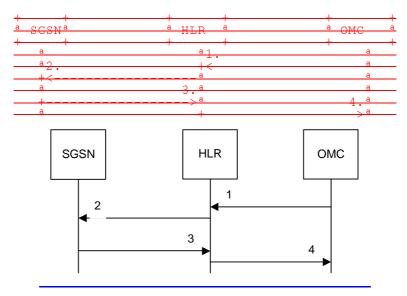
The subscriber deletion and subscriber data modification procedures are initiated by the OMC (see figures 20.3/1-, 20.3/2,  $20.3/\frac{3}{2}$  and  $20.3/\frac{49}{2}$ ).



- 1) Delete Subscriber-
- 2) MAP\_CANCEL\_LOCATION\_reg/ind-
- 3) MAP\_CANCEL\_LOCATION\_rsp/cnfACK.
- 4) Subscriber Deleted-

Figure 20.3/1: Subscriber deletion procedure for non-GPRS

In the subscriber deletion procedure <u>for a non-GPRS subscriber</u> the subscriber data <u>should be are</u> removed from the VLR and <u>from</u> the HLR. The HLR uses the MAP\_CANCEL\_LOCATION service.

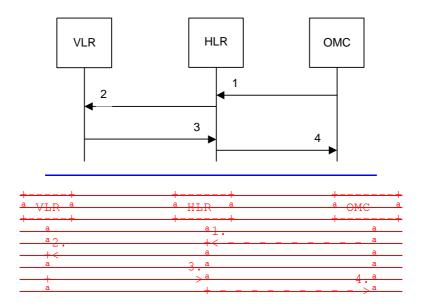


1) Delete GPRS Subscriber-

- 2) MAP\_CANCEL\_LOCATION\_reg/ind-
- 3) MAP\_CANCEL\_LOCATION\_rsp/cnfACK.
- 4) GPRS Subscriber Deleted.

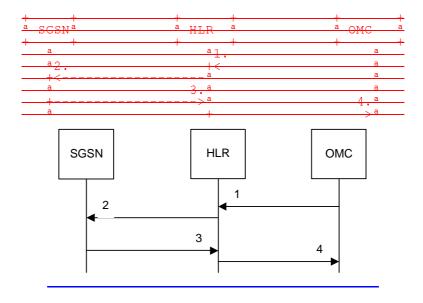
### Figure 20.3/28: Subscriber deletion procedure for GPRS

In the subscriber deletion procedure <u>for a GPRS subscriber</u> the subscriber data <u>should beare</u> removed from the SGSN and <u>from</u> the HLR. The HLR uses the MAP\_CANCEL\_LOCATION service.



- 1) Modify Subscriber Data-
- 2) MAP\_CANCEL\_LOCATION\_<u>req/ind</u>, MAP\_INSERT\_SUBSCRIBER\_DATA\_<u>req/ind</u> or MAP\_DELETE\_SUBSCRIBER\_DATA\_<u>req/ind</u>.
- 3) MAP\_CANCEL\_LOCATION\_<u>rsp/cnf</u>ACK, MAP\_INSERT\_SUBSCRIBER\_DATA\_<u>rsp/cnf</u>ACK or MAP\_DELETE\_SUBSCRIBER\_DATA\_<u>rsp/cnf</u>ACK.
- 4) Subscriber Data Modified-

Figure 20.3/32: Subscriber data modification procedure for non-GPRS



- 1) Modify Subscriber Data-
- 2) MAP\_CANCEL\_LOCATION\_req/ind, MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind or—MAP\_DELETE\_SUBSCRIBER\_DATA\_req/ind-

- MAP\_CANCEL\_LOCATION\_rsp/cnfACK, MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnfACK or— MAP\_DELETE\_SUBSCRIBER\_DATA\_rsp/cnfACK.
- 4) Subscriber Data Modified-

### Figure 20.3/49: Subscriber data modification procedure for GPRS

In the subscriber data modification procedure the subscriber data is modified in the HLR and when necessary also in the VLR or in the SGSN. The HLR initiates either the

MAP\_INSERT\_SUBSCRIBER\_DATA,MAP\_DELETE\_SUBSCRIBER\_DATA or MAP\_CANCEL\_LOCATION service depending on the modified data.

# 20.3.1.1 Subscriber deletion procedure

### 20.3.1.1 Procedures in the HLR

When the subscriber deletion request is received from the OMC, the HLR shall delete the subscriber data from the HLR and initiate the MAP\_CANCEL\_LOCATION request to the VLR or to the SGSN where the subscriber is registered.

The subscriber deletion process dure in the HLR is shown in the figure 20.3/53. The MAP process invokes processes not defined in this clause; the definitions of these processes can be found as follows:

Cancel\_GPRS\_Location\_Child\_HLRsee subclause 19.1.2.2;Cancel\_Location\_Child\_HLRsee subclause 19.1.2.2.

## 20.3.1.2 Procedures in the VLR

The subscriber deletion procedure in the VLR is described in the subclause 19.1.2.3 of the present document.

### 20.3.1.3 Procedures in the SGSN

The subscriber deletion procedure in the SGSN is described in the subclause 19.1.2.4 of the present document.

# 20.3.1.2 Subscriber data modification procedure

#### 20.3.2.1 Procedure in the HLR

The OMC can modify the subscriber data in several different ways. The modifications can be categorised in the following groups:

- A1) data shall be modified in the HLR; no effect in the VLR;
- B2) data shall be modified in both the HLR and the VLR;
- e3) withdrawal of a basic service or a supplementary service requiring change to VLR data;
- D4) modification affects on the roaming of permission for the subscriber and the subscriber record shall be removed from the VLR data base;
- 5) withdrawal of non-GPRS Subscription caused by a change of Network Access Mode;
- E) authentication algorithm or authentication key of the subscriber is modified;

F6) data shall be modified in the HLR; no effect in the SGSN;

- G7) data shall be modified in both the HLR and the SGSN;
- H8) withdrawal of a GPRS subscription data or a basic service or a supplementary service both requiring change to SGSN data;
- <u>19</u>) modification affects <u>on</u> the roaming <u>permission for <u>of</u> the subscriber and the subscriber <u>record</u> shall be removed from the SGSN data base;</u>

**J10**) withdrawal of GPRS Subscription <u>caused by a change of <del>related to</del></u> Network Access Mode;

K) withdrawal of non-GPRS Subscription related to Network Access Mode;

11) authentication algorithm or authentication key of the subscriber is modified.

In cases 2"b" and 7"g" the HLR uses the MAP\_INSERT\_SUBSCRIBER\_DATA service is initiated in the HLR.

In cases 3"e" and 8"h" the HLR uses the MAP\_DELETE\_SUBSCRIBER\_DATA service is initiated in the HLR.

In cases 4"d", 5"e", 9"i", 10"j" and 11"k" the HLR uses the MAP\_CANCEL\_LOCATION service is initiated in the HLR.

If the result of a primitive received from the VLR or from the SGSN is unsuccessful deletion of subscriber data fails, the HLR may initiate re-repeat the request attempts; the number of repeat attempts and the time in between are HLR operator options, depending on the error returned by the VLR or by the SGSN.

The subscriber data modification procedure in the HLR is shown in the figures 20.3/4, 20.3/5 and 25.7/2.

The subscriber data modification process in the HLR is shown in figure 20.3/6. The MAP process invokes processes not defined in this clause; the definitions of these processes can be found as follows:

Insert\_Subs\_Data\_Stand\_Alone\_HLR see subclause 25.7.3;

Cancel\_Location\_Child\_HLR see subclause 19.1.2.2;

<u>Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR</u> see subclause 25.7.4;

Cancel GPRS Location Child HLR see subclause 19.1.2.2.

The macro Delete\_Subscriber\_Data\_HLR is shown in figure 20.3/7. The macro invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see subclause 25.1.2;

Check Confirmation see subclause 25.2.2.

The macro Delete\_GPRS\_Subscriber\_Data\_HLR is shown in figure 20.3/8. The macro invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;

Check Confirmation see subclause 25.2.2.

### 20.3.2.2 Procedures in the VLR

### 20.3.2.1 Subscriber deletion procedure

### 20.3.2.2 Subscriber data modification procedure

When receiving either the MAP\_INSERT\_SUBSCRIBER\_DATA indication or the MAP\_DELETE\_SUBSCRIBER\_DATA indication, the VLR checks the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

After receiving the first MAP\_INSERT\_SUBSCRIBER\_DATA indication, the VLR will check the IMSI that is included in the primitive. If the IMSI is unknown, the error "Unidentified subscriber" is returned.

If the VLR does not support received basic or supplementary services or the network feature Operator Determined Barring, or there is a problem with Regional Subscription Data then it reports it to the HLR.

If the entire MSC area is restricted due to regional subscription, this is reported to the HLR.

If the updating of the subscriber data is not possible, the VLR will initiate the MAP\_U\_ABORT request primitive. If the updating is successful, the MAP\_CLOSE indication is received from the HLR.

The subscriber data modification procedure in the VLR is shown in the figures 20.3/6, 20.3/7 and 25.7/1.

The process in the VLR to update subscriber data in a stand-alone dialogue is shown in figure 20.3/9. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

<u>Check\_Indication</u> see subclause 25.2.1;

Insert Subs Data VLR see subclause 25.7.1.

The process in the VLR to delete subscriber data is shown in figure 20.3/10. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check\_Indication see subclause 25.2.1.

### 20.3.2.3 Procedures in the SGSN

20.3.3.1 Subscriber deletion procedure

## 20.3.3.2 Subscriber data modification procedure

When receiving either the MAP\_INSERT\_SUBSCRIBER\_DATA indication or the

MAP\_DELETE\_SUBSCRIBER\_DATA indication, the SGSN checks the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

After receiving the first MAP\_INSERT\_SUBSCRIBER\_DATA indication, the SGSN will check the IMSI that is included in the primitive. If the IMSI is unknown, the error "Unidentified subscriber" is returned.

If the SGSN does not support received basic services or the network feature Operator Determined Barring, or there is a problem with Regional Subscription Data then it reports it to the HLR.

If the entire SGSN area is restricted due to regional subscription, this is reported to the HLR.

If the updating of the subscriber data is not possible, the SGSN will initiate the MAP\_U\_ABORT request primitive. If the updating is successful, the MAP\_CLOSE indication is received from the HLR.

The subscriber data modification procedure in the SGSN is shown in the figures 20.3/11, 20.3/12 and 25.7/5.

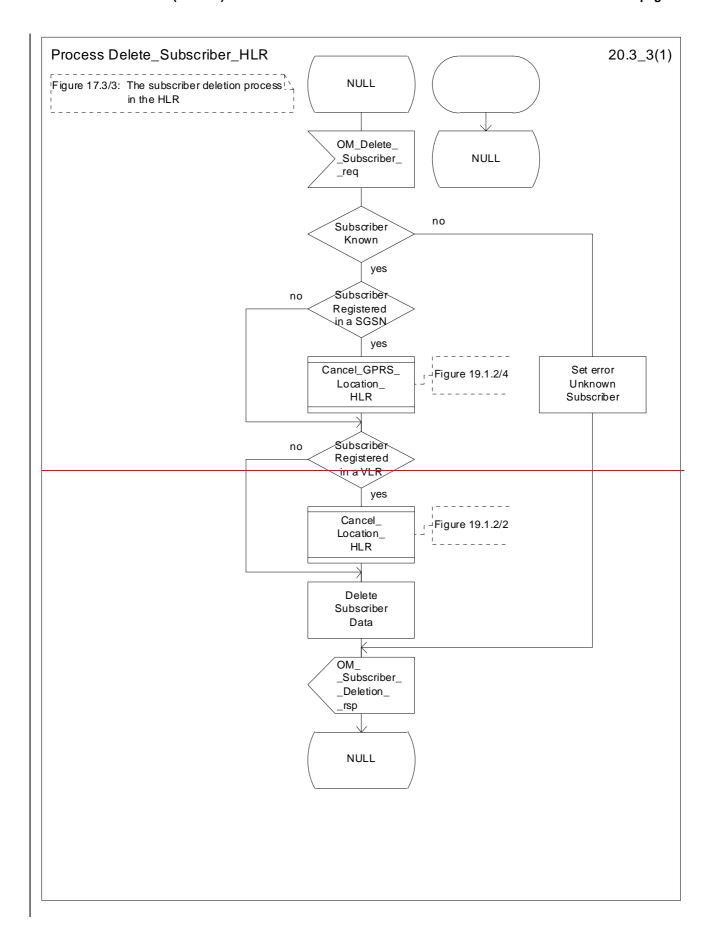
The process in the SGSN to update subscriber data in a stand-alone dialogue is shown in figure 20.3/11. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

<u>Check Indication</u> see subclause 25.2.1;

<u>Insert\_Subs\_Data\_SGSN</u> see subclause 25.7.2.

The process in the SGSN to delete subscriber data is shown in figure 20.3/12. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

<u>Check\_Indication</u> see subclause 25.2.1.



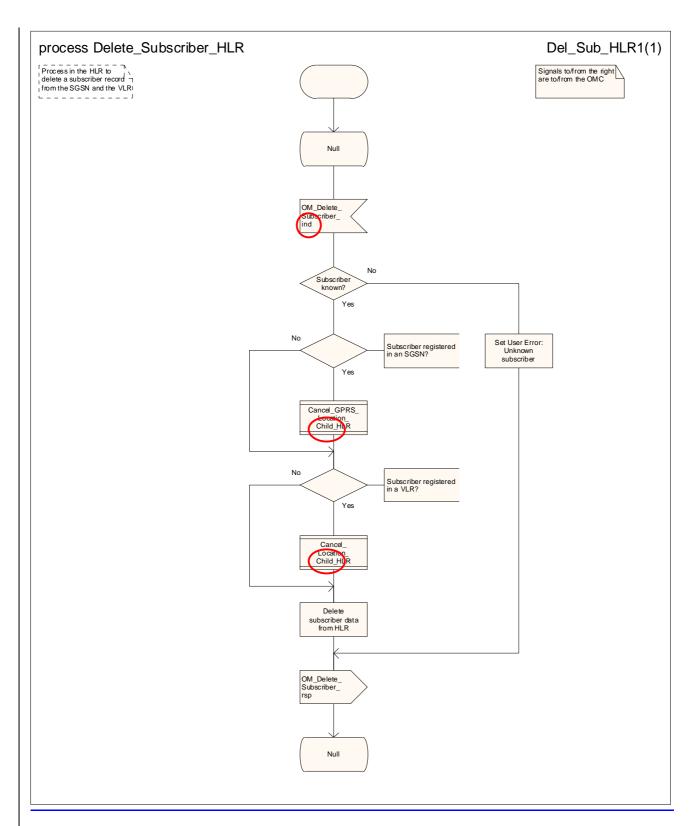
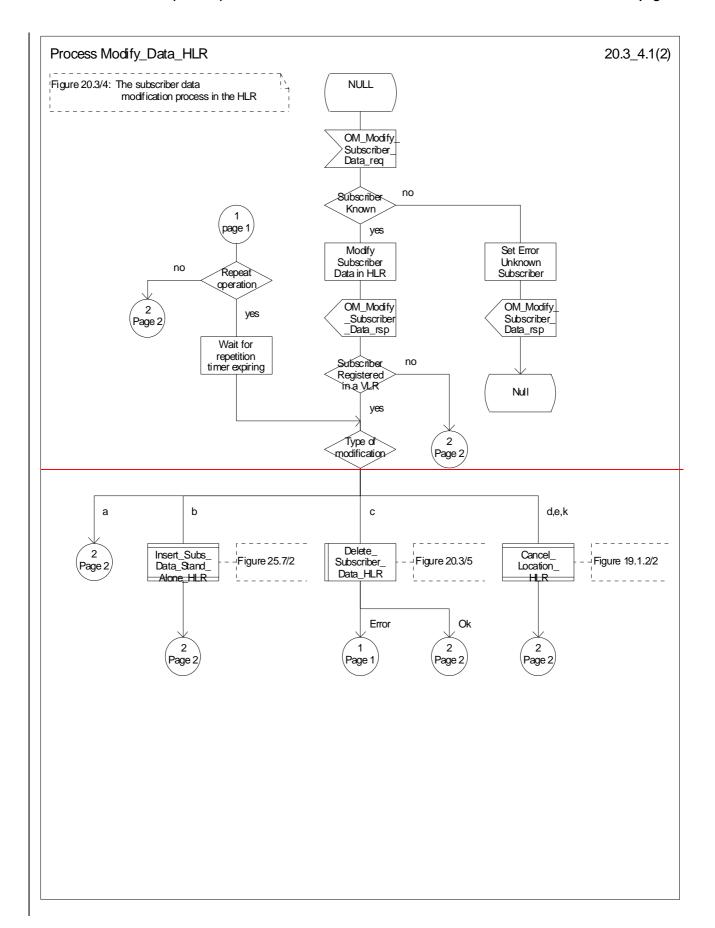


Figure 20.3/53: Process Delete\_Subscriber\_HLR



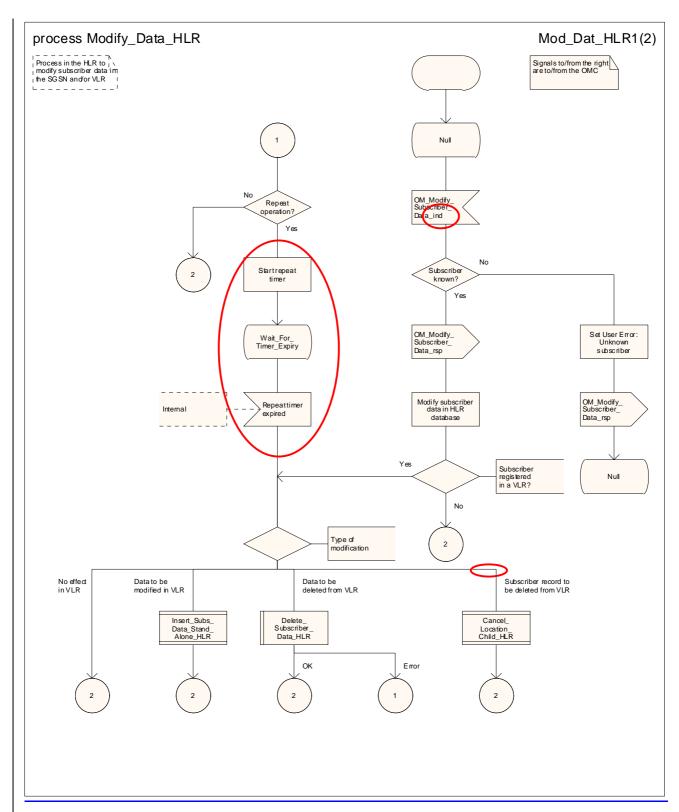
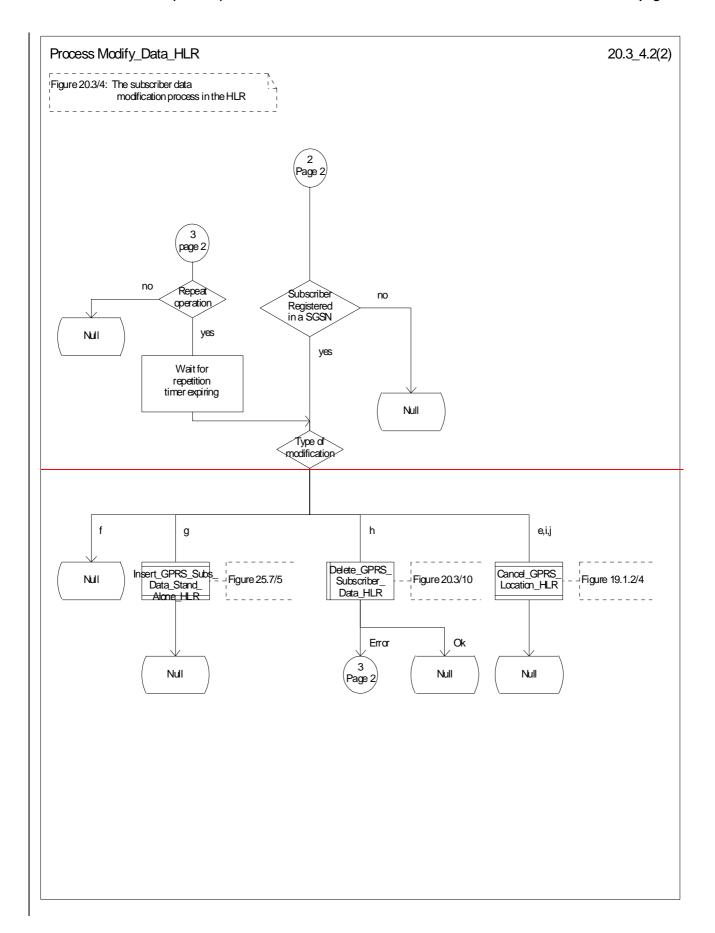


Figure 20.3/64 (sheet 1 of 2): Process Modify\_Data\_HLR



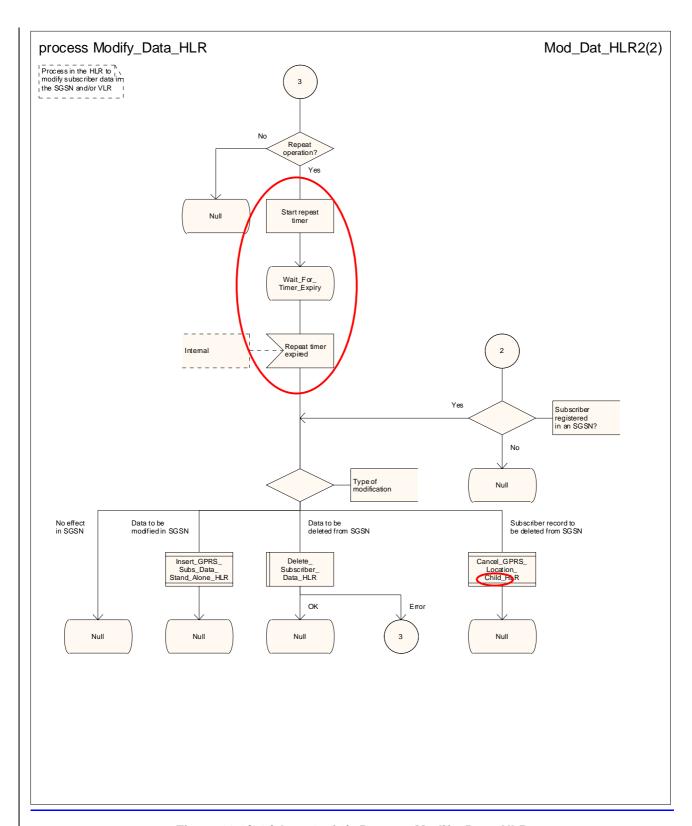
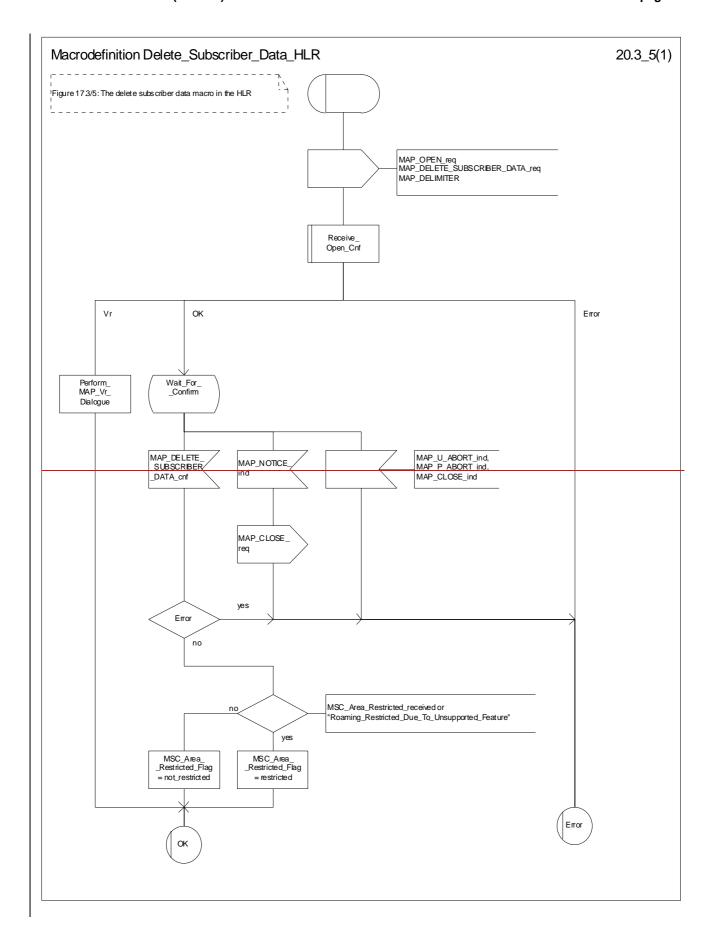


Figure 20.3/64 (sheet 2 of 2): Process Modify\_Data\_HLR



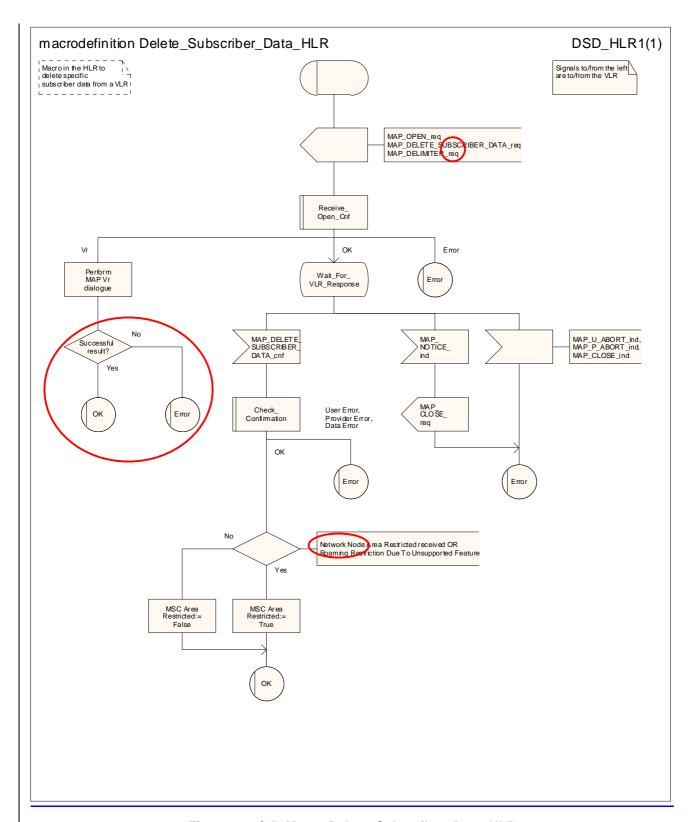
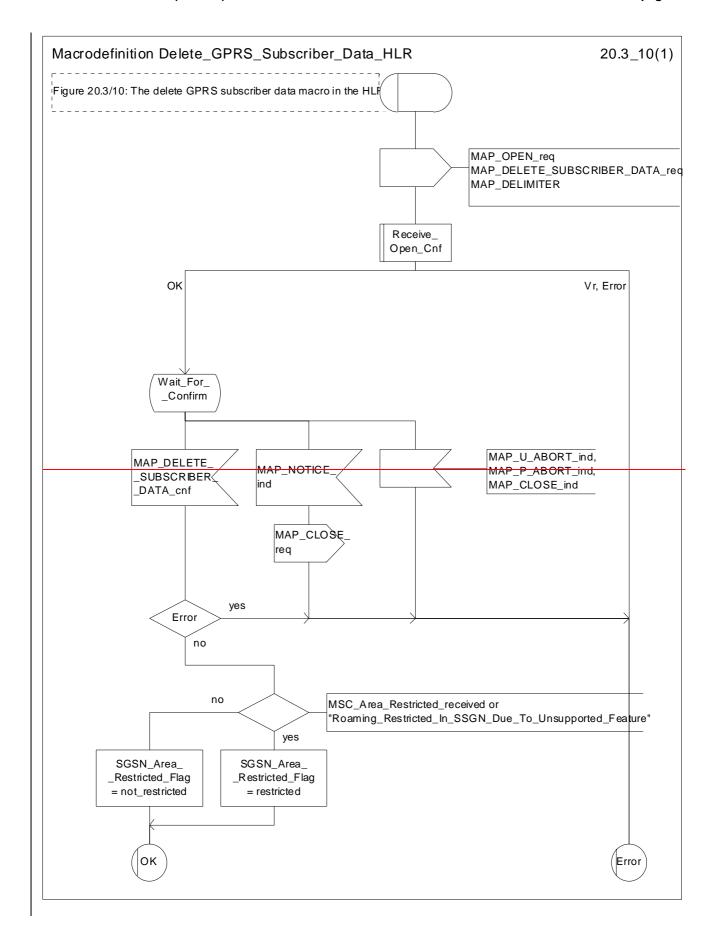


Figure 20.3/75: Macro Delete\_Subscriber\_Data\_HLR



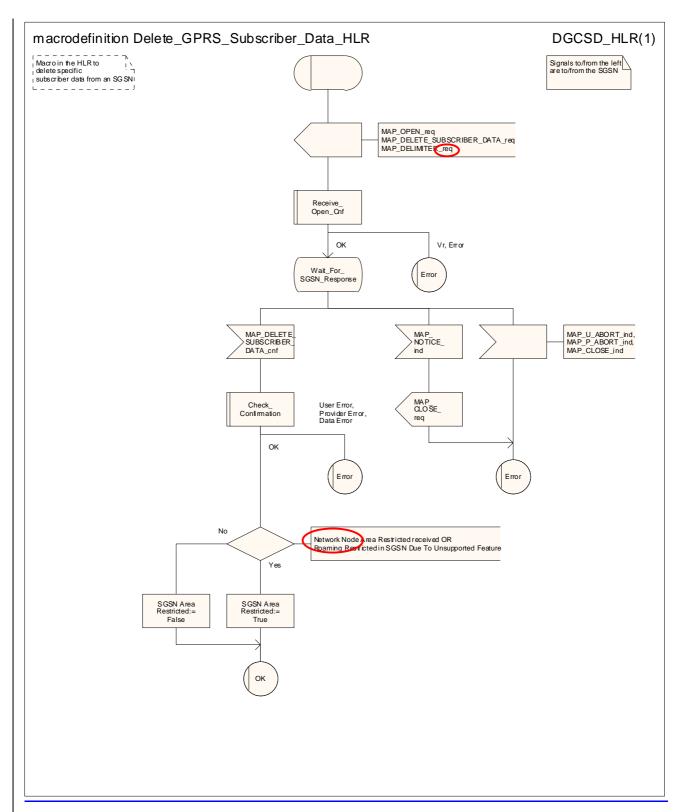
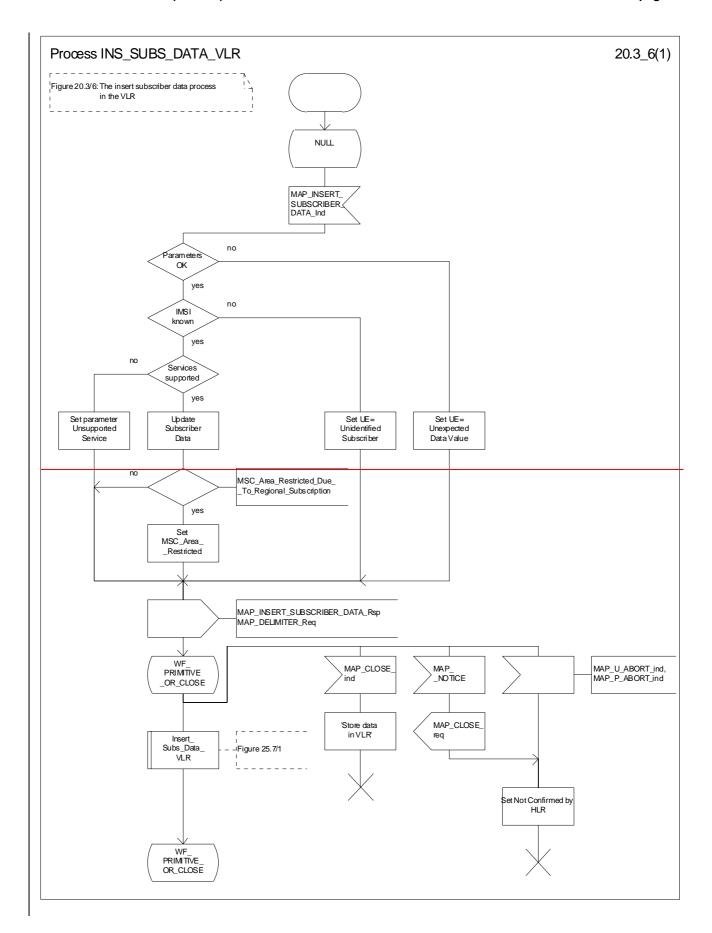


Figure 20.3/810: Macro Delete\_GPRS\_Subscriber\_Data\_HLR



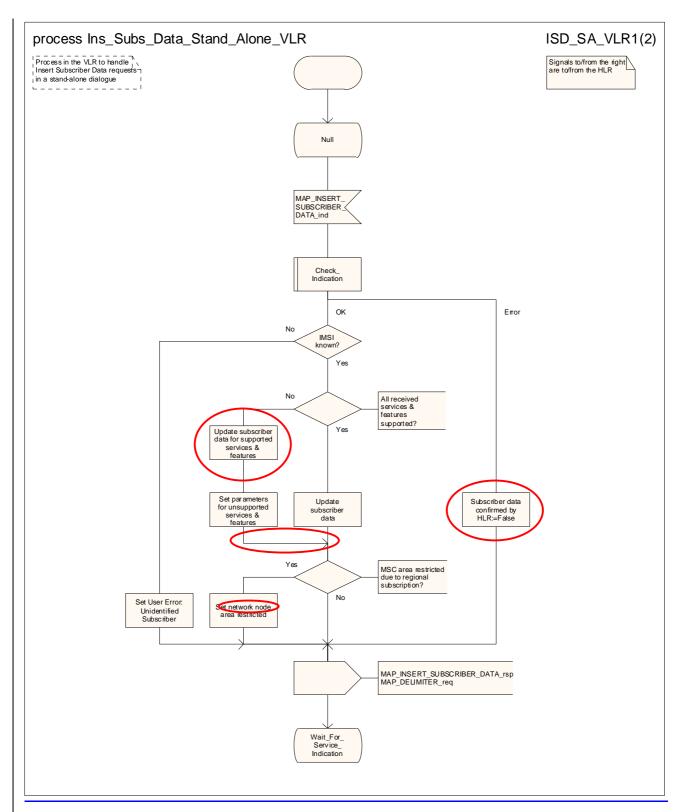


Figure 20.3/96 (sheet 1 of 2): Process INS\_SUBS\_DATAINS Subs Data Stand Alone\_VLR

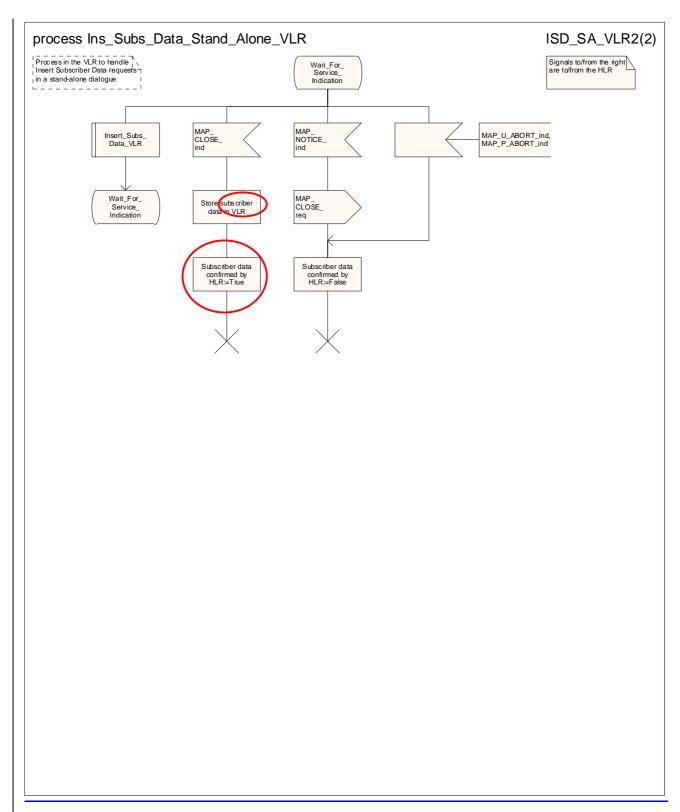
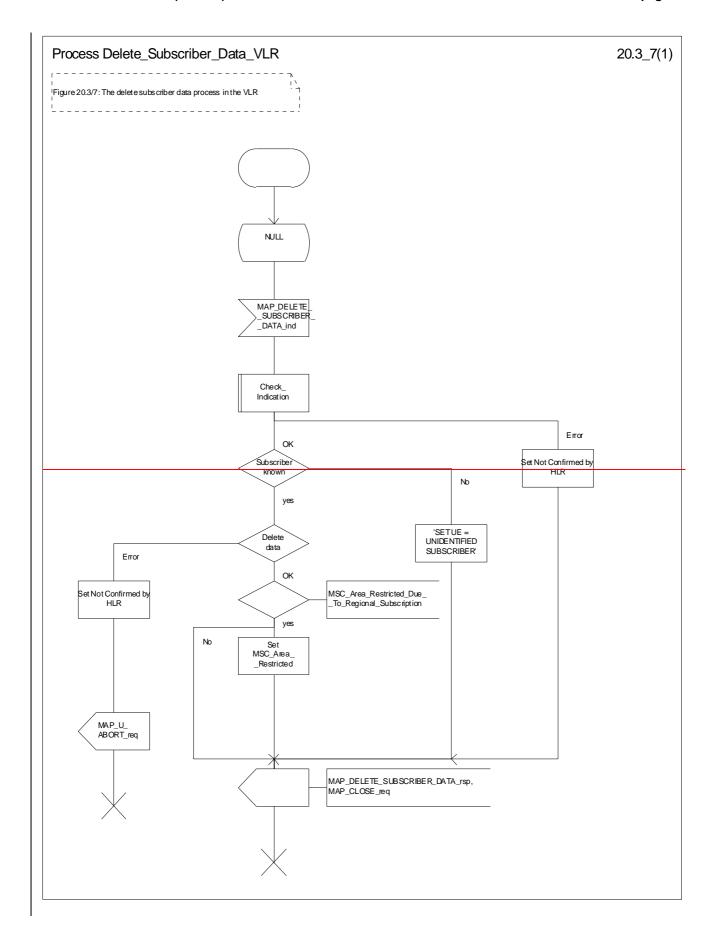


Figure 20.3/9 (sheet 2 of 2): Process Ins Subs Data Stand Alone VLR



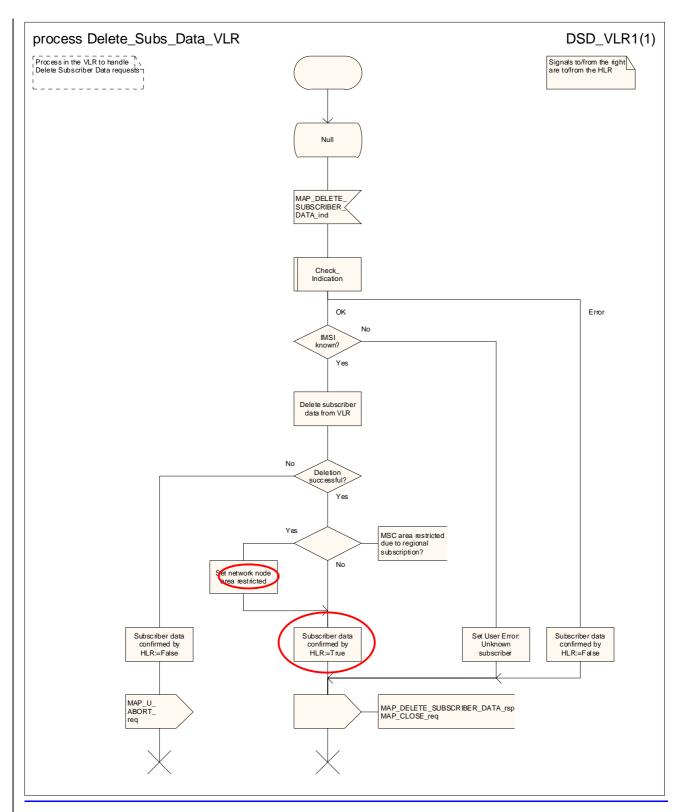
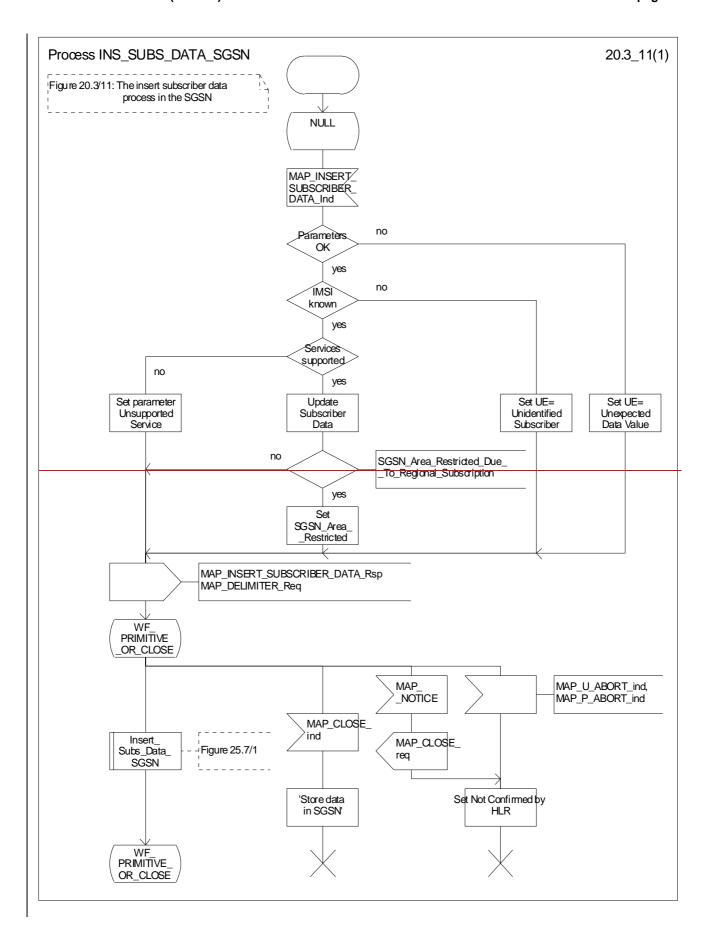


Figure 20.3/107: Process Delete\_Subscriber\_Data\_VLR



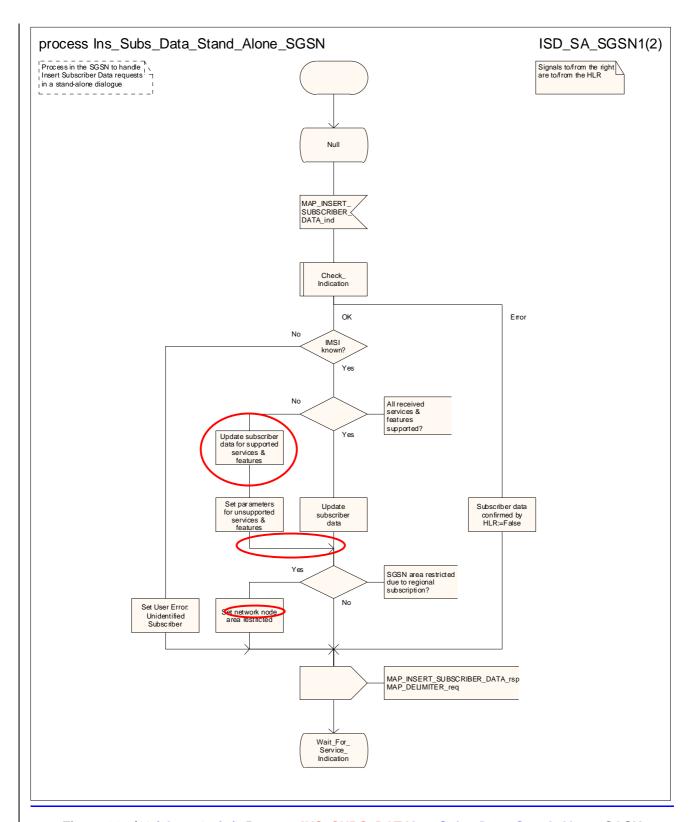


Figure 20.3/11 (sheet 1 of 2): Process INS\_SUBS\_DATA Subs Data Stand Alone\_SGSN

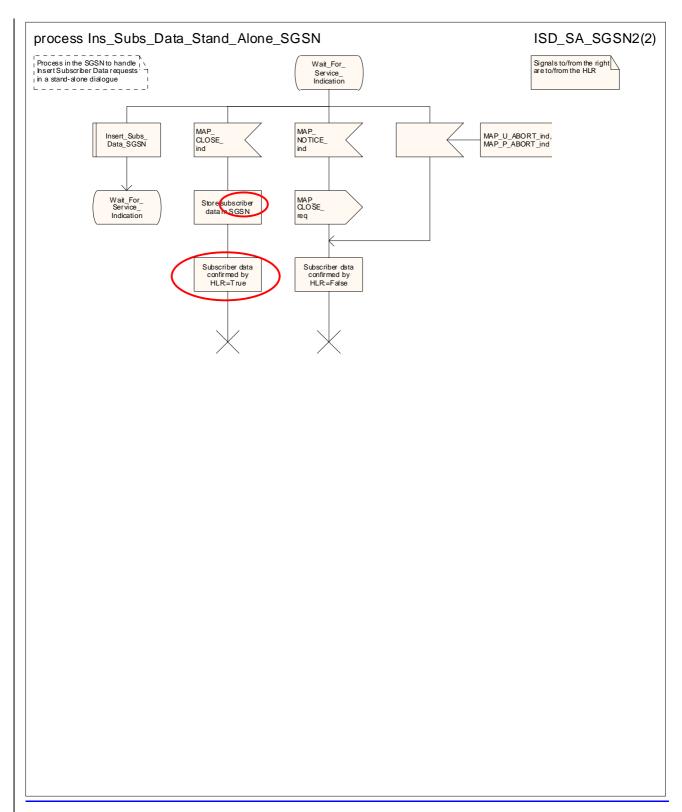
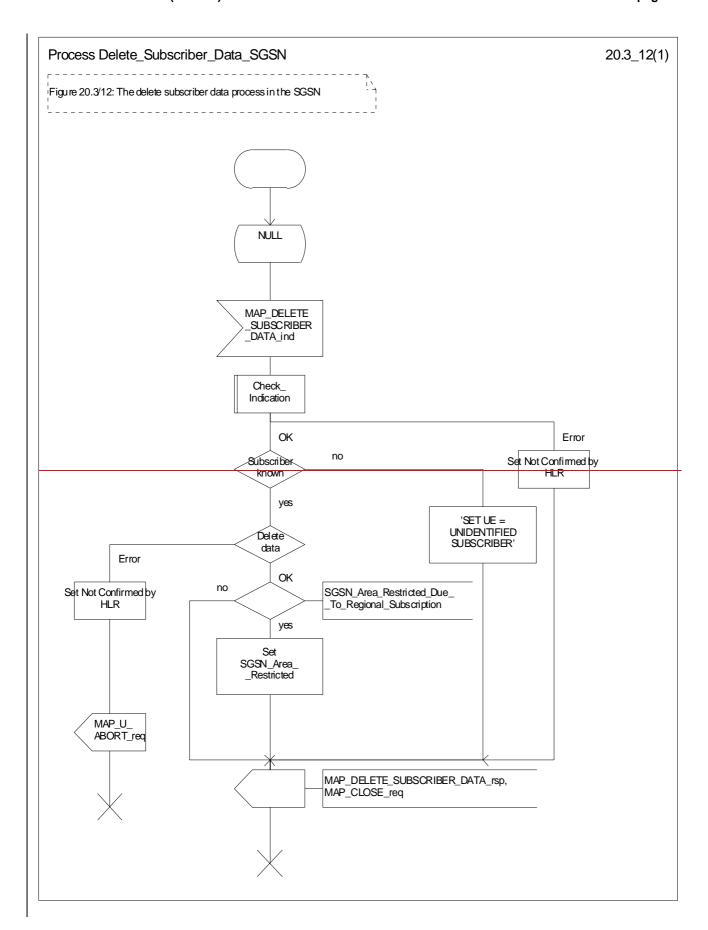


Figure 20.3/11 (sheet 2 of 2): Process Ins Subs Data Stand Alone SGSN



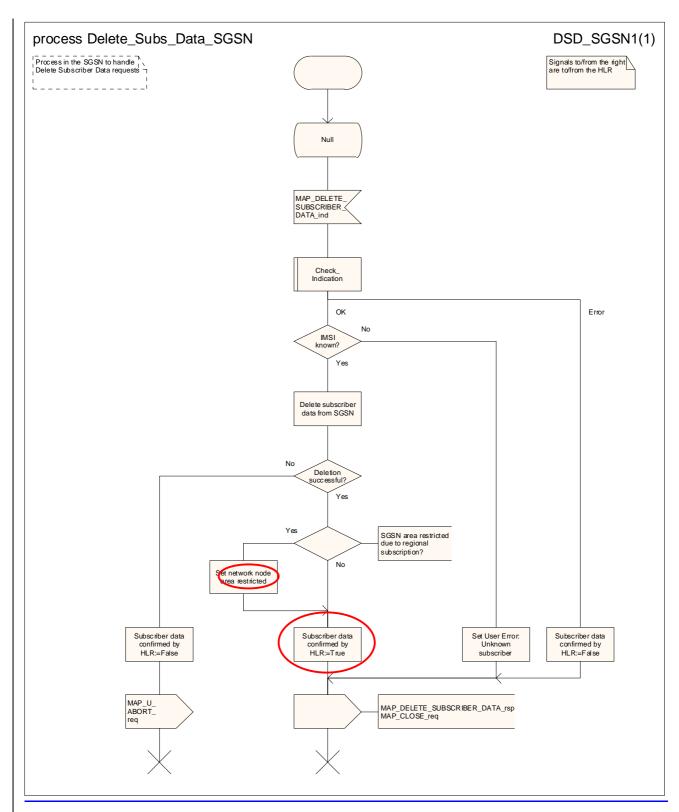
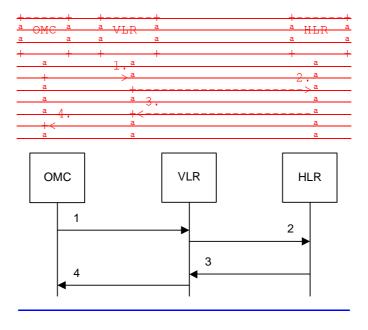


Figure 20.3/12: Process Delete\_Subscriber\_Data\_SGSN

# 20.4 Subscriber Identity procedure

In the subscriber identity procedure the IMSI of the subscriber is retrieved from the HLR. The procedure is shown in figure 20.4/1.



- 1) Identity request-
- 2) MAP SEND IMSI reg/ind-
- 3) MAP\_SEND\_IMSI\_rsp/cnfACK.
- 4) Identity confirm-

Figure 20.4/1: The subscriber identity procedure

# 20.4.12 Subscriber identity pProcedure in the VLR

When the IMSI request is received from the OMC, the VLR will send the MAP\_SEND\_IMSI request to the HLR. The contents of the response are sent to the OMC.

The subscriber identity processedure in the VLR is shown in figure 20.4/23. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive_Open_Cnf	see subclause 25.1.2;			
Check Confirmation	see subclause 25.2.2.			

# 20.4.21 Subscriber identity pProcedure in the HLR

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

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

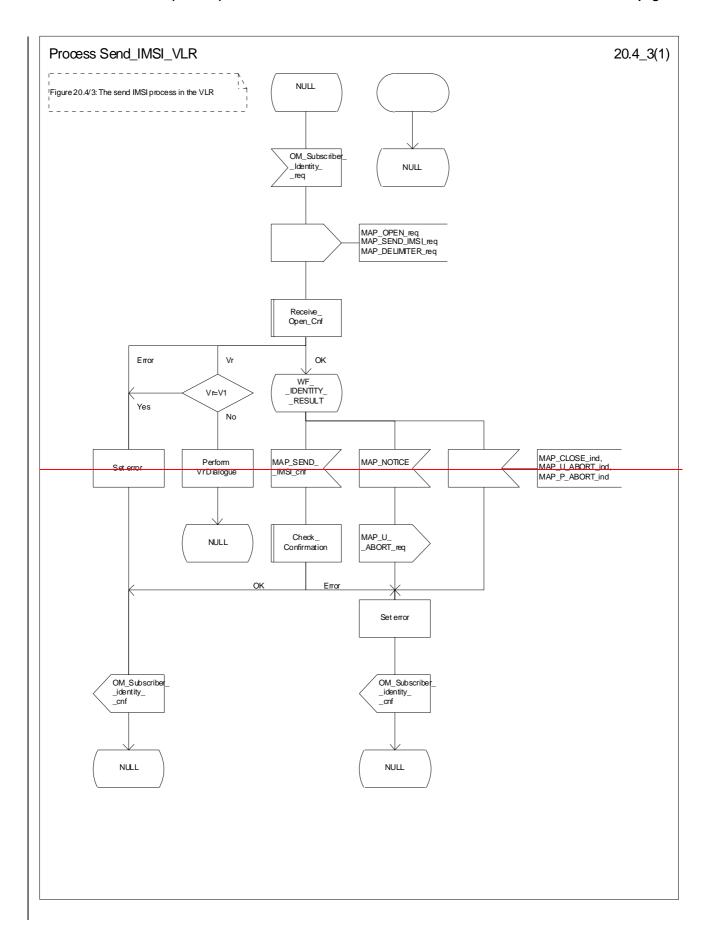
When receiving the MAP\_SEND\_IMSI indication, the HLR will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

If the subscriber is known in the HLR, the IMSI is fetched from the database and sent to the VLR. If the MSISDN cannot be identified, unknown subscriber indication is passed to the VLR.

The subscriber identity processedure in the HLR is shown in figure 20.4/32. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

<u>Check Indication</u> see subclause 25.2.1.



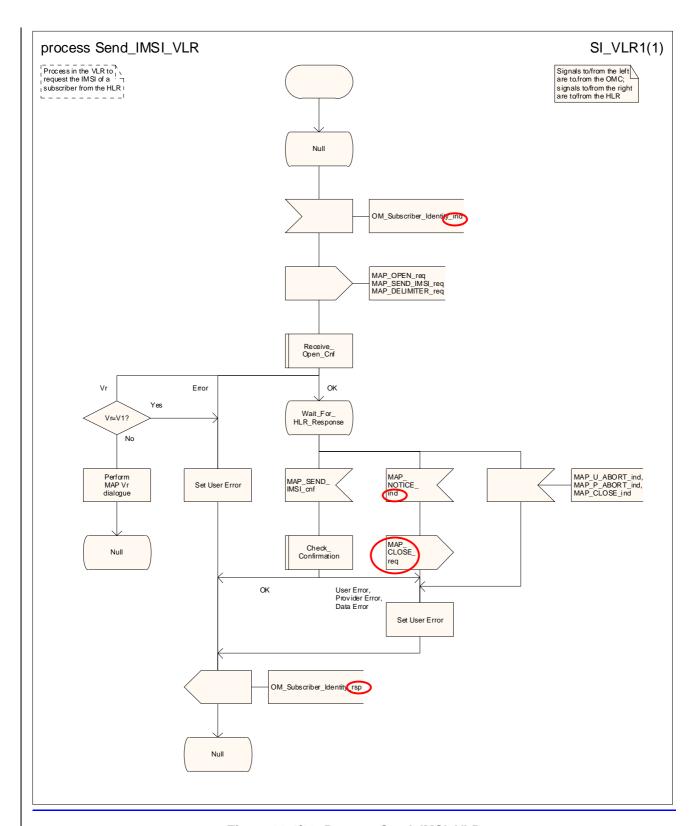
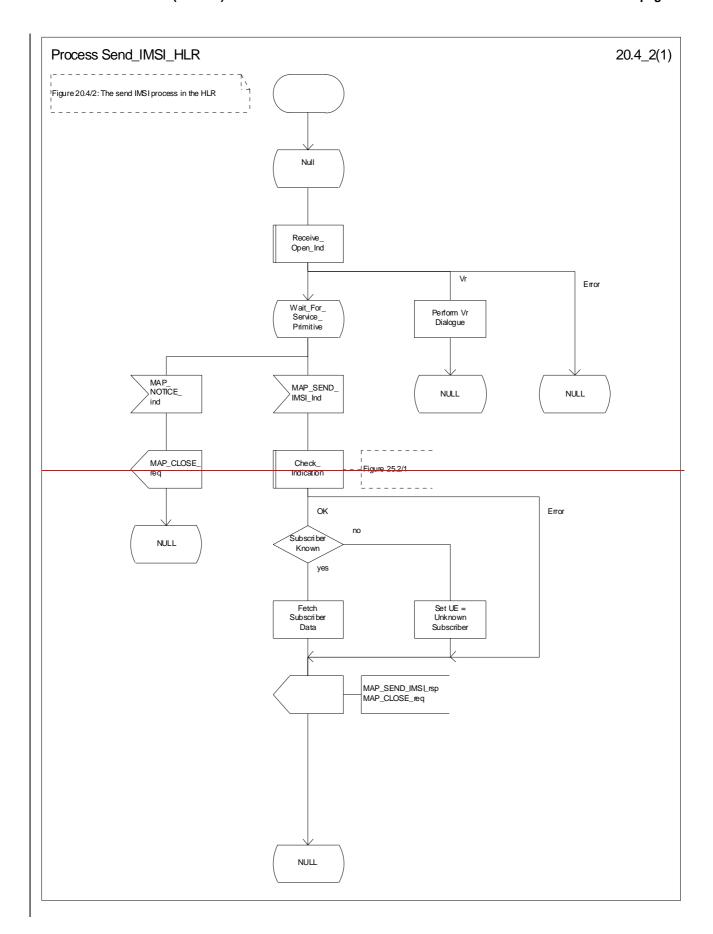


Figure 20.4/23: Process Send\_IMSI\_VLR



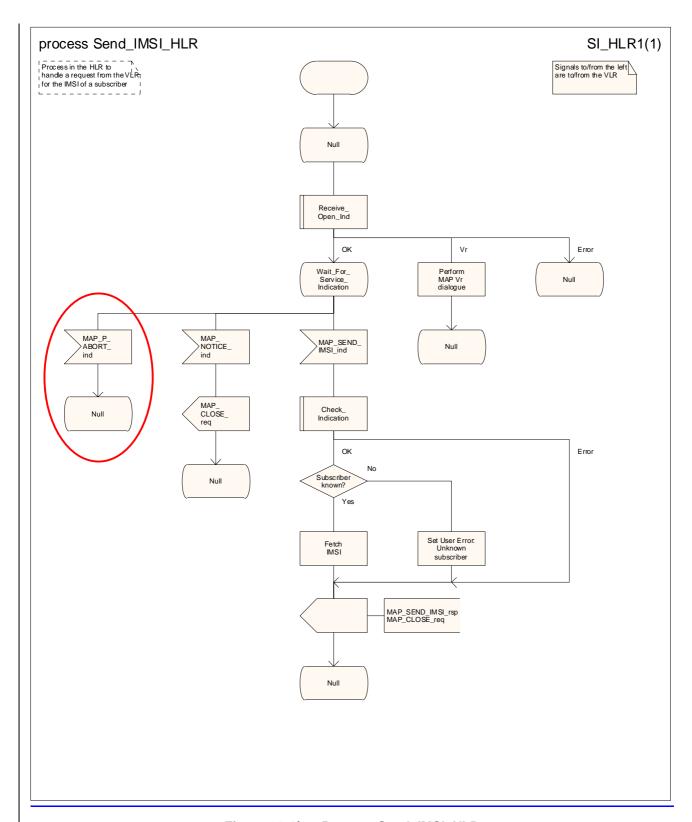


Figure 20.4/32: Process Send\_IMSI\_HLR

# 3GPP TSG CN WG4 Meeting #20 Sophia Antipolis, FRANCE, 25<sup>th</sup> – 29<sup>th</sup> August 2003

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- Reason for change: # 1. There are no source files available for the SDL diagrams in 29.002 chapter 20. Many SDL diagrams are poorly laid out.
  - 2. Some message flow diagrams are drawn using linedraw characters, which do not display correctly in Word 2000.
  - 3. Most of the text repeats the information in the SDL diagrams; the useful additional information is buried in superfluous verbiage. The principle of making the text a **supplement** to the SDL diagrams has been accepted by CN #20, with the approval of CRs to chapters 22 – 25 to remove the redundant
  - 4. Some SDL diagrams use the wrong notation for MAP and other service primitives (the correct notation is req/rsp for an output signal, ind/cnf for an input signal).
  - 5. In the processes in the HLR for activating trace mode, the text description allows a repeat attempt if the VLR or SGSN returns an error, but the SDL does not show this possibility. The text is aligned with the SDL for deactivating trace mode, so the SDL has been aligned with the text.
  - 6. In the processes in the HLR for deactivating trace mode, if the dialogue opening fails the HLR stores the trace mode in the VLR or SGSN as deactive, but it should be active.
  - 7. In the macro in the HLR to delete subscriber data from a VLR, the macro should take the Error exit if the MAP Vr dialogue does not have a successful result.
  - 8. The name of the parameter which is returned in the Delete Subscriber Data response if the whole service area of the MSC/VLR or SGSN is restricted due to regional subscription is "Network Node Area Restricted".
  - 9. In the macro Delete\_Subscriber\_Data\_HLR, if the dialogue drops back to a previous protocol version the result of the dialogue should be reflected in the exit from the macro.

- 10.In the processes INS\_SUBS\_DATA\_VLR & INS\_SUBS\_DATA\_SGSN, the setting of the "Subscriber data confirmed by HLR" flag is not completely covered.
- 11. The reference to the interworking between the MSC and the VLR for tracing during location management is redundant; this is defined in the stage 2 for location management (23.012).

- Summary of change: \$\mathbb{1}\$. Redraw SDL diagrams to a consistent style. Redraw message flow diagrams. Remove text which replicates the information in SDL diagrams.
  - 2. Correct errors in SDL diagrams.

#### Consequences if not approved:

- # 1. No SDL source files to use as the basis for future changes.
  - 2 Message flow diagrams are difficult to read.
  - 3. Useful information to supplement the SDL diagrams is buried in superfluous verbiage.

7. The convention for the directions of signal inputs and outputs in some SDL diagrams has been changed to reflect the relative positions of entities in the

4. Many minor technical errors in the SDL diagrams.

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Clauses affected:	¥ 20
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Other specs affected:	<ul> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>O&amp;M Specifications</li> </ul> X <ul> <li>X</li> <li>O&amp;M Specifications</li> </ul>
Other comments:	# 1. The text for each first level subclause has been grouped together, before the
Other comments:	<ol> <li>The text for each first level subclause has been grouped together, before the SDL diagrams for that subclause.</li> <li>Within each first level subclause, the description of the behaviour of network entities has been re-ordered to show the behaviour of the dialogue initiator first, then the behaviour of the dialogue responder. This change has not been revision marked, except for the changes to subclause numbers and figure numbers.</li> <li>Where a first level subclause includes descriptions of the behaviour of network entities in the CS domain and the PS domain for similar functions, the lower level subclauses have been re-ordered to group the descriptions of the behaviour in the CS and PS domain together. This change has not been</li> </ol>
	revision marked, except for the changes to subclause numbers and figure numbers.  4. The modelling of repeat attempts after a delay (in processes
	ATM_With_VLR_HLR, ATM_With_SGSN_HLR, DTM_With_VLR_HLR, DTM_With_SGSN_HLR & Modify_Data_HLR) has been changed to show the timer being started, the process entering a wait state and the input of an internal signal to show timer expiry.
	<ul><li>5. In some SDL diagrams, the test "Error" is used after a confirm primitive has been received; this has been replaced with a call to the macro Check_Confirmation.</li><li>6. Many process names have been changed to follow the convention that the last</li></ul>
	component of the name indicates the entity in which the process runs.

message flow diagrams.

# 20 Operation and maintenance procedures

## 20.1 General

The Operation and Maintenance procedures are <u>needed for used to support</u> operation and maintenainceing of the <u>GSM\_PLMN</u> network.

The following procedures exist for operation and maintenance purposes:

- i) Tracing procedures;
- ii) Subscriber Data Management procedures;
- iii) Subscriber Identity procedures.

The following application contexts refer to complex MAP Users consisting of several processes:

- subscriberDataManagementContext;
- tracingContext.

<u>Each of These two application contexts needs</u> a co-ordinating process in the VLR or in the SGSN as described in the following <u>sub</u>clauses.

# 20.1.1 Tracing Co-ordinator for the VLR

The MAP\_OPEN indication opens the dialogue for the stand-alone tracing procedure when the application context tracingContext is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_ACTIVATE\_TRACE\_MODE indication is received, the process ATM\_VLR\_Standalone is created;
- if the MAP\_DEACTIVATE\_TRACE\_MODE indication is received, the process DTM\_VLR\_Standalone is ereated.

After creation of the user process the Co ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Tracing Co-ordinator <u>process in the VLR</u> is shown in the figure 20.1/1. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

# 20.1.23 Tracing Co-ordinator for the SGSN

The MAP\_OPEN indication opens the dialogue for the stand-alone tracing procedure when the application context tracingContext is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_ACTIVATE\_TRACE\_MODE indication is received, the process ATM\_SGSN\_Standalone is created;
- if the MAP\_DEACTIVATE\_TRACE\_MODE indication is received, the process DTM\_SGSN\_Standalone is created.

After creation of the user process the Co-ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Tracing Co-ordinator <u>process in for the SGSN</u> is shown in the figure 20.1/23. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

# 20.1.32 Subscriber Data Management Co-ordinator for the VLR

The MAP\_OPEN indication opens the dialogue for the stand alone subscriber data management procedure when the application context subscriber DataManagement Contex is received. If that service is successful, the Co-ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_INSERT\_SUBSCRIBER\_DATA indication is received, the process INS\_SUBS\_DATA\_VLR is created:
- if the MAP\_DELETE\_SUBSCRIBER\_DATA indication is received, the process Delete\_Subscriber\_Data\_VLR is created.

After creation of the user process the Co-ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Subscriber\_Data\_Management Co-ordinator <u>process in the VLR</u> is shown in the figure 20.1/32. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

# 20.1.4 Subscriber Data Management Co-ordinator for the SGSN

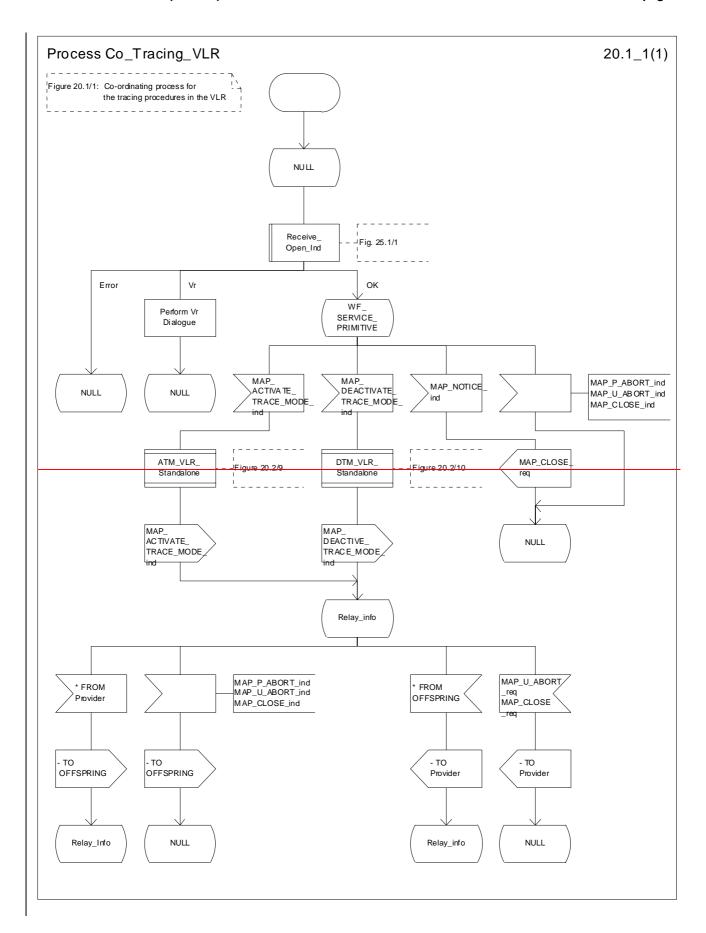
The MAP\_OPEN indication opens the dialogue for the stand alone subscriber data management procedure when the application context subscriberDataManagementContext is received. If that service is successful, the Co ordinator can receive the first service primitive from the MAP\_PM. Depending on the received primitive, the user process is created as follows:

- if the MAP\_INSERT\_SUBSCRIBER\_DATA indication is received, the process INS\_SUBS\_DATA\_SGSN is created;
- if the MAP\_DELETE\_SUBSCRIBER\_DATA indication is received, the process Delete\_Subscriber\_Data\_SGSN is created.

After creation of the user process the Co ordinator relays the messages between the MAP\_PM and the invoked process until a request or an indication for dialogue termination is received.

The Subscriber\_Data\_Management Co-ordinator <u>process in the SGSN</u> is shown in <u>the figure 20.1/4</u>. <u>The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:</u>

Receive\_Open\_Ind see subclause 25.1.1.



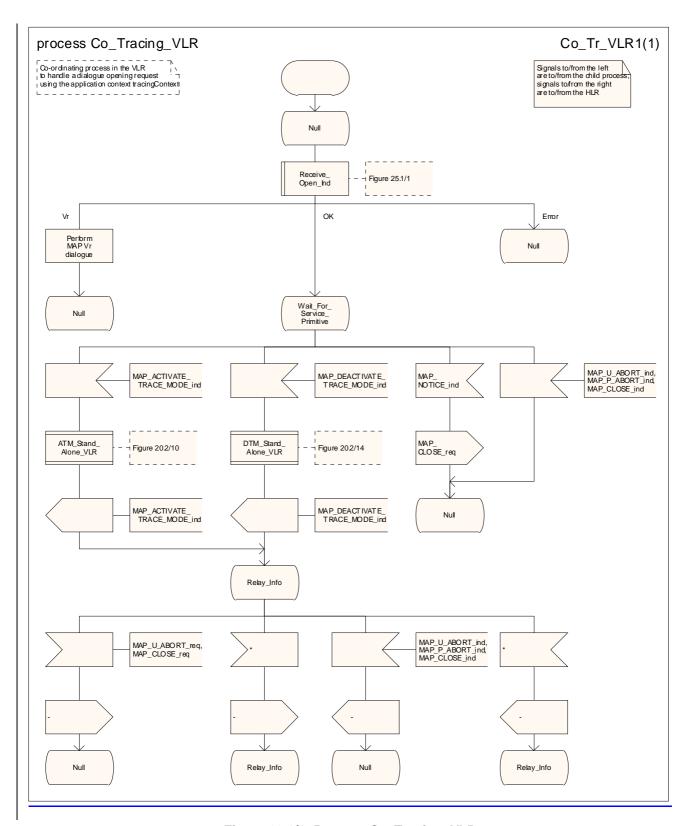
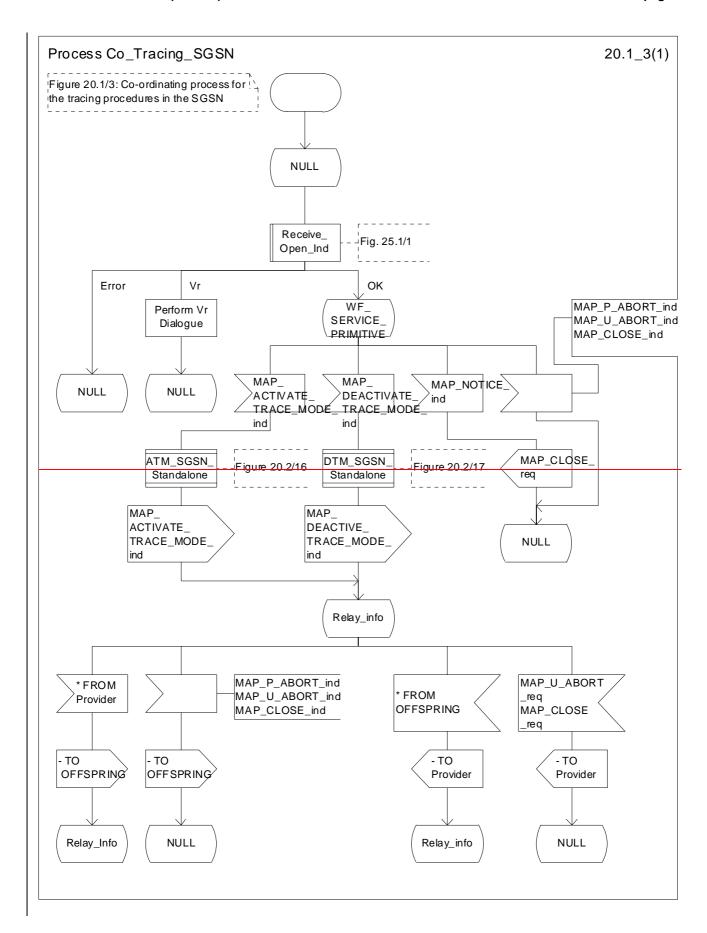


Figure 20.1/1: Process Co\_Tracing\_VLR



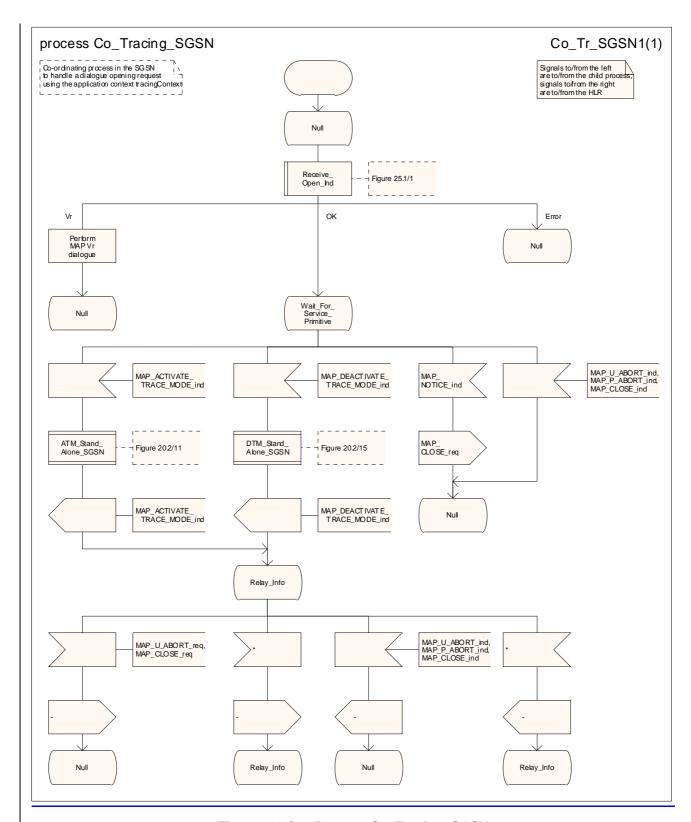
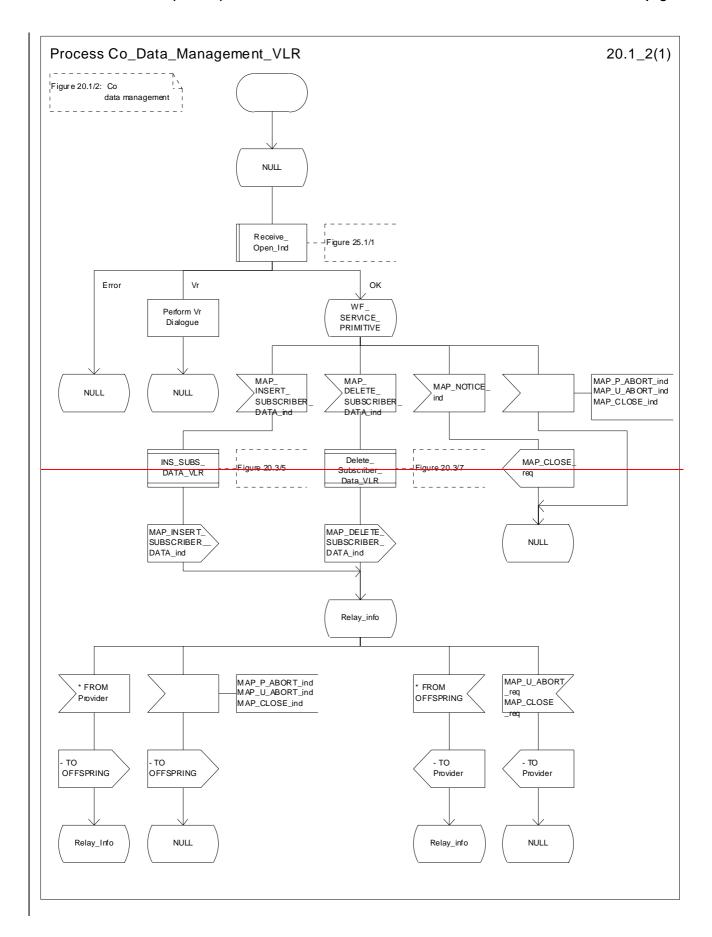


Figure 20.1/23: Process Co\_Tracing\_SGSN



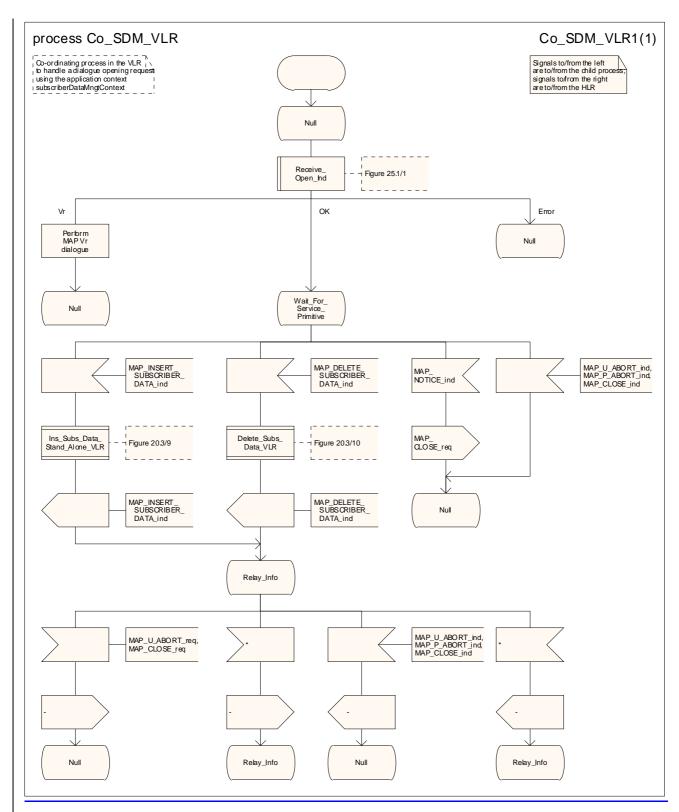
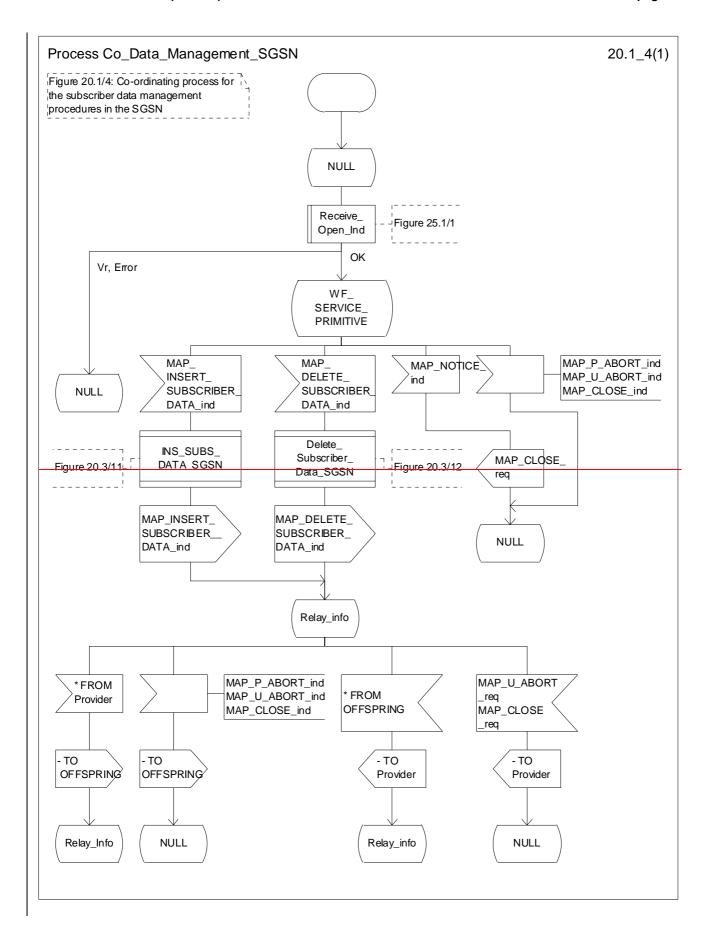


Figure 20.1/32: Process Co\_Data\_ManagementSDM\_VLR



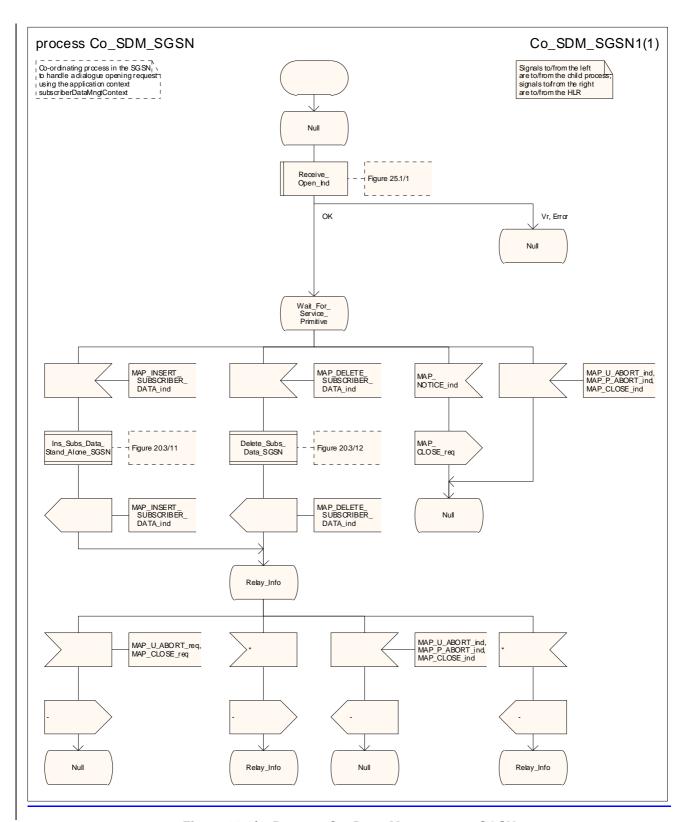


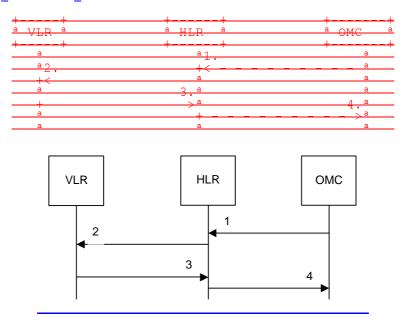
Figure 20.1/4: Process Co\_Data\_Management\_SGSN

#### 20.2 Tracing procedures

Three types of tracing procedures exist:

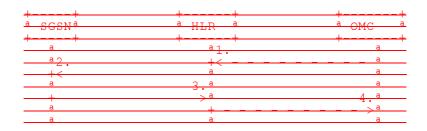
- i) Subscriber tracing management procedures;
- ii) Subscriber tracing procedures;
- iii) Event tracing procedures.

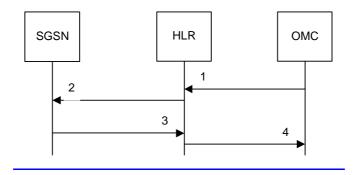
The subscriber tracing management procedures are used for to management of the status and the type of the tracing. The subscriber tracing activation procedure is used at location updating or data restoration when the trace mode of a subscriber is set active in the HLR or, as a stand-alone procedure, when the subscriber is already registered and the trace mode becomes active in the HLR. The procedures for providing a trace request to activate tracing in the VLR are shown in figures 20.2/1 and 20.2/32. The procedures for providing a trace request to activate tracing in the SGSN are shown in figures 20.2/211 and 20.2/412.



- 1) Subscriber Tracing Activation-
- 2) 3) MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Activation Accepted-

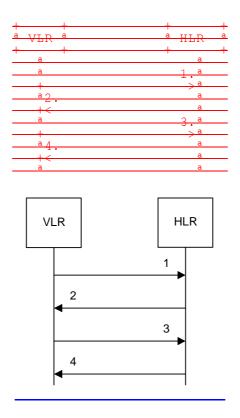
Figure 20.2/1: Stand-alone subscriber tracing activation procedure for non-GPRS





- Subscriber Tracing Activation-1)
- 2) 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Activation Accepted-

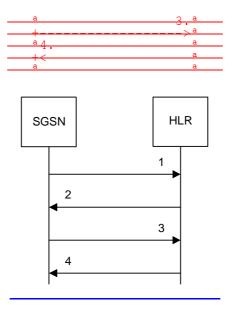
Figure 20.2/241: Stand-alone subscriber tracing activation procedure for GPRS



- MAP\_UPDATE\_LOCATION or MAP\_RESTORE\_DATA\_req/ind-1)
- 2)
- 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK. MAP\_UPDATE\_LOCATION\_ACK or MAP\_RESTORE\_DATA\_rsp/cnfACK.

Figure 20.2/32: Subscriber tracing activation procedure at location updating or data restoration

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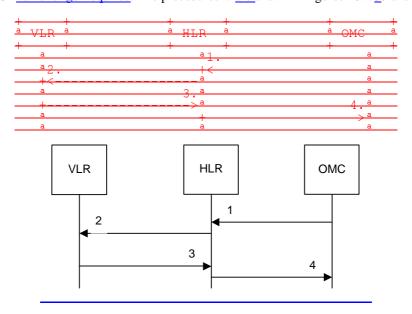


- MAP\_UPDATE\_GPRS\_LOCATION\_req/ind-1)
- 2)
- MAP\_ACTIVATE\_TRACE\_MODE\_req/ind-MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnfACK. 3)
- MAP\_UPDATE\_GPRS\_LOCATION\_rsp/cnfACK.

Figure 20.2/412: Subscriber tracing activation procedure at GPRS location updating

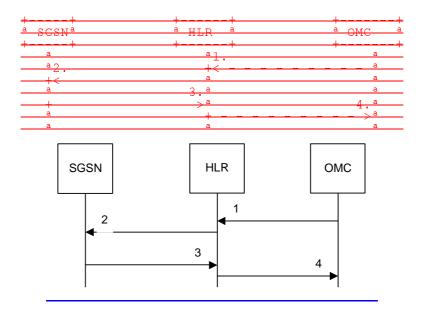
The HLR sends the trace request (IMSI, trace reference, trace type and identity of the OMC) to the VLR or to the SGSN in a MAP\_ACTIVATE\_TRACE\_MODE request includes the IMSI, trace reference, trace type and identity of the OMC. The receipt of this primitive is acknowledged. The acknowledge primitive will indicate that the trace request is accepted by the VLR or by the SGSN. If the request is not accepted, the reason will be reported to the HLR.

The subscriber tracing deactivation procedure is used when the trace requesttracing of a subscriber is to be cancelled in the VLR or in the SGSN is no longer required. The procedures is are shown in figures 20.2/53 and 20.2/613.



- Subscriber Tracing Deactivation-1)
- MAP\_DEACTIVATE\_TRACE\_MODE\_reg/ind-2)
- 3) MAP\_DEACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Deactivation Accepted-

Figure 20.2/53: Subscriber tracing deactivation procedure for non-GPRS

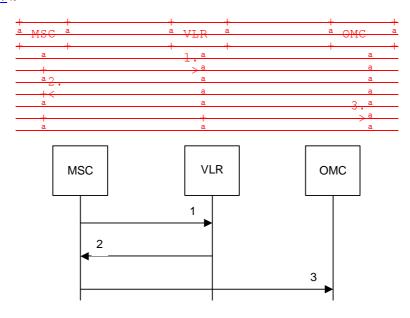


- 1) Subscriber Tracing Deactivation-
- 2) MAP\_DEACTIVATE\_TRACE\_MODE\_req/ind-
- 3) MAP\_DEACTIVATE\_TRACE\_MODE\_rsp/cnfACK.
- 4) Subscriber Tracing Deactivation Accepted-

Figure 20.2/613: Subscriber tracing deactivation procedure for GPRS

The HLR sends a MAP\_DEACTIVATE\_TRACE\_MODE request to the VLR or to the SGSN. The VLR or the SGSN will acknowledge the deactivation. The acknowledge primitive will indicate that the trace request has been deleted by the VLR or by the SGSN. If the deactivation is not accepted, the reason will be reported to the HLR.

The subscriber tracing procedures are used when the VLR detects any subscriber related activity for which the trace mode is activated, e.g. <u>the VLR</u> receives <u>the a MAP\_PROCESS\_ACCESS\_REQUEST</u> indication. The procedure is shown in figure 20.2/74.



- 1) MAP\_PROCESS\_ACCESS\_REQUEST\_<u>req/ind</u>, <u>MAP\_UPDATE\_LOCATION\_AREA.</u>
- 2) MAP\_TRACE\_SUBSCRIBER\_ACTIVITY\_req/ind-
- Subscriber tracing information-

Figure 20.2/74: Subscriber tracing procedure in the servicing MSC

The VLR will generate the MAP\_TRACE\_SUBSCRIBER\_ACTIVITY indication. The receiving MSC will send the trace record to the OMC.

[Figure numbers 20.2/5 and 20.2/6 are spare.]

### 20.2.1 Procedures in the HLR

# 20.2.1.4 Subscriber tracing activation procedure

#### 20.2.1.1 Procedures in the HLR

A subscriber tracing activation request from the OMC starts the appropriate process in the HLR: ATM\_HLR\_With\_VLR if tracing is required in the MSC/VLR, ATM\_HLR\_With\_SGSN if tracing is required in the SGSN.

When receiving the subscriber tracing mode activation command for a subscriber from the OMC, the HLR will activate tracing, if the subscriber is known and registered in the HLR and the subscriber is roaming in the home PLMN area. The MAP\_ACTIVATE\_TRACE\_MODE request is sent to the VLR or to the SGSN where the subscriber is registered.

If the MAP\_ACTIVATE\_TRACE\_MODE confirmation is received indicating an error situation, the errors are mapped to the OMC interface. The activation request may also be repeated; the number of repeat attempts and the time in between are HLR operator options, depending on the error returned by the VLR or the SGSN.

If the subscriber is known in the HLR, but is deregistered or roaming outside the home PLMN area, the subscriber tracing status is activated in the HLR, but the VLR or the SGSN is not updated.

When receiving a request for location updating or data restoration while the subscriber trace mode is active, the macro Control\_Tracing\_HLR (see figure 25.9/6) shall be initiated by the location updating process in the HLR.

The subscriber tracing activation process in the HLR with VLR is shown in figure 20.2/7.

The process in the HLR to activate tracing in the VLR is shown in figure 20.2/8. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

The subscriber tracing activation process in the HLR with SGSN is shown in figure 20.2/14.

The process in the HLR to activate tracing in the SGSN is shown in figure 20.2/9. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open\_Cnf see subclause 25.1.2;
Check\_Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

#### 20.2.1.2 Procedure in the VLR

When receiving a MAP\_ACTIVATE\_TRACE\_MODE indication, the VLR will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known, the tracing facility is supported and the tracing capacity is not exceeded, the successful report is sent in the MAP\_ACTIVATE\_TRACE\_MODE response primitive.

The MAP\_ACTIVATE\_TRACE\_MODE indication primitive may be received during a location updating or data restoration procedure, so the location updating or restore data process shall use the macro-Activate\_Tracing\_VLR (see figure 25.9/4).

The subscriber tracing activation process in the VLR is shown in figure 20.2/9.

The process in the VLR to activate tracing in a stand-alone dialogue is shown in figure 20.2/10. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check Indication see subclause 25.2.1.

## 20.2.1.3 Procedure in the SGSN

When receiving a MAP\_ACTIVATE\_TRACE\_MODE indication, the SGSN will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known, the tracing facility is supported and the tracing capacity is not exceeded, the successful report is sent in the MAP\_ACTIVATE\_TRACE\_MODE response primitive.

The MAP\_ACTIVATE\_TRACE\_MODE indication primitive may be received during a location updating or data restoration procedure, so the location updating or restore data process shall use the macro Activate\_Tracing\_SGSN (see figure 25.9/5).

The subscriber tracing activation process in the SGSN is shown in figure 20.2/16.

The process in the SGSN to activate tracing in a stand-alone dialogue is shown in figure 20.2/11. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check Indication see subclause 25.2.1.

# 20.2.1.2 Subscriber tracing deactivation procedure

#### 20.2.2.1 Procedures in the HLR

A subscriber tracing deactivation request from the OMC starts the appropriate process in the HLR: DTM\_HLR\_With\_VLR if tracing is no longer required in the MSC/VLR, DTM\_HLR\_With\_SGSN if tracing is no longer required in the SGSN.

When receiving the subscriber trace mode deactivation command for a subscriber from the OMC, the HLR will send the MAP\_DEACTIVATE\_TRACE\_MODE request to the VLR or to the SGSN where the subscriber is registered, if the trace mode activation has been carried out. The subscriber tracing in HLR is set to a deactive state.

If the operation is successful, the HLR will set the subscriber tracing in VLR or in SGSN to a deactive state.

If the MAP\_DEACTIVATE\_TRACE\_MODE confirmation is received indicating an error situation, the errors are mapped to the OMC interface. The deactivation request may be also repeated; the number of repeat attempts and the time in between are HLR operator options, depending on the error returned by the VLR or by the SGSN.

The subscriber tracing deactivation procedure with VLR is shown in figure 20.2/8.

The process in the HLR to deactivate tracing in the VLR is shown in figure 20.2/12. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

The subscriber tracing deactivation procedure with SGSN is shown in figure 20.2/15.

The process in the HLR to deactivate tracing in the SGSN is shown in figure 20.2/13. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open\_Cnf see subclause 25.1.2;
Check\_Confirmation see subclause 25.2.2.

Sheet 1: If the Repeat attempt counter has reached its limit, the test "Repeat Attempt" takes the "No" exit; otherwise the test takes the "Yes" exit. The number of repeat attempts and the interval between successive repeat attempts are operator options.

#### 20.2.2.2 Procedures in the VLR

The VLR is involved in the following tracing procedures:

- i) Subscriber tracing activation procedure;
- ii) Subscriber tracing deactivation procedure;
- iii) Subscriber tracing procedure.

#### 20.2.2.1 Subscriber tracing activation procedure

## 20.2.2.2 Subscriber tracing deactivation procedure

When receiving a MAP\_DEACTIVATE\_TRACE\_MODE indication, the VLR will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known and the tracing facility is supported, the successful report is sent in the MAP\_DEACTIVATE\_TRACE\_MODE response primitive.

The subscriber tracing deactivation procedure in the VLR is shown in figure 20.2/10.

The process in the VLR to deactivate tracing is shown in figure 20.2/14. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check\_Indication see subclause 25.2.1.

#### 20.2.2.3 Procedure in the SGSN

When receiving a MAP\_DEACTIVATE\_TRACE\_MODE indication, the SGSN will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or as a data missing error depending on the nature of the error.

If the subscriber is known and the tracing facility is supported, the successful report is sent in the MAP\_DEACTIVATE\_TRACE\_MODE response primitive.

The subscriber tracing deactivation procedure in the SGSN is shown in figure 20.2/17.

The process in the SGSN to deactivate tracing is shown in figure 20.2/15. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

<u>Check\_Indication</u> see subclause 25.2.1.

# 20.2.2.3 Subscriber tracing procedure

When the VLR receives a MAP\_PROCESS\_ACCESS\_REQUEST or MAP\_UPDATE\_LOCATION\_AREA indication related to any subscriber activity from the MSC, the subscriber tracing procedure may be carried out. The macro Trace\_Subscriber\_Activity\_VLR is shown in figure 25.9/2.

### 20.2.3 Procedures in the MSC

The MSC is involved in the following tracing procedure:

i) Subscriber tracing procedure.

# 20.2.3.1 Subscriber tracing procedure

When receiving the MAP\_TRACE\_SUBSCRIBER\_ACTIVITY indication from the VLR, the MSC stores trace reference, trace type and the identity of the OMC in charge of the trace, and the MSC starts to collect the trace information. The MSC will send the trace record to the OMC.

The macro Trace\_Subscriber\_Activity\_MSC is shown in figure 25.9/1.

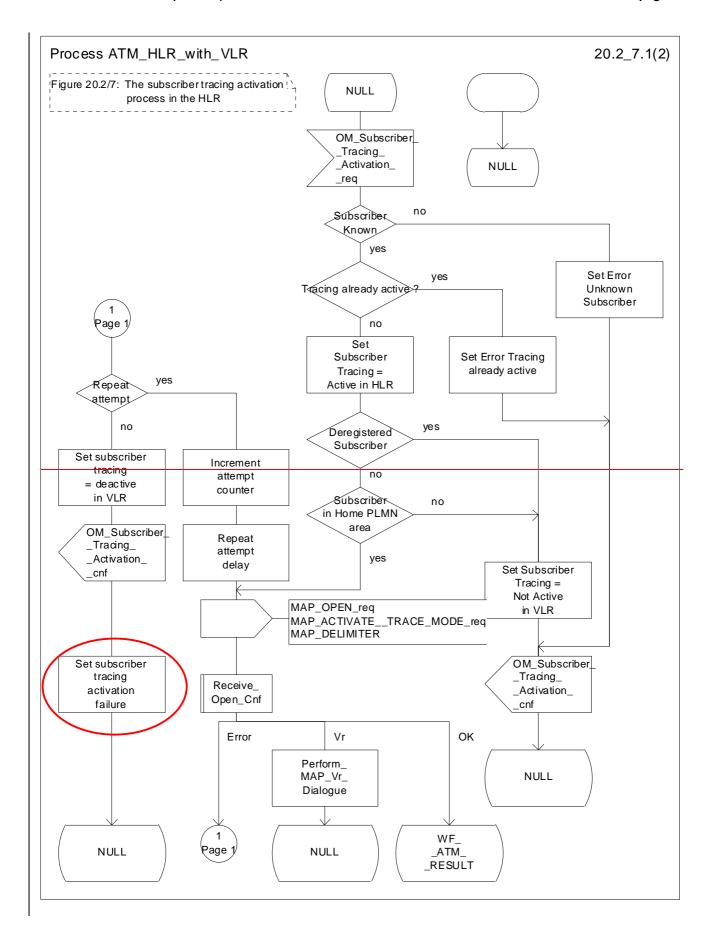
### 20.2.4 Procedures in the SGSN

The SGSN is involved in the following tracing procedures:

- i) Subscriber tracing activation procedure;
- ii) Subscriber tracing deactivation procedure.

### 20.2.4.1 Subscriber tracing activation procedure

## 20.2.4.2 Subscriber tracing deactivation procedure in SGSN



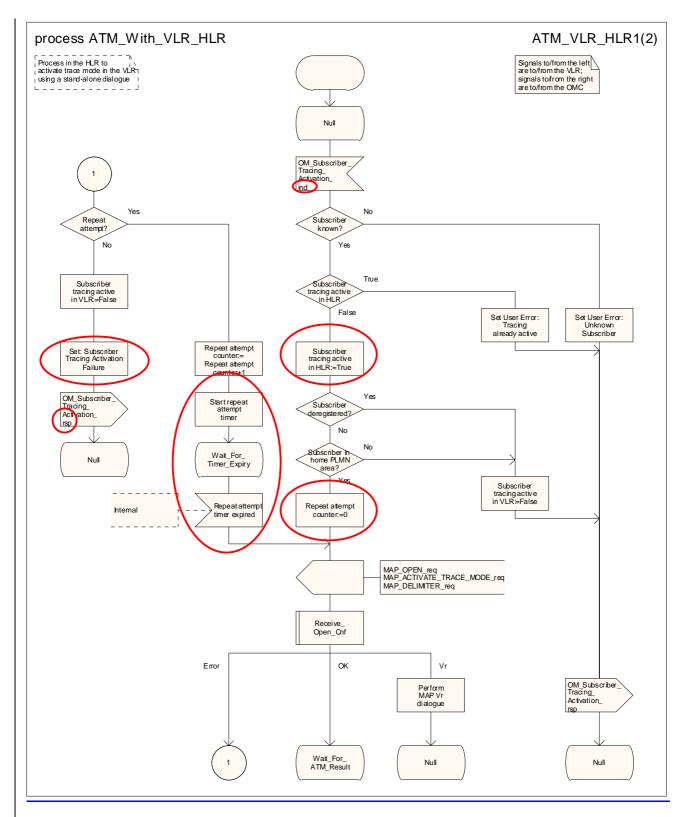
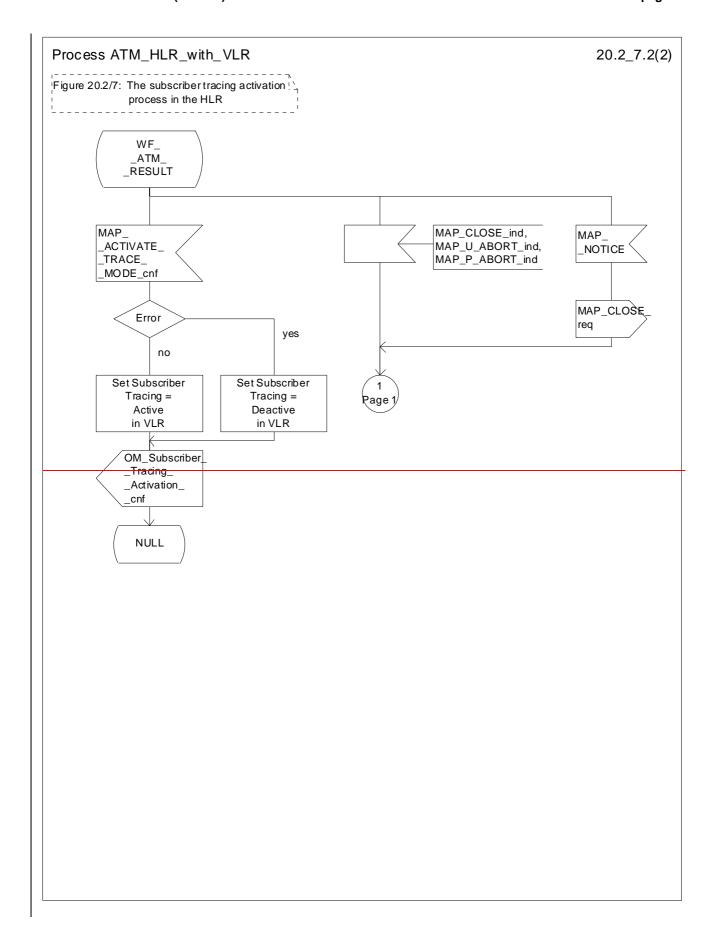


Figure 20.2/87 (sheet 1 of 2): Process ATM\_With\_VLR\_HLR\_with\_VLR



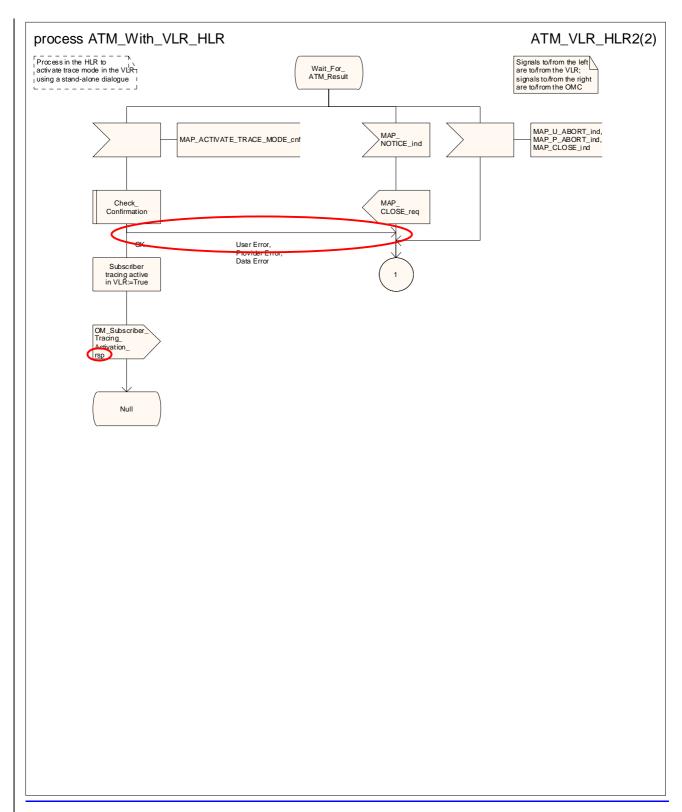
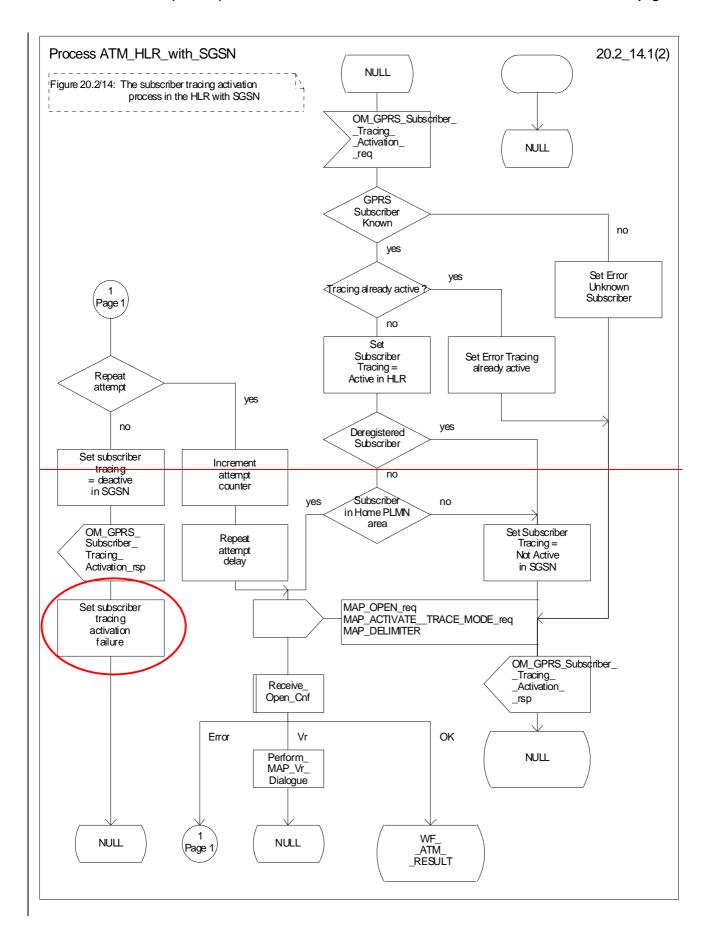


Figure 20.2/87 (sheet 2 of 2): Process ATM With VLR HLR with VLR



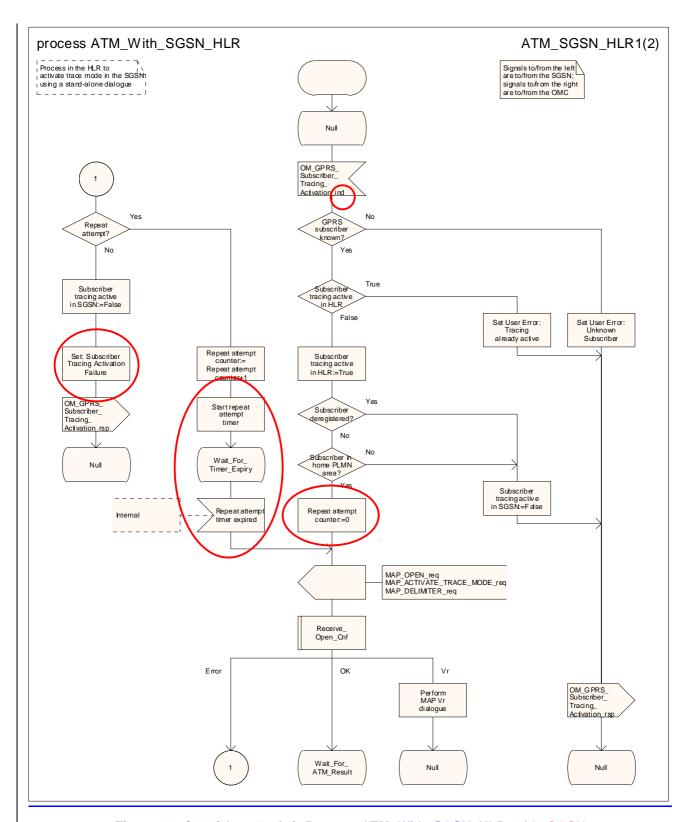
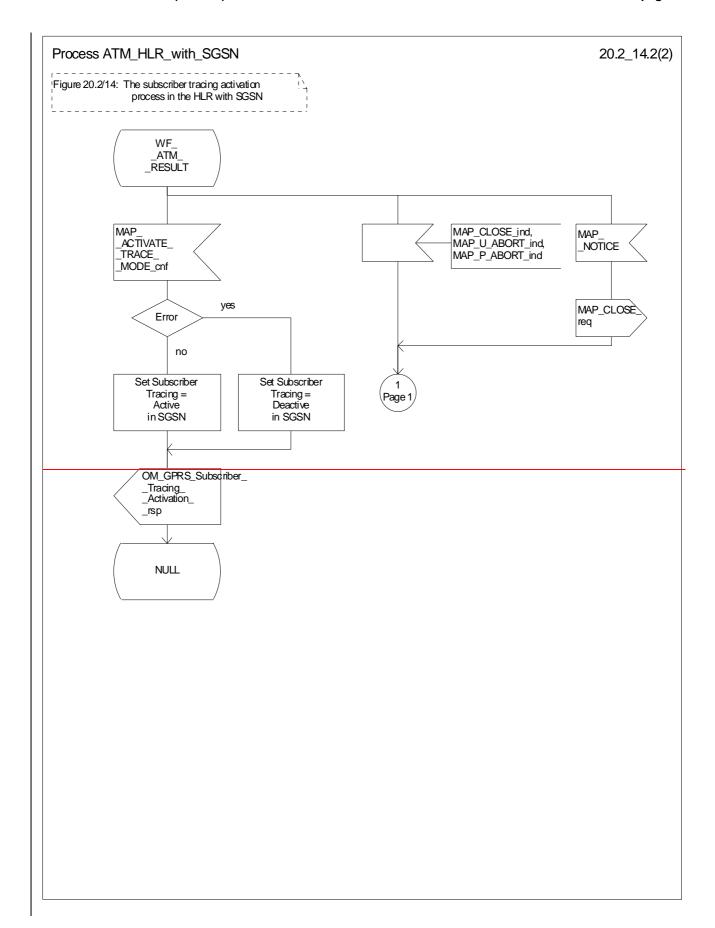


Figure 20.2/914 (sheet 1 of 2): Process ATM With SGSN\_HLR\_with\_SGSN



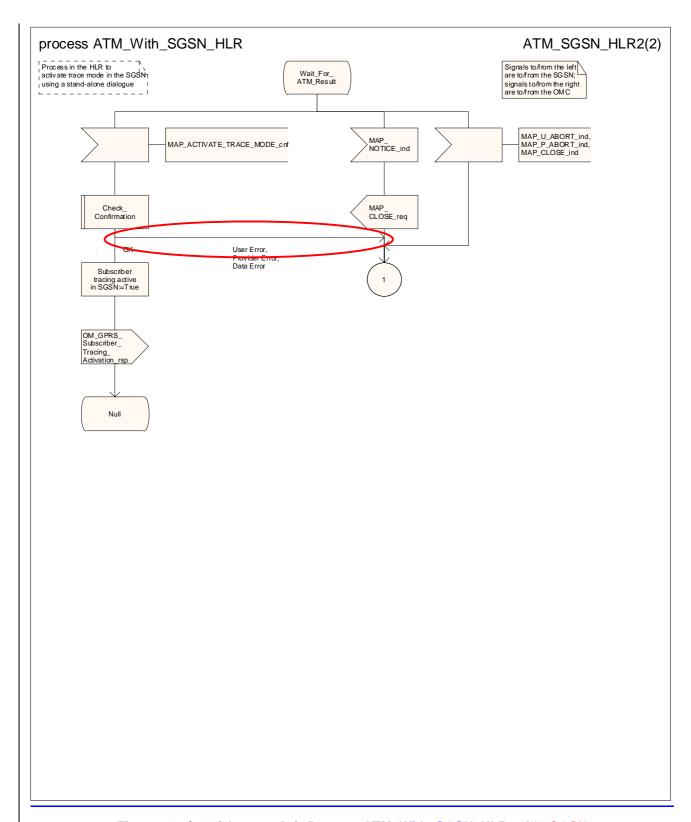
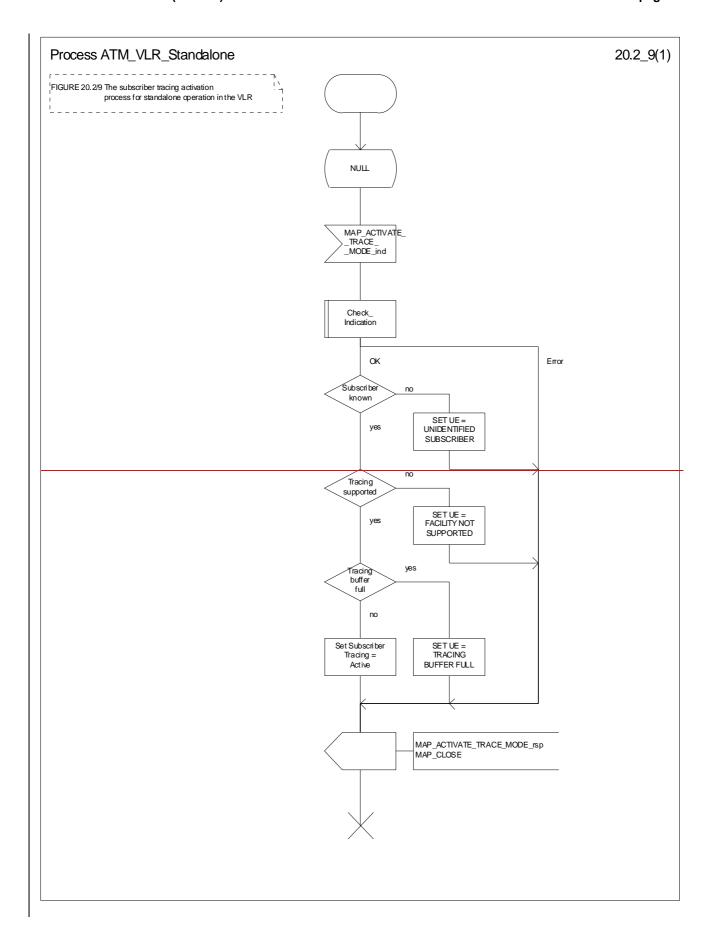


Figure 20.2/914 (sheet 2 of 2): Process ATM With SGSN\_HLR\_with\_SGSN



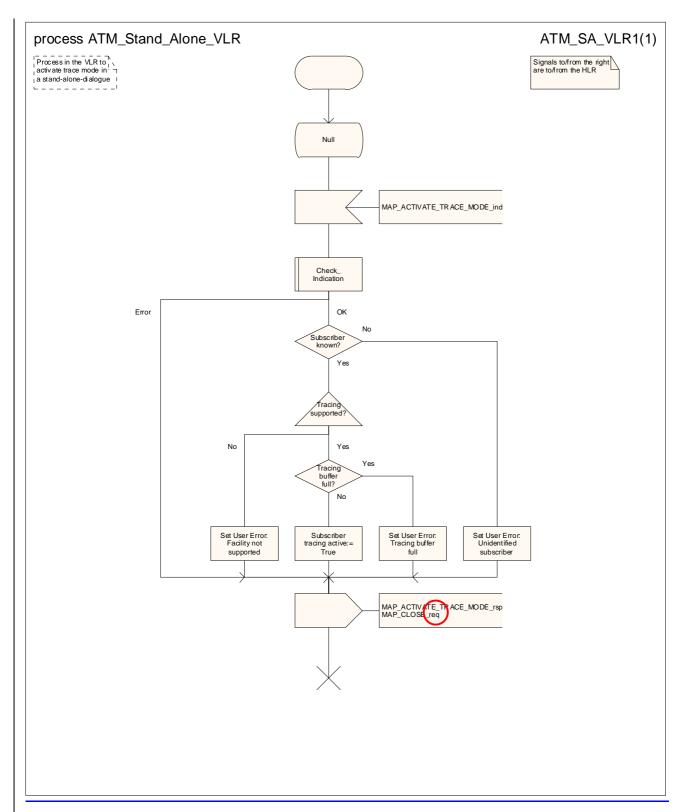
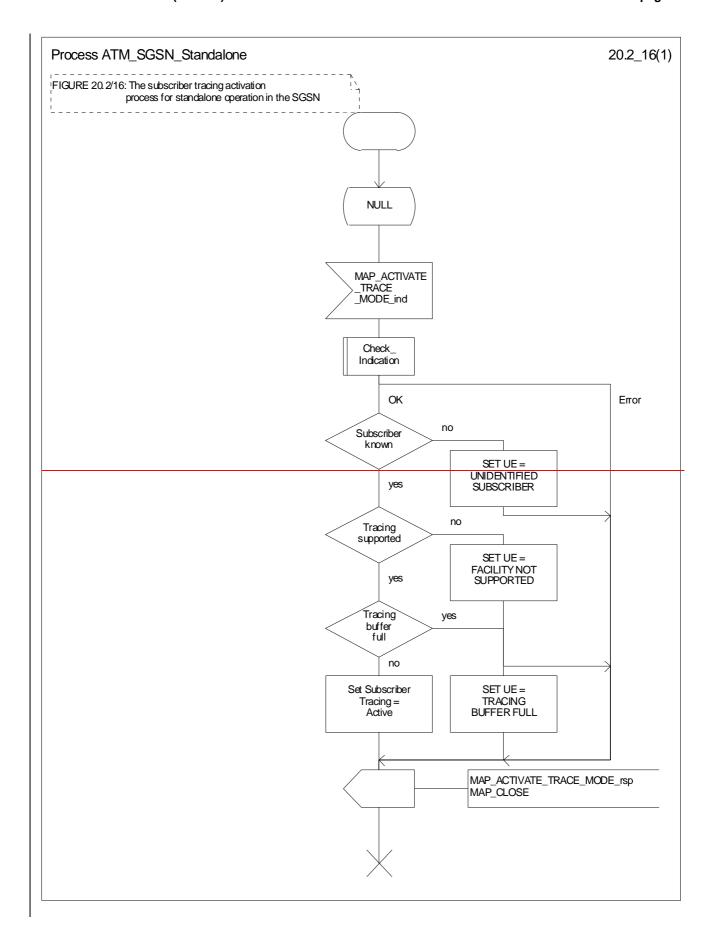


Figure 20.2/109: Process ATM\_Stand\_Alone\_VLR\_Standalone



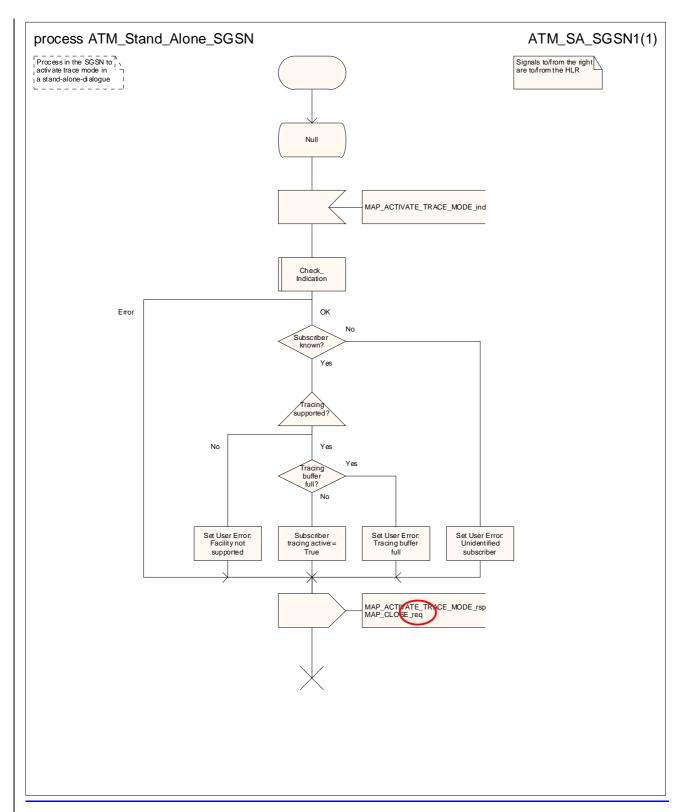
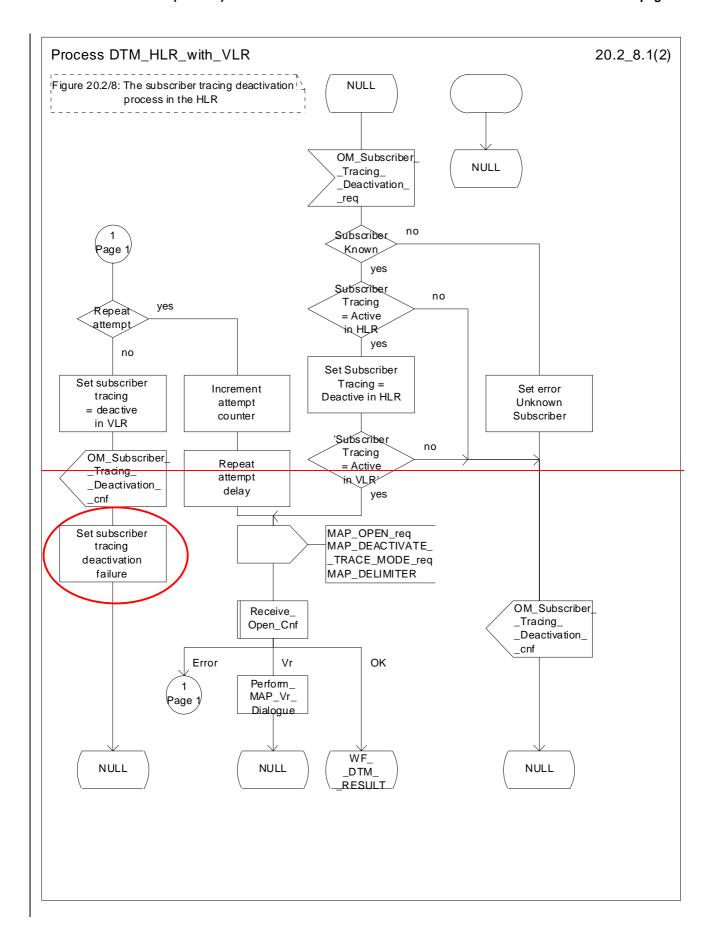


Figure 20.2/116: Process ATM Stand Alone SGSN Standalone



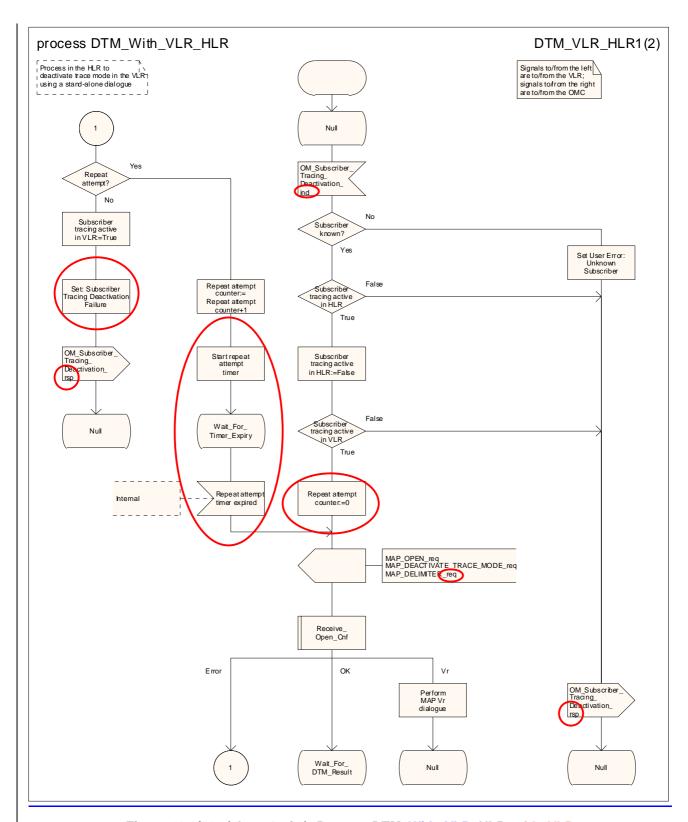
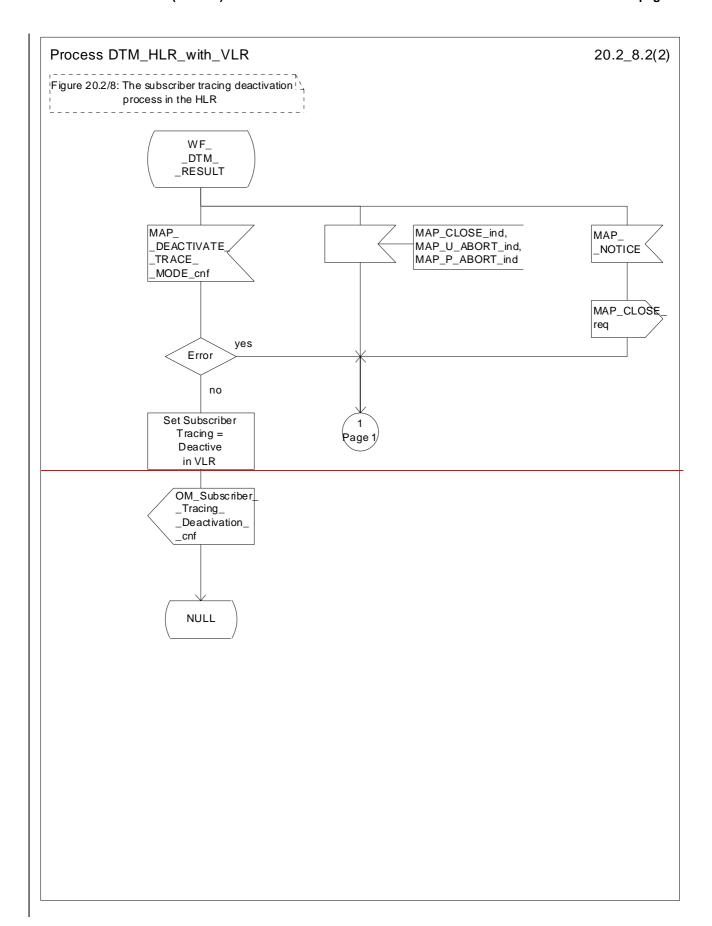


Figure 20.2/128 (sheet 1 of 2): Process DTM\_With\_VLR\_HLR\_with\_VLR



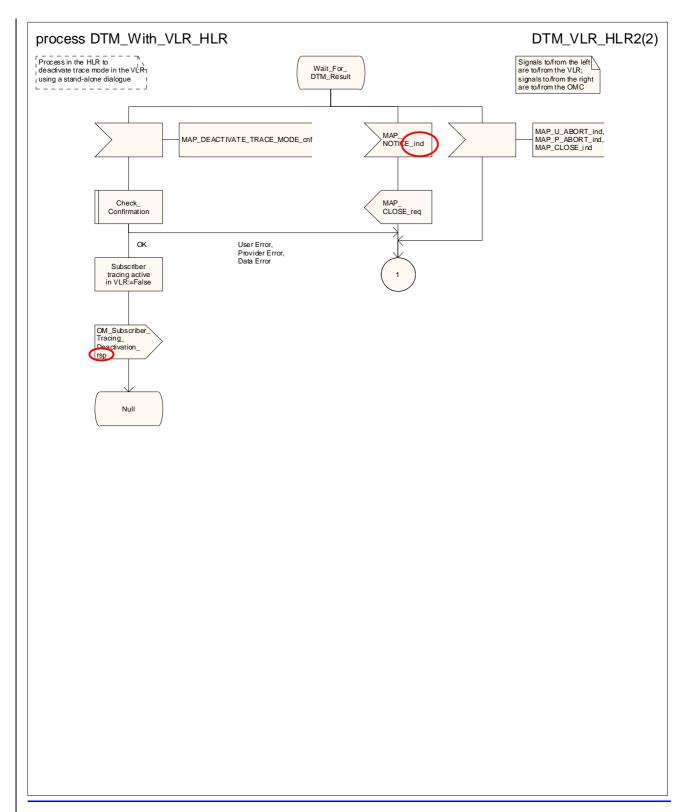
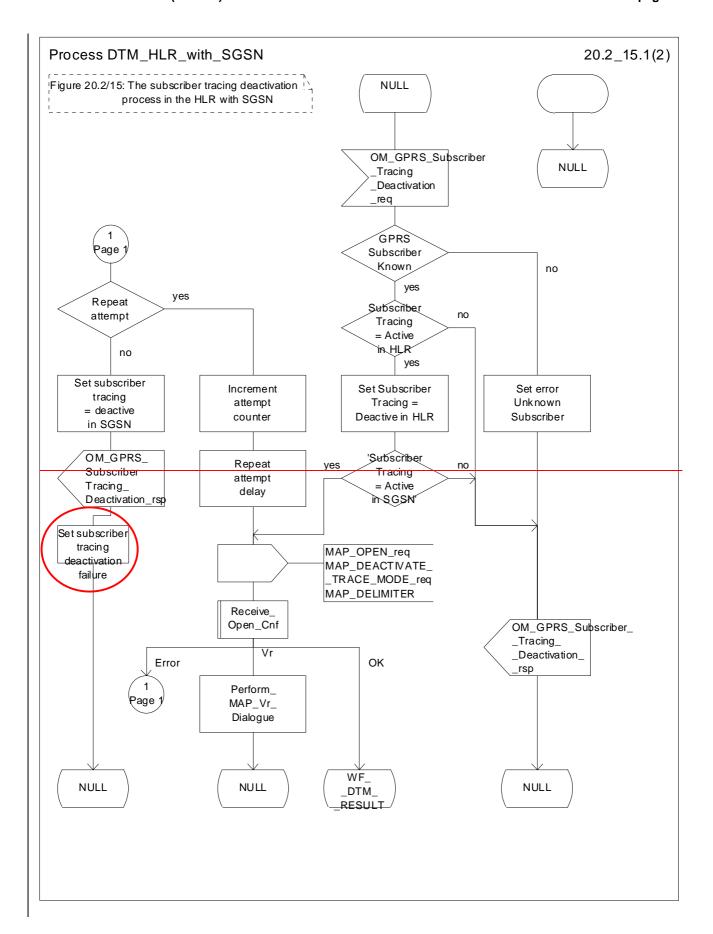


Figure 20.2/128 (sheet 2 of 2): Process DTM With VLR HLR with VLR



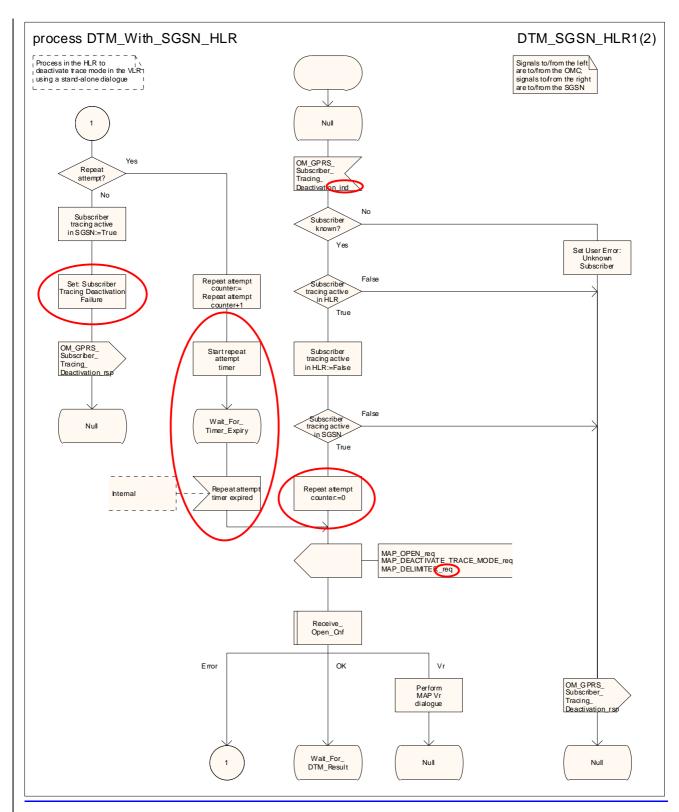
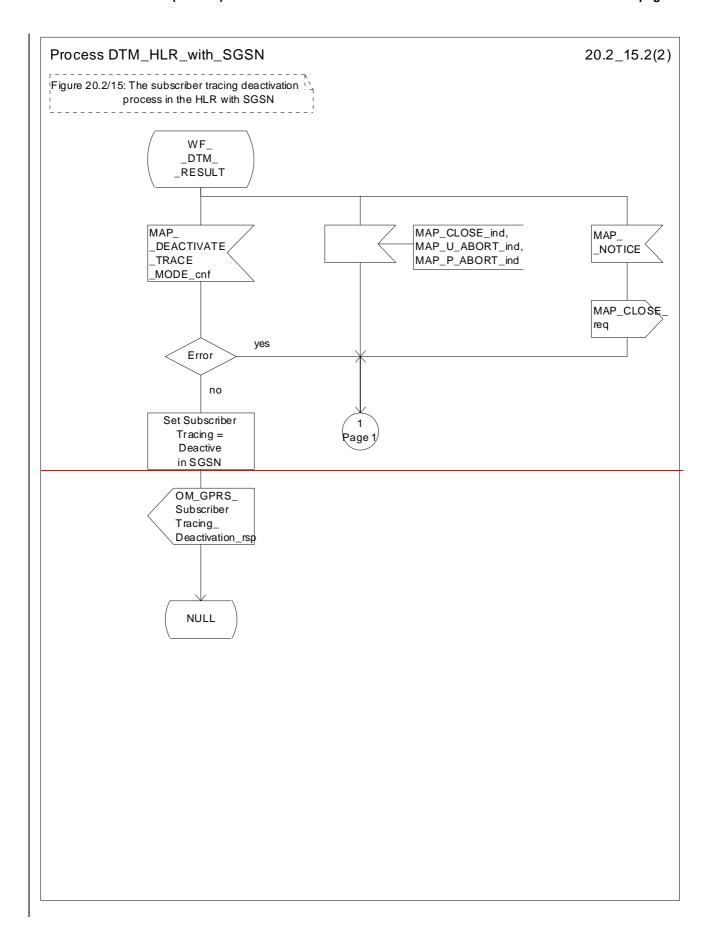


Figure 20.2/135 (sheet 1 of 2): Process DTM With SGSN\_HLR\_with\_SGSN



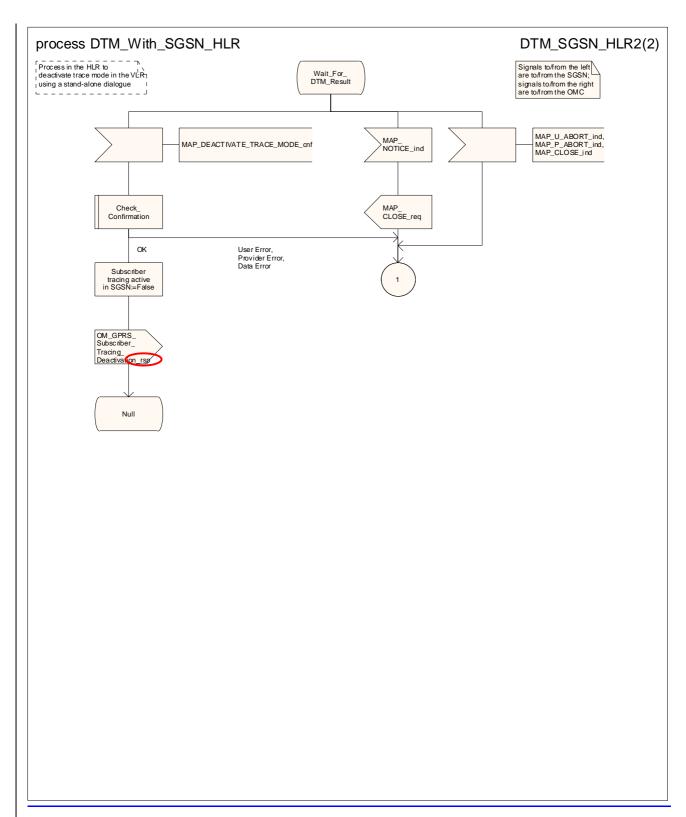
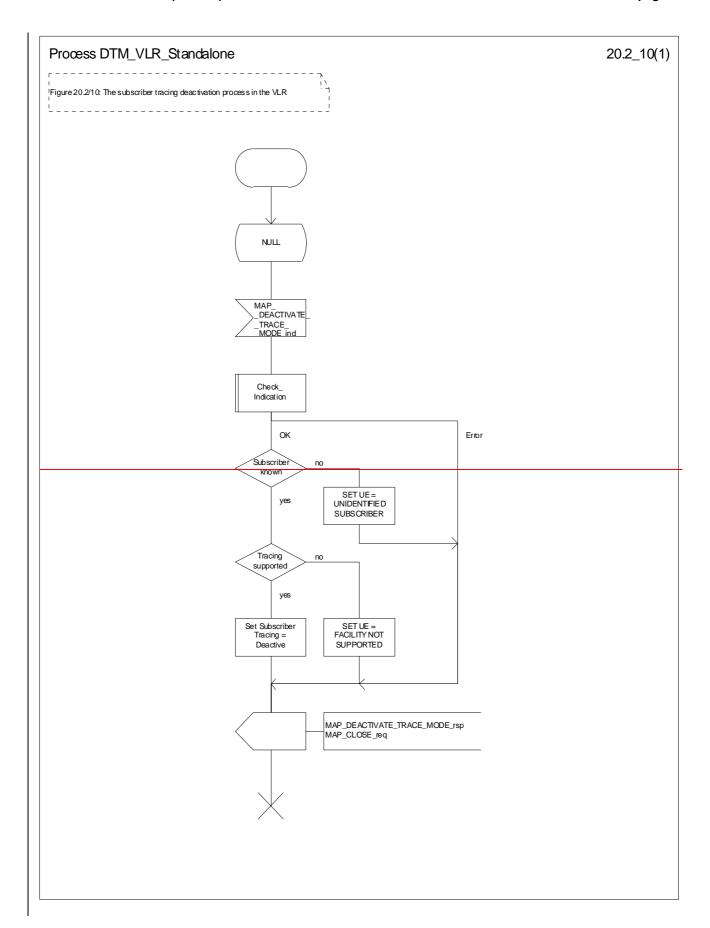


Figure 20.2/135 (sheet 2 of 2): Process DTM\_With\_SGSN\_HLR\_with\_SGSN



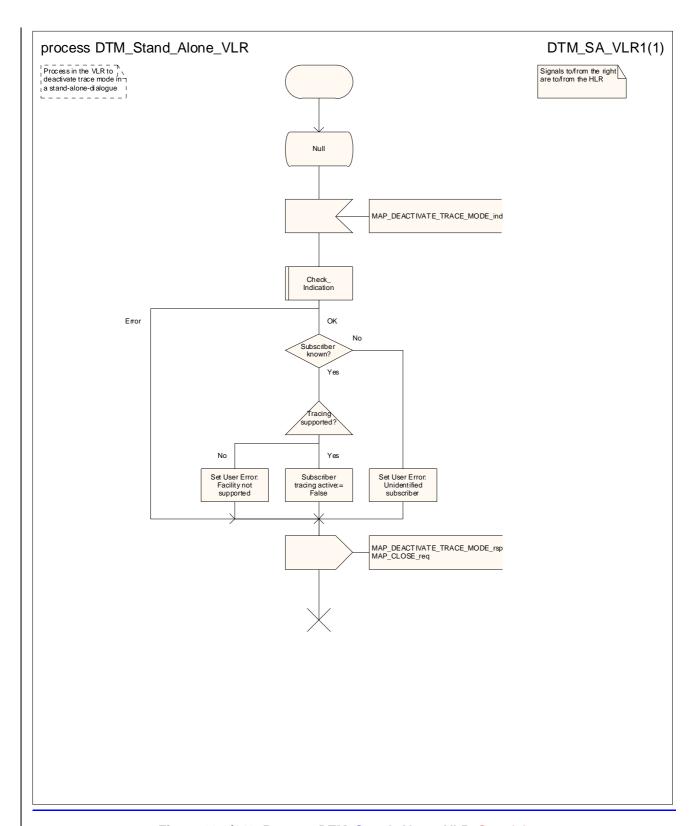
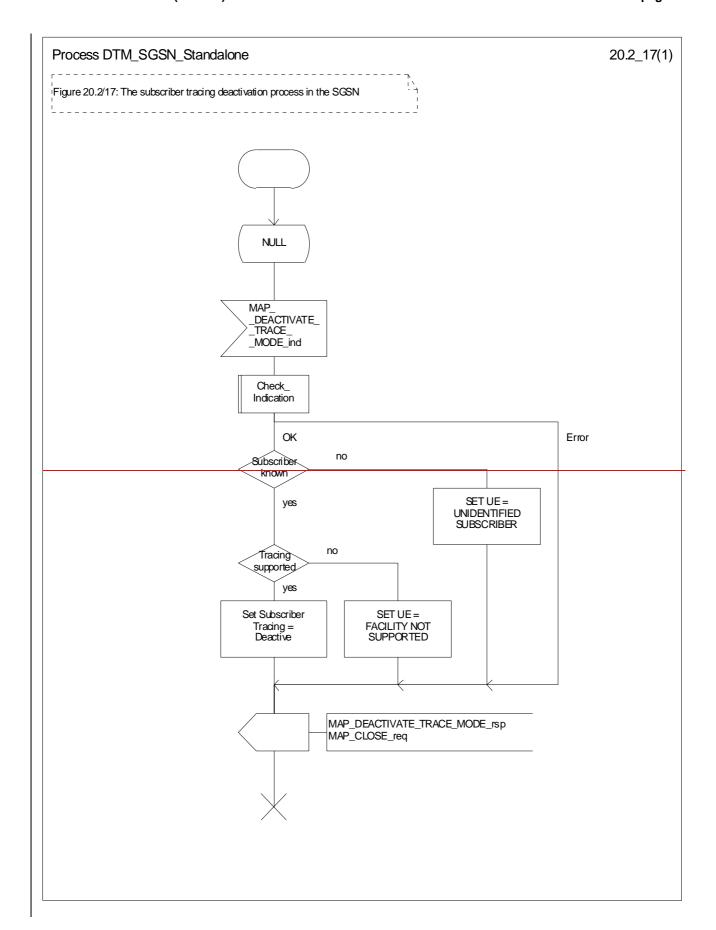


Figure 20.2/140: Process DTM Stand Alone VLR Standalone



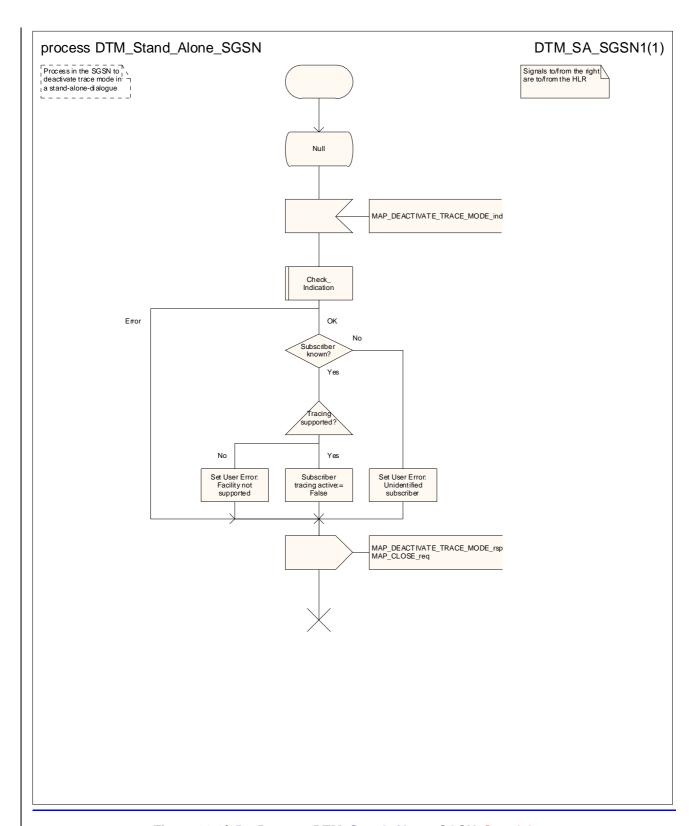


Figure 20.2/157: Process DTM Stand Alone SGSN Standalone

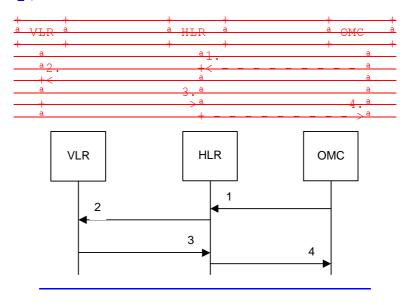
# 20.3 Subscriber data management procedures

Two types of subscriber data management procedures exist: in the Mobile Application Part

- 1i) Subscriber Deletion;
- 2#)Subscriber Data Modification.

No requirements have been identified for the Subscriber creation and subscriber data interrogation procedures.

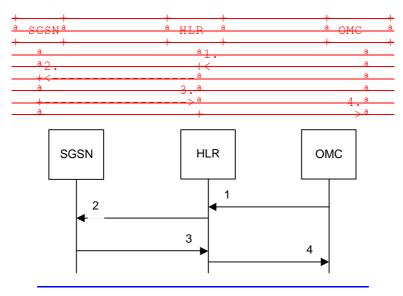
The subscriber deletion and subscriber data modification procedures are initiated by the OMC (see figures 20.3/1-, 20.3/2,  $20.3/\frac{3}{2}$  and  $20.3/\frac{49}{2}$ ).



- 1) Delete Subscriber-
- 2) MAP\_CANCEL\_LOCATION\_reg/ind-
- 3) MAP\_CANCEL\_LOCATION\_rsp/cnfACK.
- 4) Subscriber Deleted-

Figure 20.3/1: Subscriber deletion procedure for non-GPRS

In the subscriber deletion procedure <u>for a non-GPRS subscriber</u> the subscriber data <u>should be are</u> removed from the VLR and <u>from</u> the HLR. The HLR uses the MAP\_CANCEL\_LOCATION service.

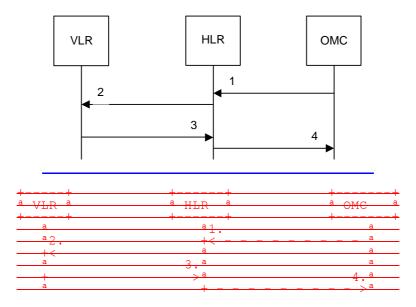


1) Delete GPRS Subscriber-

- 2) MAP\_CANCEL\_LOCATION\_reg/ind-
- 3) MAP\_CANCEL\_LOCATION\_rsp/cnfACK.
- 4) GPRS Subscriber Deleted-

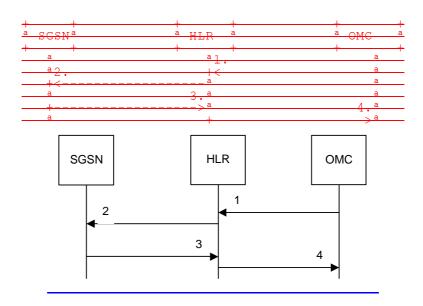
#### Figure 20.3/28: Subscriber deletion procedure for GPRS

In the subscriber deletion procedure <u>for a GPRS subscriber</u> the subscriber data <u>should beare</u> removed from the SGSN and <u>from</u> the HLR. The HLR uses the MAP\_CANCEL\_LOCATION service.



- 1) Modify Subscriber Data-
- 2) MAP\_CANCEL\_LOCATION\_<u>req/ind</u>, MAP\_INSERT\_SUBSCRIBER\_DATA\_<u>req/ind</u> or MAP\_DELETE\_SUBSCRIBER\_DATA\_<u>req/ind</u>.
- 3) MAP\_CANCEL\_LOCATION\_<u>rsp/cnf</u>ACK, MAP\_INSERT\_SUBSCRIBER\_DATA\_<u>rsp/cnf</u>ACK or MAP\_DELETE\_SUBSCRIBER\_DATA\_<u>rsp/cnf</u>ACK.
- 4) Subscriber Data Modified-

Figure 20.3/32: Subscriber data modification procedure for non-GPRS



- 1) Modify Subscriber Data-
- 2) MAP\_CANCEL\_LOCATION\_req/ind, MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind or—MAP\_DELETE\_SUBSCRIBER\_DATA\_req/ind-

- MAP\_CANCEL\_LOCATION\_rsp/cnfACK, MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnfACK or— MAP\_DELETE\_SUBSCRIBER\_DATA\_rsp/cnfACK.
- 4) Subscriber Data Modified-

#### Figure 20.3/49: Subscriber data modification procedure for GPRS

In the subscriber data modification procedure the subscriber data is modified in the HLR and when necessary also in the VLR or in the SGSN. The HLR initiates either the

MAP\_INSERT\_SUBSCRIBER\_DATA,MAP\_DELETE\_SUBSCRIBER\_DATA or MAP\_CANCEL\_LOCATION service depending on the modified data.

## 20.3.1.1 Subscriber deletion procedure

## 20.3.1.1 Procedures in the HLR

When the subscriber deletion request is received from the OMC, the HLR shall delete the subscriber data from the HLR and initiate the MAP\_CANCEL\_LOCATION request to the VLR or to the SGSN where the subscriber is registered.

The subscriber deletion process dure in the HLR is shown in the figure 20.3/53. The MAP process invokes processes not defined in this clause; the definitions of these processes can be found as follows:

Cancel\_GPRS\_Location\_Child\_HLRsee subclause 19.1.2.2;Cancel\_Location\_Child\_HLRsee subclause 19.1.2.2.

## 20.3.1.2 Procedures in the VLR

The subscriber deletion procedure in the VLR is described in the subclause 19.1.2.3 of the present document.

#### 20.3.1.3 Procedures in the SGSN

The subscriber deletion procedure in the SGSN is described in the subclause 19.1.2.4 of the present document.

## 20.3.1.2 Subscriber data modification procedure

#### 20.3.2.1 Procedure in the HLR

The OMC can modify the subscriber data in several different ways. The modifications can be categorised in the following groups:

- A1) data shall be modified in the HLR; no effect in the VLR;
- B2) data shall be modified in both the HLR and the VLR;
- e3) withdrawal of a basic service or a supplementary service requiring change to VLR data;
- <del>D4</del>) modification affects <del>on</del>-the roaming <del>of permission for</del> the subscriber and the subscriber <u>record</u> shall be removed from the VLR data base;
- 5) withdrawal of non-GPRS Subscription caused by a change of Network Access Mode;
- E) authentication algorithm or authentication key of the subscriber is modified;

<u>F6)data shall be modified in the HLR;</u> no effect in the SGSN;

- G7) data shall be modified in both the HLR and the SGSN;
- H8) withdrawal of a GPRS subscription data or a basic service or a supplementary service both requiring change to SGSN data;
- <u>19</u>) modification affects <u>on</u> the roaming <u>permission for <u>of</u> the subscriber and the subscriber <u>record</u> shall be removed from the SGSN data base;</u>

**J10**) withdrawal of GPRS Subscription <u>caused by a change of <del>related to</del></u> Network Access Mode;

K) withdrawal of non-GPRS Subscription related to Network Access Mode;

11) authentication algorithm or authentication key of the subscriber is modified.

In cases 2"b" and 7"g" the HLR uses the MAP\_INSERT\_SUBSCRIBER\_DATA service is initiated in the HLR.

In cases 3"e" and 8"h" the HLR uses the MAP\_DELETE\_SUBSCRIBER\_DATA service is initiated in the HLR.

In cases 4"d", 5"e", 9"i", 10"j" and 11"k" the HLR uses the MAP\_CANCEL\_LOCATION service is initiated in the HLR.

If the result of a primitive received from the VLR or from the SGSN is unsuccessful deletion of subscriber data fails, the HLR may initiate re-repeat the request attempts; the number of repeat attempts and the time in between are HLR operator options, depending on the error returned by the VLR or by the SGSN.

The subscriber data modification procedure in the HLR is shown in the figures 20.3/4, 20.3/5 and 25.7/2.

The subscriber data modification process in the HLR is shown in figure 20.3/6. The MAP process invokes processes not defined in this clause; the definitions of these processes can be found as follows:

Insert\_Subs\_Data\_Stand\_Alone\_HLR see subclause 25.7.3;

Cancel\_Location\_Child\_HLR see subclause 19.1.2.2;

<u>Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR</u> see subclause 25.7.4;

Cancel GPRS Location Child HLR see subclause 19.1.2.2.

The macro Delete\_Subscriber\_Data\_HLR is shown in figure 20.3/7. The macro invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see subclause 25.1.2;

Check Confirmation see subclause 25.2.2.

The macro Delete\_GPRS\_Subscriber\_Data\_HLR is shown in figure 20.3/8. The macro invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;

Check Confirmation see subclause 25.2.2.

### 20.3.2.2 Procedures in the VLR

## 20.3.2.1 Subscriber deletion procedure

### 20.3.2.2 Subscriber data modification procedure

When receiving either the MAP\_INSERT\_SUBSCRIBER\_DATA indication or the MAP\_DELETE\_SUBSCRIBER\_DATA indication, the VLR checks the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

After receiving the first MAP\_INSERT\_SUBSCRIBER\_DATA indication, the VLR will check the IMSI that is included in the primitive. If the IMSI is unknown, the error "Unidentified subscriber" is returned.

If the VLR does not support received basic or supplementary services or the network feature Operator Determined Barring, or there is a problem with Regional Subscription Data then it reports it to the HLR.

If the entire MSC area is restricted due to regional subscription, this is reported to the HLR.

If the updating of the subscriber data is not possible, the VLR will initiate the MAP\_U\_ABORT request primitive. If the updating is successful, the MAP\_CLOSE indication is received from the HLR.

The subscriber data modification procedure in the VLR is shown in the figures 20.3/6, 20.3/7 and 25.7/1.

The process in the VLR to update subscriber data in a stand-alone dialogue is shown in figure 20.3/9. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

<u>Check\_Indication</u> see subclause 25.2.1;

Insert Subs Data VLR see subclause 25.7.1.

The process in the VLR to delete subscriber data is shown in figure 20.3/10. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

<u>Check\_Indication</u> see subclause 25.2.1.

## 20.3.2.3 Procedures in the SGSN

#### 20.3.3.1 Subscriber deletion procedure

## 20.3.3.2 Subscriber data modification procedure

When receiving either the MAP\_INSERT\_SUBSCRIBER\_DATA indication or the

MAP\_DELETE\_SUBSCRIBER\_DATA indication, the SGSN checks the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

After receiving the first MAP\_INSERT\_SUBSCRIBER\_DATA indication, the SGSN will check the IMSI that is included in the primitive. If the IMSI is unknown, the error "Unidentified subscriber" is returned.

If the SGSN does not support received basic services or the network feature Operator Determined Barring, or there is a problem with Regional Subscription Data then it reports it to the HLR.

If the entire SGSN area is restricted due to regional subscription, this is reported to the HLR.

If the updating of the subscriber data is not possible, the SGSN will initiate the MAP\_U\_ABORT request primitive. If the updating is successful, the MAP\_CLOSE indication is received from the HLR.

The subscriber data modification procedure in the SGSN is shown in the figures 20.3/11, 20.3/12 and 25.7/5.

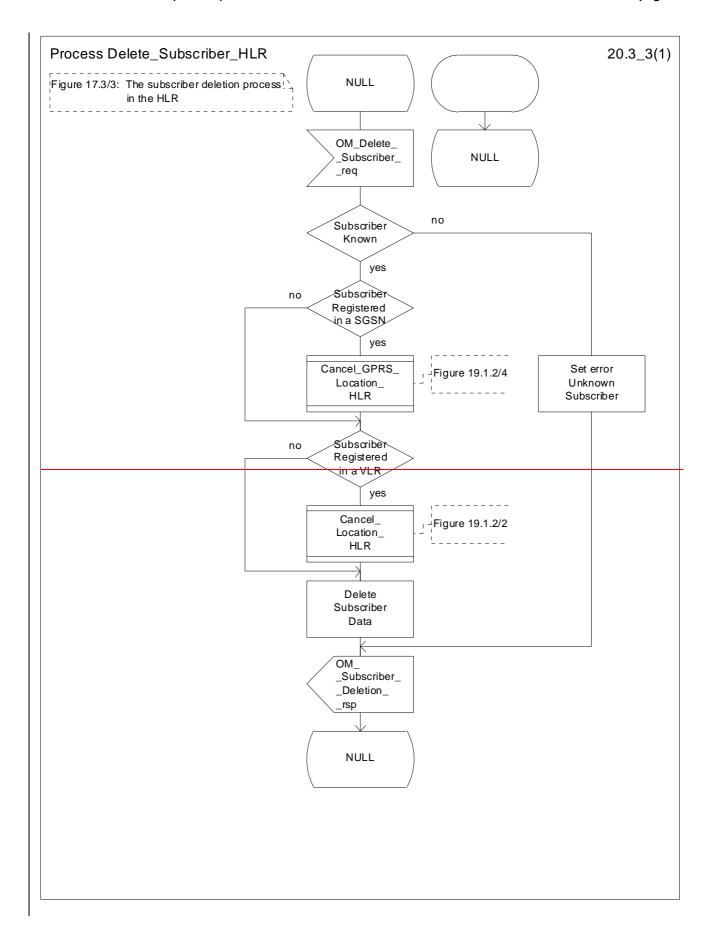
The process in the SGSN to update subscriber data in a stand-alone dialogue is shown in figure 20.3/11. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

<u>Check Indication</u> see subclause 25.2.1;

<u>Insert\_Subs\_Data\_SGSN</u> see subclause 25.7.2.

The process in the SGSN to delete subscriber data is shown in figure 20.3/12. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Check Indication see subclause 25.2.1.



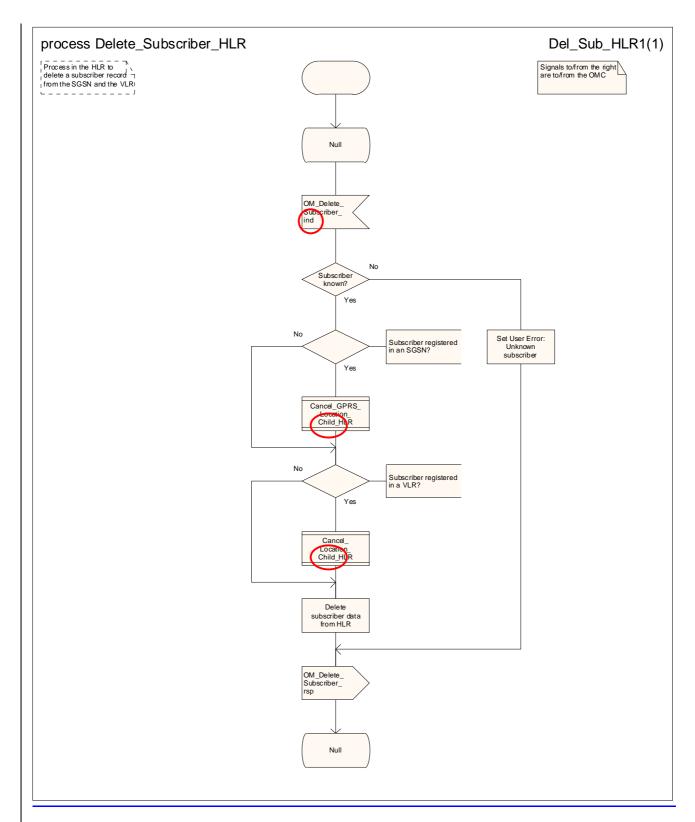
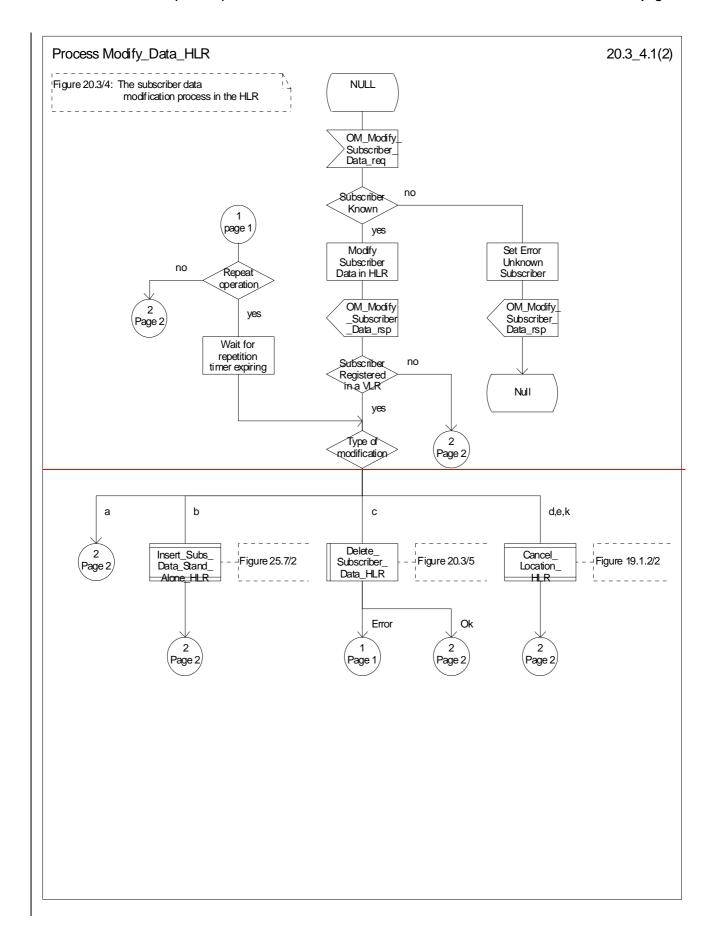


Figure 20.3/53: Process Delete\_Subscriber\_HLR



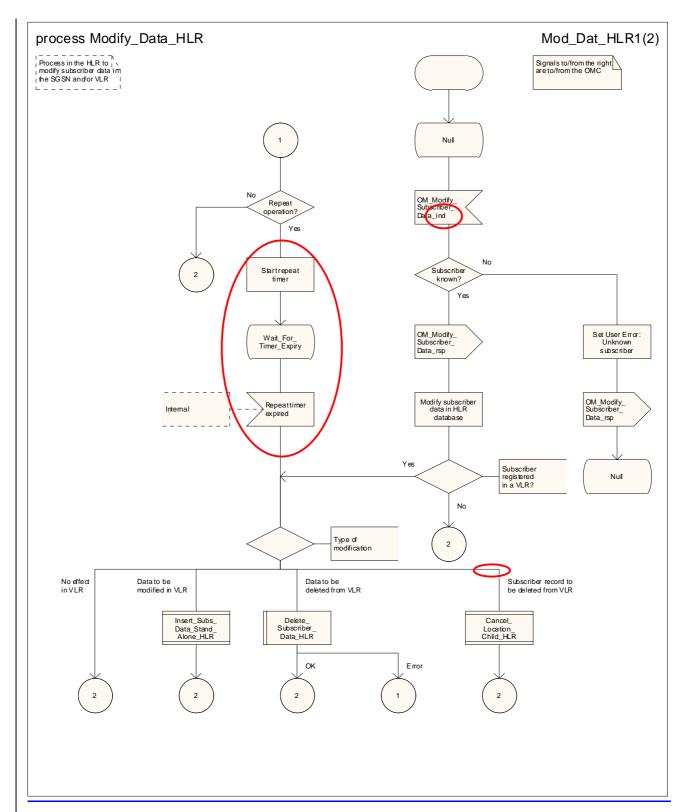
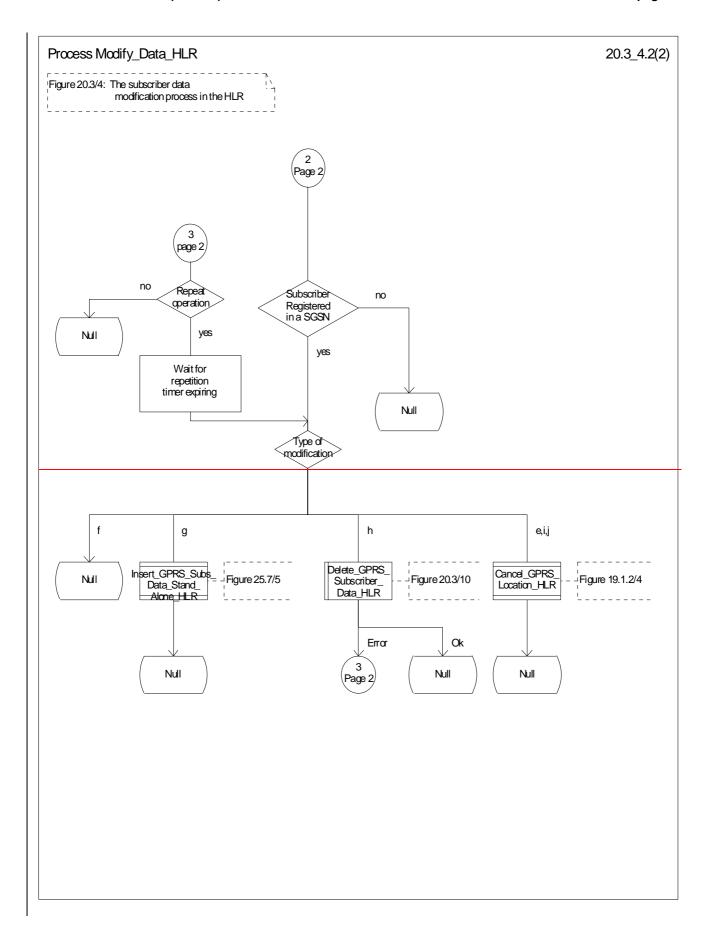


Figure 20.3/64 (sheet 1 of 2): Process Modify\_Data\_HLR



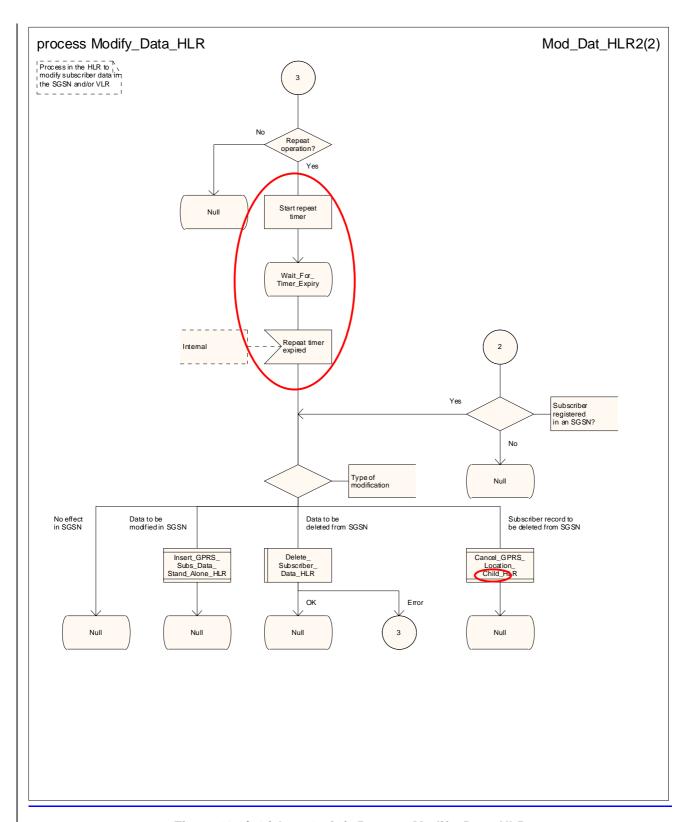
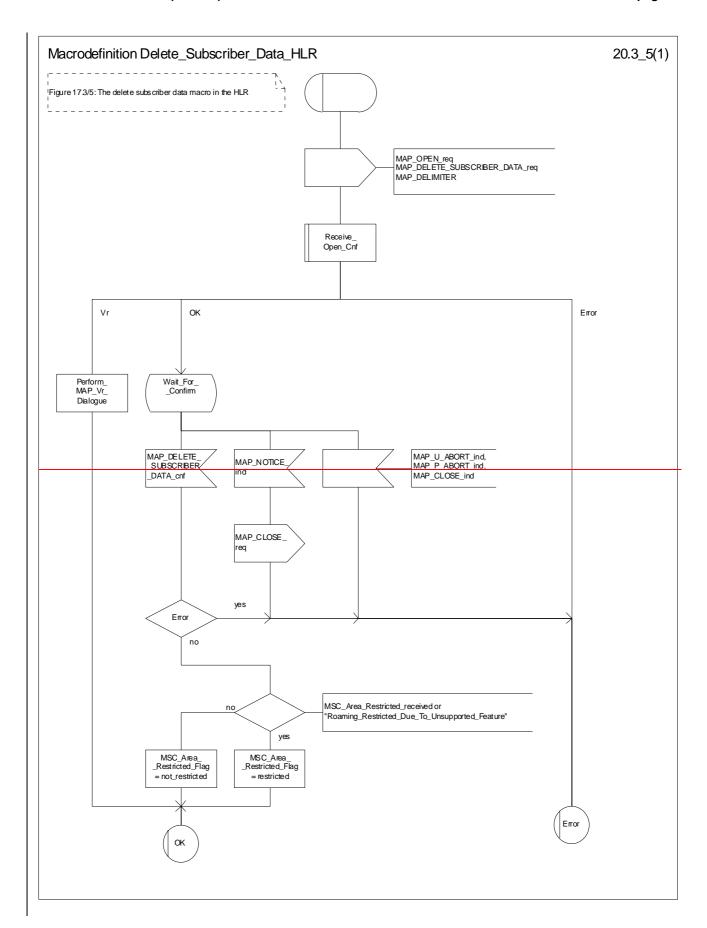


Figure 20.3/64 (sheet 2 of 2): Process Modify\_Data\_HLR



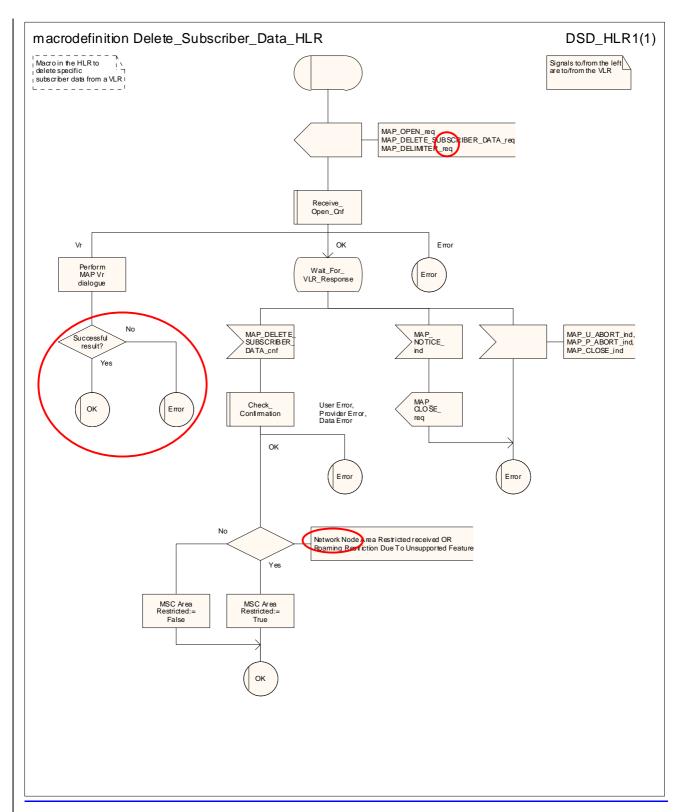
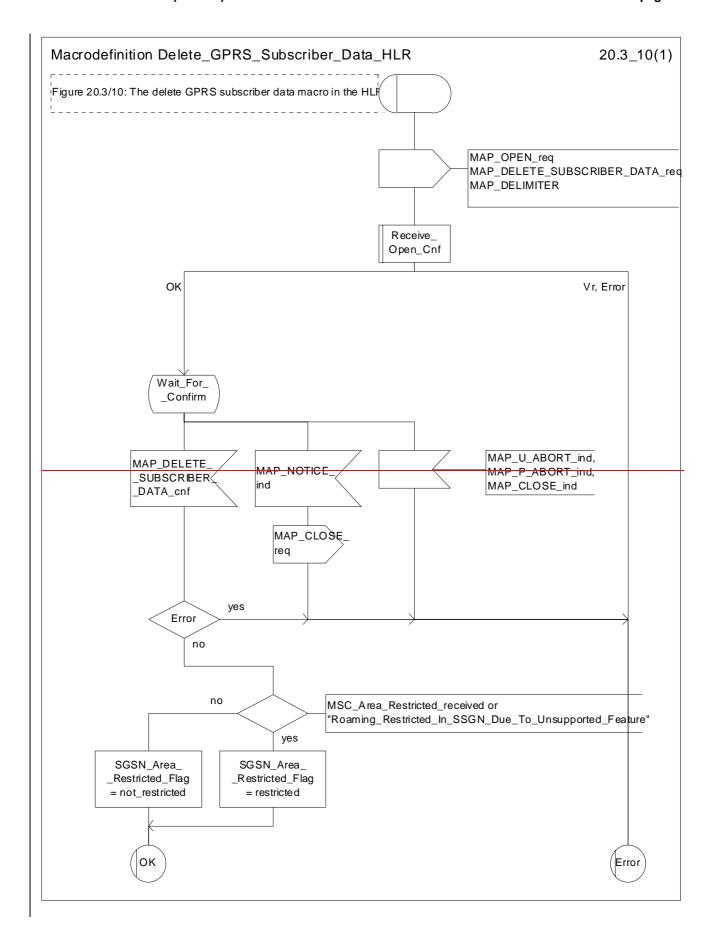


Figure 20.3/75: Macro Delete\_Subscriber\_Data\_HLR



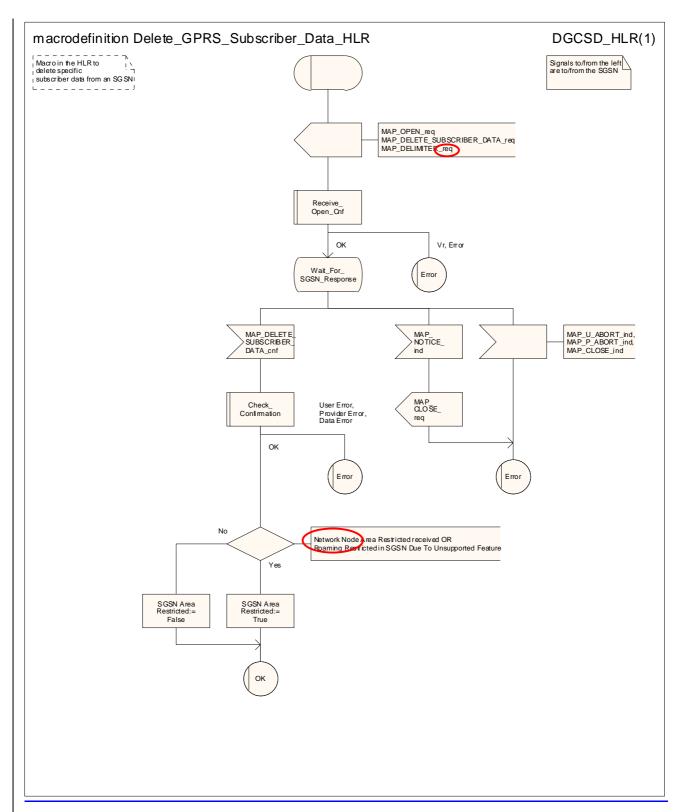
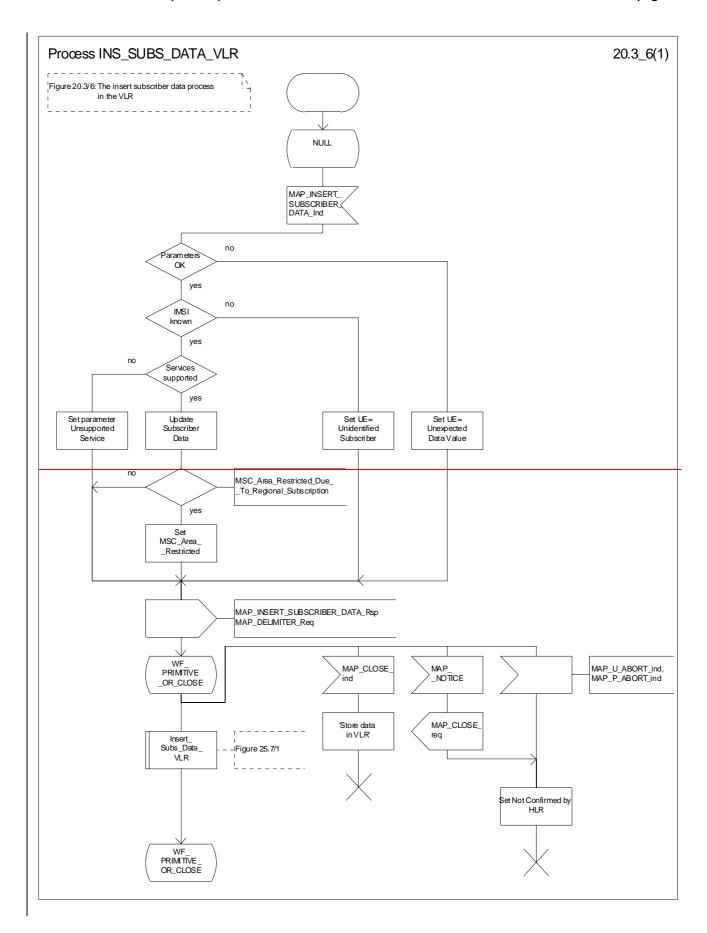


Figure 20.3/810: Macro Delete\_GPRS\_Subscriber\_Data\_HLR



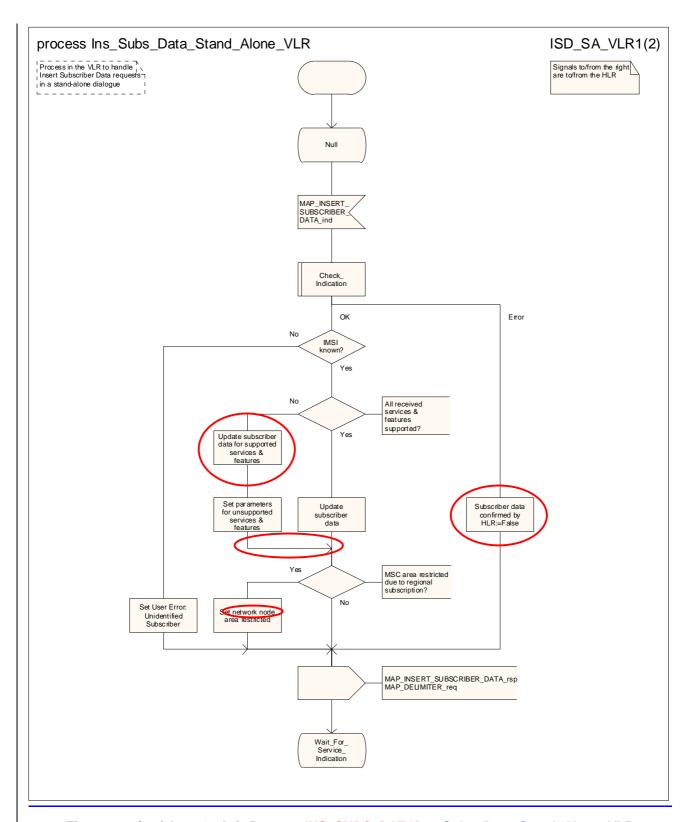


Figure 20.3/96 (sheet 1 of 2): Process INS\_SUBS\_DATAINS Subs Data Stand Alone\_VLR

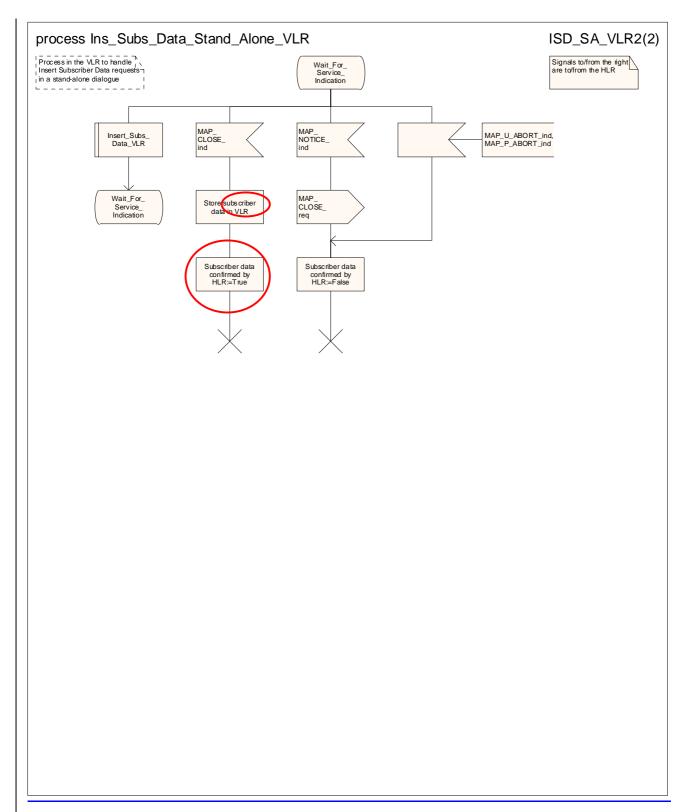
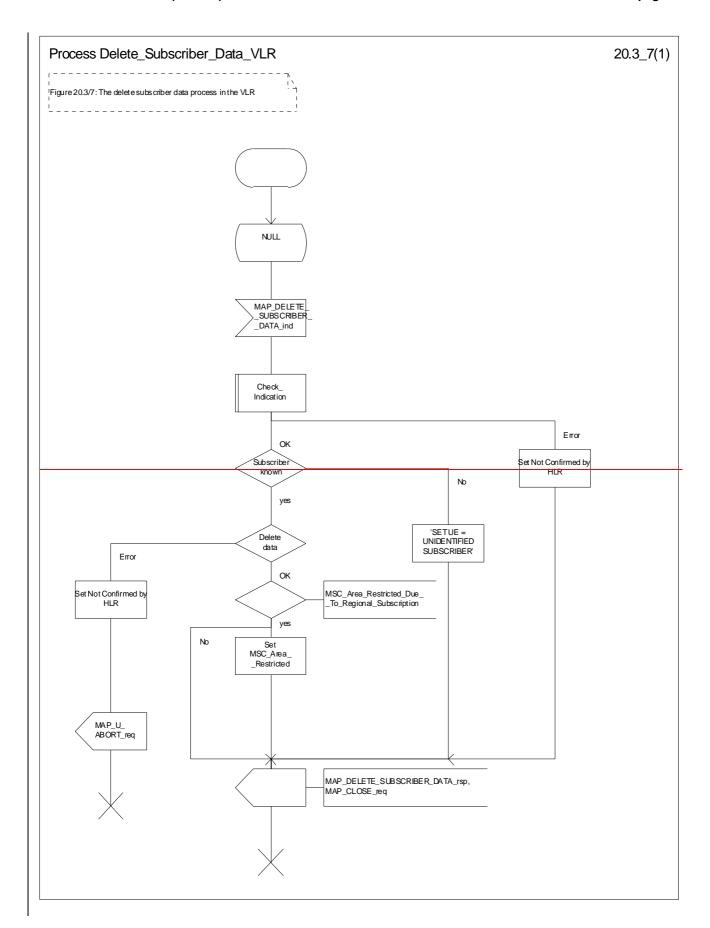


Figure 20.3/9 (sheet 2 of 2): Process Ins Subs Data Stand Alone VLR



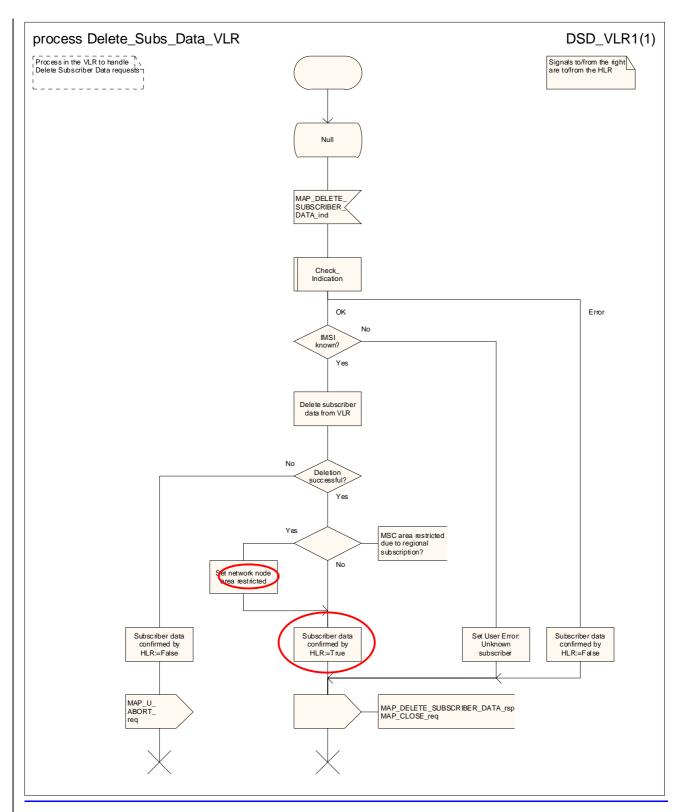
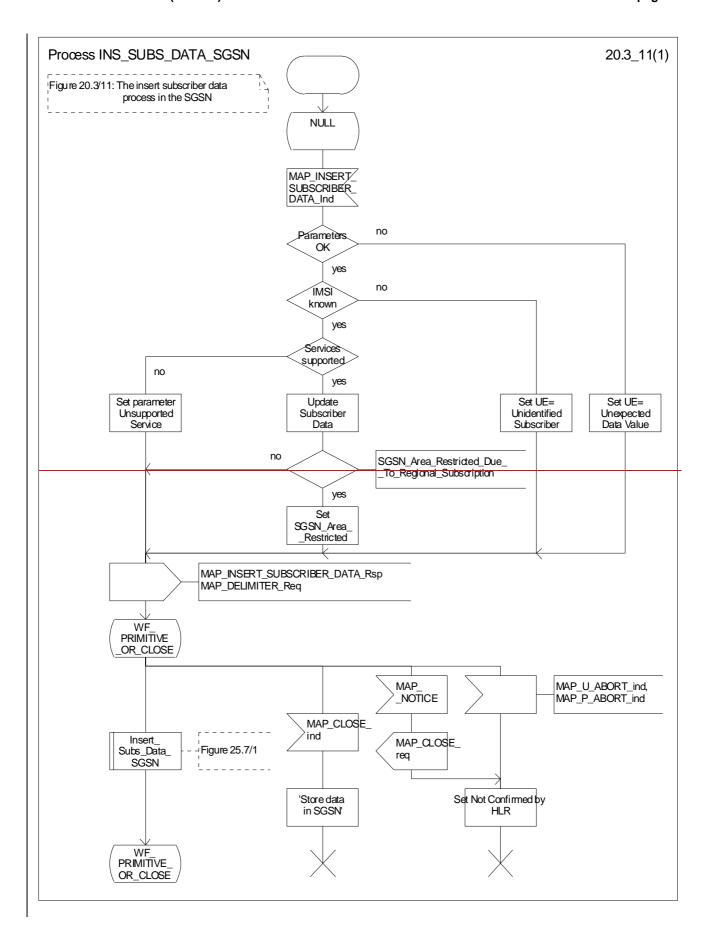


Figure 20.3/107: Process Delete\_Subscriber\_Data\_VLR



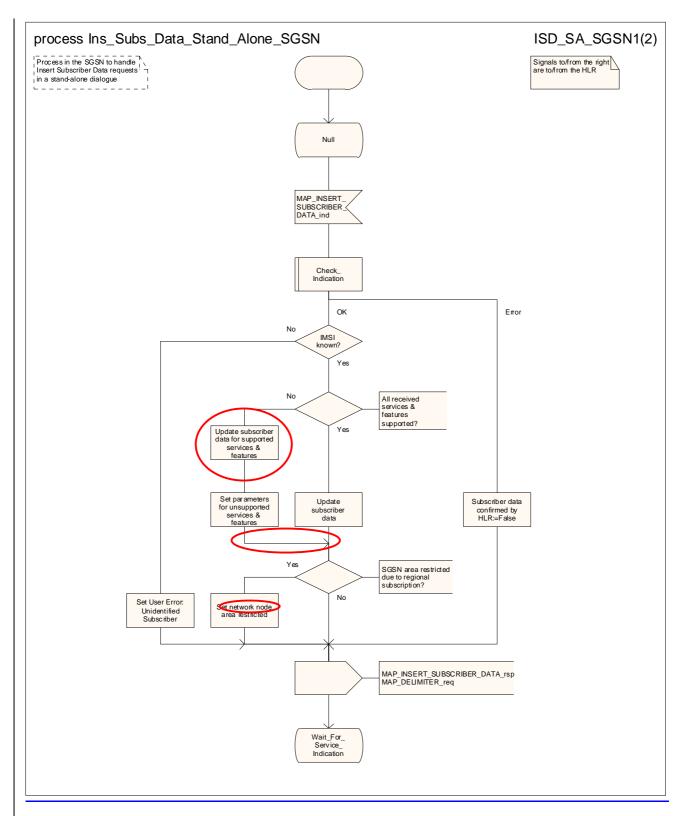


Figure 20.3/11 (sheet 1 of 2): Process INS\_SUBS\_DATA Subs\_Data\_Stand\_Alone\_SGSN

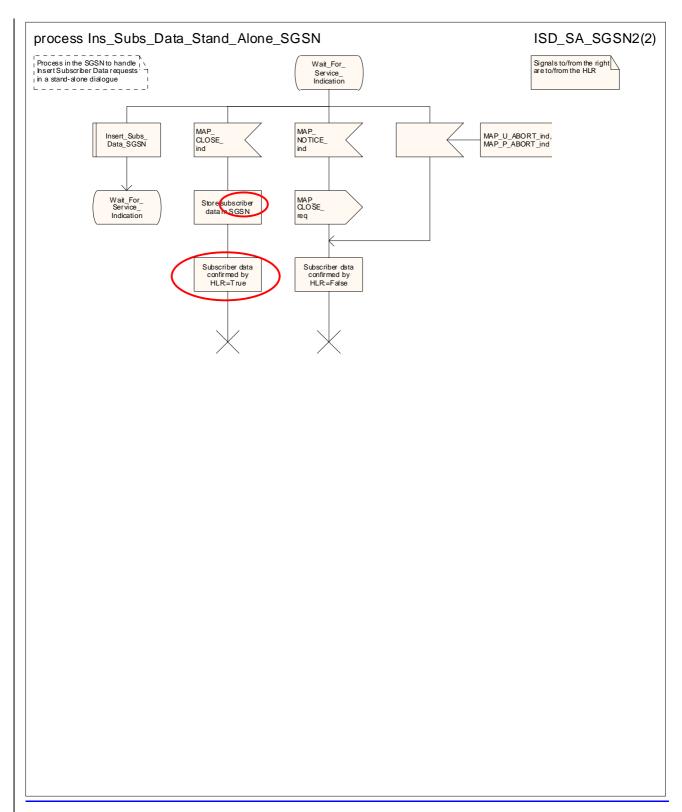
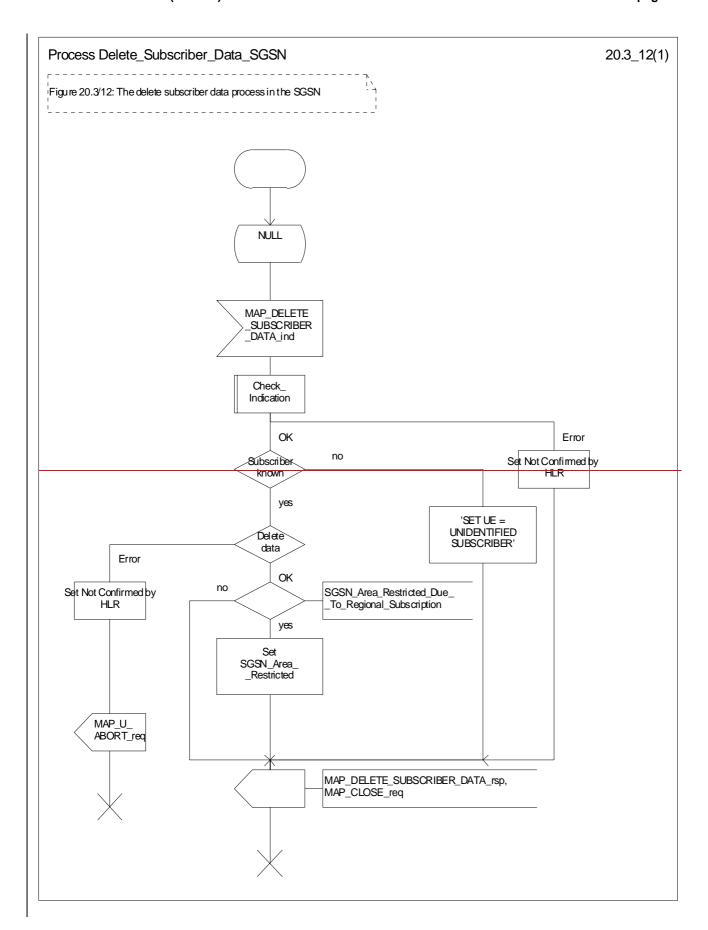


Figure 20.3/11 (sheet 2 of 2): Process Ins Subs Data Stand Alone SGSN



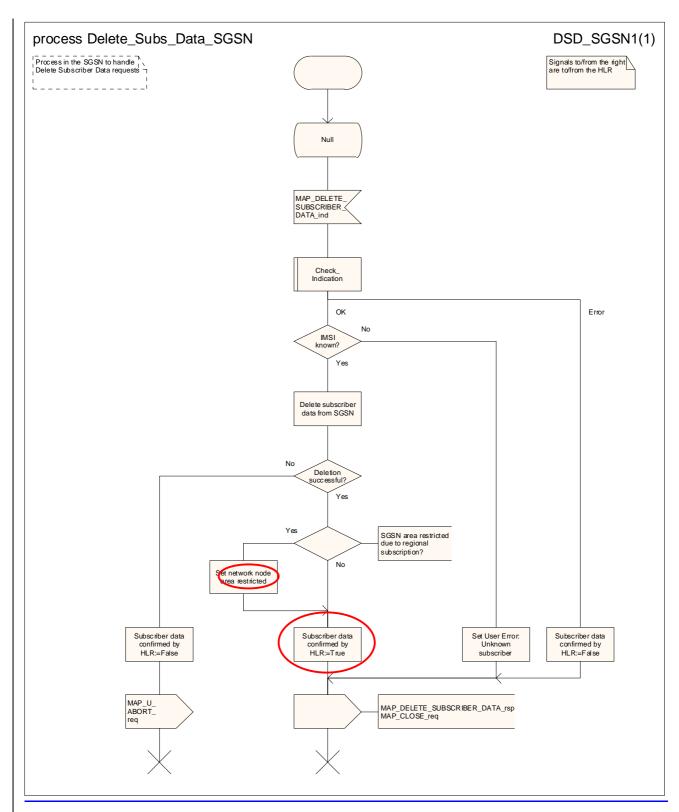
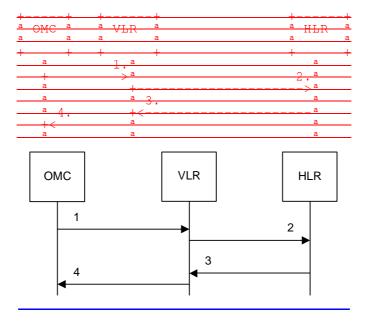


Figure 20.3/12: Process Delete\_Subscriber\_Data\_SGSN

## 20.4 Subscriber Identity procedure

In the subscriber identity procedure the IMSI of the subscriber is retrieved from the HLR. The procedure is shown in figure 20.4/1.



- 1) Identity request-
- 2) MAP\_SEND\_IMSI\_reg/ind-
- 3) MAP\_SEND\_IMSI\_rsp/cnfACK.
- 4) Identity confirm-

Figure 20.4/1: The subscriber identity procedure

### 20.4.12 Subscriber identity pProcedure in the VLR

When the IMSI request is received from the OMC, the VLR will send the MAP\_SEND\_IMSI request to the HLR. The contents of the response are sent to the OMC.

The subscriber identity processedure in the VLR is shown in figure 20.4/23. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive_Open_Cnf	see subclause 25.1.2;		
Check Confirmation	see subclause 25.2.2.		

## 20.4.21 Subscriber identity pProcedure in the HLR

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

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

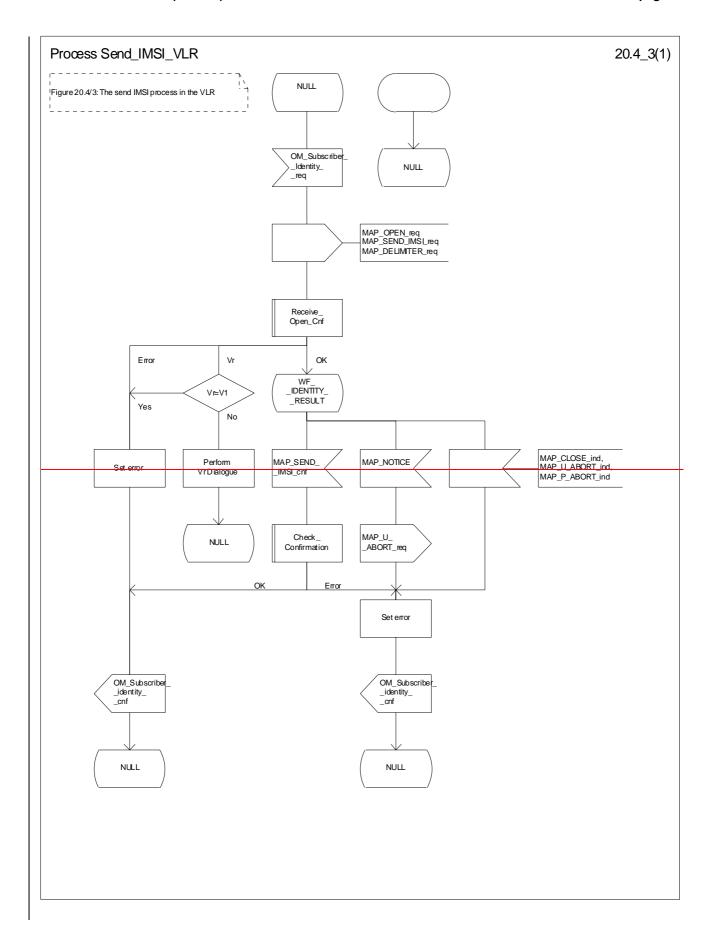
When receiving the MAP\_SEND\_IMSI indication, the HLR will check the parameters and data in the primitive. Data errors are reported as an unexpected data value error or a data missing error depending on the nature of the error.

If the subscriber is known in the HLR, the IMSI is fetched from the database and sent to the VLR. If the MSISDN cannot be identified, unknown subscriber indication is passed to the VLR.

The subscriber identity processedure in the HLR is shown in figure 20.4/32. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

<u>Check Indication</u> see subclause 25.2.1.



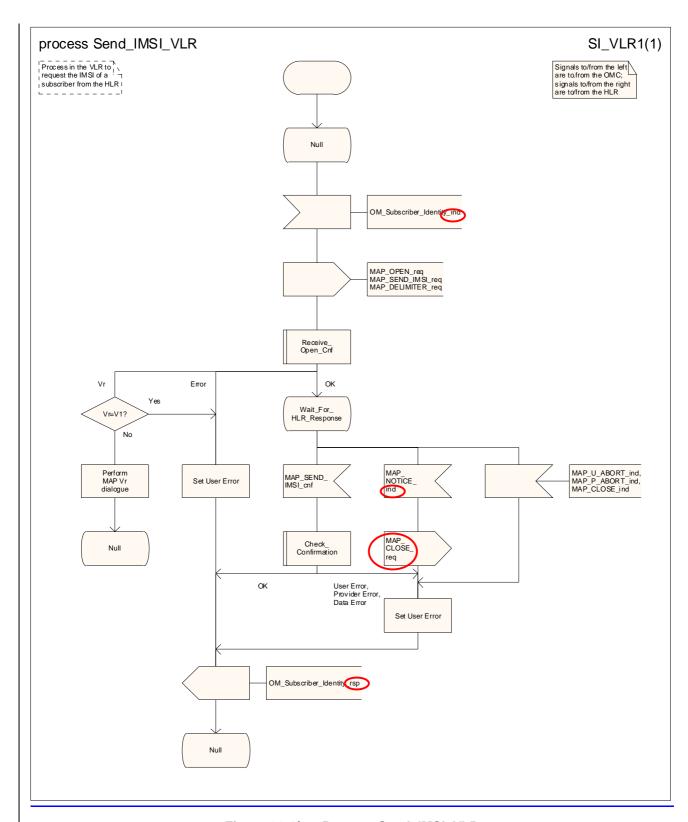
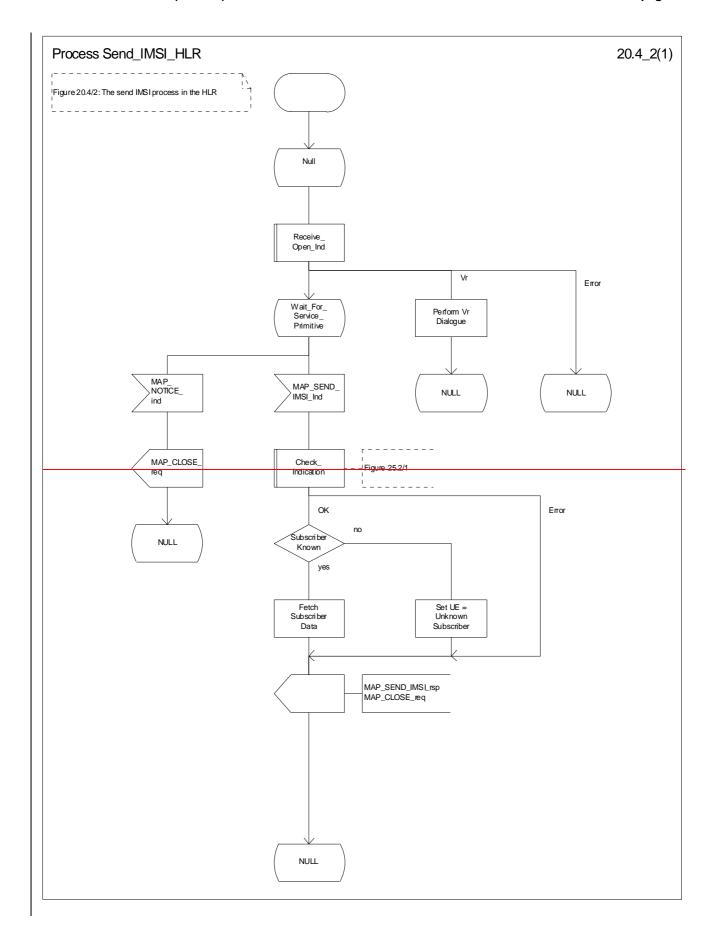


Figure 20.4/23: Process Send\_IMSI\_VLR



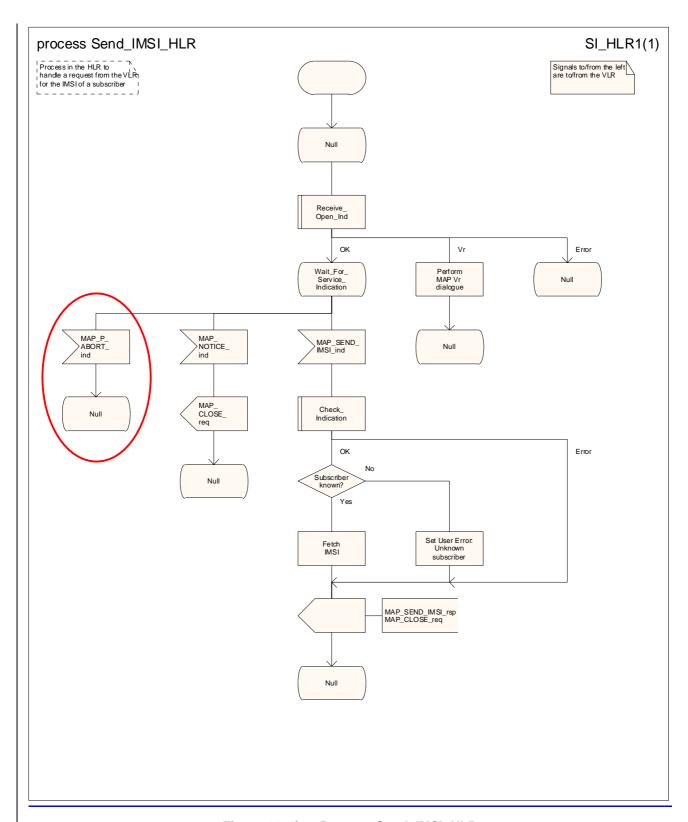


Figure 20.4/32: Process Send\_IMSI\_HLR

### 3GPP TSG CN WG4 Meeting #20 Sophia Antipolis, FRANCE, 25<sup>th</sup> – 29<sup>th</sup> August 2003

CHANGE REQUEST					
*	29.002 CR 640	Current vers	ion: <b>5.6.2</b> **		
For <u>HELP</u> on using this form, see bottom of this page or look at the pop-up text over the <b>%</b> symbols.					
Proposed chang	e <b>affects:</b> UICC apps <b>%</b> ME Radio Acc	cess Networ	ck Core Network X		
Title:	# Provision of SDL diagrams and removal of redundation	ant text in ch	napter 21		
Source:	₩ CN4				
Work item code:	¥ TEI5	Date: %	02/07/2003		
Category:	Use one of the following categories:  F (correction)  A (corresponds to a correction in an earlier release)  B (addition of feature),  C (functional modification of feature)  D (editorial modification)  Detailed explanations of the above categories can be found in 3GPP TR 21.900.	2 <i>R</i> 96	Rel-5 the following releases: (GSM Phase 2) (Release 1996) (Release 1997) (Release 1998) (Release 1999) (Release 4) (Release 5) (Release 6)		

- Reason for change: # 1. There are no source files available for the SDL diagrams in 29.002 chapter 21. Many SDL diagrams are poorly laid out.
  - 2. Some message flow diagrams are drawn using linedraw characters, which do not display correctly in Word 2000.
  - 3. Most of the text repeats the information in the SDL diagrams; the useful additional information is buried in superfluous verbiage. The principle of making the text a **supplement** to the SDL diagrams has been accepted by CN #20, with the approval of CRs to chapters 22 – 25 to remove the redundant
  - 4. There are several lurking references to CCITT recommendations.
  - 5. The procedures for Any Time Interrogation are not related to the retrieval of routeing information.
  - 6. The processes for retrieval of routeing information in the HLR and provision of a roaming number in the VLR do not close the MAP dialogue before the process returns to the idle state in the successful case.
  - 7. The handling in the process ASCI Anchor MSC for a provider error in the MAP PREPARE GROUP CALL confirmation does not reflect the fact that the dialogue between the anchor MSC and the relay MSC has already been
  - 8. The procedures for the use of a shared data interworking function in subclause 21.5) refer to a stage 2 specification which was withdrawn after GSM Release 98. CN #13 decided that this functionality should not be part of UMTS.
  - 9. The handling in the process Request\_Subscriber\_Info\_GMLC (which runs in the gsmSCF, not the GMLC) when a provider error is received in the MAP\_ANY\_TIME\_INTERROGATION confirmation shows an unnecessary MAP P ABORT request; when the macro Check Confirmation takes the Provider Error exit, the dialogue has already been closed.
  - 10. The handling in the process ATI\_GMLC shows that a User Error input from the

application process causes a MAP\_U\_ABORT to the gsmSCF, but there is no corresponding User Error output in the stage 2 process in 23.078.

### This is a non-critical correction, proposed for agreement by consensus

- Summary of change: \$ 1. Redraw SDL diagrams to a consistent style. Redraw message flow diagrams. Remove text which replicates the information in SDL diagrams.
  - 2. Replace references to "CCITT" with "ITU-T".
  - 3. Add MAP\_CLOSE\_req outputs where required in the processes SRI\_HLR and PRN\_VLR.
  - 4. Show the appropriate handling for the Provider Error case in ASCI Anchor MSC
  - 5. Move the procedures for Any Time Interrogation to clause 24A.
  - 6. Make subclause 21.5 void

### Consequences if not approved:

- # 1. No SDL source files to use as the basis for future changes. Message flow diagrams are difficult to read. Useful information to supplement the SDL diagrams is buried in superfluous verbiage.
  - 2. The style of chapter 21 will be markedly different from the style of chapters 22 - 25, making the specification more difficult to use for implementers who are not aware of the history, and leading to a perception of poor quality.

Clauses affected:	<b>21</b> ; 24A; 24A.1; 24A.5 (new)	
Other specs affected:	Y N  X Other core specifications Test specifications O&M Specifications	
Other comments:	<ul> <li>The text for each first level subclause has been grouped together before the SDL diagrams for that subclause.</li> <li>The procedures for CCBS status monitoring and reporting have been grouped together in a single first level subclause. The procedures for Immediate Service Termination alerting and command have been grouped together in a single first level subclause.</li> <li>These editorial changes have not been revision marked, except for the changes in subclause heading numbers and figure numbers.</li> </ul>	

### \*\*\* First modified section \*\*\*

# 21 Call handling procedures

### 21.1 General

The MAP call handling procedures are used:

- to retrieve routeing information to handle a mobile terminating call;
- to transfer control of a call back to the GMSC if the call is to be forwarded;
- to retrieve and transfer information between anchor MSC and relay MSC for inter MSC group calls / broadcast calls;
- to allocate resources in an SIWFS;
- to handle the reporting of MS status for call completion services;
- to handle the notification of remote user free for CCBS:
- to handle the alerting and termination of ongoing call activities for a specific subscriber.

The procedures to handle a mobile originating call and a mobile terminating call after the call has arrived at the destination MSC do not require any signalling over a MAP interface. These procedures are specified in 3GPP TS 23.018 [97].

The stage 2 specification for the retrieval of routeing information to handle a mobile terminating call is in 3GPP TS 23.018 [97]; modifications to this procedure for CAMEL are specified in 3GPP TS 23.078 [98], for optimal routeing of a basic mobile-to-mobile call in 3GPP TS 23.079 [99] and for CCBS in 3GPP TS 23.093 [107]. The interworking between the MAP signalling procedures and the call handling procedures for each entity (GMSC, HLR and VLR) is shown by the transfer of signals between these procedures.

The stage 2 specification for the transfer of control of a call back to the GMSC if the call is to be forwarded is in 3GPP TS 23.079 [99]. The interworking between the MAP signalling procedures and the call handling procedures for each entity (VMSC and GMSC) is shown by the transfer of signals between these procedures.

The stage 2 specifications for inter MSC group calls / broadcast calls are in 3GPP TS 43.068 [100] and 3GPP TS 43.069 [101]. The interworking between the MAP signalling procedures and the group call /broadcast call procedures for each entity (Anchor MSC and Relay MSC) is shown by the transfer of signals between these procedures.

The stage 2 specification for the allocation of resources in an SIWFS is in GSM 03.54. The interworking between the MAP signalling procedures and the call handling procedures for each entity (VMSC and SIWFS) is shown by the transfer of signals between these procedures.

The interworking between the call handling procedures and signalling protocols other than MAP are shown in 3GPP TS 23.018, 3GPP TS 23.078 and 3GPP TS 23.079 [99].

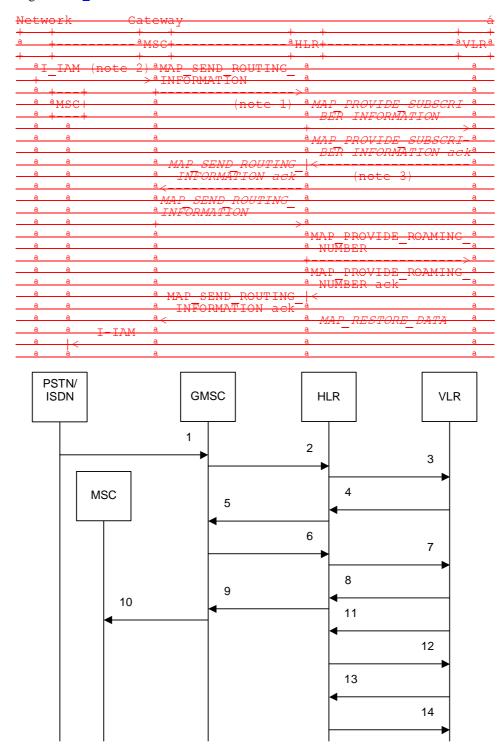
The stage 2 specification for the handling of reporting of MS status for call completion services and notification of remote user free for CCBS is in 3GPP TS 23.093 [107].

## 21.2 Retrieval of routing information

#### 21.2.1 General

The message flows for successful retrieval of routeing information for a mobile terminating call are shown in figure 21.2/1 (mobile terminating call which has not been optimally routed) and 21.2/2 (mobile-to-mobile call which

has been optimally routed). The message flow for successful-retrieval of routeing information for a gsmSCF initiated call is shown in figure 21.2/3\*.



- I\_IAM (Note 1)
- MAP\_SEND\_ROUTING\_INFORMATION\_req/ind (Note 2)
- MAP\_PROVIDE\_SUBSCRIBER\_INFO\_req/ind (Note 3, Note 4)
  MAP\_PROVIDE\_SUBSCRIBER\_INFO\_rsp/cnf (Note 4) 3)
- 4)
- MAP SEND ROUTING INFORMATION rsp/cnf (Note 4) <u>5)</u>
- 6) MAP\_SEND\_ROUTING\_INFORMATION\_reg/ind (Note 4)
- MAP PROVIDE ROAMING NUMBER reg/ind 7)
- 8) MAP\_PROVIDE\_ROAMING\_NUMBER\_rsp/cnf
- MAP SEND ROUTING INFORMATION rsp/cnf
- 10) I\_IAM (Note 1)

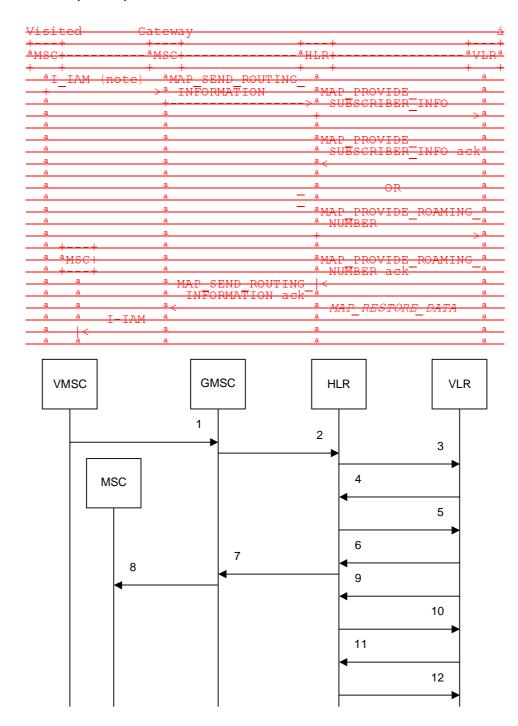
- 11) MAP RESTORE DATA reg/ind (Note 4)
- 12) MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind (Note 4)
- 13) MAP INSERT SUBSCRIBER DATA rsp/cnf (Note 4)
- 12) MAP RESTORE DATA rsp/cnf (Note 4)

xxx = Optional Procedure

NOTE 1: This service may also be used by an ISDN exchange for obtaining routing information from the HLR.

- NOTE 12: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following ITU-T Recommendations and ETSI specification:
  - Q.721-725 Telephone User Part (TUP);
  - ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.
- NOTE 2: This service may also be used by an ISDN exchange for obtaining routing information from the HLR.
- NOTE 3: As a network operator option, the HLR sends MAP\_PROVIDE\_SUBSCRIBER\_INFORMATION to the VLR. For further details on the CAMEL procedures refer to 3GPP TS 23.078 [98].
- NOTE 4: Services printed in italics are optional.

Figure 21.2/1: Message flow for retrieval of routeing information (non-optimally routed call)

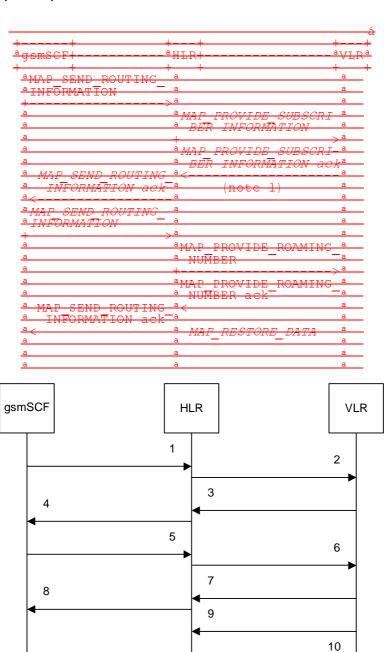


- I\_IAM (Note 1)
- MAP SEND ROUTING INFORMATION reg/ind
- 3)
- 4)
- MAP\_PROVIDE\_SUBSCRIBER\_INFO\_req/ind (Note 2)
  MAP\_PROVIDE\_SUBSCRIBER\_INFO\_rsp/cnf (Note 2)
  MAP\_PROVIDE\_ROAMING\_NUMBER\_req/ind (Note 2) 5)
- MAP PROVIDE ROAMING NUMBER rsp/cnf (Note 2) <u>6)</u>
- MAP SEND ROUTING INFORMATION rsp/cnf 7)
- 8) I\_IAM (Note 1)
- 9) MAP\_RESTORE\_DATA\_req/ind (Note 3)
- MAP INSERT SUBSCRIBER DATA reg/ind (Note 3) 10)
- MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf (Note 3) 11)
- MAP RESTORE DATA rsp/cnf (Note 3) 12)

xxx = Optional Procedure

- NOTE 1: For Optimal Routeing phase 1, only one of the information flows for Provide Subscriber Info and Provide Roaming Number is used. For later phases of Optimal Routeing, the HLR may return a MAP\_SEND\_ROUTEING\_INFORMATION ack after the Provide Subscriber Info information flow, and the GMSC may send a second MAP\_SEND\_ROUTEING\_INFORMATION, which will trigger the Provide Roaming Number information flow.
- NOTE 12: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following CCITU-T Recommendations & ETSI specification:
  - Q.721-725 Telephone User Part (TUP);
  - ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.
- NOTE 2: For Optimal Routeing phase 1, only one of the information flows for Provide Subscriber Info and Provide Roaming Number is used.
- NOTE 3: Services printed in italics are optional.

Figure 21.2/2: Message flow for retrieval of routeing information (optimally routed call)



- MAP\_SEND\_ROUTING\_INFORMATION\_req/ind MAP PROVIDE SUBSCRIBER INFO reg/ind (Note 1, Note 2) 2) 3) MAP\_PROVIDE\_SUBSCRIBER\_INFO\_rsp/cnf (Note 2) 4) MAP SEND ROUTING INFORMATION rsp/cnf (Note 2) 5) MAP\_SEND\_ROUTING\_INFORMATION\_reg/ind (Note 2) MAP PROVIDE ROAMING NUMBER req/ind MAP PROVIDE ROAMING NUMBER rsp/cnf 6) 7) MAP SEND ROUTING INFORMATION rsp/cnf 8)
- MAP\_RESTORE\_DATA\_req/ind (Note 2) 9)
- MAP\_INSERT\_SUBSCRIBER\_DATA\_reg/ind (Note 2) 10)
- MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf (Note 2) 11)
- MAP RESTORE DATA rsp/cnf (Note 2) 12)

xxx = Optional Procedure

12

NOTE 1: As a network operator option, the HLR sends\_MAP\_PROVIDE\_SUBSCRIBER\_INFORMATION to the VLR. For further details on the CAMEL procedures refer to 3GPP TS 23.078 [98].

NOTE 2: Services printed in italics are optional.

#### Figure 21.2/3x: Message flow for retrieval of routeing information for a gsmSCF initiated call

The following MAP services are used to retrieve routing information:

MAP\_SEND\_ROUTING\_INFORMATION see <u>sub</u>clause 10.1;

MAP\_PROVIDE\_ROAMING\_NUMBER see <u>sub</u>clause 10.2;

MAP\_PROVIDE\_SUBSCRIBER\_INFO see <u>sub</u>clause 8.11.2;

MAP\_RESTORE\_DATA see <u>sub</u>clause 8.10.3.

### 21.2.2 Proceduress in the GMSC

The MAP process in the GMSC to retrieve routeing information for a mobile terminating call is shown in figure 21.2/63. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

Sheet 1: if the MAP\_SEND\_ROUTING\_INFORMATION request included the OR Interrogation parameter, the test "OR interrogation?" takes the "Yes" exit; otherwise the test takes the "No" exit.

#### **Successful Outcome**

When the MAP process receives a Send Routeing Info request from the call handling process in the GMSC, it requests a dialogue with the HLR whose identity is contained in the Send Routeing Info request by sending a MAP\_OPEN service request, requests routeing information using a MAP\_SEND\_ROUTING\_INFORMATION service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

If the MAP process receives a MAP\_SEND\_ROUTING\_INFORMATION service confirm from the HLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm. If the MAP\_SEND\_ROUTING\_INFORMATION confirm from the HLR cannot be carried in a single TC Result component, it is carried in one or more TC Result NL components (each sent in a TC CONTINUE), followed by a TC Result L component in a TC-END message.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a Send Routeing Info ack containing the routeing information received from the HLR to the call handling process in the GMSC and returns to the idle state.

#### Earlier version MAP dialogue with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit, the MAP process checks whether this is an OR interrogation (indicated by the inclusion of the OR interrogation parameter in the MAP\_SEND\_ROUTING\_INFORMATION service request).

If this is not an OR interrogation, the GMSC performs the earlier version MAP dialogue as specified in [51] and the process returns to the idle state.

If this is an OR interrogation, the MAP process sends a Send Routeing Info negative response indicating OR not allowed to the call handling process in the GMSC and returns to the idle state.

#### Dialogue opening failure

If the macro Receive\_Open\_Cnf indicates that the dialogue with the HLR could not be opened, the MAP process sends an Abort to the call handling process in the GMSC and returns to the idle state.

#### **Error in MAP SEND ROUTING INFORMATION confirm**

If the MAP\_SEND\_ROUTING\_INFORMATION service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Send Routeing Info negative response to the call handling process in the GMSC and returns to the idle state.

#### **Call release**

If the call handling process in the GMSC indicates that the call has been aborted (i.e. prematurely released by the calling subscriber), the MAP process returns to the idle state. Any response from the HLR will be discarded.

#### **Abort of HLR dialogue**

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the HLR may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends a Send Routeing Info negative response to the call handling process in the GMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the HLR, sends a Send Routeing Info negative response indicating system failure to the call handling process in the GMSC and returns to the idle state.

### 21.2.39 Proceduress in the gsmSCF

For the purposes of retrieving routing information from the HLR, the gsmSCF takes the role of the GMSC -and follows the process specified in subclause 21.2.2.

### 21.2.43 Procedures in the HLR

The MAP process in the HLR to retrieve routeing information for a mobile terminating call is shown in figure 21.2/74. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1;
Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2;
Check\_Confirmation see <u>sub</u>clause 25.2.2.

Sheet 3: if the MAP\_PROVIDE\_ROAMING\_NUMBER request included the OR Interrogation parameter, the test "OR interrogation?" takes the "Yes" exit; otherwise the test takes the "No" exit.

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context locInfoRetrieval, it checks it by invoking the macro Receive Open Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_SEND\_ROUTING\_INFORMATION service indication is received, the MAP process sends a Send Routeing Info request to the call handling process in the HLR, and waits for a response. The Send Routeing Info request contains the parameters received in the MAP\_SEND\_ROUTING\_INFORMATION service indication.

If the call handling process in the HLR returns a Send Routeing Info ack, the MAP process constructs a MAP\_SEND\_ROUTING\_INFORMATION service response containing the routeing information contained in the Send Routeing Info ack, constructs a MAP\_CLOSE service request, sends them to the GMSC and returns to the idle state. If the MAP\_SEND\_ROUTING\_INFORMATION response cannot be carried in a single TC-Result component, it is carried in one or more TC Result NL components (each sent in a TC CONTINUE), followed by a TC Result L component in a TC END message.

If the call handling process in the HLR returns a Provide Subscriber Info request, the MAP process requests a dialogue with the VLR whose identity is contained in the Provide Subscriber Info request by sending a MAP\_OPEN service request, requests the subscriber status using a MAP\_PROVIDE\_SUBSCRIBER\_INFO service request, and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request.

If the macro takes the OK exit, the MAP process waits for the response from the VLR.

If the MAP process receives a MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm, it invokes the macro Check\_Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Provide Subscriber Info ack containing the information received in the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm contains a provider error or a data error, the MAP process sends a Provide Subscriber Info negative response indicating the type of error to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

NOTE: The 'User Error' exit from the macro Check\_Confirmation is shown for formal completeness; the MAP\_PROVIDE\_SUBSCRIBER\_INFO\_enf primitive cannot contain a user error.

If the call handling process in the HLR returns a Provide Roaming Number request, the MAP process requests a dialogue with the VLR whose identity is contained in the Provide Roaming Number request by sending a MAP\_OPEN service request, requests a roaming number using a MAP\_PROVIDE\_ROAMING\_NUMBER service request, and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request.

If the macro takes the OK exit, the MAP process waits for the response from the VLR.

If the MAP process receives a MAP\_PROVIDE\_ROAMING\_NUMBER service confirm, it invokes the macro Check\_Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Provide Roaming Number ack containing the MSRN received in the MAP\_PROVIDE\_ROAMING\_NUMBER service confirm to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP\_PROVIDE\_ROAMING\_NUMBER service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Provide Roaming Number negative response indicating the type of error to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

#### Negative response from HLR call handling process

If the call handling process in the HLR returns a negative response, either before or after a dialogue with the VLR to obtain a roaming number, the MAP process constructs a MAP\_SEND\_ROUTING\_INFORMATION service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the GMSC and returns to the idle state.

#### Earlier version MAP Provide Roaming Number dialogue with the VLR

If the macro Receive\_Open\_Cnf takes the Vr exit after the MAP process has requested opening of a Provide Roaming Number dialogue with the VLR, the MAP process checks whether this is an OR interrogation (indicated by the inclusion of the OR interrogation parameter in the MAP\_PROVIDE\_ROAMING\_NUMBER service request).

If this is not an OR interrogation, the HLR performs the earlier version MAP dialogue as specified in [51], relays the result of the dialogue to the HLR call handling process, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If this is an OR interrogation, the MAP process sends a Provide Roaming Number negative response indicating OR not allowed to the call handling process in the HLR and waits for a response. The handling of the response from the call handling process in the HLR is described above.

#### Failure of Provide Subscriber Info dialogue with the VLR

If the Receive\_Open\_Cnf macro takes the Vr exit or the Error exit after the MAP process has requested opening of a Provide Subscriber Info dialogue with the VLR, the MAP process sends a Provide Subscriber Info negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

#### Failure of Provide Roaming Number dialogue with the VLR

If the Receive\_Open\_Cnf macro takes the Error exit after the MAP process has requested opening of a Provide Roaming Number dialogue with the VLR, the MAP process sends a Provide Roaming Number negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP process receives a MAP\_U\_ABORT, a MAP\_P\_ABORT or a premature MAP\_CLOSE from the MAP provider, it sends a Provide Roaming Number negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP process receives a MAP\_NOTICE from the MAP provider, it returns a MAP\_CLOSE request to the MAP provider, sends a Provide Roaming Number negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

#### Earlier version MAP dialogue with the GMSC

If the macro Receive\_Open\_Ind takes the Vr exit, the HLR performs the earlier version MAP dialogue as specified in [51] and the process returns to the idle state.

#### Failure of dialogue opening with the GMSC

If the macro Receive Open Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

### 21.2.54 Proceduress in the VLR to provide a roaming number

The MAP process in the VLR to provide a roaming number for a mobile terminating call is shown in figure 21.2/85. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context roamingNbEnquiry, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PROVIDE\_ROAMING\_NUMBER service indication is received, the MAP process sends a Provide Roaming Number request to the call handling process in the VLR, and waits for a response. The Provide Roaming Number request contains the parameters received in the MAP\_PROVIDE\_ROAMING\_NUMBER service indication.

If the call handling process in the VLR returns a Provide Roaming Number ack, the MAP process constructs a MAP\_PROVIDE\_ROAMING\_NUMBER service response containing the roaming number contained in the Send Routeing Info ack, constructs a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

#### Earlier version MAP dialogue with the HLR

If the macro Receive\_Open\_Ind takes the Vr exit, the VLR performs the earlier version MAP dialogue as specified in [51] and the process returns to the idle state.

#### Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

#### Negative response from VLR call handling process

If the call handling process in the HLR returns a negative response, the MAP process constructs a MAP\_PROVIDE\_ROAMING\_NUMBER service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

### 21.2.65 Proceduress in the VLR to restore subscriber data

The MAP process in the HLR to restore subscriber data is shown in figure 21.2/96. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2;
Check\_Confirmation see <u>sub</u>clause 25.2.2;
Insert\_Subs\_Data\_VLR see <u>sub</u>clause 25.7.1;
Activate\_Tracing\_VLR see <u>sub</u>clause 25.9.4.

#### Successful outcome

When the MAP process receives a Restore Data request from the data restoration process in the VLR, it requests a dialogue with the HLR whose identity is contained in the Restore Data request by sending a MAP\_OPEN service request, requests data restoration using a MAP\_RESTORE\_DATA service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

The VLR may receive a MAP\_INSERT\_SUBSCRIBER\_DATA service indication from the HLR; this is handled by the macro Insert\_Subs\_Data\_VLR as described in clause 25.7.1, and the MAP process waits for a further response from the HLR.

The VLR may receive a MAP\_ACTIVATE\_TRACE\_MODE service indication from the HLR; this is handled by the macro Activate\_Tracing\_VLR as described in clause 25.9.4, and the MAP process waits for a further response from the HLR.

If the MAP process receives a MAP\_RESTORE\_DATA service confirm, it invokes the macro Check\_Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Restore Data ack containing the information received from the HLR to the data restoration process in the VLR and returns to the idle state.

#### Error in MAP\_RESTORE\_DATA confirm

If the MAP\_RESTORE\_DATA service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Restore Data negative response indicating the type of error to the call handling process in the HLR, and returns to the idle state.

#### Earlier version MAP dialogue with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit, the VLR performs the earlier MAP version dialogue as specified in [51] and the process terminates.

#### Dialogue opening failure

If the macro Receive\_Open\_Cnf indicates that the dialogue with the HLR could not be opened, the MAP process sends a negative response indicating system failure to the data restoration process in the GMSC and returns to the idle state.

### 21.2.76 Proceduress in the VLR to provide subscriber information

The MAP process in the VLR to provide subscriber information for a mobile terminating call subject to CAMEL invocation is shown in figure 21.2/96. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1;

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context subscriberInfoEnquiry, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PROVIDE\_SUBSCRIBER\_INFO service indication is received, the MAP process sends a Provide Subscriber Info request to the subscriber information request process in the VLR, and waits for a response. The Provide Subscriber Info request contains the parameters received in the MAP\_PROVIDE\_SUBSCRIBER\_INFO service indication.

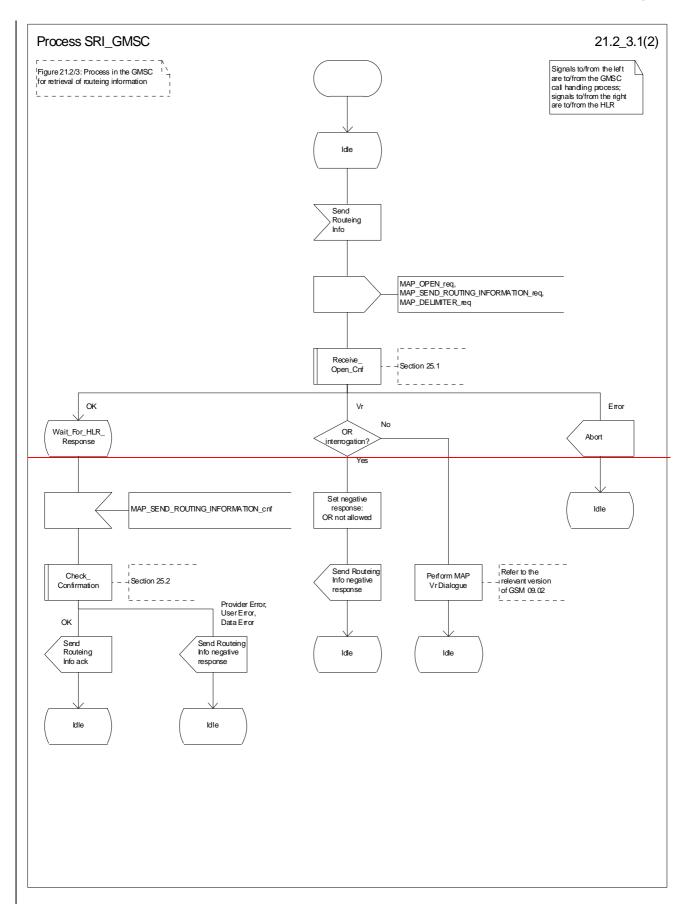
If the subscriber information request process in the VLR returns a Provide Subscriber Info ack, the MAP process constructs a MAP\_PROVIDE\_SUBSCRIBER\_INFO service response containing the information contained in the Provide Subscriber Info ack, constructs a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

#### Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.



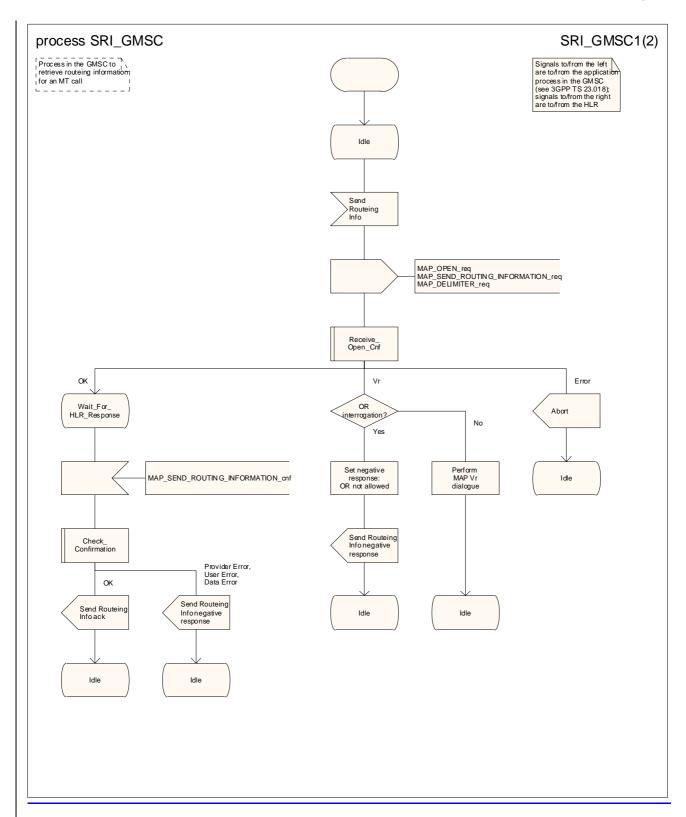
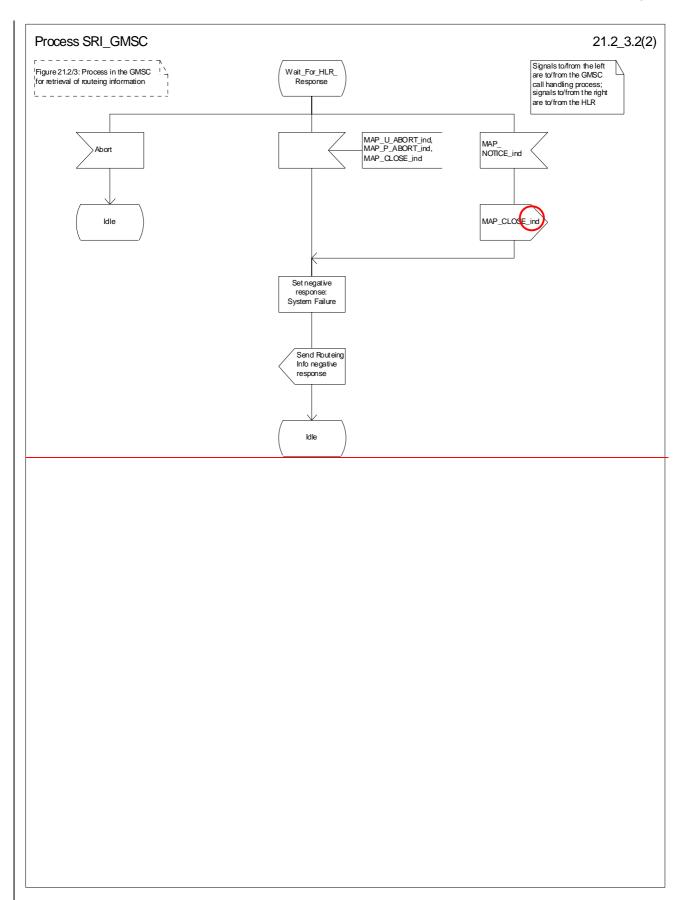


Figure 21.2/63 (sheet 1 of 2): Process SRI\_GMSC



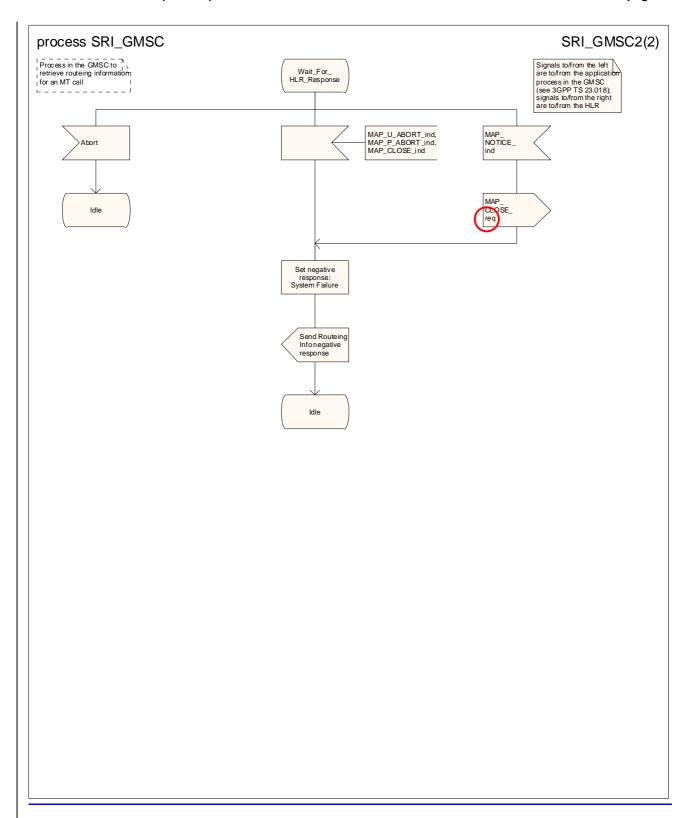
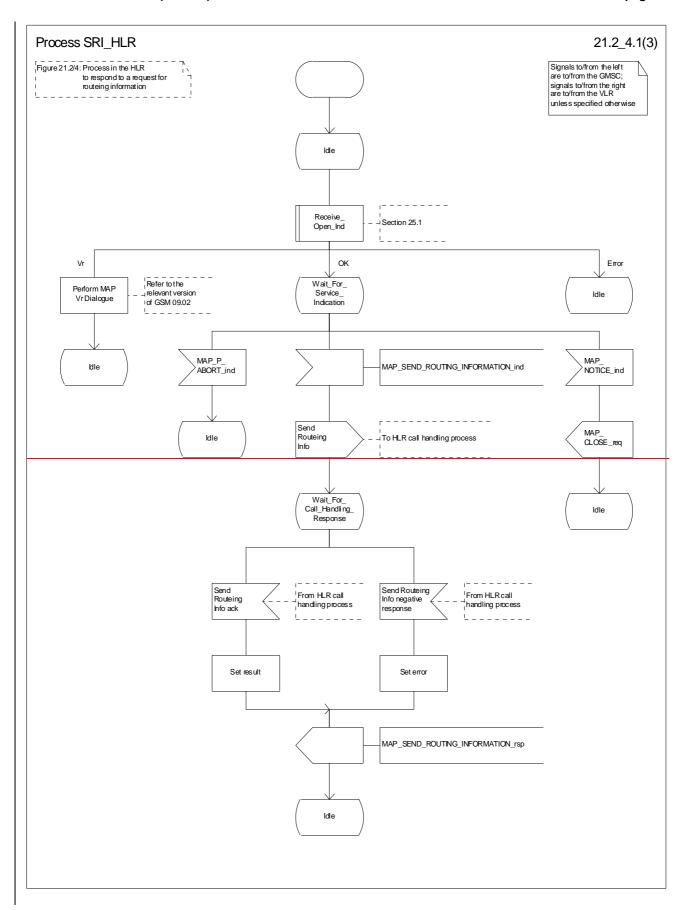


Figure 21.2/63 (sheet 2 of 2): Process SRI\_GMSC



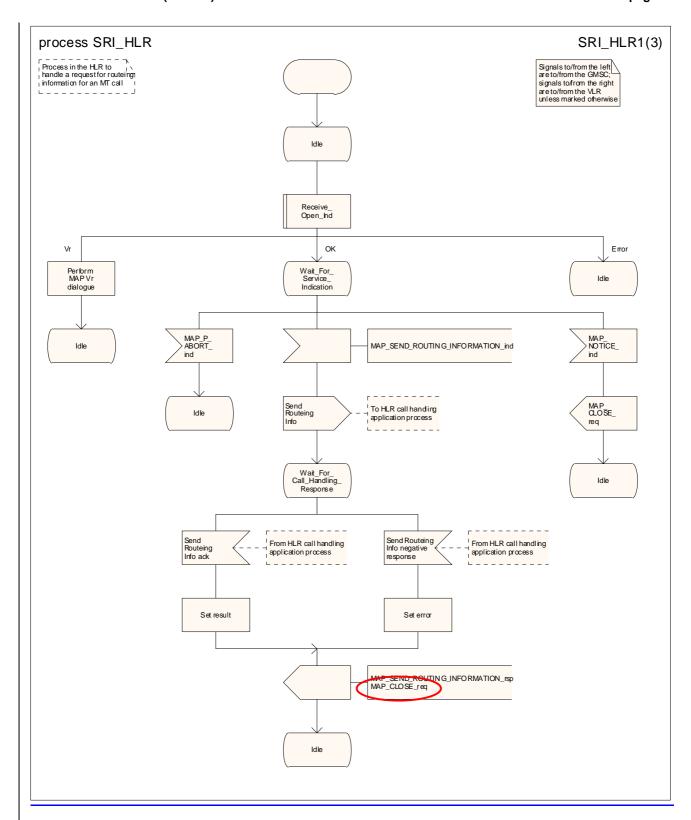
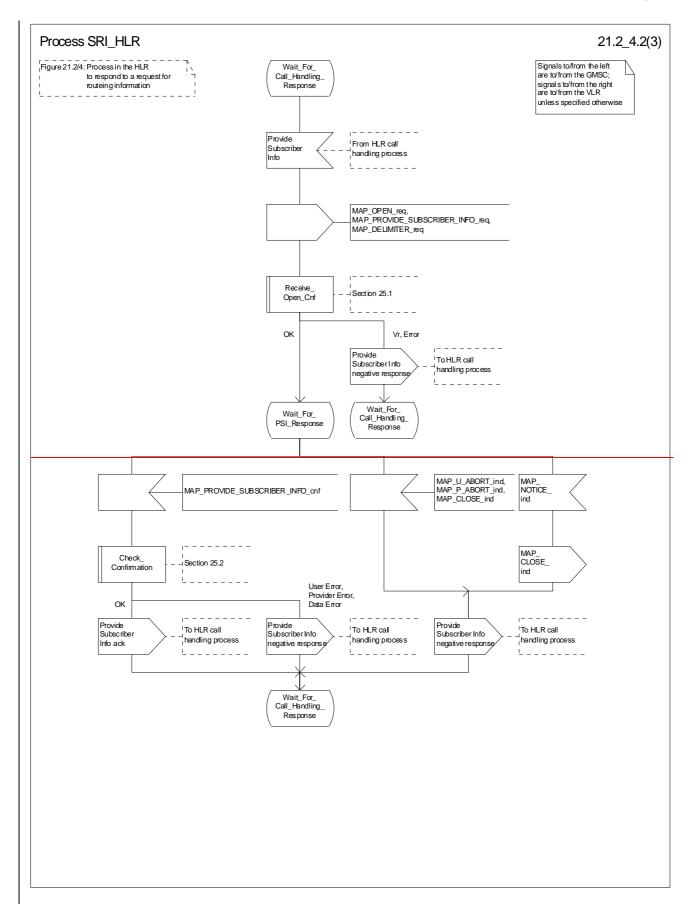


Figure 21.2/74 (sheet 1 of 3): Process SRI\_HLR



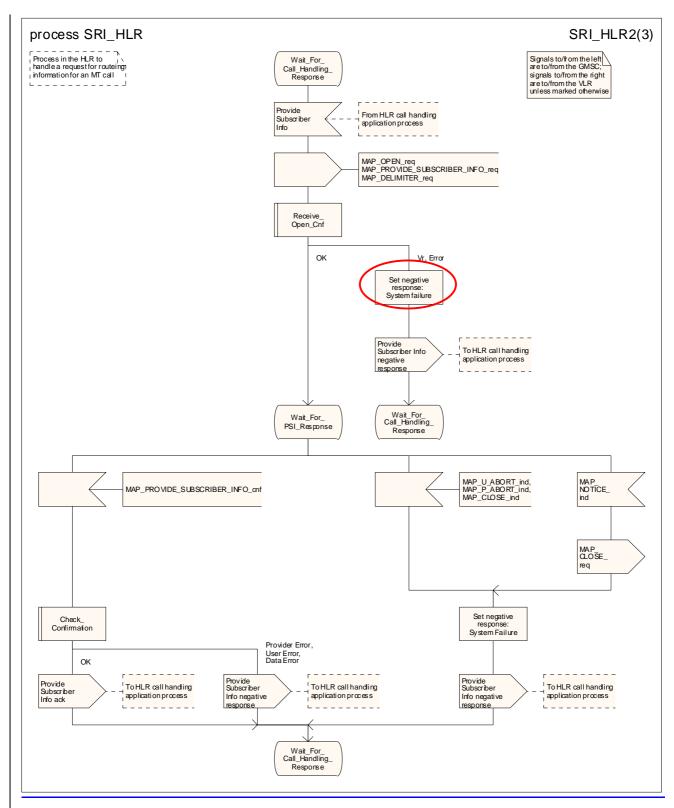
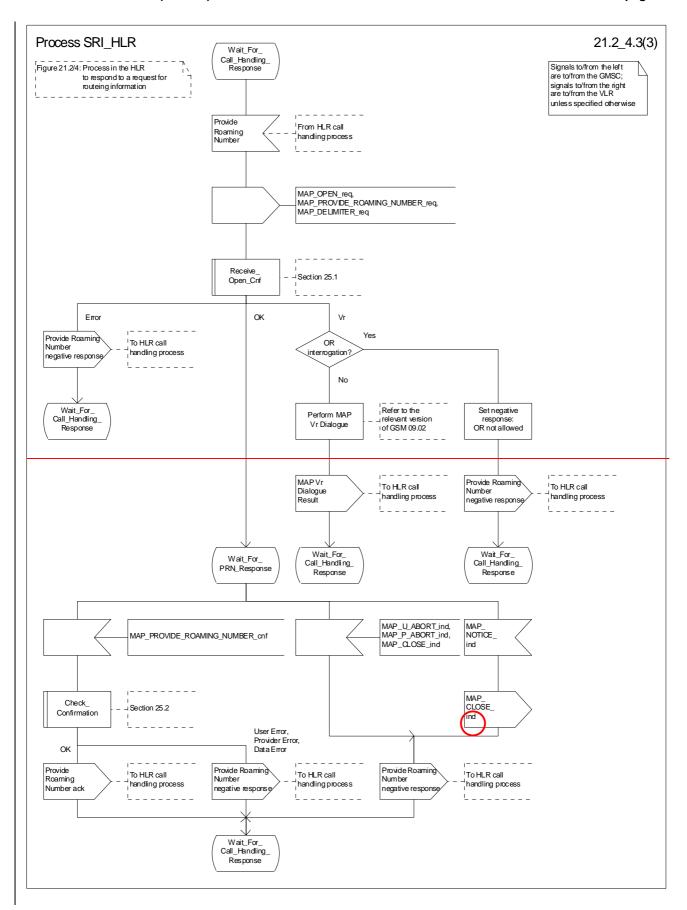


Figure 21.2/74 (sheet 2 of 3): Process SRI\_HLR



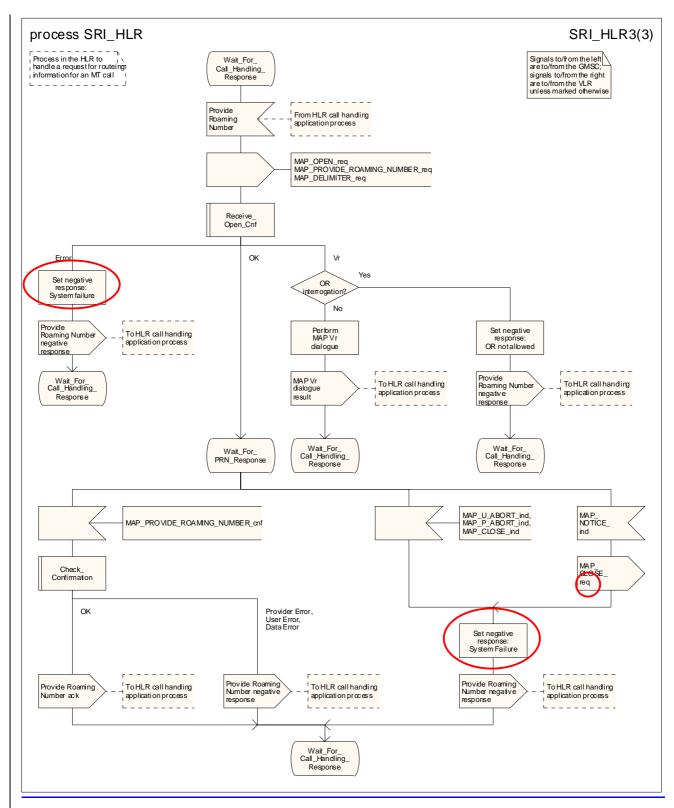
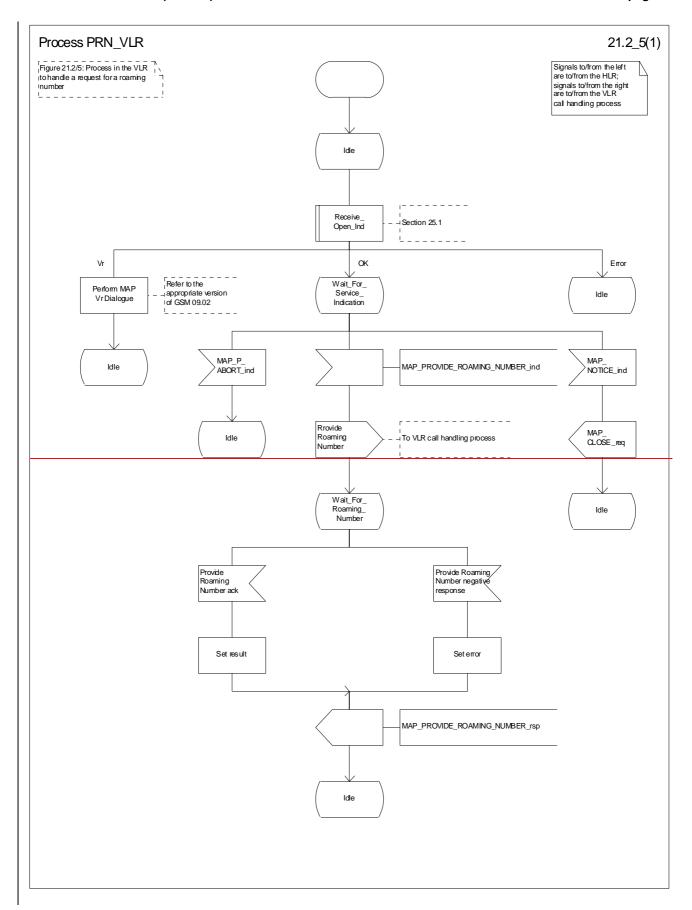


Figure 21.2/74 (sheet 3 of 3): Process SRI\_HLR



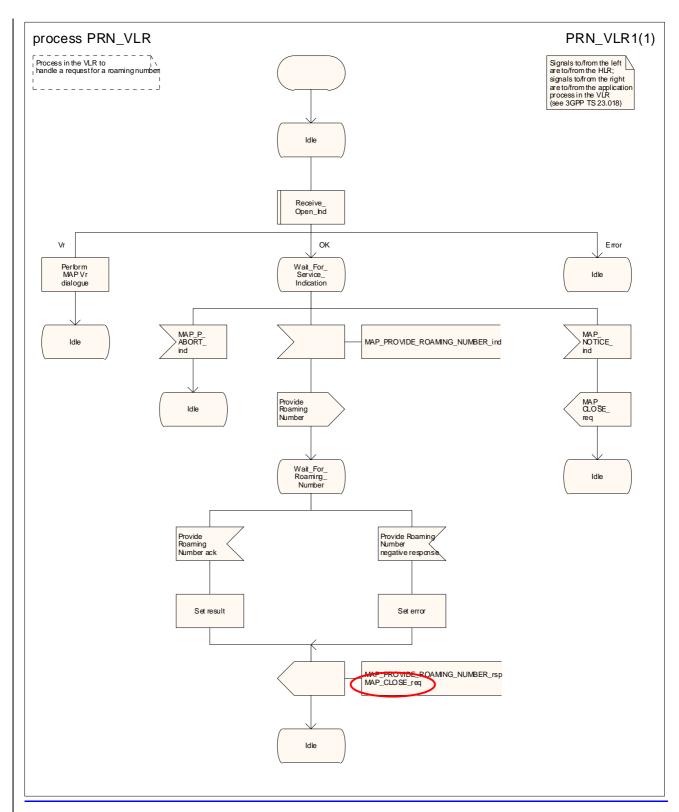
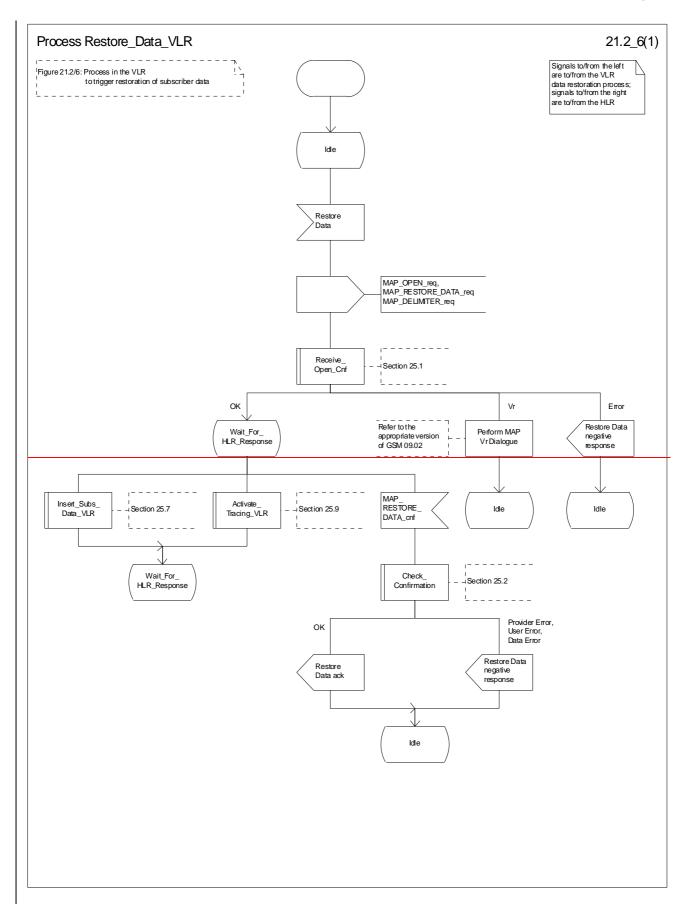


Figure 21.2/85: Process PRN\_VLR



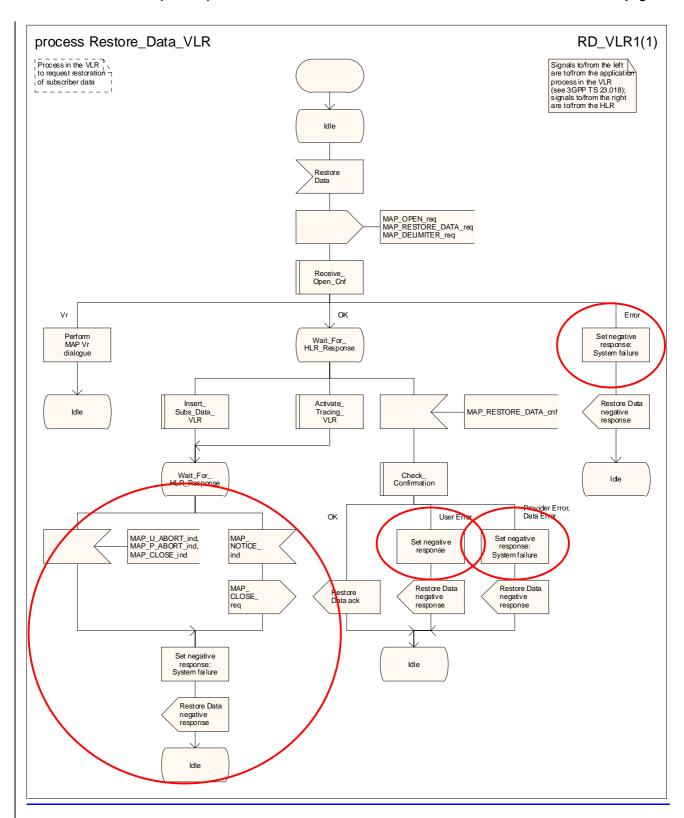
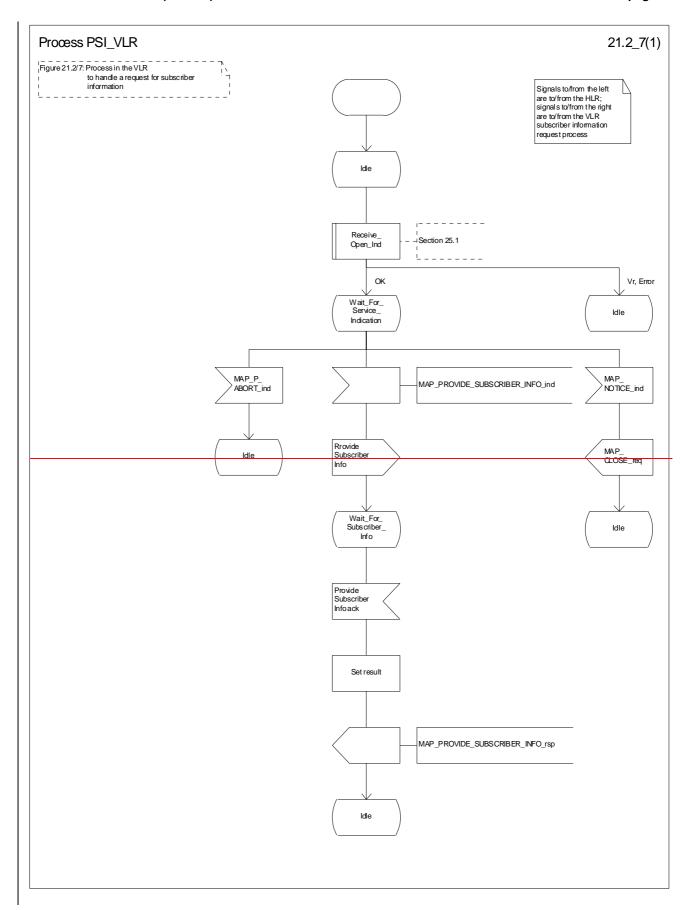


Figure 21.2/96: Process Restore\_Data\_VLR



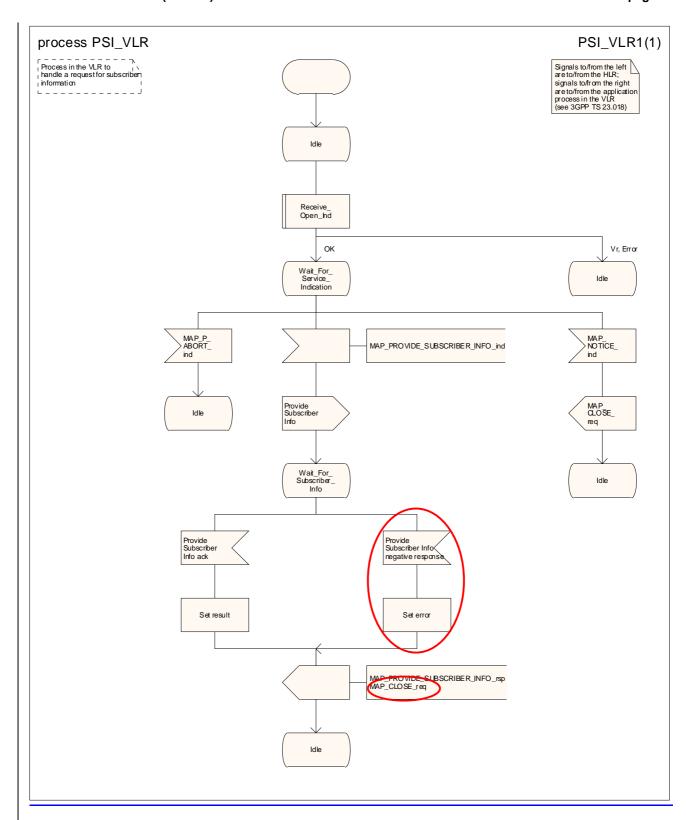
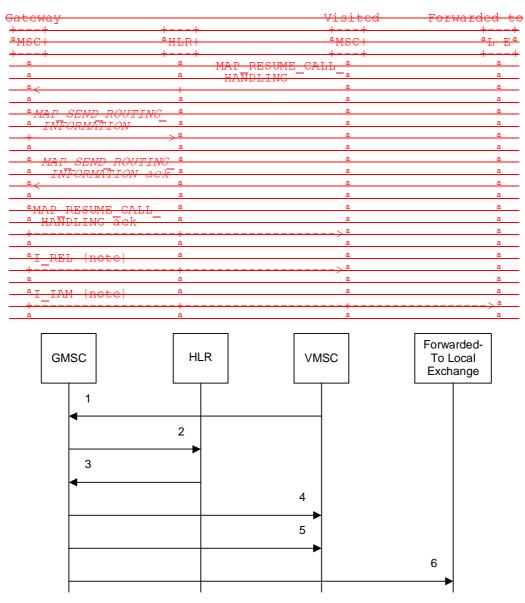


Figure 21.2/107: Process PSI\_VLR

# 21.3 Transfer of call handling

# 21.3.1 General

The message flow for successful transfer of call handling to forward a call is shown in figure 21.3/1.



- 1) MAP\_RESUME\_CALL\_HANDLING\_req/ind
- 2) MAP SEND ROUTING INFORMATION reg/ind (Note 2)
- 3) MAP SEND ROUTING INFORMATION rsp/cnf (Note 2)
- 4) MAP\_RESUME\_CALL\_HANDLING\_rsp/cnf
- 5) I REL (Note 1)
- I\_IAM (Note 1)

#### xxx = Optional Procedure

NOTE\_1: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following CCITU-TT Recommendations & ETSI specification:

- Q.721-725 Telephone Üser Part (TUP);
- ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.

NOTE 2: Services printed in italics are optional.

#### Figure 21.3/1: Message flow for transfer of call handling

If the HLR indicated in the response to the original request for routeing information that forwarding interrogation is required, the GMSC executes the Send Routeing Information procedure with the HLR to obtain forwarding information; otherwise the GMSC uses the forwarding data which were sent in the MAP\_RESUME\_CALL\_HANDLING req/ind.

# 21.3.2 Process in the VMSC

The MAP process in the VMSC to retrieve routeing information for a mobile terminating call is shown in figure 21.3/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

If the capacity of a message signal unit in the lower layers of the protocol is enough to carry all the information which has to be sent to the GMSC, the test "Segmentation needed?" takes the "No" exit; otherwise the test takes the "Yes" exit.

#### Successful Outcome

When the MAP process receives a Resume Call Handling request from the call handling process in the VMSC, it requests a dialogue with the GMSC whose identity is contained in the Resume Call Handling request by sending a MAP\_OPEN service request, requests routeing information using a MAP\_RESUME\_CALL\_HANDLING service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the GMSC. VMSC shall not send any duplicate data to the GMSC.

If the VMSC notices after receiving a Resume Call Handling request that the segmentation is needed the VMSC does not set the "All Information Sent" indicator. Otherwise the indicator is set and the process returns to the Wait For GMSC Response state.

If the MAP process receives a MAP\_RESUME\_CALL\_HANDLING service confirm from the GMSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process checks if the "All Information Sent" indicator is set. If it is set the MAP process sends a Resume Call Handling ack to the call handling process in the VMSC and returns to the idle state. If the "All Information Sent" indicator is not set the MAP process checks if further segmentation is needed. If segmentation is needed the VMSC does not set the indicator and sends

MAP\_RESUME\_CALL\_HANDLING service request to the GMSC. Otherwise the indicator is set and the MAP\_RESUME\_CALL\_HANDLING service request is sent to the GMSC.

#### **Dialogue opening failure**

If the macro Receive\_Open\_Cnf indicates that the dialogue with the GMSC could not be opened or that the dialogue can be opened only at an earlier version, the MAP process sends an Resume Call Handling negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

## Error in MAP\_RESUME\_CALL\_HANDLING confirm

If the MAP\_RESUME\_CALL\_HANDLING service confirm contains a user error or a provider error, the MAP process sends a Resume Call Handling negative response to the call handling process in the VMSC and returns to the idle state.

NOTE: the 'Data Error' exit from the macro Check\_Confirmation is shown for formal completeness; the result is empty, so the MAP\_PROVIDE\_SUBSCRIBER\_INFO\_cnf primitive cannot contain a data error.

#### **Abort of GMSC dialogue**

After the dialogue with the GMSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the GMSC may send a MAP\_CLOSE indication. In either of these cases, the MAP process sends a Resume Call Handling negative response to the call handling process in the GMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the GMSC, sends a Resume Call Handling negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

# 21.3.3 Process in the GMSC

The MAP process in the GMSC to handle a request for the GMSC to resume call handling is shown in figure 21.3/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1;

If the parameter All Information Sent was present in the MAP\_RESUME\_CALL\_HANDLING indication, the test "All Information Sent" takes the "Yes" exit; otherwise the test takes the "No" exit.

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context callControlTransfer, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_RESUME\_CALL\_HANDLING service indication is received, the MAP process checks if the "All Information Sent" indicator is set and if so it sends a Resume Call Handling request including all the stored data to the call handling process in the GMSC, and waits for a response. The Resume Call Handling request contains the parameters received in the MAP\_RESUME\_CALL\_HANDLING service indication. If the "All Information Sent" indicator is not set, the received data is stored and the MAP process constructs an empty MAP\_RESUME\_CALL\_HANDLING service response, sends it to the VMSC and returns to the Wait For Service Indication state.

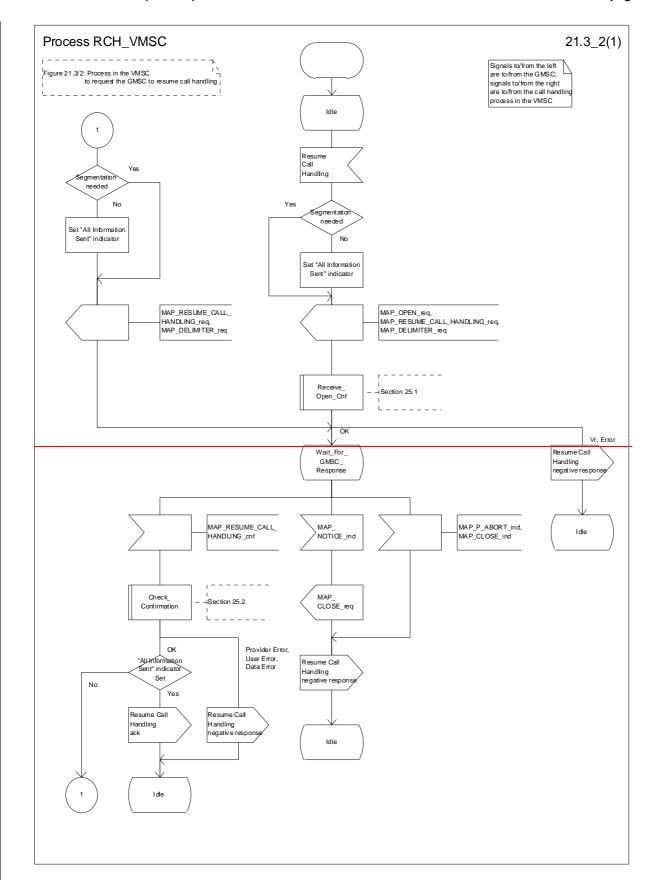
If the call handling process in the GMSC returns a Resume Call Handling ack, the MAP process constructs a MAP\_RESUME\_CALL\_HANDLING service response, constructs a MAP\_CLOSE service request, sends them to the VMSC and returns to the idle state.

#### Failure of dialogue opening with the VMSC

If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.



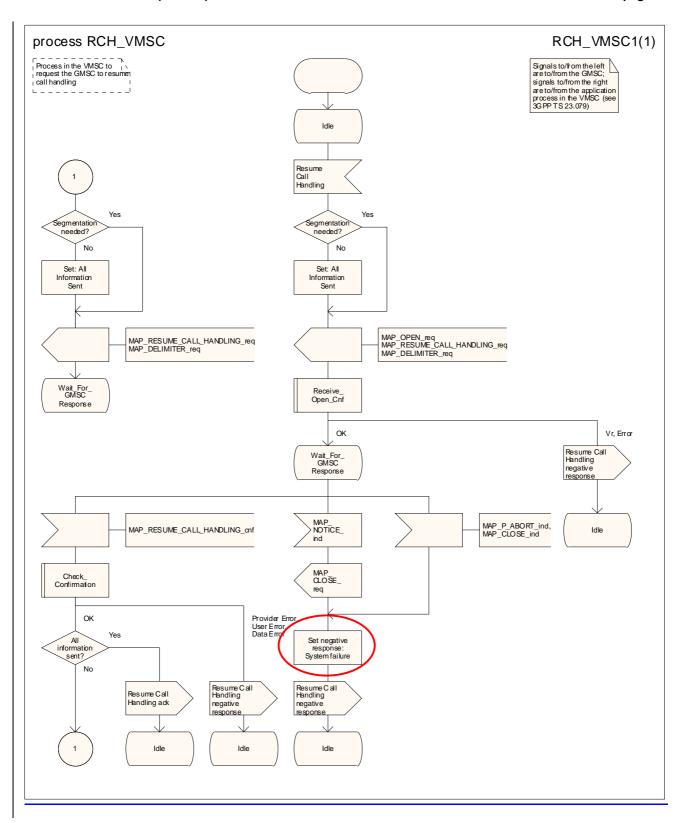
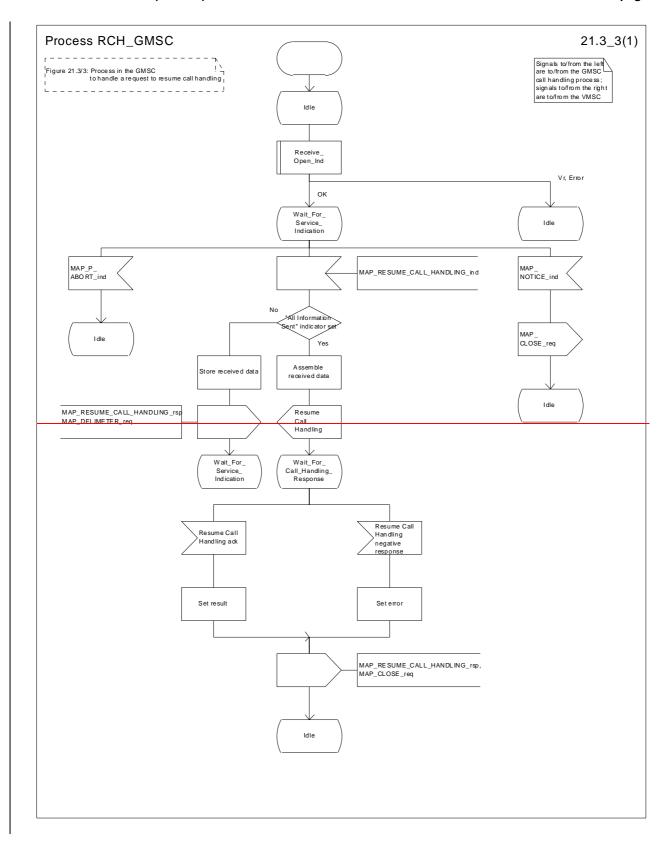


Figure 21.3/2: Process RCH\_VMSC



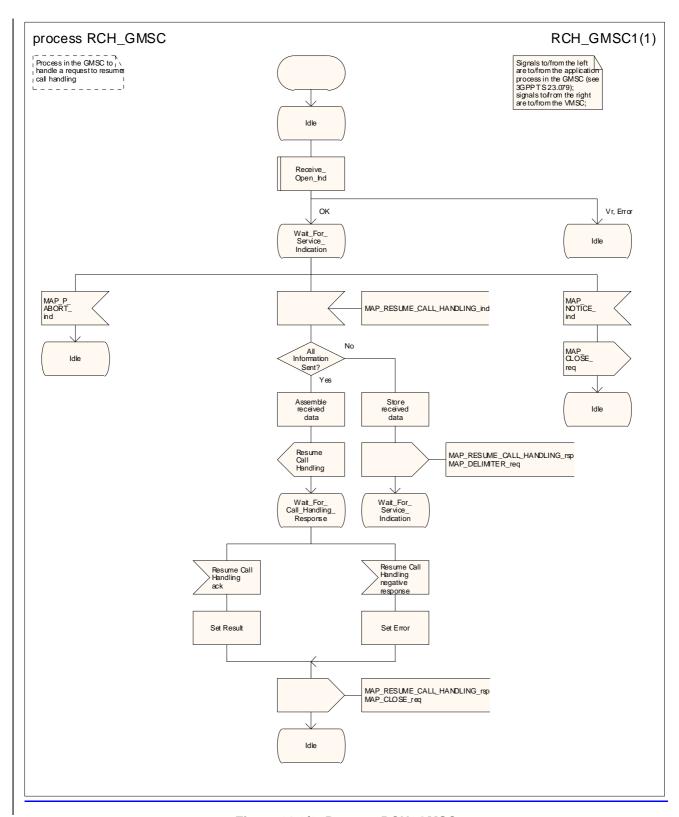
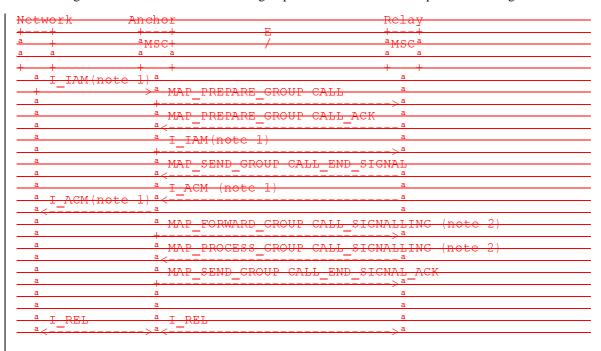


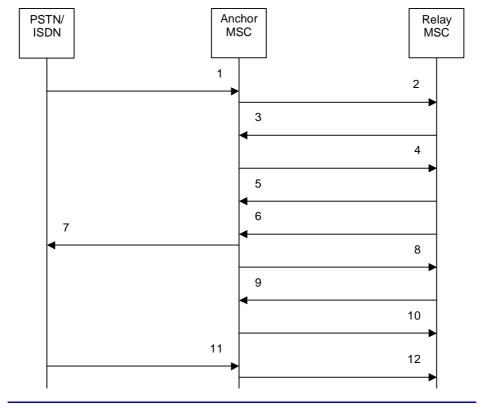
Figure 21.3/3: Process RCH\_GMSC

#### Inter MSC Group Call Procedures 21.4

#### 21.4.1 General

The message flows for successful inter MSC group call / broadcast call set-up is shown in figure 21.4/1.





- I\_IAM (Note 1)
- MAP PREPARE GROUP CALL reg/ind
- 2) 3) MAP\_PREPARE\_GROUP\_CALL\_rsp/cnf
- I\_IAM (Note 1)
- MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL\_req/ind

- 6) I ACM (Note 1)
  7) I\_ACM (Note 1)
  8) MAP FORWARD GROUP CALL SIGNALLING req/ind (Note 2)
  9) MAP PROCESS GROUP CALL SIGNALLING req/ind (Note 2)
  10) MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL\_rsp/cnf
  11) I\_REL (Note 3)
  12) \_I REL (Note 3)
- NOTE 1: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following ITU-T Recommendations and ETSI specification:
  - Q.721-725 Telephone User Part (TUP);
  - ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.
- NOTE 2: The MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING and

MAP\_PROCESS\_GROUP\_CALL\_SIGNALLING services are not applicable for voice broadcast calls.

NOTE 3: The call can be released from the PSTN/ISDN or the Relay MSC

Figure 21.4/1: Message flow for inter MSC group call / broadcast call

### 21.4.2 Process in the Anchor MSC

The MAP process in the Anchor MSC to retrieve and transfer information from / to the Relay MSC for VBS and VGCS calls is shown in figure 21.4/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Indication see <u>sub</u>clause 25.2.1; Check\_Confirmation see <u>sub</u>clause 25.2.2.

#### **Successful Outcome**

When the MAP process receives a Prepare Group Call request from the ASCI handling process in the anchor MSC, it requests a dialogue with the relay MSC whose identity is contained in the Prepare Group Call request by sending a MAP\_OPEN service request, requests an Group Call number by using a MAP\_PREPARE\_GROUP\_CALL service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the relay MSC.

If the MAP process receives a MAP\_PREPARE\_GROUP\_CALL service confirm from the relay MSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a Prepare Group Call ack containing the Group Call number received from the relay MSC to the ASCI handling process in the anchor MSC and waits for completion of call set up in the relay MSC.

On receipt of a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service indication from the relay MSC the MAP process invokes the macro Check. Indication to check the content of the indication.

If the macro Check\_Indication takes the OK exit, the MAP process sends a Send Group Call End Signal to the ASCI handling process in the anchor MSC and waits for uplink management signals. In this state the following events are processed:

- Reception of a Send Group Call End Signal ack from the ASCI handling process in the anchor MSC;
- Reception of a Forward Group Call Signalling request from the ASCI handling process in the anchor MSC;
- Reception of a MAP PROCESS GROUP CALL SIGNALLING service indication from the relay MSC.

On reception of a Send Group Call End Signal ack from the ASCI handling process in the anchor MSC, the MAP process constructs a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service response, constructs a MAP\_CLOSE service request, sends them to the relay MSC and returns to the idle state.

On reception of a Forward Group Call Signalling request from the ASCI handling process in the anchor MSC, the MAP process constructs a MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING service request, sends it to the relay MSC and returns to the uplink management state.

On reception of a MAP\_PROCESS\_GROUP\_CALL\_SIGNALLING service indication from the relay MSC, the MAP process invokes the macro Check Indication to check the content of the indication.

If the macro Check\_Indication takes the OK exit, the MAP process sends a Process Group Call Signalling to the ASCI handling process in the anchor MSC and returns to the uplink management state.

#### **Dialogue opening failure**

If the macro Receive\_Open\_Cnf indicates that the dialogue with the relay MSC could not be opened, the MAP process sends an Abort to the ASCI handling process and returns to the idle state.

### Error in MAP\_PREPARE\_GROUP\_CALL confirm

If the MAP\_PREPARE\_GROUP\_CALL service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Prepare Group Call negative response to the ASCI handling process in the anchor MSC, sends a MAP\_U\_ABORT request to the relay MSC and returns to the idle state.

#### **Abort of MAP dialogue**

After the dialogue with the relay MSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the relay MSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an Abort to the ASCI handling process in the anchor MSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the relay MSC, sends an Abort to the ASCI handling process in the anchor MSC and returns to the idle state.

# 21.4.3 Process in the Relay MSC

The MAP process in the Relay MSC to receive and transfer information from / to the Anchor MSC for VBS and VGCS calls is shown in figure 21.4/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.2;

Check\_Indication see <u>sub</u>clause 25.2.1.

#### **Successful Outcome**

When the MAP process receives a MAP\_OPEN indication with the application context groupCallControl, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PREPARE\_GROUP\_CALL service indication is received, the MAP process invokes the macro Check Indication.

If the macro takes the OK exit, the MAP process sends a Prepare Group Call request to the ASCI handling process in the relay MSC and waits for a response. The Prepare Group Call request contains the parameters received in the MAP\_PREPARE\_GROUP\_CALL service indication.

If the ASCI handling process in the relay MSC returns a Prepare Group Call ack, the MAP process constructs a MAP\_PREPARE\_GROUP\_CALL service response containing the information contained in the Prepare Group Call ack, constructs a MAP\_DELIMITER service request, sends them to the anchor MSC and waits for the GROUP CALL END SIGNAL.

If the ASCI handling process in the relay MSC sends a Send Group Call End Signal request to the MAP process, the MAP process constructs a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service request containing the information

contained in the SEND GROUP CALL End Signal request, constructs a MAP\_DELIMITER service request, sends them to the anchor MSC and waits for uplink management signals. In this state the following events are processed:

- Reception of a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service confirmation from the anchor MSC;
- Reception of a MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING service indication from the anchor MSC;
- Reception of a Process Group Call Signalling request from the ASCI handling process in the relay MSC.

On reception of a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service confirmation from the anchor MSC, the MAP process returns to the idle state.

On reception of a MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING service indication from the anchor MSC, the MAP process invokes the macro Check Indication. If the macro takes the OK exit, the MAP process sends a Forward Group Call Signalling request to the ASCI handling process in the relay MSC and waits for further uplink management signals.

On reception of a Process Group Call Signalling request from the ASCI handling process in the relay MSC, the MAP process constructs a MAP\_PROCESS\_GROUP\_CALL\_SIGNALLING service request containing the information received in the Process Group Call Signalling request, constructs a MAP\_DELIMITER service request, sends them to the anchor MSC and waits for further uplink management signals.

#### Failure of dialogue opening with the anchor MSC

If the macro Receive\_Open\_Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

#### **Error in MAP\_PREPARE\_GROUP\_CALL indication**

If the macro Check Indication takes the Error exit, the MAP process sends a MAP\_U\_ABORT request to the anchor MSC and returns to the idle state.

#### Negative response received from the ASCI handling process

If the ASCI handling process in the relay MSC returns a negative response to the Prepare Group Call request, the MAP process constructs a MAP\_PREPARE\_GROUP\_CALL service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the anchor MSC and returns to the idle state.

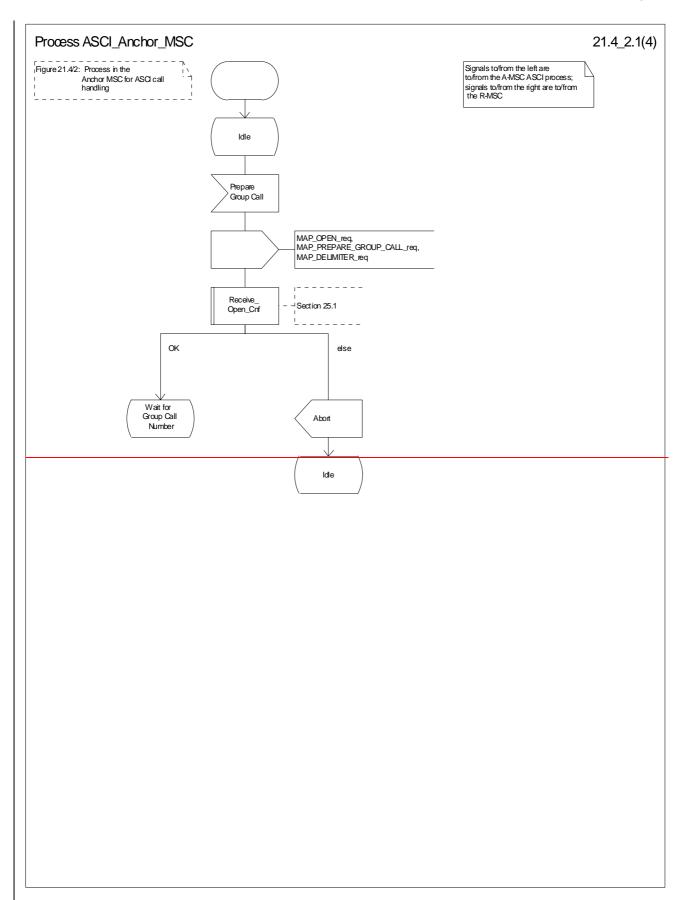
#### **Error in MAP FORWARD GROUP CALL SIGNALLING indication**

If the macro Check Indication takes the Error exit, the MAP process sends a MAP\_U\_ABORT request to the anchor MSC, sends an Abort to the ASCI handling process in the relay MSC ind returns to the idle state.

#### **Abort of MAP dialogue**

After the dialogue with the anchor MSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the anchor MSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an Abort to the ASCI handling process in the relay MSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the anchor MSC, sends an Abort to the ASCI handling process in the anchor MSC and returns to the idle state.



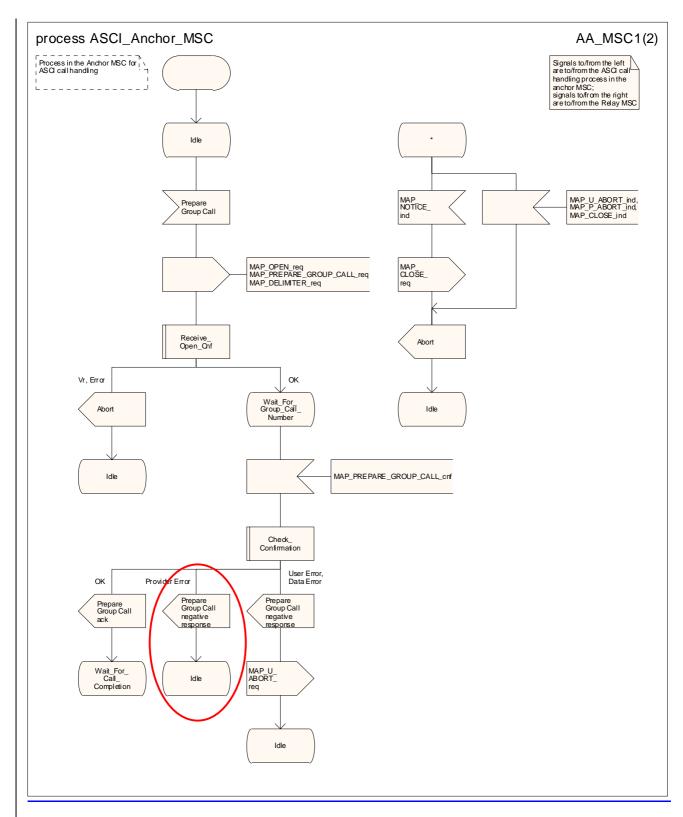
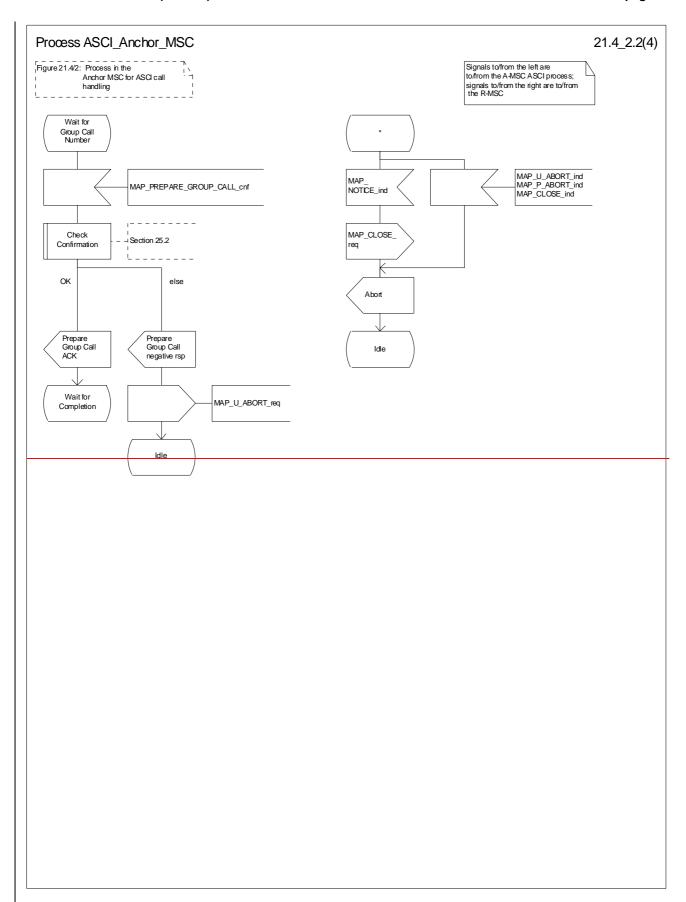


Figure 21.4/2 (sheet 1 of 24): Process ASCI\_Anchor\_MSC



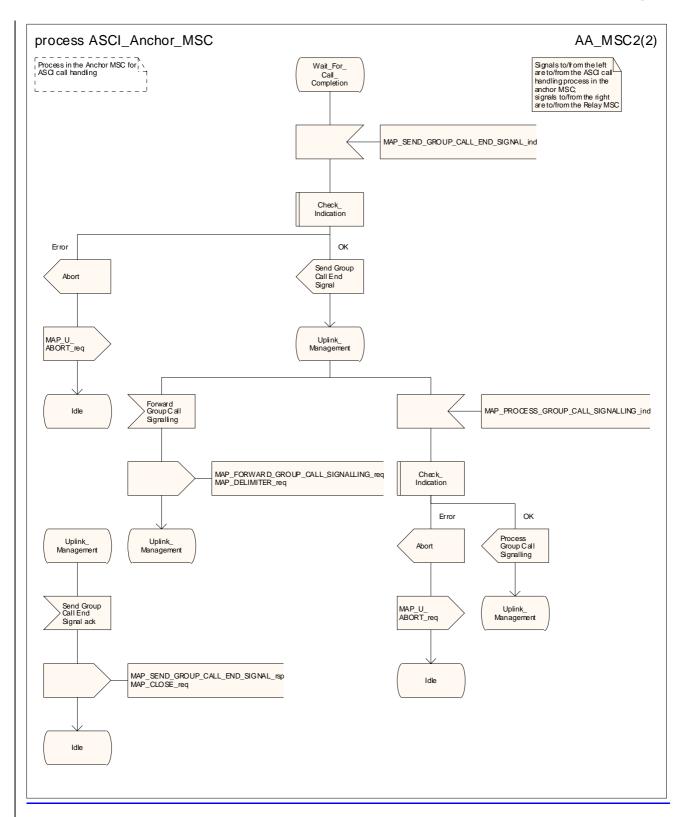


Figure 21.4/2 (sheet 2 of 24): Process ASCI\_Anchor\_MSC

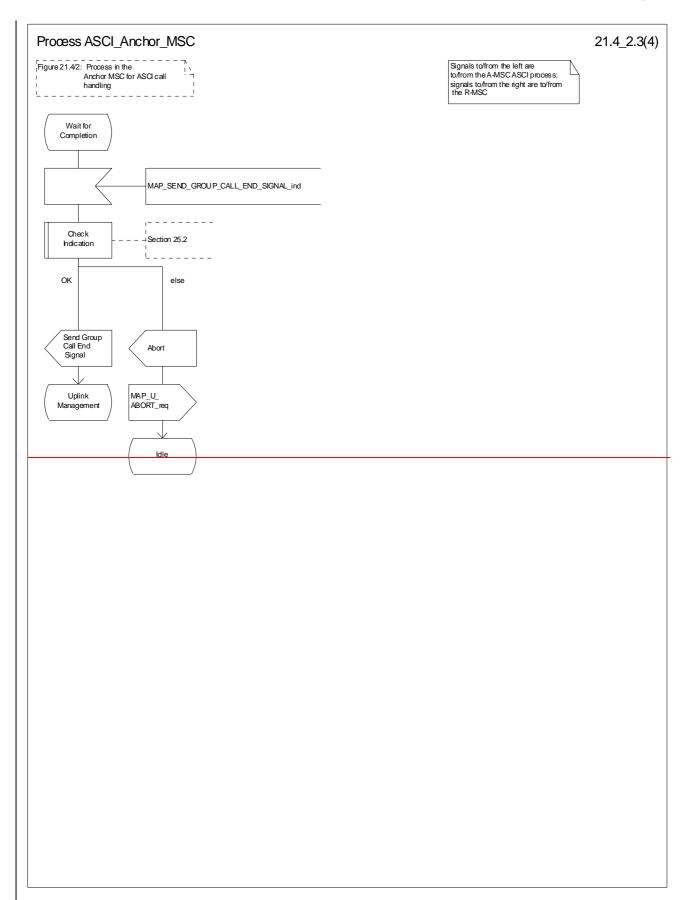


Figure 21.4/2 (sheet 3 of 4): Process ASCI\_Anchor\_MSC

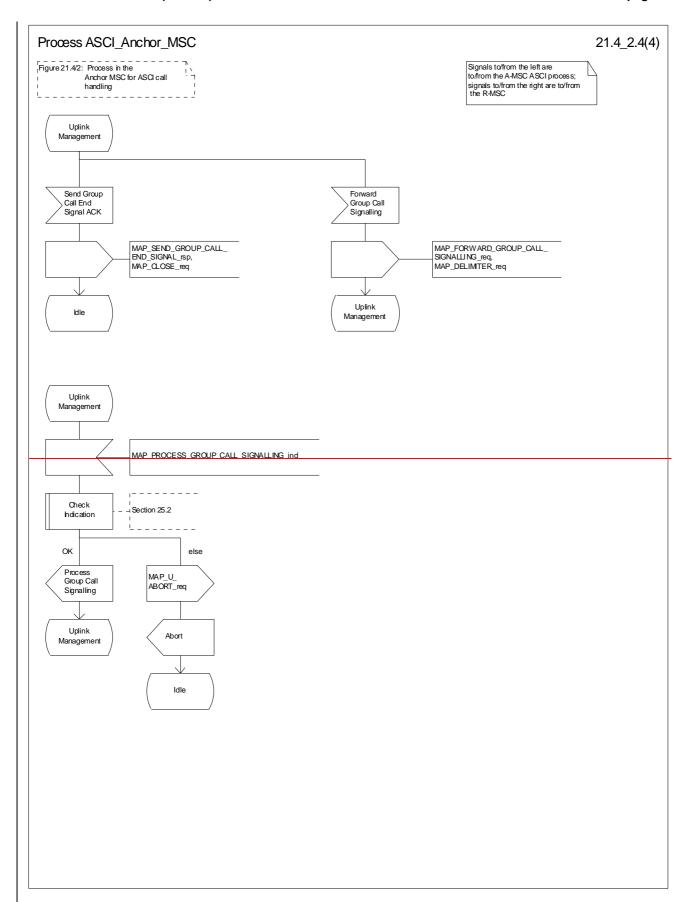
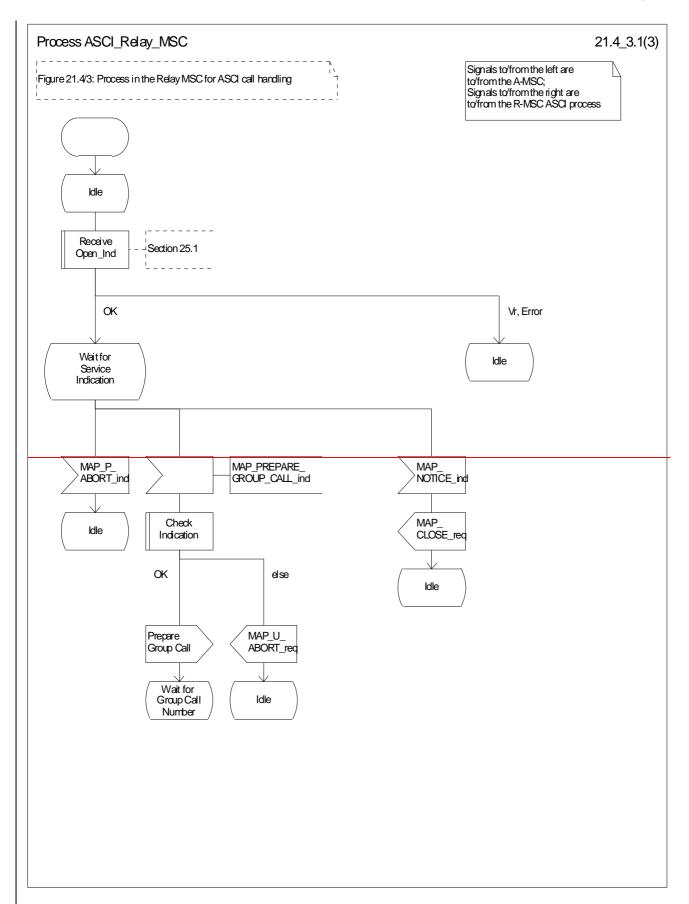


Figure 21.4/2 (sheet 4 of 4): Process ASCI\_Anchor\_MSC



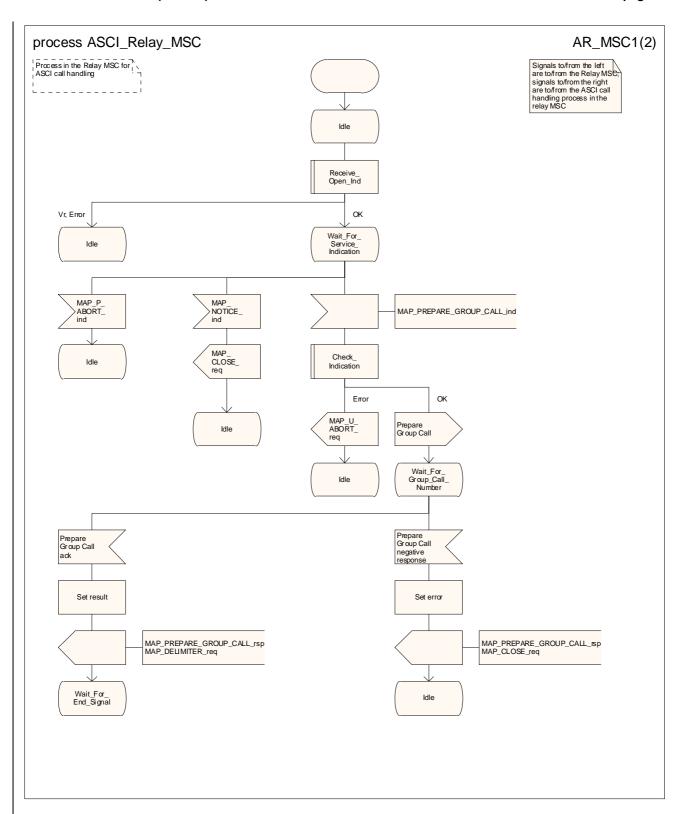
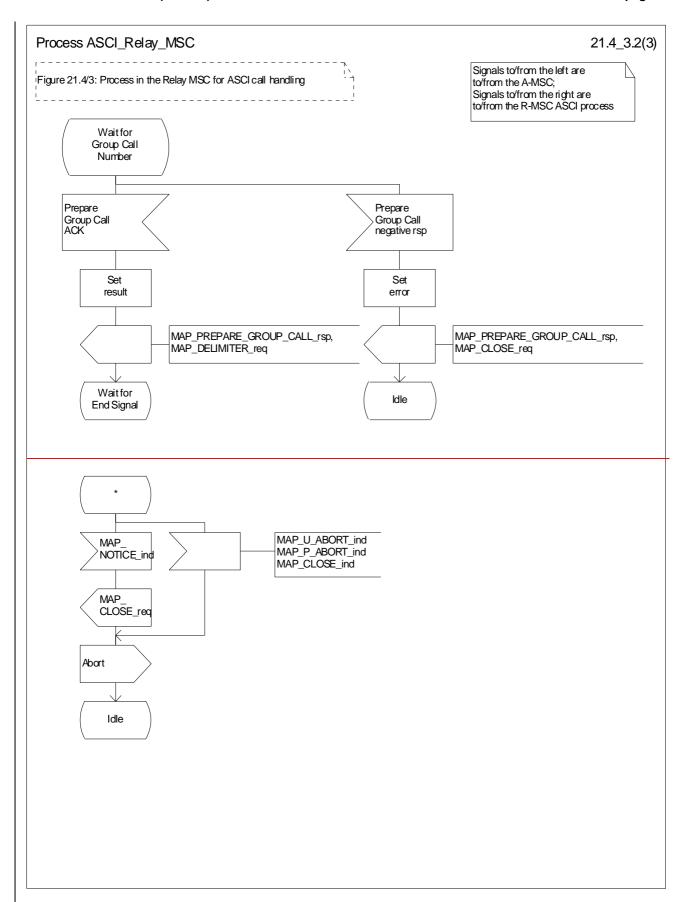


Figure 21.4/3 (sheet 1 of 23): Process ASCI\_Relay\_MSC



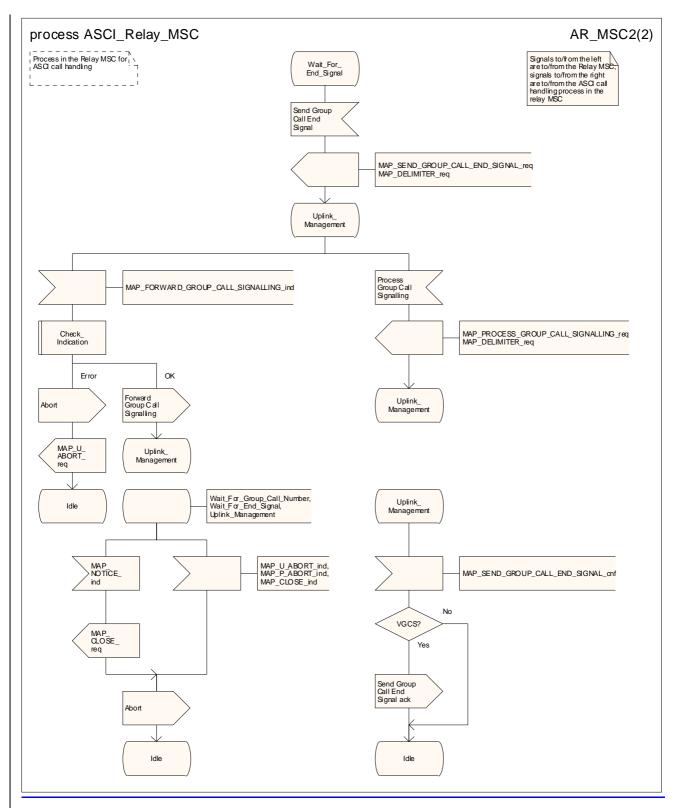


Figure 21.4/3 (sheet 2 of 23): Process ASCI\_Relay\_MSC

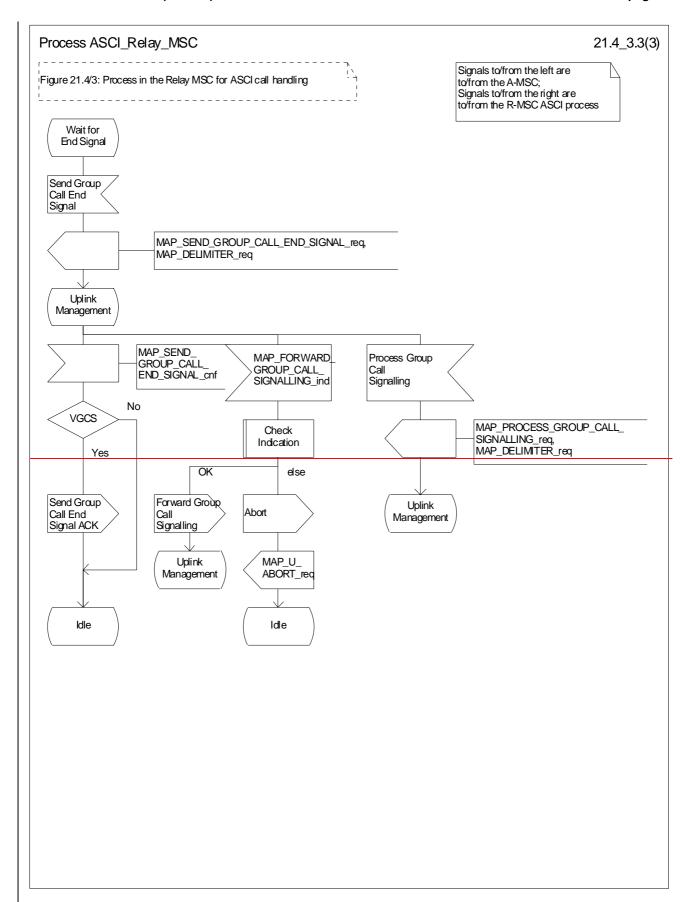
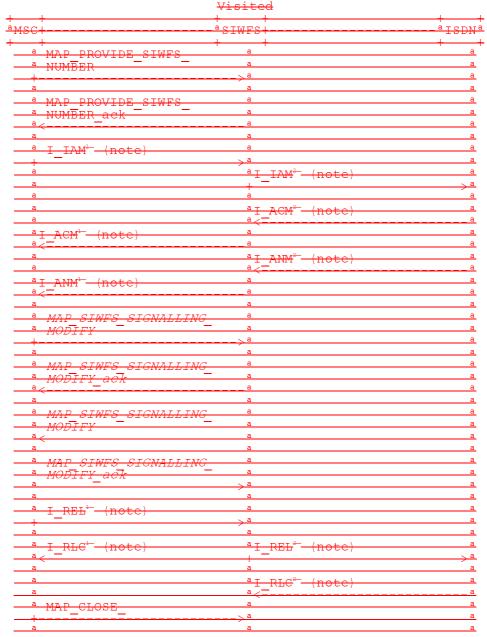


Figure 21.4/3 (sheet 3 of 3): Process ASCI\_Relay\_MSC

# 21.5 VoidAllocation and modifications of resources in an SIWFS

### 21.5.1 General

The message flow for successful allocation and modification of resources in an SIWFS is shown in figure 21.5/1 (mobile originating call non-loop method), 21.5/2 (mobile originating call loop method) and 21.5/3 (mobile terminating call loop method).



xxx = Optional Procedure

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

NOTE 2: The number on the ISUP messages have been added to link the messages to respective signalling sequence.

NOTE 3: The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

Figure 21.5/1: Message flow for mobile originating call non-loop method



xxx = Optional Procedure

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

NOTE 2: The number on the ISUP messages have been added to link the messages to respective signalling sequence.

NOTE 3: The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

Figure 21.5/2: Message flow for mobile originating call loop method

MSC + as:	TWEST.	a ISDN
150	IWFS	+ 15DN
al_IAM (note)	a	a
<del>- °</del> <	+	<u>a</u> a
a MAD DDOMINE CIMEC	<u>а</u> а	<u>a</u>
a MAP PROVIDE SIWFS NUMBER	ā	a
+	> a	a
ā	a	<u>a</u>
* MAP PROVIDE SIWFS	a	<u>a</u>
<del></del>	<u>a</u> a	<u>а</u> а
a	a	<u>a</u>
a I IAM²— (note)	a	a
<del>-+</del>	_> a	a
<u>a</u>	<u>a</u>	<u>a</u>
<del>a I IAM³ (note)</del>	<u>a</u> a	a
a	a a	a
a I ACM3 (note)	ā	a
+	_ <u>&gt;</u> a	a
å	<u> </u>	<u>a</u>
al ACM2 (note)	a	<u>a</u>
a <u></u>	<u>a</u> a	a
a I ACM <sup>1</sup> (note)	a	<u>a</u>
a		√ a
a	a	
al ANM <sup>3</sup> (note)	a	<u>a</u>
<del>-+</del>	<del>-&gt; a</del>	a
a TANIM <sup>2</sup> (note)	<u>а</u> а	<u>a</u> a
<u>a I ANM² (note)</u>	a	a
a	a	a
<u>aI ANM¹— (note)</u>	ā	a
a <del>-</del>		<del>&gt; a</del>
a MAD STRES STENATITMS	<u>а</u> а	<u>a</u> a
a MAP SIWFS SIGNALLING a MODIFY	a	a
+ + + + + + + + + + + + + + + + + + +	∖ a	a
a	a	a
<sup>а</sup> <i>MAP SIWFS SIGNALLING</i>	a	a
<u> </u>	a a	<u>a</u> a
a	a	a
a <i>MAP SIWFS SIGNALLING</i>	ā	a
a MODIFY — —	a	a
a <	a	a
a	a	<u>a</u>
a MAP SIWFS SICNALLING	<u>а</u> а	a a
<u> </u>	a	a
a	a	a
a I_REL (note)	a	a
<u> </u>	+	a
a	<u>a</u>	a
a I_RLC (note)	a	a
a	a	a
aI_REL (note)	a	a
	_ > a	a
å	a	a
a _ RLC <sup>2</sup> (note)	a a	a
a a	a a	a a
a I_REL <sup>3</sup> (note)	a	a
	a	a
a	a	a
	a	a
al RLC3 (note)		
<del></del>	_> a	a
a I_RLC3 (note) a a MAP_CLOSE		

— xxx = Optional Procedure
NOTE 1: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. The Release message can be initiated either by calling or called subscriber. For further details on the TUP and ISUP procedures refer to the following CCITT Recommendations & ETSI specification:
— Q.721-725 - Telephone User Part (TUP);

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

NOTE 2: The number on the ISUP messages have been added to link the messages to respective signalling sequence.

NOTE 3: The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

#### Figure 21.5/3: Message flow for mobile terminating call loop method

The following MAP services are used to allocate resources in an SIWFS:

MAP PROVIDE SIWFS NUMBER see clause 10.8.

The following MAP services are used to modify resources in an SIWFS:

MAP\_SIWFS\_SIGNALLING\_MODIFY see clause 10.9.

### 21.5.2 Process in the VMSC

The MAP process in the VMSC to allocate and modify resources in an SIWFS for a mobile call is shown in figure 21.5/4. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see clause 25.1.2;

Check Confirmation see clause 25.2.2.

## 21.5.2.1 Allocation of SIWFS resources

## **Successful Outcome**

When the MAP process receives a Provide SIWFS Number request from the call handling process in the VMSC, it requests a dialogue with the SIWF whose identity is contained in the Provide SIWFS Number request by sending a MAP\_OPEN service request, requests resources in the SIWFS using a MAP\_PROVIDE\_SIWFS\_NUMBER service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the SIWFS.

If the MAP process receives a MAP\_PROVIDE\_SIWFS\_NUMBER service confirm from the SIWFS, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a Provide SIWFS Number ack containing the SIWFS Number received from the SIWFS to the call handling process in the VMSC and go to Wait\_For\_Modification state.

## Earlier version MAP dialogue with the SIWFS

If the macro Receive\_Open\_Cnf takes the Vr exit, the MAP process sends an Abort to the call handling process in the VMSC and returns to the idle state.

#### **Dialogue opening failure**

If the macro Receive\_Open\_Cnf indicates that the dialogue with the SIWFS could not be opened, the MAP process sends an Abort to the call handling process in the VMSC and returns to the idle state.

# Error in MAP\_PROVIDE\_SIWFS\_NUMBER confirm

If the MAP\_PROVIDE\_SIWFS\_NUMBER service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Provide SIWFS number negative response to the call handling process in the VMSC and returns to the idle state.

#### **Call release**

If the call handling process in the VMSC indicates that the call has been aborted, the MAP process returns to the idle state. Any response from the SIWFS will be discarded.

If the call handling process in the VMSC indicates that the traffic channel has been released (i.e. call released by a user) a MAP\_CLOSE\_req is sent and the process is returned to the idle state.

### **Abort of SIWFS dialogue**

During the time an answer is expected from the SIWFS, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the SIWFS may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends a Provide SIWFS number negative response to the call handling process in the VMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the SIWFS, sends a Provide SIWFS number negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

After the dialogue with the SIWFS has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the SIWFS may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the SIWFS, and returns to the idle state.

## 21.5.2.2 Modification of SIWFS resources initiated by the user

#### Successful Outcome

When the MAP process receives an SIWFS Signalling Modify request from the call handling process in the VMSC, it requests a dialogue with the SIWFS whose identity is contained in the SIWFS Signalling Modify request by sending a MAP\_SIWFS\_SIGNALLING\_MODIFY service request and waits for a response from the SIWFS.

If the MAP process receives a MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm from the SIWFS, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends an SIWFS Signalling Modify ack containing the response received from the SIWFS to the call handling process in the VMSC and go to Wait\_For\_Modification state.

#### **Error in MAP SIWFS SIGNALLING MODIFY confirm**

If the MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the VMSC and go to Wait\_For\_Modification state.

#### **Abort of SIWFS dialogue**

During the time an answer is expected from the SIWFS, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the SIWFS may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the VMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the SIWFS, sends an SIWFS Signalling Modify negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

# 21.5.2.3 Modification of SIWFS resources initiated by the SIWFS

### Successful outcome

If a MAP\_SIWFS\_SIGNALLING\_MODIFY service indication is received, the MAP process sends an SIWFS signalling modify Info request to the call handling process in the VMSC, and waits for a response. The SIWFS signalling modify request contains the parameters received in the MAP\_SIWFS\_SIGNALLING\_MODIFY service indication.

If the call handling process in the VMSC returns an SIWFS signalling modify ack, the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response contained in the Provide SIWFS Number ack, send it to the SIWFS and go to Wait\_For\_Modification state.

## Negative response from VMSC call handling process

If the call handling process in the VMSC returns a negative response the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response containing the appropriate error, send it to the SIWFS and go to Wait\_For\_Modification state.

## 21.5.3 Process in the SIWFS

The MAP process in the SIWFS to allocate and modify SIWFS resources for a mobile call is shown in figure 21.5/5. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see clause 25.1.1.

Check Confirmation see clause 25.2.2.

#### 21.5.3.1 Procedures for allocation of SIWFS resources

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context locInfoRetrieval, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PROVIDE\_SIWFS\_NUMBER service indication is received, the MAP process sends a Provide SIWFS number Info request to the call handling process in the SIWFS, and waits for a response. The Provide SIWFS number request contains the parameters received in the MAP\_PROVIDE\_SIWFS\_NUMBER service indication.

If the call handling process in the SIWFS returns a Provide SIWFS number ack, the MAP process constructs a MAP\_PROVIDE\_SIWFS\_NUMBER service response containing the routing information contained in the Provide SIWFS Number ack, constructs a MAP\_DELIMITER service request, sends them to the VMSC and go to Wait\_For\_Modification state.

#### Earlier version MAP dialogue with the VMSC

If the macro Receive\_Open\_Ind takes the Vr exit, the MAP process returns to the idle state.

#### **Dialogue opening failure**

If the macro Receive Open Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

### Negative response from SIWFS call handling process

If the call handling process in the SIWFS returns a negative response the MAP process constructs a MAP\_PROVIDE\_SIWFS\_NUMBER service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the VMSC and returns to the idle state.

#### Call release

If the call handling process in the SIWFS indicates that the call has been aborted, the MAP process returns to the idle state. Any response from the VMSC will be discarded.

If the call handling process in the SIWFS indicates that the traffic channel has been released (i.e. call released by a user) a MAP\_CLOSE\_req is sent and the process is returned to the idle state.

#### **Abort of VMSC dialogue**

After the dialogue with the VMSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the VMSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VMSC, and returns to the idle state.

# 21.5.3.2 Process for modification of SIWFS resources initiated by the user

#### **Successful outcome**

If a MAP\_SIWFS\_SIGNALLING\_MODIFY service indication is received, the MAP process sends an SIWFS signalling modify Info request to the call handling process in the SIWFS, and waits for a response. The SIWFS signalling modify request contains the parameters received in the MAP\_SIWFS\_SIGNALLING\_MODIFY service indication.

If the call handling process in the SIWFS returns an SIWFS signalling modify ack, the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response contained in the Provide SIWFS Number ack, send it to the VMSC and go to Wait\_For\_Modification state.

### Negative response from SIWFS call handling process

If the call handling process in the SIWFS returns a negative response the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response containing the appropriate error, send it to the VMSC and go to Wait\_For\_Modification state.

# 21.5.3.3 Process for modification of SIWFS resources initiated by the SIWFS

#### **Successful Outcome**

When the MAP process receives an SIWFS Signalling Modify request from the call handling process in the SIWF, it requests a dialogue with the VMSC whose identity is contained in the VMSC Signalling Modify request by sending a MAP\_DELIMITER service request, requests resources in the VMSC using a MAP\_SIWFS\_SIGNALLING\_MODIFY service request, the MAP process waits for a response from the VMSC.

If the MAP process receives a MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm from the VMSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends an SIWFS Signalling Modify ack containing the response received from the VMSC to the call handling process in the SIWF and go to Wait\_For\_Modification state.

### **Error in MAP SIWFS SIGNALLING MODIFY confirm**

If the MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm contains a user error or a provider error, or the macro Cheek\_Confirmation indicates that there is a data error, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the SIWFS and go to Wait\_For\_Modification state.

### **Abort of SIWFS dialogue**

During the time an answer is expected from the VMSC, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the VMSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the SIWFS and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VMSC, sends an SIWFS Signalling Modify negative response indicating system failure to the call handling process in the SIWFS and returns to the idle state.

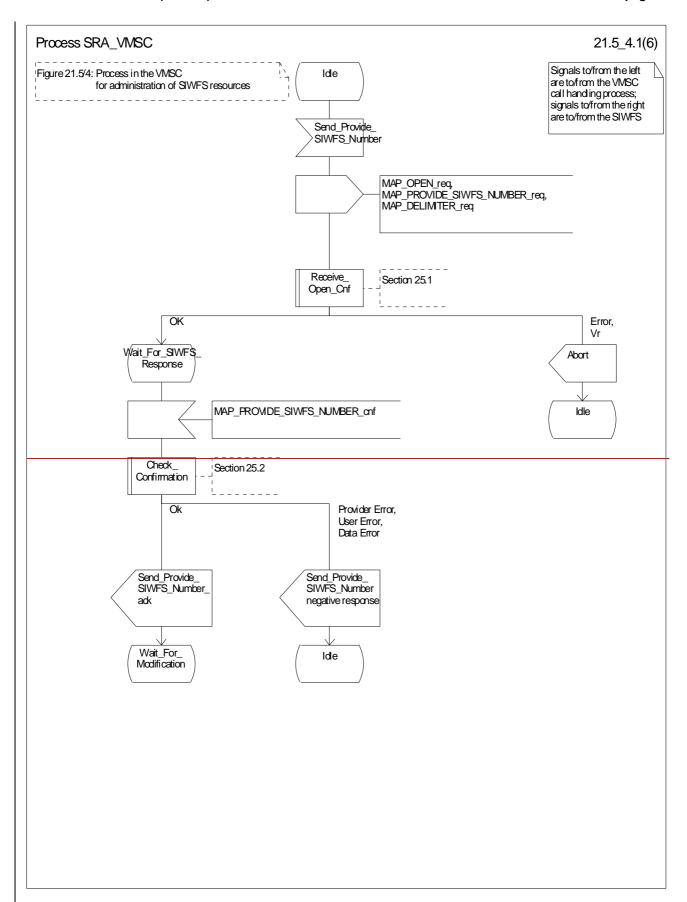


Figure 21.5/4 (sheet 1 of 6): Process SRA (SIWFS\_RESOURCE\_ADMINISTRATION)\_VMSC

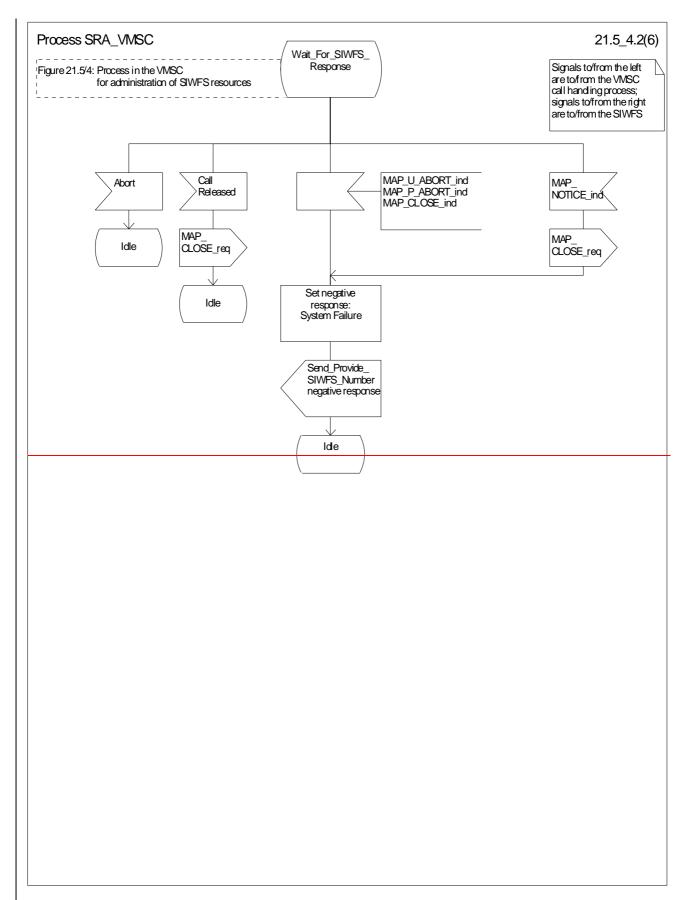


Figure 21.5/4 (sheet 2 of 6): Process SRA\_VMSC

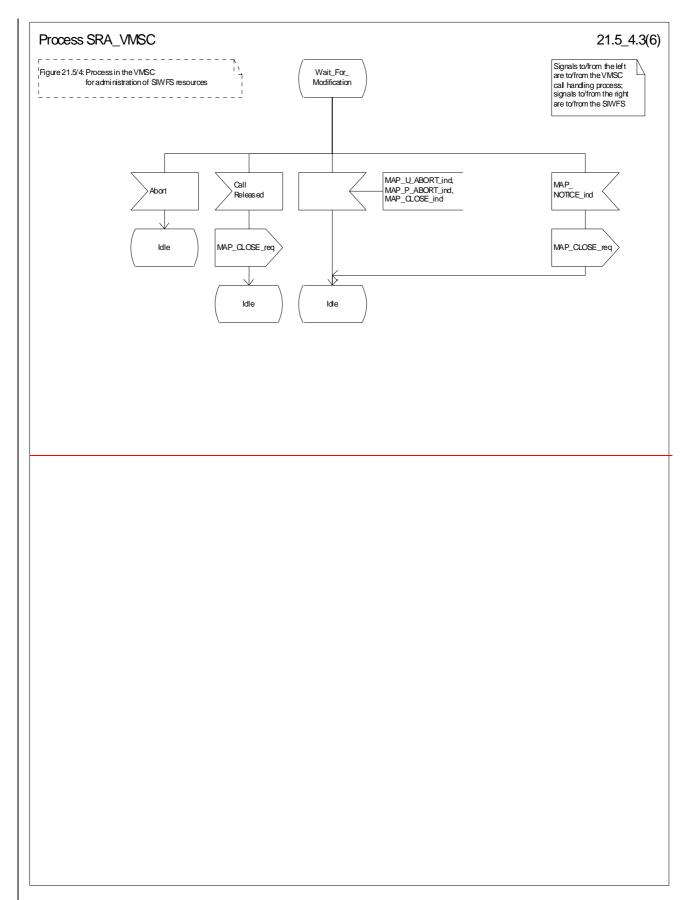


Figure 21.5/4 (sheet 3 of 6): Process SRA\_VMSC

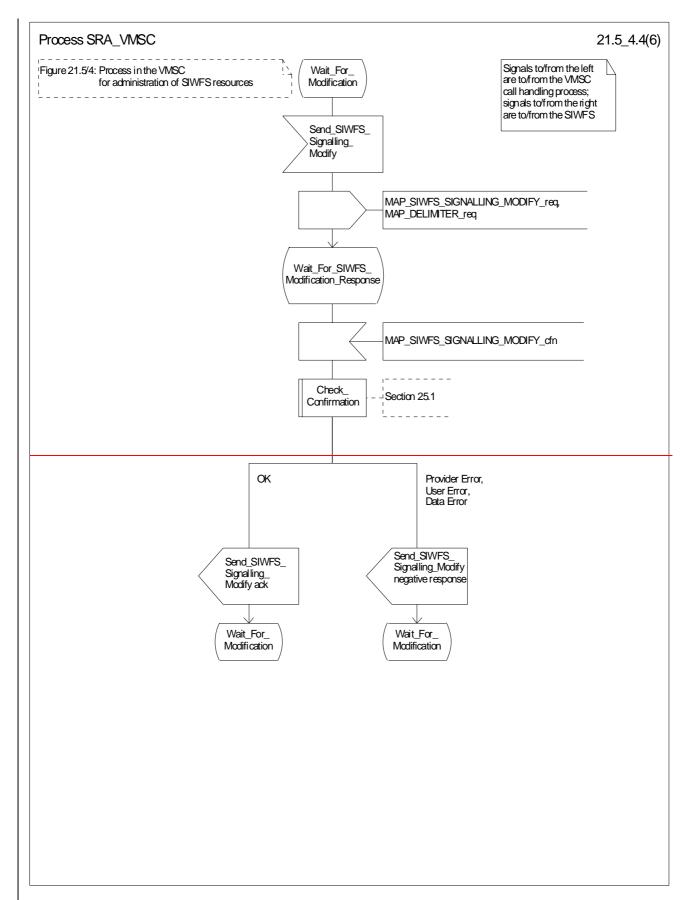


Figure 21.5/4 (sheet 4 of 6): Process SRA\_VMSC

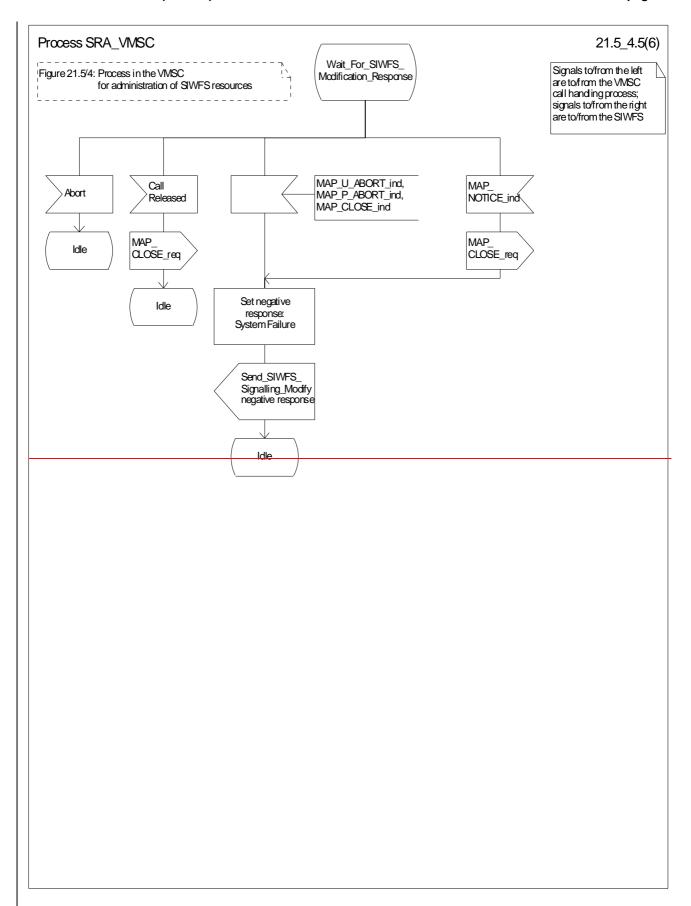


Figure 21.5/4 (sheet 5 of 6): Process SRA\_VMSC

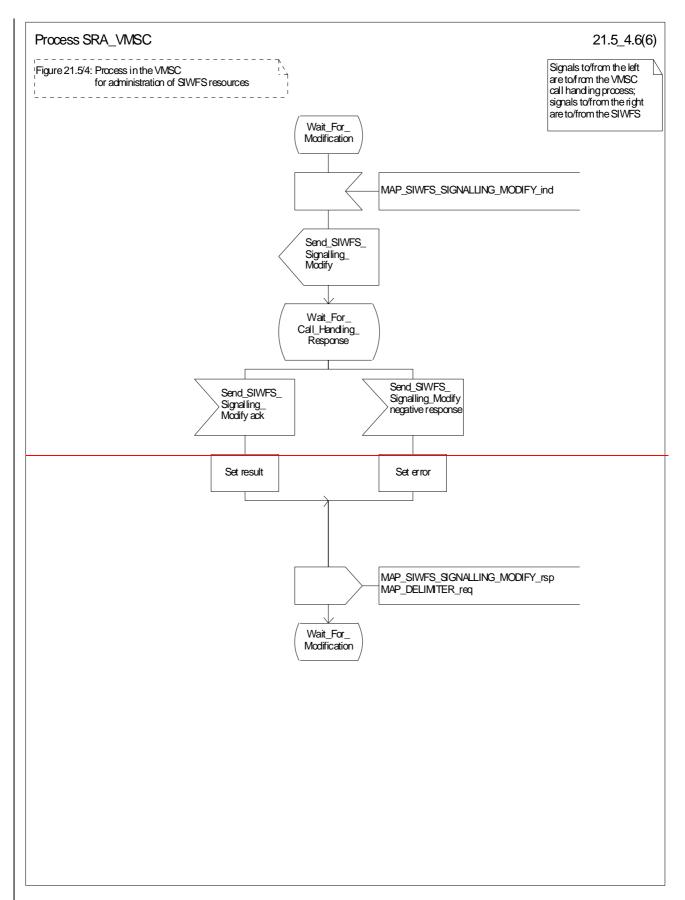


Figure 21.5/4 (sheet 6 of 6): Process SRA\_VMSC

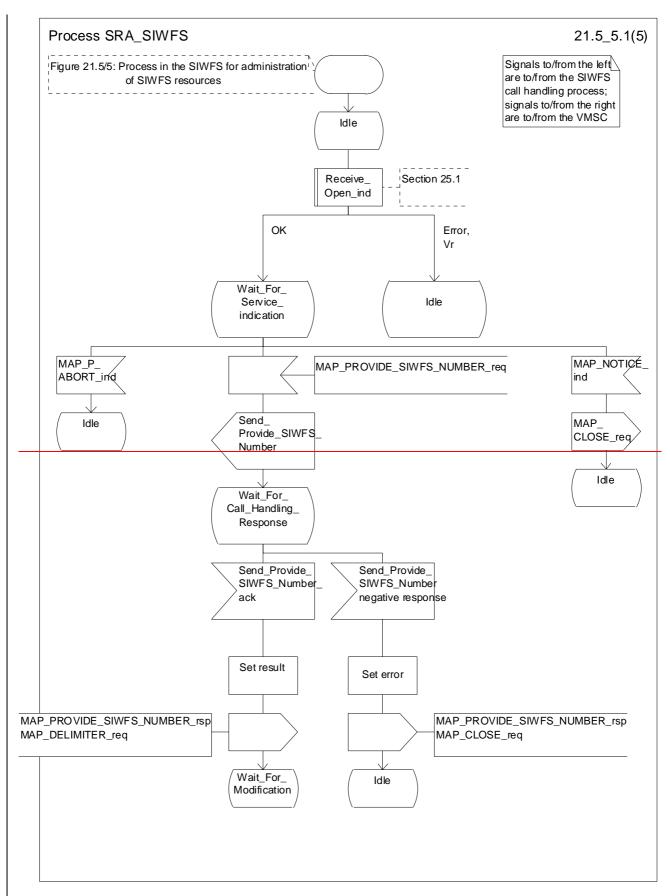


Figure 21.5/5 (sheet 1 of 5): Process SRA\_SIWFS

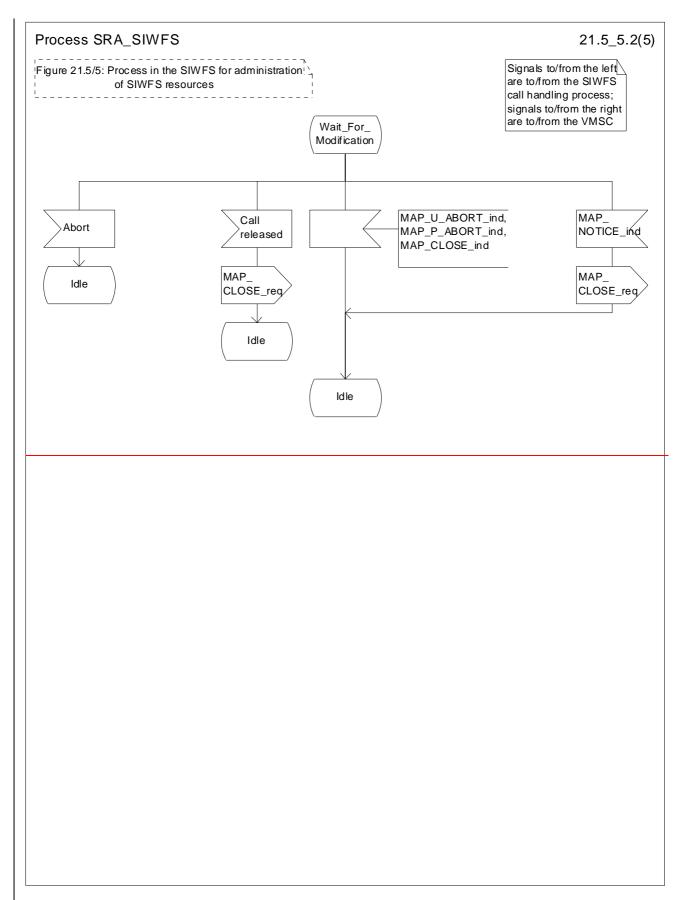


Figure 21.5/5 (sheet 2 of 5): Process SRA\_SIWFS

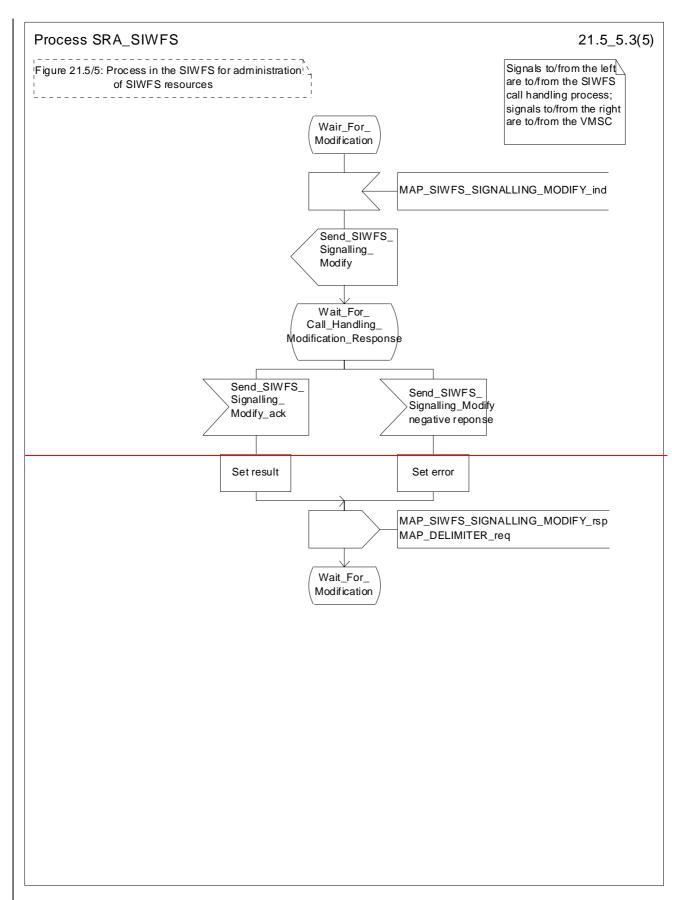


Figure 21.5/5 (sheet 3 of 5): Process SRA\_SIWFS

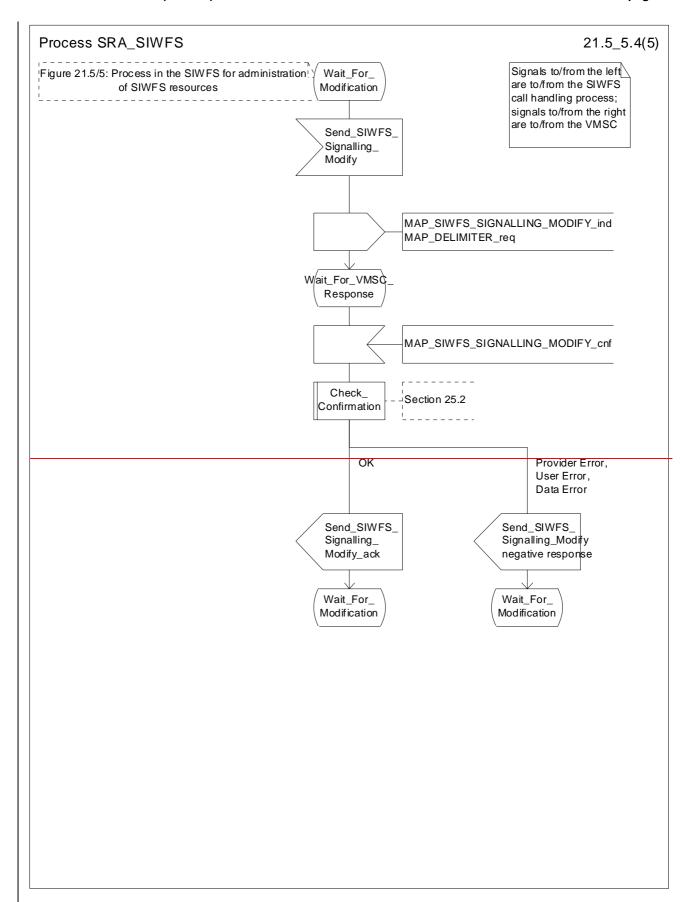


Figure 21.5/5 (sheet 4 of 5): Process SRA\_SIWFS

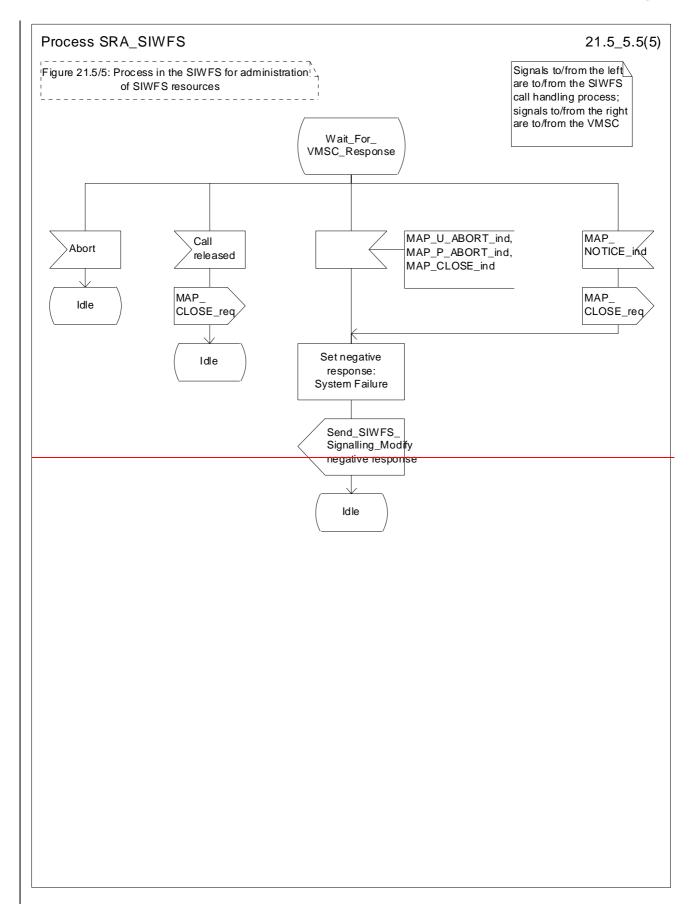


Figure 21.5/5 (sheet 5 of 5): Process SRA\_SIWFS

# 21.6 CCBS: monitoring and reporting the status of the subscriberSetting of Reporting State

# 21.6.13 Reporting co-ordinator process in the VLR

The MAP co-ordinating process in the VLR to handle a dialogue opened with the reporting application context is shown in figure 21.6/63. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see clause 25.1.1.

Any reporting process in the VLR starts by the VLR receiving a MAP OPEN service indication. If that service is successful, the VLR can handle reporting indications from the HLR. Table 21.6/1 shows the co-ordinating process' reaction on receipt of specific reporting indications from the HLR. After the relevant process is invoked, the received service indication is sent to that process.

Table 21.6/1: Relationship between received service indication and invoked process in the VLR

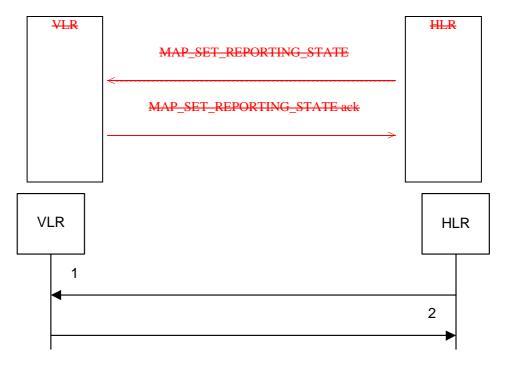
Service indication received	Process invoked
MAP_REMOTE_USER_FREE_ind	REMOTE_USER_FREE_VLR
MAP_SET_REPORTING_STATE_ind	SET_REPORTING_STATE_VLR

After creation of the user process the co-ordinator relays the messages between the MAP protocol machine and the invoked process until a request or an indication for dialogue termination is received.

# 21.6.2 Setting the reporting state – stand-alone

# 21.6.1 General

The message flow for setting the reporting state in a stand-alone dialogue is shown in figure 21.6.1/1.



- 1) MAP\_SET\_REPORTING\_STATE\_req/ind
- 2) MAP SET REPORTING STATE rsp/cnf

## Figure 21.6/1: Message Fflow for Setting the Rreporting Sstate - stand-alone dialogue

In Set Reporting State, the HLR can request a The MAP\_SET\_REPORTING\_STATE request can be used to start or a stop of monitoring in the VLR.

## 21.6.2.1 Process in the HLR for Set Reporting State stand-alone

The MAP process in the HLR to set the reporting state in the VLR in a separate-stand-alone dialogue is shown in figure 21.6/72. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

The result of a request to stop reporting is not reported to the CCBS application in the HLR.

#### **Successful Outcome**

When the MAP process receives a Start Reporting or Stop Reporting request from the CCBS application process in the HLR, it requests a dialogue with the VLR whose identity is contained in the request by sending a MAP\_OPEN service request and sending the necessary information using a MAP\_SET\_REPORTING\_STATE service request. The HLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the VLR.

If the MAP process receives a MAP\_SET\_REPORTING\_STATE service confirm from the VLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit and the request was for Start Reporting, the MAP process sends a positive acknowledgement containing the information received from the VLR to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the CCBS application process returns to the idle state.

#### Failure of dialogue opening with the VLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends (in the case of Start Reporting) a negative response to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the process returns to the idle state.

## Error in MAP\_SET\_REPORTING\_STATE confirm

If the MAP\_SET\_REPORTING\_STATE service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a negative response (in the case of Start Reporting) to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the CCBS application process returns to the idle state.

## **Abort of VLR dialogue**

After the dialogue with the VLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. If the request was for the Start Reporting, the MAP process sends a Start Reporting negative response to the CCBS application process in the HLR and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VLR, sends a negative response (in the case of the Start Reporting) indicating system failure to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the CCBS application process returns to the idle state.

### 21.6.2.24 Process in the VLR to set the reporting state

The MAP process in the VLR to set the reporting state is shown in figure 21.6/84.

The co-ordinator opens the process. The macro Receive\_Set\_Reporting\_State\_VLR handles the receipt of the request from the HLR, and the possible response from the CCBS application process in the VLR. When the macro exits, a MAP CLOSE is sent to the HLR and the process terminates.

The macro Set\_Reporting\_State\_VLR is defined shown in figure 21.6/95.

The MAP process does not wait for a response from the CCBS application process if the required reporting state is Stop.

When the VLR receives a MAP\_SET\_REPORTING\_STATE service indication, it checks whether the required monitoring state is stopped.

If the required monitoring state is stopped, the MAP process sends a Stop Reporting message to the CCBS application in the VLR, sends a MAP\_SET\_REPORTING\_STATE response to the HLR and exits from the macro.

If the required monitoring state is started, the MAP process sends a Start Reporting message to the CCBS application in the VLR and waits for a response.

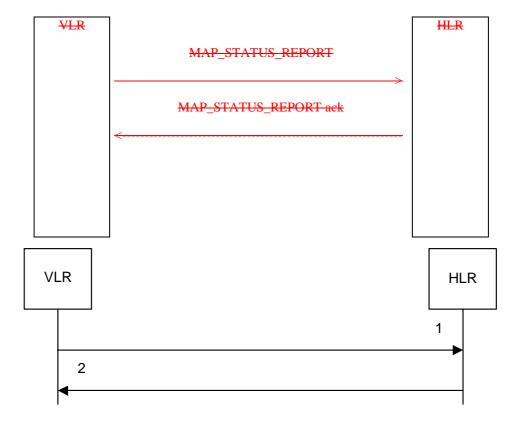
If the CCBS application sends a Start Reporting ack, the MAP process sends a MAP\_SET\_REPORTING\_STATE response to the HLR and exits from the macro.

If the CCBS application sends a Start Reporting negative response, the MAP process translates the negative response into a MAP user error, sends a MAP\_SET\_REPORTING\_STATE response to the HLR and exits from the macro.

# 21.6.37 Status Rreporting

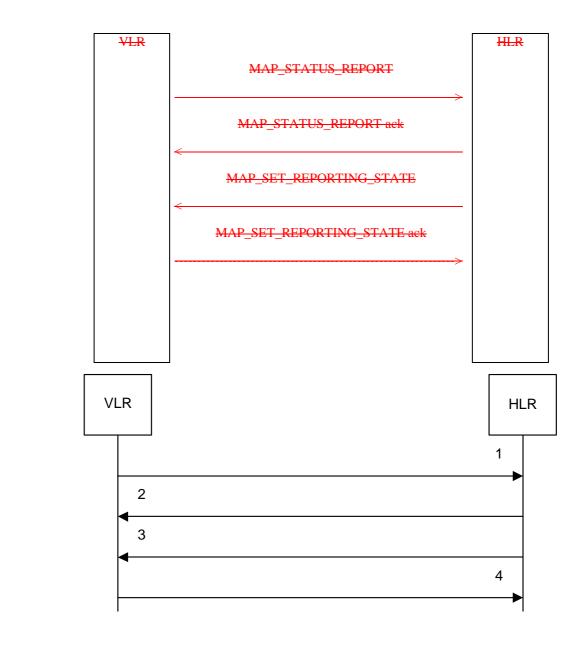
## 21.7.1 General

The message flows for reporting the status of a subscriber are shown in figures 21.6/27/1 and 21.6/37/2.



MAP\_STATUS\_REPORT\_req/ind
 MAP\_STATUS\_REPORT\_rsp/cnf

Figure 21.6/27/1: Message flow for Status reporting, when monitoring continues in the VLR



- 1) MAP STATUS REPORT reg/ind
- 2) MAP\_STATUS\_REPORT\_rsp/cnf
- MAP SET REPORTING STATE req/ind
- 4) MAP\_SET\_REPORTING\_STATE\_rsp/cnf

Figure 21.6/37/2: Message flow for Sstatus reporting, when monitoring stops

The MAP\_SET\_REPORTING\_STATE request is used to stop monitoring in the VLR. If the HLR requires the VLR to continue monitoring, it closes the dialogue without sending a MAP\_SET\_REPORTING\_STATE request.

When the HLR sends a MAP\_SET\_REPORTING\_STATE, it requests the stop of monitoring in the VLR.

# 21.<u>6.3.17.2</u> Process in the VLR for Status Reporting

The MAP process in the VLR to send a status report to the HLR is shown in figure 21.6/107/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2. This process can be used to report:

- an event, such as the user becoming free, or
- the result of a CCBS call attempt

#### to the HLR

#### Successful Outcome

When the MAP process receives a Event Report or CCBS Call Report from the CCBS application process in the VLR, it requests a dialogue with the HLR whose identity is contained in the request by sending a MAP\_OPEN service request, and requests status report using a MAP\_STATUS\_REPORT service request. The VLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

If the MAP process receives a MAP\_STATUS\_REPORT service confirm from the HLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends an Event Report ack or a CCBS Call Report ack containing the information received from the HLR to the CCBS application process in the VLR and waits for a possible instruction from the HLR to set the reporting state.

If the HLR requests the VLR to set a reporting state (in the macro Receive\_Set\_Reporting\_State\_VLR), the VLR closes the dialogue with the HLR by sending a MAP CLOSE to the HLR.

If the HLR requires monitoring in the VLR to continue, it closes the dialogue by sending a MAP\_CLOSE, and the MAP process in the VLR sends Continue Monitoring message to the CCBS application process in the VLR and returns to the idle state.

#### Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a Event Report negative response or CCBS Call Report negative response to the CCBS application process in the VLR and returns to the idle state.

#### Error in MAP\_STATUS\_REPORT confirm

If the MAP\_STATUS\_REPORT service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends an Event Report negative response or CCBS Call Report negative response to the CCBS application process in the VLR and returns to the idle state.

# Abort of HLR dialogue in State Wait\_For\_HLR\_Response

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a Event Report or CCBS Call Report negative response to the CCBS application process in the VLR and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the HLR. The VLR sends an Event Report negative response or CCBS Call Report negative response indicating system failure to the CCBS application process in the VLR and returns to the idle state.

#### Abort of HLR dialogue in State Wait\_For\_Set\_Reporting

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP P ABORT or a MAP U ABORT indication. In this case, the VLR returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the HLR and returns to the idle state.

#### 21.6.3.27.3 Process in the HLR for Status Reporting

The MAP process in the HLR to handle a status report is shown in figure  $21.\underline{6/117/4}$ . The MAP process invokes <u>a</u> macros not defined in this clause; the definitions of thisese macros can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1.;

Check Confirmation see clause 25.2.2.

<u>It is an implementation option whether to send the MAP\_DELIMITER request before invoking the macro Set\_Reporting\_State\_HLR.</u>

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context reporting, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

The MAP process invokes the macro Receive\_Status\_Report\_HLR to handle a MAP\_STATUS\_REPORT service indication; this macro is defined in figure 21.7/5. The MAP process then waits for a response from the CCBS application in the HLR.

If the MAP process receives a Stop Reporting message from the CCBS process, it sets the required monitoring state to stop, and may send a MAP\_DELIMITER service request to the VLR. The HLR then invokes the macro Set\_Reporting\_State\_HLR. After exiting the macro, the MAP process returns to the idle state.

If the MAP process receives a Continue Monitoring from the CCBS process, it sends a MAP CLOSE Request to VLR and returns to the idle state.

### Failure of dialogue opening with the VLR

If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

#### Abort of VLR dialogue in State Wait\_For\_Service\_Indication

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication. In this case, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VLR and returns to the idle state.

#### Macro Receive\_Status\_Report\_HLR

The macro Receive\_Status\_Report\_HLR is shown in figure 21.6/127/5.

When a MAP\_STATUS\_REPORT service indication is received, the HLR checks whether call report data are present.

If call report data are present, the MAP process sends a CCBS Call Report message to the CCBS application process in the HLR and waits for a response; otherwise it sends an Event Report message to the CCBS application process in the HLR and waits for a response.

If the MAP process receives a CCBS Call Report ack or Event Report ack from the CCBS application process in the HLR, it sends a MAP\_STATUS\_REPORT service confirm to the VLR and exits from the macro.

If the MAP process receives a CCBS Call Report negative response or Event Report negative response from the CCBS application process in the HLR, it sets the User Error according to the negative response, sends a MAP\_STATUS\_REPORT service confirm to the VLR and exits from the macro.

### Macro Set\_Reporting\_State\_HLR

The macro Set\_Reporting\_State\_HLR is shown in figure 21.6/13<del>7/6</del>. The macro invokes a macro not defined in this clause; the definition of this macro can be found as follows:

<u>Check\_Confirmation</u> see subclause 25.2.2.

The MAP process in the HLR sends a MAP\_SET\_REPORTING\_STATE service request to the VLR and waits for a response.

If the MAP process receives a MAP\_SET\_REPORTING\_STATE service confirm from the VLR, it invokes the macro Check Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the macro Set\_Reporting\_State\_HLR takes the OK exit.

If the macro Cheek\_Confirmation takes the Data error, Provider error or User error exit, the macro Set\_Reporting\_State\_HLR takes the Error exit.

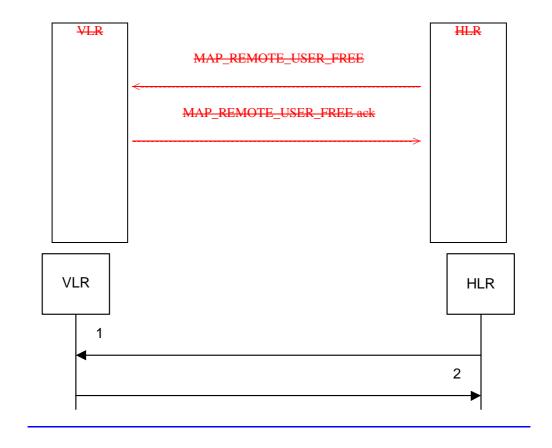
While the MAP process is waiting for a response from the VLR, the MAP provider may terminate the dialogue by sending a MAP\_CLOSE, MAP\_P\_ABORT or MAP\_U\_ABORT. In this case the macro takes the Aborted exit.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VLR and the macro takes the Aborted exit.

# 21.6.38 CCBS: Remote User Free

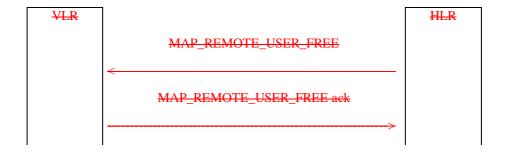
# 21.8.1 General

The message flows for handling remote user free are shown in figures 21.6/48/1 and 21.6/58/2.



MAP\_REMOTE\_USER\_FREE\_req/ind
 MAP\_REMOTE\_USER\_FREE\_rsp/cnf

Figure 21.6/48/1: Remote User Free: recall not accepted



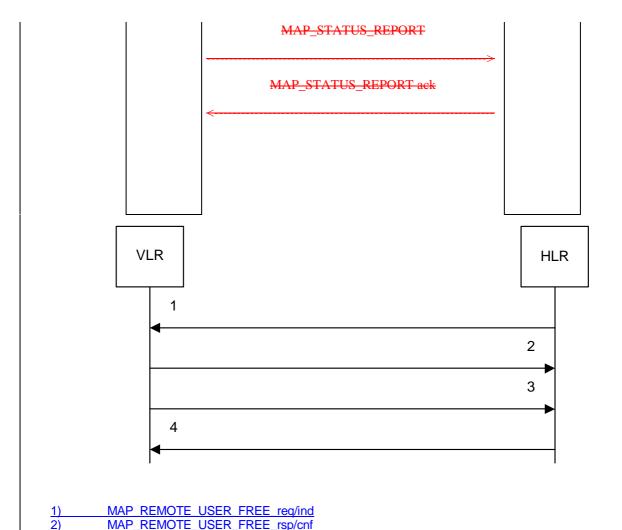


Figure 21.6/58/2: Remote User Free: recall accepted

# 21.6.3.18.2 Process in the HLR for Remote User Free

MAP STATUS REPORT req/ind MAP STATUS REPORT rsp/cnf

The MAP process in the HLR to handle Remote User Free is shown in figure 21.6/148/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

#### **Successful Outcome**

When the MAP process receives a CCBS RUF request from the CCBS application process in the HLR, it requests a dialogue with the VLR whose identity is contained in the request by sending a MAP\_OPEN service request and sending the necessary information using a MAP\_REMOTE\_USER\_FREE service request. The HLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the VLR.

If the MAP process receives a MAP\_REMOTE\_USER\_FREE service confirm from the VLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a CCBS RUF ack containing the information received from the VLR to the CCBS application process in the HLR and waits for a MAP\_STATUS\_REPORT service indication from the VLR. If in this state a MAP\_CLOSE service indication is received, the MAP process returns to the idle state. If in this state a MAP\_STATUS\_REPORT service indication is

received, further processing is described by the macro Receive\_Status\_Report\_HLR (described in clause 21.7.3). When the macro exits, the MAP process constructs a MAP\_CLOSE service request, sends it to the VLR and returns to the idle state-

#### Failure of dialogue opening with the VLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a negative response to the CCBS application process in the HLR and returns to the idle state.

### Error in MAP\_REMOTE\_USER\_FREE confirm

If the MAP\_REMOTE\_USER\_FREE service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a CCBS RUF negative response to the CCBS application process in the HLR and returns to the idle state.

### **Abort of VLR dialogue**

When the MAP process is waiting for a VLR response to the MAP\_REMOTE\_USER\_FREE, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a CCBS RUF negative response to the CCBS application process in the HLR and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for a VLR response to the MAP\_REMOTE\_USER\_FREE, the MAP process closes the dialogue with the VLR, sends a CCBS RUF negative response indicating system failure to the CCBS application process in the HLR and returns to the idle state.

When the MAP process is waiting for a possible MAP\_STATUS\_REPORT from the VLR, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for a possible MAP\_STATUS\_REPORT from the VLR, the MAP process closes the dialogue with the VLR and returns to the idle state.

If the CCBS application in the HLR decides to abort the dialogue, it sends an Abort message to the MAP process, which closes the dialogue with the VLR and returns to the idle state.

#### 21.6.3.28.3 Process in the VLR for Remote User Free

The MAP process in the VLR to handle Remote User Free is shown in figure 21.6/158/4. The MAP process invokes a macro not defined in this clause; the definitions of this macro can be found as follows:

Check\_Confirmation see subclause 25.2.2.

#### Successful outcome (Recall accepted)

When the MAP process receives a MAP\_REMOTE\_USER\_FREE service indication, the VLR sends a CCBS RUF request to the CCBS application process in the VLR, and waits for a response. The request contains the parameters received in the MAP\_REMOTE\_USER\_FREE service indication.

If the CCBS application process in the VLR returns a positive response indicating "recall accepted", the MAP process constructs a MAP\_REMOTE\_USER\_FREE service response and a MAP\_DELIMITER service request, sends them to the VLR and waits for a CCBS Call Report message from the CCBS application process in the VLR. When the MAP process receives the CCBS Call Report from the CCBS application process in the VLR, it constructs a MAP\_STATUS\_REPORT service request and a MAP\_DELIMITER service request, sends them to the HLR and waits for a response. If the MAP process receives a MAP\_STATUS\_REPORT service confirm, the VLR calls the macro Check\_Confirmation. If this macro takes the OK exit, the MAP process sends a CCBS Call Report ack to the CCBS application process in the VLR and the MAP process terminates.

## Successful outcome (Recall not accepted)

If the CCBS application process in the VLR returns a positive response indicating "recall not accepted", the MAP process constructs a MAP\_REMOTE\_USER\_FREE service response and a MAP\_CLOSE service request, sends them to the HLR and terminates.

### Negative response from VLR CCBS application process

If the CCBS application process in the VLR returns a negative response, the MAP process constructs a MAP\_REMOTE\_USER\_FREE service response containing the appropriate error and a MAP\_CLOSE service request, sends them to the HLR and terminates.

#### Failure of dialogue with the HLR

When waiting for a response or a call result from the CCBS application process in the VLR, the MAP process may receive a MAP\_CLOSE service indication, a MAP\_U\_ABORT service indication or a MAP\_P\_ABORT service indication from the co-ordinating process, in which case the MAP process terminates.

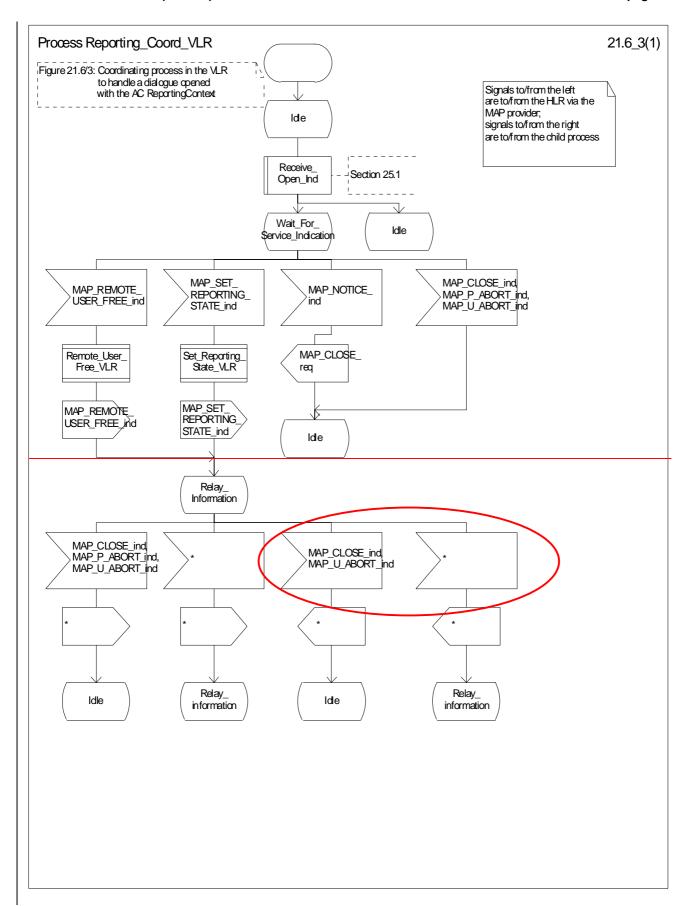
When waiting for a call result from the CCBS application process in the VLR, the MAP process may receive a MAP\_NOTICE indication from the co-ordinating process, in which case the MAP process constructs a MAP\_CLOSE service request, sends it to the co-ordinating process and terminates.

When waiting for a response from the HLR, the MAP process may receive a MAP\_CLOSE indication, a MAP\_U\_ABORT indication or a MAP\_P\_ABORT indication from the co-ordinating process, in which case the MAP process sends a CCBS Call Report negative response to the CCBS application process in the VLR and terminates.

When waiting for a response from the HLR, the MAP process may receive a MAP\_NOTICE indication from the co-ordinating process, in which case the MAP process constructs a MAP\_CLOSE service request, sends it to the co-ordinating process, sends a CCBS Call Report negative response to the CCBS application process in the VLR and terminates.

#### **Error in MAP STATUS REPORT confirm**

If the MAP\_STATUS\_REPORT service confirm contains a user error or a provider error, the MAP process sends a CCBS Call Report negative response to the CCBS application process in the VLR and terminates.



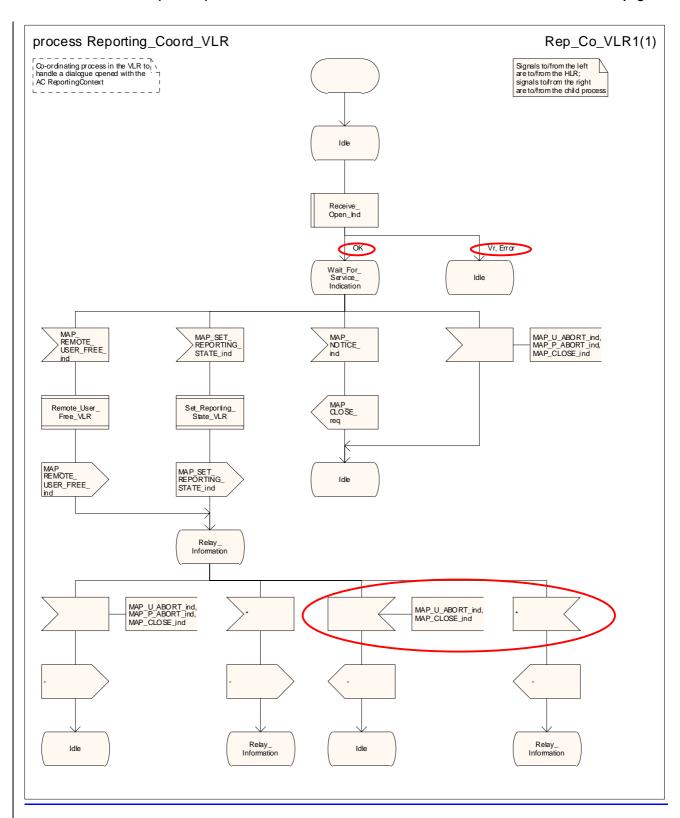
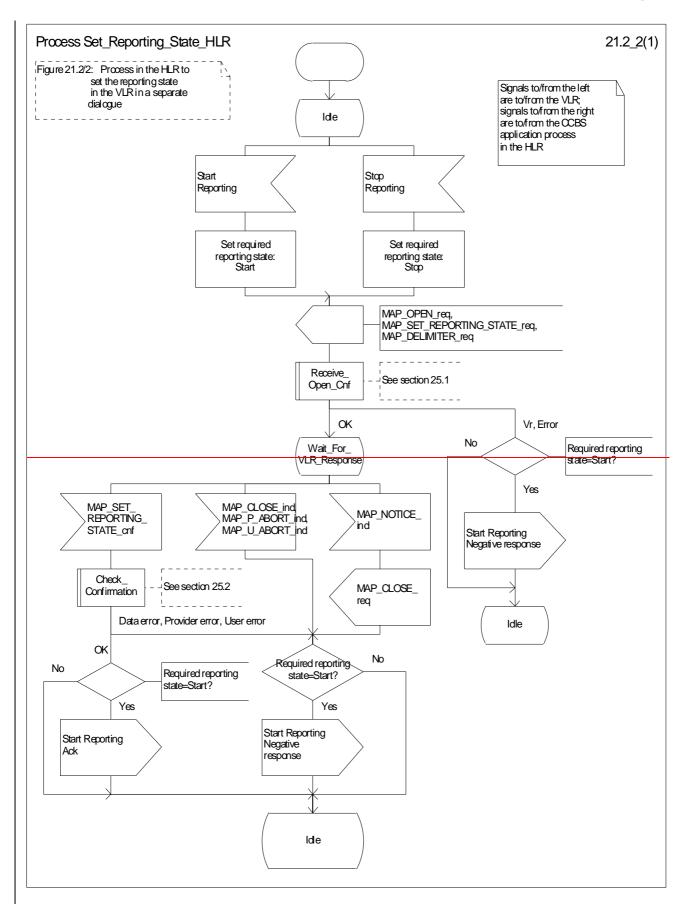


Figure 21.6/63: Process Reporting\_Coord\_VLR



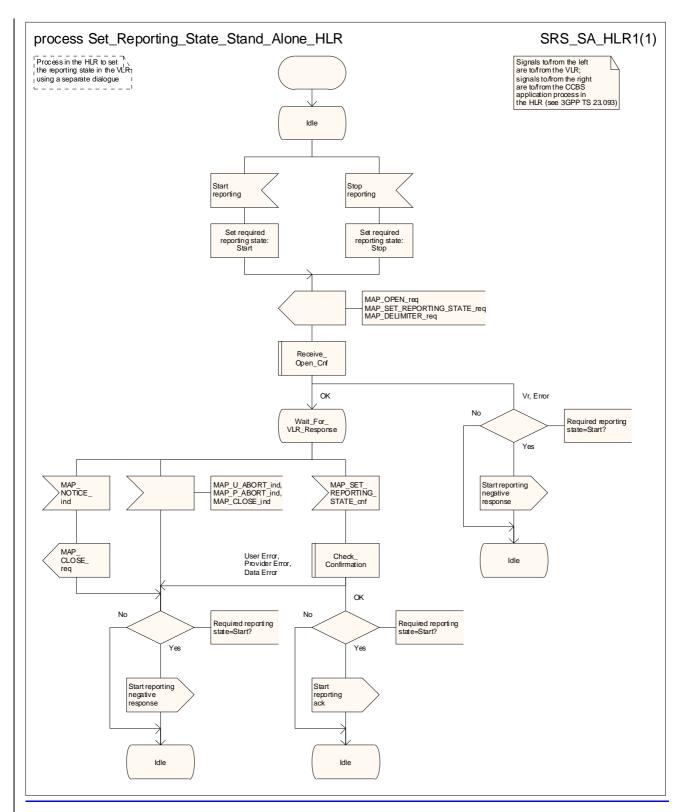
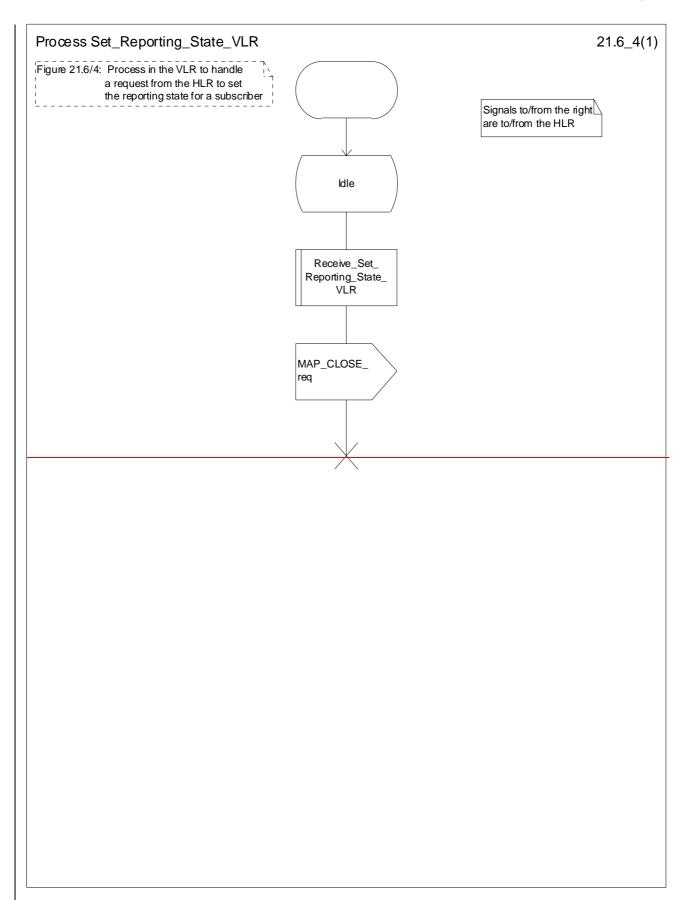


Figure 21.6/72: Process Set\_Reporting\_State\_Stand\_Alone\_HLR



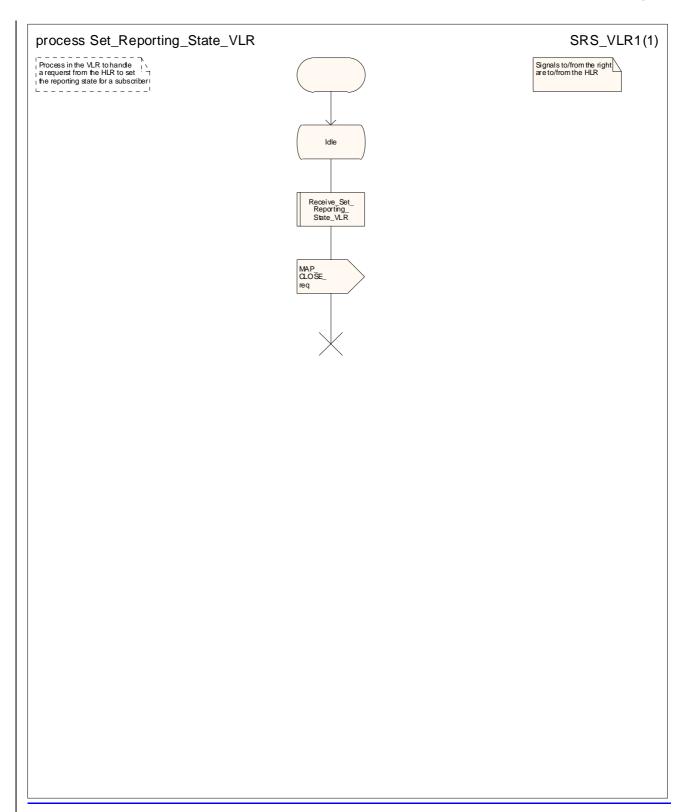
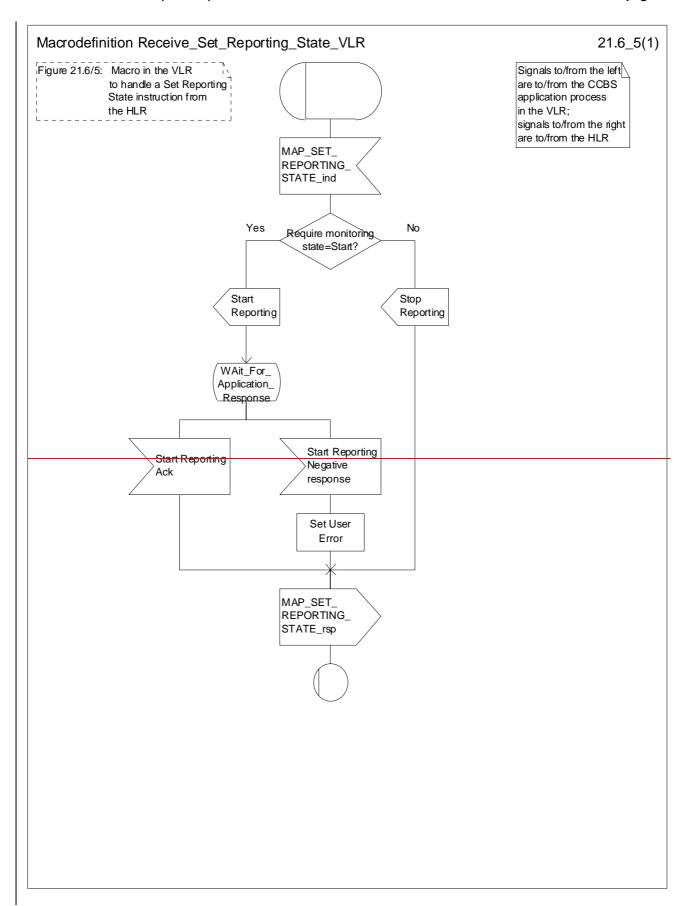


Figure 21.6/84: Process Set\_Reporting\_State\_VLR



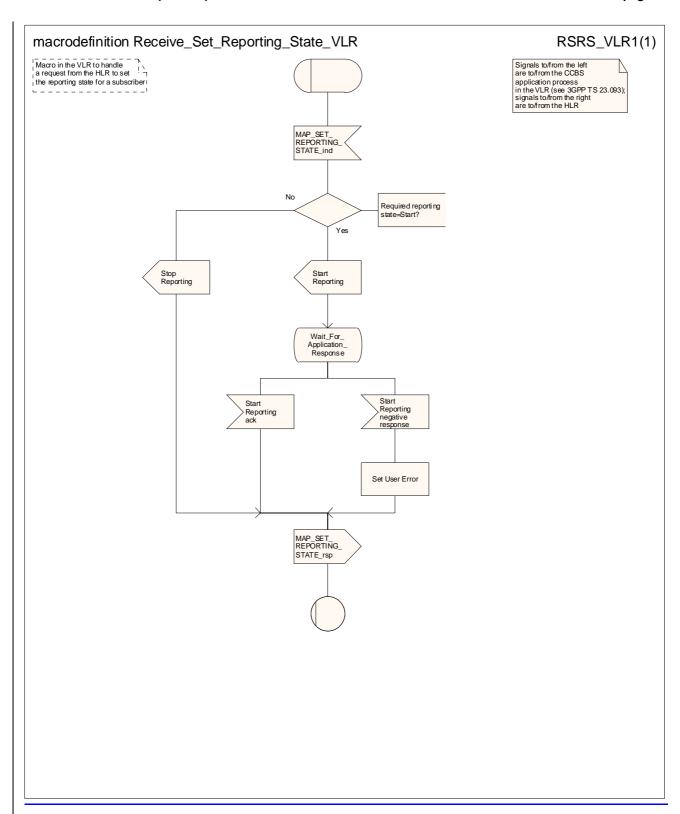
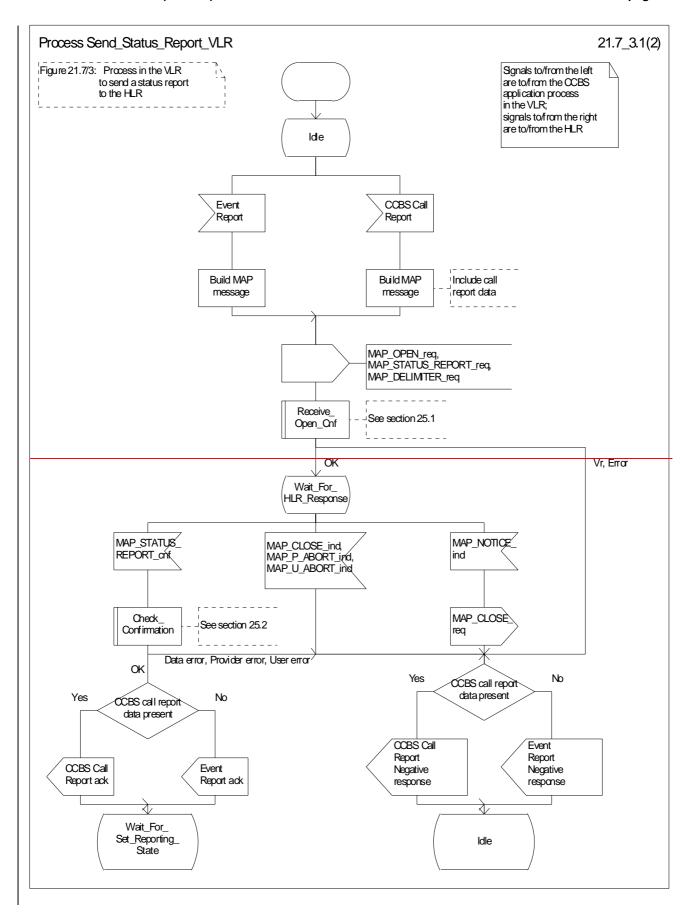


Figure 21.6/95: Macro Receive\_Set\_Reporting\_State\_VLR



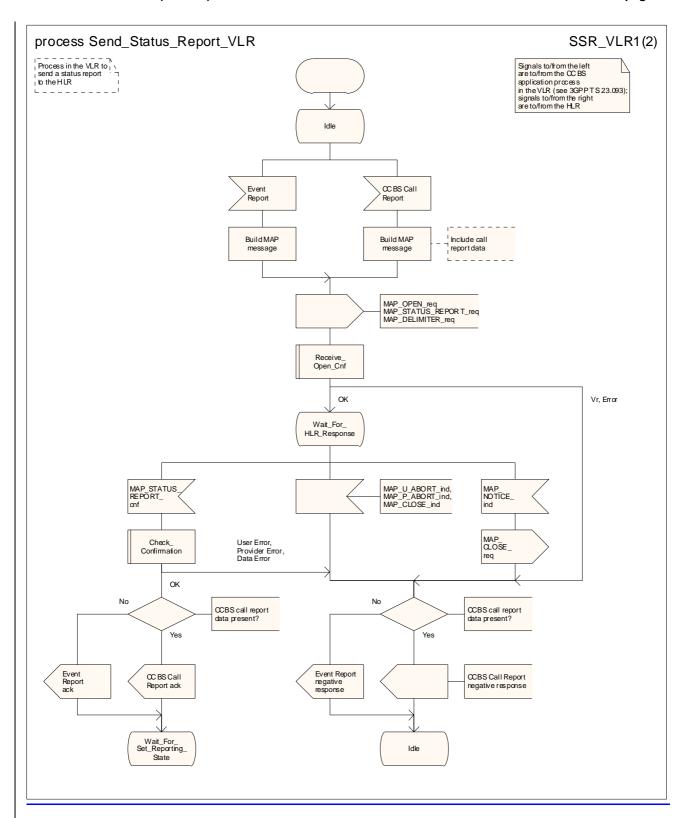
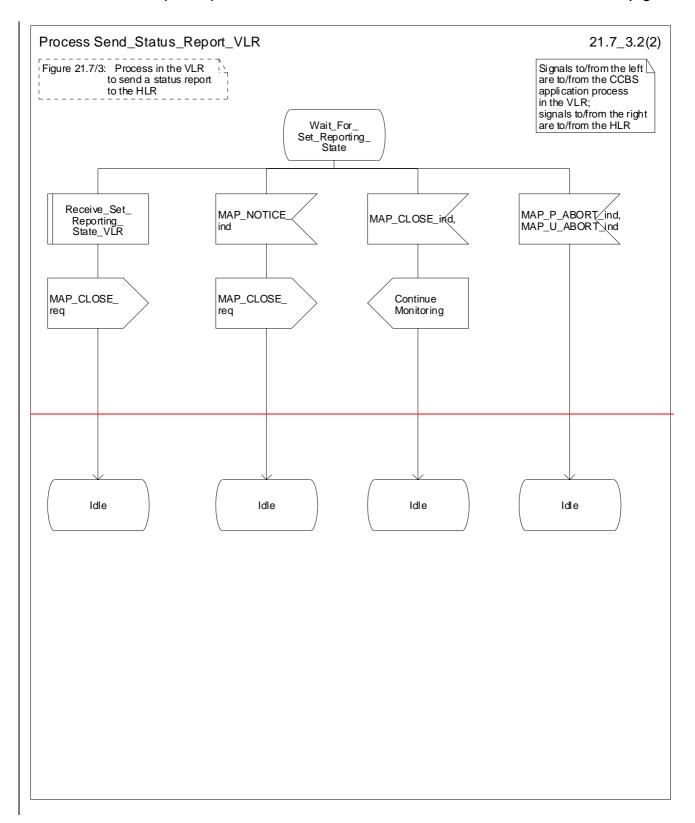


Figure 21.6/107/3 (sheet 1 of 2): Process Send\_Status\_Report\_VLR



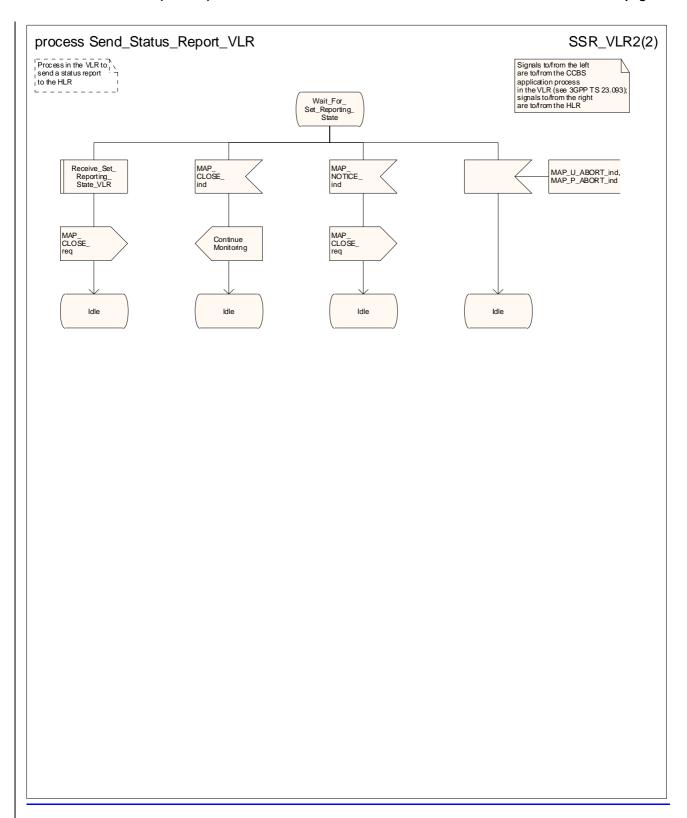
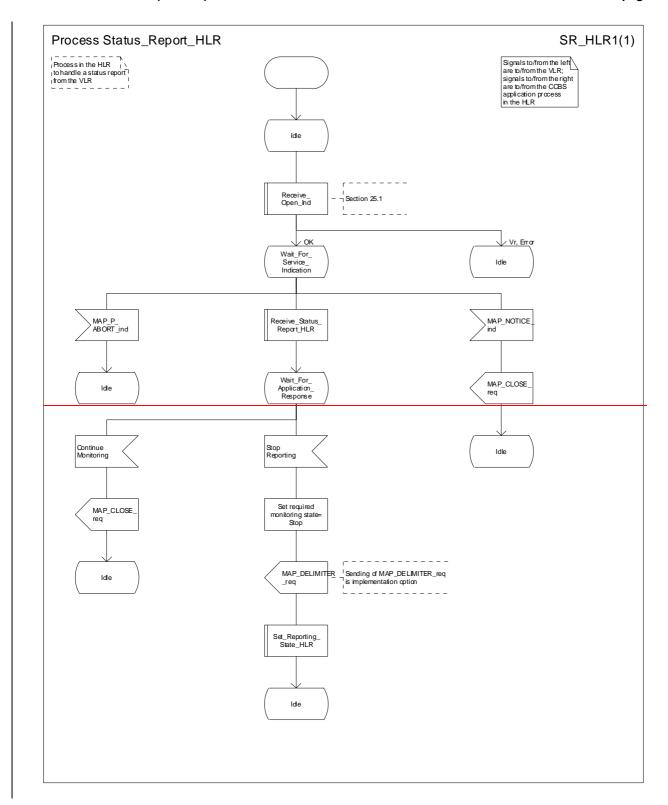


Figure 21.6/107/3 (sheet 2 of 2): Process Send\_Status\_Report\_VLR



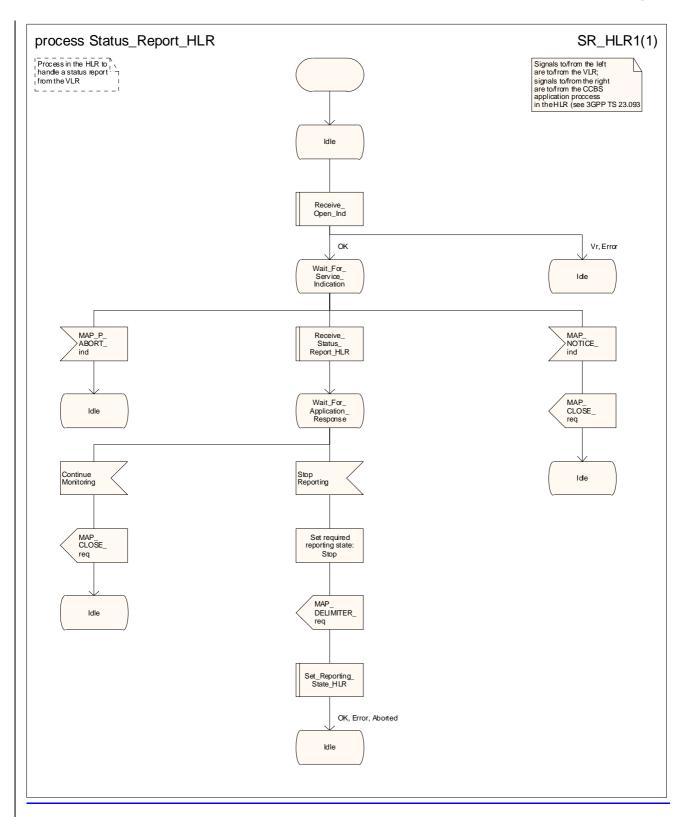
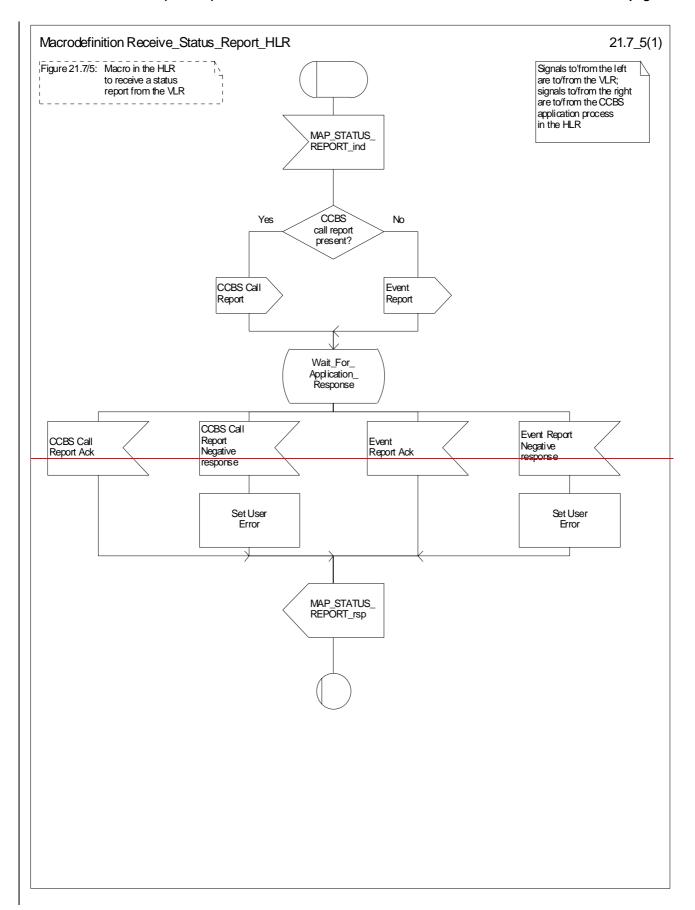


Figure 21.6/117/4: Process Status Report\_HLR



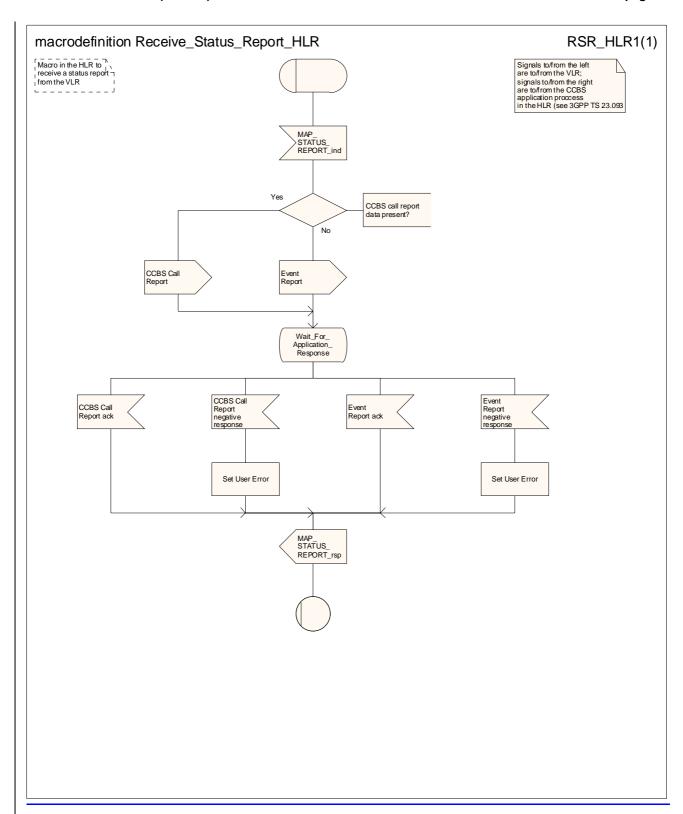
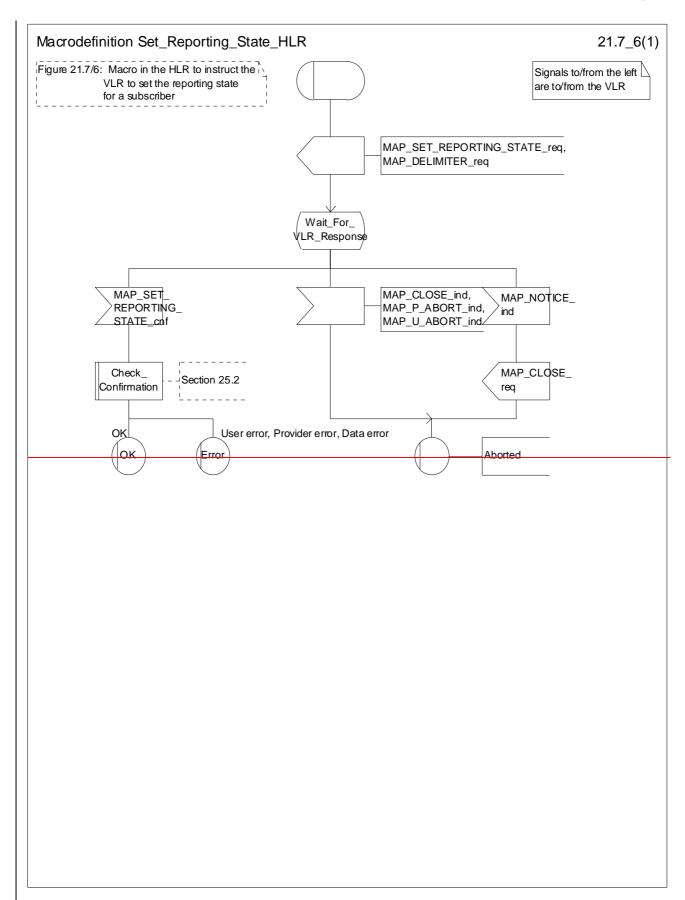


Figure 21.6/127/5: Macro Receive\_Status\_Report\_HLR



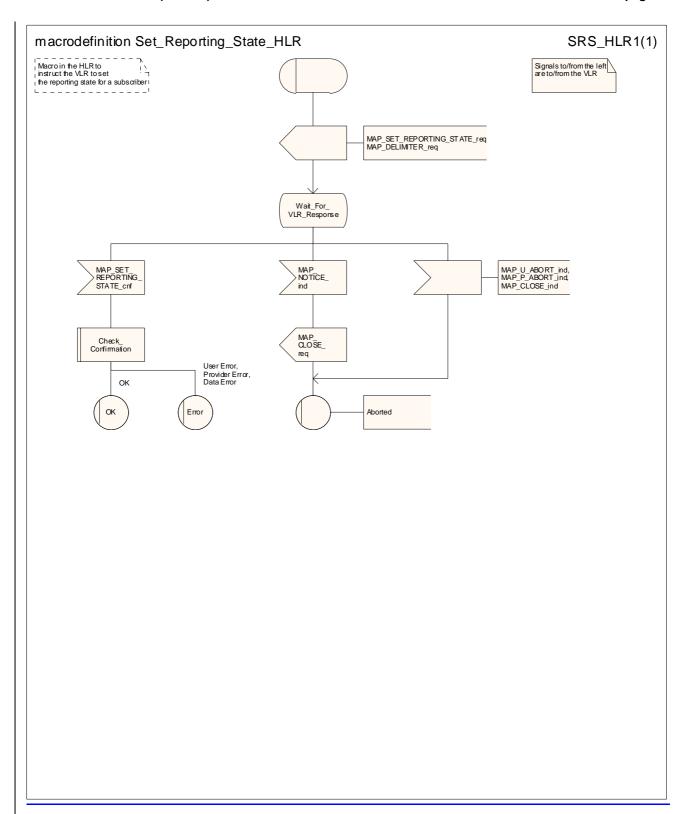
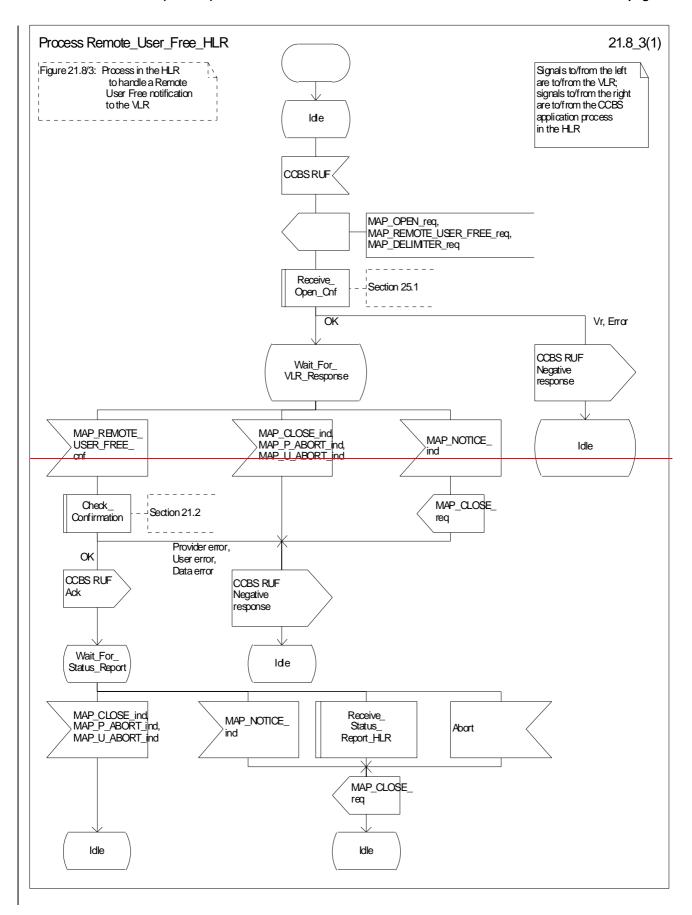


Figure 21.6/137/6: Macro Set\_Reporting\_State\_HLR



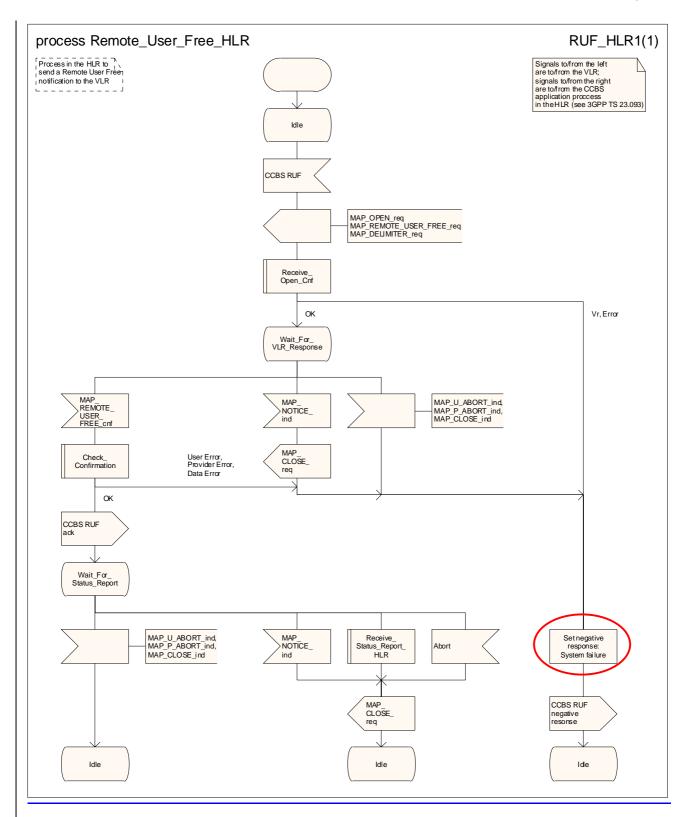
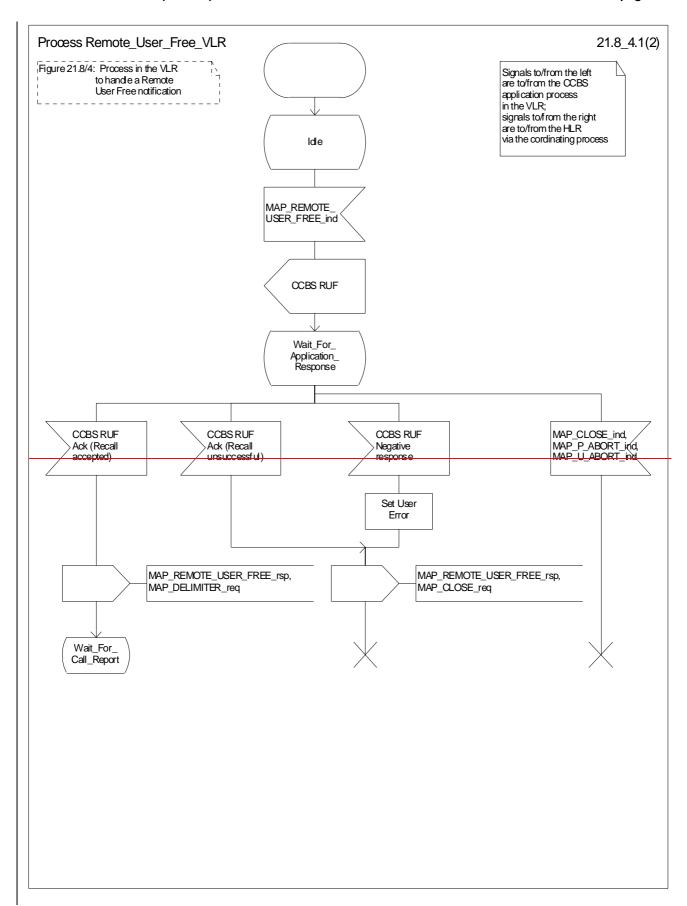


Figure 21.6/148/3: Process Remote\_User\_Free\_HLR



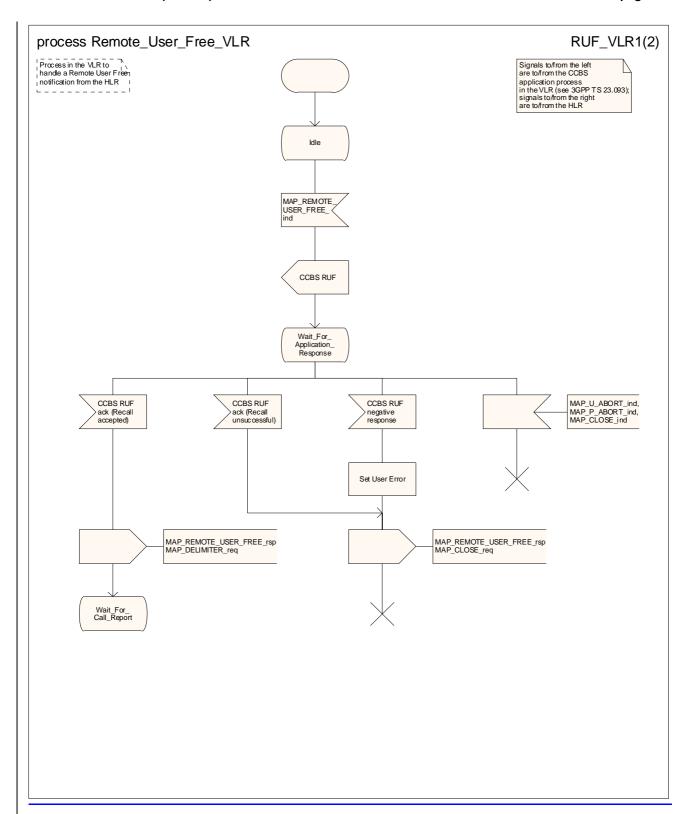
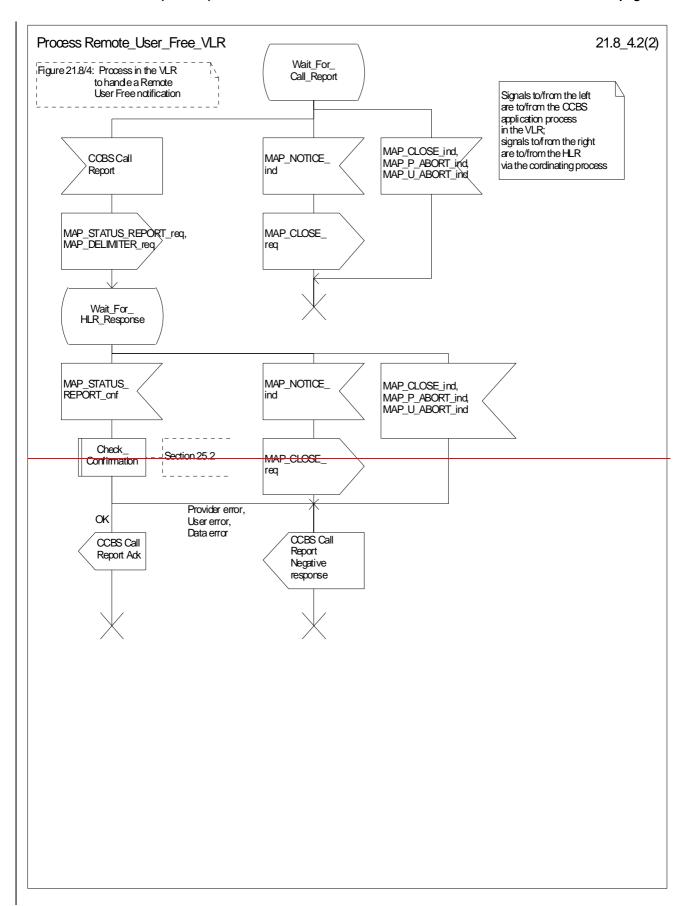


Figure 21.6/158/4 (sheet 1 of 2): Process Remote\_User\_Free\_VLR



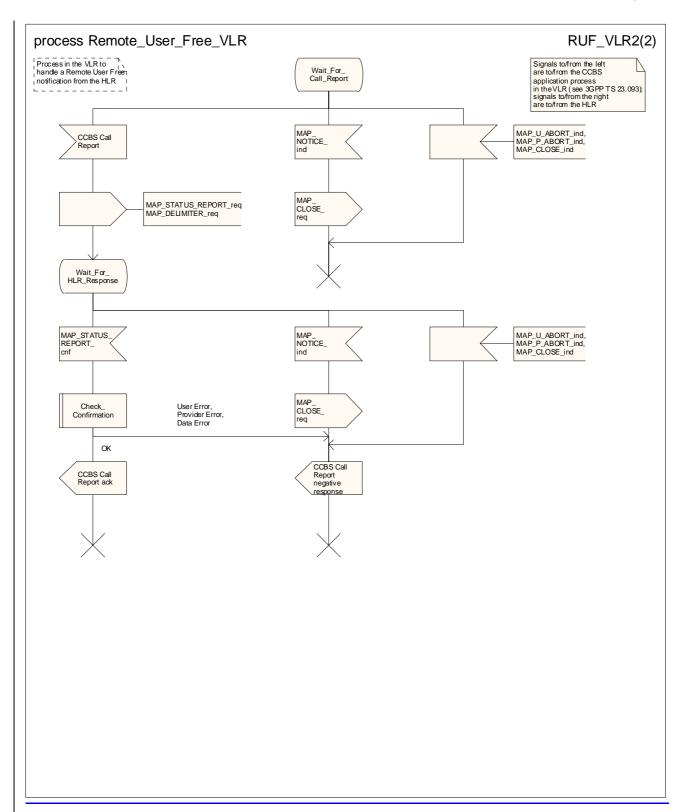


Figure 21.6/158/4 (sheet 2 of 2): Process Remote\_User\_Free\_VLR

#### 21.7 Void

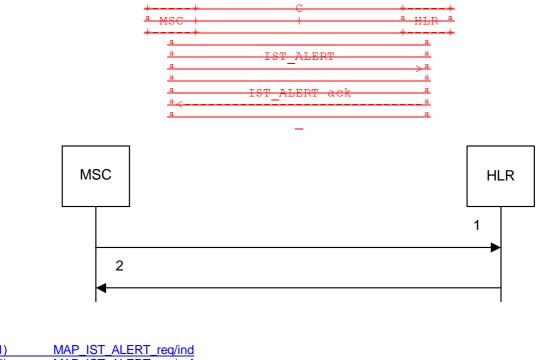
#### 21.8 Void

#### Immediate Service Termination (IST) Alert 21.9

#### 21.9.1 IST AlertGeneral

The Immediate Service Termination Alert procedure is used to keep track of the call activities performed by IST subscribers who are marked as being subject to IST monitoring and, eventually possibly, to terminate the alerted call activities for which the alert was sent, or all the call activities related to the alerted subscriber for whom the alert was sent.

The message flow for alerting and possibly terminating the call(s) is shown in figure 21.9/1; where the MSC may be a Visited MSC or a Gateway MSC.



MAP\_IST\_ALERT\_rsp/cnf

Figure 21.9/1: Message flow for IST Alert

#### 21.9.1.12 Procedure in the MSC

The MAP process in the MSC (Visited MSC or Gateway MSC) is shown in figure 21.9/32. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

—Receive\_Open\_Cnf see subclause 25.1.2; -Check\_Confirmation see subclause 25.2.2.

#### **Successful Outcome**

When the MAP process receives an IST Alert request from a call handling process in the Visited MSC or Gateway MSC, it requests a dialogue with the HLR that the subscriber belongs to, by sending a MAP\_OPEN service request, a MAP\_IST\_ALERT service request, and a MAP\_DELIMITER service request. The MSC then invokes the macro

Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

If the MAP process receives a MAP\_IST\_ALERT service confirm from the HLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends a IST Alert ack containing the information received from the HLR to the call handling process in the MSC and returns to the idle state.

#### Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a negative response to the call handling process in the MSC, and returns to the idle state.

#### **Error in MAP IST ALERT confirm**

If the MAP\_IST\_ALERT service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a negative response to the call handling process in the MSC, and returns to the idle state.

#### **Abort of HLR dialogue**

When the MAP process is waiting for an HLR response to the MAP\_IST\_ALERT, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a negative response to the call handling process in the MSC, and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for an HLR response to the MAP\_IST\_ALERT, the MAP process closes the dialogue with the HLR, sends a negative response to the call handling process in the MSC, and returns to the idle state.

#### 21.9.1.23 Procedure in the HLR

The MAP process in the HLR is shown in figure 21.9/43. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

—Receive Open Ind see subclause 25.1.1;

#### Successful outcome

When the MAP process in the HLR receives a request to open a dialogue, it invokes the macro Receive\_Open\_Ind to check if the dialogue can be opened.

If the dialogue can be opened, and the service indication received is a MAP\_IST\_ALERT, the HLR then sends the IST alert indication to the call handling process in the HLR, and waits for a response.

If the call handling process in the HLR returns a positive response, the MAP process constructs a MAP\_IST\_ALERT service response and a MAP\_CLOSE service request, sends them to the MSC, and returns to the idle state.

#### Negative response from HLR call handling process

If the call handling process in the HLR returns a negative response, the MAP process constructs a MAP\_IST\_ALERT service response containing the appropriate error and a MAP\_CLOSE service request, sends them to the MSC and returns to the idle state.

#### Failure of dialogue opening in the HLR

If the macro Recive Open Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

#### **Abort of MSC dialogue**

If the MAP process receives a MAP\_P\_ABORT indication before receiving a service indication, the MAP process returns to the idle state.

When the MAP process receives a MAP\_NOTICE indication before receiving a service indication, the MAP process closes the dialogue with the MSC, and returns to the idle state.

When the MAP process is waiting for the application response to the IST Alert, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process returns to the idle state.

### 21.9.210 IST Command

#### 21.10.1 General

The Immediate Service Termination Command procedure is used to terminate the call activities related to a subscriber.

The message flow for the IST Command service-procedure is shown in figure 21.9/210/1; where the MSC may be a Visited MSC or a Gateway MSC.

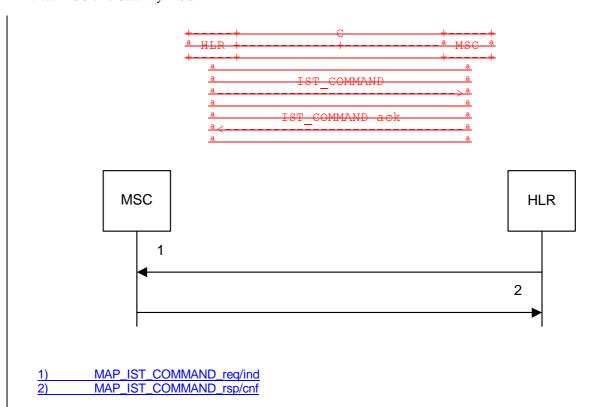


Figure 21.9/210/1: Message flow for IST Command

#### 21.<u>9.2.</u>1<del>0.2</del> Procedure in the HLR

The MAP process in the HLR is shown in figure  $21.\underline{9/5}\frac{10/2}{10/2}$ . The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

#### **Successful Outcome**

When the MAP process receives an IST Command request, it requests a dialogue with the MSC (Gateway MSC or Visited MSC), by sending a MAP\_OPEN service request, a MAP\_IST\_COMMAND service request, and a MAP\_DELIMITER service request. The HLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the MSC.

If the MAP process receives a MAP\_IST\_COMMAND service confirm from the MSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends a IST Command ack containing the information received from the MSC to the call handling process in the HLR and returns to the idle state.

#### Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a negative response to the call handling process in the HLR, and returns to the idle state.

#### Error in MAP\_IST\_COMMAND confirm

If the MAP\_IST\_COMMAND service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a negative response to the call handling process in the HLR, and returns to the idle state.

#### **Abort of MSC dialogue**

When the MAP process is waiting for an MSC response to the MAP\_IST\_COMMAND, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a negative response to the call handling process in the HLR, and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for an MSC response to the MAP\_IST\_COMMAND, the MAP process closes the dialogue with the MSC, sends a negative response to the call handling process in the HLR, and returns to the idle state.

### 21.<u>9.2.2</u><del>10.3</del> Procedure in the MSC

The MAP process in the MSC is shown in figure 21.9/610/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

—Receive Open Ind see subclause 25.1.1.

#### Successful outcome

When the MAP process in the MSC receives a request to open a dialogue, it invokes the macro Receive\_Open\_Ind to check if the dialogue can be opened.

If the dialogue can be opened, and the service indication received is a MAP\_IST\_COMMAND, the MSC then sends the IST command indication to the call handling process in the MSC, and waits for a response.

If the call handling process in the MSC returns a positive response, the MAP process constructs a MAP\_IST\_COMMAND service response and a MAP\_CLOSE service request, sends them to the HLR, and returns to the idle state.

#### Negative response from MSC call handling process

If the call handling process in the MSC returns a negative response, the MAP process constructs a MAP\_IST\_COMMAND service response containing the appropriate error and a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

#### Failure of dialogue opening in the MSC

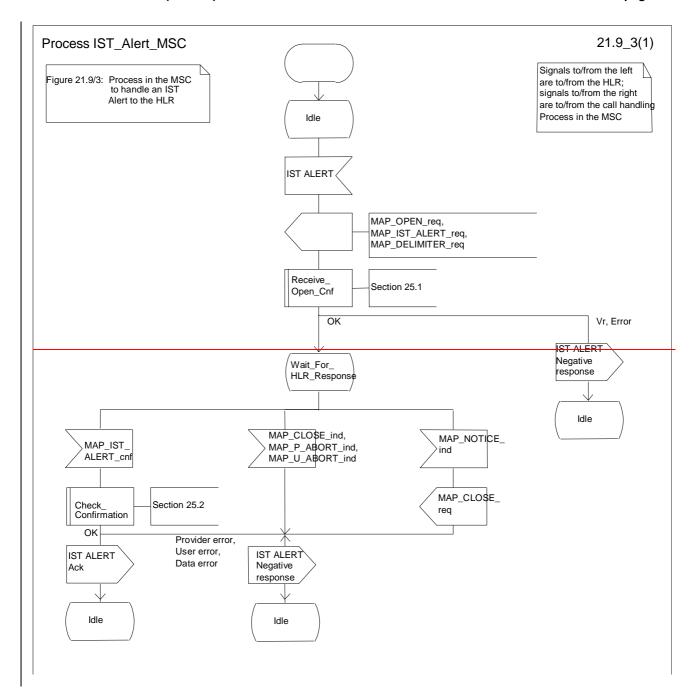
If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

#### Abort of HLR dialogue

If the MAP process receives a MAP\_P\_ABORT indication before receiving a service indication, the MAP process returns to the idle state.

When the MAP process receives a MAP\_NOTICE indication before receiving a service indication, the MAP process closes the dialogue with the HLR, and returns to the idle state.

When the MAP process is waiting for the application response to the IST Command, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process returns to the idle state.



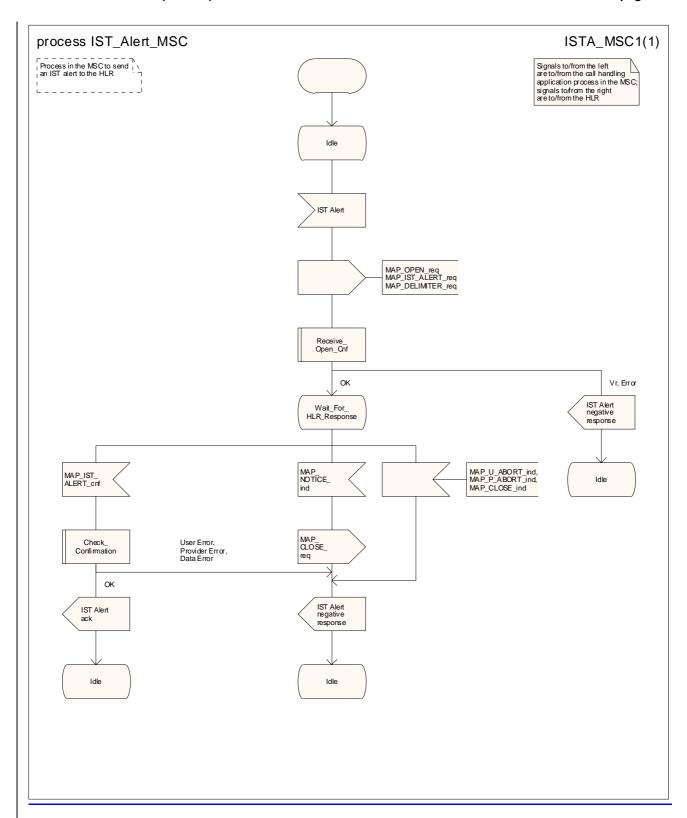
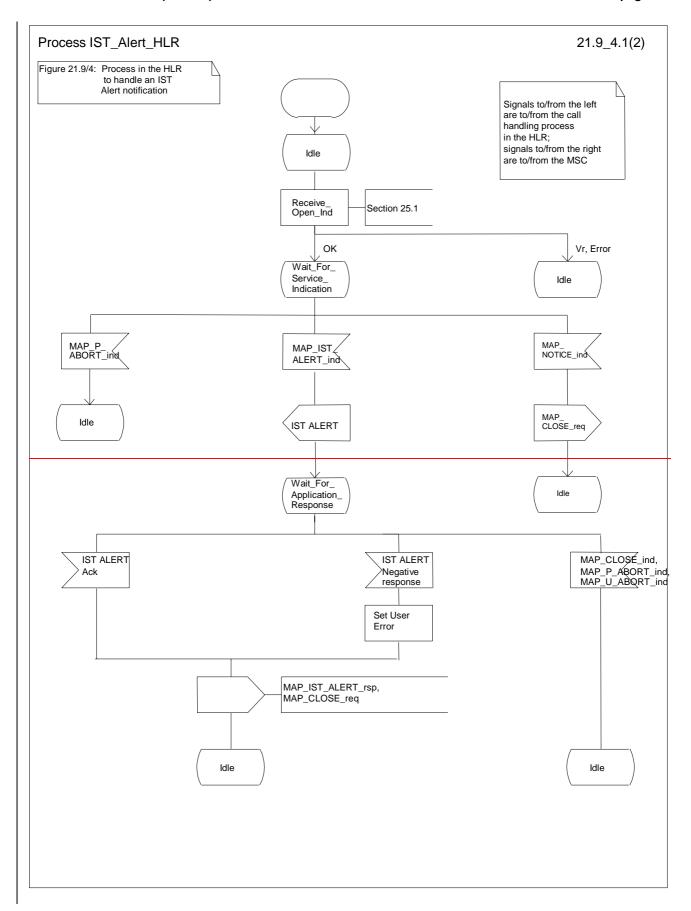


Figure 21.9/32: Process IST\_Alert\_MSC



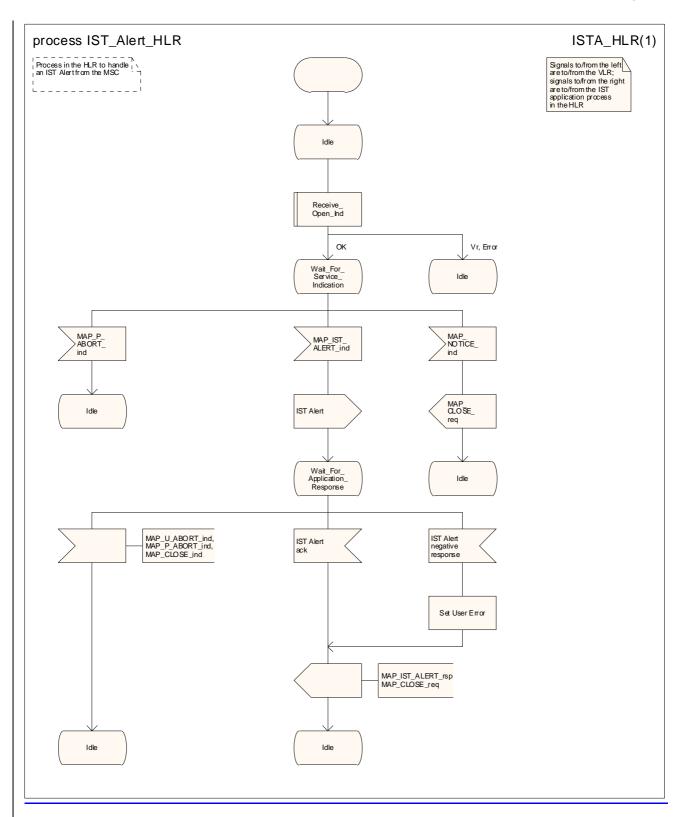
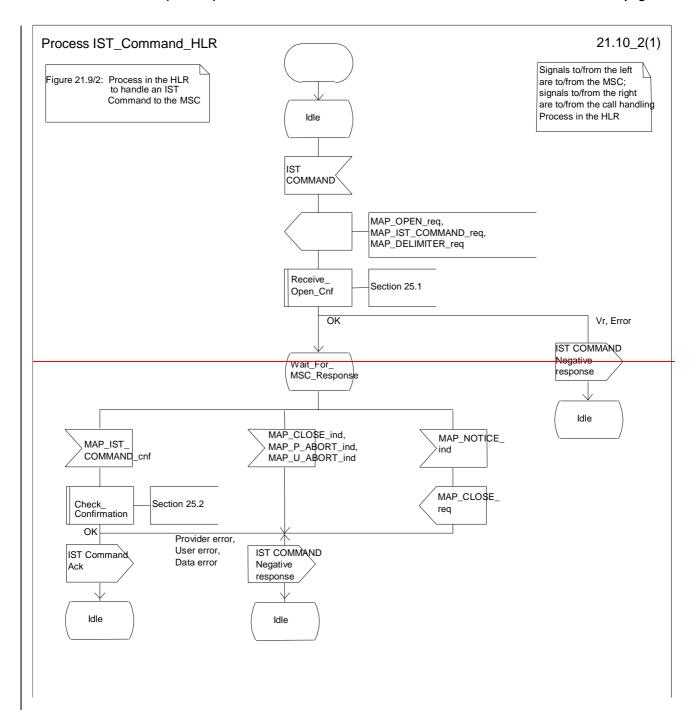


Figure 21.9/43: Process IST\_Alert\_HLR



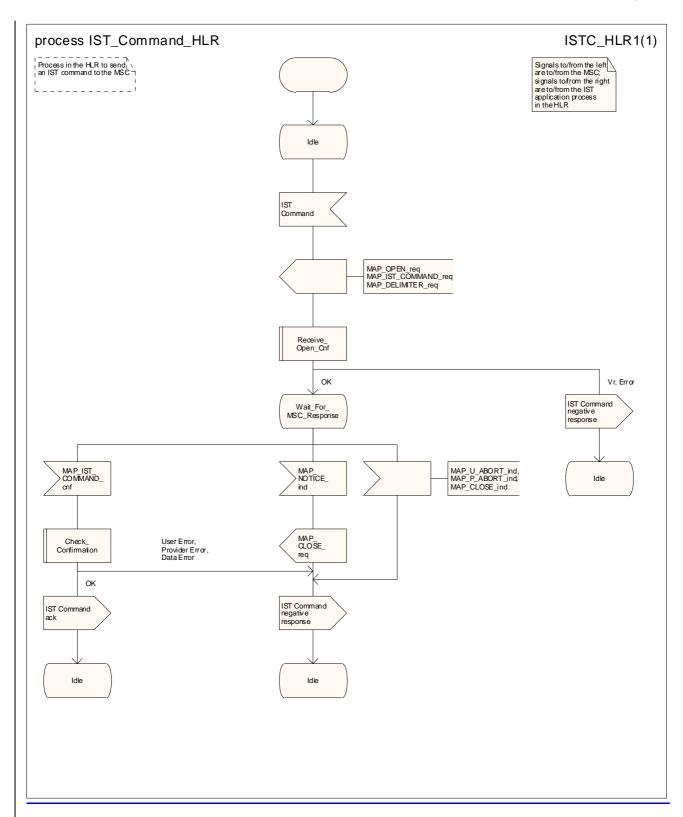
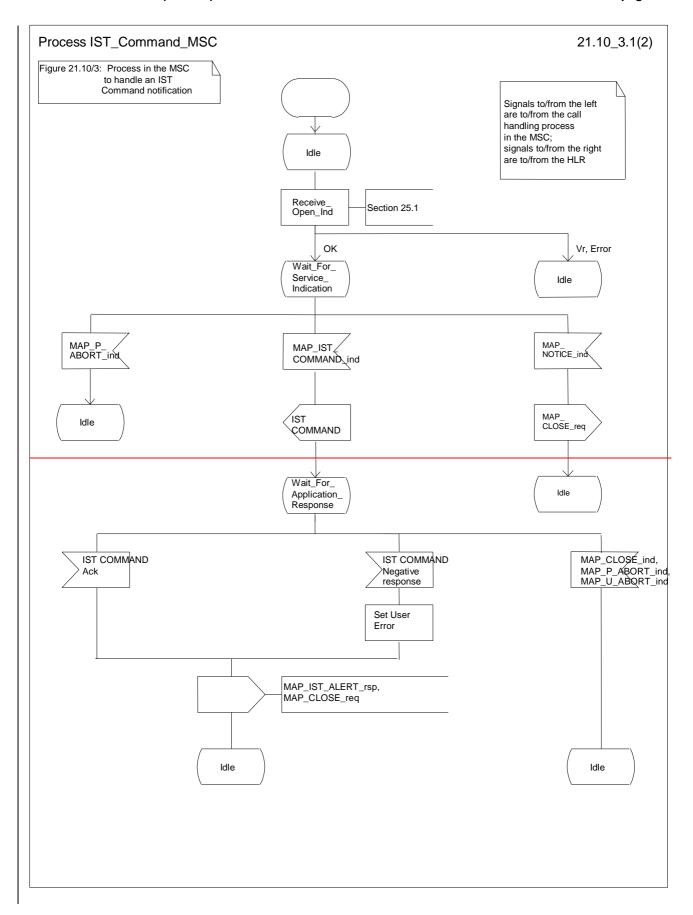


Figure 21.9/510/2: Process IST\_Command\_HLR



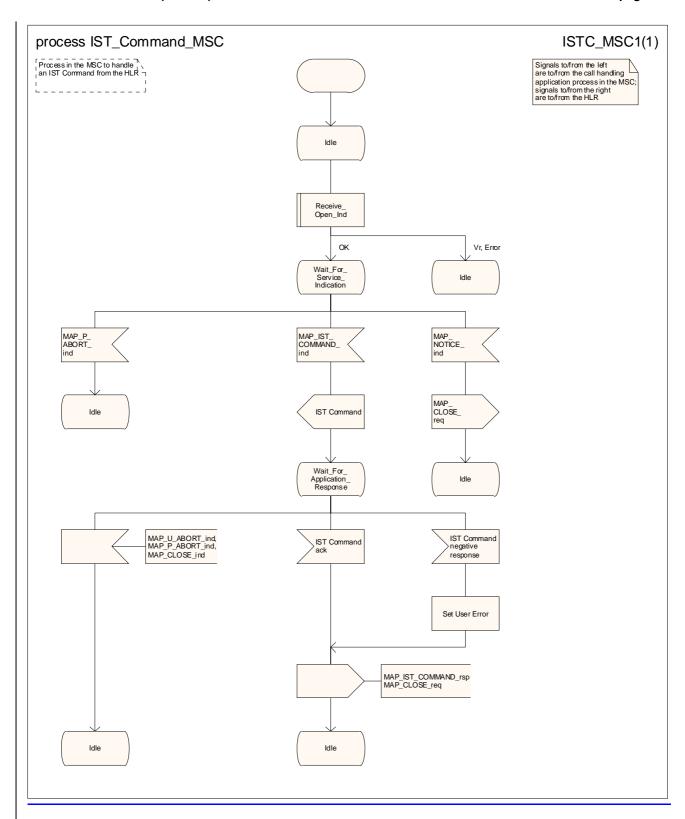


Figure 21.9/610/3: Process IST\_Command\_MSC

# \*\*\* Next modified section \*\*\*

# 24A CSE interrogation and control of subscriber data

### 24A.1 General

The MAP procedures for interrogation and control of subscriber data are used to allow the CSE:

- to retrieve subscriber data from the HLR;
- to modify subscriber data in the HLR;
- to receive notification from the HLR when there is a change in subscriber data;
- to request information about the location of a subscriber from the HLR or the GMLC;
- to request information about the state of a subscriber from the HLR.

The following application context refers to a complex MAP user consisting of several processes:

- anyTimeInfoHandlingContext

This application context needs a co-ordinating process in the HLR.

The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

The Any Time Info Handling Co-ordinator process in the HLR is shown in figure 24A.1/1.

### \*\*\* Next modified section \*\*\*

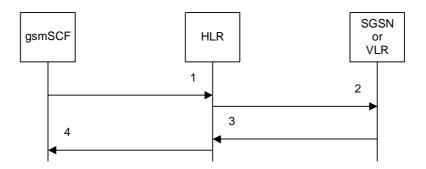
# 24A.5 Any Time Interrogation procedure

### 21.2.7 Process in the HLR for Any Time Interrogation

### 24A.5.1 General

The message flows for successful retrieval of subscriber information related to an any time interrogation from the CAMEL server are shown in figure  $2\underline{4A.5/1.2/8}$  for interrogation directed to an HLR and figure 24A.5/2 for interrogation directed to a GMLC.

<del>asmSCF</del>		
4 T	т т	т т
<del>†</del>	<del> </del>	<del></del>
<del><sup>a</sup>SCF+</del>	<del>aHLR+</del>	<del>aVLRa</del>
+ +	+ +	
- aMAP ANY TIME	' a '	' a '
- INTERROGATION	a	a
+	a	a
a	**************************************	SUBSCRT a
a	* BER INFORMA	рт∩м а
a	+	<u>a</u>
a		SUBSCRI-a
a	*** BER INFORMAT	<del>rion acka -</del>
a MAP ANY TIME	<	a
- a INTERROGATION	ack-4	<u>a</u>
a<	a	a
a	a	a



- MAP ANY TIME INTERROGATION req/ind MAP PROVIDE SUBSCRIBER INFO req/ind MAP PROVIDE SUBSCRIBER INFO rsp/cnf
- MAP ANY TIME INTERROGATION rsp/cnf

Figure 24A.5/1.2/8: Message flow for any time interrogation (gsmSCF to HLR)

The following MAP services are used to retrieve routing information about the status and/or location of a subscriber:

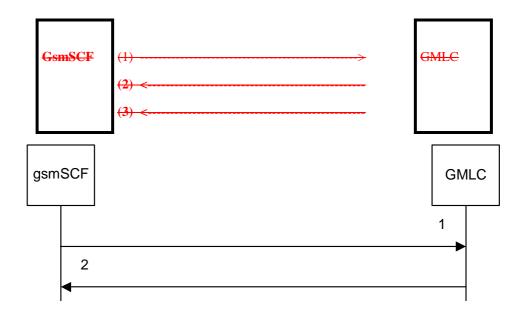
MAP\_ANY\_TIME\_INTERROGATION see subclause 8.11.1;

MAP\_PROVIDE\_SUBSCRIBER\_INFO see <u>sub</u>clause 8.11.2.

The HLR sends the MAP PROVIDE SUBSCRIBER INFO request to the SGSN or the VLR, according to the domain for which the gsmSCF requested the information.

# 21.2.8 Process in the GMLC for Any Time Interrogation

The message flows for successful retrieval of subscriber information related to an any time interrogation from the CAMEL server are shown in figure 21.2.8/1.



- MAP ANY TIME INTERROGATION req/ind MAP ANY TIME INTERROGATION rsp/cnf
- Any Time Interrogation (gsmSCF to GMLC).
- Any Time Interrogation Result (GMLC to gsmSCF).

3) Any Time Interrogation Error (GMLC to gsmSCF)The following MAP services are used to retrieve routing information:

#### Figure 24A.5/2: Message flow for any time interrogation (gsmSCF to GMLC)

The following MAP service is used to retrieve location information from a GMLC:

```
——MAP_ANY_TIME_INTERROGATION see <u>sub</u>clause 8.11.1;
```

#### Figure 21.2.8/1

In addition, the GMLC may use MAP Location Services specific to MAP Location Services.

### 21.2.7.1 Process in the gsmSCF

Out of the scope of the MAP specification.

## 24A.5.21.2.8.1 Procedures in the gsmSCF

The process in the gsmSCF to request information about the location and/or state of a subscriber from the HLR is shown in figure 24A.5/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive Open Cnf see subclause 25.1.2;
Check_Confirmation see subclause 25.2.2.
```

The process in the gsmSCF to request location information from the GMLC is shown in figure 24A.5/41.2.8/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive Open_Cnf see subclause 25.1.2;
Check_Confirmation see subclause 25.2.2.
```

The process is started with internal signal Request\_Subscriber\_Info\_GMLC. This signal is sent by the Service Logic in the gsmSCF.

The process responds with 'Request\_Subscriber\_Info\_GMLC positive response' or 'Request\_Subscriber\_Info\_GMLC negative response'.

# 24A.5.31.2.7.2 Proceduress in the HLR

The MAP process in the HLR to provide subscriber information in response to an interrogation from the CAMEL server is shown in figure  $2\underline{4A.5/5}\underline{1.2/8}$ . The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive_Open_Ind see <u>sub</u>clause 25.1.1;
Receive_Open_Cnf see <u>sub</u>clause 25.1.2;
Check_Confirmation see <u>sub</u>clause 25.2.2.
```

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context anyTimeInterrogationEnquiry, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_ANY\_TIME\_INTERROGATION service indication is received, the MAP process sends an Any Time Interrogation request to the call handling process in the HLR (described in 3GPP TS 23.078), and waits for a response. The Any Time Interrogation request contains the parameters received in the MAP\_ANY\_TIME\_INTERROGATION service indication.

If the call handling process in the HLR returns an Any Time Interrogation response, the MAP process constructs a MAP\_ANY\_TIME\_INTERROGATION service response containing the subscriber information contained in the Any Time Interrogation response, constructs a MAP\_CLOSE service request, sends them to the CAMEL server and returns to the idle state.

If the call handling process in the HLR returns a Provide Subscriber Info request, the MAP process requests a dialogue with the VLR whose identity is contained in the Provide Subscriber Info request by sending a MAP\_OPEN service request, requests the subscriber status using a MAP\_PROVIDE\_SUBSCRIBER\_INFO service request, and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request.

If the macro takes the OK exit, the MAP process waits for the response from the VLR.

If the MAP process receives a MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm, it invokes the macro Check Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Provide Subscriber Info ack containing the information received in the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm contains a provider error or a data error, the MAP process sends a Provide Subscriber Info negative response indicating the type of error to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

NOTE: The 'User Error' exit from the macro Check\_Confirmation is shown for formal completeness; the MAP\_PROVIDE\_SUBSCRIBER\_INFO\_enf primitive cannot contain a user error.

#### Negative response from HLR call handling process

If the call handling process in the HLR returns a negative response, either before or after a dialogue with the VLR to obtain subscriber information, the MAP process constructs a MAP\_ANY\_TIME\_INTERROGATION service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the CAMEL server and returns to the idle state.

#### Failure of Provide Subscriber Info dialogue with the VLR

If the Receive\_Open\_Cnf macro takes the Vr exit or the Error exit after the MAP process has requested opening of a Provide Subscriber Info dialogue with the VLR, the MAP process sends a Provide Subscriber Info negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

#### Failure of dialogue opening with the CAMEL server

If the macro Receive\_Open\_Ind takes the Vr or Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

### 24A.5.41.2.8.2 Proceduress in the GMLC

The MAP process in the GMLC to provide location information in response to a request from the gsmSCF is shown in figure 24A.5/61.2.8/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

#### Successful outcome

When the GMLC has successfully received the MAP Any\_Time\_Interrogation MAP Message, it will send an internal signal to the Location Service process in the GMLC to obtain the subscriber's Location Information. The result received from that process is sent back to the gsmSCF, in the Any\_Time\_Interrogation Result MAP Message.

#### **Unsuccessful outcome**

In the case of a Provider Error received, the process will terminate.

When a User error is received from the Location Services process in the GMLC, then a User Abort is sent to the gsmSCF.

If a negative response is received from the Location Services process in the GMLC, then this response is forwarded to the gsmSCF.

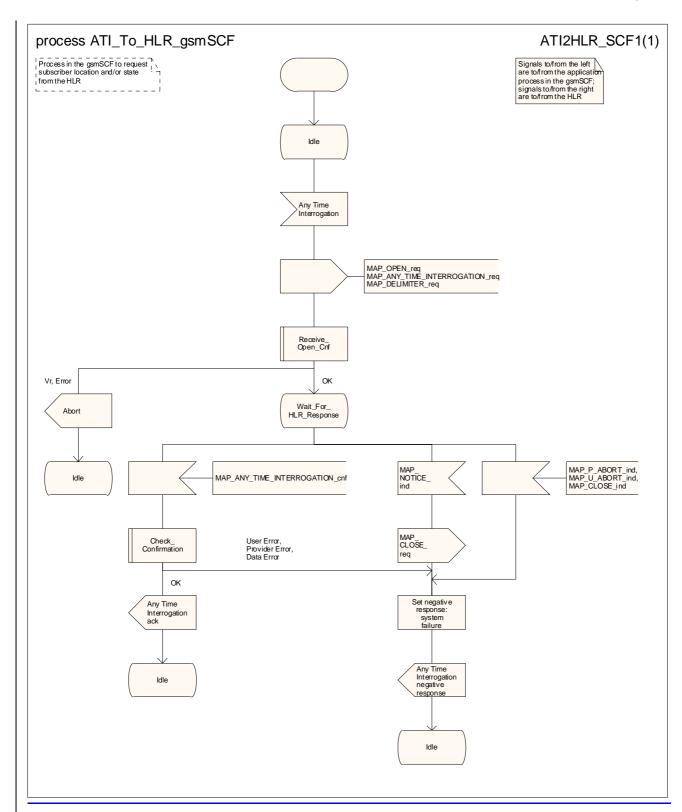
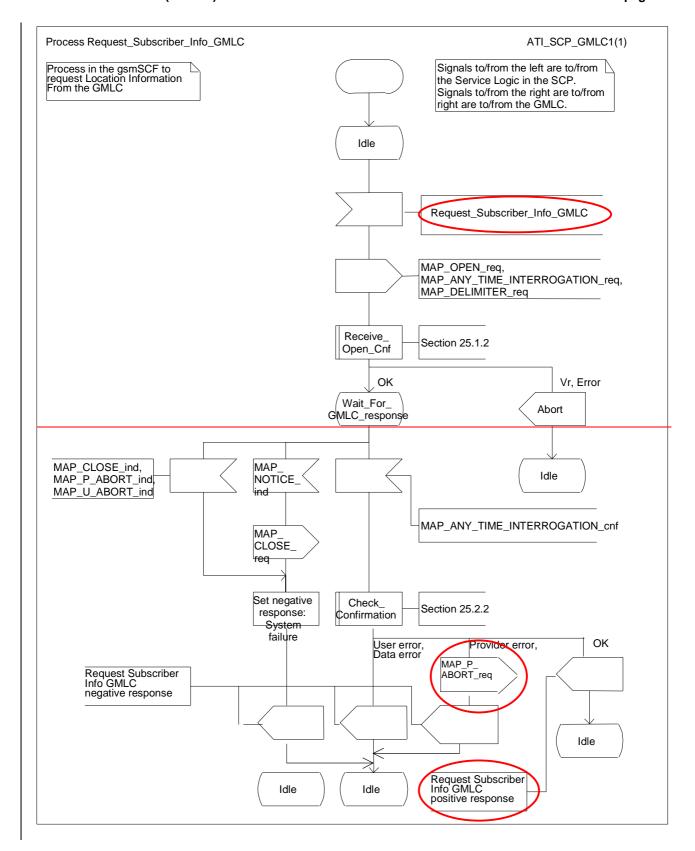


Figure 24A.5/3: Process ATI To HLR gsmSCF



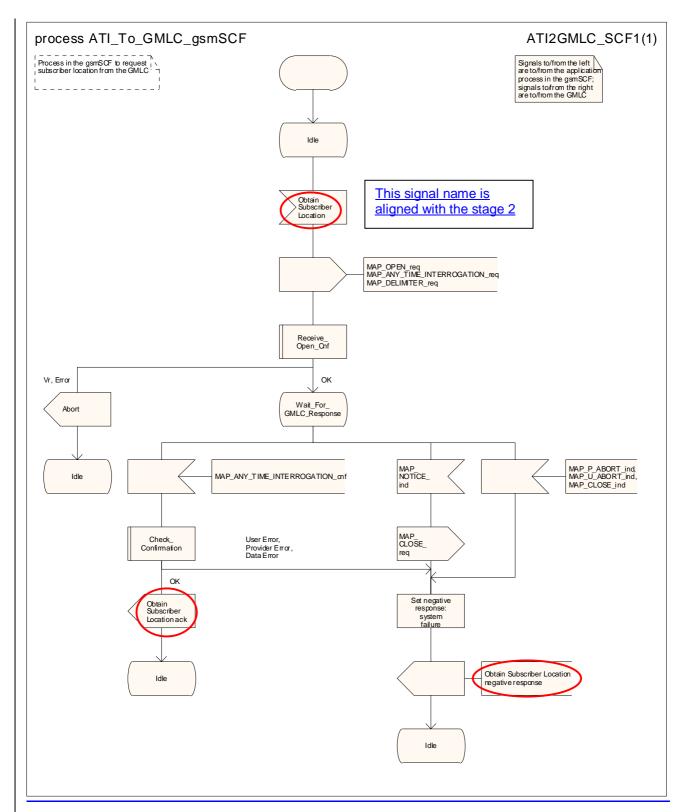
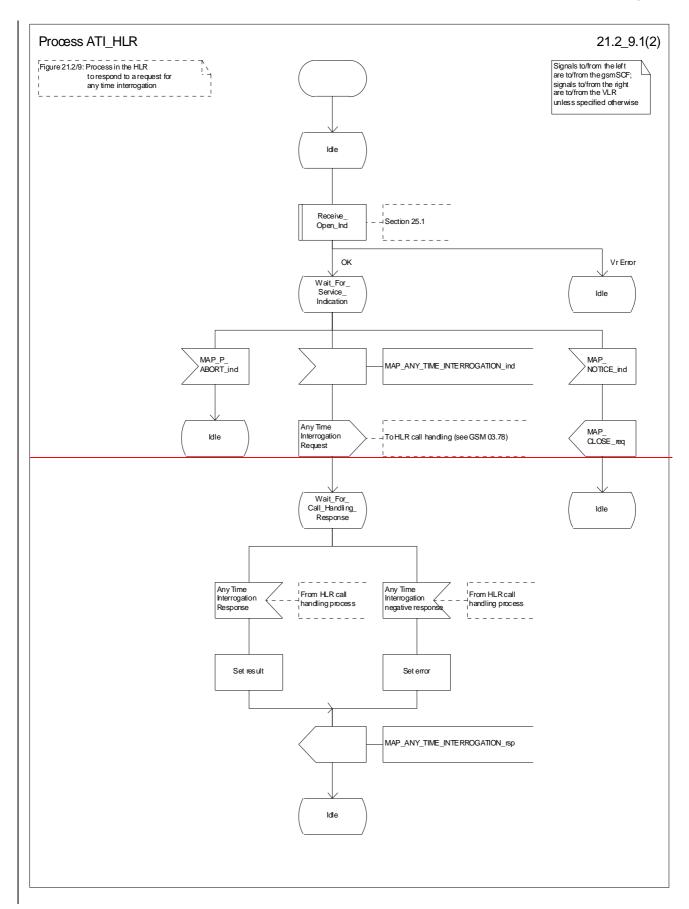


Figure 24A.5/41.2.8/2: Process Request\_Subscriber\_InfoATI To\_GMLC\_gsmSCF



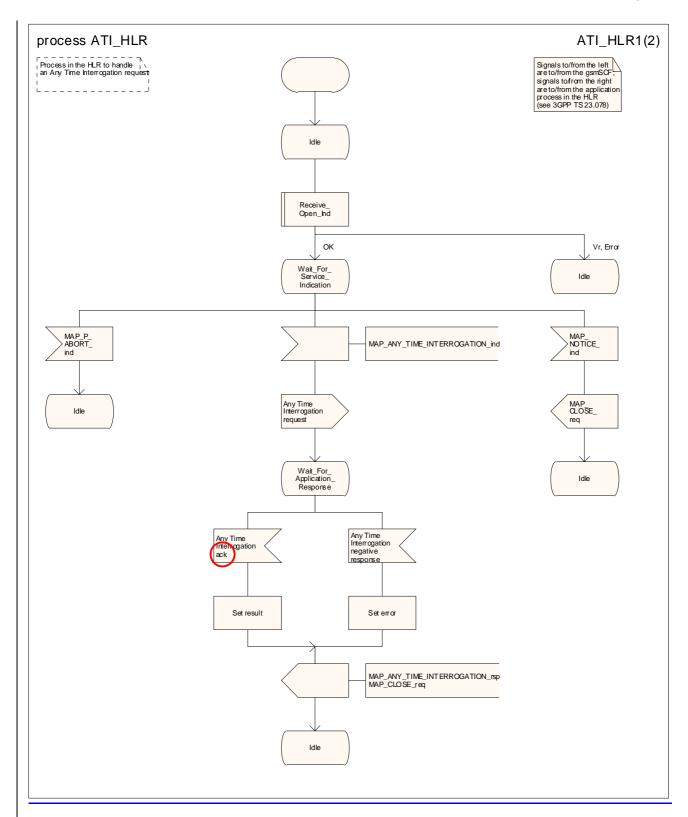
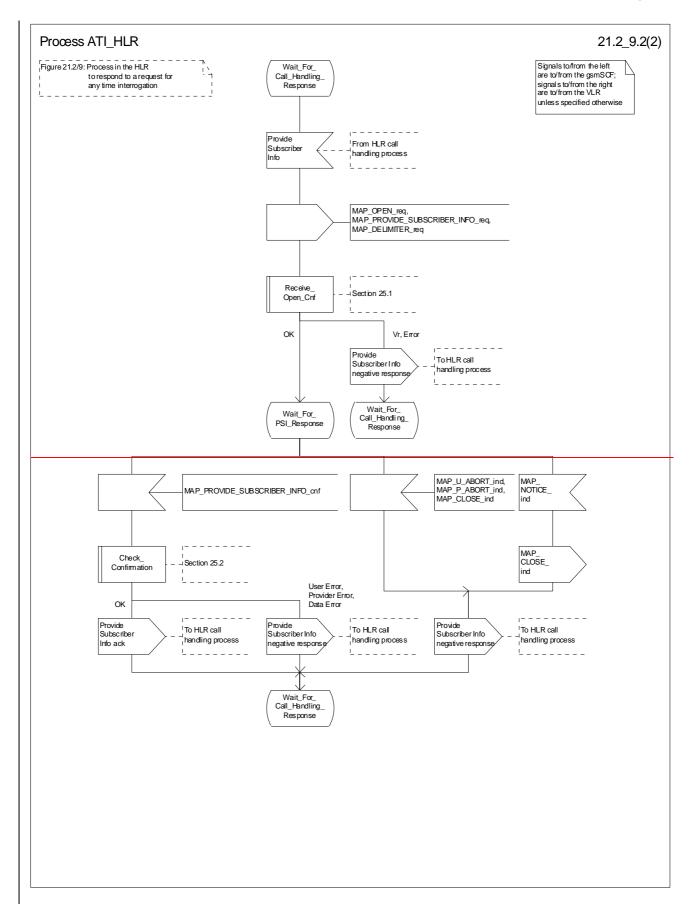


Figure 24A.5/51.2/9 (sheet 1 of 2): Process ATI\_HLR-(New)



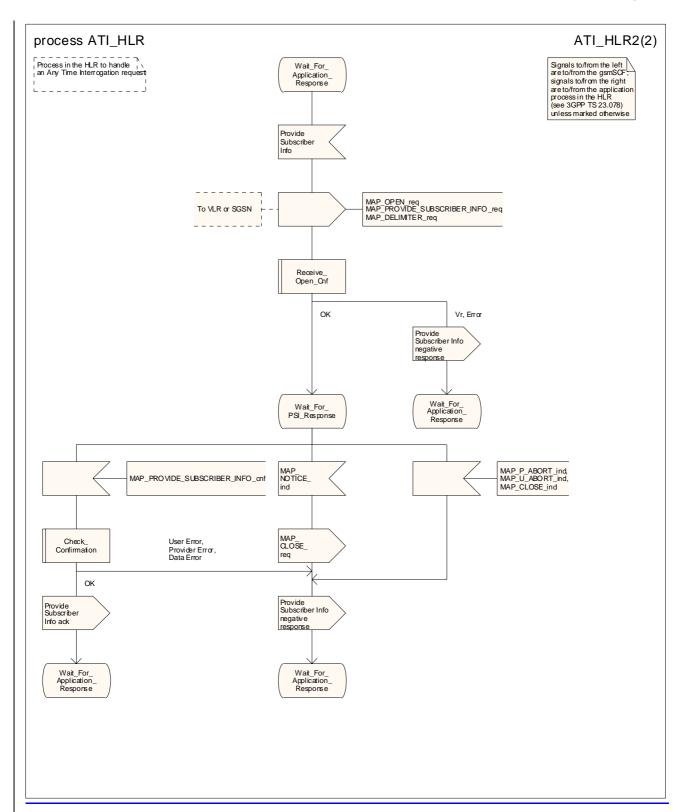
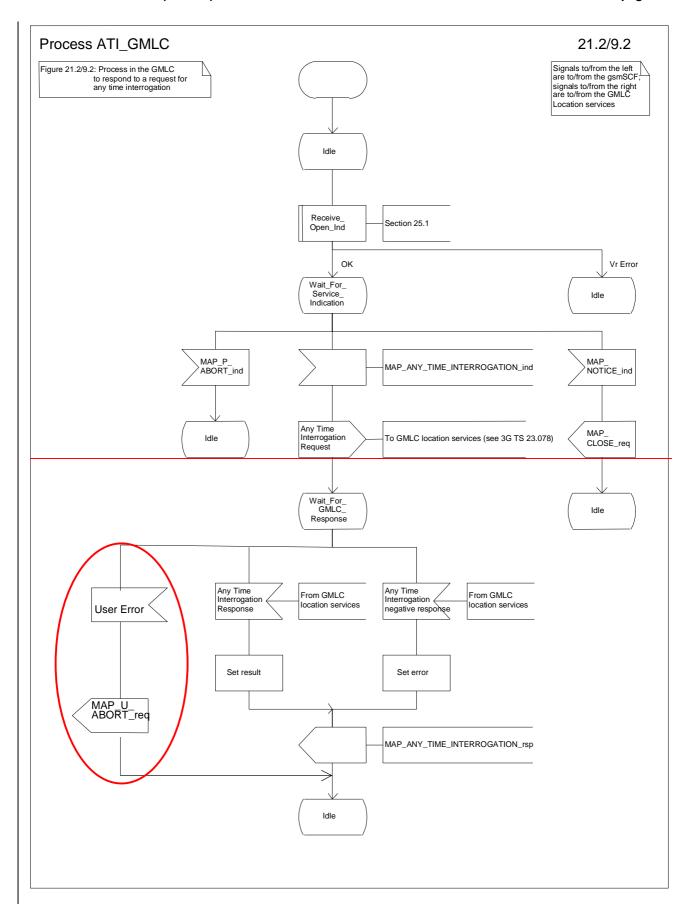


Figure 24A.5/51.2/9 (sheet 2 of 2): Process ATI\_HLR-(New)



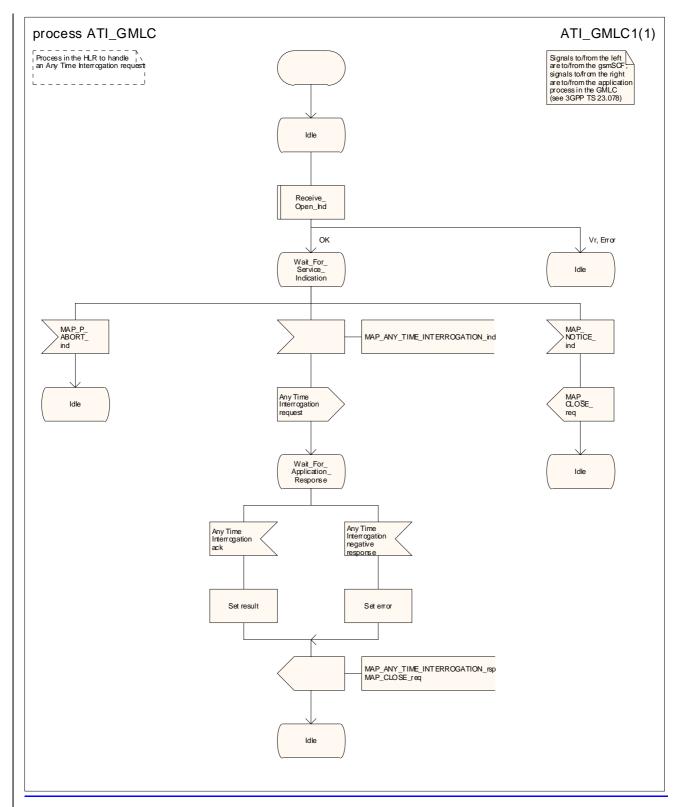


Figure 24A.5/61.2.8/3: Process ATI\_GMLC

## \*\*\* End of document \*\*\*

### 3GPP TSG CN WG4 Meeting #20 Sophia Antipolis, FRANCE, 25<sup>th</sup> – 29<sup>th</sup> August 2003

CHANGE REQUEST				
æ	29.002 CR 641 **rev - **	Current vers	ion: <b>6.2.0</b> **	
For <u>HELP</u> on using this form, see bottom of this page or look at the pop-up text over the <b>%</b> symbols.				
Proposed change affects: UICC apps# ME Radio Access Network Core Network X				
Title:	R Provision of SDL diagrams and removal of redun	dant text in ch	napter 21	
Source:	₩ Vodafone			
Work item code:	₩ <mark>TEI5</mark>	Date: ℁	02/07/2003	
Category:	Use one of the following categories:  F (correction)  A (corresponds to a correction in an earlier release  B (addition of feature),  C (functional modification of feature)  D (editorial modification)  Detailed explanations of the above categories can be found in 3GPP TR 21.900.	2	Rel-6 the following releases: (GSM Phase 2) (Release 1996) (Release 1997) (Release 1998) (Release 1999) (Release 4) (Release 5) (Release 6)	

- Reason for change: # 1. There are no source files available for the SDL diagrams in 29.002 chapter 21. Many SDL diagrams are poorly laid out.
  - 2. Some message flow diagrams are drawn using linedraw characters, which do not display correctly in Word 2000.
  - 3. Most of the text repeats the information in the SDL diagrams; the useful additional information is buried in superfluous verbiage. The principle of making the text a supplement to the SDL diagrams has been accepted by CN #20, with the approval of CRs to chapters 22 – 25 to remove the redundant
  - 4. There are several lurking references to CCITT recommendations.
  - 5. The procedures for Any Time Interrogation are not related to the retrieval of routeing information.
  - 6. The processes for retrieval of routeing information in the HLR and provision of a roaming number in the VLR do not close the MAP dialogue before the process returns to the idle state in the successful case.
  - 7. The handling in the process ASCI Anchor MSC for a provider error in the MAP PREPARE GROUP CALL confirmation does not reflect the fact that the dialogue between the anchor MSC and the relay MSC has already been
  - 8. The procedures for the use of a shared data interworking function in subclause 21.5) refer to a stage 2 specification which was withdrawn after GSM Release 98. CN #13 decided that this functionality should not be part of UMTS.
  - 9. The handling in the process Request\_Subscriber\_Info\_GMLC (which runs in the gsmSCF, not the GMLC) when a provider error is received in the MAP\_ANY\_TIME\_INTERROGATION confirmation shows an unnecessary MAP P ABORT request; when the macro Check Confirmation takes the Provider Error exit, the dialogue has already been closed.
  - 10. The handling in the process ATI\_GMLC shows that a User Error input from the

application process causes a MAP\_U\_ABORT to the gsmSCF, but there is no corresponding User Error output in the stage 2 process in 23.078.

Summary of change: 
1. Redraw SDL diagrams to a consistent style. Redraw message flow diagrams. Remove text which replicates the information in SDL diagrams.
2. Replace references to "CCITT" with "ITU-T".
3. Add MAP\_CLOSE\_req outputs where required in the processes SRI\_HLR and PRN\_VLR.
4. Show the appropriate handling for the Provider Error case in ASCI\_Anchor\_MSC

5. Move the procedures for Any Time Interrogation to clause 24A.

6. Make subclause 21.5 void

# Consequences if not approved:

X 1. No SDL source files to use as the basis for future changes. Message flow diagrams are difficult to read. Useful information to supplement the SDL diagrams is buried in superfluous verbiage.

Clauses affected:	# 21; 24A; 24A.1; 24A.5 (new)	
Other specs affected:	Y N  X Other core specifications Test specifications O&M Specifications	
Other comments:	<ol> <li>The text for each first level subclause has been grouped together before the SDL diagrams for that subclause.</li> <li>The procedures for CCBS status monitoring and reporting have been grouped together in a single first level subclause. The procedures for Immediate Service Termination alerting and command have been grouped together in a single first level subclause.</li> <li>These editorial changes have not been revision marked, except for the changes in subclause heading numbers and figure numbers.</li> <li>The deletion of subclause 21.5 is a duplicate of the deletion of that subclause in CR 29.002-642 (Tdoc N4-030748).</li> </ol>	

### \*\*\* First modified section \*\*\*

## 21 Call handling procedures

### 21.1 General

The MAP call handling procedures are used:

- to retrieve routeing information to handle a mobile terminating call;
- to transfer control of a call back to the GMSC if the call is to be forwarded;
- to retrieve and transfer information between anchor MSC and relay MSC for inter MSC group calls / broadcast calls;
- to allocate resources in an SIWFS;
- to handle the reporting of MS status for call completion services;
- to handle the notification of remote user free for CCBS:
- to handle the alerting and termination of ongoing call activities for a specific subscriber.

The procedures to handle a mobile originating call and a mobile terminating call after the call has arrived at the destination MSC do not require any signalling over a MAP interface. These procedures are specified in 3GPP TS 23.018 [97].

The stage 2 specification for the retrieval of routeing information to handle a mobile terminating call is in 3GPP TS 23.018 [97]; modifications to this procedure for CAMEL are specified in 3GPP TS 23.078 [98], for optimal routeing of a basic mobile-to-mobile call in 3GPP TS 23.079 [99] and for CCBS in 3GPP TS 23.093 [107]. The interworking between the MAP signalling procedures and the call handling procedures for each entity (GMSC, HLR and VLR) is shown by the transfer of signals between these procedures.

The stage 2 specification for the transfer of control of a call back to the GMSC if the call is to be forwarded is in 3GPP TS 23.079 [99]. The interworking between the MAP signalling procedures and the call handling procedures for each entity (VMSC and GMSC) is shown by the transfer of signals between these procedures.

The stage 2 specifications for inter MSC group calls / broadcast calls are in 3GPP TS 43.068 [100] and 3GPP TS 43.069 [101]. The interworking between the MAP signalling procedures and the group call /broadcast call procedures for each entity (Anchor MSC and Relay MSC) is shown by the transfer of signals between these procedures.

The stage 2 specification for the allocation of resources in an SIWFS is in GSM 03.54. The interworking between the MAP signalling procedures and the call handling procedures for each entity (VMSC and SIWFS) is shown by the transfer of signals between these procedures.

The interworking between the call handling procedures and signalling protocols other than MAP are shown in 3GPP TS 23.018, 3GPP TS 23.078 and 3GPP TS 23.079 [99].

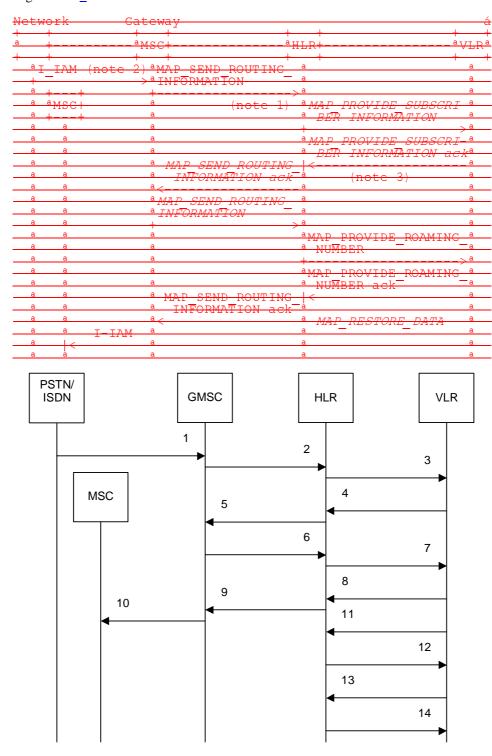
The stage 2 specification for the handling of reporting of MS status for call completion services and notification of remote user free for CCBS is in 3GPP TS 23.093 [107].

## 21.2 Retrieval of routing information

### 21.2.1 General

The message flows for successful retrieval of routeing information for a mobile terminating call are shown in figure 21.2/1 (mobile terminating call which has not been optimally routed) and 21.2/2 (mobile-to-mobile call which

has been optimally routed). The message flow for successful-retrieval of routeing information for a gsmSCF initiated call is shown in figure 21.2/3\*.



- I\_IAM (Note 1)
- MAP\_SEND\_ROUTING\_INFORMATION\_req/ind (Note 2)
- MAP\_PROVIDE\_SUBSCRIBER\_INFO\_req/ind (Note 3, Note 4)
  MAP\_PROVIDE\_SUBSCRIBER\_INFO\_rsp/cnf (Note 4) 3)
- 4)
- MAP SEND ROUTING INFORMATION rsp/cnf (Note 4) <u>5)</u>
- 6) MAP\_SEND\_ROUTING\_INFORMATION\_reg/ind (Note 4)
- MAP PROVIDE ROAMING NUMBER reg/ind 7)
- 8) MAP\_PROVIDE\_ROAMING\_NUMBER\_rsp/cnf
- MAP SEND ROUTING INFORMATION rsp/cnf
- 10) I\_IAM (Note 1)

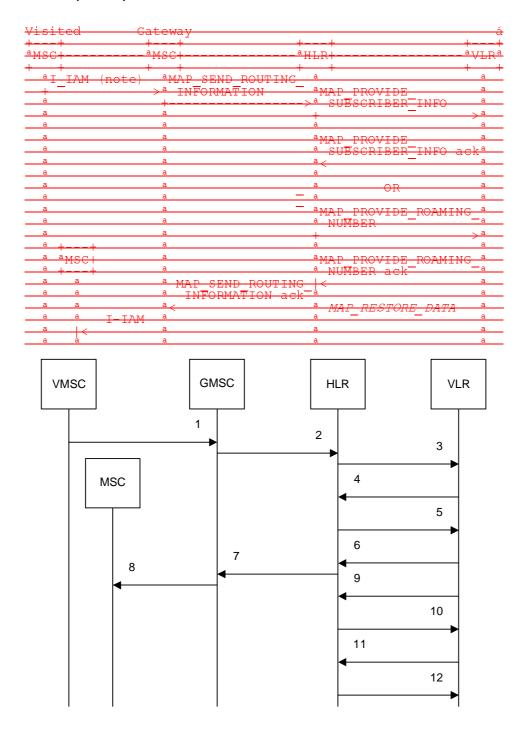
- 11) MAP RESTORE DATA reg/ind (Note 4)
- 12) MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind (Note 4)
- 13) MAP INSERT SUBSCRIBER DATA rsp/cnf (Note 4)
- 12) MAP RESTORE DATA rsp/cnf (Note 4)

xxx = Optional Procedure

NOTE 1: This service may also be used by an ISDN exchange for obtaining routing information from the HLR.

- NOTE 12: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following ITU-T Recommendations and ETSI specification:
  - Q.721-725 Telephone User Part (TUP);
  - ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.
- NOTE 2: This service may also be used by an ISDN exchange for obtaining routing information from the HLR.
- NOTE 3: As a network operator option, the HLR sends MAP\_PROVIDE\_SUBSCRIBER\_INFORMATION to the VLR. For further details on the CAMEL procedures refer to 3GPP TS 23.078 [98].
- NOTE 4: Services printed in italics are optional.

Figure 21.2/1: Message flow for retrieval of routeing information (non-optimally routed call)

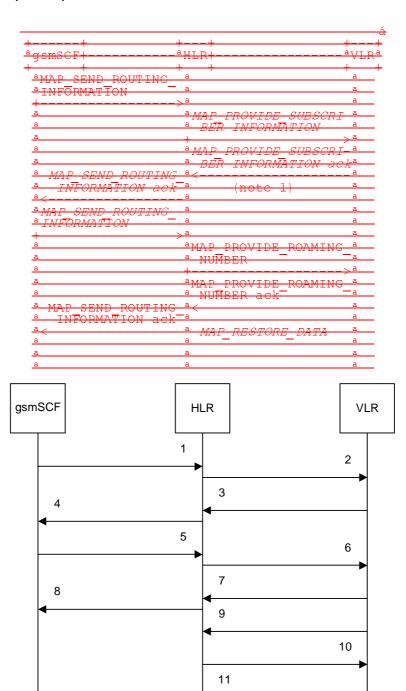


- I\_IAM (Note 1) MAP SEND ROUTING INFORMATION reg/ind 3) 4)
- MAP\_PROVIDE\_SUBSCRIBER\_INFO\_req/ind (Note 2)
  MAP\_PROVIDE\_SUBSCRIBER\_INFO\_rsp/cnf (Note 2)
  MAP\_PROVIDE\_ROAMING\_NUMBER\_req/ind (Note 2) 5)
- MAP PROVIDE ROAMING NUMBER rsp/cnf (Note 2) <u>6)</u>
- MAP SEND ROUTING INFORMATION rsp/cnf 7)
- 8) I\_IAM (Note 1)
- 9) MAP\_RESTORE\_DATA\_req/ind (Note 3)
- MAP INSERT SUBSCRIBER DATA reg/ind (Note 3) 10)
- MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf (Note 3) 11)
- MAP RESTORE DATA rsp/cnf (Note 3) 12)

xxx = Optional Procedure

- NOTE 1: For Optimal Routeing phase 1, only one of the information flows for Provide Subscriber Info and Provide Roaming Number is used. For later phases of Optimal Routeing, the HLR may return a MAP\_SEND\_ROUTEING\_INFORMATION ack after the Provide Subscriber Info information flow, and the GMSC may send a second MAP\_SEND\_ROUTEING\_INFORMATION, which will trigger the Provide Roaming Number information flow.
- NOTE 12: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following CCITU-T Recommendations & ETSI specification:
  - Q.721-725 Telephone User Part (TUP);
  - ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.
- NOTE 2: For Optimal Routeing phase 1, only one of the information flows for Provide Subscriber Info and Provide Roaming Number is used.
- NOTE 3: Services printed in italics are optional.

Figure 21.2/2: Message flow for retrieval of routeing information (optimally routed call)



- 1) MAP\_SEND\_ROUTING\_INFORMATION\_req/ind
  2) MAP\_PROVIDE\_SUBSCRIBER\_INFO\_req/ind (Note 1, Note 2)
  3) MAP\_PROVIDE\_SUBSCRIBER\_INFO\_rsp/cnf (Note 2)
  4) MAP\_SEND\_ROUTING\_INFORMATION\_req/ind (Note 2)
  5) MAP\_SEND\_ROUTING\_INFORMATION\_req/ind (Note 2)
- 6) MAP PROVIDE ROAMING NUMBER req/ind 7) MAP PROVIDE ROAMING NUMBER rsp/cnf
- 8) MAP SEND ROUTING INFORMATION rsp/cnf
- 9) MAP\_RESTORE\_DATA\_req/ind (Note 2)
- 10) MAP INSERT SUBSCRIBER DATA reg/ind (Note 2)
- 11) MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf (Note 2)
- 12) MAP RESTORE DATA rsp/cnf (Note 2)

xxx = Optional Procedure

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NOTE 1: As a network operator option, the HLR sends\_MAP\_PROVIDE\_SUBSCRIBER\_INFORMATION to the VLR. For further details on the CAMEL procedures refer to 3GPP TS 23.078 [98].

NOTE 2: Services printed in italics are optional.

### Figure 21.2/3x: Message flow for retrieval of routeing information for a gsmSCF initiated call

The following MAP services are used to retrieve routing information:

MAP\_SEND\_ROUTING\_INFORMATION see <u>sub</u>clause 10.1;
MAP\_PROVIDE\_ROAMING\_NUMBER see <u>sub</u>clause 10.2;
MAP\_PROVIDE\_SUBSCRIBER\_INFO see <u>sub</u>clause 8.11.2;
MAP\_RESTORE\_DATA see <u>sub</u>clause 8.10.3.

### 21.2.2 Proceduress in the GMSC

The MAP process in the GMSC to retrieve routeing information for a mobile terminating call is shown in figure 21.2/63. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

Sheet 1: if the MAP\_SEND\_ROUTING\_INFORMATION request included the OR Interrogation parameter, the test "OR interrogation?" takes the "Yes" exit; otherwise the test takes the "No" exit.

#### **Successful Outcome**

When the MAP process receives a Send Routeing Info request from the call handling process in the GMSC, it requests a dialogue with the HLR whose identity is contained in the Send Routeing Info request by sending a MAP\_OPEN service request, requests routeing information using a MAP\_SEND\_ROUTING\_INFORMATION service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

If the MAP process receives a MAP\_SEND\_ROUTING\_INFORMATION service confirm from the HLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm. If the MAP\_SEND\_ROUTING\_INFORMATION confirm from the HLR cannot be carried in a single TC Result component, it is carried in one or more TC Result NL components (each sent in a TC CONTINUE), followed by a TC Result L component in a TC-END message.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a Send Routeing Info ack containing the routeing information received from the HLR to the call handling process in the GMSC and returns to the idle state.

### Earlier version MAP dialogue with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit, the MAP process checks whether this is an OR interrogation (indicated by the inclusion of the OR interrogation parameter in the MAP\_SEND\_ROUTING\_INFORMATION service request).

If this is not an OR interrogation, the GMSC performs the earlier version MAP dialogue as specified in [51] and the process returns to the idle state.

If this is an OR interrogation, the MAP process sends a Send Routeing Info negative response indicating OR not allowed to the call handling process in the GMSC and returns to the idle state.

### Dialogue opening failure

If the macro Receive\_Open\_Cnf indicates that the dialogue with the HLR could not be opened, the MAP process sends an Abort to the call handling process in the GMSC and returns to the idle state.

### **Error in MAP SEND ROUTING INFORMATION confirm**

If the MAP\_SEND\_ROUTING\_INFORMATION service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Send Routeing Info negative response to the call handling process in the GMSC and returns to the idle state.

#### Call release

If the call handling process in the GMSC indicates that the call has been aborted (i.e. prematurely released by the calling subscriber), the MAP process returns to the idle state. Any response from the HLR will be discarded.

#### **Abort of HLR dialogue**

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the HLR may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends a Send Routeing Info negative response to the call handling process in the GMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the HLR, sends a Send Routeing Info negative response indicating system failure to the call handling process in the GMSC and returns to the idle state.

### 21.2.39 Proceduress in the gsmSCF

For the purposes of retrieving routeing information from the HLR, the gsmSCF takes the role of the GMSC -and follows the process specified in subclause 21.2.2.

### 21.2.43 Procedures in the HLR

The MAP process in the HLR to retrieve routeing information for a mobile terminating call is shown in figure 21.2/74. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1;
Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2;
Check\_Confirmation see <u>sub</u>clause 25.2.2.

Sheet 3: if the MAP\_PROVIDE\_ROAMING\_NUMBER request included the OR Interrogation parameter, the test "OR interrogation?" takes the "Yes" exit; otherwise the test takes the "No" exit.

### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context locInfoRetrieval, it checks it by invoking the macro Receive Open Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_SEND\_ROUTING\_INFORMATION service indication is received, the MAP process sends a Send Routeing Info request to the call handling process in the HLR, and waits for a response. The Send Routeing Info request contains the parameters received in the MAP\_SEND\_ROUTING\_INFORMATION service indication.

If the call handling process in the HLR returns a Send Routeing Info ack, the MAP process constructs a MAP\_SEND\_ROUTING\_INFORMATION service response containing the routeing information contained in the Send Routeing Info ack, constructs a MAP\_CLOSE service request, sends them to the GMSC and returns to the idle state. If the MAP\_SEND\_ROUTING\_INFORMATION response cannot be carried in a single TC-Result component, it is carried in one or more TC Result NL components (each sent in a TC CONTINUE), followed by a TC Result L component in a TC END message.

If the call handling process in the HLR returns a Provide Subscriber Info request, the MAP process requests a dialogue with the VLR whose identity is contained in the Provide Subscriber Info request by sending a MAP\_OPEN service request, requests the subscriber status using a MAP\_PROVIDE\_SUBSCRIBER\_INFO service request, and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request.

If the macro takes the OK exit, the MAP process waits for the response from the VLR.

If the MAP process receives a MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm, it invokes the macro Check\_Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Provide Subscriber Info ack containing the information received in the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm contains a provider error or a data error, the MAP process sends a Provide Subscriber Info negative response indicating the type of error to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

NOTE: The 'User Error' exit from the macro Check\_Confirmation is shown for formal completeness; the MAP\_PROVIDE\_SUBSCRIBER\_INFO\_enf primitive cannot contain a user error.

If the call handling process in the HLR returns a Provide Roaming Number request, the MAP process requests a dialogue with the VLR whose identity is contained in the Provide Roaming Number request by sending a MAP\_OPEN service request, requests a roaming number using a MAP\_PROVIDE\_ROAMING\_NUMBER service request, and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request.

If the macro takes the OK exit, the MAP process waits for the response from the VLR.

If the MAP process receives a MAP\_PROVIDE\_ROAMING\_NUMBER service confirm, it invokes the macro Check\_Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Provide Roaming Number ack containing the MSRN received in the MAP\_PROVIDE\_ROAMING\_NUMBER service confirm to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP\_PROVIDE\_ROAMING\_NUMBER service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Provide Roaming Number negative response indicating the type of error to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

### Negative response from HLR call handling process

If the call handling process in the HLR returns a negative response, either before or after a dialogue with the VLR to obtain a roaming number, the MAP process constructs a MAP\_SEND\_ROUTING\_INFORMATION service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the GMSC and returns to the idle state.

### Earlier version MAP Provide Roaming Number dialogue with the VLR

If the macro Receive\_Open\_Cnf takes the Vr exit after the MAP process has requested opening of a Provide Roaming Number dialogue with the VLR, the MAP process checks whether this is an OR interrogation (indicated by the inclusion of the OR interrogation parameter in the MAP\_PROVIDE\_ROAMING\_NUMBER service request).

If this is not an OR interrogation, the HLR performs the earlier version MAP dialogue as specified in [51], relays the result of the dialogue to the HLR call handling process, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If this is an OR interrogation, the MAP process sends a Provide Roaming Number negative response indicating OR not allowed to the call handling process in the HLR and waits for a response. The handling of the response from the call handling process in the HLR is described above.

### Failure of Provide Subscriber Info dialogue with the VLR

If the Receive\_Open\_Cnf macro takes the Vr exit or the Error exit after the MAP process has requested opening of a Provide Subscriber Info dialogue with the VLR, the MAP process sends a Provide Subscriber Info negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

### Failure of Provide Roaming Number dialogue with the VLR

If the Receive\_Open\_Cnf macro takes the Error exit after the MAP process has requested opening of a Provide Roaming Number dialogue with the VLR, the MAP process sends a Provide Roaming Number negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP process receives a MAP\_U\_ABORT, a MAP\_P\_ABORT or a premature MAP\_CLOSE from the MAP provider, it sends a Provide Roaming Number negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP process receives a MAP\_NOTICE from the MAP provider, it returns a MAP\_CLOSE request to the MAP provider, sends a Provide Roaming Number negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

### Earlier version MAP dialogue with the GMSC

If the macro Receive\_Open\_Ind takes the Vr exit, the HLR performs the earlier version MAP dialogue as specified in [51] and the process returns to the idle state.

### Failure of dialogue opening with the GMSC

If the macro Receive Open Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

### 21.2.54 Proceduress in the VLR to provide a roaming number

The MAP process in the VLR to provide a roaming number for a mobile terminating call is shown in figure 21.2/85. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context roamingNbEnquiry, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PROVIDE\_ROAMING\_NUMBER service indication is received, the MAP process sends a Provide Roaming Number request to the call handling process in the VLR, and waits for a response. The Provide Roaming Number request contains the parameters received in the MAP\_PROVIDE\_ROAMING\_NUMBER service indication.

If the call handling process in the VLR returns a Provide Roaming Number ack, the MAP process constructs a MAP\_PROVIDE\_ROAMING\_NUMBER service response containing the roaming number contained in the Send Routeing Info ack, constructs a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

### Earlier version MAP dialogue with the HLR

If the macro Receive\_Open\_Ind takes the Vr exit, the VLR performs the earlier version MAP dialogue as specified in [51] and the process returns to the idle state.

### Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

### Negative response from VLR call handling process

If the call handling process in the HLR returns a negative response, the MAP process constructs a MAP\_PROVIDE\_ROAMING\_NUMBER service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

### 21.2.65 Proceduress in the VLR to restore subscriber data

The MAP process in the HLR to restore subscriber data is shown in figure 21.2/96. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2; Insert\_Subs\_Data\_VLR see <u>sub</u>clause 25.7.1; Activate\_Tracing\_VLR see <u>sub</u>clause 25.9.4.

#### Successful outcome

When the MAP process receives a Restore Data request from the data restoration process in the VLR, it requests a dialogue with the HLR whose identity is contained in the Restore Data request by sending a MAP\_OPEN service request, requests data restoration using a MAP\_RESTORE\_DATA service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

The VLR may receive a MAP\_INSERT\_SUBSCRIBER\_DATA service indication from the HLR; this is handled by the macro Insert\_Subs\_Data\_VLR as described in clause 25.7.1, and the MAP process waits for a further response from the HLR.

The VLR may receive a MAP\_ACTIVATE\_TRACE\_MODE service indication from the HLR; this is handled by the macro Activate\_Tracing\_VLR as described in clause 25.9.4, and the MAP process waits for a further response from the HLR.

If the MAP process receives a MAP\_RESTORE\_DATA service confirm, it invokes the macro Check\_Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Restore Data ack containing the information received from the HLR to the data restoration process in the VLR and returns to the idle state.

### Error in MAP\_RESTORE\_DATA confirm

If the MAP\_RESTORE\_DATA service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Restore Data negative response indicating the type of error to the call handling process in the HLR, and returns to the idle state.

### Earlier version MAP dialogue with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit, the VLR performs the earlier MAP version dialogue as specified in [51] and the process terminates.

### Dialogue opening failure

If the macro Receive\_Open\_Cnf indicates that the dialogue with the HLR could not be opened, the MAP process sends a negative response indicating system failure to the data restoration process in the GMSC and returns to the idle state.

### 21.2.76 Proceduress in the VLR to provide subscriber information

The MAP process in the VLR to provide subscriber information for a mobile terminating call subject to CAMEL invocation is shown in figure 21.2/96. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1;

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context subscriberInfoEnquiry, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PROVIDE\_SUBSCRIBER\_INFO service indication is received, the MAP process sends a Provide Subscriber Info request to the subscriber information request process in the VLR, and waits for a response. The Provide Subscriber Info request contains the parameters received in the MAP\_PROVIDE\_SUBSCRIBER\_INFO service indication.

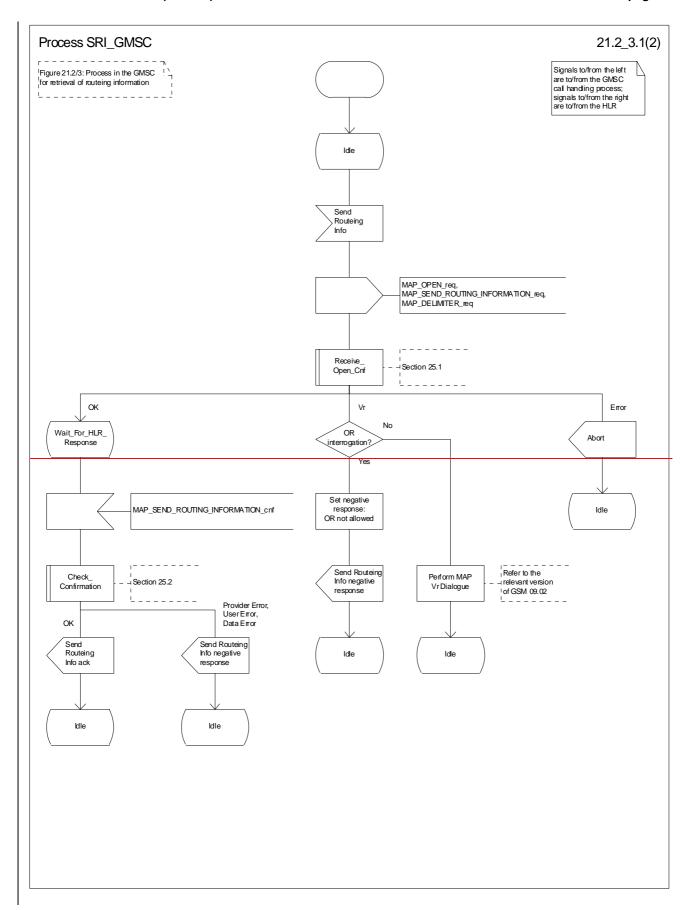
If the subscriber information request process in the VLR returns a Provide Subscriber Info ack, the MAP process constructs a MAP\_PROVIDE\_SUBSCRIBER\_INFO service response containing the information contained in the Provide Subscriber Info ack, constructs a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

### Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.



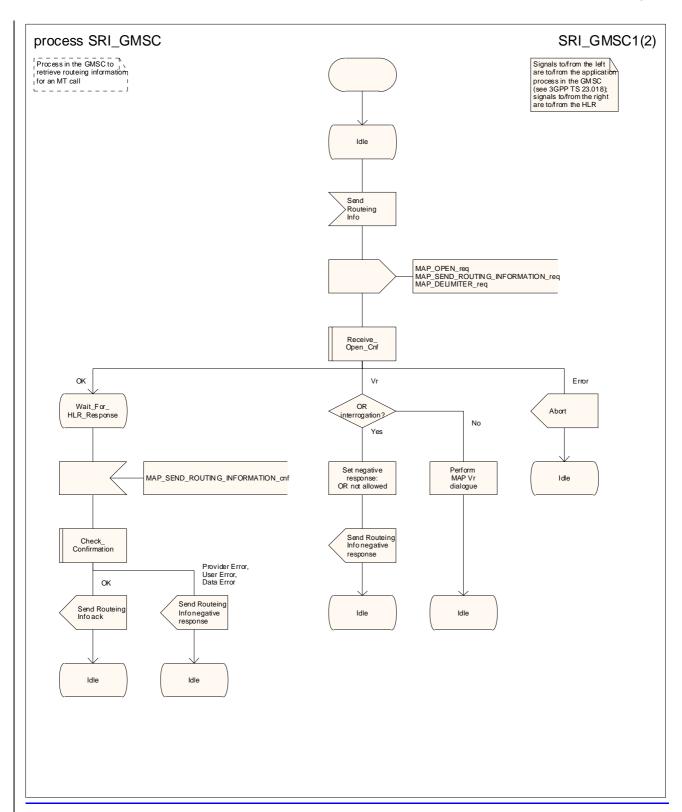
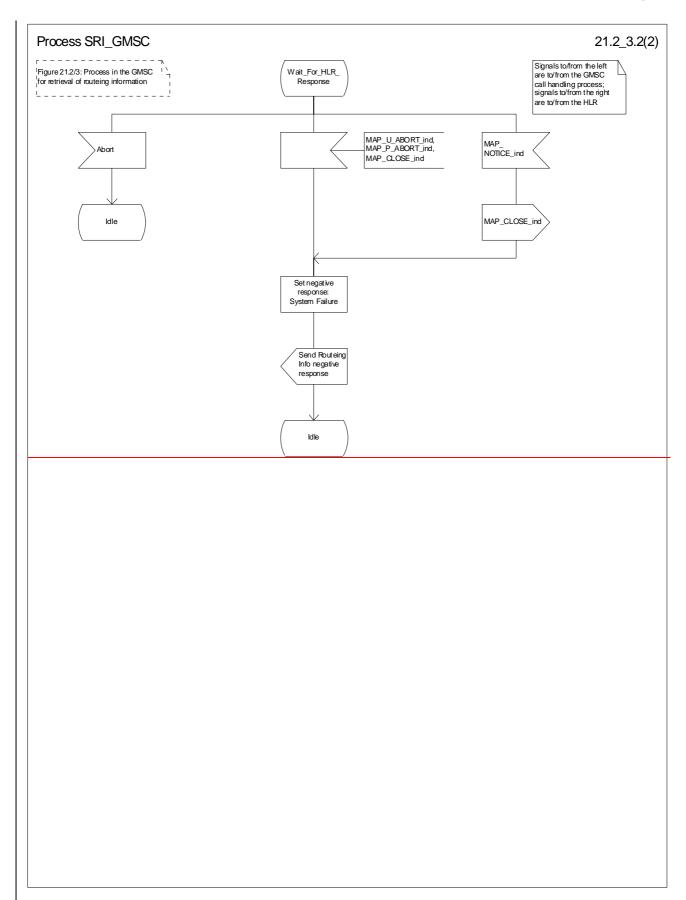


Figure 21.2/63 (sheet 1 of 2): Process SRI\_GMSC



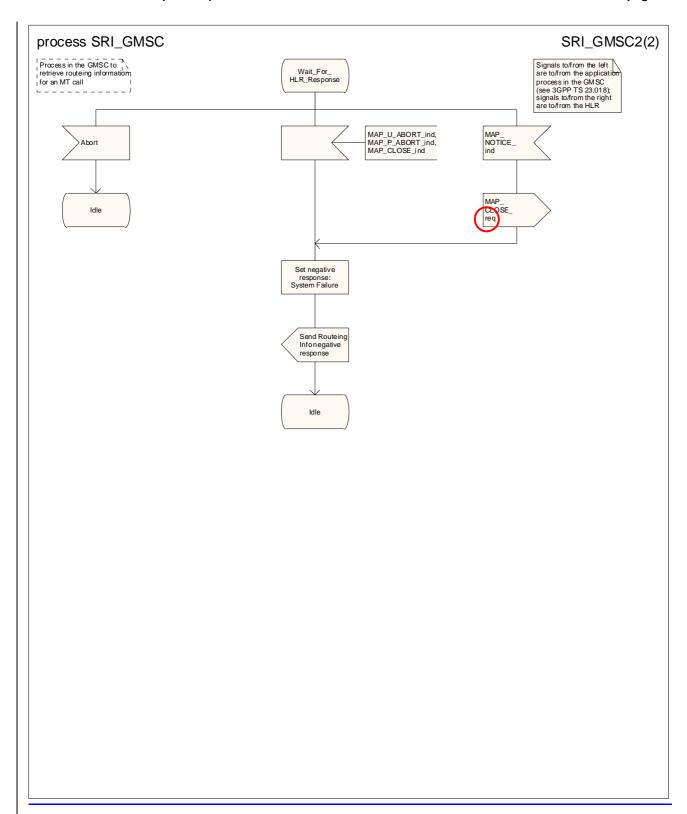
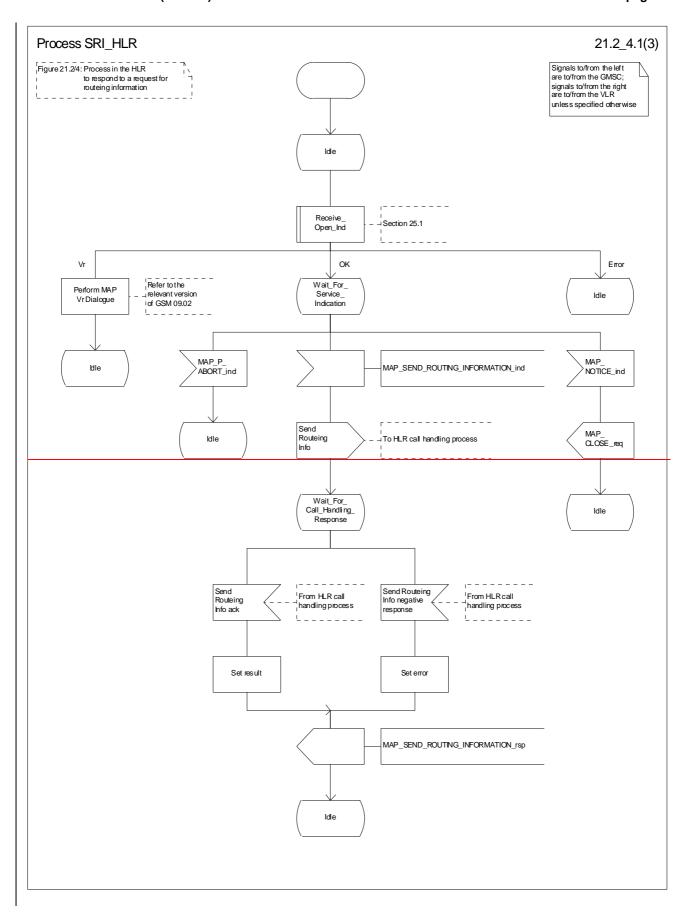


Figure 21.2/63 (sheet 2 of 2): Process SRI\_GMSC



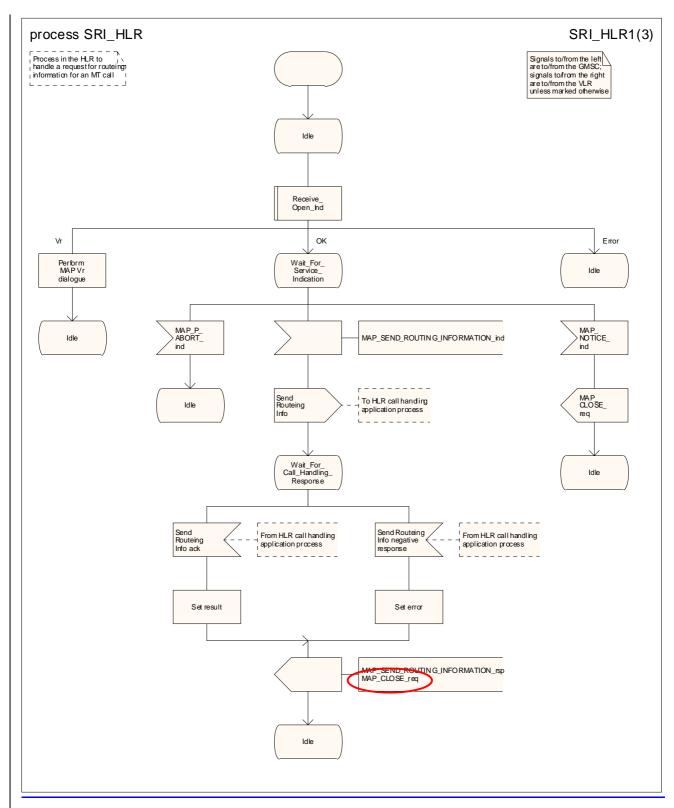
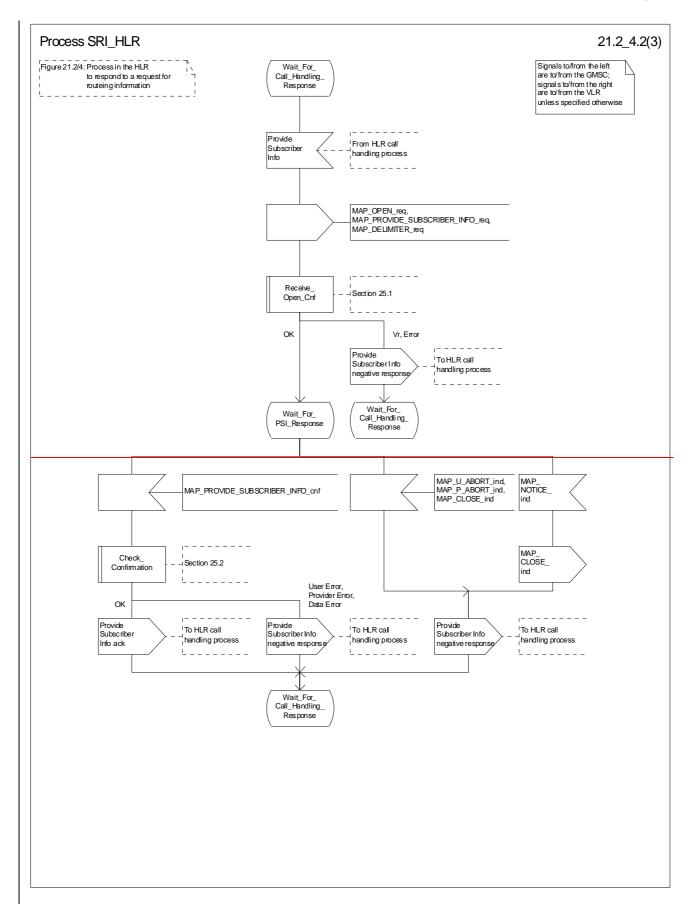


Figure 21.2/74 (sheet 1 of 3): Process SRI\_HLR



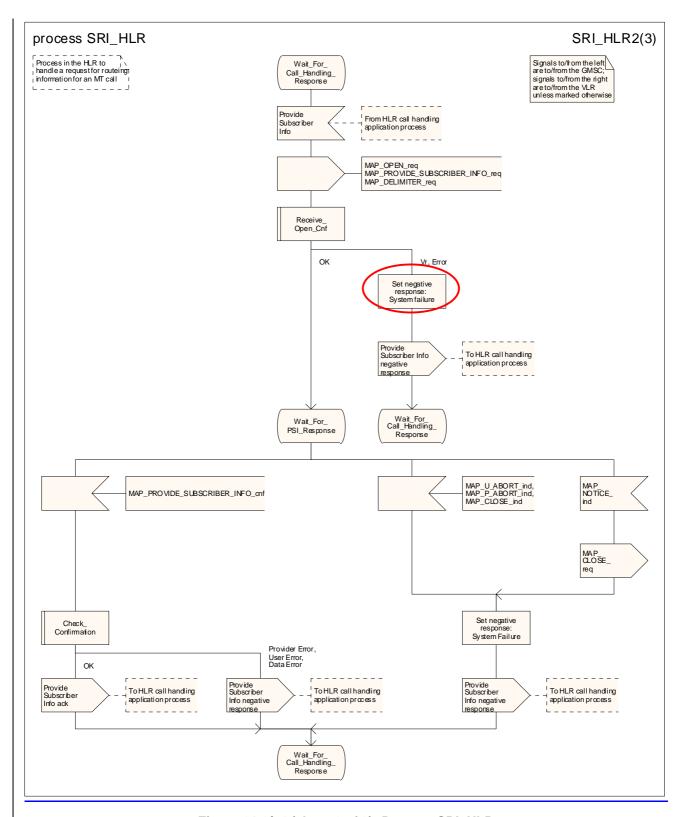
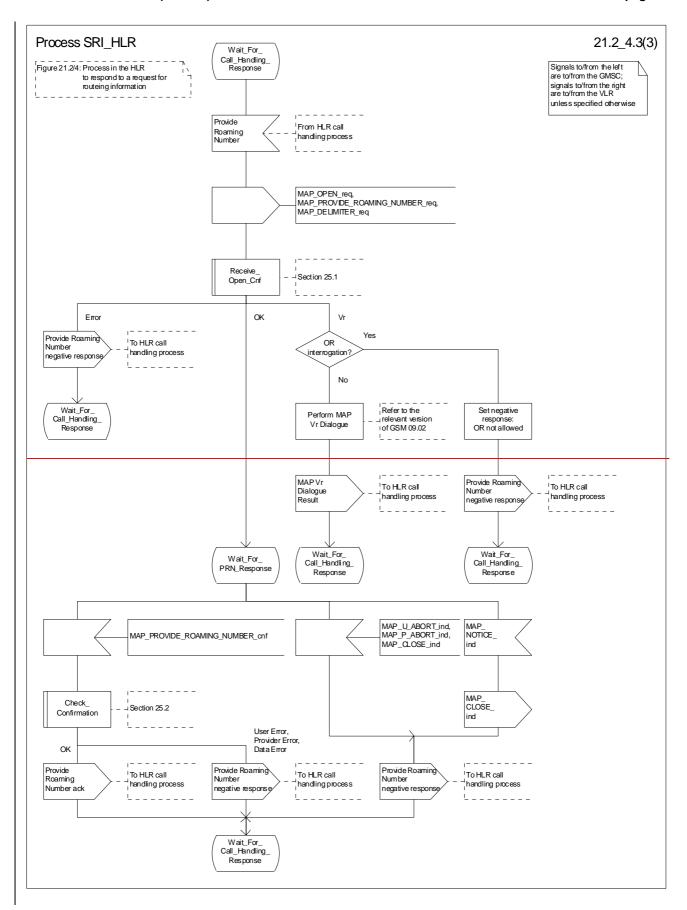


Figure 21.2/74 (sheet 2 of 3): Process SRI\_HLR



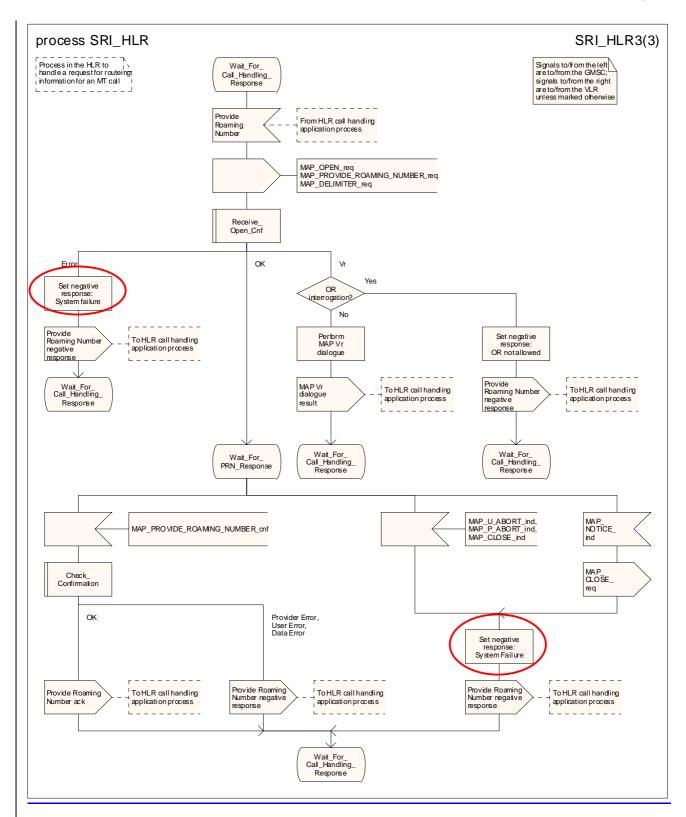
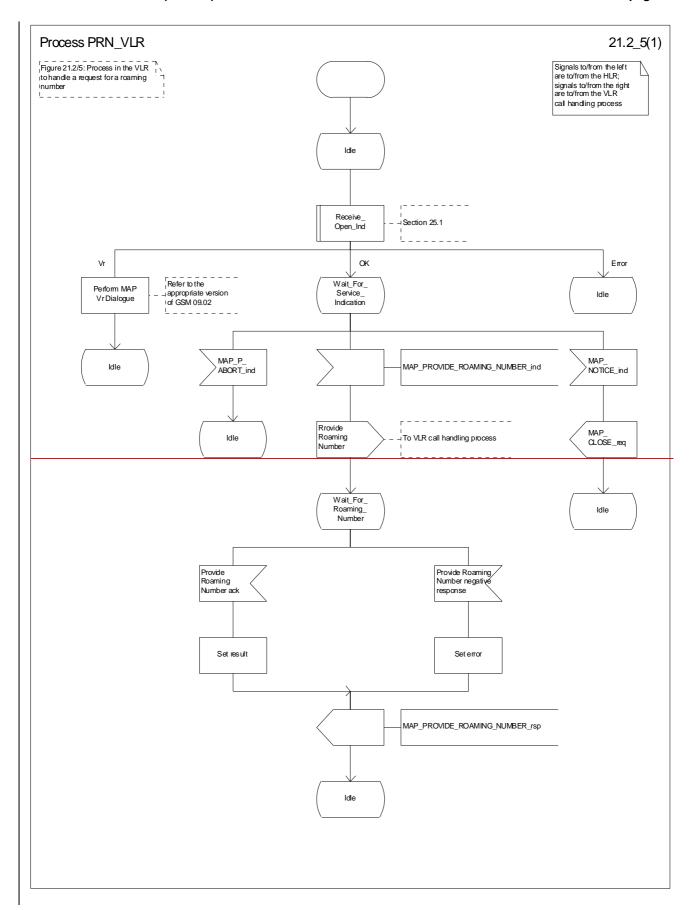


Figure 21.2/74 (sheet 3 of 3): Process SRI\_HLR



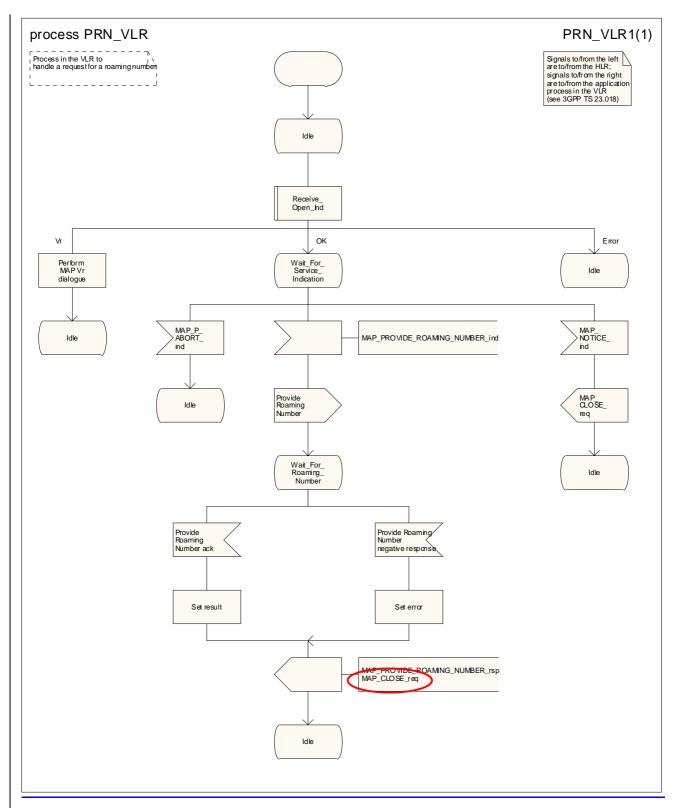
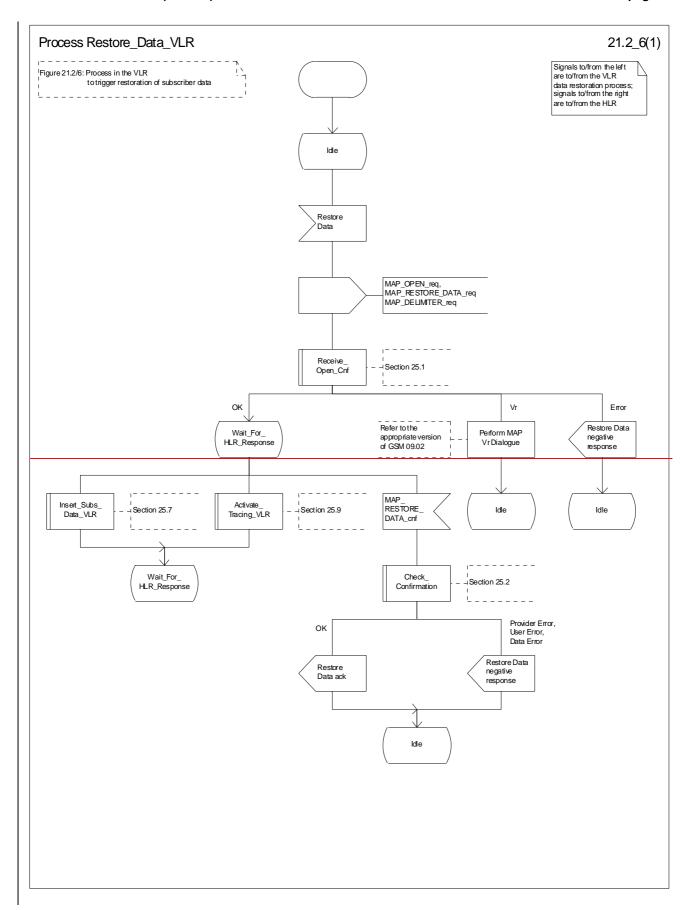


Figure 21.2/85: Process PRN\_VLR



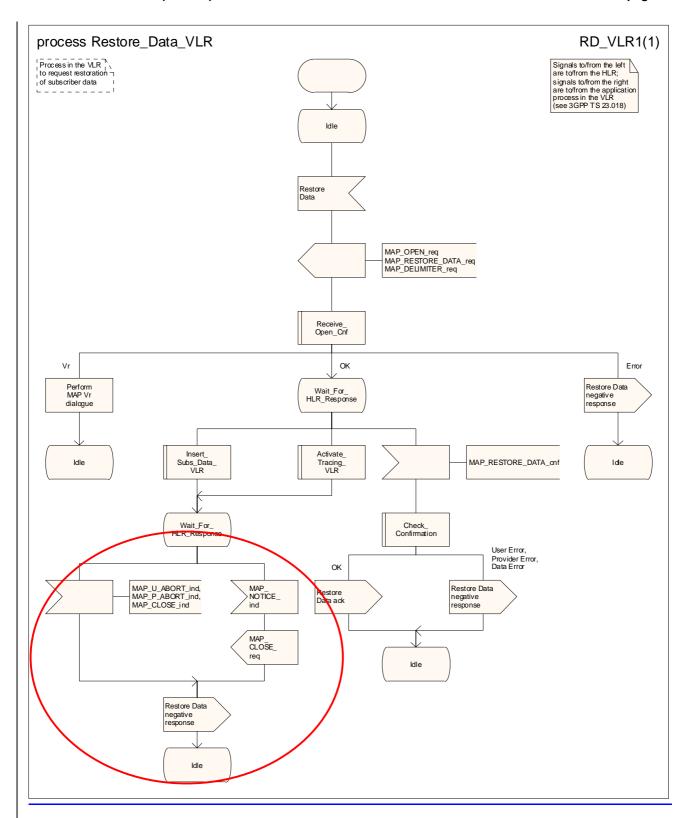
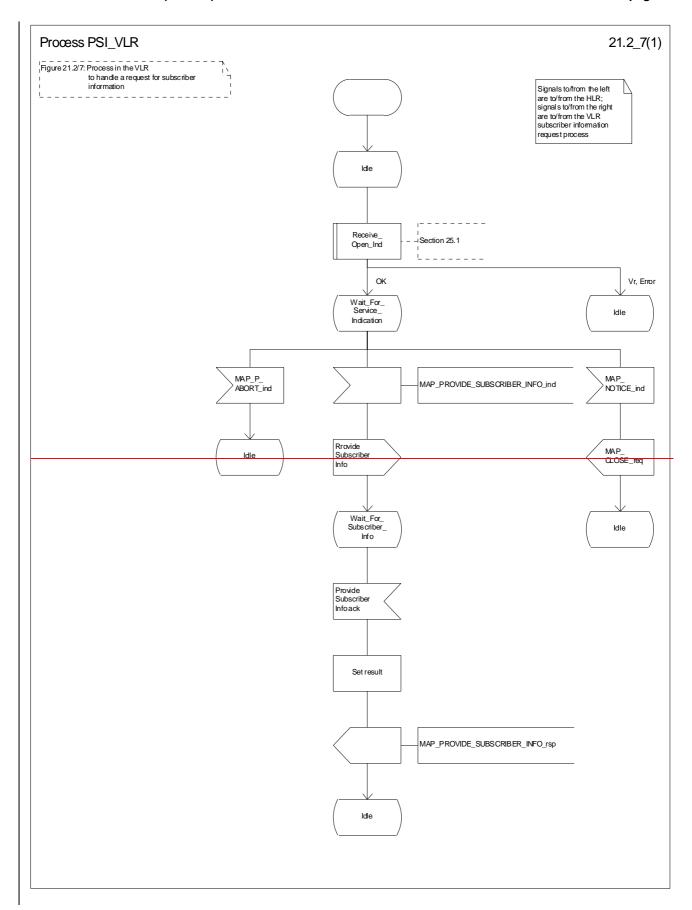


Figure 21.2/96: Process Restore\_Data\_VLR



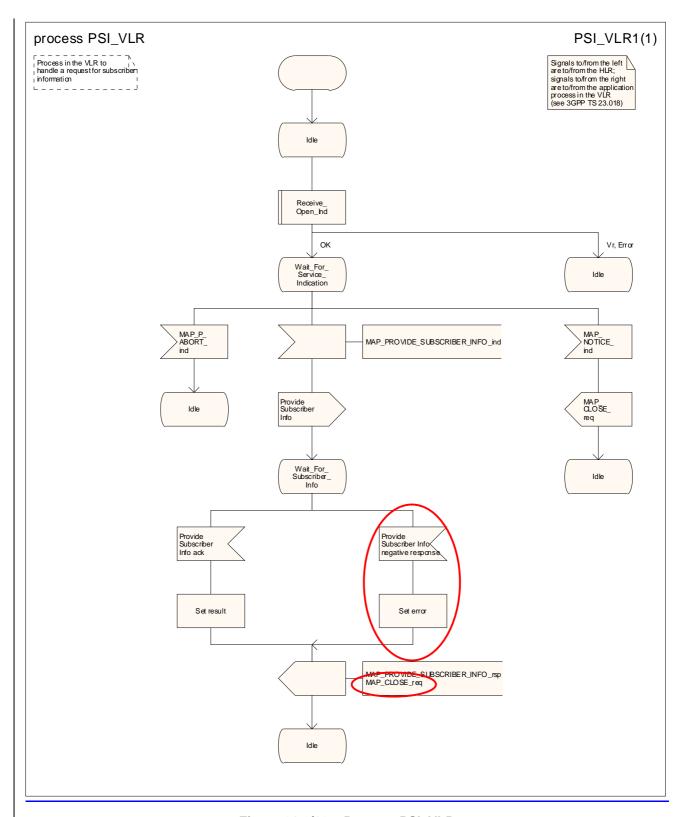
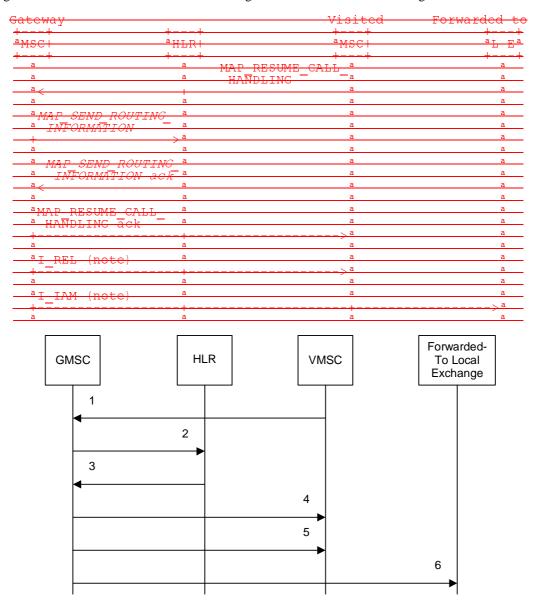


Figure 21.2/107: Process PSI\_VLR

### 21.3 Transfer of call handling

### 21.3.1 General

The message flow for successful transfer of call handling to forward a call is shown in figure 21.3/1.



- 1) MAP\_RESUME\_CALL\_HANDLING\_req/ind
- 2) MAP SEND ROUTING INFORMATION reg/ind (Note 2)
- 3) MAP SEND ROUTING INFORMATION rsp/cnf (Note 2)
- 4) MAP\_RESUME\_CALL\_HANDLING\_rsp/cnf
- 5) I REL (Note 1)
- I\_IAM (Note 1)

#### xxx = Optional Procedure

NOTE\_1: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following CCITU-TT Recommendations & ETSI specification:

- Q.721-725 Telephone User Part (TUP);
- ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.

NOTE 2: Services printed in italics are optional.

### Figure 21.3/1: Message flow for transfer of call handling

If the HLR indicated in the response to the original request for routeing information that forwarding interrogation is required, the GMSC executes the Send Routeing Information procedure with the HLR to obtain forwarding information; otherwise the GMSC uses the forwarding data which were sent in the MAP\_RESUME\_CALL\_HANDLING req/ind.

### 21.3.2 Process in the VMSC

The MAP process in the VMSC to retrieve routeing information for a mobile terminating call is shown in figure 21.3/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

If the capacity of a message signal unit in the lower layers of the protocol is enough to carry all the information which has to be sent to the GMSC, the test "Segmentation needed?" takes the "No" exit; otherwise the test takes the "Yes" exit.

#### Successful Outcome

When the MAP process receives a Resume Call Handling request from the call handling process in the VMSC, it requests a dialogue with the GMSC whose identity is contained in the Resume Call Handling request by sending a MAP\_OPEN service request, requests routeing information using a MAP\_RESUME\_CALL\_HANDLING service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the GMSC. VMSC shall not send any duplicate data to the GMSC.

If the VMSC notices after receiving a Resume Call Handling request that the segmentation is needed the VMSC does not set the "All Information Sent" indicator. Otherwise the indicator is set and the process returns to the Wait For GMSC Response state.

If the MAP process receives a MAP\_RESUME\_CALL\_HANDLING service confirm from the GMSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process checks if the "All Information Sent" indicator is set. If it is set the MAP process sends a Resume Call Handling ack to the call handling process in the VMSC and returns to the idle state. If the "All Information Sent" indicator is not set the MAP process checks if further segmentation is needed. If segmentation is needed the VMSC does not set the indicator and sends

MAP\_RESUME\_CALL\_HANDLING service request to the GMSC. Otherwise the indicator is set and the MAP\_RESUME\_CALL\_HANDLING service request is sent to the GMSC.

#### **Dialogue opening failure**

If the macro Receive\_Open\_Cnf indicates that the dialogue with the GMSC could not be opened or that the dialogue can be opened only at an earlier version, the MAP process sends an Resume Call Handling negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

### Error in MAP\_RESUME\_CALL\_HANDLING confirm

If the MAP\_RESUME\_CALL\_HANDLING service confirm contains a user error or a provider error, the MAP process sends a Resume Call Handling negative response to the call handling process in the VMSC and returns to the idle state.

NOTE: the 'Data Error' exit from the macro Check\_Confirmation is shown for formal completeness; the result is empty, so the MAP\_PROVIDE\_SUBSCRIBER\_INFO\_cnf primitive cannot contain a data error.

### **Abort of GMSC dialogue**

After the dialogue with the GMSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the GMSC may send a MAP\_CLOSE indication. In either of these cases, the MAP process sends a Resume Call Handling negative response to the call handling process in the GMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the GMSC, sends a Resume Call Handling negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

## 21.3.3 Process in the GMSC

The MAP process in the GMSC to handle a request for the GMSC to resume call handling is shown in figure 21.3/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1;

If the parameter All Information Sent was present in the MAP\_RESUME\_CALL\_HANDLING indication, the test "All Information Sent" takes the "Yes" exit; otherwise the test takes the "No" exit.

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context callControlTransfer, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_RESUME\_CALL\_HANDLING service indication is received, the MAP process checks if the "All Information Sent" indicator is set and if so it sends a Resume Call Handling request including all the stored data to the call handling process in the GMSC, and waits for a response. The Resume Call Handling request contains the parameters received in the MAP\_RESUME\_CALL\_HANDLING service indication. If the "All Information Sent" indicator is not set, the received data is stored and the MAP process constructs an empty MAP\_RESUME\_CALL\_HANDLING service response, sends it to the VMSC and returns to the Wait For Service Indication state.

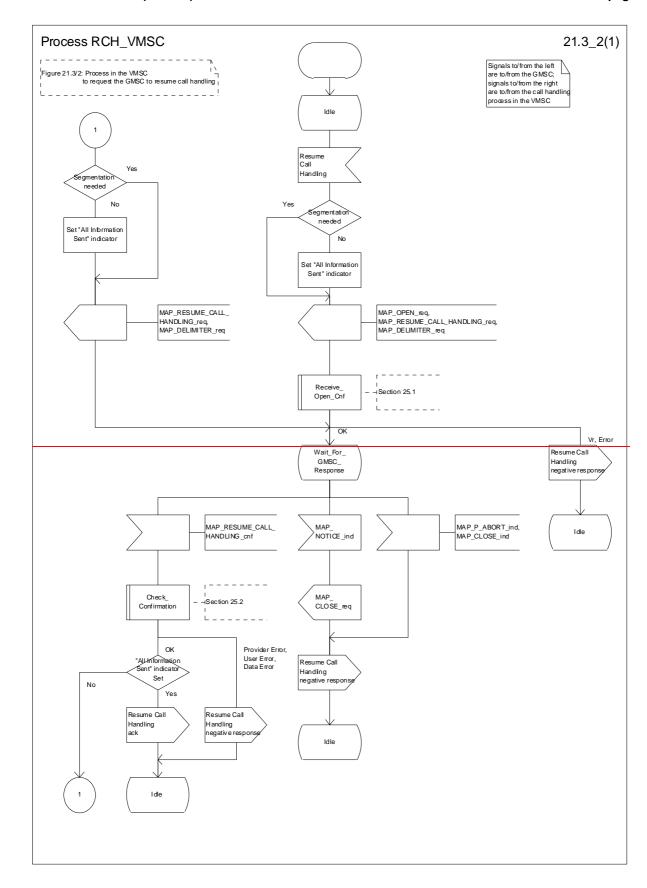
If the call handling process in the GMSC returns a Resume Call Handling ack, the MAP process constructs a MAP\_RESUME\_CALL\_HANDLING service response, constructs a MAP\_CLOSE service request, sends them to the VMSC and returns to the idle state.

#### Failure of dialogue opening with the VMSC

If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.



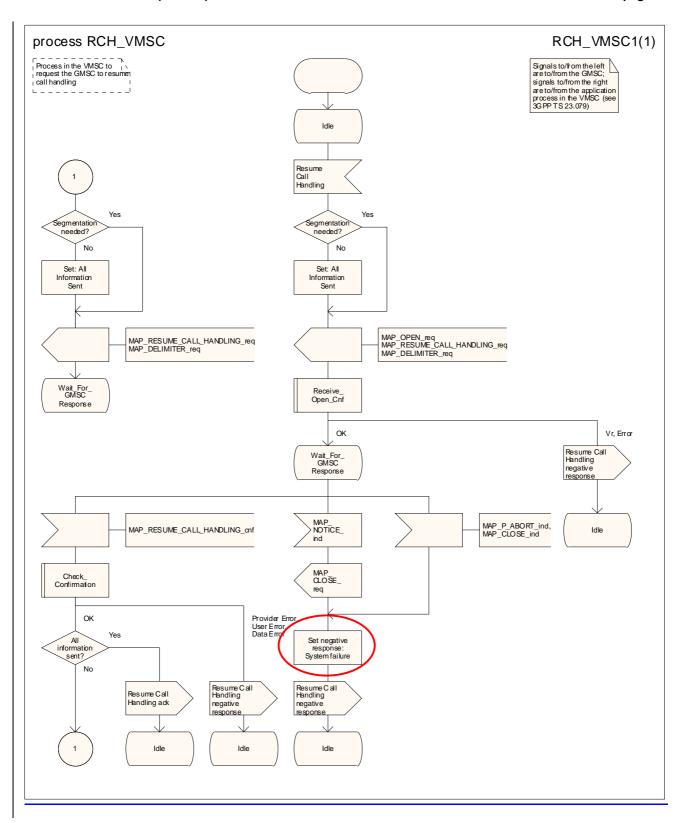
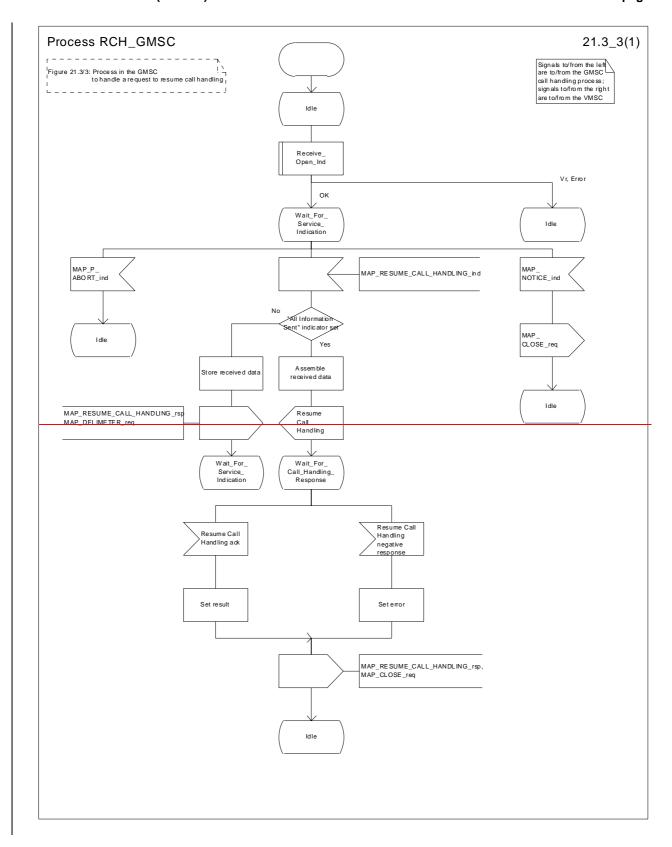


Figure 21.3/2: Process RCH\_VMSC



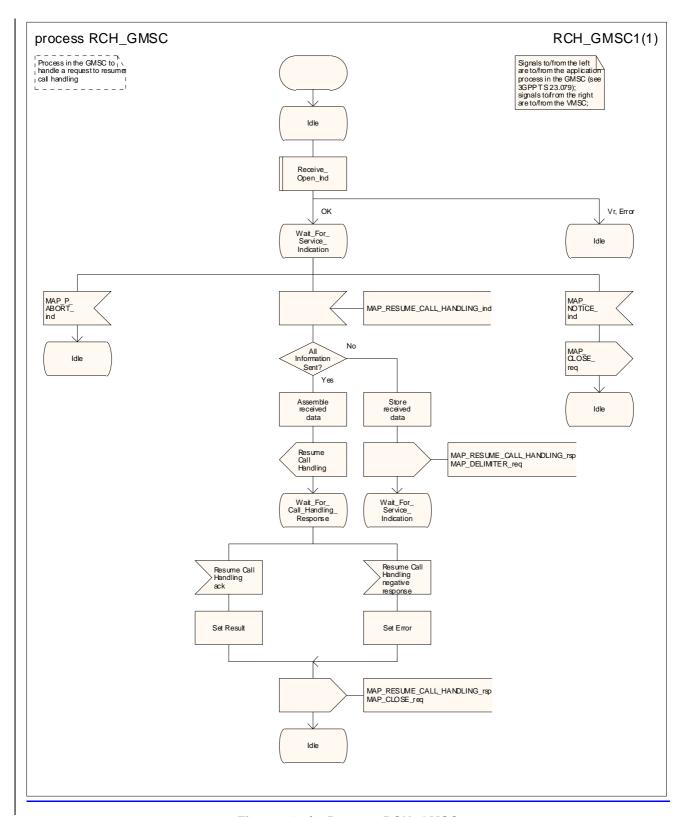
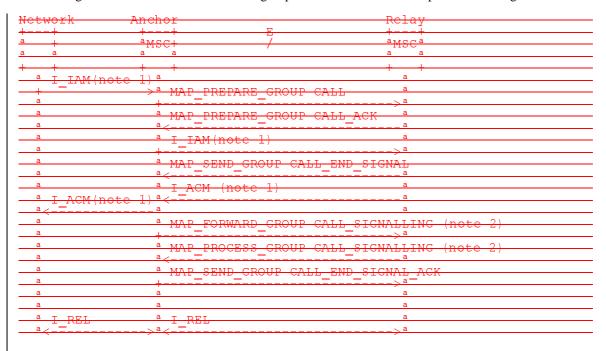


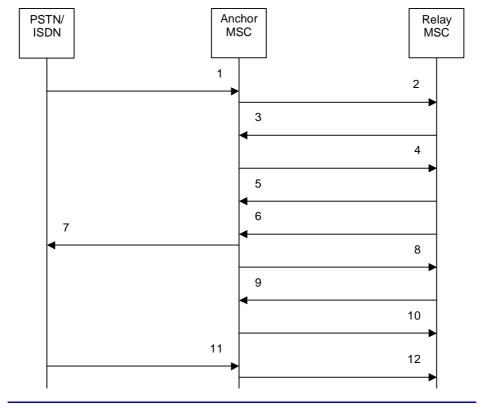
Figure 21.3/3: Process RCH\_GMSC

#### Inter MSC Group Call Procedures 21.4

#### 21.4.1 General

The message flows for successful inter MSC group call / broadcast call set-up is shown in figure 21.4/1.





- I\_IAM (Note 1)
- MAP PREPARE GROUP CALL reg/ind
- 2) 3) MAP\_PREPARE\_GROUP\_CALL\_rsp/cnf
- I IAM (Note 1)
- MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL\_req/ind

- 6) I ACM (Note 1)
  7) I\_ACM (Note 1)
  8) MAP FORWARD GROUP CALL SIGNALLING req/ind (Note 2)
  9) MAP PROCESS GROUP CALL SIGNALLING req/ind (Note 2)
  10) MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL\_rsp/cnf
  11) I\_REL (Note 3)
  12) \_I REL (Note 3)
- NOTE 1: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. For further details on the TUP and ISUP procedures refer to the following ITU-T Recommendations and ETSI specification:
  - Q.721-725 Telephone User Part (TUP);
  - ETS 300 356-1 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 1: Basic services.
- NOTE 2: The MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING and
- MAP\_PROCESS\_GROUP\_CALL\_SIGNALLING services are not applicable for voice broadcast calls.

NOTE 3: The call can be released from the PSTN/ISDN or the Relay MSC

Figure 21.4/1: Message flow for inter MSC group call / broadcast call

## 21.4.2 Process in the Anchor MSC

The MAP process in the Anchor MSC to retrieve and transfer information from / to the Relay MSC for VBS and VGCS calls is shown in figure 21.4/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Indication see <u>sub</u>clause 25.2.1; Check\_Confirmation see <u>sub</u>clause 25.2.2.

### **Successful Outcome**

When the MAP process receives a Prepare Group Call request from the ASCI handling process in the anchor MSC, it requests a dialogue with the relay MSC whose identity is contained in the Prepare Group Call request by sending a MAP\_OPEN service request, requests an Group Call number by using a MAP\_PREPARE\_GROUP\_CALL service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the relay MSC.

If the MAP process receives a MAP\_PREPARE\_GROUP\_CALL service confirm from the relay MSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a Prepare Group Call ack containing the Group Call number received from the relay MSC to the ASCI handling process in the anchor MSC and waits for completion of call set up in the relay MSC.

On receipt of a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service indication from the relay MSC the MAP process invokes the macro Check\_Indication to check the content of the indication.

If the macro Check\_Indication takes the OK exit, the MAP process sends a Send Group Call End Signal to the ASCI handling process in the anchor MSC and waits for uplink management signals. In this state the following events are processed:

- Reception of a Send Group Call End Signal ack from the ASCI handling process in the anchor MSC;
- Reception of a Forward Group Call Signalling request from the ASCI handling process in the anchor MSC;
- Reception of a MAP PROCESS GROUP CALL SIGNALLING service indication from the relay MSC.

On reception of a Send Group Call End Signal ack from the ASCI handling process in the anchor MSC, the MAP process constructs a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service response, constructs a MAP\_CLOSE service request, sends them to the relay MSC and returns to the idle state.

On reception of a Forward Group Call Signalling request from the ASCI handling process in the anchor MSC, the MAP process constructs a MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING service request, sends it to the relay MSC and returns to the uplink management state.

On reception of a MAP\_PROCESS\_GROUP\_CALL\_SIGNALLING service indication from the relay MSC, the MAP process invokes the macro Check Indication to check the content of the indication.

If the macro Check\_Indication takes the OK exit, the MAP process sends a Process Group Call Signalling to the ASCI handling process in the anchor MSC and returns to the uplink management state.

## **Dialogue opening failure**

If the macro Receive\_Open\_Cnf indicates that the dialogue with the relay MSC could not be opened, the MAP process sends an Abort to the ASCI handling process and returns to the idle state.

## Error in MAP\_PREPARE\_GROUP\_CALL confirm

If the MAP\_PREPARE\_GROUP\_CALL service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Prepare Group Call negative response to the ASCI handling process in the anchor MSC, sends a MAP\_U\_ABORT request to the relay MSC and returns to the idle state.

#### **Abort of MAP dialogue**

After the dialogue with the relay MSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the relay MSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an Abort to the ASCI handling process in the anchor MSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the relay MSC, sends an Abort to the ASCI handling process in the anchor MSC and returns to the idle state.

# 21.4.3 Process in the Relay MSC

The MAP process in the Relay MSC to receive and transfer information from / to the Anchor MSC for VBS and VGCS calls is shown in figure 21.4/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.2;

Check\_Indication see <u>sub</u>clause 25.2.1.

#### **Successful Outcome**

When the MAP process receives a MAP\_OPEN indication with the application context groupCallControl, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PREPARE\_GROUP\_CALL service indication is received, the MAP process invokes the macro Check Indication.

If the macro takes the OK exit, the MAP process sends a Prepare Group Call request to the ASCI handling process in the relay MSC and waits for a response. The Prepare Group Call request contains the parameters received in the MAP\_PREPARE\_GROUP\_CALL service indication.

If the ASCI handling process in the relay MSC returns a Prepare Group Call ack, the MAP process constructs a MAP\_PREPARE\_GROUP\_CALL service response containing the information contained in the Prepare Group Call ack, constructs a MAP\_DELIMITER service request, sends them to the anchor MSC and waits for the GROUP CALL END SIGNAL.

If the ASCI handling process in the relay MSC sends a Send Group Call End Signal request to the MAP process, the MAP process constructs a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service request containing the information

contained in the SEND GROUP CALL End Signal request, constructs a MAP\_DELIMITER service request, sends them to the anchor MSC and waits for uplink management signals. In this state the following events are processed:

- Reception of a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service confirmation from the anchor MSC;
- Reception of a MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING service indication from the anchor MSC;
- Reception of a Process Group Call Signalling request from the ASCI handling process in the relay MSC.

On reception of a MAP\_SEND\_GROUP\_CALL\_END\_SIGNAL service confirmation from the anchor MSC, the MAP process returns to the idle state.

On reception of a MAP\_FORWARD\_GROUP\_CALL\_SIGNALLING service indication from the anchor MSC, the MAP process invokes the macro Check Indication. If the macro takes the OK exit, the MAP process sends a Forward Group Call Signalling request to the ASCI handling process in the relay MSC and waits for further uplink management signals.

On reception of a Process Group Call Signalling request from the ASCI handling process in the relay MSC, the MAP process constructs a MAP\_PROCESS\_GROUP\_CALL\_SIGNALLING service request containing the information received in the Process Group Call Signalling request, constructs a MAP\_DELIMITER service request, sends them to the anchor MSC and waits for further uplink management signals.

## Failure of dialogue opening with the anchor MSC

If the macro Receive\_Open\_Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

#### **Error in MAP\_PREPARE\_GROUP\_CALL indication**

If the macro Check Indication takes the Error exit, the MAP process sends a MAP\_U\_ABORT request to the anchor MSC and returns to the idle state.

#### Negative response received from the ASCI handling process

If the ASCI handling process in the relay MSC returns a negative response to the Prepare Group Call request, the MAP process constructs a MAP\_PREPARE\_GROUP\_CALL service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the anchor MSC and returns to the idle state.

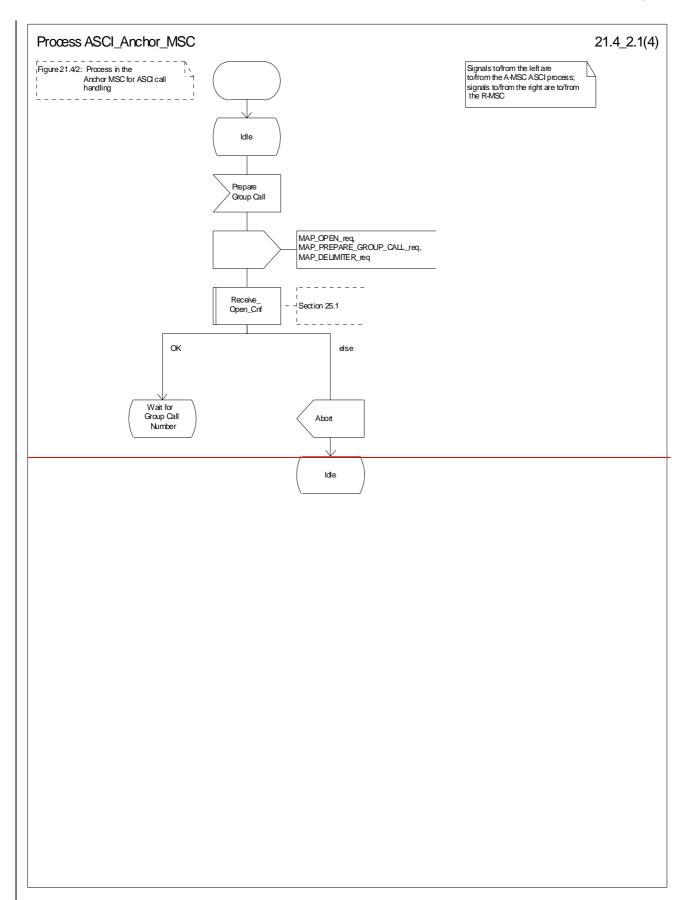
#### **Error in MAP FORWARD GROUP CALL SIGNALLING indication**

If the macro Check Indication takes the Error exit, the MAP process sends a MAP\_U\_ABORT request to the anchor MSC, sends an Abort to the ASCI handling process in the relay MSC ind returns to the idle state.

#### **Abort of MAP dialogue**

After the dialogue with the anchor MSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the anchor MSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an Abort to the ASCI handling process in the relay MSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the anchor MSC, sends an Abort to the ASCI handling process in the anchor MSC and returns to the idle state.



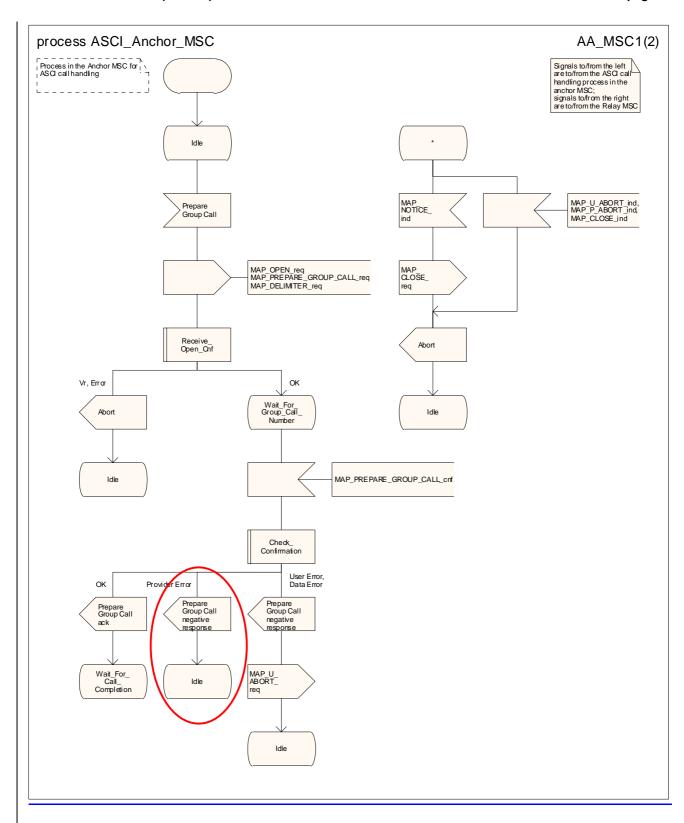
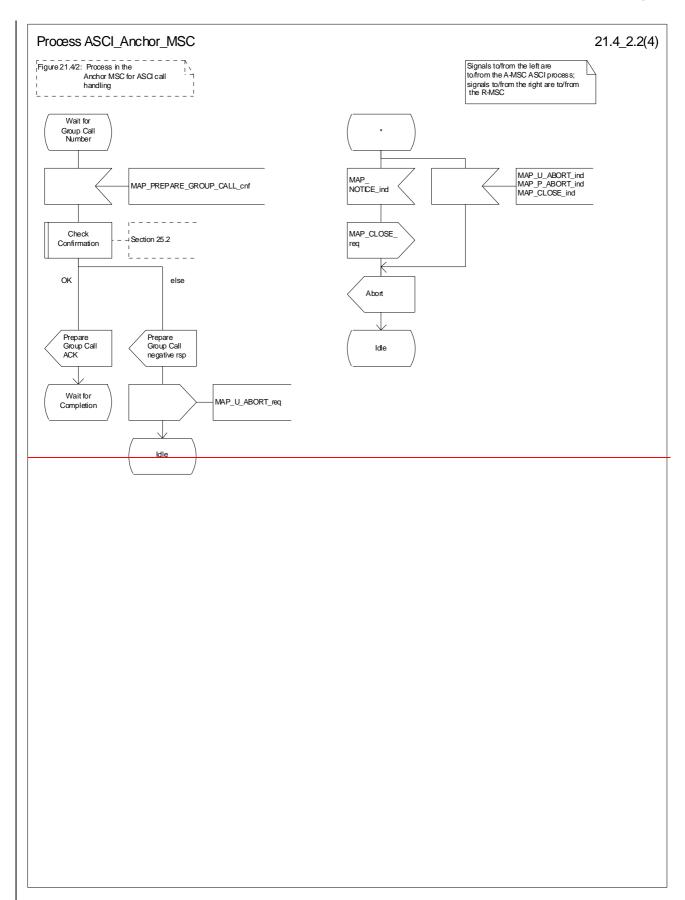


Figure 21.4/2 (sheet 1 of 24): Process ASCI\_Anchor\_MSC



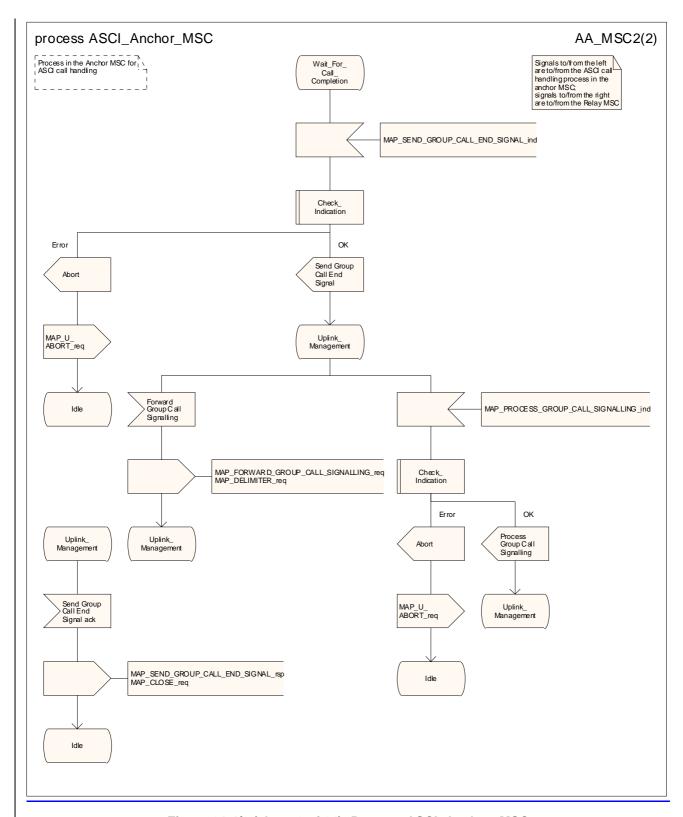


Figure 21.4/2 (sheet 2 of 24): Process ASCI\_Anchor\_MSC

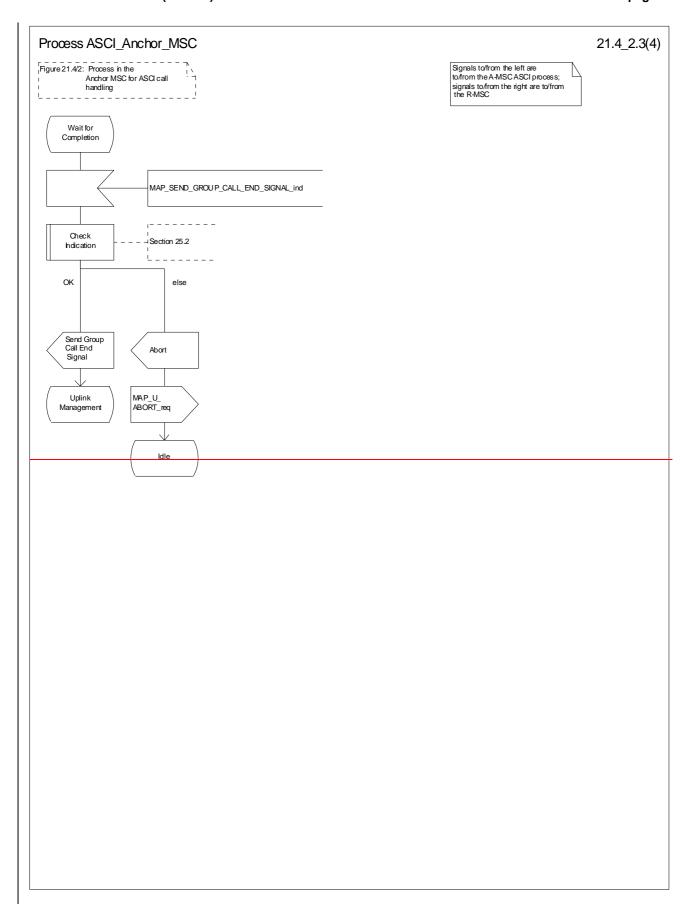


Figure 21.4/2 (sheet 3 of 4): Process ASCI\_Anchor\_MSC

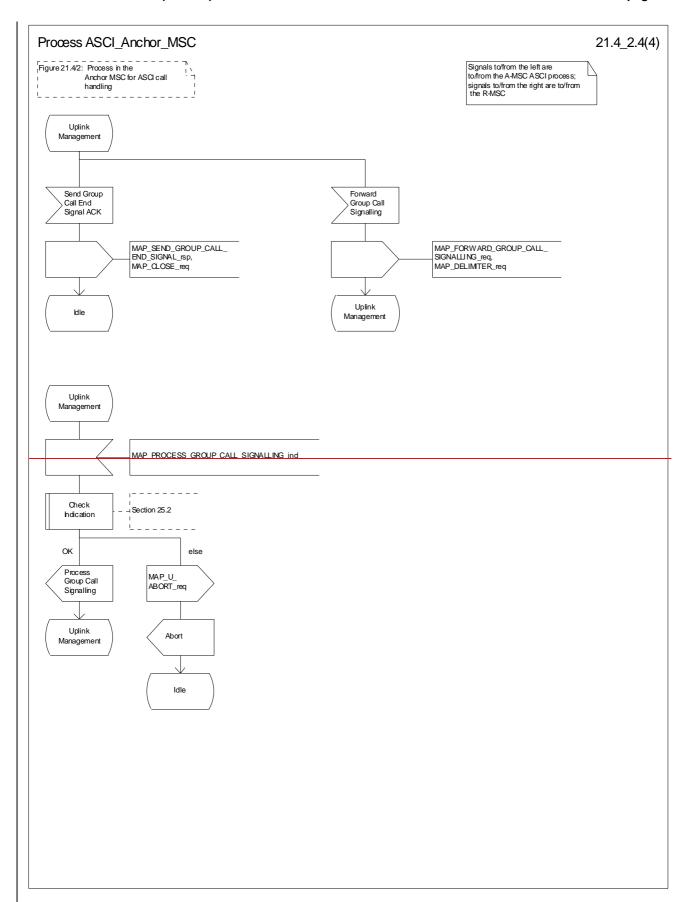
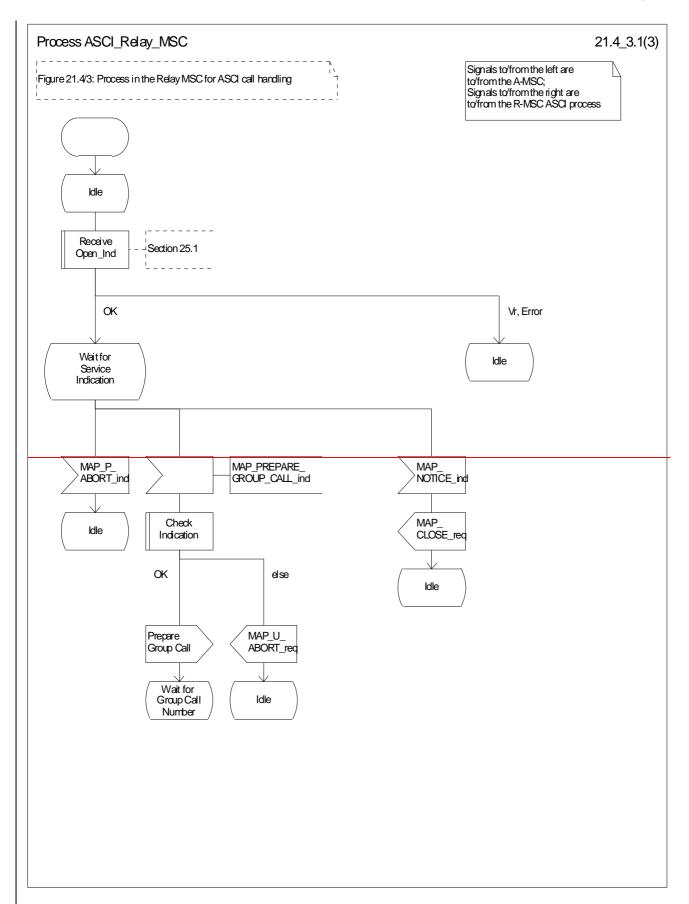


Figure 21.4/2 (sheet 4 of 4): Process ASCI\_Anchor\_MSC



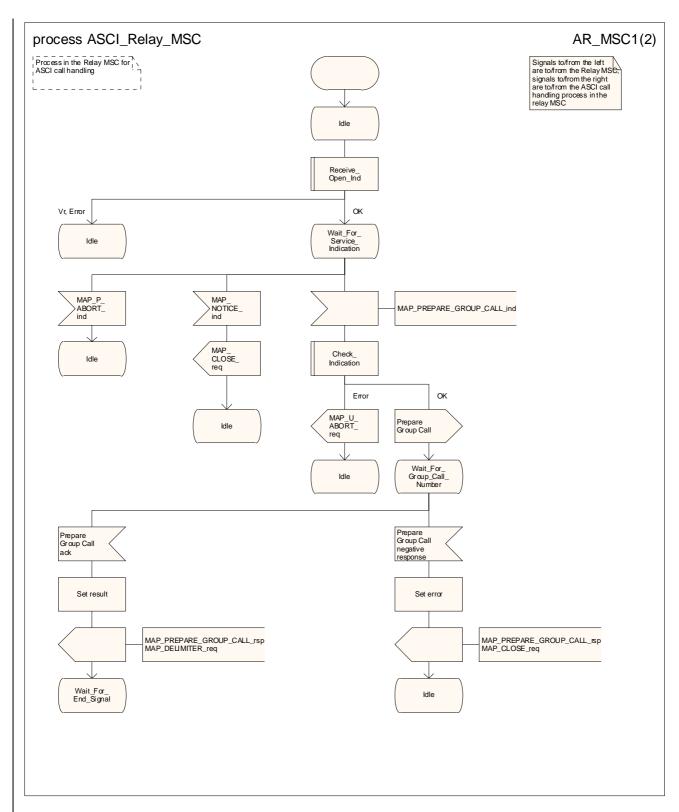
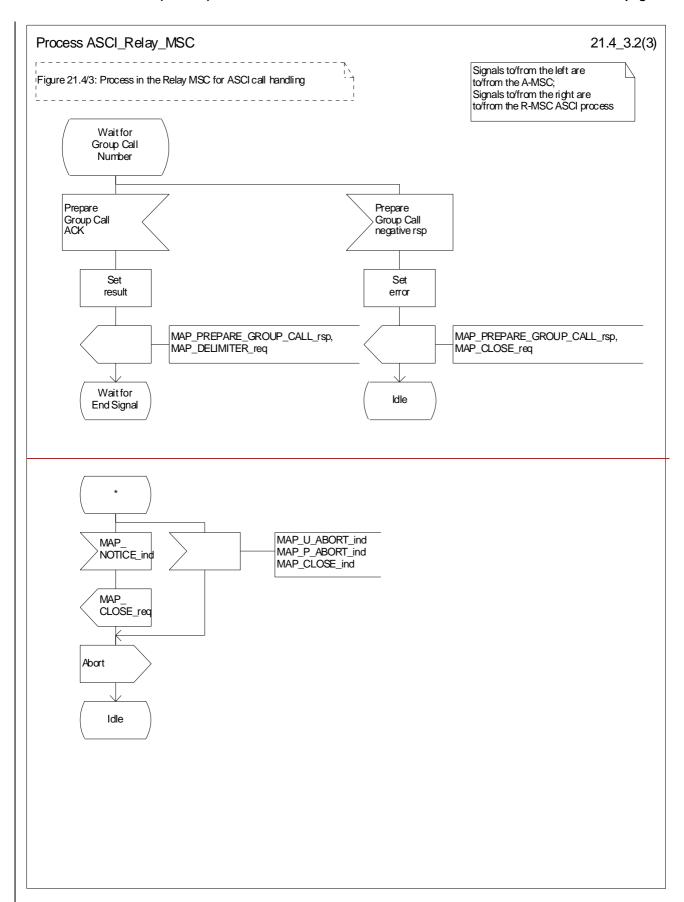


Figure 21.4/3 (sheet 1 of 23): Process ASCI\_Relay\_MSC



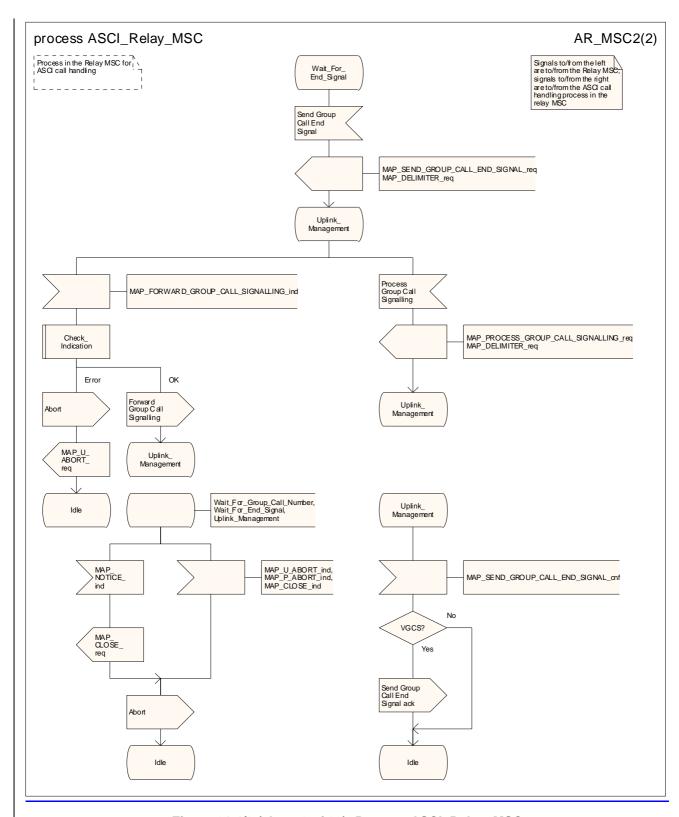


Figure 21.4/3 (sheet 2 of 23): Process ASCI\_Relay\_MSC

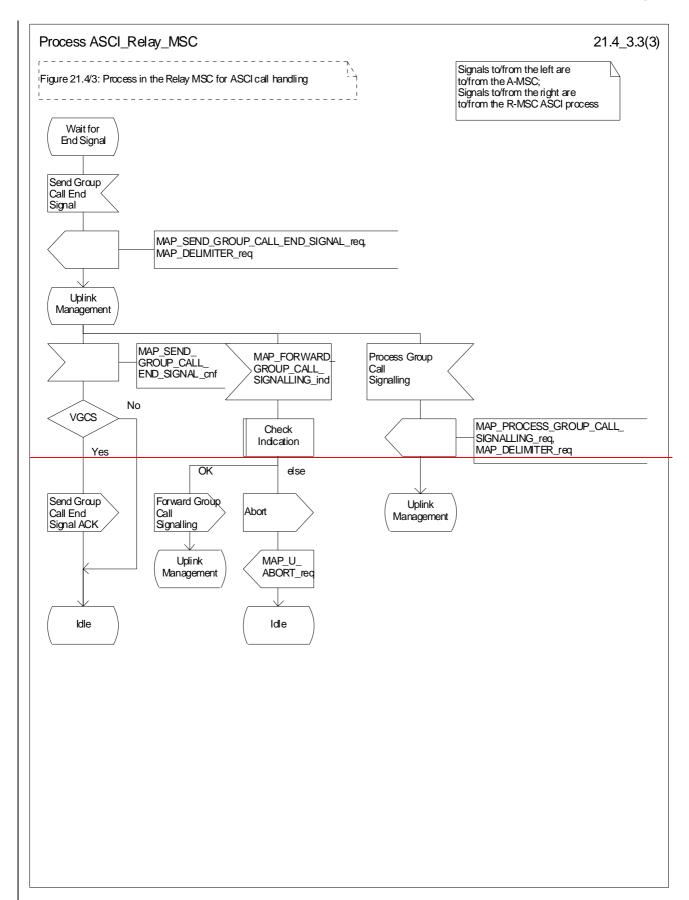
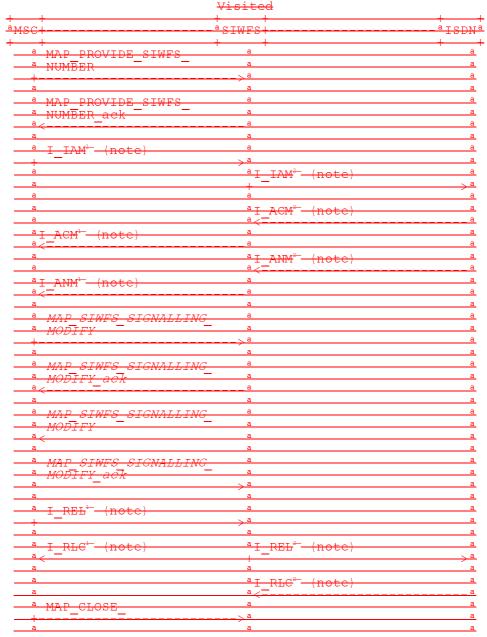


Figure 21.4/3 (sheet 3 of 3): Process ASCI\_Relay\_MSC

## 21.5 VoidAllocation and modifications of resources in an SIWFS

## 21.5.1 General

The message flow for successful allocation and modification of resources in an SIWFS is shown in figure 21.5/1 (mobile originating call non-loop method), 21.5/2 (mobile originating call loop method) and 21.5/3 (mobile terminating call loop method).



xxx = Optional Procedure

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

NOTE 2: The number on the ISUP messages have been added to link the messages to respective signalling sequence.

NOTE 3: The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

Figure 21.5/1: Message flow for mobile originating call non-loop method



xxx = Optional Procedure

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

NOTE 2: The number on the ISUP messages have been added to link the messages to respective signalling sequence.

NOTE 3: The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

Figure 21.5/2: Message flow for mobile originating call loop method

MCCL ACTION	+ + + + + + + + + + + + + + + + + + +
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MAL LICOTOR SIMES	
a NUMBER ack — — a	·
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a a	
- a I ACM <sup>a-</sup> (note)	·
a I ACM <sup>2</sup> (note)	
a< <del>_</del> a	
a a	
a _ ACM¹ (note)	aa
a a	
al ANM <sup>3</sup> (note)	
<del>-+</del>	
a a a a a a a a a a a a a a a a a a a	
a I ANM <sup>2</sup> (note)	
a a	<u>a</u>
<del>al ANM¹ (note) a</del>	
a	
a MAP SIWFS SIGNALLING	
a MODIFY - a	<u>a</u>
<del>-+</del>	<del>-</del>
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THIL DIMED DIGMIDDING	
a <u>MODIFY ack</u>	
a · a	
<u> </u>	
a <i>MODTFY</i> a	
a a	
a MAP SIWFS SIGNALLING	
<del>a MODIFY ack — a</del>	
a I REL <sup>+</sup> (note)	a
a a	
- I_RLC (note)	
#	
aI_REL2 (note)	
+	
<u>a</u> a	
a I RLC2 (note)	
a a	
a I REL <sup>3</sup> (note)	
a <a< td=""><td></td></a<>	
a a	
<u>a I RLC<sup>3</sup> (note)</u>	
<del> </del>	
a MAP_CLOSE	
111/31 3211/22/11	

— xxx = Optional Procedure
NOTE 1: TUP or ISUP may be used in signalling between MSCs, depending on the network type between the MSCs. The Release message can be initiated either by calling or called subscriber. For further details on the TUP and ISUP procedures refer to the following CCITT Recommendations & ETSI specification:
— Q.721-725 - Telephone User Part (TUP);

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

NOTE 2: The number on the ISUP messages have been added to link the messages to respective signalling sequence.

NOTE 3: The modification of SIWF resources could be initiated any time during the call either by the VMSC or the SIWFS.

### Figure 21.5/3: Message flow for mobile terminating call loop method

The following MAP services are used to allocate resources in an SIWFS:

MAP PROVIDE SIWFS NUMBER see clause 10.8.

The following MAP services are used to modify resources in an SIWFS:

MAP\_SIWFS\_SIGNALLING\_MODIFY see clause 10.9.

## 21.5.2 Process in the VMSC

The MAP process in the VMSC to allocate and modify resources in an SIWFS for a mobile call is shown in figure 21.5/4. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see clause 25.1.2;

Check Confirmation see clause 25.2.2.

## 21.5.2.1 Allocation of SIWFS resources

#### **Successful Outcome**

When the MAP process receives a Provide SIWFS Number request from the call handling process in the VMSC, it requests a dialogue with the SIWF whose identity is contained in the Provide SIWFS Number request by sending a MAP\_OPEN service request, requests resources in the SIWFS using a MAP\_PROVIDE\_SIWFS\_NUMBER service request and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the SIWFS.

If the MAP process receives a MAP\_PROVIDE\_SIWFS\_NUMBER service confirm from the SIWFS, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a Provide SIWFS Number ack containing the SIWFS Number received from the SIWFS to the call handling process in the VMSC and go to Wait\_For\_Modification state.

## Earlier version MAP dialogue with the SIWFS

If the macro Receive\_Open\_Cnf takes the Vr exit, the MAP process sends an Abort to the call handling process in the VMSC and returns to the idle state.

#### **Dialogue opening failure**

If the macro Receive\_Open\_Cnf indicates that the dialogue with the SIWFS could not be opened, the MAP process sends an Abort to the call handling process in the VMSC and returns to the idle state.

## Error in MAP\_PROVIDE\_SIWFS\_NUMBER confirm

If the MAP\_PROVIDE\_SIWFS\_NUMBER service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a Provide SIWFS number negative response to the call handling process in the VMSC and returns to the idle state.

#### **Call release**

If the call handling process in the VMSC indicates that the call has been aborted, the MAP process returns to the idle state. Any response from the SIWFS will be discarded.

If the call handling process in the VMSC indicates that the traffic channel has been released (i.e. call released by a user) a MAP\_CLOSE\_req is sent and the process is returned to the idle state.

#### **Abort of SIWFS dialogue**

During the time an answer is expected from the SIWFS, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the SIWFS may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends a Provide SIWFS number negative response to the call handling process in the VMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the SIWFS, sends a Provide SIWFS number negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

After the dialogue with the SIWFS has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the SIWFS may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the SIWFS, and returns to the idle state.

## 21.5.2.2 Modification of SIWFS resources initiated by the user

#### Successful Outcome

When the MAP process receives an SIWFS Signalling Modify request from the call handling process in the VMSC, it requests a dialogue with the SIWFS whose identity is contained in the SIWFS Signalling Modify request by sending a MAP\_SIWFS\_SIGNALLING\_MODIFY service request and waits for a response from the SIWFS.

If the MAP process receives a MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm from the SIWFS, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends an SIWFS Signalling Modify ack containing the response received from the SIWFS to the call handling process in the VMSC and go to Wait\_For\_Modification state.

#### **Error in MAP SIWFS SIGNALLING MODIFY confirm**

If the MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the VMSC and go to Wait\_For\_Modification state.

#### **Abort of SIWFS dialogue**

During the time an answer is expected from the SIWFS, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the SIWFS may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the VMSC and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the SIWFS, sends an SIWFS Signalling Modify negative response indicating system failure to the call handling process in the VMSC and returns to the idle state.

## 21.5.2.3 Modification of SIWFS resources initiated by the SIWFS

## Successful outcome

If a MAP\_SIWFS\_SIGNALLING\_MODIFY service indication is received, the MAP process sends an SIWFS signalling modify Info request to the call handling process in the VMSC, and waits for a response. The SIWFS signalling modify request contains the parameters received in the MAP\_SIWFS\_SIGNALLING\_MODIFY service indication.

If the call handling process in the VMSC returns an SIWFS signalling modify ack, the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response contained in the Provide SIWFS Number ack, send it to the SIWFS and go to Wait\_For\_Modification state.

## Negative response from VMSC call handling process

If the call handling process in the VMSC returns a negative response the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response containing the appropriate error, send it to the SIWFS and go to Wait\_For\_Modification state.

## 21.5.3 Process in the SIWFS

The MAP process in the SIWFS to allocate and modify SIWFS resources for a mobile call is shown in figure 21.5/5. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see clause 25.1.1.

Check Confirmation see clause 25.2.2.

#### 21.5.3.1 Procedures for allocation of SIWFS resources

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context locInfoRetrieval, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_PROVIDE\_SIWFS\_NUMBER service indication is received, the MAP process sends a Provide SIWFS number Info request to the call handling process in the SIWFS, and waits for a response. The Provide SIWFS number request contains the parameters received in the MAP\_PROVIDE\_SIWFS\_NUMBER service indication.

If the call handling process in the SIWFS returns a Provide SIWFS number ack, the MAP process constructs a MAP\_PROVIDE\_SIWFS\_NUMBER service response containing the routing information contained in the Provide SIWFS Number ack, constructs a MAP\_DELIMITER service request, sends them to the VMSC and go to Wait\_For\_Modification state.

## Earlier version MAP dialogue with the VMSC

If the macro Receive\_Open\_Ind takes the Vr exit, the MAP process returns to the idle state.

#### **Dialogue opening failure**

If the macro Receive Open Ind takes the Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

## Negative response from SIWFS call handling process

If the call handling process in the SIWFS returns a negative response the MAP process constructs a MAP\_PROVIDE\_SIWFS\_NUMBER service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the VMSC and returns to the idle state.

#### Call release

If the call handling process in the SIWFS indicates that the call has been aborted, the MAP process returns to the idle state. Any response from the VMSC will be discarded.

If the call handling process in the SIWFS indicates that the traffic channel has been released (i.e. call released by a user) a MAP\_CLOSE\_req is sent and the process is returned to the idle state.

#### **Abort of VMSC dialogue**

After the dialogue with the VMSC has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the VMSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VMSC, and returns to the idle state.

## 21.5.3.2 Process for modification of SIWFS resources initiated by the user

#### **Successful outcome**

If a MAP\_SIWFS\_SIGNALLING\_MODIFY service indication is received, the MAP process sends an SIWFS signalling modify Info request to the call handling process in the SIWFS, and waits for a response. The SIWFS signalling modify request contains the parameters received in the MAP\_SIWFS\_SIGNALLING\_MODIFY service indication.

If the call handling process in the SIWFS returns an SIWFS signalling modify ack, the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response contained in the Provide SIWFS Number ack, send it to the VMSC and go to Wait\_For\_Modification state.

## Negative response from SIWFS call handling process

If the call handling process in the SIWFS returns a negative response the MAP process constructs a MAP\_SIWFS\_SIGNALLING\_MODIFY service response containing the appropriate error, send it to the VMSC and go to Wait\_For\_Modification state.

## 21.5.3.3 Process for modification of SIWFS resources initiated by the SIWFS

### **Successful Outcome**

When the MAP process receives an SIWFS Signalling Modify request from the call handling process in the SIWF, it requests a dialogue with the VMSC whose identity is contained in the VMSC Signalling Modify request by sending a MAP\_DELIMITER service request, requests resources in the VMSC using a MAP\_SIWFS\_SIGNALLING\_MODIFY service request, the MAP process waits for a response from the VMSC.

If the MAP process receives a MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm from the VMSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends an SIWFS Signalling Modify ack containing the response received from the VMSC to the call handling process in the SIWF and go to Wait For Modification state.

## **Error in MAP SIWFS SIGNALLING MODIFY confirm**

If the MAP\_SIWFS\_SIGNALLING\_MODIFY service confirm contains a user error or a provider error, or the macro Cheek\_Confirmation indicates that there is a data error, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the SIWFS and go to Wait\_For\_Modification state.

## **Abort of SIWFS dialogue**

During the time an answer is expected from the VMSC, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication, or the VMSC may send a MAP\_U\_ABORT indication or a MAP\_CLOSE indication. In any of these cases, the MAP process sends an SIWFS Signalling Modify negative response to the call handling process in the SIWFS and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VMSC, sends an SIWFS Signalling Modify negative response indicating system failure to the call handling process in the SIWFS and returns to the idle state.

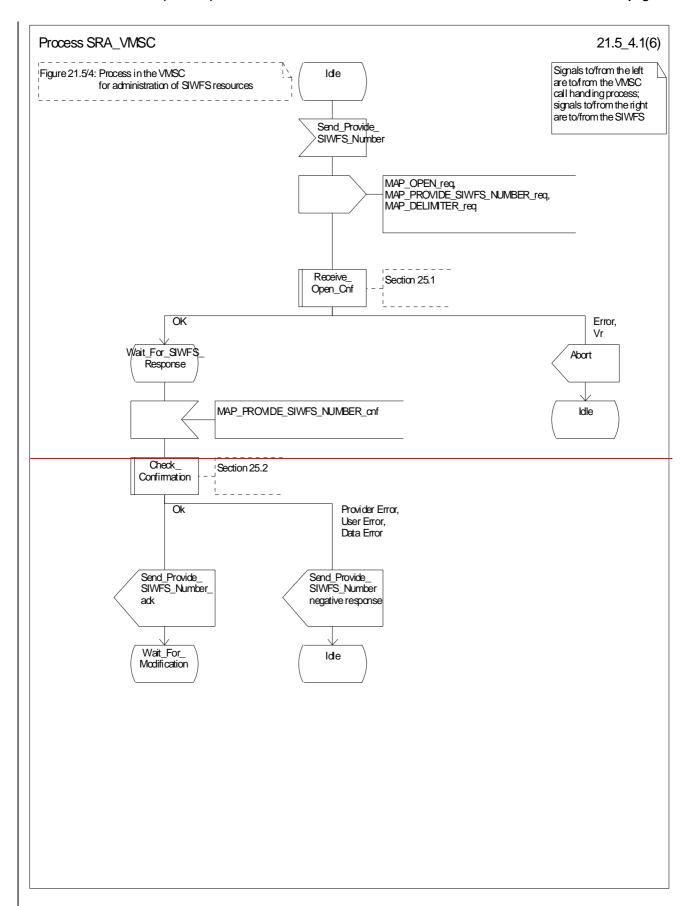


Figure 21.5/4 (sheet 1 of 6): Process SRA (SIWFS\_RESOURCE\_ADMINISTRATION)\_VMSC

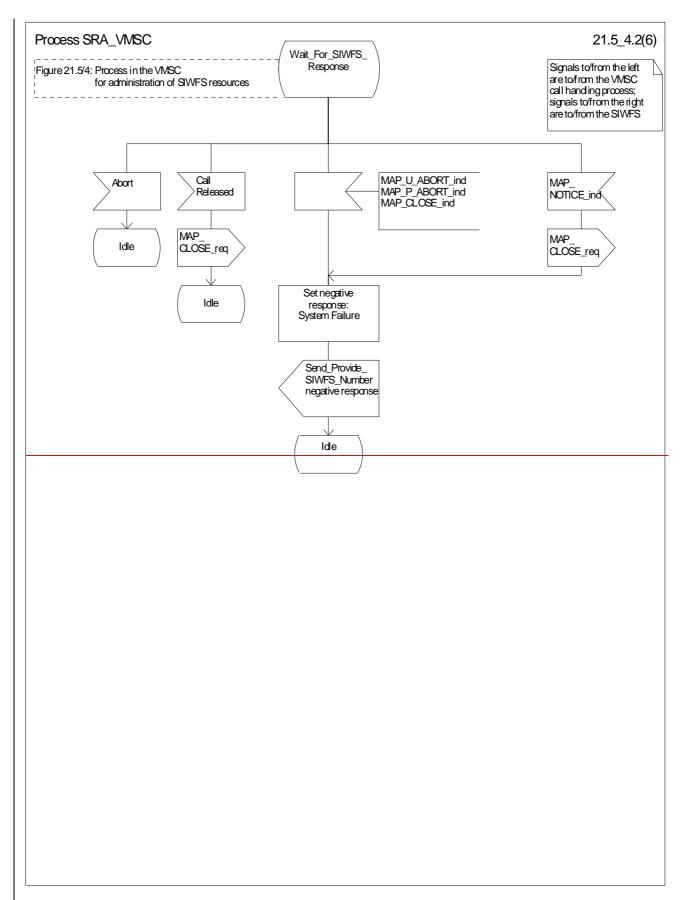


Figure 21.5/4 (sheet 2 of 6): Process SRA\_VMSC

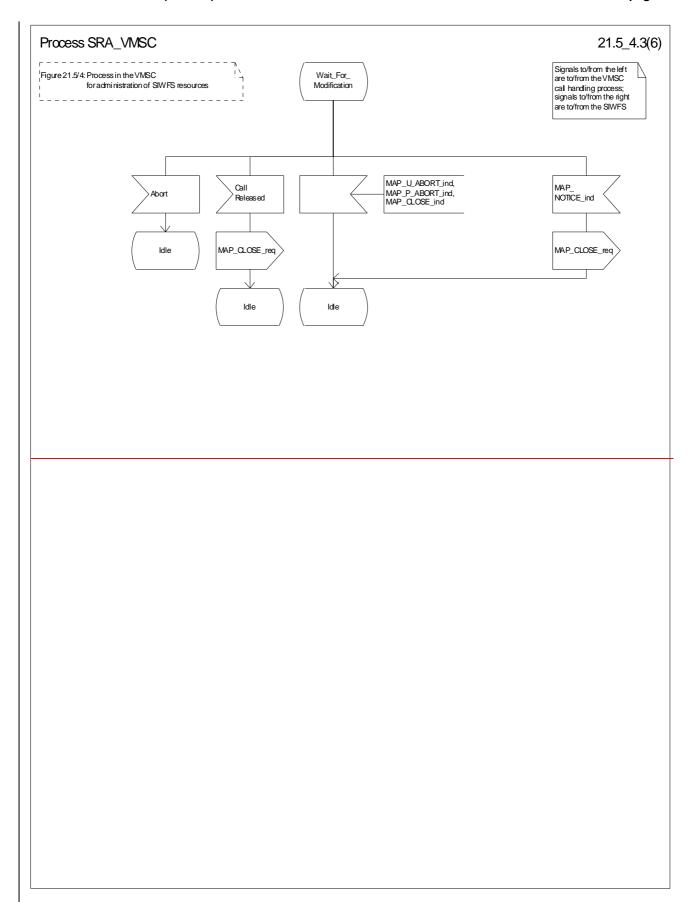


Figure 21.5/4 (sheet 3 of 6): Process SRA\_VMSC

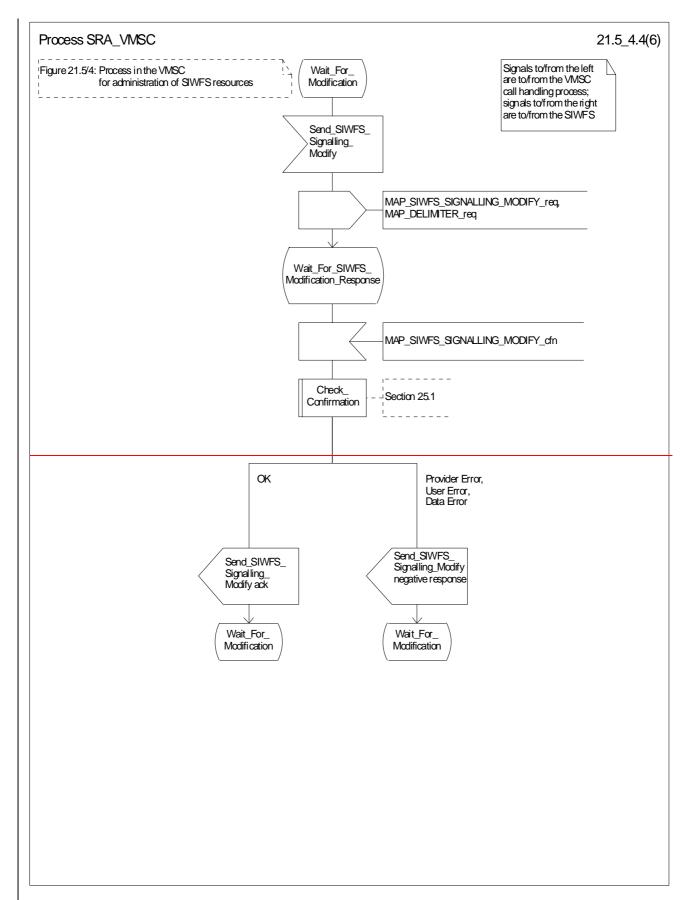


Figure 21.5/4 (sheet 4 of 6): Process SRA\_VMSC

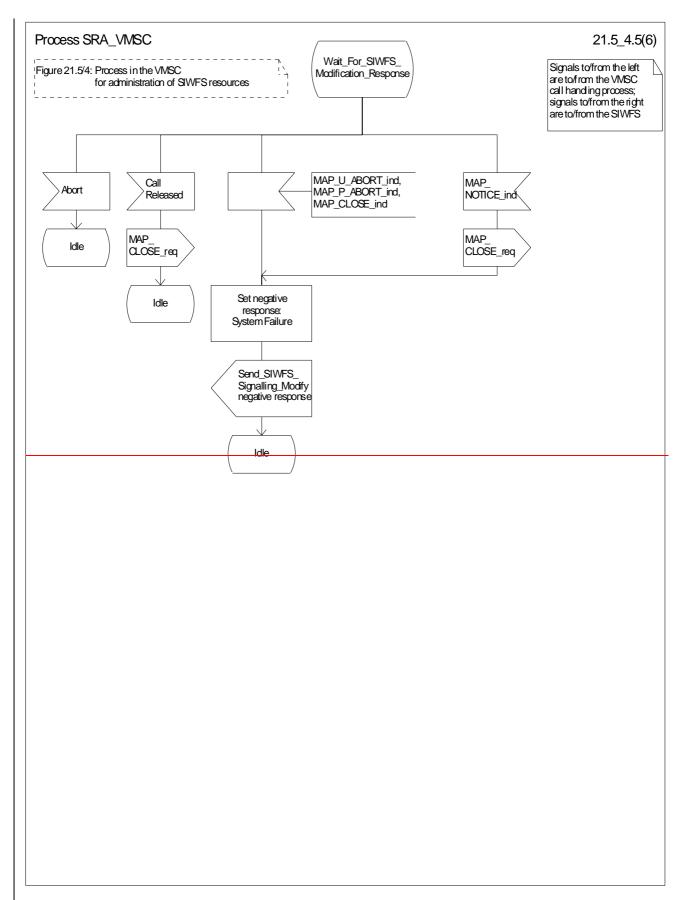


Figure 21.5/4 (sheet 5 of 6): Process SRA\_VMSC

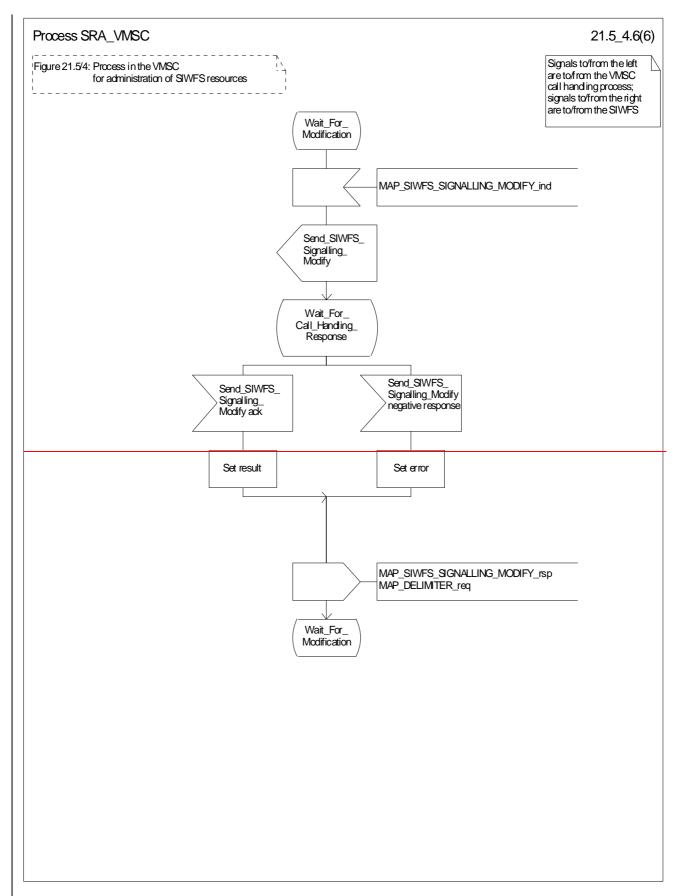


Figure 21.5/4 (sheet 6 of 6): Process SRA\_VMSC

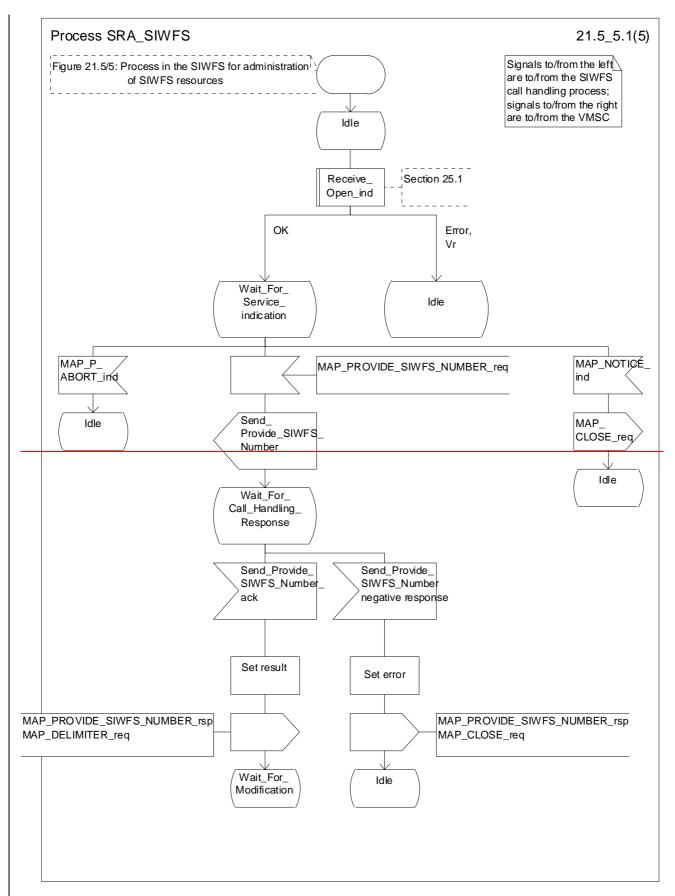


Figure 21.5/5 (sheet 1 of 5): Process SRA\_SIWFS

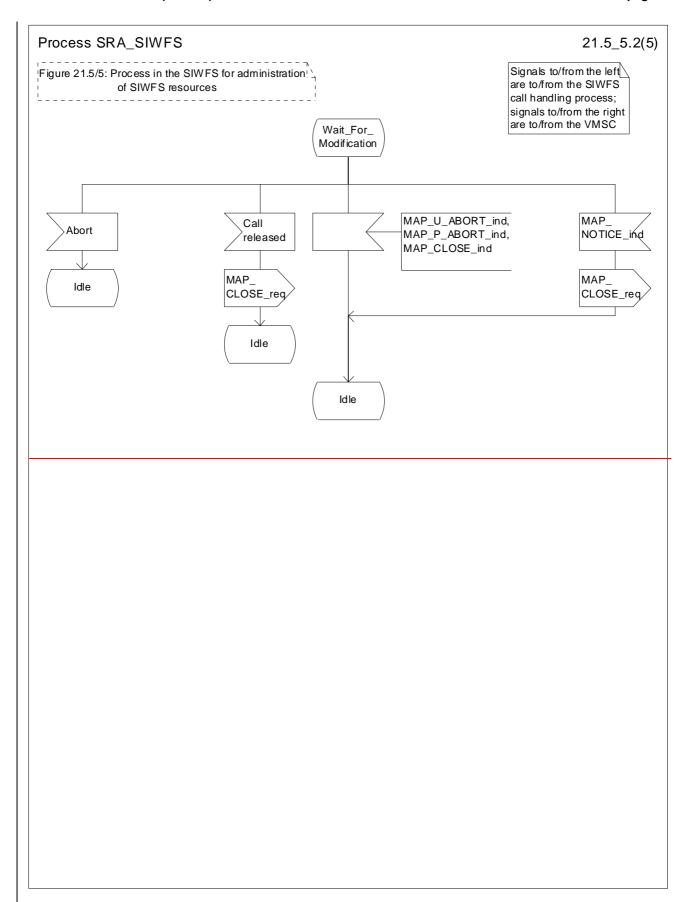


Figure 21.5/5 (sheet 2 of 5): Process SRA\_SIWFS

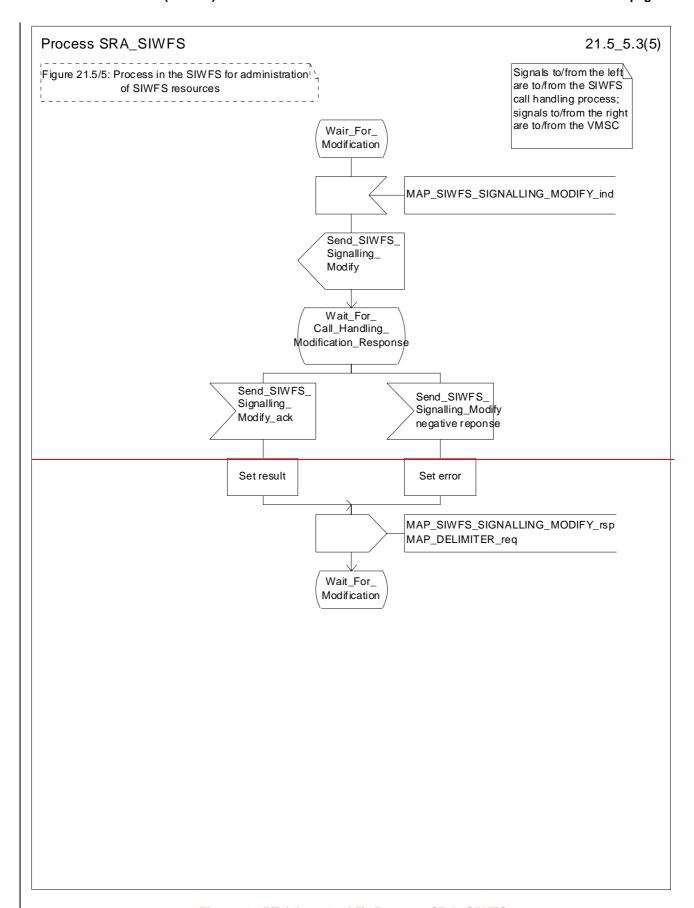


Figure 21.5/5 (sheet 3 of 5): Process SRA\_SIWFS

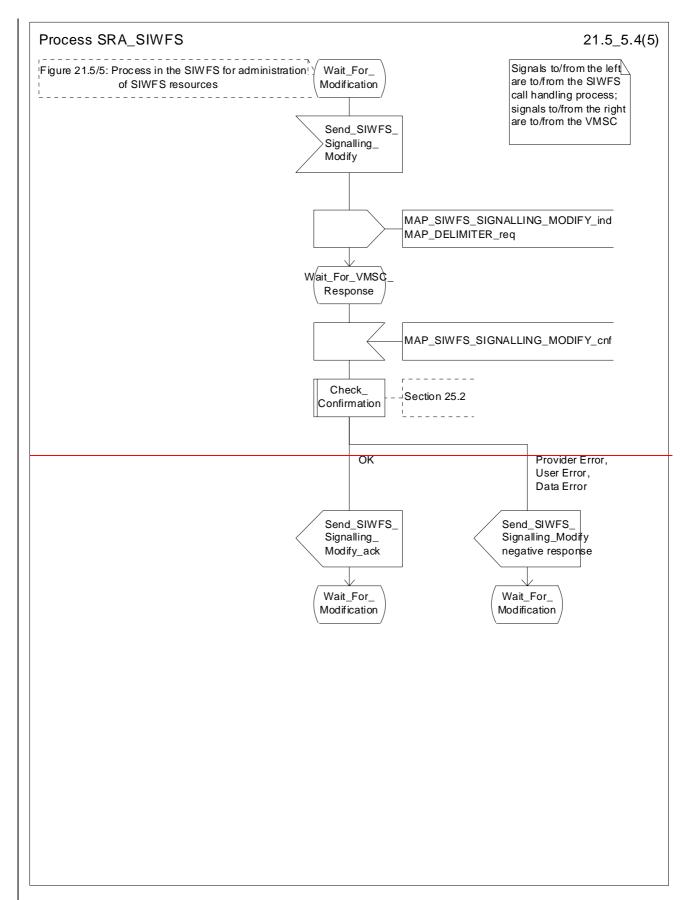


Figure 21.5/5 (sheet 4 of 5): Process SRA\_SIWFS

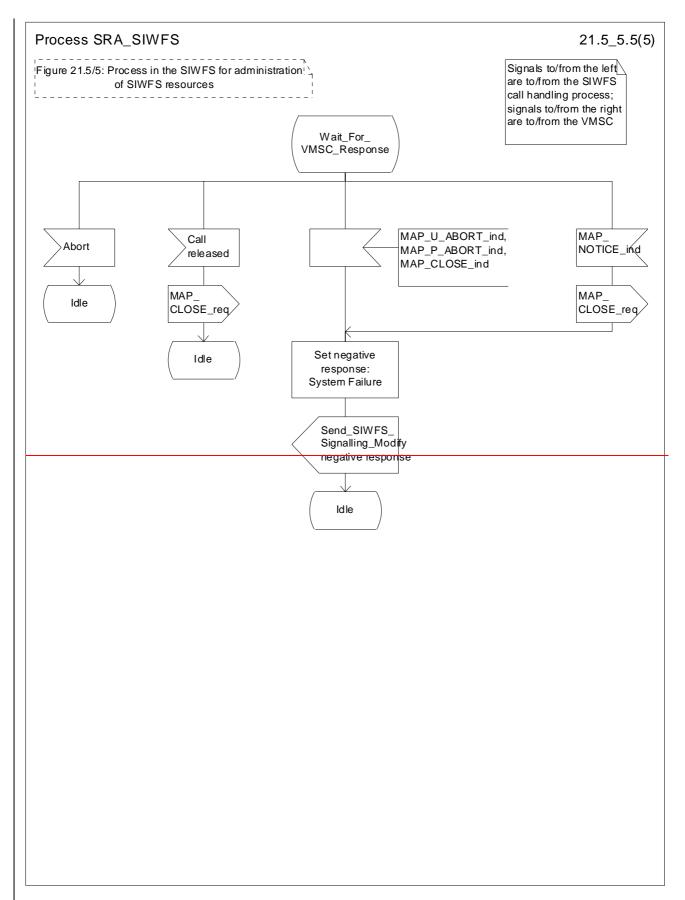


Figure 21.5/5 (sheet 5 of 5): Process SRA\_SIWFS

# 21.6 CCBS: monitoring and reporting the status of the subscriberSetting of Reporting State

## 21.6.13 Reporting co-ordinator process in the VLR

The MAP co-ordinating process in the VLR to handle a dialogue opened with the reporting application context is shown in figure 21.6/63. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see clause 25.1.1.

Any reporting process in the VLR starts by the VLR receiving a MAP OPEN service indication. If that service is successful, the VLR can handle reporting indications from the HLR. Table 21.6/1 shows the co-ordinating process' reaction on receipt of specific reporting indications from the HLR. After the relevant process is invoked, the received service indication is sent to that process.

Table 21.6/1: Relationship between received service indication and invoked process in the VLR

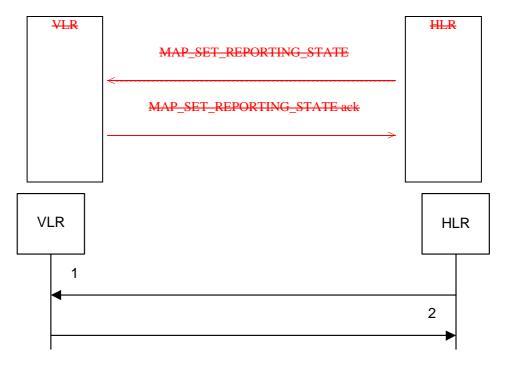
Service indication received	Process invoked
MAP_REMOTE_USER_FREE_ind	REMOTE_USER_FREE_VLR
MAP_SET_REPORTING_STATE_ind	SET_REPORTING_STATE_VLR

After creation of the user process the co-ordinator relays the messages between the MAP protocol machine and the invoked process until a request or an indication for dialogue termination is received.

## 21.6.2 Setting the reporting state – stand-alone

## 21.6.1 General

The message flow for setting the reporting state in a stand-alone dialogue is shown in figure 21.6.1/1.



- 1) MAP\_SET\_REPORTING\_STATE\_req/ind
- 2) MAP SET REPORTING STATE rsp/cnf

## Figure 21.6/1: Message Fflow for Setting the Rreporting Setate - stand-alone dialogue

In Set Reporting State, the HLR can request a The MAP\_SET\_REPORTING\_STATE request can be used to start or a stop of monitoring in the VLR.

## 21.6.2.1 Process in the HLR for Set Reporting State stand-alone

The MAP process in the HLR to set the reporting state in the VLR in a separate-stand-alone dialogue is shown in figure 21.6/72. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

The result of a request to stop reporting is not reported to the CCBS application in the HLR.

#### **Successful Outcome**

When the MAP process receives a Start Reporting or Stop Reporting request from the CCBS application process in the HLR, it requests a dialogue with the VLR whose identity is contained in the request by sending a MAP\_OPEN service request and sending the necessary information using a MAP\_SET\_REPORTING\_STATE service request. The HLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the VLR.

If the MAP process receives a MAP\_SET\_REPORTING\_STATE service confirm from the VLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit and the request was for Start Reporting, the MAP process sends a positive acknowledgement containing the information received from the VLR to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the CCBS application process returns to the idle state.

## Failure of dialogue opening with the VLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends (in the case of Start Reporting) a negative response to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the process returns to the idle state.

## Error in MAP\_SET\_REPORTING\_STATE confirm

If the MAP\_SET\_REPORTING\_STATE service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a negative response (in the case of Start Reporting) to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the CCBS application process returns to the idle state.

## **Abort of VLR dialogue**

After the dialogue with the VLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. If the request was for the Start Reporting, the MAP process sends a Start Reporting negative response to the CCBS application process in the HLR and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VLR, sends a negative response (in the case of the Start Reporting) indicating system failure to the CCBS application process in the HLR and returns to the idle state. In the case of Stop Reporting the CCBS application process returns to the idle state.

## 21.6.2.24 Process in the VLR to set the reporting state

The MAP process in the VLR to set the reporting state is shown in figure 21.6/84.

The co-ordinator opens the process. The macro Receive\_Set\_Reporting\_State\_VLR handles the receipt of the request from the HLR, and the possible response from the CCBS application process in the VLR. When the macro exits, a MAP CLOSE is sent to the HLR and the process terminates.

The macro Set\_Reporting\_State\_VLR is defined shown in figure 21.6/95.

The MAP process does not wait for a response from the CCBS application process if the required reporting state is Stop.

When the VLR receives a MAP\_SET\_REPORTING\_STATE service indication, it checks whether the required monitoring state is stopped.

If the required monitoring state is stopped, the MAP process sends a Stop Reporting message to the CCBS application in the VLR, sends a MAP\_SET\_REPORTING\_STATE response to the HLR and exits from the macro.

If the required monitoring state is started, the MAP process sends a Start Reporting message to the CCBS application in the VLR and waits for a response.

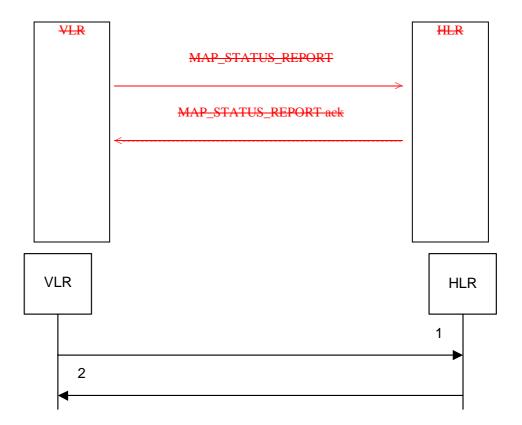
If the CCBS application sends a Start Reporting ack, the MAP process sends a MAP\_SET\_REPORTING\_STATE response to the HLR and exits from the macro.

If the CCBS application sends a Start Reporting negative response, the MAP process translates the negative response into a MAP user error, sends a MAP\_SET\_REPORTING\_STATE response to the HLR and exits from the macro.

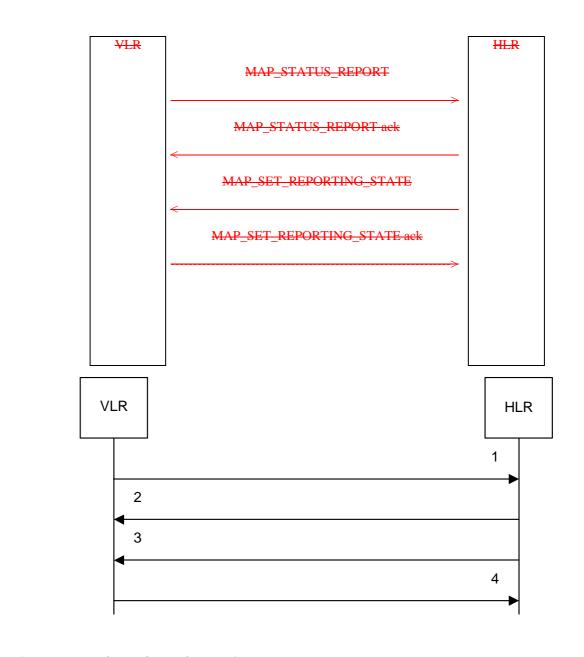
## 21.6.37 Status Rreporting

## 21.7.1 General

The message flows for reporting the status of a subscriber are shown in figures 21.6/27/1 and 21.6/37/2.



- MAP\_STATUS\_REPORT\_req/ind
   MAP\_STATUS\_REPORT\_rsp/cnf
  - Figure 21.6/27/4: Message flow for Sstatus reporting, when monitoring continues in the VLR



- MAP STATUS REPORT req/ind
- 2) MAP\_STATUS\_REPORT\_rsp/cnf
- MAP SET REPORTING STATE req/ind
- 4) MAP\_SET\_REPORTING\_STATE\_rsp/cnf

Figure 21.6/37/2: Message flow for Sstatus reporting, when monitoring stops

The MAP\_SET\_REPORTING\_STATE request is used to stop monitoring in the VLR. If the HLR requires the VLR to continue monitoring, it closes the dialogue without sending a MAP\_SET\_REPORTING\_STATE request.

When the HLR sends a MAP\_SET\_REPORTING\_STATE, it requests the stop of monitoring in the VLR.

## 21.<u>6.3.17.2</u> Process in the VLR for Status Reporting

The MAP process in the VLR to send a status report to the HLR is shown in figure 21.6/107/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2. This process can be used to report:

- an event, such as the user becoming free, or
- the result of a CCBS call attempt

#### to the HLR

## Successful Outcome

When the MAP process receives a Event Report or CCBS Call Report from the CCBS application process in the VLR, it requests a dialogue with the HLR whose identity is contained in the request by sending a MAP\_OPEN service request, and requests status report using a MAP\_STATUS\_REPORT service request. The VLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

If the MAP process receives a MAP\_STATUS\_REPORT service confirm from the HLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends an Event Report ack or a CCBS Call Report ack containing the information received from the HLR to the CCBS application process in the VLR and waits for a possible instruction from the HLR to set the reporting state.

If the HLR requests the VLR to set a reporting state (in the macro Receive\_Set\_Reporting\_State\_VLR), the VLR closes the dialogue with the HLR by sending a MAP CLOSE to the HLR.

If the HLR requires monitoring in the VLR to continue, it closes the dialogue by sending a MAP\_CLOSE, and the MAP process in the VLR sends Continue Monitoring message to the CCBS application process in the VLR and returns to the idle state.

## Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a Event Report negative response or CCBS Call Report negative response to the CCBS application process in the VLR and returns to the idle state.

## Error in MAP\_STATUS\_REPORT confirm

If the MAP\_STATUS\_REPORT service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends an Event Report negative response or CCBS Call Report negative response to the CCBS application process in the VLR and returns to the idle state.

## Abort of HLR dialogue in State Wait\_For\_HLR\_Response

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a Event Report or CCBS Call Report negative response to the CCBS application process in the VLR and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the HLR. The VLR sends an Event Report negative response or CCBS Call Report negative response indicating system failure to the CCBS application process in the VLR and returns to the idle state.

## Abort of HLR dialogue in State Wait\_For\_Set\_Reporting

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP P ABORT or a MAP U ABORT indication. In this case, the VLR returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the HLR and returns to the idle state.

## 21.6.3.27.3 Process in the HLR for Status Reporting

The MAP process in the HLR to handle a status report is shown in figure  $21.\underline{6/117/4}$ . The MAP process invokes <u>a</u> macros not defined in this clause; the definitions of thisese macros can be found as follows:

Receive\_Open\_Ind see <u>sub</u>clause 25.1.1.;

Check Confirmation see clause 25.2.2.

It is an implementation option whether to send the MAP\_DELIMITER request before invoking the macro Set\_Reporting\_State\_HLR.

#### Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context reporting, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

The MAP process invokes the macro Receive\_Status\_Report\_HLR to handle a MAP\_STATUS\_REPORT service indication; this macro is defined in figure 21.7/5. The MAP process then waits for a response from the CCBS application in the HLR.

If the MAP process receives a Stop Reporting message from the CCBS process, it sets the required monitoring state to stop, and may send a MAP\_DELIMITER service request to the VLR. The HLR then invokes the macro Set\_Reporting\_State\_HLR. After exiting the macro, the MAP process returns to the idle state.

If the MAP process receives a Continue Monitoring from the CCBS process, it sends a MAP CLOSE Request to VLR and returns to the idle state.

## Failure of dialogue opening with the VLR

If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

## Abort of VLR dialogue in State Wait\_For\_Service\_Indication

After the dialogue with the HLR has been established, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT indication. In this case, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VLR and returns to the idle state.

## Macro Receive\_Status\_Report\_HLR

The macro Receive\_Status\_Report\_HLR is shown in figure 21.6/127/5.

When a MAP\_STATUS\_REPORT service indication is received, the HLR checks whether call report data are present.

If call report data are present, the MAP process sends a CCBS Call Report message to the CCBS application process in the HLR and waits for a response; otherwise it sends an Event Report message to the CCBS application process in the HLR and waits for a response.

If the MAP process receives a CCBS Call Report ack or Event Report ack from the CCBS application process in the HLR, it sends a MAP\_STATUS\_REPORT service confirm to the VLR and exits from the macro.

If the MAP process receives a CCBS Call Report negative response or Event Report negative response from the CCBS application process in the HLR, it sets the User Error according to the negative response, sends a MAP\_STATUS\_REPORT service confirm to the VLR and exits from the macro.

## Macro Set\_Reporting\_State\_HLR

The macro Set\_Reporting\_State\_HLR is shown in figure 21.6/137/6. The macro invokes a macro not defined in this clause; the definition of this macro can be found as follows:

<u>Check\_Confirmation</u> see subclause 25.2.2.

The MAP process in the HLR sends a MAP\_SET\_REPORTING\_STATE service request to the VLR and waits for a response.

If the MAP process receives a MAP\_SET\_REPORTING\_STATE service confirm from the VLR, it invokes the macro Check Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the macro Set\_Reporting\_State\_HLR takes the OK exit.

If the macro Cheek\_Confirmation takes the Data error, Provider error or User error exit, the macro Set\_Reporting\_State\_HLR takes the Error exit.

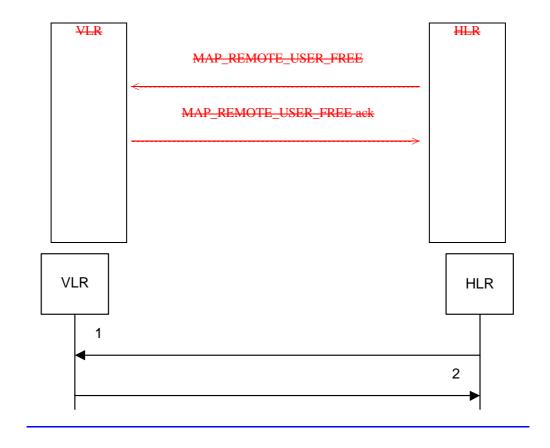
While the MAP process is waiting for a response from the VLR, the MAP provider may terminate the dialogue by sending a MAP\_CLOSE, MAP\_P\_ABORT or MAP\_U\_ABORT. In this case the macro takes the Aborted exit.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication, the MAP process closes the dialogue with the VLR and the macro takes the Aborted exit.

## 21.6.38 CCBS: Remote User Free

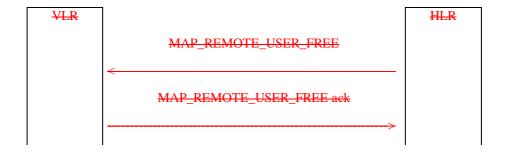
## 21.8.1 General

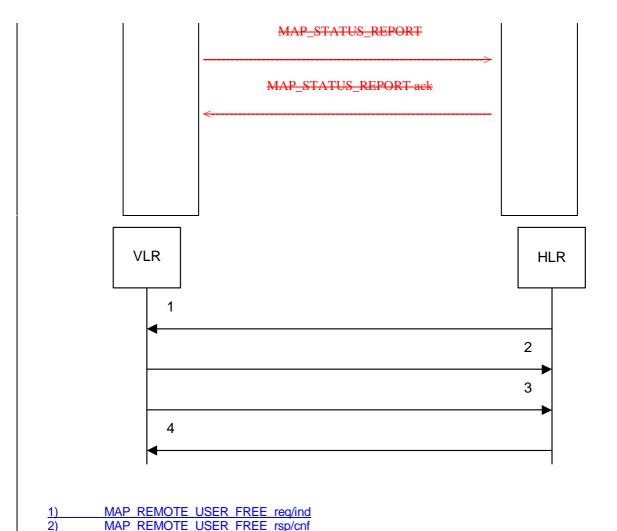
The message flows for handling remote user free are shown in figures  $21.\underline{6/48/4}$  and  $21.\underline{6/58/2}$ .



1) MAP\_REMOTE\_USER\_FREE\_req/ind 2) MAP\_REMOTE\_USER\_FREE\_rsp/cnf

Figure 21.6/48/1: Remote User Free: recall not accepted





## 21.6.3.18.2 Process in the HLR for Remote User Free

MAP STATUS REPORT req/ind MAP STATUS REPORT rsp/cnf

The MAP process in the HLR to handle Remote User Free is shown in figure 21.6/148/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Figure 21.6/58/2: Remote User Free: recall accepted

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

## **Successful Outcome**

When the MAP process receives a CCBS RUF request from the CCBS application process in the HLR, it requests a dialogue with the VLR whose identity is contained in the request by sending a MAP\_OPEN service request and sending the necessary information using a MAP\_REMOTE\_USER\_FREE service request. The HLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the VLR.

If the MAP process receives a MAP\_REMOTE\_USER\_FREE service confirm from the VLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Check\_Confirmation takes the OK exit, the MAP process sends a CCBS RUF ack containing the information received from the VLR to the CCBS application process in the HLR and waits for a MAP\_STATUS\_REPORT service indication from the VLR. If in this state a MAP\_CLOSE service indication is received, the MAP process returns to the idle state. If in this state a MAP\_STATUS\_REPORT service indication is

received, further processing is described by the macro Receive\_Status\_Report\_HLR (described in clause 21.7.3). When the macro exits, the MAP process constructs a MAP\_CLOSE service request, sends it to the VLR and returns to the idle state-

## Failure of dialogue opening with the VLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a negative response to the CCBS application process in the HLR and returns to the idle state.

## Error in MAP\_REMOTE\_USER\_FREE confirm

If the MAP\_REMOTE\_USER\_FREE service confirm contains a user error or a provider error, or the macro Cheek\_Confirmation indicates that there is a data error, the MAP process sends a CCBS RUF negative response to the CCBS application process in the HLR and returns to the idle state.

## **Abort of VLR dialogue**

When the MAP process is waiting for a VLR response to the MAP\_REMOTE\_USER\_FREE, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a CCBS RUF negative response to the CCBS application process in the HLR and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for a VLR response to the MAP\_REMOTE\_USER\_FREE, the MAP process closes the dialogue with the VLR, sends a CCBS RUF negative response indicating system failure to the CCBS application process in the HLR and returns to the idle state.

When the MAP process is waiting for a possible MAP\_STATUS\_REPORT from the VLR, the MAP service provider may abort the dialogue by issuing a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for a possible MAP\_STATUS\_REPORT from the VLR, the MAP process closes the dialogue with the VLR and returns to the idle state.

If the CCBS application in the HLR decides to abort the dialogue, it sends an Abort message to the MAP process, which closes the dialogue with the VLR and returns to the idle state.

## 21.6.3.28.3 Process in the VLR for Remote User Free

The MAP process in the VLR to handle Remote User Free is shown in figure 21.6/158/4. The MAP process invokes a macro not defined in this clause; the definitions of this macro can be found as follows:

Check\_Confirmation see subclause 25.2.2.

## Successful outcome (Recall accepted)

When the MAP process receives a MAP\_REMOTE\_USER\_FREE service indication, the VLR sends a CCBS RUF request to the CCBS application process in the VLR, and waits for a response. The request contains the parameters received in the MAP\_REMOTE\_USER\_FREE service indication.

If the CCBS application process in the VLR returns a positive response indicating "recall accepted", the MAP process constructs a MAP\_REMOTE\_USER\_FREE service response and a MAP\_DELIMITER service request, sends them to the VLR and waits for a CCBS Call Report message from the CCBS application process in the VLR. When the MAP process receives the CCBS Call Report from the CCBS application process in the VLR, it constructs a MAP\_STATUS\_REPORT service request and a MAP\_DELIMITER service request, sends them to the HLR and waits for a response. If the MAP process receives a MAP\_STATUS\_REPORT service confirm, the VLR calls the macro Check\_Confirmation. If this macro takes the OK exit, the MAP process sends a CCBS Call Report ack to the CCBS application process in the VLR and the MAP process terminates.

## Successful outcome (Recall not accepted)

If the CCBS application process in the VLR returns a positive response indicating "recall not accepted", the MAP process constructs a MAP\_REMOTE\_USER\_FREE service response and a MAP\_CLOSE service request, sends them to the HLR and terminates.

## Negative response from VLR CCBS application process

If the CCBS application process in the VLR returns a negative response, the MAP process constructs a MAP\_REMOTE\_USER\_FREE service response containing the appropriate error and a MAP\_CLOSE service request, sends them to the HLR and terminates.

## Failure of dialogue with the HLR

When waiting for a response or a call result from the CCBS application process in the VLR, the MAP process may receive a MAP\_CLOSE service indication, a MAP\_U\_ABORT service indication or a MAP\_P\_ABORT service indication from the co-ordinating process, in which case the MAP process terminates.

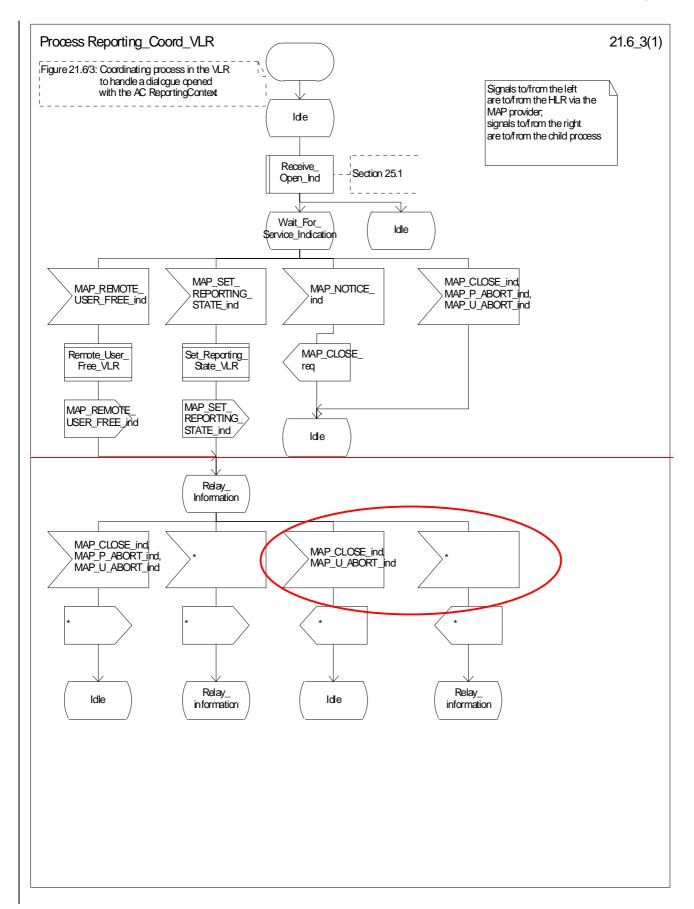
When waiting for a call result from the CCBS application process in the VLR, the MAP process may receive a MAP\_NOTICE indication from the co-ordinating process, in which case the MAP process constructs a MAP\_CLOSE service request, sends it to the co-ordinating process and terminates.

When waiting for a response from the HLR, the MAP process may receive a MAP\_CLOSE indication, a MAP\_U\_ABORT indication or a MAP\_P\_ABORT indication from the co-ordinating process, in which case the MAP process sends a CCBS Call Report negative response to the CCBS application process in the VLR and terminates.

When waiting for a response from the HLR, the MAP process may receive a MAP\_NOTICE indication from the co-ordinating process, in which case the MAP process constructs a MAP\_CLOSE service request, sends it to the co-ordinating process, sends a CCBS Call Report negative response to the CCBS application process in the VLR and terminates.

## **Error in MAP STATUS REPORT confirm**

If the MAP\_STATUS\_REPORT service confirm contains a user error or a provider error, the MAP process sends a CCBS Call Report negative response to the CCBS application process in the VLR and terminates.



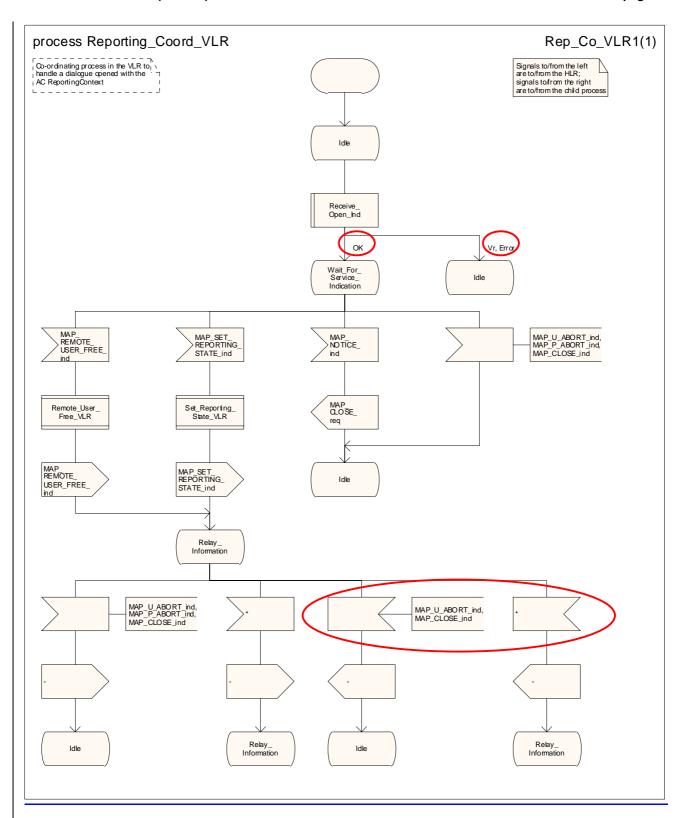
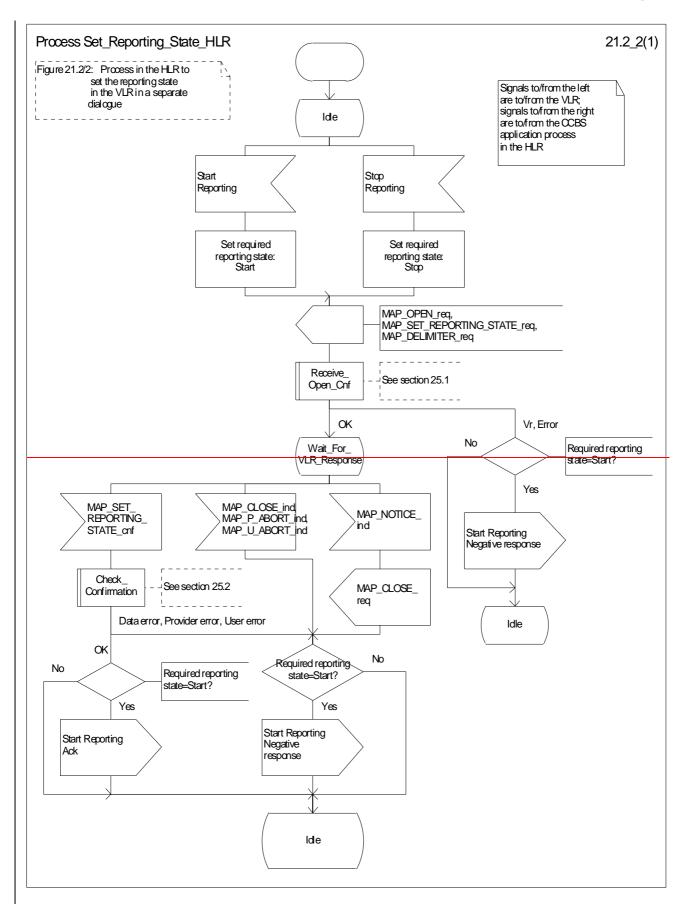


Figure 21.6/63: Process Reporting\_Coord\_VLR



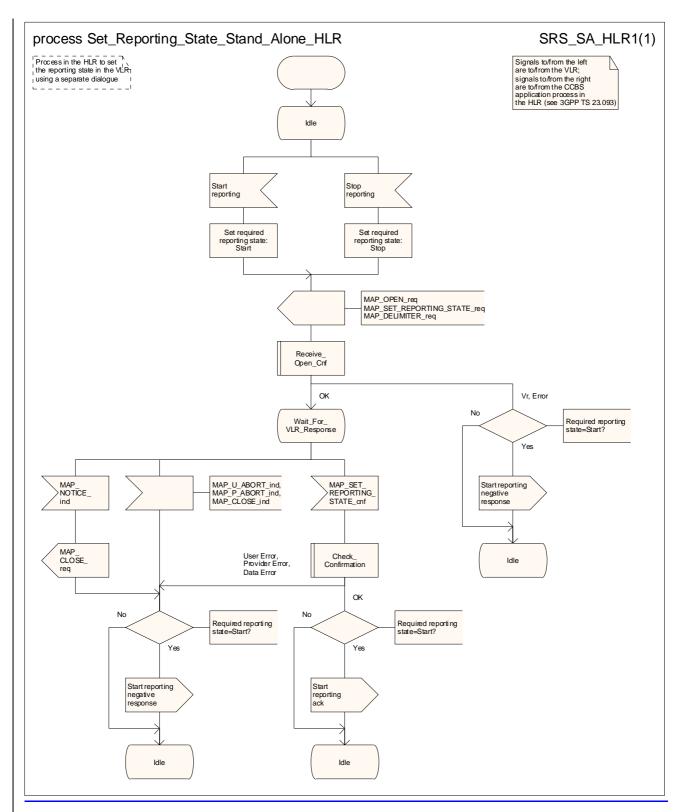
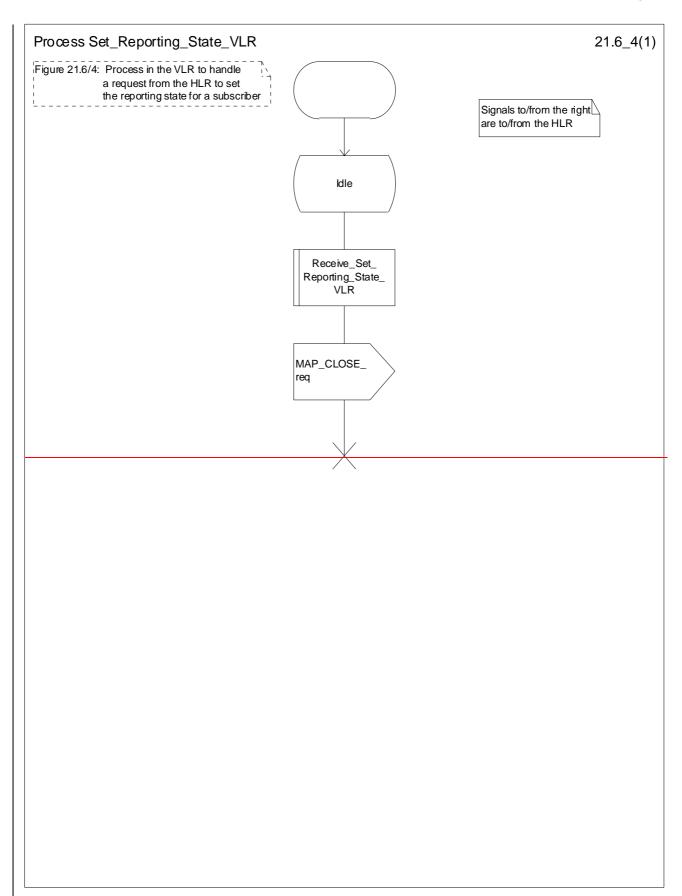


Figure 21.6/72: Process Set\_Reporting\_State\_Stand\_Alone\_HLR



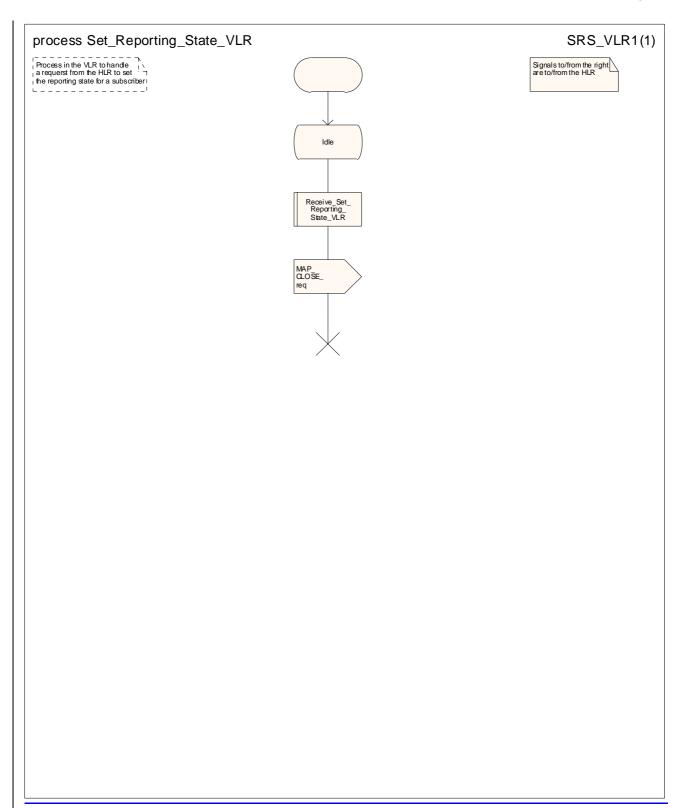
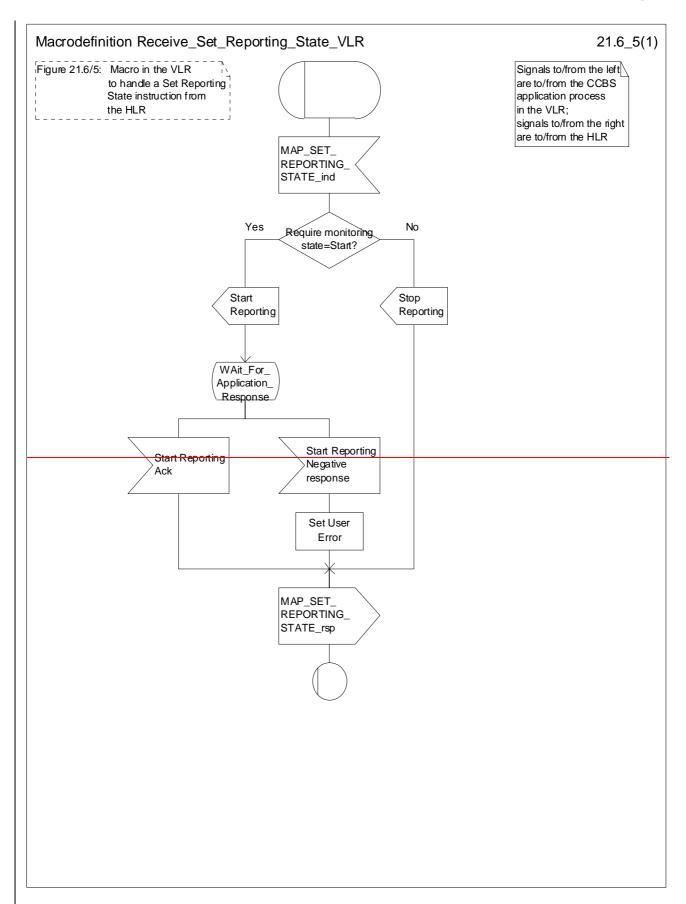


Figure 21.6/84: Process Set\_Reporting\_State\_VLR



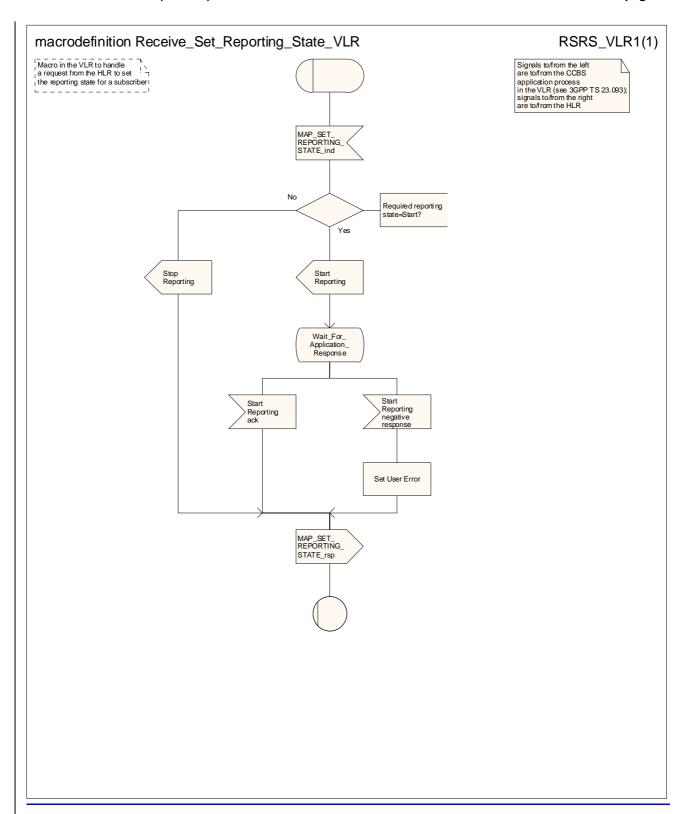
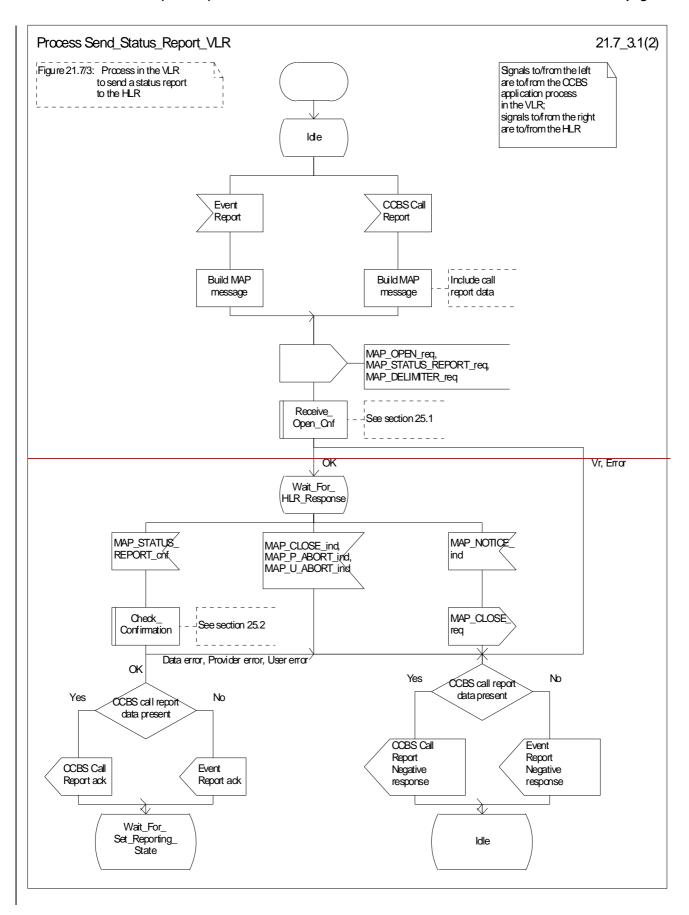


Figure 21.6/95: Macro Receive\_Set\_Reporting\_State\_VLR



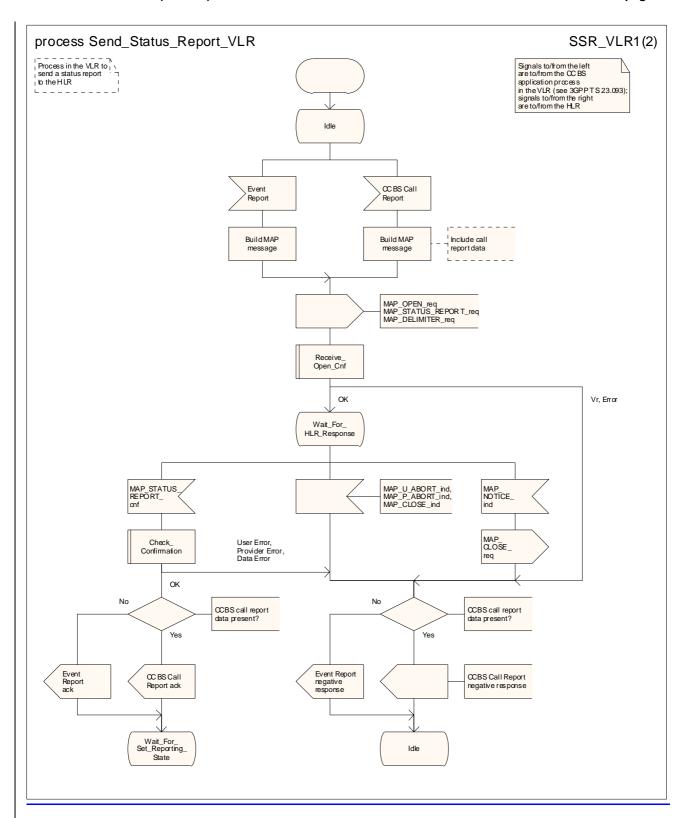
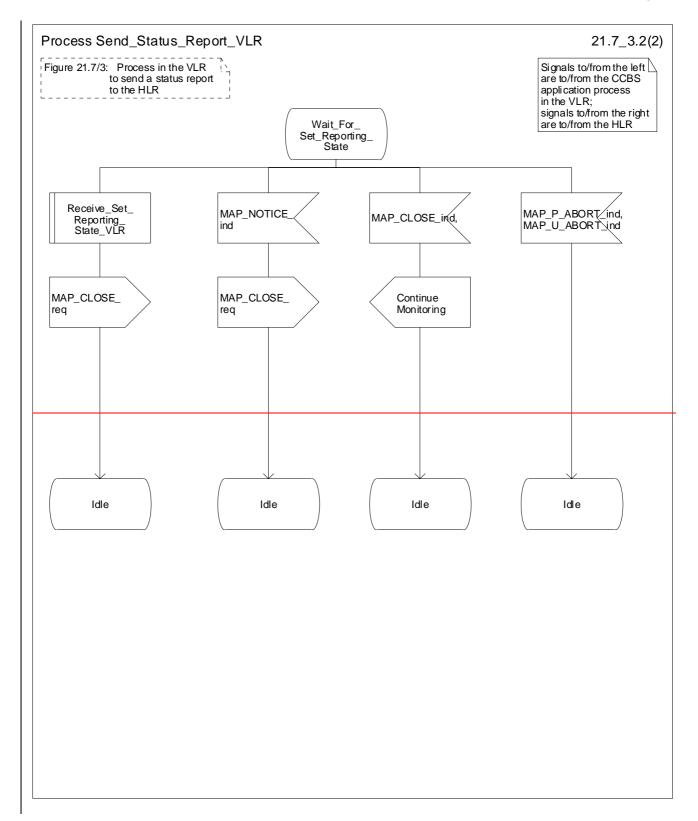


Figure 21.6/107/3 (sheet 1 of 2): Process Send\_Status\_Report\_VLR



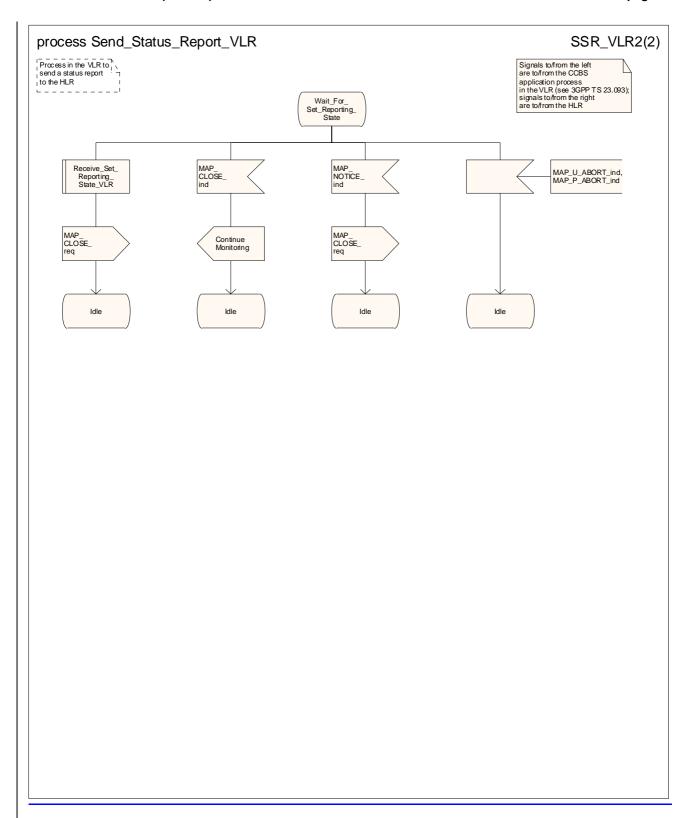
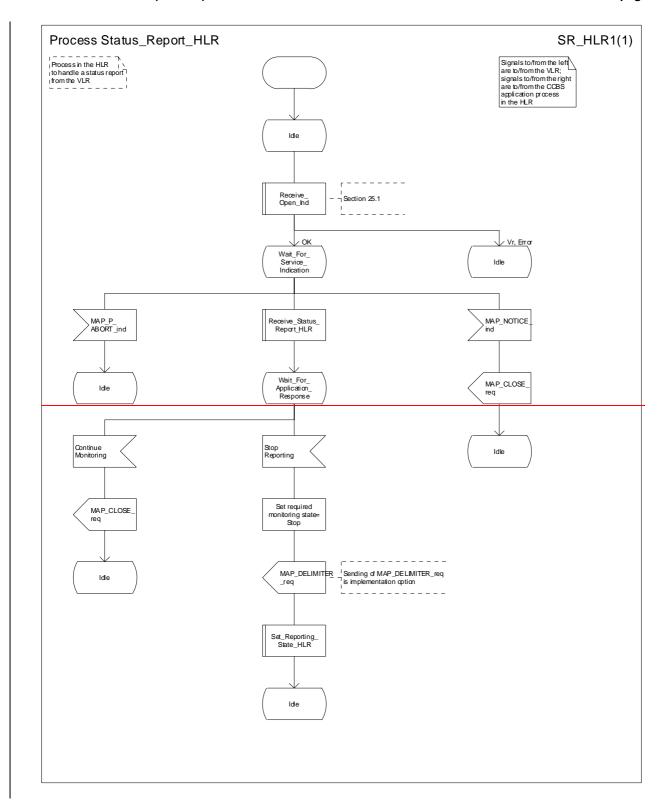


Figure 21.6/107/3 (sheet 2 of 2): Process Send\_Status\_Report\_VLR



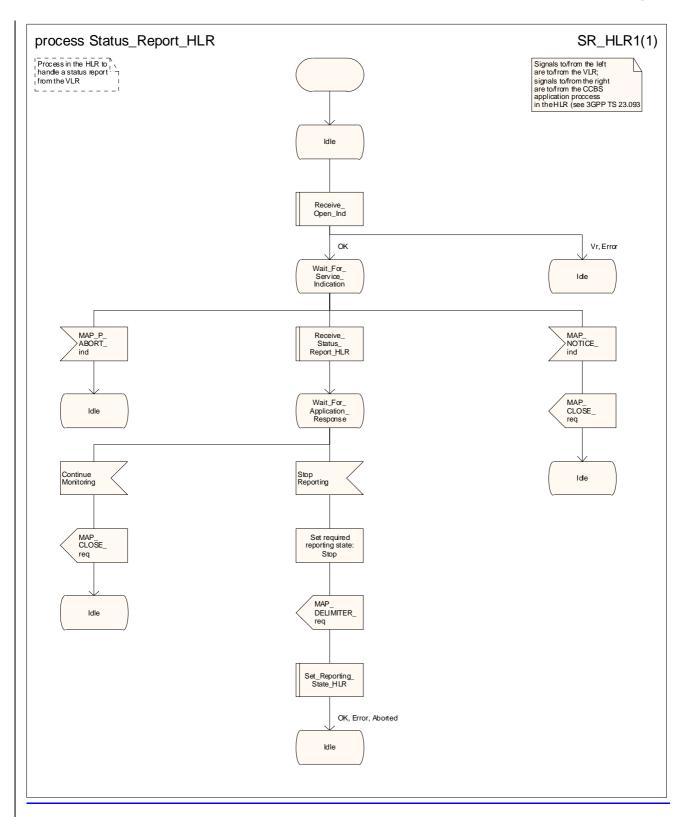
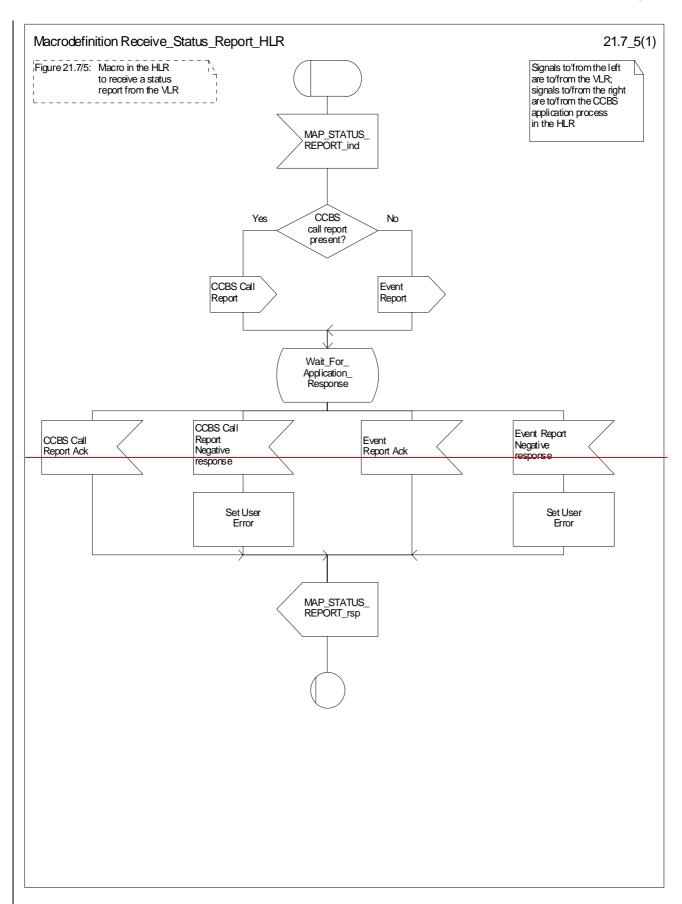


Figure 21.6/117/4: Process Status Report\_HLR



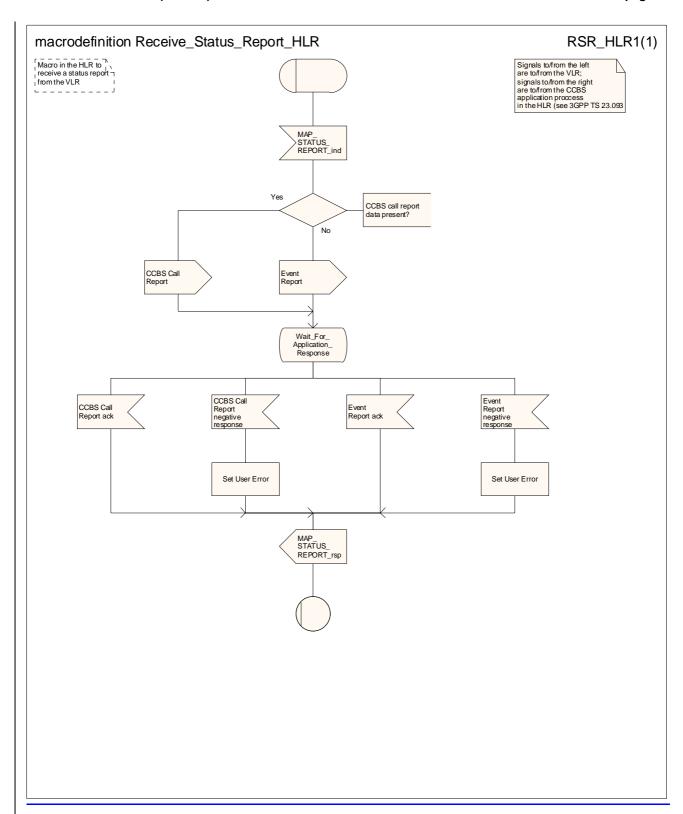
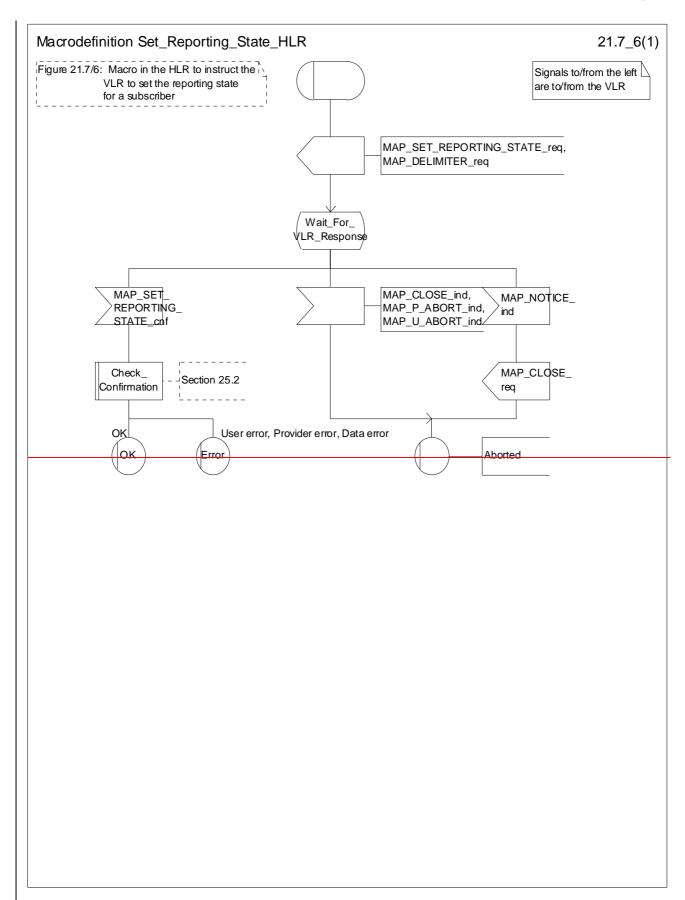


Figure 21.6/127/5: Macro Receive\_Status\_Report\_HLR



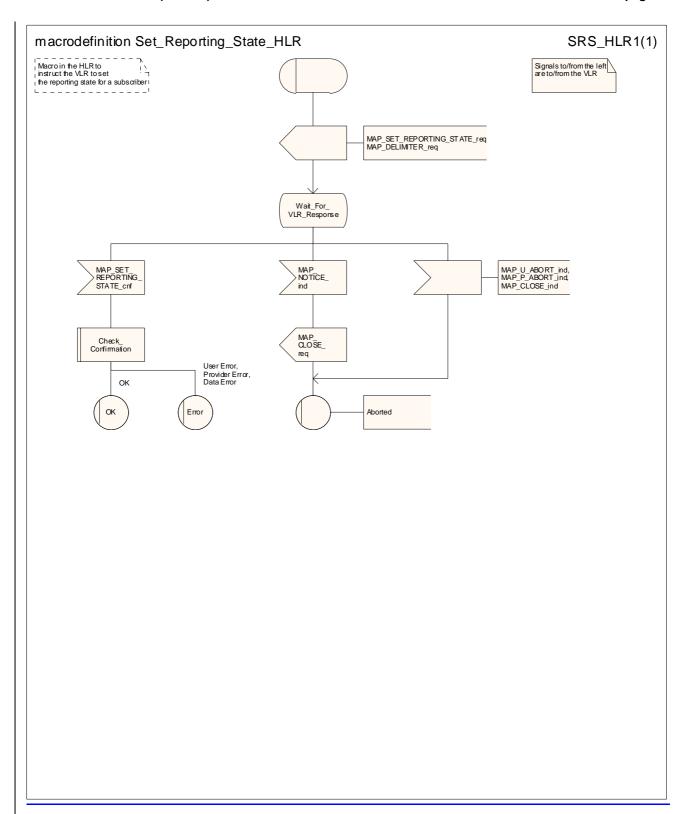
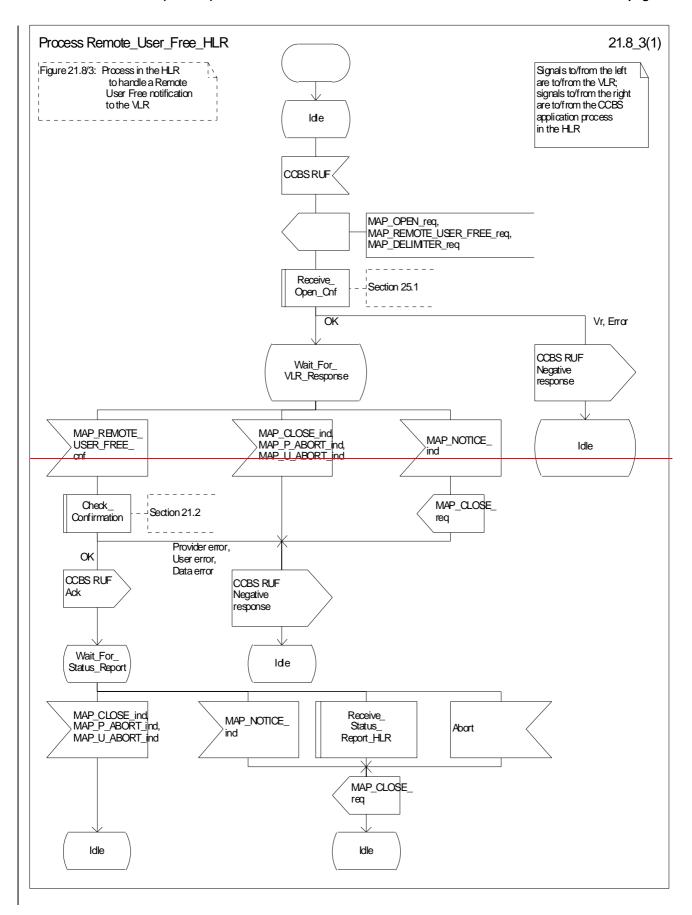


Figure 21.6/137/6: Macro Set\_Reporting\_State\_HLR



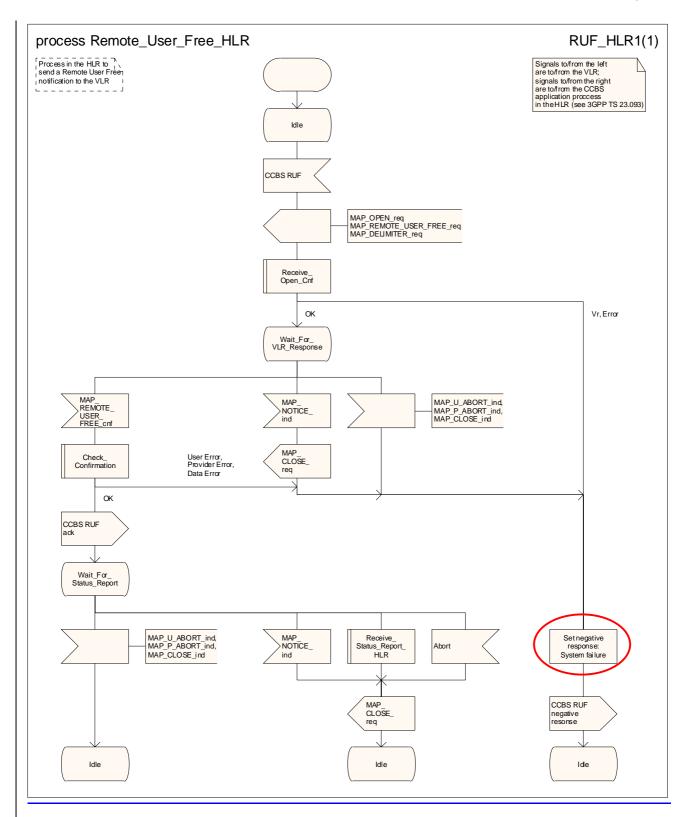
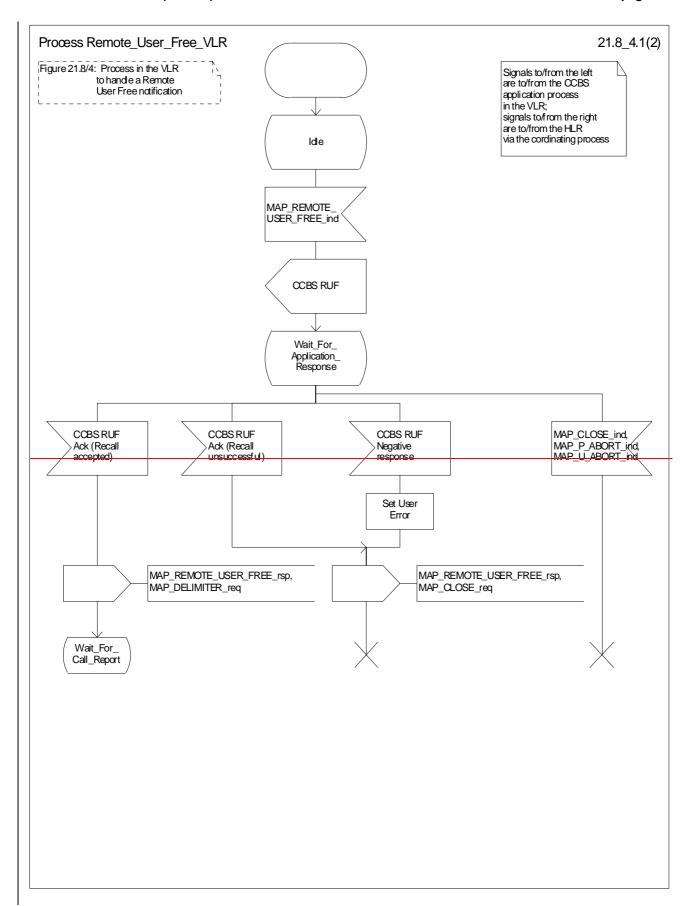


Figure 21.6/148/3: Process Remote\_User\_Free\_HLR



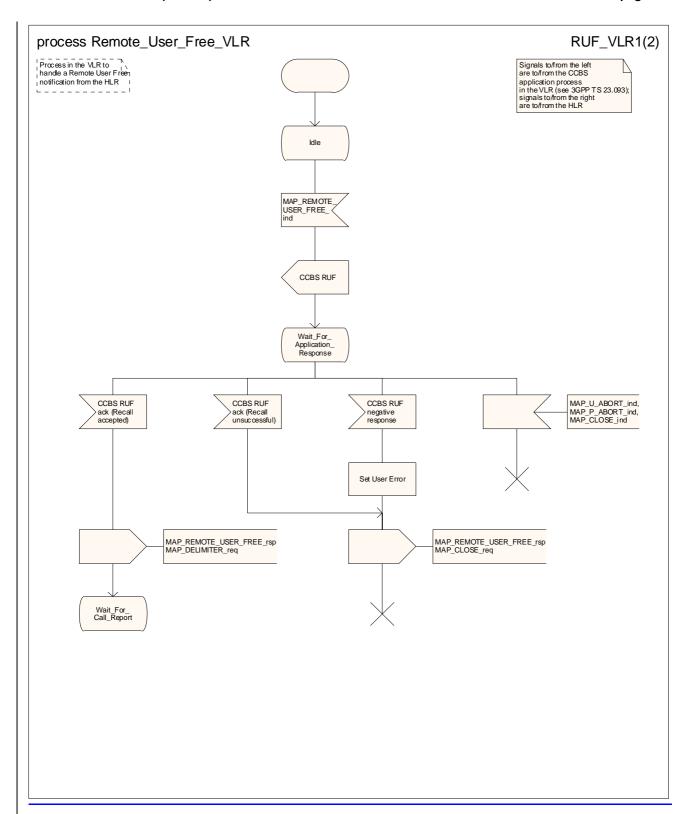
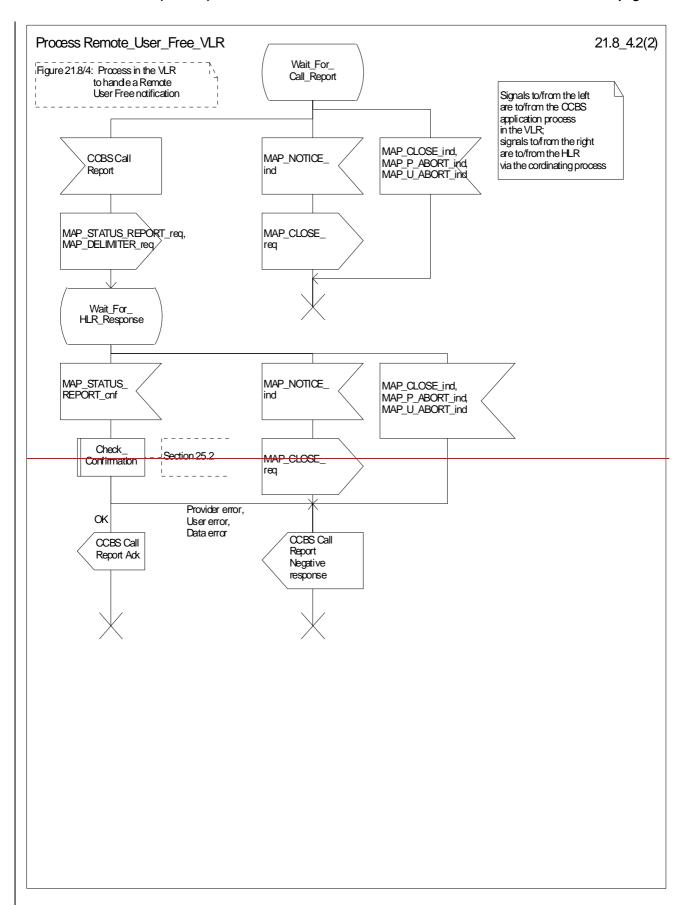


Figure 21.6/158/4 (sheet 1 of 2): Process Remote\_User\_Free\_VLR



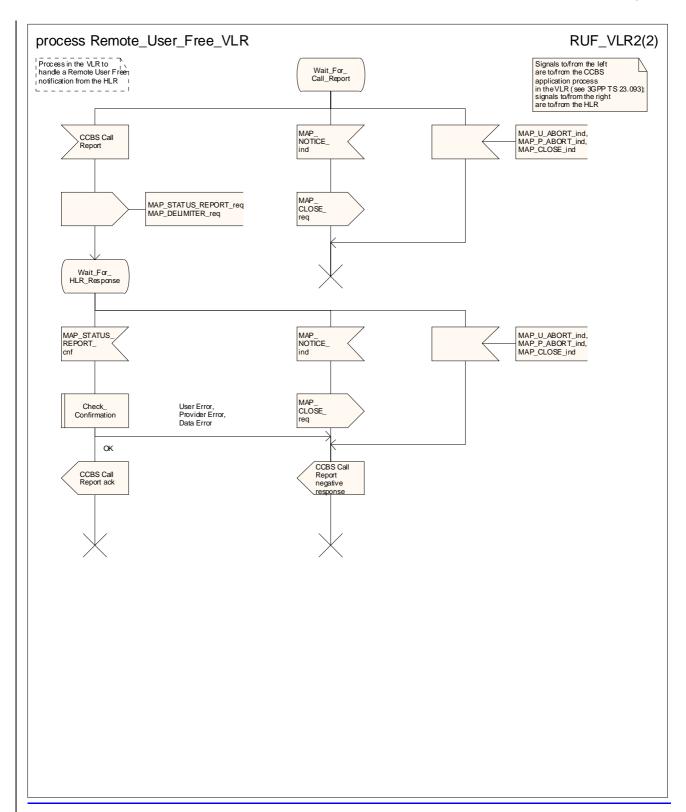


Figure 21.6/158/4 (sheet 2 of 2): Process Remote\_User\_Free\_VLR

#### 21.7 Void

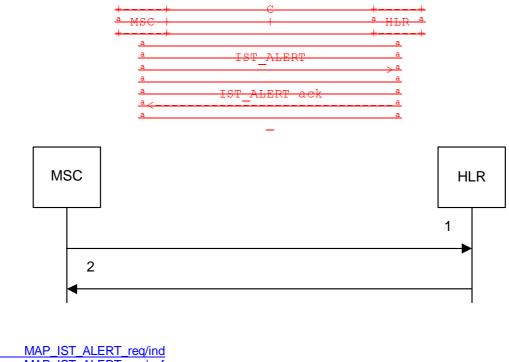
#### 21.8 Void

## Immediate Service Termination (IST) Alert 21.9

#### 21.9.1 IST AlertGeneral

The Immediate Service Termination Alert procedure is used to keep track of the call activities performed by IST subscribers who are marked as being subject to IST monitoring and, eventually possibly, to terminate the alerted call activities for which the alert was sent, or all the call activities related to the alerted subscriber for whom the alert was sent.

The message flow for alerting and possibly terminating the call(s) is shown in figure 21.9/1; where the MSC may be a Visited MSC or a Gateway MSC.



MAP\_IST\_ALERT\_rsp/cnf

Figure 21.9/1: Message flow for IST Alert

#### 21.9.1.12 Procedure in the MSC

The MAP process in the MSC (Visited MSC or Gateway MSC) is shown in figure 21.9/32. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

—Receive\_Open\_Cnf see subclause 25.1.2; -Check\_Confirmation see subclause 25.2.2.

# **Successful Outcome**

When the MAP process receives an IST Alert request from a call handling process in the Visited MSC or Gateway MSC, it requests a dialogue with the HLR that the subscriber belongs to, by sending a MAP\_OPEN service request, a MAP\_IST\_ALERT service request, and a MAP\_DELIMITER service request. The MSC then invokes the macro

Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the HLR.

If the MAP process receives a MAP\_IST\_ALERT service confirm from the HLR, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends a IST Alert ack containing the information received from the HLR to the call handling process in the MSC and returns to the idle state.

## Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a negative response to the call handling process in the MSC, and returns to the idle state.

## **Error in MAP IST ALERT confirm**

If the MAP\_IST\_ALERT service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a negative response to the call handling process in the MSC, and returns to the idle state.

# **Abort of HLR dialogue**

When the MAP process is waiting for an HLR response to the MAP\_IST\_ALERT, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a negative response to the call handling process in the MSC, and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for an HLR response to the MAP\_IST\_ALERT, the MAP process closes the dialogue with the HLR, sends a negative response to the call handling process in the MSC, and returns to the idle state.

# 21.9.1.23 Procedure in the HLR

The MAP process in the HLR is shown in figure 21.9/43. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

—Receive Open Ind see subclause 25.1.1;

#### Successful outcome

When the MAP process in the HLR receives a request to open a dialogue, it invokes the macro Receive\_Open\_Ind to check if the dialogue can be opened.

If the dialogue can be opened, and the service indication received is a MAP\_IST\_ALERT, the HLR then sends the IST alert indication to the call handling process in the HLR, and waits for a response.

If the call handling process in the HLR returns a positive response, the MAP process constructs a MAP\_IST\_ALERT service response and a MAP\_CLOSE service request, sends them to the MSC, and returns to the idle state.

# Negative response from HLR call handling process

If the call handling process in the HLR returns a negative response, the MAP process constructs a MAP\_IST\_ALERT service response containing the appropriate error and a MAP\_CLOSE service request, sends them to the MSC and returns to the idle state.

#### Failure of dialogue opening in the HLR

If the macro Recive Open Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

# **Abort of MSC dialogue**

If the MAP process receives a MAP\_P\_ABORT indication before receiving a service indication, the MAP process returns to the idle state.

When the MAP process receives a MAP\_NOTICE indication before receiving a service indication, the MAP process closes the dialogue with the MSC, and returns to the idle state.

When the MAP process is waiting for the application response to the IST Alert, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process returns to the idle state.

# 21.9.210 IST Command

# 21.10.1 General

The Immediate Service Termination Command procedure is used to terminate the call activities related to a subscriber.

The message flow for the IST Command service-procedure is shown in figure 21.9/210/1; where the MSC may be a Visited MSC or a Gateway MSC.

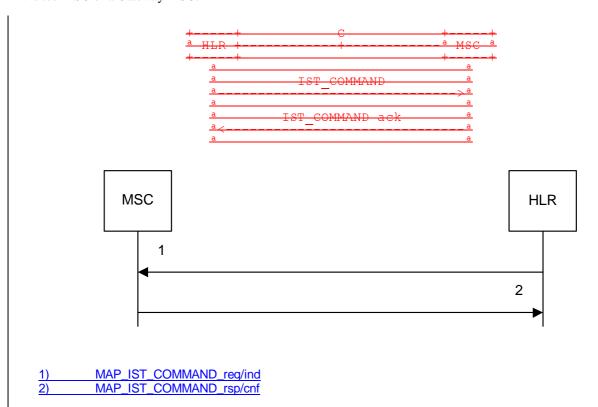


Figure 21.9/210/1: Message flow for IST Command

# 21.<u>9.2.</u>1<del>0.2</del> Procedure in the HLR

The MAP process in the HLR is shown in figure  $21.\underline{9/5}\frac{10/2}{10/2}$ . The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see <u>sub</u>clause 25.1.2; Check\_Confirmation see <u>sub</u>clause 25.2.2.

## **Successful Outcome**

When the MAP process receives an IST Command request, it requests a dialogue with the MSC (Gateway MSC or Visited MSC), by sending a MAP\_OPEN service request, a MAP\_IST\_COMMAND service request, and a MAP\_DELIMITER service request. The HLR then invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request. If the dialogue opening is successful, the MAP process waits for a response from the MSC.

If the MAP process receives a MAP\_IST\_COMMAND service confirm from the MSC, the MAP process invokes the macro Check\_Confirmation to check the content of the confirm.

If the macro Cheek\_Confirmation takes the OK exit, the MAP process sends a IST Command ack containing the information received from the MSC to the call handling process in the HLR and returns to the idle state.

## Failure of dialogue opening with the HLR

If the macro Receive\_Open\_Cnf takes the Vr exit or the Error exit, the MAP process sends a negative response to the call handling process in the HLR, and returns to the idle state.

## Error in MAP\_IST\_COMMAND confirm

If the MAP\_IST\_COMMAND service confirm contains a user error or a provider error, or the macro Check\_Confirmation indicates that there is a data error, the MAP process sends a negative response to the call handling process in the HLR, and returns to the idle state.

## **Abort of MSC dialogue**

When the MAP process is waiting for an MSC response to the MAP\_IST\_COMMAND, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process sends a negative response to the call handling process in the HLR, and returns to the idle state.

If the MAP provider indicates a protocol problem by sending a MAP\_NOTICE indication when the MAP process is waiting for an MSC response to the MAP\_IST\_COMMAND, the MAP process closes the dialogue with the MSC, sends a negative response to the call handling process in the HLR, and returns to the idle state.

# 21.9.2.210.3 Procedure in the MSC

The MAP process in the MSC is shown in figure 21.9/610/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

—Receive\_Open\_Ind see <u>sub</u>clause 25.1.1.

## Successful outcome

When the MAP process in the MSC receives a request to open a dialogue, it invokes the macro Receive\_Open\_Ind to eheck if the dialogue can be opened.

If the dialogue can be opened, and the service indication received is a MAP\_IST\_COMMAND, the MSC then sends the IST command indication to the call handling process in the MSC, and waits for a response.

If the call handling process in the MSC returns a positive response, the MAP process constructs a MAP\_IST\_COMMAND service response and a MAP\_CLOSE service request, sends them to the HLR, and returns to the idle state.

# Negative response from MSC call handling process

If the call handling process in the MSC returns a negative response, the MAP process constructs a MAP\_IST\_COMMAND service response containing the appropriate error and a MAP\_CLOSE service request, sends them to the HLR and returns to the idle state.

## Failure of dialogue opening in the MSC

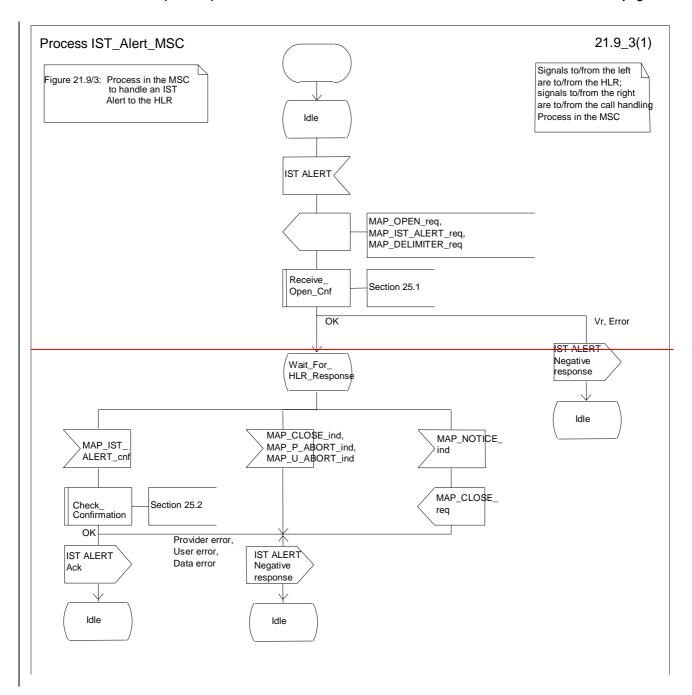
If the macro Receive\_Open\_Ind takes the Vr exit or the Error exit, the MAP process returns to the idle state.

## Abort of HLR dialogue

If the MAP process receives a MAP\_P\_ABORT indication before receiving a service indication, the MAP process returns to the idle state.

When the MAP process receives a MAP\_NOTICE indication before receiving a service indication, the MAP process closes the dialogue with the HLR, and returns to the idle state.

When the MAP process is waiting for the application response to the IST Command, the MAP service provider may abort the dialogue by issuing a MAP\_CLOSE, a MAP\_P\_ABORT or a MAP\_U\_ABORT indication. In this case, the MAP process returns to the idle state.



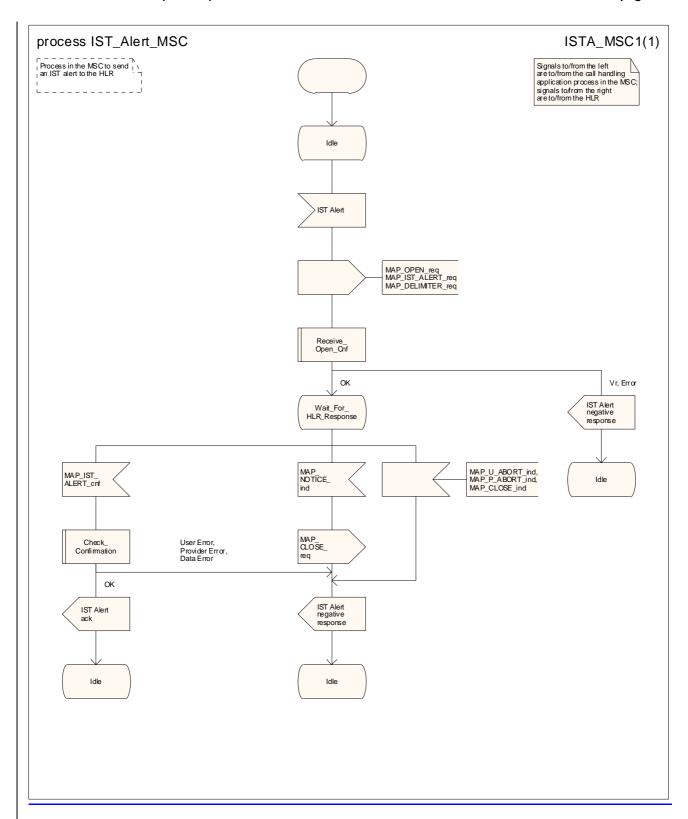
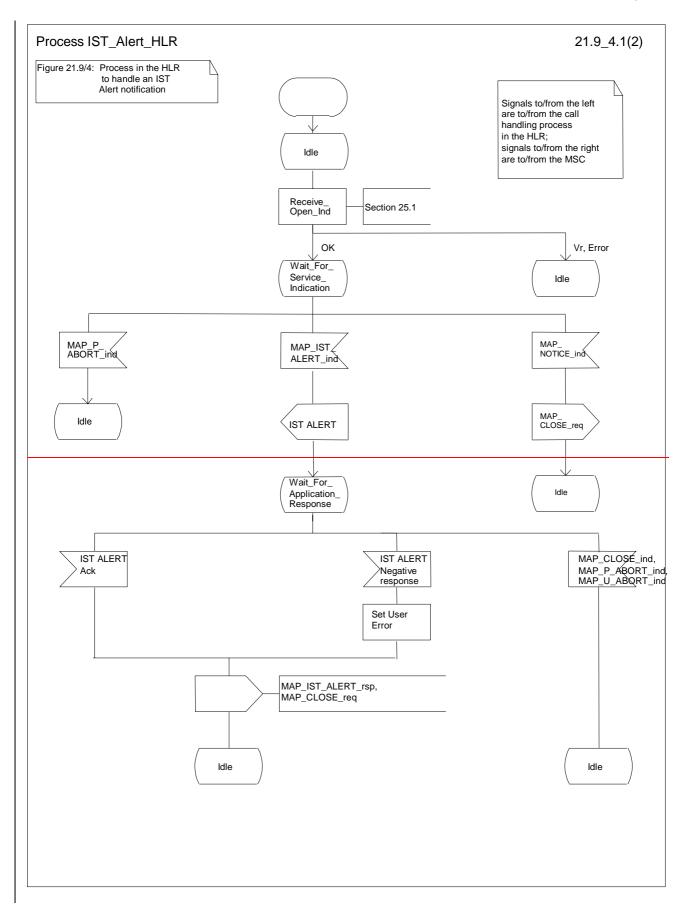


Figure 21.9/32: Process IST\_Alert\_MSC



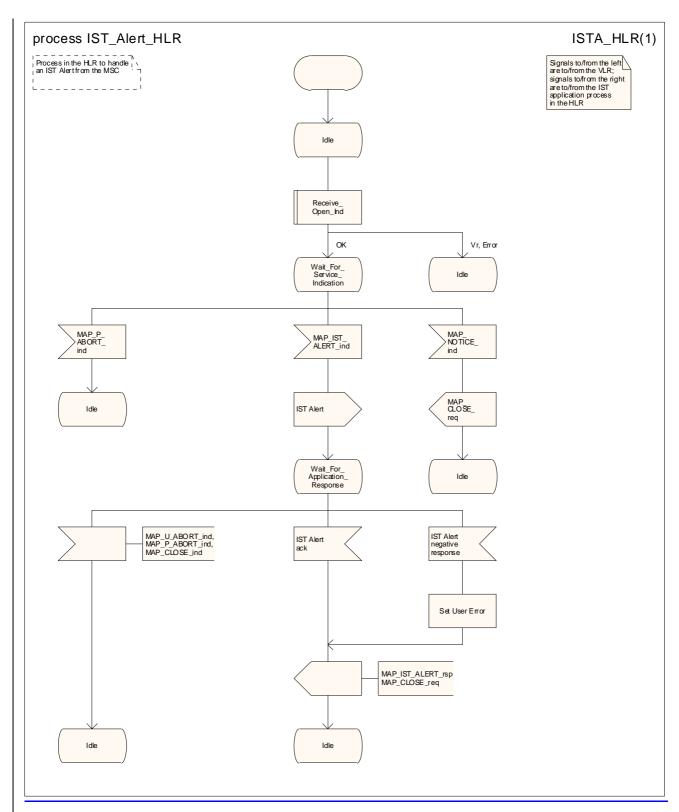
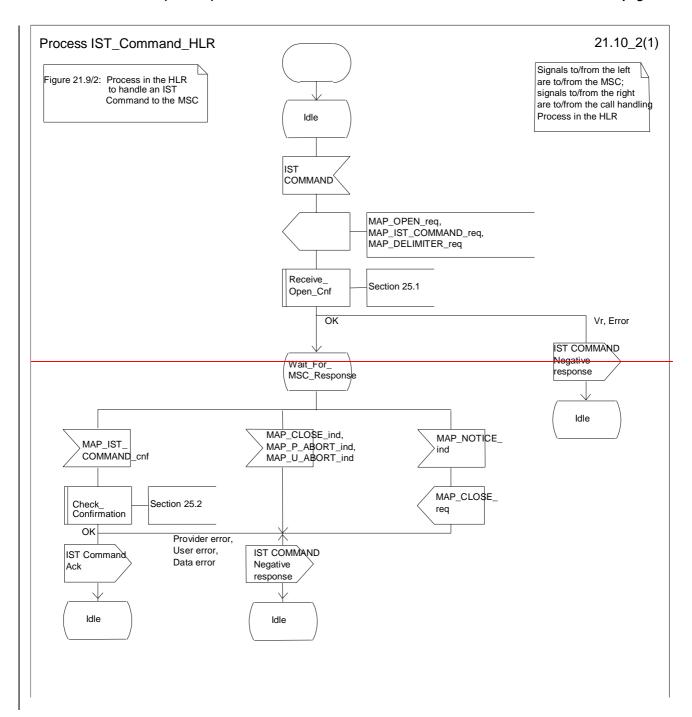


Figure 21.9/43: Process IST\_Alert\_HLR



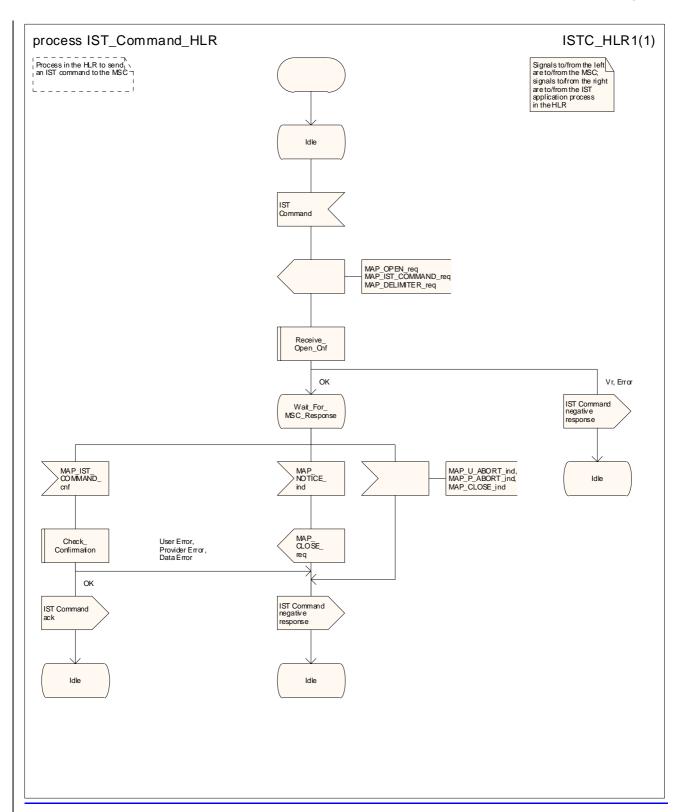
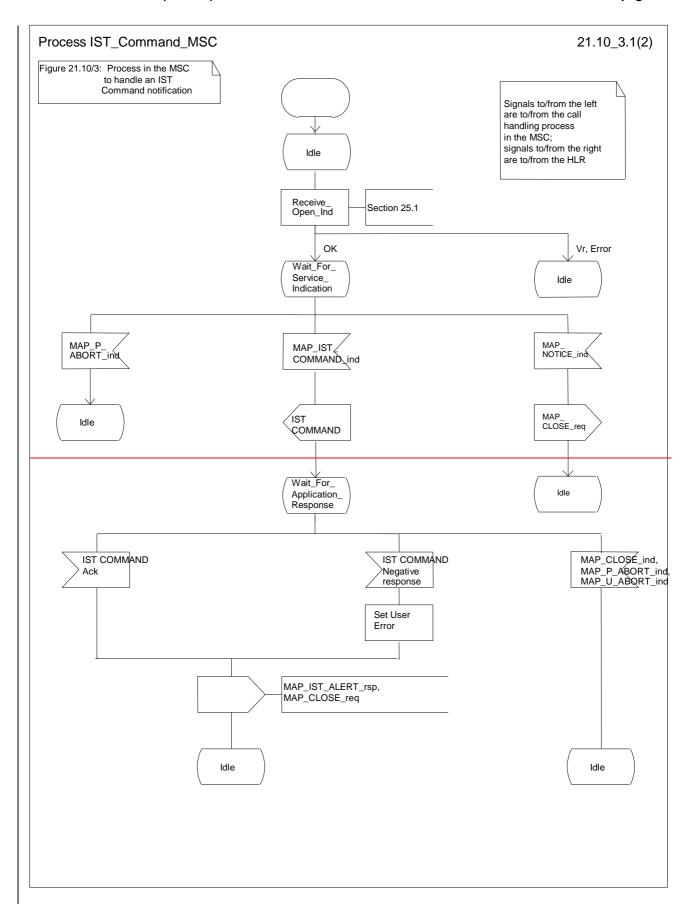


Figure 21.9/510/2: Process IST\_Command\_HLR



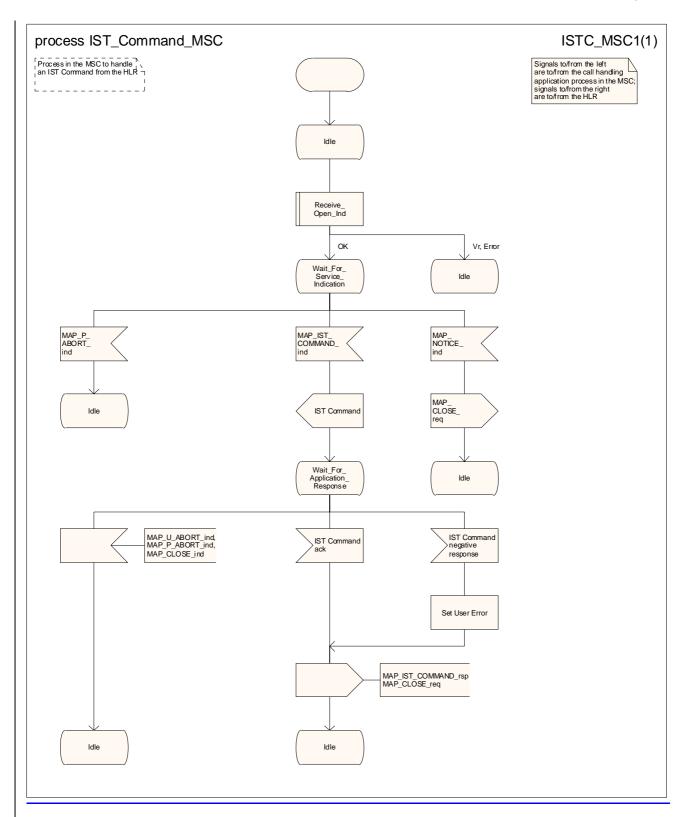


Figure 21.9/610/3: Process IST\_Command\_MSC

# \*\*\* Next modified section \*\*\*

# 24A CSE interrogation and control of subscriber data

# 24A.1 General

The MAP procedures for interrogation and control of subscriber data are used to allow the CSE:

- to retrieve subscriber data from the HLR;
- to modify subscriber data in the HLR;
- to receive notification from the HLR when there is a change in subscriber data;
- to request information about the location of a subscriber from the HLR or the GMLC;
- to request information about the state of a subscriber from the HLR.

The following application context refers to a complex MAP user consisting of several processes:

- anyTimeInfoHandlingContext

This application context needs a co-ordinating process in the HLR.

The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

The Any Time Info Handling Co-ordinator process in the HLR is shown in figure 24A.1/1.

# \*\*\* Next modified section \*\*\*

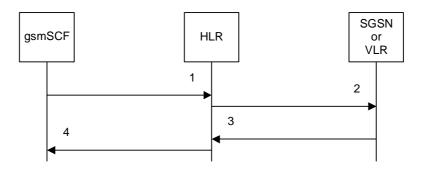
# 24A.5 Any Time Interrogation procedure

# 21.2.7 Process in the HLR for Any Time Interrogation

# 24A.5.1 General

The message flows for successful retrieval of subscriber information related to an any time interrogation from the CAMEL server are shown in figure  $2\underline{4A.5/1.2/8}$  for interrogation directed to an HLR and figure 24A.5/2 for interrogation directed to a GMLC.

<del>asmSCF</del>		
9811801	4 4	
a c c m i	a TIT DI	a 777 D a
- SCET	- H L K I	- <del>V D K -</del>
++	+ +	++++
- amal and a second	a	a
- a INTERROGATION	a	<u>a</u>
	a	<u>a</u> _
a	- amap provid	E SUBSCRI ª
a	a pr <del>D</del> tnr∩r	MATION a
a		<u> </u>
a	aMAP PROVID	
a	а ред тиеле	M <del>ATION acka</del>
a MAP ANY TIME	DEIX INTOI	a
	-2 ck-a `	<u>a</u>
a/	a	<u>a</u>
a	a	<u>a</u>



- MAP ANY TIME INTERROGATION req/ind MAP PROVIDE SUBSCRIBER INFO req/ind MAP PROVIDE SUBSCRIBER INFO rsp/cnf
- MAP ANY TIME INTERROGATION rsp/cnf

Figure 24A.5/1.2/8: Message flow for any time interrogation (gsmSCF to HLR)

The following MAP services are used to retrieve routing information about the status and/or location of a subscriber:

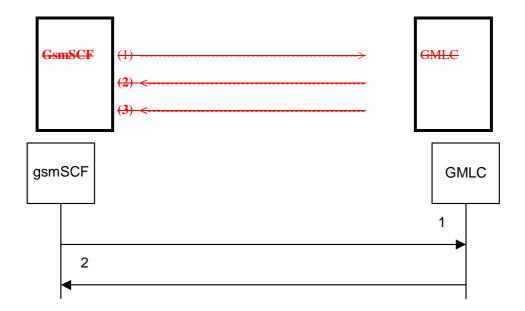
MAP\_ANY\_TIME\_INTERROGATION see subclause 8.11.1;

MAP\_PROVIDE\_SUBSCRIBER\_INFO see <u>sub</u>clause 8.11.2.

The HLR sends the MAP PROVIDE SUBSCRIBER INFO request to the SGSN or the VLR, according to the domain for which the gsmSCF requested the information.

# 21.2.8 Process in the GMLC for Any Time Interrogation

The message flows for successful retrieval of subscriber information related to an any time interrogation from the CAMEL server are shown in figure 21.2.8/1.



- MAP ANY TIME INTERROGATION req/ind MAP ANY TIME INTERROGATION rsp/cnf
- Any Time Interrogation (gsmSCF to GMLC).
- Any Time Interrogation Result (GMLC to gsmSCF).

3) Any Time Interrogation Error (GMLC to gsmSCF)The following MAP services are used to retrieve routing information:

## Figure 24A.5/2: Message flow for any time interrogation (gsmSCF to GMLC)

The following MAP service is used to retrieve location information from a GMLC:

```
——MAP_ANY_TIME_INTERROGATION see <u>sub</u>clause 8.11.1;
```

# Figure 21.2.8/1

In addition, the GMLC may use MAP Location Services specific to MAP Location Services.

# 21.2.7.1 Process in the gsmSCF

Out of the scope of the MAP specification.

# 24A.5.21.2.8.1 Procedures in the gsmSCF

The process in the gsmSCF to request information about the location and/or state of a subscriber from the HLR is shown in figure 24A.5/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive Open Cnf see subclause 25.1.2;
Check_Confirmation see subclause 25.2.2.
```

The process in the gsmSCF to request location information from the GMLC is shown in figure 24A.5/41.2.8/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive Open Cnf see subclause 25.1.2;
Check_Confirmation see subclause 25.2.2.
```

The process is started with internal signal Request\_Subscriber\_Info\_GMLC. This signal is sent by the Service Logic in the gsmSCF.

The process responds with 'Request\_Subscriber\_Info\_GMLC positive response' or 'Request\_Subscriber\_Info\_GMLC negative response'.

# 24A.5.31.2.7.2 Proceduress in the HLR

The MAP process in the HLR to provide subscriber information in response to an interrogation from the CAMEL server is shown in figure  $2\underline{4A.5/5}\underline{1.2/8}$ . The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive_Open_Ind see <u>sub</u>clause 25.1.1;
Receive_Open_Cnf see <u>sub</u>clause 25.1.2;
Check_Confirmation see <u>sub</u>clause 25.2.2.
```

## Successful outcome

When the MAP process receives a MAP\_OPEN indication with the application context anyTimeInterrogationEnquiry, it checks it by invoking the macro Receive\_Open\_Ind.

If the macro takes the OK exit, the MAP process waits for a service indication.

If a MAP\_ANY\_TIME\_INTERROGATION service indication is received, the MAP process sends an Any Time Interrogation request to the call handling process in the HLR (described in 3GPP TS 23.078), and waits for a response. The Any Time Interrogation request contains the parameters received in the MAP\_ANY\_TIME\_INTERROGATION service indication.

If the call handling process in the HLR returns an Any Time Interrogation response, the MAP process constructs a MAP\_ANY\_TIME\_INTERROGATION service response containing the subscriber information contained in the Any Time Interrogation response, constructs a MAP\_CLOSE service request, sends them to the CAMEL server and returns to the idle state.

If the call handling process in the HLR returns a Provide Subscriber Info request, the MAP process requests a dialogue with the VLR whose identity is contained in the Provide Subscriber Info request by sending a MAP\_OPEN service request, requests the subscriber status using a MAP\_PROVIDE\_SUBSCRIBER\_INFO service request, and invokes the macro Receive\_Open\_Cnf to wait for the response to the dialogue opening request.

If the macro takes the OK exit, the MAP process waits for the response from the VLR.

If the MAP process receives a MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm, it invokes the macro Check Confirmation to check the content of the confirm.

If the Check\_Confirmation macro takes the OK exit, the MAP process sends a Provide Subscriber Info ack containing the information received in the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

If the MAP\_PROVIDE\_SUBSCRIBER\_INFO service confirm contains a provider error or a data error, the MAP process sends a Provide Subscriber Info negative response indicating the type of error to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

NOTE: The 'User Error' exit from the macro Check\_Confirmation is shown for formal completeness; the MAP\_PROVIDE\_SUBSCRIBER\_INFO\_cnf primitive cannot contain a user error.

## Negative response from HLR call handling process

If the call handling process in the HLR returns a negative response, either before or after a dialogue with the VLR to obtain subscriber information, the MAP process constructs a MAP\_ANY\_TIME\_INTERROGATION service response containing the appropriate error, constructs a MAP\_CLOSE service request, sends them to the CAMEL server and returns to the idle state.

# Failure of Provide Subscriber Info dialogue with the VLR

If the Receive\_Open\_Cnf macro takes the Vr exit or the Error exit after the MAP process has requested opening of a Provide Subscriber Info dialogue with the VLR, the MAP process sends a Provide Subscriber Info negative response indicating system failure to the call handling process in the HLR, and waits for a response. The handling of the response from the call handling process in the HLR is described above.

# Failure of dialogue opening with the CAMEL server

If the macro Receive\_Open\_Ind takes the Vr or Error exit, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_P\_ABORT while the MAP process is waiting for a service indication, the MAP process returns to the idle state.

If the MAP provider sends a MAP\_NOTICE while the MAP process is waiting for a service indication, the MAP process sends a MAP\_CLOSE request to terminate the dialogue and returns to the idle state.

# 24A.5.41.2.8.2 Proceduress in the GMLC

The MAP process in the GMLC to provide location information in response to a request from the gsmSCF is shown in figure 24A.5/61.2.8/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

## Successful outcome

When the GMLC has successfully received the MAP Any\_Time\_Interrogation MAP Message, it will send an internal signal to the Location Service process in the GMLC to obtain the subscriber's Location Information. The result received from that process is sent back to the gsmSCF, in the Any\_Time\_Interrogation Result MAP Message.

# **Unsuccessful outcome**

In the case of a Provider Error received, the process will terminate.

When a User error is received from the Location Services process in the GMLC, then a User Abort is sent to the gsmSCF.

If a negative response is received from the Location Services process in the GMLC, then this response is forwarded to the gsmSCF.

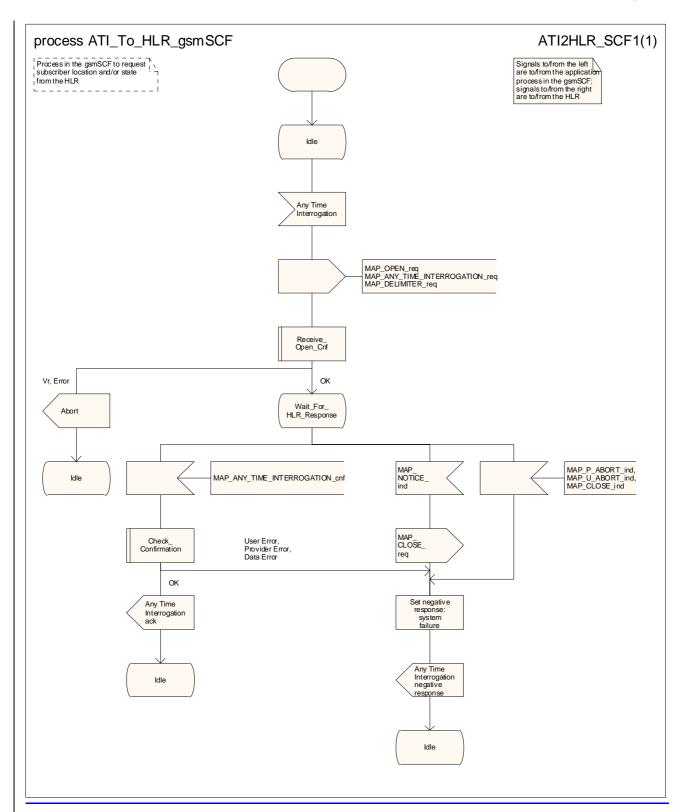
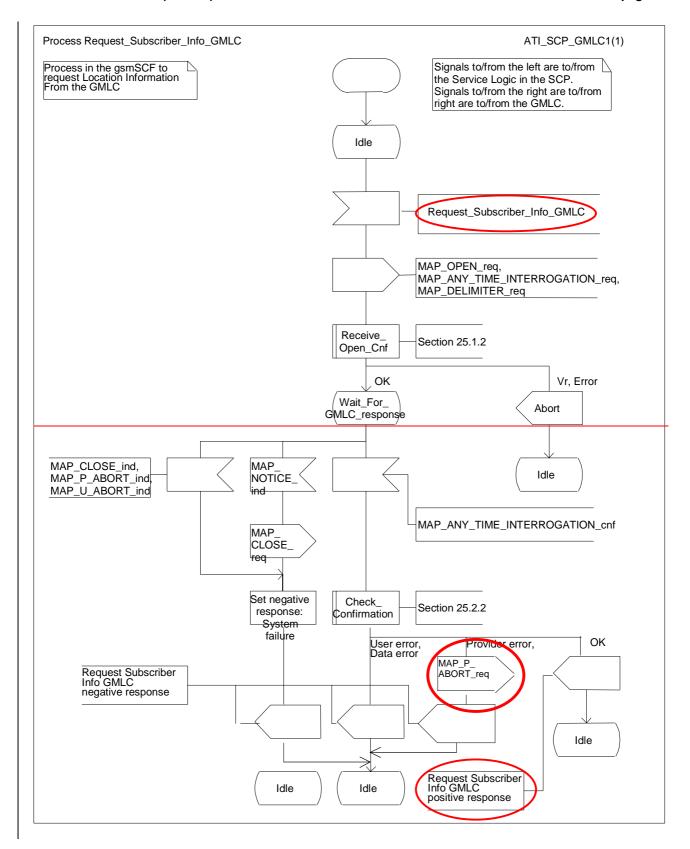


Figure 24A.5/3: Process ATI To HLR gsmSCF



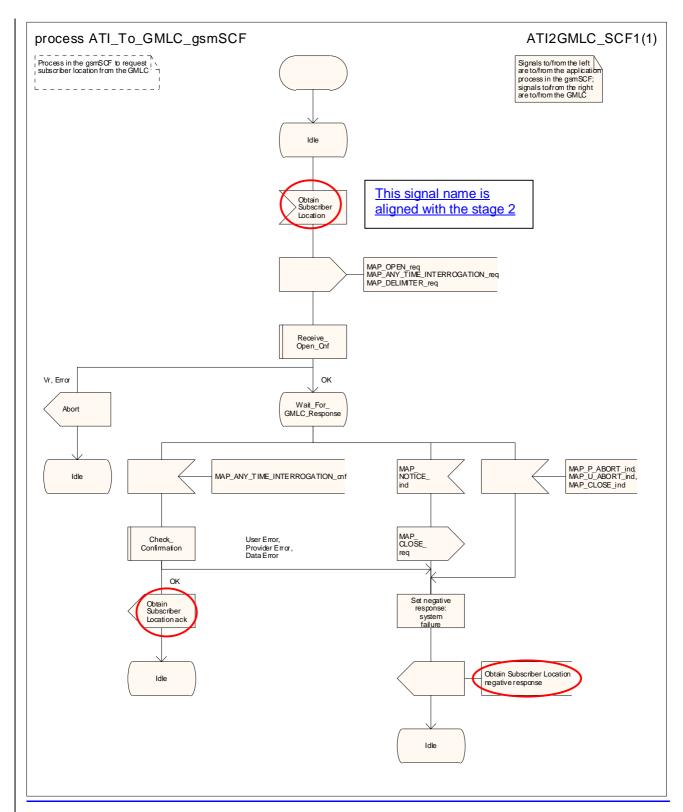
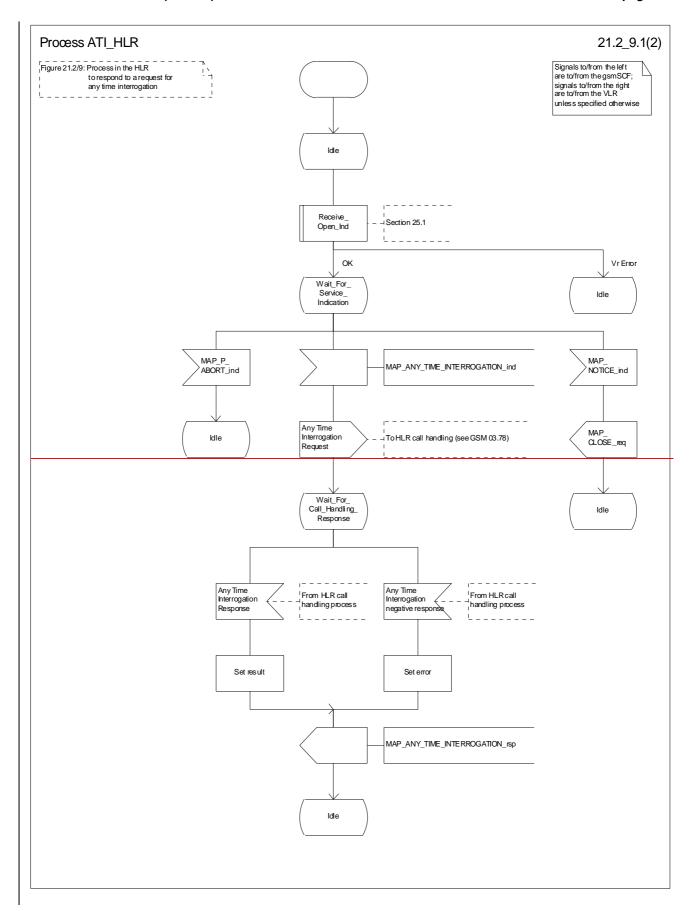


Figure 24A.5/41.2.8/2: Process Request\_Subscriber\_InfoATI To\_GMLC\_gsmSCF



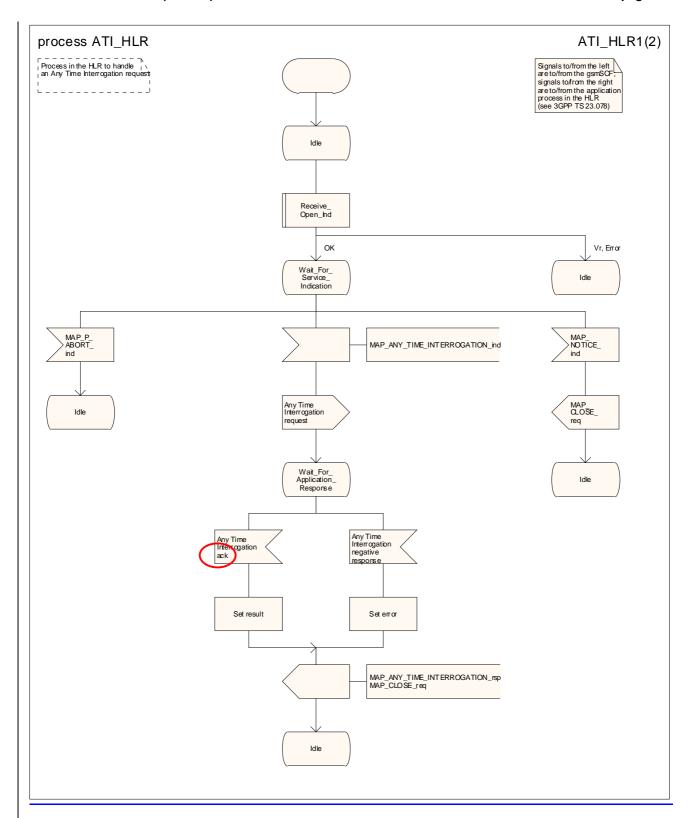
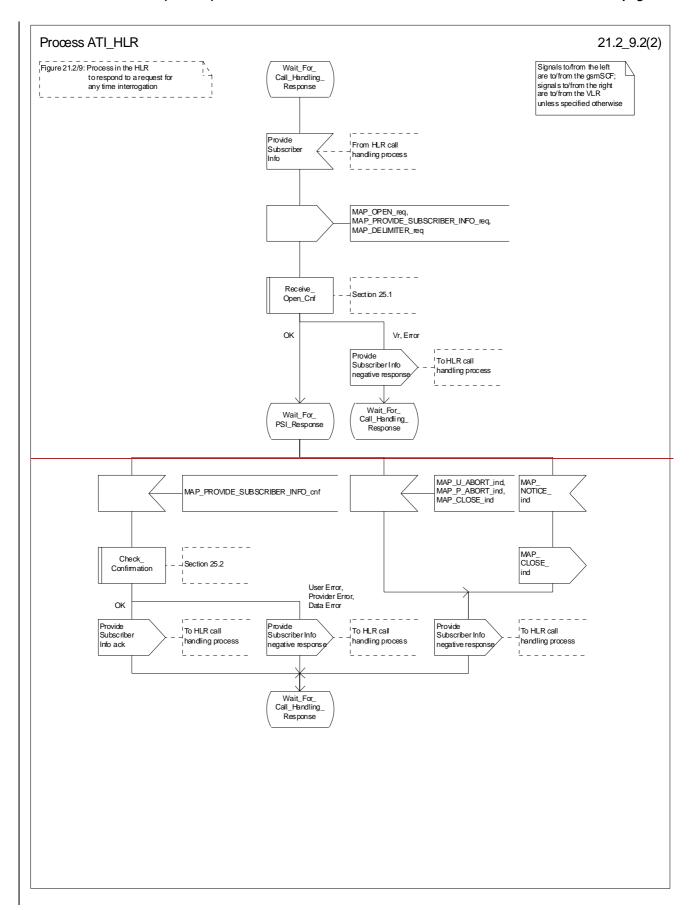


Figure 24A.5/51.2/9 (sheet 1 of 2): Process ATI\_HLR-(New)



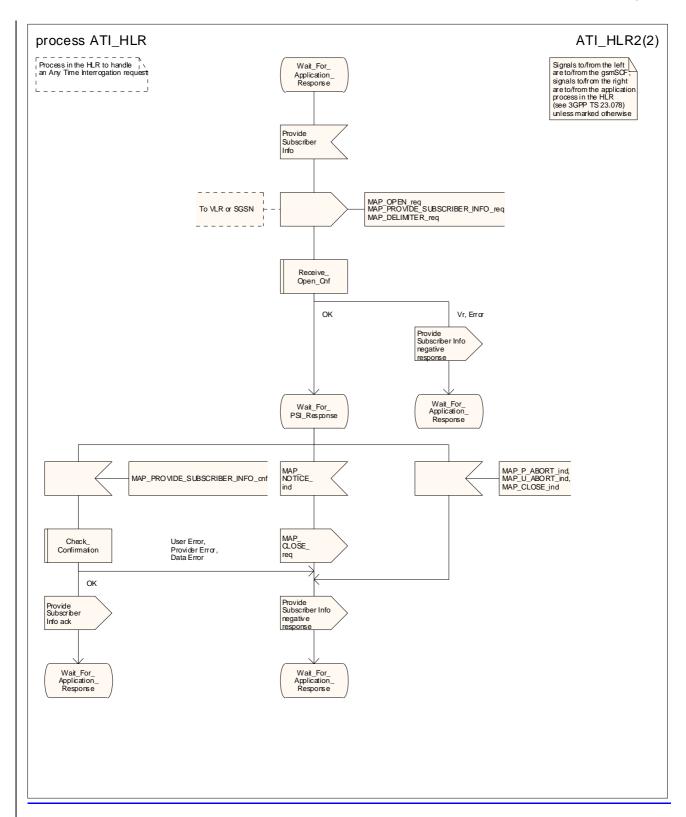
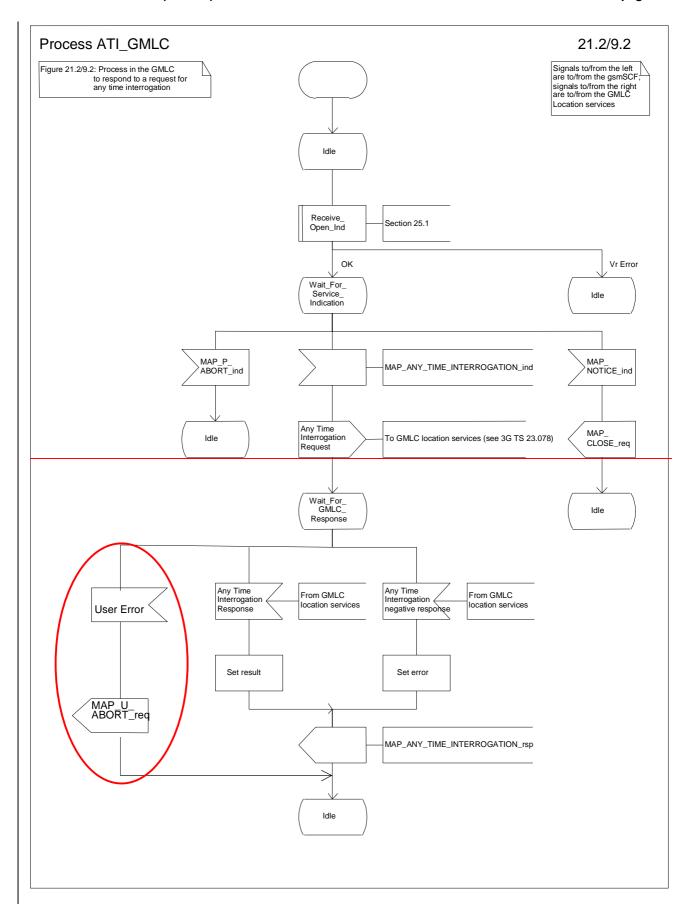


Figure 24A.5/51.2/9 (sheet 2 of 2): Process ATI\_HLR-(New)



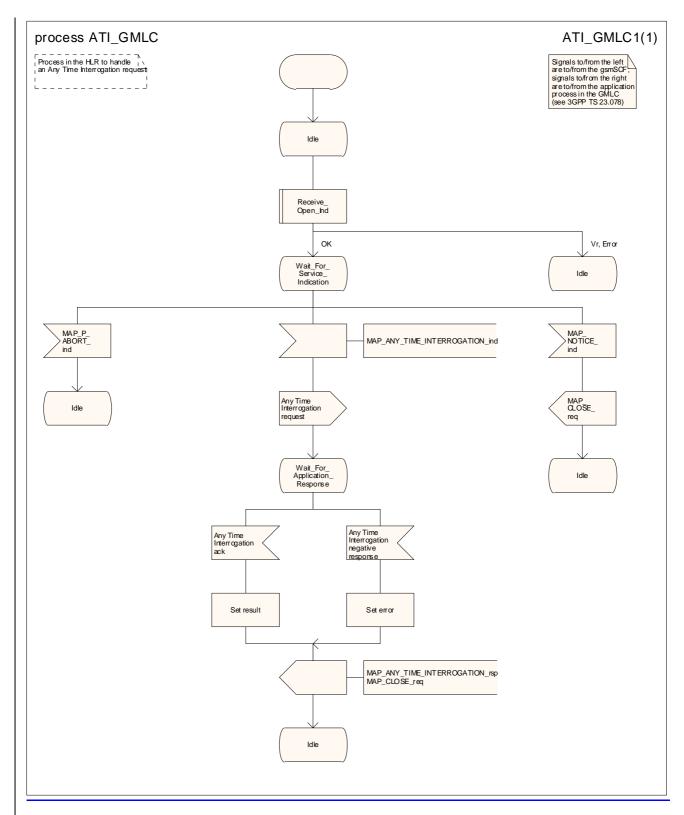


Figure 24A.5/61.2.8/3: Process ATI\_GMLC

# \*\*\* End of document \*\*\*

# 3GPP TSG CN WG4 Meeting #20 Sophia Antipolis, FRANCE, 25<sup>th</sup> – 29<sup>th</sup> August 2003

N4-030952 (Revision of N4-030822)

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- Reason for change: # 1. There are no source files available for the SDL diagrams in 29.002 chapter 20. Many SDL diagrams are poorly laid out.
  - 2. Some message flow diagrams are drawn using linedraw characters, which do not display correctly in Word 2000.
  - 3. Most of the text repeats the information in the SDL diagrams; the useful additional information is buried in superfluous verbiage. The principle of making the text a supplement to the SDL diagrams has been accepted by CN #20, with the approval of CRs to chapters 22 – 25 to remove the redundant
  - 4. The naming convention for SDL processes is not consistent.
  - 5. There are several references to the non-existent process Subscriber\_Present\_HLR in the non-existent subclause 19.1.1.7
  - 6. The signal names between the application processes in the VLR (process Send Identification VLR) and the PVLR (process Send Identification PVLR) are misaligned; the signal Request IMSI from the application process in the VLR corresponds to the signal Send Identification to the application process in the PVLR. This is aligned with 23.012.
  - 7. The process Update Location VLR calls a non-existent macro, VLR Update HLR, which was removed from 29.002 as part of the transfer of the stage 2 for location management into 23.012 in Release 99. Further, the process invoked only from the macro Process\_Access\_Request\_VLR, in subclause 25.4.
  - 8. The modelling of the Cancel\_Location\_HLR and Cancel\_GPRS\_Location\_HLR processes is faulty. A process which terminates (rather than returning to the Null state) is required to interwork with the subscriber deletion and subscriber data modification processes in chapter 20; however a process which returns to the Null state is required for communication with the application processes defined in 23.012 (for non-GPRS) and 23.060 (for GPRS).

- 9. The process Cancel\_Location\_SGSN shows (some of) the stage 2 handling, which is covered more fully in the GPRS stage 2 (23.060).
- 10. There is no supporting text for the SDL processes in the VLR and the HLR for the MS purging procedure.
- 11. The handling in the MAP Handover processes for the Provider Error exit from the macro Check Confirmation does not take account of the fact that when the macro takes the Provider Error exit the dialogue has already been closed.
- 12. Several of the signal names for signals to & from the Handover Control application in the MAP processes for handover in MSC-A & MSC-B are not aligned with the signal names used in the Handover stage 2 (23.009).
- 13. The MAP process for handover in MSC-A omits the error handling for failure of a subsequent handover back to MSC-A.
- 14. The MAP process for handover in MSC-A should close the dialogue with MSC-B and return to the Null state when it has sent the MAP\_SEND\_END\_SIGNAL response at the end of a successful subsequent handover back to MSC-A.
- 15. In the MAP process for handover in MSC-A, when a MAP SEND END SIGNAL indication is received from the distant MSC and the Check Indication macro takes the Error exit, the dialogue is aborted but this is not reported to the Handover Control application.
- 16. The modelling of the handling in MSC-A for the dialogue with MSC-B at subsequent handover to MSC-B' is unnecessarily complex for the case when the dialogue with MSC-B' uses the current protocol version, and inaccurate when the dialogue with MSC-B' reverts to an earlier protocol version.
- 17. The macro Receive\_error\_from\_HO\_CA\_or\_MSC (subclause 19.2.4) fails the syntax check in SDT, so it cannot be drawn. Furthermore, if the test "Error indication" takes the "Keep dialogue" exit, the macro should take the "Error" exit to indicate that the dialogue is maintained, rather than the "Null" exit to indicate that the dialogue has been terminated.
- 18. The macro Receive\_error\_from\_HO\_CA\_or\_MSC is misused in many places. When the macro takes the Null exit the dialogue with the distant MSC has been closed or aborted, so the MAP process should return to the Null state; when the macro takes the Error exit the dialogue has not been closed, so if the MAP process is to return to the Null state the dialogue should be closed or aborted first.

This is a non-critical correction, proposed for agreement by consensus

- Summary of change: # 1. Redraw SDL diagrams to a consistent style.
  - 2. Redraw message flow diagrams.
  - 3. Remove text which replicates the information in SDL diagrams.
  - 4. Correct errors in SDL diagrams.
  - 5. Add the definition of the process Subscriber\_Present\_HLR.
  - 6. Redefine the process Update\_Location\_VLR to avoid the use of the VLR\_Update\_HLR macro, and move it to subclause 25.4.
  - 7. Align the signal names used in the VLR and the PVLR for inter-VLR IMSI retrieval
  - 8. Define two layers of processes for location cancellation, to provide interworking with the processes defined in 29.002 chapter 20 and the application processes in 23.012 & 23.060.
  - 9. Model the process Cancel\_Location\_SGSN on the process Cancel Location VLR, to communicate with the application process defined in the stage 2 specification
  - 10. Apply a consistent naming convention for SDL processes: the last component of the name of the process is the entity in which the process runs.
  - 11. Provide supporting text in subclause 19.1.4 for the SDL processes in the VLR and the HLR for the MS purging procedure.
  - 12. Correct the handling in the MAP handover processes to reflect that the dialogue has been closed when the macro Check Confirmation takes the Provider Error exit.
  - 13. Align signal names to & from HO CA with those used in 23.009.
  - 14. Add the error handling for failure of subsequent handover back to MSC-A.
  - 15. Close the dialogue with MSC-B and return the process to the Null state after successful completion of subsequent handover.

- 16.Report the error to the HO\_CA when a badly formed MAP\_SEND\_END\_SIGNAL indication is received.
- 17. Change the modelling in MSC-A for subsequent handover to indicate that a separate instance of the process Handover\_MSC\_A is triggered to handle the dialogue with MSC-B' for subsequent handover to a third MSC.
- 18. Expand in line the handling for error indications from the distant MSC during inter-MSC handover.
- 19. Correct the handling in the macro Receive Error From HO CA.
- 20. Correct the handling in the calling processes for the Error and Null exits from the macro Receive\_Error\_From\_HO\_CA.

# Consequences if not approved:

- # 1. No SDL source files to use as the basis for future changes.
  - 2. Message flow diagrams are difficult to read.
  - 3. Useful information to supplement the SDL diagrams is buried in superfluous verbiage, which (inaccurately) repeats the information in the SDL diagrams.
  - 4. Many formal errors in SDL diagrams.
  - 5. The style of chapter 19 will be markedly different from the style of chapters 22 25, making the specification more difficult to use for implementers who are not aware of the history, and leading to a perception of poor quality.

Clauses affected:	# 19; 25.4.4 (new); 25.7.7; 25.9.6; 25.9.7					
Other specs affected:	X	Other core specifications Test specifications D&M Specifications	æ	CR 23.012-012		

#### Other comments:

- X 1. The text for each of the second level subclauses 19.1.1, 19.1.2, 19.1.4, 19.3.1 & 19.3.2 has been grouped together before the SDL diagrams. Similarly, the text for each of subclauses 19.2, 19.4 & 19.5 has been grouped together before the SDL diagrams. This editorial rearrangement has not been revision marked.
  - 2. Figure numbers have been systematically updated to reflect the order within each subclause. In subclause 19.1, figure numbers are allocated sequentially in each **second** level subclause; in subclauses 19.2, 19.3, 19.4 & 19.5, figure numbers are allocated sequentially in each **first** level subclause.
  - 3. The subclauses within 19.1.1 have been re-ordered to group the overall description, including message flows, in 19.1.1.1, the VLR behaviour in 19.1.1.2, the SGSN behaviour in 19.1.1.3 and the HLR behaviour in 19.1.1.4. The behaviour of the VLR and the previous VLR for retrieval of the IMSI at inter-VLR location updating is included in subclause 19.1.1.2. This editorial change has not been revision marked, apart from the changes to subclause heading numbers and figure numbers.
  - 4. Subclause 19.1.1.6 (the independent process UL\_VLR) describes a process which is called only from the macro Process\_Access\_Request\_VLR; it has been moved to subclause 25.4. This editorial change has not been revision marked, apart from the changes to subclause heading numbers and figure numbers.
  - 5. The subclauses in 19.1.4 (MS purging) have been re-ordered to give the oreder: general description, VLR behaviour, SGSN behaviour, HLR behaviour. This editorial change has not been revision marked, apart from the changes to subclause heading numbers and figure numbers.
  - 6. Subclauses 19.4 (the macros Insert\_Subscriber\_Data\_Framed\_HLR and Insert\_Subs\_Data\_In\_SGSN\_Framed\_HLR) and 19.5 (Mobility Management Event notification procedure) have been re-ordered to put the macro definitions in subclause 19.5. This editorial change has not been revision marked, apart from the changes to subclause heading numbers and figure numbers.

# \*\*\* First modified section \*\*\*

# 19 Mobility procedures

# 19.1 Location management Procedures

The signalling procedures in this subclause support:

- Interworking between the VLR and the HLR and between the VLR and the previous VLR (PVLR) when a non-GPRS subscriber performs a location update to a new VLR service area;
- Interworking between the SGSN, the HLR and the VLR when a subscriber with both GPRS and non-GPRS subscriptions performs a routeing area update in an SGSN and the Gs interface is implemented;
- Interworking between the SGSN and the VLR when a GPRS subscriber performs a routeing area update to a new SGSN service area;
- Interworking between the HLR and the VLR and between the HLR and the SGSN to delete a subscriber record from the VLR or the SGSN;
- Interworking between the VLR and the HLR and between the SGSN and the HLR to report to the HLR that a subscriber record has been purged from the VLR or the SGSN.

For non-GPRS subscribers, this clause 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 clause:

```
Process Update Location Area:

Update_Location_Area_VLR, clause 19.1.1.3;

Process Update Location:
```

```
Initiator: Update_Location_Area_VLR, clause 19.1.1.3;
```

Responder: Update\_Location\_HLR, clause 19.1.1.4;

**Process Send Identification:** 

```
Initiator: Send_Identification_VLR, clause 19.1.1.x;
```

Responder: Send\_Identification\_PVLR, clause 19.1.1.5;

**Process Cancel Location:** 

```
Initiator: Cancel_Location_HLR, clause 19.1.2.2;
```

Responder: Cancel Location VLR, clause 19.1.2.3;

**Process Purge MS:** 

```
Initiator: Purge_MS_VLR, clause 19.1.4.2;
```

Responder: Purge\_MS\_HLR, clause 19.1.4.3.

For GPRS subscribers, this clause 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 clause:

```
Process GPRS Update Location:
```

```
Initiator: GPRS_Update_Location_Area_VLR, clause 19.1.1.3, or
```

SGSN\_Update\_HLR, clause 19.1.1.8,

Responder: Update GPRS Location HLR, clause 19.1.1.4;

**Process Cancel Location:** 

Initiator: Cancel GPRS Location HLR, clause 19.1.2.2;

Responder: Cancel\_Location\_SGSN, clause 19.1.2.4;

**Process Purge MS:** 

Initiator: Purge\_MS\_SGSN, clause 19.1.4.4;

Responder: Purge\_MS\_HLR, clause 19.1.4.3.

The following existing process is also used for GPRS subscribers:

**Process Subscriber Present HLR:** 

Initiator: Subscriber Present HLR, clause 19.1.1.7;

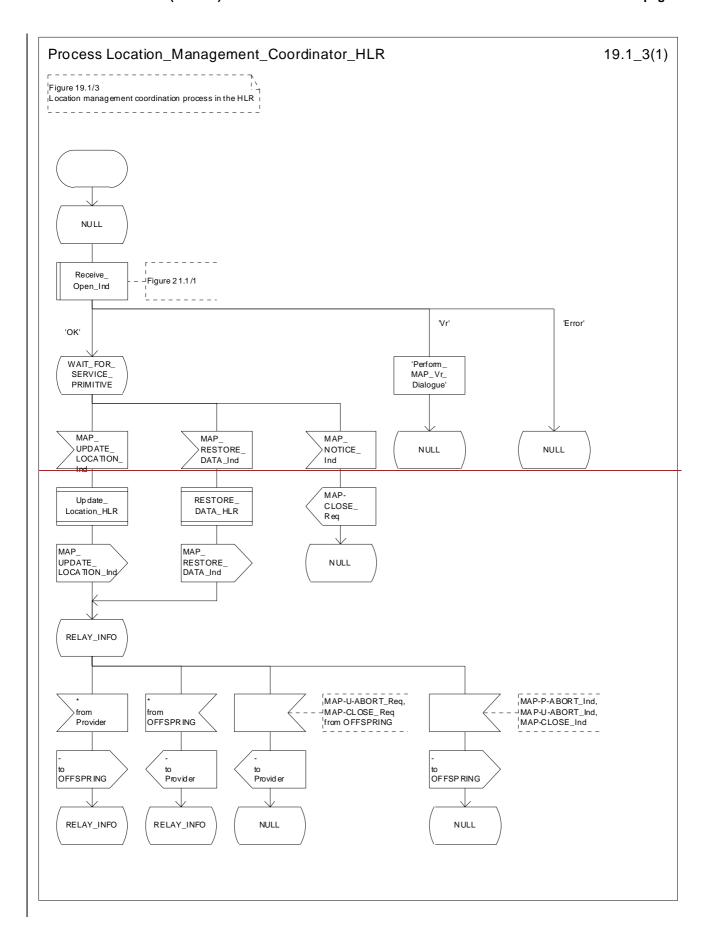
Responder: Short Message Alert IWMSC, clause 23.4.3;

# **Location Management Coordinator HLR**

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.

The MAP co-ordinating process in the HLR to handle a dialogue opened with the network location updating context is shown in figure 19.1/1. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see clause 25.1.1.



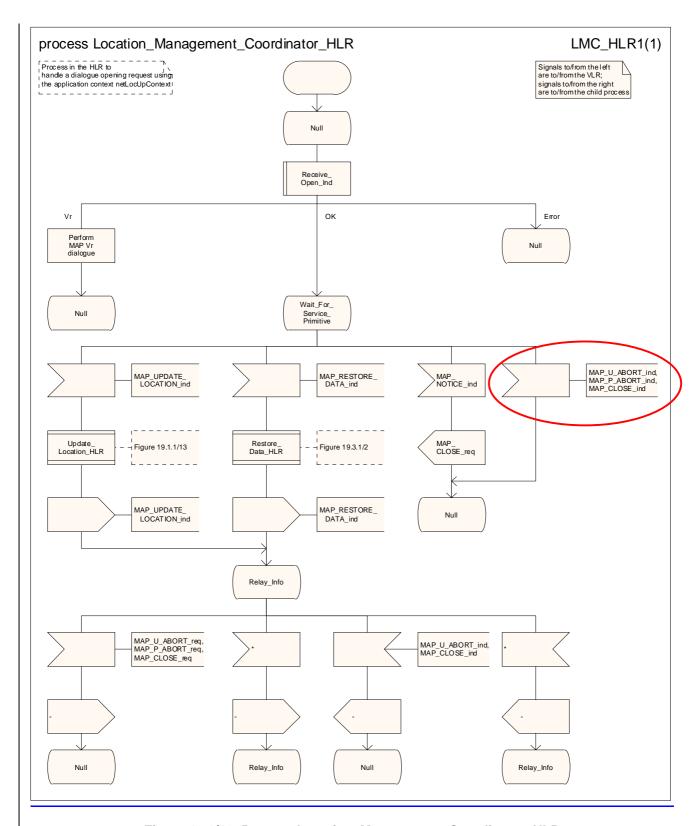


Figure 19.1/13: Process Location\_Management\_Coordinator\_HLR

# 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 3GPP TS 23.012 [23] and 3GPP TS 23.060 [104]). The use of the IMSI Detach / Attach feature is optional for the network operator.

To minimise 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 location management for a non-GPRS subscriber is 3GPP TS 23.012 [23]. The interworking between the MAP signalling procedures and the location management procedures in the VLR, the PVLR and the HLR is shown by the transfer of signals between these procedures.

The stage 2 specification for GPRS is in 3GPP TS 23.060 [104]. The interworking between the MAP signalling procedures and the GPRS procedures in the SGSN and the HLR is shown by the transfer of signals between these procedures (see clause 19.1.1.8).

The message flow for successful inter-VLR location updating when the IMSI can be retrieved from the PVLR is shown in figure 19.1.1/2.

The message flow for successful inter-VLR location updating when the IMSI cannot be retrieved from the PVLR is shown in figure 19.1.1/3.

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 clause 8.1);(**)

MAP_UPDATE_LOCATION (see clause 8.1);(**)

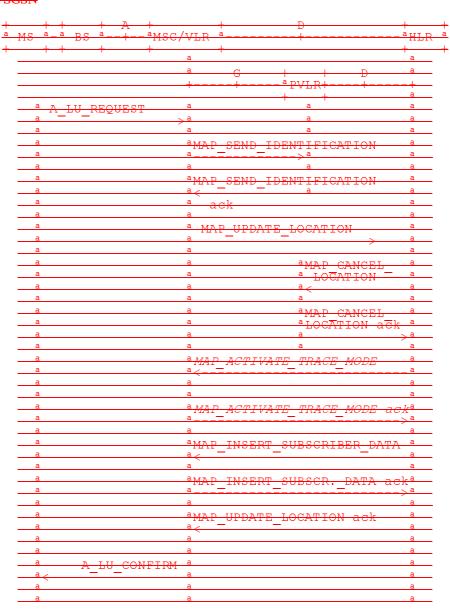
MAP_UPDATE_GPRS_LOCATION (see clause 8.1) (*);

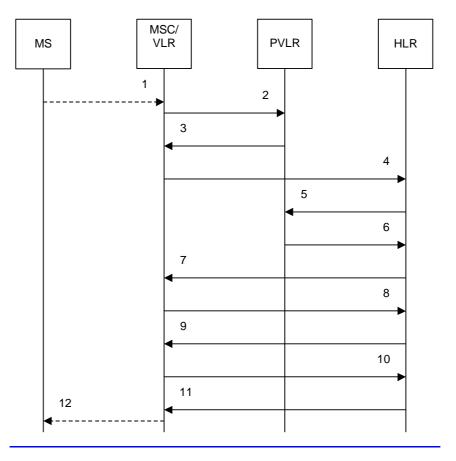
MAP_CANCEL_LOCATION (see clause 8.1);

MAP_INSERT_SUBSCRIBER_DATA (see clause 8.8);
```

MAP\_SEND\_IDENTIFICATION (see clause 8.1) (\*\*); MAP PROVIDE IMSI (see clause 8.9) (\*\*); MAP AUTHENTICATE (see clause 8.5) (\*\*); MAP SET CIPHERING MODE MAP\_FORWARD\_NEW\_TMSI (see clause 8.9) (\*\*); MAP\_CHECK\_IMEI MAP\_ACTIVATE\_TRACE\_MODE MAP\_TRACE\_SUBSCRIBER\_ACTIVITY (see clause 9.2) (\*\*). (\*): only used in SGSN and HLR for GPRS

(\*\*): not used in SGSN



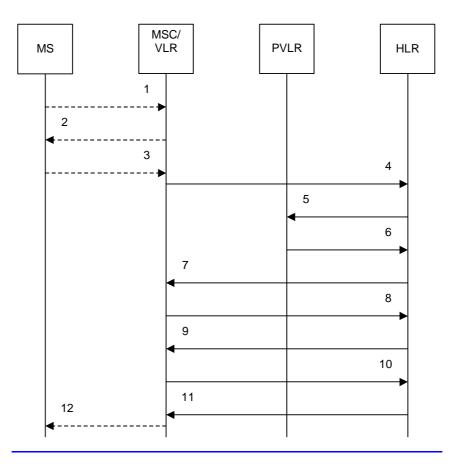


# PVLR = Previous VLR

- A LU REQUEST (Note 1)
- MAP SEND IDENTIFICATION reg/ind
- MAP\_SEND\_IDENTIFICATION\_rsp/cnf
- MAP\_UPDATE\_LOCATION\_req/ind 4)
- 5) MAP CANCEL LOCATION req/ind
- 6) MAP\_CANCEL\_LOCATION\_rsp/cnf
- MAP ACTIVATE TRACE MODE req/ind (Note 2)
  MAP ACTIVATE TRACE MODE rsp/cnf (Note 2) 7)
- 8)
- 9) MAP INSERT SUBSCRIBER DATA reg/ind
- 10) MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf
- MAP UPDATE LOCATION rsp/cnf 11)
- A LU CONFIRM (Note 1) 12)
- NOTE 1: For details of the procedure on the radio path, see 3GPP TS 24.008 [35]. 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 <u>2</u>: Procedures shown <u>Services printed</u> in *italics* are optional.

Figure 19.1.1/2: Interface and services Message flow for location updating when changing the to a new VLR area, when the IMSI can be retrieved from the previous VLR





## PVLR = Previous VLR

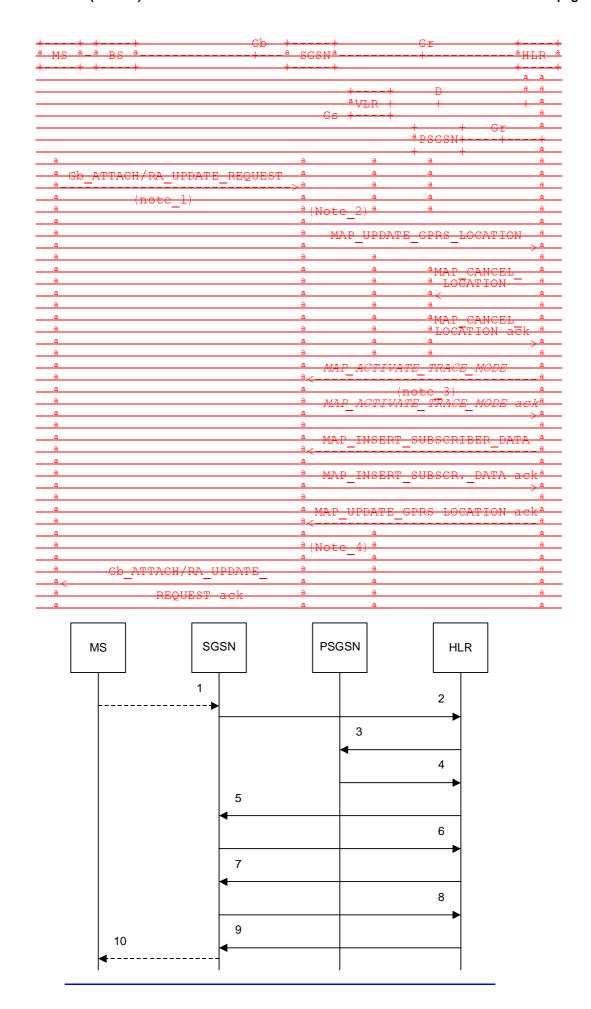
- A LU REQUEST (Note 1)
- A\_IDENTITY\_REQUEST (Note 1)
- A\_IDENTITY\_RESPONSE (Note 1)
- MAP\_UPDATE\_LOCATION\_req/ind 4)
- 5) MAP CANCEL LOCATION req/ind
- 6) MAP\_CANCEL\_LOCATION\_rsp/cnf
- MAP ACTIVATE TRACE MODE req/ind (Note 2)
  MAP ACTIVATE TRACE MODE rsp/cnf (Note 2) 7)
- 8)
- 9) MAP INSERT SUBSCRIBER DATA reg/ind
- 10) MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf
- MAP UPDATE LOCATION rsp/cnf 11)
- A LU CONFIRM (Note 1) 12)

NOTE 1: For details of the procedure on the radio path, see 3GPP TS 24.008 [35]. 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 <u>2</u>: Procedures shown <u>Services printed</u> in *italics* are optional.

Figure 19.1.1/3: Interface and services Message flow for location updating involving both to a new VLR areand an HLR,

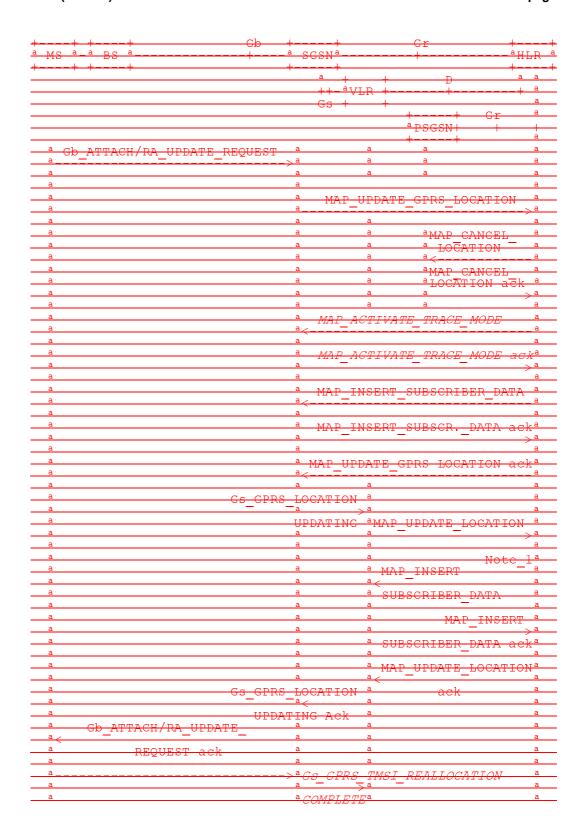
when the IMSI can-not be retrieved from the previous VLR

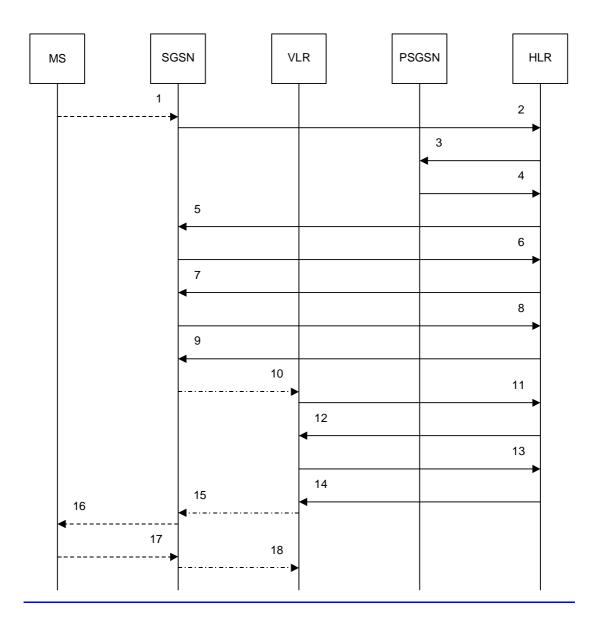


#### PSGSN = Previous SGSN

- Gb\_ATTACH\_REQUEST or RA\_UPDATE\_REQUEST (Note 1, note 2)
- MAP UPDATE GPRS LOCATION req/ind MAP\_CANCEL\_LOCATION\_req/ind
- 3)
- MAP\_CANCEL\_LOCATION\_rsp/cnf 4)
- MAP ACTIVATE TRACE MODE reg/ind (Note 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 3) 6)
- MAP INSERT SUBSCRIBER DATA reg/ind 7)
- MAP INSERT SUBSCRIBER DATA rsp/cnf MAP\_UPDATE\_GPRS\_LOCATION\_rsp/cnf 8)
- 10) Gb ATTACH ACCEPT or RA UPDATE ACCEPT (Note 1)
- NOTE 1: For details of the procedure on the radio path, see 3GPP TS-48.018 [35]. 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 3GPP -TS -23.060 [104]. The MAP processes signalling invoked for the ese procedures are functions is described in section clause 25 of the present document.
- NOTE 3: Optional s Services are printed in *italics* are optional.
- NOTE 4: Refer to 3GPP TS -23.060 -[104] for termination of the procedure and triggering of the signalling on the Gb interface between the BSS and the SGSN.

Figure 19.1.1/4: Interface and servicesMessage flow for GPRS location updating (Gs\_interface not installed)





- Gb\_ATTACH\_REQUEST or RA\_UPDATE\_REQUEST (Note 1, note 2)
- MAP UPDATE GPRS LOCATION reg/ind 2)
- 3) MAP CANCEL LOCATION reg/ind
- 4) MAP\_CANCEL\_LOCATION\_rsp/cnf
- 5) MAP ACTIVATE TRACE MODE reg/ind (Note 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 3)
  MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind 6)
- 7)
- MAP INSERT SUBSCRIBER DATA rsp/cnf 8)
- MAP UPDATE GPRS LOCATION rsp/cnf 9)
- Gs\_LOCATION\_UPDATE\_REQUEST (Note 4) 10)
- MAP UPDATE LOCATION reg/ind (Note 5) <u>11)</u>
- MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind 12)
- 13) MAP INSERT SUBSCRIBER DATA rsp/cnf
- MAP\_UPDATE\_LOCATION\_rsp/cnf 14)
- 15) Gs LOCATION UPDATE ACCEPT (Note 4)
- 16) Gb\_ATTACH\_ACCEPT or RA\_UPDATE\_ACCEPT (Note 1)
- 17) Gb TMSI REALLOCATION COMPLETE (Note 1)
- TMSI\_REALLOCATION\_COMPLETE (Note 4) 18)
- NOTE 1: For details of the procedure on the radio path, see 3GPP TS 24.008 [35]. 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.
- For security functions (authentication, ciphering, IMEI check) triggering refer to 3GPP TS 23.060 [104]. MAP processes invoked for those procedures are described in subclause 25.5.
- Services printed in italics are optional. NOTE 3:

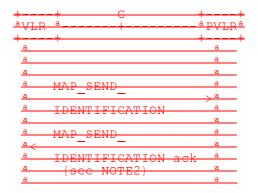
- NOTE 5: For details of the procedure on the path between the SGSN and the VLR, see 3GPP TS 29.018 [106]. The services shown in chain lines indicate the trigger provided by the signalling on the path between the SGSN and the VLR, and the signalling triggered on the path between the SGSN and the VLR.
- NOTE 4: Refer to 3GPP TS 23.060 [104] for termination of the procedure and triggering of the signalling on the interface between the BSS and the SGSN.
- NOTE 5: For simplicity, the Location Cancellation procedure towards the previous VLR and optional tracing activation towards the new VLR are not shown in this figure.
- NOTE 1: The optional procedures in figure 19.1.1/14 apply here respectively. For details of the procedure on the Gs interface, see 3GPP TS 29.018 [106].
- NOTE 2: Location Cancellation procedure toward the old VLR and optional tracing activation toward the new VLR are not represented on this figure.

Figure 19.1.1/5: Interface and services Message flow for GPRS location updating (Gs\_-interface installed)

### 19.1.1.5.1 General

This service is invoked by the VLR when it receives Update location from the MSC 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 clause 19.1.1.3), using the service described in clause 8.1.4.

If the version negotiation between R99 VLR and pre R99 PVLR leads to the MAP version 1 or 2, the VLR shall request authentication sets from the HLR.



NOTE1: The service shown in dotted lines indicates the trigger provided by other MAP signalling.

NOTE2: Several MAP\_SEND\_IDENTIFICATION request/response may be used if message segmentation is required.

Figure 19.1.1/10: Interface and services for Send Identification

## 19.1.1.23 Detailed pProcedures in the VLR

The MAP process in the VLR for location updating for a non-GPRS subscriber is shown in figure 19.1.1/6. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive_Open_Cnf	see subclause 25.1.2;
Check Confirmation	see subclause 25.2.2.

The MAP process in the VLR to retrieve the IMSI of a subscriber from the previous VLR (PVLR) is shown in figure 19.1.1/7. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf	see subclause 25.1.2;
Check Confirmation	see subclause 25.2.2.

The process in the VLR for location updating for a GPRS subscriber when the Gs interface is installed is shown in figure 19.1.1/8.

The macro GPRS Location Update Completion VLR is shown in figure 19.1.1/9. The macro invokes a process not defined in this clause; the definition of this process can be found as follows:

```
Subscriber_Present_VLR see subclause 25.10.1.
```

The macro GPRS\_Update\_HLR\_VLR is shown in figure 19.1.1/10. The macro invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive_Open_Cnf see subclause 25.1.2;
Check_Confirmation see subclause 25.2.2;
Insert_Subs_Data_VLR see subclause 25.7.1;
Activate Tracing_VLR see subclause 25.9.4.
```

#### 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 3GPP TS 23.060 [104] 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 exits 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 clause 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 3GPP TS 23.060 [104]). 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

In case the HLR rejects dialogue opening (see clause 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 clause 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 clause 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.

### 19.1.1.5 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 clause 19.1.1.X.

## 19.1.1.5.3 Detailed pProcedure in the PVLR

The MAP process in the PVLR to handle a request for the IMSI of a subscriber from the new VLR is shown in figure 19.1.1/11. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

On receipt of a dialogue request for the Send Identification procedure, (see Receive\_Open\_Ind macro in clause 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.

If the VLR has indicated that segmentation is prohibited then the PVLR sends a MAP\_SEND\_IDENTIFICATION response to the VLR by means of the TC RESULT L service and terminates the dialogue towards the VLR by a MAP\_CLOSE request with parameter Release Method indicating Normal Release.

If the VLR has not indicated that segmentation is prohibited then the PVLR sends a MAP\_SEND\_IDENTIFICATION response to the VLR by means of the TC RESULT L service, followed either by a MAP\_DELIMITER if more authentication sets are to be returned, or by a MAP\_CLOSE request with parameter Release Method indicating Normal Release.

# 19.1.1.48 Detailed pProcedure in the SGSN

The MAP process in the SGSN for location updating for a GPRS subscriber is shown in figure 19.1.1/12. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnfsee subclause 25.1.2;Check\_Confirmationsee subclause 25.2.2;Insert\_Subs\_Data\_SGSNsee subclause 25.7.2;Activate\_Tracing\_SGSNsee subclause 25.9.5.

Sheet 2: The procedure Check User Error In Serving Network Entity is specific to Super-Charger; it is specified in 3GPP TS 23.116 [110].

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

- Receive\_Open\_Cnf clause 25.1;
  Insert\_Subscriber\_Data\_SGSN clause 25.7;
  Activate Tracing SGSN clause 25.9;
- Sheet 2: The procedure Check\_User\_Error\_In\_Serving\_Network\_Entity is specific to Super-Charger; it is specified in 3GPP TS 23.116 [110].

### The location updating process

The MAP process receives an « Update HLR request » from the relevant process in the SGSN (see 3GPP TS 23.060 [104]) 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 Unknown HLR 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 clause 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 clause 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 clause 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 3GPP TS 23.060 [104]).
  - 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.

# 19.1.1.<u>54</u> Detailed pProcedures in the HLR

The MAP process in the HLR to handle a location updating request from a VLR is shown in figure 19.1.1/13. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

```
Check Confirmation see subclause 25.2.2.
```

The MAP process in the HLR to handle a location updating request from an SGSN is shown in figure 19.1.1/14. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Indsee subclause 25.1.1;Check\_Indicationsee subclause 25.2.1;Check\_Confirmationsee subclause 25.2.2;

Control Tracing With SGSN HLR see subclause 25.9.7.

Sheet 24: The procedure Super\_Charged\_Cancel\_Location\_HLR is specific to Super-Charger; it is specified in 3GPP\_TS 23.116 [110]. If the previous SGSN and the originating HLR does not support the Super-Charger functionality, processing continues from the "YesNo" exit of the test "Result=Pass?".

Sheet 2: The procedure Super\_Charged\_Location\_Updating\_HLR is specific to Super-Charger; it is specified in <u>3GPP\_TS</u> 23.116 [110]. If the HLR does not support the Super-Charger functionality subscription data needs to be sent to the SGSN, processing continues from the "No" exit of the test "Result=Pass?".

The MAP process in the HLR to notify Short Message Service Centres that a subscriber is now reachable is shown in figure 19.1.1/15. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Alert\_Service\_Centre\_HLR see subclause 25.10.3.

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

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

and the processes Cancel\_Location\_HLR (see clause 19.1.2) and Subscriber\_Present\_HLR (see clause 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 clause 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 deactive 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 clause 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). The HLR operator should avoid sending the error Roaming not Allowed with cause 'PLMN Roaming Not Allowed' or 'Operator determined Barring' to an SGSN in the HPLMN because this may lead to undesirable behaviour by the MS;
- 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 clause 25.9.

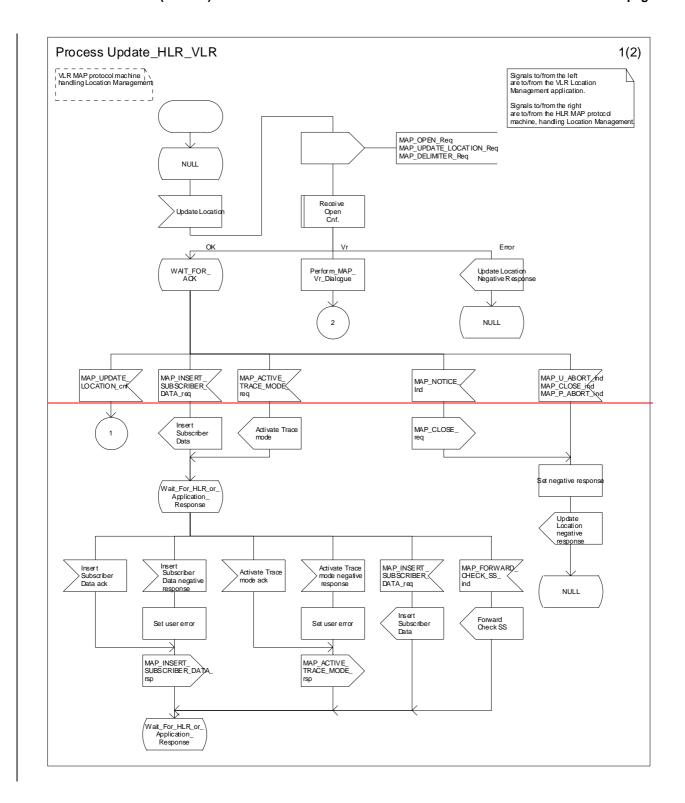
Thereafter, the macro Insert\_Subs\_Data\_In\_SGSN\_Framed\_HLR described in clause 19.4 is invoked. The outcome of this macro may be:

- 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 clause 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.



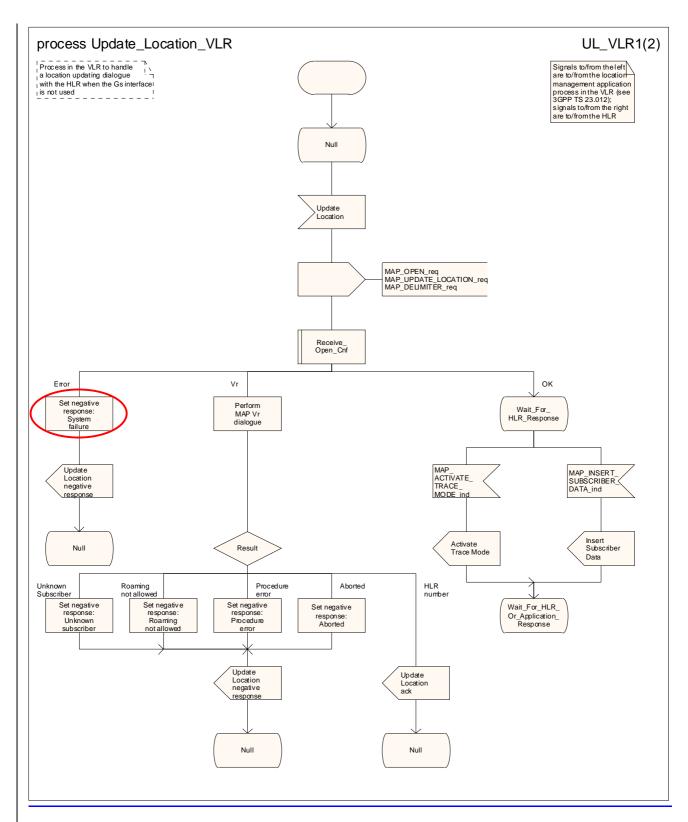
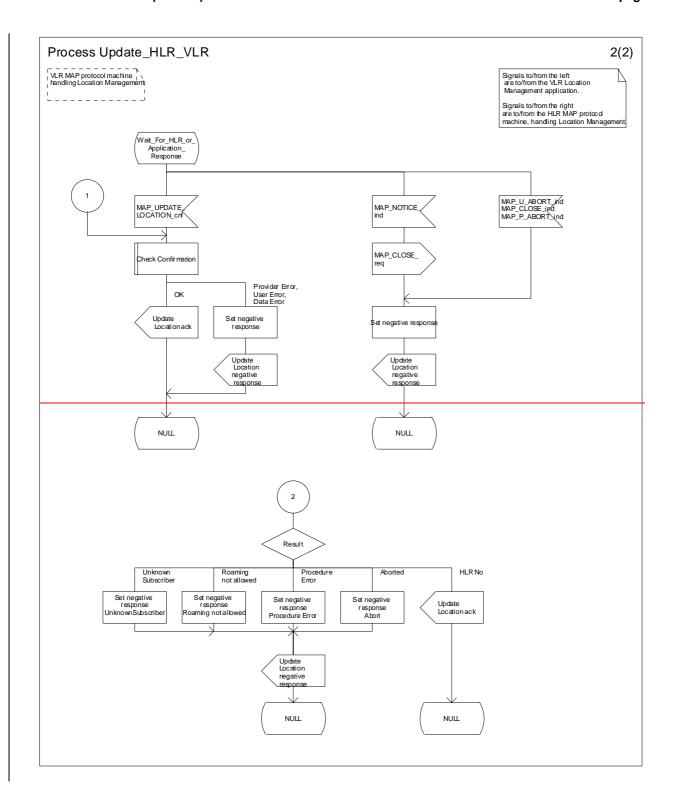


Figure 19.1.1/6 (sheet 1 of 2): Process Update\_LocationHLR\_VLR



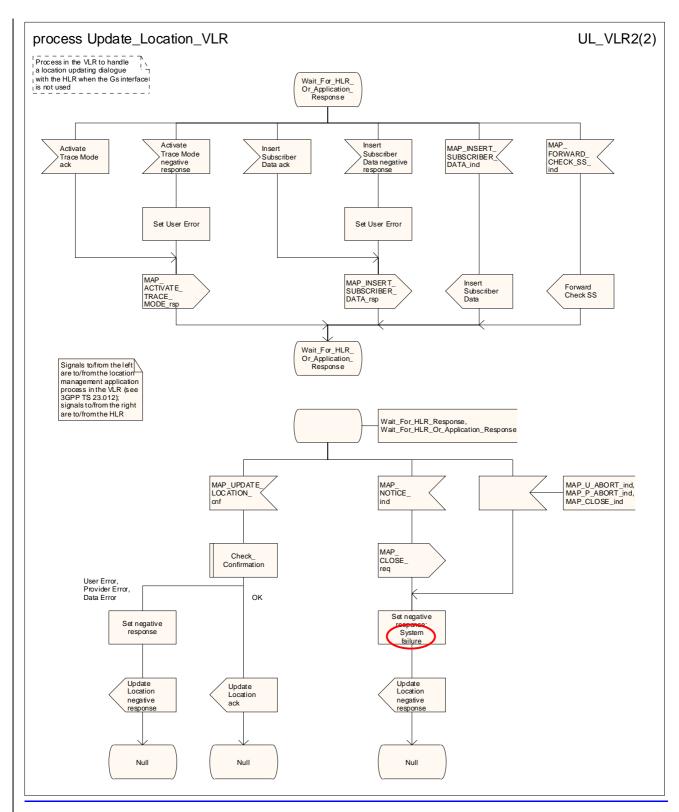
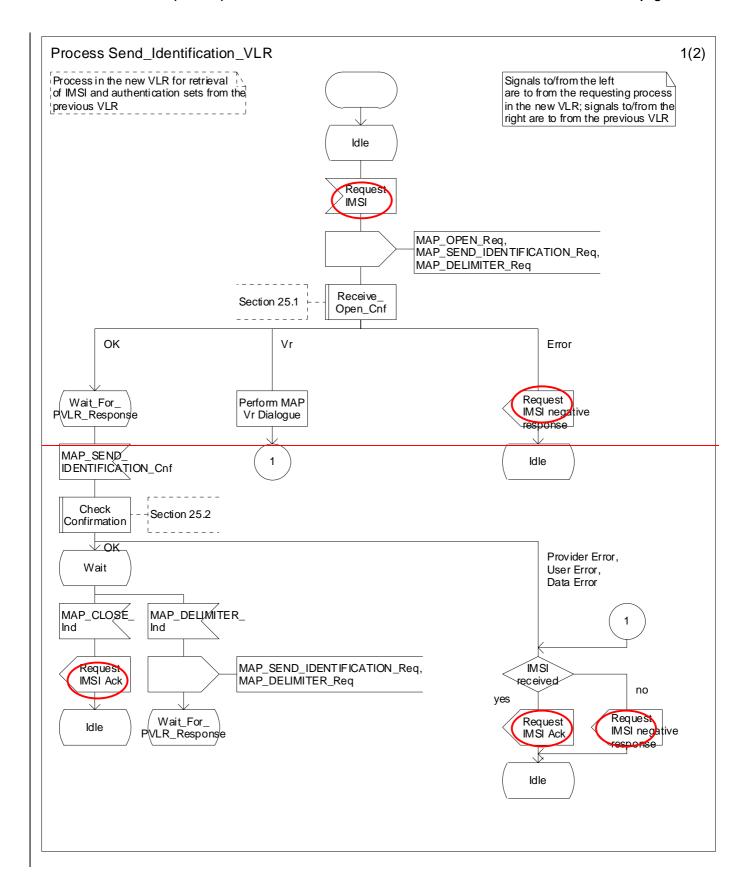


Figure 19.1.1/6 (sheet 2 of 2): Process Update\_LocationHLR\_VLR



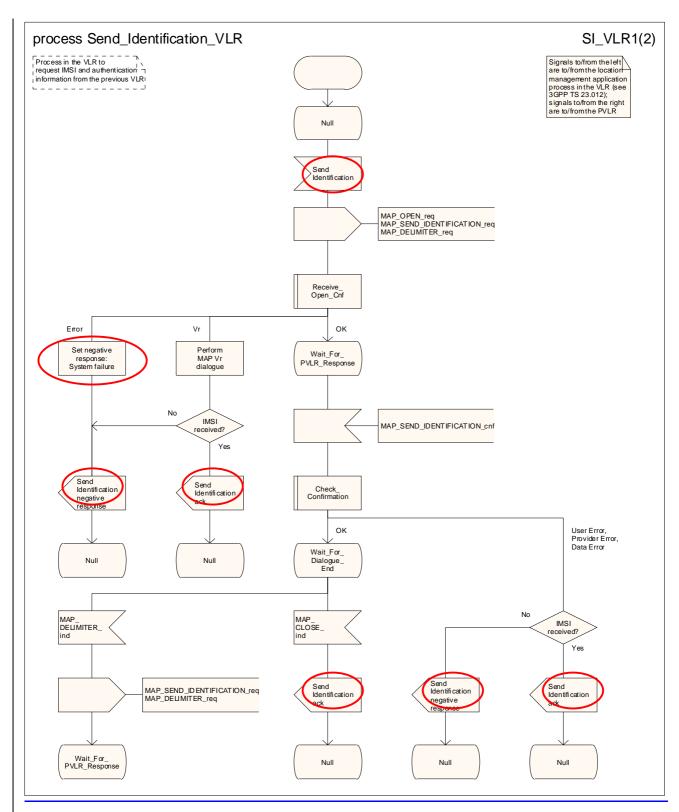
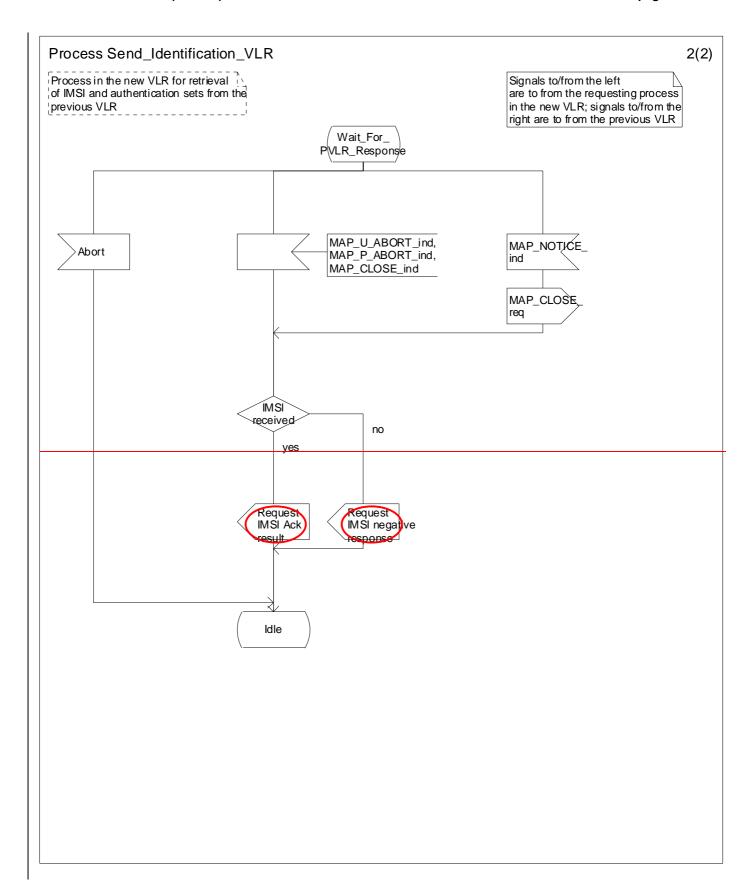


Figure 19.1.1/7XX (sheet 1 of 2): Process Send\_Identification\_VLR



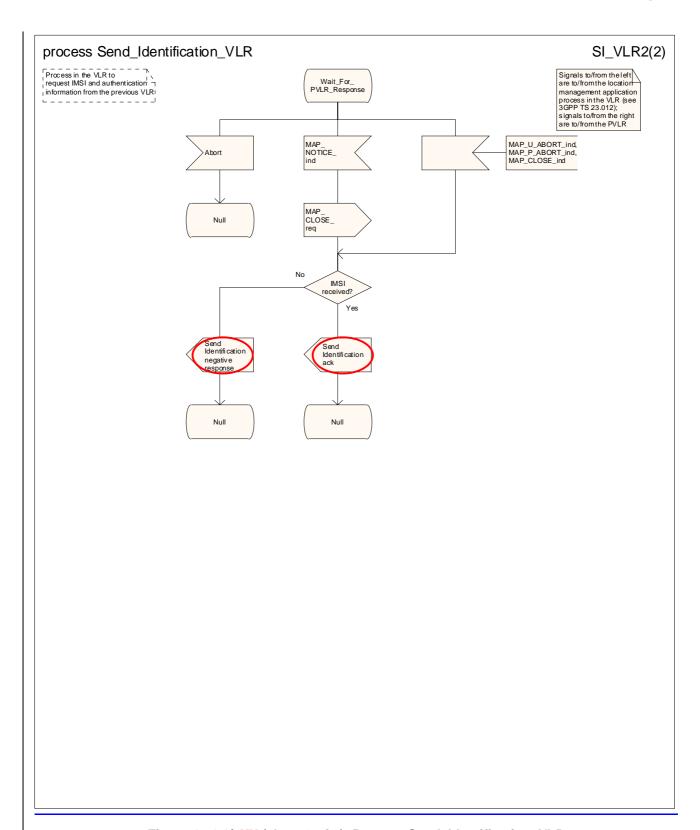
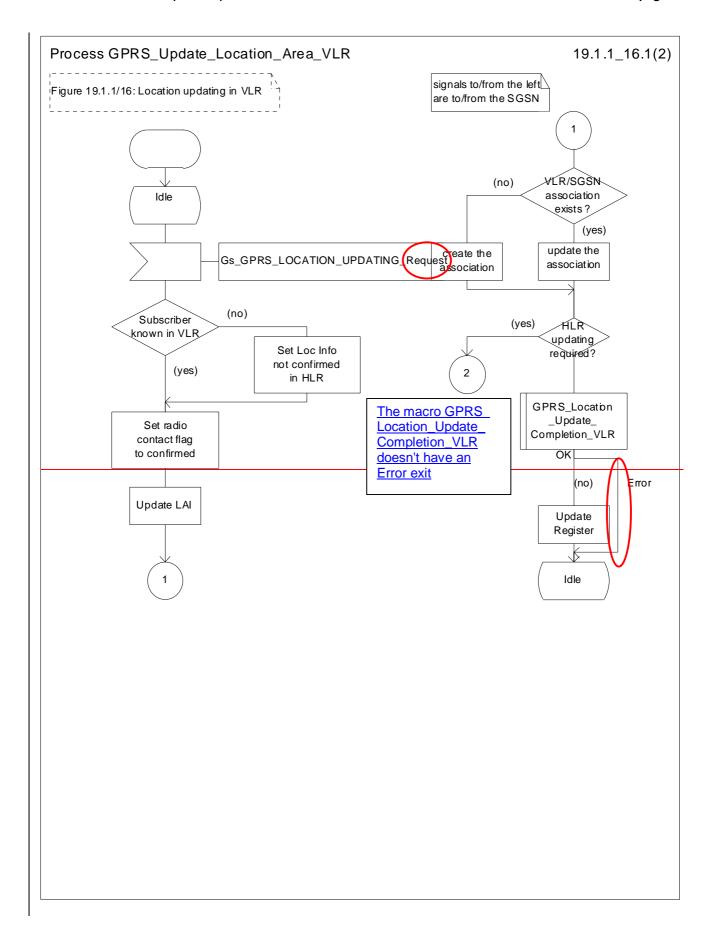


Figure 19.1.1/7XX (sheet 2 of 2): Process Send\_Identification\_VLR



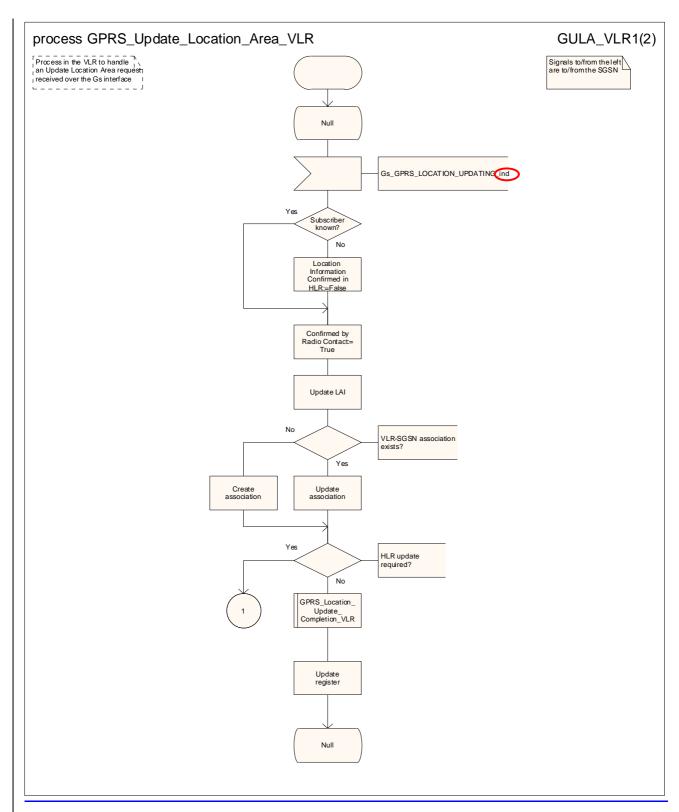
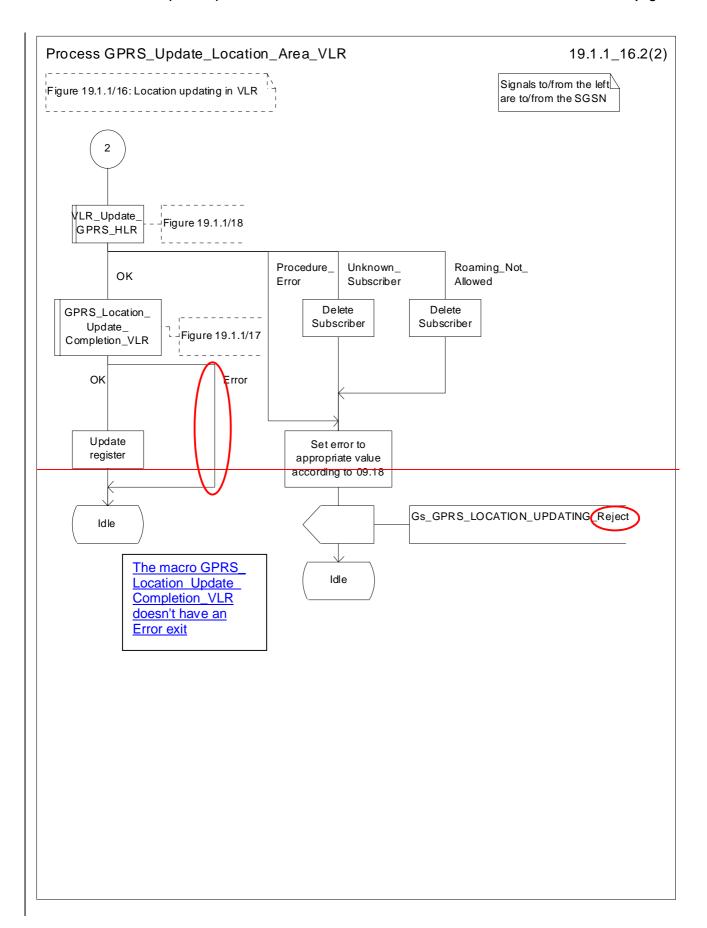


Figure 19.1.1/816 (sheet 1 of 2): Process GPRS\_Update\_Location\_Area\_VLR



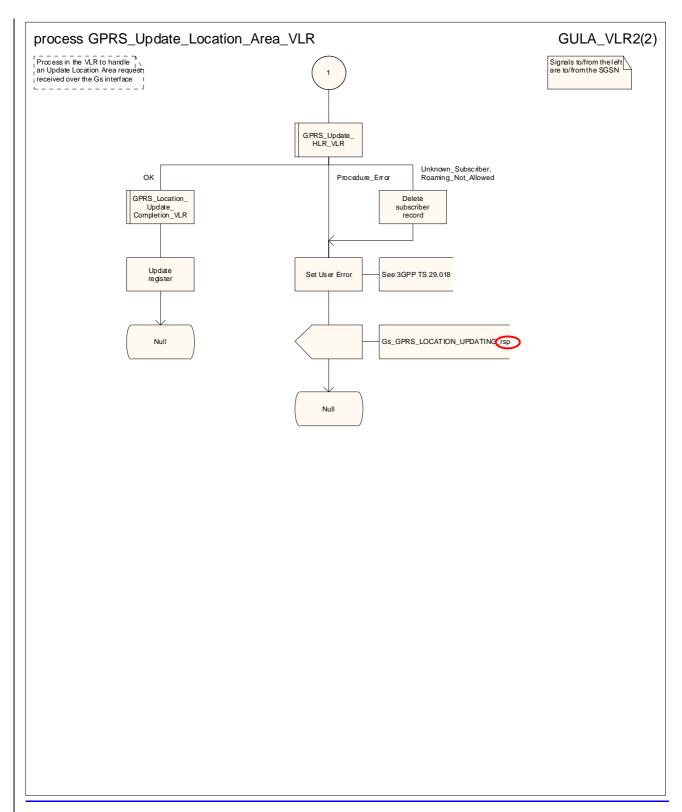
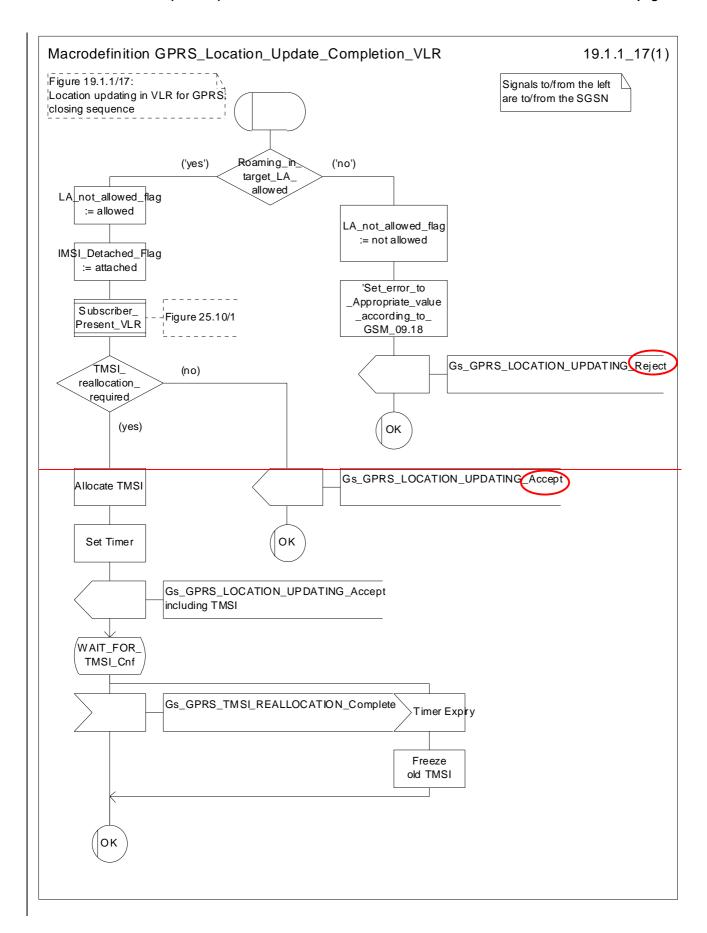


Figure 19.1.1/816 (sheet 2 of 2): Process GPRS\_Update\_Location\_Area\_VLR



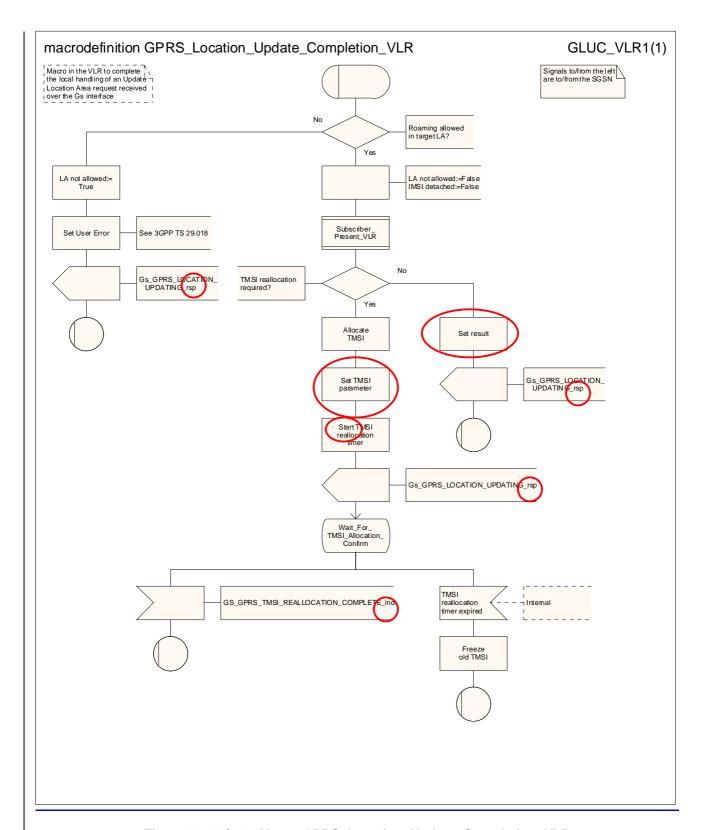
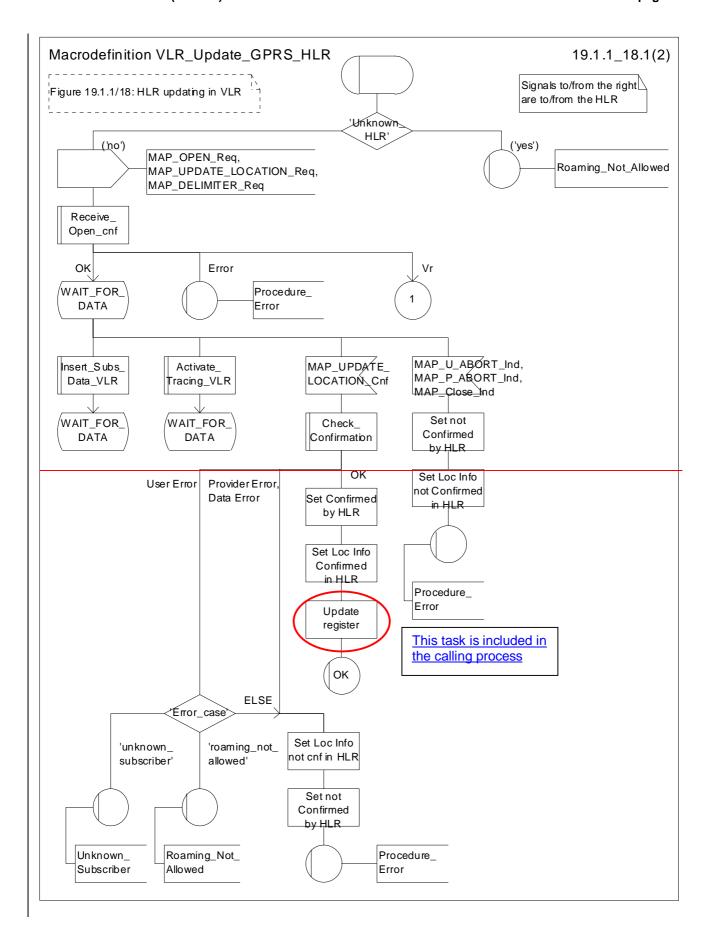


Figure 19.1.1/917: Macro GPRS\_Location\_Update\_Completion\_VLR



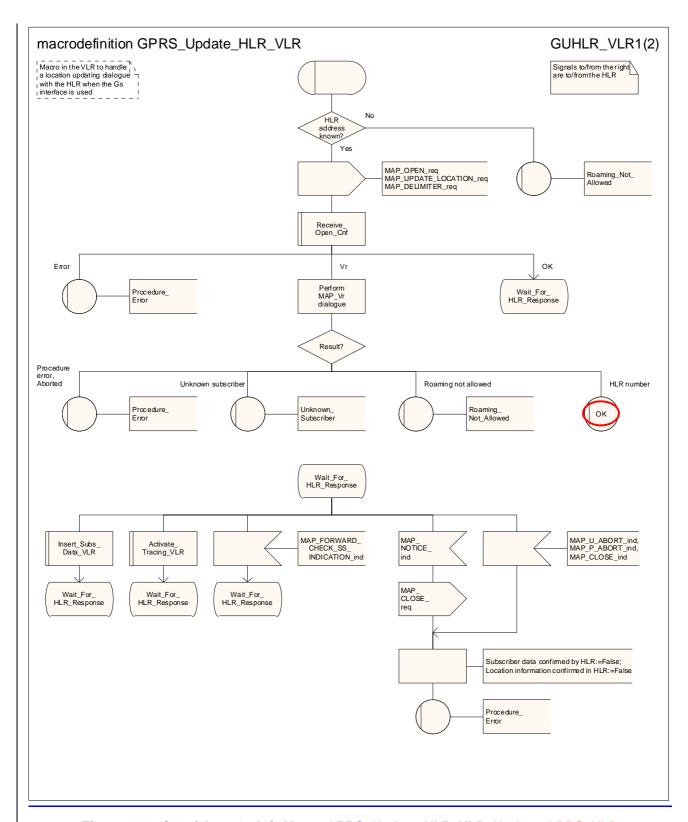
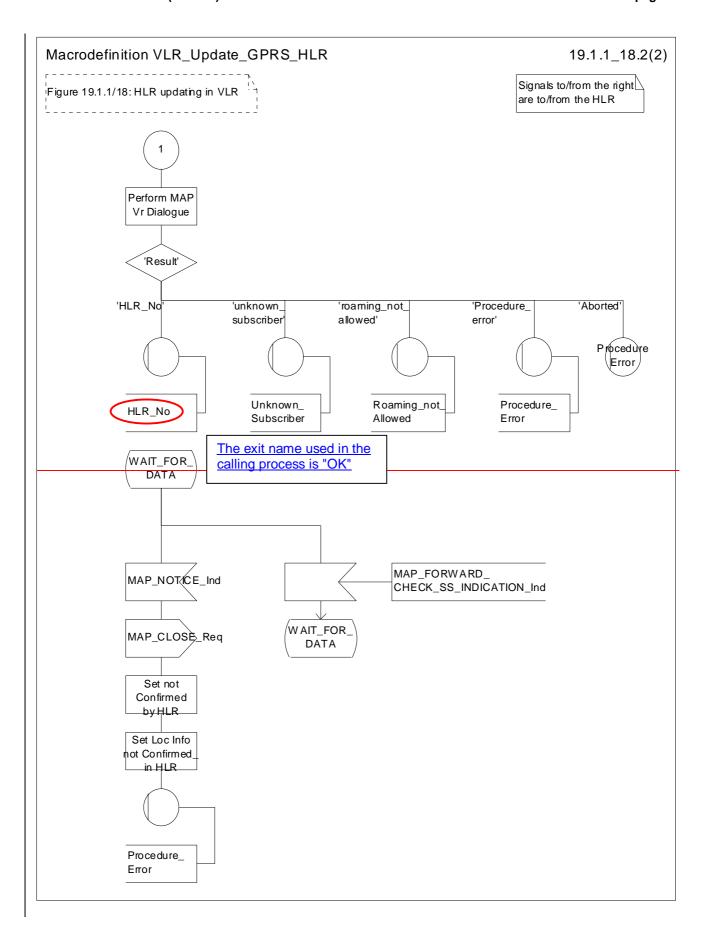


Figure 19.1.1/108 (sheet 1 of 2): Macro GPRS Update HLR\_VLR\_Update\_GPRS\_HLR



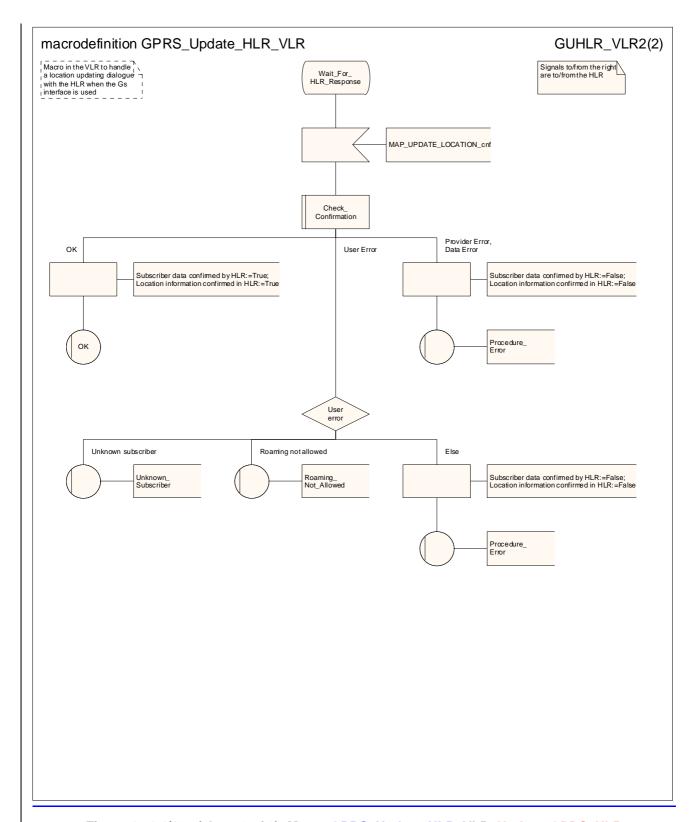
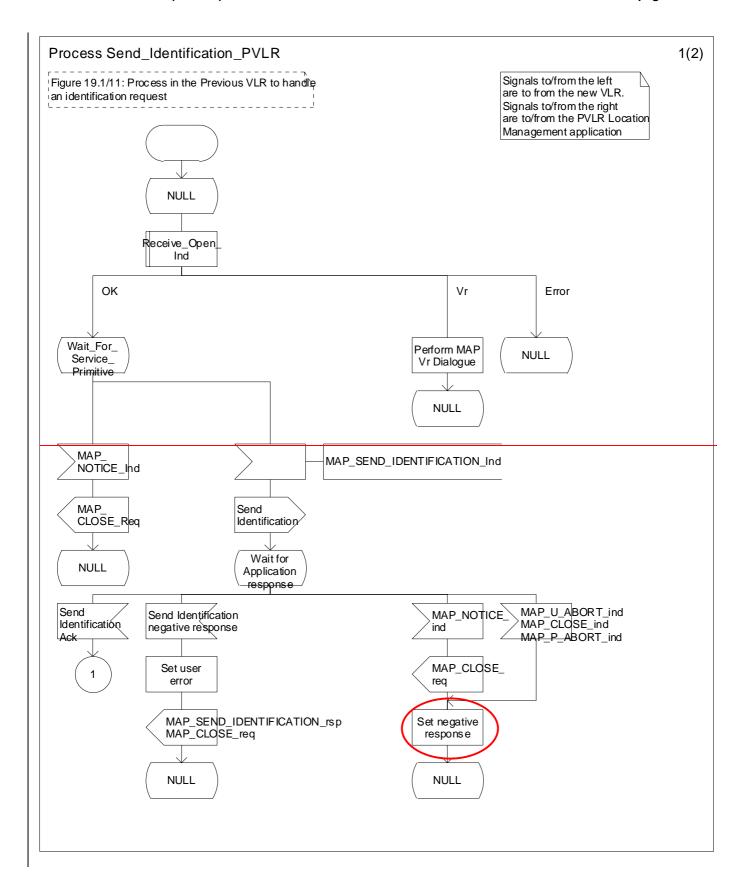


Figure 19.1.1/108 (sheet 2 of 2): Macro GPRS Update HLR\_VLR\_Update\_GPRS\_HLR



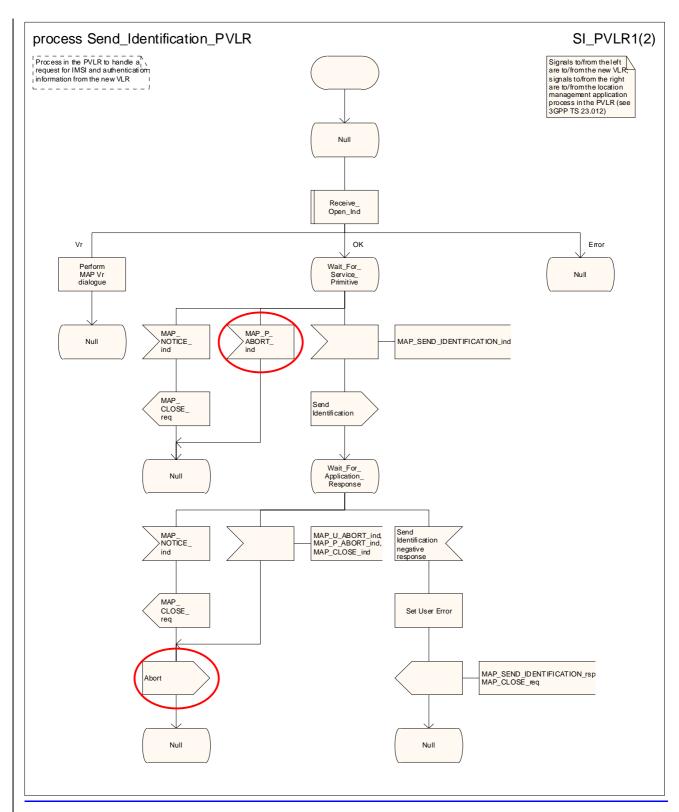
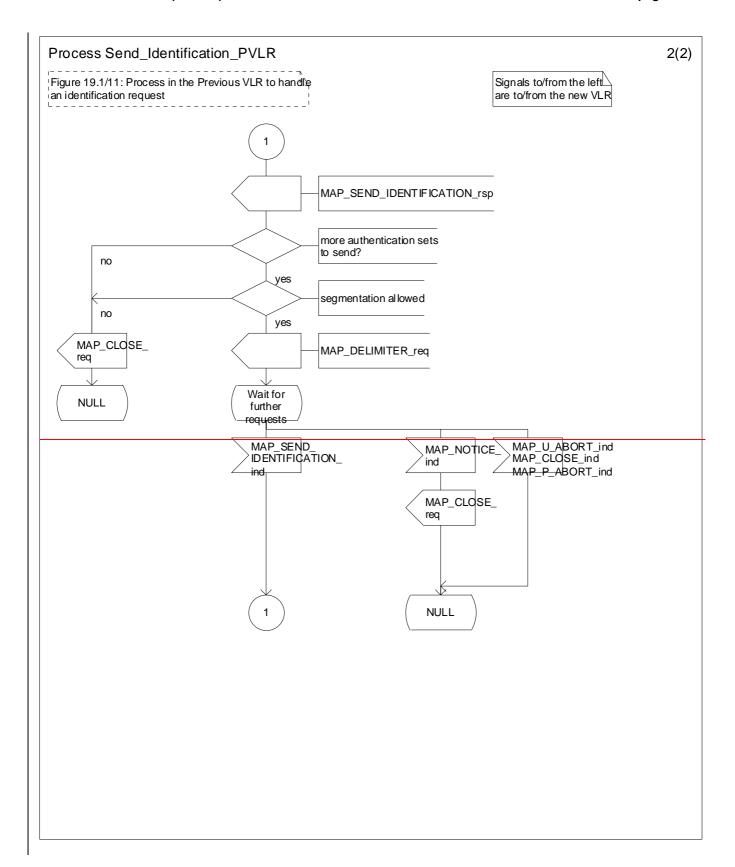


Figure 19.1.1/11XX (sheet 1 of 2): Process Send\_Identification\_PVLR



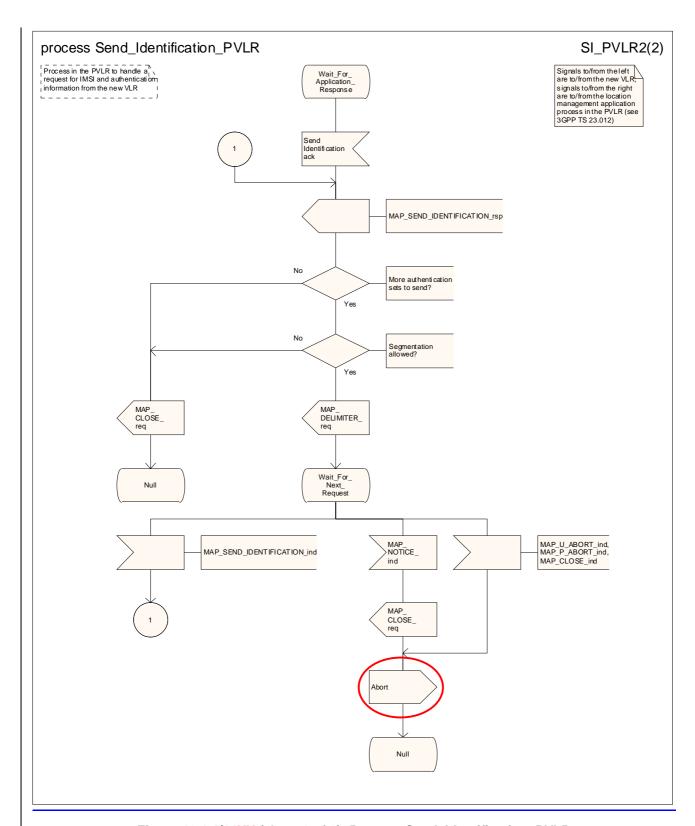
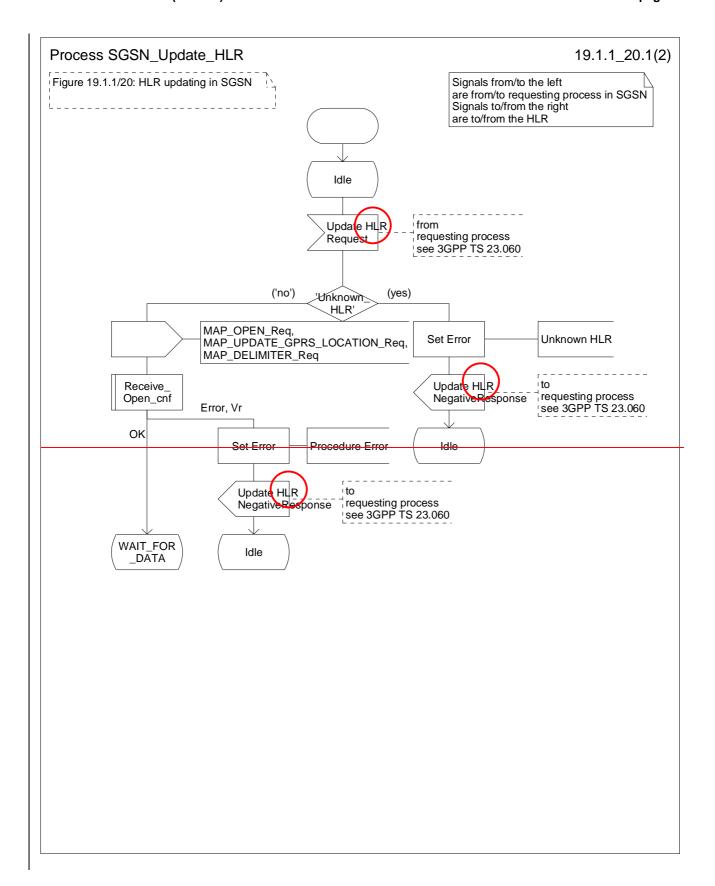


Figure 19.1.1/11XX (sheet 2 of 2): Process Send\_Identification\_PVLR



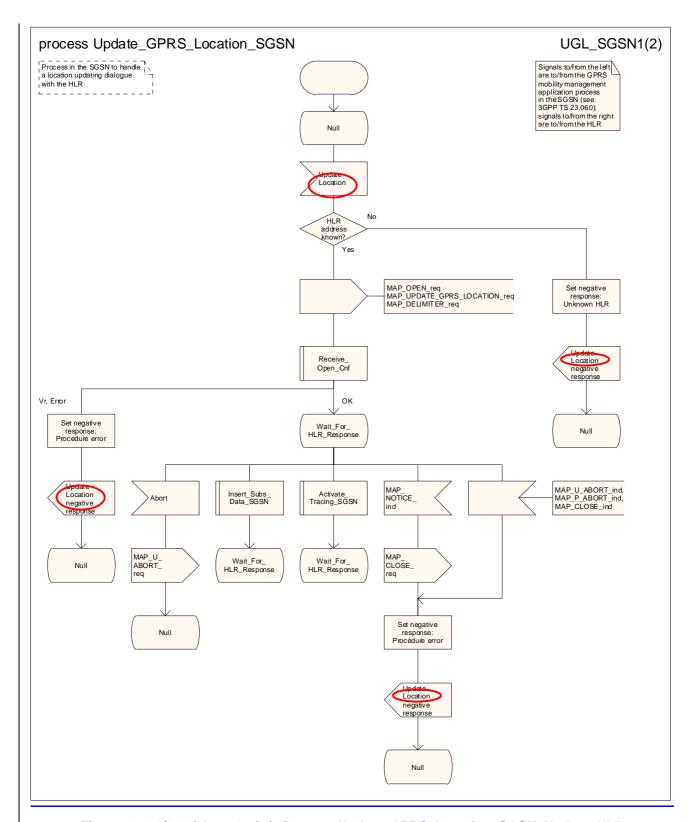
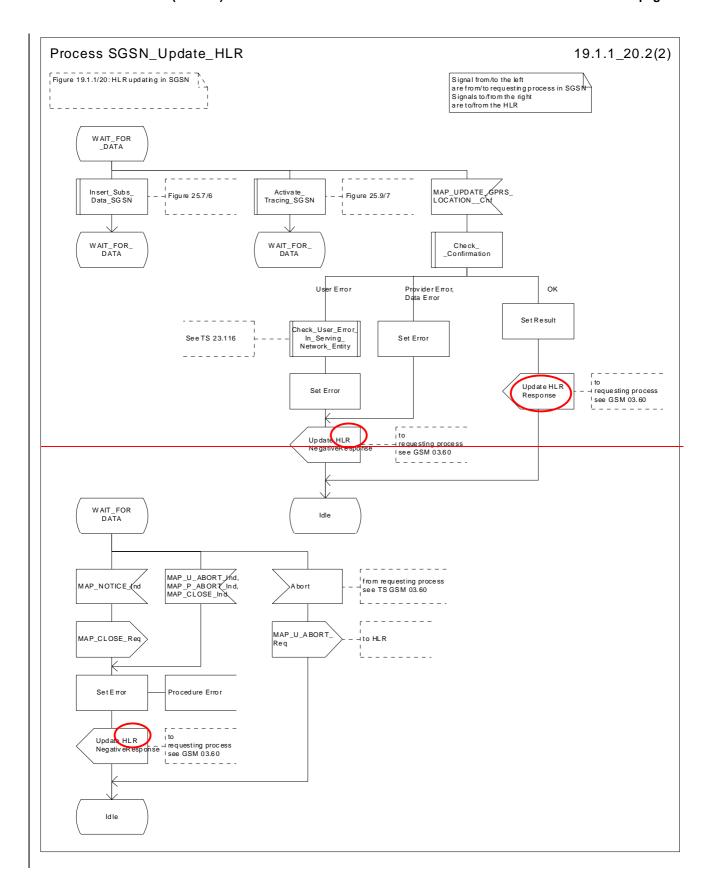


Figure 19.1.1/120 (sheet 1 of 2): Process Update GPRS Location SGSN\_Update\_HLR



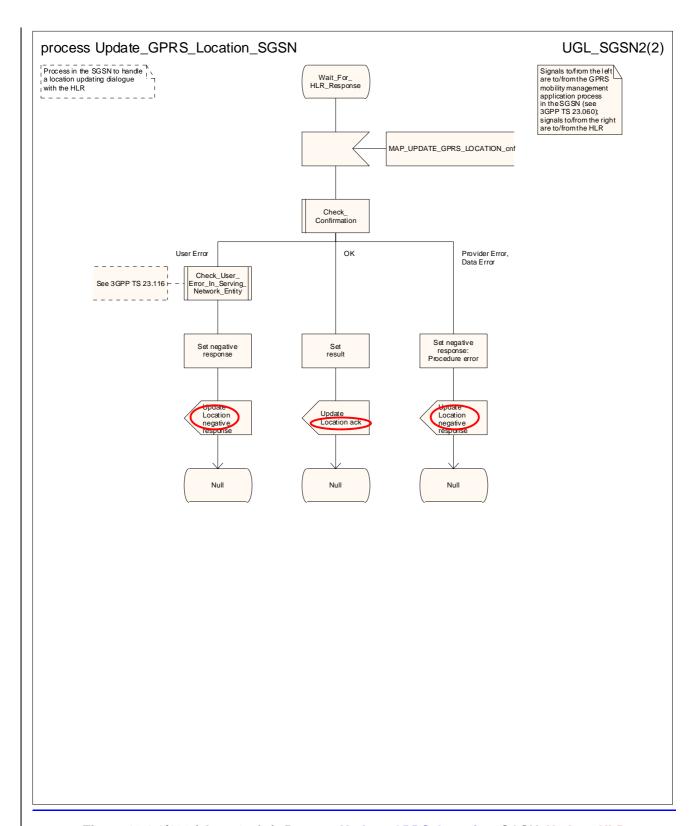
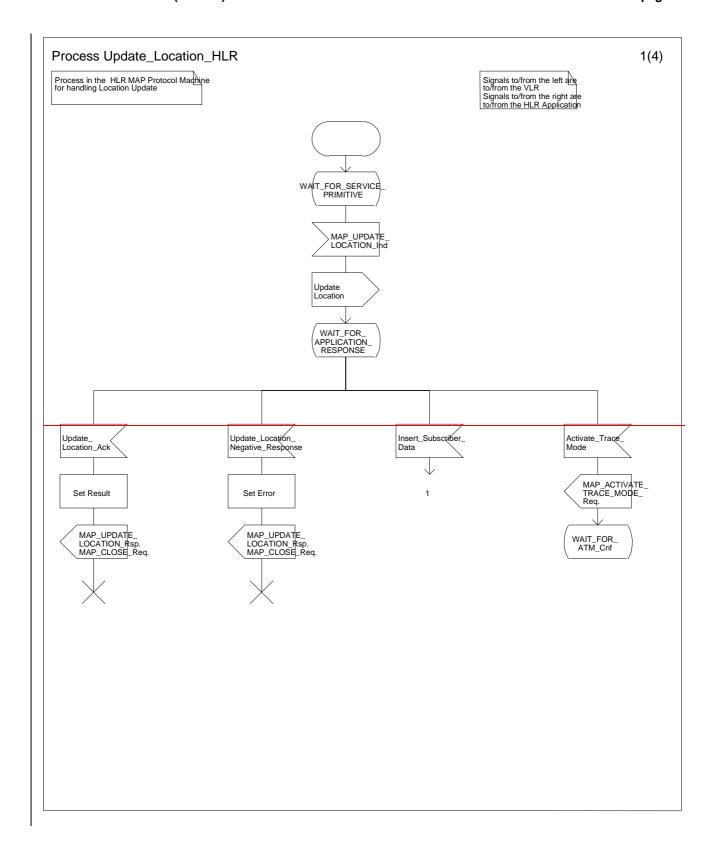


Figure 19.1.1/120 (sheet 2 of 2): Process Update GPRS Location SGSN\_Update\_HLR



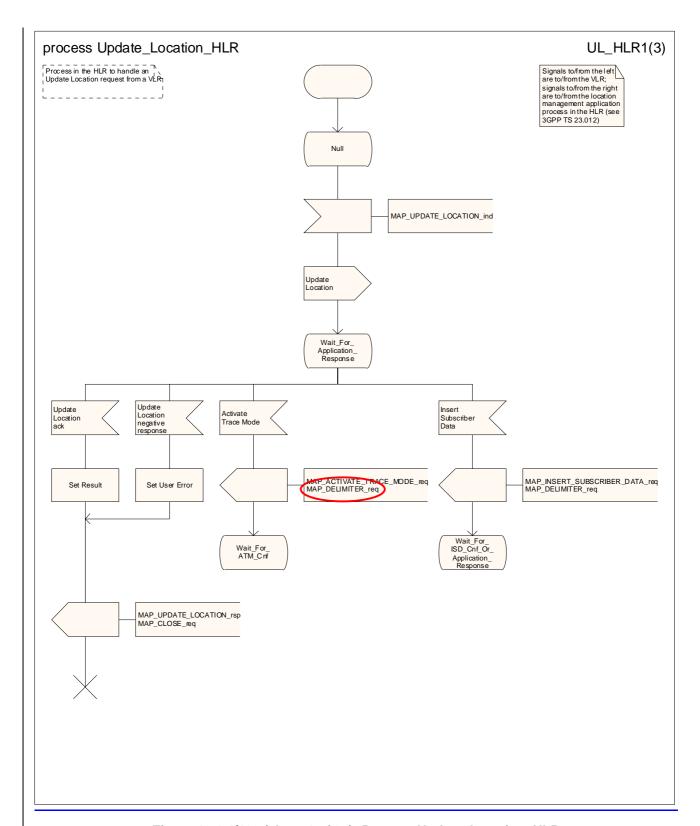
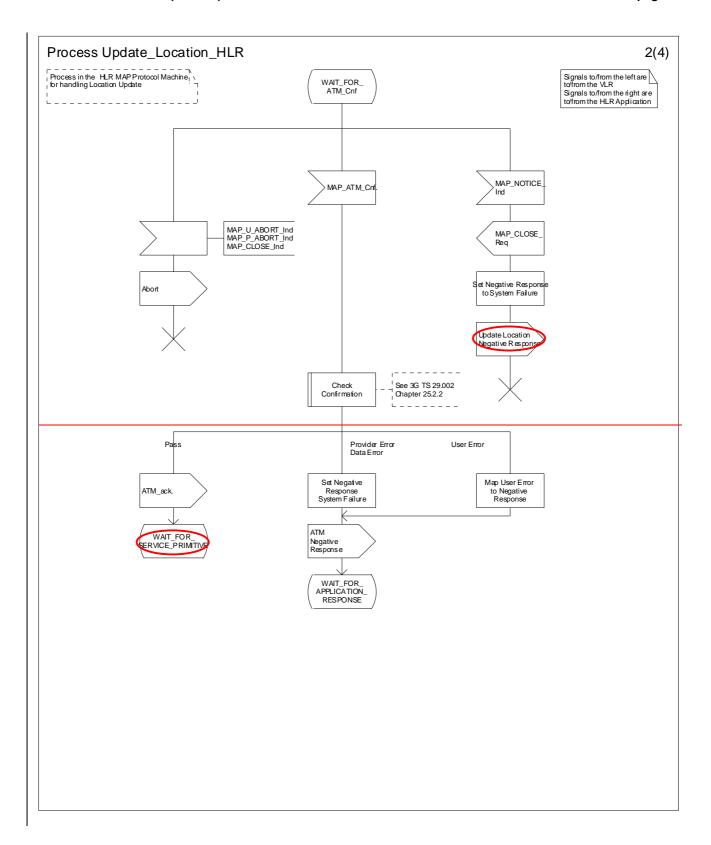


Figure 19.1.1/139 (sheet 1 of 34): Process Update\_Location\_HLR



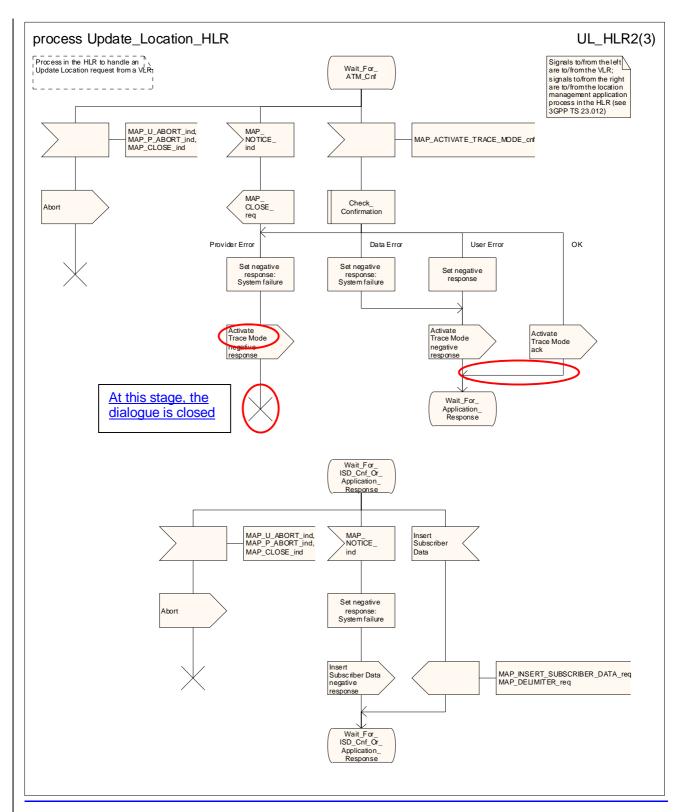
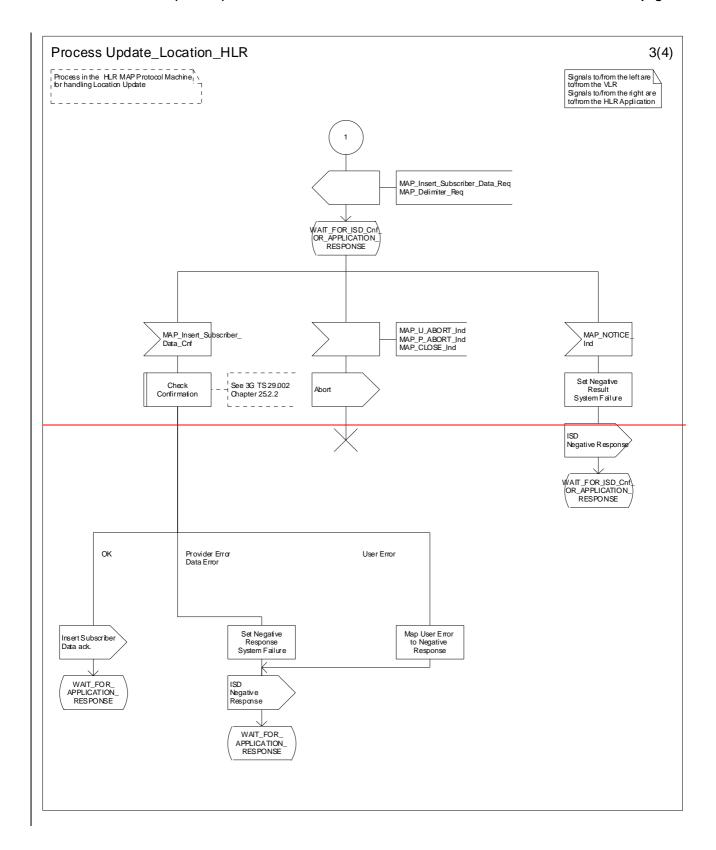


Figure 19.1.1/139 (sheet 2 of 34): Process Update\_Location\_HLR



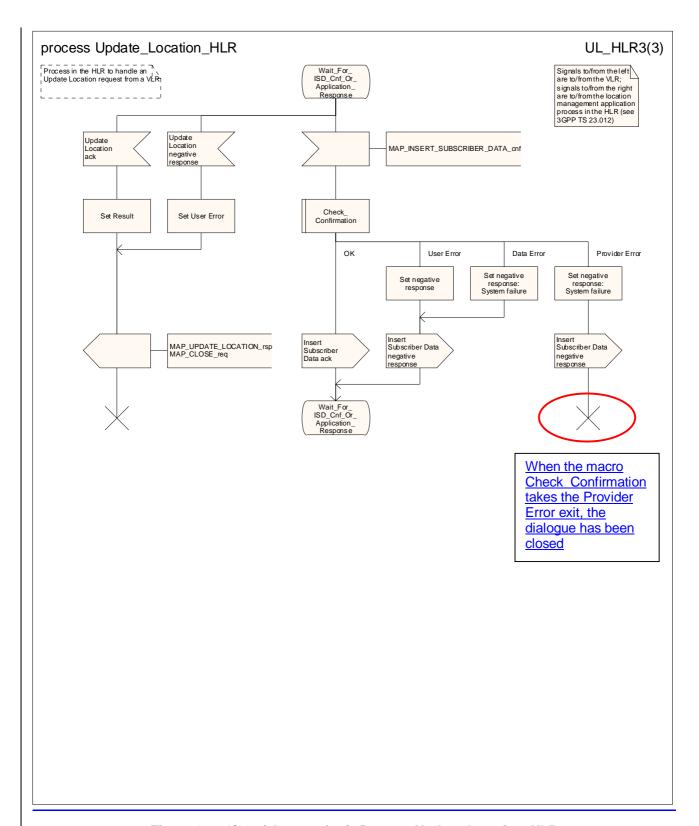


Figure 19.1.1/139 (sheet 3 of 34): Process Update\_Location\_HLR

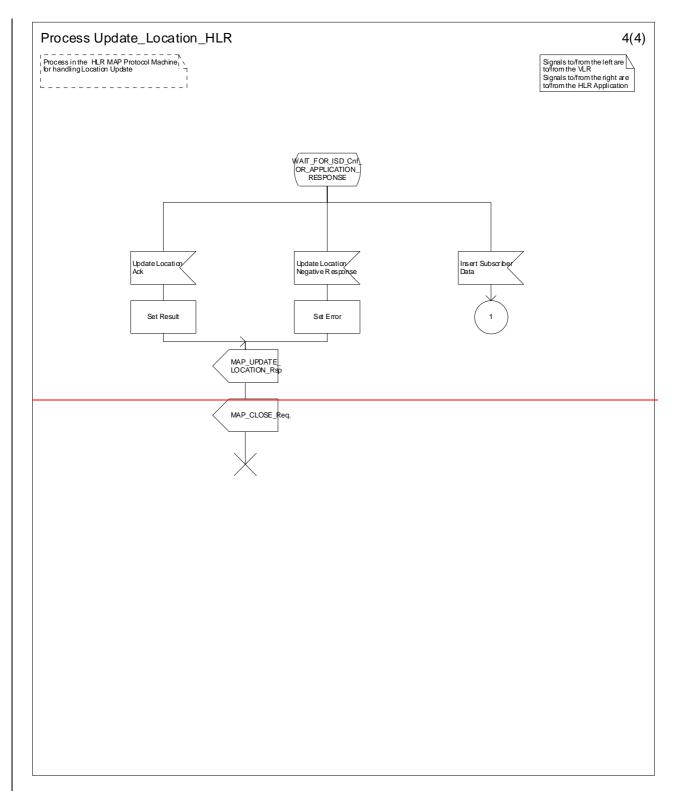
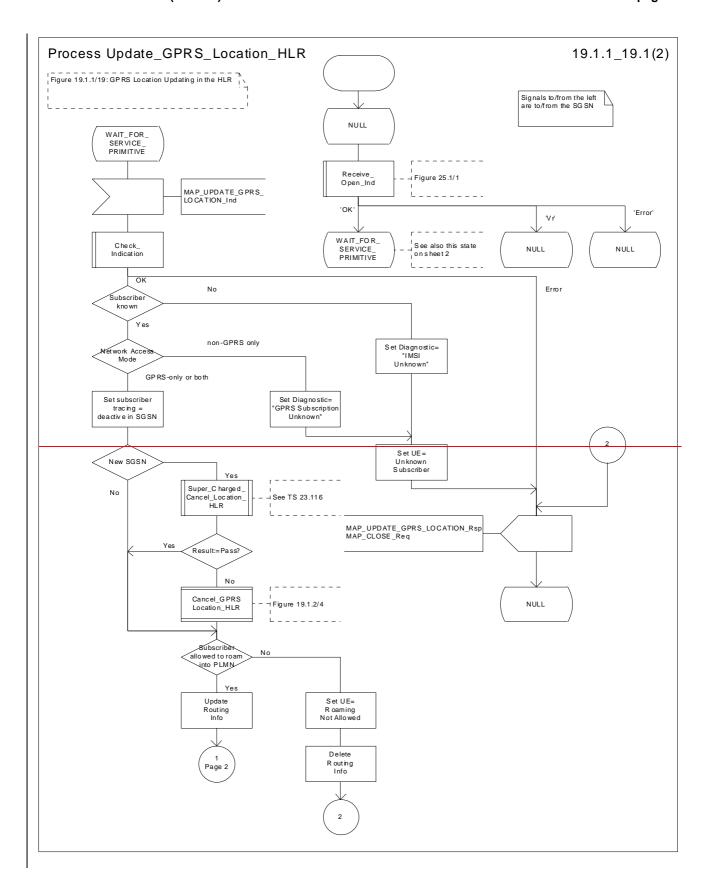


Figure 19.1.1/9 (sheet 4 of 4): Process Update\_Location\_HLR



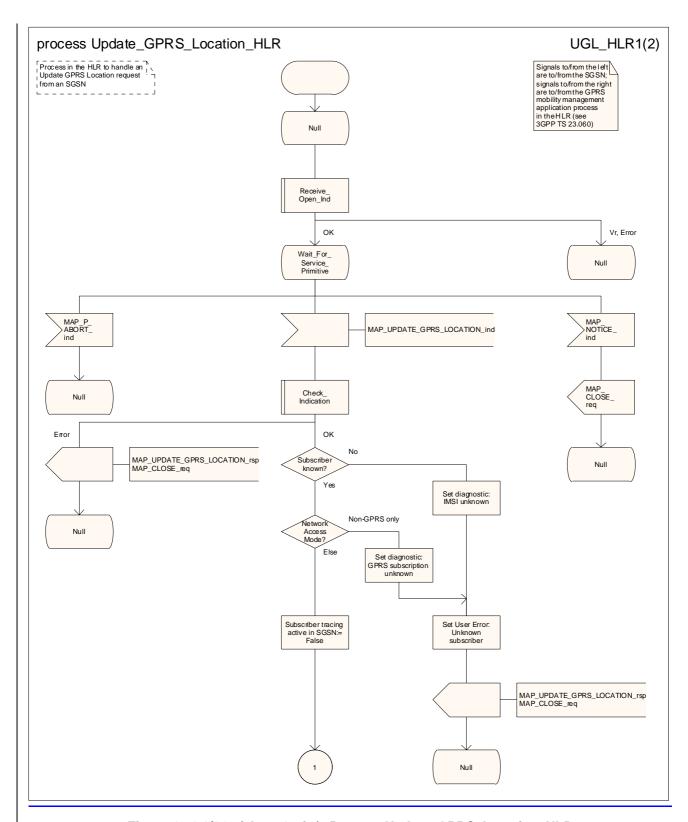
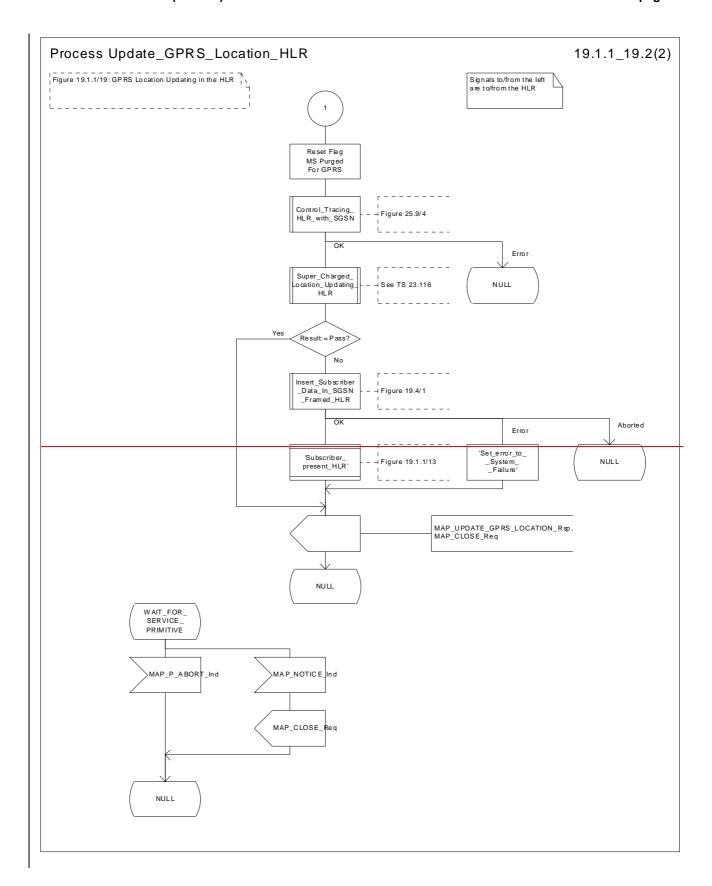


Figure 19.1.1/149 (sheet 1 of 2): Process Update\_GPRS\_Location\_HLR



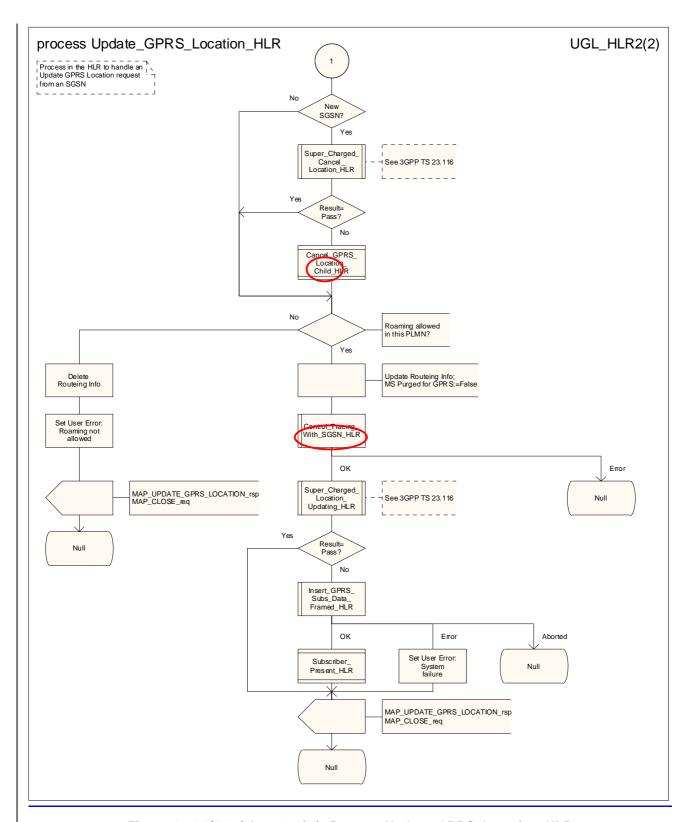


Figure 19.1.1/149 (sheet 2 of 2): Process Update\_GPRS\_Location\_HLR

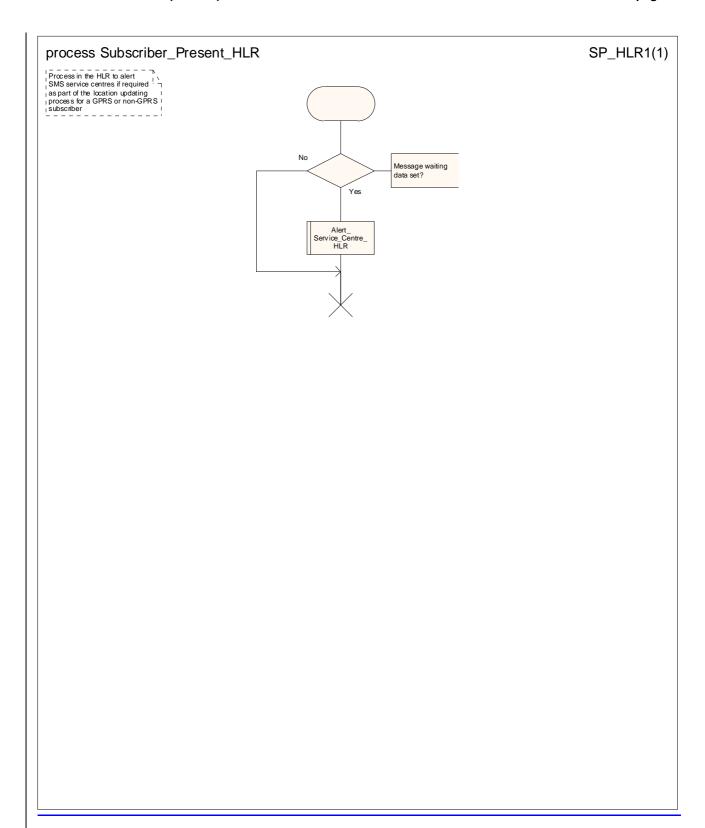


Figure 19.1.1/15: Process Subscriber Present HLR

## 19.1.2 Location Cancellation

#### 19.1.2.1 General

Location cancellation is used to delete a subscriber record from the serving node (VLR or SGSN). The procedure is invoked:

- because the subscriber has registered with a new serving node, or
- because the HPLMN operator has decided to delete the subscriber record from the serving node, e.g. because the subscription has been withdrawn, or because roaming restrictions have been imposed. Location cancellation can be used to force location updating including updating of subscriber data in the serving node at the next subscriber access.

The message flow for location cancellation for a non-GPRS subscriber is shown in figure 19.1.2/1.

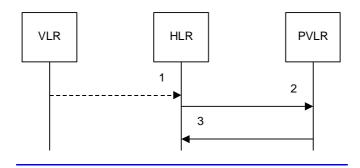
The message flow for location cancellation for a GPRS subscriber is shown in figure 19.1.2/2.

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 clause 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.

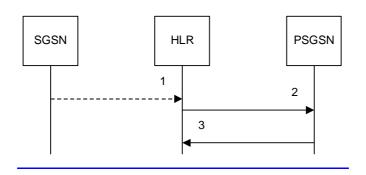
++	D	+	-+ D	
aVLR +	<del></del>	-aHLR	<del>-</del>	PVLRª
++		+	-+	
a		a		a
a	MAP UPDATE LOCATION	a		a
a		a		a
a		a	MAP CANCEL	a
a		a		_ <u>&gt;</u> a
a		a	LOCATION	a
a		a	100/11101	a
a		a		a
a		a	MAD CANCEL LOCATION	л а
a		a /	TATE CANCEL LOCALION	' <u>а</u>
a		a `	ack	a
a		a	ack	a



- 1) MAP\_UPDATE\_LOCATION\_req/ind
- MAP CANCEL LOCATION reg/ind
- 3) MAP CANCEL LOCATION rsp/cnf

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

Figure 19.1.2/1: Interface and services Message flow for Location Cancellation (non-GPRS)



- 1) MAP UPDATE GPRS LOCATION req/ind
- 2) MAP\_CANCEL\_LOCATION\_req/ind
- MAP CANCEL LOCATION rsp/cnf

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

Figure 19.1.2/2: Message flow for Location Cancellation (GPRS)

## 19.1.2.2 Detailed pProcedure in the HLR

The MAP process in the HLR to cancel the location information in a VLR is shown in figure 19.1.2/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

The MAP process in the HLR to cancel the location information in a VLR as an independent process invoked from another process is shown in figure 19.1.2/4.

The MAP process in the HLR to cancel the location information in an SGSN is shown in figure 19.1.2/5. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

The MAP process in the HLR to cancel the location information in an SGSN as an independent process invoked from another process is shown in figure 19.1.2/6.

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 19.1.2/2 and 19.1.2/4), 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 does not understand it, this parameter shall be ignored.

## 19.1.2.3 Detailed pProcedure in the VLR

The MAP process in the VLR to handle a location cancellation request is shown in figure 19.1.2/7. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

## 19.1.2.4 Detailed pProcedure in the SGSN

The MAP process in the SGSN to handle a location cancellation request is shown in figure 19.1.2/8. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

Opening of the dialogue is described in the macro Receive Open Ind in clause 25.1, with outcomes:

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

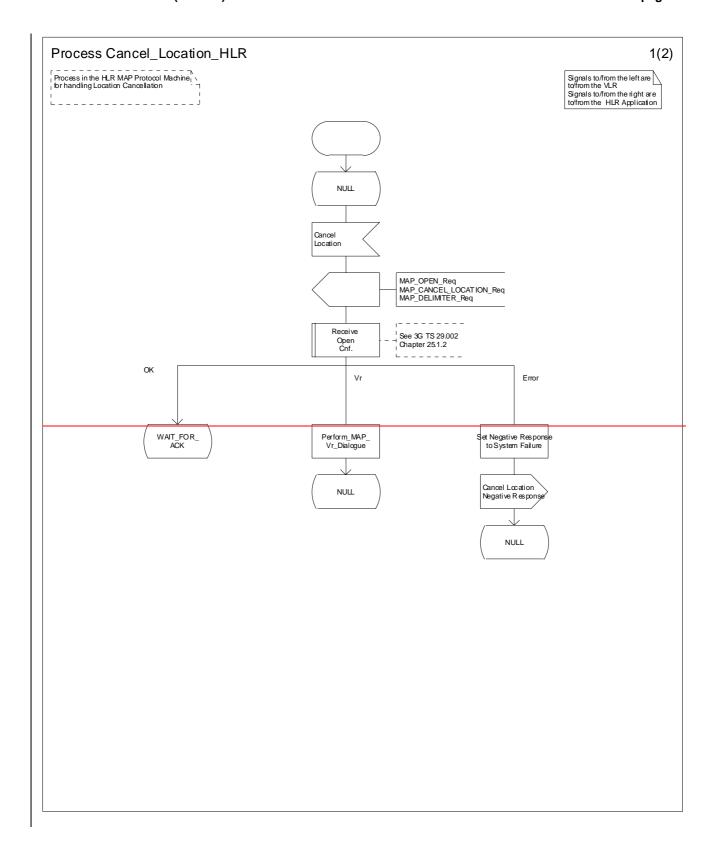
If the SGSN process receives a MAP\_NOTICE indication, it terminates the dialogue by sending a MAP\_CLOSE request.

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 clause 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.



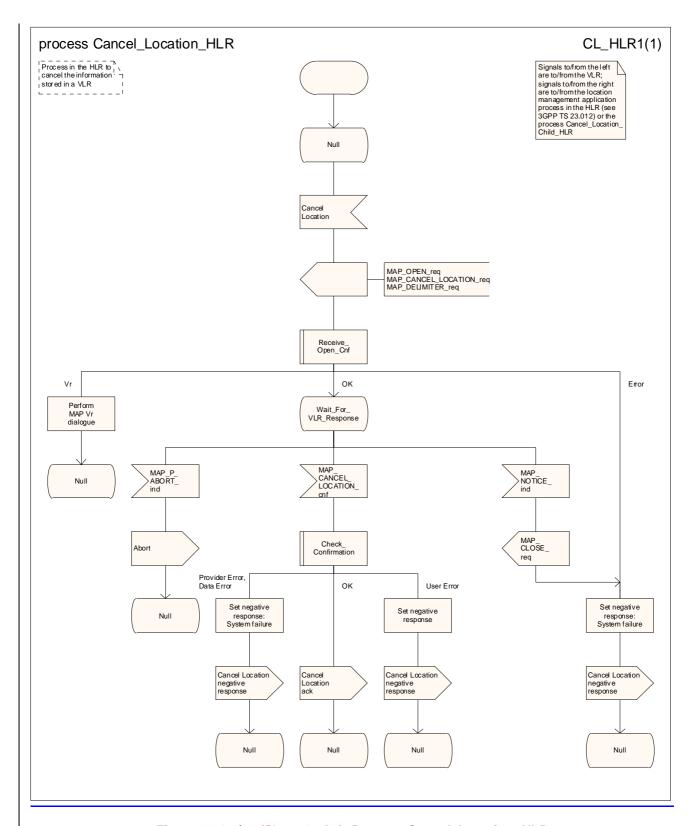
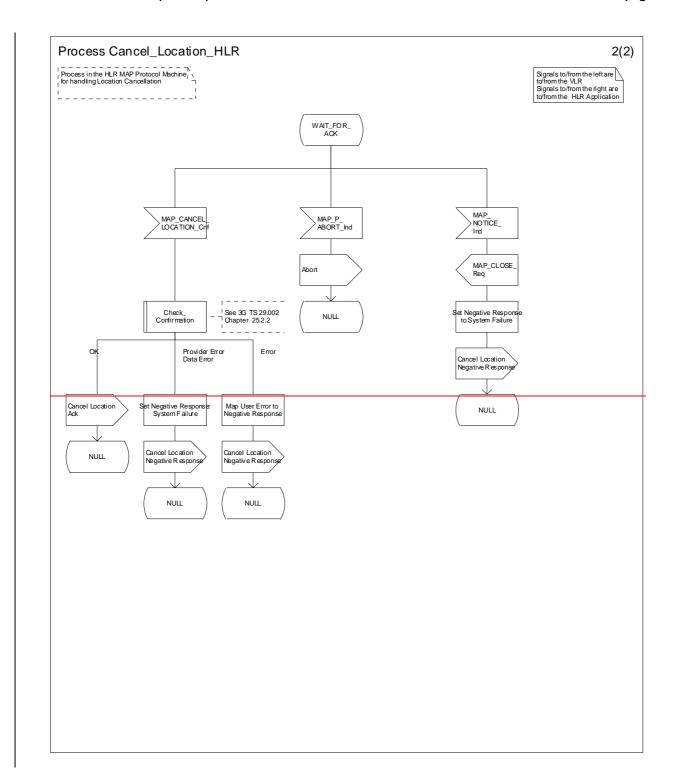


Figure 19.1.2/32 (Sheet 1 of 2): Process Cancel\_Location\_HLR



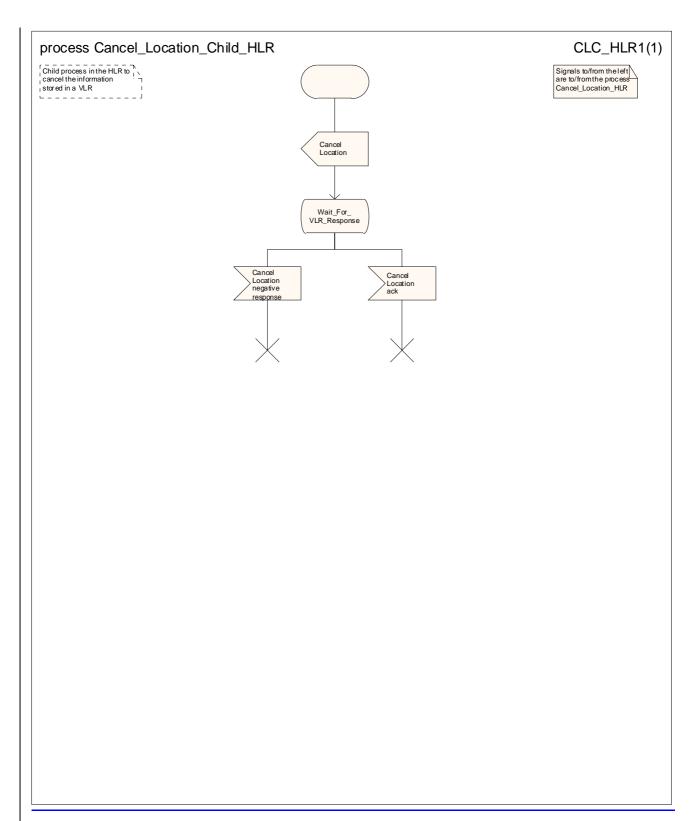
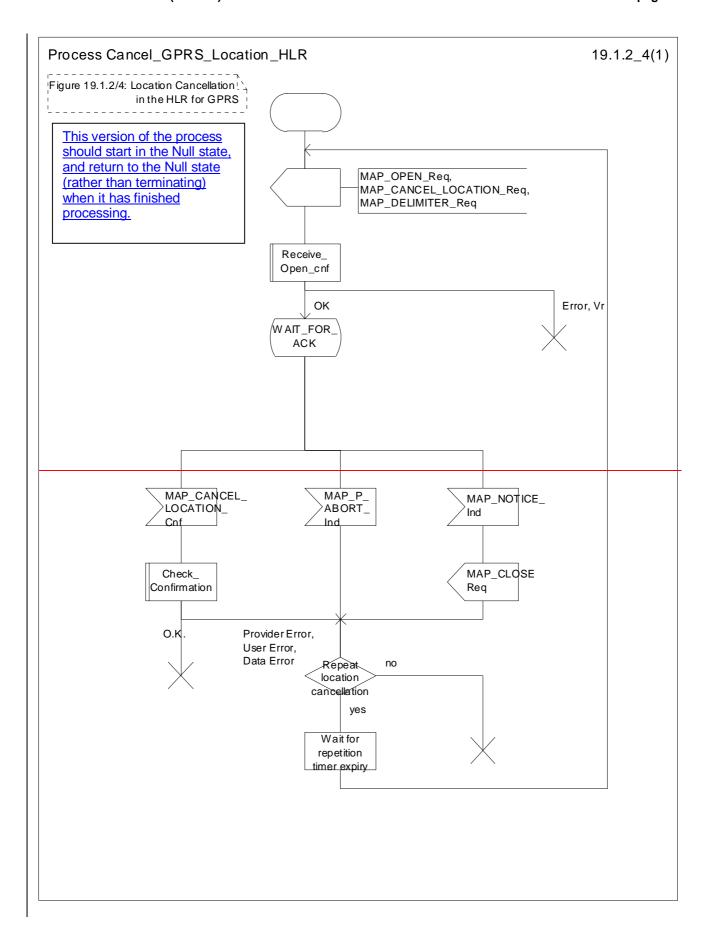


Figure 19.1.2/42 (Sheet 2 of 2): Process Cancel\_Location\_Child\_HLR



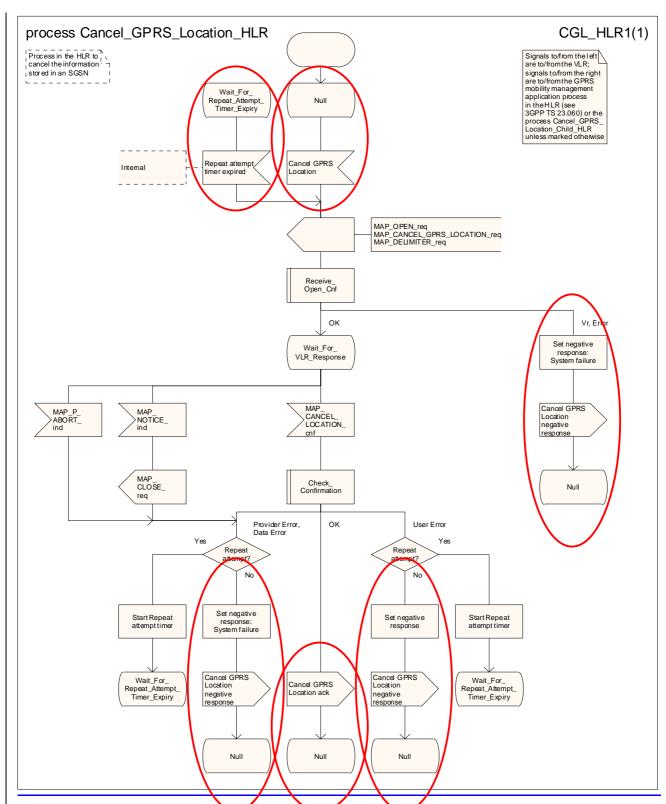


Figure 19.1.2/54: Process Cancel\_GPRS\_Location\_HLR

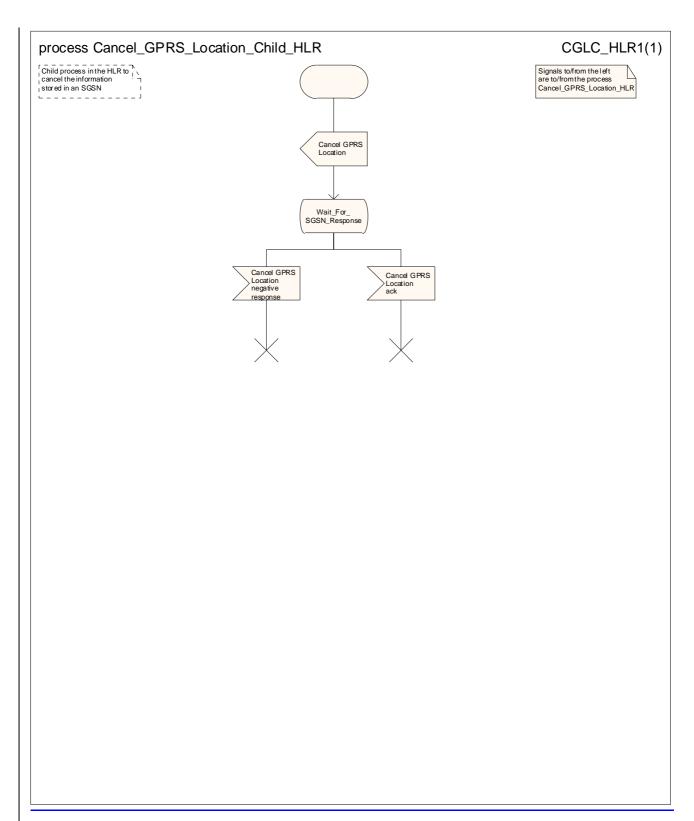
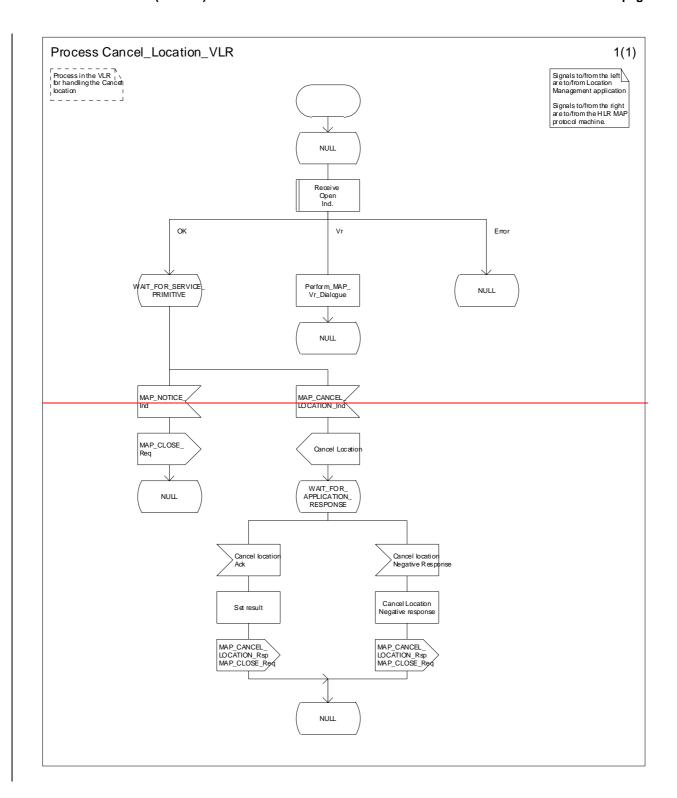


Figure 19.1.2/6: Process Cancel GPRS Location Child HLR



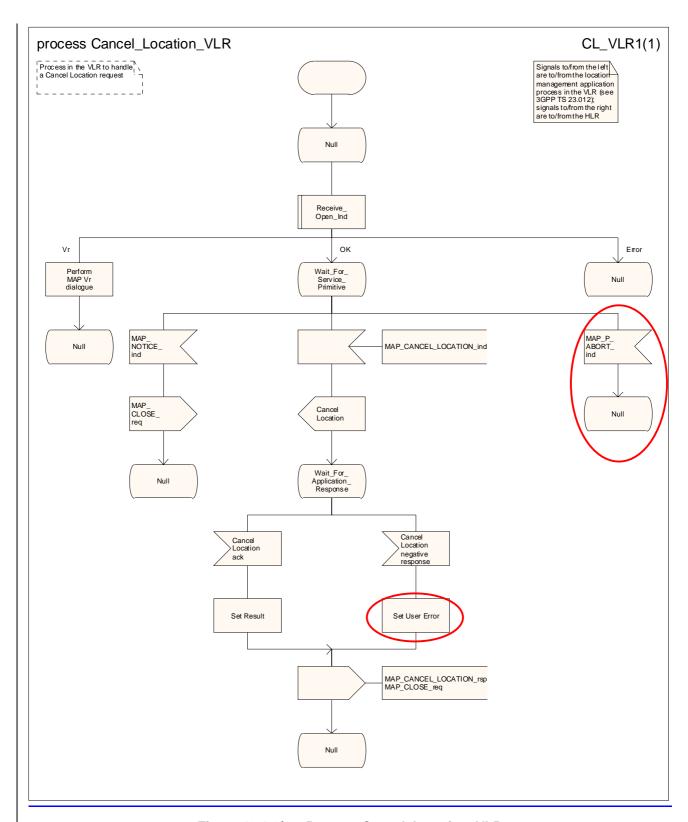
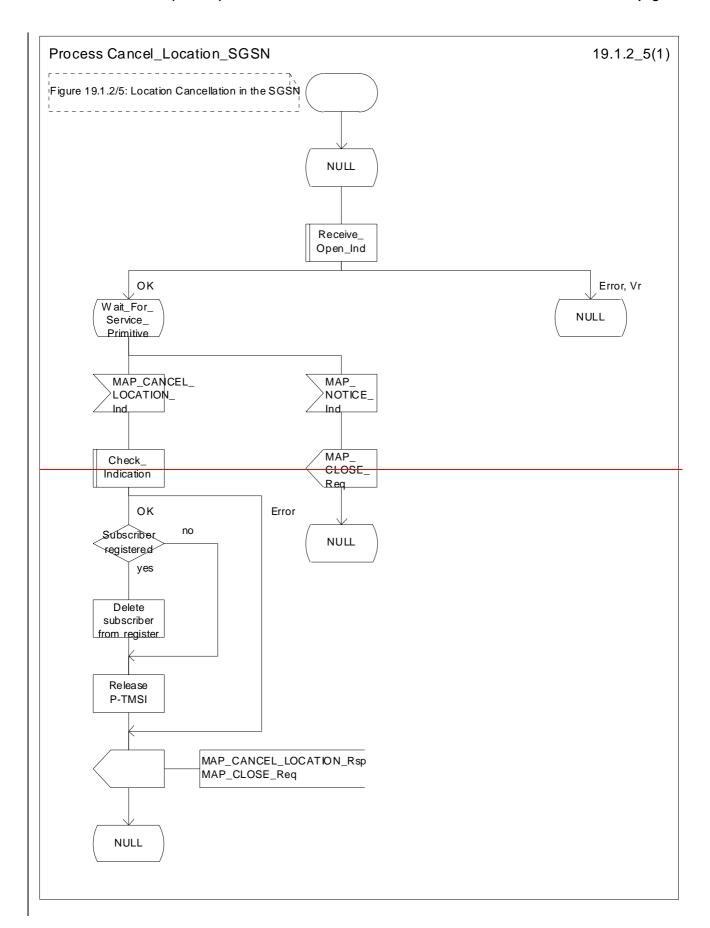


Figure 19.1.2/73: Process Cancel\_Location\_VLR



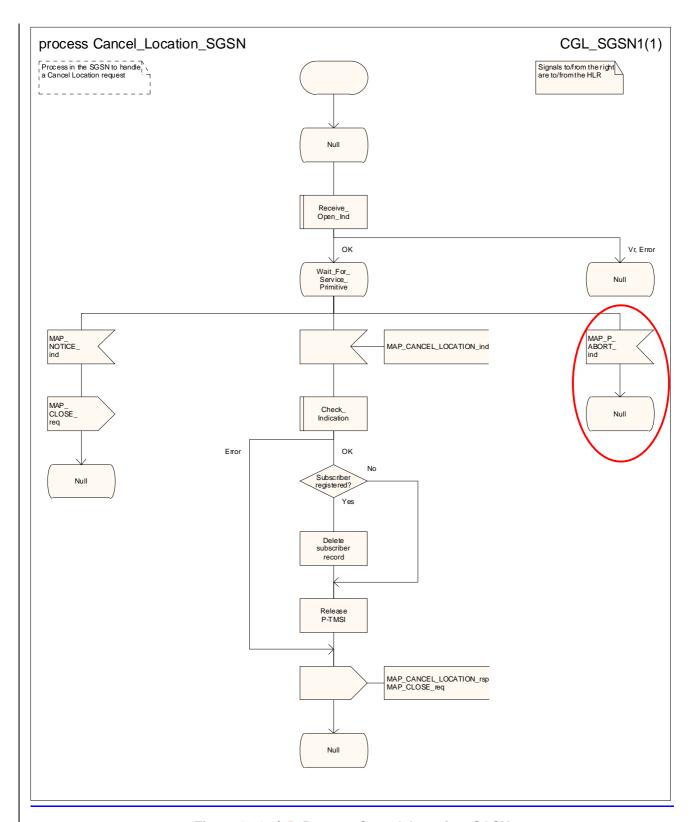


Figure 19.1.2/85: Process Cancel\_Location\_SGSN

## 19.1.3 Void

19.1.3.1 Void

19.1.3.2 Void

19.1.3.3 Void

# 19.1.4 Purge MS Purging

#### 19.1.4.1 General

O&M procedures in the VLR or SGSN can trigger MS purging either because of administrative action or because the MS has been inactive for an extended period. The O&M process in the VLR or in the SGSN should ensure that during the MS purging procedure any other attempt to access the MS record is blocked, to maintain consistency of data.

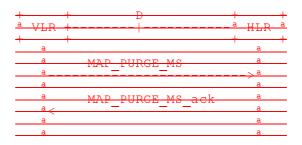
The message flow for a VLR to report MS purging to the HLR is shown in figure 19.1.4/1.

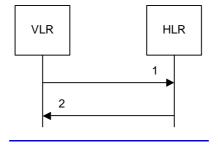
The message flow for an SGSN to report MS purging to the HLR is shown in figure 19.1.4/2.

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 clause 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 19.1.4/1and 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.

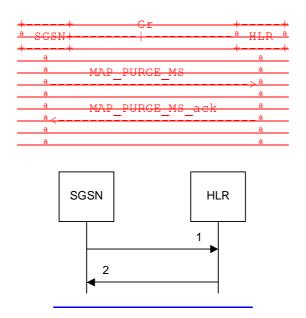




MAP PURGE MS req/ind
 MAP PURGE MS rsp/cnf

Figure 19.1.4/1: Message flow for MS purging (non-GPRS)

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



MAP PURGE MS req/ind
 MAP\_PURGE\_MS\_rsp/cnf

Figure 19.1.4/2: Message flow for MS purging (GPRS)

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

## 19.1.4.2 <u>Detailed procedure in the VLR Void</u>

The MAP process in the VLR to report MS purging to the HLR is shown in figure 19.1.4/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check\_Confirmation see subclause 25.2.2.

### 19.1.4.3 Detailed procedure in the SGSN<del>Void</del>

The MAP process in the SGSN to report MS purging to the HLR is shown in figure 19.1.4/4. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see subclause 25.1.2;
Check\_Confirmation see subclause 25.2.2.

Figure 19.1.4/4 shows the MAP process in the SGSN to notify the HLR that an MS record has been purged. The following general macro is used:

Receive\_Open\_Cnf clause 25.1;

Sheet 1: The procedure Purge\_MS\_In\_Serving\_Network\_Entity is specific to Super-Charger; it is specified in 3GPP TS 23.116 [110]. If the SGSN and the originating HLR does not support the Super-Charger functionality, processing continues from the "YesNo" exit of the test "Result=Pass?".

When the SGSN receives an indication from O&M that an MS record is to be purged, it invokes the MAP\_PURGE\_MS service.

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 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.

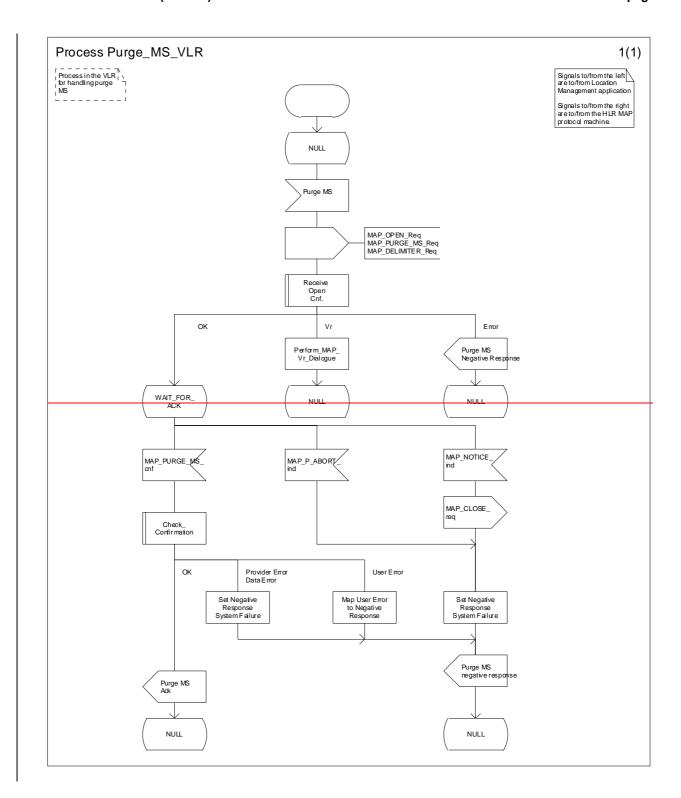
If a MAP\_PURGE\_MS confirmation containing a provider error, data error or user error, or a MAP\_P\_ABORT, MAP\_NOTICE or premature MAP\_CLOSE indication, has been received, the failure is reported to the O&M interface. Successful outcome of the procedure leads to deletion of the subscriber data and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

## 19.1.4.4 Detailed procedure in the <u>HLRSGSN</u>

The MAP process in the HLR to handle a notification from a VLR or an SGSN that an MS record has been purged is shown in figure 19.1.4/5. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Ind see subclause 25.1.1;
Check Indication see subclause 25.2.1.

If the notification was received from a VLR, the MAP process communicates with the location management application process specified in 3GPP TS 23.012 [23]; if the notification was received from an SGSN, the MAP process communicates with the GPRS mobility management application process specified in 3GPP TS 23.060 [104].



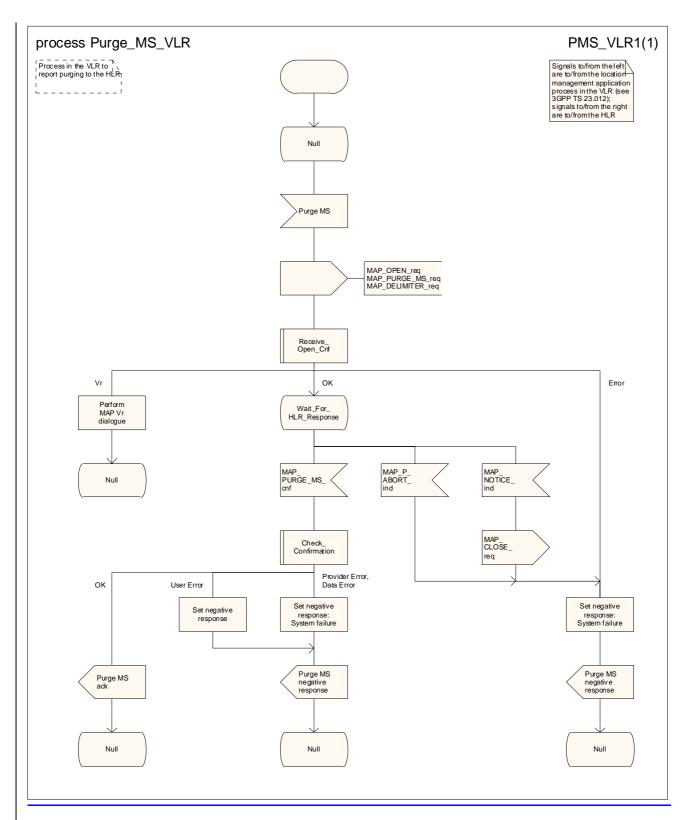
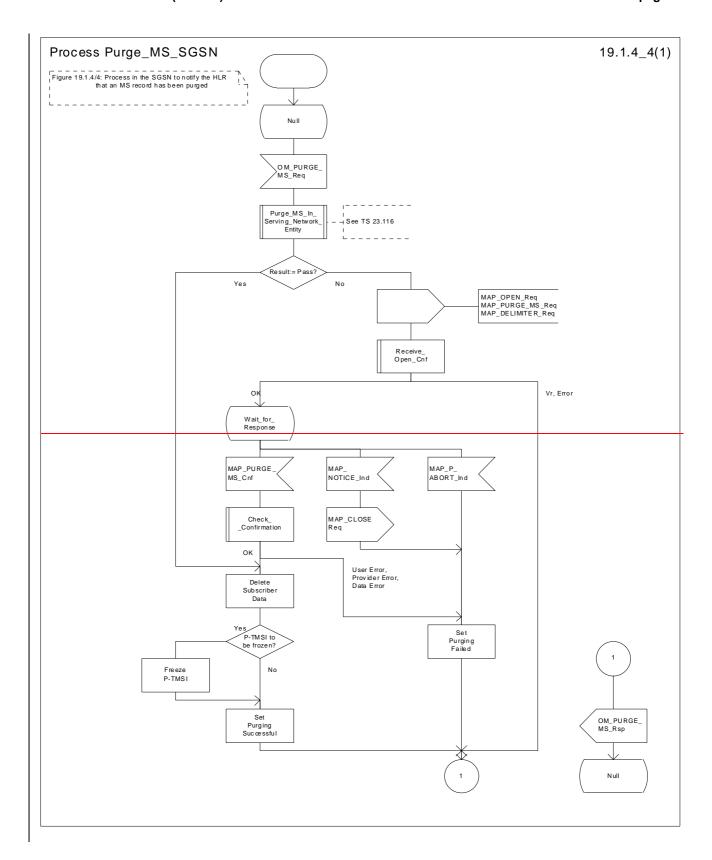


Figure 19.1.4/32: Process Purge\_MS\_VLR



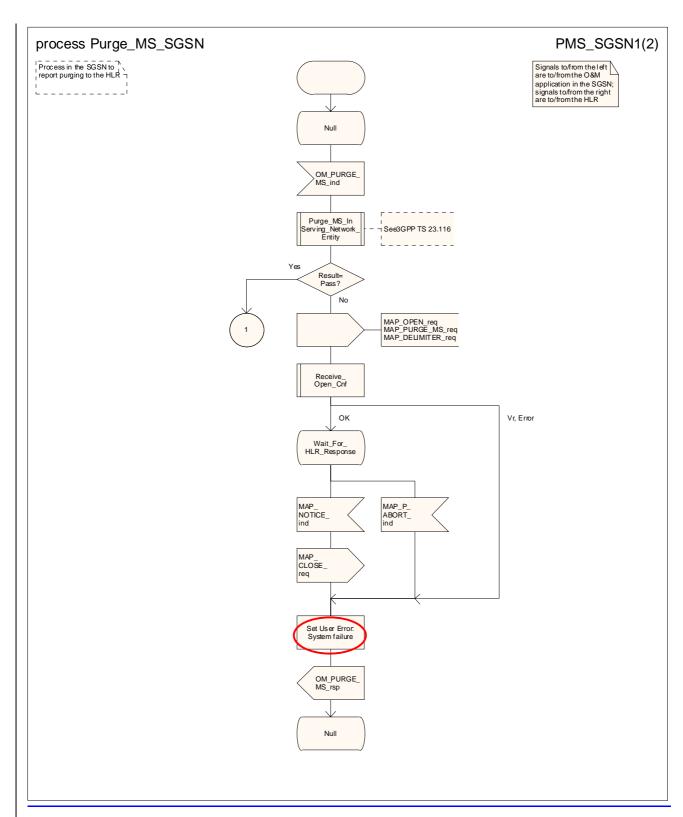


Figure 19.1.4/4 (sheet 1 of 2): Process Purge\_MS\_SGSN

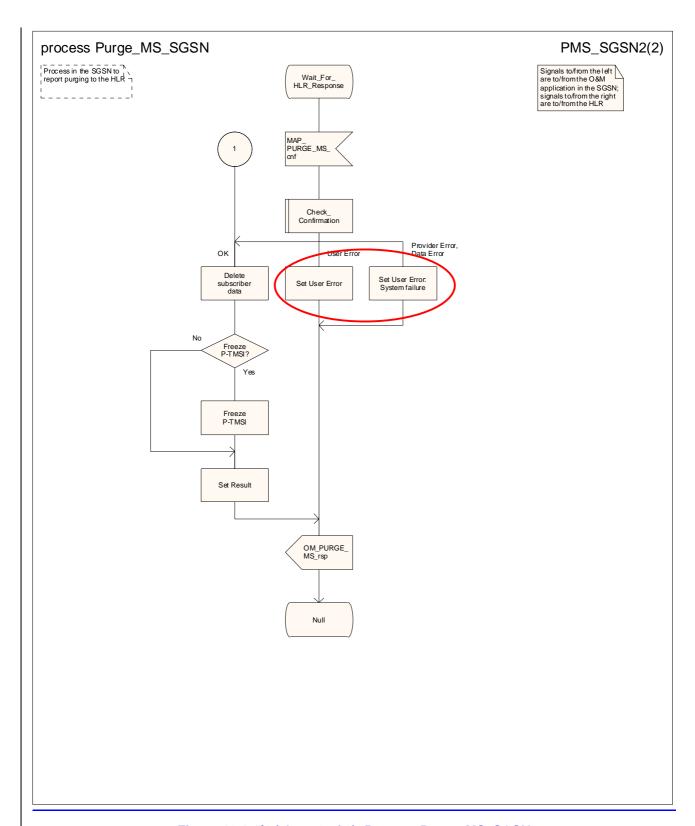
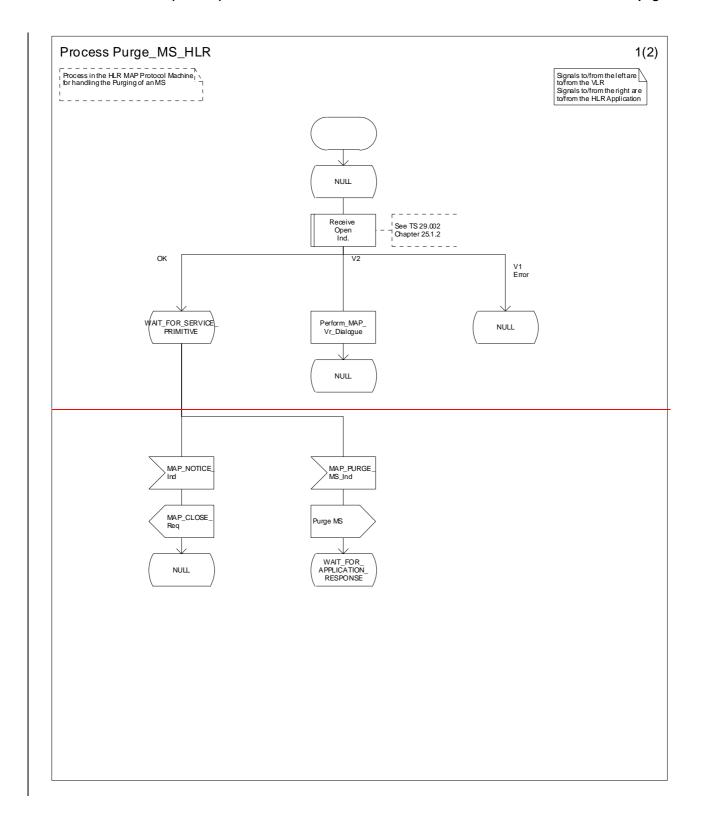


Figure 19.1.4/4 (sheet 2 of 2): Process Purge MS SGSN



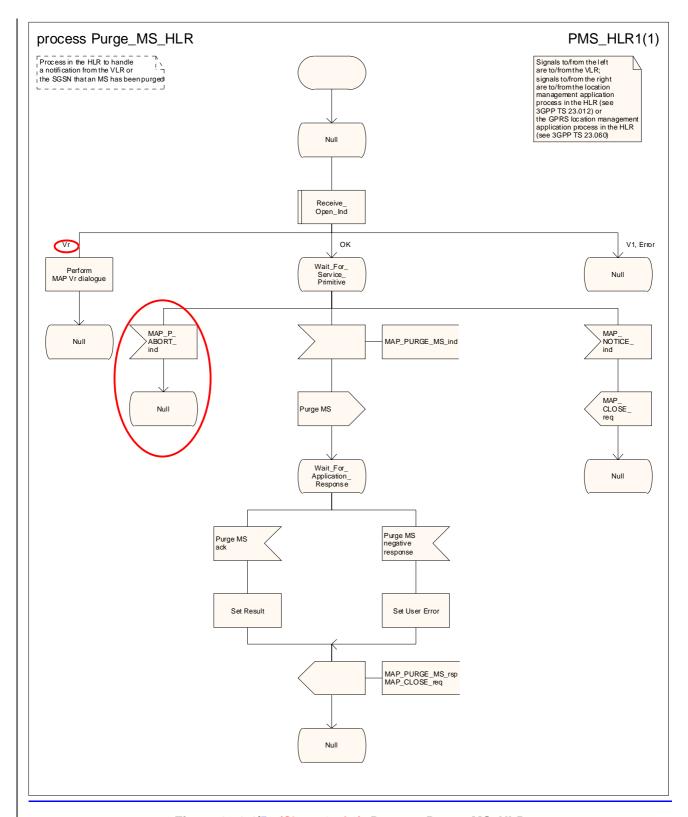


Figure 19.1.4/53 (Sheet 1 of 2): Process Purge\_MS\_HLR

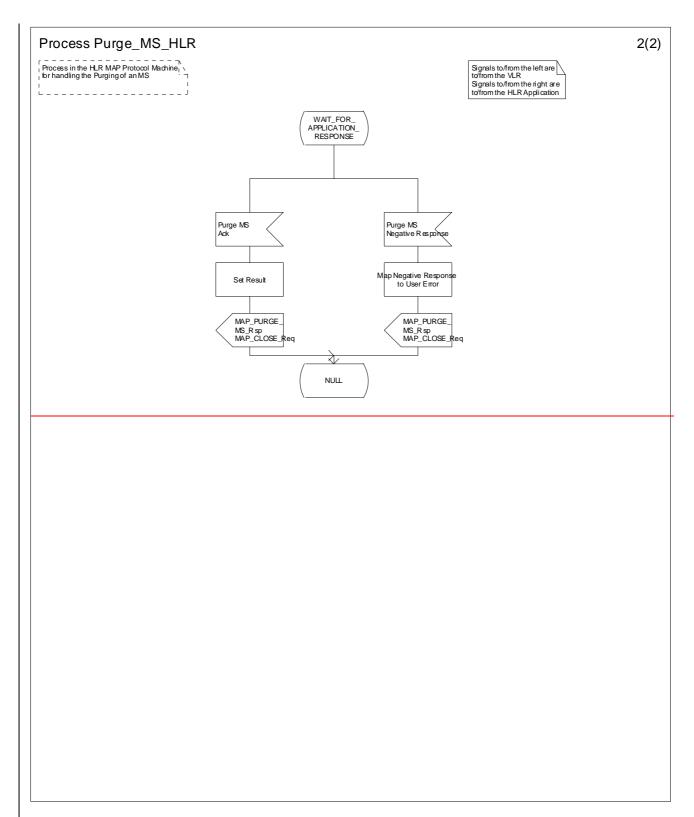


Figure 19.1.4/3 (Sheet 2 of 2): Process Purge\_MS\_HLR

# 19.2 Handover procedures

It should be noted that procedures related to the B interface have not been updated for Release 99. The B interface is not fully operational specified. It is strongly recommended not to implement the B interface as an external interface.

## 19.2.1 General

In this subclause, the term "Inter-MSC handover" is used to denote The handover or relocation between different MSCs. is called Inter-MSC handover.

The interfaces involved for Inter-MSC handover are shown in figure 19.2/1. Following There are two Inter-MSC handover procedures apply:

1) Basic Inter-MSC handover:

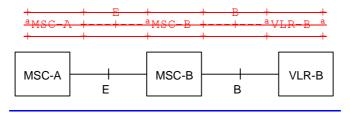
The call is handed over from the controlling MSC<del>, called</del> (MSC-A) to another MSC<del>, called</del> (MSC-B) (figure 19.2/1a).

Figure 19.2/2 shows the message flow for a successful handover between from MSC\_-A and to MSC\_-B, including a request for handover number allocation by from MSC\_-B to VLR\_-B.

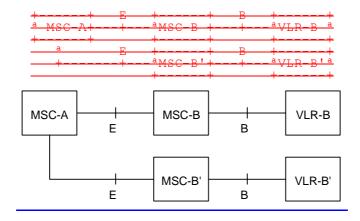
2) Subsequent Inter-MSC handover:

After the call has been handed over from MSC\_-A to MSC\_-B, a <u>further handover to-either to MSC\_-A</u> (figure 19.2/1a) or to a third MSC (MSC\_-B') (figure 19.2/1b) <u>is-may be</u> necessary in order to continue the <u>connection\_call</u>.

\_Figure 19.2/3 shows the message flow for a successful subsequent handover to MSC-B'. For a successful subsequent handover to MSC-A, the messages to and from MSC-B' and VLR-B' are omitted.



a) Basic handover procedure MSC-A to MSC-B and subsequent handover procedure MSC-B to MSC-A.



b) Subsequent handover procedure MSC\_-B to MSC\_-B'.

Figure 19.2/1: Interface structure for handover

The MAP handover procedures achieve the functionality required to set up an MSC MSC dialogue, to optionally allocate a handover number or one or several relocation numbers and to transport BSSAP or RANAP messages.

Minimum applicable MAP AC for intersystem inter-MSC GSM BSS to UTRAN handover shall be MAP handover AC version 3.

Minimum applicable MAP AC for intersystem inter-MSC UTRAN to GSM BSS handover shall be MAP handover AC version 2.

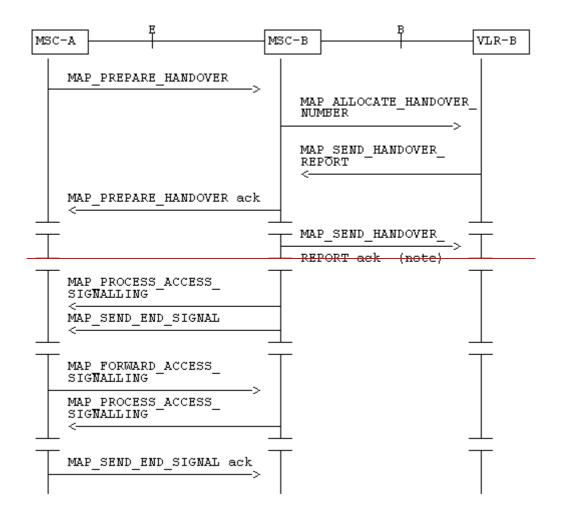
Note: If MAP AC version 2 is used, subsequent handover to UTRAN is not possible.

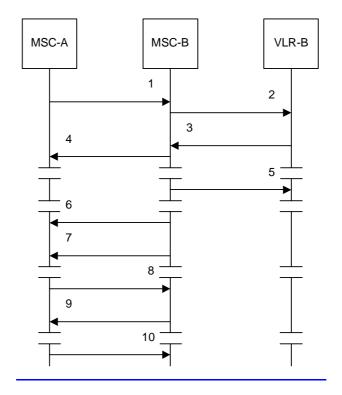
Minimum applicable MAP AC for inter MSC GSM BSS to GSM BSS handover should be MAP handover AC version 2.

NOTE: If MAP AC version 2 or lower is used, subsequent handover to UTRAN is not possible.

The transported BSSAP or RANAP messages are controlled and handled by the Handover Control Application in the MSCs. This information will be transparent to the MAP protocol. If the MSC receives via the MAP protocol BSSAP or RANAP messages, this information will be forwarded to the Handover Control Application (shown in the handover SDL diagrams with the internal HO\_CA signalling, it is an internal process in the MSC) and vice versa if the Handover Control Application requires the sending of BSSAP or RANAP messages via the MAP protocol.

For detailed interworking between the A-interface and MAP procedures or the Iu-interface and MAP procedures, see 3GPP TS 23.009 and 3GPP TS 29.010.

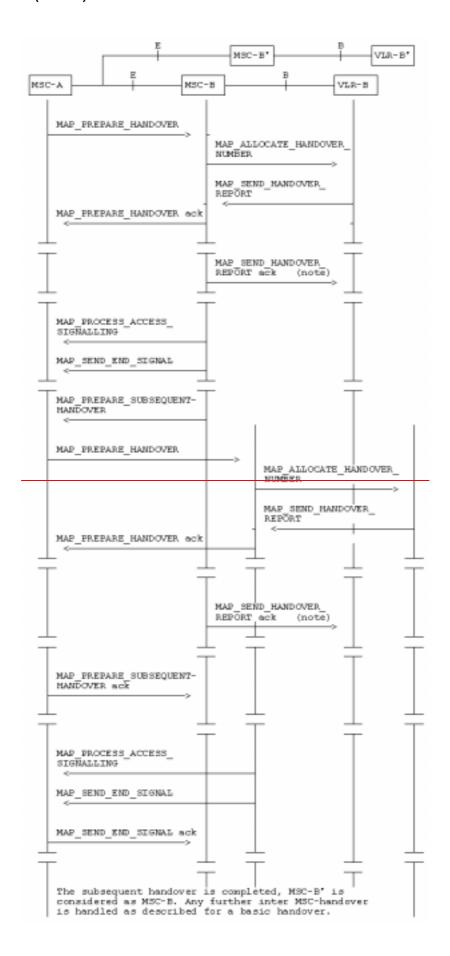


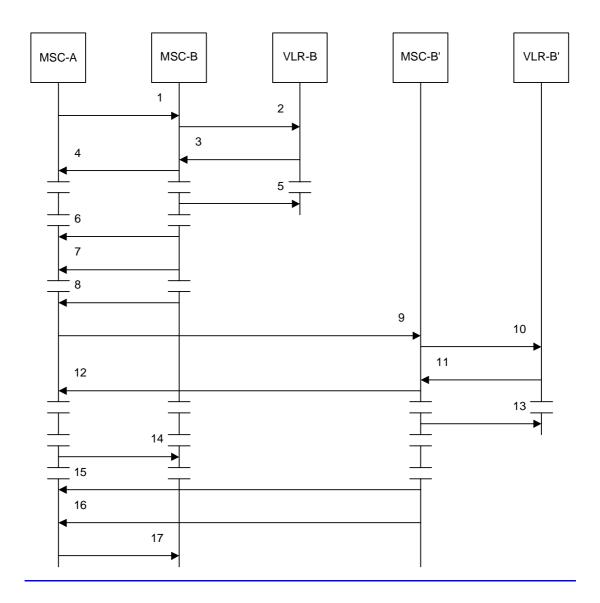


- MAP\_PREPARE\_HANDOVER\_req/ind
  MAP\_ALLOCATE\_HANDOVER\_NUMBER\_req/ind
  MAP\_SEND\_HANDOVER\_REPORT\_req/ind 1) 2) 3)
- 4) MAP\_PREPARE\_HANDOVER\_rsp/cnf
- 5) MAP SEND HANDOVER REPORT rsp/cnf (Note)
- 6) MAP\_PROCESS\_ACCESS\_SIGNALLING\_req/ind
- 7)
- MAP SEND END SIGNAL req/ind
  MAP FORWARD ACCESS SIGNALLING req/ind
  MAP PROCESS ACCESS SIGNALLING req/ind 8)
- 9)
- MAP\_SEND\_END\_SIGNAL\_rsp/cnf 10)

NOTE: This can be sent at any time after the connection between MSC\_-A and MSC\_-B is established.

Figure 19.2/2: Example of a successful basic handover procedure to MSC\_-B





- MAP\_PREPARE\_HANDOVER\_reg/ind
- MAP ALLOCATE HANDOVER NUMBER reg/ind
- MAP SEND HANDOVER REPORT req/ind 3)
- MAP\_PREPARE\_HANDOVER\_rsp/cnf 4)
- 5) MAP SEND HANDOVER REPORT rsp/cnf (Note 1)
- <u>6)</u> MAP\_PROCESS\_ACCESS\_SIGNALLING\_req/ind
- 7) MAP SEND END SIGNAL req/ind
- 8) MAP\_PREPARE\_SUBSEQUENT\_HANDOVER\_reg/ind
- MAP PREPARE HANDOVER req/ind 9)
- MAP\_ALLOCATE\_HANDOVER\_NUMBER\_req/ind 10)
- MAP SEND HANDOVER REPORT reg/ind 11)
- 12) MAP\_PREPARE\_HANDOVER\_rsp/cnf
- MAP SEND HANDOVER REPORT rsp/cnf (Note 2) 13)
- MAP\_PREPARE\_SUBSEQUENT\_HANDOVER\_rsp/cnf 14)
- 15) MAP PROCESS ACCESS SIGNALLING reg/ind
- MAP\_SEND\_END\_SIGNAL\_req/ind 16)
- MAP SEND END SIGNAL rsp/cnf (Note 3) 17)
- NOTE\_1: This can be sent at any time after the connection between MSC--A and MSC--B is established.

  NOTE 2: This can be sent at any time after the connection between MSC-A and MSC-B' is established.
- NOTE 3: At this stage, the subsequent handover is complete. Any further interworking between MSC-A and MSC-B' is the same as the interworking between MSC-A and MSC-B after basic handover

Figure 19.2/3: Example of a successful subsequent handover towards a third MSC

The MAP signalling procedures for inter-MSC handover support the allocation of a handover number or one or more relocation numbers and the transfer of encapsulated BSSAP or RANAP messages.

The minimum application context version for the MAP handover application context shall be:

- version 3 for inter-MSC UTRAN to UTRAN handover;
- version 3 for inter-MSC intersystem handover from GSM BSS to UTRAN;
- version 2 for inter-MSC intersystem handover from UTRAN to GSM BSS.

NOTE: If the MAP handover application context version 2 is used, subsequent handover to UTRAN is not possible.

The minimum application context version for the MAP handover application context should be version 2 for inter-MSC handover from GSM BSS to GSM BSS.

NOTE: If the MAP handover application context version 2 or lower is used, subsequent handover to UTRAN is not possible.

The BSSAP or RANAP messages encapsulated in MAP messages are processed by the Handover Control Application in each MSC. The information in the encapsulated BSSAP or RANAP messages is passed from the Handover Control Application to the MAP process at the sending end; the notation used in the SDL diagrams for the MAP processes is "HO\_CA\_MESSAGE\_ind(Message transfer)". The information in the encapsulated BSSAP or RANAP messages is passed from the MAP process to the Handover Control Application at the sending end; the notation used in the SDL diagrams for the MAP processes is "HO\_CA\_MESSAGE\_req(Message transfer)".

For details of the interworking between the A-interface and MAP procedures or the Iu-interface and MAP procedures, see 3GPP TS 23.009 [21] and 3GPP TS 29.010 [58].

# 19.2.2 Handover pProcedure in MSC--A

This subclause describes the inter-MSC handover procedure in MSC-A; it covers basic inter-MSC handover to another MSC (MSC-B) and subsequent inter-MSC handover to a third MSC (MSC-B') or back to the controlling MSC (MSC-A).

The MAP process in MSC-A to handle inter-MSC handover is shown in figure 19.2/4. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive_Open_Cnf	see subclause 25.1.2;
Check_Indication	see subclause 25.2.1.
Check Confirmation	see subclause 25.2.2.

Communication between the MAP handover process and the Handover Control application is represented by the HO CA MESSAGE service. For a detailed description of the interworking between the Handover Control applications in different MSCs for the inter-MSC handover procedure, see 3GPP TS 23.009 [21].

This clause describes the handover or relocation procedure in MSC-A, including the request for a basic handover or relocation to another MSC (MSC-B), subsequent handover or relocation to a third MSC (MSC-B') or back to the controlling MSC (MSC-A).

#### 19.2.2.1 Basic handover

The handling in MSC-A for basic inter-MSC handover is shown in sheets 1 to 6 of figure 19.2/4.

Sheet 1: The MAP PREPARE HANDOVER request may contain:

- an indication that handover number allocation is not required;
- the target Cell ID, for compatibility for handover to GSM;
- the target RNC ID, for SRNS relocation or inter-system handover from GSM to UMTS;

- the IMSI;
- UMTS encryption information and UMTS integrity protection information, which are necessary for inter-system handover from GSM to UMTS;
- GSM radio resource information (channel type).

The conditions for the presence of these parameters and the processing in MSC-B (3G\_MSC-B) are described in detail in 3GPP TS 29.010 [58] and 3GPP TS 23.009 [21].

Sheet 2: The MAP\_PREPARE\_HANDOVER confirmation contains one of:

- no handover number, if the MAP\_PREPARE\_HANDOVER request included an indication that handover number allocation is not required;
- a handover number;
- one or more relocation numbers.

Sheet 2: The MAP\_PREPARE\_HANDOVER confirmation contains BSSAP or RANAP signalling information, which is passed to the Handover Control application in MSC-A.

Sheet 2: If the MAP\_PREPARE\_HANDOVER confirmation contains an indication that MSC-B does not support multiple bearers, the Handover Control application in MSC-A may request handover of one bearer to the same cell in MSC-B.

Sheet 5: If the original MAP\_PREPARE\_HANDOVER request included a parameter indicating that handover number allocation is not required, the Handover Control application in MSC-A may request a handover number (or one or more relocation numbers); this triggers a further MAP\_PREPARE\_HANDOVER request towards MSC-B

When MSC-A has decided that a call has to be handed over or relocated to MSC-B, the Handover Control Application in MSC A requests the MAP application to initiate the MAP\_PREPARE\_HANDOVER request to MSC B.

MSC A opens the dialogue to MSC B with a MAP\_OPEN request containing no user specific parameters and sends a MAP\_PREPARE\_HANDOVER request. This request shall contain all the information required by MSC B to allocate the necessary radio resources. In addition, it may optionally contain:

- -an indication that a handover number allocation is not required;
- -the targetCellId, for compatibility reasons in the case of handover or inter-system handover to GSM;
- -the targetRNCId, in case of SRNS relocation or inter-system handover from GSM to UMTS;
- the IMSI:
- -UMTS encryption information and UMTS integrity protection information, which are necessary parameters for inter-system handover from GSM to UMTS;
- -GSM radio resource information (channel type) shall be included at inter MSC relocation to prepare for a possible subsequent intra MSC handover from UMTS to GSM in MSC B.

The conditions when these parameters shall be included and the processing of them in MSC-B (3G\_MSC-B) are described in detail in 3GPP TS 29.010 and 23.009.

If MSC-B accepts the dialogue, it returns a MAP\_PREPARE\_HANDOVER confirmation containing a handover number or one or several relocation numbers, unless the request has included the HO NumberNotRequired parameter, and BSSAP or RANAP information which is forwarded to and handled by the Handover Control Application in MSC-A.

Optionally MSC A can receive, after a MAP\_PREPARE\_HANDOVER confirmation, a MAP\_PROCESS\_ACCESS\_SIGNALLING indication containing BSSAP or RANAP information.

When the connection has been established between the MS and MSC B, MSC A will be informed by a MAP\_SEND\_END\_SIGNAL indication.

When MSC-A wants to clear the connection with BSS-B, an indication from the Handover Control Application is received in the Map Application to send the MAP\_SEND\_END SIGNAL response to MSC B to close the MAP dialogue.

MSC A may abort the handover or relocation procedure at any time (e.g. if the call is cleared).

# 19.2.2.2 Handling of access signalling

The Handover Control application in MSC-A may forward access signalling to any of the MS, RNS-B or BSS-B using the MAP\_FORWARD\_ACCESS\_SIGNALLING service; any of the MS, RNS-B or BSS-B may forward access signalling to the Handover Control application in MSC-A using the MAP\_PROCESS\_ACCESS\_SIGNALLING service. These are non-confirmed services.

If required, the Handover Control Application in MSC-A requests the MAP application to invoke the MAP\_FORWARD\_ACCESS\_SIGNALLING request containing the information to be transferred to the A-interface or the Iu interface of MSC-B (e.g. call control information).

MAP\_FORWARD\_ACCESS\_SIGNALLING is a non-confirmed service.

MSC B will then forward the required information to the Handover Control Application. The MAP\_FORWARD\_ACCESS\_SIGNALLING is composed in such a way that the information can be passed transparently to the A interface or the Iu interface for call control and mobility management information. Any response received in MSC B from the A interface or the Iu interface that should be brought to MSC A will require a new independent request from the Handover Control Application in MSC-B to MSC-A by invoking a MAP\_PROCESS\_ACCESS\_SIGNALLING request.

### 19.2.2.3 Other procedures in stable handover situation

During a call and after handover or relocation, a number of procedures between MSC-A and BSS-B or RNS-B controlled by or reported to MSC-A may be initiated in both directions by invoking a MAP\_FORWARD\_ACCESS\_SIGNALLING request and reception of a MAP\_PROCESS\_ACCESS\_SIGNALLING indication.

### 19.2.2.34 Subsequent handover

The handling in MSC-A for subsequent inter-MSC handover is shown in sheets 7 & 8 of figure 19.2/4. If the Handover Control Application determines that the call is to be handed over to a third MSC (MSC-B') it triggers another instance of the MAP process to handle the basic handover to MSC-B', and reports the result of the subsequent handover to the instance of the MAP process which handles the dialogue with MSC-B.

Sheet 8: While the MAP process in MSC-A is waiting for the completion of subsequent handover, it relays access signalling between the Handover Control application and the MS, RNS-B or BSS-B as described in subclause 19.2.2.2.

When MSC A receives a MAP\_PREPARE\_SUBSEQUENT\_HANDOVER request, it will start the procedure of handing or relocating the call over to a third MSC (MSC-B'), or back to the controlling MSC (MSC-A). If the new handover or relocation procedure towards MSC B' or MSC A is successful, the handover control application in MSC A will request the release of the dialogue towards MSC B by sending the MAP\_SEND\_END\_SIGNAL confirmation.

### 19.2.2.5 SDL Diagrams

The SDL diagrams on the following pages describe the user processes in MSC A for the procedures described in this clause.

The services used are defined in clause 8.4.

NOTE: The message primitives HO\_CA\_MESSAGE used in the SDL-Diagrams are used to show the internal coordination between the MAP application and the Handover Control Application. For a detailed description of the co-ordination between the applications for the handover or relocation procedure, see 3GPP TS 23.009. Note that in case of reception of errors from the MSCs (see the Handover error handling macro), the MAP user reports them to the Handover Control Application and does not take any action except in cases explicitly mentioned in the SDL diagrams.

# 19.2.3 Handover pProcedure in MSC-B

This subclause describes the handover or relocation procedure in MSC-B; it covers basic handover or relocation from the controlling MSC (MSC-A) and subsequent handover or relocation.

The MAP process in MSC-B to handle handover or relocation is shown in figure 19.2/5. The MAP process invokes macros not defined in this clause: the definitions of these macros can be found as follows:

Receive_Open_Ind	see subclause 25.1.1;
Receive_Open_Cnf	see subclause 25.1.2;
Check_Indication	see subclause 25.2.1.
Check Confirmation	see subclause 25.2.2.

Communication between the MAP handover process and the Handover Control application is represented by the HO\_CA\_MESSAGE service. For a detailed description of the interworking between the Handover Control applications in different MSCs for the inter-MSC handover procedure, see 3GPP TS 23.009 [21].

The ordering of allocation of handover number and radio resources shown in the SDL diagrams is not mandatory.

This clause describes the handover or relocation procedure in MSC B, including the request for a handover or relocation from another MSC (MSC-A), subsequent handover or relocation to a third MSC (MSC-B') or back to the controlling MSC (MSC-A).

#### 19.2.3.1 Basic handover

The handling in MSC-B for basic inter-MSC handover is shown in sheets 1 to 7 of figure 19.2/5.

Sheet 2: If the MAP\_PREPARE\_HANDOVER indication included a parameter requesting multiple bearers but MSC-B does not support multiple bearers, MSC-B sends a MAP\_PREPARE\_HANDOVER response indicating that multiple bearers are not supported, and waits for a possible MAP\_PREPARE\_HANDOVER indication requesting handover of a single bearer.

Sheet 6: If the original MAP\_PREPARE\_HANDOVER indication included a parameter indicating that handover number allocation is not required, MSC-A may send a further MAP\_PREPARE\_HANDOVER request to request the allocation of a handover number (or one or more relocation numbers).

Opening of the dialogue is described in the macro Receive\_Open\_Ind in clause 25.1.

When MSC B process receives a MAP\_PREPARE\_HANDOVER indication from MSC A, MSC B requests its associated VLR to provide a handover number, unless the parameter HO NumberNotRequired is received in the indication.

When the connection between the MS and MSC B is established on MSC B, the Handover Control Application will request the MAP application to indicate this event to MSC-A by invoking the MAP\_SEND\_END\_SIGNAL request. When a call is released, MSC-A will inform MSC-B by MAP\_SEND\_END\_SIGNAL response and the MAP dialogue between MSC A and MSC B is closed.

#### 19.2.3.2 Allocation of handover number

When a handover number is required, a MAP\_ALLOCATE\_HANDOVER\_NUMBER request will be sent to the VLR. The handover number is received in the MAP\_SEND\_HANDOVER\_REPORT request, and will be included in the MAP\_PREPARE\_HANDOVER response to MSC A.

When relocation numbers are required, one or several MAP\_ALLOCATE\_HANDOVER\_NUMBER requests will be sent to the VLR. Each relocation number is received in a MAP\_SEND\_HANDOVER\_REPORT request, and the collected relocation numbers will be included in the MAP\_PREPARE\_HANDOVER response to MSC-A.

As soon as the call from MSC-A using the handover number arrives in MSC-B, MSC-B shall release the handover number in the VLR using the MAP\_SEND\_HANDOVER\_REPORT response.

As soon as a call from MSC A using a relocation number arrives in MSC B, MSC B shall release the relocation number in the VLR using the MAP\_SEND\_HANDOVER\_REPORT response.

# 19.2.3.23 Handling of access signalling

The Handover Control application in MSC-A may forward access signalling to any of the MS, RNS-B or BSS-B using the MAP\_FORWARD\_ACCESS\_SIGNALLING service; any of the MS, RNS-B or BSS-B may forward access signalling to the Handover Control application in MSC-A using the MAP\_PROCESS\_ACCESS\_SIGNALLING service. These are non-confirmed services. Signals to or from any of the MS, RNS-B or BSS-B are routed through the Handover Control application in MSC-B.

If required by the Handover Control Application, MSC-B invokes the MAP\_PROCESS\_ACCESS\_SIGNALLING request containing the information received on the A interface or the Iu interface that should be transferred to MSC A (e.g. call control information).

MAP\_PROCESS\_ACCESS\_SIGNALLING is a non-confirmed service and any response from MSC-A will require a MAP\_FORWARD\_ACCESS\_SIGNALLING request.

### 19.2.3.4 Other procedures in stable handover situation

During a call and after handover or relocation, a number of procedures between MSC A and BSS B or RNS B controlled by or reported to MSC A may be initiated by involving access signalling transfer in both directions.

### 19.2.3.35 Subsequent handover

The handling in MSC-B for subsequent inter-MSC handover is shown in sheet 8 of figure 19.2/5.

While the MAP process in MSC-B is waiting for the completion of subsequent handover, it relays access signalling between MSC-A and the MS, RNS-B or BSS-B through the Handover Control application as described in subclause 19.2.3.2.

The procedure is used when the Handover Control Application in MSC B has decided that a call is to be handed over or relocated to another MSC (either back to the controlling MSC (MSC-A) or to a third MSC (MSC-B')).

After the MAP\_PREPARE\_SUBSEQUENT\_HANDOVER response is received from MSC A, MSC B will await the disconnection of the call. Once the disconnect is complete, MSC B will inform its VLR by invoking the MAP\_SEND\_HANDOVER\_REPORT confirmation. VLR-B will then release the allocated handover number.

The subsequent handover procedure is shown in figure 19.2/3.

# 19.2.3.6 SDL Diagrams

The SDL diagrams on the following pages describe the user process in MSC B for the procedures described in this clause.

The services used are defined in clause 8.4.

NOTE 1: The message primitives HO\_CA\_MESSAGE in the SDL-diagrams are used to show the internal coordination between the MAP application and the Handover Control Application. For a detailed description of the co-ordination between the applications for the handover procedure, see 3GPP TS 23.009.

NOTE 2: The order in the SDL diagrams to allocate first the handover number and then the radio resources is not binding.

# 19.2.4 Handover error handling macro Macro Receive Error From HO CA

This macro is used <u>for by</u> the handover processes <u>dures</u> in <u>MSC-A</u> and <u>MSC-B</u> to receive errors <u>from the MSCs and</u> from the Handover Control Application at any state of a handover process.

If a MAP\_NOTICE indication is received, the Handover Control Application is informed and the actual situation is kept and the Handover Control Application decides how the handover or relocation process should continue. In all other cases the MSC is returned to a "NULL" state.

# 19.2.5 Handover pProcedure in VLR-B

The process in VLR-B to handle a request for a handover number is shown in figure 19.2/7. The process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;
Check Indication see subclause 25.2.1.

## 19.2.5.1 Allocation of handover number

When receiving the MAP\_ALLOCATE\_HANDOVER\_NUMBER indication, the VLR will determine whether a handover number is available. If no handover number is available, this will be indicated by a MAP\_ALLOCATE\_HANDOVER\_NUMBER response with the appropriate error.

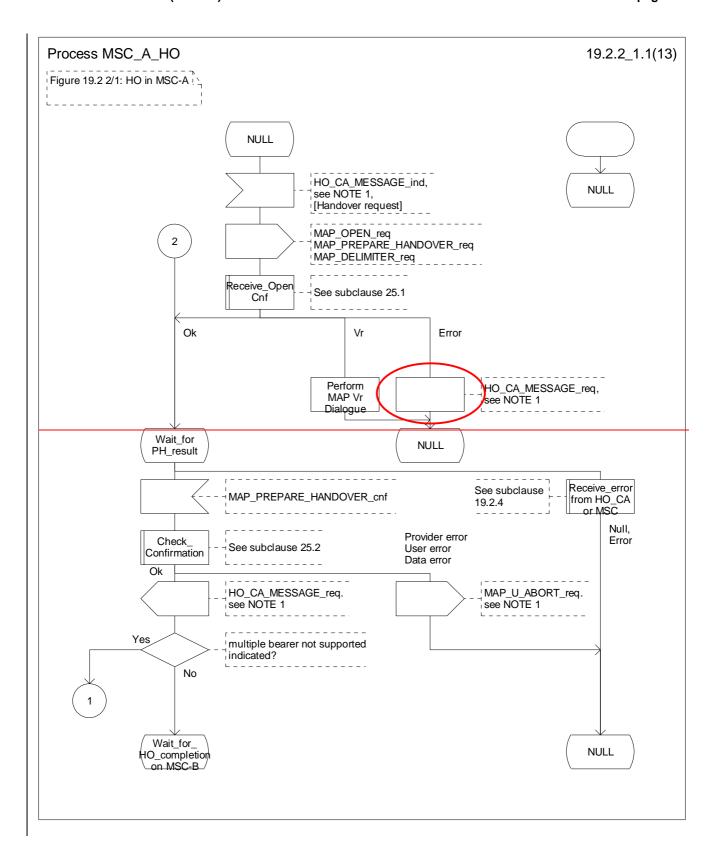
The handover number allocated will otherwise be returned to MSC B in the MAP\_SEND\_HANDOVER\_REPORT request.

The handover number will be reserved until a MAP\_SEND\_HANDOVER\_REPORT confirmation is received from MSC B.

### 19.2.5.2 SDL Diagrams

The SDL diagrams on the following pages describe the user processes in VLR for the procedures described in this clause.

The services used are defined in clause 8.4.



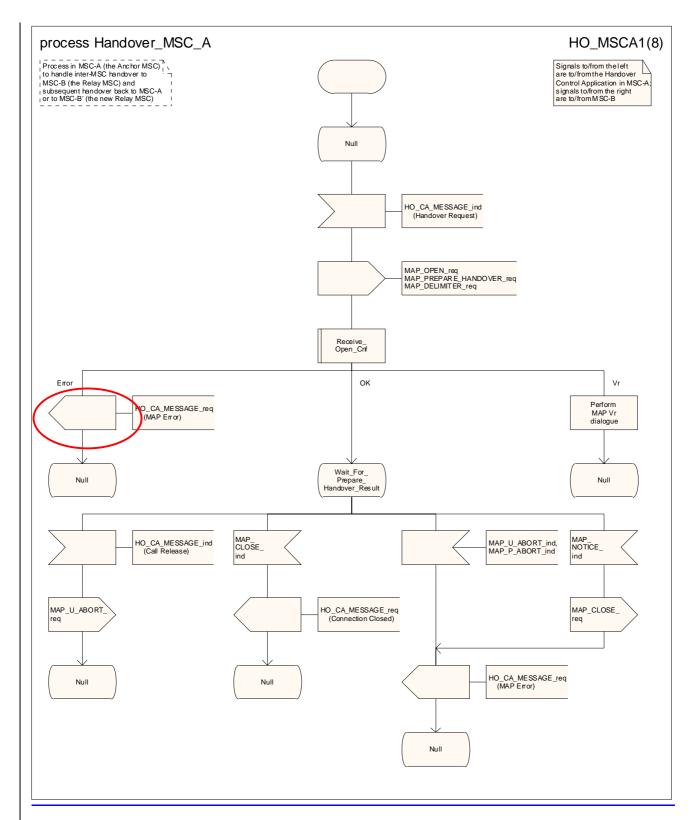
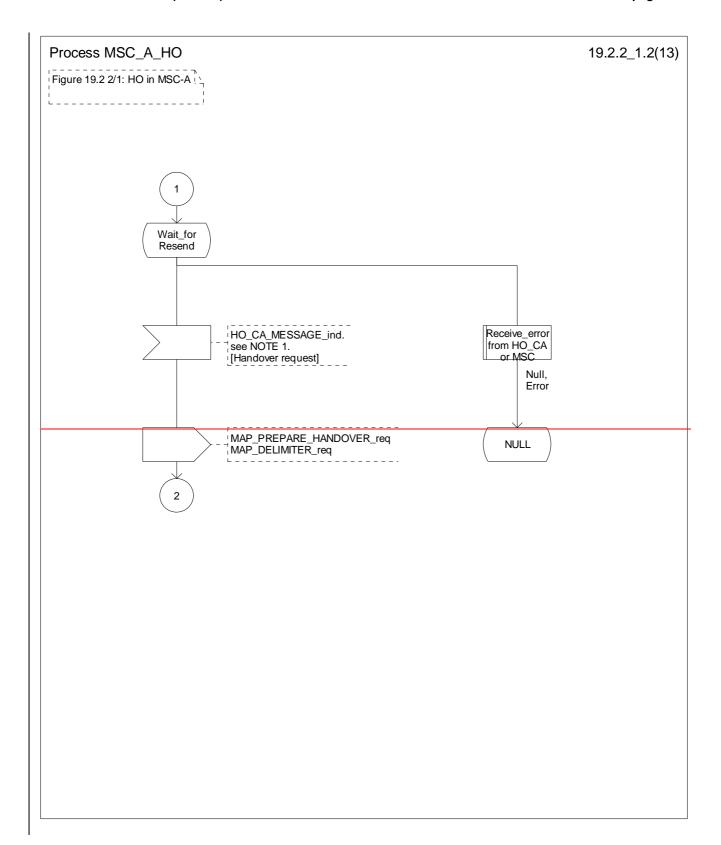


Figure 19.2/4.2/1 (sheet 1 of 813): Process HO\_MSC\_A\_HO



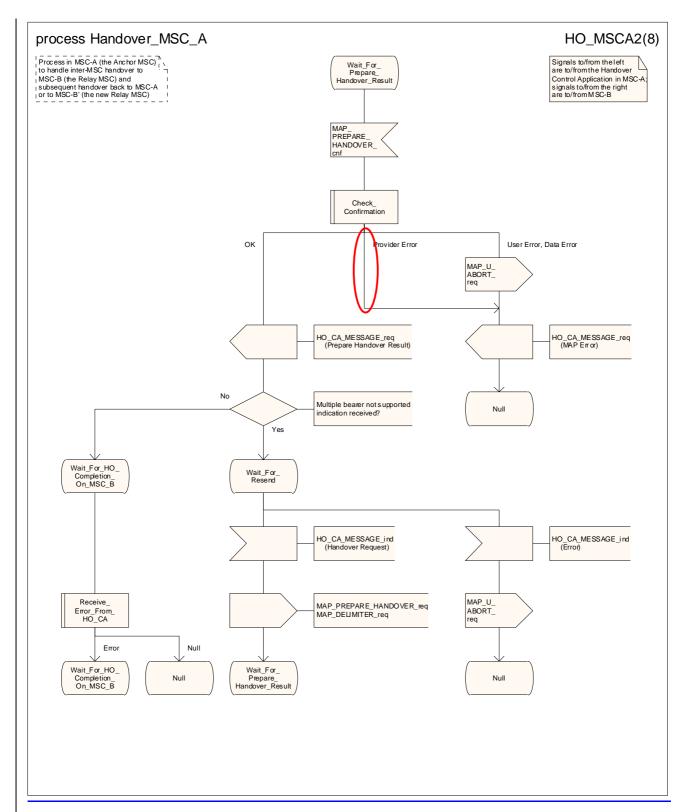
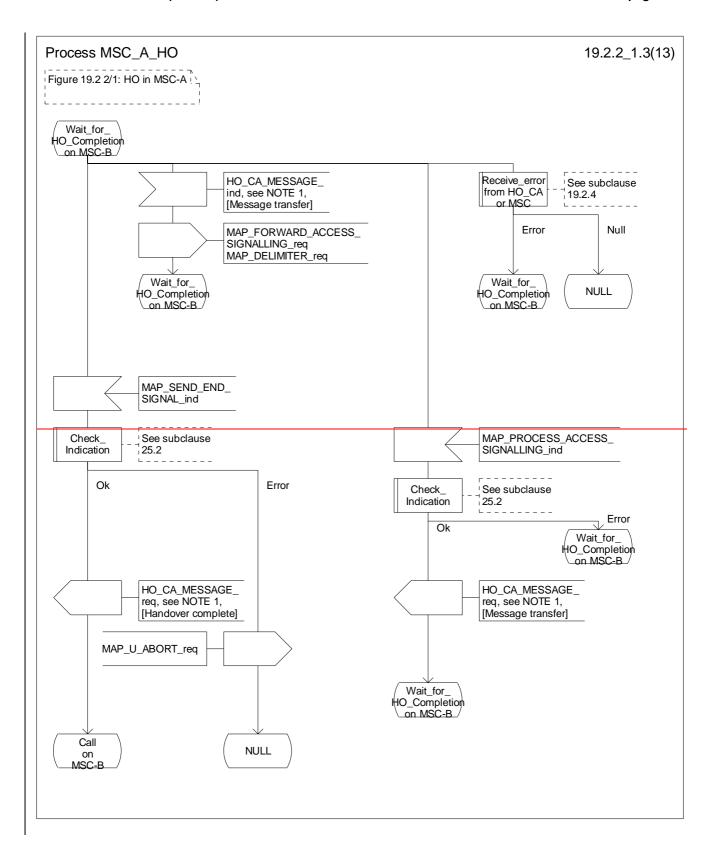


Figure 19.2/4.2/1 (sheet 2 of 813): Process HO\_MSC\_A\_HO



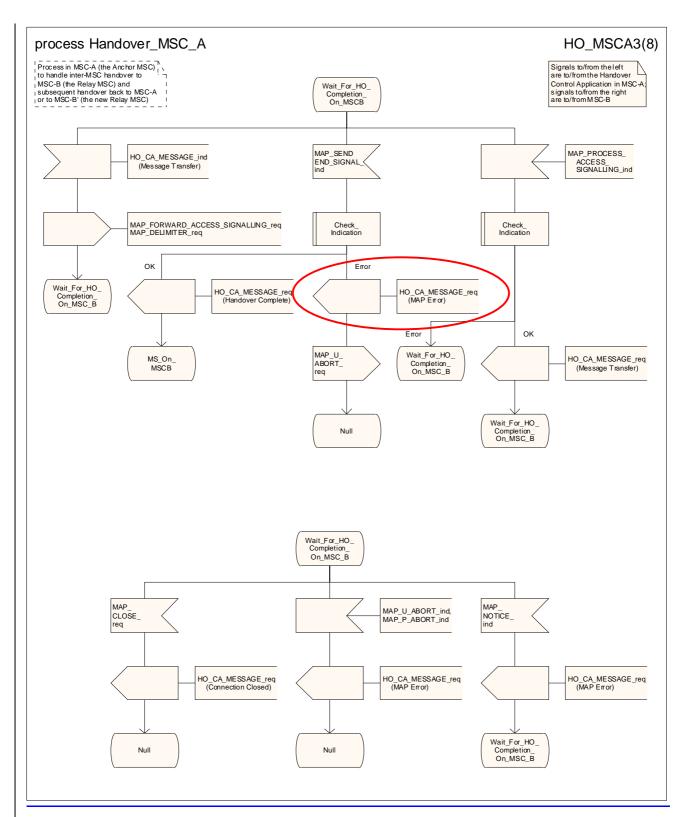
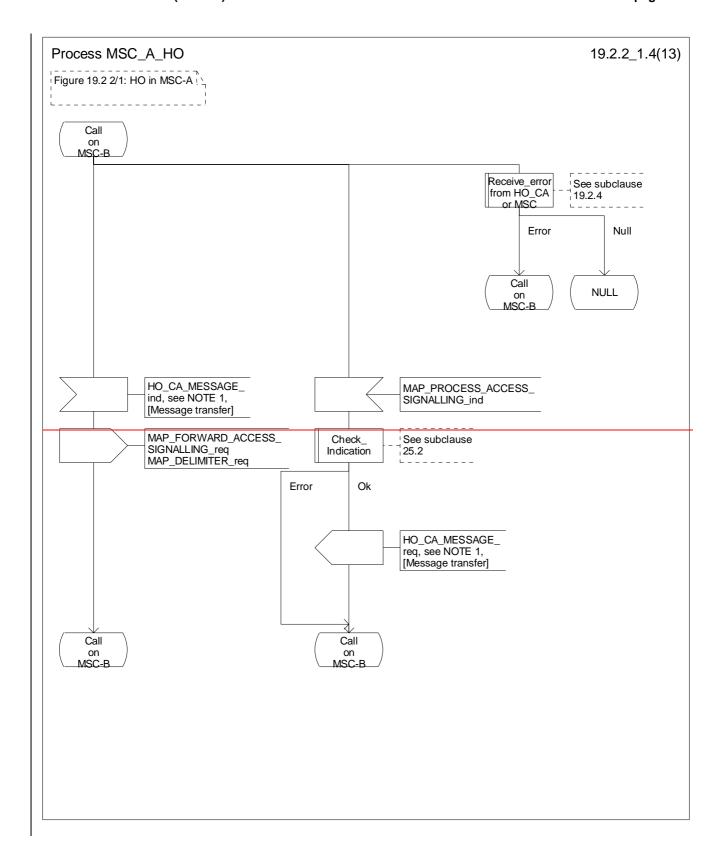


Figure 19.2/4.2/1 (sheet 3 of 813): Process HO\_MSC\_A\_HO



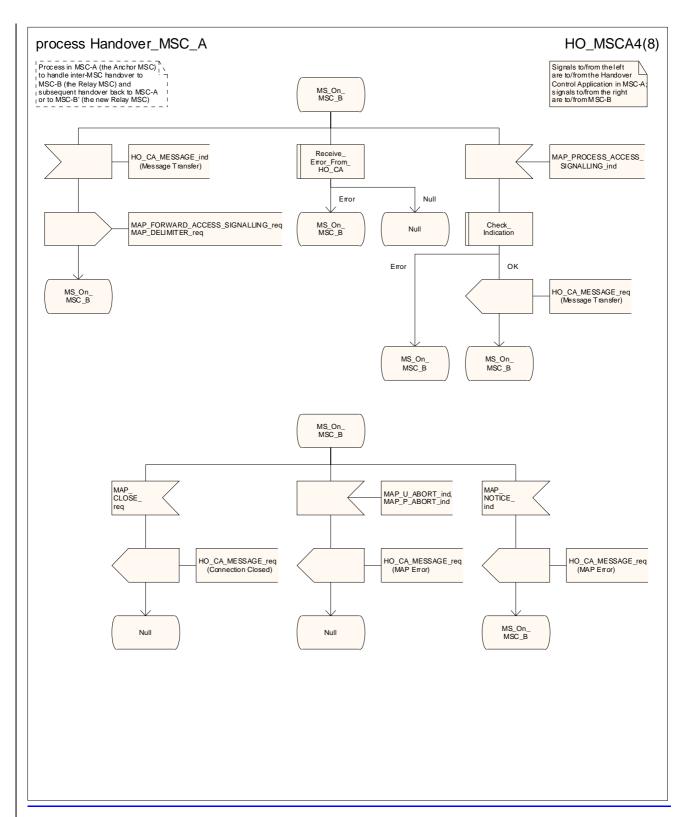
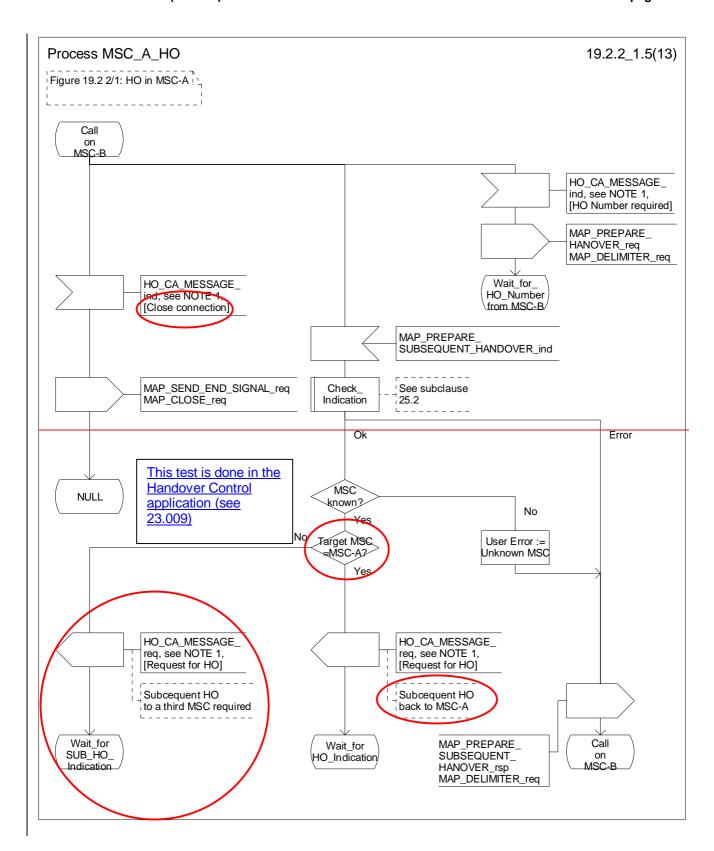


Figure 19.2/4.2/1 (sheet 4 of 813): Process HO\_MSC\_A\_HO



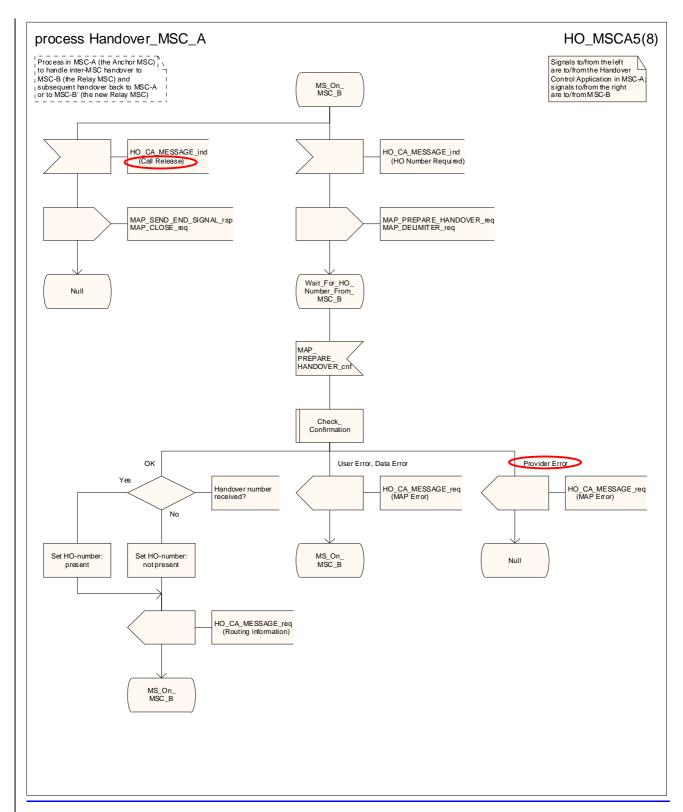
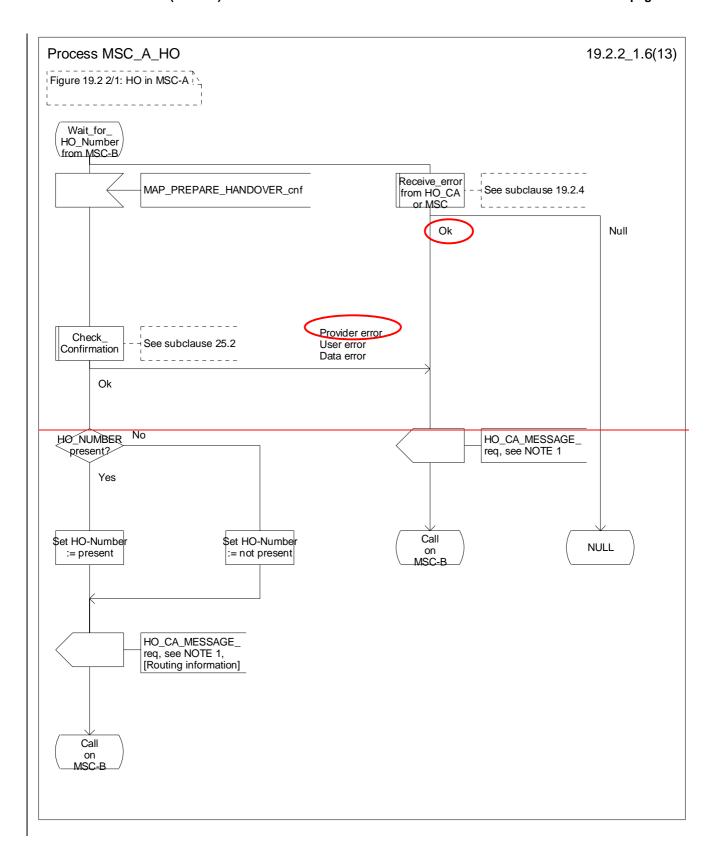


Figure 19.2/4.2/1 (sheet 5 of 813): Process HO\_MSC\_A\_HO



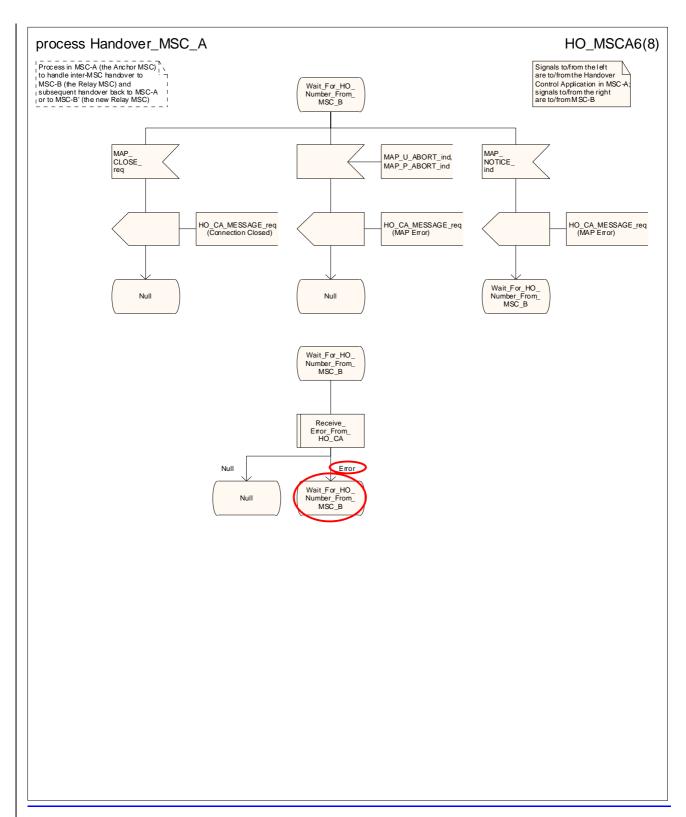
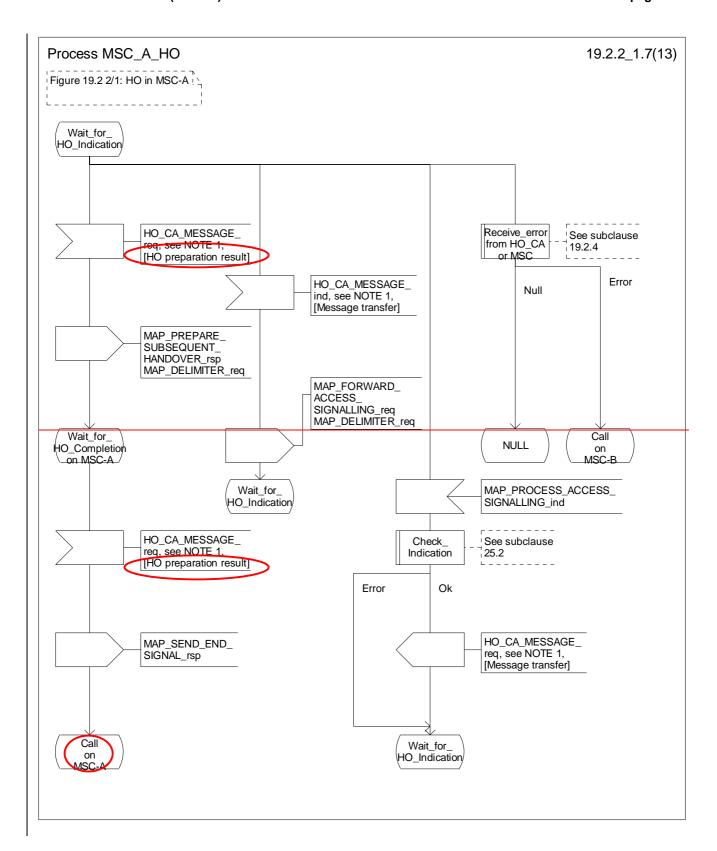


Figure 19.2/4.2/1 (sheet 6 of 813): Process HO\_MSC\_A\_HO



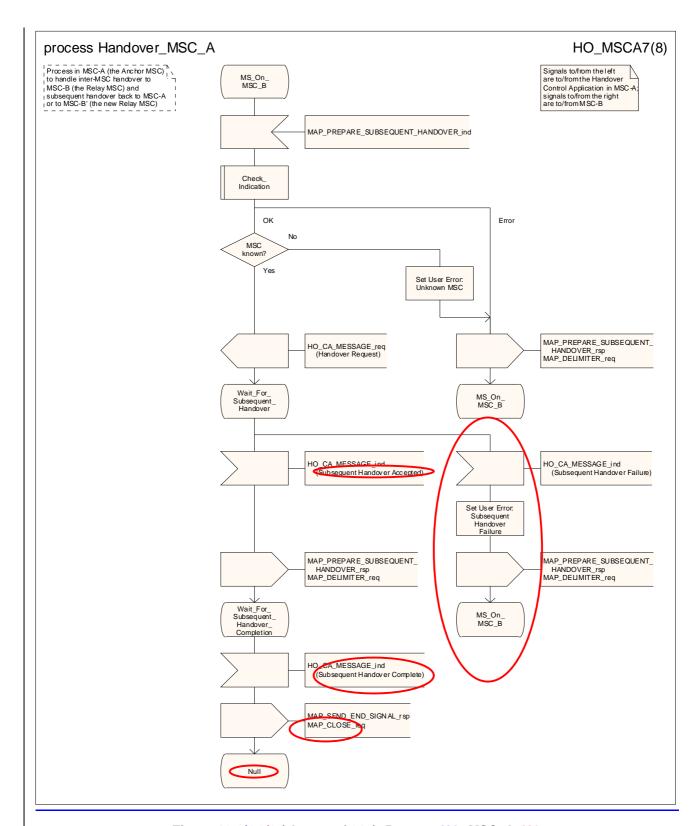
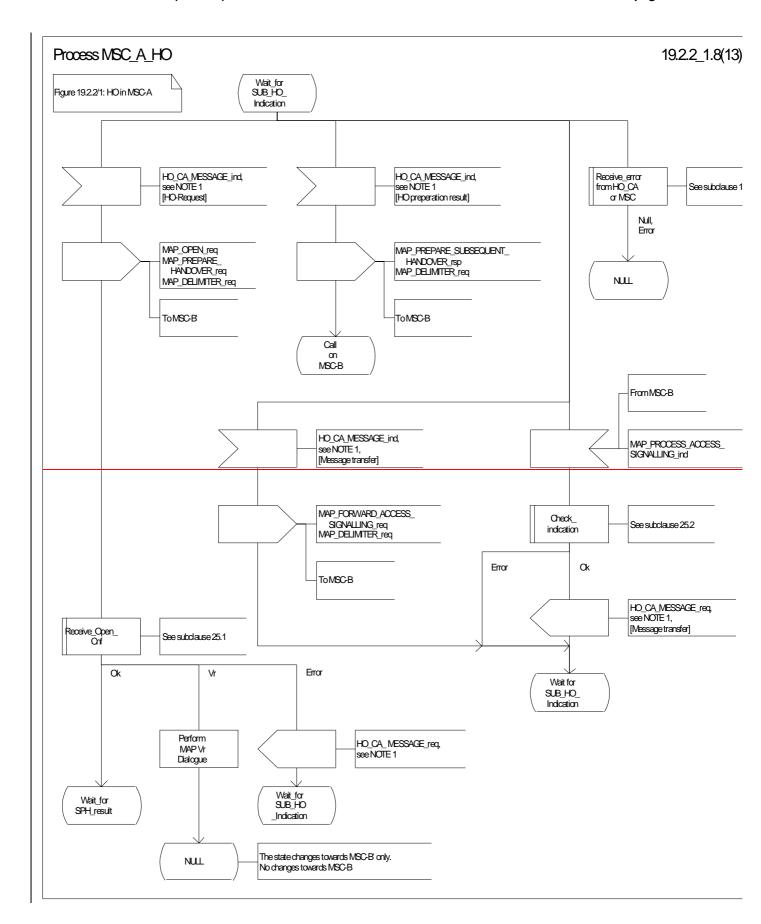


Figure 19.2/4.2/1 (sheet 7 of 813): Process HO\_MSC\_A\_HO



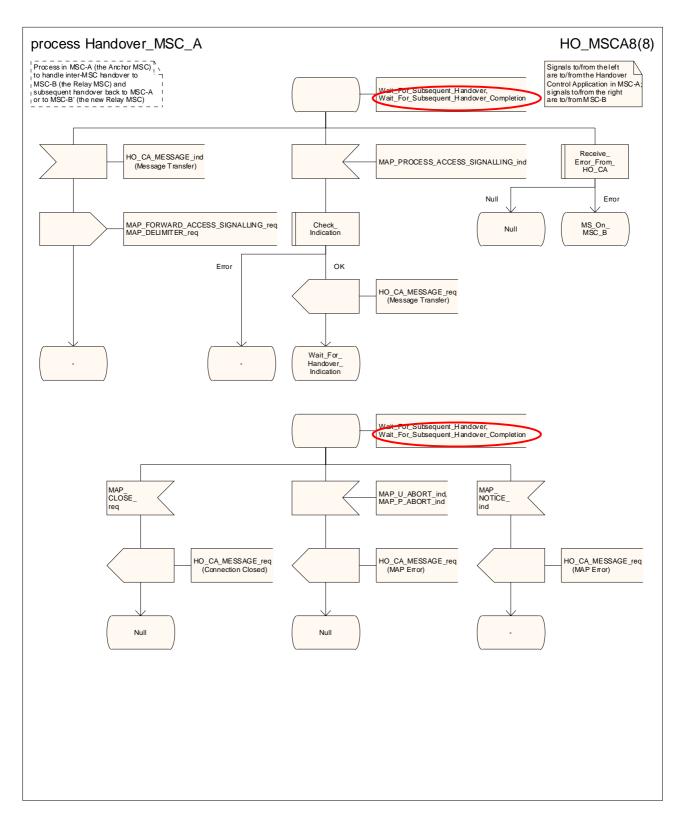


Figure 19.2/4.2/1 (sheet 8 of 813): Process HO\_MSC\_A\_HO

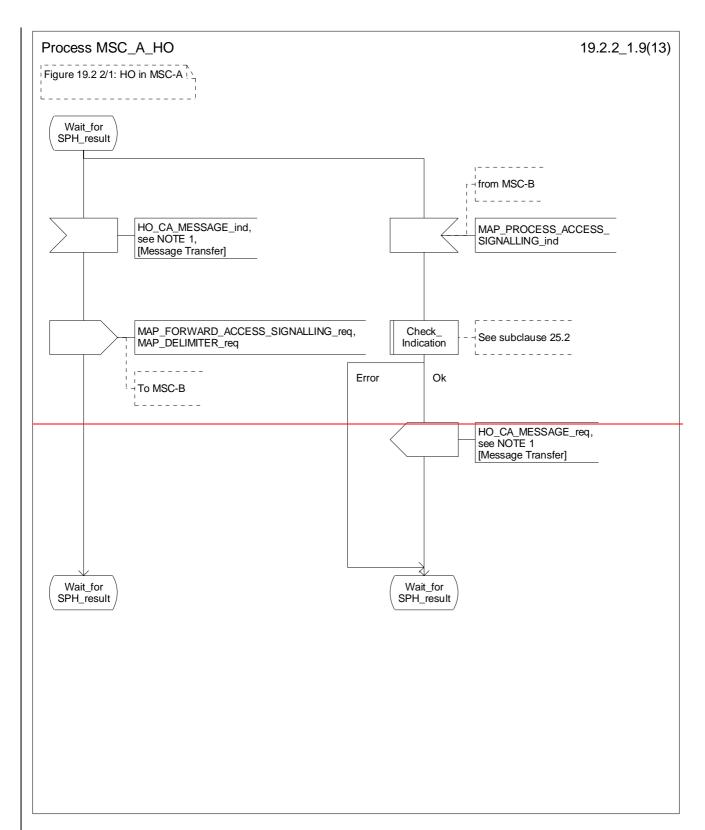


Figure 19.2.2/1 (sheet 9 of 13): Process MSC\_A\_HO

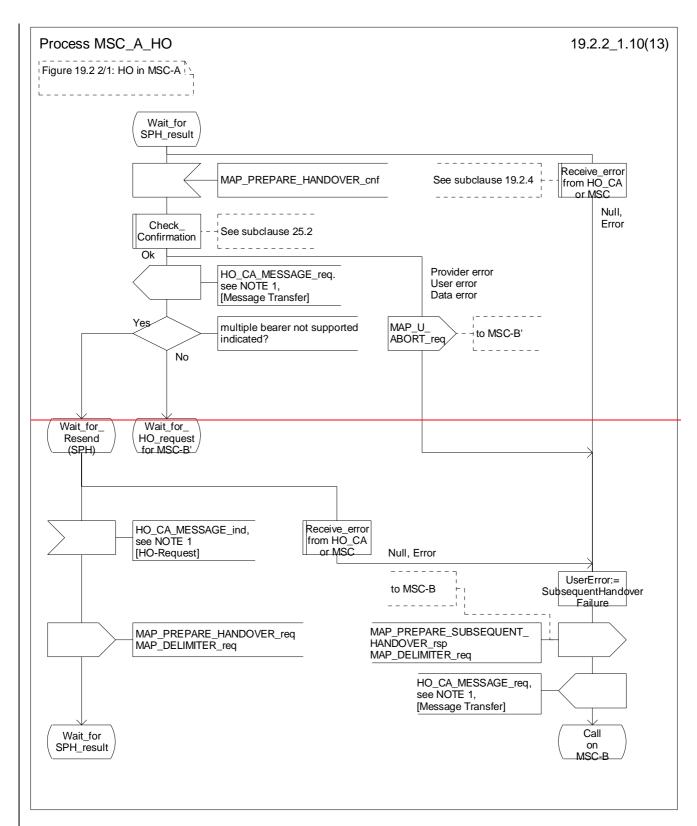


Figure 19.2.2/1 (sheet 10 of 13): Process MSC\_A\_HO

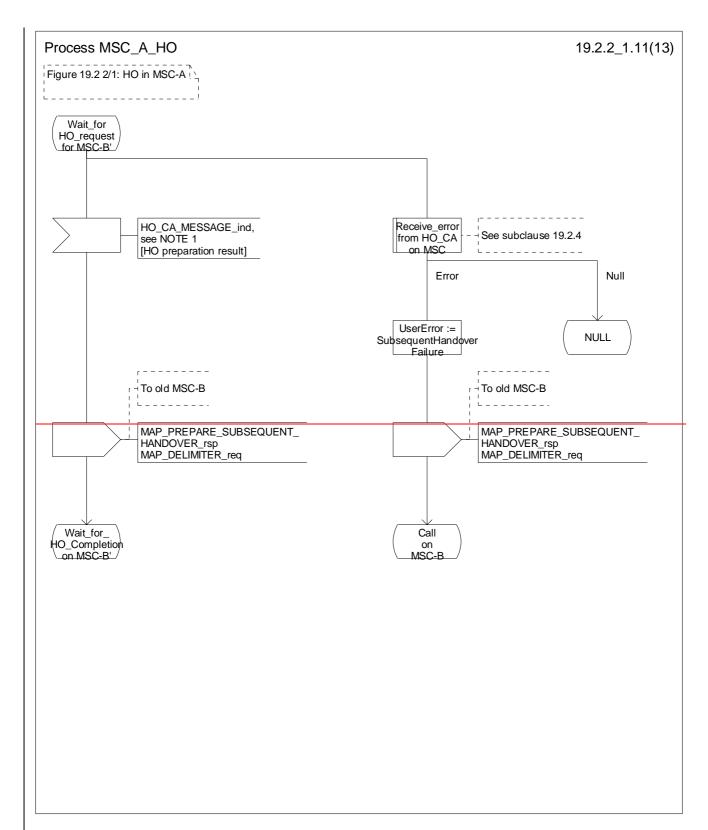


Figure 19.2.2/1 (sheet 11 of 13): Process MSC\_A\_HO

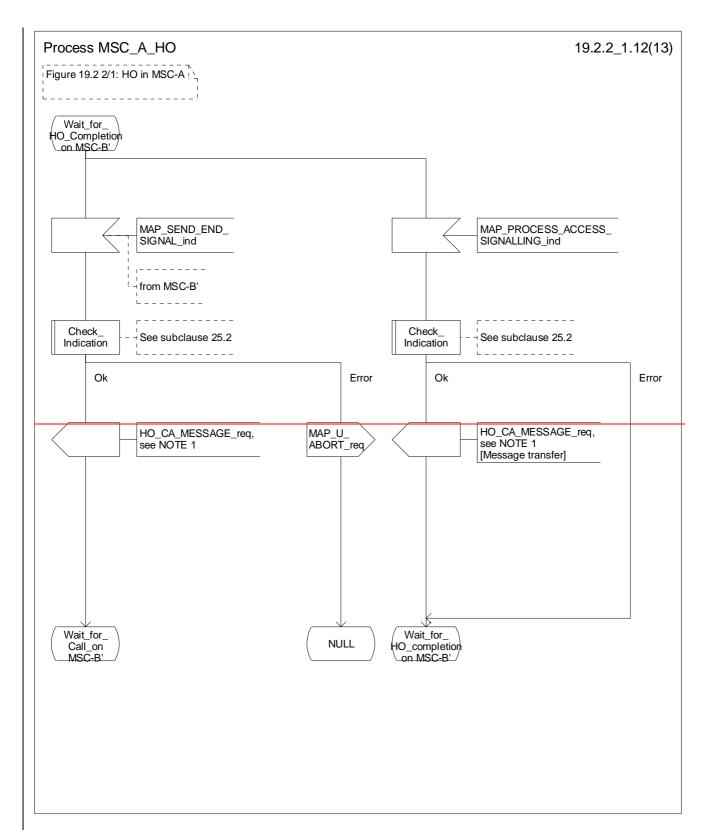


Figure 19.2.2/1 (sheet 12 of 13): Process MSC\_A\_HO

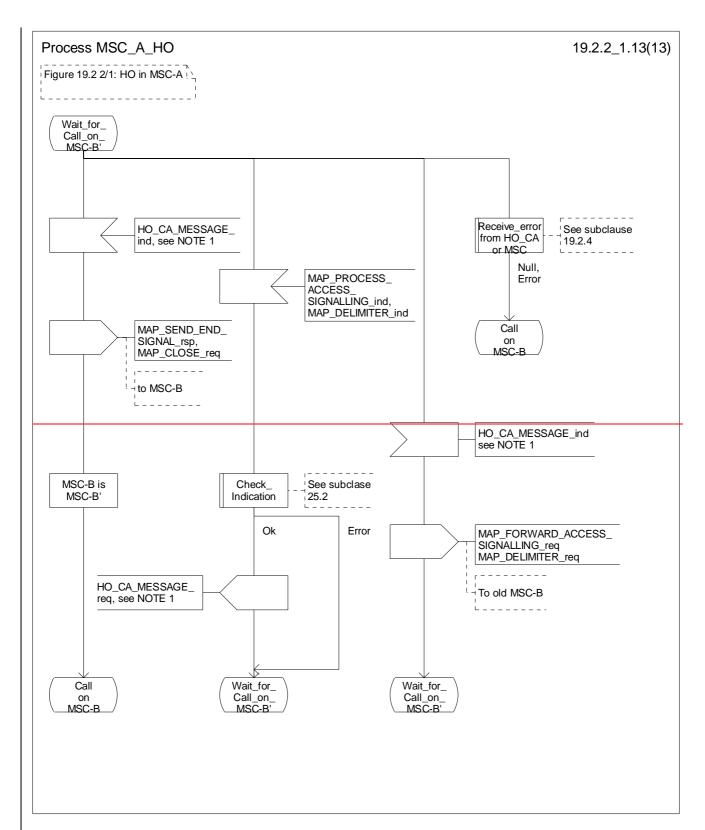
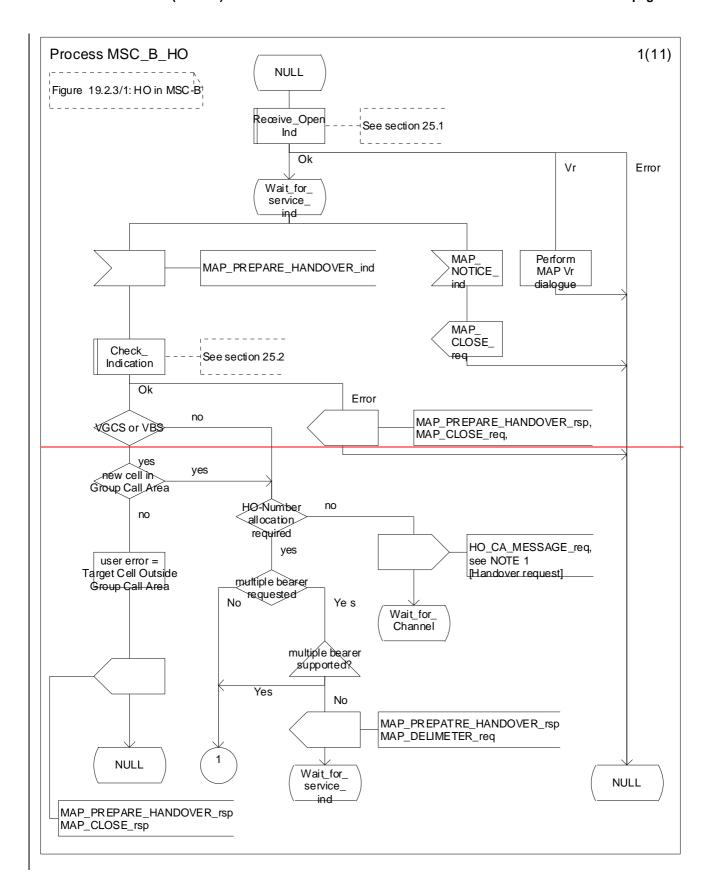


Figure 19.2.2/1 (sheet 13 of 13): Process MSC\_A\_HO



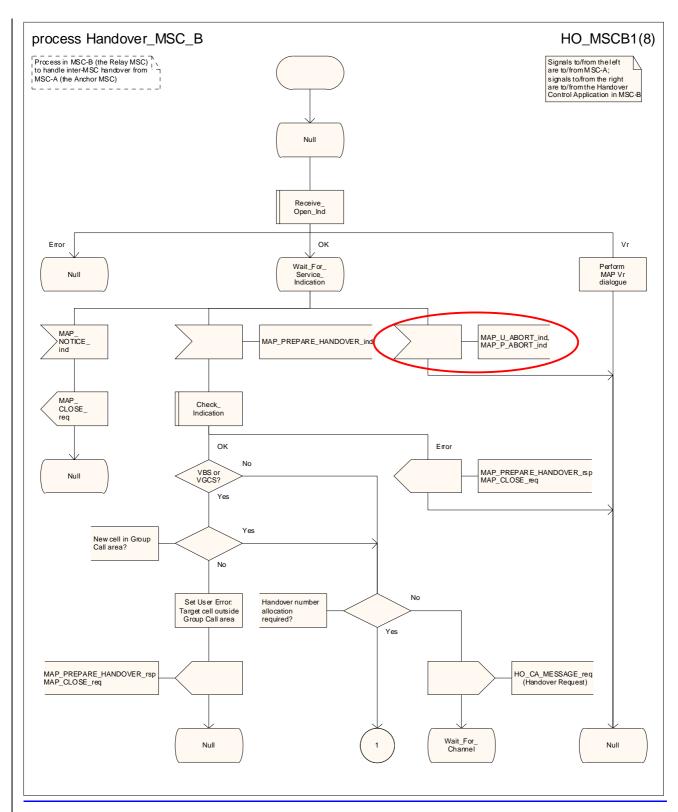
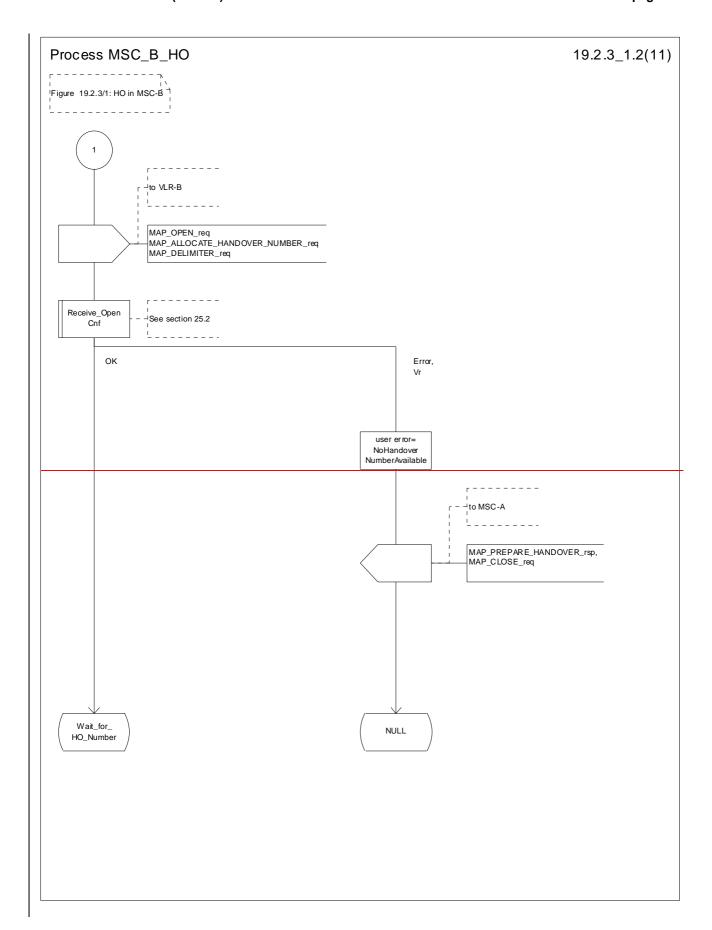


Figure 19.2/5.3/4 (sheet 1 of 844): Process HO\_MSC\_B\_HO



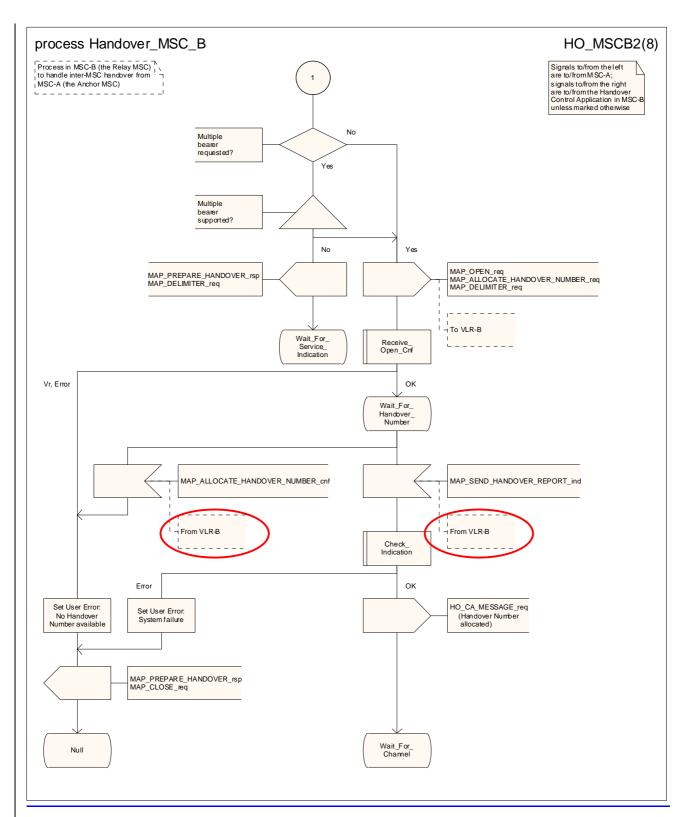
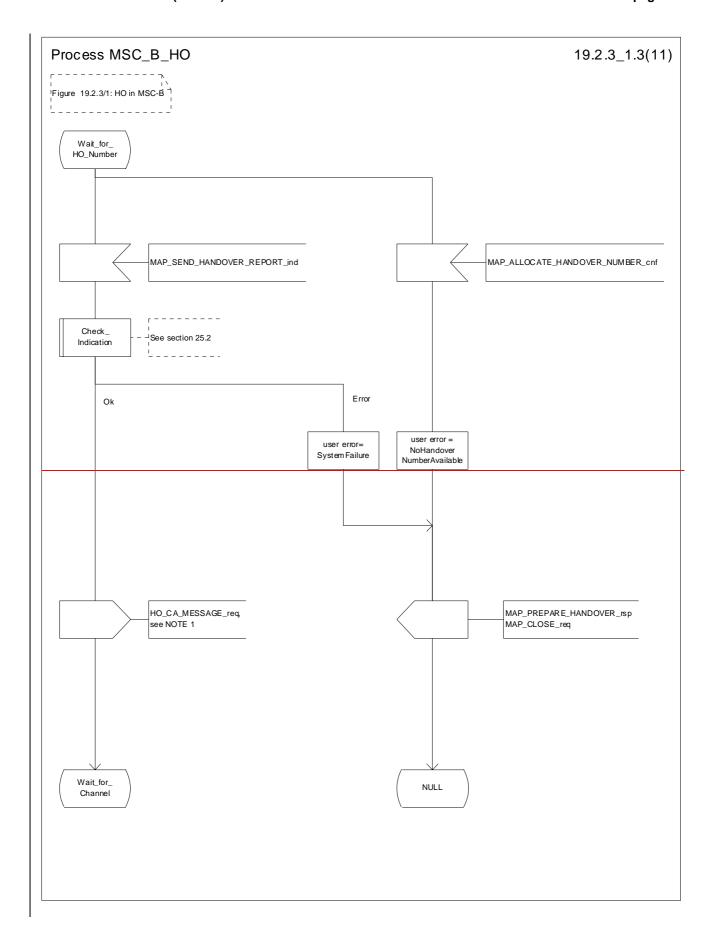


Figure 19.2/5.3/4 (sheet 2 of 814): Process HO\_MSC\_B\_HO



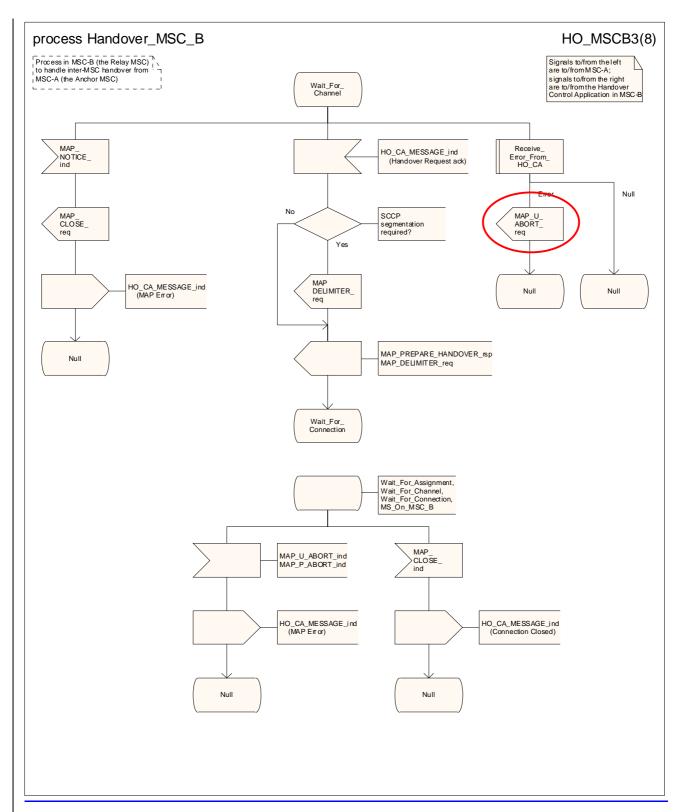
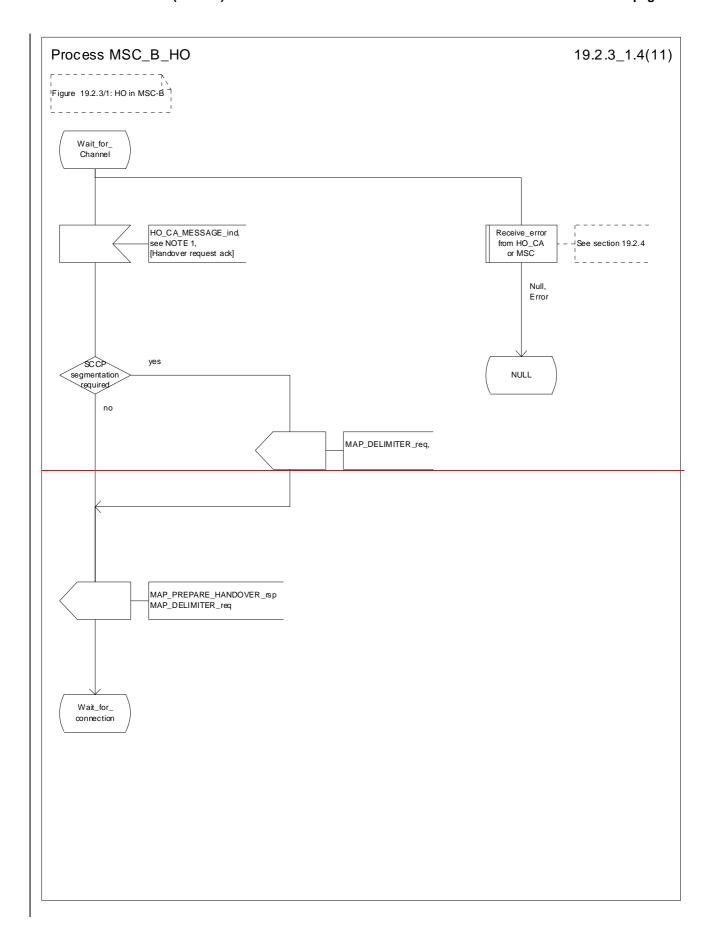


Figure 19.2/5.3/4 (sheet 3 of 814): Process HO\_MSC\_B\_HO



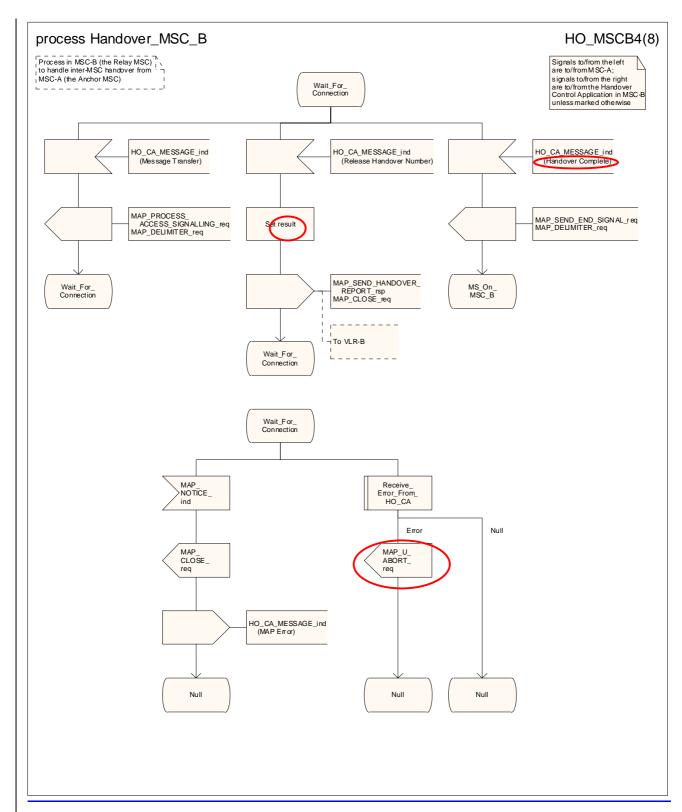
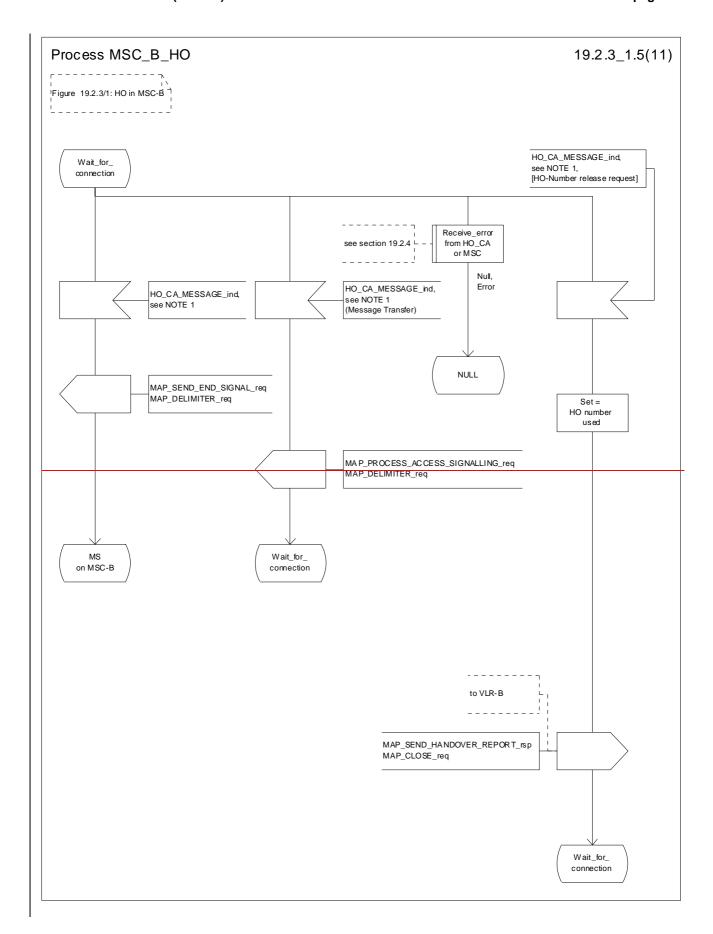


Figure 19.2/5.3/4 (sheet 4 of 814): Process HO\_MSC\_B\_HO



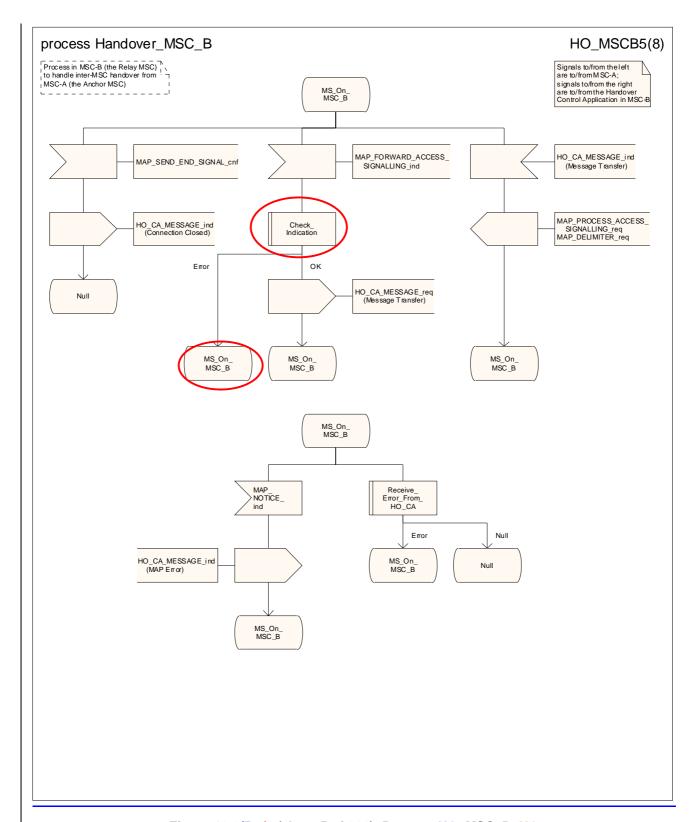
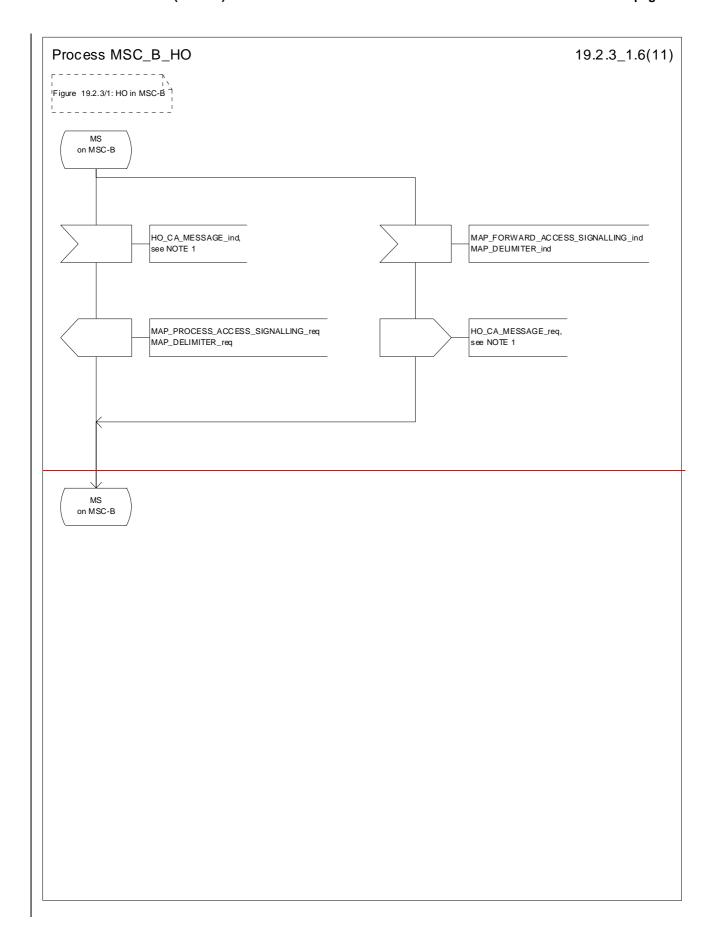


Figure 19.2/5.3/1 (sheet 5 of 811): Process HO\_MSC\_B\_HO



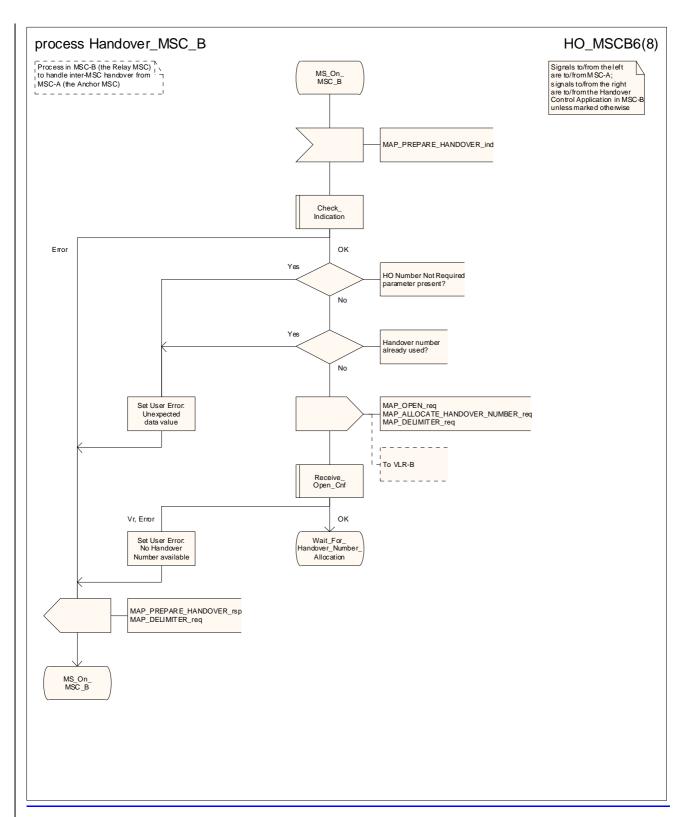
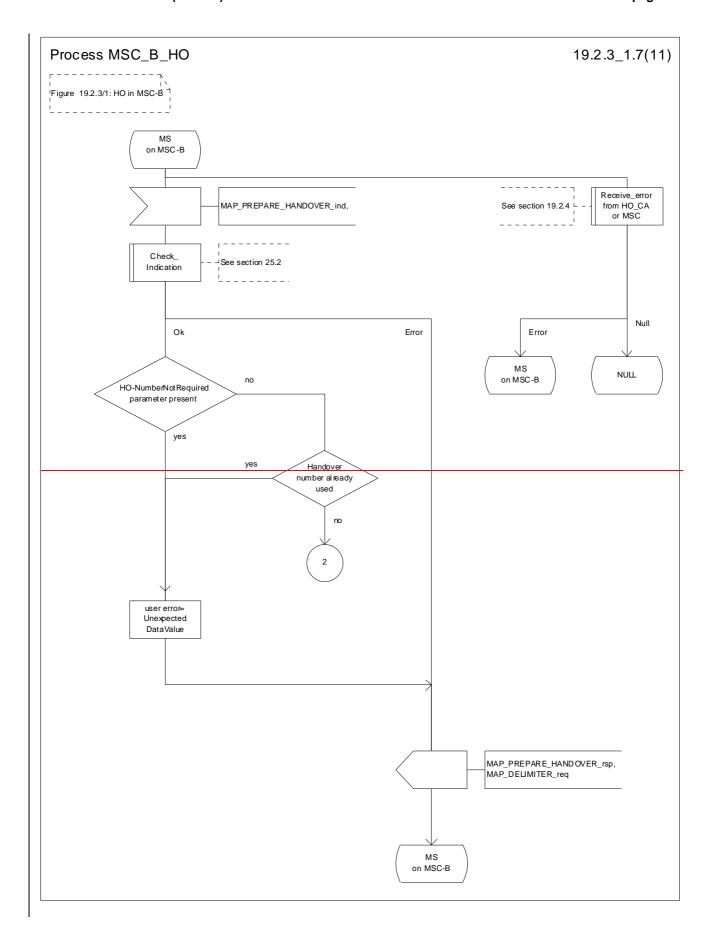


Figure 19.2/5.3/4 (sheet 6 of 814): Process HO\_MSC\_B\_HO



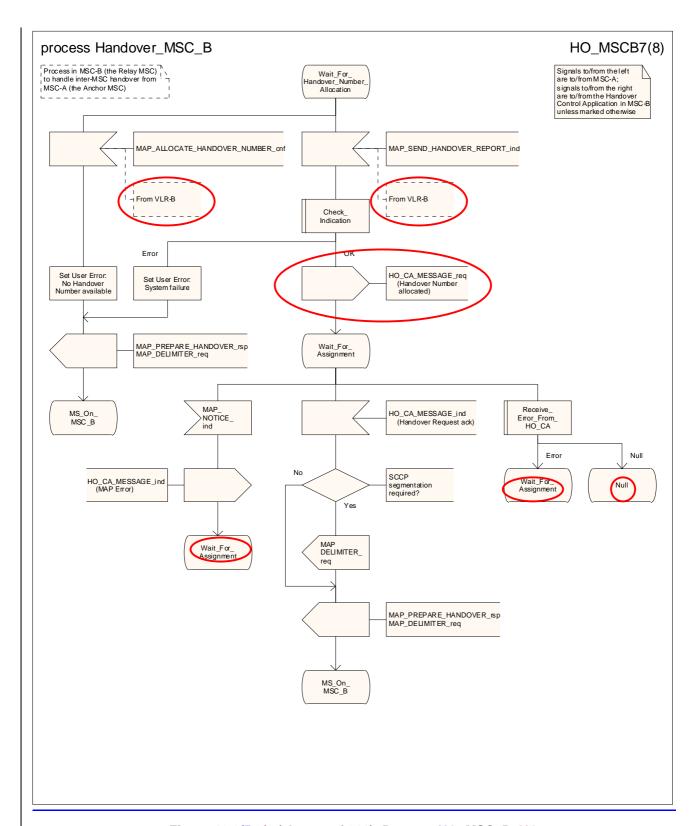
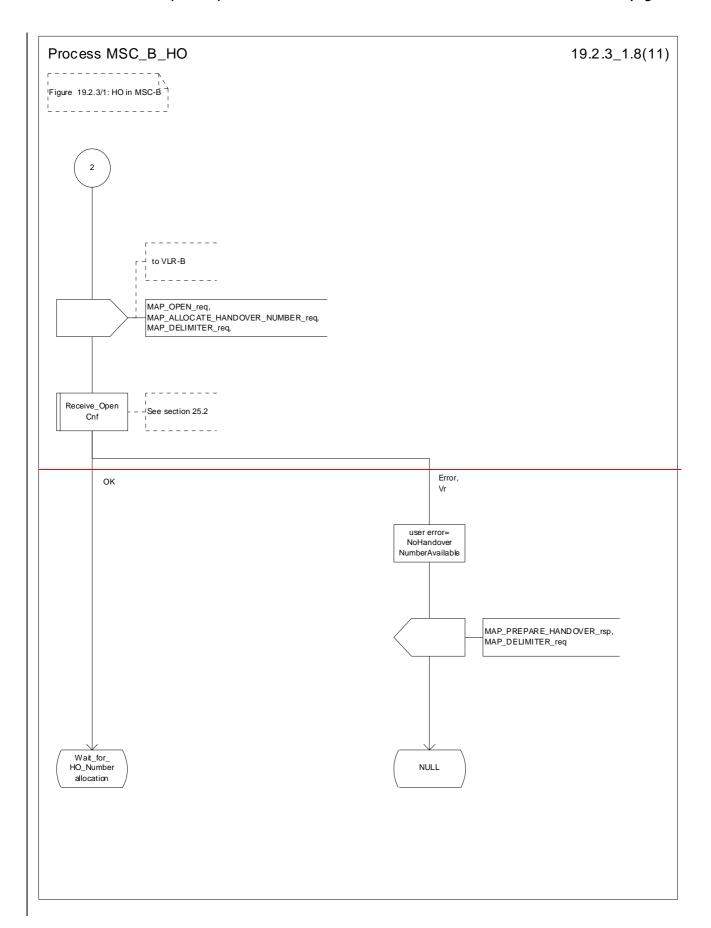


Figure 19.2/5.3/1 (sheet 7 of 811): Process HO\_MSC\_B\_HO



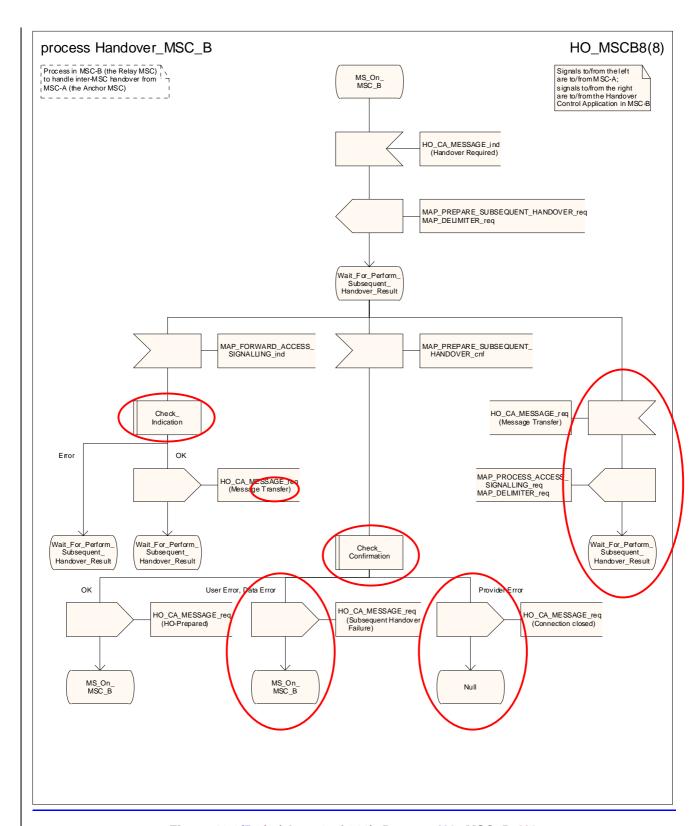


Figure 19.2/5.3/1 (sheet 8 of 811): Process HO\_MSC\_B\_HO

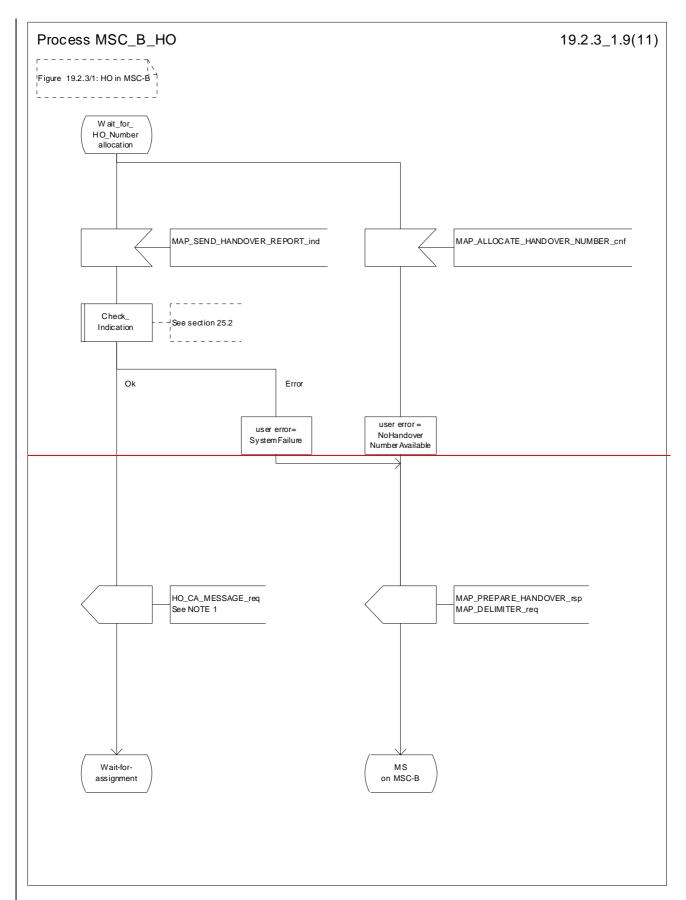


Figure 19.2.3/1 (sheet 9 of 11): Process MSC\_B\_HO

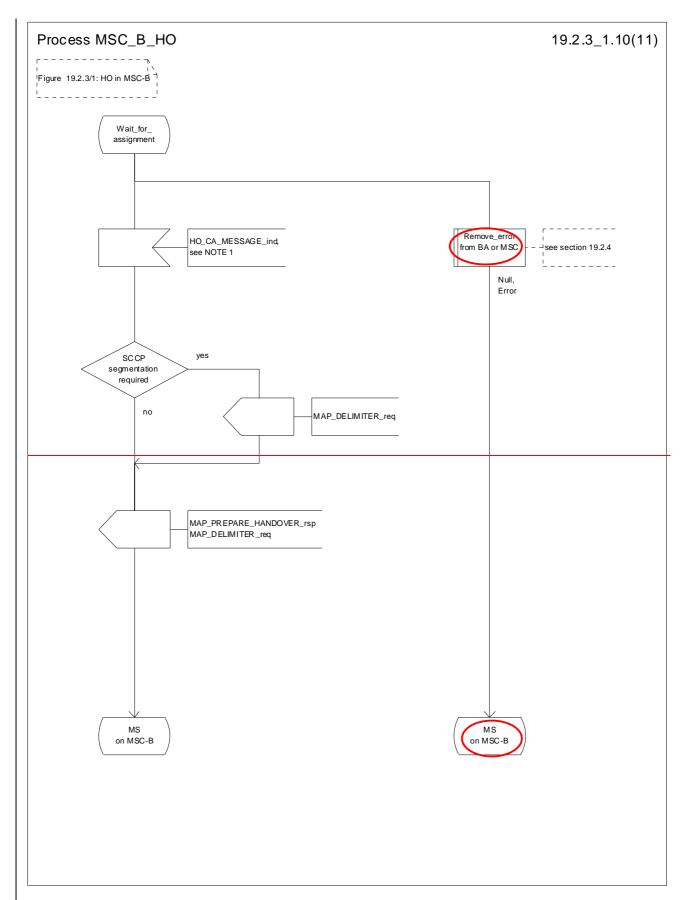


Figure 19.2.3/1 (sheet 10 of 11): Process MSC\_B\_HO

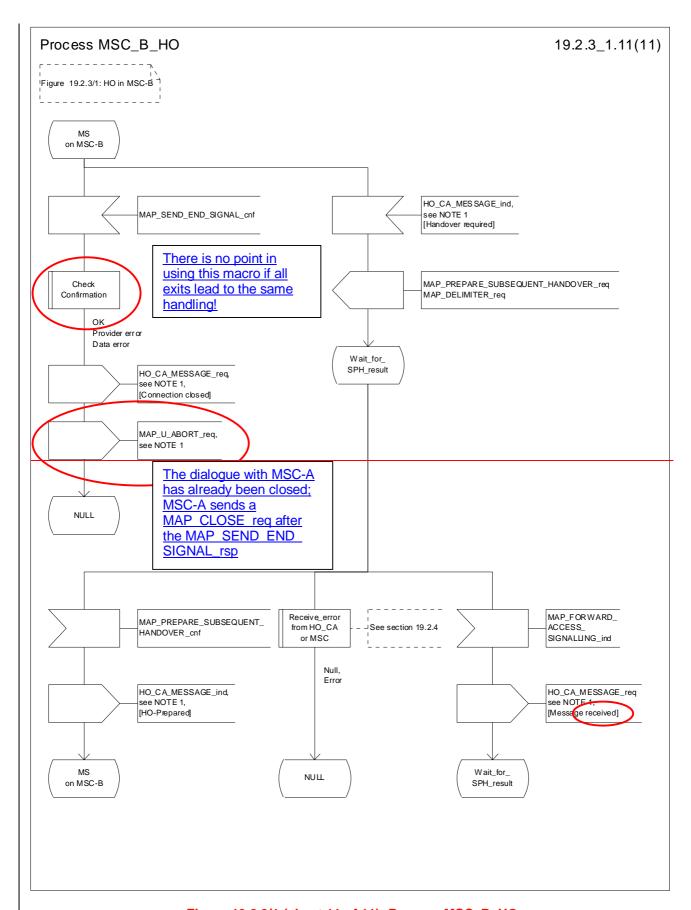
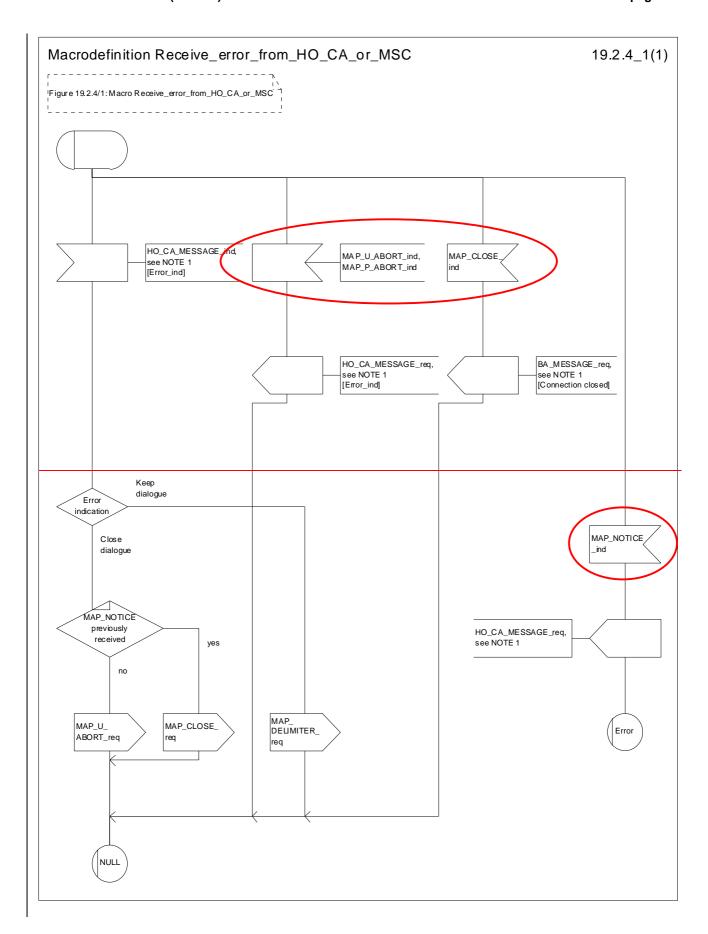


Figure 19.2.3/1 (sheet 11 of 11): Process MSC\_B\_HO



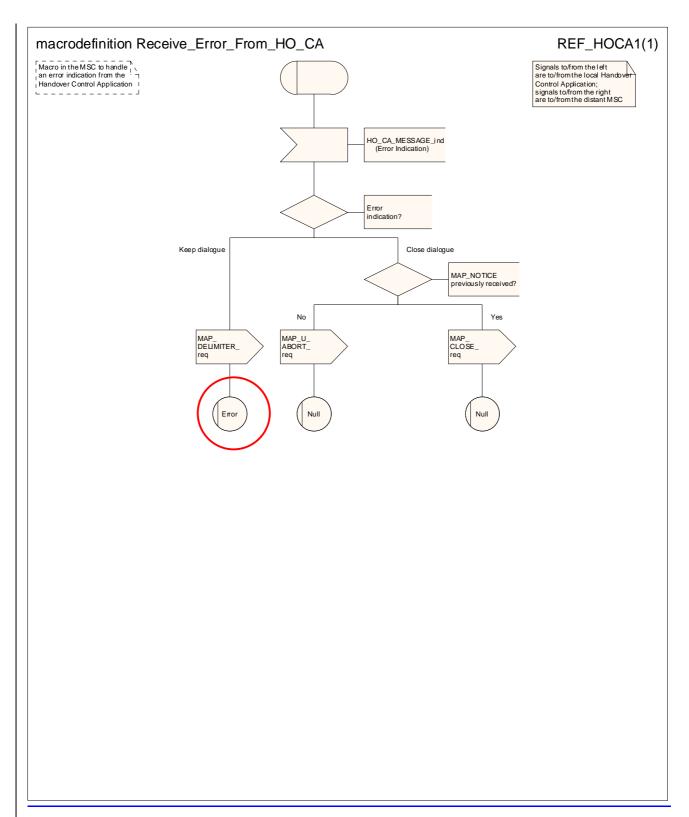
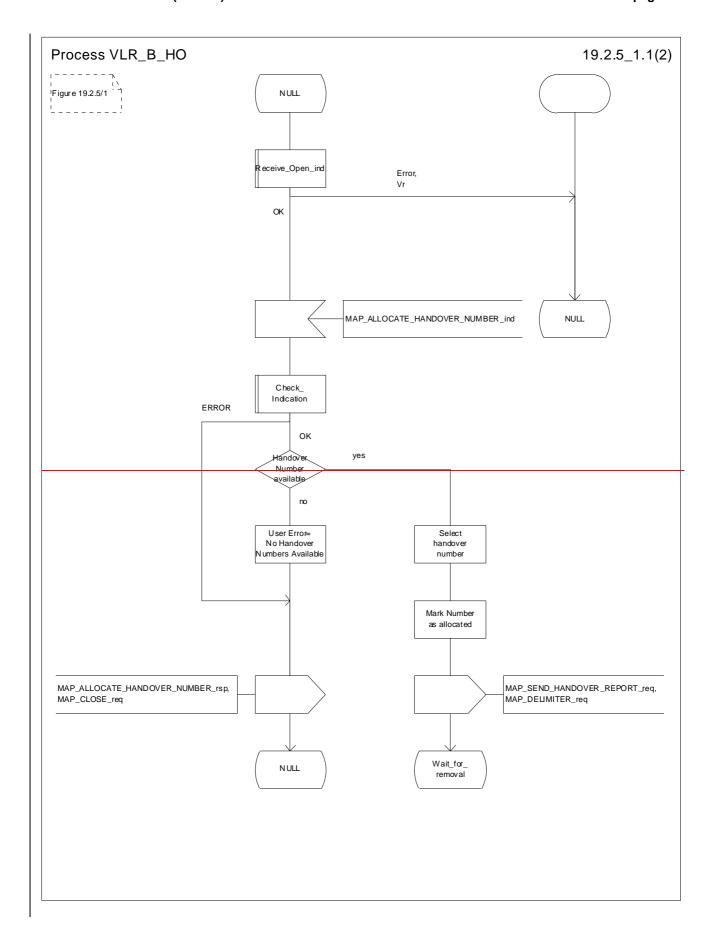


Figure 19.2/6.4/1: Macro Receive\_error\_from\_HO\_CA\_or\_MSC



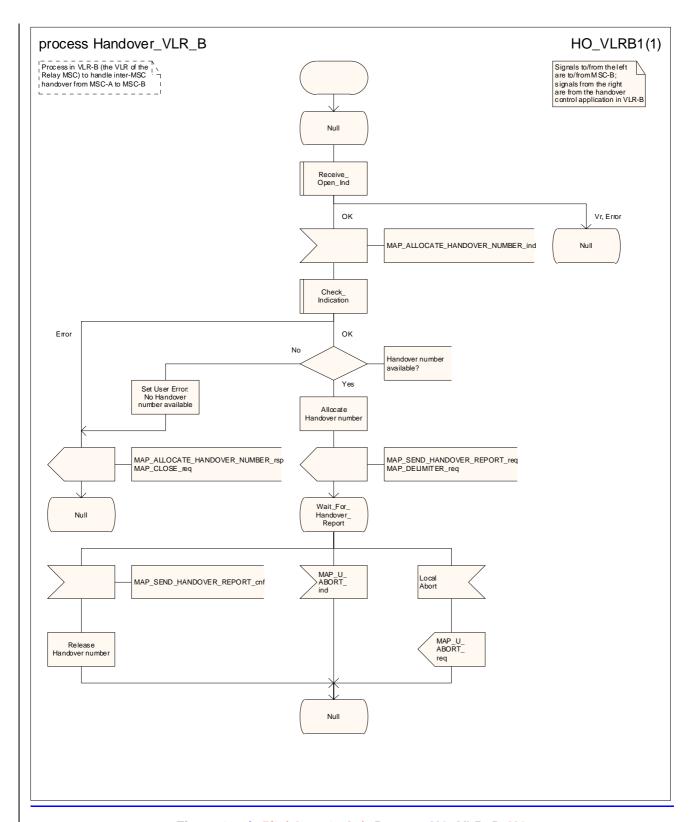


Figure 19.2/7.5/1 (sheet 1 of 2): Process HO\_VLR\_B\_HO

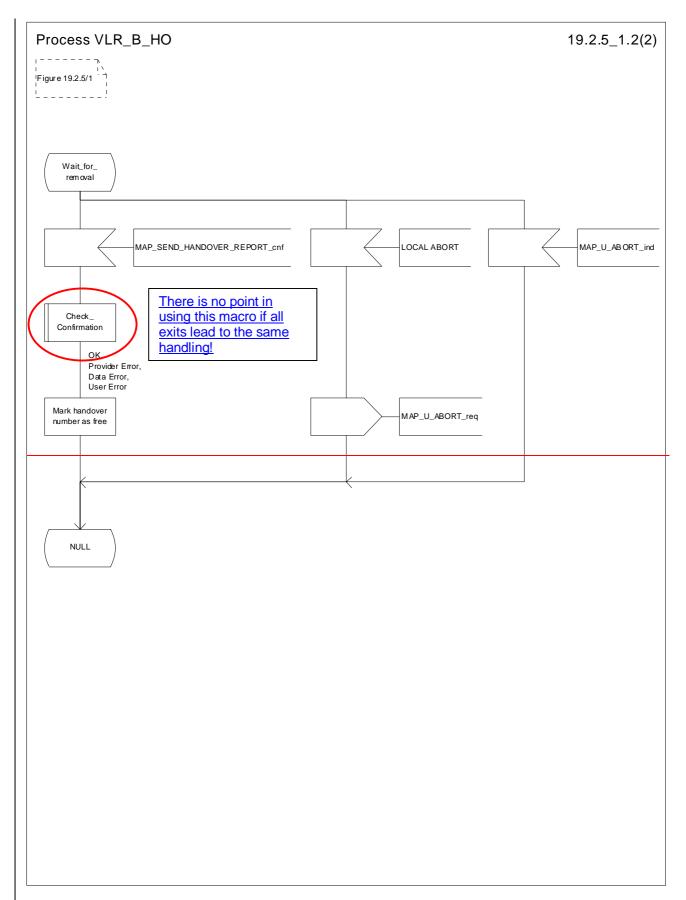


Figure 19.2.5/1 (sheet 2 of 2): Process VLR\_B\_HO

# 19.3 Fault recovery procedures

After a fault of When a location register has restarted after a fault, the fault recovery procedures ensure that the subscriber data in the VLR or in the SGSN become consistent with the subscriber data that are stored in the HLR for the MS concerned and that the location information in the HLR-, the VLR and the SGSN reflect accurately the current location of the MS.

The detailed stage 2 specification of fault recovery procedures of in location registers is given in 3GPP TS 23.007 [19].

## 19.3.1 VLR fault recovery procedures

## 19.3.1.1 General

Restoration of an IMSI record in a VLR can be triggered by a location registration request from the MS or by a request from the HLR for a roaming number to route a mobile terminated call to the MS. If the restoration is triggered by a location registration request from the MS, the VLR performs the location updating procedure described in 3GPP TS 23.012 [23] and subclause 19.1.1 of the present document. If the restoration is triggered by a request for a roaming number, the VLR provides the roaming number and triggers an independent dialogue to restore the subscriber data as described in 3GPP TS 23.018 [97]. The message flow for data restoration triggered by a request for a roaming number is shown in figure 19.3.1/1.

The following processes are involved with the restoration of one IMSI record in the VLR:

— In case of a location registration request from the MS:

Update\_Location\_Area\_VLR clause 19.1.1.3;

Update\_Location\_HLR clause 19.1.1.4.

— In case of a mobile terminated call:

PRN\_VLR clause 21.2.4;
RESTORE DATA VLR clause 21.2.4;

RESTORE DATA HLR clause 19.3.3:

ICS VLR clause 21.3.3.

After a restart, the VLR shall crase all IMSI records affected by the failure and shall cause all affected TMSIs and all affected LMSIs to become invalid. There will be no subscriber data or location information stored for an affected MS until after the VLR has received either a MAP\_PROVIDE\_ROAMING\_NUMBER indication or a MAP\_UPDATE\_LOCATION\_AREA indication for that MS. Restoration of subscriber data in the VLR is triggered individually for each IMSI record by receipt of either of these indications.

Reception of either a MAP\_UPDATE\_LOCATION\_AREA indication or a MAP\_PROVIDE\_ROAMING\_NUMBER indication with an IMSI that is unknown in the VLR causes creation of a skeleton IMSI record that is marked as:

- not confirmed by radio contact by the indicator "Confirmed by Radio Contact" (The function of this indicator is described in 3GPP TS 23.007 [19]); and
- not confirmed by HLR by the indicator "Confirmed by HLR" (The function of this indicator is described in 3GPP TS 23.007 [19]).

A third indicator "Location Information Confirmed in HLR" is allocated to each IMSI record in the VLR (The function of this indicator is described in 3GPP TS 23.007 [19]).

The indicator "Location Information Confirmed in HLR" shall be checked whenever authenticated radio contact with an MS has been established. The status "Not Confirmed" of this indicator shall force the VLR to invoke the MAP\_UPDATE\_LOCATION service but it shall never cause rejection of a mobile originated request. The status is changed from "Not Confirmed" to "Confirmed" only after successful completion of a MAP\_UPDATE\_LOCATION procedure for the MS concerned.

If the VLR serves only one MSC, the indicator "Location Information Confirmed in HLR" is only relevant to the HLR restoration procedure and an initial value must be assigned when an IMSI record is created in the VLR:

- if the IMSI record was created due to a roaming number request, the initial value must be set to "Confirmed";
- if reception of a MAP\_UPDATE\_LOCATION\_AREA indication causes creation of the IMSI record, the initial value must be "Not Confirmed".

If the VLR serves more than one MSC, the indicator "Location Information Confirmed in HLR" is used in the VLR restoration procedure as well as in the HLR restoration procedure. When an IMSI record is created in the VLR, the indicator must be set to "Not Confirmed".

#### VLR restoration triggered by a location registration request

Upon receipt of a MAP\_UPDATE\_LOCATION\_AREA indication, the VLR retrieves authentication data from the HLR by using the MAP\_SEND\_AUTHENTICATION\_INFO service if authentication is required and if no authentication data are available in the VLR for the IMSI concerned (see figure 19.1.1/6).

Receipt of a MAP\_UPDATE\_LOCATION\_AREA indication for an MS whose IMSI is unknown in the VLR or whose data stored in the VLR are marked as "Not Confirmed" by the indicator "Confirmed by HLR" and/or by the indicator "Location Information Confirmed in HLR" forces the VLR to invoke the MAP\_UPDATE\_LOCATION service after successful authentication, if required. The location updating procedure is performed as described in clause 19.1.

Any other mobile originated request from an MS whose IMSI is unknown in the VLR or whose subscriber data stored in the VLR are marked as "Not Confirmed" by the indicator "Confirmed by HLR" shall be rejected with error cause "Unidentified Subscriber". This causes the MS to trigger the location registration procedure.

After successful completion of the MAP\_UPDATE\_LOCATION procedure, the indicators "Confirmed by HLR" and "Location Information Confirmed in HLR" are set to "Confirmed".

The indicator "Confirmed by Radio Contact" is set to "Confirmed" when the radio contact with the MS is authenticated.

### VLR restoration triggered by a roaming number request

Figure 19.3/1 illustrates the signalling sequence for restoration of an IMSI record in the VLR triggered by a mobile terminating call set up.

Upon receipt of a MAP\_PROVIDE\_ROAMING\_NUMBER indication for an IMSI that is unknown in the VLR and for which authentication is required, the VLR retrieves authentication data from the HLR by using the MAP\_SEND\_AUTHENTICATION\_INFO service after an MSRN has been sent to the HLR in the MAP\_PROVIDE\_ROAMING\_NUMBER response.

Receipt of a MAP\_PROVIDE\_ROAMING\_NUMBER indication for an MS whose IMSI is unknown in the VLR or whose data record in the VLR is marked as "Not Confirmed" by the indicator "Confirmed by HLR" forces the VLR to request subscriber data from the HLR by sending a MAP\_RESTORE\_DATA request which triggers one or more INSERT\_SUBSCRIBER\_DATA operations from the HLR. The MAP\_RESTORE\_DATA request may also be used to send the LMSI to the HLR.

The MAP\_RESTORE\_DATA process in the VLR is described in clause 21.2.4.

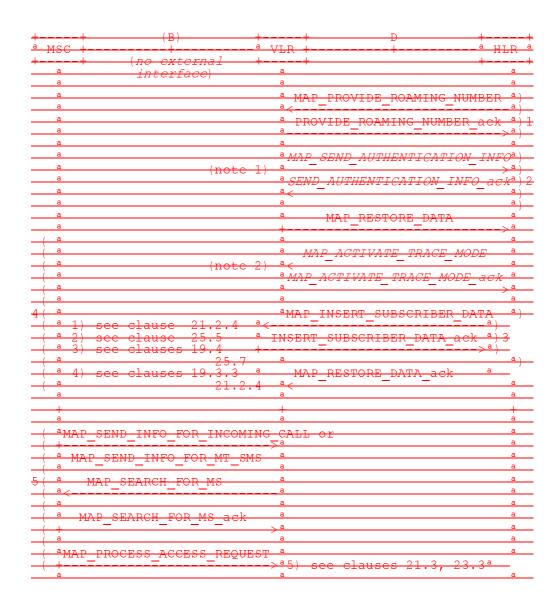
The MAP\_RESTORE\_DATA process in the HLR is described in clause 19.3.3.

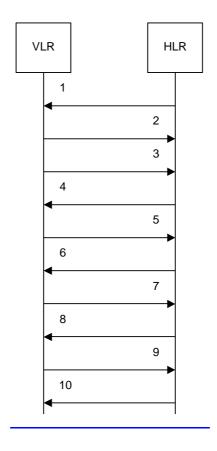
After successful completion of the MAP\_RESTORE\_DATA procedure, the indicator "Confirmed by HLR" is set to "Confirmed".

If restoration of an IMSI record was triggered by a MAP\_PROVIDE\_ROAMING\_NUMBER indication (i.e. by a mobile terminating call), the VLR has no valid Location Area Identity information for the MS concerned before successful establishment of the first authenticated radio contact. Upon receipt of a MAP\_SEND\_INFO\_FOR\_INCOMING\_CALL indication from the MSC (see 5 in figure 19.3/1) for an MS whose subscriber data are marked as "Confirmed" by the indicator "Confirmed by HLR" but not confirmed by radio contact, the VLR shall invoke a "MAP\_SEARCH\_FOR\_MS" instead of a "MAP\_PAGE".

A MAP\_SEARCH\_FOR\_MS shall also be performed if the VLR receives a MAP\_SEND\_INFO\_FOR\_MT\_SMS indication from the MSC for an MS whose IMSI record is marked as "Confirmed" by the indicator "Confirmed by HLR" but not confirmed by radio contact.

The indicator "Confirmed by Radio Contact" is set to "Confirmed" when authenticated radio contact caused by a mobile originated or a mobile terminated activity is established.





- 1) MAP PROVIDE ROAMING NUMBER req/ind
- MAP\_PROVIDE\_ROAMING\_NUMBER\_rsp/cnf
- 3) MAP SEND AUTHENTICATION INFO reg/ind (Note 1, note 2)
- 4) MAP\_SEND\_AUTHENTICATION\_INFO\_rsp/cnf (Note 1, note 2)
- 5) MAP RESTORE DATA req/ind
- 6) MAP\_ACTIVATE\_TRACE\_MODE\_reg/ind (Note 1, note 3)
- 7) MAP ACTIVATE TRACE MODE rsp/cnf (Note 1, note 3)
- 8) MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind
- 9) MAP INSERT SUBSCRIBER DATA rsp/cnf 10) MAP\_RESTORE\_DATA\_rsp/cnf

NOTE 1: Services printed in italics are optional.

NOTE 2: If authentication is required.

NOTE 32: If subscriber tracing is active in the HLR.

Figure 19.3.1/1: Procedures related to Message flow for VLR restoration of VLR in case of at mobile terminated call set-up

## 19.3.1.2 Procedure in the VLR

The procedure in the VLR to handle a dialogue for subscriber data restoration is defined in subclause 21.2.6 of the present document.

## 19.3.<u>1.</u>3 VLR restoration: the restore data pProcedure in the HLR

The MAP process in the HLR to handle a request for data restoration in the VLR is shown in figure 19.3.1/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Check\_Indication see subclause 25.2.1;

Control\_Tracing\_With\_VLR\_HLR see subclause 25.9.6.

The MAP\_RESTORE\_DATA procedure in the HLR (Process RESTORE\_DATA\_HLR) is described in this clause; the corresponding procedure in the VLR (RESTORE\_DATA\_VLR) is described in clause 21.2.4.

The process RESTORE\_DATA\_HLR makes use of the following macros:



The MAP\_RESTORE\_DATA service is invoked by the VLR after provision of a roaming number in response to a MAP\_PROVIDE\_ROAMING\_NUMBER indication for an unidentified MS (i.e. IMSI unknown in VLR), or for a known MS whose IMSI record is marked as "Not Confirmed" by the indicator "Confirmed by HLR" (see 4 in figure 19.3/1). The process RESTORE\_DATA\_VLR is shown in figure 21.2/6.

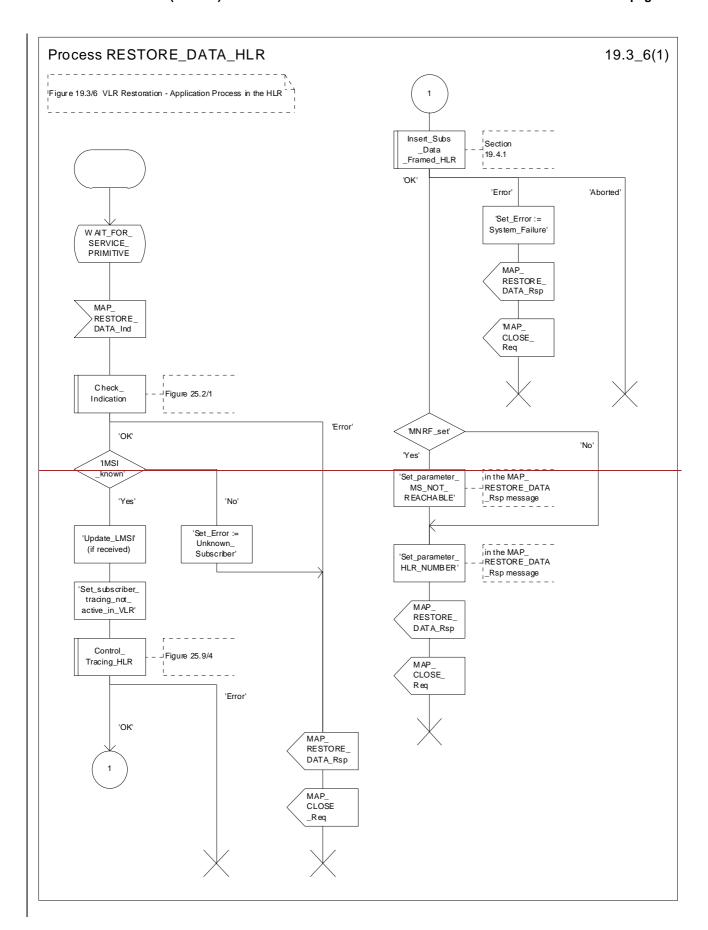
The restore data process in the HLR is activated by receipt of a MAP\_RESTORE\_DATA indication from the VLR (see figure 19.3/6). If there is a parameter problem in the indication, either of the errors "Unexpected Data Value" or "Data Missing" is returned in the MAP\_RESTORE\_DATA response; if the subscriber is not known in the HLR, the error "Unknown Subscriber" is returned in the MAP\_RESTORE\_DATA response. In all of these cases the process in the HLR terminates.

If the MAP\_RESTORE\_DATA indication is accepted and if the LMSI is received, the HLR updates the LMSI for the IMSI received in the MAP\_RESTORE\_DATA indication. For this IMSI the HLR sets "subscriber tracing not active in VLR" and checks whether tracing is required. This check is handled by the macro "Control\_Tracing\_HLR" that is described in clause 25.9. Thereafter, the macro "Insert\_Subs\_Data\_Framed\_HLR" that is described in clause 19.4 is invoked. The outcome of the macro Insert\_Subs\_Data\_Framed\_HLR is one of:

- abort, in which case the process terminates;
- error, in which case the HLR returns the error "System Failure" in the MAP\_RESTORE\_DATA response, and the process terminates;
- OK, indicating successful outcome of downloading the subscriber data to the VLR.

After successful completion of the framed MAP\_INSERT\_SUBSCRIBER\_DATA procedure, the HLR Number and, if applicable, the "MS Not Reachable Flag" which is used for SMS, are provided in the MAP\_RESTORE\_DATA response.

Upon receipt of the MAP\_RESTORE\_DATA confirmation, the VLR behaves as described in clause 21.2.4, figure 21.2/6.



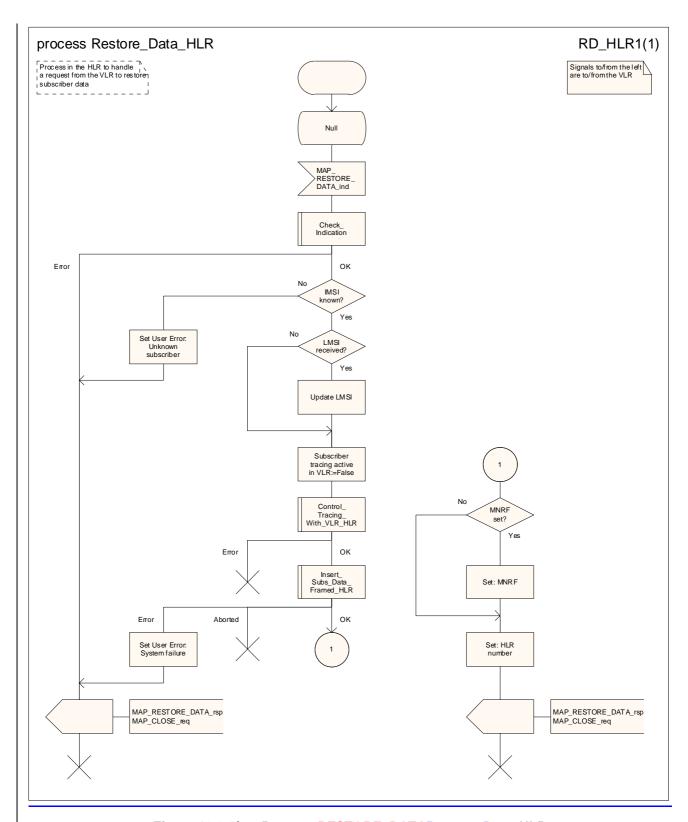


Figure 19.3.1/26: Process RESTORE\_DATARestore Data\_HLR

## 19.3.2 HLR fault recovery procedures

## 19.3.2.1 General

The following processes are involved with the restart of the HLR:

```
HLR_RESTART clause 19.3.2;

REC_RESET_IN_VLR clause 19.3.2;

REC_RESET_IN_SGSN clause 19.3.2.
```

In the case of a location registration request from the MS, the following processes are involved with the HLR restoration procedure:

```
    Update_Location_Area_VLR clause 19.1.1.3;
    Update_Location_HLR clause 19.1.1.4;
    Update_GPRS_Location_HLR clause 19.1.1.4;
    GPRS_Update_Location_Area_VLR clause 19.1.1.3;
    SGSN_Update_HLR clause 19.1.1.8.
```

In the case of a mobile originated service request, the

- Macro Process\_Access\_Request\_VLR clause 25.4.2; and the
- Process Update\_Location\_HLR clause 19.1.1.4,

are involved with the HLR restoration procedure.

For the HLR, periodic back-up of data to non-volatile memory is mandatory.

Data that have been changed in the period of time after the last back-up storage and before the restart of the HLR cannot be recovered by reload from the non-volatile memory. Therefore, a restoration procedure is triggered individually for each IMSI record that has been affected by the HLR fault at the first authenticated radio contact that is established with the MS concerned.

The HLR restoration procedure forces updating of MSC number, VLR number, SGSN number and, if provided by the VLR, LMSI in the HLR. Consistency of subscriber data that are stored in the VLR or in the SGSN for an MS that has been affected by a HLR fault with the subscriber data stored in the HLR for this MS will be achieved.

As an implementation option, a notification can be forwarded to the MS to alert the subscriber to check the parameters for supplementary services that allow subscriber controlled input (MAP\_FORWARD\_CHECK\_SS\_INDICATION service). If the VLR receives this notification from the HLR it shall forward the notification to the MS. If the Gs-interface is <a href="mailto:present-implemented">present-implemented</a> the VLR shall not forward this notification.

The message flow for HLR restoration for a non-GPRS subscriber is shown in figure 19.3.2/1.

The message flow for HLR restoration for a GPRS subscriber is shown in figure 19.3.2/2.

Figures 19.3/2 and 19.3/9 illustrates the signalling sequence for HLR restoration.

After a restart, the home location register performs the following actions for the subscriber data records that have been affected by the HLR fault (see figure 19.3/3):

- reload all data from the non-volatile back-up;
- if the MAP\_FORWARD\_CHECK\_SS\_INDICATION service is implemented, mark each subscriber record "SS Check Required" by setting the "Check SS" indicator;
- set subscriber tracing deactive in the VLR for each of its Mss;
- reset the "MS Purged" flag for each of its MSs;

- send a MAP\_RESET request to the VLRs where its MSs are located (see figure 19.3/4).
- send a MAP RESET request to the SGSNs where its MSs are located (see figure 19.3/7).

The MAP\_RESET request contains the HLR number and optionally the HLR Identity List.

When receiving a MAP\_RESET indication, the VLR or the SGSN will derive all involved MSs of that HLR either from the HLR Identity List (if present), or from the HLR number. The VLR or the SGSN will then mark these MSs with the indicator "Location Information Confirmed in HLR" set to "Not Confirmed" and will deactivate all subscriber tracings for these Mss (see figures 19.3/5 and 19.3/8).

The status "Not Confirmed" of the indicator "Location Information Confirmed in HLR" forces the VLR to invoke the MAP\_UPDATE\_LOCATION service after establishment of authenticated radio contact with the MS concerned.

Also the status "Not Confirmed" of the indicator "Location Information Confirmed in HLR" forces the SGSN to invoke the MAP\_UPDATE\_GPRS\_LOCATION service after establishment of authenticated radio contact with the MS concerned.

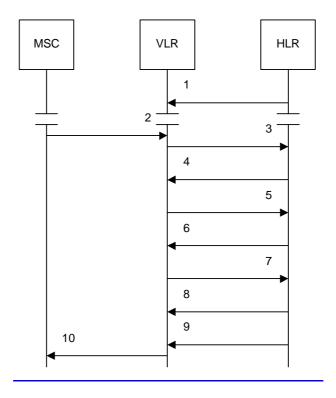
The MAP\_UPDATE\_LOCATION procedure is performed as described in clause 19.1.

After receipt of the MAP\_UPDATE\_LOCATION or the MAP\_UPDATE\_GPRS\_LOCATION acknowledgement containing the HLR number, the status of the indicator "Location Information Confirmed in HLR" is changed to "Confirmed".

If the MAP\_UPDATE\_LOCATION procedure is unsuccessful for any reason, the status of the indicator "Location Information Confirmed in HLR" remains unchanged except for the case that the IMSI record in the VLR is deleted because either of the errors "Unknown Subscriber" or "Roaming Not Allowed" has been received from the HLR in response to a MAP\_UPDATE\_LOCATION request.

If the MAP\_UPDATE\_GPRS\_LOCATION procedure is unsuccessful for any reason, the status of the indicator "Location Information Confirmed in HLR" remains unchanged except for the case that the IMSI record in the SGSN is deleted because either of the errors "Unknown Subscriber" or "Roaming Not Allowed" has been received from the HLR in response to a MAP\_UPDATE\_GPRS\_LOCATION request.

	- D +		-+ (B)	+
HLR	a	VLR	<del></del>	a MSC
a	MAP RESET	a	-+ (no external	a
+		_ <u>&gt;</u> a	interrace)	a
a		a		a
a		aa 1	MAP UPDATE LOCATION AR	<u>д∧ а</u>
a		aa (		a
a		a a M	AP PROCESS ACCESS REOUI	zgm a
a	MAP UPDATE LOCATION	a a <		a a
a <	<u> </u>	a a		a
а му	AP ACTIVATE TRACE MODE	a	)	a
a		<u> → a</u>	<del>) If subscriber tracin</del>	g <u>a</u>
<u>a</u> 2	<del>ACTIVATE TRACE MODE ack</del>	<u>a</u>	<del>) is active in HLR.</del>	a a
_ a <		a		a
<u>a</u> M	AP INSERT SUBSCR DATA	a	•	a
+		<u> </u>		a
a I	NSERT SUBSCR DATA ack	a		a
a <		a		a
<u>а М</u> Л	P UPDATE LOCATION ack	a	MAP FORWARD CHECK SS	a
<del>&gt;+</del>		<del>-&gt;+-</del>		- <u>a</u>
a and	<del>l map forward check ss</del>	a a	- INDICATION	a
a	<del>- INDICATION (optional</del>	<del>7 a</del>	<del>(if received from HL</del>	<del>R) a</del>

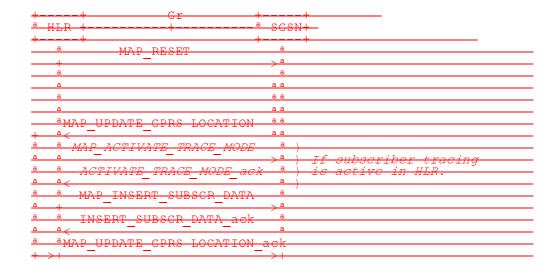


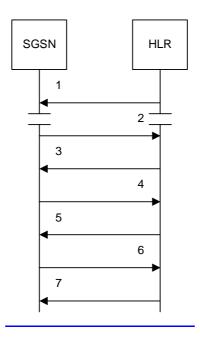
- MAP\_RESET\_reg/ind
- MAP PROCESS ACCESS REQUEST reg/ind
- MAP UPDATE LOCATION reg/ind 3)
- 4) MAP\_ACTIVATE\_TRACE\_MODE\_reg/ind (Note 1, Note 2)
- 5) MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 1, Note 2)
- MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind 6)
- MAP INSERT SUBSCRIBER DATA rsp/cnf MAP\_UPDATE\_LOCATION\_rsp/cnf 7)
- 8)
- MAP\_FORWARD\_CHECK\_SS\_INDICATION\_req/ind (Note 1) 9)
- MAP\_FORWARD\_CHECK\_SS\_INDICATION\_reg/ind (Note 1) 10)

NOTE 1: Services printed in italics are optional. NOTE 2: If subscriber tracing is active in the HLR.

### Figure 19.3.2/1: Message flow for HLR restoration (non-GPRS)

Figure 19.3/2: Procedures related to restoration of HLR





- MAP RESET reg/ind
- MAP UPDATE GPRS LOCATION reg/ind
- 3) MAP\_ACTIVATE\_TRACE\_MODE\_reg/ind (Note 1, Note 2)
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 1, Note 2) 4)
- 5) MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind
- MAP INSERT SUBSCRIBER DATA rsp/cnf MAP\_UPDATE\_GPRS\_LOCATION\_rsp/cnf 7)

NOTE 1: Services printed in italics are optional. NOTE 2: If subscriber tracing is active in the HLR.

Figure 19.3.2/2: Message flow for HLR restoration (GPRS)

Figure 19.3/9: Procedures related to restoration of HLR for GPRS

#### 19.3.2.2 Procedure in the HLR

The MAP process in the HLR to notify the relevant serving nodes that the HLR has restarted is shown in figure 19.3.2/3.

The SGSN address list includes one instance of the address of each SGSN in which (according to the HLR data retrieved from the non-volatile memory) there is at least one subscriber registered who is affected by the HLR restart.

The VLR address list includes one instance of the address of each VLR in which (according to the HLR data retrieved from the non-volatile memory) there is at least one subscriber registered who is affected by the HLR restart.

The MAP process in the HLR to notify a VLR that the HLR has restarted is shown in figure 19.3.2/4. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Cnf see subclause 25.1.2.

The MAP process in the HLR to notify an SGSN that the HLR has restarted is shown in figure 19.3.2/5. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Cnf see subclause 25.1.2.

#### Procedure in the VLR 19.3.2.3

The MAP process in the VLR to handle a notification that an HLR has restarted is shown in figure 19.3.2/6. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

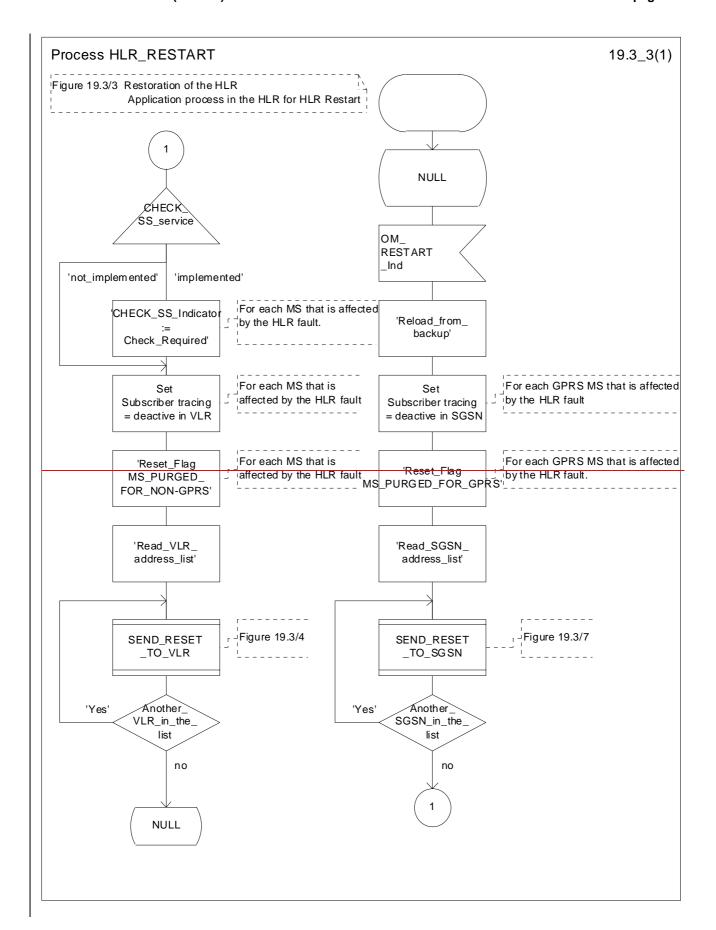
The VLR uses the HLR number or the HLR identity list included in the MAP\_RESET indication to identify the IMSI records which are affected by the HLR restart.

#### 19.3.2.4 Procedure in the SGSN

The MAP process in the SGSN to handle a notification that an HLR has restarted is shown in figure 19.3.2/6. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

The SGSN uses the HLR number or the HLR identity list included in the MAP\_RESET indication to identify the IMSI records which are affected by the HLR restart.



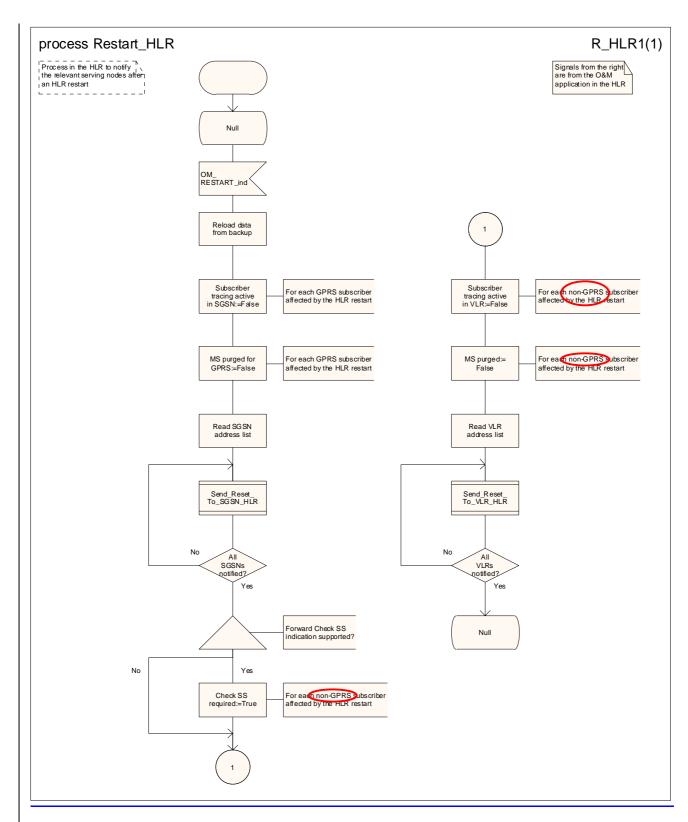
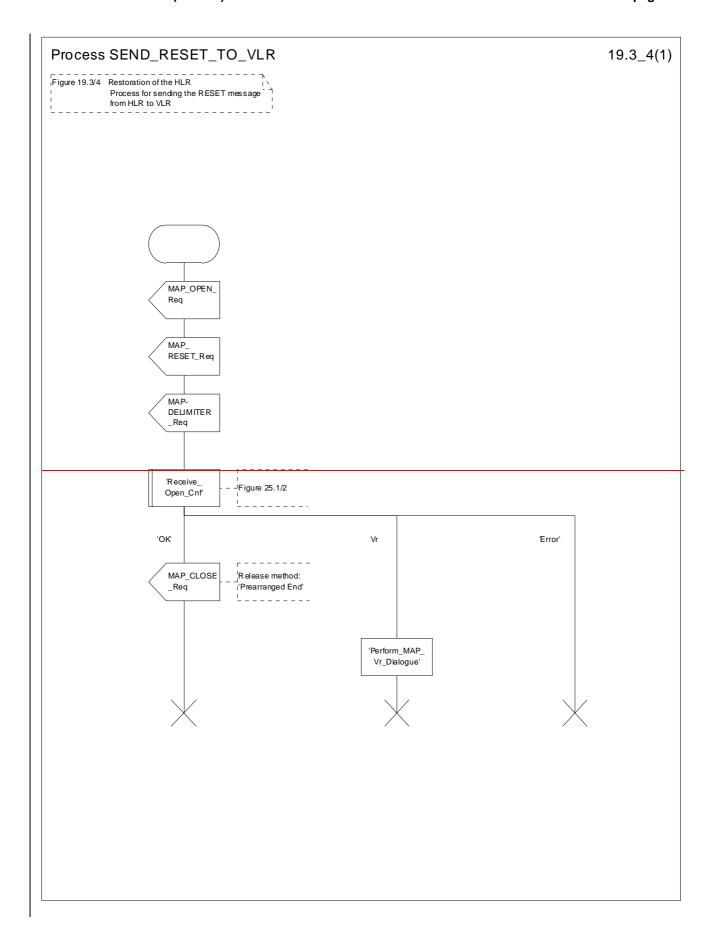


Figure 19.3.2/3: Process Restart\_HLR\_RESTART



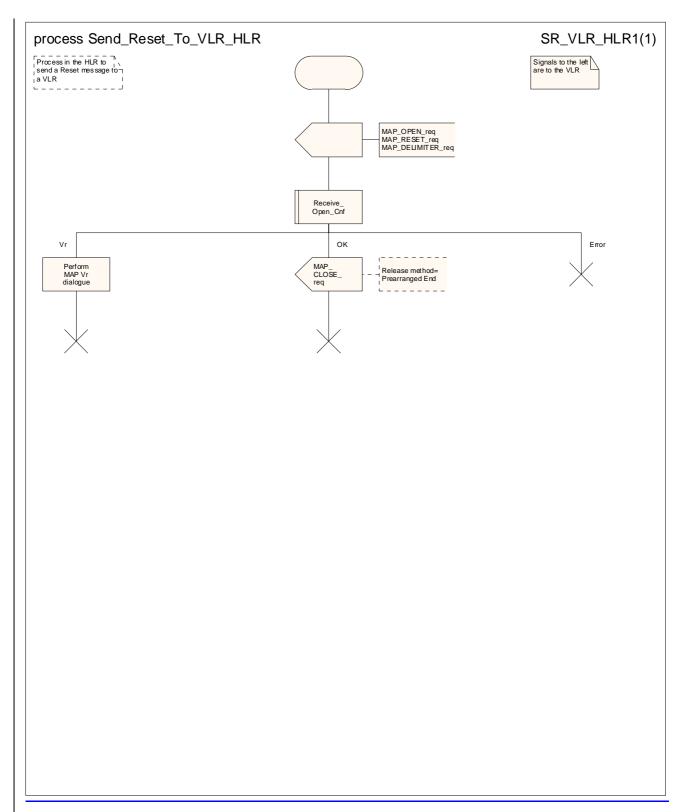
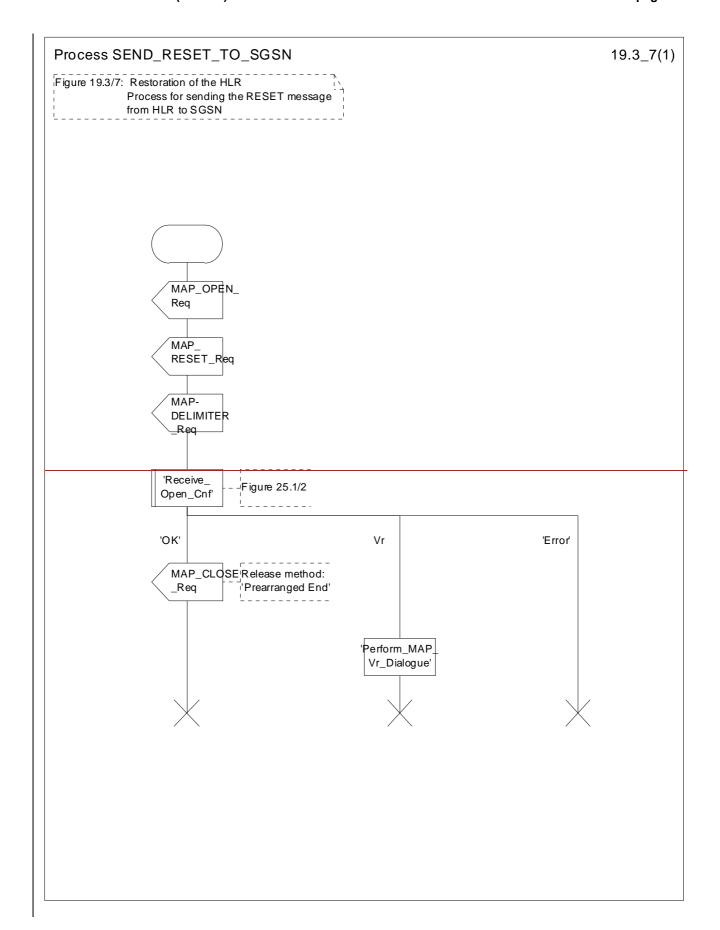


Figure 19.3.2/4: Process SEND\_RESET\_TOSend Reset To\_VLR\_HLR



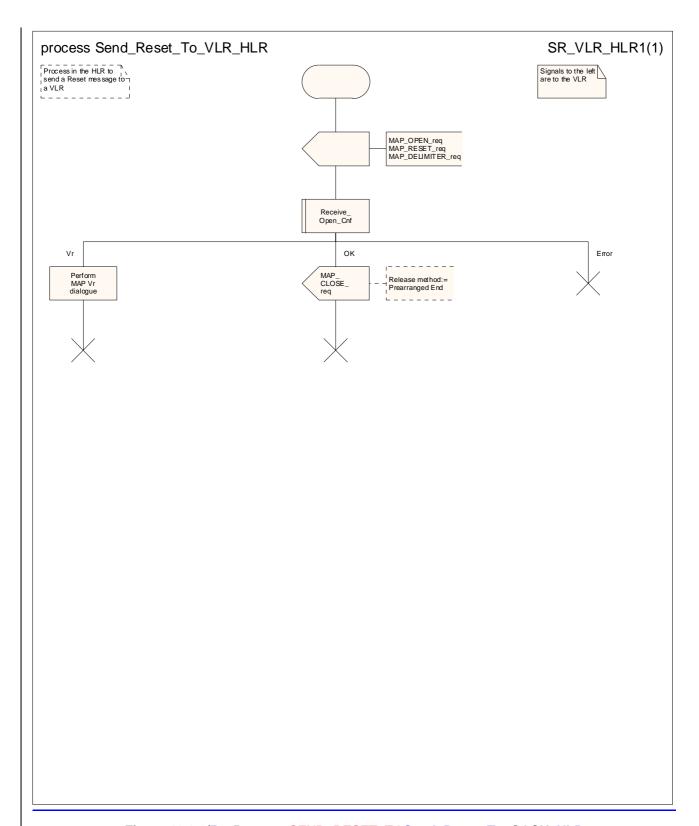
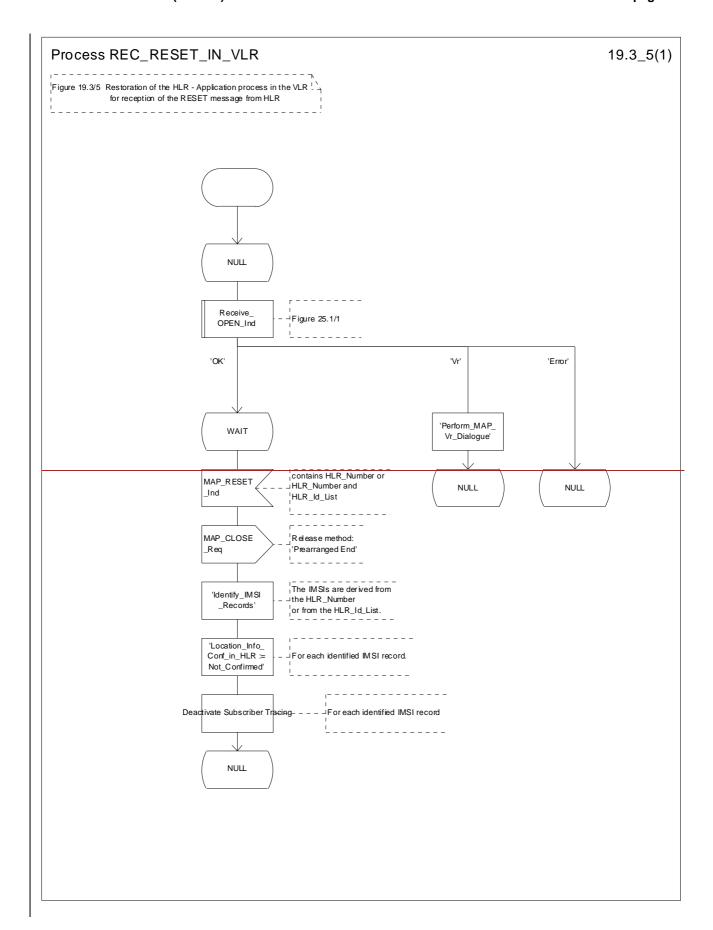


Figure 19.3.2/57: Process SEND\_RESET\_TOSend Reset To\_SGSN\_HLR



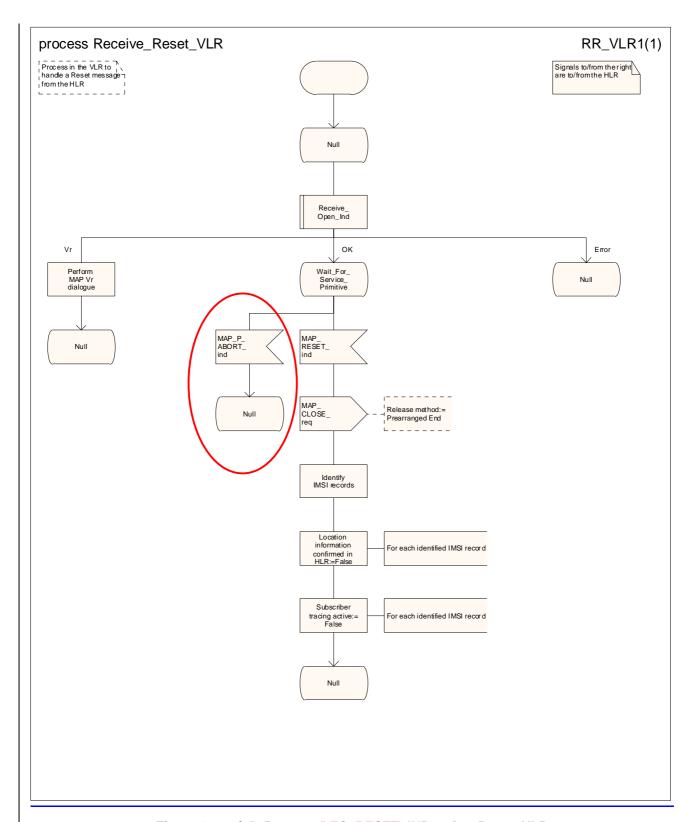
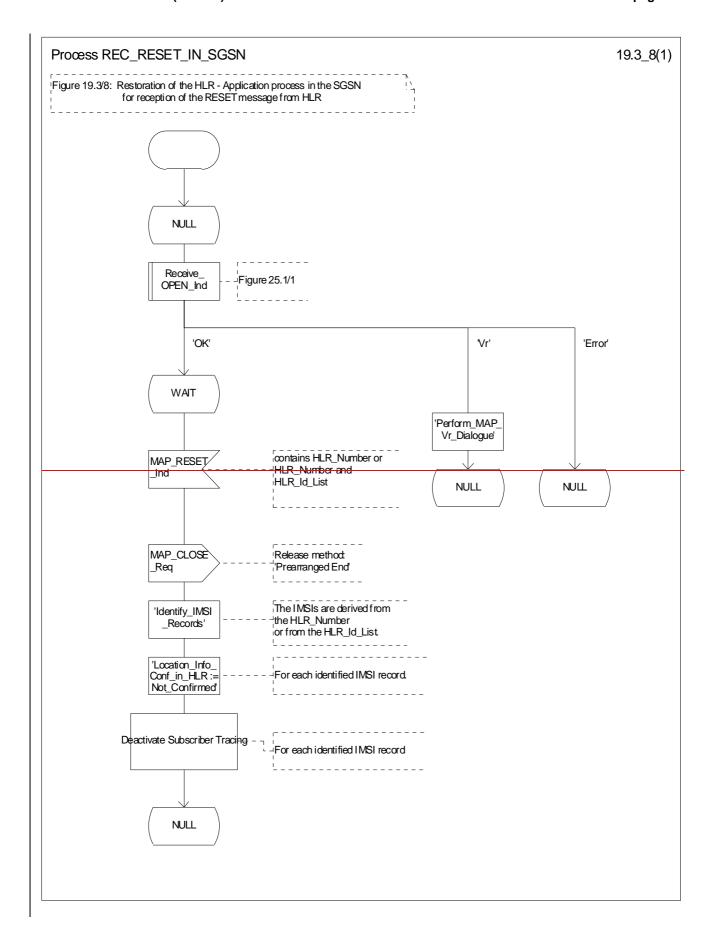


Figure 19.3.2/65: Process REC\_RESET\_INReceive Reset\_VLR



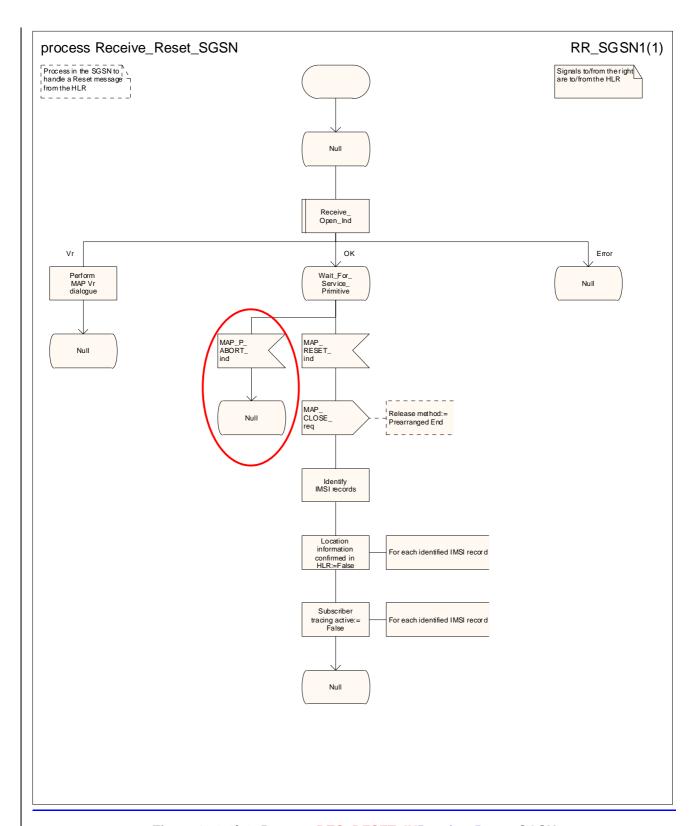


Figure 19.3.2/78: Process REC\_RESET\_INReceive Reset\_SGSN

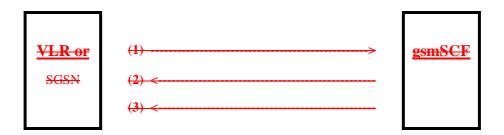
# 19.45 Mobility Management Eevent notification procedure

### 19.45.1 General

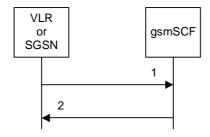
The Mobility Management Event Notification event notification procedure VLR process (MMEN\_VLR) is used to notify a gsmSCF about the successful completion of a Mobility Management event.

The message flow for Mobility Management event notification is shown in figure 19.4/1.

Figure 19.5/1. depicts the MAP signalling used for the event notification.



- (1) Report Mobility Management Event (VLR or SGSN to gsmSCF).
- (2) Report Mobility Management Event Result (gsmSCF to VLR or SGSN).
- (3) Report Mobility Management Event Error (gsmSCF to VLR or SGSN).



- 1) MAP\_REPORT\_MM\_EVENT\_req/ind
- 2) MAP REPORT MM EVENT rsp/cnf

Figure 19.45/1: Interfaces and MAP Messages flow for Mobility Management Event notifications

### 19.45.2 Proceduress in the VLR or SGSN

The MAP process in the VLR or the SGSN to report a Mobility Management event to the gsmSCF is shown in figure 19.4/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see subclause 25.1.2;
Check\_Confirmation: see subclause 25.2.2.

The Mobility Management event notification procedure in the VLR/SGSN is triggered when the following conditions are fulfilled:

- 1. the VLR/SGSN has successfully completed a Mobility Management event;
- 2. the subscriber has a subscription to Mobility Management event notifications;
- 3. the Mobility Management event is marked for reporting.

The VLR/SGSN notifies the gsmSCF of a mobility management event with the ReportMMEvent MAP message. This message is sent in a TCAP TC BEGIN primitive. The VLR/SGSN then awaits a positive result (RESULT) or a negative result (ERROR). This is received in a TCAP TC END primitive. The Basic End procedure is used.

When the VLR/SGSN has received the RESULT or ERROR, the relationship between the VLR/SGSN and the gsmSCF is terminated. The relationship, if existing, is also terminated when the VLR/SGSN sends a TCAP P-ABORT primitive to the calling procedure or when the VLR/SGSN receives a TCAP P ABORT or a TCAP U ABORT primitive from the gsmSCF.

The sending process shall indicate to the MMEN\_VLR process, which Mobility Management event shall be reported to the gsmSCF.

The MMEN VLR process is illustrated in figure 19.5/2.

## 19.45.3 Proceduress in the gsmSCF

The MAP process in the gsmSCF to handle the report of a Mobility Management event is shown in figure 19.4/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

When the gsmSCF receives the ReportMMEvent MAP Message (in a TCAP TC-BEGIN primitive), the MM\_Event\_Notification\_gsmSCF' (MMEN\_SCF) process is started.

If the gsmSCF has validated the information it has received in the ReportMMEvent MAP Message, then it informs the Service Logic in the SCP and awaits a response.

If a positive response is received from the Service Logic, then a REPORT\_MM\_EVENT\_RESULT is sent to the VLR/SGSN.

If a negative response is received from the Service Logic, then a REPORT\_MM\_EVENT\_ERROR is sent to the VLR/SGSN.

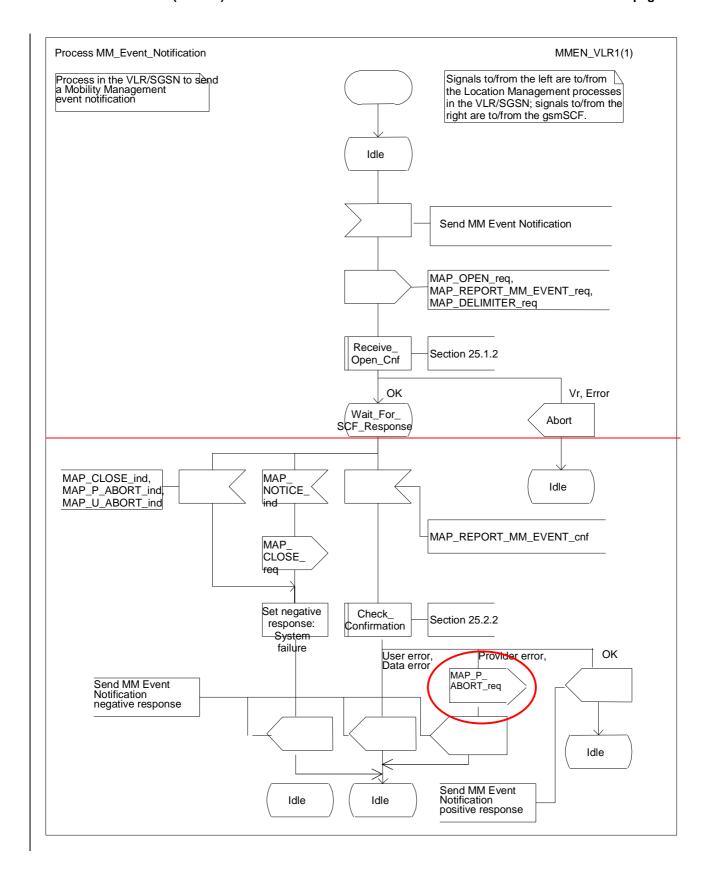
Both RESULT and ERROR are sent in a TCAP TC END primitive. The Basic End procedure is used.

If the Service Logic returns a User Error, then a MAP U ABORT primitive is sent to the VLR/SGSN.

The gsmSCF TCAP service may choose to abort the relationship with the VLR/SGSN by sending a TCAP P ABORT primitive to the VLR/SGSN.

When the gsmSCF receives a TCAP P-ABORT primitive from the VLR/SGSN, it shall immediately terminate the mobility management process.

This is illustrated in figure 19.5/3.



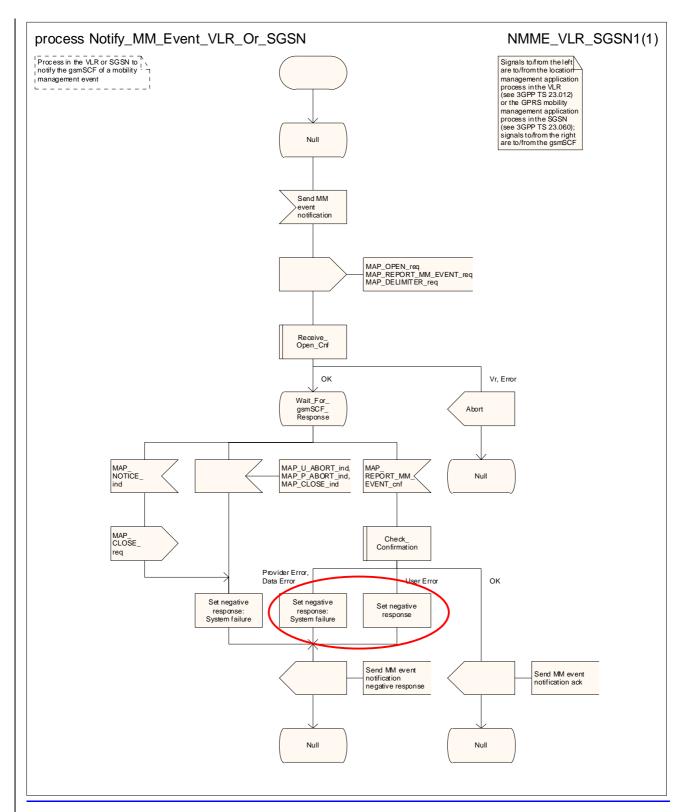
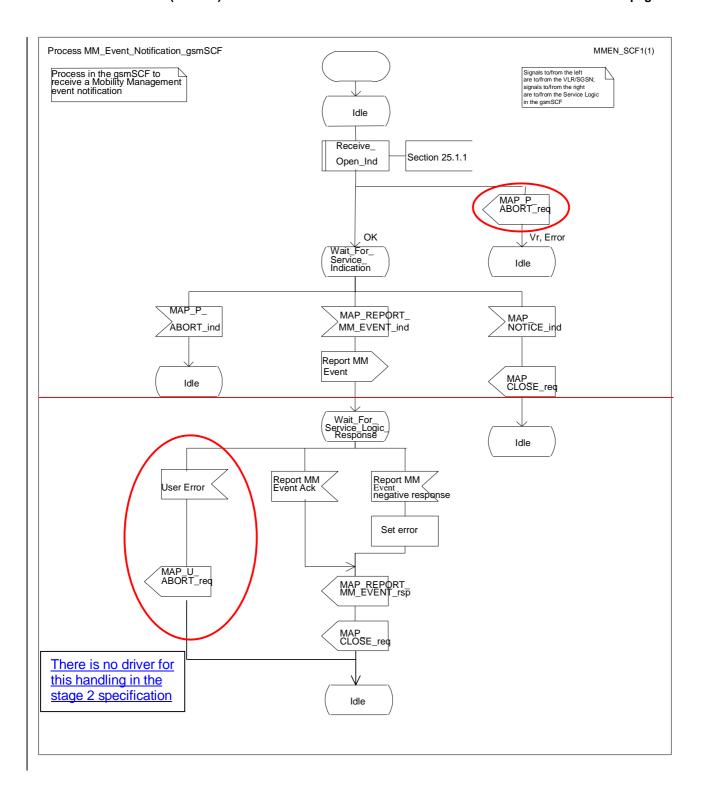


Figure 19.45/2: Process Notify MM\_Event\_Notification\_VLR\_Or SGSN (sheet 1 of 1)



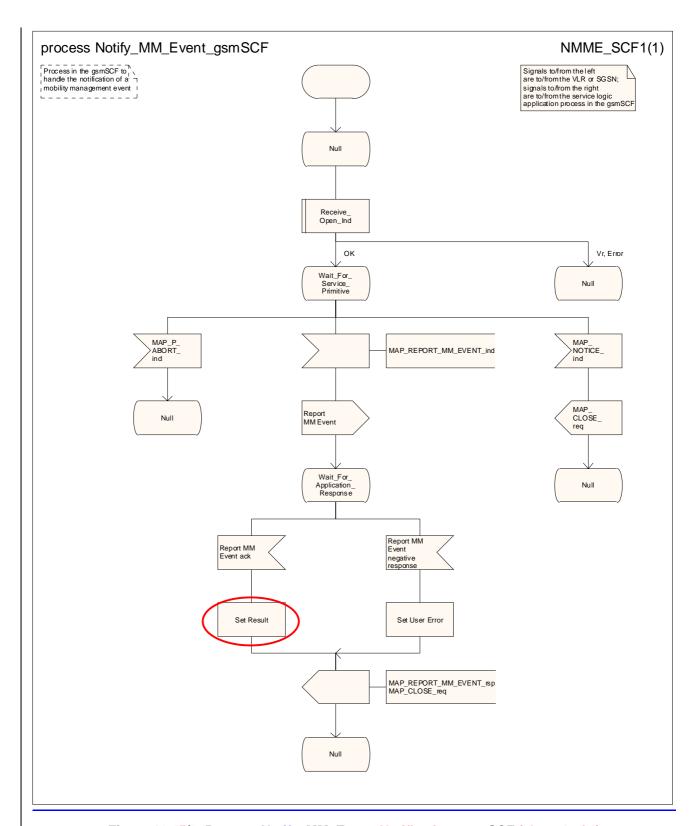


Figure 19.45/3: Process Notify MM\_Event\_Notification\_gsmSCF (sheet 1 of 1)

# 19.<u>5</u>4 <u>Macro Insert\_Subs\_Data\_Framed\_</u>HLR\_<u>Insert Subscriber</u> Data macros

#### 19.5.1 Macro Insert Subs Data Framed HLR

This macro is used to transfer subscriber data to the VLR as part of an existing dialogue for location updating or data restoration. The macro invokes a macro and a process not defined in this clause; the definitions of the macro and the process can be found as follows:

Wait\_For\_Insert\_Subs\_Data\_Cnf see subclause 25.7.5;

Send\_Insert\_Subs\_Data\_HLR: see subclause 25.7.7.

The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

If the VLR has indicated that it does not support a service or feature (e.g. Closed User Group or Advice Of Charge Charging Level) which the HLR operator regards as essential for the subscriber, the macro Wait for Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restriction Due To Unsupported Feature flag to roaming restricted and sends Roaming Restriction Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

If subscriber data for CAMEL Phase 2 or later services are sent to a VLR which does not support the appropriate phase of CAMEL, the service behaviour may be unpredictable or incorrect. The HLR should therefore ensure that at the conclusion of a stand alone Insert Subscriber data procedure the data in the VLR do not require a capability that the VLR does not have. Possible mechanisms to ensure this are described in 3GPP TS 23.078 [98].

The HLR should send a Forwarded-to number which is not in E.164 international format to the VLR only when the HLR has ascertained that the VLR supports CAMEL Phase 2 or later. Thus, the ISD message containing the Forwarded-to number which is not in E.164 international format shall be sent to the VLR only if the HLR previously received confirmation from the VLR at Location Update that CAMEL Phase 2 or later is supported.

This macro is used by any procedure invoked in HLR which requires the transfer of subscriber data by means of the InsertSubscriberData operation (e.g. Update Location or Restore Data).

The invocation of the operation is done in a dialogue already opened by the framing procedure. Therefore the latter is the one that handles the reception of the open indication and sends the dialogue close request.

The macro calls the process "Send\_Insert\_Subs\_Data" (see clause 25.7.7) as many times as it is needed for transferring all subscriber data. This process call is meant to describe two possible behaviours of HLR to handle service requests and confirmations:

- either the HLR handles requests and confirmations in parallel; or
- the HLR sends the next request only after receiving the confirmation to the previous one.

Another call is done to the macro "Wait\_for\_Insert\_Subs\_Data\_Cnf" (see clause 25.7.5). There the reception and handling of the service confirmations is described.

If certain services required for a subscriber are not supported by the VLR or by the SGSN (e.g. Advice of Charge Charging Level), this may result in one of the following outcomes:

The HLR stores and sends "Roaming Restriction Due To Unsupported Feature" in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA service. If "Roaming Restriction Due To Unsupported Feature" is stored in the HLR, the "MSC Area Restricted Flag" shall be set to "restricted". This will prevent MT calls, MT SM and MT USSD from being forwarded to the MSC/VLR;

- The HLR stores and sends other induced subscriber data (e.g. a specific barring program) in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA service. This will cause rejection of mobile originated service requests, except emergency calls.
- The HLR stores and sends "Roaming Restricted in the SGSN Due To Unsupported Feature" in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA service. If "Roaming Restricted In SGSN Due To Unsupported Feature" is stored in the HLR, the "SGSN Area Restricted Flag" shall be set to "restricted". This will prevent MT SM from being forwarded to the SGSN and Network Requested PDP-Context Activation;

When the VLR receives regional subscription data (Zone Code List) it may respond with "MSC Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response. In this case the "MSC Area Restricted Flag" shall be set to "restricted" in the HLR. This will prevent MT calls, MT SM and MT USSD from being forwarded to the MSC/VLR.

If the HLR neither stores "Roaming Restriction Due To Unsupported Feature" nor receives "MSC Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response, the "MSC Area Restricted Flag" in the HLR shall be set to "not restricted".

If subscriber data for CAMEL Phase 2 or 3 services are sent to a VLR which does not support CAMEL Phase 2 or 3, the service behaviour may be unpredictable or incorrect. The HLR therefore needs to ensure that at the conclusion of a location updating dialogue the data in the VLR do not require a capability that the VLR does not have. Possible mechanisms to ensure this are described in 3GPP TS 23.078.

The HLR should send a Forwarded to number which is not in E.164 international format to the VLR only when the HLR has ascertained that the VLR supports CAMEL Phase 2 or higher. Thus, the ISD message containing the Forwarded to number which is not in E.164 international format shall be sent to the VLR only after the HLR receives confirmation in the first ISD message result that CAMEL Phase 2 or higher is supported.

A Forwarded to number non-international E.164 format shall only be sent from an HLR to a VLR if the VLR supports CAMEL Phase 2, or a subsequent phase of CAMEL.

When the SGSN receives regional subscription data (Zone Code List) it may respond with "SGSN Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response. In this case the "SGSN Area Restricted Flag" shall be set to "restricted" in the HLR. This will prevent MT SM from being forwarded to the SGSN and Network Requested PDP Context Activation.

If the HLR neither stores "Roaming Restricted In SGSN Due To Unsupported Feature" nor receives "SGSN Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response, the "SGSN Area Restricted Flag" in the HLR shall be set to "not restricted".

The SDL diagrams are shown in figures 19.4/1 and 19.4/2.

### 19.5.1 Macro Insert\_GPRS\_Subs\_Data\_Framed\_HLR

This macro is used to transfer subscriber data to the SGSN as part of an existing dialogue for location updating. The macro invokes a macro and a process not defined in this clause; the definitions of the macro and the process can be found as follows:

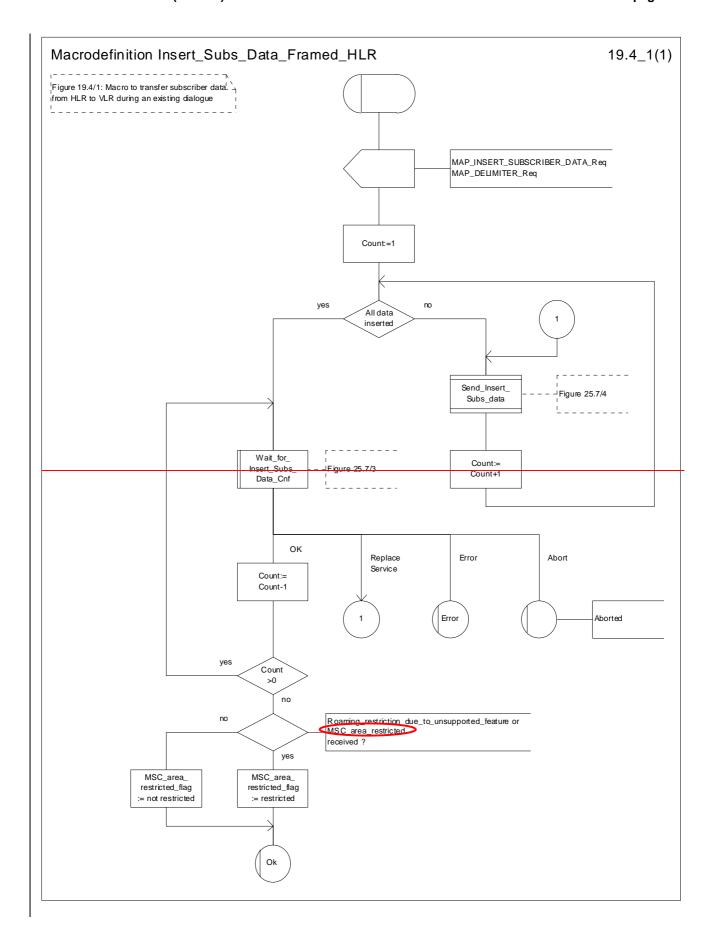
Wait\_For\_Insert\_GPRS\_Subs\_Data\_Cnf\_see subclause 25.7.5;

Send Insert Subs Data HLR: see subclause 25.7.7.

The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

If the SGSN has indicated that it does not support a service or feature which the HLR operator regards as essential for the subscriber, the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restricted In SGSN Due To Unsupported Feature flag to roaming restricted and sends Roaming Restricted In SGSN Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.



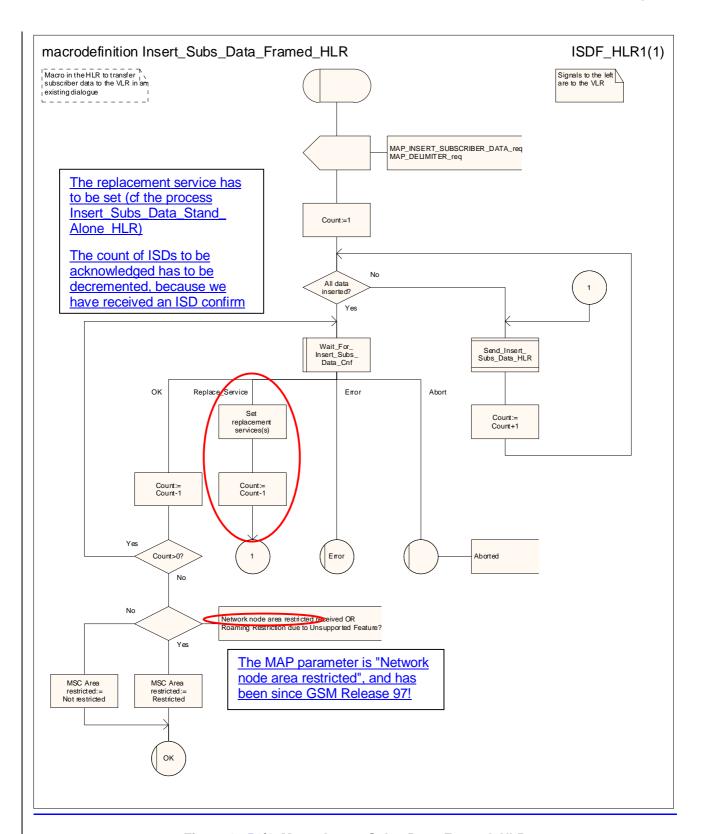
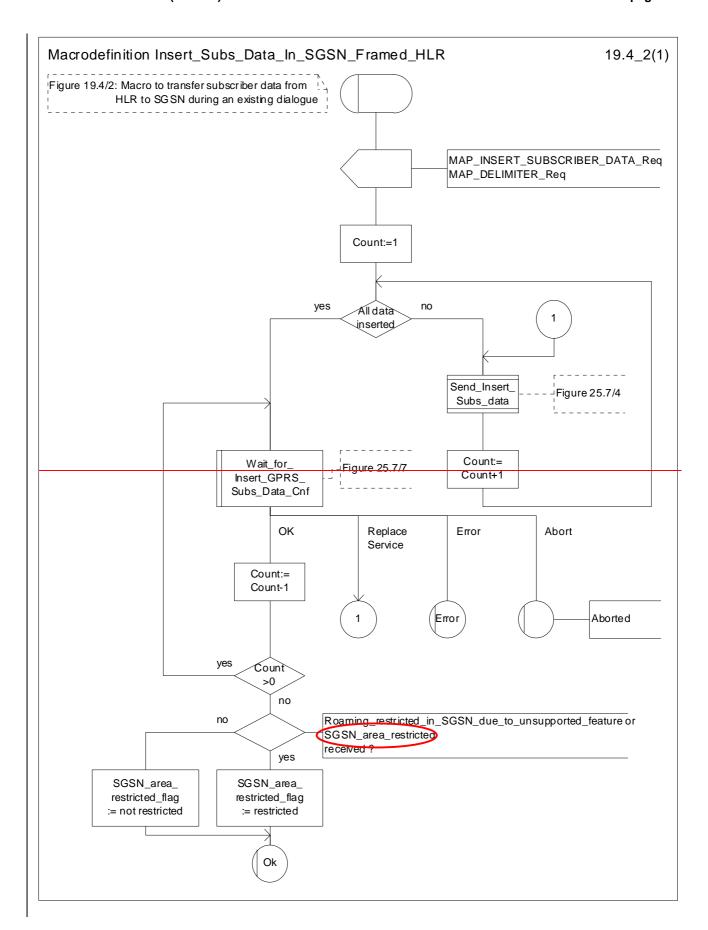


Figure 19.54/1: Macro Insert\_Subs\_Data\_Framed\_HLR



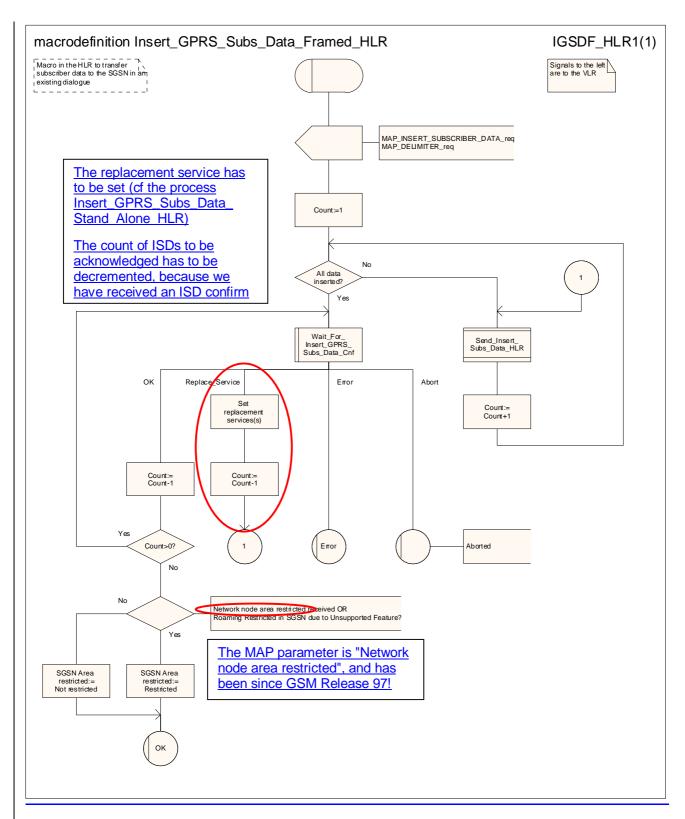


Figure 19.<u>54</u>/2: Macro Insert\_<u>GPRS\_</u>Subs\_Data\_<u>In\_SGSN\_</u>Framed\_HLR

# \*\*\* Next modified section \*\*\*

# 25.4 Macros for handling an Access Request

These macros are invoked when an MS accesses the network, e.g. to submit an MO short message or when responding to paging. The macros handle identification and authentication of the mobile subscriber as well as invocation of security related features (see 3GPP TS 42.009 [6]).

### 25.4.1 Macro Process\_Access\_Request\_MSC

Sheet 1: The MAP\_PROCESS\_ACCESS\_REQUEST request includes the following parameters:

- the received subscriber identification (IMSI, TMSI);
- the CM service type, indicating the type of request;
- the status of the access connection, i.e. whether a connection to this MS already exists and if so, whether it is already authenticated and ciphered;
- the current location area id of the MS; and
- the CKSN received from the MS.

Sheet 2, sheet 3: If the MSC receives an A\_SETUP indication while it is waiting for further instructions from the VLR or for the acknowledgment of TMSI reallocation from the MS, the MSC saves the setup request for processing after control has returned from the macro Process\_Access\_Request\_MSC to the calling process.

Sheet 3: When the MSC is waiting for a possible instruction to allocate a new TMSI, a MAP\_DELIMITER indication indicates that TMSI reallocation is not required.

Sheet 3: If the MS sends a TMSI reallocation failure in response to the TMSI reallocation command, the MSC takes the OK exit; the VLR treats the lack of response as a provider error (see macro Process\_Access\_Request\_VLR).

# 25.4.2 Macro Process\_Access\_Request\_VLR

Sheet 3: If the MSC does not send a positive response to the MAP\_FORWARD\_NEW\_TMSI request, this is treated as a MAP\_FORWARD\_NEW\_TMSI confirmation containing a provider error. The Macro takes the Error exit. If TMSI reallocation does not succeed, the old TMSI is frozen, to prevent it from being reallocated. In this case, both old and new TMSIs are regarded as valid.

# 25.4.3 Macro Obtain\_Identity

This macro is invoked by the macro Process\_Access\_Request\_VLR if the subscriber's identity is not known in the VLR.

It is an operator option to allow or prevent retrieval of the IMSI without encryption.

# 19.1.1.625.4.4 Process Update Location VLR

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

The procedure Notify\_gsmSCF is specified in 3GPP TS 23.078.

- If updating is successful (OK), the HLR Number is received in the MAP\_UPDATE\_LOCATION confirm primitive; the register will be updated and the SCP will be informed about the Mobility Management event. The process then terminates.
  - In the above case, the notification sent to the gsmSCF shall be 'Location Update to new VLR Service Area'.
- 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 the 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 1: This process will be performed independent from the calling process, no coordination is required.

NOTE 2: The procedure Notify\_gsmSCF is specified in 3GPP TS 23.078.

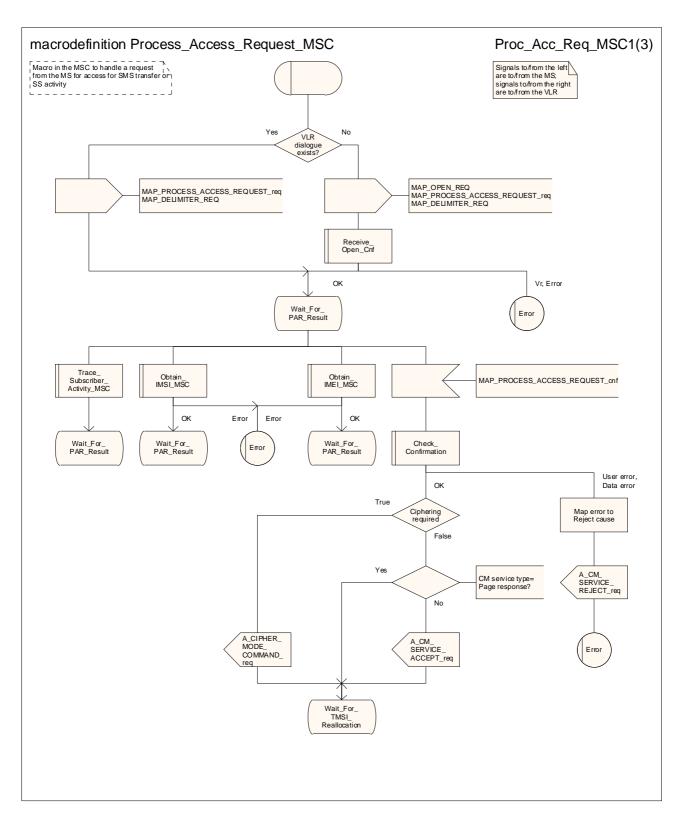


Figure 25.4/1 (sheet 1 of 3): Macro Process\_Access\_Request\_MSC

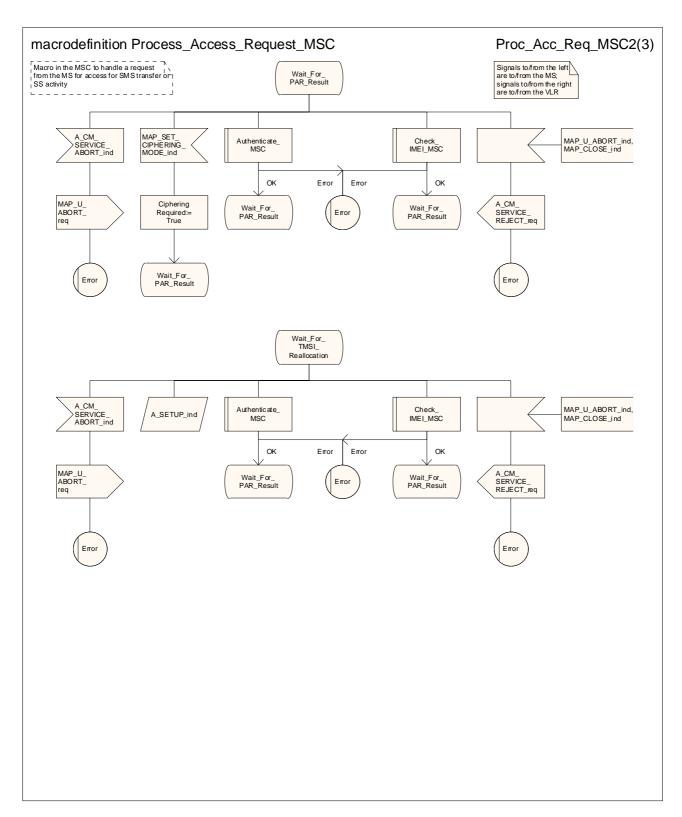


Figure 25.4/1 (sheet 2 of 3): Macro Process\_Access\_Request\_MSC

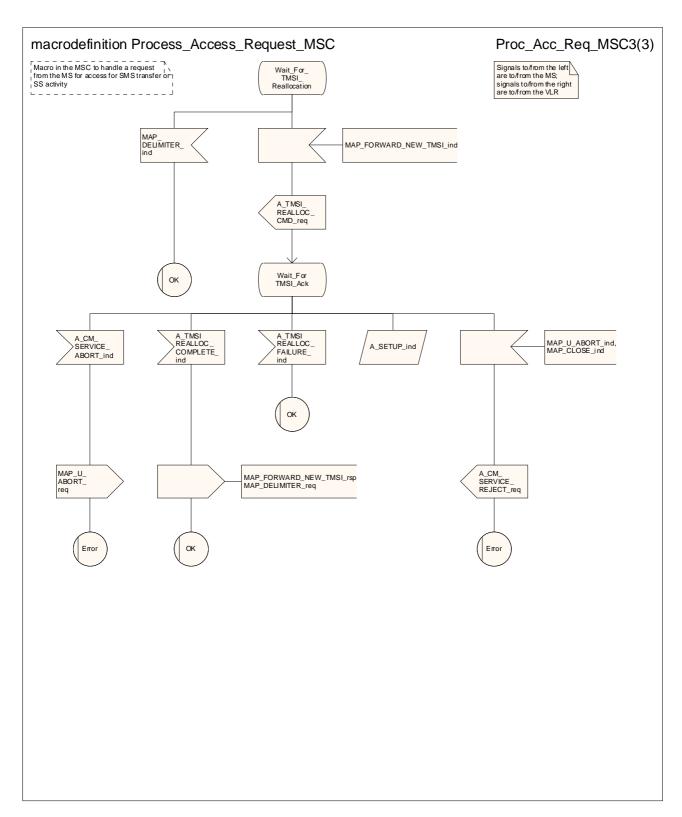


Figure 25.4/1 (sheet 3 of 3): Macro Process\_Access\_Request\_MSC

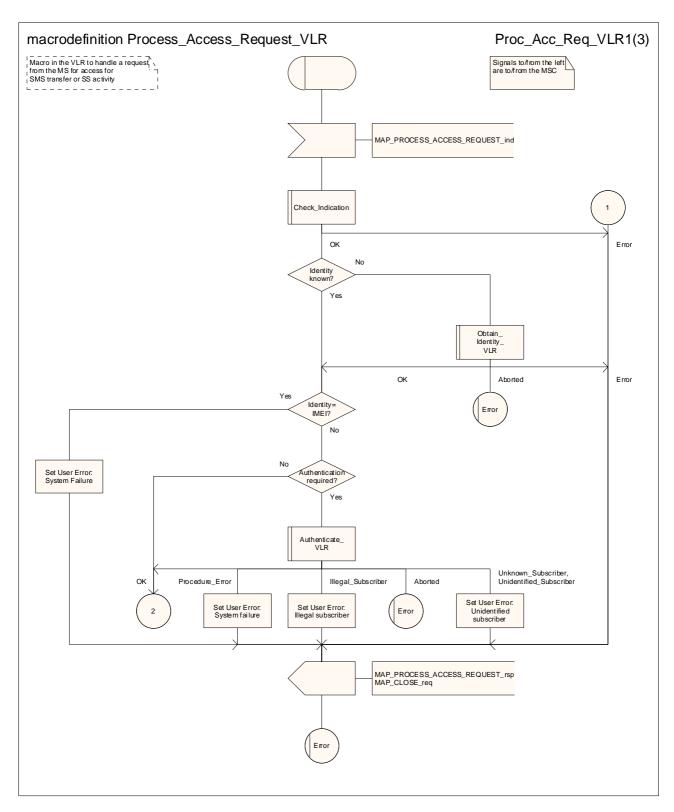
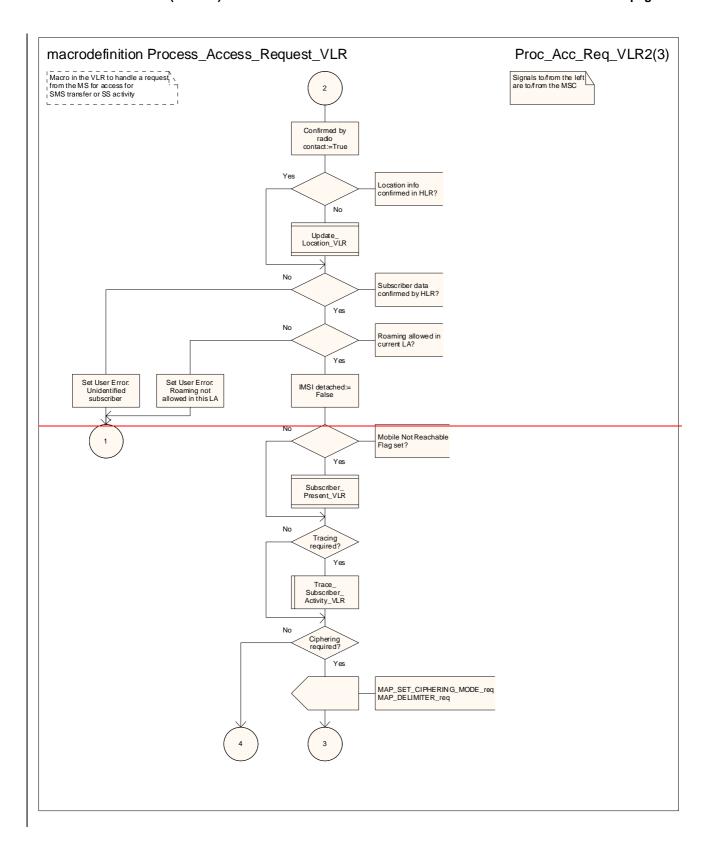


Figure 25.4/2 (sheet 1 of 3): Macro Process\_Access\_Request\_VLR



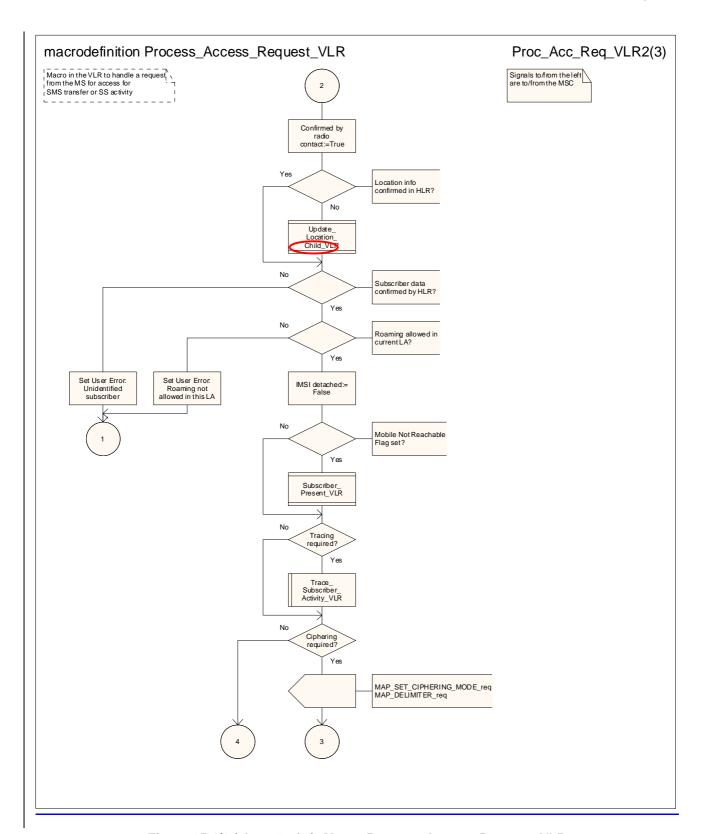


Figure 25.4/2 (sheet 2 of 3): Macro Process\_Access\_Request\_VLR

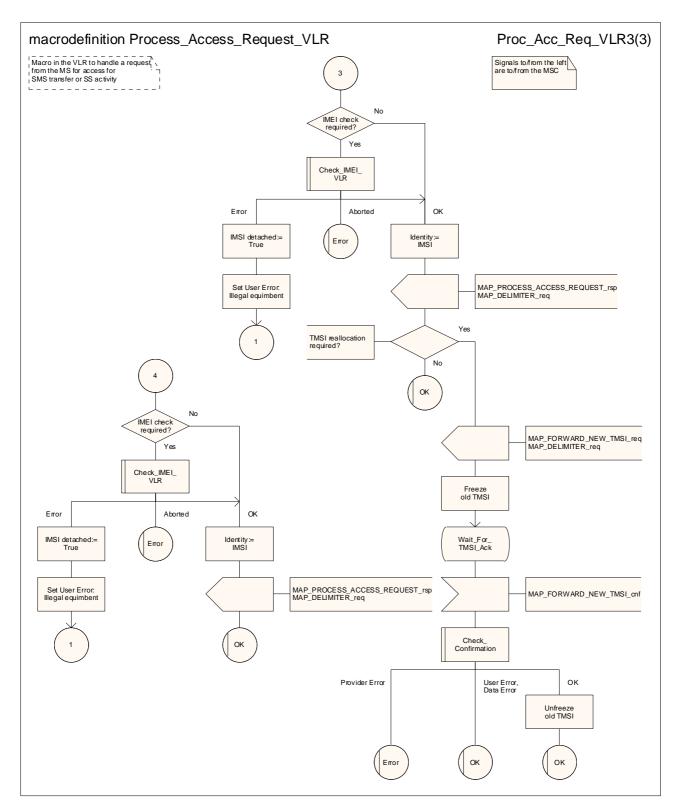


Figure 25.4/2 (sheet 3 of 3): Macro Process\_Access\_Request\_VLR

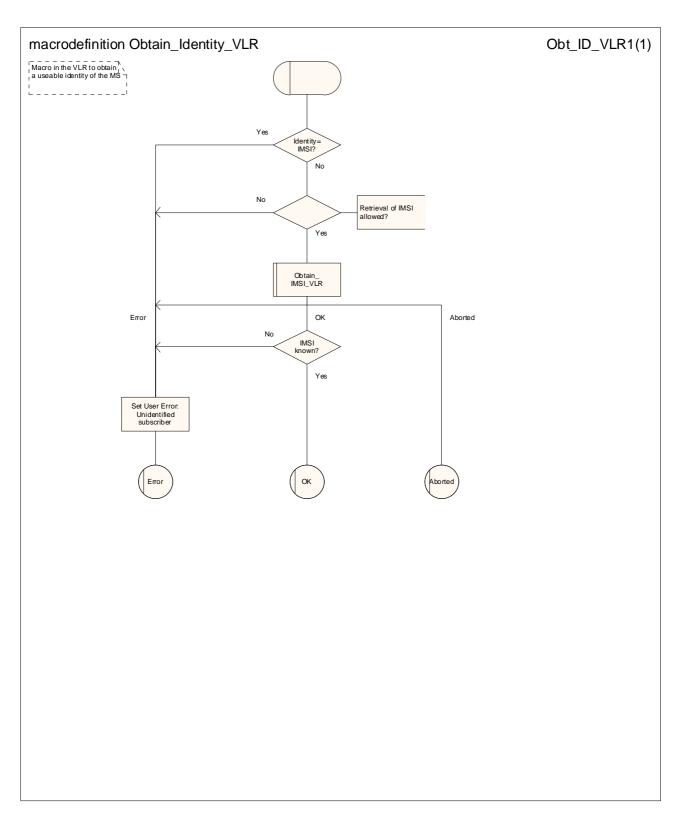
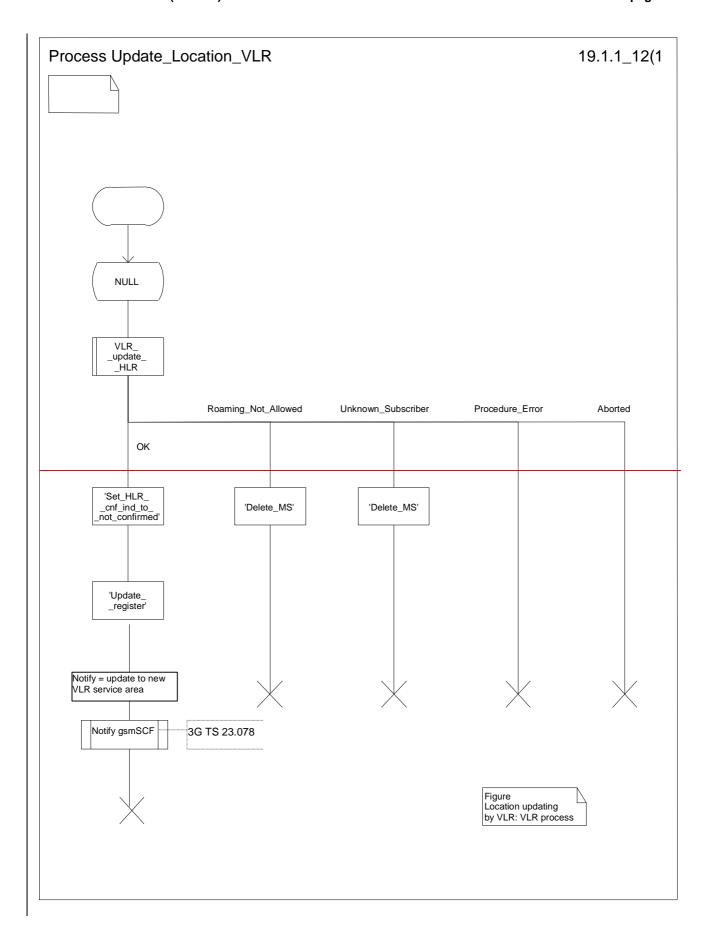


Figure 25.4/3: Macro Obtain\_Identity\_VLR



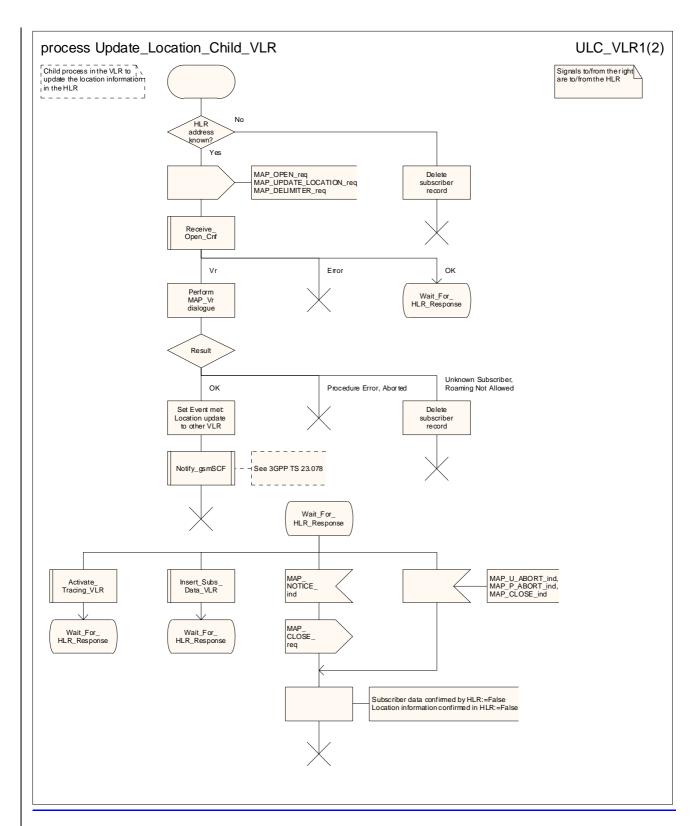


Figure 19.1.1/1225.4/4 (sheet 1 of 2): Process Update Location Child VLR

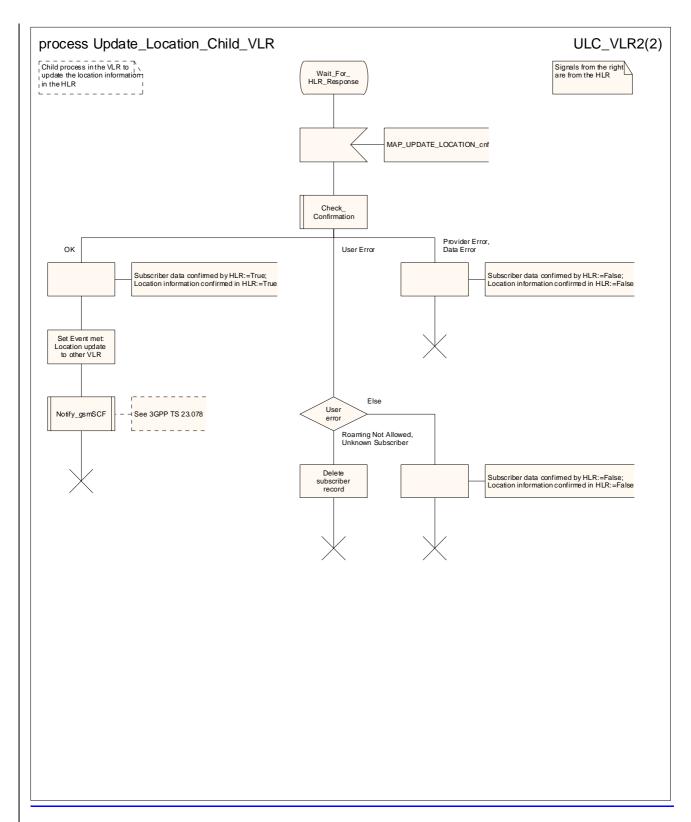


Figure 25.4/4 (sheet 2 of 2): Process Update Location Child VLR

# \*\*\* Next modified section \*\*\*

## 25.7 Insert Subscriber Data macros and processes

## 25.7.1 Macro Insert\_Subs\_Data\_VLR

This macro is used by any procedure in the VLR that triggers the reception of subscriber data (e.g. Update Location or Restore Data).

## 25.7.2 Macro Insert Subs Data SGSN

This macro is used by any procedure in the SGSN that triggers the reception of subscriber data (e.g. Update GPRS Location ).

## 25.7.3 Process Insert\_Subs\_Data\_Stand\_Alone\_HLR

This process is used by HLR to transfer subscriber data to VLR or to SGSN in a stand alone mode, i.e. in a separate dialogue. This is done whenever a change of subscriber data is performed either by the operator or by the subscriber and this change has to be reported to the VLR.

Sheet 1: The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

Sheet 1, sheet 2: If the VLR has indicated that it does not support a service or feature (e.g. Closed User Group or Advice Of Charge Charging Level) which the HLR operator regards as essential for the subscriber, the macro Wait\_for\_Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restriction Due To Unsupported Feature flag to roaming restricted and sends Roaming Restriction Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 1, sheet 2: If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 2: It is an operator option whether to repeat the download of subscriber data if the VLR returns an error response. The number of repeat attempts and the interval between them is also an operator option, depending on the error response from the VLR.

If subscriber data for CAMEL Phase 2 or later services are sent to a VLR which does not support the appropriate phase of CAMEL, the service behaviour may be unpredictable or incorrect. The HLR should therefore ensure that at the conclusion of a stand alone Insert Subscriber data procedure the data in the VLR do not require a capability that the VLR does not have. Possible mechanisms to ensure this are described in 3GPP TS 23.078 [98].

The HLR should send a Forwarded-to number which is not in E.164 international format to the VLR only when the HLR has ascertained that the VLR supports CAMEL Phase 2 or later. Thus, the ISD message containing the Forwarded-to number which is not in E.164 international format shall be sent to the VLR only if the HLR previously received confirmation from the VLR at Location Update that CAMEL Phase 2 or later is supported.

## 25.7.4 Process Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR

This process is used by the HLR to transfer subscriber data from the HLR to the SGSN in a stand alone mode, i.e. in a separate dialogue. This is done whenever a change of subscriber data is performed either by the operator or by the subscriber and this change has to be reported to the SGSN.

Sheet 1: The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

Sheet 1, sheet 2: If the SGSN has indicated that it does not support a service or feature which the HLR operator regards as essential for the subscriber, the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restricted In SGSN Due To Unsupported Feature flag to roaming restricted and sends Roaming Restricted In SGSN Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 1, sheet 2: If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 2: It is an operator option whether to repeat the download of subscriber data if the SGSN returns an error response. The number of repeat attempts and the interval between them is also an operator option, depending on the error response from the SGSN.

## 25.7.5 Macro Wait\_for\_Insert\_Subs\_Data\_Cnf

This macro is used by any process or macro that describes the handling in the HLR of the transfer of subscriber data to the VLR (e.g. Update Location or Restore Data).

## 25.7.6 Macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf

This macro is used by any process or macro that describes the handling in the HLR of the transfer of subscriber data to the SGSN (e.g. Update GPRS Location).

## 25.7.7 Process Send\_Insert\_Subs\_Data\_HLR

This process is used by any process or macro in the HLR where a MAP\_INSERT\_SUBSCRIBER\_DATA request is sent to the VLR or to the SGSN.

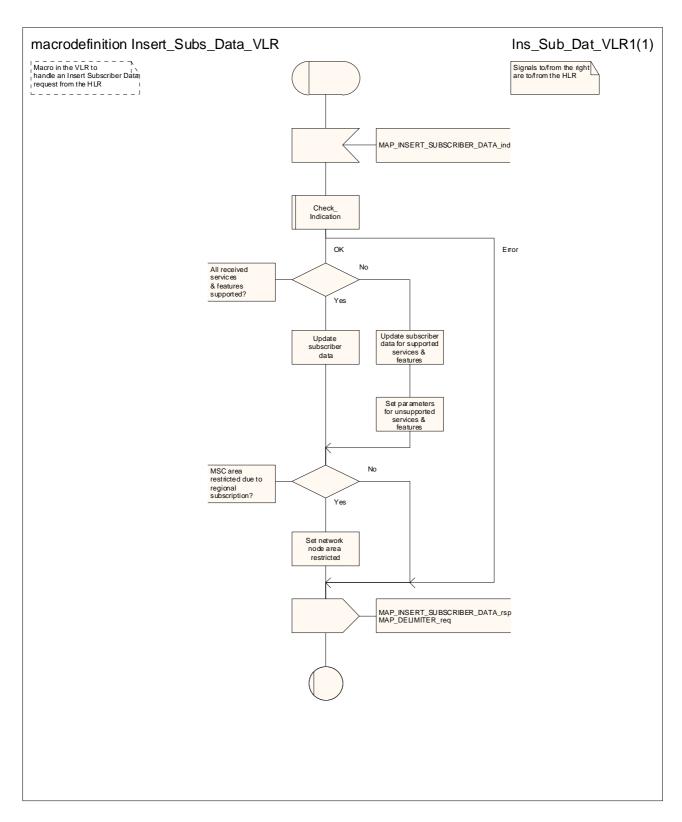


Figure 25.7/1: Macro Insert\_Subs\_Data\_VLR

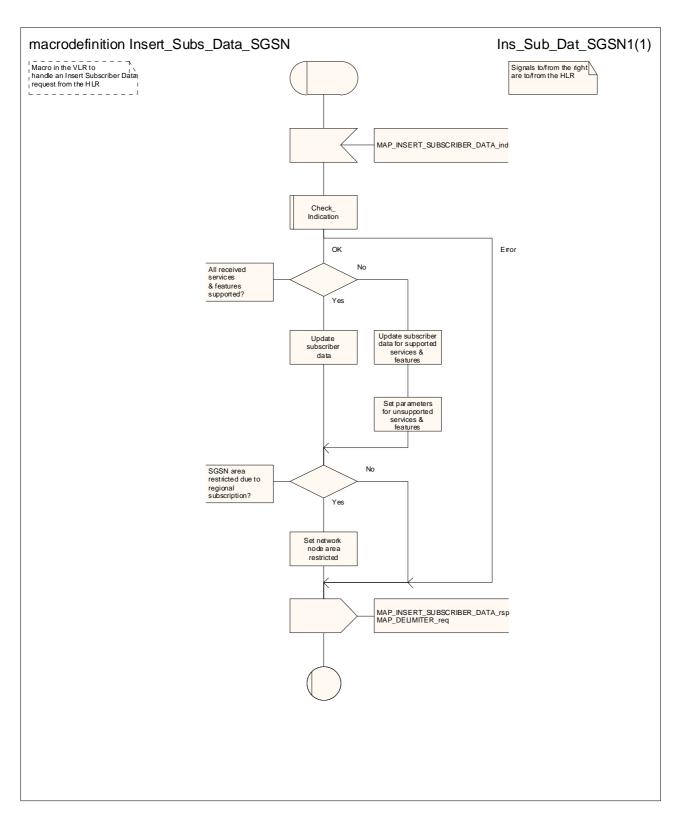


Figure 25.7/2: Macro Insert\_Subs\_Data\_SGSN

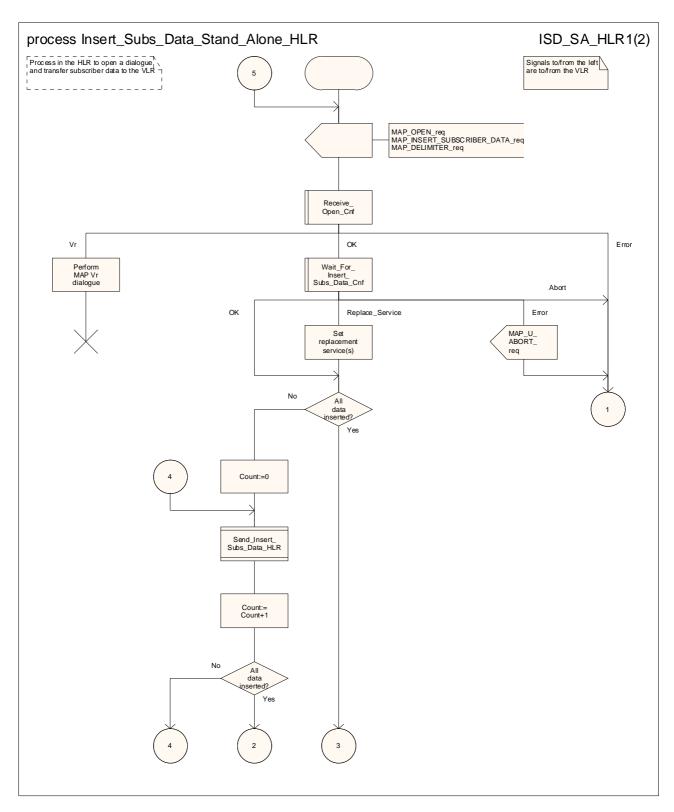


Figure 25.7/3 (sheet 1 of 2): Process Insert\_Subs\_Data\_Stand\_Alone\_HLR

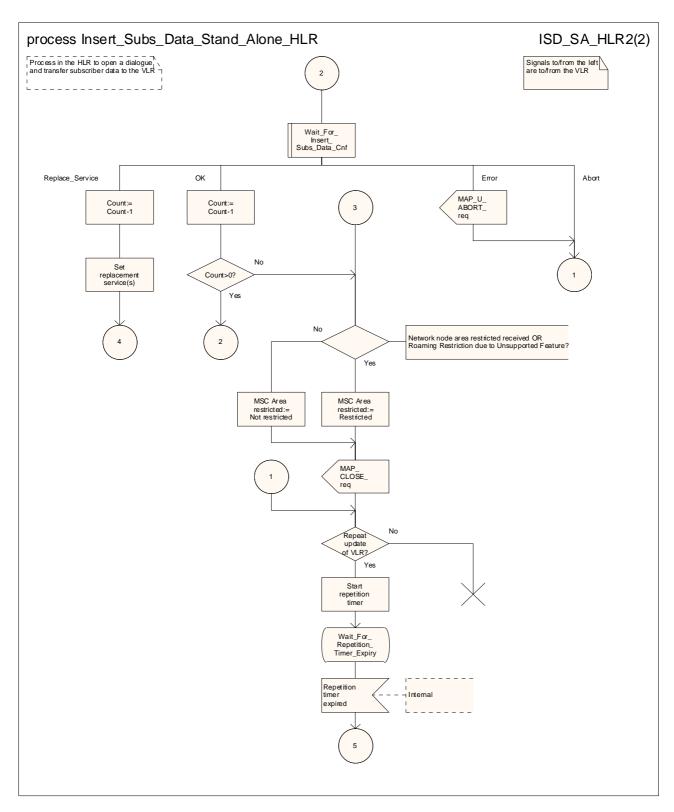


Figure 25.7/3 (sheet 2 of 2): Process Insert\_Subs\_Data\_Stand\_Alone\_HLR

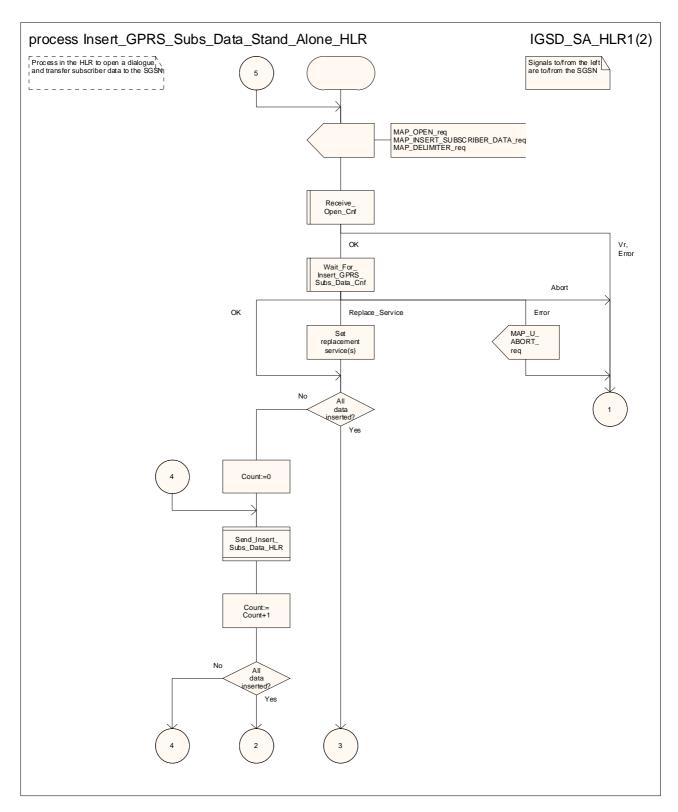


Figure 25.7/4 (sheet 1 of 2): Process Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR

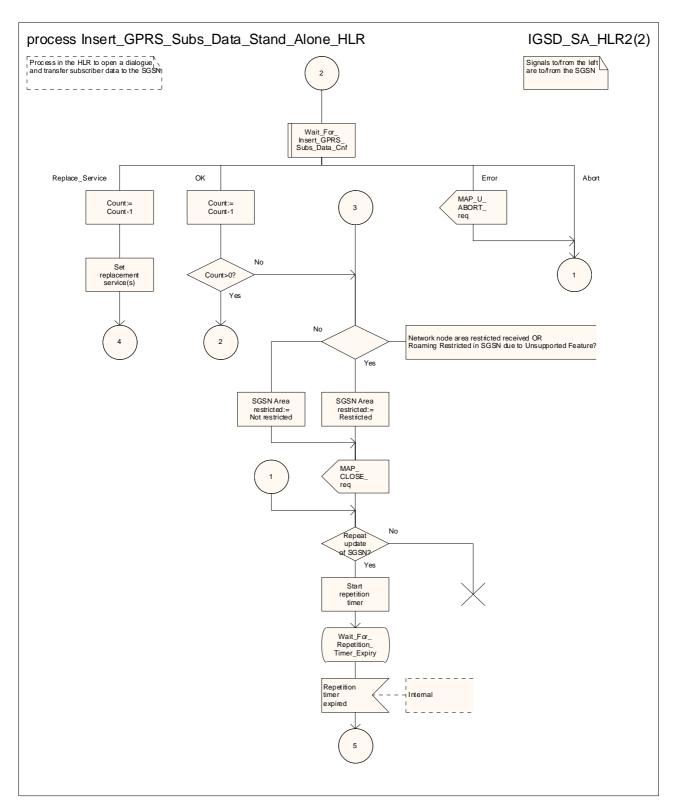


Figure 25.7/4 (sheet 2 of 2): Process Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR

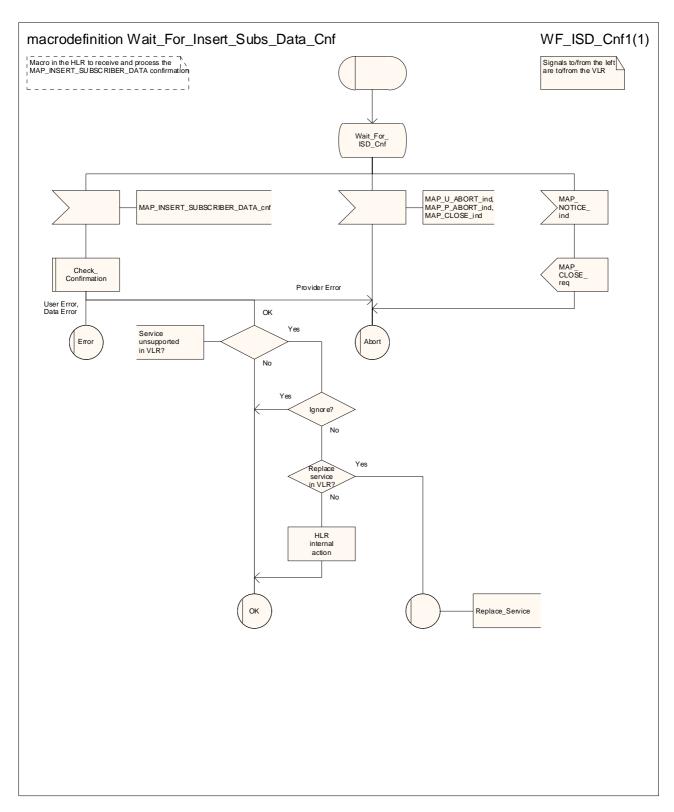


Figure 25.7/5: Macro Wait\_for\_Insert\_Subs\_Data\_Cnf

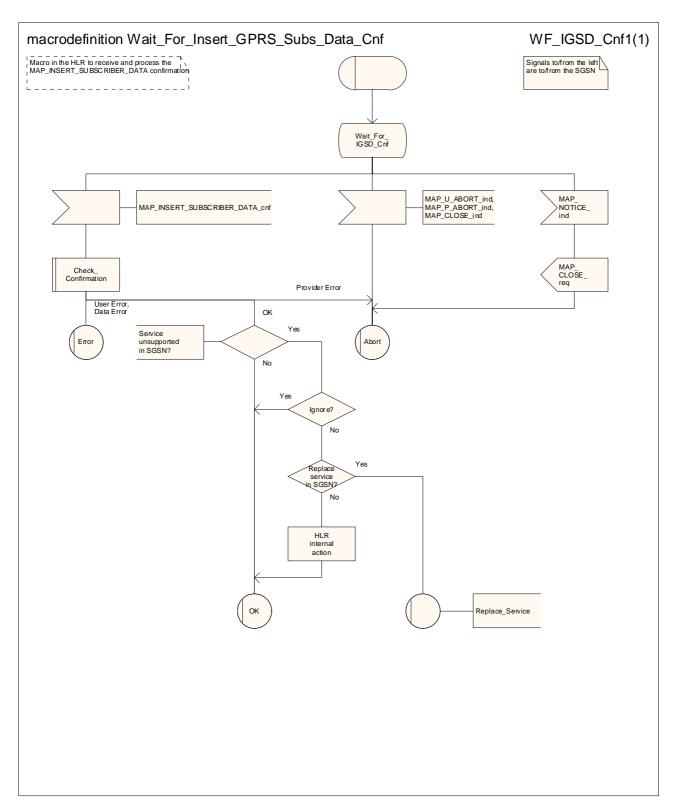


Figure 25.7/6: Macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf

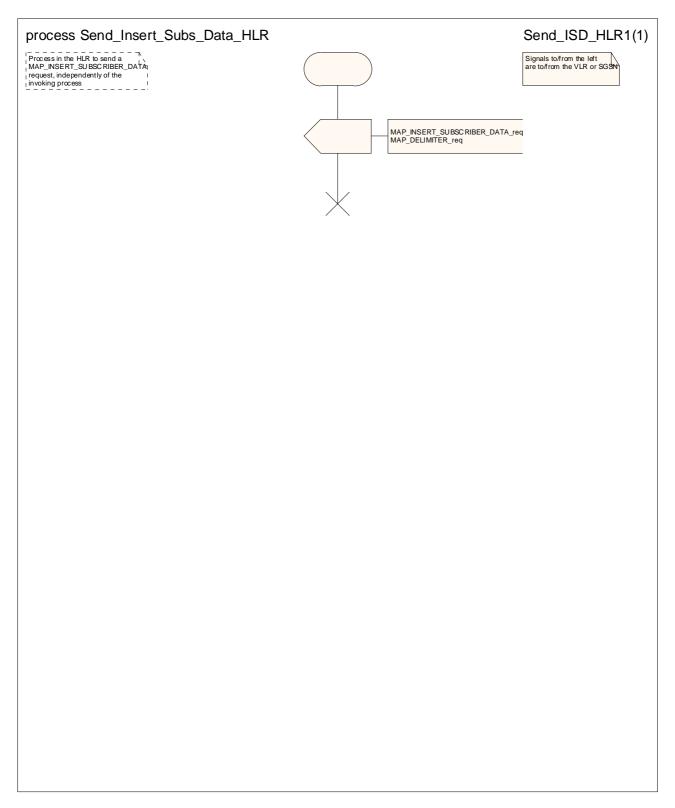


Figure 25.7/7: Process Send\_Insert\_Subs\_Data\_HLR

# \*\*\* Next modified section \*\*\*

## 25.9 Tracing macros

## 25.9.1 Macro Trace\_Subscriber\_Activity\_MSC

This macro shows the handling in the MSC for a request from the VLR to trace the activity of a subscriber.

## 25.9.2 Macro Trace\_Subscriber\_Activity\_VLR

This macro is called during the handling of subscriber activity in the VLR to activate tracing if necessary.

## 25.9.3 Macro Trace\_Subscriber\_Activity\_SGSN

This macro is called during the handling of subscriber activity in the SGSN to activate tracing if necessary.

## 25.9.4 Macro Activate\_Tracing\_VLR

This macro shows the handling in the VLR for a request from the HLR to activate tracing for a subscriber.

## 25.9.5 Macro Activate\_Tracing\_SGSN

This macro shows the handling in the SGSN for a request from the HLR to activate tracing for a subscriber.

## 25.9.6 Macro Control\_Tracing\_With\_VLR\_HLR

This macro shows the handling in the HLR to activate tracing in the VLR if it is required during a dialogue between the VLR and the HLR

## 25.9.7 Macro Control\_Tracing\_HLR\_wWith\_SGSN\_HLR

This macro shows the handling in the HLR to activate tracing in the SGSN if it is required during a dialogue between the SGSN and the HLR

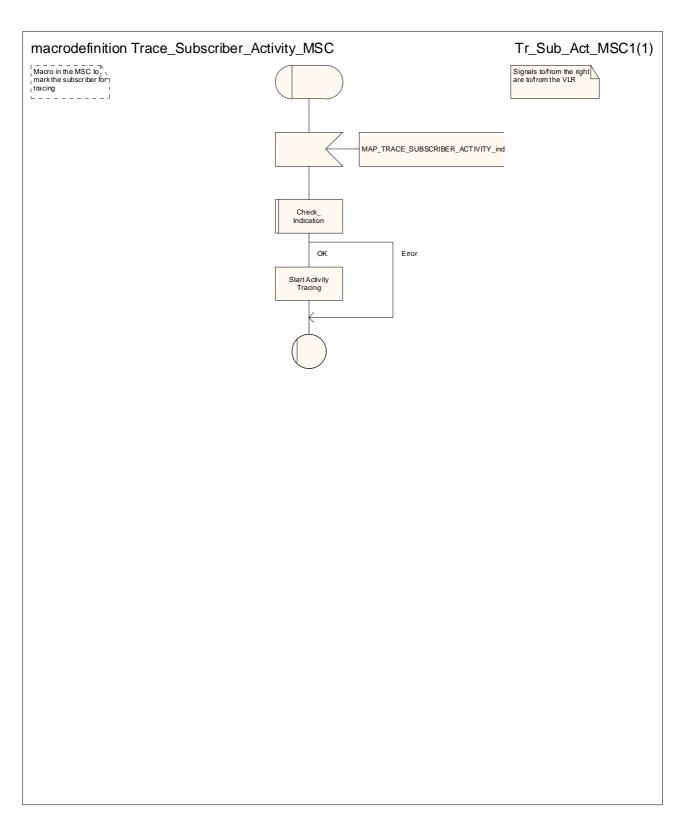


Figure 25.9/1: Macro Trace\_Subscriber\_Activity\_MSC

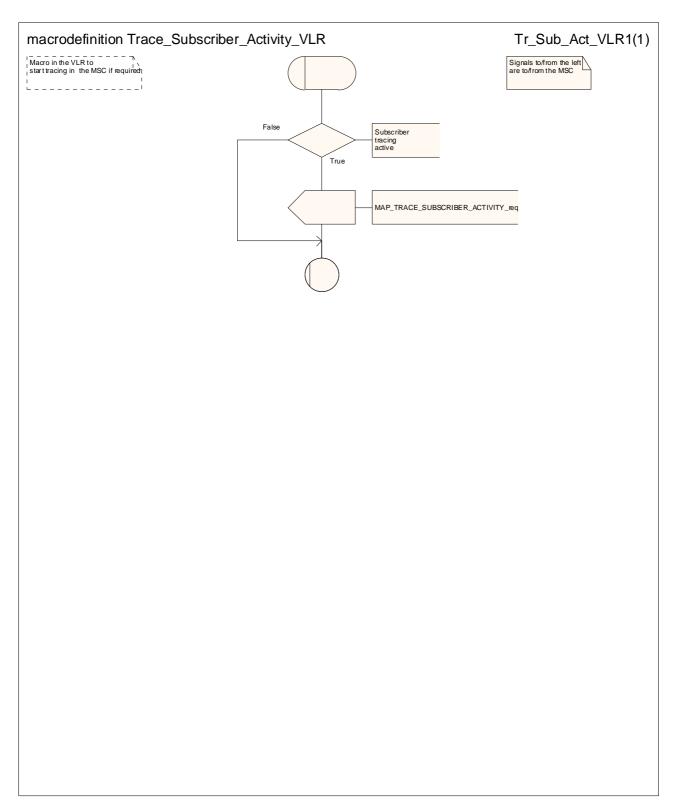


Figure 25.9/2: Macro Trace\_Subscriber\_Activity\_VLR

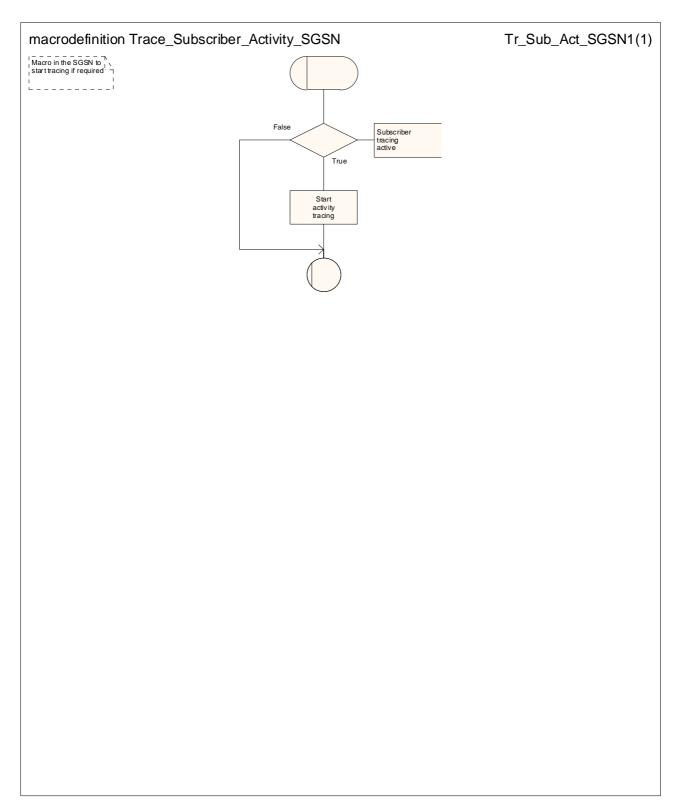


Figure 25.9/3: Macro Trace\_Subscriber\_Activity\_SGSN

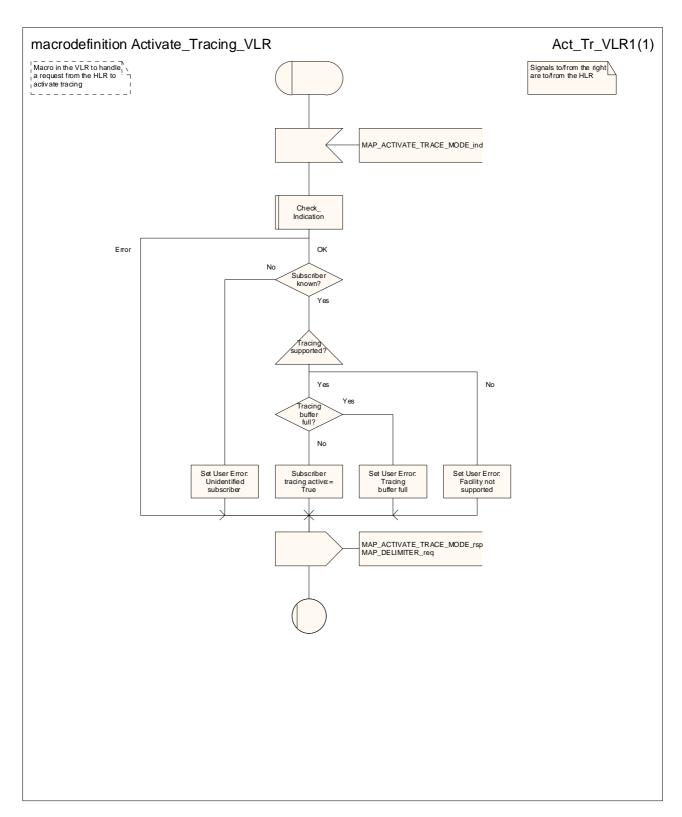


Figure 25.9/4: Macro Activate\_Tracing\_VLR

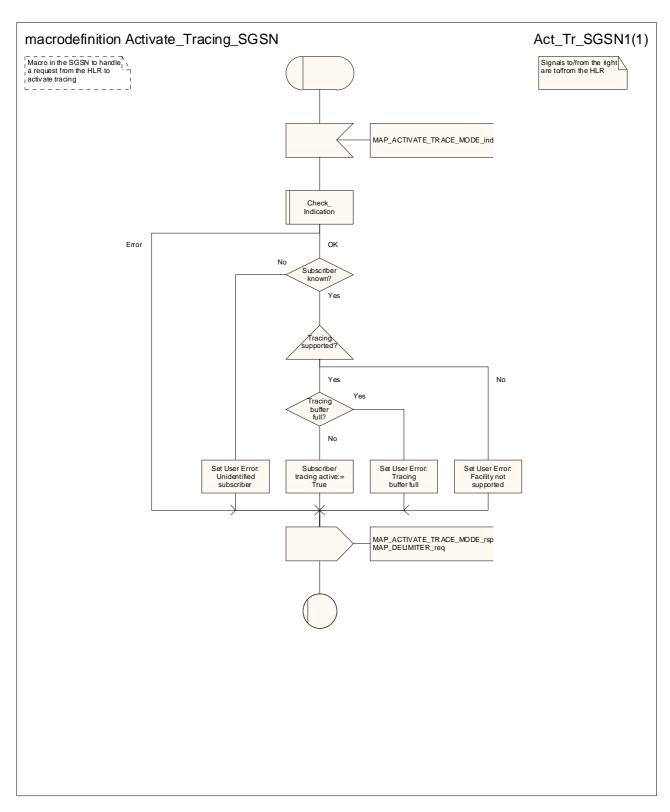
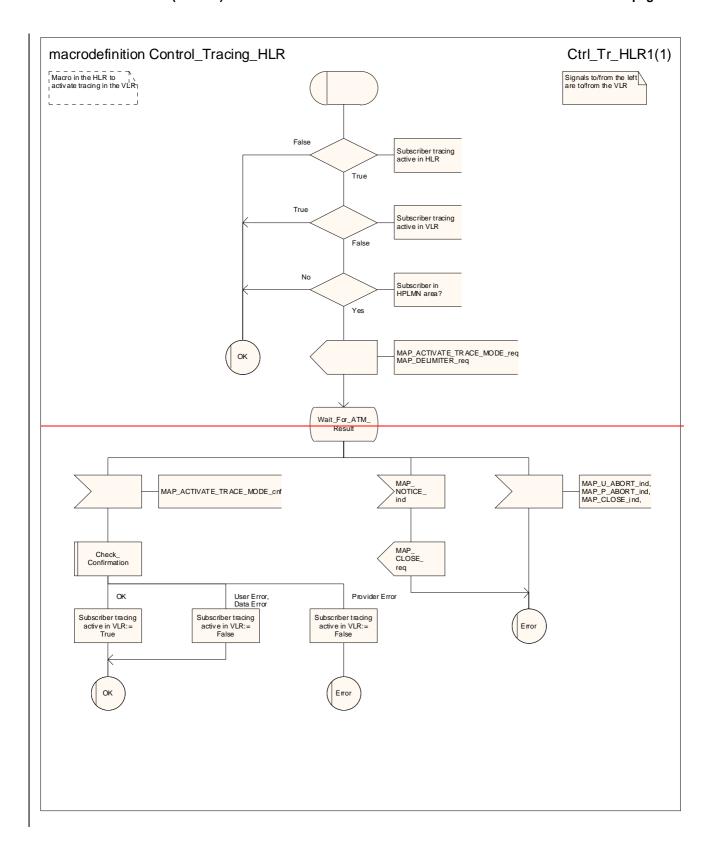


Figure 25.9/5: Macro Activate\_Tracing\_SGSN



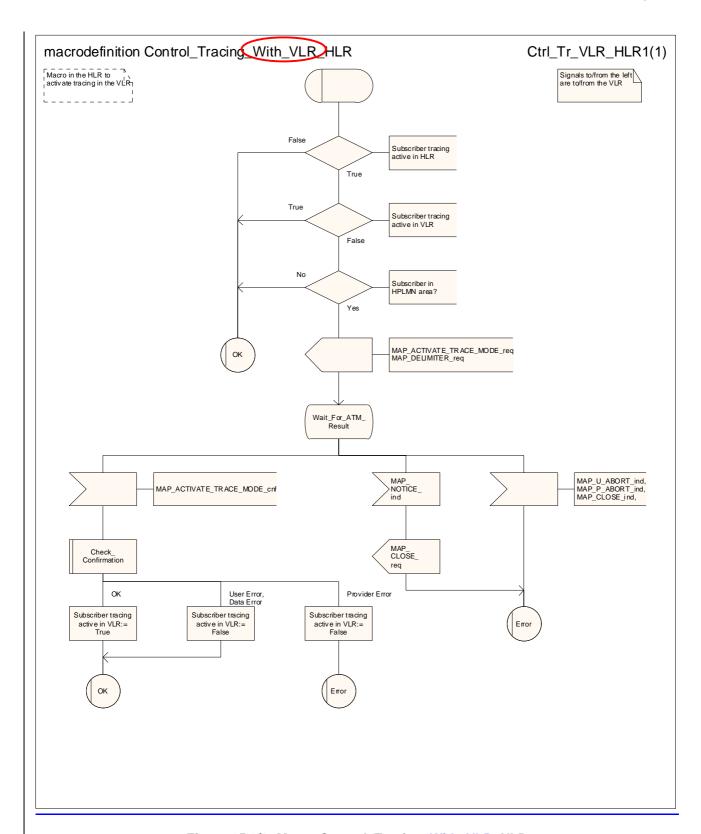
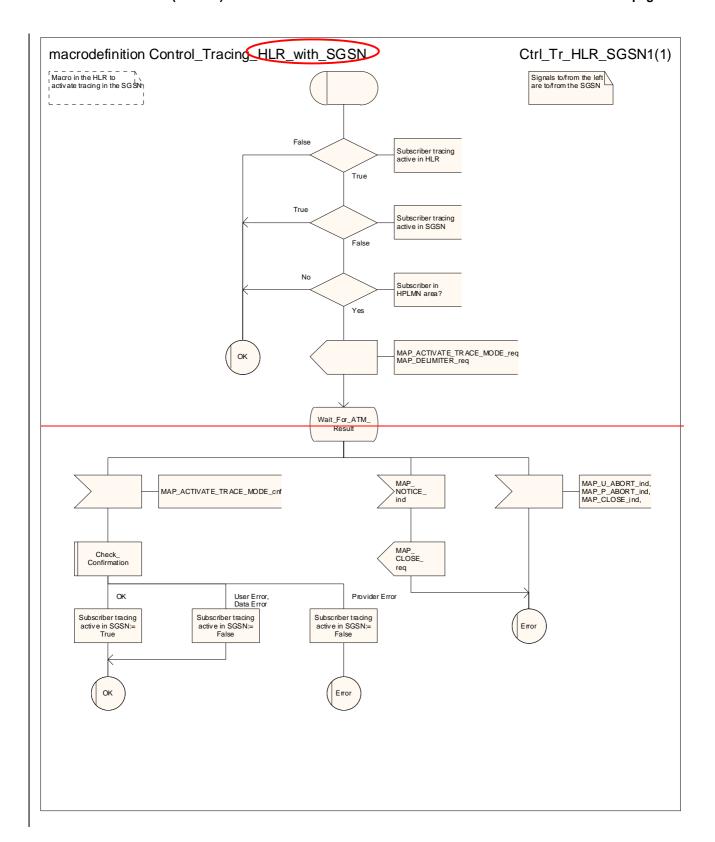


Figure 25.9/6: Macro Control\_Tracing\_With VLR\_HLR



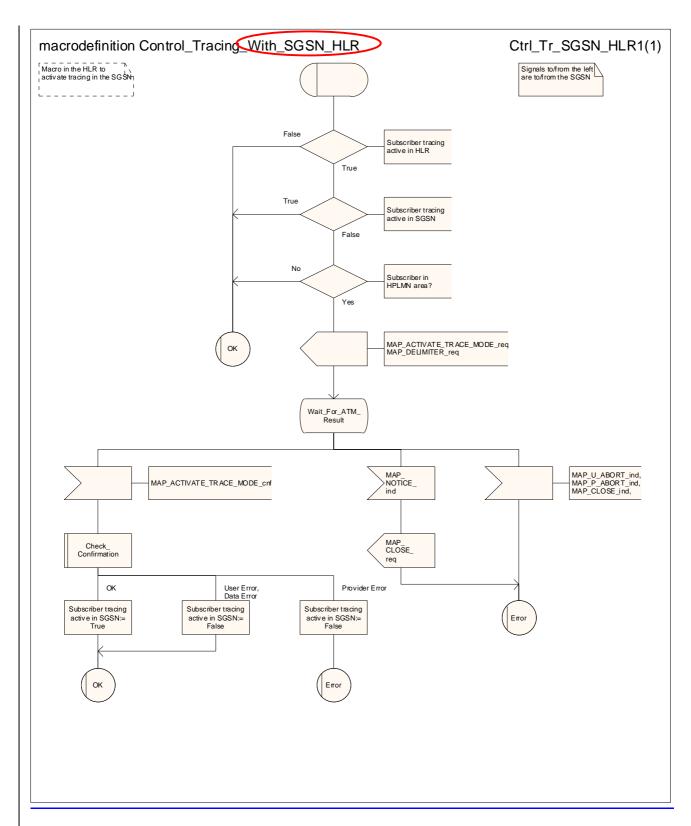


Figure 25.9/7: Macro Control\_Tracing\_HLR\_wWith\_SGSN\_HLR

## \*\*\* End of document \*\*\*

## 3GPP TSG CN WG4 Meeting #20 Sophia Antipolis, FRANCE, 25<sup>th</sup> – 29<sup>th</sup> August 2003

N4-030953 (Revision of N4-030743)

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Reason for change: # 1. There are no source files available for the SDL diagrams in 29.002 chapter 20. Many SDL diagrams are poorly laid out.

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- 2. Some message flow diagrams are drawn using linedraw characters, which do not display correctly in Word 2000.
- 3. Most of the text repeats the information in the SDL diagrams; the useful additional information is buried in superfluous verbiage. The principle of making the text a supplement to the SDL diagrams has been accepted by CN #20, with the approval of CRs to chapters 22 – 25 to remove the redundant
- 4. The naming convention for SDL processes is not consistent.
- 5. There are several references to the non-existent process Subscriber\_Present\_HLR in the non-existent subclause 19.1.1.7
- 6. The signal names between the application processes in the VLR (process Send Identification VLR) and the PVLR (process Send Identification PVLR) are misaligned; the signal Request IMSI from the application process in the VLR corresponds to the signal Send Identification to the application process in the PVLR. This is aligned with 23.012.
- 7. The process Update Location VLR calls a non-existent macro, VLR Update HLR, which was removed from 29.002 as part of the transfer of the stage 2 for location management into 23.012 in Release 99. Further, the process invoked only from the macro Process\_Access\_Request\_VLR, in subclause 25.4.
- 8. The modelling of the Cancel\_Location\_HLR and Cancel\_GPRS\_Location\_HLR processes is faulty. A process which terminates (rather than returning to the Null state) is required to interwork with the subscriber deletion and subscriber data modification processes in chapter 20; however a process which returns to the Null state is required for communication with the application processes defined in 23.012 (for non-GPRS) and 23.060 (for GPRS).

- 9. The process Cancel\_Location\_SGSN shows (some of) the stage 2 handling, which is covered more fully in the GPRS stage 2 (23.060).
- 10. There is no supporting text for the SDL processes in the VLR and the HLR for the MS purging procedure.
- 11. The handling in the MAP Handover processes for the Provider Error exit from the macro Check Confirmation does not take account of the fact that when the macro takes the Provider Error exit the dialogue has already been closed.
- 12. Several of the signal names for signals to & from the Handover Control application in the MAP processes for handover in MSC-A & MSC-B are not aligned with the signal names used in the Handover stage 2 (23.009).
- 13. The MAP process for handover in MSC-A omits the error handling for failure of a subsequent handover back to MSC-A.
- 14. The MAP process for handover in MSC-A should close the dialogue with MSC-B and return to the Null state when it has sent the MAP\_SEND\_END\_SIGNAL response at the end of a successful subsequent handover back to MSC-A.
- 15. In the MAP process for handover in MSC-A, when a MAP SEND END SIGNAL indication is received from the distant MSC and the Check Indication macro takes the Error exit, the dialogue is aborted but this is not reported to the Handover Control application.
- 16. The modelling of the handling in MSC-A for the dialogue with MSC-B at subsequent handover to MSC-B' is unnecessarily complex for the case when the dialogue with MSC-B' uses the current protocol version, and inaccurate when the dialogue with MSC-B' reverts to an earlier protocol version.
- 17. The macro Receive\_error\_from\_HO\_CA\_or\_MSC (subclause 19.2.4) fails the syntax check in SDT, so it cannot be drawn. Furthermore, if the test "Error indication" takes the "Keep dialogue" exit, the macro should take the "Error" exit to indicate that the dialogue is maintained, rather than the "Null" exit to indicate that the dialogue has been terminated.
- 18. The macro Receive\_error\_from\_HO\_CA\_or\_MSC is misused in many places. When the macro takes the Null exit the dialogue with the distant MSC has been closed or aborted, so the MAP process should return to the Null state; when the macro takes the Error exit the dialogue has not been closed, so if the MAP process is to return to the Null state the dialogue should be closed or aborted first.

- Summary of change: # 1. Redraw SDL diagrams to a consistent style.
  - 2. Redraw message flow diagrams.
  - 3. Remove text which replicates the information in SDL diagrams.
  - 4. Correct errors in SDL diagrams.
  - 5. Add the definition of the process Subscriber\_Present\_HLR.
  - 6. Redefine the process Update\_Location\_VLR to avoid the use of the VLR\_Update\_HLR macro, and move it to subclause 25.4.
  - 7. Align the signal names used in the VLR and the PVLR for inter-VLR IMSI retrieval
  - 8. Define two layers of processes for location cancellation, to provide interworking with the processes defined in 29.002 chapter 20 and the application processes in 23.012 & 23.060.
  - 9. Model the process Cancel Location SGSN on the process Cancel\_Location\_VLR, to communicate with the application process defined in the stage 2 specification
  - 10. Apply a consistent naming convention for SDL processes: the last component of the name of the process is the entity in which the process runs.
  - 11. Provide supporting text in subclause 19.1.4 for the SDL processes in the VLR and the HLR for the MS purging procedure.
  - 12. Correct the handling in the MAP handover processes to reflect that the dialogue has been closed when the macro Check Confirmation takes the Provider Error exit.
  - 13. Align signal names to & from HO CA with those used in 23.009.
  - 14. Add the error handling for failure of subsequent handover back to MSC-A.
  - 15. Close the dialogue with MSC-B and return the process to the Null state after successful completion of subsequent handover.
  - 16. Report the error to the HO\_CA when a badly formed

MAP\_SEND\_END\_SIGNAL indication is received.

- 17. Change the modelling in MSC-A for subsequent handover to indicate that a separate instance of the process Handover\_MSC\_A is triggered to handle the dialogue with MSC-B' for subsequent handover to a third MSC.
- 18. Expand in line the handling for error indications from the distant MSC during inter-MSC handover.
- 19. Correct the handling in the macro Receive Error From HO CA.
- 20. Correct the handling in the calling processes for the Error and Null exits from the macro Receive\_Error\_From\_HO\_CA.

# Consequences if not approved:

- # 1. No SDL source files to use as the basis for future changes.
  - 2. Message flow diagrams are difficult to read.
  - 3. Useful information to supplement the SDL diagrams is buried in superfluous verbiage, which (inaccurately) repeats the information in the SDL diagrams.
  - 4. Many formal errors in SDL diagrams.
  - 5. The style of chapter 19 will be markedly different from the style of chapters 22 25, making the specification more difficult to use for implementers who are not aware of the history, and leading to a perception of poor quality.

Clauses affected:	<b>%</b> 19; 25.4.4 (new); 25.7.7; 25.9.6; 25.9.7
Other specs affected:	Y N  X Other core specifications   Test specifications   X O&M Specifications
Other comments:	<ol> <li>The text for each of the second level subclauses 19.1.1, 19.1.2, 19.1.4, 19.3.1 &amp; 19.3.2 has been grouped together before the SDL diagrams. Similarly, the text for each of subclauses 19.2, 19.4 &amp; 19.5 has been grouped together before the SDL diagrams. This editorial rearrangement has not been revision marked.</li> <li>Figure numbers have been systematically updated to reflect the order within each subclause. In subclause 19.1, figure numbers are allocated sequentially in each second level subclause; in subclauses 19.2, 19.3, 19.4 &amp; 19.5, figure numbers are allocated sequentially in each first level subclause.</li> <li>The subclauses within 19.1.1 have been re-ordered to group the overall description, including message flows, in 19.1.1.1, the VLR behaviour in 19.1.1.4. The behaviour of the VLR and the previous VLR for retrieval of the IMSI at inter-VLR location updating is included in subclause 19.1.1.2. This editorial change has not been revision marked, apart from the changes to subclause heading numbers and figure numbers.</li> <li>Subclause 19.1.1.6 (the independent process UL_VLR) describes a process which is called only from the macro Process_Access_Request_VLR; it has been moved to subclause 25.4. This editorial change has not been revision marked, apart from the changes to subclause heading numbers and figure numbers.</li> <li>The subclauses in 19.1.4 (MS purging) have been re-ordered to give the oreder: general description, VLR behaviour, SGSN behaviour, HLR behaviour. This editorial change has not been revision marked, apart from the changes to</li> </ol>

subclause heading numbers and figure numbers.

6. Subclauses 19.4 (the macros Insert\_Subscriber\_Data\_Framed\_HLR and

Insert\_Subs\_Data\_In\_SGSN\_Framed\_HLR) and 19.5 (Mobility Management Event notification procedure) have been re-ordered to put the macro definitions in subclause 19.5. This editorial change has not been revision marked, apart from the changes to subclause heading numbers and figure numbers.

## \*\*\* First modified section \*\*\*

### 19 Mobility procedures

#### 19.1 **Location management Procedures**

The signalling procedures in this subclause support:

- Interworking between the VLR and the HLR and between the VLR and the previous VLR (PVLR) when a non-GPRS subscriber performs a location update to a new VLR service area;
- Interworking between the SGSN, the HLR and the VLR when a subscriber with both GPRS and non-GPRS subscriptions performs a routeing area update in an SGSN and the Gs interface is implemented;
- Interworking between the SGSN and the VLR when a GPRS subscriber performs a routeing area update to a new SGSN service area;
- Interworking between the HLR and the VLR and between the HLR and the SGSN to delete a subscriber record from the VLR or the SGSN;
- Interworking between the VLR and the HLR and between the SGSN and the HLR to report to the HLR that a subscriber record has been purged from the VLR or the SGSN.

For non-GPRS subscribers, this clause 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 clause:

```
Process Update Location Area:
   Update Location Area VLR, clause 19.1.1.3;
Process Update Location:
                 Update_Location_Area_VLR, clause 19.1.1.3;
```

Responder: — Update\_Location\_HLR, clause 19.1.1.4;

**Process Send Identification:** 

Send Identification VLR, clause 19.1.1.x;

Responder: Send\_Identification\_PVLR, clause 19.1.1.5;

**Process Cancel Location:** 

Initiator: Cancel Location HLR, clause 19.1.2.2;

Responder: Cancel Location VLR, clause 19.1.2.3;

**Process Purge MS:** 

Purge\_MS\_VLR, clause 19.1.4.2;

Responder: Purge\_MS\_HLR, clause 19.1.4.3.

For GPRS subscribers, this clause 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 clause:

```
Process GPRS Update Location:
```

```
GPRS_Update_Location_Area_VLR, clause 19.1.1.3, or
```

SGSN\_Update\_HLR, clause 19.1.1.8,

Responder: Update\_GPRS\_Location\_HLR, clause 19.1.1.4;

**Process Cancel Location:** 

Initiator: Cancel\_GPRS\_Location\_HLR, clause 19.1.2.2;

Responder: Cancel\_Location\_SGSN, clause 19.1.2.4;

**Process Purge MS:** 

Initiator: Purge\_MS\_SGSN, clause 19.1.4.4;

Responder: Purge\_MS\_HLR, clause 19.1.4.3.

The following existing process is also used for GPRS subscribers:

**Process Subscriber Present HLR:** 

Initiator: Subscriber Present HLR, clause 19.1.1.7;

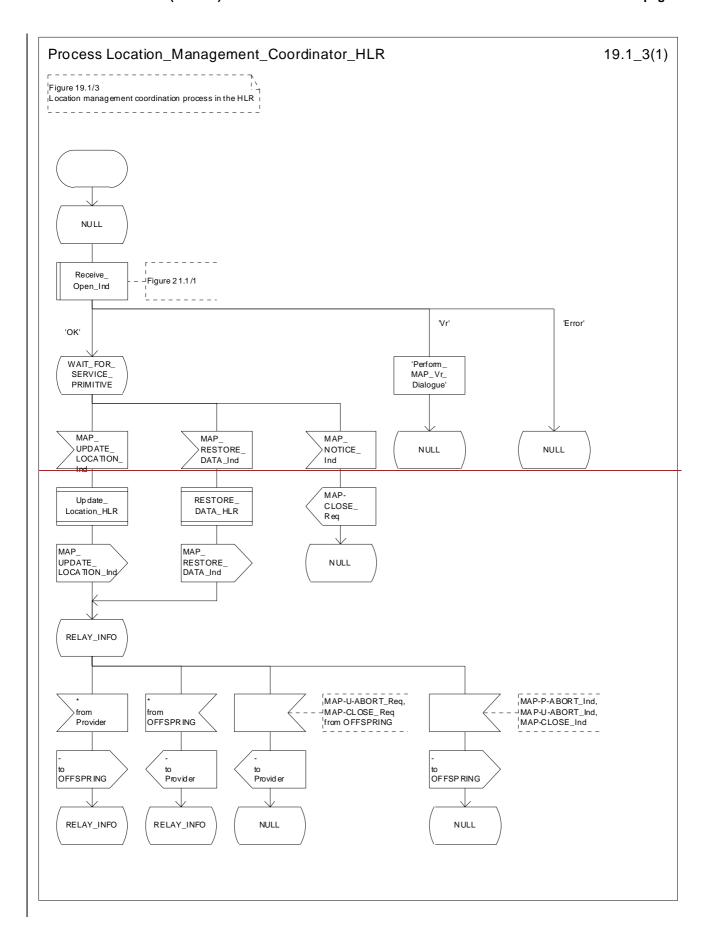
Responder: Short Message Alert IWMSC, clause 23.4.3;

### **Location Management Coordinator HLR**

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.

The MAP co-ordinating process in the HLR to handle a dialogue opened with the network location updating context is shown in figure 19.1/1. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see clause 25.1.1.



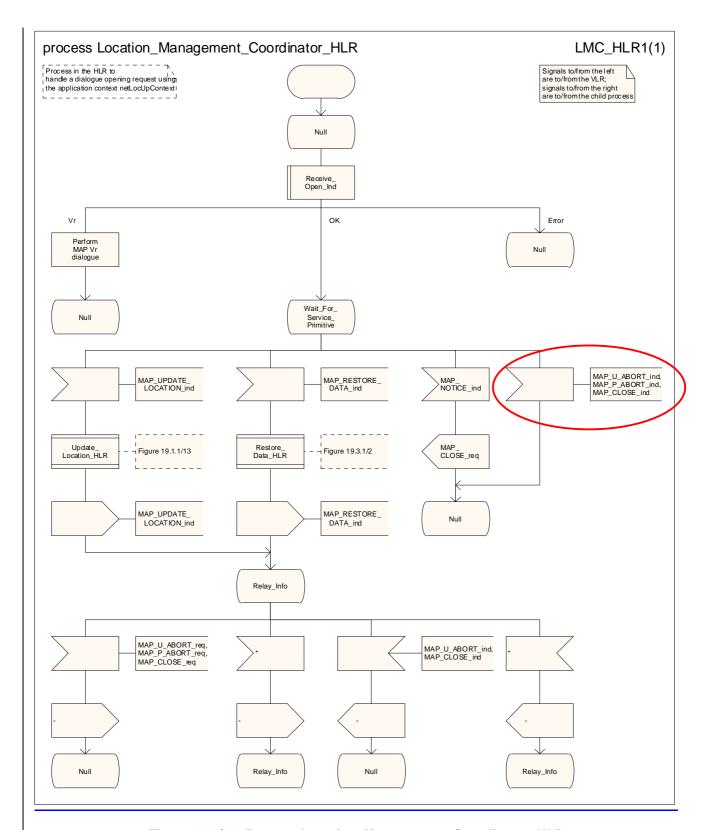


Figure 19.1/13: Process Location\_Management\_Coordinator\_HLR

## 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 3GPP TS 23.012 [23] and 3GPP TS 23.060 [104]). The use of the IMSI Detach / Attach feature is optional for the network operator.

To minimise 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 location management for a non-GPRS subscriber is 3GPP TS 23.012 [23]. The interworking between the MAP signalling procedures and the location management procedures in the VLR, the PVLR and the HLR is shown by the transfer of signals between these procedures.

The stage 2 specification for GPRS is in 3GPP TS 23.060 [104]. The interworking between the MAP signalling procedures and the GPRS procedures in the SGSN and the HLR is shown by the transfer of signals between these procedures (see clause 19.1.1.8).

The message flow for successful inter-VLR location updating when the IMSI can be retrieved from the PVLR is shown in figure 19.1.1/2.

The message flow for successful inter-VLR location updating when the IMSI cannot be retrieved from the PVLR is shown in figure 19.1.1/3.

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 clause 8.1);(**)

MAP_UPDATE_LOCATION (see clause 8.1);(**)

MAP_UPDATE_GPRS_LOCATION (see clause 8.1) (*);

MAP_CANCEL_LOCATION (see clause 8.1);

MAP_INSERT_SUBSCRIBER_DATA (see clause 8.8);
```

MAP\_PROVIDE\_IMSI (see clause 8.9) (\*\*);

MAP\_AUTHENTICATE (see clause 8.5) (\*\*);

MAP\_SET\_CIPHERING\_MODE (see clause 8.6) (\*\*);

MAP\_FORWARD\_NEW\_TMSI (see clause 8.9) (\*\*);

MAP\_CHECK\_IMEI (see clause 8.7);

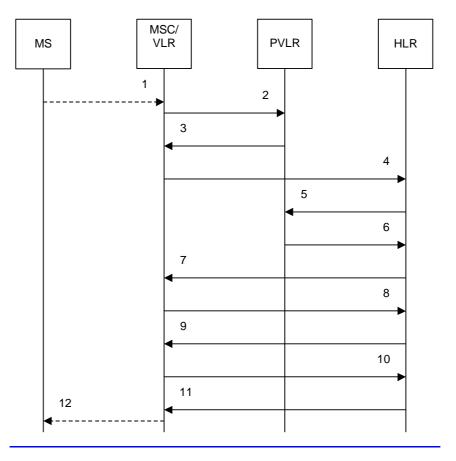
MAP\_ACTIVATE\_TRACE\_MODE (see clause 9.2);

MAP\_TRACE\_SUBSCRIBER\_ACTIVITY (see clause 9.2) (\*\*).

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

(\*\*): not used in SGSN

<sup>a</sup>MAP INSERT SUBSCR. DATA ack<sup>a</sup> <sup>a</sup>MAP UPDATE LOCATION ack



## PVLR = Previous VLR

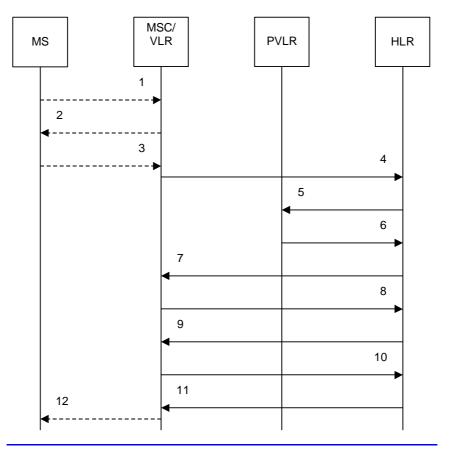
- A LU REQUEST (Note 1)
- MAP SEND IDENTIFICATION reg/ind
- MAP\_SEND\_IDENTIFICATION\_rsp/cnf
- MAP\_UPDATE\_LOCATION\_req/ind 4)
- 5) MAP CANCEL LOCATION req/ind
- 6) MAP\_CANCEL\_LOCATION\_rsp/cnf
- MAP ACTIVATE TRACE MODE req/ind (Note 2)
  MAP ACTIVATE TRACE MODE rsp/cnf (Note 2) 7)
- 8)
- 9) MAP INSERT SUBSCRIBER DATA reg/ind
- 10) MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf
- MAP UPDATE LOCATION rsp/cnf 11)
- A LU CONFIRM (Note 1) 12)

NOTE 1: For details of the procedure on the radio path, see 3GPP TS 24.008 [35]. 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 <u>2</u>: Procedures shown <u>Services printed</u> in *italics* are optional.

Figure 19.1.1/2: Interface and services Message flow for location updating when changing the to a new VLR area, when the IMSI can be retrieved from the previous VLR





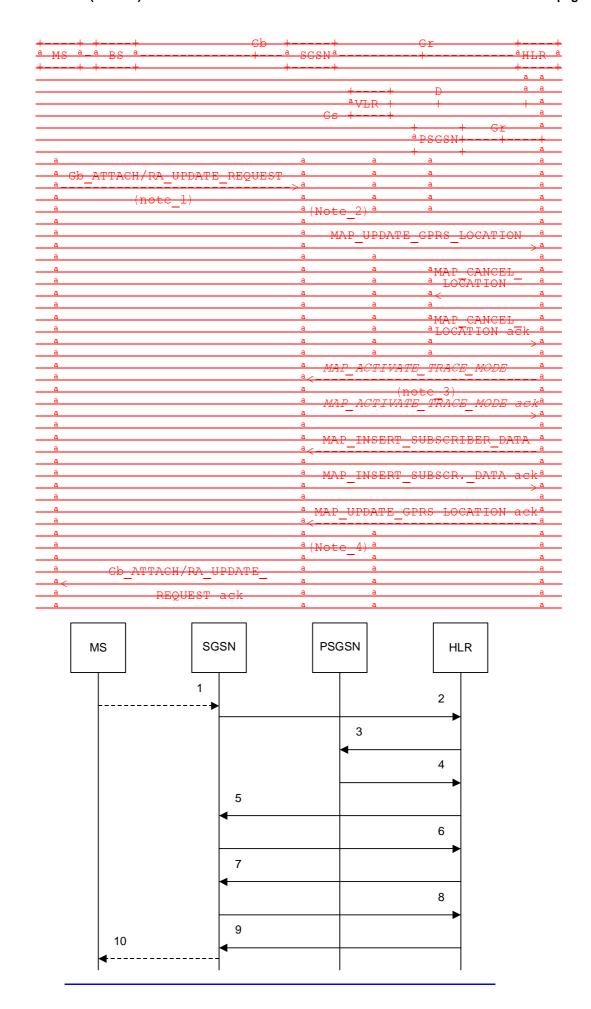
### PVLR = Previous VLR

- A LU REQUEST (Note 1)
- A\_IDENTITY\_REQUEST (Note 1)
- A\_IDENTITY\_RESPONSE (Note 1)
- MAP\_UPDATE\_LOCATION\_req/ind 4)
- 5) MAP CANCEL LOCATION req/ind
- 6) MAP\_CANCEL\_LOCATION\_rsp/cnf
- MAP ACTIVATE TRACE MODE req/ind (Note 2)
  MAP ACTIVATE TRACE MODE rsp/cnf (Note 2) 7)
- 8)
- 9) MAP INSERT SUBSCRIBER DATA reg/ind
- 10) MAP\_INSERT\_SUBSCRIBER\_DATA\_rsp/cnf
- MAP UPDATE LOCATION rsp/cnf 11)
- A LU CONFIRM (Note 1) 12)

NOTE 1: For details of the procedure on the radio path, see 3GPP TS 24.008 [35]. 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 <u>2</u>: Procedures shown <u>Services printed</u> in *italics* are optional.

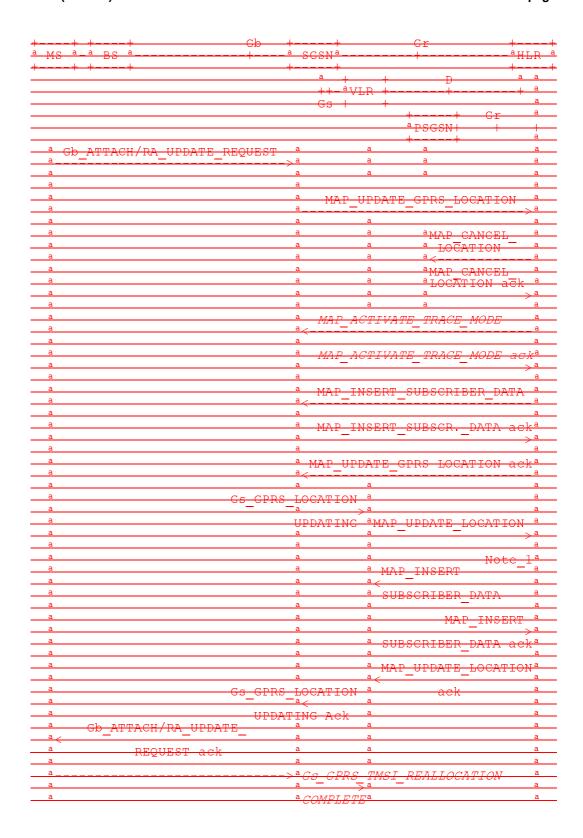
Figure 19.1.1/3: Interface and services Message flow for location updating involving both to a new VLR areand an HLR, when the IMSI can-not be retrieved from the previous VLR

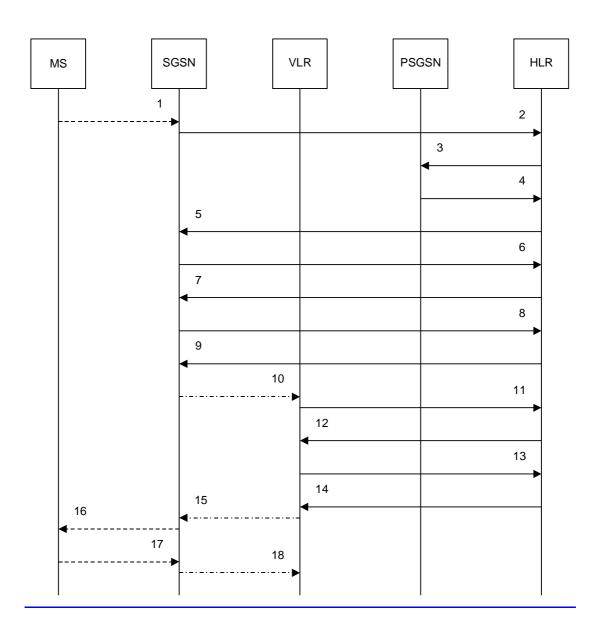


### PSGSN = Previous SGSN

- Gb\_ATTACH\_REQUEST or RA\_UPDATE\_REQUEST (Note 1, note 2)
- MAP UPDATE GPRS LOCATION req/ind MAP\_CANCEL\_LOCATION\_req/ind
- 3)
- MAP\_CANCEL\_LOCATION\_rsp/cnf 4)
- MAP ACTIVATE TRACE MODE reg/ind (Note 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 3) 6)
- MAP INSERT SUBSCRIBER DATA reg/ind 7)
- MAP INSERT SUBSCRIBER DATA rsp/cnf MAP\_UPDATE\_GPRS\_LOCATION\_rsp/cnf 8)
- 10) Gb ATTACH ACCEPT or RA UPDATE ACCEPT (Note 1)
- NOTE 1: For details of the procedure on the radio path, see 3GPP TS-48.018 [35]. 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 3GPP -TS -23.060 [104]. The MAP processes signalling invoked for theese procedures are functions is described in section clause 25 of the present document.
- NOTE 3: Optional s Services are printed in *italics* are optional.
- NOTE 4: Refer to 3GPP TS -23.060 -[104] for termination of the procedure and triggering of the signalling on the Gb interface between the BSS and the SGSN.

Figure 19.1.1/4: Interface and servicesMessage flow for GPRS location updating (Gs\_interface not installed)





- Gb\_ATTACH\_REQUEST or RA\_UPDATE\_REQUEST (Note 1, note 2)
- MAP UPDATE GPRS LOCATION reg/ind 2)
- 3) MAP CANCEL LOCATION reg/ind
- 4) MAP\_CANCEL\_LOCATION\_rsp/cnf
- 5) MAP ACTIVATE TRACE MODE reg/ind (Note 3)
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 3)
  MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind 6)
- 7)
- MAP INSERT SUBSCRIBER DATA rsp/cnf 8)
- MAP UPDATE GPRS LOCATION rsp/cnf 9)
- Gs\_LOCATION\_UPDATE\_REQUEST (Note 4) 10)
- MAP UPDATE LOCATION reg/ind (Note 5) <u>11)</u>
- MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind 12)
- 13) MAP INSERT SUBSCRIBER DATA rsp/cnf
- MAP\_UPDATE\_LOCATION\_rsp/cnf 14)
- 15) Gs LOCATION UPDATE ACCEPT (Note 4)
- 16) Gb\_ATTACH\_ACCEPT or RA\_UPDATE\_ACCEPT (Note 1)
- 17) Gb TMSI REALLOCATION COMPLETE (Note 1)
- TMSI\_REALLOCATION\_COMPLETE (Note 4) 18)
- NOTE 1: For details of the procedure on the radio path, see 3GPP TS 24.008 [35]. 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.
- For security functions (authentication, ciphering, IMEI check) triggering refer to 3GPP TS 23.060 [104]. MAP processes invoked for those procedures are described in subclause 25.5.
- Services printed in italics are optional. NOTE 3:

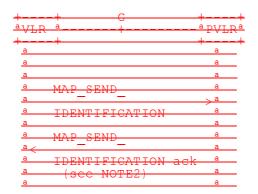
- NOTE 5: For details of the procedure on the path between the SGSN and the VLR, see 3GPP TS 29.018 [106]. The services shown in chain lines indicate the trigger provided by the signalling on the path between the SGSN and the VLR, and the signalling triggered on the path between the SGSN and the VLR.
- NOTE 4: Refer to 3GPP TS 23.060 [104] for termination of the procedure and triggering of the signalling on the interface between the BSS and the SGSN.
- NOTE 5: For simplicity, the Location Cancellation procedure towards the previous VLR and optional tracing activation towards the new VLR are not shown in this figure.
- NOTE 1: The optional procedures in figure 19.1.1/14 apply here respectively. For details of the procedure on the Gs interface, see 3GPP TS 29.018 [106].
- NOTE 2: Location Cancellation procedure toward the old VLR and optional tracing activation toward the new VLR are not represented on this figure.

Figure 19.1.1/5: Interface and services Message flow for GPRS location updating (Gs\_-interface installed)

### 19.1.1.5.1 General

This service is invoked by the VLR when it receives Update location from the MSC 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 clause 19.1.1.3), using the service described in clause 8.1.4.

If the version negotiation between R99 VLR and pre R99 PVLR leads to the MAP version 1 or 2, the VLR shall request authentication sets from the HLR.



NOTE1: The service shown in dotted lines indicates the trigger provided by other MAP signalling.

NOTE2: Several MAP\_SEND\_IDENTIFICATION request/response may be used if message segmentation is required.

Figure 19.1.1/10: Interface and services for Send Identification

## 19.1.1.23 Detailed pProcedures in the VLR

The MAP process in the VLR for location updating for a non-GPRS subscriber is shown in figure 19.1.1/6. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive_Open_Cnf	see subclause 25.1.2;
Check Confirmation	see subclause 25 2.2

The MAP process in the VLR to retrieve the IMSI of a subscriber from the previous VLR (PVLR) is shown in figure 19.1.1/7. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf	see subclause 25.1.2;
Check Confirmation	see subclause 25.2.2.

The process in the VLR for location updating for a GPRS subscriber when the Gs interface is installed is shown in figure 19.1.1/8.

The macro GPRS Location Update Completion VLR is shown in figure 19.1.1/9. The macro invokes a process not defined in this clause; the definition of this process can be found as follows:

```
Subscriber_Present_VLR see subclause 25.10.1.
```

The macro GPRS\_Update\_HLR\_VLR is shown in figure 19.1.1/10. The macro invokes macros not defined in this clause; the definitions of these macros can be found as follows:

```
Receive Open_Cnf see subclause 25.1.2;
Check_Confirmation see subclause 25.2.2;
Insert_Subs_Data_VLR see subclause 25.7.1;
Activate Tracing VLR see subclause 25.9.4.
```

#### **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 3GPP TS 23.060 [104] 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 exits 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 3GPP TS 29.018 [106]) 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 clause 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 3GPP TS 23.060 [104]). 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

In case the HLR rejects dialogue opening (see clause 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 clause 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 clause 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.

## 19.1.1.5 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 clause 19.1.1.X.

## 19.1.1.5.3 Detailed pProcedure in the PVLR

The MAP process in the PVLR to handle a request for the IMSI of a subscriber from the new VLR is shown in figure 19.1.1/11. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

On receipt of a dialogue request for the Send Identification procedure, (see Receive\_Open\_Ind macro in clause 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.

If the VLR has indicated that segmentation is prohibited then the PVLR sends a MAP\_SEND\_IDENTIFICATION response to the VLR by means of the TC RESULT L service and terminates the dialogue towards the VLR by a MAP\_CLOSE request with parameter Release Method indicating Normal Release.

If the VLR has not indicated that segmentation is prohibited then the PVLR sends a MAP\_SEND\_IDENTIFICATION response to the VLR by means of the TC RESULT L service, followed either by a MAP\_DELIMITER if more authentication sets are to be returned, or by a MAP\_CLOSE request with parameter Release Method indicating Normal Release.

# 19.1.1.48 Detailed pProcedure in the SGSN

The MAP process in the SGSN for location updating for a GPRS subscriber is shown in figure 19.1.1/12. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnfsee subclause 25.1.2;Check\_Confirmationsee subclause 25.2.2;Insert\_Subs\_Data\_SGSNsee subclause 25.7.2;Activate\_Tracing\_SGSNsee subclause 25.9.5.

Sheet 2: The procedure Check User Error In Serving Network Entity is specific to Super-Charger; it is specified in 3GPP TS 23.116 [110].

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

- Receive\_Open\_Cnf clause 25.1;
  Insert\_Subscriber\_Data\_SGSN clause 25.7;
  Activate Tracing SGSN clause 25.9;
- Sheet 2: The procedure Check\_User\_Error\_In\_Serving\_Network\_Entity is specific to Super-Charger; it is specified in 3GPP TS 23.116 [110].

### The location updating process

The MAP process receives an « Update HLR request » from the relevant process in the SGSN (see 3GPP TS 23.060 [104]) 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 Unknown HLR 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 clause 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 clause 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 clause 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 3GPP TS 23.060 [104]).
  - 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.

# 19.1.1.54 Detailed pProcedures in the HLR

The MAP process in the HLR to handle a location updating request from a VLR is shown in figure 19.1.1/13. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

```
Check Confirmation see subclause 25.2.2.
```

The MAP process in the HLR to handle a location updating request from an SGSN is shown in figure 19.1.1/14. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Indsee subclause 25.1.1;Check\_Indicationsee subclause 25.2.1;Check\_Confirmationsee subclause 25.2.2;

Control Tracing With SGSN HLR see subclause 25.9.7.

Sheet 24: The procedure Super\_Charged\_Cancel\_Location\_HLR is specific to Super-Charger; it is specified in 3GPP TS 23.116 [110]. If the previous SGSN and the originating HLR does not support the Super-Charger functionality, processing continues from the "YesNo" exit of the test "Result=Pass?".

Sheet 2: The procedure Super\_Charged\_Location\_Updating\_HLR is specific to Super-Charger; it is specified in <u>3GPP\_TS</u> 23.116 [110]. If <u>the HLR does not support the Super-Charger functionality</u>subscription data needs to be sent to the SGSN, processing continues from the "No" exit of the test "Result=Pass?".

The MAP process in the HLR to notify Short Message Service Centres that a subscriber is now reachable is shown in figure 19.1.1/15. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Alert\_Service\_Centre\_HLR see subclause 25.10.3.

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

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

and the processes Cancel\_Location\_HLR (see clause 19.1.2) and Subscriber\_Present\_HLR (see clause 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 clause 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 deactive 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 clause 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). The HLR operator should avoid sending the error Roaming not Allowed with cause 'PLMN Roaming Not Allowed' or 'Operator determined Barring' to an SGSN in the HPLMN because this may lead to undesirable behaviour by the MS;
- 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 clause 25.9.

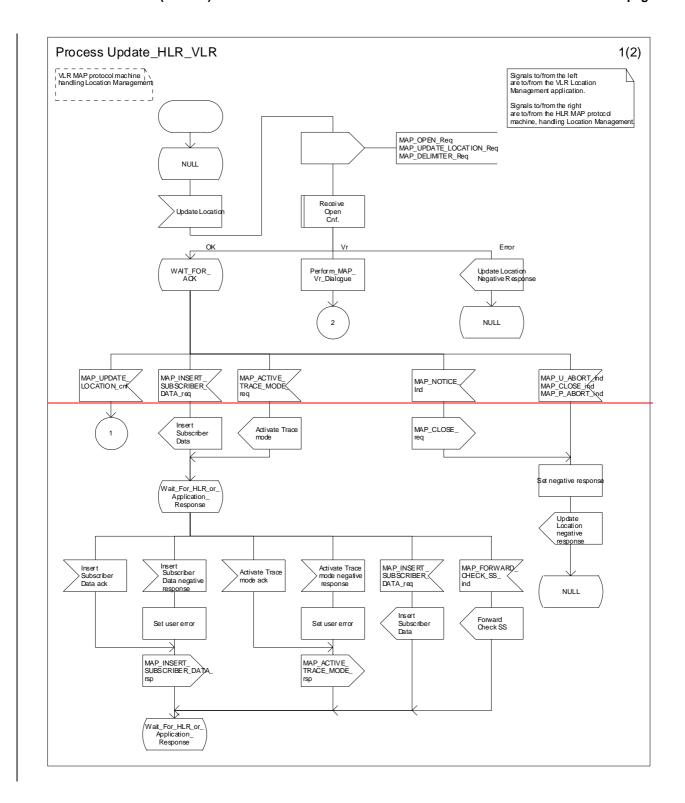
Thereafter, the macro Insert\_Subs\_Data\_In\_SGSN\_Framed\_HLR described in clause 19.4 is invoked. The outcome of this macro may be:

- 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 clause 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.



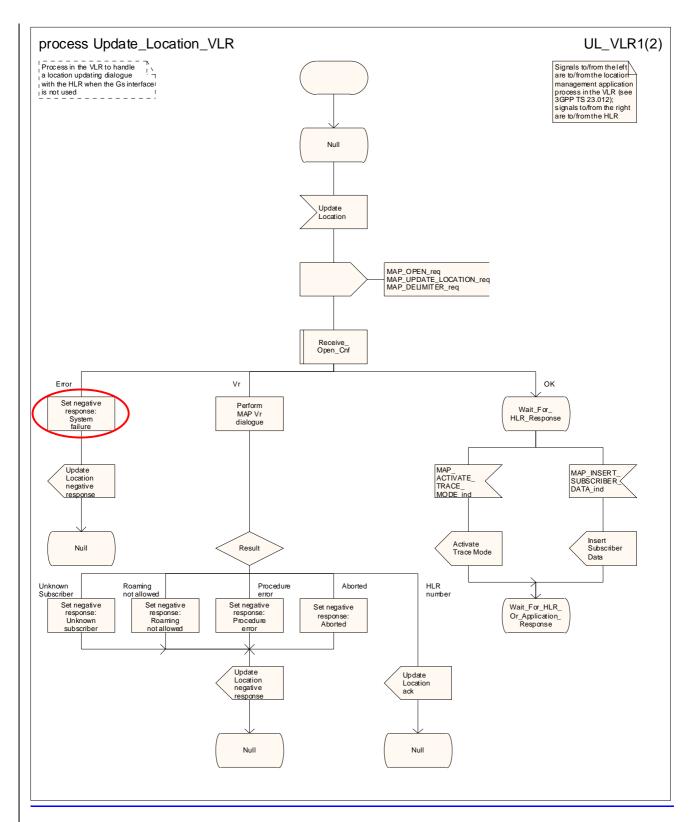
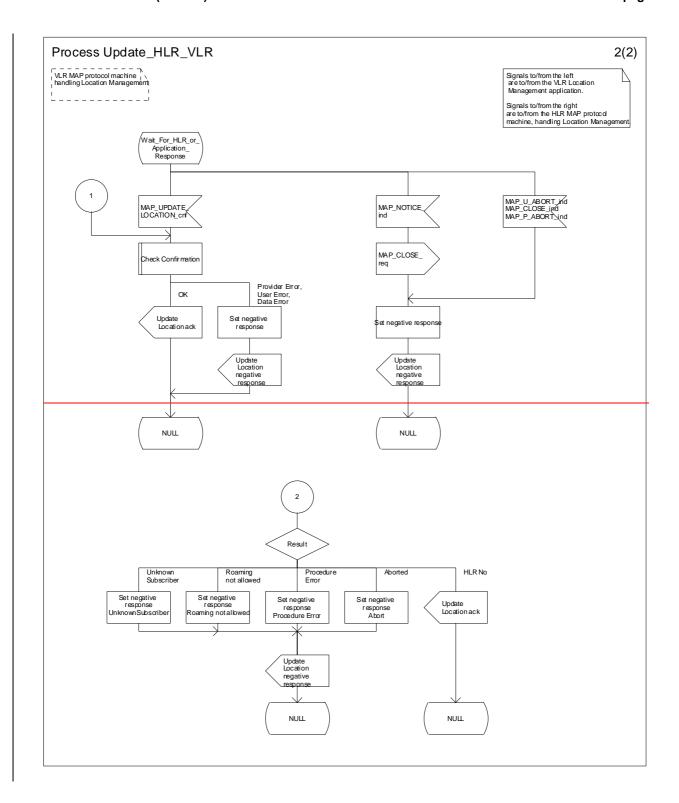


Figure 19.1.1/6 (sheet 1 of 2): Process Update\_LocationHLR\_VLR



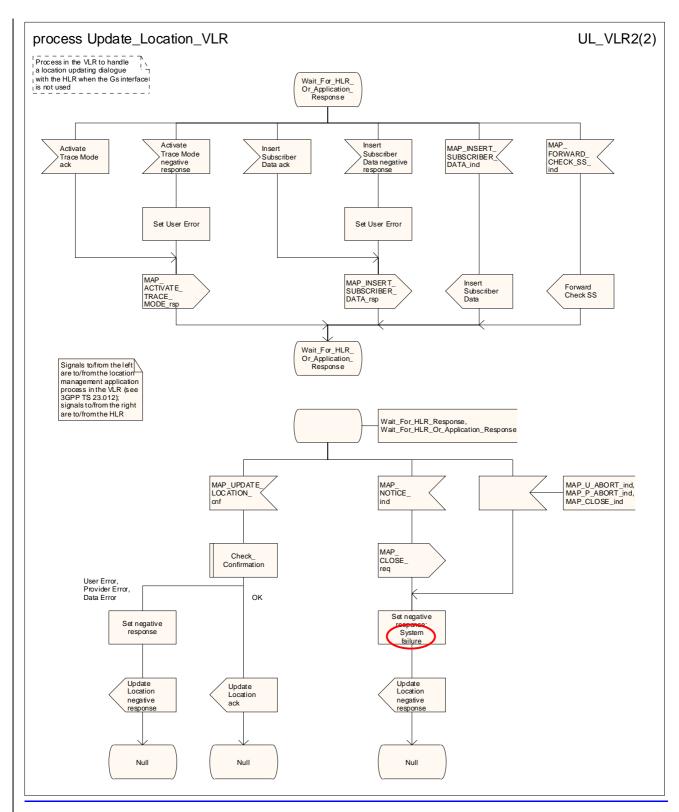
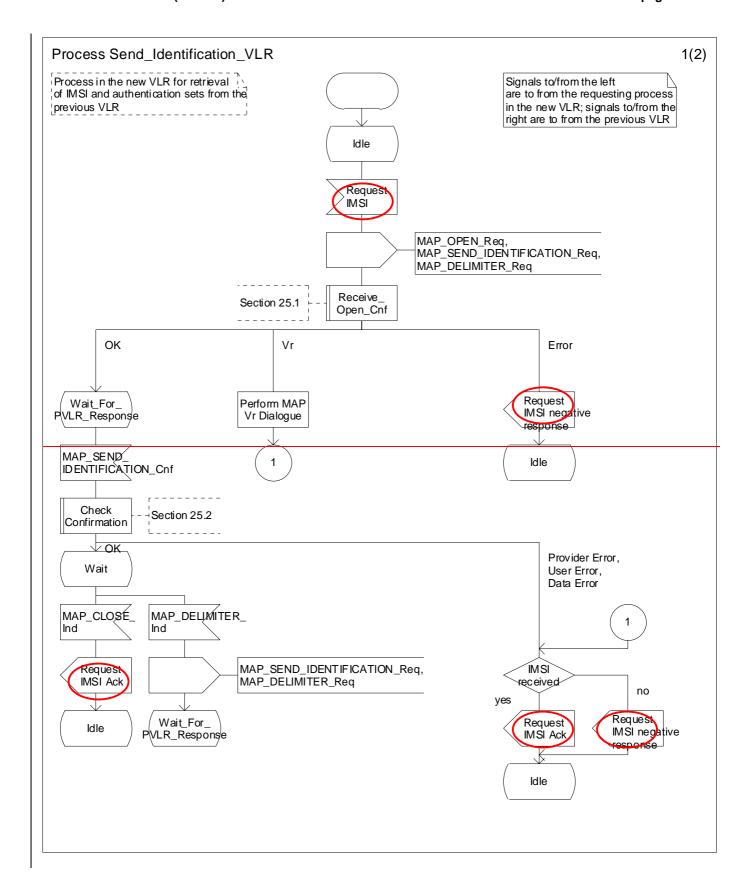


Figure 19.1.1/6 (sheet 2 of 2): Process Update\_LocationHLR\_VLR



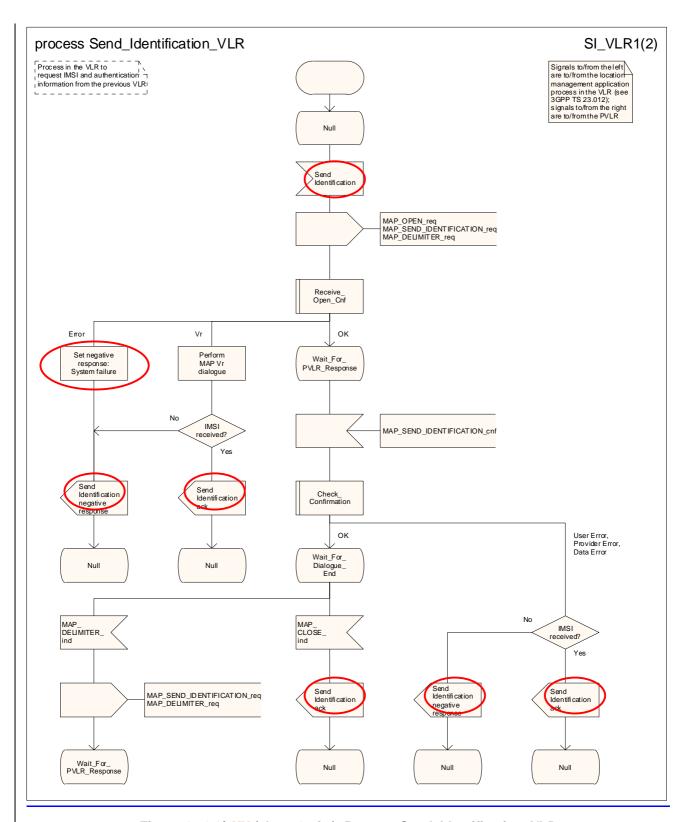
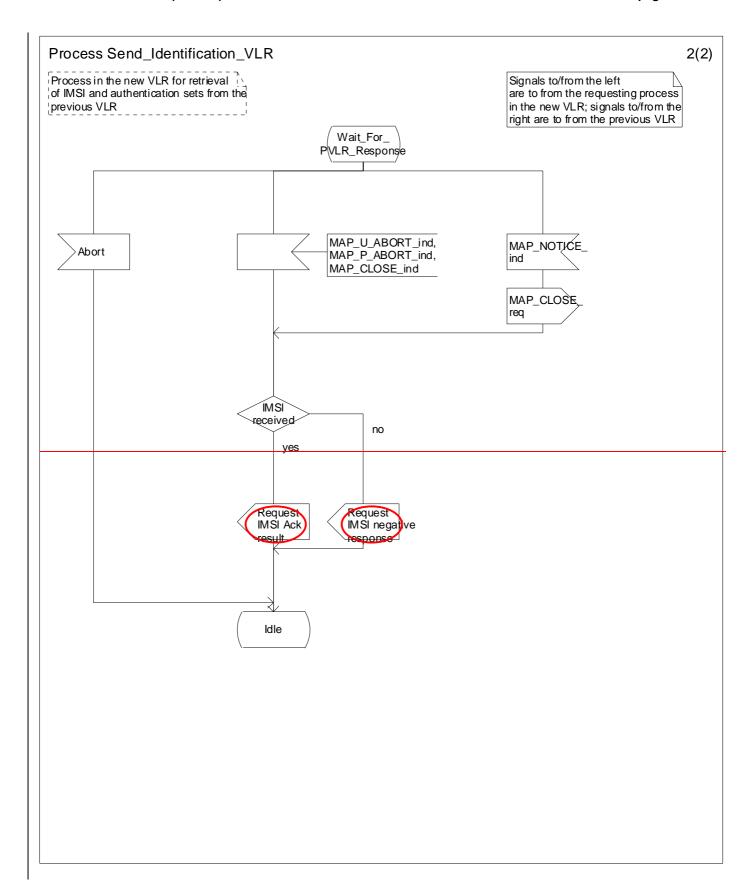


Figure 19.1.1/TXX (sheet 1 of 2): Process Send\_Identification\_VLR



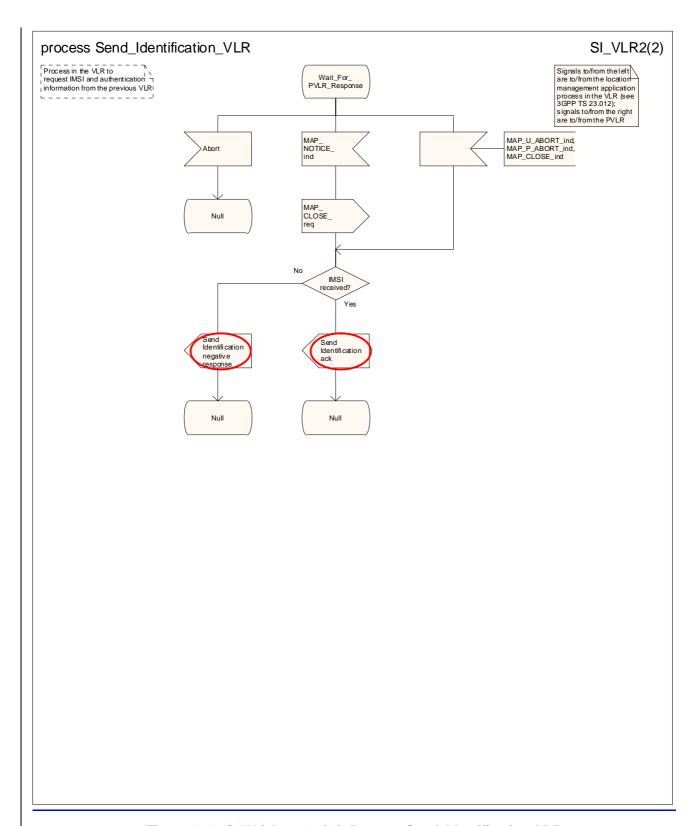
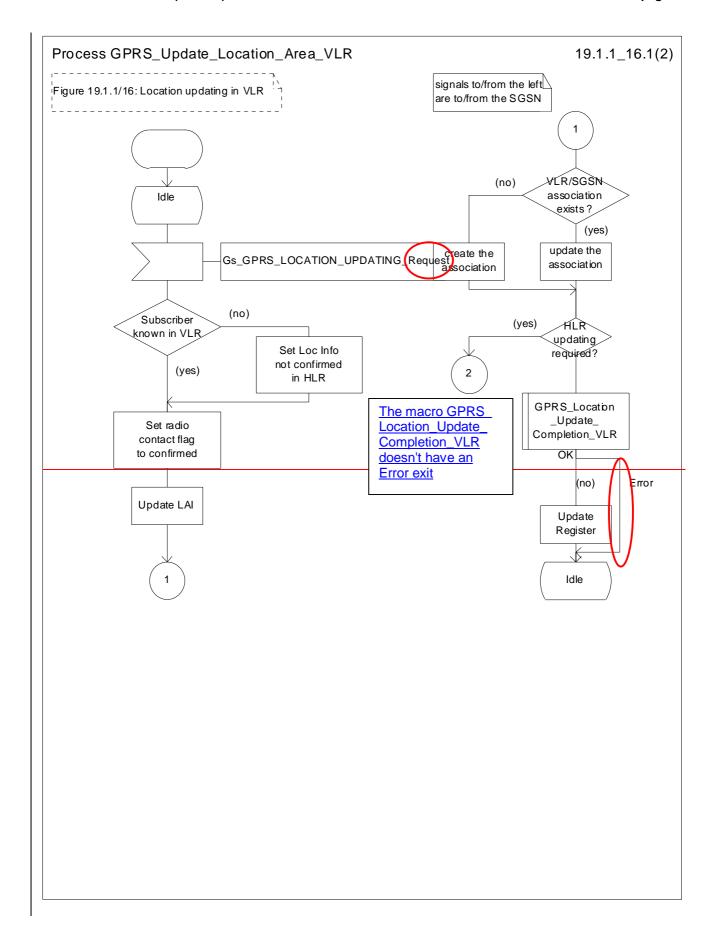


Figure 19.1.1/7XX (sheet 2 of 2): Process Send\_Identification\_VLR



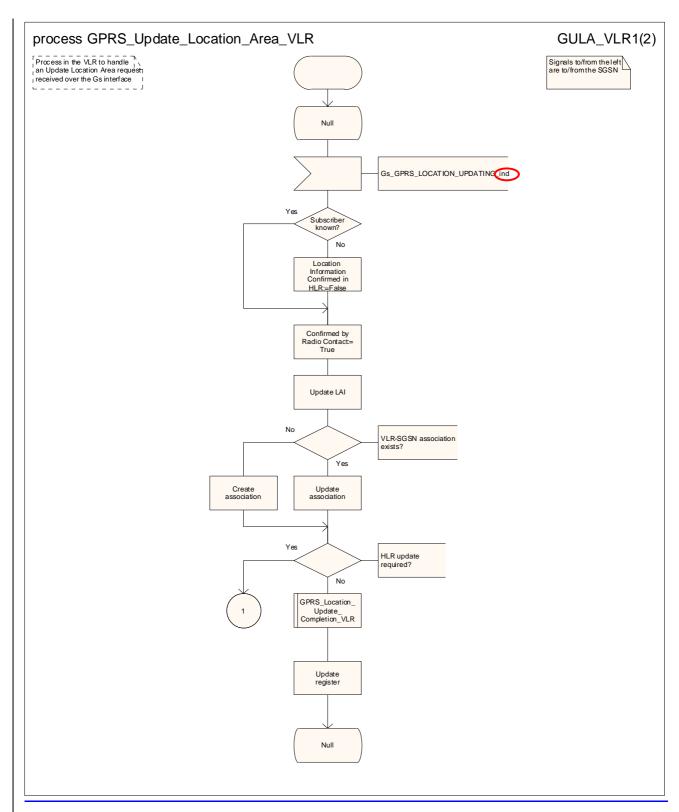
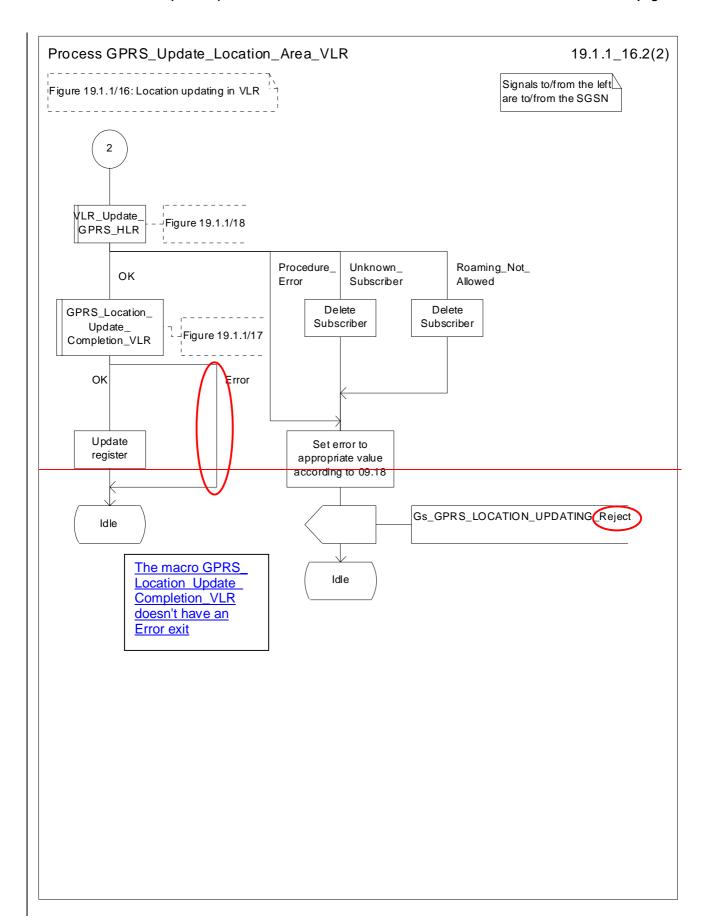


Figure 19.1.1/816 (sheet 1 of 2): Process GPRS\_Update\_Location\_Area\_VLR



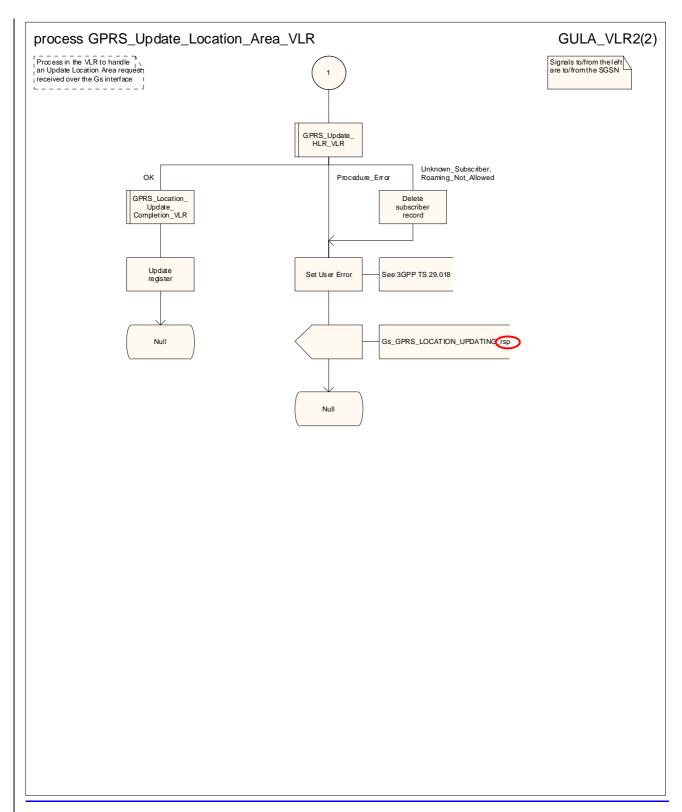
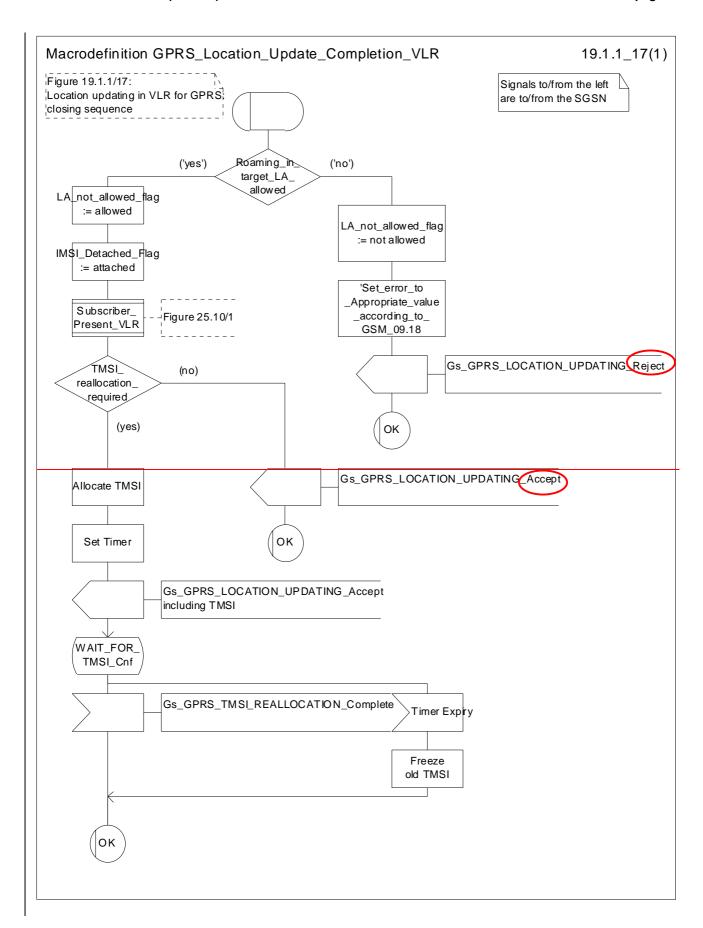


Figure 19.1.1/816 (sheet 2 of 2): Process GPRS\_Update\_Location\_Area\_VLR



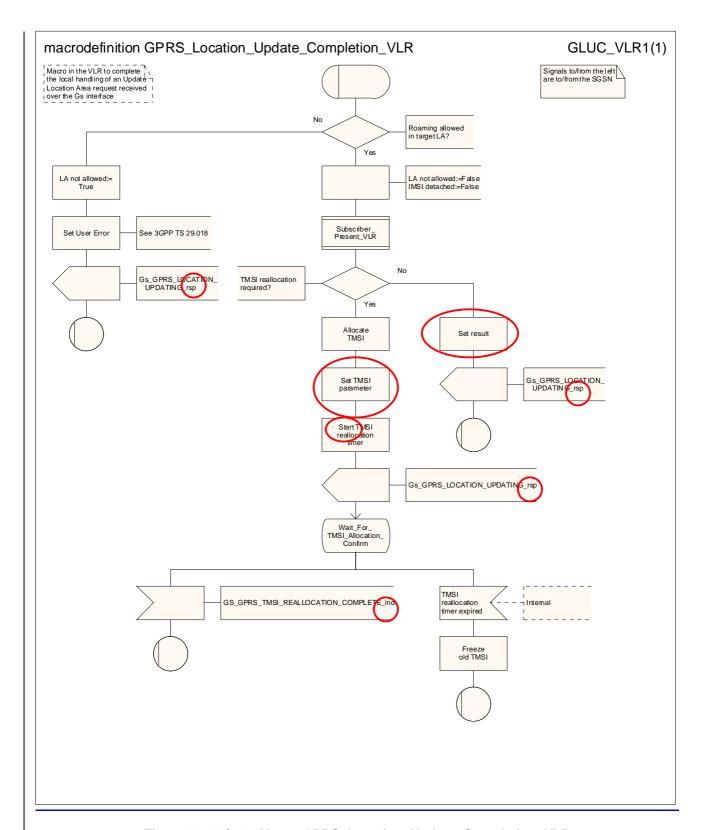
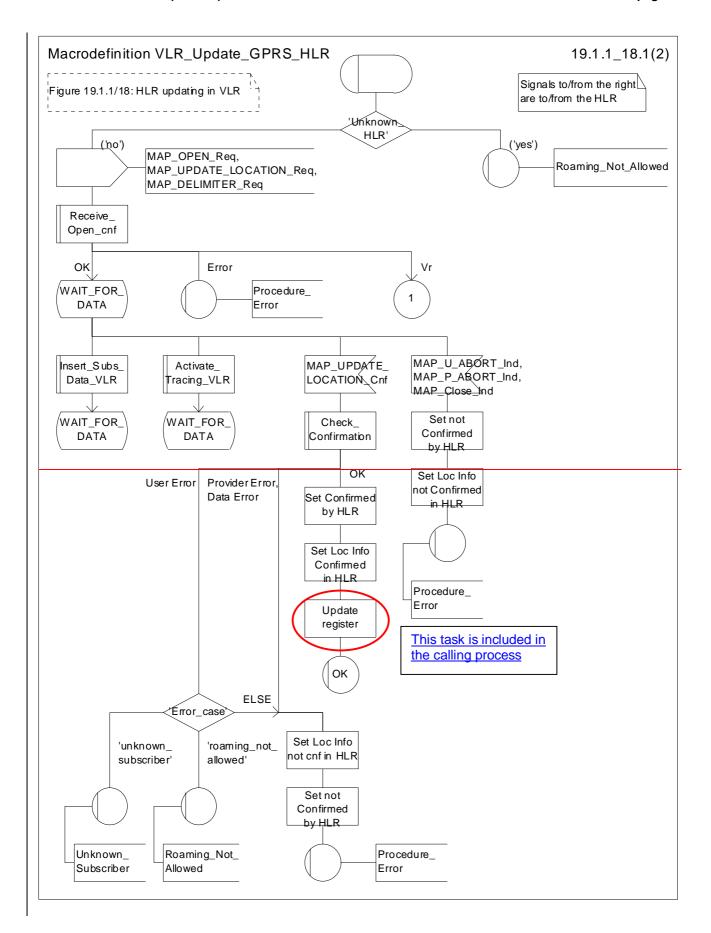


Figure 19.1.1/917: Macro GPRS\_Location\_Update\_Completion\_VLR



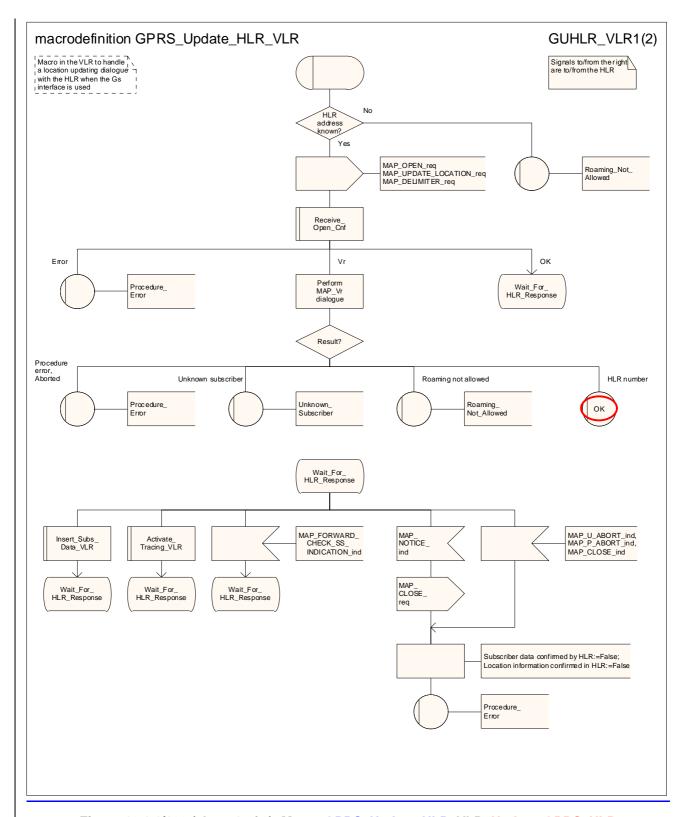
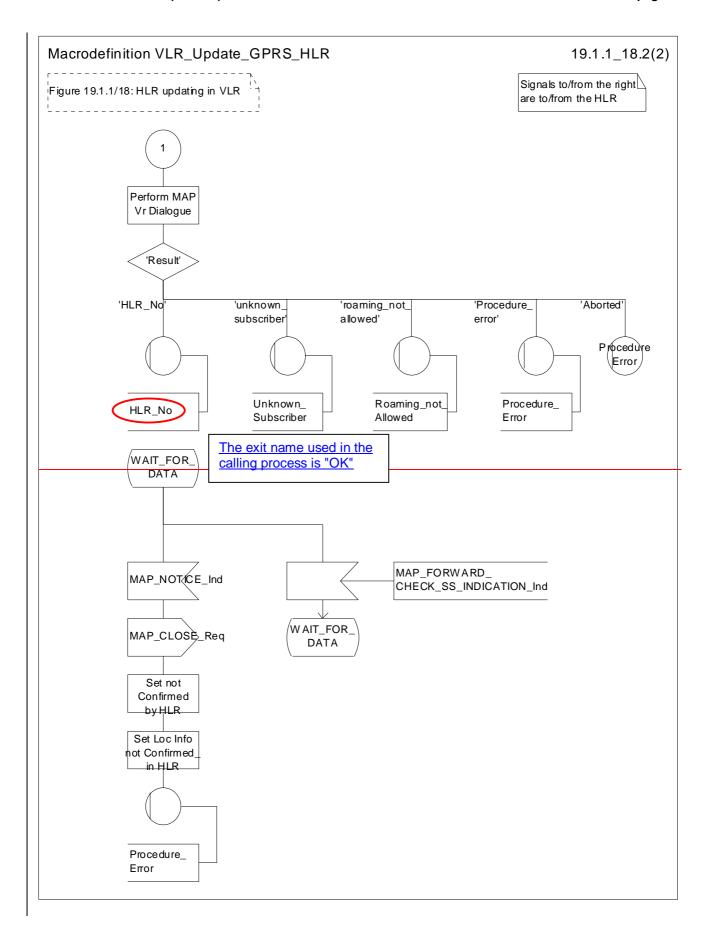


Figure 19.1.1/108 (sheet 1 of 2): Macro GPRS Update HLR\_VLR\_Update\_GPRS\_HLR



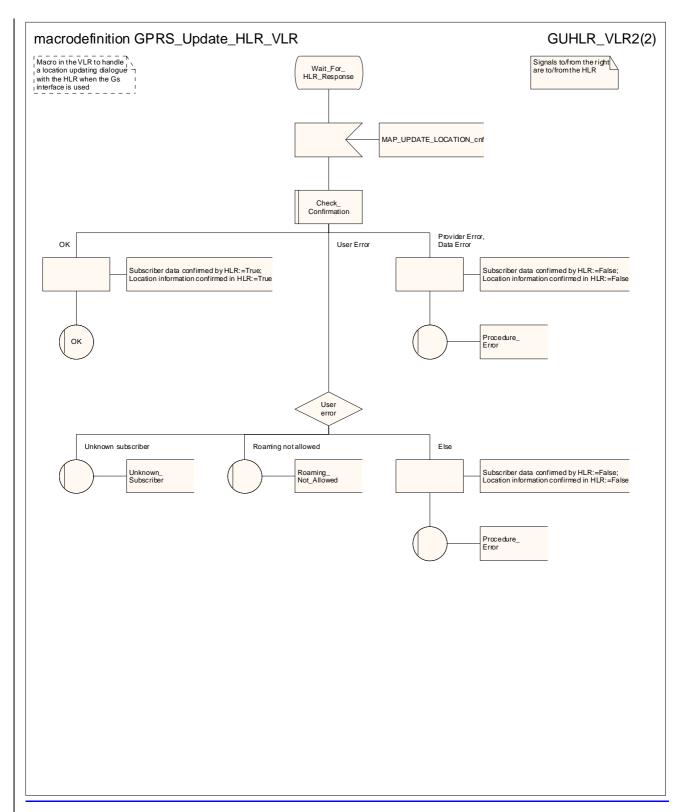
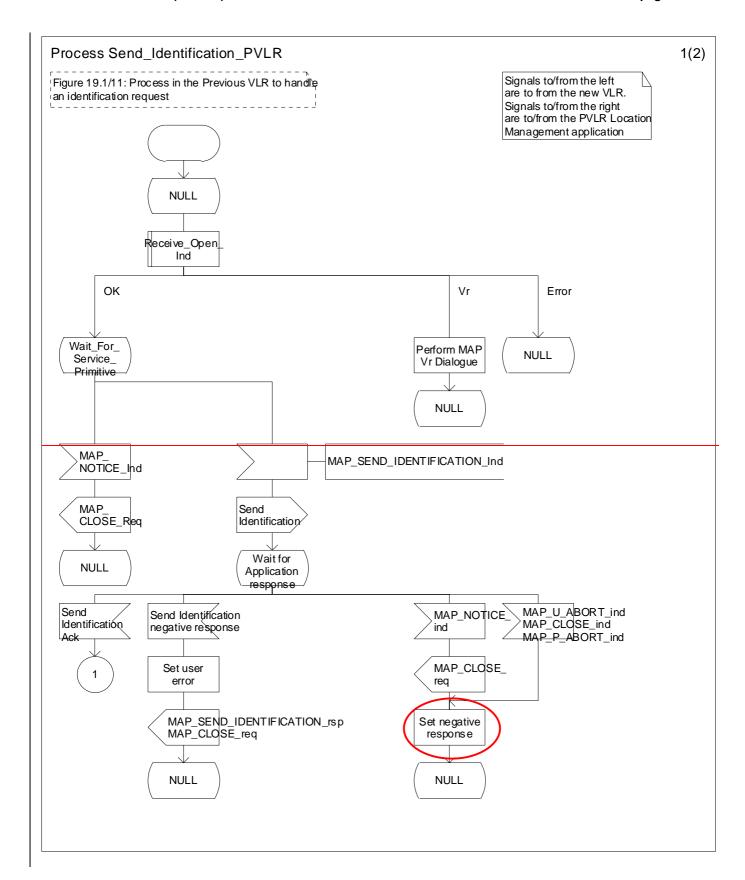


Figure 19.1.1/108 (sheet 2 of 2): Macro GPRS Update HLR\_VLR\_Update\_GPRS\_HLR



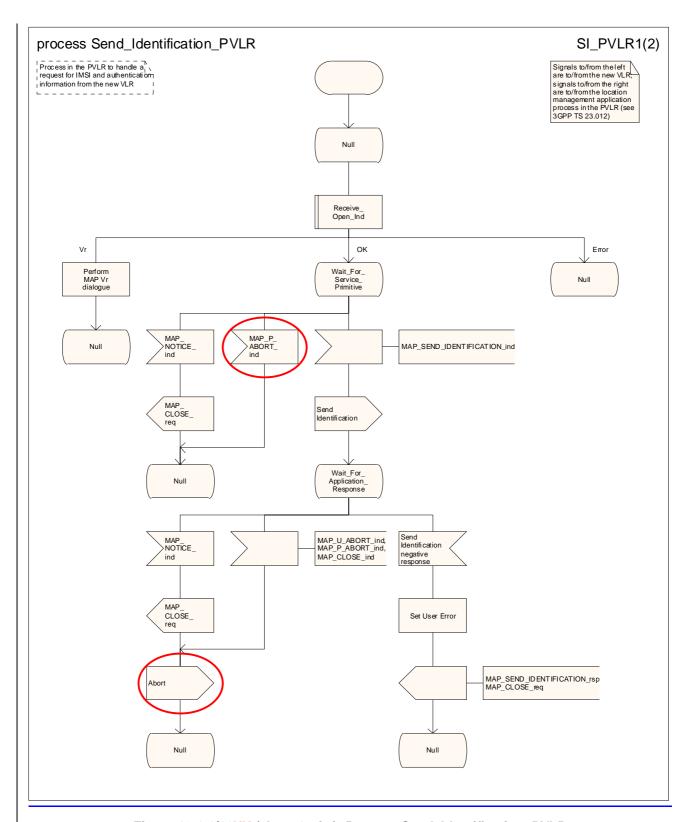
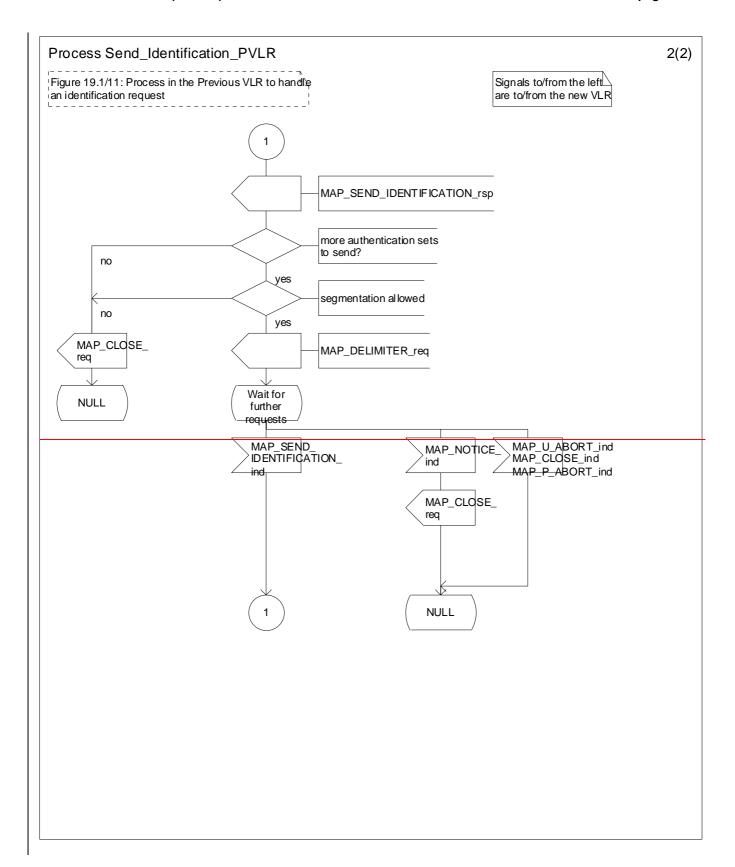


Figure 19.1.1/11XX (sheet 1 of 2): Process Send\_Identification\_PVLR



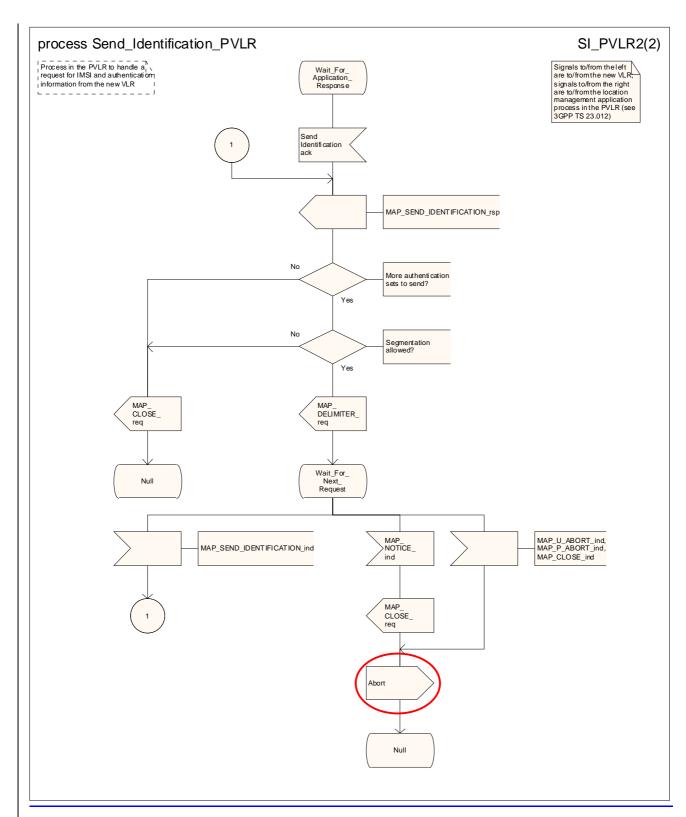
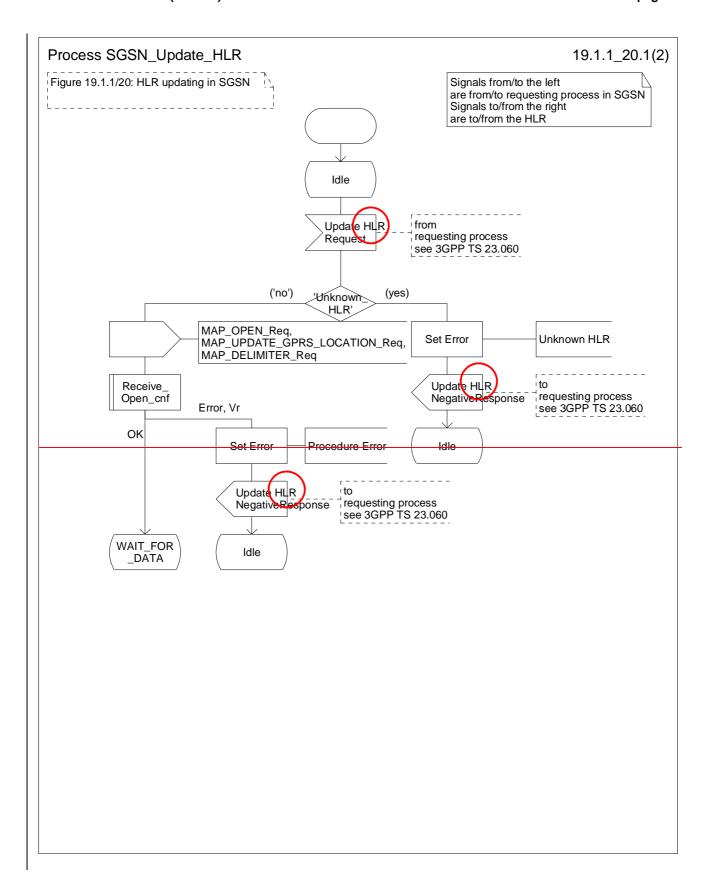


Figure 19.1.1/11XX (sheet 2 of 2): Process Send\_Identification\_PVLR



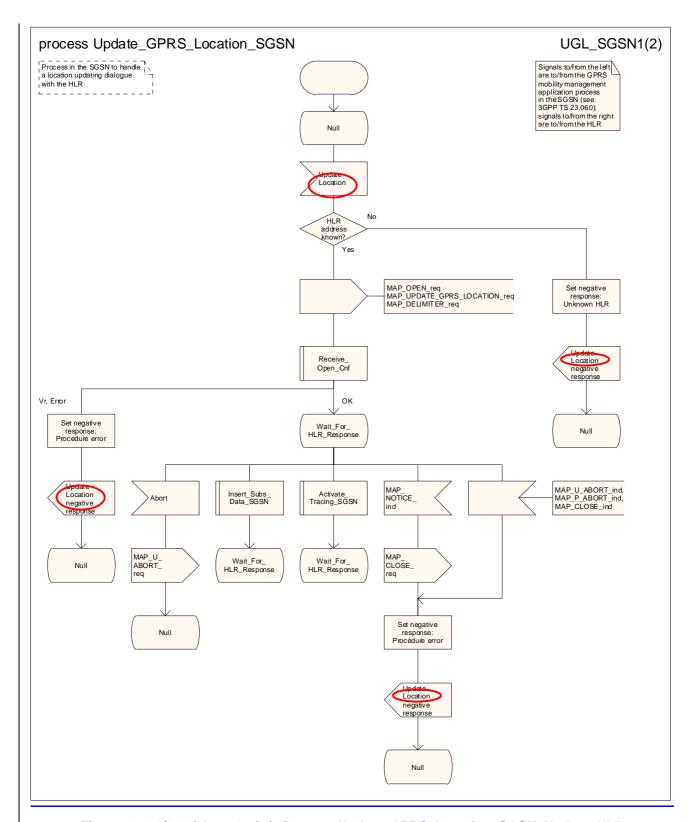
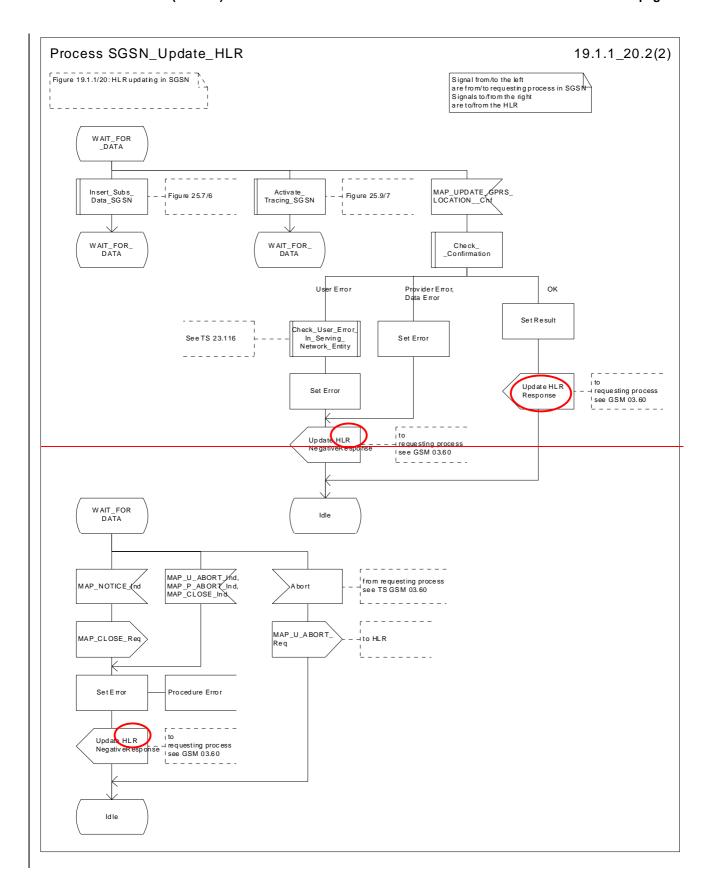


Figure 19.1.1/120 (sheet 1 of 2): Process Update GPRS Location SGSN\_Update\_HLR



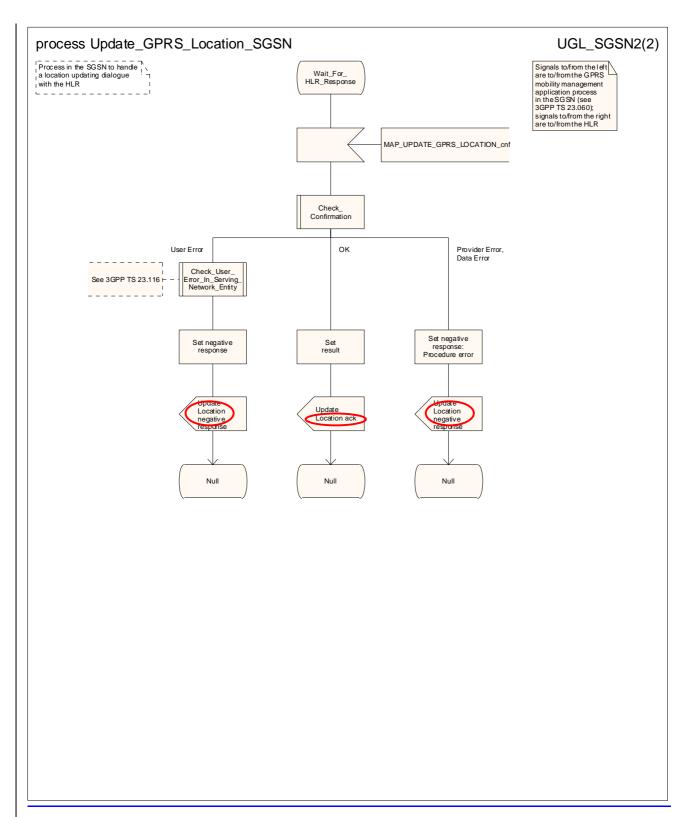
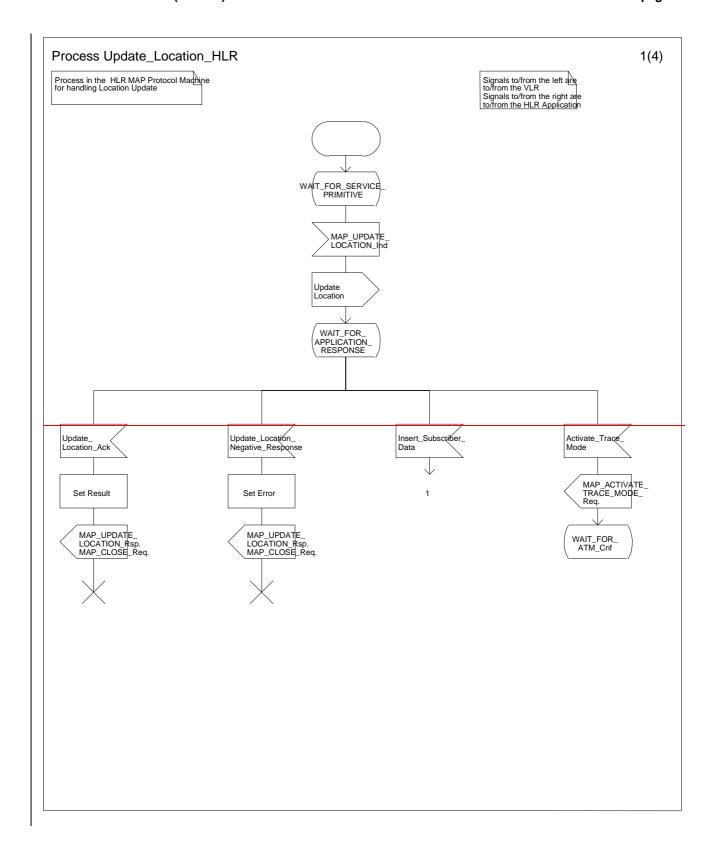


Figure 19.1.1/120 (sheet 2 of 2): Process Update GPRS Location SGSN\_Update\_HLR



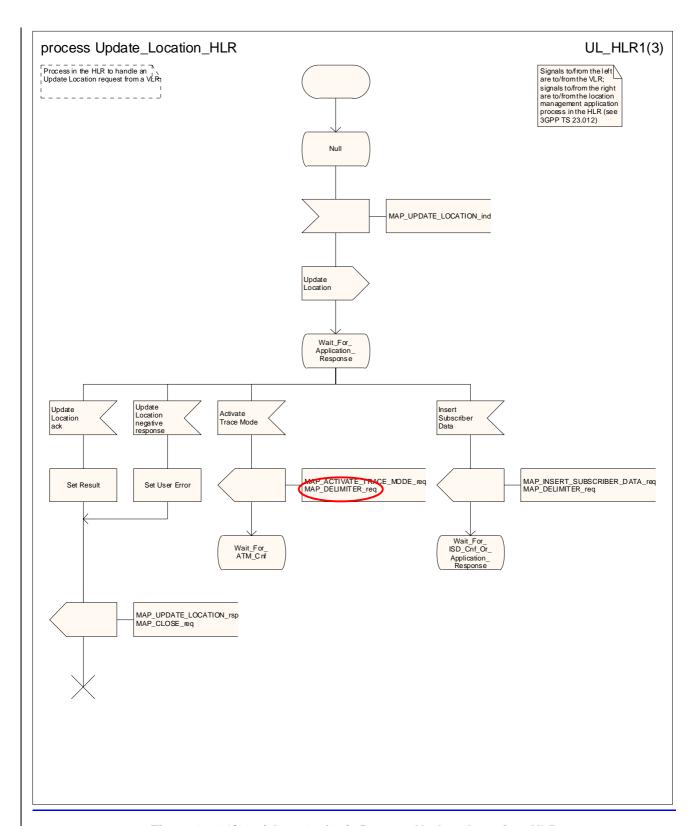
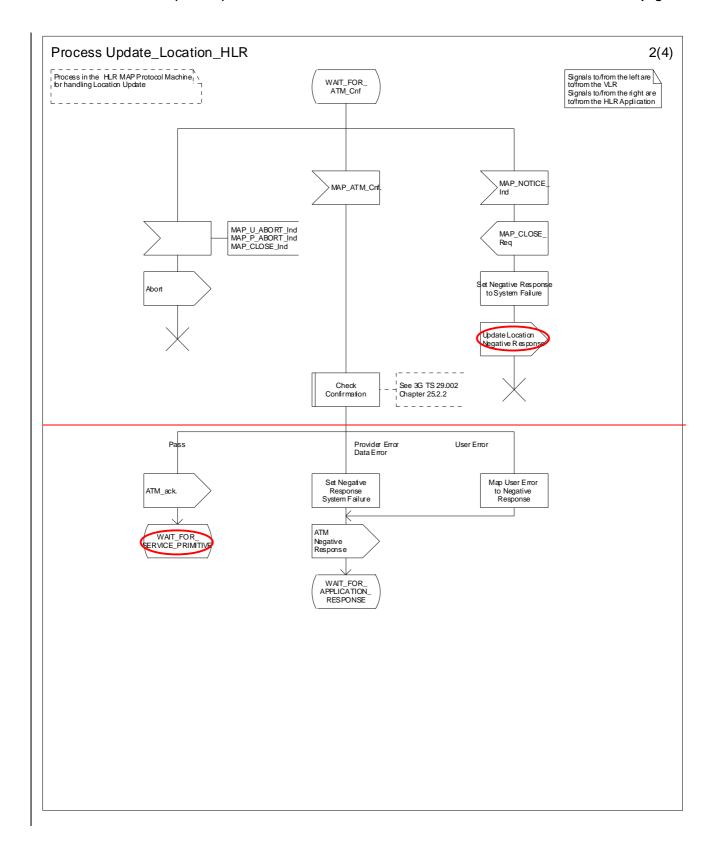


Figure 19.1.1/139 (sheet 1 of 34): Process Update\_Location\_HLR



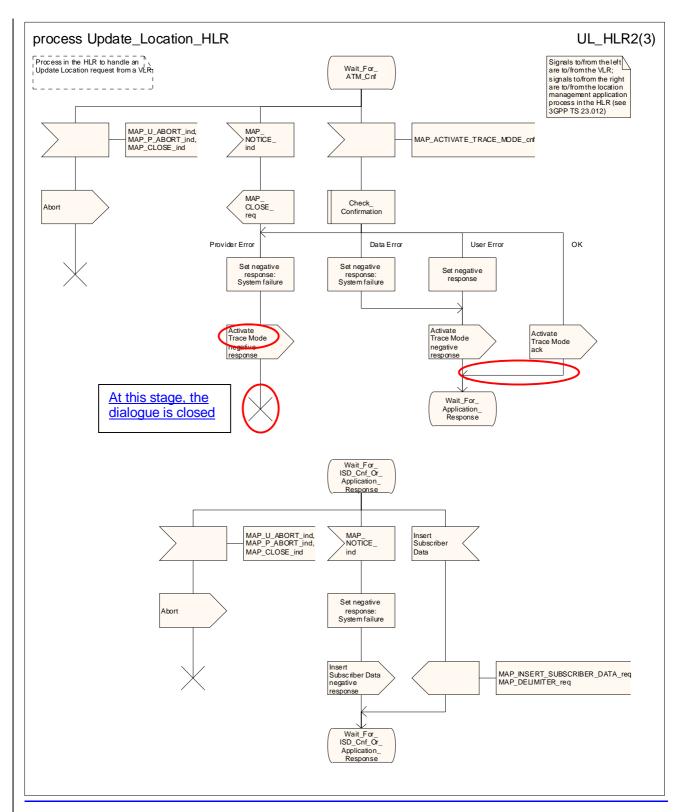
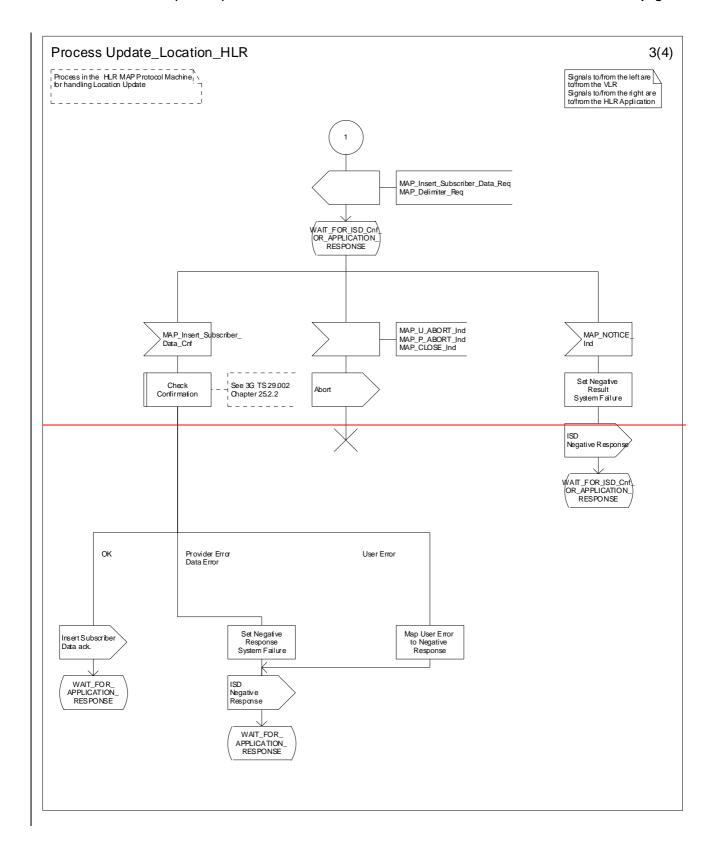


Figure 19.1.1/139 (sheet 2 of 34): Process Update\_Location\_HLR



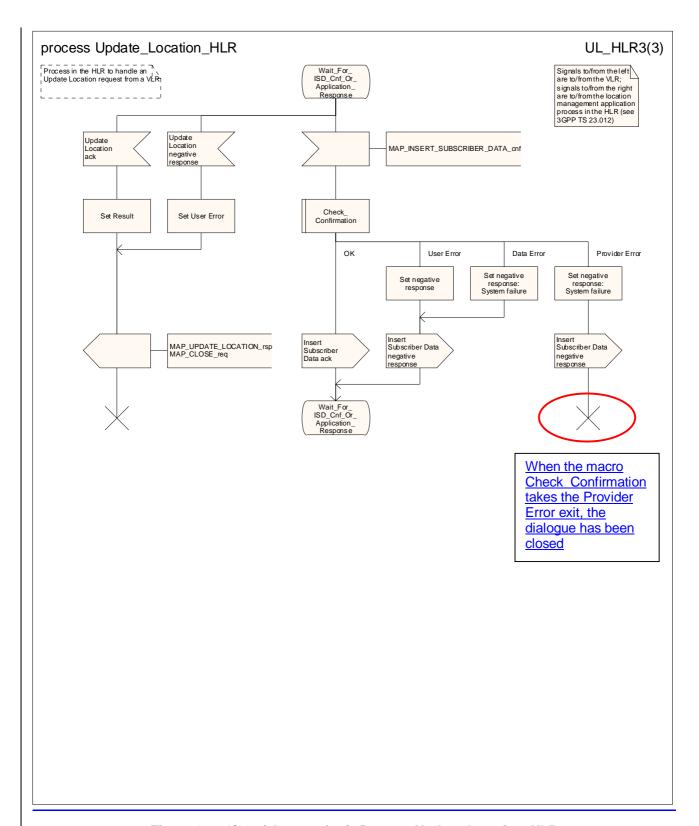


Figure 19.1.1/139 (sheet 3 of 34): Process Update\_Location\_HLR

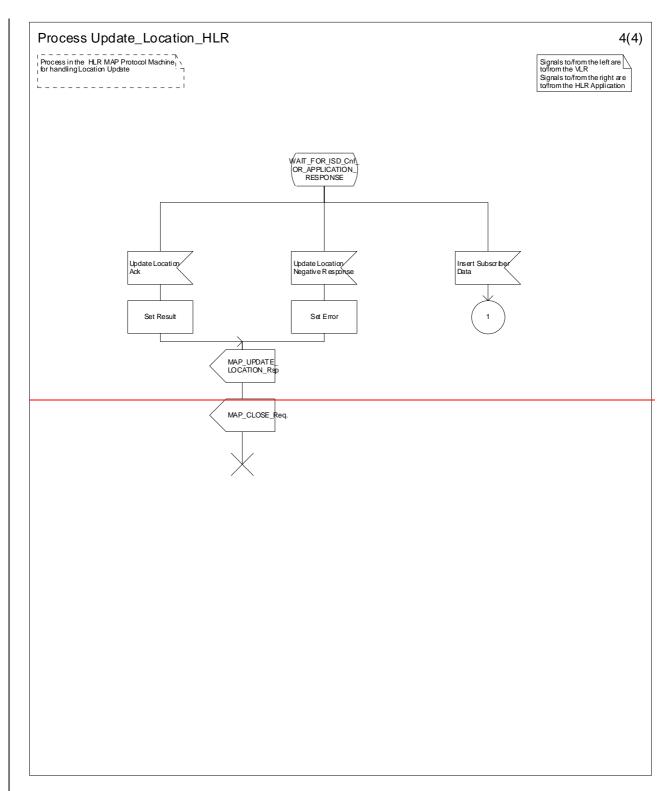
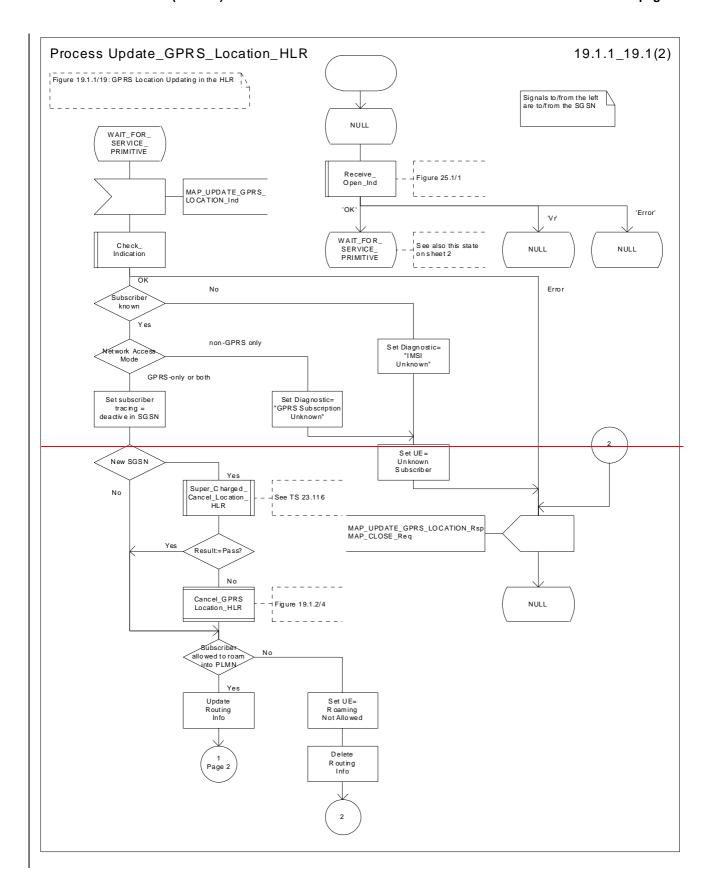


Figure 19.1.1/9 (sheet 4 of 4): Process Update\_Location\_HLR



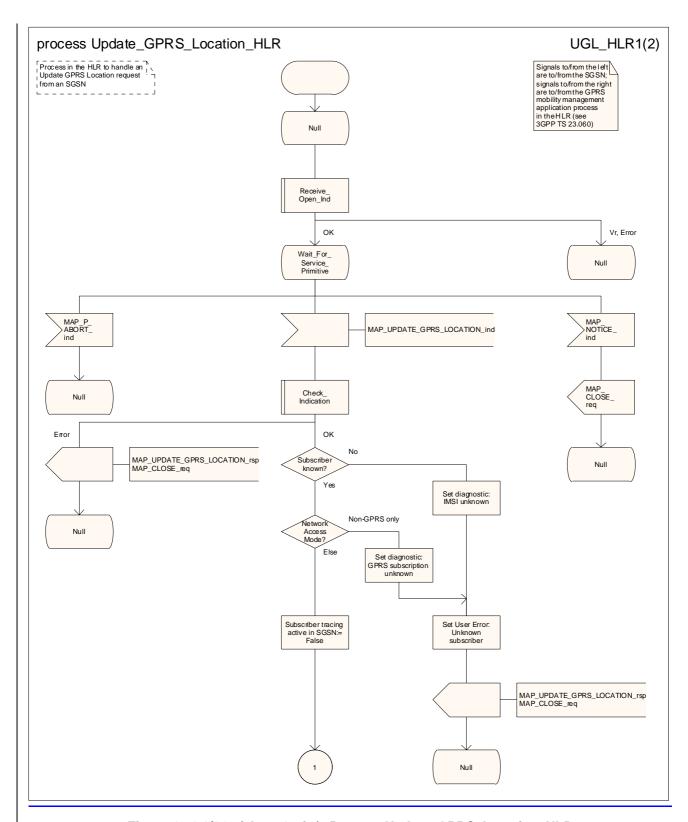
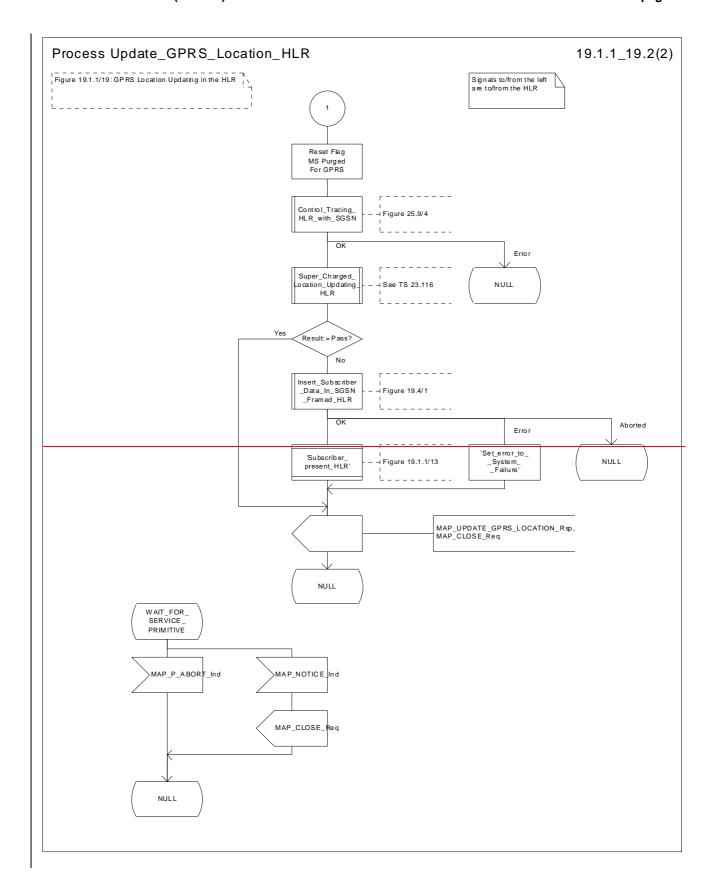


Figure 19.1.1/149 (sheet 1 of 2): Process Update\_GPRS\_Location\_HLR



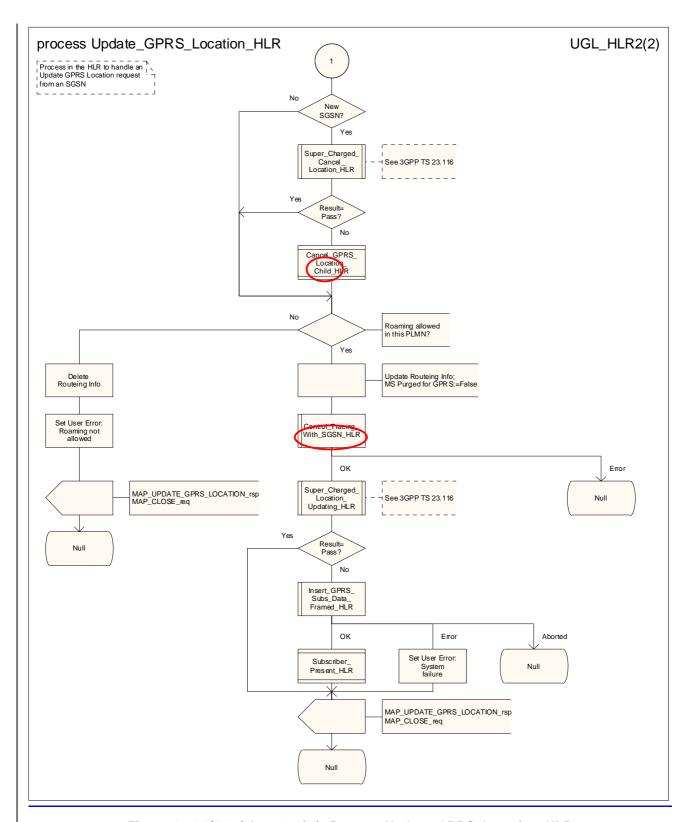


Figure 19.1.1/149 (sheet 2 of 2): Process Update\_GPRS\_Location\_HLR

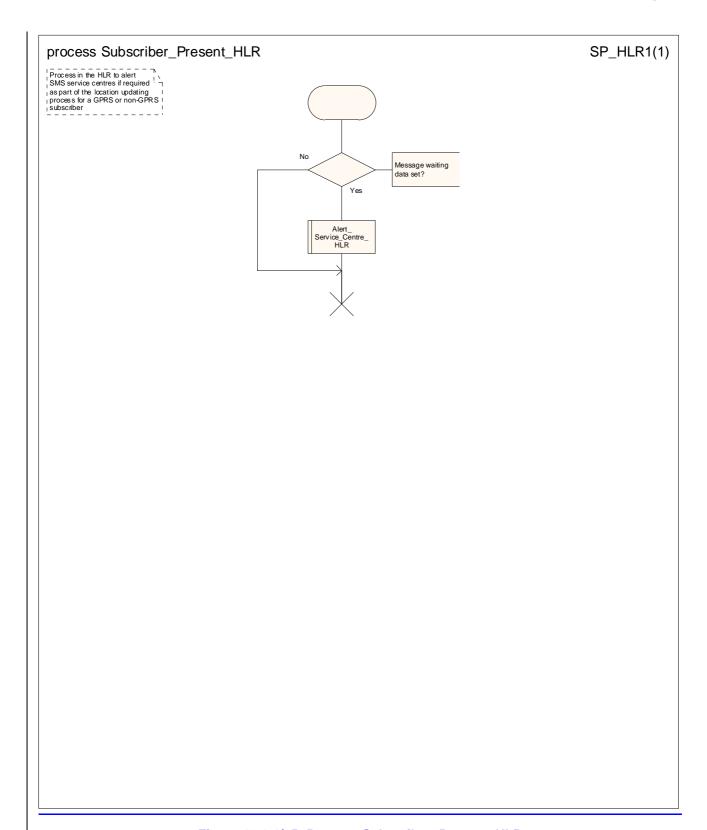


Figure 19.1.1/15: Process Subscriber Present HLR

## 19.1.2 Location Cancellation

#### 19.1.2.1 General

Location cancellation is used to delete a subscriber record from the serving node (VLR or SGSN). The procedure is invoked:

- because the subscriber has registered with a new serving node, or
- because the HPLMN operator has decided to delete the subscriber record from the serving node, e.g. because the subscription has been withdrawn, or because roaming restrictions have been imposed. Location cancellation can be used to force location updating including updating of subscriber data in the serving node at the next subscriber access.

The message flow for location cancellation for a non-GPRS subscriber is shown in figure 19.1.2/1.

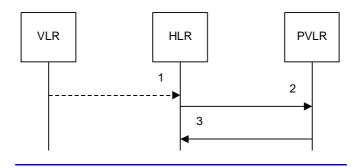
The message flow for location cancellation for a GPRS subscriber is shown in figure 19.1.2/2.

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 clause 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.

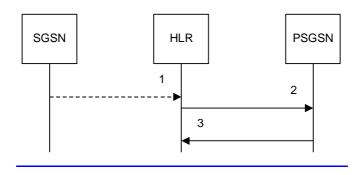
++	D	+	-+ D +	
aVLR +-		- aHLR		PVLRa
+		+	-+	
а		а	•	<u>a</u> .
a	MAP UPDATE LOCATION	a		a
a		a		a
a		a	MAP CANCEL	a
a		a		_ <u> </u>
a		a	LOCATION	a
a		a		a
a		a		a
a		a	MAP CANCEL LOCATION	a
a		a _		a
a		a `	ack	a
a		a	aon	a



- 1) MAP\_UPDATE\_LOCATION\_req/ind
- 2) MAP CANCEL LOCATION reg/ind
- 3) MAP CANCEL LOCATION rsp/cnf

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

Figure 19.1.2/1: Interface and services Message flow for Location Cancellation (non-GPRS)



- 1) MAP\_UPDATE\_GPRS\_LOCATION\_reg/ind
- 2) MAP\_CANCEL\_LOCATION\_req/ind
- B) MAP CANCEL LOCATION rsp/cnf

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

Figure 19.1.2/2: Message flow for Location Cancellation (GPRS)

# 19.1.2.2 Detailed pProcedure in the HLR

The MAP process in the HLR to cancel the location information in a VLR is shown in figure 19.1.2/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

The MAP process in the HLR to cancel the location information in a VLR as an independent process invoked from another process is shown in figure 19.1.2/4.

The MAP process in the HLR to cancel the location information in an SGSN is shown in figure 19.1.2/5. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

The MAP process in the HLR to cancel the location information in an SGSN as an independent process invoked from another process is shown in figure 19.1.2/6.

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 19.1.2/2 and 19.1.2/4), 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 does not understand it, this parameter shall be ignored.

# 19.1.2.3 Detailed pProcedure in the VLR

The MAP process in the VLR to handle a location cancellation request is shown in figure 19.1.2/7. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

# 19.1.2.4 Detailed pProcedure in the SGSN

The MAP process in the SGSN to handle a location cancellation request is shown in figure 19.1.2/8. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

Opening of the dialogue is described in the macro Receive Open Ind in clause 25.1, with outcomes:

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

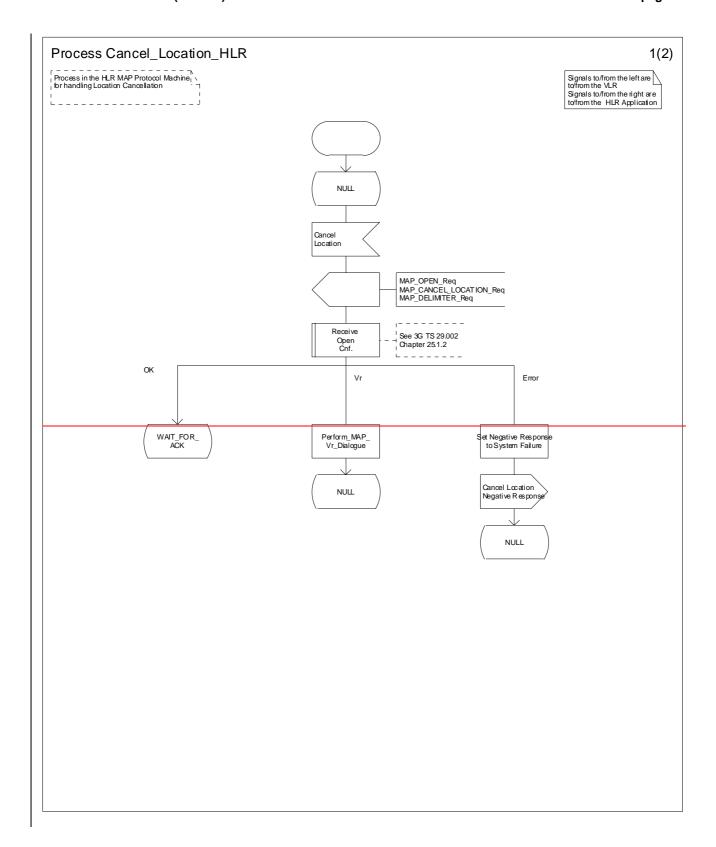
If the SGSN process receives a MAP\_NOTICE indication, it terminates the dialogue by sending a MAP\_CLOSE request.

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 clause 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.



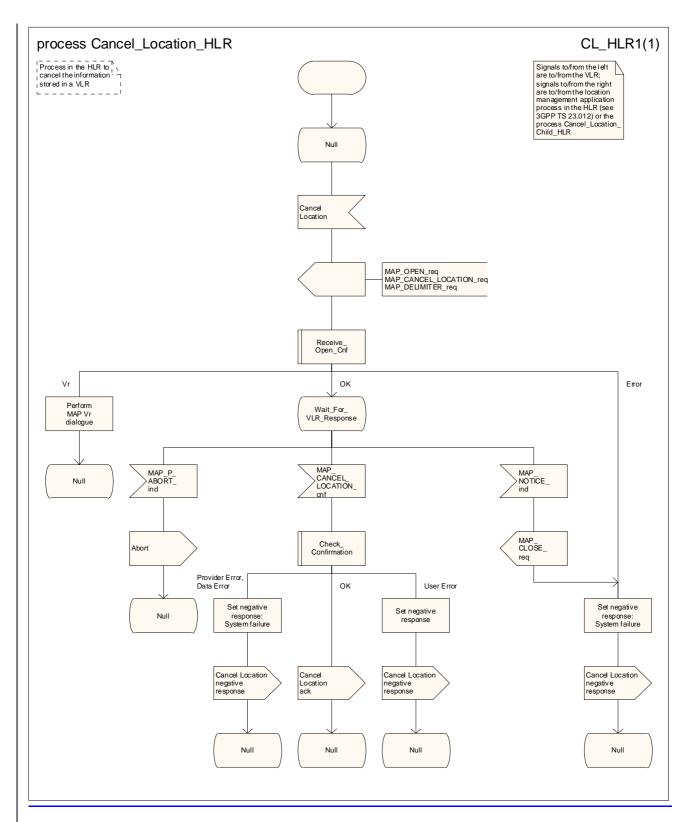
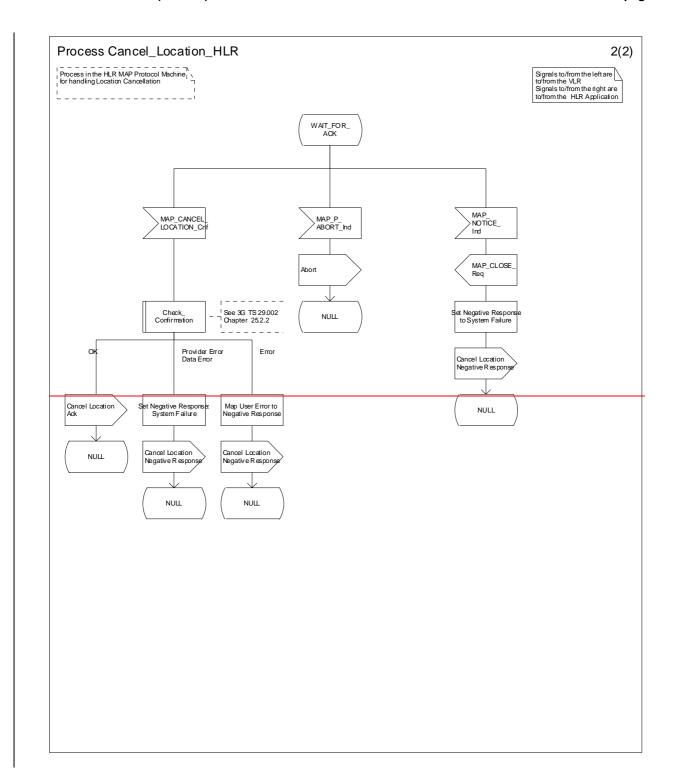


Figure 19.1.2/32 (Sheet 1 of 2): Process Cancel\_Location\_HLR



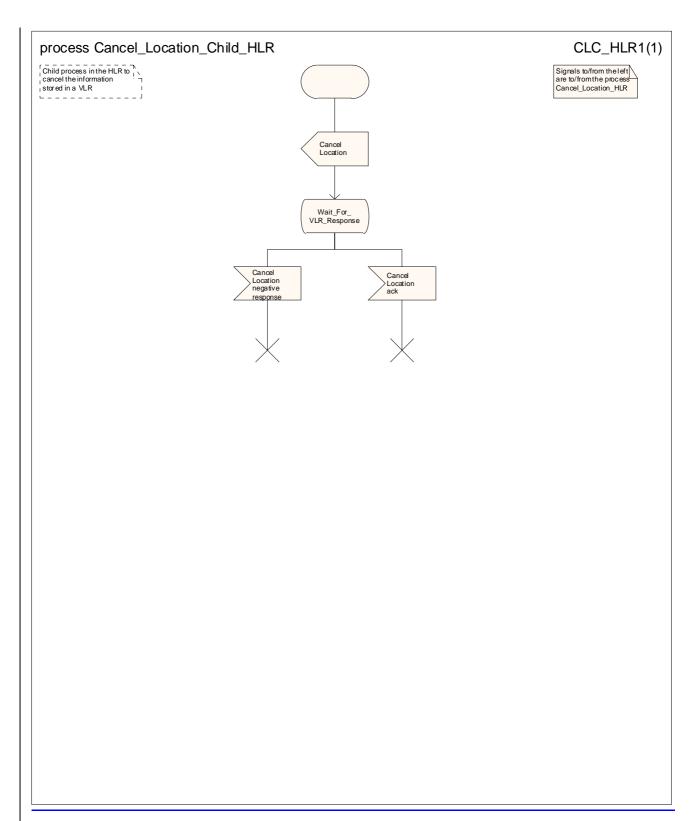
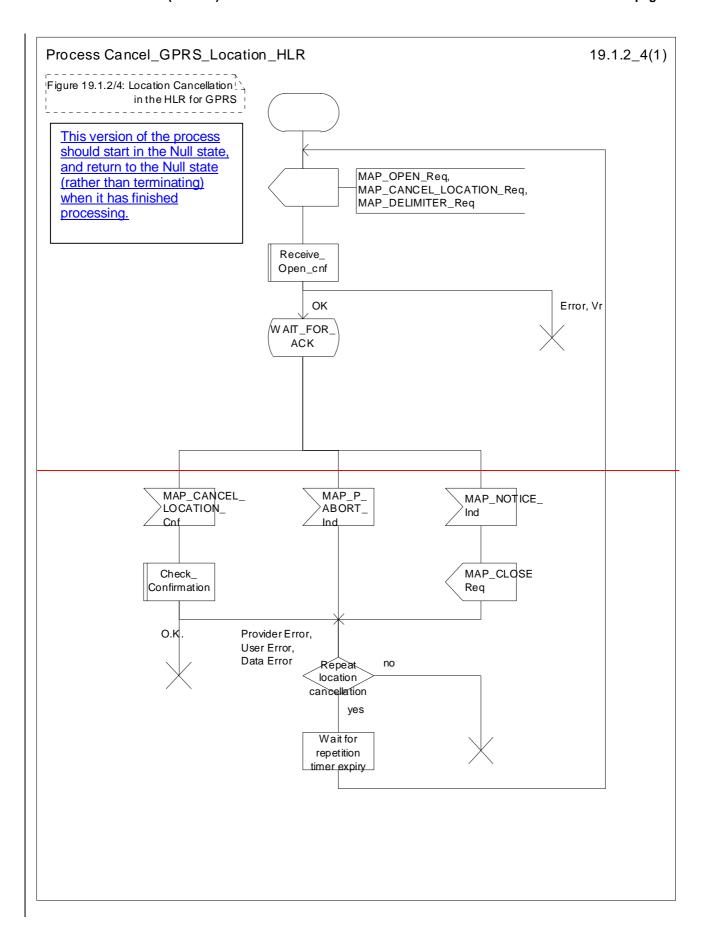


Figure 19.1.2/42 (Sheet 2 of 2): Process Cancel\_Location\_Child\_HLR



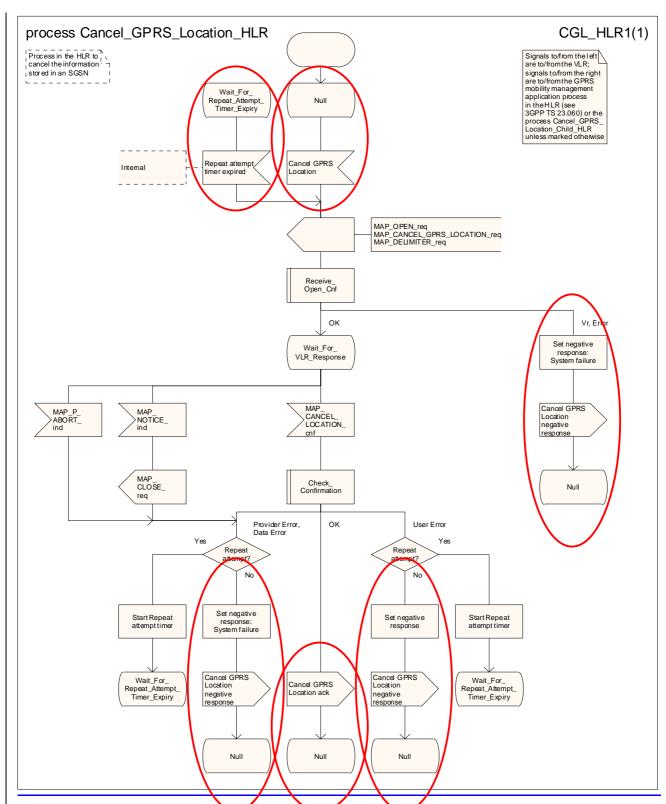


Figure 19.1.2/54: Process Cancel\_GPRS\_Location\_HLR

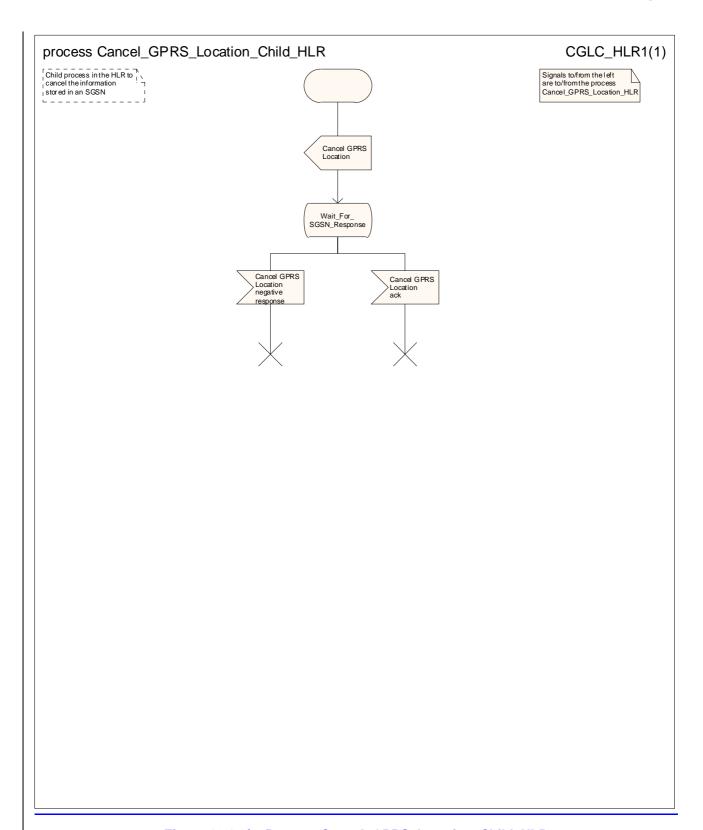
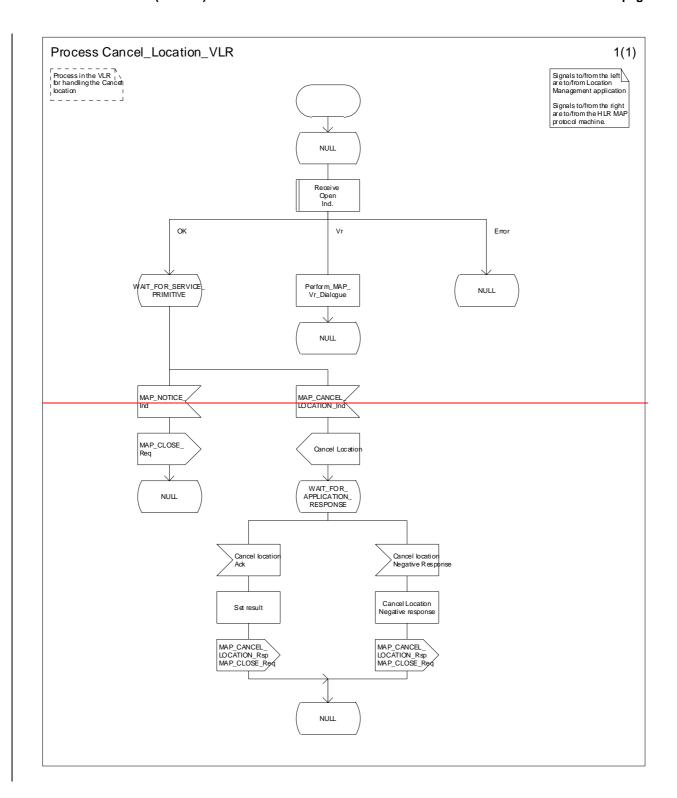


Figure 19.1.2/6: Process Cancel GPRS Location Child HLR



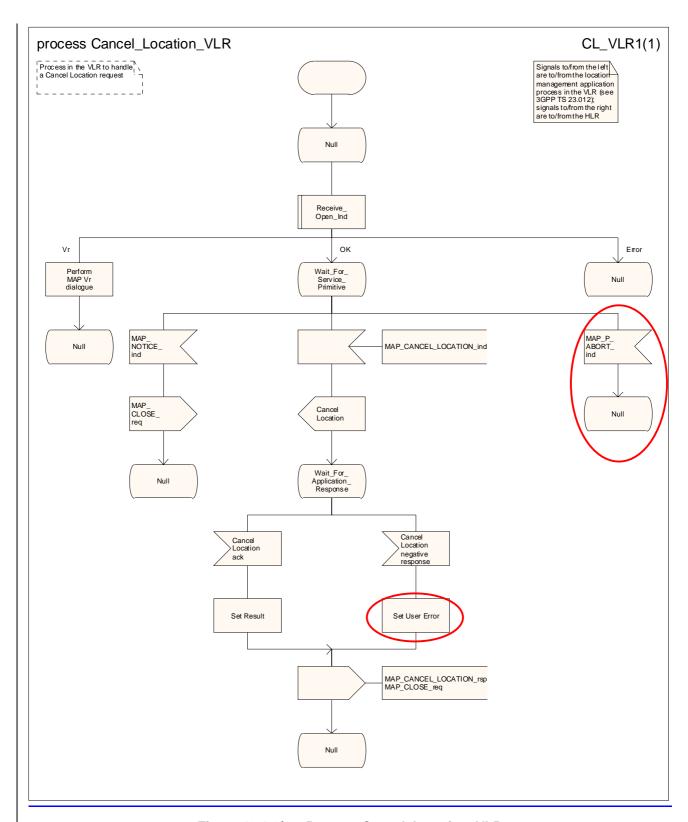
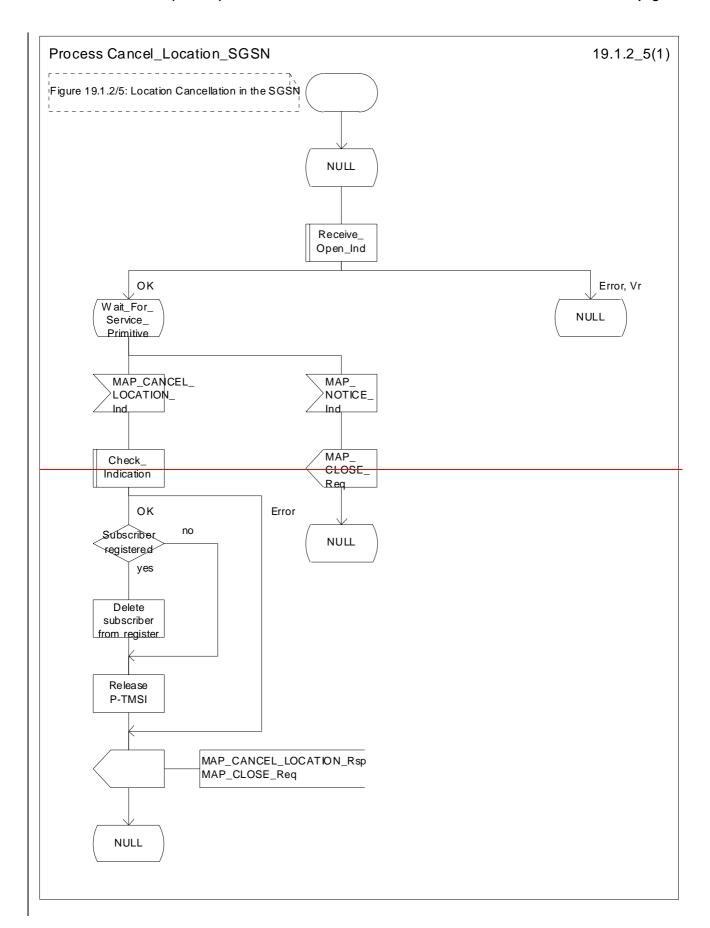


Figure 19.1.2/73: Process Cancel\_Location\_VLR



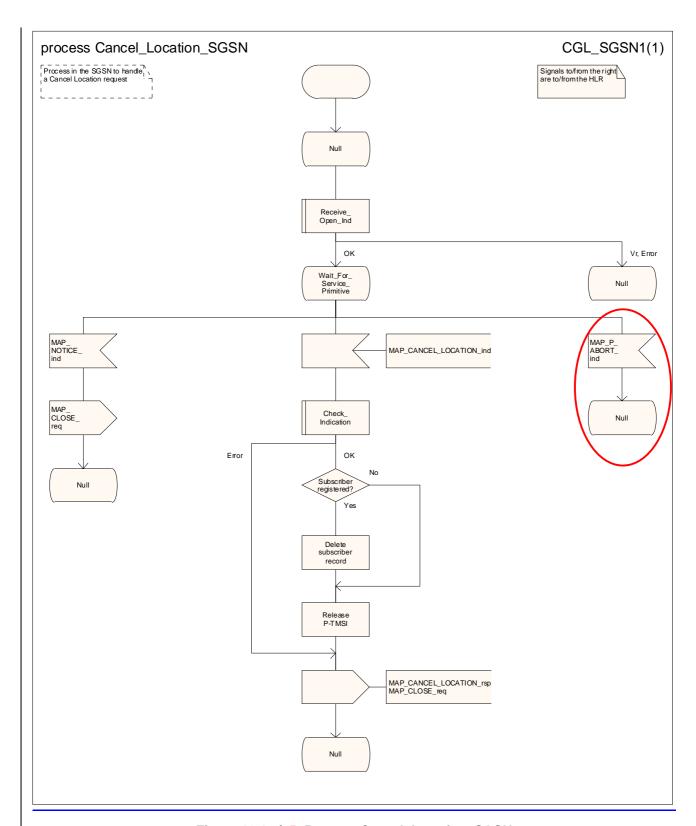


Figure 19.1.2/85: Process Cancel\_Location\_SGSN

# 19.1.3 Void

19.1.3.1 Void

19.1.3.2 Void

19.1.3.3 Void

# 19.1.4 Purge MS Purging

#### 19.1.4.1 General

O&M procedures in the VLR or SGSN can trigger MS purging either because of administrative action or because the MS has been inactive for an extended period. The O&M process in the VLR or in the SGSN should ensure that during the MS purging procedure any other attempt to access the MS record is blocked, to maintain consistency of data.

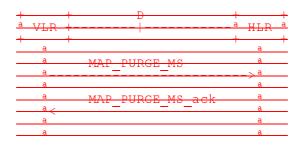
The message flow for a VLR to report MS purging to the HLR is shown in figure 19.1.4/1.

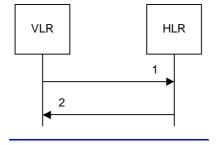
The message flow for an SGSN to report MS purging to the HLR is shown in figure 19.1.4/2.

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 clause 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 19.1.4/1and 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.

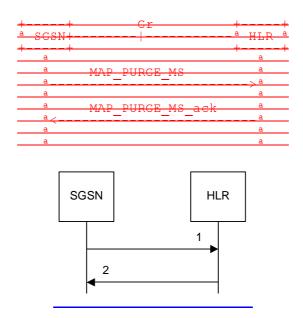




MAP PURGE MS req/ind
 MAP PURGE MS rsp/cnf

Figure 19.1.4/1: Message flow for MS purging (non-GPRS)

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



MAP PURGE MS req/ind
 MAP\_PURGE\_MS\_rsp/cnf

Figure 19.1.4/2: Message flow for MS purging (GPRS)

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

## 19.1.4.2 <u>Detailed procedure in the VLR Void</u>

The MAP process in the VLR to report MS purging to the HLR is shown in figure 19.1.4/3. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Cnf see subclause 25.1.2;
Check Confirmation see subclause 25.2.2.

#### 19.1.4.3 Detailed procedure in the SGSN<del>Void</del>

The MAP process in the SGSN to report MS purging to the HLR is shown in figure 19.1.4/4. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnfsee subclause 25.1.2;Check\_Confirmationsee subclause 25.2.2.

Figure 19.1.4/4 shows the MAP process in the SGSN to notify the HLR that an MS record has been purged. The following general macro is used:

Receive\_Open\_Cnf clause 25.1;

Sheet 1: The procedure Purge\_MS\_In\_Serving\_Network\_Entity is specific to Super-Charger; it is specified in 3GPP TS 23.116 [110]. If the SGSN and the originating HLR does not support the Super-Charger functionality, processing continues from the "YesNo" exit of the test "Result=Pass?".

When the SGSN receives an indication from O&M that an MS record is to be purged, it invokes the MAP\_PURGE\_MS service.

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 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.

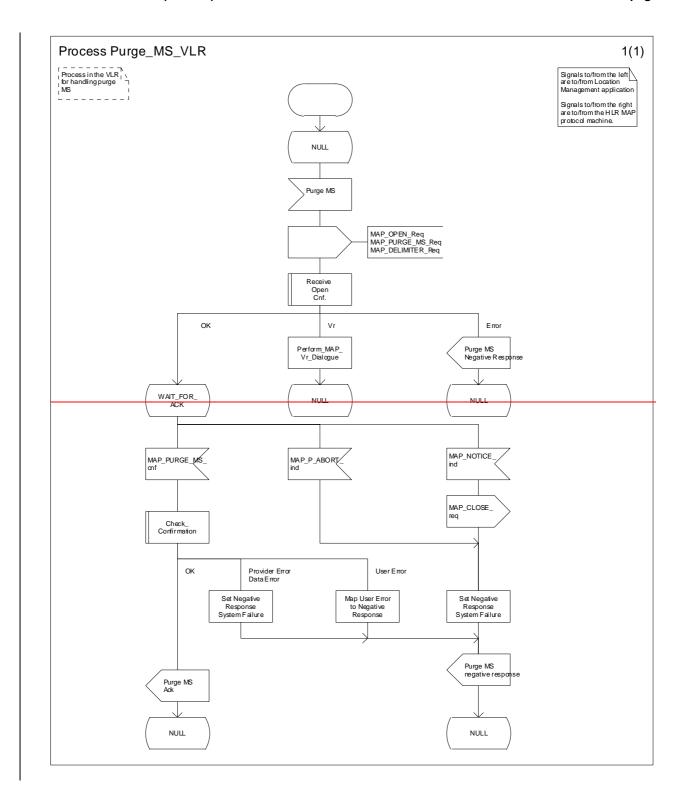
If a MAP\_PURGE\_MS confirmation containing a provider error, data error or user error, or a MAP\_P\_ABORT, MAP\_NOTICE or premature MAP\_CLOSE indication, has been received, the failure is reported to the O&M interface. Successful outcome of the procedure leads to deletion of the subscriber data and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

## 19.1.4.4 Detailed procedure in the <u>HLRSGSN</u>

The MAP process in the HLR to handle a notification from a VLR or an SGSN that an MS record has been purged is shown in figure 19.1.4/5. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive Open Ind see subclause 25.1.1;
Check Indication see subclause 25.2.1.

If the notification was received from a VLR, the MAP process communicates with the location management application process specified in 3GPP TS 23.012 [23]; if the notification was received from an SGSN, the MAP process communicates with the GPRS mobility management application process specified in 3GPP TS 23.060 [104].



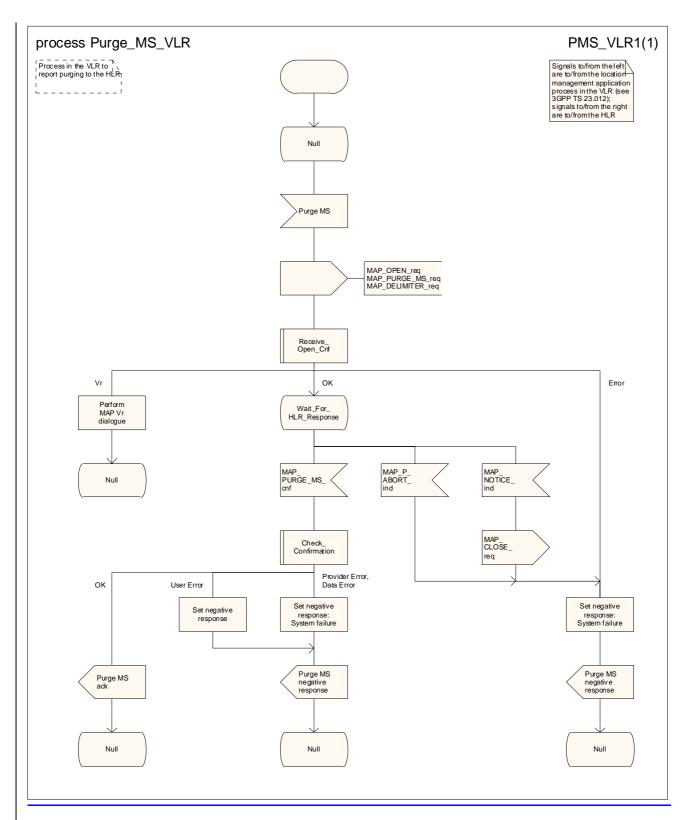
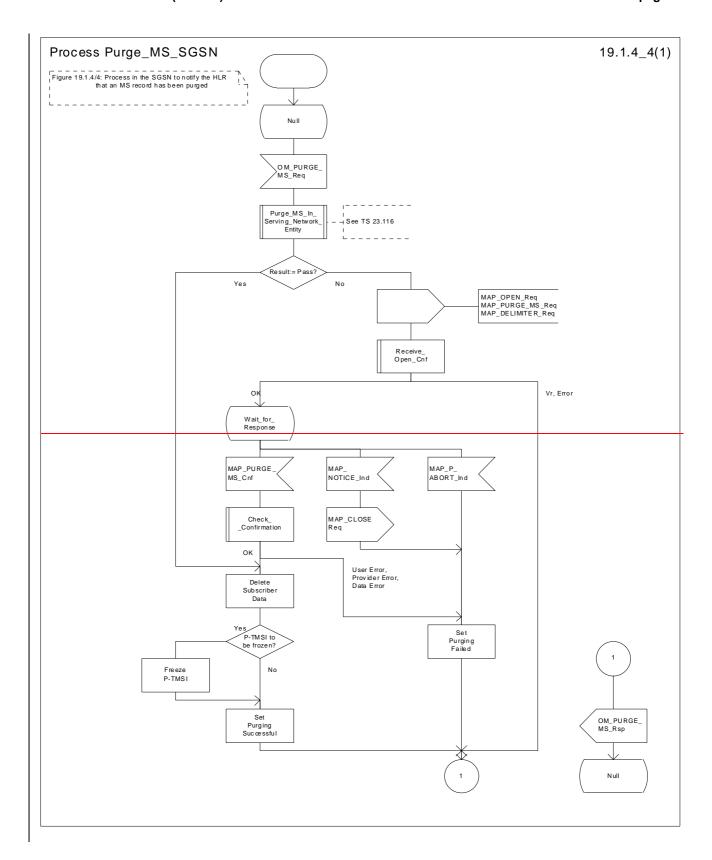


Figure 19.1.4/32: Process Purge\_MS\_VLR



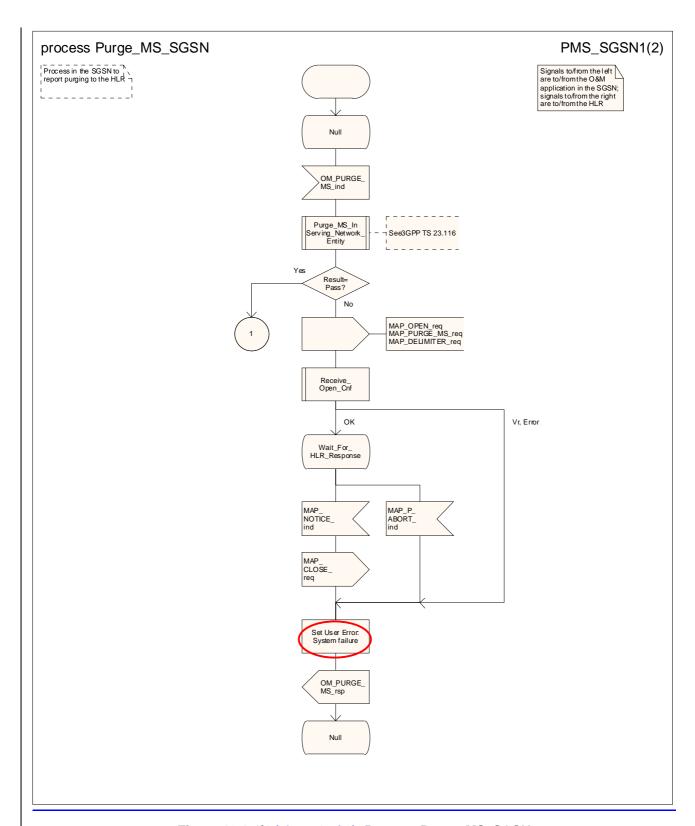


Figure 19.1.4/4 (sheet 1 of 2): Process Purge\_MS\_SGSN

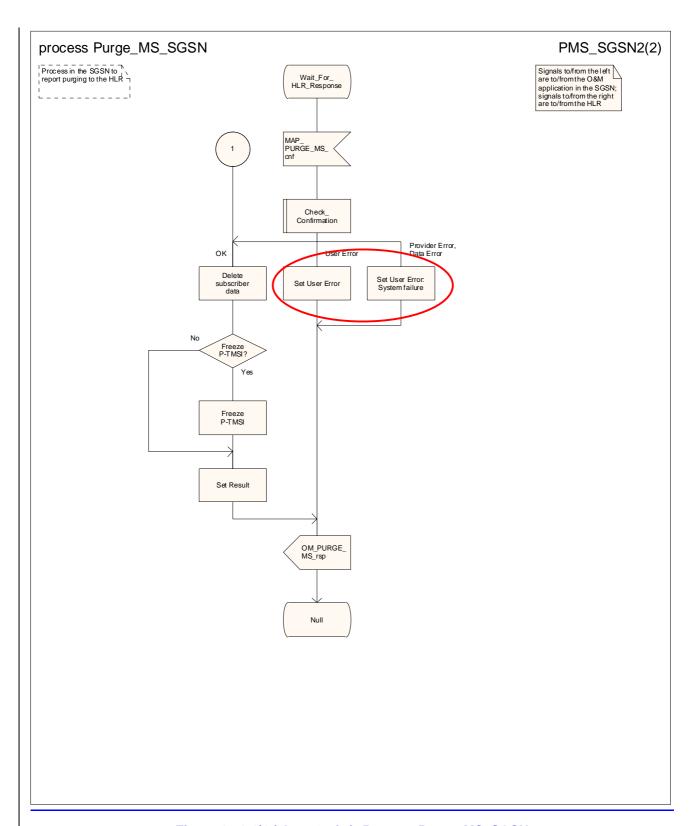
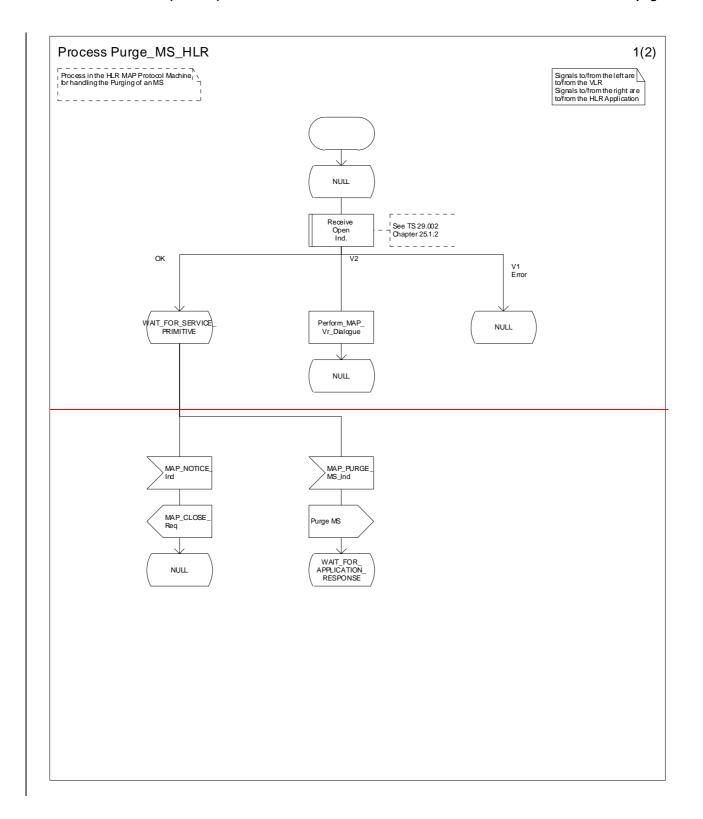


Figure 19.1.4/4 (sheet 2 of 2): Process Purge MS SGSN



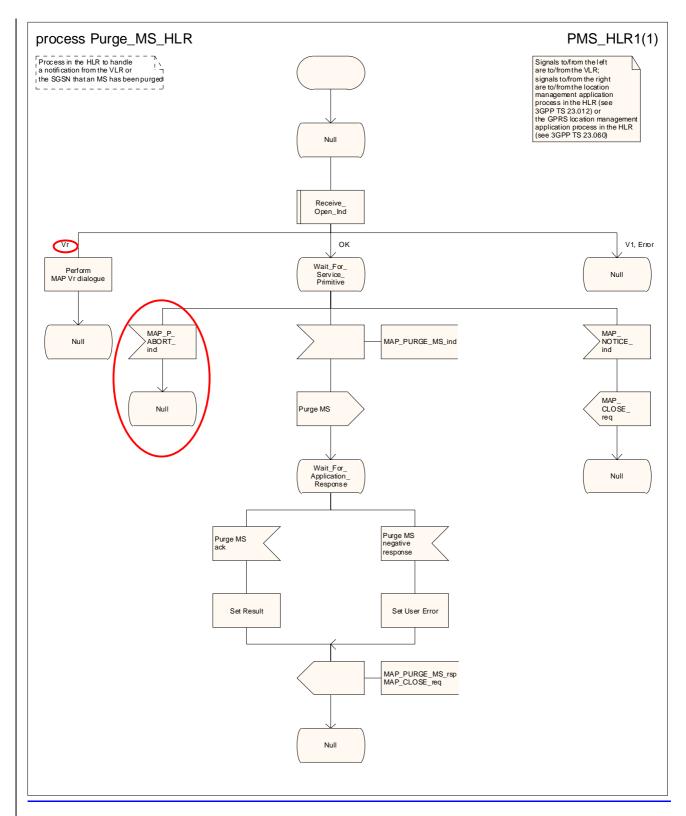


Figure 19.1.4/53 (Sheet 1 of 2): Process Purge\_MS\_HLR

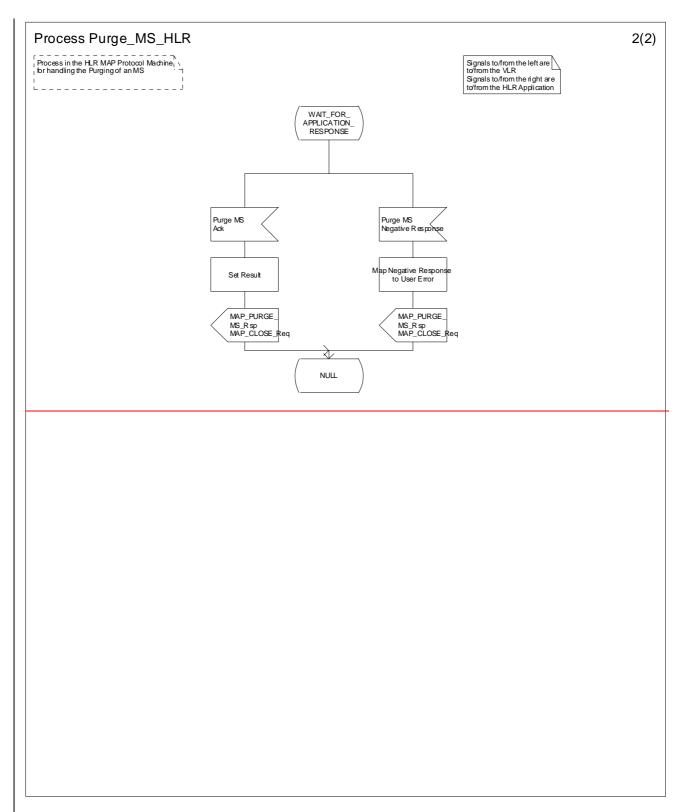


Figure 19.1.4/3 (Sheet 2 of 2): Process Purge\_MS\_HLR

# 19.2 Handover procedures

It should be noted that procedures related to the B interface have not been updated for Release 99. The B interface is not fully operational specified. It is strongly recommended not to implement the B interface as an external interface.

## 19.2.1 General

In this subclause, the term "Inter-MSC handover" is used to denote The handover or relocation between different MSCs. is called Inter-MSC handover.

The interfaces involved for Inter-MSC handover are shown in figure 19.2/1. Following There are two Inter-MSC handover procedures apply:

1) Basic Inter-MSC handover:

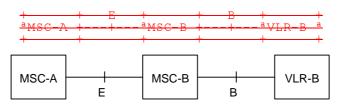
The call is handed over from the controlling MSC<del>, called</del> (MSC-A) to another MSC<del>, called</del> (MSC-B) (figure 19.2/1a).

Figure 19.2/2 shows the message flow for a successful handover between from MSC-A and to MSC-B, including a request for handover number allocation by from MSC-B to VLR-B.

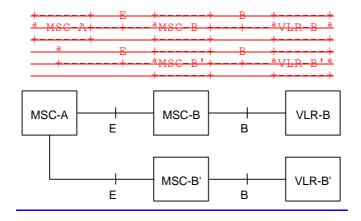
2) Subsequent Inter-MSC handover:

After the call has been handed over from MSC\_-A to MSC\_-B, a <u>further</u> handover <u>to</u> either <u>to</u> MSC\_-A (figure 19.2/1a) or to a third MSC (MSC\_-B') (figure 19.2/1b) <u>is may be</u> necessary in order to continue the <u>connection</u>call.

\_Figure 19.2/3 shows the message flow for a successful subsequent handover to MSC-B'. For a successful subsequent handover to MSC-A, the messages to and from MSC-B' and VLR-B' are omitted.



a) Basic handover procedure MSC-A to MSC-B and subsequent handover procedure MSC-B to MSC-A.



b) Subsequent handover procedure MSC\_-B to MSC\_-B'.

Figure 19.2/1: Interface structure for handover

The MAP handover procedures achieve the functionality required to set up an MSC MSC dialogue, to optionally allocate a handover number or one or several relocation numbers and to transport BSSAP or RANAP messages.

Minimum applicable MAP AC for intersystem inter-MSC GSM BSS to UTRAN handover shall be MAP handover AC version 3.

Minimum applicable MAP AC for intersystem inter-MSC UTRAN to GSM BSS handover shall be MAP handover AC version 2.

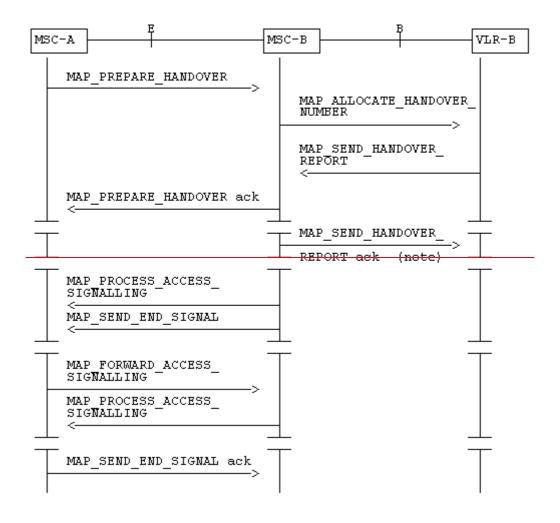
Note: If MAP AC version 2 is used, subsequent handover to UTRAN is not possible.

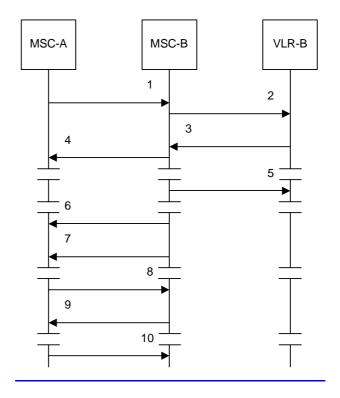
Minimum applicable MAP AC for inter MSC GSM BSS to GSM BSS handover should be MAP handover AC version 2.

NOTE: If MAP AC version 2 or lower is used, subsequent handover to UTRAN is not possible.

The transported BSSAP or RANAP messages are controlled and handled by the Handover Control Application in the MSCs. This information will be transparent to the MAP protocol. If the MSC receives via the MAP protocol BSSAP or RANAP messages, this information will be forwarded to the Handover Control Application (shown in the handover SDL diagrams with the internal HO\_CA signalling, it is an internal process in the MSC) and vice versa if the Handover Control Application requires the sending of BSSAP or RANAP messages via the MAP protocol.

For detailed interworking between the A-interface and MAP procedures or the Iu-interface and MAP procedures, see 3GPP TS 23.009 and 3GPP TS 29.010.

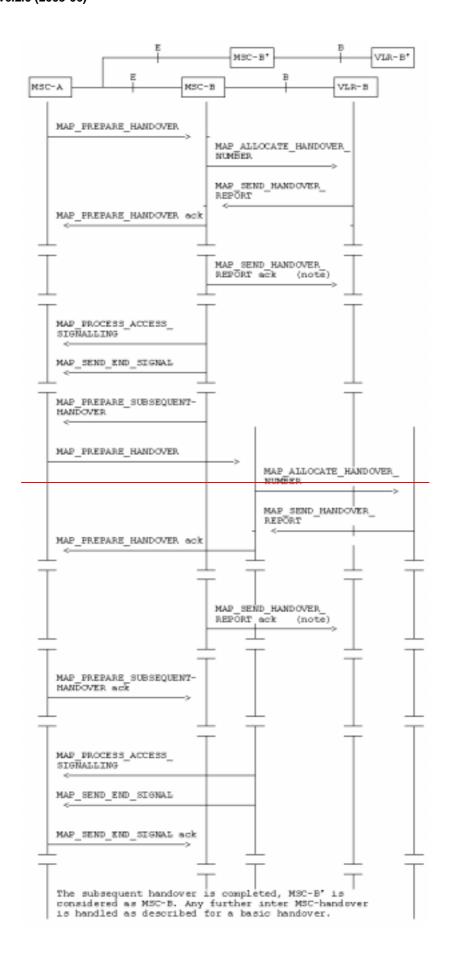


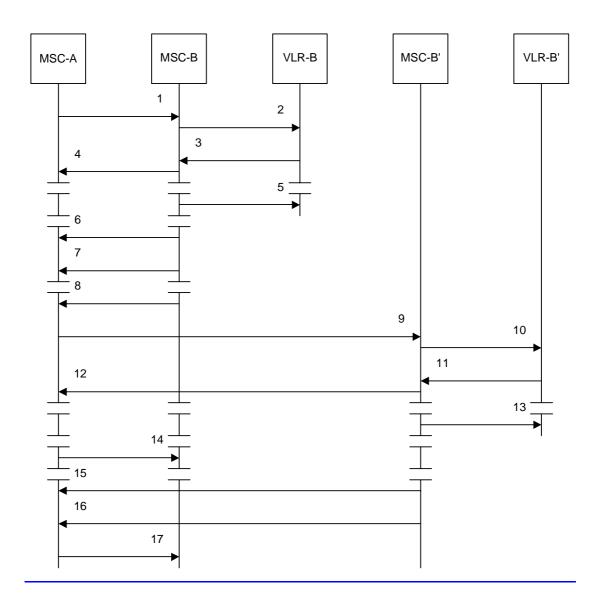


- MAP\_PREPARE\_HANDOVER\_req/ind
  MAP\_ALLOCATE\_HANDOVER\_NUMBER\_req/ind
  MAP\_SEND\_HANDOVER\_REPORT\_req/ind 1) 2) 3)
- 4) MAP\_PREPARE\_HANDOVER\_rsp/cnf
- 5) MAP SEND HANDOVER REPORT rsp/cnf (Note)
- 6) MAP\_PROCESS\_ACCESS\_SIGNALLING\_req/ind
- 7)
- MAP SEND END SIGNAL req/ind
  MAP FORWARD ACCESS SIGNALLING req/ind
  MAP PROCESS ACCESS SIGNALLING req/ind 8)
- 9)
- MAP\_SEND\_END\_SIGNAL\_rsp/cnf 10)

NOTE: This can be sent at any time after the connection between MSC\_-A and MSC\_-B is established.

Figure 19.2/2: Example of a successful basic handover procedure to MSC\_-B





- MAP\_PREPARE\_HANDOVER\_reg/ind
- MAP ALLOCATE HANDOVER NUMBER reg/ind
- MAP SEND HANDOVER REPORT reg/ind 3)
- MAP\_PREPARE\_HANDOVER\_rsp/cnf 4)
- 5) MAP SEND HANDOVER REPORT rsp/cnf (Note 1)
- <u>6)</u> MAP\_PROCESS\_ACCESS\_SIGNALLING\_req/ind
- 7) MAP SEND END SIGNAL req/ind
- 8) MAP\_PREPARE\_SUBSEQUENT\_HANDOVER\_reg/ind
- MAP PREPARE HANDOVER req/ind 9)
- MAP\_ALLOCATE\_HANDOVER\_NUMBER\_req/ind 10)
- MAP SEND HANDOVER REPORT reg/ind 11)
- 12) MAP\_PREPARE\_HANDOVER\_rsp/cnf
- MAP SEND HANDOVER REPORT rsp/cnf (Note 2) 13)
- MAP\_PREPARE\_SUBSEQUENT\_HANDOVER\_rsp/cnf 14)
- MAP PROCESS ACCESS SIGNALLING reg/ind 15)
- MAP\_SEND\_END\_SIGNAL\_req/ind 16)
- MAP SEND END SIGNAL rsp/cnf (Note 3) 17)
- NOTE\_1: This can be sent at any time after the connection between MSC--A and MSC--B is established.

  NOTE 2: This can be sent at any time after the connection between MSC-A and MSC-B' is established.
- NOTE 3: At this stage, the subsequent handover is complete. Any further interworking between MSC-A and MSC-B' is the same as the interworking between MSC-A and MSC-B after basic handover

Figure 19.2/3: Example of a successful subsequent handover towards a third MSC

The MAP signalling procedures for inter-MSC handover support the allocation of a handover number or one or more relocation numbers and the transfer of encapsulated BSSAP or RANAP messages.

The minimum application context version for the MAP handover application context shall be:

- version 3 for inter-MSC UTRAN to UTRAN handover;
- version 3 for inter-MSC intersystem handover from GSM BSS to UTRAN;
- version 2 for inter-MSC intersystem handover from UTRAN to GSM BSS.

NOTE: If the MAP handover application context version 2 is used, subsequent handover to UTRAN is not possible.

The minimum application context version for the MAP handover application context should be version 2 for inter-MSC handover from GSM BSS to GSM BSS.

NOTE: If the MAP handover application context version 2 or lower is used, subsequent handover to UTRAN is not possible.

The BSSAP or RANAP messages encapsulated in MAP messages are processed by the Handover Control Application in each MSC. The information in the encapsulated BSSAP or RANAP messages is passed from the Handover Control Application to the MAP process at the sending end; the notation used in the SDL diagrams for the MAP processes is "HO\_CA\_MESSAGE\_ind(Message transfer)". The information in the encapsulated BSSAP or RANAP messages is passed from the MAP process to the Handover Control Application at the sending end; the notation used in the SDL diagrams for the MAP processes is "HO\_CA\_MESSAGE\_req(Message transfer)".

For details of the interworking between the A-interface and MAP procedures or the Iu-interface and MAP procedures, see 3GPP TS 23.009 [21] and 3GPP TS 29.010 [58].

# 19.2.2 Handover pProcedure in MSC--A

This subclause describes the inter-MSC handover procedure in MSC-A; it covers basic inter-MSC handover to another MSC (MSC-B) and subsequent inter-MSC handover to a third MSC (MSC-B') or back to the controlling MSC (MSC-A).

The MAP process in MSC-A to handle inter-MSC handover is shown in figure 19.2/4. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive_Open_Cnf	see subclause 25.1.2;
Check_Indication	see subclause 25.2.1.
Check Confirmation	see subclause 25.2.2.

Communication between the MAP handover process and the Handover Control application is represented by the HO CA MESSAGE service. For a detailed description of the interworking between the Handover Control applications in different MSCs for the inter-MSC handover procedure, see 3GPP TS 23.009 [21].

This clause describes the handover or relocation procedure in MSC-A, including the request for a basic handover or relocation to another MSC (MSC B), subsequent handover or relocation to a third MSC (MSC B') or back to the controlling MSC (MSC A).

#### 19.2.2.1 Basic handover

The handling in MSC-A for basic inter-MSC handover is shown in sheets 1 to 6 of figure 19.2/4.

Sheet 1: The MAP PREPARE HANDOVER request may contain:

- an indication that handover number allocation is not required;
- the target Cell ID, for compatibility for handover to GSM;
- the target RNC ID, for SRNS relocation or inter-system handover from GSM to UMTS;

- the IMSI;
- UMTS encryption information and UMTS integrity protection information, which are necessary for inter-system handover from GSM to UMTS;
- GSM radio resource information (channel type).

The conditions for the presence of these parameters and the processing in MSC-B (3G\_MSC-B) are described in detail in 3GPP TS 29.010 [58] and 3GPP TS 23.009 [21].

Sheet 2: The MAP\_PREPARE\_HANDOVER confirmation contains one of:

- no handover number, if the MAP\_PREPARE\_HANDOVER request included an indication that handover number allocation is not required;
- a handover number;
- one or more relocation numbers.

Sheet 2: The MAP\_PREPARE\_HANDOVER confirmation contains BSSAP or RANAP signalling information, which is passed to the Handover Control application in MSC-A.

Sheet 2: If the MAP\_PREPARE\_HANDOVER confirmation contains an indication that MSC-B does not support multiple bearers, the Handover Control application in MSC-A may request handover of one bearer to the same cell in MSC-B.

Sheet 5: If the original MAP\_PREPARE\_HANDOVER request included a parameter indicating that handover number allocation is not required, the Handover Control application in MSC-A may request a handover number (or one or more relocation numbers); this triggers a further MAP\_PREPARE\_HANDOVER request towards MSC-B

When MSC-A has decided that a call has to be handed over or relocated to MSC-B, the Handover Control Application in MSC A requests the MAP application to initiate the MAP\_PREPARE\_HANDOVER request to MSC B.

MSC A opens the dialogue to MSC B with a MAP\_OPEN request containing no user specific parameters and sends a MAP\_PREPARE\_HANDOVER request. This request shall contain all the information required by MSC B to allocate the necessary radio resources. In addition, it may optionally contain:

- -an indication that a handover number allocation is not required;
- -the targetCellId, for compatibility reasons in the case of handover or inter-system handover to GSM;
- -the targetRNCId, in case of SRNS relocation or inter-system handover from GSM to UMTS;
- the IMSI:
- -UMTS encryption information and UMTS integrity protection information, which are necessary parameters for inter-system handover from GSM to UMTS;
- -GSM radio resource information (channel type) shall be included at inter MSC relocation to prepare for a possible subsequent intra MSC handover from UMTS to GSM in MSC B.

The conditions when these parameters shall be included and the processing of them in MSC-B (3G\_MSC-B) are described in detail in 3GPP TS 29.010 and 23.009.

If MSC-B accepts the dialogue, it returns a MAP\_PREPARE\_HANDOVER confirmation containing a handover number or one or several relocation numbers, unless the request has included the HO NumberNotRequired parameter, and BSSAP or RANAP information which is forwarded to and handled by the Handover Control Application in MSC-A.

Optionally MSC A can receive, after a MAP\_PREPARE\_HANDOVER confirmation, a MAP\_PROCESS\_ACCESS\_SIGNALLING indication containing BSSAP or RANAP information.

When the connection has been established between the MS and MSC B, MSC A will be informed by a MAP\_SEND\_END\_SIGNAL indication.

When MSC-A wants to clear the connection with BSS-B, an indication from the Handover Control Application is received in the Map Application to send the MAP\_SEND\_END SIGNAL response to MSC B to close the MAP dialogue.

MSC A may abort the handover or relocation procedure at any time (e.g. if the call is cleared).

# 19.2.2.2 Handling of access signalling

The Handover Control application in MSC-A may forward access signalling to any of the MS, RNS-B or BSS-B using the MAP\_FORWARD\_ACCESS\_SIGNALLING service; any of the MS, RNS-B or BSS-B may forward access signalling to the Handover Control application in MSC-A using the MAP\_PROCESS\_ACCESS\_SIGNALLING service. These are non-confirmed services.

If required, the Handover Control Application in MSC-A requests the MAP application to invoke the MAP\_FORWARD\_ACCESS\_SIGNALLING request containing the information to be transferred to the A-interface or the Iu interface of MSC-B (e.g. call control information).

MAP\_FORWARD\_ACCESS\_SIGNALLING is a non-confirmed service.

MSC B will then forward the required information to the Handover Control Application. The MAP\_FORWARD\_ACCESS\_SIGNALLING is composed in such a way that the information can be passed transparently to the A interface or the Iu interface for call control and mobility management information. Any response received in MSC B from the A interface or the Iu interface that should be brought to MSC A will require a new independent request from the Handover Control Application in MSC-B to MSC-A by invoking a MAP\_PROCESS\_ACCESS\_SIGNALLING request.

### 19.2.2.3 Other procedures in stable handover situation

During a call and after handover or relocation, a number of procedures between MSC-A and BSS-B or RNS-B controlled by or reported to MSC-A may be initiated in both directions by invoking a MAP\_FORWARD\_ACCESS\_SIGNALLING request and reception of a MAP\_PROCESS\_ACCESS\_SIGNALLING indication.

## 19.2.2.34 Subsequent handover

The handling in MSC-A for subsequent inter-MSC handover is shown in sheets 7 & 8 of figure 19.2/4. If the Handover Control Application determines that the call is to be handed over to a third MSC (MSC-B') it triggers another instance of the MAP process to handle the basic handover to MSC-B', and reports the result of the subsequent handover to the instance of the MAP process which handles the dialogue with MSC-B.

Sheet 8: While the MAP process in MSC-A is waiting for the completion of subsequent handover, it relays access signalling between the Handover Control application and the MS, RNS-B or BSS-B as described in subclause 19.2.2.2.

When MSC A receives a MAP\_PREPARE\_SUBSEQUENT\_HANDOVER request, it will start the procedure of handing or relocating the call over to a third MSC (MSC-B'), or back to the controlling MSC (MSC-A). If the new handover or relocation procedure towards MSC B' or MSC A is successful, the handover control application in MSC A will request the release of the dialogue towards MSC B by sending the MAP\_SEND\_END\_SIGNAL confirmation.

### 19.2.2.5 SDL Diagrams

The SDL diagrams on the following pages describe the user processes in MSC A for the procedures described in this clause.

The services used are defined in clause 8.4.

NOTE: The message primitives HO\_CA\_MESSAGE used in the SDL-Diagrams are used to show the internal coordination between the MAP application and the Handover Control Application. For a detailed description of the co-ordination between the applications for the handover or relocation procedure, see 3GPP TS 23.009. Note that in case of reception of errors from the MSCs (see the Handover error handling macro), the MAP user reports them to the Handover Control Application and does not take any action except in cases explicitly mentioned in the SDL diagrams.

# 19.2.3 Handover pProcedure in MSC--B

This subclause describes the handover or relocation procedure in MSC-B; it covers basic handover or relocation from the controlling MSC (MSC-A) and subsequent handover or relocation.

The MAP process in MSC-B to handle handover or relocation is shown in figure 19.2/5. The MAP process invokes macros not defined in this clause: the definitions of these macros can be found as follows:

Receive_Open_Ind	see subclause 25.1.1;
Receive_Open_Cnf	see subclause 25.1.2;
Check_Indication	see subclause 25.2.1.
Check Confirmation	see subclause 25.2.2.

Communication between the MAP handover process and the Handover Control application is represented by the HO\_CA\_MESSAGE service. For a detailed description of the interworking between the Handover Control applications in different MSCs for the inter-MSC handover procedure, see 3GPP TS 23.009 [21].

The ordering of allocation of handover number and radio resources shown in the SDL diagrams is not mandatory.

This clause describes the handover or relocation procedure in MSC B, including the request for a handover or relocation from another MSC (MSC-A), subsequent handover or relocation to a third MSC (MSC-B') or back to the controlling MSC (MSC-A).

#### 19.2.3.1 Basic handover

The handling in MSC-B for basic inter-MSC handover is shown in sheets 1 to 7 of figure 19.2/5.

Sheet 2: If the MAP\_PREPARE\_HANDOVER indication included a parameter requesting multiple bearers but MSC-B does not support multiple bearers, MSC-B sends a MAP\_PREPARE\_HANDOVER response indicating that multiple bearers are not supported, and waits for a possible MAP\_PREPARE\_HANDOVER indication requesting handover of a single bearer.

Sheet 6: If the original MAP\_PREPARE\_HANDOVER indication included a parameter indicating that handover number allocation is not required, MSC-A may send a further MAP\_PREPARE\_HANDOVER request to request the allocation of a handover number (or one or more relocation numbers).

Opening of the dialogue is described in the macro Receive\_Open\_Ind in clause 25.1.

When MSC B process receives a MAP\_PREPARE\_HANDOVER indication from MSC A, MSC B requests its associated VLR to provide a handover number, unless the parameter HO NumberNotRequired is received in the indication.

When the connection between the MS and MSC B is established on MSC B, the Handover Control Application will request the MAP application to indicate this event to MSC-A by invoking the MAP\_SEND\_END\_SIGNAL request. When a call is released, MSC-A will inform MSC-B by MAP\_SEND\_END\_SIGNAL response and the MAP dialogue between MSC A and MSC B is closed.

#### 19.2.3.2 Allocation of handover number

When a handover number is required, a MAP\_ALLOCATE\_HANDOVER\_NUMBER request will be sent to the VLR. The handover number is received in the MAP\_SEND\_HANDOVER\_REPORT request, and will be included in the MAP\_PREPARE\_HANDOVER response to MSC A.

When relocation numbers are required, one or several MAP\_ALLOCATE\_HANDOVER\_NUMBER requests will be sent to the VLR. Each relocation number is received in a MAP\_SEND\_HANDOVER\_REPORT request, and the collected relocation numbers will be included in the MAP\_PREPARE\_HANDOVER response to MSC-A.

As soon as the call from MSC-A using the handover number arrives in MSC-B, MSC-B shall release the handover number in the VLR using the MAP\_SEND\_HANDOVER\_REPORT response.

As soon as a call from MSC A using a relocation number arrives in MSC B, MSC B shall release the relocation number in the VLR using the MAP\_SEND\_HANDOVER\_REPORT response.

# 19.2.3.23 Handling of access signalling

The Handover Control application in MSC-A may forward access signalling to any of the MS, RNS-B or BSS-B using the MAP\_FORWARD\_ACCESS\_SIGNALLING service; any of the MS, RNS-B or BSS-B may forward access signalling to the Handover Control application in MSC-A using the MAP\_PROCESS\_ACCESS\_SIGNALLING service. These are non-confirmed services. Signals to or from any of the MS, RNS-B or BSS-B are routed through the Handover Control application in MSC-B.

If required by the Handover Control Application, MSC-B invokes the MAP\_PROCESS\_ACCESS\_SIGNALLING request containing the information received on the A interface or the Iu interface that should be transferred to MSC A (e.g. call control information).

MAP\_PROCESS\_ACCESS\_SIGNALLING is a non-confirmed service and any response from MSC-A will require a MAP\_FORWARD\_ACCESS\_SIGNALLING request.

### 19.2.3.4 Other procedures in stable handover situation

During a call and after handover or relocation, a number of procedures between MSC A and BSS B or RNS B controlled by or reported to MSC A may be initiated by involving access signalling transfer in both directions.

## 19.2.3.35 Subsequent handover

The handling in MSC-B for subsequent inter-MSC handover is shown in sheet 8 of figure 19.2/5.

While the MAP process in MSC-B is waiting for the completion of subsequent handover, it relays access signalling between MSC-A and the MS, RNS-B or BSS-B through the Handover Control application as described in subclause 19.2.3.2.

The procedure is used when the Handover Control Application in MSC B has decided that a call is to be handed over or relocated to another MSC (either back to the controlling MSC (MSC-A) or to a third MSC (MSC-B')).

After the MAP\_PREPARE\_SUBSEQUENT\_HANDOVER response is received from MSC A, MSC B will await the disconnection of the call. Once the disconnect is complete, MSC B will inform its VLR by invoking the MAP\_SEND\_HANDOVER\_REPORT confirmation. VLR-B will then release the allocated handover number.

The subsequent handover procedure is shown in figure 19.2/3.

# 19.2.3.6 SDL Diagrams

The SDL diagrams on the following pages describe the user process in MSC B for the procedures described in this clause:

The services used are defined in clause 8.4.

NOTE 1: The message primitives HO\_CA\_MESSAGE in the SDL diagrams are used to show the internal coordination between the MAP application and the Handover Control Application. For a detailed description of the co-ordination between the applications for the handover procedure, see 3GPP TS 23.009.

NOTE 2: The order in the SDL diagrams to allocate first the handover number and then the radio resources is not binding.

# 19.2.4 Handover error handling macro Macro Receive Error From HO CA

This macro is used <u>for by</u> the handover processes <u>dures</u> in <u>MSC-A</u> and <u>MSC-B</u> to receive errors <u>from the MSCs and</u> from the Handover Control Application at any state of a handover process.

If a MAP\_NOTICE indication is received, the Handover Control Application is informed and the actual situation is kept and the Handover Control Application decides how the handover or relocation process should continue. In all other cases the MSC is returned to a "NULL" state.

# 19.2.5 Handover pProcedure in VLR-B

The process in VLR-B to handle a request for a handover number is shown in figure 19.2/7. The process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;
Check Indication see subclause 25.2.1.

### 19.2.5.1 Allocation of handover number

When receiving the MAP\_ALLOCATE\_HANDOVER\_NUMBER indication, the VLR will determine whether a handover number is available. If no handover number is available, this will be indicated by a MAP\_ALLOCATE\_HANDOVER\_NUMBER response with the appropriate error.

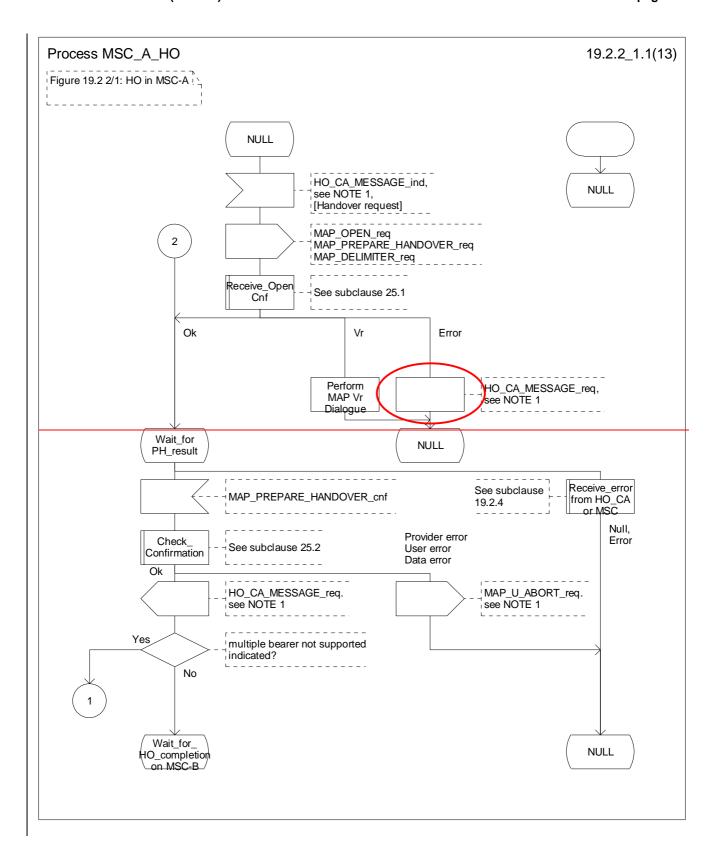
The handover number allocated will otherwise be returned to MSC B in the MAP\_SEND\_HANDOVER\_REPORT request.

The handover number will be reserved until a MAP\_SEND\_HANDOVER\_REPORT confirmation is received from MSC B.

## 19.2.5.2 SDL Diagrams

The SDL diagrams on the following pages describe the user processes in VLR for the procedures described in this clause.

The services used are defined in clause 8.4.



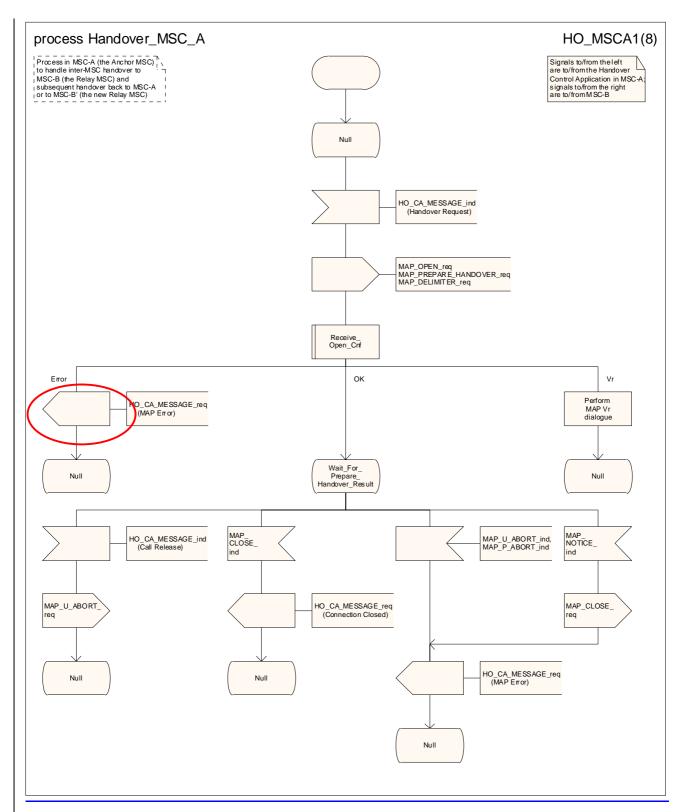
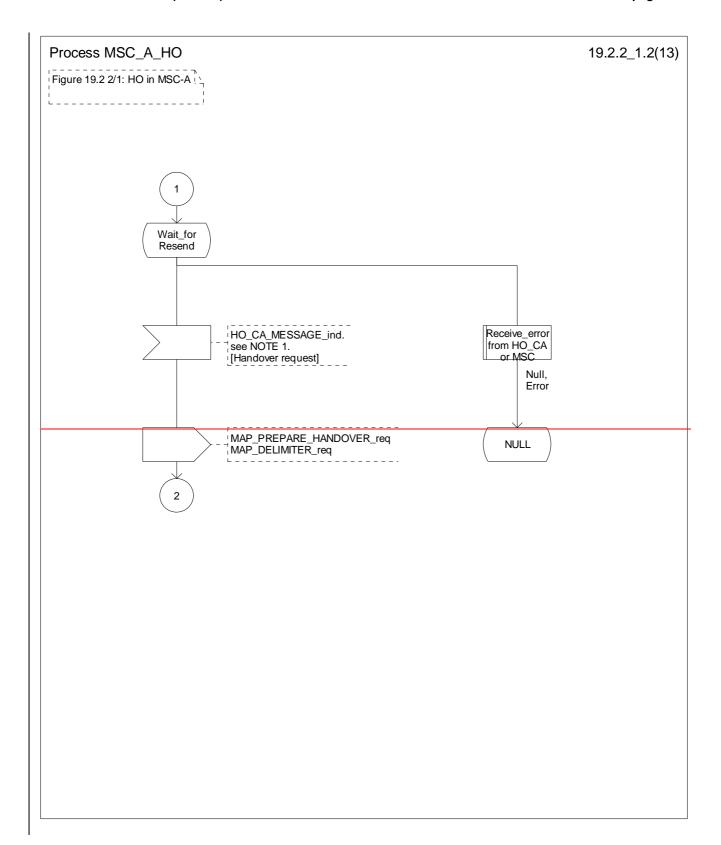


Figure 19.2/4.2/1 (sheet 1 of 813): Process HO\_MSC\_A\_HO



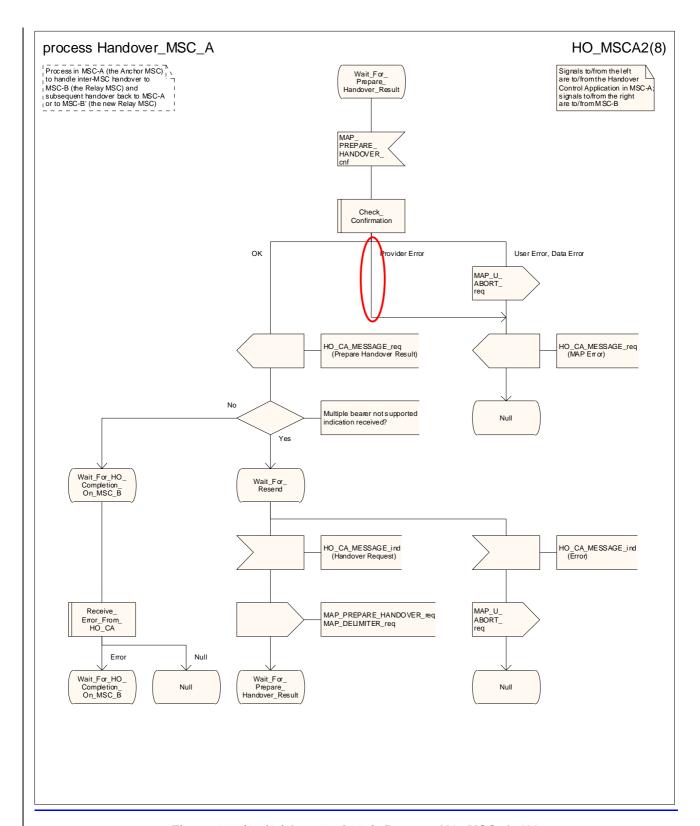
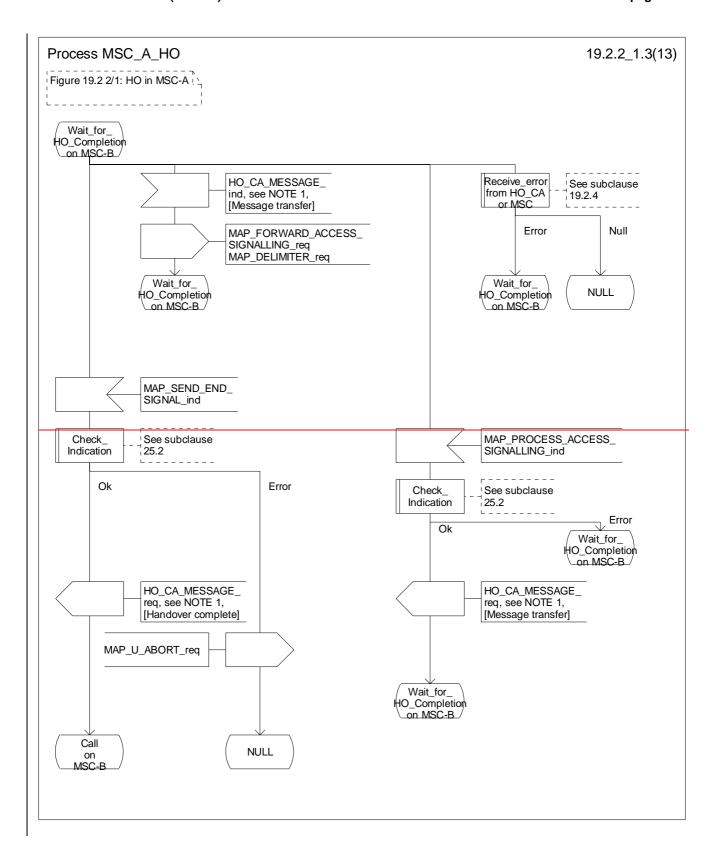


Figure 19.2/4.2/1 (sheet 2 of 813): Process HO\_MSC\_A\_HO



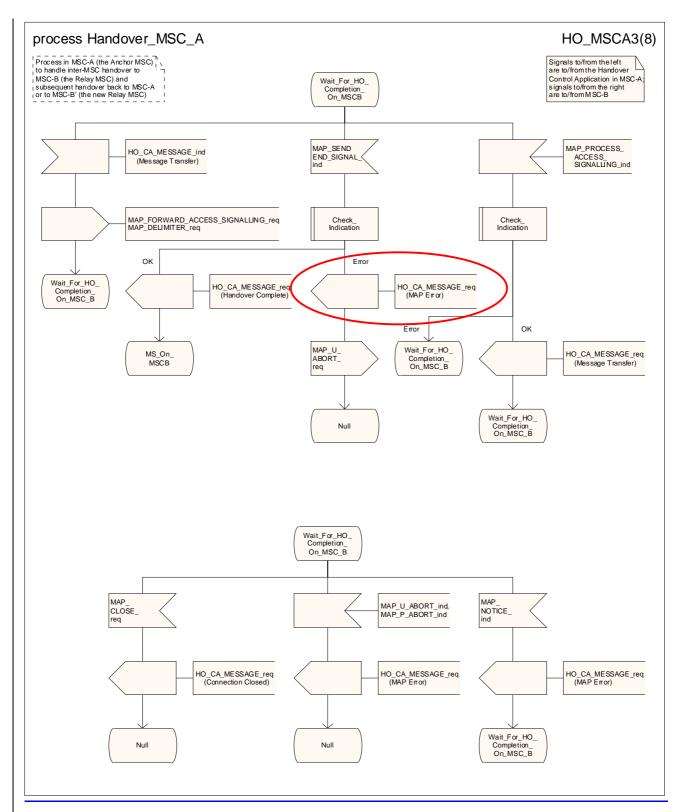
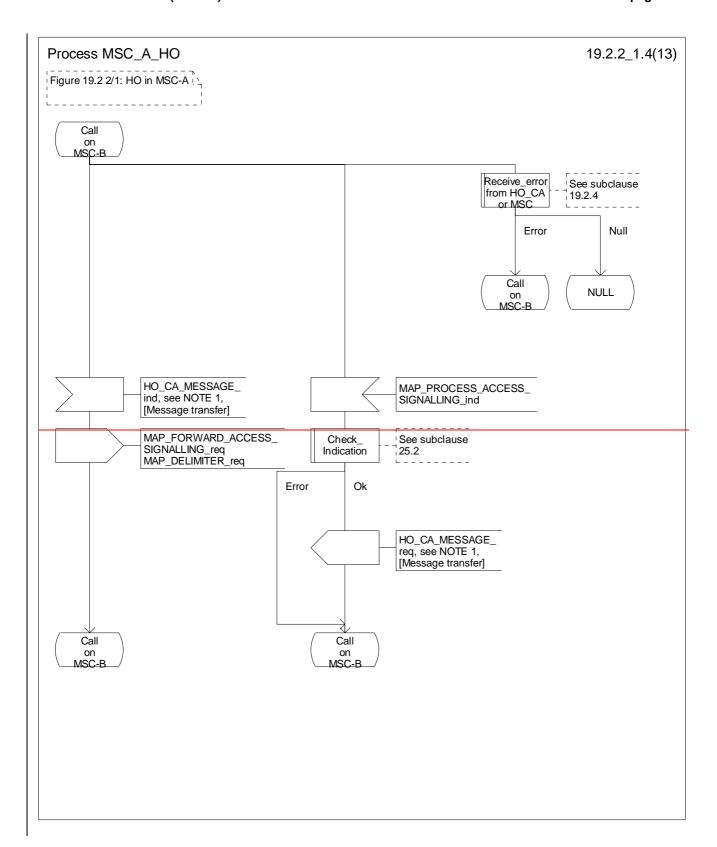


Figure 19.2/4.2/1 (sheet 3 of 813): Process HO\_MSC\_A\_HO



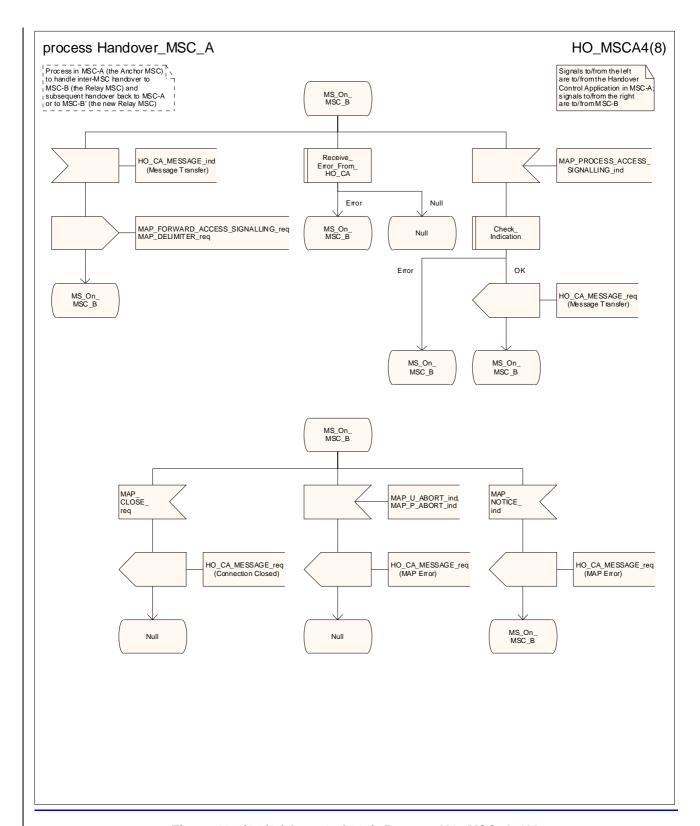
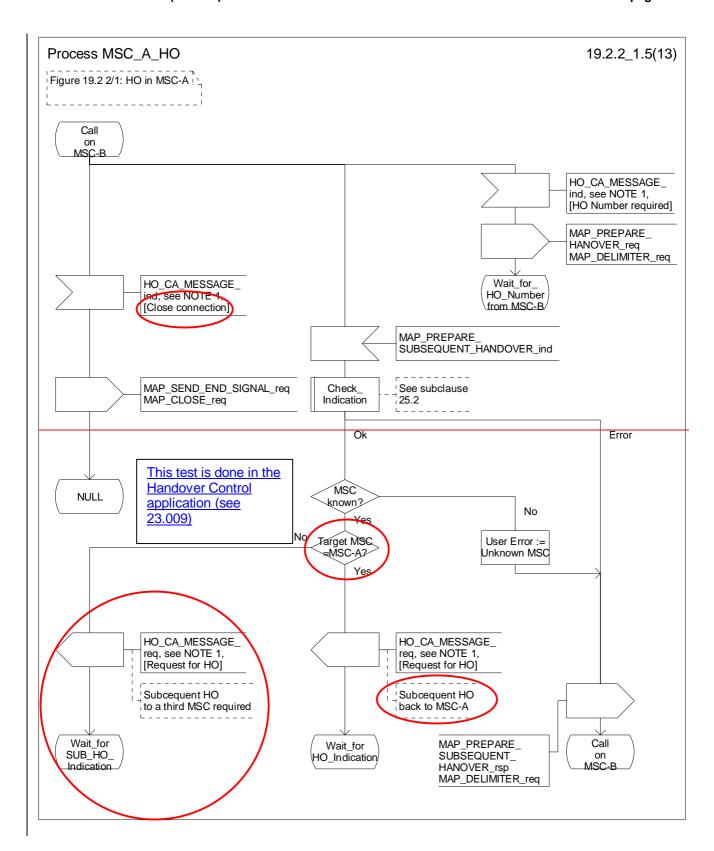


Figure 19.2/4.2/1 (sheet 4 of 813): Process HO\_MSC\_A\_HO



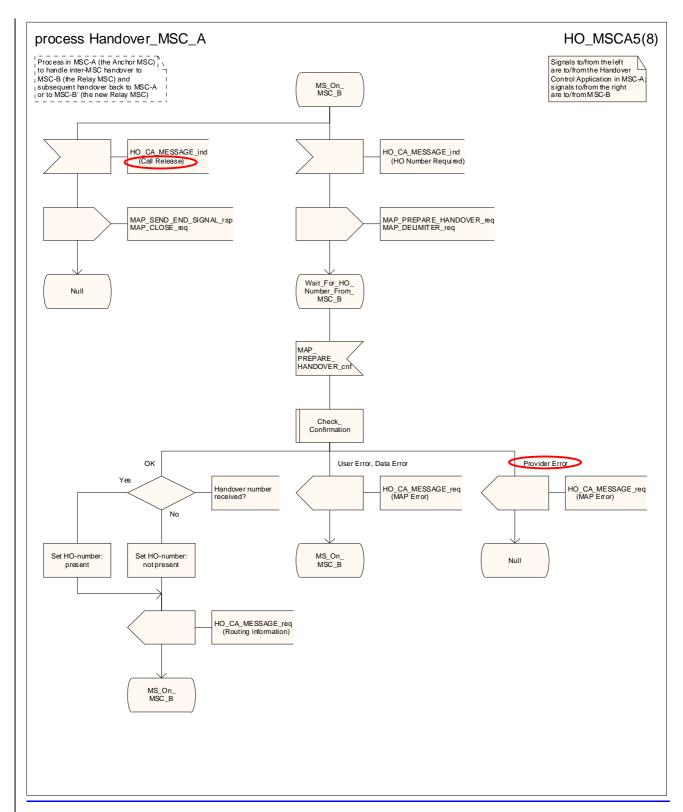
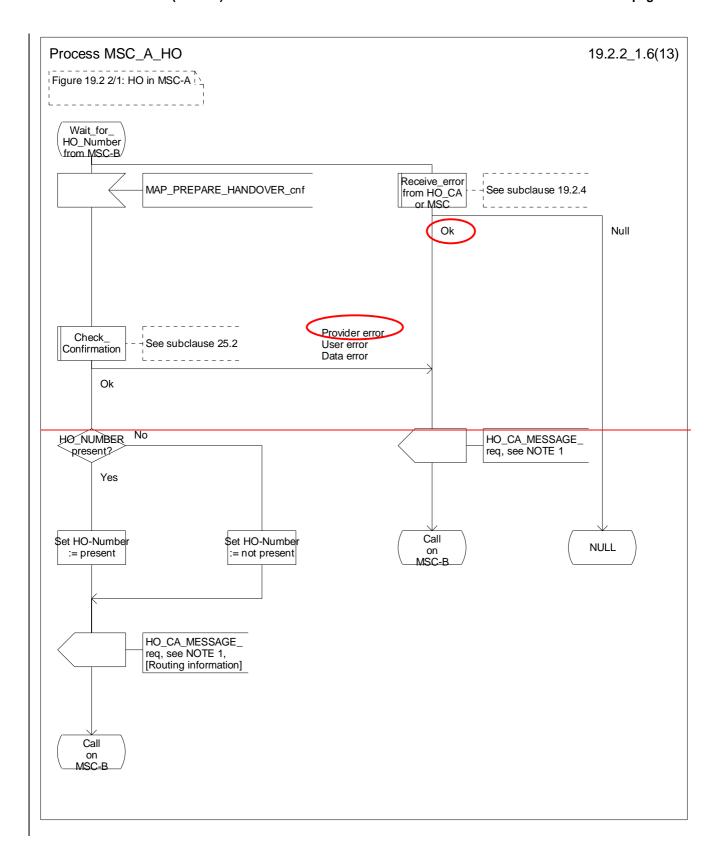


Figure 19.2/4.2/1 (sheet 5 of 813): Process HO\_MSC\_A\_HO



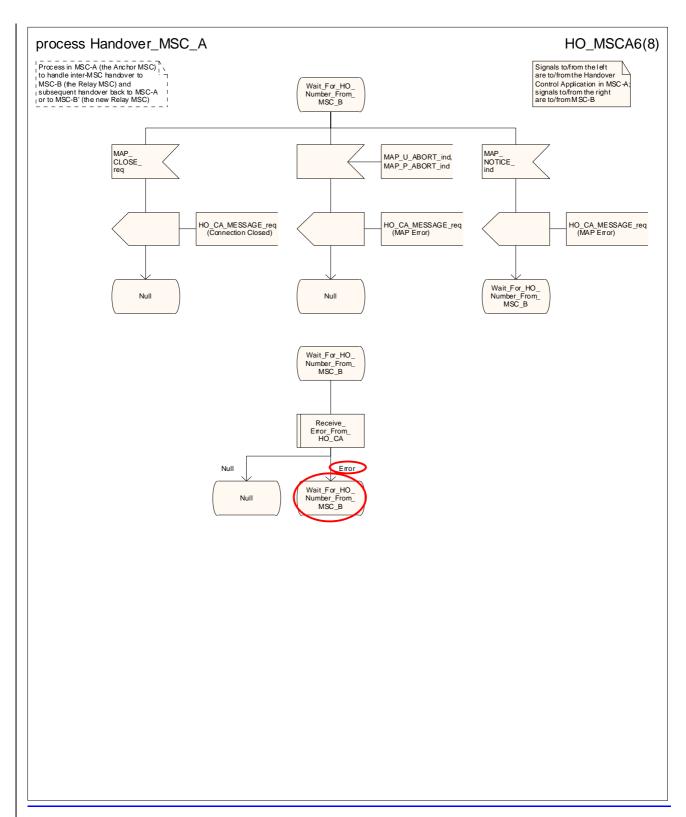
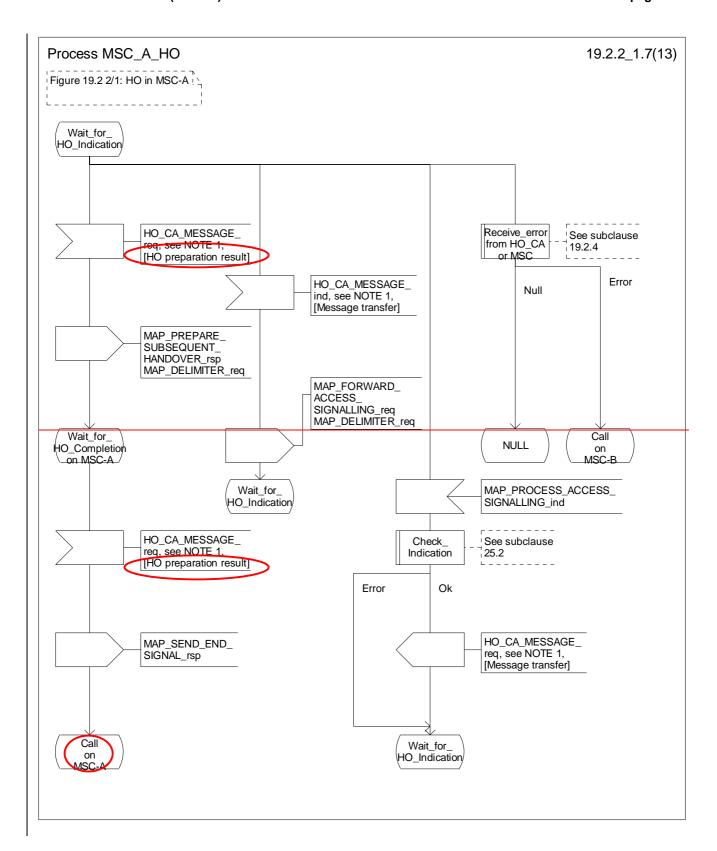


Figure 19.2/4.2/1 (sheet 6 of 813): Process HO\_MSC\_A\_HO



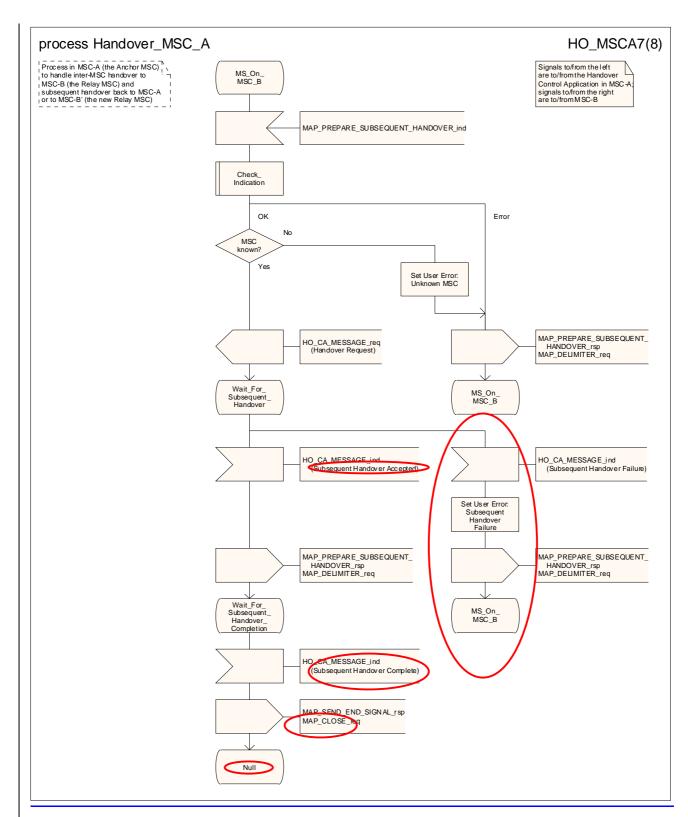
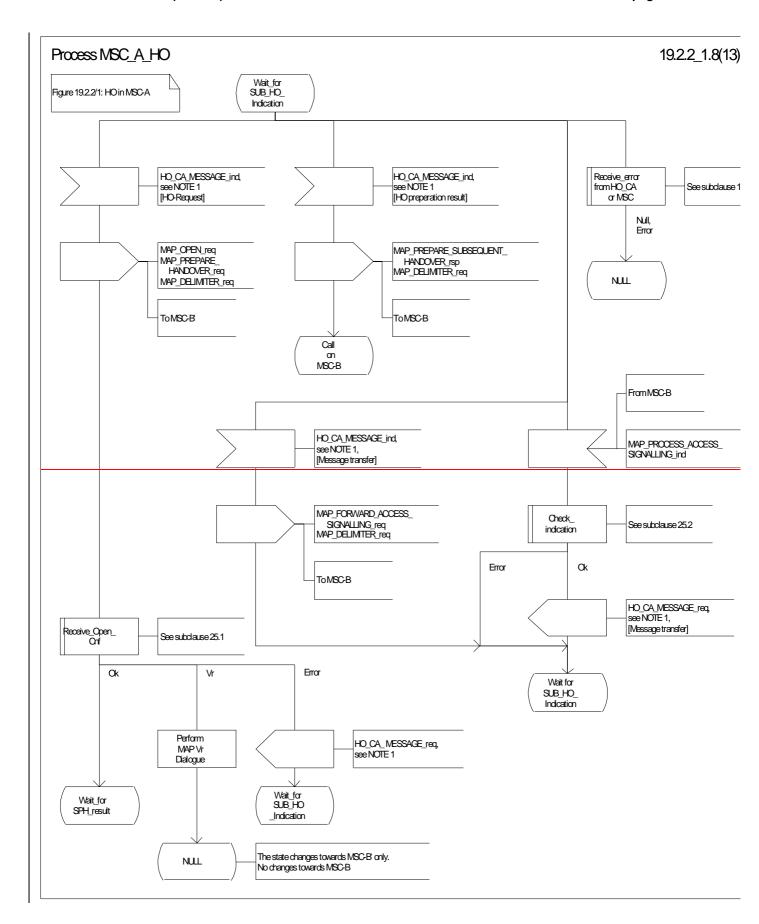


Figure 19.2/4.2/1 (sheet 7 of 813): Process HO\_MSC\_A\_HO



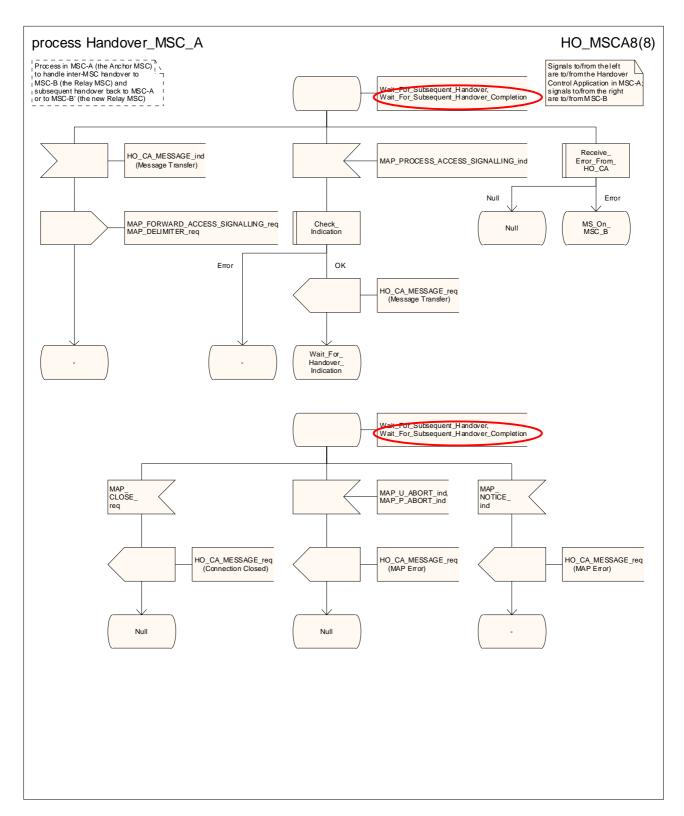


Figure 19.2/4.2/1 (sheet 8 of 813): Process HO\_MSC\_A\_HO

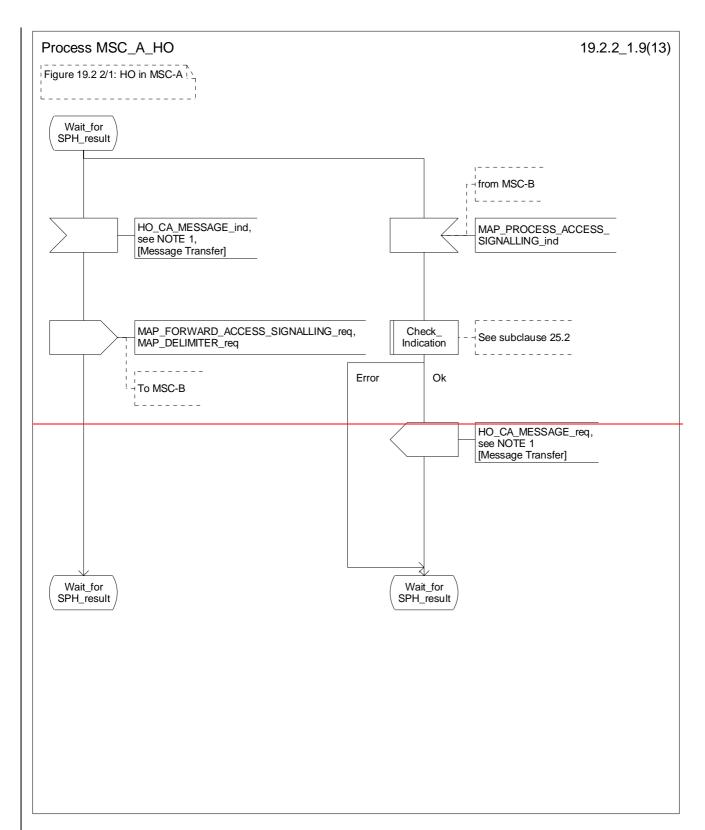


Figure 19.2.2/1 (sheet 9 of 13): Process MSC\_A\_HO

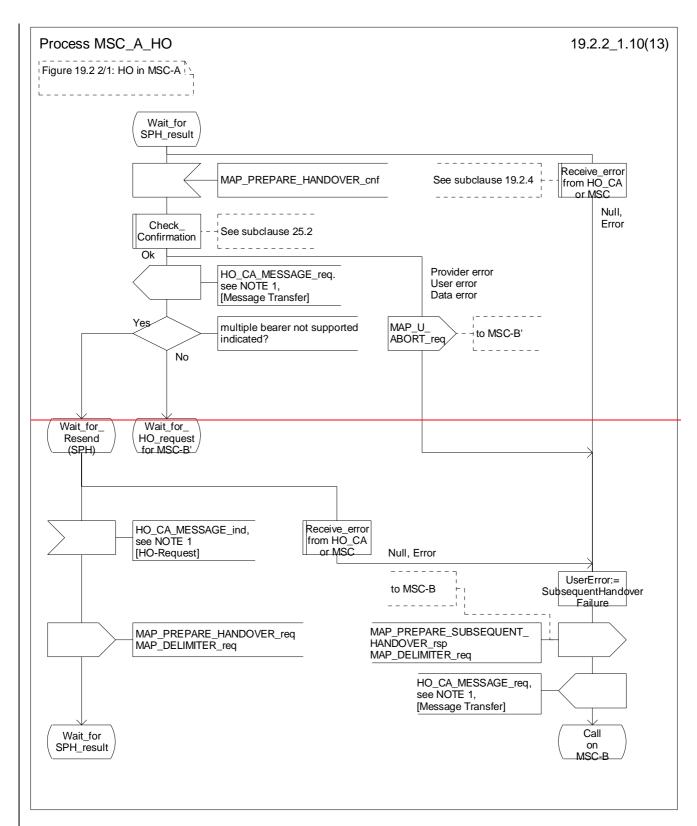


Figure 19.2.2/1 (sheet 10 of 13): Process MSC\_A\_HO

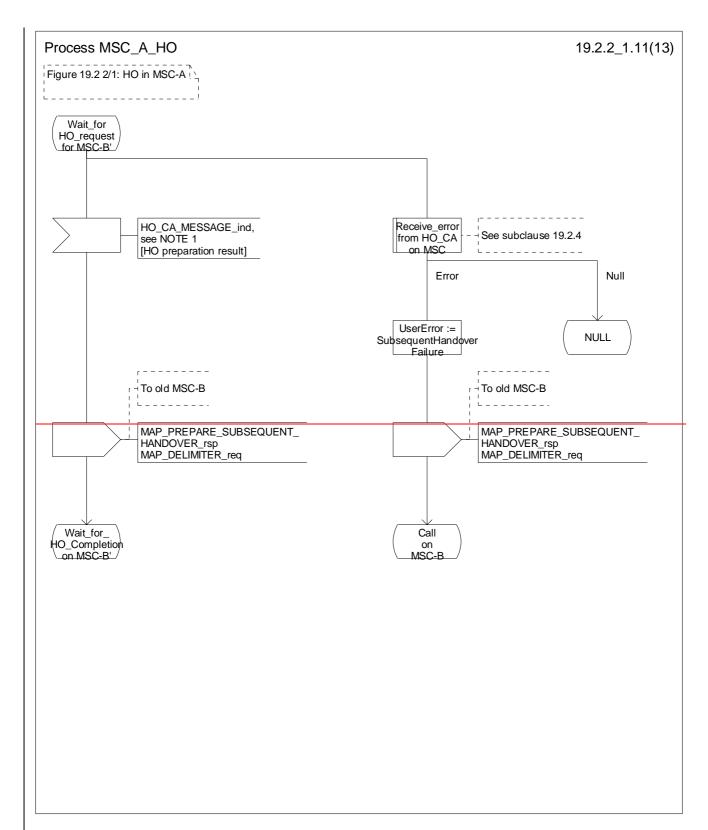


Figure 19.2.2/1 (sheet 11 of 13): Process MSC\_A\_HO

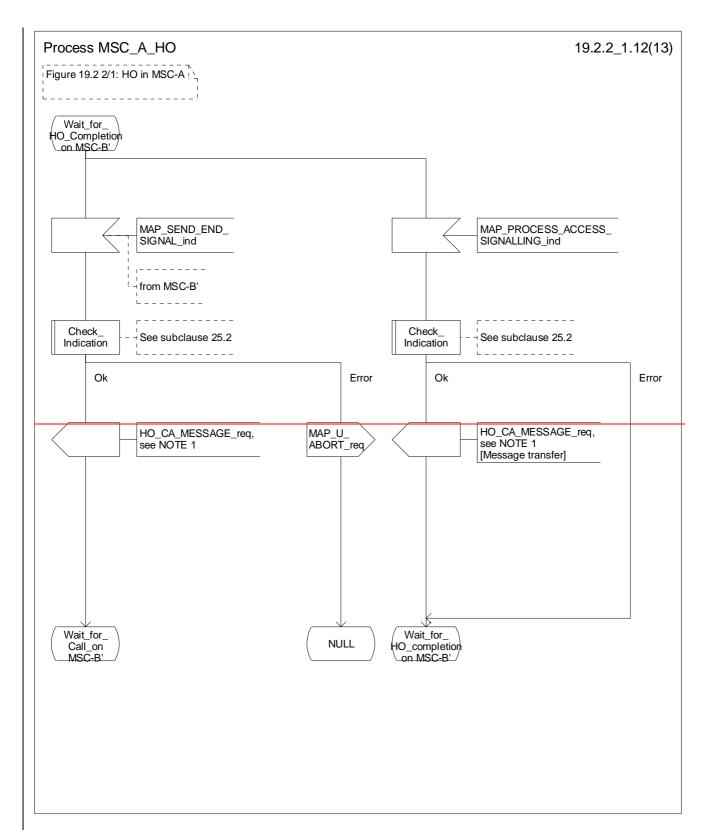


Figure 19.2.2/1 (sheet 12 of 13): Process MSC\_A\_HO

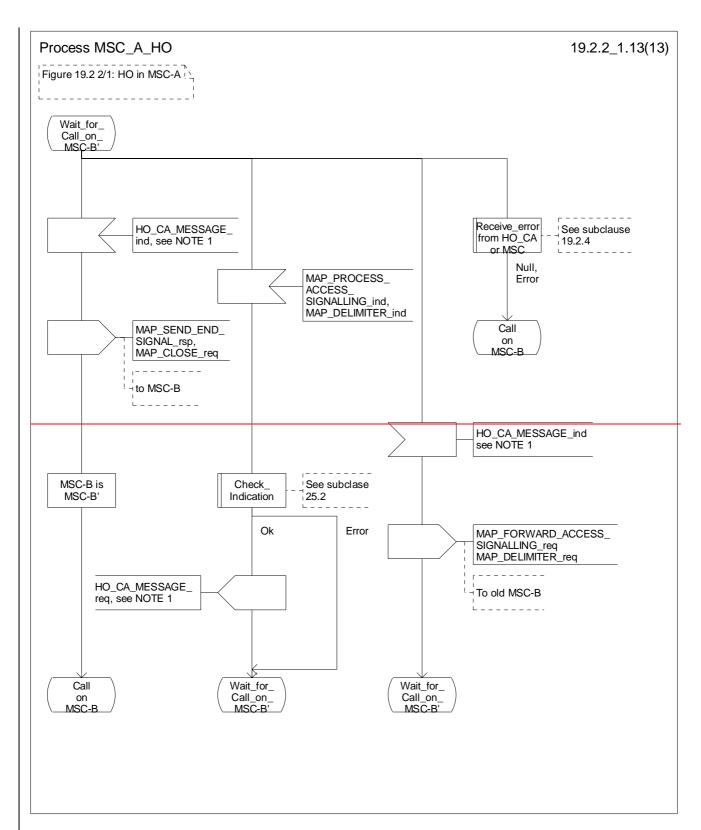
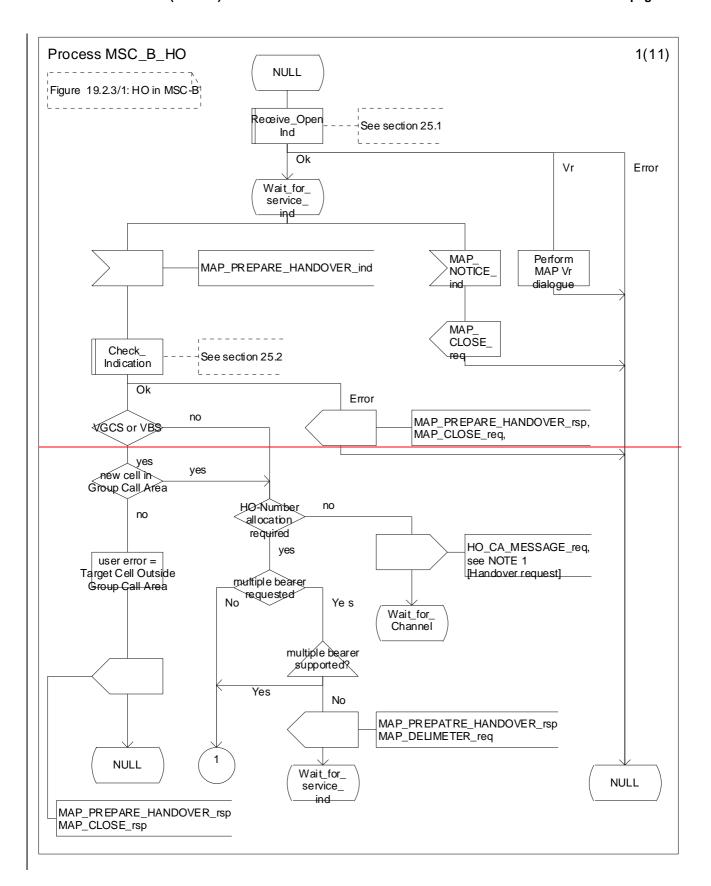


Figure 19.2.2/1 (sheet 13 of 13): Process MSC\_A\_HO



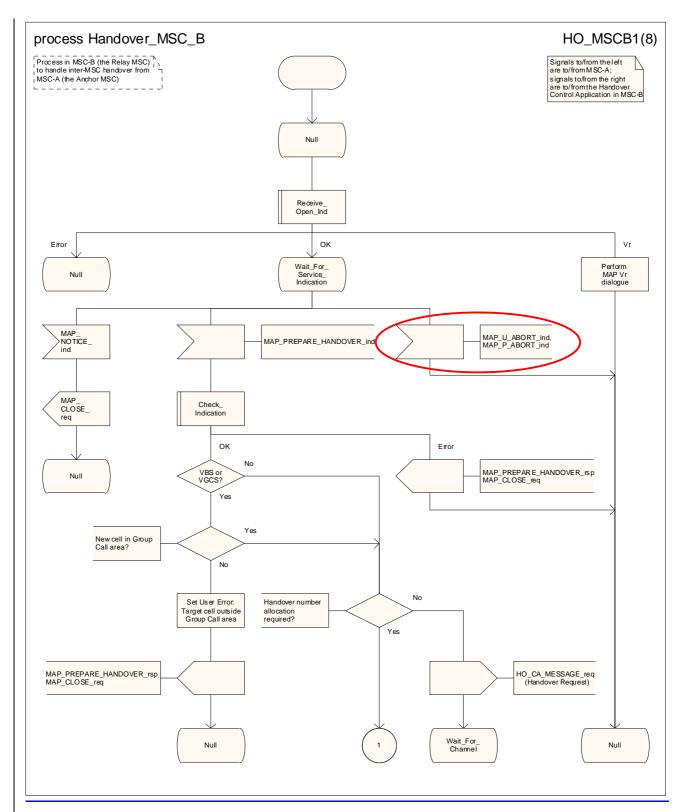
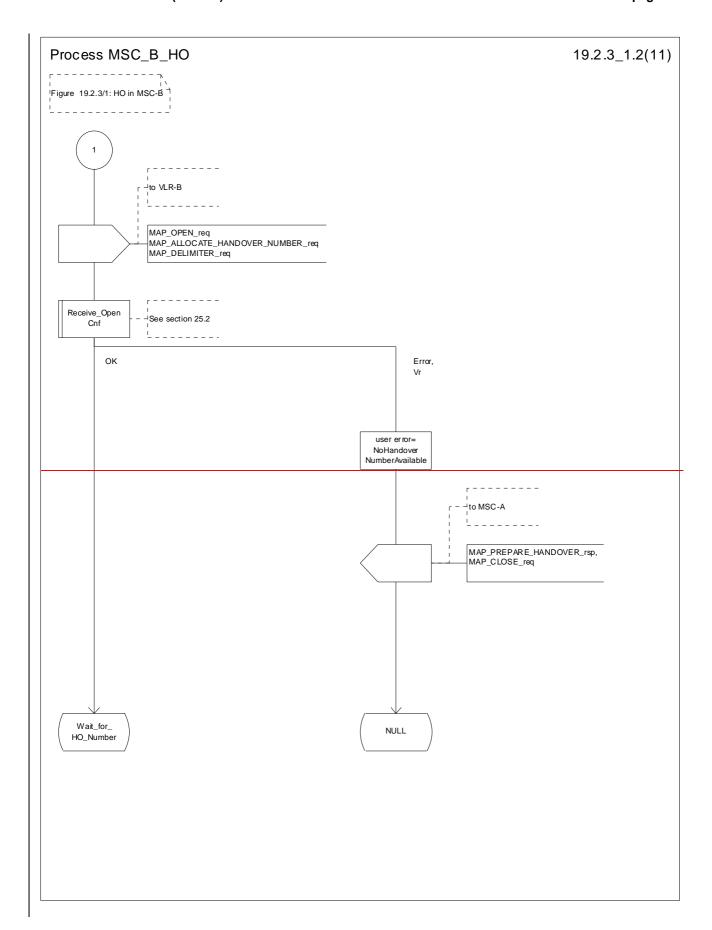


Figure 19.2/5.3/4 (sheet 1 of 844): Process HO\_MSC\_B\_HO



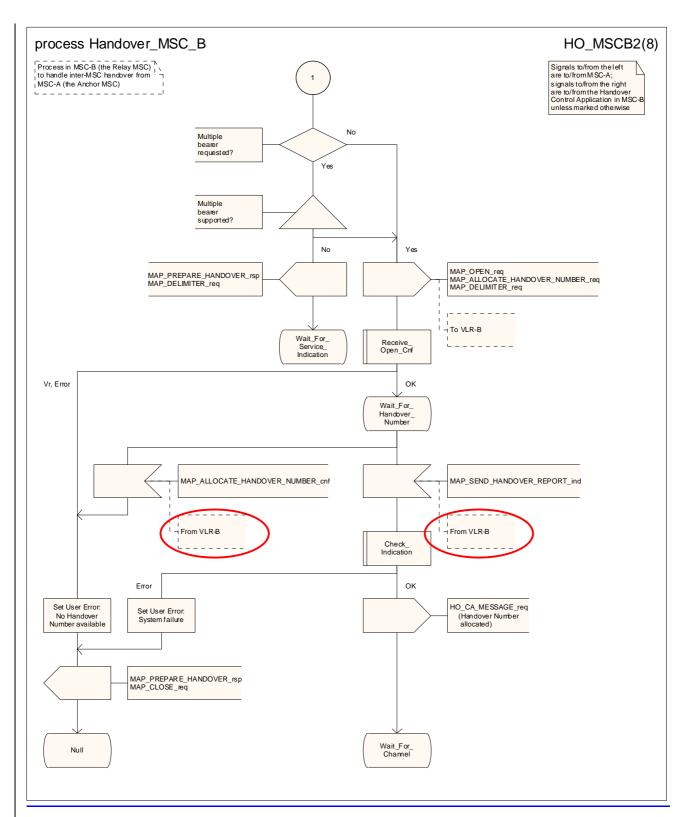
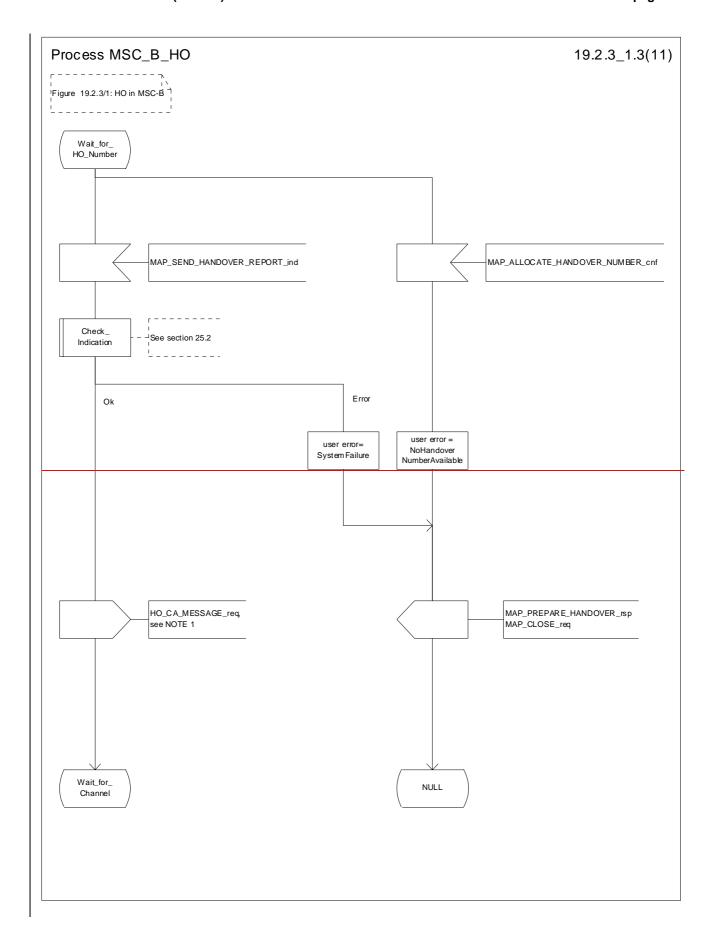


Figure 19.2/5.3/4 (sheet 2 of 814): Process HO\_MSC\_B\_HO



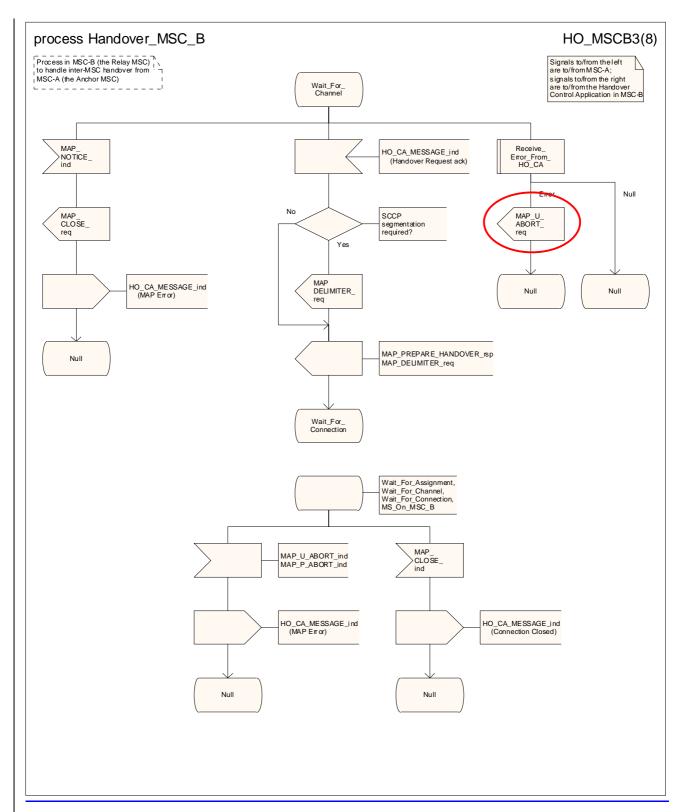
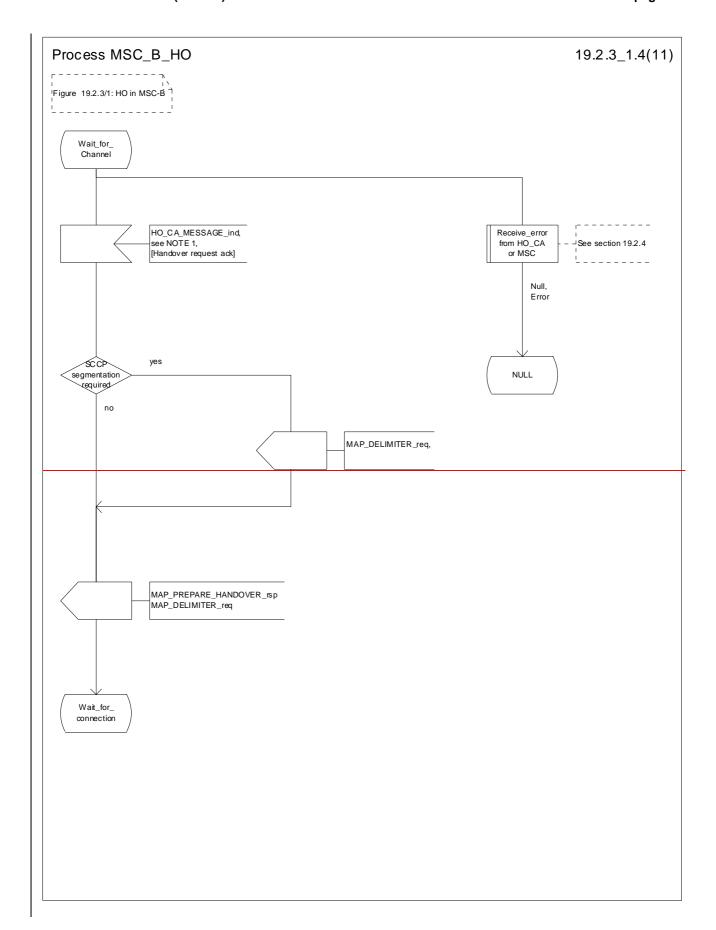


Figure 19.2/5.3/4 (sheet 3 of 814): Process HO\_MSC\_B\_HO



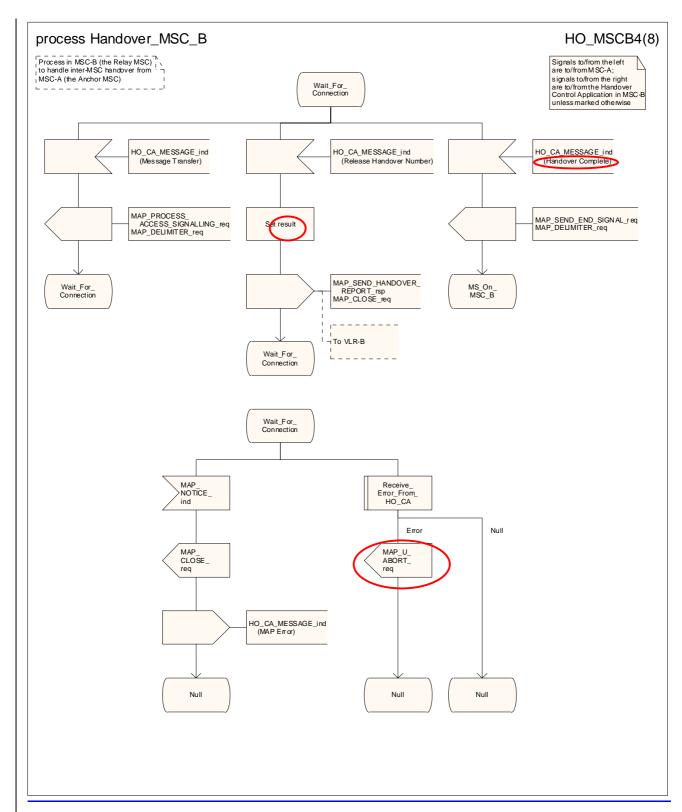
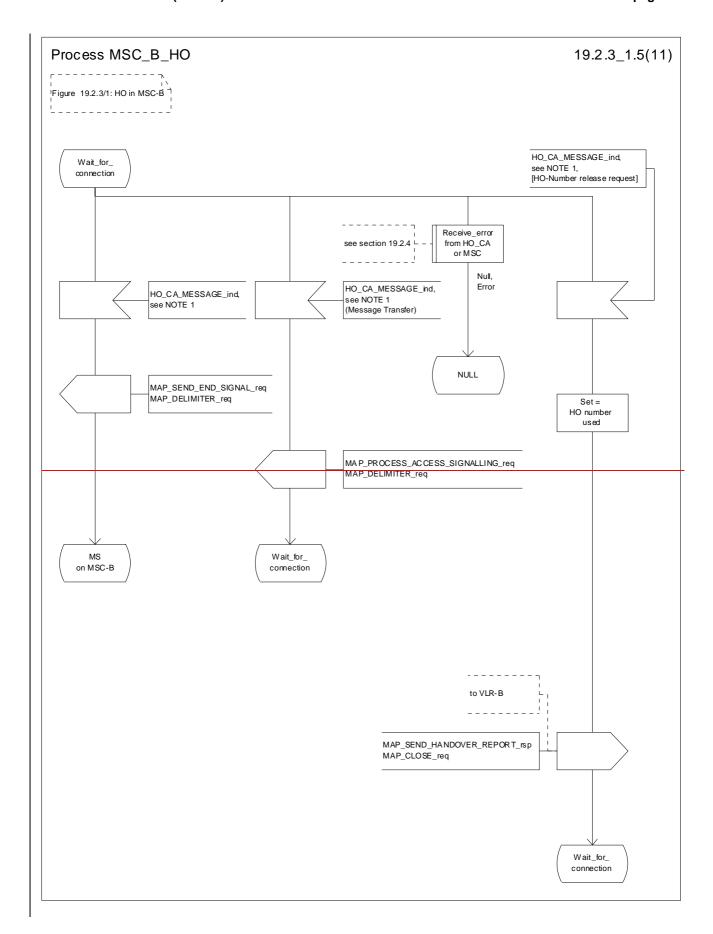


Figure 19.2/5.3/4 (sheet 4 of 814): Process HO\_MSC\_B\_HO



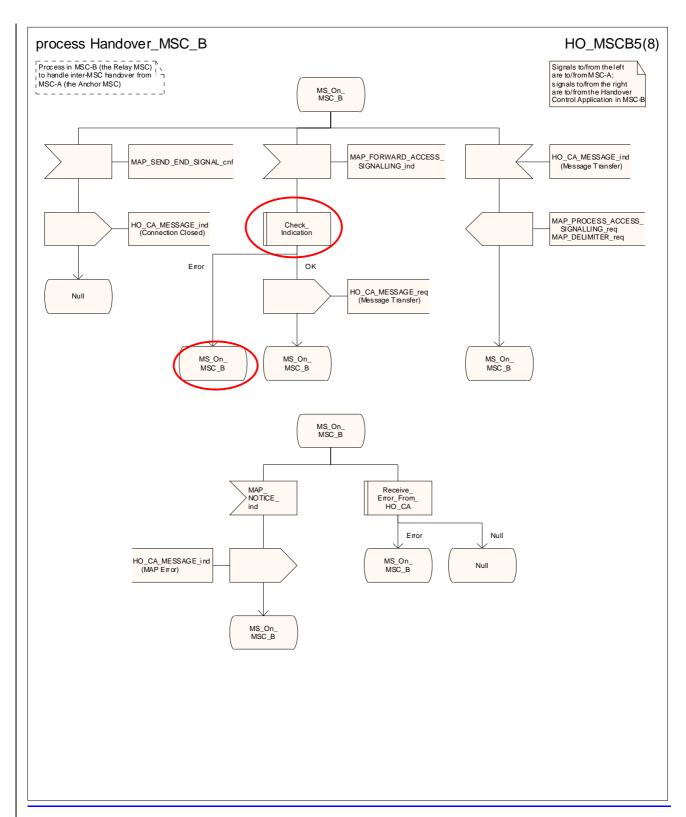
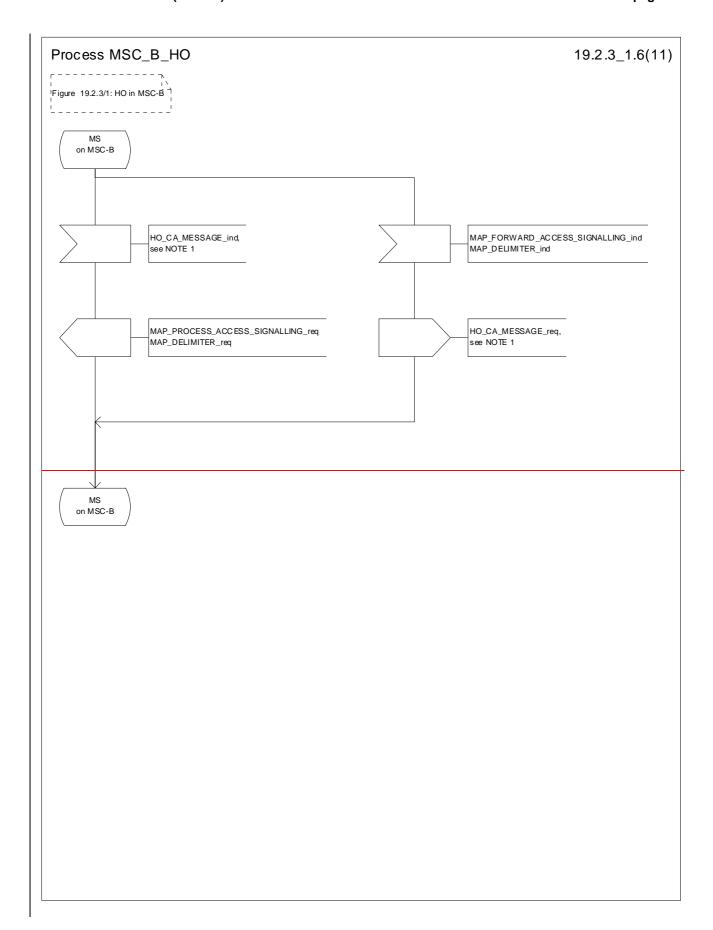


Figure 19.2/5.3/4 (sheet 5 of 814): Process HO\_MSC\_B\_HO



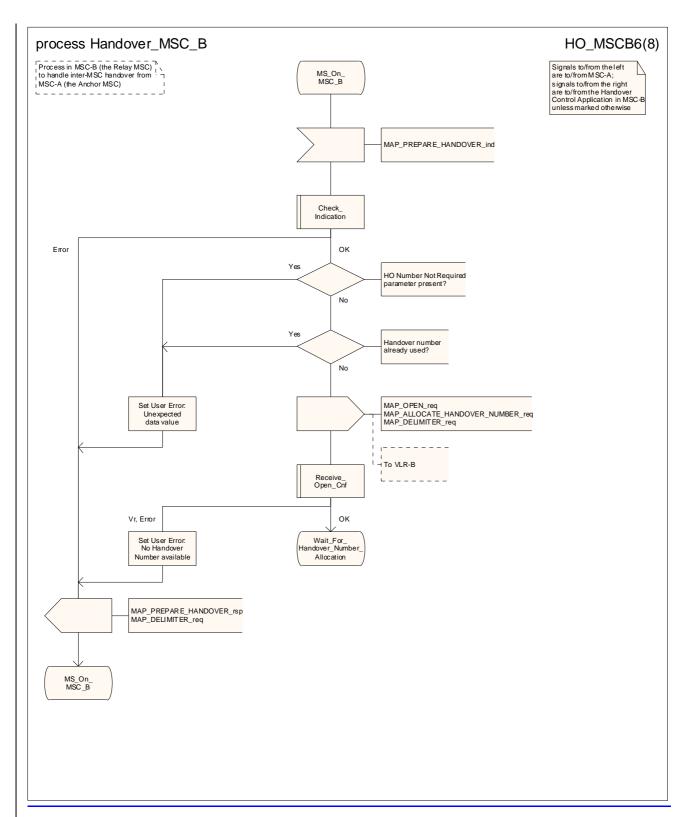
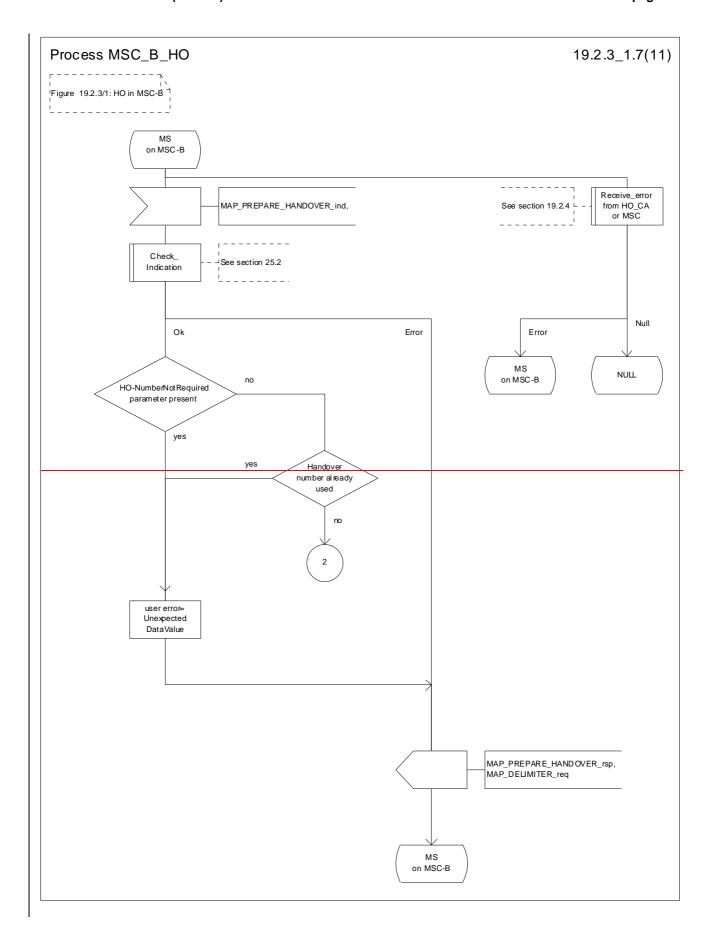


Figure 19.2/5.3/4 (sheet 6 of 814): Process HO\_MSC\_B\_HO



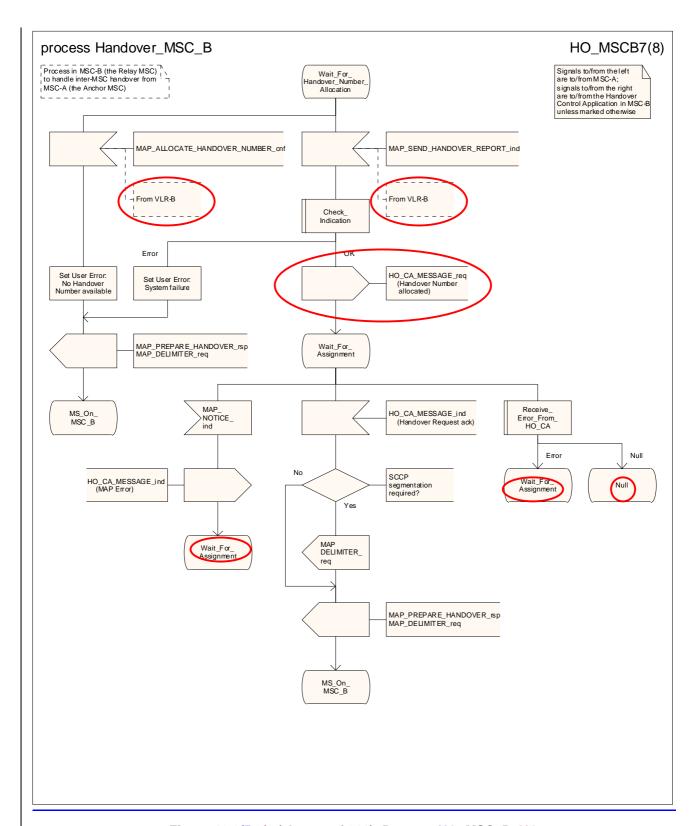
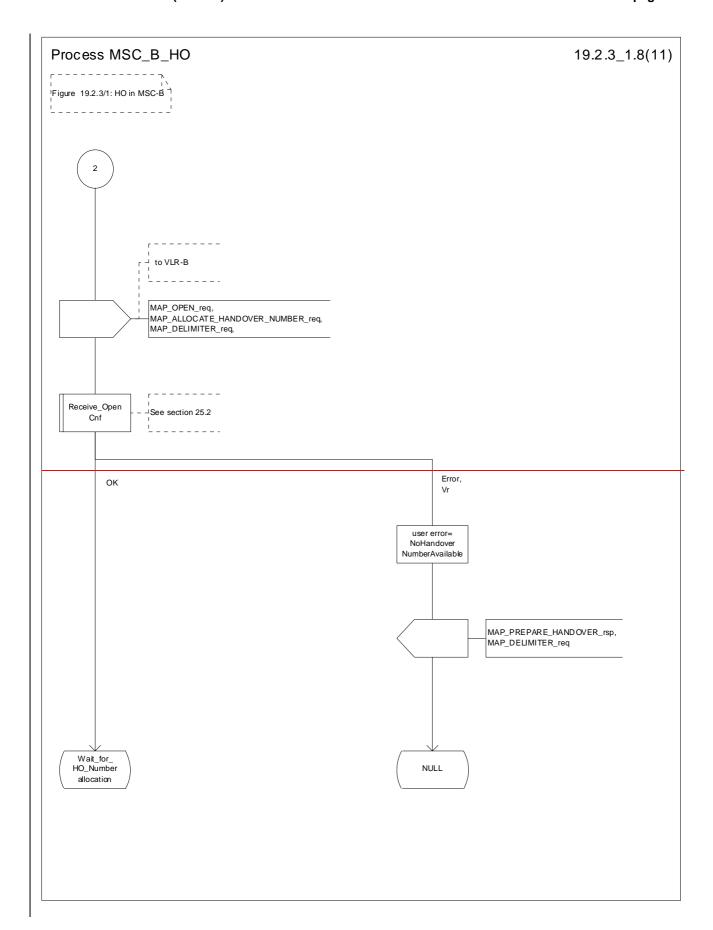


Figure 19.2/5.3/1 (sheet 7 of 811): Process HO\_MSC\_B\_HO



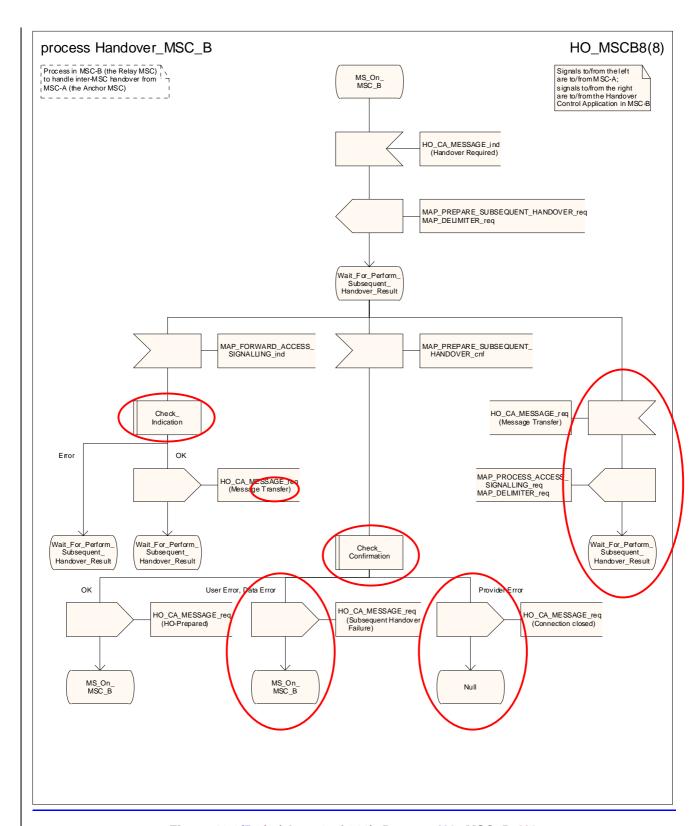


Figure 19.2/5.3/1 (sheet 8 of 811): Process HO\_MSC\_B\_HO

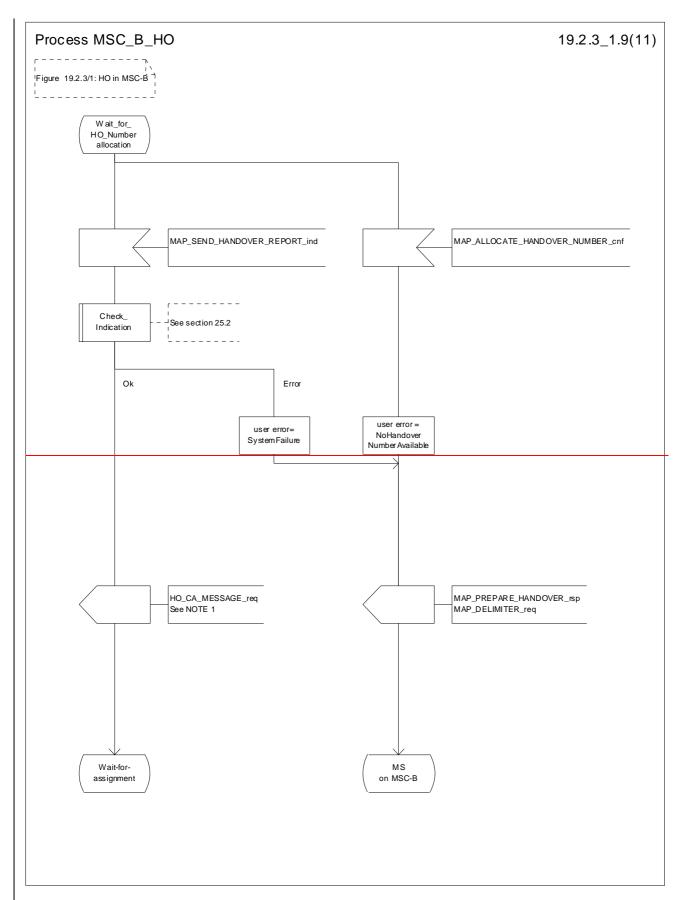


Figure 19.2.3/1 (sheet 9 of 11): Process MSC\_B\_HO

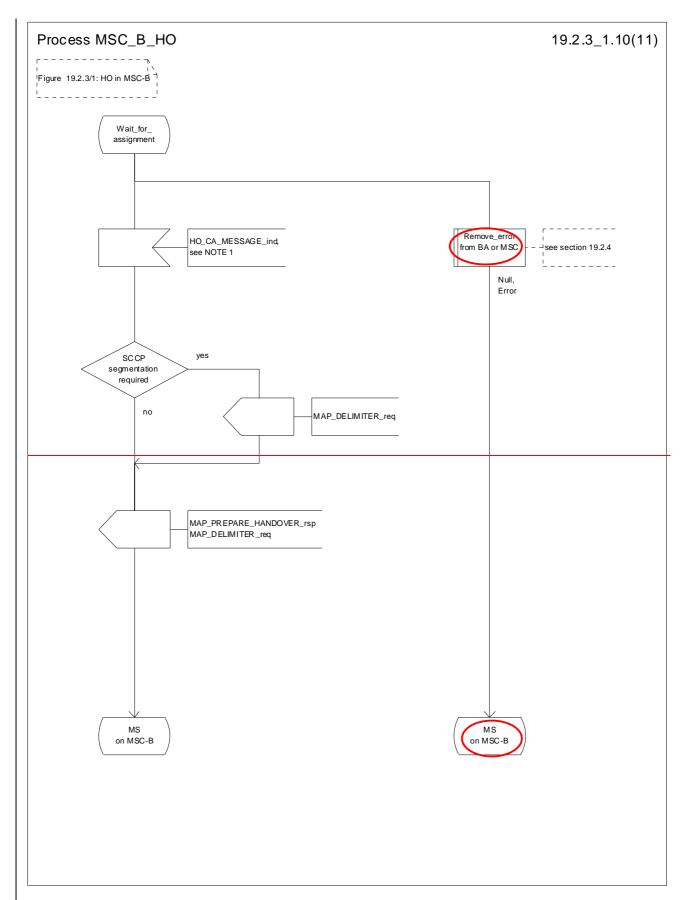


Figure 19.2.3/1 (sheet 10 of 11): Process MSC\_B\_HO

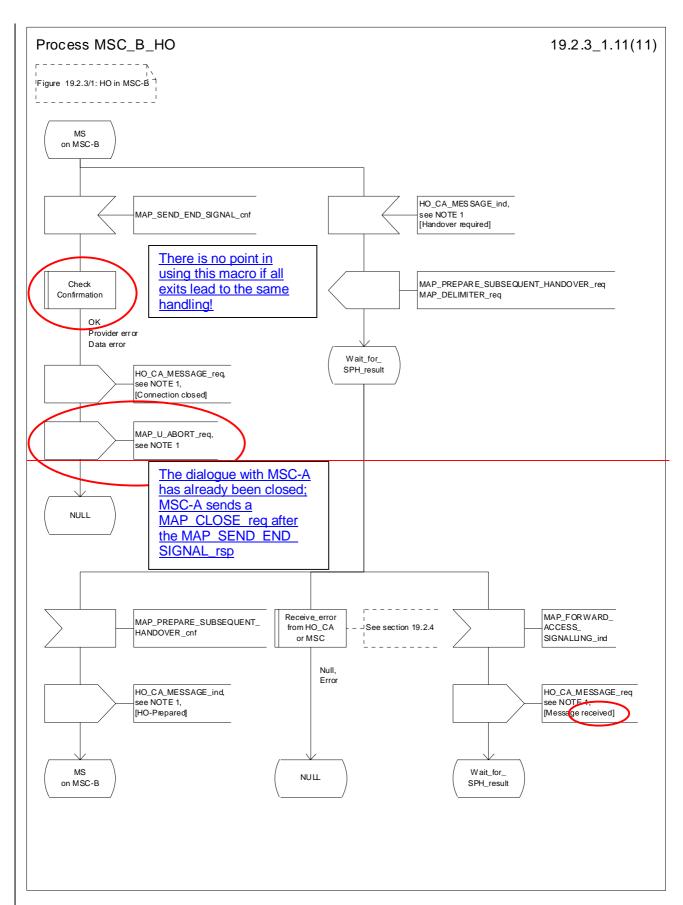
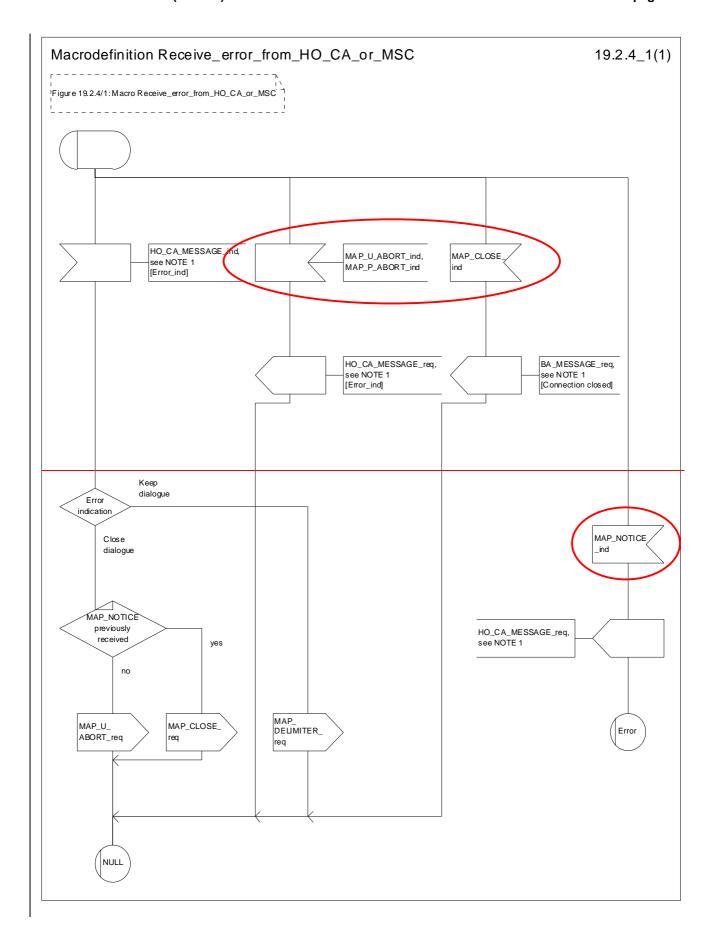


Figure 19.2.3/1 (sheet 11 of 11): Process MSC\_B\_HO



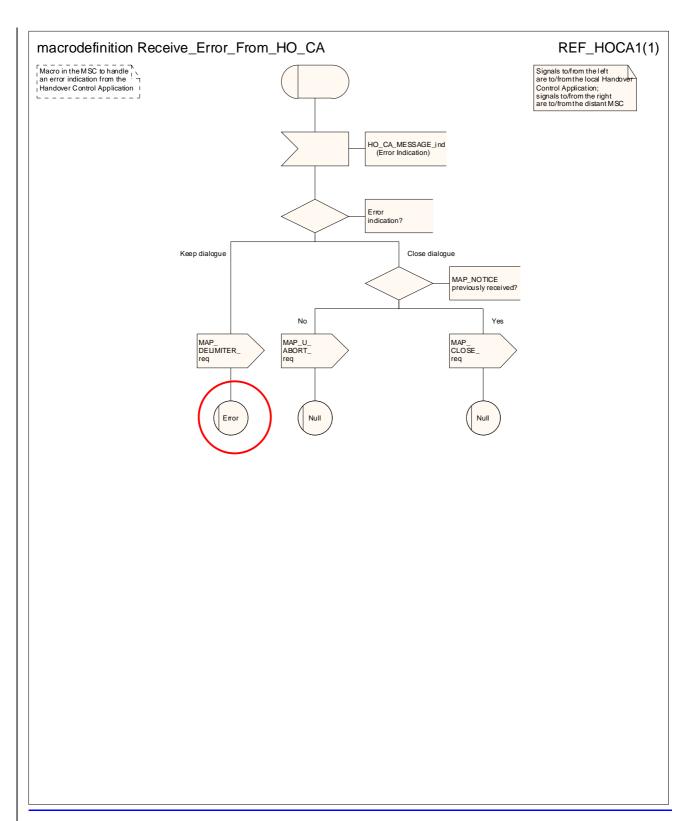
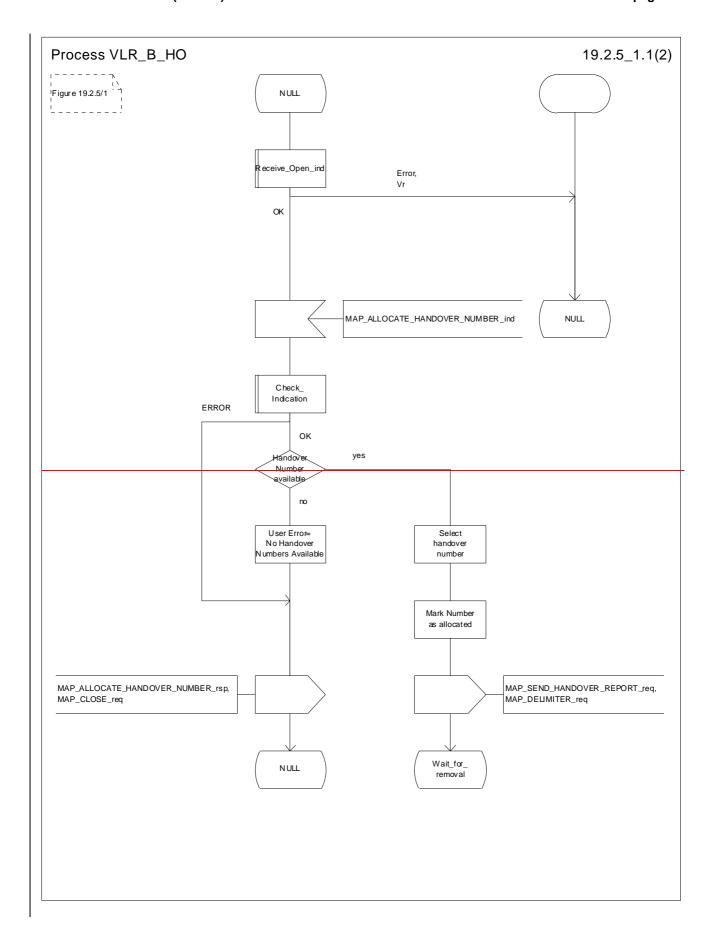


Figure 19.2/6.4/1: Macro Receive\_error\_from\_HO\_CA\_or\_MSC



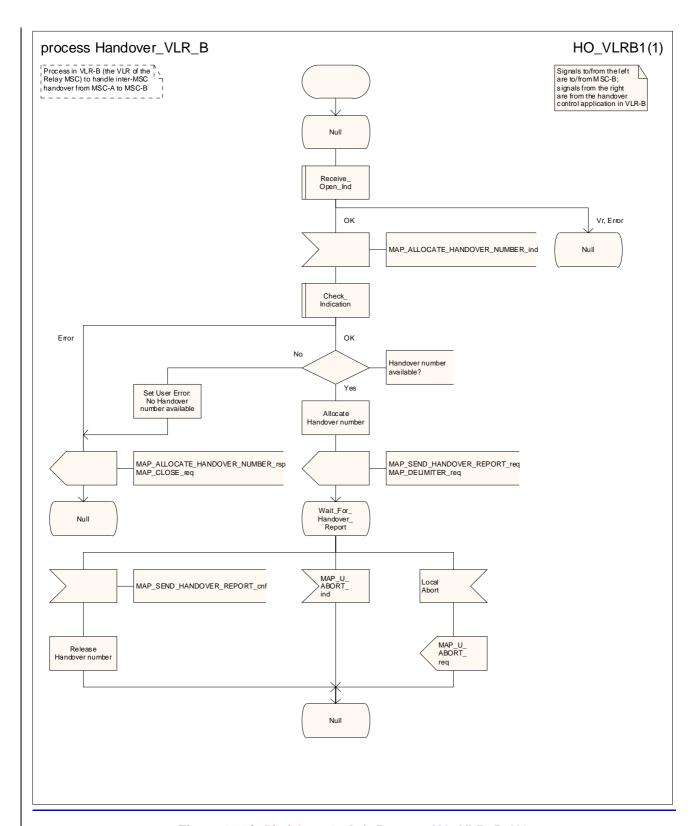


Figure 19.2/7.5/1 (sheet 1 of 2): Process HO\_VLR\_B\_HO

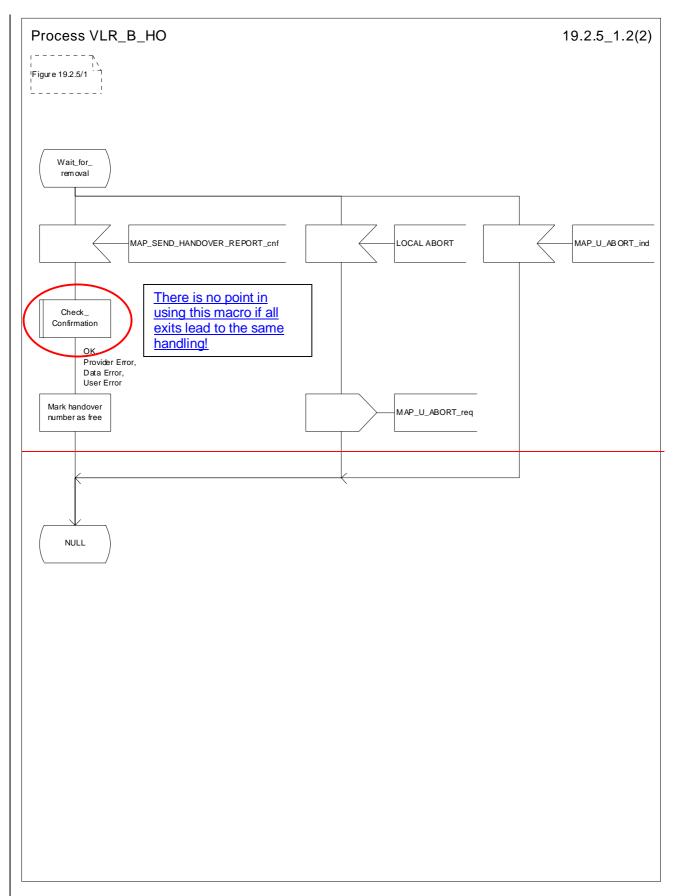


Figure 19.2.5/1 (sheet 2 of 2): Process VLR\_B\_HO

# 19.3 Fault recovery procedures

After a fault of When a location register has restarted after a fault, the fault recovery procedures ensure that the subscriber data in the VLR or in the SGSN become consistent with the subscriber data that are stored in the HLR for the MS concerned and that the location information in the HLR-, the VLR and the SGSN reflect accurately the current location of the MS.

The detailed stage 2 specification of fault recovery procedures of in location registers is given in 3GPP TS 23.007 [19].

# 19.3.1 VLR fault recovery procedures

## 19.3.1.1 General

Restoration of an IMSI record in a VLR can be triggered by a location registration request from the MS or by a request from the HLR for a roaming number to route a mobile terminated call to the MS. If the restoration is triggered by a location registration request from the MS, the VLR performs the location updating procedure described in 3GPP TS 23.012 [23] and subclause 19.1.1 of the present document. If the restoration is triggered by a request for a roaming number, the VLR provides the roaming number and triggers an independent dialogue to restore the subscriber data as described in 3GPP TS 23.018 [97]. The message flow for data restoration triggered by a request for a roaming number is shown in figure 19.3.1/1.

The following processes are involved with the restoration of one IMSI record in the VLR:

— In case of a location registration request from the MS:
Update Location Area VLR — clause 19.1.1.3:

Update\_Location\_HLR clause 19.1.1.4.

— In case of a mobile terminated call:

PRN\_VLR clause 21.2.4;

RESTORE\_DATA\_VLR clause 21.2.4;

RESTORE\_DATA\_HLR clause 19.3.3;

ICS\_VLR clause 21.3.3.

After a restart, the VLR shall crase all IMSI records affected by the failure and shall cause all affected TMSIs and all affected LMSIs to become invalid. There will be no subscriber data or location information stored for an affected MS until after the VLR has received either a MAP\_PROVIDE\_ROAMING\_NUMBER indication or a MAP\_UPDATE\_LOCATION\_AREA indication for that MS. Restoration of subscriber data in the VLR is triggered individually for each IMSI record by receipt of either of these indications.

Reception of either a MAP\_UPDATE\_LOCATION\_AREA indication or a MAP\_PROVIDE\_ROAMING\_NUMBER indication with an IMSI that is unknown in the VLR causes creation of a skeleton IMSI record that is marked as:

- not confirmed by radio contact by the indicator "Confirmed by Radio Contact" (The function of this indicator is described in 3GPP TS 23.007 [19]); and
- not confirmed by HLR by the indicator "Confirmed by HLR" (The function of this indicator is described in 3GPP TS 23.007 [19]).

A third indicator "Location Information Confirmed in HLR" is allocated to each IMSI record in the VLR (The function of this indicator is described in 3GPP TS 23.007 [19]).

The indicator "Location Information Confirmed in HLR" shall be checked whenever authenticated radio contact with an MS has been established. The status "Not Confirmed" of this indicator shall force the VLR to invoke the MAP\_UPDATE\_LOCATION service but it shall never cause rejection of a mobile originated request. The status is changed from "Not Confirmed" to "Confirmed" only after successful completion of a MAP\_UPDATE\_LOCATION procedure for the MS concerned.

If the VLR serves only one MSC, the indicator "Location Information Confirmed in HLR" is only relevant to the HLR restoration procedure and an initial value must be assigned when an IMSI record is created in the VLR:

- if the IMSI record was created due to a roaming number request, the initial value must be set to "Confirmed";
- if reception of a MAP\_UPDATE\_LOCATION\_AREA indication causes creation of the IMSI record, the initial value must be "Not Confirmed".

If the VLR serves more than one MSC, the indicator "Location Information Confirmed in HLR" is used in the VLR restoration procedure as well as in the HLR restoration procedure. When an IMSI record is created in the VLR, the indicator must be set to "Not Confirmed".

#### VLR restoration triggered by a location registration request

Upon receipt of a MAP\_UPDATE\_LOCATION\_AREA indication, the VLR retrieves authentication data from the HLR by using the MAP\_SEND\_AUTHENTICATION\_INFO service if authentication is required and if no authentication data are available in the VLR for the IMSI concerned (see figure 19.1.1/6).

Receipt of a MAP\_UPDATE\_LOCATION\_AREA indication for an MS whose IMSI is unknown in the VLR or whose data stored in the VLR are marked as "Not Confirmed" by the indicator "Confirmed by HLR" and/or by the indicator "Location Information Confirmed in HLR" forces the VLR to invoke the MAP\_UPDATE\_LOCATION service after successful authentication, if required. The location updating procedure is performed as described in clause 19.1.

Any other mobile originated request from an MS whose IMSI is unknown in the VLR or whose subscriber data stored in the VLR are marked as "Not Confirmed" by the indicator "Confirmed by HLR" shall be rejected with error cause "Unidentified Subscriber". This causes the MS to trigger the location registration procedure.

After successful completion of the MAP\_UPDATE\_LOCATION procedure, the indicators "Confirmed by HLR" and "Location Information Confirmed in HLR" are set to "Confirmed".

The indicator "Confirmed by Radio Contact" is set to "Confirmed" when the radio contact with the MS is authenticated.

### VLR restoration triggered by a roaming number request

Figure 19.3/1 illustrates the signalling sequence for restoration of an IMSI record in the VLR triggered by a mobile terminating call set up.

Upon receipt of a MAP\_PROVIDE\_ROAMING\_NUMBER indication for an IMSI that is unknown in the VLR and for which authentication is required, the VLR retrieves authentication data from the HLR by using the MAP\_SEND\_AUTHENTICATION\_INFO service after an MSRN has been sent to the HLR in the MAP\_PROVIDE\_ROAMING\_NUMBER response.

Receipt of a MAP\_PROVIDE\_ROAMING\_NUMBER indication for an MS whose IMSI is unknown in the VLR or whose data record in the VLR is marked as "Not Confirmed" by the indicator "Confirmed by HLR" forces the VLR to request subscriber data from the HLR by sending a MAP\_RESTORE\_DATA request which triggers one or more INSERT\_SUBSCRIBER\_DATA operations from the HLR. The MAP\_RESTORE\_DATA request may also be used to send the LMSI to the HLR.

The MAP\_RESTORE\_DATA process in the VLR is described in clause 21.2.4.

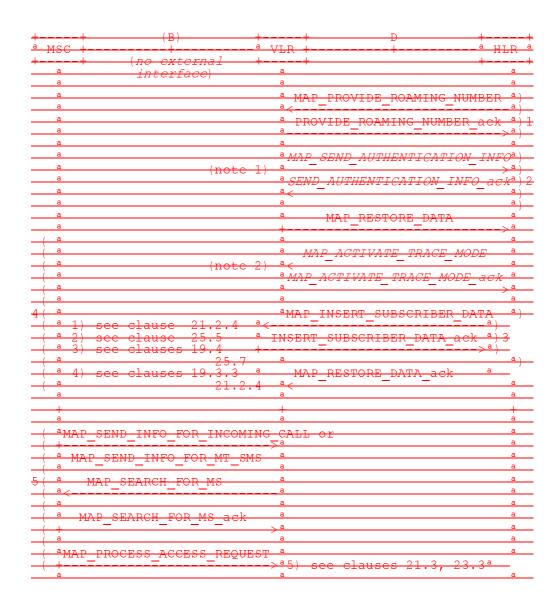
The MAP\_RESTORE\_DATA process in the HLR is described in clause 19.3.3.

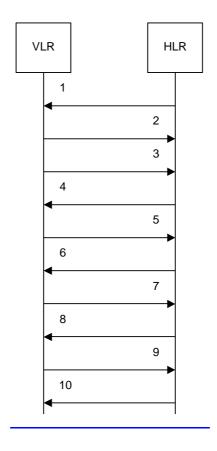
After successful completion of the MAP\_RESTORE\_DATA procedure, the indicator "Confirmed by HLR" is set to "Confirmed".

If restoration of an IMSI record was triggered by a MAP\_PROVIDE\_ROAMING\_NUMBER indication (i.e. by a mobile terminating call), the VLR has no valid Location Area Identity information for the MS concerned before successful establishment of the first authenticated radio contact. Upon receipt of a MAP\_SEND\_INFO\_FOR\_INCOMING\_CALL indication from the MSC (see 5 in figure 19.3/1) for an MS whose subscriber data are marked as "Confirmed" by the indicator "Confirmed by HLR" but not confirmed by radio contact, the VLR shall invoke a "MAP\_SEARCH\_FOR\_MS" instead of a "MAP\_PAGE".

A MAP\_SEARCH\_FOR\_MS shall also be performed if the VLR receives a MAP\_SEND\_INFO\_FOR\_MT\_SMS indication from the MSC for an MS whose IMSI record is marked as "Confirmed" by the indicator "Confirmed by HLR" but not confirmed by radio contact.

The indicator "Confirmed by Radio Contact" is set to "Confirmed" when authenticated radio contact caused by a mobile originated or a mobile terminated activity is established.





- 1) MAP PROVIDE ROAMING NUMBER req/ind
- MAP\_PROVIDE\_ROAMING\_NUMBER\_rsp/cnf
- 3) MAP SEND AUTHENTICATION INFO reg/ind (Note 1, note 2)
- 4) MAP\_SEND\_AUTHENTICATION\_INFO\_rsp/cnf (Note 1, note 2)
- 5) MAP RESTORE DATA req/ind
- 6) MAP\_ACTIVATE\_TRACE\_MODE\_req/ind (Note 1, note 3)
- 7) MAP ACTIVATE TRACE MODE rsp/cnf (Note 1, note 3)
- 8) MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind
- 9) MAP INSERT SUBSCRIBER DATA rsp/cnf 10) MAP\_RESTORE\_DATA\_rsp/cnf
- TO WITH \_TREGTOTRE\_BITTITE\_TOPICITE

NOTE 1: Services printed in *italics* are optional.

NOTE 2: If authentication is required.

NOTE 32: If subscriber tracing is active in the HLR.

Figure 19.3.1/1: Procedures related to Message flow for VLR restoration of VLR in case of at mobile terminated call set-up

## 19.3.1.2 Procedure in the VLR

The procedure in the VLR to handle a dialogue for subscriber data restoration is defined in subclause 21.2.6 of the present document.

# 19.3.<u>1.</u>3 VLR restoration: the restore data pProcedure in the HLR

The MAP process in the HLR to handle a request for data restoration in the VLR is shown in figure 19.3.1/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Check\_Indication see subclause 25.2.1;

Control\_Tracing\_With\_VLR\_HLR see subclause 25.9.6.

The MAP\_RESTORE\_DATA procedure in the HLR (Process RESTORE\_DATA\_HLR) is described in this clause; the corresponding procedure in the VLR (RESTORE\_DATA\_VLR) is described in clause 21.2.4.

The process RESTORE\_DATA\_HLR makes use of the following macros:



The MAP\_RESTORE\_DATA service is invoked by the VLR after provision of a roaming number in response to a MAP\_PROVIDE\_ROAMING\_NUMBER indication for an unidentified MS (i.e. IMSI unknown in VLR), or for a known MS whose IMSI record is marked as "Not Confirmed" by the indicator "Confirmed by HLR" (see 4 in figure 19.3/1). The process RESTORE\_DATA\_VLR is shown in figure 21.2/6.

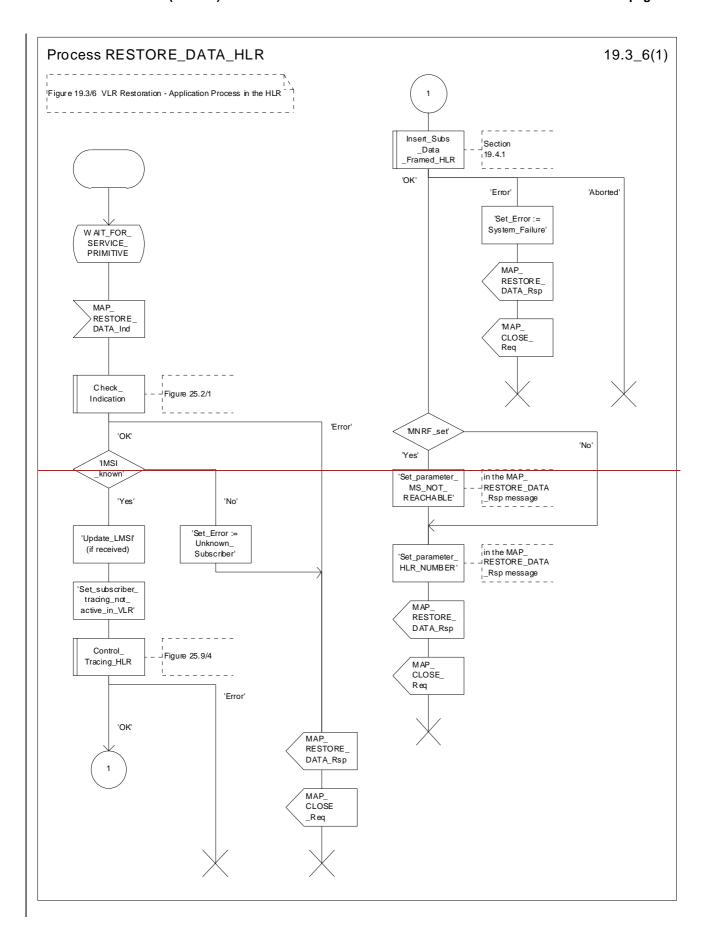
The restore data process in the HLR is activated by receipt of a MAP\_RESTORE\_DATA indication from the VLR (see figure 19.3/6). If there is a parameter problem in the indication, either of the errors "Unexpected Data Value" or "Data Missing" is returned in the MAP\_RESTORE\_DATA response; if the subscriber is not known in the HLR, the error "Unknown Subscriber" is returned in the MAP\_RESTORE\_DATA response. In all of these cases the process in the HLR terminates.

If the MAP\_RESTORE\_DATA indication is accepted and if the LMSI is received, the HLR updates the LMSI for the IMSI received in the MAP\_RESTORE\_DATA indication. For this IMSI the HLR sets "subscriber tracing not active in VLR" and checks whether tracing is required. This check is handled by the macro "Control\_Tracing\_HLR" that is described in clause 25.9. Thereafter, the macro "Insert\_Subs\_Data\_Framed\_HLR" that is described in clause 19.4 is invoked. The outcome of the macro Insert\_Subs\_Data\_Framed\_HLR is one of:

- abort, in which case the process terminates;
- error, in which case the HLR returns the error "System Failure" in the MAP\_RESTORE\_DATA response, and the process terminates;
- OK, indicating successful outcome of downloading the subscriber data to the VLR.

After successful completion of the framed MAP\_INSERT\_SUBSCRIBER\_DATA procedure, the HLR Number and, if applicable, the "MS Not Reachable Flag" which is used for SMS, are provided in the MAP\_RESTORE\_DATA response.

Upon receipt of the MAP\_RESTORE\_DATA confirmation, the VLR behaves as described in clause 21.2.4, figure 21.2/6.



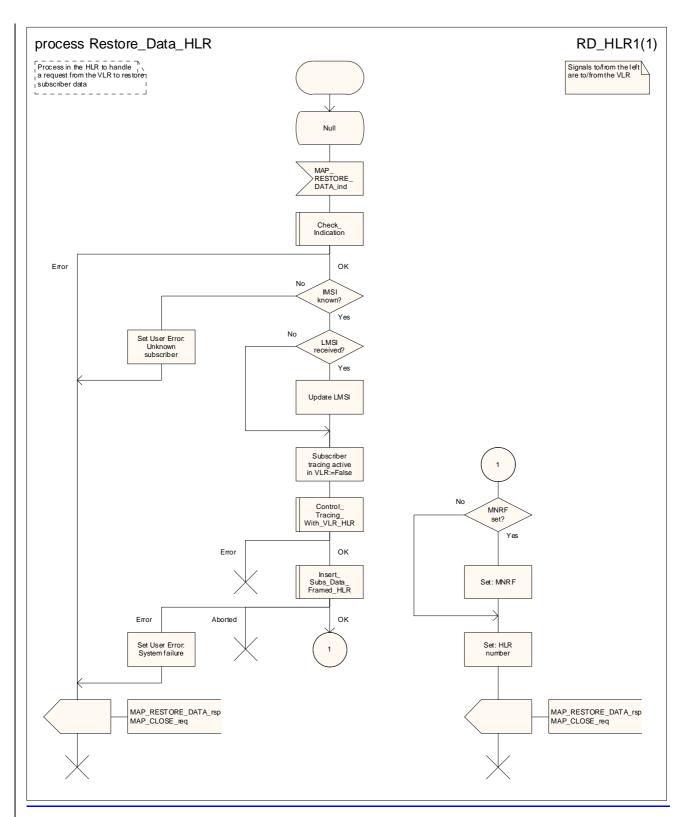


Figure 19.3.1/26: Process RESTORE\_DATARestore Data\_HLR

# 19.3.2 HLR fault recovery procedures

# 19.3.2.1 General

The following processes are involved with the restart of the HLR:

```
HLR_RESTART clause 19.3.2;

REC_RESET_IN_VLR clause 19.3.2;

REC_RESET_IN_SGSN clause 19.3.2.
```

In the case of a location registration request from the MS, the following processes are involved with the HLR restoration procedure:

```
    Update_Location_Area_VLR clause 19.1.1.3;
    Update_Location_HLR clause 19.1.1.4;
    Update_GPRS_Location_HLR clause 19.1.1.4;
    GPRS_Update_Location_Area_VLR clause 19.1.1.3;
    SGSN_Update_HLR clause 19.1.1.8.
```

In the case of a mobile originated service request, the

- Macro Process\_Access\_Request\_VLR clause 25.4.2; and the
- Process Update\_Location\_HLR clause 19.1.1.4,

are involved with the HLR restoration procedure.

For the HLR, periodic back-up of data to non-volatile memory is mandatory.

Data that have been changed in the period of time-after the last back-up storage and before the restart of the HLR cannot be recovered by reload from the non-volatile memory. Therefore, a restoration procedure is triggered individually for each IMSI record that has been affected by the HLR fault at the first authenticated radio contact that is established with the MS concerned.

The HLR restoration procedure forces updating of MSC number, VLR number, SGSN number and, if provided by the VLR, LMSI in the HLR. Consistency of subscriber data that are stored in the VLR or in the SGSN for an MS that has been affected by a HLR fault with the subscriber data stored in the HLR for this MS will be achieved.

As an implementation option, a notification can be forwarded to the MS to alert the subscriber to check the parameters for supplementary services that allow subscriber controlled input (MAP\_FORWARD\_CHECK\_SS\_INDICATION service). If the VLR receives this notification from the HLR it shall forward the notification to the MS. If the Gs-interface is <a href="mailto:present-implemented">present-implemented</a> the VLR shall not forward this notification.

The message flow for HLR restoration for a non-GPRS subscriber is shown in figure 19.3.2/1.

The message flow for HLR restoration for a GPRS subscriber is shown in figure 19.3.2/2.

Figures 19.3/2 and 19.3/9 illustrates the signalling sequence for HLR restoration.

After a restart, the home location register performs the following actions for the subscriber data records that have been affected by the HLR fault (see figure 19.3/3):

- reload all data from the non-volatile back-up;
- if the MAP\_FORWARD\_CHECK\_SS\_INDICATION service is implemented, mark each subscriber record "SS Check Required" by setting the "Check SS" indicator;
- set subscriber tracing deactive in the VLR for each of its Mss;
- reset the "MS Purged" flag for each of its MSs;

- send a MAP\_RESET request to the VLRs where its MSs are located (see figure 19.3/4).
- send a MAP RESET request to the SGSNs where its MSs are located (see figure 19.3/7).

The MAP RESET request contains the HLR number and optionally the HLR Identity List.

When receiving a MAP\_RESET indication, the VLR or the SGSN will derive all involved MSs of that HLR either from the HLR Identity List (if present), or from the HLR number. The VLR or the SGSN will then mark these MSs with the indicator "Location Information Confirmed in HLR" set to "Not Confirmed" and will deactivate all subscriber tracings for these Mss (see figures 19.3/5 and 19.3/8).

The status "Not Confirmed" of the indicator "Location Information Confirmed in HLR" forces the VLR to invoke the MAP\_UPDATE\_LOCATION service after establishment of authenticated radio contact with the MS concerned.

Also the status "Not Confirmed" of the indicator "Location Information Confirmed in HLR" forces the SGSN to invoke the MAP\_UPDATE\_GPRS\_LOCATION service after establishment of authenticated radio contact with the MS concerned.

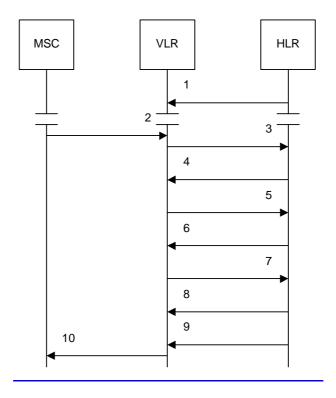
The MAP\_UPDATE\_LOCATION procedure is performed as described in clause 19.1.

After receipt of the MAP\_UPDATE\_LOCATION or the MAP\_UPDATE\_GPRS\_LOCATION acknowledgement containing the HLR number, the status of the indicator "Location Information Confirmed in HLR" is changed to "Confirmed".

If the MAP\_UPDATE\_LOCATION procedure is unsuccessful for any reason, the status of the indicator "Location Information Confirmed in HLR" remains unchanged except for the case that the IMSI record in the VLR is deleted because either of the errors "Unknown Subscriber" or "Roaming Not Allowed" has been received from the HLR in response to a MAP\_UPDATE\_LOCATION request.

If the MAP\_UPDATE\_GPRS\_LOCATION procedure is unsuccessful for any reason, the status of the indicator "Location Information Confirmed in HLR" remains unchanged except for the case that the IMSI record in the SGSN is deleted because either of the errors "Unknown Subscriber" or "Roaming Not Allowed" has been received from the HLR in response to a MAP\_UPDATE\_GPRS\_LOCATION request.

	- D +		-+ (B)	+
HLR	a	VLR	<del></del>	a MSC
a	MAP RESET	a	-+ (no external	a
+		_ <u>&gt;</u> a	interrace)	a
a		a		a
a		aa 1	MAP UPDATE LOCATION AR	<u>д∧ а</u>
a		aa (		a
a		a a M	AP PROCESS ACCESS REOUI	zgm a
a	MAP UPDATE LOCATION	a a <		a a
a <	<u> </u>	a a		a
а му	AP ACTIVATE TRACE MODE	a	)	a
a		<u> → a</u>	<del>) If subscriber tracin</del>	g <u>a</u>
<u>a</u> 2	<del>ACTIVATE TRACE MODE ack</del>	<u>a</u>	<del>) is active in HLR.</del>	a a
_ a <		a		a
<u>a</u> M	AP INSERT SUBSCR DATA	a	•	a
+		<u> </u>		a
a I	NSERT SUBSCR DATA ack	a		a
a <		a		a
<u>а М</u> Л	P UPDATE LOCATION ack	a	MAP FORWARD CHECK SS	a
<del>&gt;+</del>		<del>-&gt;+-</del>		- <u>a</u>
a and	<del>l map forward check ss</del>	a a	- INDICATION	a
a	<del>- INDICATION (optional</del>	<del>7 a</del>	<del>(if received from HL</del>	<del>R) a</del>

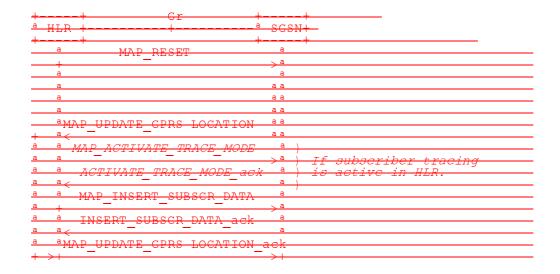


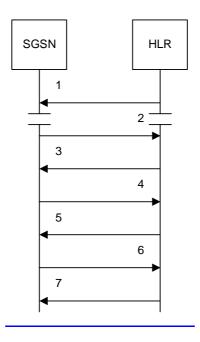
- MAP\_RESET\_reg/ind
- MAP PROCESS ACCESS REQUEST reg/ind
- MAP UPDATE LOCATION reg/ind 3)
- 4) MAP\_ACTIVATE\_TRACE\_MODE\_reg/ind (Note 1, Note 2)
- 5) MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 1, Note 2)
- MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind 6)
- MAP INSERT SUBSCRIBER DATA rsp/cnf MAP\_UPDATE\_LOCATION\_rsp/cnf 7)
- 8)
- MAP\_FORWARD\_CHECK\_SS\_INDICATION\_req/ind (Note 1) 9)
- MAP\_FORWARD\_CHECK\_SS\_INDICATION\_reg/ind (Note 1) 10)

NOTE 1: Services printed in italics are optional. NOTE 2: If subscriber tracing is active in the HLR.

### Figure 19.3.2/1: Message flow for HLR restoration (non-GPRS)

Figure 19.3/2: Procedures related to restoration of HLR





- MAP RESET reg/ind
- MAP UPDATE GPRS LOCATION reg/ind
- 3) MAP\_ACTIVATE\_TRACE\_MODE\_reg/ind (Note 1, Note 2)
- MAP\_ACTIVATE\_TRACE\_MODE\_rsp/cnf (Note 1, Note 2) 4)
- 5) MAP\_INSERT\_SUBSCRIBER\_DATA\_req/ind
- MAP INSERT SUBSCRIBER DATA rsp/cnf MAP\_UPDATE\_GPRS\_LOCATION\_rsp/cnf
- 7)

NOTE 1: Services printed in italics are optional. NOTE 2: If subscriber tracing is active in the HLR.

Figure 19.3.2/2: Message flow for HLR restoration (GPRS)

Figure 19.3/9: Procedures related to restoration of HLR for GPRS

#### 19.3.2.2 Procedure in the HLR

The MAP process in the HLR to notify the relevant serving nodes that the HLR has restarted is shown in figure 19.3.2/3.

The SGSN address list includes one instance of the address of each SGSN in which (according to the HLR data retrieved from the non-volatile memory) there is at least one subscriber registered who is affected by the HLR restart.

The VLR address list includes one instance of the address of each VLR in which (according to the HLR data retrieved from the non-volatile memory) there is at least one subscriber registered who is affected by the HLR restart.

The MAP process in the HLR to notify a VLR that the HLR has restarted is shown in figure 19.3.2/4. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Cnf see subclause 25.1.2.

The MAP process in the HLR to notify an SGSN that the HLR has restarted is shown in figure 19.3.2/5. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Cnf see subclause 25.1.2.

#### Procedure in the VLR 19.3.2.3

The MAP process in the VLR to handle a notification that an HLR has restarted is shown in figure 19.3.2/6. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive Open Ind see subclause 25.1.1.

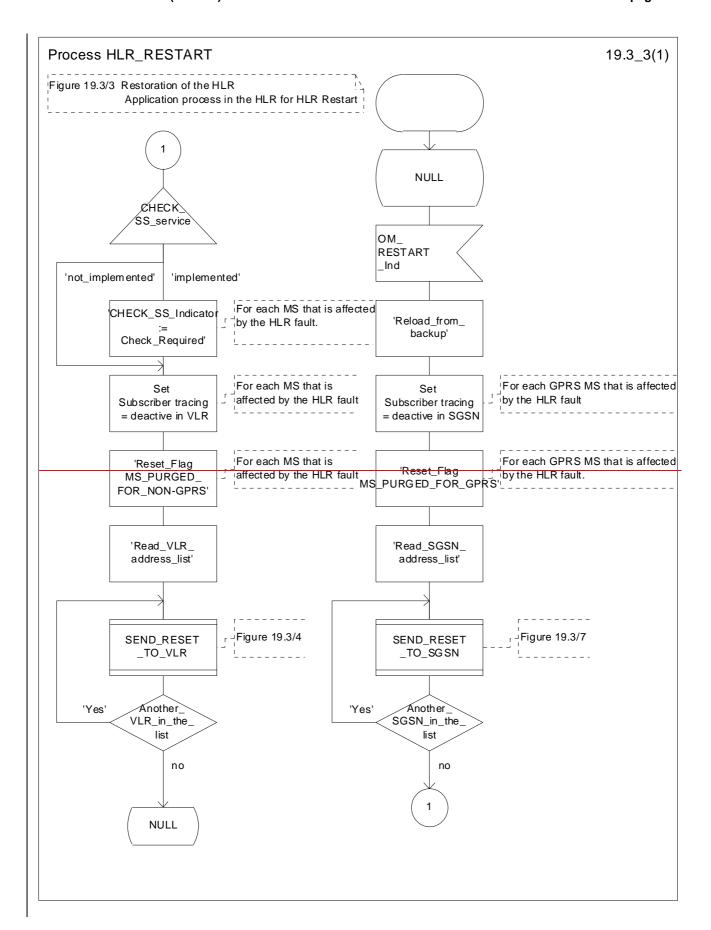
The VLR uses the HLR number or the HLR identity list included in the MAP\_RESET indication to identify the IMSI records which are affected by the HLR restart.

## 19.3.2.4 Procedure in the SGSN

The MAP process in the SGSN to handle a notification that an HLR has restarted is shown in figure 19.3.2/6. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1.

The SGSN uses the HLR number or the HLR identity list included in the MAP\_RESET indication to identify the IMSI records which are affected by the HLR restart.



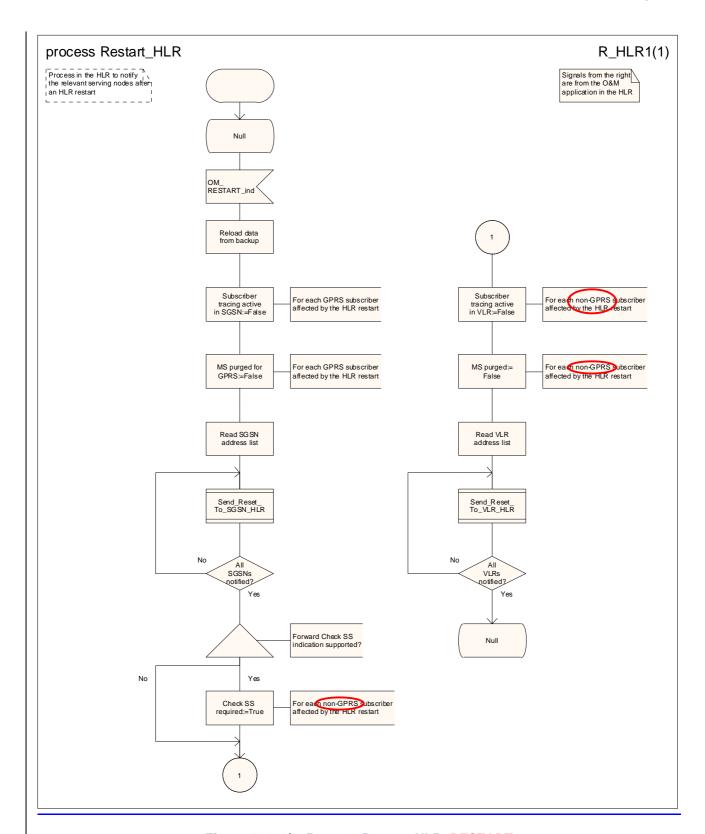
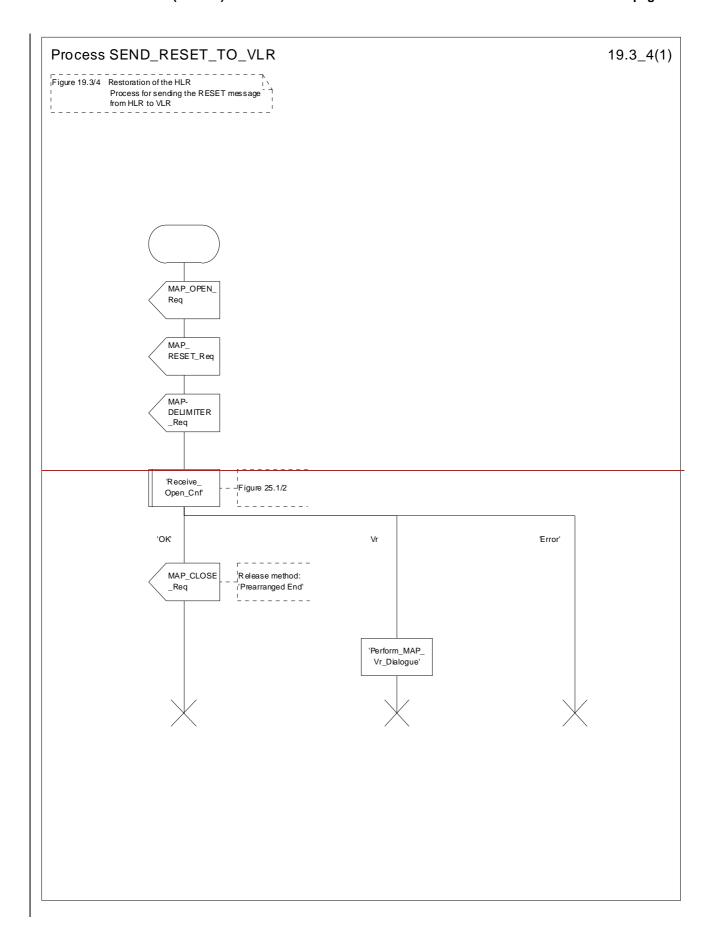


Figure 19.3.2/3: Process Restart\_HLR\_RESTART



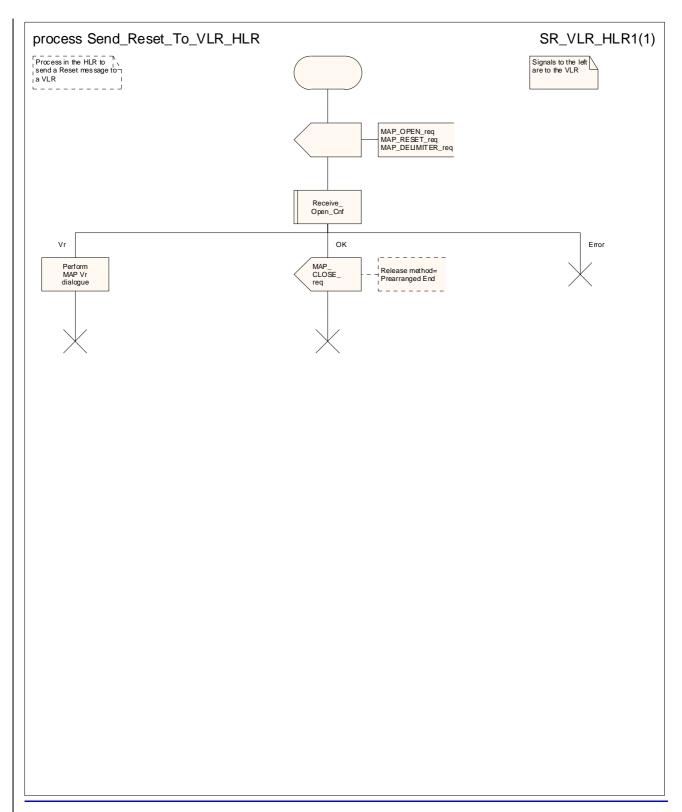
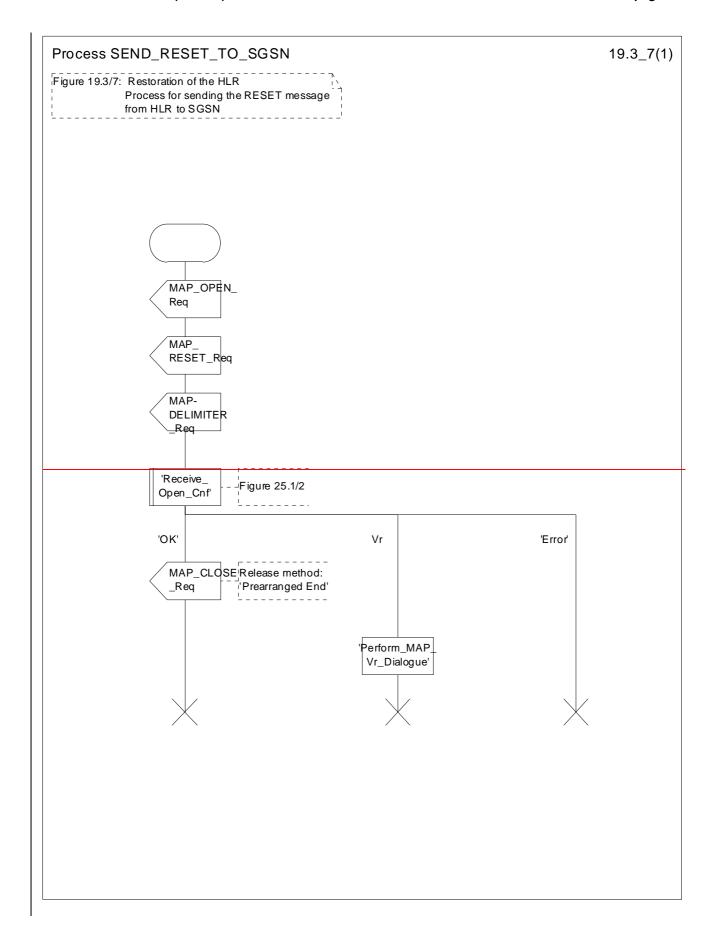


Figure 19.3.2/4: Process SEND\_RESET\_TOSend Reset To\_VLR\_HLR



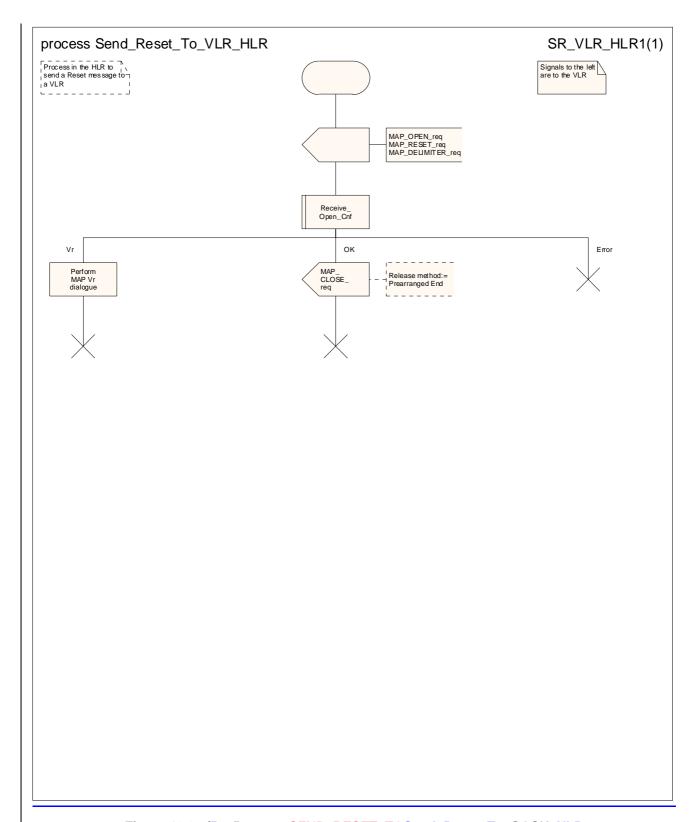
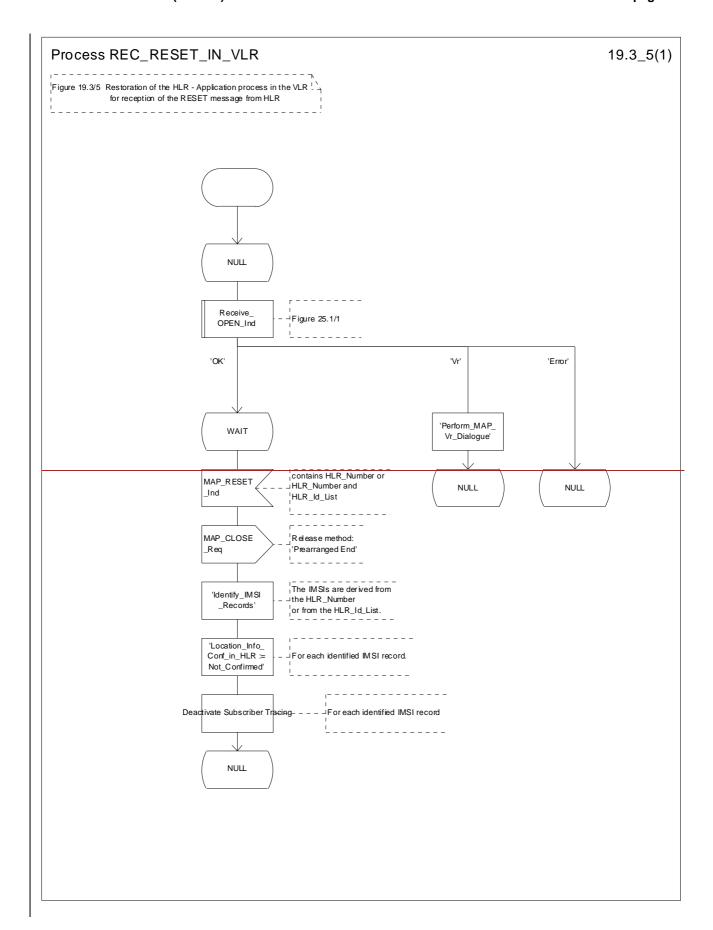


Figure 19.3.2/57: Process SEND\_RESET\_TOSend Reset To\_SGSN\_HLR



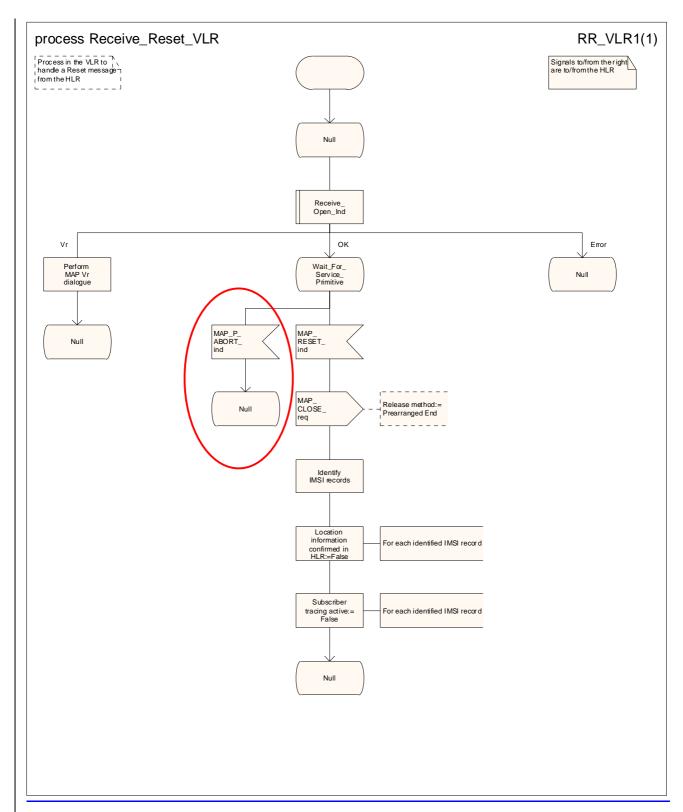
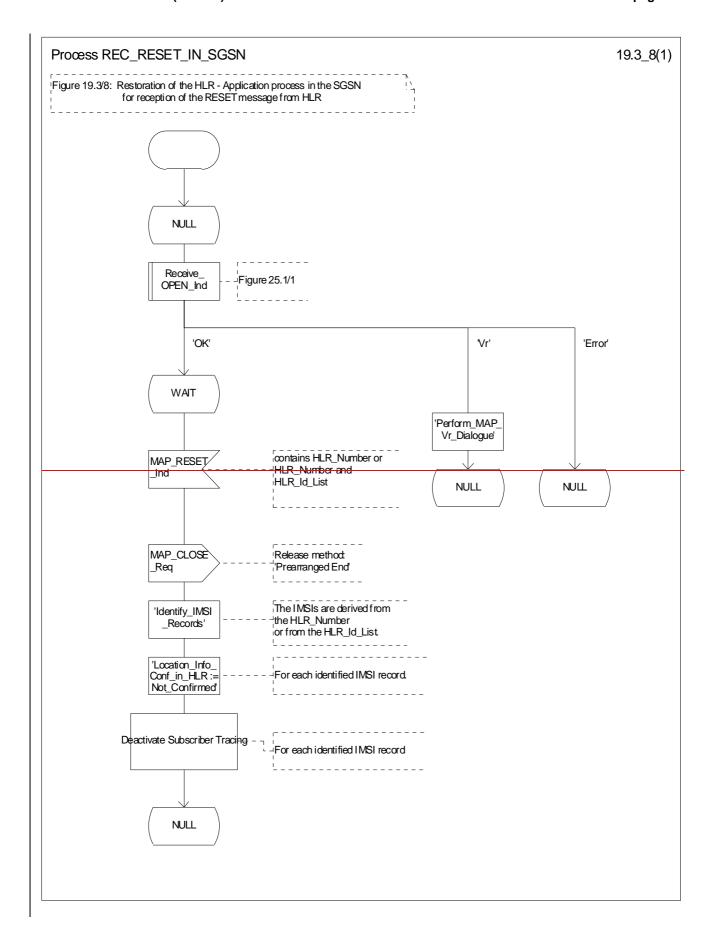


Figure 19.3.2/65: Process REC\_RESET\_INReceive Reset\_VLR



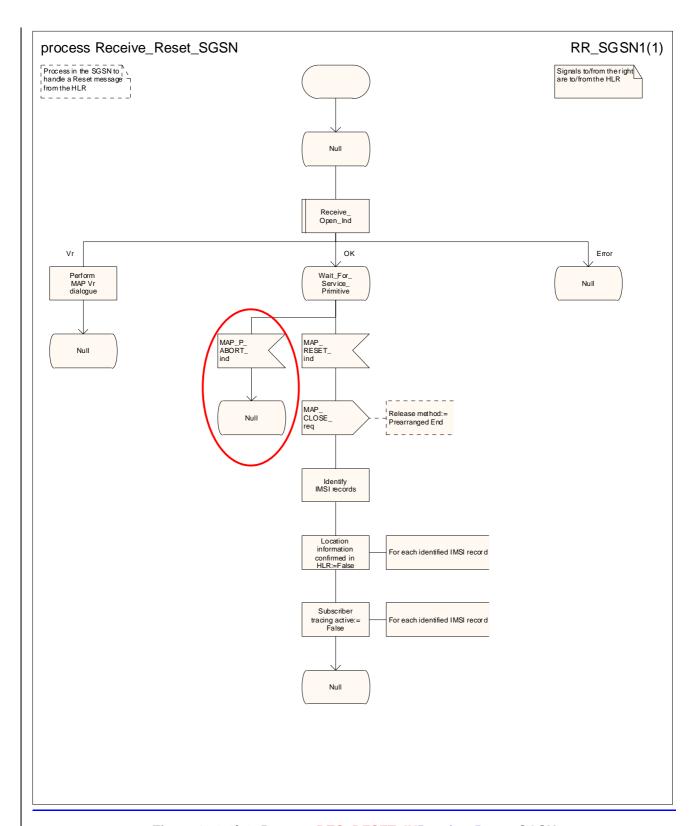


Figure 19.3.2/78: Process REC\_RESET\_INReceive Reset\_SGSN

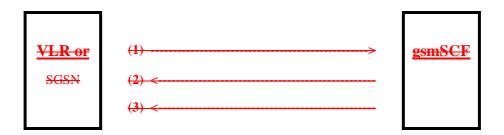
# 19.45 Mobility Management Eevent notification procedure

#### 19.45.1 General

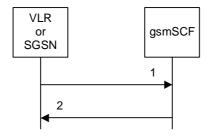
The Mobility Management Event Notification event notification procedure VLR process (MMEN\_VLR) is used to notify a gsmSCF about the successful completion of a Mobility Management event.

The message flow for Mobility Management event notification is shown in figure 19.4/1.

Figure 19.5/1. depicts the MAP signalling used for the event notification.



- (1) Report Mobility Management Event (VLR or SGSN to gsmSCF).
- (2) Report Mobility Management Event Result (gsmSCF to VLR or SGSN).
- (3) Report Mobility Management Event Error (gsmSCF to VLR or SGSN).



- 1) MAP\_REPORT\_MM\_EVENT\_req/ind
- 2) MAP REPORT MM EVENT rsp/cnf

Figure 19.45/1: Interfaces and MAP Messages flow for Mobility Management Event notifications

### 19.45.2 Proceduress in the VLR/or SGSN

The MAP process in the VLR or the SGSN to report a Mobility Management event to the gsmSCF is shown in figure 19.4/2. The MAP process invokes macros not defined in this clause; the definitions of these macros can be found as follows:

Receive\_Open\_Cnf see subclause 25.1.2;
Check Confirmation: see subclause 25.2.2.

The Mobility Management event notification procedure in the VLR/SGSN is triggered when the following conditions are fulfilled:

- 1. the VLR/SGSN has successfully completed a Mobility Management event;
- 2. the subscriber has a subscription to Mobility Management event notifications;
- 3. the Mobility Management event is marked for reporting.

The VLR/SGSN notifies the gsmSCF of a mobility management event with the ReportMMEvent MAP message. This message is sent in a TCAP TC BEGIN primitive. The VLR/SGSN then awaits a positive result (RESULT) or a negative result (ERROR). This is received in a TCAP TC END primitive. The Basic End procedure is used.

When the VLR/SGSN has received the RESULT or ERROR, the relationship between the VLR/SGSN and the gsmSCF is terminated. The relationship, if existing, is also terminated when the VLR/SGSN sends a TCAP P-ABORT primitive to the calling procedure or when the VLR/SGSN receives a TCAP P ABORT or a TCAP U ABORT primitive from the gsmSCF.

The sending process shall indicate to the MMEN\_VLR process, which Mobility Management event shall be reported to the gsmSCF.

The MMEN VLR process is illustrated in figure 19.5/2.

### 19.45.3 Proceduress in the gsmSCF

The MAP process in the gsmSCF to handle the report of a Mobility Management event is shown in figure 19.4/3. The MAP process invokes a macro not defined in this clause; the definition of this macro can be found as follows:

Receive\_Open\_Ind see subclause 25.1.1;

When the gsmSCF receives the ReportMMEvent MAP Message (in a TCAP TC-BEGIN primitive), the MM\_Event\_Notification\_gsmSCF' (MMEN\_SCF) process is started.

If the gsmSCF has validated the information it has received in the ReportMMEvent MAP Message, then it informs the Service Logic in the SCP and awaits a response.

If a positive response is received from the Service Logic, then a REPORT\_MM\_EVENT\_RESULT is sent to the VLR/SGSN.

If a negative response is received from the Service Logic, then a REPORT\_MM\_EVENT\_ERROR is sent to the VLR/SGSN.

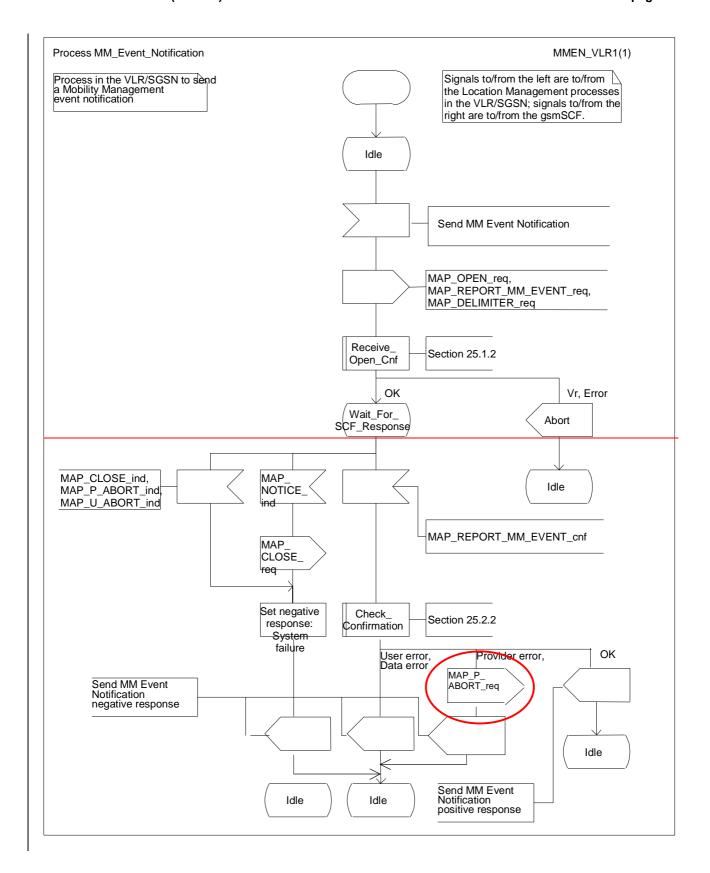
Both RESULT and ERROR are sent in a TCAP TC END primitive. The Basic End procedure is used.

If the Service Logic returns a User Error, then a MAP U ABORT primitive is sent to the VLR/SGSN.

The gsmSCF TCAP service may choose to abort the relationship with the VLR/SGSN by sending a TCAP P ABORT primitive to the VLR/SGSN.

When the gsmSCF receives a TCAP P-ABORT primitive from the VLR/SGSN, it shall immediately terminate the mobility management process.

This is illustrated in figure 19.5/3.



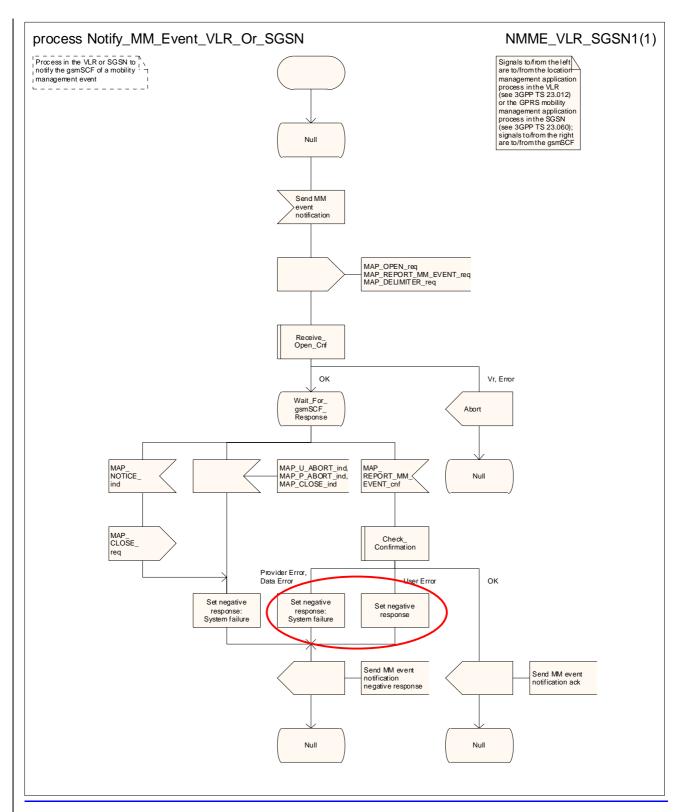
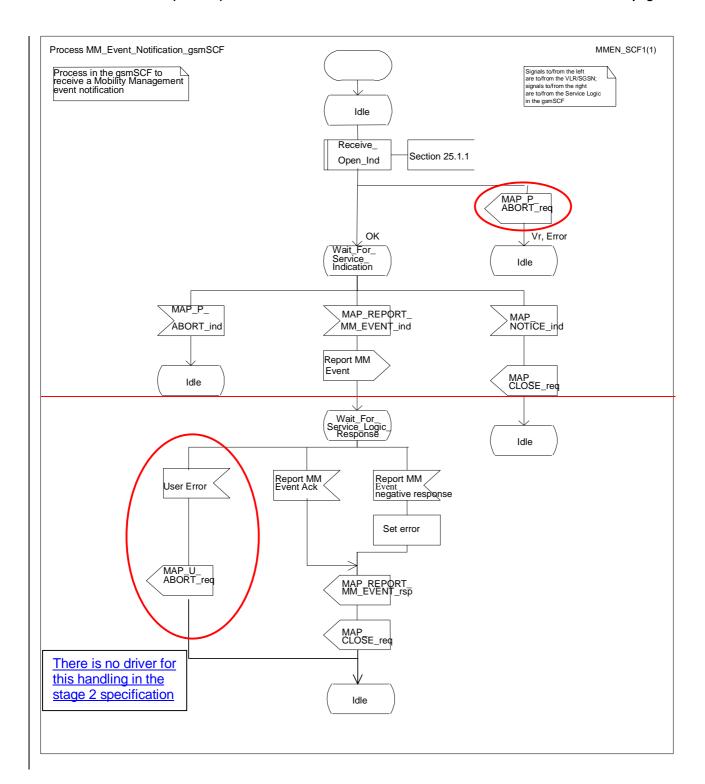


Figure 19.45/2: Process Notify MM\_Event\_Notification\_VLR\_Or SGSN (sheet 1 of 1)



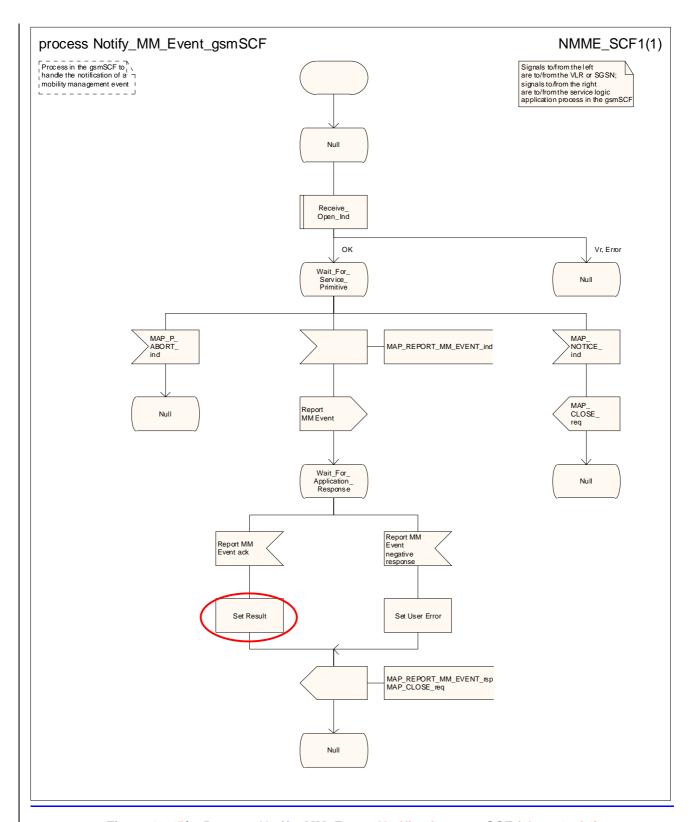


Figure 19.45/3: Process Notify MM\_Event\_Notification\_gsmSCF (sheet 1 of 1)

# 19.<u>5</u>4 <u>Macro Insert\_Subs\_Data\_Framed\_</u>HLR<u>Insert Subscriber</u> Data macros

#### 19.5.1 Macro Insert Subs Data Framed HLR

This macro is used to transfer subscriber data to the VLR as part of an existing dialogue for location updating or data restoration. The macro invokes a macro and a process not defined in this clause; the definitions of the macro and the process can be found as follows:

Wait\_For\_Insert\_Subs\_Data\_Cnf see subclause 25.7.5;

Send\_Insert\_Subs\_Data\_HLR: see subclause 25.7.7.

The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

If the VLR has indicated that it does not support a service or feature (e.g. Closed User Group or Advice Of Charge Charging Level) which the HLR operator regards as essential for the subscriber, the macro Wait for Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restriction Due To Unsupported Feature flag to roaming restricted and sends Roaming Restriction Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

If subscriber data for CAMEL Phase 2 or later services are sent to a VLR which does not support the appropriate phase of CAMEL, the service behaviour may be unpredictable or incorrect. The HLR should therefore ensure that at the conclusion of a stand alone Insert Subscriber data procedure the data in the VLR do not require a capability that the VLR does not have. Possible mechanisms to ensure this are described in 3GPP TS 23.078 [98].

The HLR should send a Forwarded-to number which is not in E.164 international format to the VLR only when the HLR has ascertained that the VLR supports CAMEL Phase 2 or later. Thus, the ISD message containing the Forwarded-to number which is not in E.164 international format shall be sent to the VLR only if the HLR previously received confirmation from the VLR at Location Update that CAMEL Phase 2 or later is supported.

This macro is used by any procedure invoked in HLR which requires the transfer of subscriber data by means of the InsertSubscriberData operation (e.g. Update Location or Restore Data).

The invocation of the operation is done in a dialogue already opened by the framing procedure. Therefore the latter is the one that handles the reception of the open indication and sends the dialogue close request.

The macro calls the process "Send\_Insert\_Subs\_Data" (see clause 25.7.7) as many times as it is needed for transferring all subscriber data. This process call is meant to describe two possible behaviours of HLR to handle service requests and confirmations:

- either the HLR handles requests and confirmations in parallel; or
- the HLR sends the next request only after receiving the confirmation to the previous one.

Another call is done to the macro "Wait\_for\_Insert\_Subs\_Data\_Cnf" (see clause 25.7.5). There the reception and handling of the service confirmations is described.

If certain services required for a subscriber are not supported by the VLR or by the SGSN (e.g. Advice of Charge Charging Level), this may result in one of the following outcomes:

The HLR stores and sends "Roaming Restriction Due To Unsupported Feature" in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA service. If "Roaming Restriction Due To Unsupported Feature" is stored in the HLR, the "MSC Area Restricted Flag" shall be set to "restricted". This will prevent MT calls, MT SM and MT USSD from being forwarded to the MSC/VLR;

- The HLR stores and sends other induced subscriber data (e.g. a specific barring program) in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA service. This will cause rejection of mobile originated service requests, except emergency calls.
- The HLR stores and sends "Roaming Restricted in the SGSN Due To Unsupported Feature" in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA service. If "Roaming Restricted In SGSN Due To Unsupported Feature" is stored in the HLR, the "SGSN Area Restricted Flag" shall be set to "restricted". This will prevent MT SM from being forwarded to the SGSN and Network Requested PDP-Context Activation;

When the VLR receives regional subscription data (Zone Code List) it may respond with "MSC Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response. In this case the "MSC Area Restricted Flag" shall be set to "restricted" in the HLR. This will prevent MT calls, MT SM and MT USSD from being forwarded to the MSC/VLR.

If the HLR neither stores "Roaming Restriction Due To Unsupported Feature" nor receives "MSC Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response, the "MSC Area Restricted Flag" in the HLR shall be set to "not restricted".

If subscriber data for CAMEL Phase 2 or 3 services are sent to a VLR which does not support CAMEL Phase 2 or 3, the service behaviour may be unpredictable or incorrect. The HLR therefore needs to ensure that at the conclusion of a location updating dialogue the data in the VLR do not require a capability that the VLR does not have. Possible mechanisms to ensure this are described in 3GPP TS 23.078.

The HLR should send a Forwarded to number which is not in E.164 international format to the VLR only when the HLR has ascertained that the VLR supports CAMEL Phase 2 or higher. Thus, the ISD message containing the Forwarded to number which is not in E.164 international format shall be sent to the VLR only after the HLR receives confirmation in the first ISD message result that CAMEL Phase 2 or higher is supported.

A Forwarded to number non-international E.164 format shall only be sent from an HLR to a VLR if the VLR supports CAMEL Phase 2, or a subsequent phase of CAMEL.

When the SGSN receives regional subscription data (Zone Code List) it may respond with "SGSN Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response. In this case the "SGSN Area Restricted Flag" shall be set to "restricted" in the HLR. This will prevent MT SM from being forwarded to the SGSN and Network Requested PDP Context Activation.

If the HLR neither stores "Roaming Restricted In SGSN Due To Unsupported Feature" nor receives "SGSN Area Restricted" in the MAP\_INSERT\_SUBSCRIBER\_DATA response, the "SGSN Area Restricted Flag" in the HLR shall be set to "not restricted".

The SDL diagrams are shown in figures 19.4/1 and 19.4/2.

### 19.5.1 Macro Insert\_GPRS\_Subs\_Data\_Framed\_HLR

This macro is used to transfer subscriber data to the SGSN as part of an existing dialogue for location updating. The macro invokes a macro and a process not defined in this clause; the definitions of the macro and the process can be found as follows:

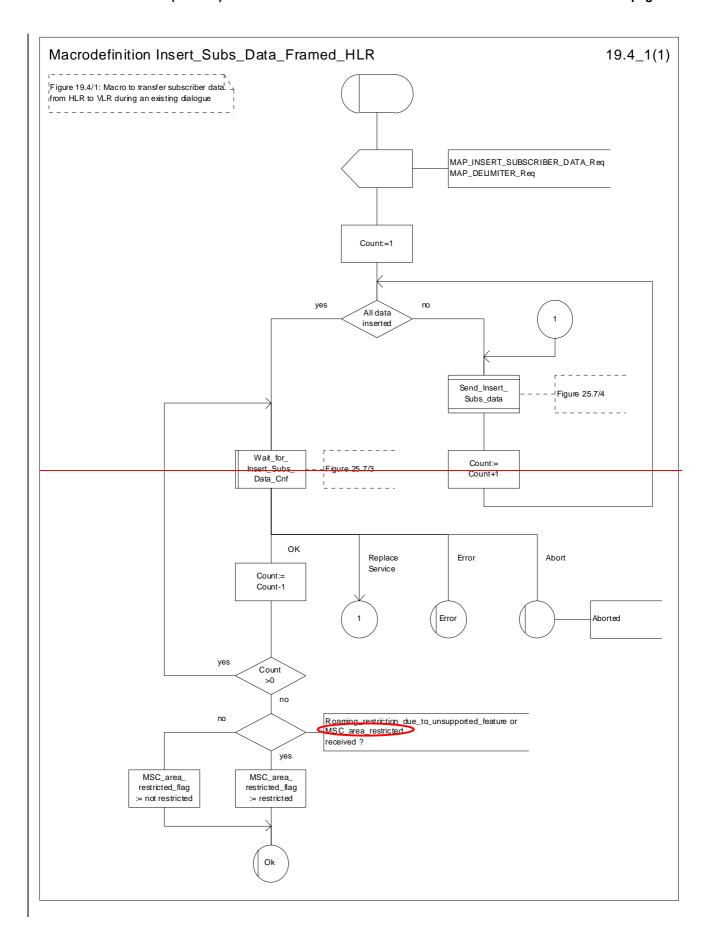
Wait\_For\_Insert\_GPRS\_Subs\_Data\_Cnf\_see subclause 25.7.5;

Send Insert Subs Data HLR: see subclause 25.7.7.

The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

If the SGSN has indicated that it does not support a service or feature which the HLR operator regards as essential for the subscriber, the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restricted In SGSN Due To Unsupported Feature flag to roaming restricted and sends Roaming Restricted In SGSN Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.



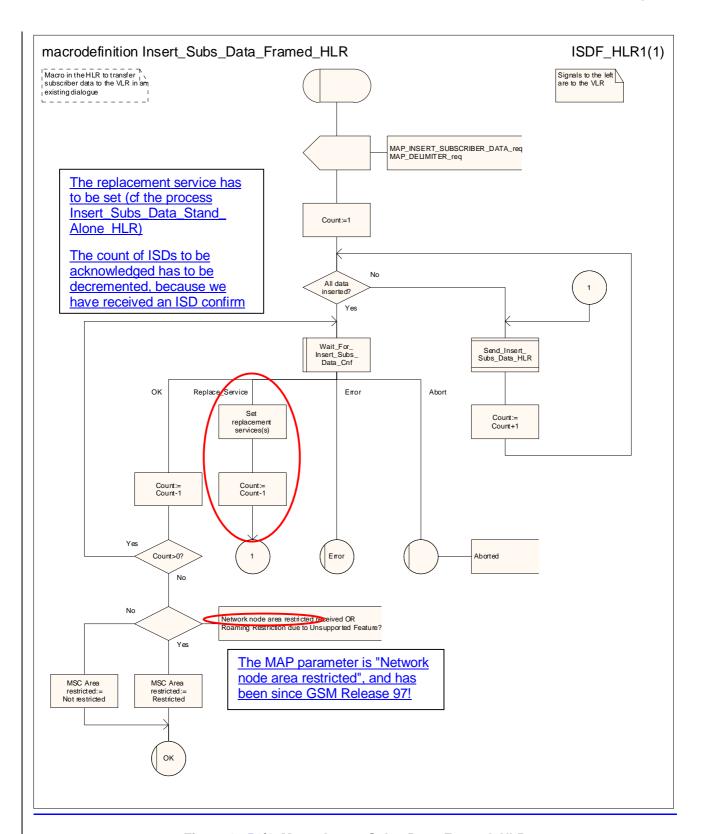
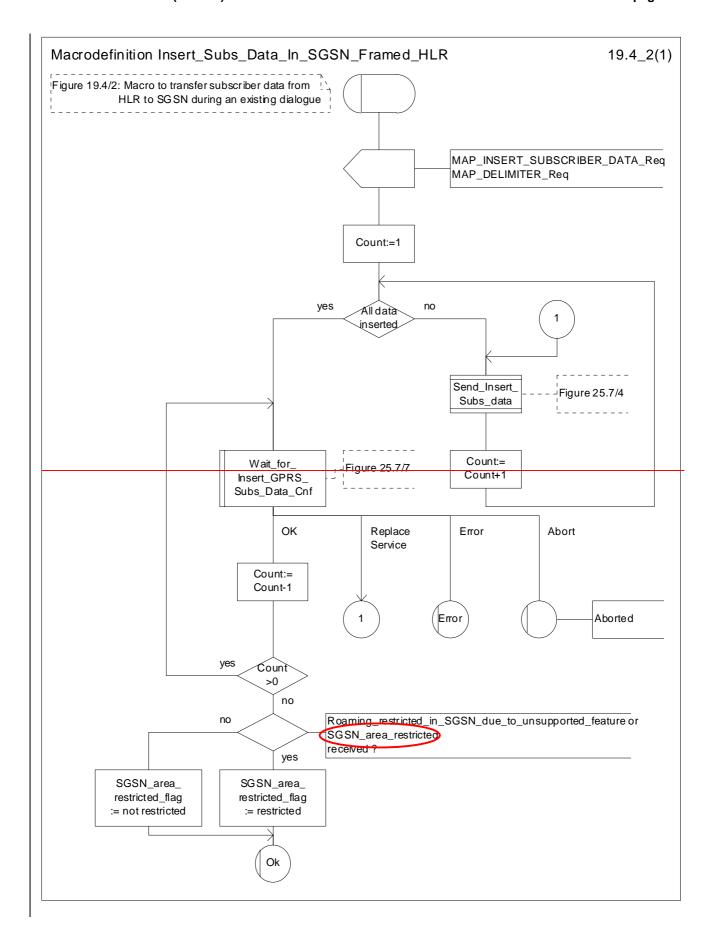


Figure 19.54/1: Macro Insert\_Subs\_Data\_Framed\_HLR



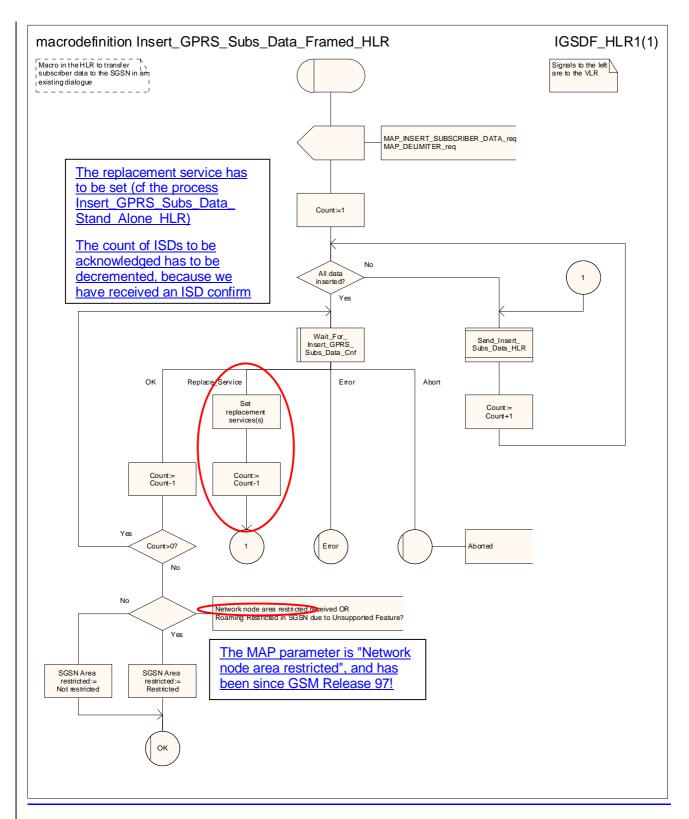


Figure 19.<u>54</u>/2: Macro Insert\_<u>GPRS\_</u>Subs\_Data\_<u>In\_SGSN\_</u>Framed\_HLR

# \*\*\* Next modified section \*\*\*

# 25.4 Macros for handling an Access Request

These macros are invoked when an MS accesses the network, e.g. to submit an MO short message or when responding to paging. The macros handle identification and authentication of the mobile subscriber as well as invocation of security related features (see 3GPP TS 42.009 [6]).

#### 25.4.1 Macro Process\_Access\_Request\_MSC

Sheet 1: The MAP\_PROCESS\_ACCESS\_REQUEST request includes the following parameters:

- the received subscriber identification (IMSI, TMSI);
- the CM service type, indicating the type of request;
- the status of the access connection, i.e. whether a connection to this MS already exists and if so, whether it is already authenticated and ciphered;
- the current location area id of the MS; and
- the CKSN received from the MS.

Sheet 2, sheet 3: If the MSC receives an A\_SETUP indication while it is waiting for further instructions from the VLR or for the acknowledgment of TMSI reallocation from the MS, the MSC saves the setup request for processing after control has returned from the macro Process\_Access\_Request\_MSC to the calling process.

Sheet 3: When the MSC is waiting for a possible instruction to allocate a new TMSI, a MAP\_DELIMITER indication indicates that TMSI reallocation is not required.

Sheet 3: If the MS sends a TMSI reallocation failure in response to the TMSI reallocation command, the MSC takes the OK exit; the VLR treats the lack of response as a provider error (see macro Process\_Access\_Request\_VLR).

# 25.4.2 Macro Process\_Access\_Request\_VLR

Sheet 3: If the MSC does not send a positive response to the MAP\_FORWARD\_NEW\_TMSI request, this is treated as a MAP\_FORWARD\_NEW\_TMSI confirmation containing a provider error. The Macro takes the Error exit. If TMSI reallocation does not succeed, the old TMSI is frozen, to prevent it from being reallocated. In this case, both old and new TMSIs are regarded as valid.

## 25.4.3 Macro Obtain\_Identity

This macro is invoked by the macro Process\_Access\_Request\_VLR if the subscriber's identity is not known in the VLR.

It is an operator option to allow or prevent retrieval of the IMSI without encryption.

# 19.1.1.625.4.4 Process Update Location VLR

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

The procedure Notify\_gsmSCF is specified in 3GPP TS 23.078.

- If updating is successful (OK), the HLR Number is received in the MAP\_UPDATE\_LOCATION confirm primitive; the register will be updated and the SCP will be informed about the Mobility Management event. The process then terminates:
  - In the above case, the notification sent to the gsmSCF shall be 'Location Update to new VLR Service Area'.
- 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 the 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 1: This process will be performed independent from the calling process, no coordination is required.

NOTE 2: The procedure Notify\_gsmSCF is specified in 3GPP TS 23.078.

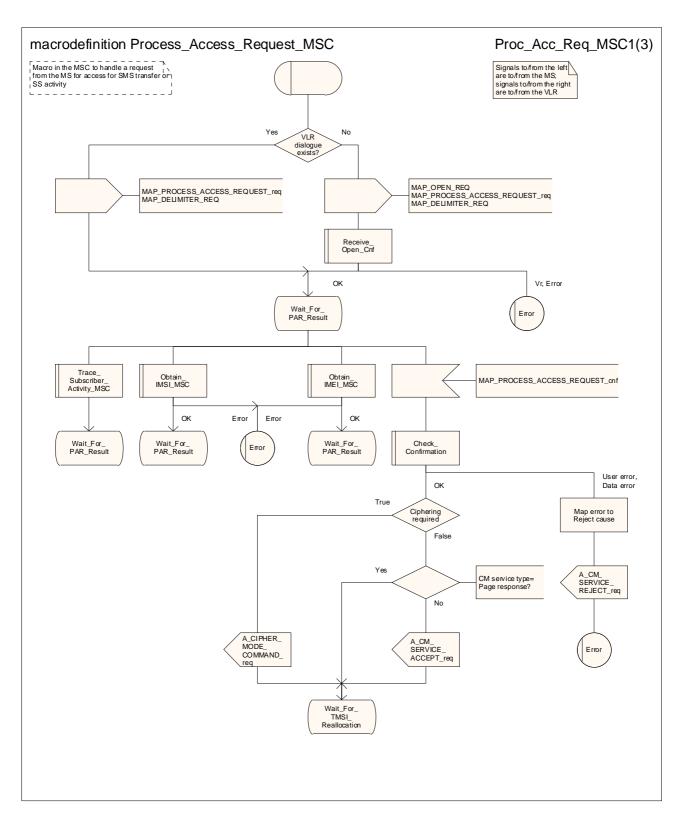


Figure 25.4/1 (sheet 1 of 3): Macro Process\_Access\_Request\_MSC

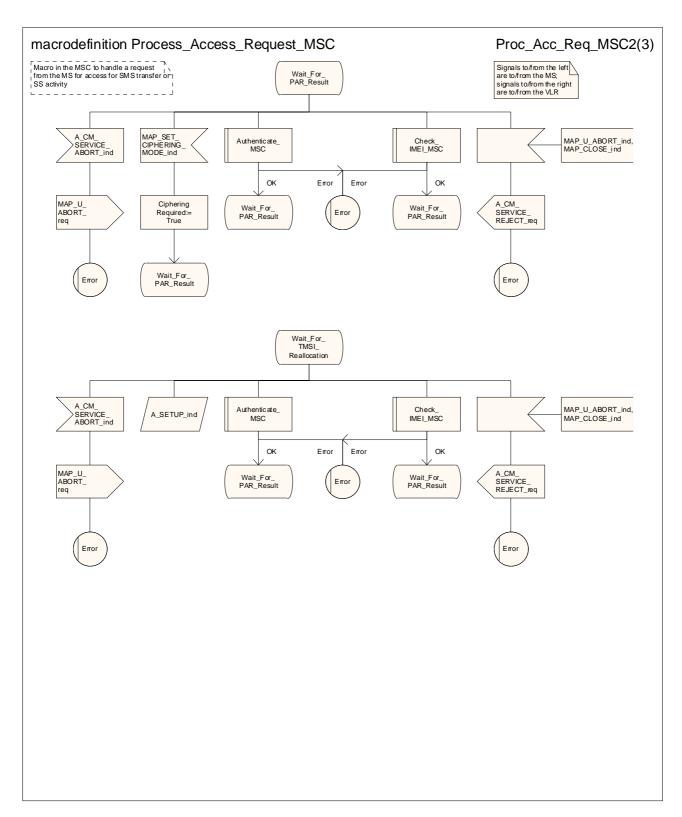


Figure 25.4/1 (sheet 2 of 3): Macro Process\_Access\_Request\_MSC

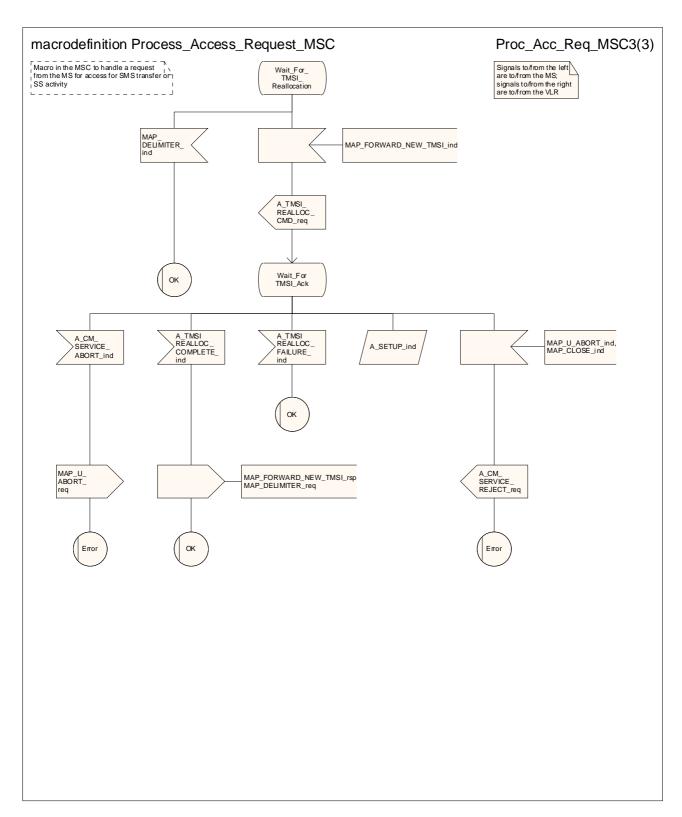


Figure 25.4/1 (sheet 3 of 3): Macro Process\_Access\_Request\_MSC

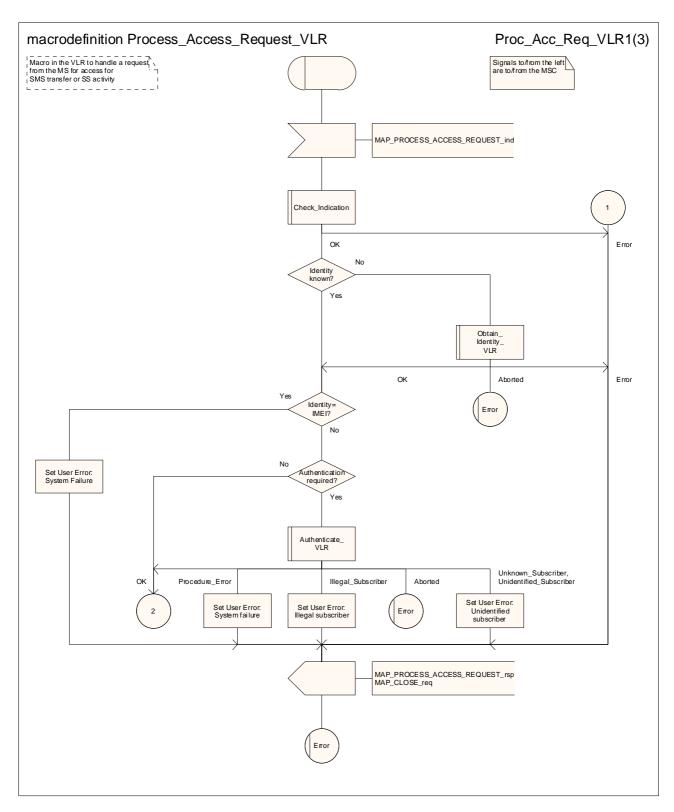
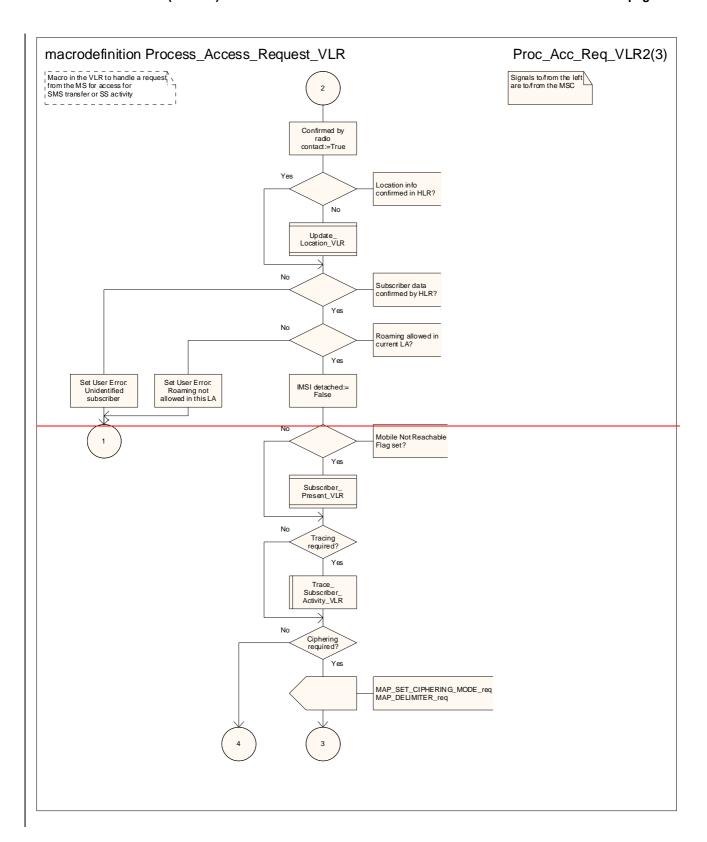


Figure 25.4/2 (sheet 1 of 3): Macro Process\_Access\_Request\_VLR



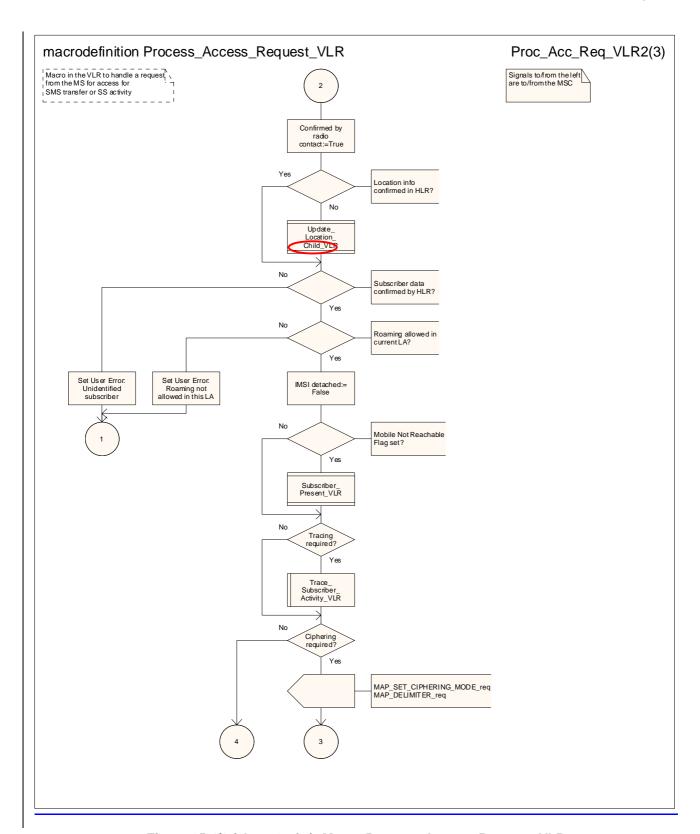


Figure 25.4/2 (sheet 2 of 3): Macro Process\_Access\_Request\_VLR

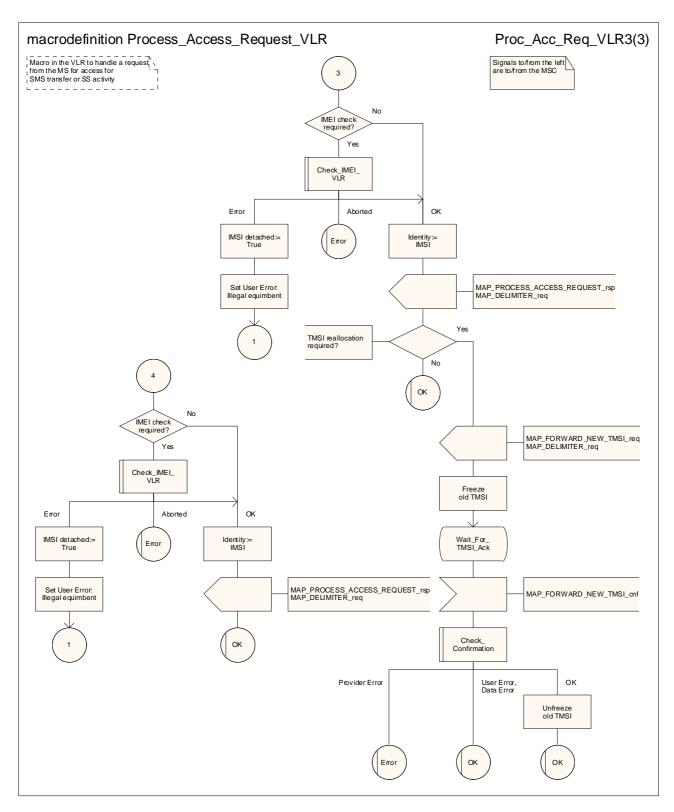


Figure 25.4/2 (sheet 3 of 3): Macro Process\_Access\_Request\_VLR

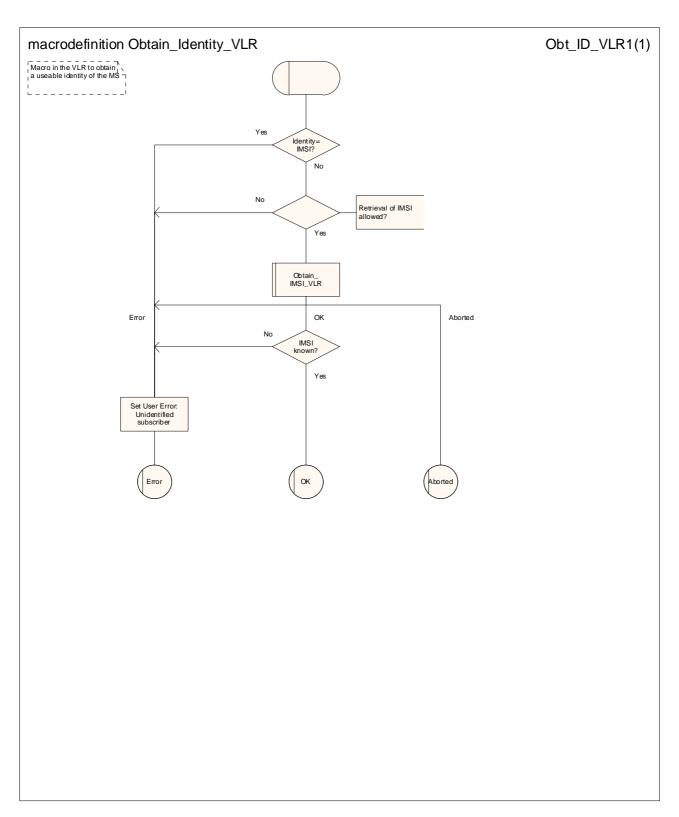
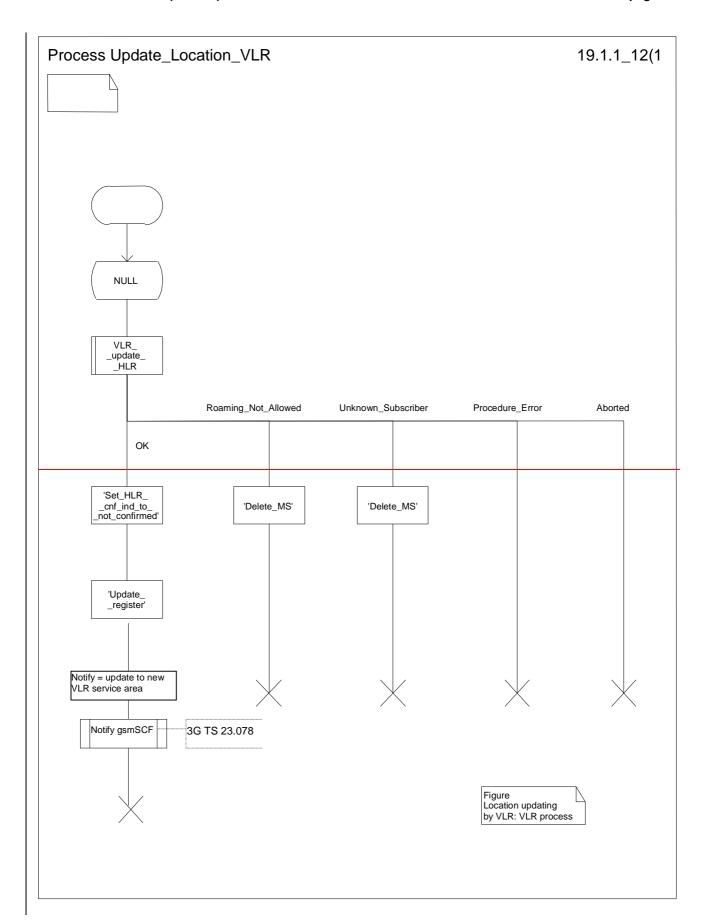


Figure 25.4/3: Macro Obtain\_Identity\_VLR



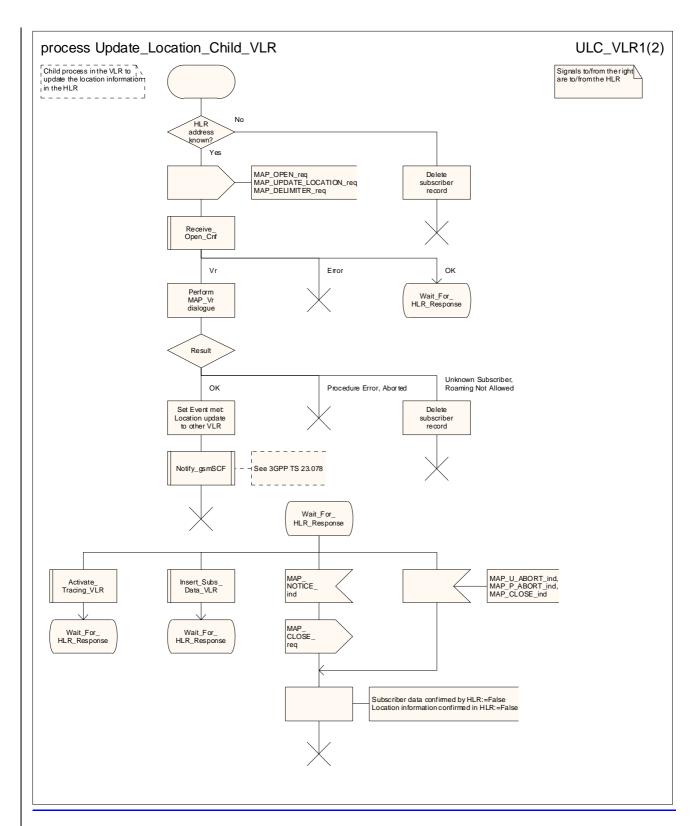


Figure 19.1.1/1225.4/4 (sheet 1 of 2): Process Update Location Child VLR

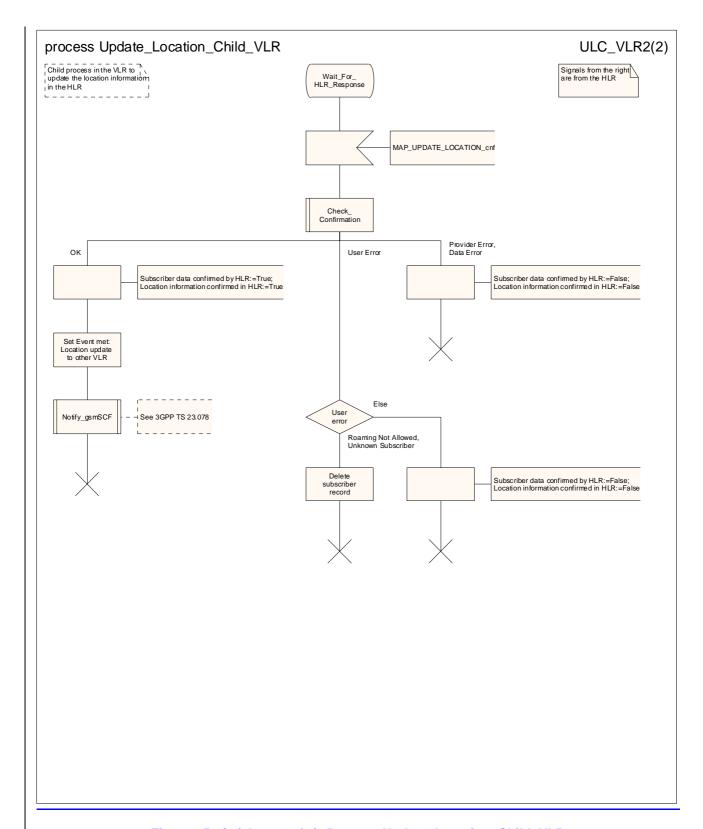


Figure 25.4/4 (sheet 2 of 2): Process Update Location Child VLR

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

## 25.7 Insert Subscriber Data macros and processes

#### 25.7.1 Macro Insert\_Subs\_Data\_VLR

This macro is used by any procedure in the VLR that triggers the reception of subscriber data (e.g. Update Location or Restore Data).

#### 25.7.2 Macro Insert\_Subs\_Data\_SGSN

This macro is used by any procedure in the SGSN that triggers the reception of subscriber data (e.g. Update GPRS Location).

### 25.7.3 Process Insert\_Subs\_Data\_Stand\_Alone\_HLR

This process is used by HLR to transfer subscriber data to VLR or to SGSN in a stand alone mode, i.e. in a separate dialogue. This is done whenever a change of subscriber data is performed either by the operator or by the subscriber and this change has to be reported to the VLR.

Sheet 1: The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

Sheet 1, sheet 2: If the VLR has indicated that it does not support a service or feature (e.g. Closed User Group or Advice Of Charge Charging Level) which the HLR operator regards as essential for the subscriber, the macro Wait\_for\_Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restriction Due To Unsupported Feature flag to roaming restricted and sends Roaming Restriction Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 1, sheet 2: If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 2: It is an operator option whether to repeat the download of subscriber data if the VLR returns an error response. The number of repeat attempts and the interval between them is also an operator option, depending on the error response from the VLR.

If subscriber data for CAMEL Phase 2 or later services are sent to a VLR which does not support the appropriate phase of CAMEL, the service behaviour may be unpredictable or incorrect. The HLR should therefore ensure that at the conclusion of a stand alone Insert Subscriber data procedure the data in the VLR do not require a capability that the VLR does not have. Possible mechanisms to ensure this are described in 3GPP TS 23.078 [98].

The HLR should send a Forwarded-to number which is not in E.164 international format to the VLR only when the HLR has ascertained that the VLR supports CAMEL Phase 2 or later. Thus, the ISD message containing the Forwarded-to number which is not in E.164 international format shall be sent to the VLR only if the HLR previously received confirmation from the VLR at Location Update that CAMEL Phase 2 or later is supported.

#### 25.7.4 Process Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR

This process is used by the HLR to transfer subscriber data from the HLR to the SGSN in a stand alone mode, i.e. in a separate dialogue. This is done whenever a change of subscriber data is performed either by the operator or by the subscriber and this change has to be reported to the SGSN.

Sheet 1: The HLR may wait for each MAP\_INSERT\_SUBSCRIBER\_DATA request to be acknowledged before it sends the next request, or it may handle the requests and the confirmations in parallel.

Sheet 1, sheet 2: If the SGSN has indicated that it does not support a service or feature which the HLR operator regards as essential for the subscriber, the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit; the HLR sets the Roaming Restricted In SGSN Due To Unsupported Feature flag to roaming restricted and sends Roaming Restricted In SGSN Due To Unsupported Feature in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 1, sheet 2: If the HLR operator does not regard the unsupported service or feature as essential for the subscriber but the macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf takes the Replace\_Service exit, the HLR sends the data for a replacement service in a subsequent MAP\_INSERT\_SUBSCRIBER\_DATA request.

Sheet 2: It is an operator option whether to repeat the download of subscriber data if the SGSN returns an error response. The number of repeat attempts and the interval between them is also an operator option, depending on the error response from the SGSN.

#### 25.7.5 Macro Wait\_for\_Insert\_Subs\_Data\_Cnf

This macro is used by any process or macro that describes the handling in the HLR of the transfer of subscriber data to the VLR (e.g. Update Location or Restore Data).

#### 25.7.6 Macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf

This macro is used by any process or macro that describes the handling in the HLR of the transfer of subscriber data to the SGSN (e.g. Update GPRS Location).

### 25.7.7 Process Send\_Insert\_Subs\_Data\_HLR

This process is used by any process or macro in the HLR where a MAP\_INSERT\_SUBSCRIBER\_DATA request is sent to the VLR or to the SGSN.

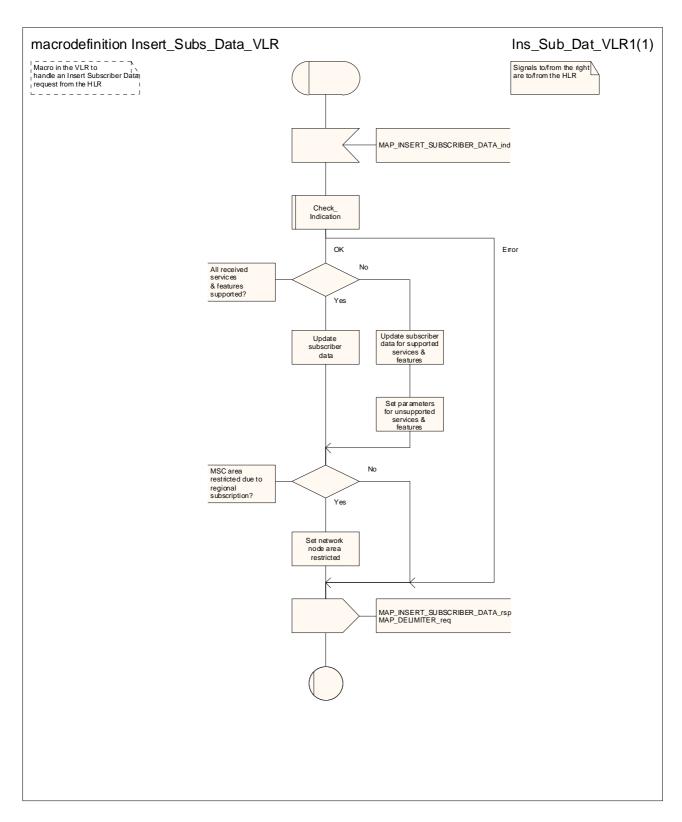


Figure 25.7/1: Macro Insert\_Subs\_Data\_VLR

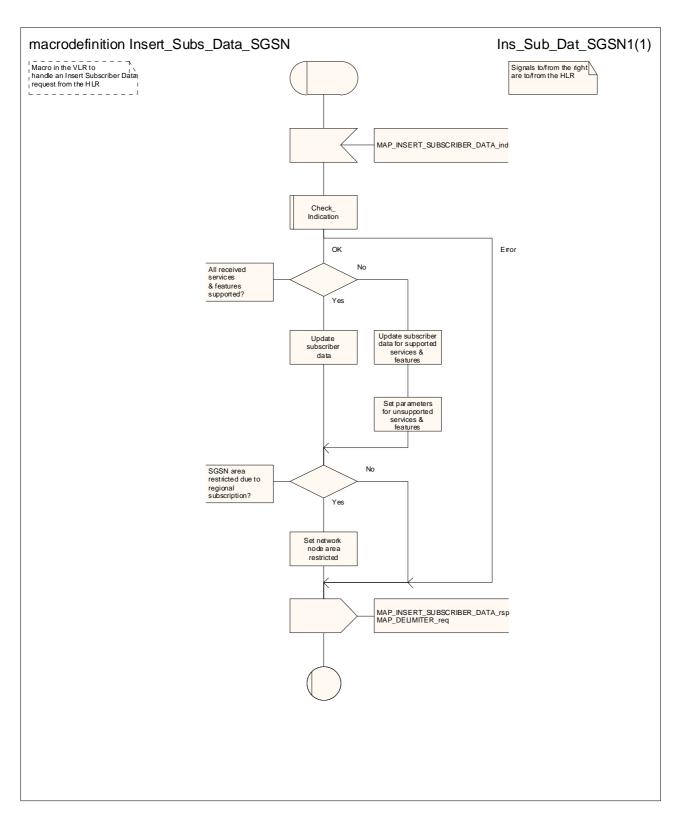


Figure 25.7/2: Macro Insert\_Subs\_Data\_SGSN

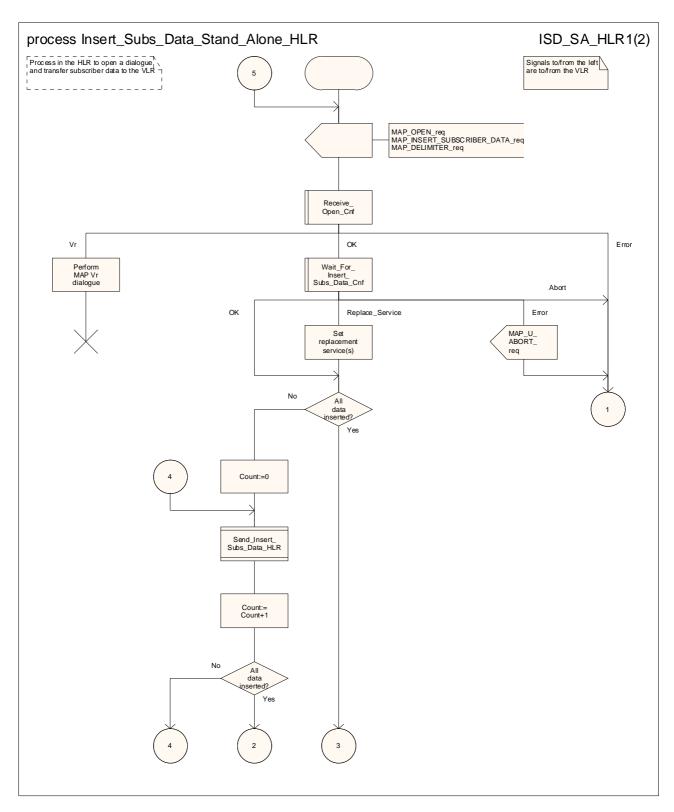


Figure 25.7/3 (sheet 1 of 2): Process Insert\_Subs\_Data\_Stand\_Alone\_HLR

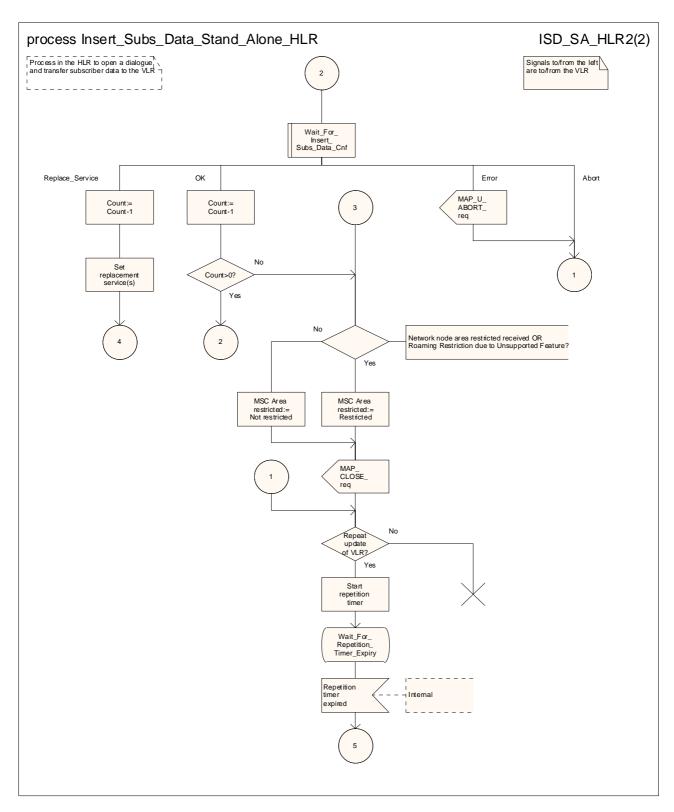


Figure 25.7/3 (sheet 2 of 2): Process Insert\_Subs\_Data\_Stand\_Alone\_HLR

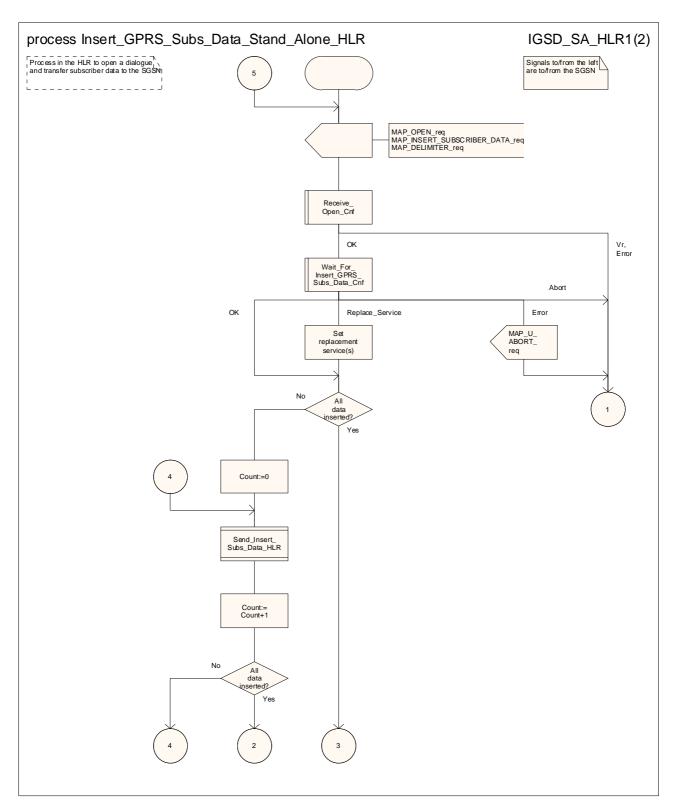


Figure 25.7/4 (sheet 1 of 2): Process Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR

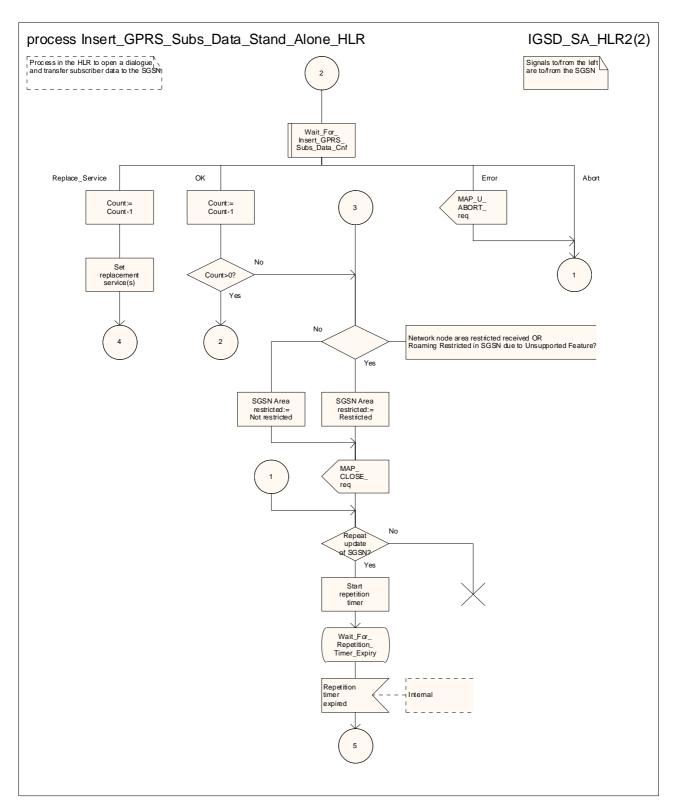


Figure 25.7/4 (sheet 2 of 2): Process Insert\_GPRS\_Subs\_Data\_Stand\_Alone\_HLR

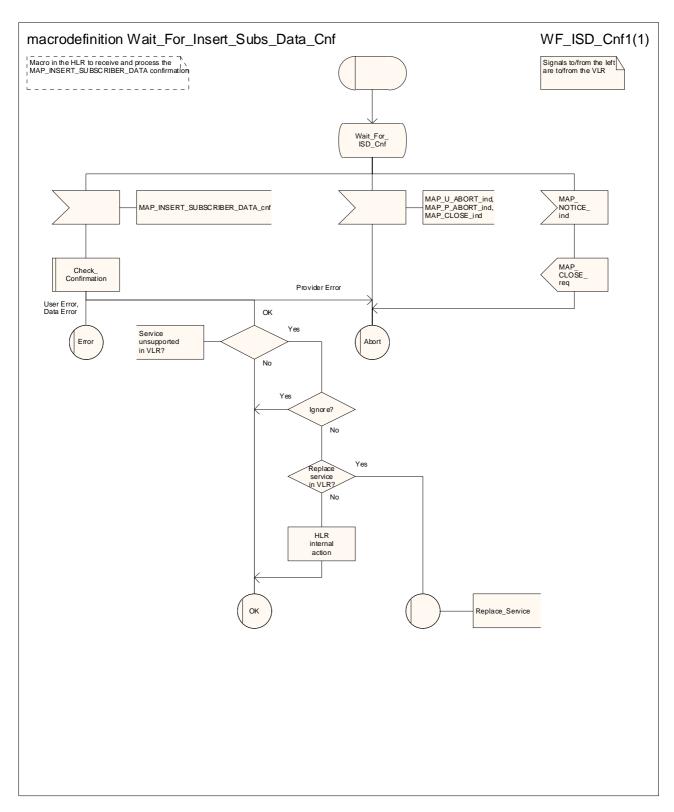


Figure 25.7/5: Macro Wait\_for\_Insert\_Subs\_Data\_Cnf

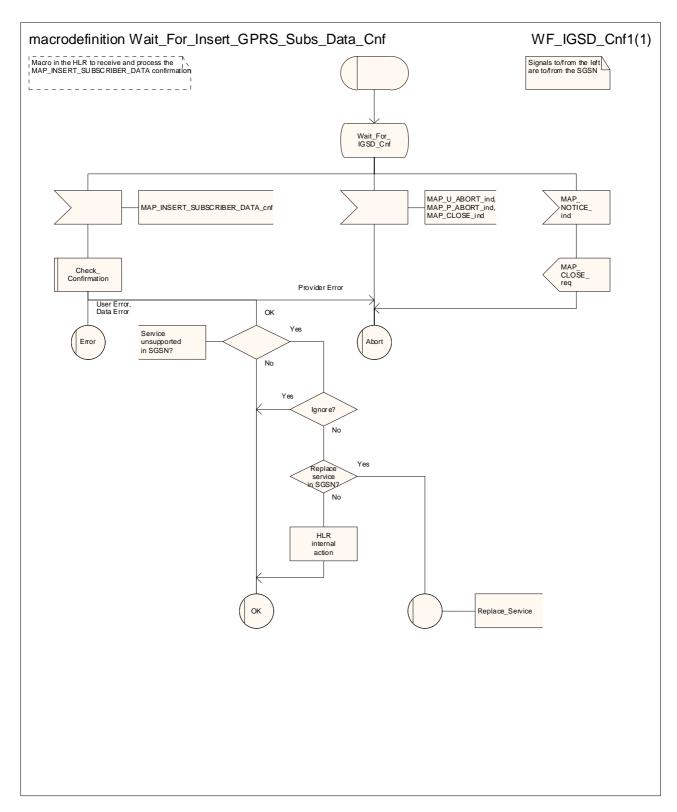


Figure 25.7/6: Macro Wait\_for\_Insert\_GPRS\_Subs\_Data\_Cnf

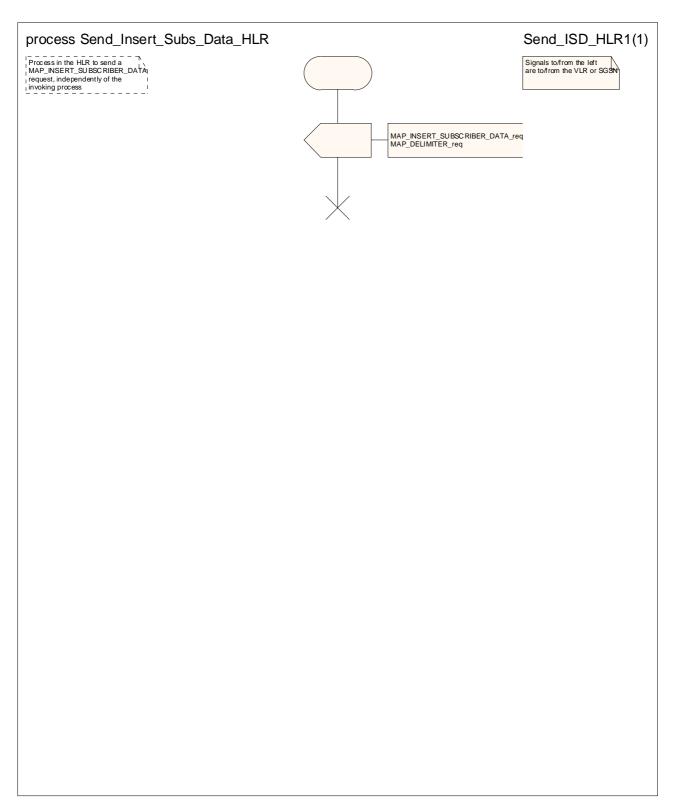


Figure 25.7/7: Process Send\_Insert\_Subs\_Data\_HLR

# \*\*\* Next modified section \*\*\*

## 25.9 Tracing macros

#### 25.9.1 Macro Trace\_Subscriber\_Activity\_MSC

This macro shows the handling in the MSC for a request from the VLR to trace the activity of a subscriber.

#### 25.9.2 Macro Trace\_Subscriber\_Activity\_VLR

This macro is called during the handling of subscriber activity in the VLR to activate tracing if necessary.

#### 25.9.3 Macro Trace\_Subscriber\_Activity\_SGSN

This macro is called during the handling of subscriber activity in the SGSN to activate tracing if necessary.

#### 25.9.4 Macro Activate\_Tracing\_VLR

This macro shows the handling in the VLR for a request from the HLR to activate tracing for a subscriber.

#### 25.9.5 Macro Activate\_Tracing\_SGSN

This macro shows the handling in the SGSN for a request from the HLR to activate tracing for a subscriber.

#### 25.9.6 Macro Control\_Tracing\_With\_VLR\_HLR

This macro shows the handling in the HLR to activate tracing in the VLR if it is required during a dialogue between the VLR and the HLR

### 25.9.7 Macro Control\_Tracing\_HLR\_wWith\_SGSN\_HLR

This macro shows the handling in the HLR to activate tracing in the SGSN if it is required during a dialogue between the SGSN and the HLR  $\alpha$ 

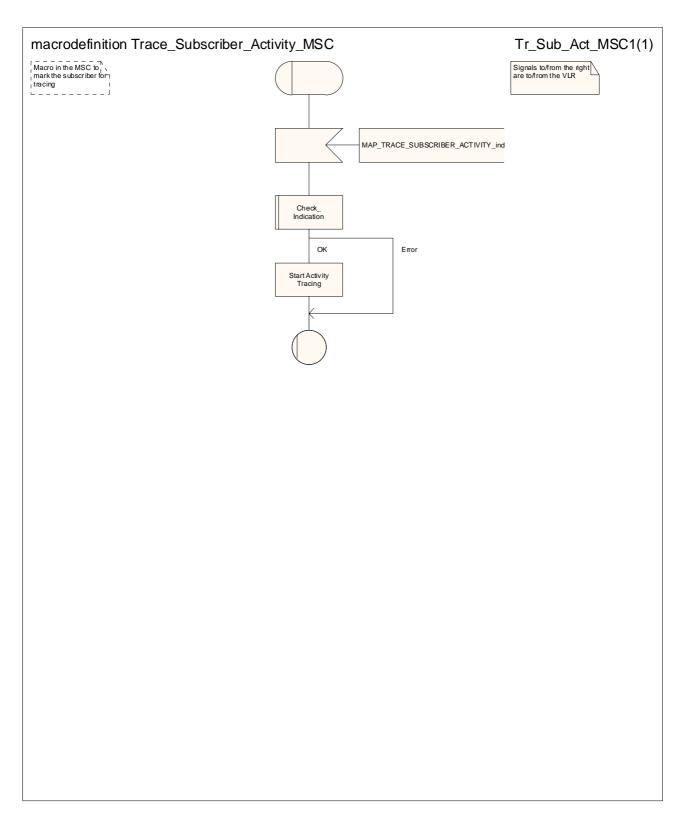


Figure 25.9/1: Macro Trace\_Subscriber\_Activity\_MSC

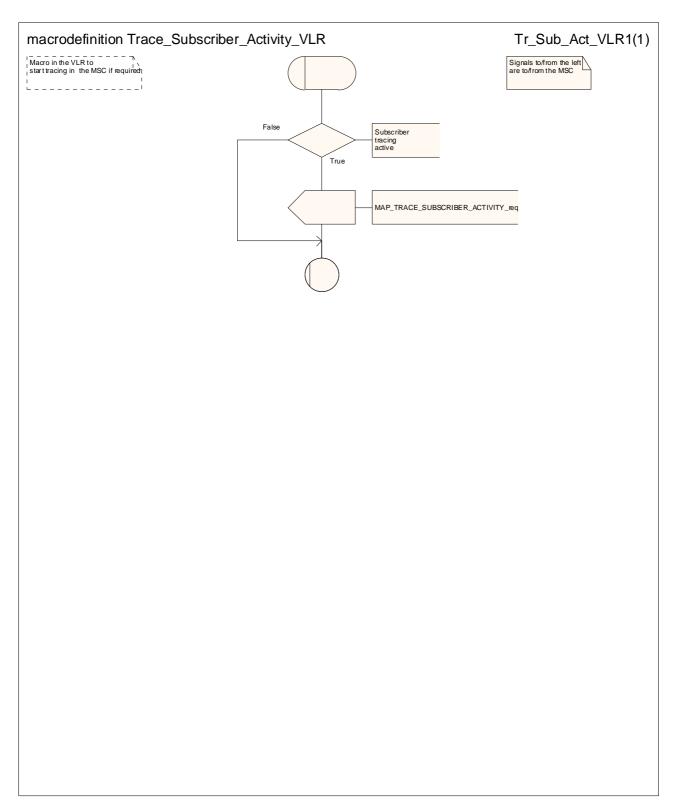


Figure 25.9/2: Macro Trace\_Subscriber\_Activity\_VLR

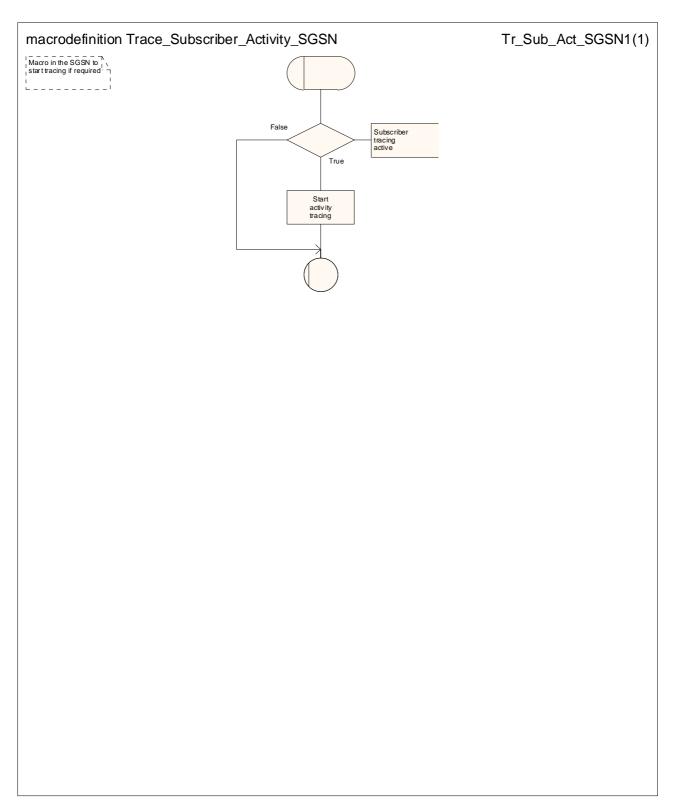


Figure 25.9/3: Macro Trace\_Subscriber\_Activity\_SGSN

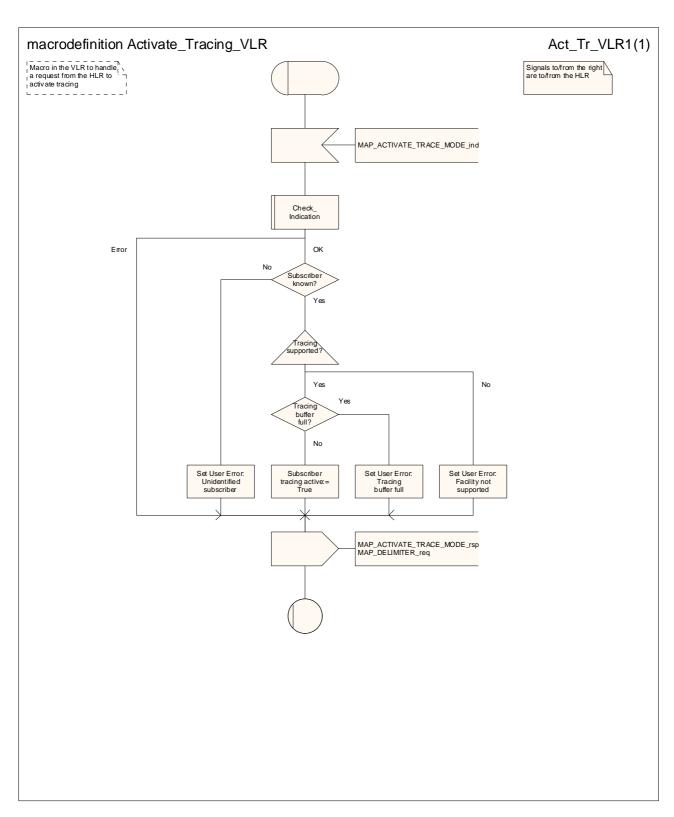


Figure 25.9/4: Macro Activate\_Tracing\_VLR

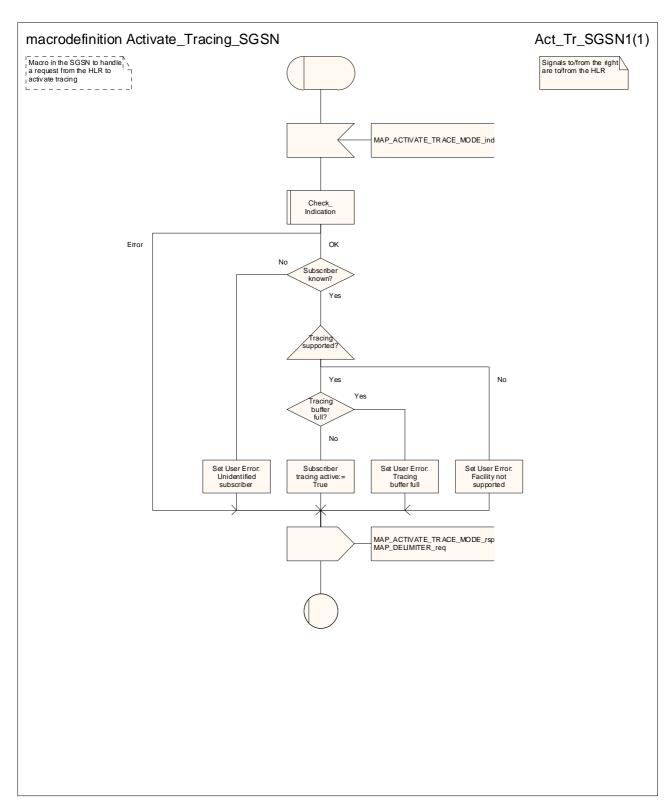
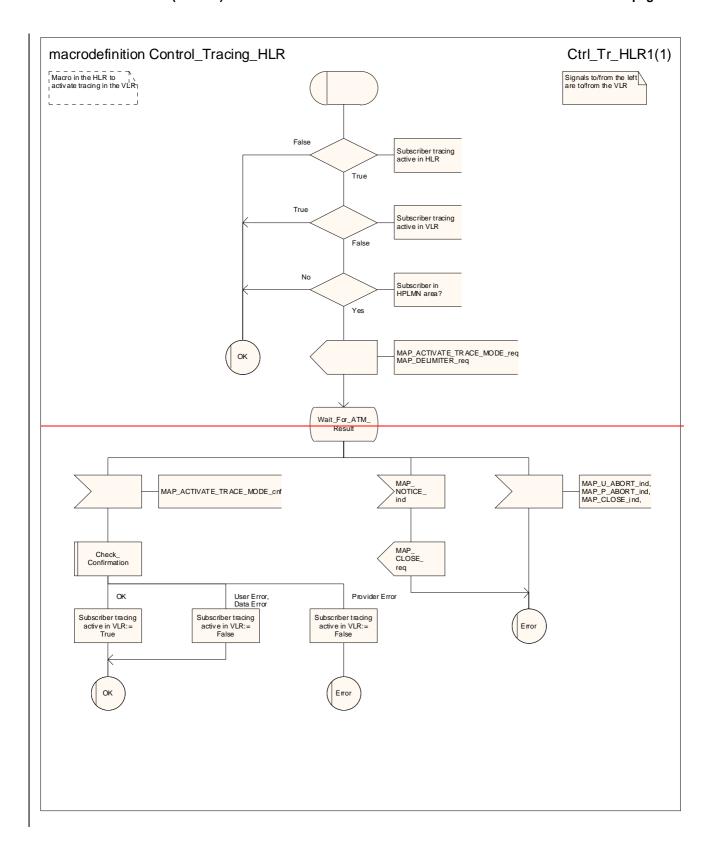


Figure 25.9/5: Macro Activate\_Tracing\_SGSN



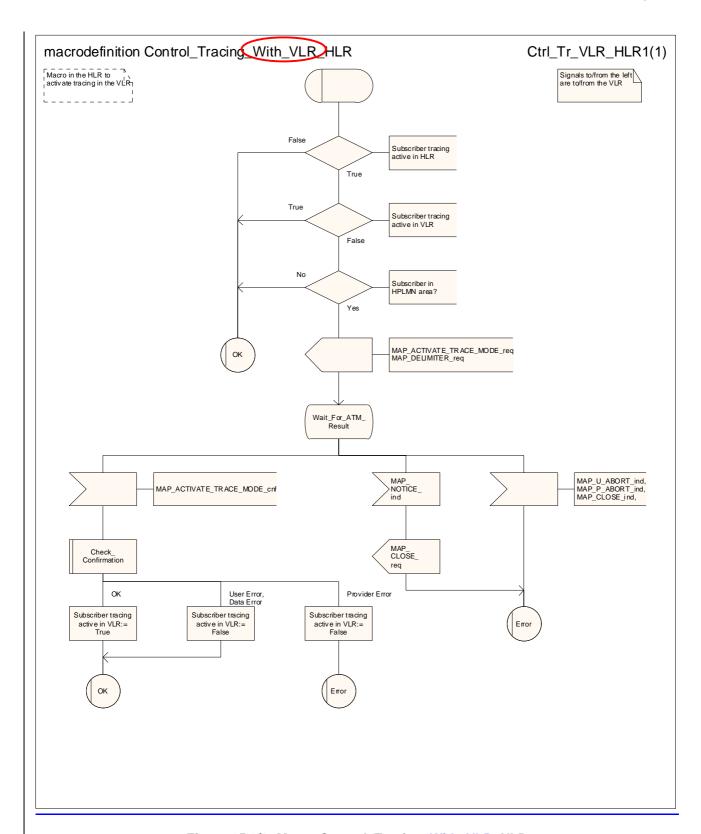
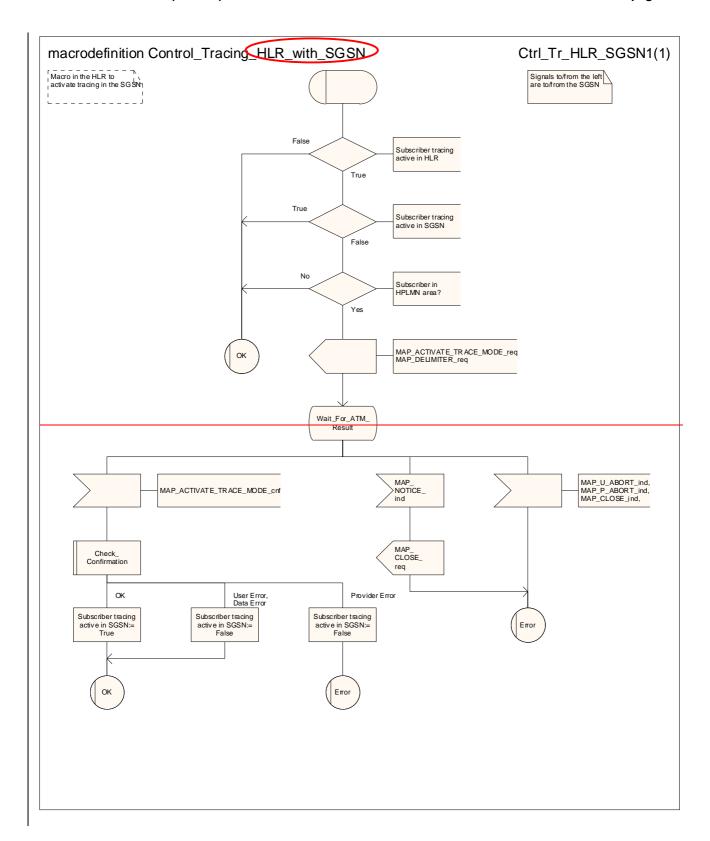


Figure 25.9/6: Macro Control\_Tracing\_With VLR\_HLR



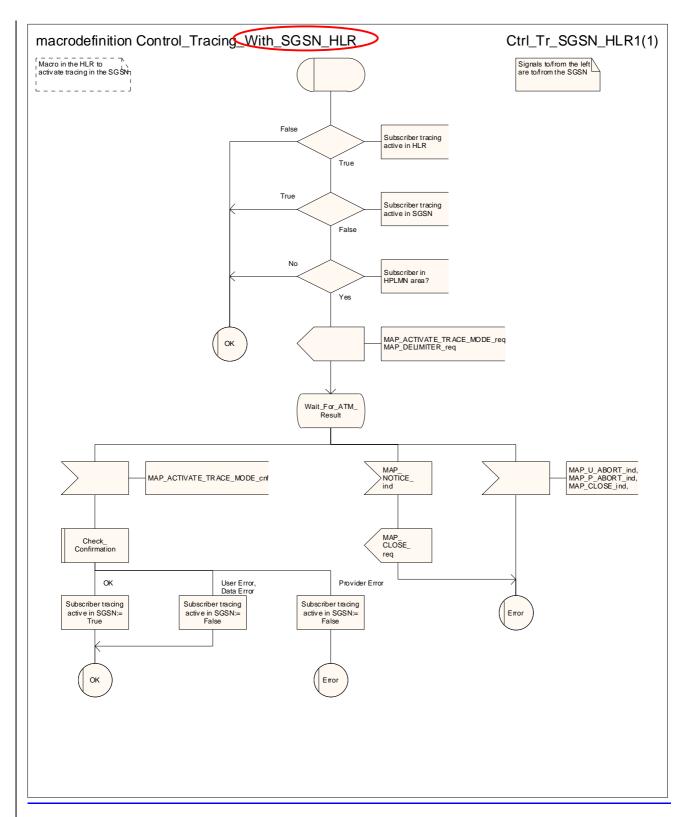


Figure 25.9/7: Macro Control\_Tracing\_HLR\_wWith\_SGSN\_HLR

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