3GPP TSG CN Plenary **Tdoc NP-000673**
Meeting #10, Bangkok, Thailand
6th – 8th December 2000

Source: **TSG CN WG 1**

Title: **CRs to R99 Work Item TEI**

Agenda item: **7.6**

Document for: **APPROVAL**

Introduction:

This document contains **9** CRs on **R99** Work Item **"TEI"**, that have been agreed by **TSG CN WG1**, and are forwarded to TSG CN Plenary meeting #10 for approval.

Spec	CR	R	Doc-2nd-Level	Phase	Subject	Cat	Ver_C
24.008	300		N1-001277	R99	3.1 kHz multimedia calls at 33.6 kbit/s data rate	F	3.5.0
24.008	301		N1-001278	Rel-4	3.1 kHz multimedia calls at 33.6 kbit/s data rate	A	4.0.0
24.008	302		N1-001279	R99	32 kbit/s UDI/RDI multimedia	F	3.5.0
24.008	303		N1-001280	Rel-4	32 kbit/s UDI/RDI multimedia	A	4.0.0
09.08	A140		N1-001319	R99	Addition of Common Id procedure on the E-	F	8.0.0
24.002	001	2	N1-001421	R99	CR 24.002 on Adaptations for UMTS	F	3.0.0
24.011	012		N1-001220	R99	Modifications of references	F	3.4.0
23.009	019		N1-001304	R99	Reference clean-up	F	3.4.0
24.007	024		N1-001188	R99	Removal of Flow Id from RR-SAP	F	3.5.0

3GPP TSG-CN1 Meeting #14 | ***Tdoc N1-001188***
Cardiff, Wales - 20 - 24 November, 2000

CR-Form-v3

CHANGE REQUEST

⌘	**24.007**	**CR 024**	⌘ rev	**-**	⌘ Current version:	**3.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Removal of Flow Id from RR-SAP		
Source:	⌘	Siemens AG		
Work item code:	⌘	TEI	***Date:*** ⌘	04.11.00
Category:	⌘	**F**	***Release:*** ⌘	R99
		Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change:	⌘	With the CR 25.331 573r1 the Flow Id is replaced by the CN domain Id. As requested by R2 in their LS "Response to LS (N1-001011) on Question about the RRC Flow Id concept" (R2-002140) this CR removes the Flow Id from 24.007.
Summary of change:	⌘	
Consequences if not approved:	⌘	Inconsistency between 25.331 and 24.007

Clauses affected:	⌘	9.1.2, 9.1.2.1, 9.1.2.5a, 9.1.2.5b, 9.1.2.6, 9.1.2.7a		
Other specs affected:	⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘	
Other comments:	⌘			

9.1.2 Service primitives

Table 9.1: Primitives and parameters at the RR-SAP - MS side

PRIMITIVES	PARAMETERS	REFERENCE
RR_EST_REQ	Layer 3 message transferred in the SABM frame, CN domain identity	9.1.2.1
RR_EST_IND	-	9.1.2.2
RR_EST_CNF	-	9.1.2.3
RR_REL_IND	cause	9.1.2.4
RR_SYNC_IND	cause (ciphering, res. ass., channel mode modify)	9.1.2.5
RR_DATA_REQ	Layer 3 message, ~~local flow identifier~~ CN domain identity	9.1.2.6
RR_DATA_IND	Layer 3 message, CN domain identity	9.1.2.7
RR_UNIT DATA_IND	Layer 3 message	9.1.2.8
RR_ABORT_REQ	cause	9.1.2.9
RR_ABORT_IND	cause	9.1.2.10
RR_ACT_REQ	reselection mode	9.1.2.11
~~RR_INIT_REQ~~	~~Initial L3 message, CN Domain identity, Protocol Discriminator~~	~~9.1.2.5a~~
~~RR_INIT_CONF~~	~~Local Flow identifier~~	~~9.1.2.5b~~
~~RR_FREL_REQ~~	~~Local flow identifier~~	~~9.1.2.7a~~

9.1.2.1 RR_EST_REQ

In A/Gb mode it i~~I~~s used by the Mobility Management entity to request establishment of a Mobile originated RR connection.
The request shall be given only in the IDLE state when the MS listens to the CCCH and the previously selected BCCH.

In Iu mode it is used by the Mobility Management entity to request the establishment of a signalling connection to the CN domain type given in the parameter CN domain identity. The request shall be given only if no signalling connection to the specific CN domain type is established.

9.1.2.2 RR_EST_IND

Indicates to the Mobility Management entity the establishment of a Mobile terminated RR connection. By this indication MM is informed that a transparent connection exists and RR is in the dedicated mode.

9.1.2.3 RR_EST_CNF

Is used by RR to indicate the successful completion of a Mobile originated RR connection establishment. RR connection exists and RR is in the dedicated mode.

9.1.2.4 RR_REL_IND

Is used by RR to indicate to the Mobility Management entity the release of a RR connection when RR has received a CHANNEL RELEASE from the Network and has triggered a normal release of the data link layer. It is also used to indicate that a requested RR connection cannot be established. In both cases, RR returns to IDLE mode.

9.1.2.5 RR_SYNC_IND

Is used for synchronizing RR and the Mobility Management entity after the establishment of a Mobile originated or Mobile terminated RR connection. This indication is provided to MM in the following cases:

- ciphering has been started (ciphering);

- integrity protection has been started (integrity) (UMTS only);
- a traffic channel has been assigned (res. ass. = "resource assigned");
- the channel mode has been modified (channel mode modify).

~~9.1.2.5a RR_INIT_REQ~~

~~For UMTS, it is used by the Mobility Management entity to request RRC to establish a new signalling flow between the UE and the Core Network via an existing RRC connection. It includes:~~

~~-the Protocol Discriminator and CN Domain Identity requested in the L3 (control data) message;~~

~~-an associated L3 message.~~

~~The primitive is invoked for every new PD/TI upper layer transaction.~~

~~9.1.2.5b RR_INIT_CONF~~

~~For UMTS, it is used by the RRC entity to inform the MM entity of the "local flow identifier" allocated to the requested signalling flow through the RR_INIT_REQ primitive.~~

9.1.2.6 RR_DATA_REQ

Is used by the Mobility Management entity to send control data to its peer entity on the Network side via an existing RR connection.

~~For UMTS, RR_DATA_REQ is used to send all subsequent control data (L3) messages belonging to an on-going signalling flow. It includes:~~

~~-associated L3 message,~~

~~- the "local flow identifier" allocated by the RRC entity, identifying the signalling flow the control data message belongs to.~~

9.1.2.7 RR_DATA_IND

Is used by RR to indicate control-data, which has been received from its peer entity on the Network side via an existing RR connection.

For UMTS, RR_DATA_IND is also used to indicate whether control-data has been:

- successfully integrity checked;
- unsuccessfully integrity checked;
- received with no integrity protection.

~~9.1.2.7a RR_FREL_REQ~~

~~For UMTS, it is used by MM to inform RRC that it can release a local flow identifier and the corresponding signalling flow.~~

~~This primitive is invoked by MM when the corresponding signalling flow is released by upper layers.~~

9.1.2.8 RR_UNIT_DATA_IND

Is used by RR to provide MM with system info. The system info is received on the current BCCH if RR is in the IDLE state. If a RR connection has been established, the system info is received on the SACCH.

9.1.2.9 RR_ABORT_REQ

Request to abort an existing RR connection or a RR connection in progress. The data link, if already established, shall be released by a normal release procedure (DISC/UA) initiated by the MS. This is the only way the MS can trigger the release of a RR connection in case of exceptional conditions. The RR returns to the IDLE state.

9.1.2.10 RR_ABORT_IND

Indication that the RR connection has been aborted by a lower layer failure and RR has returned to the IDLE state.

3GPP TSG-CN1 Meeting #14 ***Tdoc N1-001220***
Cardiff, Wales - 20 - 24 November, 2000

CR-Form-v3

CHANGE REQUEST

⌘	**24.011**	**CR**	**012**	⌘ rev	**-**	⌘ Current version:	**3.4.0** ⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title: ⌘	Modifications of references			
Source: ⌘	NTT Communicationware			
Work item code: ⌘	TEI		***Date:*** ⌘	10-Nov-2000
Category: ⌘	**F**		***Release:*** ⌘	R99
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*	

Reason for change: ⌘	It is proposed that all the references of 3GPP specs shall be align with the regular style as “3GPP TS xxxxx”.
Summary of change: ⌘	- References of 3GPP specs shall look like “3GPP TS xxxxx”.
Consequences if not approved: ⌘	

Clauses affected: ⌘	Whole the spec	
Other specs affected: ⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	
Other comments: ⌘		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

Foreword

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

The present document defines the Short Message Service (SMS) support on mobile radio interface within the 3GPP system.

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the procedures used across the mobile radio interface by the signalling layer 3 function Short Message Control (SMC) and Short Message Relay function (SM-RL) for both circuit switched GSM and GPRS.

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.

[1] 3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

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

[2] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS) Point-to-Point (PP)".

[3a] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[3] 3GPP TS 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[4] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[5] 3GPP TS 24.008: "Mobile radio interface layer 3 specification".

[6a] 3GPP TS 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Logical Link Control (LLC)".

[6] ISO 7498: "Information processing systems - Open Systems Interconnection - Basic Reference Model".

[7] 3GPP TS 04.18: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification; Radio Resource Control Protocol".

1.2 Abbreviations

Abbreviations used in the present document are listed in ~~GSM~~ 3GPP TS 01.04 and 3GPP TR 21.905, except below:

RR connection: A RR connection is a dedicated physical circuit switched domain connection used by the two RR or RRC peer entities to support the upper layers' exchange of information flows.

PS signalling connection: is a peer to peer UMTS connection between MS and CN packet domain node.

GPRS: Packet Services for GSM and UMTS system.

The label **(GSM only):** indicates this section or paragraph applies only to GSM system. For multi system case this is determined by the current serving radio access network.

The label **(UMTS only):** indicates this section or paragraph applies only to UMTS system. For multi system case this is determined by the current serving radio access network.

In GSM,...: Indicates this paragraph applies only to GSM System. For multi system case this is determined by the current serving radio access network.

In UMTS,...: Indicates this paragraph applies only to UMTS System. For multi system case this is determined by the current serving radio access network.

SIM: Subscriber Identity Module (see 3GPP TS ~~GSM~~ 02.17). This specification makes no distinction between SIM and USIM.

MS: Mobile Station. This specification makes no distinction between MS and UE.

2 Overview of Short Message Service (SMS) support

The purpose of the Short Message Service is to provide the means to transfer messages between a GSM PLMN Mobile Station (MS) and a Short Message Entity via a Service Centre, as described in 3GPP TS 23.040. The terms "MO" - Mobile Originating - and "MT" - Mobile Terminating - are used to indicate the direction in which the short message is sent.

The present document describes the procedures necessary to support the Short Message Service between the MS and the MSC or SGSN and vice versa, as described in 3GPP TS 23.040.

The procedures are based on services provided by the Mobility Management sublayer as described in 3GPP TS 24.007/24.008 for GSM CS and UMTS CS/PS services and the Logical Link Control layer described in 3GPP TS~~GSM~~ 04.64 for GPRS services.

2.1 Protocols and protocol architecture

In UMTS only, integrity protected signalling (see 3GPP TS 24.008, subclause ‘Integrity Protection of Signalling Messages,’ and in general, see 3GPP TS 33.102) is mandatory. In UMTS only, all protocols shall use integrity protected signalling. Integrity protection of all SMS signalling messages is the responsibility of lower layers. It is the network which activates integrity protection. This is done using the security mode control procedure (3GPP TS 25.331).

The hierarchical model in Figure 2.1a shows the layer structure of the MSC and the MS in GSM. The hierarchical model in Figure 2.1c shows the layer structure of the SGSN and the MS in UMTS.

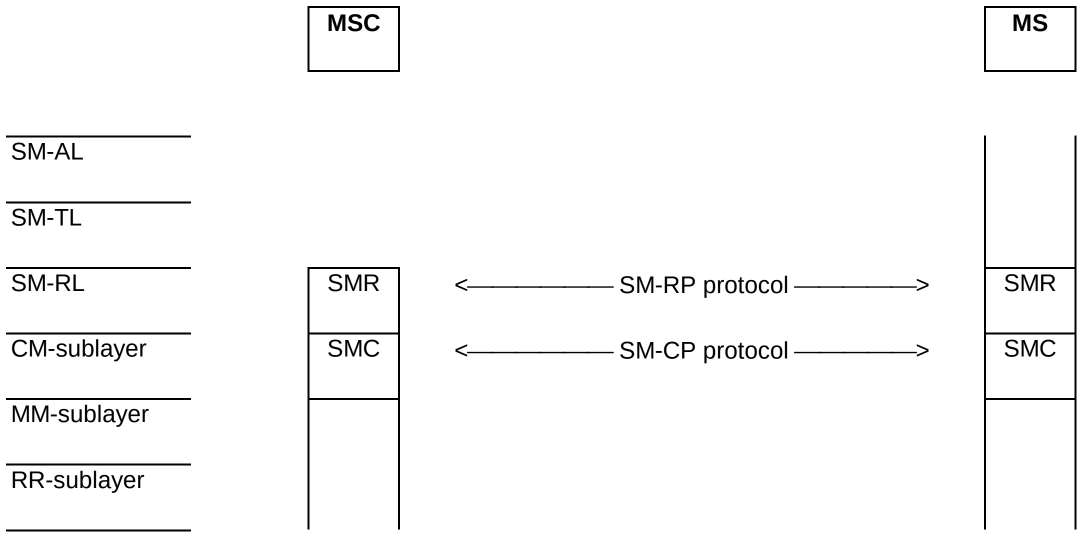


Figure 2.1a/3GPP TS 24.011: Protocol hierarchy for circuit switched service

The hierarchical model in Figure 2.1b shows the layer structure of the SGSN and the MS.

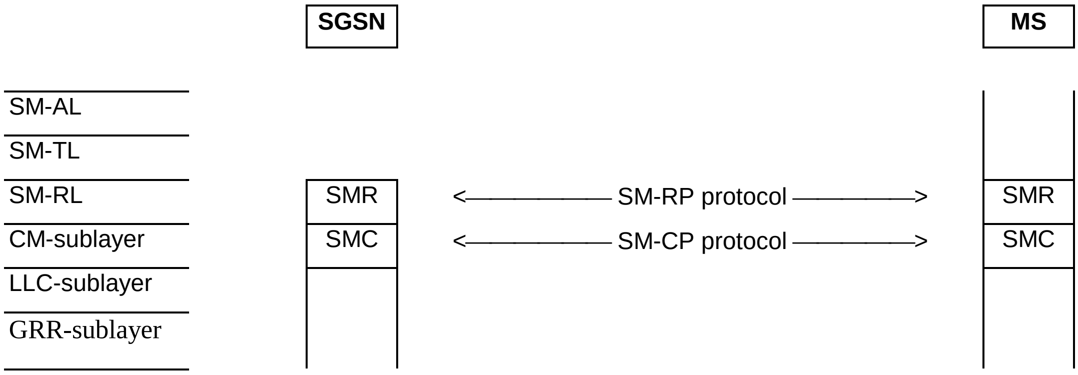


Figure 2.1b/3GPP TS 24.011: Protocol hierarchy for GPRS in GSM

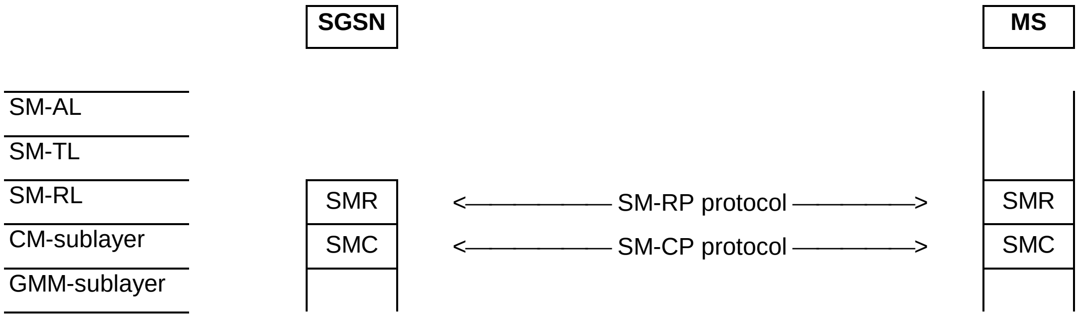


Figure 2.1c/3GPP TS 24.011: Protocol hierarchy for packet switched service in UMTS

The CM-sublayer, in terms of the Short Message Service Support, provides services to the Short Message Relay Layer.

On the MS-side the Short Message Relay Layer provides services to the Short Message Transfer Layer. The Short Message Relay Layer is the upper layer on the network side (MSC or SGSN), and the SM-user information elements are mapped to TCAP/MAP.

The peer protocol between two SMC entities is denoted SM-CP, and between two SMR entities, SM-RP.

Abbreviations:

SM-AL	Short Message Application Layer
SM-TL	Short Message Transfer Layer
SM-RL	Short Message Relay Layer
SM-RP	Short Message Relay Protocol
SMR	Short Message Relay (entity)
CM-sub	Connection Management sublayer
SM-CP	Short Message Control Protocol
SMC	Short Message Control (entity)
MM-sub:	Mobility Management sublayer
GMM-sub:	GPRS Mobility Management sublayer
RR-sub:	Radio Resource Management sublayer
LLC-sub	Logical Link Control sublayer
GRR-sub	GPRS Radio Resource sublayer in GSM

2.2 Use of channels (GSM only)

Table 2.1/3GPP TS 24.011 summarizes the use of channels for the short message service for circuit switched GSM. Arrows indicate changes of channel.

Table 2.1/3GPP TS 24.011: Channels used for short message transfer over circuit switched GSM

Channel dependency	Channel used
TCH not allocated	SDCCH
TCH not allocated -> TCH allocated	SDCCH -> SACCH
TCH allocated	SACCH
TCH allocated -> TCH not allocated	SACCH -> SACCH opt. SDCCH³

The short message service for GPRS shall be supported by a PDTCH.

2.3 Layer 2 SAPI 3 handling for circuit switched GSM

General rule:

The Radio Resource Management (RR reference 3GPP TS~~GSM~~ 04.18) in the Mobile Station and on the network side (i.e. in the BSC) shall establish the acknowledged mode of operation on SAPI 3 whenever needed, i.e. when a message requiring SAPI 3 transfer shall be transmitted.

RR shall control the layer 2 also for SAPI 3, and keep knowledge of the mode.

The network side may initiate release of the acknowledged mode for SAPI 3 either explicitly (by the use of DISC- and UA-frames, see 3GPP TS~~GSM~~ 04.06) or indirectly by channel release (see ~~GSM~~ 3GPP TS 04.18).

This means:

- the Mobile Station side will initiate establishment of SAPI 3 acknowledged mode in the case of mobile originating short message transfer;
- the network side will initiate establishment of SAPI 3 acknowledged mode in the case of mobile terminating short message transfer;
- the network side may choose to keep the channel and the acknowledged mode of operation to facilitate transfer of several short messages for or from the same Mobile Station. The queuing and scheduling function for this should reside in the MSC.

2.4 Layer 2 (LLC) GPRS support (GSM only)

It shall be possible for a GPRS-attached MS of any class (A, B, C) to send and receive short messages over GPRS radio channels.

GPRS shall use the unacknowledged mode of LLC frame transfer as described in 3GPP TS ~~GSM~~ 04.64, and shall use SAPI 7 to identify the SMS Logical Link Entity within the LLC layer.

A description of the different GPRS MS classes can be found in 3GPP TS 23.060, and a brief overview is given below:-

- Class A/B MSs may be able to send and receive short messages using either the MM sublayer (using SACCH or SDCCH) or the LLC layer (using PDTCH).
- Class C MSs may be able to send and receive short messages using only the LLC layer (using the PDTCH). The capability for GPRS-attached class-C MSs to receive and transmit SMS messages is optional.

The GSMS entity for GPRS class A/B MS is shown in Figure 3. The GSMS shall communicate with the MM entity via the GMMSMS-SAP for GPRS Class A/B MO SMS, in order to ascertain which transport service to use.

SMS delivery via GPRS is normally a more radio resource efficient method than SMS delivery via CS GSM. The delivery path for MO SMS is selected by the MS.

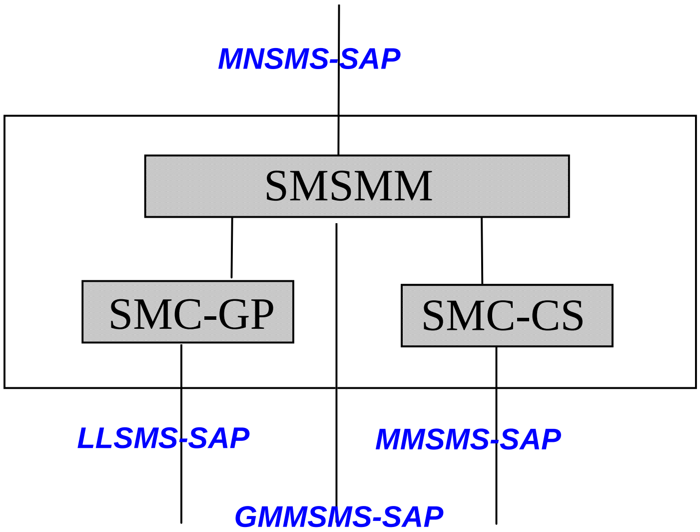


Figure 2.2/3GPP TS 24.011: GSMS entity for GPRS Class A/B MS

2.5 GSMS entity in UMTS

It shall be possible for a PS-attached MS of any mode of operation to send and receive short messages over UMTS radio channels.

A description of the different mode of operation UMTS MS can be found in 3GPP TS 23.060, and a brief overview is given below:-

- CS/PS mode of operation MSs may be able to send and receive short messages using either the MM sublayer or the GMM sublayer.

- PS mode of operation MSs may be able to send and receive short messages using only GMM sublayer.

The GSMS entity for CS/PS mode of operation MS is shown in Figure 2.3. The GSMS shall communicate with the MM entity via the GMMSMS-SAP for UMTS CS/PS mode of operation MO SMS, in order to ascertain which transport service to use.

The delivery path for MO SMS is selected by the MS.

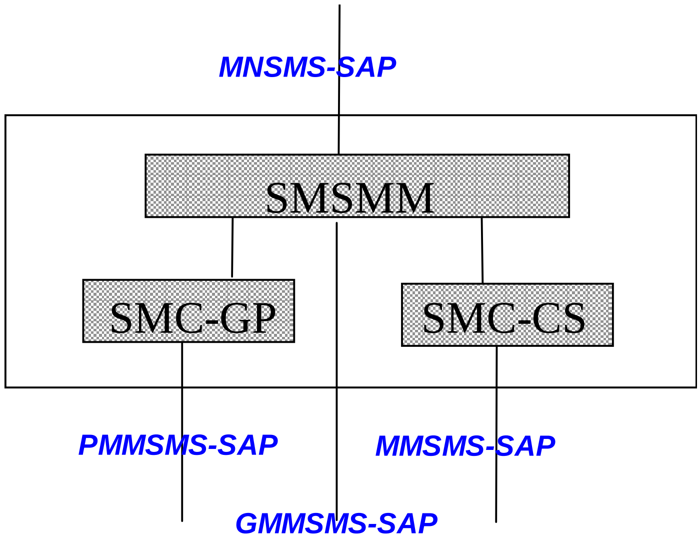


Figure 2.3/3GPP TS 24.011: GSMS entity for CS/PS mode of operation MS in UMTS

3 Service definition

3.1 General

The layer service is described as a set of service primitives. These service primitives are abstractions and attempt to capture only those details of the interaction between the entities that are aspects of the layer service itself. A service primitive neither specifies nor constrains the implementation of entities or the interface between them.

The general syntax of a primitive and the initials of them are in line with the 24-series of 3G Technical Specifications.

NOTE: In order to limit the number of primitives and state definitions to a reasonable amount, a description method has been chosen which does not claim to be totally in line with the formal description method of the layered ISO reference model (ISO 7498) for Open Systems Interconnection.

3.2 Service provided by the CM-sublayer

In order to support the Short Message Service, the CM-sublayer provides services to the Short Message Relay Layer.

The CM-sublayer services are provided using layer specific functions and lower layer services offered to the CM-sublayer, controlled by short message service control entities called SMCs.

An SMC entity in the MS communicates with an SMC entity in the MSC or SGSN by means of a peer protocol, SM-CP (Short Message Service Control Protocol). The arrow diagrams in annex A give an overview of the messaging on the CM-sublayer during a short message transfer.

A mobile station supporting the Short Message Service shall have a minimum of two SMC entities per service type (i.e. two for CS GSM and two for GPRS). This enables the MS to receive MT messages during an MO message transfer.

To ensure that an MS having the minimum of two SMC entities is able to receive MT messages during an MO message transfer, and to send MO messages during MT message transfer, parallel message transfer in the same direction is prohibited. This means that the SMC entities shall not simultaneously perform messaging in the same direction. The rules for concatenation of message transfers are described in subclause 5.4.

The MSC or SGSN shall have a minimum of two SMC entities available each during an MT message transfer to a mobile station, one being reserved for MO message transfer. In an MO message transfer, the MSC or SGSN shall have one SMC entity reserved for handling of an MT message.

3.2.1 Definition of primitives on the MS side

This subclause defines the service primitives used on the MS side. Table 3.1/3GPP TS 24.011 gives an overview of the service primitives and main parameter linked to the primitives. All necessary control parameters to be used in the Short Message Service are defined in clause 7. All MNSMS service primitives defined in this subclause are passed to an SMC-entity.

Table 3.1/3GPP TS 24.011: MNSMS service primitives on the MS-side

SERVICE PRIMITIVES		PARAMETER
NAME	TYPE	
MNSMS-ABORT-	Req	Cause
MNSMS-DATA	Req	MT RPDU
	Ind	MO RPDU
MNSMS-EST-	Req	MO RPDU
	Ind	MT RPDU
MNSMS-ERROR-	Ind	Cause
MNSMS-REL-	Req	Cause

3.2.1.1 MNSMS-ABORT-REQuest

A request from an SMR entity to release a CM-connection in abnormal cases.

When the CM-sublayer receives this request, and if the MM connection exists, it shall form and send the CP-ERROR message. Irrespective of whether or not the CP-ERROR message was sent, the CM-sublayer shall then release the lower layer services.

3.2.1.2 MNSMS-DATA-REQuest

A request from an SMR entity to send a RPDU on the established CM-connection.

The SMC entity forms the CP-DATA message, the user information element being the RPDU, and transfers the message by means of the lower layer services.

NOTE: After reception of an incoming RP-DATA, the SMR entity typically returns the acknowledgement RP-ACK, or an error indication, RP-ERROR, to the Service Centre.

3.2.1.3 MNSMS-DATA-INDication

An indication used by the SMC entity to pass the user information element (RPDU) of a received CP-DATA message to SM-RL.

NOTE: The RPDU is typically an RP-ACK or an RP-ERROR. Normally this service is used to report the outcome of either a MO message transfer attempt or a mobile station memory available notification attempt.

3.2.1.4 MNSMS-ESTablish-REQuest

A request from an SMR entity to establish a CM-connection. The request contains a RP-DATA UNIT as a parameter. It implies the:

- establishment of a CM-connection for this SMR entity;
- forming of the CP-DATA message containing the RPDU; and
- passing of CP-DATA to the MM-sublayer.

3.2.1.5 MNSMS-ESTablish-INDication

An indication used by the SMC entity to pass the SM-user information (RPDU) of a received CP-DATA message to SM-RL. It implies completion of the establishment of the CM-connection for this SMR entity.

3.2.1.6 MNSMS-ERROR-INDication

An indication used by the SMC entity to pass error information to SM-RL. The error information may be local or relayed by the CP-ERROR message.

Use of this service primitive implies release of both CM and MM-connection.

3.2.1.7 MNSMS-RELease-REQuest

A request to release the CM-connection (if it still exists).

Use of this service primitive implies release of the associated CM and MM-connections.

3.2.2 Definition of primitives on the network side

This subclause defines the service primitives used on the network side.

Table 3.2/3GPP TS 24.011 gives an overview of the service primitives and linked main parameter. All MNSMS service primitives defined in this subclause are passed to an SMC-entity.

Table 3.2/3GPP TS 24.011: MNSMS service primitives on the network side

SERVICE PRIMITIVES		PARAMETER
NAME	TYPE	
MNSMS-ABORT-	Req	Cause
MNSMS-DATA	Req	MO RPDU
	Ind	MT RPDU
MNSMS-EST-	Req	MT RPDU
	Ind	MO RPDU
MNSMS-ERROR-	Ind	Cause
MNSMS-REL-	Req	Cause

3.2.2.1 MNSMS-ABORT-REQuest

A request from an SMR entity to release a CM-connection in abnormal cases.

When the CM-sublayer receives this request, it may form and send the CP-ERROR message to release the connection. Irrespective of whether or not the CP-ERROR message was sent, the CM-sublayer shall then release the lower layer services.

3.2.2.2 MNSMS-DATA-REQuest

A request from an SMR entity to send a RPDU on the established CM-connection.

The SMC entity forms the CP-DATA message, the user information element being the RPDU, and transfers the message by means of the lower layer services.

NOTE: After reception of an incoming RP-DATA or RP-SMMA the RPDU typically returns the acknowledgement, RP-ACK, or an error indication RP-ERROR, to the Mobile Station.

3.2.2.3 MNSMS-DATA-INDication

An indication used by the SMC entity to pass the user information element (RPDU) of a received CP-DATA message to SM-RL.

NOTE: The RPDU is typically an RP-ACK or an RP-ERROR. Normally this is used to report the outcome of a MT messaging attempt.

3.2.2.4 MNSMS-ESTablish-REQuest

A request from an SMR entity to transmit a RPDU, containing the SM-user information element; it implies the:

- establishment of a CM-connection for this SMR entity;
- forming of the CP-DATA message containing the RPDU; and
- passing of CP-DATA to the MM-sublayer.

3.2.2.5 MNSMS-ESTablish-INDication

An indication used by the SMC entity to pass the SM-user information (RPDU) of a received CP-DATA message to SM-RL; it implies completion of the establishment of the CM-connection for this SMR entity.

3.2.2.6 MNSMS-ERROR-INDication

An indication used by the SMC entity to pass error information to SM-RL. The error information may be local or relayed by the CP-ERROR message.

Use of the service primitive implies release of both CM and MM-connection.

3.2.2.7 MNSMS-RELease-REQuest

A request to release the CM-connection (if it still exists).

Use of this service implies release of the associated CM and MM-connections.

3.3 Service provided by SM-RL

In order to support the Short Message Service, the Short Message Relay Layer provides services to the Short Message Transfer Layer.

The Short Message Relay Layer services are provided using layer specific functions and lower layer services offered to the Short Message Relay Layer, controlled by short message control entities called SMRs.

An SMR entity in the MS communicates with an SMR entity in the MSC by means of a peer protocol, SM-RP (Short Message Relay Protocol). The arrow diagrams in annex C give an overview of the messaging on the Short Message Relay Layer used for the Short Message Service. The diagrams in annex C indicate a layer RL. This is not a layer, but the functional interface to the fixed network. The SM-RL is the upper layer in the MSC. Consequently the service primitives passed between SM-RL and RL indicate the interworking function.

The requirements on the SM-RL are the same as for the CM-sublayer. This means that there is exactly one SMR entity for each SMC entity, operating as described in subclause 3.2.

3.3.1 Definition of primitives on the MS side

This subclause defines the service primitives used on the MS side. Table 3.3/3GPP TS 24.011 gives an overview of the service primitives and linked main parameters. All SM-RL service primitives defined in this subclause are passed on an SM-RL-connection.

Table 3.3/3GPP TS 24.011: SM-RL service primitives on the mobile station side

SERVICE PRIMITIVES		PARAMETER
NAME	TYPE	
SM-RL-DATA-	Req	MO SMS-TPDU
	Ind	MT SMS-TPDU
SM-RL-MEMORY AVAILABLE	Req	See subclause 3.3.1.3
SM-RL-REPORT-	Req	See subclause 3.3.1.4
	Ind	See subclause 3.3.1.5

3.3.1.1 SM-RL-DATA-REQuest

A request from the SM-TL entity to pass the SMS-TPDU and necessary control information to SM-RL; it implies:

- establishment of an SM-RL connection for MO message transfer;
- forming of the RP-DATA message, containing the SMS-TPDU;
- transfer of the RP-DATA message as an RPDU in an MNSMS-EST-Req.

The purpose of this service is to relay the SMS-TPDU from the mobile station to the peer entity in the MSC.

3.3.1.2 SM-RL-DATA-INDication

An indication used by the SMR entity to pass the SMS-TPDU and necessary control information of a received RP-DATA message to SM-TL.

3.3.1.3 SM-RL-MEMORY-AVAILABLE-REQuest

When received without a parameter, this is a request from the SM-TL entity to pass the necessary control information to SM-RL; it implies:

- establishment of an SM-RL-connection for transfer of the notification to the network that the mobile has memory available to receive one or more short messages;
- forming the RP-SM-MEMORY-AVAILABLE message; and
- transfer of the RP-SM-MEMORY-AVAILABLE message as an RPDU in an MNSMS-EST-Req.

The SM-TL entity may abort the transmission of an RP-SM-MEMORY-AVAILABLE message by use of a SM-RL-MEMORY-AVAILABLE-REQuest with the added parameter, SMS-MEM-NOTIF-ABORT, being present. This parameter is, of course, defined only on the interface between the SM-TL and SMR entities within the mobile station. Use of this request with the added parameter will have no effect on messages already given to the lower layers for transmission, but will only abort retransmission of the RP-SM-MEMORY-AVAILABLE message by the SMR entity.

3.3.1.4 SM-RL-REPORT-REQest

A request used by the SM-TL to relay the RP-ACK or RP-ERROR message from the mobile station to the network. This implies transfer of the RP-ACK or RP-ERROR message as an RPDU in an MNSMS-DATA-Req.

3.3.1.5 SM-RL-REPORT-INDication

An indication used by the SMR entity to pass an acknowledgement (RP-ACK) or error information to SM-TL. The error information may be local or relayed by the RP-ERROR message; it consists of an appropriate cause and optionally extended diagnostic information.

3.3.2 Definition of primitives on the network side

This subclause defines the service primitives used on the network side.

Table 3.4/3GPP TS 24.011 gives an overview of the service primitives and linked main parameter. All SM-RL service primitives defined in this subclause are passed on an SM-RL-connection.

Table 3.4/3GPP TS 24.011: SM-RL service primitives on the network side

SERVICE PRIMITIVES		PARAMETER
NAME	TYPE	
SM-RL-DATA-	Req	MT SMS-TPDU
	Ind	MO SMS-TPDU
SM-RL-MEMORY AVAILABLE	Ind	None
SM-RL-REPORT-	Req	See subclause 3.3.2.4
	Ind	See subclause 3.3.2.5

3.3.2.1 SM-RL-DATA-REQuest

A request from RL to pass the SMS-TPDU to SM-RL; it implies:

- establishment of a SM-RL-connection for MT message transfer;
- forming of the RP-DATA message, containing the SMS-TPDU; and
- transfer of the RP-DATA message as an RPDU in an MNSMS-EST-Req.

The purpose of this service is to relay the SMS-TPDU from the MSC to the peer entity in the mobile station.

3.3.2.2 SM-RL-DATA-INDication

An indication used by the SMR entity to pass the SMS-TPDU of a received RP-DATA message to RL.

3.3.2.3 SM-RL-MEMORY-AVAILABLE-INDication

An indication used by the SMR entity to pass to RL the notification to the network that the mobile has memory available to receive one or more short messages.

3.3.2.4 SM-RL-REPORT-REQuest

A request used by RL (the network interworking function) to relay the RP-ACK or RP-ERROR message from the network to the mobile station. This implies transfer of the RP-ACK or RP-ERROR message as an RPDU in an MNSMS-DATA-Req.

3.3.2.5 SM-RL-REPORT-INDication

An indication used by the SMR entity to pass an acknowledgement (RP-ACK) or error information to RL. The error information may be local or relayed by the RP-ERROR message.

4 [Void]

5 CM-procedures

5.1 General

This clause describes the procedures used by the SMC entity on the Connection Management sublayer. An SMC entity communicates with a corresponding peer entity using an MM-connection for CS GSM/UMTS or the LLC layer for GPRS in GSM or the GMM-connection in for PS in UMTS.

Multiple MM-connections may be established at the same time, allowing parallel transactions. The description of the procedures is related to one single transaction.

For circuit switched service, the CM-procedures described can only be performed if an MM-connection has been established between the mobile station and the network.

For GPRS, no connection has to be established, and thus the CM procedures for GPRS reflect this. Detailed SDL diagrams for SMC entities are contained in annex B.

5.2 Short Message Control states

The state transition diagrams for the MO and MT SMC entities on both the MS side and network side are contained in annex B.

5.2.1 SMC-CS states at the MS side of the radio interface

5.2.1.1 Mobile Originating Case

The states described in this clause are for an SMC entity in an MS handling mobile originating short message transfer and notification to the network that the mobile has memory available to receive one or more short messages (referred to below as "notification").

5.2.1.1.1 MO-Idle (State 0)

This state exists when the MO-SMC entity is in idle mode, or when an MO short message transfer or notification ends in a normal or abnormal way.

5.2.1.1.2 MO-MM-connection pending (State 1)

This state exists when the MO-SMC has requested the establishment of an MM-connection.

5.2.1.1.3 MO-Wait for CP-ACK (State 2)

This state exists after the MO-SMC has initiated the transfer of a CP-DATA message.

5.2.1.1.4 MO-MM-connection established (State 3)

This state exists when the MO-SMC has:

- received the acknowledgement, CP-ACK; or
- received the message CP-DATA (including sending of the associated CP-ACK).

5.2.1.2 Mobile Terminating case

The states described in this subclause are for an SMC entity in an MS handling mobile terminating short message transfer.

5.2.1.2.1 MT-Idle (State 0)

This state exists when the MT-SMC entity is in idle mode, or when a short message transfer ends in a normal or abnormal way.

5.2.1.2.2 MT-Wait for CP-ACK (State 2)

This state exists after the MT-SMC has initiated the transfer of a CP-DATA message.

5.2.1.2.3 MT-MM-connection established (State 3)

This state exists when the MT-SMC has:

- received the acknowledgement, CP-ACK; or
- received the message CP-DATA (including sending of the associated CP-ACK).

5.2.2 SMC-GP states at the MS side of the radio interface

5.2.2.1 Mobile Originating Case

The states described in this clause are for an SMC-GP entity in a GPRS MS handling mobile originating short message transfer and notification to the network that the mobile has memory available to receive one or more short messages (referred to below as "notification").

5.2.2.1.1 MO-Idle (State 0)

This state exists when the MO-SMC entity is in idle mode, or when an MO short message transfer or notification ends in a normal or abnormal way.

5.2.2.1.2 MO-GMM-connection pending (State 1) (UMTS only)

This state exists when the MO-SMC has requested the establishment of an PS signalling connection.

5.2.2.1.3 MO-Wait for CP-ACK (State 2)

This state exists after the MO-SMC has initiated the transfer of a CP-DATA message.

5.2.2.1.4 MO-Wait for CP-Data (State 3)

This state exists when the MO-SMC has received the acknowledgement, CP-ACK.

5.2.2.2 Mobile Terminating case

The states described in this subclause are for an SMC-GP entity in an GPRS MS handling mobile terminating short message transfer.

5.2.2.2.1 MT-Idle (State 0)

This state exists when the MT-SMC entity is in idle mode, or when a short message transfer ends in a normal or abnormal way.

5.2.2.2.2 MT-Wait for RP-ACK (State 1)

This state exists after the MT-SMC has received the message CP-DATA (including sending of the associated CP-ACK)

5.2.2.2.3 MT-Wait for CP-ACK (State 2)

This state exists when the MT-SMC has initiated the transfer of the CP DATA message.

5.2.3 SMC-CS states at the network side of the radio interface

5.2.3.1 Mobile Originating Case

The states described in this subclause are for an SMC entity in an MSC handling both mobile originating short message transfer and notification to the network that the mobile has memory available to receive one or more short messages (referred to below as "notification").

5.2.3.1.1 MO-Idle (State 0)

This state exists when the MO-SMC entity is in idle mode, or when a short message transfer or notification ends in a normal or abnormal way.

5.2.3.1.2 MO-Wait for CP-ACK (State 2)

This state exists after the MO-SMC has initiated the transfer of a CP-DATA message.

5.2.3.1.3 MO-MM-connection established (State 3)

This state exists when the SMC has:

- received the acknowledgement, CP-ACK; or
- received the message CP-DATA (including sending of the associated CP-ACK).

5.2.3.2 Mobile Terminating Case

The states described in this subclause are for an SMC entity in an MSC handling mobile terminating short message transfer.

5.2.3.2.1 MT-Idle (State 0)

This state exists when the MT-SMC entity is in idle mode, or when a short message transfer ends in a normal or abnormal way.

5.2.3.2.2 MT-MM-connection pending (State 1)

This state exists when the MT-SMC has requested an MM-connection for mobile terminating short message transfer.

5.2.3.2.3 MT-Wait for CP-ACK (State 2)

This state exists after the SMC has initiated the transfer of a CP-DATA message.

5.2.3.2.4 MT-MM-connection established (State 3)

This state exists when the SMC has:

- received the acknowledgement, CP-ACK; or
- received the message CP-DATA (including sending of the associated CP-ACK).

5.2.4 SMC-GP states at the network side of the radio interface

5.2.4.1 Mobile Originating Case

The states described in this subclause are for an SMC-GP entity in an SGSN handling both mobile originating short message transfer and notification to the network that the mobile has memory available to receive one or more short messages (referred to below as "notification").

5.2.4.1.1 MO-Idle (State 0)

This state exists when the MO-SMC entity is in idle mode, or when a short message transfer or notification ends in a normal or abnormal way.

5.2.4.1.2 MO-Wait for RP-ACK (State 1)

This state exists after the MO-SMC has received the message CP-DATA (including sending of the associated CP-ACK).

5.2.4.1.3 MO-Wait for CP-ACK(State 2)

This state exists when the SMC hasreceived the RP acknowledgement, RP-ACK

5.2.4.2 Mobile Terminating Case

The states described in this subclause are for an SMC-GP entity in an SGSN handling mobile terminating short message transfer.

5.2.4.2.1 MT-Idle (State 0)

This state exists when the MT-SMC entity is in idle mode, or when a short message transfer ends in a normal or abnormal way.

5.2.4.2.2 MT-Wait for CP-ACK (State 1)

This state exists after the SMC has initiated the transfer of a CP-DATA message.

5.2.4.2.3 MT-Wait for CP DATA (State 2)

This state exists when the SMC has received the acknowledgement, CP-ACK.

5.3 Short Message Control procedures

The procedures needed for short message control are:

- connection establishment procedures;
- RP Data Unit (RPDU) transfer procedures;
- connection release procedures; and
- procedures for abnormal cases.

The procedures of subclause 5.3 are described with respect to one particular instance of an SMC entity. Different SMC entities are identified by their Transaction Identifier. Messages with Transaction Identifiers that do not correspond to this particular instance of the SMC entity are not treated by it.

5.3.1 MM-connection establishment for circuit switched service

When an SMC entity is in the Idle state and transfer of an RPDU is requested, the peer to peer connection between the MM-sublayers in the MS and the network (MSC) has to be established.

The SMC entity on the originating side requests the MM-sublayer to establish an MM-connection, and enters the MM-Connection Pending state.

After completion of the MM-connection establishment, a confirmation is given to the originating side to indicate that the MM sublayer is ready for RPDU transfer.

The MM-connection establishment is indicated to the SMC entity at the destination side when the CP-DATA message has been received by the MM-sublayer (in line with 3GPP TS 24.008). The destination side SMC entity then sends a CP-ACK and enters the MM-Connection Established state.

5.3.2.1 RPDU transfer for circuit switched service

In GSM, when an SMC entity in the MM-Connection Pending state is informed that an MM-connection has been established, the SMC entity forwards the CP-DATA message containing the RPDU, sets the timer TC1* and enters the Wait for CP-ACK state.

In UMTS, when an SMC-GP entity in the MS side is in the Idle state and transfer of an RPDU is requested, the SMC-GP entity on the originating side requests the MM-sublayer to establish an PS signalling connection, and enters the GMM-Connection Pending state.

In UMTS, in the MS, after completion of the PS signalling connection establishment, a confirmation is given to the originating side to indicate that the MM sublayer is ready for RPDU transfer.

In UMTS, in the MS, after confirmation of the PS signalling connection establishment, , the SMC-GP entity on the originating side forwards the CP-DATA message to the GMM sublayer. This contains the RPDU, and also the SMC-GP entity sets the timer TC1* and enters the Wait for CP-ACK state.

In UMTS, when an SMC-GP entity in the network side is in Idle state and transfer of an RPDU is requested, the SMC-GP entity on the originating side forwards the CP-DATA message to the GMM sublayer. This contains the RPDU, and also the SMC-GP entity sets the timer TC1* and enters the Wait for CP-ACK state.

The value of TC1* may vary with the length of the CP-DATA message and the channel type that is being used for its transmission. However, the value of TC1* shall be sufficiently great to allow the lower layers to transmit the CP-DATA and CP-ACK messages and to allow for some retransmissions of layer 2 frames.

If an SMC entity in the Wait for CP-ACK state gets an indication that the CP-DATA message has probably been lost (e.g. due to dedicated channel assignment, hand over, assignment failure, hand over failure, or a SAPI 3 data link failure) then, as an implementation option, that SMC entity may reduce the time until expiry of TC1*.

If the timer TC1* expires in the Wait for CP-ACK state, the CP-DATA message is retransmitted and the state Wait for CP-ACK is re-entered. The maximum number of CP-DATA message retransmissions is an implementation option but shall be either 1, 2 or 3. If the timer TC1* expires after the maximum number of retransmission attempts, an error indication is passed to SM-RL and an MM-connection release request is passed to the MM-sublayer. The Idle state is then entered.

On receipt of the CP-ACK message in the Wait for CP-ACK state, the SMC resets the timer TC1* and enters the MM-Connection Established state.

In GSM, when receiving a CP-DATA message in the MM-Connection Established state, the SMC entity checks the parameters relevant to the CP protocol. If these are valid, the RPDU is passed to the SM-RL, the CP-ACK message is sent and the state MM-Connection Established is re-entered.

In UMTS, when receiving a CP-DATA message from the GMM sublayer, the SMC-GP entity checks the parameters relevant to the CP protocol. If these are valid, the RPDU is passed to the SM-RL, the CP-ACK message is sent.

If an SMC entity in the Idle state is unable to accept a CP-DATA message, it sends a CP-ERROR message followed by an MM-connection release request and then enters the Idle state.

When receiving a MNSMS-DATA-Req primitive in the MM-Connection Established state, the SMC entity forwards a CP-DATA message containing the RPDU to the MM-sublayer, sets the timer TC1* and enters the Wait for CP-ACK state.

5.3.2.2 RPDU transfer for GPRS

When an SMC-GP entity is in the Idle state and transfer of an RPDU is requested, the SMC-GP entity on the originating side forwards the CP-DATA message to the LLC sublayer. This contains the RPDU, and also the SMC-GP entity sets the timer TC1* and enters the Wait for CP-ACK state.

The value of TC1* may vary with the length of the CP-DATA. However, the value of TC1* shall be sufficiently great to allow the lower layers to transmit the CP-DATA and CP-ACK messages and to allow for some re-transmissions of layer 2 frames.

If an SMC entity in the Wait for CP-ACK state gets an indication that the CP-DATA message has probably been lost then, as an implementation option, that SMC-GP entity may reduce the time until expiry of TC1*.

If the timer TC1* expires in the Wait for CP-ACK state, the CP-DATA message is retransmitted and the state Wait for CP-ACK is re-entered. The maximum number of CP-DATA message re-transmissions is an implementation option but shall be either 1, 2 or 3. If the timer TC1* expires after the maximum number of retransmission attempts, an error indication is passed to SM-RL. The Idle state is then entered.

On receipt of the CP-ACK message in response to the CP-DATA (RP DATA) message in the Wait for CP-ACK state, the SMC-GP resets the timer TC1* and enters the Wait for CP DATA state.

On receipt of the CP-ACK message in response to the CP-DATA (RP ACK) message in the Wait for CP-ACK state, the SMC-GP resets the timer TC1* and enters the Idle State.

When receiving a CP-DATA message form the LLC sublayer, the SMC-GP entity checks the parameters relevant to the CP protocol. If these are valid, the RPDU is passed to the SM-RL, the CP-ACK message is sent.

If an SMC entity in the Idle state is unable to accept a CP-DATA message, it sends a CP-ERROR message and then enters the Idle state.

5.3.3 Release of MM and CM connections

With the exception of error situations, release of the MM and CM connection is controlled by the SM-RL.

When an SMC entity in the Wait for CP-ACK state receives a release request from SM-RL, this request is stored until the next state (either MM Connection Established or Idle) is entered. If the Idle state is entered, the request is discarded. If the MM Connection Established state is entered, or if the SMC entity receives a release request from SM-RL in this state, an MM-connection release request is sent to the MM-sublayer and the SMC entity enters the Idle state.

5.3.4 Abnormal cases

Abnormal cases that shall be handled by the SMC entity in any state can be classified into five cases:

- **Upper Layer Abort:** Errors occurring in the SM-RL may cause the SM-RL to send an MNSMS-ABORT Request to the SMC entity.
- **CP-Layer Abort:** Errors occurring within the SMC entity itself may require termination of all activities related to that transaction identifier.
- **Lower Layer Abort:** Errors occurring within the layers beneath the CP-layer may cause an MMSM-ERROR Indication or a GMMSMS-ERROR Indication to be sent to the SMC entity.
- **CP-Layer Protocol Errors:** Errors occurring within the protocol exchange between the SMC entities may result in the sending of a CP-ERROR message between the entities.
- **Lower Layer Release:** Events occurring within the layers beneath the CP layer may cause an MMSM-REL Indication to be sent to the SMC entity.

When the CM-sublayer in the network receives an Upper Layer Abort, it may form and send the CP-ERROR message to release the connection. Irrespective of whether or not the CP-ERROR message was sent, an MM-connection release request, without indication of release cause, is passed to the MM-sublayer. The SMC entity in the network then enters the Idle state.

When the CM-sublayer in the MS receives an Upper Layer Abort and if the MM connection exists, it shall form and send the CP-ERROR message. Irrespective of whether or not the CP-ERROR message was sent, an MM-connection release request, without indication of release cause, is passed to the MM-sublayer. The SMC entity in the mobile station then enters the Idle state.

In the case of a CP-Layer Abort, an error indication is passed to SM-RL. If possible, a CP-ERROR message is sent to the partner SMC entity to indicate the error situation. Then the SMC entity enters the Idle state.

In the case of a Lower Layer Abort, the SMC entity passes an error indication to SM_RL, an MM-connection release request is passed to the MM-sublayer, and the SMC entity immediately enters the Idle state.

In the case of the reception of a CP-ERROR message from the partner SMC entity, an error indication is passed to SM-RL, an MM-connection release request, without indication of release cause, is passed to the MM-sublayer, and the SMC entity enters the Idle state.

In the case of a lower layer release, the SMC entity passes an MNSMS-ERROR Indication to SM-RL and then enters the Idle state.

In all cases, if the timer TC1* is running, it is reset.

It is possible that the CP-ACK of a short message transfer might not be received (e.g. due to hand over). If the first CP-ACK (acknowledging the CP-DATA that carried the first RPDU) is not received the reception of CP-DATA may be interpreted as the reception of the awaited CP-ACK and CP-DATA message.

5.4 Concatenating short message or notification transfers

If an entity has more than one short message or notification to send, then it is useful to maintain the Radio Resource (RR) connection in between transfers for circuit switched service. For mobile terminated short messages this is simple because the network decides when, and whether, to release the RR connection. However, for mobile originated transfers, the network does not know whether or not the mobile has more messages to transfer.

If another short message or a memory available notification is to be sent, an originating SMR entity in the MS may choose to continue to use the same RR connection. When the MS chooses to use the same RR connection, then:

- the MS shall transmit a CM SERVICE REQUEST for the new CM connection before the final CP-ACK (e.g. the one that acknowledges the CP-DATA that carried the RP-ACK) for the old MM connection is transmitted;
- before transmission of the first CP-DATA on the new MM connection, the MS shall transmit the CP-ACK for the old MM connection;
- the Transaction Identifier used on the new MM connection shall be different to that used on the old MM connection; and
- the MS shall not initiate establishment of the new MM connection before the final CP-DATA (e.g. the one carrying the RP-ACK) has been received.

NOTE: When an MS sends successive memory available notifications and/or mobile originated short messages on different RR connections, the MS is strongly recommended to use different Transaction Identifiers for the old and new MM connections.

It is possible that the final CP-ACK of a short message transfer may not be received (e.g. due to transmission errors and/or hand overs). For mobile terminated transfers, if the CP-ACK is lost, the reception of a CP-DATA with a different transaction identifier and carrying an RPDU shall be interpreted as the implicit reception of the awaited CP-ACK followed by the reception of the new CP-DATA message. For mobile originated transfers, if the CP-ACK is lost, the reception of a CM SERVICE REQUEST followed by a CP-DATA with a different transaction identifier and carrying an RPDU shall be interpreted as the implicit reception of the awaited CP-ACK followed by the reception of the new CP-DATA message.

6 SM-RL-procedures

6.1 General

This clause describes the procedures used by the SMR entity for short message and notification support on the Short Message Relay Layer. An SMR entity communicates with a corresponding peer entity using a CM-connection.

Multiple CM-connections may be established at the same time, allowing parallel transactions. There is a functional one to one relation between the SMR entity and the SMC entity of the CM-sublayer. The descriptions of the procedures are related to one single transaction.

The RL-procedures described in this subclause can only be performed if a CM-connection has been established between the mobile station and the network. Detailed SDL-diagrams for short message control on SM-RL are contained in annex D.

6.2 Transition states of SMR entity

The state transition diagram for the SMR entities on both MS-side and network side are contained in annex D.

6.2.1 SMR-states at the MS-side of the radio interface

The states described in this subclause are for a SMR entity in a MS, handling mobile originating- and mobile terminating short messages and notification transfer.

6.2.1.1 Idle (State 0)

This state exists when the SMR entity is in idle mode, or when a short message or notification transfer ends in a normal or abnormal way.

6.2.1.2 Wait for RP-ACK (State 1)

This state exists for mobile originating short message or notification transfer when the SMR has passed the RP-DATA or RP-SMMA to the SMC entity and set the timer TR1M.

6.2.1.3 Wait for RETRANS TIMER (State 4)

This state exists for memory available notification when the SMR is waiting to retransmit the RP-SMMA message. Timer TRAM has been set. The possibility of an abort of the sending of the memory available notification by the SM-TL exists. No underlying connection exists.

6.2.2 SMR-states at the network side of the radio interface

The states described in this subclause are for a SMR entity in a MSC, handling mobile originating- and mobile terminating short message and notification transfer.

6.2.2.1 Idle (State 0)

This state exists when the SMR entity is in idle mode, or when a short message transfer or notification end in a normal or abnormal way.

6.2.2.2 Wait for RP-ACK (State 1)

This state exists for a mobile terminating short message transfer when the SMR has passed the RP-DATA message to the SMC entity and set the timer TR1N.

6.2.2.3 Wait to send RP-ACK (State 3)

The SMR entity will enter this state after passing a received RP-DATA or RP-SMMA message to RL and setting the timer TR2N.

6.3 Short Message Relay procedures

The procedures needed for short message and notification relaying are:

- TP Data Unit (TPDU) relay procedures;
- notification relay procedures;
- procedures for abnormal cases.

6.3.1 TPDU relaying

When the SMR entity is in the Idle state and receives a request from SM-TL to relay a TPDU, it forms and transfers the RP-DATA message (containing the TPDU), sets the timer TR1* and enters the state Wait for RP-ACK.

Retransmission of RP data units by the CM-sublayer is described in clause 5.

When the SMR entity is in the "Wait for RP-ACK" state, the following situations may occur:

a) reception of an RP-ACK or RP-ERROR message (containing the same reference number as the transmitted RP-DATA message);

b) reception of an error indication from the CM-sublayer;

c) the timer TR1* expires.

In case a) or b), the timer TR1* is reset, a report indication is passed to SM-TL, a request to release the CM-connection is passed to CM-sublayer, and the SMR entity enters the Idle state.

In case c), a request to abort the CM-connection is passed to the CM-sublayer, a report indication is passed to SM-TL, and the SMR entity enters the Idle state.

When the SMR entity is in the Idle state and receives an MNSMS-EST-Ind containing a valid RP-DATA message, it passes the SMS-TPDU to the SM-TL, starts timer TR2*, and enters the state "Wait to Send RP-ACK".

When the SMR entity is in the state "Wait to Send RP-ACK" and the SMR entity receives the SM-RL-Report-Request, the timer TR2* is reset, the RP-message (RP-ACK or RP-ERROR) is generated and relayed to the peer entity, a CM-connection release request is passed to the CM-sublayer, and the SMR entity enters the Idle state.

When the SMR entity is in the state "Wait to Send RP-ACK" and the SMR entity receives an error indication from the CM-sublayer, the timer TR2* is reset, a report indication is passed to the SM-TL and the SMR entity enters the Idle state.

When the SMR entity is in the state "Wait to send RP-ACK" and the timer TR2* expires, the SMR entity passes a CM-connection abort request to the CM-sublayer, a report indication is passed to the SM-TL, and the SMR entity enters the Idle state.

6.3.2 [Void]

6.3.3 Notification relaying

6.3.3.1 MS side

6.3.3.1.1 Idle state

When the SMR entity in the MS in the Idle state receives a request from the SM-TL to relay a notification to the network, it forms and transfers the RP-SMMA message, starts timer TR1M, and enters the state Wait for RP-ACK.

6.3.3.1.2 Wait for RP-ACK state

When the SMR entity in the MS is in the Wait for RP-ACK state and it receives either:

- an RP-ACK (containing the same reference number as the last transmitted RP-SMMA message); or
- an RP-ERROR (containing the same reference number as the last transmitted RP-SMMA message) with a permanent failure indication; or
- an error indication from the CP-sublayer;

then the MS shall reset timer TR1M, pass a report indication to SM-TL, give a CM-connection release request to the CM-sublayer, and enter the Idle state. If set, timer TRAM and the RETRANS flag are also reset.

When the SMR entity in the MS is in the Wait for RP-ACK state and either:

- it receives an RP-ERROR (containing the same reference number as the last transmitted RP-SMMA message) with a temporary failure indication; or
- timer TR1M expires;

then the MS shall examine the RETRANS flag:

- if the RETRANS flag is set (i.e. no more transmissions of the RP-SMMA message are permitted) then:
  - the MS shall pass a report indication to SM-TL, give a CM-connection release request to the CM-sublayer, reset the RETRANS flag, reset TR1M, and enter the Idle state.
- If the RETRANS flag is not set (i.e. at least another transmission of the RP-SMMA message is currently permitted) then:
  - the MS shall give a CM-connection release request to the CM-sublayer, set the RETRANS flag, reset TR1M, start timer TRAM and enter the Wait for Retrans Timer state.

When the SMR entity in the MS is in the Wait for RP-ACK state and it receives an SM-RL-MEMORY-AVAILABLE-Req (SMS-MEM-NOTIF-ABORT) primitive, then the MS shall set the RETRANS flag and reenter the Wait for RP-ACK state.

6.3.3.1.3 Wait for RETRANS Timer state

When the SMR entity in the MS is in the Wait for Retrans Timer state and timer TRAM expires then, the MS shall form and transfer an RP-SMMA message, start timer TR1M, and enter the state Wait for RP-ACK. The RP-Message Reference in this RP-SMMA message shall be different from that in the previous RP-SMMA message.

When the SMR entity in the MS is in the Wait for Retrans Timer state and it receives an SM-RL-MEMORY-AVAILABLE-Req (SMS-MEM-NOTIF-ABORT) primitive, then the MS shall reset the RETRANS flag, reset timer TRAM, pass a report indication to SM-TL, and enter the Idle state.

6.3.3.2 Network side

6.3.3.2.1 Idle state

When the SMR entity in the network is in the Idle state and receives an MNSMS-EST-Ind containing a valid RP-SMMA message, it passes the SMS-TPDU to the SM-TL, starts timer TR2N, and enters the state "Wait to send RP-ACK".

6.3.3.2.2 Wait to Send RP-ACK state

When the SMR entity in the network is in the state "Wait to Send RP-ACK" and the SMR entity receives the SM-RL-Report-Request, timer TR2N is reset, the RP-message (RP-ACK or RP-ERROR) is generated and relayed to the MS, a CM-connection release request is passed to the CM-sublayer, and the SMR entity enters the Idle state.

When the SMR entity in the network is in the state "Wait to Send RP-ACK" and the SMR entity receives an error indication from the CM-sublayer, timer TR2N is reset, a report indication is passed to the SM-TL and the SMR entity enters the Idle state.

When the SMR entity in the network is in the state "Wait to Send RP-ACK" and the timer TR2N expires, the SMR entity passes a CM-connection abort request to the CM-sublayer, a report indication is passed to the SM-TL, and the SMR entity enters the Idle state.

6.3.4 Abnormal cases

Format errors etc.:

If the SMR entity upon receipt of an RP-DATA or RP-SMMA message detects an erroneous condition which it can act on, (e.g. format errors, invalid parameters etc.) it shall return an RP-ERROR message with an appropriate cause value and possibly extended diagnostic information, release or abort the CM-connection, and enter the Idle state.

7 Message functional definitions and content

7.1 General

The notation used is as used in 3GPP TS 24.008/clause 9, and each definition includes:

a) A brief description of the message direction and use.

b) A table listing the information elements in the order of their appearance in the message. For each information element the table indicates:

1) A reference to the (sub)clause/Technical Specification describing the information element.

2) The presence requirement indication (M, C, or O) for the IE as defined in 3GPP TS 24.007.

3) The format of the information element (T, V, TV, LV, TLV) as defined in 3GPP TS 24.007.

4) The length of the information element (or permissible range of lengths), in octets, in the messages.

7.2 Messages for short message or notification transfer on CM

This subclause describes the functional definition and content of the messages sent between two SMC entities.

There are three messages defined: CP-DATA, CP-ACK and CP-ERROR.

7.2.1 CP-DATA

The CP-DATA message is sent between an MSC and an MS, in both directions. The message contains the user data to be relayed between the CM-users, and associated parameters. See table 7.1/ 3GPP TS 24.011.

Table 7.1/3GPP TS 24.011: CP-DATA message content

	Information element	Reference	Presence	Format	Length
	Protocol discriminator	3GPP TS 24.007	M	V	1/2 octet
	Transaction identifier	3GPP TS 24.007	M	V	1/2 octet
	Message type	Subclause 8.1.3	M	V	1 octet
	CP-User data	Subclause 8.1.4.1	M	LV	≤ 249 octets

7.2.2 CP-ACK

The CP-ACK message is sent between an MSC and an MS, in both directions, and is used to acknowledge the reception of a CP-DATA message.

See table 7.2/3GPP TS 24.011.

Table 7.2/3GPP TS 24.011: CP-ACK message content

	Information element	Reference	Presence	Format	Length
	Protocol discriminator	3GPP TS 24.007	M	V	1/2 octet
	Transaction identifier	3GPP TS 24.007	M	V	1/2 octet
	Message type	Subclause 8.1.3	M	V	1 octet

7.2.3 CP-ERROR

The CP-ERROR message is sent between an MSC and an MS, in both directions, and used to convey error information. See table 7.3/3GPP TS 24.011.

Table 7.3/3GPP TS 24.011: CP-ERROR message content

	Information element	Reference	Presence	Format	Length
	Protocol discriminator	3GPP TS 24.007	M	V	1/2 octet
	Transaction identifier	3GPP TS 24.007	M	V	1/2 octet
	Message type	Subclause 8.1.3	M	V	1 octet
	CP-Cause	Subclause 8.1.4.2	M	V	1 octet

7.3 Messages for short message and notification transfer on SM-RL

This subclause describes the functional definition and content of the messages sent between two SMR entities.

There are 4 messages defined: RP-DATA, RP-SMMA, RP-ACK and RP-ERROR.

7.3.1 RP-DATA

A phase 2 entity shall not reject a RP-DATA message where both address elements have a length greater than 0.

7.3.1.1 RP-DATA (Network to Mobile Station)

This message is sent in MSC -> MS direction. The message is used to relay the TPDUs. The information elements are in line with 3GPP TS 23.040. See table 7.4/3GPP TS 24.011.

Table 7.4/3GPP TS 24.011: RP-DATA message content

	Information element	Reference	Presence	Format	Length
	RP-Message Type	Subclause 8.2.2	M	V	3 bits
	RP-Message Reference	Subclause 8.2.3	M	V	1 octet
	RP-Originator Address	Subclause 8.2.5.1	M	LV	1-12 octets
	RP-Destination Address	Subclause 8.2.5.2	M	LV	1 octet
	RP-User Data	Subclause 8.2.5.3	M	LV	≤ 233 octets

7.3.1.2 RP-DATA (Mobile Station to Network)

This message is sent in MS -> MSC direction. The message is used to relay the TPDUs. The information elements are in line with 3GPP TS 23.040. See table 7.5/3GPP TS 24.011.

Table 7.5/3GPP TS 24.011: RP-DATA message content

	Information element	Reference	Presence	Format	Length
	RP-Message Type	Subclause 8.2.2	M	V	3 bits
	RP-Message Reference	Subclause 8.2.3	M	V	1 octet
	RP-Originator Address	Subclause 8.2.5.1	M	LV	1 octet
	RP-Destination Address	Subclause 8.2.5.2	M	LV	1-12 octets
	RP-User Data	Subclause 8.2.5.3	M	LV	≤ 233 octets

7.3.2 RP-SMMA

This message is sent by the mobile station to relay a notification to the network that the mobile has memory available to receive one or more short messages. The information elements are in line with 3GPP TS 23.040. See table 7.6/3GPP TS 24.011.

Table 7.6/3GPP TS 24.011: RP-SMMA message content

	Information element	Reference	Presence	Format	Length
	RP-Message Type	Subclause 8.2.2	M	V	3 bits
	RP-Message Reference	Subclause 8.2.3	M	V	1 octet

7.3.3 RP-ACK

This message is sent between the MSC and the mobile station in both directions and used to relay the acknowledgement of a RP-DATA or RP-SMMA message reception. The information elements are in line with 3GPP TS 23.040. See table 7.7/3GPP TS 24.011.

Table 7.7/3GPP TS 24.011: RP-ACK message content

IEI	Information element	Reference	Presence	Format	Length
	RP-Message Type	Subclause 8.2.2	M	V	3 bits
	RP-Message Reference	Subclause 8.2.3	M	V	1 octet
41	RP-User Data	Subclause 8.2.5.3	O	TLV	≤ 234 octets

7.3.4 RP-ERROR

This message is sent between the MSC and the mobile station in both directions and used to relay an error cause from an erroneous short message or notification transfer attempt. The information elements are in line with 3GPP TS 23.040. See table 7.8/3GPP TS 24.011.

The contents of the cause field are given in subclause 8.2.5.4.

Table 7.8/3GPP TS 24.011: RP-ERROR message content

IEI	Information element	Reference	Presence	Format	Length
	RP-Message Type	Subclause 8.2.2	M	V	3 bits
	RP-Message Reference	Subclause 8.2.3	M	V	1 octet
	RP-Cause	Subclause 8.2.5.4	M	LV	2-3 octets
41	RP-User Data	Subclause 8.2.5.3	O	TLV	≤ 234 octets

8 Message format and information elements coding

8.1 CP-messages

8.1.1 General

The message format and information elements coding is in line with 3GPP TS 24.007 and 3GPP TS 24.008.

The message shall consist of the following parts:

a) protocol discriminator;

b) transaction identifier;

c) message type;

d) other required information elements.

This organization is illustrated in the example shown in figure 8.1/3GPP TS 24.011.

8	7	6	5	4	3	2	1
Transaction Id.				Protocol Discr.			
Message Type							
Other Information Elements							

Figure 8.1/3GPP TS 24.011

8.1.2 Protocol Discriminator and Transaction Identifier

The Protocol Discriminator and Transaction Identifier is described in 3GPP TS 24.007.

8.1.3 Message type

The purpose of the message type, together with the protocol discriminator, is to identify the function of the message being sent. The coding of message types is shown in table 8.1/3GPP TS 24.011.

Table 8.1/3GPP TS 24.011: Message types for short message and notification transfer on CM

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	1	CP-DATA
0	0	0	0	0	1	0	0	CP-ACK
0	0	0	1	0	0	0	0	CP-ERROR

8.1.4 Other required information elements

8.1.4.1 CP-User data element

The CP-User data element is used to carry the RPDU. It has an information element identifier, a length indicator and a data field. The data field will contain the RPDUs. The maximum length of the data field is 248 octets. The layout is indicated in figure 8.2/3GPP TS 24.011.

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	1	
	CP-User Data IEI							1 octet
Length indicator								1 octet
RPDU Maximum length 248 octets								? octet

Figure 8.2/3GPP TS 24.011: CP-User data element layout

8.1.4.2 CP-Cause element

This element is included in the CP-ERROR message, the layout is given in figure 8.3/3GPP TS 24.011. The error causes are listed in table 8.2/3GPP TS 24.011.

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	1	0	
	CP-Cause IEI							1 octet
0	Cause value							1 octet

Figure 8.3/3GPP TS 24.011: CP-Cause element layout

Table 8.2/3GPP TS 24.011: Content and coding of CP-Cause

Cause value	Cause nr.	Cause
7 6 5 4 3 2 1	#	
0 0 1 0 0 0 1	17	Network failure
0 0 1 0 1 1 0	22	Congestion
1 0 1 0 0 0 1	81	Invalid Transaction Identifier value
1 0 1 1 1 1 1	95	Semantically incorrect message
1 1 0 0 0 0 0	96	Invalid mandatory information
1 1 0 0 0 0 1	97	Message type non-existent or not implemented
1 1 0 0 0 1 0	98	Message not compatible with the short message protocol state
1 1 0 0 0 1 1	99	Information element non-existent or not implemented
1 1 0 1 1 1 1	111	Protocol error, unspecified
All other cause values shall be treated as cause number 111.		

8.2 RP-messages

8.2.1 General

The message shall consist of the following parts:

a) message type indicator;

b) message reference;

c) other required information elements.

This organization is illustrated in the example shown in figure 8.4/3GPP TS 24.011:

8	7	6	5	4	3	2	1
spare					MTI		
0	0	0	0	0			
Message reference							
Other Information Elements							

Figure 8.4/3GPP TS 24.011

8.2.2 Message type indicator (MTI)

The message type indicator, MTI, is a 3-bit field, located in the first octet of all RP-messages. The coding of the MTI is defined by table 8.3/3GPP TS 24.011.

Table 8.3/3GPP TS 24.011: Coding of Message Type Indicator

Bit value 3 2 1	**Direction**	**RP-Message**
0 0 0	ms -> n	RP-DATA
0 0 0	n -> ms	Reserved
0 0 1	ms -> n	Reserved
0 0 1	n -> ms	RP-DATA
0 1 0	ms -> n	RP-ACK
0 1 0	n -> ms	Reserved
0 1 1	ms -> n	Reserved
0 1 1	n -> ms	RP-ACK
1 0 0	ms -> n	RP-ERROR
1 0 0	n -> ms	Reserved
1 0 1	ms -> n	Reserved
1 0 1	n -> ms	RP-ERROR
1 1 0	ms -> n	RP-SMMA
1 1 0	n -> ms	Reserved
1 1 1	ms -> n	Reserved
1 1 1	n -> ms	Reserved

8.2.3 Message reference

The message reference field contains a sequence number in the range 0 through 255, and is used to link an RP-ACK message or RP-ERROR message to the associated (preceding) RP-DATA or RP-SMMA message transfer attempt.

8.2.4 [Void]

8.2.5 Other required information elements

8.2.5.1 Originator address element

In the case of MT transfer this element contains the originating Service Centre address.

The RP-Originator Address information element is coded as shown in figure 8.5/3GPP TS 24.011.

The RP-Originator Address is a type 4 information element. In the network to mobile station direction the minimum value of the length octet is 2 and the maximum value is 11. In the mobile station to network direction the value of the length octet of the element is set to 0.

8	7 6 5	4 3 2 1	
	RP-Originator Address IEI		octet 1
Length of RP-Originator Address contents			octet 2
1 ext	type of number	Numbering plan identification	octet 3
Number digit 2		Number digit 1	octet 4
Number digit 4		Number digit 3	octet 5
			:
			:

Figure 8.5/3GPP TS 24.011: RP-Originator Address information element

If the RP-Originator Address contains an odd number of digits, bits 5 to 8 of the last octet shall be filled with an end mark coded as "1111".

The contents of octets 3, 4, etc. are the same as those defined for the Called Party BCD Number IE defined in ~~GSM~~ 3GPP TS 04.08.

8.2.5.2 Destination address element

In the case of MO transfer, this element contains the destination Service Centre address.

The RP-Destination Address information element is coded as shown in figure 8.6/3GPP TS 24.011.

The RP-Destination Address is a type 4 information element. In the mobile station to network direction the minimum value of the length octet is 2 and the maximum value is 11. In the network to mobile station direction, the value of the length octet of the element is set to 0.

8	7 6 5	4 3 2 1	
	RP-Destination Address number IEI		octet 1
Length of RP-Destination Address contents			octet 2
1 ext	type of number	Numbering plan identification	octet 3
Number digit 2		Number digit 1	octet 4
Number digit 4		Number digit 3	octet 5
			:
			:

Figure 8.6/3GPP TS 24.011: RP-Destination Address information element

The number digit(s) in octet 4 precede the digit(s) in octet 5 etc. The number digit which would be entered first is located in octet 4, bits 1 to 4.

If the RP-Destination Address contains an odd number of digits, bits 5 to 8 of the last octet shall be filled with an end mark coded as "1111".

Since the information element contains the complete RP-Destination Address there is no need for an additional complete indication.

The contents of octets 3, 4, etc. are the same as those defined for the Called Party BCD Number IE defined in 3GPP TS 24.008.

8.2.5.3 RP-User data element

The RP-User data field contains the TPDU and is mandatory in a RP-DATA message. RP-User data is also optionally carried in an RP-Error message. In a RP DATA message, the element has a variable length, up to 233 octets, and in a RP ERROR and in a RP ACK message the length is up to 234 octets .

RP-User data in an RP-Error message is conveyed as diagnostic information within the "SM-DeliveryFailureCause" response to a MAP Forward-Short-Message procedure (see 3GPP TS 29.002). The diagnostic information may be sent in both directions, and shall always be forwarded by the MSC if it is received.

8	7	6	5	4	3	2	1	
	1	0	0	0	0	0	1	
0	RP-User Data IEI							1 octet
Length indicator								1 octet
TPDU Maximum length 232 octets								

Figure 8.7/3GPP TS 24.011: RP-User data element layout

8.2.5.4 RP-Cause element

This element is a variable length element always included in the RP-ERROR message, conveying a negative result of a RP-DATA message transfer attempt or RP-SMMA notification attempt. The element contains a cause value and optionally a diagnostic field giving further details of the error cause.

The coding of the cause value is given in table 8.4/3GPP TS 24.011. The mapping between error causes in 3GPP TS 24.011 and 3GPP TS 29.002 (MAP) is specified in 3GPP TS 23.040. Parameters included in the return error from MAP (e.g. System Failure) are mapped directly into the diagnostic field.

8	7	6	5	4	3	2	1	
	1	0	0	0	0	1	0	
0	RP-Cause IEI							1 octet
Length indicator								1 octet
0 ext	Cause value Cause value							1 octet
Diagnostic field								1 octet *

Figure 8.8/3GPP TS 24.011: RP-Cause element layout

Table 8.4/3GPP TS 24.011 (part 1): Cause values that may be contained in an RP-ERROR message in a mobile originating SM-transfer attempt

Cause value Class value	Cause number	Cause
7 6 5 4 3 2 1	#	
0 0 0 0 0 0 1	1	Unassigned (unallocated) number
0 0 0 1 0 0 0	8	Operator determined barring
0 0 0 1 0 1 0	10	Call barred
0 0 0 1 0 1 1	11	Reserved
0 0 1 0 1 0 1	21	Short message transfer rejected
0 0 1 1 0 1 1	27	Destination out of order
0 0 1 1 1 0 0	28	Unidentified subscriber
0 0 1 1 1 0 1	29	Facility rejected
0 0 1 1 1 1 0	30	Unknown subscriber
0 1 0 0 1 1 0	38	Network out of order
0 1 0 1 0 0 1	41	Temporary failure
0 1 0 1 0 1 0	42	Congestion
0 1 0 1 1 1 1	47	Resources unavailable, unspecified
0 1 1 0 0 1 0	50	Requested facility not subscribed
1 0 0 0 1 0 1	69	Requested facility not implemented
1 0 1 0 0 0 1	81	Invalid short message transfer reference value
1 0 1 1 1 1 1	95	Semantically incorrect message
1 1 0 0 0 0 0	96	Invalid mandatory information
1 1 0 0 0 0 1	97	Message type non-existent or not implemented
1 1 0 0 0 1 0	98	Message not compatible with short message protocol state
1 1 0 0 0 1 1	99	Information element non-existent or not implemented
1 1 0 1 1 1 1	111	Protocol error, unspecified
1 1 1 1 1 1 1	127	Interworking, unspecified
All other cause values shall be treated as cause number 41, "Temporary Failure".		

Table 8.4/3GPP TS 24.011 (part 2): Cause values that may be contained in an RP-ERROR message in a mobile terminating SM-transfer attempt

Cause value Class value	Cause number	Cause
7 6 5 4 3 2 1	#	
0 0 1 0 1 1 0	22	Memory capacity exceeded
1 0 1 0 0 0 1	81	Invalid short message transfer reference value
1 0 1 1 1 1 1	95	Semantically incorrect message
1 1 0 0 0 0 0	96	Invalid mandatory information
1 1 0 0 0 0 1	97	Message type non-existent or not implemented
1 1 0 0 0 1 0	98	Message not compatible with short message protocol state
1 1 0 0 0 1 1	99	Information element non-existent or not implemented
1 1 0 1 1 1 1	111	Protocol error, unspecified
All other cause values shall be treated as cause number 111, "Protocol error, unspecified".		

Table 8.4/3GPP TS 24.011 (part 3): Cause values that may be contained in an RP-ERROR message in a memory available notification attempt

Cause value	Cause	Cause	Cause
Class value	**number**	**type**	
7 6 5 4 3 2 1	#		
0 0 1 1 1 1 0	30	P	Unknown Subscriber
0 1 0 0 1 1 0	38	T	Network out of order
0 1 0 1 0 0 1	41	T	Temporary failure
0 1 0 1 0 1 0	42	T	Congestion
0 1 0 1 1 1 1	47	T	Resources unavailable, unspecified
1 0 0 0 1 0 1	69	P	Requested facility not implemented
1 0 1 1 1 1 1	95	P	Semantically incorrect message
1 1 0 0 0 0 0	96	P	Invalid mandatory information
1 1 0 0 0 0 1	97	P	Message type non-existent or not implemented
1 1 0 0 0 1 0	98	P	Message not compatible with short message protocol state
1 1 0 0 0 1 1	99	P	Information element non-existent or not implemented
1 1 0 1 1 1 1	111	P	Protocol error, unspecified
1 1 1 1 1 1 1	127	P	Interworking, unspecified
All other cause values are treated as cause number 41, "Temporary failure".			
Each cause is classified as "Temporary" or "Permanent", as indicated by T and P respectively in the cause type column.			

9 Handling of unknown, unforeseen, and erroneous protocol data

9.1 General

This subclause specifies procedures for handling of unknown, unforeseen, and erroneous protocol data by the receiving entity. These procedures are called "error handling procedures", but in addition to providing recovery mechanisms for error situations they define a compatibility mechanism for future extensions of the protocols.

Most error handling procedures are mandatory for the MS but optional for the network. Detailed error handling procedures in the network are implementation dependent and may vary from PLMN to PLMN.

In this subclause the following terminology is used:

- An IE is defined to be syntactically incorrect in a message if it contains at least one value defined as "reserved", or if its value part violates rules. However it is not a syntactical error that a type 4 IE specifies in its length indicator a greater length than defined.

- A message is defined to have semantically incorrect contents if it contains information which, possibly dependant on the state of the receiver, is in contradiction to the resources of the receiver and/or to the procedural part of TS 24.011.

9.2 CP Error Handling

Upon receiving a CP-ERROR message the SMC-CS entity (in any state) shall pass an error indication to SM-RL, pass an MM-connection release request to the MM-sublayer, and enter the Idle State.

After sending a CP-ERROR message the SMC-CS entity (in any state) shall pass an MM-connection release request to the MM sublayer and then enter the Idle State.

Upon receiving a CP-ERROR message the SMC-GP entity (in any state) shall pass an error indication to SM-RL and enter the Idle State.

After sending a CP-ERROR message the SMC-GP entity (in any state) shall enter the Idle State.

9.2.1 Message too short

When a message is received that is too short to contain a complete message type information element, that message shall be ignored, see 3GPP TS 24.007.

9.2.2 Unknown or unforeseen transaction identifier

The Mobile Station shall ignore a CP message (CP-DATA, CP-ACK, CP-ERROR) received with TI value "111". Whenever a CP-ACK message is received specifying a Transaction Identifier which is not associated with an active SM transfer, the mobile station shall discard the message and return a CP-ERROR message with cause #81, "Invalid Transaction Identifier" using the received Transaction Identifier, if an appropriate connection exists. The Mobile Station shall ignore a CP-ERROR message that is received specifying a Transaction Identifier which is not associated with an active SM transfer. The Mobile Station shall ignore a CP-DATA message that is received specifying a Transaction Identifier which is not associated with an active SM transfer and with transaction identifier flag set to "1".

The same procedures may apply to the network.

9.2.3 Unknown or unforeseen message type

If the Mobile Station receives a message with message type not defined for the PD or not implemented by the receiver, it shall ignore the message and return a CP-ERROR message with cause #97 "message type non-existent or not implemented", if an appropriate connection exists.

NOTE: A message type not defined for the PD in the given direction is regarded by the receiver as a message type not defined for the PD, see 3GPP TS 24.007.

If the Mobile Station receives a message not consistent with the protocol state, the Mobile Station shall ignore the message and return a CP-ERROR message with cause #98 "Message type not compatible with the short message protocol state", if an appropriate connection exists.

The network may follow the same procedures.

9.2.4 Non-semantical mandatory information element errors

When on receipt of a message:

- an "imperative message part" error; or

- a "missing mandatory IE" error.

is diagnosed or when a message containing a syntactically incorrect mandatory IE is received, the mobile station shall proceed as follows.

When the corresponding SM transfer is not seen as successfully transferred, i.e. the transaction is not completed, the mobile station shall ignore the message and return a CP-ERROR message with cause #96 "invalid mandatory information", if an appropriate connection exists.

When the SM transfer is seen as successfully transferred, the mobile station shall ignore the message and enter the Idle State.

In the case that the message received is a CP-ERROR message, the mobile station shall ignore the message and enter the Idle State.

The network may follow the applicable procedures defined in this subclause.

9.2.5 Messages with semantically incorrect contents

When a message with semantically incorrect contents is received, the foreseen reactions of the procedural part of 3GPP TS 24.011 are performed. If however no such reactions are specified, the mobile station shall proceed as follows:

- When the corresponding SM transfer is not seen as successfully transferred, the mobile station shall ignore the message and return a CP-ERROR message with cause value #95 "semantically incorrect message", if an appropriate connection exists.

- When the SM transfer is seen as successfully transferred, the mobile station shall ignore the message and enter the Idle State.

- In the case that the message received is a CP-ERROR message, the mobile station shall ignore the message and enter the Idle State.

The network may follow the same procedure.

9.3 RP Error Handling

Upon receiving or sending an RP-ERROR message the SMR entity shall behave as described in the procedural description in clause 6.

9.3.1 Message too short

When a message is received that is too short to contain a complete message type information element and Message Reference, that message shall be ignored.

9.3.2 Unknown or unforeseen Message Reference

Whenever any RP-ACK message is received specifying a Message Reference which is not associated with an active SM transfer, the mobile station shall discard the message and return an RP-ERROR message with cause #81, "Invalid short message transfer reference value" using the received Message Reference, if an appropriate connection exists.

When an RP-ERROR message is received specifying a Message Reference which is not associated with an active SM transfer, the mobile station shall discard the message.

When the mobile station's SMR entity is not in the Idle state, and it receives an RP-DATA message specifying a Message Reference which is not associated with the active SM transfer, then it shall either:

- send an RP-ERROR message with cause #81, "Invalid short message transfer reference value" using the received Message Reference, if an appropriate connection exists; or

- behave as described below for the receipt of an message not consistent with the protocol state.

The same procedures may apply to the network.

9.3.3 Unknown or unforeseen message type

If the Mobile Station receives a RP-message indicating a value of the message type indicator (MTI) defined as reserved, it shall ignore the message and return an RP-ERROR message with cause #97 "message type non-existent or not implemented", if an appropriate connection exists.

If the Mobile Station receives a message (except RP-ERROR) not consistent with the protocol state, the Mobile Station shall ignore the message and return a RP-ERROR message with cause #98 "Message type not compatible with Short Message protocol state", if an appropriate connection exists.

If the Mobile Station receives an RP-ERROR message not consistent with the protocol state, the Mobile Station shall ignore the message.

The network may follow the same procedures.

9.3.4 Non-semantical mandatory information element errors

When on receipt of a message:

- an "imperative message part" error; or
- a "missing mandatory IE" error;

is diagnosed or when a message containing a syntactically incorrect mandatory IE is received, the mobile station shall (except for the case of a reserved value of the MTI as defined above) proceed as follows:

- when the message is an RP-DATA or RP-ACK, the mobile station shall ignore the message and return an RP-ERROR message with cause #96 "invalid mandatory information", if an appropriate connection exists;
- when the message is an RP-ERROR, the mobile station shall treat the message as an RP-ERROR message carrying RP-Cause value 111 without any diagnostic field, and with no RP-User Data.

The network may follow the applicable procedures defined in this subclause.

9.3.5 Messages with semantically incorrect contents

When a message with semantically incorrect contents is received, the foreseen reactions of the procedural part of 3GPP TS 24.011 are performed. If however no such reactions are specified then:

- if the message was not an RP-ERROR message, the MS shall ignore the message and return an RP-ERROR message with cause value #95 "semantically incorrect message", if an appropriate connection exists; while
- if the message was an RP-ERROR message, the mobile station shall treat the message as an RP-ERROR message carrying RP-Cause value #111 without any diagnostic field, and with no RP-User Data.

The network may follow the same procedure.

10 Timers

The present document places the following requirements on the timers described in the present document:

- timer TR1M shall be greater than 35 seconds and less than 45 seconds;
- the value of timer TRAM shall be greater than 25 seconds and less than 35 seconds;
- timer TR2M shall be greater than 12 seconds and less than 20 seconds.

Annex A (informative): Arrow diagrams

Arrow diagram A1:

The diagram shows CS MO-message transfer by means of interlayer service primitives and the actual messages being transferred between the layer entities.

Arrow diagram A2:

The diagram shows CS MT-messaging by means of interlayer service primitives and the actual messages being transferred between the layer entities in GSM.

Arrow diagram A5:

The diagram shows GPRS MO-message transfer by means of interlayer service primitives and the actual messages being transferred between the layer entities.

- MNSMS-primitives indicate services provided by CM to SM-RL.
- LLSMS-primitives indicate services provided by LLC to CM.
- CP-DATA is the CM-message carrying SM-RP data units.
- CP-ACK acknowledge CP-DATA reception on CM.

Arrow diagram A6:

The diagram shows GPRS MT-message transfer by means of interlayer service primitives and the actual messages being transferred between the layer entities in GSM.

- MNSMS-primitives indicate services provided by CM to SM-RL.
- LLSMS-primitives indicate services provided by LLC to CM.
- CP-DATA is the CM-message carrying SM-RP data units.
- CP-ACK acknowledge CP-DATA reception on CM.

Arrow diagram A7:

The diagram shows UMTS PS MO-message transfer by means of interlayer service primitives and the actual messages being transferred between the layer entities.

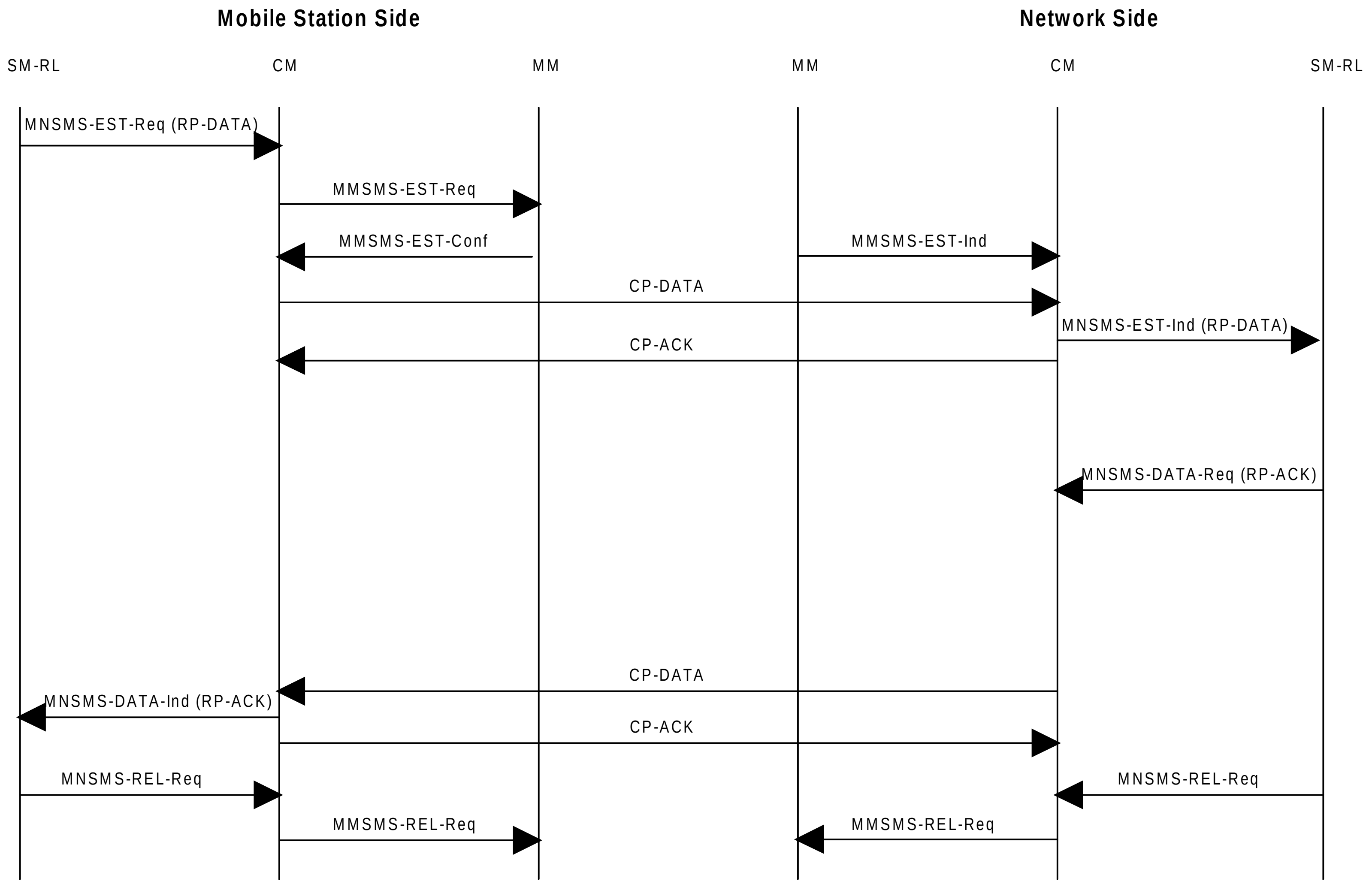
- MNSMS-primitives indicate services provided by CM to SM-RL.
- PMMSMS-primitives indicate services provided by GMM to CM.
- CP-DATA is the CM-message carrying SM-RP data units.
- CP-ACK acknowledge CP-DATA reception on CM.

Arrow diagram A8:

The diagram shows UMTS PS MT-messaging by means of interlayer service primitives and the actual messages being transferred between the layer entities.

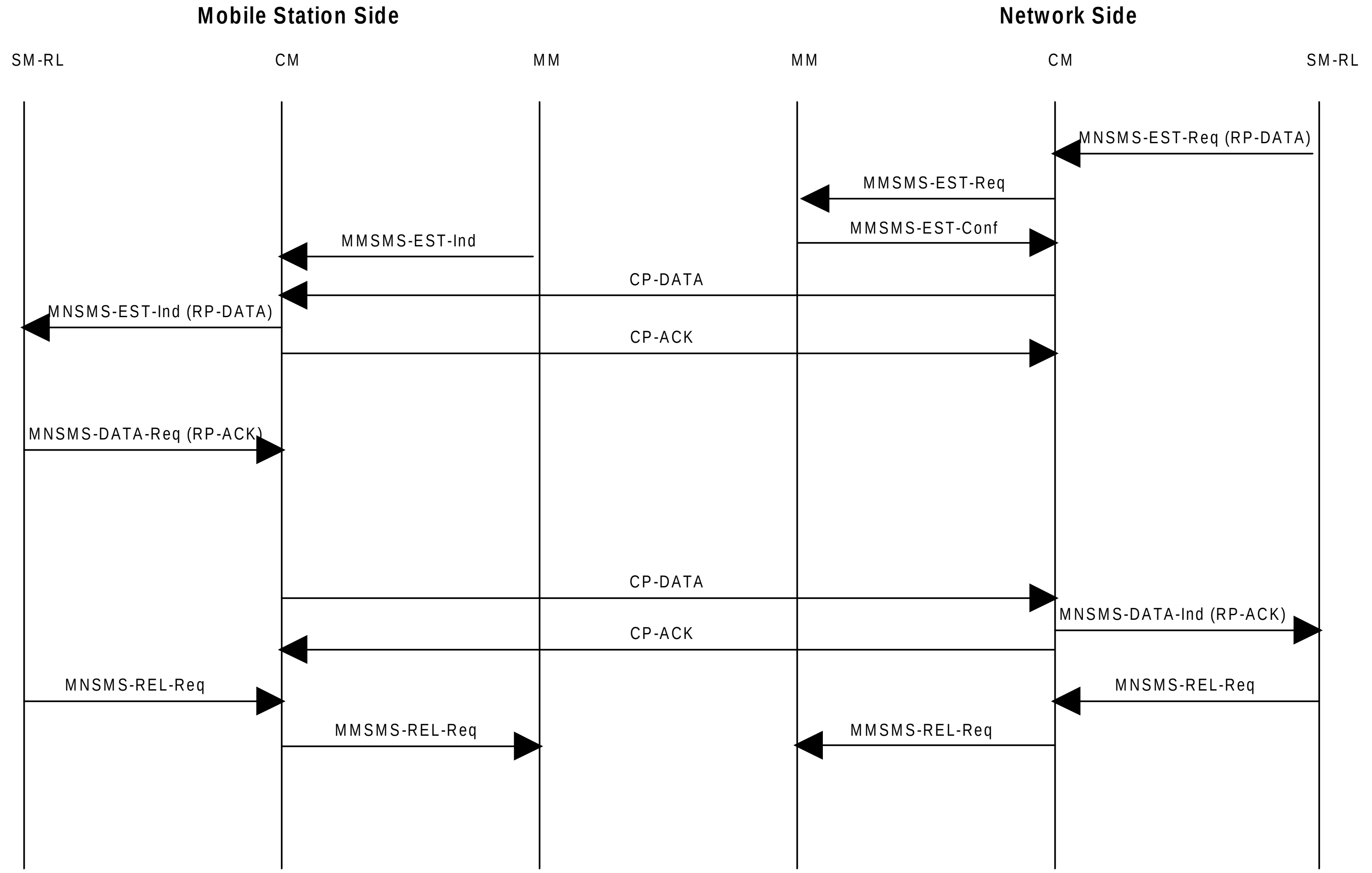
- MNSMS-primitives indicate services provided by CM to SM-RL.
- PMMSMS-primitives indicate services provided by GMM to CM.
- CP-DATA is the CM-message carrying SM-RP data units.
- CP-ACK acknowledge CP-DATA reception on CM.

Mobile Originated Messaging on CM-sublayer



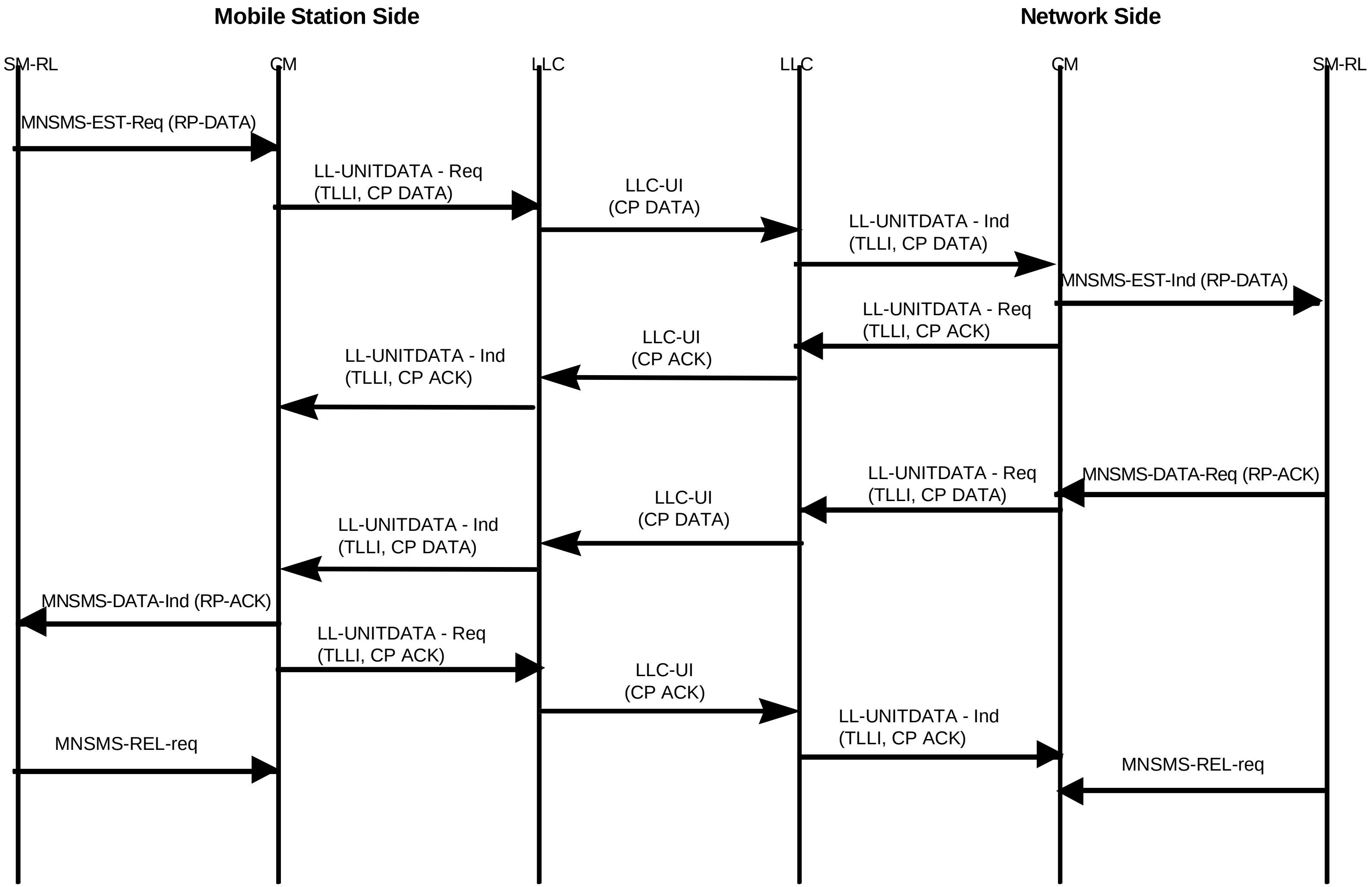
Arrow diagram A1

Mobile Terminated Messaging on CM-sublayer



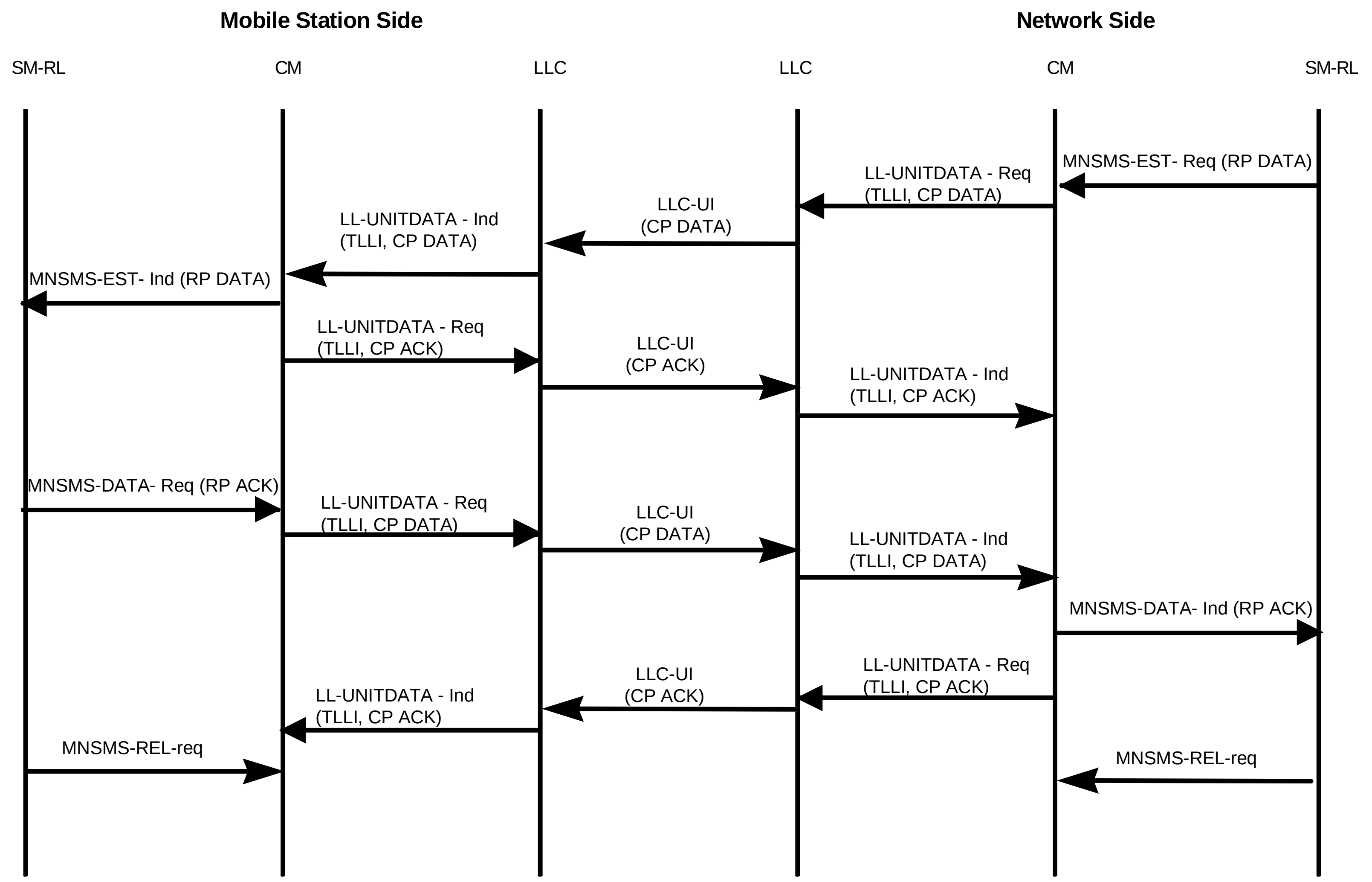
Arrow diagram A2

GPRS Mobile Originated Messaging on CM-sublayer in GSM



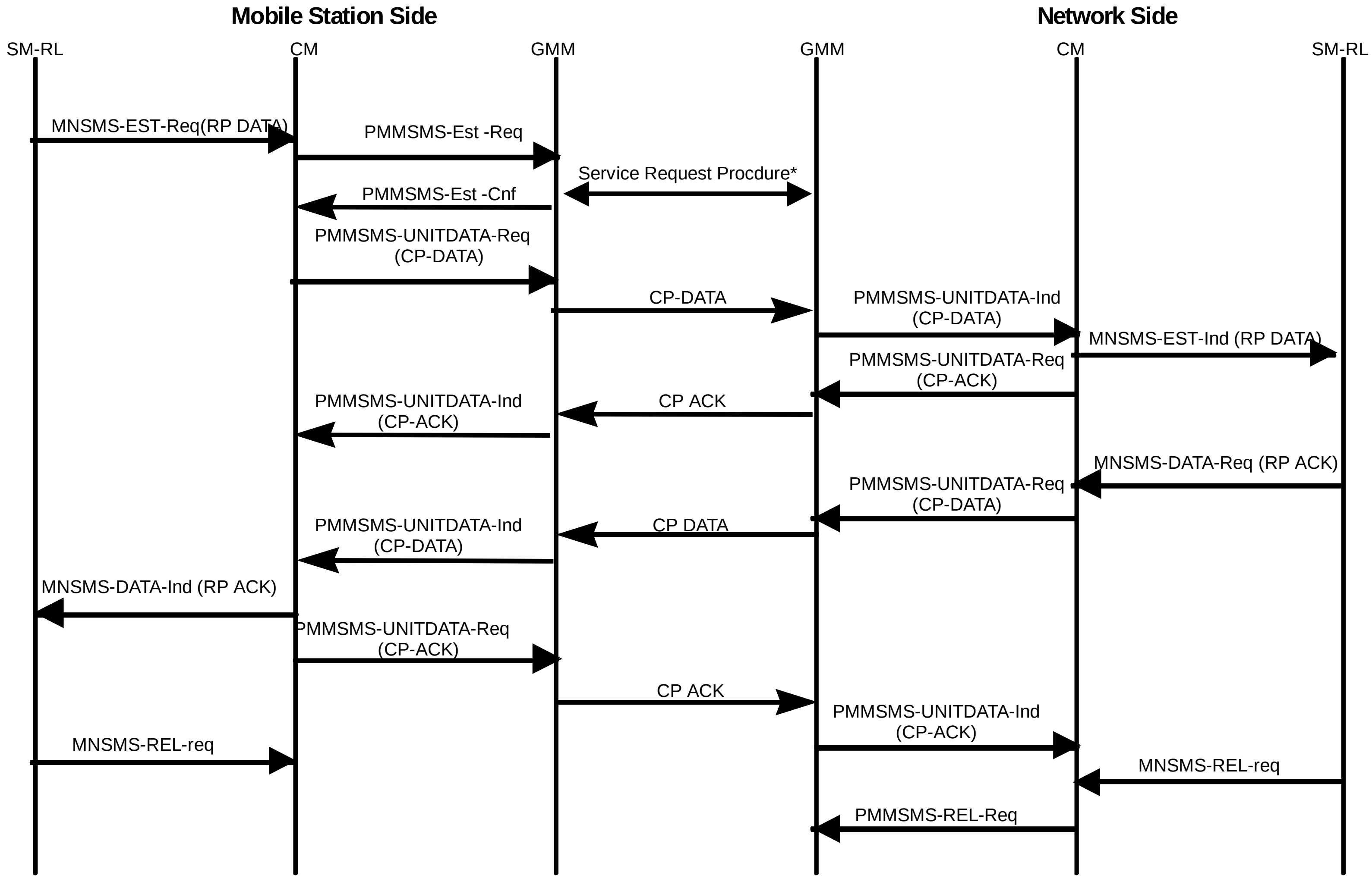
Arrow diagram A5

GPRS Mobile Terminated Messaging on CM-sublayer in GSM



Arrow diagram A6

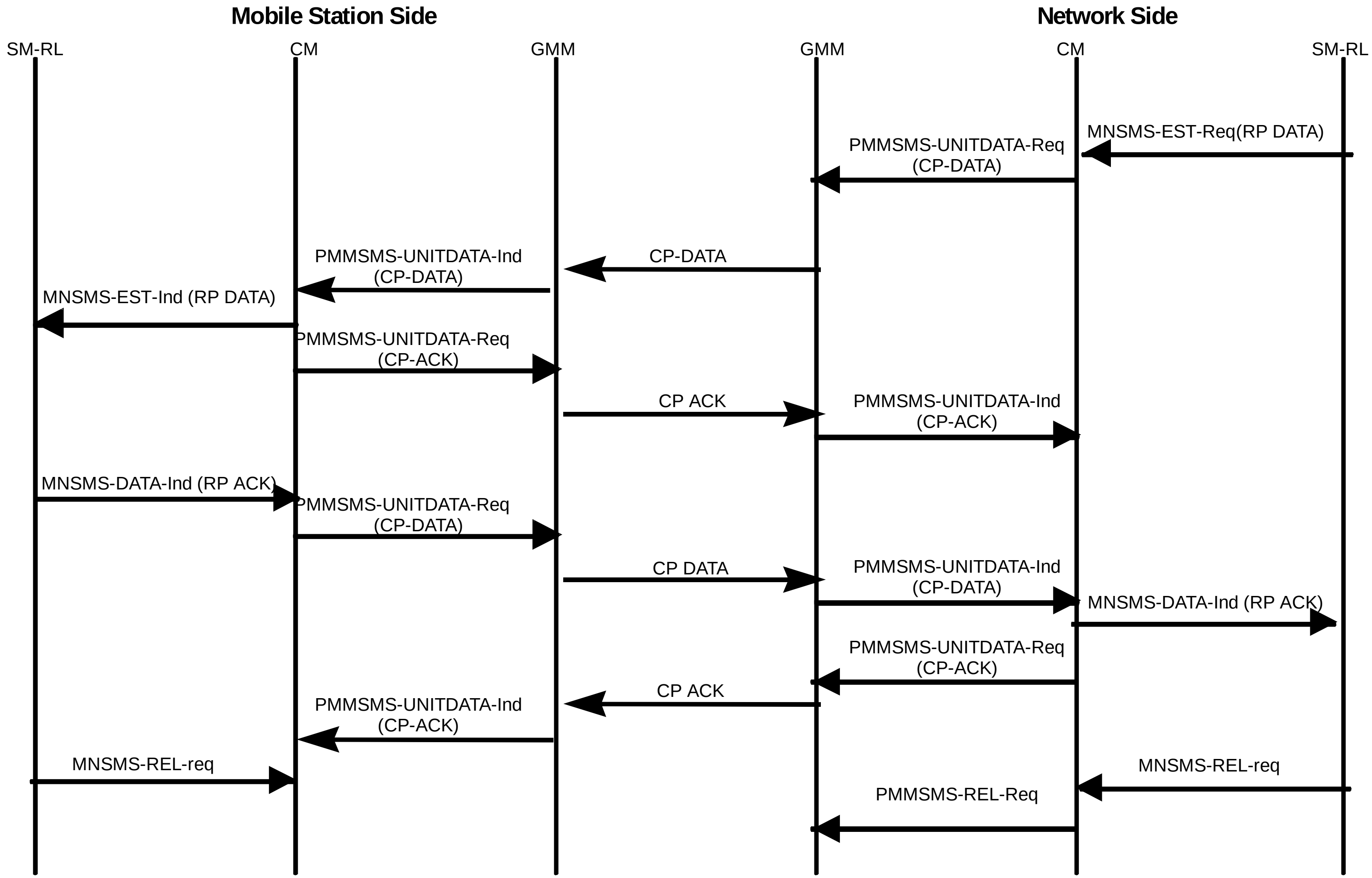
GPRS Mobile Originated Messaging on CM-sublayer in UMTS



NOTE: Service Request Procedure may not be initiated

Arrow diagram A7

GPRS Mobile Terminated Messaging on CM-sublayer in UMTS



Arrow diagram A8

Annex B (normative): SDL-description of the CM-layer

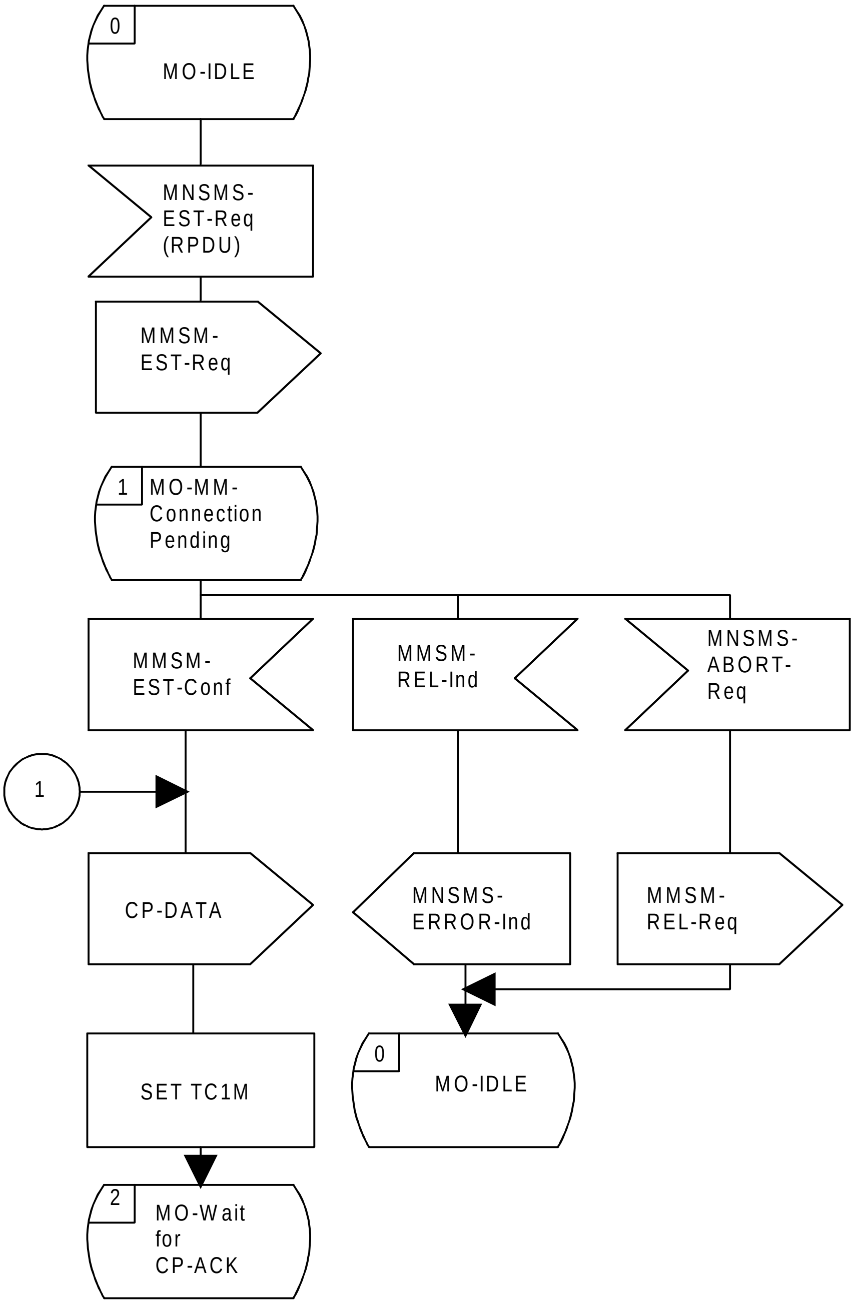
B.1 Introduction

This annex contains an SDL-description of the Connection Management Sublayer in terms of the Short Message Service Support. The CM- sublayer provides services to Short Message Relay Layer.

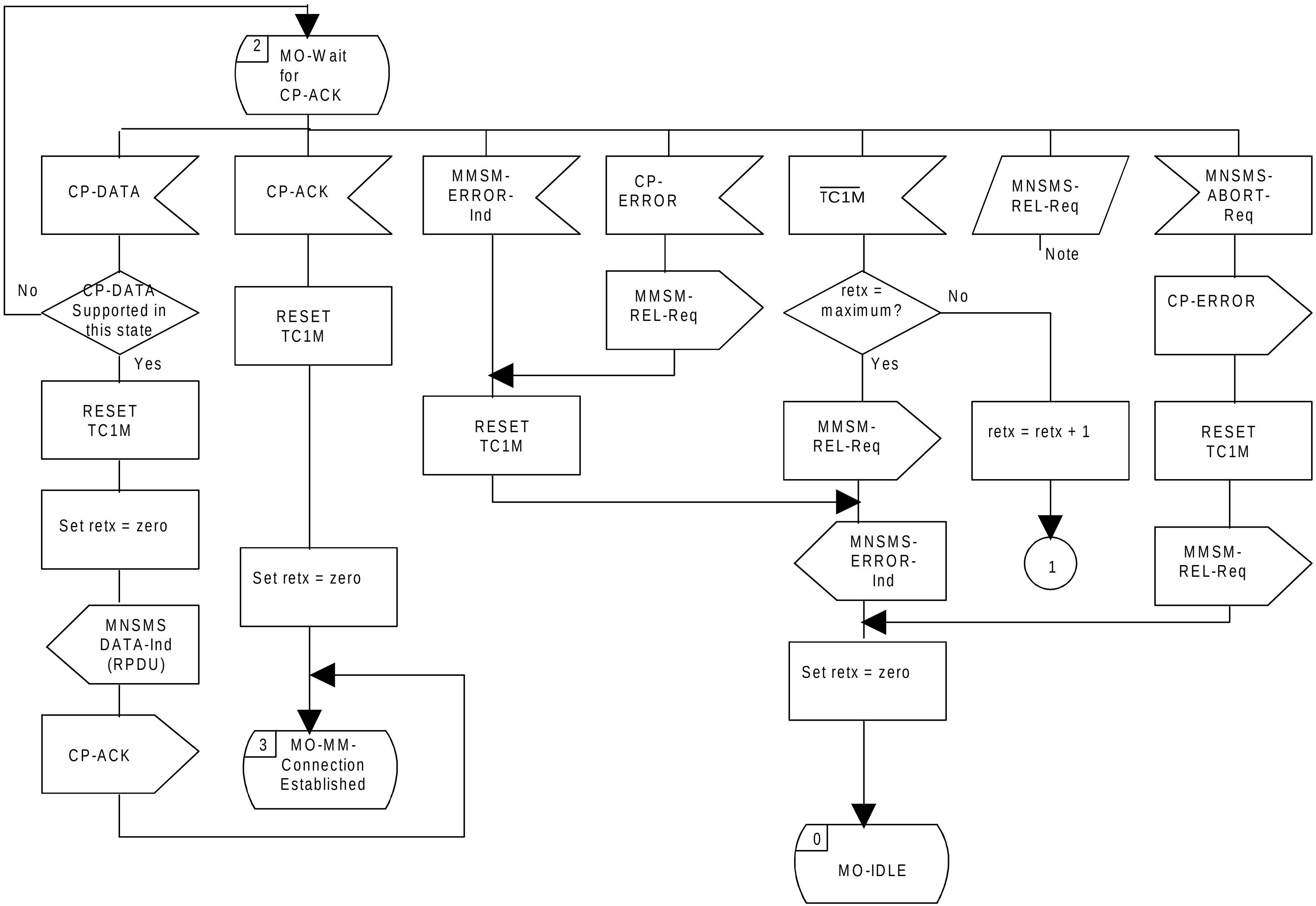
The SDLs contain a mixture of peer to peer messages and conceptual primitives between the layers SM-RL, CM, MM and LLC, as viewed by the SMC entities. SDL-1/2/3 show the CS SMC entity on MS-side for Mobile Originated (MO) short message transfer, SDL-4/5/6 show the CS SMC entity on MS-side for Mobile Terminated (MT) short message transfer, SDL-7/8/9 show the CS SMC entity on the network side for Mobile Originated (MO) short message transfer, and SDL-10/11/12 show the CS SMC entity on the network side for Mobile Terminated (MT) short message transfer.

SDL-13/14/15 show the GPRS SMC entity on MS-side for Mobile Originated (MO) short message transfer, SDL-16/17/18 show the GPRS SMC entity on MS-side for Mobile Terminated (MT) short message transfer, SDL-19/20/21 show the GPRS SMC entity on the network side for Mobile Originated (MO) short message transfer, and SDL-22/23/24 show the GPRS SMC entity on the network side for Mobile Terminated (MT) short message transfer.

The lower layers (below MM, GMM and LLC) are transparent to an SMC entity.

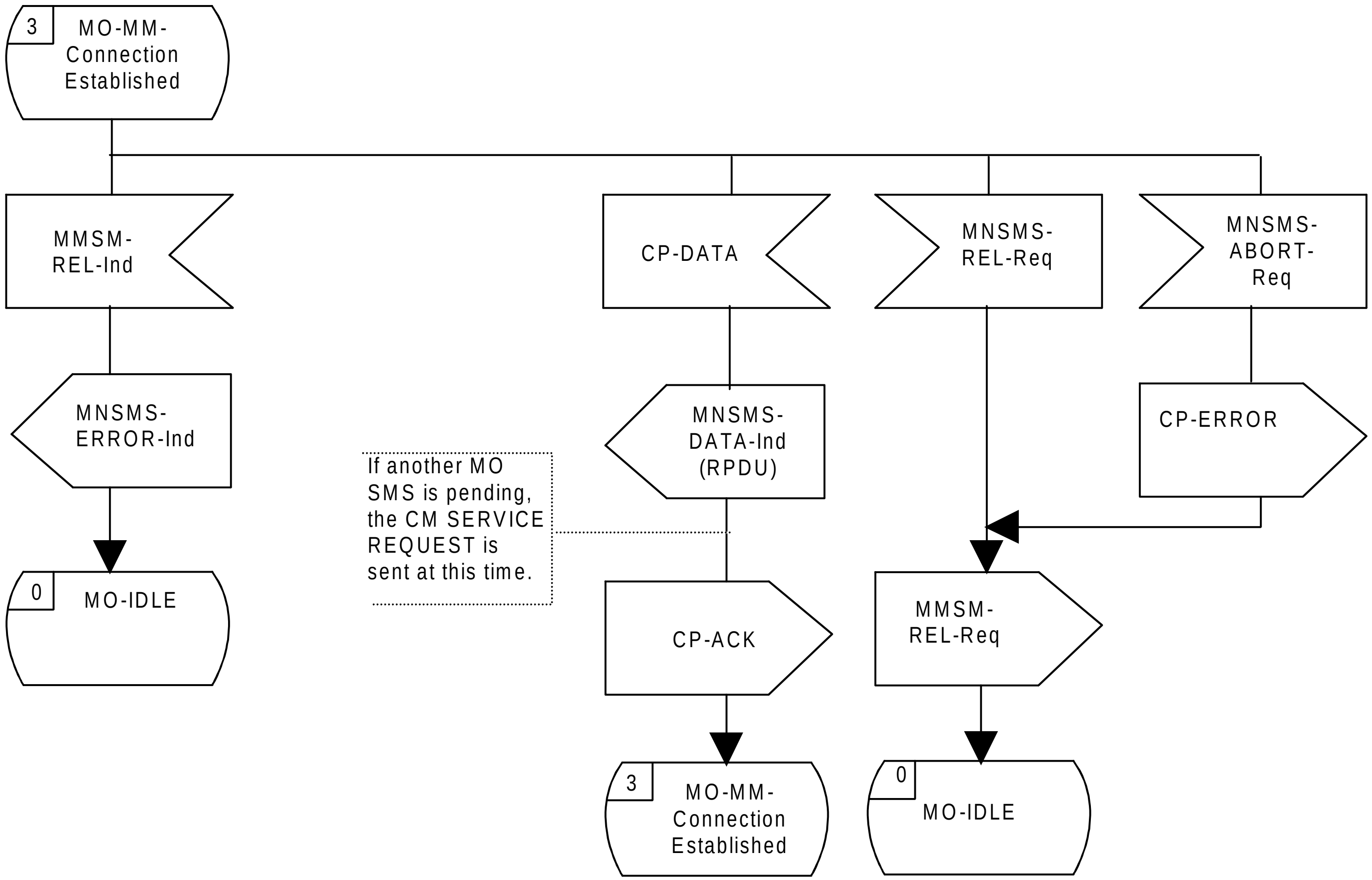


MO-SMC-CP-entity on MS-side
SDL-1

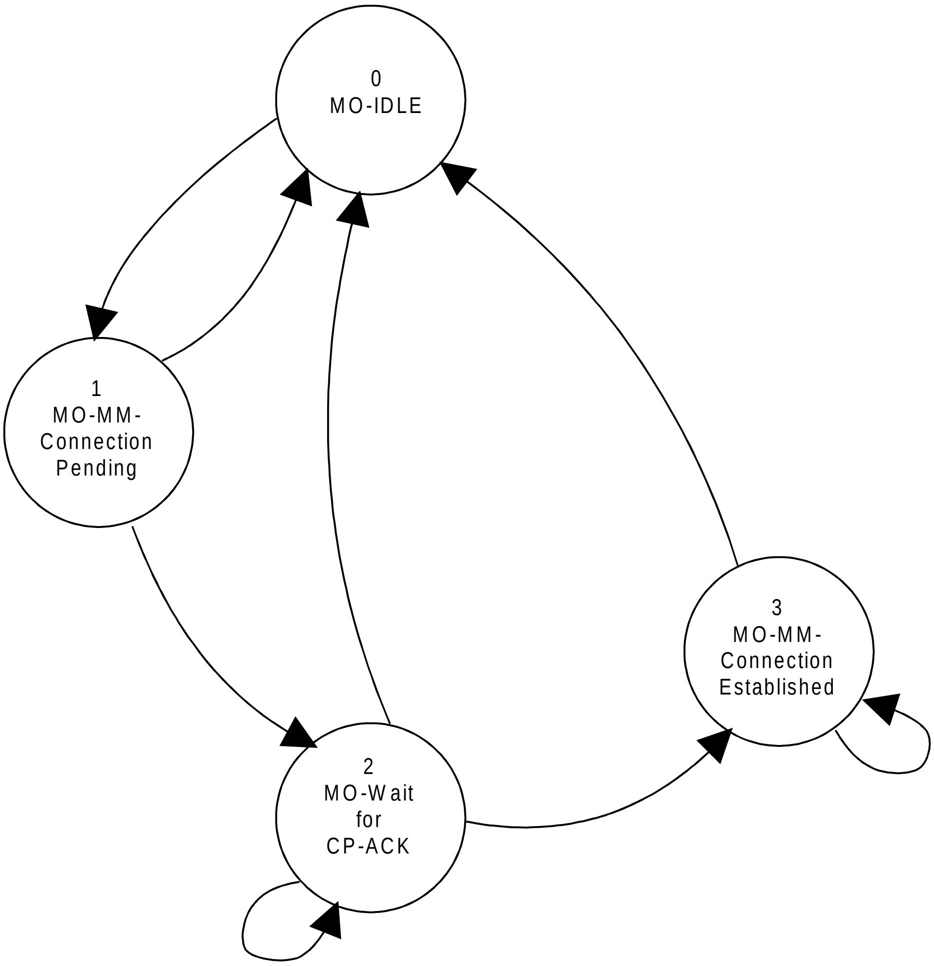


NOTE: The release is delayed until the next state

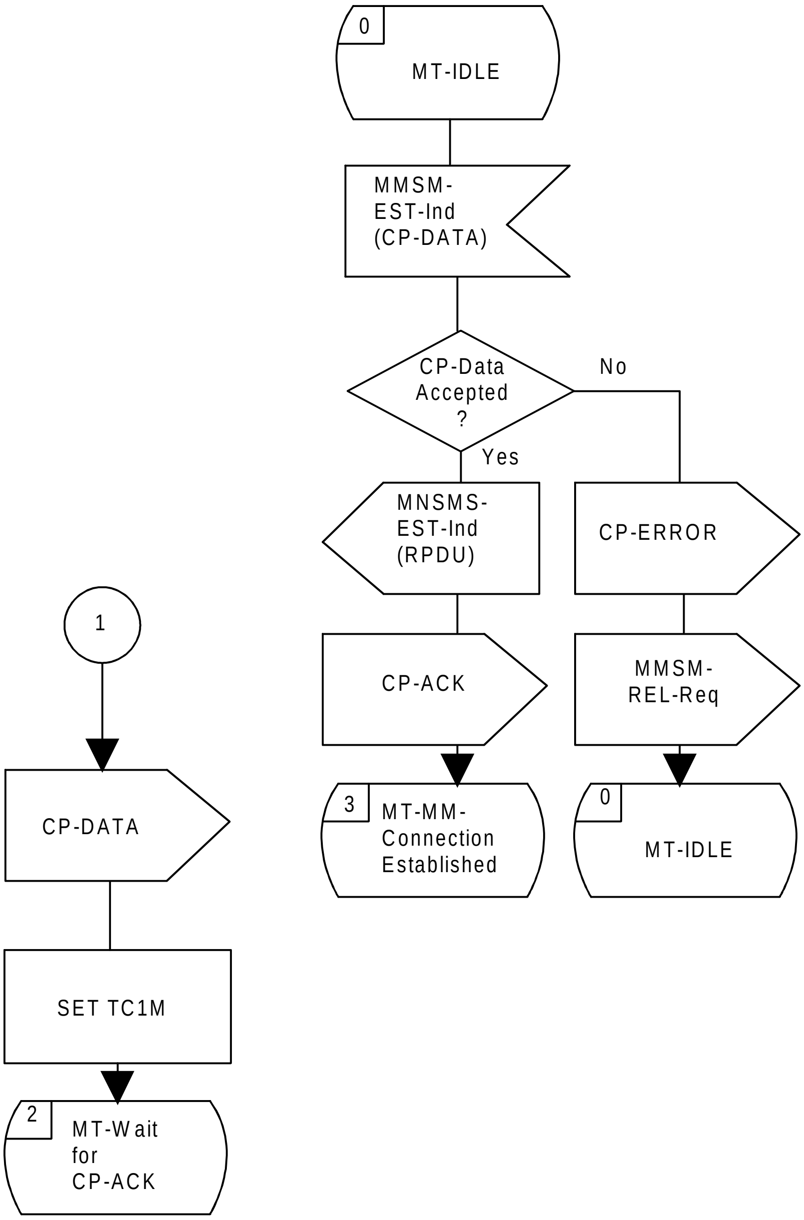
MO-SMC-CP-entity on MS-side
SDL-2



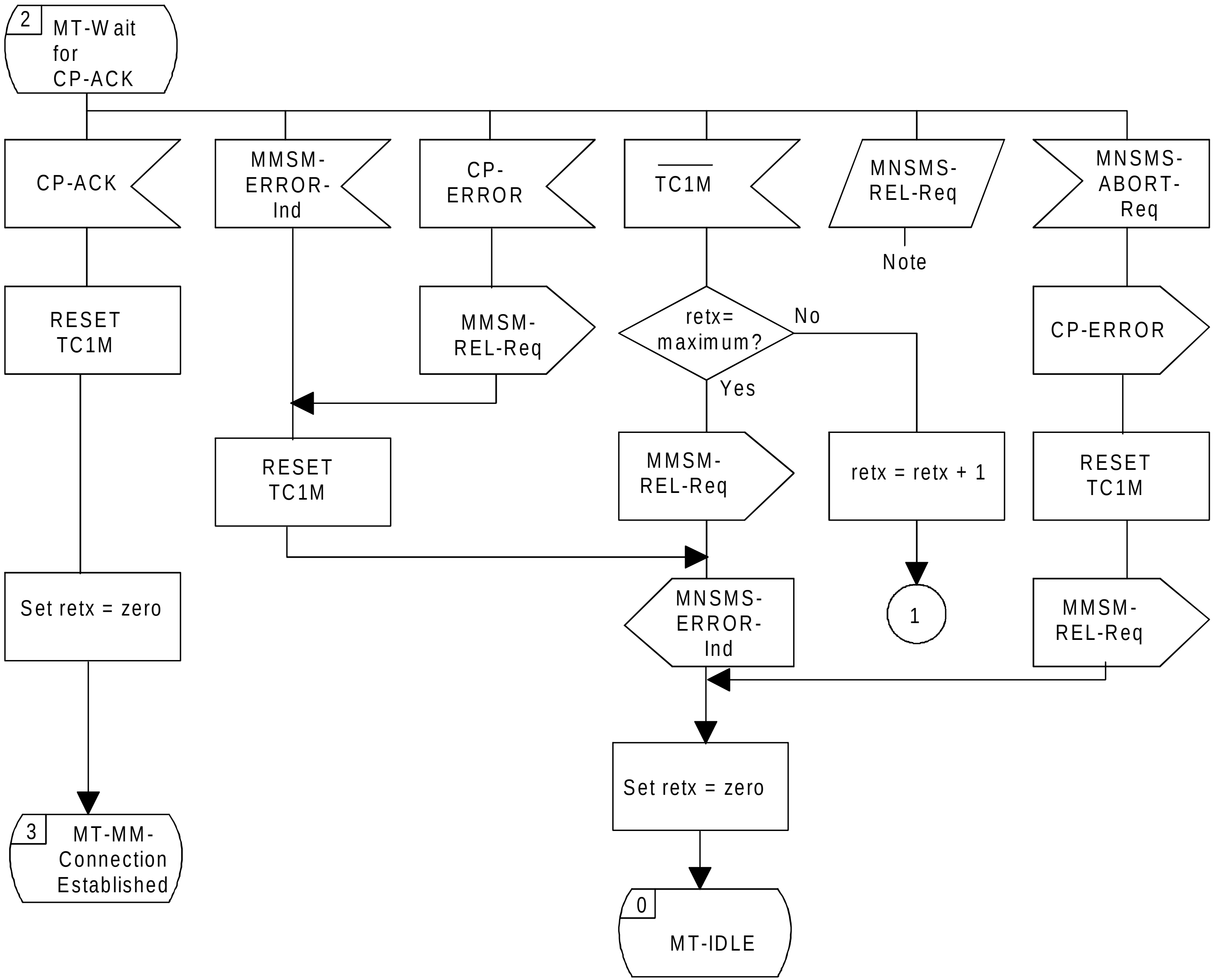
MO-SMC-CP-entity on MS-side
SDL-3



MO-SMC-CP-entity on MS-side
State transition diagram

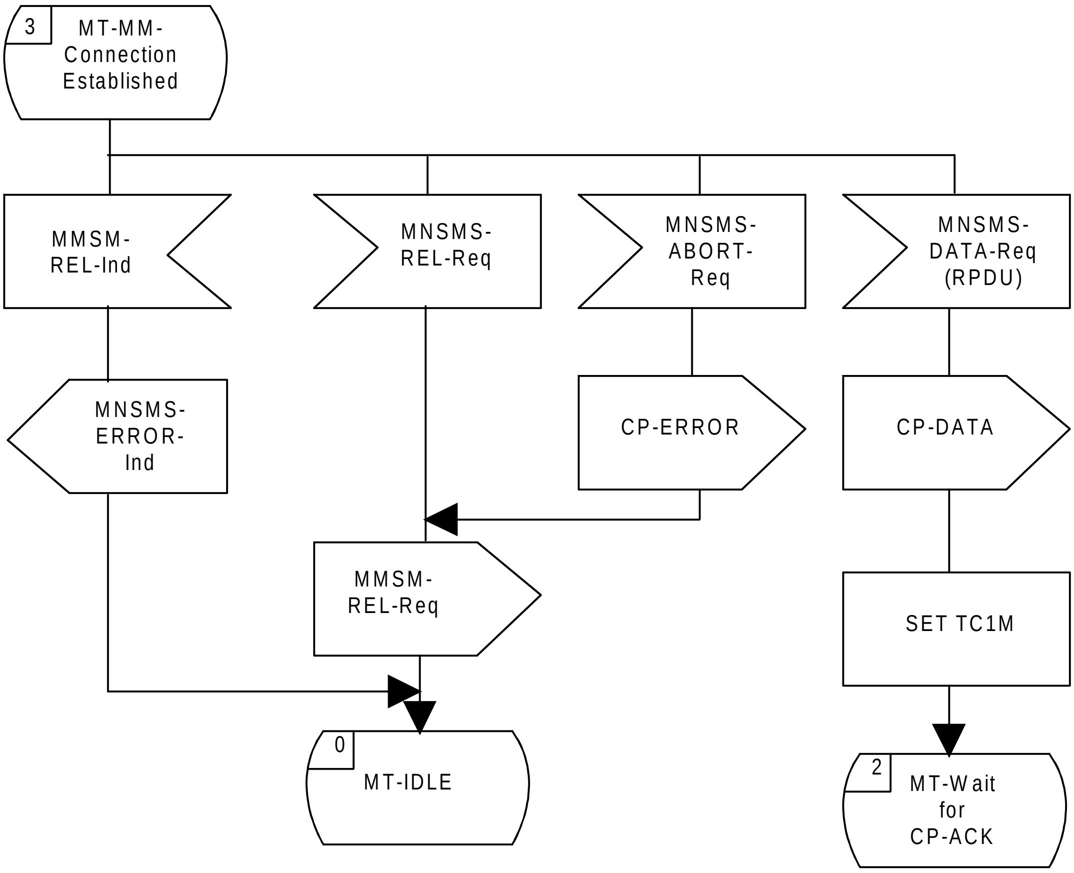


MT-SMC-CP-entity on MS-side
Initiating message transfer
SDL-4

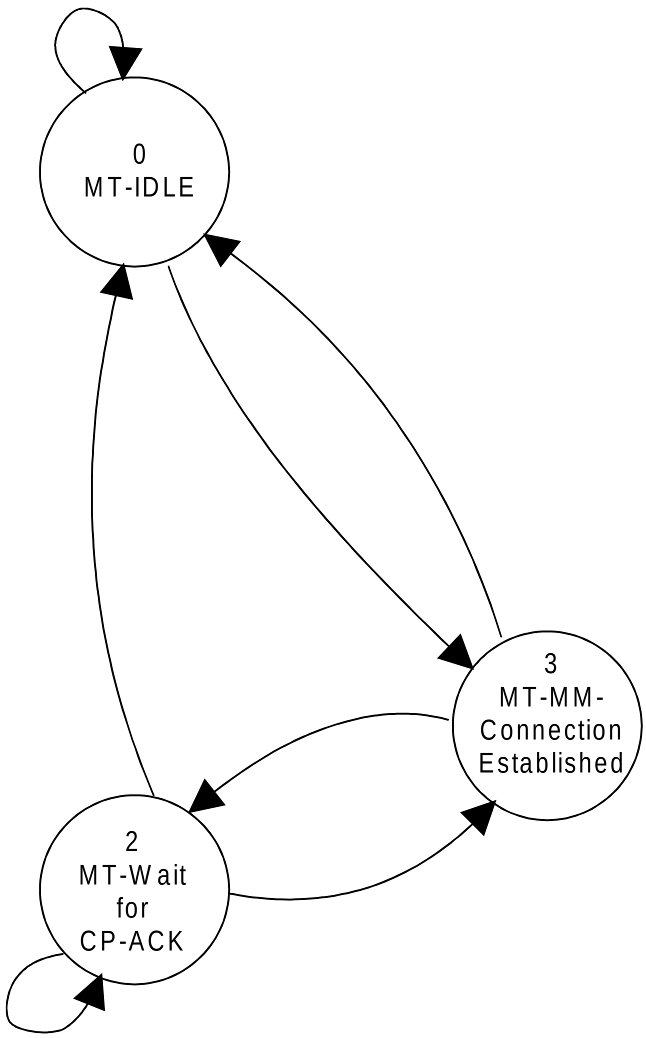


NOTE: The release is delayed until the next state

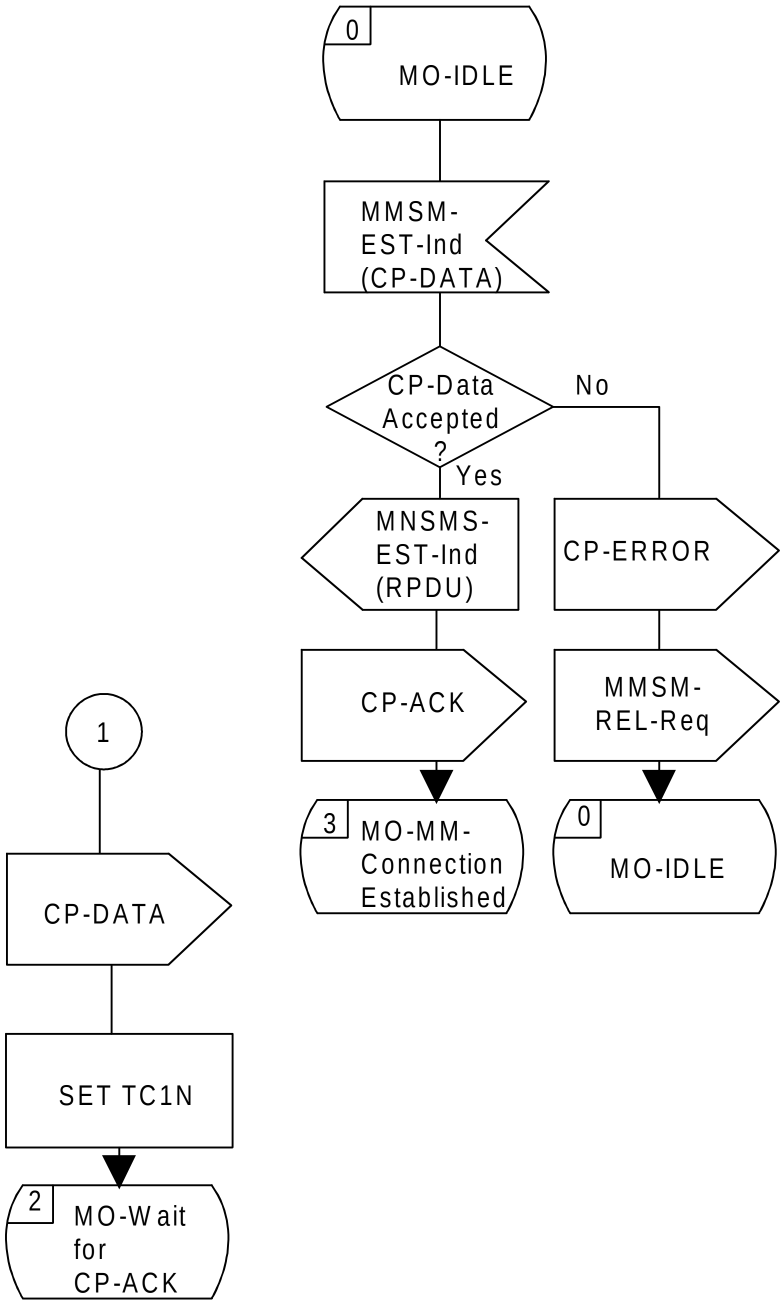
MT-SMC-CP-entity on MS-side
MM-connection established
SDL-5



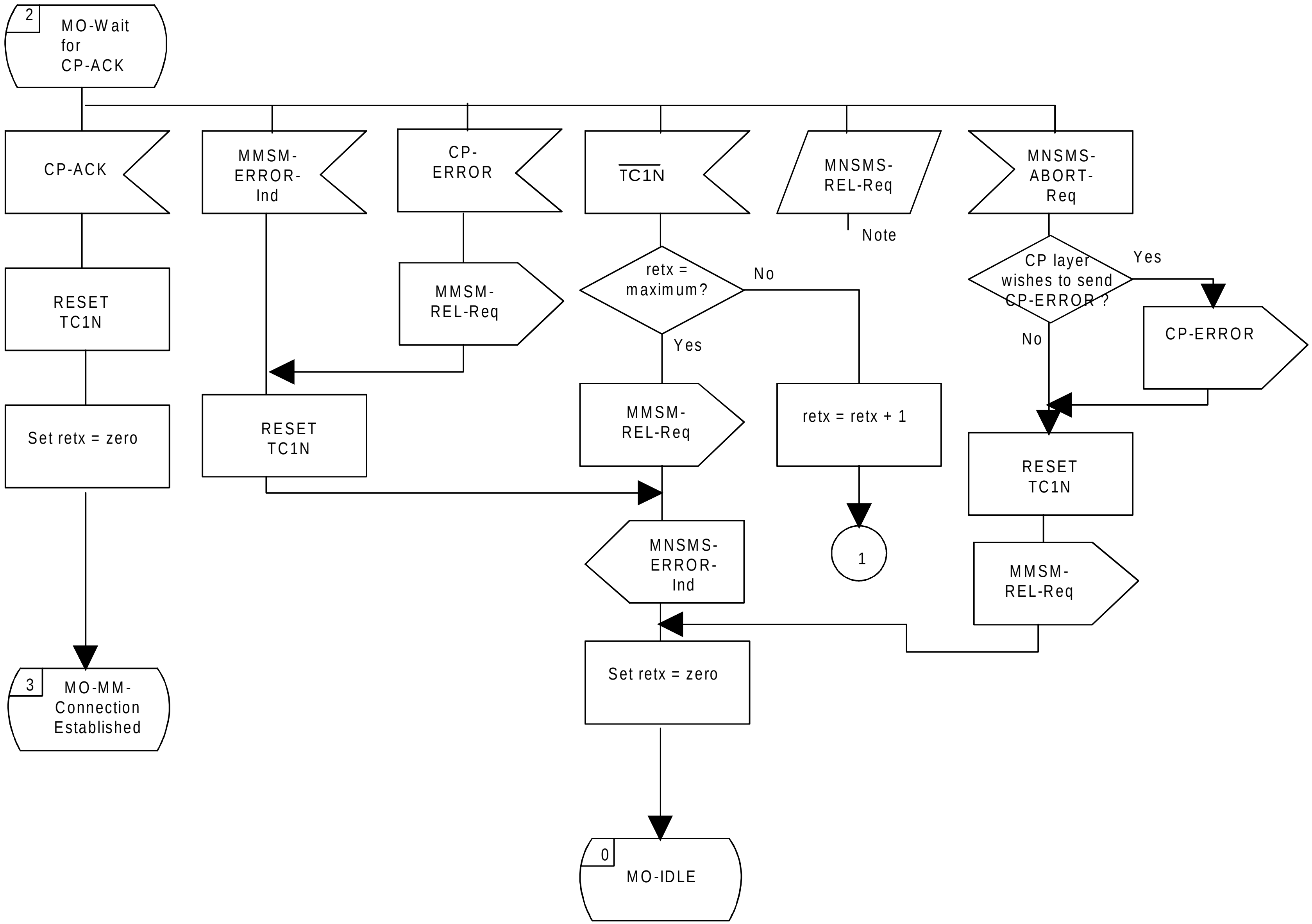
MT-SMC-CP-entity on MS-side
MM-connection released
SDL-6



MT-SMC-CP-entity on MS-side
State transition diagram

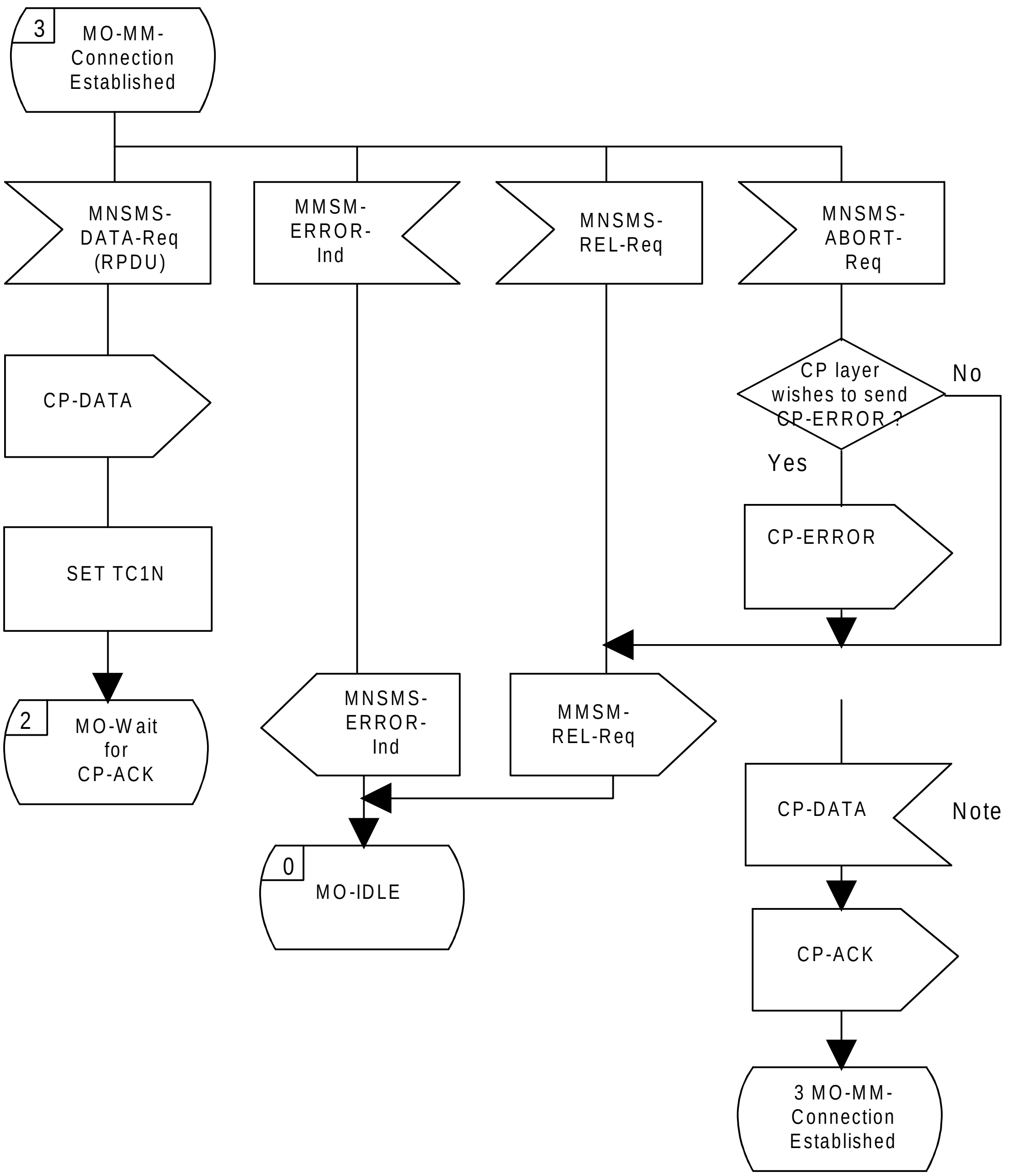


MO-SMC-CP-entity on Network-side
SDL-7



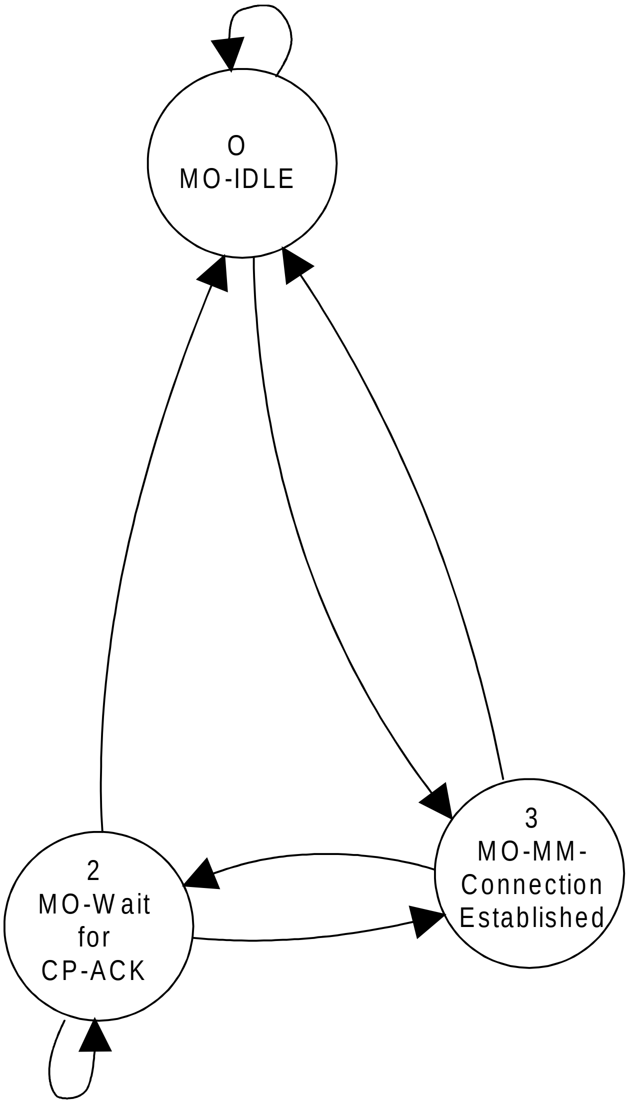
NOTE: The release is delayed until the next state

MO-SMC-CP-entity on Network-side
SDL-8

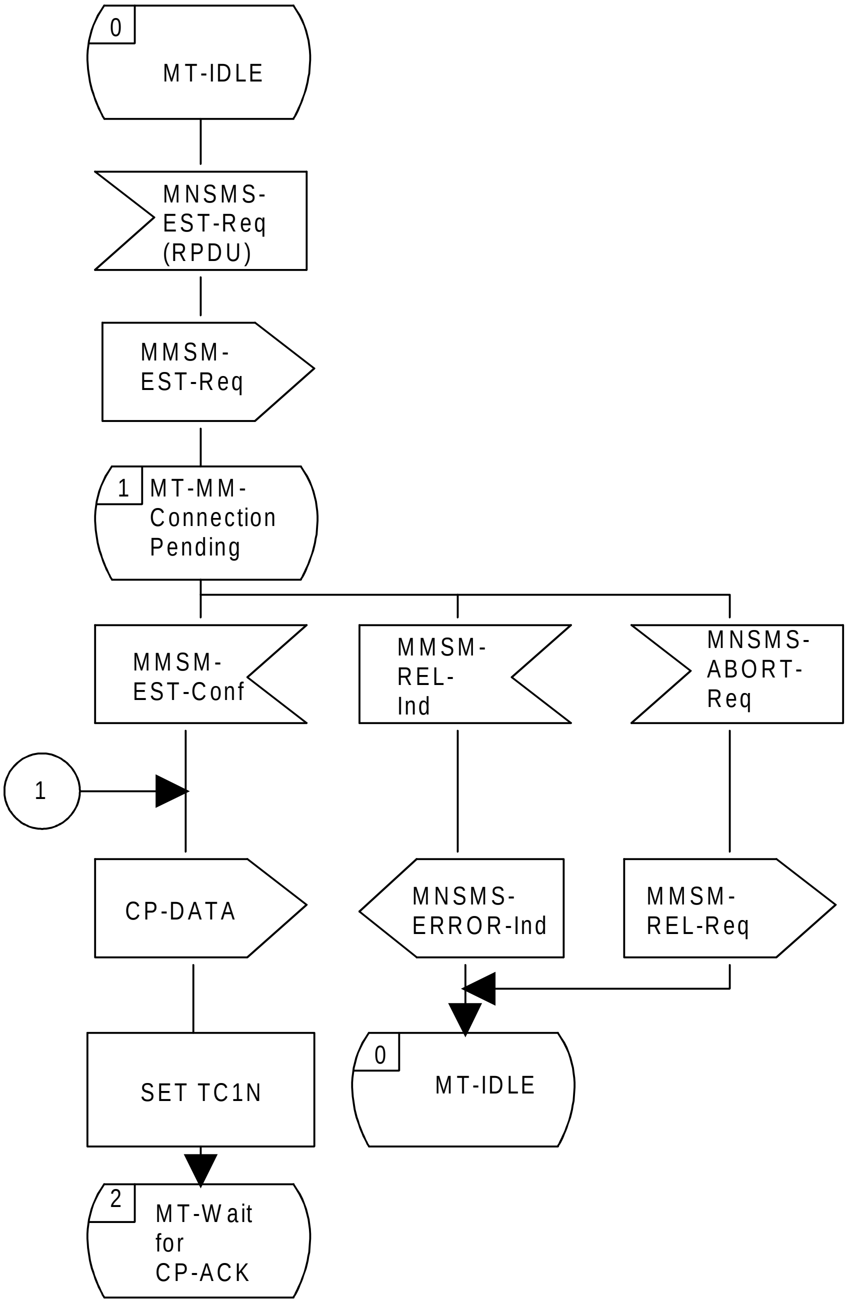


NOTE: This message is a retransmission from the MS

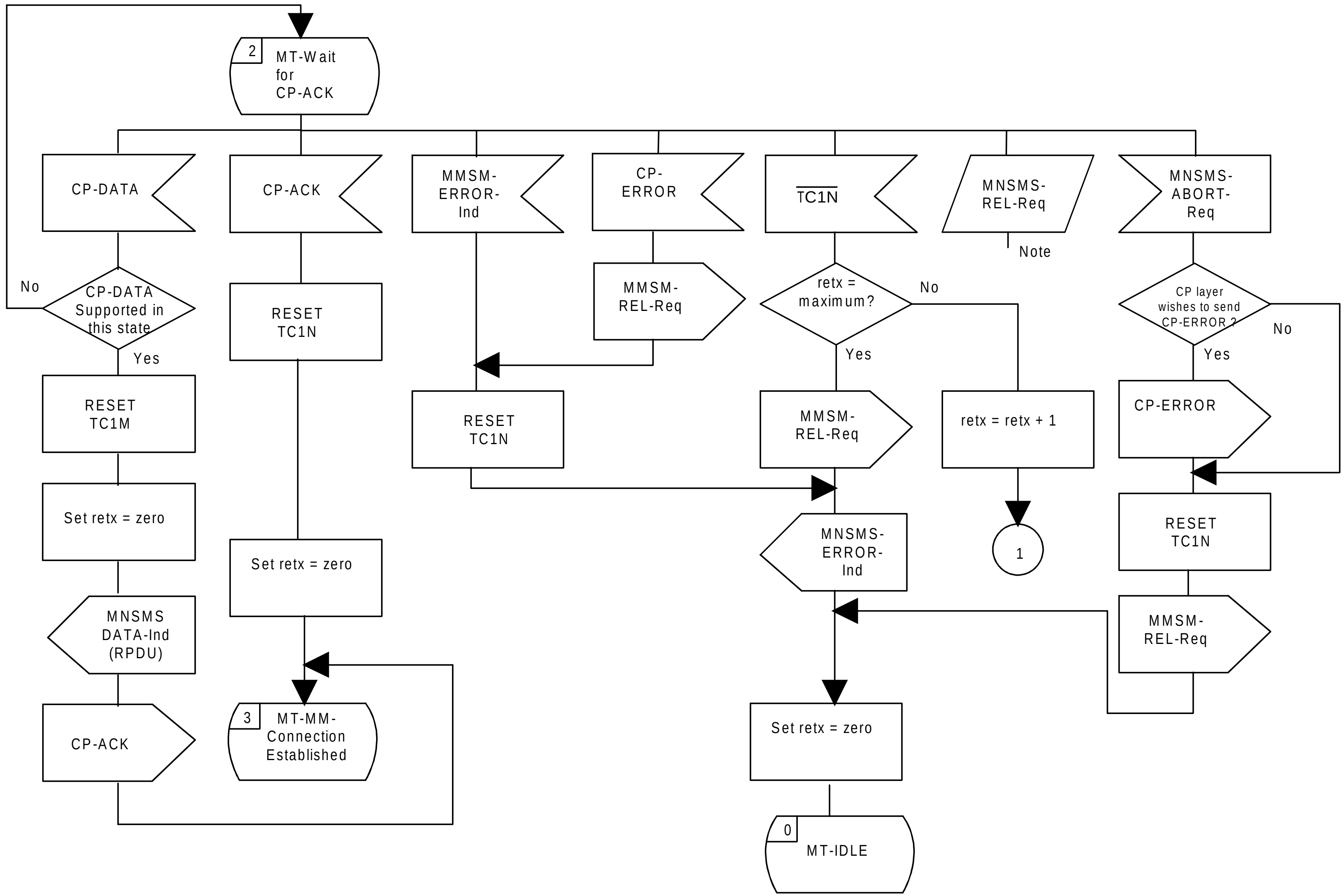
MO-SMC-CP-entity on Network-side
SDL-9



MO-SMC-CP-entity on Network-side
State transition diagram

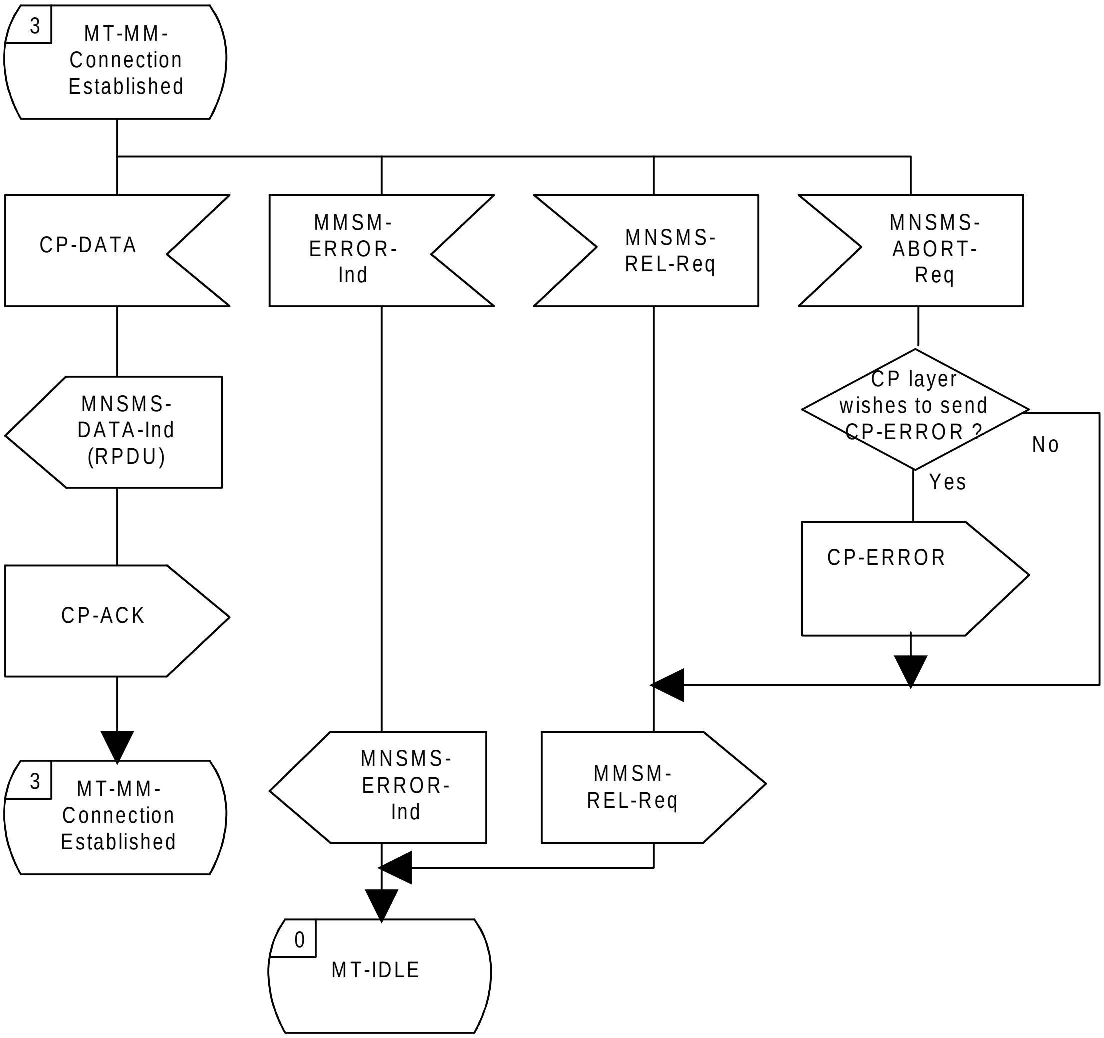


MT-SMC-CP-entity on Network-side
SDL-10

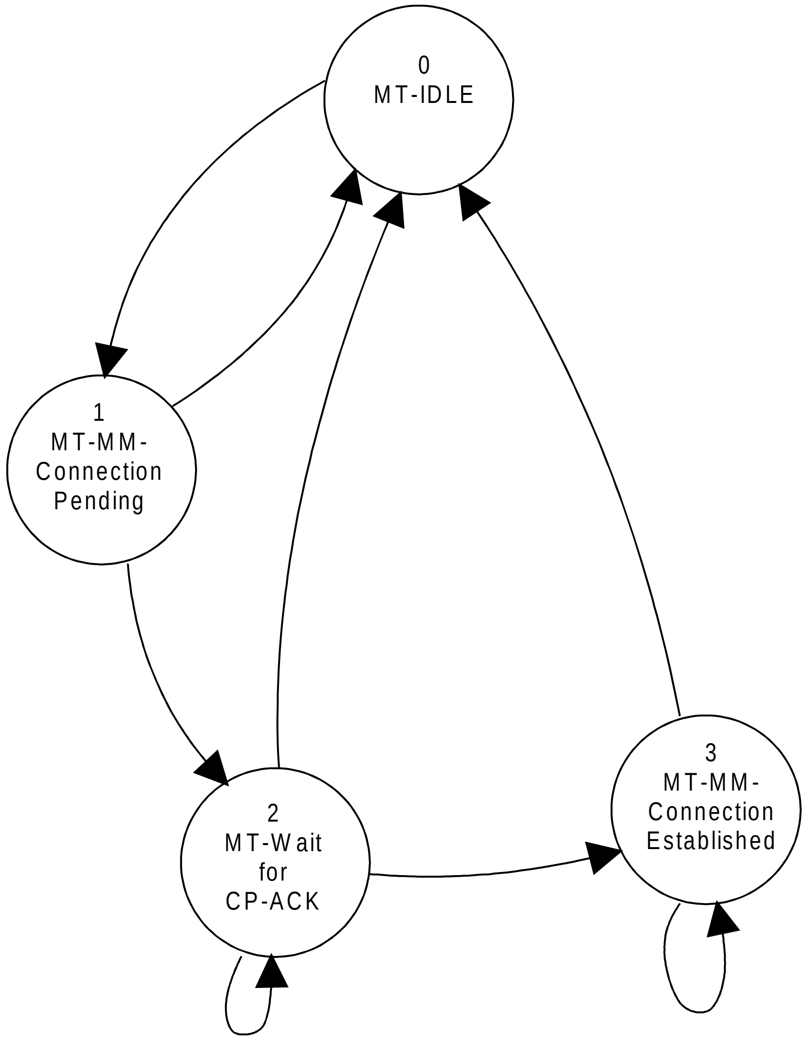


NOTE: The release is delayed until the next state

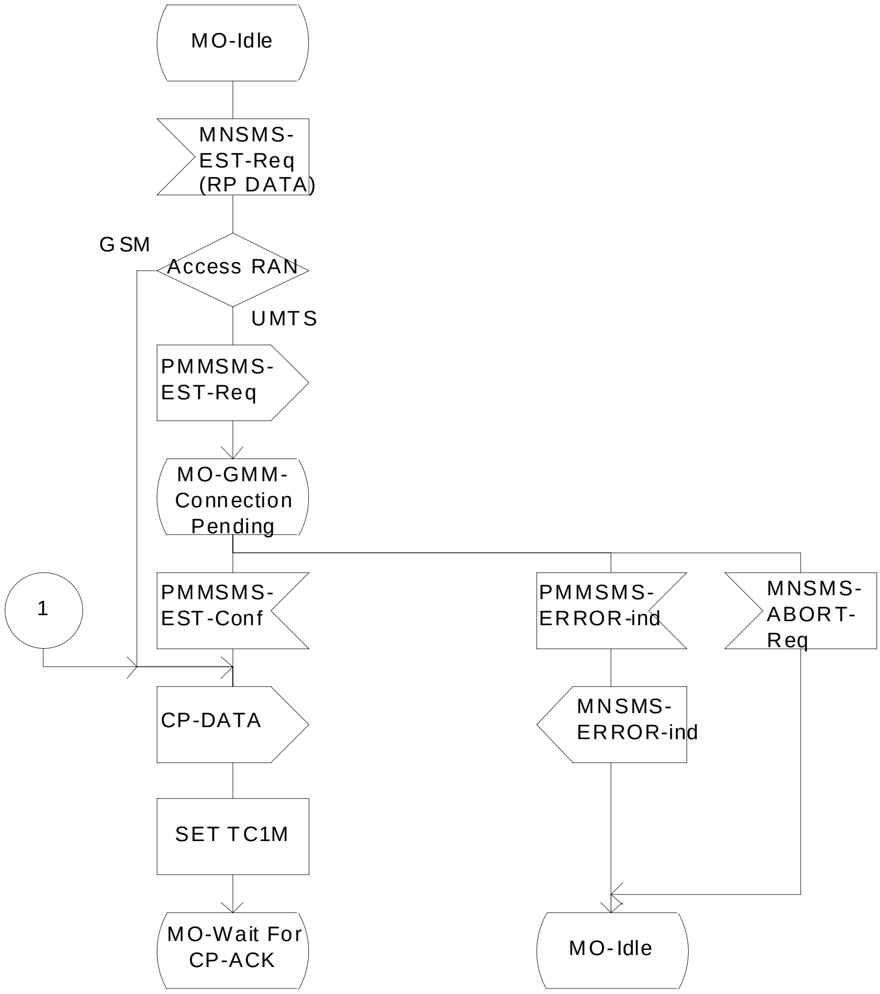
MT-SMC-CP-entity on Network-side
MM-connection established
SDL-11



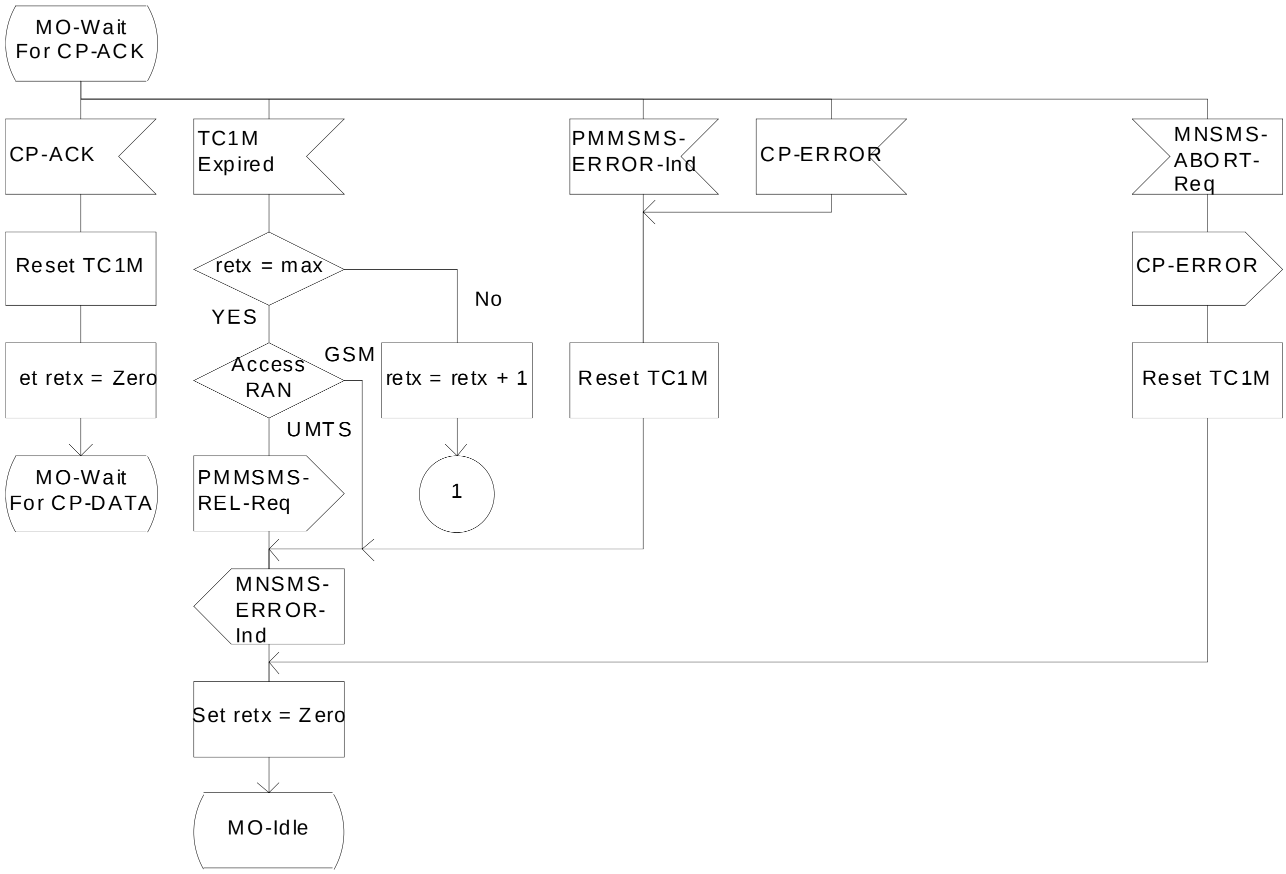
MT-SMC-CP-entity on Network-side
Message transfer active
SDL-12



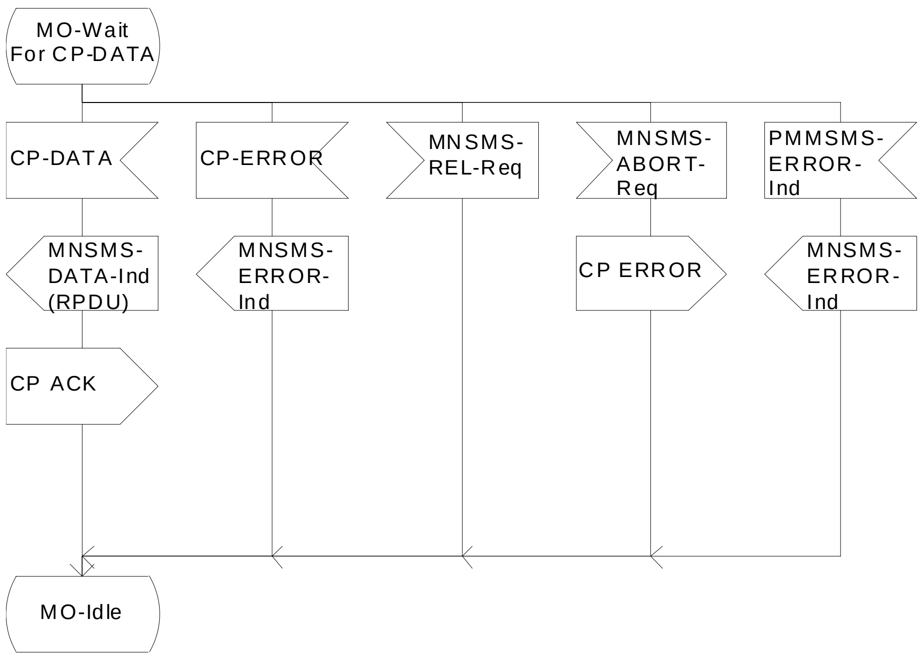
MT-SMC-CP-entity on Network-side
State transition diagram



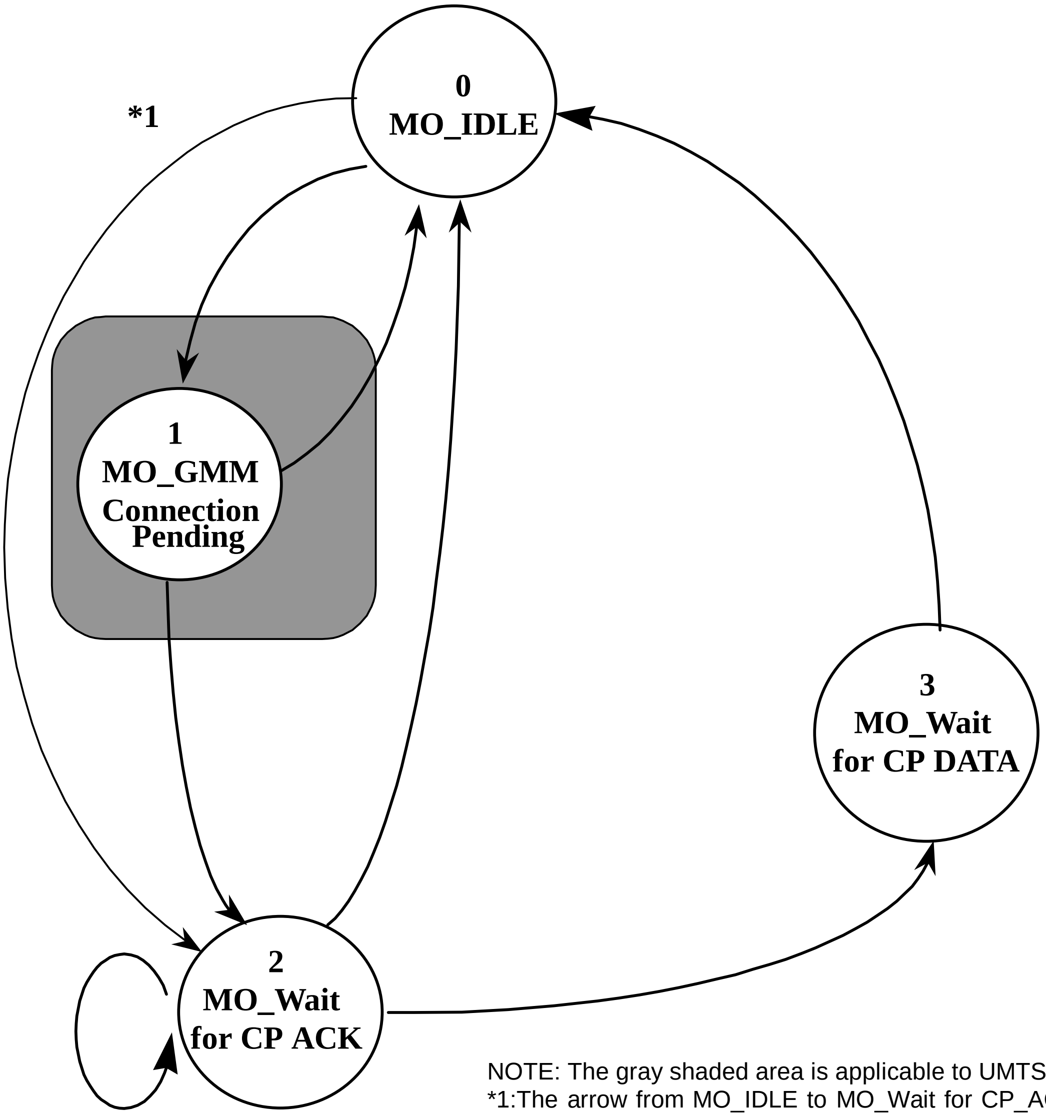
MO-SMC-GP entity on MS-side for GPRS
SDL-13



MO-SMC-GP entity on MS-side for GPRS
SDL-14

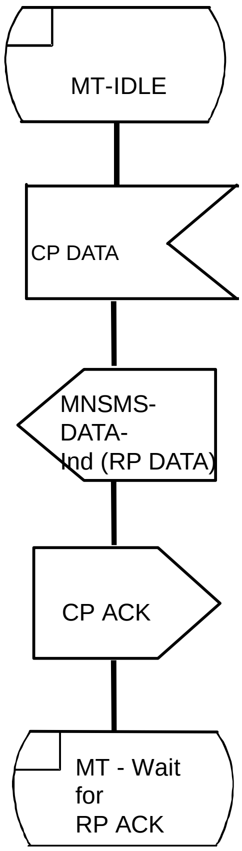


MO-SMC-GP entity on MS-side for GPRS
SDL-15

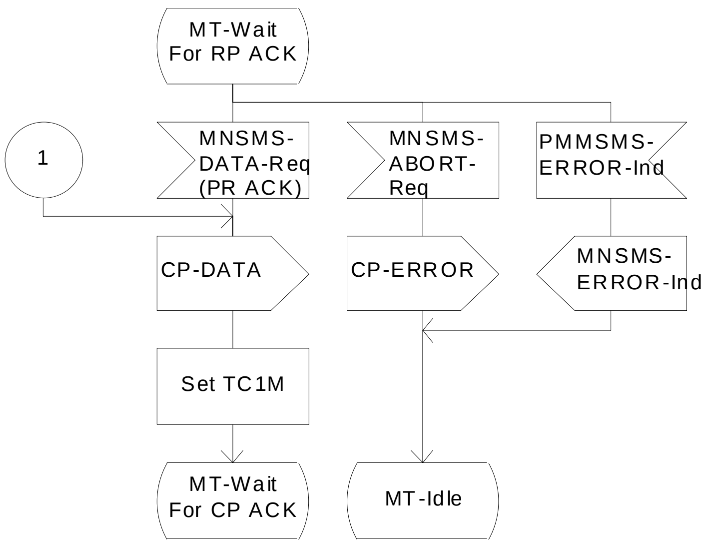


NOTE: The gray shaded area is applicable to UMTS only.
*1:The arrow from MO_IDLE to MO_Wait for CP_ACK is for GSM only.

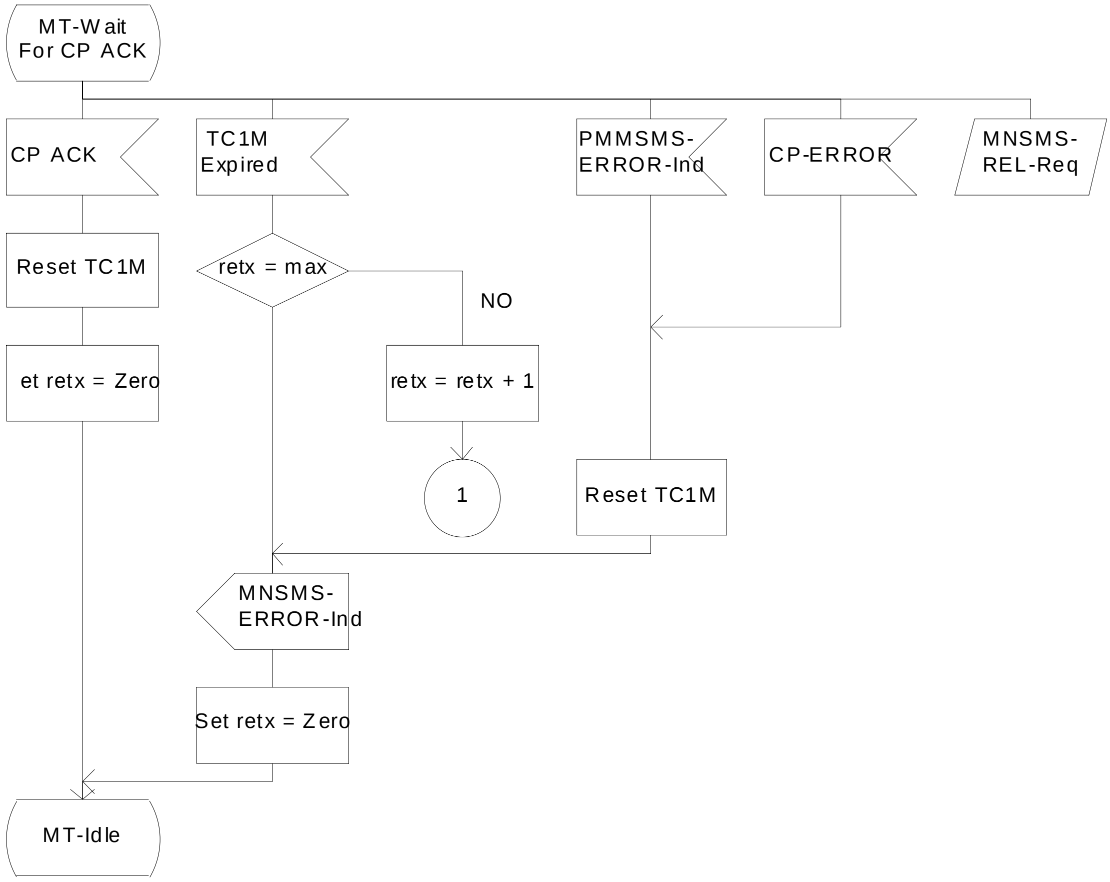
MO-SMC-GP entity on MS-side for GPRS
State transition diagram



MT-SMC-GP entity on MS-side for GPRS
SDL-16

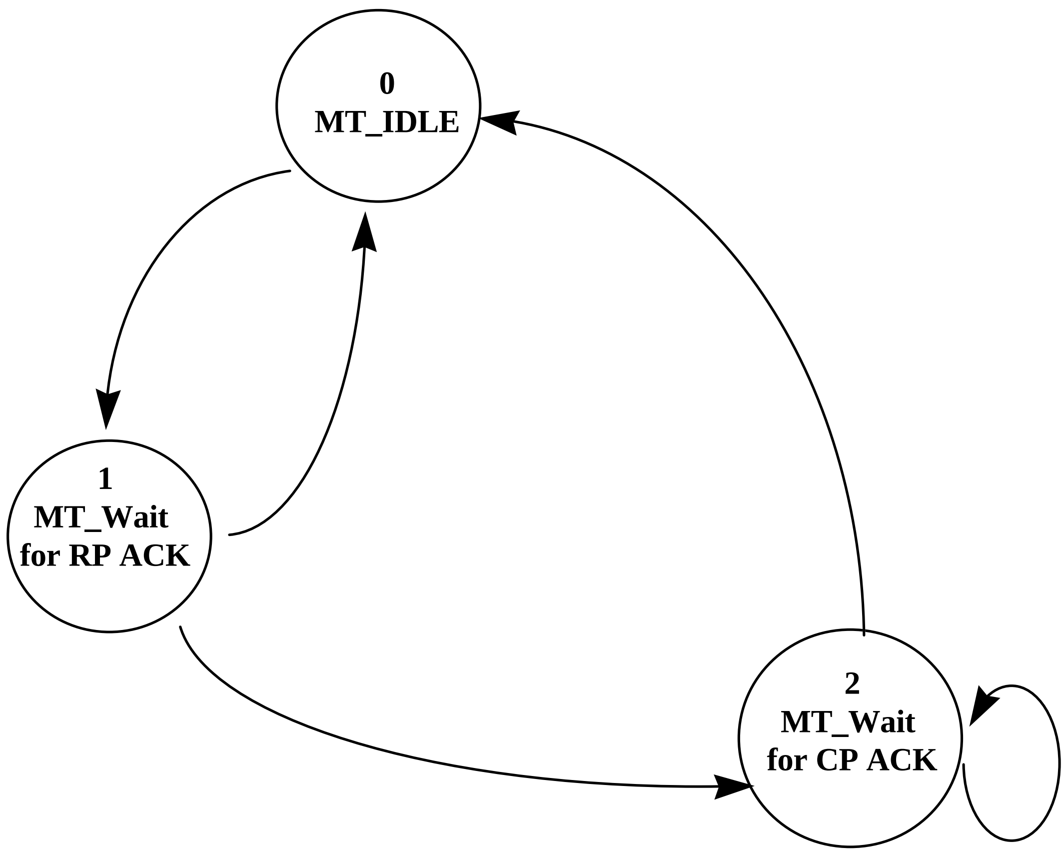


MT-SMC-GP entity on MS-side for GPRS
SDL-17

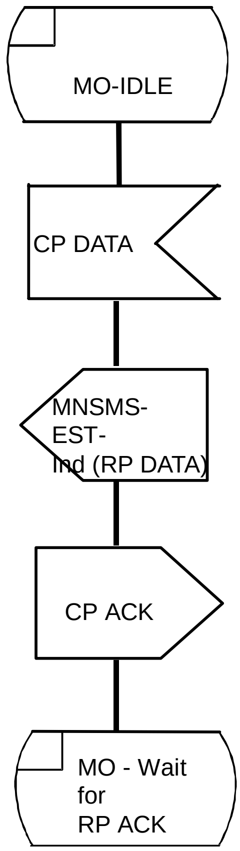


Note: The MNSMS-REL-Req is delayed until the next state

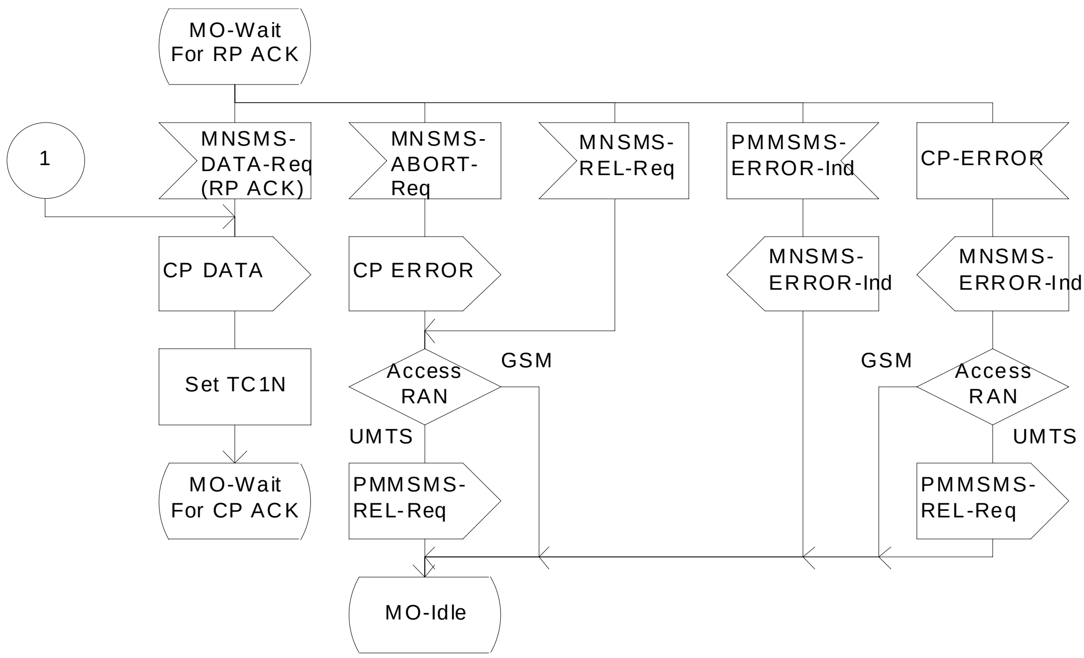
MT-SMC-GP entity on MS-side for GPRS
SDL-18



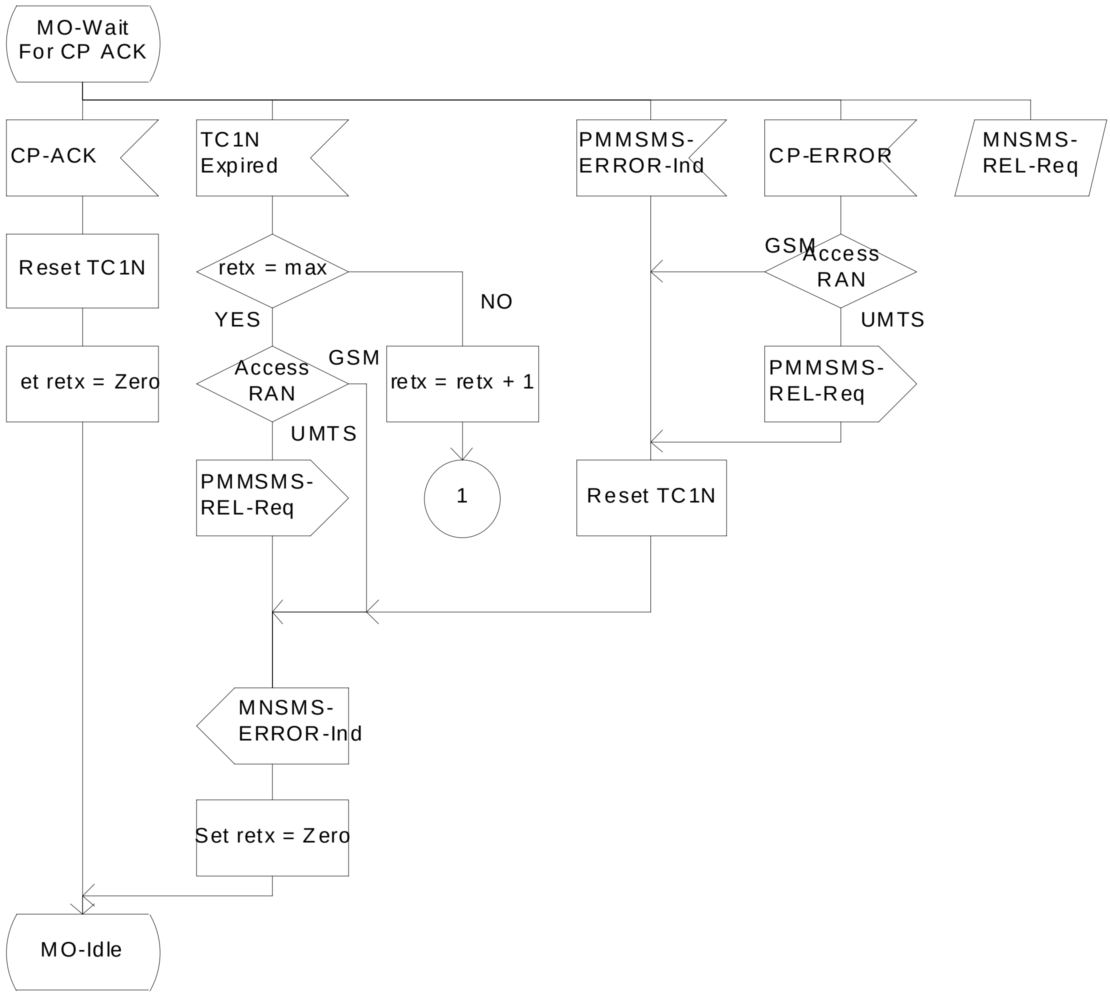
MT-SMC-GP entity on MS-side for GPRS
State transition diagram



MO-SMC-GP entity on Network side for GPRS
SDL-19

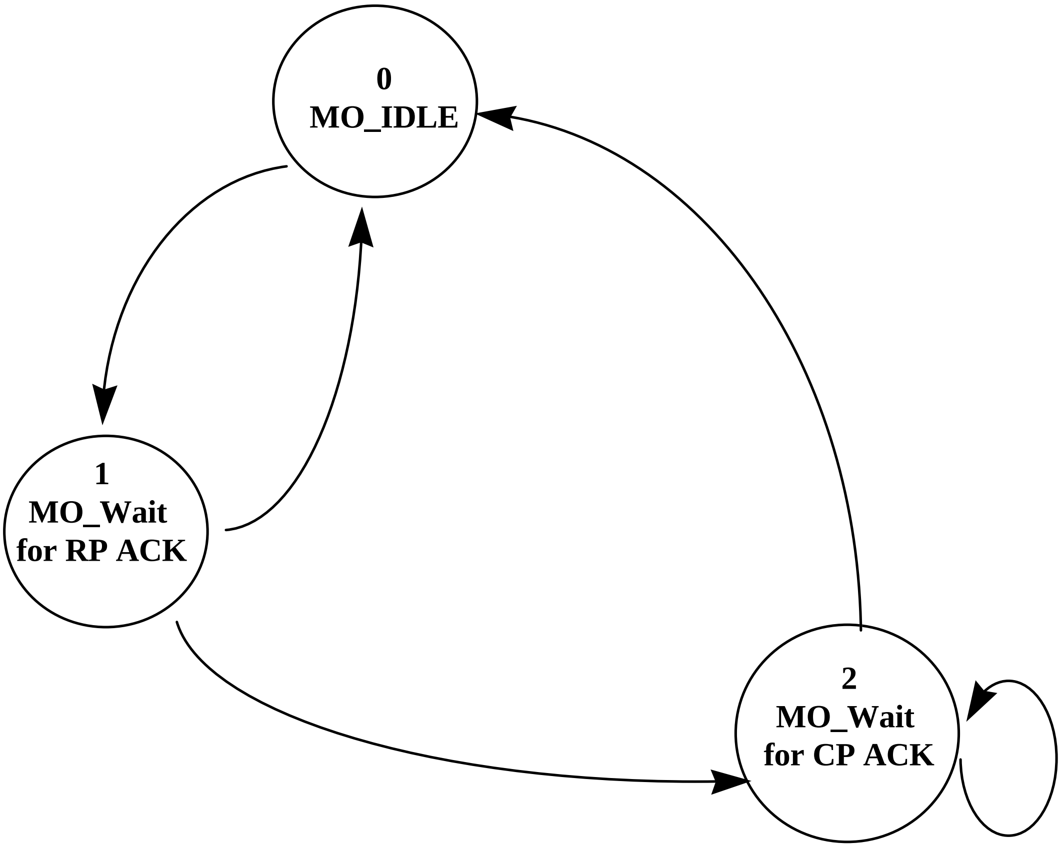


MO-SMC-GP entity on Network side for GPRS
SDL-20

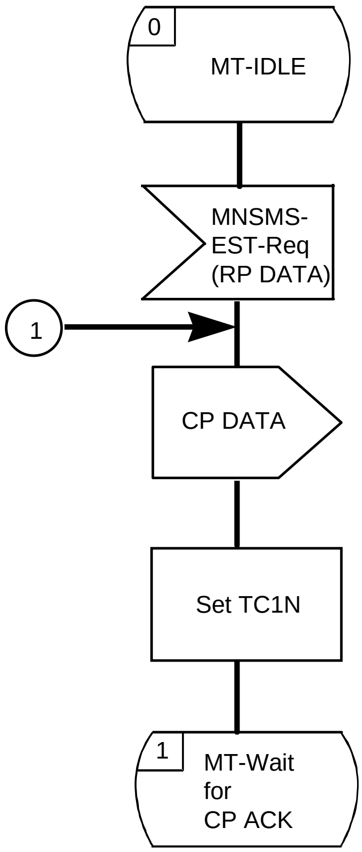


Note: The MNSMS-REL-Req is delayed until next state

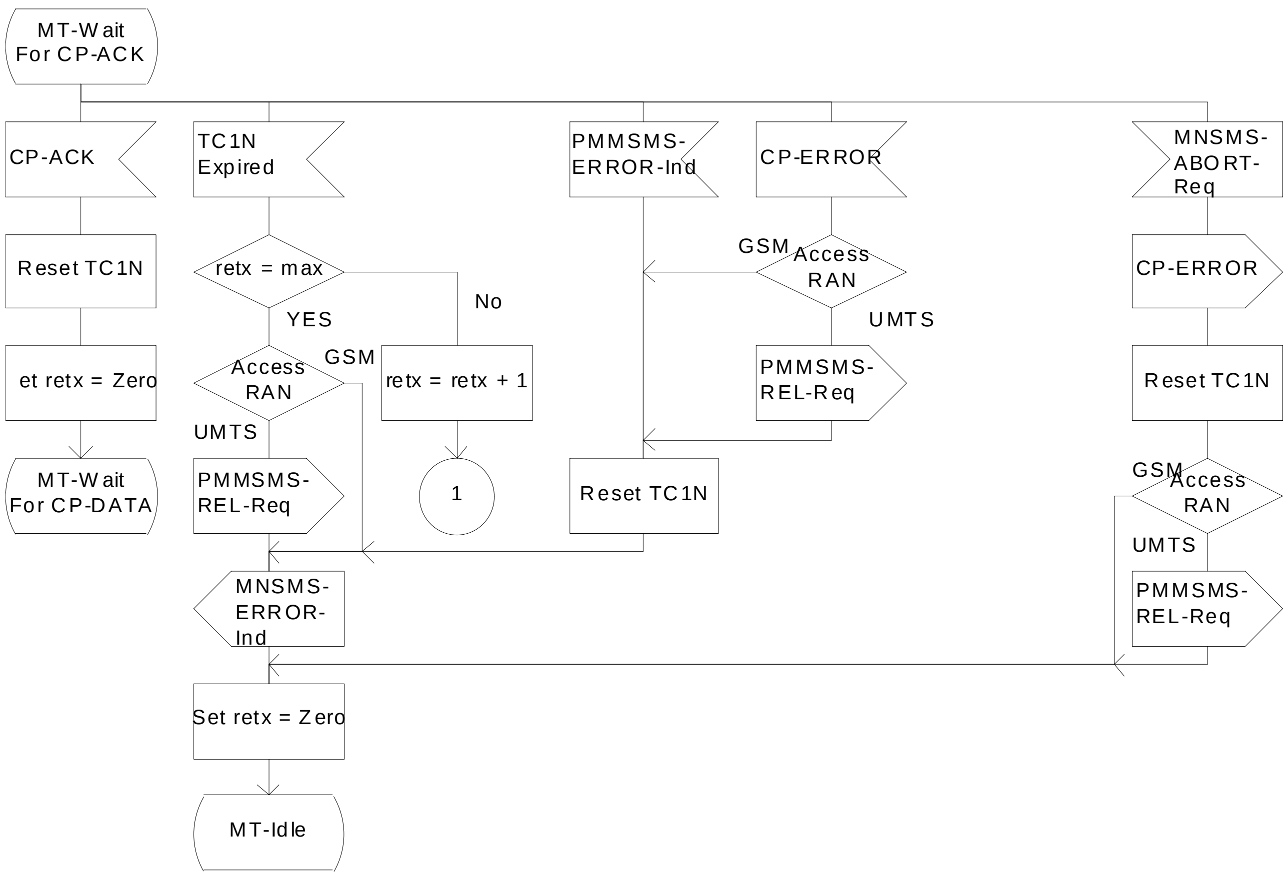
MO-SMC-GP entity on Network side for GPRS
SDL-21



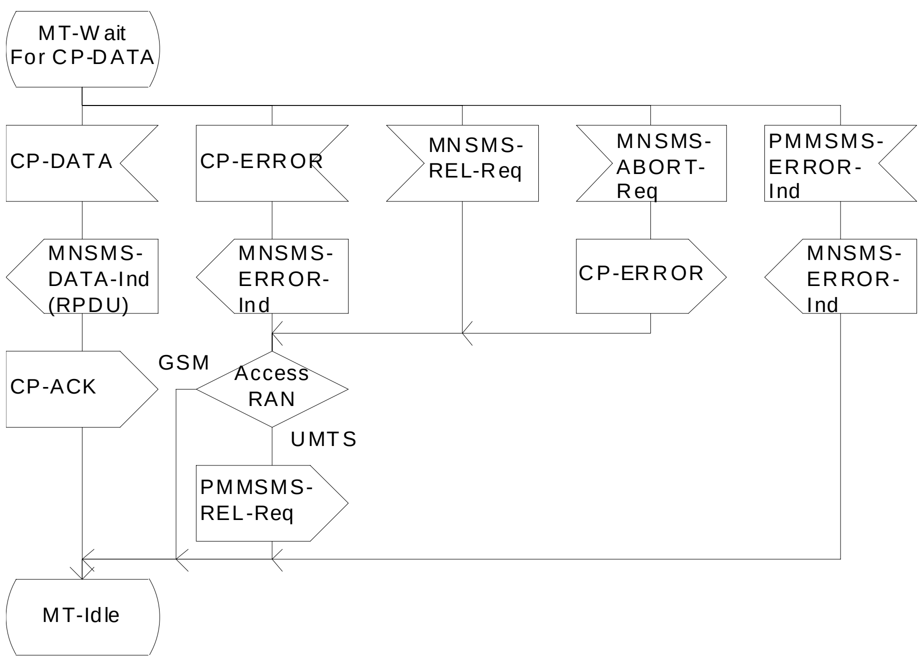
MO-SMC-GP entity on Network-side for GPRS
State transition diagram



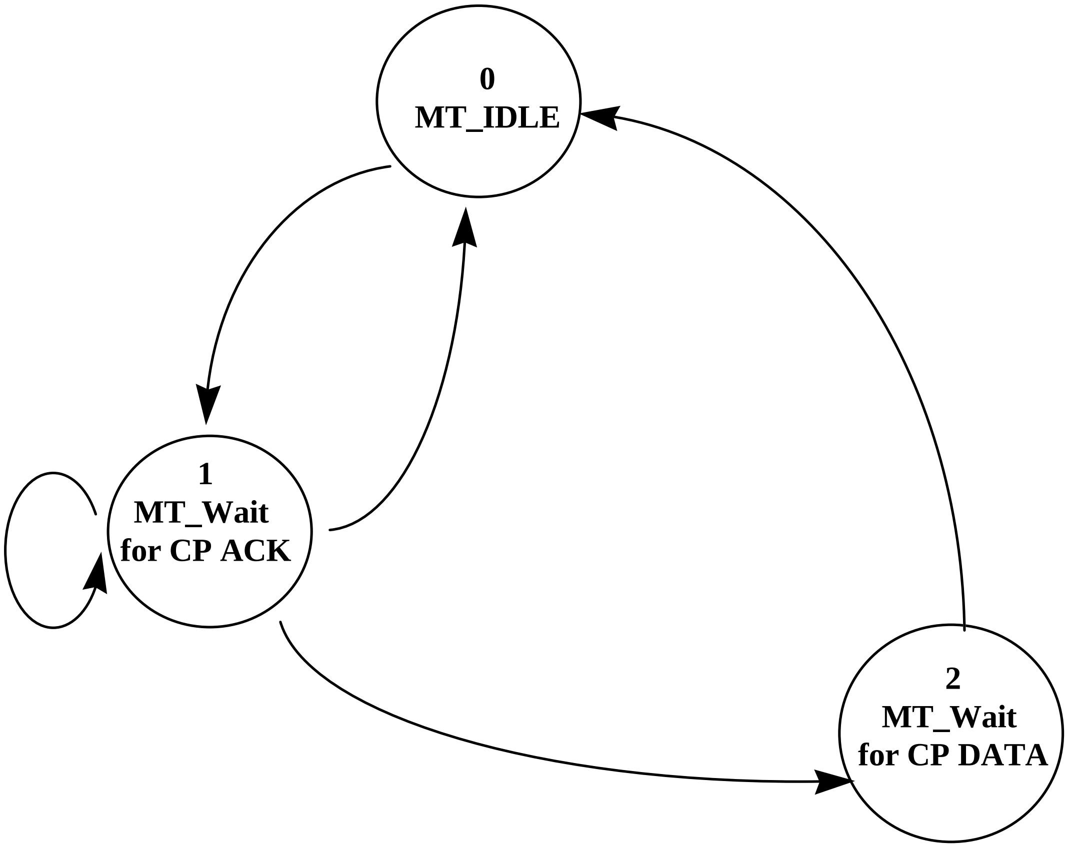
MT-SMC-GP entity on Network-side for GPRS
SDL-22



MT-SMC-GP entity on Network-side for GPRS
SDL-23



MT-SMC-GP entity on Network-side for GPRS
SDL-24



MT-SMC-GP entity on Network-side for GPRS
State transition diagram

Annex C (informative): Arrow diagrams

Arrow diagram C1:

The diagram reflects MO-message transfer by means of interlayer service primitives and the actual messages being transferred between the layer entities.

- SM-RL-primitives indicate services provided by SM-RL to SM-TL and RL (* see note).
- MNSMS-primitives indicate services provided by CM to SM-RL.
- RP-DATA is the SM-RL message carrying SM-TP data units.
- RP-ACK acknowledges RP-DATA reception on SM-RL.

Arrow diagram C2:

The diagram reflects MT-messaging by means of interlayer service primitives and the actual messages being transferred between the layer entities.

- SM-RL-primitives indicate services provided by SM-RL to SM-TL and RL (* see note).
- MNSMS-primitives indicate services provided by CM to SM-RL.
- RP-DATA is the SM-RL message carrying SM-TP data units.
- RP-ACK acknowledges RP-DATA reception on SM-RL.

Arrow diagram C3:

The diagram reflects memory available notification transfer by means of interlayer service primitives and the actual messages being transferred between the layer entities.

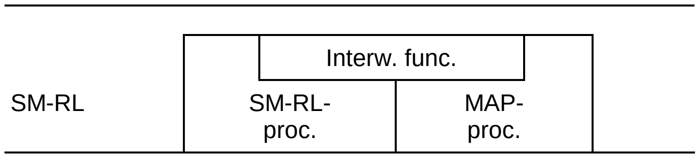
- SM-RL-primitives indicate services provided by SM-RL to SM-TL and RL (* see note).
- MNSMS-primitives indicate services provided by CM to SM-RL.
- RP-SMMA is the SM-RL message indicating that the mobile has memory available to receive one or more short messages.
- RP-ACK acknowledges RP-SMMA reception on SM-RL.
- RP-ERROR reports a failure in the notification procedure on the network side.

Arrow diagram C4:

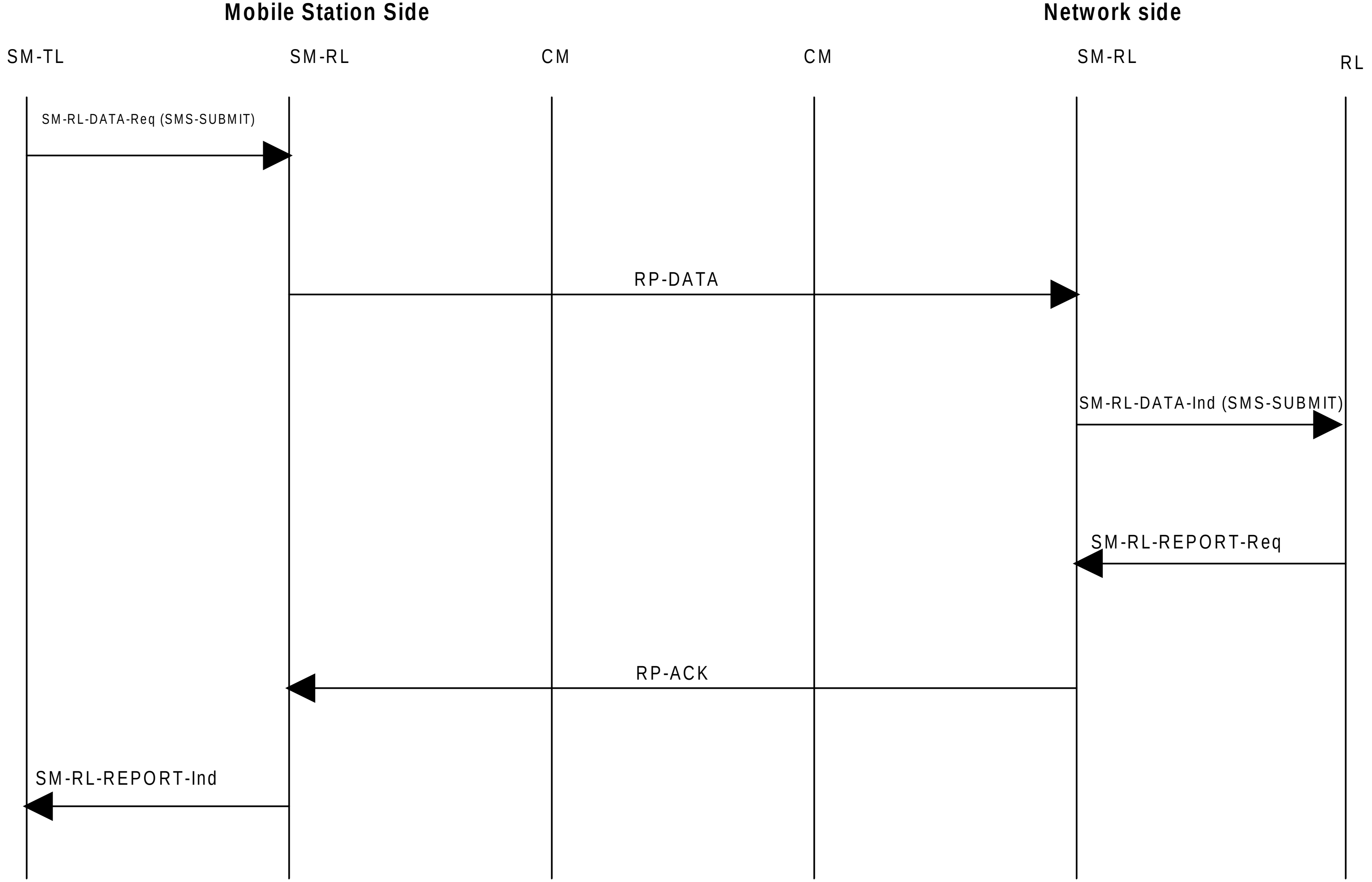
The diagram reflects the abort of any retransmission of a memory available notification by SM-RL by means of the SM-RL-MEMORY-AVAILABLE interlayer service primitive request with the SM-MEM-NOTIF-ABORT parameter present. The use of this primitive and the associated parameter are, of course, local to the mobile station.

- SM-RL-primitives indicate services provided by SM-RL to SM-TL and RL (note).
- MNSMS-primitives indicate services provided by CM to SM-RL.
- RP-SMMA is the SM-RL message indicating that the mobile has memory available to receive one or more short messages.
- RP-ACK acknowledges RP-SMMA reception on SM-RL.
- RP-ERROR reports a failure in the notification procedure on the network side.

NOTE: The SM-RL being the upper layer in the MSC, an interworking function between SM-RL-procedures and MAP-procedure is necessary. The term "RL" is used in the diagrams to indicate this function (see figure).

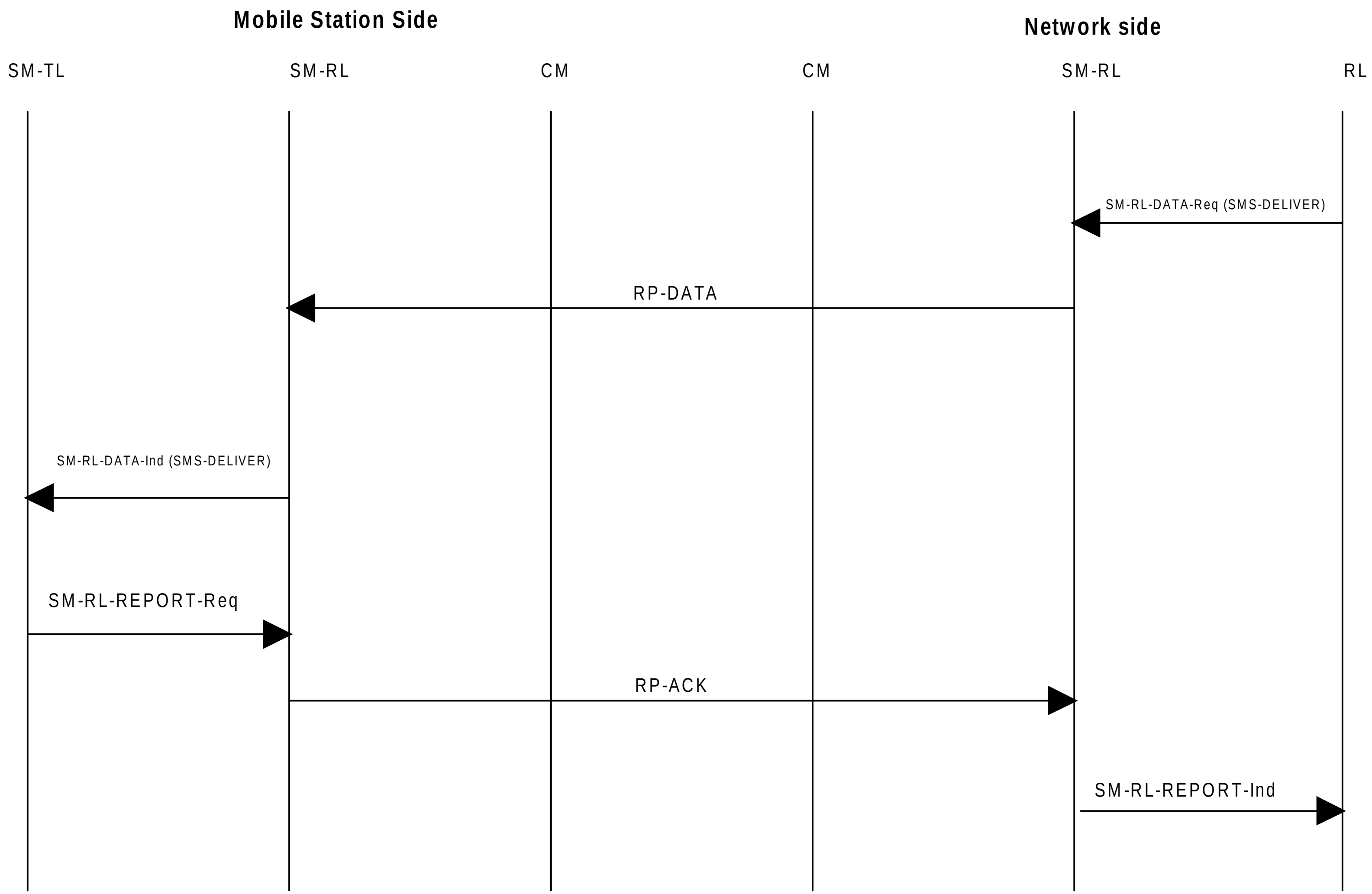


Mobile Originated Messaging on SM-RL



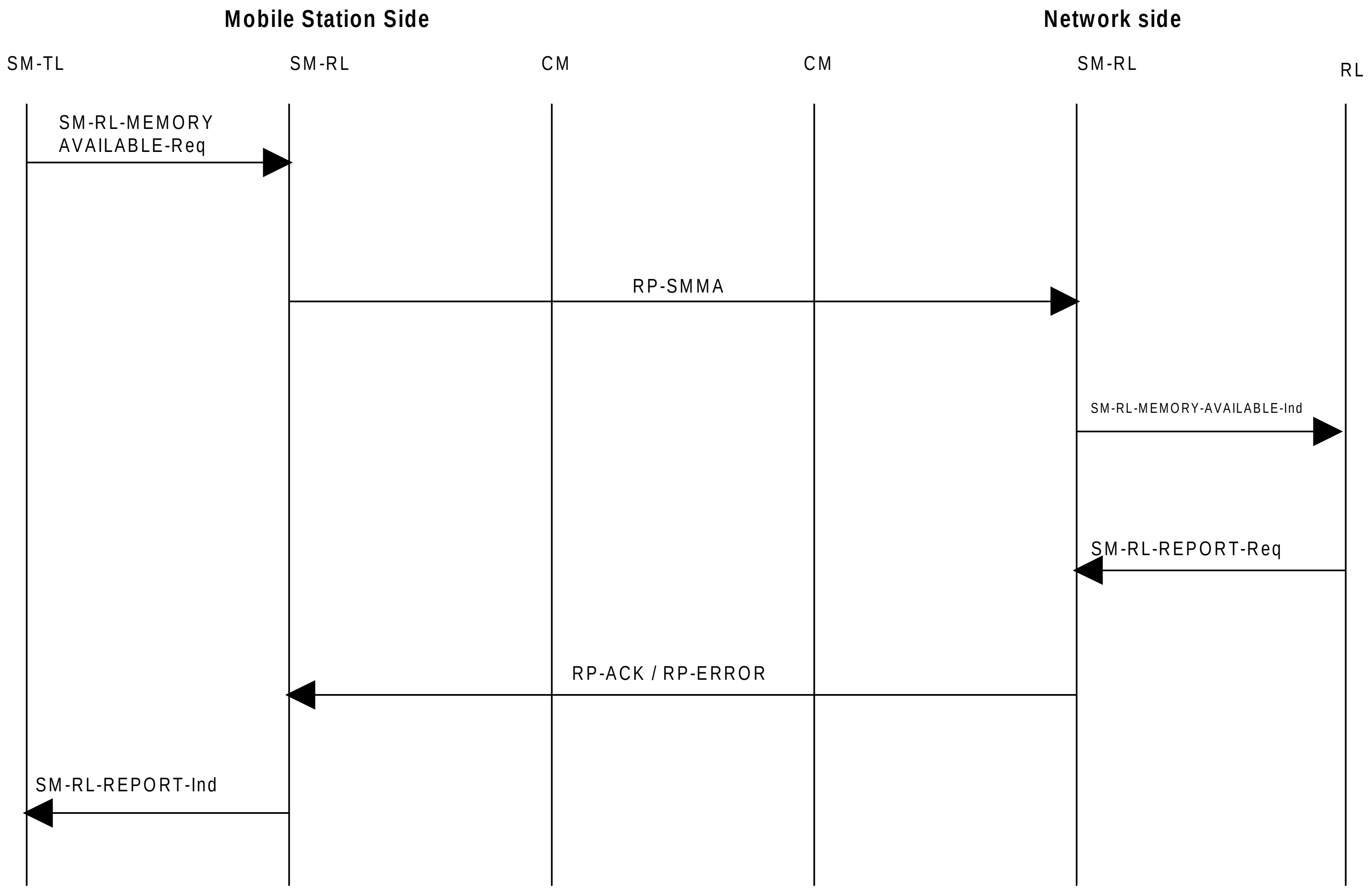
Arrow diagram C1

Mobile Terminated Messaging on SM-RL



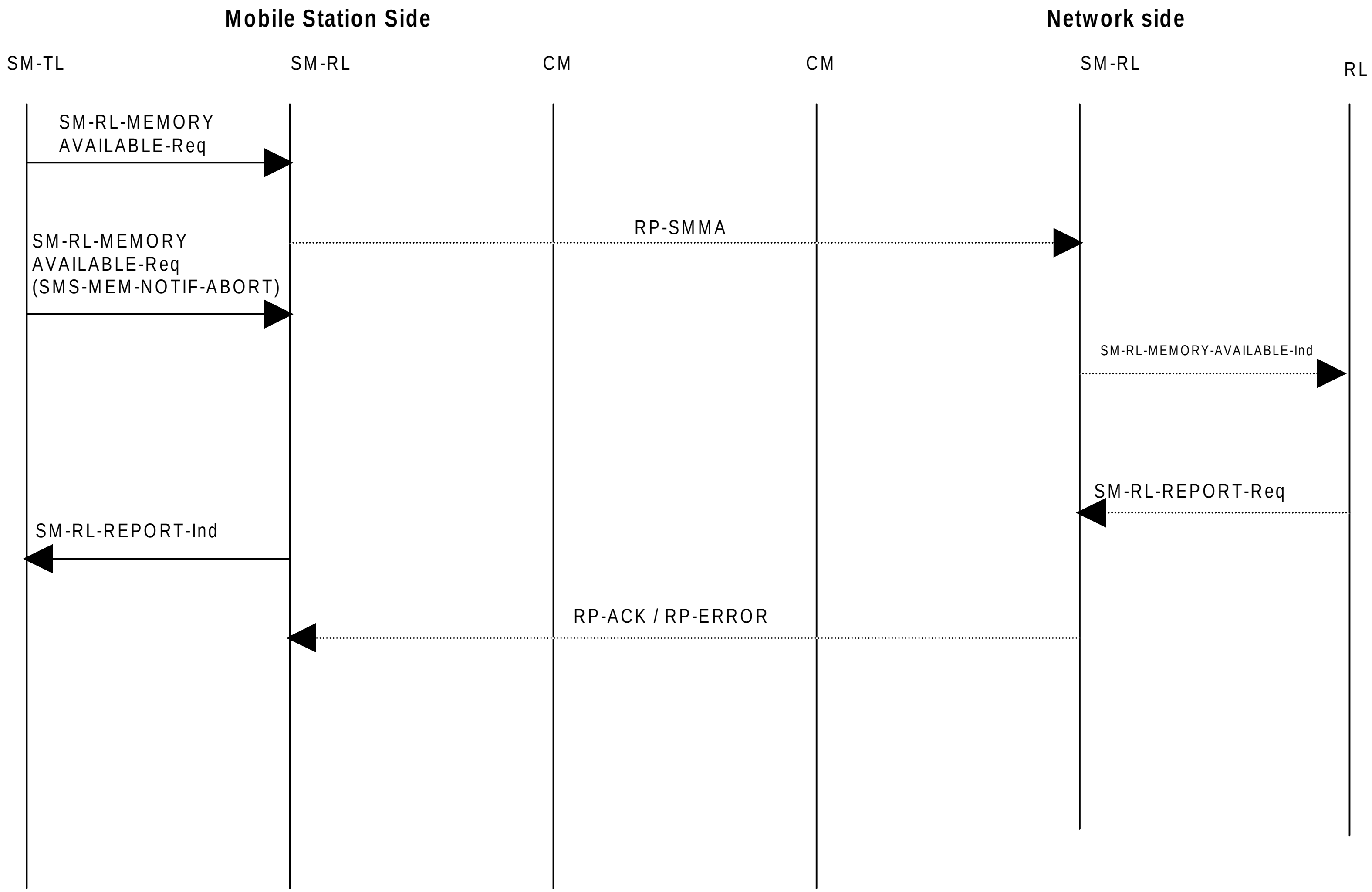
Arrow diagram C2

Memory Available Notification on SM-RL



Arrow diagram C3

Memory Available Notification Abort on SM-RL



NOTE: Dashed lines indicates messages that may be sent, even though an abort request was given

Arrow diagram C4

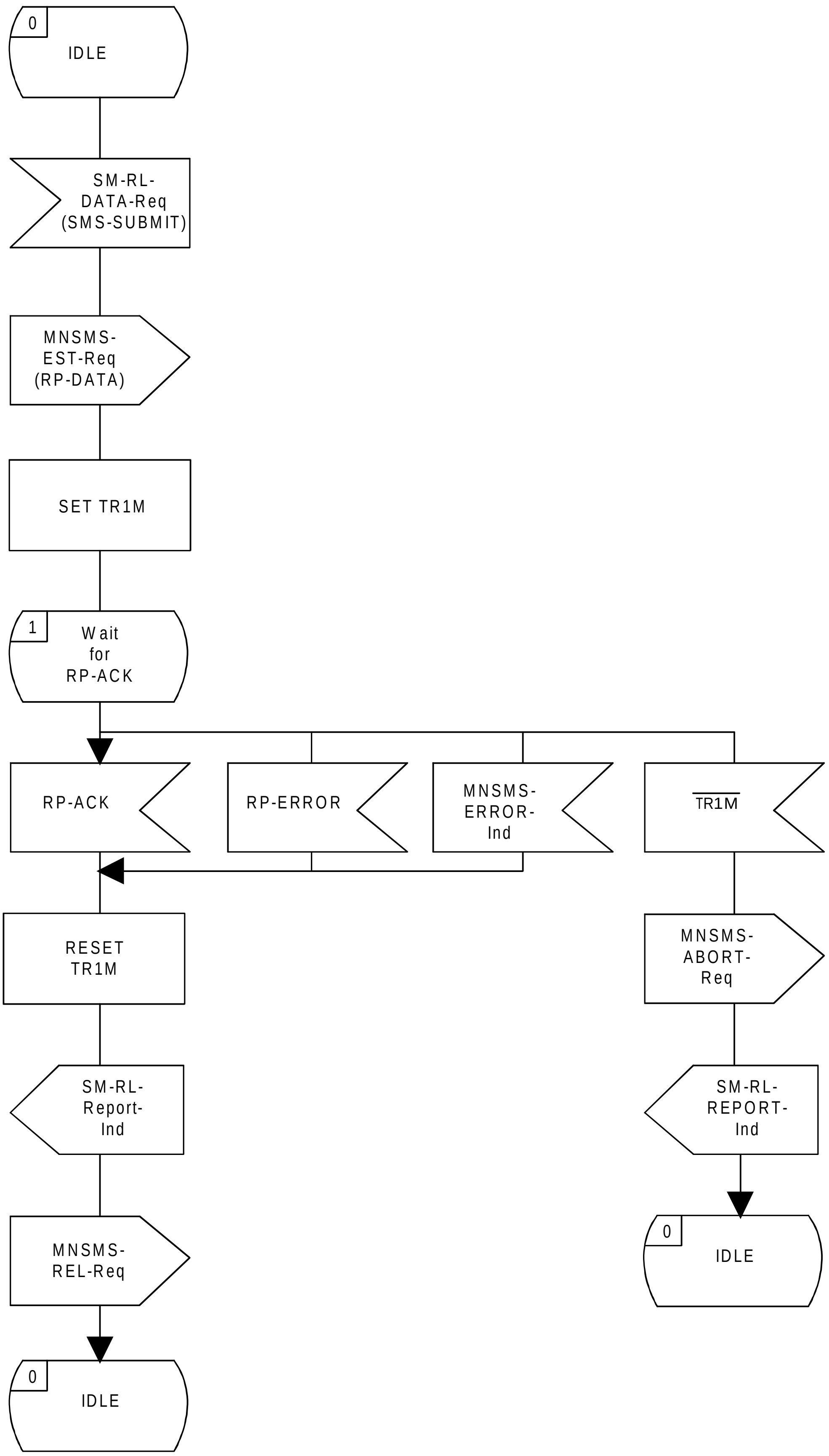
Annex D (normative): SDL-description of the short message relay layer

D.1 Introduction

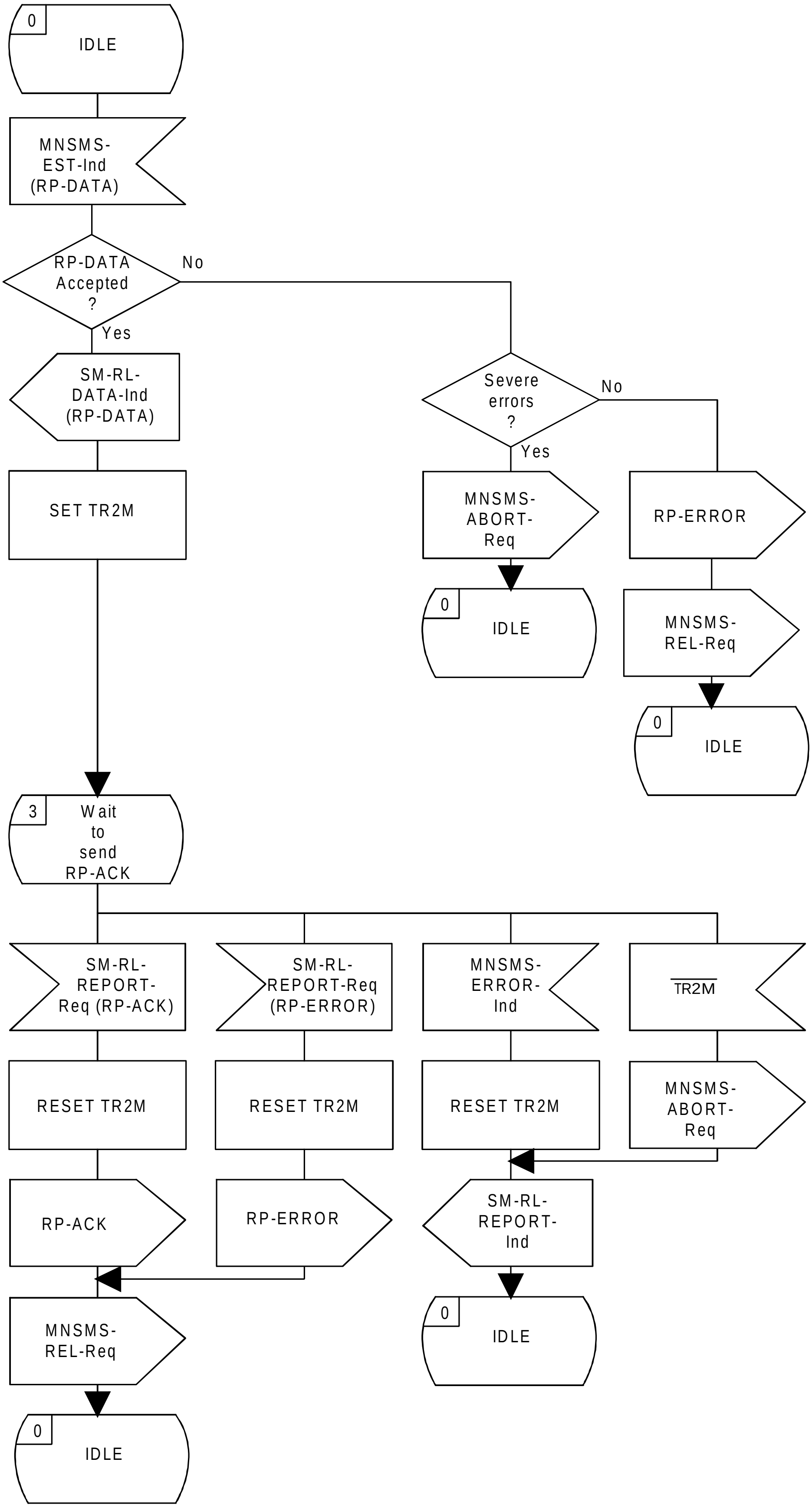
This annex contains an SDL-description of the Short Message Relay Layer in terms of the Short Message Service Support. The Short Message Relay Layer provides services to Short Message Transfer Layer.

The SDLs contain a mixture of peer to peer messages and conceptual primitives between the layers SM-TL, SM-RL and CM, as viewed by the SMR entities. SDL-1/2/3 show the SMR entity on MS-side, and SDL-4/5 on the network side.

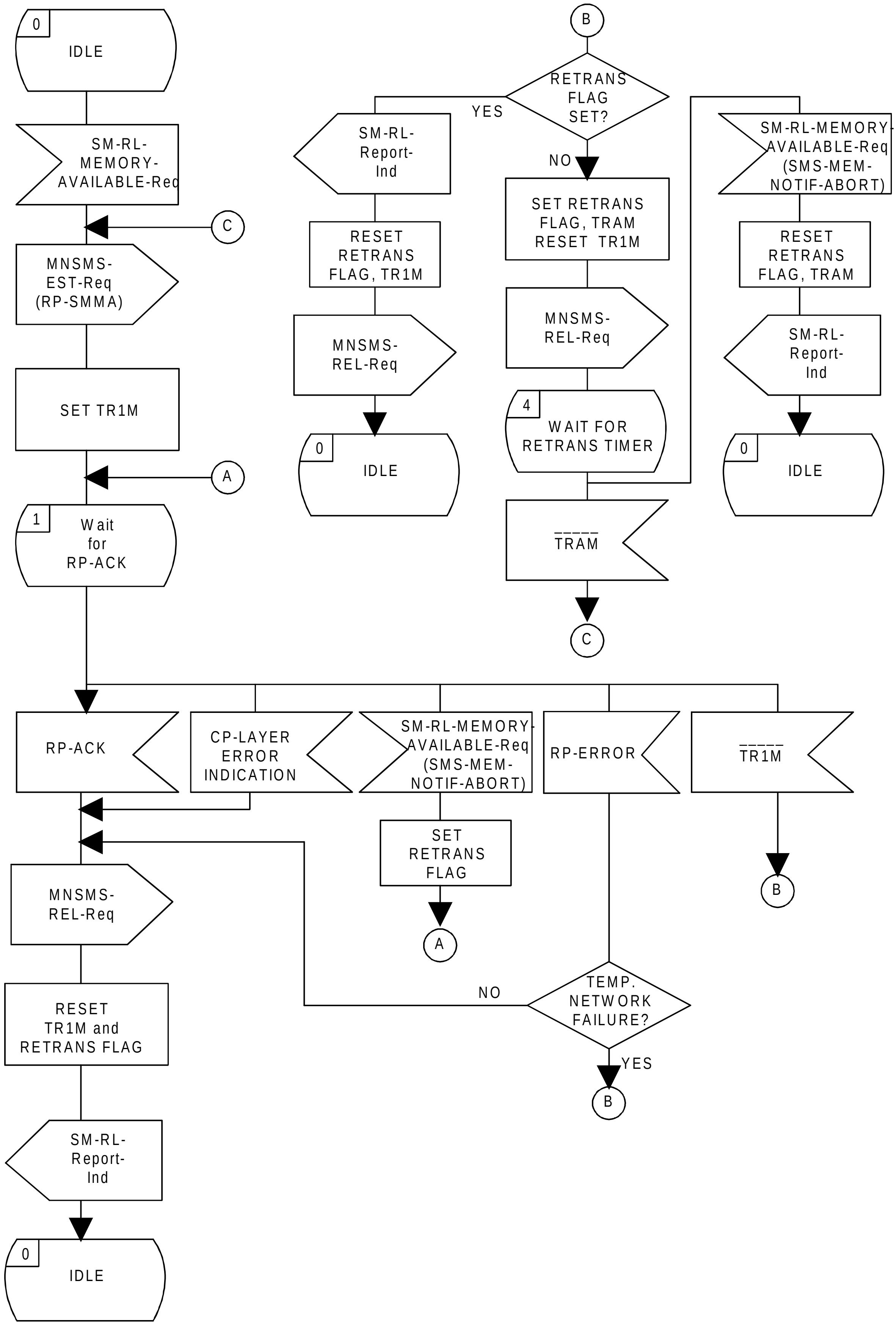
The lower layers (below CM) are transparent to an SMR entity.



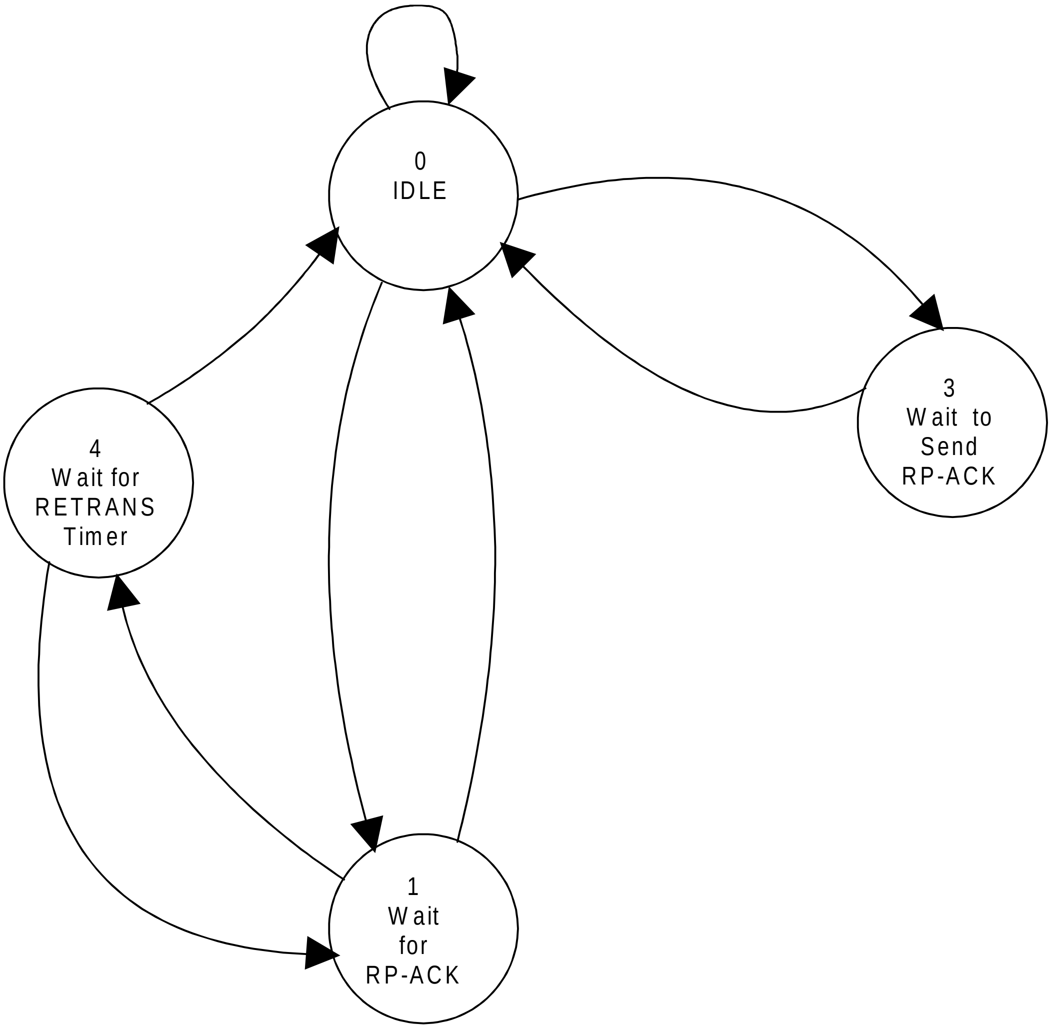
SMR-entity on MS-side
MO Short Message transfer
SDL-1



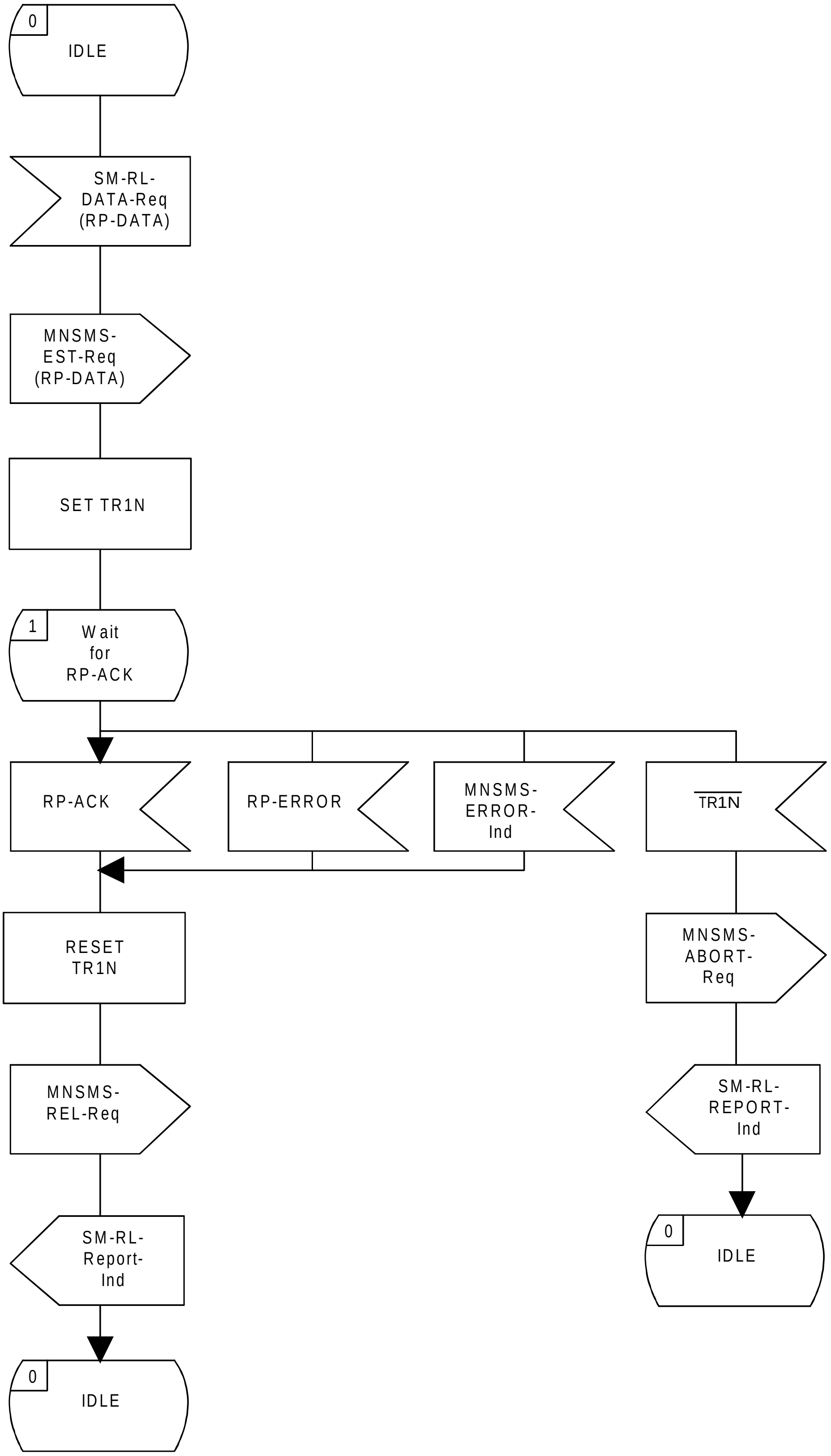
SMR-entity on MS-side
MT Short Message transfer
SDL-2



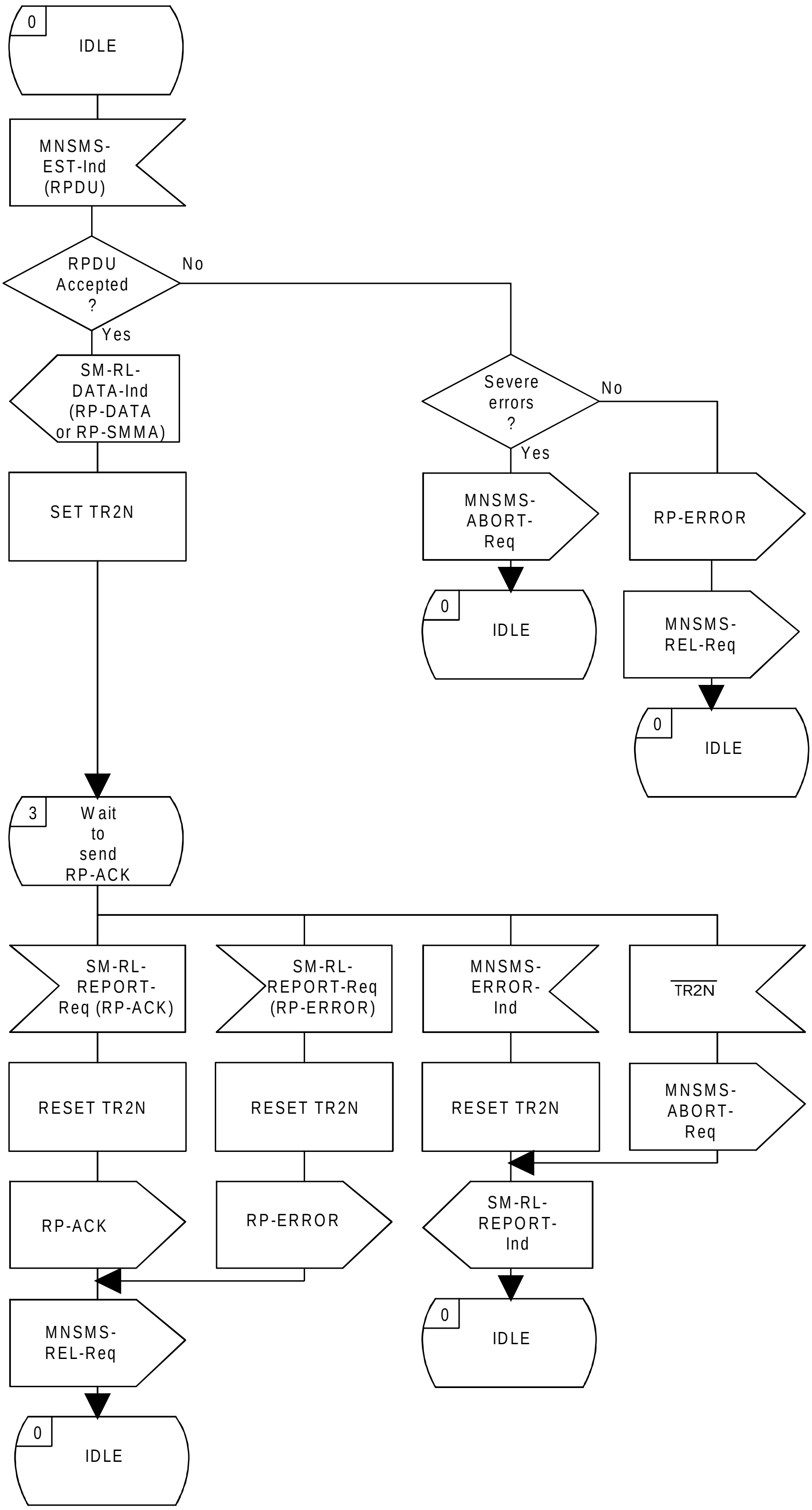
SMR-entity on MS-side
Memory Available Notification
SDL-3



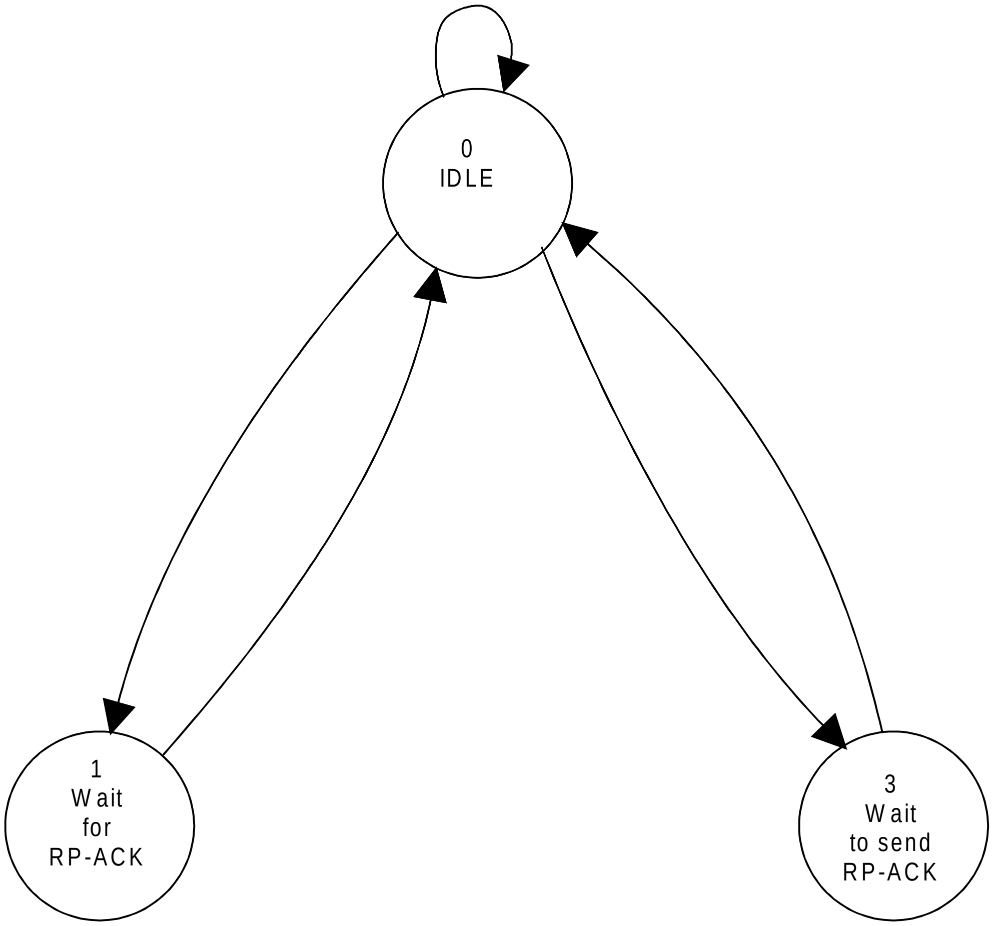
SMR-entity on MS-side
State transition diagram



SMR-entity on Network-side
MT Short Message transfer
SDL-4



SMR-entity on Network-side
MO Short Message and Notification transfer
SDL-5



SMR-entity on Network-side
State transition diagram

Annex E (informative): Cause definition

E-1: CP-cause definition.

Cause no. 17: "Network failure".

This cause is sent to the MS if the MSC cannot service an MS generated request because of PLMN failures, e.g. problems in MAP.

Cause no. 22: "Congestion".

This cause is sent if the service request cannot be actioned because of congestion (e.g. no channel, facility busy/congested etc.).

Cause no. 81: "Invalid Transaction Identifier".

This cause indicates that the equipment sending this cause has received a message with a Transaction Identifier which is currently not use on the MS - network interface.

Cause no. 95: "Semantically incorrect message".

This cause is used to report the receipt of a message with semantically incorrect content.

Cause no. 96: "Invalid mandatory information".

This cause indicates that the equipment sending this cause has received a message with non-semantical mandatory information element errors.

Cause no. 97: "Message type non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.

Cause no. 98: "Message not compatible with short message protocol state".

This cause indicates that the equipment sending this cause has received a message not compatible with the Short Message protocol state.

Cause no. 99: "Information element non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message which includes information elements not recognized because the information element identifier is not defined or it is defined but not implemented by the equipment sending the cause.

However, the information element is not required to be present in the message in order for the equipment sending the cause to process the message.

Cause no. 111: "Protocol error, unspecified".

This cause is used to report a protocol error event only when no other cause applies.

E-2: RP-cause definition mobile originating SM-transfer.

Cause no. 1: "Unassigned (unallocated) number".

This cause indicates that the destination requested by the Mobile Station cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).

Cause no. 8: "Operator determined barring".

This cause indicates that the MS has tried to send a mobile originating short message when the MS's network operator or service provider has forbidden such transactions.

Cause no. 10: "Call barred".

This cause indicates that the outgoing call barred service applies to the short message service for the called destination.

Cause no. 21: "Short message transfer rejected".

This cause indicates that the equipment sending this cause does not wish to accept this short message, although it could have accepted the short message since the equipment sending this cause is neither busy nor incompatible.

Cause no. 27: "Destination out of service".

This cause indicates that the destination indicated by the Mobile Station cannot be reached because the interface to the destination is not functioning correctly. The term "not functioning correctly" indicates that a signalling message was unable to be delivered to the remote user; e.g., a physical layer or data link layer failure at the remote user, user equipment off-line, etc.

Cause no. 28: "Unidentified subscriber".

This cause indicates that the subscriber is not registered in the PLMN (i.e. IMSI not known).

Cause no. 29: "Facility rejected".

This cause indicates that the facility requested by the Mobile Station is not supported by the PLMN.

Cause no. 30: "Unknown subscriber".

This cause indicates that the subscriber is not registered in the HLR (i.e. IMSI or directory number is not allocated to a subscriber).

Cause no. 38: "Network out of order".

This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time; e.g., immediately reattempting the short message transfer is not likely to be successful.

Cause no. 41: "Temporary failure".

This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time; e.g., the Mobile Station may wish to try another short message transfer attempt almost immediately.

Cause no. 42: "Congestion".

This cause indicates that the short message service cannot be serviced because of high traffic.

Cause no. 47: "Resources unavailable, unspecified".

This cause is used to report a resource unavailable event only when no other cause applies.

Cause no. 50: "Requested facility not subscribed".

This cause indicates that the requested short message service could not be provided by the network because the user has not completed the necessary administrative arrangements with its supporting networks.

Cause no. 69: "Requested facility not implemented".

This cause indicates that the network is unable to provide the requested short message service.

Cause no. 81: "Invalid short message transfer reference value".

This cause indicates that the equipment sending this cause has received a message with a short message reference which is not currently in use on the MS-network interface.

Cause no. 95: "Invalid message, unspecified".

This cause is used to report an invalid message event only when no other cause in the invalid message class applies.

Cause no. 96: "Invalid mandatory information".

This cause indicates that the equipment sending this cause has received a message where a mandatory information element is missing and/or has a content error (the two cases are indistinguishable).

Cause no. 97: "Message type non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.

Cause no. 98: "Message not compatible with short message protocol state".

This cause indicates that the equipment sending this cause has received a message such that the procedures do not indicate that this is a permissible message to receive while in the short message transfer state.

Cause no. 99: "Information element non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message which includes information elements not recognized because the information element identifier is not defined or it is defined but not implemented by the equipment sending the cause.

However, the information element is not required to be present in the message in order for the equipment sending the cause to process the message.

Cause no. 111: "Protocol error, unspecified".

This cause is used to report a protocol error event only when no other cause applies.

Cause no. 127: "Interworking, unspecified".

This cause indicates that there has been interworking with a network which does not provide causes for actions it takes; thus, the precise cause for a message which is being send cannot be ascertained.

E-3: RP-cause definition mobile terminating SM-transfer.

Cause no. 22: "Memory capacity exceeded".

This cause indicates that the mobile station cannot store the incoming short message due to lack of storage capacity.

Cause no. 81: "Invalid short message reference value".

This cause indicates that the equipment sending this cause has received a message with a short message reference which is not currently in use on the MS-network interface.

Cause no. 95: "Invalid message, unspecified".

This cause is used to report an invalid message event only when no other cause in the invalid message class applies.

Cause no. 96: "Invalid mandatory information".

This cause indicates that the equipment sending this cause has received a message where a mandatory information element is missing and/or has a content error (the two cases are indistinguishable).

Cause no. 97: "Message type non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.

Cause no. 98: "Message not compatible with short message protocol state".

This cause indicates that the equipment sending this cause has received a message such that the procedures do not indicate that this is a permissible message to receive while in the short message transfer state.

Cause no. 99: "Information element non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message which includes information elements not recognized because the information element identifier is not defined or it is defined but not implemented by the equipment sending the cause.

However, the information element is not required to be present in the message in order for the equipment sending the cause to process the message.

Cause no. 111: "Protocol error, unspecified".

This cause is used to report a protocol error event only when no other cause applies.

E-4: RP-Cause definition memory available notification.

Cause no. 30: "Unknown Subscriber".

This cause indicates that the subscriber is not registered in the HLR (i.e. IMSI or directory number is not allocated to a subscriber).

Cause no. 38: "Network out of order".

This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time; e.g., immediately reattempting the short message transfer is not likely to be successful.

Cause no. 41: "Temporary failure".

This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time; e.g., the Mobile Station may wish to try another short message transfer attempt almost immediately.

Cause no. 42: "Congestion".

This cause indicates that the short message service cannot be serviced because of high traffic.

Cause no. 47: "Resources unavailable, unspecified".

This cause is used to report a resource unavailable event only when no other cause applies.

Cause no. 69: "Requested facility not implemented".

This cause indicates that the network is unable to provide the requested memory available notification service.

Cause no. 95: "Invalid message, unspecified".

This cause is used to report an invalid message event only when no other cause in the invalid message class applies.

Cause no. 96: "Invalid mandatory information".

This cause indicates that the equipment sending this cause has received a message where a mandatory information element is missing and/or has a content error (the two cases are indistinguishable).

Cause no. 97: "Message type non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.

Cause no. 98: "Message not compatible with short message protocol state".

This cause indicates that the equipment sending this cause has received a message such that the procedures do not indicate that this is a permissible message to receive while in the short message transfer state.

Cause no. 99: "Information element non-existent or not implemented".

This cause indicates that the equipment sending this cause has received a message which includes information elements not recognized because the information element identifier is not defined or it is defined but not implemented by the equipment sending the cause.

However, the information element is not required to be present in the message in order for the equipment sending the cause to process the message.

Cause no. 111: "Protocol error, unspecified".

This cause is used to report a protocol error event only when no other cause applies.

Cause no. 127: "Interworking, unspecified".

This cause indicates that there has been interworking with a network which does not provide causes for actions it takes; thus, the precise cause for a message which is being send cannot be ascertained.

Annex F (informative): LAPDm SAPI 3 handling for short message service

This annex describes several typical SMS message transfer scenarios for circuit switched GSM.

For GPRS SMS transfer, refer to 3GPP TS 23.060 for channel set up and upper layer message flow.

Case A: Mobile originating short message transfer, no parallel call.

The mobile station side will initiate SAPI 3 establishment by a SABM command on the SDCCH after the cipher mode has been set. If no hand over occurs, the SAPI 3 link will stay up until the last CP-ACK is received by the MSC, and the clearing procedure is invoked.

Case B: Mobile terminating short message transfer, no parallel call.

The network side, i.e. the BSS will initiate SAPI3 establishment by a SABM command on the SDCCH when the first CP-Data message is received from the MSC. If no hand over occurs, the link will stay up until the MSC has given the last CP-ack and invokes the clearing procedure.

Case C: Mobile originating short message transfer, parallel call.

The mobile station will send a SABM command on the SACCH when a CM_SERV_ACC message has been received from the network, allowing the short message transfer to start. If no hand over occurs the link will stay up until the MSC orders a explicit release, or the clearing procedure is invoked. If the parallel call is cleared before the short message transfer is finalized, the MSC will delay the clearing procedure toward the BSS, i.e. the channel release procedure is delayed.

Case D: Mobile terminating short message transfer, parallel call.

The network side, i.e. the BSS will initiate SAPI3 establishment by a SABM command on the SACCH when the first CP-DATA message is received from the MSC. The further handling is exactly as described for case C.

Case E: Mobile terminating short message transfer together with Inter-MSC hand over, parallel call.

The MAP procedures "Forward access signalling" and "Process access signalling" will be used between the two MSCs to transfer the CP-DATA, CP-ACK and CP-ERROR messages.

Case F: Mobile terminating short message transfer on SDCCH channel together with Inter-MSC hand over.

The MAP procedures "Forward access signalling" and "Process access signalling" will be used between the two MSC's to transfer the CP-DATA, CP-ACK and CP-ERROR messages.

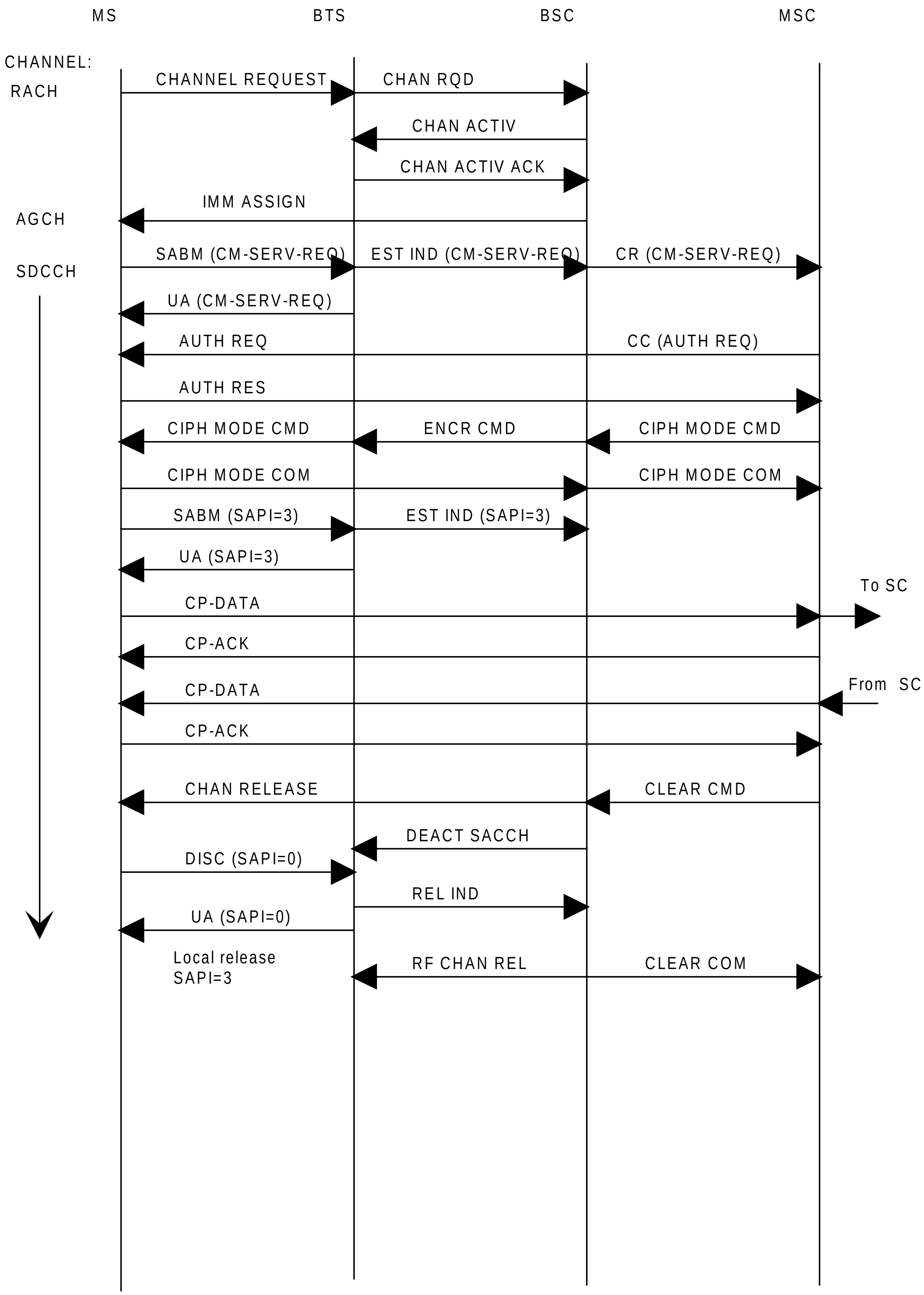


Figure F1/3GPP TS 24.011: Mobile originated Short Message on SDCCH

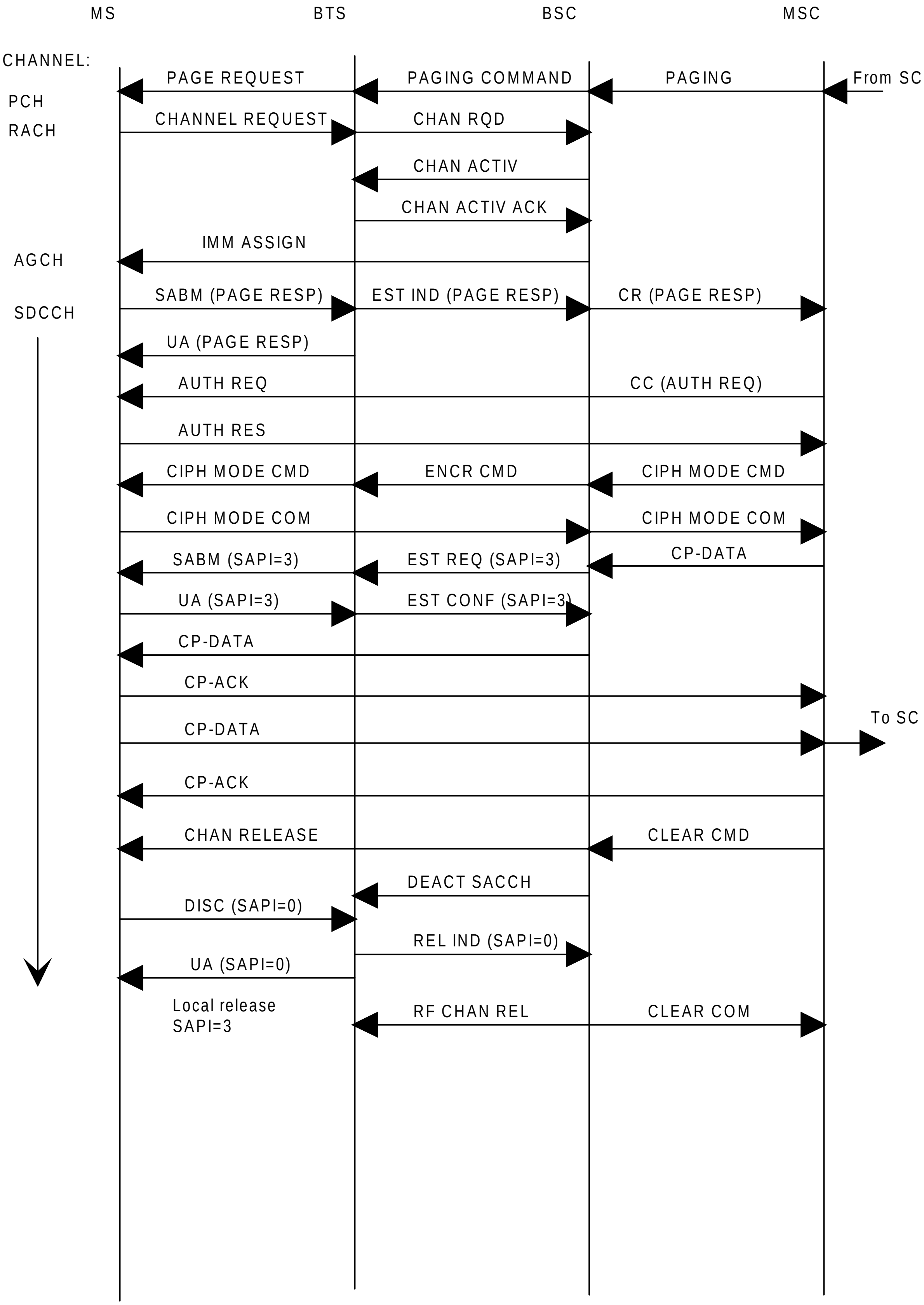


Figure F2/3GPP TS 24.011: Mobile terminated Short Message on SDCCH

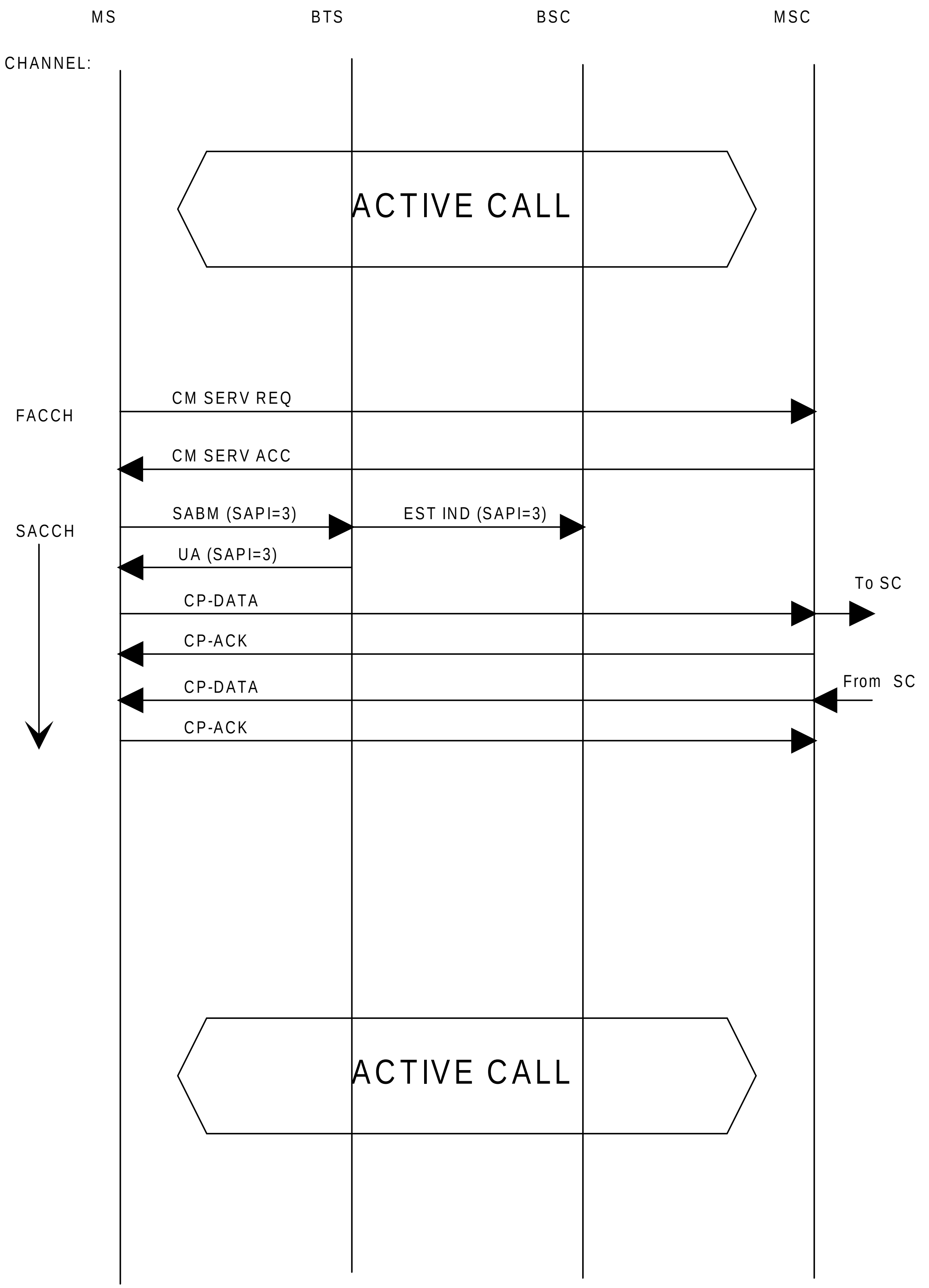


Figure F3/3GPP TS 24.011: Mobile originated Short Message on SACCH

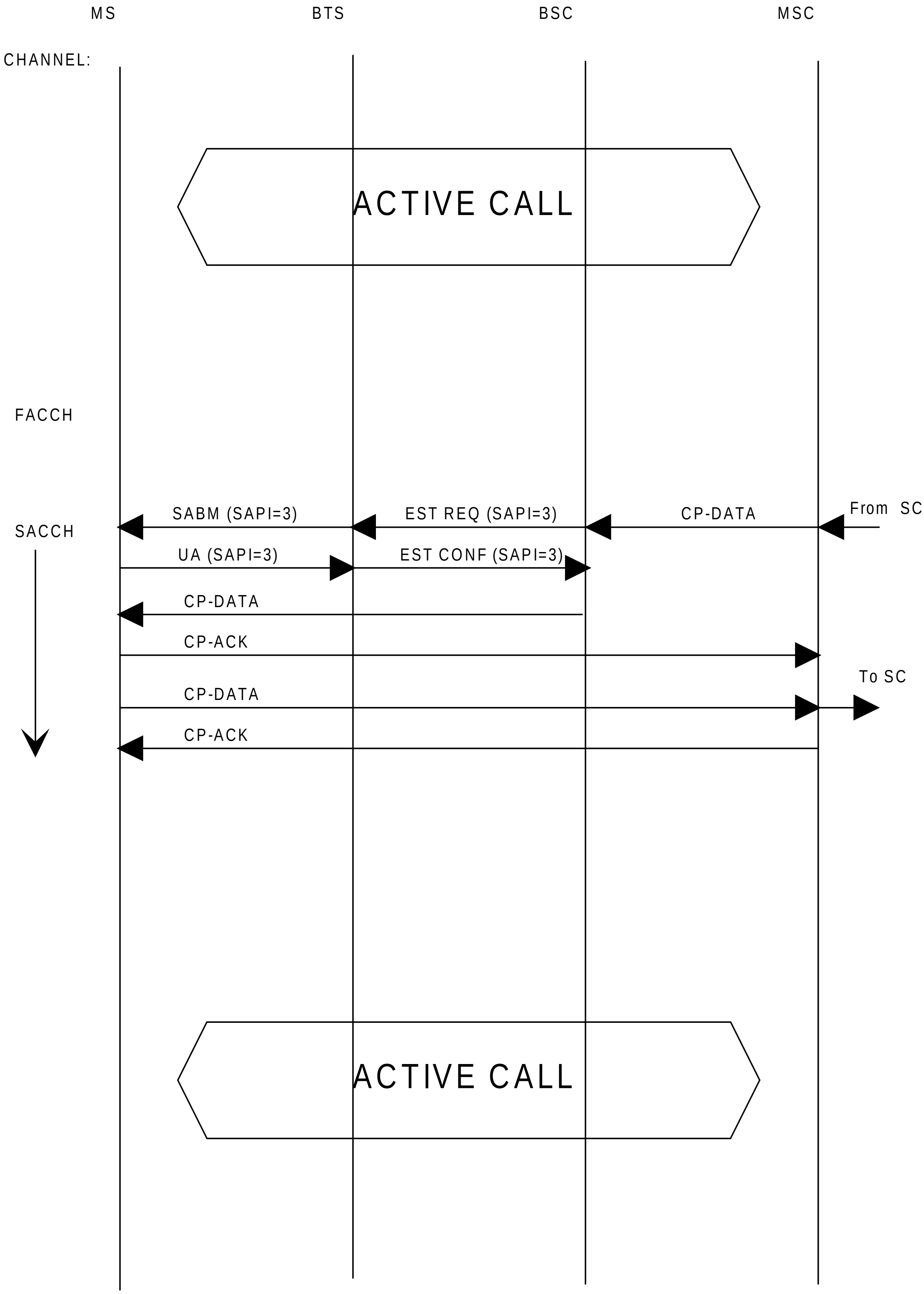


Figure F4/3GPP TS 24.011: Mobile terminated Short Message on SACCH

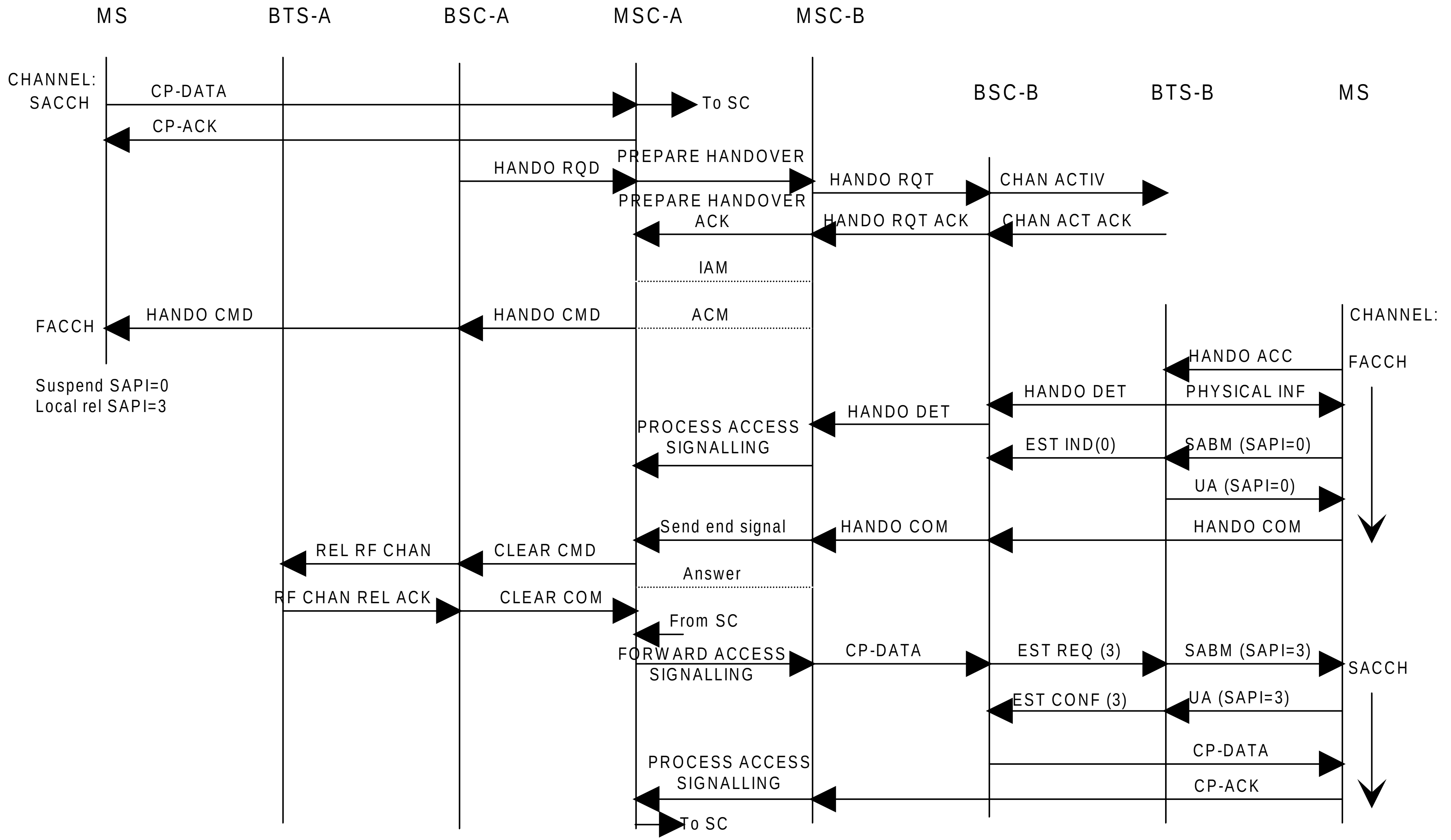


Figure F5/3GPP TS 24.011: Inter/MSC handover during Short Message transfer on SACCH

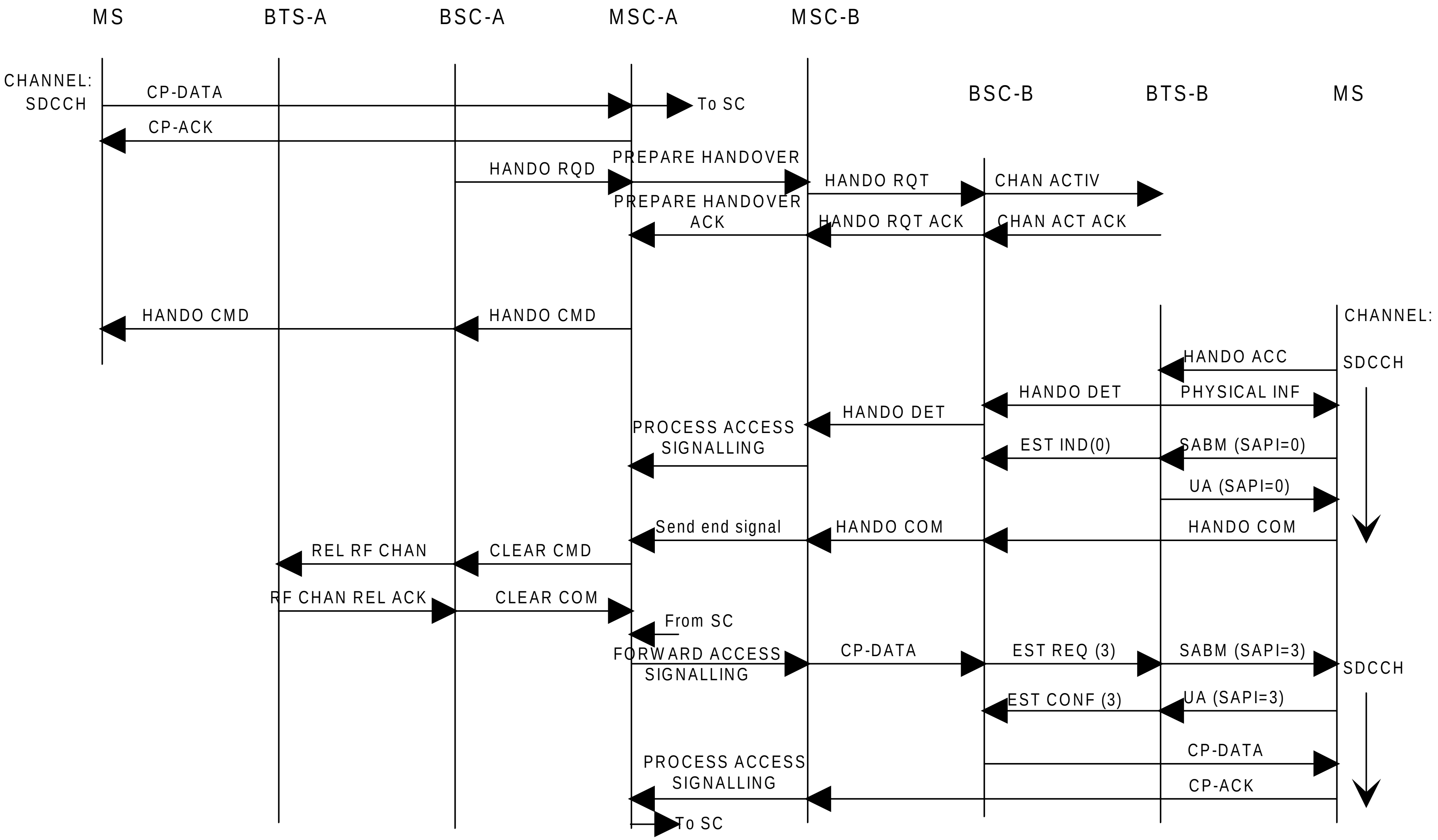


Figure F6/3GPP TS 24.011: Inter/MSC handover during Short Message transfer on SDCCH

Annex G (informative): Change history

Change history						
TSG SA#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Jun 1999	GSM 04.11	7.0.0				Transferred to 3GPP CN1
CN#04	24.011				3.0.0	Transferred to TSG CN at ETSI SMG#29. Under TSG TSG CN Change Control
CN#06	24.011	3.0.0	001r6	R99	3.1.0	Using MM sublayer for PS-SMS message transfer
CN#07	24.011	3.1.0	003r1	R99	3.2.0	SMC-GP SDL modification to transfer SMS messages via GMM
CN#07	24.011	3.1.0	004r1	R99	3.2.0	Reintroduction of deleted arrow diagrams
CN#07	24.011	3.1.0	005	R99	3.2.0	Cleaning up the References

TSGN	TSGN-number	WG Number	Spec	CR	Rev	Rel	Cat	Old vers	New ver	Title	WI	Notes
CN#08	NP-000273	N1-000747	24.011	006	1	R99	C	3.2.0	3.3.0	Alignment of SMS protocol with current MM/GMM integrity protection rules	Security	
CN#09	NP-000440	N1-000943	24.011	008		R99	A	3.3.0	3.4.0	Corrections of CP/RP-DATA IE lengths	TEI	

3GPP TSG-CN1 Meeting #14 ***Tdoc N1-001277***
Cardiff, Wales - 20 - 24 November, 2000

CR-Form-v3

CHANGE REQUEST

⌘	**24.008**	**CR**	**300**	⌘ rev	**-**	⌘	Current version:	**3.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	3.1 kHz multimedia calls at 33.6 kbit/s data rate		
Source:	⌘	Nokia		
Work item code:	⌘	TEI	***Date:*** ⌘	14 Nov 2000
Category:	⌘	**F**	***Release:*** ⌘	R99
		Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change:	⌘	CN#9 has approved a CR which added an in-call modification procedure for Multimedia Calls. Corresponding CRs have been approved to 3G TS 29.007 and 3G TS 27.001. It has been identified that currently procedure description in 3G TS 24.008 describes details of TAF and IWF, which are the scope of before mentioned CN3 specification. Therefore, this CR propose to replace detailed TAF and IWF procedural description with referencies to relevant specifications.
Summary of change:	⌘	In chapter 5.3.6.3.1 the detailed description of IWF is replaced with reference to 29.007. In chapter 5.3.6.3.2 the detailed description of TAF is removed as it is described in 27.001.
Consequences if not approved:	⌘	There is duplicated description of IWF and TAF procedures, which may lead to inconsistencies when specifications will evolve. Also description of TAF and IWF procedures is out of the scope of 24.008.

Clauses affected:	⌘	5.3.6.3.1, 5.3.6.3.2		
Other specs affected:	⌘	[X] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘	29.007 CR027, 27.001 CR039 (NP-000542)
Other comments:	⌘	The CRs to other affected specifications have beed approved in CN#9 plenary meeting.		

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.3.6 Support of multimedia calls

5.3.6.1 Service description

The GSM-UMTS circuit-switched multimedia call is based on the 3G-324M [26.111], which is a 3GPP-variant of the ITU-T H.324 recommendation. CS Multimedia telephony is a Bearer Service, which utilizes the Synchronous Transparent Data service (BS30) [3].

At the multimedia call setup the required call type, 3G-324M, is indicated, for the network to be able to invoke appropriate interworking functionality. In the peer end the H.324 information is used to invoke the terminal application. In addition to H.324 indication the terminal must select Information Transfer Capability (ITC) for the multimedia call. The 'correct' ITC depends on the peer end and the transporting networks; an all-ISDN call is a UDI/RDI call, and a call, which involves PSTN, is an analog '3.1 kHz audio' call.

For the case when the setup of a multimedia call is not successful, fallback to speech is specified.

5.3.6.2 Call establishment

For both mobile originating and mobile terminating calls, the normal call establishment procedures apply, with the exceptions specified in the following sections.

For further description of the function of MSC/IWF in the following sections, see TS 29.007 [38].

5.3.6.2.1 Mobile originated multimedia call establishment

At call setup the required call type, 3G-324M, is indicated by the originating MS in the SETUP message, with the *bearer capabilityIE* parameter Other Rate Adaptation set to 'H.223 and H.245'. The support of a fallback to speech is requested by including also a *bearer capabilityIE 2 with speech indication* in the SETUP message. The network shall examine each mode described in the *bearer capability IEs* included in the SETUP message by performing compatibility checking as defined in Annex B. If as a result of this compatibility checking the network decides to reject the call, then the network shall initiate call clearing as specified in section 5.4 with the following causes:

a) #57 "bearer capability not authorized"

b) #58 "bearer capability not presently available"

c) #65 "bearer service not implemented"

d) #70 "only restricted digital information bearer capability is available"

The originating user shall determine (possibly by pre-configuration of the terminal) whether a digital connection is required or if the call will be an analog modem call. If the call is expected to be digital the *bearer capability* IE parameter ITC is set to UDI/RDI. In an analog call the *bearer capability* IE parameter ITC is set to '3.1kHz audio ex PLMN'. Additionally required modem type is indicated (Other Modem Type = V.34).

5.3.6.2.1.1 Fallback to speech

If the network, during setup of an analogue H.324-call, detects that the called end does not support a H.324 call, then network initiates the in-call modification procedure (see section 5.3.4.3) towards the MS to modify the call mode to speech, if the MS had included a speech *bearer capability IE* in the SETUP message.

NOTE : fallback from digital (UDI) H.324-call to speech is not supported.

5.3.6.2.2 Mobile terminating multimedia call

At call setup the required call type, 3G-324M, is indicated by the network in the SETUP message, with the *bearer capability IE* parameter Other Rate Adaptation set to 'H.223 and H.245'. ITC is either '3.1kHz audio ex PLMN' or 'UDI/RDI'. If the network supports fallback to speech, and if the subscriber has subscription to speech, a *bearer capability* IE *2* with speech indication is included in the SETUP message. *The bearer capabilityIE(s)* may (in the case of the single numbering scheme) be missing from the SETUP-message.

The MS shall perform the compatibility checking as defined in Annex B for the required mode(s) if indicated in the SETUP message. If as a result of compatibility checking the MS decides to reject the call, the MS shall initiate call clearing according to the procedures of section 5.4 with one of the following causes:

a) #57 "bearer capability not authorized"

b) #58 "bearer capability not presently available"

c) #65 "bearer service not implemented"

d) #88 "incompatible destination"

The MS shall indicate the supported call type(s) in the CALL_CONFIRMED-message, which is the acknowledgement to SETUP. The MS has following options for the inclusion of *bearer capability IE* in the CALL_CONFIRMED message:

- if the MS/user accepts the offered multimedia call, and supports speech fallback both multimedia and speech *bearer capability IEs* shall be included

- if the MS/user accepts the offered multimedia call, but does not support speech fallback only a multimedia *bearer capability IE shall be included*

- if the MS/user wishes a speech (only) call a speech *bearer capability IE* is included

If the SETUP contained no *bearer capability IE* the network shall perform compatibility checking of the CALL CONFIRMED message in the same way as the compatibility checking of the SETUP message in the mobile originating call case, described in section 5.3.6.2.1.

If modem handshaking fails (in a modem call) the call mode will be modified to speech. The modem signalling is inband, so the call must have reached the active state, when these conclusions about the presence of modems can be done. The call modifications are realized through the in-call modification procedure, by which the network requests the MS to modify the call mode (see section 5.3.4.3).

NOTE: Fallback from digital (UDI) H.324-call to speech is not supported.

5.3.6.3 In-call modification in the "active" state

In order to change the bearer capability for a multimedia call, the following in-call modification procedure shall be used. Following bearer capability parameters can be modified with the procedure (see TS 29.007 [38]):

- Fixed Network User Rate

Only network side of the radio interface may act as the requesting user to invoke the in-call modification.

5.3.6.3.1 Initiation of in-call modification

The procedure is initiated by the network in the "active" state of the call. The network shall send a MODIFY message including *Immediate modification indicator IE* and the new bearer capability to be changed to; start timer T323; and enter the "mobile terminating modify" state. Any internal resources necessary to support the new bearer capability shall be reserved. The detailed operation of the MODIFY originating side is described in 3GTS 29.007~~shall stop sending Bm-channel information; and stop interpreting received Bm-channel information according to the old bearer capability~~.

Upon receipt of the MODIFY message with *Immediate modification indicator IE*, the MS shall check to ensure that the requested bearer capability can be supported and if so, it shall initiate the reservation of any resources necessary to support the new bearer capability and enter the "mobile terminating modify" state.

5.3.6.3.2 Successful completion of in-call modification

If the MS can support the requested bearer capability the MS shall perform actions defined in TS 27.001 [37]. After successful modifications defined in TS 27.001 [37] the MS shall ~~start sending user information according to the new bearer capability and start interpreting received user channel information according to the new bearer capability;~~ send a MODIFY COMPLETE message with the new bearer capability included and enter the "active" state.

Upon receipt of the MODIFY COMPLETE message the network shall: initiate the alternation to those resources necessary to support the new bearer capability; stop timer T323; and enter the "active" state.

5.3.6.3.3 Failure of in-call modification

5.3.6.3.3.1 MS rejection of in-call modification

If the MS cannot support the requested bearer capability, the MS shall: release any resources which had been reserved for the modification; send a MODIFY REJECT message with the old bearer capability and cause # 58 "bearer capability not presently available", and enter the "active" state.

Upon receipt of the MODIFY REJECT message the network shall: stop timer T323, release any resources which had been reserved for the modification, enter the "active" state and perform activities defined in TS 29.007 [38].

5.3.6.3.3.2 Time-out recovery

Upon expiration of T323 in the network the procedures for call clearing shall be initiated with cause # 102 "recovery on timer expiry".

3GPP TSG-CN1 Meeting #14 **Tdoc N1-001278**
Cardiff, Wales - 20 - 24 November, 2000

CR-Form-v3

CHANGE REQUEST

⌘	**24.008**	**CR**	**301**	⌘ rev	**-**	⌘ Current version:	**4.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	3.1 kHz multimedia calls at 33.6 kbit/s data rate		
Source:	⌘	Nokia		
Work item code:	⌘	TEI	***Date:*** ⌘	14 Nov 2000
Category:	⌘	**A**	***Release:*** ⌘	R4
		Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change:	⌘	CN#9 has approved a CR which added an in-call modification procedure for Multimedia Calls. Corresponding CRs have been approved to 3G TS 29.007 and 3G TS 27.001. It has been identified that currently procedure description in 3G TS 24.008 describes details of TAF and IWF, which are the scope of before mentioned CN3 specification. Therefore, this CR propose to replace detailed TAF and IWF procedural description with referencies to relevant specifications.
Summary of change:	⌘	In chapter 5.3.6.3.1 the detailed description of IWF is replaced with reference to 29.007. In chapter 5.3.6.3.2 the detailed description of TAF is removed as it is described in 27.001.
Consequences if not approved:	⌘	There is duplicated description of IWF and TAF procedures, which may lead to inconsistencies when specifications will evolve. Also description of TAF and IWF procedures is out of the scope of 24.008.

Clauses affected:	⌘	5.3.6.3.1, 5.3.6.3.2		
Other specs affected:	⌘	[X] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘	29.007 CR026, 27.001 CR034 (NP-000542)
Other comments:	⌘	The CRs to other affected specifications have beed approved in CN#9 plenary meeting.		

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2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.3.6 Support of multimedia calls

5.3.6.1 Service description

The GSM-UMTS circuit-switched multimedia call is based on the 3G-324M [26.111], which is a 3GPP-variant of the ITU-T H.324 recommendation. CS Multimedia telephony is a Bearer Service, which utilizes the Synchronous Transparent Data service (BS30) [3].

At the multimedia call setup the required call type, 3G-324M, is indicated, for the network to be able to invoke appropriate interworking functionality. In the peer end the H.324 information is used to invoke the terminal application. In addition to H.324 indication the terminal must select Information Transfer Capability (ITC) for the multimedia call. The 'correct' ITC depends on the peer end and the transporting networks; an all-ISDN call is a UDI/RDI call, and a call, which involves PSTN, is an analog '3.1 kHz audio' call.

For the case when the setup of a multimedia call is not successful, fallback to speech is specified.

5.3.6.2 Call establishment

For both mobile originating and mobile terminating calls, the normal call establishment procedures apply, with the exceptions specified in the following sections.

For further description of the function of MSC/IWF in the following sections, see TS 29.007 [38].

5.3.6.2.1 Mobile originated multimedia call establishment

At call setup the required call type, 3G-324M, is indicated by the originating MS in the SETUP message, with the *bearer capabilityIE* parameter Other Rate Adaptation set to 'H.223 and H.245'. The support of a fallback to speech is requested by including also a *bearer capabilityIE 2 with speech indication* in the SETUP message. The network shall examine each mode described in the *bearer capability IEs* included in the SETUP message by performing compatibility checking as defined in Annex B. If as a result of this compatibility checking the network decides to reject the call, then the network shall initiate call clearing as specified in section 5.4 with the following causes:

a) #57 "bearer capability not authorized"

b) #58 "bearer capability not presently available"

c) #65 "bearer service not implemented"

d) #70 "only restricted digital information bearer capability is available"

The originating user shall determine (possibly by pre-configuration of the terminal) whether a digital connection is required or if the call will be an analog modem call. If the call is expected to be digital the *bearer capability* IE parameter ITC is set to UDI/RDI. In an analog call the *bearer capability* IE parameter ITC is set to '3.1kHz audio ex PLMN'. Additionally required modem type is indicated (Other Modem Type = V.34).

5.3.6.2.1.1 Fallback to speech

If the network, during setup of an analogue H.324-call, detects that the called end does not support a H.324 call, then network initiates the in-call modification procedure (see section 5.3.4.3) towards the MS to modify the call mode to speech, if the MS had included a speech *bearer capability IE* in the SETUP message.

NOTE : fallback from digital (UDI) H.324-call to speech is not supported.

5.3.6.2.2 Mobile terminating multimedia call

At call setup the required call type, 3G-324M, is indicated by the network in the SETUP message, with the *bearer capability IE* parameter Other Rate Adaptation set to 'H.223 and H.245'. ITC is either '3.1kHz audio ex PLMN' or 'UDI/RDI'. If the network supports fallback to speech, and if the subscriber has subscription to speech, a *bearer capability* IE *2* with speech indication is included in the SETUP message. *The bearer capabilityIE(s)* may (in the case of the single numbering scheme) be missing from the SETUP-message.

The MS shall perform the compatibility checking as defined in Annex B for the required mode(s) if indicated in the SETUP message. If as a result of compatibility checking the MS decides to reject the call, the MS shall initiate call clearing according to the procedures of section 5.4 with one of the following causes:

a) #57 "bearer capability not authorized"

b) #58 "bearer capability not presently available"

c) #65 "bearer service not implemented"

d) #88 "incompatible destination"

The MS shall indicate the supported call type(s) in the CALL_CONFIRMED-message, which is the acknowledgement to SETUP. The MS has following options for the inclusion of *bearer capability IE* in the CALL_CONFIRMED message:

- if the MS/user accepts the offered multimedia call, and supports speech fallback both multimedia and speech *bearer capability IEs* shall be included
- if the MS/user accepts the offered multimedia call, but does not support speech fallback only a multimedia *bearer capability IE shall be included*
- if the MS/user wishes a speech (only) call a speech *bearer capability IE* is included

If the SETUP contained no *bearer capability IE* the network shall perform compatibility checking of the CALL CONFIRMED message in the same way as the compatibility checking of the SETUP message in the mobile originating call case, described in section 5.3.6.2.1.

If modem handshaking fails (in a modem call) the call mode will be modified to speech. The modem signalling is inband, so the call must have reached the active state, when these conclusions about the presence of modems can be done. The call modifications are realized through the in-call modification procedure, by which the network requests the MS to modify the call mode (see section 5.3.4.3).

NOTE: Fallback from digital (UDI) H.324-call to speech is not supported.

5.3.6.3 In-call modification in the "active" state

In order to change the bearer capability for a multimedia call, the following in-call modification procedure shall be used. Following bearer capability parameters can be modified with the procedure (see TS 29.007 [38]):

- Fixed Network User Rate

Only network side of the radio interface may act as the requesting user to invoke the in-call modification.

5.3.6.3.1 Initiation of in-call modification

The procedure is initiated by the network in the "active" state of the call. The network shall send a MODIFY message including *Immediate modification indicator IE* and the new bearer capability to be changed to; start timer T323; and enter the "mobile terminating modify" state. Any internal resources necessary to support the new bearer capability shall be reserved. The detailed operation of the MODIFY originating side is described in 3GTS 29.007~~shall stop sending Bm-channel information; and stop interpreting received Bm-channel information according to the old bearer capability~~.

Upon receipt of the MODIFY message with *Immediate modification indicator IE*, the MS shall check to ensure that the requested bearer capability can be supported and if so, it shall initiate the reservation of any resources necessary to support the new bearer capability and enter the "mobile terminating modify" state.

5.3.6.3.2 Successful completion of in-call modification

If the MS can support the requested bearer capability the MS shall perform actions defined in TS 27.001 [37]. After successful modifications defined in TS 27.001 [37] the MS shall ~~start sending user information according to the new bearer capability and start interpreting received user channel information according to the new bearer capability;~~ send a MODIFY COMPLETE message with the new bearer capability included and enter the "active" state.

Upon receipt of the MODIFY COMPLETE message the network shall: initiate the alternation to those resources necessary to support the new bearer capability; stop timer T323; and enter the "active" state.

5.3.6.3.3 Failure of in-call modification

5.3.6.3.3.1 MS rejection of in-call modification

If the MS cannot support the requested bearer capability, the MS shall: release any resources which had been reserved for the modification; send a MODIFY REJECT message with the old bearer capability and cause # 58 "bearer capability not presently available", and enter the "active" state.

Upon receipt of the MODIFY REJECT message the network shall: stop timer T323, release any resources which had been reserved for the modification, enter the "active" state and perform activities defined in TS 29.007 [38].

5.3.6.3.3.2 Time-out recovery

Upon expiration of T323 in the network the procedures for call clearing shall be initiated with cause # 102 "recovery on timer expiry".

3GPP TSG-CN1 Meeting #14 ***Tdoc N1-001279***
Cardiff, Wales - 20 - 24 November, 2000

CR-Form-v3

CHANGE REQUEST

⌘	**24.008**	**CR**	**302**	⌘ rev	**-**	⌘	Current version:	**3.5.0** ⌘

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Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	32 kbit/s UDI/RDI multimedia in GSM		
Source:	⌘	Nokia		
Work item code:	⌘	TEI	***Date:*** ⌘	14 Nov 2000
Category:	⌘	**F**	***Release:*** ⌘	R99
		Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change:	⌘	The circuit switched multimedia service was specified in the 3GPP R99 for both UMTS and GSM. However, there were restrictions in some specifications that prevented the use of the 32 kbit/s UDI/RDI multimedia in GSM, based on the use of a single TCH/F32 ECSD channel. TSG-SA WG1, TSG-GERAN WG2 and TSG-CN WG3 have updated their specifications to remove the restrictions. See LS from CN3 (N1-001134).
Summary of change:	⌘	A note restricting 32 kbit/s for UMTS only is removed.
Consequences if not approved:	⌘	24.008 is not in line with other specifications on the same topic.

Clauses affected:	⌘	10.5.4.5			
Other specs	⌘	X	Other core specifications	⌘	22.002 CR007 (SP-000371) 27.001 CR031, 29.007 CR030, 48.008, 03.10 CRA012r1, 04.21 CRA019r1, 08.20 CRA008r1 (NP-000551) 08.08 CRA215r1 (GP-000263), 08.58 CRA054 (GP-000382)
affected:			Test specifications		
			O&M Specifications		
Other comments:	⌘	CRs to other related specifications have been approved in previous plenary meetings.			

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10.5.4.5 Bearer capability

The purpose of the bearer capability information element is to describe a bearer service. The use of the bearer capability information element in relation to compatibility checking is described in annex B.

The bearer capability information element is coded as shown in figure 10.5.88/TS 24.008 and tables 10.5.102/TS 24.008 to 10.5.115/TS 24.008.

The bearer capability is a type 4 information element with a minimum length of 3 octets and a maximum length of 16 octets.

8	7	6	5	4	3	2	1	
	Bearer capability IEI							octet 1
Length of the bearer capability contents								octet 2
0/1 ext	radio channel requirement		co-ding std	trans fer mode	information transfer capability			octet 3
0/1 ext	0 co-ding	0 0 spare		speech version indication				octet 3a etc*
1 ext	comp -ress.	structure		dupl. mode	confi gur.	NIRR	esta-bli.	octet 4*
0/1 ext	0 0 access id.		rate adaption		signalling access protocol			octet 5*
0/1 ext	Other ITC		Other rate adaption		0 0 0 Spare			octet 5a*
1 ext	Hdr/ noHdr	Multi frame	Mode	LLI	Assig nor/e	Inb. neg	0 Spare	octet 5b*
0/1 ext	0 1 layer 1 id.		User information layer 1 protocol				sync/ async	octet 6*
0/1 ext	numb. stop bits	nego-tia-tion	numb. data bits	user rate				octet 6a*
0/1 ext	intermed. rate		NIC on TX	NIC on RX	Parity			octet 6b*
0/1 ext	connection element		modem type					octet 6c*
0/1 ext	Other modem type		Fixed network user rate					octet 6d*
0/1 ext	Acceptable channel codings				Maximum number of traffic channels			octet 6e*
0/1 ext	UIMI			Wanted air interface user rate				octet 6f*
1 ext	Acceptable channel codings extended			Asymmetry Indication		0 0 Spare		octet 6g*
1 ext	1 0 layer 2 id.		User information layer 2 protocol					octet 7*

Figure 10.5.88/TS 24.008 Bearer capability information element

NOTEs: The coding of the octets of the bearer capability information element is not conforming to ITU Q.931.

An MS shall encode the Bearer Capability infomation element according to GSM call control requirements also if it is requesting for a UMTS service.

For UTRAN access following parameters are irrelevant, because multiple traffic channels (multislot) are not deployed [TS 23.034]. The multislot parameters shall, however, be stored in MSC, and forwarded at handover:

- Maximum number of traffic channels (octet 6e, bits 1-3)
- Acceptable Channel coding(s) (octet 6e, bits 4, 5 and 7)
- UIMI, User initiated modification indication (octet 6f, bits 5-7)
- Acceptable Channel Codings extended (octet 6g, bits 5-7)

A mobile station not supporting GSM shall set these parameters to the value "0".

Table 10.5.102/TS 24.008: Bearer capability information element

Radio channel requirement (octet 3), network to MS direction In GSM, i.e. not applicable for UMTS data services. Bits 6 and 7 are spare bits. The sending side (i.e. the network) shall set bit 7 to value 0 and bit 6 to value 1. Radio channel requirement (octet 3) MS to network direction When information transfer capability (octet 3) indicates other values than speech: Bits **7 6** 0 0 reserved 0 1 full rate support only MS 1 0 dual rate support MS/half rate preferred 1 1 dual rate support MS/full rate preferred When information transfer capability (octet 3) indicates the value speech and no speech version indication is present in octet 3a etc.: Bits **7 6** 0 0 reserved 0 1 full rate support only MS/fullrate speech version 1 supported 1 0 dual rate support MS/half rate speech version 1 preferred, full rate speech version 1 also supported 1 1 dual rate support MS/full rate speech version 1 preferred, half rate speech version 1 also supported When information transfer capability (octet 3) indicates the value speech and speech version indication(s) is(are) present in octet 3a etc.: Bits **7 6** 0 0 reserved 0 1 the mobile station supports at least full rate speech version 1 but does not support half rate speech version 1. The complete voice codec preference is specified in octet(s) 3a etc. 1 0 The mobile station supports at least full rate speech version 1 and half rate speech version 1. The mobile station has a greater preference for half rate speech version 1 than for full rate speech version 1. The complete voice codec preference is specified in octet(s) 3a etc. 1 1 The mobile station supports at least full rate speech version 1 and half rate speech version 1. The mobile station has a greater preference for full rate speech version 1 than for half rate speech version 1. The complete voice codec preference is specified in octet(s) 3a etc.

(continued...)

Table 10.5.102/TS 24.008: Bearer capability information element (continued)

Coding standard (octet 3) Bit **5** 0 GSM standardized coding as described below 1 reserved Transfer mode (octet 3) Bit **4** 0 circuit mode 1 packet mode Information transfer capability (octet 3) Bits **3 2 1** 0 0 0 speech 0 0 1 unrestricted digital information 0 1 0 3.1 kHz audio, ex PLMN 0 1 1 facsimile group 3 1 0 1 Other ITC (See Octet 5a) 1 1 1 reserved, to be used in the network. The meaning is: alternate speech/facsimile group 3 - starting with speech. All other values are reserved

Table 10.5.103/TS 24.008 Bearer capability information element

Octet(s) 3a etc. MS to network direction Octet(s) 3a etc. shall only be used to convey speech coding information belonging to a GSM Radio Access. When included for a UMTS call establishment they shall be used for handover to a GSM Radio Acess.   Coding Bit **7** 0 octet used for extension of information transfer capability 1 octet used for other extension of octet 3 When information transfer capability (octet 3) indicates speech and coding (bit 7 in octet 3a etc.) is coded as 0, bits 1 through 6 are coded: Bits 5 and 6 are spare. Speech version indication (octet(s) 3a etc.) Bits **4 3 2 1** 0 0 0 0 GSM full rate speech version 1 0 0 1 0 GSM full rate speech version 2 0 1 0 0 GSM full rate speech version 3 0 0 0 1 GSM half rate speech version 1 0 1 0 1 GSM half rate speech version 3 All other values have the meaning "speech version tbd" and shall be ignored when received. If octet 3 is extended with speech version indication(s) (octets 3a etc.), all speech versions supported shall be indicated and be included in order of preference (the first octet (3a) has the highest preference and so on). If information transfer capability (octet 3) indicates speech and coding (bit 7 in octet 3a etc.) is coded as 1, or the information transfer capability does not indicate speech, then the extension octet shall be ignored. Octet(s) 3a etc. network to MS direction The octet(s) 3a etc. shall be ignored by the MS.

Table 10.5.104/TS 24.008: Bearer capability information element

Compression (octet 4), network to MS direction: Bit **7** 0 data compression not possible 1 data compression possible Compression (octet 4), MS to network direction: Bit **7** 0 data compression not allowed 1 data compression allowed Structure (octet 4) Bits **6 5** 0 0 service data unit integrity 1 1 unstructured All other values are reserved. Duplex mode (octet 4) Bit **4** 0 half duplex 1 full duplex Configuration (octet 4) Bit **3** 0 point-to-point All other values are reserved. NIRR (octet 4) (Negotiation of Intermediate Rate Requested) In GSM, i.e. not applicable for UMTS data services. Bit **2** 0 No meaning is associated with this value. 1 Data up to and including 4.8 kb/s, full rate, non-transparent, 6 kb/s radio interface rate is requested. Establishment (octet 4) Bit **1** 0 demand All other values are reserved

Table 10.5.105/TS 24.008: Bearer capability information element

Access identity (octet 5) Bits **7 6** 0 0 octet identifier All other values are reserved   Rate adaption (octet 5) Bits **5 4** 0 0 no rate adaption 0 1 V.110, I.460/X.30 rate adaptation 1 0 ITU-T X.31 flag stuffing 1 1 Other rate adaption (see octet 5a) Signalling access protocol (octet 5) Bits **3 2 1** 0 0 1 I.440/450 0 1 0 X.21 0 1 1 reserved: was allocated in earlier phases of the protocol 1 0 0 reserved: was allocated in earlier phases of the protocol. 1 0 1 X.28 - non dedicated PAD 1 1 0 X.32 All other values are reserved.

Table 10.5.106/TS 24.008: Bearer capability information element

Other ITC (octet 5a) If the value "Other ITC" is not signalled in the field "ITC" then the contents of this field shall be ignored. Bit **7 6** 0 0 restricted digital information All other values are reserved   Other rate adaption (octet 5a) If the value " Other rate adaption" is not signalled in the field "Rate adaption" then the contents of this field shall be ignored. In UMTS, PIAFS shall be considered. In GSM, call shall be rejected if PIAFS requested.   Bit **5 4** 0 0 V.120 0 1 H.223 & H.245 1 0 PIAFS All other values are reserved.

Table 10.5.107/TS 24.008: Bearer capability information element

Rate adaption header/no header (octet 5b) Bit **7** 0 Rate adaption header not included 1 Rate adaption header included Multiple frame establishment support in data link (octet 5b) Bit **6** 0 Multiple frame establishment not supported, only UI frames allowed 1 Multiple frame establishment supported Mode of operation (octet 5b) Bit **5** 0 Bit transparent mode of operation 1 Protocol sensitive mode of operation Logical link identifier negotiation (octet 5b) Bit **4** 0 Default, LLI=256 only 1 Full protocol negotiation, (note: A connection over which protocol negotiation will be executed is indicated in bit 2 of octet 5b) Assignor/Assignee (octet 5b) Bit **3** 0 Message originator is "default assignee" 1 Message originator is "assignor only" In band/Out of band negotiation (octet 5b) Bit **2** 0 Negotiation is done in-band using logical link zero 1 Negotiation is done with USER INFORMATION messages on a temporary signalling connection Bit 1 is spare and set to the value "0"

Table 10.5.108/TS 24.008: Bearer capability information element

Layer 1 identity (octet 6) Bits **7 6** 0 1 octet identifier All other values are reserved User information layer 1 protocol (octet 6) Bits **5 4 3 2** 0 0 0 0 default layer 1 protocol All other values reserved. Synchronous/asynchronous (octet 6) Bit **1** 0 synchronous 1 asynchronous

Table 10.5.109/TS 24.008: Bearer capability information element

Number of Stop Bits (octet 6a) Bit **7** 0 1 bit (This value is also used in the case of synchronous mode) 1 2 bits Negotiation (octet 6a) Bit **6** 0 in-band negotiation not possible NOTE: See Rec. V.110 and X.30 All other values are reserved Number of data bits excluding parity bit if present (octet 6a) Bit **5** 0 7 bits 1 8 bits (this value is also used in the case of bit oriented protocols) User rate (octet 6a) In GSM only. Bits **4 3 2 1** 0 0 0 1 0.3 kbit/s Recommendation X.1 and V.110 0 0 1 0 1.2 kbit/s Recommendation X.1 and V.110 0 0 1 1 2.4 kbit/s Recommendation X.1 and V.110 0 1 0 0 4.8 kbit/s Recommendation X.1 and V.110 0 1 0 1 9.6 kbit/s Recommendation X.1 and V.110 0 1 1 0 12.0 kbit/s transparent (non compliance with X.1 and V.110) 0 1 1 1 reserved: was allocated in earlier phases of the protocol. All other values are reserved. For facsimile group 3 calls the user rate indicates the first and maximum speed the mobile station is using.

Table 10.5.110/TS 24.008: Bearer capability information element

Octet 6b for V.110/X.30 rate adaptation Intermediate rate (octet 6b) In GSM only.   Bits **7 6** 0 0 reserved 0 1 reserved 1 0 8 kbit/s 1 1 16 kbit/s Network independent clock (NIC) on transmission (Tx) (octet 6b) (See Rec. V.110 and X.30). in GSM only.   Bit **5** 0 does not require to send data with network independent clock 1 requires to send data with network independent clock Network independent clock (NIC) on reception (Rx) (octet 6b) (See Rec. V.110 and X.30) In GSM only.   Bit **4** 0 cannot accept data with network independent clock (i.e. sender does not support this optional procedure) 1 can accept data with network independent clock (i.e. sender does support this optional procedure) Parity information (octet 6b) Bits **3 2 1** 0 0 0 odd 0 1 0 even 0 1 1 none 1 0 0 forced to 0 1 0 1 forced to 1 All other values are reserved.

Table 10.5.111/TS 24.008: Bearer capability information element

Connection element (octet 6c) Bit **7 6** 0 0 transparent 0 1 non transparent (RLP) 1 0 both, transparent preferred 1 1 both, non transparent preferred The requesting end (e.g. the one sending the SETUP message) should use the 4 values depending on its capabilities to support the different modes. The answering party shall only use the codings 00 or 01, based on its own capabilities and the proposed choice if any. If both MS and network support both transparent and non transparent, priority should be given to the MS preference. Modem type (octet 6c) Bits **5 4 3 2 1** 0 0 0 0 0 none 0 0 0 0 1 V.21 (note 1) 0 0 0 1 0 V.22 (note 1) 0 0 0 1 1 V.22 bis (note 1) 0 0 1 0 0 reserved: was allocated in earlier phases of the protocol 0 0 1 0 1 V.26 ter (note 1) 0 0 1 1 0 V.32 0 0 1 1 1 modem for undefined interface 0 1 0 0 0 autobauding type 1 All other values are reserved. Note 1: In GSM only.

Table 10.5.112/TS 24.008: Bearer capability information element

Other modem type (octet 6d) Bits **7 6** 0 0 no other modem type specified in this field 1 0 V.34 All other values are reserved. Fixed network user rate (octet 6d) Bit **5 4 3 2 1** 0 0 0 0 0 Fixed network user rate not applicable/No meaning is associated with this value. 0 0 0 0 1 9.6 kbit/s Recommendation X.1 and V.110 0 0 0 1 0 14.4 kbit/s Recommendation X.1 and V.110 0 0 0 1 1 19.2 kbit/s Recommendation X.1 and V.110 0 0 1 0 0 28.8 kbit/s Recommendation X.1 and V.110 0 0 1 0 1 38.4 kbit/s Recommendation X.1 and V.110 0 0 1 1 0 48.0 kbit/s Recommendation X.1 and V.110(synch) (note 1) 0 0 1 1 1 56.0 kbit/s Recommendation X.1 and V.110(synch) /bit transparent 0 1 0 0 0 64.0 kbit/s bit transparent 0 1 0 0 1 33.6 kbit/s bit transparent (note 2) 0 1 0 1 0 32.0 kbit/s Recommendation I.460 ~~(note 2)~~ 0 1 0 1 1 31.2 kbit/s Recommendation V.34 (note 2) The value 31.2 kbit/s Recommendation V.34 shall be used only by the network to inform the MS about FNUR modification due to negotiation between the modems in a 3.1 kHz multimedia call. All other values are reserved. Note 1: In GSM only. Note 2: In UMTS only

Table 10.5.113/TS 24.008: Bearer capability information element

Acceptable channel codings (octet 6e), mobile station to network direction: Bit **7** 0 TCH/F14.4 not acceptable 1 TCH/F14.4 acceptable Bit **6** 0 Spare Bit **5** 0 TCH/F9.6 not acceptable 1 TCH/F9.6 acceptable Bit **4** 0 TCH/F4.8 not acceptable 1 TCH/F4.8 acceptable Acceptable channel codings (octet 6e), network to MS direction: Bits 4 to 7 are spare and shall be set to "0". Maximum number of traffic channels (octet 6e), MS to network direction: Bits **3 2 1** 0 0 0 1 TCH 0 0 1 2 TCH 0 1 0 3 TCH 0 1 1 4 TCH 1 0 0 5 TCH 1 0 1 6 TCH 1 1 0 7 TCH 1 1 1 8 TCH Maximum number of traffic channels (octet 6e), network to MS direction: Bits 1 to 3 are spare and shall be set to "0".

Table 10.5.114/TS 24.008: Bearer capability information element

UIMI, User initiated modification indication (octet 6f),

7 6 5
0 0 0 User initiated modification not allowed/required/applicable
0 0 1 User initiated modification up to 1 TCH/F allowed/may be requested
0 1 0 User initiated modification up to 2 TCH/F allowed/may be requested
0 1 1 User initiated modification up to 3 TCH/F allowed/may be requested
1 0 0 User initiated modification up to 4 TCH/F allowed/may be requested

All other values shall be interpreted as "User initiated modification up to 4 TCH/F may be requested".

User initiated modification indication is not applicable for transparent connection.

Wanted air interface user rate (octet 6f), MS to network direction:
Bits
4 3 2 1
0 0 0 0 Air interface user rate not applicable/No meaning associated with this value
0 0 0 1 9.6 kbit/s
0 0 1 0 14.4 kbit/s
0 0 1 1 19.2 kbit/s
0 1 0 1 28.8 kbit/s
0 1 1 0 38.4 kbit/s
0 1 1 1 43.2 kbit/s
1 0 0 0 57.6 kbit/s
1 0 0 1 interpreted by the network as 38.4 kbit/s in this version of the protocol
1 0 1 0 interpreted by the network as 38.4 kbit/s in this version of the protocol
1 0 1 1 interpreted by the network as 38.4 kbit/s in this version of the protocol
1 1 0 0 interpreted by the network as 38.4 kbit/s in this version of the protocol

All other values are reserved.

Wanted air interface user rate (octet 6f), network to MS direction:
Bits 1 to 4 are spare and shall be set to "0".

Table 10.5.115/TS 24.008: Bearer capability information element

Layer 2 identity (octet 7) Bits **7 6** 1 0 octet identifier All other values are reserved User information layer 2 protocol (octet 7) Bits **5 4 3 2 1** 0 0 1 1 0 recommendation X.25, link level 0 1 0 0 0 ISO 6429, codeset 0 (DC1/DC3) 0 1 0 0 1 reserved: was allocated but never used in earlier phases of the protocol 0 1 0 1 0 videotex profile 1 0 1 1 0 0 COPnoFlCt (Character oriented Protocol with no Flow Control mechanism) 0 1 1 0 1 X.75 layer 2 modified (CAPI) All other values are reserved.

Table 10.5.115a/TS 24.008: Bearer capability information element

Acceptable Channel Codings extended (octet 6g) mobile station to network direction: Bit 7 0 TCH/F28.8 not acceptable 1 TCH/F28.8 acceptable Bit 6 0 TCH/F32.0 not acceptable 1 TCH/F32.0 acceptable Bit 5 0 TCH/F43.2 not acceptable 1 TCH/F43.2 acceptable Channel Coding Asymmetry Indication Bits 4 3 0 0 Channel coding symmetry preferred 1 0 Downlink biased channel coding asymmetry is preferred 0 1 Uplink biased channel coding asymmetry is preferred 1 1 Unused, if received it shall be interpreted as "Channel coding symmetry preferred" EDGE Channel Codings (octet 6g), network to MS direction: Bits 3 to 7 are spare and shall be set to "0". Bits 2 and 1 are spare.

CR-Form-v3

CHANGE REQUEST

⌘ **24.008**	**CR 303**	⌘ rev	**-**	⌘ Current version:	**4.0.0**	⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title: ⌘	32 kbit/s UDI/RDI multimedia in GSM		
Source: ⌘	Nokia		
Work item code: ⌘	TEI	***Date:*** ⌘	14 Nov 2000
Category: ⌘	**A**	***Release:*** ⌘	R4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	The circuit switched multimedia service was specified in the 3GPP R99 for both UMTS and GSM. However, there were restrictions in some specifications that prevented the use of the 32 kbit/s UDI/RDI multimedia in GSM, based on the use of a single TCH/F32 ECSD channel. TSG-SA WG1, TSG-GERAN WG2 and TSG-CN WG3 have updated their specifications to remove the restrictions. See LS from CN3 (N1-001134).
Summary of change: ⌘	A note restricting 32 kbit/s for UMTS only is removed.
Consequences if not approved: ⌘	24.008 is not in line with other specifications on the same topic.

Clauses affected: ⌘	10.5.4.5		
Other specs affected: ⌘	[X] Other core specifications	⌘	27.001 CR032, 29.007 CR029 (NP-000551) 48.008 CR007 (GP-000383)
	[ ] Test specifications		
	[ ] O&M Specifications		
Other comments: ⌘	CRs to other related specifications have been approved in previous plenary meetings.		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

10.5.4.5 Bearer capability

The purpose of the bearer capability information element is to describe a bearer service. The use of the bearer capability information element in relation to compatibility checking is described in annex B.

The bearer capability information element is coded as shown in figure 10.5.88/TS 24.008 and tables 10.5.102/TS 24.008 to 10.5.115/TS 24.008.

The bearer capability is a type 4 information element with a minimum length of 3 octets and a maximum length of 16 octets.

8	7	6	5	4	3	2	1	
	Bearer capability IEI							octet 1
Length of the bearer capability contents								octet 2
0/1 ext	radio channel requirement		co-ding std	trans fer mode	information transfer capability			octet 3
0/1 ext	0 co-ding	0 spare	0	speech version indication				octet 3a etc*
1 ext	comp -ress.	structure		dupl. mode	confi gur.	NIRR	esta-bli.	octet 4*
0/1 ext	0 access id.	0	rate adaption		signalling access protocol			octet 5*
0/1 ext	Other ITC		Other rate adaption		0 Spare	0	0	octet 5a*
1 ext	Hdr/ noHdr	Multi frame	Mode	LLI	Assig nor/e	Inb. neg	0 Spare	octet 5b*
0/1 ext	0 layer 1 id.	1	User information layer 1 protocol				sync/ async	octet 6*
0/1 ext	numb. stop bits	nego- tia- tion	numb. data bits	user rate				octet 6a*
0/1 ext	intermed. rate		NIC on TX	NIC on RX	Parity			octet 6b*
0/1 ext	connection element		modem type					octet 6c*
0/1 ext	Other modem type		Fixed network user rate					octet 6d*
0/1 ext	Acceptable channel codings				Maximum number of traffic channels			octet 6e*
0/1 ext	UIMI			Wanted air interface user rate				octet 6f*
1 ext	Acceptable channel codings extended			Asymmetry Indication		0 Spare	0	octet 6g*
1 ext	1 layer 2 id.	0	User information layer 2 protocol					octet 7*

Figure 10.5.88/TS 24.008 Bearer capability information element

NOTEs: The coding of the octets of the bearer capability information element is not conforming to ITU Q.931.

An MS shall encode the Bearer Capability infomation element according to GSM call control requirements also if it is requesting for a UMTS service.

For UTRAN access following parameters are irrelevant, because multiple traffic channels (multislot) are not deployed [TS 23.034]. The multislot parameters shall, however, be stored in MSC, and forwarded at handover:
- Maximum number of traffic channels (octet 6e, bits 1-3)
- Acceptable Channel coding(s) (octet 6e, bits 4, 5 and 7)
- UIMI, User initiated modification indication (octet 6f, bits 5-7)
- Acceptable Channel Codings extended (octet 6g, bits 5-7)

A mobile station not supporting GSM shall set these parameters to the value "0".

Table 10.5.102/TS 24.008: Bearer capability information element

Radio channel requirement (octet 3), network to MS direction In GSM, i.e. not applicable for UMTS data services. Bits 6 and 7 are spare bits. The sending side (i.e. the network) shall set bit 7 to value 0 and bit 6 to value 1. Radio channel requirement (octet 3) MS to network direction When information transfer capability (octet 3) indicates other values than speech: Bits **7 6** 0 0 reserved 0 1 full rate support only MS 1 0 dual rate support MS/half rate preferred 1 1 dual rate support MS/full rate preferred When information transfer capability (octet 3) indicates the value speech and no speech version indication is present in octet 3a etc.: Bits **7 6** 0 0 reserved 0 1 full rate support only MS/fullrate speech version 1 supported 1 0 dual rate support MS/half rate speech version 1 preferred, full rate speech version 1 also supported 1 1 dual rate support MS/full rate speech version 1 preferred, half rate speech version 1 also supported When information transfer capability (octet 3) indicates the value speech and speech version indication(s) is(are) present in octet 3a etc.: Bits **7 6** 0 0 reserved 0 1 the mobile station supports at least full rate speech version 1 but does not support half rate speech version 1. The complete voice codec preference is specified in octet(s) 3a etc. 1 0 The mobile station supports at least full rate speech version 1 and half rate speech version 1. The mobile station has a greater preference for half rate speech version 1 than for full rate speech version 1. The complete voice codec preference is specified in octet(s) 3a etc. 1 1 The mobile station supports at least full rate speech version 1 and half rate speech version 1. The mobile station has a greater preference for full rate speech version 1 than for half rate speech version 1. The complete voice codec preference is specified in octet(s) 3a etc.

(continued...)

Table 10.5.102/TS 24.008: Bearer capability information element (continued)

Coding standard (octet 3) Bit **5** 0 GSM standardized coding as described below 1 reserved Transfer mode (octet 3) Bit **4** 0 circuit mode 1 packet mode Information transfer capability (octet 3) Bits **3 2 1** 0 0 0 speech 0 0 1 unrestricted digital information 0 1 0 3.1 kHz audio, ex PLMN 0 1 1 facsimile group 3 1 0 1 Other ITC (See Octet 5a) 1 1 1 reserved, to be used in the network. The meaning is: alternate speech/facsimile group 3 - starting with speech. All other values are reserved

Table 10.5.103/TS 24.008 Bearer capability information element

Octet(s) 3a etc. MS to network direction Octet(s) 3a etc. shall only be used to convey speech coding information belonging to a GSM Radio Access. When included for a UMTS call establishment they shall be used for handover to a GSM Radio Acess.   Coding Bit **7** 0 octet used for extension of information transfer capability 1 octet used for other extension of octet 3 When information transfer capability (octet 3) indicates speech and coding (bit 7 in octet 3a etc.) is coded as 0, bits 1 through 6 are coded: Bits 5 and 6 are spare. Speech version indication (octet(s) 3a etc.) Bits **4 3 2 1** 0 0 0 0 GSM full rate speech version 1 0 0 1 0 GSM full rate speech version 2 0 1 0 0 GSM full rate speech version 3 0 0 0 1 GSM half rate speech version 1 0 1 0 1 GSM half rate speech version 3 All other values have the meaning "speech version tbd" and shall be ignored when received. If octet 3 is extended with speech version indication(s) (octets 3a etc.), all speech versions supported shall be indicated and be included in order of preference (the first octet (3a) has the highest preference and so on). If information transfer capability (octet 3) indicates speech and coding (bit 7 in octet 3a etc.) is coded as 1, or the information transfer capability does not indicate speech, then the extension octet shall be ignored. Octet(s) 3a etc. network to MS direction The octet(s) 3a etc. shall be ignored by the MS.

Table 10.5.104/TS 24.008: Bearer capability information element

Compression (octet 4), network to MS direction: Bit **7** 0 data compression not possible 1 data compression possible Compression (octet 4), MS to network direction: Bit **7** 0 data compression not allowed 1 data compression allowed Structure (octet 4) Bits **6 5** 0 0 service data unit integrity 1 1 unstructured All other values are reserved. Duplex mode (octet 4) Bit **4** 0 half duplex 1 full duplex Configuration (octet 4) Bit **3** 0 point-to-point All other values are reserved. NIRR (octet 4) (Negotiation of Intermediate Rate Requested) In GSM, i.e. not applicable for UMTS data services. Bit **2** 0 No meaning is associated with this value. 1 Data up to and including 4.8 kb/s, full rate, non-transparent, 6 kb/s radio interface rate is requested. Establishment (octet 4) Bit **1** 0 demand All other values are reserved

Table 10.5.105/TS 24.008: Bearer capability information element

Access identity (octet 5) Bits **7 6** 0 0 octet identifier All other values are reserved   Rate adaption (octet 5) Bits **5 4** 0 0 no rate adaption 0 1 V.110, I.460/X.30 rate adaptation 1 0 ITU-T X.31 flag stuffing 1 1 Other rate adaption (see octet 5a) Signalling access protocol (octet 5) Bits **3 2 1** 0 0 1 I.440/450 0 1 0 X.21 0 1 1 reserved: was allocated in earlier phases of the protocol 1 0 0 reserved: was allocated in earlier phases of the protocol. 1 0 1 X.28 - non dedicated PAD 1 1 0 X.32 All other values are reserved.

Table 10.5.106/TS 24.008: Bearer capability information element

Other ITC (octet 5a) If the value "Other ITC" is not signalled in the field "ITC" then the contents of this field shall be ignored. Bit **7 6** 0 0 restricted digital information All other values are reserved   Other rate adaption (octet 5a) If the value " Other rate adaption" is not signalled in the field "Rate adaption" then the contents of this field shall be ignored. In UMTS, PIAFS shall be considered. In GSM, call shall be rejected if PIAFS requested.   Bit **5 4** 0 0 V.120 0 1 H.223 & H.245 1 0 PIAFS All other values are reserved.

Table 10.5.107/TS 24.008: Bearer capability information element

Rate adaption header/no header (octet 5b) Bit **7** 0 Rate adaption header not included 1 Rate adaption header included Multiple frame establishment support in data link (octet 5b) Bit **6** 0 Multiple frame establishment not supported, only UI frames allowed 1 Multiple frame establishment supported Mode of operation (octet 5b) Bit **5** 0 Bit transparent mode of operation 1 Protocol sensitive mode of operation Logical link identifier negotiation (octet 5b) Bit **4** 0 Default, LLI=256 only 1 Full protocol negotiation, (note: A connection over which protocol negotiation will be executed is indicated in bit 2 of octet 5b) Assignor/Assignee (octet 5b) Bit **3** 0 Message originator is "default assignee" 1 Message originator is "assignor only" In band/Out of band negotiation (octet 5b) Bit **2** 0 Negotiation is done in-band using logical link zero 1 Negotiation is done with USER INFORMATION messages on a temporary signalling connection Bit 1 is spare and set to the value "0"

Table 10.5.108/TS 24.008: Bearer capability information element

Layer 1 identity (octet 6) Bits **7 6** 0 1 octet identifier All other values are reserved User information layer 1 protocol (octet 6) Bits **5 4 3 2** 0 0 0 0 default layer 1 protocol All other values reserved. Synchronous/asynchronous (octet 6) Bit **1** 0 synchronous 1 asynchronous

Table 10.5.109/TS 24.008: Bearer capability information element

Number of Stop Bits (octet 6a) Bit **7** 0 1 bit (This value is also used in the case of synchronous mode) 1 2 bits Negotiation (octet 6a) Bit **6** 0 in-band negotiation not possible NOTE: See Rec. V.110 and X.30 All other values are reserved Number of data bits excluding parity bit if present (octet 6a) Bit **5** 0 7 bits 1 8 bits (this value is also used in the case of bit oriented protocols) User rate (octet 6a) In GSM only. Bits **4 3 2 1** 0 0 0 1 0.3 kbit/s Recommendation X.1 and V.110 0 0 1 0 1.2 kbit/s Recommendation X.1 and V.110 0 0 1 1 2.4 kbit/s Recommendation X.1 and V.110 0 1 0 0 4.8 kbit/s Recommendation X.1 and V.110 0 1 0 1 9.6 kbit/s Recommendation X.1 and V.110 0 1 1 0 12.0 kbit/s transparent (non compliance with X.1 and V.110) 0 1 1 1 reserved: was allocated in earlier phases of the protocol. All other values are reserved. For facsimile group 3 calls the user rate indicates the first and maximum speed the mobile station is using.

Table 10.5.110/TS 24.008: Bearer capability information element

Octet 6b for V.110/X.30 rate adaptation Intermediate rate (octet 6b) In GSM only. Bits **7 6** 0 0 reserved 0 1 reserved 1 0 8 kbit/s 1 1 16 kbit/s Network independent clock (NIC) on transmission (Tx) (octet 6b) (See Rec. V.110 and X.30). in GSM only. Bit **5** 0 does not require to send data with network independent clock 1 requires to send data with network independent clock Network independent clock (NIC) on reception (Rx) (octet 6b) (See Rec. V.110 and X.30) In GSM only. Bit **4** 0 cannot accept data with network independent clock (i.e. sender does not support this optional procedure) 1 can accept data with network independent clock (i.e. sender does support this optional procedure) Parity information (octet 6b) Bits **3 2 1** 0 0 0 odd 0 1 0 even 0 1 1 none 1 0 0 forced to 0 1 0 1 forced to 1 All other values are reserved.

Table 10.5.111/TS 24.008: Bearer capability information element

Connection element (octet 6c)
Bit
7 6
0 0 transparent
0 1 non transparent (RLP)
1 0 both, transparent preferred
1 1 both, non transparent preferred

The requesting end (e.g. the one sending the SETUP message) should use the 4 values depending on its capabilities to support the different modes. The answering party shall only use the codings 00 or 01, based on its own capabilities and the proposed choice if any. If both MS and network support both transparent and non transparent, priority should be given to the MS preference.

Modem type (octet 6c)
Bits
5 4 3 2 1
0 0 0 0 0 none
0 0 0 0 1 V.21 (note 1)
0 0 0 1 0 V.22 (note 1)
0 0 0 1 1 V.22 bis (note 1)
0 0 1 0 0 reserved: was allocated in earlier phases of the protocol
0 0 1 0 1 V.26 ter (note 1)
0 0 1 1 0 V.32
0 0 1 1 1 modem for undefined interface
0 1 0 0 0 autobauding type 1

All other values are reserved.
Note 1: In GSM only.

Table 10.5.112/TS 24.008: Bearer capability information element

Other modem type (octet 6d) Bits **7 6** 0 0 no other modem type specified in this field 1 0 V.34 All other values are reserved. Fixed network user rate (octet 6d) Bit **5 4 3 2 1** 0 0 0 0 0 Fixed network user rate not applicable/No meaning is associated with this value. 0 0 0 0 1 9.6 kbit/s Recommendation X.1 and V.110 0 0 0 1 0 14.4 kbit/s Recommendation X.1 and V.110 0 0 0 1 1 19.2 kbit/s Recommendation X.1 and V.110 0 0 1 0 0 28.8 kbit/s Recommendation X.1 and V.110 0 0 1 0 1 38.4 kbit/s Recommendation X.1 and V.110 0 0 1 1 0 48.0 kbit/s Recommendation X.1 and V.110(synch) (note 1) 0 0 1 1 1 56.0 kbit/s Recommendation X.1 and V.110(synch) /bit transparent 0 1 0 0 0 64.0 kbit/s bit transparent 0 1 0 0 1 33.6 kbit/s bit transparent (note 2) 0 1 0 1 0 32.0 kbit/s Recommendation I.460 ~~(note 2)~~ 0 1 0 1 1 31.2 kbit/s Recommendation V.34 (note 2) The value 31.2 kbit/s Recommendation V.34 shall be used only by the network to inform the MS about FNUR modification due to negotiation between the modems in a 3.1 kHz multimedia call. All other values are reserved. Note 1: In GSM only. Note 2: In UMTS only

Table 10.5.113/TS 24.008: Bearer capability information element

Acceptable channel codings (octet 6e), mobile station to network direction: Bit **7** 0 TCH/F14.4 not acceptable 1 TCH/F14.4 acceptable Bit **6** 0 Spare Bit **5** 0 TCH/F9.6 not acceptable 1 TCH/F9.6 acceptable Bit **4** 0 TCH/F4.8 not acceptable 1 TCH/F4.8 acceptable Acceptable channel codings (octet 6e), network to MS direction: Bits 4 to 7 are spare and shall be set to "0". Maximum number of traffic channels (octet 6e), MS to network direction: Bits **3 2 1** 0 0 0 1 TCH 0 0 1 2 TCH 0 1 0 3 TCH 0 1 1 4 TCH 1 0 0 5 TCH 1 0 1 6 TCH 1 1 0 7 TCH 1 1 1 8 TCH Maximum number of traffic channels (octet 6e), network to MS direction: Bits 1 to 3 are spare and shall be set to "0".

Table 10.5.114/TS 24.008: Bearer capability information element

UIMI, User initiated modification indication (octet 6f),

7 6 5
0 0 0 User initiated modification not allowed/required/applicable
0 0 1 User initiated modification up to 1 TCH/F allowed/may be requested
0 1 0 User initiated modification up to 2 TCH/F allowed/may be requested
0 1 1 User initiated modification up to 3 TCH/F allowed/may be requested
1 0 0 User initiated modification up to 4 TCH/F allowed/may be requested

All other values shall be interpreted as "User initiated modification up to 4 TCH/F may be requested".

User initiated modification indication is not applicable for transparent connection.

Wanted air interface user rate (octet 6f), MS to network direction:
Bits
4 3 2 1
0 0 0 0 Air interface user rate not applicable/No meaning associated with this value
0 0 0 1 9.6 kbit/s
0 0 1 0 14.4 kbit/s
0 0 1 1 19.2 kbit/s
0 1 0 1 28.8 kbit/s
0 1 1 0 38.4 kbit/s
0 1 1 1 43.2 kbit/s
1 0 0 0 57.6 kbit/s
1 0 0 1 interpreted by the network as 38.4 kbit/s in this version of the protocol
1 0 1 0 interpreted by the network as 38.4 kbit/s in this version of the protocol
1 0 1 1 interpreted by the network as 38.4 kbit/s in this version of the protocol
1 1 0 0 interpreted by the network as 38.4 kbit/s in this version of the protocol

All other values are reserved.

Wanted air interface user rate (octet 6f), network to MS direction:
Bits 1 to 4 are spare and shall be set to "0".

Table 10.5.115/TS 24.008: Bearer capability information element

Layer 2 identity (octet 7)
Bits
7 6
1 0 octet identifier

All other values are reserved

User information layer 2 protocol (octet 7)

Bits
5 4 3 2 1
0 0 1 1 0 recommendation X.25, link level
0 1 0 0 0 ISO 6429, codeset 0 (DC1/DC3)
0 1 0 0 1 reserved: was allocated but never used in earlier phases of the protocol
0 1 0 1 0 videotex profile 1
0 1 1 0 0 COPnoFlCt (Character oriented Protocol with no Flow Control mechanism)
0 1 1 0 1 X.75 layer 2 modified (CAPI)

All other values are reserved.

Table 10.5.115a/TS 24.008: Bearer capability information element

Acceptable Channel Codings extended (octet 6g) mobile station to network direction:

Bit
7
0 TCH/F28.8 not acceptable
1 TCH/F28.8 acceptable

Bit
6
0 TCH/F32.0 not acceptable
1 TCH/F32.0 acceptable

Bit
5
0 TCH/F43.2 not acceptable
1 TCH/F43.2 acceptable
Channel Coding Asymmetry Indication

Bits
4 3
0 0 Channel coding symmetry preferred
1 0 Downlink biased channel coding asymmetry is preferred
0 1 Uplink biased channel coding asymmetry is preferred
1 1 Unused, if received it shall be interpreted as "Channel coding symmetry preferred"

EDGE Channel Codings (octet 6g), network to MS direction:

Bits 3 to 7 are spare and shall be set to "0".

Bits 2 and 1 are spare.

3GPP TSG-CN1 Meeting #14 ***Tdoc N1-001304***
Cardiff, Wales - 20 - 24 November, 2000

CR-Form-v3

CHANGE REQUEST

⌘ **23.009**	**CR 019**	⌘ rev	**-**	⌘ Current version:	**3.4.0**	⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [ ] Radio Access Network [ ] Core Network [X]

Title: ⌘	Reference clean-up		
Source: ⌘	Ericsson		
Work item code: ⌘	TEI	***Date:*** ⌘	2000-11-16
Category: ⌘	**F**	***Release:*** ⌘	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘	Clean-up of references
Summary of change: ⌘	
Consequences if not approved: ⌘	Not according to TSG#9 agreement

Clauses affected: ⌘		
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Postal address

3GPP support office address

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

Internet

http://www.3gpp.org

Contents

Foreword

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

The present document provides a mechanism giving reliable transfer of signalling messages within the 3GPP system.

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

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where:

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

1 Scope

The present document contains a detailed description of the handover procedures to be used in PLMNs. The purpose of the handover procedures, as described in the present document, are to ensure that the connection to the Mobile Station (MS) or User Equipment (UE) is maintained as it moves from one cell or radio network to another. The document defines the circuit switched handover functionality based on the service requirements in ~~TS 22.129~~3GPP TS 22.129 [9].

The present document considers the following four cases:

i) handover between Base Stations connected to the same MSC, this is termed an Intra-MSC handover;

ii) handover between Radio Network Subsystems connected to the same 3G_MSC, this is termed an Intra-3G_MSC handover/relocation. This case also includes inter-system handover between RNS and BSS if the 3G_MSC supports the A-interface;

iii) handover between Base Stations connected to different MSCs, this is termed an Inter-MSC handover. This category can be sub-divided into three further procedures:

- a) the Basic Inter-MSC Handover procedure, where the MS is handed over from a controlling MSC (MSC-A) to another MSC (MSC-B);
- b) the Subsequent Inter-MSC Handover procedure, where the MS is handed over from MSC-B to a third MSC (MSC-B');
- c) the Subsequent Inter-MSC handback, where the MS is handed back from MSC-B to MSC-A.

iv) handover between Radio Network Subsystems connected to different 3G_MSCs, this is termed an Inter-3G_MSC handover/relocation. This category can be divided into three further sub-procedures:

- a) the Inter-3G_MSC Handover procedure from UMTS to GSM, where the UE/MS is handed over from a controlling 3G_MSC (3G_MSC-A) to an MSC (MSC-B);
- b) the Inter-3G_MSC Handover procedure from GSM to UMTS, where the UE/MS is handed over from a controlling MSC (MSC-A) to a 3G_MSC (3G_MSC-B);
- c) the Inter-3G_MSC Relocation procedure, where the UE is relocated from 3G_MSC-A to 3G_MSC-B. This procedure can also be combined with a hard change of radio resources (Hard Handover with switch in the core network).

The MSC in this category can optionally be a 3G_MSC supporting the A-interface. The three sub-procedures do also cover subsequent handover/relocation to a third MSC-B' or 3G_MSC-B' and subsequent handover/relocation back to MSC-A or 3G_MSC-A.

In both cases i) and iii) the same procedures as defined in the ~~GSM 08.08~~3GPP TS 08.08 [5] and the ~~TS 24.008~~3GPP TS 24.008 [10] shall be used on the A-interface and on the Radio Interface, respectively.

In case ii) the same procedures as defined in the ~~TS 25.413~~3GPP TS 25.413 [11] and the ~~TS 24.008~~3GPP TS 24.008 [10] shall be used on the Iu-interface. If the 3G_MSC in case ii) also supports the A-interface, the ~~GSM 08.08~~3GPP TS 08.08 [5] and the ~~TS 24.008~~3GPP TS 24.008 [10] shall be used on the A-interface.

In case iii) the handover procedures shall transport the A-interface messages between MSC-A and MSC-B described in the Mobile Application Part (MAP), ~~TS 29.002~~3GPP TS 29.002 [12].

In case iv) the handover procedures shall transport the A-interface messages between 3G_MSC and MSC described in the Mobile Application Part (MAP), ~~TS 29.002~~3GPP TS 29.002 [12].

In case iv) the relocation procedure shall transport the Iu-interface messages between 3G_MSC-A and 3G_MSC-B described in the Mobile Application Part (MAP), ~~TS 29.002~~3GPP TS 29.002 [12].

The interworking between the ~~TS 29.002~~3GPP TS 29.002 [12] protocol and the ~~GSM 08.08~~3GPP TS 08.08 [5] protocol is described in the ~~GSM~~ 3GPP TS ~~09.10~~29.010 [8] ~~Technical Specification~~.

Handovers, which take place on the same MSC are termed Intra-MSC handovers; this includes both Inter-BSS and Intra-BSS handovers.

Handovers, which take place on the same 3G_MSC are termed Intra-3G_MSC handovers; this includes Inter-RNS handovers and optionally RNS to BSS and BSS to RNS handovers.

The present document also covers the requirements for handover in ongoing GSM voice group calls, directed retry and handover without a circuit connection between (U)MSCs. The present document does not consider the case of handovers between radio channels on the same BSS (Intra-BSS handover) or the handover of packet radio services. The Inter-RNS handover case that results in a relocation is covered by the present document but not other Inter-RNS or Intra-RNS handover cases.

For voice broadcast calls in GSM, the speaker uses normal point-to-point handover procedures, whilst the listeners use idle mode cell reselection procedures, as for the voice group call listeners.

Voice group calls is only applicable to GSM and handover of voice group calls is therefore only possible in GSM.

Inter-MSC hand-over imposes a few limitations on the system. After inter-MSC hand-over:

- call re-establishment is not supported.

The list of ~~GSM 08.08~~3GPP TS 08.08 [5] features supported during and after Inter-MSC handover is given in ~~GSM 09.08~~3GPP TS 09.08 [7].

In the Inter-MSC handover case, the interworking between a Phase 1 BSSMAP protocol possibly used by one MSC and the Phase 2 BSSMAP protocol used in the Phase 2 MAP protocol on the E-interface is performed by this MSC.

NOTE: The message primitive names used in the SDL diagrams and message flows in the present document do not represent the actual messages specified in the GSM or 3GPP stage 3 technical specifications. The primitive names are only intended to be indicative of their use in the present document.

2 References

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

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

[1] ITU-T Recommendation Q.118: "Special release arrangements".

[2] ~~GSM 01.04~~3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2a] ~~TS 21.905~~3GPP TS 21.905: "3G Vocabulary".

[3] ~~GSM 03.68~~3GPP TS 03.68: "Digital cellular telecommunications system (Phase 2+); Voice Group Call Service (VGCS) - Stage 2".

[4] ~~GSM 05.08~~3GPP TS 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

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

[6] ~~GSM 08.58~~3GPP TS 08.58: "Digital cellular telecommunications system (Phase 2+); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification".

[7] ~~GSM 09.08~~3GPP TS 09.08: "Digital cellular telecommunications system (Phase 2+); Application of the Base Station System Application Part (BSSAP) on the E-interface".

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

[9] ~~TS 22.129~~3GPP TS 22.129: "Handover Requirements between UMTS and GSM or other Radio Systems".

[10] ~~TS 24.008~~3GPP TS 24.008: "Mobile radio interface layer 3 specification".

[11] ~~TS 25.413~~3GPP TS 25.413: "UTRAN Iu interface RANAP signalling".

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

[13] ~~TS 25.303~~3GPP TS 25.303: "Interlayer procedures in Connected Mode".

[14] ~~TS 25.331~~3GPP TS 25.331: "RRC Protocol Specification".

[15] ~~TS 29.108~~3GPP TS 29.108: "Application Part (RANAP) on the E-interface".

[16] ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

[17] ~~TS 23.135~~3GPP TS 23.135: "Multicall supplementary service - Stage 2"

3 Abbreviations

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

3G_MSC	A third generation MSC that supports the Iu interface and optionally the A interface
3G_MSC-A	The controlling 3G_MSC on which the call was originally established
3G_MSC-B	The 3G_MSC to which the UE is handed over in a Basic Handover
3G_MSC-B'	The 3G_MSC to which the UE is handed over in a Subsequent Handover
BSC	Base Station Controller
BSS	Base Station System
BSS-A	The BSS from which the MS is being handed over
BSS-B	The BSS to which the MS is being handed over
BTS	Base Transceiver Station
ISC	International Switching Centre
MS	Mobile Station
MSC	A second generation Mobile Services Switching Centre that only supports the A interface
MSC-A	The controlling MSC on which the call was originally established
MSC-B	The MSC to which the MS is handed over in a Basic Handover
MSC-B'	The MSC to which the MS is handed over in a Subsequent Handover
RNC	Radio Network Controller
RNS	Radio Network Subsystem
UE	A User Equipment is a terminal that supports USIM and the UMTS Uu interface
UE/MS	A terminal that supports USIM, SIM, the Uu interface and the Um interface
USIM	UMTS Subscriber Identity Module

Other abbreviations used in the ~~GSM~~ 3GPP specifications are listed in ~~GSM 01.04~~3GPP TS 01.04 [2] and ~~TS 21.905~~3GPP TS 21.905[2a].

4 Role, functional composition of MSCs and interfaces for handover

4.1 MSC-A

4.1.1 Role of MSC-A

In the Intra-MSC handover case, the MSC-A (simply termed MSC) controls the call, the mobility management and the radio resources before, during and after an Intra-MSC handover. When BSSAP procedures have to be performed, they are initiated and driven by MSC-A.

In the Inter-MSC handover case, MSC-A is the MSC which controls the call and the mobility management of the Mobile during the call, before, during and after a basic or subsequent handover. When BSSAP procedures related to dedicated resources have to be performed towards the MS, they are initiated and driven by MSC-A. The MSC-A - MSC-B interface works as a MSC - BSS interface for a subset of BSSMAP procedures. These BSSMAP procedures, described in ~~GSM 09.08~~3GPP TS 09.08 [7] are only those related to dedicated resources. The DTAP signalling is relayed transparently by MSC-B between MSC-A and the MS.

During a basic handover, MSC-A initiates and controls all the handover procedure, from its initiation (reception of Handover Required from BSS-A on A-interface) until its completion (reception of Handover Complete from MSC-B on E-interface).

During a subsequent handover back to MSC-A, MSC-A acts as a BSS towards MSC-B, which controls the handover procedure until the termination in MSC-A of the handover radio resources allocation (sending of the Handover Request Acknowledge to MSC-B from MSC-A). Then all handover related messages shall terminate at MSC-A (e.g. Handover Detect/Complete from BSS-B, Handover Failure from BSS-A).

During a subsequent handover to a third MSC, MSC-A works towards MSC-B' as described above in the basic handover paragraph and towards MSC-B as described above in subsequent handover paragraph.

In the Inter-System, inter-MSC handover case, MSC-A is the MSC which controls the call and the mobility management of the Mobile during the call, before, during and after a basic or subsequent handover. When BSSAP procedures related to dedicated resources have to be performed towards the MS, they are initiated and driven by MSC-A. The MSC-A - 3G_MSC-B interface works as a MSC - BSS interface for a subset of BSSMAP procedures. These BSSMAP procedures, described in ~~GSM 09.08~~3GPP TS 09.08 [7] are only those related to dedicated resources. The DTAP signalling is relayed transparently by 3G_MSC-B between MSC-A and the MS.

During a basic inter-system handover, MSC-A initiates and controls all the handover procedure, from its initiation (reception of Handover Required from BSS-A on A-interface) until its completion (reception of Handover Complete from 3G_MSC-B on E-interface).

During a subsequent inter-system handover back to MSC-A, MSC-A acts as a BSS towards 3G_MSC-B, which controls the handover procedure until the termination in MSC-A of the handover radio resources allocation (sending of the Handover Request Acknowledge to 3G_MSC-B from MSC-A). Then all handover related messages shall terminate at MSC-A (e.g. Handover Detect/Complete from BSS-B, Handover Failure from BSS-A).

During a subsequent inter-system handover to a third MSC, MSC-A works towards 3G_MSC-B' as described above in the basic inter-system handover paragraph and towards 3G_MSC-B as described above in subsequent inter-system handover paragraph.

4.1.2 Functional composition of MSC-A and its interfaces for handover

In order to simplify the description of the handover procedures the controlling MSC (MSC-A) can be considered to be composed of five functional units, as shown in figure 1.

Signalling functions

1) BSC/MSC (MS/BSC) Procedures MSC-A. This unit is used to control the signalling between the MSC, BSC and MS. Interface A' is the connection to the old BSC and interface A'' is the connection to the new BSC, when an

Intra-MSC handover takes place. Interface x represents the interworking connection to the Handover Control Procedures MSC-A.

2) Call Control Procedures MSC-A. This unit is used to control the call. Interface B' is used for normal call control procedures. When a Basic handover from MSC-A to MSC-B is to be performed then interface B'' is employed to provide a signalling and call control connection to MSC-B. If a Subsequent handover to MSC-B' is to be performed then interface B''' is used. Similarly, when a Basic inter-system handover from MSC-A to 3G_MSC-B is to be performed, then interface B'' is employed to provide a signalling and call control connection to 3G_MSC-B. If a subsequent inter-system handover to 3G_MSC-B' is to be performed, then interface B''' is used.

3) Handover Control Procedures MSC-A. This unit provides both the overall control of the handover procedure and interworking between the internal interfaces (x, y and z).

4) MAP Procedures MSC-A. This unit is responsible for controlling the exchange of MAP messages between MSCs during an Inter-MSC handover, or between MSC-A and 3G_MSC-B during an Inter-system Inter-MSC handover. This unit communicates with the Handover Control Procedures MSC-A via interface z.

Switching functions

5) Switch and Handover Device MSC-A. For all calls, except for ongoing voice group calls (see ~~GSM 03.68~~3GPP TS 03.68 [3] for a definition) this unit is responsible for connecting the new path into the network via interface B'. In the case of ongoing voice group calls this unit is responsible for maintaining the connection between the down link group call channels and the active uplink. In specific cases it may be unnecessary to take any explicit action in the MSC concerning the handover device. The handover device interconnections are illustrated in figure 2.

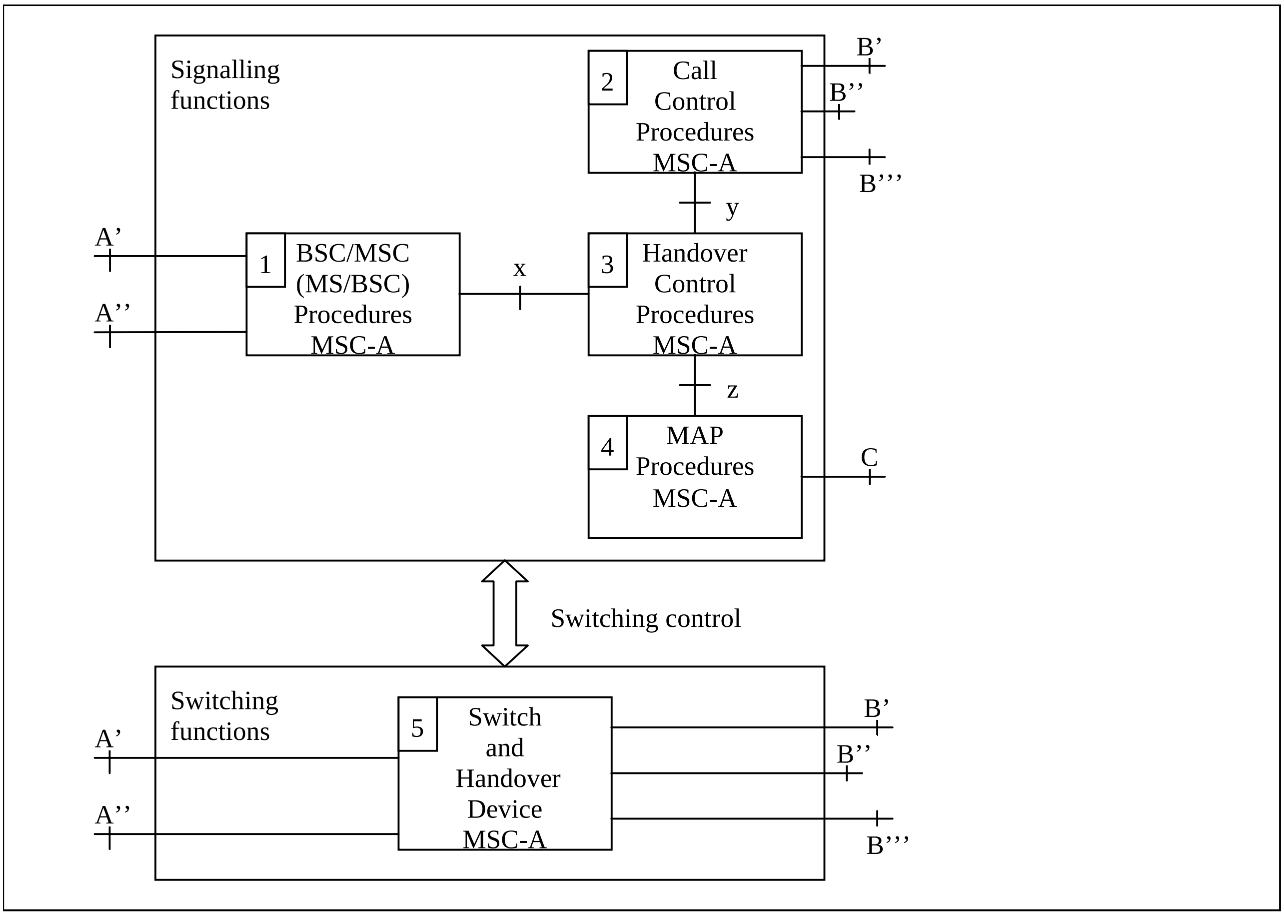


Figure 1: Functional composition of the controlling MSC (MSC-A) for supporting handover

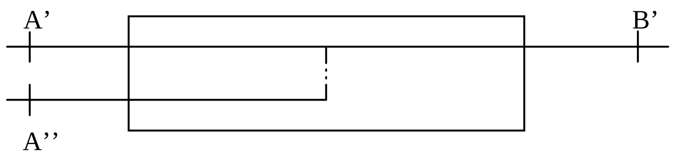
For MS to MS calls in the same MSC the configuration in Figure 2b) applies. In this case interface B'' is internal to MSC-A and does not connect to another MSC.

The handover device can either be a three-party bridge or a switching facility without three-party connection capabilities. For a three-party bridge configuration the states of the handover device are as shown in table 1. The three-party configuration exists in the intermediate state. This type of handover device may reduce the interruption time. However, this may require noise reduction if one of the radio channels is unterminated at some time in the intermediate state.

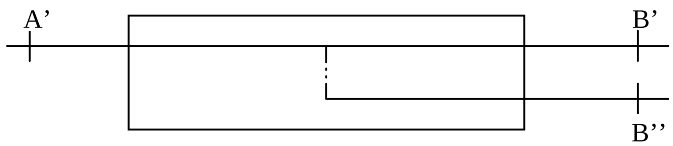
For a handover device consisting of a simple switch there will be no intermediate state.

Table 1: States of the handover device

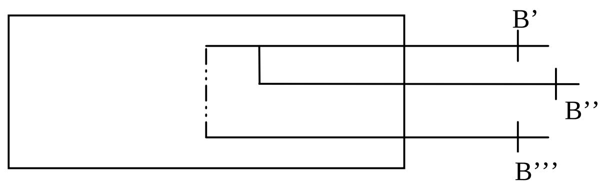
Case	Initial Connection	Intermediate Connection	Resulting Connection	
			Successful Procedure	Unsuccessful Procedure
Figure 2a)	B' to A'	B' to A' and A"	B' to A"	B' to A'
Figure 2b)	B' to A'	B' to A' and B"	B' to B"	B' to A'
Figure 2c)	B' to B"	B' to B"and B"'	B' to B"'	B' to B"



a) Intra-MSC Handover case.



b) Basic Handover case and handover of MS to MS call in the same MSC.



c) Subsequent Handover case

NOTE: In a) and b) A’ is released after handover;
In c) B’’ is released after handover.

Figure 2: Connections in the handover device (Unit 5)

4.2 MSC-B

4.2.1 Role of MSC-B

In the Intra-MSC handover case, the MSC-B keeps the control of the whole Intra-MSC handover procedure. MSC-A, or 3G_MSC-A in the case of a previous inter-system handover, is only notified on the successful completion of the Intra-MSC handover procedure.

In the Inter-MSC handover case, the role of MSC-B (MSC-B') is only to provide radio resources control within its area. This means that MSC-B keeps control of the radio resources connection and release towards BSS-B. MSC-B will do some processing on the BSSMAP information received on the E-interface or A-interface whereas it will relay the DTAP information transparently between A-interface and E-interface. MSC-A initiates and drives a subset of BSSMAP procedures towards MSC-B, while MSC-B controls them towards its BSSs to the extent that MSC-B is responsible for the connections of its BSSs. The release of the dedicated resources between MSC-B and BSS-B is under the responsibility of MSC-B and BSS-B, and is not directly controlled by MSC-A. When clearing is to be performed due to information received from BSS-B, MSC-B shall transfer this clearing indication to MSC-A, to clear its connection with BSS-B, to terminate the dialogue with MSC-A through the E-interface, and to release its circuit connection with MSC-A, if any. In the same way, the release of the connection to its BSS-B, is initiated by MSC-B, when the dialogue with MSC-A ends normally and a release is received from the circuit connection with MSC-A, if any, or when the dialogue with the MSC-A ends abnormally.

When a release is received by MSC-B for the circuit connection with MSC-A then MSC-B shall release the circuit connection.

In the Inter-system Inter-MSC handover case, the role of MSC-B (MSC-B') is only to provide radio resources control within its area. This means that MSC-B keeps control of the radio resources connection and release towards BSS-B. MSC-B will do some processing on the BSSMAP information received on the E-interface or A-interface whereas it will relay the DTAP information transparently between A-interface and E-interface. 3G_MSC-A initiates and drives a subset of BSSMAP procedures towards MSC-B, while MSC-B controls them towards its BSSs to the extent that MSC-B is responsible for the connections of its BSSs. The release of the dedicated resources between MSC-B and BSS-B is under the responsibility of MSC-B and BSS-B, and is not directly controlled by 3G_MSC-A. When clearing is to be performed due to information received from BSS-B, MSC-B shall transfer this clearing indication to 3G_MSC-A, to clear its connection with BSS-B, to terminate the dialogue with 3G_MSC-A through the E-interface, and to release its circuit connection with 3G_MSC-A, if any. In the same way, the release of the connection to its BSS-B, is initiated by MSC-B, when the dialogue with 3G_MSC-A ends normally and a release is received from the circuit connection with MSC-A, if any, or when the dialogue with the MSC-A ends abnormally.

When a release is received by MSC-B for the circuit connection with 3G_MSC-A then MSC-B shall release the circuit connection.

4.2.2 Functional composition of MSC-B and its interfaces for handover

The functional composition of an MSC acting as MSC-B is essentially the same as that of MSC-A. However, there are some differences. The functional units are as follows (see figure 3).

Signalling functions

1) BSC/MSC (MS/BSC) Procedures MSC-B. This unit is used to control the signalling between the MSC, BSC and MS. Interface A" is the connection to the new BSC, when an Intra-MSC handover takes place. Interface x represents the interworking connection to the Handover Control Procedures MSC-B.

2) Call Control Procedures MSC-B. This unit is used for normal call control and signalling to MSC-A, or 3G_MSC-A in the case of inter-system inter-MSC handover.

3) Handover Control Procedures MSC-B. This unit provides both the overall control of the handover procedure and interworking between the internal interfaces (x, y and z) in MSC-B.

4) MAP Procedures MSC-B. This unit is responsible for controlling the exchange of MAP messages between MSC-A, or 3G_MSC-A, and MSC-B and for signalling to the VLR in MSC-B.

Switching functions

5) Switch MSC-B. For all calls, except ongoing voice group calls (see ~~GSM 03.68~~3GPP TS 03.68 [3] for a definition) this unit is responsible, with BSS-B, for connecting the circuit from MSC-A, or 3G_MSC-A, to BSS-B. This unit may also need to act as a handover device for Intra-MSC handovers controlled by MSC-B. In the case of ongoing voice group calls this unit is responsible for maintaining the connection between the group member currently assigned the uplink and the distribution device. In specific cases it may be unnecessary to take any explicit action in the MSC concerning the handover device.

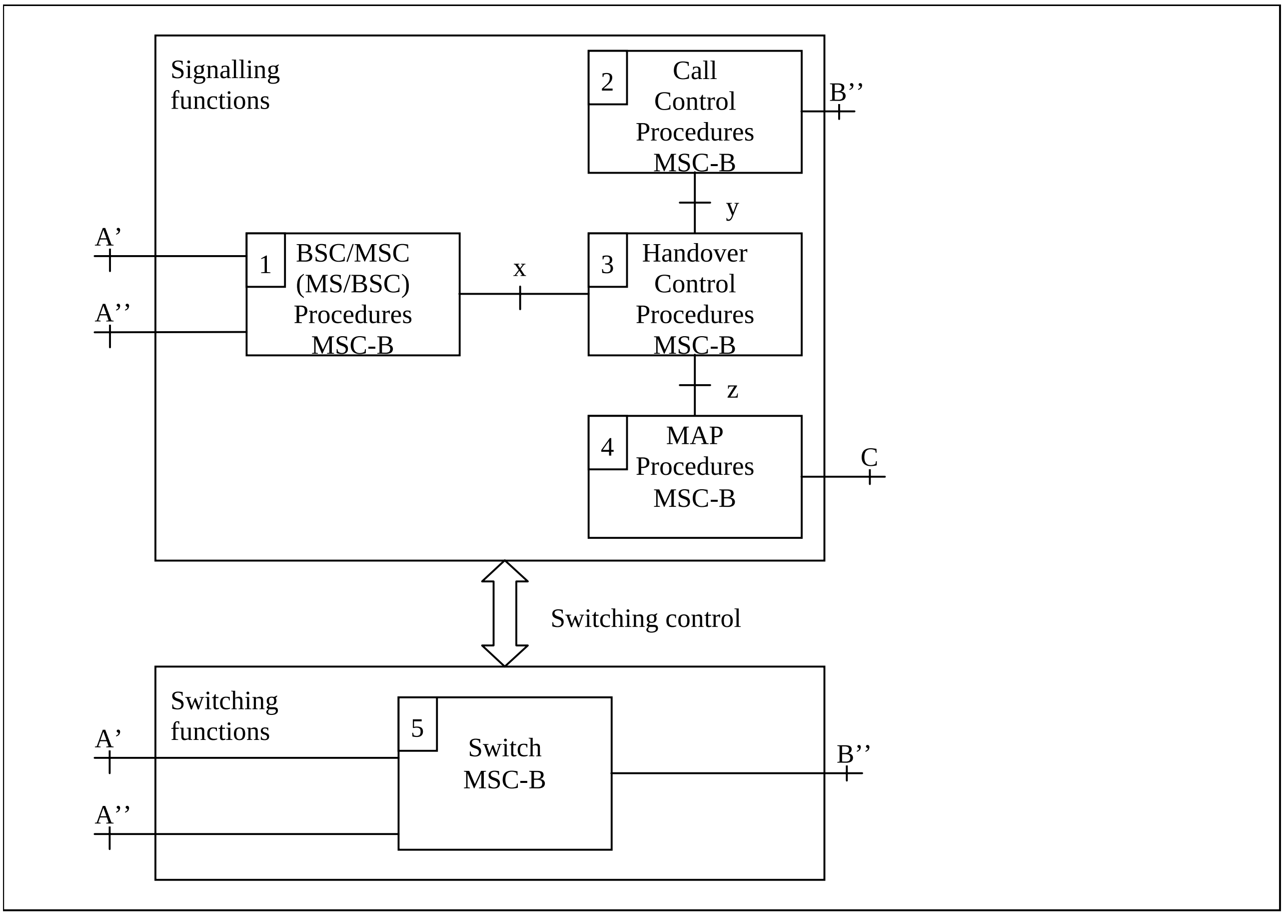


Figure 3: Functional composition of MSC-B for supporting handover

4.3 3G_MSC-A

For roles and functional composition of the 3G_MSC-A working as pure GSM MSC, please see previous clause ("MSC-A").

4.3.1 Role of 3G_MSC-A

In the Intra-3G_MSC handover/relocation case, the 3G_MSC-A (simply termed 3G_MSC) controls the call, the mobility management and the radio resources before, during and after an Intra-3G_MSC handover/relocation. When RANAP or BSSMAP procedures have to be performed, they are initiated and driven by 3G_MSC-A.

In the case of intra-MSC handover of a speech call, 3G_MSC-A controls the transcoder in the core network. The 3G_MSC-A determines if a transcoder is required to be inserted or released in the CN.

In the case of Inter-3G_MSC relocation, 3G_MSC-A links out the transcoder.

In the Inter-3G_MSC relocation case, 3G_MSC-A is the 3G_MSC that controls the call and the mobility management of the UE during the call, before, during and after a basic or subsequent relocation. When RANAP procedures related to dedicated resources have to be performed towards the UE, they are initiated and driven by 3G_MSC-A. The 3G_MSC-A - 3G_MSC-B interface works as a 3G_MSC - RNS interface for the RANAP procedures. The Direct Transfer signalling is relayed transparently by 3G_MSC-B between 3G_MSC-A and the UE.

During a basic relocation, 3G_MSC-A initiates and controls all the relocation procedure, from its initiation (reception of Relocation Required from RNS-A on Iu-interface) until its completion (reception of Relocation Complete from 3G_MSC-B on E-interface).

During a subsequent relocation back to 3G_MSC-A, 3G_MSC-A acts as an RNS towards 3G_MSC-B, which controls the relocation procedure until the termination in 3G_MSC-A of the handover radio resources allocation (sending of the

Relocation Request Acknowledge to 3G_MSC-B from 3G_MSC-A). Then all relocation related messages shall terminate at 3G_MSC-A (e.g. Relocation Detect/Complete from RNS-B, Relocation Cancel from RNS-A).

During a subsequent relocation to a third 3G_MSC, 3G_MSC-A works towards 3G_MSC-B' as described above in the basic relocation paragraph and towards 3G_MSC-B as described above in subsequent relocation paragraph.

In the Inter-System, inter-3G_MSC handover case, 3G_MSC-A is the 3G_MSC which controls the call and the mobility management of the UE/MS during the call, before, during and after a basic or subsequent inter-system handover. When BSSAP procedures related to dedicated resources have to be performed towards the UE/MS, they are initiated and driven by 3G_MSC-A. The 3G_MSC-A – MSC-B interface works as a 3G_MSC – BSS interface for a subset of BSSMAP procedures. These BSSMAP procedures described in ~~GSM~~ 3GPP TS 09 08 [7] are those related to dedicated resources. The DTAP signalling is relayed transparently by MSC-B between 3G_MSC-A and the UE/MS.

During a basic inter-system UMTS to GSM handover, 3G_MSC-A initiates and controls all the handover procedure, from its initiation (reception of Relocation Required from RNS-A on Iu-interface) until its completion (reception of Handover Complete from MSC-B on E-interface).

During a subsequent inter-system UMTS to GSM handover back to 3G_MSC-A, 3G_MSC-A acts as a BSS towards 3G_MSC-B, which controls the handover procedure until the termination in 3G_MSC-A of the handover radio resources allocation (sending of the Handover Request Acknowledge to 3G_MSC-B from 3G_MSC-A). Then all handover related messages shall terminate at 3G_MSC-A (e.g. Handover Detect/Complete from BSS-B, Relocation Cancel from RNS-A).

During a subsequent inter-system UMTS to GSM handover to a third 3G_MSC, 3G_MSC-A works towards MSC-B' as described above in the basic inter-system handover paragraph and towards 3G_MSC-B as described above in subsequent inter-system handover paragraph.

During a basic inter-system GSM to UMTS handover, 3G_MSC-A initiates and controls all the handover procedure, from its initiation (reception of Handover Required from BSS-A on A-interface) until its completion (reception of Handover Complete from 3G_MSC-B on E-interface).

During a subsequent inter-system GSM to UMTS handover back to 3G_MSC-A, 3G_MSC-A acts as an RNS towards MSC-B, which controls the handover procedure until the termination in 3G_MSC-A of the handover radio resources allocation (sending of the Handover Request Acknowledge to MSC-B from 3G_MSC-A). Then all handover related messages shall terminate at 3G_MSC-A (e.g. Relocation Detect/Complete from RNS-B, Handover Failure from BSS-A).

During a subsequent inter-system GSM to UMTS handover to a third 3G_MSC, 3G_MSC-A works towards 3G_MSC-B' as described above in the basic inter-system handover paragraph and towards MSC-B as described above in subsequent inter-system handover paragraph.

If 3G_MSC-A supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135) and UE is engaged with multiple bearers the following description applies;

- In the Intra-3G_MSC relocation case, the 3G-MSC-A tries to relocate all bearers to a new RNS.

- In the basic relocation case, the 3G-MSC-A tries to relocate all bearers to 3G_MSC-B. If 3G_MSC-A receives an indication that the 3G_MSC-B does not support multiple bearers, then 3G_MSC-A shall be able to select one bearer to be handed over according to the priority level defined as RAB parameters in ~~TS 25.413~~3GPP TS 25.413 [11] and tries again to relocate the selected bearer.

- In the subsequent relocation to a third 3G_MSC-B' case, the 3G-MSC-A tries to relocate all bearers to 3G_MSC-B'. If 3G_MSC-A receives an indication that the 3G_MSC-B' does not support multiple bearers, then 3G_MSC-A shall be able to select one bearer to be handed over according to the priority level defined as RAB parameters in ~~TS 25.413~~3GPP TS 25.413 [11] and tries again to relocate the selected bearer.

- In the Intra-3G_MSC inter-system UMTS to GSM handover case and the basic inter-system UMTS to GSM handover case, the 3G_MSC-A shall be able to select one bearer to be handed over according to the priority level defined as RAB parameters in ~~TS 25.413~~3GPP TS 25.413 [11] and tries to handover the selected bearer.

- In all cases described above, 3G_MSC-A shall release some calls which has been carried by the bearers failed to set up in new RNS or the bearers not to be handed over.

4.3.2 Functional composition of 3G_MSC-A and its interfaces for handover/relocation

In order to simplify the description of the handover/relocation procedures the controlling 3G_MSC (3G_MSC-A) can be considered to be composed of five functional units, as shown in figure 4.

Signalling functions

1) RNC/BSC/3G_MSC (UE/MS/RNC/BSC) Procedures 3G_MSC-A. This unit is used to control the signalling between the 3G_MSC, RNC or BSC and UE/MS. Interface Iu' is the connection to the old RNC and interface Iu" is the connection to the new RNC, when an Intra-3G_MSC relocation takes place. Interface Iu' is the connection to the old RNC and interface A" is the connection to the new BSC, when an Intra-3G_MSC UMTS to GSM handover takes place. Interface A' is the connection to the old BSC and interface Iu" is the connection to the new RNC, when an Intra-3G_MSC GSM to UMTS handover takes place. Interface x represents the interworking connection to the Handover/Relocation Control Procedures 3G_MSC-A.

2) Call Control Procedures 3G_MSC-A. This unit is used to control the call. Interface B' is used for normal call control procedures. When a Basic relocation from 3G_MSC-A to 3G_MSC-B is to be performed then interface B" is employed to provide a signalling and call control connection to 3G_MSC-B. If a Subsequent handover/relocation to 3G_MSC-B' is to be performed then interface B"' is used. Similarly, when a Basic inter-system handover from 3G_MSC-A to 3G_MSC-B is to be performed, then interface B" is employed to provide a signalling and call control connection to 3G_MSC-B. If a Subsequent inter-system handover to 3G_MSC-B' is to be performed then interface B"' is used.

3) Handover/Relocation Control Procedures 3G_MSC-A. This unit provides both the overall control of the handover/relocation procedure and interworking between the internal interfaces (x, y and z).

4) MAP Procedures 3G_MSC-A. This unit is responsible for controlling the exchange of MAP messages between 3G_MSCs during an Inter-3G_MSC handover/relocation, or between 3G_MSC-A and MSC-B during an Inter-system Inter-3G_MSC handover. This unit communicates with the Handover/Relocation Control Procedures 3G_MSC-A via interface z.

Switching functions

5) Switch and Handover/Relocation Device 3G_MSC-A. For all calls this unit is responsible for connecting the new path into the network via interface B'. In specific cases it may be unnecessary to take any explicit action in the 3G_MSC concerning the handover/relocation device. The handover/relocation device interconnections are illustrated in figure 5.

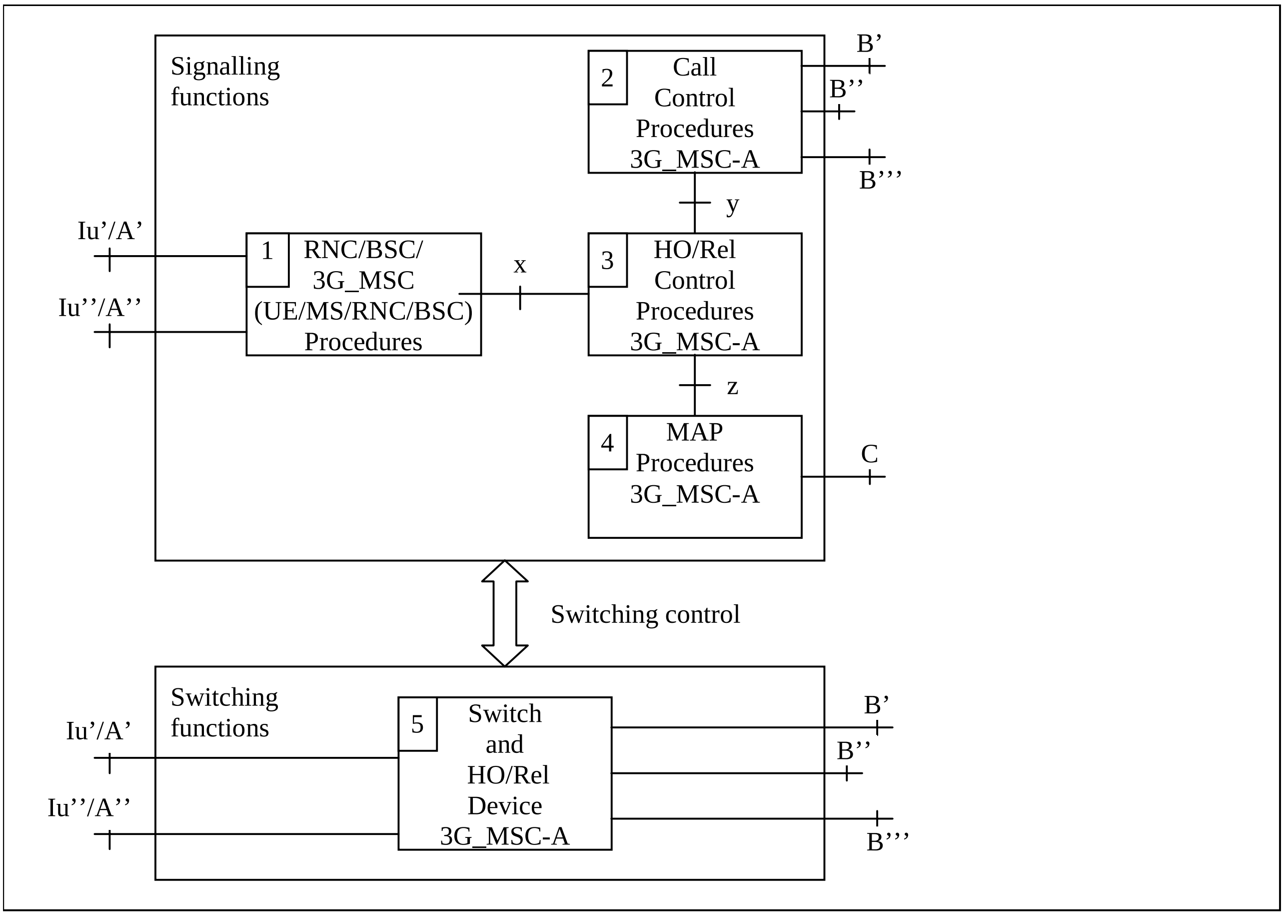


Figure 4: Functional composition of the controlling 3G_MSC (3G_MSC-A) for supporting handover/relocation

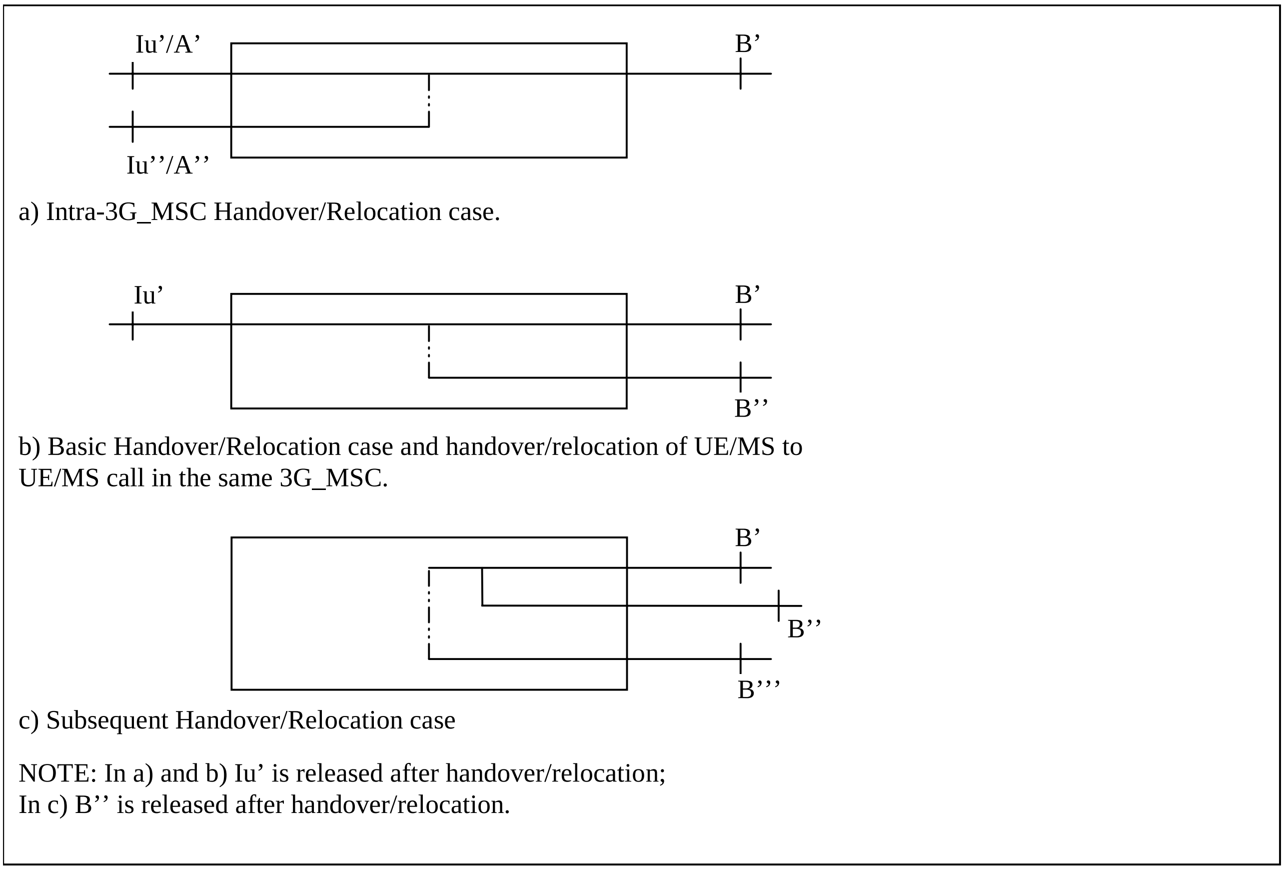
For UE/MS to UE/MS calls in the same 3G_MSC the configuration in figure 5b) applies. In this case interface B" is internal to 3G_MSC-A and does not connect to another 3G_MSC.

The handover/relocation device can be either a three-party bridge or a switching facility without three-party connection capabilities. For a three-party bridge configuration the states of the handover/relocation device are as shown in table 2. The three-party configuration exists in the intermediate state. This type of handover/relocation device may reduce the interruption time. However, this may require noise reduction if one of the radio channels is unterminated at some time in the intermediate state.

For a handover/relocation device consisting of a simple switch there will be no intermediate state.

Table 2: States of the handover/relocation device

Case	Initial Connection	Intermediate Connection	Resulting Connection	
			Successful Procedure	Unsuccessful Procedure
Figure 5a)	B' to Iu' B' to Iu' B' to A'	B' to Iu' and Iu" B' to Iu' and A" B' to A' and Iu"	B' to Iu" B' to A" B' to Iu"	B' to Iu' B' to Iu' B' to A'
Figure 5b)	B' to Iu'	B' to Iu' and B"	B' to B"	B' to Iu'
Figure 5c)	B' to B"	B' to B"and B"'	B' to B"'	B' to B"



a) Intra-3G_MSC Handover/Relocation case.

b) Basic Handover/Relocation case and handover/relocation of UE/MS to UE/MS call in the same 3G_MSC.

c) Subsequent Handover/Relocation case

NOTE: In a) and b) Iu' is released after handover/relocation;
In c) B'' is released after handover/relocation.

Figure 5: Connections in the handover/relocation device (Unit 5)

4.4 3G_MSC-B

For roles and functional composition of the 3G_MSC-B working as pure GSM MSC, please see previous clause ("MSC-B").

4.4.1 Role of 3G_MSC-B

In the Intra-3G_MSC handover/relocation case, the 3G_MSC-B keeps the control of the whole Intra-3G_MSC handover/relocation procedure.

The role of 3G_MSC-B is also to provide transcoder resources.

In the Inter-3G_MSC relocation case, the role of 3G_MSC-B (3G_MSC-B') is only to provide radio resources control within its area. This means that 3G_MSC-B keeps control of the radio resources connection and release towards RNS-B. 3G_MSC-B will do some processing on the RANAP information received on the E-interface or the RANAP information received on the Iu-interface whereas it will relay the Direct Transfer information transparently between Iu-interface and E-interface. 3G_MSC-A initiates and drives RANAP procedures towards 3G_MSC-B, while 3G_MSC-B controls them towards its RNSs to the extent that 3G_MSC-B is responsible for the connections of its RNSs. The release of the dedicated resources between 3G_MSC-B and RNS-B is under the responsibility of 3G_MSC-B and RNS-B, and is not directly controlled by 3G_MSC-A. When clearing is to be performed due to information received from RNS-B, 3G_MSC-B shall transfer this clearing indication to 3G_MSC-A, to clear its connection with RNS-B, to terminate the dialogue with 3G_MSC-A through the E-interface, and to release its circuit connection with 3G_MSC-A, if any. In the same way, the release of the connection to its RNS-B, is initiated by 3G_MSC-B, when the dialogue with 3G_MSC-A ends normally and a release is received from the circuit connection with 3G_MSC-A, if any, or when the dialogue with the 3G_MSC-A ends abnormally.

When a release is received by 3G_MSC-B for the circuit connection with 3G_MSC-A then 3G_MSC-B shall release the circuit connection.

In the Inter-system UMTS to GSM Inter-3G_MSC handover case, the role of 3G_MSC-B (3G_MSC-B') is only to provide radio resources control within its area. This means that 3G_MSC-B keeps control of the radio resources connection and release towards BSS-B. 3G_MSC-B will do some processing on the BSSMAP information received on the E-interface or the BSSMAP information received on the A-interface whereas it will relay the DTAP information transparently between A-interface and E-interface. 3G_MSC-A initiates and drives a subset of BSSMAP procedures towards 3G_MSC-B, while 3G_MSC-B controls them towards its BSSs to the extent that 3G_MSC-B is responsible for the connections of its BSSs. The release of the dedicated resources between 3G_MSC-B and BSS-B is under the responsibility of 3G_MSC-B and BSS-B, and is not directly controlled by 3G_MSC-A. When clearing is to be performed due to information received from BSS-B, 3G_MSC-B shall transfer this clearing indication to 3G_MSC-A, to clear its connection with BSS-B, to terminate the dialogue with 3G_MSC-A through the E-interface, and to release its circuit connection with MSC-A, if any. In the same way, the release of the connection to its BSS-B, is initiated by 3G_MSC-B, when the dialogue with 3G_MSC-A ends normally and a release is received from the circuit connection with 3G_MSC-A, if any, or when the dialogue with the MSC-A ends abnormally.

When a release is received by 3G_MSC-B for the circuit connection with 3G_MSC-A then 3G_MSC-B shall release the circuit connection.

In the Inter-system GSM to UMTS Inter-3G_MSC handover case, the role of 3G_MSC-B (3G_MSC-B') is only to provide radio resources control within its area. This means that 3G_MSC-B keeps control of the radio resources connection and release towards RNS-B. 3G_MSC-B will do some processing on the BSSMAP information received on the E-interface or the RANAP information received on the Iu-interface whereas it will relay the Direct Transfer information transparently between Iu-interface and E-interface. MSC-A initiates and drives a subset of BSSMAP procedures towards 3G_MSC-B, while 3G_MSC-B controls them towards its RNSs to the extent that 3G_MSC-B is responsible for the connections of its RNSs. The release of the dedicated resources between 3G_MSC-B and RNS-B is under the responsibility of 3G_MSC-B and RNS-B, and is not directly controlled by MSC-A. When clearing is to be performed due to information received from RNS-B, 3G_MSC-B shall transfer this clearing indication to MSC-A, to clear its connection with RNS-B, to terminate the dialogue with MSC-A through the E-interface, and to release its circuit connection with MSC-A, if any. In the same way, the release of the connection to its RNS-B, is initiated by 3G_MSC-B, when the dialogue with MSC-A ends normally and a release is received from the circuit connection with MSC-A, if any, or when the dialogue with the MSC-A ends abnormally.

When a release is received by 3G_MSC-B for the circuit connection with MSC-A then 3G_MSC-B shall release the circuit connection.

If 3G_MSC-B does not support the optional supplementary service Mutlicall (See ~~TS 23.135~~3GPP TS 23.135) and 3G_MSC-A requests to relocate multiple bearers, 3G_MSC-B shall indicate that it does not support multiple bearers to 3G_MSC-A.

If 3G_MSC-B supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135) and UE is engaged with multiple bearers the following description applies;

- In the basic relocation case, the 3G_MSC-B shall be able to allocate an Handover Number for each bearer. The 3G-MSC-B shall also be able to select some bearers so that the number of bearers will fulfill the maximum number of bearers supported by the 3G_MSC-B.
- In the Intra-3G_MSC relocation case, the 3G-MSC-B tries to relocate all bearers to a new RNS.
- In the subsequent relocation back to the 3G_MSC-A or to a third 3G_MSC-B' case, the 3G-MSC-B tries to request to the 3G_MSC-A to relocate all bearers to the 3G_MSC-A or to the 3G_MSC-B'.
- In the Intra-3G_MSC inter-system UMTS to GSM handover case and the subsequent inter-system UMTS to GSM handover back to the 3G_MSC-A or to a third MSC-B' case, the 3G_MSC-B shall be able to select one bearer to be handed over according to the priority level defined as RAB parameters in ~~TS 25.413~~3GPP TS 25.413 [11] and tries to handover the selected bearer.

4.4.2 Functional composition of 3G_MSC-B and its interfaces for handover/relocation

The functional composition of a 3G_MSC acting as 3G_MSC-B is essentially the same as that of 3G_MSC-A. However, there are some differences. The functional units are as follows (see figure 6).

Signalling functions

1) RNC/BSC/3G_MSC (UE/MS/RNC/BSC) Procedures 3G_MSC-B. This unit is used to control the signalling between the 3G_MSC, RNC, BSC and UE/MS. Interface Iu' is the connection to the old RNC and interface Iu" is the connection to the new RNC, when an Intra-3G_MSC relocation takes place. Interface Iu' is the connection to the old RNC and interface A" is the connection to the new BSC, when an Intra-3G_MSC UMTS to GSM handover takes place. Interface A' is the connection to the old BSC and interface Iu" is the connection to the new RNC, when an Intra-3G_MSC GSM to UMTS handover takes place. Interface x represents the interworking connection to the Handover/Relocation Control Procedures 3G_MSC-B.

2) Call Control Procedures 3G_MSC-B. This unit is used for normal call control and signalling to 3G_MSC-A or MSC-A in the case of inter-system inter-3G_MSC handover.

3) Handover/Relocation Control Procedures 3G_MSC-B. This unit provides both the overall control of the handover/relocation procedure and interworking between the internal interfaces (x, y and z) in 3G_MSC-B.

4) MAP Procedures 3G_MSC-B. This unit is responsible for controlling the exchange of MAP messages between 3G_MSC-A, or MSC-A, and 3G_MSC-B and for signalling to the VLR in 3G_MSC-B.

Switching functions

5) Switch 3G_MSC-B. For all calls this unit is responsible, with RNS-B, for connecting the circuit from 3G_MSC-A, or MSC-A, to RNS-B. This unit may also need to act as a handover/relocation device for Intra-3G_MSC handovers/relocation controlled by 3G_MSC-B. In specific cases it may be unnecessary to take any explicit action in the 3G_MSC concerning the handover/relocation device.

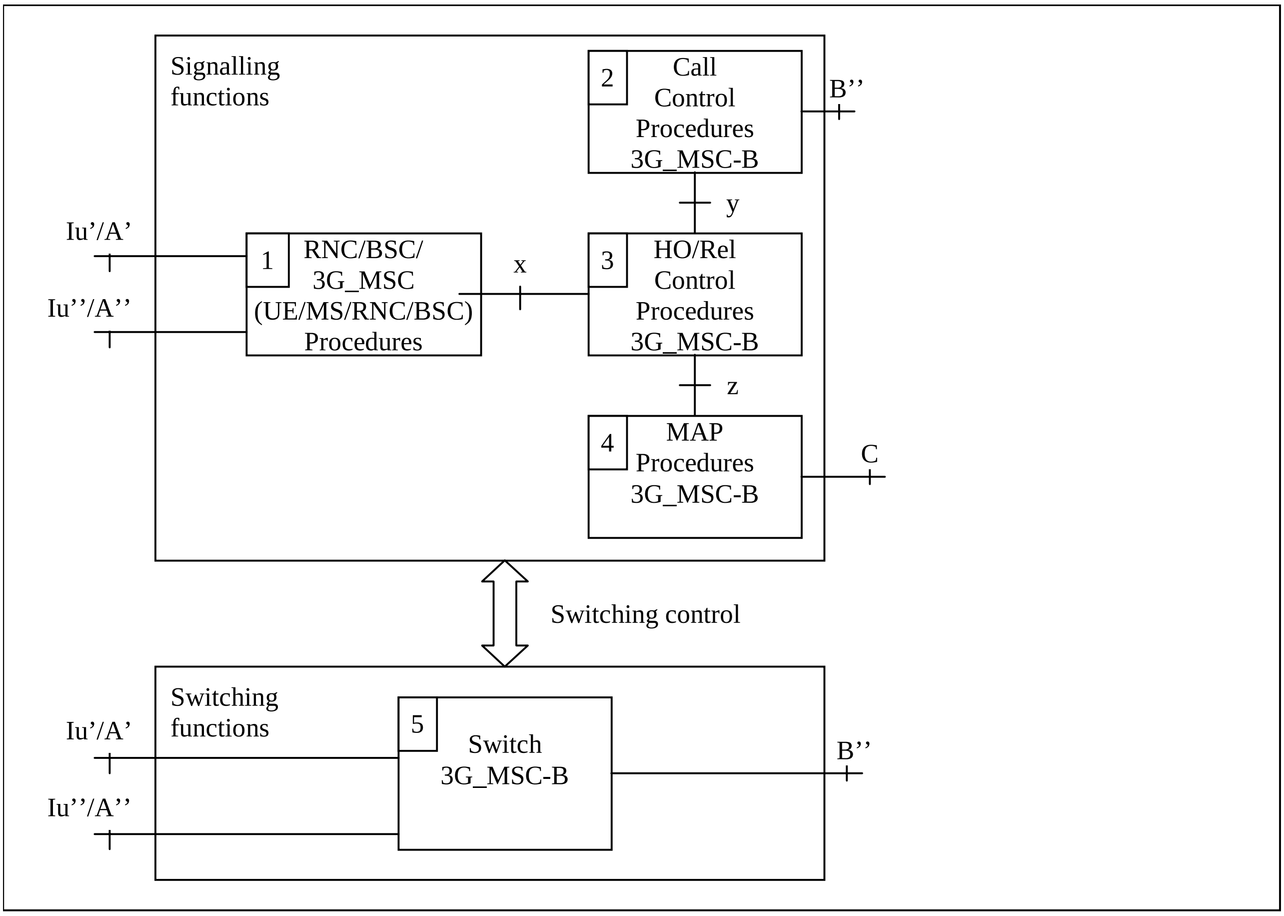


Figure 6: Functional composition of 3G_MSC-B for supporting handover/relocation

5 Handover initiation conditions

Handover may be initiated by the network based on RF criteria as measured by the MS or the Network (signal level, Connection quality, power level propagation delay) as well as traffic criteria (e.g. current traffic loading per cell, interference levels, maintenance requests, etc.).

In order to determine if a handover is required, due to RF criteria, it is typically the MS that shall take radio measurements from neighbouring cells. These measurements are reported to the serving cell on an event driven or regular basis. When a network determines a need for executing a handover the procedures given in ~~GSM 08.08~~3GPP TS 08.08 [5], ~~TS 25.303~~3GPP TS 25.303 [13], ~~TS 25.331~~3GPP TS 25.331 [14] are followed.

The decision process used to determine when to perform soft handover or hard handover will typically differ. Depending on the support for soft or hard handover the Intra-MSC and Inter-MSC handover may differ.

In the case of an ongoing GSM voice group call (see ~~GSM 03.68~~3GPP TS 03.68 [3]) the criteria described above shall only apply to the mobile station currently assigned the uplink and other users with a dedicated connection, no actions shall be taken for the listening users.

6 General description of the procedures for intra - MSC handovers

This clause gives a brief overview of the procedures that shall be followed when performing Intra-MSC handovers. Detailed explanation of these procedures can be found in ~~GSM 08.08~~3GPP TS 08.08 [5] and ~~TS 24.008~~3GPP TS 24.008 [10].

There are two types of handover that can be considered which involve a BSS and single MSC. These are Internal Handover and External Handover. An Internal Handover is a handover which takes place between channels on a cell or cells controlled by a single BSS, without reference to the MSC, although the MSC maybe informed of its occurrence. This case is not considered in the present document.

Handovers between channels on the same cell or between cells on the same BSS which are controlled by the MSC are termed External Handovers and use identical procedures to those for Intra-MSC handovers. Only the Intra-MSC handover case will be considered in the present document.

Handovers from a BSS to an RNS controlled by the same 3G_MSC are intra-3G_MSC GSM to UMTS handovers. Handovers from an RNS to a BSS controlled by the same 3G_MSC are intra-3G_MSC UMTS to GSM handovers.

There are two types of handover in UMTS: soft handover and hard handover. The first one is fully performed within UTRAN, without involving the core network. The second one may be also performed within UTRAN, or the core network may be involved if the Iur interface between RNSs does not exist. This case of hard handover involving the core network is the only one that is covered in the present document, together with SRNS relocation with Iur interface.

6.1 Procedure for Intra-MSC Handovers

The procedure for a successful External Intra-MSC handover is shown in figure 7. It is assumed that selection of a candidate MS has already taken place within the BSS based upon the criteria presented in clause 5. The exact algorithm, in the BSS, for determining a candidate MS is not addressed in the present document. The procedures discussed do not make use of the Mobile Application Part (MAP), represented by signalling function 4 in figure 2 and figure 3. The procedure described in this subclause covers case i).

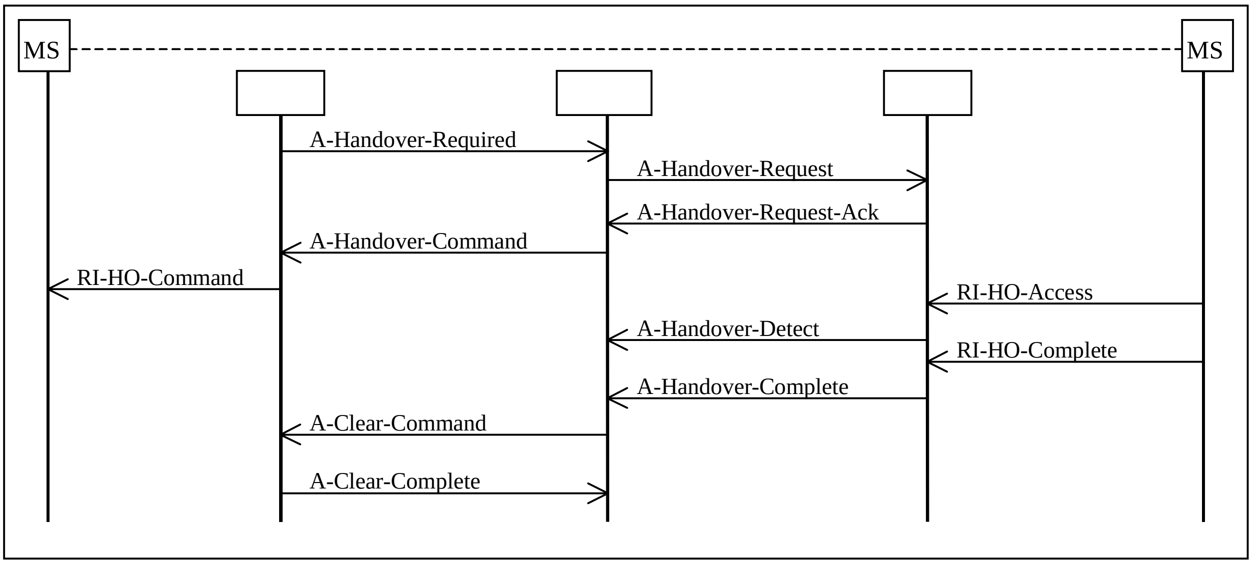


Figure 7: Basic External Intra-MSC Handover Procedure

The successful operation of the procedure is as follows. When the BSS (BSS-A), currently supporting the MS, determines that the MS requires to be handed over it will send an A-HANDOVER-REQUIRED message to the MSC (MSC-A). The A-HANDOVER-REQUIRED message shall contain a list of cells, or a single cell, to which the MS can be handed over. The list of cells shall be given in order of preference based upon operator determined criteria (These criteria are not addressed within the present document and are operator dependent). When the MSC-A receives the A-HANDOVER-REQUIRED message it shall begin the process of handing over the MS to a new BSS (BSS-B). (NOTE: BSS-A and BSS-B maybe the same BSS). The MSC-A shall generate an A-HANDOVER-REQUEST message to the selected BSS (BSS-B). When BSS-B receives the A-HANDOVER-REQUEST message it shall take the necessary action to allow the MS to access the radio resource of BSS-B, this is detailed in ~~GSM 08.58~~3GPP TS 08.58 [6] and in ~~GSM 05.08~~3GPP TS 05.08 [4]. The switching of the radio resource through the necessary terrestrial resources is detailed in ~~TS 24.008~~3GPP TS 24.008 [10] and ~~GSM 08.08~~3GPP TS 08.08 [5].

Once resource allocation has been completed by BSS-B it shall return an A-HANDOVER-REQUEST-ACK. to MSC-A. When this message is received by MSC-A it shall begin the process of instructing the MS to tune to a new dedicated radio resource. An A-HANDOVER-COMMAND will be sent by the MSC-A to BSS-A. On receipt of the A-HANDOVER-COMMAND message BSS-A will send the radio interface message RI-HANDOVER-COMMAND, containing a Handover Reference number previously allocated by BSS-B, to the MS. The MS will then access the new radio resource using the Handover Reference number contained in the RI-HANDOVER-ACCESS message. The number will be checked by BSS-B to ensure it is as expected and the correct MS has been captured. If this is the correct MS then the BSS-B shall send an A-HANDOVER-DETECT to MSC-A. When the MS is successfully communicating with the BSS-B a RI-HANDOVER-COMPLETE message will be sent by the MS to BSS-B. The BSS-B will then send an A-HANDOVER-COMPLETE message to MSC-A.

NOTE: The A-HANDOVER-REQUEST-ACK from BSS-B contains the complete Radio Interface message that shall be sent by BSS-A to the MS in the RI-HANDOVER-COMMAND, MSC-A transparently passes this radio interface message onto BSS-A.

After MSC-A has received the A-HANDOVER-COMPLETE message from BSS-B it shall begin to release the resources allocated on BSS-A. In figure 7 the resource is released by using the A-CLEAR-COMMAND sequence.

In the case of ongoing GSM voice group calls the clearing of resources on BSS-A shall not be used if the resources are still be used on the down link.

If a failure occurs during the handover attempt, for example A-HANDOVER-FAILURE returned from BSS-A or BSS-B, then MSC-A will terminate the handover to BSS-B. Under these conditions MSC-A may optionally take one of a number of actions:

i) retry the handover to the same cell;

ii) select the next cell from the list contained in the A-HANDOVER-REQUIRED message and attempt a handover to the new cell;

iii) await the next A-HANDOVER-REQUIRED message;

iv) send an A-HANDOVER-REQUIRED-REJECT to BSS-A, if an A-HANDOVER-COMMAND has not already been sent.

The exact action taken is dependent on whether the failure occurs before or after the A-HANDOVER-COMMAND has been sent.

In all cases the existing connection to the MS shall not be cleared.

During the period that the MS is not in communication with the network MSC-A shall queue all appropriate messages. All messages shall be delivered to the MS once communication is resumed . In the case of an Intra-MSC handover on MSC-B then the messages shall be queued by MSC-B.

In the case of ongoing GSM voice group calls if a failure occurs when handing over a user on a dedicated channel then the procedures described above may optionally be applied.

6.2 Procedure for Intra-3G_MSC Handovers

6.2.1 Intra-3G_MSC Handover from UMTS to GSM

The procedure for a successful Intra-3G_MSC handover from UMTS to GSM is shown in figure 8. It is assumed that selection of a candidate UE/MS has already taken place within the RNS based upon the criteria presented in clause 5. The exact algorithm, in the RNS, for determining a candidate UE/MS is not addressed in the present document. The procedures discussed do not make use of the Mobile Application Part (MAP), represented by signalling function 4 in figures 4 and 6. The procedure described in this subclause covers case ii).

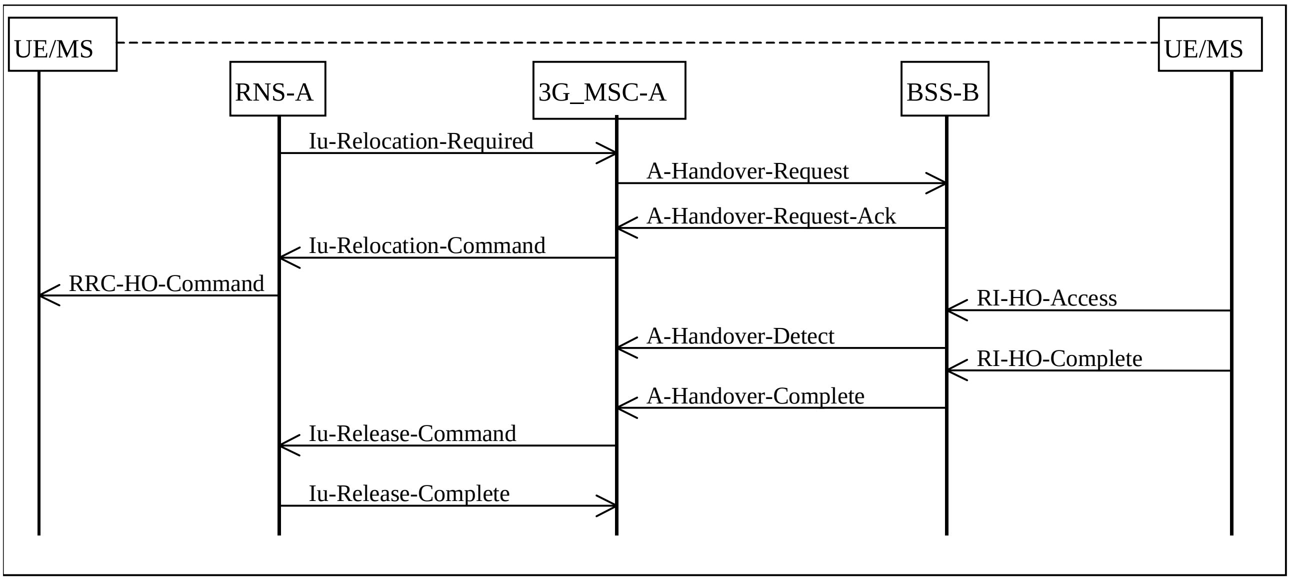


Figure 8: Basic Intra-3G_MSC Handover from UMTS to GSM Procedure

6.2.1.1 With no bearer or one bearer

The successful operation of the procedure is as follows. When the RNS (RNS-A), currently supporting the UE/MS, determines that the UE/MS requires to be handed over to GSM it will send an IU-RELOCATION-REQUIRED message to the 3G_MSC (3G_MSC-A). The IU-RELOCATION-REQUIRED message shall contain a single cell, to which the UE/MS can be handed over. When the 3G_MSC-A receives the IU-RELOCATION-REQUIRED message it shall begin the process of handing over the UE/MS to a BSS (BSS-B). The 3G_MSC-A shall generate an A-HANDOVER-REQUEST message to the selected BSS (BSS-B). When BSS-B receives the A-HANDOVER-REQUEST message it shall take the necessary action to allow the UE/MS to access the radio resource of BSS-B, this is detailed in ~~GSM 08.58~~3GPP TS 08.58 [6] and in ~~GSM 05.08~~3GPP TS 05.08 [4]. The switching of the radio resource through the necessary terrestrial resources is detailed in ~~TS 24.008~~3GPP TS 24.008 [10] and ~~GSM 08.08~~3GPP TS 08.08 [5].

Once resource allocation has been completed by BSS-B it shall return an A-HANDOVER-REQUEST-ACK. to 3G_MSC-A. When this message is received by 3G_MSC-A it shall begin the process of instructing the UE/MS to tune to a new dedicated radio resource. An IU-RELOCATION-COMMAND will be sent by the 3G_MSC-A to RNS-A. On receipt of the IU-RELOCATION-COMMAND message RNS-A will send the radio resource control message RRC-HANDOVER-COMMAND, containing a Handover Reference number previously allocated by BSS-B, to the UE/MS. The UE/MS will then access the new radio resource using the Handover Reference number contained in the RI-HANDOVER-ACCESS message. The number will be checked by BSS-B to ensure it is as expected and the correct UE/MS has been captured. If this is the correct UE/MS then the BSS-B shall send an A-HANDOVER-DETECT to 3G_MSC-A. When the UE/MS is successfully communicating with the BSS-B a RI-HANDOVER-COMPLETE message will be sent by the UE/MS to BSS-B. The BSS-B will then send an A-HANDOVER-COMPLETE message to 3G_MSC-A.

NOTE: The A-HANDOVER-REQUEST-ACK from BSS-B contains the complete radio resource control message that shall be sent by RNS-A to the UE/MS in the RRC-HANDOVER-COMMAND, 3G_MSC-A transparently passes this radio interface message onto RNS-A.

After 3G_MSC-A has received the A-HANDOVER-COMPLETE message from BSS-B it shall begin to release the resources allocated on RNS-A. In figure 8 the resource is released by using the IU-RELEASE-COMMAND sequence.

If a failure occurs during the handover attempt, for example A-HANDOVER-FAILURE returned from BSS-B, then 3G_MSC-A will terminate the handover to BSS-B and send an IU-RELOCATION-PREPARATION-FAILURE message to RNS-A.

If RNS-A has decided to cancel the handover, it sends IU-RELOCATION-CANCEL message to 3G_MSC-A. The 3G_MSC-A will then terminate the handover towards BSS-B (if initiated) and send IU-RELOCATION-CANCEL-ACKNOWLEDGE message to RNS-A.

In all cases the existing connection to the UE/MS shall not be cleared except in the case of expiry of the timer for receipt of A-HANDOVER-COMPLETE.

During the period that the UE/MS is not in communication with the network 3G_MSC-A shall queue all appropriate messages. All messages shall be delivered to the UE/MS once communication is resumed. In the case of an Intra-3G_MSC handover from UMTS to GSM on 3G_MSC-B then the messages shall be queued by 3G_MSC-B.

6.2.1.2 With multiple bearers (Optional functionality)

If 3G_MSC-A supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A shall have the following functionality additionally to the description in section 6.2.1.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-A 3G_MSC-A shall select one bearer to be handed over if the UE is engaged with multiple bearers. After that, 3G_MSC-A generates an A-HO-REQUEST message for the selected bearer to BSS-B.

When an A-HO-REQUEST-ACK is received from BSS-B, 3G_MSC-A sends IU-RELOCATION-COMMAND, which indicates the bearers not to be handed over as bearers to be released, to RNS-A.

After 3G_MSC-A receives A-HO-COMPLETE message from BSS-B, 3G_MSC-A shall release calls via BSS-B, which has been carried by the bearers not to be handed over, and then sends IU-RELEASE-COMMAND to RNS-A.

6.2.2 Intra-3G_MSC GSM to UMTS Handover

The procedure for a successful Intra-3G_MSC handover is shown in figure 9. It is assumed that selection of a candidate UE/MS has already taken place within the BSC based upon the criteria presented in clause 5. The exact algorithm, in the BSC, for determining a candidate UE/MS is not addressed in the present document. The procedures discussed do not make use of the Mobile Application Part (MAP), represented by signalling function 4 in figures 4 and 6. The procedure described in this subclause covers case ii).

In the case of ongoing voice group calls, the handover does not take place since voice group calls are not supported in UMTS.

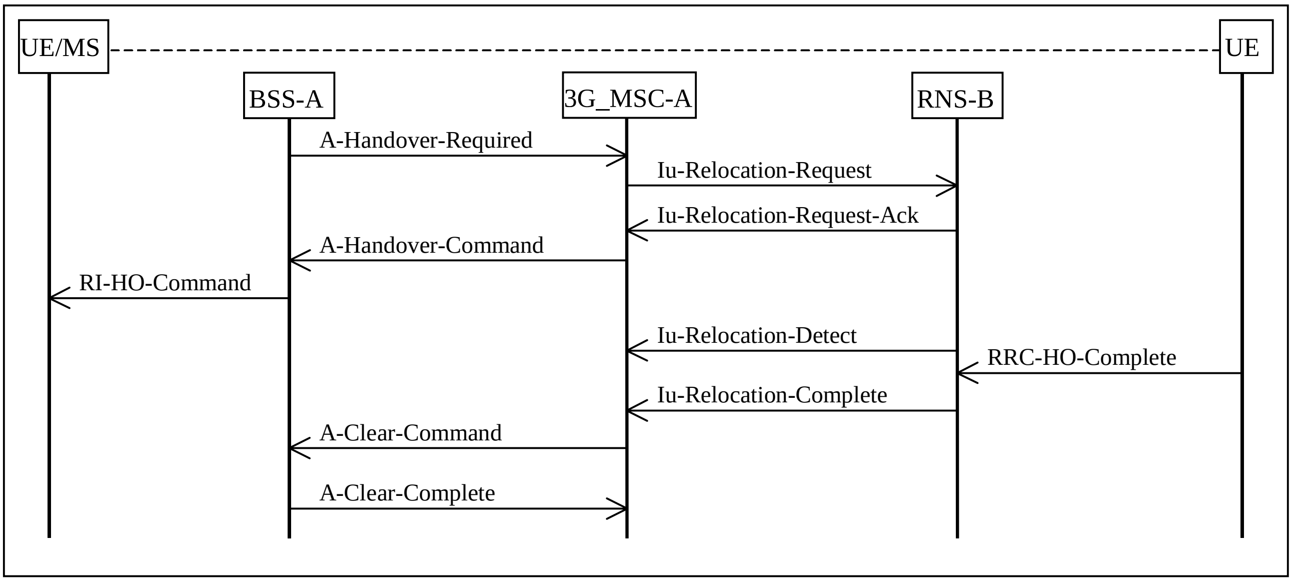


Figure 9: Basic External Intra-3G_MSC GSM to UMTS Handover Procedure

The successful operation of the procedure is as follows. When the BSS (BSS-A), currently supporting the UE, determines that the UE requires to be handed over to UMTS it will send an A-HANDOVER-REQUIRED message to the 3G_MSC (3G_MSC-A). The A-HANDOVER-REQUIRED message shall contain a single cell, to which the UE can be handed over. When the 3G_MSC-A receives the A-HANDOVER-REQUIRED message it shall begin the process of handing over the UE to a new RNS (RNS-B). The 3G_MSC-A shall generate an Iu-RELOCATION-REQUEST message to the selected RNS (RNS-B). When RNS-B receives the Iu-RELOCATION-REQUEST message it shall take the necessary action to allow the UE to access the radio resource of RNS-B, this is detailed in the 3GPP TS 25.300 series and the 3GPP TS 25.200 series of Technical Specifications. The switching of the radio resource through the necessary terrestrial resources is detailed in the 3GPP TS 25.430 series and ~~TS 25.413~~3GPP TS 25.413 [11].

Once resource allocation has been completed by RNS-B, it shall return an Iu-RELOCATION-REQUEST-ACK. to 3G_MSC-A. When this message is received by 3G_MSC-A it shall begin the process of instructing the UE to tune to a new dedicated radio resource. An A-HANDOVER-COMMAND will be sent by the 3G_MSC-A to BSS-A. On receipt of the A-HANDOVER-COMMAND message BSS-A will send the radio interface message RI-HANDOVER-COMMAND. The UE will then access the new radio resource. On detection of the UE, the RNS-B shall send an Iu-RELOCATION-DETECT to 3G_MSC-A. When the UE is successfully communicating with the RNS-B an RRC-HANDOVER-COMPLETE message will be sent by the UE to RNS-B. The RNS-B will then send an Iu-RELOCATION-COMPLETE message to 3G_MSC-A.

NOTE: The Iu-RELOCATION-REQUEST-ACK from RNS-B contains the complete RRC message that shall be sent by BSS-A to the MS in the RI-HANDOVER-COMMAND, 3G_MSC-A transparently passes this radio interface message onto BSS-A.

After 3G_MSC-A has received the Iu-RELOCATION-COMPLETE message from RNS-B, it shall begin to release the resources allocated on BSS-A. In figure 9 the resource is released by using the A-CLEAR-COMMAND sequence.

If a failure occurs during the handover attempt, for example, A-HANDOVER-FAILURE returned from BSS-A or Iu-RELOCATION FAILURE returned from RNS-B, then 3G_MSC-A will terminate the handover to RNS-B. Under these conditions 3G_MSC-A may optionally take one of a number of actions:

i) await the next A-HANDOVER-REQUIRED message;

ii) send an A-HANDOVER-REQUIRED-REJECT to BSS-A, if an A-HANDOVER-COMMAND has not already been sent.

The exact action taken is dependent on whether the failure occurs before or after the A-HANDOVER-COMMAND has been sent.

In all cases the existing connection to the UE shall not be cleared.

During the period that the UE is not in communication with the network 3G_MSC-A shall queue all appropriate messages. All messages shall be delivered to the UE once communication is resumed. In the case of an Intra-3G_MSC GSM to UMTS handover on 3G_MSC-B then the messages shall be queued by 3G_MSC-B.

6.2.3 Procedure for Intra-3G_MSC SRNS Relocation

The procedure for a successful Intra-3G_MSC SRNS Relocation is shown in figures 10 and 11. SRNS Relocation is used to relocate the serving RNS functionality from one RNS to another. The procedure may or may not involve change of the radio resources assigned for the corresponding UE. Whether or not the Relocation includes change of radio resources assigned for the UE does not affect the SRNS Relocation procedure in the Core Network.

It is assumed that selection of a candidate UE has already taken place within RNS based upon the criteria presenting in clause 5. The exact algorithm, in RNS, for determining a candidate UE is not addressed in the present document. The procedure discussed does not make use of the Mobile Application Part (MAP), represented by signalling function 4 in figures 4 and 6. The procedure described in this subclause covers case ii).

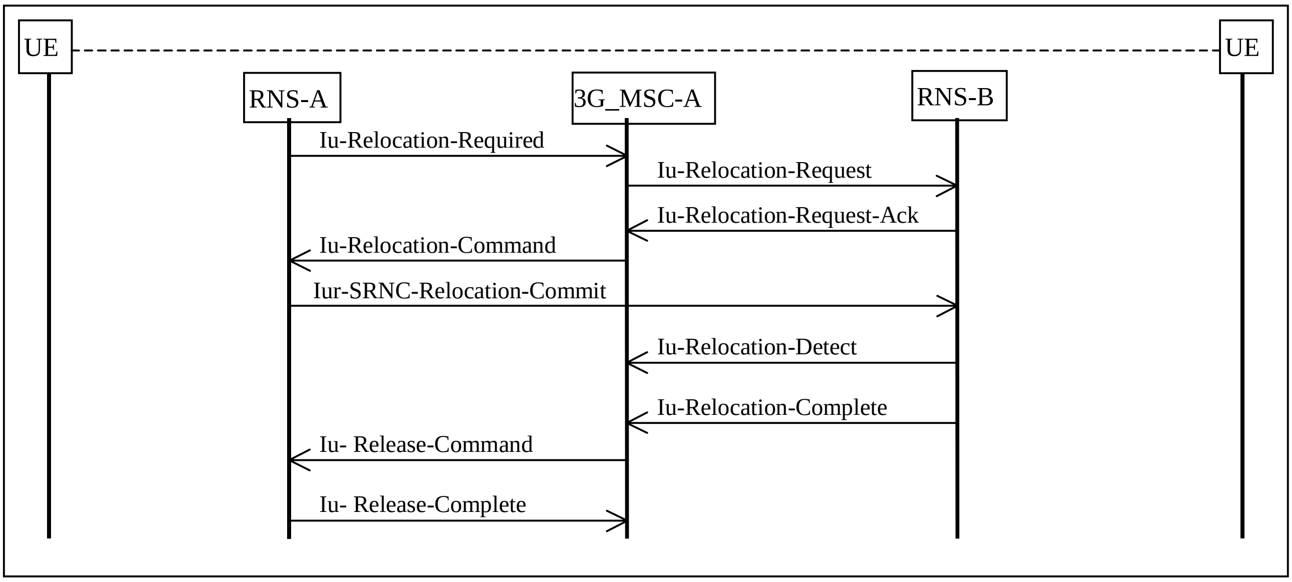


Figure 10 Basic intra-3G_MSC SRNS Relocation Procedure

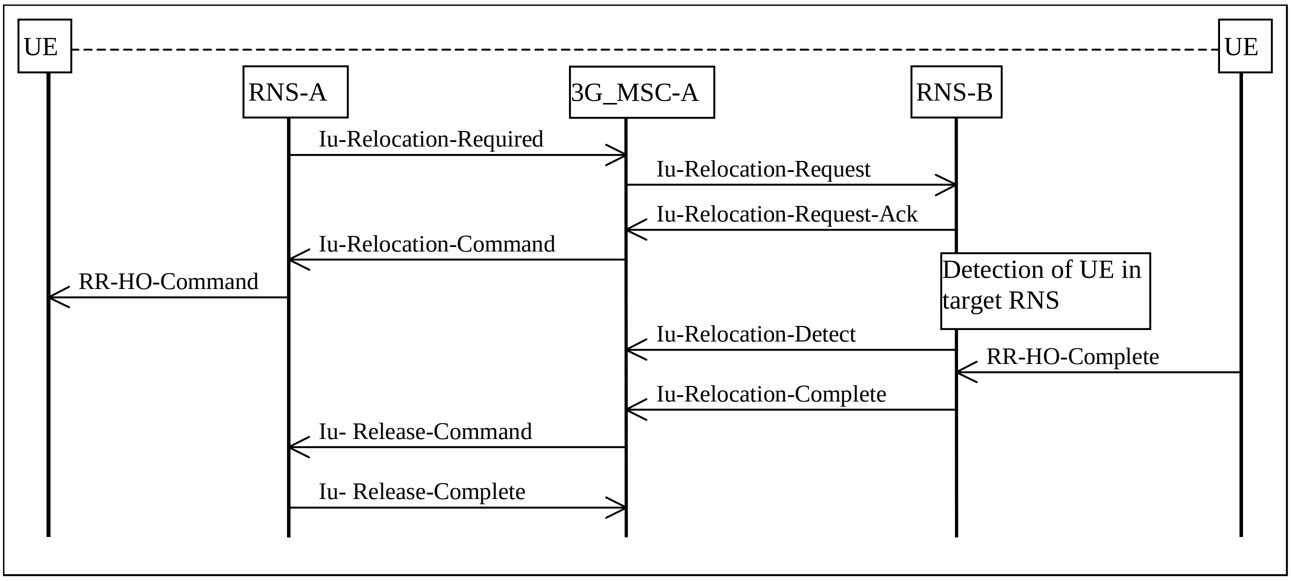


Figure 11 Basic intra-3G_MSC SRNS Relocation Procedure combined with hard change of radio resources (Hard Handover with switch in the Core Network)

6.2.3.1 With no bearer or one bearer

The successful operation of the procedure is as follows. When the Serving RNS (RNS-A) makes the decision to perform the SRNS Relocation procedure it will send an IU-RELOCATION-REQUIRED message to the 3G_MSC (3G_MSC-A). The IU-RELOCATION-REQUIRED message shall contain the identifier of the target RNS to which the Relocation is to be performed. When the 3G_MSC-A receives the IU-RELOCATION-REQUIRED message it shall begin the process of relocating the serving RNS functionality to the new RNS (RNS-B). The 3G_MSC-A shall generate an IU-RELOCATION-REQUEST message to the selected RNS (RNS-B). When RNS-B receives the IU-RELOCATION-REQUEST message it shall take the necessary action to establish the new Iu transport bearers for each Radio Access Bearer related to 3G_MSC-A for the UE in question, this is detailed in the TS 25.430 series and ~~TS 25.413~~3GPP TS 25.413 [11] ~~Technical Specification~~.

Once resource allocation has been completed by RNS-B it shall return an IU-RELOCATION-REQUEST-ACKNOWLEDGE to 3G_MSC-A. When this message is received by 3G_MSC-A, and 3G_MSC-A is ready for the move in Serving RNS functionality, it shall indicate the completion of the preparation phase on the core network side for the SRNS Relocation. An IU-RELOCATION-COMMAND message is sent by 3G_MSC-A to RNS-A. RNS-A acts as follows:

i) if the procedure is a SRNS Relocation without change of radio resources, which means that the Iur interface between RNS-A and RNS-B can be used for the procedure, the RNS-A shall send IUR-SRNS-RELOCATION-COMMIT message to the RNS-B to trigger the Relocation execution. See figure 10.

ii) if the procedure is a SRNS Relocation with change of radio resources, which means that the Iur interface between RNS-A and RNS-B is not used for the procedure, the RNS-A shall trigger the handover procedure on the air interface by sending the RRC-HANDOVER-COMMAND to the UE. The UE will then access the new radio resources. See figure 11.

NOTE: The IU-RELOCATION-REQUEST-ACKNOWLEDGE from RNS-B may optionally contain a transparent container, which is transferred by 3G_MSC-A to the RNS-A using the IU-RELOCATION-COMMAND message.

When the relocation execution trigger is received, RNS-B shall then take the necessary action to assume the role of Serving RNS and shall send an IU-RELOCATION-DETECT message to 3G_MSC-A. When the UE is successfully in communication with the RNS-B, then RNS-B shall send an IU-RELOCATION-COMPLETE message to 3G_MSC-A.

After 3G_MSC-A has received the IU-RELOCATION-COMPLETE message from RNS-B, it shall begin to release the resources associated to the RNS-A. In figures 10 and 11, the resources are released by using the IU-RELEASE-COMMAND sequence.

If a failure occurs during the SRNS Relocation attempt, then 3G_MSC-A will terminate the relocation to RNS-B. For example, if IU-RELOCATION-FAILURE is returned from RNS-B then 3G_MSC-A will terminate the relocation to RNS-B and send IU-RELOCATION-PREPARATION-FAILURE to RNS-A. If IU-RELOCATION-CANCEL is returned from RNS-A, then 3G_MSC-A will terminate the relocation to RNS-B and send IU-RELOCATION-CANCEL-ACKNOWLEDGE to RNS-A.

In all cases the existing connection to the UE shall not be cleared.

During the period that the UE is not in communication with the network, 3G_MSC-A shall queue all appropriate messages. All messages shall be delivered to the UE once communication is resumed. In the case of an Intra-3G_MSC SRNS Relocation (with or without change of radio resources) on 3G_MSC-B, then the messages shall be queued by 3G_MSC-B.

6.2.3.2 With multiple bearers (Optional functionality)

If 3G_MSC-A supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A shall have the following functionality additionally to the description in section 6.2.3.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-A, 3G_MSC-A generates an IU-RELOCATION-REQUEST message, which may include multiple bearers, to RNS-B.

When an IU-RELOCATION-REQUEST-ACK is received from RNS-B, 3G_MSC-A sends IU-RELOCATION-COMMAND, which indicates the bearers failed to set up in RNS-B as bearers to be released, to RNS-A.

After 3G_MSC-A receives IU-RELOCATION-COMPLETE message from RNS-B, 3G_MSC-A shall release calls via RNS-B, which has been carried by the bearers failed to set up in RNS-B, and then sends IU-RELEASE-COMMAND to RNS-A.

7 General description of the procedures for inter - MSC handovers

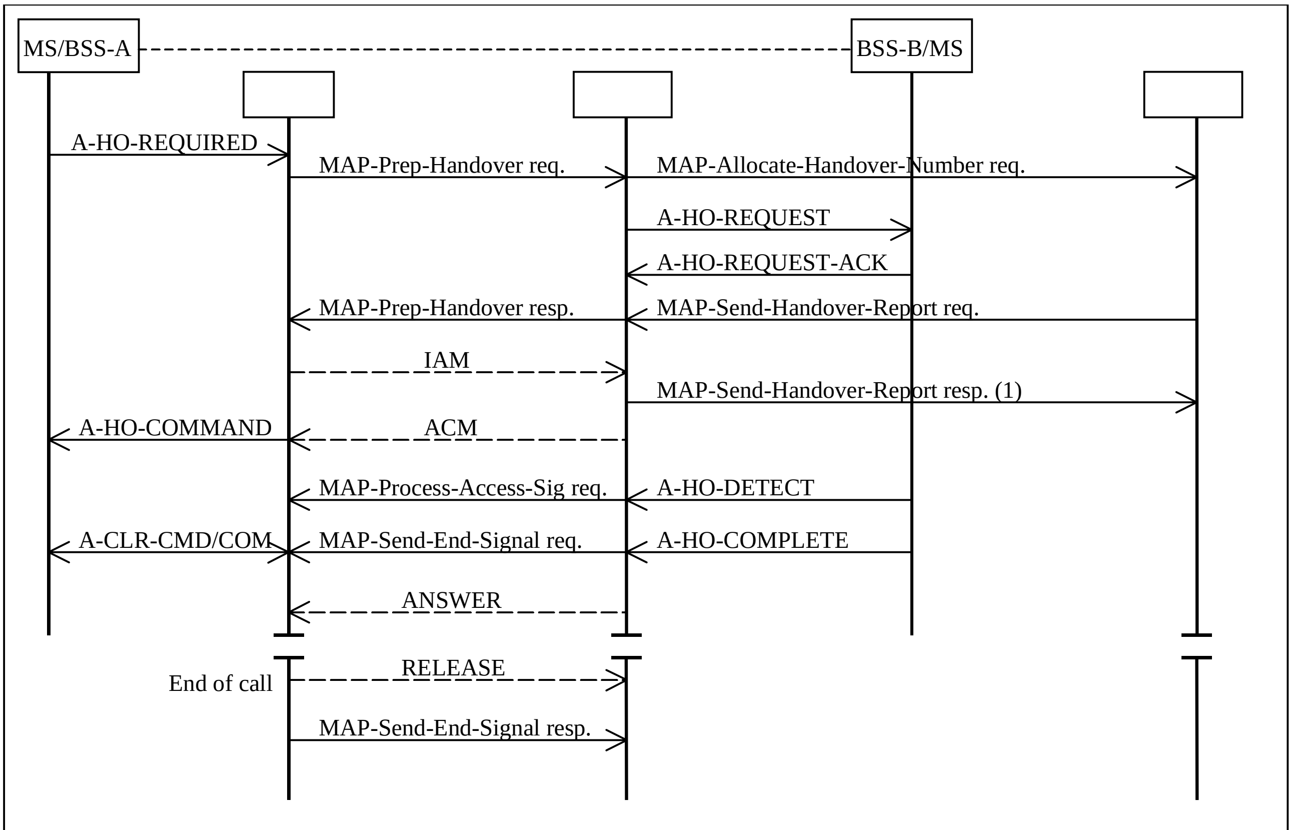
The following subclauses describe two options for the Basic and Subsequent Handover procedures. The first, as described in subclauses 7.1 and 7.3 respectively, provides for a circuit connection between MSC-A and MSC-B. The second, as described in subclauses 7.2 and 7.4 respectively, provides for a Basic and Subsequent Handover without the provision of a circuit connection between MSC-A and MSC-B.

In all the above mentioned subclauses, the following principles apply:

- during the handover resource allocation, only the handover related messages that are part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - shall be transferred on the E-interface;
- the trace related messages that are part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - can be sent by the MSC-A on the E-interface after successful handover resource allocation. In the subclauses 7.1 and 7.2, it is however allowed at basic handover initiation on the E-Interface to transfer one trace related message that is part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - together with the applicable handover related message. The applicable handover related message shall always appear as the first message;
- during the handover execution, ie while the MS is not in communication with the network, the MSC-A shall queue all outgoing BSSAP messages until the communication with the MS is resumed;
- finally, during supervision, ie while the MS is not in the area of MSC-A after a successful Inter-MSC handover, the subset of BSSAP procedures and their related messages - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - shall apply on the E-Interface;
- during the intra-MSC-B handover execution, if any, the MSC-B shall queue all outgoing BSSAP messages until the communication with the MS is resumed.

7.1 Basic handover procedure requiring a circuit connection between MSC-A and MSC-B

The procedure used for successful Inter-MSC Handover is shown in figure 12. Initiation of the handover procedure is described in clause 5. The procedure described in this subclause makes use of messages from the ~~Technical Specification GSM 08.08~~3GPP TS 08.08 [5] and of the transport mechanism from the Mobile Application Part (MAP) (~~Technical Specification TS 29.002~~3GPP TS 29.002 [12]). After an Inter-MSC handover further Intra-MSC handovers may occur on MSC-B, these handovers will follow the procedures specified in the previous clause.



NOTE 1: Can be sent at any time after the reception of IAM

Figure 12: Basic Handover Procedure requiring a circuit connection

The handover is initiated as described in subclause 6.1. (This is represented by A-HO-REQUIRED in figure 12. Upon receipt of the A-HO-REQUIRED from BSS-A, MSC-A shall send a MAP-PREPARE-HANDOVER request to MSC-B including a complete A-HO-REQUEST message.

NOTE: MSC-A shall not send further MAP-PREPARE-HANDOVER requests while a MAP-PREPARE-HANDOVER response is pending or before any timeouts.

The MAP-PREPARE-HANDOVER request shall carry in the A-HO-REQUEST all information needed by MSC-B for allocating a radio channel, see ~~Technical Specification GSM 08.08~~3GPP TS 08.08 [5]. For compatibility reasons, the MAP-PREPARE-HANDOVER request will also identify the cell to which the call is to be handed over. MSC-B will return the MAP-PREPARE-HANDOVER response after having retrieved a Handover Number from its associated VLR (exchange of the messages MAP-allocate-handover-number request and MAP-send-handover-report request). The Handover Number shall be used for routing the connection of the call from MSC-A to MSC-B. If a traffic channel is available in MSC-B the MAP-PREPARE-HANDOVER response, sent to MSC-A will contain the complete A-HO-REQUEST-ACKNOWLEDGE message received from BSS-B, containing the radio resources definition to be sent by BSS-A to the MS and possible extra BSSMAP information, amended by MSC-B due to the possible interworking between the BSSMAP protocol carried on the E-interface and the BSSMAP protocol used on the A-interface. If the traffic channel allocation is queued by BSS-B, the A-QUEUING-INDICATION may optionaly be sent back to MSC-A. The further traffic channel allocation result (A-HO-REQUEST-ACK or A-HO-FAILURE) will be transferred to MSC-A using the MAP-PROCESS-ACCESS-SIGNALLING request. If the traffic channel allocation is not possible, the MAP-PREPARE-HANDOVER response containing an A-HO-FAILURE will be sent to MSC-A. MSC-B will do the same if a fault is detected on the identity of the cell where the call has to be handed over. MSC-B simply reports the events related to the dialogue. It is up to MSC-A to decide the action to perform if it receives negative responses or the operation fails due to the expiry of the MAP-PREPARE-HANDOVER timer.

If an error related to the TCAP dialogue or to the MAP-PREPARE-HANDOVER request is returned from MSC-B, this will be indicated to MSC-A and MSC-A will terminate the handover attempt. MSC-A may retry the handover attempt using the cell identity list, if provided, or may reject the handover attempt towards BSS-A. The existing connection to the MS shall not be cleared.

When the A-HO-REQUEST-ACKNOWLEDGE has been received, MSC-A shall establish a circuit between MSC-A and MSC-B by signalling procedures supported by the network. In figure 12 this is illustrated by the messages IAM (Initial Address Message) and ACM (Address Complete Message) of Signalling System no 7. MSC-B awaits the capturing of the MS (subclause 6.1) on the radio path when the ACM is sent and MSC-A initiates the handover execution when ACM is received (illustrated by the A-HO-COMMAND and described in the subclause 6.1).

MSC-B transfers to MSC-A the acknowledgement received from the correct MS (A-HO-DETECT/A-HO-COMPLETE). The A-HO-DETECT, if received, is transferred to MSC-A using the MAP-PROCESS-ACCESS-SIGNALLING request. The A-HO-COMPLETE, when received from the correct MS, is included in the MAP-SEND-END-SIGNAL request and sent back to MSC-A. The circuit is through-connected in MSC-A when the A-HO-DETECT or the A-HO-COMPLETE is received from MSC-B. The old radio channel is released when the A-HO-COMPLETE message is received from MSC-B. The sending of the MAP-SEND-END-SIGNAL request starts the MAP supervision timer for the MAP dialogue between MSC-A and MSC-B. When the MAP-SEND-END-SIGNAL request including the A-HO-COMPLETE message is received in MSC-A the resources in BSS-A shall be cleared.

In order not to conflict with the PSTN/ISDN signalling system(s) used between MSC-A and MSC-B, MSC-B must generate an answer signal when A-HO-DETECT/COMPLETE is received.

MSC-B shall release the Handover Number when the circuit between MSC-A and MSC-B has been established.

If the circuit between MSC-A and MSC-B cannot be established (e.g. an unsuccessful backward message is received instead of ACM). MSC-A terminates the inter-MSC handover attempt by sending an appropriate MAP message, for example an ABORT. MSC-A may retry the handover at this point, see subclause 6.1.

MSC-A shall retain overall call control until the call is cleared by the fixed subscriber or the MS and there is no further call control functions to be performed (e.g. servicing waiting calls, echo cancellers).

When MSC-A clears the call to the MS it also clears the call control functions in MSC-A and sends the MAP-SEND-END-SIGNAL response to release the MAP resources in MSC-B.

MSC-A may terminate the procedure at any time by sending an appropriate MAP message to MSC-B. If establishment of the circuit between MSC-A and MSC-B has been initiated, the circuit must also be cleared.

The handover will be aborted by MSC-A if it detects clearing or interruption of the radio path before the call has been established on MSC-B.

7.2 Basic handover procedure not requiring the establishment of a circuit connection between MSC-A and MSC-B

The basic handover procedures to be used when no circuit connection is required by MSC-A are similar to those described in subclause 7.1 for circuit switched calls. The main differences to the procedures described in subclause 7.1 relate to the establishment of circuits between the network entities and the Handover Number allocation.

In the case of ongoing GSM voice group calls the circuit connections are already established therefore the procedures described in this subclause are also applicable. When applied to ongoing voice group calls the clearing of resources on BSS-A shall not be used if the resources are still be used on the down link. Consequently the A-CLEAR-COMMAND message shall not be sent, but an HANDOVER-SUCCEEDED message shall be sent.

In the case of basic handover, MSC-A shall specify to MSC-B that no Handover Number is required in the MAP-PREPARE-HANDOVER request (see ~~TS 29.002~~3GPP TS 29.002 [12]). As for the basic handover using a circuit connection, the A-HO-REQUEST is transmitted at the same time. Any subsequent Handover Number allocation procedure will not be invoked until the completion of the basic handover procedure (see clause: Subsequent Channel Assignment using a circuit connection). MSC-B shall then perform the radio resources allocation as described in subclause 7.1. The MAP-PREPARE-HANDOVER response shall be returned to MSC-A including either the response of the radio resources allocation request received from BSS-B (A-HO-REQUEST-ACKNOWLEDGE/A-HO-FAILURE with possible extra BSSMAP information. These extra information are amended by MSC-B due to the possible interworking between the BSSMAP protocol carried on the E-interface and the BSSMAP protocol used on the A-interface) or potentially the A-QUEUING-INDICATION . The basic handover procedure will continue as described in subclause 7.1 except that no circuit connection will be established towards MSC-B.

The relevant case for the basic handover without circuit connection is shown in figure 13. As can be seen the major differences to the equivalent figure 12 is the omission of any circuit establishment messaging and the omission of handover number allocation signalling.

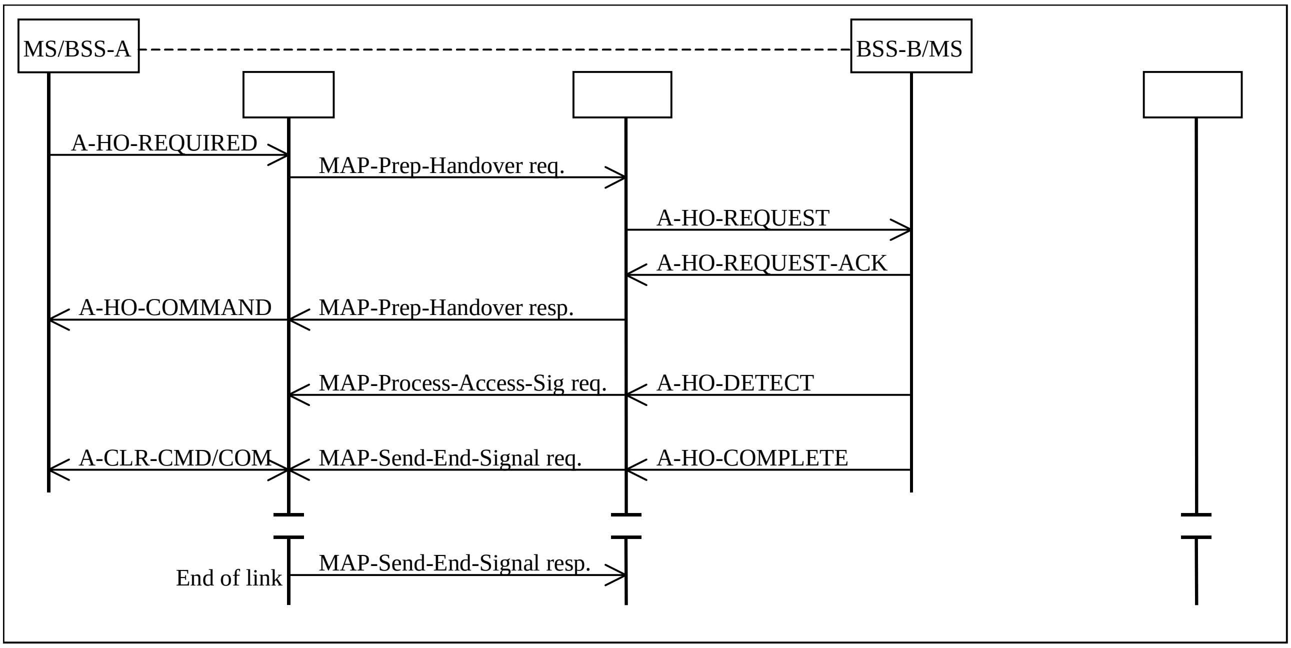


Figure 13: Basic Handover Procedure without circuit connection

7.3 Procedure for subsequent handover requiring a circuit connection between MSC-A and MSC-B

After the call has been handed over from MSC-A to MSC-B, if the MS leaves the area of MSC-B during the same call, subsequent handover is necessary in order to continue the connection.

The following cases apply:

i) the MS moves back to the area of MSC-A;

ii) the MS moves into the area of a third MSC (MSC-B').

In both cases the call is switched in MSC-A; the circuit between MSC-A and MSC-B shall be released after a successful subsequent handover has been performed.

7.3.1 Description of subsequent handover procedure i): MSC-B to MSC-A

The procedure for successful handover from MSC-B back to MSC-A is shown in figure 14.

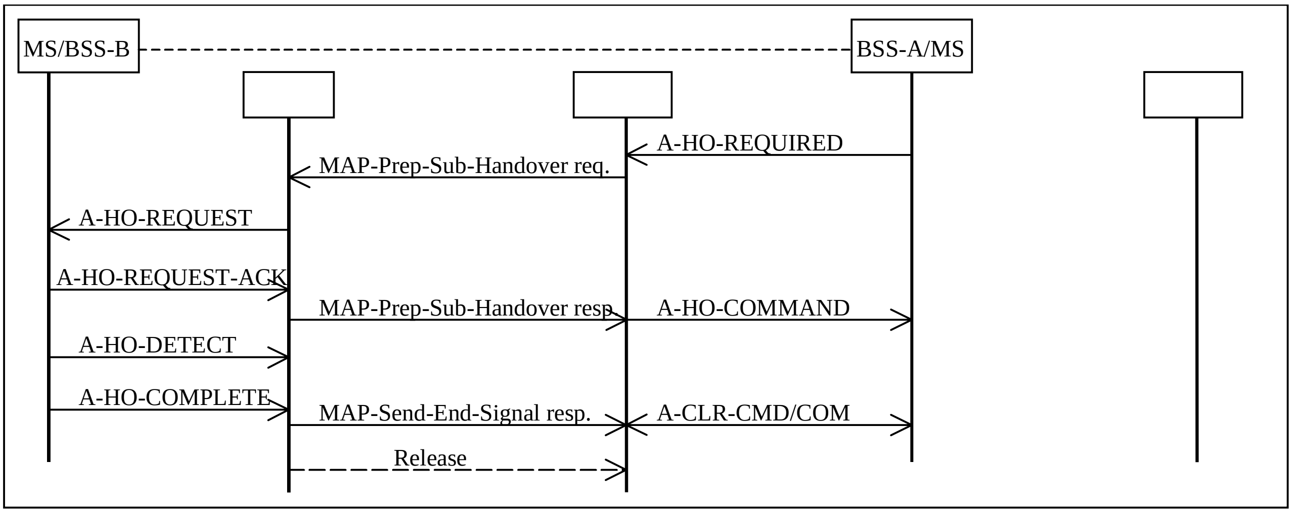


Figure 14: Subsequent handover procedure i):successful handover from MSC-B to MSC-A using a circuit connection

The procedure is as follows.

MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to MSC-A indicating the new MSC number(MSC-A number), indicating also the identity of the cell where the call has to be handed over and including a complete A-HO-REQUEST message. (NOTE: MSC-B shall not send further MAP-PREPARE-SUBSEQUENT-HANDOVER requests while a handover attempt is pending or before any timeouts). Since MSC-A is the call controlling MSC, this MSC needs no Handover Number for routing purposes; MSC-A can immediately initiate the search for a free radio channel.

When a radio channel can be assigned, MSC-A shall return in the MAP-PREPARE-SUBSEQUENT-HANDOVER response the complete A-HO-REQUEST-ACKNOWLEDGE message received from the BSS-B and possible extra BSSMAP information, amended by MSC-A due to the possible interworking between the BSSMAP protocol carried on the E-interface and the BSSMAP protocol used on the A-interface. If the traffic channel allocation is queued by BSS-B, the A-QUEUING-INDICATION may optionaly be sent back to MSC-B. The further traffic channel allocation result (A-HO-REQUEST-ACK or A-HO-FAILURE) will be transferred to MSC-B using the MAP-FORWARD-ACCESS-SIGNALLING request.If a radio channel cannot be assigned or if a fault is detected on the target cell identity, or the target cell identity in the A-HO-REQUEST is not consistent with the target MSC number, the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing an A-HO-FAILURE message shall be given to MSC-B, in addition MSC-B shall maintain the connection with the MS.

If the procedure in MSC-A is successful then MSC-B can request the MS to retune to the new BSS-B on MSC-A. This is illustrated in figure 14 by the A-HO-COMMAND message. The operation is successfully completed when MSC-A receives the A-HO-COMPLETE message.

After handover MSC-A shall release the circuit to MSC-B.

MSC-A must also terminate the MAP procedure for the basic handover between MSC-A and MSC-B by sending an appropriate MAP message. MSC-B will clear the resources in BSS-A when the MAP-SEND-END-SIGNAL response is received.

7.3.2 Description of the subsequent handover procedure ii): MSC-B to MSC-B'

The procedure for successful handover from MSC-B to MSC-B' is shown in figure 15.

The procedure consists of two parts:

- a subsequent handover from MSC-B back to MSC-A as described in subclause 7.3.1; and
- a basic handover from MSC-A to MSC-B' as described in subclause 7.1.

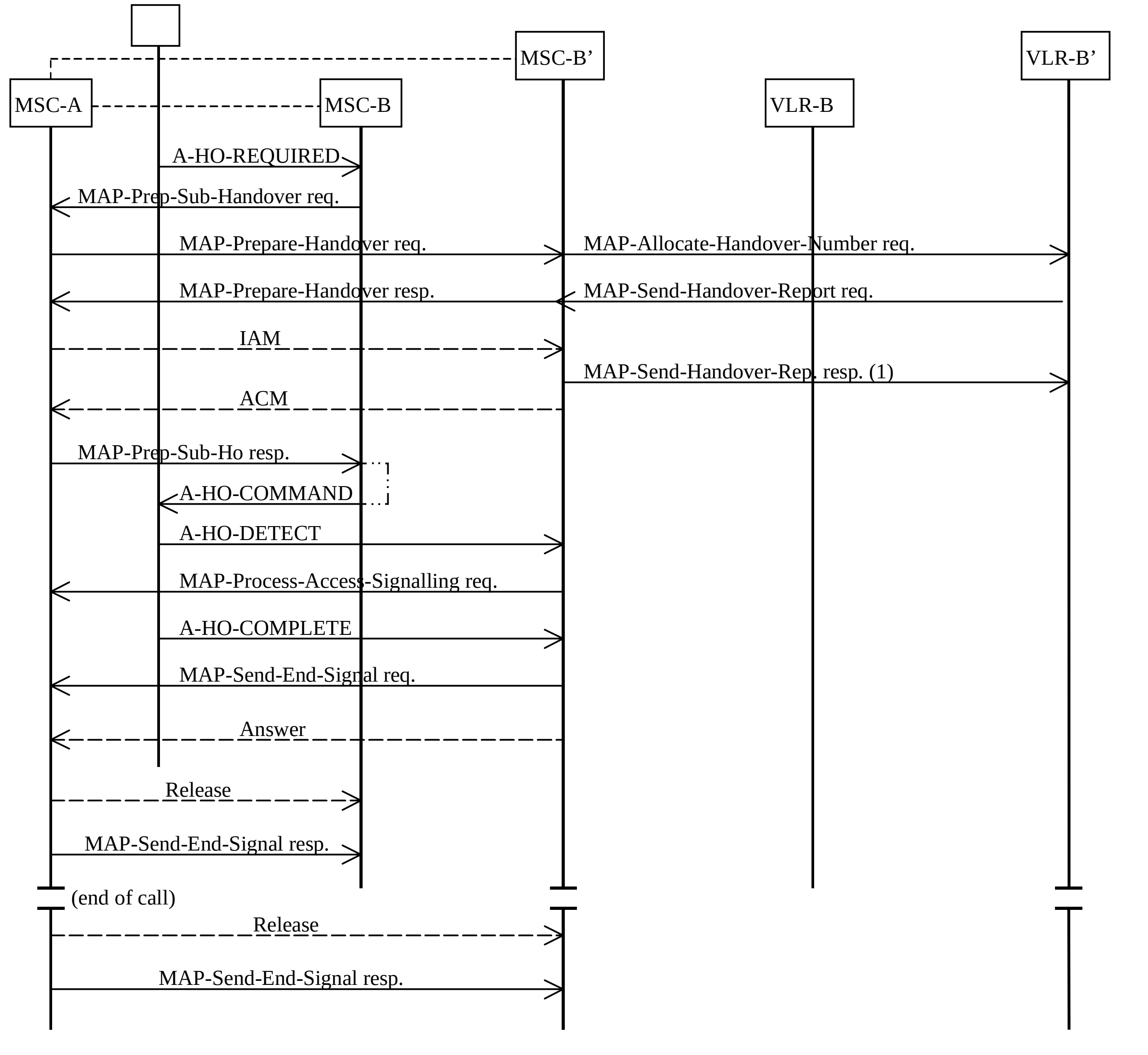
MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to MSC-A indicating a new MSC number (which is the identity of MSC-B'), indicating also the target cell identity and including a complete A-HO-REQUEST, MSC-A then starts a basic handover procedure towards MSC-B'.

When MSC-A receives the ACM from MSC-B', MSC-A informs MSC-B that MSC-B' has successfuly allocated the radio resources on BSS-B' side by sending the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing the complete A-HO-REQUEST-ACKNOWLEDGE received from BSS-B'and possible extra BSSMAP information, amended by MSC-A due to the possible interworking between the BSSMAP protocol carried on the E-interface between MSC-A and MSC-B' and the BSSMAP protocol carried on the E-interface between MSC-A and MSC-B. Now MSC-B can start the procedure on the radio path.

For MSC-A the handover is completed when it has received the MAP-SEND-END-SIGNAL REQUEST from MSC-B'containing the A-HO-COMPLETE received from the BSS-B'. The circuit between MSC-A and MSC-B is released. MSC-A also sends the MAP-SEND-END-SIGNAL response to MSC-B in order to terminate the original MAP dialogue between MSC-A and MSC-B. MSC-B releases the radio resources when it receives this message.

If the traffic channel allocation is queued by the BSS-B', the A-QUEUING-INDICATION may optionaly be sent back to MSC-B. If no radio channel can be allocated by MSC-B' or no circuit between MSC-A and MSC-B' can be established or a fault is detected on the target cell identity or the target cell identity in the A-HO-REQUEST is not consistent with the target MSC number, MSC-A informs MSC-B by using the A-HO-FAILURE message included in the MAP-PREPARE-SUBSEQUENT-HANDOVER response. MSC-B shall maintain the existing connection with the MS.

When the subsequent handover is completed, MSC-B' is considered as MSC-B. Any further inter-MSC handover is handled as described above for a subsequent handover.



NOTE 1: Can be sent at any time after the reception of IAM

Figure 15: Subsequent handover procedure ii): Successful handover from MSC-B to MSC-B'requiring a circuit connection

7.4 Procedure for subsequent handover not requiring a circuit connection between MSC-A and MSC-B

As for the subsequent handover with a circuit connection between MSC-A and MSC-B, the same two cases of subsequent handover apply:

i) the MS moves back to the area of MSC-A;

ii) the MS moves into the area of a third MSC (MSC-B').

7.4.1 Description of the subsequent handover procedure without circuit connection i): MSC-B to MSC-A

The procedure for successful handover from MSC-B back to MSC-A without circuit connection is shown in figure 16. The only difference with the figure 14, is that no circuit release is needed between MSC-A and MSC-B.

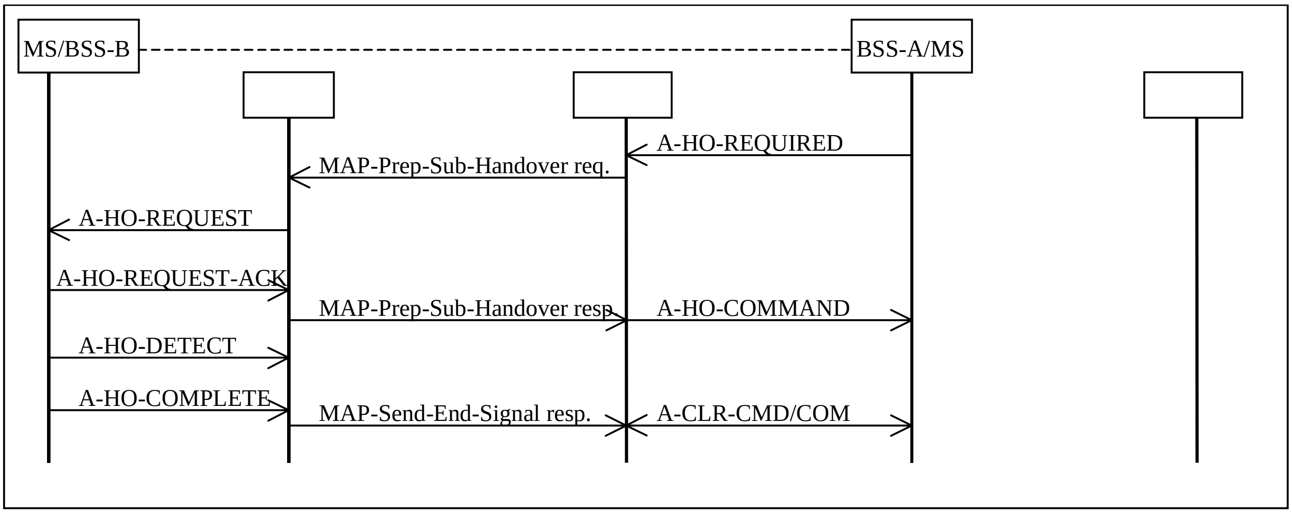


Figure 16: Subsequent handover procedure i): Successful handover from MSC-B to MSC-A not requiring a circuit connection

7.4.2 Description of the subsequent handover procedure without circuit connection ii): MSC-B to MSC-B'

The procedure for successful handover from MSC-B to MSC-B' is shown in figure 17.

The procedure consists of two parts:

- a subsequent handover from MSC-B back to MSC-A as described in subclause 7.4.1; and
- a basic handover from MSC-A to MSC-B' as described in subclause 7.2.

The only difference to the equivalent figure 15 is the omission of the circuit and handover number allocation signallings.

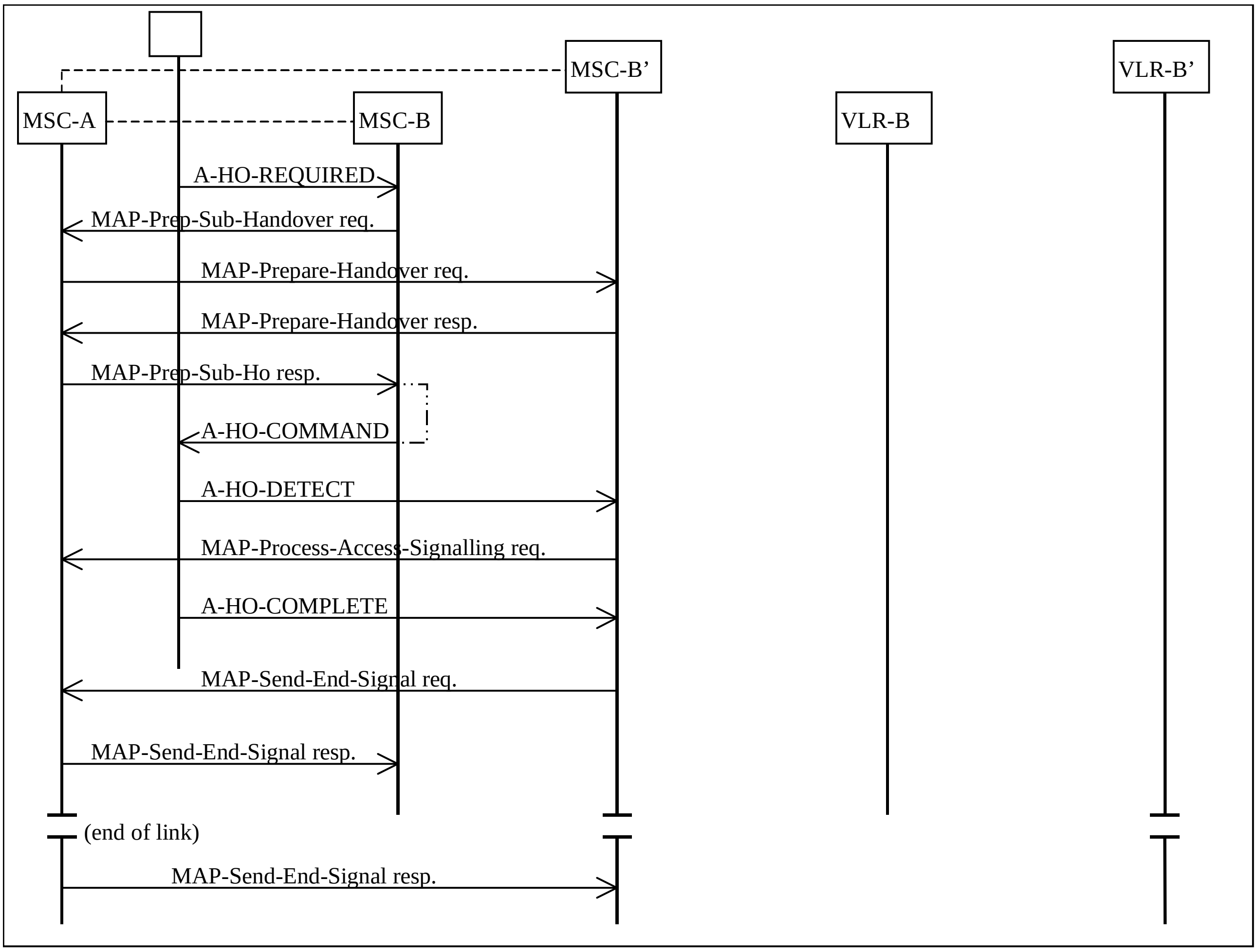


Figure 17: Subsequent handover procedure ii): Successful handover from MSC-B to MSC-B' without circuit connection

8 General Description of the procedures for inter - 3G_MSC handovers

8.1 Handover UMTS to GSM

The following subclauses describe two options for the Basic and Subsequent UMTS to GSM Handover procedures. The first, as described in subclauses 8.1.1 and 8.1.3 respectively, provides for a circuit connection between 3G_MSC-A and 3G_MSC-B. The second, as described in subclauses 8.1.2 and 8.1.4 respectively, provides for a Basic and Subsequent Handover without the provision of a circuit connection between 3G_MSC-A and 3G_MSC-B. 3G_MSC can also be a pure GSM MSC.

In all the above mentioned subclauses, the following principles apply:

- during the handover resource allocation, only the handover related messages that are part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - shall be transferred on the E-interface;

- the trace related messages that are part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08- can be sent by the 3G_MSC-A on the E-interface after successful handover resource allocation. In the subclauses 8.1.1 and 8.1.2, it is however allowed at basic handover initiation on the E-Interface to transfer one trace related message that is part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7]- together with the applicable handover related message. The applicable handover related message shall always appear as the first message;

- during the handover execution, i.e. while the UE/MS is not in communication with the network, the 3G_MSC-A shall queue all outgoing BSSAP/Direct Transfer messages until the communication with the UE/MS is resumed;
- finally, during supervision, i.e. while the UE/MS is not in the area of 3G_MSC-A after a successful Inter-3G_MSC handover, the subset of BSSAP procedures and their related messages - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - shall apply on the E-Interface;
- during the intra-3G_MSC -B handover execution, if any, the 3G_MSC -B shall queue all outgoing BSSAP messages until the communication with the UE/MS is resumed.

8.1.1 Basic Handover procedure requiring a circuit connection between 3G_MSC -A and MSC-B

The procedure used for successful Inter-3G_MSC UMTS to GSM Handover is shown in figure 18. Initiation of the UMTS to GSM handover procedure is described in clause 5. The procedure described in this subclause makes use of messages from the ~~Technical Specification GSM 08.08~~3GPP TS 08.08 and of the transport mechanism from the Mobile Application Part (MAP) (~~Technical Specification GSM 29.002~~3GPP TS 29.002 [12]). After an Inter-3G_MSC relocation/handover, Intra-3G_MSC UMTS to GSM handover may occur on 3G_MSC -B, this handover will follow the procedures specified in a previous subclause.

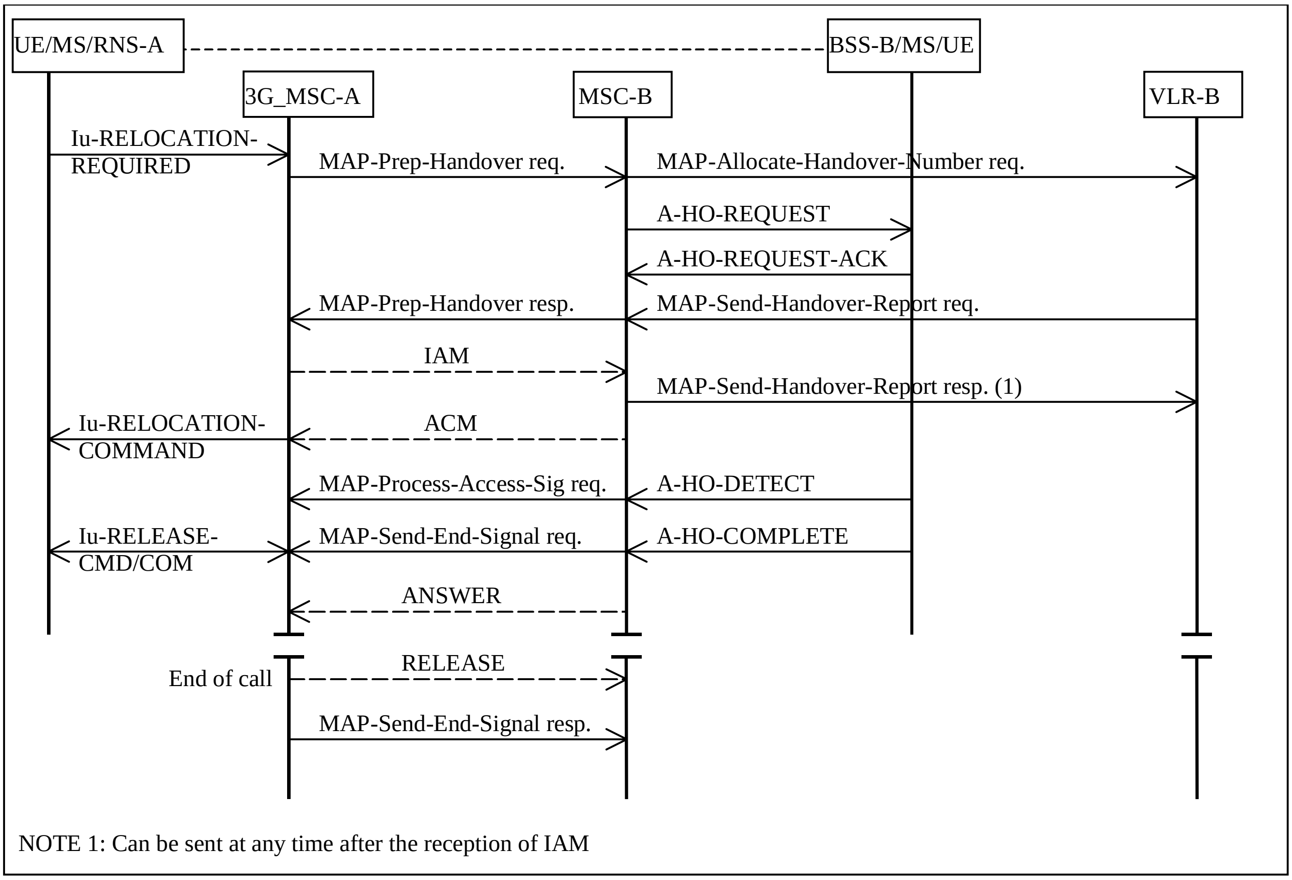


Figure 18: Basic UMTS to GSM Handover Procedure requiring a circuit connection

8.1.1.1 With one circuit connection

The UMTS to GSM handover is initiated as described in subclause 6.2.1. (This is represented by Iu-RELOCATION-REQUIRED in figure 18). Upon receipt of the Iu-RELOCATION-REQUIRED from RNS-A, 3G_MSC-A shall send a MAP-PREPARE-HANDOVER request to MSC-B including a complete A-HO-REQUEST message.

NOTE: 3G_MSC-A shall not send further MAP-PREPARE-HANDOVER requests while a MAP-PREPARE-HANDOVER response is pending or before any timeouts.

The MAP-PREPARE-HANDOVER request shall carry in the A-HO-REQUEST all information needed by MSC-B for allocating a radio channel, see ~~Technical Specification GSM 08.08~~3GPP TS 08.08. For compatibility reasons, the MAP-PREPARE-HANDOVER request will also identify the cell to which the call is to be handed over. MSC-B will return the MAP-PREPARE-HANDOVER response after having retrieved a Handover Number from its associated VLR (exchange of the messages MAP-allocate-handover-number request and MAP-send-handover-report request). The Handover Number shall be used for routing the connection of the call from 3G_MSC-A to MSC-B. If a traffic channel is available in MSC-B the MAP-PREPARE-HANDOVER response, sent to 3G_MSC-A will contain the complete A-HO-REQUEST-ACKNOWLEDGE message received from BSS-B, containing the radio resources definition to be sent by RNS-A to the UE/MS and possible extra BSSMAP information, amended by MSC-B due to the possible interworking between the BSSMAP protocol carried on the E-interface and the BSSMAP protocol used on the A-interface. If the traffic channel allocation is queued by BSS-B, the A-QUEUING-INDICATION may optionally be sent back to 3G_MSC-A. The further traffic channel allocation result (A-HO-REQUEST-ACK or A-HO-FAILURE) will be transferred to 3G_MSC-A using the MAP-PROCESS-ACCESS-SIGNALLING request. If the traffic channel allocation is not possible, the MAP-PREPARE-HANDOVER response containing an A-HO-FAILURE will be sent to 3G_MSC-A. MSC-B will do the same if a fault is detected on the identity of the cell where the call has to be handed over. MSC-B simply reports the events related to the dialogue. It is up to 3G_MSC-A to decide the action to perform if it receives negative responses or the operation fails due to the expiry of the MAP-PREPARE-HANDOVER timer.

If an error related to the TCAP dialogue or to the MAP-PREPARE-HANDOVER request is returned from MSC-B, this will be indicated to 3G_MSC-A and 3G_MSC-A will terminate the handover attempt. 3G_MSC-A rejects the handover attempt towards RNS-A. The existing connection to the UE/MS shall not be cleared.

When the A-HO-REQUEST-ACKNOWLEDGE has been received, 3G_MSC-A shall establish a circuit between 3G_MSC-A and MSC-B by signalling procedures supported by the network. In figure 18 this is illustrated by the messages IAM (Initial Address Message) and ACM (Address Complete Message) of Signalling System no 7. MSC-B awaits the capturing of the UE/MS (subclause 6.2.1) on the radio path when the ACM is sent and 3G_MSC-A initiates the UMTS to GSM handover execution when ACM is received (illustrated by the Iu-RELOCATION-COMMAND and described in the subclause 6.2.1). 3G_MSC-A removes the transcoder from the path to the other party. As handover to GSM means that a transcoder is inserted in the BSS-B then G.711 [16] is assumed on the E-interface.

MSC-B transfers to 3G_MSC-A the acknowledgement received from the correct UE/MS (A-HO-DETECT/A-HO-COMPLETE). The A-HO-DETECT, if received, is transferred to 3G_MSC-A using the MAP-PROCESS-ACCESS-SIGNALLING request. The A-HO-COMPLETE, when received from the correct UE/MS, is included in the MAP-SEND-END-SIGNAL request and sent back to 3G_MSC-A. The circuit is through connected in 3G_MSC-A when the A-HO-DETECT or the A-HO-COMPLETE is received from MSC-B. The old radio channel is released when the A-HO-COMPLETE message is received from MSC-B. The sending of the MAP-SEND-END-SIGNAL request starts the MAP supervision timer for the MAP dialogue between 3G_MSC-A and MSC-B. When the MAP-SEND-END-SIGNAL request including the A-HO-COMPLETE message is received in 3G_MSC-A, the resources in RNS-A shall be cleared.

In order not to conflict with the PSTN/ISDN signalling system(s) used between 3G_MSC-A and MSC-B, MSC-B must generate an answer signal when A-HO-DETECT/COMPLETE is received.

MSC-B shall release the Handover Number when the circuit between 3G_MSC-A and MSC-B has been established.

If the circuit between 3G_MSC-A and MSC-B cannot be established, (e.g. an unsuccessful backward message is received instead of ACM), 3G_MSC-A terminates the inter-3G_MSC UMTS to GSM handover attempt by sending an appropriate MAP message, for example an ABORT.

3G_MSC-A shall retain overall call control until the call is cleared by the fixed subscriber or the UE/MS and there is no further call control functions to be performed (e.g. servicing waiting calls, echo cancellers).

When 3G_MSC-A clears the call to the UE/MS it also clears the call control functions in 3G_MSC-A and sends the MAP-SEND-END-SIGNAL response to release the MAP resources in MSC-B.

3G_MSC-A may terminate the procedure at any time by sending an appropriate MAP message to MSC-B. If establishment of the circuit between 3G_MSC-A and MSC-B has been initiated, the circuit must also be cleared.

The UMTS to GSM handover will be aborted by 3G_MSC-A if it detects clearing or interruption of the radio path before the call has been established on MSC-B.

8.1.1.2 With multiple circuit connections (Optional functionality)

If 3G_MSC-A supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A shall have the following functionality additionally to the description in section 8.1.1.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-A 3G_MSC-A shall select one bearer to be handed over if the UE is engaged with multiple bearers. After that, the 3G_MSC-A generates an A-HO-REQUEST message for the selected bearer and sends it to MSC-B over MAP-PREPARE-HANDOVER request.

When MAP-PREPARE-HANDOVER response including an A-HO-REQUEST-ACK is received from MSC-B, 3G_MSC-A sends IU-RELOCATION-COMMAND, which indicates the bearers not to be handed over as bearers to be released, to RNS-A.

After 3G_MSC-A receives MAP-SEND-END-SIGNAL request from MSC-B, 3G_MSC-A shall release calls via MSC-B, which has been carried by the bearers not to be handed over, and then 3G_MSC-A sends IU-RELEASE-COMMAND to RNS-A.

8.1.2 Basic UMTS to GSM Handover procedure not requiring the establishment of a circuit connection between 3G_MSC-A and MSC-B

The basic UMTS to GSM handover procedures to be used when no circuit connection is required by 3G_MSC-A are similar to those described in subclause 8.1.1 for circuit switched calls. The main differences to the procedures described in subclause 8.1.1 relate to the establishment of circuits between the network entities and the Handover Number allocation.

In the case of basic UMTS to GSM handover, 3G_MSC-A shall specify to MSC-B that no Handover Number is required in the MAP-PREPARE-HANDOVER request (~~see Technical Specification 29.002~~3GPP TS 29.002 [12]). As for the basic UMTS to GSM handover using a circuit connection, the A-HO-REQUEST is transmitted at the same time. Any subsequent Handover Number allocation procedure will not be invoked until the completion of the basic UMTS to GSM handover procedure (see clause: Subsequent Channel Assignment using a circuit connection). MSC-B shall then perform the radio resources allocation as described in subclause 8.1.1. The MAP-PREPARE-HANDOVER response shall be returned to 3G_MSC-A including either the response of the radio resources allocation request received from BSS-B (A-HO-REQUEST-ACKNOWLEDGE/A-HO-FAILURE with possible extra BSSMAP information. These extra information are amended by MSC-B due to the possible interworking between the BSSMAP protocol carried on the E-interface and the BSSMAP protocol used on the A-interface) or potentially the A-QUEUING-INDICATION. The basic UMTS to GSM handover procedure will continue as described in subclause 8.1.1 except that no circuit connection will be established towards MSC-B.

The relevant case for the basic UMTS to GSM handover without circuit connection is shown in figure 19. As can be seen the major differences to the equivalent figure 18 is the omission of any circuit establishment messaging and the omission of handover number allocation signalling.

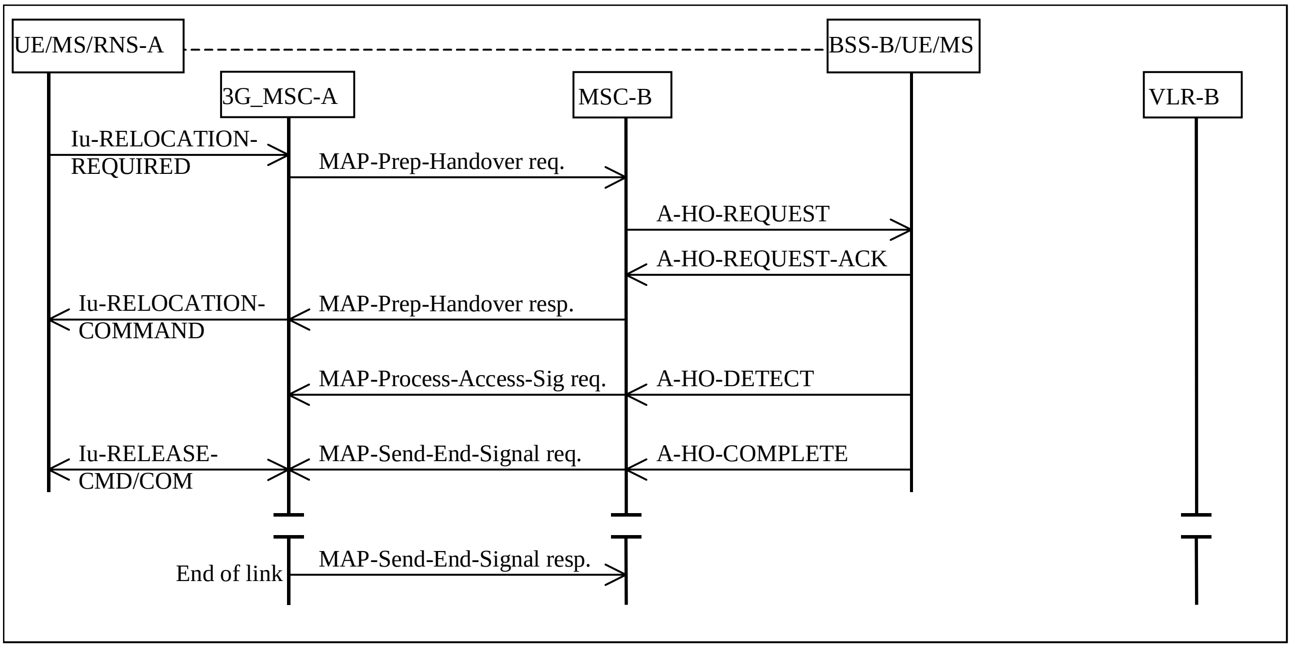


Figure 19: Basic UMTS to GSM Handover Procedure without circuit connection

8.1.3 Procedure for subsequent UMTS to GSM handover requiring a circuit connection between 3G_MSC-A and 3G_MSC-B

After the call has been handed over from 3G_MSC-A to 3G_MSC-B, if the UE/MS leaves the area of 3G_MSC-B during the same call and enters a GSM area, subsequent UMTS to GSM handover is necessary in order to continue the connection.

The following cases apply:

i) the UE/MS moves back to the area of MSC-A;

ii) the UE/MS moves into the area of a third MSC (MSC-B').

In both cases the call is switched in 3G_MSC-A; the circuit between 3G_MSC-A and MSC-B shall be released after a successful subsequent handover has been performed (remember that 3G_MSC-A can be a pure GSM MSC).

8.1.3.1 Description of subsequent UMTS to GSM handover procedure i): 3G_MSC-B to MSC-A

The procedure for successful UMTS to GSM handover from MSC-B back to 3G_MSC-A is shown in figure 20.

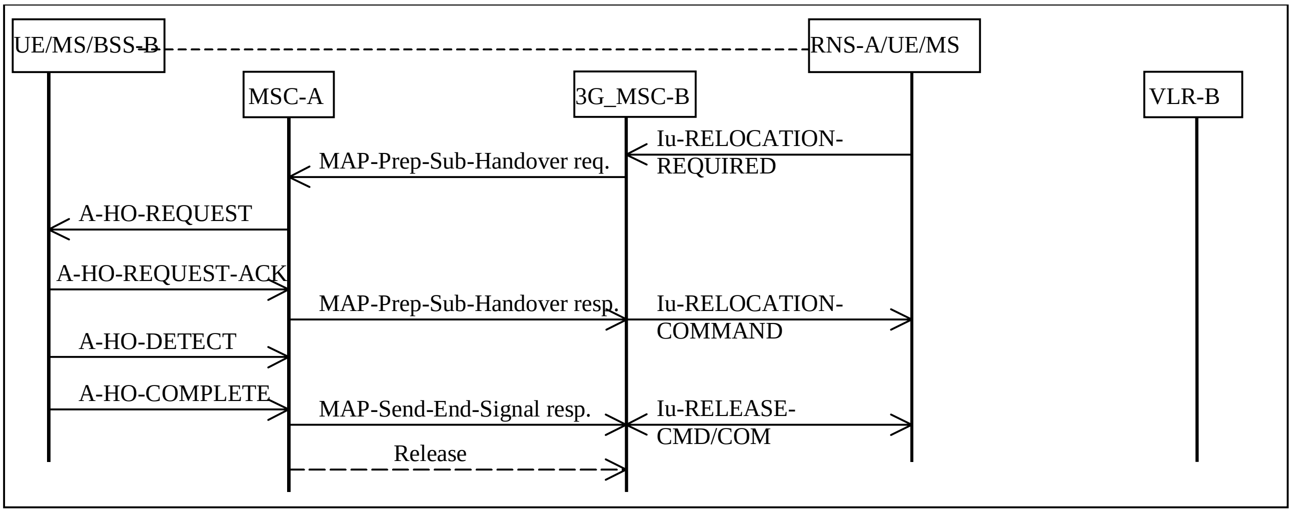


Figure 20: Subsequent UMTS to GSM handover procedure i): successful UMTS to GSM handover from 3G_MSC-B to MSC-A using a circuit connection

8.1.3.1.1 With one circuit connection

The procedure is as follows.

3G_MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to MSC-A indicating the new MSC number (MSC-A number), indicating also the identity of the cell where the call has to be handed over and including a complete A-HO-REQUEST message. (NOTE: 3G_MSC-B shall not send further MAP-PREPARE-SUBSEQUENT-HANDOVER requests while a handover attempt is pending or before any timeouts). Since MSC-A is the call controlling MSC, this MSC needs no Handover Number for routing purposes; MSC-A can immediately initiate the search for a free radio channel.

When a radio channel can be assigned, MSC-A shall return in the MAP-PREPARE-SUBSEQUENT-HANDOVER response the complete A-HO-REQUEST-ACKNOWLEDGE message received from the BSS-B and possible extra BSSMAP information, amended by MSC-A due to the possible interworking between the BSSMAP protocol carried on the E-interface and the BSSMAP protocol used on the A-interface. If the traffic channel allocation is queued by BSS-B, the A-QUEUING-INDICATION may optionally be sent back to 3G_MSC-B. The further traffic channel allocation result (A-HO-REQUEST-ACK or A-HO-FAILURE) will be transferred to 3G_MSC-B using the MAP-FORWARD-ACCESS-SIGNALLING request. If a radio channel cannot be assigned or if a fault is detected on the target cell identity, or the target cell identity in the A-HO-REQUEST is not consistent with the target MSC number, the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing an A-HO-FAILURE message shall be given to 3G_MSC-B, in addition 3G_MSC-B shall maintain the connection with the UE/MS.

If the procedure in MSC-A is successful then 3G_MSC-B can request the UE/MS to retune to the new BSS-B on MSC-A. This is illustrated in figure 20 by the Iu-RELOCATION-COMMAND message. The operation is successfully completed when MSC-A receives the A-HO-COMPLETE message.

After UMTS to GSM handover MSC-A shall release the circuit to 3G_MSC-B.

MSC-A must also terminate the MAP procedure for the basic UMTS to GSM handover between MSC-A and 3G_MSC-B by sending an appropriate MAP message. 3G_MSC-B will clear the resources in RNS-A when the MAP-SEND-END-SIGNAL response is received.

8.1.3.1.2 With multiple circuit connections (Optional functionality)

If 3G_MSC-B supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-B shall have the following functionality additionally to the description in section 8.1.3.1.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-A which indicates the target is BSS, 3G_MSC-B shall select one bearer to be handed over if the UE is engaged with multiple bearers. After that, the 3G_MSC-B generates an A-HO-REQUEST message for the selected bearer and sends it to 3G_MSC-A over MAP-PREPARE-SUBSEQUENT-HANDOVER request with indication of RAB ID of the selected bearer.

When MAP-PREPARE-SUBSEQUENT-HANDOVER response including an A-HO-REQUEST-ACK is received from the 3G_MSC-A, 3G_MSC-B sends IU-RELOCATION-COMMAND, which indicates the bearers not to be handed over as bearers to be released, to RNS-A.

After 3G_MSC-A receives A-HO-COMPLETE message from BSS-B, 3G_MSC-A shall release calls via BSS-B, which has been carried by the bearers not to be handed over, and then 3G_MSC-A sends MAP-SEND-END-SIGNAL response to 3G_MSC-B.

8.1.3.2 Description of subsequent UMTS to GSM handover procedure ii): 3G_MSC-B to MSC-B'

The procedure for successful UMTS to GSM handover from 3G_MSC-B to MSC-B' is shown in figure 21.

The procedure consists of two parts:

- a subsequent UMTS to GSM handover from 3G_MSC-B back to 3G_MSC-A as described in subclause 8.1.3.1 (3G_MSC-A can also be a pure GSM MSC, the procedure is the same in both casess); and

- a basic handover from 3G_MSC-A to MSC-B' as described in subclause 7.1.

8.1.3.2.1 With one circuit connection

3G_MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to 3G_MSC-A indicating a new MSC number (which is the identity of MSC-B'), indicating also the target cell identity and including a complete A-HO-REQUEST, 3G_MSC-A then starts a basic handover procedure towards MSC-B'.

When 3G_MSC-A receives the ACM from MSC-B', 3G_MSC-A informs 3G_MSC-B that MSC-B' has successfully allocated the radio resources on BSS-B' side by sending the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing the complete A-HO-REQUEST-ACKNOWLEDGE received from BSS-B' and possible extra BSSMAP information, amended by 3G_MSC-A due to the possible interworking between the BSSMAP protocol carried on the E-interface between 3G_MSC-A and MSC-B' and the BSSMAP protocol carried on the E-interface between 3G_MSC-A and 3G_MSC-B. Now 3G_MSC-B can start the procedure on the radio path.

For 3G_MSC-A the UMTS to GSM handover is completed when it has received the MAP-SEND-END-SIGNAL REQUEST from MSC-B' containing the A-HO-COMPLETE received from the BSS-B'. The circuit between 3G_MSC-A and 3G_MSC-B is released. 3G_MSC-A also sends the MAP-SEND-END-SIGNAL response to 3G_MSC-B in order to terminate the original MAP dialogue between 3G_MSC-A and 3G_MSC-B. 3G_MSC-B releases the radio resources when it receives this message.

If the traffic channel allocation is queued by the BSS-B', the A-QUEUING-INDICATION may optionally be sent back to 3G_MSC-B. If no radio channel can be allocated by MSC-B' or no circuit between 3G_MSC-A and MSC-B' can be established or a fault is detected on the target cell identity or the target cell identity in the A-HO-REQUEST is not consistent with the target MSC number, 3G_MSC-A informs 3G_MSC-B by using the A-HO-FAILURE message included in the MAP-PREPARE-SUBSEQUENT-HANDOVER response. 3G_MSC-B shall maintain the existing connection with the UE/MS.

When the subsequent UMTS to GSM handover is completed, MSC-B' is considered as MSC-B. Any further inter-MSC handover is handled as described earlier for a subsequent handover.

8.1.3.2.2 With multiple circuit connections (Optional functionality)

If 3G_MSC-B supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-B shall have the following functionality additionally to the description in section 8.1.3.2.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-B 3G_MSC-B shall select one bearer to be handed over if the UE is engaged with multiple bearers. After that, the 3G_MSC-B generates an A-HO-REQUEST message for the selected bearer and sends it to 3G_MSC-A over MAP-PREPARE-SUBSEQUENT-HANDOVER request with indication of RAB ID of the selected bearer.

Upon receipt of the MAP-PREPARE-SUBSEQUENT-HANDOVER request from 3G_MSC-B, 3G_MSC-A starts a basic handover procedure towards MSC-B'.

When 3G_MSC-A receives the ACM from MSC-B', 3G_MSC-A informs 3G_MSC-B that MSC-B' has successfully allocated the radio resources on BSS-B' side by sending the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing the complete A-HO-REQUEST-ACK received from BSS-B' and possible extra BSSAP information, amended by 3G_MSC-A due to the possible interworking between the BSSMAP protocol carried on the E-interface between 3G_MSC-A and MSC-B' and the BSSMAP protocol carried on the E-interface between 3G_MSC-A and 3G_MSC-B.

When MAP-PREPARE-SUBSEQUENT-HANDOVER response including an A-HO-REQUEST-ACK is received from 3G_MSC-A, 3G_MSC-B sends IU-RELOCATION-COMMAND, which indicates the bearers not to be handed over as bearers to be released, to RNS-A.

After 3G_MSC-A receives MAP-SEND-END-SIGNAL request from MSC-B', 3G_MSC-A shall release calls via MSC-B', which has been carried by the bearers not to be handed over, and then 3G_MSC-A sends MAP-SEND-END-SIGNAL response to 3G_MSC-B.

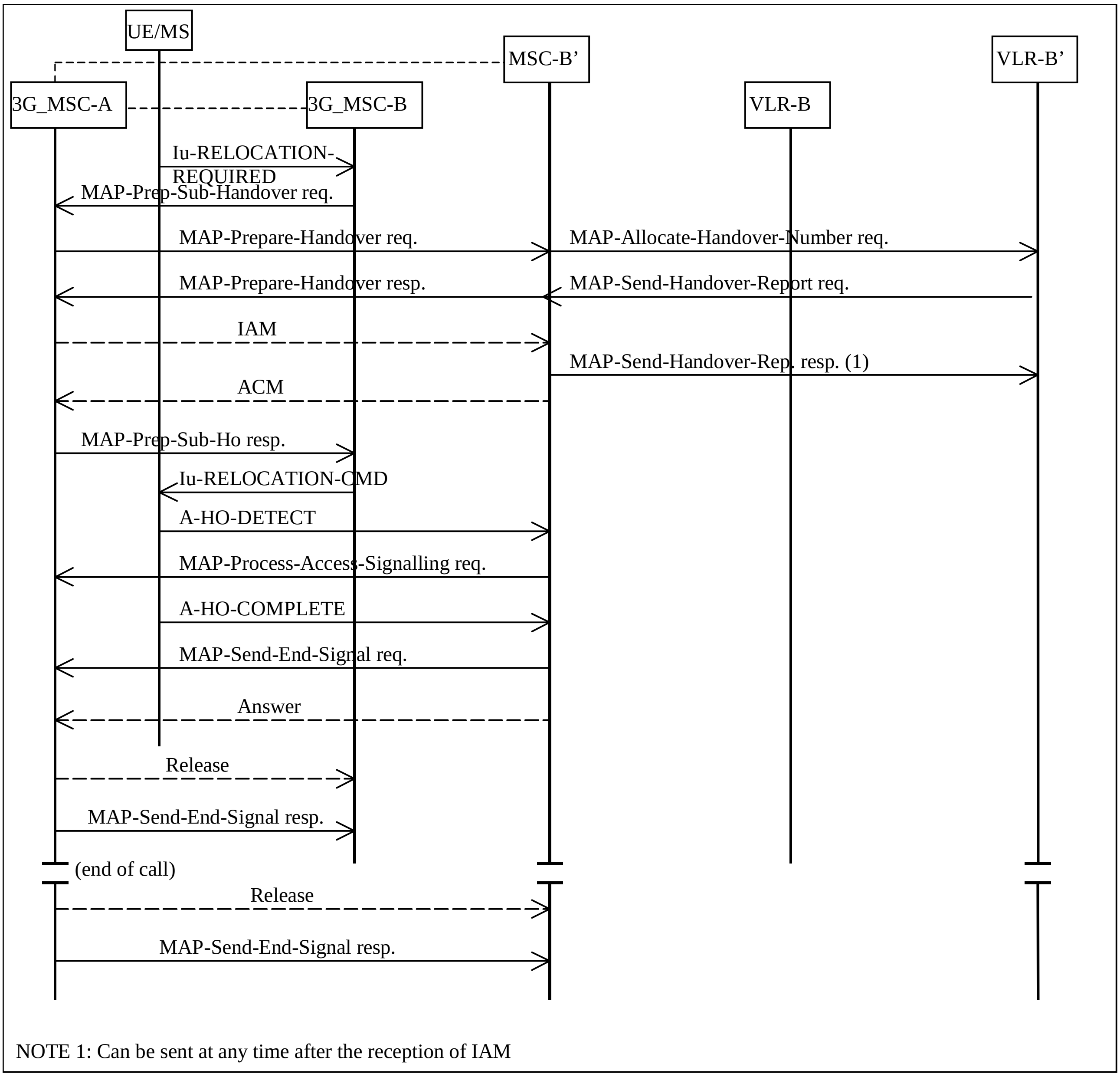


Figure 21: Subsequent handover procedure ii): Successful UMTS to GSM handover from 3G_MSC-B to MSC-B' requiring a circuit connection

8.1.4 Procedure for subsequent UMTS to GSM handover not requiring a circuit connection between 3G_MSC-A and 3G_MSC-B

As for the subsequent UMTS to GSM handover with a circuit connection between 3G_MSC-A and 3G_MSC-B, the same two cases of subsequent handover apply:

i) the UE/MS moves back to the area of MSC-A;

ii) the UE/MS moves into the area of a third MSC (MSC-B').

8.1.4.1 Description of subsequent UMTS to GSM handover procedure i): 3G_MSC-B to MSC-A

The procedure for successful UMTS to GSM handover from 3G_MSC-B back to MSC-A without circuit connection is shown in figure 22. The only difference with the figure 20, is that no circuit release is needed between MSC-A and 3G_MSC-B.

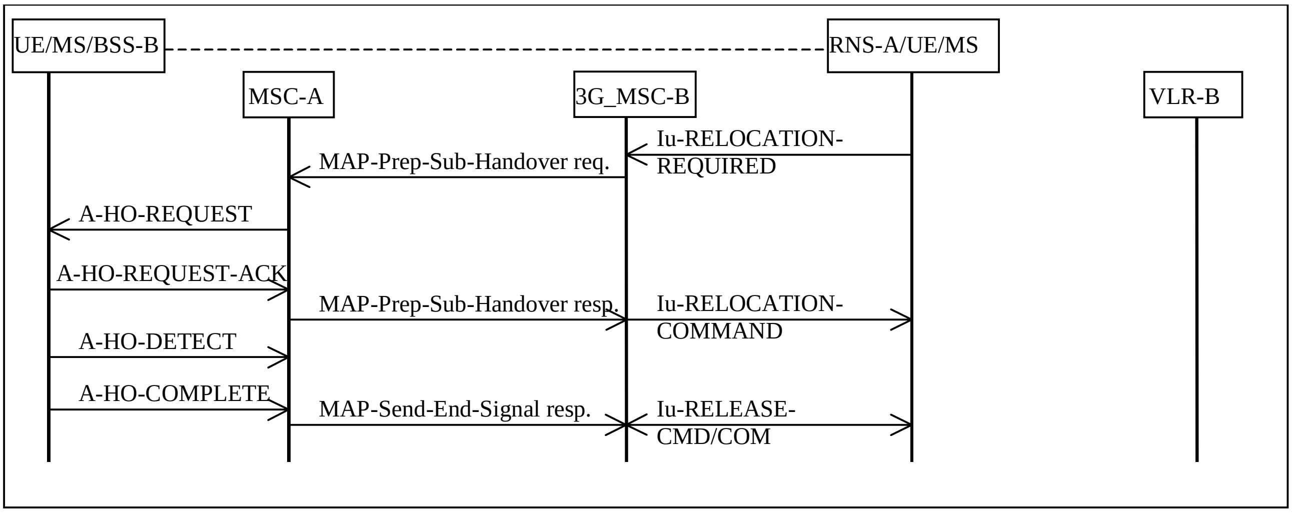


Figure 22: Subsequent UMTS to GSM handover procedure i): Successful UMTS to GSM handover from 3G_MSC-B to MSC-A not requiring a circuit connection

8.1.4.2 Description of the subsequent UMTS to GSM handover procedure without circuit connection ii): 3G_MSC-B to MSC-B'

The procedure for successful UMTS to GSM handover from 3G_MSC-B to MSC-B' is shown in figure 23.

The procedure consists of two parts:

- a subsequent UMTS to GSM handover from 3G_MSC-B back to 3G_MSC-A as described in subclause 8.1.4.1 (3G_MSC-A can also be a pure GSM MSC, the procedure is the same in both casess); and

- a basic handover from 3G_MSC-A to MSC-B' as described in subclause 7.2.

The only difference to the equivalent figure 21 is the omission of the circuit and handover number allocation signallings.

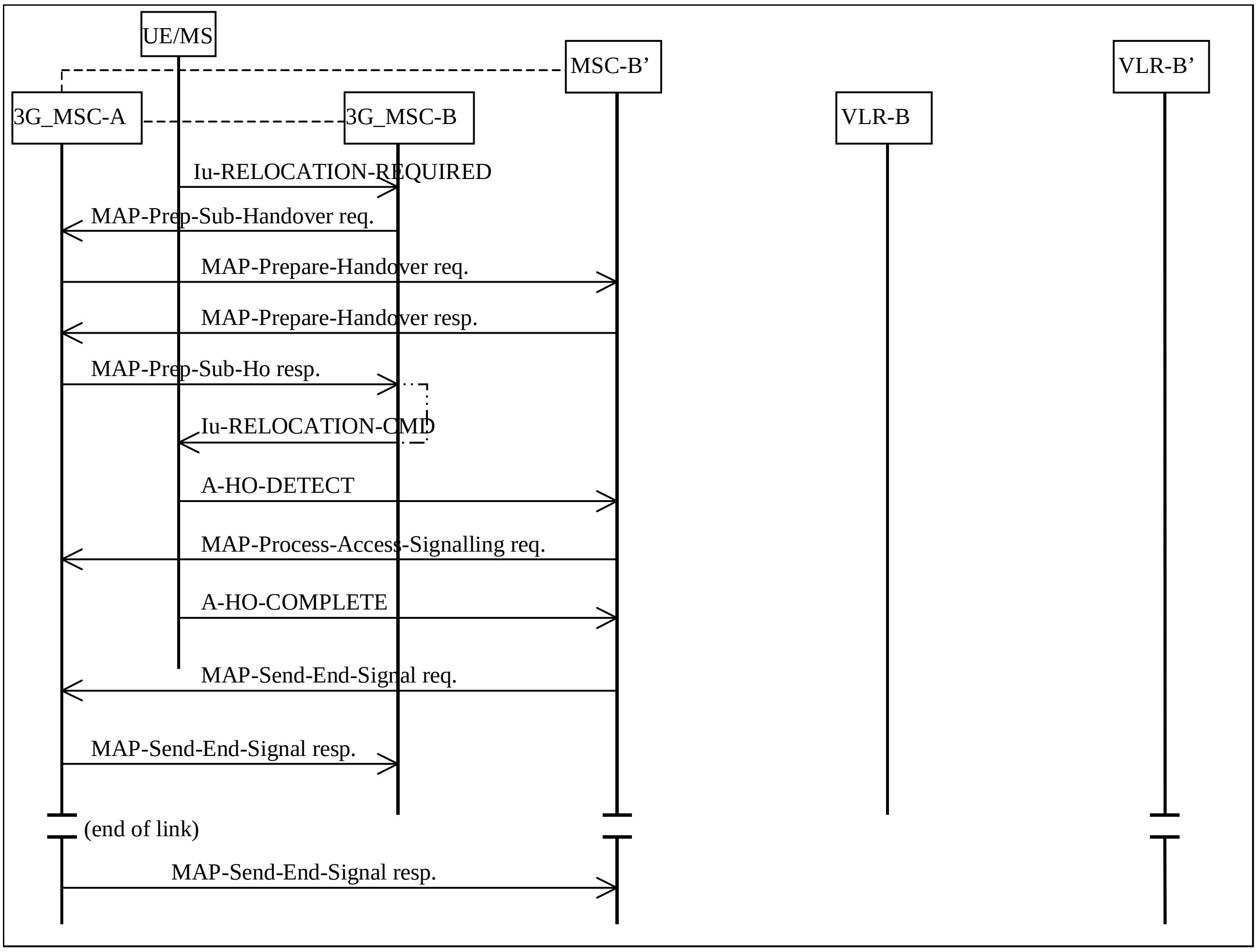


Figure 23: Subsequent UMTS to GSM handover procedure ii): Successful UMTS to GSM handover from 3G_MSC-B to MSC-B' without circuit connection

8.2 Handover GSM to UMTS

The following subclauses describe two options for the Basic and Subsequent GSM to UMTS Handover procedures. The first, as described in subclauses 8.2.1 and 8.2.3 respectively, provides for a circuit connection between (3G_)MSC-A and (3G_)MSC-B. The second, as described in subclauses 8.2.2 and 8.2.4 respectively, provides for a Basic and Subsequent Handover without the provision of a circuit connection between (3G_)MSC-A and (3G_)MSC-B. In all the above mentioned subclauses, the following principles apply:

- during the handover resource allocation, only the handover related messages that are part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - shall be transferred on the E-interface;

- the trace related messages that are part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - can be sent by the MSC-A on the E-interface after successful handover resource allocation. In the subclauses 8.2.1 and 8.2.2, it is however allowed at basic handover initiation on the E-Interface to transfer one trace related message that is part of the applicable BSSAP subset - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - together with the applicable handover related message. The applicable handover related message shall always appear as the first message;

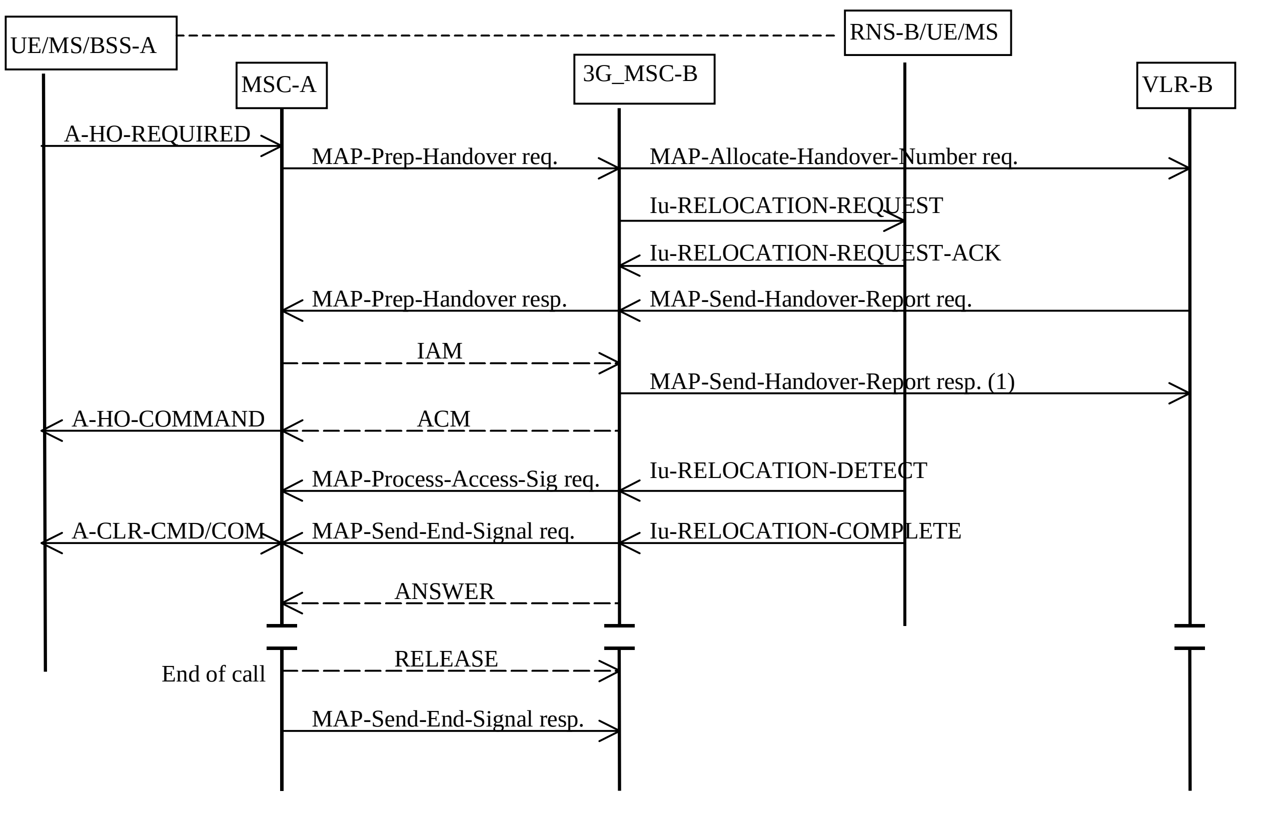
- during the handover execution, i.e. while the UE/MS is not in communication with the network, the MSC-A shall queue all outgoing BSSAP messages until the communication with the UE/MS is resumed;

- finally, during supervision, i.e. while the UE/MS is not in the area of MSC-A after a successful Inter-3G_MSC GSM to UMTS handover, the subset of BSSAP procedures and their related messages - as defined in ~~GSM 09.08~~3GPP TS 09.08 [7] - shall apply on the E-Interface;

- during the intra-3G_MSC-B GSM to UMTS handover execution, if any, the 3G_MSC-B shall queue all outgoing Direct Transfer messages until the communication with the UE/MS is resumed.

8.2.1 Basic Handover procedure requiring a circuit connection between MSC-A and 3G_MSC-B

The procedure used for successful Inter-3G_MSC Handover from GSM to UMTS is shown in figure 24. Initiation of the GSM to UMTS handover procedure is described in clause 5. The procedure described in this subclause makes use of messages from the ~~Technical Specification GSM 08.08~~3GPP TS 08.08 [5], ~~TS 25.413~~3GPP TS 25.413 [11] and of the transport mechanism from the Mobile Application Part (MAP) (~~TS 29.002~~3GPP TS 29.002 [12]). After an Inter-3G_MSC handover further Intra-3G_MSC handovers may occur on 3G_MSC-B, these handovers will follow the procedures specified in the previous subclauses.



NOTE 1: Can be sent at any time after the reception of IAM

Figure 24: Basic GSM to UMTS Handover Procedure requiring a circuit connection

The GSM to UMTS handover is initiated as described in subclause 6.2.2. (This is represented by A-HO-REQUIRED in figure 24). Upon receipt of the A-HO-REQUIRED from BSS-A, MSC-A shall send a MAP-PREPARE-HANDOVER request to 3G_MSC-B including a complete A-HO-REQUEST message.

NOTE: MSC-A shall not send further MAP-PREPARE-HANDOVER requests while a MAP-PREPARE-HANDOVER response is pending or before any timeouts.

The MAP-PREPARE-HANDOVER request shall carry in the A-HO-REQUEST all information needed by 3G_MSC-B for allocating radio resources in RNS-B, see ~~Technical Specification GSM 08.08~~3GPP TS 08.08 [5].

For compatibility reasons, the MAP-PREPARE-HANDOVER request will also identify the cell to which the call is to be handed over. 3G_MSC-B will return the MAP-PREPARE-HANDOVER response after having retrieved a Handover Number from its associated VLR (exchange of the messages MAP-allocate-handover-number request and MAP-send-handover-report request). The Handover Number shall be used for routing the connection of the call from MSC-A to 3G_MSC-B. 3G_MSC-B inserts a transcoder as G711 is assumed between 2G MSC and 3G_MSC-B. If radio resources are available in RNS-B the MAP-PREPARE-HANDOVER response, sent to MSC-A from 3G_MSC-B will contain the complete A-HO-REQUEST-ACK message generated from the Iu-RELOCATION-REQUEST-ACK received from RNS-B, containing the radio resources definition to be sent by BSS-A to the UE/MS. If the radio resource allocation is not possible, the MAP-PREPARE-HANDOVER response containing an A-HO-FAILURE will be sent to MSC-A. 3G_MSC-B will do the same if a fault is detected on the identity of the cell where the call has to be handed over. 3G_MSC-B simply reports the events related to the dialogue. It is up to MSC-A to decide the action to perform if it receives negative responses or the operation fails due to the expiry of the MAP-PREPARE-HANDOVER timer.

If an error related to the TCAP dialogue or to the MAP-PREPARE-HANDOVER request is returned from 3G_MSC-B, this will be indicated to MSC-A and MSC-A will terminate the handover attempt. MSC-A shall reject the handover attempt towards BSS-A. The existing connection to the UE/MS shall not be cleared.

When the A-HO-REQUEST-ACK has been received, MSC-A shall establish a circuit between MSC-A and 3G_MSC-B by signalling procedures supported by the network. In figure 24 this is illustrated by the messages IAM (Initial Address Message) and ACM (Address Complete Message) of Signalling System no 7. 3G_MSC-B awaits the capturing of the UE/MS (subclause 6.2.2) on the radio path when the ACM is sent and MSC-A initiates the handover execution when ACM is received (illustrated by the A-HO-COMMAND and described in the subclause 6.2.2).

3G_MSC-B transfers to MSC-A the acknowledgement received from the correct UE/MS (A-HO-DETECT/A-HO-COMPLETE). The Iu-RELOCATION-DETECT, if received, is converted to A-HO-DETECT and transferred to MSC-A using the MAP-PROCESS-ACCESS-SIGNALLING request. The Iu-RELOCATION-COMPLETE, when received from the correct UE/MS, is converted to A-HO-COMPLETE and included in the MAP-SEND-END-SIGNAL request and sent back to MSC-A. The circuit is through-connected in MSC-A when the A-HO-DETECT or the A-HO-COMPLETE is received from 3G_MSC-B. The old radio channel is released when the A-HO-COMPLETE message is received from 3G_MSC-B. The sending of the MAP-SEND-END-SIGNAL request starts the MAP supervision timer for the MAP dialogue between MSC-A and 3G_MSC-B. When the MAP-SEND-END-SIGNAL request including the A-HO-COMPLETE message is received in MSC-A the resources in BSS-A shall be cleared.

In order not to conflict with the PSTN/ISDN signalling system(s) used between MSC-A and 3G_MSC-B, 3G_MSC-B must generate an answer signal when Iu-RELOCATION-DETECT/COMPLETE is received.

3G_MSC-B shall release the Handover Number when the circuit between MSC-A and 3G_MSC-B has been established.

If the circuit between MSC-A and 3G_MSC-B cannot be established (e.g. an unsuccessful backward message is received instead of ACM). MSC-A terminates the inter3G_MSC handover attempt by sending an appropriate MAP message, for example an ABORT.

MSC-A shall retain overall call control until the call is cleared by the fixed subscriber or the UE/MS and there is no further call control functions to be performed (e.g. servicing waiting calls, echo cancellers).

When MSC-A clears the call to the UE/MS it also clears the call control functions in MSC-A and sends the MAP-SEND-END-SIGNAL response to release the MAP resources in 3G_MSC-B.

MSC-A may terminate the procedure at any time by sending an appropriate MAP message to 3G_MSC-B. If establishment of the circuit between MSC-A and 3G_MSC-B has been initiated, the circuit must also be cleared.

The GSM to UMTS handover will be aborted by MSC-A if it detects clearing or interruption of the radio path before the call has been established on 3G_MSC-B.

8.2.2 Basic GSM to UMTS Handover procedure not requiring the establishment of a circuit connection between MSC-A and 3G_MSC-B

The basic GSM to UMTS handover procedures to be used when no circuit connection is required by MSC-A are similar to those described in subclause 8.2.1 for circuit switched calls. The main differences to the procedures described in subclause 8.2.1 relate to the establishment of circuits between the network entities and the Handover Number allocation.

In the case of basic GSM to UMTS handover, MSC-A shall specify to 3G_MSC-B that no Handover Number is required in the MAP-PREPARE-HANDOVER request (see ~~TS 29.002~~3GPP TS 29.002 [12]). As for the basic GSM to UMTS handover using a circuit connection, the A-HO-REQUEST is transmitted at the same time. Any subsequent Handover Number allocation procedure will not be invoked until the completion of the basic GSM to UMTS handover procedure (see subclause: Subsequent Channel Assignment using a circuit connection). 3G_MSC-B shall then perform the radio resources allocation as described in subclause 8.2.1. The MAP-PREPARE-HANDOVER response shall be returned to MSC-A including either the translated response of the radio resources allocation request received from RNS-B (A-HO-REQUEST-ACK/A-HO-FAILURE). The basic GSM to UMTS handover procedure will continue as described in subclause 8.2.1 except that no circuit connection will be established towards 3G_MSC-B.

The relevant case for the basic GSM to UMTS handover without circuit connection is shown in figure 25. As can be seen the major differences to the equivalent figure 24 are the omission of any circuit establishment messaging and the omission of handover number allocation signalling.

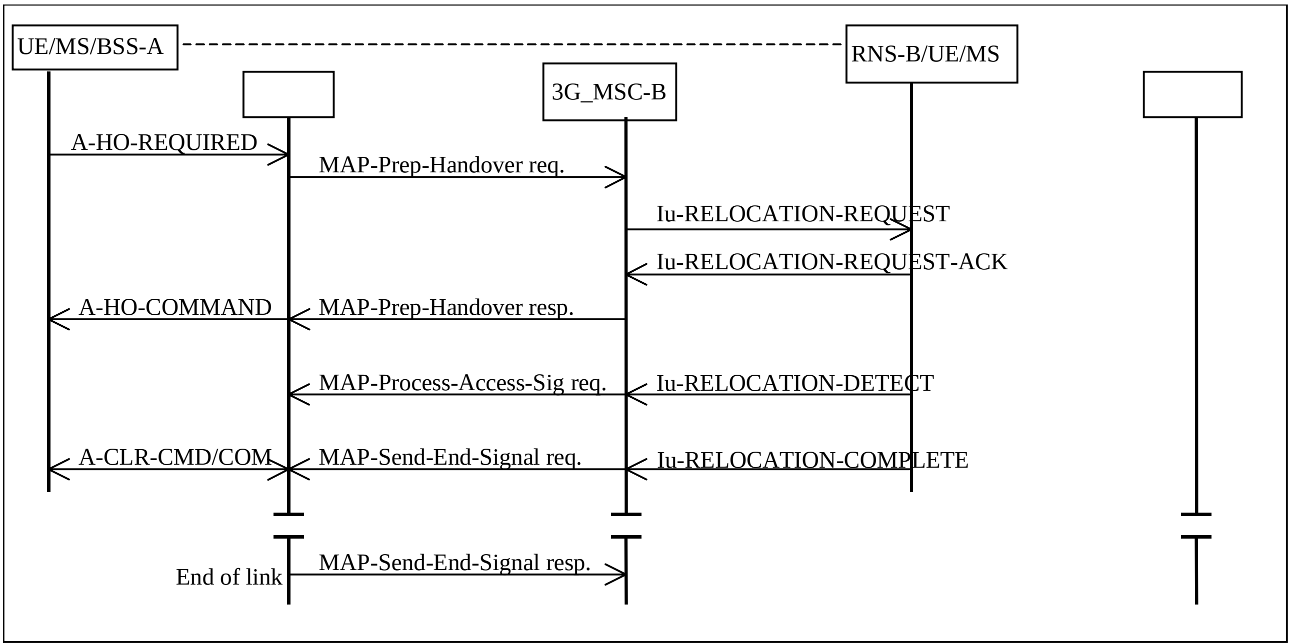


Figure 25: Basic GSM to UMTS Handover Procedure without circuit connection

8.2.3 Procedure for subsequent GSM to UMTS handover requiring a circuit connection between 3G_MSC-A and MSC-B

After the call has been handed over to MSC-B, if the UE/MS leaves the GSM area of MSC-B during the same call and enters a UTRAN area, subsequent GSM to UMTS handover is necessary in order to continue the connection.

The following cases apply:

i) the UE/MS moves back to the area of 3G_MSC-A;

ii) the UE/MS moves into the area of a third 3G_MSC (3G_MSC-B').

In both cases the call is switched in 3G_MSC-A; the circuit between 3G_MSC-A and MSC-B shall be released after a successful subsequent handover has been performed.

8.2.3.1 Description of subsequent GSM to UMTS handover procedure i): MSC-B to 3G_MSC-A

The procedure for successful GSM to UMTS handover from MSC-B back to 3G_MSC-A is shown in figure 26.

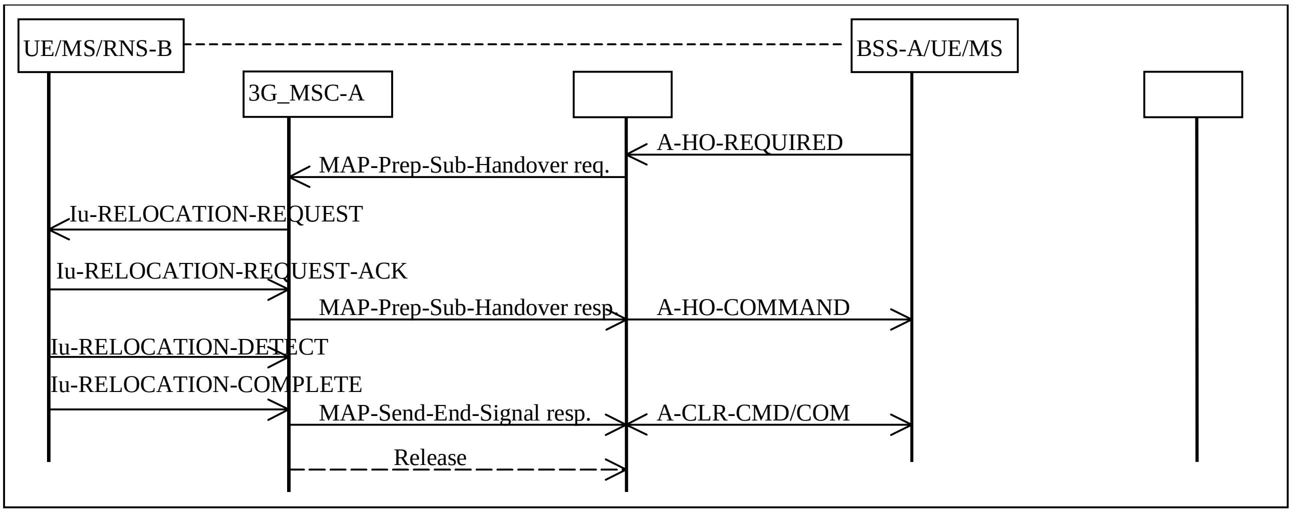


Figure 26: Subsequent GSM to UMTS handover procedure i): successful handover from MSC-B to 3G_MSC-A using a circuit connection

The procedure is as follows.

MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to 3G_MSC-A indicating the new MSC number (3G_MSC-A number), indicating also the identity of the cell where the call has to be handed over and including a complete A-HO-REQUEST message. (NOTE: MSC-B shall not send further MAP-PREPARE-SUBSEQUENT-HANDOVER requests while a handover attempt is pending or before any timeouts). Since 3G_MSC-A is the call controlling MSC, this MSC needs no Handover Number for routing purposes; 3G_MSC-A can immediately initiate the search for free radio resources. 3G_MSC-A then inserts a transcoder between it’s RNS and the connection to the other party.

When radio resources can be assigned, 3G_MSC-A shall return in the MAP-PREPARE-SUBSEQUENT-HANDOVER response the complete A-HO-REQUEST-ACK message generated from the Iu-RELOCATION-REQUEST-ACK received from the RNS-B and possible extra BSSMAP information, amended by 3G_MSC-A due to the possible interworking between the BSSMAP protocol carried on the E-interface and the RANAP protocol used on the Iu-interface. If radio resources cannot be assigned or if a fault is detected on the target cell identity, or the target cell identity in the A-HO-REQUEST is not consistent with the target MSC number, the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing an A-HO-FAILURE message shall be given to MSC-B, in addition MSC-B shall maintain the connection with the UE/MS.

If the procedure in 3G_MSC-A is successful then MSC-B can request the UE/MS to retune to the new RNS-B on 3G_MSC-A. This is illustrated in figure 26 by the A-HO-COMMAND message. The operation is successfully completed when 3G_MSC-A receives the Iu-RELOCATION-COMPLETE message.

After GSM to UMTS handover 3G_MSC-A shall release the circuit to MSC-B.

3G_MSC-A must also terminate the MAP procedure for the basic handover between 3G_MSC-A and MSC-B by sending an appropriate MAP message. MSC-B will clear the resources in BSS-A when the MAP-SEND-END-SIGNAL response is received.

8.2.3.2 Description of subsequent GSM to UMTS handover procedure ii): MSC-B to 3G_MSC-B''

The procedure for successful GSM to UMTS handover from MSC-B to 3G_MSC-B' is shown in figure 27.

The procedure consists of two parts:

- a subsequent handover from MSC-B back to MSC-A as described in subclause 7.3.1 (MSC-A can also be a 3G_MSC, the procedure is the same in both cases); and

- a basic GSM to UMTS handover from MSC-A to 3G_MSC-B' as described in subclause 8.2.1.

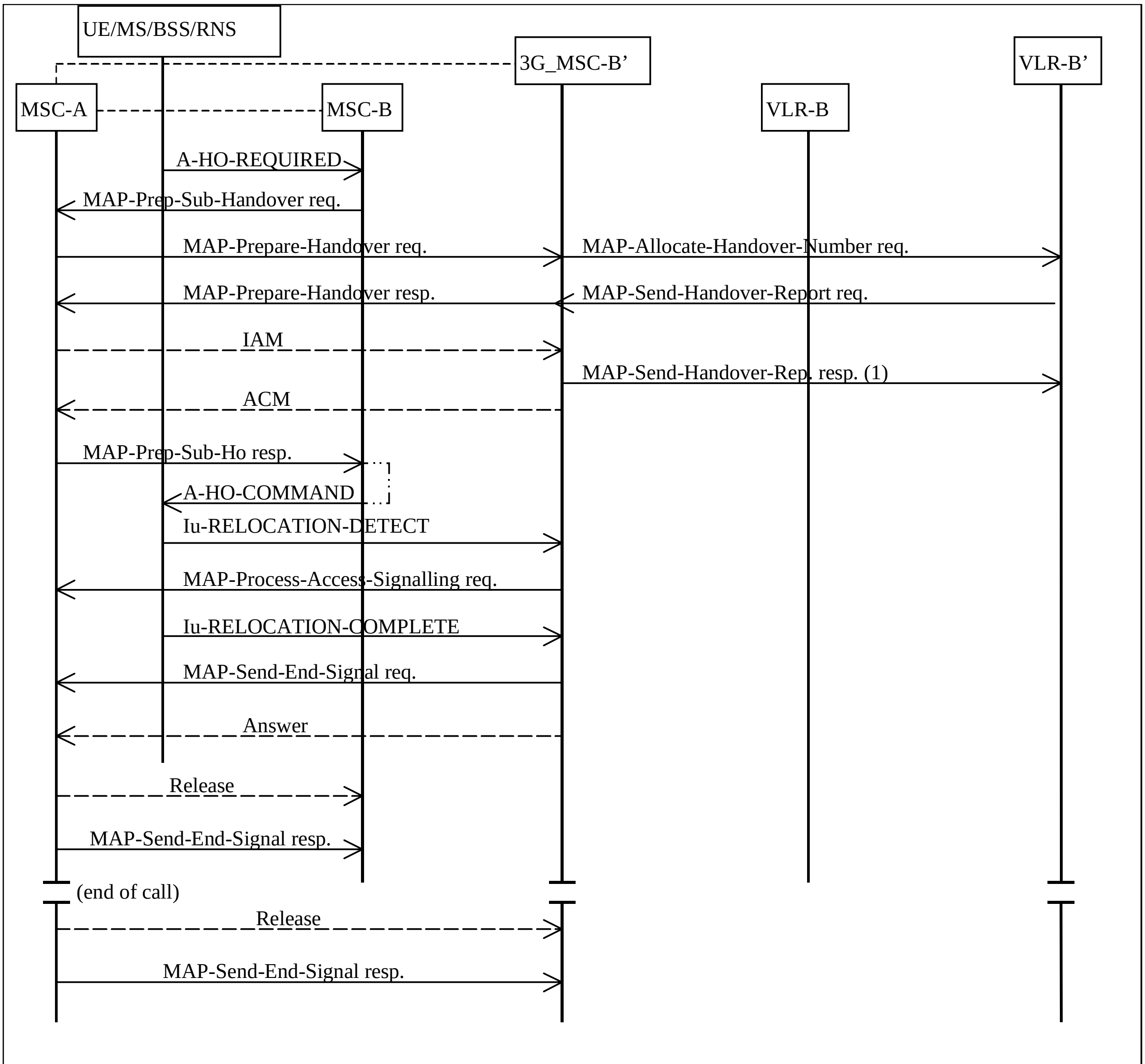
MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to MSC-A indicating a new MSC number (which is the identity of 3G_MSC-B'), indicating also the target cell identity and including a complete A-HO-REQUEST, MSC-A then starts a basic handover procedure towards 3G_MSC-B'.

When MSC-A receives the ACM from 3G_MSC-B', MSC-A informs MSC-B that 3G_MSC-B' has successfully allocated the radio resources on RNS-B' side by sending the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing the complete A-HO-REQUEST-ACK generated from the RELOCATION-REQUEST-ACK received from RNS-B' and possible extra BSSMAP information, amended by MSC-A due to the possible interworking between the BSSMAP protocol carried on the E-interface between MSC-A and 3G_MSC-B' and the BSSMAP protocol carried on the E-interface between MSC-A and MSC-B. Now MSC-B can start the procedure on the radio path.

For MSC-A the handover is completed when it has received the MAP-SEND-END-SIGNAL REQUEST from 3G_MSC-B' containing the A-HO-COMPLETE generated from Iu-RECOLATION COMPLETE received from the RNS-B'. The circuit between MSC-A and MSC-B is released. MSC-A also sends the MAP-SEND-END-SIGNAL response to MSC-B in order to terminate the original MAP dialogue between MSC-A and MSC-B. MSC-B releases the radio resources when it receives this message.

If no radio resources can be allocated by 3G_MSC-B' or no circuit between MSC-A and 3G_MSC-B' can be established or a fault is detected on the target cell identity or the target cell identity in the A-HO-REQUEST is not consistent with the target MSC number, MSC-A informs MSC-B by using the A-HO-FAILURE message included in the MAP-PREPARE-SUBSEQUENT-HANDOVER response. MSC-B shall maintain the existing connection with the UE/MS.

When the subsequent GSM to UMTS handover is completed, 3G_MSC-B' is considered as 3G_MSC-B. Any further inter-MSC handover is handled as described above for a subsequent handover.



NOTE 1: Can be sent at any time after the reception of IAM

Figure 27: Subsequent GSM to UMTS handover procedure ii): Successful handover from MSC-B to 3G_MSC-B' requiring a circuit connection

8.2.4 Procedure for subsequent GSM to UMTS handover not requiring a circuit connection between 3G_MSC-A and MSC-B

As for the subsequent GSM to UMTS handover with a circuit connection between 3G_MSC-A and MSC-B, the same two cases of subsequent handover apply:

i) the UE/MS moves back to the area of 3G_MSC-A;

ii) the UE/MS moves into the area of a third 3G_MSC (3G_MSC-B').

8.2.4.1 Description of subsequent GSM to UMTS handover procedure without circuit connection i): MSC-B to 3G_MSC-A

The procedure for successful GSM to UMTS handover from MSC-B back to 3G_MSC-A without circuit connection is shown in figure 28. The only difference with the figure 26, is that no circuit release is needed between 3G_MSC-A and MSC-B.

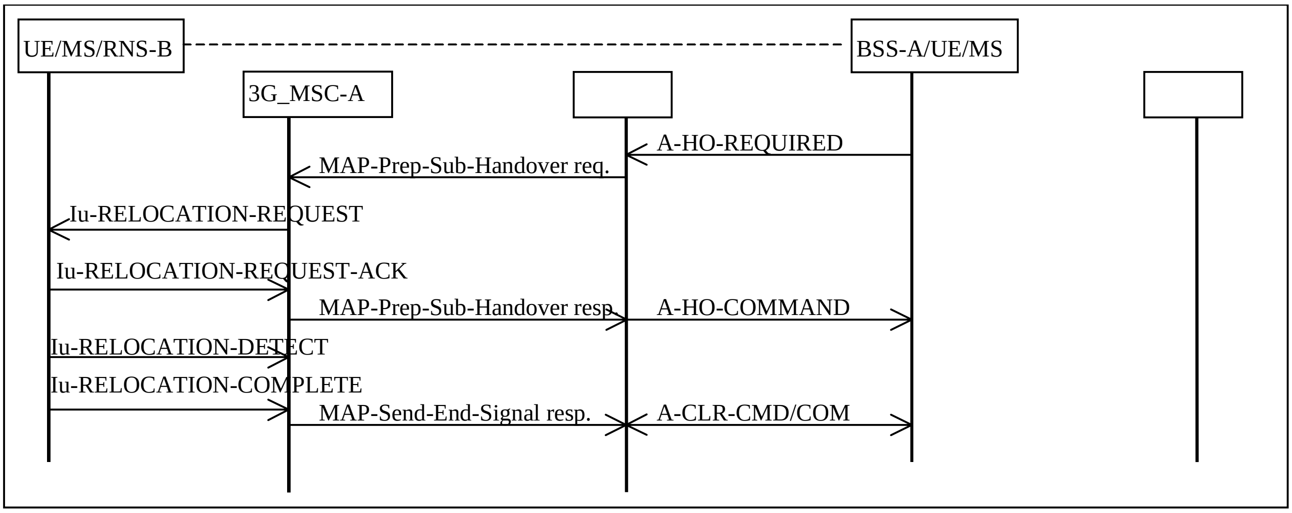


Figure 28: Subsequent GSM to UMTS handover procedure i): Successful handover from MSC-B to 3G_MSC-A not requiring a circuit connection

8.2.4.2 Description of subsequent GSM to UMTS handover procedure without circuit connection ii): MSC-B to 3G_MSC-B'

The procedure for successful GSM to UMTS handover from MSC-B to 3G_MSC-B' is shown in figure 29.

The procedure consists of two parts:

- a subsequent handover from MSC-B back to MSC-A as described in subclause 7.4.1 (MSC-A can also be a 3G_MSC, the procedure is the same in both cases); and

- a basic GSM to UMTS handover from MSC-A to 3G_MSC-B' as described in subclause 8.2.2.

The only difference to the equivalent figure 27 is the omission of the circuit and handover number allocation signallings.

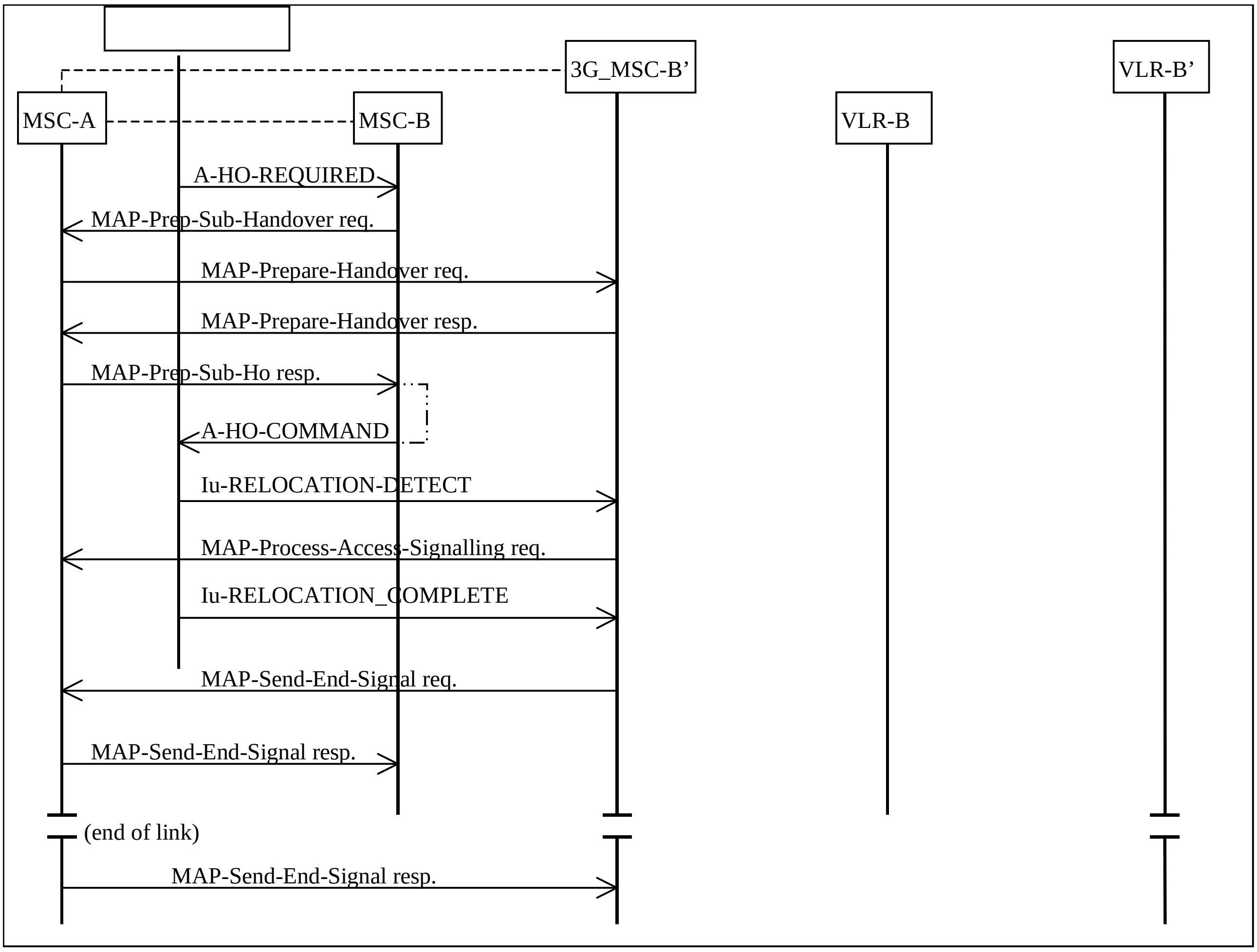


Figure 29: Subsequent GSM to UMTS handover procedure ii): Successful handover from MSC-B to 3G_MSC-B' without circuit connection

8.3 SRNS Relocation

The following subclauses describe two options for the Basic and Subsequent Relocation procedures. The first, as described in subclauses 8.3.1 and 8.3.3 respectively, provides for a circuit connection between 3G_MSC-A and 3G_MSC-B. The second, as described in subclauses 8.3.2 and 8.3.4 respectively, provides for a Basic and Subsequent Relocation without the provision of a circuit connection between 3G_MSC-A and 3G_MSC-B.

In all the above mentioned subclauses, the following principles apply:

- during the relocation resource allocation, only the handover related messages that are part of the applicable RANAP subset - as defined in ~~TS 29.108~~3GPP TS 29.108 [15] - shall be transferred on the E-interface;

- the trace related messages that are part of the applicable RANAP subset - as defined in ~~TS 29.108~~3GPP TS 29.108 [15] - can be sent by the 3G_MSC-A on the E-interface after successful relocation resource allocation. In the subclauses 8.3.1 and 8.3.2, it is however allowed at basic relocation initiation on the E-Interface to transfer one trace related message that is part of the applicable RANAP subset - as defined in ~~TS 29.108~~3GPP TS 29.108 [15] - together with the applicable relocation related message. The applicable relocation related message shall always appear as the first message;

- during the relocation execution, i.e. while the UE is not in communication with the network, the 3G_MSC-A shall queue all outgoing RANAP messages until the communication with the UE is resumed;

- finally, during supervision, i.e. while the UE is not in the area of 3G_MSC-A after a successful Inter-3G_MSC relocation, the subset of RANAP procedures and their related messages - as defined in ~~TS 29.108~~3GPP TS 29.108 [15] - shall apply on the E-Interface;

- during the intra-3G_MSC-B relocation execution, if any, the 3G_MSC-B shall queue all outgoing RANAP messages until the communication with the UE is resumed.

8.3.1 Basic relocation procedure requiring a circuit connection between 3G_MSC-A and 3G_MSC-B

The procedure used for successful Inter-3G_MSC SRNS relocation is shown in figure 30. Initiation of the relocation procedure is described in clause 5. The procedure described in this subclause makes use of messages from the ~~TS 25.413~~3GPP TS 25.413 [11] and of the transport mechanism from the Mobile Application Part (MAP) (~~Technical Specification TS 29.002~~3GPP TS 29.002 [12]). After an Inter-3G_MSC SRNS relocation further Intra-3G_MSC relocations may occur on 3G_MSC-B, these relocations will follow the procedures specified in a previous clause.

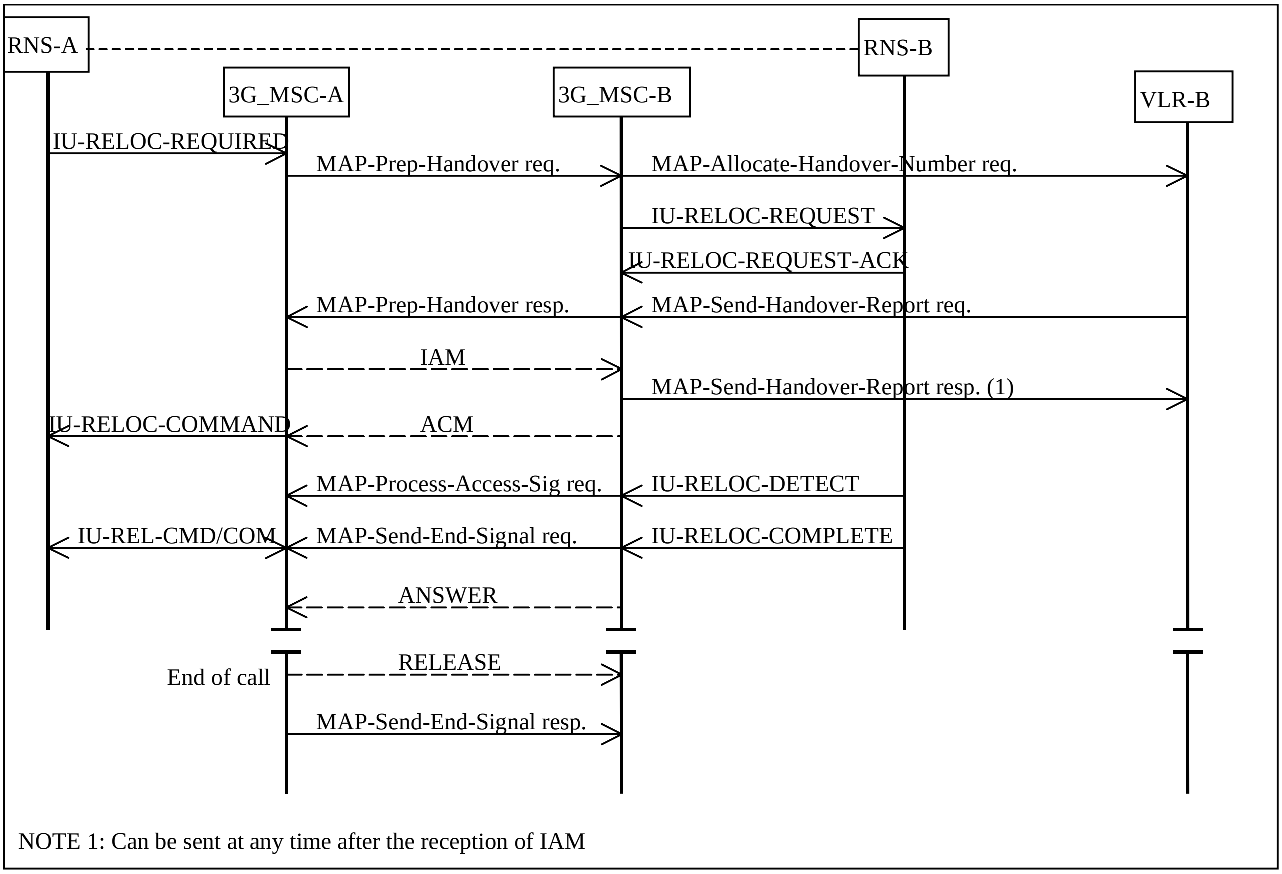


Figure 30: Basic SRNS Relocation Procedure requiring a circuit connection

8.3.1.1 With one circuit connection

The relocation is initiated as described in subclause 6.2.3. (This is represented by IU-RELOC-REQUIRED in figure 30). Upon receipt of the IU-RELOC-REQUIRED from RNS-A, 3G_MSC-A shall send a MAP-PREPARE-HANDOVER request to 3G_MSC-B including a complete IU-RELOC-REQUEST message. (NOTE: 3G_MSC-A shall not send further MAP-PREPARE-HANDOVER requests while a MAP-PREPARE-HANDOVER response is pending or before any timeouts). The MAP-PREPARE-HANDOVER request shall carry in the IU-RELOC-REQUEST all information needed by 3G_MSC-B for allocating radio resources in the case of SRNS relocation without Iur interface, see ~~TS 25.413~~3GPP TS 25.413 [11].

3G_MSC-A shall configure the RANAP RAB parameters according to the current selected codec.

MAP-PREPARE-HANDOVER request shall also carry the identity of the target RNS to which the call is to be relocated, see ~~TS 29.002~~3GPP TS 29.002 [12]. 3G_MSC-B will return the MAP-PREPARE-HANDOVER response after having retrieved one or several Handover Numbers from its associated VLR (exchange of the messages MAP-allocate-handover-number request and MAP-send-handover-report request), 3G_MSC-B shall connect a transcoder. The Handover Numbers shall be used for routing the connections of the calls from 3G_MSC-A to 3G_MSC-B. If radio resources are available in 3G_MSC-B, the MAP-PREPARE-HANDOVER response sent to 3G_MSC-A will contain the complete IU-RELOC-REQUEST-ACKNOWLEDGE message received from RNS-B, containing the radio resources definition to be sent by RNS-A to the UE (in case of relocation without Iur interface) and possible extra RANAP information, amended by 3G_MSC-B due to the possible interworking between the RANAP protocol carried on the E-interface and the RANAP protocol used on the Iu-interface. If the radio resource allocation is not possible, the MAP-PREPARE-HANDOVER response containing an IU-RELOCATION-FAILURE will be sent to 3G_MSC-A. 3G_MSC-B will do the same if a fault is detected on the identity of the RNS where the call has to be relocated. 3G_MSC-B simply reports the events related to the dialogue. It is up to 3G_MSC-A to decide the action to perform if it receives negative responses or the operation fails due to the expiry of the MAP-PREPARE-HANDOVER timer.

If an error related to the TCAP dialogue or to the MAP-PREPARE-HANDOVER request is returned from 3G_MSC-B, this will be indicated to 3G_MSC-A and 3G_MSC-A will terminate the relocation attempt. The existing connection to the UE shall not be cleared.

When the IU-RELOC-REQUEST-ACKNOWLEDGE has been received, 3G_MSC-A shall establish a circuit between 3G_MSC-A and 3G_MSC-B by signalling procedures supported by the network. In figure 30 this is illustrated by the messages IAM (Initial Address Message) and ACM (Address Complete Message) of Signalling System no 7. 3G_MSC-B awaits the capturing of the UE (subclause 6.2.3) on the radio path when the ACM is sent and 3G_MSC-A initiates the relocation execution when ACM is received (illustrated by the IU-RELOC-COMMAND and described in the subclause 6.2.3). 3G_MSC-A shall remove the transcoder between the MSC and other party.

3G_MSC-B transfers to 3G_MSC-A the acknowledgement received from the correct UE (IU-RELOC-DETECT/IU-RELOC-COMPLETE). The IU-RELOC-DETECT, if received, is transferred to 3G_MSC-A using the MAP-PROCESS-ACCESS-SIGNALLING request. The IU-RELOC-COMPLETE, when received from the correct UE, is included in the MAP-SEND-END-SIGNAL request and sent back to 3G_MSC-A. The circuit is through connected in 3G_MSC-A when the IU-RELOC-DETECT or the IU-RELOC-COMPLETE is received from 3G_MSC-B. The old radio resources are released when the IU-RELOC-COMPLETE message is received from 3G_MSC-B. The sending of the MAP-SEND-END-SIGNAL request starts the MAP supervision timer for the MAP dialogue between 3G_MSC-A and 3G_MSC-B. When the MAP-SEND-END-SIGNAL request including the IU-RELOC-COMPLETE message is received in 3G_MSC-A, the resources in RNS-A shall be released.

In order not to conflict with the PSTN/ISDN signalling system(s) used between 3G_MSC-A and 3G_MSC-B, 3G_MSC-B must generate an answer signal when IU-RELOC-DETECT/COMPLETE is received.

3G_MSC-B shall release the Handover Number when the circuit between 3G_MSC-A and 3G_MSC-B has been established.

If the circuit between 3G_MSC-A and 3G_MSC-B cannot be established, (e.g. an unsuccessful backward message is received instead of ACM) 3G_MSC-A terminates the inter-3G_MSC relocation attempt by sending an appropriate MAP message, for example an ABORT.

3G_MSC-A shall retain overall call control until the call is cleared by the fixed subscriber or the UE and there is no further call control functions to be performed (e.g. servicing waiting calls, echo cancellers).

When 3G_MSC-A clears the call to the UE it also clears the call control functions in 3G_MSC-A and sends the MAP-SEND-END-SIGNAL response to release the MAP resources in 3G_MSC-B.

3G_MSC-A may terminate the procedure at any time by sending an appropriate MAP message to 3G_MSC-B. If establishment of the circuit between 3G_MSC-A and 3G_MSC-B has been initiated, the circuit must also be cleared.

The relocation will be aborted by 3G_MSC-A if it detects release or interruption of the radio path before the call has been established on 3G_MSC-B.

8.3.1.2 With multiple circuit connections (Optional functionality)

8.3.1.2.1 3G_MSC-B does not support multiple bearers

If 3G_MSC-A supports the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A shall have the following functionality additionally to the description in section 8.3.1.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-A, 3G_MSC-A generates IU-RELOCATION-REQUEST and sends a MAP-PREPARE-HANDOVER request to 3G_MSC-B including the IU-RELOCATION-REQUEST message, which may include multiple bearers. If 3G_MSC-A receives an indication that 3G_MSC-B does not support multiple bearers, 3G_MSC-A shall select one bearer to be handed over if the UE is engaged with multiple bearers. 3G_MSC-A reconstructs IU-RELOCATION-REQUEST and sends again a MAP-PREPARE-HANDOVER request to 3G_MSC-B including the IU-RELOCATION-REQUEST message, which includes only the selected bearer.

When MAP-PREPARE-HANDOVER response including an IU-RELOCATION-REQUEST-ACK is received from 3G_MSC-B, 3G_MSC-A sends IU-RELOCATION-COMMAND, which indicates the bearers not to be handed over as bearers to be released, to RNS-A.

After 3G_MSC-A receives MAP-SEND-END-SIGNAL request from 3G_MSC-B, 3G_MSC-A shall release calls via 3G_MSC-B, which has been carried by the bearers not to be handed over, and then 3G_MSC-A sends IU-RELEASE-COMMAND to RNS-A.

8.3.1.2.2 3G_MSC-B supports multiple bearers

If 3G_MSC-A and 3G_MSC_B support the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A and 3G_MSC-B shall have the following functionality additionally to the description in section 8.3.1.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-A, 3G_MSC-A generates IU-RELOCATION-REQUEST and sends a MAP-PREPARE-HANDOVER request to 3G_MSC-B including the IU-RELOCATION-REQUEST message, which may include multiple bearers.

When MAP-PREPARE-HANDOVER request including an IU-RELOCATION-REQUEST message is received by the 3G_MSC-B and the number of bearers included in the IU-RELOCATION-REQUEST message has exceeded the maximum number of bearers supported by 3G_MSC-B, the 3G_MSC-B shall select several bearers so that the number of bearers will fulfil the range of 3G_MSC-B capability. In this case 3G_MSC-B shall reconstruct IU-RELOCATION-REQUEST message to cope with the capability of 3G_MSC-B. The 3G_MSC-B shall retrieve multiple Handover Numbers from its associated VLR (exchange of the messages MAP-allocate-handover-number request and MAP-send-handover-report request several times). The number of Handover Numbers depends on the number of RAB IDs in the reconstructed IU-RELOCATION-REQUEST.

After the completion of Handover Number allocation 3G_MSC-B may select several bearers and reconstruct IU-RELOCATION-REQUEST again if the number of successfully allocated Handover Numbers is less than the number of required bearers, and sends IU-RELOCATION-REQUEST to RNS-B.

After the reception of IU-RELOCATION-REQUEST-ACK from RNS-B, the 3G_MSC-B shall generate Relocation Number List, which includes couples of RAB ID (See ~~TS 25.413~~3GPP TS 25.413 [11]) and Handover Number successfully allocated. Then the 3G_MSC-B sends MAP-PREPARE-HANDOVER response including Relocation Number List back to the 3G_MSC-A.

Upon receipt of the MAP-PREPARE-HANDOVER response 3G_MSC-A shall establish circuits between 3G_MSC-A and 3G_MSC-B by signalling procedures supported by the network according to the Relocation Number List. When 3G_MSC-A receives all the results from attempted circuits (the results may be successful ACM message or unsuccessful backward message for each attempt) and if at least one circuit has been successfully established, 3G_MSC-A sends IU-RELOCATION-COMMAND, which indicates the bearers failed to set up in RNS-B and the bearers associated with circuits which has failed to set up as bearers to be released, to RNS-A.

After 3G_MSC-A receives MAP-SEND-END-SIGNAL request from 3G_MSC-B, 3G_MSC-A shall release calls via 3G_MSC-B, which has been carried by the bearers failed to set up in RNS-B and the bearers associated with circuits which has failed to set up, and then 3G_MSC-A sends IU-RELEASE-COMMAND to RNS-A.

If no circuit connection has been successfully established 3G_MSC-A terminates the inter-3G_MSC relocation attempt by sending an appropriate MAP massage, for example ABORT.

8.3.2 Basic relocation procedure not requiring the establishment of a circuit connection between 3G_MSC-A and 3G_MSC-B

The basic SRNS relocation procedures to be used when no circuit connection is required by 3G_MSC-A are similar to those described in subclause 8.3.1 for circuit switched calls. The main differences to the procedures described in subclause 8.3.1 relate to the establishment of circuits between the network entities and the Handover Number allocation.

In the case of basic relocation, 3G_MSC-A shall specify to 3G_MSC-B that no Handover Number is required in the MAP-PREPARE-HANDOVER request (see ~~TS 29.002~~3GPP TS 29.002 [12]). As for the basic relocation using a circuit connection, the IU-RELOC-REQUEST is transmitted at the same time together with the identity of the target RNS to which the call is to be relocated. Any subsequent Handover Number allocation procedure will not be invoked until the completion of the basic relocation procedure (see clause: Subsequent Channel Assignment using a circuit connection). 3G_MSC-B shall then perform the radio resources allocation as described in subclause 8.3.1 if applicable. The MAP-PREPARE-HANDOVER response shall be returned to 3G_MSC-A including either the response of the radio resources allocation request received from RNS-B (IU-RELOC-REQUEST-ACKNOWLEDGE/IU-RELOC-FAILURE with possible extra RANAP information. This extra information is amended by 3G_MSC-B due to the possible interworking between the RANMAP protocol carried on the E-interface and the RANAP protocol used on the Iu-interface). The basic relocation procedure will continue as described in subclause 8.3.1 except that no circuit connection will be established towards 3G_MSC-B.

The relevant case for the basic relocation without circuit connection is shown in figure 31. As can be seen the major differences to the equivalent figure 30 are the omission of any circuit establishment messaging and the omission of handover number allocation signalling.

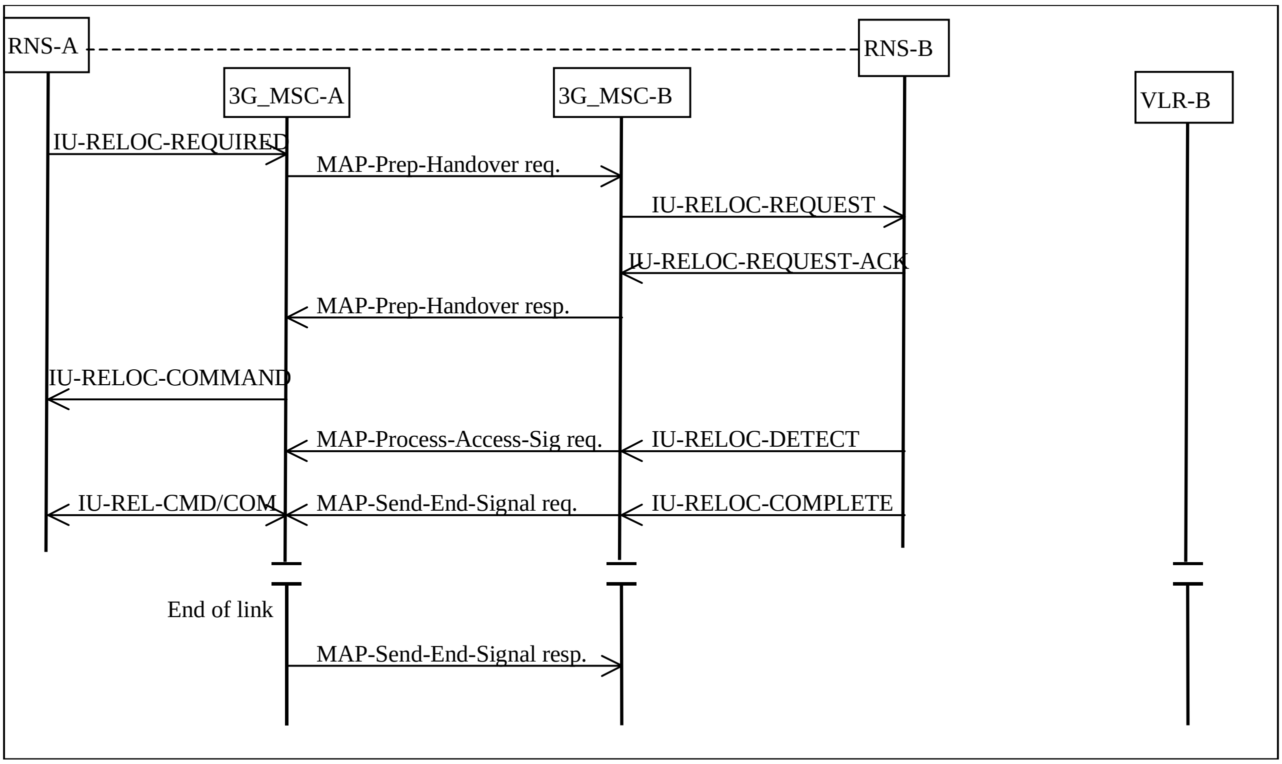


Figure 31: Basic SRNS relocation procedure without a circuit connection

8.3.3 Procedure for subsequent relocation requiring a circuit connection between 3G_MSC-A and 3G_MSC-B

After the call has been relocated from 3G_MSC-A to 3G_MSC-B, if the UE leaves the area of 3G_MSC-B during the same call, subsequent relocation is necessary in order to continue the connection when no Iur interface exists between the involved RNSs, or to optimise the transmission path when the Iur interface is used.

The following cases apply:

i) the UE moves back to the area of 3G_MSC-A;

ii) the UE moves into the area of a third 3G_MSC (3G_MSC-B').

In both cases the call is switched in 3G_MSC-A; the circuit between 3G_MSC-A and 3G_MSC-B shall be released after a successful subsequent relocation has been performed.

8.3.3.1 Description of subsequent relocation procedure i): 3G_MSC-B to 3G_MSC-A

The procedure for successful relocation from 3G_MSC-B back to 3G_MSC-A is shown in figure 32.

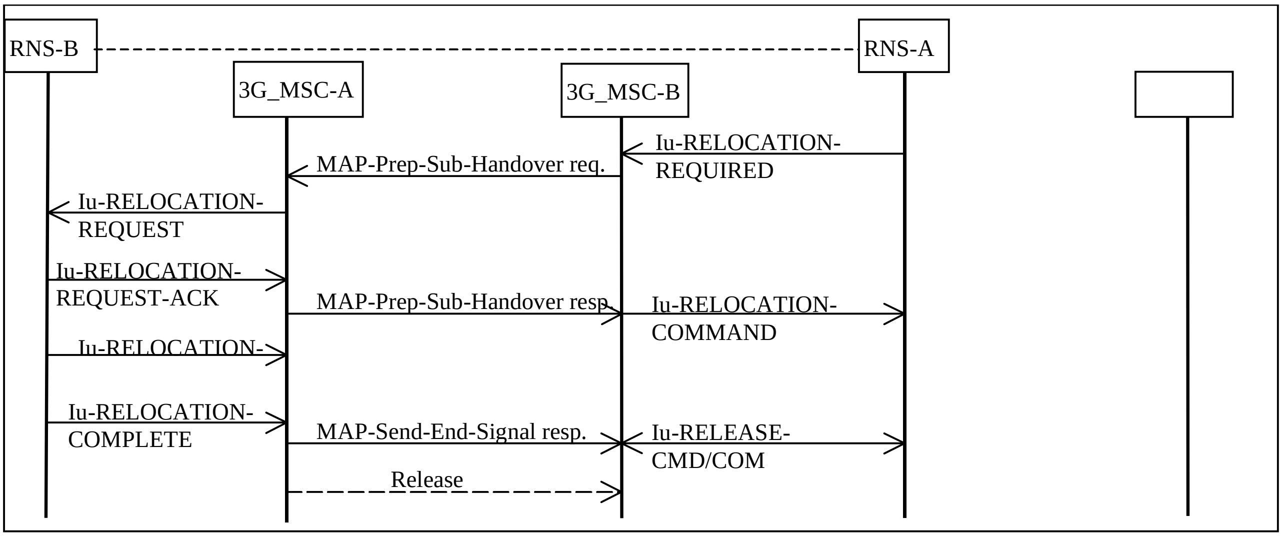


Figure 32: Subsequent relocation procedure i) successful relocation from 3G_MSC-B to 3G_MSC-A using a circuit connection

8.3.3.1.1 With one circuit connection

The procedure is as follows.

3G_MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to 3G_MSC-A indicating the new 3G_MSC number (3G_MSC-A number), indicating also the identity of the target RNS where the call has to be relocated and including a complete IU-RELOC-REQUEST message.

NOTE: 3G_MSC-B shall not send further MAP-PREPARE-SUBSEQUENT-HANDOVER requests while a relocation attempt is pending or before any timeouts.

Since 3G_MSC-A is the call controlling 3G_MSC, this 3G_MSC needs no Handover Number for routing purposes; 3G_MSC-A can immediately initiate the relocation towards the target RNS.

When relocation can be initiated, 3G_MSC-A shall return in the MAP-PREPARE-SUBSEQUENT-HANDOVER response the complete IU-RELOC-REQUEST-ACKNOWLEDGE message received from the RNS-B and possible extra RANAP information, amended by 3G_MSC-A due to the possible interworking between the RANAP protocol carried on the E-interface and the RANAP protocol used on the Iu-interface. If a radio resource cannot be assigned or if a fault is detected on the target RNS identity, or the target RNS identity in the IU-RELOC-REQUEST is not consistent with the target 3G_MSC number, the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing an IU-

RELOC-FAILURE message shall be given to 3G_MSC-B, in addition 3G_MSC-B shall maintain the connection with the UE.

If the procedure in 3G_MSC-A is successful then 3G_MSC-B can request the UE to retune to the new RNS-B on 3G_MSC-A in the case of relocation without Iur interface, or request RNS-B to become serving RNS in the case of relocation with Iur interface. This is illustrated in figure 32 by the IU-RELOC-COMMAND message. The operation is successfully completed when 3G_MSC-A receives the IU-RELOC-COMPLETE message.

3G_MSC-A shall insert a transcoder at successful subsequent relocation back to 3G_MSC-A.

After relocation 3G_MSC-A shall release the circuit to 3G_MSC-B.

3G_MSC-A must also terminate the MAP procedure for the basic relocation between 3G_MSC-A and 3G_MSC-B by sending an appropriate MAP message. 3G_MSC-B will release the resources in RNS-A when the MAP-SEND-END-SIGNAL response is received.

8.3.3.1.2 With multiple circuit connections (Optional functionality)

If 3G_MSC-A and 3G_MSC_B support the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A and 3G_MSC-B shall have the following functionality additionally to the description in section 8.3.3.1.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-A, 3G_MSC-B generates IU-RELOCATION-REQUEST which may include several bearers and sends it to 3G_MSC-A over MAP-PREPARE-SUBSEQUENT-HANDOVER request.

3G_MSC-A sends IU-RELOCATION-REQUEST to RNS-B and receives IU-RELOCATION-REQUEST-ACK.

When MAP-PREPARE-SUBSEQUENT-HANDOVER response is received from 3G_MSC-A, 3G_MSC-B sends IU-RELOCATION-COMMAND, which indicates the bearers failed to set up in RNS-B as bearers to be released, to RNS-A.

After 3G_MSC-A receives IU-RELOCATION-COMPLETE message from RNS-B, 3G_MSC-A shall release calls via RNS-B, which has been carried by the bearers failed to set up in RNS-B, and then 3G_MSC-A sends MAP-SEND-END-SIGNAL response to 3G_MSC-B.

8.3.3.2 Description of subsequent relocation procedure ii): 3G_MSC-B to 3G_MSC-B'

The procedure for successful relocation from 3G_MSC-B to 3G_MSC-B' is shown in figure 33.

The procedure consists of two parts:

- a subsequent relocation from 3G_MSC-B back to 3G_MSC-A as described in subclause 8.3.3.1; and
- a basic relocation from 3G_MSC-A to 3G_MSC-B' as described in subclause 8.3.1.

8.3.3.2.1 With one circuit connection

3G_MSC-B sends the MAP-PREPARE-SUBSEQUENT-HANDOVER request to 3G_MSC-A indicating a new 3G_MSC number (which is the identity of 3G_MSC-B'), indicating also the target RNS identity and including a complete IU-RELOC-REQUEST, 3G_MSC-A then starts a basic relocation procedure towards 3G_MSC-B'.

When 3G_MSC-A receives the ACM from 3G_MSC-B', 3G_MSC-A informs 3G_MSC-B that 3G_MSC-B' has successfully allocated the radio resources on RNS-B' side by sending the MAP-PREPARE-SUBSEQUENT-HANDOVER response containing the complete IU-RELOC-REQUEST-ACKNOWLEDGE received from RNS-B' and possible extra RANAP information, amended by 3G_MSC-A due to the possible interworking between the RANAP protocol carried on the E-interface between 3G_MSC-A and 3G_MSC-B' and the RANAP protocol carried on the E-interface between 3G_MSC-A and 3G_MSC-B. Now 3G_MSC-B can start the procedure on the radio path if needed.

For 3G_MSC-A the relocation is completed when it has received the MAP-SEND-END-SIGNAL REQUEST from 3G_MSC-B'containing the IU-RELOC-COMPLETE received from the RNS-B'. The circuit between 3G_MSC-A and 3G_MSC-B is released. 3G_MSC-A also sends the MAP-SEND-END-SIGNAL response to 3G_MSC-B in order to terminate the original MAP dialogue between 3G_MSC-A and 3G_MSC-B. 3G_MSC-B releases the radio resources when it receives this message.

If no radio resource can be allocated by 3G_MSC-B' or no circuit between 3G_MSC-A and 3G_MSC-B' can be established or a fault is detected on the target RNS identity or the target RNS identity in the IU-RELOC-REQUEST is not consistent with the target 3G_MSC number, 3G_MSC-A informs 3G_MSC-B by using the IU-RELOC-FAILURE message included in the MAP-PREPARE-SUBSEQUENT-HANDOVER response. 3G_MSC-B shall maintain the existing connection with the UE.

When the subsequent relocation is completed, 3G_MSC-B' is considered as 3G_MSC-B. Any further inter-3G_MSC relocation is handled as described above for a subsequent relocation.

8.3.3.2.2 With multiple circuit connections (Optional functionality)

If 3G_MSC-A and 3G_MSC-B support the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A and 3G_MSC-B shall have the following functionality additionally to the description in section 8.3.3.2.1.

Upon receipt of the IU-RELOCATION-REQUIRED from RNS-B 3G_MSC-B generates an IU-RELOCATION-REQUEST message which may include multiple bearer and sends it to 3G_MSC-A over MAP-PREPARE-SUBSEQUENT-HANDOVER request.

Upon receipt of the MAP-PREPARE-SUBSEQUENT-HANDOVER request from 3G_MSC-B, 3G_MSC-A starts a basic relocation procedure towards 3G_MSC-B'.

8.3.3.2.2.1 3G_MSC-B' does not support multiple bearers

If 3G_MSC-A receives an indication that 3G_MSC-B' does not support multiple bearers, 3G_MSC-A shall select one bearer to be handed over. 3G_MSC-A reconstructs IU-RELOCATION-REQUEST and sends again a MAP-PREPARE-HANDOVER request to 3G_MSC-B' including the IU-RELOCATION-REQUEST message, which includes only the selected bearer. Upon receipt of MAP-PREPARE-HANDOVER response from 3G_MSC-B', 3G_MSC-A shall reconstructs IU-RELOCATION-REQUEST-ACK to indicate the bearers not to be handed over as the bearers failed to set up in IU-RELOCATION-REQUEST-ACK and send it over MAP-PREPARE-SUBSEQUENT-HANDOVER response to 3G_MSC-B.

When MAP-PREPARE-SUBSEQUENT-HANDOVER response is received from 3G_MSC-A 3G_MSC-B sends IU-RELOCATION-COMMAND, which indicates the bearers failed to set up as bearers to be released, to RNS-A.

After 3G_MSC-A receives MAP-SEND-END-SIGNAL request from 3G_MSC-B', 3G_MSC-A shall release calls via 3G_MSC-B', which has been carried by the bearers failed to set up, and then 3G_MSC-A sends MAP-SEND-END-SIGNAL response to 3G_MSC-B.

8.3.3.2.2.2 3G_MSC-B' supports multiple bearers

If some of circuit connections failed to set up between 3G_MSC-A and 3G_MSC-B', 3G_MSC-A shall reconstruct IU-RELOCATION-REQUEST-ACK message so that the IU-RELOCATION-REQUEST-ACK includes only the bearers which have successfully established circuit connection and sends it to 3G_MSC-B over MAP-PREPARE-SUBSEQUENT-HANDOVER response.

When MAP-PREPARE-SUBSEQUENT-HANDOVER response is received from 3G_MSC-A 3G_MSC-B sends IU-RELOCATION-COMMAND, which indicates the bearers failed to set up as bearers to be released, to RNS-A.

After 3G_MSC-A receives MAP-SEND-END-SIGNAL request from 3G_MSC-B', 3G_MSC-A shall release calls via 3G_MSC-B', which has been carried by the bearers failed to set up, and then 3G_MSC-A sends MAP-SEND-END-SIGNAL response to 3G_MSC-B.

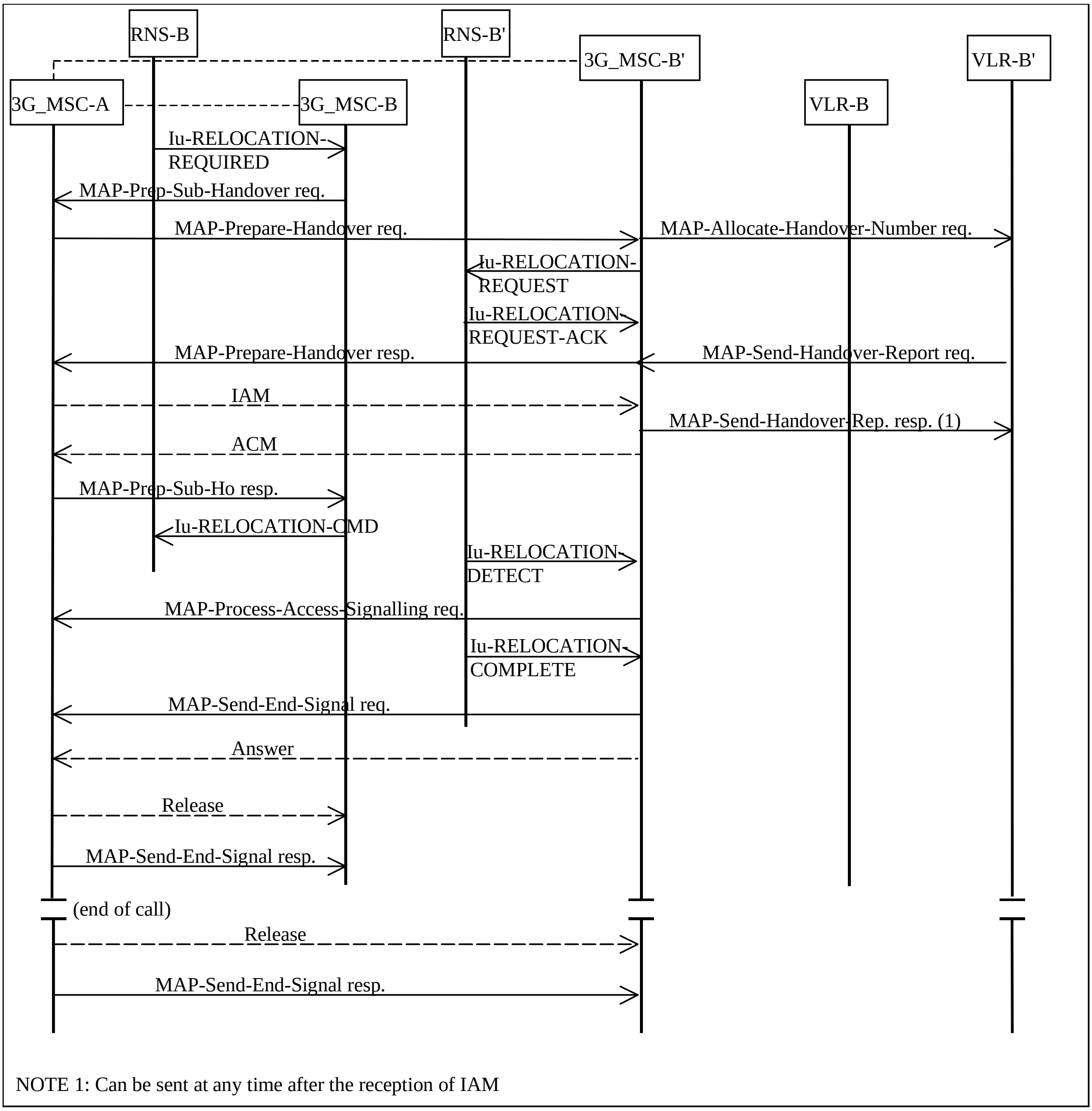


Figure 33: Subsequent relocation procedure ii) Successful SRNS relocation from 3G_MSC-B to 3G_MSC-B' requiring a circuit connection

8.3.4 Procedure for subsequent relocation not requiring a circuit connection between 3G_MSC-A and 3G_MSC-B

As for the subsequent relocation with a circuit connection between 3G_MSC-A and 3G_MSC-B, the same two cases of subsequent relocation apply:

i) the UE moves back to the area of 3G_MSC-A;

ii) the UE moves into the area of a third 3G_MSC (3G_MSC-B').

8.3.4.1 Description of subsequent relocation procedure i): 3G_MSC-B to 3G_MSC-A

The procedure for successful relocation from 3G_MSC-B back to 3G_MSC-A without circuit connection is shown in figure 34. The only difference with the figure 32 is that no circuit release is needed between 3G_MSC-A and 3G_MSC-B.

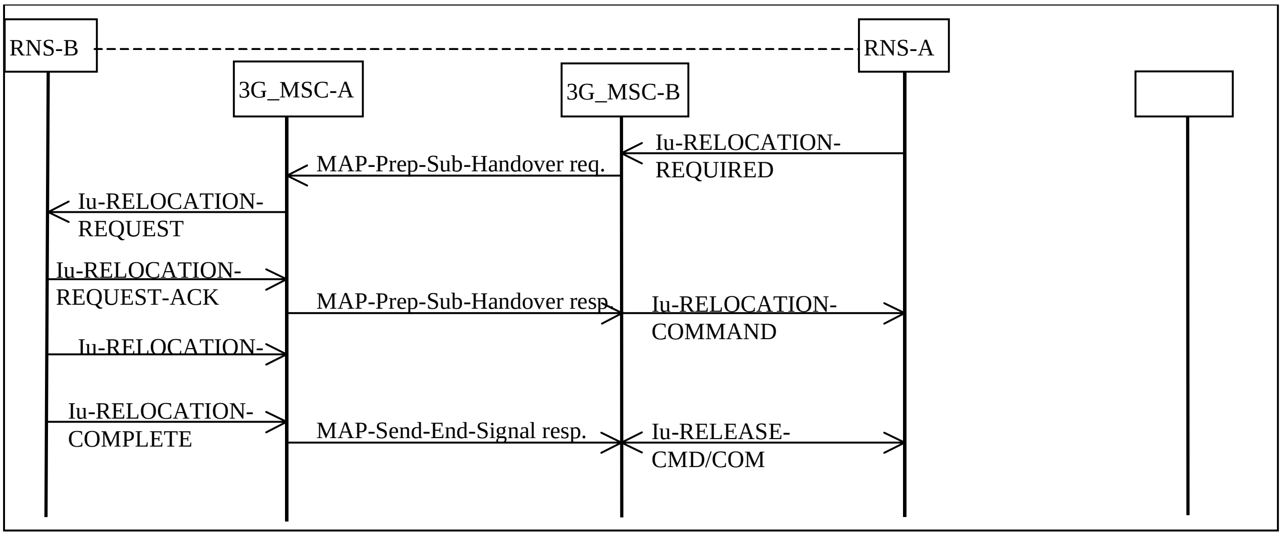


Figure 34: Subsequent relocation procedure i) successful relocation from 3G_MSC-B to 3G_MSC-B not requiring a circuit connection

8.3.4.2 Description of subsequent relocation procedure ii): 3G_MSC-B to 3G_MSC-B''

The procedure for successful relocation from 3G_MSC-B to 3G_MSC-B' is shown in figure 35.

The procedure consists of two parts:

- a subsequent relocation from 3G_MSC-B back to 3G_MSC-A as described in subclause 8.3.4.1; and
- a basic relocation from 3G_MSC-A to 3G_MSC-B' as described in subclause 8.3.2.

The only difference to the equivalent figure 33 is the omission of the circuit and handover number allocation signallings.

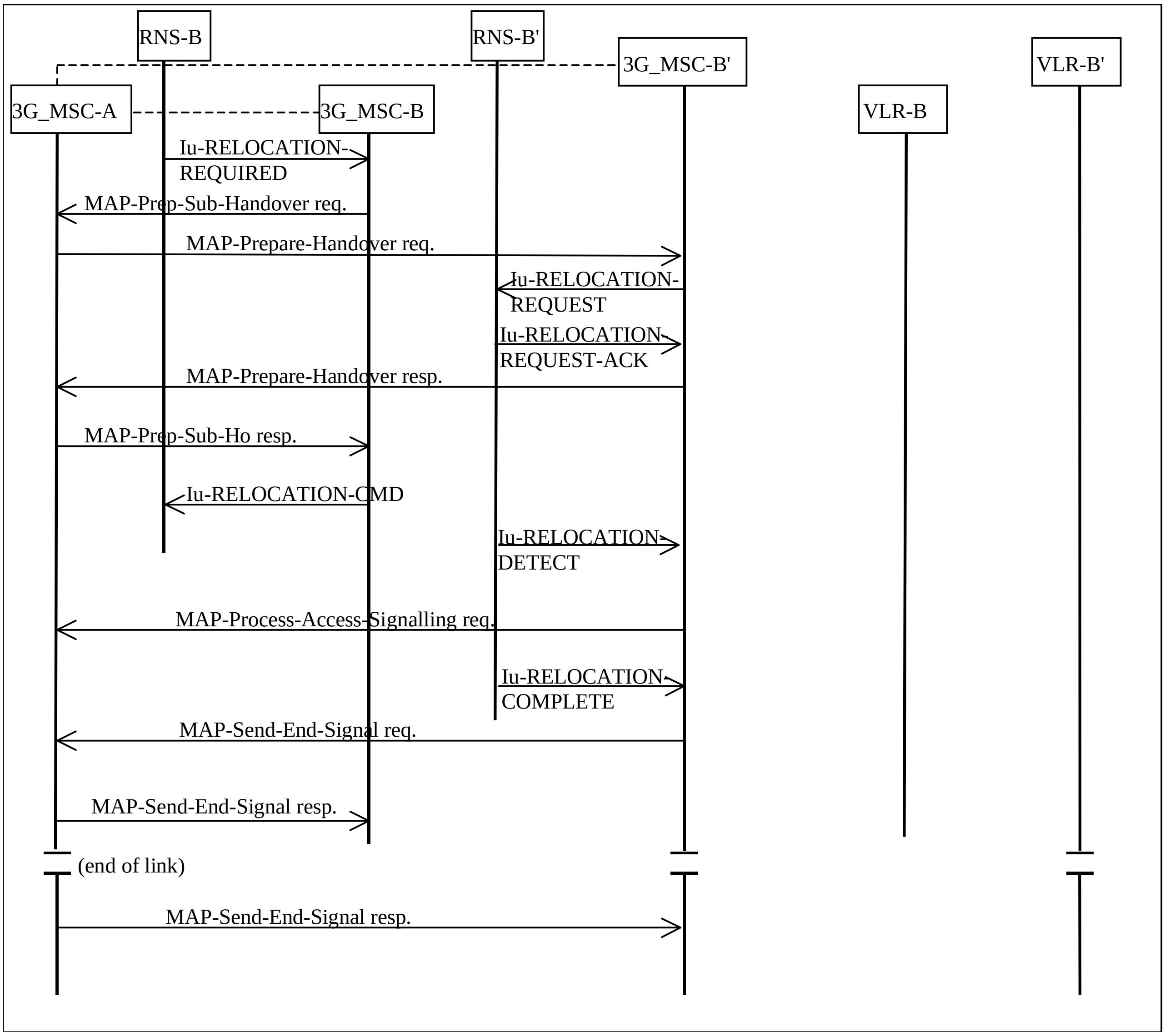


Figure 35: Subsequent relocation procedure ii) Successful SRNS relocation from 3G_MSC-B to 3G_MSC-B' not requiring a circuit connection

9 Detailed procedures in MSC-A

9.1 BSS/MSC and MS/MSC procedures in MSC-A (functional unit 1)

The handover procedures in this functional unit consist of:

i) signalling between the MS and the MSC;

ii) signalling between the BSS and the MSC for access management.

9.2 Call control procedures MSC-A (functional unit 2)

The call control procedures related to handover in MSC-A can be divided into two functional entities:

- the first entity is the call control procedure as part of the normal interworking between the PSTN/ISDN and the PLMN; for an MS originating call MSC-A is the originating exchange, for an MS terminating call MSC-A is the destination exchange;

- the second entity is the call control procedure for the connection between MSC-A and MSC-B in case of a handover from MSC-A to MSC-B. For this call control procedure the following applies.

Call set-up

- the connection to MSC-B is set up by procedures relevant to the signalling system used in the PSTN/ISDN to which MSC-A is connected. The call is set up by using the MS Handover Number received from MSC-B as part of the MAP procedure;

- the call set-up direction will always be from MSC-A to MSC-B, even when the call was originally established by the MS. Functional unit 2 (see figure 2) should therefore keep information on call set-up direction in order to be able to interpret correctly any clearing signals (see below);

- the unit should indicate the address complete condition to functional unit 3 and through-connect without awaiting the answer signal from MSC-B. This applies also to signalling systems where address complete signals are not supported. In such cases an artificial address complete is established by functional unit 2.

Call clearing

- call clearing consists of two parts: after inter-MSC handover, clearing of the MS-BSS connection and clearing of the inter-MSC connection. If a request to release the call is generated by the network while the MS is re-tuning from one BSS to another BSS, then MSC-A shall begin clearing the call to the network and queue the call release to the MS until the MS has resumed communication. This includes the case when MSC-B and/or MSC-B' are involved;

- the MAP procedures are used to transfer information between MSC-B and MSC-A in order to maintain full call control within MSC-A. MSC-A determines, based on information received from MSC-B, the appropriate signals (according to ~~TS 24.008~~3GPP TS 24.008 [10]) to be sent to the MS, and sends this information to MSC-B;

- when MSC-A clears the call to the MS it also clears the call control functions in MSC-B and sends the MAP-SEND-END-SIGNAL response to release the MAP resources in MSC-B. The clearing of the connection is by procedures relevant to the signalling system in the PSTN/ISDN to which MSC-A is connected;

- when the Signalling System no 7 ISDN User Part is used, the normal symmetric release procedures apply on both the connection to the fixed network and to MSC-B;

- when a signalling system is used without a symmetric release possibility, some notice should be given to the clear-forward and clear-back procedures;

- for MS terminating calls the following conditions apply on clear-forward and clear-back:

  - when a clear-forward signal is received on interface B' (see figure 1), MSC-A clears the circuit to MSC-B by normal clear-forward procedures;

  - when a clear-back signal is received from MSC-B, MSC-A starts normal clear-back procedures towards the fixed network (interface B') and sends the clear-forward signal on interface B" in order to clear the connection with MSC-B.

NOTE 1: This case corresponds to a fault situation.

- for MS originated calls the following applies:

  - when MSC-A receives a clear-back signal from MSC-B, this signal must be interpreted as indicating a clear-forward condition. MSC-A then clears both the connection on interface B' (see figure 1) and to MSC-B by normal clear-forward procedures.

NOTE 2: This case corresponds to a fault situation.

- when MSC-A receives a clear-back signal on interface B', MSC-A should distinguish between national and international connections:
  - for international connections where the Q.118 [1] supervision is done in the ISC, MSC-A sends a clear-forward signal on both interface B' to the fixed network and interface B" to MSC-B;
  - for national connections or for international connections where the Q.118 [1] supervision is not done in the ISC, a timer is started according to national practice for clear-back supervision and MSC-A proceeds as follows:
    - i) if a clear-back signal is received from MSC-B, MSC-A interprets this as indicating a clear-forward condition and proceeds by clearing the connections on interface B' and to MSC-B by normal clear-forward procedures;
    - ii) if the timer expires, MSC-A proceeds by normal clear-forward of the connections on interface B' and to MSC-B.

9.3 Handover control procedures MSC-A (functional unit 3)

The procedures of functional unit 3 are given in terms of SDL diagrams in figure 41. To easily distinguish the interface concerned the messages received or sent from this unit are prefixed with either 'MAP' for a MAP message, 'A' for an A-Interface message or 'I' for an ISDN/PSTN message.

The procedures of functional unit 3 include:

i) initiation. The initiation condition is shown by the signal A-HANDOVER-REQUIRED.

   The diagram also includes queuing when there is no channel available. Calls for which handover has been initiated should be queued with priority higher than normal calls. They should have lower priority than emergency calls.

ii) handover of calls within the area of MSC-A, i.e. handover case i). In this case MSC-A controls the procedures on both the previous and the new radio channel, using signals A-HANDOVER-REQUEST and A-HANDOVER-COMMAND. The handover procedure is completed when A-HANDOVER-COMPLETE is received. If this signal is not received, the radio path and the connection on interface B' are either released or the original connection is maintained.

   In the case of ongoing GSM voice group calls for subsequent users of the VGCS channel uplink the original connection shall always be maintained.

   For handover devices with three-party capabilities the handover device is first set up so that all interfaces A', A" and B' are connected (illustrated by the signal 'set up handover device'). This is done when the Handover Command is sent to the MS . The device is connected in its final position (i.e. A" to B' for case ii)) (illustrated by the signal 'connect handover device') when A-HANDOVER-COMPLETE is received.

iii) handover to MSC-B . This procedure is the one described in subclauses 7.1. and 7.2. For handover devices with three-party capabilities the handover device is set-up when MSC-A sends the Handover Command to the MS , i.e. the interfaces A', B' and B" are then connected. The device is connected in its final position (i.e. B' to B") when the successful procedure indication is received from functional unit 4.

iv) subsequent handover to MSC-A . The procedure is described in subclauses 7.3. and 7.4. When a handover to MSC-A indication is received from functional unit 4, the handover device is set up so that interfaces B', B" and A' are connected (for handover devices with three-party capabilities). When A-HANDOVER-COMPLETE is received, the device is connected in its final position (i.e. B' to A').

   If A-HANDOVER-COMPLETE is not received (expiry of timer T104), the handover device releases interface A' and returns to a position where B' and B" are connected.

v) subsequent handover to a third MSC (MSC-B') . The procedure is described in subclauses 7.3. and 7.4. The handover device is set up in its initial position, (i.e. interconnection of interfaces B', B" and B"') when the connection to MSC-B' has been established. MSC-B is informed via functional unit 4 that the connection has been established and that the procedure on the radio path can be initiated. The device is connected in its final position (i.e. B' to B"') when a successful procedure indication is received from functional unit 4. MSC-B is informed that all procedures in MSC-B can be terminated (illustrated by the MAP-SEND-END-SIGNAL response). The device returns to the state where B' and B" are connected if the subsequent handover procedure fails.

Timers in MSC-A.

The procedures are supervised by timers in order to avoid a deadlock when responses are not received or the procedures fail. The following timers are defined:

T101: this timer supervises the queuing time for a free channel. If T101 expires, a no channel indication is generated, a retry procedure could be applied as described in subclause 6.1. T101 is set by O&M,

T102: this timer supervises the time for handover completion for handover between BSSs in MSC-A. T102 is set by O&M,

T103: this timer supervises the time between issuing an A-HANDOVER-COMMAND from MSC-A and receiving a successful procedure indication from MSC-B. This timer also supervises the time between sending an A-HO-REQUEST-ACKNOWLEDGE to MSC-B and receiving a successful procedure indication from MSC-B'. If T103 expires, the handover procedure is terminated. T103 is set by O&M,

T104: this timer supervises the time between sending of an A-HO-REQUEST-ACKNOWLEDGE to MSC-B and receiving the A-HANDOVER-COMPLETE from BSS-B on MSC-A. If the timer expires, the new radio channel is released and the existing handover device connection to MSC-B is maintained. T104 is set by O&M.

9.4 MAP procedures in MSC-A (functional unit 4)

The MAP procedures for handover are defined in ~~Technical Specification TS 29.002~~3GPP TS 29.002 [12]. They include:

- procedures for basic handover;
- procedures for subsequent handover.

These procedures are as outlined in clause 7.

9.5 Interworking between Handover control procedures and MAP procedures in MSC-A

The interworking between the Handover control procedures and the MAP procedures for handover is defined in ~~Technical Specification GSM~~ 3GPP TS ~~09.10~~29.010 [8]. It includes:

- interworking at basic handover initiation;
- interworking at subsequent handover completion.

This interworking is not described in the present document.

9.6 Compatibility with GSM Phase 1

If the MSC-A initiates an Inter-MSC handover procedure according to Phase 2 MAP and BSSMAP protocols while using a Phase 1 BSSMAP protocol towards BSS-A, MSC-A has to perform the protocol interworking.

The same holds if a Phase 2 BSSMAP protocol is used between MSC-A and BSS-A and the E-interface supports only Phase 1 protocol.

10 Detailed procedures in MSC-B

10.1 BSS/MSC (MS/BSS) procedures MSC-B (functional unit 1)

The handover procedures in this functional unit consist of:

i) signalling between the MS and the MSC;

ii) signalling between the BS and the MSC for access management.

Signals exchanged with functional unit 3 are indicated in subclause 10.3.

10.2 Call control procedures MSC-B (functional unit 2)

These procedures relate to the call control in MSC-B of the "handover" connection with MSC-A. For these procedures the following apply:

Call set-up:

- the connection is set up by MSC-A. MSC-B should provide, if possible, the following backward signals:
    - signals indicating unsuccessful call set-up and, if possible, the cause of call failure;
    - address complete signal;
    - answer signal (see note).

NOTE: The answer signal is not related to answering by the MS and it has no meaning in the handover procedure between MSC-A and MSC-B. But after successful handover or successful subsequent channel assignment using a circuit connection between MSC-A and MSC-B this signal is needed for bringing the connection in the answered state in the intermediate PSTN/ISDN exchanges.

- there will be no indication that the call applies to a handover. This information has to be derived from the MS Handover Number received during call set-up in relation to the earlier MAP-PREPARE-HANDOVER request/MAP-PREPARE-HANDOVER response procedure between MSC-A and MSC-B.

Call clearing:

- call clearing consists of two parts after inter-MSC handover: clearing of the BSS-MS connection and clearing of the inter-MSC connection, this case is only applicable to calls successfully handed over. If a request to release the call is generated by the network while the MS is re-tuning from one BSS to another BSS, then MSC-B shall begin clearing the call to the network and queue the call release to the MS until the MS has resumed communication;
- the MAP is used to transfer information between MSC-A and MSC-B in order to make it possible for MSC-B to send the appropriate signals to the MS, specified in 3GPP TS 24.008 [10], and still leave the call control to MSC-A. MSC-A normally initiates release of the connection between MSC-A and MSC-B. Exceptionally MSC-B is allowed to release the connection if no MAP-SEND-END-SIGNAL response is received, or if the Handover is to be aborted.
- when the Signalling System no 7 ISDN User Part is used, the normal symmetric release procedures apply. When a signalling system is used without a symmetric release possibility or a fault condition occurs, the following may apply:
    - when MSC-B receives a clear-forward signal from MSC-A, it shall release the radio resources;
    - in fault situation eg. machine malfunction or loss of the connection on interface A, MSC-B may send a clear-back signal to MSC-A.

10.3 Handover control procedures MSC-B (functional unit 3)

The procedures of functional unit 3 are given in form of SDL diagrams in figure 42. To easily distinguish the interface concerned the messages received or sent from this unit are prefixed with either 'MAP' for a MAP message, 'A' for an A-Interface message or 'I' for an ISDN/PSTN message. The procedure in functional unit 3 include:

i) handover from MSC-A.

This case is initiated by MSC-A, and includes allocation and establishment of the new radio channel. The procedure is outlined in subclauses 7.1. and 7.2.

ii) intra-MSC handovers within the area controlled by MSC-B.

This procedure is the same as that of i) in subclause 9.3, except that the A-HANDOVER-REQUERED is received by MSC-B.

iii) subsequent handover to another MSC (MSC-A or MSC-B').

The initiation procedure is essentially the same as that of i) of subclause 9.3. The Handover Command to the MS is now generated by MSC-B after the A-HO-REQUEST-ACKNOWLEDGE is received from MSC-A (via functional unit 4). The procedure is terminated in MSC-B when MSC-B receives a terminate procedure indication from functional unit 4.

Timers in MSC-B.

The following procedures are supervised by timers in order to avoid a deadlock when responses are not received or the procedures fail.

The following timers are defined:

T201: this timer supervises the queuing time for a free channel. T201 is set by O&M;

T202: this timer supervises the time for handover completion for handover between BSSs in MSC-B. If T202 expires, the radio path and the connection on interface B' are released. T202 is set by O&M;

T204: this timer supervises the time between sending of address complete message to MSC-A and receiving the A-HANDOVER-COMPLETE from BSS-B on MSC-B. This timer also supervises the time between issuing the handover command to the MS and receiving the MAP-SEND-END-SIGNAL response from MSC-A, for a subsequent handover. In the case of a handover without circuit connection between MSC-A and MSC-B this timer supervises the time between issuing the A-HO-REQUEST-ACKNOWLEDGE to the MSC-A and receiving the A-HANDOVER-COMPLETE from BSS-B on MSC-B. If the timer expires, then any new radio channel is released. T204 is set by O&M;

T210: this timer is used to supervise the time for establishing a circuit connection from MSC-A to MSC-B. When T210 expires, the allocated channel in MSC-B is released. T210 is set by O&M. This timer is not started when MSC-A explicitly indicates that no handover number is needed;

T211: this timer is used to control the time between requesting a subsequent handover (A-HO-REQUEST to the MSC-A) and receiving the response from MSC-A (A-REQUEST-ACKNOWLEDGE/A-HO-FAILURE). If T211 expires, the existing connection with the MS is maintained. T211 is set by O&M.

10.4 MAP procedures MSC-B (functional unit 4)

The MAP procedures for handover are defined in ~~Technical Specification TS 29.002~~3GPP TS 29.002 [12]. They include:

- procedures for basic handover;
- procedures for subsequent handover;
- procedures for obtaining the handover number from the VLR.

These procedures are outlined in clause 7.

10.5 Interworking between Handover control procedures and MAP procedures in MSC-B

The interworking between the Handover control procedures and the MAP procedures for handover is defined in ~~Technical Specification GSM~~ 3GPP TS ~~09.10~~29.010 [8]. It includes:

- interworking at basic handover completion;
- interworking at subsequent handover initiation.

This interworking is not described in the present document.

10.6 Compatibility with GSM Phase 1

If the MSC-B accepts an Inter-MSC handover procedure according to Phase 2 MAP and BSSMAP protocols while using a Phase 1 BSSMAP protocol towards BSS-B, MSC-B has to perform the protocol interworking.

The same holds if a Phase 1 MAP protocol is requested on the E-interface and MSC-B uses a Phase 2 BSSMAP protocol towards BSS-B.

11 Detailed procedures in 3G_MSC-A

For detailed procedures in MSC-A at handover within the GSM network, please see clause 9 "Detailed procedures in MSC-A".

11.1 RNC/BSC/3G_MSC and UE/MS/3G_MSC procedures in 3G_MSC-A (functional unit 1)

The handover/relocation procedures in this functional unit consist of:

i) signalling between the UE/MS and the 3G_MSC;

ii) signalling between the RNS/BSS and the 3G_MSC for access management.

11.2 Call control procedures 3G_MSC-A (functional unit 2)

The call control procedures related to handover/relocation in 3G_MSC-A can be divided into two functional entities:

- the first entity is the call control procedure as part of the normal interworking between the PSTN/ISDN and the PLMN/UTRAN; for an UE/MS originating call 3G_MSC-A is the originating exchange, for an UE/MS terminating call 3G_MSC-A is the destination exchange;
- the second entity is the call control procedure for the connection between 3G_MSC-A and 3G_MSC-B in case of a handover/relocation from 3G_MSC-A to 3G_MSC-B. For this call control procedure the following applies.

Call set-up:

- the connection to 3G_MSC-B is set up by procedures relevant to the signalling system used in the PSTN/ISDN to which 3G_MSC-A is connected. The call is set up by using the Handover Number received from 3G_MSC-B as part of the MAP procedure;
- the call set-up direction will always be from 3G_MSC-A to 3G_MSC-B, even when the call was originally established by the UE/MS. Functional unit 2 (see figure 5) should therefore keep information on call set-up direction in order to be able to interpret correctly any clearing signals (see below);
- the unit should indicate the address complete condition to functional unit 3 and through-connect without awaiting the answer signal from 3G_MSC-B. This applies also to signalling systems where address complete signals are not supported. In such cases an artificial address complete is established by functional unit 2.

Call clearing:

- call clearing consists of two parts: after handover/relocation, clearing of the RNS-UE/MS or BSS-UE/MS connection and clearing of the inter-3G_MSC connection. If a request to release the call is generated by the network while the UE/MS is re-tuning from one RNS/BSS to another RNS/BSS, then 3G_MSC-A shall begin clearing the call to the network and queue the call release to the UE/MS until the UE/MS has resumed communication. This includes the case when 3G_MSC-B and/or 3G_MSC-B' are involved;

- the MAP procedures are used to transfer information between 3G_MSC-B and 3G_MSC-A in order to maintain full call control within 3G_MSC-A. 3G_MSC-A determines, based on information received from 3G_MSC-B, the appropriate signals (according to ~~TS 24.008~~3GPP TS 24.008 [10]) to be sent to the UE/MS, and sends this information to 3G_MSC-B;

- when 3G_MSC-A clears the call to the UE/MS it also clears the call control functions in 3G_MSC-B and sends the MAP-SEND-END-SIGNAL response to release the MAP resources in 3G_MSC-B. The clearing of the connection is by procedures relevant to the signalling system in the PSTN/ISDN to which 3G_MSC-A is connected;

- when the Signalling System no 7 ISDN User Part is used, the normal symmetric release procedures apply on both the connection to the fixed network and to 3G_MSC-B;

- when a signalling system is used without a symmetric release possibility, some notice should be given to the clear-forward and clear-back procedures;

- for UE/MS terminating calls the following conditions apply on clear-forward and clear-back:

  - when a clear-forward signal is received on interface B' (see figure 4), 3G_MSC-A clears the circuit to 3G_MSC-B by normal clear-forward procedures;

  - when a clear-back signal is received from 3G_MSC-B, 3G_MSC-A starts normal clear-back procedures towards the fixed network (interface B') and sends the clear-forward signal on interface B" in order to clear the connection with 3G_MSC-B.

NOTE 1: This case corresponds to a fault situation.

- for UE/MS originated calls the following applies:

  - when 3G_MSC-A receives a clear-back signal from 3G_MSC-B, this signal must be interpreted as indicating a clear-forward condition. 3G_MSC-A then clears both the connection on interface B' (see figure 4) and to 3G_MSC-B by normal clear-forward procedures;

NOTE 2: This case corresponds to a fault situation.

  - when 3G_MSC-A receives a clear-back signal on interface B', 3G_MSC-A should distinguish between national and international connections:

    - for international connections where the Q.118 [1] supervision is done in the ISC, 3G_MSC-A sends a clear-forward signal on both interface B' to the fixed network and interface B" to 3G_MSC-B;

    - for national connections or for international connections where the Q.118 [1] supervision is not done in the ISC, a timer is started according to national practice for clear-back supervision and MSC-A proceeds as follows:

      i) if a clear-back signal is received from 3G_MSC-B, 3G_MSC-A interprets this as indicating a clear-forward condition and proceeds by clearing the connections on interface B' and to 3G_MSC-B by normal clear-forward procedures;

      ii) if the timer expires, 3G_MSC-A proceeds by normal clear-forward of the connections on interface B' and to 3G_MSC-B.

11.3 Handover/Relocation control procedures 3G_MSC-A (functional unit 3)

The procedures of functional unit 3 are given in terms of SDL diagrams in figure 43. To easily distinguish the interface concerned the messages received or sent from this unit are prefixed with either 'MAP' for a MAP message, 'A' for an A-Interface message, 'I' for an ISDN/PSTN message or 'Iu' for an Iu-message.

The procedures of functional unit 3 include:

i) initiation. The initiation condition is shown by the signal Iu-RELOCATION-REQUIRED or A-HANDOVER-REQUIRED;

The diagram also includes queuing when there is no channel available. Calls for which handover/relocation has been initiated should be queued with priority higher than normal calls. They should have lower priority than emergency calls.

ii) handover/relocation of calls within the area of 3G_MSC-A, i.e. handover/relocation case i);

In the handover/relocation from RNS-A/BSS-A to RNS-B/BSS-B 3G_MSC-A controls the procedures on both the previous and the new radio channel, using signals Iu-RELOCATION-REQUEST/A-HANDOVER-REQUEST and Iu-RELOCATION-COMMAND/A-HANDOVER-COMMAND. The handover/relocation procedure is completed when Iu-RELOCATION-COMPLETE/A-HANDOVER-COMPLETE is received. If this signal is not received, the radio path and the connection on interface B' are either released or the original connection is maintained.

For handover/relocation devices with three-party capabilities the device is first set up so that all interfaces Iu'/A', Iu"/A" and B' are connected (illustrated by the signal 'set up handover device'). This is done when the Relocation Command is sent to serving RNS or Handover Command is sent to the serving BSS. The device is connected in its final position (i.e. Iu"/ A" to B' for case ii)) (illustrated by the signal 'connect handover device') when Iu-RELOCATION-COMPLETE/A-HANDOVER-COMPLETE is received.

iii) relocation to 3G_MSC-B. This procedure is the one described in subclauses 8.3.1 and 8.3.2. For handover/relocation devices with three-party capabilities the device is set-up when 3G_MSC-A sends the Relocation Command to the UE, i.e. the interfaces Iu', B' and B" are then connected. The device is connected in its final position (i.e. B' to B") when the successful procedure indication is received from functional unit 4;

iv) UMTS to GSM handover to MSC-B. This procedure is the one described in subclauses 8.1.1 and 8.1.2. For handover/relocation devices with three-party capabilities the device is set-up when 3G_MSC-A sends the Relocation Command to the serving RNS, i.e. the interfaces Iu', B' and B" are then connected. The device is connected in its final position (i.e. B' to B") when the successful procedure indication is received from functional unit 4;

v) GSM to UMTS handover to 3G_MSC-B. This procedure is the one described in subclauses 8.2.1 and 8.2.2. For handover/relocation devices with three-party capabilities the device is set-up when MSC-A sends the Handover Command to the serving BSS , i.e. the interfaces A', B' and B" are then connected. The device is connected in its final position (i.e. B' to B") when the successful procedure indication is received from functional unit 4;

vi) subsequent relocation from 3G_MSC-B to 3G_MSC-A. The procedure is described in subclauses 8.3.3.1 and 8.3.4.1. When a relocation to 3G_MSC-A indication is received from functional unit 4, the handover/relocation device is set up so that interfaces B', B" and Iu' are connected (for devices with three-party capabilities). When Iu-RELOCATION-COMPLETE is received, the device is connected in its final position (i.e. B' to Iu');

If Iu-RELOCATION-COMPLETE is not received (expiry of timer T704), the handover/relocation device releases interface Iu' and returns to a position where B' and B" are connected.

vii) subsequent GSM to UMTS handover from MSC-B to 3G_MSC-A. The procedure is described in subclauses 8.2.3.1 and 8.2.4.1. When a handover to 3G_MSC-A indication is received from functional unit 4, the handover device is set up so that interfaces B', B" and A' are connected (for handover devices with three-party capabilities). When A-RELOCATION-COMPLETE is received, the device is connected in its final position (i.e. B' to Iu');

If A-RELOCATION-COMPLETE is not received (expiry of timer T504), the device releases interface Iu' and returns to a position where B' and B" are connected.

viii) subsequent UMTS to GSM handover from 3G_MSC-B to MSC-A. The procedure is described in subclauses 8.1.3.1 and 8.1.4.1. When a handover to MSC-A indication is received from functional unit 4, the handover device is set up so that interfaces B', B'' and Iu' are connected (for handover devices with three-party capabilities). When A-HANDOVER-COMPLETE is received, the device is connected in its final position (i.e. B' to A');

If A-HANDOVER-COMPLETE is not received (expiry of timer T304), the device releases interface A' and returns to a position where B' and B'' are connected.

ix) subsequent relocation from 3G_MSC-B to a third 3G_MSC (3G_MSC-B'). The procedure is described in subclauses 8.3.4.2 and 8.3.5.2. The handover/relocation device is set up in its initial position, (i.e. interconnection of interfaces B', B'' and B''') when the connection to 3G_MSC-B' has been established. 3G_MSC-B is informed via functional unit 4 that the connection has been established and that the procedure on the radio path can be initiated. The device is connected in its final position (i.e. B' to B''') when a successful procedure indication is received from functional unit 4. 3G_MSC-B is informed that all procedures in 3G_MSC-B can be terminated (illustrated by the MAP-SEND-END-SIGNAL response). The device returns to the state where B' and B'' are connected if the subsequent relocation procedure fails;

x) subsequent UMTS to GSM handover from 3G_MSC-B to a third MSC (MSC-B'). The procedure is described in subclauses 8.1.3.2 and 8.1.4.2. The handover/relocation device is set up in its initial position, (i.e. interconnection of interfaces B', B'' and B''') when the connection to MSC-B' has been established. 3G_MSC-B is informed via functional unit 4 that the connection has been established and that the procedure on the radio path can be initiated. The device is connected in its final position (i.e. B' to B''') when a successful procedure indication is received from functional unit 4. 3G_MSC-B is informed that all procedures in 3G_MSC-B can be terminated (illustrated by the MAP-SEND-END-SIGNAL response). The device returns to the state where B' and B'' are connected if the subsequent UMTS to GSM handover procedure fails;

xi) subsequent GSM to UMTS handover from MSC-B to a third MSC (3G_MSC-B'). The procedure is described in subclauses 8.2.3.2 and 8.2.4.2. The handover/relocation device is set up in its initial position, (i.e. interconnection of interfaces B', B'' and B''') when the connection to 3G_MSC-B' has been established. MSC-B is informed via functional unit 4 that the connection has been established and that the procedure on the radio path can be initiated. The device is connected in its final position (i.e. B' to B''') when a successful procedure indication is received from functional unit 4. MSC-B is informed that all procedures in MSC-B can be terminated (illustrated by the MAP-SEND-END-SIGNAL response). The device returns to the state where B' and B'' are connected if the subsequent GSM to UMTS handover procedure fails.

Timers in 3G_MSC-A.

The procedures are supervised by timers in order to avoid a deadlock when responses are not received or the procedures fail.

The following timers are defined for SRNS Relocation:

T701: this timer supervises the queuing time for a free channel for the relocation inside UMTS. If T701 expires, a no channel indication is generated and 3G_MSC-A will terminate the relocation as described in subclause 6.2.3. T701 is set by O&M;

T702: this timer supervises the time for relocation completion for relocation between RNSs in 3G_MSC-A. T702 is set by O&M;

T703: this timer supervises the time between issuing an Iu-RELOCATION-COMMAND from 3G_MSC-A and receiving a successful procedure indication from 3G_MSC-B. This timer also supervises the time between sending an IU-RELOCATION-REQUEST-ACKNOWLEDGE to 3G_MSC-B and receiving a successful procedure indication from 3G_MSC-B'. If T703 expires, the relocation procedure is terminated. T703 is set by O&M;

T704: this timer supervises the time between sending of an IU-RELOCATION-REQUEST-ACKNOWLEDGE to 3G_MSC-B and receiving the Iu-RELOCATION-COMPLETE from RNS-B on 3G_MSC-A. If the timer expires, the new radio channel is released and the existing handover/relocation device connection to 3G_MSC-B is maintained. T704 is set by O&M.

The following timers are defined for UMTS to GSM handover:

T301: this timer supervises the queuing time for a free channel for the UMTS to GSM handover. If T301 expires, a no channel indication is generated and 3G_MSC-A will terminate the handover as described in subclause 6.2.3. T301 is set by O&M;

T302: this timer supervises the time for UMTS to GSM handover completion for handover from RNS to BSS in 3G_MSC-A. T302 is set by O&M;

T303: this timer supervises the time between issuing an Iu-RELOCATION-COMMAND from 3G_MSC-A and receiving a successful procedure indication from MSC-B. This timer also supervises the time between sending an A-HO-REQUEST-ACKNOWLEDGE to MSC-B and receiving a successful procedure indication from MSC-B'. If T303 expires, the UMTS to GSM handover procedure is terminated. T303 is set by O&M;

T304: this timer supervises the time between sending of an A-HO-REQUEST-ACKNOWLEDGE to MSC-B and receiving the A-HANDOVER-COMPLETE from BSS-B on 3G_MSC-A. If the timer expires, the new radio channel is released and the existing handover device connection to MSC-B is maintained. T304 is set by O&M.

The following timers are defined for GSM to UMTS handover:

T501: this timer supervises the queuing time for a free channel for the GSM to UMTS handover. If T501 expires, a no channel indication is generated and 3G_MSC-A will terminate the handover as described in subclause 6.2.3. T501 is set by O&M;

T502: this timer supervises the time for GSM to UMTS handover completion for handover from BSS to RNS in 3G_MSC-A. T502 is set by O&M;

T503: this timer supervises the time between issuing an A-HANDOVER-COMMAND from MSC-A and receiving a successful procedure indication from 3G_MSC-B. This timer also supervises the time between sending an A-HANDOVER-REQUEST-ACKNOWLEDGE to 3G_MSC-B and receiving a successful procedure indication from 3G_MSC-B'. If T503 expires, the GSM to UMTS handover procedure is terminated. T503 is set by O&M;

T504: this timer supervises the time between sending of an A-HANDOVER-REQUEST-ACKNOWLEDGE to 3G_MSC-B and receiving the Iu-RELOCATION-COMPLETE from RNS-B on 3G_MSC-A. If the timer expires, the new radio channel is released and the existing handover device connection to MSC-B is maintained. T504 is set by O&M.

11.4 MAP procedures in 3G_MSC-A (functional unit 4)

The MAP procedures for handover/relocation are defined in ~~TS 29.002~~3GPP TS 29.002 [12]. They include:

- procedures for basic handover/relocation;
- procedures for subsequent handover/relocation.

These procedures are as outlined in clause 8.

11.5 Interworking between Handover/Relocation control procedures and MAP procedures in 3G_MSC-A

The interworking between the Handover/Relocation control procedures and the MAP procedures for handover/relocation is defined in ~~GSM~~ 3GPP TS 29.010 [8]. It includes:

- interworking at basic handover/relocation initiation;
- interworking at subsequent handover/relocation completion.

This interworking is not described in the present document.

11.6 Compatibility with GSM Phase 1

Interworking with the GSM Phase 1 is not supported.

11.7 Protocol interworking

If the 3G_MSC-A initiates an Inter UMTS to GSM handover procedure according to MAP and BSSMAP protocols while using a RANAP protocol towards RNS-A, 3G_MSC-A has to perform the protocol interworking.

The same holds if 3G_MSC-A accepts a subsequent GSM to UMTS handover while using a RANAP protocol towards RNS-B.

12 Detailed procedures in 3G_MSC-B

For detailed procedures in 3G_MSC-B at handover within the GSM network, please see clause 10 'Detailed procedures in MSC-B'.

12.1 RNC/BSC/3G_MSC (UE/MS/RNC/BSC) procedures in 3G_MSC-B (functional unit 1)

The Intra and Inter-3G_MSC handover/relocation procedures in this functional unit consist of:

i) signalling between the UE/MS and the 3G_MSC;

ii) signalling between the RNS/BSS and the 3G_MSC for access management.

Signals exchanged with functional unit 3 are indicated in subclause 12.3.

12.2 Call control procedures 3G_MSC-B (functional unit 2)

These procedures relate to the call control in 3G_MSC-B of the "3G_MSC handover/relocation" connection with 3G_MSC-A. For these procedures the following apply:

Call set-up:

- the connection is set up by 3G_MSC-A. 3G_MSC-B should provide, if possible, the following backward signals:
  - signals indicating unsuccessful call set-up and, if possible, the cause of call failure;
  - address complete signal;
  - answer signal (see note).

NOTE: The answer signal is not related to answering by the UE/MS and it has no meaning in the 3G_MSC handover/relocation procedure between 3G_MSC-A and 3G_MSC-B. But after successful handover/relocation or successful subsequent channel assignment using a circuit connection between 3G_MSC-A and 3G_MSC-B this signal is needed for bringing the connection in the answered state in the intermediate PSTN/ISDN exchanges.

- there will be no indication that the call applies to a 3G_MSC handover/relocation. This information has to be derived from the UE/MS Handover Number received during call set-up in relation to the earlier MAP-PREPARE-HANDOVER request/MAP-PREPARE-HANDOVER response procedure between 3G_MSC-A and 3G_MSC-B.

Call clearing:

- call clearing consists of two parts after inter-3G_MSC handover/relocation: clearing of the RNS-UE/MS or the BSS-UE/MS connection and clearing of the inter-3G_MSC connection, these cases are only applicable to calls successfully handed over or relocated. If a request to release the call is generated by the network while the UE/MS is re-tuning from one RNS/BSS to another RNS/BSS, then 3G_MSC-B shall begin clearing the call to the network and queue the call release to the UE/MS until the UE/MS has resumed communication;

- the MAP is used to transfer information between 3G_MSC-A and 3G_MSC-B in order to make it possible for 3G_MSC-B to send the appropriate signals to the UE/MS, specified in ~~TS 24.008~~3GPP TS 24.008 [10], and still leave the call control to 3G_MSC-A. 3G_MSC-A normally initiates release of the connection between 3G_MSC-A and 3G_MSC-B. Exceptionally 3G_MSC-B is allowed to release the connection if no MAP-SEND-END-SIGNAL response is received, or if the 3G_MSC Handover/Relocation is to be aborted;

- when the Signalling System no 7 ISDN User Part is used, the normal symmetric release procedures apply. When a signalling system is used without a symmetric release possibility or a fault condition occurs, the following may apply:

  - when 3G_MSC-B receives a clear-forward signal from 3G_MSC-A, it shall release the radio resources;

  - in fault situation e.g. machine malfunction or loss of the connection on interface Iu or interface A, 3G_MSC-B may send a clear-back signal to 3G_MSC-A.

12.3 Handover/Relocation control procedures in 3G_MSC-B (functional unit 3)

The procedures of functional unit 3 are given in form of SDL diagrams in figure 44. To easily distinguish the interface concerned the messages received or sent from this unit are prefixed with either 'MAP' for a MAP message, 'A' for an A-Interface message, 'Iu' for an Iu-Interface message or 'I' for an ISDN/PSTN message. The procedure in functional unit 3 include:

i) inter 3G_MSC handover/relocation from 3G_MSC-A;

   This case is initiated by 3G_MSC-A, and includes allocation and establishment of the new radio resources. The procedure is outlined in subclauses 8.1.1 and 8.1.2. for UMTS to GSM handover, subclauses 8.2.1 and 8.2.2 for GSM to UMTS handover and subclauses 8.3.1 and 8.3.2 for relocation.

ii) intra-3G_MSC UMTS to GSM handovers within the area controlled by 3G_MSC-B;

   This procedure is the same as that of ii) in subclause 11.3, except that the Iu-RELOCATION-REQUIRED is received by 3G_MSC-B.

iii) intra-3G_MSC GSM to UMTS handovers within the area controlled by 3G_MSC-B;

   This procedure is the same as that of ii) in subclause 11.3, except that the A-HANDOVER-REQUIRED is received by 3G_MSC-B.

iv) intra-3G_MSC SRNS Relocation within the area controlled by 3G_MSC-B;

   This procedure is the same as that of ii) in subclause 11.3, except that the Iu-RELOCATION-REQUIRED is received by 3G_MSC-B.

v) subsequent handover/relocation to another 3G_MSC (3G_MSC-A or 3G_MSC-B');

   The initiation procedure is essentially the same as that of i) of subclause 11.3. The Handover Command to the BSS or the Relocation Command to the RNS is now generated by 3G_MSC-B after the A-HO-REQUEST-ACKNOWLEDGE or Iu-RELOCATION-REQUEST-ACKNOWLEDGE is received from 3G_MSC-A (via functional unit 4). The procedure is terminated in 3G_MSC-B when 3G_MSC-B receives a terminate procedure indication from functional unit 4.

Timers in 3G_MSC-B.

The following procedures are supervised by timers in order to avoid a deadlock when responses are not received or the procedures fail.

The following timers are defined for UMTS to GSM handover:

T401: this timer supervises the queuing time for a free channel. T401 is set by O&M;

T402: this timer supervises the time for handover completion for UMTS to GSM handover from RNS to BSS in 3G_MSC-B. If T402 expires, the radio path and the connection on interface B' are released. T402 is set by O&M;

T404: this timer supervises the time between sending of address complete message to 3G_MSC-A and receiving the A-HANDOVER-COMPLETE from BSS-B on 3G_MSC-B. This timer also supervises the time between issuing the handover command to the UE/MS and receiving the MAP-SEND-END-SIGNAL response from 3G_MSC-A, for a subsequent handover from UMTS to GSM. In the case of a UMTS to GSM handover without circuit connection between 3G_MSC-A and 3G_MSC-B this timer supervises the time between issuing the A-HO-REQUEST-ACKNOWLEDGE to the 3G_MSC-A and receiving the A-HANDOVER-COMPLETE from BSS-B on 3G_MSC-B. If the timer expires, then any new radio channel is released. T404 is set by O&M;

T410: this timer is used to supervise the time for establishing a circuit connection from 3G_MSC-A to 3G_MSC-B. When T410 expires, the allocated channel in 3G_MSC-B is released. T410 is set by O&M. This timer is not started when 3G_MSC-A explicitly indicates that no handover number is needed;

T411: this timer is used to control the time between requesting a subsequent UMTS to GSM handover (A-HO-REQUEST to the 3G_MSC-A) and receiving the response from 3G_MSC-A (A-HO-REQUEST-ACKNOWLEDGE/A-HO-FAILURE). If T411 expires, the existing connection with the UE/MS is maintained. T411 is set by O&M.

The following timers are defined for GSM to UMTS handover:

T601: this timer supervises the queuing time for a free radio resource. T601 is set by O&M;

T602: this timer supervises the time for handover completion for GSM to UMTS handover from BSS to RNS in 3G_MSC-B. If T602 expires, the radio path and the connection on interface B' are released. T602 is set by O&M;

T604: this timer supervises the time between sending of address complete message to 3G_MSC-A and receiving the Iu-RELOCATION-COMPLETE from RNS-B on 3G_MSC-B. This timer also supervises the time between issuing the handover command to the UE/MS and receiving the MAP-SEND-END-SIGNAL response from 3G_MSC-A, for a subsequent handover from GSM to UMTS. In the case of a GSM to UMTS handover without circuit connection between 3G_MSC-A and 3G_MSC-B this timer supervises the time between issuing the A-HO-REQUEST-ACKNOWLEDGE to the 3G_MSC-A and receiving the Iu-RELOCATION-COMPLETE from RNS-B on 3G_MSC-B. If the timer expires, then any new radio resource is released. T604 is set by O&M;

T610: this timer is used to supervise the time for establishing a circuit connection from 3G_MSC-A to 3G_MSC-B. When T610 expires, the allocated radio resource in 3G_MSC-B is released. T610 is set by O&M. This timer is not started when 3G_MSC-A explicitly indicates that no handover number is needed;

T611: this timer is used to control the time between requesting a subsequent GSM to UMTS handover (A-HO-REQUEST to the 3G_MSC-A) and receiving the response from 3G_MSC-A (A-HO-REQUEST-ACKNOWLEDGE/A-HO-FAILURE). If T611 expires, the existing connection with the UE/MS is maintained. T611 is set by O&M.

The following timers are defined for SRNS Relocation:

T801: this timer supervises the queuing time for a free radio resource. T801 is set by O&M;

T802: this timer supervises the time for relocation completion for relocation between RNSs in 3G_MSC-B. If T802 expires, the radio path and the connection on interface B' are released. T802 is set by O&M;

T804: this timer supervises the time between sending of address complete message to 3G_MSC-A and receiving the Iu-RELOCATION-COMPLETE from RNS-B on 3G_MSC-B. This timer also supervises the time between issuing the handover command to the UE and receiving the MAP-SEND-END-SIGNAL response from 3G_MSC-A, for a subsequent relocation. In the case of a relocation without circuit connection between 3G_MSC-A and 3G_MSC-B this timer supervises the time between issuing the Iu-RELOCATION-REQUEST-ACKNOWLEDGE to the 3G_MSC-A and receiving the Iu-RELOCATION-COMPLETE from RNS-B on 3G_MSC-B. If the timer expires, then any new radio resource is released. T804 is set by O&M;

T810: this timer is used to supervise the time for establishing a circuit connection from 3G_MSC-A to 3G_MSC-B. When T810 expires, the allocated channel in 3G_MSC-B is released. T810 is set by O&M. This timer is not started when 3G_MSC-A explicitly indicates that no handover number is needed;

T811: this timer is used to control the time between requesting a subsequent relocation (Iu-RELOCATION-REQUEST to the 3G_MSC-A) and receiving the response from 3G_MSC-A (Iu-RELOCATION-REQUEST-ACKNOWLEDGE/ Iu-RELOCATION-FAILURE). If T811 expires, the existing connection with the UE is maintained. T811 is set by O&M.

12.4 MAP procedures in 3G_MSC-B (functional unit 4)

The MAP procedures for handover/relocation are defined in ~~TS 29.002~~3GPP TS 29.002 [12]. They include:

- procedures for basic handover/relocation;
- procedures for subsequent handover/relocation;
- procedures for obtaining the handover number from the VLR.

These procedures are outlined in clause 8.

12.5 Interworking between Handover/Relocation control procedures and MAP procedures in 3G_MSC-B

The interworking between the Handover/Relocation control procedures and the MAP procedures for handover/relocation is defined in ~~TS 29.010~~3GPP TS 29.010 [8]. It includes:

- interworking at basic handover/relocation completion;
- interworking at subsequent handover/relocation initiation.

This interworking is not described in the present document.

12.6 Compatibility with GSM Phase 1

GSM phase 1 is not supported.

12.7 Protocol interworking

If the 3G_MSC-B accepts an Inter-3G_MSC GSM to UMTS handover procedure according to MAP and BSSMAP protocols while using a RANAP protocol towards RNS-B, 3G_MSC-B has to perform the protocol interworking.

The same holds if 3G_MSC-B initiates a subsequent UMTS to GSM handover while using a RANAP protocol towards RNS-A.

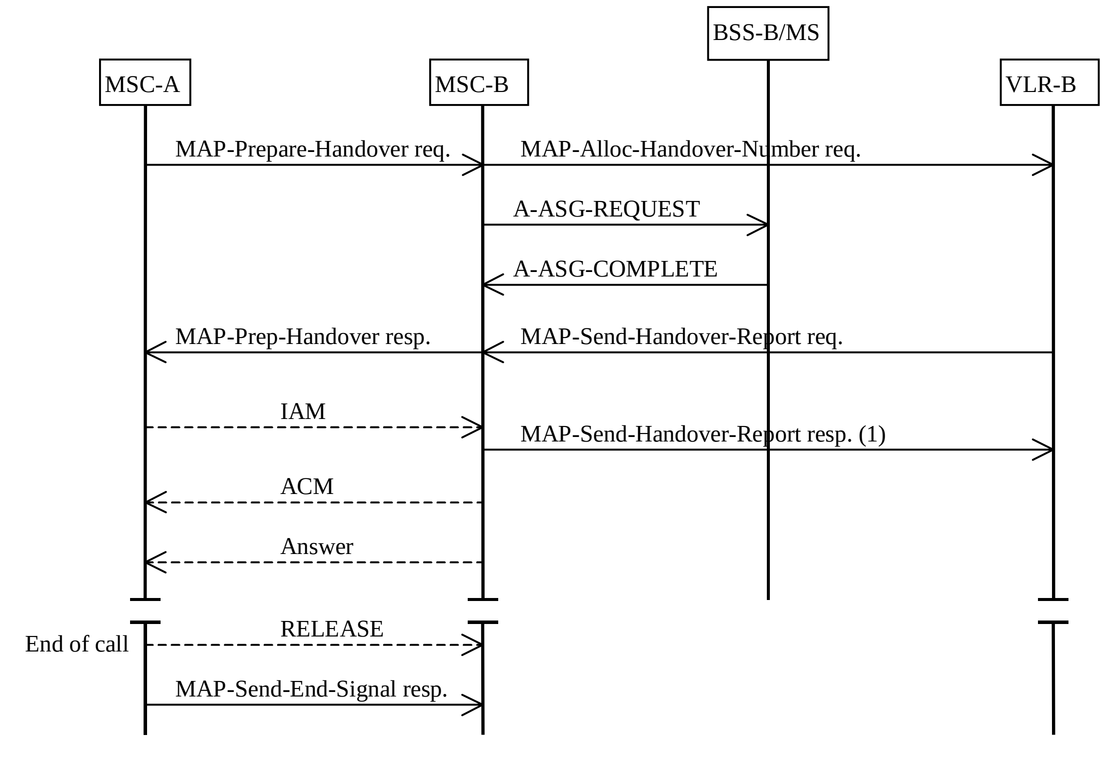
13 Subsequent channel assignment using a circuit connection between MSC-A and MSC-B

13.1 GSM handover

If a circuit connection has to be set up (for example for a Mobile Originated or Mobile Terminated Call Establishment) after an Inter-MSC handover without circuit connection, MSC-A shall request a Handover Number using a MAP-PREPARE-HANDOVER request, containing the A-ASSIGNMENT-REQUEST, on the established MAP connection. If MSC-B indicates to MSC-B and to MSC-A that at least one of two procedures assignment or Handover Number allocation can not be completed, then MSC-A shall terminate the circuit establishment attempt. The existing connection to the MS shall be maintained, if possible.

Upon receipt of the MAP-PREPARE-HANDOVER request MSC-B shall perform the requested assignment operation towards the BSS. In addition it shall retrieve a Handover Number from VLR-B. If a failure occurs in the assignment or Handover Number allocation then it shall be reflected in the MAP-PREPARE-HANDOVER response that at least one of these two procedures has not been completed (i.e. either by a MAP-PREPARE-HANDOVER result with the assignment procedure outcome and the Handover Number allocation outcome or by a MAP-PREPARE-HANDOVER error).

When MSC-A receives a successful MAP-PREPARE-HANDOVER response it shall establish a circuit connection to MSC-B by using the appropriate network supported procedures. In figure 36 this is indicated by the IAM (Initial Address Message) and ACM (Address Complete Message). MSC-B shall also send the Answer message if appropriate to the signalling system. Upon receipt of the Answer MSC-A shall consider the circuit connection establishment phase complete. If a failure occurs during the cirucit establishment phase then the existing connection to the MS shall be maintained, if possible.



NOTE 1: Can be sent at any time after the reception of IAM

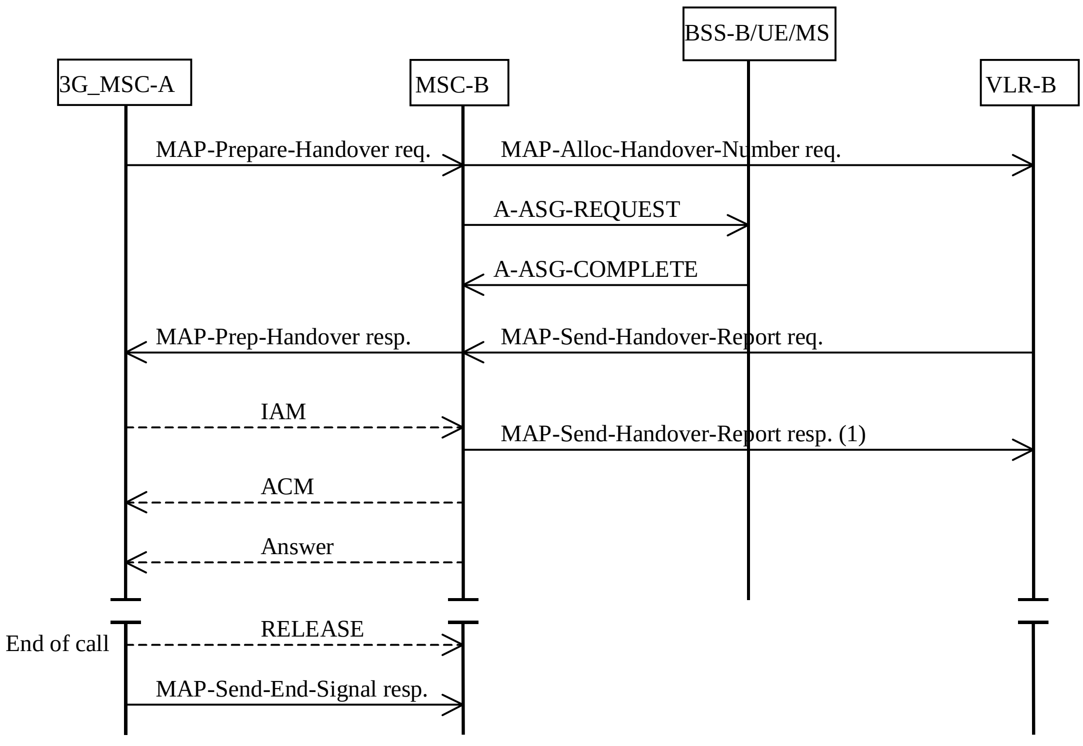
Figure 36: Successful circuit-switched call establishment after a Basic Handover without circuit connection

13.2 UMTS to GSM handover

If a circuit connection has to be set up (for example for a Mobile Originated or Mobile Terminated Call Establishment) after an Inter-3G_MSC UMTS to GSM handover without circuit connection, 3G_MSC-A shall request a Handover Number using a MAP-PREPARE-HANDOVER request, containing the A-ASSIGNMENT-REQUEST, on the established MAP connection. If MSC-B indicates to MSC-B and to 3G_MSC-A that at least one of two procedures assignment or Handover Number allocation can not be completed, then 3G_MSC-A shall terminate the circuit establishment attempt. The existing connection to the UE/MS shall be maintained, if possible.

Upon receipt of the MAP-PREPARE-HANDOVER request MSC-B shall perform the requested assignment operation towards the BSS. In addition it shall retrieve a Handover Number from VLR-B. If a failure occurs in the assignment or Handover Number allocation then it shall be reflected in the MAP-PREPARE-HANDOVER response that at least one of these two procedures has not been completed (i.e. either by a MAP-PREPARE-HANDOVER result with the assignment procedure outcome and the Handover Number allocation outcome or by a MAP-PREPARE-HANDOVER error).

When 3G_MSC-A receives a successful MAP-PREPARE-HANDOVER response, it shall establish a circuit connection to MSC-B by using the appropriate network supported procedures. In figure 37 this is indicated by the IAM (Initial Address Message) and ACM (Address Complete Message). MSC-B shall also send the Answer message if appropriate to the signalling system. Upon receipt of the Answer 3G_MSC-A shall consider the circuit connection establishment phase complete. If a failure occurs during the circuit establishment phase then the existing connection to the UE/MS shall be maintained, if possible.



NOTE 1: Can be sent at any time after the reception of IAM

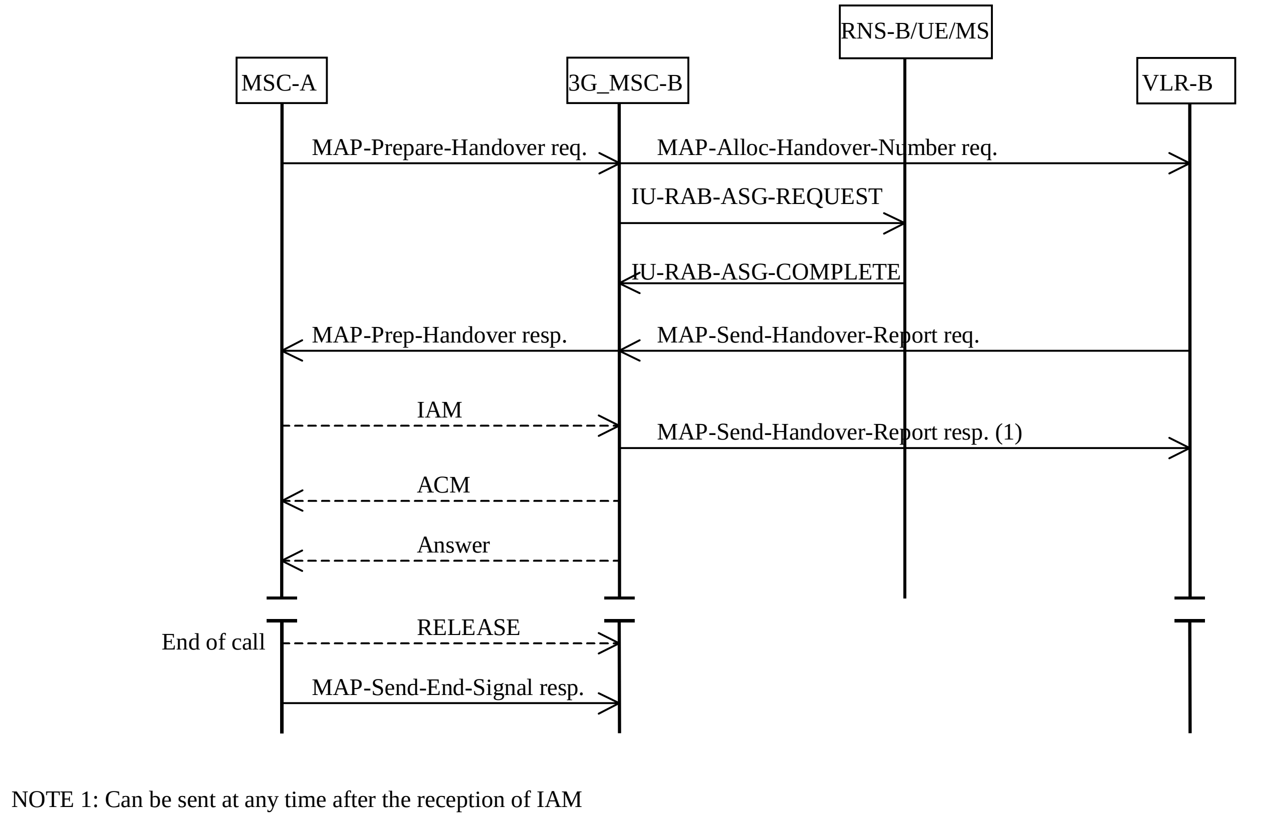
Figure 37: Successful circuit-switched call establishment after a Basic UMTS to GSM Handover without circuit connection

13.3 GSM to UMTS handover

If a circuit connection has to be set up (for example for a Mobile Originated or Mobile Terminated Call Establishment) after an Inter-3G_MSC GSM to UMTS handover without circuit connection, MSC-A shall request a Handover Number using a MAP-PREPARE-HANDOVER request, containing the A-ASSIGNMENT-REQUEST, on the established MAP connection. If 3G_MSC-B indicates to 3G_MSC-B and to MSC-A that at least one of two procedures assignment or Handover Number allocation can not be completed, then MSC-A shall terminate the circuit establishment attempt. The existing connection to the UE/MS shall be maintained, if possible.

Upon receipt of the MAP-PREPARE-HANDOVER request 3G_MSC-B shall perform the requested assignment operation towards the RNS. In addition it shall retrieve a Handover Number from VLR-B. If a failure occurs in the assignment or Handover Number allocation then it shall be reflected in the MAP-PREPARE-HANDOVER response that at least one of these two procedures has not been completed (i.e. either by a MAP-PREPARE-HANDOVER result with the assignment procedure outcome and the Handover Number allocation outcome or by a MAP-PREPARE-HANDOVER error). 3G_MSC-B inserts the transcoder according to the information received from MSC-A.

When MSC-A receives a successful MAP-PREPARE-HANDOVER response, it shall establish a circuit connection to 3G_MSC-B by using the appropriate network supported procedures. In figure 38 this is indicated by the IAM (Initial Address Message) and ACM (Address Complete Message). 3G_MSC-B shall also send the Answer message if appropriate to the signalling system. Upon receipt of the Answer MSC-A shall consider the circuit connection establishment phase complete. If a failure occurs during the circuit establishment phase then the existing connection to the UE/MS shall be maintained, if possible.



NOTE 1: Can be sent at any time after the reception of IAM

Figure 38: Successful circuit-switched call establishment after a Basic GSM to UMTS Handover without circuit connection

13.4 SRNS Relocation

13.4.1 Without circuit connection

If a circuit connection has to be set up (for example for a Mobile Originated or Mobile Terminated Call Establishment) after an Inter-3G_MSC relocation without circuit connection, 3G_MSC-A shall request a Handover Number using a MAP-PREPARE-HANDOVER request, containing the IU-RAB-ASSIGNMENT-REQUEST, on the established MAP connection. If 3G_MSC-B indicates to 3G_MSC-B and to 3G_MSC-A that at least one of two procedures (RAB) assignment or Handover Number allocation can not be completed, then 3G_MSC-A shall terminate the circuit establishment attempt. The existing connection to the UE shall be maintained, if possible.

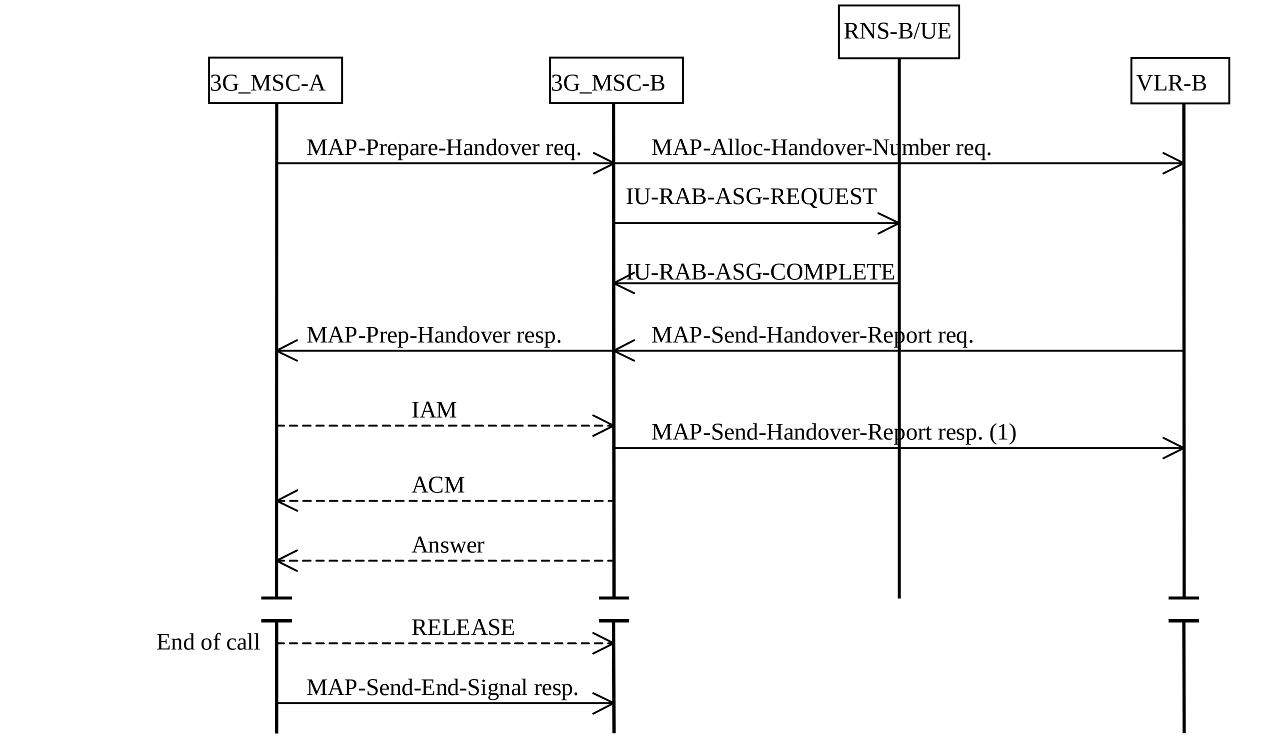
Upon receipt of the MAP-PREPARE-HANDOVER request, 3G_MSC-B shall perform the requested RAB assignment operation towards the RNS. In addition it shall retrieve a Handover Number from VLR-B. and connect a transcoder in case of TDM networks. If a failure occurs in the RAB assignment or Handover Number allocation then it shall be reflected in the MAP-PREPARE-HANDOVER response that at least one of these two procedures has not been completed (i.e. either by a MAP-PREPARE-HANDOVER result with the RAB assignment procedure outcome and the Handover Number allocation outcome or by a MAP-PREPARE-HANDOVER error).

When 3G_MSC-A receives a successful MAP-PREPARE-HANDOVER response, it shall establish a circuit connection to 3G_MSC-B by using the appropriate network supported procedures. In figure 39 this is indicated by the IAM (Initial Address Message) and ACM (Address Complete Message). 3G_MSC-B shall also send the Answer message if appropriate to the signalling system. Upon receipt of the Answer 3G_MSC-A shall consider the circuit connection establishment phase complete. If a failure occurs during the circuit establishment phase then the existing connection to the UE shall be maintained, if possible.

13.4.2 With circuit connection (Optional functionality)

If 3G_MSC-A and 3G_MSC-B support the optional supplementary service Multicall (See ~~TS 23.135~~3GPP TS 23.135), 3G_MSC-A and 3G_MSC-B shall have the following functionality additionally to the description in section 13.4.1.

A new circuit connection shall be able to set up (for example for a new Mobile Originated or a new Mobile Terminated Call Establishment) after an Inter-3G_MSC relocation with one or several circuit connections. The procedures for the establishment of the additional circuit connection in 3G_MSC-A and 3G_MSC-B are the same as that described in section 13.4.1.



NOTE 1: Can be sent at any time after the reception of IAM

Figure 39: Successful circuit-switched call establishment after a Basic Relocation without circuit connection

14 Directed retry handover

[Directed retry in the cases of inter-system handover and SRNS relocation is FFS]

The directed retry procedure allows the network to select the optimum cell for the Mobile Station. The process of directed retry involves the assignment of a Mobile Station to a radio channel on a cell other than the serving cell. This process is triggered by the assignment procedures, as described in ~~GSM 08.08~~3GPP TS 08.08 [5], and employs internal or external handover procedures as described in clauses 6 and 7. The successful procedure for a directed retry is as shown in figure 40 and as described below.

If during the assignment phase, as represented by the A-ASSIGNMENT-REQUEST message, a handover becomes necessary, due to either radio conditions or congestion, then the Mobile Station may be handed over to a different cell. When the decision has been made to handover the MS the BSS-A may send an A-ASSIGNMENT-FAILURE message, indicating 'directed retry', before sending the A-HANDOVER-REQUIRED message to MSC-A, indicating 'directed retry'. However BSS-A may alternatively send the A-HANDOVER-REQUIRED message, indicating 'directed retry', without sending the A-ASSIGNMENT-FAILURE message. Other cause values may be used instead of "Directed Retry" in the A-HANDOVER-REQUIRED message, this will allow the MSC to take different actions dependent on the received cause. Upon receipt of the A-HANDOVER-REQUIRED message from BSS-A, then MSC-A shall initiate the handover as described in clauses 6 and 7. No resources shall be cleared in the MSC-A or BSS-A for this connection.

After receipt of the A-HANDOVER-COMPLETE message from BSS-B the assignment procedure shall be considered to be complete and the resources on BSS-A shall be cleared.

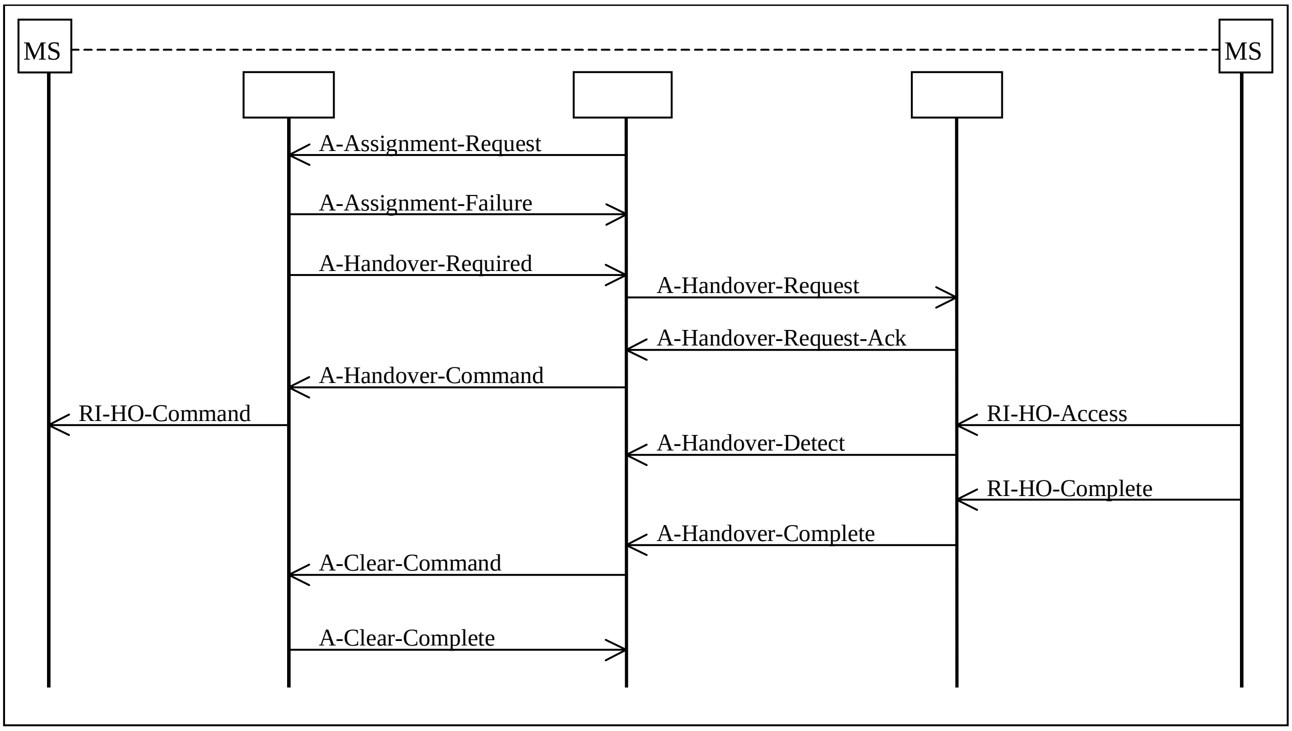


Figure 40: Example of a Directed Retry Intra-MSC Handover Procedure

If a failure occurs during the handover attempt, for example A-HANDOVER-FAILURE returned from BSS-A or BSS-B, then MSC-A will terminate the handover to BSS-B. Under these conditions MSC-A may optionally take one of a number of actions:

i) retry the handover to the same cell;

ii) select the next cell from the list contained in the A-HANDOVER-REQUIRED message and attempt a handover to the new cell;

iii) send an A-HANDOVER-REQUIRED-REJECT to BSS-A, if an A-HANDOVER-COMMAND has not already been sent;

iv) retry the assignment procedure to BSS-A, if the failure message was returned from BSS-A. This option is additional to those for normal handover;

v) Clear the complete call.

The procedures for Inter-MSC handover are also applicable to the directed retry process. If an Inter-MSC handover is necessary then the assignment process should be considered to have completed successfully upon receipt of the A-HO-COMPLETE included in the MAP-SEND-END-SIGNAL request.

15 SDL diagrams

NOTE 1: The message primitive names used in the SDL diagrams and message flows in the present document do not represent the actual messages specified in the GSM or 3GPP stage 3 technical specifications. The primitive names are only intended to be indicative of their use in the present document.

SDL Annotation.

The following conventions and abbreviations have been used in the SDLs. Text included in '[]' is used to indicate either, the BSSMAP message (as defined in ~~GSM 09.08~~3GPP TS 09.08 [7]) included in the message, or the transport of a Handover Number.

When traversing the following SDLs it may be possible that resources appear to be released repeatedly, however these operations are only executed once on their first occurrence. Furthermore it maybe that certain messages cannot, in practice, be received in particular states, after specific events have taken place. In general both of the above cases are obvious. This approach has been adopted (in line with other ~~GSM~~ 3GPP Technical Specifications) in order to reduce the complexity of the SDLs and improve clarity, without reducing the quality of the functional description.

The following abbreviations have been used in the SDLs:

A-HO-REQUEST	A-HANDOVER-REQUEST
A-HO-REQUEST-ACK	A-HANDOVER-REQUEST-ACK.
A-HO-COMPLETE	A-HANDOVER-COMPLETE
A-HO-DETECT	A-HANDOVER-DETECT
A-HO-PERFORMED	A-HANDOVER-PERFORMED
A-ASG-REQUEST	A-ASSIGNMENT-REQUEST
A-ASG-COMPLETE	A-ASSIGNMENT-COMPLETE
A-ASG-FAILURE	A-ASSIGNMENT-FAILURE
MAP-PAS req	MAP-PROCESS-ACCESS-SIGNALLING req.
MAP-FAS req	MAP-FORWARD-ACCESS-SIGNALLING req.
IU-RLC-REQUEST	IU-RELOCATION-REQUEST
IU-RLC-REQUEST-ACK	IU-RELOCATION-REQUEST-ACK
IU-RLC-COMPLETE	IU-RELOCATION-COMPLETE
IU-RLC-DETECT	IU-RELOCATION-DETECT
IU-IREL-REQUEST	IU-IU-RELEASE-REQUEST
IU-RREL-REQUEST	IU-RAB-RELEASE-REQUEST
IU-RASG-REQUEST	IU-RAB-ASSIGNMENT-REQUEST
IU-RASG-RESPONSE	IU-RAB-ASSIGNMENT-RESPONSE

NOTE 2: The SDL diagrams have been checked for consistency with the allocation of the A interface circuits by the BSC. The conclusion was that SDLs are expressed in general terms, and offer a sufficient latitude of interpretation to be consistent with the allocation of A interface circuits by the BSC.

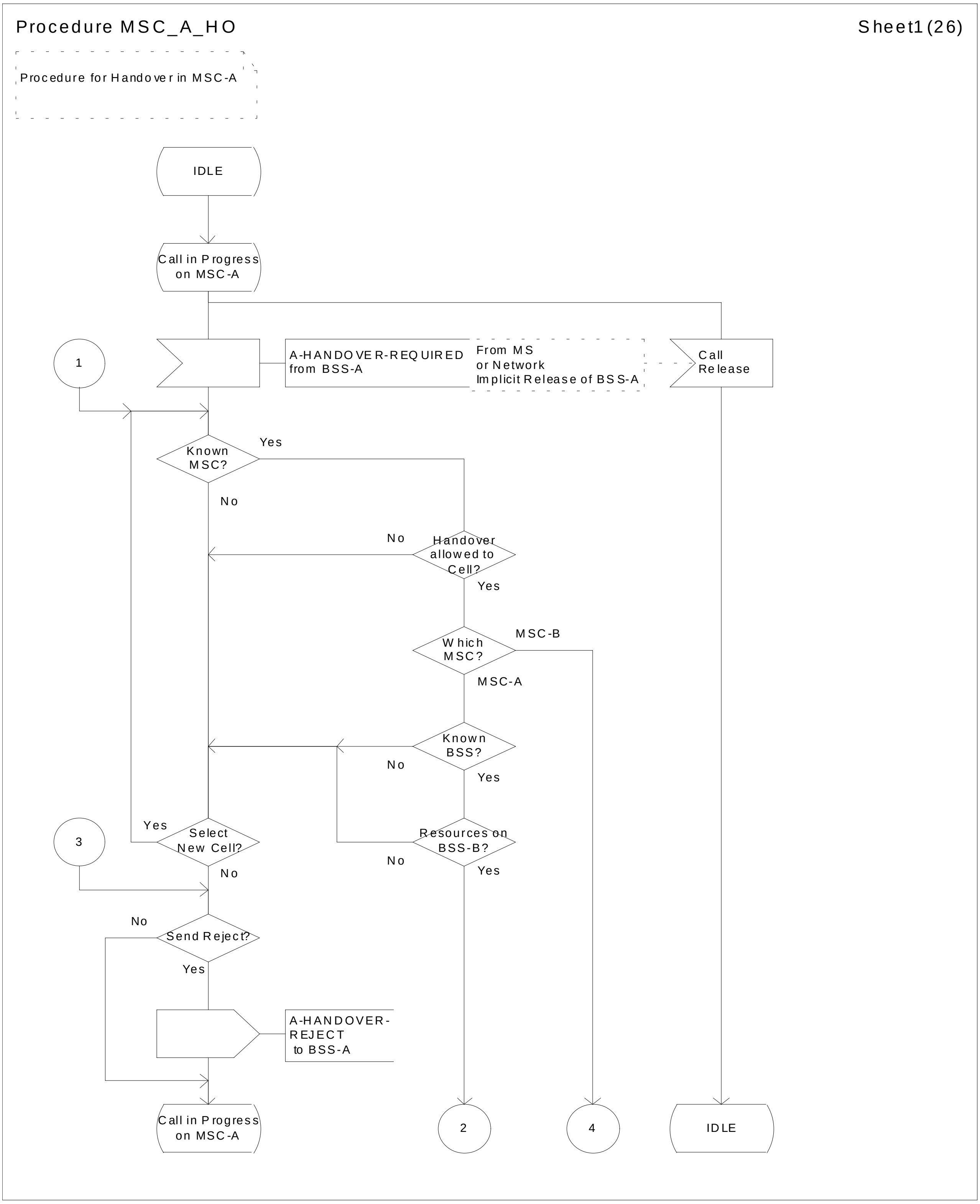


Figure 41 (Sheet 1 of 26): Handover control procedure in MSC-A

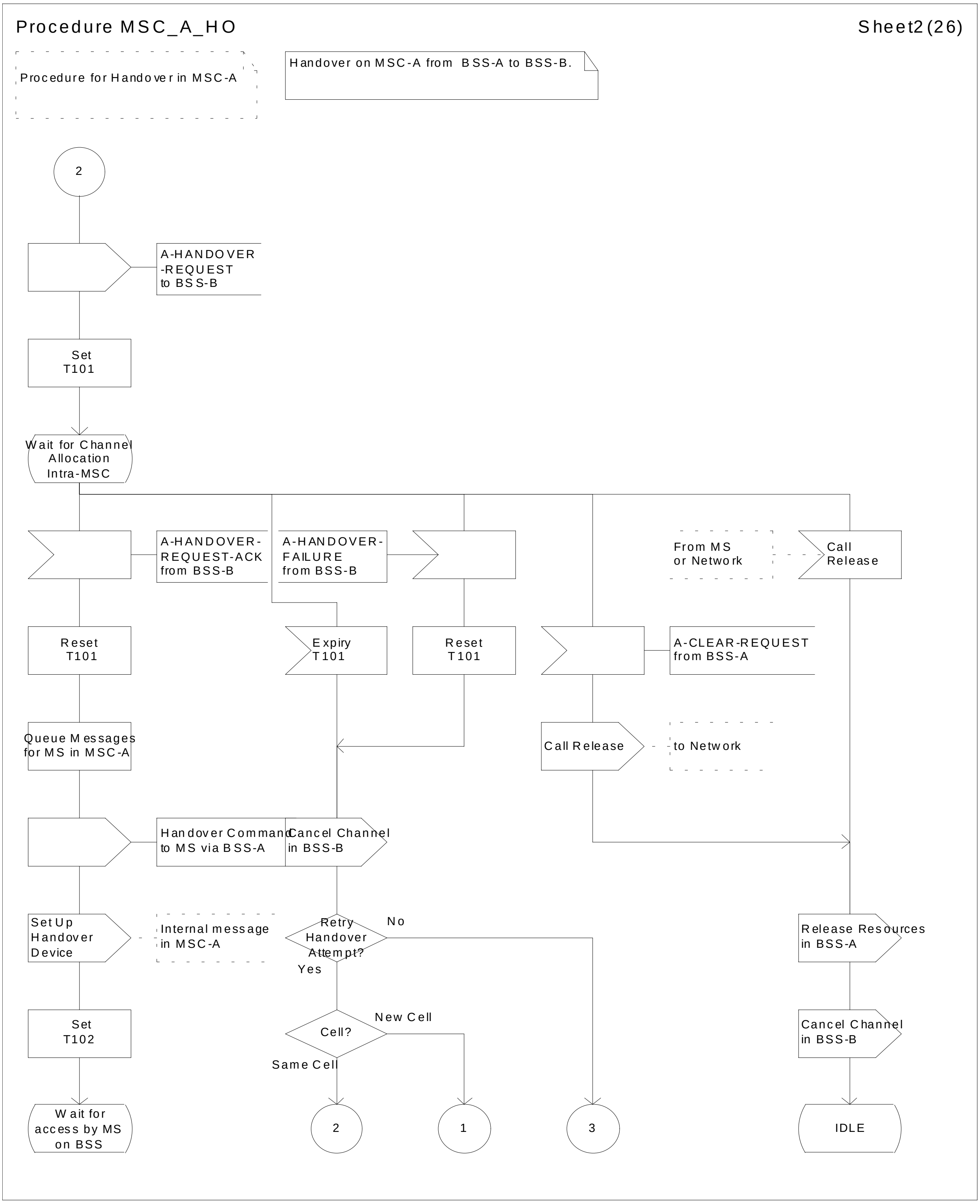


Figure 41 (Sheet 2 of 26): Handover control procedure in MSC-A

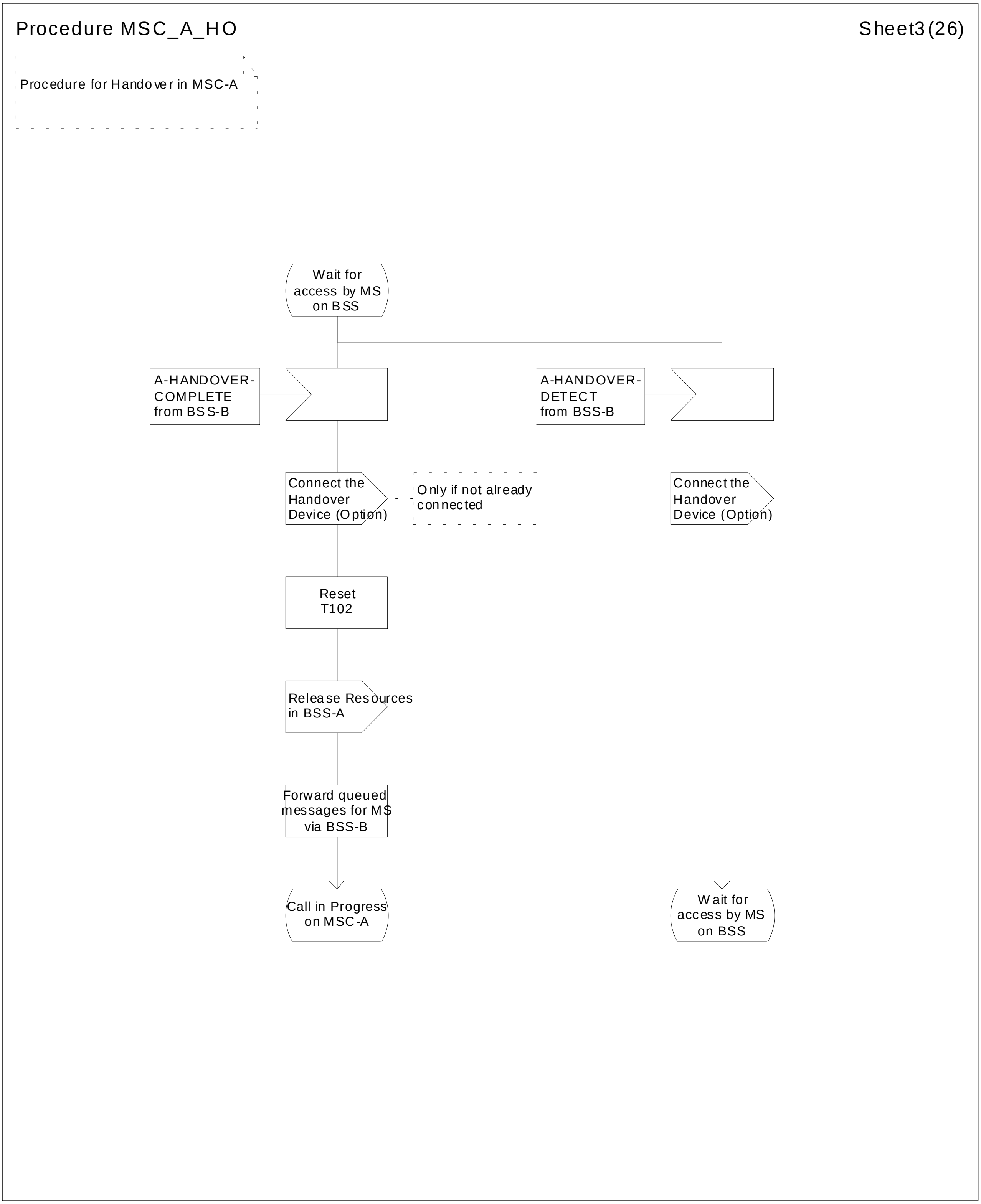


Figure 41 (Sheet 3 of 26): Handover control procedure in MSC-A

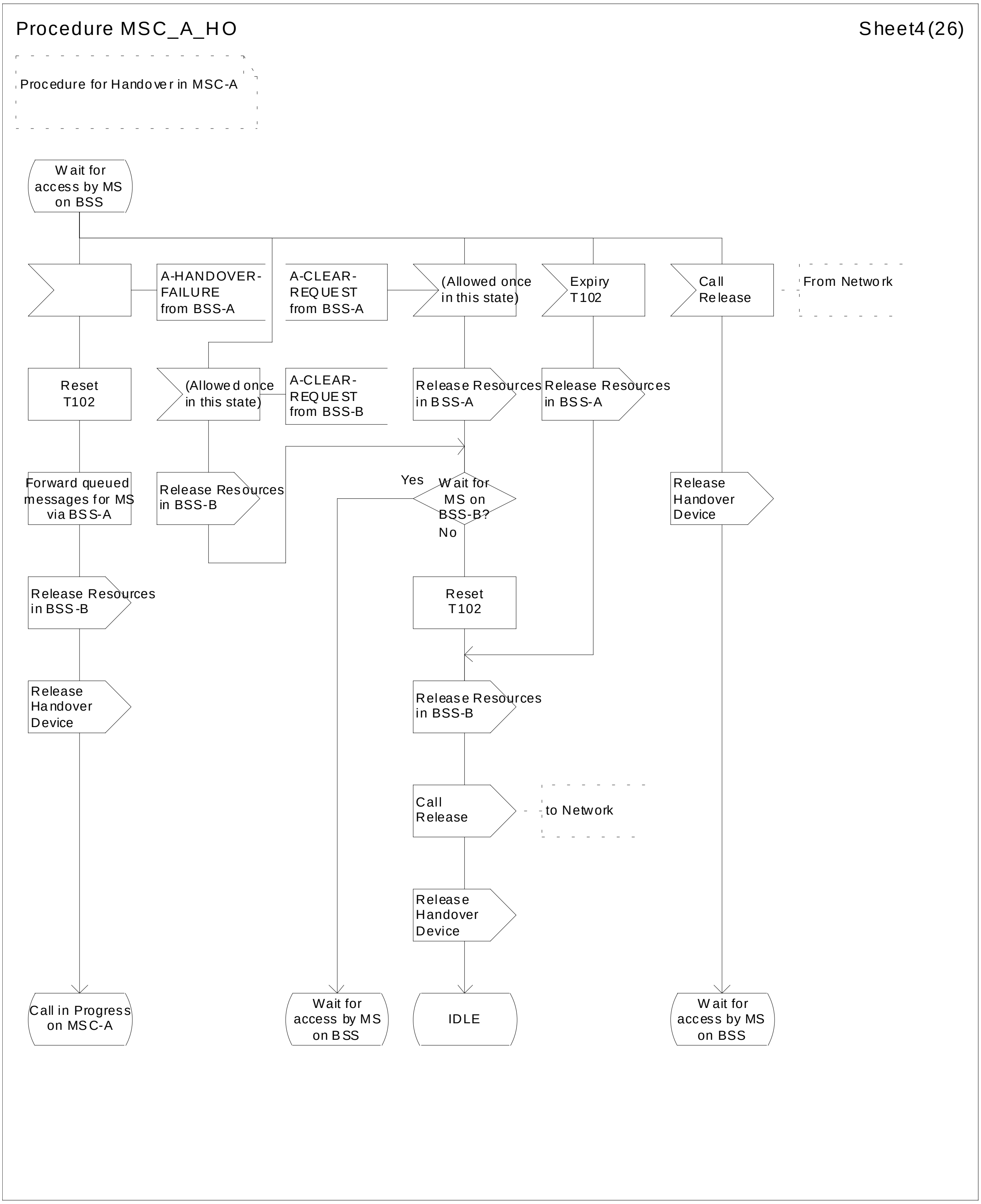


Figure 41 (Sheet 4 of 26): Handover control procedure in MSC-A

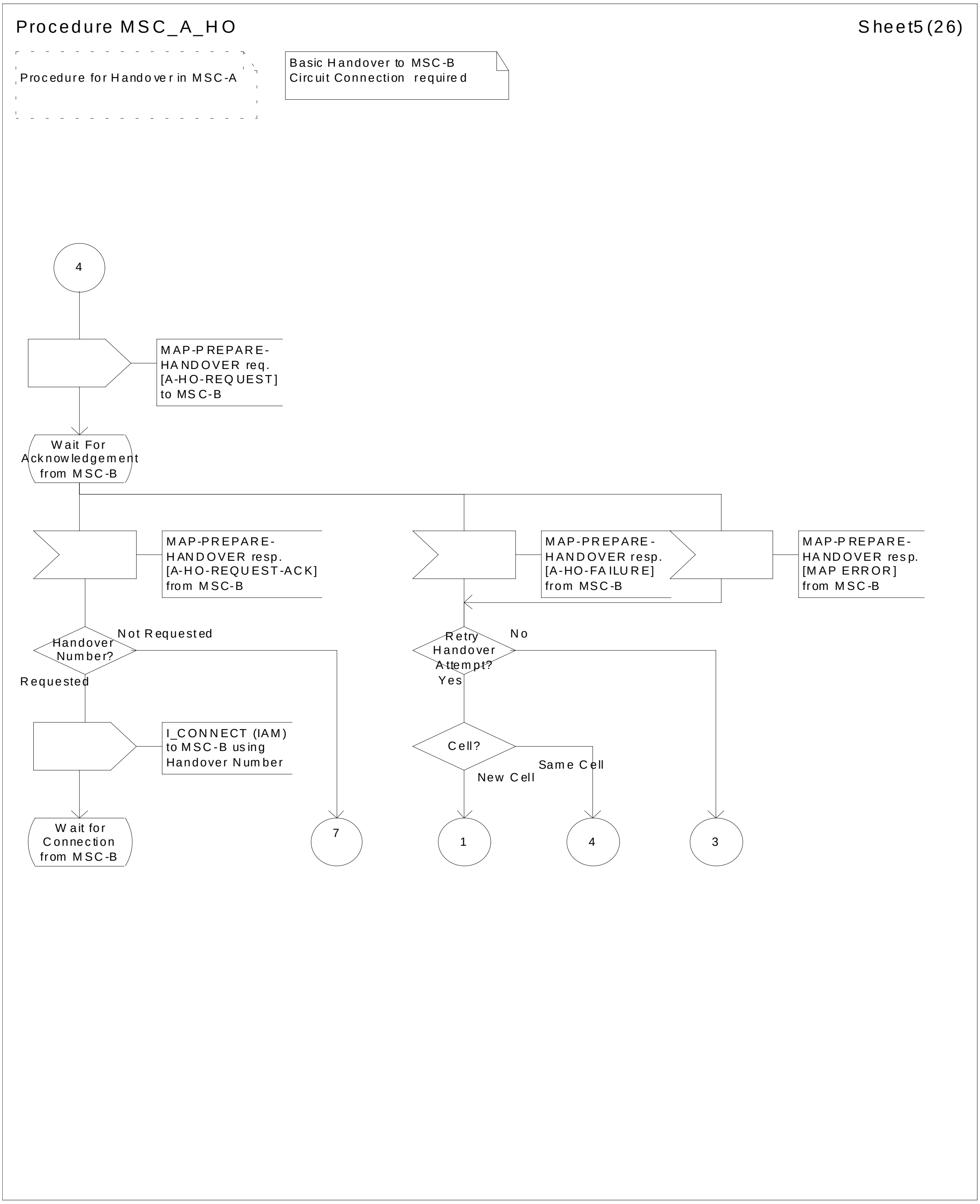


Figure 41 (Sheet 5 of 26): Handover control procedure in MSC-A

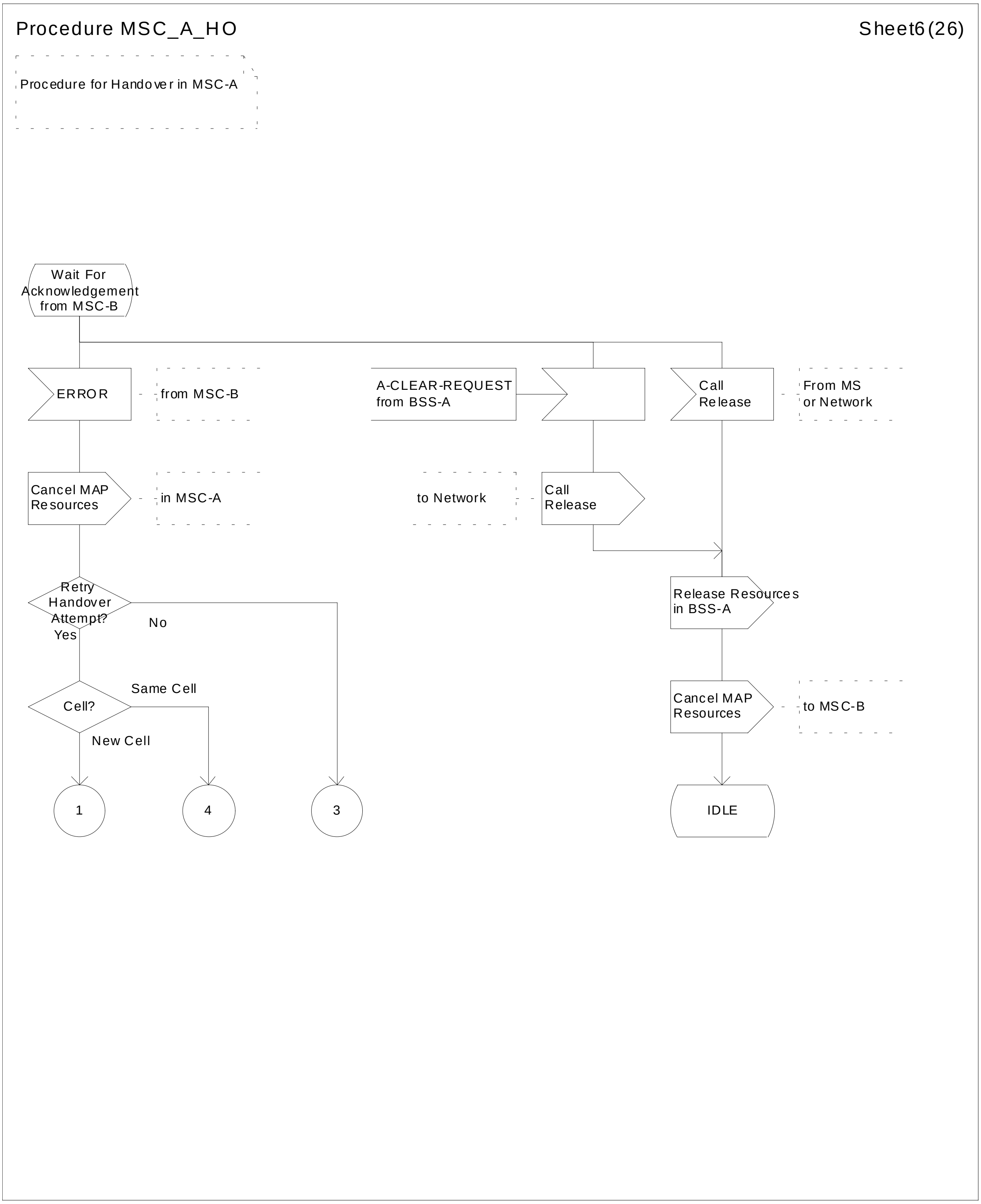


Figure 41 (Sheet 6 of 26): Handover control procedure in MSC-A

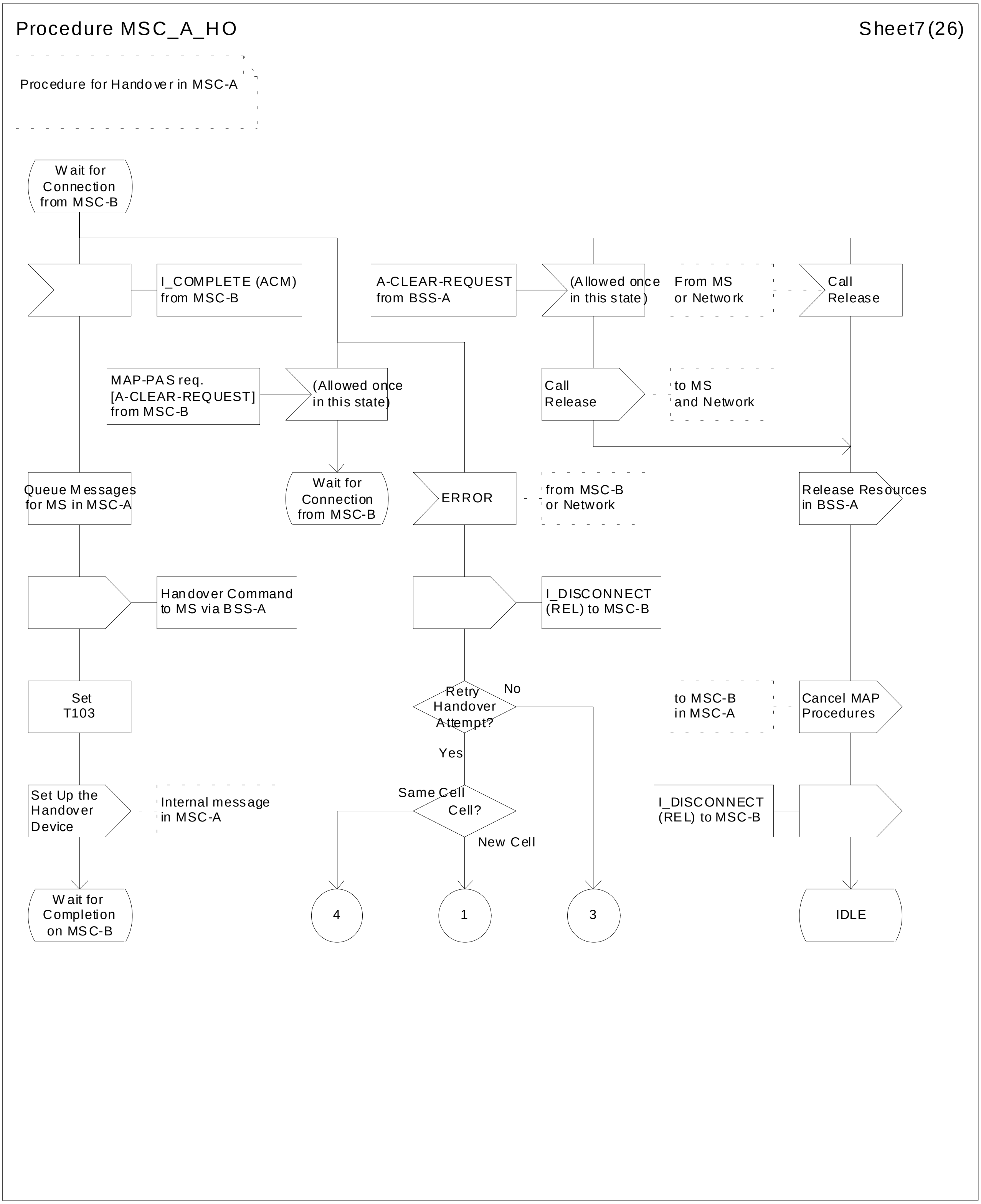


Figure 41 (Sheet 7 of 26): Handover control procedure in MSC-A

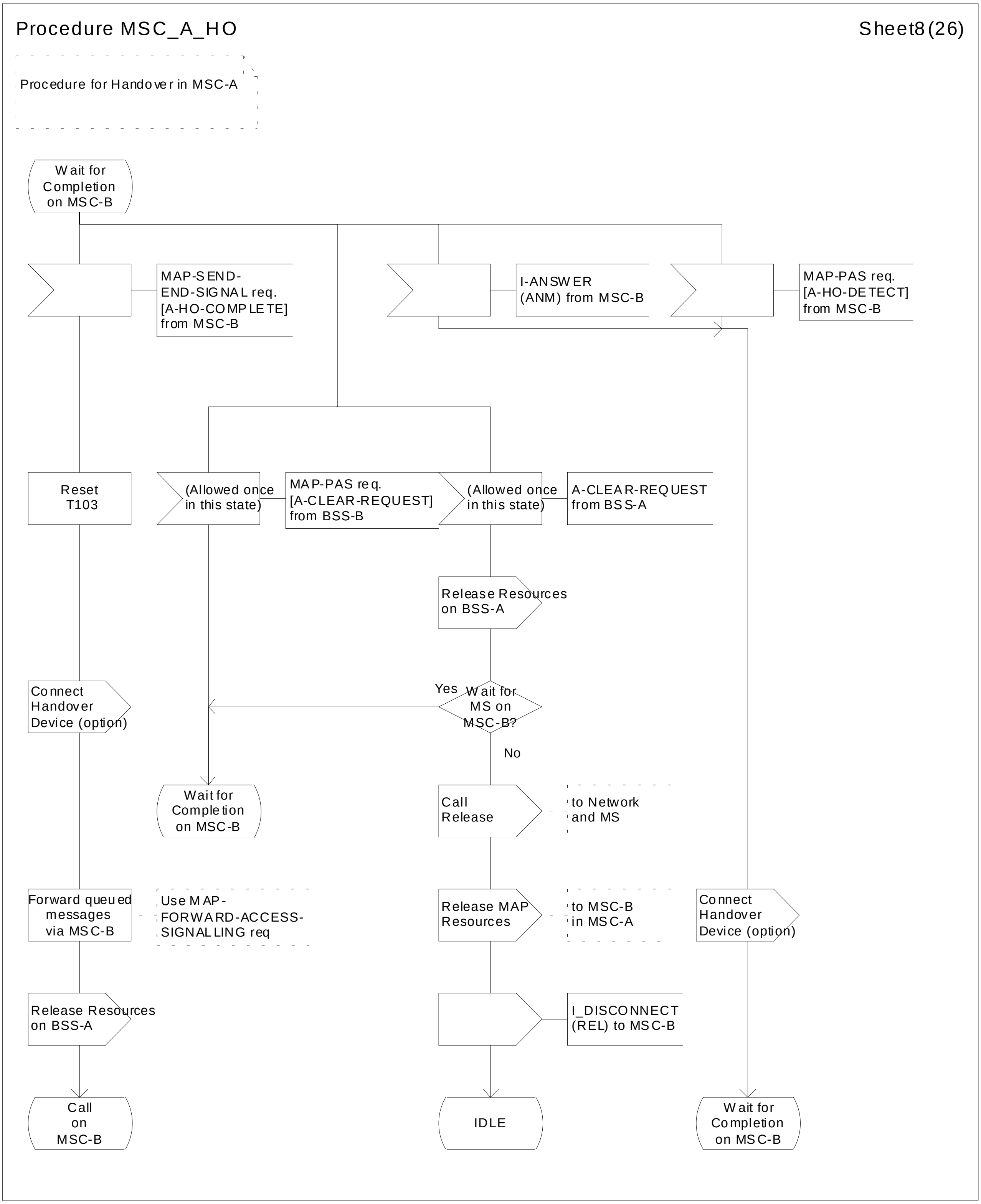


Figure 41 (Sheet 8 of 26): Handover control procedure in MSC-A

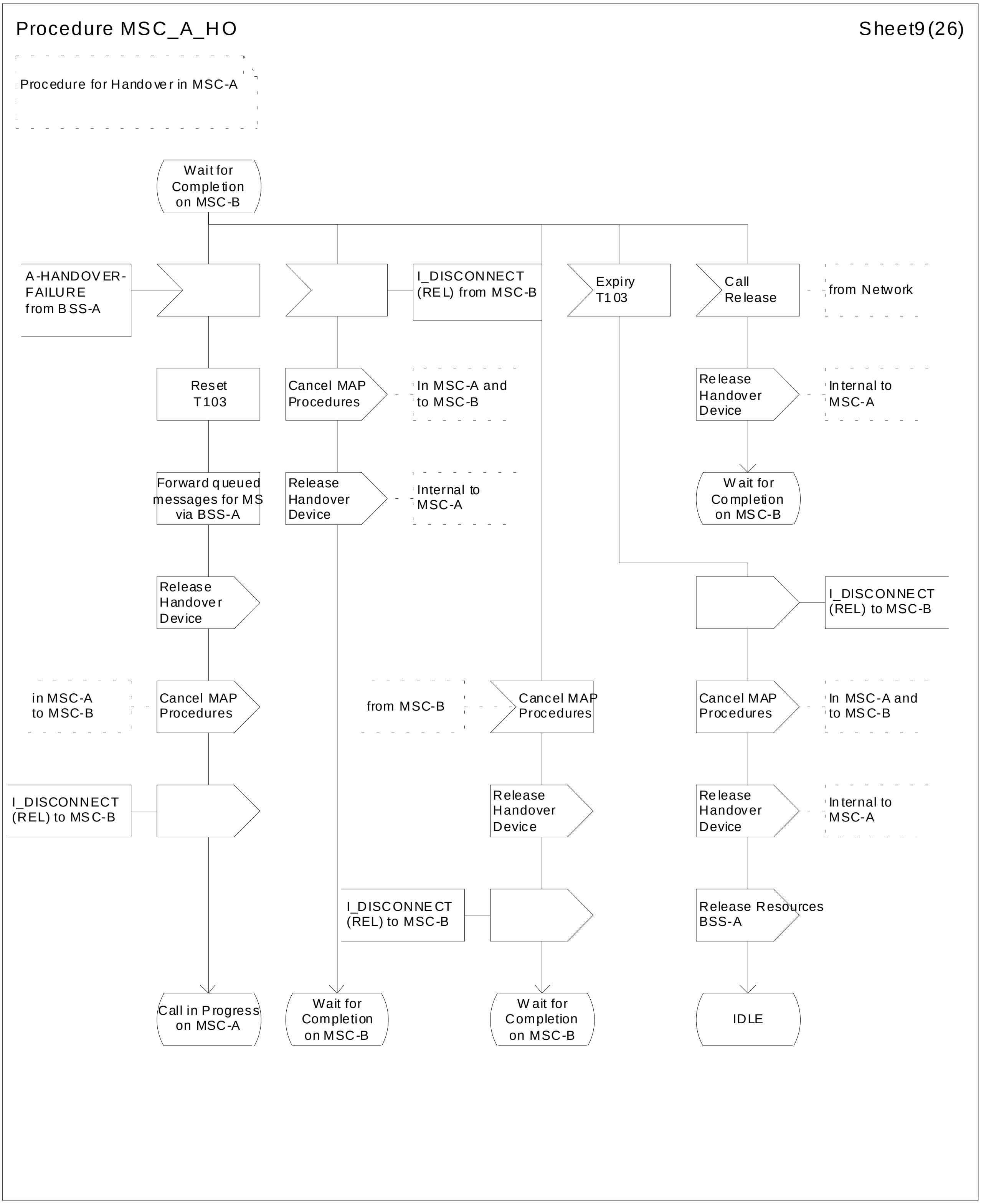


Figure 41 (Sheet 9 of 26): Handover control procedure in MSC-A

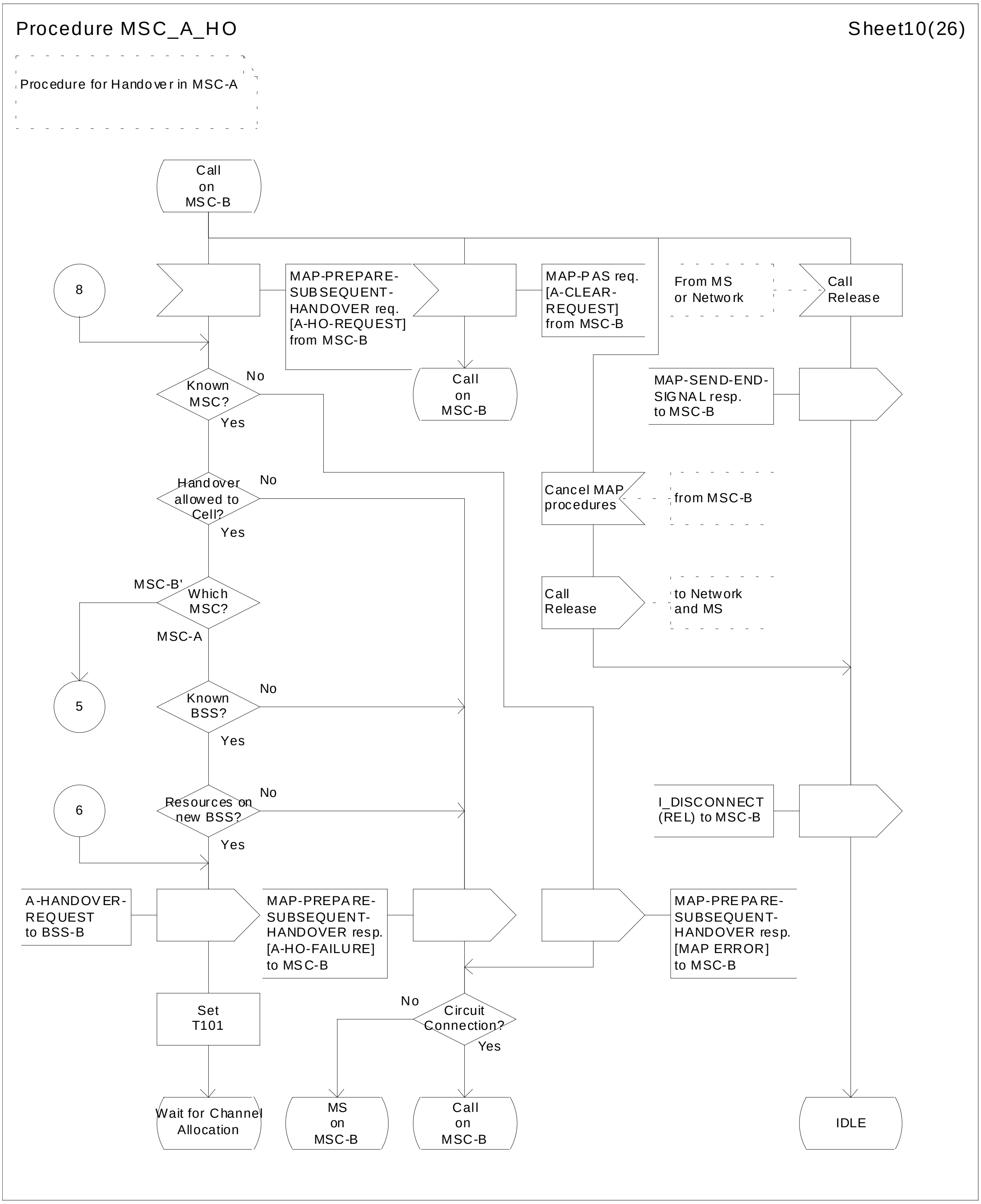


Figure 41 (Sheet 10 of 26): Handover control procedure in MSC-A

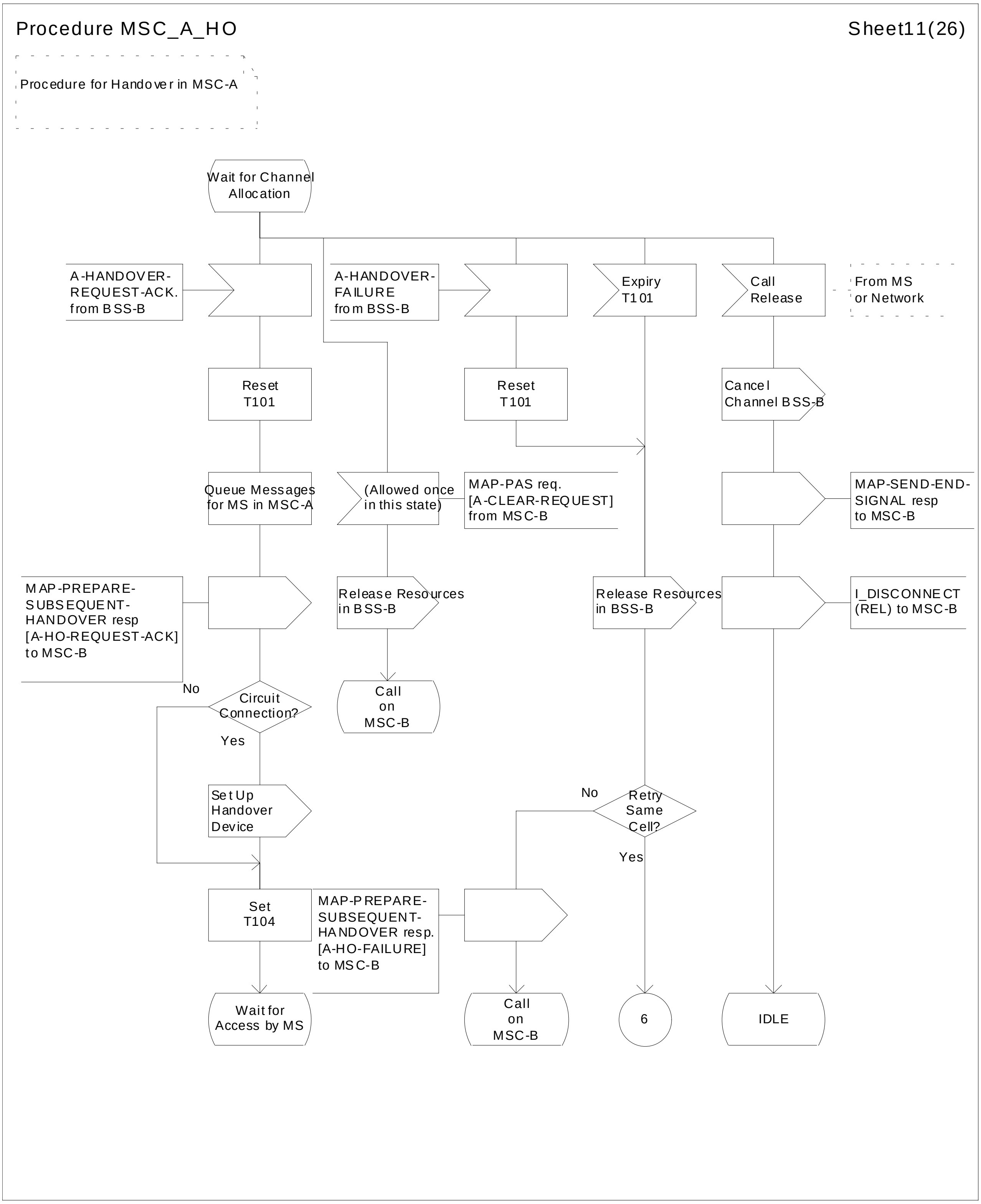


Figure 41 (Sheet 11 of 26): Handover control procedure in MSC-A

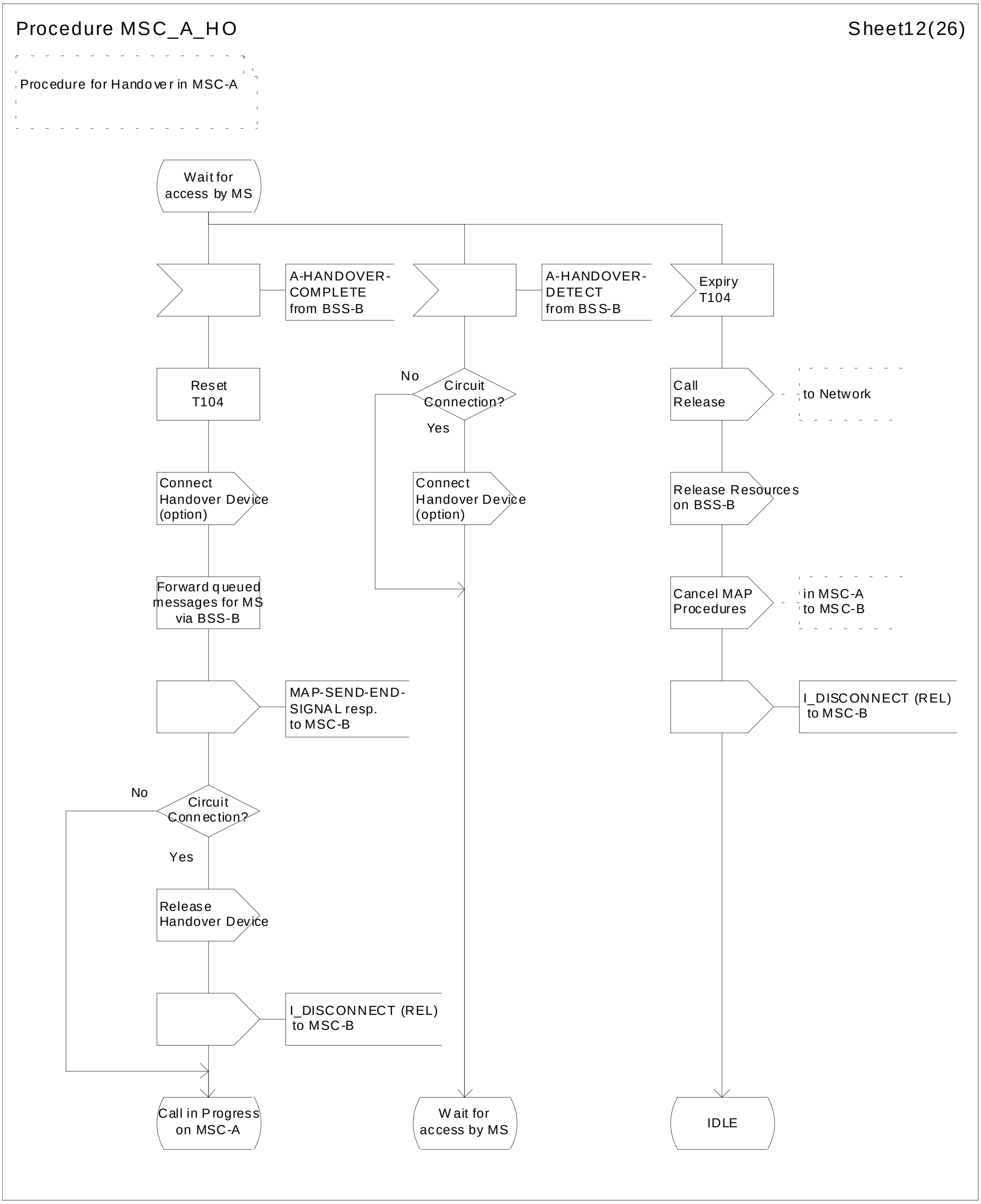


Figure 41 (Sheet 12 of 26): Handover control procedure in MSC-A

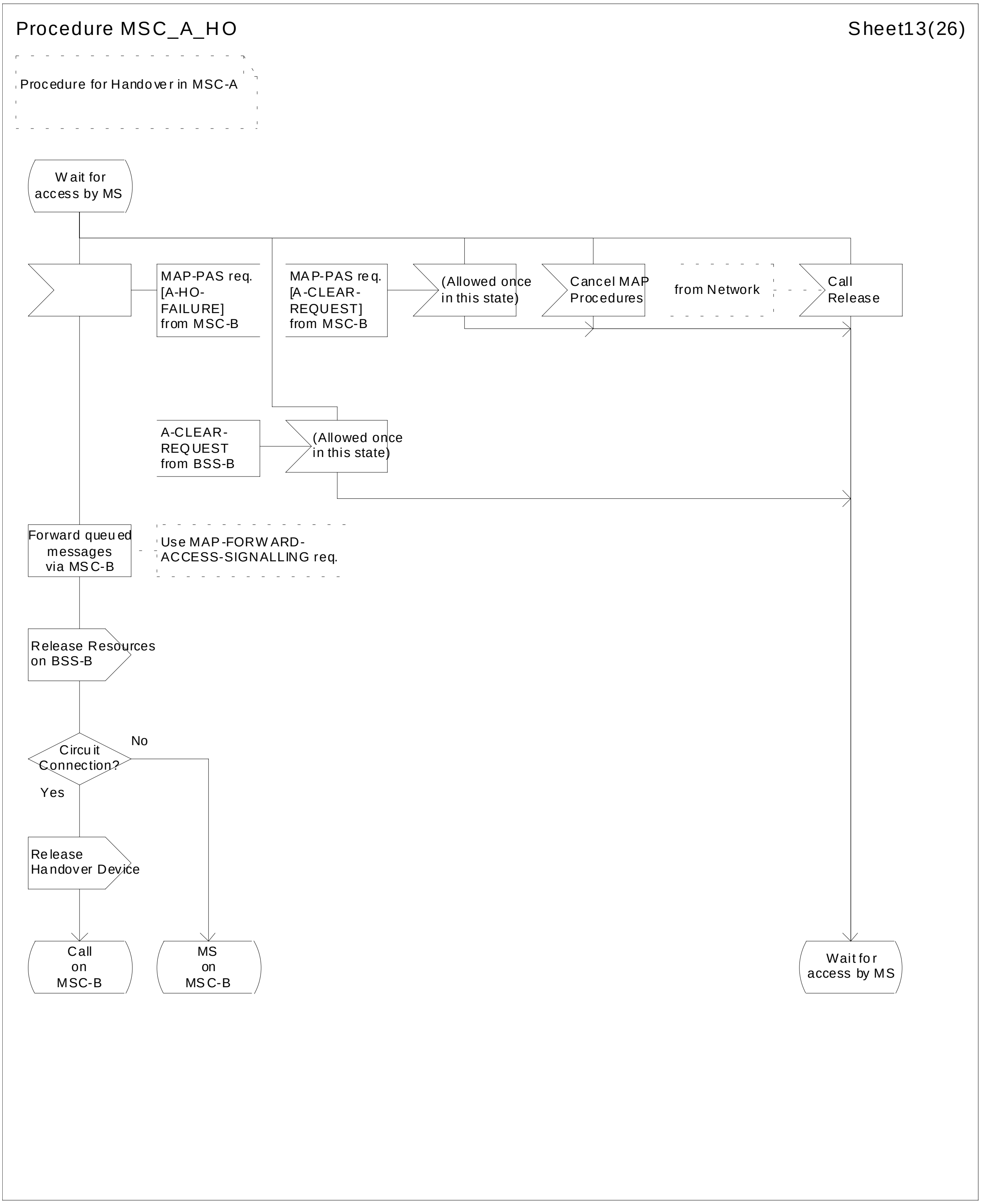


Figure 41 (Sheet 13 of 26): Handover control procedure in MSC-A

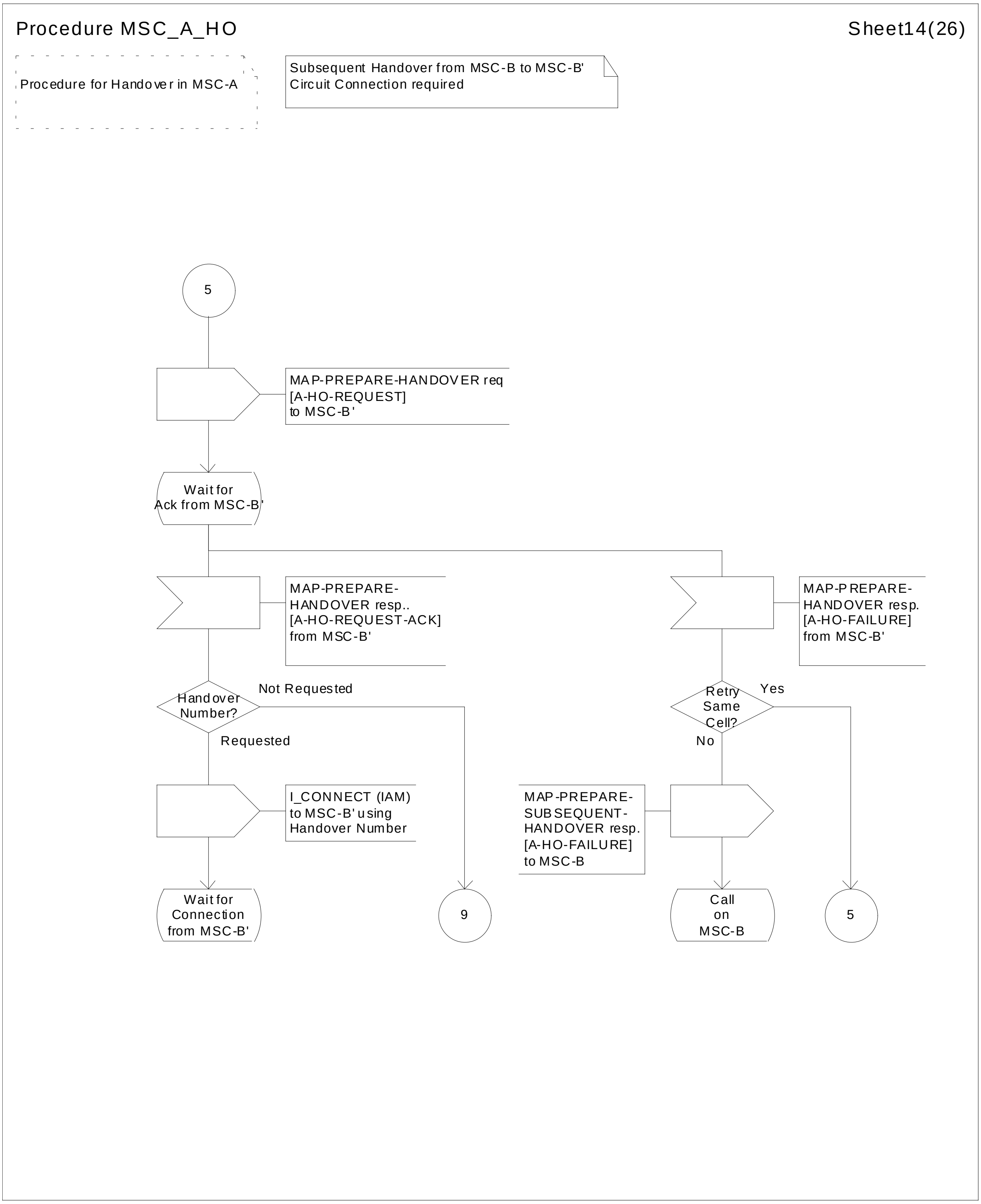


Figure 41 (Sheet 14 of 26): Handover control procedure in MSC-A

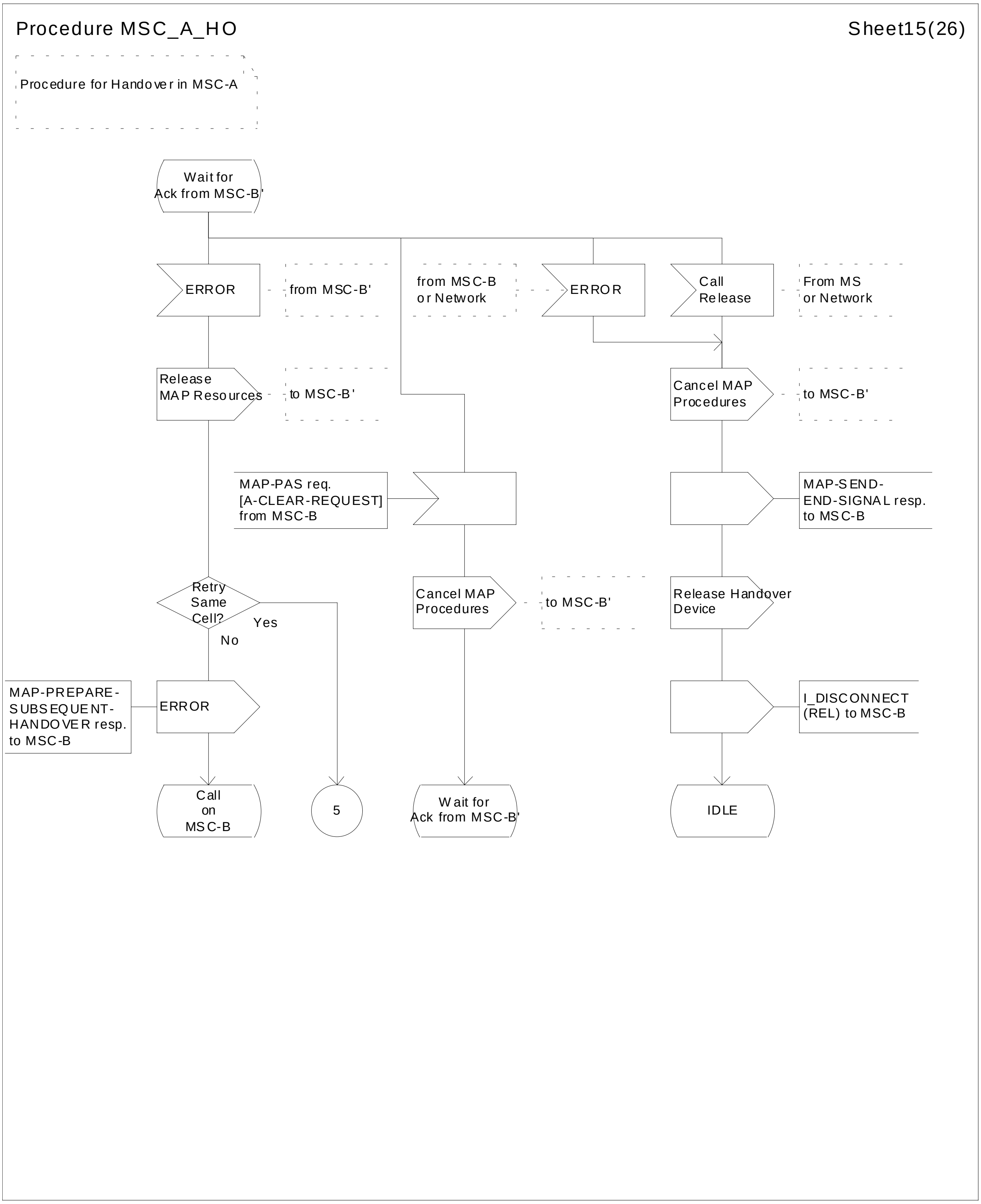


Figure 41 (Sheet 15 of 26): Handover control procedure in MSC-A

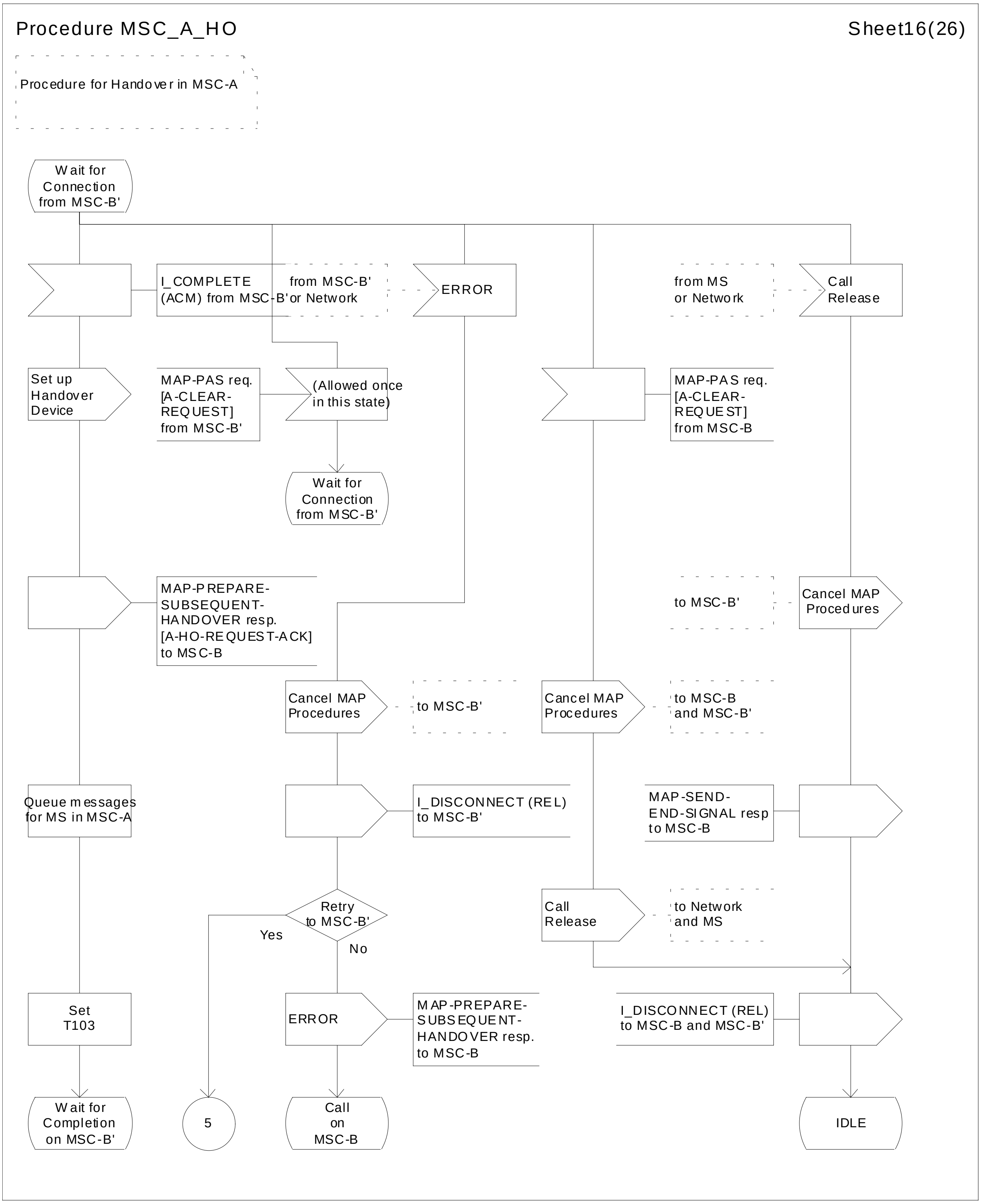


Figure 41 (Sheet 16 of 26): Handover control procedure in MSC-A

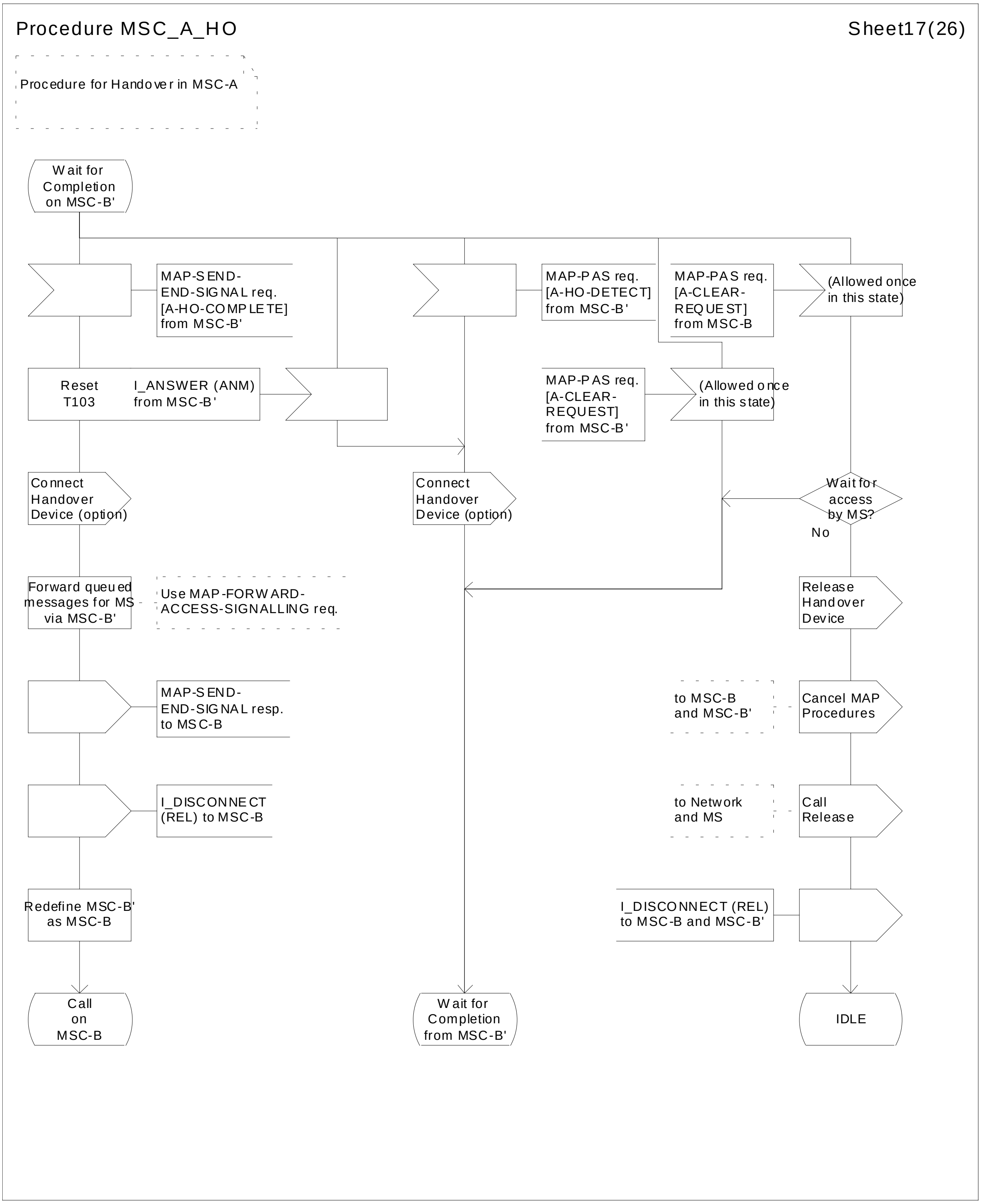


Figure 41 (Sheet 17 of 26): Handover control procedure in MSC-A

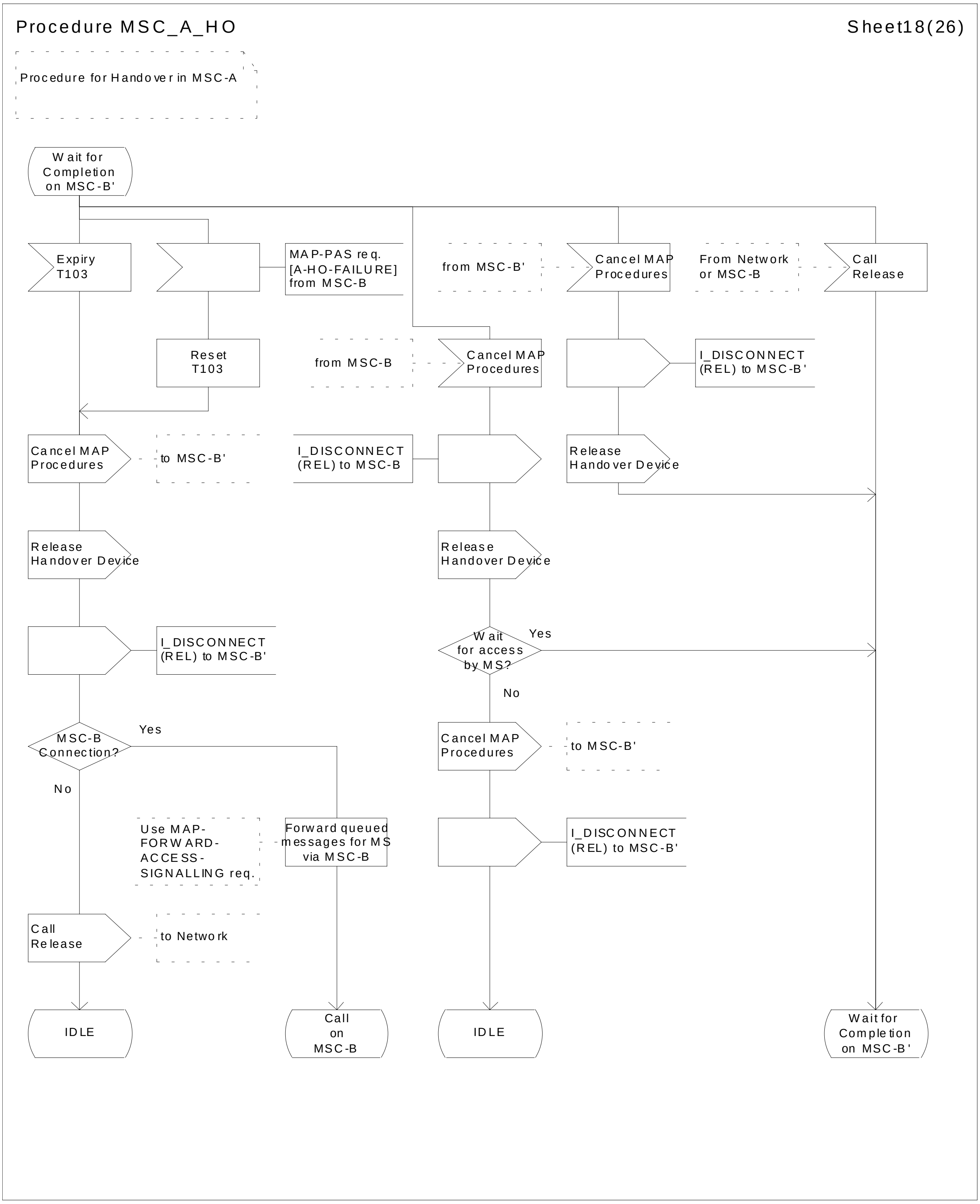


Figure 41 (Sheet 18 of 26): Handover control procedure in MSC-A

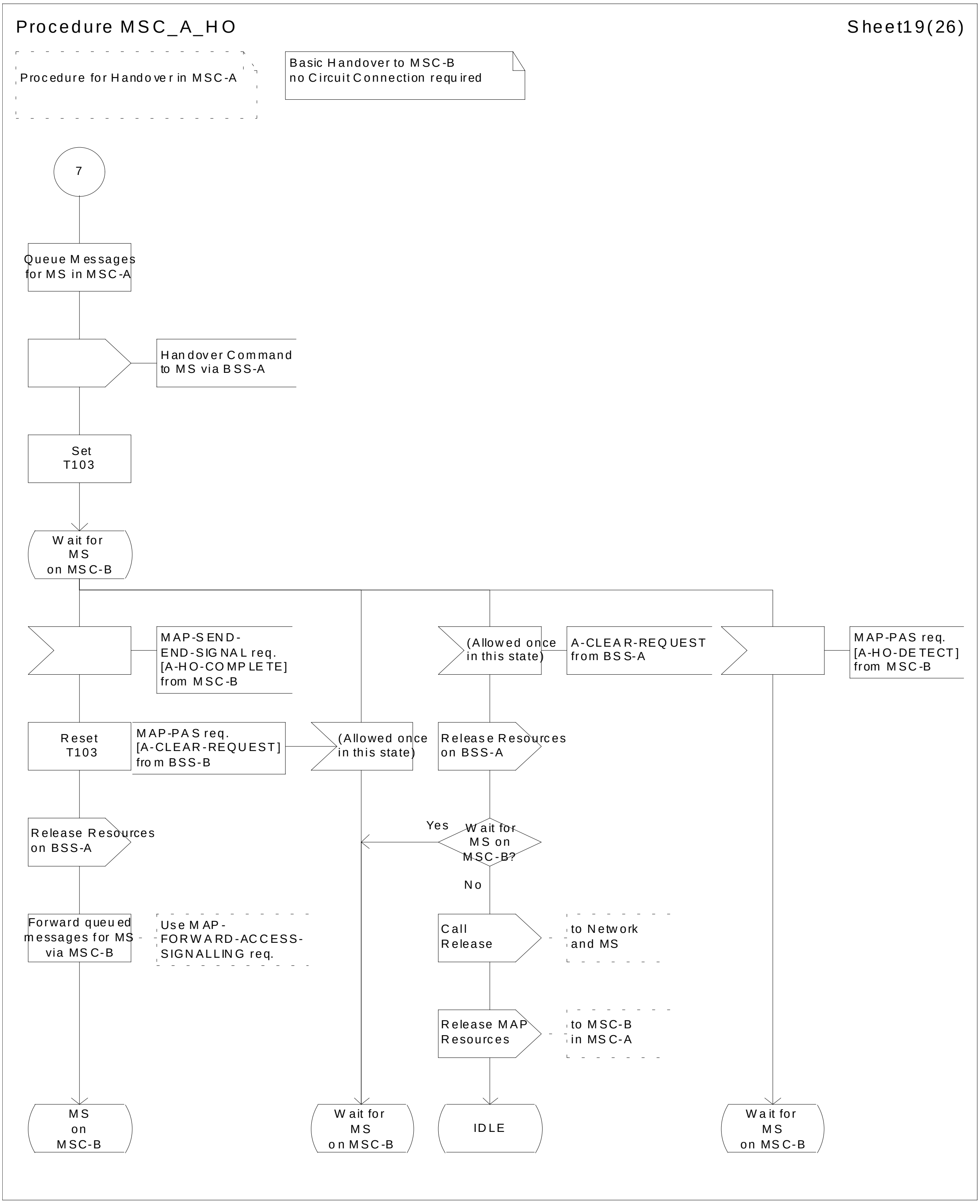


Figure 41 (Sheet 19 of 26): Handover control procedure in MSC-A

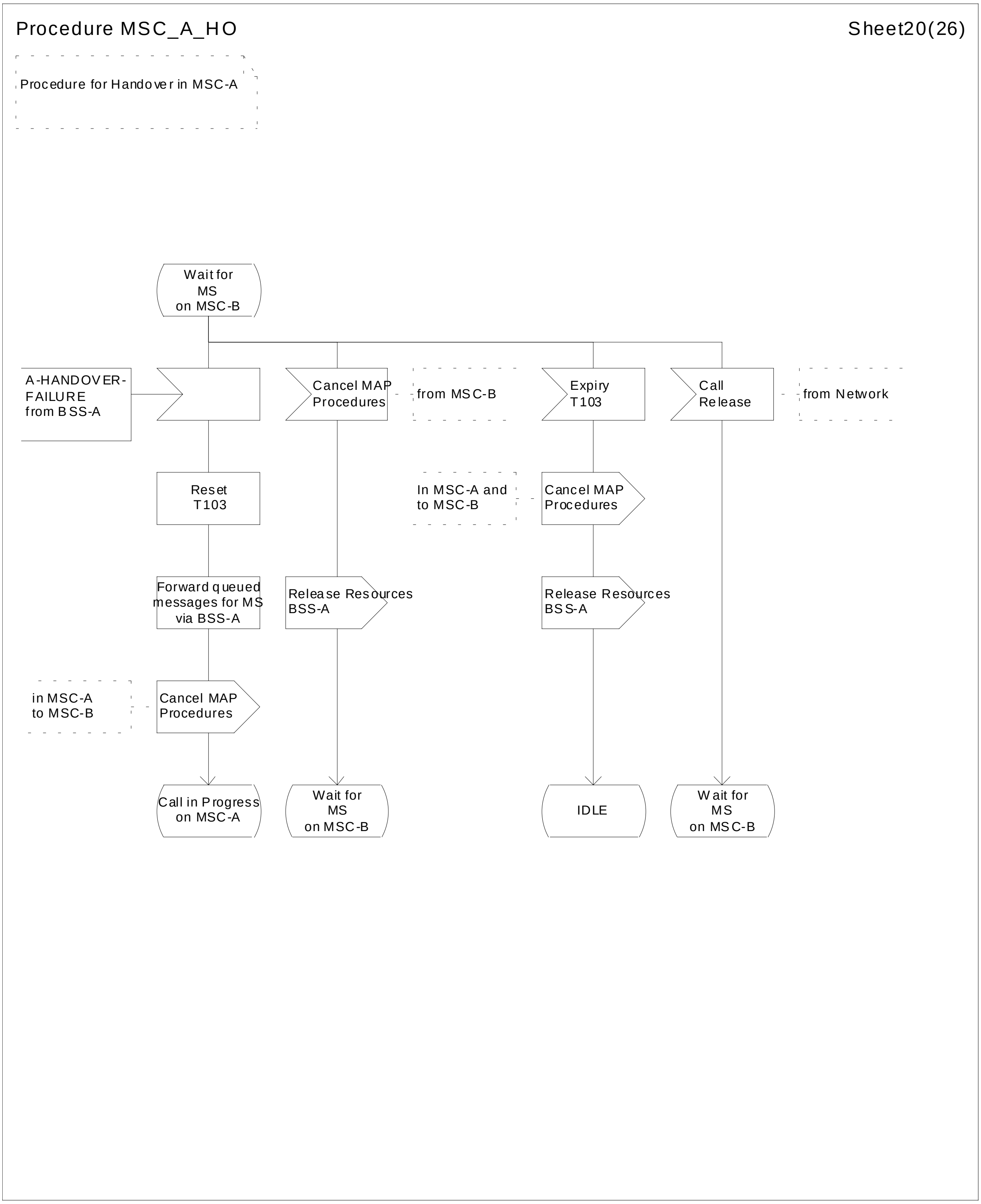


Figure 41 (Sheet 20 of 26): Handover control procedure in MSC-A

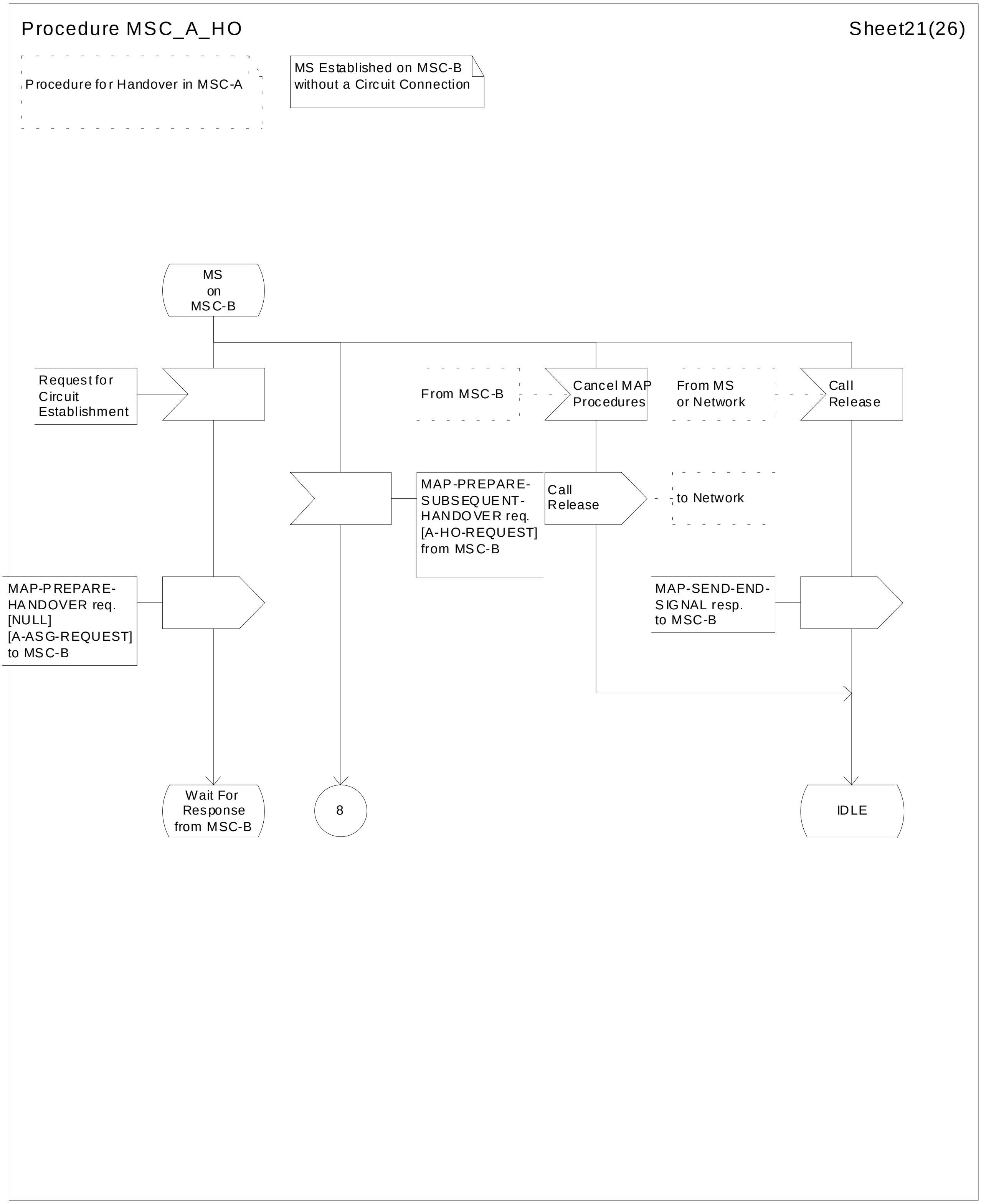


Figure 41 (Sheet 21 of 26): Handover control procedure in MSC-A

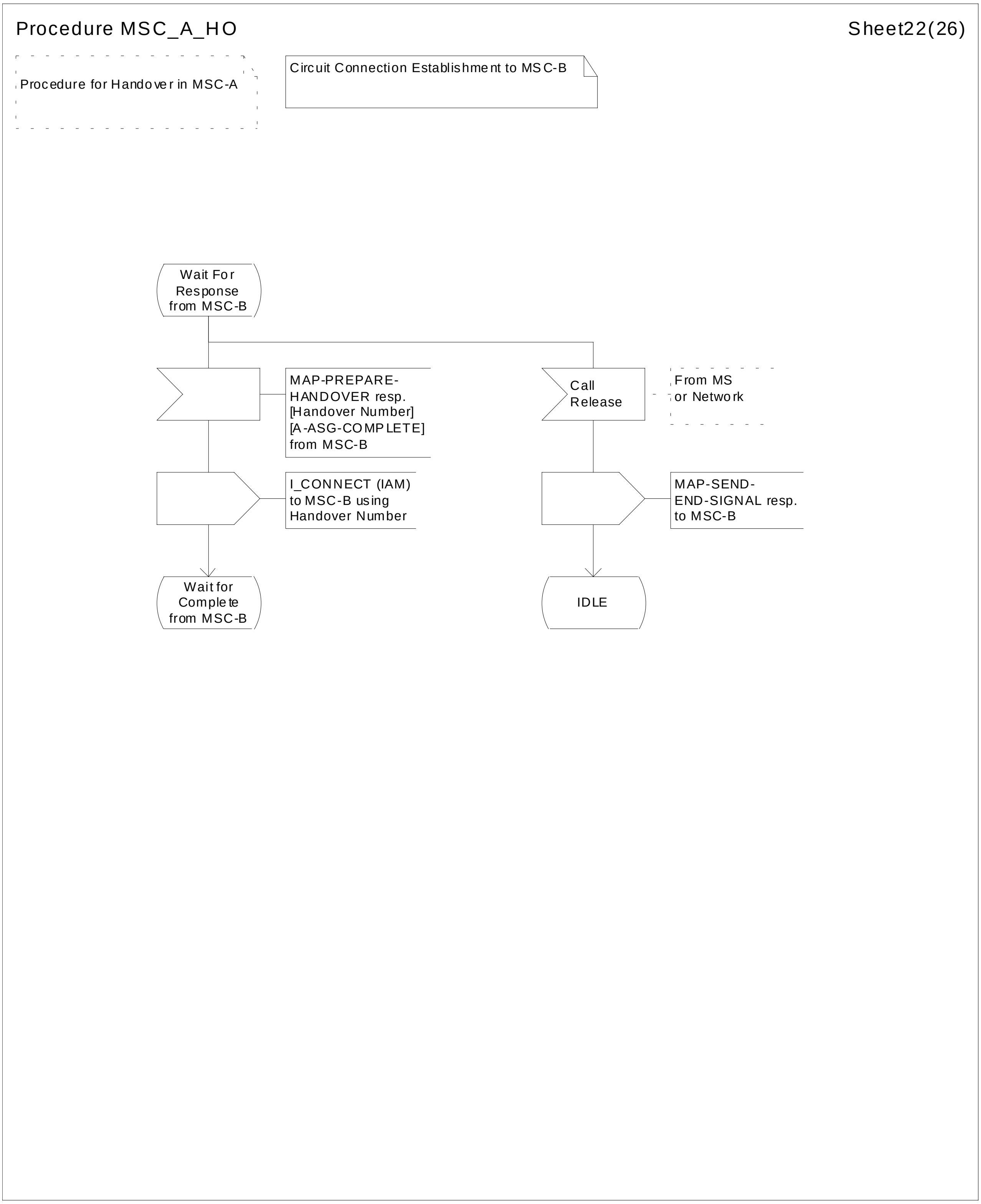


Figure 41 (Sheet 22 of 26): Handover control procedure in MSC-A

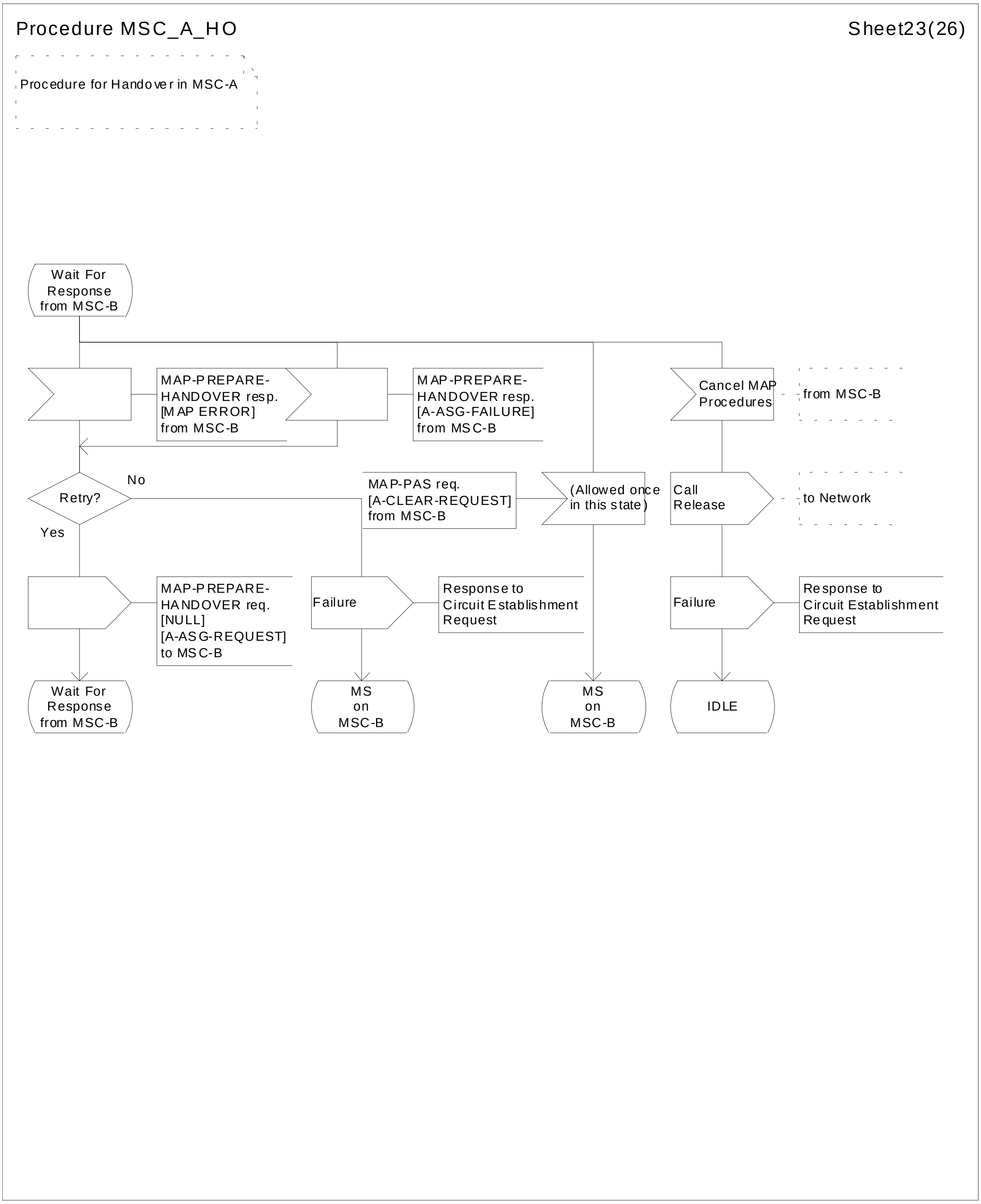


Figure 41 (Sheet 23 of 26): Handover control procedure in MSC-A

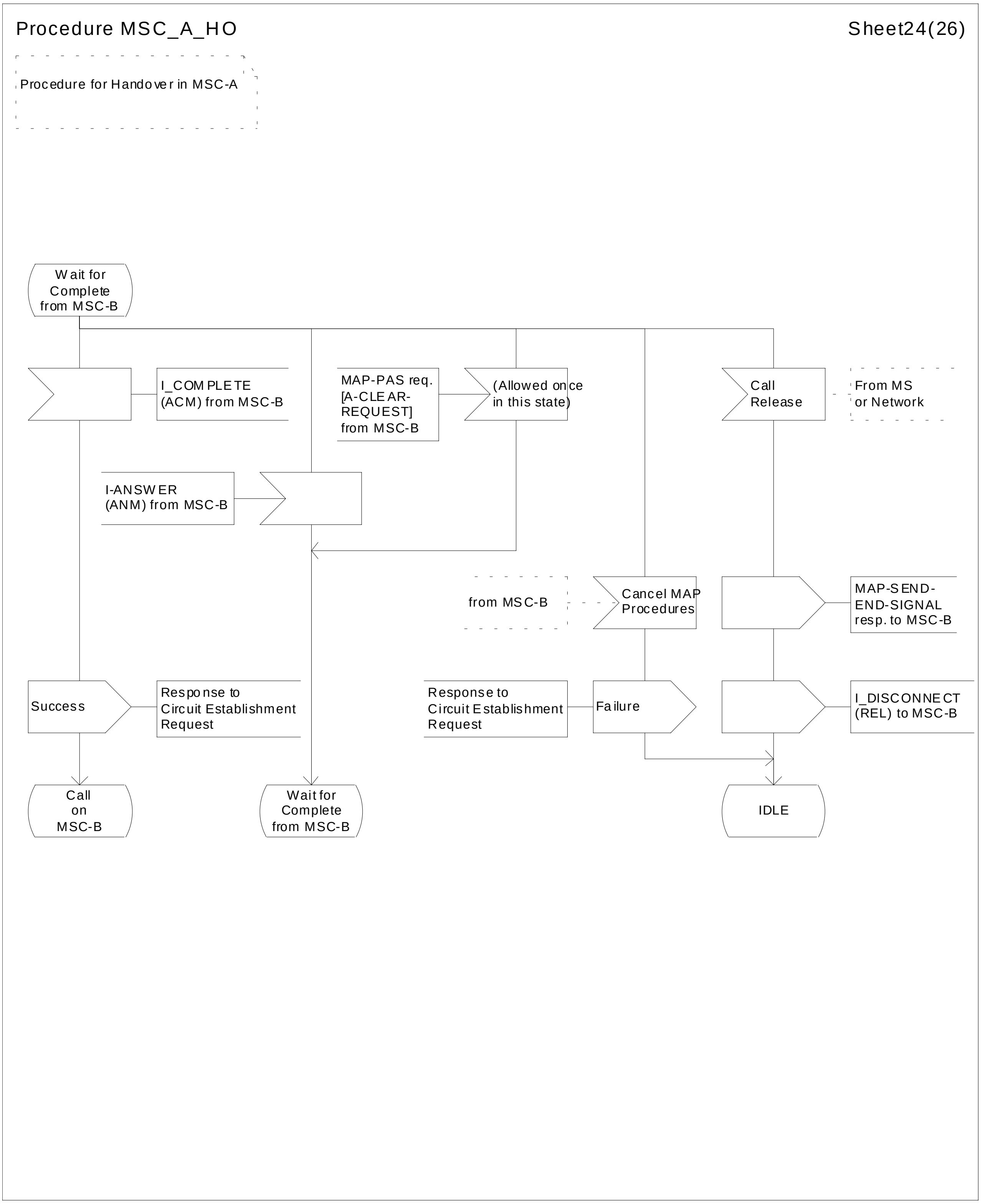


Figure 41 (Sheet 24 of 26): Handover control procedure in MSC-A

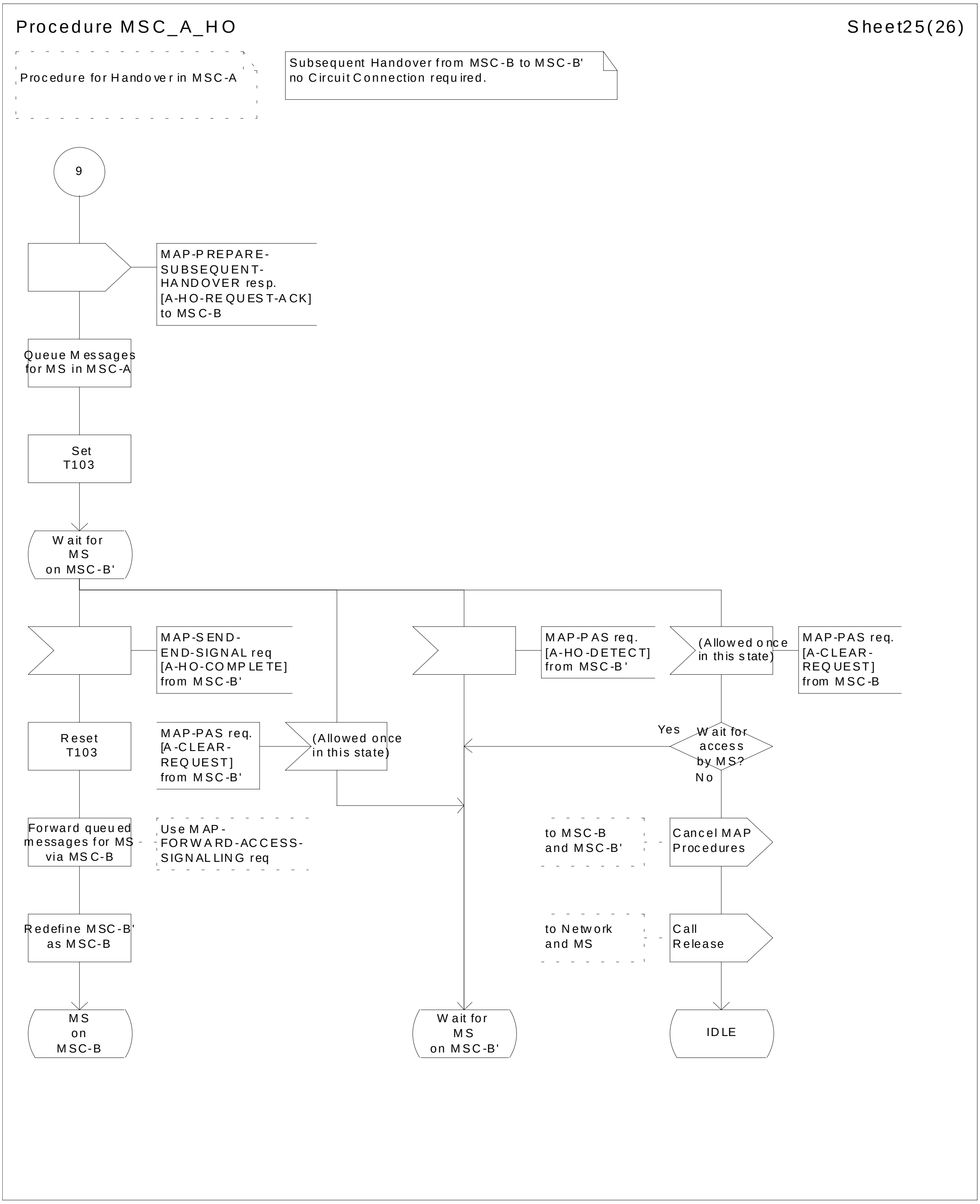


Figure 41 (Sheet 25 of 26): Handover control procedure in MSC-A

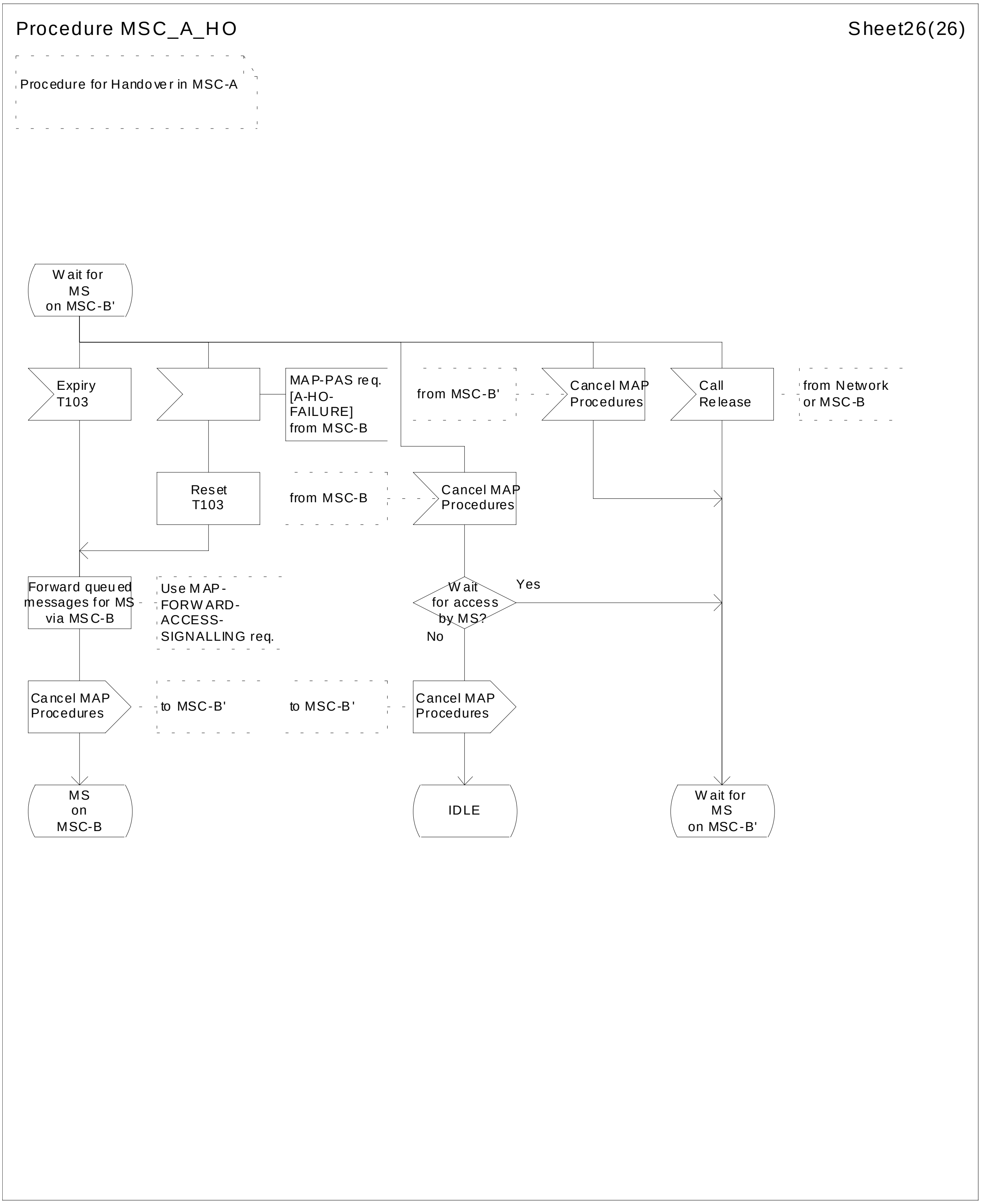


Figure 41 (Sheet 26 of 26): Handover control procedure in MSC-A

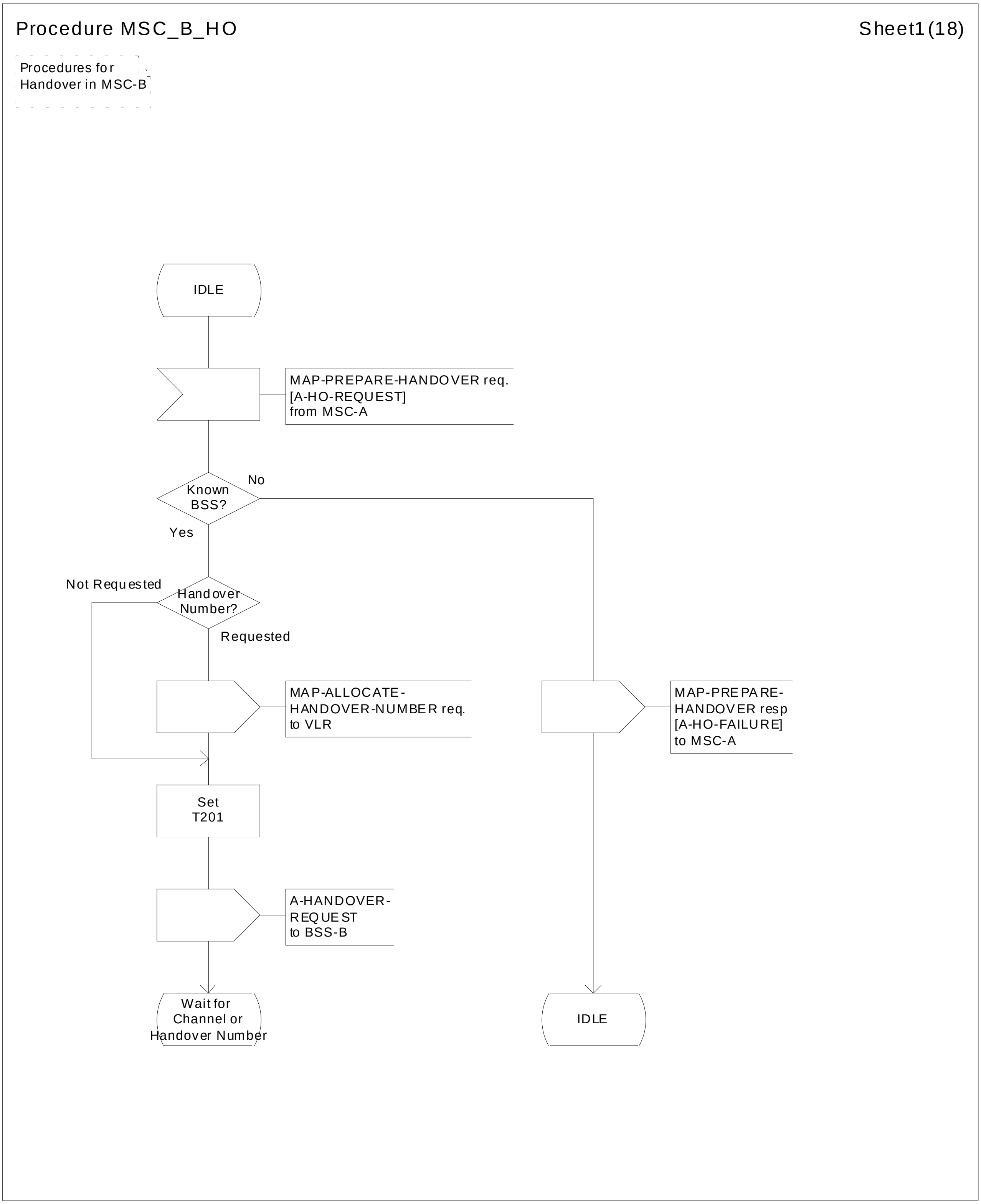


Figure 42 (Sheet 1 of 18): Handover control procedure in MSC-B

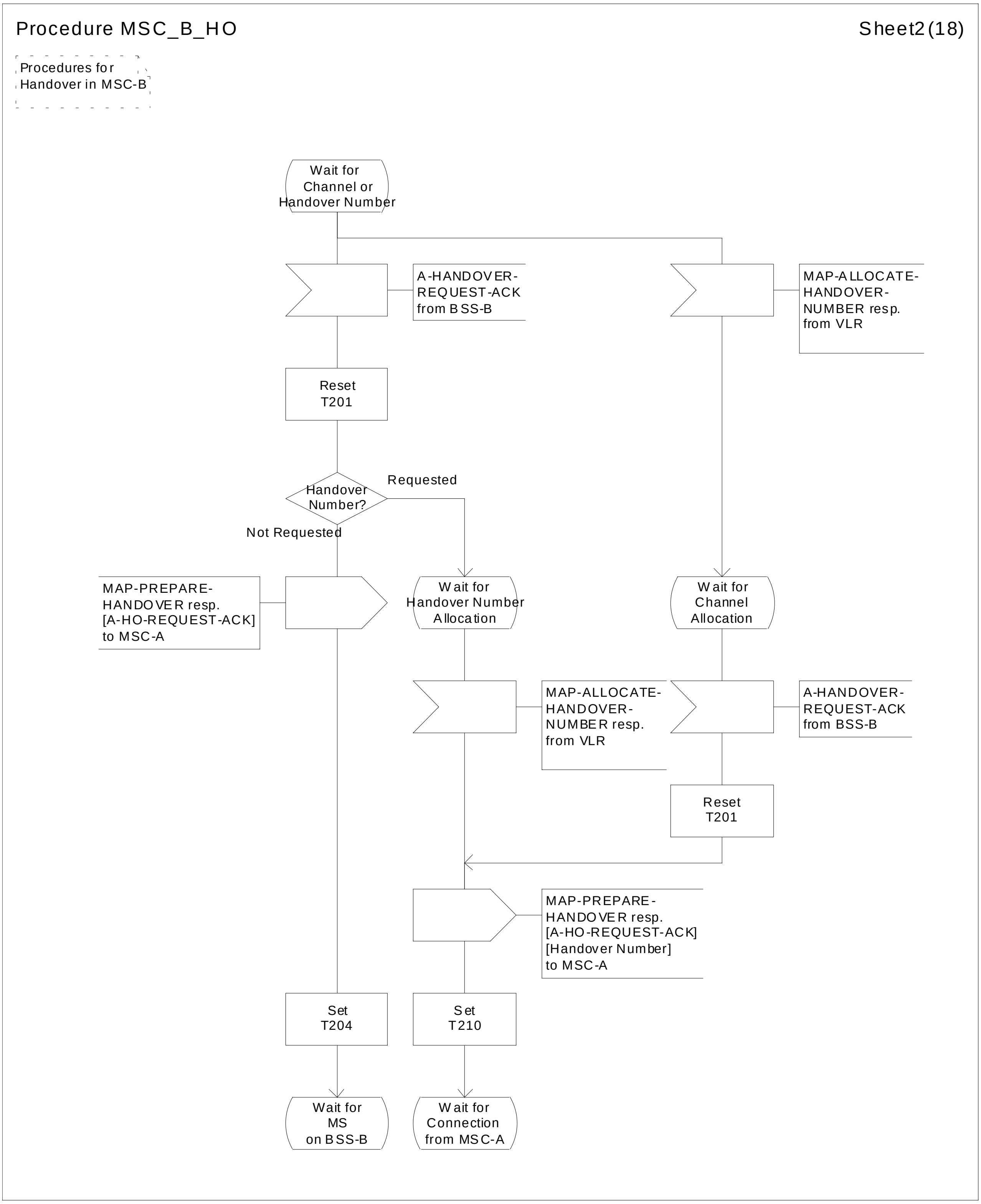


Figure 42 (Sheet 2 of 18): Handover control procedure in MSC-B

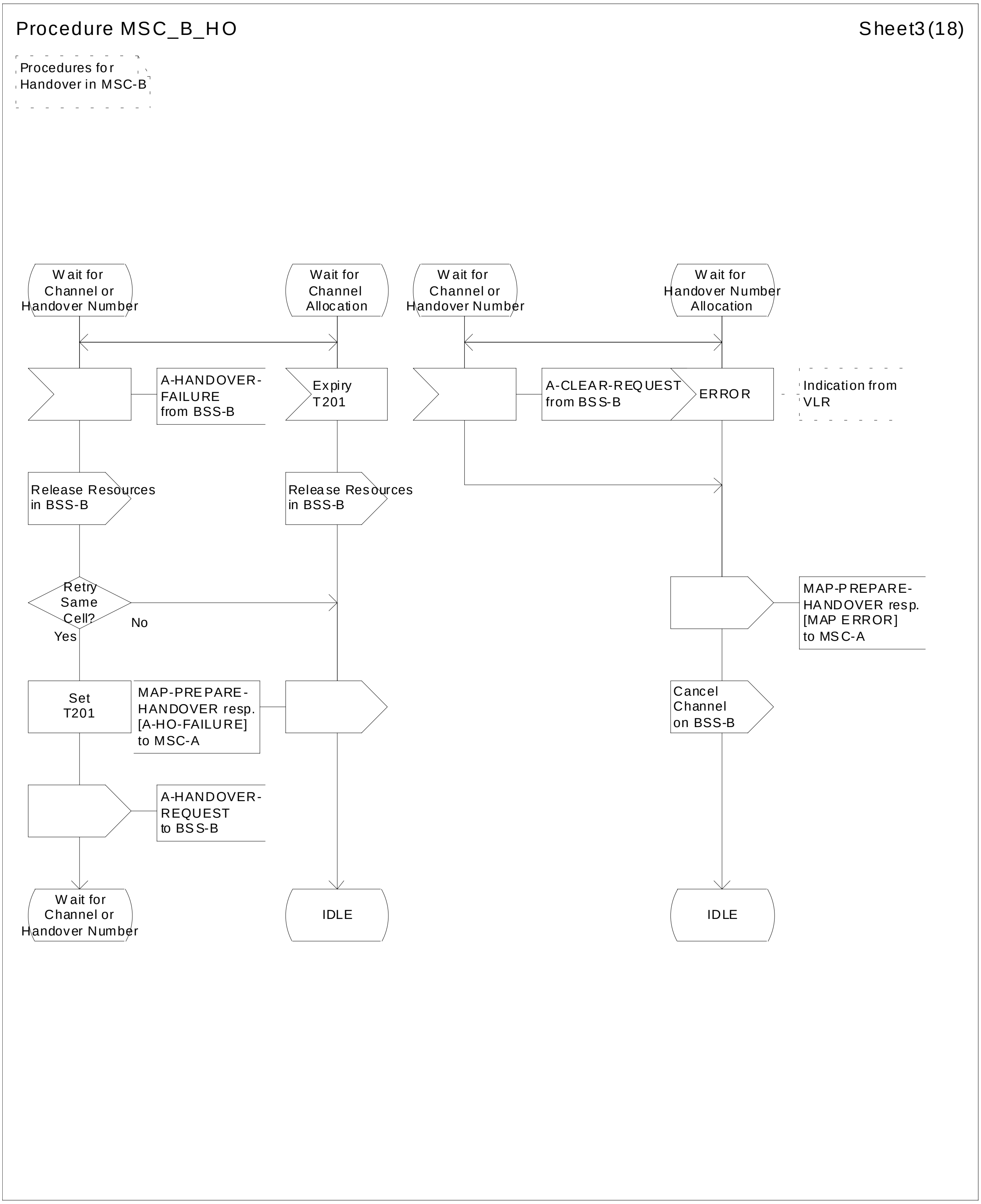


Figure 42 (Sheet 3 of 18): Handover control procedure in MSC-B

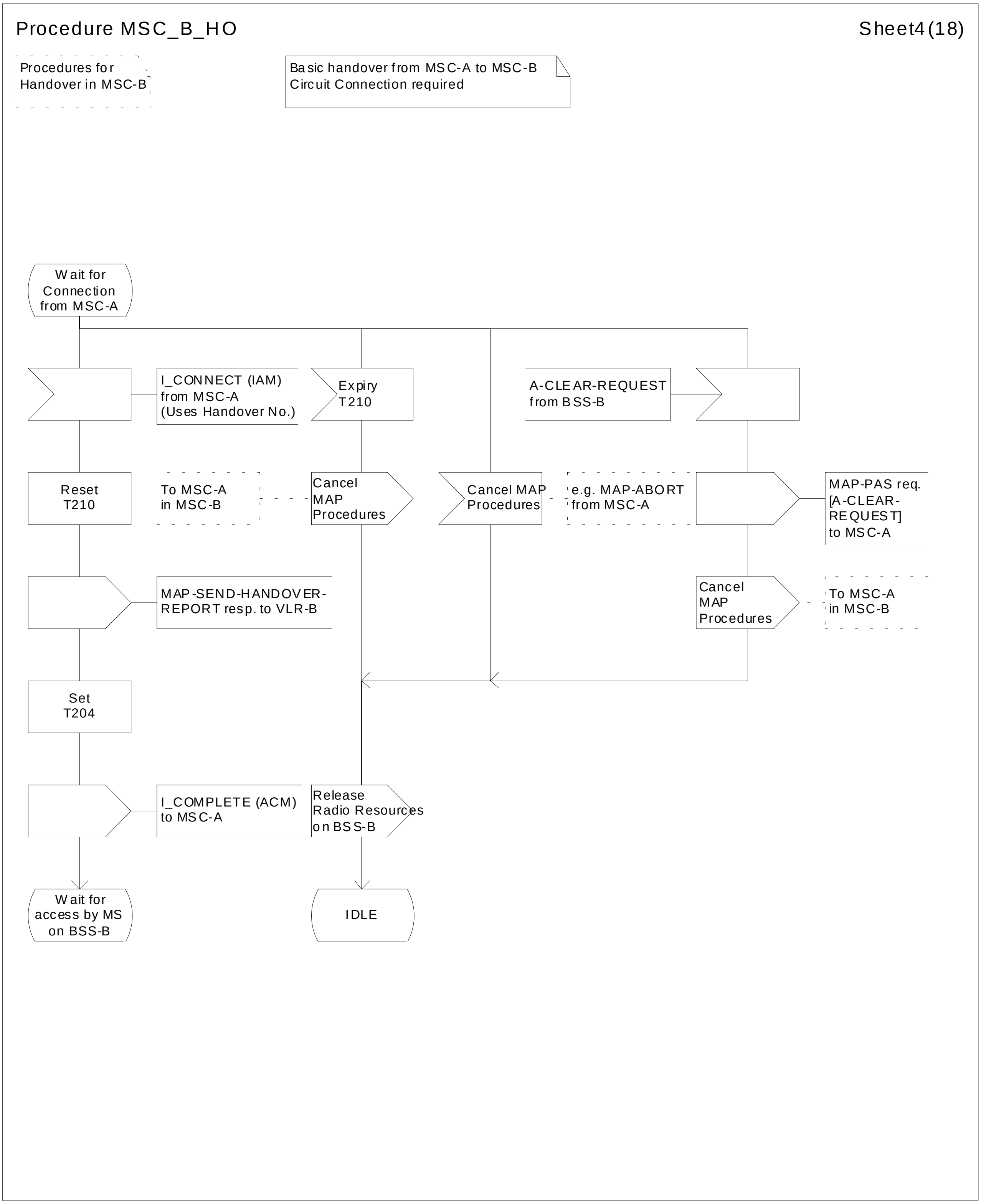


Figure 42 (Sheet 4 of 18): Handover control procedure in MSC-B

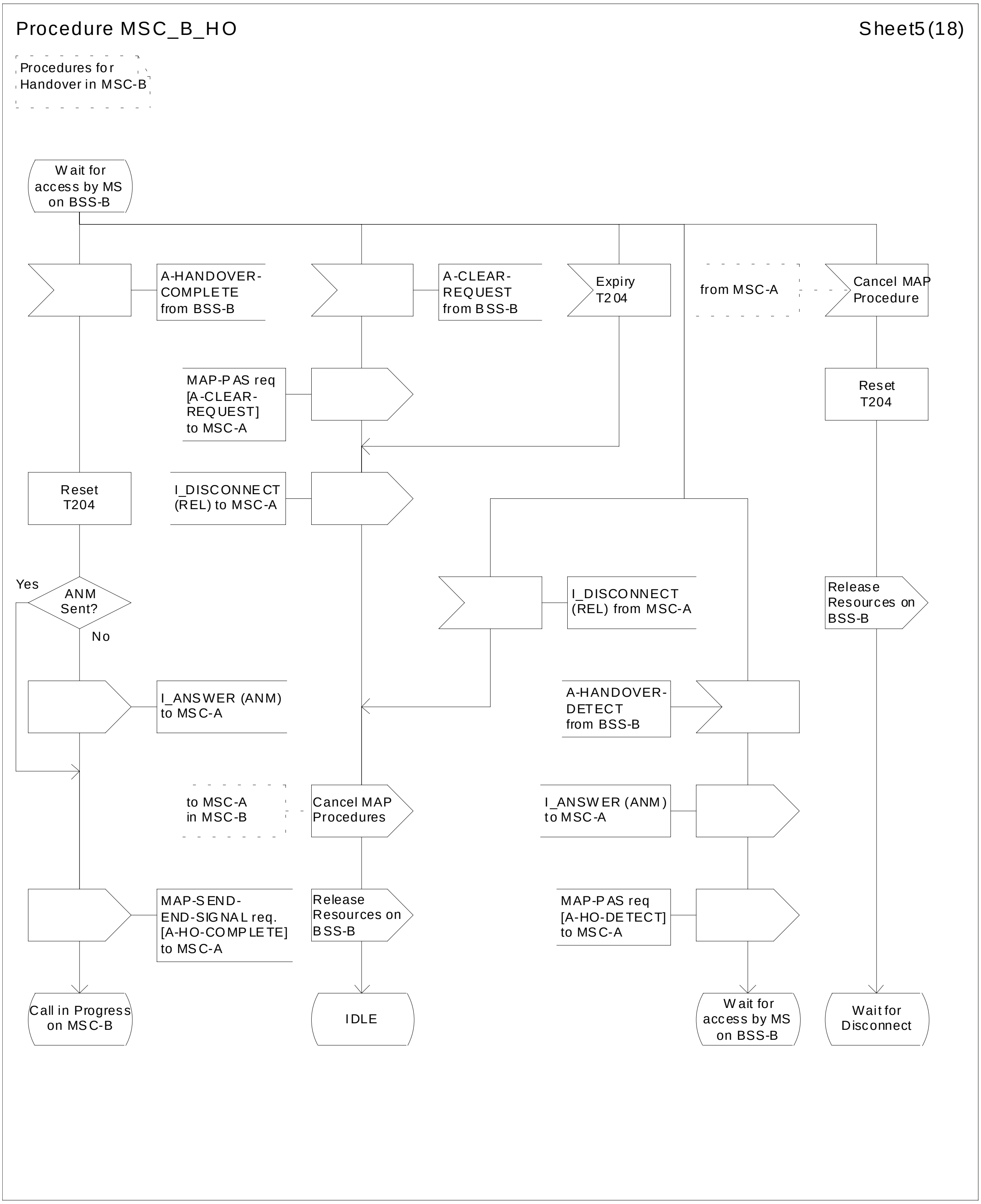


Figure 42 (Sheet 5 of 18): Handover control procedure in MSC-B

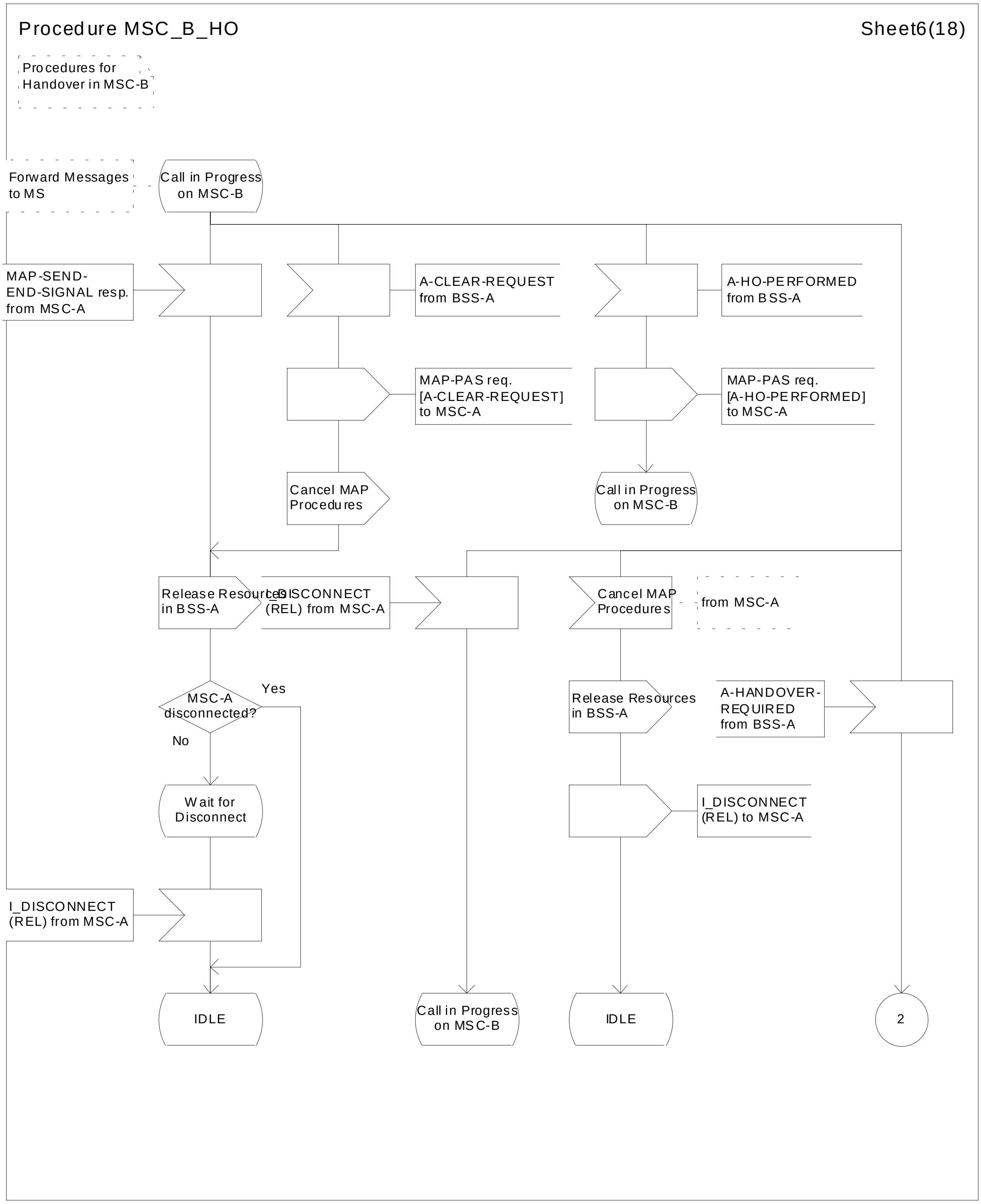


Figure 42 (Sheet 6 of 18): Handover control procedure in MSC-B

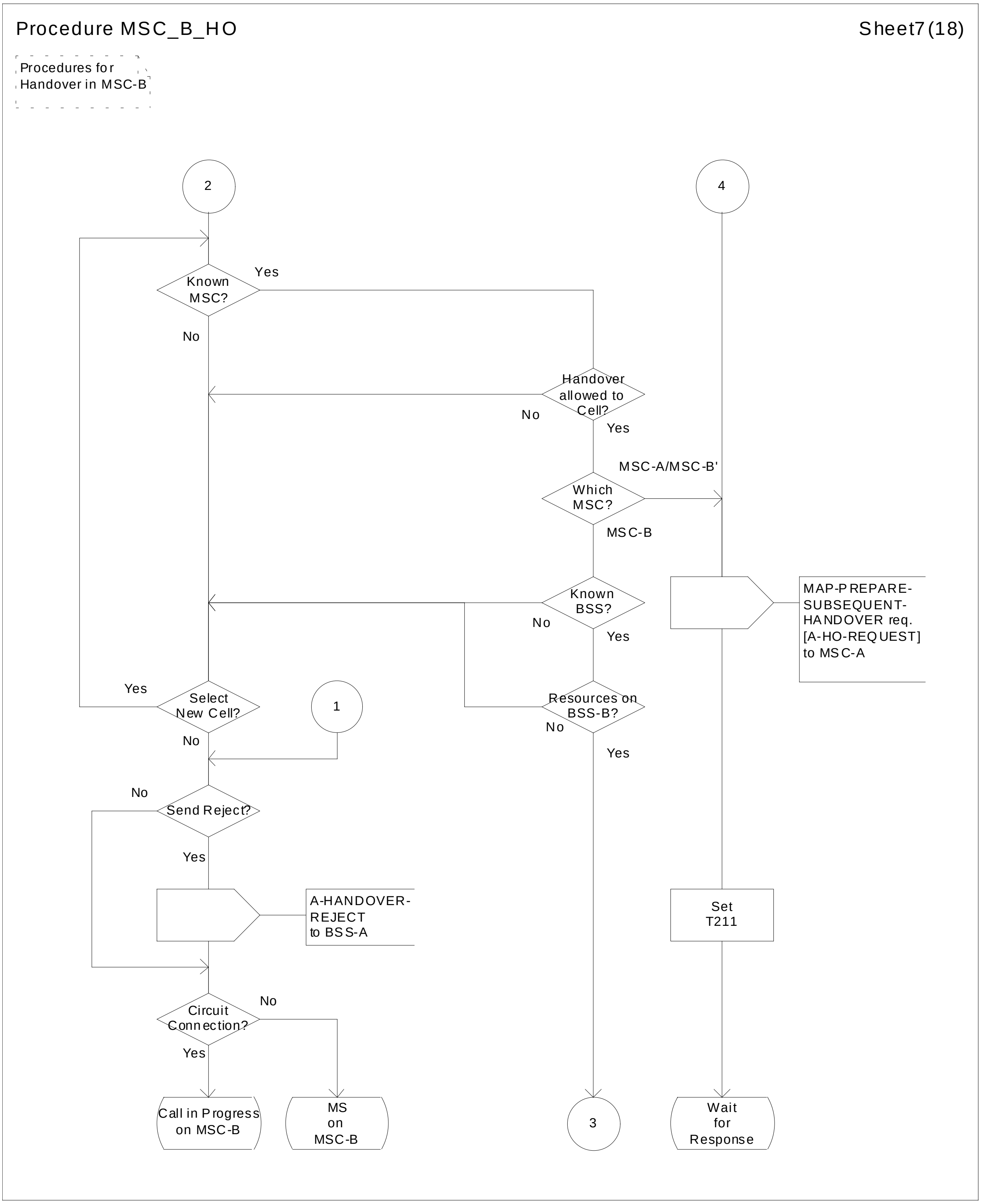


Figure 42 (Sheet 7 of 18): Handover control procedure in MSC-B

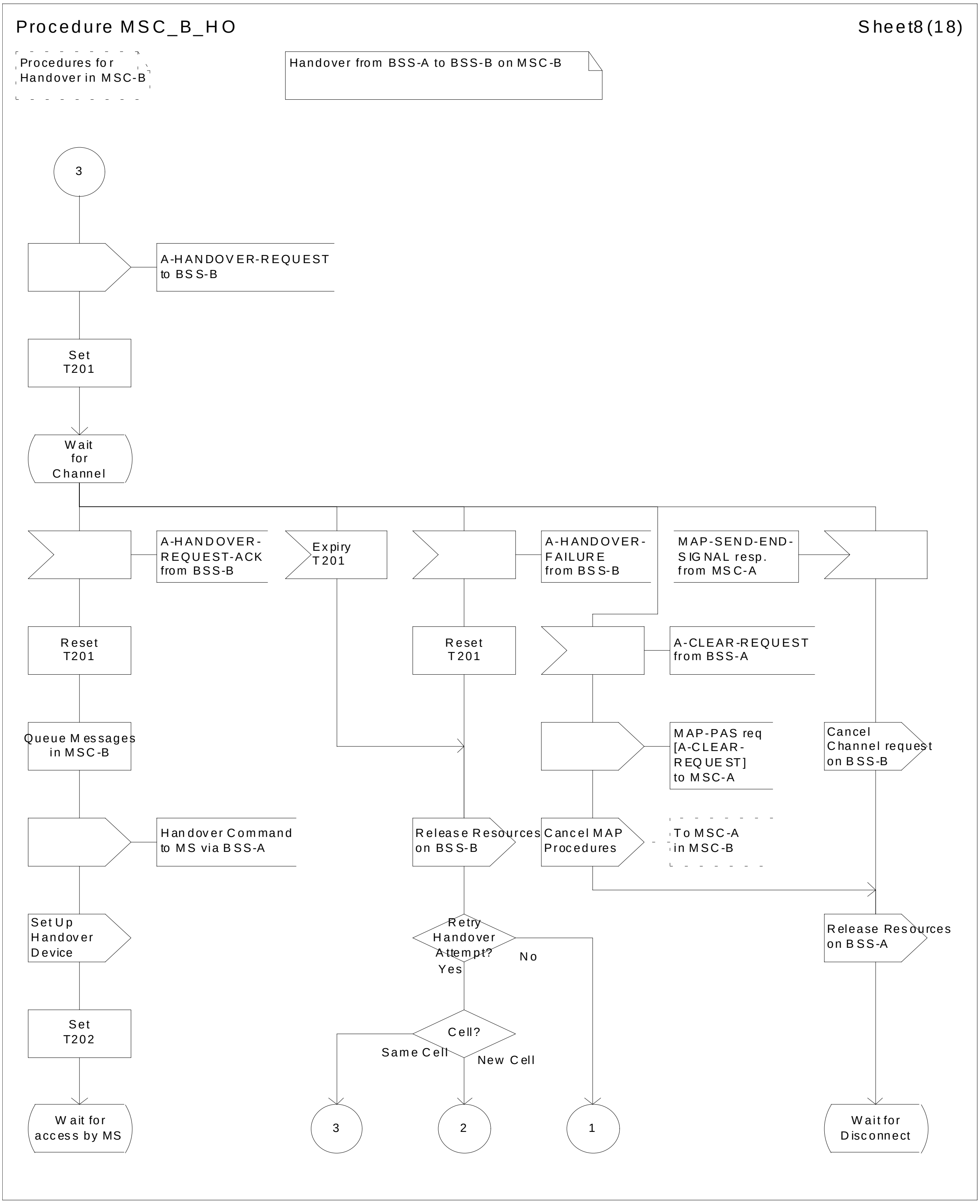


Figure 42 (Sheet 8 of 18): Handover control procedure in MSC-B

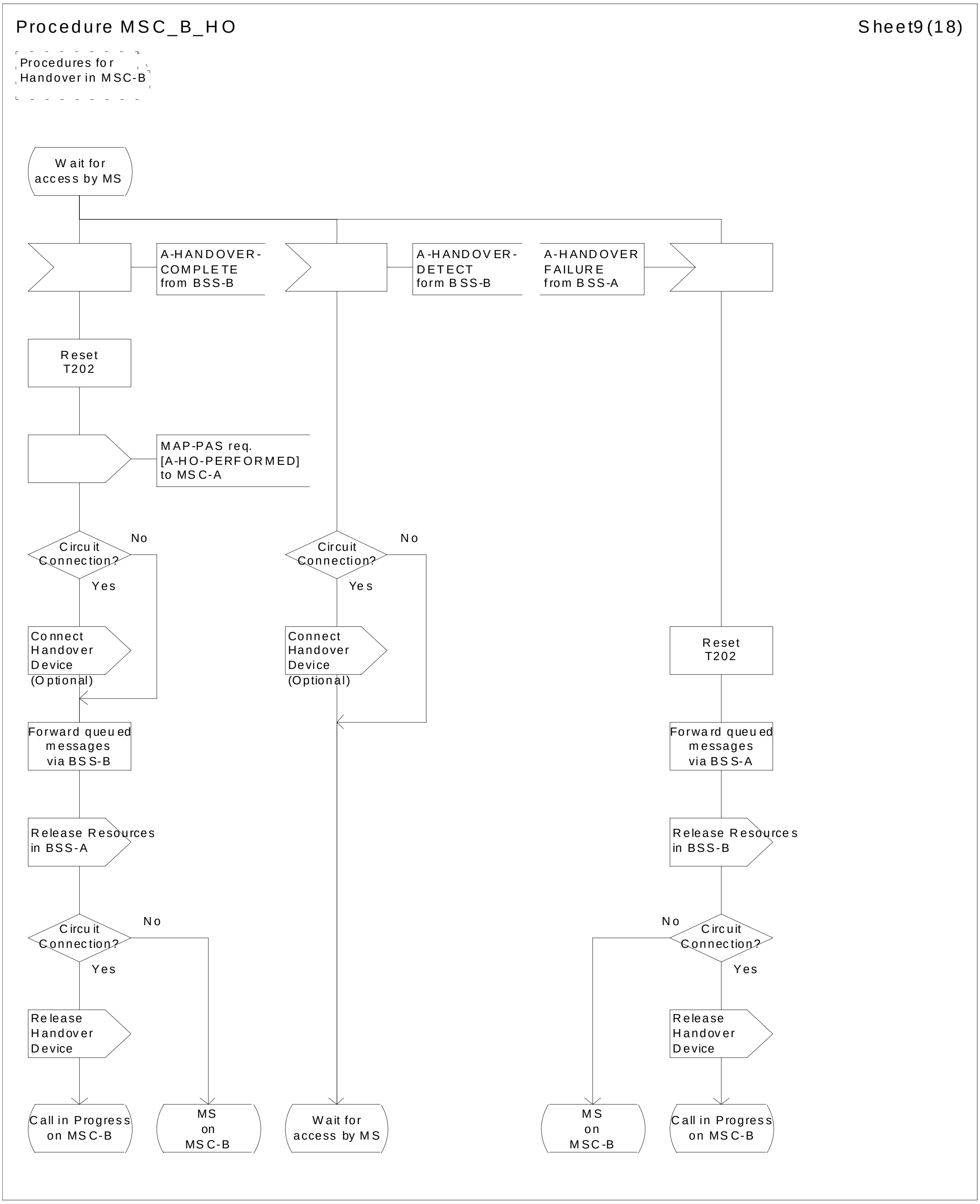


Figure 42 (Sheet 9 of 18): Handover control procedure in MSC-B

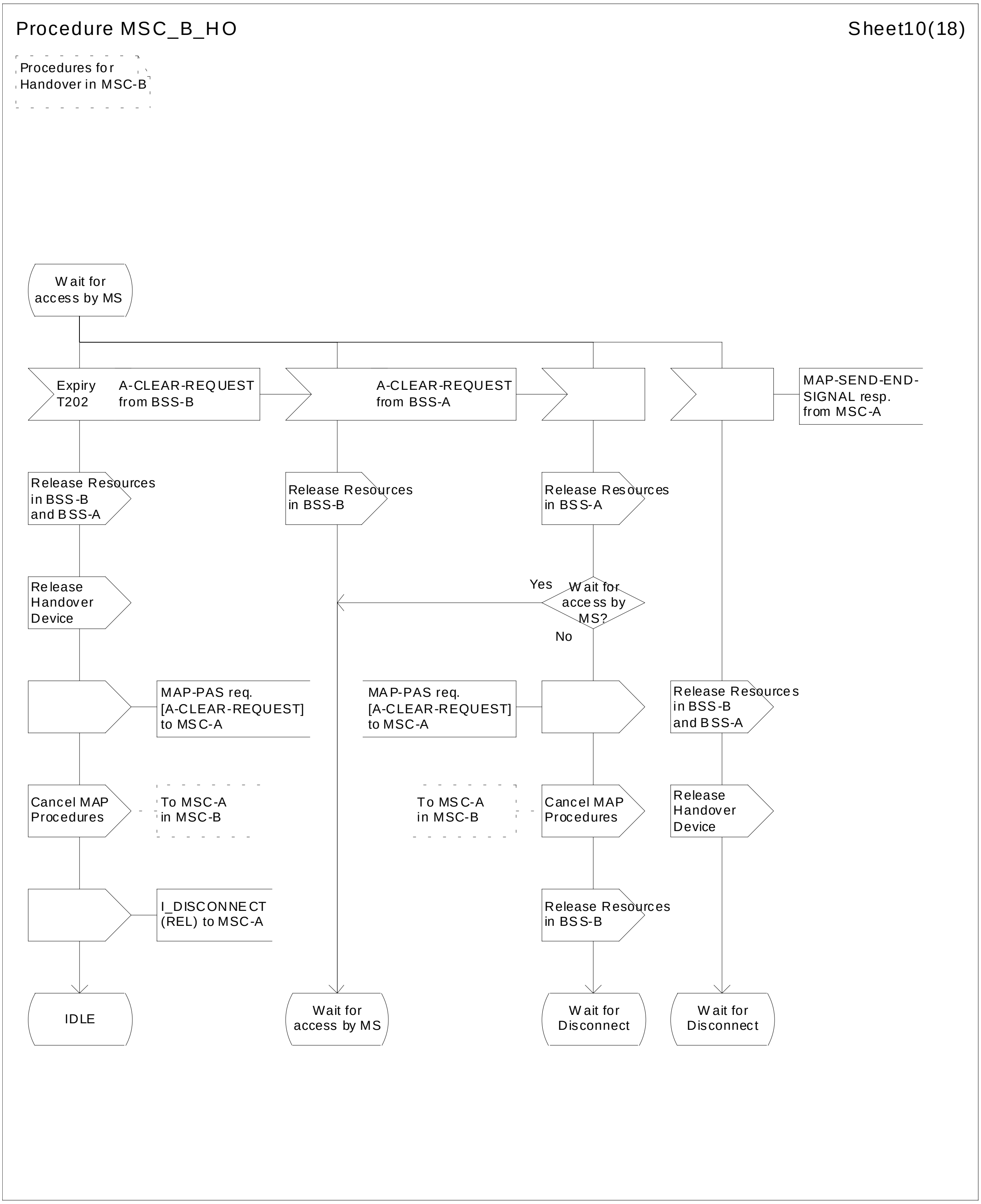


Figure 42 (Sheet 10 of 18): Handover control procedure in MSC-B

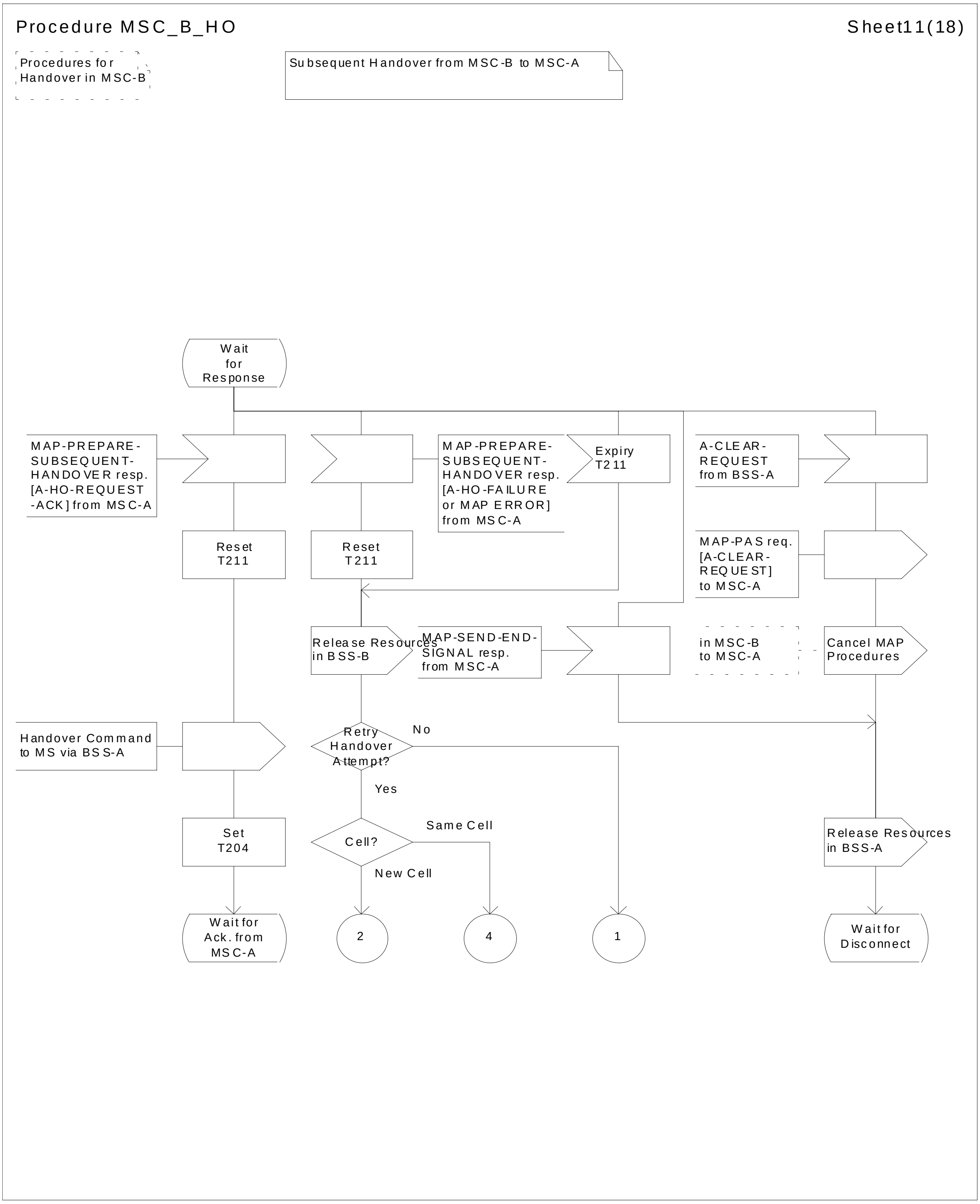


Figure 42 (Sheet 11 of 18): Handover control procedure in MSC-B

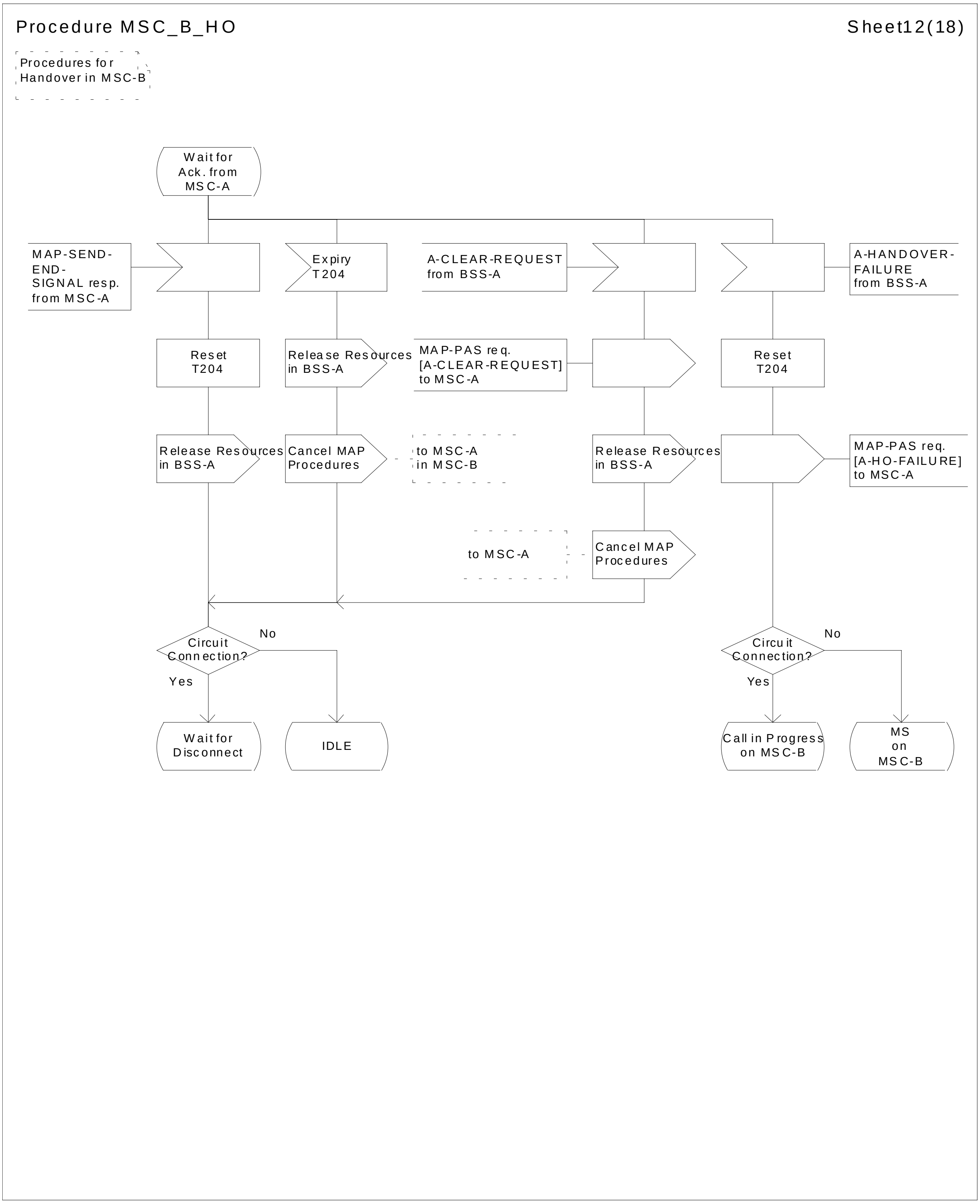


Figure 42 (Sheet 12 of 18): Handover control procedure in MSC-B

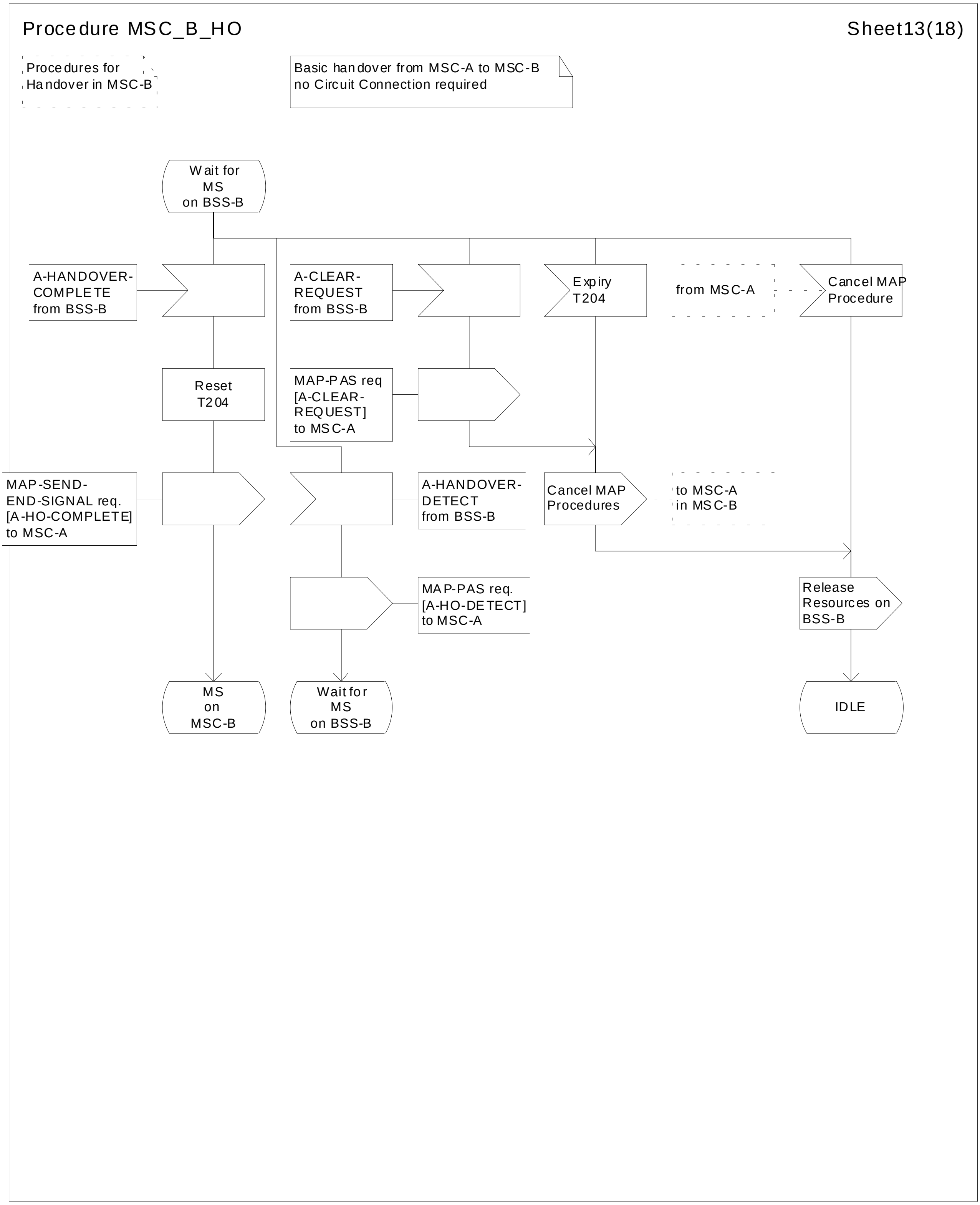


Figure 42 (Sheet 13 of 18): Handover control procedure in MSC-B

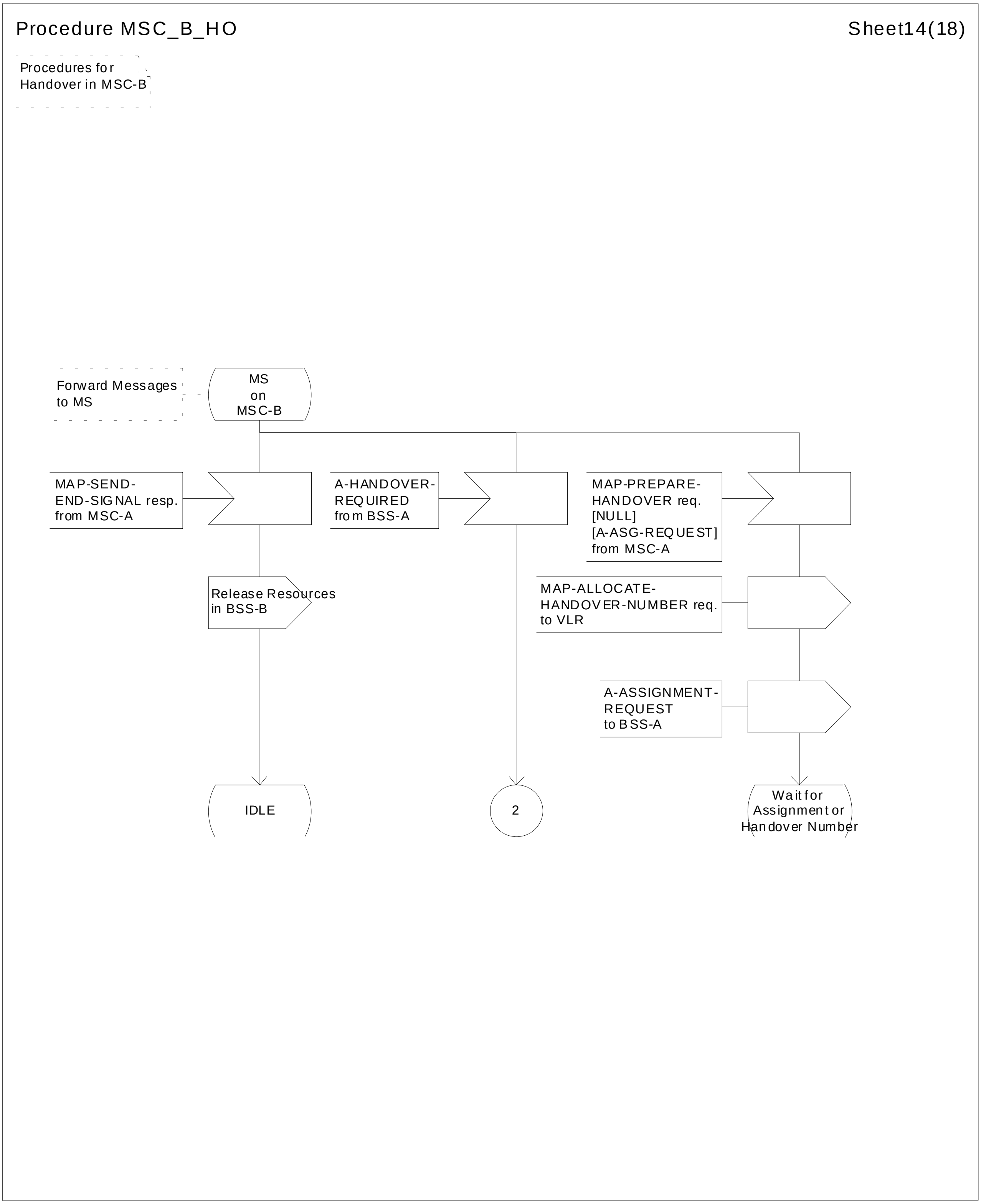


Figure 42 (Sheet 14 of 18): Handover control procedure in MSC-B

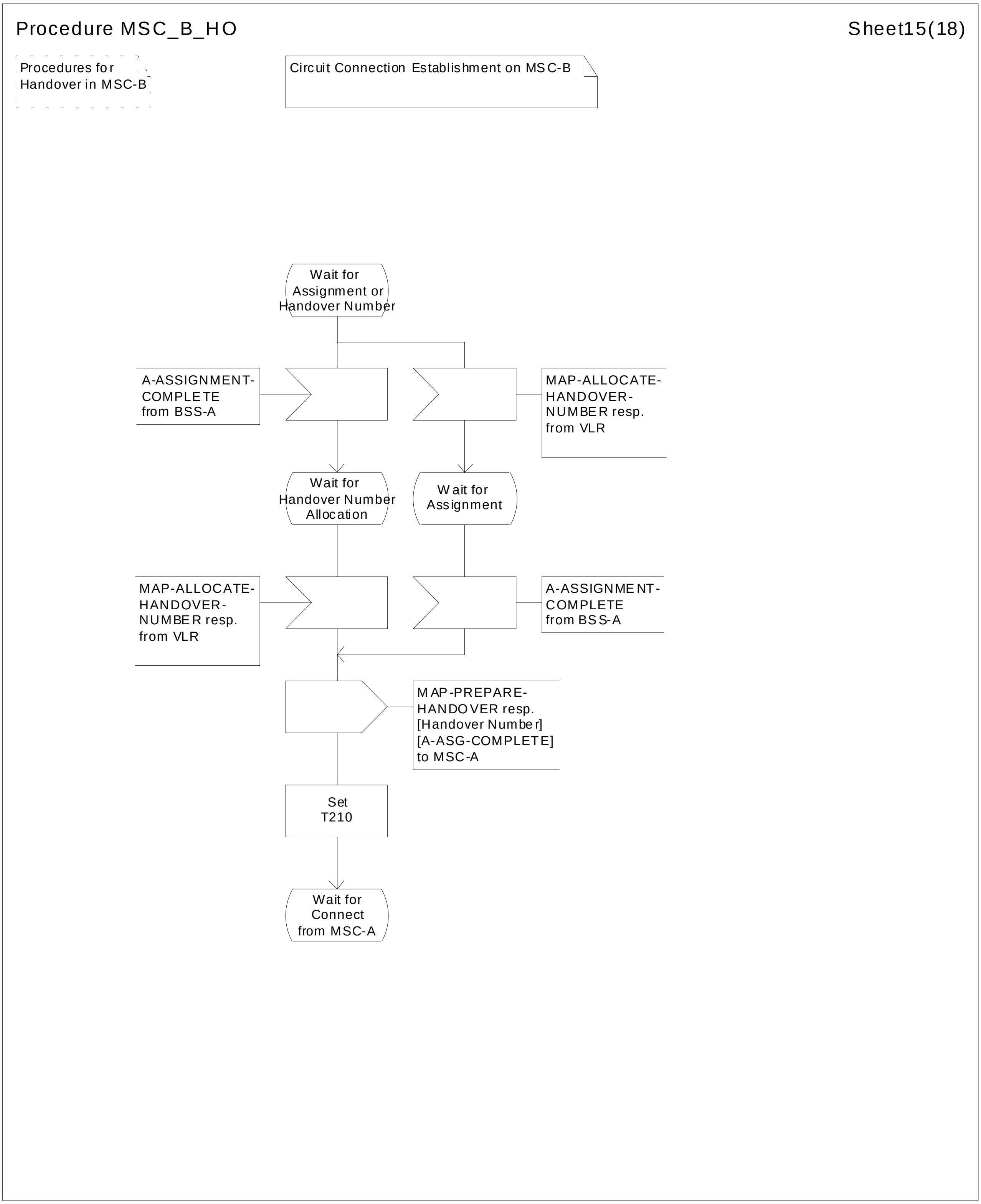


Figure 42 (Sheet 15 of 18): Handover control procedure in MSC-B

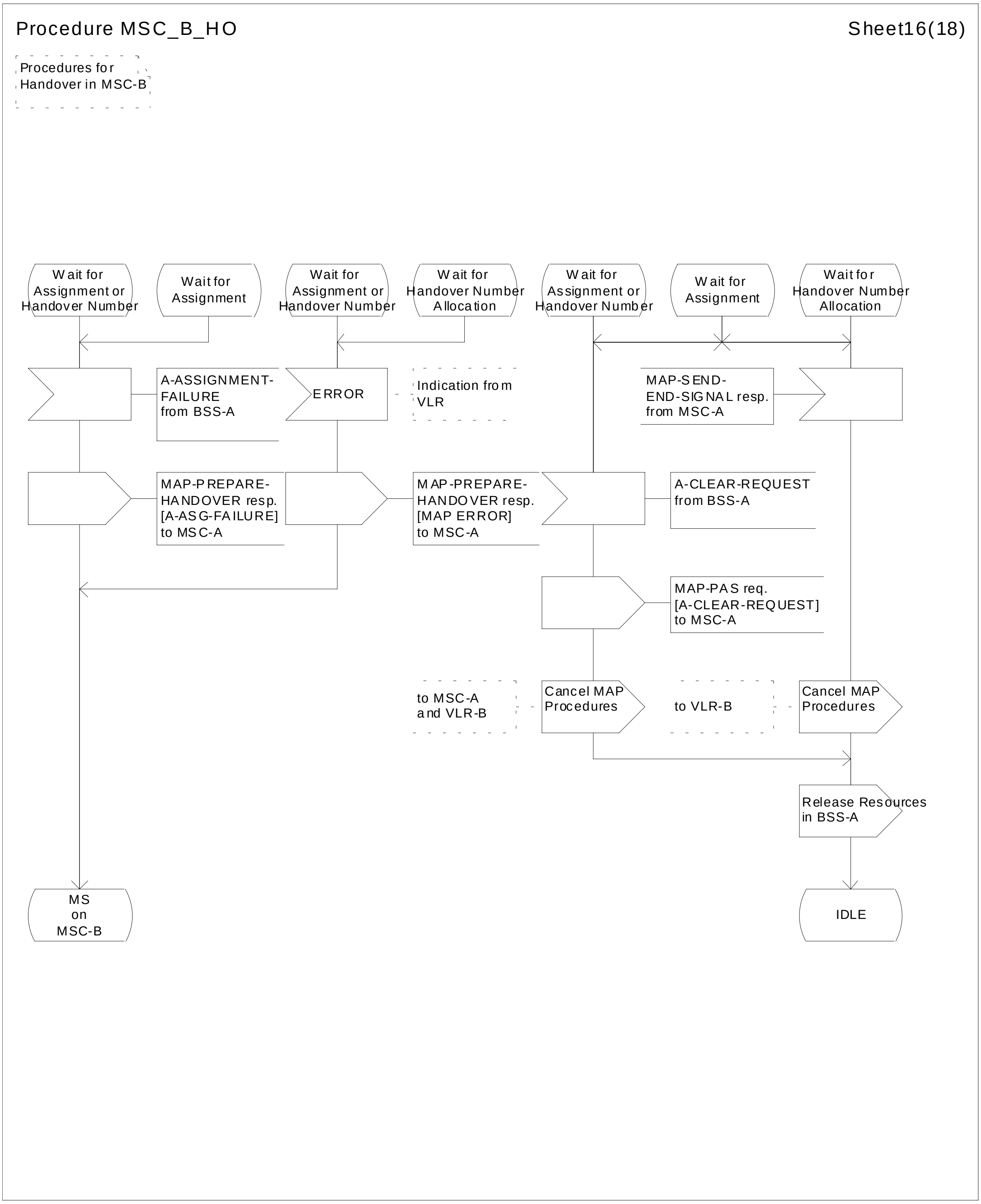


Figure 42 (Sheet 16 of 18): Handover control procedure in MSC-B

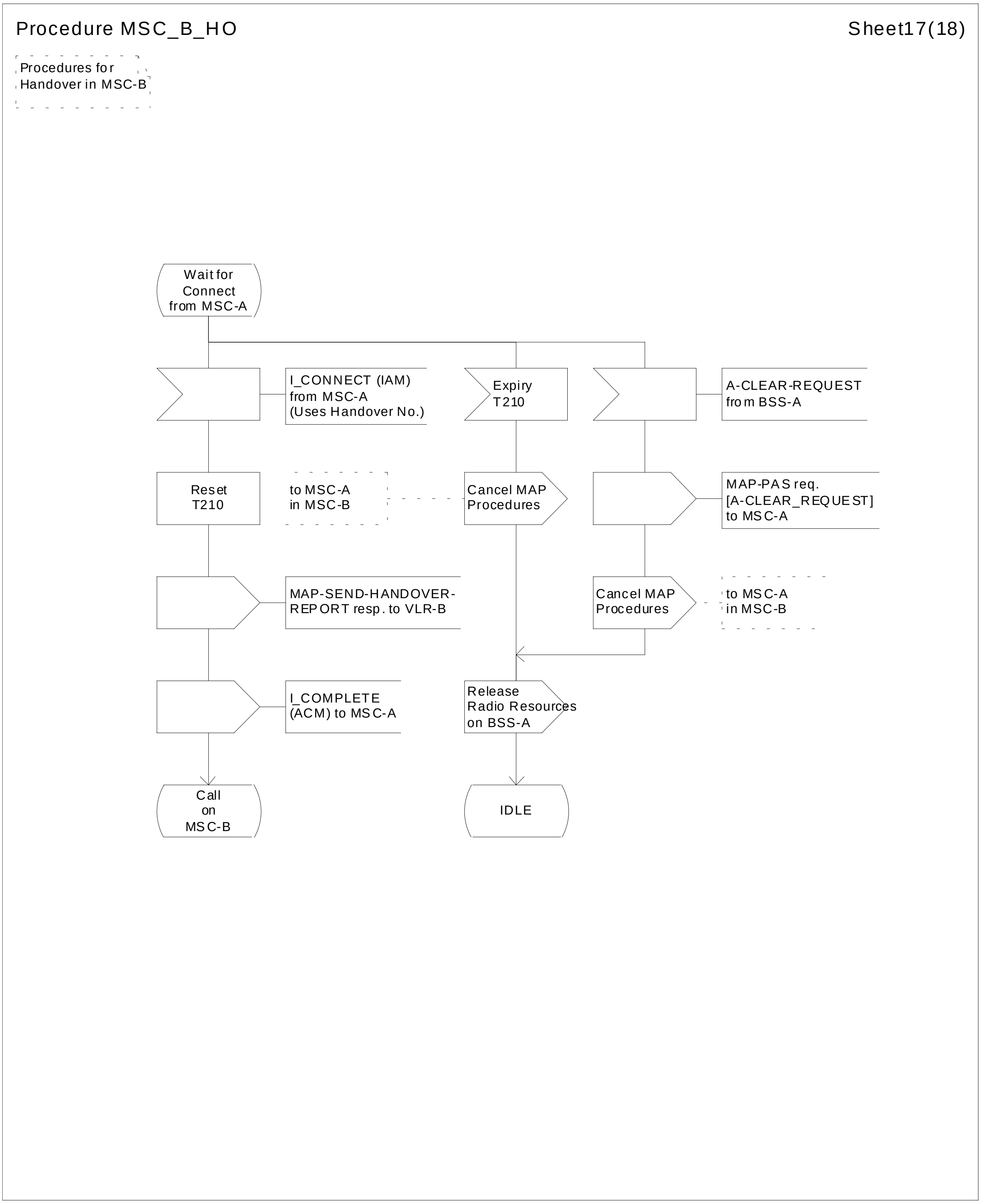


Figure 42 (Sheet 17 of 18): Handover control procedure in MSC-B

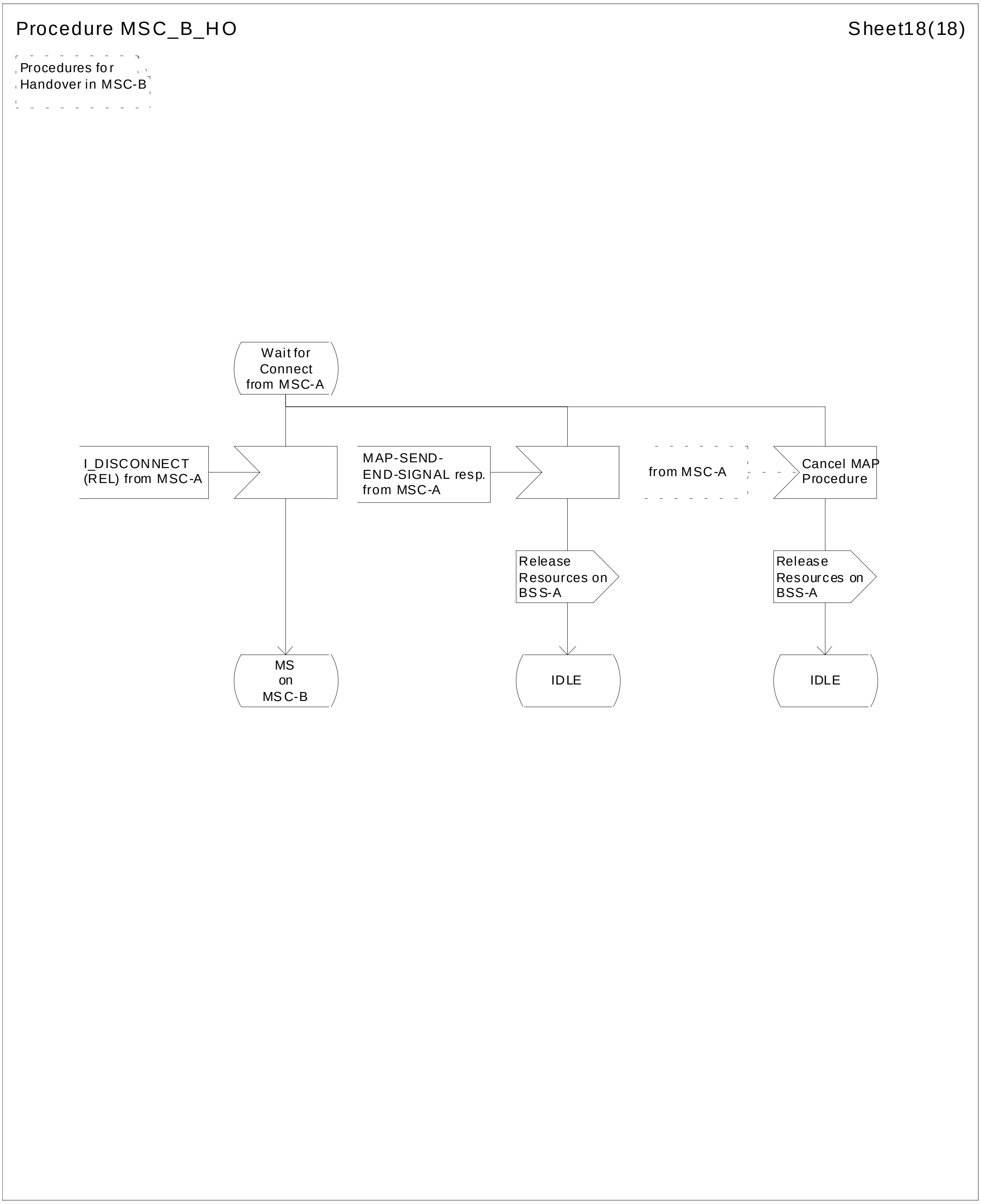


Figure 42 (Sheet 18 of 18): Handover control procedure in MSC-B

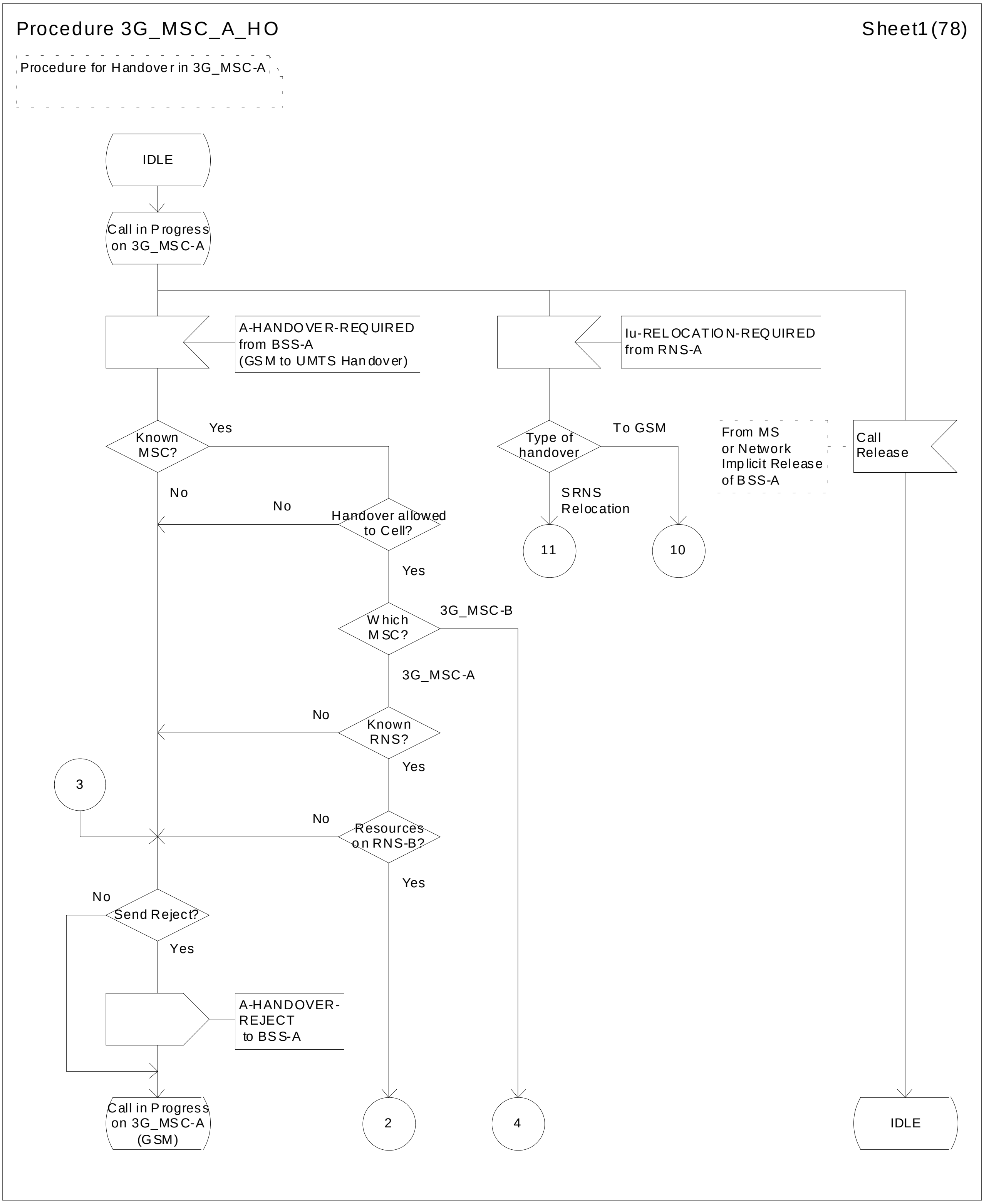


Figure 43 (sheet 1 of 78): Handover control procedure in 3G_MSC-A

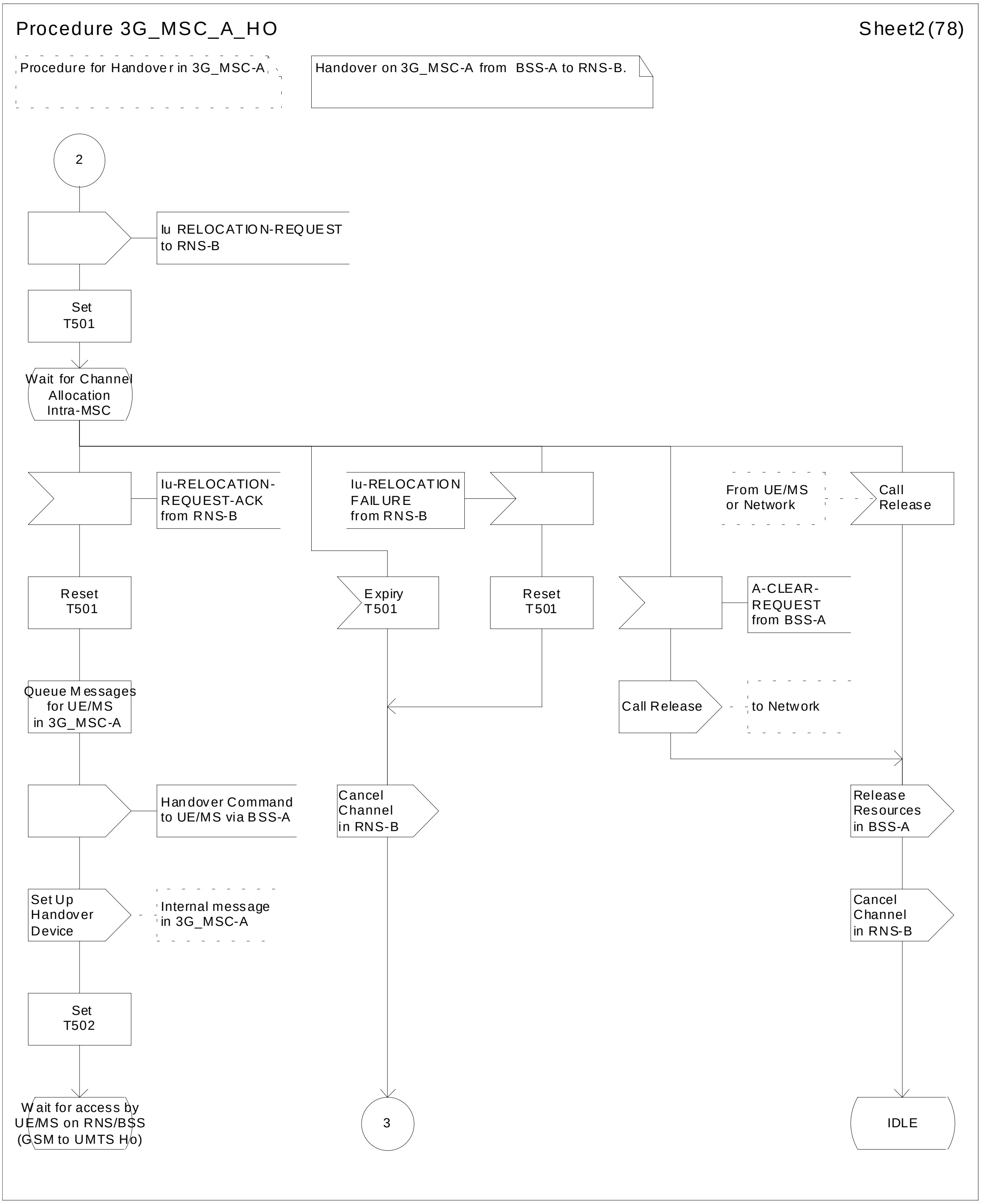


Figure 43 (sheet 2 of 78): Handover control procedure in 3G_MSC-A

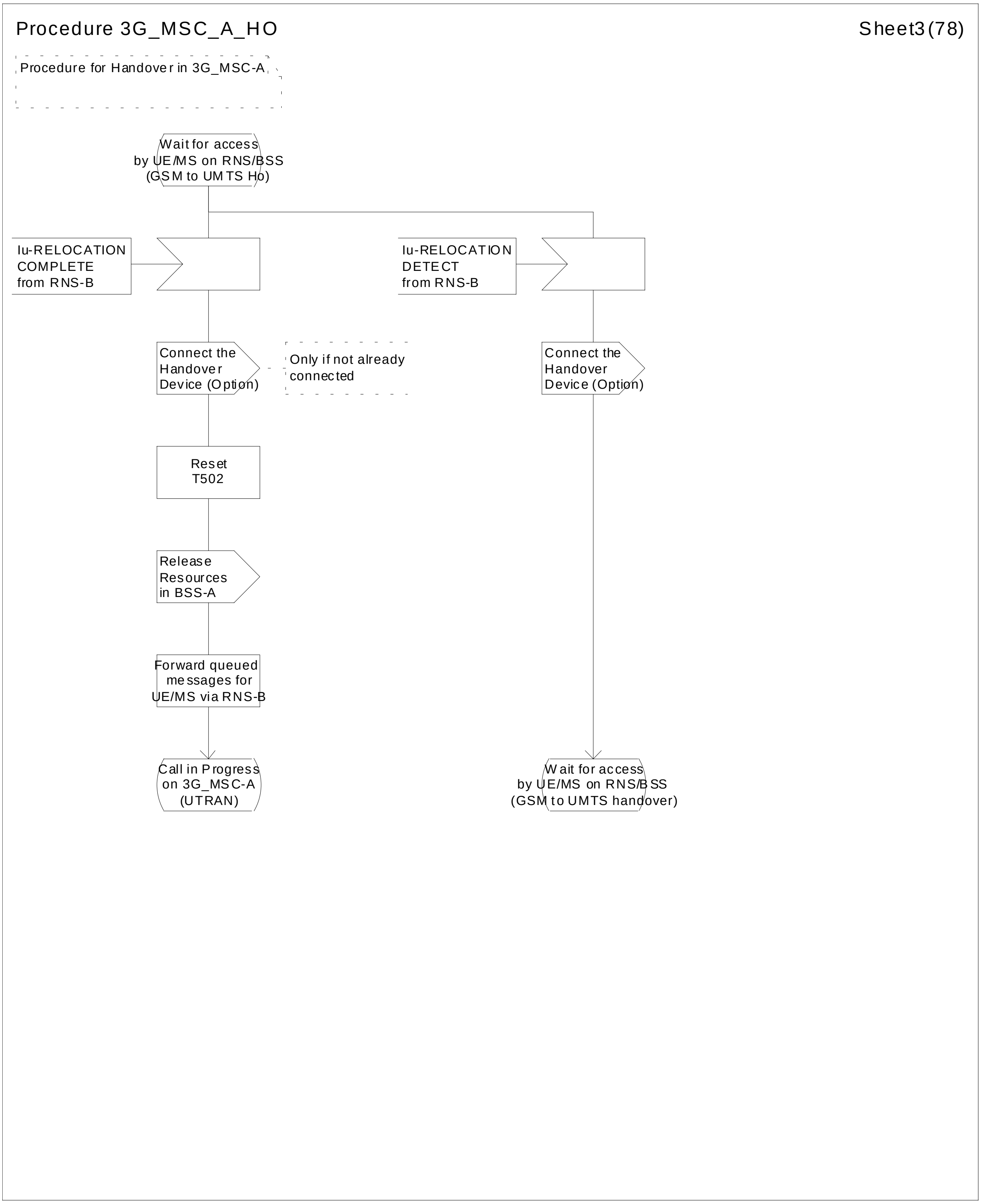


Figure 43 (sheet 3 of 78): Handover control procedure in 3G_MSC-A

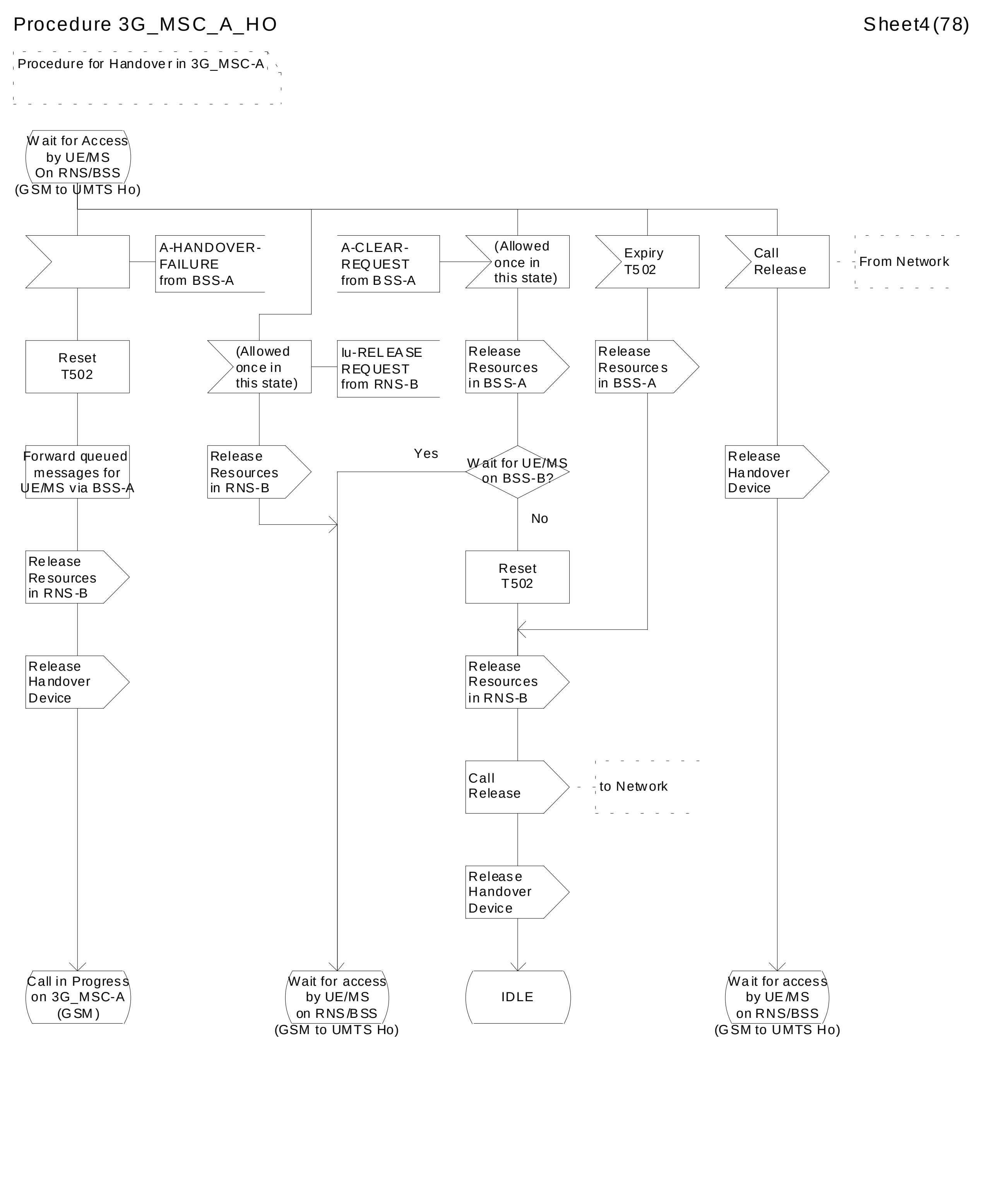


Figure 43 (sheet 4 of 78): Handover control procedure in 3G_MSC-A

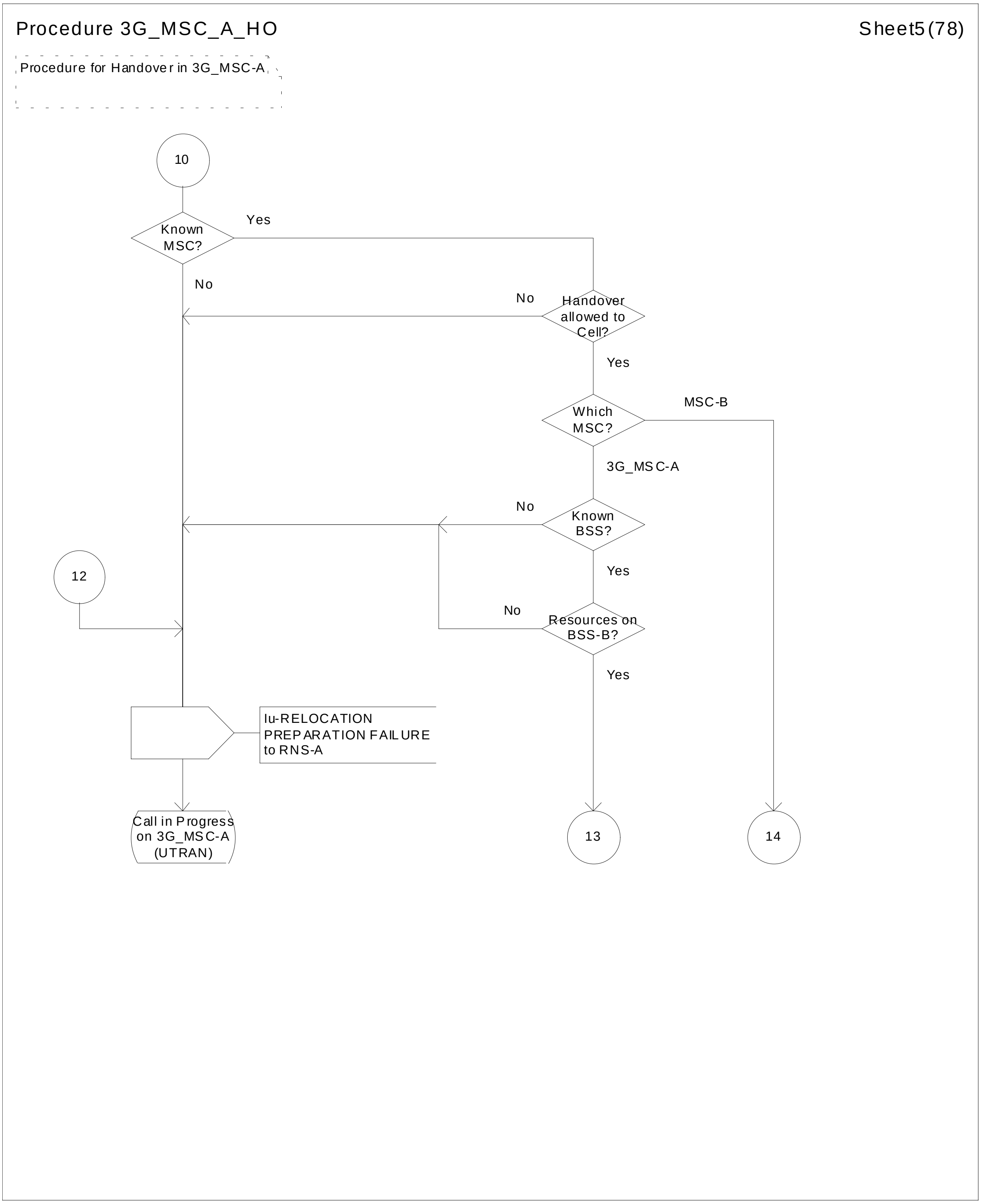


Figure 43 (sheet 5 of 78): Handover control procedure in 3G_MSC-A

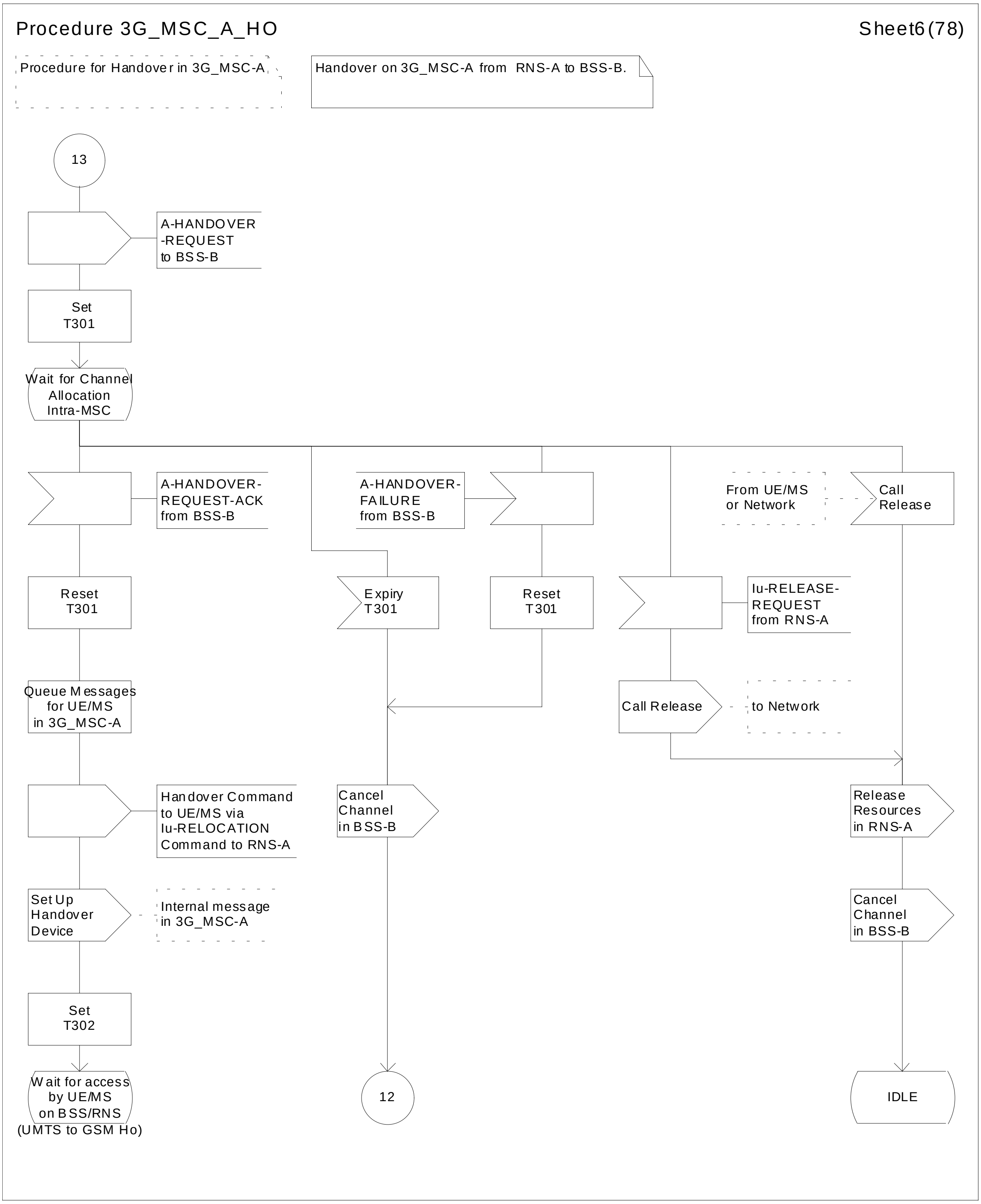


Figure 43 (sheet 6 of 78): Handover control procedure in 3G_MSC-A

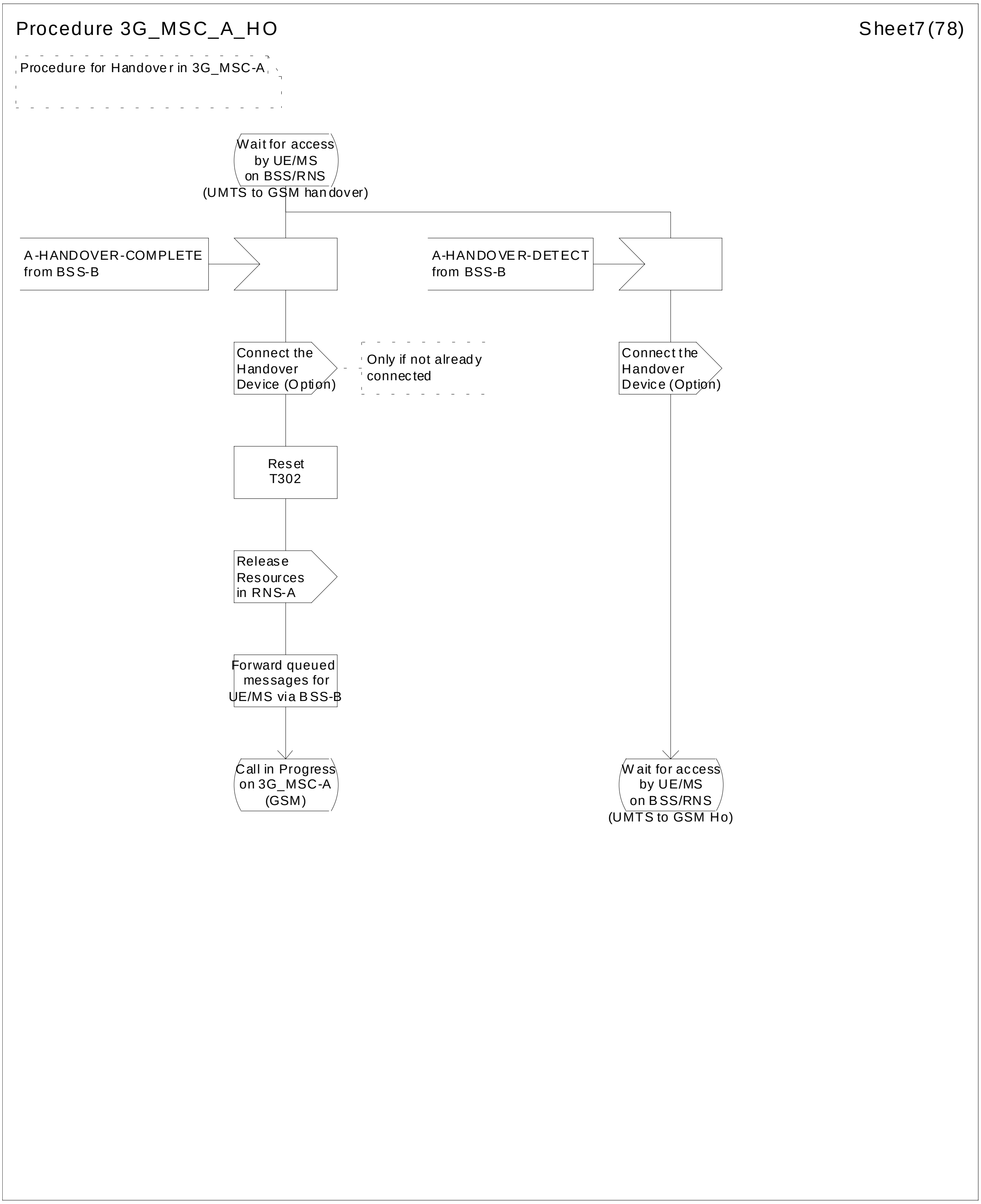


Figure 43 (sheet 7 of 78): Handover control procedure in 3G_MSC-A

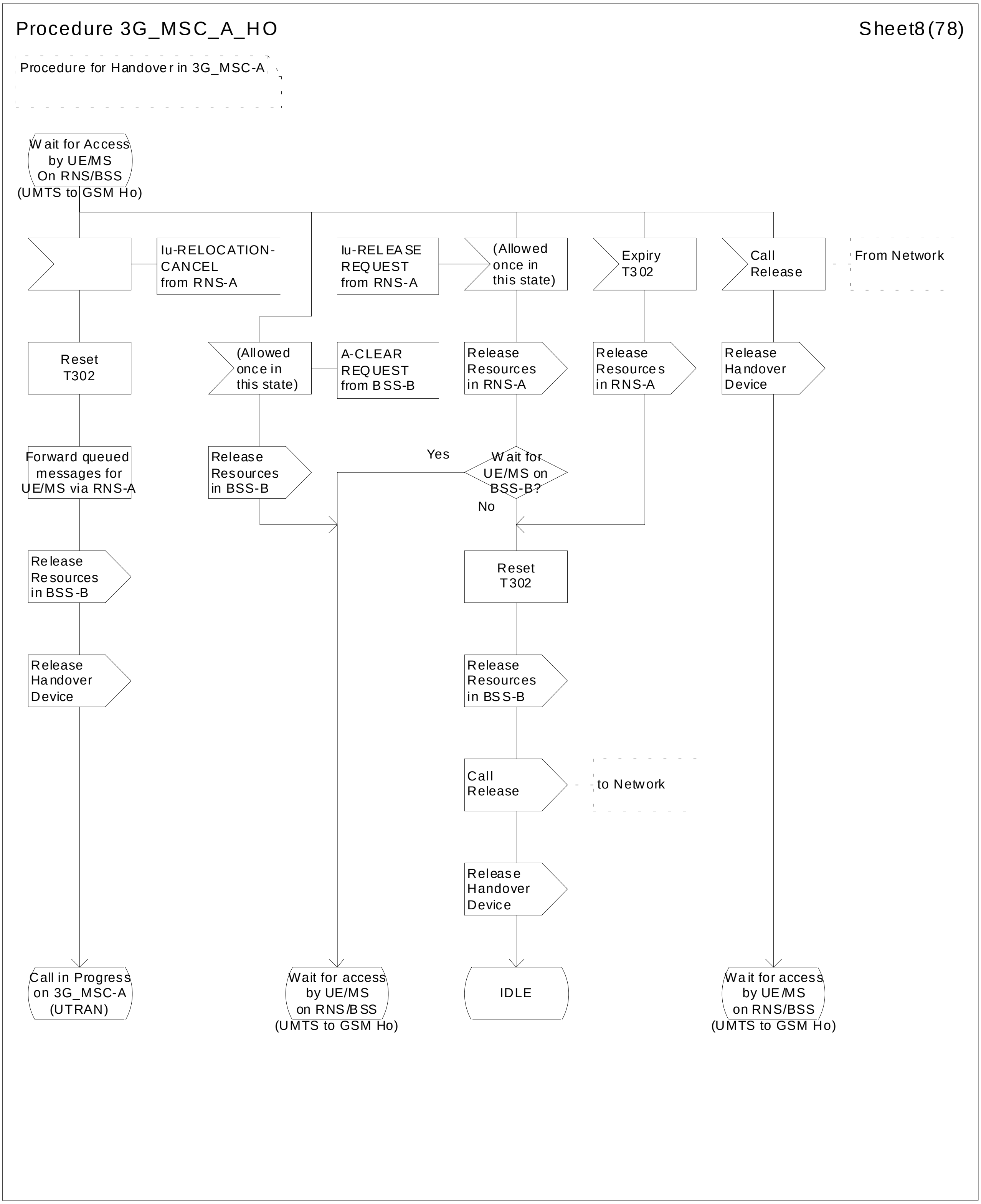


Figure 43 (sheet 8 of 78): Handover control procedure in 3G_MSC-A

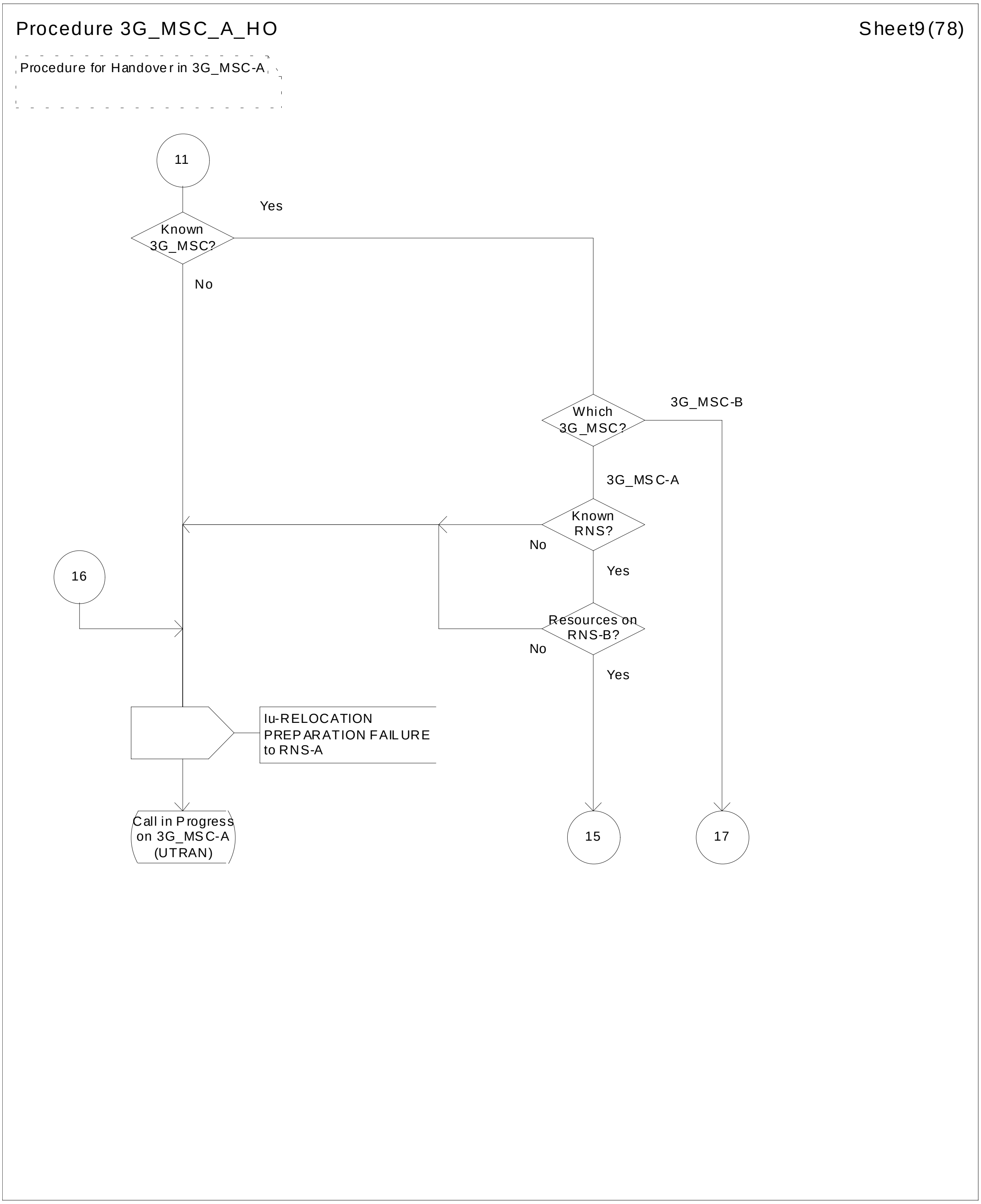


Figure 43 (sheet 9 of 78): Handover control procedure in 3G_MSC-A

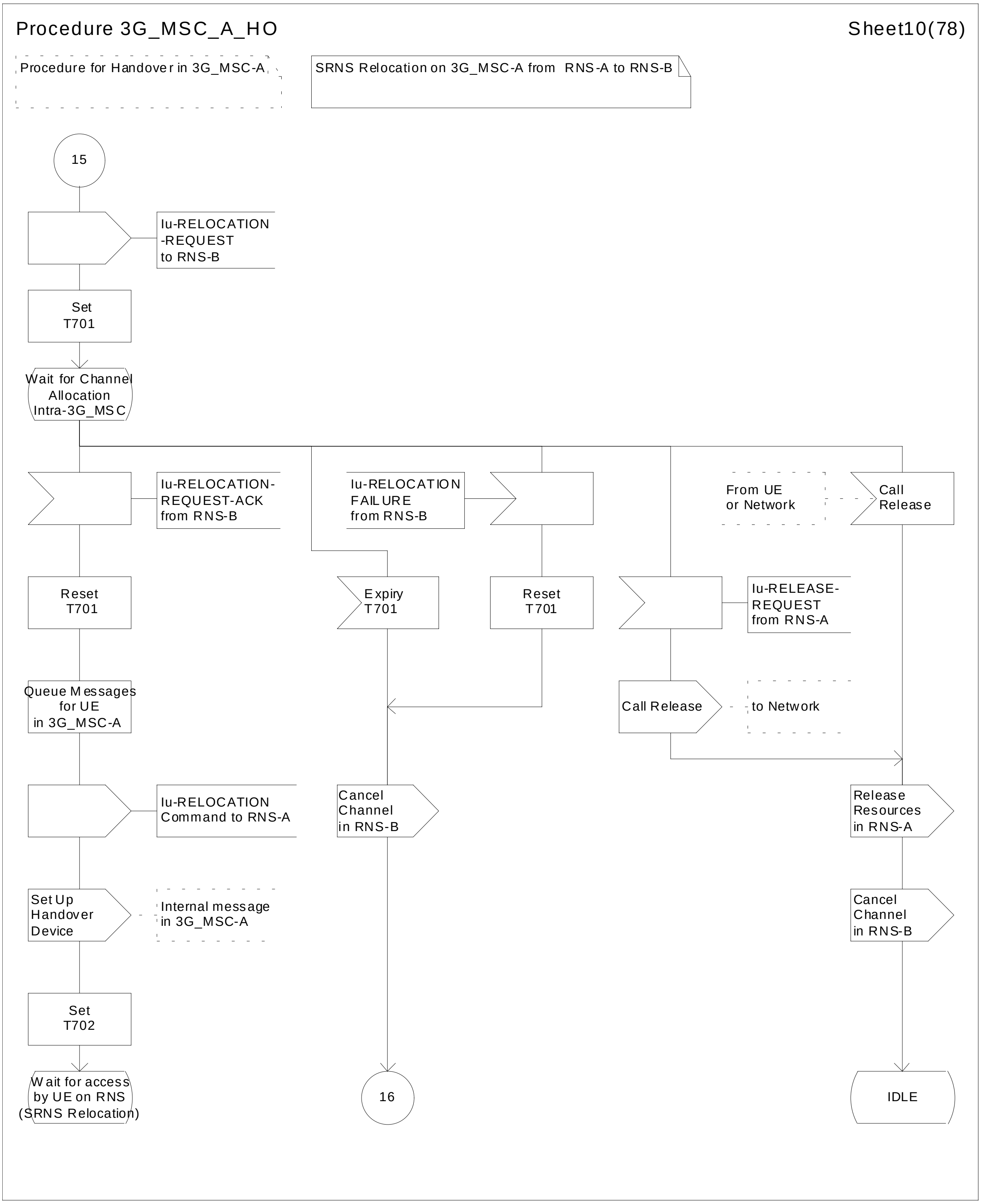


Figure 43 (sheet 10 of 78): Handover control procedure in 3G_MSC-A

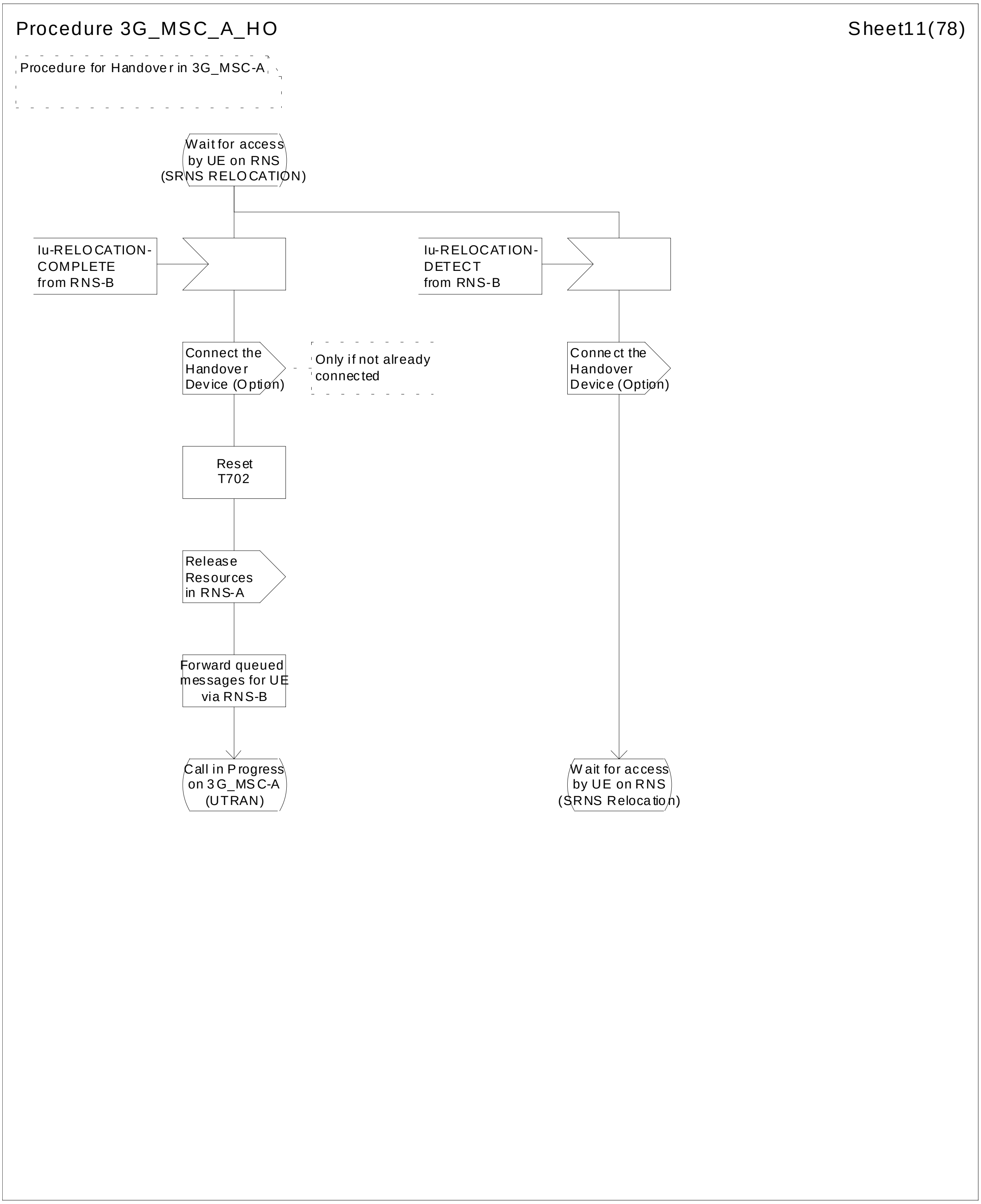


Figure 43 (sheet 11 of 78): Handover control procedure in 3G_MSC-A

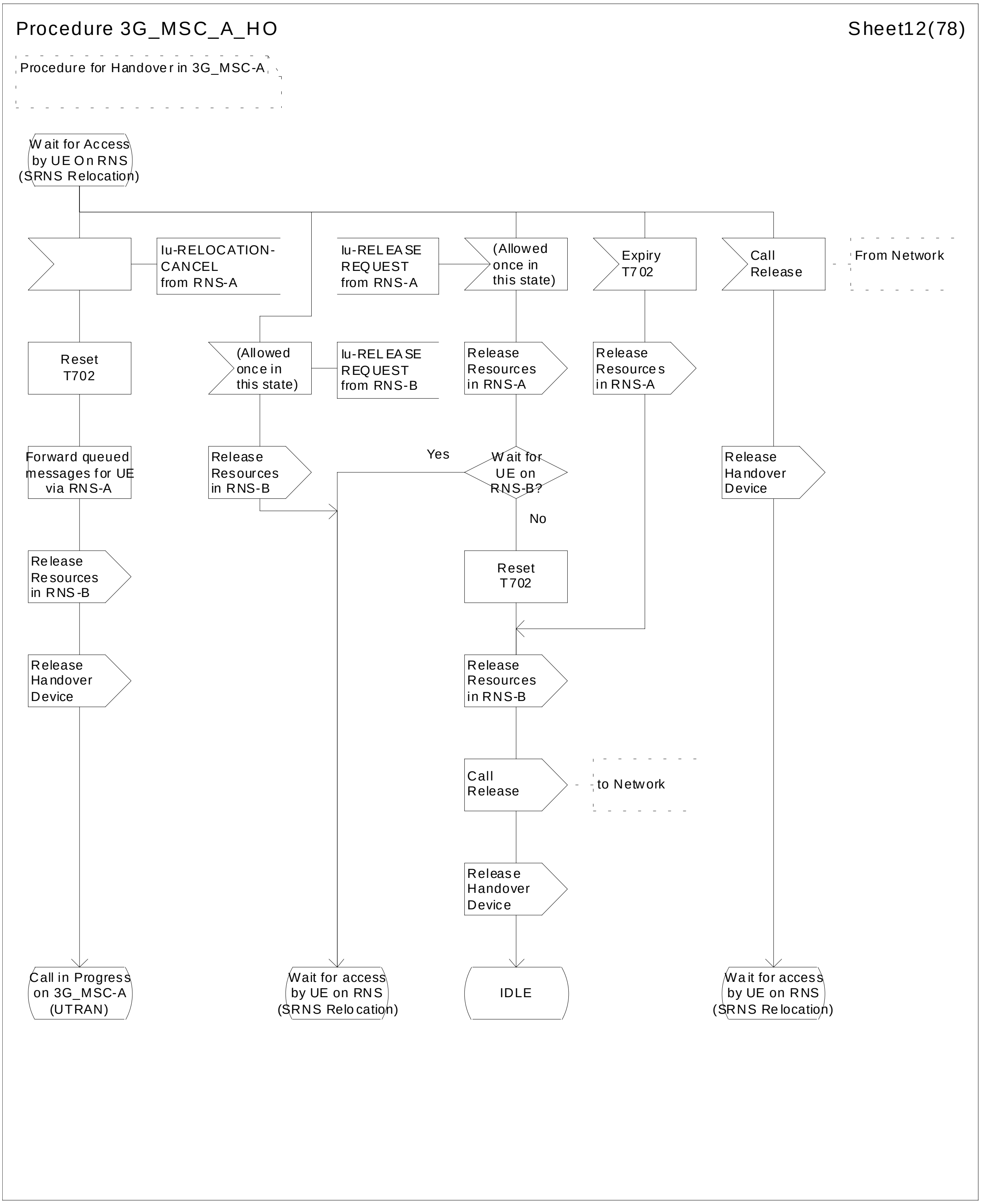


Figure 43 (sheet 12 of 78): Handover control procedure in 3G_MSC-A

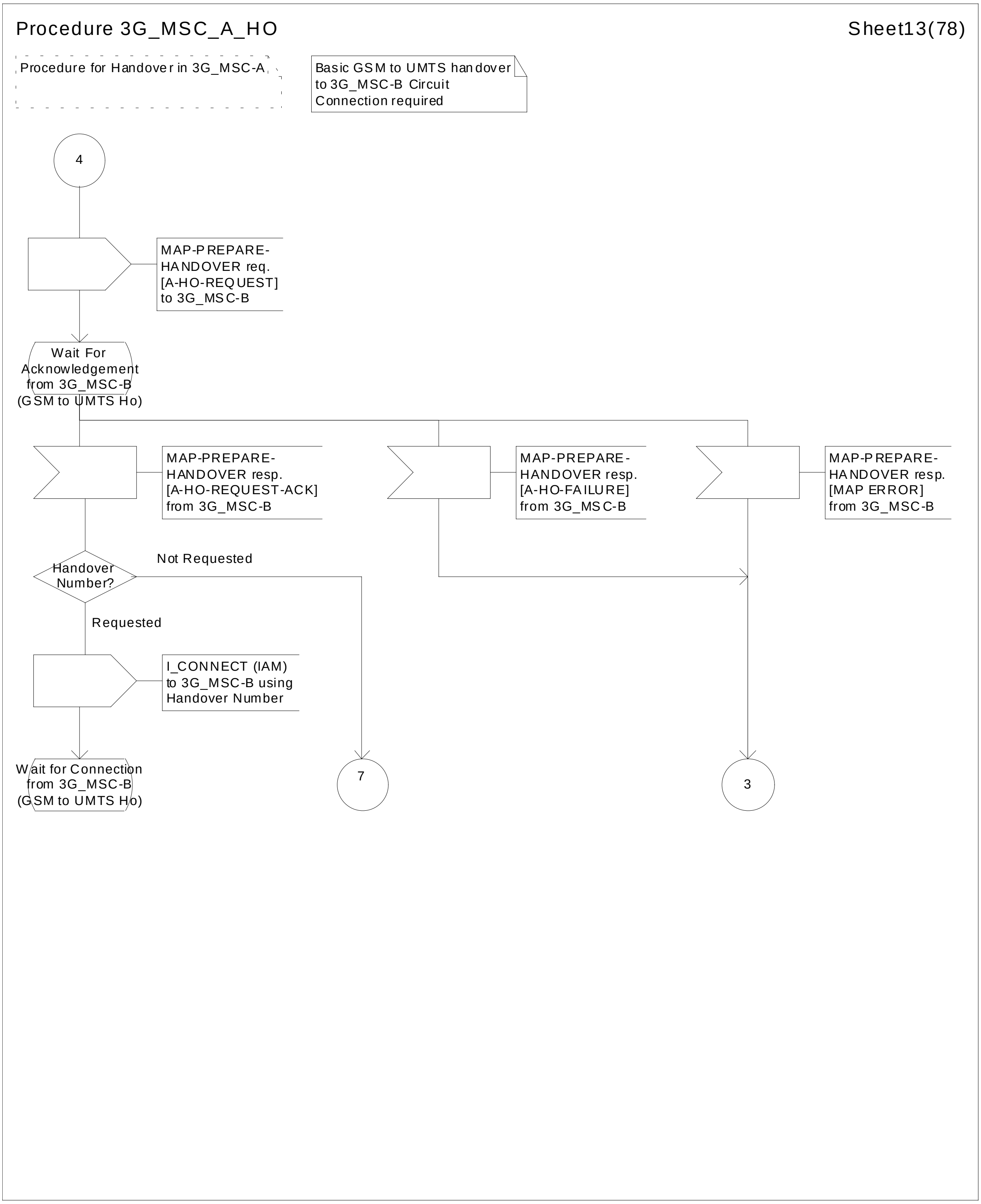


Figure 43 (sheet 13 of 78): Handover control procedure in 3G_MSC-A

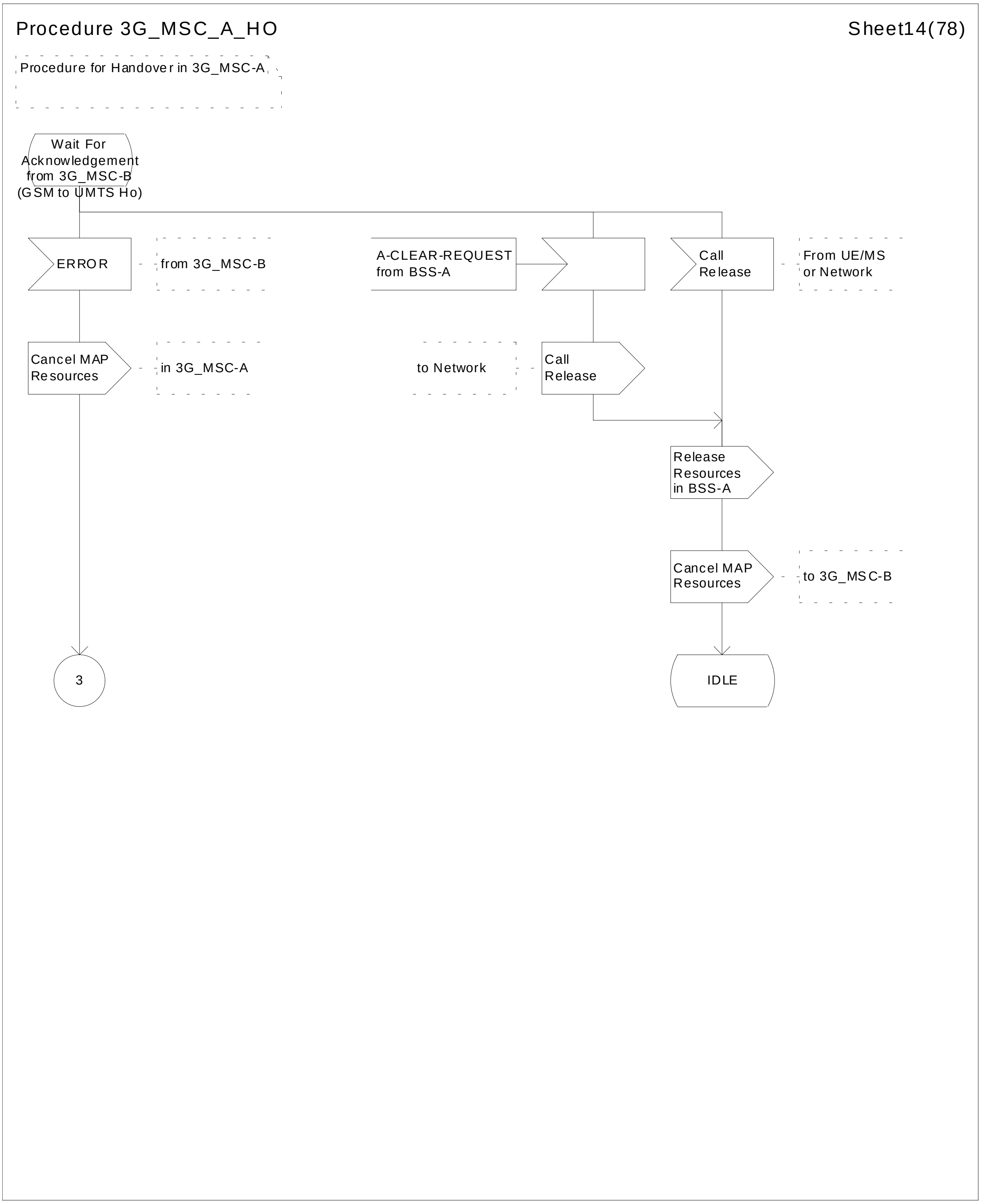


Figure 43 (sheet 14 of 78): Handover control procedure in 3G_MSC-A

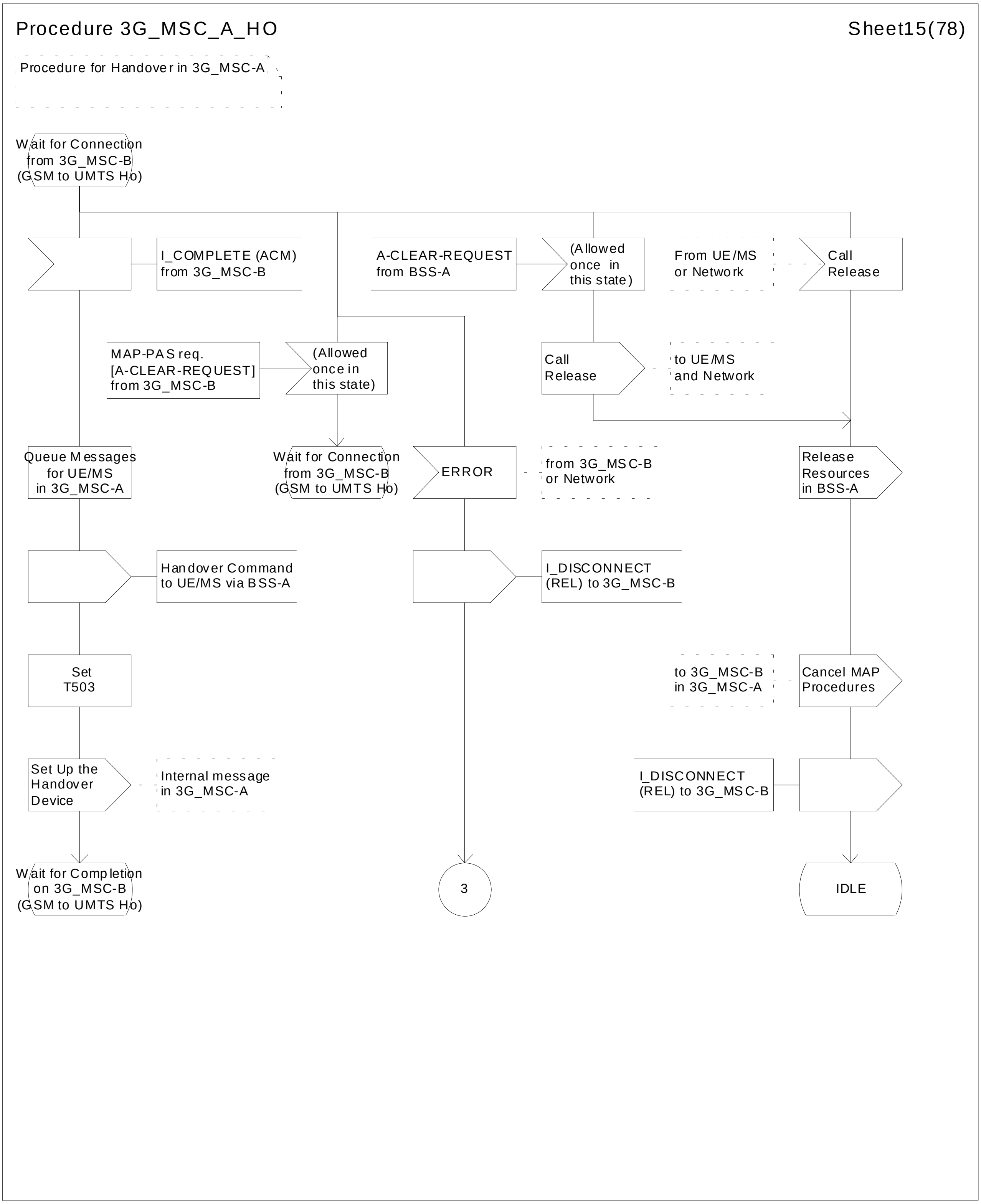


Figure 43 (sheet 15 of 78): Handover control procedure in 3G_MSC-A

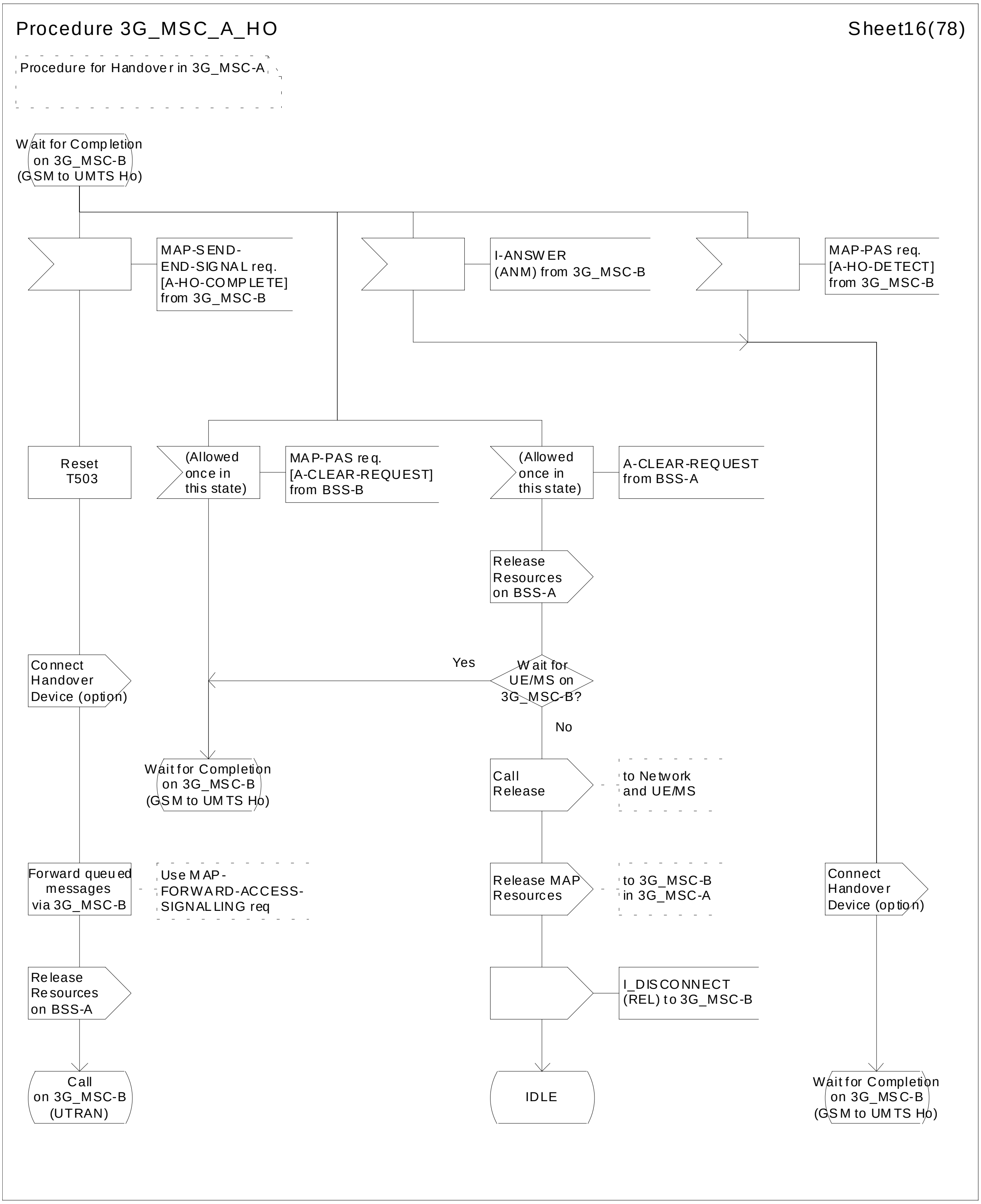


Figure 43 (sheet 16 of 78): Handover control procedure in 3G_MSC-A

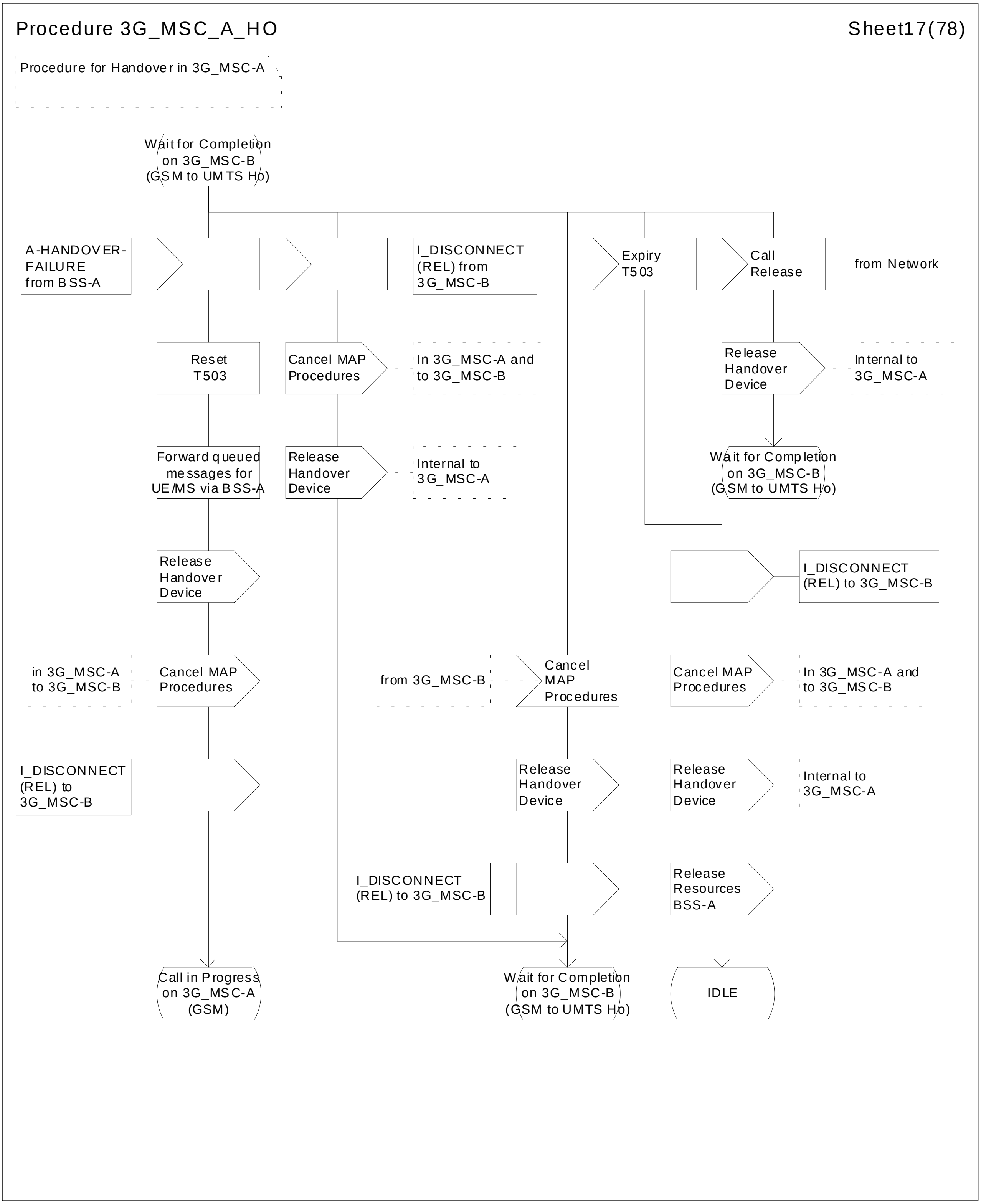


Figure 43 (sheet 17 of 78): Handover control procedure in 3G_MSC-A

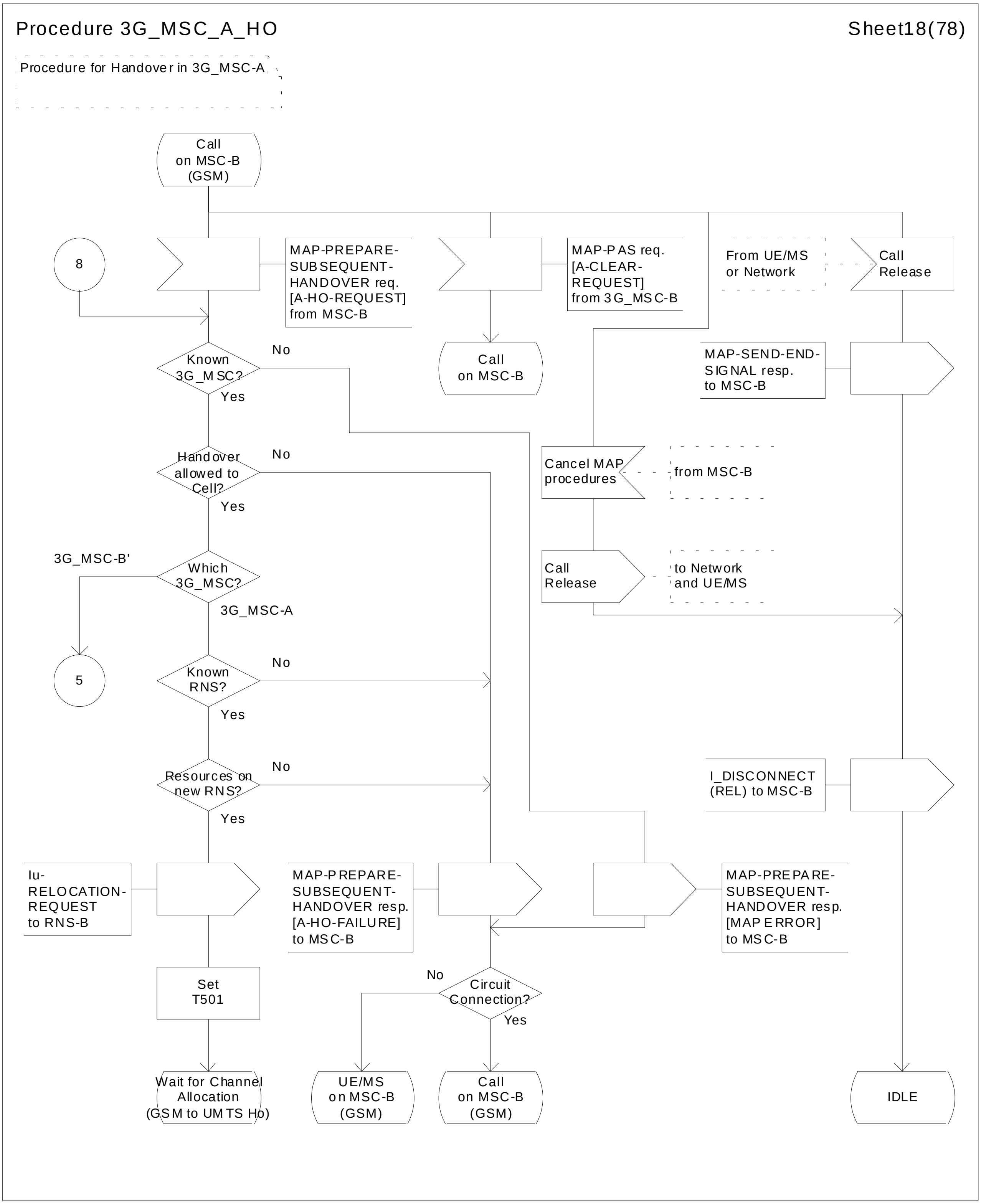


Figure 43 (sheet 18 of 78): Handover control procedure in 3G_MSC-A

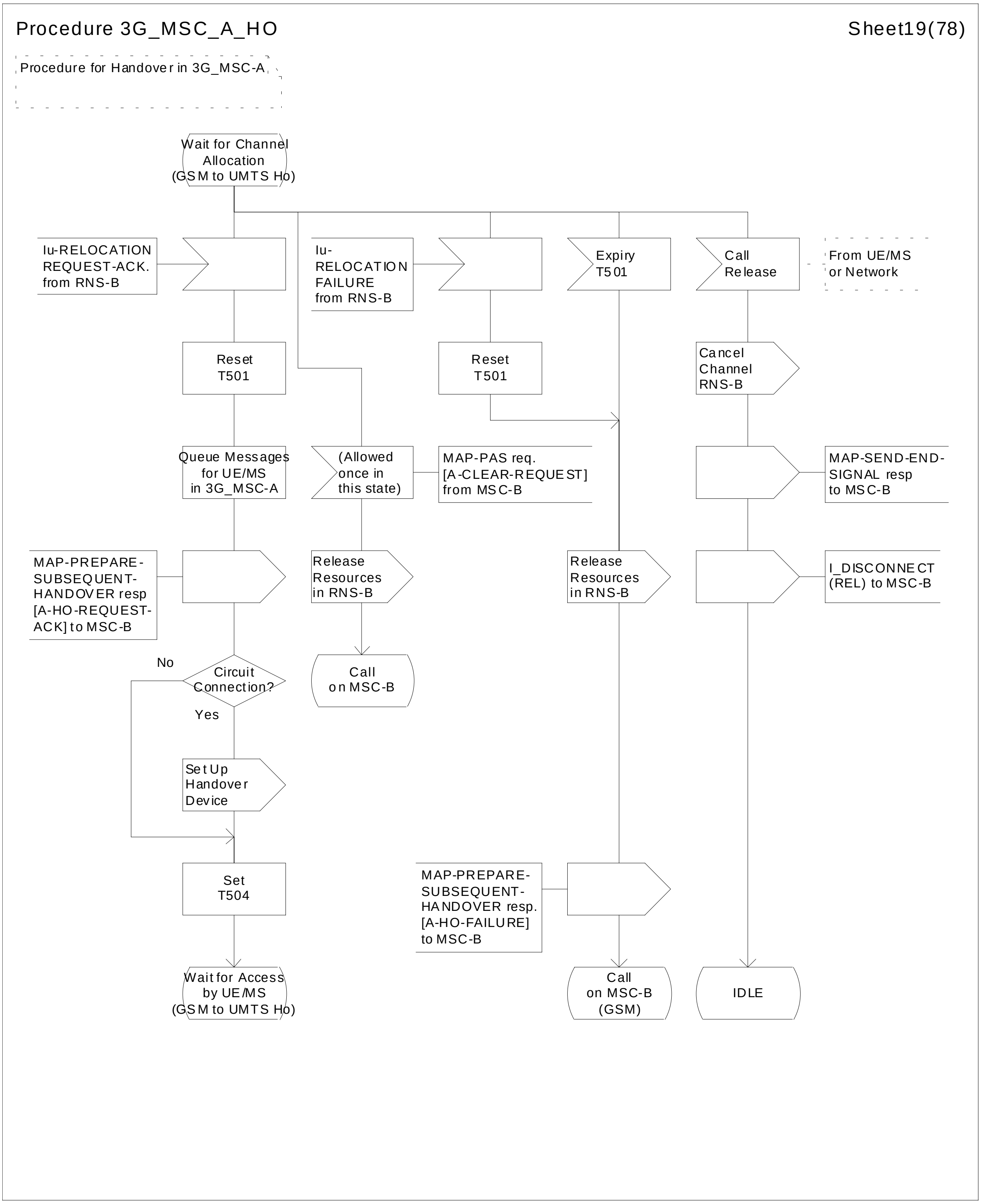


Figure 43 (sheet 19 of 78): Handover control procedure in 3G_MSC-A

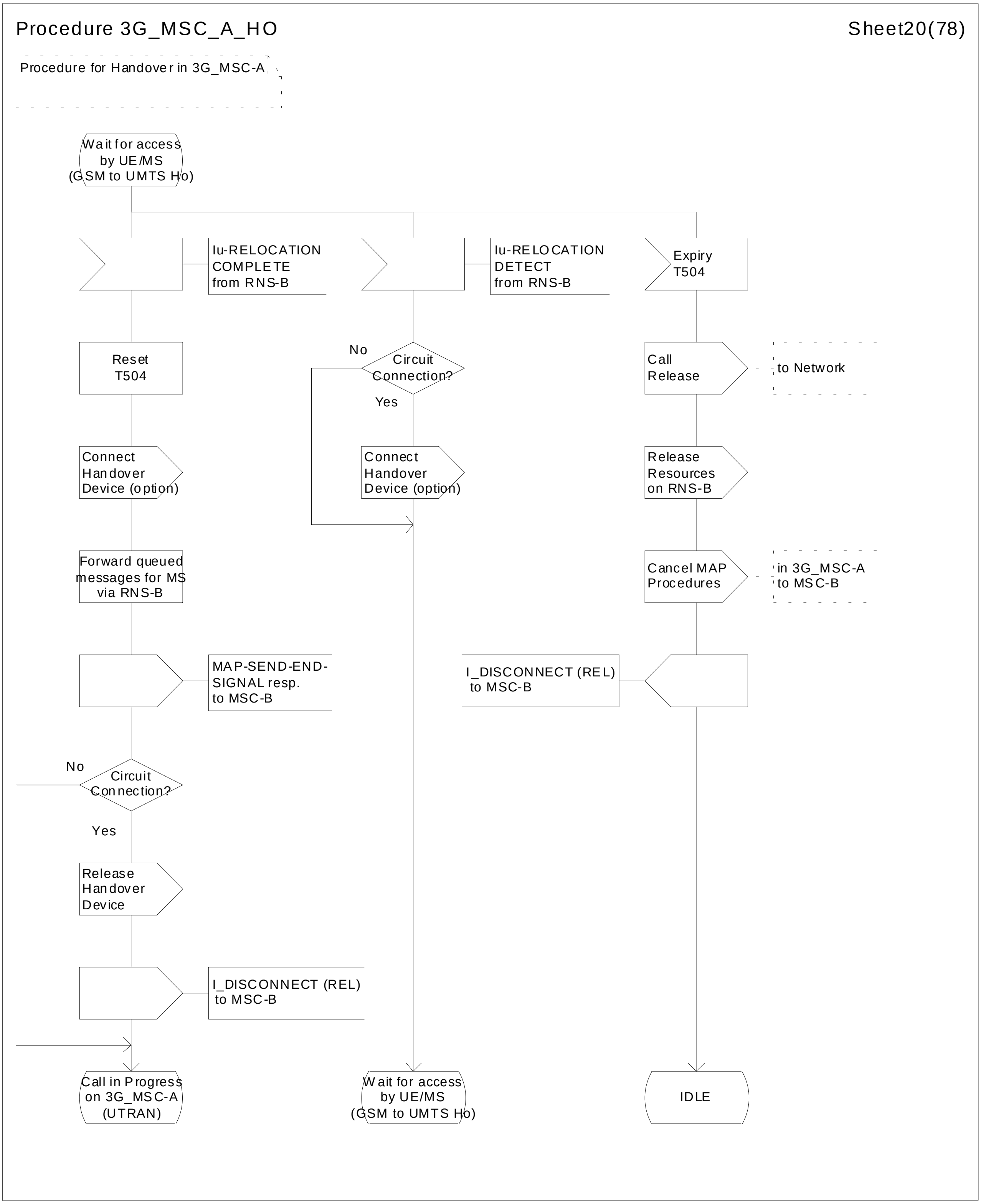


Figure 43 (sheet 20 of 78): Handover control procedure in 3G_MSC-A

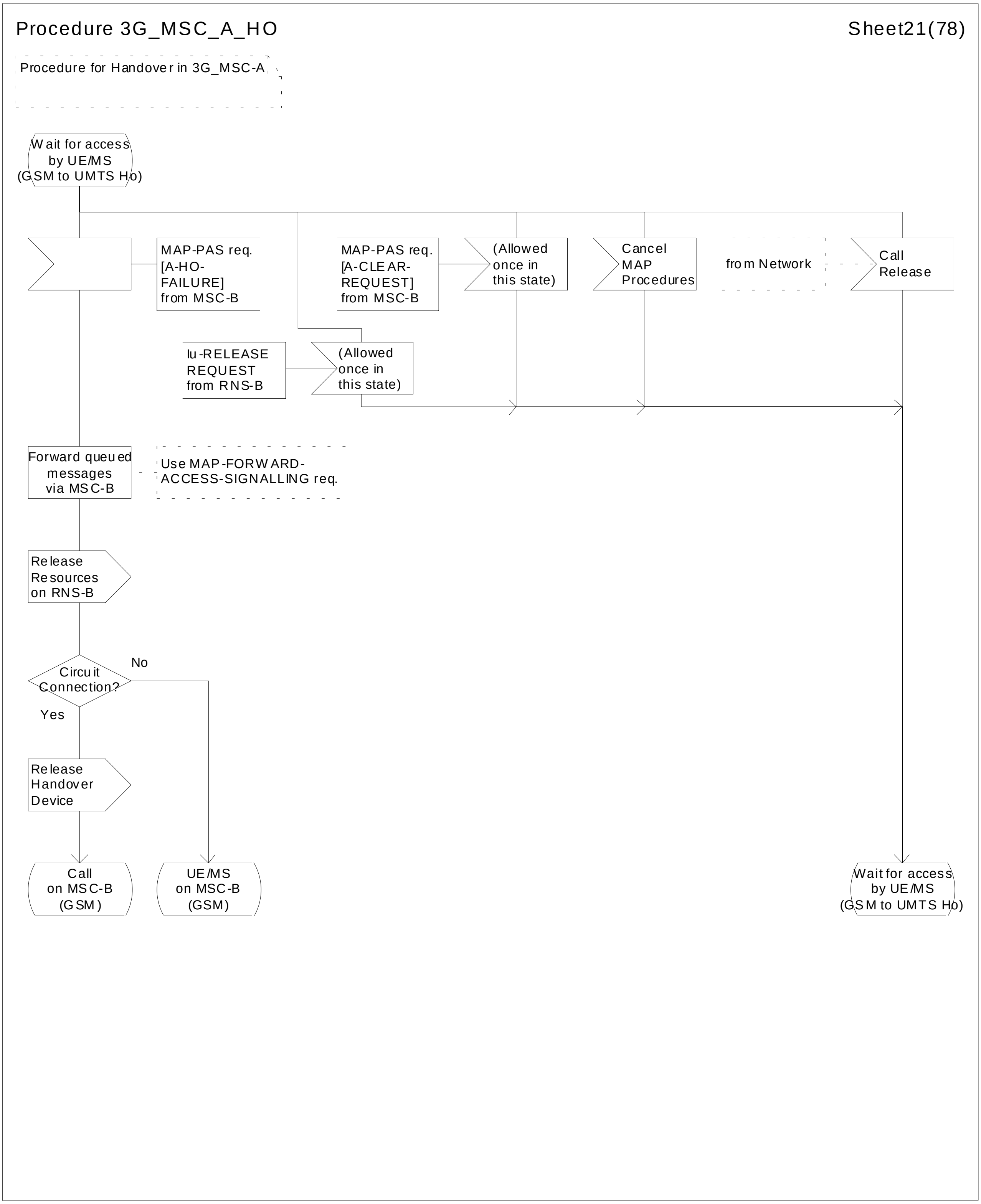


Figure 43 (sheet 21 of 78): Handover control procedure in 3G_MSC-A

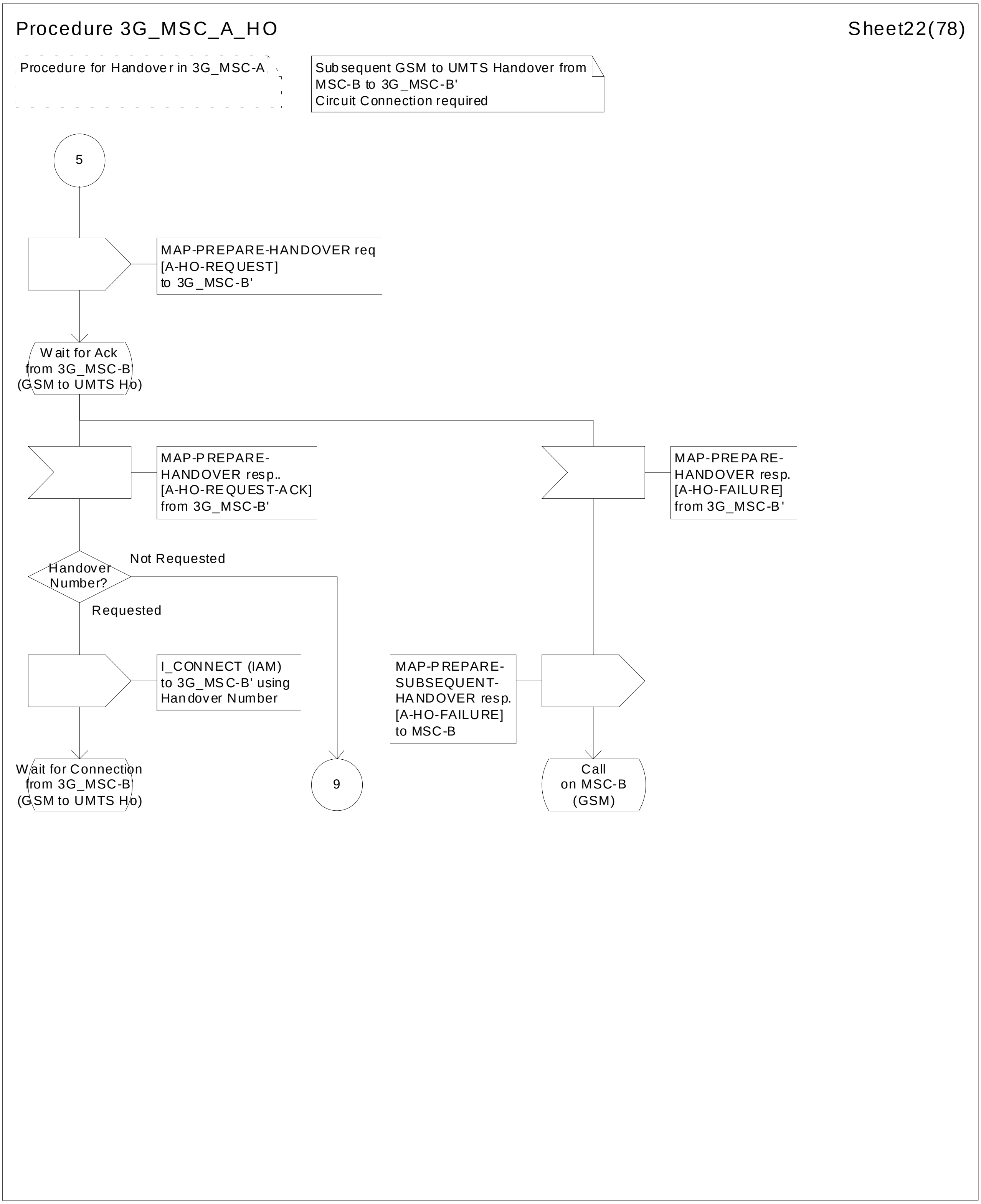


Figure 43 (sheet 22 of 78): Handover control procedure in 3G_MSC-A

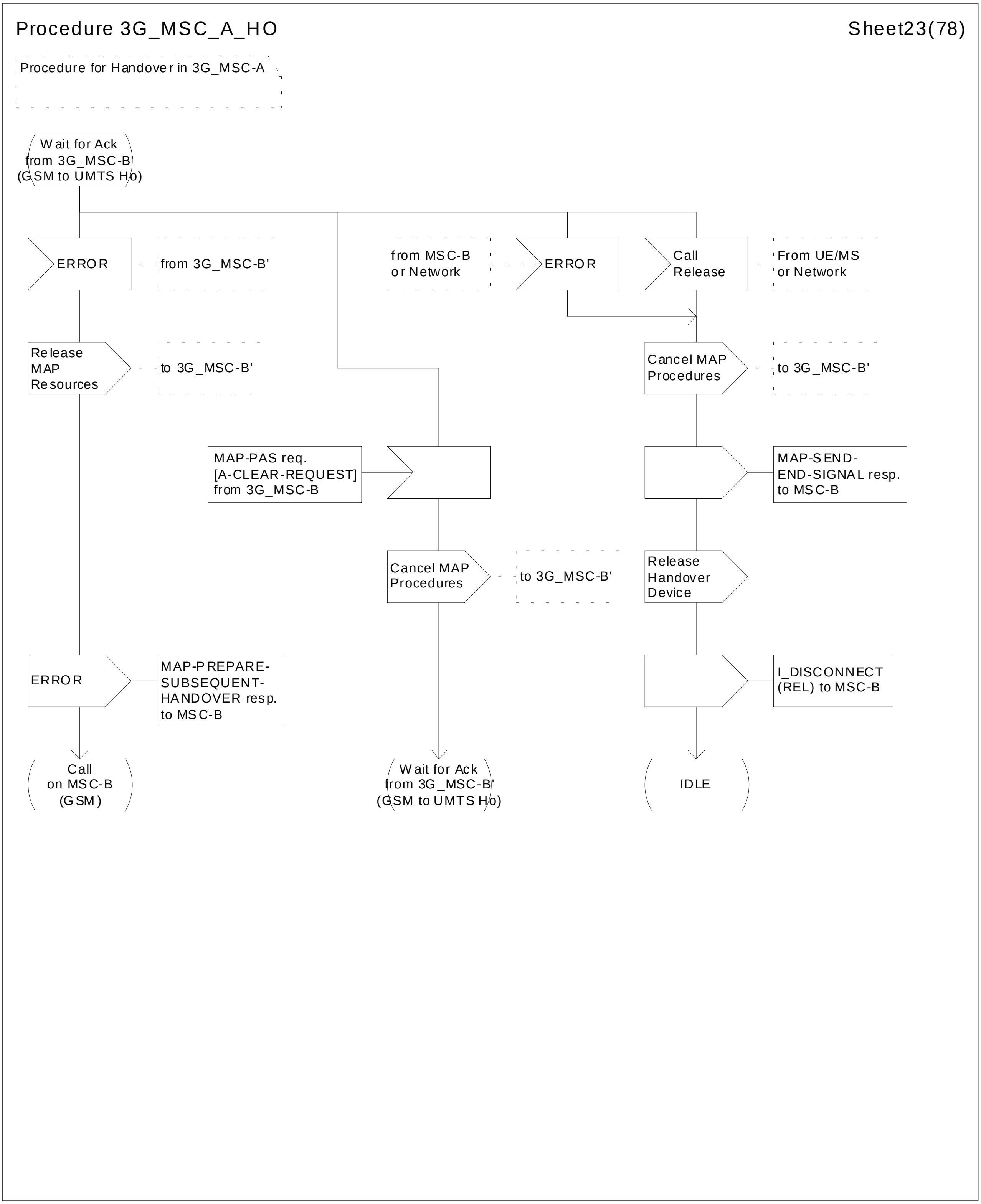


Figure 43 (sheet 23 of 78): Handover control procedure in 3G_MSC-A

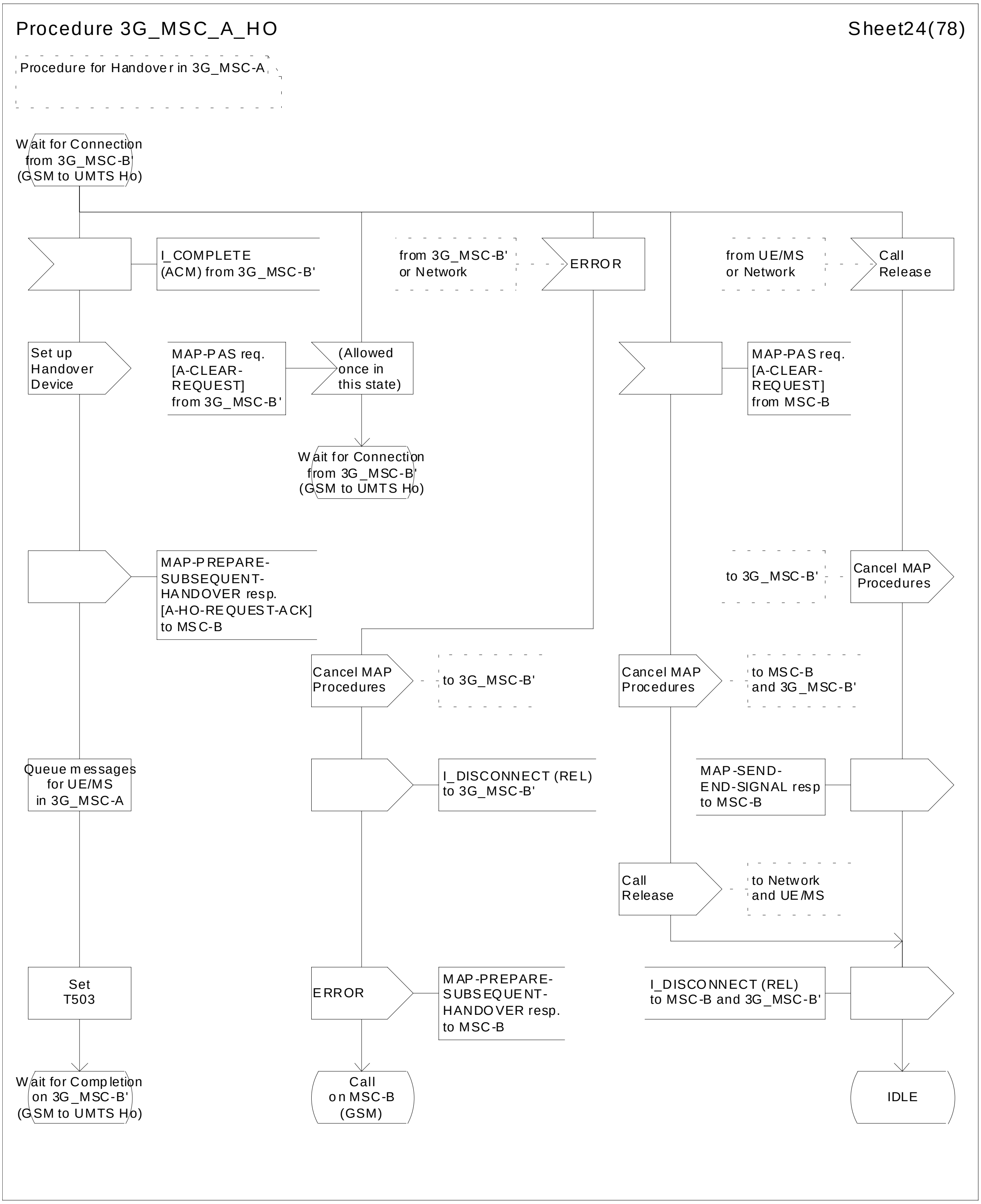


Figure 43 (sheet 24 of 78): Handover control procedure in 3G_MSC-A

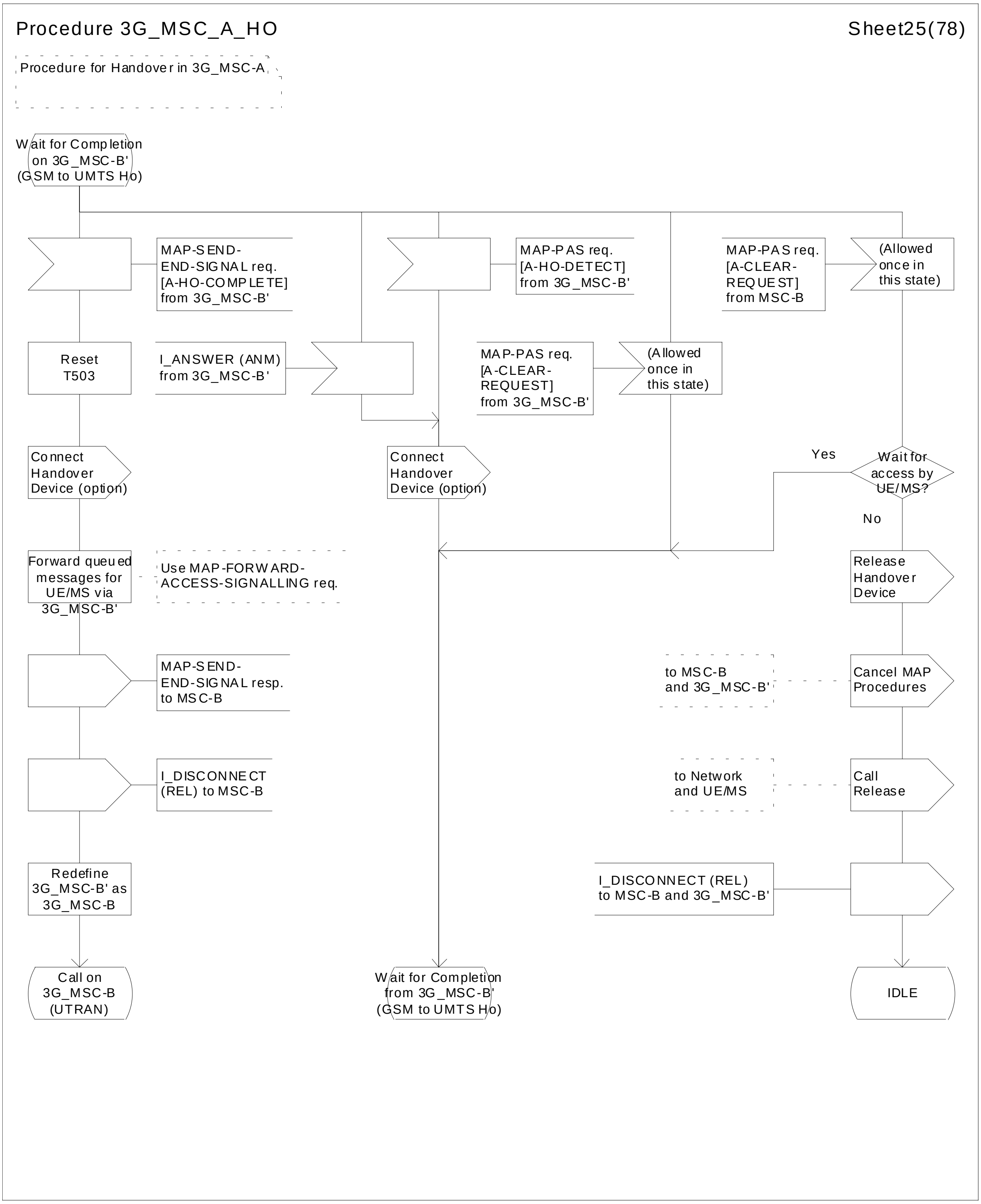


Figure 43 (sheet 25 of 78): Handover control procedure in 3G_MSC-A

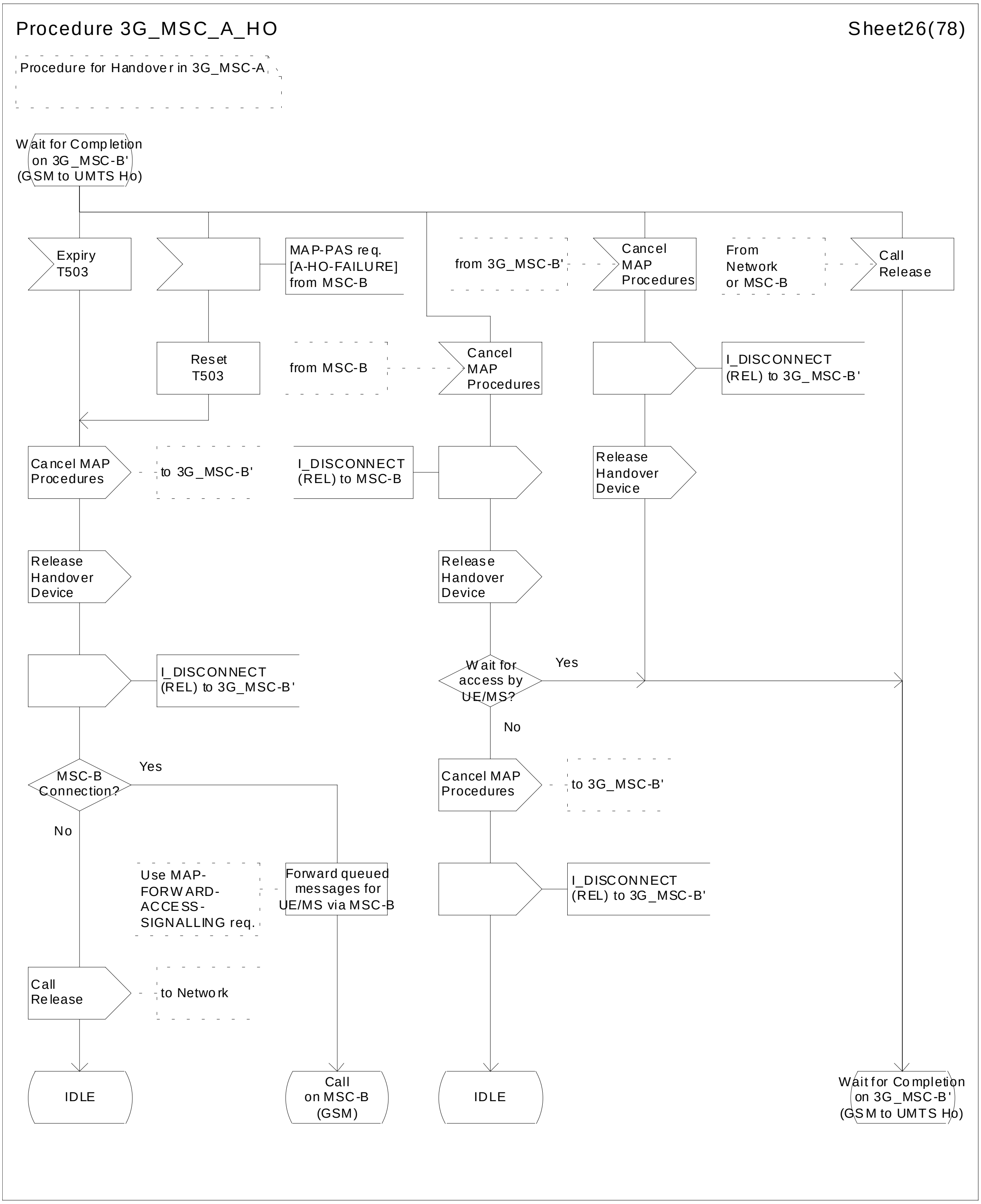


Figure 43 (sheet 26 of 78): Handover control procedure in 3G_MSC-A

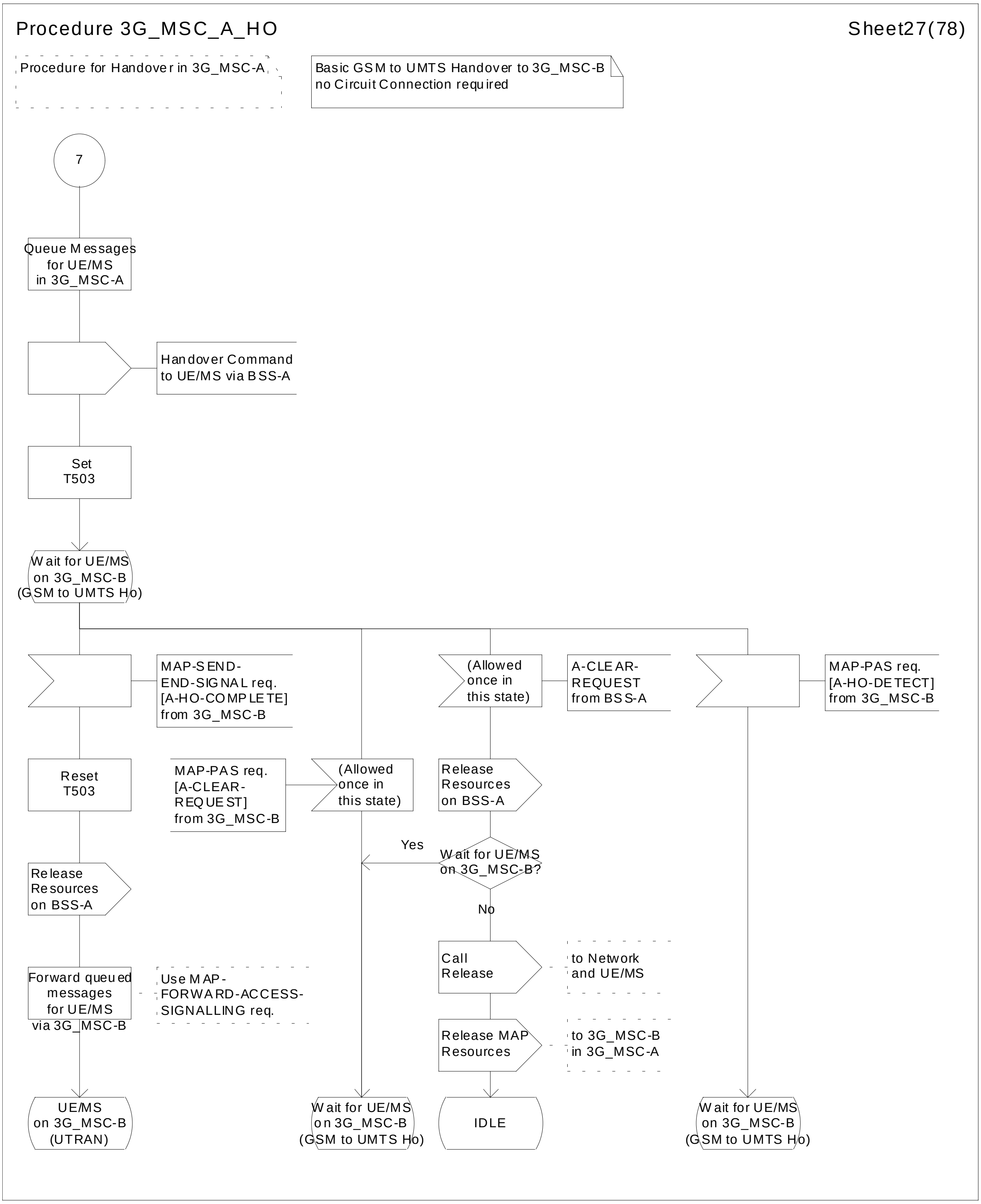


Figure 43 (sheet 27 of 78): Handover control procedure in 3G_MSC-A

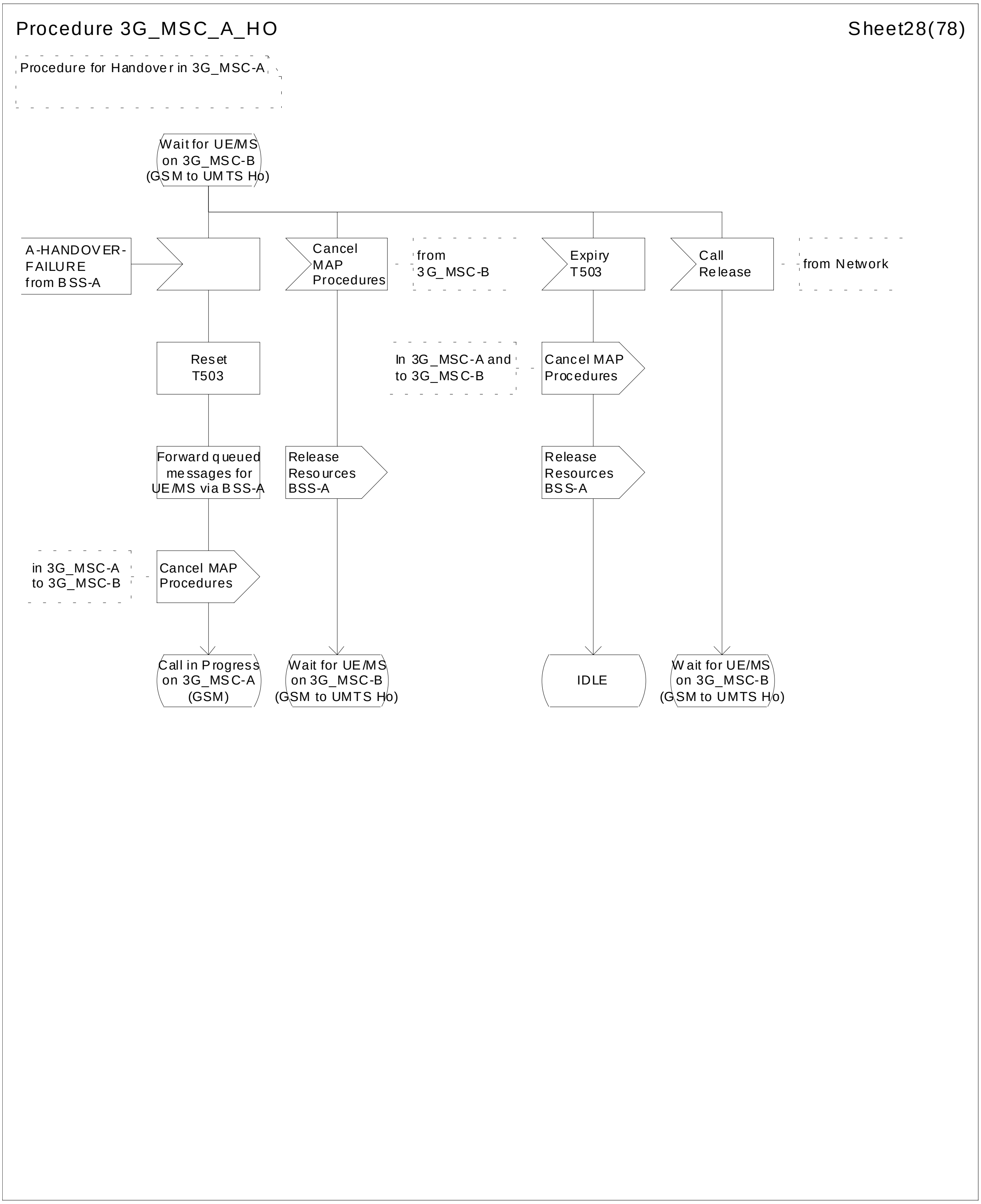


Figure 43 (sheet 28 of 78): Handover control procedure in 3G_MSC-A

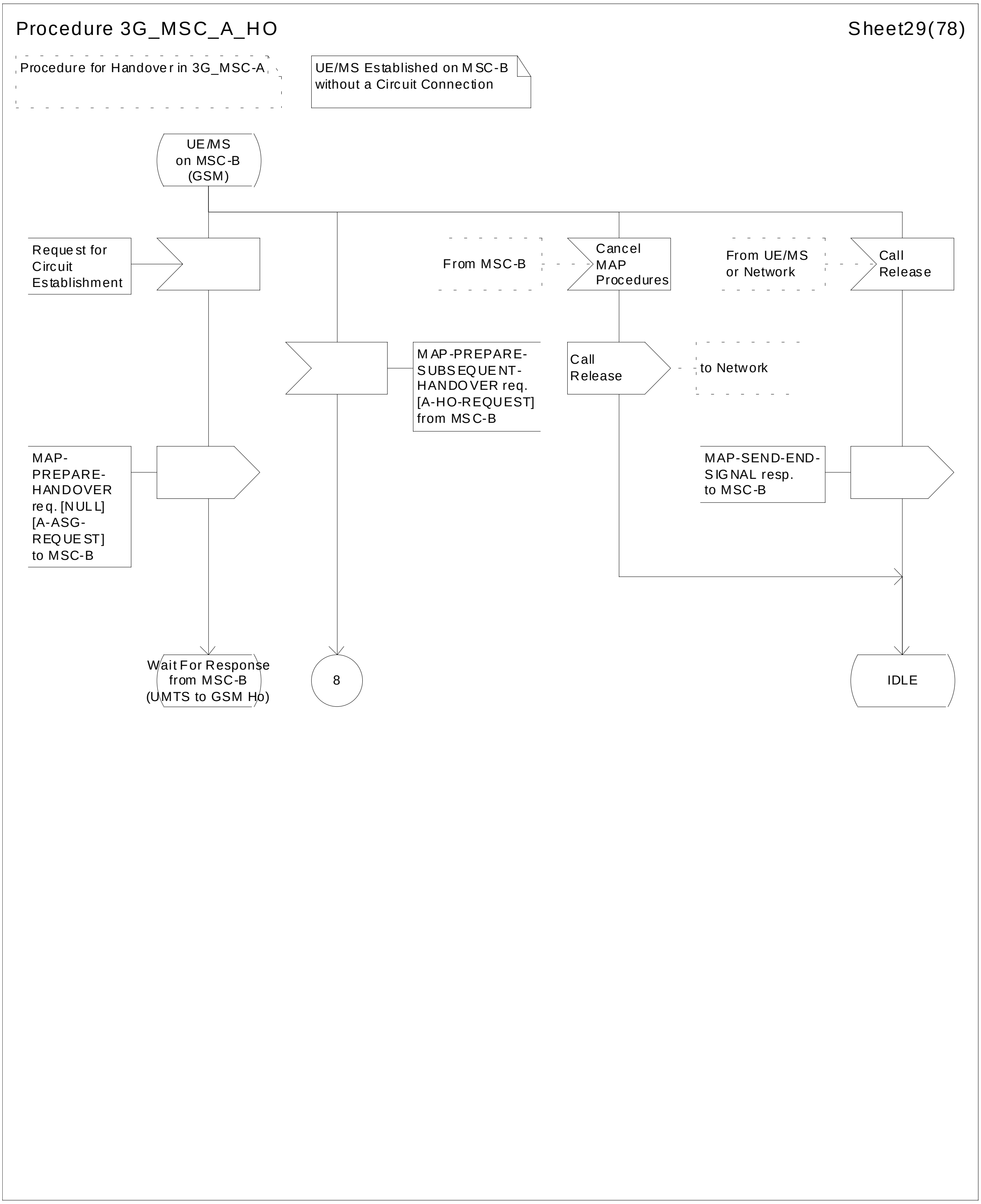


Figure 43 (sheet 29 of 78): Handover control procedure in 3G_MSC-A

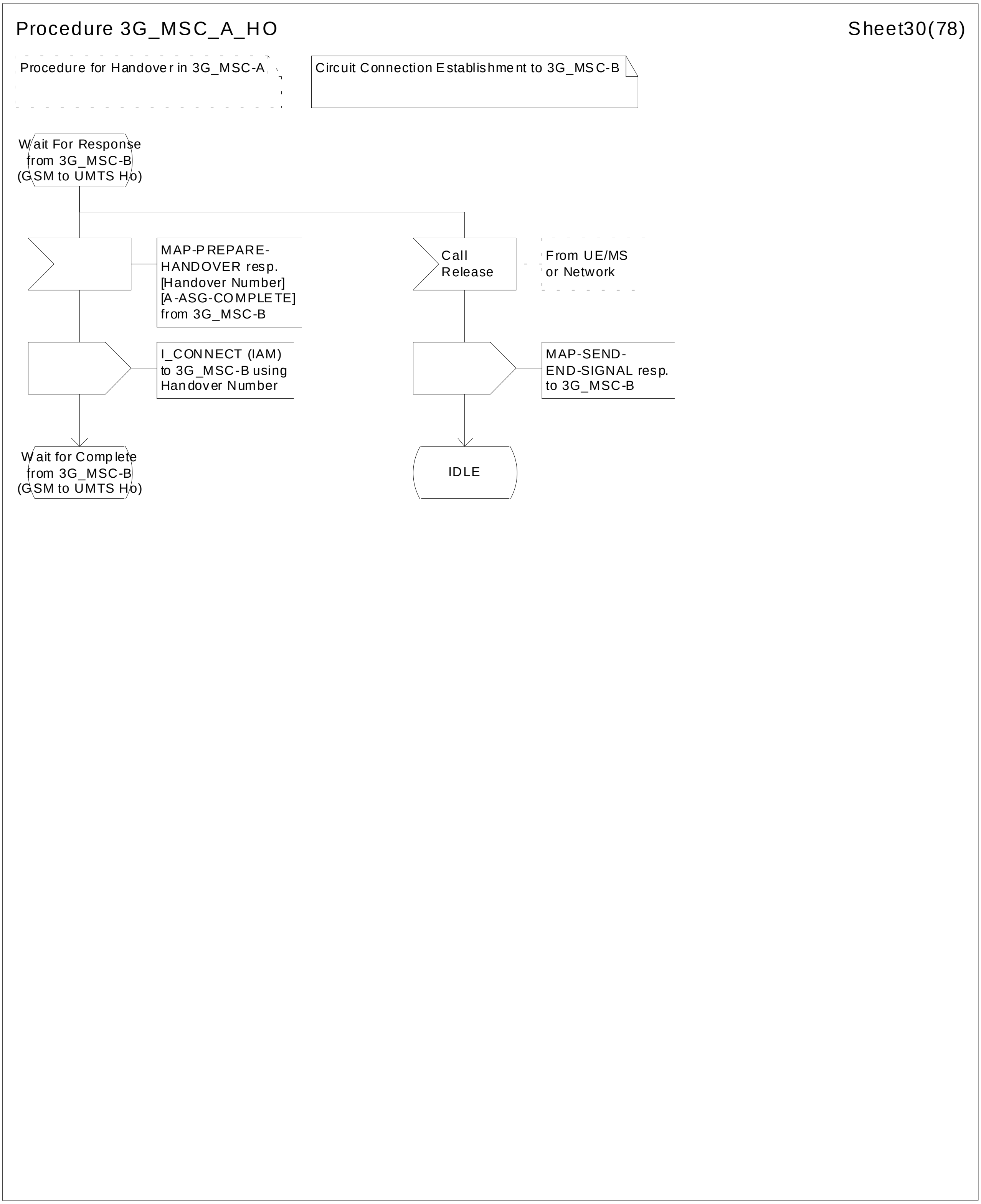


Figure 43 (sheet 30 of 78): Handover control procedure in 3G_MSC-A

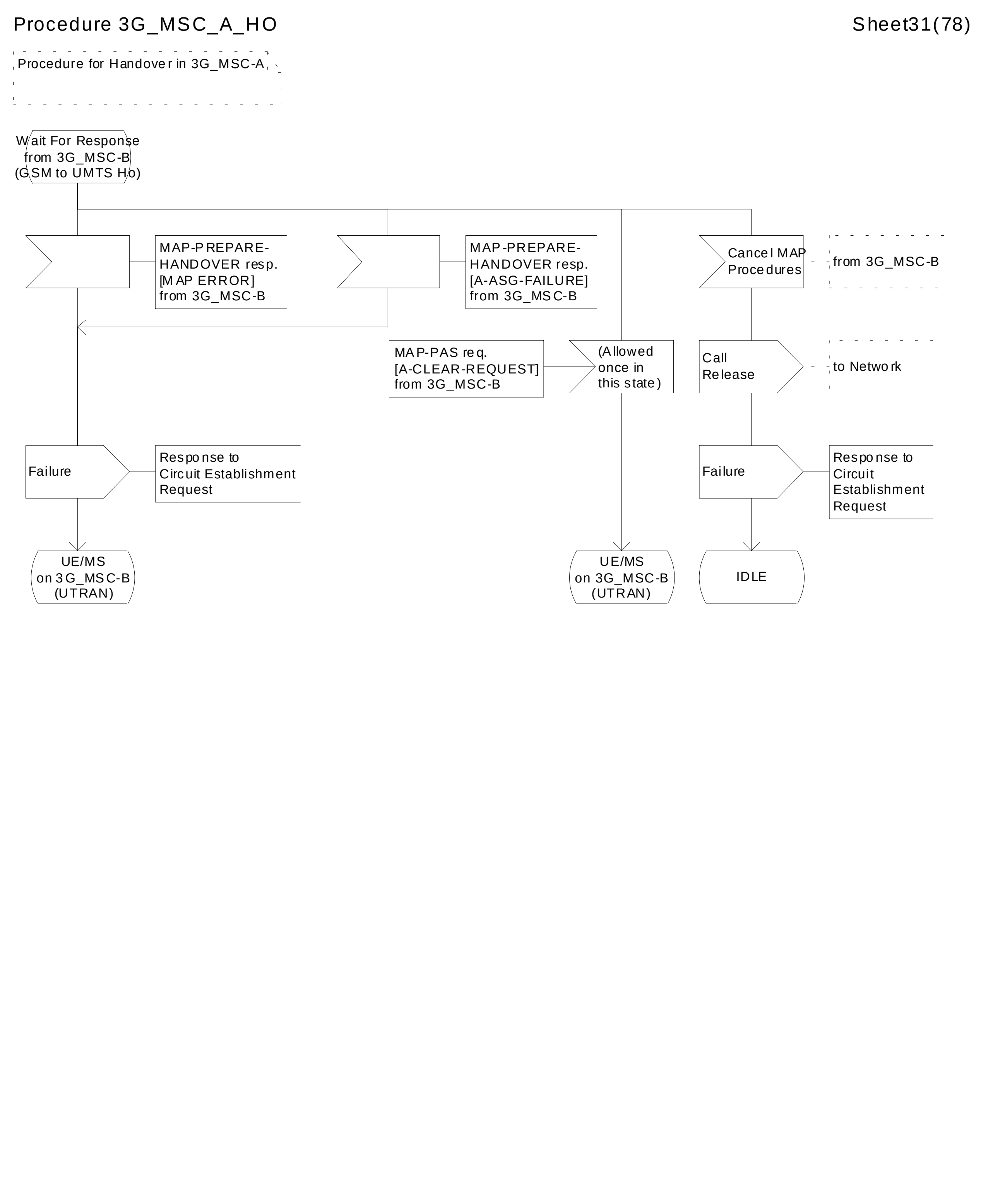


Figure 43 (sheet 31 of 78): Handover control procedure in 3G_MSC-A

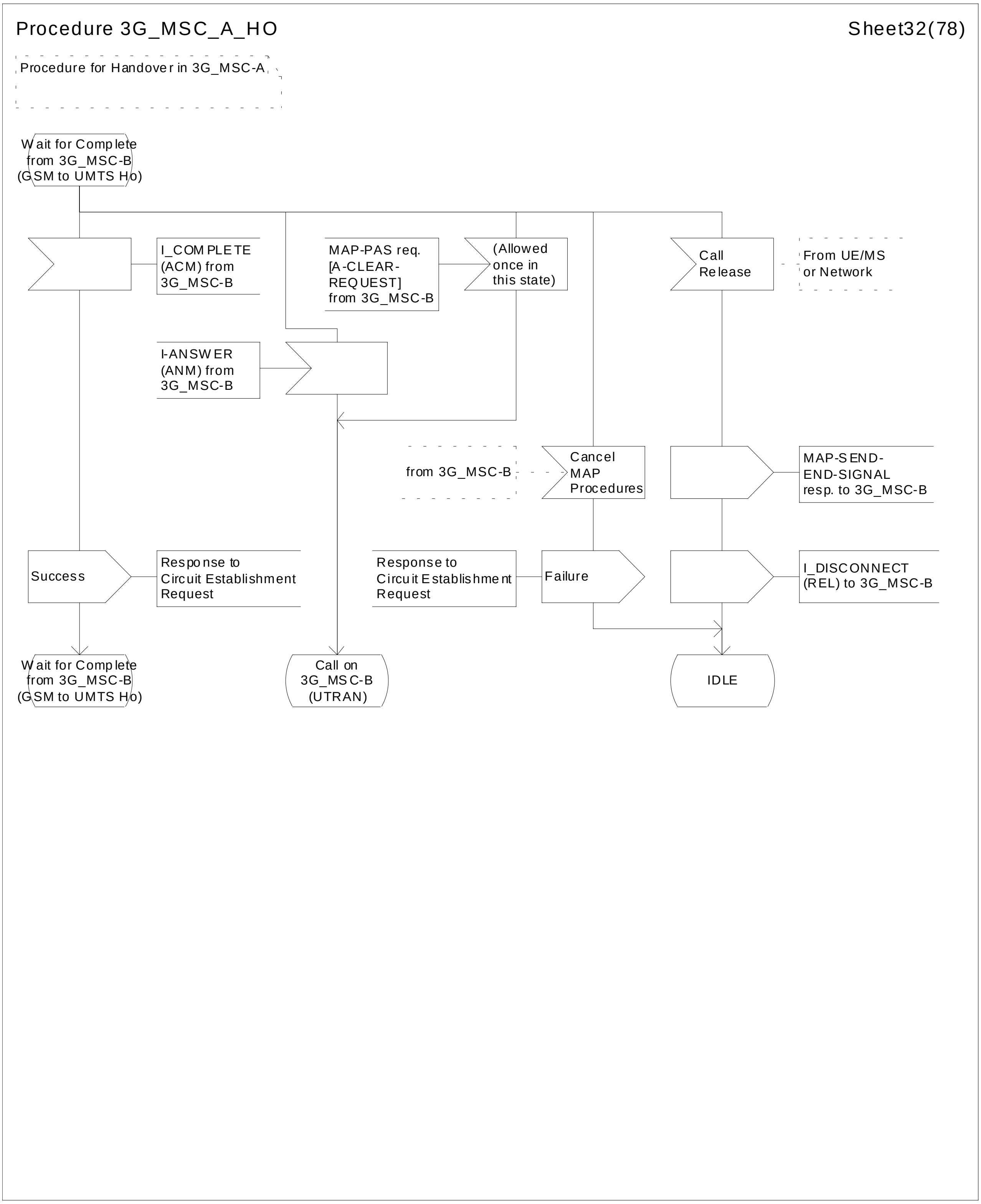


Figure 43 (sheet 32 of 78): Handover control procedure in 3G_MSC-A

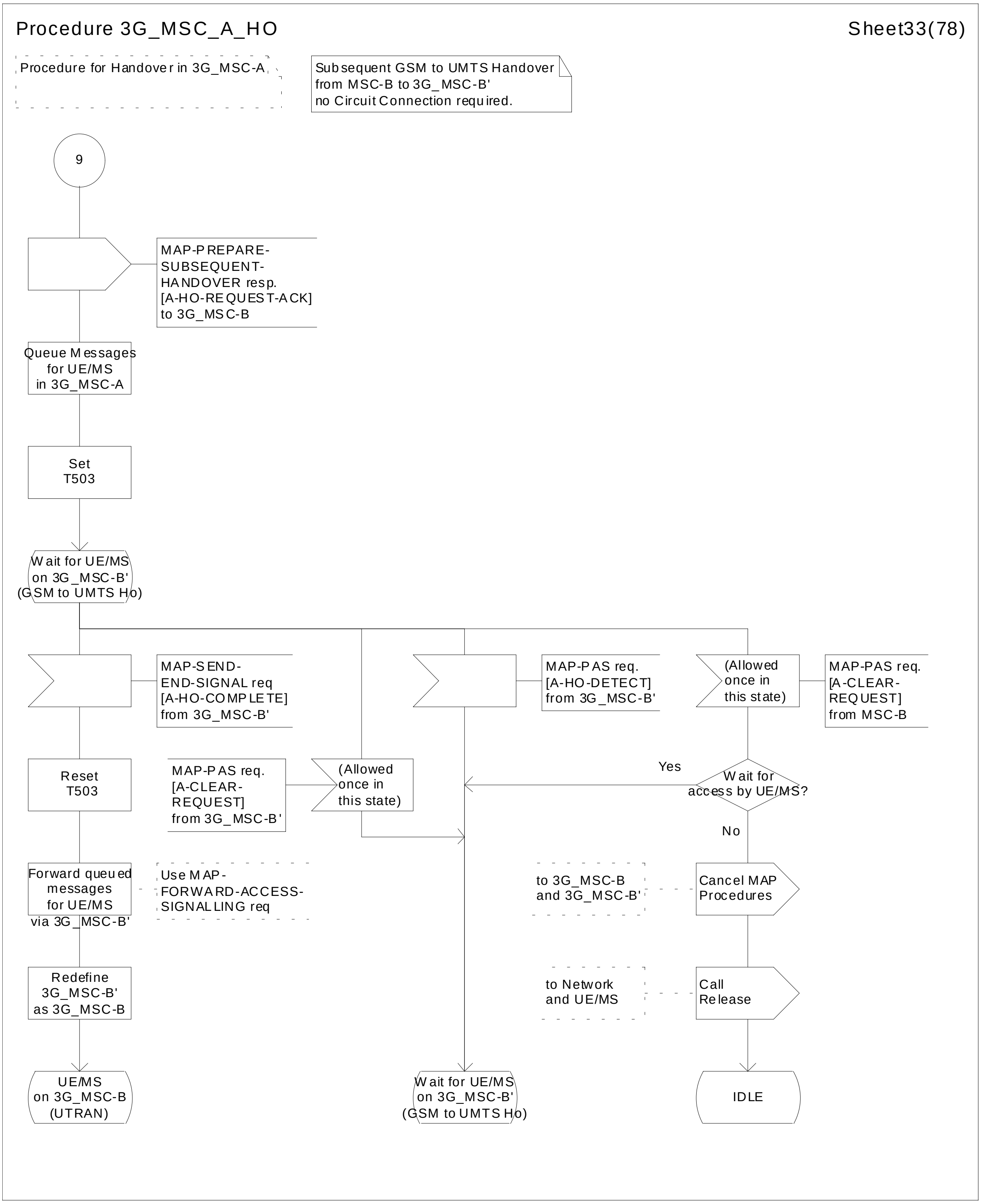


Figure 43 (sheet 33 of 78): Handover control procedure in 3G_MSC-A

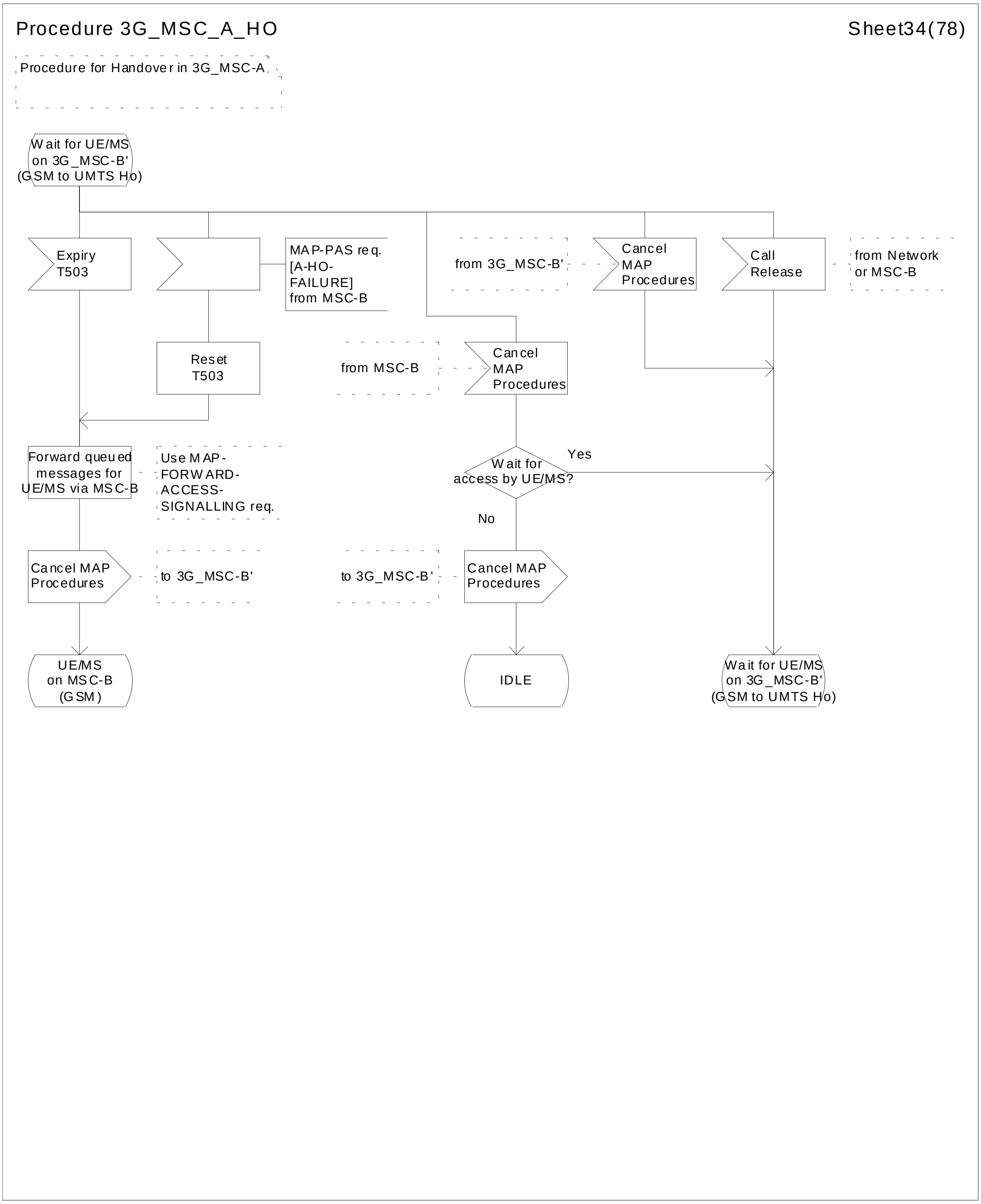


Figure 43 (sheet 34 of 78): Handover control procedure in 3G_MSC-A

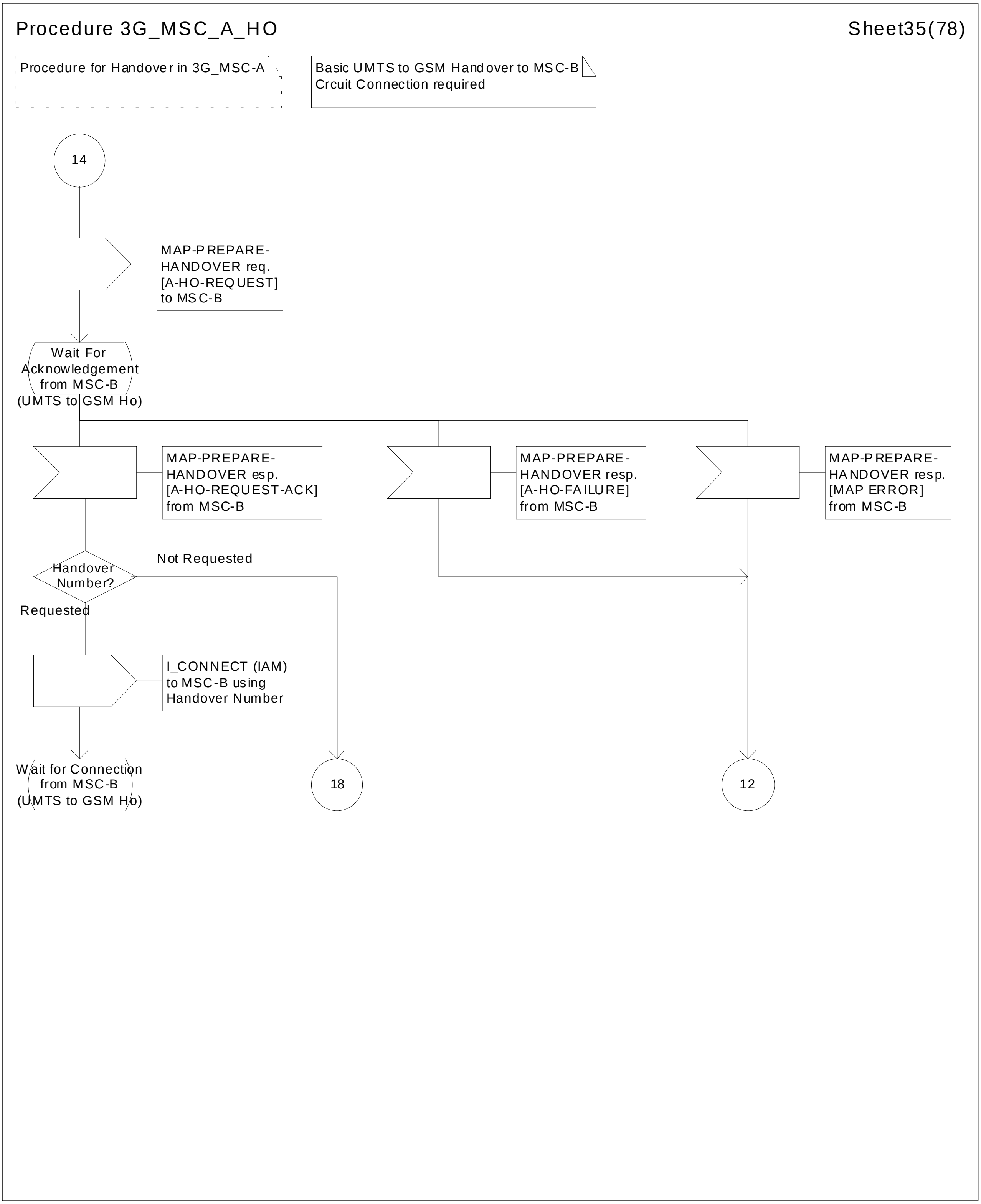


Figure 43 (sheet 35 of 78): Handover control procedure in 3G_MSC-A

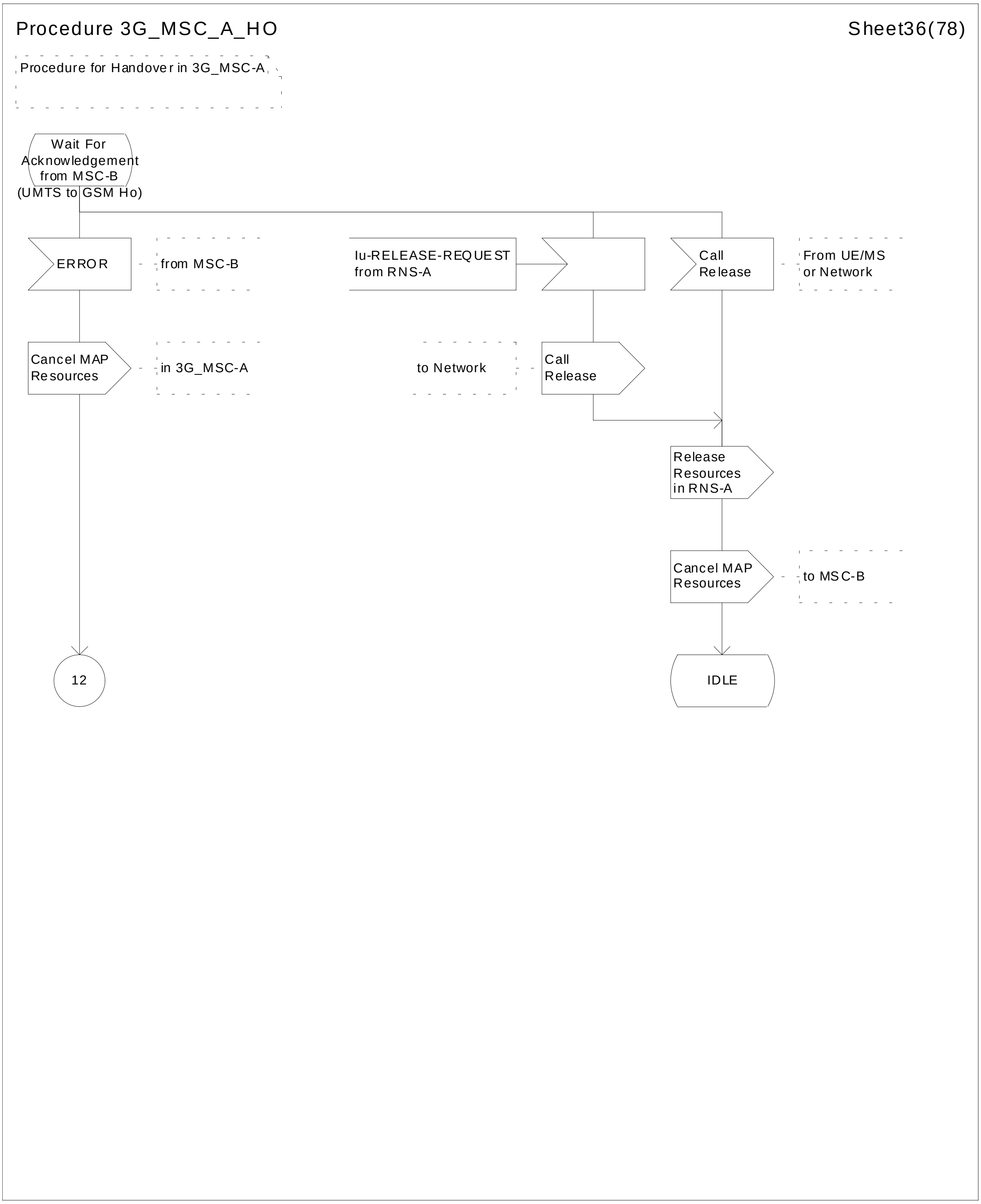


Figure 43 (sheet 36 of 78): Handover control procedure in 3G_MSC-A

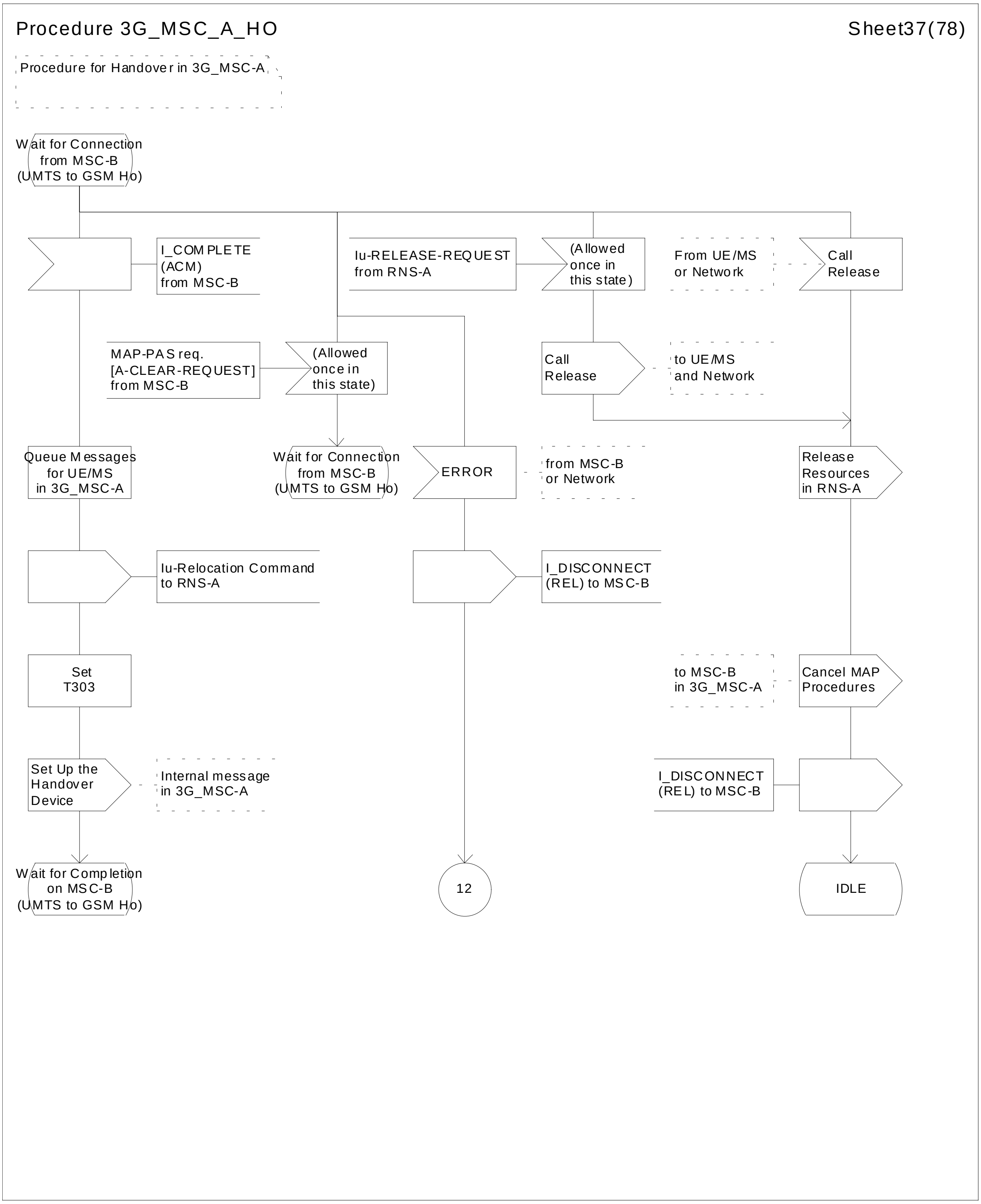


Figure 43 (sheet 37 of 78): Handover control procedure in 3G_MSC-A

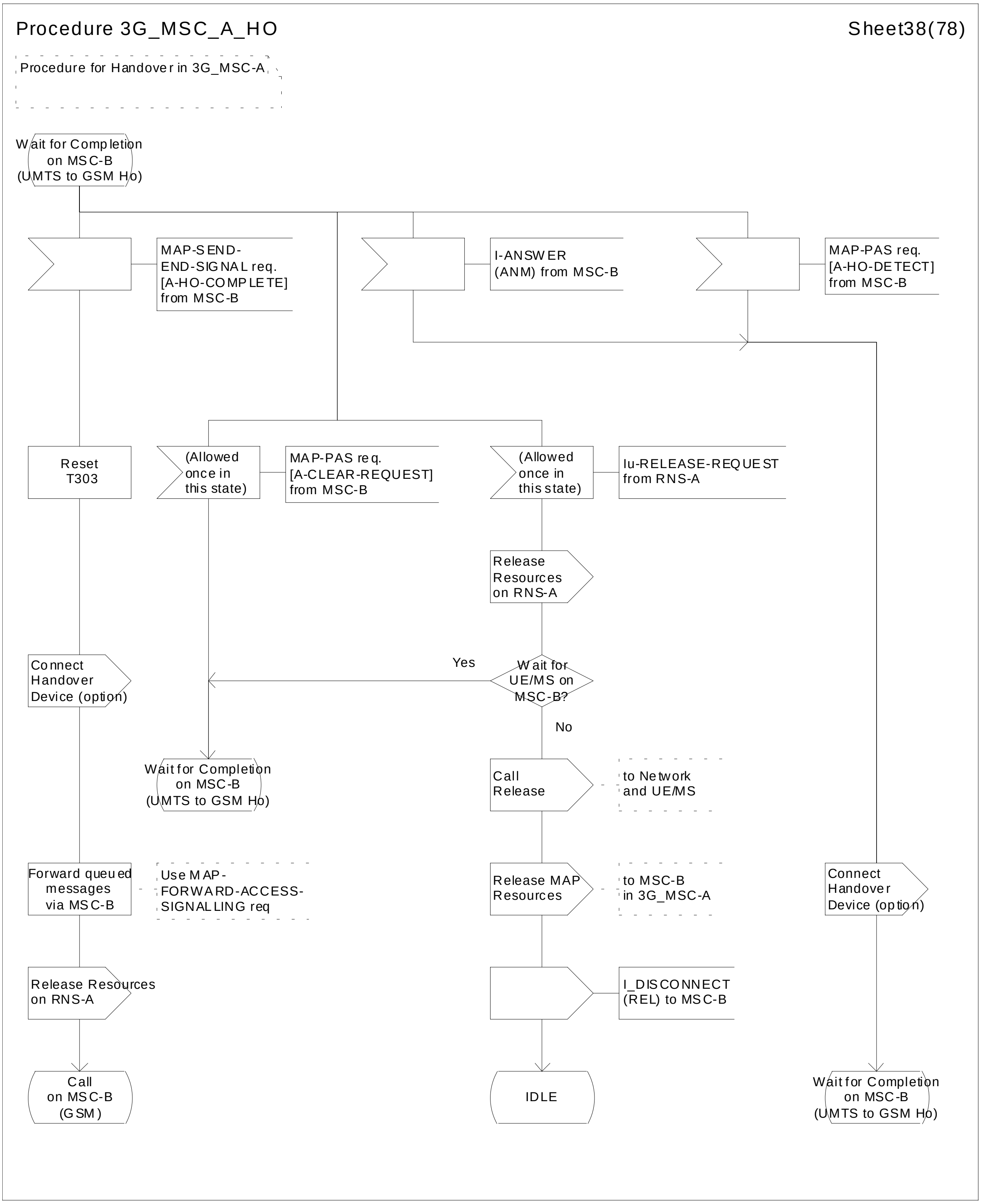


Figure 43 (sheet 38 of 78): Handover control procedure in 3G_MSC-A

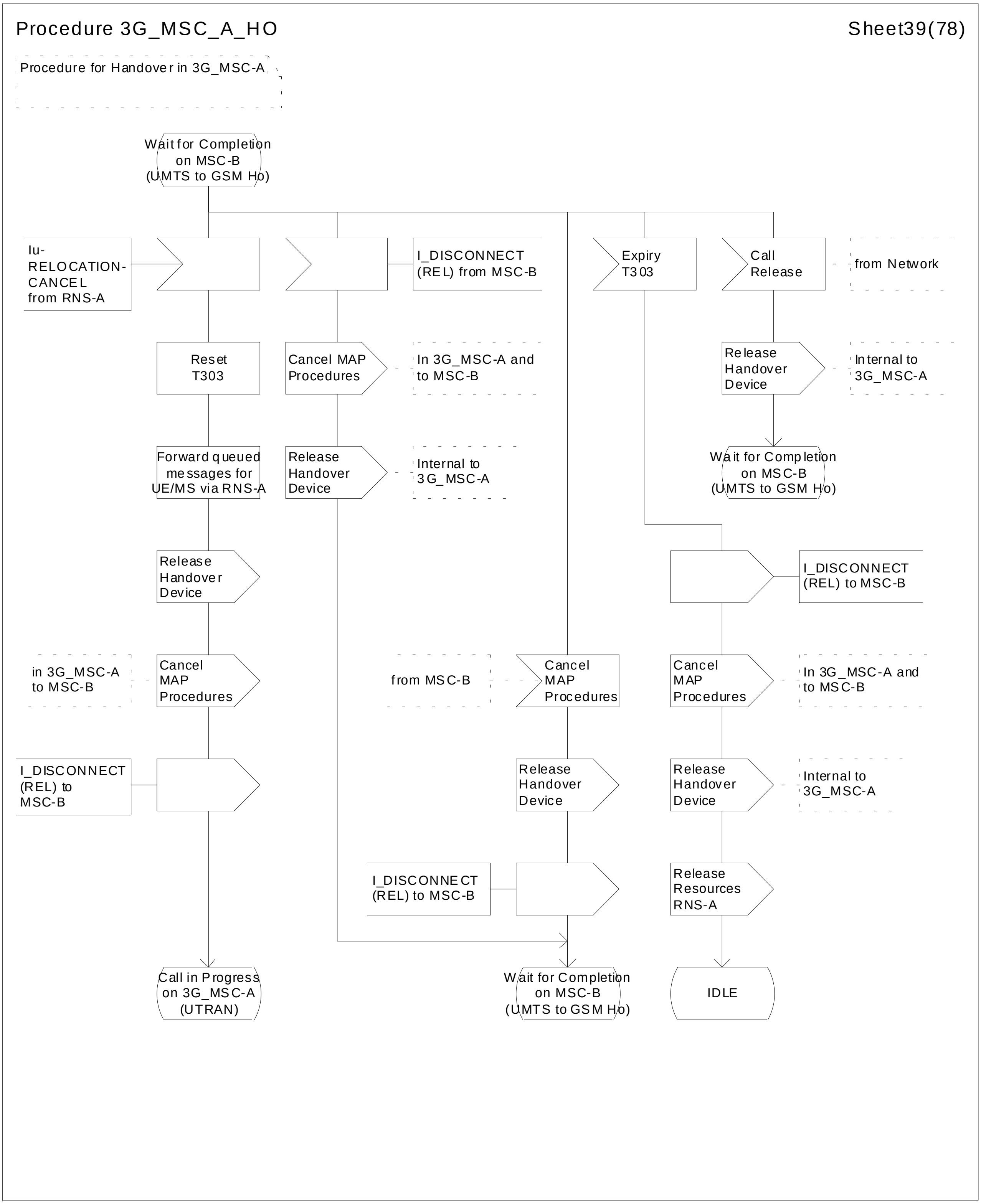


Figure 43 (sheet 39 of 78): Handover control procedure in 3G_MSC-A

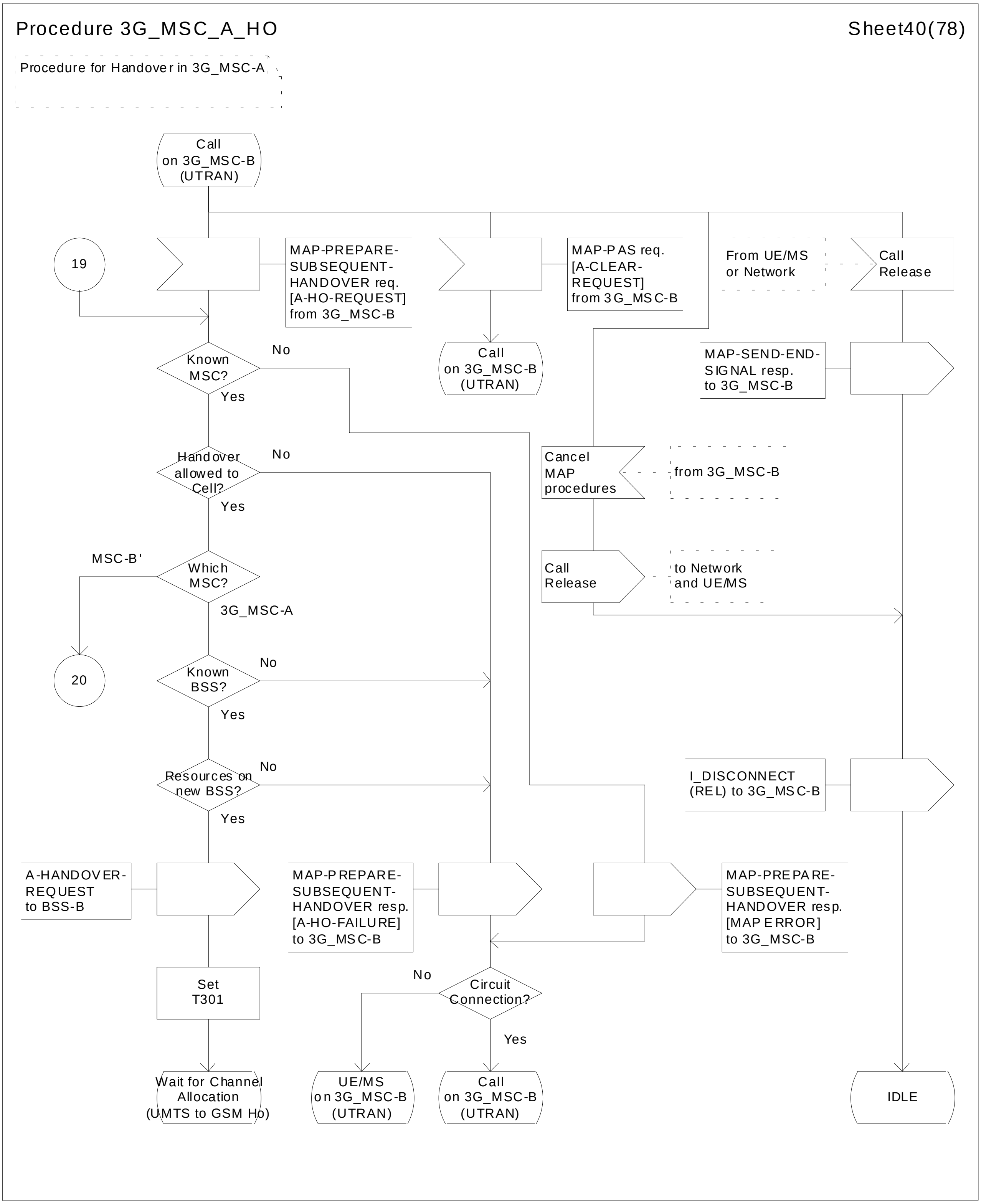


Figure 43 (sheet 40 of 78): Handover control procedure in 3G_MSC-A

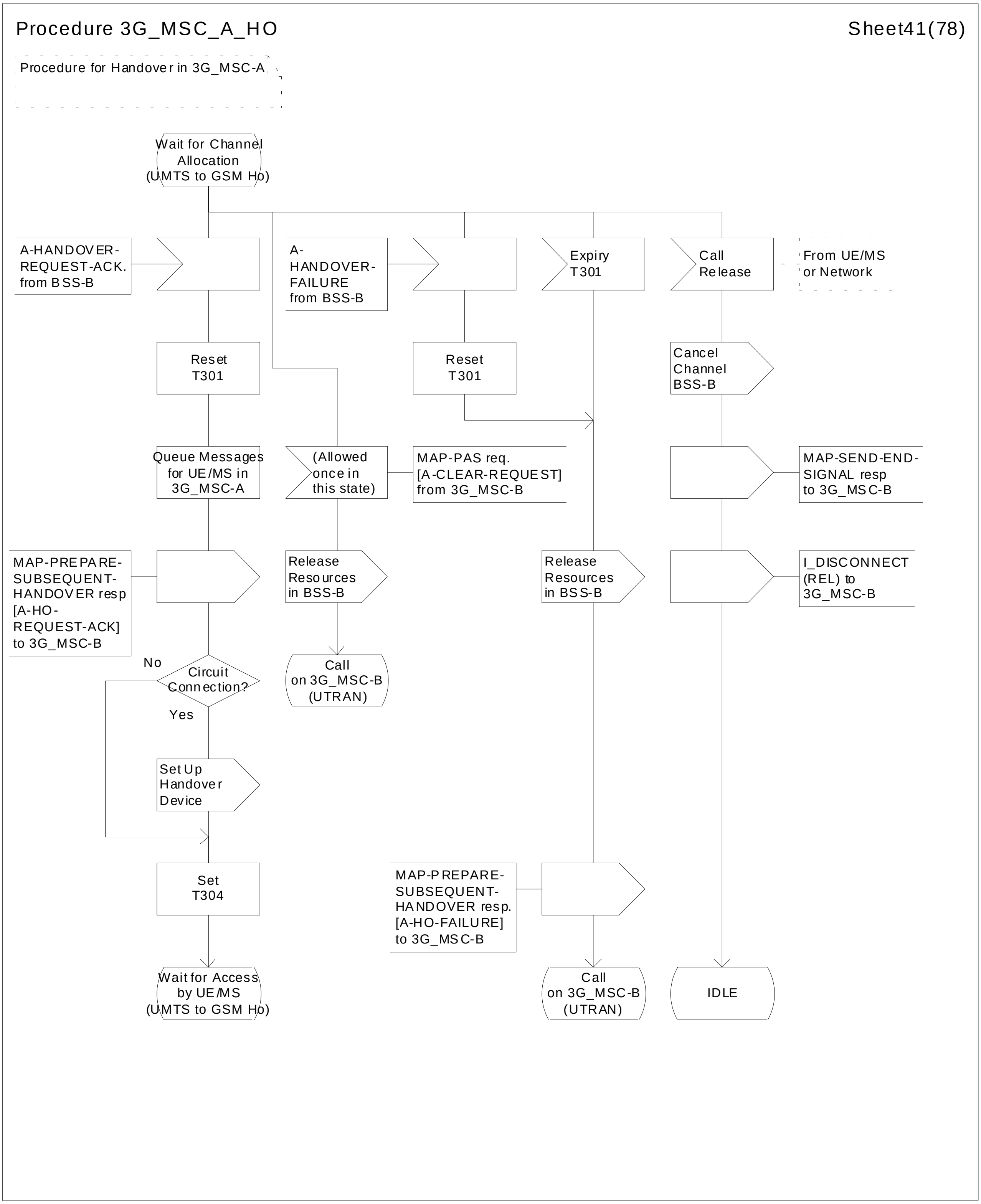


Figure 43 (sheet 41 of 78): Handover control procedure in 3G_MSC-A

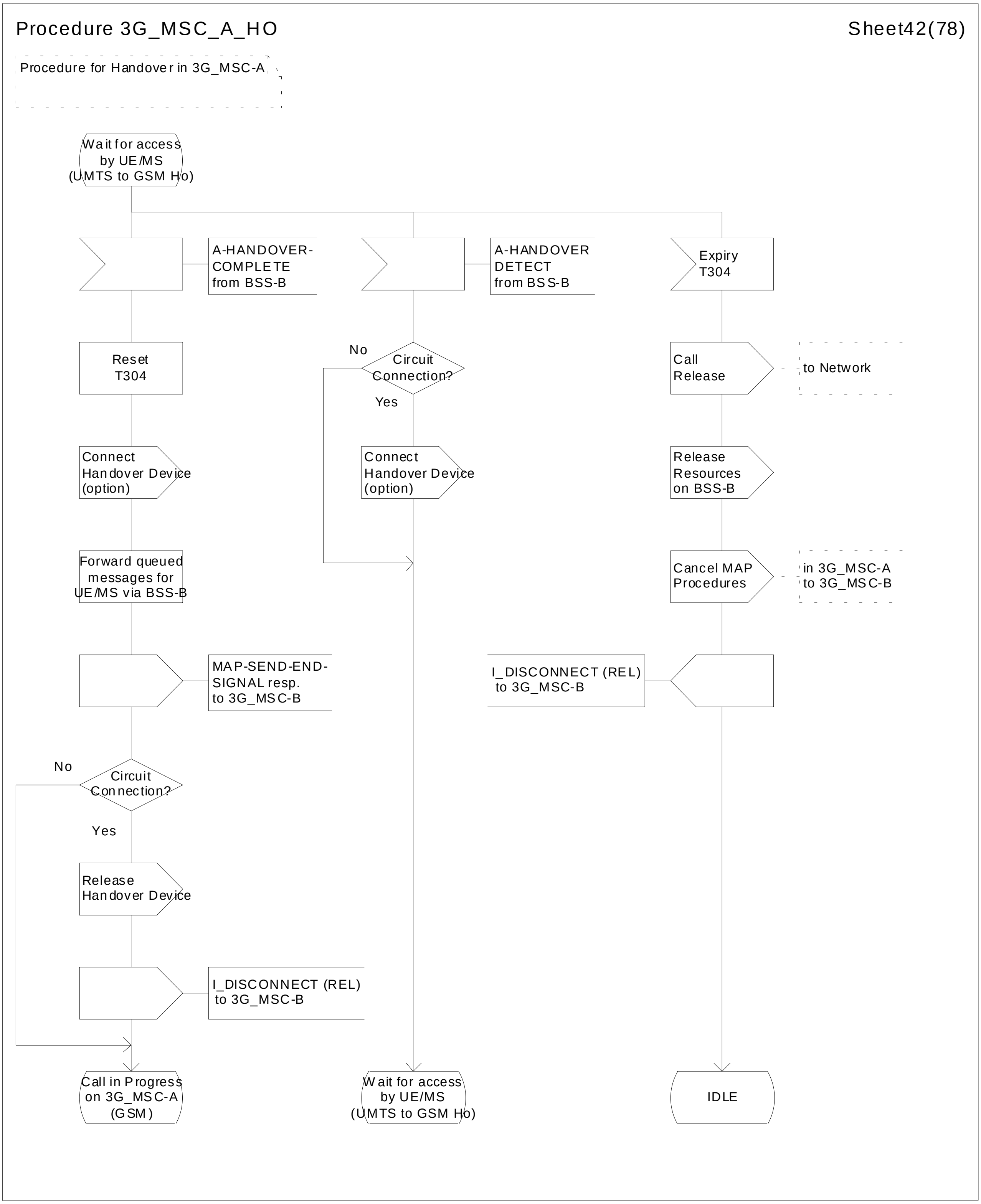


Figure 43 (sheet 42 of 78): Handover control procedure in 3G_MSC-A

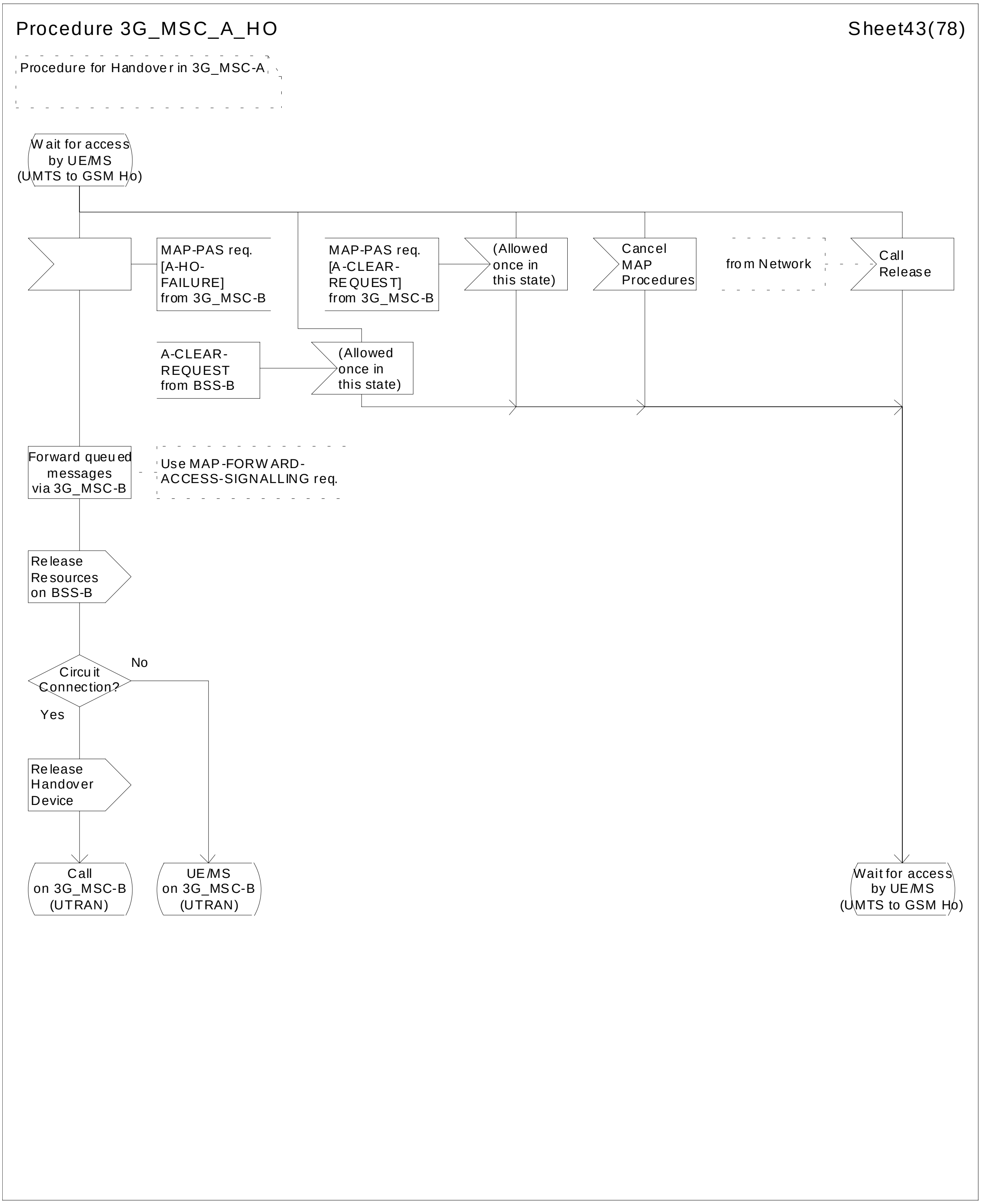


Figure 43 (sheet 43 of 78): Handover control procedure in 3G_MSC-A

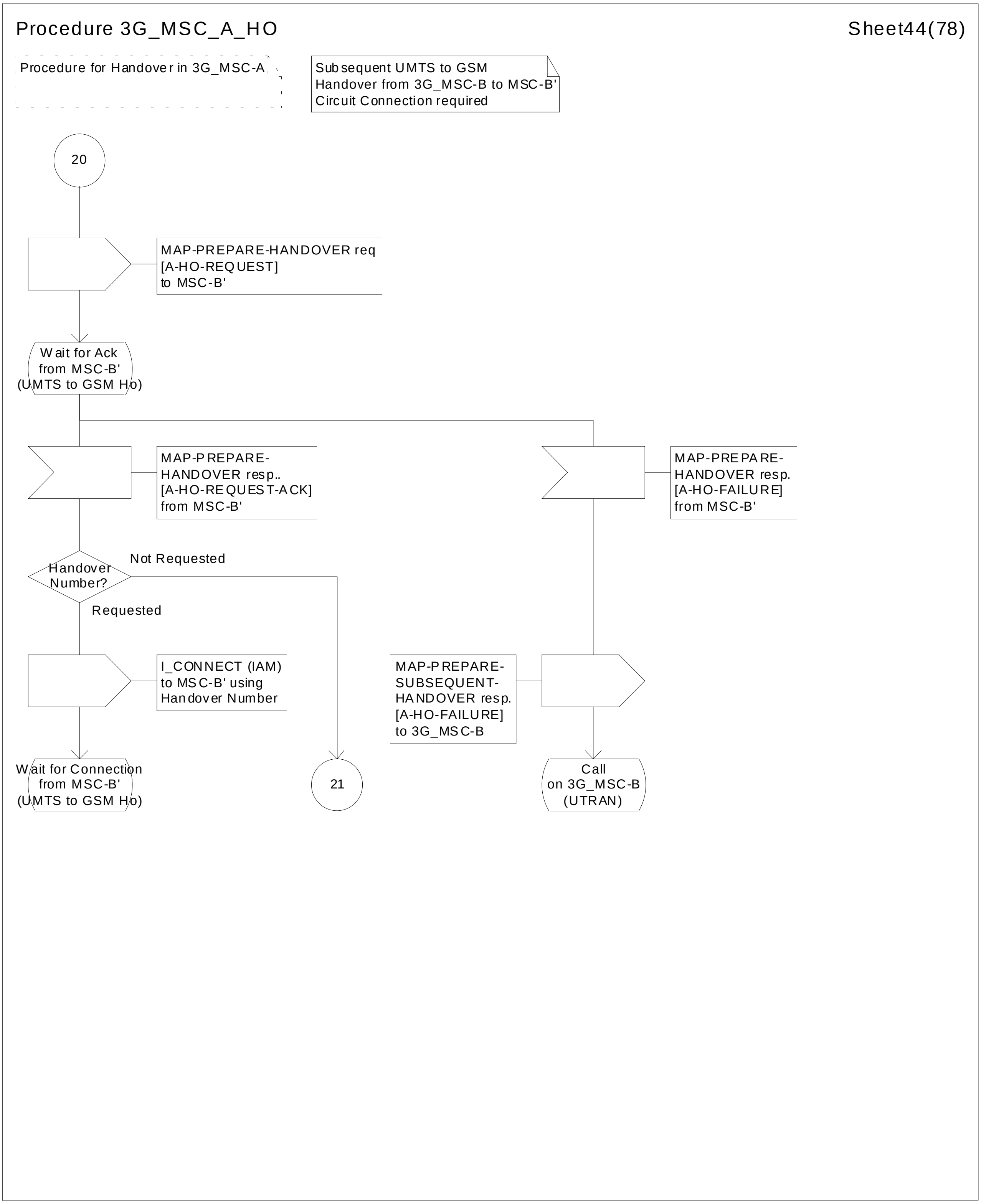


Figure 43 (sheet 44 of 78): Handover control procedure in 3G_MSC-A

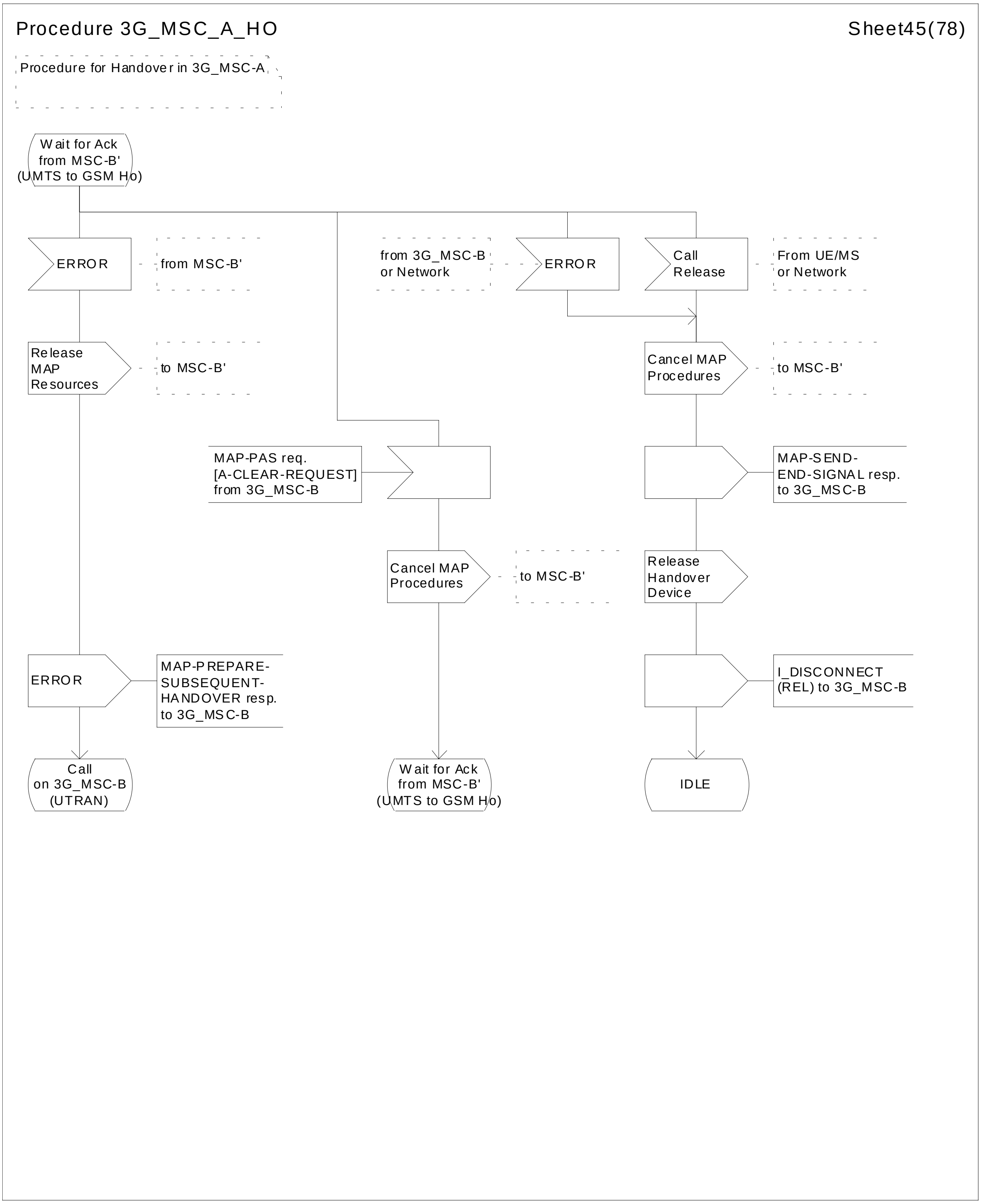


Figure 43 (sheet 45 of 78): Handover control procedure in 3G_MSC-A

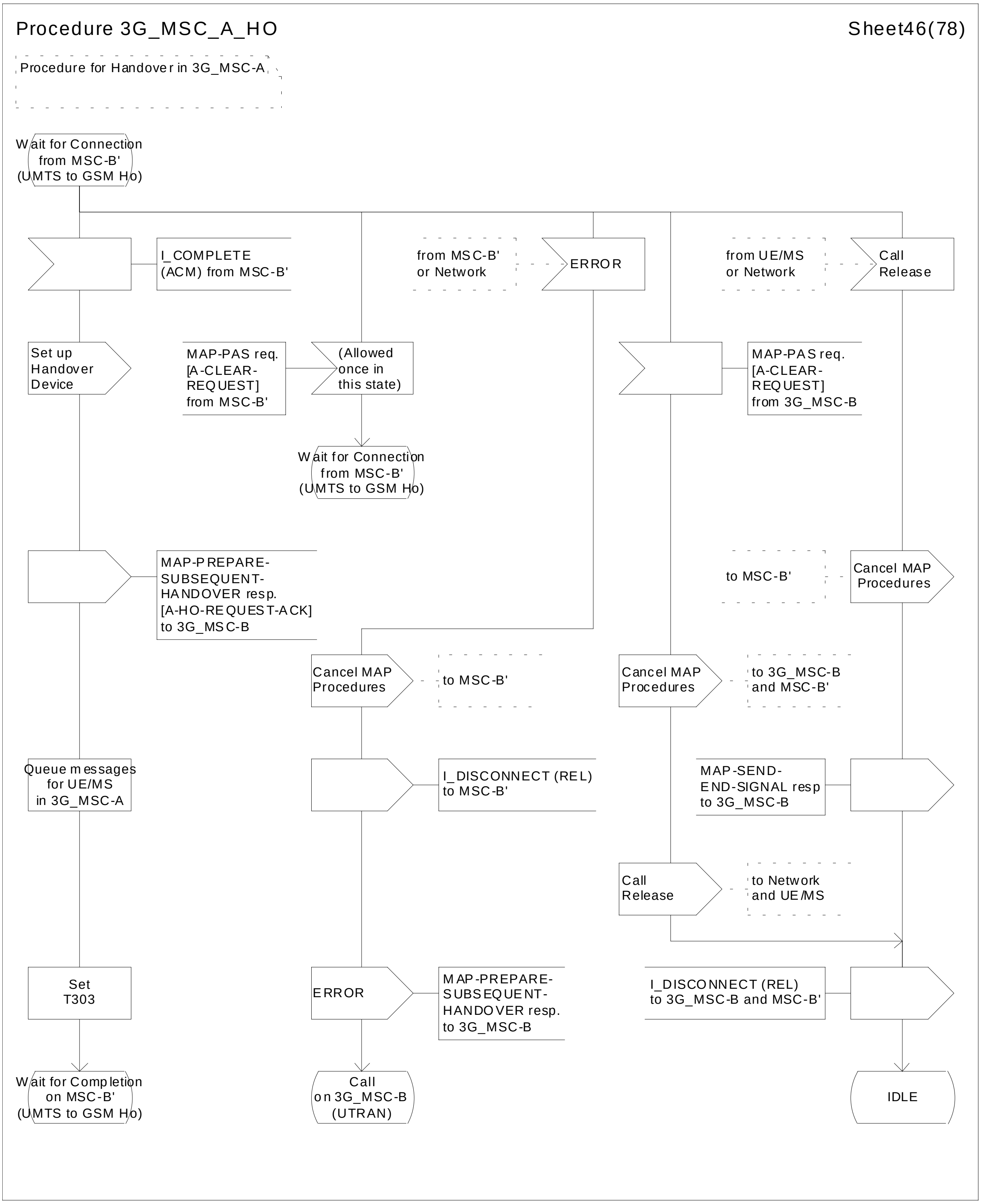


Figure 43 (sheet 46 of 78): Handover control procedure in 3G_MSC-A

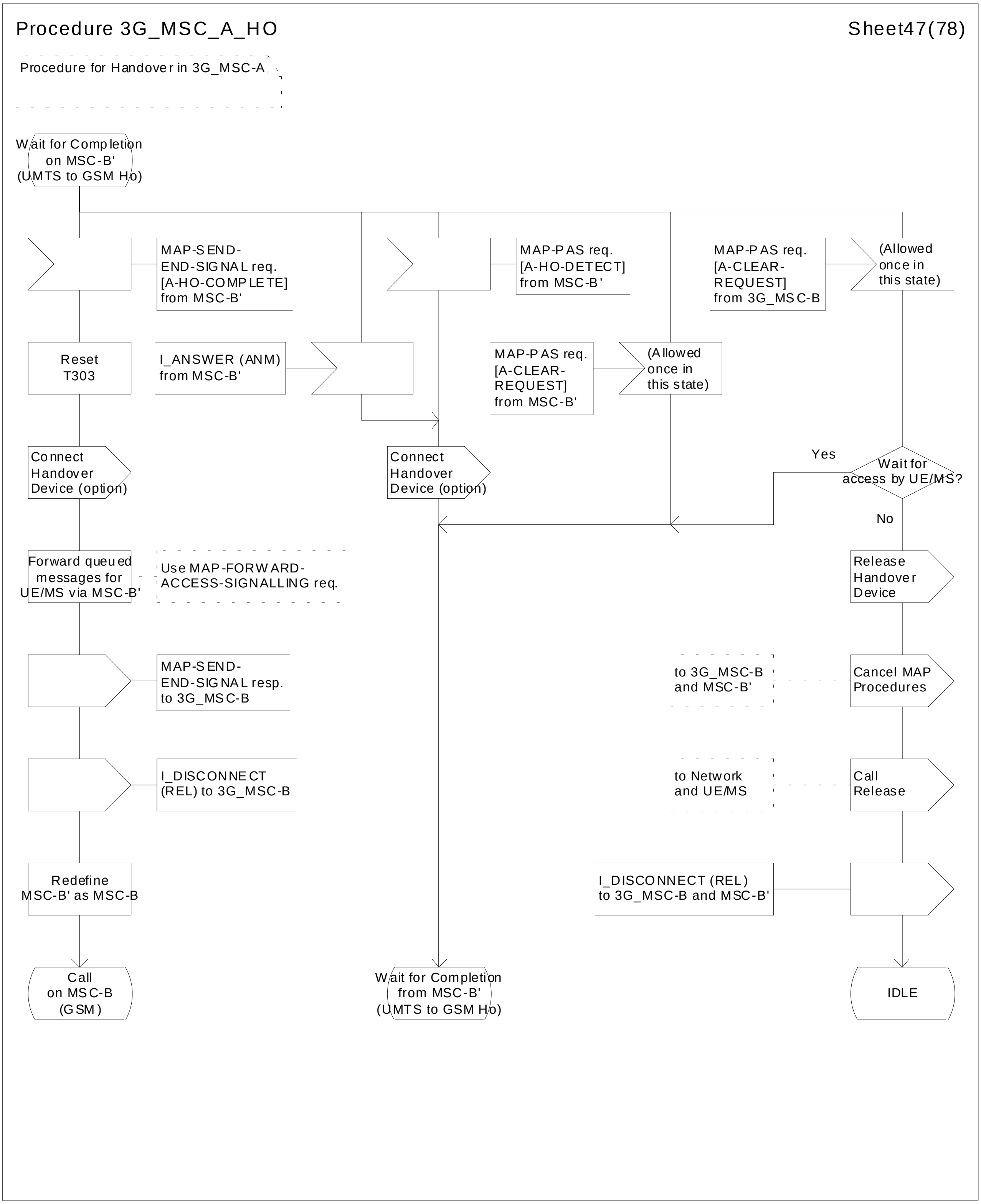


Figure 43 (sheet 47 of 78): Handover control procedure in 3G_MSC-A

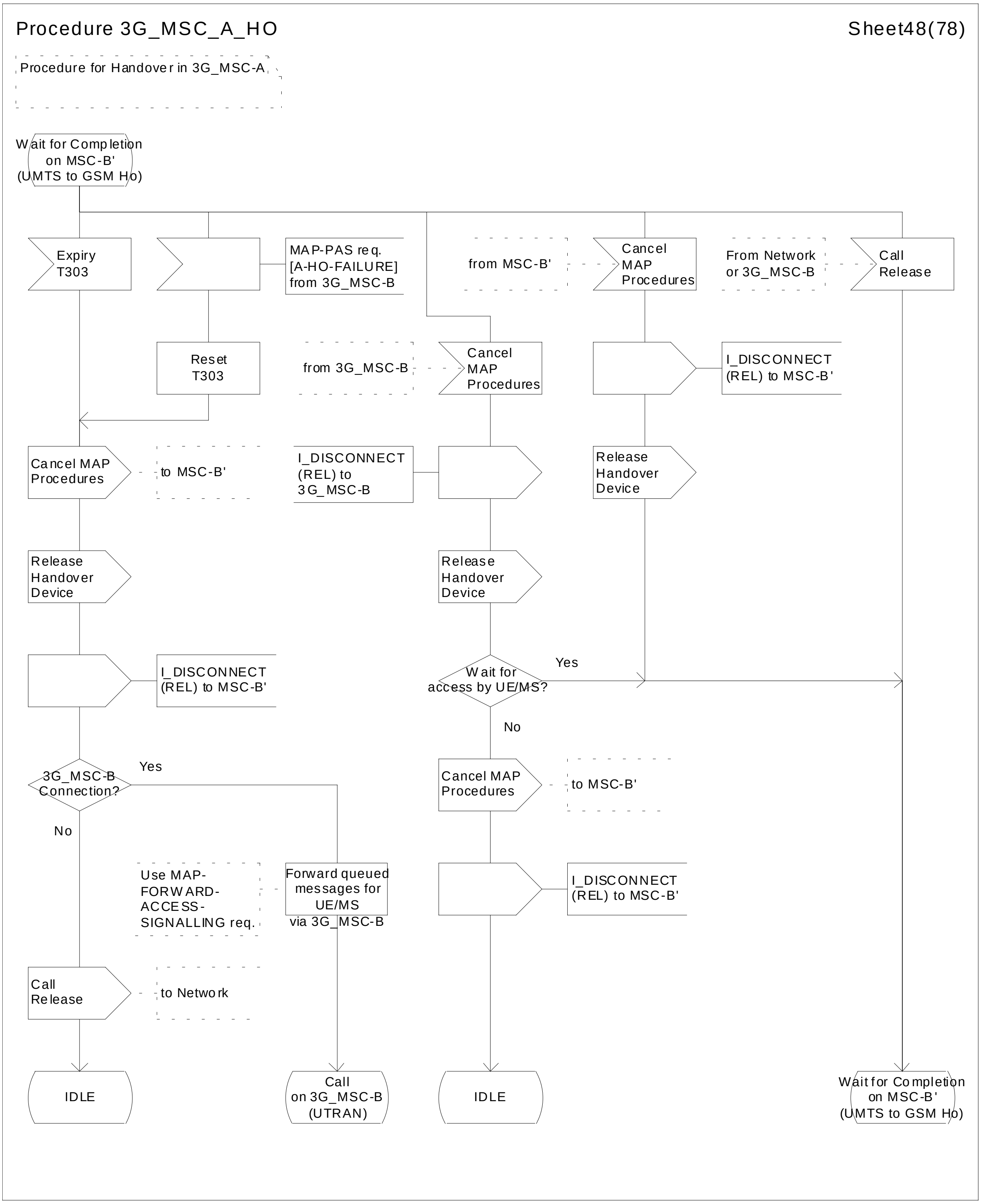


Figure 43 (sheet 48 of 78): Handover control procedure in 3G_MSC-A

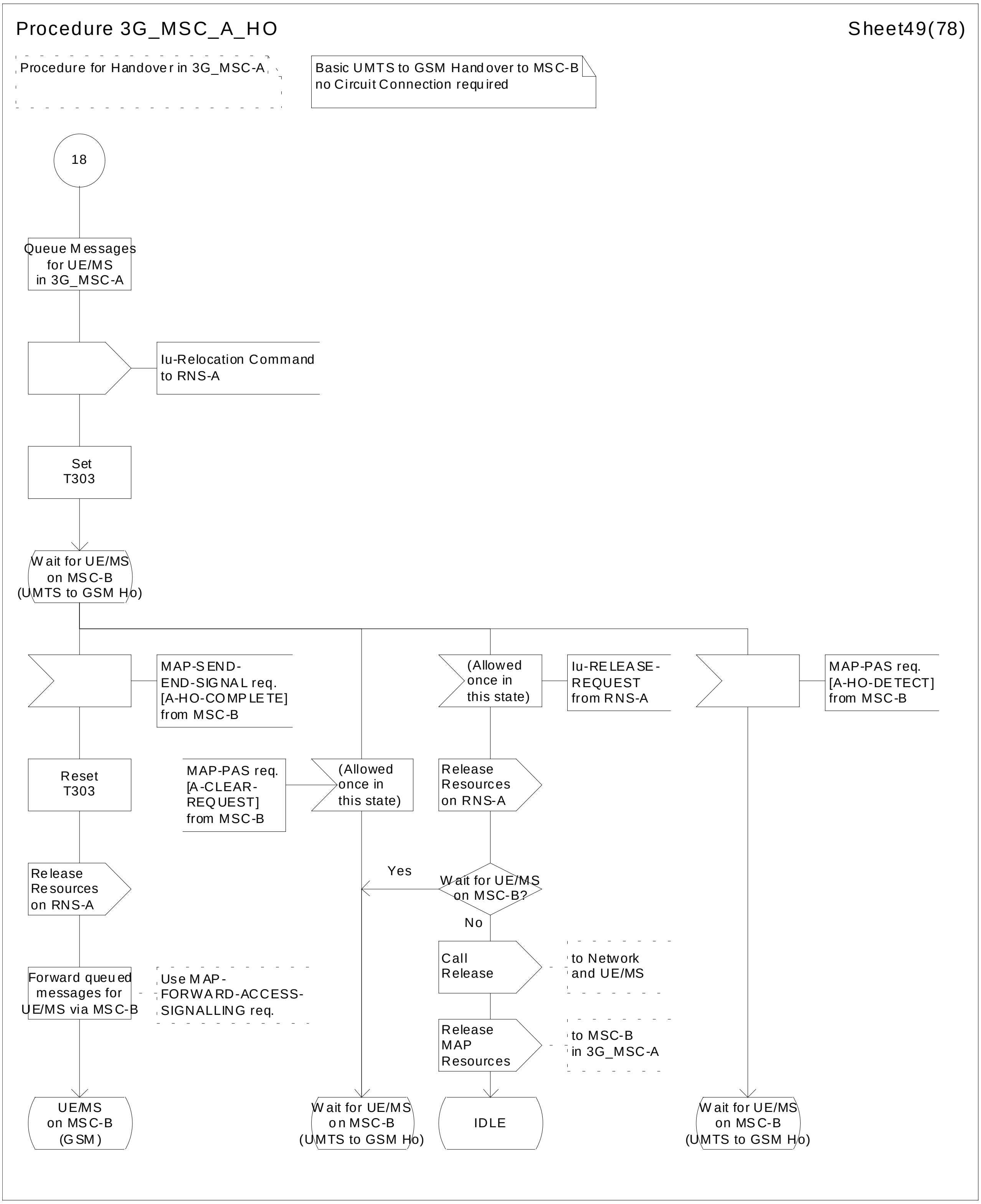


Figure 43 (sheet 49 of 78): Handover control procedure in 3G_MSC-A

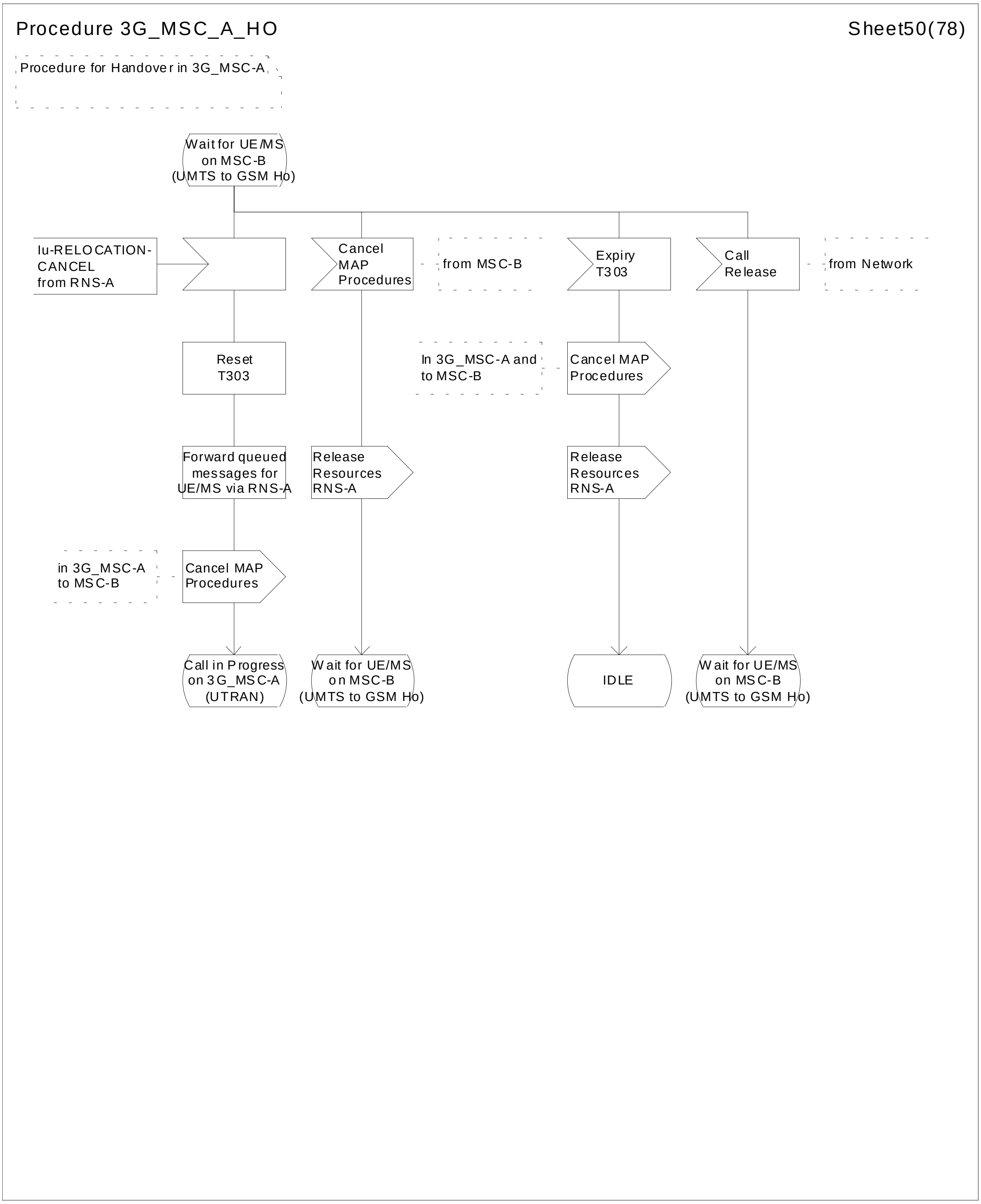


Figure 43 (sheet 50 of 78): Handover control procedure in 3G_MSC-A

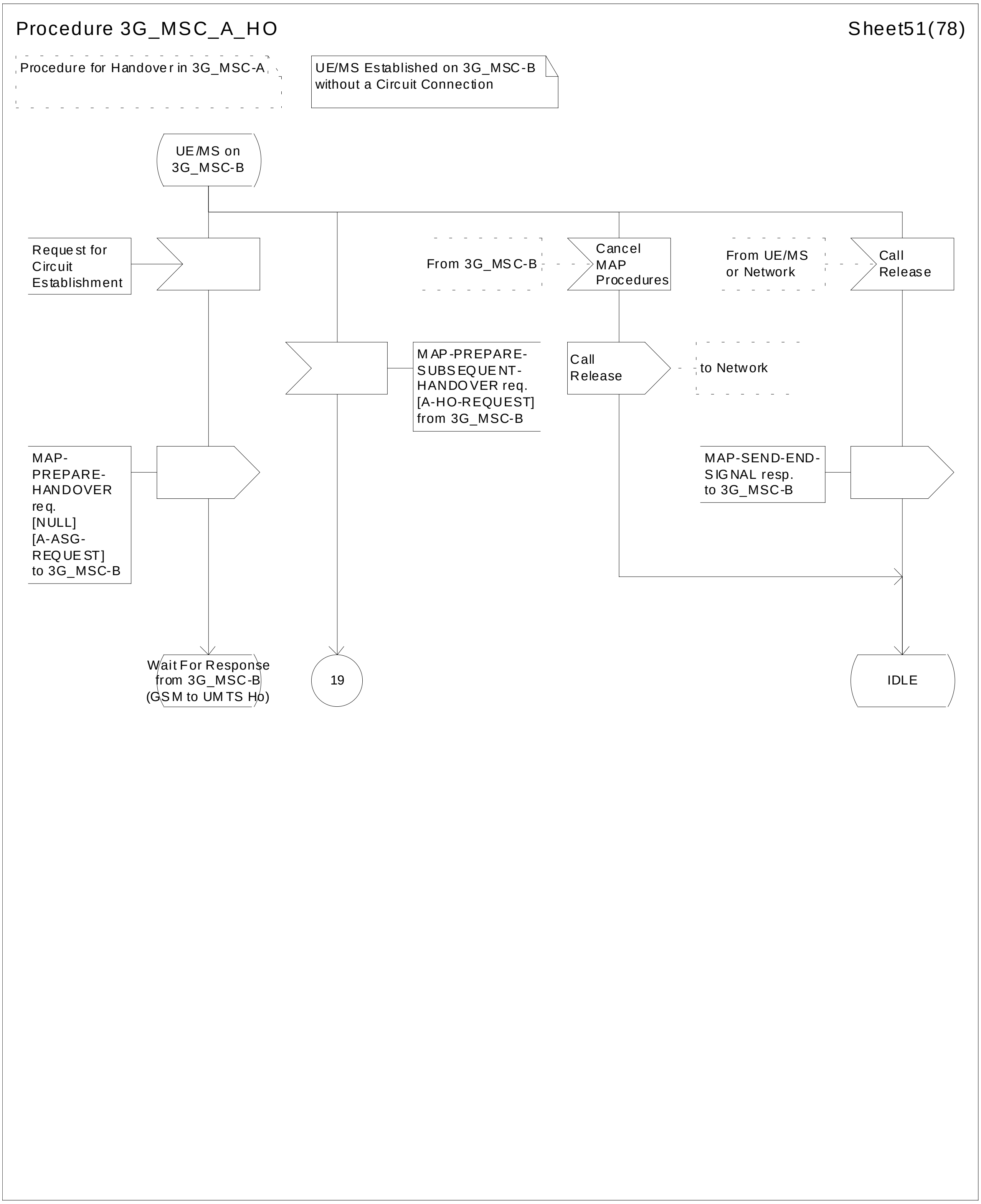


Figure 43 (sheet 51 of 78): Handover control procedure in 3G_MSC-A

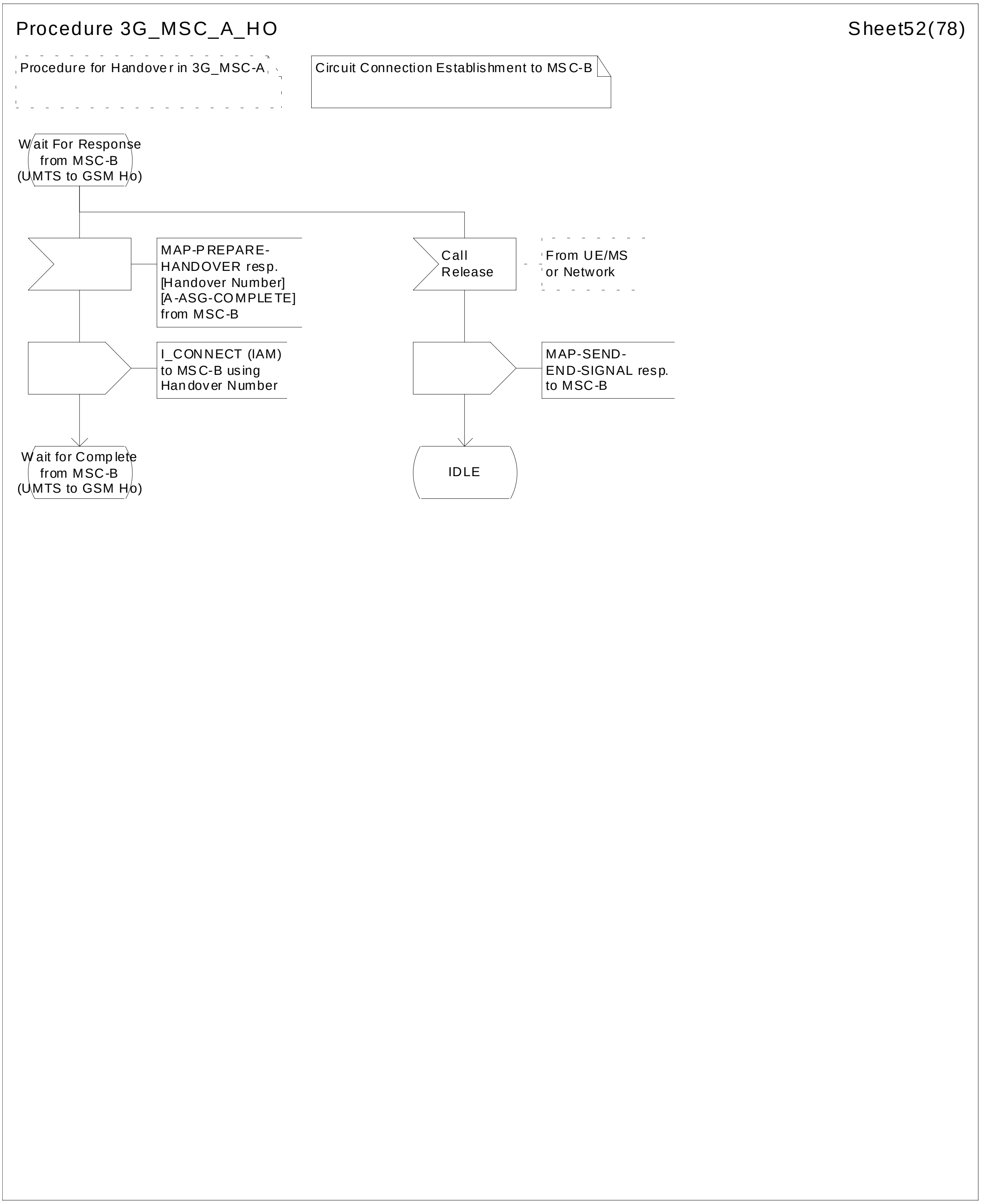


Figure 43 (sheet 52 of 78): Handover control procedure in 3G_MSC-A

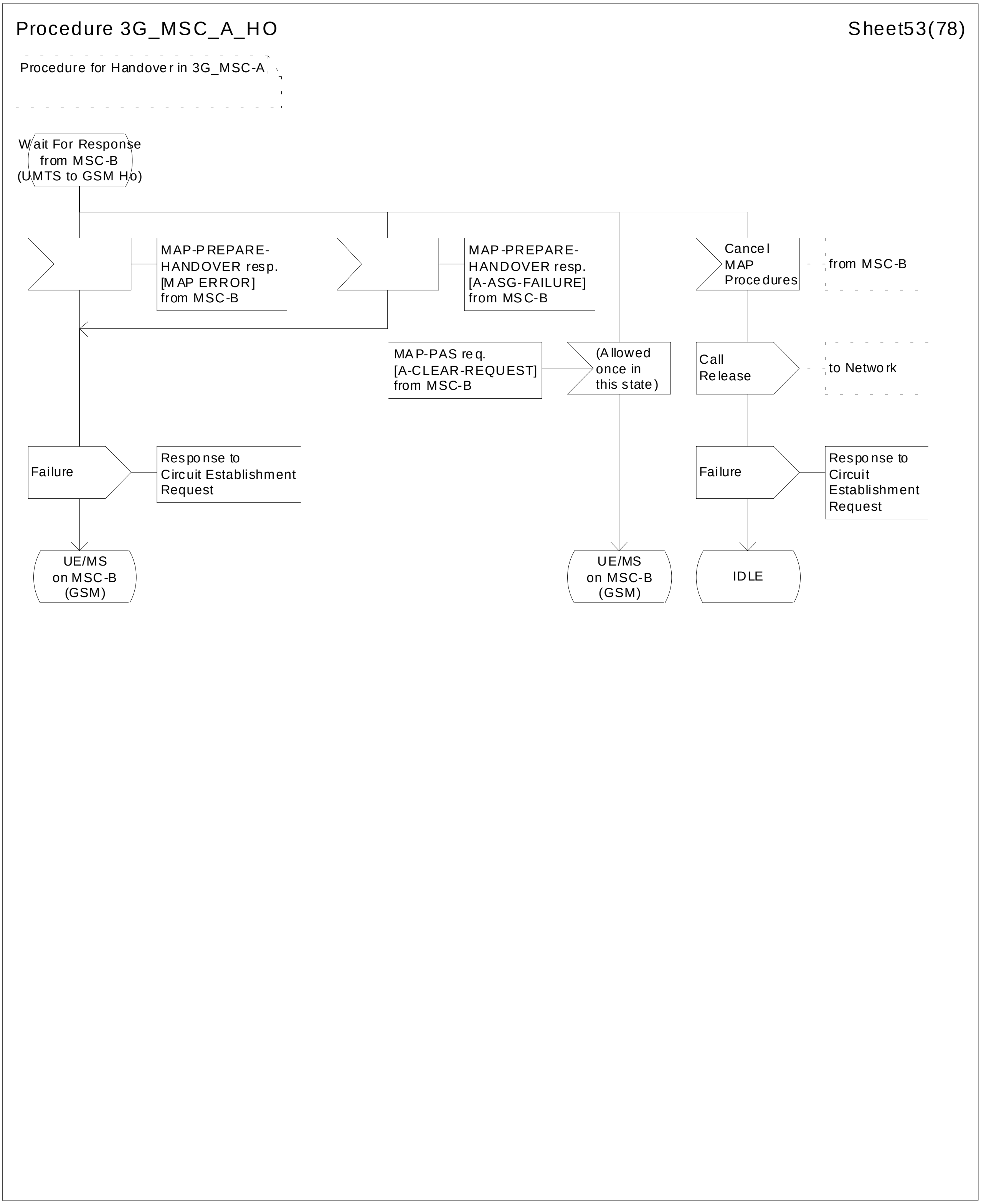


Figure 43 (sheet 53 of 78): Handover control procedure in 3G_MSC-A

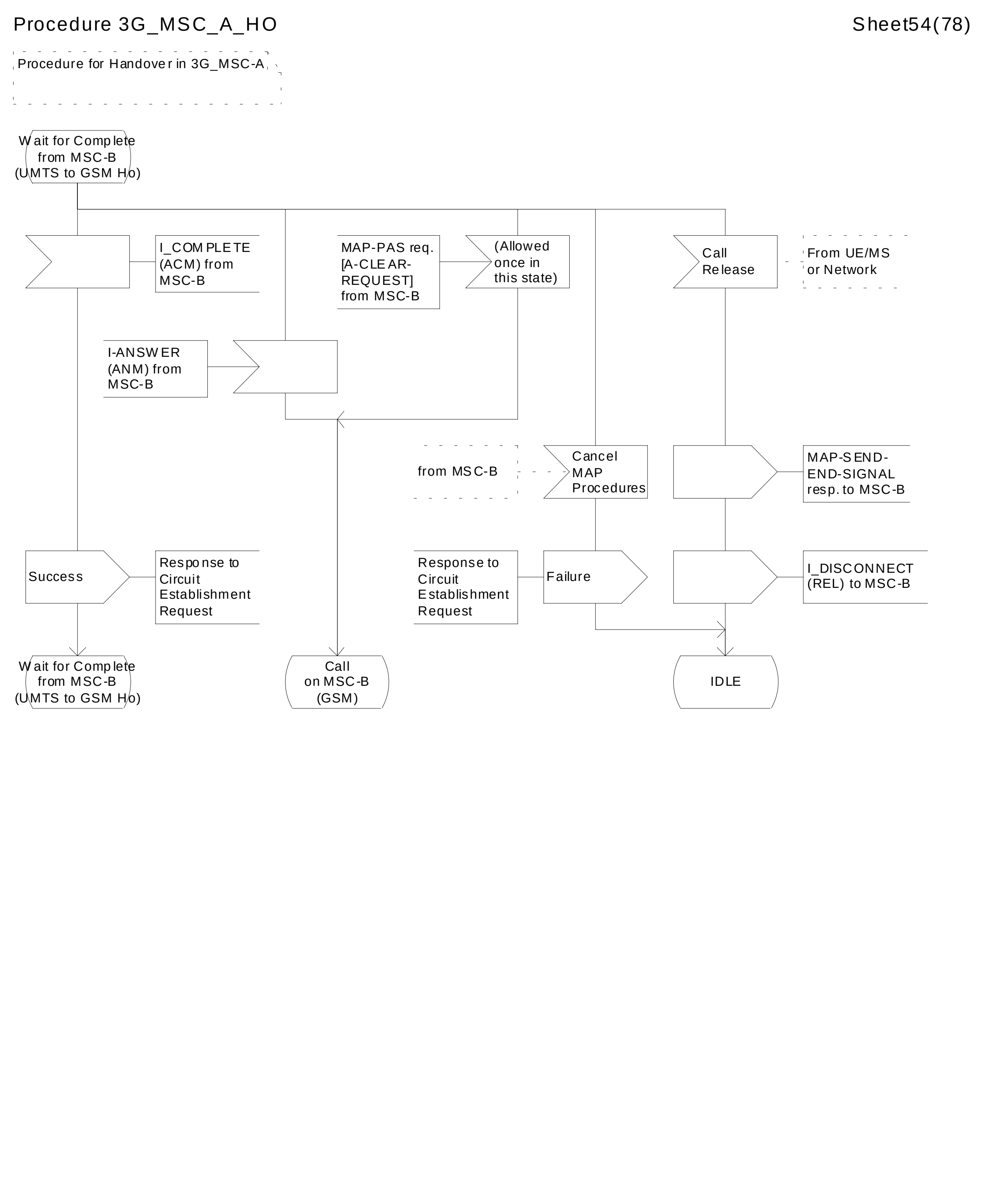


Figure 43 (sheet 54 of 78): Handover control procedure in 3G_MSC-A

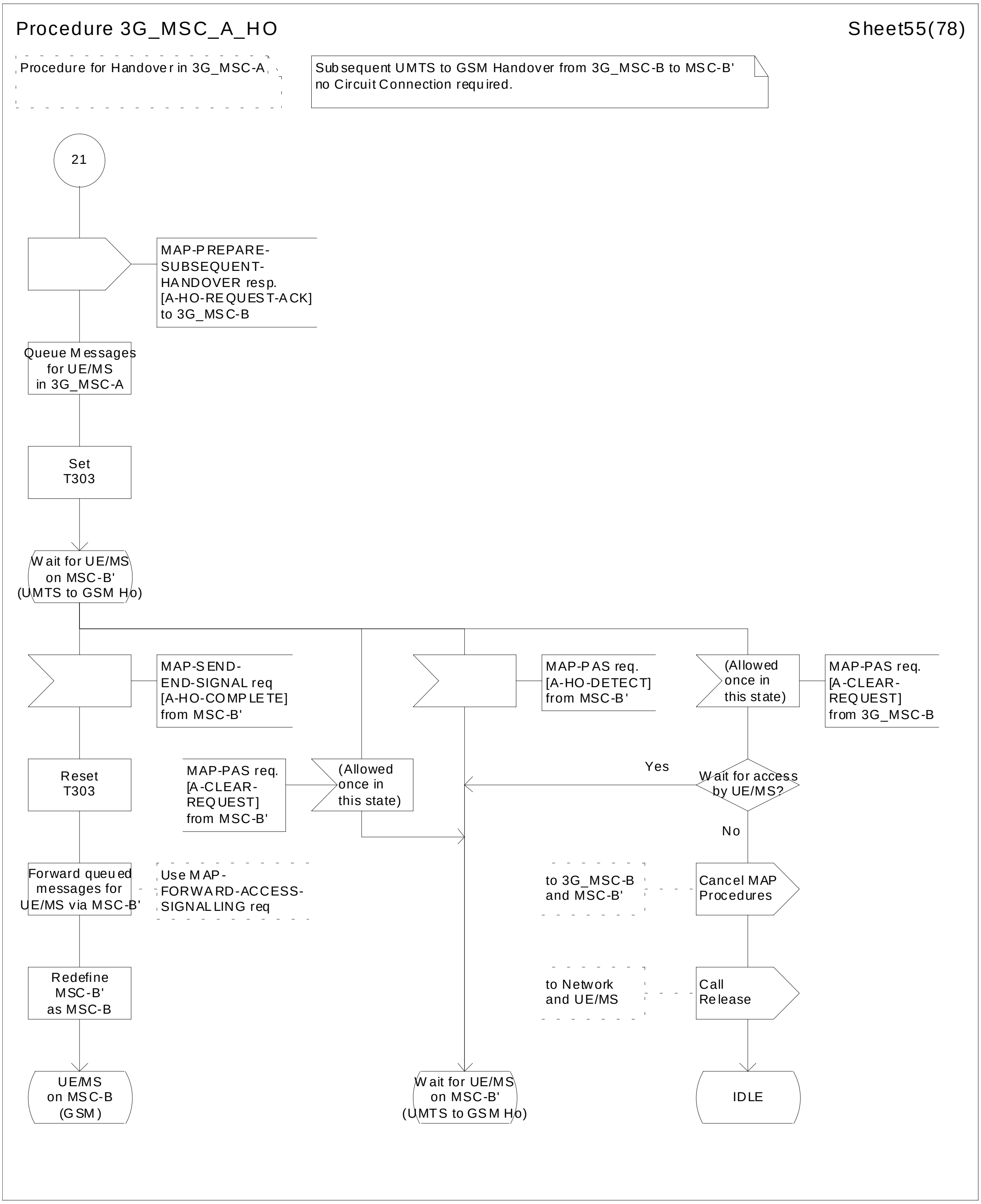


Figure 43 (sheet 55 of 78): Handover control procedure in 3G_MSC-A

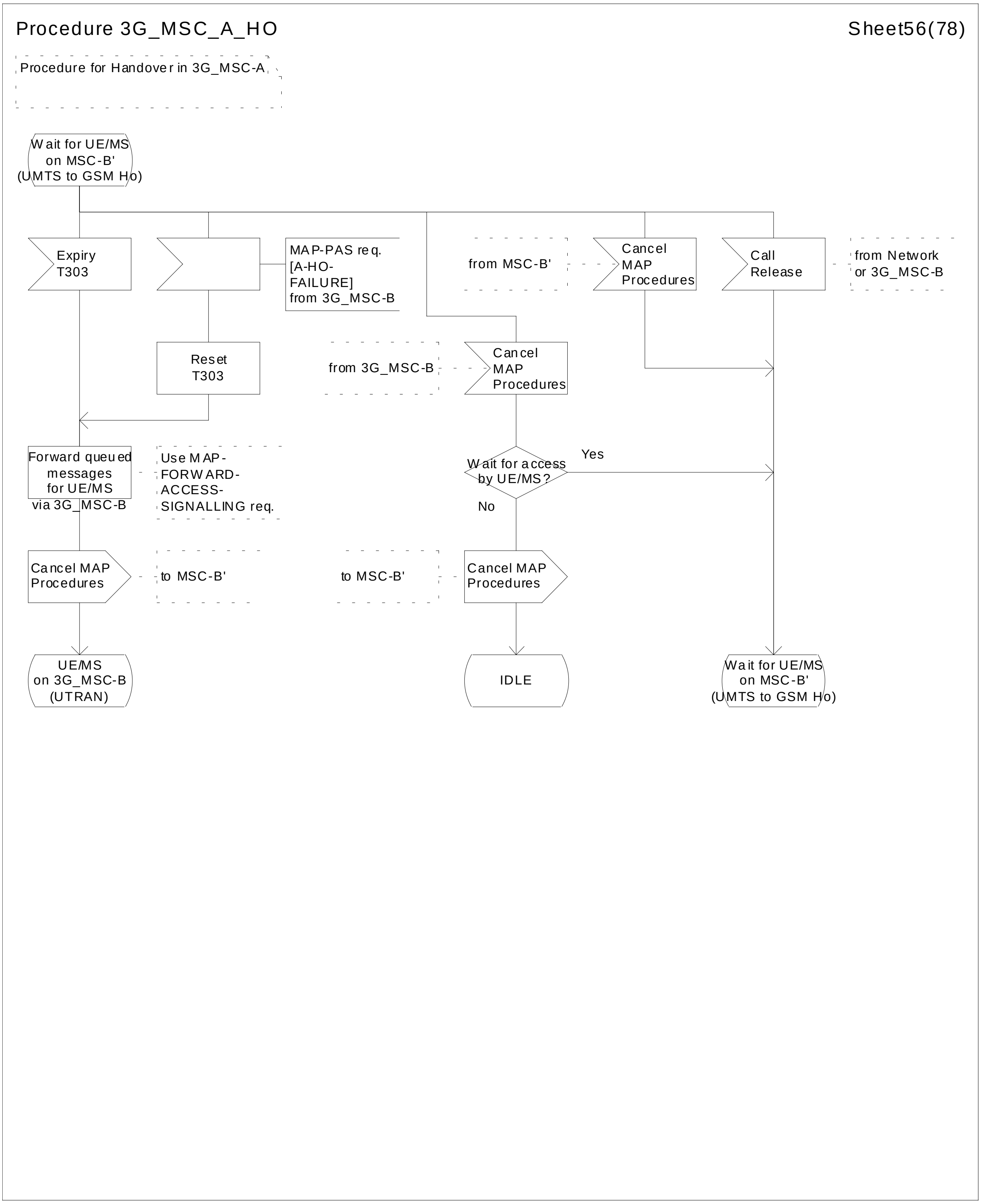


Figure 43 (sheet 56 of 78): Handover control procedure in 3G_MSC-A

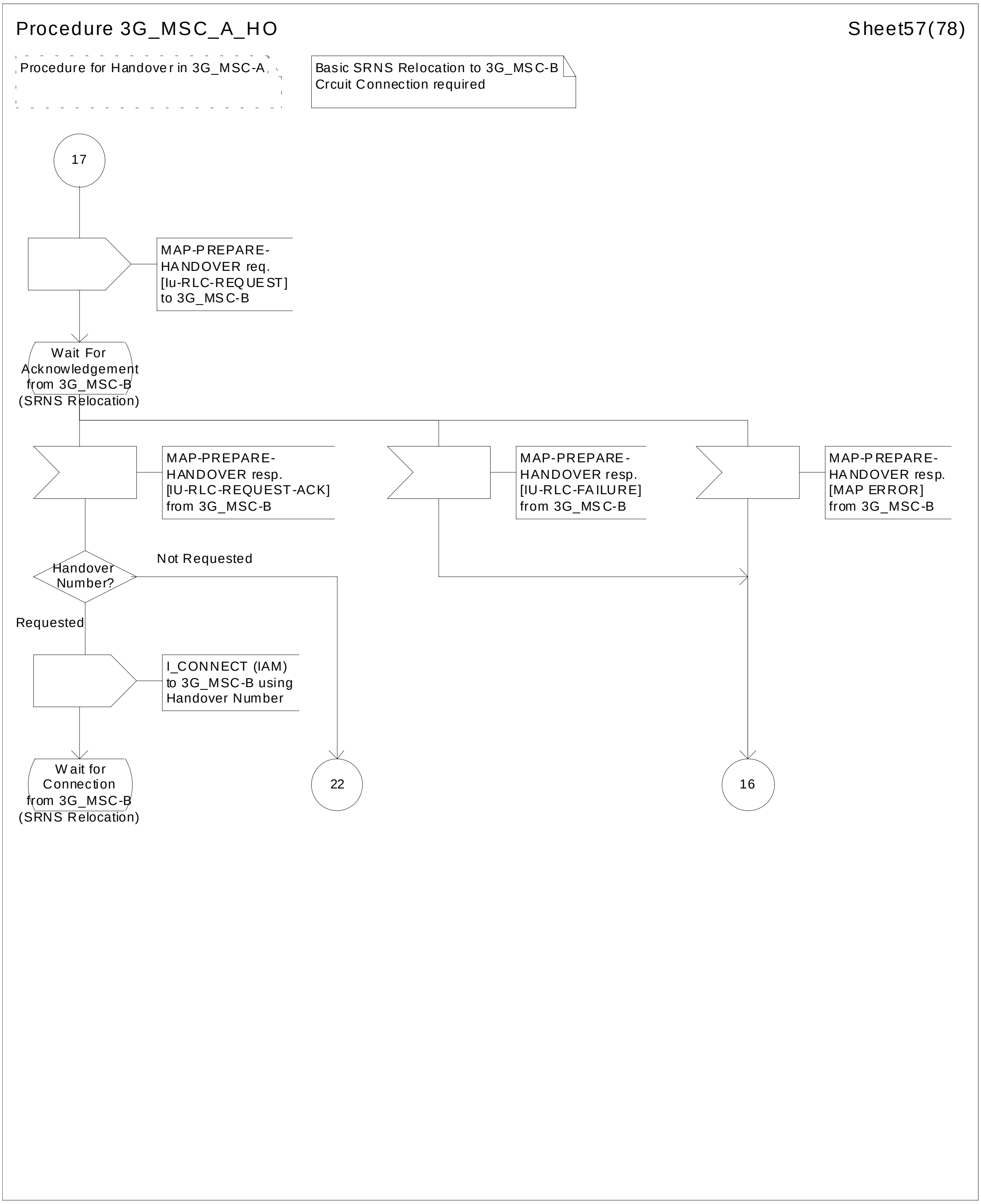


Figure 43 (sheet 57 of 78): Handover control procedure in 3G_MSC-A

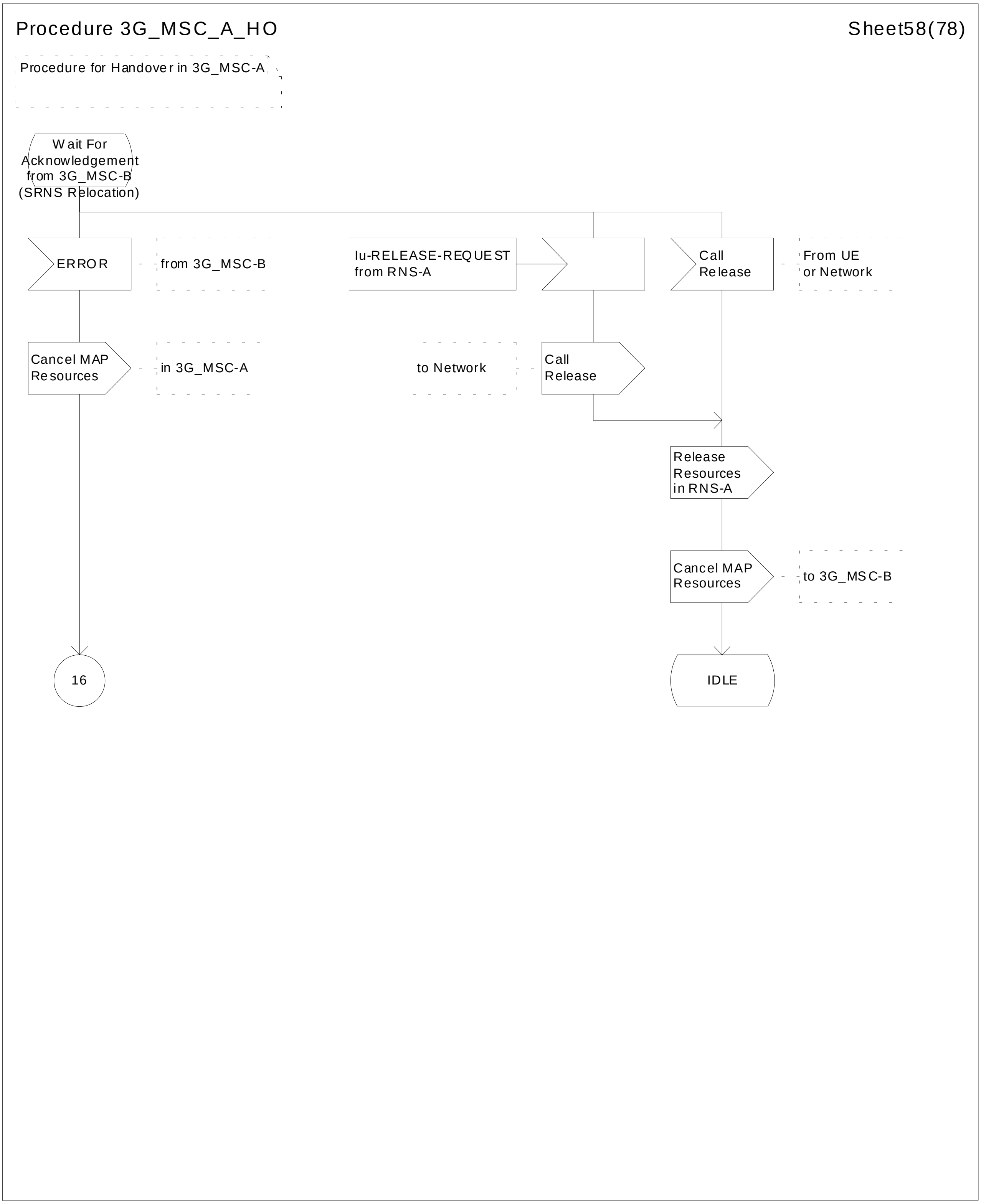


Figure 43 (sheet 58 of 78): Handover control procedure in 3G_MSC-A

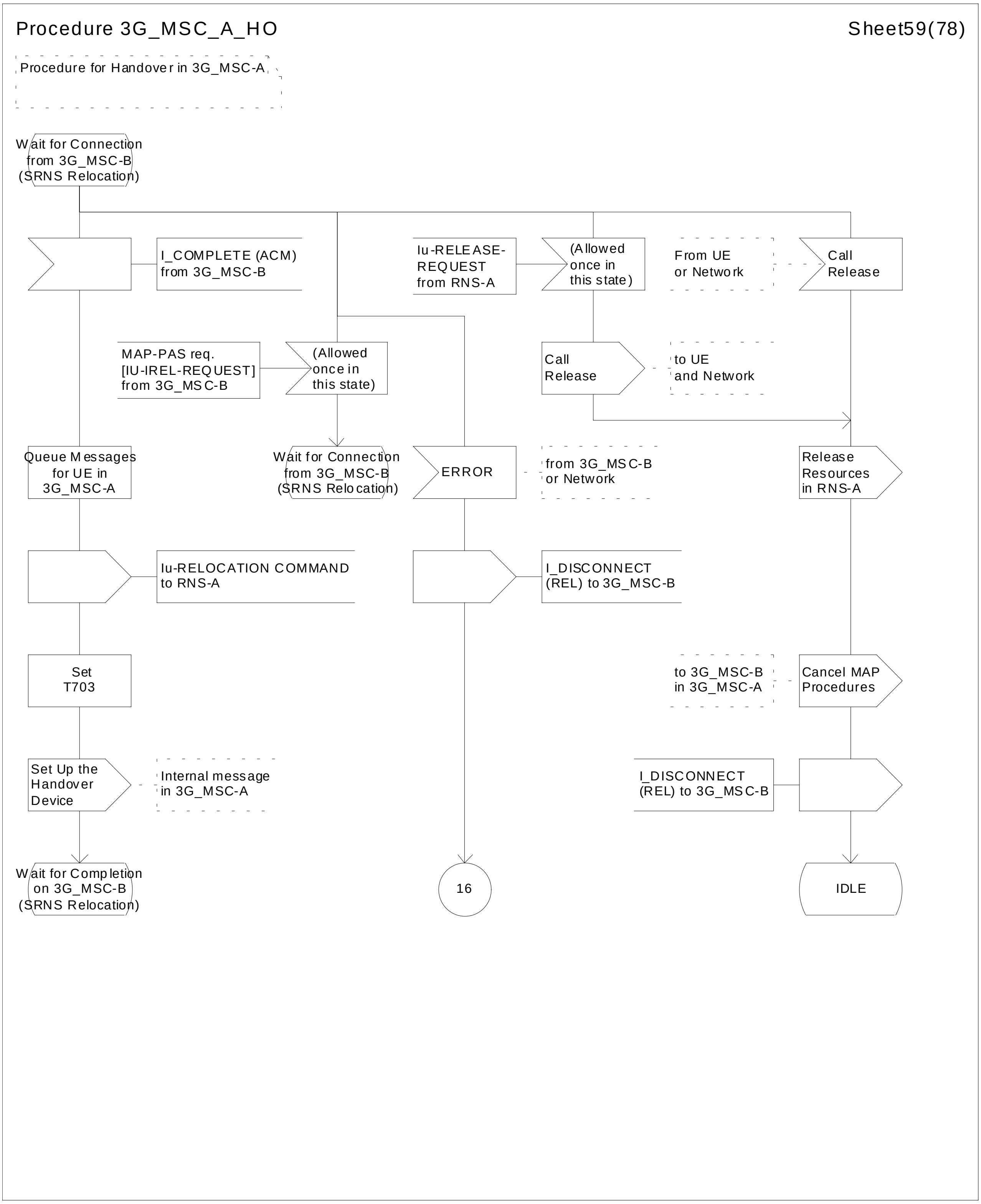


Figure 43 (sheet 59 of 78): Handover control procedure in 3G_MSC-A

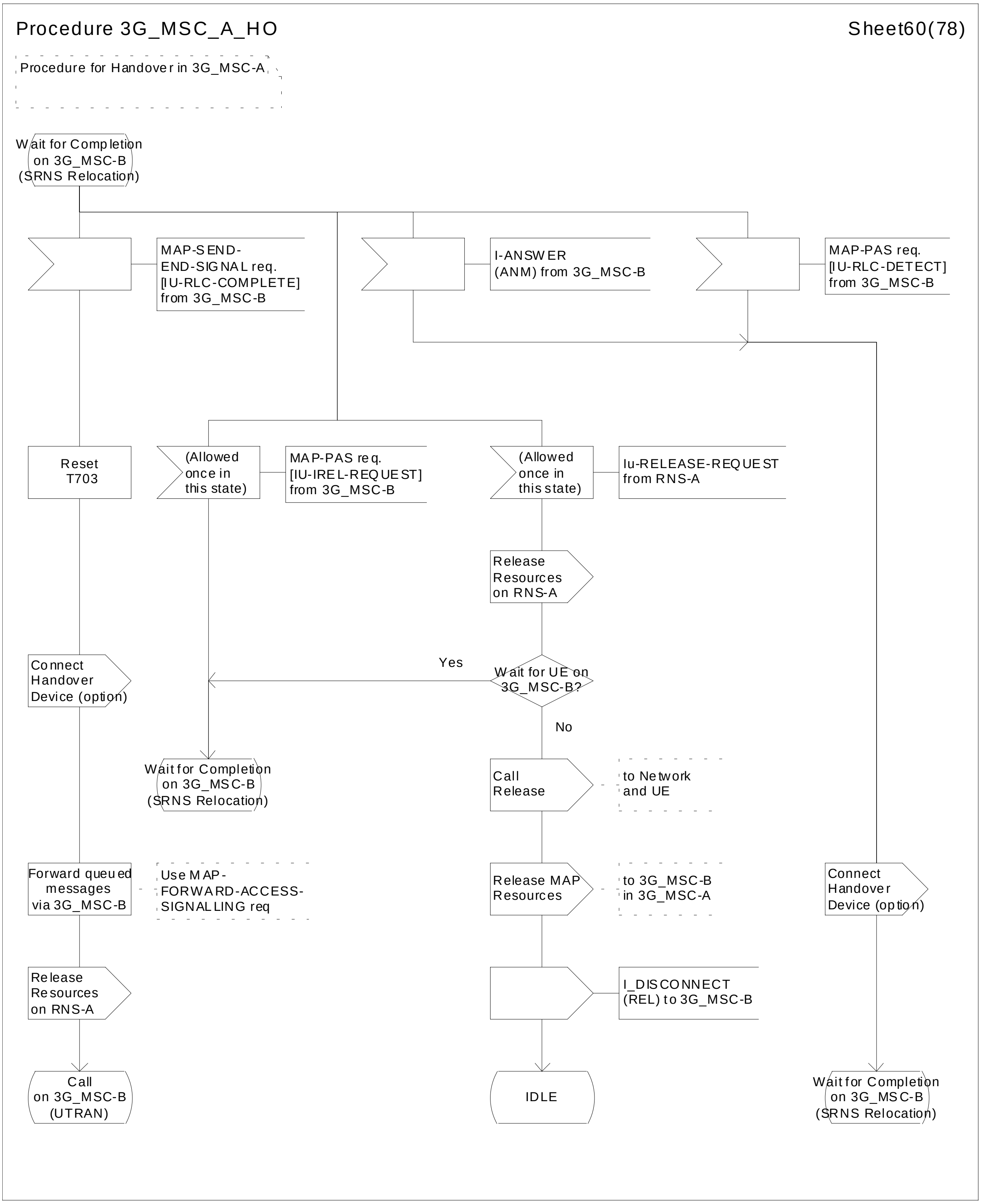


Figure 43 (sheet 60 of 78): Handover control procedure in 3G_MSC-A

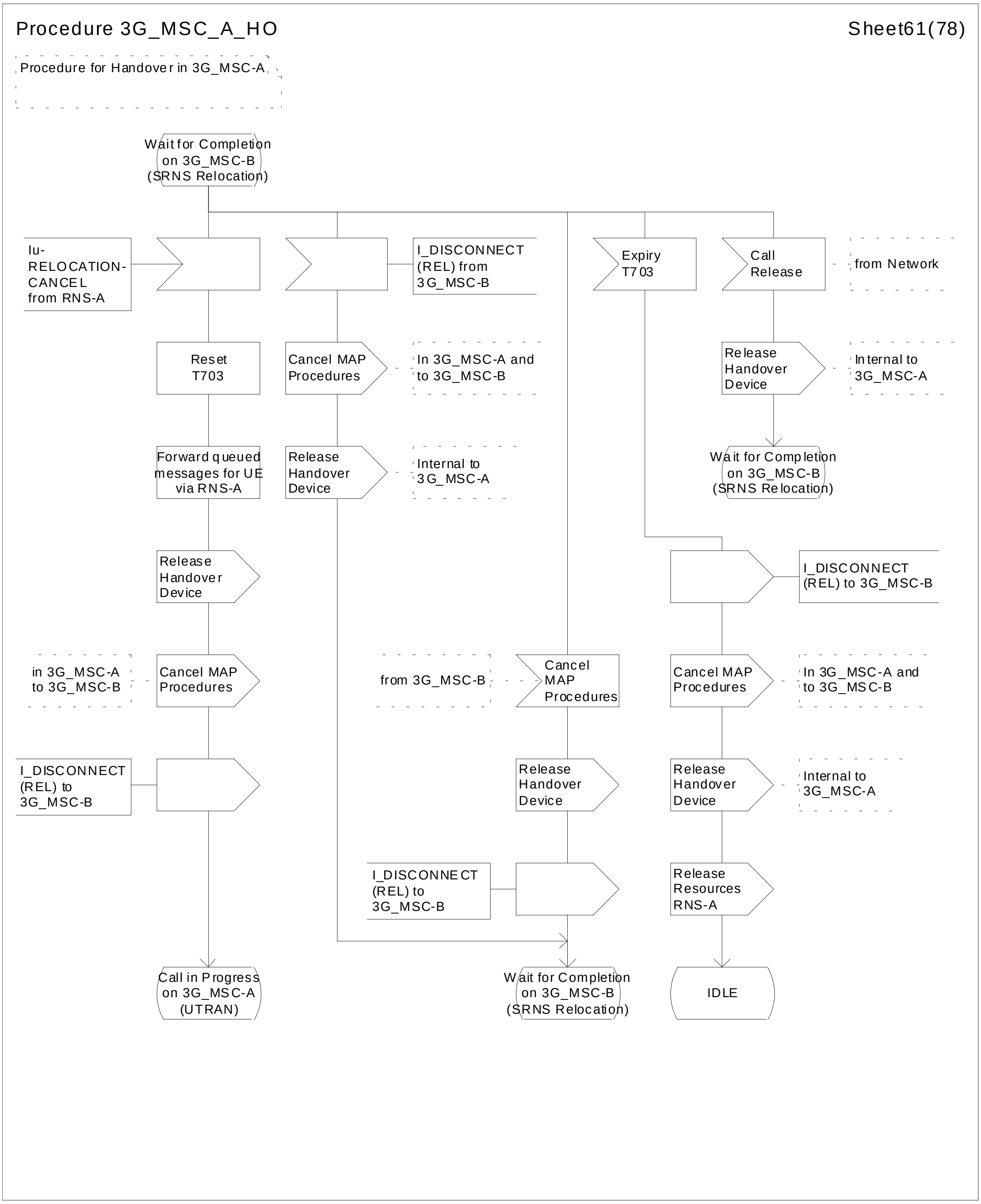


Figure 43 (sheet 61 of 78): Handover control procedure in 3G_MSC-A

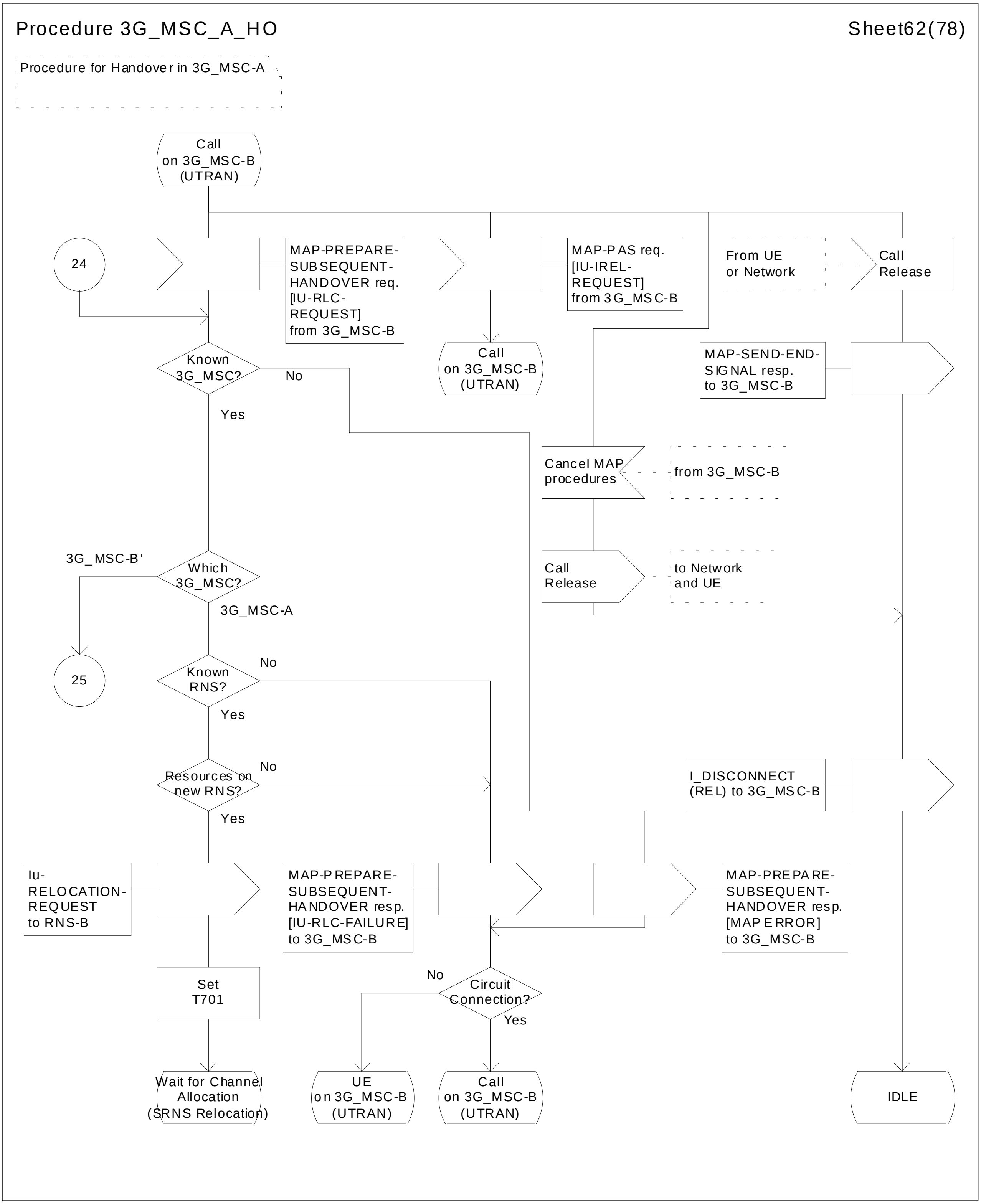


Figure 43 (sheet 62 of 78): Handover control procedure in 3G_MSC-A

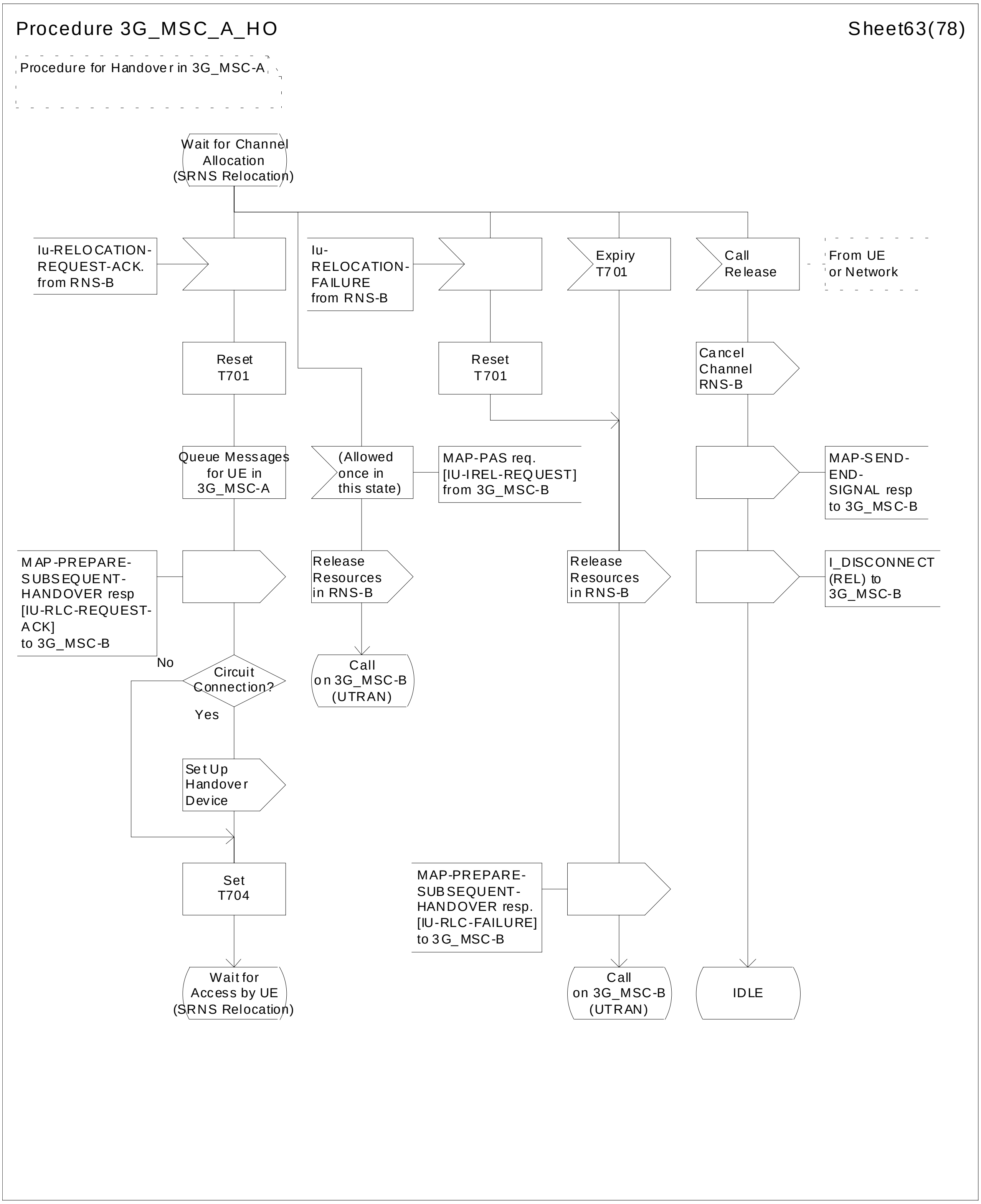


Figure 43 (sheet 63 of 78): Handover control procedure in 3G_MSC-A

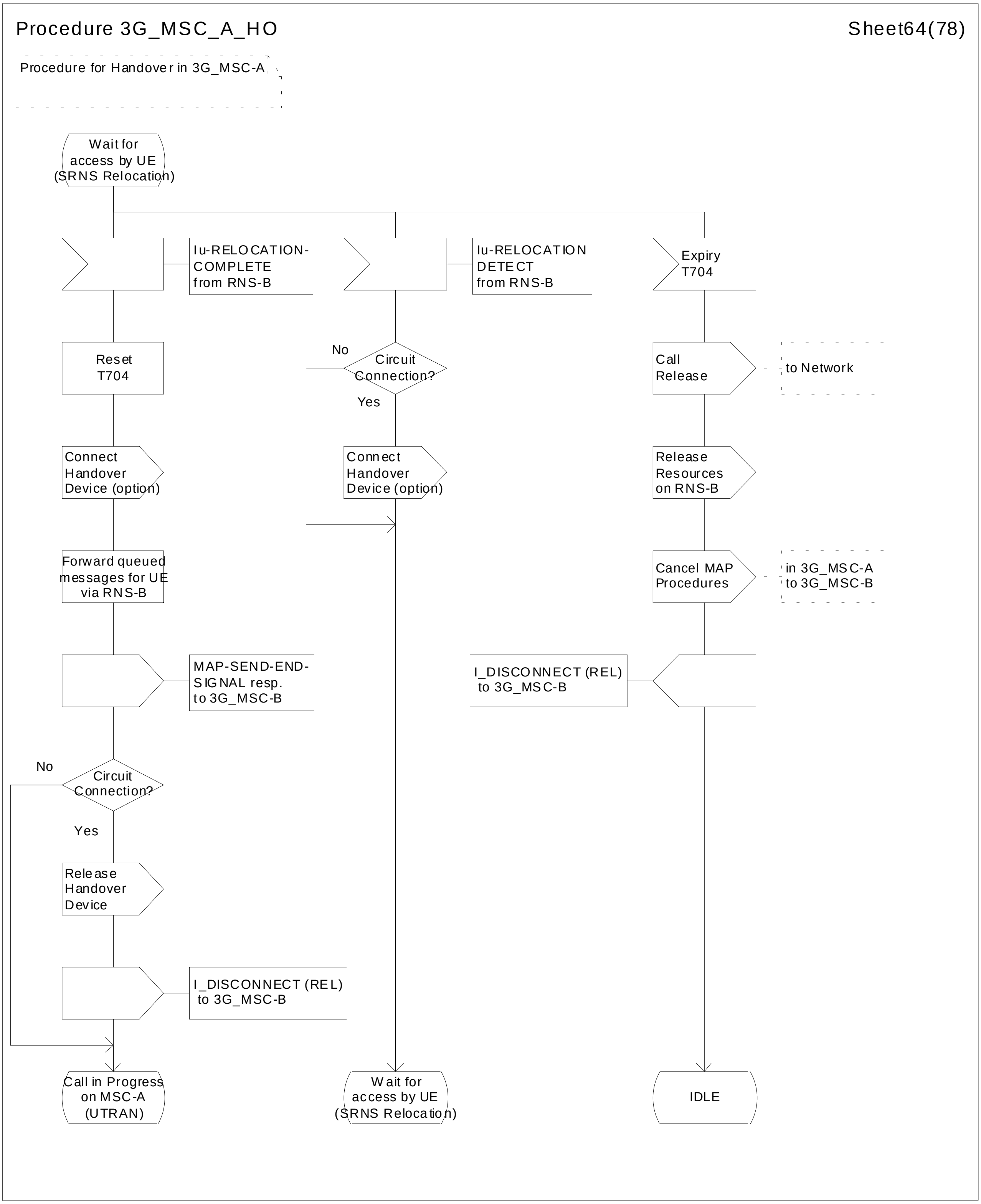


Figure 43 (sheet 64 of 78): Handover control procedure in 3G_MSC-A

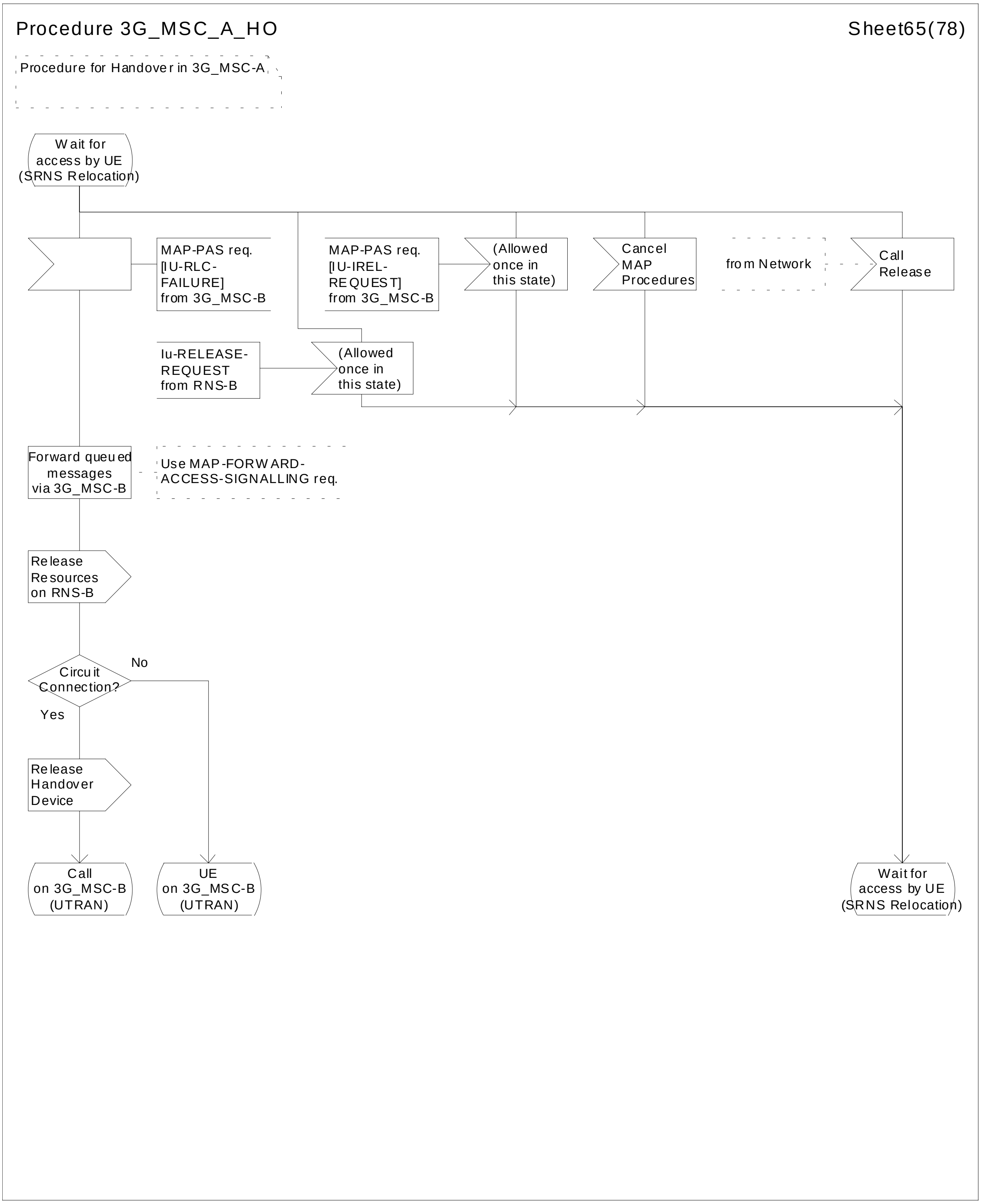


Figure 43 (sheet 65 of 78): Handover control procedure in 3G_MSC-A

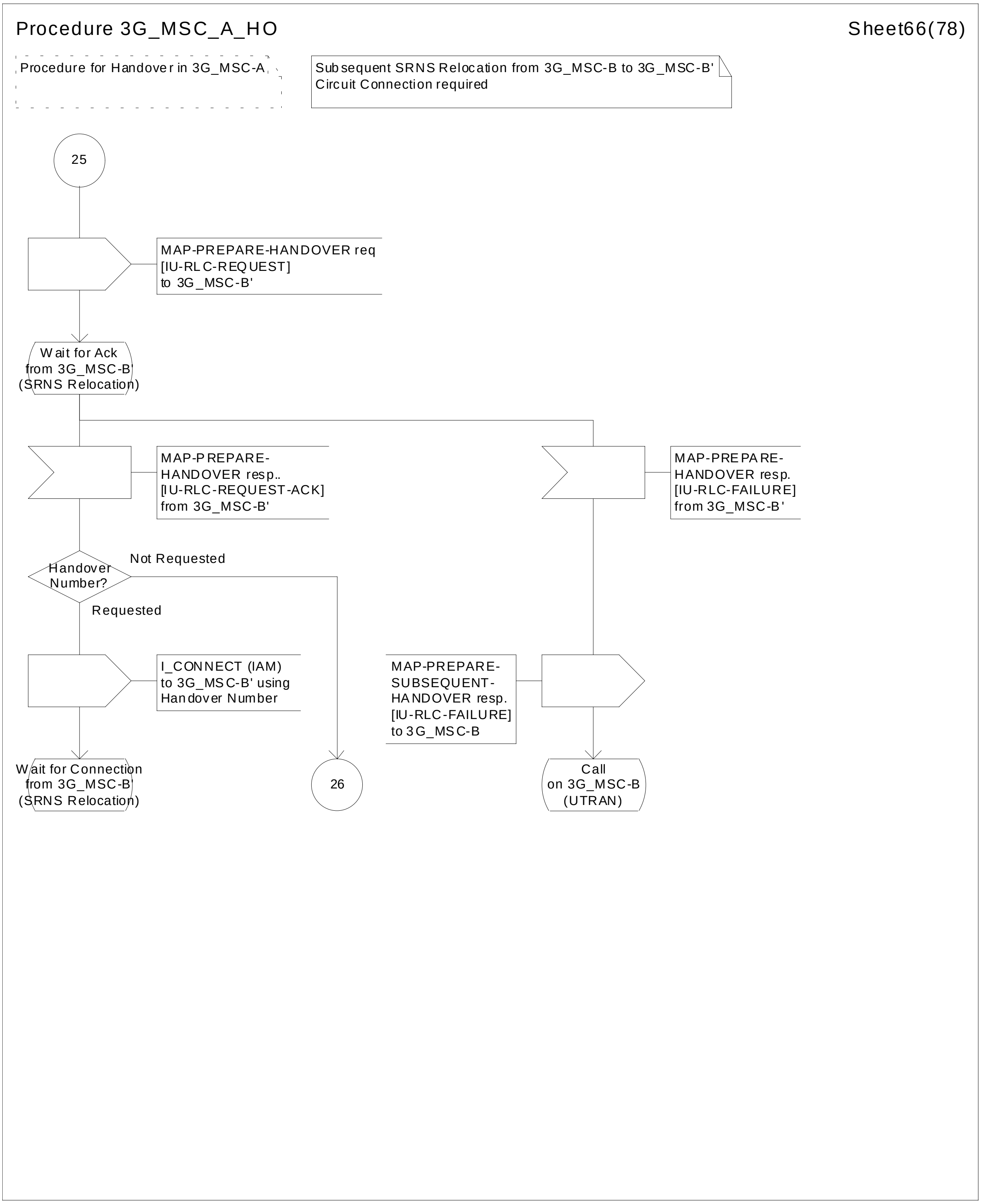


Figure 43 (sheet 66 of 78): Handover control procedure in 3G_MSC-A

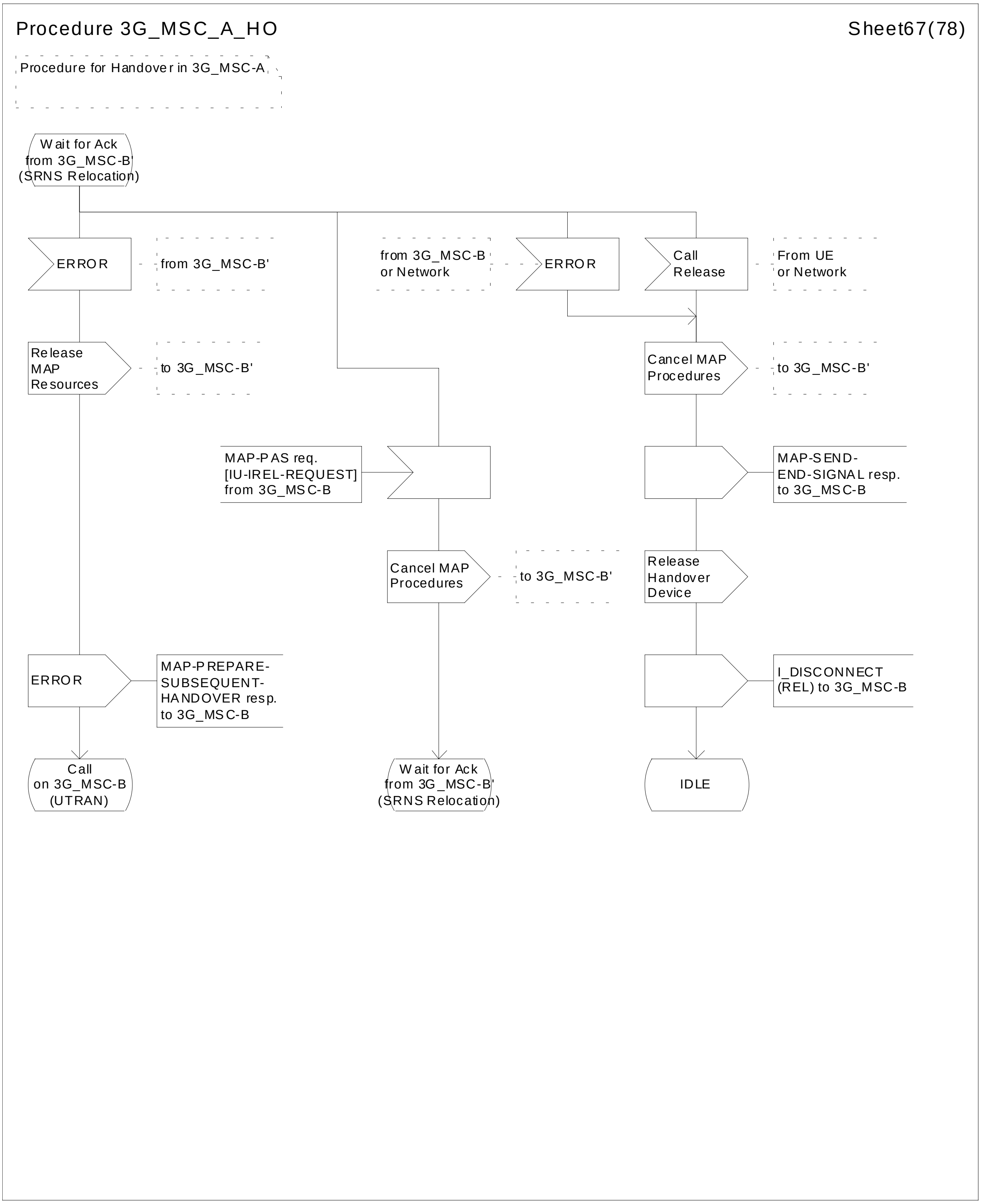


Figure 43 (sheet 67 of 78): Handover control procedure in 3G_MSC-A

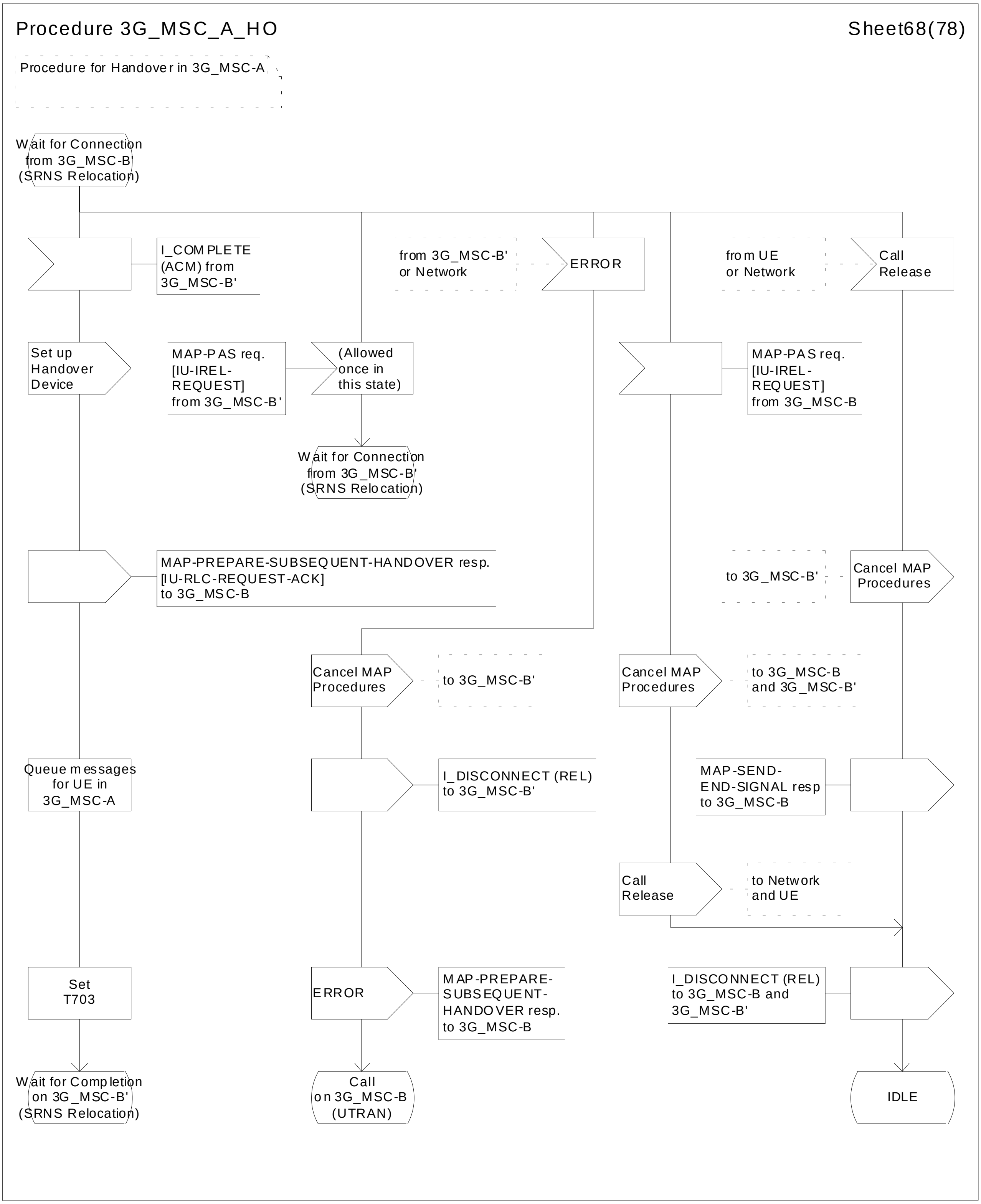


Figure 43 (sheet 68 of 78): Handover control procedure in 3G_MSC-A

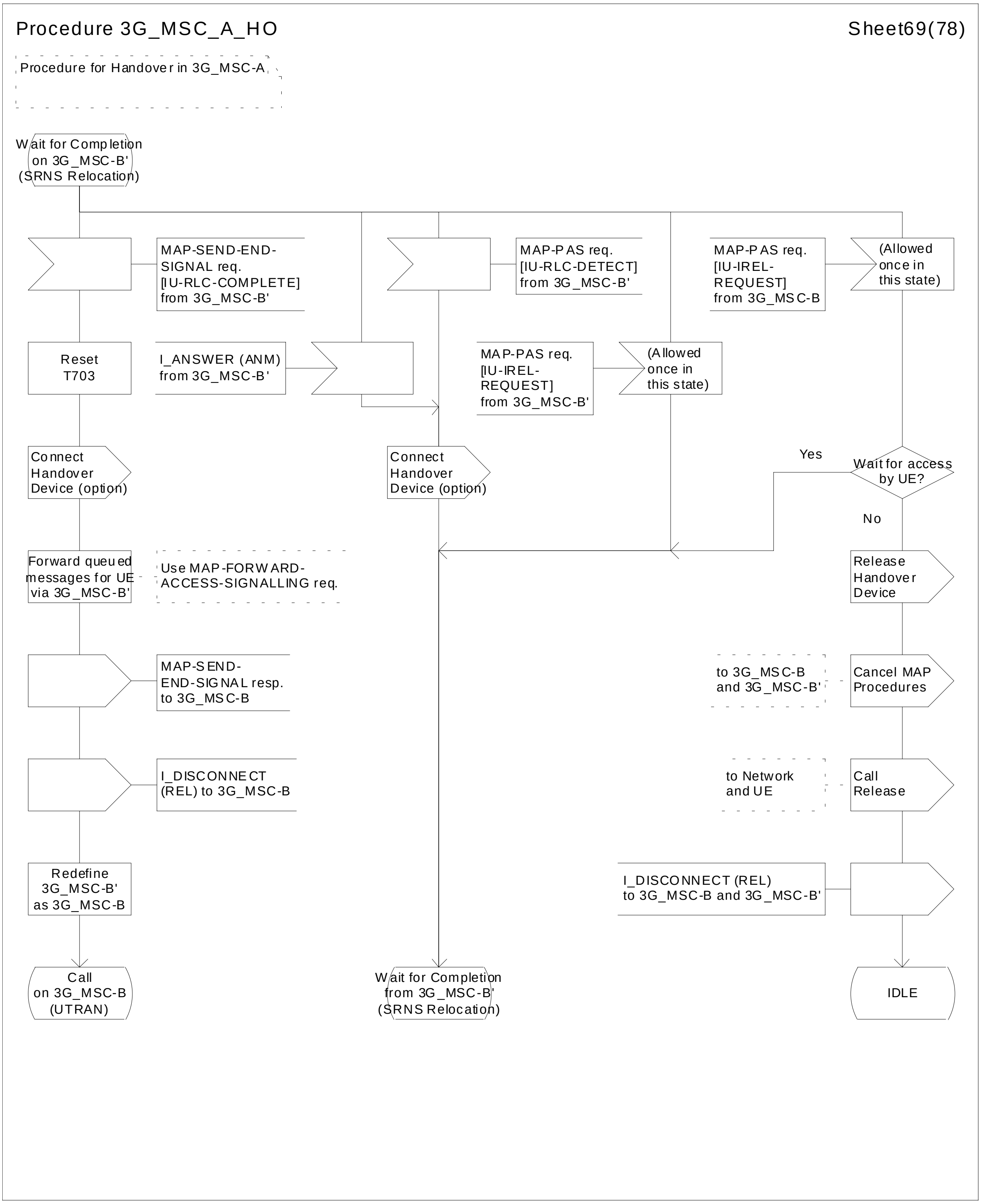


Figure 43 (sheet 69 of 78): Handover control procedure in 3G_MSC-A

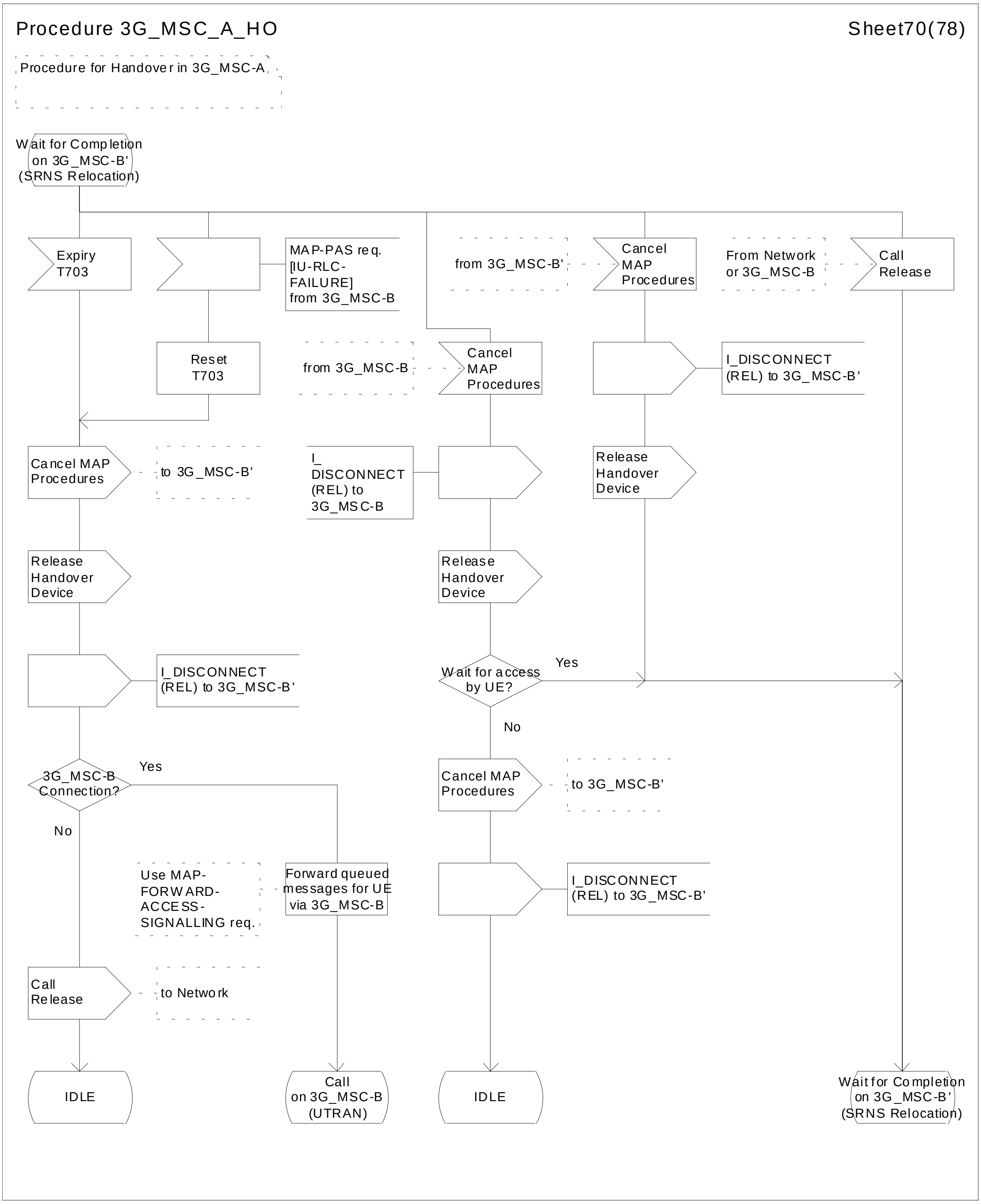


Figure 43 (sheet 70 of 78): Handover control procedure in 3G_MSC-A

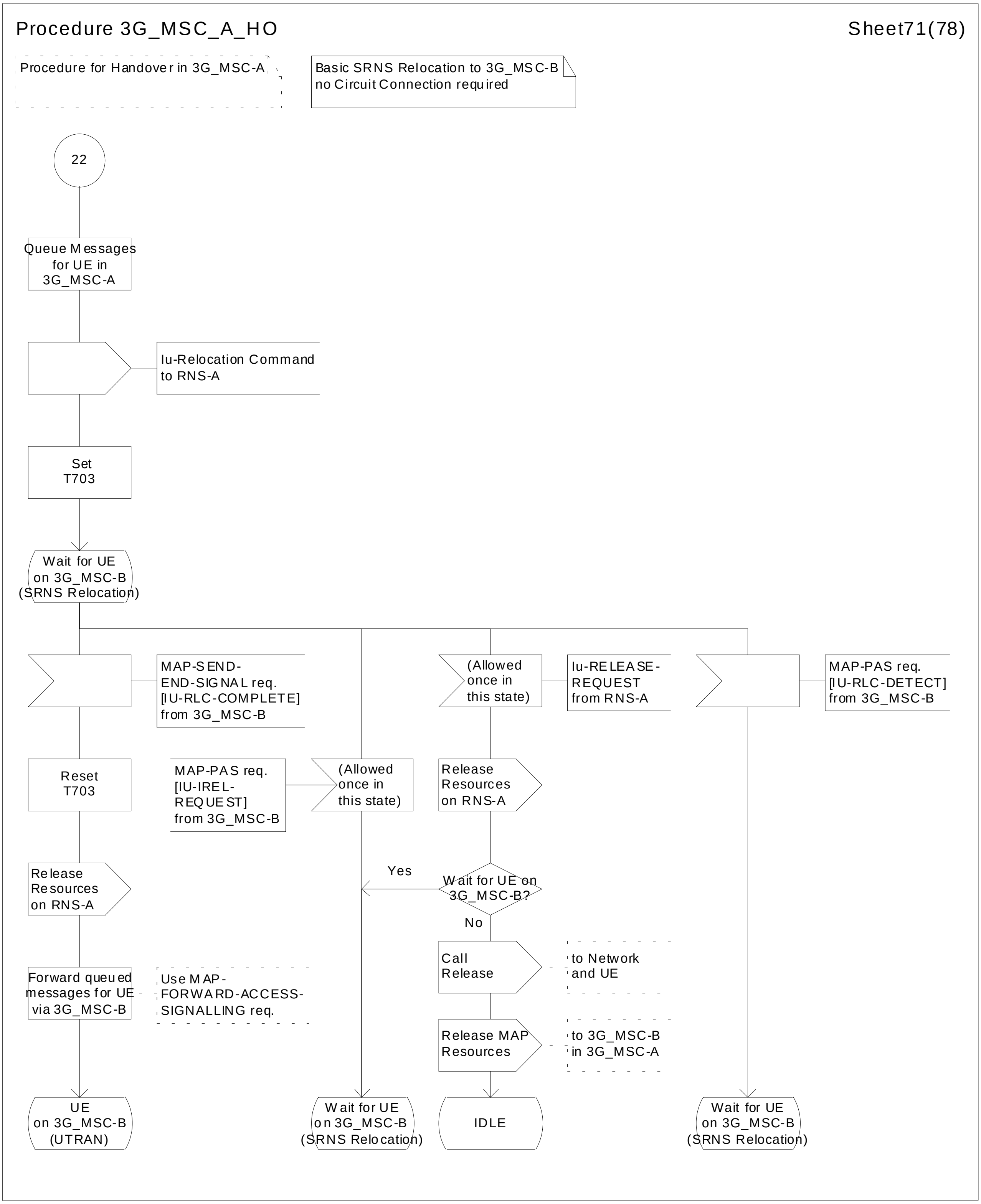


Figure 43 (sheet 71 of 78): Handover control procedure in 3G_MSC-A

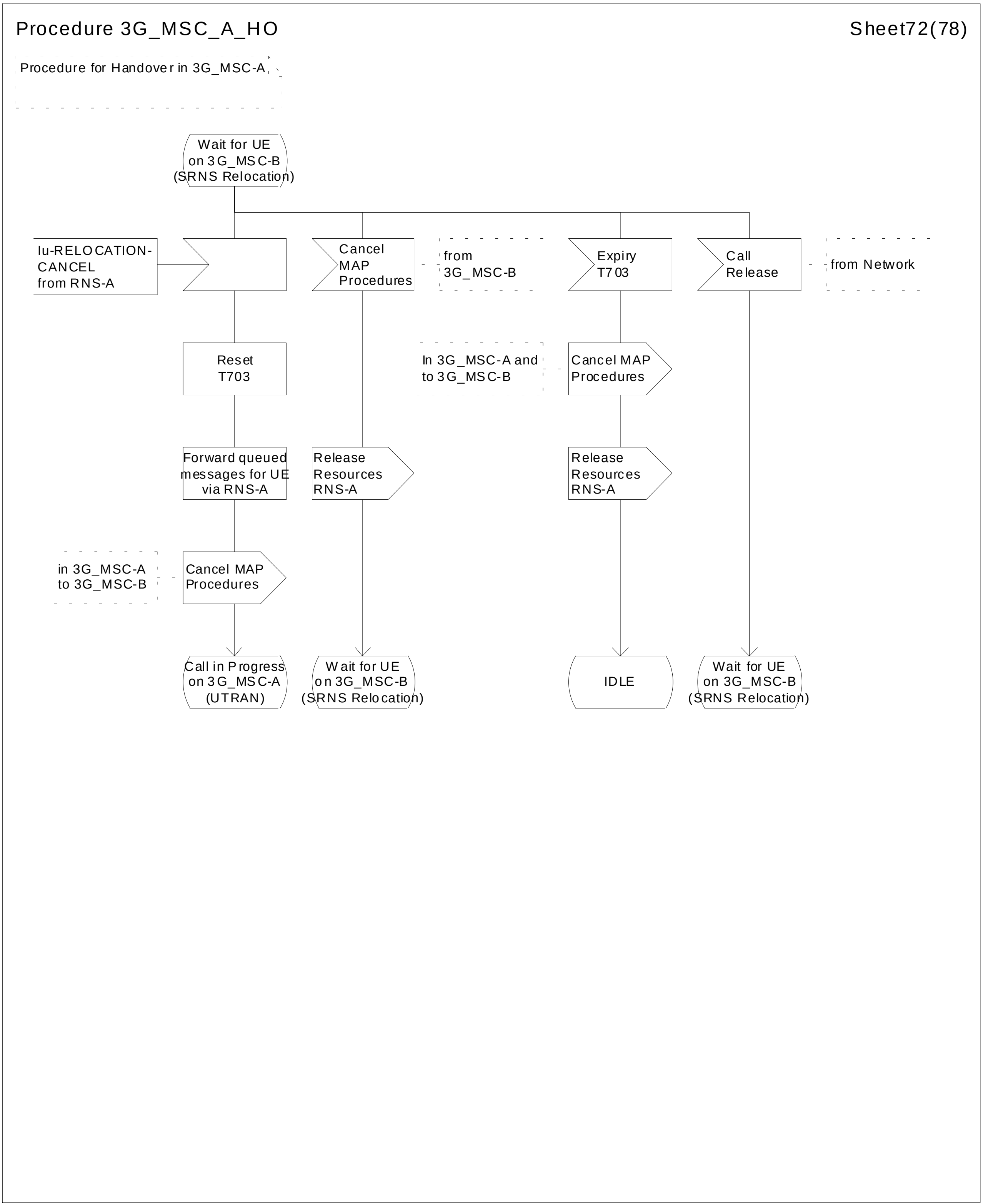


Figure 43 (sheet 72 of 78): Handover control procedure in 3G_MSC-A

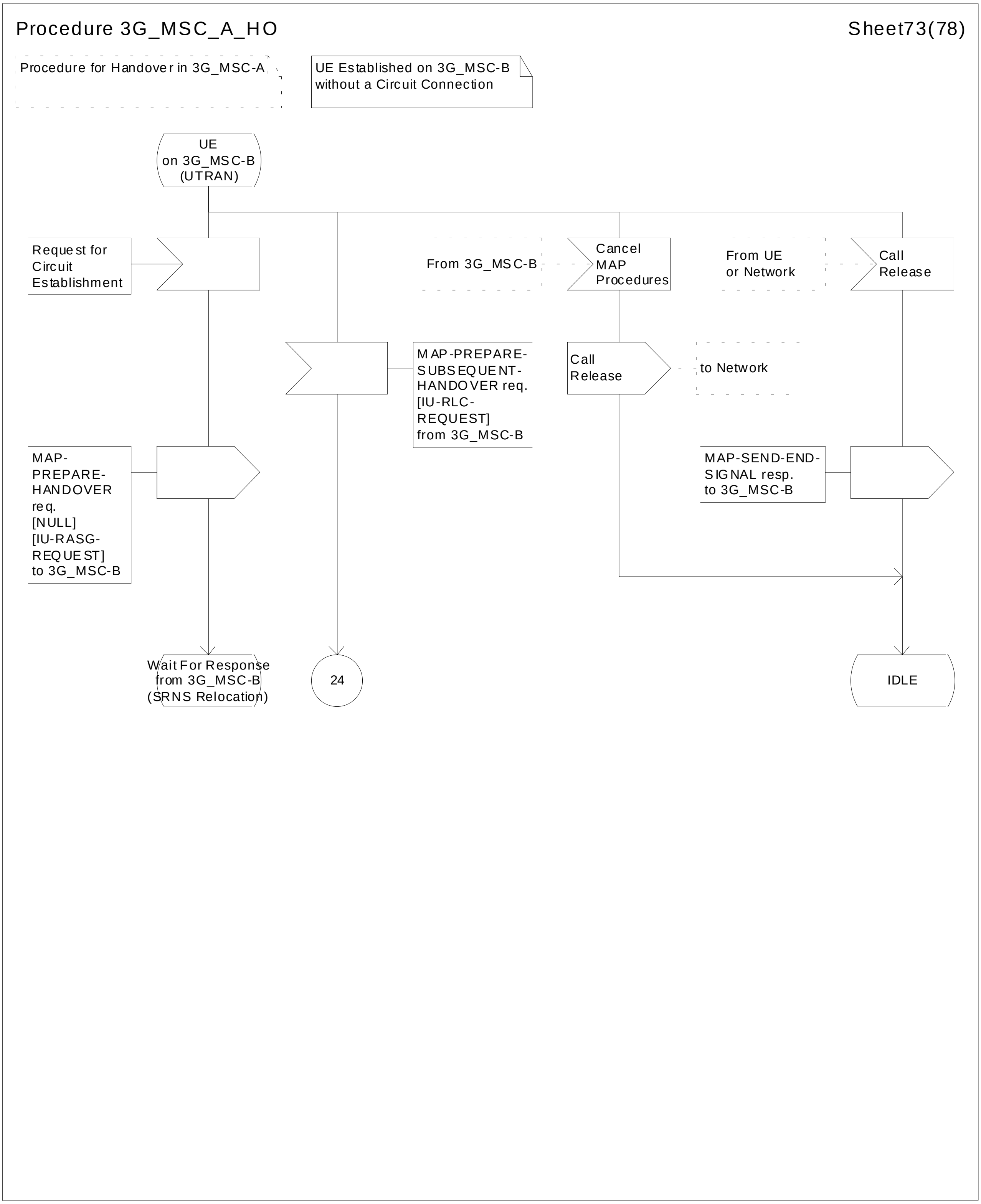


Figure 43 (sheet 73 of 78): Handover control procedure in 3G_MSC-A

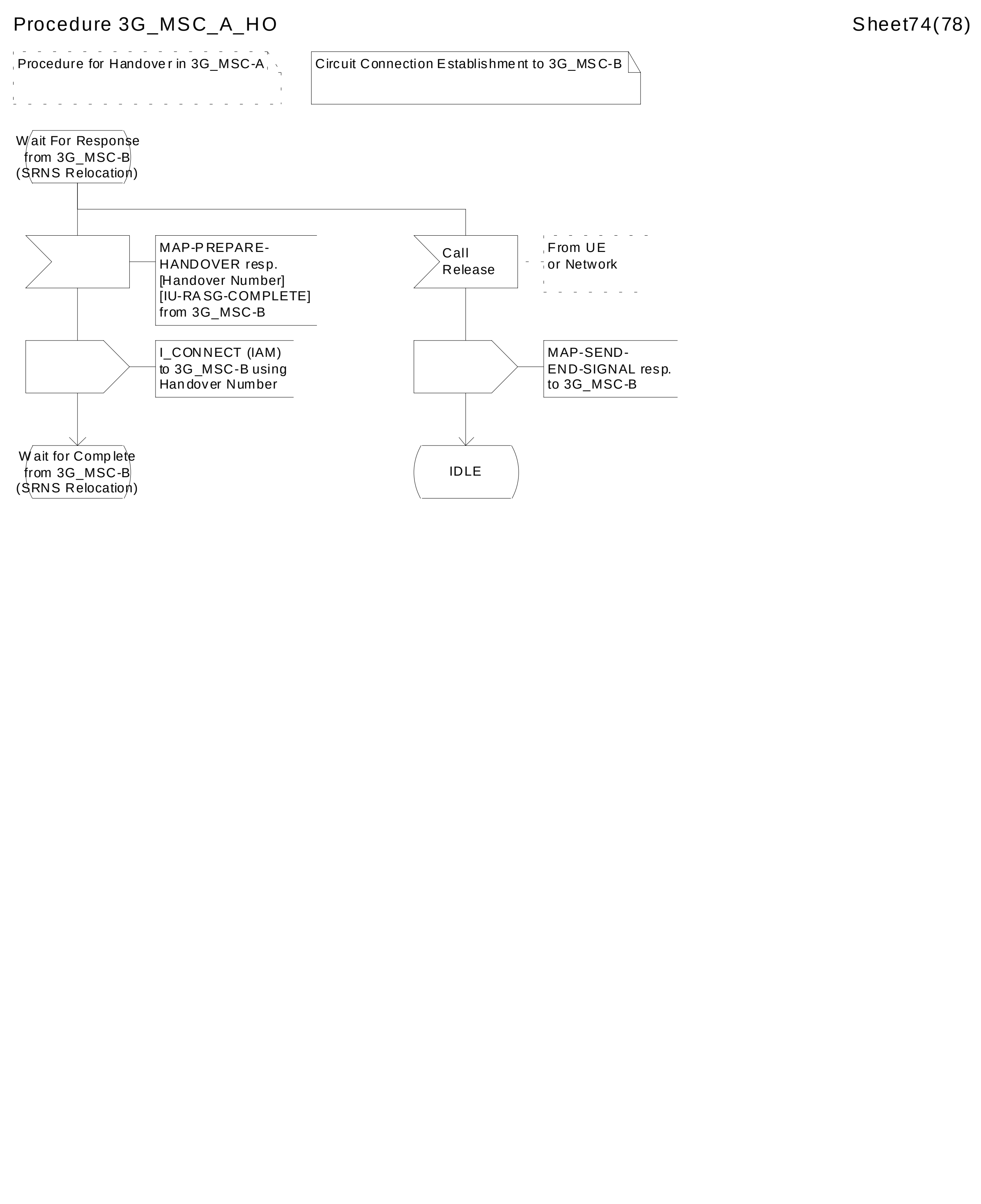


Figure 43 (sheet 74 of 78): Handover control procedure in 3G_MSC-A

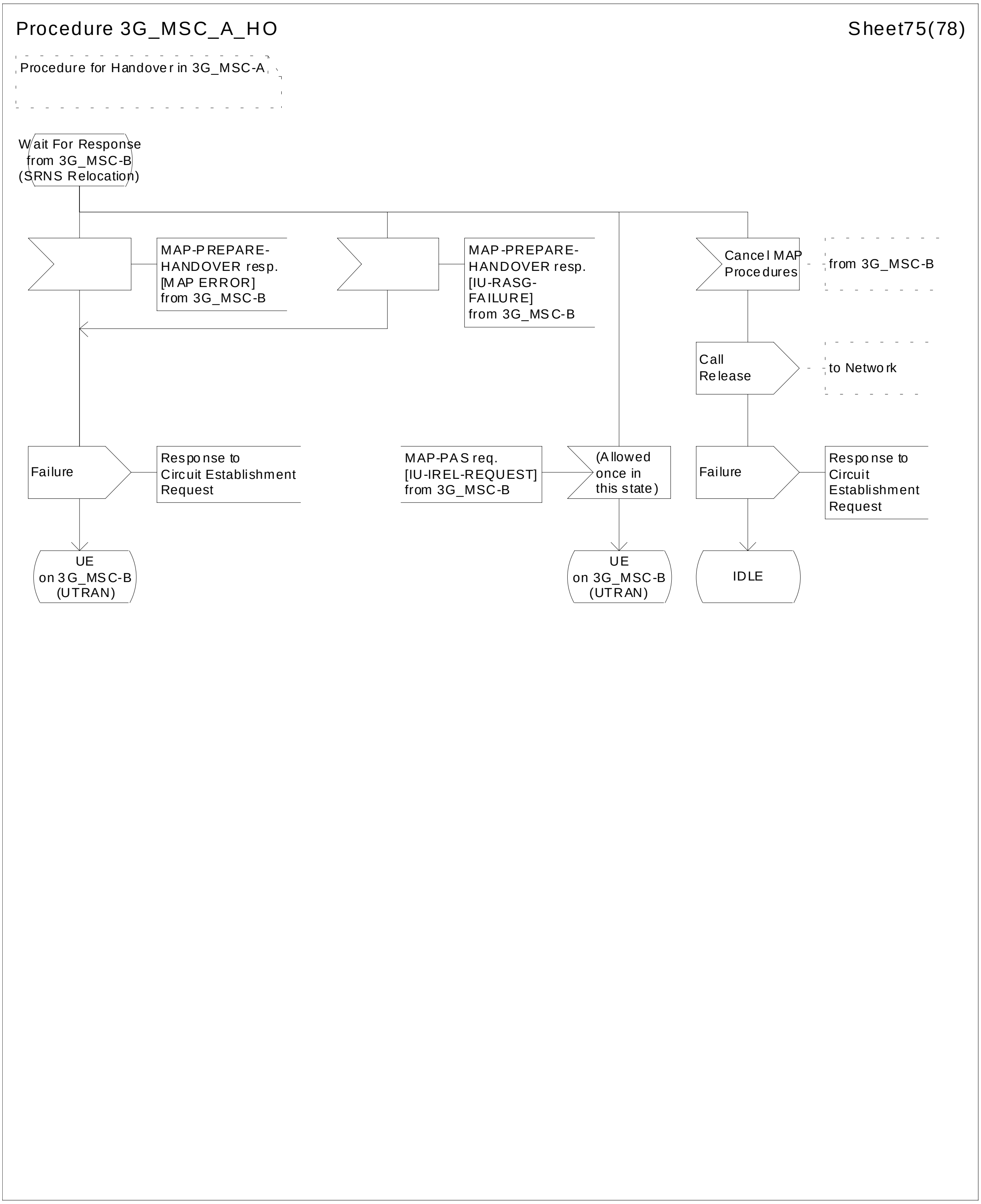


Figure 43 (sheet 75 of 78): Handover control procedure in 3G_MSC-A

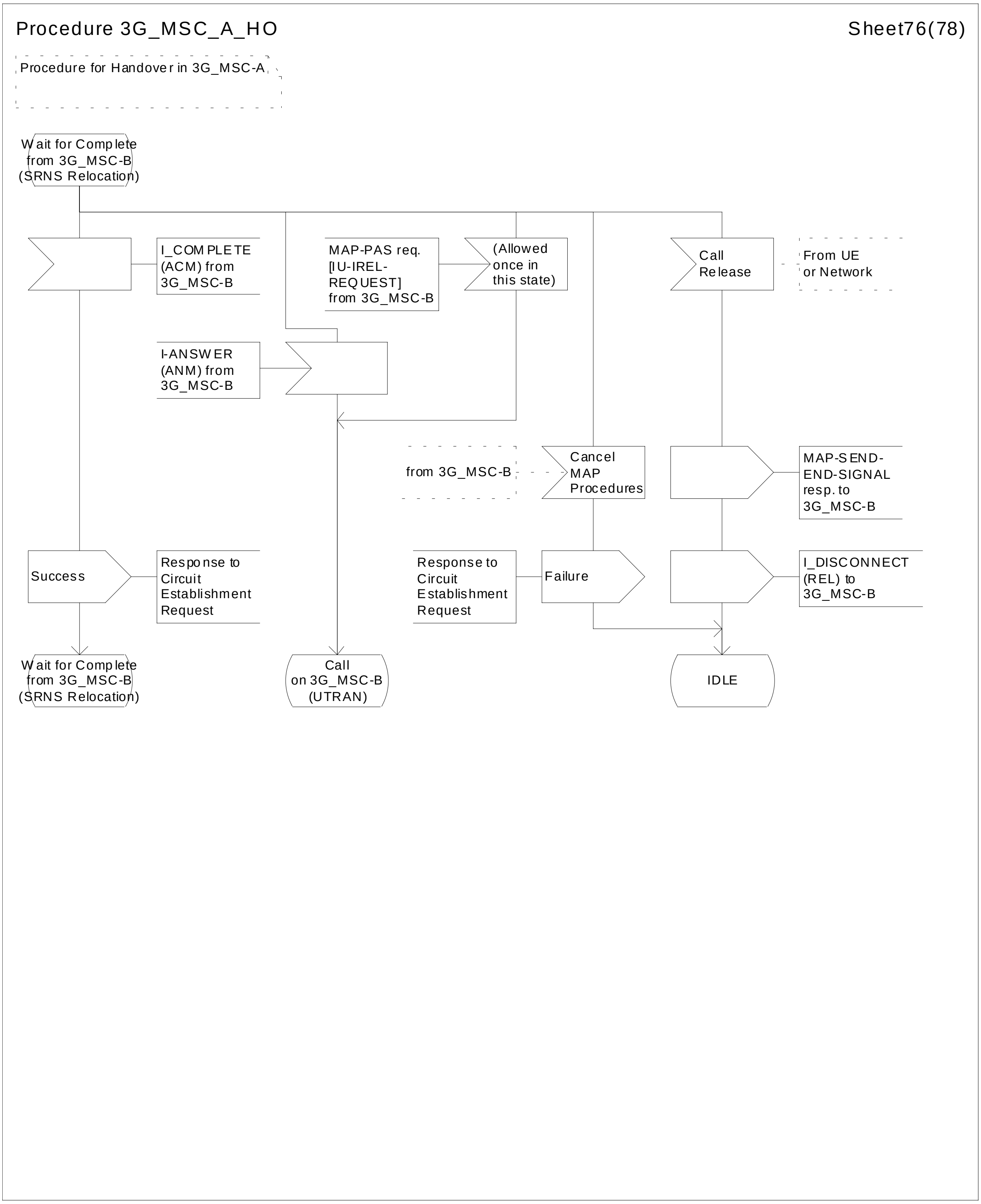


Figure 43 (sheet 76 of 78): Handover control procedure in 3G_MSC-A

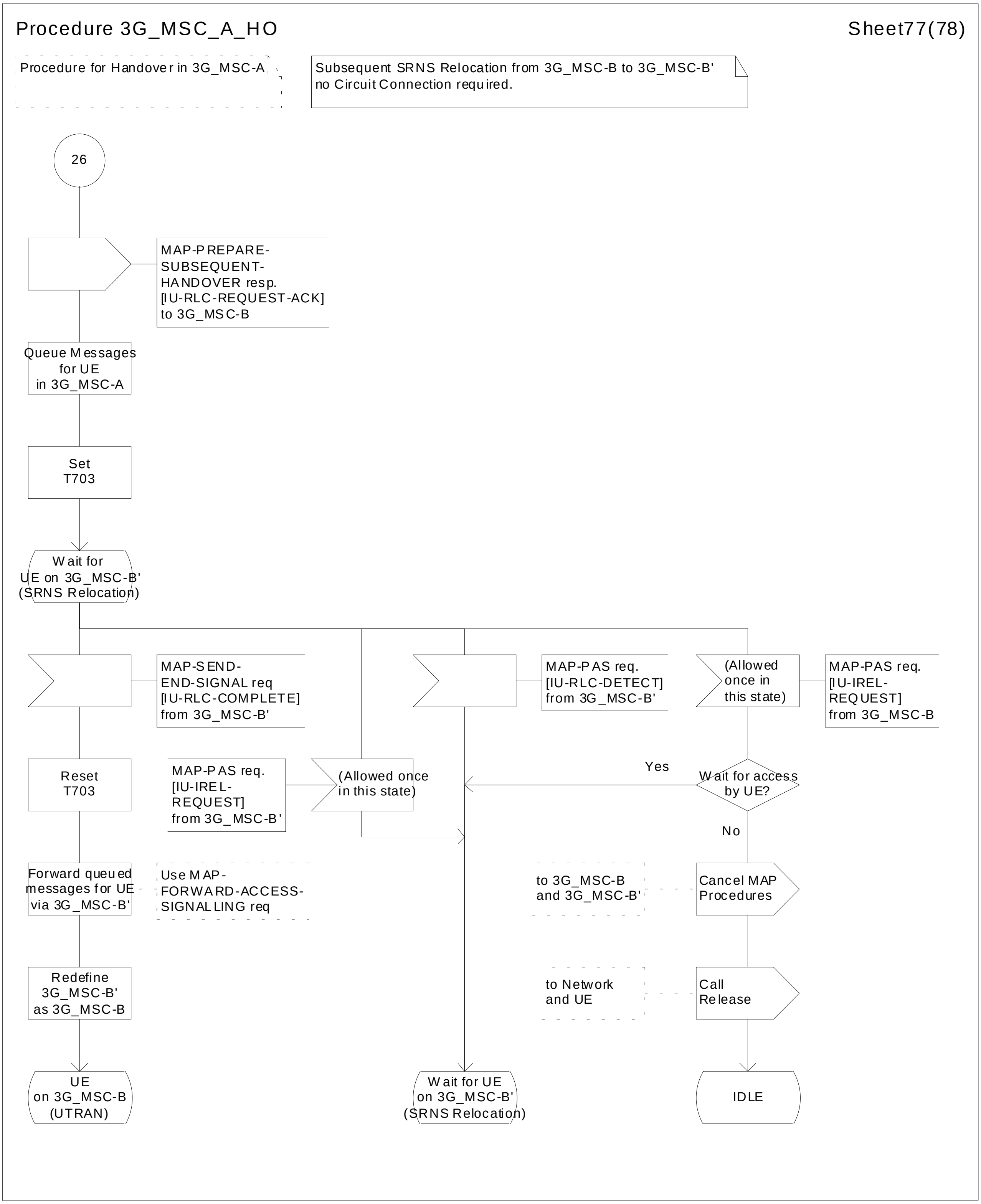


Figure 43 (sheet 77 of 78): Handover control procedure in 3G_MSC-A

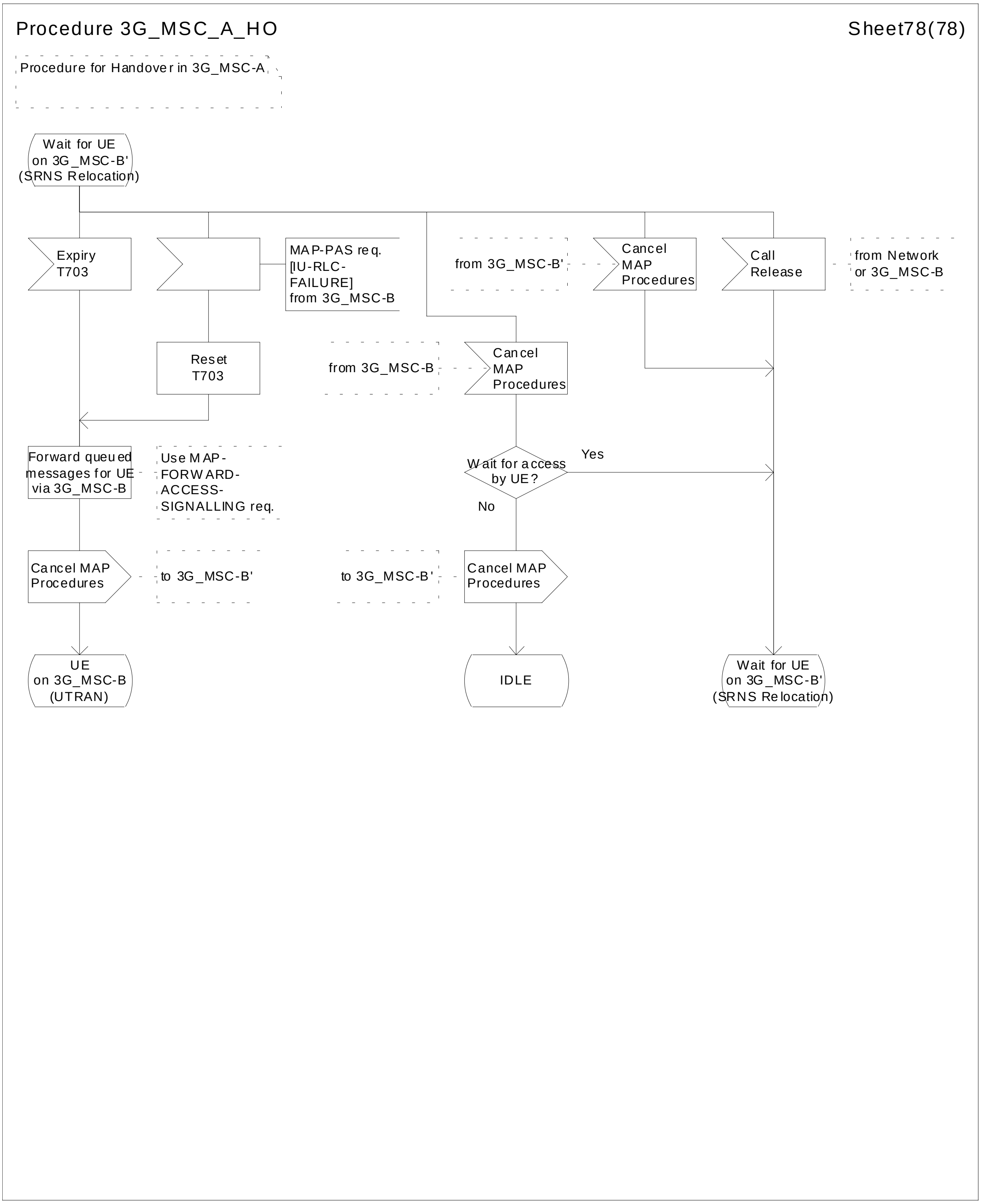


Figure 43 (sheet 78 of 78): Handover control procedure in 3G_MSC-A

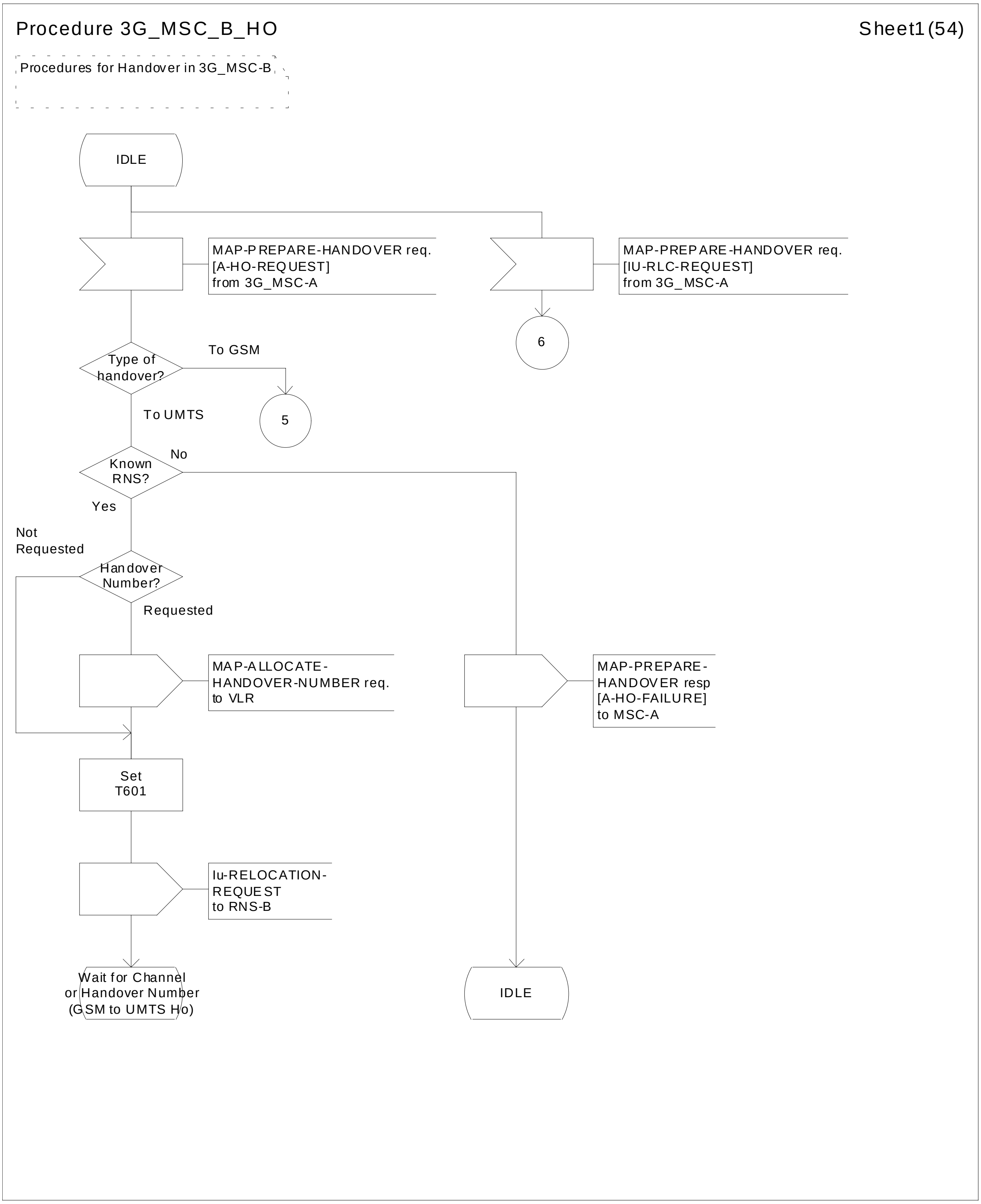


Figure 44 (sheet 1 of 54): Handover control procedure in 3G_MSC-B

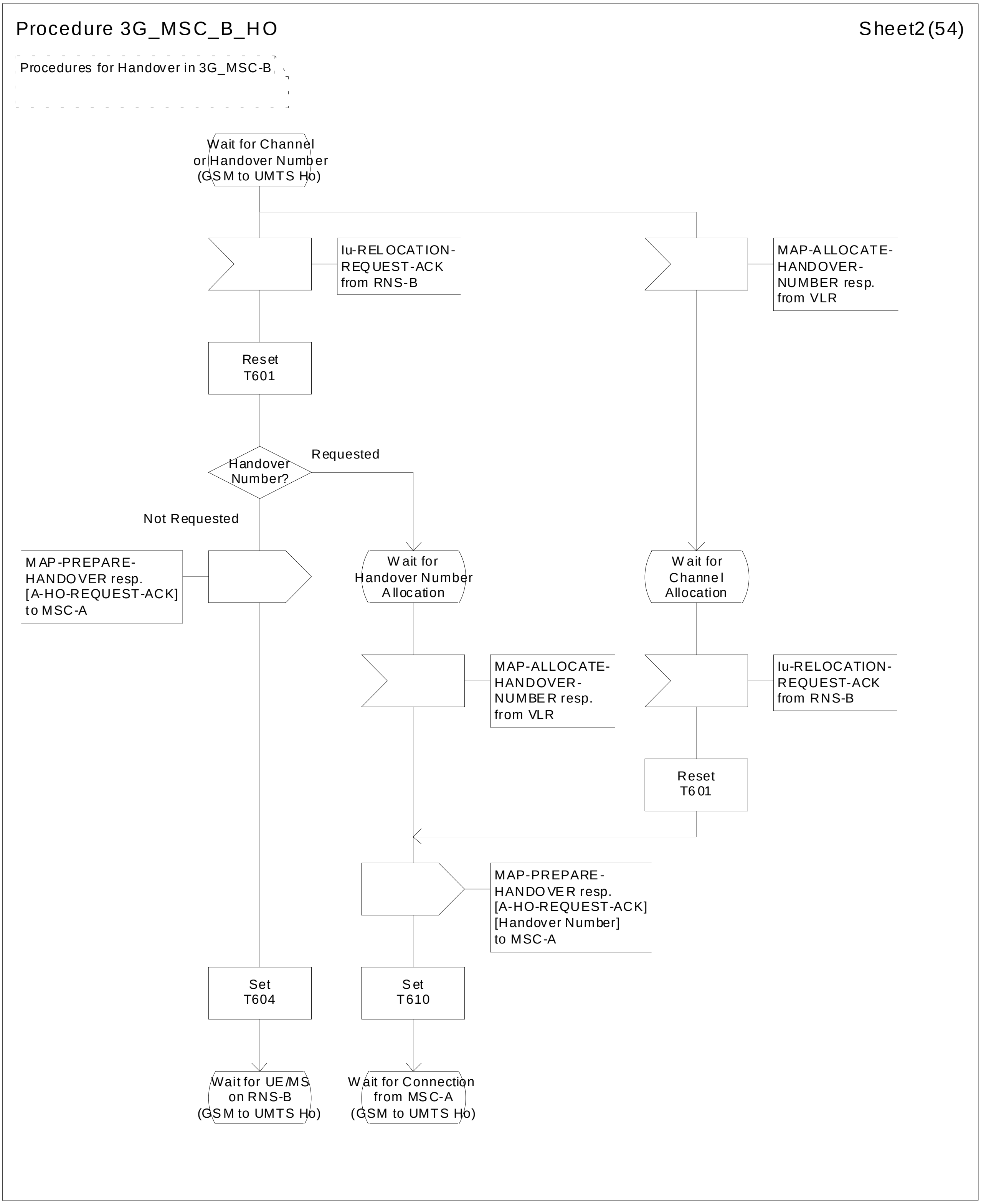


Figure 44 (sheet 2 of 54): Handover control procedure in 3G_MSC-B

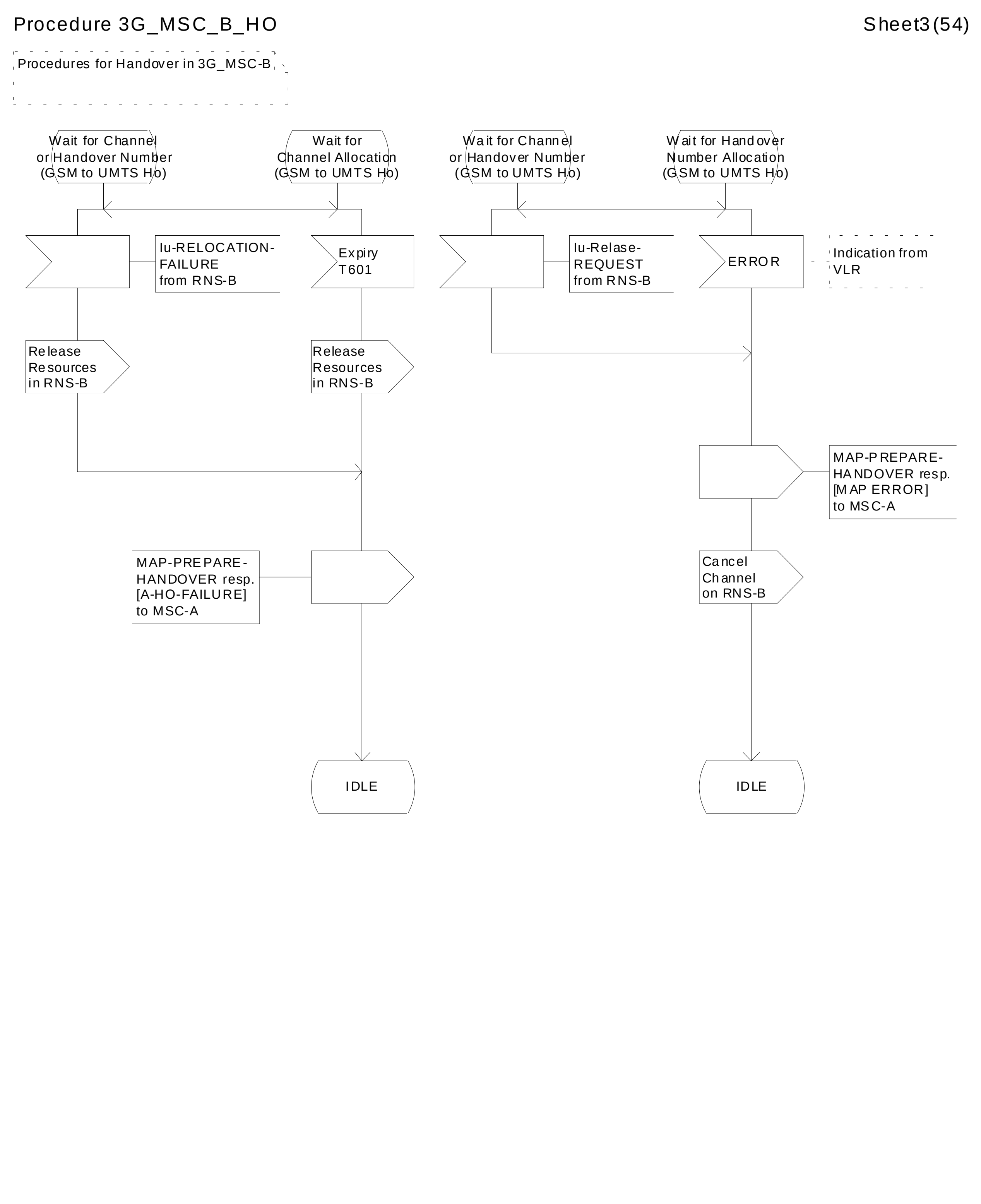


Figure 44 (sheet 3 of 54): Handover control procedure in 3G_MSC-B

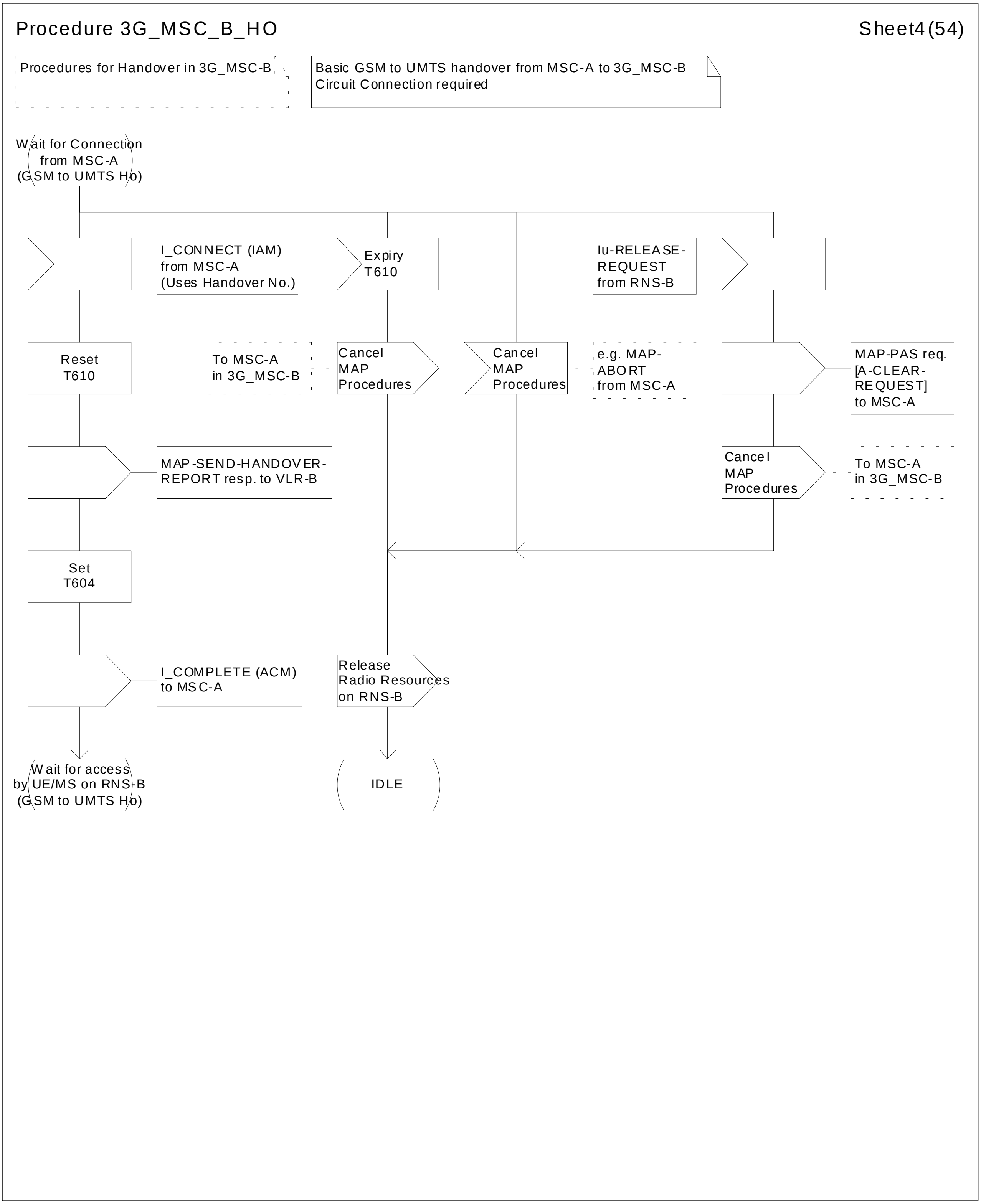


Figure 44 (sheet 4 of 54): Handover control procedure in 3G_MSC-B

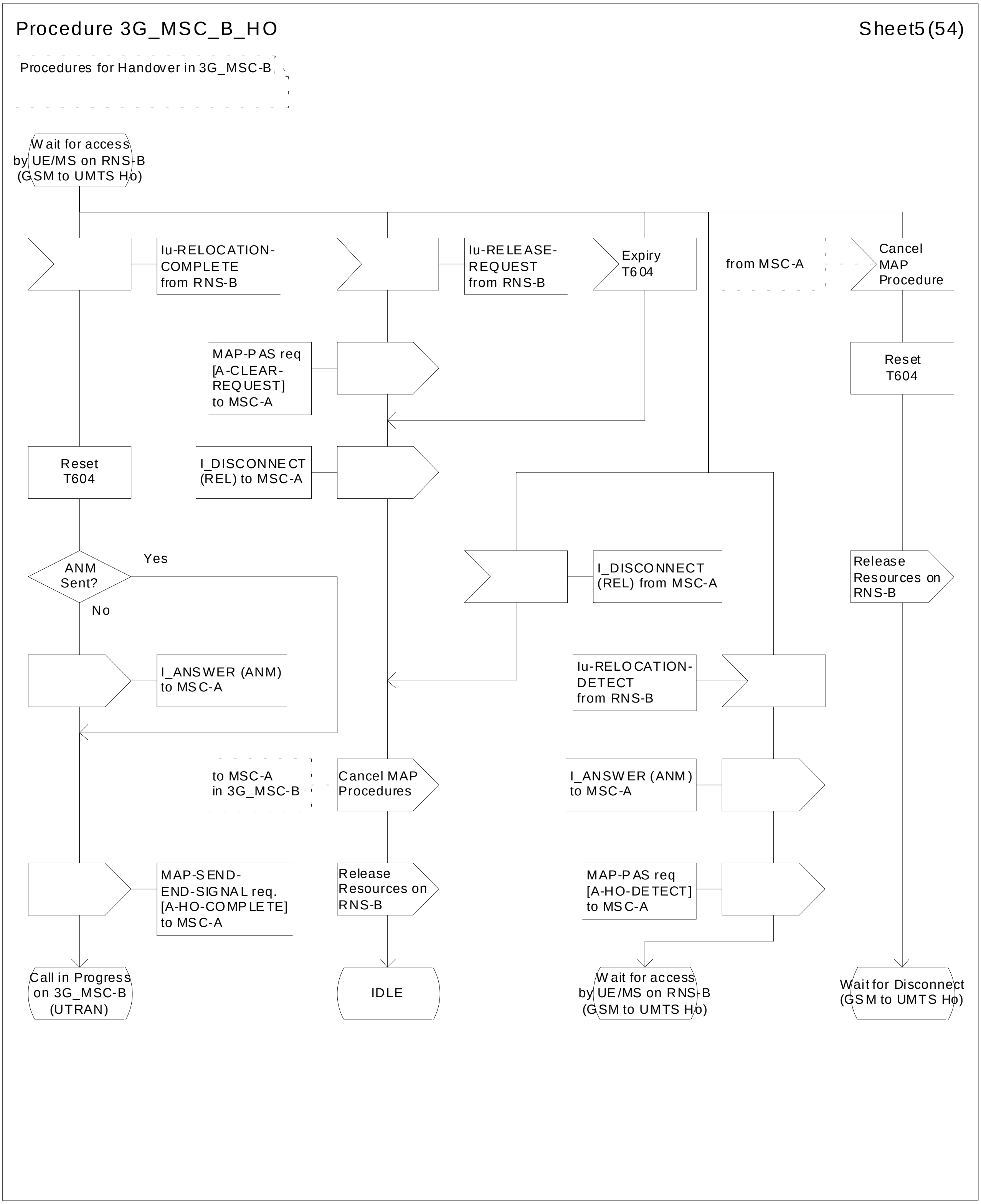


Figure 44 (sheet 5 of 54): Handover control procedure in 3G_MSC-B

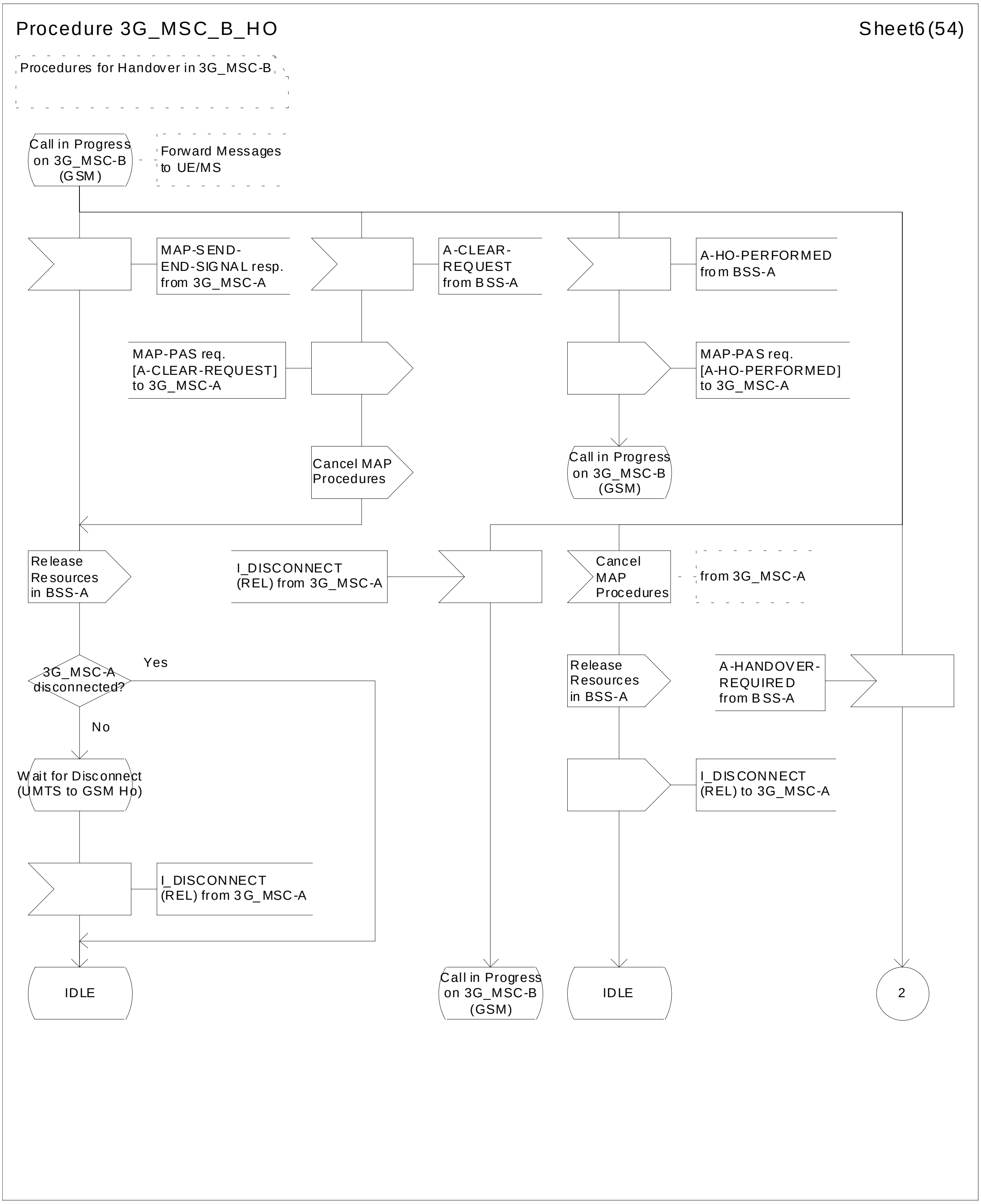


Figure 44 (sheet 6 of 54): Handover control procedure in 3G_MSC-B

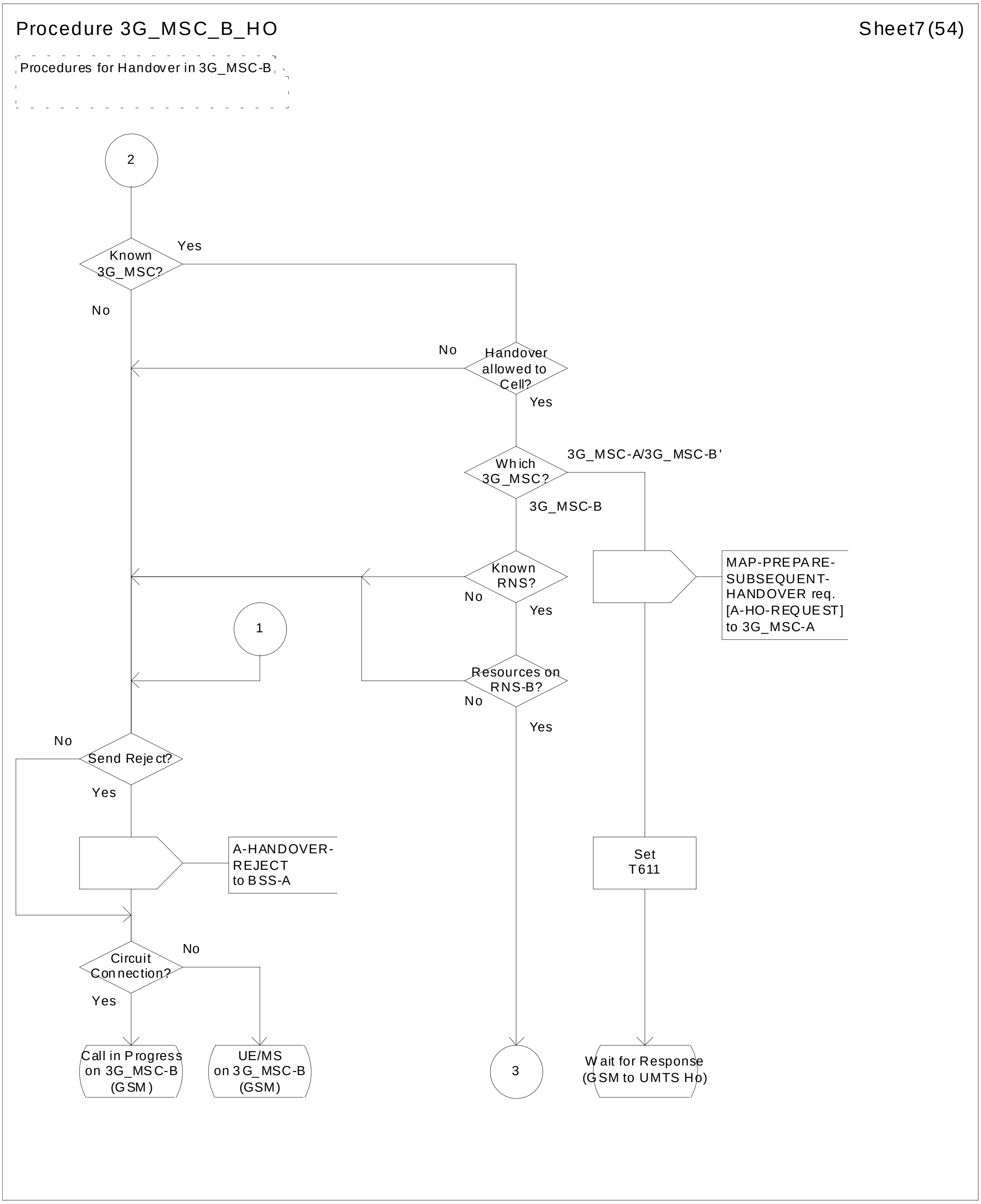


Figure 44 (sheet 7 of 54): Handover control procedure in 3G_MSC-B

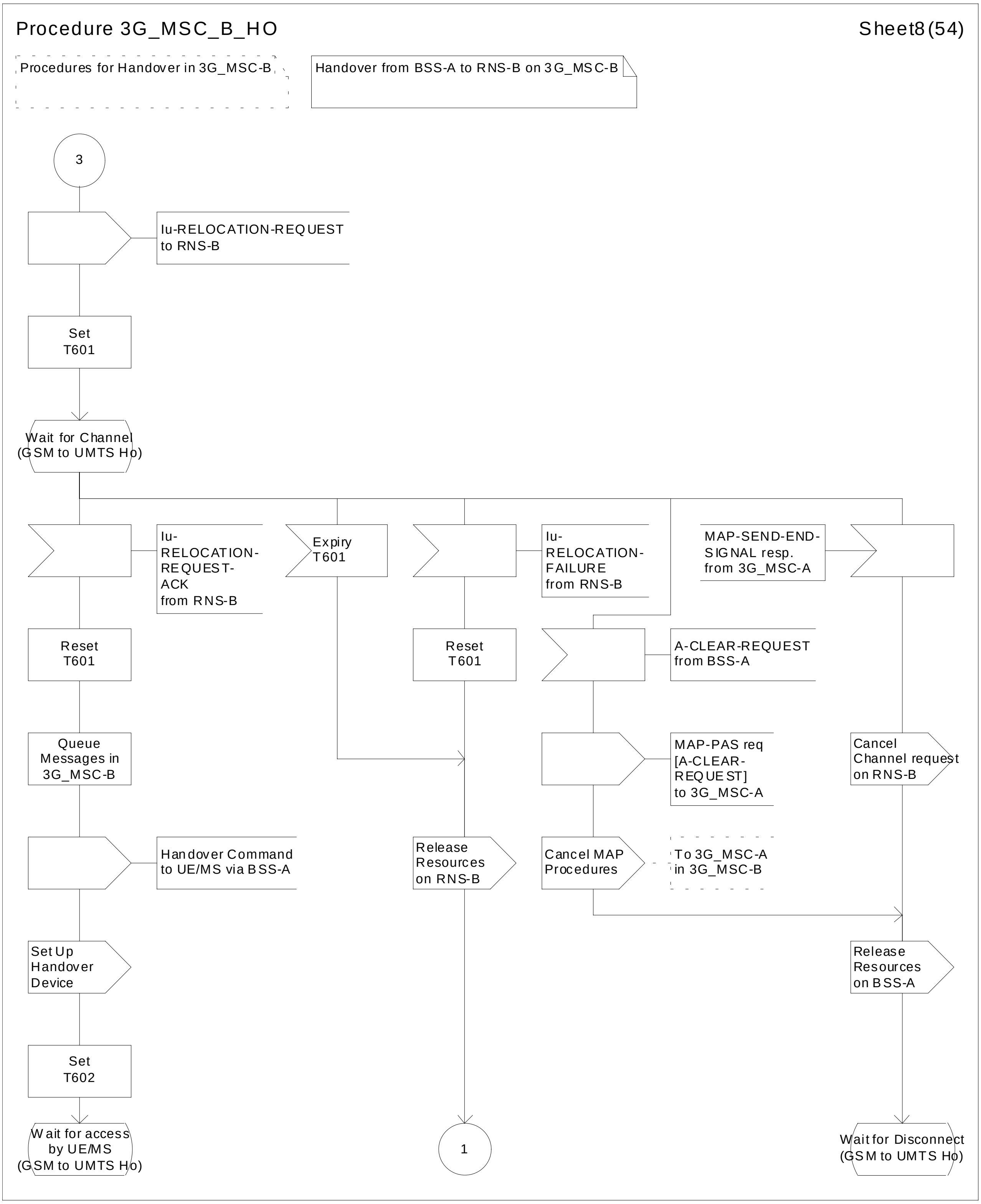


Figure 44 (sheet 8 of 54): Handover control procedure in 3G_MSC-B

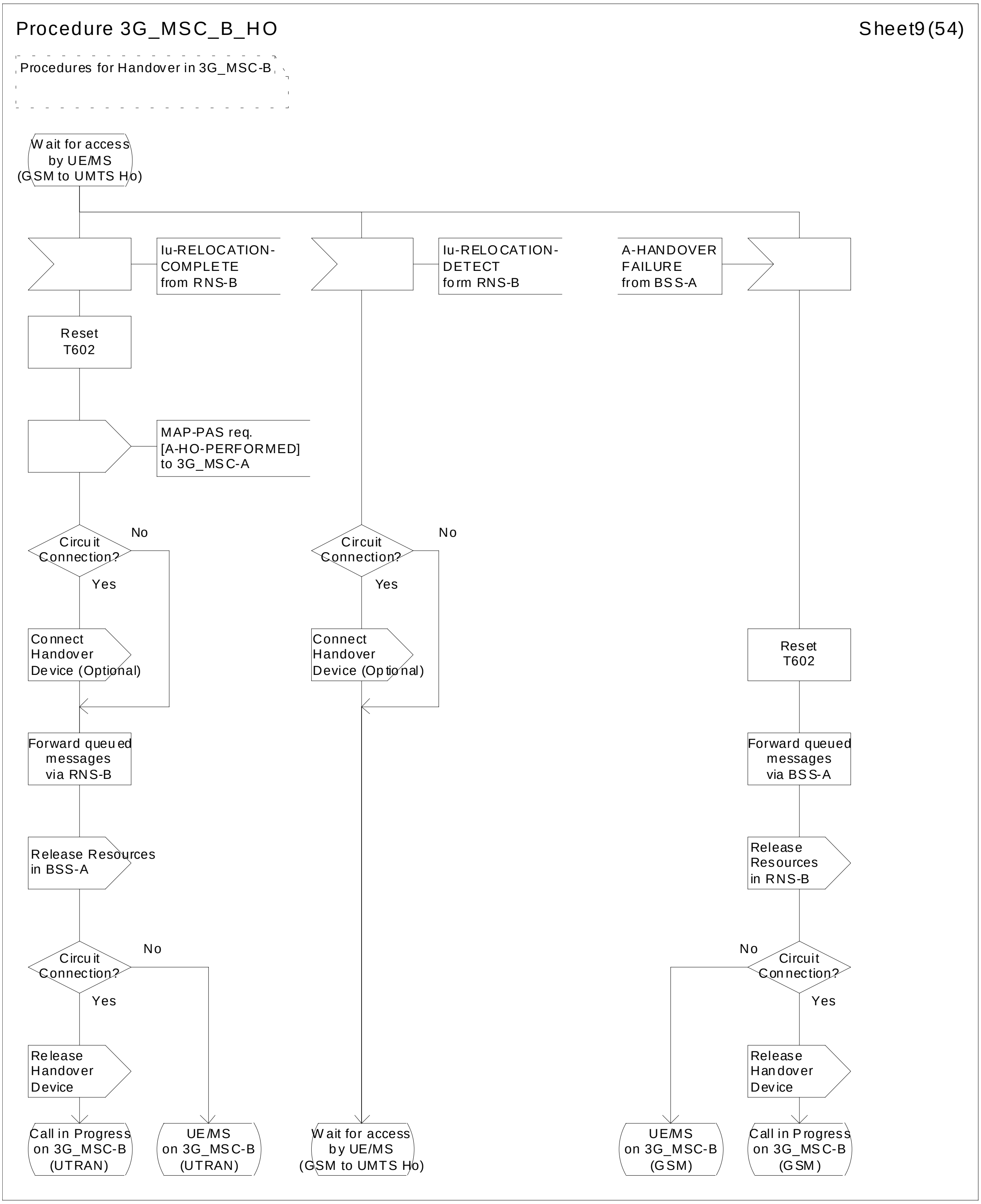


Figure 44 (sheet 9 of 54): Handover control procedure in 3G_MSC-B

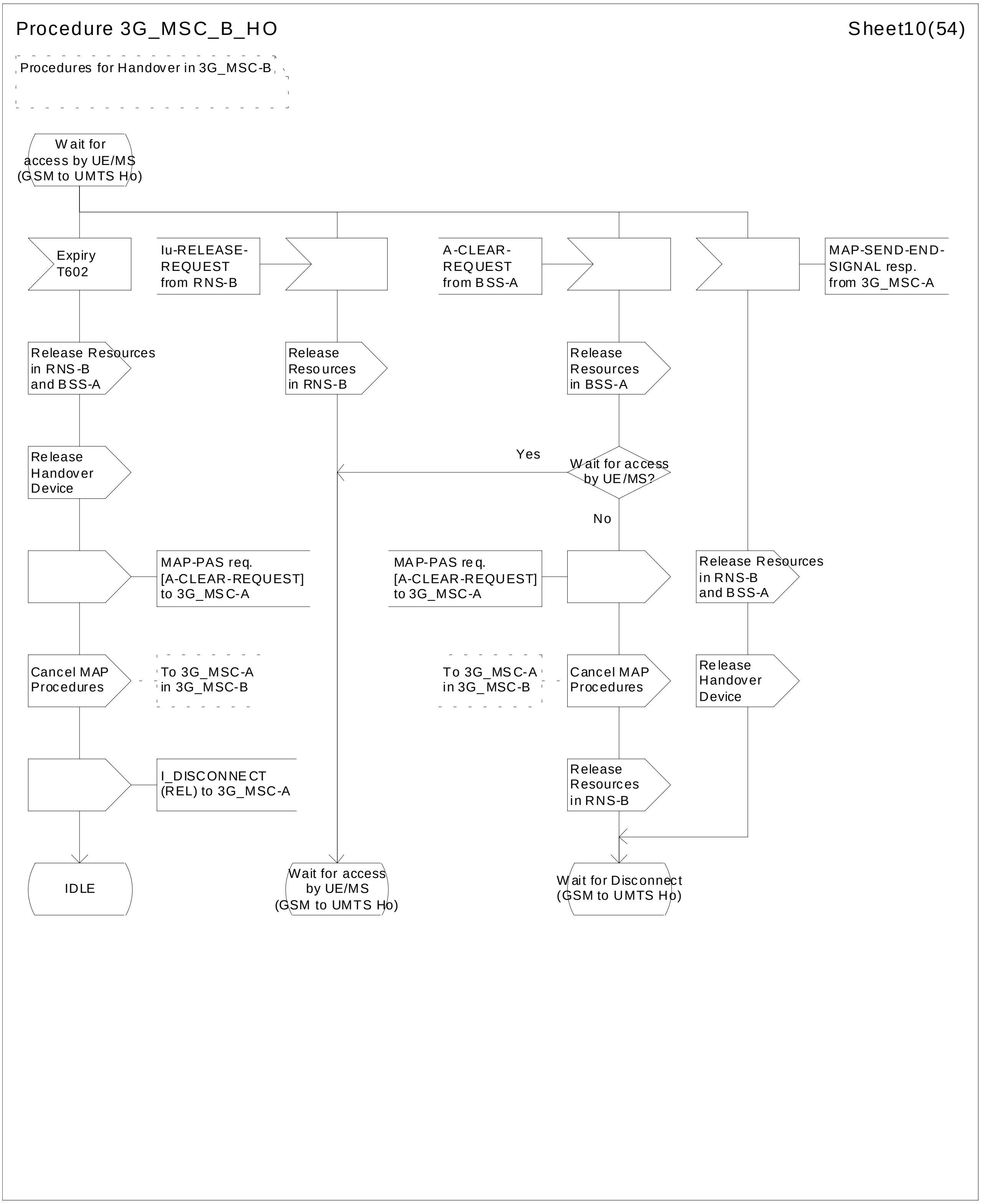


Figure 44 (sheet 10 of 54): Handover control procedure in 3G_MSC-B

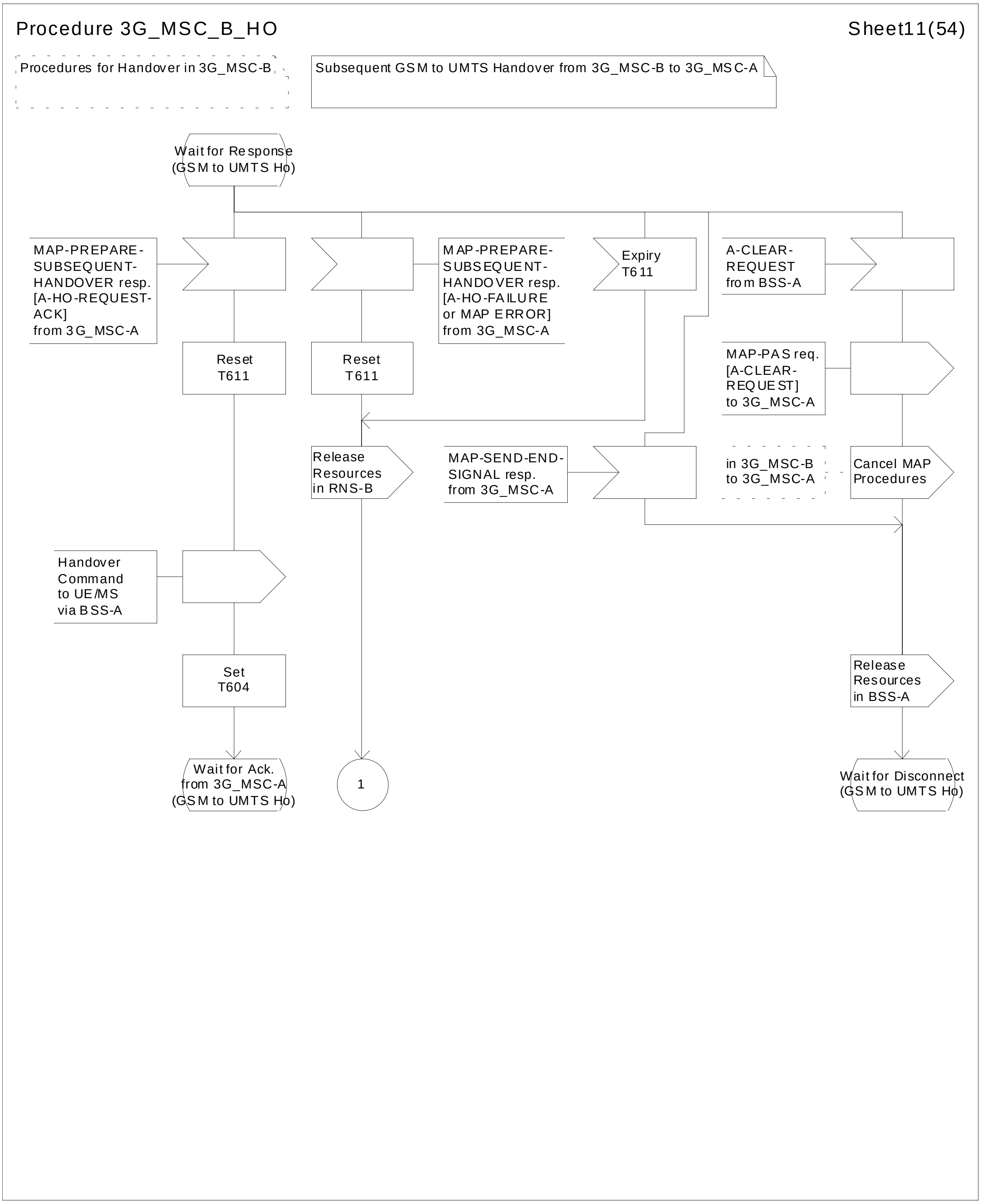


Figure 44 (sheet 11 of 54): Handover control procedure in 3G_MSC-B

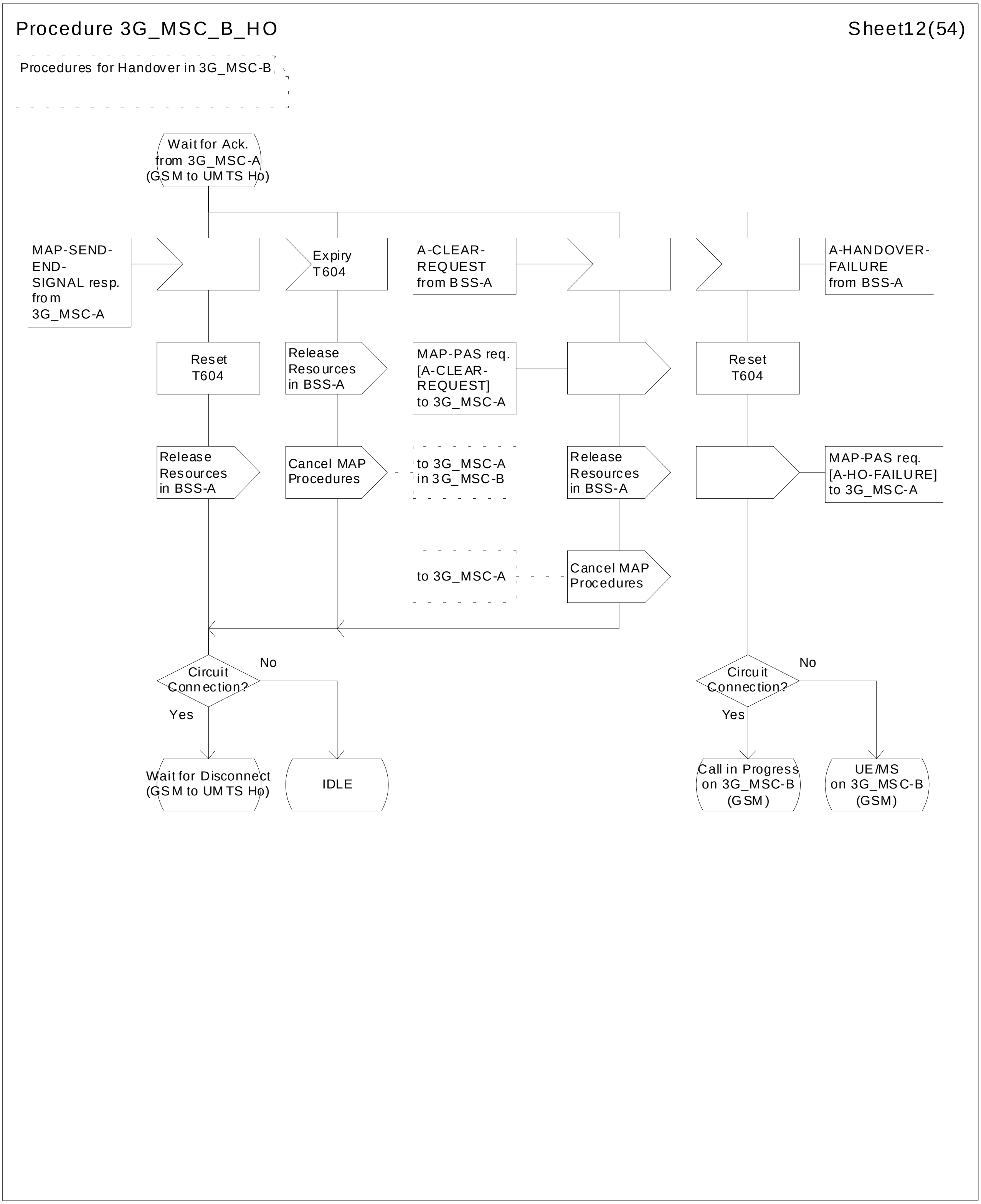


Figure 44 (sheet 12 of 54): Handover control procedure in 3G_MSC-B

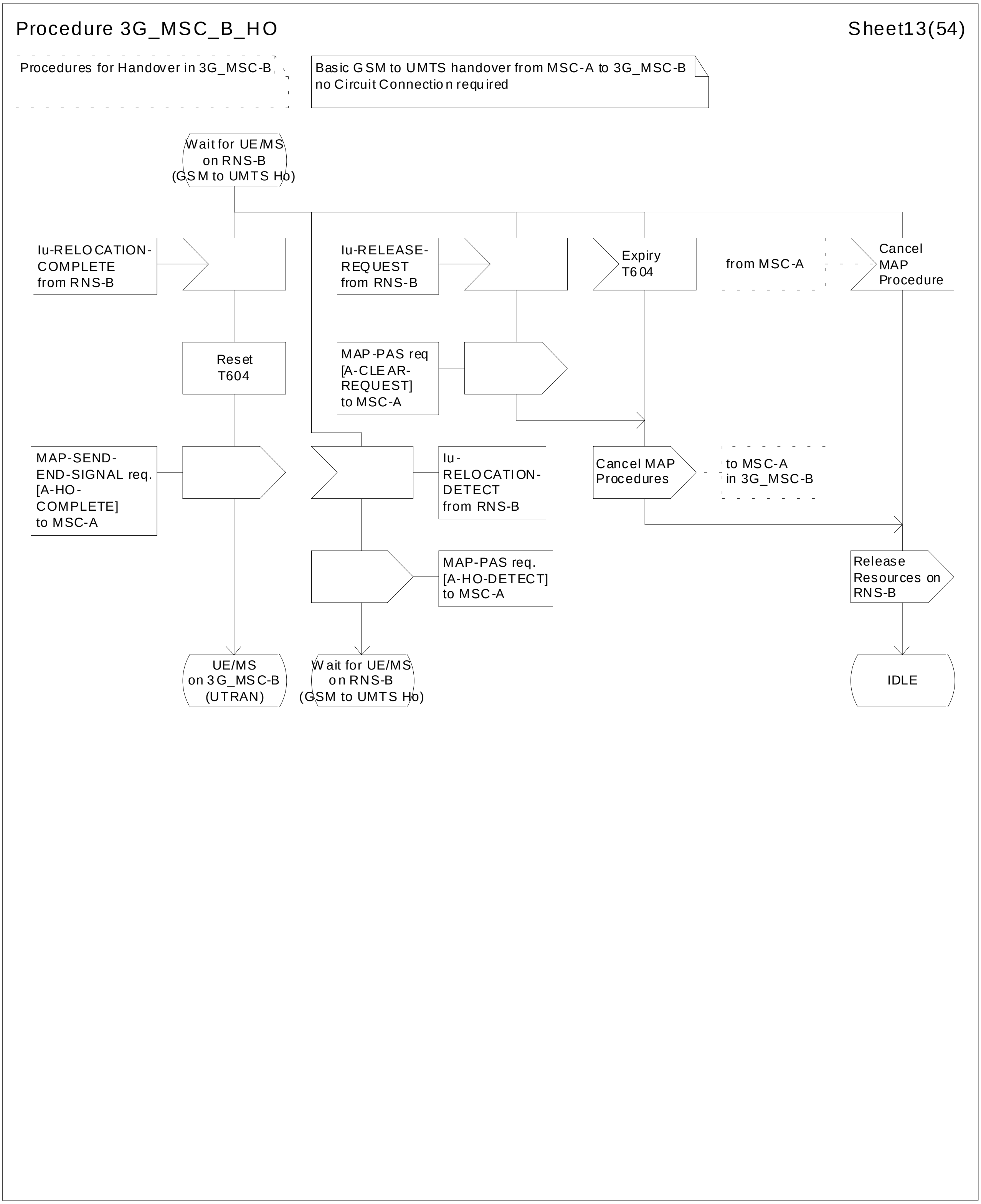


Figure 44 (sheet 13 of 54): Handover control procedure in 3G_MSC-B

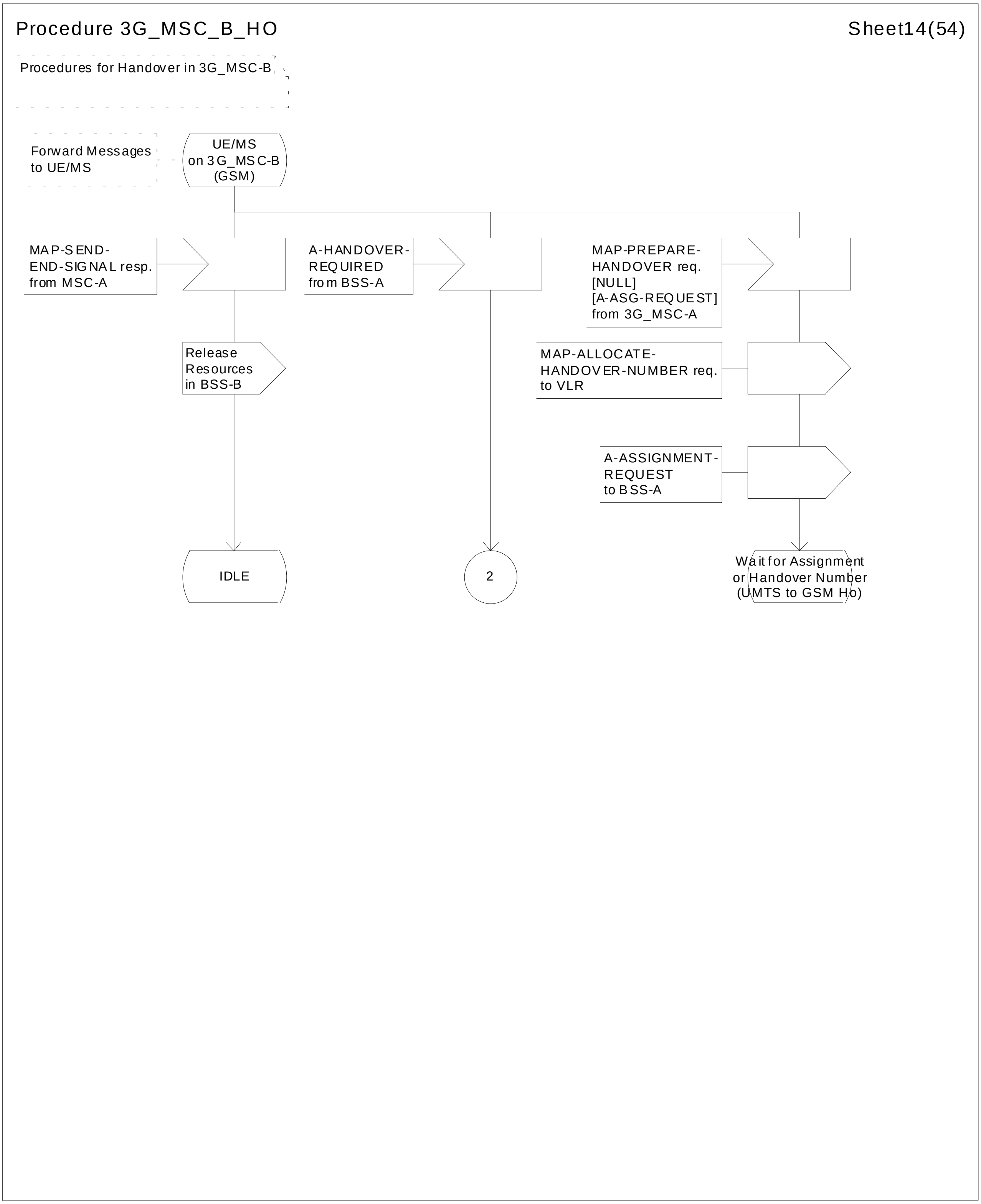


Figure 44 (sheet 14 of 54): Handover control procedure in 3G_MSC-B

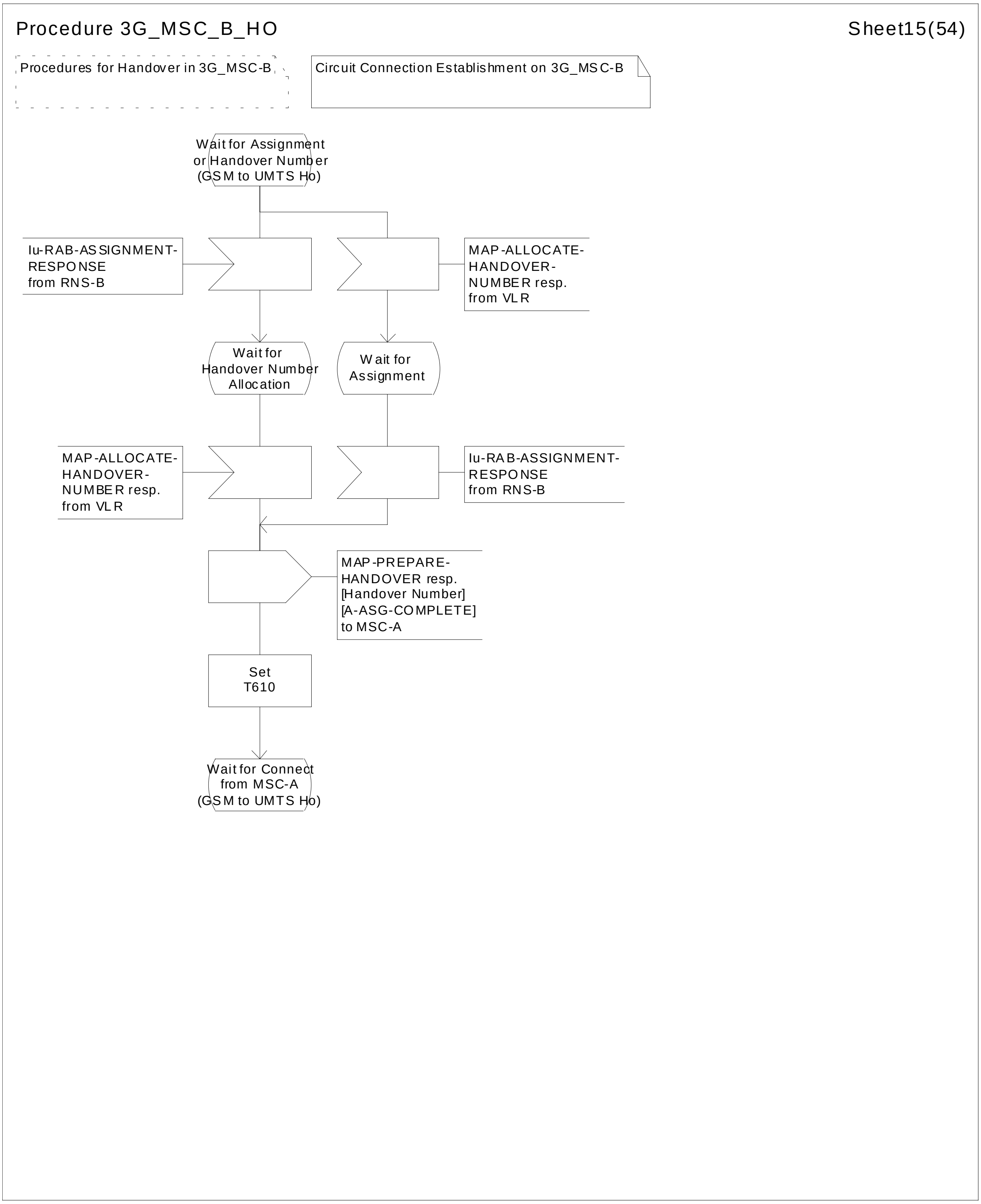


Figure 44 (sheet 15 of 54): Handover control procedure in 3G_MSC-B

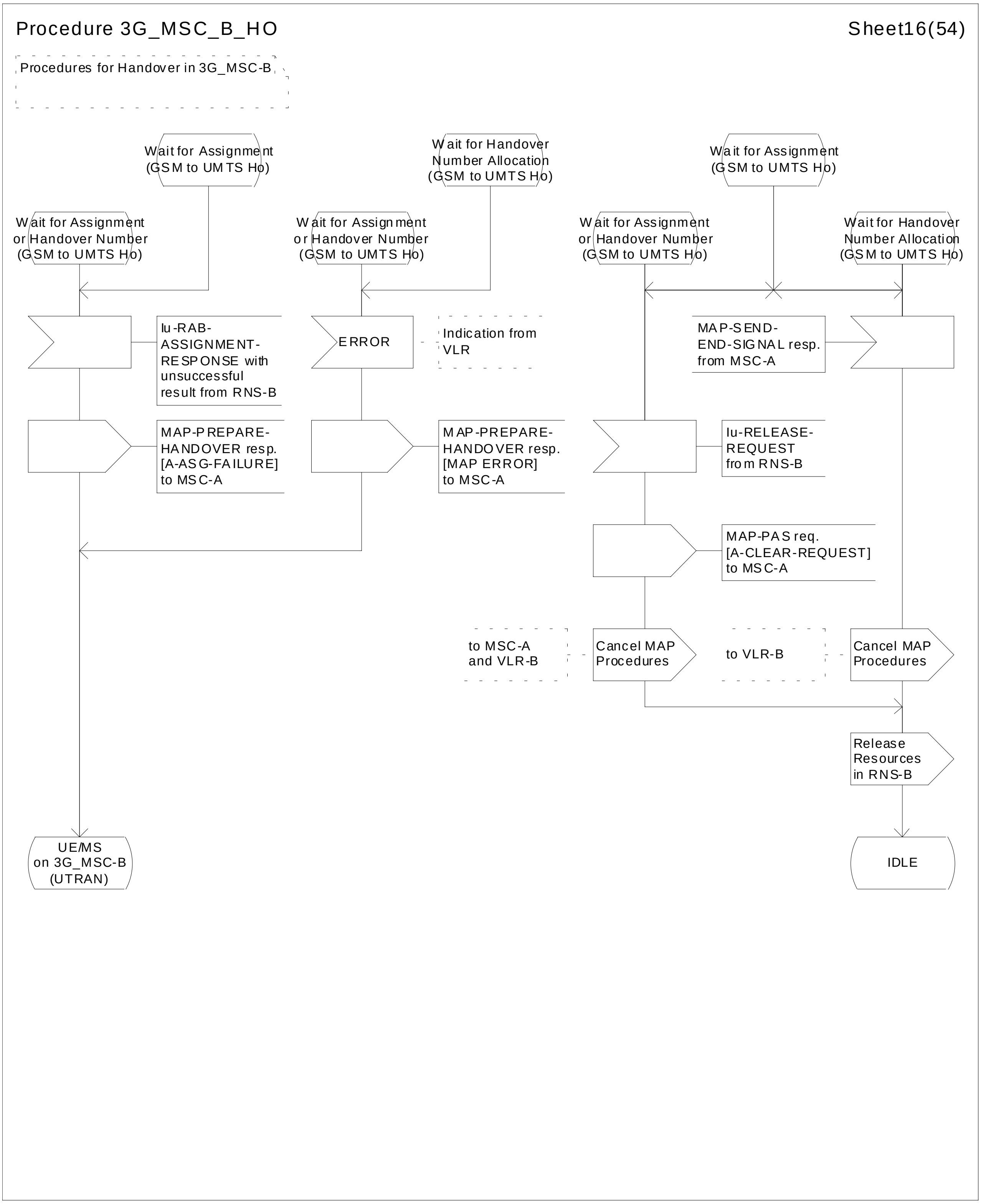


Figure 44 (sheet 16 of 54): Handover control procedure in 3G_MSC-B

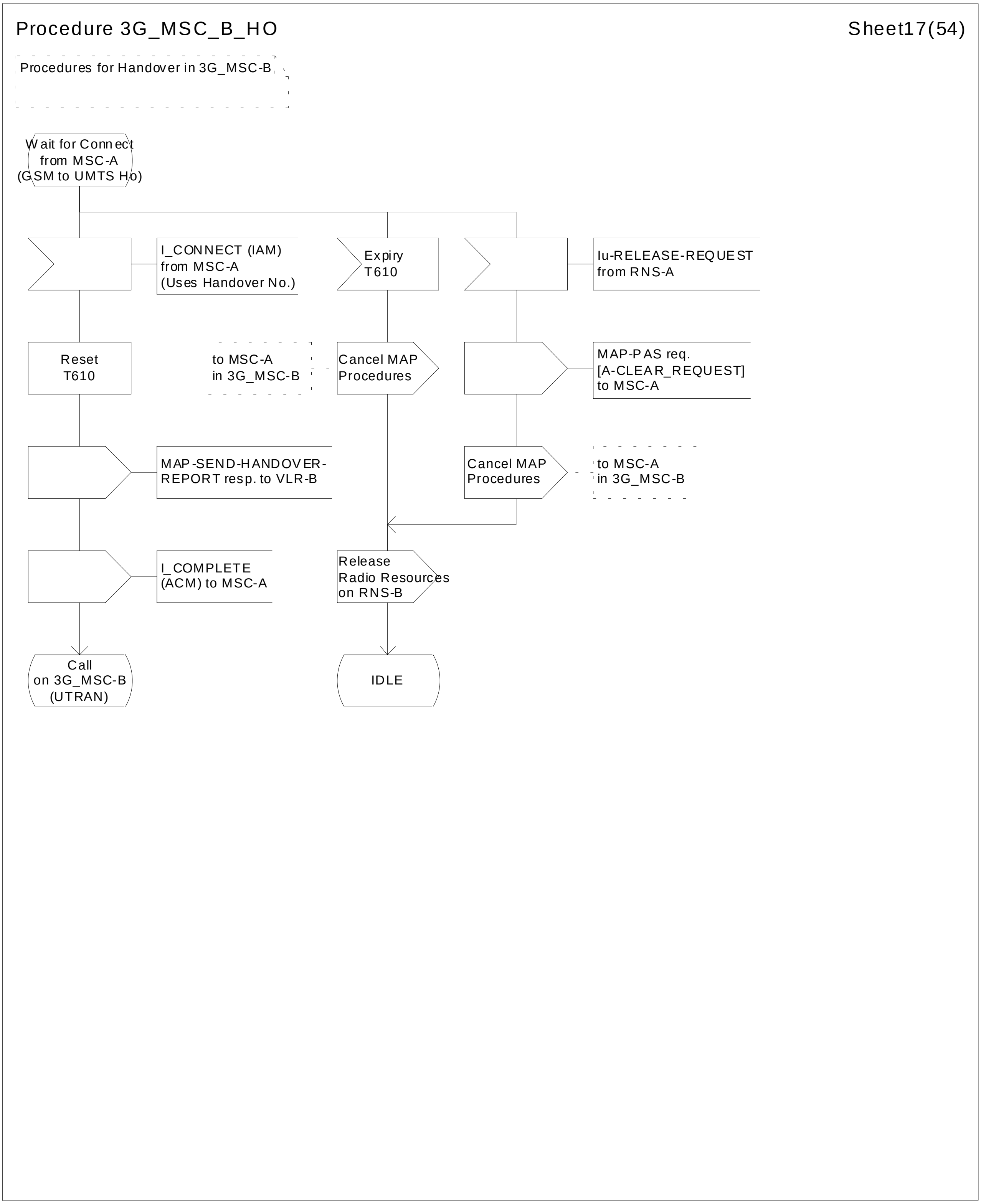


Figure 44 (sheet 17 of 54): Handover control procedure in 3G_MSC-B

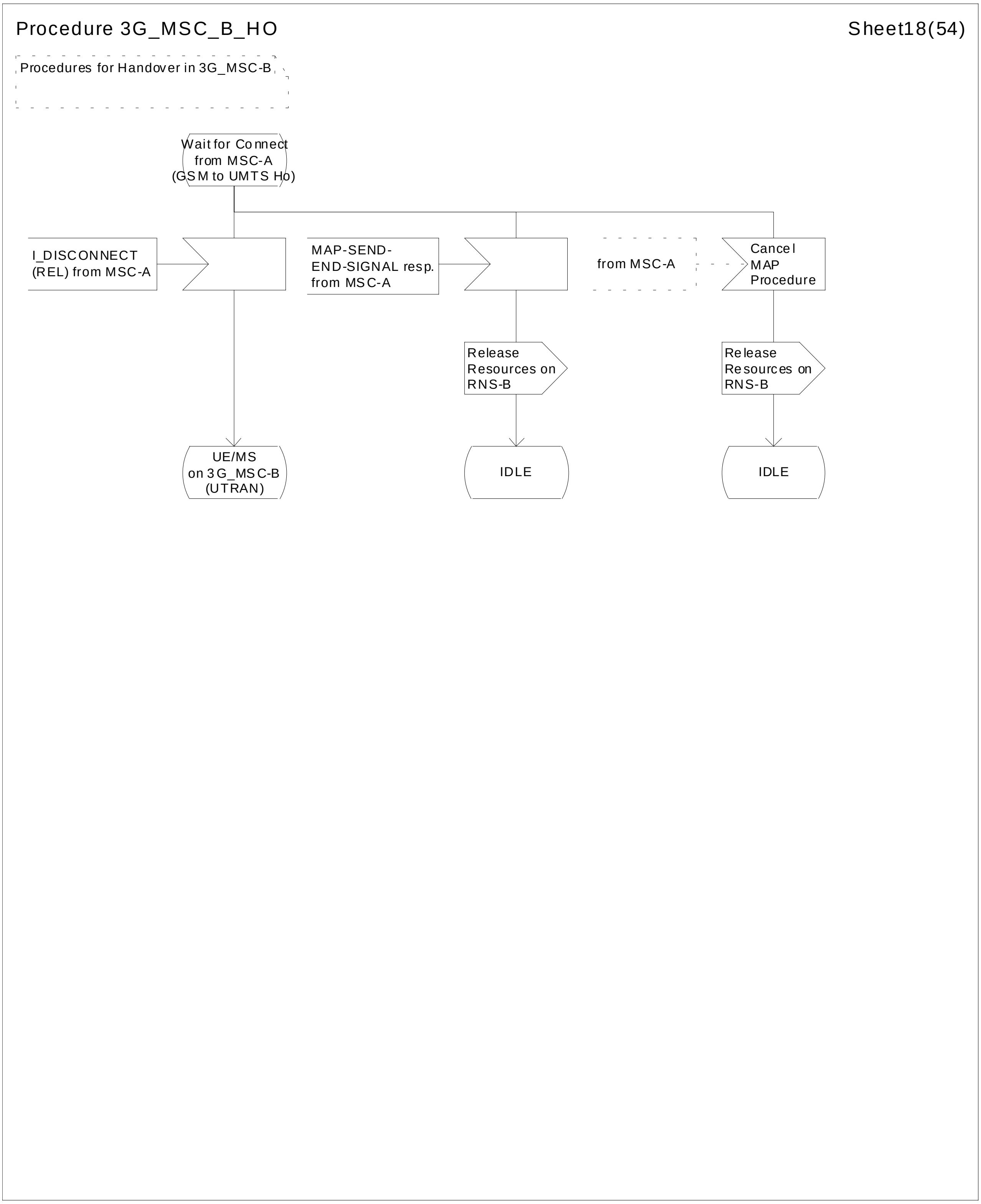


Figure 44 (sheet 18 of 54): Handover control procedure in 3G_MSC-B

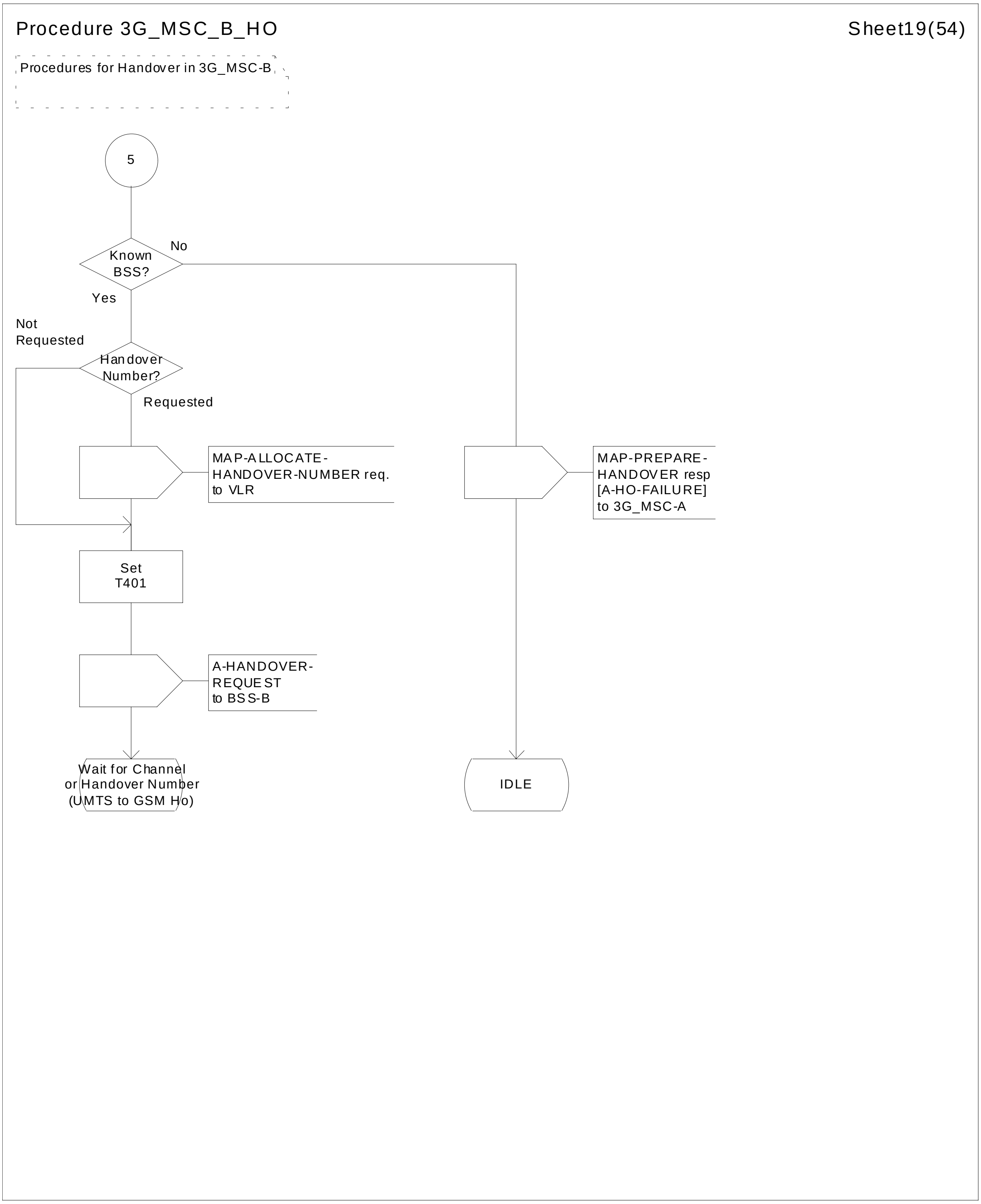


Figure 44 (sheet 19 of 54): Handover control procedure in 3G_MSC-B

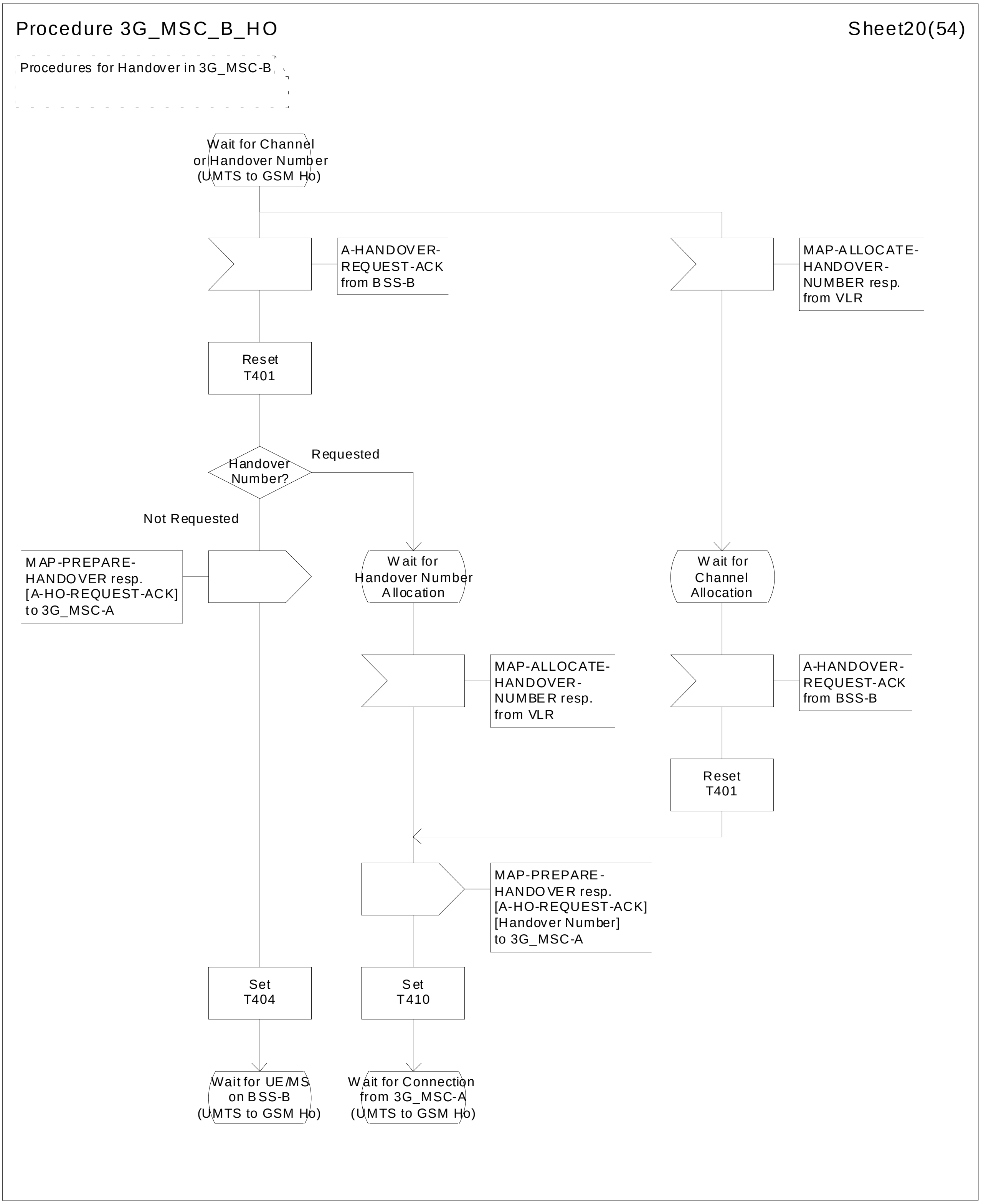


Figure 44 (sheet 20 of 54): Handover control procedure in 3G_MSC-B

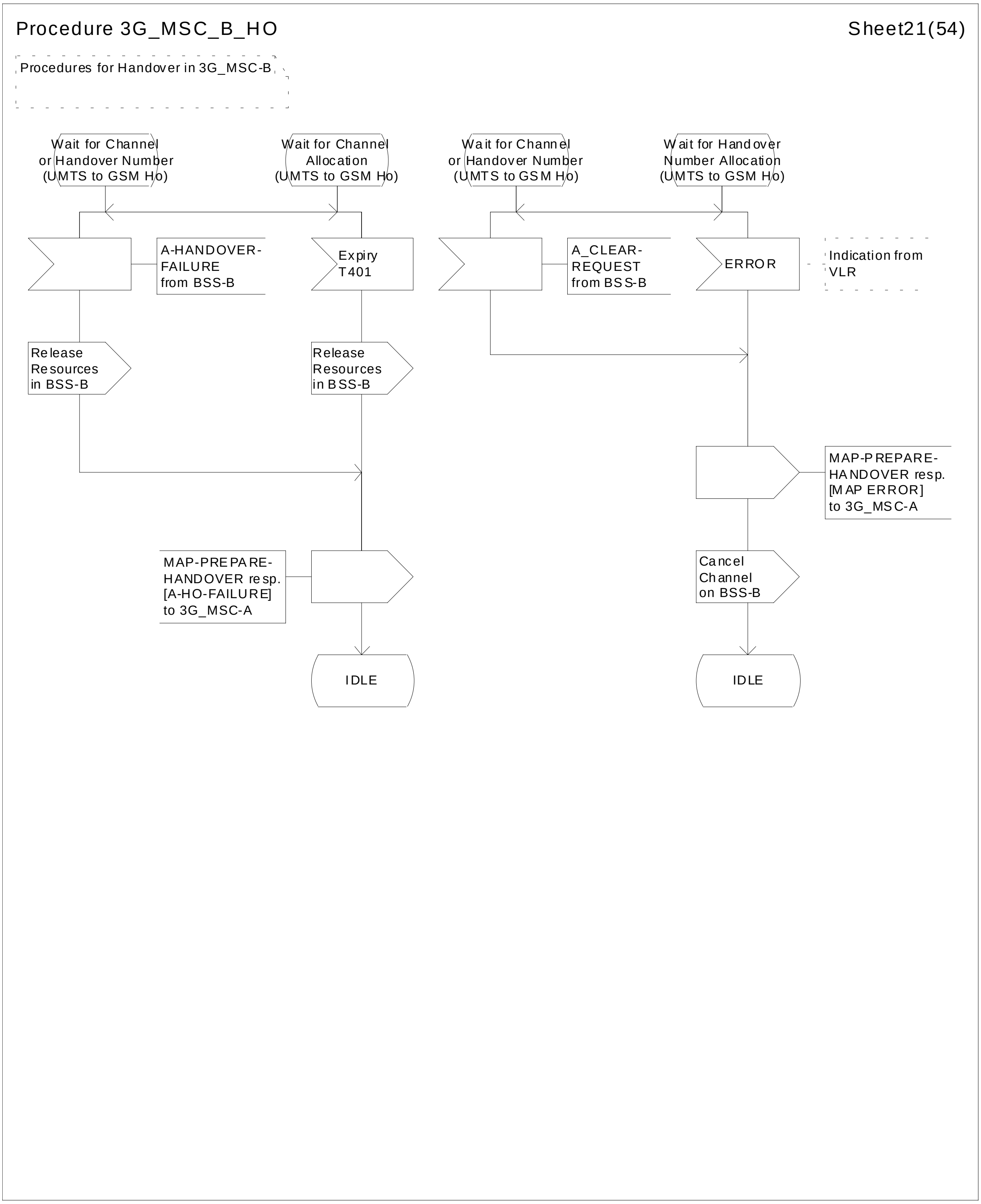


Figure 44 (sheet 21 of 54): Handover control procedure in 3G_MSC-B

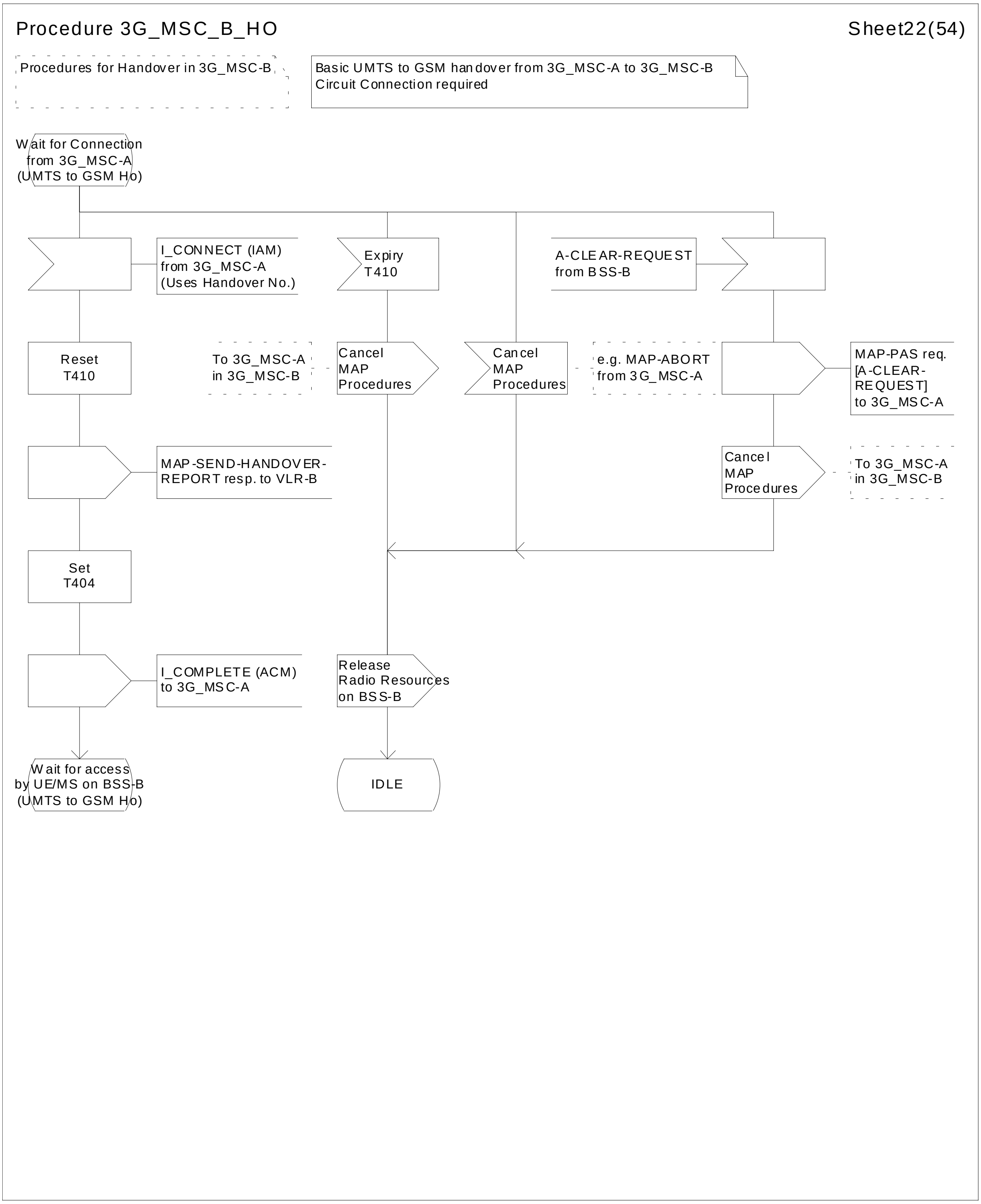


Figure 44 (sheet 22 of 54): Handover control procedure in 3G_MSC-B

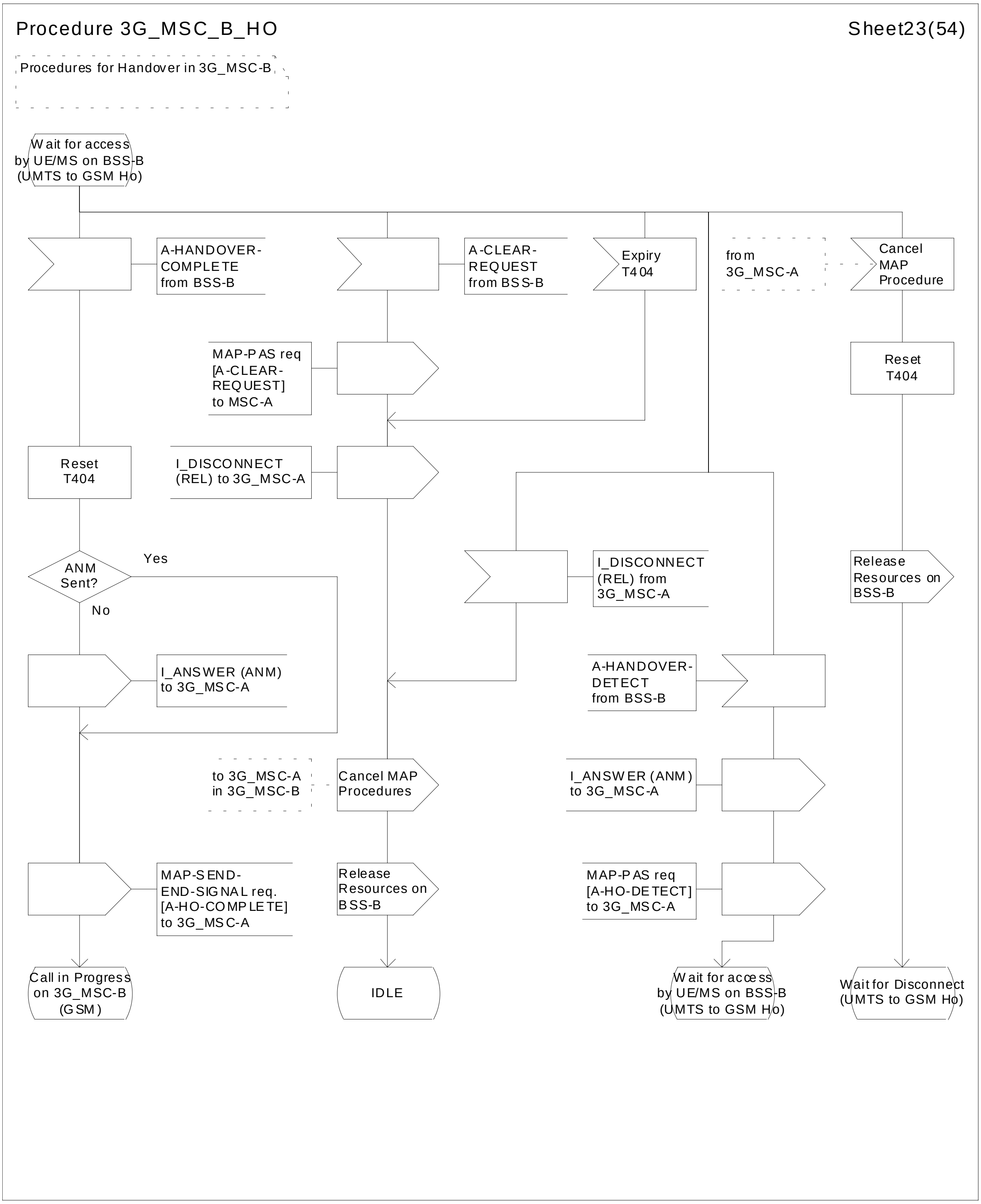


Figure 44 (sheet 23 of 54): Handover control procedure in 3G_MSC-B

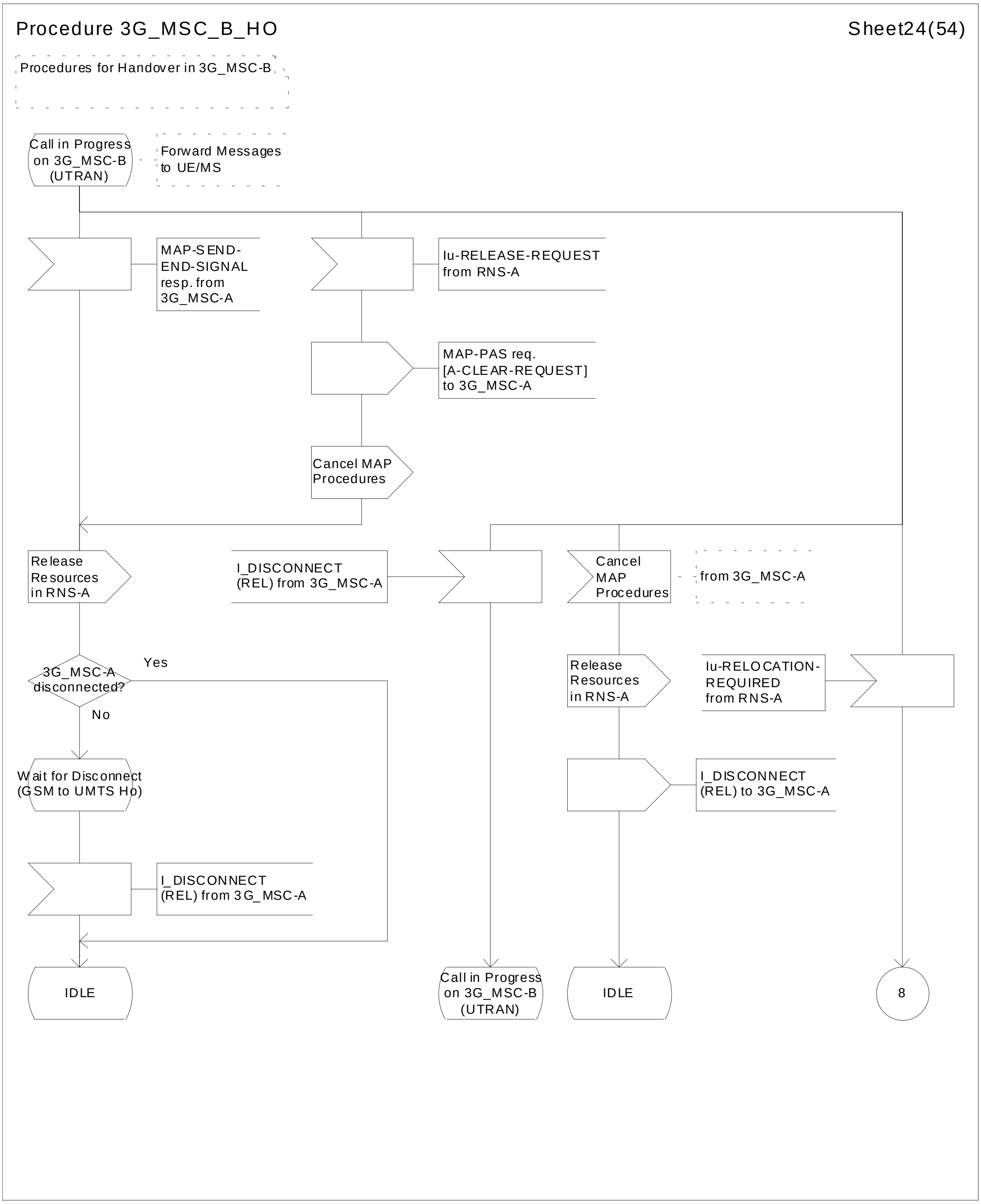


Figure 44 (sheet 24 of 54): Handover control procedure in 3G_MSC-B

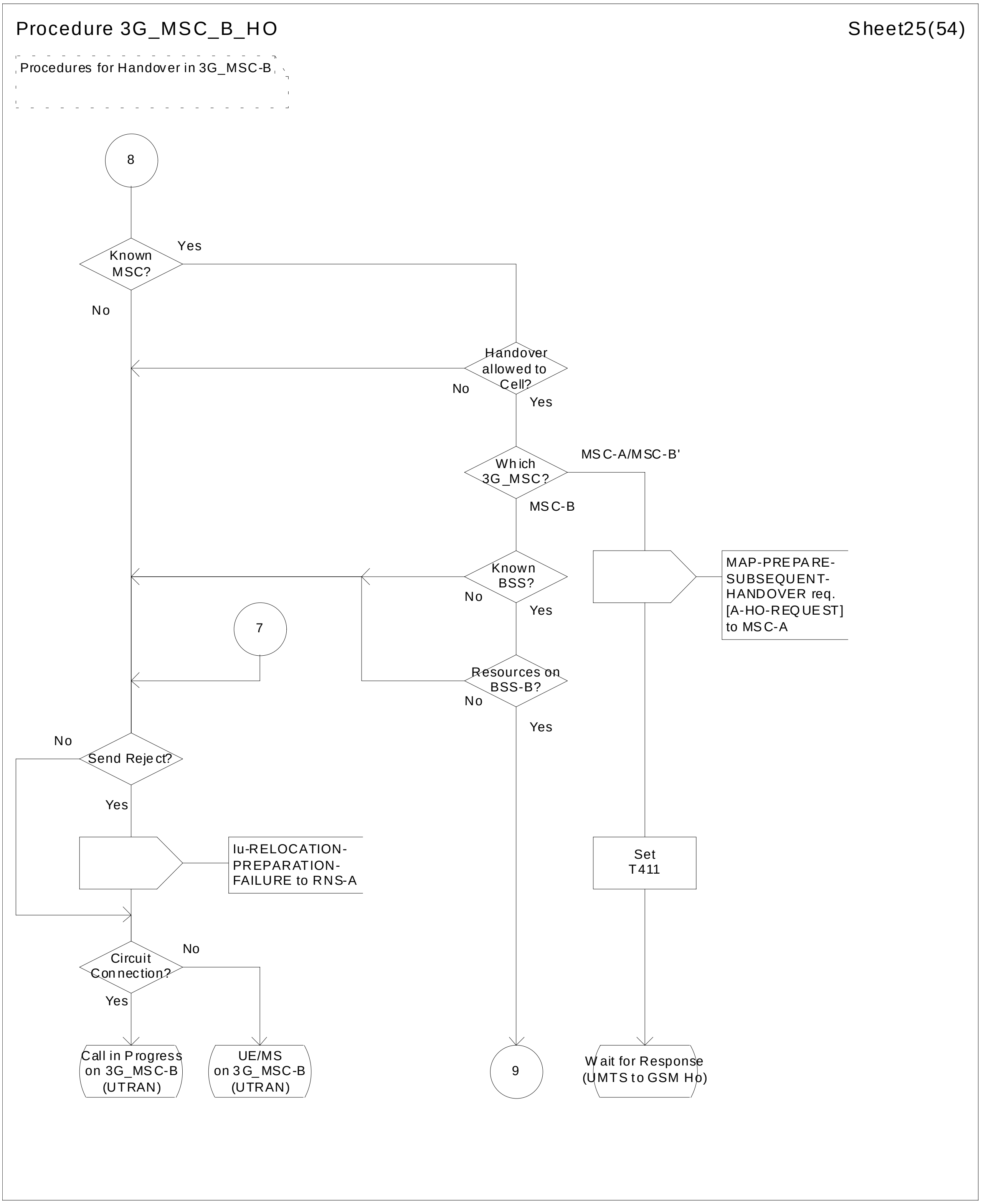


Figure 44 (sheet 25 of 54): Handover control procedure in 3G_MSC-B

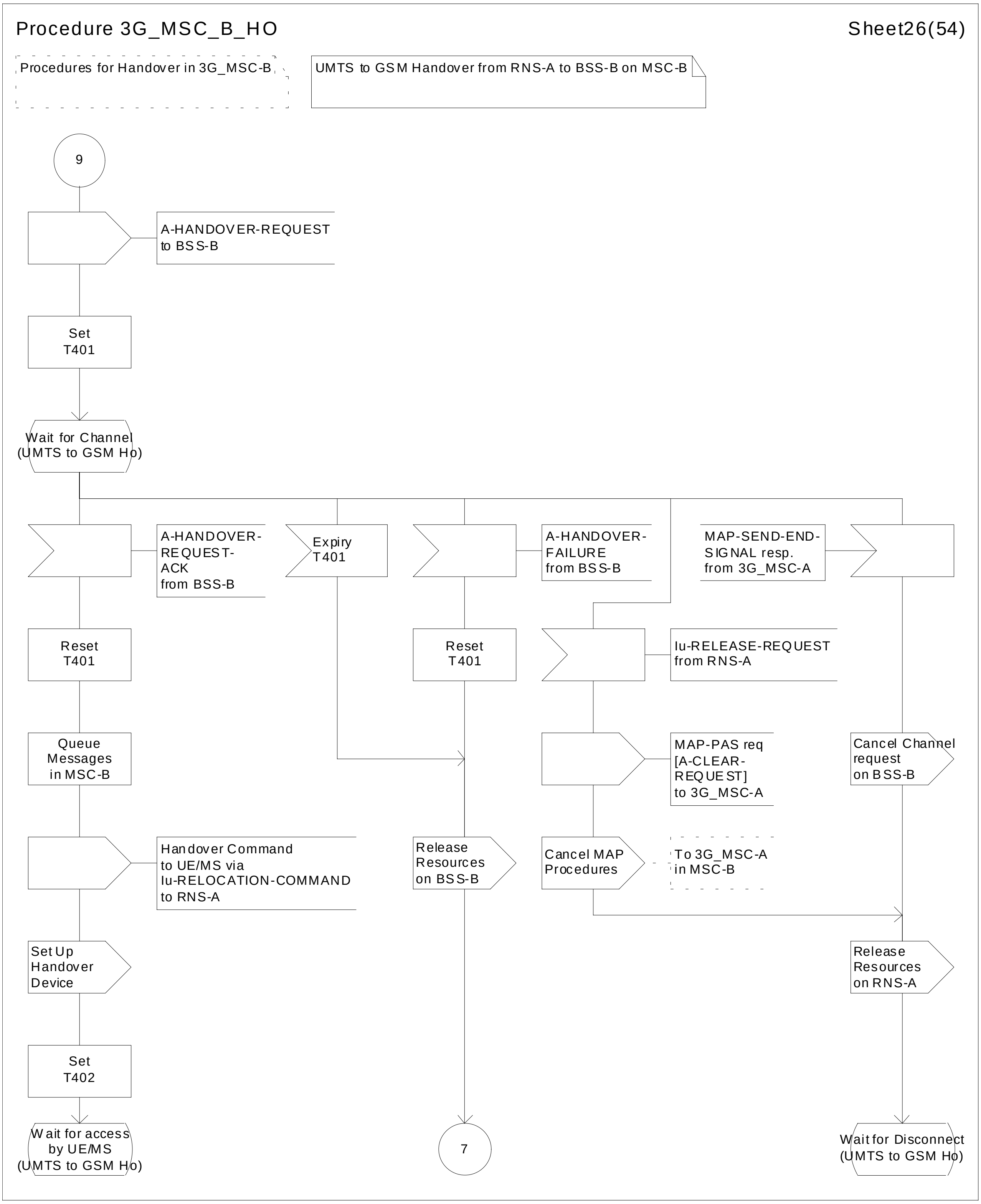


Figure 44 (sheet 26 of 54): Handover control procedure in 3G_MSC-B

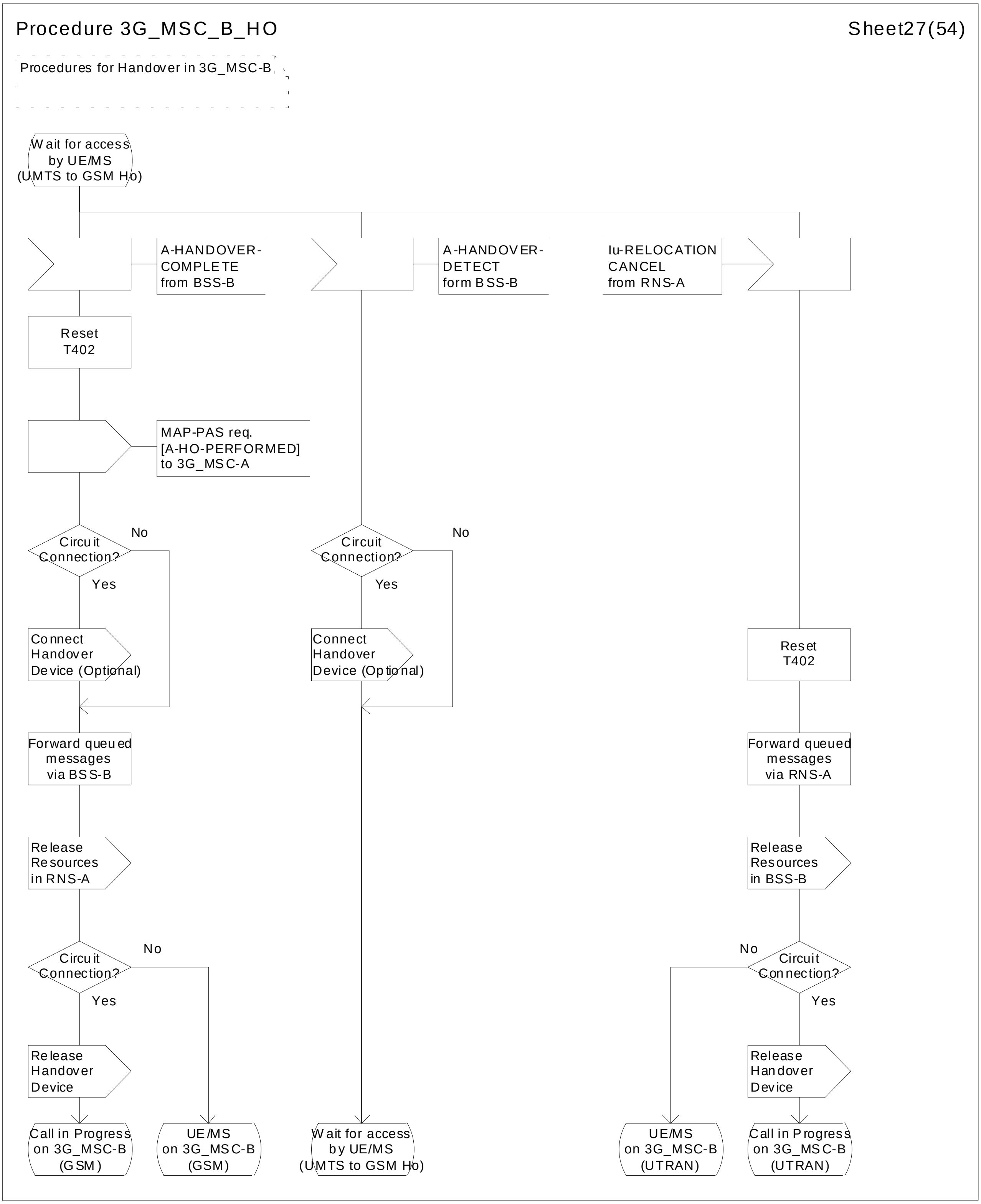


Figure 44 (sheet 27 of 54): Handover control procedure in 3G_MSC-B

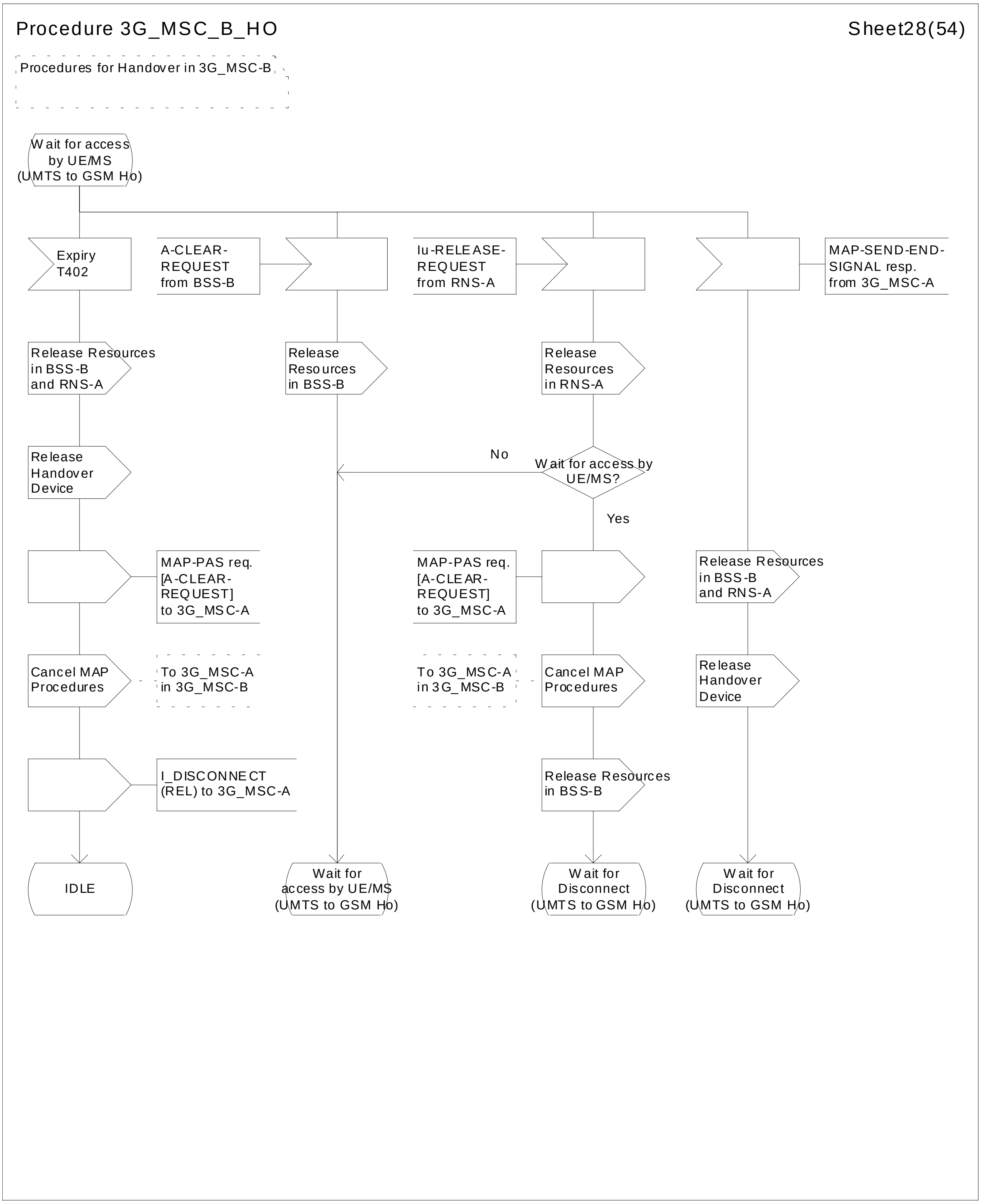


Figure 44 (sheet 28 of 54): Handover control procedure in 3G_MSC-B

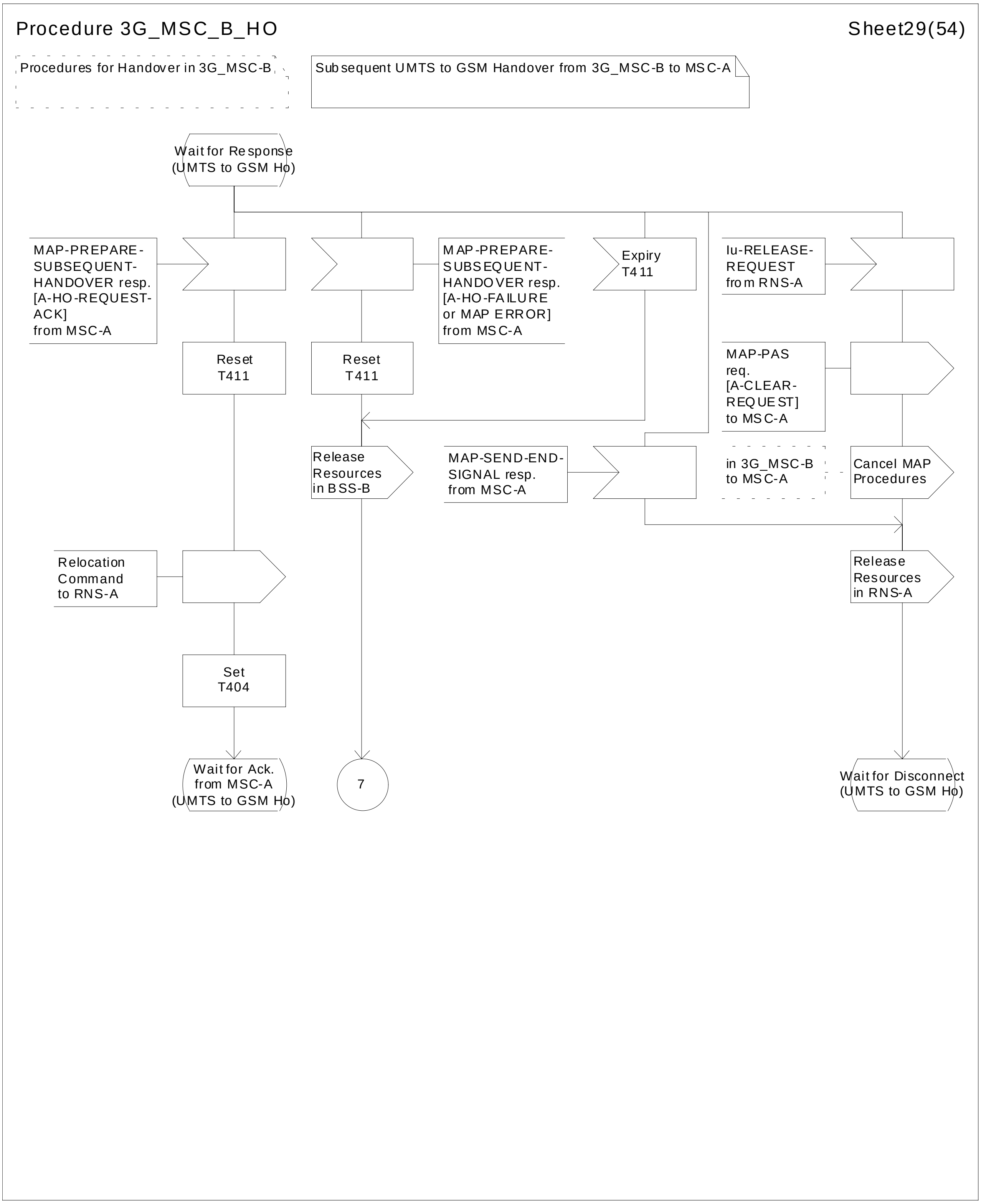


Figure 44 (sheet 29 of 54): Handover control procedure in 3G_MSC-B

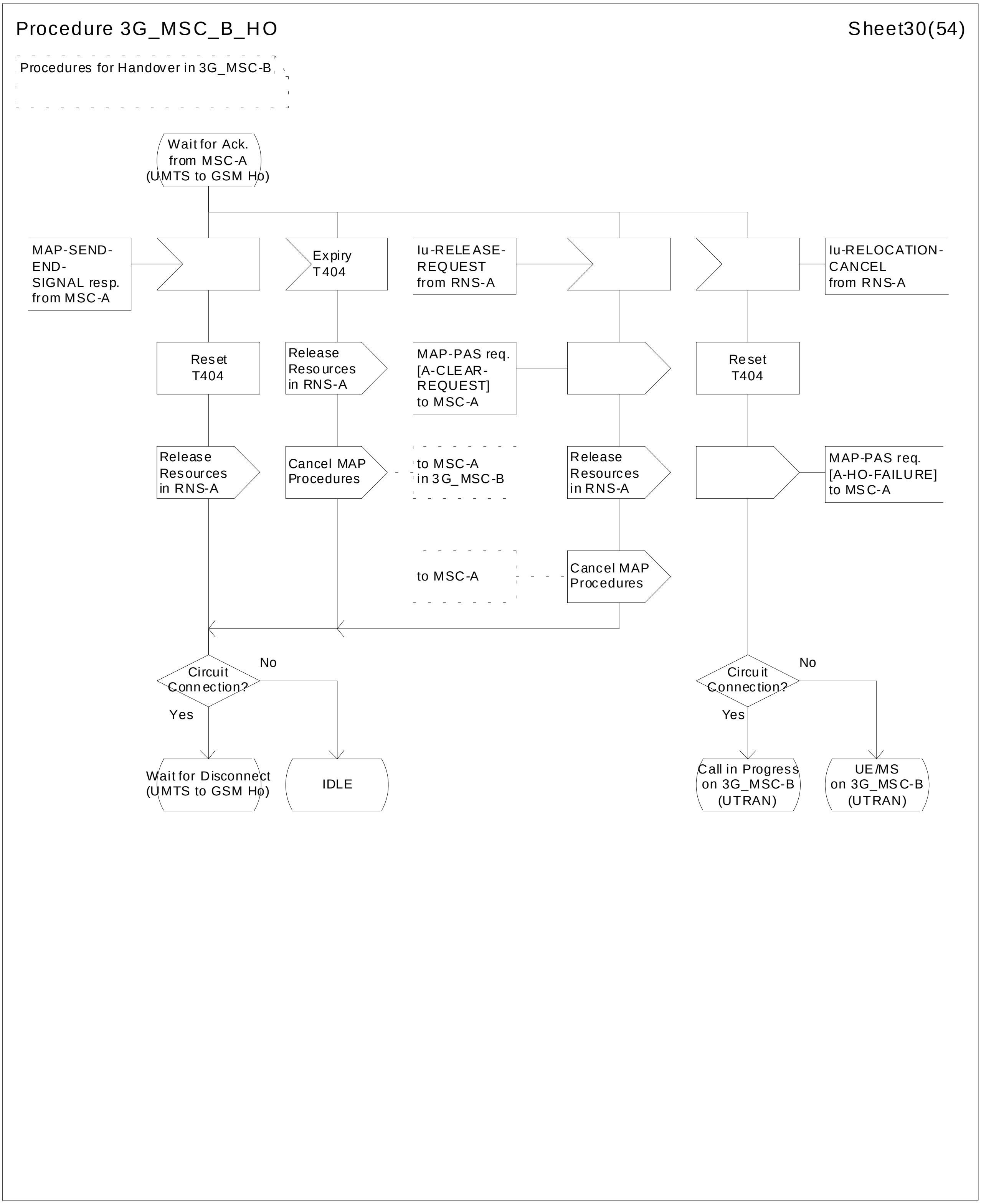


Figure 44 (sheet 30 of 54): Handover control procedure in 3G_MSC-B

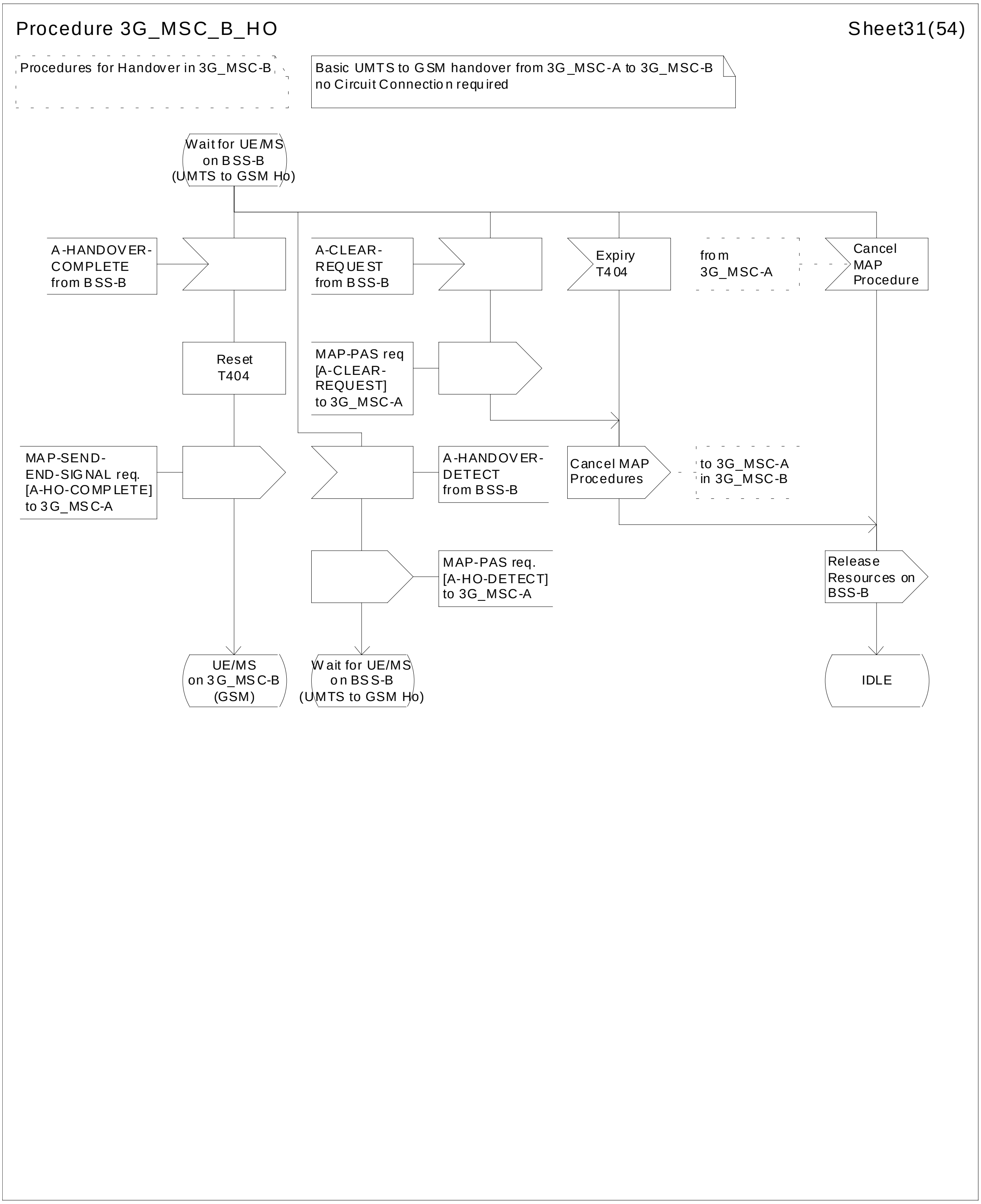


Figure 44 (sheet 31 of 54): Handover control procedure in 3G_MSC-B

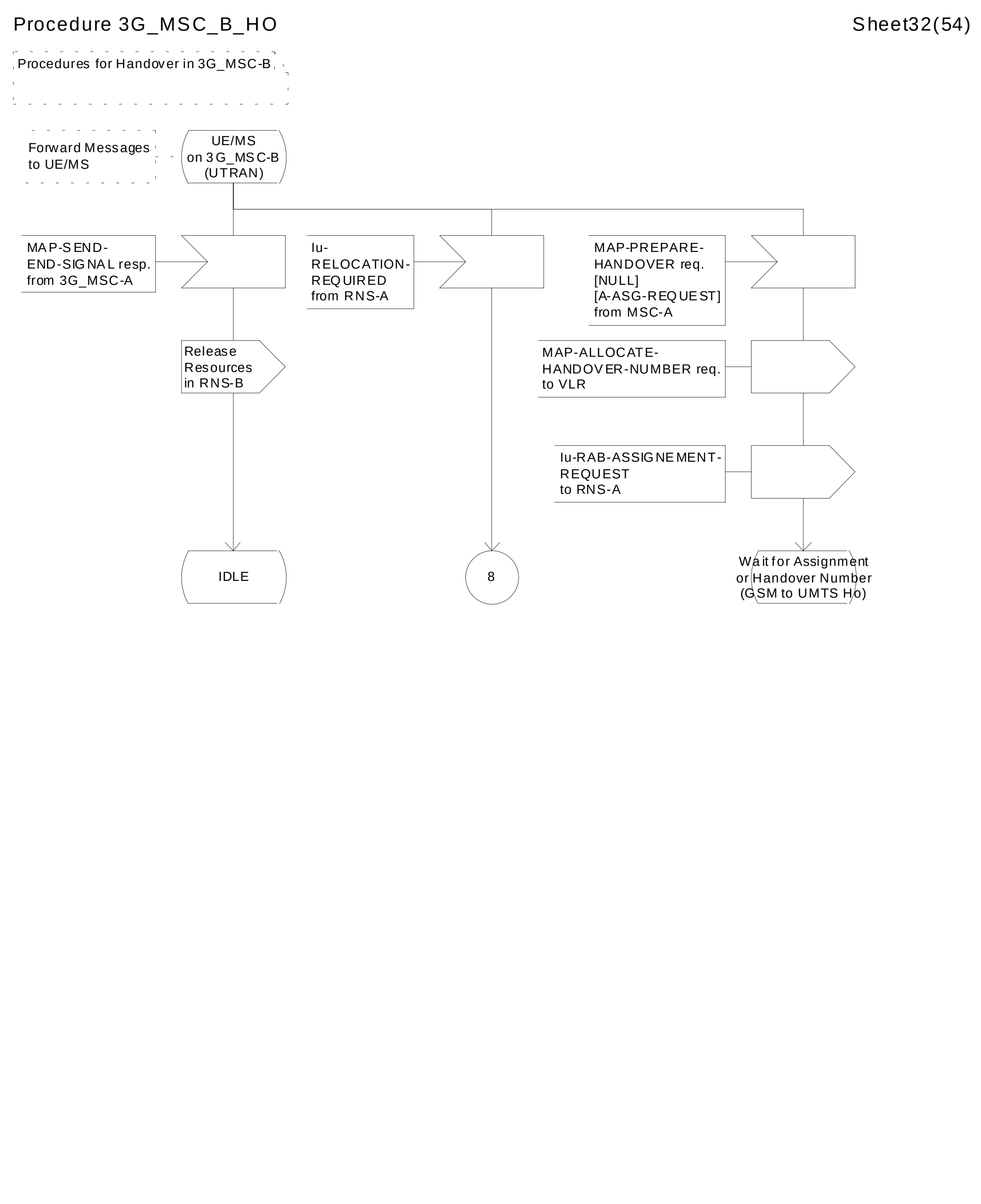


Figure 44 (sheet 32 of 54): Handover control procedure in 3G_MSC-B

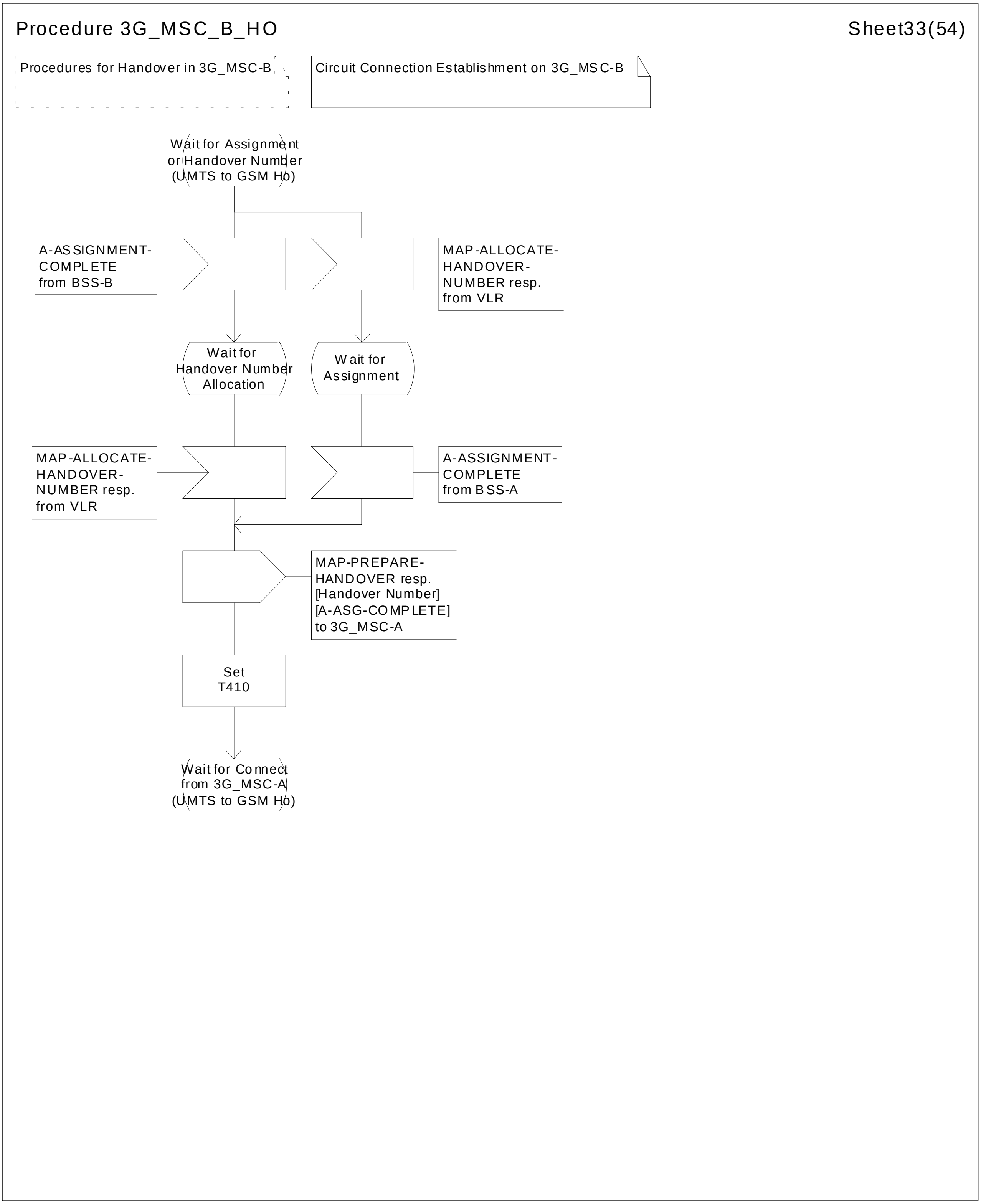


Figure 44 (sheet 33 of 54): Handover control procedure in 3G_MSC-B

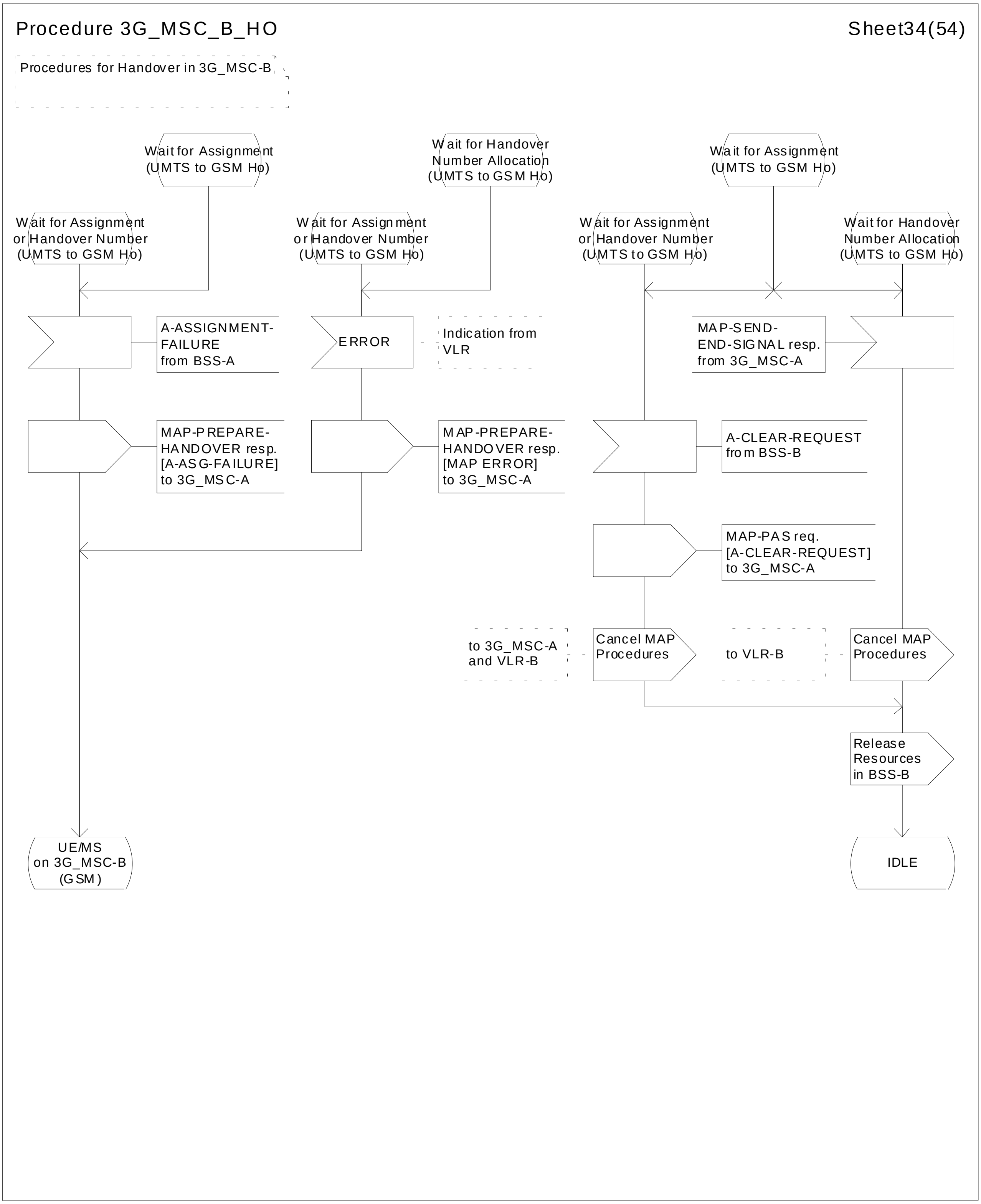


Figure 44 (sheet 34 of 54): Handover control procedure in 3G_MSC-B

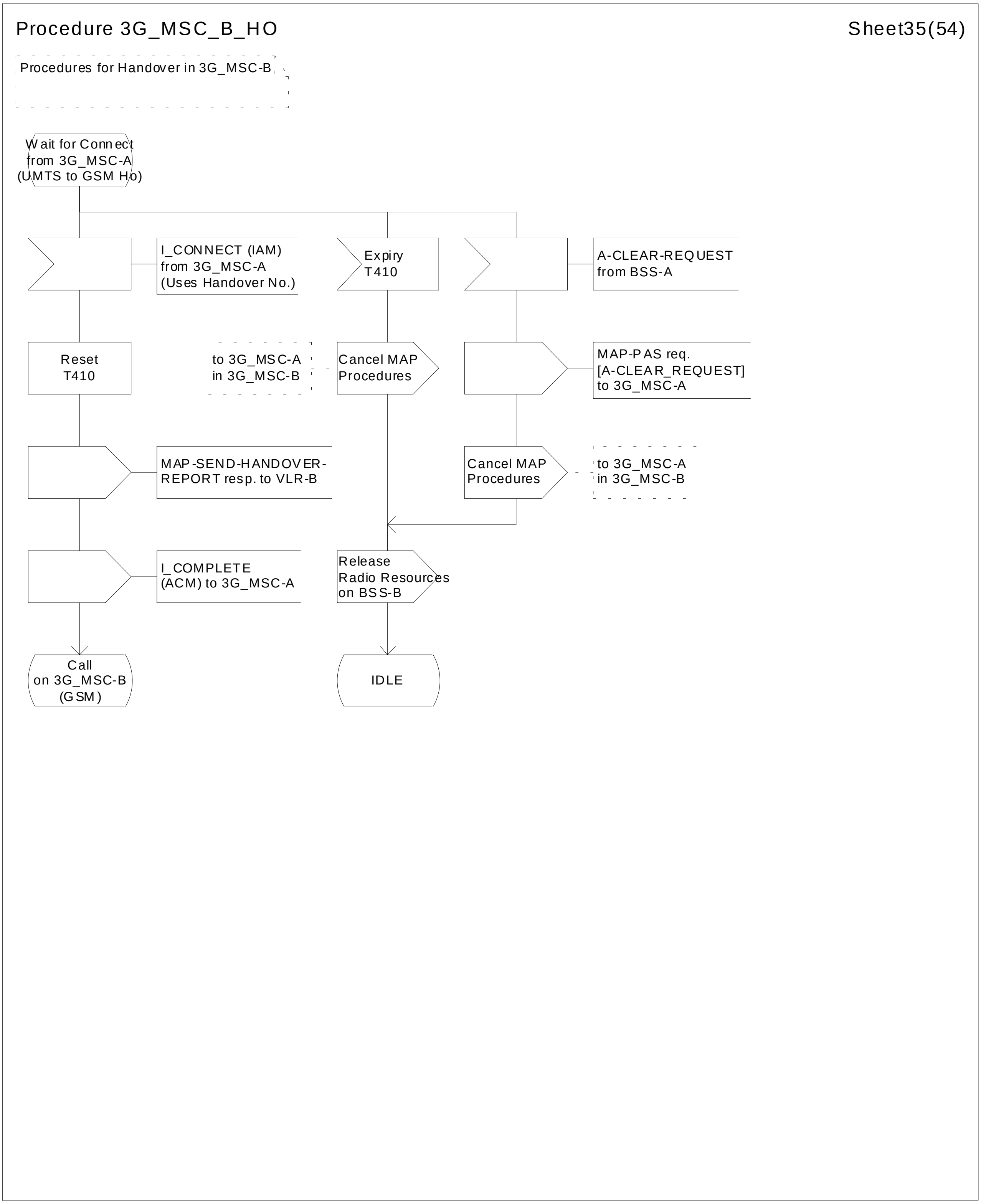


Figure 44 (sheet 35 of 54): Handover control procedure in 3G_MSC-B

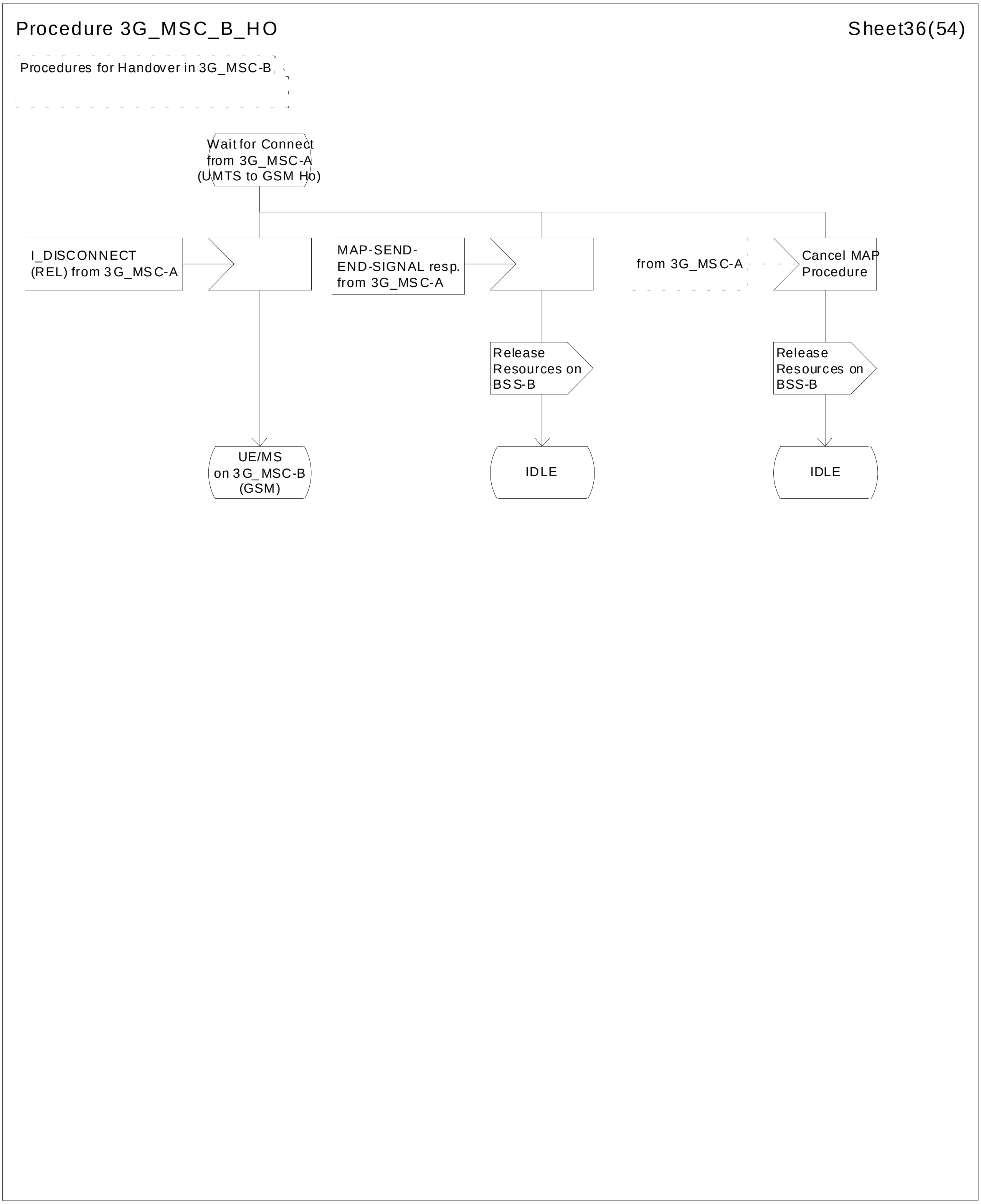


Figure 44 (sheet 36 of 54): Handover control procedure in 3G_MSC-B

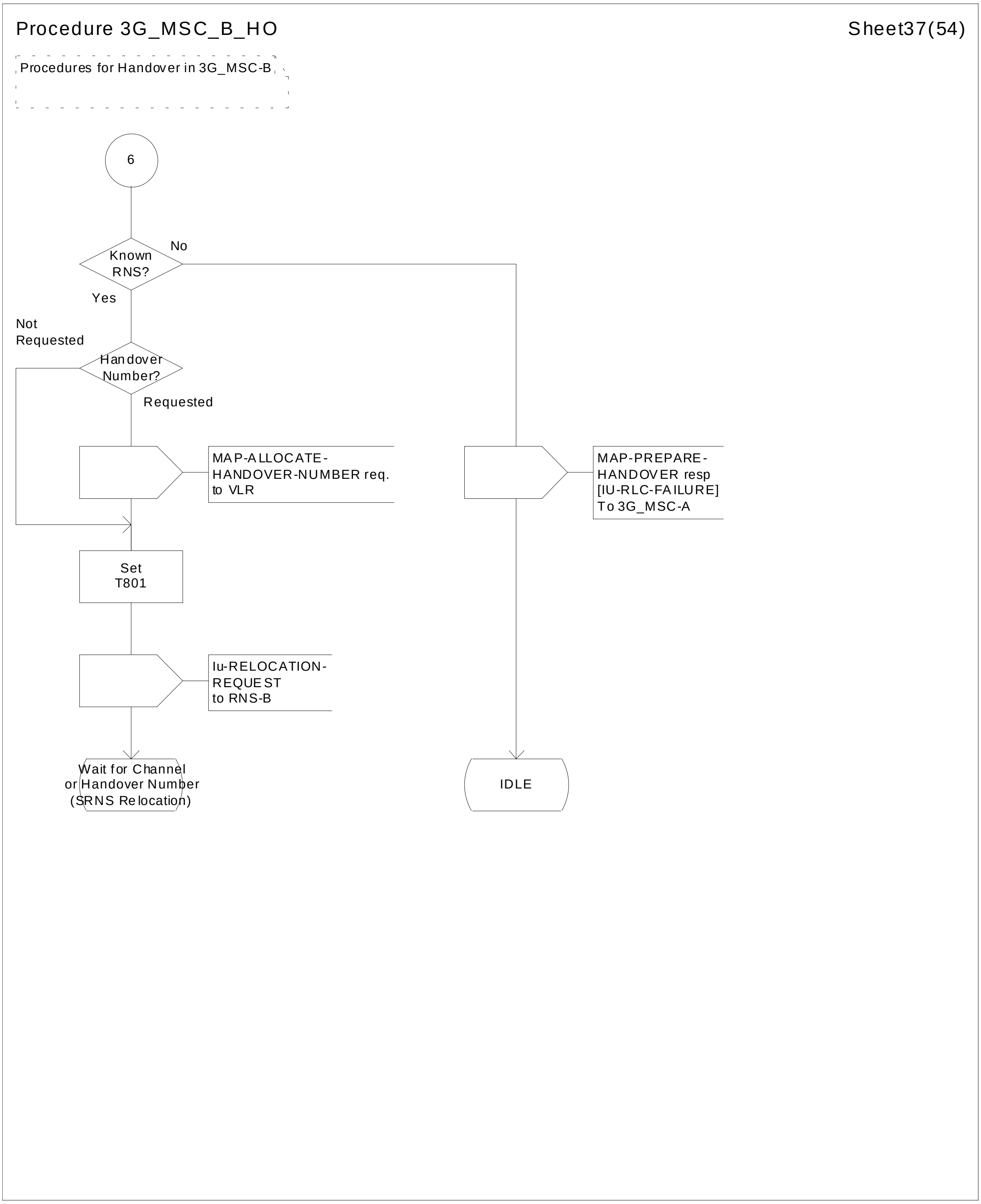


Figure 44 (sheet 37 of 54): Handover control procedure in 3G_MSC-B

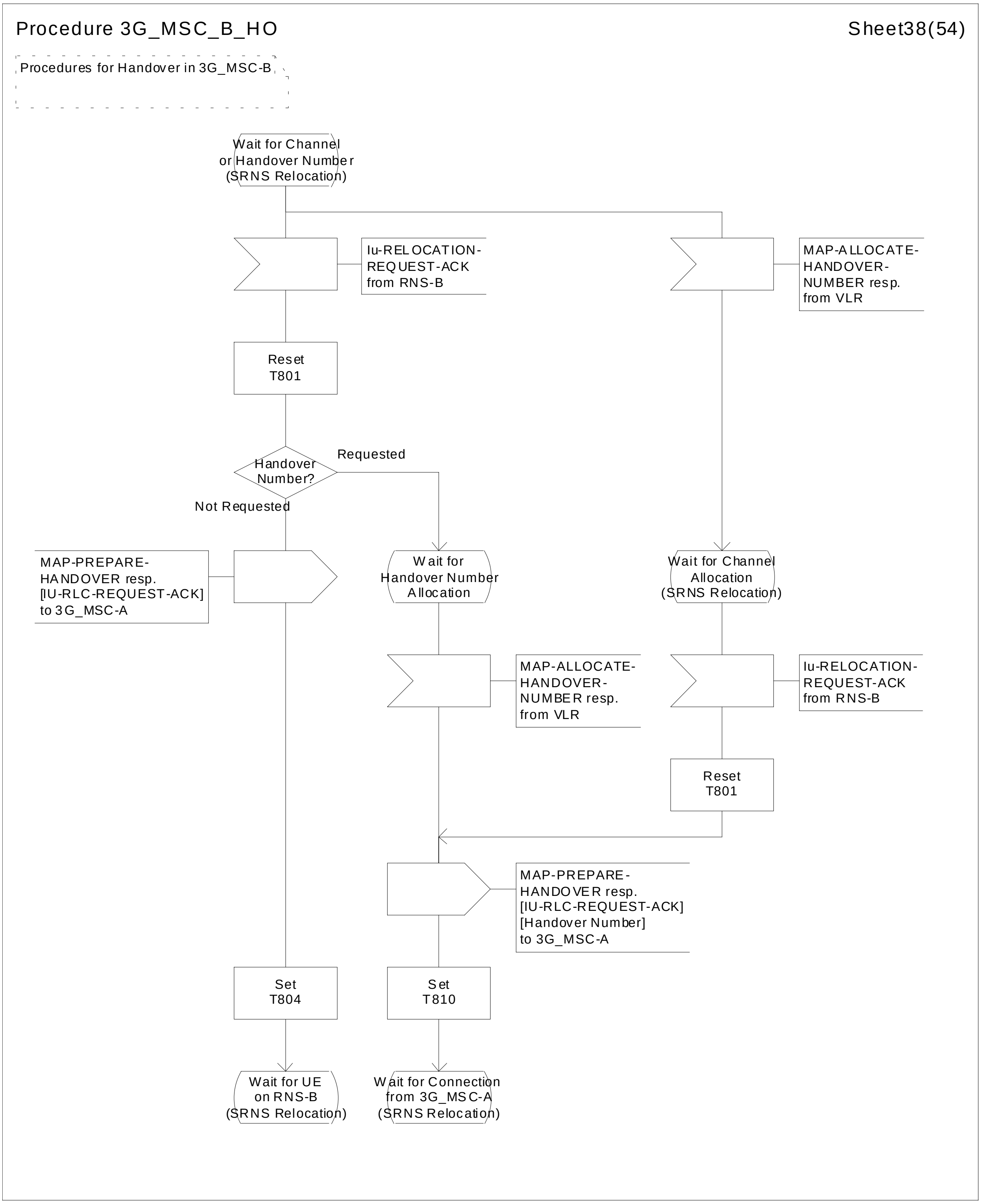


Figure 44 (sheet 38 of 54): Handover control procedure in 3G_MSC-B

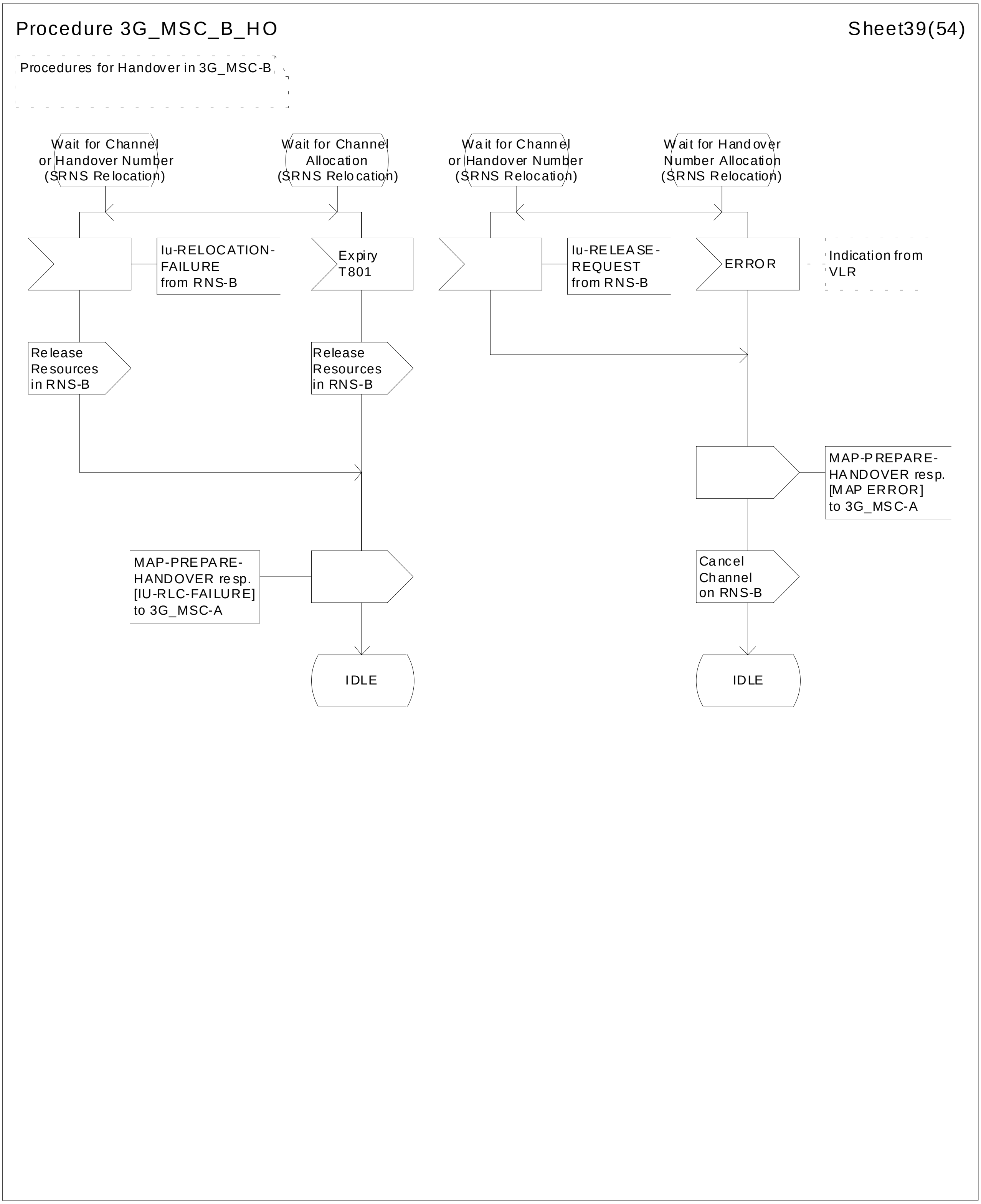


Figure 44 (sheet 39 of 54): Handover control procedure in 3G_MSC-B

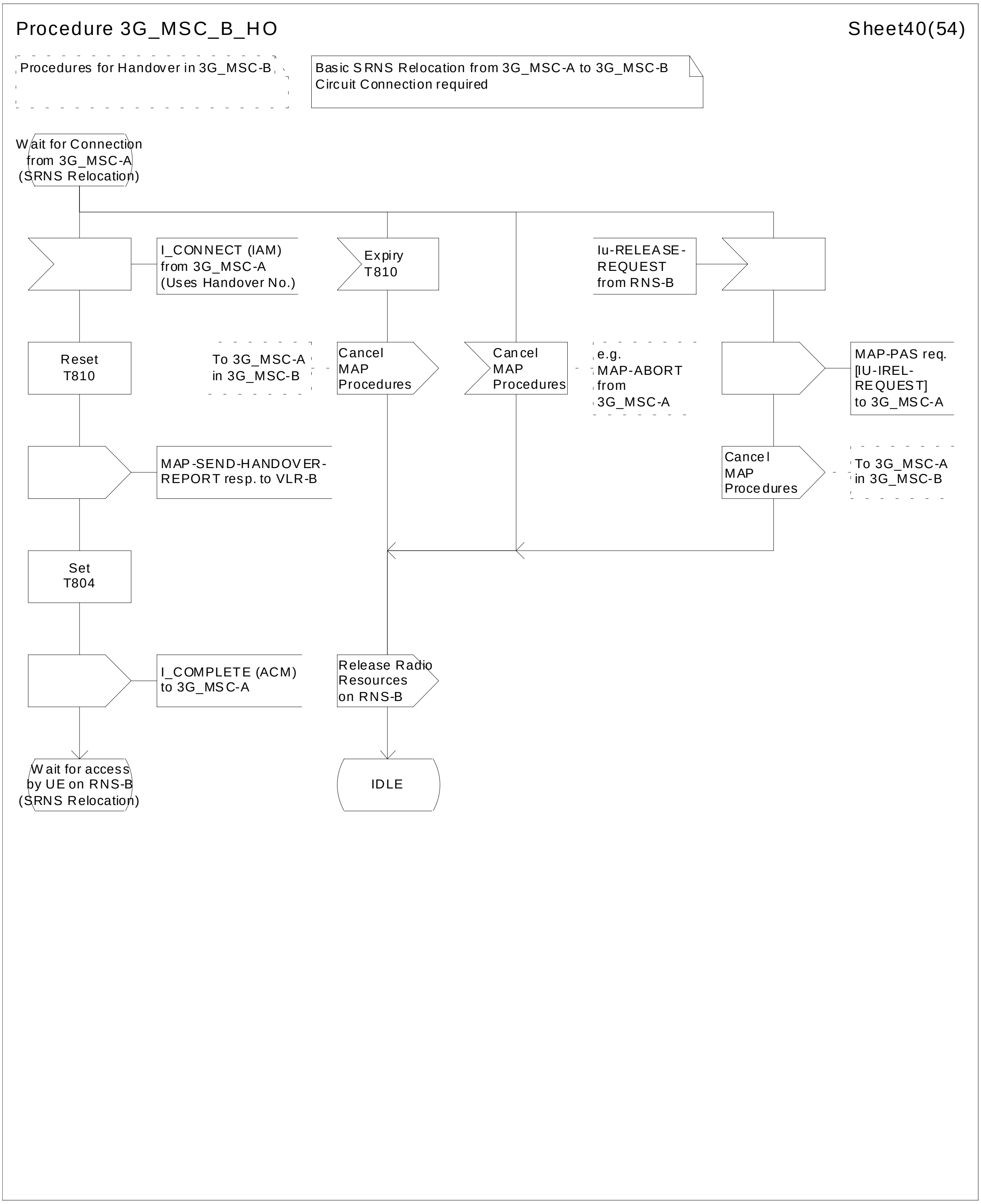


Figure 44 (sheet 40 of 54): Handover control procedure in 3G_MSC-B

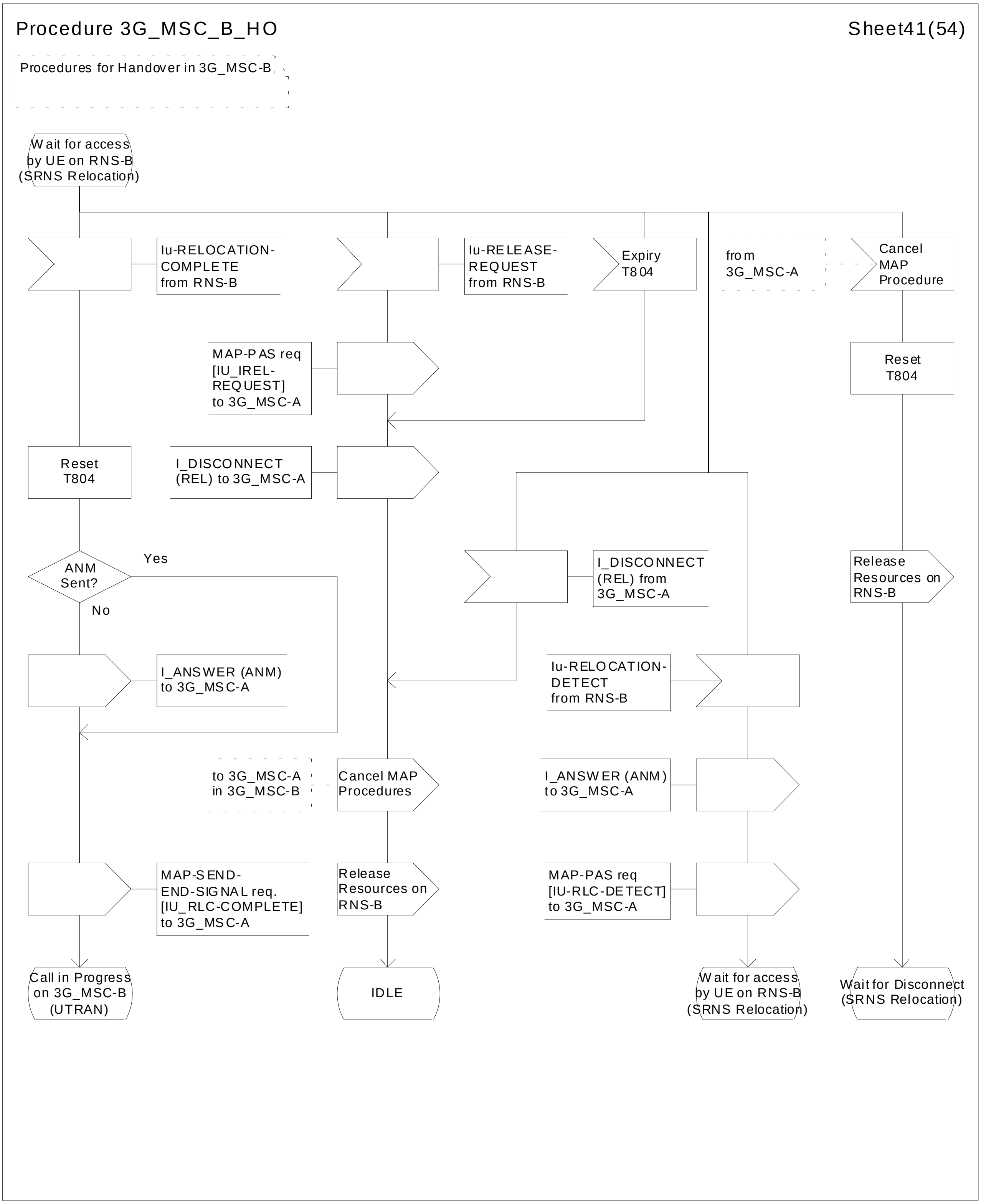


Figure 44 (sheet 41 of 54): Handover control procedure in 3G_MSC-B

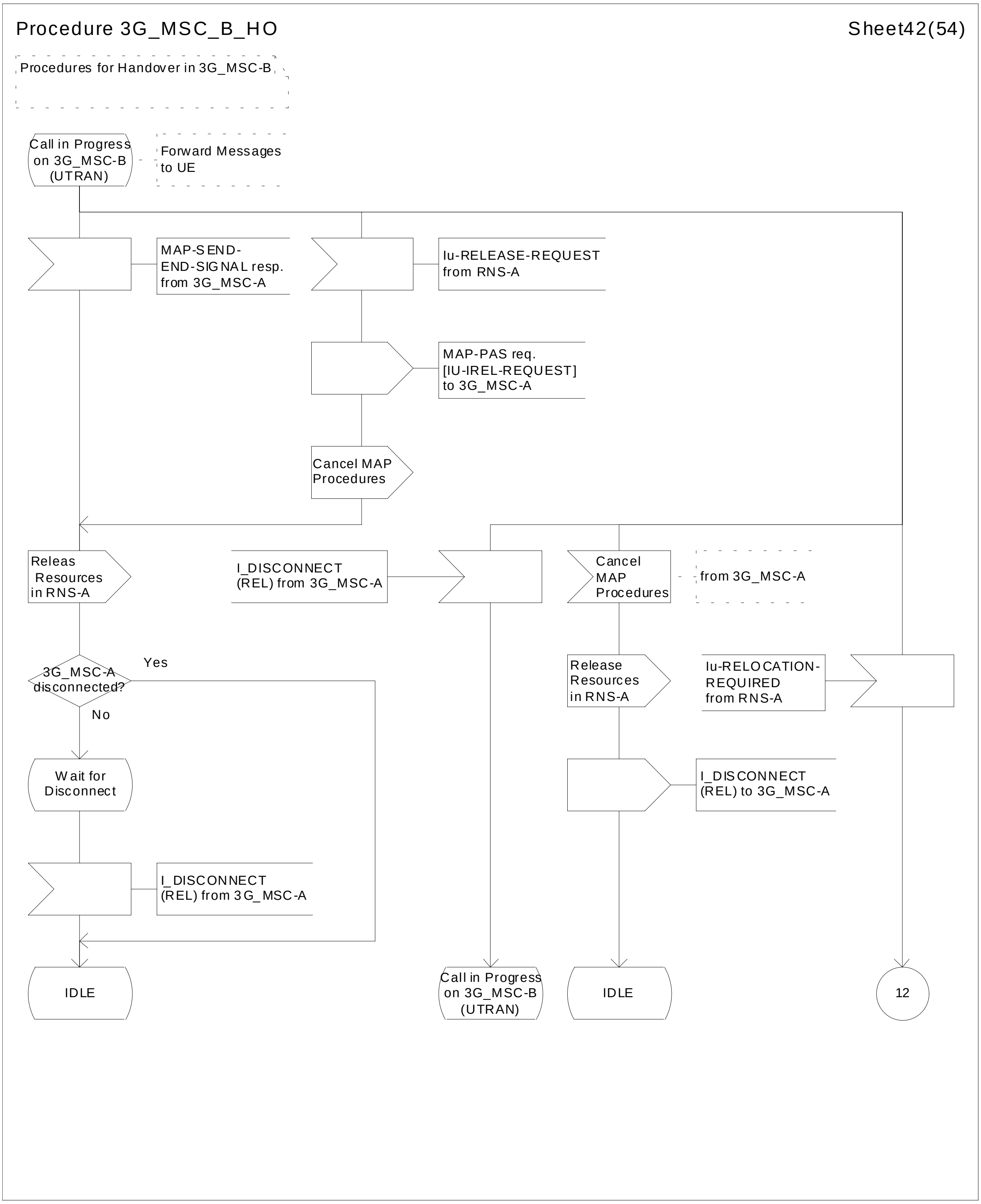


Figure 44 (sheet 42 of 54): Handover control procedure in 3G_MSC-B

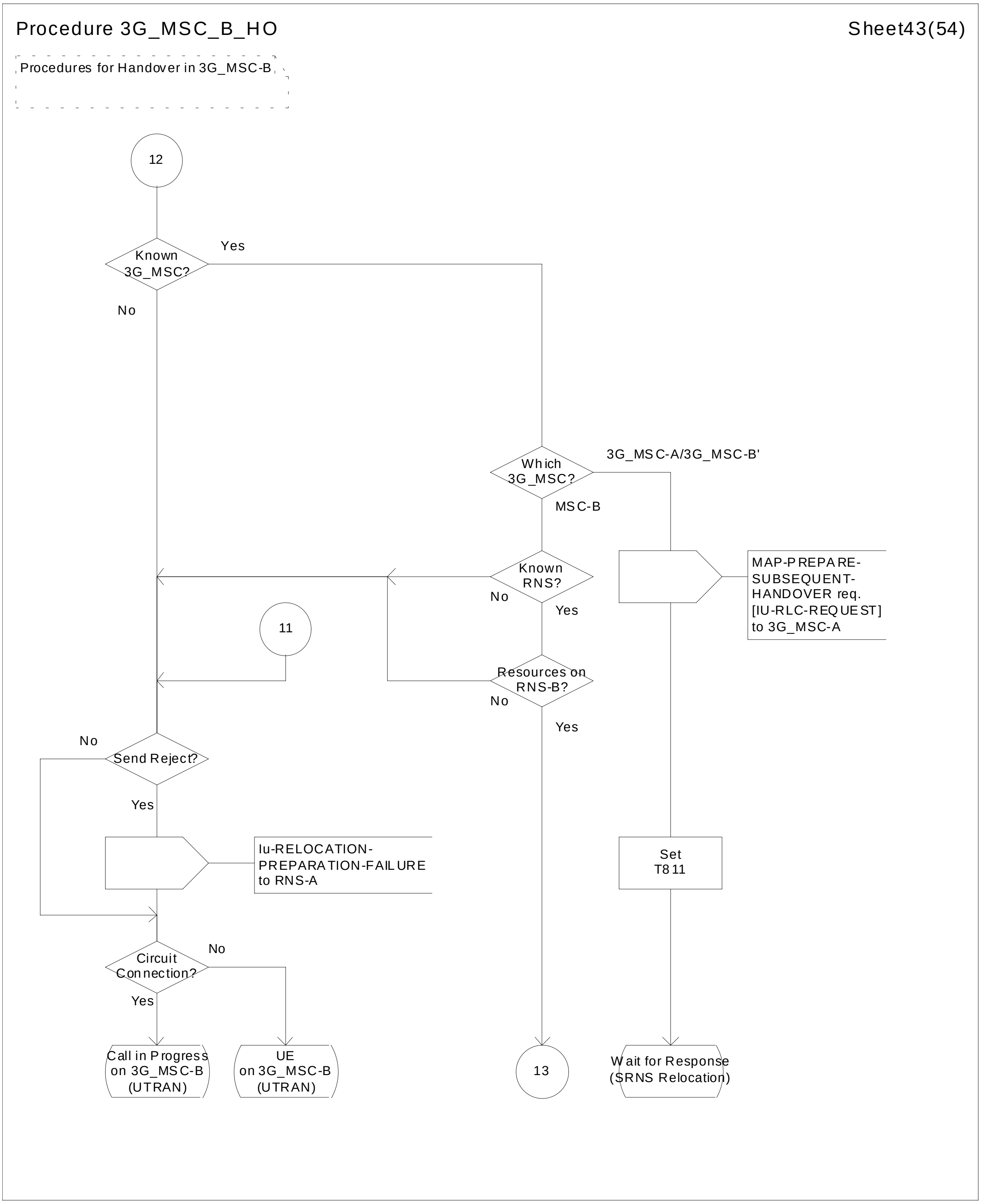


Figure 44 (sheet 43 of 54): Handover control procedure in 3G_MSC-B

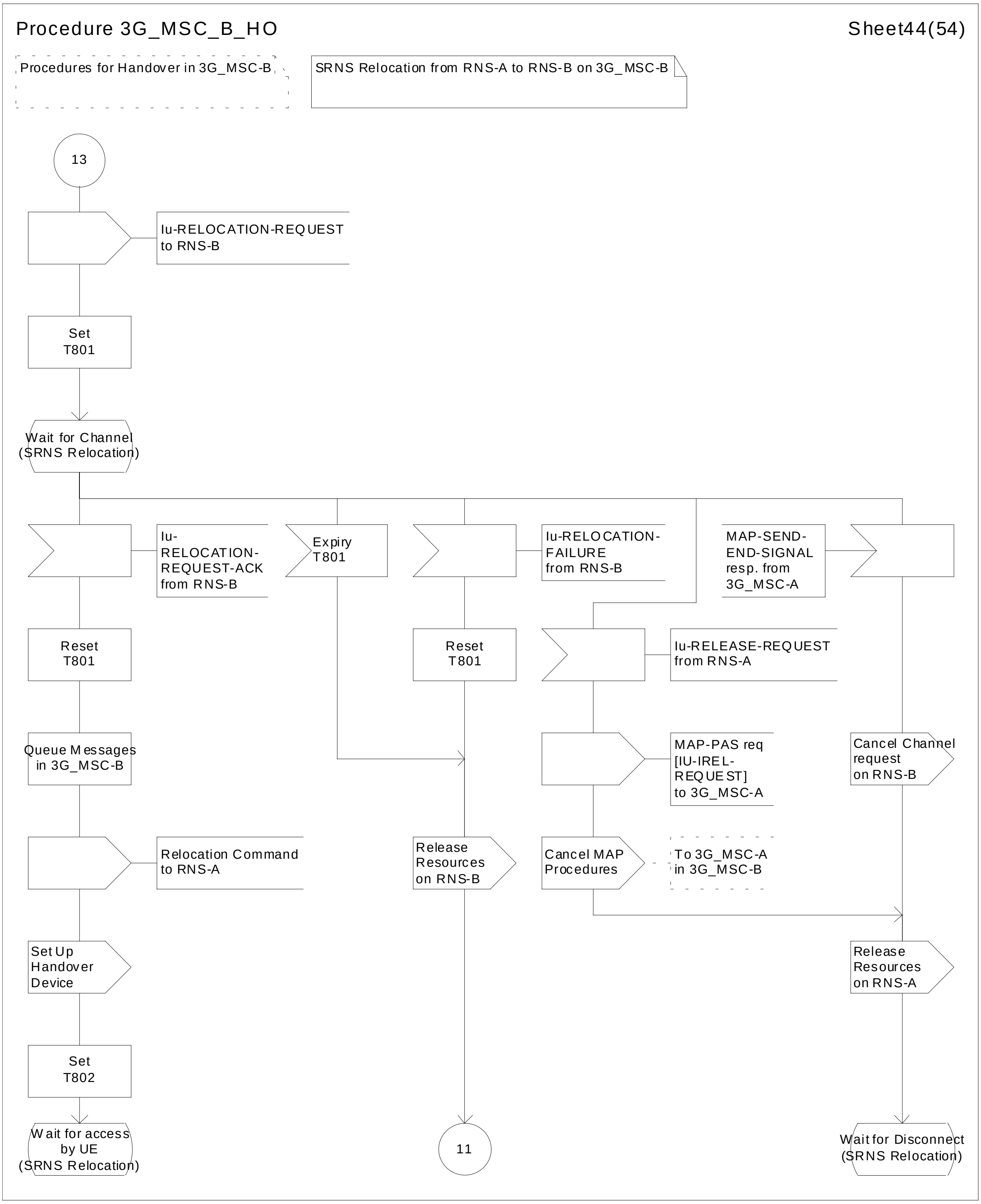


Figure 44 (sheet 44 of 54): Handover control procedure in 3G_MSC-B

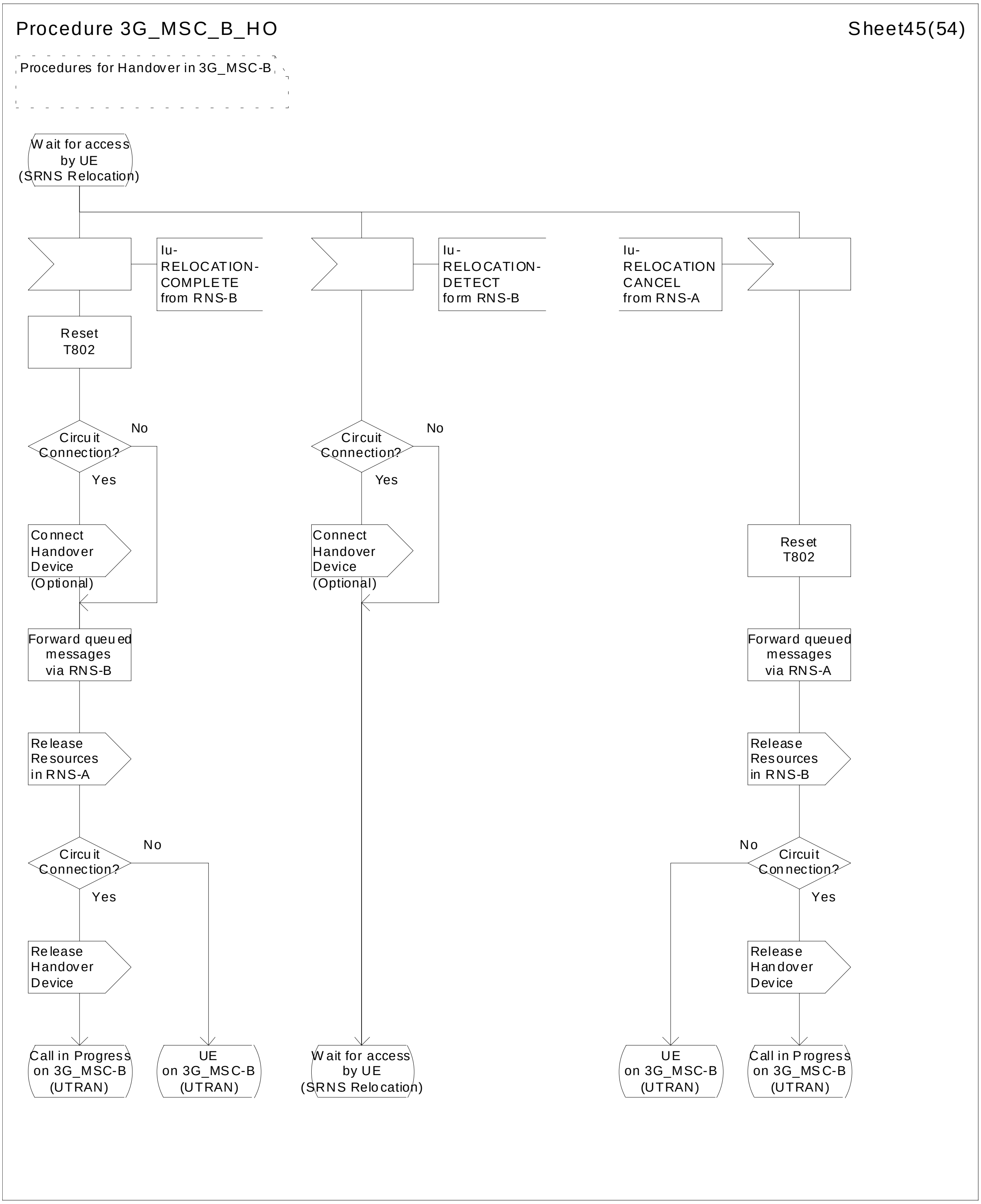


Figure 44 (sheet 45 of 54): Handover control procedure in 3G_MSC-B

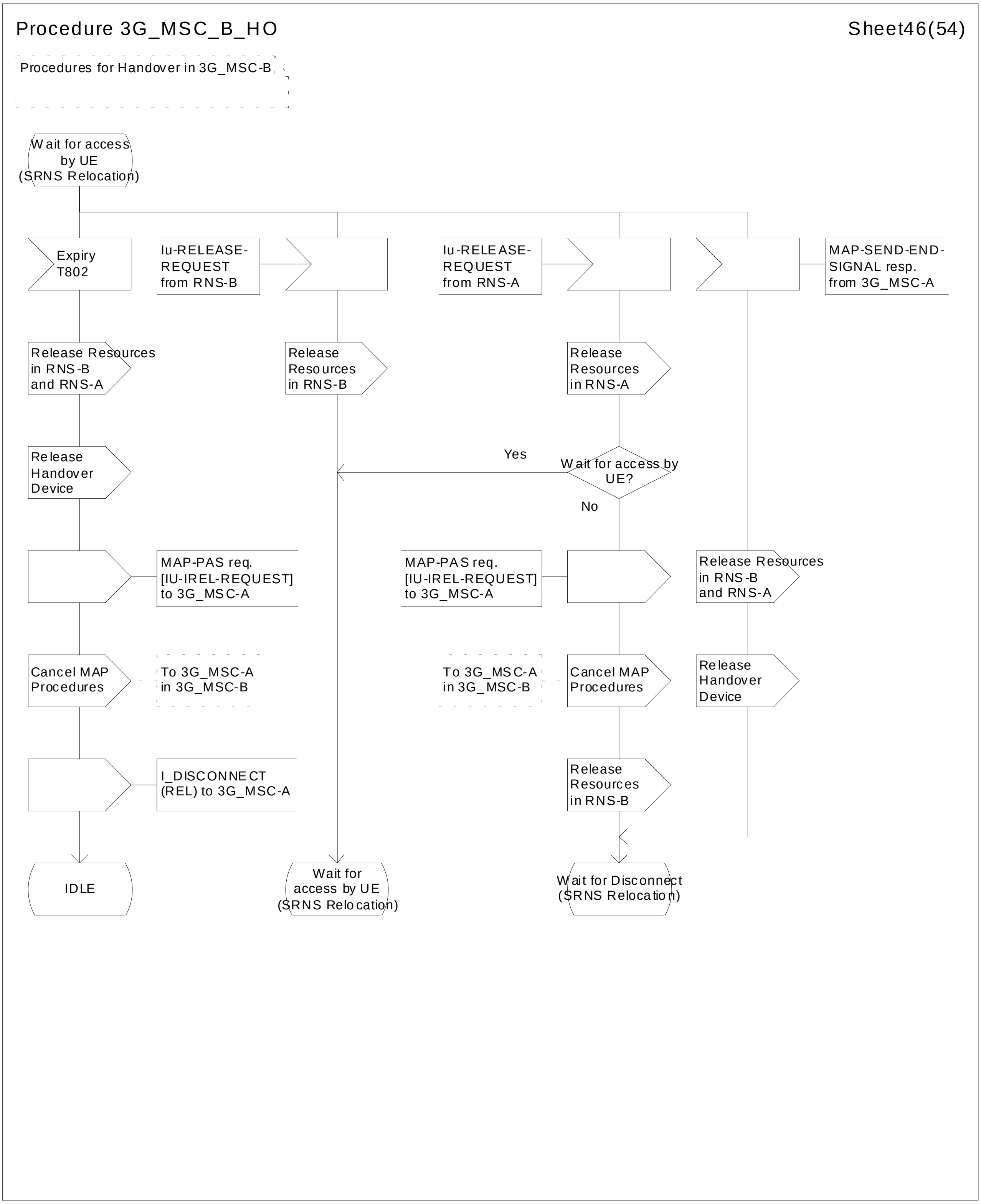


Figure 44 (sheet 46 of 54): Handover control procedure in 3G_MSC-B

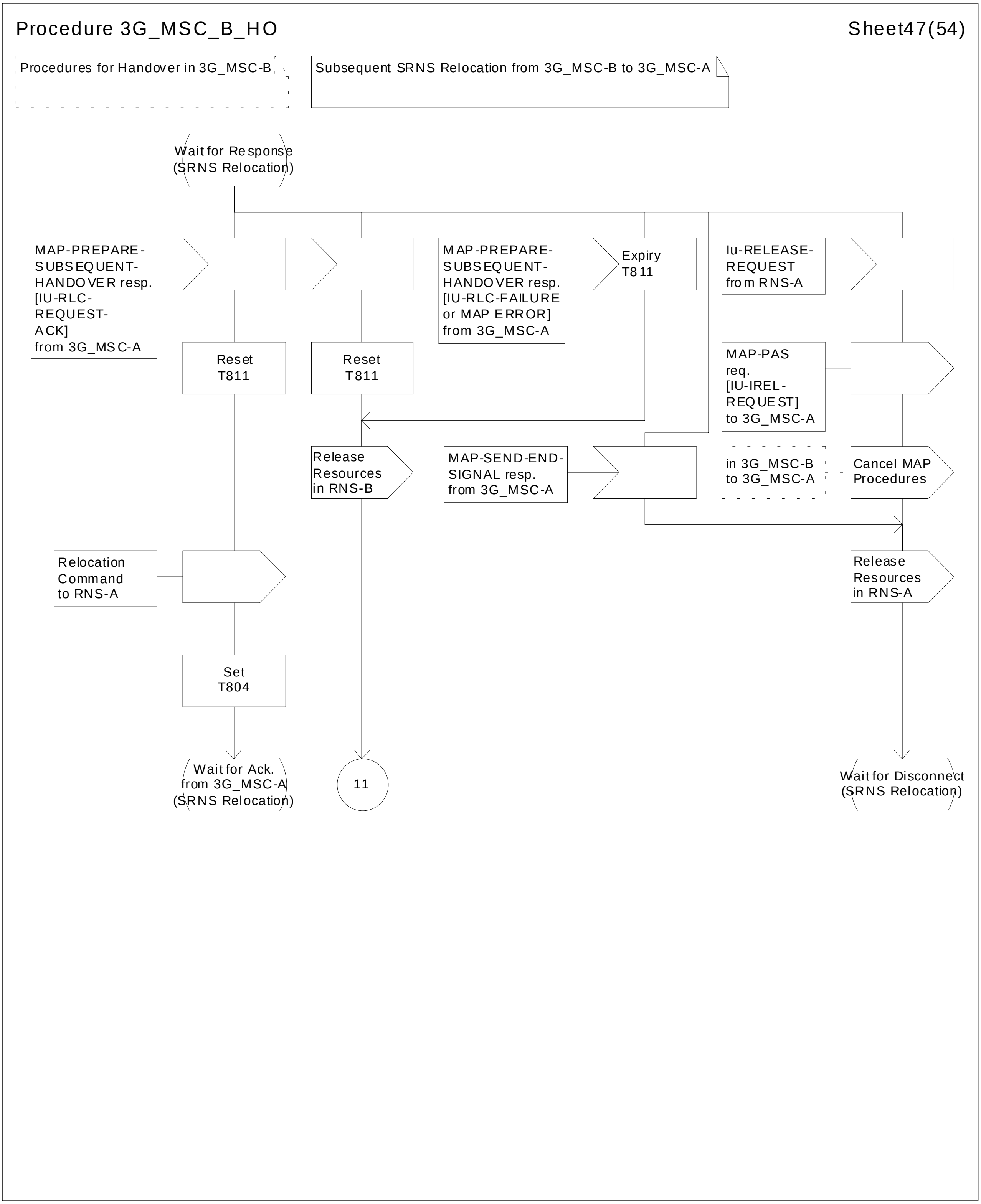


Figure 44 (sheet 47 of 54): Handover control procedure in 3G_MSC-B

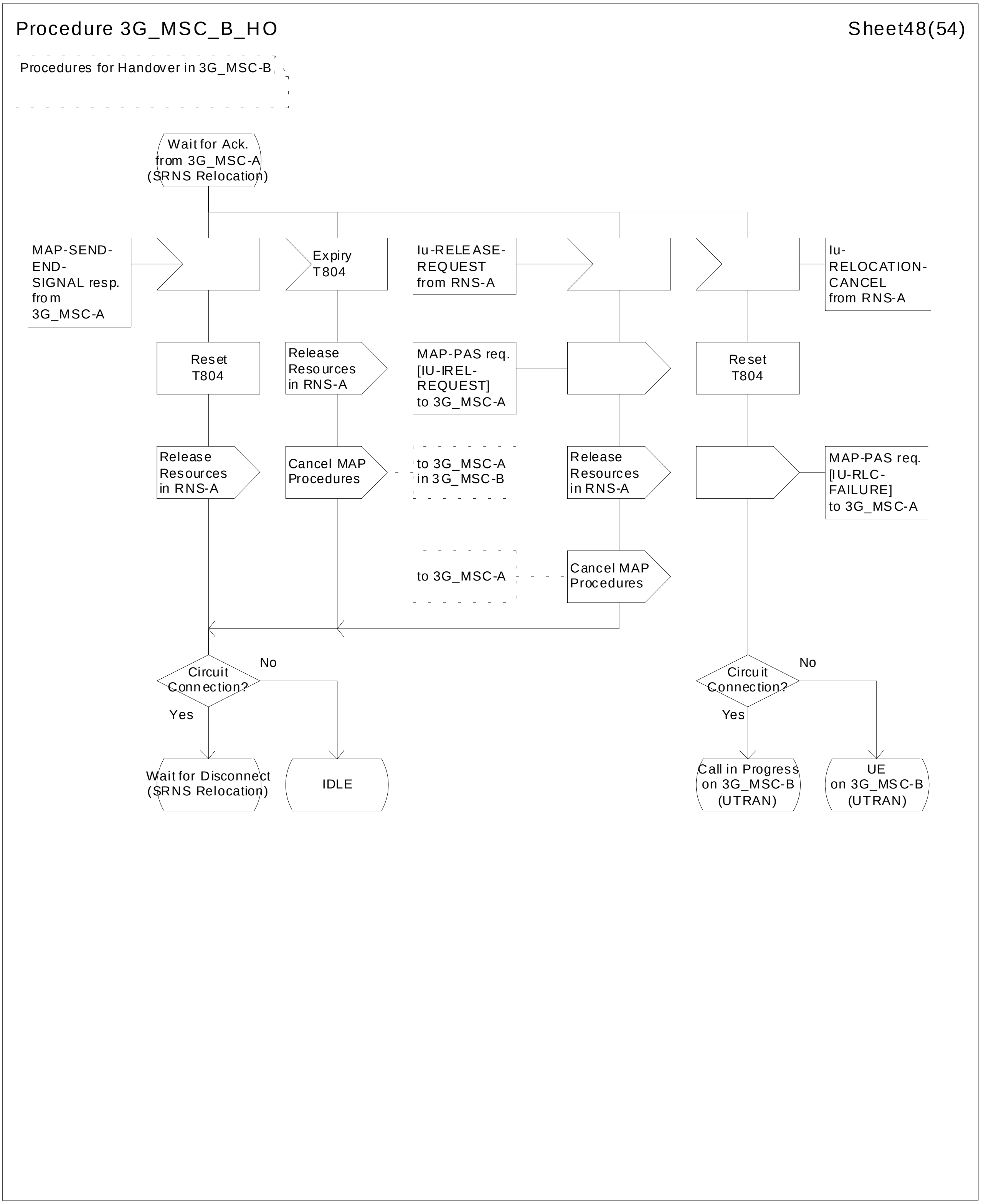


Figure 44 (sheet 48 of 54): Handover control procedure in 3G_MSC-B

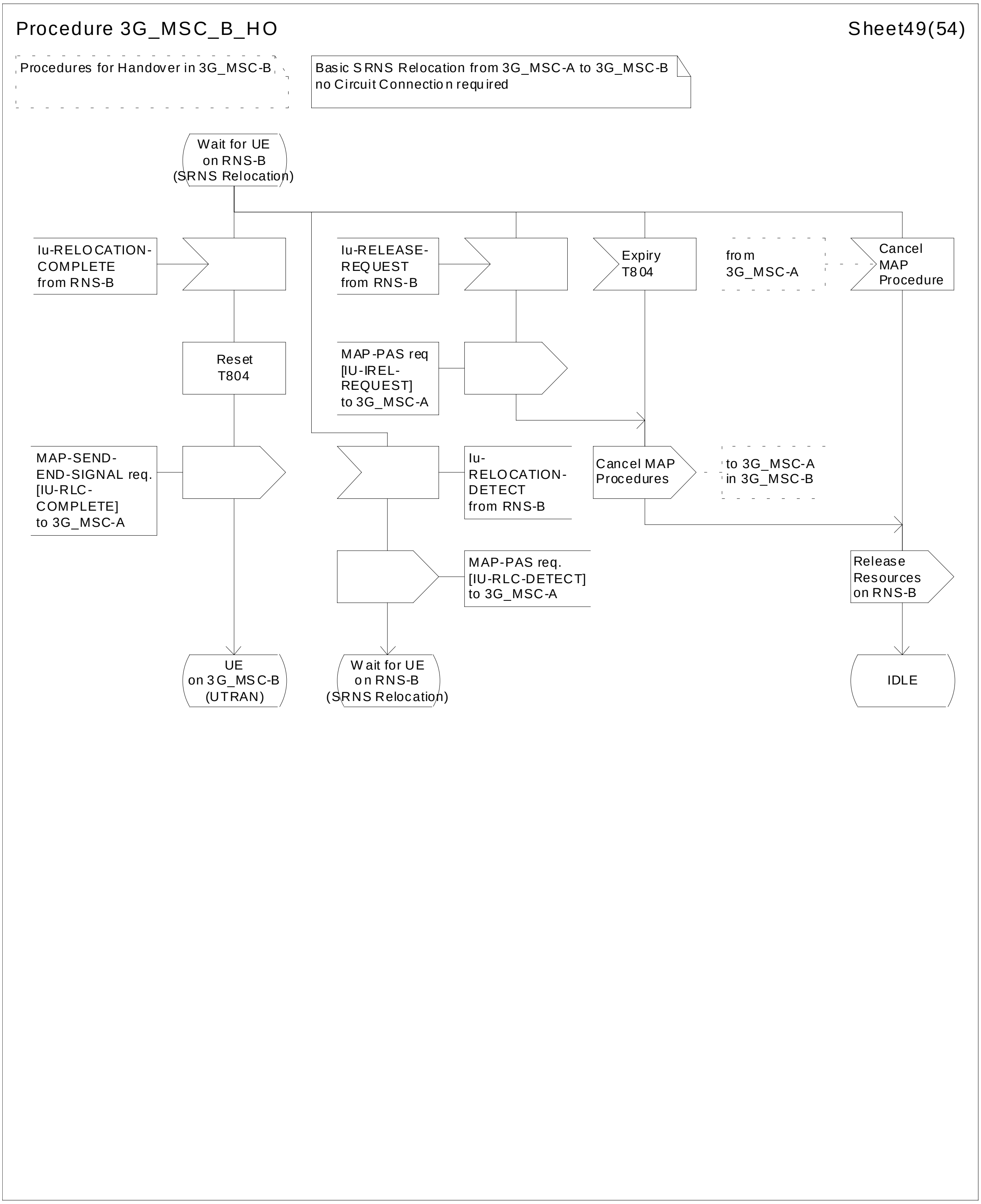


Figure 44 (sheet 49 of 54): Handover control procedure in 3G_MSC-B

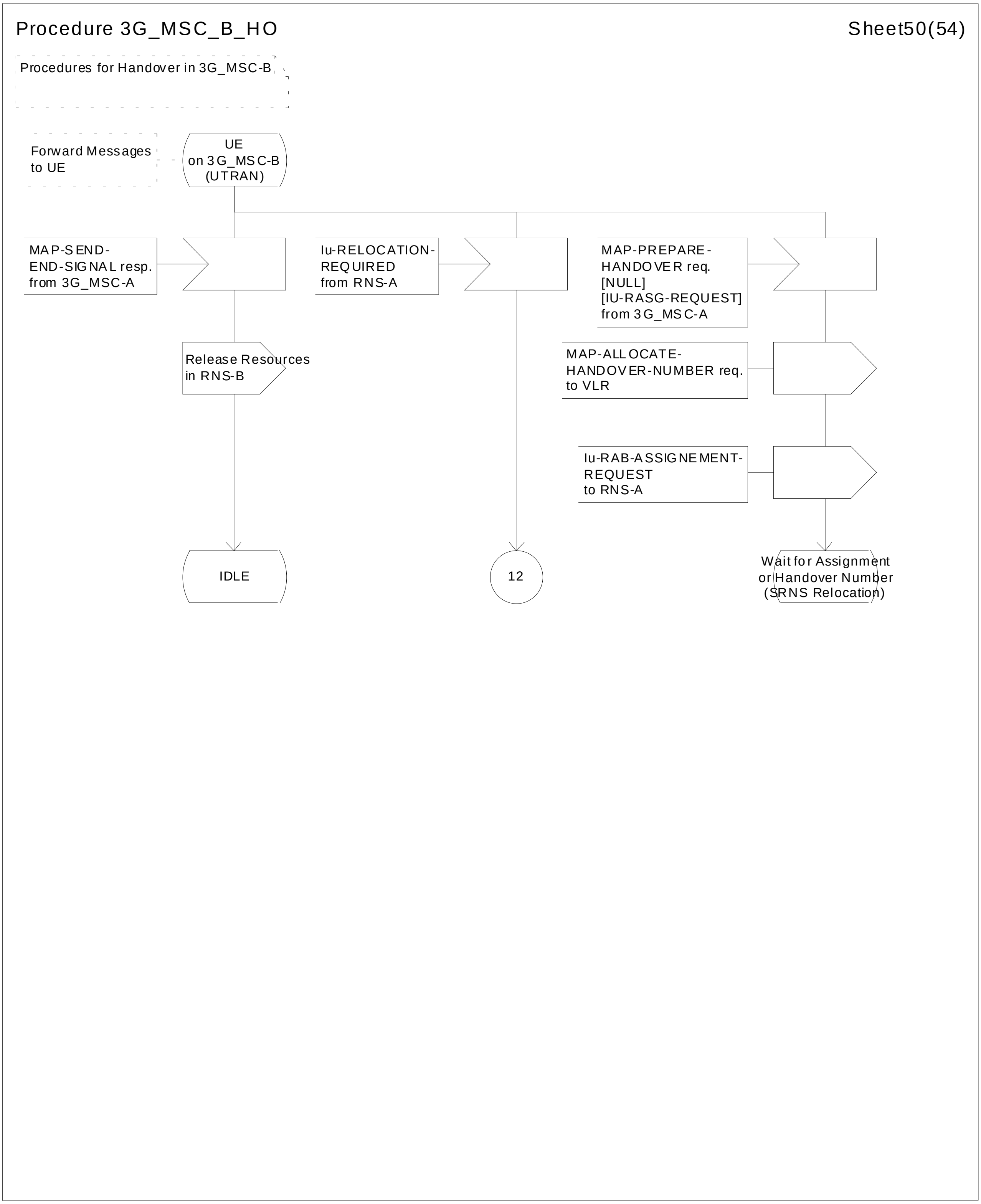


Figure 44 (sheet 50 of 54): Handover control procedure in 3G_MSC-B

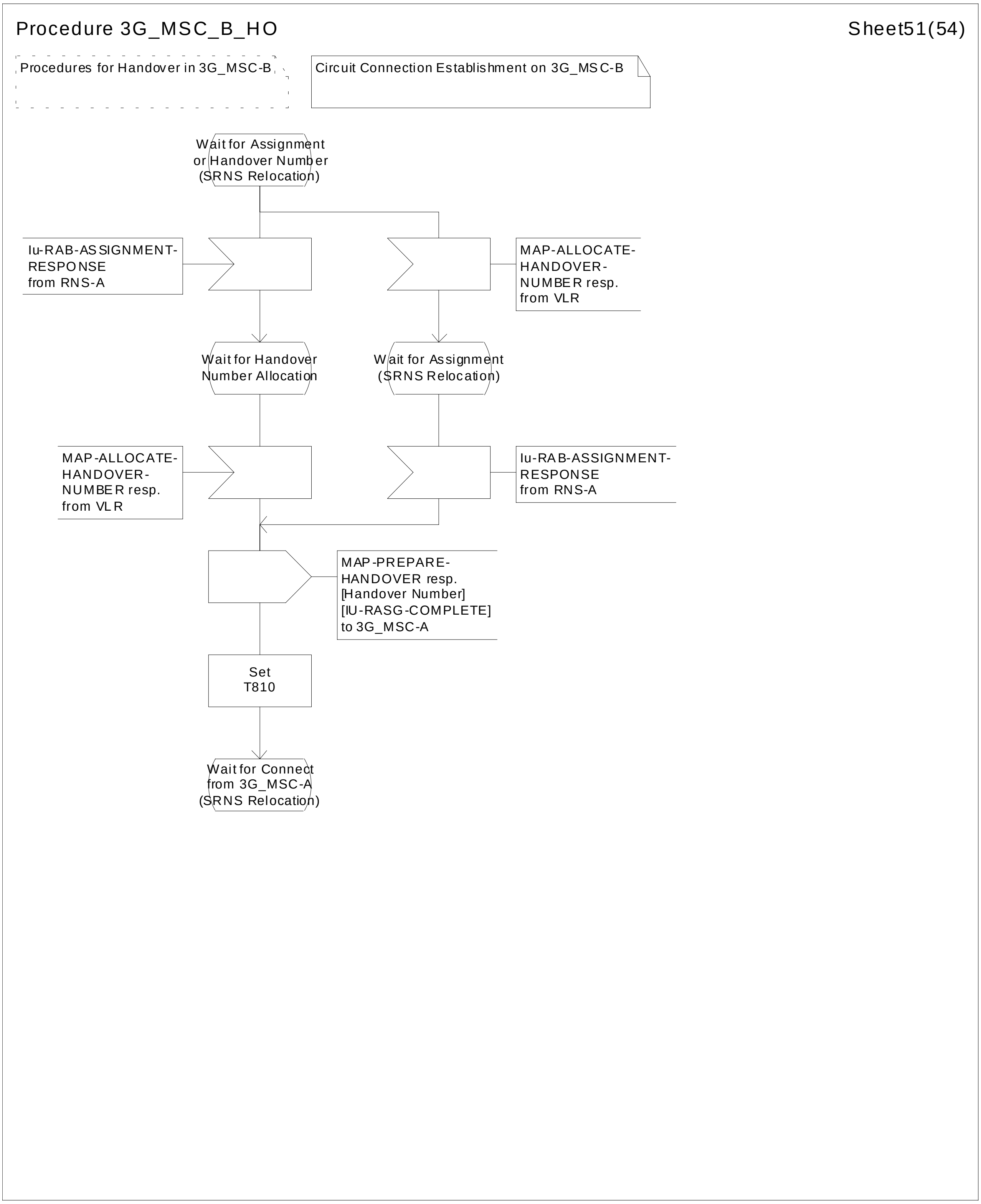


Figure 44 (sheet 51 of 54): Handover control procedure in 3G_MSC-B

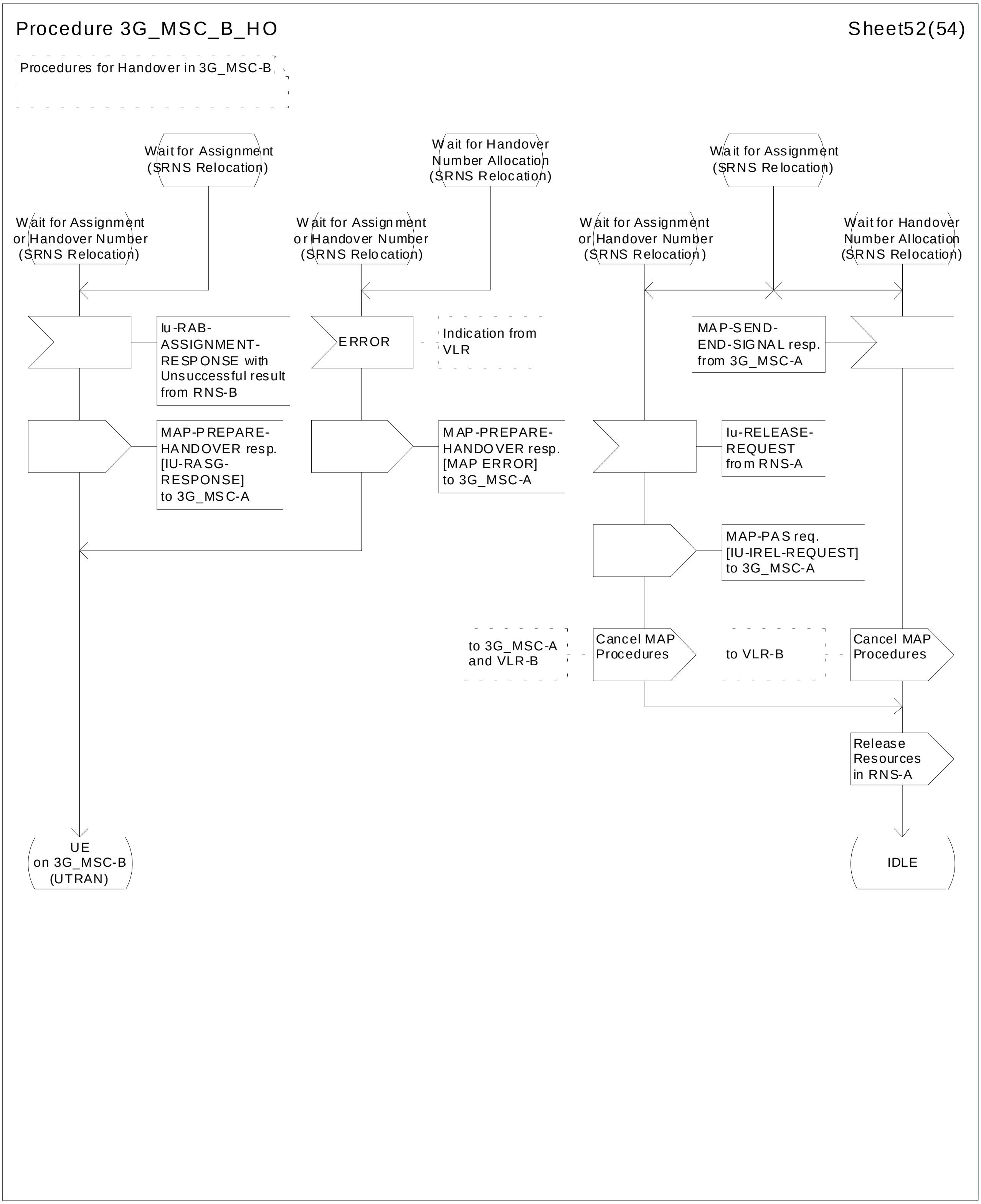


Figure 44 (sheet 52 of 54): Handover control procedure in 3G_MSC-B

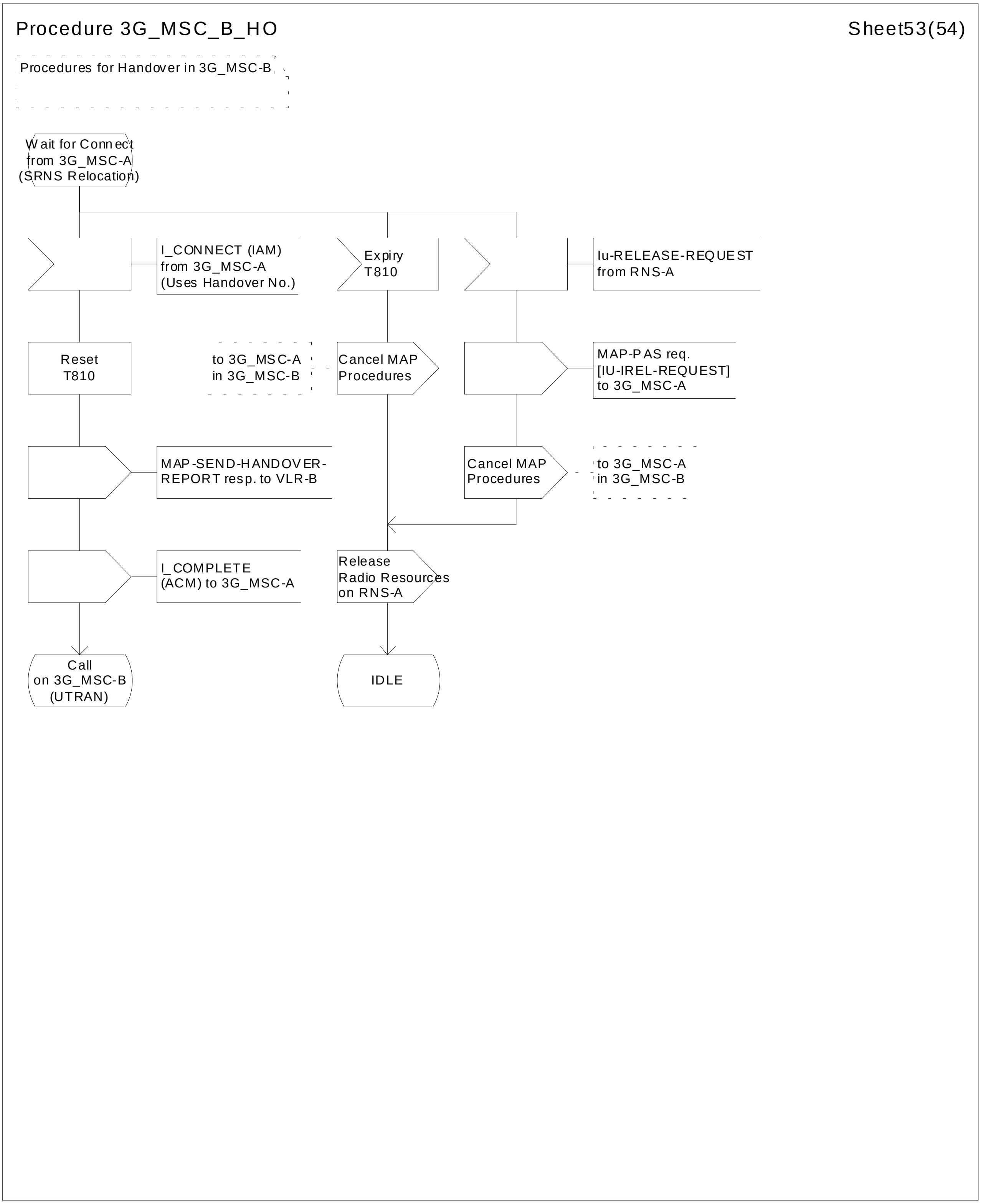


Figure 44 (sheet 53 of 54): Handover control procedure in 3G_MSC-B

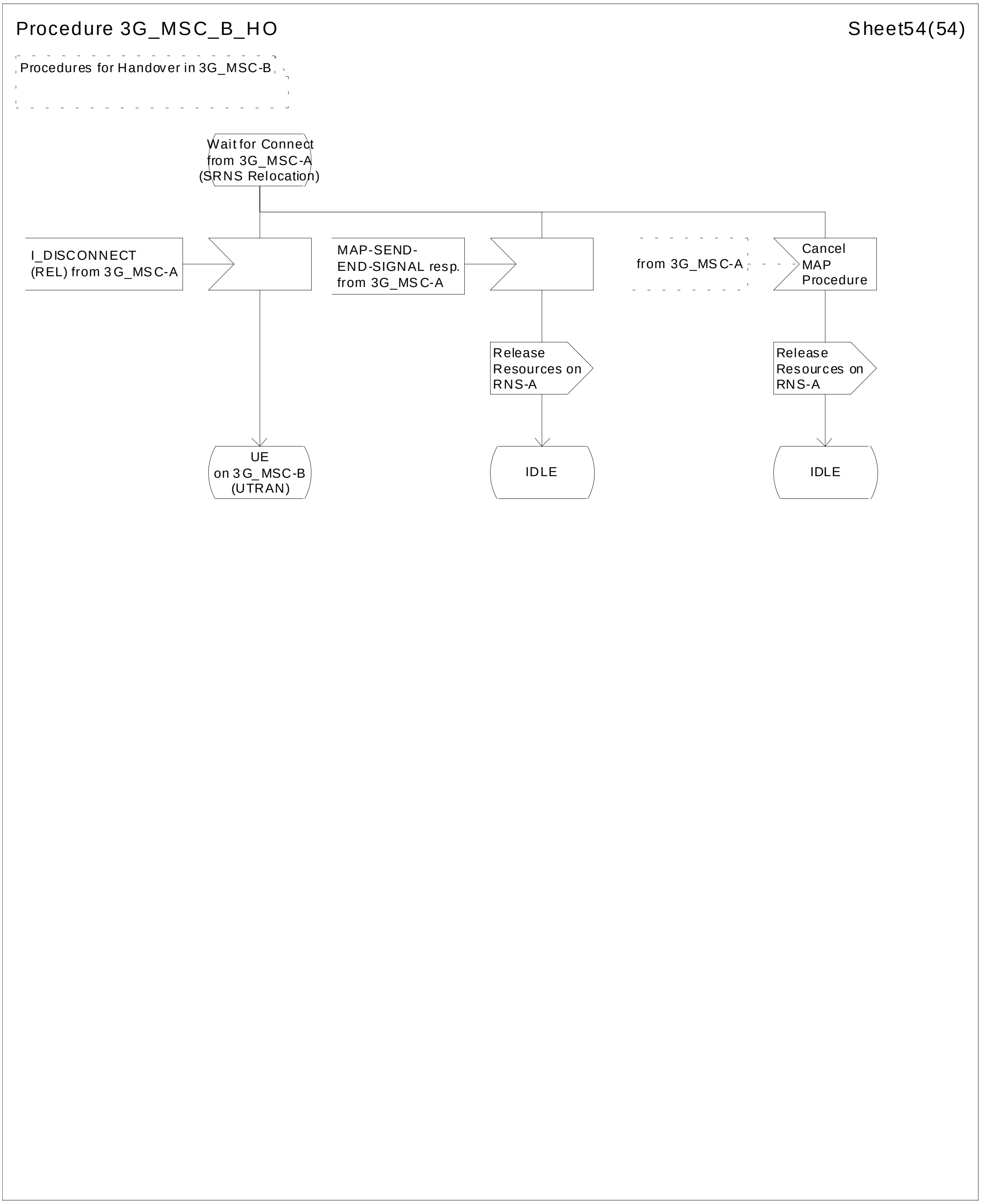


Figure 44 (sheet 54 of 54): Handover control procedure in 3G_MSC-B

Annex A (informative): Change history

Change history							
TSG CN#	**Spec**	**Version**	**CR**	**Rel**	**New Version**	**Subject**	**Comment**
Apr 1999	GSM 03.09	6.0.0					Transferred to 3GPP CN1
CN#03	23.009				3.0.0		Approved at CN#03
CN#06	23.009	3.0.0	CR001r2	R99	3.1.0	Introduction of UMTS functionalities in 23.009	
CN#7	23.009	3.1.0	CR003	R99	3.2.0	Functional requirements for the use of RANAP over the E i/f	
CN#7	23.009	3.1.0	CR004	R99	3.2.0		SDLs
CN#7	23.009	3.1.0	CR005	R99	3.2.0		SDLs
CN#7	23.009	3.1.0	CR006	R99	3.2.0	Introduction of RANAP for intra-UMTS inter-MSC relocation	
CN#7	23.009	3.1.0	CR007	R99	3.2.0	Clarifications of 3G_MSC-A and 3G_MSC-B roles	
CN#7	23.009	3.1.0	CR008r2	R99	3.2.0	Transcoder handling in the CN at inter-system handover and relocation	
15/05/00	23.009	3.2.0	-	R99	3.2.1	Missing SDLs re-inserted by MCC for Figures 41 - 42 (GSM Handover control procedure in MSC-A and MSC-B)	SDLs

TSGN	TSGN-number	WG Number	Spec	CR	Rev	Rel	Cat	Old vers	New ver	Title	WI	Notes
NP-08	NP-000278	N1-000638	23.009	002	4	R99	B	3.2.1	3.3.0	CR to 23.009 on Handover scenario for Multicall	Multicall	
NP-08	NP-000270	N1-000607	23.009	009		R99	C	3.2.1	3.3.0	Clean-up of 3G_MSC-A_HO SDLs	GSM/UMTS Interworking	
NP-08	NP-000270	N1-000608	23.009	010		R99	C	3.2.1	3.3.0	Clean-up of 3G_MSC-B_HO SDLs	GSM/UMTS Interworking	
NP-09	NP-000444	N1-000922	23.009	012	1	R99	F	3.3.0	3.4.0	Correction to transcoder handling for R99	TrFo/OoBTC	

CR-Form-v3

CHANGE REQUEST

⌘	**09.08**	**CR**	**A140**	⌘ rev	**-**	⌘ Current version:	**8.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [ ] Radio Access Network [ ] Core Network [X]

Title:	⌘ Addition of Common Id procedure on the E-interface		
Source:	⌘ Nokia		
Work item code:	⌘ TEI	***Date:*** ⌘	16 Nov 2000
Category:	⌘ **F**	***Release:*** ⌘	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘	BSSMAP Common ID procedure is currently missing from GSM 09.08, which defines the BSSMAP procedures used on the E-interface. As defined in the GSM 08.08 the purpose of the Common ID procedure is to inform the BSC about the IMSI of a user. This is done at A-interface in the beginning of the SCCP connection with Common ID message as soon as IMSI is known by the MSC and also during handover procedure in Handover Request message to the target BSC. The current version of GSM 09.08 enables IMSI transmission on E-interface during handover signalling, but because IMSI is not always known e.g. during signalling channel handover, the sending of Common ID message on the E-interface needs to be allowed as soon as the IMSI of a user is available in the MSC.
Summary of change: ⌘	Common ID BSSMAP procedure is added to clause 5, and Common ID BSSMAP message to clause 6.
Consequences if not approved: ⌘	Specifications are not consistent, because CRs to other related specifications have already been agreed.

Clauses affected: ⌘	5, 5.XX, 6	
Other specs affected: ⌘	[X] Other core specifications ⌘	08.08 CR A226 (GP-000618), 29.108 CR002r1 (R3-002837)
	[ ] Test specifications	
	[ ] O&M Specifications	
Other comments: ⌘		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5 Use of the BSSAP on the E-interface

DTAP is used on the E-interface for the transfer of messages between the MSC-A and the MS.

The dedicated BSSMAP procedures (GSM 08.08 subclause 3.1) used on the E-interface to some extent are:

- assignment;
- handover resource allocation;
- handover execution;
- internal handover indication;
- release due to BSS generated reasons;
- classmark handling;
- cipher mode control;
- trace invocation;
- queuing indication;
- data link control SAPI not equal to "0";
- Location Acquisition.
- LSA handling.
- Common ID.

5.13 LSA handling

For the LSA handling (GSM 08.08 subclause 3.1.27), the involved MSCs shall act according to the following:

- the MSC-A acts as the MSC;
- the MSC-I acts as the BSS.

5.XX Common ID

For the Common Id (GSM TS 08.08), the involved MSCs shall act according to the following:

- the MSC-A acts as the MSC;
- the MSC-I acts as the BSS.

6 BSSMAP messages transferred on the E-interface

The following BSSMAP messages, defined in GSM 08.08 subclause 3.2.1, are transferred on the E-interface:

ASSIGNMENT REQUEST (MSC-A -> MSC-I)

Excluded information element: CIRCUIT IDENTITY CODE

ASSIGNMENT COMPLETE (MSC-I -> MSC-A)

Excluded information element: CIRCUIT POOL, CIRCUIT IDENTITY CODE

ASSIGNMENT FAILURE (MSC-I -> MSC-A)

Excluded information elements: CIRCUIT POOL, CIRCUIT POOL LIST

* HANDOVER REQUEST (MSC-A -> MSC-T and MSC-I -> MSC-A)

Excluded information element: CIRCUIT IDENTITY CODE

* HANDOVER REQUEST ACKNOWLEDGE (MSC-T -> MSC-A and MSC-A -> MSC-I)

Excluded information element: CIRCUIT POOL, CIRCUIT IDENTITY CODE

* HANDOVER COMPLETE (MSC-T -> MSC-A)

* HANDOVER FAILURE (MSC-T -> MSC-A and MSC-I -> MSC-A)

Excluded information elements: CIRCUIT POOL, CIRCUIT POOL LIST

HANDOVER PERFORMED (MSC-I -> MSC-A)

* HANDOVER DETECT (MSC-T -> MSC-A)

CLEAR REQUEST (MSC-I -> MSC-A)

SAPI "n" REJECT (MSC-I -> MSC-A)

CONFUSION (MSC-T -> MSC-A, MSC-A -> MSC-T,
MSC-I -> MSC-A and MSC-A -> MSC-I)

\# MSC INVOKE TRACE (MSC-A -> MSC-I)

\# BSS INVOKE TRACE (MSC-I -> MSC-A and MSC-A -> MSC-T)

CIPHER MODE COMMAND (MSC-A -> MSC-I)

CIPHER MODE COMPLETE (MSC-I -> MSC-A)

CIPHER MODE REJECT (MSC-I -> MSC-A)

** QUEUING INDICATION (MSC-T -> MSC-A, MSC-I -> MSC-A,
and MSC-A -> MSC-I)

CLASSMARK UPDATE (MSC-I -> MSC-A and MSC-A -> MSC-T)

CLASSMARK REQUEST (MSC-A -> MSC-I)

CONNECTION ORIENTED INFORMATION (MSC-I -> MSC-A, MSC-A->MSC-I)

LSA INFORMATION (MSC-A -> MSC-I)

PERFORM LOCATION REQUEST (MSC-I->MSC-A, MSC-A -> MSC-I)

PERFORM LOCATION ABORT (MSC-I->MSC-A, MSC-A -> MSC-I)

PERFORM LOCATION RESPONSE (MSC-I -> MSC-A, MSC-A->MSC-I)

COMMON ID (MSC-A -> MSC-I)

All other BSSMAP messages shall be considered as non-existent on the E-interface.

NOTE: Segmentation procedures for LCS CONNECTION ORIENTED INFORMATION message in GSM 08.08 apply to the corresponding message on the E-interface.

Some of the messages above are qualified by *, ** or #. This signifies whether the message, when sent on the E-interface, is considered as:

- handover related message (*);
- handover related when sent as a response to HANDOVER REQUEST (**); or
- trace related message (#).

3GPP TSG-CN1 Meeting #14 ***Tdoc N1-001421~~13631274~~***
Cardiff, Wales - 20 - 24 November, 2000

CR-Form-v3

CHANGE REQUEST

⌘	**24.002**	**CR**	**001**	⌘ rev	**R2** ~~1~~	⌘	Current version:	**3.0.0** ⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title: ⌘	CR 24.002 on Adaptations for UMTS		
Source: ⌘	Ericsson		
Work item code: ⌘	TEI	***Date:*** ⌘	2000-11-23
Category: ⌘	**F**	***Release:*** ⌘	R99
	Use <u>one</u> of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use <u>one</u> of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	TS 24.002 has been transferred from SMG to 3GPP. Therefore, adaptations for UMTS are required. In addition, some texts which were not conformity the latest standard (e.g. X.21 and V.11 had been removed.) or not accordant to this document (e.g.subclause 3.2) have been removed.
Summary of change: ⌘	-Revised and added the references. -Add the PLMN (Iu mode) Access Reference Configuration and clear up of GSM. -Remove subclause 3.2 Base Station + MSC (BS/MSC)
Consequences if not approved: ⌘	Inapplicable to UMTS.

Clauses affected: ⌘		
Other specs affected: ⌘	[X] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	TS 27 series
Other comments: ⌘	Regarding the S interface (and consequently TE1 and MT1), we would like to ask T2 for advice. MT1 is an idea from the early days of GSM, when the GSM PLMN was thought of as the mobile extension of ISDN. In 3G it was removed since this idea was never realised, It is only reason leaving it in for 2G for legacy reasons. However, if T2 decides to remove MT1 in GSM as well, it will be removed from this document.	

Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document describes the reference configuration for access to a ~~GSM~~ PLMN.

A user accesses a ~~GSM~~ PLMN via a number of interfaces, including the MS-BS (in A/Gb mode) and UE-UTRAN (in Iu mode) interface. The purpose of this Technical Specification is to indicate the possible access arrangements that may be used in conjunction with the MS-BS (in A/Gb mode) and UE-UTRAN (in Iu mode) interface.

1.1 References

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

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

~~A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.~~

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

[1] ~~GSM~~3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] ~~GSM 02.02~~3GPP TS 22.002: "~~Digital cellular telecommunications system (Phase 2+);~~Circuit Bearer Services (BS) supported by a ~~GSM~~ Public Land Mobile Network (PLMN)".

[3] ~~GSM~~3GPP TS 04.01: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface General aspects and principles".

[4] ~~GSM~~3GPP TS 04.03: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities".

[5] ~~GSM~~3GPP TS 04.04: "Digital cellular telecommunications system (Phase 2+); layer 1 General requirements".

[6] ~~GSM~~3GPP TS 04.05: "Digital cellular telecommunications system (Phase 2+); Data Link (DL) layer General aspects".

[7] ~~GSM~~3GPP TS 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[8] ~~GSM 04.07~~3GPP TS 24.007: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile radio interface signalling layer 3 General aspects".

[9] ~~GSM 04.08~~3GPP TS 24.008: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile radio interface Core Network protocol layer 3 specification".

[10] ~~GSM 04.10~~3GPP TS 24.010: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile radio interface layer 3 Supplementary services specification General aspects".

[11] ~~GSM 04.11~~3GPP TS 24.011: "~~Digital cellular telecommunications system (Phase 2+);~~ Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[12] ~~GSM 04.12~~3GPP TS 24.012: "~~Digital cellular telecommunications system (Phase 2+);~~ Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".

[13] ~~GSM~~3GPP TS 04.13: "Digital cellular telecommunications system (Phase 2+); Performance requirements on mobile radio interface".

[14] ~~GSM~~3GPP TS 04.21: "Digital cellular telecommunications system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[15] ~~GSM 04.22~~3GPP TS 24.022: "~~Digital cellular telecommunications system (Phase 2+);~~ Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS - BSS) interface and the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[16] ~~GSM 04.80~~3GPP TS 24.080: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile radio interface layer 3 supplementary services specification Formats and coding".

[17] ~~GSM 04.81~~3GPP TS 24.081: "~~Digital cellular telecommunications system (Phase 2+);~~ Line identification supplementary services - Stage 3".

[18] ~~GSM 04.82~~3GPP TS 24.082: "~~Digital cellular telecommunications system (Phase 2+);~~ Call Forwarding (CF) supplementary services - Stage 3".

[19] ~~GSM 04.83~~3GPP TS 24.083: "~~Digital cellular telecommunications system (Phase 2+);~~ Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 3".

[20] ~~GSM 04.84~~3GPP TS 24.084: "~~Digital cellular telecommunications system (Phase 2+);~~ MultiParty (MPTY) supplementary services - Stage 3".

[21] ~~GSM 04.85~~3GPP TS 24.085: "~~Digital cellular telecommunications system (Phase 2+);~~ Closed User Group (CUG) supplementary services - Stage 3".

[22] ~~GSM 04.86~~3GPP TS 24.086: "~~Digital cellular telecommunications system (Phase 2+);~~ Advice of Charge (AoC) supplementary services - Stage 3".

[23] ~~GSM 04.88~~3GPP TS 24.088: "~~Digital cellular telecommunications system (Phase 2+);~~ Call Barring (CB) supplementary services - Stage 3".

[24] ~~GSM 04.90~~3GPP TS 24.090: "~~Digital cellular telecommunications system (Phase 2+);~~ Unstructured supplementary services operation - Stage 3".

[25] ~~GSM~~3GPP TS 05.01: "Digital cellular telecommunications system (Phase 2+); Physical layer on the radio path General description".

[26] ~~GSM~~3GPP TS 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".

[27] ~~GSM~~3GPP TS 05.03: "Digital cellular telecommunications system (Phase 2+); Channel coding".

[28] ~~GSM~~3GPP TS 05.04: "Digital cellular telecommunications system (Phase 2+); Modulation".

[29] ~~GSM~~3GPP TS 05.05: "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception".

[30] ~~GSM~~3GPP TS 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[31] ~~GSM~~3GPP TS 05.10: "Digital cellular telecommunications system (Phase 2+); Radio subsystem synchronisation".

[32] ~~GSM~~3GPP TS 05.90: "Digital cellular telecommunications system (Phase 2+); GSM Electro Magnetic Compatibility (EMC) considerations".

[33] ~~GSM 07.01~~3GPP TS 27.001: "~~Digital cellular telecommunications system (Phase 2+);~~ General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[34] ~~GSM 07.02~~3GPP TS 27.002: "~~Digital cellular telecommunications system (Phase 2+);~~ Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[35] ~~GSM 07.03~~3GPP TS 27.003: "~~Digital cellular telecommunications system (Phase 2+);~~ Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[36] ~~CCITT~~ITU-T Series V Recommendations: "Data communication over the Telephone network".

[37] ~~CCITT~~ITU-T Series X Recommendations: "Data communication networks".

[38] ~~CCITT~~ITU-T Recommendation I.420: "Basic user-network interface".

[39] 3GPP TS 21.905: "3G Vocabulary".

[40] 3GPP TS 23.910: "Circuit Switched Data Bearer Services".

[41] 3GPP TS 25.322: "Radio Link Control (RLC) Protocol Specification".

[42] ITU-T Recommendation V.24 (1996):"List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[43] ITU-T Recommendation V.28 (1993): "Electrical characteristics for unbalanced double-current interchange circuits".

[44] Infrared Data Association IrDA: "IrPHY Physical layer signalling standard".

[45] Personal Computer Memory Card Association: "PCMCIA 2.1 or PC-Card 3.0 electrical specification or later revisions".

1.2 Abbreviations

Abbreviations used in the present document are listed in ~~GSM~~3GPP TS 01.04 and 3GPP TS 21.905.

2 General definitions

The following definitions 2.1-2.3 are based on those used for ISDN.

2.1 Reference Configurations

Reference Configurations are conceptual configurations useful in identifying access arrangements to a network. Two concepts are used in defining reference configurations:

reference points and functional groups.

2.2 Functional Groups

Functional Groups are sets of functions which may be needed in network access arrangements. In a particular access arrangement, specific functions in a functional group may or may not be present. ~~Note that s~~Specific functions in a functional group may be performed in one or more pieces of equipment.

2.3 Reference Points

Reference Points are the conceptual points dividing functional groups. In a specific access arrangement, a reference point may correspond to a physical interface between pieces of equipment, or there may not be any physical interface corresponding to the reference point.

~~The following definition is used in the present document:~~

2.4 ~~GSM~~ Interface Points

~~GSM~~ Interface Points are reference points within a ~~GSM~~ PLMN at which a ~~GSM~~3GPP specified interface is always identified.

2.5 Terminal Definitions

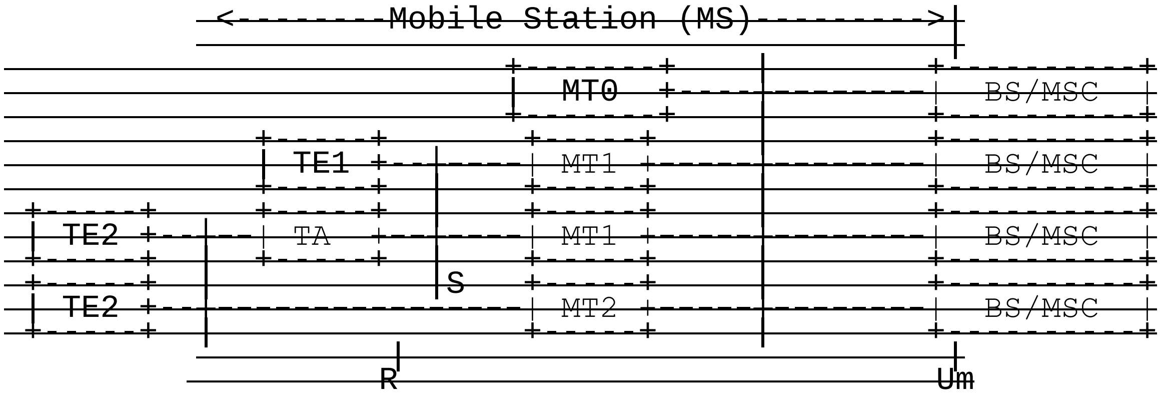
The term 'mobile station' (MS) in the present document is synonymous with the term 'user equipment' (UE) in 3G terminology as defined in 3GPP TR 21.905.

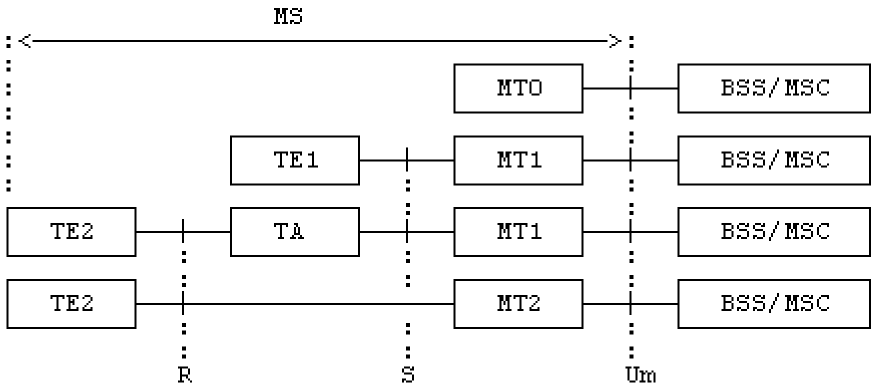
The term 'TE2' in the present document is synonymous with the term 'TE' in 3G terminology as defined in 3GPP TR 21.905.

The term 'MT2' in the present document is synonymous with the term 'MT' in 3G terminology as defined in 3GPP TR 21.905.

3 ~~GSM~~ Reference Configuration

The reference configuration for ~~GSM~~ PLMN (in A/Gb mode) access interfaces is shown in figure 1.





: reference point.
TE1: ISDN terminal.
TE2: V- or X-type terminal.
TA: Terminal Adaptor.
BSS: Base Station System.
MSC: Mobile Switching Centre.

Figure 1: ~~GSM~~ PLMN Access Reference Configuration (in A/Gb mode)

There are three types of MT:

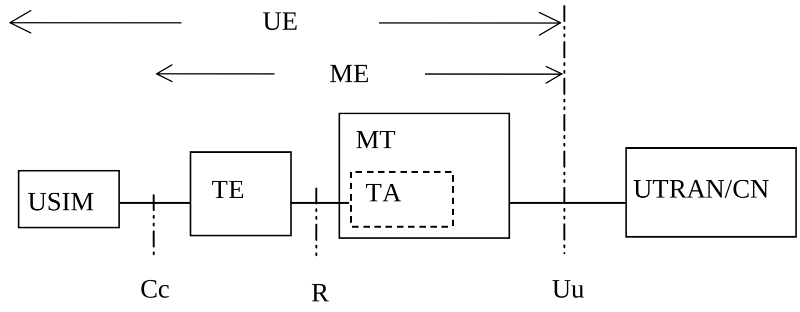
- MT0 includes functions belonging to the functional group MT, with support of no terminal interfaces.
- MT1 includes functions belonging to the functional group MT, and with an interface that complies with the GSM recommmended subset of the ISDN user-network interface specifications.
- MT2 includes functions belonging to the functional group MT, and with an interface that complies with the 3GPP TS 27.00z series Terminal Adaptation Function specifications. Accordingly, the interchange circuit mapping at the MT2 to TE interface shall comply with the ITU-T V.24 [42] recmmendation; while the physical implementation shall conform either to the ITU-T V.28 [43], or to the IrDA IrPHY Physical signalling standard specification [44], or to the PCMCIA 2.1[45], or to the PC-Card 3.0[45], electrical specification or to later revisions.

The MT plus any TE/(TE + TA) constitutes the Mobile Station, MS.

The terminal equipment functional groups TE1, TE2 and TA are conceptually the same functional groups as those in the ISDN.

~~The terminal equipment functional groups TE1, TE2 and TA are conceptually the same functional groups as those in the ISDN. The two new functional groups are:~~

The reference configuration for PLMN (Iu mode) access interfaces is shown in figure 2.



: reference point.
TA: Terminal Adaptor.
MT: Mobile Termination.
ME: Mobile Equipment.
UE: User Equipment
UTRAN: UMTS Radio Access Network.
CN: Core Network.

Figure 2: PLMN Access Reference Configuration (Iu mode)

There is no reference point identified for the TA Function~~F~~. The TA Function~~F~~ is considered as a part of the Mobile Termination and with an interface that complies with the 3GPP TS 27.00z series Terminal Adaptation Function specifications.

3.1 Mobile Termination (MT)

The MT performs the following functions, which performs the following functions:

- radio transmission termination;
- radio transmission channel management;
- terminal capabilities, including presentation of a man-machine interface to a user;
- speech encoding/decoding;
- error protection for all information sent across the radio path. This includes FEC (forward error correction) and, for signalling and user data (except for transparent data services), ARQ (automatic request forretransmission);
- flow control of signalling and mapping of user signalling to/from PLMN access signalling;
- flow control of user data (except for transparent data services) and mapping of flow control for asynchronous transparent data services;
- ~~rate adaptation of user data between the radio channel rate and user rates;~~
- rate adaptation of user data (see 3GPP TS 04.21[14]) and data formatting for the transmission SAP (3GPP TS 25.322);
- multiple terminal support;
- mobility management.

~~There are three types of MT:~~

- ~~MT0 includes functions belonging to the functional group MT, with support of no terminal interfaces.~~
- ~~MT1 includes functions belonging to the functional group MT, and with an interface that complies with the GSM~~

~~recommmended subset of the ISDN user-network interface specifications.~~

- ~~MT2 includes functions belonging to the functional group MT, and with an interface that complies with the GSM 07.0x series Terminal Adaptation Function specifications. Accordingly, the interchange circuit mapping at the MT2 to TE interface shall comply with the CCITT V.24 or X.21 recmmendations; while the physical implementation shall conform either to the CCITT V.28, or V.11, or to the IrDA IrPHY, or to the PCMCIA 2.1, or to the PC-Card 3.0 electrical specification, or to later revisions.~~

~~The MT plus any TE/(TE + TA) constitutes the Mobile Station, MS.~~

~~3.2 Base Station + MSC (BS/MSC)~~

~~which include the following functions:~~

- ~~radio transmission termination;~~
- ~~speech transcoding;~~
- ~~radio transmission channel management;~~
- ~~error protection for all information sent across the radio path. This includes FEC (forward error correction) and for signalling and user data (except for transparent data services), ARQ (automatic request for retransmission);~~
- ~~link layer functions for signalling across the radio path;~~
- ~~MS-BS circuit establishment and release functions;~~
- ~~handover functions;~~
- ~~rate adaptation of user data.~~

4 Physical Realisation

In a ~~GSM~~PLMN, the reference point Um/Uu is an ~~GSM~~interface point, i.e. it is always implemented as a physical interface (according to ~~GSM~~3GPP Technical Specifications in the 04, 05, ~~0~~24 and ~~0~~25 series). The reference points S and R may be optionally implemented as physical interfaces. The implementation of interfaces at these reference points is according to Technical Specifications 3GPP TS ~~GSM~~ ~~0~~27.001, ~~0~~27.002 and ~~0~~27.003.

Figure 3~~2~~ gives examples of configurations illustrating combinations of physical interfaces at reference points R and S. The examples shown are not exhaustive, but only serve to illustrate possible implementations of the respective functional blocks.

Example (a) of figure 3~~2~~ illustrates a fully integrated MS including data terminal functions within the mobile station equipment.

Example (b) of figure 3~~2~~ illustrates the connection of a TE1 in accordance with Technical Specifications ~~GSM~~3GPP TS ~~0~~27.002 and~~/~~ ~~0~~27.003 (and ITU-T~~CCITT~~ Recommendation I.420). In this example the speech service is offered via the TE1.

Example (c) of figure 3~~2~~ illustrates the connection of a TE2 by a ITU-T~~CCITT X or~~ V series interface according to Technical Specifications ~~GSM~~3GPP TS ~~0~~27.002 and ~~0~~27.003.

Example (d) of figure 3~~2~~ illustrates the connection of a MT2 PCMCIA card to a TE2 by a PCMCIA 2.1 interface according to the Technical Specifications 3GPP TS ~~GSM~~ ~~0~~27.002 and ~~0~~27.003.

Example (e) of figure 3~~2~~ illustrates the connection of a TE2 by means of an ISDN TA to the MT equipment.

Example (f) of figure 3~~2~~ illustrates the connection of a speech only MS.

```
                                +---------------------+          +-----------+
                                |       Mobile        |          |           |
(a)                             |        Data         +-----//--|  Base     |
                                |   Terminal [MT0]    |          |  Station  |
                                +---------------------+          +-----------+


     +-------------------+           +-------+       +-----------+
     |       ISDN        |           |       |       |           |
(b)  |  speech + data    +-------//--| [MT1] +--//--|  Base     |
     | workstation [TE1] |           |       |       |  Station  |
     +-------------------+           +-------+       +-----------+


     +----------------+              +-------+       +-----------+
     | X.21 and V.11  |              |       |       |           |
(c)  |      DTE       +----------//--| [MT2] +--//--|  Base     |
     |     [TE2]      |              |       |       |  Station  |
     +----------------+              +-------+       +-----------+


     +----------------+                +-------+     +-----------+
     |      V.24      |                |       |     |           |
     | and PCMCIA 2.1 |                |       |     |           |
(d)  |      DTE       +-------------//-| [MT2] +-//-|  Base     |
     |     [TE2]      |                |       |     |  Station  |
     +----------------+                +-------+     +-----------+

     +----------------+    +------+    +-------+     +-----------+
     |     V- or X    |    |      |    |       |     |           |
     |                |    | ISDN |    |       |     |           |
(e)  |      DTE       +-//-|  TA  +-//-| [MT1] +-//-|  Base     |
     |     [TE2]      |    | [TA] |    |       |     |  Station  |
     +----------------+    +------+    +-------+     +-----------+

                                +--------------------+          +-----------+
                                |   Speech-only MS   |          |           |
(f)                             |                    +-----//--|  Base     |
                                |        [MT0]       |          |  Station  |
                                +--------------------+          +-----------+
```

Figure ~~2~~3: Examples of physical implementations

Annex <A> (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
30.3.2000	CN#7	-	-	-	Transferred to 3GPP for R99 (from GSM 04.02 v7.0.0).		3.0.0