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TECHNICAL SPECIFICATION

Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
LTE;
5G;
Information element mapping between Mobile Station - Base Station System (MS - BSS) and Base Station System - Mobile-services Switching Centre (BSS - MSC);
Signalling Procedures and the Mobile Application Part (MAP)
(3GPP TS 29.010 version 16.1.0 Release 16)

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Contents

Foreword

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

The present document specifies Information element mapping between Mobile Station - Base Station System (MS - BSS) and Base Station System - Mobile-services Switching Centre (BSS - MSC) Signalling procedures and the Mobile Application Part (MAP) within the digital cellular telecommunications system.

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1 Scope

The scope of the present document is:

i) to provide a detailed specification for the interworking between information elements contained in layer 3 messages sent on the MS-MSC interface (Call Control and Mobility Management parts of 3GPP TS 24.008 [4]) and parameters contained in MAP services sent over the MSC-VLR interface (3GPP TS 29.002 [9]) where the MSC acts as a transparent relay of information;

ii) to provide a detailed specification for the interworking between information elements contained in BSSMAP messages sent on the BSC-MSC interface (3GPP TS 48.008 [12]) and parameters contained in MAP services sent over the MSC-VLR interface (3GPP TS 29.002 [9]) where the MSC acts as a transparent relay of information;

iii) to provide a detailed specification for the interworking between information elements contained in BSSMAP messages (3GPP TS 48.008 [12]) and RANAP ((3GPP TS 25.413 [7]);

iv) to provide a detailed specification for the interworking as in i) and ii) above when the MSC also processes the information;

v) to provide a detailed specification for the interworking between information elements contained in layer 3 messages sent on the MS-SGSN interface (GPRS mobility part of 3GPP TS 24.008 [4]) and parameters contained in MAP services sent over the SGSN-HLR interface (3GPP TS 29.002 [9]);

vi) to provide a detailed specification for the interworking between information elements contained in RANAP messages sent on the SGSN-RNC interface (3GPP TS 25.413 [7]) and parameters contained in S1AP messages sent on the MME-eNodeB interface (3GPP TS 36.413 [21]);

vii) to provide a detailed specification for the interworking between information elements contained in BSSMAP messages (3GPP TS 48.008 [12]) or RANAP messages (3GPP TS 25.413 [7]) during SRVCC handovers.

Interworking for supplementary services is given in 3GPP TS 29.011 [11]. Interworking for the short message service is given in 3GPP TS 23.040 [3] and 3GPP TS 24.011. Interworking between the call control signalling of 3GPP TS 24.008 [4] and the PSTN/ISDN is given in GSM 09.03 [13], 3GPP TS 29.007 [10] and 3GPP TS 49.008 [14] [14]. Interworking between the 'A' and 'E' interfaces for inter-MSC handover signalling is given in 3GPP TS 29.007 [10] and 3GPP TS 49.008 [14] [14].

1.1 References

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

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

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

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

[1] 3GPP TS 21.905: "3G Vocabulary".

[2] 3GPP TS 23.009: "Handover procedures".

[3] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS) Point to Point (PP)".

[4] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols-Stage 3".

[5] 3GPP TS 24.010: "Mobile radio interface layer 3 Supplementary services specification - General aspects".

[6]   3GPP TSº24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[7]   3GPP TS 25.413: "Iu interface RANAP signalling".

[8]   3GPP TS 27.001: " General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[9]   3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[10]   3GPP TS 29.007: "General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[11]   3GPP TS 29.011: "Digital cellular telecommunications system (Phase 2+); Signalling interworking for supplementary services".

[12]   3GPP TS 48.008: " Mobile Switching Centre - Base Station System (MSC - BSS) interface Layer 3 specification".

[13]   GSM 09.03: "Digital cellular telecommunications system (Phase 2+); Signalling requirements on interworking between the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) and the Public Land Mobile Network (PLMN)".

[14]   3GPP TS 49.008 [14]: "Digital cellular telecommunications system (Phase 2+); Application of the Base Station System Application Part (BSSAP) on the E-interface".

[15]   3GPP TS 29.108: "Application of the Radio Access Network Application Part (RANAP) on the E-interface"

[16]   3GPP TS 23.271: "Functional stage 2 description of LCS"

[17]   3GPP TS 43.051: "Technical Specification Group GSM/EDGE; Radio Access Network; Overall description - Stage 2".

[18]   3GPP TS 23.012: "Location management procedures".

[19]   Void.

[20]   3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS)".

[21]   3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network E-UTRAN); S1 Application Protocol (S1AP)".

[22]   3GPP TS 23.401: " General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access ".

[23]   3GPP TS 29.060: "GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".

[24]   3GPP TS 48.018: " Base Station System (BSS) -Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[25]   3GPP TS 29.280: "3GPP EPS Sv interface (MME to MSC) for SRVCC".

[26]   3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

1.2   Abbreviations

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

1.3   Definitions

The following terms are used in this Technical Specification:

A/Gb mode: mode of operation of the MS when connected to the Core Network via GERAN and the A and/or Gb interfaces. Throughout this specification the term GSM refers to GERAN A/Gb mode.

Iu mode: mode of operation of the MS when connected to the Core Network via GERAN or UTRAN and the Iu interface. Throughout this specification the term UMTS refers to UTRAN or GERAN Iu mode.

2 Classification of interworking cases

2.1 Transparent procedures

The following MSC procedures require transparent mapping of access protocol information elements into MAP parameters and vice versa (see 3GPP TS 29.002 [9] for definitions and the use of the procedures):

- location update;

- forward new TMSI;

- provide IMSI;

- obtain IMEI;

- check IMEI;

- authenticate;

- trace subscriber activity.

2.2 Non-transparent procedures

Procedures in this class require processing in the MSC and information element mapping. These procedures include those related to:

- outgoing call set-up;

- incoming call set-up;

- handover;

- cipher mode setting;

- location services.

3 Interworking in the MSC, Transparent case

3.1 General

When the MSC receives a forward message from the BSS (possibly forwarded transparently from the MS), it will invoke the desired MAP service and establish a cross reference between the BSSAP procedure and the MAP procedure in order to return the result of the operation to the BSS (which may forward it transparently to the MS. The cross reference is deleted when the MSC terminates the MAP procedure.

Positive or negative results of the MAP procedure are returned in the appropriate BSSAP message.

The parameters of the forward BSSAP message are mapped by a one-to-one mapping into the parameters of the MAP service. However, in some cases parameters received on the radio path may be suppressed at the MSC because they are related to another protocol entity, e.g. information related to RR-management may be included in MM-management messages. Similarly, parameters received in the (positive) MAP service response are mapped one-to-one into parameters of the corresponding backward BSSAP message.

A negative outcome, as carried in various MAP services (MAP specific service response, MAP_U_ABORT, MAP_P_ABORT, MAP_NOTICE and premature MAP_CLOSE, see 3GPP TS 29.002 [9] for definitions) is mapped into a cause value in the required backward BSSAP message. In this case several negative results of MAP may be mapped into the same BSSAP cause value, i.e. without discrimination between these negative results.

NOTE: For O & M purposes, the MAP procedure entity in the MSC may require a more detailed overview of negative results than the MS.

These principles are illustrated in figure 1.

```
24.008 (48.008)                                      MAP service
forward message                                        request
------------>                                        ----------->
+----------+                                         +---------+
|information|                                        |parameter|
|  element  |                                        +---------+
+----------+                                         +---------+
     +----->----------------------------------->----+
                     one-to-one
                      mapping

positive ack                                         MAP service
                                                       response
<-----------                                         <----------
+----------+                                         +---------+
|information|                                        |parameter|
|  element  |                                        +---------+
+----------+                                         +---------+
     +-----<-----------------------------------<----+
                     one-to-one
                      mapping

                                                      negative
negative cause                                        response
<-----------                                         <----------
+----------+                                         +---------+
|   cause  |                                         |  cause  |
+----------+        one-to-one or many-to-one        +---------+
     +-----<-----------------------------------<----+
                      mapping
```
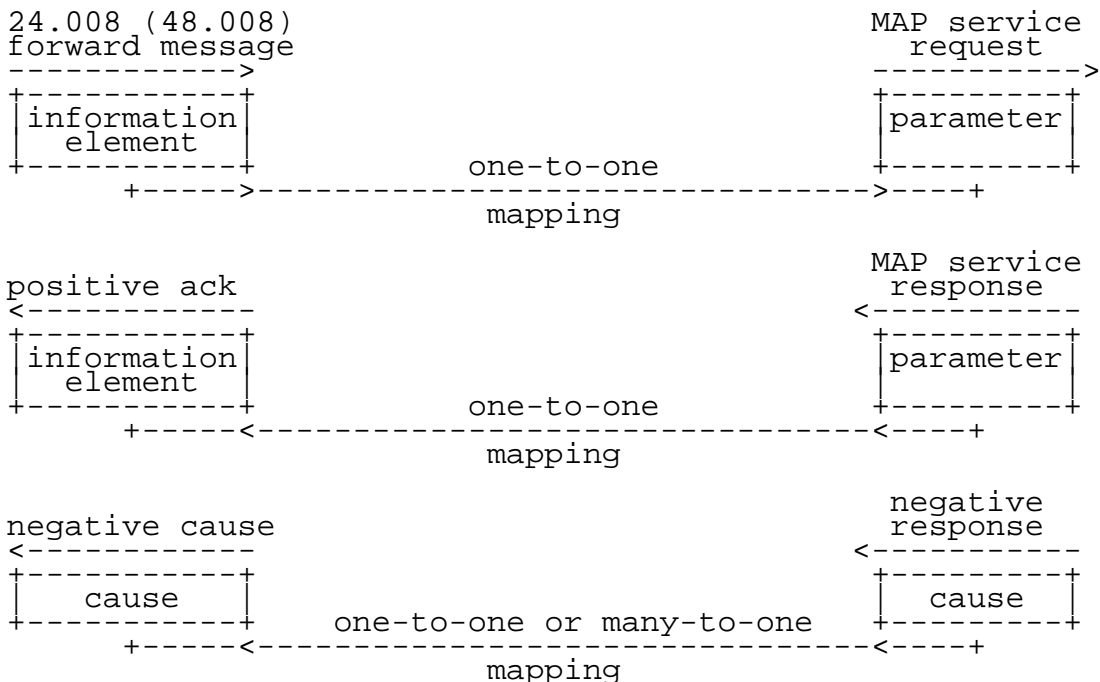
Figure 1: Illustration of mapping principles in the MSC

For each of the transparent operations listed in clause 2.1, the following format is used to show the mapping.

```
------------------------------------------------------------------------------
         | 24.008 or 48.008                         29.002             |Notes
------------------------------------------------------------------------------
Forward  | MS/BSS to MSC                      MSC to VLR               |
message  |   message name                    MAP service request      |
         | information element 1  <--->  parameter 1                   |
         | information element 2  <--->  parameter 2                   |
------------------------------------------------------------------------------
Positive | MSC to MS/BSS                      VLR to MSC               |
result   |   message name                    positive response        |
         | information element 1  <--->  parameter 1                   |
         | information element 2  <--->  parameter 2                   |
------------------------------------------------------------------------------
Negative | MSC to MS/BSS                      VLR to MSC               |
result   |   message name                    negative response        |
         |       cause 1             <--->       cause 1               |
         |       cause 2             <--->       cause 2               |
         |       cause 3             <--->   MAP_U/P_ABORT             |
         |       cause 3             <--->   MAP_NOTICE                |
         |       cause 3             <--->   MAP_CLOSE                 |
------------------------------------------------------------------------------
```

Equivalent mapping principles apply for operations invoked by the VLR towards the BSS/MS. However, negative results are generally not received from the BSS/MS but are generated in the MSC. Therefore, for such operations the interworking for negative results is not normally shown.

3.2 Routeing area updating

	24.008	29.002	Notes
Forward message	GMM (ROUTEING AREA UPDATE REQUEST)	MAP_UPDATE_GPRS _ LOCATION request	
	MS classmark 1	-	
	MS classmark 4	-	
	GPRS Ciphering key seq number	-	
	Mobile station identity	IMSI	
	Old routeing area identification	-	
Positive results	GMM (ROUTEING AREA UPDATE ACCEPT)	MAP_UPDATE_GPRS LOCATION response	
	Routeing area identification	-	
	Mobile station identity	-	1
C	Mobile station	-	2 3
C	Reject: IMSI unknown in HLR	-	3
C	Reject: MSC temporarily not reacheable	-	4
Negative results	GMM (ROUTEING AREA UPDATE REJECT)	MAP_UPDATE_GPRS LOCATION response	
	Network failure	-	5
	GPRS services not allowed in this PLMN	Unknown HLR	
	GPRS services not allowed	Unknown subscriber (no GPRS subscription)	6
	GPRS services and non GPRS services not allowed	Unknown subscriber (IMSI unknown)	7
C	GPRS services not allowed	Unknown subscriber (no GPRS subscription)	8
C	GPRS services and non-GPRS services not allowed	Unknown subscriber (IMSI unknown)	9
	MS identity cannot be derived by the network	-	10
	GPRS services not allowed in this PLMN	Roaming not allowed: PLMN not allowed	
	LA not allowed	-	14
	Roaming not allowed in this LA	-	
	No Suitable cells in location area	-	11
	GPRS services not allowed in this PLMN	Operator determined barring	
	GPRS services not allowed in this PLMN	-	12
C	GPRS services not allowed in this PLMN	-	12
	No Suitable cells in location area	Additional roaming not allowed: Supported RAT Types not allowed	13
	Illegal MS	-	
	Illegal ME	-	
	Network failure	System Failure	
	Network failure	Unexpected data value	
	Network failure	MAP_U/P_ABORT	
	Network failure	MAP_NOTICE	

```
        │     Network failure              MAP_CLOSE                    │
_____│_____│____
```

NOTE 1:   The mobile station identity is inserted by the SGSN if the SGSN wants to deallocate or re-allocate a P-TMSI. If the SGSN wants to deallocate the P-TMSI it shall include the IMSI. If the SGSN wants to re-allocate the P-TMSI it shall include the new P-TMSI. If a P-TMSI is included, the MS shall respond with a ROUTEING AREA UPDATE COMPLETE message.

NOTE 2:   The mobile station identity is inserted by the SGSN if it is received in a BSSAP+ LOCATION UPDATE ACCEPT message from the VLR. If a TMSI is included, the MS shall respond with a ROUTEING AREA UPDATE COMPLETE message. Only used in the Combined Routeing and Location Area procedure.

NOTE 3:   This reject cause is inserted on the positive response by the SGSN if the SGSN receives a BSSAP+ LOCATION UPDATE REJECT message from the VLR indicating in the reject cause IMSI unknown in HLR. Only used in the Combined Routeing and Location Area procedure.

NOTE 4:   This reject cause is inserted on the positive response by the SGSN if the SGSN does not receive any response from the VLR to a previous BSSAP+ LOCATION UPDATE REQUEST message. Only used in the Combined Routeing and Location Area procedure.

NOTE 5:   The Unknown RA error is only generated as a result of incorrect information being inserted by the BSS.

NOTE 6:   The HLR shall send Unknown subscriber with diagnostic value No GPRS subscription if the HLR indicates that there is an error in the type of subscription (i.e. SGSN requests service for a non-GPRS only subscriber). The HLR may also send this error in the MAP SEND AUTHENTICATION INFO RESPONSE message.

NOTE 7:   The HLR shall send Unknown subscriber with diagnostic value IMSI unknown if the HLR indicates that the IMSI provided by the SGSN is unknown.

NOTE 8:   The HLR shall send Unknown subscriber with diagnostic value No GPRS subscription if the HLR indicates that there is an error in the type of subscription (i.e. SGSN requests service for a non-GPRS only subscriber). Used in the Combined Routeing and Location Area procedure. The HLR may also send this error in the MAP SEND AUTHENTICATION INFO RESPONSE message.

NOTE 9:   This reject cause is inserted if the SGSN receives a MAP GPRS UPDATE LOCATION negative response message indicating IMSI unknown. Used in the Combined Routeing and Location Area procedure.

NOTE 10: This reject cause is inserted if the SGSN does not receive any response from the old SGSN to a previous SGSN CONTEXT REQUEST message.

NOTE 11: The "No Suitable cells in location area" error is generated when the MS has access to only part of the PLMN e.g. due to Administrative Restriction of Subscribers' Access, but where there may also be suitable location areas available. The MS retries on another location area. The recommended cause due to Administrative Restriction of Subscriber"s Access is "No Suitable Cells in Location Area", but cause "Roaming Not Allowed in this LA" may also be used, based on operator configuration.

NOTE 12: This reject cause is inserted if the SGSN receives in MAP INSERT SUBSCRIBER DATA message an indication of Roaming restricted in SGSN due to unsupported feature.

NOTE 13: Other reject causes than "no Suitable cells in location area" can be used (e.g. "Roaming not allowed in this location area").

NOTE 14: The cause "LA not allowed" shall be sent only if the HLR indicates that due to subscription to a "regionally restricted service" the MS is not allowed to operate in the location area.

3.3   Authentication

The message flow for the authentication procedure is shown in figure 2.

```
MS                              MSC                                    VLR
                                             MAP_AUTHENTICATE request
    AUTHENTICATION REQUEST       <------------------------------------
    <----------------------

    AUTHENTICATION RESPONSE
    ---------------------->          MAP_AUTHENTICATE response
                                 ------------------------------------>
                                                 or
                                             MAP_U/P_ABORT
                                 ------------------------------------>
```
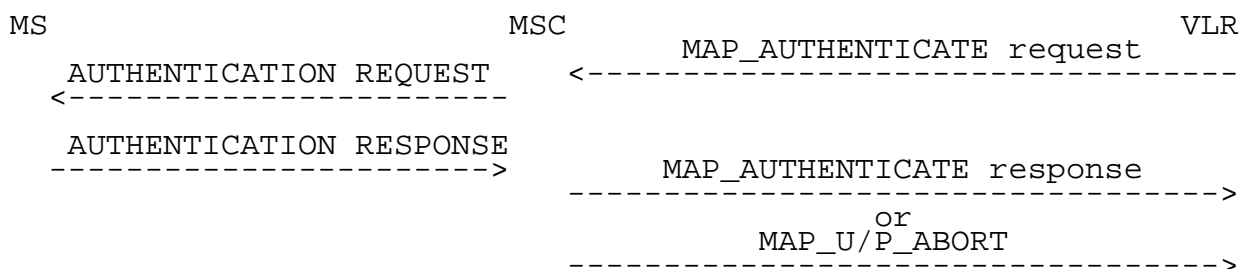
Figure 2: Authentication operation

The MSC can only act on a MAP_AUTHENTICATE request if an RR connection exists with the MS. If such a connection does not exist, the MSC shall terminate the MAP procedure with a MAP_U_ABORT. The same applies if the MS does not respond to an AUTHENTICATION REQUEST message.

	24.008	29.002	Notes
Forward message	AUTHENTICATION REQUEST	MAP_AUTHENTICATE request	
	RAND	RAND	
	Ciphering key seq number	CKSN	
Backward result	AUTHENTICATION REQUEST	MAP_AUTHENTICATE response	
	SRES	SRES	

If the SRES parameter does not match the value stored in the VLR, then the ongoing MAP procedure shall be terminated with a cause 'illegal subscriber'. This shall cause the MSC to send an AUTHENTICATION REJECT message.

3.4 Retrieval of the IMSI from the MS

The VLR may request open identification of an MS with a MAP_PROVIDE_IMSI request.

The mapping of information elements is as follows:

	24.008	29.002	Notes
Forward message	IDENTITY REQUEST Identity type set to: IMSI	MAP_PROVIDE_IMSI request	1
Backward result	IDENTITY RESPONSE Mobile Identity (IMSI)	MAP_PROVIDE_IMSI response	

NOTE 1: The INVOKE does not carry any parameters. The identity type is inferred from the invoke name.

The MSC shall return a MAP_PROVIDE_IMSI response with user error "absent subscriber" if:

- there is no RR connection with the MS when the MAP service request is received;

- there is no response from the MS.

3.5 Reallocation of TMSI

This operation is invoked by the VLR. The MAP_FORWARD_NEW_TMSI request contains the new TMSI which is forwarded to the MS in the TMSI REALLOCATION COMMAND. When the MS acknowledges the receipt of the new TMSI, the MSC will return a MAP_FORWARD_NEW_TMSI response to the VLR.

If there is no radio connection to the MS when the MSC receives the MAP service request, the MSC shall ignore the message.

```
--------------------------------------------------------------------
            |    24.008                  29.002              |Notes
--------------------------------------------------------------------
Forward     | TMSI REALLOCATION          MAP_FORWARD_NEW_TMSI |
message     |    COMMAND                    request           |
            |                                                 |
            | Mobile identity            TMSI                 |
            |                                                 |
            | Location area                                   |
            | identification                -                 |
--------------------------------------------------------------------
Backward    | TMSI REALLOCATION          MAP_FORWARD_NEW_TMSI |
result      |    COMPLETE                   response          |
--------------------------------------------------------------------
```

3.6 Retrieval of the IMEI from the MS

The VLR may use the MAP_OBTAIN_IMEI service to request the MS to supply its IMEI , or may use the MAP_CHECK_IMEI service to request the MSC to check the MS's IMEI. For either MAP service the BSSAP signalling is the same.

The mapping of information elements is as follows:

```
--------------------------------------------------------------------
            |    24.008                  29.002              |Notes
--------------------------------------------------------------------
Forward     |                          (MAP_CHECK_IMEI request|
message     | IDENTITY REQUEST         (   or                 |
            |                          (MAP_OBTAIN_IMEI request|
            |    Identity type                                |
            |    set to: IMEI                                 |  1
--------------------------------------------------------------------
Backward    |                          (MAP_CHECK_IMEI response|
result      | IDENTITY RESPONSE        (   or                 |
            |                          (MAP_OBTAIN_IMEI response|
            |                                                 |
            | Mobile Identity             IMEI                |  2
            |    (IMEI)                                       |
--------------------------------------------------------------------
```

NOTE 1: The MAP service request does not carry any parameters. The identity type is inferred from the service name.

NOTE 2: If the MAP_CHECK_IMEI service was used, the MSC also returns the equipment status to the VLR in the MAP_CHECK_IMEI response, after a successful dialogue with the EIR using the IMEI received from the MS.

The MSC shall terminate the MAP dialogue with the VLR using a MAP_U_ABORT if:

- there is no RR connection with the MS when the MAP service request is received;

- there is no response from the MS.

NOTE: The MSC can also obtain the IMEI from a phase 2 MS by including appropriate information in the BSSMAP Cipher Mode Command.

3.7   Tracing subscriber activity

The VLR may request the MSC and/or BSS to record data about the current transaction with an MS.

```
------------------------------------------------------------------
         |   48.008                       29.002           | Notes
---------+--------------------------------------------------+-----
Forward  | MSC INVOKE TRACE            MAP_TRACE_SUBSCRIBER_|
message  |                               ACTIVITY request   |
         |                                                   |
         | Trace type                 Trace type            |
         | TriggerId                      -                 |
         | Trace reference            Trace reference       |
         | TransactionId                  -                 |
         | Mobile identity(IMSI)      IMSI                  |  1
         | Mobile identity(IMEI)      IMEI                  |  1
         | OMCId                      OMCId                 |
---------+--------------------------------------------------+-----
Backward | none                       none                 |
result   |                                                  |
---------+--------------------------------------------------+-----
```

   NOTE 1: The VLR may provide either an IMSI or IMEI, but not both.

3.8 Location update

```
------------------------------------------------------------------
       |         24.008              29.002          |Notes
-------|-------------------------------------------------|------
Forward| MM (LOCATION UPDATING    MAP_UPDATE_LOCATION_   |
message|    REQUEST)                     request         |
       |                                                 |
       |    Location area id             -               |
       |    Mobile identity            IMSI              |
       |    Mobile station                               |
       |       classmark 1              -                |
       |    Mobile station                               |
       |       classmark 2              -                |
       |    Ciphering key                -               |
       |       seq number                               |
       |    Location update             -               |
       |       type                                     |
-------|-------------------------------------------------|------
Positive| MM (LOCATION            MAP_UPDATE_LOCATION    |
results| UPDATING ACCEPT)              response          |
       |                                                 |
       |    Location area identity      -               |
       |    Mobile identity             -               |
       |    Follow on proceed           -               |
-------|-------------------------------------------------|------
Negative| MM (LOCATION            MAP_UPDATE_LOCATION    |
results| UPDATING REJECT)              response          |
       |                                                 |
       |    IMSI unknown in HLR    Unknown subscriber    | 1
       |                          Roaming not allowed:    |
       |    PLMN not allowed        PLMN not allowed      |
       |    LA not allowed               -               | 3
       |    Roaming not                  -               |
       |    allowed in this LA                           |
       |    No Suitable cells in         -               |
       |       location area                            |
       |    PLMN not allowed          Operator           |
       |                             determined barring  |
       |                          Additional roaming     |
       |                             not allowed:         |
       |    No Suitable cells in    Supported RAT Types  | 2
       |       location area         not allowed         |
       |    Illegal MS                   -               |
       |    Illegal ME                   -               |
       |    Network failure        System Failure        |
       |    Network failure        Unexpected data value |
       |    Network failure        Data Missing          |
       |    Network failure        MAP_U/P_ABORT         |
       |    Network failure        MAP_NOTICE            |
       |    Network failure        MAP_CLOSE             |
-------|-------------------------------------------------|------
```

NOTE 1   The HLR shall also send this error if there is an error in the type of subscription (i.e. VLR requests service for a GPRS only subscriber).

NOTE 2: Other reject causes than "no Suitable cells in location area" can be used (e.g. "Roaming not allowed in this location area").

NOTE 3   The VLR shall return the cause "LA not allowed" only if the HLR indicates that due to subscription to a "regionally restricted service" the MS is not allowed to operate in the location area.

If the VLR finds out that the access is denied due to Administrative Restriction of Subscribers" Access based on subscription info received from HLR, VLR will send negative response to the MSC. The MSC will map the received cause using following mapping table:

```
------------------------------------------------------------------
          |           24.008                               |Notes
----------|-------------------------------------------------|-----
Negative  | MM (LOCATION                  UPDATE_LOCATION   | 1
results   | UPDATING REJECT)                AREA response   |
          |                                                 |
          |   PLMN not allowed              PLMN not allowed|
          |   Roaming not                   National Roaming|
          |   allowed in this LA            not allowed     |
          |   No Suitable cells in          RAT not allowed |
          |        location area                            |
```

> NOTE 1   The UPDATE LOCATION AREA response refers to the internal interface used between VLR and MSC
> (see 3GPP TS 23.012 [18]).

4 Interworking in the MSC, Non-transparent cases

4.1 General

For interworking other than the mapping of information fields, see 3GPP TS 49.008 [14] [14].

4.2 Outgoing call set-up (MS originating call)

Figure 3 shows those elements of a call set-up sequence which require interworking between BSSAP and MAP. BSSAP messages which do not require interworking with MAP are not shown.

```
MS                                    MSC                                        VLR
         CM SERVICE REQUEST
    ------------------------->          MAP_PROCESS_ACCESS_REQUEST request
                                        ------------------------------------->
                                        +-----------------------------+
                                        │            Possibly         │
                                        │   identification procedure/ │
                                        │   authentication procedure  │
                                        +-----------------------------+
                                          MAP_SET_CIPHERING_MODE request
                                        <-------------------------------------
                                                     (Note 1)
          CM SERVICE ACCEPT             MAP_PROCESS_ACCESS_REQUEST response
    <-----------------------           <-------------------------------------
             (Note 2)                        positive result (Note 1)
        CIPHER MODE COMMAND
    <-----------------------
             (Note 2)
        CIPHER MODE COMPLETE
    ----------------------->
                                          MAP_FORWARD_NEW_TMSI request
    TMSI REALLOCATION COMMAND           <-------------------------------------
    <-----------------------                         (Note 3)

    TMSI REALLOCATION COMPLETE
    ----------------------->             MAP_FORWARD_NEW_TMSI response
                                        ------------------------------------->

                                        MAP_PROCESS_ACCESS_REQUEST response
          CM SERVICE REJECT            <-------------------------------------
    <-----------------------             negative result, MAP_U/P_ABORT,
             (Note 4)                          MAP_NOTICE, MAP_CLOSE

         SETUP (Note 5)     ->            MAP_SEND_INFO_FOR_OUTGOING_CALL
    ----------------------->            ------------------------------------->
                                                      request

                                          MAP_COMPLETE_CALL request
          CALL PROCEEDING              <-------------------------------------
    <-----------------------

                                          MAP_SEND_INFO_FOR_OUTGOING_CALL
         RELEASE COMPLETE              <-------------------------------------
    <-----------------------             response, MAP_U/P_ABORT,
             (Note 6)                        MAP_NOTICE, MAP_CLOSE
```

Figure 3: Part of outgoing call set-up sequence

NOTE 1: If the MSC received a MAP_SET_CIPHERING_MODE request, it stores it until it receives the MAP_PROCESS_ACCESS_ REQUEST response.

NOTE 2: CM SERVICE ACCEPT is sent only if the ciphering procedure is not invoked.

NOTE 3: TMSI reallocation need not be sequenced with other messages, but should be sent after ciphering.

NOTE 4: CM SERVICE REJECT is sent as a result of a user error parameter in the MAP_PROCESS_ACCESS_REQUEST response, or termination of the MAP dialogue.

NOTE 5: The SETUP message is sent after the MS has either received a CM SERVICE ACCEPT or sent a CIPHER MODE COMPLETE.

NOTE 6: RELEASE COMPLETE is sent as a result of a user error parameter in the MAP_SEND_INFO_FOR_OUTGOING_CALL response, or termination of the MAP dialogue.

The procedure can be considered in two parts: the handling of the CM SERVICE REQUEST and the handling of the SETUP request.

The procedure is initiated by the MS sending a CM SERVICE REQUEST message. The MSC will forward the service request to the VLR in the MAP_PROCESS_ACCESS_REQUEST request. The VLR may then invoke other operations, e.g. authentication and identification. These operations are defined in clauses 3.4 and 3.5.

If there is a positive outcome for the CM SERVICE REQUEST procedure, the VLR always sends a MAP_PROCESS_ACCESS_REQUEST response. If the request is for a first MM-connection and ciphering is required, the MAP_PROCESS_ACCESS_REQUEST response is preceded by a MAP_SET_CIPHERING_MODE request. In this case the MSC sends a CIPHER MODE COMMAND towards the MS. The interworking for cipher mode setting is described in clause 4.4. If the request is for an additional MM-connection or for a first MM-connection where ciphering is not required, then the positive MAP_PROCESS_ACCESS_ REQUEST response causes the MSC to send a CM SERVICE ACCEPT message to the MS. After cipher mode setting has been completed or the CM SERVICE ACCEPT message has been returned, the MS will send the SETUP (or EMERGENCY SETUP) message and information retrieval takes place as shown.

A negative outcome for the MAP_PROCESS_ACCESS_REQUEST procedure can be signalled by a MAP_PROCESS_ACCESS_REQUEST response containing a user error parameter, or by terminating the MAP dialogue between the MSC and the VLR.

A positive outcome for the call setup procedure is indicated by a MAP_COMPLETE_CALL request from the VLR to the MSC, which causes the MSC to send a CALL PROCEEDING message towards the MS.

A negative outcome for the call setup procedure can be signalled by a MAP_SEND_INFO_FOR_INCOMING_CALL response or by terminating the dialogue between the MSC and the VLR.

Information element mapping is required between the messages:

-   CM SERVICE REQUEST to MAP_PROCESS_ACCESS_REQUEST request;

-   SETUP to MAP_SEND_INFO_FOR_OUTGOING CALL request;

-   MAP_SEND_INFO_FOR_OUTGOING_CALL response, MAP_U/P_ABORT, MAP_NOTICE or premature MAP_CLOSE to RELEASE COMPLETE or CM SERVICE REJECT.

The information contained in the MAP_COMPLETE_CALL request is not transmitted on the radio interface but is used in the MSC for connecting the call.

The conversion of information elements is as follows:

```
---------------------------------------------------------------------
        |    48.008/24.008              29.002              |Notes
---------------------------------------------------------------------
Forward | COMPLETE LAYER 3 INFO    MAP_PROCESS_ACCESS_      |
        | (CM SERVICE REQUEST)         REQUEST request      |
        |                                                   |
        |    CM Service type       CM Service type          |  1
        |    Ciphering key         CKSN                     |
        |       sequence number                             |
        |    Mobile identity       TMSI or IMSI or IMEI     |
        |    Mobile station                                 |
        |       Classmark 2              -                  |
        |                                                   |
        |    Cell identifier       Current LA Id            |  4
        |    Chosen channel              -                  |
        |         -                Access Connection        |
        |                             Status                |  3
---------------------------------------------------------------------
Positive| DTAP(CM SERVICE ACCEPT)  MAP_PROCESS_ACCESS_      |
result  |                             REQUEST response      |  2
---------------------------------------------------------------------
Negative| DTAP(CM SERVICE REJECT)  MAP_PROCESS_ACCESS_      |
result  |                             REQUEST response      |
        |                                                   |
        |    IMSI unknown in VLR      Unidentified          |
[       |                                Subscriber         |
[       |    Requested service     ???????                 |
        |       option not                                 |
        |       subscribed                                  | ]
        |    Illegal ME               Illegal equipment     |
        |    Network failure          System failure        |
        |    Network failure       MAP_U/P_ABORT            |
        |    Network failure       MAP_NOTICE               |
        |    Network failure       MAP_CLOSE                |
---------------------------------------------------------------------
        | DTAP(AUTHENTICATION      MAP_PROCESS_ACCESS_      |
        |    REJECT)                  REQUEST response       |
        |                                                   |
        |                             Illegal subscriber    |
---------------------------------------------------------------------
```

NOTE 1: Indicates, in this case, a mobile originating call establishment or an emergency call establishment.

NOTE 2: The CM SERVICE ACCEPT is sent when the ciphering procedure is not invoked.

NOTE 3: Indicates whether or not an RR-connection exists and whether or not ciphering has been started.

NOTE 4: The Current LA Id parameter is derived by the MSC from the Cell identifier information element.

```
----------------------------------------------------------------------
        |      24.008                     29.002              | Notes
--------+-------------------------------------------------------+------
Forward | SETUP                       MAP_SEND_INFO_FOR_        |
message |                             OUTGOING_CALL request     |
        |                                                       |
        | BC repeat indicator             -                     |
        | Bearer capability 1             -                     |   3
        | Bearer capability 2             -                     |   3
        | Calling party subaddress        -                     |
        | Called party BCD number     Called Number             |
        | Called party subaddress         -                     |
        | LLC repeat indicator            -                     |
        | Low layer compatibility I       -                     |
        | Low layer compatibility II      -                     |
        | HLC repeat indicator            -                     |
        | High layer compatibility i      -                     |
        | High layer compatibility ii     -                     |
        |        -                    Bearer service            |   3
        |        -                    Teleservice               |   3
        | Facility                        -                     |   1
        |        -                    CUG index                 |   4
        |        -                    Suppress pref CUG          |   4
        |        -                    Suppress CUG OA            |   4
        | User-user                       -                     |
        | SS version                      -                     |
        | CLIRO flag                      -                     |
--------+-------------------------------------------------------+------
Positive|                                                       |
result  |                                                       |   2
--------+-------------------------------------------------------+------
Negative| RELEASE COMPLETE            MAP_SEND_INFO_FOR_         |
result  |                             OUTGOING_CALL response     |
        |                                                       |
        | 3GPP TS 24.010             Call Barred                |
        |                               Barring Service         |
        |                                 Active                |
        | Operator determined        Call Barred                |
        |    barring                    Operator Determined     |
        |                                 Barring               |
        | Network out of order       Data Missing               |
        | Network out of order       Unexpected Data Value      |
        | Network out of order       System Failure             |
        | Bearer capability          Bearer service not         |
        |    not authorized             provisioned             |
        | Bearer capability          Teleservice not            |
        |    not authorized             provisioned             |
        | [User not member of CUG]   CUG reject                 |
        |                                                       |
        | Network out of order       MAP_U/P_ABORT              |
        | Network out of order       MAP_NOTICE                 |
        | Network out of order       MAP_CLOSE                  |
--------+-------------------------------------------------------+------
```

NOTE 1: If the Facility IE contains CUG information, the CUG information is transferred to the VLR in the MAP_SEND_INFO_FOR_OUTGOING_CALL service; any other information contained in a Facility IE is transferred to the VLR in a MAP Supplementary Services related service.

NOTE 2: The call setup parameters retrieved from the VLR are not sent to the MS. The parameters are carried in the MAP_COMPLETE_CALL service.

NOTE 3: The bearer capabilities can be used to derive the bearer/tele service.

NOTE 4: CUG information is derived from the contents of the Facility IE.

4.3 Incoming call set-up (MS terminating call)

Figure 4 shows those elements of the procedure which require interworking between MAP and 3GPP TS 24.008 [4] procedures.

```
MS                              MSC                                        VLR
                                    +--------------------------+
                                    │      Info retrieval      │
                                    +--------------------------+
                PAGE REQUEST         MAP_PAGE request or
      <-----------------------    <---------------------------------
                (Note 1)             MAP_SEARCH_FOR_MS request

             PAGING RESPONSE
      ----------------------->    MAP_SEARCH_FOR_MS response (Note 2)
                                  --------------------------------->

                                  MAP_PROCESS_ACCESS_REQUEST request
                                  --------------------------------->
                                    +--------------------------+
                                    │          Possibly        │
                                    │ authentication procedure │
                                    +--------------------------+
                                     MAP_SET_CIPHERING_MODE request
                                  <---------------------------------
                                                (Note 3)

          CIPHER MODE COMMAND       MAP_PROCESS_ACCESS_REQUEST response
      <-----------------------    <---------------------------------
                (Note 3)               positive result (Note 4)
          CIPHER MODE COMPLETE
      ----------------------->

                                     MAP_FORWARD_NEW_TMSI request
   TMSI REALLOCATION COMMAND      <---------------------------------
      <-----------------------                  (Note 5)

   TMSI REALLOCATION COMPLETE
      ----------------------->       MAP_FORWARD_NEW_TMSI response
                                  --------------------------------->

                                      MAP_COMPLETE_CALL request
                SETUP             <---------------------------------
      <-----------------------

                                   MAP_SEND_INFO_FOR_INCOMING_CALL
          RELEASE COMPLETE        <---------------------------------
      <-----------------------        response negative result,
                (Note 6)         MAP_U/P_ABORT,MAP_NOTICE, MAP_CLOSE
```

Figure 4: Incoming call set-up

NOTE 1: If an MM connection already exists, the PAGE REQUEST is not sent. If the call can be accepted, the MSC sends a MAP_PROCESS_ACCESS_REQUEST request in response to the MAP_PAGE request. If the call cannot be accepted the MSC sends a MAP_PAGE response containing the error 'busy subscriber'.

NOTE 2: Sent only if MAP_SEARCH_FOR_MS was used.

NOTE 3: Needed only if a ciphered MM-connection does not exist already.

NOTE 4: If the MSC received a MAP_SET_CIPHERING_MODE request, it stores it until it receives the MAP_PROCESS_ACCESS_ REQUEST response.

NOTE 5: TMSI reallocation need not be sequenced with other messages, but should be sent after ciphering.

NOTE 6: RELEASE COMPLETE is sent as a result of a user error parameter in the MAP_SEND_INFO_FOR_OUTGOING_CALL response, or termination of the MAP dialogue.

The paging procedure is controlled by the VLR. It may be followed by authentication (clause 3.4), ciphering (clause 4.4) and reallocation of TMSI(clause 3.6). The SETUP message is sent when the MAP_COMPLETE_CALL request is received.

Normally there is no interworking between the MAP_COMPLETE_CALL request and the SETUP message. However, the MAP_COMPLETE_CALL request may contain a bearer service indication which will be used to establish the bearer capabilities at the MSC. The interworking between the MAP_PAGE request or MAP_SEARCH_FOR_MS request and the BSSMAP PAGING REQUEST message is as follows:

```
-----------------------------------------------------------------------------
           |     48.008/24.008              29.002                  |Notes
-----------------------------------------------------------------------------
Forward    | PAGING REQUEST             MAP_PAGE request or         |
message    |                            MAP_SEARCH_FOR_MS request   |
           |                                                        |
           | IMSI                       IMSI                        |
           | TMSI                       TMSI                        | 1
           | Cell identifier            Stored LA Id                |
           |      list                                              |
-----------------------------------------------------------------------------
Backward   | COMPLETE LAYER 3 INFO      MAP_PROCESS_ACCESS_         |
message    | (PAGING RESPONSE)               REQUEST request        |
           |                                                        |
           |           -                CM service type            | 2
           | Ciphering key              CKSN                        |
           |     sequence number                                    |
           | Mobile identity            TMSI or IMSI                |
           | Mobile station                                         |
           |     classmark 2                 -                      |
           | Cell Identifier            Current LA Id               | 3
           |           -                Access connection           |
           |                                 status                 |
           | Chosen channel                  -                      |
-----------------------------------------------------------------------------
```

NOTE 1: If TMSI is included, the TMSI is used as the mobile identity in the 3GPP TS 24.008 [4] PAGE REQUEST message, otherwise the IMSI is used as the mobile identity.

NOTE 2: In this case the MAP CM service type is set to 'mobile terminating call'.

NOTE 3: The Target LA Id parameter is derived by the MSC from the Cell identifier information element.

4.4 Cipher mode setting

The interworking is as follows:

```
-----------------------------------------------------------------------------
           |     48.008                     29.002                  |Notes
-----------------------------------------------------------------------------
Forward    | CIPHER MODE COMMAND        MAP_SET_CIPHERING_MODE      |
           |                                 request                |
           |                                                        |
           | Cipher mode setting        Ciphering mode             |
           | Encryption information     Kc                          | 1
-----------------------------------------------------------------------------
Positive   | CIPHER MODE COMPLETE       None                        |
result     |                                                        |
-----------------------------------------------------------------------------
Negative   | CIPHER MODE REJECT         None                        |
result     |                                                        |
-----------------------------------------------------------------------------
```

NOTE 1: The key Kc is passed through the BSS to the BTS, but is not passed to the MS.

4.5 Inter-MSC Handover

The general principles of the handover procedures are given in 3GPP TS 23.009 [2]. 3GPP TS 29.010 gives the necessary information for interworking between the 3GPP TS 48.008 [12] handover protocol and the 3GPP TS 29.002 [9] MAP protocol.

The following principle shall apply when new parameters need to be added for transfer on the E-interface:

1- The parameters shall be added to be carried in the AN-APDU when they need to be forwarded to the target radio access network and the encapsulated protocol is the same as the protocol used at the interface between the target MSC and the target radio access network.

2. The parameters shall be added to be carried in a MAP message

   - when they need to be forwarded to the target radio access network and the encapsulated protocol is different from the protocol used at the interface between the target MSC and the target radio access network;

   - when they are required by the target MSC, but not to be forwarded to the target radio access network; or

   - when they are required by the target MSC for subsequent procedures

and they cannot be derived from the message encapsulated in the AN-APDU.

4.5.1   Basic Inter-MSC Handover

When a Mobile Station is handed over between two MSCs, the establishment of a connection between them (described in 3GPP TS 23.009 [2]) requires interworking between A-Interface and E-Interface.

The signalling at initiation, execution, completion of the Basic Inter-MSC handover procedure is shown in figures 5 to 10 with both possible positive or negative outcomes.

Additionally figures 5b and 5c show the possible interworking when trace related messages are transparently transferred on the E-Interface at Basic Inter-MSC Handover initiation.

```
BSS-A           MSC-A                              MSC-B
|                 |                                  |
| HANDOVER        |                                  |
| --------------->| MAP PREPARE HANDOVER             |
| REQUIRED        | ------------------------------>  |
|                 | request                          | +----------------+
|                 |                                  | |Possible Alloc. |
|                 |                                  | |of a handover   |
|                 |                                  | |no. in the VLR-B|
|                 |                                  | +----------------+
|                 |                                  |
|                 |                                  |              BSS-B
|                 |                                  |                |
|                 |                                  | HANDOVER REQUEST
|                 |                                  | ------------------>|
|                 |                                  |                |
```
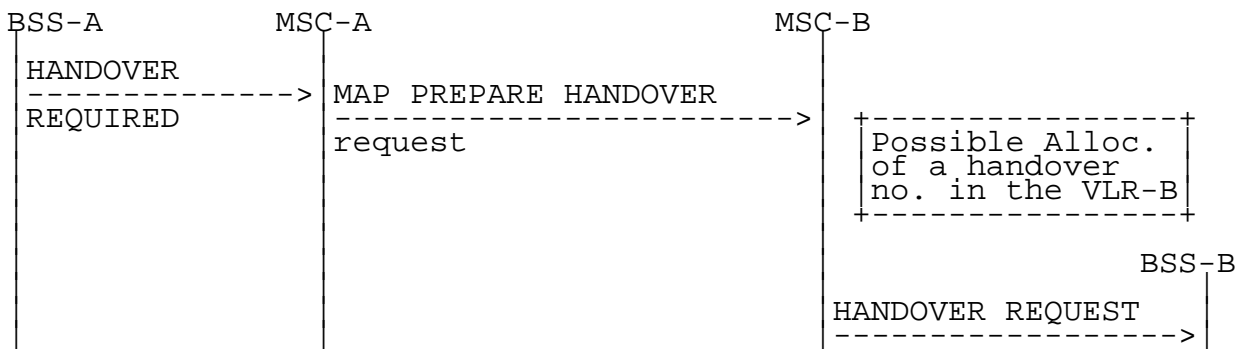
Figure 5a: Signalling for Basic Inter-MSC Handover initiation (no trace related messages transferred)

```
BSS-A           MSC-A                              MSC-B
| BSC INVOKE TRACE|                                  |
| --------------->|                                  |
|                 |                                  |
| HANDOVER        |                                  |
| --------------->| MAP PREPARE HANDOVER             |
| REQUIRED        | ------------------------------>  |
|                 | request(*)                       | +----------------+
|                 |                                  | |Possible Alloc. |
|                 |                                  | |of a handover   |
|                 |                                  | |no. in the VLR-B|
|                 |                                  | +----------------+
|                 |                                  |
|                 |                                  |              BSS-B
|                 |                                  |                |
|                 |                                  | HANDOVER REQUEST
|                 |                                  | ------------------>|
|                 |                                  |                |
|                 |                                  | BSC INVOKE TRACE
|                 |                                  | ---------------->(**)
```
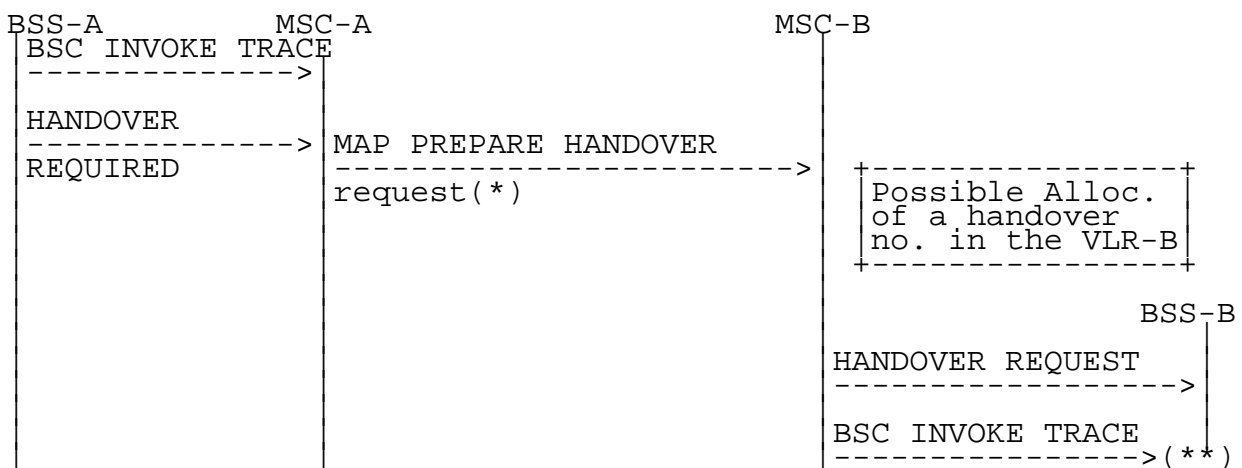
Figure 5b: Signalling for Basic Inter-MSC Handover initiation (BSC invoke trace message transferred)

(*):   In that case, HANDOVER REQUEST and BSC INVOKE TRACE messages are included within the AN-APDU parameter.

(**):   BSC INVOKE TRACE is forwarded to BSS-B if supported by MSC-B.

```
BSS-A              MSC-A                          MSC-B
|                   |(*)                           |
| HANDOVER          |                              |
|-------------->|MAP PREPARE HANDOVER            |
| REQUIRED      |------------------------->| +-----------------+
|               |request(**)               | |Possible Alloc.  |
|               |                          | |of a handover    |
|               |                          | |no. in the VLR-B |
|               |                          | +-----------------+
|               |                          |
|               |                          |                BSS-B
|               |                          |                  |
|               |                          |HANDOVER REQUEST  |
|               |                          |----------------->|
|               |                          |MSC INVOKE TRACE  |
|               |                          |---------------->(***)
```
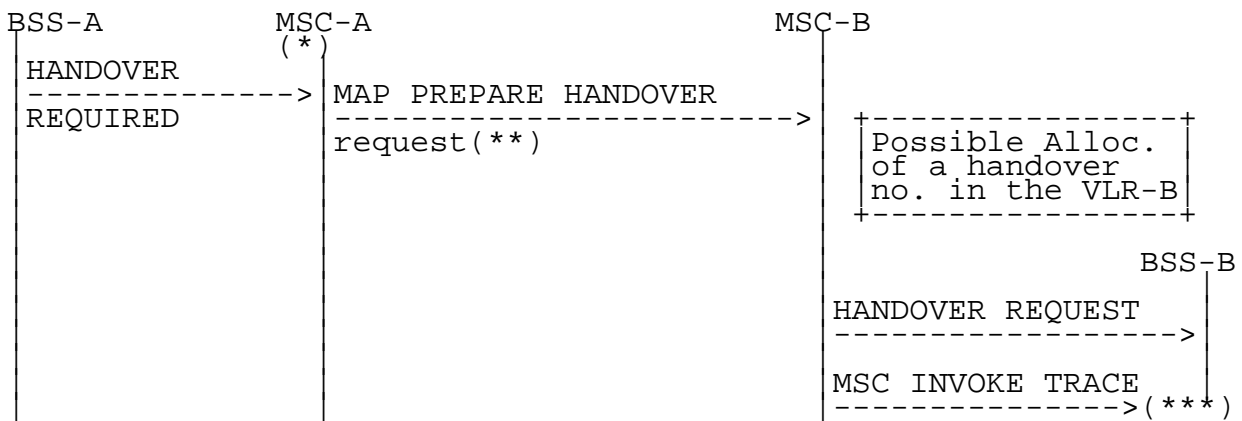
Figure 5c: Signalling for Basic Inter-MSC Handover initiation (MSC invoke trace message transferred)

(*):   Tracing invocation has been received from VLR.

(**):   In that case, HANDOVER REQUEST and MSC INVOKE TRACE messages are included within the AN-APDU parameter.

(***):   MSC INVOKE TRACE is forwarded to BSS-B if supported by MSC-B.

Possible Positive outcomes:

a) successful radio resources allocation and handover number allocation (if performed):

```
BSS-A              MSC-A                          MSC-B              BSS-B
|                   |                              |                  |
|                   |                              |HANDOVER REQUEST  |
|                   |                              |<-----------------|
|                   |                              |ACKNOWLEDGE       |
|                   | MAP PREPARE HANDOVER        |                  |
|                   |<------------------------|                  |
|                   | response                |                  |
|HANDOVER COMMAND   |                              |                  |
|<--------------|                              |                  |
```

b) radio resources allocation queued and successful handover number allocation (if performed). Later successful radio resources allocation indication:

```
BSS-A              MSC-A                          MSC-B              BSS-B
|                   |                              |                  |
|                   |                              |QUEUING INDICATION|
|                   |                              |<-----------------|
|                   |MAP PREPARE HANDOVER         |                  |
|                   |<------------------------|                  |
|                   | response                |                  |
|                   |                              |HANDOVER REQUEST  |
|                   |                              |<-----------------|
|                   |                              |ACKNOWLEDGE       |
|                   |MAP PROCESS ACCESS           |                  |
|                   |<------------------------|                  |
|HANDOVER COMMAND   | SIGNALLING request          |                  |
|<--------------|                              |                  |
```
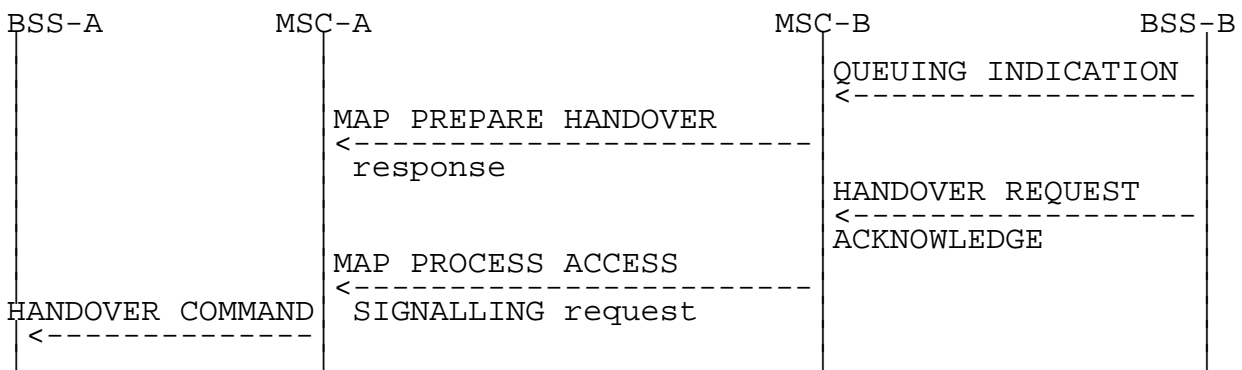
Figure 6: Signalling for Basic Inter-MSC Handover execution (Positive outcomes)

Possible Negative outcomes:

c) user error detected, or handover number allocation unsuccessful (if performed), or component rejection or dialogue abortion performed by MSC-B:

```
BSS-A            MSC-A                           MSC-B              BSS-B
 │                │       MAP PREPARE HANDOVER response              │
 │                │       negative result, MAP CLOSE                 │
 │                │<-------------------------│                       │
 │                │  MAP U/P-ABORT           │                       │
 │ HANDOVER REQUIRED                         │                       │
 │<--------------│                           │                       │
 │ REJECT (Note 1)│                          │                       │
 │                │                          │                       │
```

d) radio resources allocation failure:

```
BSS-A            MSC-A                           MSC-B              BSS-B
 │                │                           │  HANDOVER FAILURE     │
 │                │                           │<------------------│   │
 │                │  MAP PREPARE HANDOVER     │                       │
 │                │<-------------------------│                       │
 │                │   response               │                       │
 │ HANDOVER REQUIRED                         │                       │
 │<--------------│                           │                       │
 │ REJECT (Note 1)│                          │                       │
 │                │                          │                       │
```

e) radio resources allocation queued and successful handover number allocation (if performed). Later unsuccessful radio resources allocation:

```
BSS-A            MSC-A                           MSC-B              BSS-B
 │                │                           │  QUEUING INDICATION   │
 │                │                           │<------------------│   │
 │                │  MAP PREPARE HANDOVER     │                       │
 │                │<-------------------------│                       │
 │                │   response               │                       │
 │                │                          │                       │
 │                │                          │  HANDOVER FAILURE     │
 │                │                          │<------------------│    │
 │                │  MAP PROCESS ACCESS       │                      │
 │                │<-------------------------│                       │
 │                │   SIGNALLING request     │                       │
 │ HANDOVER REQUIRED                         │                       │
 │<--------------│                           │                       │
 │ REJECT (Note 1)│                          │                       │
```
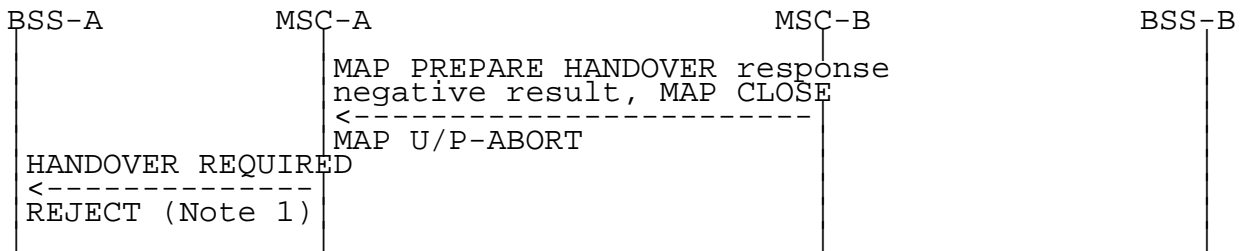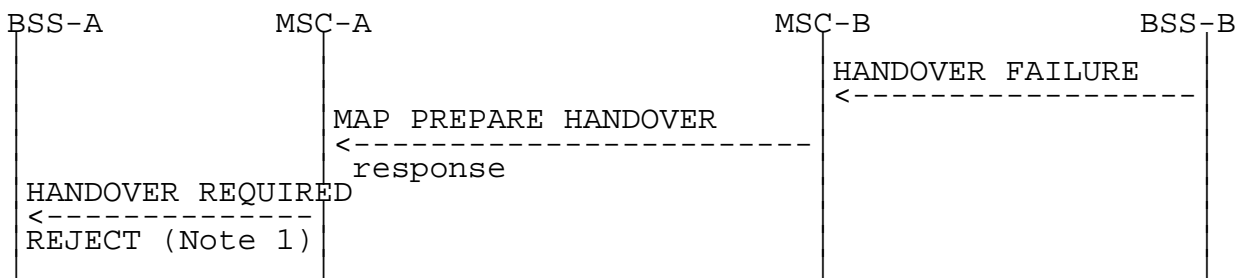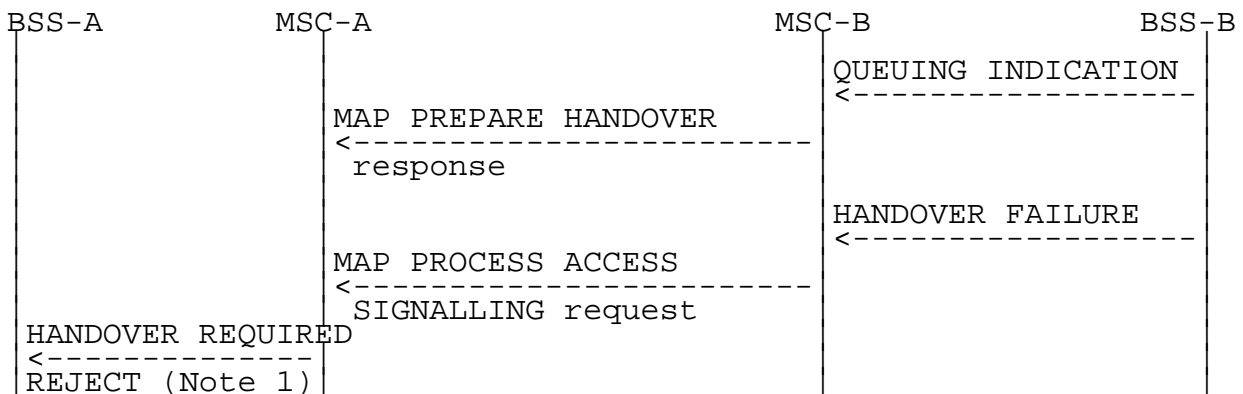
f) unsuccessful handover execution (Reversion to the old channel):

```
BSS-A            MSC-A                           MSC-B              BSS-B
 │ HANDOVER       │                           │                       │
 │-------------->│                           │                       │
 │ FAILURE        │                           │                      │
 │                │  MAP U -ABORT            │                       │
 │                │------------------------->│                       │
 │                │                          │  CLEAR COMMAND        │
 │                │                          │------------------>    │
 │                │                          │                       │
```
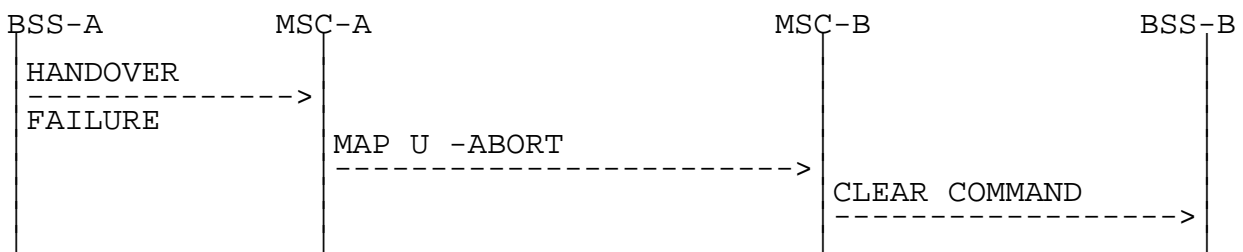
Figure 7: Signalling for Basic Inter-MSC Handover execution (Negative outcomes)

NOTE: Possible rejection of the handover because of the negative outcome of MAP or BSSMAP procedure.

```
  BSS-A             MSC-A                          MSC-B              BSS-B
    |                 |                              |                  |
    |                 |                              | HANDOVER COMPLETE
    |                 |                              |<------------------
    |                 |    MAP SEND END SIGNAL request
    |                 |<----------------------------
    | CLEAR sCOMMAND  |                              |                  |
    |<--------------  |                              |                  |
    |                 |                              |                  |
```
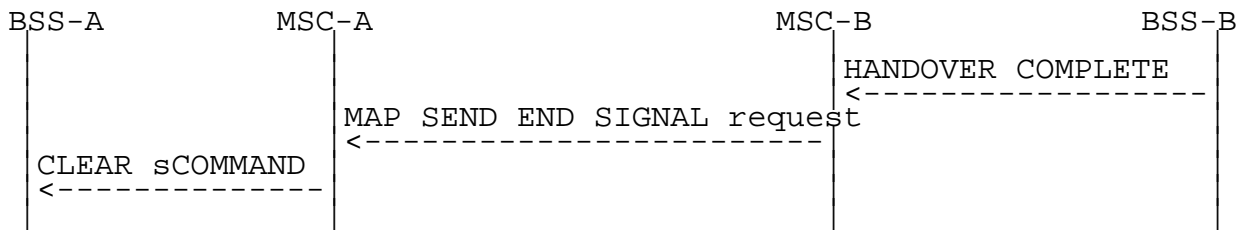
Figure 8: Signalling for Basic Inter-MSC Handover completion

Positive outcome

```
  BSS-A             MSC-A                          MSC-B              BSS-B
    |                 |                              |                  |
    |                 | MAP SEND END SIGNAL          |                  |
    |                 |---------------------------->|                  |
    |                 |   response                   | CLEAR COMMAND    |
    |                 |                              |----------------->|
    |                 |                              |  (Note 1)        |
```
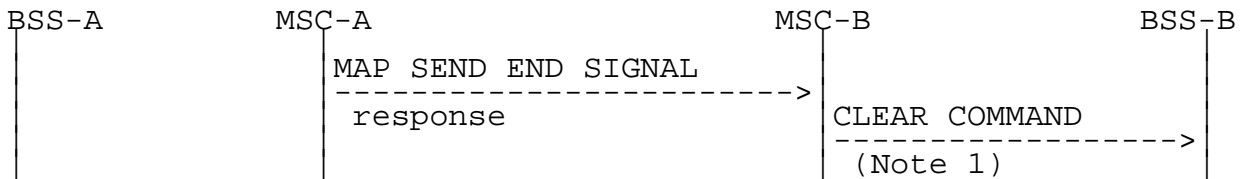
Figure 9: Signalling for Basic Inter-MSC Handover completion (Positive outcome)

Negative outcome

```
  BSS-A             MSC-A                          MSC-B              BSS-B
    |                 |                              |                  |
    |                 |   MAP U/P -ABORT             |                  |
    |                 |---------------------------->|                  |
    |                 |                              | CLEAR COMMAND    |
    |                 |                              |----------------->|
    |                 |                              |                  |
```
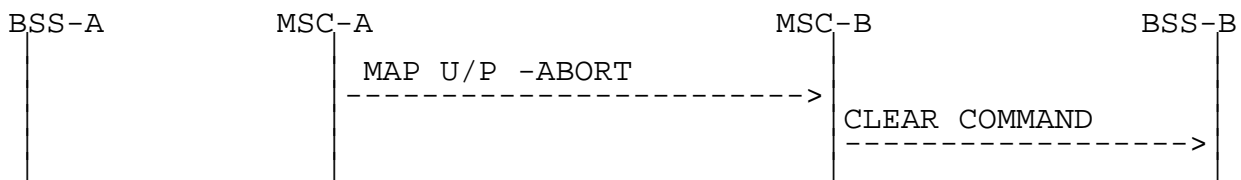
Figure 10: Signalling for Basic Inter-MSC Handover completion (Negative outcome)

NOTE: From interworking between MAP and BSSMAP point of view.

The handover procedure is normally triggered by BSS-A by sending a HANDOVER REQUIRED message on A-Interface to MSC-A. The invocation of the Basic Inter-MSC handover procedure is performed and controlled by MSC-A. The sending of the MAP Prepare-Handover request to MSC-B is triggered in MSC-A upon receipt of the HANDOVER REQUIRED message. For compatibility reason, the cell identity of the cell where the call is to be handed over in MSC-B area, provided in the HANDOVER REQUIRED message, is mapped into targetCellId MAP parameter and the HANDOVER REQUEST message is encapsulated in the AN-APDU MAP parameter of the Prepare-Handover MAP request. MSC-B can invoke another operation towards the VLR-B (allocation of the handover number described in 3GPP TS 29.002 [9]).

Additionally, if tracing activity has been invoked, the trace related messages can be transferred on the E-Interface encapsulated in the AN-APDU MAP parameter of the Prepare-Handover Request. If transferred, one complete trace related message at a time shall be included in the AN-APDU MAP parameter after the HANDOVER REQUEST message.

The interworking between Prepare Handover and HANDOVER REQUIRED is as follows:

```
-------------------------------------------------------------------------------
         |      48.008                         29.002            | Notes
---------|------------------------------------------------------|------
Forward  | HANDOVER REQUIRED    MAP PREPARE HANDOVER request     |
message  |                                                      |
         |                          -ho-NumberNotRequired|   1
         |    BSSMAP information     -targetCellId               |
         |           elements       -AN-APDU(                    |   2
         |                            HANDOVER REQUEST,           |
         |                            BSC INVOKE TRACE            |   3
         |                       or MSC INVOKE TRACE)             |
---------|------------------------------------------------------|------
Positive |                    MAP PREPARE HANDOVER response      |
result   |                                                      |   4
         |                          -handover number             |
         |                          -AN-APDU(                     |
         |                            QUEUING INDICATION          |
         |                            or HANDOVER REQUEST         |
         |                            ACKNOWLEDGE or              |
         |                            HANDOVER FAILURE)           |
---------|------------------------------------------------------|------
Negative | HANDOVER REQUIRED REJECT   MAP PREPARE HANDOVER       |   5
result   |                                                      |
         | equipment failure         System Failure              |
         | equipment failure         No Handover Number          |
         |                              available                 |
         | equipment failure         UnexpectedDataValue          |
         | equipment failure         Data Missing                 |
         |                                                       |
         | equipment failure         MAP CLOSE                    |
         | equipment failure         MAP U/P -ABORT               |
         |                                                       |
-------------------------------------------------------------------------------
```

NOTE 1: The ho-NumberNotRequired parameter is included by MSC-A, when MSC-A decides not to use any circuit connection with MSC-B. No handover number shall be present in the positive result. Any negative response from MSC-B shall not be due to handover number allocation problem.

NOTE 2: The process performed on the BSSMAP information elements received in the HANDOVER REQUIRED message is described in the GSM Recommendation 48.008.

NOTE 3: The process performed on the BSSMAP information elements received in the MSC or BSC INVOKE TRACE message is described in clause 4.5.6.6.

NOTE 4: The response to the Prepare-Handover request can include in its AN-APDU parameter, identifying the GSM-08.06 protocol, either a BSSMAP QUEUING INDICATION, or a BSSMAP HANDOVER REQUEST ACKNOWLEDGE or a BSSMAP HANDOVER FAILURE.

In the first case, MSC-A shall wait for the radio resources allocation response from MSC-B, transmitted to MSC-A as described in clause 4.5.4.

In the second case, the positive result triggers in MSC-A the sending on A-Interface of the HANDOVER COMMAND.

In the third case, the positive result triggers in MSC-A one of the following:

- another handover attempt is initiated by MSC-A;

- optionally the sending of the HANDOVER REQUIRED REJECT.

(The possible sending of the HANDOVER REQUIRED REJECT message upon receipt of the HANDOVER FAILURE is out of the scope of 3GPP TS 29.010 and lies in 3GPP TS 48.008 [12]).

NOTE 5: The possible sending of the HANDOVER REQUIRED REJECT message is described in 3GPP TS 48.008 [12].

The interworking between Send End Signal and HANDOVER COMPLETE in MSC-B is as follows:

```
-------------------------------------------------------------------------------
           |     48.008                          29.002            |Notes
-----------+-------------------------------------------------------+-----
Forward    | HANDOVER COMPLETE    MAP SEND END SIGNAL request      |
message    |                                                       |
           |                         -AN-APDU(                     |
           |                         HANDOVER COMPLETE)            |
-----------+-------------------------------------------------------+-----
Positive   | CLEAR COMMAND        MAP SEND END SIGNAL response     |
result     |  -Call Control release                                | 1
-----------+-------------------------------------------------------+-----
Negative   | CLEAR COMMAND                                         |
result     |  -Call Control release               MAP CLOSE        | 2
           |  -Call Control release               MAP U/P -ABORT   |
           |                                                       |
-------------------------------------------------------------------------------
```

NOTE 1: The positive empty result triggers the clearing of the Radio Resources on the A-Interface and the release of the SCCP connection between MSC-B and BSS-B. If a circuit connection is used between MSC-A and MSC-B, the 'Call Control release' clearing cause shall only be given to BSS-B when MSC-B has received a clearing indication on its circuit connection with MSC-A.

NOTE 2: The abortion of the dialogue or the rejection of the component triggers in MSC-B the clearing of its circuit connection with MSC-A, if any, of the Radio Resources on the A-Interface and the release of the SCCP connection between MSC-B and BSS-B.

The interworking between Send End Signal and CLEAR COMMAND in MSC-A is as follows:

```
-------------------------------------------------------------------------------
           |     29.002                          48.008            |Notes
-----------+-------------------------------------------------------+-----
Forward    | MAP SEND END SIGNAL              CLEAR COMMAND        |
message    | response                                              |
           |                                                       |
           |         -AN-APDU(               - Handover            |
           |         HANDOVER COMPLETE)          Successful        |
-----------+-------------------------------------------------------+-----
Positive   |                                                       |
result     |                                                       |
-----------+-------------------------------------------------------+-----
Negative   |                                                       |
result     |                                                       |
-------------------------------------------------------------------------------
```

The interworking between HANDOVER FAILURE in case of reversion to old channel of the MS and User Abort in MSC-A is as follows:

```
-------------------------------------------------------------------------------
           |     48.008                          29.002            |Notes
-----------+-------------------------------------------------------+-----
Forward    | HANDOVER FAILURE                 MAP U -ABORT         |
message    |                                                       |
           |  - Reversion to old                                   |
           |    channel                                            |
-----------+-------------------------------------------------------+-----
Positive   |                                                       |
result     |                                                       |
-----------+-------------------------------------------------------+-----
Negative   |                                                       |
result     |                                                       |
-------------------------------------------------------------------------------
```

4.5.2   Subsequent Inter-MSC Handover back to MSC-A

When a Mobile Station is being handed over back to MSC-A, the procedure (described in 3GPP TS 23.009 [2]) requires interworking between A-Interface and E-Interface.

The signalling at initiation, execution and completion of the Subsequent Inter-MSC handover procedure is shown in figures 11 to 15.

```
BSS-A            MSC-B                          MSC-A
|                 |                              |
|HANDOVER         |                              |
|---------------->|MAP PREPARE SUBSEQUENT        |
|REQUIRED         |---------------------------->|
|                 |HANDOVER request             |
|                 |                              |
|                 |                              |                     BSS-B
|                 |                              |HANDOVER REQUEST       |
|                 |                              |---------------------->|
|                 |                              |                       |
```
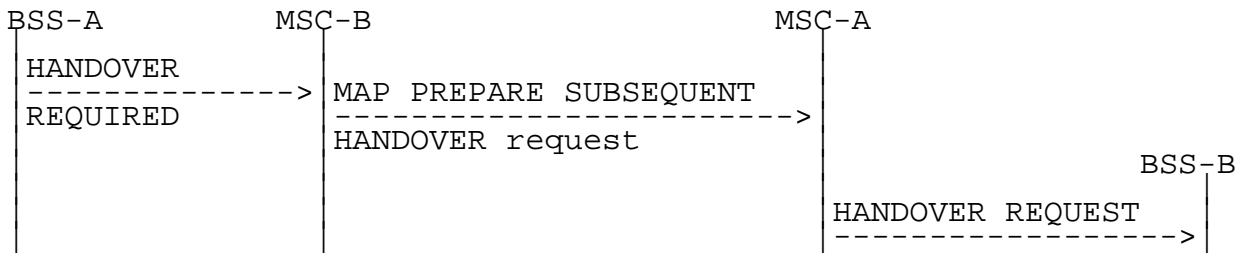
Figure 11: Signalling for Subsequent Inter-MSC Handover back to MSC-A initiation

Possible Positive outcomes:

   a) successful radio resources allocation:

```
BSS-A            MSC-B                          MSC-A                  BSS-B
|                 |                              |                       |
|                 |                              |HANDOVER REQUEST       |
|                 |                              |<----------------------|
|                 |                              |ACKNOWLEDGE            |
|                 |       MAP PREPARE SUBSEQUENT |                       |
|                 |<-----------------------------|                       |
|                 |       HANDOVER response      |                       |
|HANDOVER COMMAND |                              |                       |
|<----------------|                              |                       |
```

   b) radio resources allocation queued. Later successful radio resources allocation indication:

```
BSS-A            MSC-B                          MSC-A                  BSS-B
|                 |                              |QUEUING INDICATION     |
|                 |                              |<----------------------|
|                 |       MAP PREPARE SUBSEQUENT |                       |
|                 |<-----------------------------|                       |
|                 |       HANDOVER response      |                       |
|                 |                              |HANDOVER REQUEST       |
|                 |                              |<----------------------|
|                 |                              |ACKNOWLEDGE            |
|                 |       MAP FORWARD ACCESS     |                       |
|                 |<-----------------------------|                       |
|                 |       SIGNALLING request     |                       |
|HANDOVER COMMAND |                              |                       |
|<----------------|                              |                       |
```
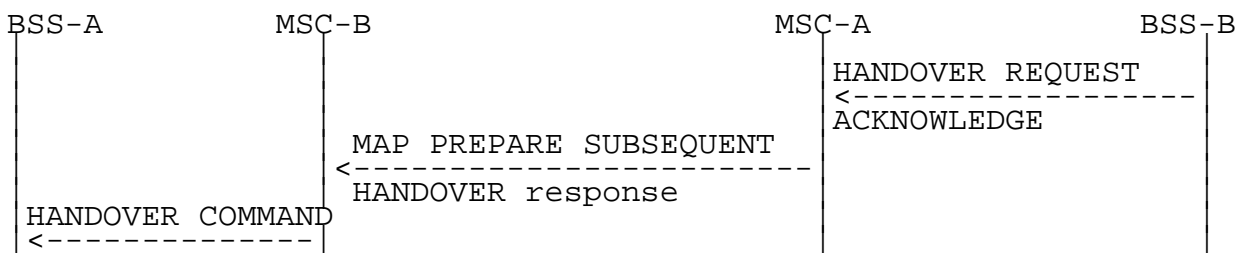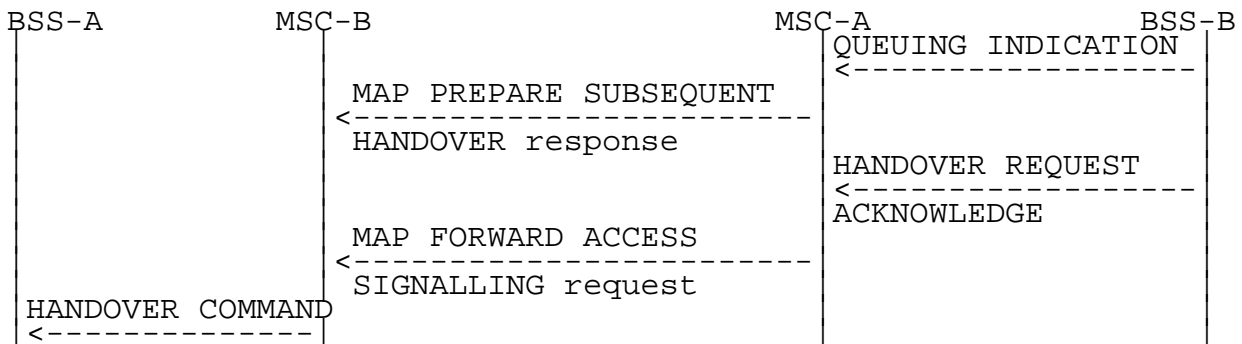
Figure 12: Signalling for Subsequent Inter-MSC Handover back to MSC-A execution (Positive outcome)

Possible Negative outcomes:

   c) user error detected, or component rejection or dialogue abortion performed by MSC-A:

```
BSS-A            MSC-B                          MSC-A                  BSS-B
|                 |MAP PREPARE SUBSEQUENT HANDOVER|                       |
|                 |<-----------------------------|                       |
|HANDOVER REQUIRED|  response negative result    |                       |
|<----------------|                              |                       |
|REJECT (Note 1)  |                              |                       |
|                 |                              |                       |
```

   d) component rejection or dialogue abortion performed by MSC-A:

```
BSS-A              MSC-B                              MSC-A              BSS-B
 |                  |  MAP CLOSE, MAP U/P ABORT        |                  |
 |                  |<------------------------         |                  |
 | CLEAR COMMAND    |                                  |                  |
 |<-------------    |                                  |                  |
 |                  |                                  |                  |
```

e) radio resources allocation failure:

```
BSS-A              MSC-B                              MSC-A              BSS-B
 |                  |                                  |  HANDOVER FAILURE |
 |                  |                                  |<----------------- |
 |                  |  MAP PREPARE SUBSEQUENT          |                  |
 |                  |<------------------------         |                  |
 | HANDOVER REQUIRED   HANDOVER response               |                  |
 |<-------------    |                                  |                  |
 | REJECT (Note 1)  |                                  |                  |
```

f) radio resources allocation queued. Later unsuccessful radio resources allocation:

```
BSS-A              MSC-B                              MSC-A              BSS-B
 |                  |                                  |  QUEUING INDICATION|
 |                  |                                  |<----------------- |
 |                  |  MAP PREPARE SUBSEQUENT          |                  |
 |                  |<------------------------         |                  |
 |                  |     HANDOVER response            |                  |
 |                  |                                  |  HANDOVER FAILURE |
 |                  |                                  |<----------------- |
 |                  |  MAP FORWARD ACCESS              |                  |
 |                  |<------------------------         |                  |
 | HANDOVER REQUIRED   SIGNALLING request              |                  |
 |<-------------    |                                  |                  |
 | REJECT (Note 1)  |                                  |                  |
```
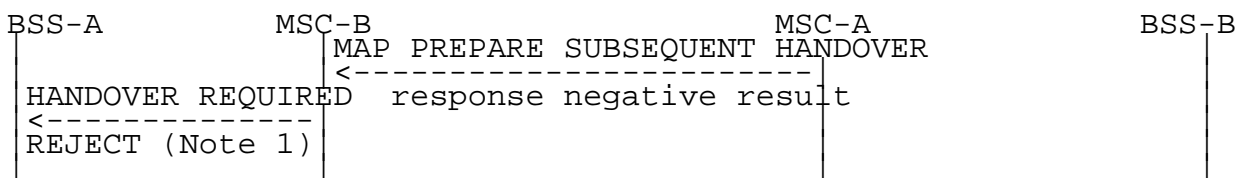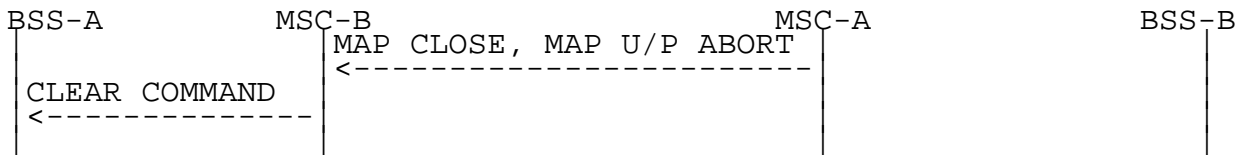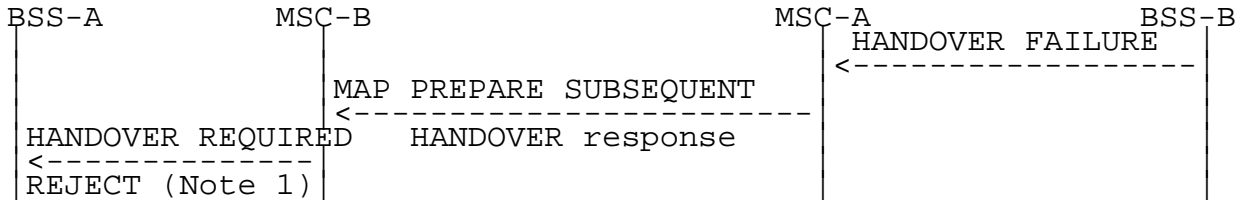
**Figure 13: Signalling for Subsequent Inter-MSC Handover back to MSC-A execution
(Negative outcome)**

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or BSSMAP procedure.

```
BSS-B              MSC-A                              MSC-B              BSS-A
 | HANDOVER         |                                  |                  |
 |--------------->  | MAP SEND END SIGNAL              |                  |
 | COMPLETE         |------------------------->        |                  |
 |                  |     response                     |                  |
 |                  |                                  | CLEAR COMMAND    |
 |                  |                                  |----------------->|
```
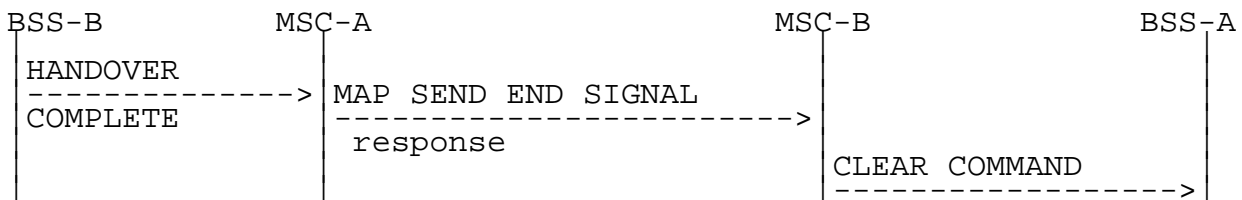
**Figure 14: Signalling for Subsequent Inter-MSC Handover back to MSC-A completion
(Successful completion of the procedure)**

NOTE: Positive outcome case shown in figure 9.

```
BSS-B              MSC-A                              MSC-B              BSS-A
 | HANDOVER         |                                  |                  |
 |--------------->  | MAP SEND END SIGNAL              |                  |
 | COMPLETE         |------------------------->        |                  |
 |                  |  response                        |                  |
 |                  | MAP U/P -ABORT                   |                  |
 |                  |<------------------------         |                  |
 |                  |                                  | CLEAR COMMAND    |
 |                  |                                  |----------------->|
 |                  |                                  | (Note 1)         |
```
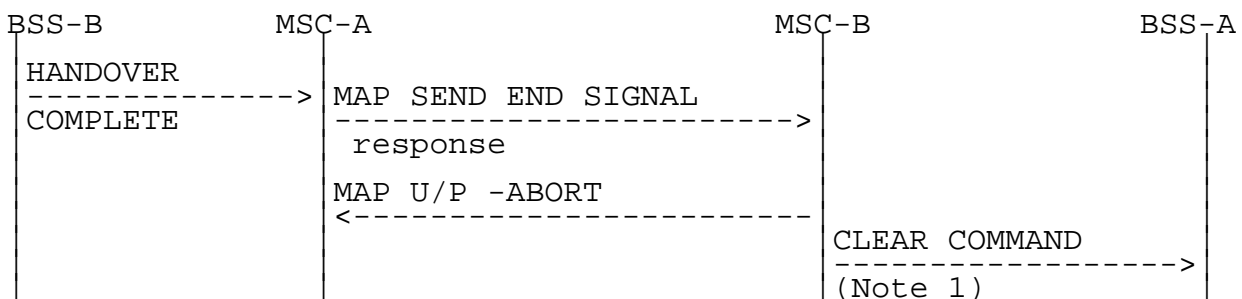
**Figure 15: Signalling for Subsequent Inter-MSC Handover back to MSC-A completion (Unsuccessful
completion of the procedure)**

NOTE 1: Abnormal end of the procedure which triggers the clearing of all resources in MSC-B.

The interworking between Prepare Subsequent Handover and HANDOVER REQUIRED is as follows:

```
----------------------------------------------------------------------
         |        48.008                           29.002         | Notes
----------------------------------------------------------------------
Forward  | HANDOVER REQUIRED MAP PREPARE SUBSEQUENT HANDOVER      |
message  |                                   request             |   1
         |
         |                                  -target MSC number
         |   BSSMAP information             -targetCellId
         |         elements                -AN-APDU(
         |                                   HANDOVER REQUEST)
----------------------------------------------------------------------
Positive | HANDOVER REQUIRED MAP PREPARE SUBSEQUENT HANDOVER      |
result   |                                   response            |   2
         |                                  -AN-APDU(
         |                                   QUEUING INDICATION
         |                                   or HANDOVER REQUEST
         |                                   ACKNOWLEDGE or
         |                                   HANDOVER FAILURE)
----------------------------------------------------------------------
Negative | HANDOVER REQUIRED REJECT   MAP PREPARE SUBSEQUENT      |   3
result   |                              HANDOVER response         |
         |   equipment failure          Unknown MSC
         |   equipment failure          Subsequent Handover
         |                                        Failure
         |   equipment failure          UnexpectedDataValue
         |   equipment failure          Data Missing
         |
         |   CLEAR COMMAND
         |
         |   equipment failure          MAP CLOSE
         |   equipment failure          MAP U/P -ABORT
         |
----------------------------------------------------------------------
```

NOTE 1:   The processing performed on the BSSMAP information elements received in the HANDOVER REQUIRED message is out of the scope of the present document. The target MSC number is provided to MSC-A by MSC-B based on the information received from BSS-B.

NOTE 2:   The response to the Prepare-Subsequent-Handover request can include in its AN-APDU parameter, identifying the GSM-0806 protocol, either a BSSMAP QUEUING INDICATION, or a BSSMAP HANDOVER REQUEST ACKNOWLEDGE or a BSSMAP HANDOVER FAILURE.

In the first case, MSC-B shall wait for the radio resources allocation response from MSC-A, transmitted to MSC-B as described in clause 4.5.4.

In the second case, the positive result triggers in MSC-B the sending on A-Interface of the HANDOVER COMMAND.

In the third case, the positive result triggers in MSC-B one of the following:

- another handover attempt is initiated by MSC-B;

- optionally the sending of the HANDOVER REQUIRED REJECT.

(The possible sending of the HANDOVER REQUIRED REJECT message upon receipt of the HANDOVER FAILURE is out of the scope of 3GPP TS 29.010 and lies in 3GPP TS 48.008 [12]).

NOTE 3:   The possible sending of the HANDOVER REQUIRED REJECT message is described in 3GPP TS 48.008 [12].

The interworking between Send End Signal Result and HANDOVER COMPLETE in MSC-A is as follows:

```
-----------------------------------------------------------------
              |    48.008                        29.002          |Notes
              |-----------------------------------------------------------
Forward       | HANDOVER COMPLETE    MAP SEND END SIGNAL         |
message       |                             response             |
              |                                                  |
              |-----------------------------------------------------------
Positive      |                                                  |
result        |                                                  |
              |-----------------------------------------------------------
Negative      |                                                  |
result        |                     MAP U/P -ABORT               |  1
              |                                                  |
-----------------------------------------------------------------
```

NOTE 1: The abortion of the dialogue ends the handover procedure with MSC-B.

4.5.3   Subsequent Inter-MSC Handover to third MSC

When a Mobile Station is being handed over to a third MSC, the procedure (described in 3GPP TS 23.009 [2]) does require one specific interworking case in MSC-A (figure 20) between E-Interface from MSC-B and E-Interface from MSC-B' other than the combination of the ones described in the clause 4.5.1 and 4.5.2.

```
BSS-A        MSC-B                       MSC-A                   MSC-B'
 |            |                           |                       |
 | HANDOVER   |                           |                       |
 |----------->| MAP PREPARE SUSEQUENT     |                       |
 | REQUIRED   |------------------------->|                        |
 |            | HANDOVER request          | MAP PREPARE           |
 |            |                           |--------------->        |
 |            |                           | HANDOVER request       |
 |            |                           |              +-------+ |
 |            |                           |              |Possib.| |
 |            |                           |              |Alloc. | |
 |            |                           |              |of ho. | |
 |            |                           |              |number | |
 |            |                           |              | VLR-B | |
 |            |                           |              +-------+ |
 |            |                           |                 BSS-B' |
 |            |                           |              HANDOVER  |
 |            |                           |              --------> |
 |            |                           |              REQUEST   |
 |            |                           |                        |
```
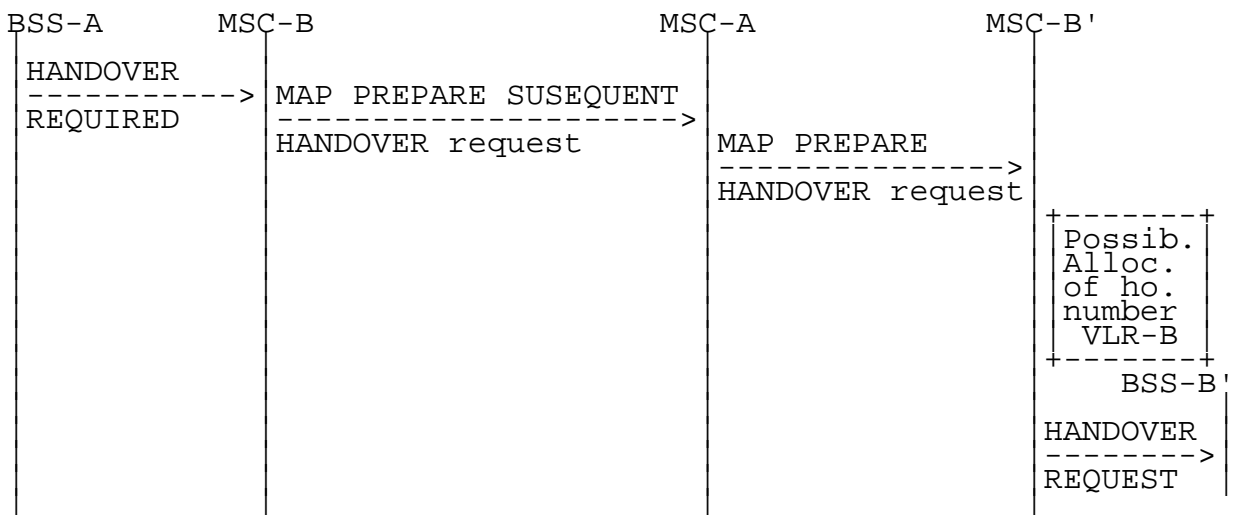
Figure 16: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') initiation

Possible Positive outcomes:

    a) successful radio resources allocation:

```
BSS-A        MSC-B                       MSC-A                   MSC-B'
 |            |                           |                       |
 |            |                           |                BSS-B' |
 |            |                           |              HANDOVER |
 |            |                           |              <------- |
 |            |                           |              REQUEST  |
 |            |                           |             ACKNOWLEDGE
 |            |                           | MAP PREPARE HANDOVER  |
 |            |                           |<--------------        |
 |            | MAP PREPARE SUBSEQUENT    |    response           |
 |            |<----------------------    |                       |
 |            | HANDOVER response          |                       |
 | HANDOVER   |                           |                       |
 |<-----------|                           |                       |
 | COMMAND    |                           |                       |
 |            |                           |                       |
```

    b) radio resources allocation queued and successful handover number allocation, if performed. Later successful radio resources allocation indication:

```
BSS-A          MSC-B                      MSC-A              MSC-B'
 |              |                          |                  |
 |              |                          |                  |    BSS-B'
 |              |                          |                  |
 |              |                          |                  | QUEUING
 |              |                          |                  |<--------
 |              |                          |                  | INDICAT.
 |              |                          |                  |
 |              |                          | MAP PREPARE HANDOVER
 |              |                          |<---------------  |
 |              | MAP PREPARE SUBSEQUENT   |    response      |
 |              |<---------------------    |                  |
 |              | HANDOVER response        |                  |
 |              |                          |                  | HANDOVER
 |              |                          |                  |<--------
 |              |                          |                  | REQUEST
 |              |                          |                  | ACKNOWLEDGE
 |              |                          | MAP PROCESS ACCESS
 |              |                          |<---------------  |
 |              | MAP FORWARD ACCESS       | SIGNALLING request
 |              |<---------------------    |                  |
 |              | SIGNALLING request       |                  |
 | HANDOVER     |                          |                  |
 |<-----------  |                          |                  |
 | COMMAND      |                          |                  |
```
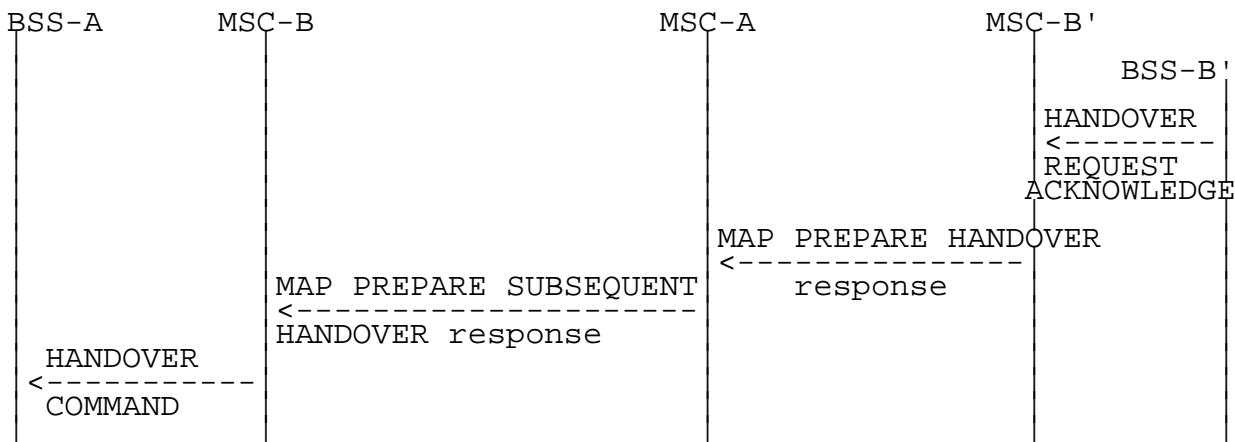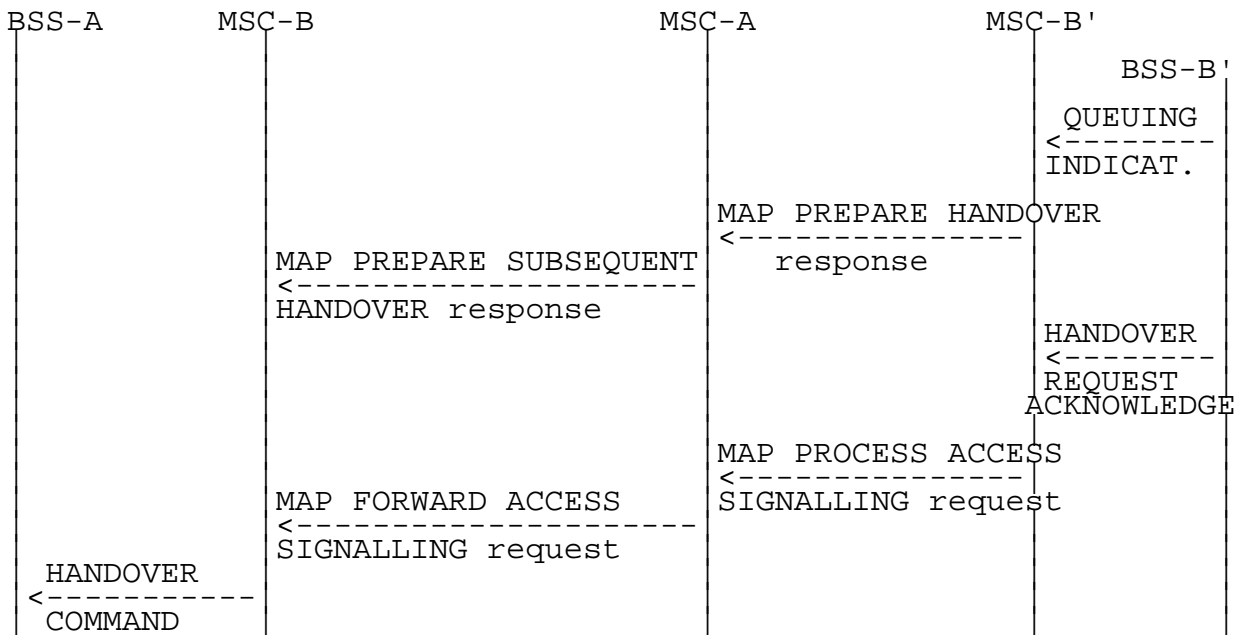
**Figure 17: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') execution
(Positive outcome)**

Possible Negative outcomes:

   c) user error detected, or component rejection or dialogue abortion performed by MSC-B':

```
BSS-A          MSC-B                      MSC-A              MSC-B'
 |              |                          |                  |
 |              |                          |                  |    BSS-B'
 |              |                          | MAP PREPARE HANDOVER
 |              |                          | response negative result
 |              |                          | MAP CLOSE        |
 |              |                          |<---------------  |
 |              |                          | MAP U/P -ABORT   |
 |              | MAP PREPARE SUBSEQUENT   |                  |
 |              |<---------------------    |                  |
 |              | HANDOVER response negative                 |
 | HANDOVER     | result                   |                  |
 |<-----------  |                          |                  |
 | REQUIRED     |                          |                  |
 | REJECT       |                          |                  |
 | (Note 1)     |                          |                  |
```

   d) radio resources allocation failure:

```
BSS-A          MSC-B                              MSC-A              MSC-B'
 |               |                                  |                   |
 |               |                                  |                  BSS-B'
 |               |                                  |                   |
 |               |                                  |         HANDOVER  |
 |               |                                  |         <--------
 |               |                                  |         FAILURE
 |               |                                  |  MAP PREPARE HANDOVER
 |               |                                  |  <---------------
 |               |  MAP PREPARE SUBSEQUENT          |   response
 |               |  <----------------------         |
 |               |  HANDOVER response               |
 |   HANDOVER    |                                  |                   |
 |  <----------- |                                  |                   |
 |   REQUIRED    |                                  |                   |
 |   REJECT      |                                  |                   |
 |   (Note 1)    |                                  |                   |
```

e) radio resources allocation queued and successful handover number allocation (if performed). Later unsuccessful radio resources allocation:

```
BSS-A          MSC-B                              MSC-A              MSC-B'
 |               |                                  |                   |
 |               |                                  |                  BSS-B'
 |               |                                  |                   |
 |               |                                  |          QUEUING  |
 |               |                                  |         <--------
 |               |                                  |         INDICAT.
 |               |                                  |  MAP PREPARE HANDOVER
 |               |                                  |  <---------------
 |               |  MAP PREPARE SUBSEQUENT          |   response
 |               |  <----------------------         |
 |               |  HANDOVER response               |
 |               |                                  |         HANDOVER  |
 |               |                                  |         <--------
 |               |                                  |         FAILURE
 |               |                                  |  MAP PROCESS ACCESS
 |               |                                  |  <---------------
 |               |  MAP FORWARD ACCESS              |  SIGNALLING request
 |               |  <----------------------         |
 |               |  SIGNALLING request              |
 |   HANDOVER    |                                  |                   |
 |  <----------- |                                  |                   |
 |   REQUIRED    |                                  |                   |
 |   REJECT      |                                  |                   |
 |   (Note 1)    |                                  |                   |
```
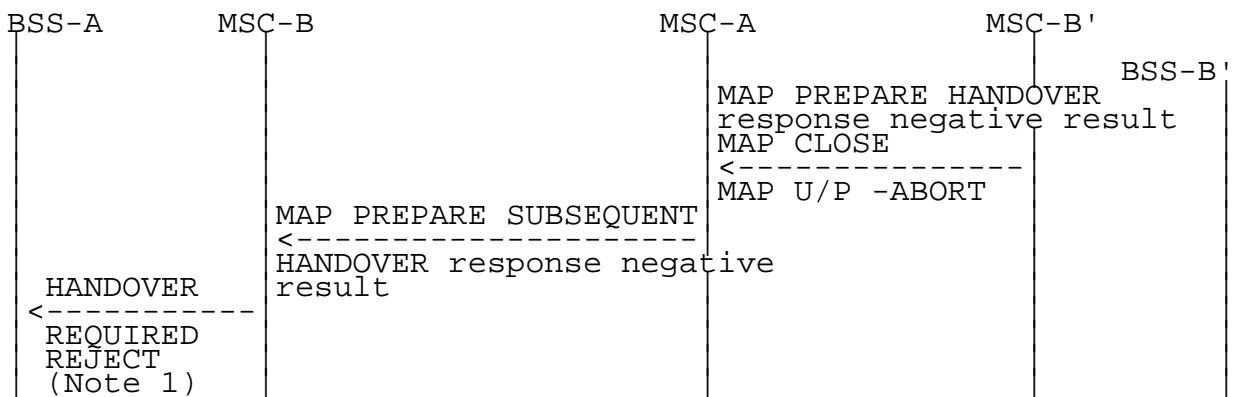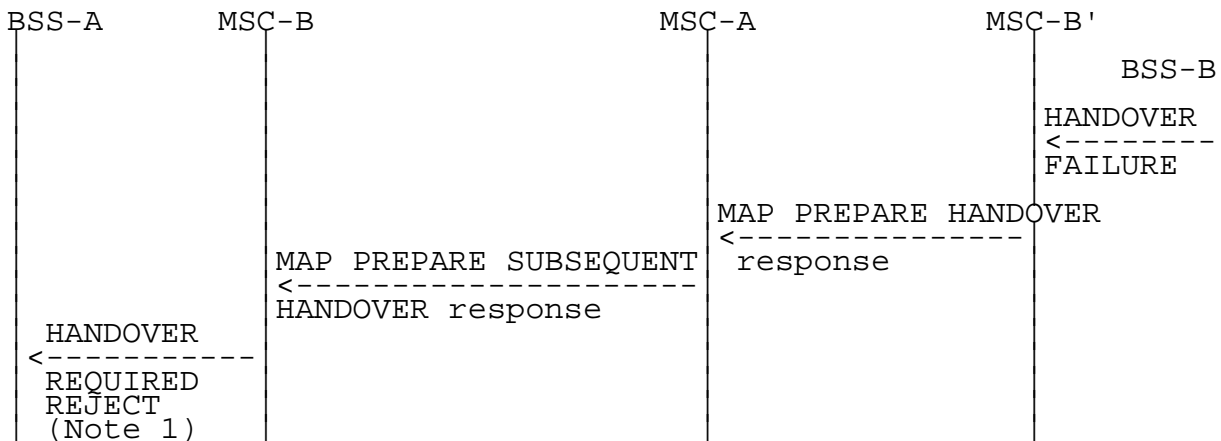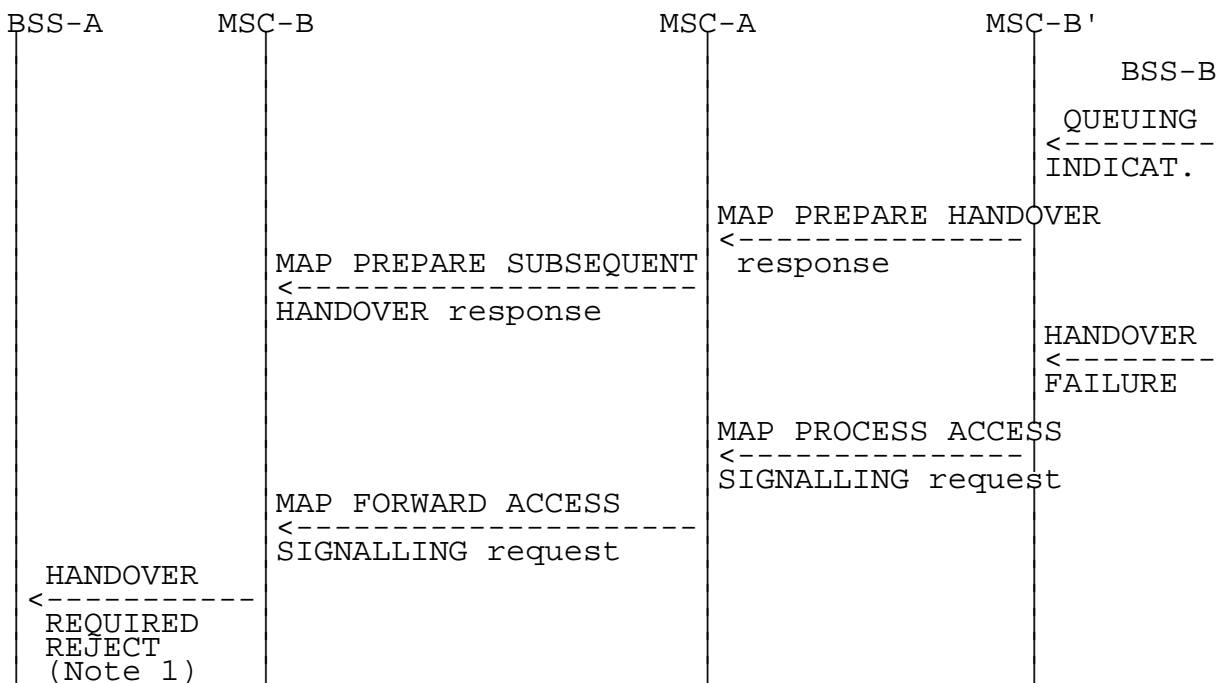
Figure 18: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') execution (Negative outcome)

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or BSSMAP procedure.

Positive outcome:

```
BSS-A         MSC-B                        MSC-A                    MSC-B'
  |             |                            |                        |
  |             |                            |                        |     BSS-B'
  |             |                            |                        |
  |             |                            |                        |   HANDOVER
  |             |                            |                        |   <--------
  |             |                            |                        |   COMPLETE
  |             |                            |   MAP SEND END SIGNAL   |
  |             |                            |   <------------------   |
  |             |   MAP SEND END SIGNAL      |                        |
  |             |   <---------------------   |                        |
  |             |   response                 |                        |
  |   CLEAR     |                            |                        |
  |   <-------- |                            |                        |
  |   COMMAND   |                            |                        |
  |             |                            |                        |
```
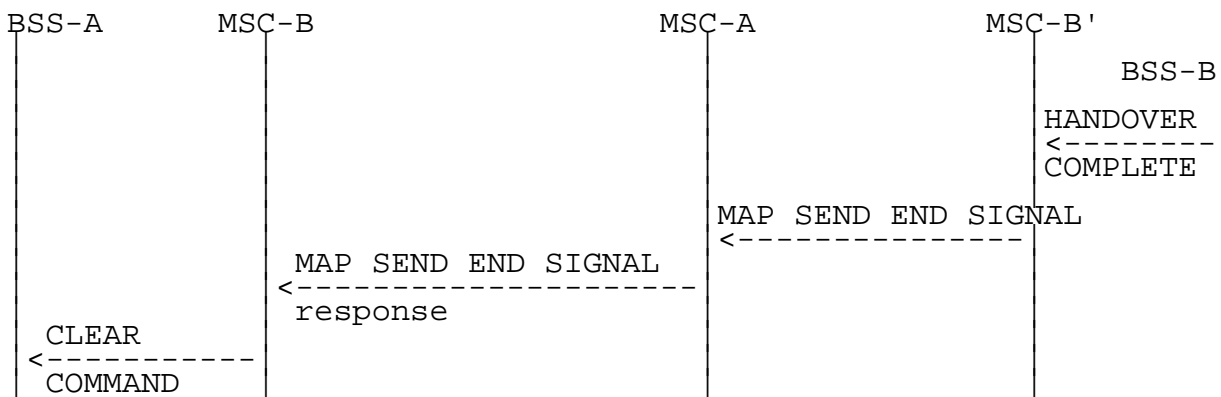
**Figure 19: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') completion
(Successful completion of the procedure)**

Negative outcome:

```
BSS-A         MSC-B                        MSC-A                    MSC-B'
  |             |                            |                        |
  | HANDOVER    |                            |                        |     BSS-B'
  | ----------> |                            |                        |
  | FAILURE     | MAP PROCESS ACCESS         |                        |
  |             | --------------------->     |                        |
  |             | SIGNALLING request (Note 1)|                        |
  |             |                            | MAP U -ABORT           |
  |             |                            | --------------->       |
  |             |                            |                        | CLEAR
  |             |                            |                        | -------->
  |             |                            |                        | COMMAND
  |             |                            |                        |
```

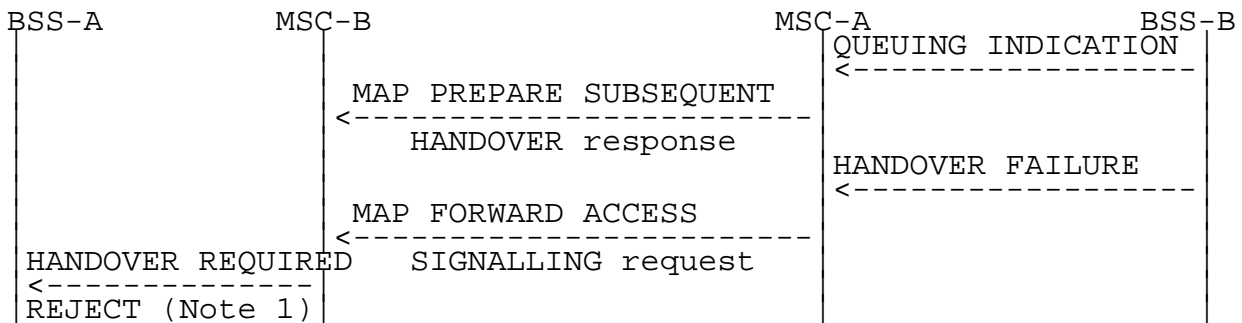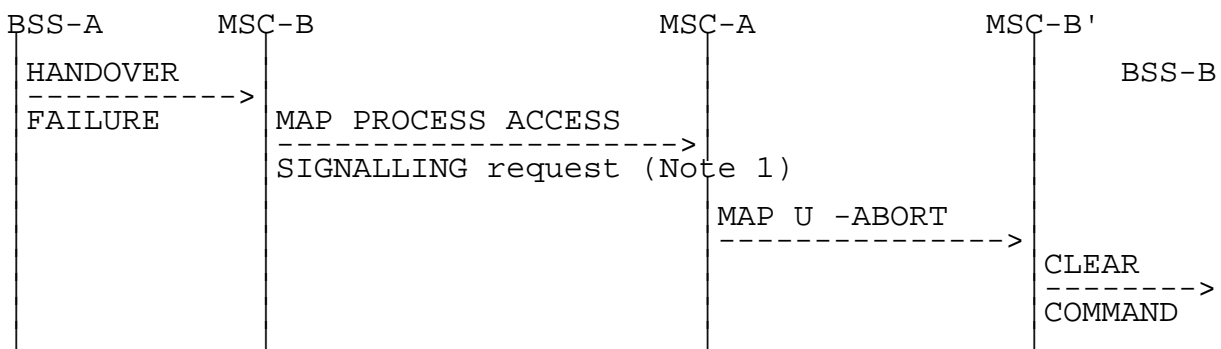**Figure 20: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') completion
(Unsuccessful completion of the procedure)**

NOTE 1: Specific interworking case detailed below.

The specific interworking case in MSC-A compared to the clauses 4.5.1 and 4.5.2 occurs between HANDOVER
FAILURE encapsulated in a Process Access Signalling from MSC-B and the abortion of the dialogue with MSC-B' in
the case of a reversion to old channel of the MS:

```
-----------------------------------------------------------------------------
            |   29.002                          29.002          | Notes
-----------------------------------------------------------------------------
Forward     | MAP PROCESS-SIGNALLING                            |
message     |         request                                  |
            |                                                  |
            |     -AN-APDU(             MAP U -ABORT            |   1
            |      HANDOVER FAILURE)                            |
            |                                                  |
-----------------------------------------------------------------------------
Positive    |                                                  |
result      |                                                  |
-----------------------------------------------------------------------------
Negative    |                                                  |
result      |                          MAP U/P -ABORT          |   2
-----------------------------------------------------------------------------
```

NOTE 1: The abortion of the dialogue triggers in MSC-B' the clearing of the circuit connection with MSC-A, if
any, and of the Resources between MSC-B' and BSS-B'.The abortion of the dialogue ends the handover
procedure with MSC-B'.

NOTE 2: The abortion of the dialogue ends the handover procedure with MSC-B.

4.5.4 BSSAP Messages transfer on E-Interface

The following mapping applies to the encapsulation performed in MSC-A.

```
--------------------------------------------------------------------------
                |       24.008/48.008                   29.002       | Notes
----------------+-----------------------------------------------------------
Forward         | BSSAP messages        MAP FORWARD ACCESS SIGNALLING|
message         |                              request               |   1
                |                                                     |
                |                       -AN-APDU (BSSAP messages)     |
----------------+-----------------------------------------------------+-----
Positive        |                                                     |
result          |                                                     |   2
----------------+-----------------------------------------------------+-----
Negative        |                                                     |
result          |                                                     |
                |                                   MAP CLOSE         |
                |                                   MAP U/P -ABORT     |
--------------------------------------------------------------------------
```

NOTE 1: Complete BSSAP messages to be sent on MSC-B - BSS-B interface (BSSMAP or DTAP messages) are embedded into the AN-APDU parameter (see clause 6 of 3GPP TS 49.008 [14] [14] for the description of the set of BSSMAP messages).

NOTE 2: The Return Result does not apply. If MSC-B returns a message, this message will arrive in an Invoke: Process Access Signalling.

The following mapping applies to the encapsulation performed in MSC-B.

```
--------------------------------------------------------------------------
                |       24.008/48.008                   29.002       | Notes
----------------+-----------------------------------------------------------
Forward         | BSSAP messages        MAP PROCESS ACCESS SIGNALLING|
message         |                              request               |   1
                |                                                     |
                |                       -AN-APDU (BSSAP messages)     |
----------------+-----------------------------------------------------+-----
Positive        |                                                     |
result          |                                                     |   2
----------------+-----------------------------------------------------+-----
Negative        |                                                     |
result          |                                   MAP CLOSE         |
                | CLEAR COMMAND                                       |
                |                                                     |
                | equipment failure                 MAP U/P -ABORT    |   3
--------------------------------------------------------------------------
```

NOTE 1: Complete BSSAP messages to be sent to MSC-A (BSSMAP or DTAP messages) are embedded into the AN-APDU parameter (see 3GPP TS 49.008 [14] for the description of the set of BSSMAP messages).

NOTE 2: The Return Result does not apply. If MSC-A returns a message, this message will arrive in an Invoke: Forward Access Signalling.

NOTE 3: The abortion of the dialogue triggers the clearing of the circuit connection with MSC-A, if any, of the Radio Resources on the A-Interface and the release of the SCCP connection between MSC-B and BSS-B. The clearing of the Radio Resources (the clearing indication received from BSS-B is transmitted to MSC-A) or the loss of the SCCP connection between MSC-B and BSS-B, triggers in MSC-B the abortion of the dialogue on the E-Interface and the clearing of the circuit connection with MSC-A, if any.

4.5.5   Processing in MSC-B, and information transfer on E-interface

The following parameters require processing (e.g. to store the parameter, to internally generate the parameter) in MSC-B. The relevant BSSMAP procedures are mentioned to ease the comprehension, their detailed description is the scope of 3GPP TS 48.008 [12]. Each BSSMAP message listed in 3GPP TS 49.008 [14] being transferred on E-interface shall use the mechanisms given in clause 4.5.4 and is described in 3GPP TS 48.008 [12].

For intra-MSC-B handover/relocation and security interworking , after inter-MSC handover from GSM to GSM, the 3G_MSC-B needs additional information to be able to perform security mode and integrity protection procedures. These RANAP informations are transferred between MSC-A and 3G-MSC-B in MAP messages, defined in 3GPP TS 29.002 [9].

For subsequent handover/relocation, after inter-MSC handover from GSM to GSM, the 3G_MSC-B needs additional information to be able to perform service handover procedures. The relevant information is transferred between MSC-A and 3G-MSC-B in MAP messages, defined in 3GPP TS 29.002 [9].

For subsequent handover/relocation, after inter-MSC handover from GSM to GSM, the 3G_MSC-B needs additional information to be able to forward access rights information in the context of Shared Network to the RAN. The relevant information is transferred between MSC-A and 3G-MSC-B in MAP messages, defined in 3GPP TS 29.002 [9].

For intra-MSC-B handover after inter MSC handover, MSC-B needs additional information to be able to perform regional subscription checks and CSG subscription checks. The relevant information is transferred between MSC-A and MSC-B in MAP messages, defined in 3GPP TS 29.002 [9].

4.5.5.1   Encryption Information

A sequence of possible encryption algorithms can be sent to a BSS in Cipher Mode Command or Handover Request. The BSS chooses one of the listed algorithms and reports this back to the MSC in Cipher Mode Complete or Handover Request Acknowledge respectively.

MSC-B shall remove algorithms not allowed by MSC-B from the list of algorithms received from MSC-A before forwarding it to the BSS. The modified list of algorithms, the ciphering key and the chosen algorithm shall be stored by MSC-B, and the chosen value sent to MSC-A.

Transfer of Information:

>   If ciphering has not been performed before Inter-MSC Handover, this will be controlled by MSC-A after the completion of Inter-MSC Handover.

>   Ciphering control towards MSC-B:

>>   If Ciphering has been performed before Inter-MSC Handover:

>>   -   in the Handover Request BSSMAP message (information included).

>>   The Handover Request Acknowledge should in this case contain the indication of the chosen algorithm.

>>   If Ciphering has NOT been performed before Inter-MSC Handover:

>>   -   in the Cipher Mode Command procedure between MSC-A and MSC-B.

>   If the encryption algorithm is changed at an intra-BSS handover in BSS-B this must be reported to MSC-A in:

>   -   the BSSMAP Handover Performed procedure.

>   If the encryption algorithm is changed at an intra-MSC handover in MSC-B this must be reported to MSC-A in:

>   -   the BSSMAP Handover Performed procedure which shall be initiated by MSC-B on reception from BSS-B of the Handover Complete message (the information being previously received in the Handover Request Acknowledge message).

>>   Note also that the chosen encryption value may be contained in the BSSMAP Assignment Complete message. This may happen if the encryption value changes e.g. at a second assignment during a call (e.g. from TCH to SDCCH).

4.5.5.2   Channel Type

Assignment Request and Handover Request (BSSMAP) may give the BSS a choice, in the same way as the Encryption Algorithm above. Depending on the Channel Type Info, the chosen channel may have impact on subsequent handovers, internal in MSC-B and inter-MSC controlled by MSC-A. Some values in channel Type Info indicate that if a particular channel once has been chosen, the same type must be used for the rest of the call.

The Channel Type, and the characteristics of the chosen channel shall be stored by MSC-B, and the Chosen Channel and/or Speech Version information elements transferred to MSC-A.

Transfer of Information:

>   Independently of the type of resource (Signalling only (e.g. SDCCH) or TCH) assigned to the MS, the Channel Type Information is transferred to MSC-B in:

- the Handover Request BSSMAP message, and the Chosen Channel and/or Speech Version should be reported back to MSC-A in the Handover Request Acknowledge.

If a new type of resource is to be assigned after Inter-MSC Handover, this can be made with:

- the BSSMAP Assignment procedure between MSC-A and MSC-B (Chosen Channel and/or Speech Version in Assignment Complete).

If the Channel Type (the chosen channel and/or chosen speech version) is changed at an intra-BSS handover in BSS-B this must be reported to MSC-A in:

- the BSSMAP Handover Performed procedure.

If the Channel Type (the chosen channel or chosen speech version) is changed at an intra-MSC handover in MSC-B this must be reported to MSC-A in:

- the BSSMAP Handover Performed procedure which shall be initiated by MSC-B on reception from BSS-B of the Handover Complete message (the information being previously received in the Handover Request Acknowledge message).

4.5.5.3   Classmark

This information shall be stored by MSC-B and might be received either from MSC-A, or from the MS when the MS initiates a Classmark Update.

Transfer of Information due to Classmark received from MSC-A:

This information shall be stored by MSC-B and is received:

- in the Handover Request BSSMAP message.

If a new type of resource is to be assigned after Inter-MSC Handover, Classmark Information MAY be included:

- in the BSSMAP Assignment procedure.

Transfer of Information, due to "Classmark Signalling Procedures".

This information shall be stored by MSC-B and can be received:

- Due to a classmark update, either requested from MSC-A (Classmark Request, Classmark Update), or an MS-Initiated Classmark Update.

This can be carried out either with:

- the BSSMAP Classmark procedure(s).

Apart from these cases there is the "odd" case where a Classmark Update can be received during an Inter-MSC Handover by MSC-B, i.e. before the MS has moved to the new channel controlled by MSC-B. This can be made with transparent transfer of BSSMAP Classmark Update.

4.5.5.4   Downlink DTX-Flag

The parameter shall be stored by MSC-B to be used at internal Handover in MSC-B.

Transfer of Information:

Received by MSC-B from MSC-A in either:

If the MS has already been assigned to a TCH for speech before the Inter-MSC Handover, the DTX-flag should be sent in:

- the Handover Request BSSMAP message;

  (if the type of resource is not TCH for speech, the DTX-flag shall not be included).

If a new assignment to a TCH for speech after an Inter-MSC Handover is to be performed, this can be made with:

- the BSSMAP Assignment procedure.

4.5.5.5   Priority

The parameter shall be stored by MSC-B and is received according to below:

Transfer of Information:

Received by MSC-B from MSC-A in:

- the Handover Request BSSMAP message.

If a change is needed after an Inter-MSC Handover with:

- the BSSMAP Assignment procedure.

4.5.5.6   MSC/BSC-Invoke Trace Information Elements

The process to be performed by MSC-B on the information elements of the MSC or BSC Invoke Trace BSSMAP messages is left for further study.

4.5.5.7   LSA Identifier List

The parameter shall be stored by MSC-B and is received according to below:

Transfer of Information:

Received by MSC-B from MSC-A in:

- the Handover Request BSSMAP message.

If a change is needed after an Inter-MSC Handover with:

- the LSA Information BSSMAP message.

4.5.5.8   Selected UMTS Algorithm

After inter-MSC handover, the 3G_MSC-B can perform intra-MSC GSM to UMTS handover. A sequence of possible encryption and integrity protection algorithms, received from the 3G_MSC-A, can be sent to an RNS in Relocation Request or in Security Mode Command in case of cipher mode setting after intra.MSC-B handover from GSM to UMTS. The RNS chooses one of the listed algorithms and reports this back to the 3G_MSC in Relocation Request Acknowledge or Security Mode Complete respectively. The MSC-B provides the Selected UMTS algorithm information to the MSC-A. The Selected UMTS algorithms IE in the MAP Process Access Signalling Request message refers to the Chosen Integrity Protection Algorithm and Chosen Encryption Algorithm, defined in RANAP specification 3GPP TS 25.413 [7]

The selected algorithm shall be stored by 3G_MSC-B, and sent to 3G_MSC-A.

Transfer of Information:

- If ciphering has not been performed before Inter-MSC Handover, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Handover and possibly after intra-MSC-B handover from GSM to UMTS. In both cases Selected UMTS algorithm information is received by 3G_MSC-A from 3G_MSC-B in:

    - The Process Access Signalling Request MAP message.

4.5.5.9   Allowed UMTS Algorithms

In case of GSM-subscriber, the Integrity Protection Information and UMTS Encryption Information are not transferred to the MSC-B during inter-MSC handover. Allowed UMTS algorithms is UMTS information that is required in

RANAP Relocation Request and RANAP Security Mode Command, and shall be provided by 3G_MSC-A. 3G_MSC-B needs this information in case of an intra-MSC GSM to UMTS handover and in subsequent security mode setting, after an inter-MSC handover. Therefore 3G_MSC-A must provide this information in case of an inter-MSC GSM to GSM handover. The Allowed UMTS algorithms IE in the MAP Prepare Handover and in the MAP Forward Access Signalling Request messages refers to the Permitted Integrity Protection Algorithms in Integrity Protection Information and Permitted Encryption Algorithms in Encryption Information, defined in RANAP specification 3GPP TS 25.413 [7].

Allowed UMTS algorithms shall be stored by 3G_MSC-B.

Transfer of information:

> If ciphering has not been performed before Inter-MSC Handover, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Handover.

> Ciphering control towards 3G_MSC-B:

> If Ciphering has been performed before Inter-MSC Handover:

> - The Prepare Handover Request MAP message.

> If Ciphering has NOT been performed before Inter-MSC Handover:

> - The Forward Access Signalling Request MAP message.

4.5.5.10   BSSMAP Service Handover

This information shall be stored by 3G_MSC-B and sent to a BSS in Handover Request, when 3G_MSC-B performs handover to GSM.

Transfer of information:

> - The BSSMAP Service Handover information is transferred to 3G_MSC-B in:

>> - the Handover Request BSSMAP message.

> If a new assignment of a TCH after an inter-MSC handover is to be performed, the BSSMAP Service Handover information is transferred to 3G_MSC-B in:

>> - the BSSMAP Assignment procedure.

4.5.5.11   RANAP Service Handover

This information shall be stored by 3G_MSC-B and sent to an RNS in Relocation Request, when 3G_MSC-B performs relocation or handover to UMTS.

Transfer of information:

> - The RANAP Service Handover information is transferred to 3G_MSC-B in:

>> - the Prepare Handover Request MAP message.

> If a new assignment of a Radio Access Bearer after an inter-MSC handover is to be performed, the information is transferred to 3G_MSC-B in:

>> - the Forward Access Signalling Request MAP message

>> and sent by 3G_MSC-B to the RNS in RAB Assignment Request.

4.5.5.12   SNA Access Information

This information shall be stored by 3G_MSC-B and sent to an RNS in the Relocation Request message when 3G_MSC-B performs handover to UMTS.

Transfer of information:

- The SNA Access Information is transferred to 3G_MSC-B in:

    - the Handover Request BSSMAP message.

4.5.5.13   UESBI

This information shall be stored by 3G_MSC-B and sent to an RNS in Relocation Request, when 3G_MSC-B performs relocation or handover to UMTS.

Transfer of information:

    The UESBI information is transferred to 3G_MSC-B in:

    - the Prepare Handover Request MAP message.

4.5.5.14   Alternative Channel Type

This information shall be stored by 3G_MSC-B and from this information 3G_MSC-B shall generate Alternative RAB Parameters Value IE sent to an RNS in Relocation Request, when 3G_MSC-B performs relocation or handover to UMTS.

Transfer of information:

- The Alternative Channel Type information is transferred to 3G_MSC-B in:

    - the Prepare Handover Request MAP message.

    If a new assignment of a Radio Access Bearer after an inter-MSC handover is to be performed, the information is transferred to 3G_MSC-B in:

    - the Forward Access Signalling Request MAP message.

4.5.5.15   Trace parameters

This information shall be stored by 3G_MSC-B and 3G_MSC-B shall use this information for trace activation for MSC-S, MGW, RNC or BSC.

Transfer of information:

- The Trace Parameter List information for MSC-S, MGW and RNC tracing is transferred to 3G_MSC-B in:

    - the Prepare Handover Request MAP message.

- The Trace Reference and Trace Type information for BSC tracing is transferred to 3G_MSC-B in:

    - the MSC Invoke Trace BSSMAP message.

4.5.6   Overview of the Technical Specifications GSM interworking for the Inter-MSC Handover

```
+-------------------------------------------------------------------------------+
| PSTN/ISDN                                                                     |
|                  ::::::::::::::::::::::::::::::::::::::::::::                   |
|                  ::::     +--------------+      ::::                           |
| ===============::::== |   =============   |   ===============                  |
| PLMN           ::::   V                   V                                    |
|              ::::                                                             |
|   ::::::::::::::::                                    :::::                     |
|   BSS-A           MSC-A            MSC-B           BSS-B           MS          |
|                                                                               |
|                  +-------+                        +-------+                    |
|                  |  C M  |       24.008 (Note)    |  C M  |                    |
|                  +-------+  <-------------------------->  +-------+            |
|                  |  M M  |                        |  M M  |                    |
|   +------+48.008 +-------+ 48.008+-------+ 48.008 +-------+ +-------+          |
|   | R R  |<----->|  R R  |<=====>|  R R  |<----->|  R R  | |  R R  |          |
|   +------+       +-------+ (Note)+-------+       +-------+ +-------+          |
|                   ^  ^             ^  ^                                        |
|                   |  |  29.010     |  |             Note: Subset of 48.008    |
|                   |  V             |  V                   procedures as described |
|                  +-----+ 29.002+-----+                    in the TS 3GPP TS 48.008. |
|                  |MAP/E|<----->|MAP/E|                                         |
|                  +-----+       +-----+            23.009                       |
|                                                                               |
|                   V                 V              Remark: The A-bis interface and |
|                  +-----------------------+                 the link layer        |
|                  |        T C A P        |                 protocols being out of |
|                  +-----------------------+                 the scope of this      |
|   +-----------------------------------------------+        Specification are not  |
|   |                  S C C P                      |        shown here.            |
|   +-----------------------------------------------+                             |
|   +-----------------------------------------------+                             |
|   |                  M T P                        |                             |
|   +-----------------------------------------------+                             |
+-------------------------------------------------------------------------------+
```
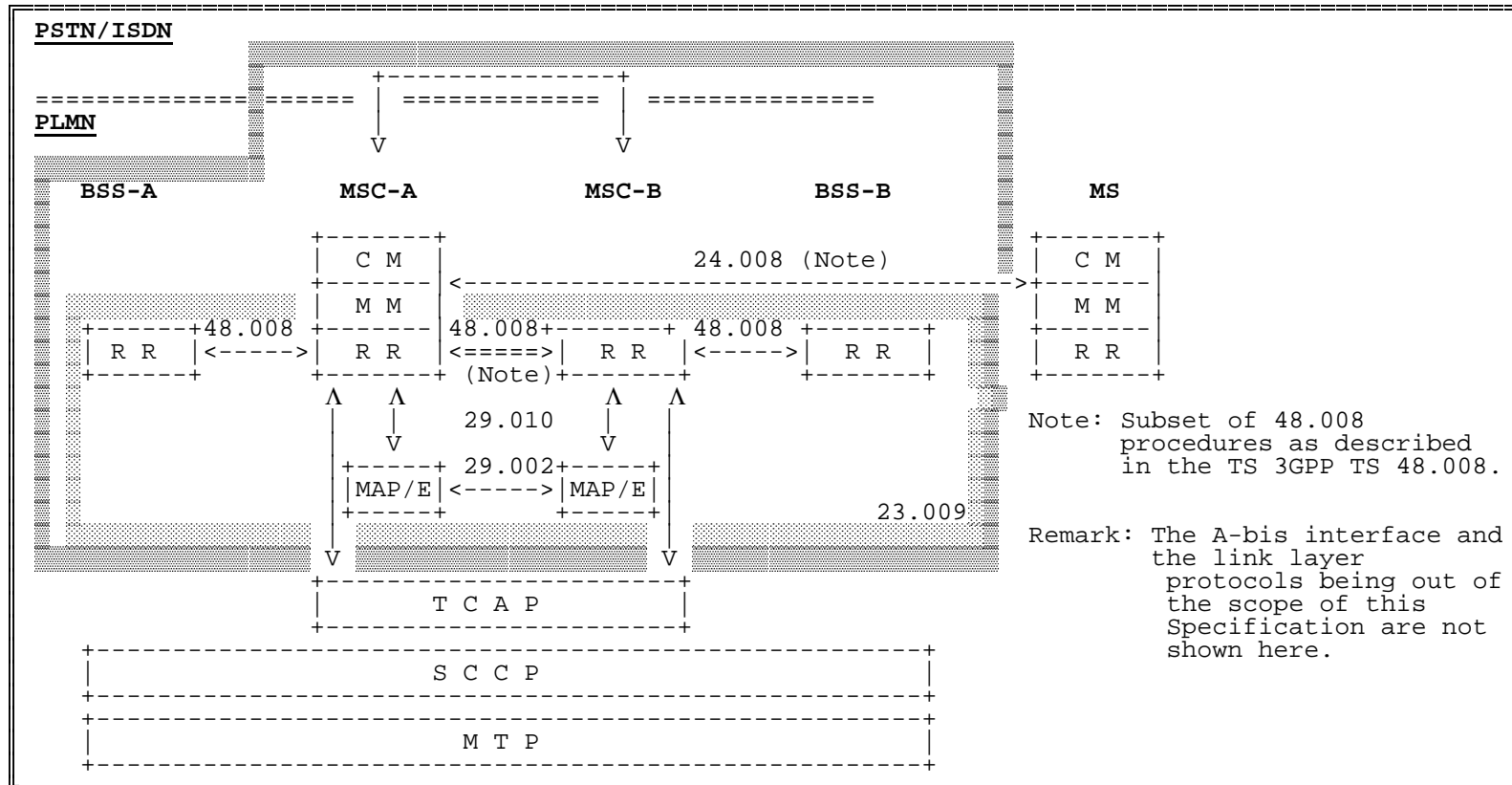
4.6   Inter-MSC Handover (UMTS to GSM)

The general principles of the handover procedures are given in 3GPP TS 23.009 [2]. 3GPP TS 29.010 gives the necessary information for interworking between the 3GPP TS 25.413 [7] RANAP protocol, GSM handover procedures and the 3GPP TS 29.002 [9] MAP protocol. The RANAP protocol is used between the RNS and the 3G-MSC.

The following three principles apply for the Inter-MSC handover UMTS to GSM:

The BSSMAP parameters required for Inter-MSC handover UMTS to GSM are generated as in GSM.

Received BSSMAP parameters, e.g. cause code or Handover command, are mapped to the appropriate RANAP parameters, e.g. cause code transparent container to source RNS.

When new parameters need to be added for transfer on the E-interface, the principles stated in the beginning of clause 4.5 shall be followed.

4.6.1   Basic Inter-MSC Handover

When a Mobile Station is handed over between two MSCs, the establishment of a connection between them (described in 3GPP TS 23.009 [2]) requires interworking between A-Interface and E-Interface.

The signalling at initiation, execution, completion of the Basic Inter-MSC handover procedure is shown in figures 21 to 26 with both possible positive or negative outcomes.

Additionally figure 21b shows the possible interworking when the trace related message is transparently transferred on the E-Interface at Basic Inter-MSC Handover initiation.

```
RNS-A                3G-MSC-A                        MSC-B
 |                      |                              |
 | RELOCATION           |                              |
 |------------------->  | MAP PREPARE HANDOVER         |
 | REQUIRED             |---------------------------->  | +----------------+
 |                      | request                      | |Possible Alloc. |
 |                      |                              | |of a handover   |
 |                      |                              | |no. in the VLR-B|
 |                      |                              | +----------------+
 |                      |                              |
 |                      |                              |              BSS-B
 |                      |                              |
 |                      |                              | HANDOVER REQUEST  |
 |                      |                              |------------------->|
 |                      |                              |                    |
```
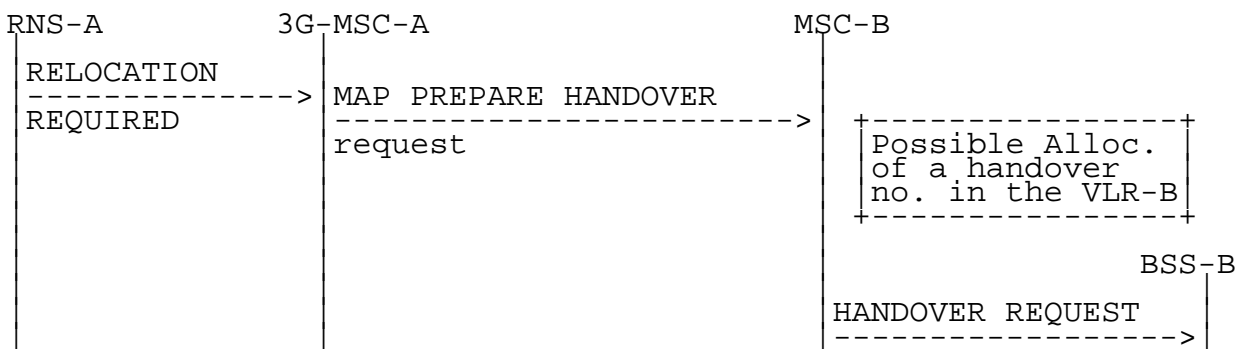
Figure 21a: Signalling for Basic Inter-MSC Handover initiation (no trace related messages transferred)

```
RNS-A                3G-MSC-A                        MSC-B
 |                      |  (*)                         |
 | RELOCATION           |                              |
 |------------------->  | MAP PREPARE HANDOVER         |
 | REQUIRED             |---------------------------->  | +----------------+
 |                      | request(**)                  | |Possible Alloc. |
 |                      |                              | |of a handover   |
 |                      |                              | |no. in the VLR-B|
 |                      |                              | +----------------+
 |                      |                              |
 |                      |                              |              BSS-B
 |                      |                              |
 |                      |                              | HANDOVER REQUEST  |
 |                      |                              |------------------->|
 |                      |                              |                    |
 |                      |                              | MSC INVOKE TRACE   |
 |                      |                              |------------------->(***)|
```
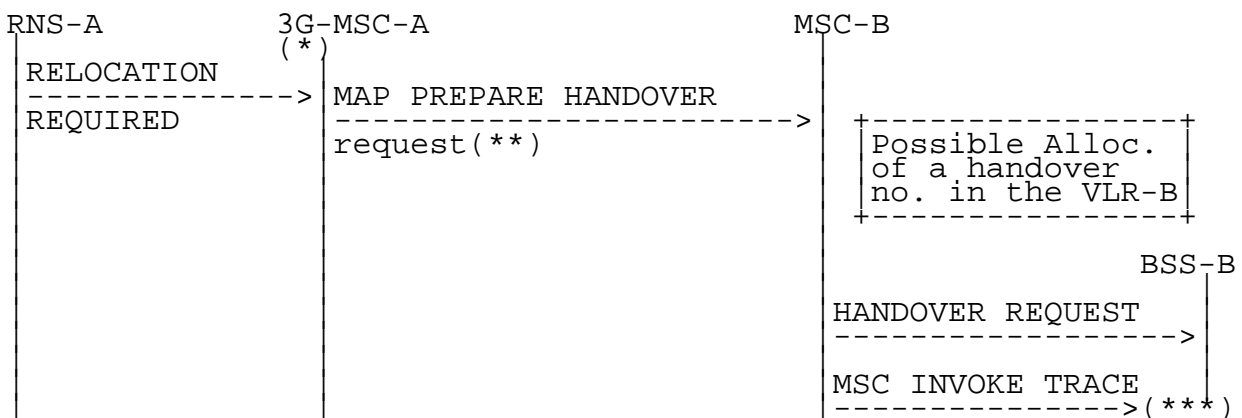
Figure 21b: Signalling for Basic Inter-MSC Handover initiation (MSC invoke trace message transferred)

(*):   Tracing invocation has been received from VLR.

(**): In that case, HANDOVER REQUEST and MSC INVOKE TRACE messages are included within the AN-APDU parameter.

(***): MSC INVOKE TRACE is forwarded to BSS-B if supported by MSC-B.

Possible Positive outcomes:

a) successful radio resources allocation and handover number allocation (if performed):

```
RNS-A              3G-MSC-A                        MSC-B                 BSS-B
 |                     |                             |    HANDOVER REQUEST  |
 |                     |                             |<--------------------|
 |                     |                             |    ACKNOWLEDGE       |
 |                     | MAP PREPARE HANDOVER         |                     |
 |                     |<----------------------------|                     |
 |                     | response                    |                     |
 | RELOCATION COMMAND  |                             |                     |
 |<--------------------|                             |                     |
```

b) radio resources allocation queued and successful handover number allocation (if performed). Later successful radio resources allocation indication:

```
RNS-A              3G-MSC-A                        MSC-B                 BSS-B
 |                     |                             |  QUEUING INDICATION  |
 |                     |                             |<--------------------|
 |                     | MAP PREPARE HANDOVER         |                     |
 |                     |<----------------------------|                     |
 |                     |  response                   |                     |
 |                     |                             |  HANDOVER REQUEST    |
 |                     |                             |<--------------------|
 |                     |                             |  ACKNOWLEDGE         |
 |                     | MAP PROCESS ACCESS          |                     |
 |                     |<----------------------------|                     |
 | RELOCATION COMMAND    SIGNALLING request         |                     |
 |<--------------------|                             |                     |
```
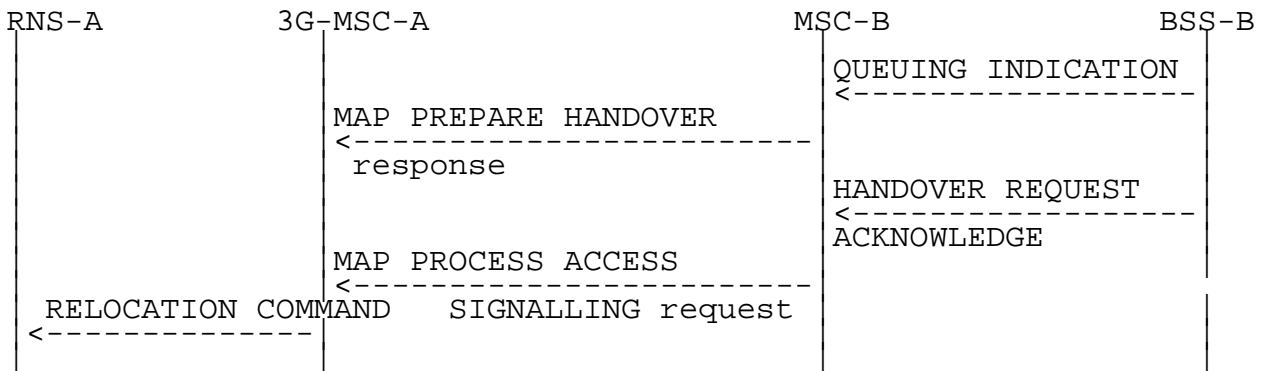
Figure 22: Signalling for Basic Inter-MSC Handover execution (Positive outcomes)

Possible Negative outcomes:

c) user error detected, or handover number allocation unsuccessful (if performed), or component rejection or dialogue abortion performed by MSC-B:

```
RNS-A              3G-MSC-A                        MSC-B                 BSS-B
 |                     | MAP PREPARE HANDOVER response |                   |
 |                     | negative result, MAP CLOSE   |                    |
 |                     |<----------------------------|                     |
 |                     | MAP U/P-ABORT               |                     |
 | RELOCATION PREPARATION|                           |                     |
 |<--------------------|                             |                     |
 | FAILURE(Note 1)     |                             |                     |
```

d) radio resources allocation failure:

```
RNS-A          3G-MSC-A                          MSC-B              BSS-B
 |                 |                                |  HANDOVER FAILURE  |
 |                 |                                |<-------------------|
 |                 | MAP PREPARE HANDOVER           |                    |
 |                 |<-----------------------------  |                    |
 |                 |  response                      |                    |
 | RELOCATION PREPARATION                           |                    |
 |<--------------  |                                |                    |
 | FAILURE(Note 1) |                                |                    |
```

    e) radio resources allocation queued and successful handover number allocation (if performed). Later unsuccessful
       radio resources allocation:

```
RNS-A          3G-MSC-A                          MSC-B              BSS-B
 |                 |                                | QUEUING INDICATION |
 |                 |                                |<-------------------|
 |                 | MAP PREPARE HANDOVER           |                    |
 |                 |<-----------------------------  |                    |
 |                 |  response                      |                    |
 |                 |                                |                    |
 |                 |                                |  HANDOVER FAILURE  |
 |                 |                                |<-------------------|
 |                 | MAP PROCESS ACCESS             |                    |
 |                 |<-----------------------------  |                    |
 |                 |  SIGNALLING request            |                    |
 | RELOCATION PREPARATION                           |                    |
 |<--------------  |                                |                    |
 | FAILURE(Note 1) |                                |                    |
```

    f) unsuccessful handover execution (Reversion to the old radio resources):

```
RNS-A          3G-MSC-A                          MSC-B              BSS-B
 | RELOCATION      |                                |                    |
 |---------------->|                                |                    |
 | CANCEL          |                                |                    |
 |                 | MAP U -ABORT                   |                    |
 |                 |------------------------------->|                    |
 |                 |                                | CLEAR COMMAND      |
 |                 |                                |------------------->|
 | RELOCATION      |                                |                    |
 |<--------------  |                                |                    |
 | CANCEL ACK      |                                |                    |
```
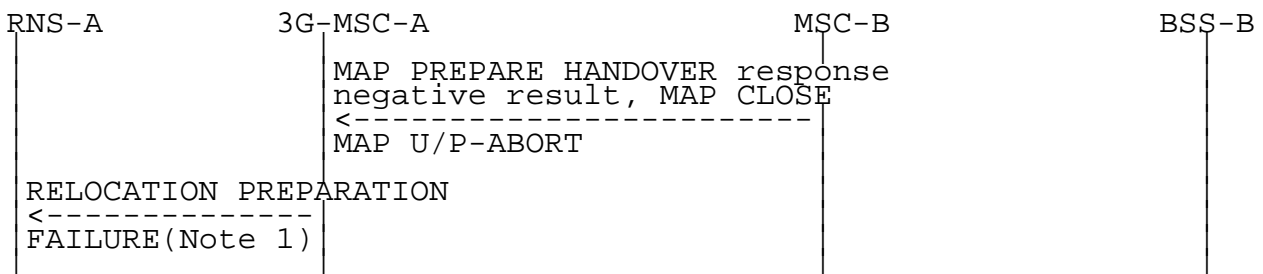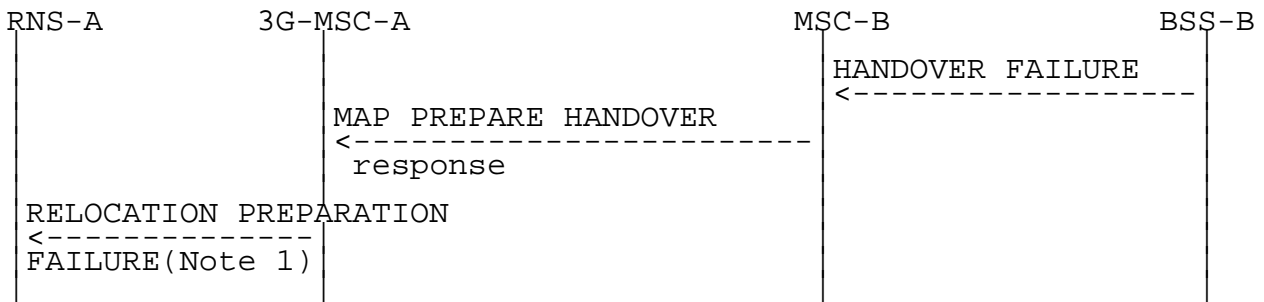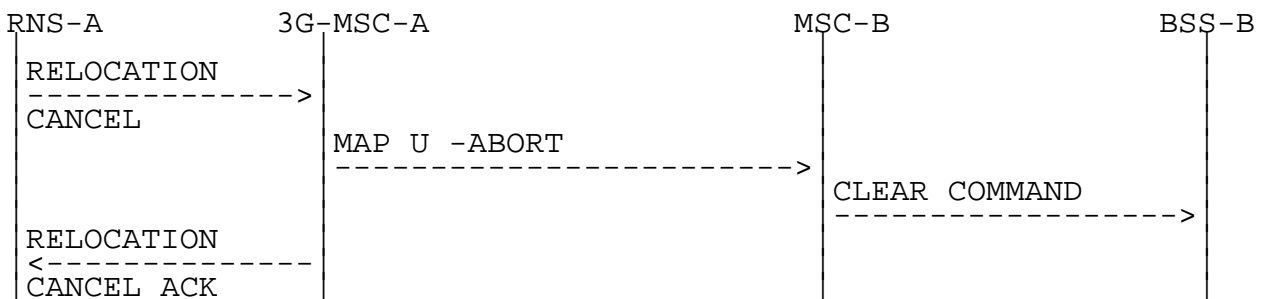
Figure 23: Signalling for Basic Inter-MSC Handover execution (Negative outcomes)

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or RANAP procedure.

```
RNS-A            3G-MSC-A                             MSC-B              BSS-B
 |                   |                                  | HANDOVER COMPLETE |
 |                   |                                  |<------------------|
 |                   | MAP SEND END SIGNAL request      |                   |
 |                   |<-------------------------------  |                   |
 | IU RELEASE COMMAND|                                  |                   |
 |<--------------    |                                  |                   |
 |                   |                                  |                   |
```
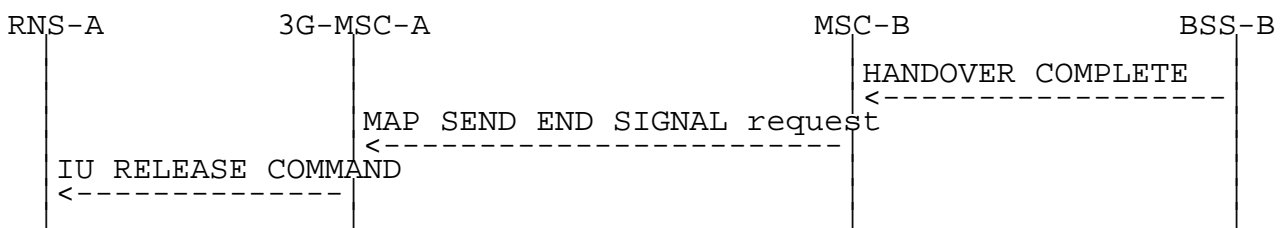
Figure 24: Signalling for Basic Inter-MSC Handover completion

Positive outcome:

```
RNS-A            3G-MSC-A                        MSC-B               BSS-B
 |                  |                              |                   |
 |                  | MAP SEND END SIGNAL          |                   |
 |                  |---------------------------->|                   |
 |                  |   response                   | CLEAR COMMAND     |
 |                  |                              |------------------>|
 |                  |                              | (Note 2)          |
 |                  |                              |                   |
```
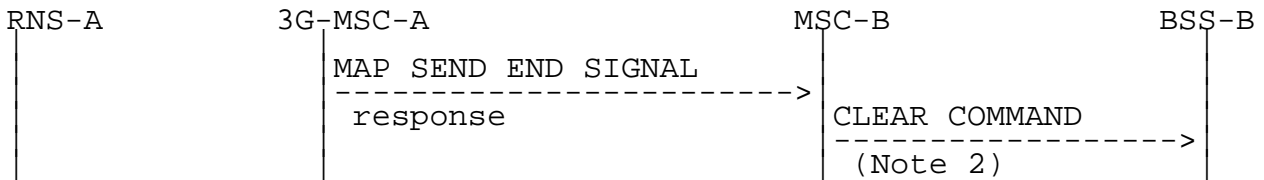
Figure 25: Signalling for Basic Inter-MSC Handover completion (Positive outcome)

Negative outcome:

```
RNS-A            3G-MSC-A                        MSC-B               BSS-B
 |                  |                              |                   |
 |                  | MAP U/P -ABORT               |                   |
 |                  |---------------------------->|                   |
 |                  |                              | CLEAR COMMAND     |
 |                  |                              |------------------>|
 |                  |                              |                   |
```
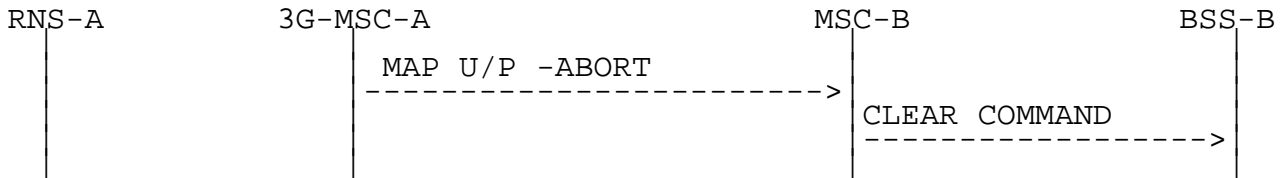
Figure 26: Signalling for Basic Inter-MSC Handover completion (Negative outcome)

NOTE 2: From interworking between MAP and BSSMAP point of view, when the call is released.

The handover procedure is normally triggered by RNS-A by sending a RELOCATION REQUIRED message on Iu-Interface to 3G-MSC-A. The invocation of the Basic Inter-MSC handover procedure is performed and controlled by 3G-MSC-A. The sending of the MAP Prepare-Handover request to MSC-B is triggered in 3G-MSC-A upon receipt of the RELOCATION REQUIRED message. For compatibility reason, the cell identity of the cell where the call is to be handed over in MSC-B area, provided in the RELOCATION REQUIRED message, is mapped into targetCellId MAP parameter and the HANDOVER REQUEST message is encapsulated in the AN-APDU MAP parameter of the Prepare-Handover MAP request. MSC-B can invoke another operation towards the VLR-B (allocation of the handover number described in 3GPP TS 29.002 [9]).

Additionally, if tracing activity has been invoked, the trace related message can be transferred on the E-Interface encapsulated in the AN-APDU MAP parameter of the Prepare-Handover Request. If transferred, one complete trace related message at a time shall be included in the AN-APDU MAP parameter after the HANDOVER REQUEST message.

The interworking between Prepare Handover and RELOCATION REQUIRED is as follows:

```
    ------------------------------------------------------------------
    |         | 25.413                        29.002            |Notes|
    ------------------------------------------------------------------
    |Forward  | RELOCATION REQUIRED MAP PREPARE HANDOVER request |     |
    |message  |                                                 |     |
    |         |                             -ho-NumberNotRequired|  1  |
    |         |   RANAP information          -targetCellId       |     |
    |         |      elements               -AN-APDU(            |  2  |
    |         |                             HANDOVER REQUEST,    |     |
    |         |                                                 |     |
    |         | MSC INVOKE TRACE)                               |     |
    ------------------------------------------------------------------
    |Positive | RELOCATION CMD      MAP PREPARE HANDOVER response|     |
    |result   |                                                 |  3  |
    |         |                             -handover number    |     |
    |         |                             -AN-APDU(            |     |
    |         |                               QUEUING INDICATION |     |
    |         |                               or HANDOVER REQUEST|     |
    |         |                               ACKNOWLEDGE)       |     |
    |         |                                                 |     |
    ------------------------------------------------------------------
    |Negative | RELOCATION PREP FAILURE     MAP  PREPARE HANDOVER|  4  |
    |result   |                                                 |     |
    |         | Relocation failure in             System Failure|     |
    |         | target RNC/CN or target system                  |     |
    |         | "                           No Handover Number  |     |
    |         |                                available         |     |
    |         | "                           UnexpectedDataValue |     |
    |         | "                           Data Missing        |     |
    |         |                                                 |     |
    |         | "                           MAP CLOSE           |     |
    |         | "                           MAP U/P -ABORT      |     |
    |         |                                                 |     |
    ------------------------------------------------------------------
```

NOTE 1: The BSSMAP information elements are already stored in 3G-MSC.

The ho-NumberNotRequired parameter is included by 3G-MSC-A, when 3G-MSC-A decides not to use any circuit connection with MSC-B. No handover number shall be present in the positive result. Any negative response from MSC-B shall not be due to handover number allocation problem.

NOTE 2: The process performed on the RANAP information elements received in the RELOCATION REQUIRED message is described in the 3GPP TS 25.413 [7].

NOTE 3: The response to the Prepare-Handover request can include in its AN-APDU parameter, identifying the 3GPP TS 48.006 protocol, either a BSSMAP QUEUING INDICATION, or a BSSMAP HANDOVER REQUEST ACKNOWLEDGE.

In the first case, 3G-MSC-A shall wait for the radio resources allocation response from MSC-B, transmitted to 3G-MSC-A as described in clause 4.5.4.

In the second case, the positive result triggers in 3G-MSC-A the sending on Iu-Interface of the RELOCATION CMD.

In the third case, the positive result triggers in 3G-MSC-A.

NOTE 4: The possible sending of the RELOCATION PREP FAILURE message is described in the 3G 25.413.

(The possible sending of the RELOCATION PREP FAILURE message upon receipt of the HANDOVER FAILURE is out of the scope of the 3GPP TS 29.010 and lies in the 3GPP TS 25.413 [7]).

The interworking between Send End Signal and HANDOVER COMPLETE in MSC-B is as follows:

	48.008	29.002	Notes
Forward message	HANDOVER COMPLETE	MAP SEND END SIGNAL request -AN-APDU(HANDOVER COMPLETE)	
Positive result	CLEAR COMMAND -Call Control release	MAP SEND END SIGNAL response	1
Negative result	CLEAR COMMAND -Call Control release -Call Control release	MAP CLOSE MAP U/P -ABORT	2

NOTE 1: The positive empty result triggers the clearing of the Radio Resources on the A-Interface and the release of the SCCP connection between MSC-B and BSS-B. If a circuit connection is used between 3G_MSC-A and MSC-B, the 'Call Control release' clearing cause shall only be given to BSS-B when MSC-B has received a clearing indication on its circuit connection with 3G_MSC-A.

NOTE 2: The abortion of the dialogue or the rejection of the component triggers in MSC-B the clearing of its circuit connection with 3G_MSC-A, if any, of the Radio Resources on the A-Interface and the release of the SCCP connection between MSC-B and BSS-B.

The interworking between Send End Signal and IU RELEASE COMMAND in 3G_MSC-A is as follows:

	29.002	25.413	Notes
Forward message	MAP SEND END SIGNAL response -AN-APDU(HANDOVER COMPLETE)	IU RELEASE COMMAND Successful Relocation	
Positive result			
Negative result			

The interworking between RELOCATION CANCEL in case of reversion to old channel of the UE and User Abort in 3G-MSC-A is as follows:

	25.413	29.002	Notes
Forward message	RELOCATION CANCEL -Relocation cancelled	MAP U -ABORT	
Positive result	RELOCATION CANCEL ACKNOWLEDGEMENT		
Negative result			

4.6.2   Subsequent Inter-MSC Handover from 3G-MSC-B back to MSC-A

When a Mobile Station is being handed over back to MSC-A, the procedure (described in TS 23.009) requires interworking between A-Interface, Iu-interface and E-Interface.

The signalling at initiation, execution and completion of the Subsequent Inter-MSC handover procedure is shown in figures 27 to 31.

```
RNS-A              3G-MSC-B                          MSC-A
|                  |                                 |
|RELOCATION        |                                 |
|-------------->|MAP PREPARE SUBSEQUENT             |
|REQUIRED        |----------------------------->    |
|                |HANDOVER request                  |
|                |                                 |                        BSS-B
|                |                                 |                        |
|                |                                 |HANDOVER REQUEST        |
|                |                                 |------------------->    |
|                |                                 |                        |
```
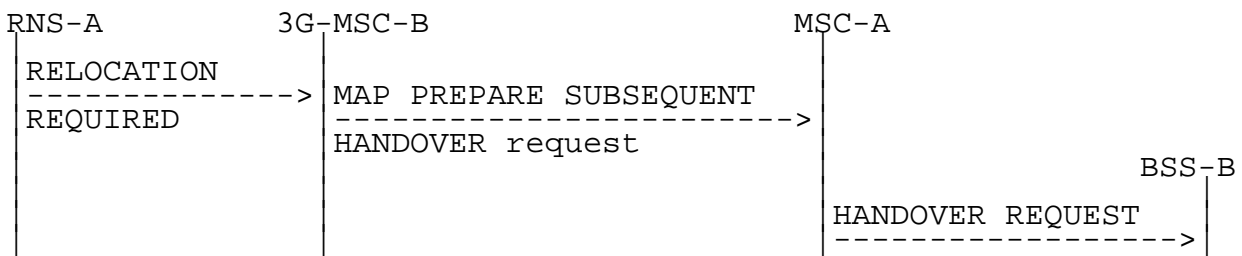
Figure 27: Signalling for Subsequent Inter-MSC Handover back to MSC-A initiation

Possible Positive outcomes:

   a) successful radio resources allocation:

```
RNS-A                 3G-MSC-B                    MSC-A                      BSS-B
|                     |                           |                         |
|                     |                           |HANDOVER REQUEST         |
|                     |                           |<--------------------    |
|                     |                           |ACKNOWLEDGE              |
|                     | MAP PREPARE SUBSEQUENT    |                         |
|                     |<----------------------    |                         |
|                     | HANDOVER response         |                         |
|RELOCATION CMD       |                           |                         |
|<--------------      |                           |                         |
|                     |                           |                         |
```

   b) radio resources allocation queued. Later successful radio resources allocation indication:

```
RNS-A                 3G-MSC-B                    MSC-A             BSS-B
|                     |                           |QUEUING INDICATION|
|                     |                           |<----------------- |
|                     | MAP PREPARE SUBSEQUENT    |                  |
|                     |<----------------------    |                  |
|                     | HANDOVER response         |                  |
|                     |                           |HANDOVER REQUEST  |
|                     |                           |<----------------- |
|                     |                           |ACKNOWLEDGE       |
|                     | MAP FORWARD ACCESS        |                  |
|                     |<----------------------    |                  |
|                     | SIGNALLING request        |                  |
|RELOCATION CMD       |                           |                  |
|<--------------      |                           |                  |
|                     |                           |                  |
```
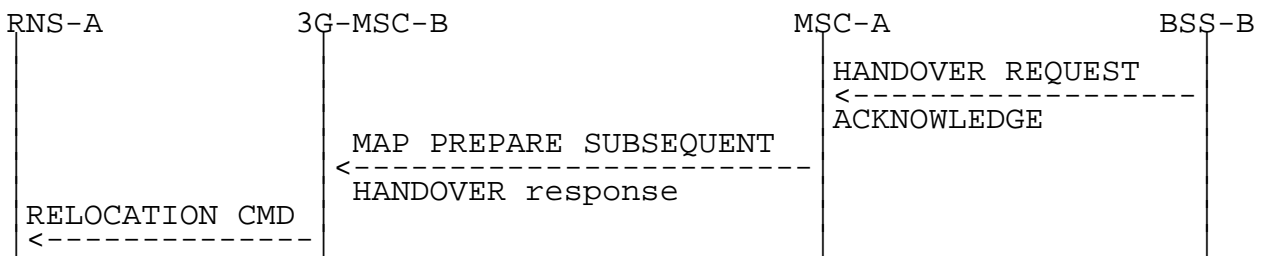
Figure 28: Signalling for Subsequent Inter-MSC Handover back to MSC-A execution (Positive outcome)

Possible Negative outcomes:

   c) user error detected, or component rejection or dialogue abortion performed by MSC-A:

```
RNS-A              3G-MSC-B                          MSC-A             BSS-B
|                  |MAP PREPARE SUBSEQUENT HANDOVER  |                 |
|                  |<----------------------         |                 |
|RELOCATION PREP|  response negative result         |                 |
|<--------------|                                    |                 |
|FAILURE(Note 1)|                                    |                 |
|                |                                   |                 |
```

   d) component rejection or dialogue abortion performed by MSC-A:

```
RNS-A              3G-MSC-B                          MSC-A             BSS-B
|                  |MAP CLOSE, MAP U/P ABORT         |                 |
|                  |<----------------------          |                 |
|IU RELEASE        |                                 |                 |
|<--------------   |                                 |                 |
|    COMMAND       |                                 |                 |
|                  |                                 |                 |
```

   e) radio resources allocation failure:

```
RNS-A            3G-MSC-B                      MSC-A                BSS-B
                                                 │ HANDOVER FAILURE  │
 │                  │                            │<──────────────────│
 │                  │ MAP PREPARE SUBSEQUENT     │                   │
 │                  │<───────────────────────   │                   │
 │ RELOCATION PREP  │    HANDOVER response       │                   │
 │<─────────────    │                            │                   │
 │ FAILURE(Note 1)  │                            │                   │
```

f) radio resources allocation queued. Later unsuccessful radio resources allocation:

```
RNS-A            3G-MSC-B                      MSC-A                BSS-B
                                                 │ QUEUING INDICATION│
 │                  │                            │<──────────────────│
 │                  │  MAP PREPARE SUBSEQUENT    │                   │
 │                  │<───────────────────────   │                   │
 │                  │   HANDOVER response        │ HANDOVER FAILURE  │
 │                  │                            │<──────────────────│
 │                  │  MAP FORWARD ACCESS        │                   │
 │                  │<───────────────────────   │                   │
 │ RELOCATION PREP  │   SIGNALLING request       │                   │
 │<─────────────    │                            │                   │
 │ FAILURE(Note 1)  │                            │                   │
```

Figure 29: Signalling for Subsequent Inter-MSC Handover back to MSC-A execution
(Negative outcome)

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or BSSMAP procedure.

```
BSS-B          MSC-A                        3G-MSC-B              RNS-A
 │ HANDOVER      │                            │                   │
 │──────────────>│ MAP SEND END SIGNAL        │                   │
 │ COMPLETE      │───────────────────────────>│                   │
 │               │  response                  │                   │
 │               │                            │ Iu RELEASE COMMAND│
 │               │                            │──────────────────>│
```

Figure 30: Signalling for Subsequent Inter-MSC Handover back to MSC-A completion
(Successful completion of the procedure)

NOTE: Positive outcome case shown in figure 9.

```
BSS-B          MSC-A                        3G-MSC-B              RNS-A
 │ HANDOVER      │                            │                   │
 │──────────────>│ MAP SEND END SIGNAL        │                   │
 │ COMPLETE      │───────────────────────────>│                   │
 │               │  response                  │                   │
 │               │ MAP U/P -ABORT             │                   │
 │               │<───────────────────────    │                   │
 │               │                            │ Iu RELEASE COMMAND│
 │               │                            │──────────────────>│
 │               │                            │ (Note 1)          │
```

Figure 31: Signalling for Subsequent Inter-MSC Handover back to MSC-A completion (Unsuccessful
completion of the procedure)

NOTE 1: Abnormal end of the procedure which triggers the clearing of all resources in 3G-MSC-B.

The interworking between Prepare Subsequent Handover and RELOCATION REQUIRED is as follows:

```
---------------------------------------------------------------------------
         |   25.413                          29.002          |Notes
---------------------------------------------------------------------------
Forward  |REL. REQUIRED    MAP PREPARE SUBSEQUENT HANDOVER   |
message  |                            request                |
         |                                                   |
         |                            -target MSC number     |
         |                            -targetCellId          |
         |                            -AN-APDU(               |
         |                             HANDOVER REQUEST)      |
         |                                                   |
         |                                                   |
         |    RANAP information          BSSMAP information   |
         |        elements:                 elements:         |
         |                                                   |
         |  MS Classmark 2               CM2                 |
         |  Source Id                    Cell Id (serving)   |
         |  Target Id                    Cell Id (target)    |
         |  Cause                        Cause                | 1
         |  MS Classmark 3               CM3                 |
         |                                                   |
         |                            info stored/generated  |
         |                            in/by 3G-MSC-B:         |
         |                                Message Type        |
         |                                Channel Type        |
         |                                Speech version      |
         |                                Priority            |
         |                                Interference Band   |
         |                                to be used          |
---------------------------------------------------------------------------
Positive |RELOCATION CMD.   MAP PREPARE SUBSEQUENT HANDOVER  | 2
result   |                            response                |
         |                            -AN-APDU(               |
         |                             QUEUING INDICATION     |
         |                             or HANDOVER REQUEST    |
         |                             ACKNOWLEDGE or         |
         |                             HANDOVER FAILURE)      |
         |                                                   |
         |    RANAP information          BSSMAP information   |
         |        elements:                 elements:         |
         |  L3 information               L3 information       |
         |                                                   |
         |                                                   |
         |                                                   |
---------------------------------------------------------------------------
Negative | REL. PREP. FAILURE           MAP PREPARE SUBSEQUENT| 3
result   |                              HANDOVER response     |
         |  Relocation Failure in Target CN/RNC or Target System
Unknown MSC
         |  Relocation Failure in Target CN/RNC or Target System
Subsequent Handover
         |                                            Failure |
         |  Relocation Failure in Target CN/RNC or Target System
UnexpectedDataValue
         |  Relocation Failure in Target CN/RNC or Target System
Data Missing
         |                                                   |
         |  Iu RELEASE COMMAND                                |
         |                                                   |
         |  Relocation Cancelled MAP CLOSE                    |
         |  Relocation Cancelled MAP U/P -ABORT               |
---------------------------------------------------------------------------
```

NOTE 1: The mapping of cause code values between BSSMAP and RANAP is FFS.

NOTE 2: The response to the Prepare-Subsequent-Handover request can include in its AN-APDU parameter, identifying the 3GPP TS 48.006 protocol, a BSSMAP QUEUING INDICATION, or a BSSMAP HANDOVER REQUEST ACKNOWLEDGE or a BSSMAP HANDOVER FAILURE.

In the first case, 3G-MSC-B shall wait for the radio resources allocation response from MSC-A, transmitted to 3G-MSC-B as described in clause 4.5.4.

In the second case, the positive result triggers in 3GMSC-B the sending on Iu-Interface of the RELOCATION COMMAND.

In the third case, the positive result triggers in 3G-MSC-B the sending of the RELOCATION PREPARATION FAILURE.

NOTE 3: The possible sending of the RELOCATION PREPARATION FAILURE message is described in 3GPP TS 25.413 [7].

The interworking between Send End Signal Result and HANDOVER COMPLETE in MSC-A is as follows:

```
---------------------------------------------------------------------------
              |        48.008                    29.002          | Notes
---------------|--------------------------------------------------|--------
Forward        | HANDOVER COMPLETE      MAP SEND END SIGNAL       |
message        |                                       response   |
               |                                                  |
---------------|--------------------------------------------------|--------
Positive       |                                                  |
result         |                                                  |
---------------|--------------------------------------------------|--------
Negative       |                                                  |
result         |                        MAP U/P -ABORT            |   1
               |                                                  |
---------------------------------------------------------------------------
```

NOTE: The abortion of the dialogue ends the handover procedure with 3G-MSC-B.

4.6.3 Subsequent Inter-MSC Handover to third MSC

When a Mobile Station is being handed over to a third MSC, the procedure (described in 3GPP TS 23.009 [2]) does require one specific interworking case in MSC-A between E-Interface from 3G-MSC-B and E-Interface from MSC-B' other than the combination of the ones described in clauses 4.6.1 and 4.6.2.

```
RNS-A          3G-MSC-B               MSC-A              MSC-B'
 |              |                      |                  |
RELOCATION      |                      |                  |
----------->|MAP PREPARE SUBSEQUENT   |                  |
REQUIRED     |-------------------->    |                  |
 |           |HANDOVER request         |MAP PREPARE       |
 |           |                         |-------------->   |
 |           |                         |HANDOVER request  |
 |           |                         |                  +-------+
 |           |                         |                  |Possib.|
 |           |                         |                  |Alloc. |
 |           |                         |                  |of ho. |
 |           |                         |                  |number |
 |           |                         |                  | VLR-B |
 |           |                         |                  +-------+
 |           |                         |                     BSS-B'
 |           |                         |                  |HANDOVER|
 |           |                         |                  |------->|
 |           |                         |                  |REQUEST |
 |           |                         |                  |        |
```
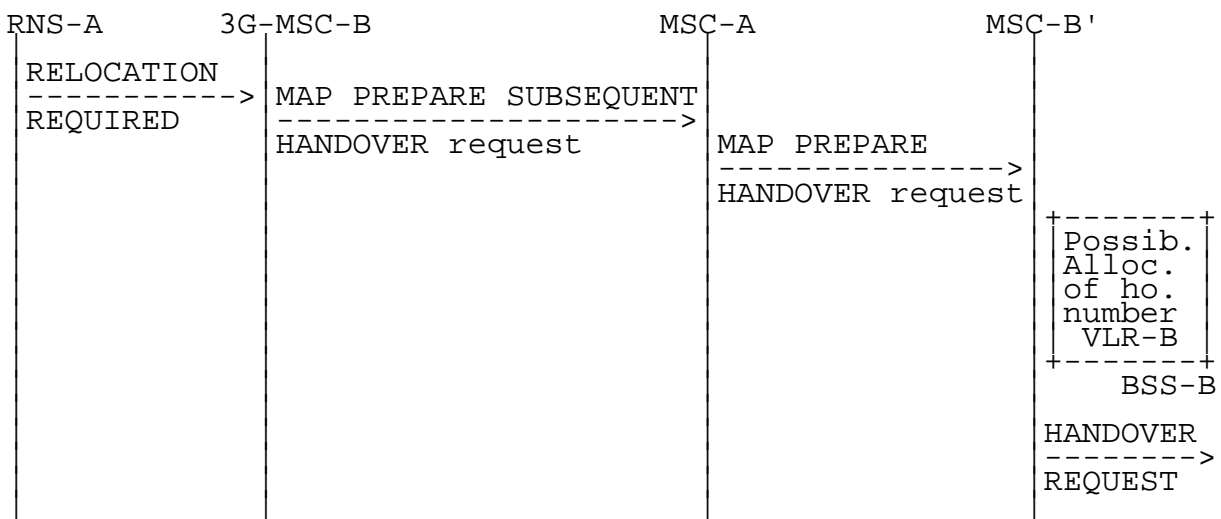
Figure 32: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') initiation

Possible Positive outcomes:

a) successful radio resources allocation:

```
RNS-A      3G-MSC-B                        MSC-A              MSC-B'
 |           |                              |                  |  BSS-B'
 |           |                              |                  |     |
 |           |                              |                  | HANDOVER
 |           |                              |                  |<--------
 |           |                              |                  | REQUEST
 |           |                              |                  | ACKNOWLEDGE
 |           |                              | MAP PREPARE HANDOVER
 |           |                              |<---------------  |
 |           | MAP PREPARE SUBSEQUENT       |     response     |
 |           |<---------------------        |                  |
 |           | HANDOVER response            |                  |
 | RELOCATION|                              |                  |
 |<----------|                              |                  |
 | COMMAND   |                              |                  |
 |           |                              |                  |
```

b) radio resources allocation queued and successful handover number allocation, if performed. Later successful radio resources allocation indication:

```
RNS-A      3G-MSC-B                        MSC-A              MSC-B'
 |           |                              |                  |  BSS-B'
 |           |                              |                  |     |
 |           |                              |                  | QUEUING
 |           |                              |                  |<--------
 |           |                              |                  | INDICAT.
 |           |                              | MAP PREPARE HANDOVER
 |           |                              |<---------------  |
 |           | MAP PREPARE SUBSEQUENT       |     response     |
 |           |<---------------------        |                  |
 |           | HANDOVER response            |                  |
 |           |                              |                  | HANDOVER
 |           |                              |                  |<--------
 |           |                              |                  | REQUEST
 |           |                              |                  | ACKNOWLEDGE
 |           |                              | MAP PROCESS ACCESS
 |           |                              |<---------------  |
 |           | MAP FORWARD ACCESS           | SIGNALLING request
 |           |<---------------------        |                  |
 |           | SIGNALLING request           |                  |
 | RELOCATION|                              |                  |
 |<----------|                              |                  |
 | COMMAND   |                              |                  |
 |           |                              |                  |
```
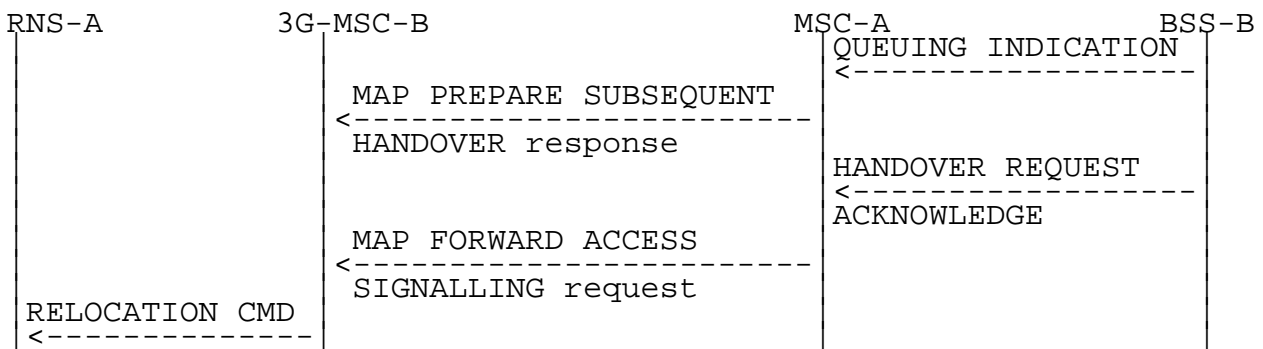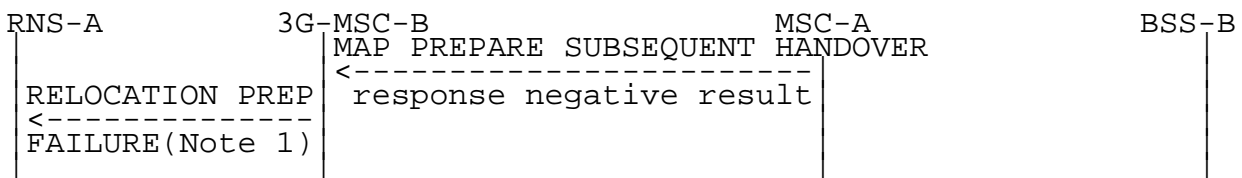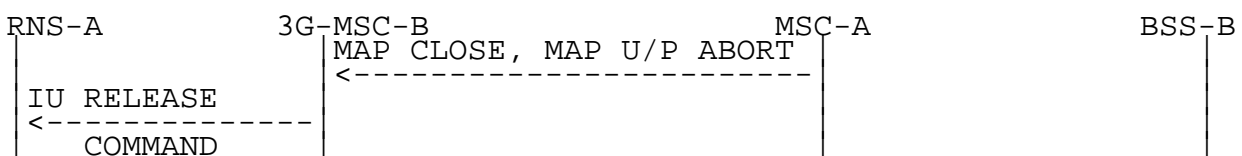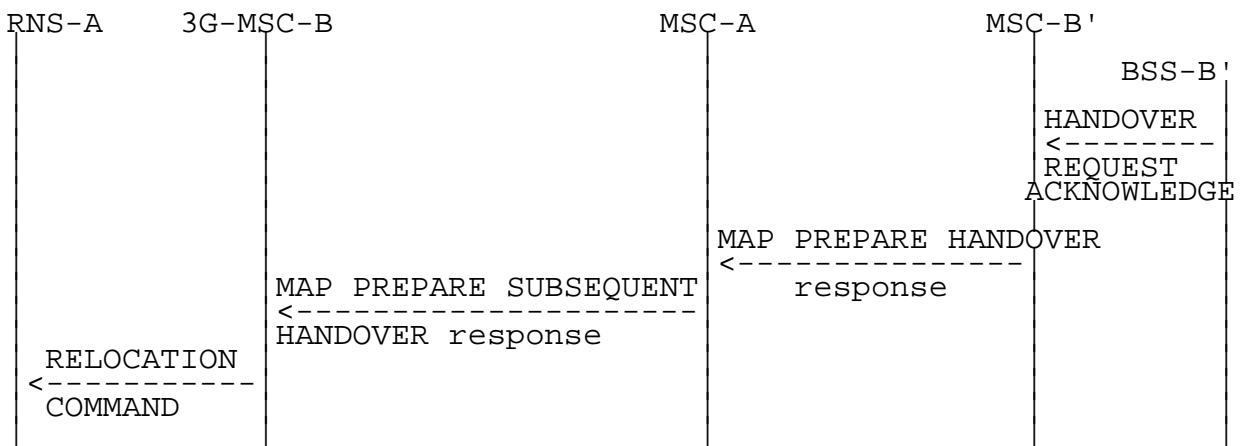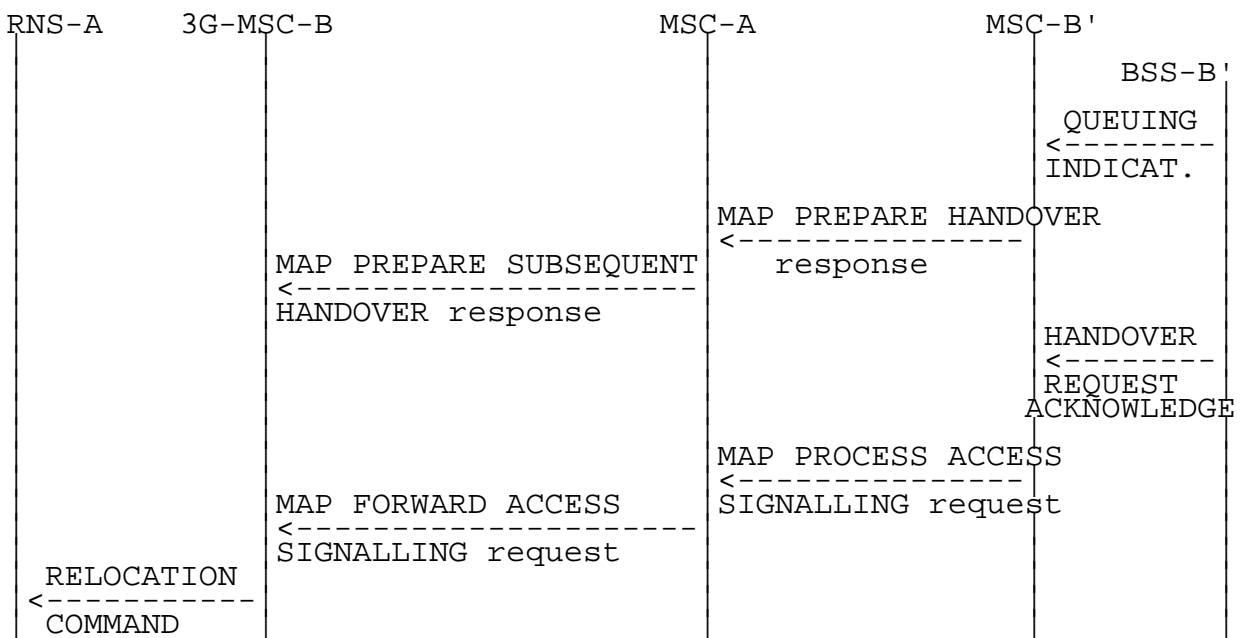
Figure 33: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') execution (Positive outcome)
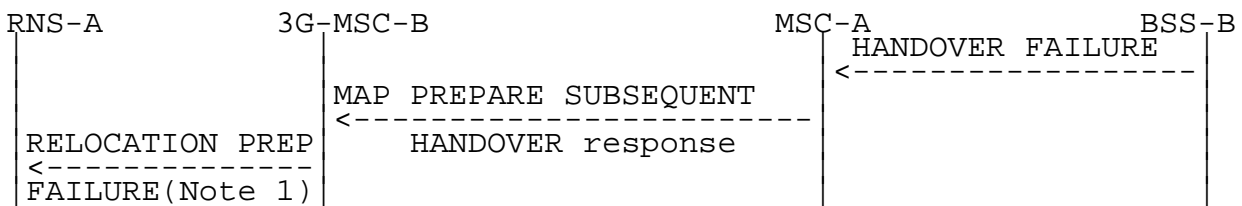
Possible Negative outcomes:

c) user error detected, or component rejection or dialogue abortion performed by MSC-B':

```
RNS-A          3G-MSC-B                    MSC-A              MSC-B'
  |               |                          |                  |        BSS-B'
  |               |                          | MAP PREPARE HANDOVER     |
  |               |                          | response negative result |
  |               |                          | MAP CLOSE                |
  |               |                          | <--------------- |       |
  |               |                          | MAP U/P -ABORT   |       |
  |               | MAP PREPARE SUBSEQUENT   |                  |       |
  |               | <---------------------   |                  |       |
  |               | HANDOVER response negative                 |       |
  | RELOCATION    | result                   |                  |       |
  | <----------   |                          |                  |       |
  | PREPARATION   |                          |                  |       |
  | FAILURE       |                          |                  |       |
  | (Note 1)      |                          |                  |       |
```

d) radio resources allocation failure:

```
RNS-A          3G-MSC-B                    MSC-A              MSC-B'
  |               |                          |                  |        BSS-B'
  |               |                          |                  |  HANDOVER    |
  |               |                          |                  |  <-------- |
  |               |                          |                  |  FAILURE   |
  |               |                          | MAP PREPARE HANDOVER         |
  |               |                          | <--------------- |           |
  |               | MAP PREPARE SUBSEQUENT   |  response        |           |
  |               | <---------------------   |                  |           |
  |               | HANDOVER response        |                  |           |
  | RELOCATION    |                          |                  |           |
  | <----------   |                          |                  |           |
  | PREPARATION   |                          |                  |           |
  | FAILURE       |                          |                  |           |
  | (Note 1)      |                          |                  |           |
```

e) radio resources allocation queued and successful handover number allocation (if performed). Later unsuccessful radio resources allocation:

```
RNS-A          3G-MSC-B                    MSC-A              MSC-B'
  |               |                          |                  |        BSS-B'
  |               |                          |                  |   QUEUING   |
  |               |                          |                  |  <-------- |
  |               |                          |                  |  INDICAT.  |
  |               |                          | MAP PREPARE HANDOVER         |
  |               |                          | <--------------- |           |
  |               | MAP PREPARE SUBSEQUENT   |  response        |           |
  |               | <---------------------   |                  |           |
  |               | HANDOVER response        |                  |           |
  |               |                          |                  |  HANDOVER  |
  |               |                          |                  |  <-------- |
  |               |                          |                  |  FAILURE   |
  |               |                          | MAP PROCESS ACCESS          |
  |               |                          | <--------------- |           |
  |               |                          | SIGNALLING request          |
  |               | MAP FORWARD ACCESS       |                  |           |
  |               | <---------------------   |                  |           |
  |               | SIGNALLING request       |                  |           |
  | RELOCATION    |                          |                  |           |
  | <----------   |                          |                  |           |
  | PREPARATION   |                          |                  |           |
  | FAILURE       |                          |                  |           |
  | (Note 1)      |                          |                  |           |
```
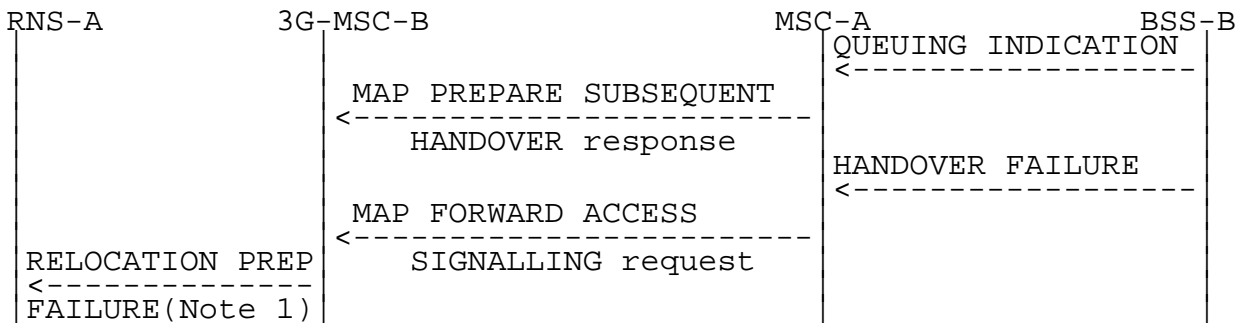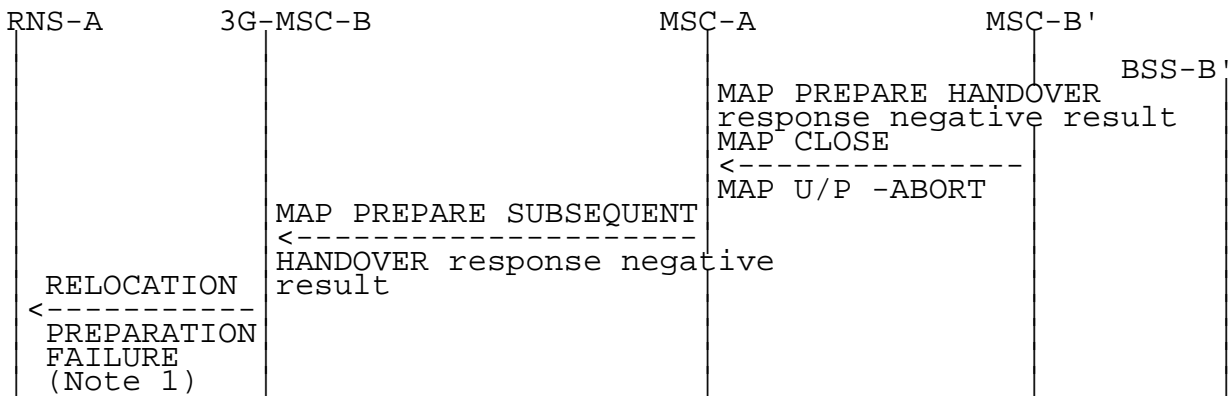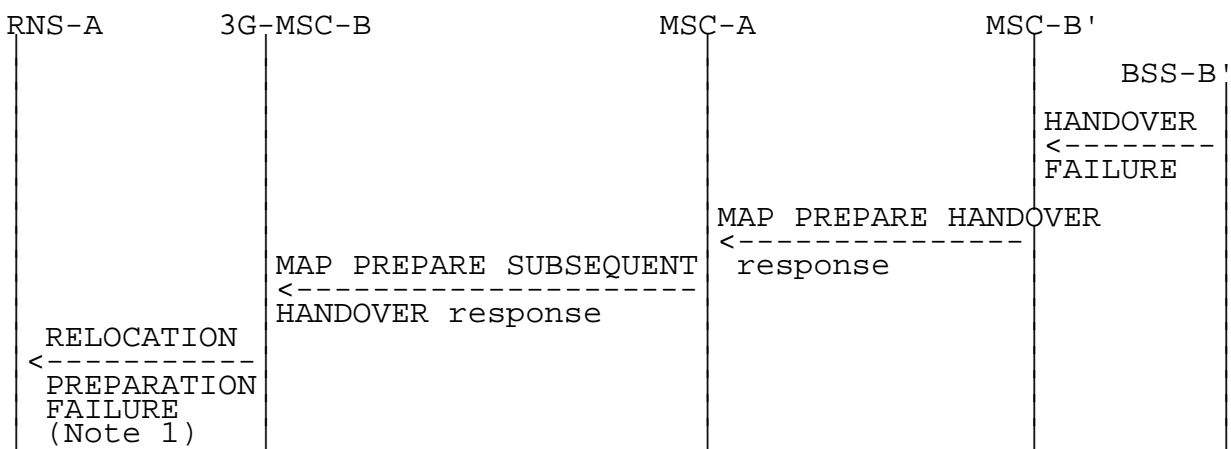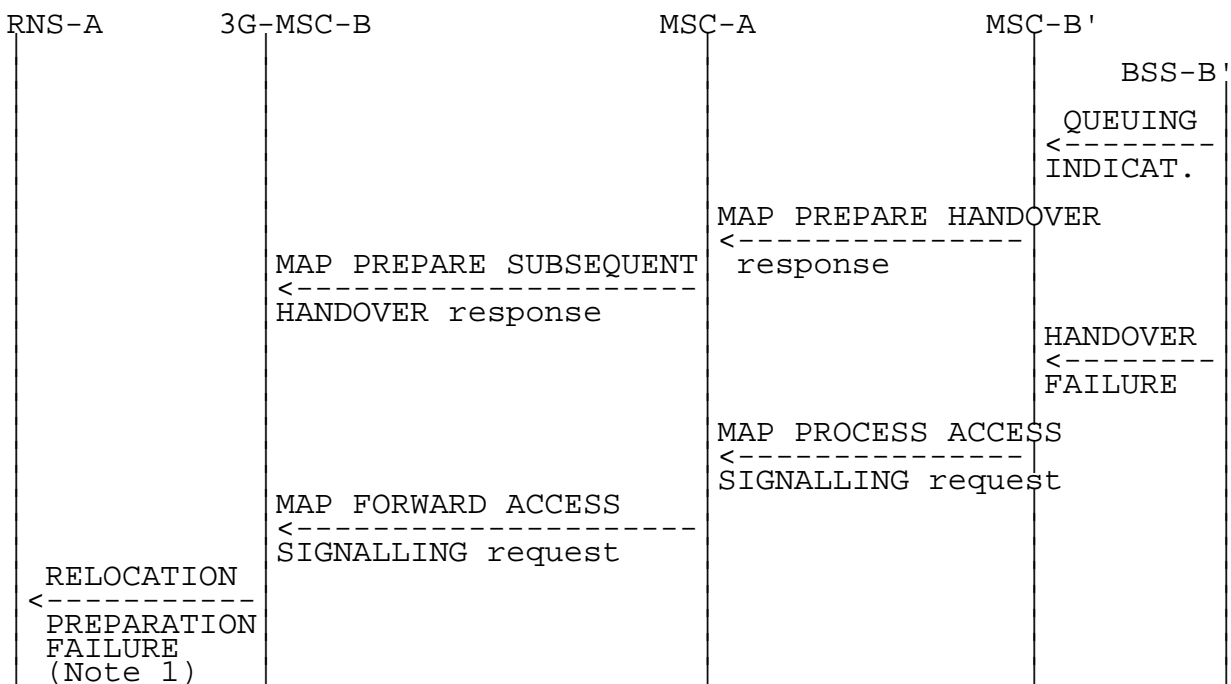
Figure 34: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') execution (Negative outcome)

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or BSSMAP procedure.

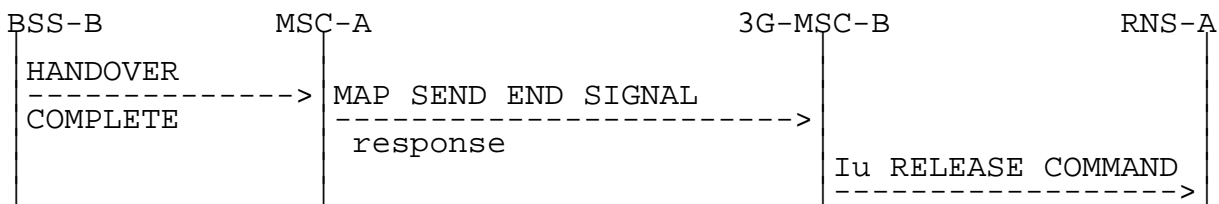Positive outcome:

```
RNS-A        3G-MSC-B                        MSC-A                  MSC-B'
 |              |                              |                      |
 |              |                              |                      |    BSS-B'
 |              |                              |                      |
 |              |                              |                      | HANDOVER
 |              |                              |                      |<--------
 |              |                              |                      | COMPLETE
 |              |                              |                      |
 |              |                              | MAP SEND END SIGNAL  |
 |              |                              |<---------------      |
 |              |   MAP SEND END SIGNAL        |                      |
 |              |<---------------------        |                      |
 |              |   response                   |                      |
 | IU-RELEASE   |                              |                      |
 |<----------   |                              |                      |
 | COMMAND      |                              |                      |
 |              |                              |                      |
```
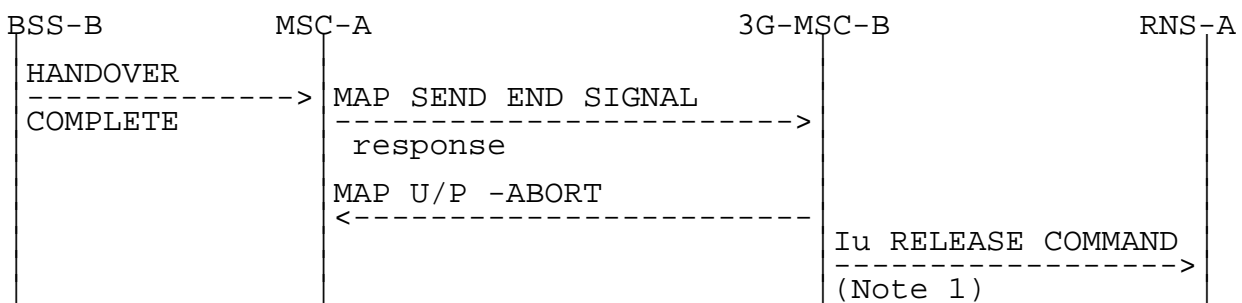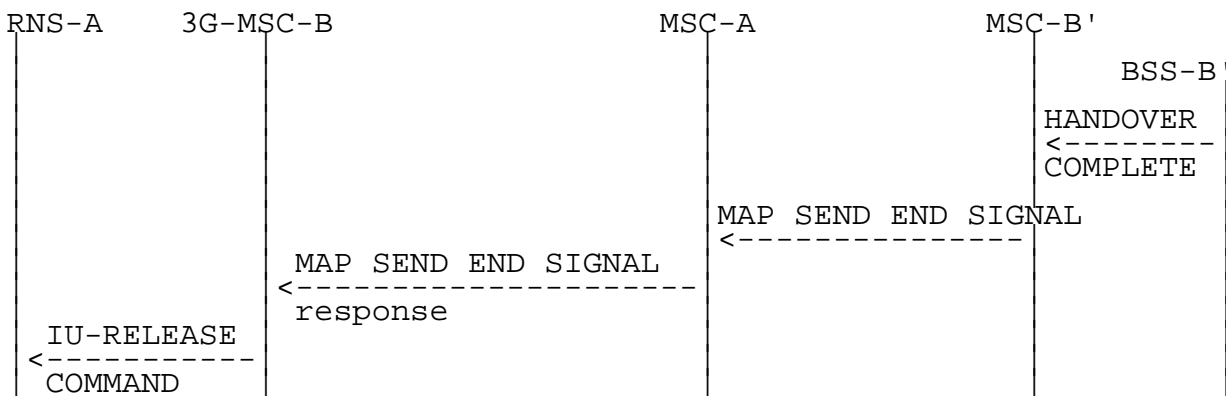
**Figure 35: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') completion
(Successful completion of the procedure)**

Negative outcome:

```
RNS-A          3G-MSC-B                       MSC-A                  MSC-B'
 | RELOCATION   |                              |                      |
 |----------->  |                              |                      |    BSS-B'
 | CANCEL       | MAP PROCESS ACCESS           |                      |
 |              |---------------------->       |                      |
 |              | SIGNALLING request (Note 1)  |                      |
 |              |                              | MAP U -ABORT         |
 |              |                              |--------------->      |
 |              |                              |                      | CLEAR
 |              |                              |                      |-------->
 | RELOCATION   |                              |                      | COMMAND
 |<----------   |                              |                      |
 | CANCEL ACK   |                              |                      |
 |              |                              |                      |
 |              |                              |                      |
```
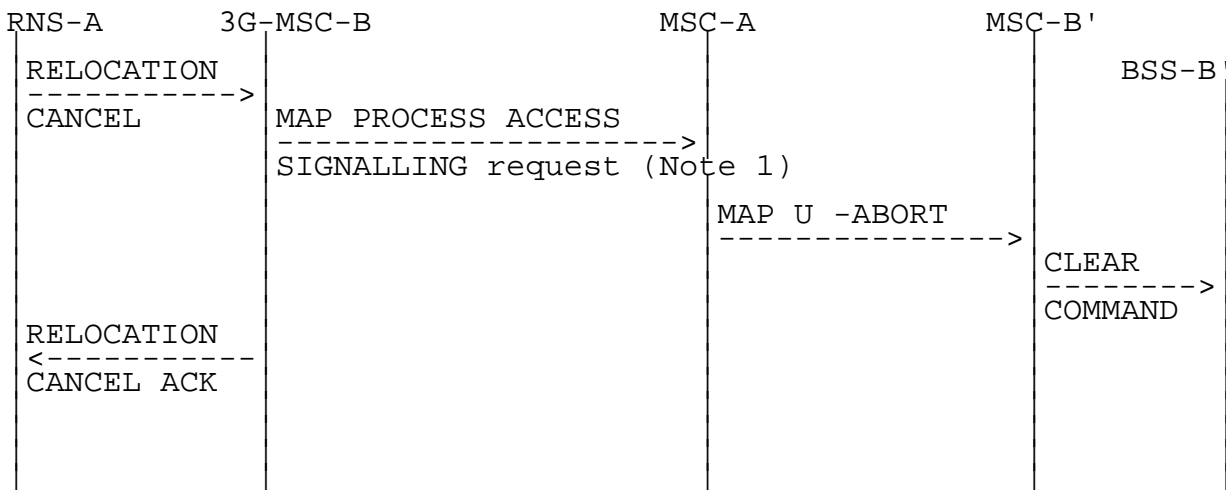
**Figure 36: Signalling for Subsequent Inter-MSC Handover to third MSC (MSC-B') completion
(Unsuccessful completion of the procedure)**

NOTE 1: Specific interworking case detailed below.

The specific interworking case in MSC-A compared to the clauses 4.5.1 and 4.5.2 occurs between HANDOVER
FAILURE encapsulated in a Process Access Signalling from 3G-MSC-B and the abortion of the dialogue with MSC-B'
in the case of a reversion to old channel of the MS:

```
---------------------------------------------------------------
         |        29.002                         29.002   |Notes
---------|-----------------------------------------------|-----
Forward  | MAP PROCESS-SIGNALLING
message  |         request
         |
         |         -AN-APDU(              MAP U -ABORT     |  1
         |         HANDOVER  FAILURE)
         |
---------|-----------------------------------------------|-----
Positive |
result   |
---------|-----------------------------------------------|-----
Negative |
result   |                                MAP U/P -ABORT   |  2
         |
---------------------------------------------------------------
```

NOTE 1: The abortion of the dialogue triggers in MSC-B' the clearing of the circuit connection with MSC-A, if any, and of the Resources between MSC-B' and BSS-B'.The abortion of the dialogue ends the handover procedure with MSC-B'.

NOTE 2: The abortion of the dialogue ends the handover procedure with 3G-MSC-B.

4.6.4   BSSAP Messages transfer on E-Interface

The handling is described in clause 4.5.4.

4.6.5   Processing in MSC-B, and information transfer on E-interface

The handling is described in clause 4.5.5.

4.6.6   Cause Code Mapping

When a Mobile Station is handed over between UMTS and GSM, a mapping of the cause codes used in the RANAP and the BSSMAP protocols is needed. The mapping described here is applicable to the BSSMAP protocol even when used inside MAP in the E-interface.

The mapping between the cause codes received in RANAP Relocation Required and the cause codes sent in BSSMAP Handover Request is as follows:

```
---------------------------------------------------------------
    25.413                         48.008               |Notes
---------------------------------------------------------|------
RELOCATION REQUIRED             HANDOVER REQUEST         |

 -Time critical relocation        -'uplink quality'      |
 -Resource optimisation           -Traffic               |
  relocation                                             |
 -Relocation desirable for        -Better cell           |
  radio reasons                                          |
 -Directed retry                  -Directed retry        |
 -Reduce Load in                  -Reduce Load in        |
  serving cell                     serving cell          |
 -Any other value                 -Better cell           |
```

The mapping between the cause codes received in RANAP Relocation Cancel and the cause codes sent in BSSMAP Clear Command is as follows:

```
--------------------------------------------------------------
     25.413                      48.008                |Notes
--------------------------------------------------------------
RELOCATION CANCEL              CLEAR COMMAND           |

  -Trelocprepexpiry              -Radio interface      |
                                 failure, reversion to |
                                 old channel           |
  -Interaction with other        -Radio interface      |
   procedure                     failure, reversion to |
                                 old channel           |
  -Any other value               -Radio interface      |
                                 failure, reversion to |
                                 old channel           |
```

The mapping between the cause codes received in BSSMAP Handover Failure and the cause codes sent in RANAP
Relocation Preparation Failure is as follows:

```
--------------------------------------------------------------
     48.008                       25.413               |Notes
--------------------------------------------------------------
HANDOVER FAILURE               RELOCATION PREP. FAILURE|

  -Ciphering algorithm not       -Requested ciphering  |
   supported                     and/or integrity      |
                                 protection is not      |
                                 supported              |
  -Circuit pool mismatch                               | 1
  -Equipment failure             -Relocation failure in |
                                 Target CN/RNC or       |
                                 target system          |
  -Invalid message contents      -Abstract Syntax Error |
  -No radio resource available   -No Radio Resources    |
                                 Available in Target    |
                                 Cell                   |
  -O and M intervention          -O and M intervention  |
  -Radio interface failure,                             | 2
   reversion to old channel                             |
  -Radio interface message       -Relocation failure in |
   failure                       Target CN/RNC or       |
                                 target system          |
  -Requested speech version      -Relocation failure in |
   unavailable                   Target CN/RNC or       |
                                 target system          |
  -Requested terrestrial         -Relocation failure in |
   resource unavailable          Target CN/RNC or       |
                                 target system          |
  -Requested transcoding/rate    -Relocation failure in |
   adaption unavailable          Target CN/RNC or       |
                                 target system          |
  -Switch circuit pool                                  | 1
  -Terrestrial circuit already   -Relocation failure in |
   allocated                     Target CN/RNC or       |
                                 target system          |
  -Traffic load in the target    -Traffic load in the   |
   cell higher than in the       -target cell higher    |
   source cell                   than in the source     |
                                 cell                   |
  -Any other value               -Relocation failure in |
                                 Target CN/RNC or       |
                                 target system          |
```

NOTE 1: Cause code not used at inter-system handover.

NOTE 2: Cause code not applicable to this traffic case.

The mapping between the cause codes received in BSSMAP Clear Request and the cause codes sent in RANAP Iu
Release Request is as follows:

```
------------------------------------------------------------------
     48.008                          25.413              |Notes
------------------------------------------------------------------
CLEAR REQUEST                      IU RELEASE REQUEST     |

 -Radio interface message          -Relocation failure in
  failure                           Target CN/RNC or
                                    target system
 -O and M intervention             -O and M intervention
 -Equipment failure                -Relocation failure in
                                    Target CN/RNC or
                                    target system
 -Joined group call channel        -Unspecified failure
 -Protocol failure between BSS     -Message not compatible
  and MSC                           with receiver state
 -Preemption                       -RAB pre-empted
 -Access restricted due            -Access restricted due
  to shared networks                to shared networks
 -Any other value                  -Relocation failure in
                                    Target CN/RNC or
                                    target system
```

4.7   Inter-MSC Handover (GSM to UMTS)

The general principles of the handover procedures are given in 3GPP TS 23.009 [2]. 3GPP TS 29.010 gives the necessary information for interworking between the 3GPP TS 25.413 [7] RANAP protocol, GSM handover procedures and the 3GPP TS 29.002 [9] MAP protocol. The RANAP protocol is used between the RNS and the 3G_MSC.

The following four principles apply for the Inter-MSC handover GSM to UMTS:

The BSSMAP parameters required for Inter-MSC handover GSM to UMTS are generated as in GSM.

Received RANAP parameters, e.g. cause code or transparent container, are mapped to the appropriate BSSMAP parameters, e.g. cause code or Handover command.

The RANAP parameters required for Inter-MSC handover GSM to UMTS are generated from received or stored GSM parameters.

When new parameters need to be added for transfer on the E-interface, the principles stated in the beginning of clause 4.5 shall be followed.

4.7.1   Basic Inter-MSC Handover

When a Mobile Station is handed over between two MSCs, the establishment of a connection between them (described in 3GPP TS 23.009 [2]) requires interworking between A-Interface, Iu-Interface and E-Interface.

The signalling at initiation, execution and completion of the Basic Inter-MSC handover procedure is shown in figures 37 to 42 with both possible positive or negative outcomes.

Additionally figure 37b shows the possible interworking when the trace related message is transparently transferred on the E-Interface at Basic Inter-MSC Handover initiation.

```
BSS-A              MSC-A                        3G-MSC-B
|                  |                            |
| HANDOVER         |                            |
|----------------->| MAP PREPARE HANDOVER       |
| REQUIRED         |-------------------------->|  +----------------+
|                  | request                   |  |Possible Alloc. |
|                  |                           |  |of a handover   |
|                  |                           |  |no. in the VLR-B|
|                  |                           |  +----------------+
|                  |                           |
|                  |                           |                RNS-B
|                  |                           |
|                  |                           | RELOCATION REQUEST |
|                  |                           |------------------->|
|                  |                           |
```
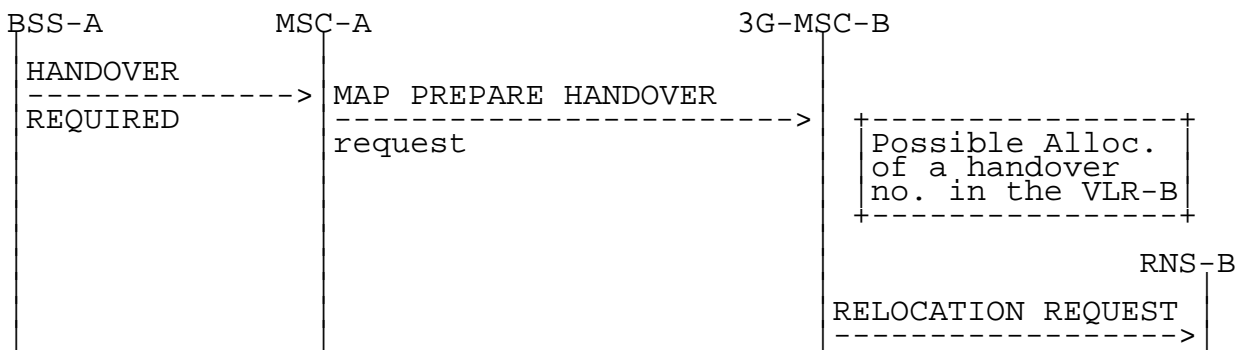
Figure 37a: Signalling for Basic Inter-MSC Handover initiation (no trace related messages transferred)

```
BSS-A              MSC-A                        3G-MSC-B
|                  (*)                          |
| HANDOVER         |                            |
|----------------->| MAP PREPARE HANDOVER       |
| REQUIRED         |------------------------->  |  +----------------+
|                  | request  (**)             |  |Possible Alloc. |
|                  |                           |  |of a handover   |
|                  |                           |  |no. in the VLR-B|
|                  |                           |  +----------------+
|                  |                           |
|                  |                           |                RNS-B
|                  |                           |
|                  |                           | RELOCATION REQUEST |
|                  |                           |------------------->|
|                  |                           |
|                  |                           | CN INVOKE TRACE    |
|                  |                           |--------------->(***)|
```
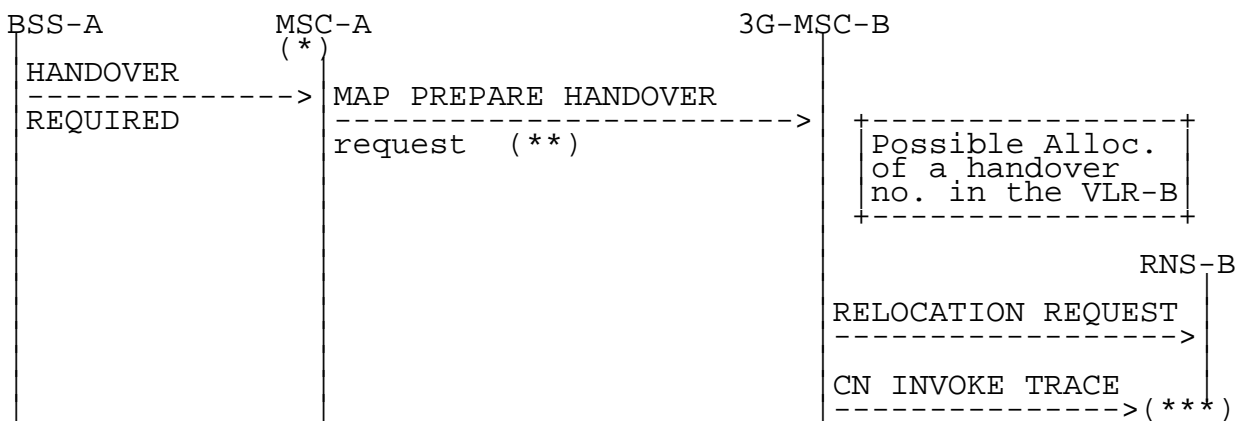
Figure 37b: Signalling for Basic Inter-MSC Handover initiation (CN invoke trace message transferred)

(*):   Tracing invocation has been received from VLR.

(**):   In that case, HANDOVER REQUEST and MSC INVOKE TRACE messages are included within the AN-apdu parameter.

(***):   CN INVOKE TRACE is forwarded to RNS-B if supported by 3G_MSC-B.

Possible Positive outcomes: successful radio resources allocation and handover number allocation (if performed):

```
BSS-A              MSC-A                        3G-MSC-B            RNS-B
|                  |                            |                  |
|                  |                            | RELOCATION REQUEST|
|                  |                            |<-----------------|
|                  |                            | ACKNOWLEDGE       |
|                  |                            | LOCATION REPORTING|
|                  |                            |----------------->|
|                  |                            | CONTROL           |
|                  |  MAP PREPARE HANDOVER      |                  |
|                  |<-------------------------  |                  |
|                  |  response                  |                  |
| HANDOVER COMMAND |                            |                  |
|<---------------- |                            |                  |
```
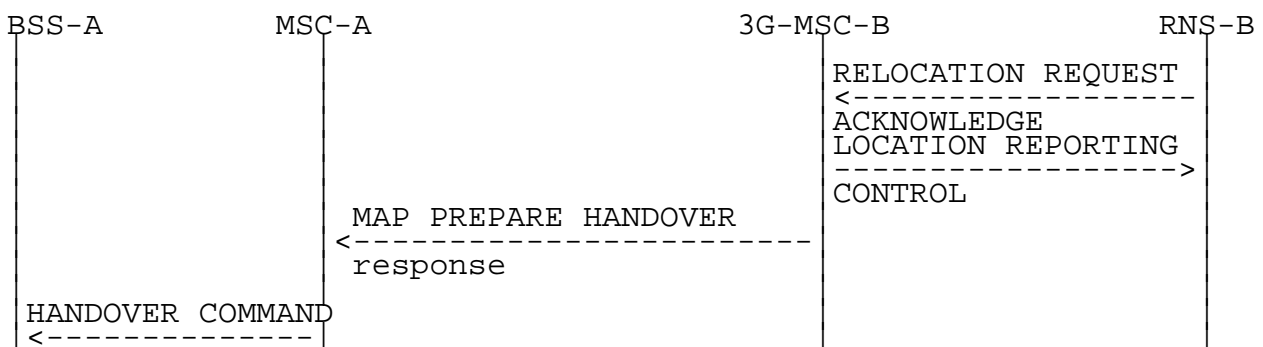
Figure 38: Signalling for Basic Inter-MSC Handover execution (Positive outcome)

Possible Negative outcomes:

   a) user error detected, or handover number allocation unsuccessful (if performed), or component rejection or dialogue abortion performed by 3G_MSC-B:

```
BSS-A            MSC-A                           3G-MSC-B           RNS-B
|                |                               |                  |
|                |  MAP PREPARE HANDOVER response|                  |
|                |  negative result, MAP CLOSE   |                  |
|                |<------------------------------|                  |
|                |  MAP U/P-ABORT                |                  |
|                |                               |                  |
| HANDOVER REQUIRED                              |                  |
|<---------------|                               |                  |
| REJECT (Note 1)|                               |                  |
|                |                               |                  |
```
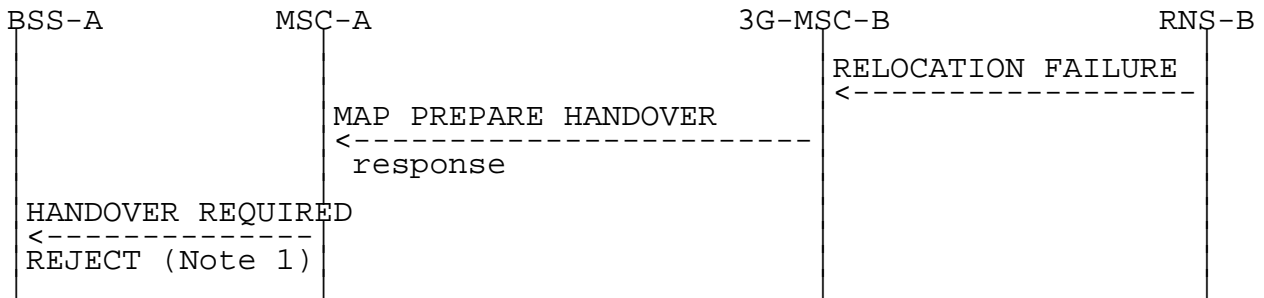
b) radio resources allocation failure:

```
BSS-A            MSC-A                           3G-MSC-B           RNS-B
|                |                               |                  |
|                |                               | RELOCATION FAILURE
|                |                               |<-----------------|
|                |  MAP PREPARE HANDOVER         |                  |
|                |<------------------------------|                  |
|                |   response                    |                  |
| HANDOVER REQUIRED                              |                  |
|<---------------|                               |                  |
| REJECT (Note 1)|                               |                  |
|                |                               |                  |
```

c) unsuccessful handover execution (Reversion to the old radio resources):

```
BSS-A            MSC-A                           3G-MSC-B           RNS-B
| HANDOVER       |                               |                  |
|--------------->|                               |                  |
| FAILURE        |                               |                  |
|                |  MAP U -ABORT                 |                  |
|                |------------------------------>|                  |
|                |                               | IU RELEASE COMMAND
|                |                               |----------------->|
|                |                               |                  |
```
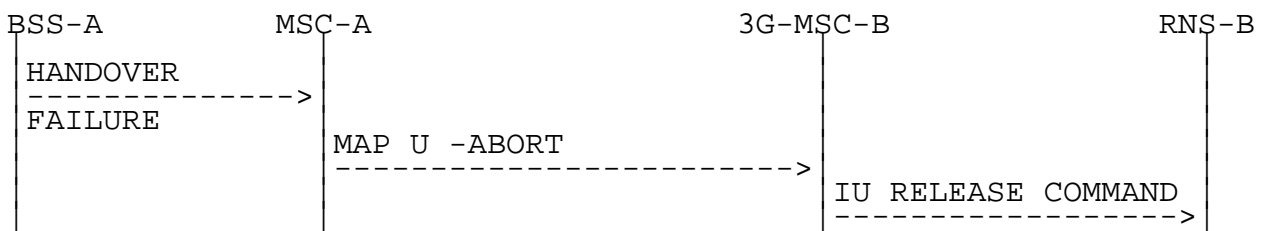
Figure 39: Signalling for Basic Inter-MSC Handover execution (Negative outcomes)

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or RANAP procedure.

```
BSS-A            MSC-A                           3G-MSC-B           RNS-B
|                |                               |                  |
|                |                               | RELOCATION COMPLETE
|                |                               |<-----------------|
|                |  MAP SEND END SIGNAL request  |                  |
|                |<------------------------------|                  |
| CLEAR COMMAND  |                               |                  |
|<---------------|                               |                  |
|                |                               |                  |
```
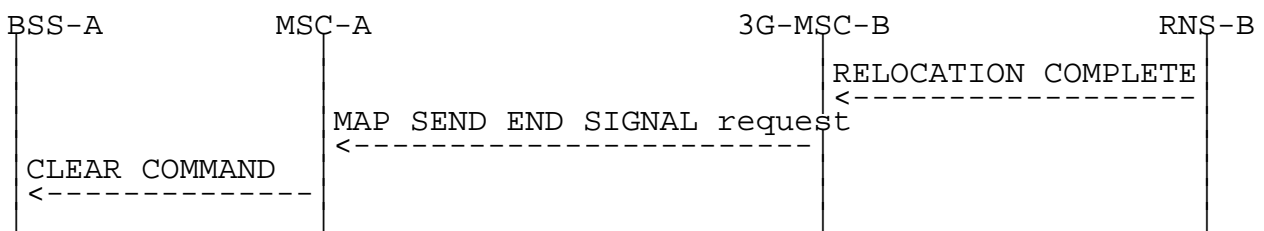
Figure 40: Signalling for Basic Inter-MSC Handover completion

Positive outcome:

```
BSS-A            MSC-A                           3G-MSC-B           RNS-B
|                |                               |                  |
|                |  MAP SEND END SIGNAL          |                  |
|                |------------------------------>|                  |
|                |   response                    | IU RELEASE COMMAND
|                |                               |----------------->|
|                |                               | (Note 2)         |
|                |                               |                  |
```
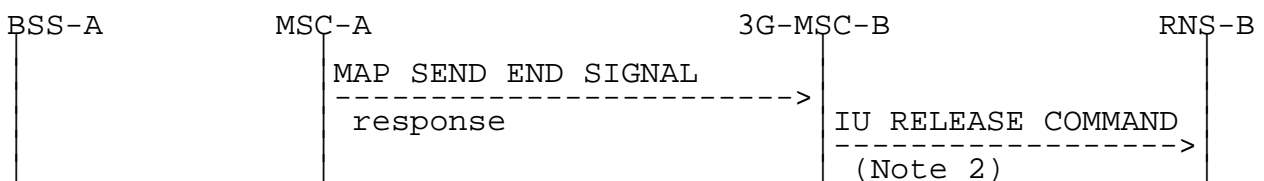
Figure 41: Signalling for Basic Inter-MSC Handover completion (Positive outcome)

Negative outcome:

```
BSS-A                MSC-A                        3G-MSC-B              RNS-B
 |                    |                            |                     |
 |                    |   MAP U/P -ABORT           |                     |
 |                    |--------------------------->|                     |
 |                    |                            | IU RELEASE COMMAND  |
 |                    |                            |-------------------->|
 |                    |                            |                     |
```
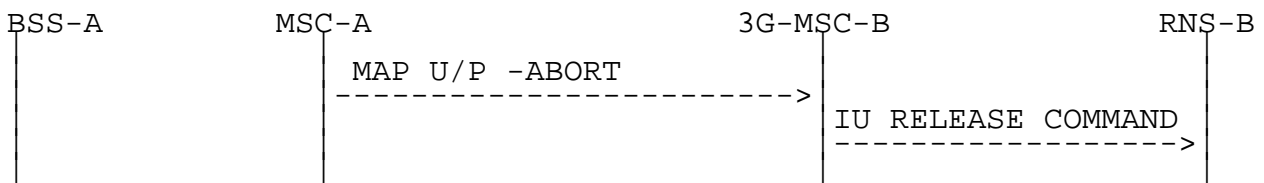
Figure 42: Signalling for Basic Inter-MSC Handover completion (Negative outcome)

NOTE 2: From interworking between MAP and RANAP point of view, when the call is released.

```
BSS-A                MSC-A                        3G-MSC-B              RNS-B
 |                    |                            |                     |
 |                    |                            | LOCATION REPORT     |
 |                    |                            |<------------------- |
 |                    | MAP PROCESS ACCESS         |                     |
 |                    |<-------------------------- |                     |
 |                    | SIGNALLING                 |                     |
```

Figure 42a: Signalling for updating of anchor MSC after change of location in RNS

The handover procedure is normally triggered by BSS-A by sending a HANDOVER REQUIRED message on A-Interface to MSC-A. The invocation of the Basic Inter-MSC handover procedure is performed and controlled by MSC-A. The sending of the MAP Prepare-Handover request to 3G_MSC-B is triggered in MSC-A upon receipt of the HANDOVER REQUIRED message. The identity of the target RNC where the call is to be handed over in 3G_MSC-B area, provided in the HANDOVER REQUIRED message in the information element Cell Identifier List (Preferred), is mapped to the target RNC Id MAP parameter and the HANDOVER REQUEST message is encapsulated in the an-APDU MAP parameter of the Prepare-Handover MAP request. 3G_MSC-B can invoke another operation towards the VLR-B (allocation of the handover number described in 3GPP TS 29.002 [9]).

Additionally, if tracing activity has been invoked, the trace related message can be transferred on the E-Interface encapsulated in the an-APDU MAP parameter of the Prepare-Handover Request. If transferred, one complete trace related message at a time shall be included in the an-APDU MAP parameter after the HANDOVER REQUEST message. Note: UMTS supports only CN initiated tracing.

The interworking between Prepare Handover and HANDOVER REQUIRED is as follows:

```
-----------------------------------------------------------------------------
       |        48.008                        29.002              |Notes
-------+--------------------------------------------------------------+------
Forward| HANDOVER REQUIRED    MAP PREPARE HANDOVER request
message|
       |                                -ho-NumberNotRequired|  1
       |    BSSMAP information           -target RNC Id
       |        elements                -IMSI
       |                                -Integrity protection|  2
       |                                    info
       |                                -Encryption info
       |                                -an-APDU(            |  3
       |                                    HANDOVER REQUEST,
       |                                    MSC INVOKE TRACE) |  4
       |    GERAN classmark             -GERAN classmark     |  7
-------+--------------------------------------------------------------+------
Positive|                              MAP PREPARE HANDOVER response
result |                                                     |  5
       |                                -handover number
       |                                -an-APDU(
       |                                    HANDOVER REQUEST
       |                                    ACKNOWLEDGE or
       |                                    HANDOVER FAILURE)
-------+--------------------------------------------------------------+------
Negative| HANDOVER REQUIRED REJECT    MAP PREPARE HANDOVER  |  6
result |
       |    equipment failure              System Failure
       |    equipment failure              No Handover Number
       |                                       available
       |    equipment failure              UnexpectedDataValue
       |    equipment failure              Data Missing
       |
       |    equipment failure              MAP CLOSE
       |    equipment failure              MAP U/P -ABORT
```

NOTE 1: The ho-NumberNotRequired parameter is included by MSC-A, when MSC-A decides not to use any circuit connection with 3G_MSC-B. No handover number shall be present in the positive result. Any negative response from 3G_MSC-B shall not be due to handover number allocation problem.

NOTE 2: Integrity protection information, encryption information and IMSI parameters are included by MSC-A, only when the MSC-A uses 29.002 as per release 99. These IEs are not included if the MSC-A is R98 or earlier.

NOTE 3: NOTE 3: The process performed on the BSSMAP information elements received in the HANDOVER REQUIRED message is described in the 3GPP TS 48.008 [12].

NOTE 4: The process performed on the BSSMAP information elements received in the MSC INVOKE TRACE message is described in clause 4.5.5.6.

NOTE 5: The response to the Prepare-Handover request can include in its an-APDU parameter, identifying the 3GPP TS 48.006 protocol, either a BSSMAP HANDOVER REQUEST ACKNOWLEDGE or a BSSMAP HANDOVER FAILURE.

In the first case, the positive result triggers in MSC-A the sending on A-Interface of the HANDOVER COMMAND.

In the second case, the positive result triggers in MSC-A optionally the sending of the HANDOVER REQUIRED REJECT.

(The possible sending of the HANDOVER REQUIRED REJECT message upon receipt of the HANDOVER FAILURE is out of the scope of 3GPP TS 29.010 and lies in 3GPP TS 48.008 [12]).

NOTE 6: The possible sending of the HANDOVER REQUIRED REJECT message is described in 3GPP TS 48.008 [12].

NOTE 7: If the GERAN Classmark was not received with the HANDOVER REQUIRED message initiating the handover, MSC-A shall include any previously received GERAN Classmark. See 3GPP TS 43.051 [17].

The interworking between Prepare Handover and RELOCATION REQUEST in 3G_MSC-B is as follows:

```
---------------------------------------------------------------------------
        |       29.002                          25.413             |Notes
---------------------------------------------------------------------------
Forward | MAP PREPARE HANDOVER       RELOCATION REQUEST           |
message | request                                                 |
        | -ho-NumberNotRequired                                   |
        | -target RNC Id                                          |
        | -IMSI                                                   |
        | -Integrity protection info                              |  1
        | -Encryption info                                        |
        | -RANAP service handover                                 |
        | -UESBI                                                  |
        | -an-APDU(                                               |
        | HANDOVER REQUEST,                                       |
        | MSC INVOKE TRACE)                                       |
        |                                                         |
        | BSSMAP information          RANAP information           |
        |     elements:                  elements:               |
        |                                                         |
        |    Channel Type                RAB parameters          |
        |    Cause                       Cause                    |
        |    sRNC to tRNC container    sRNC to tRNC container     |
        |    SNA Access Information    SNA Access Information     |  3
        |                                                         |
        |                             info stored/generated      |
        |                             in/by 3G_MSC-B:            |
        |                                CN domain indicator      |
---------------------------------------------------------------------------
Positive| MAP PREPARE HANDOVER       RELOCATION REQUEST ACK       |
result  | response                                                |
        | -an-APDU(                                               |
        |  HANDOVER REQUEST ACK)                                  |
        |                                                         |
        | BSSMAP information          RANAP information           |
        |     elements:                  elements:               |
        |                                                         |
        |    Layer 3 info                tRNC to sRNC container   |
---------------------------------------------------------------------------
Negative| MAP PREPARE HANDOVER       RELOCATION FAILURE           |
result  | response                                                |
        | -an-APDU(                                               |
        |  HANDOVER FAILURE)                                      |
        | BSSMAP information          RANAP information           |
        |     elements:                  elements:               |
        |                                                         |
        |    GERAN classmark             GERAN classmark          |  2
        |                                                         |
---------------------------------------------------------------------------
```

NOTE 1:   Integrity protection information, encryption information, IMSI and RANAP service handover parameters are included by MSC-A only when the MSC-A uses 29.002 as per release 99. These IEs are not included if the MSC-A is R98 or earlier.

NOTE 2:   If a handover to GERAN Iu-mode failed, the target RNS may include a GERAN classmark in the RELOCATION FAILURE message. See 3GPP TS 43.051 [17].

NOTE 3:   SNA Access Information parameter is included by MSC-A only when the MSC-A uses 29.002 as per release 5. This IE is not included if the MSC-A is release 4 or earlier.

The interworking between Send End Signal and RELOCATION COMPLETE in 3G_MSC-B is as follows:

```
-----------------------------------------------------------------------
             |        25.413                           29.002         |Notes
-----------------------------------------------------------------------
Forward      | RELOCATION COMPLETE MAP SEND END SIGNAL request        |
message      |                                                        |
             |                               -an-APDU(                |
             |                                HANDOVER COMPLETE)       |
             |                                                        |
-----------------------------------------------------------------------
Positive     | IU RELEASE COMMAND   MAP SEND END SIGNAL response      |
result       |  -Normal release                                       | 1
-----------------------------------------------------------------------
Negative     | IU RELEASE COMMAND                                     |
result       |  -Normal release                             MAP CLOSE | 2
             |  -Normal release                         MAP U/P -ABORT |
             |                                                        |
-----------------------------------------------------------------------
```

NOTE 1: The positive empty result triggers the clearing of the Radio Resources on the Iu-Interface and the release of the SCCP connection between 3G_MSC-B and RNS-B. If a circuit connection is used between MSC-A and 3G_MSC-B, the 'Normal release' clearing cause shall only be given to RNS-B when 3G_MSC-B has received a clearing indication on its circuit connection with MSC-A.

NOTE 2: The abortion of the dialogue or the rejection of the component triggers in 3G_MSC-B the clearing of its circuit connection with MSC-A, if any, of the Radio Resources on the Iu-Interface and the release of the SCCP connection between 3G_MSC-B and RNS-B.

The interworking between Send End Signal and CLEAR COMMAND in MSC-A is as follows:

```
-----------------------------------------------------------------------
             |        29.002                           48.008         |Notes
-----------------------------------------------------------------------
Forward      | MAP SEND END SIGNAL          CLEAR COMMAND             |
message      | request                                                |
             |               -an-APDU(            - Handover          |
             |                HANDOVER COMPLETE)     Successful        |
-----------------------------------------------------------------------
Positive     |                                                        |
result       |                                                        |
-----------------------------------------------------------------------
Negative     |                                                        |
result       |                                                        |
-----------------------------------------------------------------------
```

The interworking between HANDOVER FAILURE in case of reversion to old channel of the MS and User Abort in MSC-A is as follows:

```
-----------------------------------------------------------------------
             |        48.008                           29.002         |Notes
-----------------------------------------------------------------------
Forward      | HANDOVER FAILURE              MAP U -ABORT             |
message      |                                                        |
             |  - Reversion to old                                    |
             |    channel                                             |
-----------------------------------------------------------------------
Positive     |                                                        |
result       |                                                        |
-----------------------------------------------------------------------
Negative     |                                                        |
result       |                                                        |
-----------------------------------------------------------------------
```

4.7.2   Subsequent Inter-MSC Handover from MSC-B back to 3G_MSC-A

When a Mobile Station is being handed over back to 3G_MSC-A, the procedure (described in 3GPP TS 23.009 [2]) requires interworking between A-Interface, Iu-Interface and E-Interface.

The signalling at initiation, execution and completion of the Subsequent Inter-MSC handover procedure is shown in figures 43 to 47.

```
BSS-A              MSC-B                        3G-MSC-A
|                  |                            |
| HANDOVER         |                            |
|---------------->|MAP PREPARE SUBSEQUENT       |
| REQUIRED        |----------------------------->|
|                 |HANDOVER request            |
|                 |                            |           RNS-B
|                 |                            |           |
|                 |                            |RELOCATION REQUEST |
|                 |                            |------------------>|
|                 |                            |           |
```

Figure 43: Signalling for Subsequent Inter-MSC Handover back to 3G_MSC-A initiation

Possible Positive outcomes: successful radio resources allocation:

```
BSS-A              MSC-B                        3G-MSC-A          RNS-B
|                  |                            |               |
|                  |                            |RELOCATION REQUEST |
|                  |                            |<------------------|
|                  |                            |ACKNOWLEDGE    |
|                  |  MAP PREPARE SUBSEQUENT    |               |
|                  |<---------------------------|               |
|                  |  HANDOVER response         |               |
| HANDOVER COMMAND |                            |               |
|<---------------|                            |               |
```

Figure 44: Signalling for Subsequent Inter-MSC Handover back to 3G_MSC-A execution (Positive outcome)

Possible Negative outcomes:

a) user error detected, or component rejection or dialogue abortion performed by 3G_MSC-A:

```
BSS-A              MSC-B                        3G-MSC-A          RNS-B
|                  |MAP PREPARE SUBSEQUENT HANDOVER            |
|                  |<---------------------------|               |
| HANDOVER REQUIRED  response negative result   |               |
|<---------------|                            |               |
| REJECT (Note 1) |                            |               |
|                 |                            |               |
```

b) component rejection or dialogue abortion performed by 3G_MSC-A:

```
BSS-A              MSC-B                        3G-MSC-A          RNS-B
|                  |MAP CLOSE, MAP U/P ABORT     |               |
|                  |<---------------------------|               |
| CLEAR COMMAND    |                            |               |
|<---------------|                            |               |
|                 |                            |               |
```

c) radio resources allocation failure:

```
BSS-A              MSC-B                        3G-MSC-A          RNS-B
|                  |                            |RELOCATION FAILURE |
|                  |                            |<------------------|
|                  |  MAP PREPARE SUBSEQUENT    |               |
|                  |<---------------------------|               |
| HANDOVER REQUIRED  HANDOVER response          |               |
|<---------------|                            |               |
| REJECT (Note 1) |                            |               |
```

d) unsuccessful relocation execution (reversion to the old radio resources):

```
BSS-A               MSC-B                           3G-MSC-A              RNS-B
 | HANDOVER           |                               |                     |
 |------------------->|                               |                     |
 | FAILURE            | MAP PROCESS ACCESS            |                     |
 |                    |------------------------------>|                     |
 |                    |       SIGNALLING request      | IU RELEASE COMMAND  |
 |                    |                               |-------------------->|
 |                    |                               |                     |
```

**Figure 45: Signalling for Subsequent Inter-MSC Handover back to 3G_MSC-A execution
(Negative outcome)**

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or BSSMAP procedure.

```
RNS-B               3G-MSC-A                        MSC-B                BSS-A
 | RELOCATION         |                               |                     |
 |------------------->| MAP SEND END SIGNAL           |                     |
 | COMPLETE           |------------------------------>|                     |
 |                    |     response                  |                     |
 |                    |                               | CLEAR COMMAND       |
 |                    |                               |-------------------->|
 |                    |                               |                     |
```

**Figure 46: Signalling for Subsequent Inter-MSC Handover back to 3G_MSC-A completion
(Successful completion of the procedure)**

NOTE: Positive outcome case shown in figure 41.

```
RNS-B               3G-MSC-A                        MSC-B                BSS-A
 |                    | MAP U/P -ABORT                |                     |
 |                    |<------------------------------|                     |
 |                    |                               | CLEAR COMMAND       |
 |                    |                               |-------------------->|
 |                    |                               | (Note 1)            |
 |                    |                               |                     |
```

**Figure 47: Signalling for Subsequent Inter-MSC Handover back to 3G_MSC-A completion
(Unsuccessful completion of the procedure)**

NOTE 1: Abnormal end of the procedure that triggers the clearing of all resources in MSC-B.

The interworking between Prepare Subsequent Handover and HANDOVER REQUIRED is as follows:

```
-----------------------------------------------------------------------------
            |     48.008                          29.002          | Notes
-----------------------------------------------------------------------------
Forward     | HANDOVER REQUIRED  MAP PREPARE SUBSEQUENT HANDOVER  |
message     |                           request                   |   1
            |                                                     |
            |                              -target MSC number     |
            |   BSSMAP information         -target RNC Id          |
            |       elements              -an-APDU(               |
            |                               HANDOVER REQUEST)      |
            |   GERAN classmark           -GERAN classmark        |   4
-----------------------------------------------------------------------------
Positive    | HANDOVER REQUIRED  MAP PREPARE SUBSEQUENT HANDOVER  |
result      |                           response                  |   2
            |                             -an-APDU(               |
            |                               HANDOVER REQUEST       |
            |                               ACKNOWLEDGE or         |
            |                               HANDOVER FAILURE)      |
-----------------------------------------------------------------------------
Negative    | HANDOVER REQUIRED REJECT   MAP PREPARE SUBSEQUENT   |   3
result      |                              HANDOVER response      |
            |   equipment failure          Unknown MSC            |
            |   equipment failure          Subsequent Handover    |
            |                                      Failure         |
            |   equipment failure          UnexpectedDataValue    |
            |   equipment failure          Data Missing           |
            |                                                     |
            |   CLEAR COMMAND                                      |
            |                                                     |
            |   equipment failure          MAP CLOSE              |
            |   equipment failure          MAP U/P -ABORT         |
            |                                                     |
-----------------------------------------------------------------------------
```

NOTE 1:   The processing performed on the BSSMAP information elements received in the HANDOVER REQUIRED message is out of the scope of the present document. The target MSC number is provided to 3G_MSC-A by MSC-B based on the information received from RNS-B.

NOTE 2:   The response to the Prepare-Subsequent-Handover request can include in its an-APDU parameter, identifying the 3GPP TS 48.006 protocol, either a BSSMAP HANDOVER REQUEST ACKNOWLEDGE or a BSSMAP HANDOVER FAILURE.

In the first case, the positive result triggers in MSC-B the sending on A-Interface of the HANDOVER COMMAND.

In the second case, the positive result triggers in MSC-B optionally the sending of the HANDOVER REQUIRED REJECT.

(The possible sending of the HANDOVER REQUIRED REJECT message upon receipt of the HANDOVER FAILURE is out of the scope of 3GPP TS 29.010 and lies in 3GPP TS 48.008 [12]).

NOTE 3:   The possible sending of the HANDOVER REQUIRED REJECT message is described in 3GPP TS 48.008 [12].

NOTE 4:   If the GERAN Classmark was not received with the HANDOVER REQUIRED message initiating the handover, MSC-B shall include any previously received GERAN Classmark. See 3GPP TS 43.051 [17].

The interworking between Prepare Subsequent Handover and RELOCATION REQUEST in 3G_MSC-A is as follows:

```
-----------------------------------------------------------------------
       |      29.002                        25.413           | Notes
-------|--------------------------------------------------------|------
Forward| MAP PREPARE SUB HANDOVER   RELOCATION REQUEST          |
message| request                                                |
       | -ho-NumberNotRequired                                  |
       | -target RNC ID                                         |
       | -an-APDU(                                              |
       | HANDOVER REQUEST,                                      |
       | MSC INVOKE TRACE)                                      |
       |                                                        |
       | BSSMAP information        RANAP information            |
       |      elements:                elements:               |
       |                                                        |
       |   Cause                      Cause                     |
       |   sRNC to tRNC container   sRNC to tRNC container      |
       |                                                        |
       |                           info stored/generated       |
       |                           in/by 3G_MSC-A:             |
       |                            CN domain indicator        |
       |                            RAB parameters             |
       |                            Permanent NAS UE id         |
       |                            Encryption info            |
       |                            Integrity protection       |
       |                                   info                |
-------|--------------------------------------------------------|------
Positive| MAP PREPARE SUB HANDOVER  RELOCATION REQUEST ACK      |
result | response                                               |
       | -an-APDU(                                              |
       |  HANDOVER REQUEST ACK)                                 |
       |                                                        |
       | BSSMAP information        RANAP information            |
       |      elements:                elements:               |
       |                                                        |
       |   Layer 3 info              tRNC to sRNC container     |
-------|--------------------------------------------------------|------
Negative| MAP SUB PREPARE HANDOVER  RELOCATION FAILURE          |
result | response                                               |
       | -an-APDU(                                              |
       |  HANDOVER FAILURE)                                     |
       |                                                        |
       |                                                        |
       | BSSMAP information        RANAP information            |
       |      elements:                elements:               |
       |                                                        |
       |   GERAN classmark           GERAN classmark           | 1
       |                                                        |
-----------------------------------------------------------------------
```

NOTE 1: If a handover to GERAN Iu-mode failed, the target RNS may include a GERAN classmark in the RELOCATION FAILURE message. See 3GPP TS 43.051 [17].

The interworking between HANDOVER FAILURE and MAP Process Signalling Request in 3G_MSC-B is as follows:

```
-----------------------------------------------------------------------
       |      48.008                        29.002           | Notes
-------|--------------------------------------------------------|------
Forward| HANDOVER FAILURE            MAP PROCESS-SIGNALLING     |
message|                                   request             |
       |                             -an-APDU(                 |
       |                              HANDOVER FAILURE)         |
       |                                                        |
-------|--------------------------------------------------------|------
Positive|                                                       |
result |                                                        |
-------|--------------------------------------------------------|------
Negative|                                                       |
result |                                                        |
       |                                                        |
-----------------------------------------------------------------------
```

The interworking between Send End Signal Response and RELOCATION COMPLETE in 3G_MSC-A is as follows:

	25.413	29.002	Notes
Forward message	RELOCATION COMPLETE	MAP SEND END SIGNAL response	
Positive result			
Negative result		MAP U/P -ABORT	1

NOTE 1: The abortion of the dialogue ends the handover procedure with MSC-B.

4.7.3 Subsequent Inter-MSC Handover to third MSC

When a Mobile Station is being handed over to a third MSC, the procedure (described in 3GPP TS 23.009 [2]) does require one specific interworking case in MSC-A (figure 49) between E-Interface from MSC-B and E-Interface from 3G_MSC-B' other than the combination of the ones described in the clause 4.5.1 and 4.7.2.

```
BSS-A        MSC-B                     MSC-A              3G-MSC-B'

 HANDOVER
 ---------->|MAP PREPARE SUBSEQUENT
 REQUIRED   |--------------------->
            |HANDOVER request       |MAP PREPARE
            |                       |--------------->
            |                       |HANDOVER request
            |                                         +-------+
            |                                         |Possib.|
            |                                         |Alloc. |
            |                                         |of ho. |
            |                                         |number |
            |                                         | VLR-B |
            |                                         +-------+
            |                                                RNS-B'
            |                                         RELOCATION
            |                                         -------->
            |                                         REQUEST
```

Figure 45: Signalling for Subsequent Inter-MSC Handover to third MSC (3G_MSC-B') initiation

Possible Positive outcomes: successful radio resources allocation:

```
BSS-A        MSC-B                     MSC-A              3G-MSC-B'
                                                                RNS-B'
                                                         RELOCATION
                                                         <--------
                                                         REQUEST
                                                         ACKNOWLEDGE

                                                         LOCATION
                                                         -------->
                                                         REPORTING
                                                         CONTROL
                                       MAP PREPARE HANDOVER
                                       <---------------
            MAP PREPARE SUBSEQUENT          response
            <---------------------
            HANDOVER response
 HANDOVER
 <-----------
   COMMAND
```

Figure 46: Signalling for Subsequent Inter-MSC Handover to third MSC (3G_MSC-B') execution (Positive outcome)

Possible Negative outcomes:

a) user error detected, or component rejection or dialogue abortion performed by MSC-B':

```
BSS-A         MSC-B                        MSC-A            3G-MSC-B'
|              |                            |                |      RNS-B'
|              |                            |                |        |
|              |                            | MAP PREPARE HANDOVER    |
|              |                            | response negative result
|              |                            | MAP CLOSE      |        |
|              |                            | <---------------        |
|              |                            | MAP U/P -ABORT |        |
|              | MAP PREPARE SUBSEQUENT     |                |        |
|              | <----------------------    |                |        |
|              | HANDOVER response negative |                |        |
|  HANDOVER    | result                     |                |        |
| <----------  |                            |                |        |
|  REQUIRED    |                            |                |        |
|  REJECT      |                            |                |        |
|  (Note 1)    |                            |                |        |
```

b) radio resources allocation failure:

```
BSS-A         MSC-B                        MSC-A            3G-MSC-B'
|              |                            |                |      RNS-B'
|              |                            |                |        |
|              |                            |                | RELOCATION
|              |                            |                | <--------
|              |                            |                | FAILURE |
|              |                            | MAP PREPARE HANDOVER     |
|              |                            | <---------------         |
|              | MAP PREPARE SUBSEQUENT     |  response      |        |
|              | <----------------------    |                |        |
|              | HANDOVER response          |                |        |
|  HANDOVER    |                            |                |        |
| <----------  |                            |                |        |
|  REQUIRED    |                            |                |        |
|  REJECT      |                            |                |        |
|  (Note 1)    |                            |                |        |
```
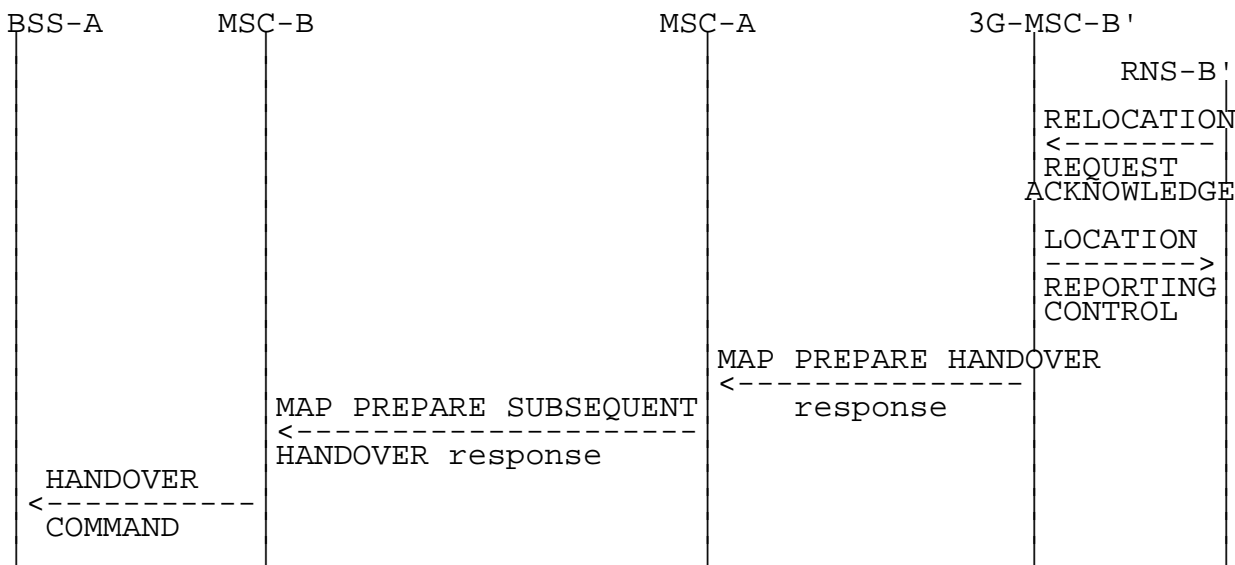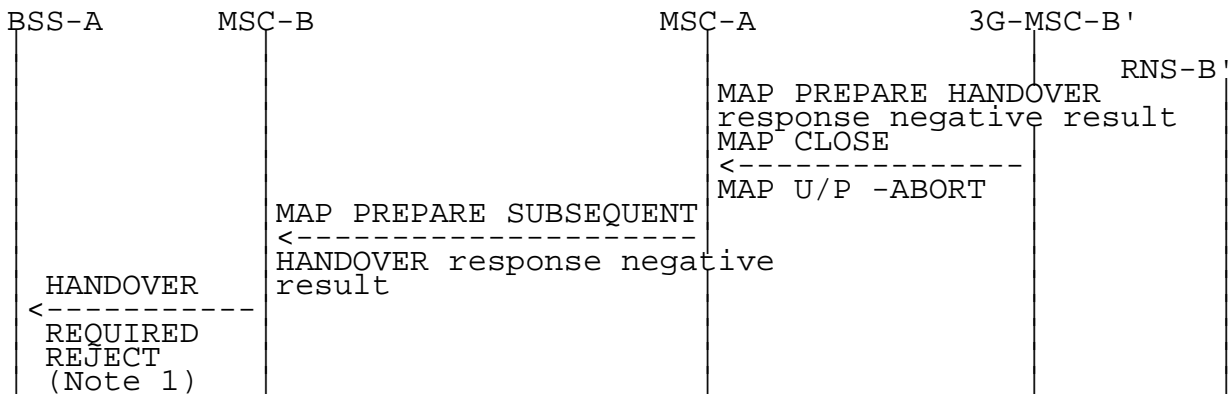
Figure 47: Signalling for Subsequent Inter-MSC Handover to third MSC (3G_MSC-B') execution (Negative outcome)

NOTE 1: Possible rejection of the handover because of the negative outcome of MAP or BSSMAP procedure.

Positive outcome:

```
BSS-A         MSC-B                        MSC-A            3G-MSC-B'
|              |                            |                |      RNS-B'
|              |                            |                |        |
|              |                            |                | RELOCATION
|              |                            |                | <--------
|              |                            |                | COMPLETE|
|              |                            | MAP SEND END SIGNAL     |
|              |                            | <---------------         |
|              |  MAP SEND END SIGNAL       | request        |        |
|              | <----------------------    |                |        |
|              |  response                  |                |        |
|  CLEAR       |                            |                |        |
| <----------  |                            |                |        |
|  COMMAND     |                            |                |        |
```

Figure 48: Signalling for Subsequent Inter-MSC Handover to third MSC (3G_MSC-B') completion (Successful completion of the procedure)

Negative outcome:

```
BSS-A          MSC-B                         MSC-A              3G-MSC-B'
│                                             │                      RNS-B'
│HANDOVER                                      │                      │
│---------->                                   │                      │
│FAILURE    │MAP PROCESS ACCESS                │                      │
│           │---------------------->           │                      │
│           │SIGNALLING request (Note 1)       │                      │
│           │                      │MAP U -ABORT                      │
│           │                      │--------------->                  │
│           │                      │                     │IU RELEASE  │
│           │                      │                     │-------->   │
│           │                      │                     │COMMAND     │
│           │                      │                     │            │
```
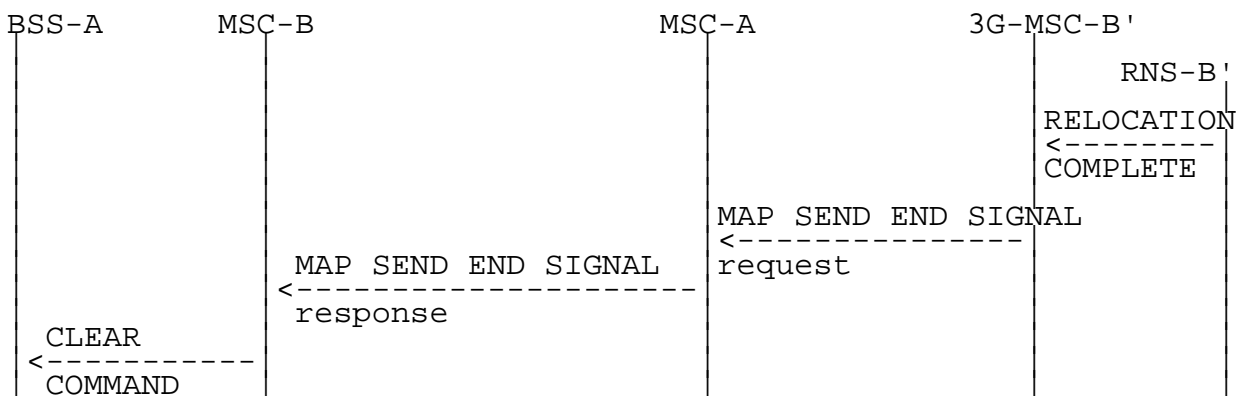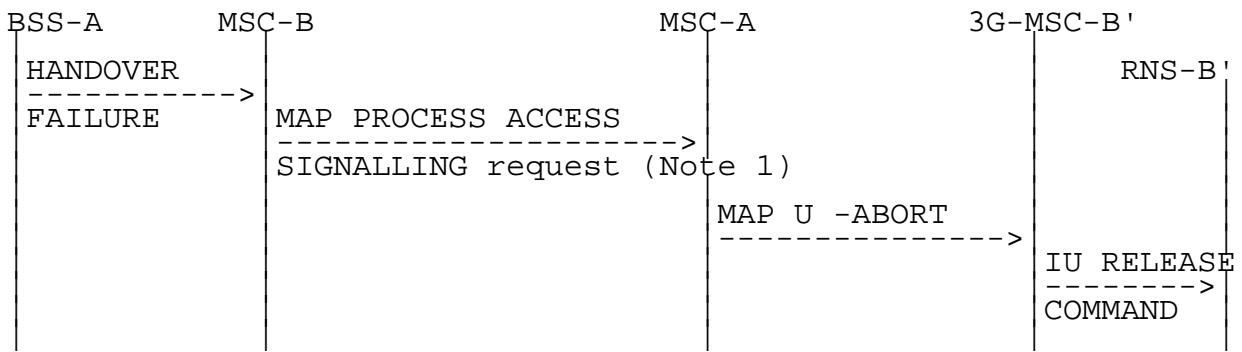
**Figure 49: Signalling for Subsequent Inter-MSC Handover to third MSC (3G_MSC-B') completion
(Unsuccessful completion of the procedure)**

NOTE: Specific interworking case detailed below.

```
BSS-A          MSC-A                         3G-MSC-B'            RNS-B'
│                │                             │                      │
│                │                             │LOCATION REPORT       │
│                │                             │<-------------------- │
│                │MAP PROCESS ACCESS           │                      │
│                │<----------------------------│                      │
│                │SIGNALLING                   │                      │
```
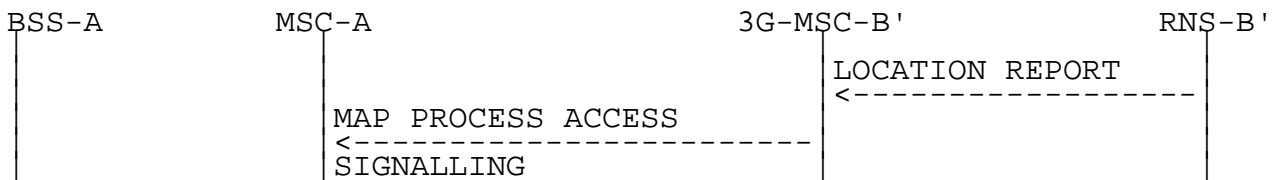
Figure 49a: Signalling for updating of anchor MSC after change of location in RNS

The specific interworking case in MSC-A compared to the clauses 4.5.1 and 4.7.2 occurs between HANDOVER
FAILURE encapsulated in a Process Access Signalling from MSC-B and the abortion of the dialogue
with 3G_MSC-B' in the case of a reversion to old channel of the MS:

	29.002	29.002	Notes
Forward message	MAP PROCESS-SIGNALLING request -an-APDU(HANDOVER FAILURE)	MAP U -ABORT	1
Positive result			
Negative result		MAP U/P -ABORT	2

NOTE 1: The abortion of the dialogue triggers in 3G_MSC-B' the clearing of the circuit connection with MSC-A, if
any, and of the Resources between 3G_MSC-B' and RNS-B'. The abortion of the dialogue ends the
handover procedure with 3G_MSC-B'.

NOTE 2: The abortion of the dialogue ends the handover procedure with MSC-B.

4.7.4   BSSAP Messages transfer on E-Interface

The handling is described in clause 4.5.4, additional cases are described in this clause.

4.7.4.1   Assignment

The interworking between the BSSMAP assignment messages in MAP and the RANAP RAB assignment messages is
as follows:

```
------------------------------------------------------------------------
         |       29.002                        25.413         | Notes
---------+----------------------------------------------------+-----
Forward  | MAP PREPARE HANDOVER              RAB ASSIGNMENT REQ|
message  |       request
         |       -RANAP service              Service handover
         |        handover
         |       -an-APDU(
         |       ASSIGNMENT REQUEST)
         |
         | BSSMAP information                RANAP information
         |     elements:                         elements:
         |
         | Channel Type                      RAB parameters
         |
---------+----------------------------------------------------+-----
Positive | MAP PREPARE HANDOVER
result   |       request
         |       -an-APDU(
         |       ASSIGNMENT COMPLETE         RAB ASSIGNMENT
         |                                       RESPONSE
         |       or                          (positive result)
         |       ASSIGNMENT FAILURE)         RAB ASSIGNMENT
         |                                       RESPONSE
         |                                   (negative result)
         |
         | BSSMAP information                RANAP information
         |     elements:                         elements:
         |
         | Cause                             Cause              |  1
---------+----------------------------------------------------+-----
Negative |
result   |
         |                                   MAP U/P -ABORT
         |
------------------------------------------------------------------------
```

NOTE 1: For the mapping between the cause codes see clause 4.7.6.

4.7.4.2   Cipher Mode Control

The interworking between the BSSMAP cipher mode messages in MAP and the RANAP security mode messages is as follows:

```
------------------------------------------------------------------------
        |       29.002                          25.413          |Notes
------------------------------------------------------------------------
Forward | MAP FORWARD ACCESS SIGN.        SECURITY MODE CMD     |
message |       request                                         |
        |       -an-APDU(                                       |
        |       CIPHER MODE CMD)                                |
        |                                                       |
        | BSSMAP information              RANAP information      |
        |       elements:                      elements:        |
        |                                                       |
        | Encryption information          Integrity             |
        |                                      protection info  |
        |                                 Encryption info       |
        |                                                       |
--------+-----------------------------------------------------+------
Positive| MAP PROCESS ACCESS SIGN.                              |
result  |       request                                        |
        |       -an-APDU(                                       |
        |       CIPHER MODE COMPLETE     SECURITY MODE          |
        |       or                             COMPLETE         |
        |       CIPHER MODE REJECT)      SECURITY MODE          |
        |                                      REJECT           |
        |                                                       |
        | BSSMAP information              RANAP information      |
        |       elements:                      elements:        |
        |                                                       |
        | Encryption information          Integrity             |
        |                                      protection info  |
        |                                 Encryption info       |
        | Cause                           Cause                | 1
--------+-----------------------------------------------------+------
Negative|                                                       |
result  |                                MAP U/P -ABORT         |
        |                                                       |
------------------------------------------------------------------------
```

NOTE 1: For the mapping between the cause codes see clause 4.7.6.

4.7.4.3 Location Reporting Control

The interworking between the RANAP location report message and the BSSMAP handover performed message in MAP is as follows:

```
------------------------------------------------------------------------
        |       25.413                          29.002          |Notes
--------+-----------------------------------------------------+------
Forward | LOCATION REPORT        MAP PROC. ACC. SIGNALLING      |
message |                                                       |
        |                                -an-APDU(              |
        |                                HANDOVER PERFORMED)    |
        |                                                       |
        | RANAP information              BSSMAP information      |
        |       elements:                      elements:        |
        |                                                       |
        | Area identity (SAI)            Cell identifier        |
        | Cause                          Cause                  |
--------+-----------------------------------------------------+------
Positive|                                                       |
result  |                                                       |
--------+-----------------------------------------------------+------
Negative|                                                       |
result  |                                                       |
------------------------------------------------------------------------
```

4.7.5 Processing in 3G_MSC-B, and information transfer on E-interface

The following parameters require processing (e.g. to store the parameter, to internally generate the parameter) in MSC-B. The relevant BSSMAP procedures are mentioned to ease the comprehension, their detailed description is the

scope of 3GPP TS 48.008 [12]. Each BSSMAP message listed in 3GPP TS 49.008 [14] being transferred on E-interface shall use the mechanisms given in clause 4.5.4 and is described in 3GPP TS 48.008 [12].

4.7.5.1 Encryption Information

3G_MSC-B shall remove algorithms not allowed by 3G_MSC-B from the list of GSM algorithms received from MSC-A. The modified list of algorithms, the ciphering key and the chosen algorithm shall be stored by 3G_MSC-B and used for generating the UMTS parameters Encryption Information and Integrity Protection Information if they are not received in MAP Prepare Handover Request (the generation of the UMTS parameters from the GSM parameters is described in TS 33.102).

Transfer of Information:

> If ciphering has not been performed before Inter-MSC Handover, this will be controlled by MSC-A after the completion of Inter-MSC Handover.

> Ciphering control towards 3G_MSC-B:

>> If Ciphering has been performed before Inter-MSC Handover:

>> - in the Handover Request BSSMAP message (information included).

>>> The Handover Request Acknowledge should in this case NOT contain the indication of the chosen algorithm.

>> If Ciphering has NOT been performed before Inter-MSC Handover:

>> - in the Cipher Mode Command procedure between MSC-A and 3G_MSC-B.

4.7.5.2 Channel Type

The Channel Type shall be stored by 3G_MSC-B and used for generating RAB parameters.

Transfer of Information:

> Independently of the type of resource (Signalling only or traffic channel) assigned to the MS, the Channel Type Information is transferred to 3G_MSC-B in:

> - the Handover Request BSSMAP message.

>> Chosen Channel and/or Speech Version shall NOT be reported back to MSC-A in the Handover Request Acknowledge

> If a new type of resource is to be assigned after Inter-MSC Handover, this can be made with:

> - the BSSMAP Assignment procedure between MSC-A and 3G_MSC-B.

4.7.5.3 Classmark

This information shall be stored by 3G_MSC-B and might be received from MSC-A.

Transfer of Information due to Classmark received from MSC-A:

> This information shall be stored by 3G_MSC-B and is received:

> - in the Handover Request BSSMAP message.

> If a new type of resource is to be assigned after Inter-MSC Handover, Classmark Information MAY be included:

> - in the BSSMAP Assignment procedure.

4.7.5.4 Priority

The parameter shall be stored by 3G_MSC-B and used for generating RAB parameters. It is received as detailed below:

Transfer of Information:

> Received by 3G_MSC-B from MSC-A in:

- the Handover Request BSSMAP message.

> If a change is needed after an Inter-MSC Handover with:

- the BSSMAP Assignment procedure.

4.7.5.5 MSC-Invoke Trace Information Elements

The process to be performed by 3G_MSC-B on the information elements of the MSC Invoke Trace BSSMAP messages is left for further study.

Note that MSC-A does not forward BSC Invoke Trace in case of GSM to UMTS handover.

4.7.5.6 Selected UMTS Algorithm

A sequence of possible encryption and integrity protection algorithms, received from the 3G_MSC-A, can be sent to an RNS in Relocation Request or in Security Mode Command in case of cipher mode setting after inter-MSC handover from GSM to UMTS. The RNS chooses one of the listed algorithms and reports this back to the 3G_MSC in Relocation Request Acknowledge or Security Mode Complete respectively. The MSC-B provides the Selected UMTS algorithm information to the MSC-A. The Selected UMTS algorithms IE in the MAP Process Access Signalling Request and MAP Prepare Handover Response messages refers to the Chosen Integrity Protection Algorithm and Chosen Encryption Algorithm, defined in RANAP specification 3GPP TS 25.413 [7]

The selected algorithm shall be stored by 3G_MSC-B, and sent to 3G_MSC-A.

Transfer of Information:

> If ciphering has not been performed before Inter-MSC Handover, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Handover.

> If Ciphering has been performed before Inter-MSC Handover, Selected UMTS algorithm information is received by 3G_MSC-A from 3G_MSC-B in:

- The Prepare Handover Response MAP message.

> If Ciphering has NOT been performed before Inter-MSC Handover, Selected UMTS algorithm information is received by 3G_MSC-A from 3G_MSC-B in:

- The Process Access Signalling Request MAP message.

4.7.5.7 Allowed UMTS Algorithms

In case of GSM-subscriber, the Integrity Protection Information and UMTS Encryption Information are not transferred to the MSC-B during inter-MSC handover from GSM to UMTS. Allowed UMTS algorithms is UMTS information that is required in RANAP Relocation Request and RANAP Security Mode Command, and shall be provided by 3G_MSC-A. 3G_MSC-B needs this information in case of an inter-MSC GSM to UMTS handover and in subsequent security mode setting, after an inter-MSC GSM to UMTS handover. Therefore 3G_MSC-A must provide this information in case of an inter-MSC GSM to UMTS handover. The Allowed UMTS algorithms IE in the MAP Prepare Handover and in the MAP Forward Access Signalling Request messages refers to the Permitted Integrity Protection Algorithms in Integrity Protection Information and Permitted Encryption Algorithms in Encryption Information, defined in RANAP specification 3GPP TS 25.413 [7].

Allowed UMTS algorithms shall be stored by 3G_MSC-B.

Transfer of information:

> If ciphering has not been performed before Inter-MSC Handover, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Handover.

> Ciphering control towards 3G_MSC-B:

If Ciphering has been performed before Inter-MSC Handover:

- The Prepare Handover Request MAP message.

If Ciphering has NOT been performed before Inter-MSC Handover:

- The Forward Access Signalling Request MAP message.

4.7.5.8 BSSMAP Service Handover

This information shall be stored by 3G_MSC-B and sent to a BSS in Handover Request, when 3G_MSC-B performs handover to GSM.

Transfer of information:

The BSSMAP Service Handover information is transferred to 3G_MSC-B in:

- the Handover Request BSSMAP message.

If a new assignment of a TCH after an inter-MSC handover is to be performed, the BSSMAP Service Handover information is transferred to 3G_MSC-B in:

- the BSSMAP Assignment procedure.

4.7.5.9 RANAP Service Handover

This information shall be stored by 3G_MSC-B and sent to an RNS in Relocation Request during the basic inter-MSC handover or when 3G_MSC-B performs a subsequent relocation or handover to UMTS.

Transfer of information:

The RANAP Service Handover information is transferred to 3G_MSC-B in:

- the Prepare Handover Request MAP message.

If a new assignment of a Radio Access Bearer after an inter-MSC handover is to be performed, the information is transferred to 3G_MSC-B in:

- the Forward Access Signalling Request MAP message

and sent by 3G_MSC-B to the RNS in RAB Assignment Request.

4.7.5.10 GERAN Classmark

The GERAN Classmark shall be stored by 3G_MSC-B and can be received from MSC-A, from the serving BSS or serving RNS, or from the target RNS. The GERAN Classmark shall be used together with other parameters, e.g. the Channel Type, for selecting a service and for generating RAB parameters for handover to GERAN Iu-mode, subsequent relocation or handover to GERAN Iu-mode, and RAB (re-)assignment when the MS is in GERAN Iu-mode.

Transfer of Information due to GERAN Classmark received from MSC-A:

Received by 3G_MSC-B in:

- the Prepare Handover Request MAP message.

Transfer of Information due to GERAN Classmark received from the serving BSS or serving RNS:

Received by 3G_MSC-B in:

- the Handover Required BSSMAP message;

- the Initial UE RANAP message; or

- the RAB Assignment Response RANAP message.

Transfer of Information due to GERAN Classmark received from the target RNS:

Received by 3G_MSC-B in:

t- he Relocation Failure RANAP message.

4.7.5.11 SNA Access Information

This information shall be stored by 3G_MSC-B and sent to an RNS in the Relocation Request message when 3G_MSC-B performs handover to UMTS.

Transfer of information:

The SNA Access Information is transferred to 3G_MSC-B in:

- the Handover Request BSSMAP message.

4.7.5.12 UESBI

This information shall be stored by 3G_MSC-B and sent to an RNS in Relocation Request during the basic inter-MSC handover or when 3G_MSC-B performs a subsequent relocation or handover to UMTS.

Transfer of information:

The UESBI information is transferred to 3G_MSC-B in:

- the Prepare Handover Request MAP message.

4.7.5.13 Alternative Channel Type

This information shall be stored by 3G_MSC-B and from this information 3G_MSC-B shall generate Alternative RAB Parameters Value IE sent to an RNS in Relocation Request, when 3G_MSC-B performs relocation or handover to UMTS.

Transfer of information:

The Alternative Channel Type information is transferred to 3G_MSC-B in:

- the Prepare Handover Request MAP message.

If a new assignment of a Radio Access Bearer after an inter-MSC handover is to be performed, the information is transferred to 3G_MSC-B in:

- the Forward Access Signalling Request MAP message.

4.7.5.14 Trace parameters

This information shall be stored by 3G_MSC-B and 3G_MSC-B shall use this information for trace activation for MSC-S, MGW, RNC or BSC.

Transfer of information:

The Trace Parameter List information for MSC-S, MGW and RNC tracing is transferred to 3G_MSC-B in:

- the Prepare Handover Request MAP message.

The Trace Reference and Trace Type information for BSC tracing is transferred to 3G_MSC-B in:

- the MSC Invoke Trace BSSMAP message.

4.7.6 Cause Code Mapping

When a Mobile Station is handed over between GSM and UMTS, a mapping of the cause codes used in the BSSMAP and the RANAP protocols is needed. The mapping described here is applicable to the BSSMAP protocol even when used inside MAP in the E-interface.

The mapping between the cause codes received in BSSMAP Handover Required and the cause codes sent in RANAP Relocation Request is as follows:

```
-------------------------------------------------------------------
      48.008                         25.413             |Notes
-------------------------------------------------------------+--------
HANDOVER REQUIRED                    RELOCATION REQUEST  |

 -Better Cell                        -Relocation Desirable |
                                      for Radio Reasons    |

 -Directed retry                     -Directed retry       |
 -Distance                           -Time critical reloc. |
 -Downlink quality                   -Time critical reloc. |
 -Downlink strength                  -Time critical reloc. |
 -O and M intervention               -O and M intervention |
 -Preemption                         -RAB pre-empted       |
 -Response to MSC invocation         -Network Optimisation |
 -Switch circuit pool                                      |  1
 -Traffic                            -Resource Optimisation|
                                      Relocation           |
 -Uplink quality                     -Time critical reloc. |
 -Uplink strength                    -Time critical reloc. |
 -Reduce Load in                     -Reduce Load in       |
  serving cell                        serving cell         |
 -Any other value                    -Relocation Desirable |
                                      For Radio Reasons     |
```

NOTE 1: Cause code not used at inter-system handover.

The mapping between the cause codes received in BSSMAP Handover Request and the cause codes sent in RANAP Relocation Request is as follows (the mapping is only used for the MAP-E interface):

```
-------------------------------------------------------------------
      48.008                         25.413             |Notes
-------------------------------------------------------------+--------
HANDOVER REQUEST                     RELOCATION REQUEST  |

 -Better Cell                        -Relocation Desirable |
                                      for Radio Reasons    |

 -Directed retry                     - Directed retry      |
 -Distance                           -Time critical reloc. |
 -Downlink quality                   -Time critical reloc. |
 -Downlink strength                  -Time critical reloc. |
 -O and M intervention               -O and M intervention |
 -Preemption                         -RAB pre-empted       |
 -Response to MSC invocation         -Network Optimisation |
 -Switch circuit pool                                      |  1
 -Traffic                            -Resource Optimisation|
                                      Relocation           |
 -Uplink quality                     -Time critical reloc. |
 -Uplink strength                    -Time critical reloc. |
 -Reduce Load in                     -Reduce Load in       |
  serving cell                        serving cell         |
 -Any other value                    -Relocation Desirable |
                                      For Radio Reasons     |
```

NOTE 1: Cause code not used at inter-system handover.

The mapping between the cause codes received in BSSMAP Handover Failure and the cause codes sent in RANAP Iu Release Command is as follows:

```
-----------------------------------------------------------------------------
     48.008                              25.413                     |Notes
-----------------------------------------------------------------------------
HANDOVER FAILURE                     IU RELEASE COMMAND             |

 -Ciphering algorithm not                                          | 2
  supported
 -Circuit pool mismatch                                            | 1
 -Equipment failure                  -Relocation cancelled         |
 -Invalid message contents           -Abstract Syntax Error        |
 -No radio resource available                                      | 2
 -O and M intervention               -O and M intervention         |
 -Radio interface failure,           -Relocation cancelled         |
  reversion to old channel
 -Radio interface message            -Relocation cancelled         |
  failure
 -Requested speech version                                         | 2
  unavailable
 -Requested terrestrial                                            | 2
  resource unavailable
 -Requested transcoding/rate                                       | 2
  adaption unavailable
 -Switch circuit pool                                              | 1
 -Terrestrial circuit already        -Relocation cancelled         |
  allocated
 -Any other value                    -Relocation cancelled         |
```

NOTE 1: Cause code not used at inter-system handover.

NOTE 2: Cause code not applicable to this traffic case.

The mapping between the cause codes received in RANAP Relocation Failure and the cause codes sent in BSSMAP Handover Failure is as follows (this mapping is only used for the MAP-E interface):

```
-----------------------------------------------------------------------------
     25.413                              48.008                     |Notes
-----------------------------------------------------------------------------
RELOCATION FAILURE                   HANDOVER FAILURE               |

-GERAN Iu-mode failure               -GERAN Iu-mode failure        |
-Traffic load in the target          -Traffic load in the          |
 cell higher than in the              target cell higher           |
 source cell                          than in the source           |
                                      cell                          |
-Any other value                     -No radio resource            |
                                      available                     |
```

The mapping between the cause codes received in RANAP Relocation Failure and the cause codes sent in BSSMAP Handover Required Reject is as follows:

```
-----------------------------------------------------------------------------
     25.413                              48.008                     |Notes
-----------------------------------------------------------------------------
RELOCATION FAILURE            HANDOVER REQUIRED REJECT              |

-GERAN Iu-mode failure               -GERAN Iu-mode failure        |
-Incoming Relocation                 -Incoming Relocation          |
 Not Supported Due To                 Not Supported Due To         |
 PUESBINE Feature                     PUESBINE Feature             |
-Traffic load in the target          -Traffic load in the          |
 cell higher than in the              target cell higher           |
 source cell                          than in the source           |
                                      cell                          |
-Any other value                     -No radio resource            |
                                      available                     |
```

The mapping between the RANAP and the BSSMAP assignment messages is used in the MAP-E interface. RANAP RAB Assignment Response with successful result is mapped to BSSMAP Assignment Complete; RANAP RAB Assignment Response with unsuccessful result is mapped to BSSMAP Assignment Failure. The mapping between the cause codes received in RANAP RAB Assignment Response and the cause codes sent in BSSMAP Assignment Failure is as follows (this mapping is only used for the MAP-E interface):

```
----------------------------------------------------------------
     25.413                         48.008                  |Notes
----------------------------------------------------------------+--------
RAB ASSIGNMENT RESPONSE        ASSIGNMENT FAILURE           |

-Requested traffic class not   -No radio resource
 available                       available
-Invalid RAB parameters value  -Invalid msg. contents
-Requested max bit rate not    -No radio resource
 available                       available
-Requested max bit rate for DL -No radio resource
 not available                   available
-Requested max bit rate for UL -No radio resource
 not available                   available
-Requested guaranteed bit rate -No radio resource
 not available                   available
-Requested guaranteed bit rate -No radio resource
 for DL not available            available
-Requested guaranteed bit rate -No radio resource
 for UL not available            available
-Requested transfer delay not  -No radio resource
 achievable                      available
-Invalid RAB param. combination-Invalid msg. contents
-Condition violation for SDU   -Invalid msg. contents
 parameters
-Condition violation for       -Invalid msg. contents
 traffic handling priority
-Condition violation for       -Invalid msg. contents
 guaranteed bit rate
-User plane not supported      -No radio resource
                                 available
-Iu UP failure                 -Equipment failure
-Tqueuing expiry               -Radio interface message
                                 failure
-Invalid RAB id                -Invalid msg. contents
-Request superseeded           -No radio resource
                                 available
-Relocation triggered          -Relocation triggered
-GERAN Iu-mode failure         -GERAN Iu-mode failure
-Any other value               -Radio interface message
                                 failure
```

The mapping between the cause codes received in RANAP Security Mode Reject and the cause codes sent in BSSMAP Cipher Mode Reject is as follows (this mapping is only used for the MAP-E interface):

```
----------------------------------------------------------------
     25.413                         48.008                  |Notes
----------------------------------------------------------------+--------
SECURITY MODE REJECT           CIPHER MODE REJECT           |

-Requested ciphering and/or     -Ciphering algorithm
 integrity protection            not supported
 algorithms not supported
-Failure in the radio           -Radio interface message
 interface procedure             failure
-Change of ciphering and/or     -Invalid msg. contents
 integrity protection is
 not supported
-Relocation triggered           -Relocation triggered
-Any other value                -Radio interface message
                                 failure
```

The mapping between the cause codes received in RANAP Location Report and the cause codes sent in BSSMAP Handover Performed is as follows (this mapping is only used for the MAP-E interface):

```
-----------------------------------------------------------------
      25.413                          48.008            |Notes
-----------------------------------------------------------------
LOCATION REPORT                   HANDOVER PERFORMED    |

-User restriction start ind.    -O&M intervention      |
-User restriction start ind.    -O&M intervention      |
-Requested report type not                             |  1
 supported                                             |
-Any other value                -Better cell           |
                                                       |
-----------------------------------------------------------------
```

NOTE 1: In this case, no Handover Performed is sent.

The mapping between the cause codes received in RANAP Iu Release Request and the cause codes sent in BSSMAP Clear Request is as follows:

```
-----------------------------------------------------------------
      25.413                          48.008            |Notes
-----------------------------------------------------------------
IU RELEASE REQUEST                CLEAR REQUEST         |

 -O and M intervention            -O and M intervention |
 -Unspecified failure             -Equipment failure    |
 -Repeated integrity checking     -Invalid message      |
  failure                          contents             |
 -Release due to UE generated     -Call control         |
  signalling connection release                         |
 -Radio connection with UE lost  -Radio interface       |
                                   failure              |
 -Access restricted due           -Access restricted due|
  to shared networks               to shared networks   |
 -Any other value                 -No radio resource    |
                                   available            |
                                                       |
-----------------------------------------------------------------
```

4.8 Inter-MSC Relocation

The general principles of the relocation procedures are given in Technical Specification TS 23.009. TS 29.010 gives the necessary information for interworking between the TS 25.413 relocation protocol and the TS 29.002 MAP protocol.

For intra UMTS handovers, RANAP is carried over the MAP-E interface instead of BSSAP. Please refer to 3GPP TS 29.108 [15].

When new parameters need to be added for transfer on the E-interface, the principles stated in the beginning of clause 4.5 shall be followed.

4.8.1 Basic Inter-MSC Relocation

When a Mobile Station is relocated between two MSCs, the establishment of a connection between them (described in TS 23.009) requires interworking between Iu-Interface and E-Interface.

The signalling at initiation, execution and completion of the Basic Inter-MSC relocation procedure is shown in figures 50 to 54 with both possible positive or negative outcomes.

Additionally figure 50b shows the possible interworking when trace related messages are transparently transferred on the E-Interface at Basic Inter-MSC Relocation initiation.

```
RNS-A            3G-MSC-A                      3G-MSC-B
|                |                             |
| RELOCATION     |                             |
|--------------->| MAP PREPARE HANDOVER        |
| REQUIRED       |--------------------------->| +-----------------+
|                | request                    | |Possible Alloc.  |
|                |                             | |of a relocation  |
|                |                             | |no. in the VLR-B |
|                |                             | +-----------------+
|                |                             |
|                |                             |             RNS-B
|                |                             |
|                |                             | RELOCATION REQUEST
|                |                             |------------------->
|                |                             |
```
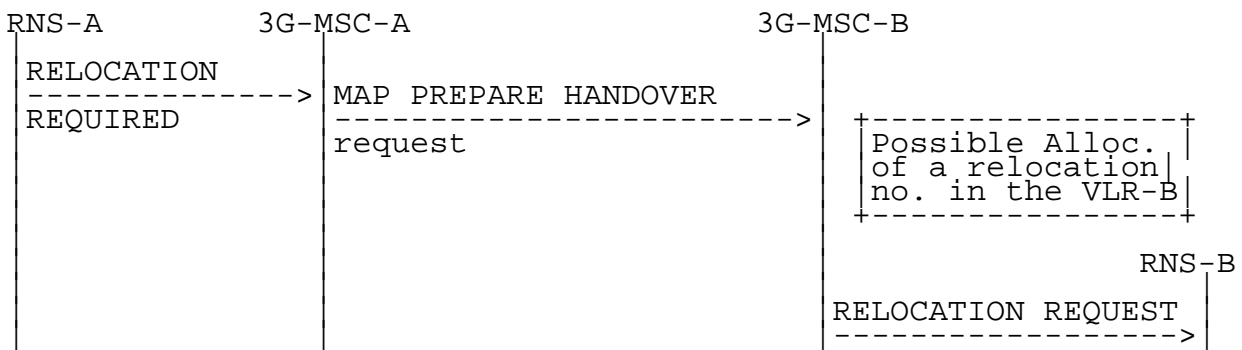
Figure 50a: Signalling for Basic Inter-MSC Relocation initiation (no trace related messages transferred)

```
RNS-A            3G-MSC-A                      3G-MSC-B
|                    (*)                       |
| RELOCATION         |                         |
|------------------->| MAP PREPARE HANDOVER    |
| REQUIRED           |----------------------->| +-----------------+
|                    | request  (**)          | |Possible Alloc.  |
|                    |                         | |of a relocation  |
|                    |                         | |no. in the VLR-B |
|                    |                         | +-----------------+
|                    |                         |
|                    |                         |             RNS-B
|                    |                         |
|                    |                         | RELOCATION REQUEST
|                    |                         |------------------->
|                    |                         |
|                    |                         | CN INVOKE TRACE
|                    |                         |------------------->(***)
```
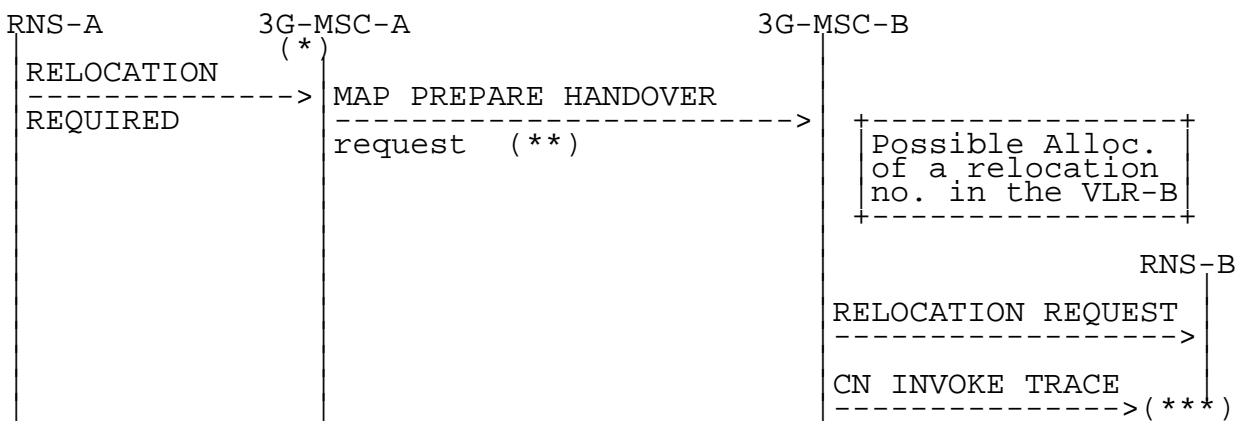
Figure 50b: Signalling for Basic Inter-MSC Relocation initiation (CN invoke trace message transferred)

(*):   Tracing invocation has been received from VLR.

(**):   In that case, RELOCATION REQUEST and CN INVOKE TRACE messages are included within the AN-apdu parameter.

(***):   CN INVOKE TRACE is forwarded to RNS-B if supported by 3G_MSC-B.

Possible Positive outcomes: successful radio resources allocation and relocation numbers allocation (if performed):

```
RNS-A            3G-MSC-A                      3G-MSC-B              RNS-B
|                |                             |                    |
|                |                             | RELOCATION REQUEST |
|                |                             |<-------------------|
|                |                             | ACKNOWLEDGE        |
|                |  MAP PREPARE HANDOVER       |                    |
|                |<--------------------------- |                    |
|                |  response                   |                    |
| RELOCATION COMMAND                           |                    |
|<---------------|                             |                    |
```
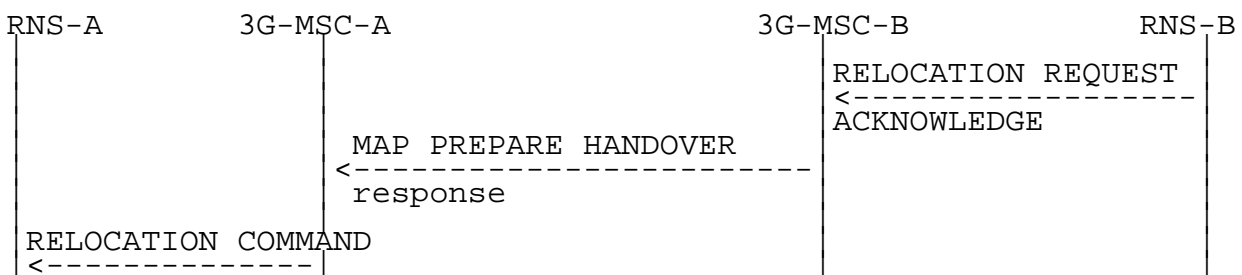
Possible Negative outcomes:

   a) user error detected, or relocation numbers allocation unsuccessful (if performed), or component rejection or dialogue abortion performed by 3G_MSC-B:

```
RNS-A          3G-MSC-A                        3G-MSC-B          RNS-B
 |               |   MAP PREPARE HANDOVER response   |             |
 |               |   negative result, MAP CLOSE      |             |
 |               |<----------------------------------|             |
 |               |   MAP U/P-ABORT                   |             |
 | RELOCATION PREPARATION                             |             |
 |<--------------|                                   |             |
 | FAILURE       |           MAP CLOSE               |             |
 |               |---------------------------------->|             |
 |               |                                   |             |
```

b) radio resources allocation failure:

```
RNS-A          3G-MSC-A                        3G-MSC-B          RNS-B
 |               |                                   | RELOCATION FAILURE
 |               |                                   |<------------------|
 |               |   MAP PREPARE HANDOVER            |             |
 |               |<----------------------------------|             |
 |               |    response                       |             |
 | RELOCATION PREPARATION                            |             |
 |<--------------|                                   |             |
 | FAILURE       |                                   |             |
 |               |                                   |             |
```

c) radio resources allocation partial failure (3G_MSC-A decides to reject the relocation):

```
RNS-A          3G-MSC-A                        3G-MSC-B          RNS-B
 |               |                                   | RELOCATION REQUEST
 |               |                                   |<------------------|
 |               |                                   |        ACK        |
 |               |   MAP PREPARE HANDOVER            |             |
 |               |<----------------------------------|             |
 |               |    response                       |             |
 | RELOCATION PREPARATION                            |             |
 |<--------------|                                   |             |
 | FAILURE       |                                   |             |
 |               |                                   |             |
```

d) unsuccessful relocation execution (relocation cancelled):

```
RNS-A          3G-MSC-A                        3G-MSC-B          RNS-B
 | RELOCATION    |                                   |             |
 |-------------->|                                   |             |
 | CANCEL        |                                   |             |
 |               |   MAP U -ABORT                    |             |
 |               |---------------------------------->|             |
 |               |                                   | IU RELEASE COMMAND
 | RELOCATION    |                                   |------------------>|
 |<--------------|                                   |             |
 | CANCEL ACK    |                                   |             |
 |               |                                   |             |
```
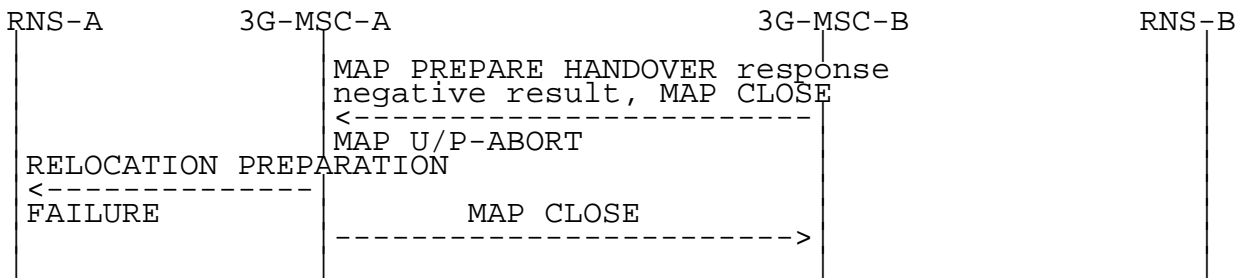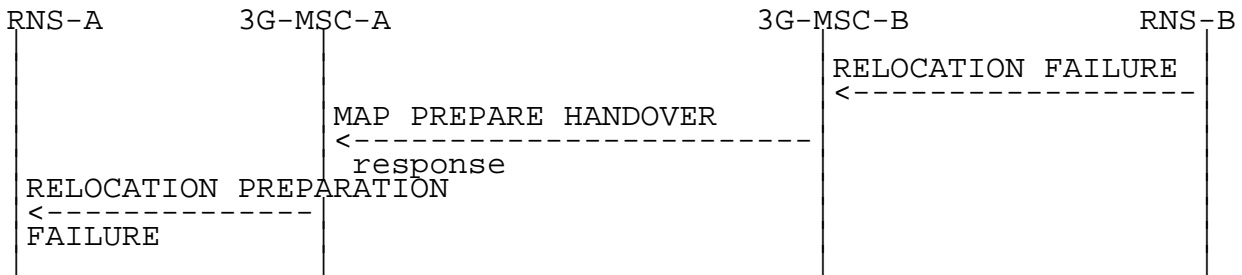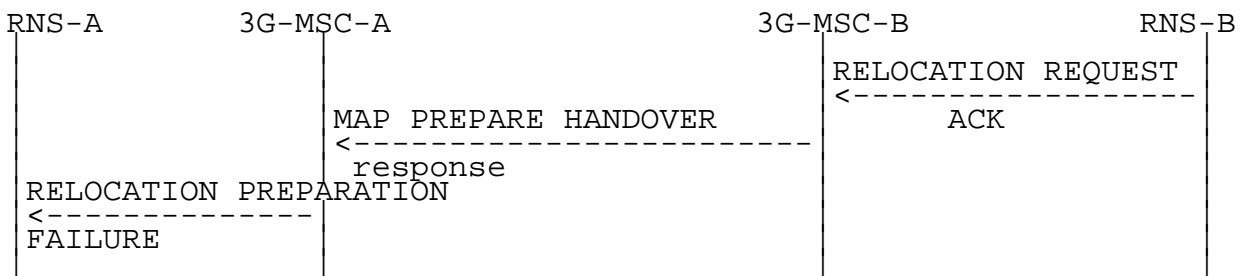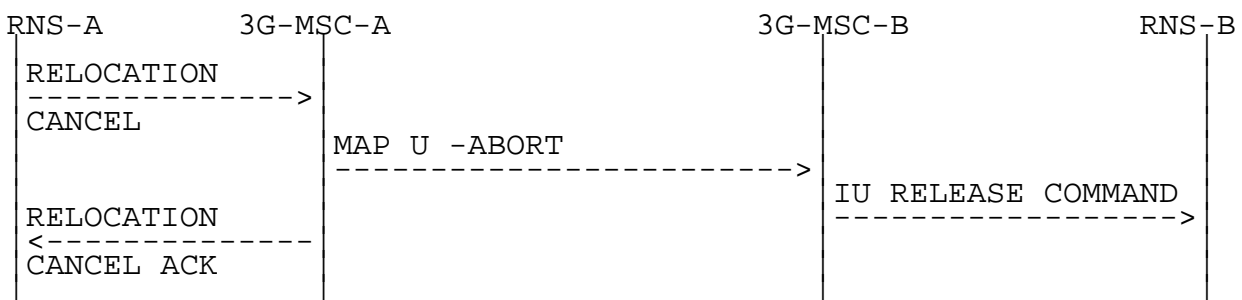
Figure 51: Signalling for Basic Inter-MSC Relocation execution (Negative outcomes)

```
RNS-A          3G-MSC-A                        3G-MSC-B          RNS-B
 |               |                                   | RELOCATION COMPLETE
 |               |                                   |<------------------|
 |               |   MAP SEND END SIGNAL request     |             |
 |               |<----------------------------------|             |
 | IU RELEASE COMMAND                                |             |
 |<--------------|                                   |             |
 |               |                                   |             |
```
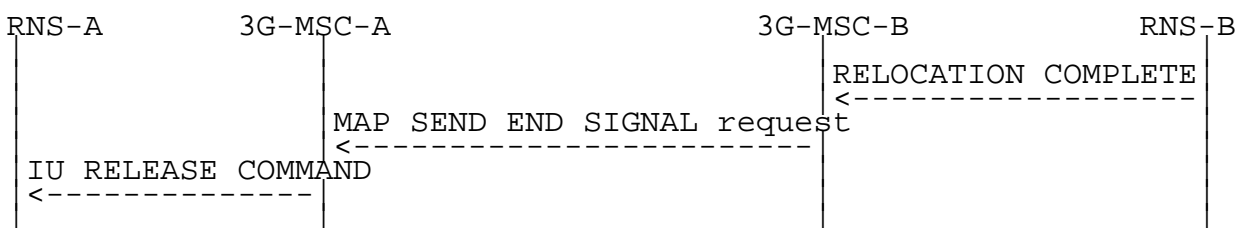
Figure 52: Signalling for Basic Inter-MSC Relocation completion

Positive outcome

```
RNS-A        3G-MSC-A                      3G-MSC-B           RNS-B
 │             │                              │               │
 │             │  MAP SEND END SIGNAL         │               │
 │             │ ---------------------------> │               │
 │             │   response                   │ IU RELEASE COMMAND │
 │             │                              │ ------------------> │
 │             │                              │  (Note 1)      │
 │             │                              │               │
```
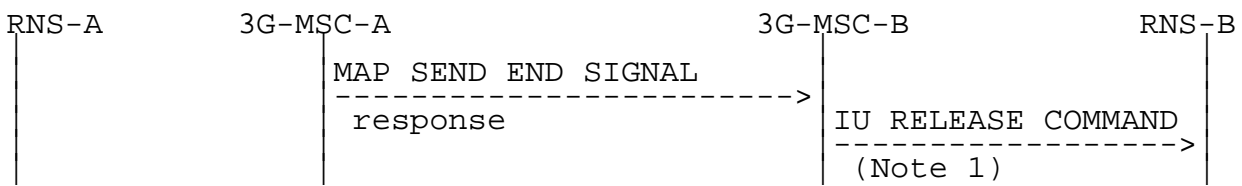
Figure 53: Signalling for Basic Inter-MSC Relocation completion (Positive outcome)

    NOTE: From interworking between MAP and RANAP point of view.

Negative outcome:

```
RNS-A        3G-MSC-A                      3G-MSC-B           RNS-B
 │             │                              │               │
 │             │   MAP U/P -ABORT             │               │
 │             │ ---------------------------> │               │
 │             │                              │ IU RELEASE COMMAND │
 │             │                              │ ------------------> │
 │             │                              │               │
```
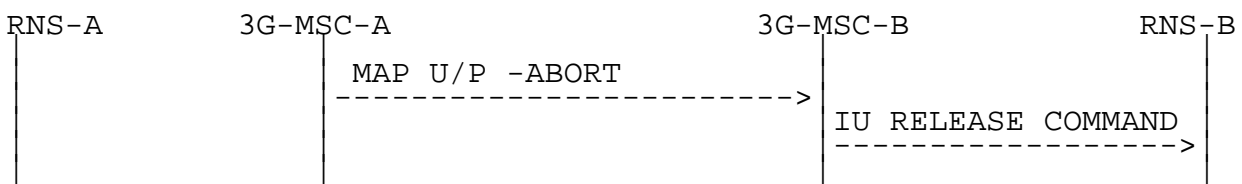
Figure 54: Signalling for Basic Inter-MSC Relocation completion (Negative outcome)

The relocation procedure is normally triggered by RNS-A by sending a RELOCATION REQUIRED message on Iu-Interface to 3G_MSC-A. The invocation of the Basic Inter-MSC relocation procedure is performed and controlled by 3G_MSC-A. The sending of the MAP Prepare-Handover request to 3G_MSC-B is triggered in 3G_MSC-A upon receipt of the RELOCATION REQUIRED message. The identity of the target RNC where the call is to be handed over in 3G_MSC-B area, provided in the RELOCATION REQUIRED message, is mapped to the target RNC Id MAP parameter and the RELOCATION REQUEST message is encapsulated in the an-APDU MAP parameter of the Prepare-Handover MAP request. 3G_MSC-B can invoke another operation towards the VLR-B (allocation of the relocation numbers described in 3GPP TS 29.002 [9]).

Additionally, if tracing activity has been invoked, the trace related messages can be transferred on the E-Interface encapsulated in the an-APDU MAP parameter of the Prepare-Handover Request. If transferred, one complete trace related message at a time shall be included in the an-APDU MAP parameter after the RELOCATION REQUEST message.

The interworking between Prepare Handover and RELOCATION REQUIRED is as follows:

```
--------------------------------------------------------------------
       |     25.413                       29.002             |Notes
-------+------------------------------------------------------+-----
Forward| RELOCATION REQUIRED MAP PREPARE HANDOVER request
message|
       |                        -ho-NumberNotRequired|  1
       |                        -target_RNC Id
       |     RANAP information  -Radio Resource Info
       |         elements       -an-APDU(
       |                          RELOCATION REQUEST,         |  2
       |                          CN INVOKE TRACE)
       |     GERAN classmark    -GERAN classmark             |  4
-------+------------------------------------------------------+-----
Positive|       MAP PREPARE HANDOVER response
result |                                                    |  3
       |                        -relocation numbers
       |                        -an-APDU(
       |  RELOCATION COMMAND      RELOCATION REQUEST
       |                          ACKNOWLEDGE
       |                          or
       |  RELOCATION PREP FAILURE  RELOCATION FAILURE)
       |
-------+------------------------------------------------------+-----
Negative| RELOCATION PREP FAILURE   MAP PREPARE HANDOVER
result |
       |  Unspecified failure       System Failure
       |  Unspecified failure       No Handover Number
       |                              available
       |  Unspecified failure       UnexpectedDataValue
       |  Unspecified failure       Data Missing
       |
       |  Unspecified failure       MAP CLOSE
       |  Unspecified failure       MAP U/P -ABORT
       |
```

NOTE 1: The RANAP information elements are already stored in 3G_MSC.

The ho-NumberNotRequired parameter is included by 3G_MSC-A, when 3G_MSC-A decides not to use any circuit connection with 3G_MSC-B. No relocation numbers shall be present in the positive result. Any negative response from 3G_MSC-B shall not be due to relocation number allocation problem.

NOTE 2: The process performed on the RANAP information elements received in the RELOCATION REQUIRED message is described in the 3GPP TS 25.413 [7].

NOTE 3: The response to the Prepare-Handover request can include in its an-APDU parameter, identifying the 3GPP TS 25.413 [7] protocol, either a RANAP RELOCATION REQUEST ACKNOWLEDGE or a RANAP RELOCATION FAILURE.

In the first case, the positive result triggers in 3G_MSC-A the sending on Iu-Interface of the RELOCATION CMD.

In the second case, the positive result triggers in 3G_MSC-A the sending of the RELOCATION PREP FAILURE.

NOTE 4: If the GERAN Classmark was not received with the RELOCATION REQUIRED message initiating the relocation, 3G_MSC-A shall include any previously received GERAN Classmark. See 3GPP TS 43.051 [17].

The interworking between Send End Signal and RELOCATION COMPLETE in 3G_MSC-B is as follows:

	25.413	29.002	Notes

Forward message	RELOCATION COMPLETE	MAP SEND END SIGNAL request
		     -an-APDU(
		     RELOCATION COMPL)	

Positive result	IU RELEASE COMMAND -Normal release	MAP SEND END SIGNAL response	1

Negative result	IU RELEASE COMMAND
	  -Normal release
	  -Normal release
		MAP CLOSE
		 MAP U/P -ABORT
			2

NOTE 1: The positive empty result triggers the clearing of the Radio Resources on the Iu-Interface and the release of the SCCP connection between 3G_MSC-B and RNS-B. If a circuit connection is used between 3G_MSC-A and 3G_MSC-B, the 'Normal release' clearing cause shall only be given to RNS-B when 3G_MSC-B has received a clearing indication on its circuit connection with 3G_MSC-A.

NOTE 2: The abortion of the dialogue or the rejection of the component triggers in 3G_MSC-B the clearing of its circuit connection with 3G_MSC-A, if any, of the Radio Resources on the Iu-Interface and the release of the SCCP connection between 3G_MSC-B and RNS-B.

The interworking between Send End Signal and IU RELEASE COMMAND in 3G_MSC-A is as follows:

	29.002	25.413	Notes

Forward message	MAP SEND END SIGNAL request
	     -an-APDU(
	     RELOCATION COMPLETE)
		IU RELEASE COMMAND
		 - Successful
		   Relocation	

Positive result			
Negative result			

The interworking between RELOCATION CANCEL in case of relocation cancelled and User Abort in 3G-MSC-A is as follows:

	25.413	29.002	Notes
Forward message	RELOCATION CANCEL - Relocation cancelled	MAP U -ABORT	
Positive result	RELOCATION CANCEL ACKNOWLEDGEMENT		
Negative result			

4.8.2 Subsequent Inter-MSC Relocation back to 3G_MSC-A

When a Mobile Station is being relocated back to 3G_MSC-A, the procedure (described in TS 23.009) requires interworking between Iu-Interface and E-Interface.

The signalling at initiation, execution and completion of the Subsequent Inter-MSC relocation procedure is shown in figures 55 to 59.

```
RNS-A          3G-MSC-B                   3G-MSC-A
│                │                           │
│ RELOCATION     │                           │
│ ─────────────> │MAP PREPARE SUBSEQUENT     │
│ REQUIRED       │──────────────────────────>│
│                │HANDOVER request           │
│                │                           │                 RNS-B
│                │                           │
│                │                           │RELOCATION REQUEST │
│                │                           │──────────────────>│
│                │                           │                   │
```
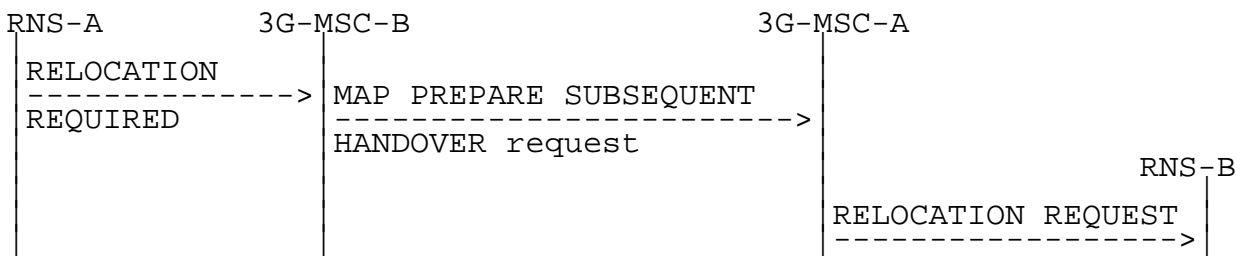
Figure 55: Signalling for Subsequent Inter-MSC Relocation back to 3G_MSC-A initiation

Possible Positive outcomes: successful radio resources allocation:

```
RNS-A          3G-MSC-B                   3G-MSC-A          RNS-B
│                │                           │                 │
│                │                           │RELOCATION REQUEST│
│                │                           │<─────────────────│
│                │                           │ACKNOWLEDGE       │
│                │  MAP PREPARE SUBSEQUENT    │                 │
│                │<──────────────────────────│                 │
│                │  HANDOVER response         │                 │
│ RELOCATION COMMAND                         │                 │
│ <────────────│                             │                 │
```
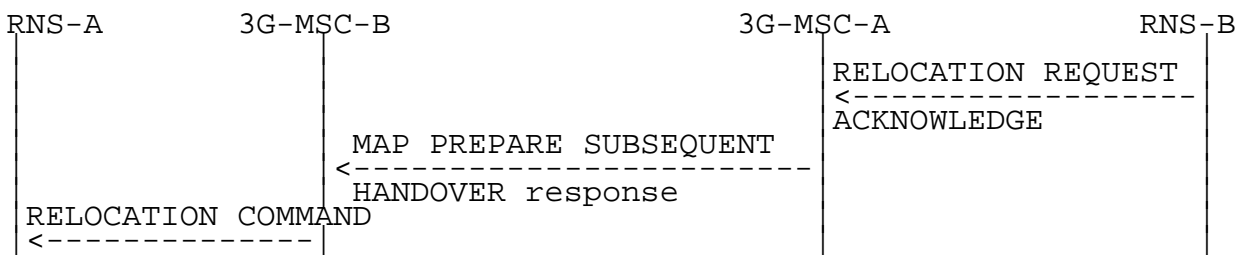
Figure 56: Signalling for Subsequent Inter-MSC Relocation back to 3G_MSC-A execution (Positive outcome)

Possible Negative outcomes:

   a) user error detected, or component rejection or dialogue abortion performed by 3G_MSC-A:

```
RNS-A          3G-MSC-B                   3G-MSC-A          RNS-B
│                │MAP PREPARE SUBSEQUENT HANDOVER            │
│                │<──────────────────────────│                 │
│ RELOCATION PREP│    response negative result                │
│ <────────────│                             │                 │
│ FAILURE (Note 1)                           │                 │
│                │                           │                 │
```

   b) component rejection or dialogue abortion performed by 3G_MSC-A:

```
RNS-A          3G-MSC-B                   3G-MSC-A          RNS-B
│                │MAP CLOSE, MAP U/P ABORT   │                 │
│                │<──────────────────────────│                 │
│ IU RELEASE COMMAND                         │                 │
│ <────────────│                             │                 │
│                │                           │                 │
```

   c) radio resources allocation failure:
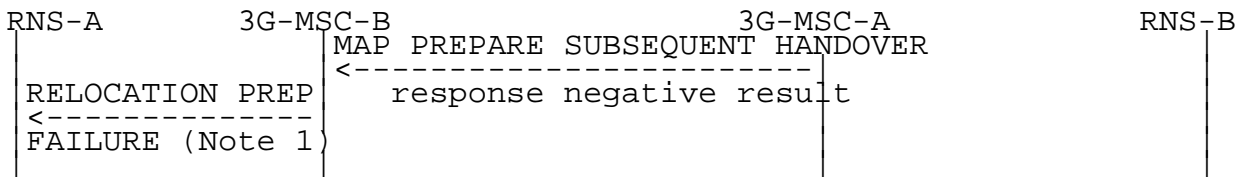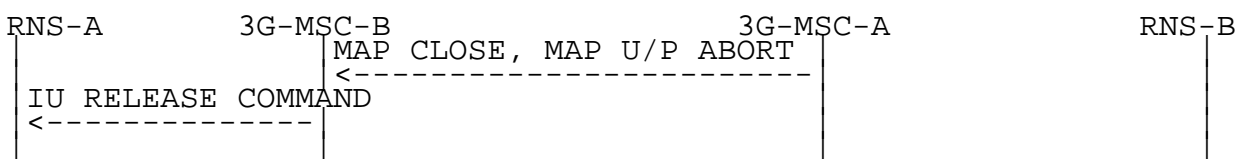
```
RNS-A          3G-MSC-B                   3G-MSC-A          RNS-B
│                │                           │RELOCATION FAILURE│
│                │                           │<─────────────────│
│                │MAP PREPARE SUBSEQUENT     │                 │
│                │<──────────────────────────│                 │
│ RELOCATION PREP│    HANDOVER response       │                 │
│ <────────────│                             │                 │
│ FAILURE        │                           │                 │
```

   d) radio resources allocation partial failure (3G_MSC-A decides to reject the relocation):

```
RNS-A          3G-MSC-B                   3G-MSC-A          RNS-B
│                │                           │RELOCATION REQUEST│
│                │                           │<─────────────────│
│                │MAP PREPARE SUBSEQUENT     │    ACK           │
│                │<──────────────────────────│                 │
│ RELOCATION PREP│    HANDOVER response       │                 │
│ <────────────│                             │                 │
│ FAILURE        │                           │                 │
```

e) unsuccessful relocation execution (relocation cancelled):

```
RNS-A          3G-MSC-B                          3G-MSC-A              RNS-B
|RELOCATION        |                                |                    |
|--------------->  |                                |                    |
|CANCEL            |MAP PROCESS ACCESS              |                    |
|                  |----------------------------->  |IU RELEASE COMMAND  |
|                  |     SIGNALLING request         |------------------->|
|                  |                                |IU RELEASE COMPLETE |
|                  |                                |<-------------------|
|                  |MAP FORWARD ACCESS             |                    |
|                  |<----------------------------- |                    |
| RELOCATION       |     SIGNALLING request         |                    |
|<--------------   |                                |                    |
|CANCEL ACK        |                                |                    |
```
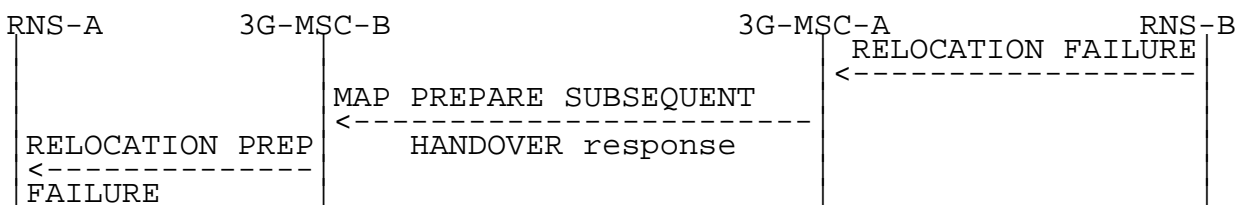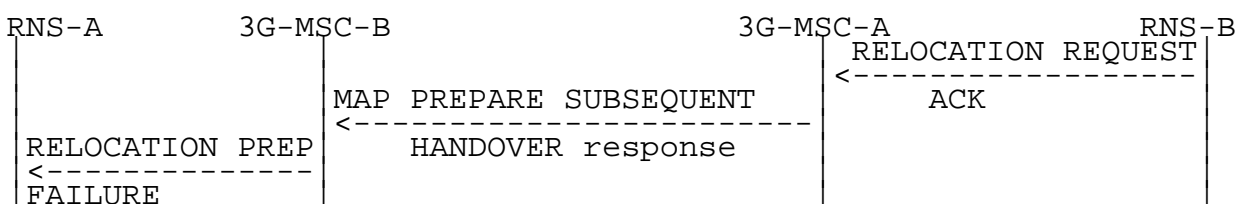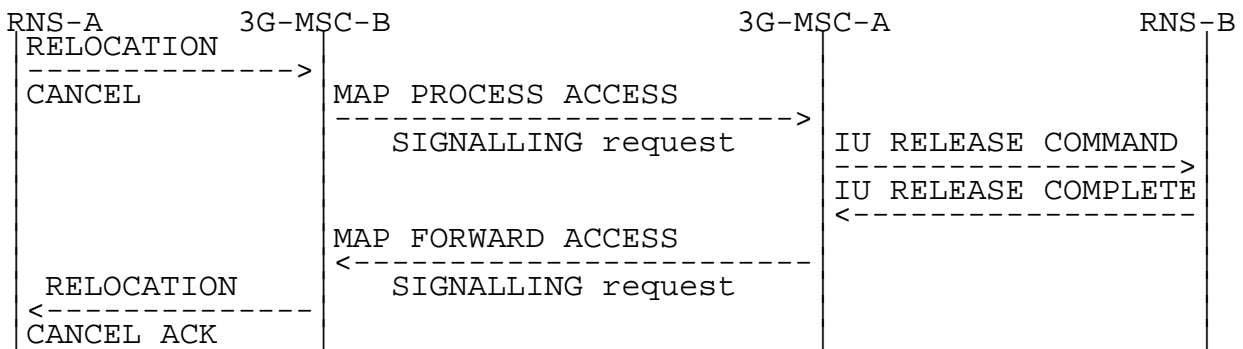
Figure 57: Signalling for Subsequent Inter-MSC Relocation back to 3G_MSC-A execution (Negative outcome)

```
RNS-A          3G-MSC-B                          3G-MSC-A              RNS-B
|                 |                                |RELOCATION          |
|                 |MAP SEND END SIGNAL            |<-------------------|
|                 |<----------------------------- |COMPLETE            |
|                 |  response                      |                    |
|IU RELEASE CMD   |                                |                    |
|<--------------  |                                |                    |
```
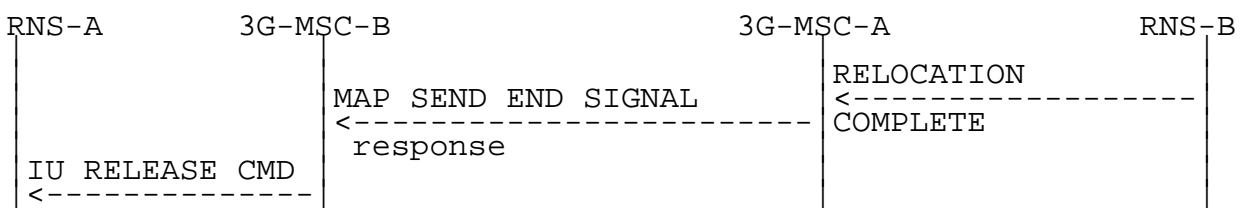
Figure 58: Signalling for Subsequent Inter-MSC Relocation back to 3G_MSC-A completion (Successful completion of the procedure)

NOTE: Positive outcome case shown in figure 53.

```
RNS-A            3G-MSC-B                          3G-MSC-A              RNS-B
|                 |                                |                    |
|                 |MAP U/P -ABORT                 |                    |
|                 |<----------------------------- |                    |
|                 |                                |IU RELEASE COMMAND  |
|                 |                                |------------------->|
|                 |                                |(Note 1)            |
```
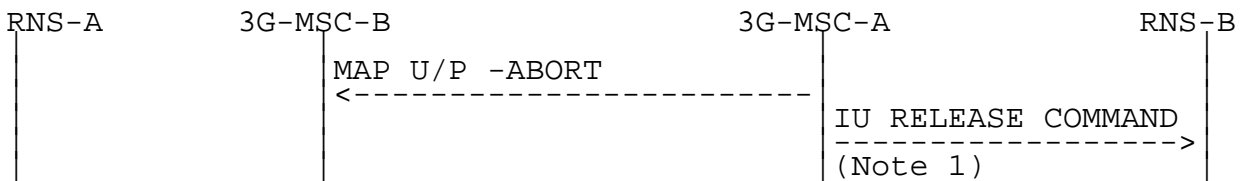
Figure 59: Signalling for Subsequent Inter-MSC Relocation back to 3G_MSC-A completion (Unsuccessful completion of the procedure)

NOTE: Abnormal end of the procedure that triggers the clearing of all resources in 3G_MSC-B.

The interworking between Prepare Subsequent Handover and RELOCATION REQUIRED is as follows:

```
--------------------------------------------------------------------------------
            |      25.413                           29.002           |  Notes
--------------+-------------------------------------------------------+------
Forward      |REL. REQUIRED       MAP PREPARE SUBSEQUENT HANDOVER     |
message      |                                  request               |
             |                                                        |
             |                                 -target MSC number     |
             |                                 -target RNC Id         |
             |  RANAP information               -an-APDU(             |   1
             |       elements                    RELOCATION REQ)      |
             |                                                        |
             |  GERAN classmark                -GERAN classmark       |   3
--------------+-------------------------------------------------------+------
Positive     |                      MAP PREPARE SUBSEQUENT HANDOVER   |   2
result       |                                  response              |
             |                                 -an-APDU(              |
             |RELOCATION CMD.                    RELOCATION REQUEST    |
             |                                   ACKNOWLEDGE           |
             |                                   or                   |
             |RELOCATION PREP FAILURE            RELOCATION FAILURE)   |
--------------+-------------------------------------------------------+------
Negative     |REL. PREP. FAILURE      MAP PREPARE SUBSEQUENT          |
result       |                        HANDOVER response               |
             |Unspecified failure        Unknown MSC                  |
             |Unspecified failure        Subsequent Handover          |
             |                                          Failure        |
             |Unspecified failure        UnexpectedDataValue          |
             |Unspecified failure        Data Missing                 |
             |                                                        |
             |Iu RELEASE COMMAND         MAP CLOSE                    |
             |                           MAP U/P -ABORT               |
             |Unspecified failure                                     |
             |Unspecified failure                                     |
--------------+-------------------------------------------------------+------
```

NOTE 1: The processing performed on the RANAP information elements received in the RELOCATION REQUIRED message is out of the scope of the present document. The target MSC number is provided to 3G_MSC-A by 3G_MSB-B based on the information received from RNS-B.

NOTE 2: The response to the Prepare-Subsequent-Handover request can include in its an-APDU parameter, identifying the 3GPP TS 25.413 [7] protocol, a RANAP RELOCATION REQUEST ACKNOWLEDGE or a RANAP RELOCATION FAILURE.

NOTE 3: If the GERAN Classmark was not received with the RELOCATION REQUIRED message initiating the relocation, MSC-B shall include any previously received GERAN Classmark. See 3GPP TS 43.051 [17].

In the first case, the positive result triggers in 3G_MSC-B the sending on Iu-Interface of the RELOCATION COMMAND.

In the second case, the positive result triggers in 3G_MSC-B the sending of the RELOCATION PREPARATION FAILURE.

The interworking between RELOCATION CANCEL and MAP Process Signalling Request in 3G_MSC-A is as follows:

```
-----------------------------------------------------------------------
        |       29.002                          25.413              |Notes
-----------------------------------------------------------------------
Forward | MAP PROCESS-SIGNALLING          IU RELEASE COMMAND        |
message |        request                                            |
        |-an-APDU(                                                  |
        | RELOCATION CANCEL)                                        |
-----------------------------------------------------------------------
Positive| MAP FORWARD-SIGNALLING          IU RELEASE COMPLETE       |
result  |        request                                            |
        |-an-APDU(                                                  |
        | RELOCATION CANCEL ACK)                                    |
-----------------------------------------------------------------------
Negative|                                                          |
result  |                                                          |
        |                                                          |
-----------------------------------------------------------------------
```

The interworking between RELOCATION CANCEL and MAP Process Signalling Request in 3G_MSC-B is as follows:

```
-----------------------------------------------------------------------
        |       25.413                          29.002             |Notes
-----------------------------------------------------------------------
Forward | RELOCATION CANCEL               MAP PROCESS-SIGNALLING    |
message |                                         request           |
        |                                -an-APDU(                  |
        |                                 RELOCATION CANCEL)        |
-----------------------------------------------------------------------
Positive| RELOCATION CANCEL ACK           MAP FORWARD-SIGNALLING    |
result  |                                         request           |
        |                                -an-APDU(                  |
        |                                 RELOCATION CANCEL ACK)    |
-----------------------------------------------------------------------
Negative|                                                          |
result  |                                                          |
        |                                                          |
-----------------------------------------------------------------------
```

The interworking between Send End Signal Result and RELOCATION COMPLETE in 3G_MSC-A is as follows:

```
-----------------------------------------------------------------------
        |       25.413                          29.002             |Notes
-----------------------------------------------------------------------
Forward | RELOCATION COMPLETE   MAP SEND END SIGNAL                 |
message |                               response                    |
-----------------------------------------------------------------------
Positive|                                                          |
result  |                                                          |
-----------------------------------------------------------------------
Negative|                                                          |
result  |                                 MAP U/P -ABORT            | 1
-----------------------------------------------------------------------
```

NOTE: The abortion of the dialogue ends the relocation procedure with 3G_MSC-B.

4.8.3   Subsequent Inter-MSC Relocation to third MSC

When a Mobile Station is being relocated to a third MSC, the procedure (described in 3GPP TS 23.009 [2]) does require one specific interworking case in 3G_MSC-A (figure 64) between E-Interface from 3G_MSC-B and E-Interface from 3G_MSC-B' other than the combination of the ones described in the clause 4.8.1 and 4.8.2.

```
RNS-A      3G-MSC-B                3G-MSC-A            3G-MSC-B'
 |          |                         |                   |
 |RELOCATION|                         |                   |
 |--------->|MAP PREPARE SUBSEQUENT    |                   |
 |REQUIRED  |------------------------->|                   |
 |          |HANDOVER request         |MAP PREPARE         |
 |          |                         |--------------->    |
 |          |                         |HANDOVER request|   |
 |          |                         |              +-------+
 |          |                         |              |Possib.|
 |          |                         |              |Alloc. |
 |          |                         |              |of relo|
 |          |                         |              |number |
 |          |                         |              | VLR-B |
 |          |                         |              +-------+
 |          |                         |                   |    RNS-B'
 |          |                         |                   |RELOCATION
 |          |                         |                   |-------->
 |          |                         |                   |REQUEST
 |          |                         |                   |    |
```

Figure 60: Signalling for Subsequent Inter-MSC Relocation to third MSC (3G_MSC-B') initiation

Possible Positive outcomes: successful radio resources allocation:

```
RNS-A      3G-MSC-B                3G-MSC-A            3G-MSC-B'
 |          |                         |                   |    RNS-B'
 |          |                         |                   |RELOCATION
 |          |                         |                   |<--------
 |          |                         |                   |REQUEST
 |          |                         |                   |ACKNOWLEDGE
 |          |                         |MAP PREPARE HANDOVER|
 |          |                         |<---------------    |
 |          |MAP PREPARE SUBSEQUENT    |      response  |   |
 |          |<------------------------ |                   |
 |          |HANDOVER response         |                   |
 |RELOCATION|                         |                   |
 |<-------- |                         |                   |
 |COMMAND   |                         |                   |
```

Figure 61: Signalling for Subsequent Inter-MSC Relocation to third MSC (3G_MSC-B') execution (Positive outcome)

Possible Negative outcomes:

   a) user error detected, or component rejection or dialogue abortion performed by 3G_MSC-B':

```
RNS-A      3G-MSC-B                3G-MSC-A            3G-MSC-B'
 |          |                         |                   |    RNS-B'
 |          |                         |MAP PREPARE HANDOVER|
 |          |                         |response negative result
 |          |                         |MAP CLOSE          |
 |          |                         |<---------------   |
 |          |                         |MAP U/P -ABORT     |
 |          |MAP PREPARE SUBSEQUENT    |                   |
 |          |<------------------------ |                   |
 |          |HANDOVER response negative|                   |
 |RELOCATION|result                    |                   |
 |<-------- |                         |                   |
 |PREPARATION|                        |                   |
 |FAILURE   |                         |                   |
```

b) radio resources allocation failure:

```
RNS-A       3G-MSC-B                      3G-MSC-A              3G-MSC-B'
 |            |                              |                    |   RNS-B'
 |            |                              |                    |    |
 |            |                              |                    | RELOCATION
 |            |                              |                    |<--------
 |            |                              |                    | FAILURE
 |            |                              | MAP PREPARE HANDOVER
 |            |                              |<---------------
 |            | MAP PREPARE SUBSEQUENT       | response
 |            |<---------------------
 |            | HANDOVER response
 | RELOCATION |
 |<-----------
 | PREPARATION
 | FAILURE
```

c) radio resources allocation partial failure (3G_MSC-A decides to reject the relocation):

```
RNS-A       3G-MSC-B                      3G-MSC-A              3G-MSC-B'
 |            |                              |                    |   RNS-B'
 |            |                              |                    |    |
 |            |                              |                    | RELOCATION
 |            |                              |                    |<--------
 |            |                              |                    | REQ ACK
 |            |                              | MAP PREPARE HANDOVER
 |            |                              |<---------------
 |            | MAP PREPARE SUBSEQUENT       | response
 |            |<---------------------
 |            | HANDOVER response
 | RELOCATION |
 |<-----------
 | PREPARATION
 | FAILURE
```

Figure 62: Signalling for Subsequent Inter-MSC Relocation to third MSC (3G_MSC-B') execution (Negative outcome)

Positive outcome:

```
RNS-A       3G-MSC-B                      3G-MSC-A              3G-MSC-B'
 |            |                              |                    |   RNS-B'
 |            |                              |                    |    |
 |            |                              |                    | RELOCATION
 |            |                              |                    |<--------
 |            |                              |                    | COMPLETE
 |            |                              | MAP SEND END SIGNAL
 |            |                              |<---------------
 |            | MAP SEND END SIGNAL          | request
 |            |<---------------------
 |            | response
 | IU RELEASE |
 |<-----------
 | COMMAND
```
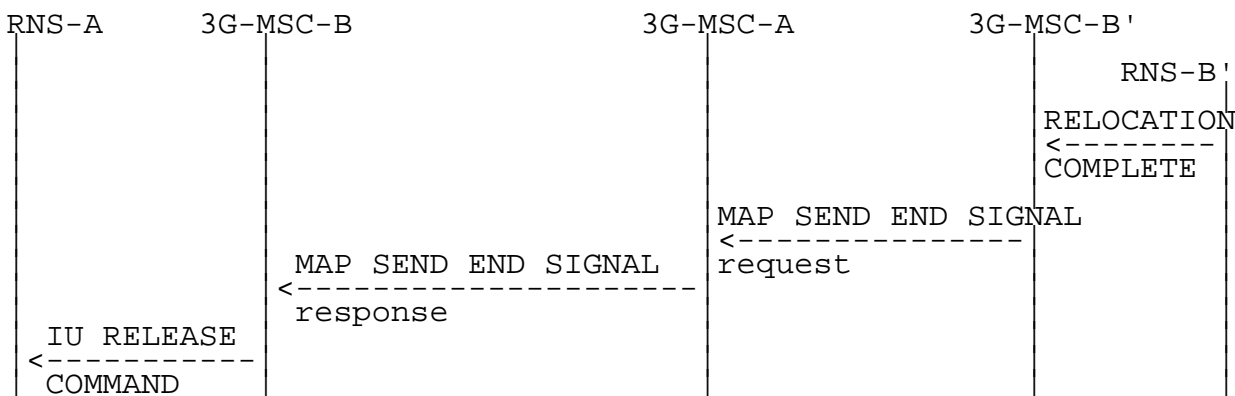
Figure 63: Signalling for Subsequent Inter-MSC Relocation to third MSC (3G_MSC-B') completion (Successful completion of the procedure)

Negative outcome:

```
RNS-A         3G-MSC-B                      3G-MSC-A              3G-MSC-B'
|                |                            |                      |
| RELOCATION     |                            |                 RNS-B'|
|----------->    |                            |                      |
| CANCEL         | MAP PROCESS ACCESS         |                      |
|                |------------------------->  |                      |
|                | SIGNALLING request (Note 1)|                      |
|                |                            |                      |
|                |                            | MAP U -ABORT         |
|                |                            |--------------->      |
|                | MAP FORWARD ACCESS         |               IU RELEASE
|                |<------------------------   |               -------->|
| RELOCATION     |  SIGNALLING request        |               COMMAND |
|<-----------    |                            |                      |
| CANCEL ACK     |                            |                      |
|                |                            |                      |
```
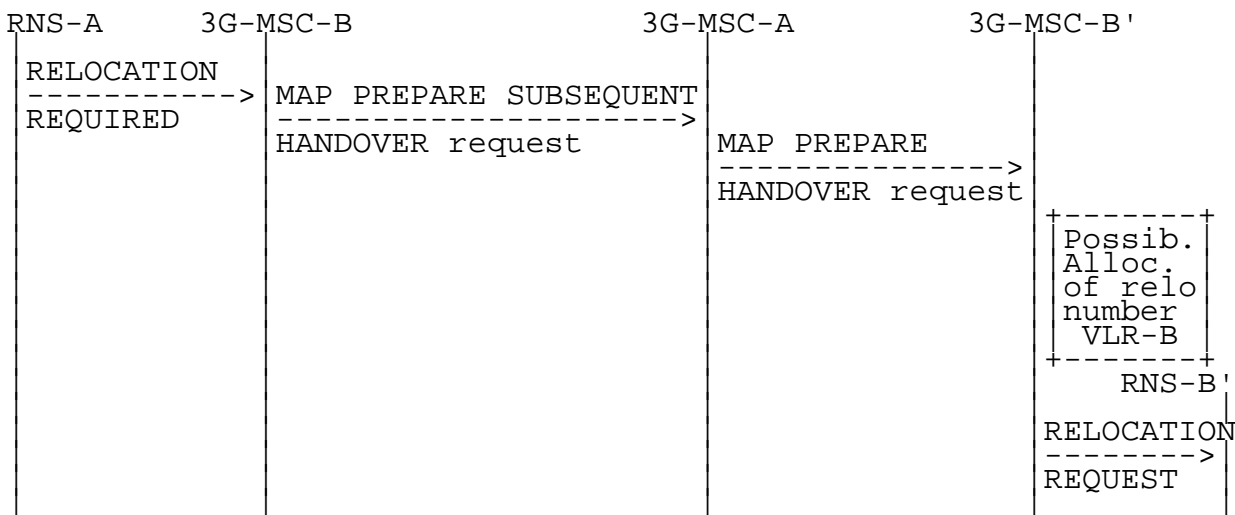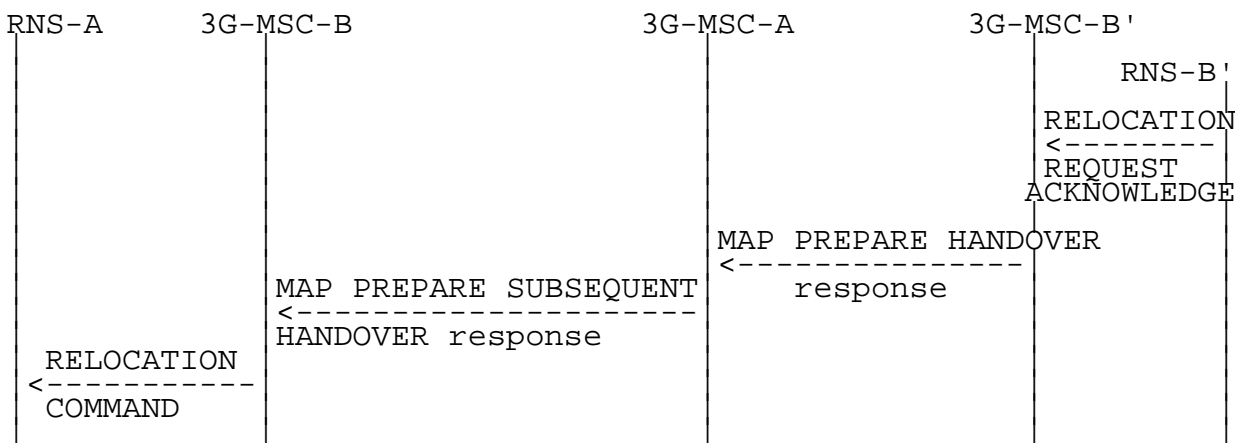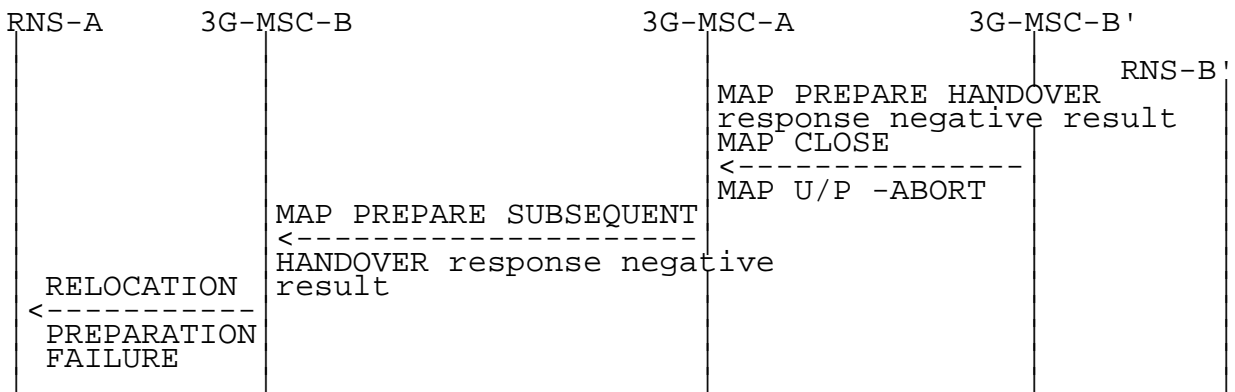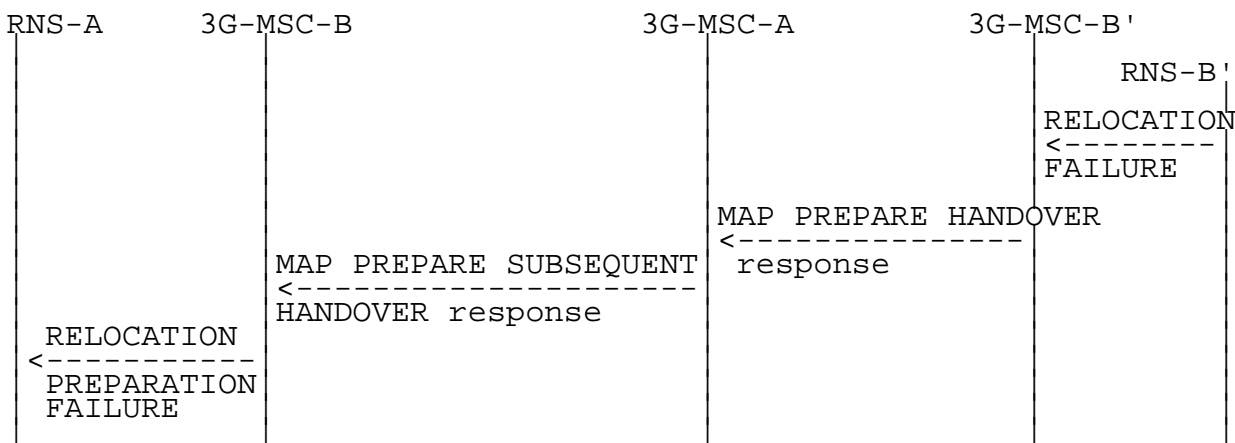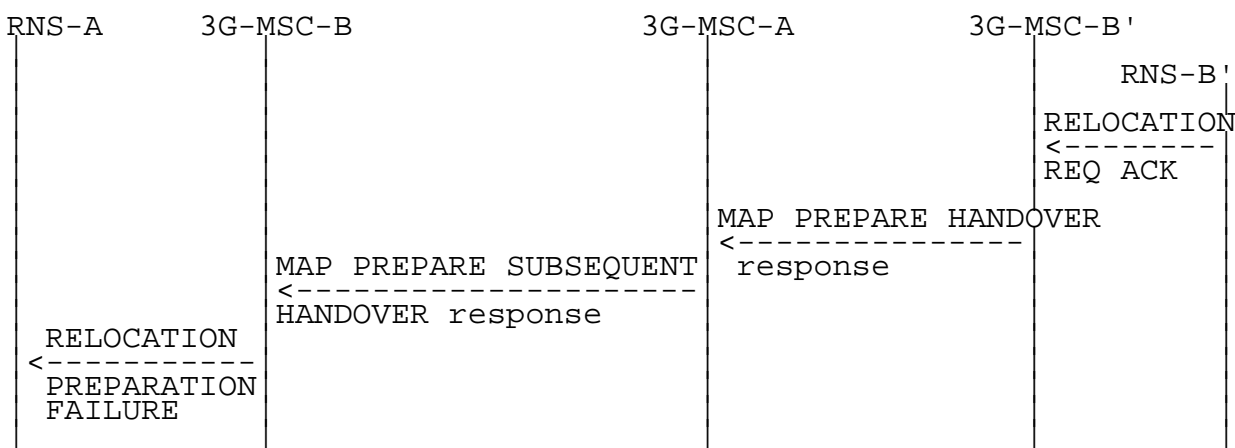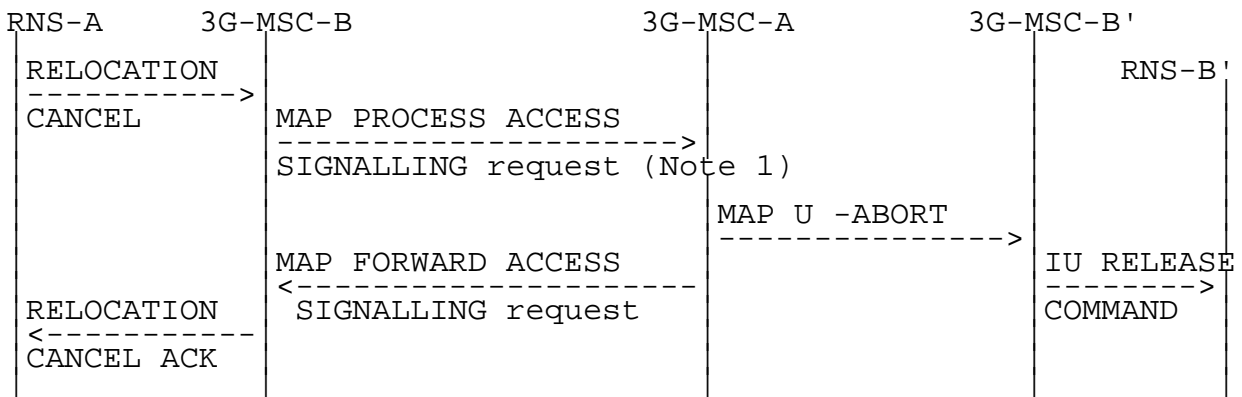
Figure 64: Signalling for Subsequent Inter-MSC Relocation to third MSC (3G_MSC-B') completion (Unsuccessful completion of the procedure)

NOTE: Specific interworking case detailed below.

The specific interworking case in 3G_MSC-A compared to the clauses 4.8.1 and 4.8.2 occurs between RELOCATION FAILURE encapsulated in a Process Access Signalling from 3G_MSC-B and the abortion of the dialogue with 3G_MSC-B' in the case of relocation cancelled:

```
---------------------------------------------------------------------------
           |       29.002                          29.002       | Notes
-----------+-----------------------------------------------------+-------
Forward    | MAP PROCESS-SIGNALLING                              |
message    |        request                                     |
           |                                                    |
           |        -an-APDU(              MAP U -ABORT         |   1
           |        RELOCATION CANCEL)                          |
-----------+-----------------------------------------------------+-------
Positive   | MAP FORWARD-SIGNALLING                             |
result     |        request                                     |
           |        -an-APDU(                                   |
           |        RELOCATION CANCEL ACK)                      |
-----------+-----------------------------------------------------+-------
Negative   |                                                    |
result     |                              MAP U/P -ABORT        |   2
           |                                                    |
---------------------------------------------------------------------------
```

NOTE 1:   The abortion of the dialogue triggers in 3G_MSC-B' the clearing of the circuit connection with 3G_MSC-A, if any, and of the Resources between 3G_MSC-B' and RNS-B'. The abortion of the dialogue ends the relocation procedure with 3G_MSC-B'.

NOTE 2:   The abortion of the dialogue ends the relocation procedure with 3G_MSC-B.

4.8.4   RANAP Messages transfer on E-Interface

The following mapping applies to the encapsulation performed in 3G_MSC-A.

	25.413	29.002	Notes
Forward message	RANAP messages	MAP FORWARD ACCESS SIGNALLING request -an-APDU (RANAP messages)	1
Positive result			2
Negative result		MAP CLOSE MAP U/P -ABORT	

NOTE 1: Complete RANAP messages to be sent on 3G_MSC-B - RNS-B interface are embedded into the an-APDU parameter.

NOTE 2: The Return Result does not apply. If 3G_MSC-B returns a message, this message will arrive in an Invoke: Process Access Signalling.

The following mapping applies to the encapsulation performed in 3G_MSC-B.

	25.413	29.002	Notes
Forward message	RANAP messages	MAP PROCESS ACCESS SIGNALLING request -an-APDU (RANAP messages)	1
Positive result			2
Negative result	IU RELEASE COMMAND Unspecified failure	MAP CLOSE MAP U/P -ABORT	3

NOTE 1: Complete RANAP messages to be sent to 3G_MSC-A are embedded into the an-APDU parameter.

NOTE 2: The Return Result does not apply. If 3G_MSC-A returns a message, this message will arrive in an Invoke: Forward Access Signalling.

NOTE 3: The abortion of the dialogue triggers the clearing of the circuit connection with 3G_MSC-A, if any, of the Radio Resources on the Iu-Interface and the release of the SCCP connection between 3G_MSC-B and RNS-B. The clearing of the Radio Resources (the clearing indication received from RNS-B is transmitted to 3G_MSC-A) or the loss of the SCCP connection between 3G_MSC-B and RNS-B, triggers in 3G_MSC-B the abortion of the dialogue on the E-Interface and the clearing of the circuit connection with 3G_MSC-A, if any.

4.8.5 Processing in 3G_MSC-B, and information transfer on E-interface

The following parameters require processing (e.g. to store the parameter, to internally generate the parameter) in 3G_MSC-B. The relevant RANAP procedures are mentioned to ease the comprehension, their detailed description is the scope of the TS 25.413. Each RANAP message being transferred on E-interface shall use the mechanisms given in clause 4.8.4 and is described in TS 25.413.

4.8.5.1 Integrity Protection Information

A sequence of possible integrity protection algorithms can be sent to an RNS in Security Mode Command or Relocation Request. The RNS chooses one of the listed algorithms and reports this back to the 3G_MSC in Security Mode Complete or Relocation Request Acknowledge respectively.

3G_MSC-B shall remove algorithms not allowed by 3G_MSC-B from the list of algorithms received from 3G_MSC-A before forwarding it to the RNS. The modified list of algorithms, the integrity protection key and the chosen algorithm shall be stored by 3G_MSC-B.

Transfer of Information:

> If integrity protection has not been performed before Inter-MSC Relocation, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Relocation.

> Integrity protection control towards 3G_MSC-B:

>> If Integrity protection has been performed before Inter-MSC Relocation:

>> - in the Relocation Request RANAP message (information included).

>>> The Relocation Request Acknowledge should in this case contain the indication of the chosen algorithm.

>> If Integrity protection has NOT been performed before Inter-MSC Relocation:

>> - in the Security Mode Command procedure between 3G_MSC-A and 3G_MSC-B.

4.8.5.2 Encryption Information

A sequence of possible encryption algorithms can be sent to an RNS in Security Mode Command or Relocation Request. The RNS chooses one of the listed algorithms and reports this back to the 3G_MSC in Security Mode Complete or Relocation Request Acknowledge respectively.

3G_MSC-B shall remove algorithms not allowed by MSC-B from the list of algorithms received from 3G_MSC-A before forwarding it to the RNS. The modified list of algorithms, the ciphering key and the chosen algorithm shall be stored by 3G_MSC-B, and the chosen value sent to 3G_MSC-A.

Transfer of Information:

> If ciphering has not been performed before Inter-MSC Relocation, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Relocation.

> Ciphering control towards 3G_MSC-B:

>> If Ciphering has been performed before Inter-MSC Relocation:

>> - in the Relocation Request RANAP message (information included).

>>> The Relocation Request Acknowledge should in this case contain the indication of the chosen algorithm.

>> If Ciphering has NOT been performed before Inter-MSC Relocation:

>> - in the Security Mode Command procedure between 3G_MSC-A and 3G_MSC-B.

4.8.5.3 RAB Parameters

The parameters shall be stored by 3G_MSC-B to be used at internal Relocation in 3G_MSC-B.

Transfer of information:

> Received by 3G_MSC-B from 3G_MSC-A in:

>> - The Relocation Request RANAP message.

> If a new type of resource is to be assigned after Inter-MSC Relocation, this can be made with:

>> - The RAB Assignment Request RANAP message.

4.8.5.4 Channel Type

Channel Type is GSM information that is required in BSSMAP Handover Request and BSSMAP Assignment Request, and it shall be provided by 3G_MSC-A. 3G_MSC-B needs this information in case of an intra-MSC UMTS to GSM

handover after an inter-MSC relocation and subsequent assignment procedures. The Channel Type derived from the Bearer Capability that is available in 3G_MSC-A. This mapping is described in 3GPP TS 27.001 [8]. Therefore 3G_MSC-A must provide this information in case of an inter-MSC relocation. The Radio Resource Information IE in the MAP Prepare Handover message refers to the Channel Type GSM information.

Channel Type shall be stored by 3G_MSC-B.

Transfer of information:

> Received by 3G_MSC-B from 3G_MSC-A in:

> > - The Prepare Handover Request MAP message.

> > - The Forward Access Signalling Request message.

4.8.5.5   Selected GSM Algorithm

After inter-MSC relocation, the 3G_MSC-B can perform intra-MSC UMTS to GSM handover. A sequence of possible encryption algorithms, received from the 3G_MSC-A, can be sent to an BSS in Handover Request or in Cipher Mode Command in case of cipher mode setting after intra.MSC-B handover from UMTS to GSM. The BSS chooses one of the listed algorithms and reports this back to the 3G_MSC in Handover Request Acknowledge or Cipher Mode Complete respectively. The MSC-B provides the Selected GSM algorithm information to the MSC-A. The Selected GSM algorithms IE in the MAP Process Access Signalling Request message refers to the Algorithm identifier octet in the Chosen Encryption Algorithm GSM information.

The chosen algorithm shall be stored by 3G_MSC-B, and sent to 3G_MSC-A.

Transfer of Information:

> If ciphering has not been performed before Inter-MSC Relocation, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Relocation.

> If Ciphering has been performed before Inter-MSC Relocation, Selected GSM algorithm information is received by 3G_MSC-A from 3G_MSC-B in:

> > - The Handover Performed BSSMAP message.

> If Ciphering has NOT been performed before Intra-MSC-B handover from UMTS to GSM after Inter-MSC Relocation, Selected GSM algorithm information is received by 3G_MSC-A from 3G_MSC-B in:

> > - The Process Access Signalling Request MAP message.

4.8.5.6   Allowed GSM Algorithms

Allowed GSM algorithms is GSM information that is required in BSSMAP Handover Request and BSSMAP Cipher Mode Command, and shall be provided by 3G_MSC-A. 3G_MSC-B needs this information in case of an intra-MSC UMTS to GSM handover and in subsequent ciphering mode setting, after an inter-MSC relocation. Therefore 3G_MSC-A must provide this information in case of an inter-MSC relocation. The Allowed GSM algorithms IE in the MAP Prepare Handover and in the MAP Forward Access Signalling Request messages refers to the Algorithm identifier octet in the Permitted Algorithms GSM information.

Allowed GSM algorithms shall be stored by 3G_MSC-B.

Transfer of information:

> If ciphering has not been performed before Inter-MSC Relocation, this will be controlled by 3G_MSC-A after the completion of Inter-MSC Relocation.

> Ciphering control towards 3G_MSC-B:

> If Ciphering has been performed before Inter-MSC Relocation:

> > - The Prepare Handover Request MAP message.

> If Ciphering has NOT been performed before Inter-MSC Relocation:

-    The Forward Access Signalling Request MAP message.

4.8.5.7   Chosen Channel

BSSMAP Assignment Request may give the BSS some freedom in the selection of radio resource (for instance channel rate selection, speech version selection etc.). Chosen Channel and/or Speech Version is reported back to 3G_MSC-B in BSSMAP Assignment Complete. The Chosen Radio Resource Information IE in the MAP Prepare Handover Response and Process Access Signalling Request messages refers to the Chosen Channel and/or Speech Version GSM information.

The Channel Type and the characteristics of the chosen channel shall be stored by 3G_MSC-B, and the Chosen Channel and/or Speech Version information elements shall be transferred to MSC-A or 3G_MSC-A.

Transfer of information:

Received by MSC-A or 3G_MSC-A from 3G_MSC-B in:

-    The Prepare Handover Response MAP message

-    The Process Access Signalling request MAP message

4.8.5.8   BSSMAP Service Handover

This information shall be stored by 3G_MSC-B and sent to a BSS in Handover Request, when 3G_MSC-B performs handover to GSM.

Transfer of information:

The BSSMAP Service Handover information is transferred to 3G_MSC-B in:

-    the Prepare Handover Request MAP message.

If a new assignment of a TCH after an inter-MSC relocation is to be performed, the BSSMAP Service Handover information is transferred to 3G_MSC-B in:

-    the Forward Access Signalling Request MAP message

and sent by 3G_MSC-B to the BSS in the Assignment Request BSSMAP message.

4.8.5.9   RANAP Service Handover

This information shall be stored by 3G_MSC-B and sent to an RNS in Relocation Request during the basic inter-MSC relocation or when 3G_MSC-B performs a subsequent intra-MSC relocation or handover to UMTS.

Transfer of information:

The RANAP Service Handover information is transferred to 3G_MSC-B in:

-    the Relocation Request RANAP message.

If a new assignment of a Radio Access Bearer after an inter-MSC relocation is to be performed, the information is transferred to 3G_MSC-B in:

-    the RANAP RAB Assignment procedure.

4.8.5.10   GERAN Classmark

The GERAN Classmark shall be stored by 3G_MSC-B and can be received from MSC-A, from the serving BSS or serving RNS, or from the target RNS. The GERAN Classmark shall be used together with other parameters, e.g. the Channel Type, for selecting a service and for generating RAB parameters for relocation to GERAN Iu-mode, subsequent relocation or handover to GERAN Iu-mode, and RAB (re-)assignment when the MS is in GERAN Iu-mode.

Transfer of Information due to GERAN Classmark received from MSC-A:

Received by 3G_MSC-B in:

- the Prepare Handover Request MAP message.

Transfer of Information due to GERAN Classmark received from the serving RNS:

Received by 3G_MSC-B in:

- the Handover Required BSSMAP message;

- the Relocation Required RANAP message;

- the Initial UE RANAP message; or

- the RAB Assignment Response RANAP message.

Transfer of Information due to GERAN Classmark received from the target RNS:

Received by 3G_MSC-B in:

- the Relocation Failure RANAP message.

4.8.5.11 SNA Access Information

This information shall be stored by 3G_MSC-B and sent to an RNS in the Relocation Request message when 3G_MSC-B performs handover to UMTS.

Transfer of information:

The SNA Access Information is transferred to 3G_MSC-B in:

- the Relocation Request RANAP message encapsulated in the Prepare Handover request MAP message.

4.8.5.12 UESBI

This information shall be stored by 3G_MSC-B and sent to an RNS in Relocation Request during the basic inter-MSC relocation or when 3G_MSC-B performs a subsequent intra-MSC relocation or handover to UMTS.

Transfer of information:

The UESBI information is transferred to 3G_MSC-B in:

- the Relocation Request RANAP message.

4.8.5.13 Alternative RAB Parameters Value

This information shall be stored by 3G_MSC-B and sent to an RNS in Relocation Request during the basic inter-MSC relocation or when 3G_MSC-B performs a subsequent intra-MSC relocation or handover to UMTS.

Transfer of information:

The Alternative RAB Parameters Value information is transferred to 3G_MSC-B in:

- the Relocation Request RANAP message.

If an assignment of a Radio Access Bearer after an inter-MSC relocation is to be performed, the information is transferred to 3G_MSC-B in:

- the RAB Assignment Request RANAP message.

4.8.5.14 Trace parameters

This information shall be stored by 3G_MSC-B and 3G_MSC-B shall use this information for trace activation for MSC-S, MGW, RNC or BSC.

Transfer of information:

      The Trace Parameter List information for MSC-S, MGW and BSC tracing is transferred to 3G_MSC-B in:

    -   the Prepare Handover Request MAP message.

      The Trace Propagation Parameter information for RNC tracing is transferred to 3G_MSC-B in:

    -   the CN Invoke Trace RANAP message.

4.8.6 Overview of the Technical Specifications 3GPP interworking for the Inter-MSC Relocation

```
PSTN/ISDN
                                      +-------------+
===============------      |  ============  ===============
UMTS                       V            V

   RNS-A          3G-MSC-A         3G-MSC-B        RNS-B           MS
                 +-------+                                      +-------+
                 |  C M  |              24.008                 |  C M  |
                 +-------+  <--------------------------------->+-------+
                 |  M M  |                                     |  M M  |
   +------+25.413 +-------+  25.413+-------+ 25.413+-------+    +-------+
   | R R  |<----->|  R R  |<=====>|  R R  |<----->|  R R  |    |  R R  |
   +------+       +-------+       +-------+       +-------+     +-------+
                  ^    ^           ^    ^
                  |    |  29.010   |    |
                  |    V           |    V
                 +-----+ 29.002+-----+
                 |MAP/E|<----->|MAP/E|
                 +-----+       +-----+                  23.009
                  |            |                                Remark: The RRC interface and
                  V            V                                        the link layer
                 +-----------------------+                              protocols being out of
                 |       T C A P         |                              the scope of this
                 +-----------------------+                              Specification are not
   +-------------------------------------------------+                  shown here.
   |                  S C C P                        |
   +-------------------------------------------------+
   +-------------------------------------------------+
   |                  M T P                          |
   +-------------------------------------------------+
```
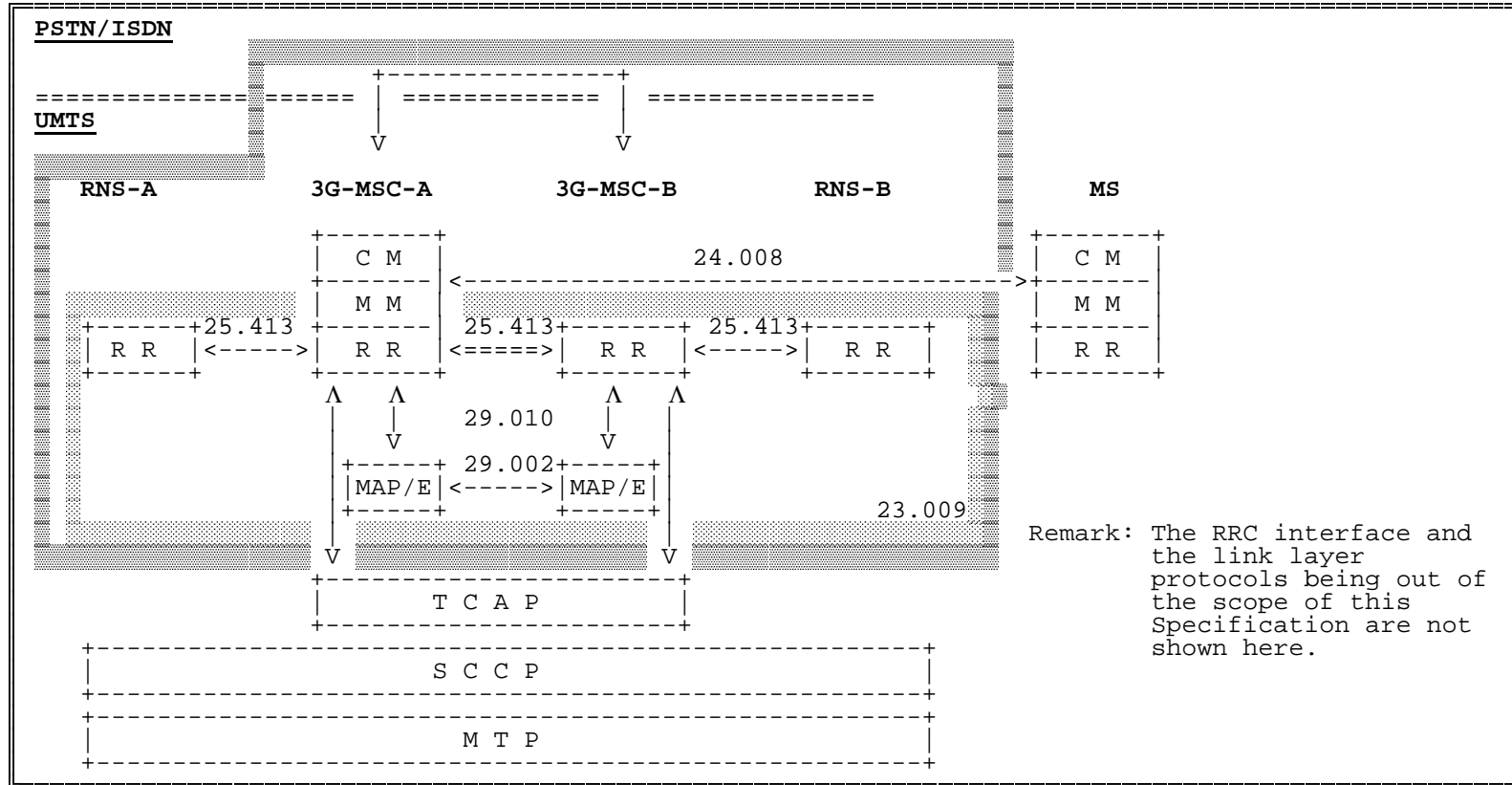
4.9 Location Services

The general principles of the location services procedures are given in Technical Specification 3GPP TS 23.271 [16].

3GPP TS 29.010 gives the necessary information for interworking between the 3GPP TS 25.413 [7] RANAP protocol and the 3GPP TS 48.008 [12] BSSMAP protocol. The interworking is necessary for positioning requests issued after a completed GSM to UMTS inter system handover. BSSMAP messages carried by MAP over the E-interface must be mapped by the non-anchor 3G-MSC into the corresponding RANAP messages to be sent over the Iu-interface and vice versa. For Inter-MSC GSM to GSM Handover and Inter-MSC UMTS to UMTS SRNS Relocation no mapping between the 3GPP TS 25.413 [7] RANAP protocol and the 3GPP TS 48.008 [12] BSSMAP protocol is necessary, but only the interworking with the MAP protocol over the E-interface needs to be described.

4.9.1 Completed Location Acquisition

4.9.1.1 Inter-MSC Handover (GSM to GSM)

After a successful Inter-MSC handover, any positioning request received by the anchor MSC via the MAP message Provide Subscriber Location triggers the BSSMAP procedure Location Acquisition described in 3GPP TS 48.008 [12]. For handover this procedure is executed according to GSM 3GPP TS 49.008 [14] with the anchor MSC playing the role of the MSC and the non anchor MSC playing the role of the BSS.

The needed BSSMAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non anchor MSC the BSSMAP messages received from the anchor MSC are forwarded to the BSS, and the BSSMAP messages received from the BSS are sent over the E-interface to the anchor MSC.

The signalling for a completed Location Acquisition procedure is shown in figures 65a.

```
GMLC                MSC-A                          MSC-B
|                   |                              |
| MAP PROVIDE       |                              |
| SUBSCRIBER        |                              |
| LOCATION          |                              |
|-------------->    | MAP FORWARD ACCESS           |
|                   |     SIGNALLING               |
|                   |---------------------------->  |
|                   |   -an-APDU(                   |
|                   |   PERFORM LOCATION            |
|                   |           REQUEST)            |
|                   |                              |
|                   |                              |                      BSS-B
|                   |                              |                         |
|                   |                              |------------------------> |
|                   |                              |   PERFORM LOCATION       |
|                   |                              |      REQUEST             |
|                   |                              |                          |
|                   |                              |          +-----------+   |
|                   |                              |          |Positioning|   |
|                   |                              |          |    is     |   |
|                   |                              |          | performed |   |
|                   |                              |          +-----------+   |
|                   |                              |                          |
|                   |                              |<------------------------ |
|                   |                              |   PERFORM LOCATION       |
|                   |                              |      RESPONSE            |
|                   |                              |                          |
|                   |        MAP PROCESS ACCESS    |
|                   |        SIGNALLING            |
|                   |<---------------------------- |
|                   |   -an-APDU(                   |
|                   |   PERFORM LOCATION            |
|                   |           RESPONSE)           |
| MAP PROVIDE       |                              |
| SUBSCRIBER        |                              |
| LOCATION res      |                              |
|<--------------    |                              |
|                   |                              |
```

Figure 65a: Signalling for a completed Location Acquisition procedure

After the inter-MSC handover, the MSC-B can perform intra-MSC GSM to UMTS handover. Any positioning request received by the anchor MSC after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.1.2).

4.9.1.2 Inter-MSC Handover (GSM to UMTS)

After a successful Inter-MSC GSM to UMTS inter system handover, any positioning request received by the anchor MSC via the MAP message Provide Subscriber Location triggers the BSSMAP procedure Location Acquisition described in 3GPP TS 48.008 [12]. For handover this procedure is executed according to 3GPP TS 49.008 [14] with the anchor MSC playing the role of the MSC and the non anchor 3G MSC playing the role of the BSS.

The needed BSSMAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non anchor 3G MSC the BSSMAP messages received from the anchor MSC are mapped into the corresponding RANAP messages to be sent to the RNS, and the received RANAP messages are mapped into the corresponding BSSMAP messages to be sent over the E-interface to the anchor MSC.

The signalling for a completed Location Acquisition procedure is shown in figures 65b.

```
GMLC              MSC-A                        3G-MSC-B
 |                  |                             |
|MAP PROVIDE        |                             |
|SUBSCRIBER         |                             |
|LOCATION           |                             |
 |---------------->|MAP FORWARD ACCESS           |
 |                  |     SIGNALLING              |
 |                  |---------------------------->|
 |                  |  -an-APDU(                  |
 |                  |  PERFORM LOCATION           |
 |                  |          REQUEST)           |
 |                  |                             |              RNS-B
 |                  |                             |               |
 |                  |                             |LOCATION REPORTING
 |                  |                             |    CONTROL     |
 |                  |                             |-------------------->|
 |                  |                             |   +-----------+
 |                  |                             |   |Positioning|
 |                  |                             |   |    is     |
 |                  |                             |   | performed |
 |                  |                             |   +-----------+
 |                  |                             |LOCATION REPORT |
 |                  |                             |<-------------------|
 |                  |MAP PROCESS ACCESS           |
 |                  |     SIGNALLING              |
 |                  |<----------------------------|
 |                  |  -an-APDU(                  |
 |                  |  PERFORM LOCATION           |
 |                  |          RESPONSE)          |
|MAP PROVIDE        |                             |
|SUBSCRIBER         |                             |
|LOCATION res       |                             |
 |<--------------|                               |
 |                  |                             |
```

Figure 65b: Signalling for a completed Location Acquisition procedure

The interworking between the BSSMAP location aquisition messages in MAP and the RANAP location reporting messages is as follows:

```
------------------------------------------------------------------------------
       |      29.002                            25.413                  |Notes
-------+------------------------------------------------------------------+-----
Forward| MAP FORWARD ACCESS SIG.       LOCATION REPORTING               |
message|     request                       CONTROL                     |
       |                                                                |
       | -an-APDU(                                                      |
       | PERFORM LOCATION REQUEST)                                      |
       |                                                                |
       | BSSMAP information            RANAP information                |
       |     elements:                    elements:                    |
       |                                                                |
       |    Location Type              Request Type                     | 1
       |     >Current Geographic        >Event = Direct                 |
       |        Location                >Report Area =                  |
       |                                   Geo. Coord.                  |
       |                                                                |
       |    Cell Identifier            ----                             |
       |    Classmark Inf. Type3       ----                             |
       |    LCS Client Type            ----                             |
       |    Chosen Channel             ----                             |
       |    LCS Priority               ----                             |
       |    LCS QoS                     Request Type                    |
       |     >Horizontal Accuracy       >Accuracy Code                  |
       |                                                                |
       |    GPS Assistance Data        ----                             |
       |    APDU                       ----                             |
       |                                                                |
-------+------------------------------------------------------------------+-----
Result | MAP PROCESS ACCESS SIG.      LOCATION REPORT                   |
       |     request                                                   |
       | -an-APDU(                                                      |
       | PERFORM LOCATION RESPONSE)                                     |
       |                                                                |
       | BSSMAP information            RANAP information                |
       |     elements:                    elements:                    |
       |                                                                |
       |                                                                |
       |    Location Estimate          Area Identity                   |
       |                                >Geographical Area              |
       |    Positioning Data           ----                             |
       |    Deciphering Keys           ----                             |
       |    LCS Cause                  Cause                            |
       |    ----                       Request Type                     |
```

NOTE 1: All other Location Type possibilities are not supported by UMTS positioning

After the inter-MSC GSM to UMTS handover, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any positioning request received by the anchor MSC after completion of the intra-MSC UMTS to GSM handover is handled as for Inter-MSC Handover GSM to GSM (see clause 4.9.1.1).

4.9.1.3 Inter-MSC Handover (UMTS to GSM)

After a successful Inter-MSC UMTS to GSM inter system handover, any positioning request received by the anchor 3G-MSC via the MAP message Provide Subscriber Location triggers the BSSMAP procedure Location Acquisition described in 3GPP TS 48.008 [12]. For handover this procedure is executed according to 3GPP TS 49.008 [14] with the anchor 3G-MSC playing the role of the 3G-MSC and the non anchor MSC playing the role of the BSS.

The needed BSSMAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non anchor MSC the BSSMAP messages received from the anchor 3G-MSC are forwarded to the BSS, and the BSSMAP messages received from the BSS are sent over the E-interface to the anchor 3G-MSC.

The signalling for a completed Location Acquisition procedure is shown in figures 65c.

```
GMLC            3G-MSC-A                        MSC-B
 |MAP PROVIDE      |                              |
 |SUBSCRIBER       |                              |
 |LOCATION         |                              |
 |---------------->|MAP FORWARD ACCESS            |
 |                 |       SIGNALLING             |
 |                 |---------------------------->|
 |                 |  -an-APDU(                   |
 |                 |  PERFORM LOCATION            |
 |                 |          REQUEST)            |
 |                 |                              |                     BSS-B
 |                 |                              |                        |
 |                 |                              |----------------------->|
 |                 |                              |  PERFORM LOCATION       |
 |                 |                              |     REQUEST             |
 |                 |                              |        +-----------+    |
 |                 |                              |        |Positioning|    |
 |                 |                              |        |    is     |    |
 |                 |                              |        | performed |    |
 |                 |                              |        +-----------+    |
 |                 |                              |                        |
 |                 |                              |<-----------------------|
 |                 |                              |  PERFORM LOCATION       |
 |                 |                              |     RESPONSE            |
 |                 |     MAP PROCESS ACCESS       |
 |                 |       SIGNALLING             |
 |                 |<----------------------------|
 |                 |  -an-APDU(                   |
 |                 |  PERFORM LOCATION            |
 |                 |          RESPONSE)           |
 |MAP PROVIDE      |                              |
 |SUBSCRIBER       |                              |
 |LOCATION res     |                              |
 |<----------------|                              |
```

Figure 65c: Signalling for a completed Location Acquisition procedure

After the inter-MSC UMTS to GSM handover, the 3G MSC-B can perform intra-MSC GSM to UMTS handover. Any positioning request received by the anchor 3G MSC after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.1.2).

4.9.1.4 Inter-MSC SRNS Relocation

After a successful Inter-MSC SRNS Relocation, any positioning request received by the anchor 3G-MSC via the MAP message Provide Subscriber Location triggers the RANAP procedure Location Reporting Control described in TS 25.413. For handover this procedure is executed according to 23.009 with the anchor 3G-MSC playing the role of the 3G-MSC and the non anchor 3G-MSC playing the role of the RNS.

The needed RANAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non anchor 3G-MSC the RANAP messages received from the anchor 3G-MSC are forwarded to the RNS, and the RANAPmessages received from the RNS are sent over the E-interface to the anchor 3G-MSC.

The signalling for a completed Location Acquisition procedure is shown in figures 65d.
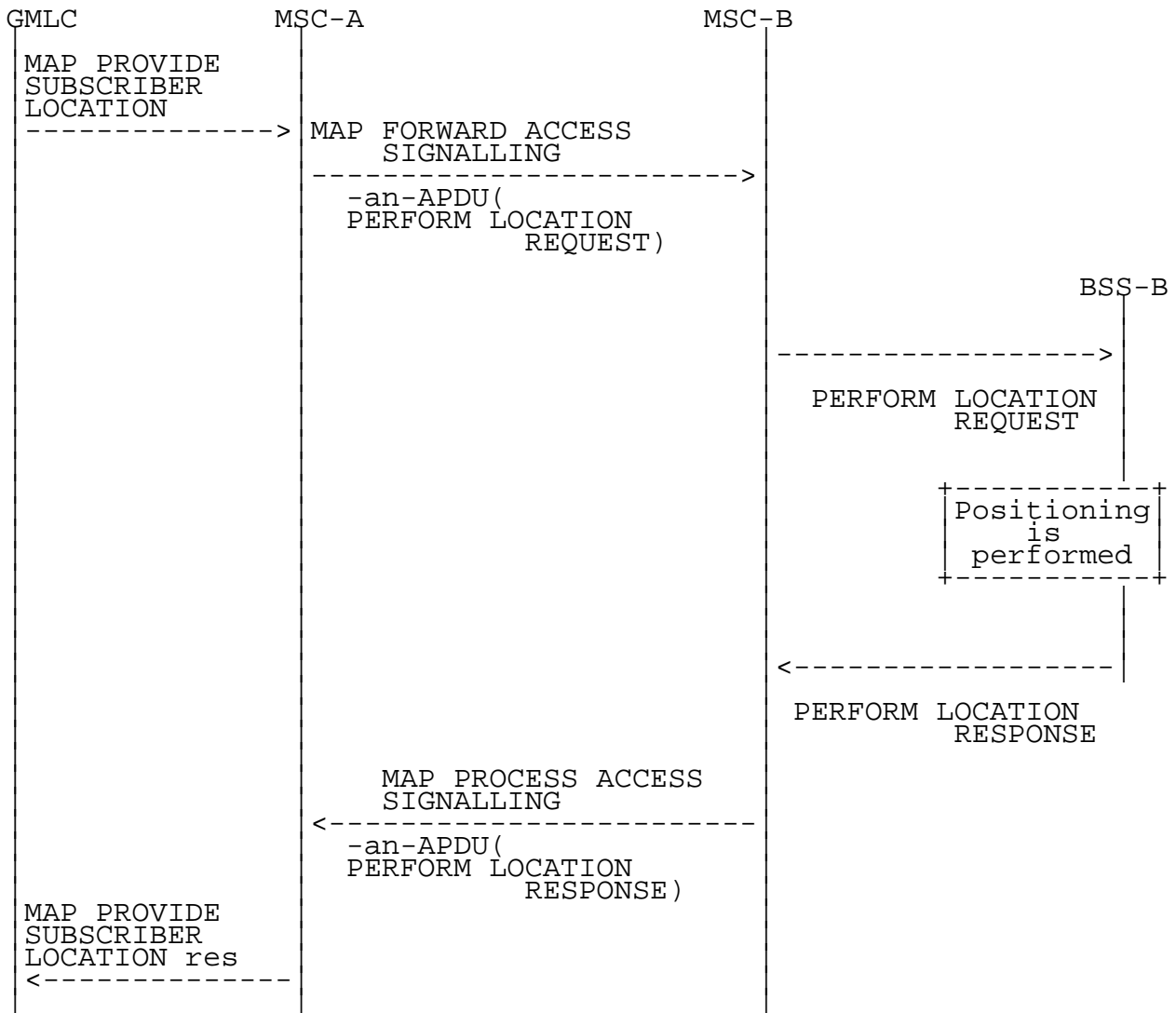
```
GMLC              3G-MSC-A                        3G-MSC-B
 |MAP PROVIDE        |                               |
 |SUBSCRIBER         |                               |
 |LOCATION           |                               |
 |-------------->|MAP FORWARD ACCESS                 |
 |               |    SIGNALLING                     |
 |               |-------------------------->|       |
 |               |  -an-APDU(                        |
 |               |  LOCATION REPORTING               |
 |               |            CONTROL)               |
 |               |                               RNS-B
 |               |                               |
 |               |                 ------------------>|
 |               |                 LOCATION REPORTING |
 |               |                     CONTROL        |
 |               |                               |    |
 |               |                     +-----------+  |
 |               |                     |Positioning|  |
 |               |                     |    is     |  |
 |               |                     | performed |  |
 |               |                     +-----------+  |
 |               |                               |    |
 |               |                 <------------------|
 |               |                 LOCATION REPORT    |
 |               |   MAP PROCESS ACCESS              |
 |               |       SIGNALLING                  |
 |               |<--------------------------        |
 |               |  -an-APDU(                        |
 |               |  LOCATION REPORT)                 |
 |MAP PROVIDE        |                               |
 |SUBSCRIBER         |                               |
 |LOCATION res       |                               |
 |<--------------    |                               |
```
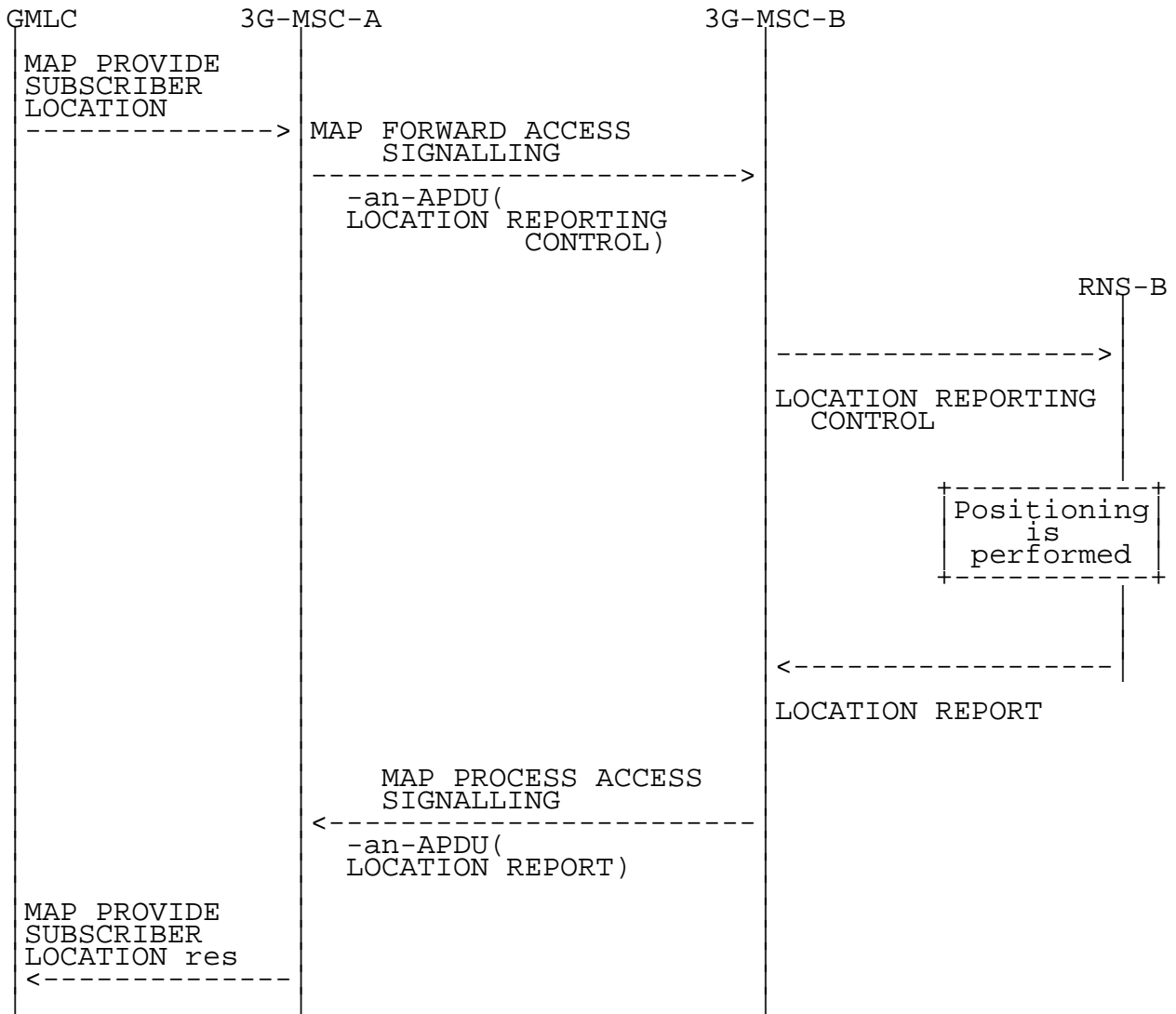
Figure 65d: Signalling for a completed Location Acquisition procedure

After the inter-MSC SRNS Relocation, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any
positioning request received by the anchor 3G MSC after completion of the intra-MSC UMTS to GSM requires that at
the non anchor 3G MSC the received RANAP messages are mapped into the corresponding BSSMAP messages to be
sent to the BSS, and the received BSSMAP messages are mapped into the corresponding RANAP messages to be sent
over the E-interface to the anchor 3G-MSC.

The signalling for a completed Location Acquisition procedure is shown in figures 65e.
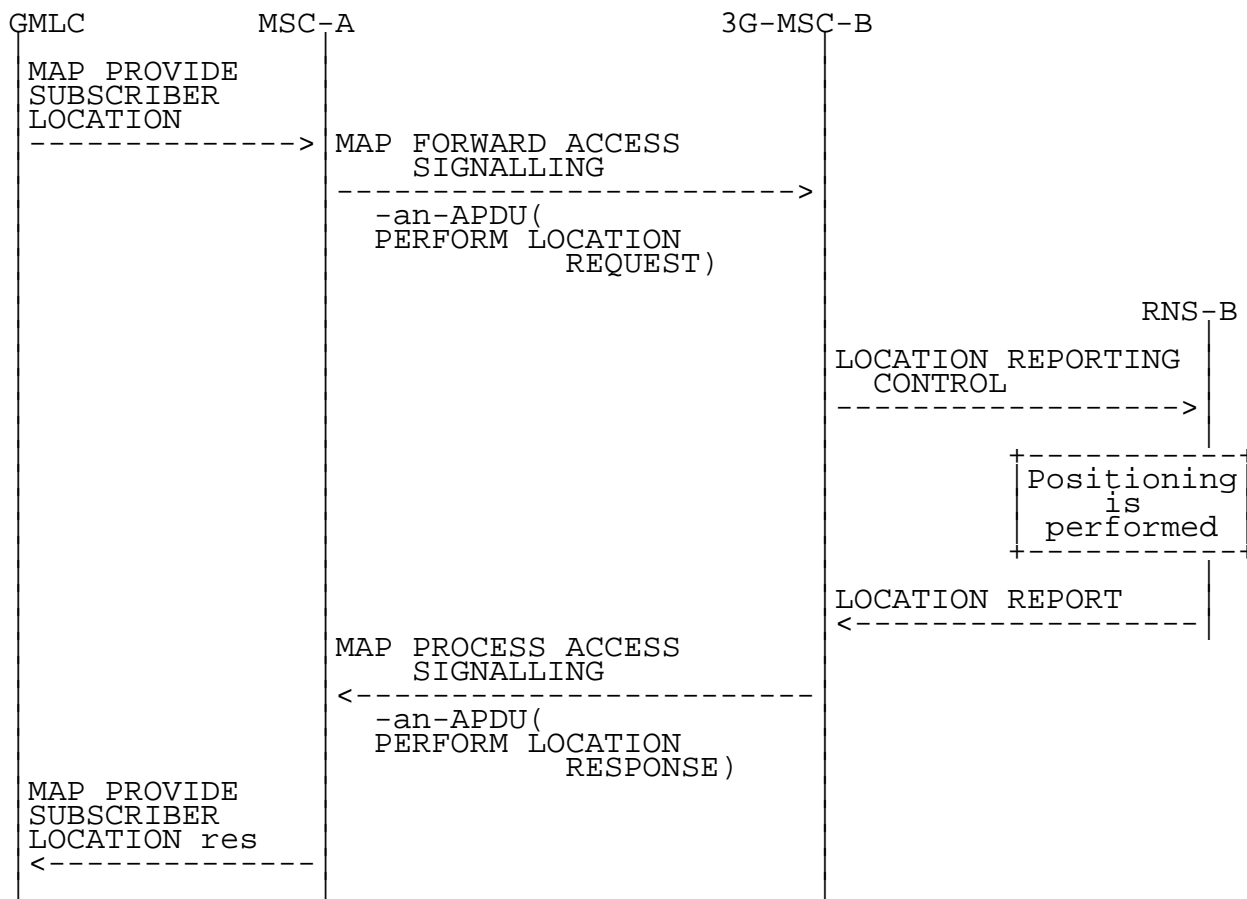
```
GMLC              3G-MSC-A               3G-MSC-B
|                 |                      |
|MAP PROVIDE      |                      |
|SUBSCRIBER       |                      |
|LOCATION         |                      |
|---------------->|MAP FORWARD ACCESS    |
|                 |     SIGNALLING       |
|                 |--------------------->|
|                 |  -an-APDU(           |
|                 |  LOCATION REPORTING  |
|                 |         CONTROL)     |
|                 |                      |
|                 |                      |                          BSS-B
|                 |                      |                           |
|                 |                      |                           |
|                 |                      |------------------>|
|                 |                      |                           |
|                 |                      |PERFORM LOCATION           |
|                 |                      |  REQUEST                  |
|                 |                      |                           |
|                 |                      |                  +----------+
|                 |                      |                  |Positioning|
|                 |                      |                  |    is     |
|                 |                      |                  | performed |
|                 |                      |                  +----------+
|                 |                      |                           |
|                 |                      |                           |
|                 |                      |                           |
|                 |                      |<------------------|
|                 |                      |                           |
|                 |                      |PERFORM LOCATION           |
|                 |                      |  RESPONSE                 |
|                 |                      |                           |
|                 |    MAP PROCESS ACCESS|
|                 |       SIGNALLING     |
|                 |<---------------------|
|                 |  -an-APDU(           |
|                 |  LOCATION REPORT)    |
|                 |                      |
|MAP PROVIDE      |                      |
|SUBSCRIBER       |                      |
|LOCATION res     |                      |
|<--------------- |                      |
|                 |                      |
```

Figure 65e: Signalling for a completed Location Acquisition procedure

the interworking between the RANAP messages encapsulated in MAP and the BSSMAP messages is as follows:

```
              -------------------------------------------------------
                    | 29.002                       48.008        |Notes
              --------+-----------------------------------------+-----
              Forward | MAP FORWARD ACCESS SIG.    PERFORM LOCATION   |
              message |    request                    REQUEST        |
                      |                                              |
                      | -an-APDU(                                    |
                      | LOCATION REPORTING CONTROL)                  |
                      |                                              |
                      | RANAP information         BSSMAP information |
                      |     elements:                 elements:     |
                      |                                              |
                      |   Request Type              Location Type    |
                      |     >Event = Direct           >Current Geographic |
                      |     >Report Area =              Location     |
                      |        Geo. Coord.                           |
                      |                                              |
                      |   Request Type              LCS QoS          |
                      |     >Accuracy Code             >Horizontal Accuracy |
                      |                                              |
              --------+------------------------------------------+-----
              Result  | MAP PROCESS ACCESS SIG.    PERFORM LOCATION  |
                      |    request                    RESPONSE       |
                      | -an-APDU(                                    |
                      | LOCATION REPORT)                             |
                      |                                              |
                      | RANAP information         BSSMAP information |
                      |     elements:                 elements:     |
                      |                                              |
                      |   Area Identity             Location Estimate |
                      |     >Geographical Area                       |
                      |                                              |
                      |   Cause                     LCS Cause        |
                      |   Request Type              ----             |
                      |                                              |
```

4.9.2   Cause Code Mapping

4.9.2.1 Inter-MSC Handover (GSM to GSM)

When a mobile station is handed over from GSM to GSM, no mapping of cause codes is required. The MSC shall use the cause codes specified in 3GPP TS 48.008 [12].

After the inter-MSC handover, the MSC-B can perform intra-MSC GSM to UMTS handover. A mapping of the cause codes used in the RANAP and the BSSMAP protocols is needed after completion of the intra-MSC GSM to UMTS handover and is the same as for Inter-MSC Handover GSM to UMTS (see clause 4.9.2.2)..

4.9.2.2 Inter-MSC Handover (GSM to UMTS)

When a Mobile Station is handed over between GSM and UMTS, a mapping of the cause codes used in the RANAP and the BSSMAP protocols is needed. The mapping described here is applicable to the BSSMAP protocol even when used inside MAP in the E-interface.

The mapping between the cause codes received in RANAP Location Report and the LCS cause codes sent in BSSMAP Perform Location Response is as follows:

```
--------------------------------------------------------------
    25.413                            48.008            |Notes
--------------------------------------------------------+-------
LOCATION REPORT                  PERFORM LOCATION RESPONSE |

 - Requested Report Type         - Position method failure|
      not Supported                                        |
 - Requested Information         - Position method failure|
      not Available                                        |
 - all other cause codes         - System Failure         |
```

After the inter-MSC GSM to UMTS handover, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. No mapping of cause codes is required after completion of the intra-MSC UMTS to GSM handover as for Inter-MSC Handover GSM to GSM (see clause 4.9.2.1).

4.9.2.3 Inter-MSC Handover (UMTS to GSM)

When a mobile station is handed over from UMTS to GSM, no mapping of cause codes is required. The 3G-MSC shall use the cause codes specified in 3GPP TS 48.008 [12].

After the inter-MSC UMTS to GSM handover, the 3G MSC-B can perform intra-MSC GSM to UMTS handover. A mapping of the cause codes used in the RANAP and the BSSMAP protocols is needed after completion of the intra-MSC GSM to UMTS handover and is the same as for Inter-MSC Handover GSM to UMTS (see clause 4.9.2.2)...

4.9.2.4 Inter-MSC SRNS Relocation

When a mobile station is handed over from UMTS to UMTS, no mapping of cause codes is required. Both 3G-MSCs shall use the cause codes specified in TS 25.413.

After the inter-MSC SRNS Relocation, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. A mapping of the cause codes used in the RANAP and the BSSMAP protocols is needed after completion of the intra-MSC UMTS to GSM handover.

The mapping between the cause codes received in BSSMAP Perform Location Response and the LCS cause codes sent in RANAP Location Report is as follows:

```
-----------------------------------------------------------
      48.008                        25.413            |Notes
-----------------------------------------------------+-------
PERFORM LOCATION RESPONSE    LOCATION REPORT          |
                                                      |
 - Position method failure   - Requested Report Type  |
                                 not Supported         |
 - System Failure            - Unspecified Failure    |
 - Protocol Error            - Unspecified Failure    |
 - Data missing              - Unspecified Failure    |
     in position request                              |
 - Unexpected data value     - Unspecified Failure    |
     in position request                              |
 - Target MS Unreachable     - Unspecified Failure    |
 - Location request aborted  - Unspecified Failure    |
 - Facility not supported    - Requested Report Type  |
                                 not Supported         |
 - Inter-BSC Handover Ongoing - Unspecified Failure   |
 - Intra-BSC                 - Unspecified Failure    |
     Handover Complete                                |
 - Congestion               - Unspecified Failure     |
 - Unspecified              - Unspecified Failure      |
```

4.9.3   Aborted Location Acquisition

4.9.3.1 Inter-MSC Handover (GSM to GSM)

When for any reason the on going location acquisition procedure needs to be aborted, the anchor MSC sends the BSSMAP message Perform Location Abort over the E-interface.

Figure 66a shows the signalling for an aborted Location Acquisition procedure.

```
GMLC                  MSC-A                              MSC-B
 |                     |                                  |
 | MAP PROVIDE         |                                  |
 | SUBSCRIBER          |                                  |
 | LOCATION            |                                  |
 |-------------->| MAP FORWARD ACCESS                     |
 |                     SIGNALLING                         |
 |               ------------------------>                |
 |                                                        |
 |                 -an-APDU(                              |
 |               PERFORM LOCATION                         |
 |                       REQUEST)                         |
 |                     |                                  |
 |                     |                               BSS-B
 |                     |                                  |
 |                     |                                  |
 |                     |       ------------------------>  |
 |                     |                                  |
 |                     |         PERFORM LOCATION         |
 |                     |                 REQUEST)         |
 |                     |                                  |
 |               MAP FORWARD ACCESS                       |
 |                   SIGNALLING                           |
 |               ------------------------>                |
 |                 -an-APDU(                              |
 |               PERFORM LOCATION ABORT)                  |
 |                     |                                  |
 |                     |       ------------------------>  |
 |                     |                                  |
 |                     |         PERFORM LOCATION         |
 |                     |                 ABORT            |
 |                     |                                  |
 |                     |       <------------------------  |
 |                     |                                  |
 |                     |         PERFORM LOCATION         |
 |                     |                 RESPONSE         |
 |                     |                                  |
 |               MAP PROCESS ACCESS                       |
 |                   SIGNALLING                           |
 |               <------------------------                |
 |                 -an-APDU(                              |
 |               PERFORM LOCATION                         |
 |                       RESPONSE)                        |
 |                     |                                  |
```
Figure 66a: Signalling for an aborted Location Acquisition procedure

After the inter-MSC handover, the MSC-B can perform intra-MSC GSM to UMTS handover. A positioning request that needs to be aborted by the anchor MSC after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.3.2).

4.9.3.2 Inter-MSC Handover (GSM to UMTS)

When for any reason the on going location acquisition procedure needs to be aborted, the anchor MSC sends the BSSMAP message Perform Location Abort over the E-interface.

Figure 66b shows the signalling for an aborted Location Acquisition procedure.

```
GMLC            MSC-A                        3G-MSC-B
 |               |                             |
 |MAP PROVIDE    |                             |
 |SUBSCRIBER     |                             |
 |LOCATION       |                             |
 |-------------->|MAP FORWARD ACCESS           |
 |               |      SIGNALLING             |
 |               |---------------------------->|
 |               |  -an-APDU(                  |
 |               |  PERFORM LOCATION           |
 |               |         REQUEST)            |
 |               |                             |
 |               |                             |                     RNS-B
 |               |                             |LOCATION REPORTING     |
 |               |                             |   CONTROL             |
 |               |                             |---------------------->|
 |               |                             |                       |
 |               |MAP FORWARD ACCESS           |                       |
 |               |      SIGNALLING             |                       |
 |               |---------------------------->|                       |
 |               |  -an-APDU(                  |                       |
 |               |  PERFORM LOCATION ABORT)    |                       |
 |               |                             |                       |
 |               |                             |LOCATION REPORTING     |
 |               |                             |   CONTROL             |
 |               |                             |---------------------->|
 |               |                             |                       |
 |               |                             |LOCATION REPORT        |
 |               |                             |                       |
 |               |                             |<----------------------|
 |               |                             |                       |
 |               |MAP PROCESS ACCESS           |                       |
 |               |      SIGNALLING             |                       |
 |               |<----------------------------|                       |
 |               |  -an-APDU(                  |                       |
 |               |  PERFORM LOCATION           |                       |
 |               |         RESPONSE)           |                       |
 |               |                             |                       |
```

Figure 66b: Signalling for an aborted Location Acquisition procedure

The interworking between the BSSMAP location aquisition messages in MAP and the RANAP location reporting messages is as follows:

	29.002	25.413	Notes
Forward message	MAP FORWARD ACCESS SIG. request -an-APDU(PERFORM LOCATION ABORT) BSSMAP information elements: LCS Cause	LOCATION REPORTING CONTROL RANAP information elements: Request Type >Event = Stop >Report Area = Geo. Coord.	
Result	MAP PROCESS ACCESS SIG. request -an-APDU(PERFORM LOCATION RESPONSE) BSSMAP information elements: ---- LCS Cause ----	LOCATION REPORT RANAP information elements: Cause	1

NOTE 1: PERFORM LOCATION RESPONSE with LCS cause shall be generated by 3G-MSC-B.

After the inter-MSC GSM to UMTS handover, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. A positioning request that needs to be aborted by the anchor MSC after completion of the intra-MSC UMTS to GSM handover is handled as for Inter-MSC Handover GSM to GSM (see clause 4.9.3.1).

4.9.3.3 Inter-MSC Handover (UMTS to GSM)

When for any reason the on going location acquisition procedure needs to be aborted, the anchor 3G-MSC sends the BSSMAP message Perform Location Abort over the E-interface.

Figure 66c shows the signalling for an aborted Location Acquisition procedure.
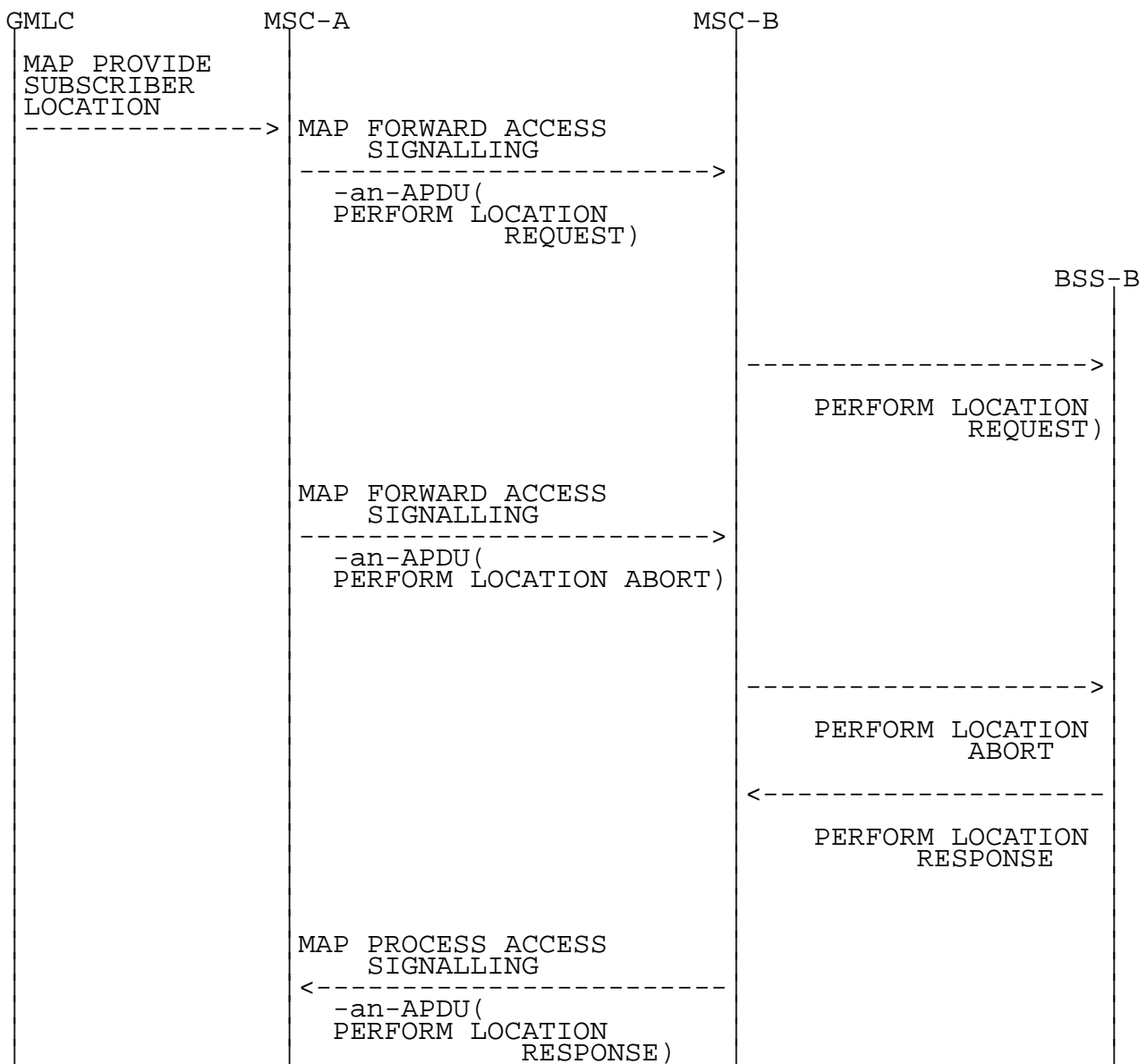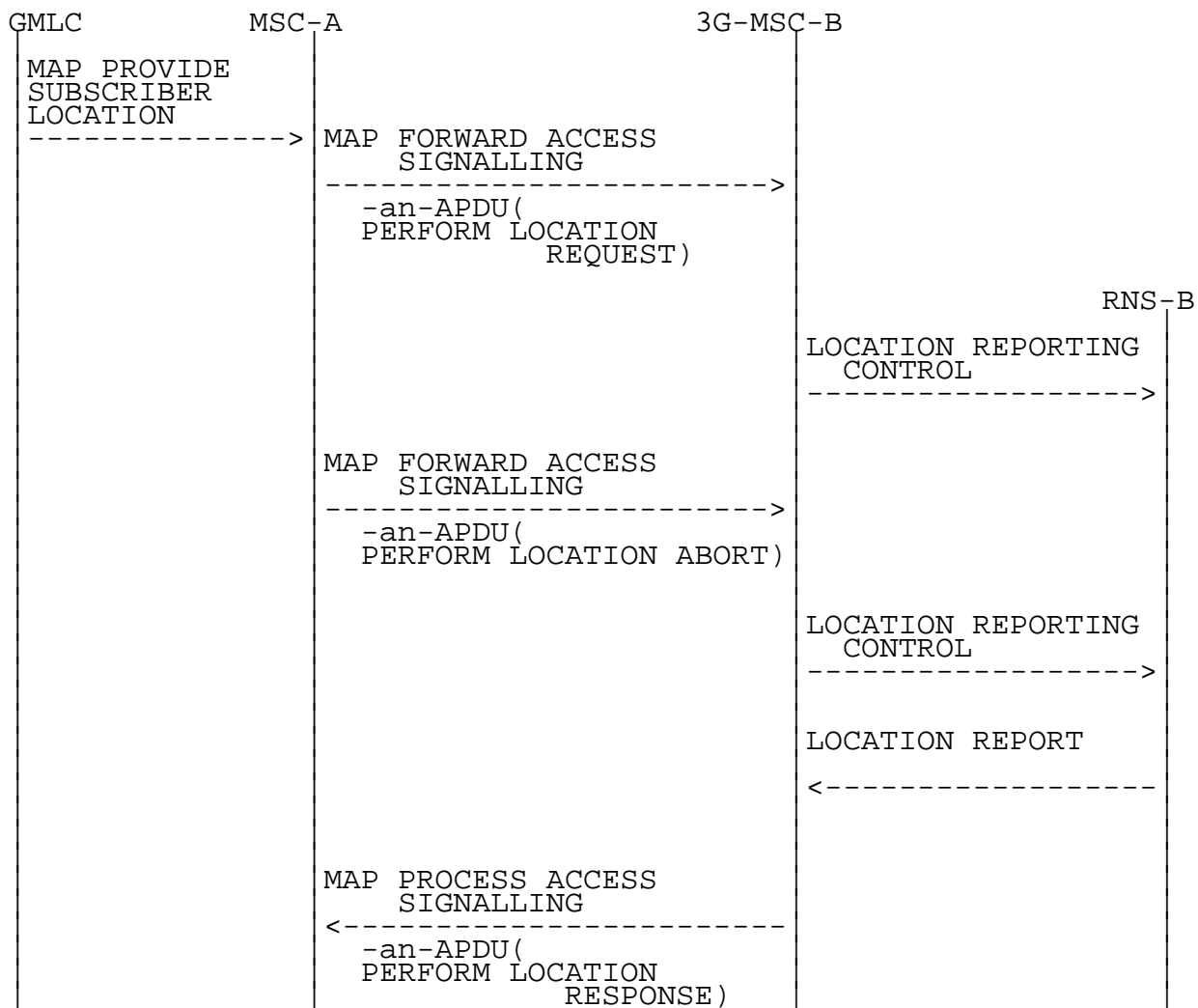
```
GMLC              3G-MSC-A                         MSC-B
 |                 |                                |
 |MAP PROVIDE      |                                |
 |SUBSCRIBER       |                                |
 |LOCATION         |                                |
 |---------------->|MAP FORWARD ACCESS              |
 |                 |      SIGNALLING                |
 |                 |------------------------------->|
 |                 |  -an-APDU(                     |
 |                 |  PERFORM LOCATION              |
 |                 |          REQUEST)              |
 |                 |                                |                    BSS-B
 |                 |                                |                     |
 |                 |                                |-------------------->|
 |                 |                                |                     |
 |                 |                                |  PERFORM LOCATION   |
 |                 |                                |          REQUEST)   |
 |                 |                                |                     |
 |                 |MAP FORWARD ACCESS              |                     |
 |                 |    SIGNALLING                  |                     |
 |                 |------------------------------->|                     |
 |                 |  -an-APDU(                     |                     |
 |                 |  PERFORM LOCATION ABORT)       |                     |
 |                 |                                |                     |
 |                 |                                |                     |
 |                 |                                |-------------------->|
 |                 |                                |                     |
 |                 |                                |  PERFORM LOCATION   |
 |                 |                                |          ABORT      |
 |                 |                                |<--------------------|
 |                 |                                |  PERFORM LOCATION   |
 |                 |                                |          RESPONSE   |
 |                 |MAP PROCESS ACCESS              |                     |
 |                 |    SIGNALLING                  |                     |
 |                 |<-------------------------------|                     |
 |                 |  -an-APDU(                     |                     |
 |                 |  PERFORM LOCATION              |                     |
 |                 |          RESPONSE)             |                     |
 |                 |                                |                     |
```

Figure 66c: Signalling for an aborted Location Acquisition procedure

After the inter-MSC UMTS to GSM handover, the 3G MSC-B can perform intra-MSC GSM to UMTS handover. A positioning request that needs to be aborted by the anchor 3G MSC after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.3.2)..

4.9.3.4 Inter-MSC SRNS Relocation

When for any reason the on going location acquisition procedure needs to be aborted, the anchor 3G-MSC sends the RANAP message Location Reporting Control over the E-interface.

Figure 66d shows the signalling for an aborted Location Acquisition procedure.

```
GMLC              3G-MSC-A                        3G-MSC-B
|                 |                               |
|MAP PROVIDE      |                               |
|SUBSCRIBER       |                               |
|LOCATION         |                               |
|---------------->|MAP FORWARD ACCESS             |
|                 |     SIGNALLING                |
|                 |------------------------------>|
|                 |  -an-APDU(                    |
|                 |  LOCATION REPORTING           |
|                 |           CONTROL)            |
|                 |                               |            RNS-B
|                 |                               |                |
|                 |                               |                |
|                 |                               |--------------->|
|                 |                               |                |
|                 |                               | LOCATION REPORTING
|                 |                               |     CONTROL    |
|                 |                               |                |
|                 |MAP FORWARD ACCESS             |                |
|                 |     SIGNALLING                |                |
|                 |------------------------------>|                |
|                 |  -an-APDU(                    |                |
|                 |  LOCATION REPORTING           |                |
|                 |     CONTROL = STOP)           |                |
|                 |                               |                |
|                 |                               |--------------->|
|                 |                               |                |
|                 |                               | LOCATION REPORTING
|                 |                               |   CONTROL =    |
|                 |                               |        STOP DIRECT
|                 |                               |                |
|                 |                               |<---------------|
|                 |                               |                |
|                 |                               | LOCATION REPORT|
|                 |                               |                |
|                 |MAP PROCESS ACCESS             |                |
|                 |     SIGNALLING               |                |
|                 |<-----------------------------|                |
|                 |  -an-APDU(                    |                |
|                 |  LOCATION REPORT)            |                |
|                 |                               |                |
```
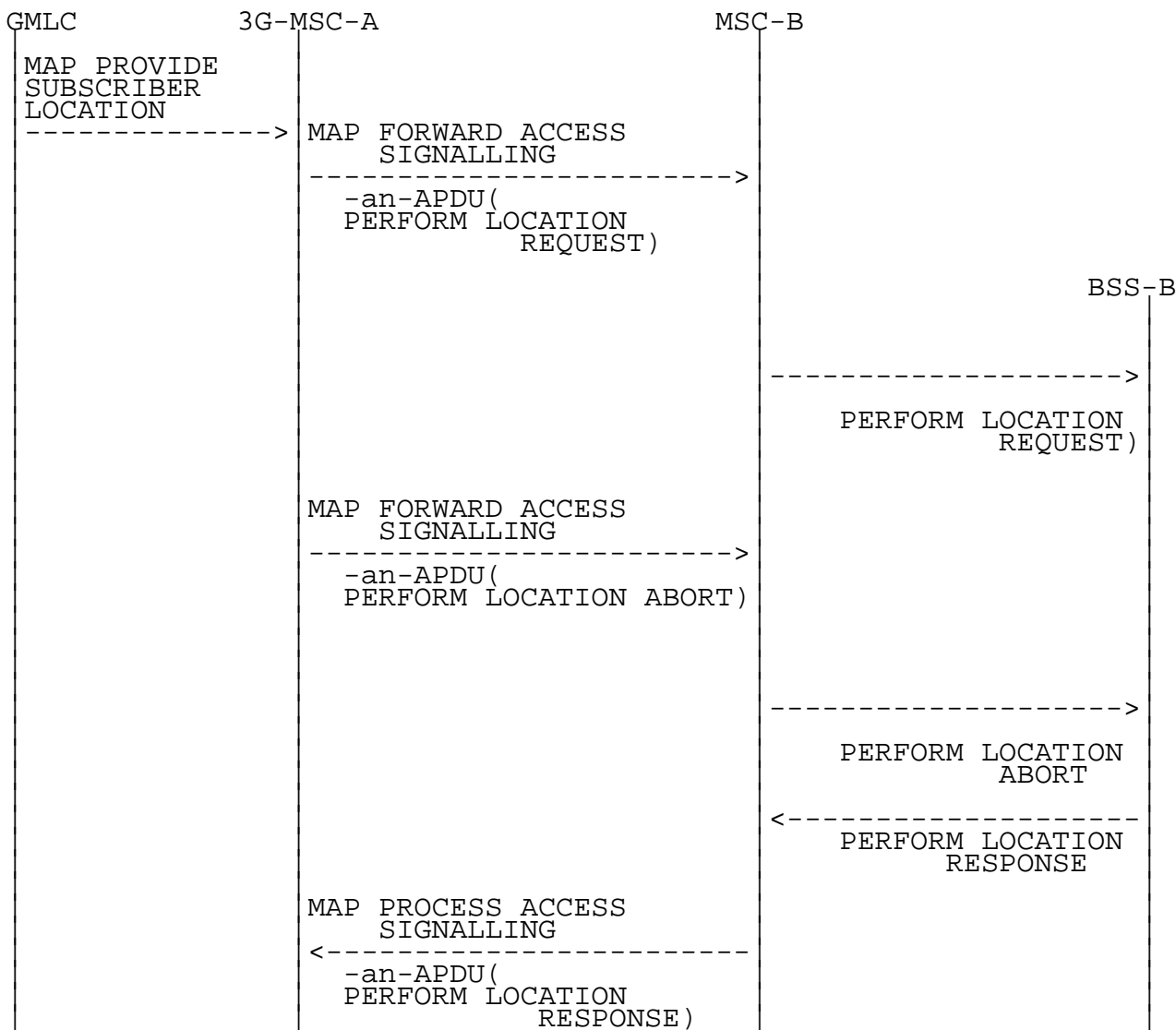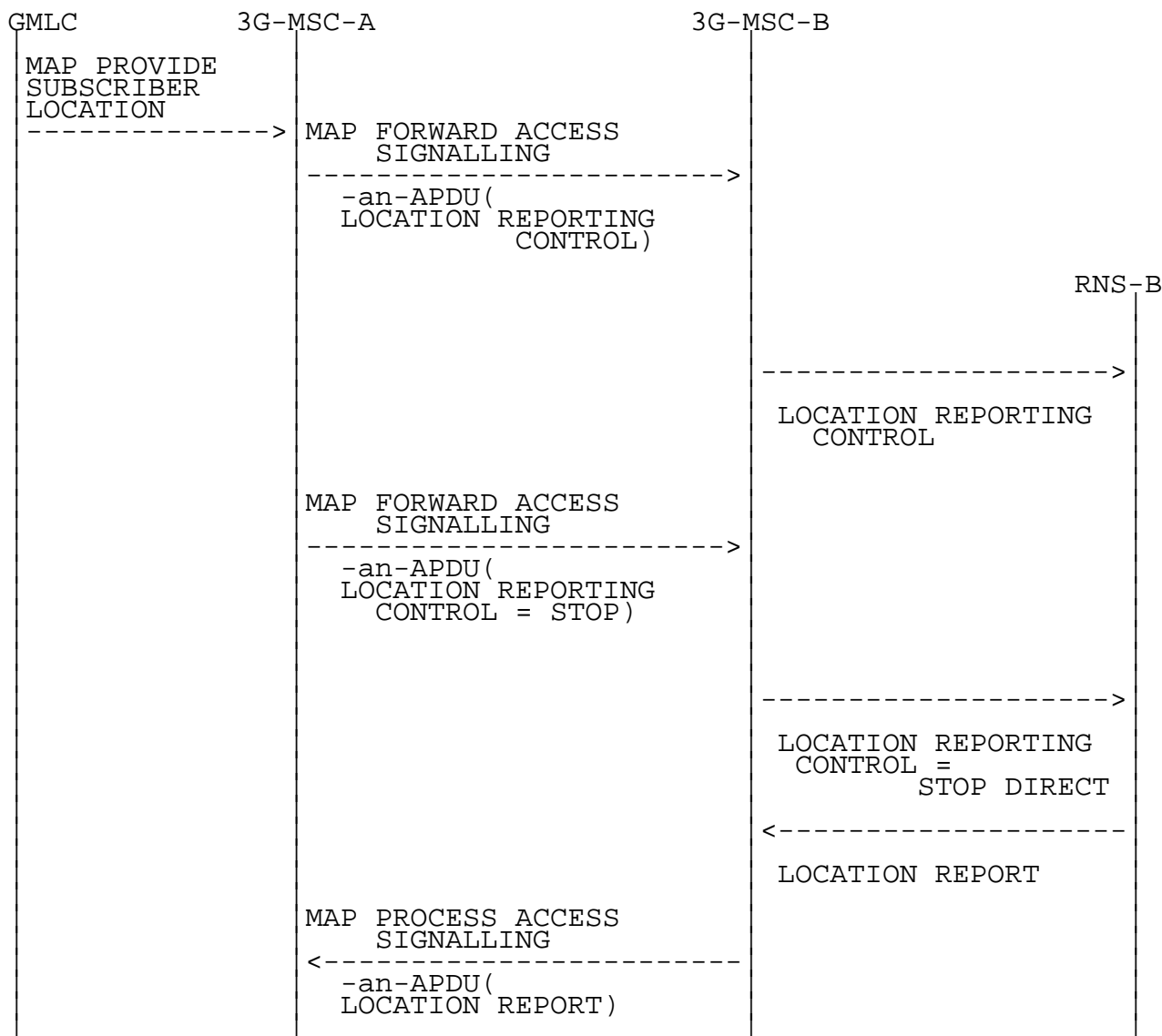
Figure 66d: Signalling for an aborted Location Acquisition procedure

After the inter-MSC SRNS Relocation, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. A positioning request that needs to be aborted by the anchor 3G MSC after completion of the intra-MSC UMTS to GSM requires that at the non anchor 3G MSC the received RANAP messages are mapped into the corresponding BSSMAP messages to be sent to the BSS, and the received BSSMAP messages are mapped into the corresponding RANAP messages to be sent over the E-interface to the anchor 3G-MSC.

The signalling for a completed Location Acquisition procedure is shown in figures 65e.

```
GMLC              3G-MSC-A                    3G-MSC-B
|                 |                           |
|MAP PROVIDE      |                           |
|SUBSCRIBER       |                           |
|LOCATION         |                           |
|---------------->|MAP FORWARD ACCESS         |
|                 |     SIGNALLING            |
|                 |-------------------------->|
|                 |  -an-APDU(                |
|                 |  LOCATION REPORTING       |
|                 |          CONTROL)         |
|                 |                           |
|                 |                           |              BSS-B
|                 |                           |              |
|                 |                           |              |
|                 |                           |------------------>|
|                 |                           |              |
|                 |                           |PERFORM LOCATION   |
|                 |                           |  ABORT            |
|                 |                           |              |
|                 |                           |              |
|                 |                           |<------------------|
|                 |                           |              |
|                 |                           |PERFORM LOCATION   |
|                 |                           |  RESPONSE         |
|                 |                           |              |
|                 |    MAP PROCESS ACCESS     |
|                 |       SIGNALLING          |
|                 |<--------------------------|
|                 |  -an-APDU(                |
|                 |  LOCATION REPORT)         |
|                 |                           |
|MAP PROVIDE      |                           |
|SUBSCRIBER       |                           |
|LOCATION res     |                           |
|<--------------- |                           |
|                 |                           |
```
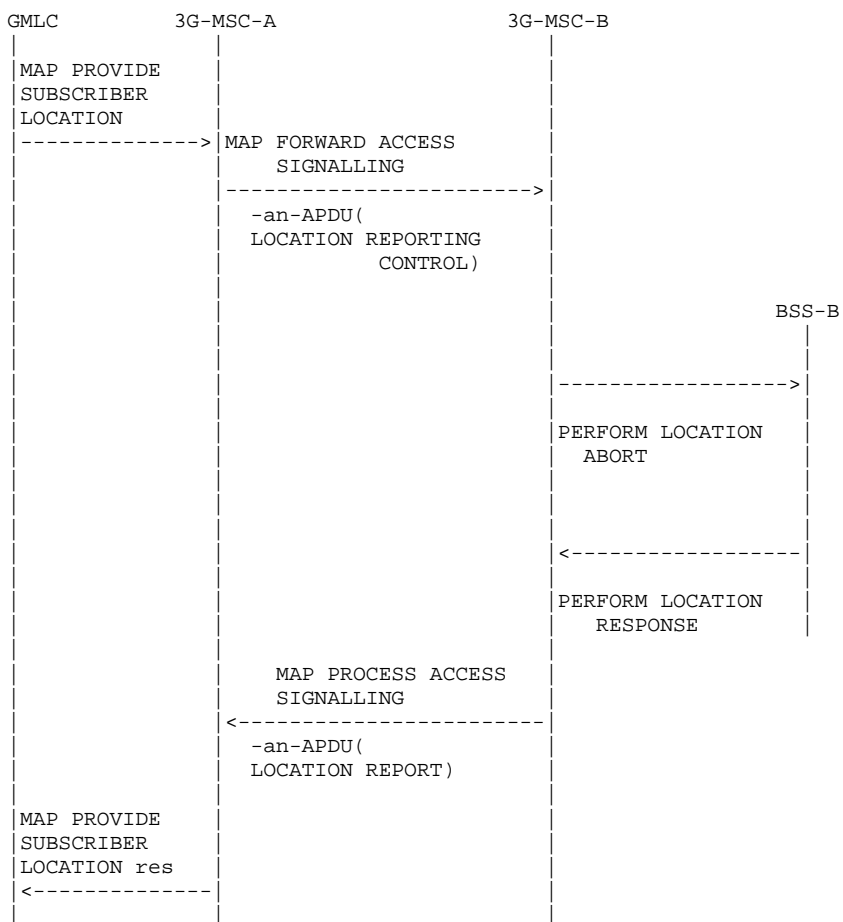
Figure 65e: Signalling for an aborted Location Acquisition procedure

the interworking between the RANAP messages encapsulated in MAP and the BSSMAP messages is as follows:

```
            ---------------------------------------------------------------
                    |    29.002                          48.008         |Notes
            --------+-------------------------------------------------+-----
            Forward | MAP FORWARD ACCESS SIG.    PERFORM LOCATION      |
            message |     request                    ABORT             |
                    |                                                   |
                    | -an-APDU(                                         |
                    | LOCATION REPORTING CONTROL)                       |
                    |                                                   |
                    | RANAP information          BSSMAP information     |
                    |     elements:                  elements:          |
                    |                                                   |
                    |  Request Type               LCS Cause            |
                    |    >Event = Stop Direct     > Location request    |
                    |    >Report Area =              aborted            |
                    |         Geo. Coord.                               |
                    |                                                   |
            --------+-------------------------------------------------+-----
            Result  | MAP PROCESS ACCESS SIG.    PERFORM LOCATION      |
                    |     request                    RESPONSE          |
                    | -an-APDU(                                         |
                    | LOCATION REPORT)                                  |
                    |                                                   |
                    | RANAP information          BSSMAP information     |
                    |     elements:                  elements:          |
                    |                                                   |
                    |  Cause                      LCS Cause            |
                    |    >Unspecified             > Location request    |
                    |       Failure                  aborted           |
                    |                                                   |
```

4.9.4   Request of Assistance Data or De-ciphering Keys: Successful Case

4.9.4.1 Inter-MSC Handover (GSM to GSM)

After a successful Inter-MSC handover, any request of Assistance Data or De-ciphering keys received by the non anchor MSC via the DTAP message LCS-MOLR is forwarded to the anchor MSC by encapsulating the DTAP message into the MAP messages Process Access Signalling. The anchor MSC triggers the BSSMAP procedure Location Acquisition described in 3G TS 48.008. For handover this procedure is executed according to 3G TS 49.008 with the anchor MSC playing the role of the MSC and the non anchor MSC playing the role of the BSS.

The needed BSSMAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non anchor MSC the BSSMAP messages received from the anchor MSC are forwarded to the BSS, and the BSSMAP messages received from the BSS are sent over the E-interface to the anchor MSC.

Once the BSSMAP procedure has been completed, the anchor MSC sends the DTAP message LCS-MOLR Response encapsulated in the MAP message Forward Access Signalling to the non anchor MSC, which relays it to the MS.

The signalling for a completed request of Assistance Data or De-ciphering Keys is shown in figures 67a.
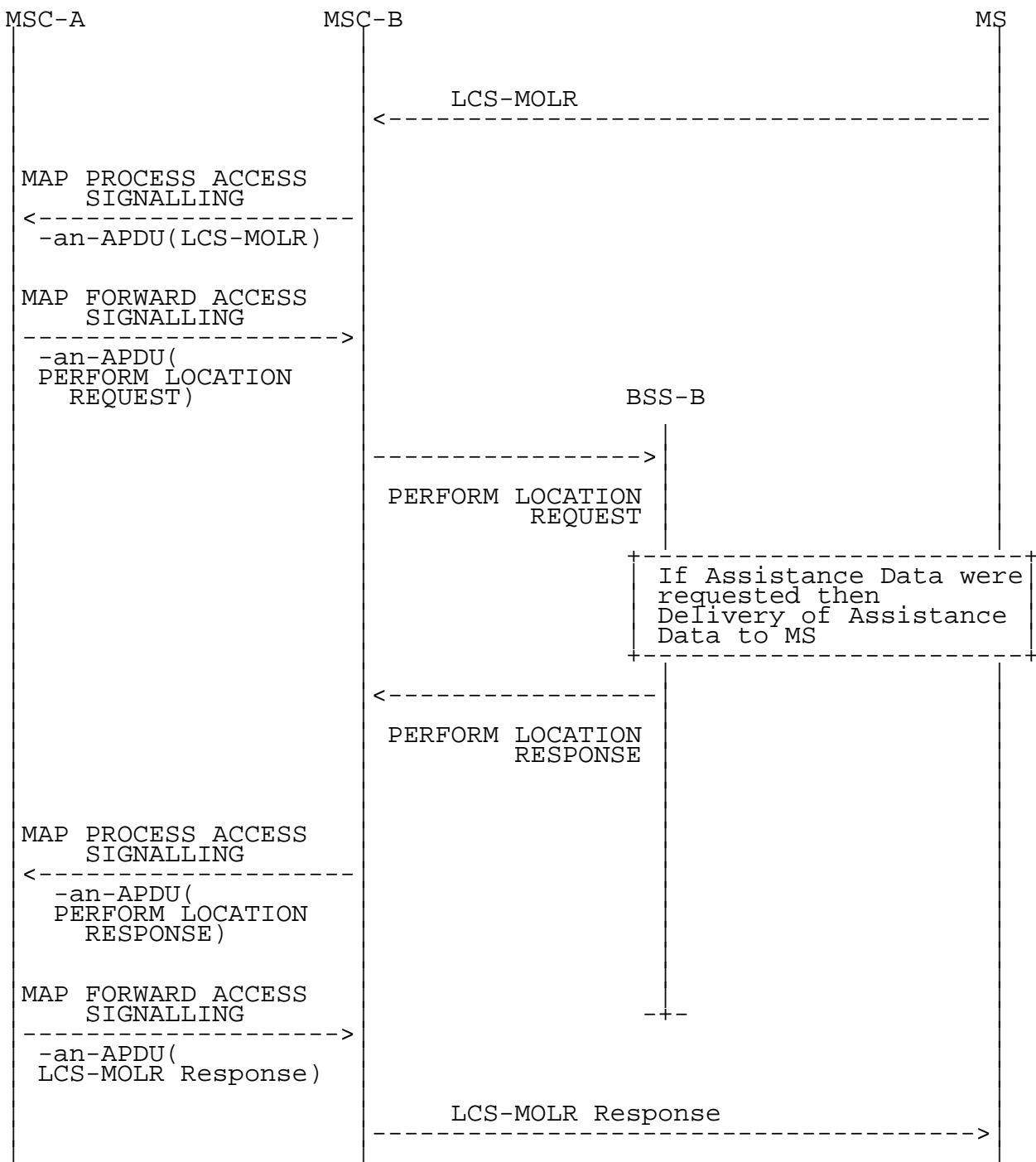
Figure 67a: Signalling for the request of Assistance Data or De-ciphering Keys

After the inter-MSC handover, the MSC-B can perform intra-MSC GSM to UMTS handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.4.2).

4.9.4.2 Inter-MSC Handover (GSM to UMTS)

After a successful Inter-MSC GSM to UMTS inter system handover, any request of Assistance Data or De-ciphering keys received by the non-anchor 3G MSC via the DTAP message LCS-MOLR is forwarded to the anchor MSC by encapsulating the DTAP message into the MAP messages Process Access Signalling. The anchor MSC triggers the BSSMAP procedure Location Acquisition described in 3G TS 48.008. For handover this procedure is executed according to 3G TS 49.008 with the anchor MSC playing the role of the MSC and the non anchor 3G MSC playing the role of the BSS.

The needed BSSMAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non-anchor 3G MSC the received BSSMAP messages are mapped into the corresponding RANAP messages to be sent to the RNS, and the received RANAP messages are mapped into the corresponding BSSMAP messages to be sent over the E-interface to the anchor MSC.

Once the BSSMAP procedure has been completed, the anchor MSC sends the DTAP message LCS-MOLR Response encapsulated in the MAP message Forward Access Signalling to the non anchor 3G MSC, which relays it to the UE.

The signalling for a completed request of Assistance Data or De-ciphering Keys is shown in figures 67b.
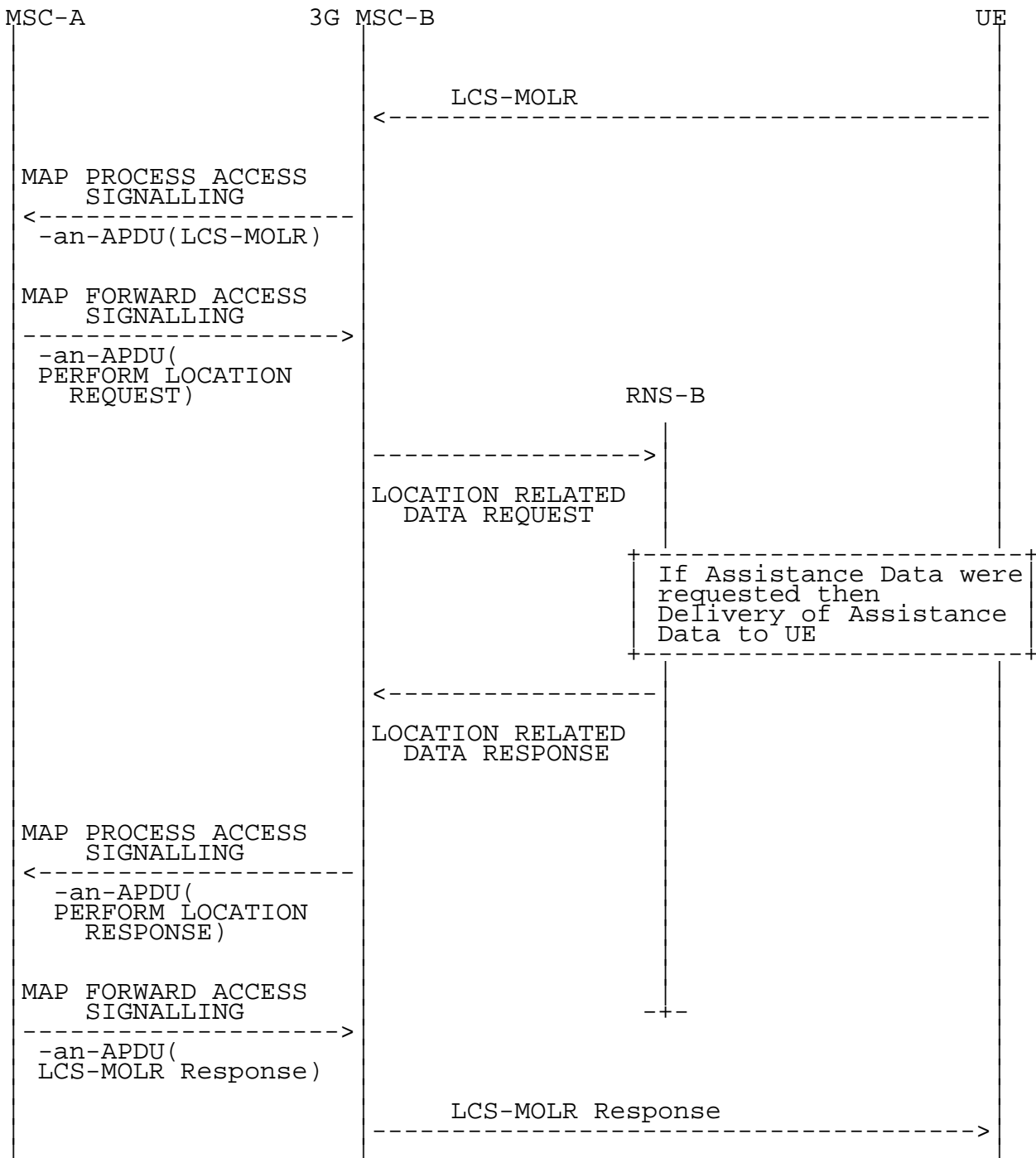
```
MSC-A                     3G MSC-B                                    UE
|                         |                                          |
|                         |             LCS-MOLR                     |
|                         |<-----------------------------------------|
|                         |                                          |
| MAP PROCESS ACCESS      |                                          |
|     SIGNALLING          |                                          |
|<--------------------    |                                          |
|  -an-APDU(LCS-MOLR)     |                                          |
|                         |                                          |
| MAP FORWARD ACCESS      |                                          |
|     SIGNALLING          |                                          |
|-------------------->    |                                          |
|  -an-APDU(              |                                          |
|  PERFORM LOCATION       |                                          |
|    REQUEST)             |                        RNS-B             |
|                         |                          |              |
|                         |------------------>        |              |
|                         | LOCATION RELATED          |              |
|                         |   DATA REQUEST            |              |
|                         |                          +---------------------------+
|                         |                          | If Assistance Data were   |
|                         |                          | requested then            |
|                         |                          | Delivery of Assistance    |
|                         |                          | Data to UE                |
|                         |                          +---------------------------+
|                         |<-----------------        |              |
|                         | LOCATION RELATED          |              |
|                         |   DATA RESPONSE           |              |
|                         |                          |              |
| MAP PROCESS ACCESS      |                          |              |
|     SIGNALLING          |                          |              |
|<--------------------    |                          |              |
|  -an-APDU(              |                          |              |
|  PERFORM LOCATION       |                          |              |
|    RESPONSE)            |                          |              |
|                         |                          |              |
| MAP FORWARD ACCESS      |                          |              |
|     SIGNALLING          |                        -+-              |
|-------------------->    |                                          |
|  -an-APDU(              |                                          |
|  LCS-MOLR Response)     |                                          |
|                         |         LCS-MOLR Response                |
|                         |----------------------------------------->|
|                         |                                          |
```

Figure 67b: Signalling for the request of Assistance Data or De-ciphering Keys

When the UE requires the delivery of Assistance Data for the GPS Assisted positioning method, the interworking between the BSSMAP messages encapsulated in MAP and the RANAP messages is as follows:

```
 ----------------------------------------------------------------
          |    29.002                          25.413          |Notes
 ---------+----------------------------------------------------+-----
Forward   | MAP FORWARD ACCESS SIG.     LOCATION RELATED       |
message   |    request                    DATA REQUEST         |
          |                                                    |
          | -an-APDU(                                          |
          | PERFORM LOCATION REQUEST)                          |
          |                                                    |
          | BSSMAP information          RANAP information      |
          |     elements:                   elements:         |
          |                                                    |
          |   Location Type.            Requested Location     |
          |    Location.Information        Related Data Type   |
          |   > location assistance      >Dedicated Assistance |
          |     info for target MS        Data for Assisted GPS|
          |   Location Type.                                   |
          |    Positioning Method                              | 1
          |   > Assisted GPS                                   |
          |                                                    |
          |                                                    |
          |    GPS Assistance Data      Requested GPS          |
          |                               Assistance Data      |
 ---------+----------------------------------------------------+-----
Result    | MAP PROCESS ACCESS SIG.     LOCATION RELATED       |
          |    request                    DATA RESPONSE        |
          | -an-APDU(                                          |
          | PERFORM LOCATION RESPONSE)                         |
          |                                                    |
          | BSSMAP information          RANAP information      | 2
          |     elements:                   elements:         |
          |                                                    |
          |                                                    |
 ----------------------------------------------------------------
```

NOTE 1: All other Positioning Method possibilities are not supported by UMTS when Location Information is "location assistance information for the target MS".

NOTE 2: The absence of the Cause IE in the RANAP message Location Related Data Response is an indication that the requested assistance data has been successfully delivered to the UE..

If the UE requires the delivery of Assistance Data for an UMTS specific method, then the anchor MSC cannot forward the request to the non anchor 3G MSC, and replies with the error "System"to the LCS-MOLR message.

If the anchor MSC sends a request for assistance data for a GSM specific method in BSSMAP Perform Location Request encapsulated in MAP Forward Access Signalling, then the non anchor 3G MSC replies immediately by generating and encapsulating BSSMAP Perform Location Response with Cause "System Failure" in MAP Process Access Signalling. This traffic case can happen if an LCS-MOLR had been received in the anchor MSC before the initiation of the handover procedure.

When the UE requires the delivery of De-ciphering Keys for the GPS Assisted positioning method, the interworking between the BSSMAP messages encapsulated in MAP and the RANAP messages is as follows:

```
-------------------------------------------------------------------------------
            |     29.002                         25.413                 | Notes
-------------+-------------------------------------------------------------+------
Forward      | MAP FORWARD ACCESS SIG.        LOCATION RELATED
message      |    request                        DATA REQUEST
             |
             | -an-APDU(
             | PERFORM LOCATION REQUEST)
             |
             | BSSMAP information             RANAP information
             |    elements:                      elements:
             |
             |   Location Type.               Requested Location
             |    Location.Information          Related Data Type
             |   > deciphering keys           > Deciphering Keys
             |     for broadcast                for Assisted GPS
             |     assistance data
             |     for the target MS
             |   Location Type.
             |    Positioning Method                                       |  1
             |   > Assisted GPS
             |
-------------+-------------------------------------------------------------+------
Result       | MAP PROCESS ACCESS SIG.       LOCATION RELATED
             |    request                        DATA RESPONSE
             | -an-APDU(
             | PERFORM LOCATION RESPONSE)
             |
             | BSSMAP information             RANAP information
             |    elements:                      elements:
             |
             | Deciphering Keys              Broadcast Assistance
             |                                  Data Deciphering Keys
             |
-------------------------------------------------------------------------------
```

NOTE 1: All other Positioning Method possibilities are not supported by UMTS when Location Information is "deciphering keys for broadcast assistance data for the target MS".

If the UE requires the delivery of De-ciphering Keys for an UMTS specific method, then the anchor MSC cannot forward the request to the non anchor 3G MSC, and replies with the error "System"to the LCS-MOLR message.

If the anchor MSC sends a request for De-ciphering Keys for a GSM specific method in BSSMAP Perform Location Request encapsulated in MAP Forward Access Signalling, then the non anchor 3G MSC replies immediately by generating and encapsulating BSSMAP Perform Location Response with Cause "System Failure" in MAP Process Access Signalling. This traffic case can happen if an LCS-MOLR had been received in the anchor MSC before the initiation of the handover procedure.

After the inter-MSC GSM to UMTS handover, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC UMTS to GSM handover is handled as for Inter-MSC Handover GSM to GSM (see clause 4.9.4.1).

4.9.4.3 Inter-MSC Handover (UMTS to GSM)

After a successful Inter-MSC UMTS to GSM inter system handover, any request of Assistance Data or De-ciphering keys received by the non-anchor MSC via the DTAP message LCS-MOLR is forwarded to the anchor 3G MSC by encapsulating the DTAP message into the MAP messages Process Access Signalling. The anchor 3G MSC triggers the BSSMAP procedure Location Acquisition described in 3G TS 48.008. For handover this procedure is executed according to 3G TS 49.008 with the anchor 3G MSC playing the role of the MSC and the non-anchor MSC playing the role of the BSS.

The needed BSSMAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non-anchor MSC the BSSMAP messages received from the anchor 3G MSC are forwarded to the BSS, and the BSSMAP messages received from the BSS are sent over the E-interface to the anchor 3G MSC.

Once the BSSMAP procedure has been completed, the anchor 3G MSC sends the DTAP message LCS-MOLR Response encapsulated in the MAP message Forward Access Signalling to the non-anchor MSC, which relays it to the UE.

The signalling for a completed request of Assistance Data or De-ciphering Keys is shown in figures 67c.
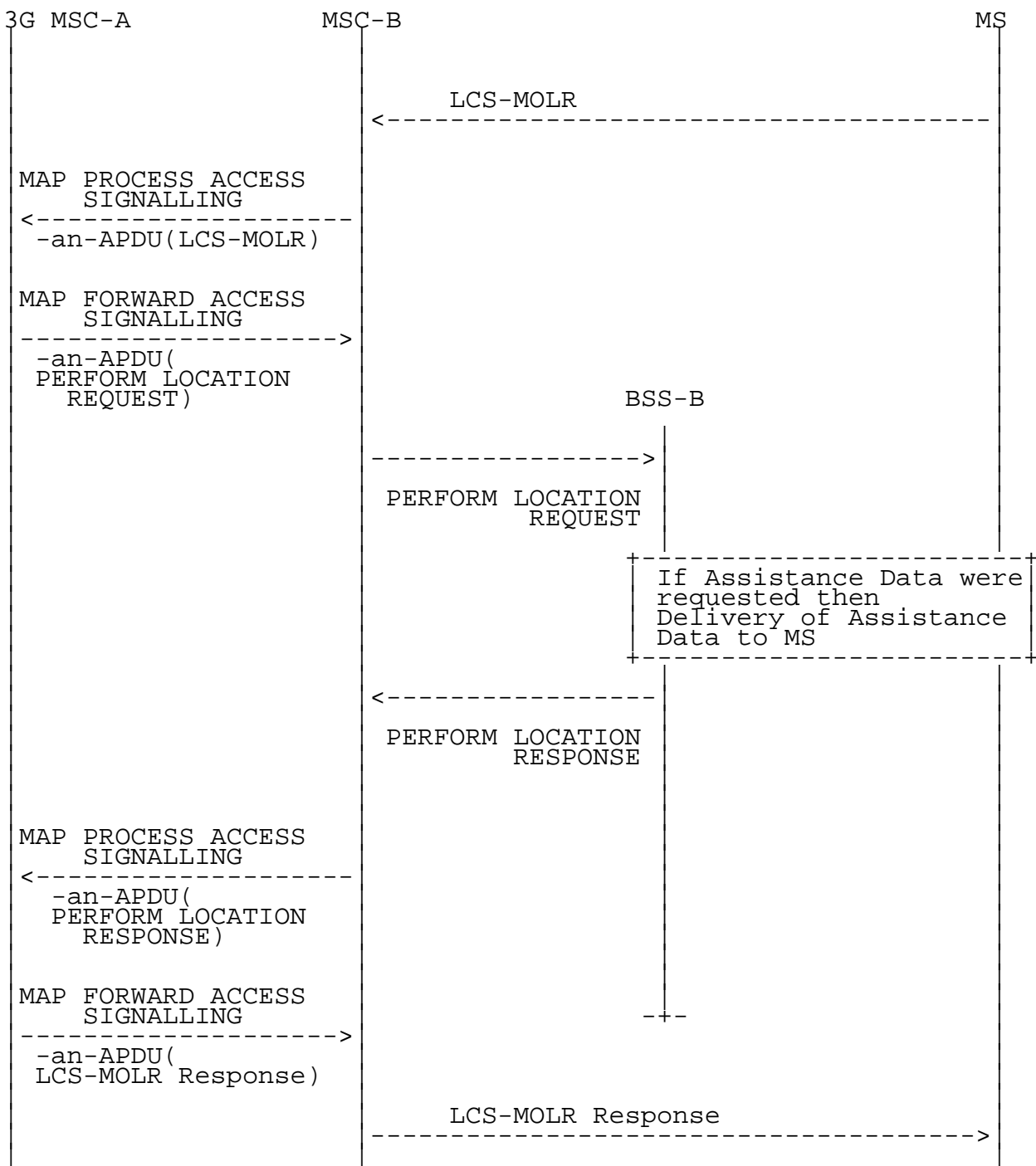
```
3G MSC-A                    MSC-B                                               MS
   |                          |                                                 |
   |                          |                                                 |
   |                          |                 LCS-MOLR                         |
   |                          |<------------------------------------------------|
   |                          |                                                 |
   | MAP PROCESS ACCESS       |                                                 |
   |    SIGNALLING            |                                                 |
   |<-------------------------|                                                 |
   |   -an-APDU(LCS-MOLR)     |                                                 |
   |                          |                                                 |
   | MAP FORWARD ACCESS       |                                                 |
   |    SIGNALLING            |                                                 |
   |------------------------->|                                                 |
   |   -an-APDU(              |                                                 |
   |   PERFORM LOCATION       |                                                 |
   |     REQUEST)             |              BSS-B                              |
   |                          |                |                                |
   |                          |                |                                |
   |                          |--------------->|                                |
   |                          | PERFORM LOCATION                                |
   |                          |     REQUEST    |                                |
   |                          |                +--------------------------------+
   |                          |                |If Assistance Data were         |
   |                          |                |requested then                  |
   |                          |                |Delivery of Assistance          |
   |                          |                |Data to MS                      |
   |                          |                +--------------------------------+
   |                          |<---------------|                                |
   |                          | PERFORM LOCATION                                |
   |                          |     RESPONSE   |                                |
   |                          |                |                                |
   | MAP PROCESS ACCESS       |                |                                |
   |    SIGNALLING            |                |                                |
   |<-------------------------|                |                                |
   |    -an-APDU(             |                |                                |
   |    PERFORM LOCATION      |                |                                |
   |      RESPONSE)           |                |                                |
   |                          |                |                                |
   | MAP FORWARD ACCESS       |                |                                |
   |    SIGNALLING            |              -+-                                |
   |------------------------->|                                                 |
   |    -an-APDU(             |                                                 |
   |    LCS-MOLR Response)    |                                                 |
   |                          |              LCS-MOLR Response                   |
   |                          |------------------------------------------------>|
   |                          |                                                 |
```
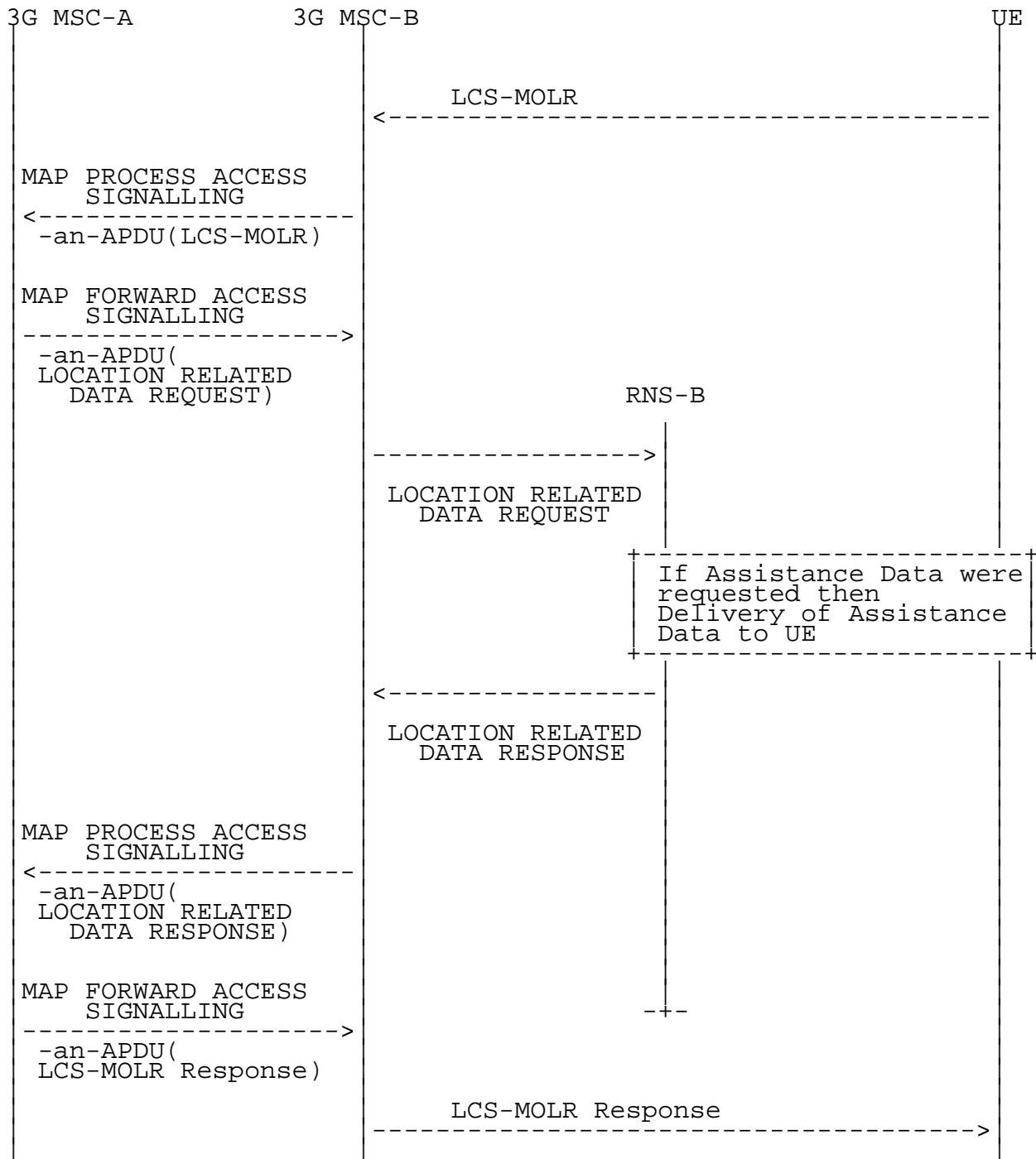
Figure 67c: Signalling for the request of Assistance Data or De-ciphering Keys

After the inter-MSC UMTS to GSM handover, the 3G MSC-B can perform intra-MSC GSM to UMTS handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.4.2)..

4.9.4.4 Inter-MSC SRNS Relocation

After a successful Inter-MSC SRNS Relocation , any request of Assistance Data or De-ciphering keys received by the non anchor 3G MSC via the DTAP message LCS-MOLR is forwarded to the anchor 3G MSC by encapsulating the DTAP message into the MAP messages Process Access Signalling. The anchor 3G MSC triggers the RANAP procedure Location Related Data described in TS 25.413. For handover this procedure is executed according to 23.009 with the anchor 3G-MSC playing the role of the 3G-MSC and the non anchor 3G-MSC playing the role of the RNS.

The needed RANAP signalling is sent over the E-interface encapsulated in the MAP messages Process Access Signalling and Forward Access Signalling.

At the non anchor 3G MSC the RANAP messages received from the anchor 3G MSC are forwarded to the RNS, and the RANAP messages received from the RNS are sent over the E-interface to the anchor 3G MSC.

Once the RANAP procedure has been completed, the anchor 3G MSC sends the DTAP message LCS-MOLR Response encapsulated in the MAP message Forward Access Signalling to the non anchor 3G MSC, which relays it to the UE.

The signalling for a completed request of Assistance Data or De-ciphering Keys is shown in figures 67d.

```
3G MSC-A              3G MSC-B                                      UE
|                      |                                            |
|                      |                                            |
|                      |              LCS-MOLR                      |
|                      |<-------------------------------------------|
|                      |                                            |
|                      |                                            |
| MAP PROCESS ACCESS   |                                            |
|      SIGNALLING      |                                            |
|<---------------------|                                            |
|  -an-APDU(LCS-MOLR)  |                                            |
|                      |                                            |
| MAP FORWARD ACCESS   |                                            |
|      SIGNALLING      |                                            |
|--------------------->|                                            |
|  -an-APDU(           |                                            |
|  LOCATION RELATED    |                                            |
|   DATA REQUEST)      |            RNS-B                           |
|                      |              |                             |
|                      |              |                             |
|                      |------------->|                             |
|                      |  LOCATION RELATED                          |
|                      |   DATA REQUEST                             |
|                      |              +-----------------------------+
|                      |              | If Assistance Data were     |
|                      |              | requested then              |
|                      |              | Delivery of Assistance      |
|                      |              | Data to UE                  |
|                      |              +-----------------------------+
|                      |              |                             |
|                      |<-------------|                             |
|                      |  LOCATION RELATED                          |
|                      |   DATA RESPONSE                            |
|                      |              |                             |
|                      |              |                             |
| MAP PROCESS ACCESS   |              |                             |
|      SIGNALLING      |              |                             |
|<---------------------|              |                             |
|  -an-APDU(           |              |                             |
|  LOCATION RELATED    |              |                             |
|   DATA RESPONSE)     |              |                             |
|                      |              |                             |
| MAP FORWARD ACCESS   |              |                             |
|      SIGNALLING      |            -+-                             |
|--------------------->|                                            |
|  -an-APDU(           |                                            |
|  LCS-MOLR Response)  |                                            |
|                      |           LCS-MOLR Response                |
|                      |------------------------------------------->|
|                      |                                            |
```

Figure 67d: Signalling for the request of Assistance Data or De-ciphering Keys

After the inter-MSC SRNS Relocation, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC UMTS to GSM requires that at the non anchor 3G MSC the received RANAP messages are mapped into the corresponding BSSMAP messages to be

sent to the BSS, and the received BSSMAP messages are mapped into the corresponding RANAP messages to be sent over the E-interface to the anchor 3G-MSC. The signalling for a completed request of Assistance Data or De-ciphering Keys in this traffic case is shown in figures 67e.

```
3G MSC-A              3G MSC-B                                               UE
  |                     |                                                    |
  |                     |                                                    |
  |                     |                       LCS-MOLR                     |
  |                     |<---------------------------------------------------|
  |                     |                                                    |
  |                     |                                                    |
  | MAP PROCESS ACCESS  |                                                    |
  |     SIGNALLING      |                                                    |
  |<--------------------|                                                    |
  |  -an-APDU(LCS-MOLR) |                                                    |
  |                     |                                                    |
  | MAP FORWARD ACCESS  |                                                    |
  |     SIGNALLING      |                                                    |
  |-------------------->|                                                    |
  |  -an-APDU(          |                                                    |
  |  LOCATION RELATED   |                                                    |
  |   DATA REQUEST)     |                       BSS-B                        |
  |                     |                         |                          |
  |                     |                         |                          |
  |                     |------------------------>|                          |
  |                     |  PERFORM LOCATION       |                          |
  |                     |     REQUEST             |                          |
  |                     |                         +--------------------------+
  |                     |                         | If Assistance Data were  |
  |                     |                         | requested then           |
  |                     |                         | Delivery of Assistance   |
  |                     |                         | Data to MS               |
  |                     |                         +--------------------------+
  |                     |<------------------------|                          |
  |                     |  PERFORM LOCATION       |                          |
  |                     |     RESPONSE            |                          |
  |                     |                         |                          |
  | MAP PROCESS ACCESS  |                         |                          |
  |     SIGNALLING      |                         |                          |
  |<--------------------|                         |                          |
  |  -an-APDU(          |                         |                          |
  |  LOCATION RELATED   |                         |                          |
  |   DATA RESPONSE)    |                         |                          |
  |                     |                         |                          |
  | MAP FORWARD ACCESS  |                         |                          |
  |     SIGNALLING      |                       -+-                          |
  |-------------------->|                                                    |
  |  -an-APDU(          |                                                    |
  |  LCS-MOLR Response) |                                                    |
  |                     |                  LCS-MOLR Response                 |
  |                     |-------------------------------------------------->|
  |                     |                                                    |
```
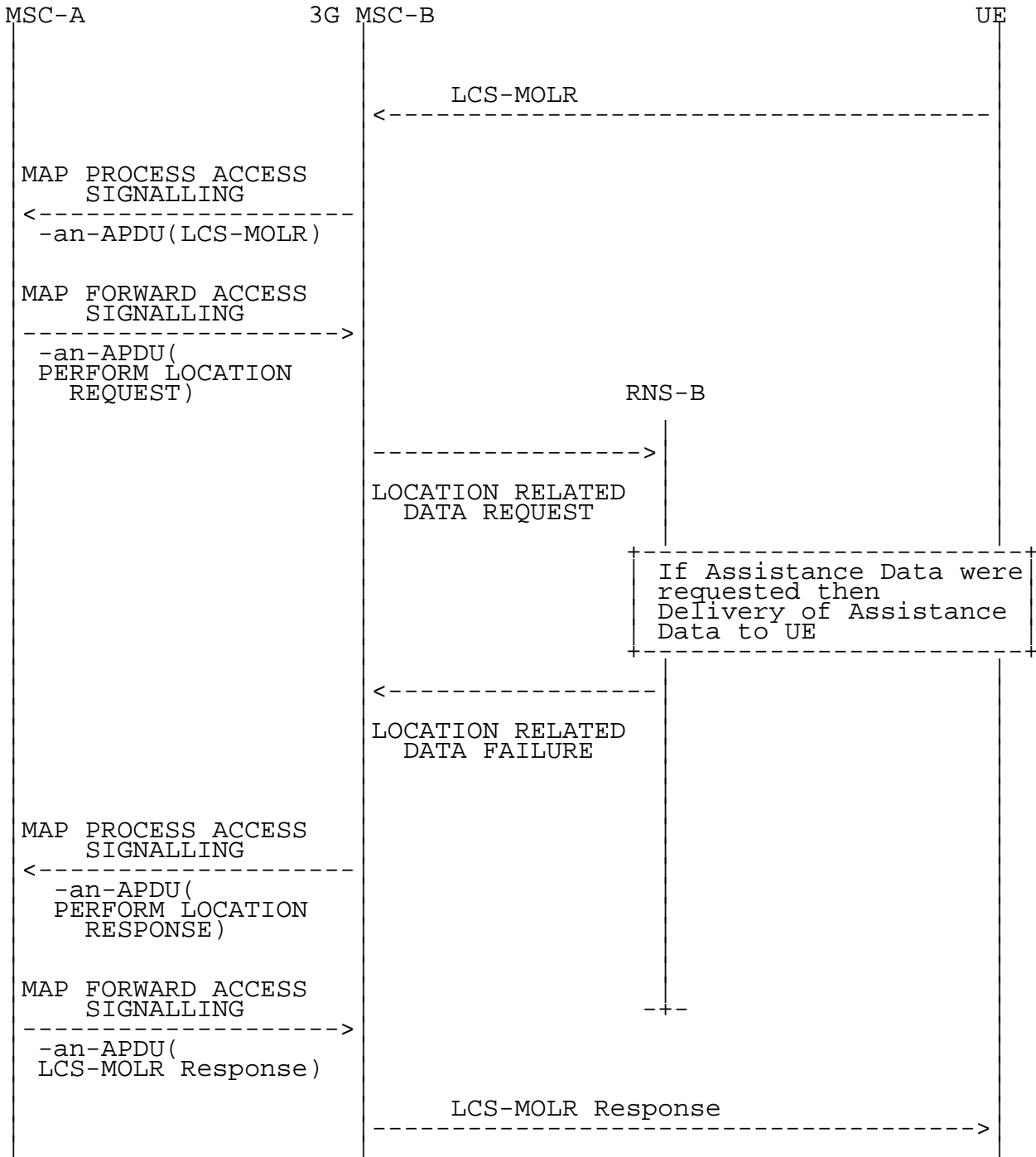
Figure 67e: Signalling for the request of Assistance Data or De-ciphering Keys

When the UE requires the delivery of Assistance Data for the GPS Assisted positioning method, the interworking between the RANAP messages encapsulated in MAP and the BSSMAP messages is as follows:

```
-------------------------------------------------------------------------
        |    29.002                           48.008             | Notes
--------|------------------------------------------------------------------
Forward | MAP FORWARD ACCESS SIG.     PERFORM LOCATION           |
message |    request                      REQUEST                |
        |                                                        |
        | -an-APDU(                                              |
        | LOCATION RELATED                                       |
        |   DATA REQUEST)                                        |
        |                                                        |
        | RANAP information          BSSMAP information          |
        |     elements:                  elements:              |
        |                                                        |
        |    Requested Location       Location Type.            |
        |      Related Data Type        Location Information     |
        |     > Dedicated Assistance  > location assistance      | 1
        |       Data for Assisted       info for target MS       |
        |       GPS                   Location Type.             |
        |                               Positioning Method       |
        |                             > Assisted GPS             |
        |                                                        |
        |    Requested GPS            GPS Assistance Data        |
        |      Assistance Data                                   |
        |                                                        |
--------|-----------------------------------------------------------------
Result  | MAP PROCESS ACCESS SIG.     PERFORM LOCATION          |
        |    request                      RESPONSE              |
        | -an-APDU(                                              |
        | LOCATION RELATED                                       |
        |   DATA RESPONSE)                                       |
        |                                                        |
        | RANAP information          BSSMAP information          | 2
        |     elements:                  elements:              |
        |                                                        |
        |                                                        |
-------------------------------------------------------------------------
```

NOTE 1: All other Positioning Method possibilities are not supported by GSM when Location Information is "deciphering keys for broadcast assistance data for the target MS".

NOTE 2: The absence of the Cause IE in the BSSMAP message Perform Location Response is an indicatioin that the requested assistance data has been successfully delivered to the UE..

If the UE requires the delivery of Assistance Data for a GSM specific method, then the anchor 3G-MSC cannot forward the request to the non anchor 3G MSC, and replies with the error "System"to the LCS-MOLR message.

If the anchor 3G MSC sends a request for Assistance Data for an UMTS specific method in RANAP Location Related Data Request encapsulated in MAP Forward Access Signalling, then the non anchor 3G MSC replies immediately by generating and encapsulating RANAP Location Related Data Failure with Cause "Unspecified Failure" in MAP Process Access Signalling. This traffic case can happen if an LCS-MOLR had been received in the anchor MSC before the initiation of the intra-MSC handover procedure.

When the UE requires the delivery of De-ciphering Keys for the GPS Assisted positioning method, the interworking between the RANAP messages encapsulated in MAP and the BSSMAP messages is as follows:

```
---------------------------------------------------------------------------
        |       29.002                        48.008         |Notes
--------+-----------------------------------------------------+-----
Forward | MAP FORWARD ACCESS SIG.    PERFORM LOCATION          |
message |    request                     REQUEST               |
        |                                                      |
        | -an-APDU(                                            |
        | LOCATION RELATED                                     |
        |   DATA REQUEST)                                      |
        |                                                      |
        | RANAP information         BSSMAP information         |
        |     elements:                 elements:             |
        |                                                      |
        |   Requested Location       Location Type.           |
        |     Related Data Type       Location Information     |
        |   > Deciphering Keys       > deciphering keys        |  1
        |     for Assisted GPS         for broadcast           |
        |                              assistance data         |
        |                              for the target MS       |
        |                            Location Type.            |
        |                             Positioning Method       |
        |                            > Assisted GPS            |
        |                                                      |
--------+-----------------------------------------------------+-----
Result  | MAP PROCESS ACCESS SIG.    PERFORM LOCATION          |
        |    request                     RESPONSE              |
        | -an-APDU(                                            |
        | LOCATION RELATED                                     |
        |   DATA RESPONSE)                                     |
        |                                                      |
        | RANAP information         BSSMAP information         |
        |     elements:                 elements:             |
        |                                                      |
        | Broadcast Assistance        Deciphering Keys         |
        |   Data Deciphering Keys                              |
        |                                                      |
```

NOTE 1: All other Positioning Method possibilities are not supported by GSM when Location Information is
         "deciphering keys for broadcast assistance data for the target MS".

If the UE requires the delivery of De-ciphering Keys for a GSM specific method, then the anchor 3G-MSC cannot
forward the request to the non anchor 3G MSC, and replies with the error "System"to the LCS-MOLR message.

If the anchor 3G MSC sends a request for De-ciphering Keys for an UMTS specific method in RANAP Location
Related Data Request encapsulated in MAP Forward Access Signalling, then the non anchor 3G MSC replies
immediately by generating and encapsulating RANAP Location Related Data Failure with Cause "Unspecified Failure"
in MAP Process Access Signalling. This traffic case can happen if an LCS-MOLR had been received in the anchor
MSC before the initiation of the intra-MSC handover procedure.

4.9.5   Request of Assistance Data or De-ciphering Keys: Failure Case

4.9.5.1 Inter-MSC Handover (GSM to GSM)

After a successful Inter-MSC handover, any request of Assistance Data or De-ciphering keys received by the non
anchor MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.1.

If the request fails, either because the BSS-B cannot return the requested De-ciphering Keys to the anchor MSC or
cannot deliver the required Assistance Data to the MS, the signalling is the same as for the successful case and is shown
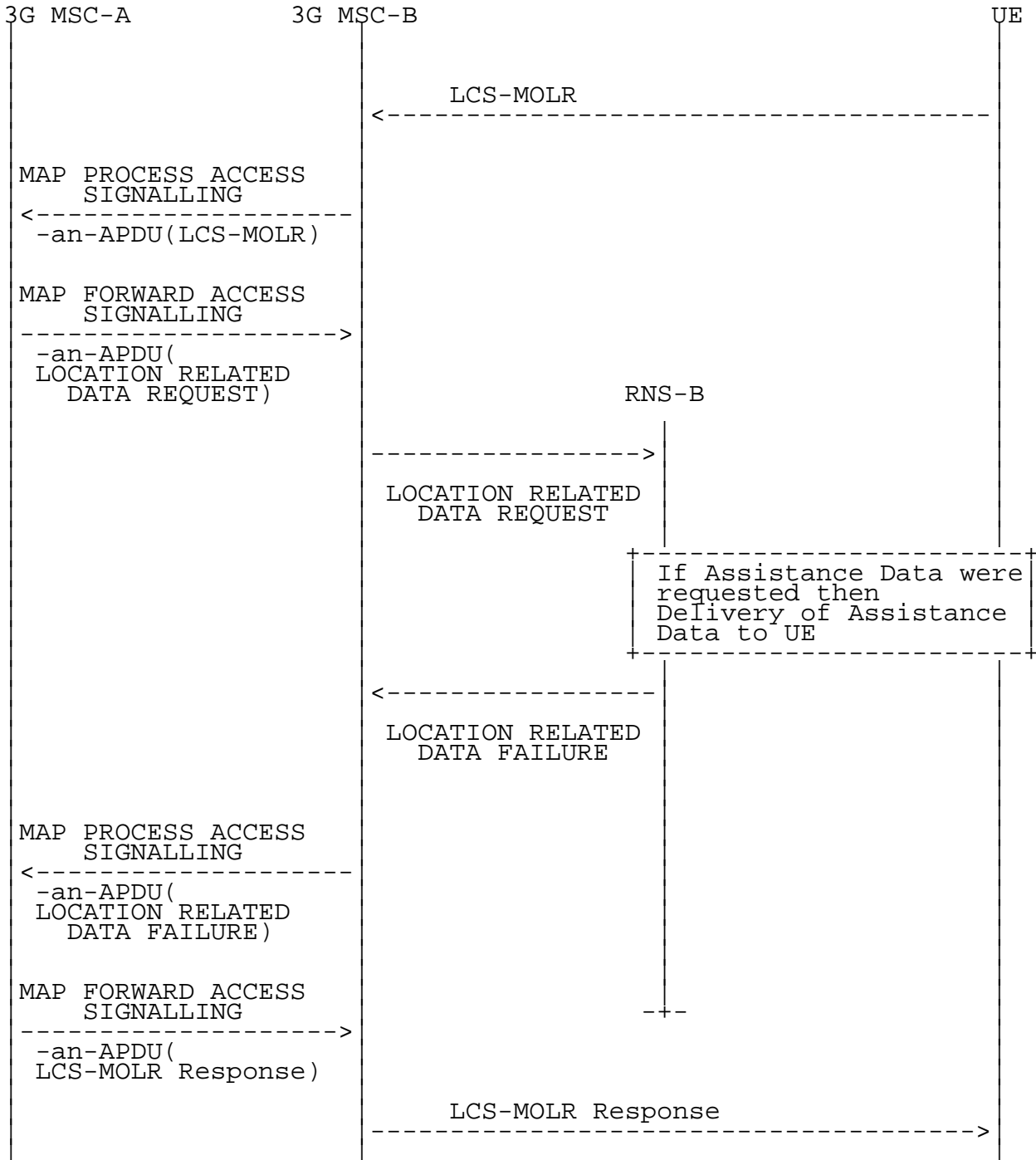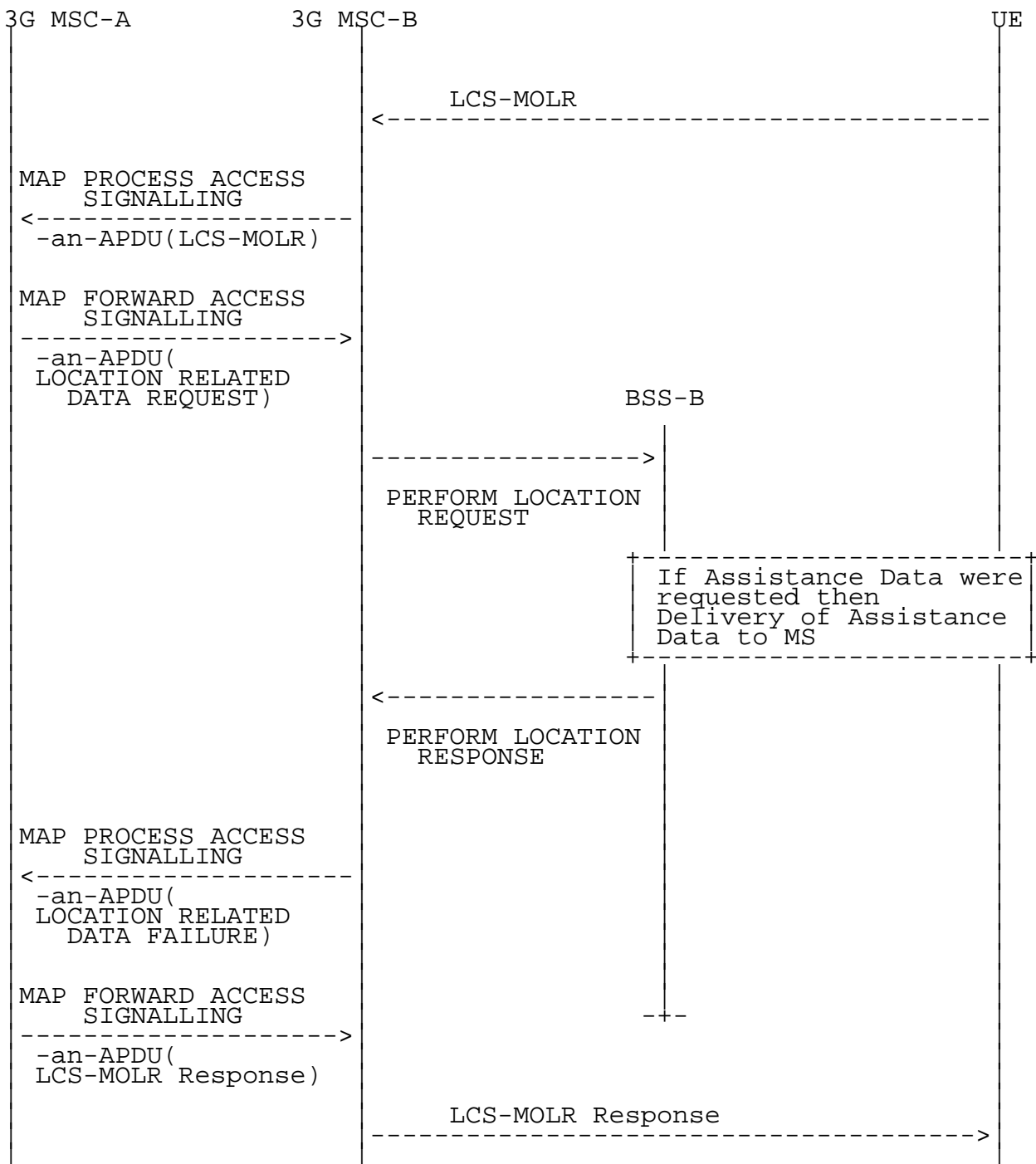in figure 67a.

After the inter-MSC handover, the MSC-B can perform intra-MSC GSM to UMTS handover. Any request for
Assistance Data or De-ciphering keys received after completion of the intra-MSC GSM to UMTS handover is handled
as for Inter-MSC Handover GSM to UMTS (see clause 4.9.4.2).

If the request fails the signalling is the same as for the failure case for Inter-MSC Handover GSM to UMTS (see
clause 4.9.5.2)

4.9.5.2 Inter-MSC Handover (GSM to UMTS)

After a successful Inter-MSC GSM to UMTS handover, any request of Assistance Data or De-ciphering keys received by the non anchor 3G MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.2.

If the request fails, either because BSS-B cannot return the requested De-ciphering Keys to the anchor MSC or because BSS-B cannot deliver the required Assistance Data to the MS, the signalling is as shown in figure 68a.

```
MSC-A                     3G MSC-B                                         UE
|                         |                                                |
|                         |                  LCS-MOLR                       |
|                         |<-------------------------------------------     |
|                         |                                                |
| MAP PROCESS ACCESS      |                                                |
|      SIGNALLING         |                                                |
|<--------------------    |                                                |
|  -an-APDU(LCS-MOLR)     |                                                |
|                         |                                                |
| MAP FORWARD ACCESS      |                                                |
|      SIGNALLING         |                                                |
|-------------------->    |                                                |
|  -an-APDU(              |                                                |
|  PERFORM LOCATION       |              RNS-B                              |
|     REQUEST)            |                                                |
|                         |---------------->|                             |
|                         |                 |                             |
|                         | LOCATION RELATED|                             |
|                         |  DATA REQUEST   |                             |
|                         |                 +-----------------------------+
|                         |                 | If Assistance Data were     |
|                         |                 | requested then              |
|                         |                 | Delivery of Assistance      |
|                         |                 | Data to UE                  |
|                         |                 +-----------------------------+
|                         |<----------------|                             |
|                         |                 |                             |
|                         | LOCATION RELATED|                             |
|                         |  DATA FAILURE   |                             |
|                         |                 |                             |
| MAP PROCESS ACCESS      |                 |                             |
|      SIGNALLING         |                 |                             |
|<--------------------    |                 |                             |
|  -an-APDU(              |                 |                             |
|  PERFORM LOCATION       |                 |                             |
|     RESPONSE)           |                 |                             |
|                         |                 |                             |
| MAP FORWARD ACCESS      |                 |                             |
|      SIGNALLING         |                -+-                            |
|-------------------->    |                                                |
|  -an-APDU(              |                                                |
|  LCS-MOLR Response)     |                                                |
|                         |             LCS-MOLR Response                  |
|                         |------------------------------------------------>|
|                         |                                                |
```

Figure 68a: Signalling for a failed request of Assistance Data or De-ciphering Keys

When the delivery to the UE of Assistance Data for the GPS Assisted positioning method fails, the interworking between the BSSMAP messages encapsulated in MAP and the RANAP messages is as follows:

```
--------------------------------------------------------------------
          |        29.002                         25.413          |Notes
----------|---------------------------------------------------------
Forward   |
message   | "For the forward messages please refer to the         |
          |  corresponding table in clause 4.9.4.2"             |
          |                                                       |
          |                                                       |
----------|---------------------------------------------------+-----
Result    | MAP PROCESS ACCESS SIG.     LOCATION RELATED          |
          |      request                   DATA FAILURE           |
          | -an-APDU(                                              |
          | PERFORM LOCATION RESPONSE)                             |
          |                                                       |
          | BSSMAP information          RANAP information          |
          |     elements:                  elements:              |
          |                                                       |
          |   LCS Cause                 Cause                     |
          |     > System Failure          > Dedicated Assistance  |
          |                                 Data Not Available     |
          |                                                       |
--------------------------------------------------------------------
```

When the RNS-B cannot satisfy the request for De-ciphering Keys, the interworking between the BSSMAP messages encapsulated in MAP and the RANAP messages is as follows:

```
--------------------------------------------------------------------
          |        29.002                         25.413          |Notes
----------|-----------------------------------------------------+-----
Forward   |
message   | "For the forward messages please refer to the         |
          |  corresponding table in clause 4.9.4.2"             |
          |                                                       |
          |                                                       |
----------|-----------------------------------------------------+-----
Result    | MAP PROCESS ACCESS SIG.     LOCATION RELATED          |
          |      request                   DATA FAILURE           |
          | -an-APDU(                                              |
          | PERFORM LOCATION RESPONSE)                             |
          |                                                       |
          | BSSMAP information          RANAP information          |
          |     elements:                  elements:              |
          |                                                       |
          |   LCS Cause                 Cause                     |
          |     > System Failure          > Deciphering Keys      |
          |                                 Not Available          |
          |                                                       |
--------------------------------------------------------------------
```

After the inter-MSC GSM to UMTS handover, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC UMTS to GSM handover is handled as for Inter-MSC Handover GSM to GSM (see clause 4.9.4.1).

If the request fails the signalling is the same as for the failure case for Inter-MSC Handover GSM to GSM (see clause 4.9.5.1)

4.9.5.3 Inter-MSC Handover (UMTS to GSM)

After a successful Inter-MSC UMTS to GSM handover, any request of Assistance Data or De-ciphering keys received by the non anchor MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.3.

If the request fails, either because the BSS-B cannot return the requested De-ciphering Keys to the anchor 3G MSC or BSS-B cannot deliver the required Assistance Data to the MS, the signalling is the same as for the successful case and is shown in figure 67c.

After the inter-MSC UMTS to GSM handover, the 3G MSC-B can perform intra-MSC GSM to UMTS handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.4.2)..

If the request fails the signalling is the same as for the failure case for Inter-MSC Handover GSM to UMTS (see clause 4.9.5.2)

4.9.5.4 Inter-MSC SRNS Relocation

After a successful Inter-MSC SRNS Relocation , any request of Assistance Data or De-ciphering keys received by the non anchor 3G MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.4.

If the request fails, either because the RNS-B cannot return the requested De-ciphering Keys to the anchor 3G MSC or RNS-B cannot deliver the required Assistance Data to the MS, the signalling is shown in figure 68b.

Figure 68b: Signalling for the request of Assistance Data or De-ciphering Keys

After the inter-MSC SRNS Relocation, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC UMTS to GSM requires that at the non anchor 3G MSC the received RANAP messages are mapped into the corresponding BSSMAP messages to be sent to the BSS, and the received BSSMAP messages are mapped into the corresponding RANAP messages to be sent over the E-interface to the anchor 3G-MSC.

If the request fails, either because the BSS-B cannot return the requested De-ciphering Keys to the anchor 3G MSC or BSS-B cannot deliver the required Assistance Data to the MS, the signalling is as shown in figure 68c.

```
3G MSC-A                    3G MSC-B                                           UE
 |                           |                                                 |
 |                           |                                                 |
 |                           |                 LCS-MOLR                         |
 |                           |<------------------------------------------------|
 |                           |                                                 |
 | MAP PROCESS ACCESS        |                                                 |
 |     SIGNALLING            |                                                 |
 |<--------------------------|                                                 |
 |   -an-APDU(LCS-MOLR)      |                                                 |
 |                           |                                                 |
 | MAP FORWARD ACCESS        |                                                 |
 |     SIGNALLING            |                                                 |
 |-------------------------->|                                                 |
 |    -an-APDU(              |                                                 |
 |  LOCATION RELATED         |                 BSS-B                           |
 |    DATA REQUEST)          |                   |                             |
 |                           |                   |                             |
 |                           |------------------>|                             |
 |                           | PERFORM LOCATION  |                             |
 |                           |    REQUEST        |                             |
 |                           |                   +-----------------------------+
 |                           |                   | If Assistance Data were     |
 |                           |                   | requested then              |
 |                           |                   | Delivery of Assistance      |
 |                           |                   | Data to MS                  |
 |                           |                   +-----------------------------+
 |                           |<------------------|                             |
 |                           | PERFORM LOCATION  |                             |
 |                           |    RESPONSE       |                             |
 |                           |                   |                             |
 | MAP PROCESS ACCESS        |                   |                             |
 |     SIGNALLING            |                   |                             |
 |<--------------------------|                   |                             |
 |    -an-APDU(              |                   |                             |
 |  LOCATION RELATED         |                   |                             |
 |    DATA FAILURE)          |                   |                             |
 |                           |                   |                             |
 | MAP FORWARD ACCESS        |                   |                             |
 |     SIGNALLING            |                 -+-                             |
 |-------------------------->|                                                 |
 |    -an-APDU(              |                                                 |
 |  LCS-MOLR Response)       |                                                 |
 |                           |                                                 |
 |                           |          LCS-MOLR Response                      |
 |                           |------------------------------------------------>|
 |                           |                                                 |
```

Figure 68c: Signalling for the request of Assistance Data or De-ciphering Keys

After the inter-MSC SRNS Relocation, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC UMTS to GSM requires that at the non anchor 3G MSC the received RANAP messages are mapped into the corresponding BSSMAP messages to be sent to the BSS, and the received BSSMAP messages are mapped into the corresponding RANAP messages to be sent over the E-interface to the anchor 3G-MSC.

When the UE requires the delivery of Assistance Data for the GPS Assisted positioning method, the interworking between the RANAP messages encapsulated in MAP and the BSSMAP messages is as follows:

```
---------------------------------------------------------------------------
        |       29.002                      48.008              |Notes
---------+------------------------------------------------------+------
Forward  |
message  | "For the forward messages please refer to the       |
         |  corresponding table in clause 4.9.4.4"             |
         |                                                      |
         |                                                      |
---------+------------------------------------------------------+------
Result   | MAP PROCESS ACCESS SIG.     PERFORM LOCATION         |
         |     request                       RESPONSE           |
         | -an-APDU(                                            |
         | LOCATION RELATED                                     |
         |   DATA FAILURE)                                     |
         |                                                      |
         | RANAP information           BSSMAP information        |
         |     elements:                   elements:            |
         |                                                      |
         | Cause                       LCS Cause                |
         |   > Dedicated Assistance      > <any value>          |
         |     Data Not Available                               |
         |                                                      |
```

When the UE requires the delivery of De-ciphering Keys for the GPS Assisted positioning method, the interworking between the RANAP messages encapsulated in MAP and the BSSMAP messages is as follows:

```
---------------------------------------------------------------------------
        |       29.002                      48.008              |Notes
---------+------------------------------------------------------+------
Forward  |
message  | "For the forward messages please refer to the       |
         |  corresponding table in clause 4.9.4.4"             |
---------+------------------------------------------------------+------
Result   | MAP PROCESS ACCESS SIG.     PERFORM LOCATION         |
         |     request                       RESPONSE           |
         | -an-APDU(                                            |
         | LOCATION RELATED                                     |
         |   DATA FAILURE)                                     |
         |                                                      |
         | RANAP information           BSSMAP information        |
         |     elements:                   elements:            |
         |                                                      |
         | Cause                       LCS Cause                |
         |   > Deciphering Keys          > <any value>          |
         |     Not Available                                    |
         |                                                      |
```

4.9.6   Abort of Request of Assistance Data or De-ciphering Keys:

4.9.6.1 Inter-MSC Handover (GSM to GSM)

After a successful Inter-MSC handover, any request of Assistance Data or De-ciphering keys received by the non anchor MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.1.

If the request is aborted by the anchor MSC the signalling is as shown in figure 69a.

```
MSC-A                    MSC-B                                          MS

 |                         |                                            |
 |                         |                 LCS-MOLR                    |
 |                         |<-------------------------------------------|
 |                         |                                            |
 | MAP PROCESS ACCESS      |                                            |
 |     SIGNALLING          |                                            |
 |<------------------------|                                            |
 |  -an-APDU(LCS-MOLR)      |                                           |
 |                         |                                            |
 | MAP FORWARD ACCESS      |                                            |
 |     SIGNALLING          |                                            |
 |------------------------>|                                            |
 |  -an-APDU(               |                                           |
 |  PERFORM LOCATION        |                                           |
 |     REQUEST)             |                   BSS-B                    |
 |                         |                     |                      |
 |                         |-------------------->|                      |
 |                         |                     |                      |
 |                         |  PERFORM LOCATION   |                      |
 |                         |      REQUEST        |                      |
 | MAP FORWARD ACCESS      |                     |                      |
 |     SIGNALLING          |                     |                      |
 |------------------------>|                     |                      |
 |  -an-APDU(               |                    |                      |
 |  PERFORM LOCATION        |                    |                      |
 |     ABORT)               |                    |                      |
 |                         |                     |                      |
 |                         |-------------------->|                      |
 |                         |                     |                      |
 |                         |  PERFORM LOCATION   |                      |
 |                         |      ABORT          |                      |
 |                         |                     |                      |
 |                         |<--------------------|                      |
 |                         |                     |                      |
 |                         |  PERFORM LOCATION   |                      |
 |                         |     RESPONSE        |                      |
 |                         |                     |                      |
 | MAP PROCESS ACCESS      |                     |                      |
 |     SIGNALLING          |                     |                      |
 |<------------------------|                     |                      |
 |  -an-APDU(               |                    |                      |
 |  PERFORM LOCATION        |                    |                      |
 |     RESPONSE)            |                    |                      |
 |                         |                     |                      |
 | MAP FORWARD ACCESS      |                     |                      |
 |     SIGNALLING          |                    -+-                     |
 |------------------------>|                                            |
 |  -an-APDU(               |                                           |
 |  LCS-MOLR Response)      |                                           |
 |                         |                                            |
 |                         |            LCS-MOLR Response               |
 |                         |------------------------------------------->|
 |                         |                                            |
```
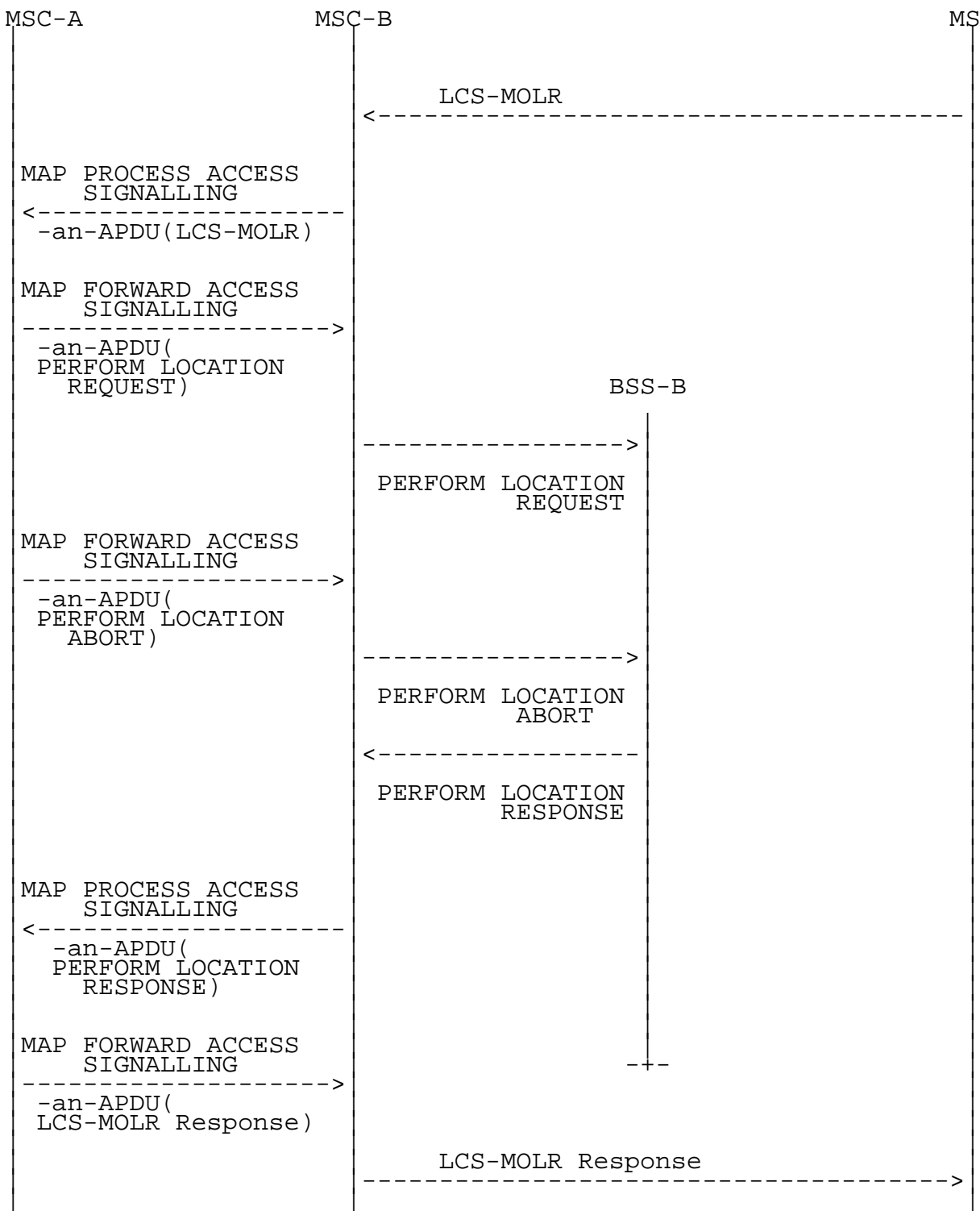
Figure 69a: Signalling for the abortion of a request for Assistance Data or De-ciphering Keys

After the inter-MSC handover, the MSC-B can perform intra-MSC GSM to UMTS handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.4.2).

If the request is aborted the signalling is the same as for the abortion case for Inter-MSC Handover GSM to UMTS (see clause 4.9.6.2)

4.9.6.2 Inter-MSC Handover (GSM to UMTS)

After a successful Inter-MSC GSM to UMTS handover, any request of Assistance Data or De-ciphering keys received by the non anchor MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.1.

If the request is aborted by the anchor MSC the signalling is as shown in figure 69b.

```
MSC-A                          3G MSC-B                                      UE

 |                                |                                           |
 |                                |                LCS-MOLR                    |
 |                                |<------------------------------------------|
 |                                |                                           |
 | MAP PROCESS ACCESS             |                                           |
 |       SIGNALLING               |                                           |
 |<-------------------            |                                           |
 |   -an-APDU(LCS-MOLR)           |                                           |
 |                                |                                           |
 | MAP FORWARD ACCESS             |                                           |
 |       SIGNALLING               |                                           |
 |------------------->            |                                           |
 |    -an-APDU(                   |                                           |
 |   PERFORM LOCATION             |               RNS-B                       |
 |      REQUEST)                  |                                           |
 |                                |                                           |
 |                                |--------------->|                          |
 |                                |                |                          |
 |                                |LOCATION RELATED|                          |
 |                                |  DATA REQUEST  |                          |
 |                                |                |                          |
 | MAP FORWARD ACCESS             |                |                          |
 |       SIGNALLING               |                |                          |
 |------------------->            |                |                          |
 |    -an-APDU(                   |                |                          |
 |   PERFORM LOCATION             |                |                          |
 |      ABORT)                    |                |                          |
 |                                |                |                          |
 | MAP PROCESS ACCESS             |                |                          |
 |       SIGNALLING               |                |                          |
 |<-------------------            |                |                          |
 |    -an-APDU(                   |                |                          |
 |   PERFORM LOCATION             |                |                          |
 |      RESPONSE)                 |                |                          |
 |                                |                |                          |
 | MAP FORWARD ACCESS             |              -+-                          |
 |       SIGNALLING               |                                           |
 |------------------->            |                                           |
 |    -an-APDU(                   |                                           |
 |   LCS-MOLR Response)           |                                           |
 |                                |            LCS-MOLR Response              |
 |                                |----------------------------------------->|
```

Figure 69b: Signalling for the abortion of the request for Assistance Data or De-ciphering Keys

There"s no interworking between the BSSMAP Perform Location Abort and any RANAP message since it is not possible to abort a request for Assistance Data or De-ciphering Keys with RANAP. The BSSMAP message Perform Location Response is generated by the non-anchor 3G MSC.

After the inter-MSC GSM to UMTS handover, the 3G MSC-B can perform intra-MSC UMTS to GSM handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC UMTS to GSM handover is handled as for Inter-MSC Handover GSM to GSM (see clause 4.9.4.1).

If the request is aborted the signalling is the same as for the abortion case for Inter-MSC Handover GSM to GSM (see clause 4.9.6.1)

4.9.6.3 Inter-MSC Handover (UMTS to GSM)

After a successful Inter-MSC UMTS to GSM handover, any request of Assistance Data or De-ciphering keys received by the non anchor MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.3.

If the request is aborted by the anchor 3G MSC the signalling is the same as for the abortion for Inter-MSC GSM to GSM handover abd is shown in figure 69a.

After the inter-MSC UMTS to GSM handover, the 3G MSC-B can perform intra-MSC GSM to UMTS handover. Any request for Assistance Data or De-ciphering keys received after completion of the intra-MSC GSM to UMTS handover is handled as for Inter-MSC Handover GSM to UMTS (see clause 4.9.4.2)..

If the request is aborted the signalling is the same as for the abortion case for Inter-MSC Handover GSM to UMTS (see clause 4.9.6.2)

4.9.6.4 Inter-MSC SRNS Relocation

After a successful Inter-MSC SRNS Relocation , any request of Assistance Data or De-ciphering keys received by the non anchor 3G MSC via the DTAP message LCS-MOLR is handled as described in clause 4.9.4.4.

The request cannot be aborted by the 3G anchor MSC since RANAP does not support abortion of a request for Assistance Data or De-Ciphering Keys.

4.10   Single Radio Voice Call Continuity (SRVCC)

4.10.1   General

The general principles of the SRVCC handover procedures are specified in 3GPP TS 23.009 [2]. This clause provides a detailed specification for the interworking performed by the MSC Server enhanced for SRVCC. It defines in particular the encoding of RANAP and BSSMAP cause values to avoid different encodings in different implementations.

4.10.2   SRVCC Handover from UTRAN (HSPA) to GERAN

Encoding of the cause code sent in BSSMAP Handover Request:

When it receives the SRVCC PS to CS Request message from the SGSN (see 3GPP TS 29.280 [25]), the MSC Server enhanced for SRVCC shall set the BSSMAP Cause to the value 'Uplink quality' in the Handover Request message.

4.10.3   SRVCC Handover from UTRAN (HSPA) to UTRAN

Encoding of the cause code sent in RANAP Relocation Request:

When it receives the SRVCC PS to CS Request message from the SGSN (see 3GPP TS 29.280 [25]), the MSC Server enhanced for SRVCC shall set the RANAP Cause to the value 'Time critical Relocation ' in the Relocation Request message.

4.10.4   SRVCC Handover from E-UTRAN to GERAN

Encoding of the cause code sent in BSSMAP Handover Request:

When it receives the SRVCC PS to CS Request message from the MME (see 3GPP TS 29.280 [25]), the MSC Server enhanced for SRVCC shall set the BSSMAP Cause to the value 'Uplink quality' in the Handover Request message.

4.10.5   SRVCC Handover from E-UTRAN to UTRAN

Encoding of the cause code sent in RANAP Relocation Request:

When it receives the SRVCC PS to CS Request message from the MME (see 3GPP TS 29.280 [25]), the MSC Server enhanced for SRVCC shall set the RANAP Cause to the value 'Time critical Relocation ' in the Relocation Request message.

5 Interworking in the MME

5.1 General

This clause provides a detailed specification for the interworking performed by the MME.

5.2 Void

5.3 Interworking between RANAP protocol messages and S1AP protocol messages

This clause defines a mapping of RANAP and S1AP cause values used in connection with inter RAT Handover to avoid different mappings in different implementations.

Inter RAT Handover from UTRAN to LTE:

Table 5.3.1 defines a cause value mapping performed by the MME when the MME receives the Forward Relocation Request message from the S4-SGSN.

Table 5.3.1: Cause value mapping from RANAP Cause to S1AP Cause

25.413 [7]		36.413 [21]	
RELOCATION REQUIRED (RANAP Cause)		**HANDOVER REQUEST (S1AP Cause)**	
Group	**Value**	**Group**	**Value**
Radio Network Layer Cause	Time critical Relocation	Radio Network Layer Cause	Time critical handover
Radio Network Layer Cause	Resource Optimisation Relocation	Radio Network Layer Cause	Resource optimisation handover
Radio Network Layer Cause	Reduce Load in Serving Cell	Radio Network Layer Cause	Reduce load in serving cell
Any other value		Radio Network Layer Cause	Handover Desirable for Radio Reasons

For inter RAT handover from UTRAN served by Gn/Gp-SGSN to LTE, the MME maps the RANAP cause in the GTPv1 Forward Relocation Request message to an S1AP cause as per Table 5.3.1. The MME sends this S1AP cause in the S1AP Handover Request message to the eNodeB.

For inter RAT handover from UTRAN served by Gn/Gp-SGSN to LTE, if the handover fails in the LTE access, the MME maps the S1AP cause in the S1AP Handover Failure message to a RANAP cause by using the mapping in Table 6.2.1. The MME uses the RANAP cause in the GTPv1 Forward Relocation Response message to the Gn/Gp-SGSN.

Inter RAT Handover from LTE to UTRAN:

The table 5.3.2 defines a cause value mapping performed by the MME when the MME receives the Forward Relocation Response message from the S4-SGSN. This mapping is only needed if the inter RAT Handover failed in UTRAN.

Table 5.3.2: Cause value mapping from RANAP Cause to S1AP Cause for failure case

25.413 [7] RELOCATION FAILURE (RANAP Cause)		36.413 [21] HANDOVER PREPARATION FAILURE (S1AP Cause)	
Group	Value	Group	Value
Radio Network Layer Cause	No Radio Resources Available in Target Cell	Radio Network Layer Cause	No Radio Resources Available in Target Cell
Radio Network Layer Cause	Requested Ciphering and/or Integrity Protection algorithms not supported	Radio Network Layer Cause	Encryption and/or integrity protection algorithms not supported
Radio Network Layer Cause	Traffic Load In The Target Cell Higher Than In The Source Cell	Radio Network Layer Cause	No Radio Resources Available in Target Cell
Miscellaneous Cause	O&M Intervention	Miscellaneous Cause	O&M Intervention
Any other value		Radio Network Layer Cause	Handover Failure In Target EPC/eNB Or Target System

For inter RAT handover from LTE to UTRAN served by Gn/Gp-SGSN, the MME maps the S1AP cause in S1AP Handover Required message to a RANAP cause by using the mapping in Table 6.2.2. The MME uses this RANAP cause in the GTPv1 Forward Relocation Request message to the Gn/Gp-SGSN.

For inter RAT handover from LTE to UTRAN served by Gn/Gp-SGSN, if the handover fails in the UTRAN access, the MME maps the RANAP cause received in the GTPv1 Forward Relocation Response message to an S1AP cause as per Table 5.3.2. The MME sends this S1AP cause in the S1AP Handover Preparation Failure message to the eNodeB.

5.4 Interworking between BSSGP protocol messages and S1AP protocol messages

This clause defines a mapping of BSSGP and S1AP cause values used in connection with inter RAT Handover to avoid different mappings in different implementations.

Inter RAT Handover from GERAN to LTE:

Table 5.4.1 defines a cause value mapping performed by the MME when the MME receives the GTPv2 Forward Relocation Request message from the S4-SGSN or the GTPv1 Forward Relocation Request message from Gn/Gp-SGSN (as per Annex D of 3GPP TS 23.401[22]).

NOTE1: The mapping in Table 5.4.1 has been derived based on Table 15.1 in 3GPP TS 29.060 [23] and Table 5.3.1 in this specification.

Table 5.4.1: Cause value mapping from BSSGP Cause to S1AP Cause

48.018 [24]	36.413 [21]	
PS HANDOVER REQUIRED (BSSGP Cause)	**HANDOVER REQUEST (S1AP Cause)**	
Value	**Group**	**Value**
Uplink quality	Radio Network Layer Cause	Time critical handover
Uplink strength	Radio Network Layer Cause	Time critical handover
Downlink quality	Radio Network Layer Cause	Time critical handover
Downlink strength	Radio Network Layer Cause	Time critical handover
Distance	Radio Network Layer Cause	Time critical handover
Traffic	Radio Network Layer Cause	Resource optimisation handover
Cell traffic congestion	Radio Network Layer Cause	Reduce load in serving cell
Any other value	Radio Network Layer Cause	Handover Desirable for Radio Reasons

For inter RAT handover from GERAN served by Gn/Gp-SGSN to LTE, if the handover fails in the LTE access, the MME maps the S1AP cause in S1AP Handover Failure message to a RANAP cause by using the mapping in Table 6.2.1. The MME uses the RANAP cause in the GTPv1 Forward Relocation Response message to the Gn/Gp-SGSN. The Gn-Gp/SGSN maps the RANAP cause to a BSSGP cause as per Table 15.2 in 3GPP TS 29.060 [23] and sends this BSSGP cause in the BSSGP PS Handover Required Nack message.

Inter RAT Handover from LTE to GERAN:

Table 5.4.2 defines a cause value mapping performed by the MME when the MME receives the GTPv2 Forward Relocation Response message from the S4-SGSN or the GTPv1Forward Relocation Response message from the Gn/Gp-SGSN (as per Annex D of 3GPP TS 23.401[22]). This mapping is only needed if the inter RAT Handover failed in GERAN.

NOTE2: The mapping in Table 5.4.2 has been derived based on Table 15.4 in 3GPP TS 29.060 [23] and Table 5.3.2 in this specification.

Table 5.4.2: Cause value mapping from BSSGP Cause to S1AP Cause for failure case

48.018 [24]	36.413 [21]	
PS HANDOVER REQUEST NACK (BSSGP Cause)	**HANDOVER PREPARATION FAILURE (S1AP Cause)**	
Value	**Group**	**Value**
Cell traffic congestion	Radio Network Layer Cause	No Radio Resources Available in Target Cell
O&M intervention	Miscellaneous Cause	O&M Intervention
Any other value	Radio Network Layer Cause	Handover Failure In Target EPC/eNB Or Target System

For inter RAT handover from LTE to GERAN served by Gn/Gp-SGSN, the MME maps the S1AP cause in S1AP Handover Required message to a RANAP cause by using the mapping in Table 6.2.2. The MME uses the RANAP cause in the GTPv1 Forward Relocation Request message to the Gn/Gp-SGSN. The Gn-Gp/SGSN maps the RANAP cause to a BSSGP cause as per Table 15.3 in 3GPP TS 29.060 [23] and sends this BSSGP cause in the BSSGP PS Handover Request message.

6 Interworking in the S4-SGSN

6.1 General

This clause provides a detailed specification for the interworking performed by the S4-SGSN.

6.2 Interworking between RANAP protocol messages and S1AP protocol messages

This clause defines a mapping of RANAP and S1AP cause values used in connection with inter RAT Handover to avoid different mappings in different implementations.

Inter RAT Handover from UTRAN to LTE:

The table 6.2.1 defines a cause value mapping performed by the S4-SGSN when the S4-SGSN receives the Forward Relocation Response message from the MME. This mapping is only needed if the inter RAT Handover failed in LTE.

Table 6.2.1: Cause value mapping from S1AP Cause to RANAP Cause for failure case

36.413 [21]		25.413 [7]	
HANDOVER FAILURE (S1AP Cause)		**RELOCATION PREPARATION FAILURE (RANAP Cause)**	
Group	**Value**	**Group**	**Value**
Radio Network Layer Cause	No Radio Resources Available in Target Cell	Radio Network Layer Cause	No Radio Resources Available in Target Cell
Radio Network Layer Cause	Encryption and/or integrity protection algorithms not supported	Radio Network Layer Cause	Requested Ciphering and/or Integrity Protection algorithms not supported
Miscellaneous Cause	O&M Intervention	Miscellaneous Cause	O&M Intervention
Any other value		Radio Network Layer Cause	Relocation Failure in Target CN/RNC or Target System

Inter RAT Handover from LTE to UTRAN:

Table 6.2.2 defines a cause value mapping performed by the S4-SGSN when the S4-SGSN receives the Forward Relocation Request message from the MME.

Table 6.2.2: Cause value mapping from S1AP Cause to RANAP Cause

36.413 [21]		25.413 [7]	
HANDOVER REQUIRED (S1AP Cause)		**RELOCATION REQUEST (RANAP Cause)**	
Radio Network Layer Cause	Handover Desirable for Radio Reasons	Radio Network Layer Cause	Relocation Desirable for Radio Reasons
Radio Network Layer Cause	Time Critical Handover	Radio Network Layer Cause	Time critical Relocation
Radio Network Layer Cause	Reduce Load in Serving Cell	Radio Network Layer Cause	Reduce Load in Serving Cell
Radio Network Layer Cause	CS Fallback Triggered	Radio Network Layer Cause	CS Fallback triggered
Any other value		Radio Network Layer Cause	Resource Optimized Relocation

6.3 Interworking between BSSGP protocol messages and S1AP protocol messages

This clause defines a mapping of BSSGP and S1AP cause values used in connection with inter RAT Handover to avoid different mappings in different implementations.

Inter RAT Handover from GERAN to LTE:

Table 6.3.1 defines a cause value mapping performed by the S4-SGSN when the S4-SGSN receives the GTPv2 Forward Relocation Response message from the MME.

> NOTE1:   The mapping in Table 6.3.1 has been derived based on Table 6.2.1 in this specification and Table 15.2 in 3GPP TS 29.060 [23].

Table 6.3.1: Cause value mapping from S1AP Cause to BSSGP Cause for failure case

36.413 [21]		48.018 [24]
HANDOVER FAILURE (S1AP Cause)		PS HANDOVER REQUIRED NACK (BSSGP Cause)
Group	Value	Value
Radio Network Layer Cause	No Radio Resources Available in Target Cell	Cell traffic congestion
Radio Network Layer Cause	Encryption and/or integrity protection algorithms not supported	Requested ciphering and/or integrity protection algorithms not supported
Miscellaneous Cause	O&M Intervention	O&M Intervention
Any other value		Relocation failure in target system

Inter RAT Handover from LTE to GERAN:

Table 6.3.2 defines a cause value mapping performed by the S4-SGSN when the S4-SGSN receives the GTPv2 Forward Relocation Request message from the MME.

> NOTE2:   The mapping in Table 6.3.2 has been derived based on Table 6.2.2 in this specification and Table 15.3 in 3GPP TS 29.060 [23].

Table 6.3.2: Cause value mapping from S1AP Cause to BSSGP Cause

36.413 [21]		48.018 [24]
HANDOVER REQUIRED (S1AP Cause)		PS HANDOVER REQUEST (BSSGP Cause)
Group	Value	Value
Radio Network Layer Cause	Handover Desirable for Radio Reasons	Better cell
Radio Network Layer Cause	Time Critical Handover	Time critical relocation
Radio Network Layer Cause	Reduce Load in Serving Cell	Cell traffic congestion
Any other value		Traffic

6.4 Interworking between BSSGP protocol messages and RANAP protocol messages

For the mapping of BSSGP and RANAP cause values used in connection with inter RAT Handover between GERAN and UTRAN, the mapping tables in clause 15 in 3GPP TS 29.060 [23] applies. The mapping is performed by the target S4-SGSN.

7 Interworking in the AMF

7.1 General

This clause provides a detailed specification for the interworking performed by the AMF.

7.2 Interworking between S1AP protocol messages and NGAP protocol messages

This clause defines a mapping of S1AP and NGAP cause values used in connection with inter RAT Handover to avoid different mappings in different implementations.

Inter RAT Handover from LTE to NG-RAN:

Table 7.2.1 defines a cause value mapping performed by the AMF when the AMF receives the Forward Relocation Request message from the MME.

Table 7.2.1: Cause value mapping from S1AP Cause to NGAP Cause

36.413 [21]		38.413 [26]	
HANDOVER REQUIRED (S1AP Cause)		**HANDOVER REQUEST (NGAP Cause)**	
Group	**Value**	**Group**	**Value**
Radio Network Layer Cause	Time critical Handover	Radio Network Layer Cause	Time critical handover
Radio Network Layer Cause	Resource Optimisation Handover	Radio Network Layer Cause	Resource optimisation handover
Radio Network Layer Cause	Reduce Load in Serving Cell	Radio Network Layer Cause	Reduce load in serving cell
Any other value		Radio Network Layer Cause	Handover Desirable for Radio Reasons

For inter RAT handover from LTE served by MME to NG-RAN, the AMF maps the S1AP cause in the GTPv2 Forward Relocation Request message to an NGAP cause as per Table 7.2.1. The AMF sends this NGAP cause in the NGAP Handover Request message to the NG-RAN.

The table 7.2.2 defines a cause value mapping performed by the AMF when the AMF receives the NGAP Handover Failure message from the NG-RAN. This mapping is only needed if the inter RAT Handover failed in NG-RAN.

Table 7.2.2: Cause value mapping from NGAP Cause to S1AP Cause for failure case

38.413 [26]		36.413 [21]	
HANDOVER FAILURE (NGAP Cause)		**HANDOVER PREPARATION FAILURE (S1AP Cause)**	
Group	**Value**	**Group**	**Value**
Radio Network Layer Cause	No Radio Resources Available in Target Cell	Radio Network Layer Cause	No Radio Resources Available in Target Cell
Radio Network Layer Cause	Encryption and/or integrity protection algorithms not supported	Radio Network Layer Cause	Encryption and/or integrity protection algorithms not supported
Radio Network Layer Cause	Insufficient UE Capabilities	Radio Network Layer Cause	Insufficient UE Capabilities
Miscellaneous Cause	O&M Intervention	Miscellaneous Cause	O&M Intervention
Any other value		Radio Network Layer Cause	Handover Failure In Target EPC/eNB Or Target System

For inter RAT handover from LTE served by MME to NG-RAN, if the handover fails in the NG-RAN access, the AMF maps the NGAP cause in the NGAP Handover Failure message to a S1AP cause by using the mapping in Table 7.2.2. The AMF uses the S1AP cause in the GTPv2 Forward Relocation Response message to the MME.

Inter RAT Handover from NG-RAN to LTE:

The table 7.2.3 defines a cause value mapping performed by the AMF when the AMF receives the HANDOVER REQUIRED from the NG-RAN.

Table 7.2.3: Cause value mapping from NGAP Cause to S1AP Cause

38.413 [26]		36.413 [21]	
HANDOVER REQUIRED (NGAP Cause)		**HANDOVER REQUEST (S1AP Cause)**	
Radio Network Layer Cause	Handover Desirable for Radio Reasons	Radio Network Layer Cause	Handover Desirable for Radio Reasons
Radio Network Layer Cause	Time Critical Handover	Radio Network Layer Cause	Time critical Handover
Radio Network Layer Cause	Reduce Load in Serving Cell	Radio Network Layer Cause	Reduce Load in Serving Cell
Any other value		Radio Network Layer Cause	Resource Optimized Relocation

For inter RAT handover from NG-RAN to LTE served by MME, the AMF maps the NGAP cause in NGAP Handover Required message to a S1AP cause by using the mapping in Table 7.2.3. The AMF uses this S1AP cause in the GTPv2 Forward Relocation Request message to the MME.

Table 7.2.4 defines a cause value mapping performed by the AMF when the AMF receives the Forward Relocation Response message from the MME. This mapping is only needed if the inter RAT Handover failed in LTE.

Table 7.2.4: Cause value mapping from S1AP Cause to NGAP Cause for failure case

36.413 [21]		38.413 [26]	
HANDOVER FAILURE (S1AP Cause)		**HANDOVER PREPARATION FAILURE (NGAP Cause)**	
Group	**Value**	**Group**	**Value**
Radio Network Layer Cause	No Radio Resources Available in Target Cell	Radio Network Layer Cause	No Radio Resources Available in Target Cell
Radio Network Layer Cause	Encryption and/or integrity protection algorithms not supported	Radio Network Layer Cause	Encryption and/or integrity protection algorithms not supported
Radio Network Layer Cause	No Radio Resources Available in Target Cell	Radio Network Layer Cause	No Radio Resources Available in Target Cell
Radio Network Layer Cause	Insufficient UE Capabilities	Radio Network Layer Cause	Insufficient UE Capabilities
Miscellaneous Cause	O&M Intervention	Miscellaneous Cause	O&M Intervention
Any other value		Radio Network Layer Cause	Handover failure in target 5GC/ NG-RAN node or target system

For inter RAT handover from NG-RAN to LTE served by MME, if the handover fails in the LTE access, the AMF maps the S1AP cause received in the GTPv2 Forward Relocation Response message to an NGAP cause as per Table 7.2.4. The AMF sends this NGAP cause in the NGAP Handover Preparation Failure message to the NG-RAN.

Annex A (informative):
Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
Sept 1999	Sept 1999					Transferred to 3GPP CN	
CN#04	CN#04					Approved by mail exploder at CN#04	3.0.0
CN#06	CN#06		001			UMTS / GSM Interworking	3.1.0
CN#06	CN#06		002			Addition of LSA Information message	3.1.0
CN#07	CN#07		003r1			UMTS / GSM Interworking	3.2.0
CN#07	CN#07		004r1			GSM / UMTS Interworking	3.2.0
CN#07	CN#07		005			UMTS/UMTS Handover	3.2.0
CN#09	CN#09		006r1			Clarification of use of Radio Resource Information	3.3.0
CN#09	CN#09		007r1			Corrections and updates to align with current R99 specs	3.3.0
CN#10	CN#10		008			GSM to 3G Handover: Location Reporting in 3G_MSC-B	3.4.0
CN#10	CN#10		009			GSM to 3G Handover: Chosen IEs in Handover Request Ack	3.4.0
CN#10	CN#10		010			GSM to 3G Handover: MAP parameter Target Cell ID	3.4.0
CN#10	CN#10		011r1			GSM/UMTS Interworking: Mapping of cause codes	3.4.0
CN#11	CN#11		012			GSM to UMTS handover: addition of MAP parameter Target RNC ID	3.5.0
CN#11	CN#11		013			Inter MSC relocation: addition of MAP parameter Target RNC ID	3.5.0
CN#11	CN#11		014			Roaming restrictions for GPRS service	3.5.0
CN#11	CN#11		015			Alignment of cause mapping for 08.08 and 25.413 (Directed Retry)	3.5.0
CN#11	CN#11		016			UMTS to GSM Directed Retry cause code mapping	3.5.0
CN#11	CN#11		017			Mapping of unknown HLR error to access interface cause code	3.5.0
CN#11	CN#11					Version increased from R99 to Rel-4	4.0.0
CN#12	CN#12		020r1			Addition of selected UMTS algorithm indication to the handover procedures	4.1.0
CN#12	CN#12		022r1			Addition of selected GSM algorithm indication to the handover procedures	4.1.0
CN#12	CN#12		024r1			Addition of allowed UMTS algorithms indication to the handover procedures	4.1.0
CN#12	CN#12		026r1			Addition of allowed GSM algorithms indication to the handover procedures	4.1.0
CN#12	CN#12		028r1			Addition of GSM channel type and GSM chosen channel indications to handover procedures	4.1.0
CN#12	CN#12		030			Partial Roaming – restriction by Location area	4.1.0
CN#12	CN#12		031			Mapping between RANAP and BSSMAP for Location Services	4.1.0
CN#12	CN#12		034r1			Mapping between RANAP and BSSMAP for Location Services	4.1.0
CN#14	CN#14		036r2			LCS/HO Location Reporting – GSM to GSM, UMTS to GSM and UMTS to UMTS	4.2.0
CN#14	CN#14		040			Global replace of BSS-APDU with AN-APDU	4.2.0
CN#14	CN#14		047			Removal of deleted MAP operations	4.2.0
CN#16	CN#16		048r1			LCS: Mapping BSSMAP-RANAP for request of assistance data on E interface	4.3.0
CN#16	CN#16		051r1			LCS: clarification of mapping for Location Acquisition	4.3.0
CN#16	CN#16		052			Check of NAM and Requesting Node Type on receipt of SendAuthenticationInfo	4.3.0
CN#16	CN#16		054r1			Addition of Service Handover parameters to MAP Handover messages	4.3.0
CN#16	CN#16					Version 5.0.0 created after CN#16.	5.0.0
CN#17	CN#17		060			Introduction of GERAN Iu-mode	5.1.0
CN#17	CN#17		069r2			Addition of an error mapping table for MAP Update Location operation	5.1.0
CN#17	CN#17		075			Support for Shared Network in connected mode (using encapsulated BSSAP transport of SNA access information)	5.1.0
CN#18	CN#18		073r1			LCS: Adding missing parameter mapping to assistance data request procedure after inter-MSC SRNS Relocation	5.2.0
CN#18	CN#18		077			Correction on the use of "User Failure" error for LCS-MOLR operation	5.2.0

CN#18	CN#18		078			Interworking between security mode procedure and relocation	5.2.0
CN#18	CN#18		084r3			Correction to the Service Handover parameters	5.2.0
CN#20	CN#20		088			Correction of LCS cause mapping between RANAP and BSSMAP	5.3.0
CN#20	CN#20		089r1			Handling of UE-specific behaviour data in the relay MSC	5.3.0
CN#20	CN#20		090			Handling of UE-specific behaviour data in the relay MSC	5.3.0
July 2003	July 2003					Implemented CR 29.010-090 removed	5.3.1
CN#21	CN#21		091			Addition of Early UE specific cause code mapping	5.4.0
CN#21	CN#21		092r2			Information transfer at MAP-E interface during inter MSC handover/relocation	6.0.0
CN#22	CN#22		095			Wrong message appears in message flow	6.1.0
CN#23	CN#23		100r1			Correction of inter system handover cause mapping	6.2.0
CN#23	CN#23		101r1			Include administrative restriction subscription parameter	6.2.0
CN#23	CN#23		103r2			Change to cause code mappings	6.2.0
CN#24	CN#24		106r3			Removing of non-existing error indications from Location update mappings	6.3.0
CN#24	CN#24		107			Addition of cause code mapping for BSSAP Clear Request and RANAP Iu Release Request	6.3.0
CN#25	CN#25		108r2			Addition of cause code mapping to the routing area update procedure	6.4.0
CN#25	CN#25		110			Addition of cause code mapping for inter-system handover	6.4.0
CN#27	CN#27		112			Correction of partly implemented CR108	6.5.0
CT#28	CT#28		111r2			Full RANAP support of network initiated SCUDIF	6.6.0
CT#29	CT#29		115			Correction of cause code mapping for the routing area update procedure	6.7.0
CT#31	CT#31		0118			Addition of UMTS Trace parameters to handover procedure	6.8.0
CT#31	CT#31		0117r2			Addition of new cause "Additional roaming not allowed " in RAU and LAU	7.0.0
CT#32	CT#32		0119r2			Use of cause #12 in VPLMNs	7.1.0
CT#32	CT#32		0121			Alignment of Cause Mapping	7.1.0
CT#42	CT#42					Upgraded unchanged from Rel-7	8.0.0
CT#46	CT#46		124r2			Addition of missing cause code mapping for EPC	8.1.0
CT#46	CT#46		0125r1			RANAP Cause and S1AP Cause mapping	9.0.0
CT#48	CT#48		0126r1			Removal of MME mapping between Diameter error codes and NAS CC's	9.1.0
CT#50	CT#50		0128r1			Missing BSSGP/RANAP/S1AP Cause Code mapping for IRAT Handover	9.2.0
CT#50	CT#50		0130r1			Wrong Reference for BSSMAP messages	10.0.0
CT#52	CT#52		0132r2			BSSMAP/RANAP/S1AP Cause Code mapping for SRVCC Handover	10.1.0
CT#53	CT#53		0134			Algorithm list handling in MSC-B	10.2.0
Jan 2012	Jan 2012					Editorial corrections in clause 5 and 6.	10.2.1
CT#56	CT#56		0135			Regional Subscription and CSG Information Propagation	11.0.0
CT#63	CT#63		0136r2			Error mapping for "Data Missing"	11.1.0
2014-09			-			Update to Rel-12 version (MCC)	12.0.0
2015-12			0139			Mapping of the S1AP cause 'CS Fallback Triggered'	13.0.0
2017-03	CT#75		-			Update to Rel-14 version (MCC)	14.0.0
2018-06	CT#80		-			Update to Rel-15 version (MCC)	15.0.0
2018-12	CT#82	CP-183237	0140	2	F	S1AP Cause and NGAP Cause mapping in the AMF	15.1.0
2020-07	CT#88e	-	-	-	-	Update to Rel-16 version (MCC)	16.0.0
2021-12	CT#94e	CP-213140	0141	-	F	Mapping of NGAP and S1AP Insufficient UE Capabilities Cause value	16.1.0

History

Document history		
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