NMT DOC 900-2, Annex 3-I
Nordic Mobile Telephone group

Edition 8,
August 1994

NORDIC MOBILE TELEPHONE

Technical Specification for Signalling System no. 7 MUP

NMT Doc. 900 - 2, Annex 3-I
Nordic Mobile Telephone Group

Edition 8
August 1994

Automatic Cellular Mobile Telephone System

NORDIC

NMT - 900

Technical specification for signalling system no. 7

MOBILE USER PART

CONTENTS

1 INTRODUCTION

1.1 General

This technical specification describes the requirements for Signalling System No. 7 for the Nordic Mobile Telephone system NMT-900 as defined in NMT Doc.900-2. The specification is split in three parts:

I Mobile User Part (MUP)

II Handover User Part (HUP)

III SCCP specification for Mobile User Part

The purpose of this specification is to define a MUP-specification for the NMT system to correspond to the signalling procedures defined in NMT Doc. 900-2. This signalling can also be used by the NMT-450 system.

The signalling system described in this document refers only to end- to-end signalling between MTXs and between MTXs and AR. The signalling between MTXs is conveyed via national and international signalling networks while the signalling between MTXs and AR in conveyed only via national signalling networks. The signalling between MTXs and the fixed telephone network is specified in the national TUP or ISUP specifications.

The following cases for MTX end-to-end signalling are specified in MUP:

- MTXV updates information about roaming subscribers in MTXH (corresponds to signal U-1 in NMT Doc. 900-2),
- MTXH cancels roaming information in an earlier MTXV (corresponds to signal U-3),
- MTXH updates MS-category information which is stored in MTXV (corresponds to signal U-2),
- MTXV updates service information in MTXH (corresponds to signal U-4),
- Security Data transfer,
- Roaming Signalling

For end-to-end signalling between MTXs and AR only Security Data Transfer is specified.

The MUP specification includes restart procedures to recover from the error situations, where an MTX has been restarted and the location register contents have been lost. The procedures for handling of abnormal cases are described.

1.2 Abbreviations

The abbreviations used for messages and signals are defined in paragraph 2.3.

AR	Authentication Register
BS	Base Station
CCITT	The International Telegraph and Telephone Consultative Committee
CEPT	Conference Europeenne des Administrations des Postes et des Telecommunications
HUP	Handover User Part
ISUP	ISDN User Part
ISC	International Switching Centre
IMTXG	International Gateway Mobile Telephone Exchange MS Mobile Station
MTP	Message Transfer Part
MUP	Mobile User Part
MTX	Mobile Telephone Exchange
MTXG	Gateway Mobile Telephone Exchange
MTXH	Home Mobile Telephone Exchange
MTXV	Visited Mobile Telephone Exchange
NMT	Nordic Mobile Telephone System
PSTN	Public Switched Telephone Network
SCCP	Signalling Connection Control Part
TN	Transaction number
TUP	Telephone User Part

2 FORMATS AND CODES

2.1 General

All mobile telephone signal messages contain a transaction number and a heading consisting of two parts, heading code HO and heading code Hl. Code HO identifies a specific message group while Hl either contains a signal code or in case of more complex messages, identifies the format of these messages.

The general structure of mobile telephony signal messages is illustrated by figure 2.1.

To adapt to limitations in the existing national signalling network, the length of the SIF field has to be restricted to 42 octets.

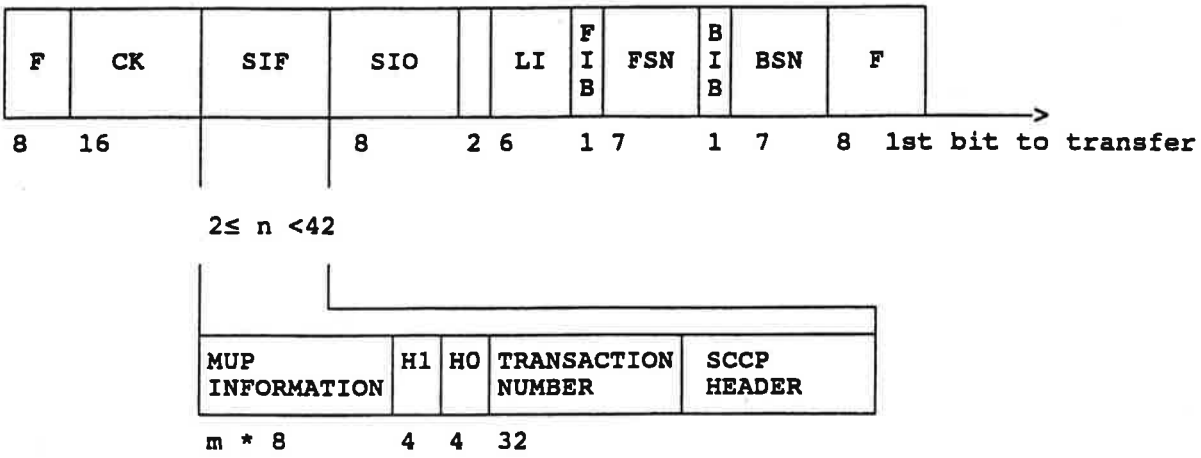


Figure 2.1 General format of Mobile Telephony Signal Messages.

2.2 Transaction number

Transaction number shall be used as a communication reference. It is used to uniquely define the communication as described in paragraph 3.1. It is always generated by the initiating end and is the MTX-identity of the MTX which started the transaction.

The format of the transaction number field is shown in the following figure. The transaction number has a length of 32 bits.

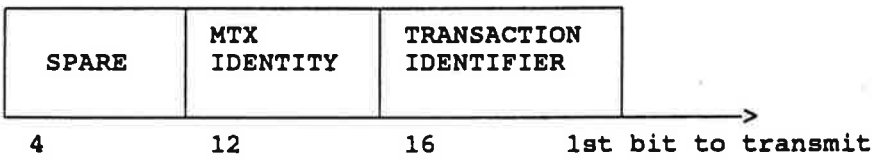


Figure 2.2. Transaction number structure.

The coding of the MTX identity is a binary representation of $Z'X_1'X_2'$ as described in paragraph 2.4.1.

The spare field is coded 0000.

2.3 Heading Codes

The heading code H0 occupies the 4-bit field following the transaction number and is coded as follows:

0000	Not used
0001	Location Data Forward Messages (LDF),
0010	Category/ Supplementary Service Forward Messages (CSF),
0011	Location Data Backward Messages (LDB),
0100	Category/ Supplementary Services Backward Messages (CSB),
0101	Spare
0110	Management and Administration Messages (MAM),
0111	Spare
1000	Security Data Transfer Messages (SDM),
1001	Roaming Signalling Messages (RSM).
1010	Gateway Signalling Messages (GSM)
1011	Home Location Register Signalling Messages(HSM)
1100	Spare
.	
.	
1111	Spare

Mess. group	H1 H0	0000	0001	0010	0011	0100	0101	0110	0111
Not used	0000	Not used							
LDF	0001		LUM	LCM					
CSF	0010		CSU	SRM	PSR				
LDB	0011		LUA	LUR	LCA				
CSB	0100		CSA	SRA	PSA				
Spare	0101								
MAM	0110		RES	REA					
Spare	0111								
SDM	1000		ADR	ADA	ADN	AKR	AKT	AKN	SDR
RSM	1001		RNE	RNM	RNR	CTE	CTA	CTR	REM
GSM	1010		GEI	GRM	GSE	GET	SEM	SEA	
HSM	1011		HRE	HRM	HRR				
Spare	1100								
Spare	1101								
Spare	1110								
Spare	1111								
	H1 H0	1000	1001	1010	1011	1100	1101	1110	1111
Not used	0000								
LDF	0001								
CSF	0010								
LDB	0011								
CSB	0100								
Spare	0101								
MAM	0110								
Spare	0111								
SDM	1000	SDA	SDN						
RSM	1001	RIM	RIR	BNE	BNM	BNR	REM2	IRI	
GSM	1010								
HSM	1011								
Spare	1100								
Spare	1101								
Spare	1110								
Spare	1111								

Table 2.3 MUP Message Heading Code Allocation

Abbreviations used in the table:

ADA	Authentication Data Request Acknowledge Message
ADN	Authentication Data Not Available Message
ADR	Authentication Data Request Message
AKN	Authentication Key Not Available Message
AKR	Authentication Key Request Message
AKT	Authentication Key Transfer Message
BNE	Business Group Number Enquiry Message
BNM	Business Group Number Information Message
BNR	Business Group Number Rejected Message
CSA	Category/ Supplementary Services Accepted Message
CSB	Category/ Supplementary Services Backward Messages
CSF	Category/ Supplementary Services Forward Messages
CSU	Category/ Supplementary Services Updating Message
CTA	Conditional Call Transfer Accepted Message
CTE	Conditional Call Transfer Enquiry Message
CTR	Conditional Call Transfer Rejected Message
GEI	Gateway Enquiry Initial Message
GET	Gateway Enquiry Terminate Message
GRM	Gateway Routing Message
GSE	Gateway Subsequent Enquiry Message
HRE	HLR Routing Enquiry Message
HRM	HLR Routing Message
HRR	HLR Routing Rejected Message
LCA	Location Cancellation Accepted Message
LCM	Location Cancellation Message
LDB	Location Data Backward Messages
LDF	Location Data Forward Messages
LUA	Location Updating Accepted Message
LUM	Location Updating Message
LUR	Location Updating Rejected Message
MAM	Management and Administration Messages
PSA	Pre-Supplementary Services Registration/ Cancellation Acknowledgement Message
PSR	Pre-Supplementary Services Registration/ Cancellation Message
REA	Restart Information Acknowledgement Message
REM	Routing Enquiry Message
REM2	Routing Enquiry Message 2
RES	Restart Information Message
RIM	Routing Information Message
IRI	IN Routing Information Message
RIR	Routing Information Reject Message
RNE	Roaming Number Enquiry Message
RNM	Roaming Number Message
RNR	Roaming Number Rejected Message
RSM	Roaming Signalling Messages
SEA	Serving Exchange Acknowledgement Message
SEM	Serving Exchange Message
SDA	Security Data Available Message
SDM	Security Data Transfer Messages
SDN	Security Data Not Available Message
SDR	Security Data Request Message
SRA	Supplementary Services Registration/ Cancellation Acknowledgement Message
SRM	Supplementary Services Registration/ Cancellation Message

2.4 Location Data Forward Messages

The following types of Location Data Forward Messages are included in the MUP and are each identified by a different heading code H1:

2.4.1 Location Updating Message (LUM),

2.4.2 Location Cancellation Message (LCM).

2.4.1 Location Updating Message (LUM)

The Basic Format of the LUM is shown in the following figure.

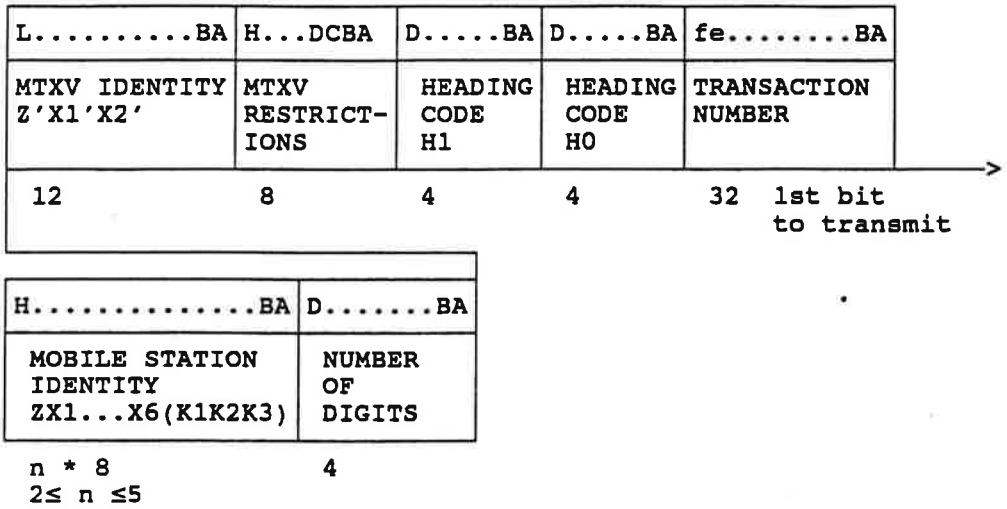


Figure 2.4.1 Location Updating Message.

The following codes are used in the fields of the Location Updating Message:

a) Transaction number.

See paragraph 2.2.

b) Heading code H0

H0 is coded 0001.

c) Heading code H1

H1 is coded 0001.

d) MTXV restrictions.

Bit A: Added Mobile Identity Security.

0: Not required.

1: Added Security is required.

Bit HGFEDCB:

Spare

e) MTXV Identity ($Z'X_1'X_2'$).

Coding of this information as in paragraph 2.4.1.g.

f) **Number of digits**

A code expressing in pure binary representation the number of digits contained in the following subfield.

g) **Mobile Station Identity ($ZX_1...X_6K_1K_2K_3$) or ($ZX_1...X_6$).**

The MS Identity will either consist of 10 digits (including $K_1K_2K_3$), or only 7 digits ($K_1K_2K_3$ not included).

If the MS Identity consists of only 7 digits, no checking of $K_1K_2K_3$ should be performed.

The digit signals are coded as shown below. The most significant digit is sent first. Subsequent digits are sent in successive 4-bit fields.

0000	digit 0
0001	digit 1
0010	digit 2
0011	digit 3
0100	digit 4
0101	digit 5
0110	digit 6
0111	digit 7
1000	digit 8
1001	digit 9
1010	Code 10
1011	Code 11
1100	Code 12
1101	Code 13
1110	Code 14
1111	Code 15

Note! Filler:

The filler 0000 is inserted after the last digit signal in case of an odd number of digit signals. This ensures that this variable length field consists of an integer number of octets.

2.4.2 Location Cancellation Message (LCM)

The basic format of the LCM is shown in the following figure.

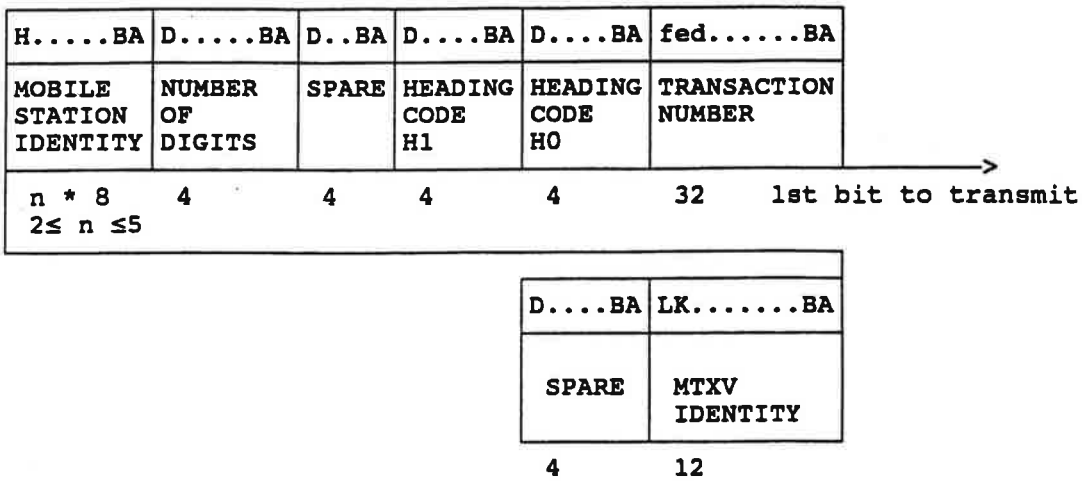


Figure 2.4.2 Location Cancellation Message.

The following codes are used in the fields of the Location Cancellation Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 0001.

c) **Heading code H1**
H1 is coded 0010.

d) **Spare.**

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Identity.**
See paragraph 2.4.1.g.

g) **MTXV identity**
See paragraph 2.4.1.e.

h) **Spare**

Not activated: Not handhold.
Activated: Handhold

Bit B: Battery saving.
Not activated: No battery saving
Activated: MS with battery saving

Bit C: Added Mobile Identity Security
Not activated: The mobile station is not equipped with Added Security.
Activated: The mobile station is equipped with Added Security.

Bit D: Payphone
Not activated: No payphone.
Activated: Payphone.

Bit E: Priority
Not activated: Not priority.
Activated: Priority.

Bit F: Official
Not activated: Not official.
Activated: Official.

Bit G: Bearer service
Not activated: Speech
Activated: Data + speech

Bit H: Test equipment
Not activated: Not test equipment
Activated: Test equipment

Bit JI: Mobile station signalling variant
00: Not used value
01: Basic NMT-450 signalling
10: Basic NMT-900 signalling
11: Extended NMT-450 signalling

Bit K: Interleaved channel(NMT-450)
Not activated: The NMT 450 mobile station is not equipped with interleaved channel capability.
Activated: The NMT 450 mobile station is equipped with interleaved channel capability.

Bit L: Spare

Bit NM: Voice privacy
00: No voice privacy unit
01: Global type no.1 of voice privacy unit
10: Global type no.2 of voice privacy unit
11: Global type no.3 of voice privacy unit
These bits are used for transfer of the type of equipment needed in an MTXV to support voice privacy

Bit PO: Spare

e) **Subscription Region Code.**
Binary number chosen by the administrations indicating the subscription area for the mobile stations.
The code: 00000000 is reserved for "No restrictions"

f) **Supplementary services activation indicators.**
This field is split into subfields:
Bit DCBA:

Outgoing call barred indicator

0000	MUP code no. 0
0001	MUP code no. 1
.	
.	
1111	MUP code no. 15

Note: The different MUP codes are linked to a "call barring value" in the MTX. The meaning of the codes are defined in ANNEX-1 of this document.

Bit GFE:

Three party service.

000	No access to enquiry
001	Access to enquiry
010	Access to enquiry and 3-party conference
011	Access to enquiry with transfer service
100	Subscriber with full 3-party service (enquiry with transfer and 3-party conference).
101	Subscriber with full 3-party service with transfer on busy
110 ┐	
├	Spare
111 ┘	

Bit LKJIH:

Conditional Call Transfer services
Coding of these indicators has the following meaning:
0: Service not activated
1: Service activated

Bit H: Conditional Call Transfer on no page response
Bit I: Conditional Call Transfer on no answer
Bit J: Conditional Call Transfer on busy
Bit K: Conditional Call Transfer on BS congestion
Bit L: Spare

2.5 Category/ Supplementary Services Forward Messages

The following types of Category/ Supplementary Services Forward Messages are included in the MUP and are each identified by a different heading code H1:

2.5.1 Category/ Supplementary Services Updating Message (CSU),

2.5.2 Supplementary Services Registration/ Cancellation Message (SRM)

2.5.3 Pre-supplementary Services Registration/ Cancellation Message (PSR)

2.5.1 Category/ Supplementary Services Updating Message (CSU)

The basic format of the CSU is shown in the following figure.

H.....BA	P.....BA	D....BA	D....BA	fe.....BA
SUBSCRIPTION REGION CODE	MOBILE STATION CATEGORIES	HEADING CODE H1	HEADING CODE H0	TRANSACTION NUMBER
8	16	4	4	32

1st bit to transmit →

P....B A	H....B A		D..B A	D.....B A	e d.....B A
INFORM. FIELD FOR IN-SERVICES	INFORM. FIELD FOR BUSINESS GR. SUB.	MOBILE STATION IDENTITY	NUMBER OF DIGITS	OPTIONAL INFORMATION FIELDS	SUPPLEMENTARY SERVICES ACTIVATION INDICATORS
0/16 Optional	0/8 Optional	n * 8 2≤n≤5	4	4	32

Figure 2.5.1 Category/Supplementary Services Updating Message.

The following codes are used in the fields of the Category/ Supplementary Services Updating Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 0010.

c) **Heading code H1**
H1 is coded 0001.

d) **Mobile station categories.**
Coding of these indicators has the following meaning:
0: Service not activated
1: Service activated
Bit A: Type of mobile station.

Bit WVUTSRQPONM:

Other supplementary services

Coding of these indicators has the following meaning:

0: Service not activated

1: Service activated

Bit M: Malicious call tracing indicator

Bit N: CCBS indicator

Bit O: Immediate price indicator

Bit P: Call waiting indicator

Bit Q: Incoming call restricted. This indicator is set when for example "Incoming Call Barred", "Immediate Call Diversion" or "Don't disturb" is activated. The indicator is used to decide whether the mobile stations call diversion indicating light shall be lit or not.

Bit R: Checking of $K_1K_2K_3$. If the MS identity transferred consists of only seven digits, the checking of $K_1K_2K_3$ is never performed (see section 2.4.1.g). Otherwise the checking is performed according to this bit.

Bit S: Business Group Subscriber

Bit T: Provide announcement on call transfer for:

- Unconditional Call Transfer
- Conditional Call Transfer on busy
- Conditional Call Transfer on BS congestion

Bit U: Provide announcement on call transfer for:

- Conditional Call Transfer on no answer
- Conditional Call Transfer on no page response

Bit V: Personal number service

Bit W: Holiday subscriber

Bit X: Immediate billing output

Bit Y: Calling line identification restriction (CLIR)

Bit Z: Maintenance supervision

Bit a: Message waiting indicator

Bit f..b:

Spare

g) **Optional Information Fields.**

Bit A: Information Field for Business Group Subscriber indicator.

0: Information Field for Business Group Subscriber not included.

1: Information Field for Business Group Subscriber included.

Bit B: Reserved

Bit C: Information field for IN-Service indicator
0: Information field for IN-Service not included
1: Information field for IN-Service included
Bit D: Spare, reserved for indicating the presence or absence of a second optional information field.

h) **Number of digits**
See paragraph 2.4.1.f.

i) **Mobile station Identity.**
See paragraph 2.4.1.g.

j) **Information Field for Business Group Subscriber**
This is an optional field. The field is used for transfer of the Access Code for Business Group subscribers. The following codes are used in this fields:
Bit DCBA:
Access Code.
The coding of the access code is as described in paragraph 2.5.2.f. If bit S is in the Supplementary services activation indicators is set to "Business Group Subscriber", and this field is not included, the default value "0" shall be assumed.
Bit HGFE:
Spare.

k) **Information Field for IN-Services**
This is an optional field. The field is used for transfer of the information concerning the IN-service for mobile calls (IN Category Key,ICK)
The coding of ICK is operator specific. If the ICK is transferred between operators, translation tables are used in the MTX's.

The following codes are used in this fields:
Bit P.....CBA.

2.5.2 Supplementary Services Registration/ Cancellation Message (SRM)

The basic format of the SRM is shown in the following figure.

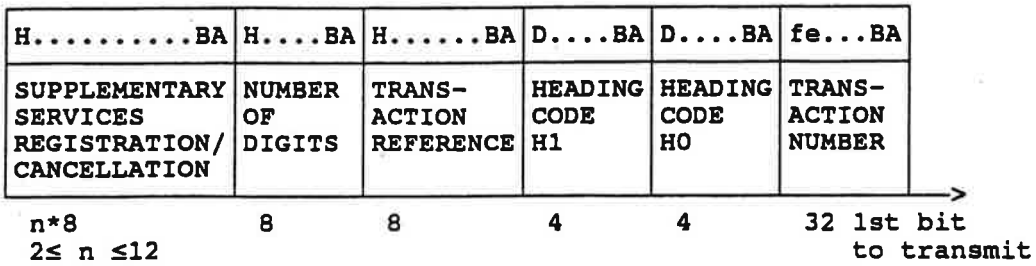


Figure 2.5.2 **Supplementary Services Registration/ Cancellation Message**

The following codes are used in the fields of the Supplementary Services Registration/ Cancellation Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 0010

c) **Heading code H1**
H1 is coded 0010

d) **Transaction reference**
This is a binary number of eight bits used to link the two messages Pre-supplementary Services Registration/ Cancellation Accepted Message (PSA) and Supplementary Services Registration/ Cancellation Message (SRM) which is considered one transaction. The reference can be reused when the transaction has been success fully completed.

e) **Number of digits.**
See paragraph 2.4.1.f

f) **Supplementary Services Registration/ Cancellation**

Supplementary services requested and/ or cancelled, (procedure dialled by the subscriber).

The information received from the subscriber is coded as shown below. The most significant digits are sent first. Subsequent digits are sent in successive 4-bit fields.

0000	digit 0
0001	digit 1
0010	digit 2
0011	digit 3
0100	digit 4
0101	digit 5
0110	digit 6
0111	digit 7
1000	digit 8
1001	digit 9
1010	A
1011	*
1100	#
1101	B
1110	C
1111	D

Note: Filler

The filler 0000 is inserted after the last digit signal in case of an odd number of digit signals. This ensures that this variable length field consists of an integer number of octets.

2.5.3 Pre-supplementary Services Registration/ Cancellation Message (PSR)

The basic format of the PSR is shown in the following figure:

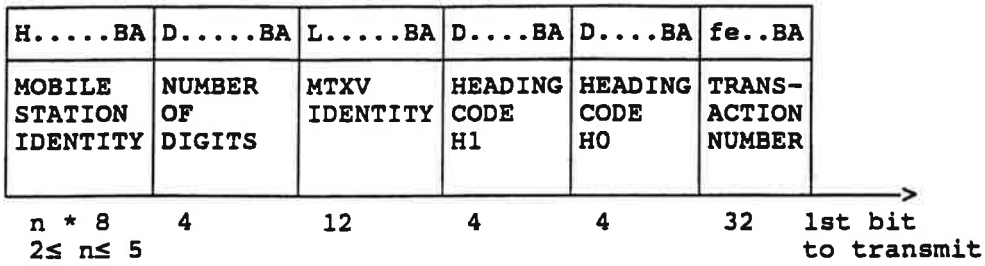


Figure 2.5.3 Pre-supplementary Services Registration/ Cancellation Message.

The following codes are used in the fields of the Pre-supplementary Services Registration/ Cancellation Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 0010.

c) **Heading code H1**
H1 is coded 0011.

d) **MTXV-identity.**
See paragraph 2.4.1.e.

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Identity.**
See paragraph 2.4.1.g.

2.6 Location Data Backward Messages

The following types of Location Data Backward Messages are included in the mobile user part and are each identified by a different heading code H1:

2.6.1 Location Updating Accepted Message (LUA),
2.6.2 Location Updating Rejected Message (LUR),
2.6.3 Location Cancellation Accepted Message (LCA).

2.6.1 Location Updating Accepted Message (LUA)

The basic format of the LUA is shown in the following figure:

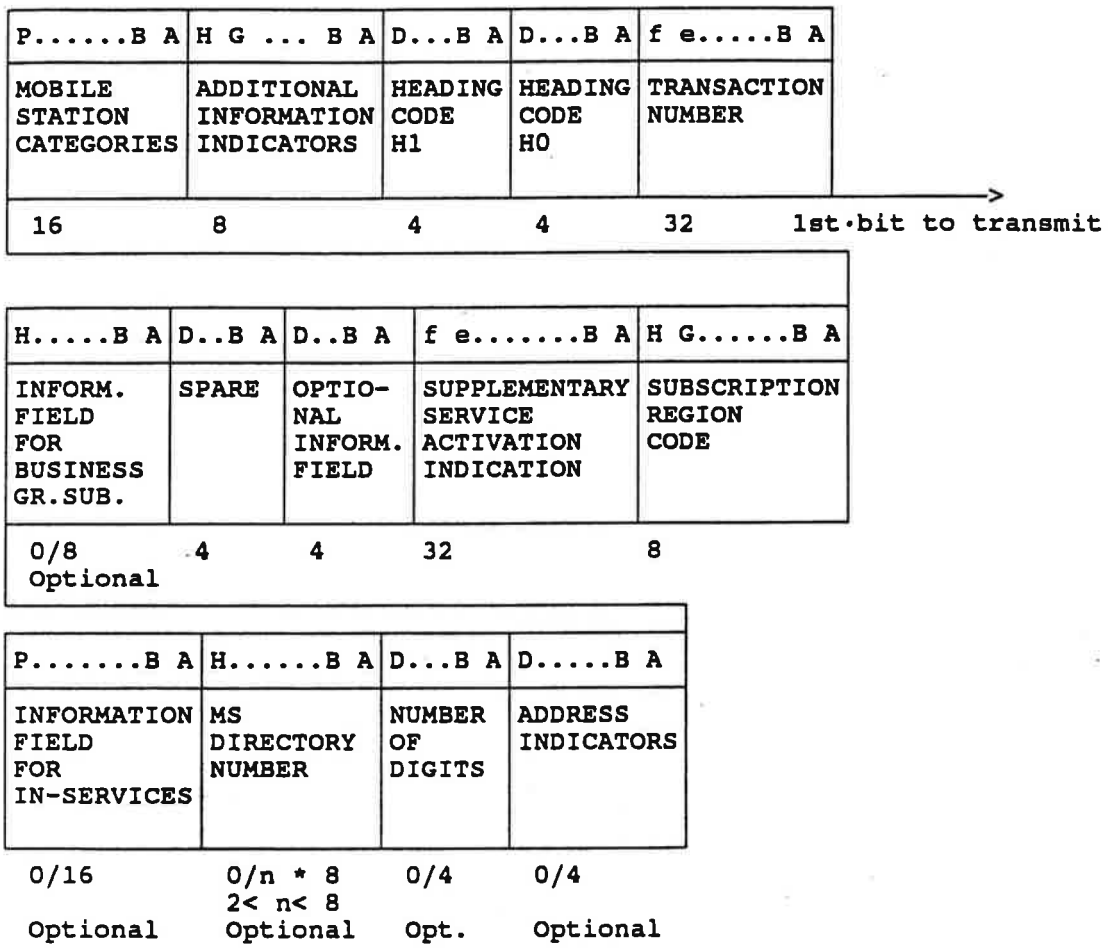


Figure 2.6.1 Location Updating Accepted Message (LUA).

The following codes are used in the fields of the Location Updating Accepted Message.

a) Transaction number.

See paragraph 2.2.

b) Heading code H0

H0 is coded 0011.

c) **Heading code H1**

H1 is coded 0001.

d) **Additional Information Indicators.**

Coding of this indicators have the following meaning:

Bit A:

0: The Secret Authentication Key is not allowed transferred.

1: The Secret Authentication Key is allowed transferred.

Bit HGFEDCB:

Spare.

e) **Mobile station categories.**

Coding of this information as in paragraph 2.5.1.d.

f) **Subscription Region Code.**

Coding of this information as in paragraph 2.5.1.e.

g) **Supplementary services activation indicators.**

Coding as in paragraph 2.5.1.f.

h) **Optional Information Fields.**

Bit A: Information Field for Business Group Subscriber indicator

0: Field not included

1: Field included

Bit B: Information field for transfer of the MS directory number:

- Address Indicators
- Number of digits
- MS directory number

0: Fields not included

1: Fields included

Bit C: Information field for IN-Services indicator

0: Field not included

1: Field included

Bit D: Spare, reserved for indicating the presence or absence of a second optional information field

i) **Spare.**

j) **Information Field for Business Group Subscriber.**

Coding as in paragraph 2.5.1.j. This is an optional field.

k) **Address Indicators**

This is an optional field. The coding of these indicators have the following meaning:

Bit A: 0: The MS Directory Number is a national significant number.
1: The MS Directory Number is an international number.

Bit B: Spare

Bit C: Calling Number Identification Restriction (CLIR)
0: No restriction.
1: Restriction.

Bit D: Spare.

l) **Number of digits.**

This is an optional field. See paragraph 2.4.1.f.

m) **Mobile Subscriber Directory Number.**

This is the Mobile Subscriber Directory Number (E.164 number). Coding of these digits as in paragraph 2.5.2.f. This is an optional field.

n) **Information Field for IN-Services**

This is an optional field. See paragraph 2.5.1.k for explanation and coding.

2.6.2 Location Updating Rejected Message (LUR)

The basic format of the LUR is shown in the following figure:

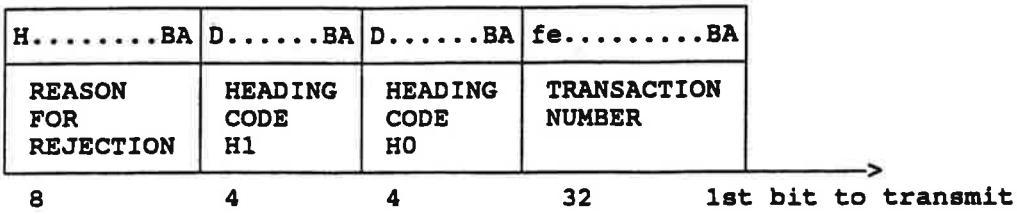


Figure 2.6.2 Location Updating Rejected Message

The following codes are used in the fields of the Location Updating Rejected Message:

a) Transaction number.

See paragraph 2.2.

b) Heading code H0

H0 is coded 0011.

c) Heading code H1

H1 is coded 0010.

d) Reason for rejection

Bit DCBA:

0000	Mobile station not allowed to roam,
0001	Non existing mobile subscriber
0010	Incorrect security code ($K_1K_2K_3$)
0011	Mobile station not equipped with Added Identity Security
0100	Miscellaneous

(The remaining codes are spare)

Bit HGFE:

Spare.

2.6.3 Location Cancellation Accepted Message (LCA)

The basic format of the LCA is shown in the following figure:

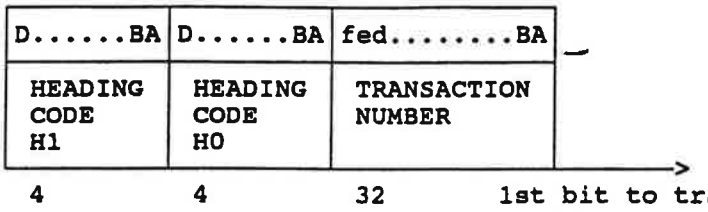


Figure 2.6.3 Location Cancellation Accepted Message

The following codes are used in the fields of the Location Cancellation Accepted Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 0011.

c) **Heading code H1**
H1 is coded 0011.

2.7 Category/ Supplementary Services Backward Messages

The following types of Category/ Supplementary Services Backward Messages are included in the MUP and each identified by different heading code H1:

2.7.1 Category/ Supplementary Services Accepted Message (CSA).

2.7.2 Supplementary Services Registration/ Cancellation Acknowledgement Message (SRA).

2.7.3 Pre-Supplementary Services Registration/ Cancellation Accepted Message (PSA).

2.7.1 Category/ Supplementary Services Accepted Message (CSA)

The basic format of the CSA is shown in the following figure:

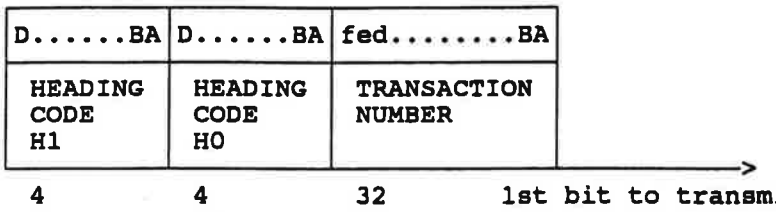


Figure 2.7.1 Category/ Supplementary Services Accepted Message.

The following codes are used in the fields of the Category/ Supplementary Services Accepted Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 0100.

c) **Heading code H1**
H1 is coded 0001.

2.7.2 Supplementary Services Registration/ Cancellation Acknowledgement Message (SRA)

The basic format of the SRA is shown in the following figure:

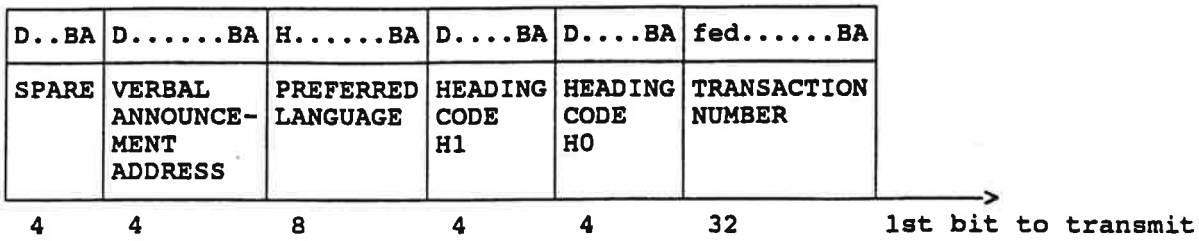


Figure 2.7.2 Supplementary Services Registration/ Cancellation Acknowledgement Message.

The following codes are used in the fields of the Supplementary Services Registration/ Cancellation Acknowledgement Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 0100.

c) **Heading code H1**
H1 is coded 0010.

d) **Preferred Language**
This is the preferred language to be used when sending announcements to the subscriber.
Bit EDCBA:

00000	Default language
00001	Danish
00010	Dutch
00011	English
00100	Finnish
00101	Flemish
00110	French
00111	German
01000	Greek
01001	Irish
01010	Islandish
01011	Italian
01100	Norwegian
01101	Portuguese
01110	Spanish
01111	Swedish
10000	Turkish
10001	Welch
10010 : 10111	Spare
11000 : 11111	Reserved for national use

Bit HGF: Spare.

e) Verbal announcement address

Bit DCBA:

0000	Spare
0001	Successful activation of services
0010	Successful deactivation of services
0011	Unsuccessful activation of services
0100	Unsuccessful deactivation of services
0101	Faulty manipulation of services
0110	Subscriber has no rights to service
0111	C-subscriber number or announcement number is illegal
1000	Interrogation answer "service activated"
1001	Interrogation answer "service deactivated"
1010	Network failure

(The remaining codes are spare)

f) Spare

2.7.3 Pre-Supplementary Services Registration/ Cancellation Accepted Message (PSA)

The basic format of the PSA is shown in the following figure:

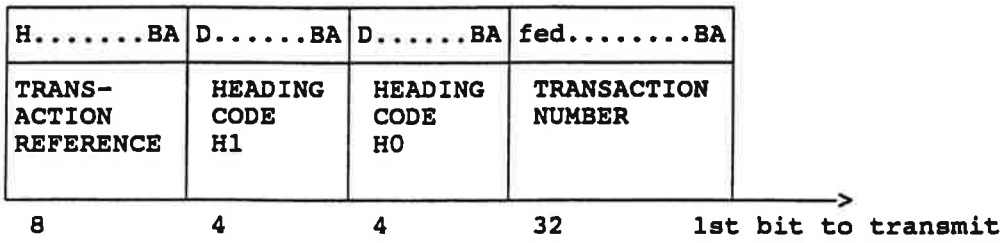


Figure 2.7.3 Pre-Supplementary Services Registration/ Cancellation Accepted Message

The following codes are used in the fields of the Pre-Supplementary Services Registration/ Cancellation Accepted Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 0100

c) **Heading code H1**
H1 is coded 0011

d) **Transaction Reference.**
See paragraph 2.5.2.d.

2.8 Management and Administration Messages (MAM)

The following types of Management and Administration Messages are included in the MUP and are each identified by a different heading code H1:

2.8.1 Restart Information Message (RES),

2.8.2 Restart Information Acknowledgement Message (REA).

2.8.1 Restart Information Message (RES)

The basic format of the RES is shown in the following figure:

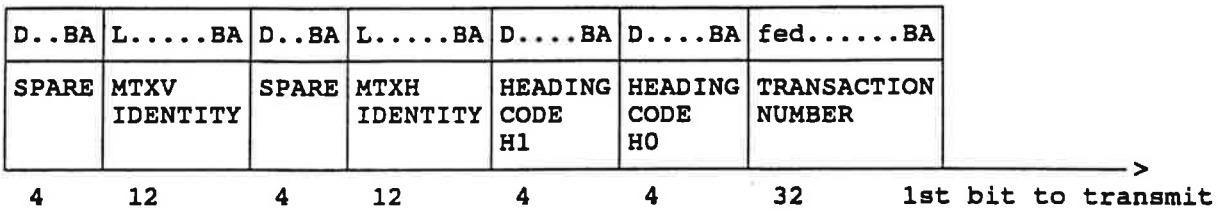


Figure 2.8.1 Restart Information Message.

The following codes are used in the fields of the Restart Information Message:

a) Transaction number.

See paragraph 2.2.

b) Heading code H0

H0 is coded 0110.

c) Heading code H1

H1 is coded 0001.

d) MTXH identity.

See paragraph 2.4.1.e.

e) Spare

f) MTXV identity.

See paragraph 2.4.1.e.

g) Spare

2.8.2 Restart Information Acknowledgement Message (REA)

The basic format for the REA is shown in the following figure:

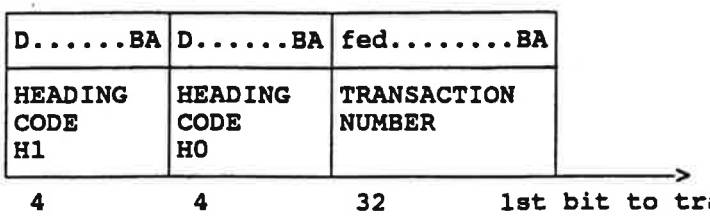


Figure 2.8.2 Restart Information Acknowledgement Message.

The following codes are used in the fields of the Restart Information Acknowledgement Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 0110.

c) **Heading code H1**
H1 is coded 0010.

2.9 Security Data Transfer Messages (SDM)

The following types of Security Data Transfer Messages are included in the MUP and are each identified by a different heading code H1:

2.9.1 Authentication Data Request Message (ADR)
2.9.2 Authentication Data Request Acknowledge Message (ADA)
2.9.3 Authentication Data Not Available Message (ADN)
2.9.4 Authentication Key Request Message (AKR)
2.9.5 Authentication Key Transfer Message (AKT)
2.9.6 Authentication Key Not Available Message (AKN)
2.9.7 Security Data Request Message (SDR)
2.9.8 Security Data Available Message (SDA)
2.9.9 Security Data Not Available Message (SDN)

2.9.1 Authentication Data Request Message (ADR)

The basic format of the ADR is shown in the following figure:

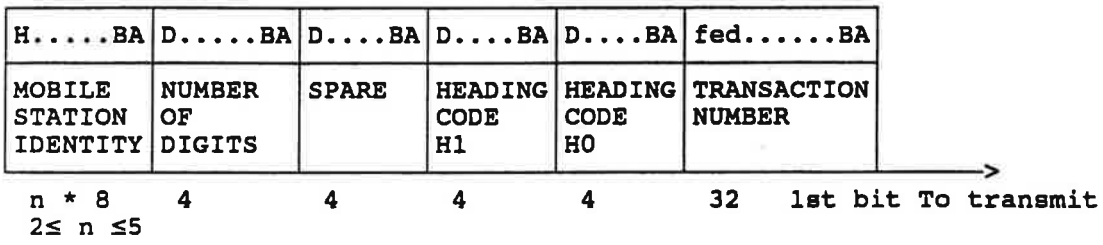


Figure 2.9.1 Authentication Data Request Message

The following codes are used in the fields of the Authentication Data Request Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 0001

d) **Spare.**

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Identity.**
See paragraph 2.4.1.g.

2.9.2 Authentication Data Request Acknowledge Message (ADA)

The basic format of the ADA is shown in the following figure:

X...BA	PO.....BA	D..BA	ba...BA	D....BA	D....BA	fed.....BA
BKEY C1..C6	SRES R1.....R4	SPARE	RAND C1...C7	HEADING CODE H1	HEADING CODE H0	TRANSACTION NUMBER
24	16	4	28	4	4	32

1st bit to transmit →

Figure 2.9.2 Authentication Data Request Acknowledge Message

The following codes are used in the fields of the Authentication Data Request Acknowledge Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 0010

d) **RAND**
RAND is a random number. It consists of seven succeeding digits (C1 .. C7). The digits are hexadecimal coded. The C7 digit is transferred first. Within each digit the least significant bit is transferred first.

e) **Spare**

f) **SRES**
SRES (Signed Response) is a number computed from RAND using SAK. It consists of four succeeding digits (R1 .. R4). The digits are hexadecimal coded. The R4 digit is transferred first. Within each digit the least significant bit is transferred first.

g) **BKEY**
BKEY is a key used to decrypt the B-number. The key is computed from RAND using the SAK. It consists of six succeeding digits (C1 .. C6). The digits are hexadecimal coded. The C6 digit is transferred first. Within each digit the least significant bit is transferred first.

2.9.3 Authentication Data Not Available Message (ADN)

The basic format of the ADN is shown in the following figure:

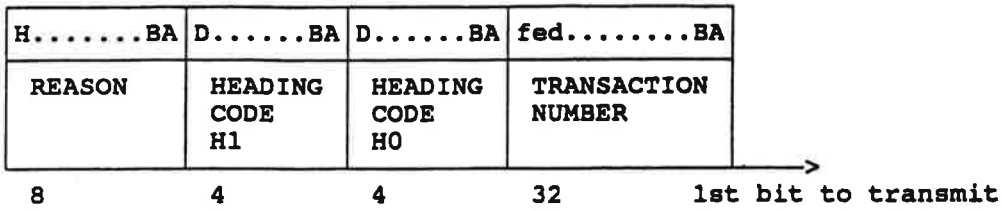


Figure 2.9.3 Authentication Data Not Available Message

The following codes are used in the fields of the Authentication Not Available Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 0011

d) **Reason**
Bit DCBA:
0000: No new data sets available
0001: Miscellaneous
(The remaining codes are spare)
Bit HGFE:
Spare

2.9.4 Authentication Key Request Message (AKR)

The basic format of the AKR is shown in the following figure:

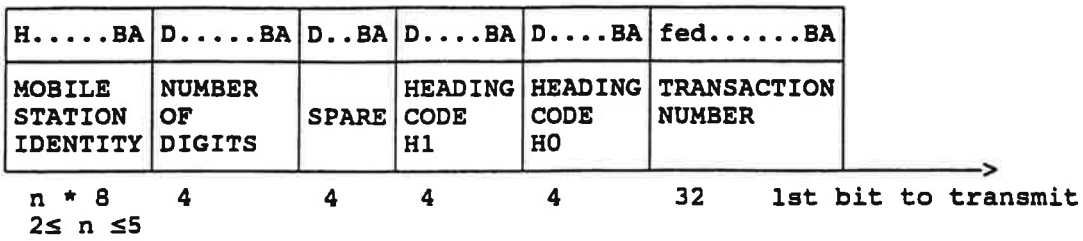


Figure 2.9.4 Authentication Key Request Message.

The following codes are used in the fields of the Authentication Key Request Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 0100

d) **Spare**

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Identity.**
See paragraph 2.4.1.g.

2.9.5 Authentication Key Transfer Message (AKT)

The basic format of the AKT is shown in the following figure:

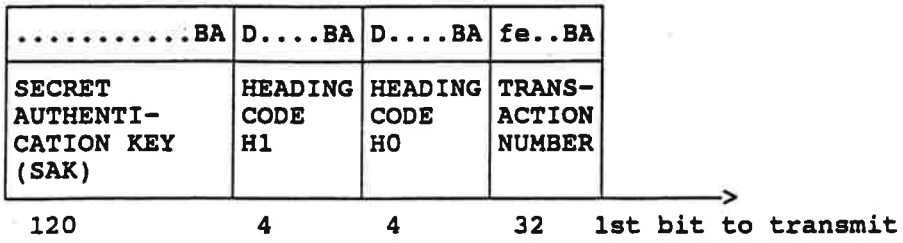


Figure 2.9.5 Authentication Key Transfer Message

The following codes are used in the fields of the Authentication Key Transfer Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 0101

d) **The Secret Authentication Key (SAK).**

2.9.6 Authentication Key Not Available Message (AKN)

The basic format of the AKN is shown in the following figure:

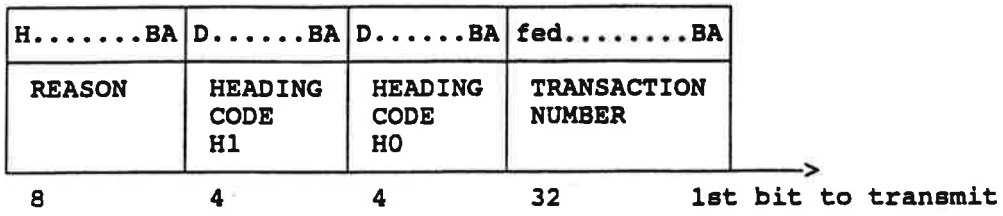


Figure 2.9.6 Authentication Key Not Available Message

The following codes are used in the fields of the Authentication Key Not Available Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 0110

d) **Reason**
Bit DCBA:

0000	No SAK available
0001	SAK not allowed to transfer
0010	Miscellaneous

(The remaining codes are spare)

Bit HGFE:
Spare

2.9.7 Security Data Request Message (SDR)

The basic format of the SDR is shown in the following figure:

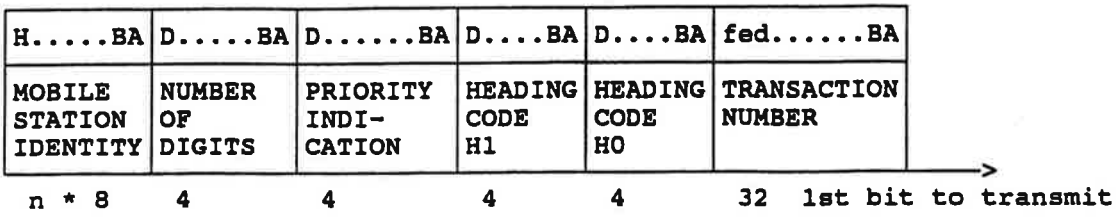


Figure 2.9.7 Security Data Request Message.

The following codes are used in the fields of the Security Data Request Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 0111

d) **Priority Indication**
Bit A: 0: No old already used security data available for the MS in the MTX.
1: Old already used security data available in the MTX.
Bit B: 0: No new unused security data available for the MS in the MTX.
1: New unused security data available for the MS in the MTX.
Bit DC:
Spare

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Identity.**
See paragraph 2.4.1.g.

2.9.8 Security Data Available Message (SDA)

The basic format of the SDA is shown in the following figure:

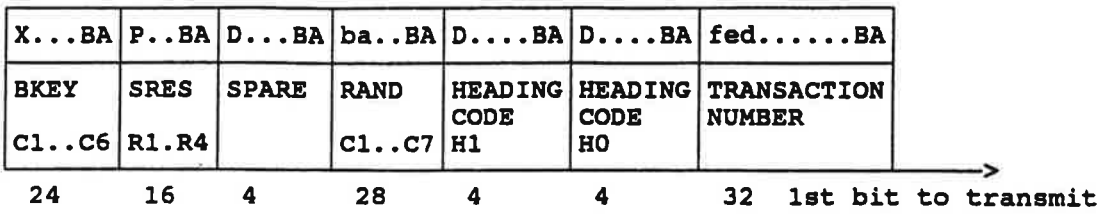


Figure 2.9.8 Security Data Available Message.

The following codes are used in the fields of the Security Data Available Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 1000

d) **RAND**
See paragraph 2.9.2.d.

e) **Spare**

f) **SRES**
See paragraph 2.9.2.f.

e) **BKEY**
See paragraph 2.9.2.g.

2.9.9 Security Data Not Available Message (SDN)

The basic format of the SDN is shown in the following figure:

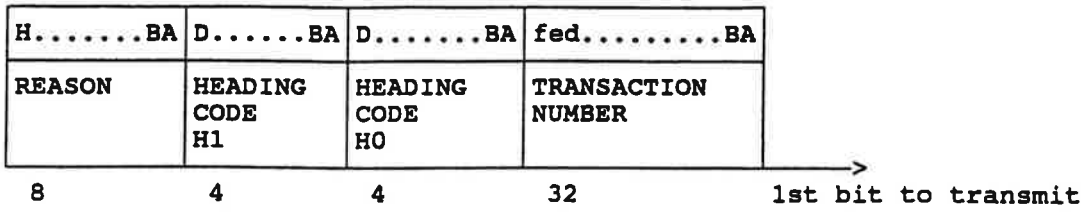


Figure 2.9.9 Security Data Not Available Message.

The following codes are used in the fields of the Security Data Not Available Messages:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1000

c) **Heading code H1**
H1 is coded 1001

d) **Reason**
Bit DCBA:

0000: No new data sets available
0001: Unknown MS
0010: Miscellaneous
(The remaining codes are spare)

Bit HGFE:

Spare

2.10 Roaming Signalling Messages

The following types of Roaming Signalling Messages are included in the MUP and are each identified by a different heading code H1:

2.10.1 Roaming Number Enquiry Message (RNE),
2.10.2 Roaming Number Message (RNM),
2.10.3 Roaming Number Rejected Message (RNR),
2.10.4 Conditional Call Transfer Enquiry Message (CTE),
2.10.5 Conditional Call Transfer Accepted Message (CTA),
2.10.6 Conditional Call Transfer Rejected Message (CTR),
2.10.7 Routing Enquiry Message (REM),
2.10.8 Routing Information Message (RIM),
2.10.9 Routing Information Reject Message (RIR).
2.10.10 Business Group Number Enquiry Message (BNE)
2.10.11 Business Group Number Information Message (BNM)
2.10.12 Business Group Number Rejected Message (BNR)
2.10.13 Routing Enquiry Message 2 (REM2)
2.10.14 IN Routing Information Message (IRI)
2.10.15 Gateway Enquiry Initial Message (GEI
2.10.16 Gateway Routing Message (GRM)
2.10.17 Gateway Subsequent Enquiry Message (GSE)
2.10.18 Gateway Enquiry Terminate Message (GET)
2.10.19 HLR Routing Enquiry Message (HRE)
2.10.20 HLR Routing Message (HRM)
2.10.21 HLR Routing Rejected Message (HRR)
2.10.22 Serving Exchange Message (SEM)
2.10.23 Serving Exchange Acknowledgement Message (SEA)

2.10.1 Roaming Number Enquiry Message (RNE)

The basic format of the RNE is shown in the following figure:

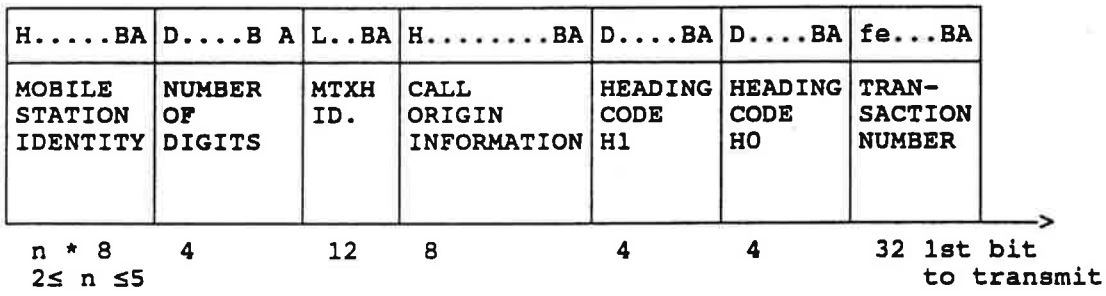


Figure 2.10.1 Roaming Number Enquiry Message.

The following codes are used in the fields of the Roaming Number Enquiry Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 0001.

d) **Call origin information**

Bit GFEDCBA:

Call announcements to the calling subscriber.

Bit EDCBA:

00000	Default language
00001	Danish
00010	Dutch
00011	English
00100	Finnish
00101	Flemish
00110	French
00111	German
01000	Greek
01001	Irish
01010	Islandish
01011	Italian
01100	Norwegian
01101	Portuguese
01110	Spanish
01111	Swedish
10000	Turkish
10001	Welch
10010 : 10111	Spare
11000 : 11111	Reserved for national use

Bit GF:

Spare.

Bit H: IN-call indication

0: Normal mobile call

1: Call routed via IN

e) **MTXH identity**

See paragraph 2.4.1.e.

f) **Number of digits**

See paragraph 2.4.1.f.

g) **Mobile Station Identity**

See paragraph 2.4.1.g.

2.10.2 Roaming Number Message (RNM)

The basic format of the RNM is shown in the following figure:

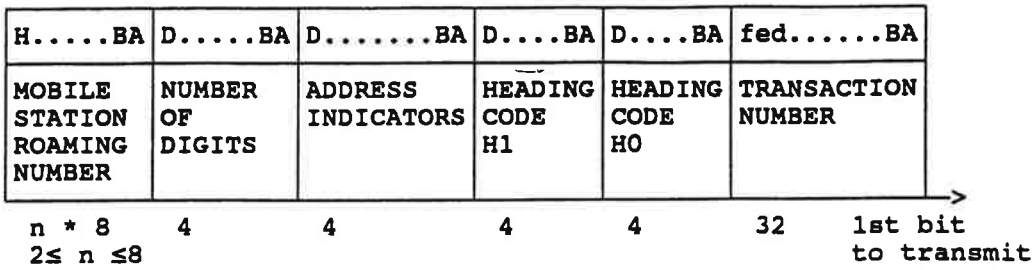


Figure 2.10.2 Roaming Number Message.

The following codes are used in the fields of the Roaming Number Message:

a) **Transaction number.**

See paragraph 2.2.

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 0010.

d) **Address Indicators**

The coding of these indicators have the following meaning:

Bit A: 0: The MSRN is a national significant number.

1: The MSRN is an international number.

Bit DCB:

Spare

e) **Number of digits.**

See paragraph 2.4.1.f.

f) **Mobile Station Roaming Number.**

Coding of these digits as in paragraph 2.5.2.f.

2.10.3 Roaming Number Rejected Message (RNR)

The basic format of the RNR is shown in the following figure:

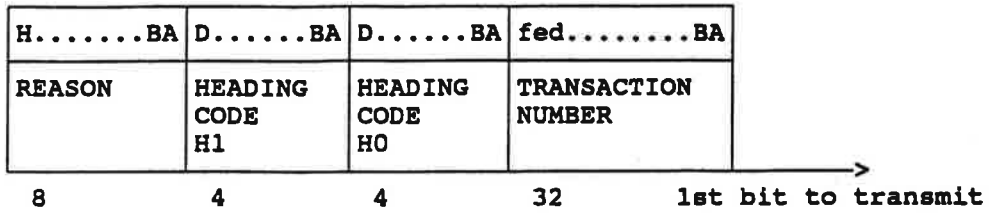


Figure 2.10.3 Roaming Number Rejected Message.

The following codes are used in the fields of the Roaming Number Rejected Message:

a) **Transaction number.**

See paragraph 2.2.

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 0011.

d) **Reason:**

Bit DCBA:

0000	No free MSRN
0001	MS identity unknown
0010	Spare
0011	Spare
0100	Not used
0101	Not used
0110	Not used
0111	Miscellaneous

(The remaining codes are spare).

Bit HGFE:

Spare.

2.10.4 Conditional Call Transfer Enquire Message (CTE)

The basic format of the CTE is shown in the following figure:

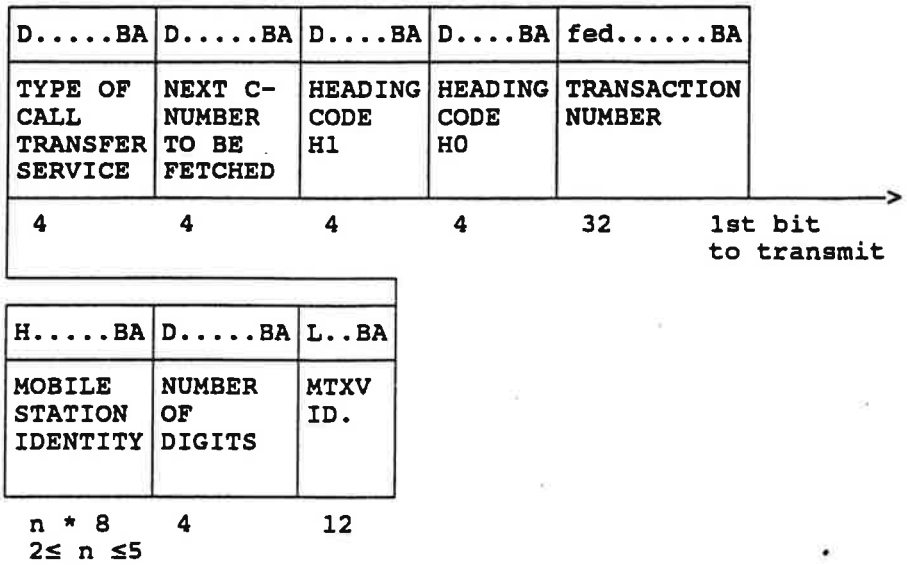


Figure 2.10.4 Conditional Call Transfer Enquire Message

The following codes are used in the fields of the Conditional Call Transfer Enquire Message:

a) **Transaction number.**

See paragraph 2.2.

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 0100.

d) **Next C-number**

This field indicates the position of the wanted C-number in the list of C-numbers. When this message is sent the first time this field is always coded 0001.

Bit DCBA:

0000	Not used
0001	1st C-number in the list or an arbitrary C-number
0010	2nd C-number in the list
:	
:	
1111	15th C-number in the list

e) **Type of Call Transfer service**

Bit DCBA:

0000	Conditional Call Transfer on no page response or Personal Number Service
0001	Conditional Call Transfer on no answer
0010	Conditional Call Transfer on busy
0011	Conditional Call Transfer on BS congestion

(The remaining codes are spare).

f) **MTXV identity.**

See paragraph 2.4.1.e.

g) **Number of digits.**

See paragraph 2.4.1.f.

h) **Mobile Station Identity.**

See paragraph 2.4.1.g.

2.10.5 Conditional Call Transfer Accepted Message (CTA)

The basic format of the CTA is shown in the following figure:

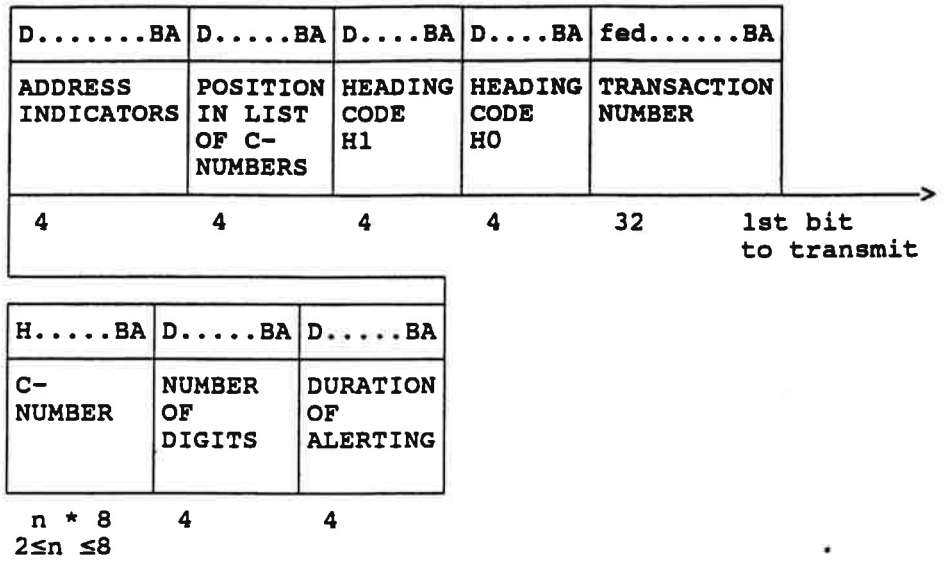


Figure 2.10.5 Conditional Call Transfer Accepted Message

The following codes are used in the fields of the Conditional Call Transfer Accepted Message:

a) **Transaction number**

See paragraph 2.2.

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 0101.

d) **Position in list of C-numbers**

This field indicates the position of the given C-number in the list of C-numbers, or it indicates if an arbitrary number is in use.

Bit DCBA:

0000	The C-number is the last number in the list. This code is also used if no list of C-numbers is in use, but an arbitrary number is transferred.
0001	1st C-number in the list
0010	2nd C-number in the list
:	
:	
1111	15th C-number in the list

e) **Address Indicators**

The coding of these indicators have the following meaning:

Bit A: 0: The C-number is a national significant number.

1: The C-number is an international number.

Bit DCB:

Spare

f) **Duration of alerting at Call transfer on no reply**

Bit DCBA:

0000	Use default value
0001	5 seconds alerting
0010	10 " "
0011	15 " "
0100	20 " "
0101	25 " "
0110	30 " "
0111	35 " "
1000	40 " "
1001	45 " "
1010	50 " "
1011	55 " "
1100	60 " "
1101	65 " "
1110	70 " "
1111	75 seconds alerting

g) **Number of digits.**

See paragraph 2.4.1.f.

h) **C-number.**

Coding of these digits as in paragraph 2.5.2.f.

2.10.6 Conditional Call Transfer Rejected Message (CTR)

The basic format of the CTR is shown in the following figure:

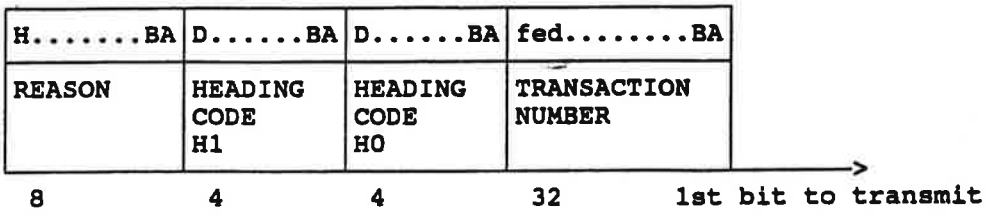


Figure 2.10.6 Conditional Call Transfer Rejected Message

The following codes are used in the fields of the Conditional Call Transfer Rejected Message:

a) **Transaction number.**

See paragraph 2.2.

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 0110.

d) **Reason**

Bit DCBA:

0000	The subscriber has not activated the requested Call Transfer service
0001	The list of C-numbers is not activated
0010	No C-number is found
0011	C-number not possible to convert to an international number
0100	Miscellaneous

(The remaining codes are spare).

Bit HGFE:

Spare.

2.10.7 Routing Enquiry Message (REM)

The basic format of the REM is shown in the following figure:

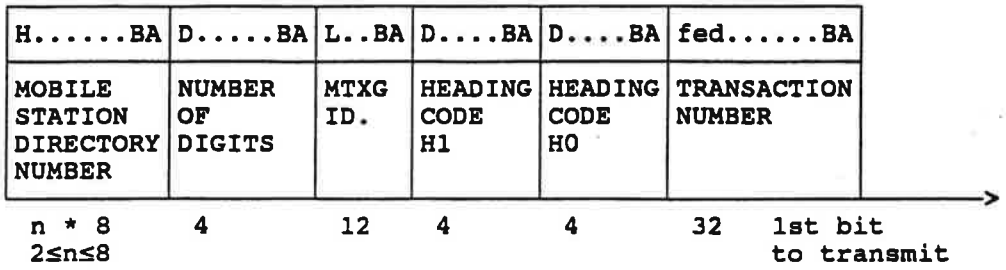


Figure 2.10.7 Routing Enquiry Message.

The following codes are used in the fields of the Routing Enquiry Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1001.

c) **Heading code H1**
H1 is coded 0111.

d) **MTXG identity.**
See paragraph 2.4.1.e.

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Directory Number.**
Coding of these digits as in paragraph 2.5.2.f.

2.10.8 Routing Information Message (RIM)

The basic format of the RIM is shown in the following figure:

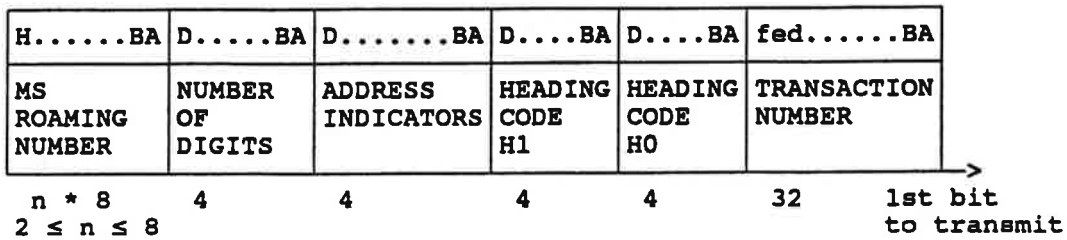


Figure 2.10.8 Routing Information Message.

The following codes are used in the fields of the Routing Information Message:

a) **Transaction number**

See paragraph 2.2.

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 1000.

d) **Address Indicators**

The coding of these indicators have the following meaning:

Bit A: 0: The MSRN is a national significant number.
1: The MSRN is an international number.
If no MSRN is transferred, this bit should be coded "0".

Bit B: 0: MSRN is not included
1: MSRN is included
If the "MSRN is not included" is set, the call shall be routed using the dialled MS directory number.
If the "MSRN is included" is set, the call shall be routed using the Mobile Station Roaming Number transferred in the message.

Bit C: 0: The MSRN is a "Roaming" number
1: The MSRN is a "Homing" number i.e. it belongs to MTXH

Bit D: Spare

e) **Number of digits.**

See paragraph 2.4.1.f.

f) **Mobile Station Roaming Number (MSRN).**

Coding of these digits as in paragraph 2.5.2.f.

2.10.9 Routing Information Rejected Message (RIR)

The basic format of the RIR is shown in the following figure:

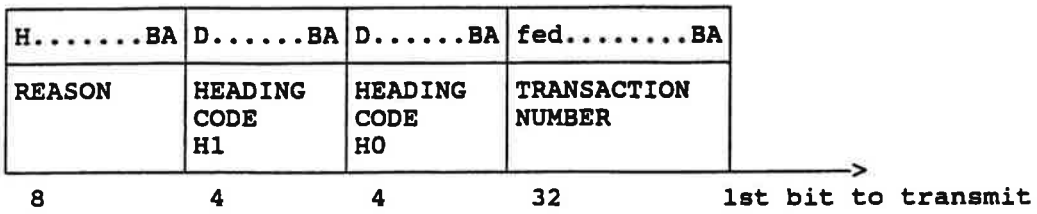


Figure 2.10.9 Routing Information Rejected Message.

The following codes are used in the fields of the Routing Information Rejected Message:

a) **Transaction number.**

See paragraph 2.2

b) **Heading code H0**

H0 is coded 1001.

c) **Heading code H1**

H1 is coded 1001.

d) **Reason:**

Bit DCBA:

0000	No free MSRN
0001	MS identity unknown
0010	Spare
0011	Spare
0100	Mobile Station Directory Number incomplete
0101	Unallocated directory number
0110	Access Barred (reserved for future use).
0111	Miscellaneous
1000	National option: Routing via IN required (IN data included in bit HGFE)

(Other codes in bit DCBA are spare)

Bit HGFE: National option: Additional information connected to code 1000 in bit DCBA.

2.10.10 Business Group Number Enquiry Message (BNE)

The basic format of the BNE is shown in the following figure:

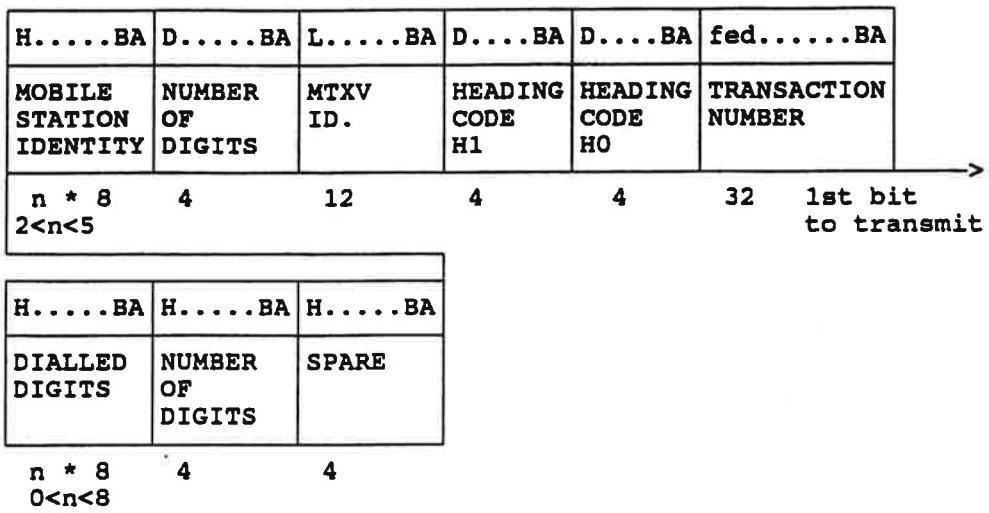


Figure 2.10.10 Business Group Number Enquiry Message

The following codes are used in the fields of the Business Group Number Enquiry Message.

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1001.

c) **Heading code H1**
H1 is coded 1010.

d) **MTXV identity.**
See paragraph 2.4.1.e.

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Identity.**
See paragraph 2.4.1.g.

g) **Spare.**

h) **Number of digits.**
See paragraph 2.4.1.f.

i) **Dialled digits.**
Coding of these digits as in paragraph 2.5.2.f.

2.10.11 Business Group Number Information Message (BNM)

The basic format of the BNE is shown in the following figure:

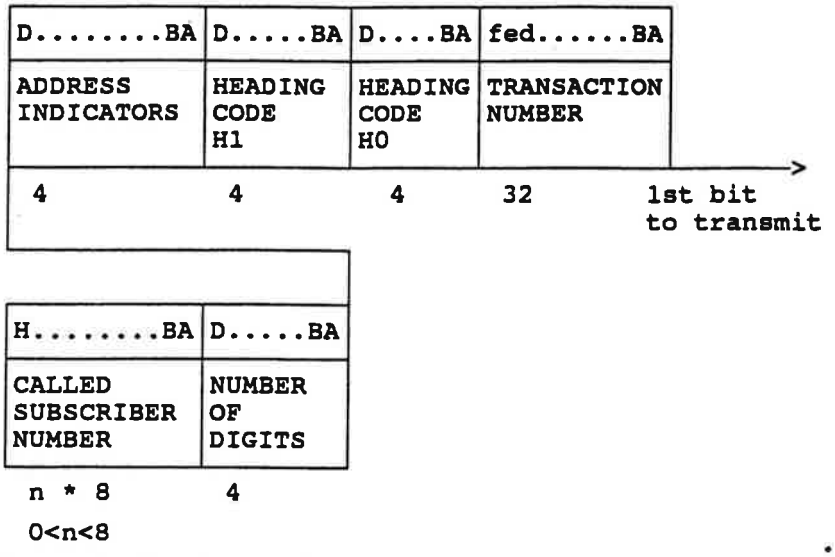


Figure 2.10.11 Business Group Number Information Message.

The following codes are used in the fields of the Business Group Number Information Message:

a) **Transaction number.**
See paragraph 2.2.

b) **Heading code H0**
H0 is coded 1001.

c) **Heading code H1**
H1 is coded 1011.

d) **Address Indicators.**
The coding of these indicators have the following meaning:

Bit A: 0: Called subscriber number is a national significant number
1: Called subscriber number is an international number.

Bit DCB:
Spare

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Called subscriber number.**
The coding of these digits as in paragraph 2.5.2.f.

2.10.12 Business Group Number Rejected Message (BNR)

The basic format of the BNR is shown in the following figure:

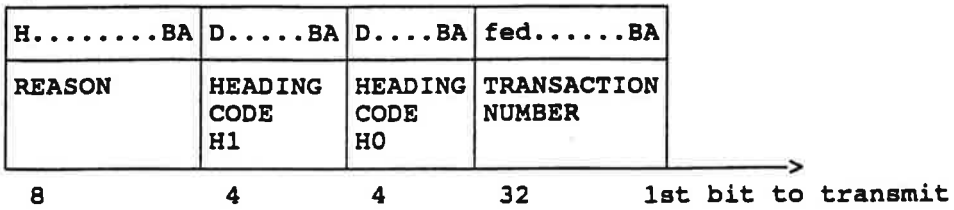


Figure 2.10.12 Business Group Number Rejected Message.

The following codes are used in the fields of the Business Group Number Rejected Message:

a) Transaction number.

See paragraph 2.2.

b) Heading code H0

H0 is coded 1001.

c) Heading code H1

H1 is coded 1100.

d) Reason:

Bit DCBA:

0000	MS identity unknown
0001	No business group found for MS identity
0010	Dialled short code not defined in MTXH.
0011	Subscribed not allowed to make short number calls in the MTXV
0100	Miscellaneous

(The remaining codes are spare).

Bit HGFE:

Spare

2.10.13 Routing Enquiry Message 2 (REM2)

The basic format of the REM2 is shown in the following figure:

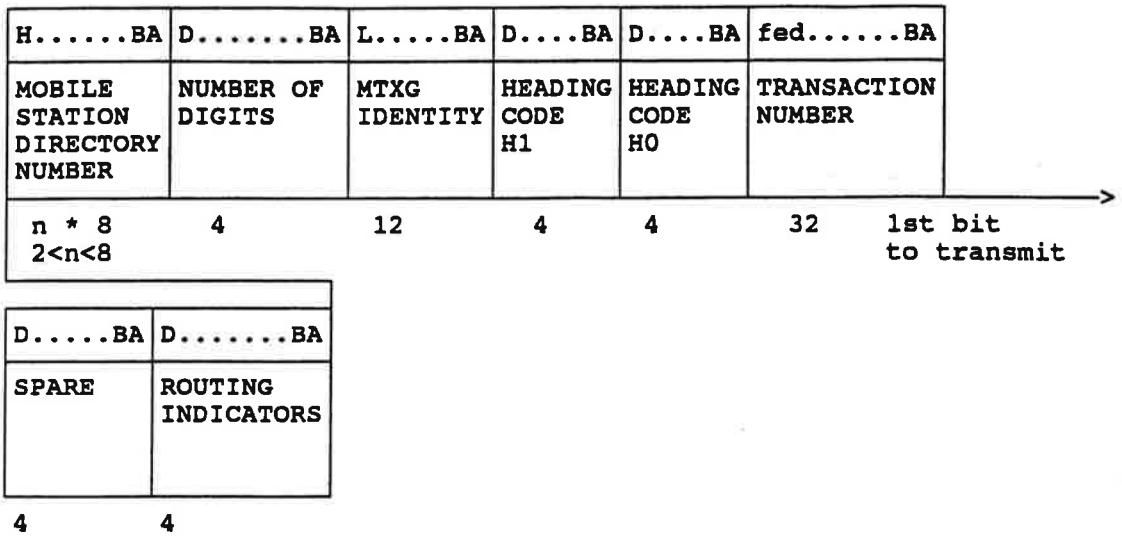


Figure 2.10.13 Routing Enquiry Message 2 (REM2)

The following codes are used in the fields of the Routing Enquiry Message 2:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1001.

c) **Heading code H1**
H1 is coded 1101.

d) **MTXG identity.**
See paragraph 2.4.1.e.

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Directory Number.**
Coding of these digits as in paragraph 2.5.2.f.

g) **Routing indicators**
Bit A: Terminating IN-category suppression
0: No suppression
1: Suppress terminating IN category
Bit DCB:
Spare

h) **Spare**

2.10.14 IN-Routing Information Message (IRI)

The basic format of the IRI is shown in the following figure:

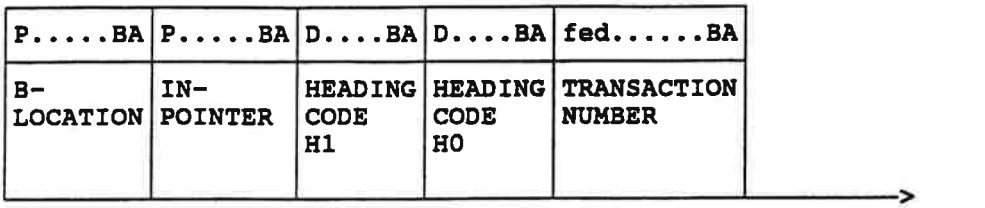


Figure 2.10.14 IN-Routing Information Message (IRI)

The following codes are used in the fields of the IN Routing Information Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1001.

c) **Heading code H1**
H1 is coded 1110.

d) **IN-Pointer**
Bit:
P.....EDCBA
Coding is a national option

e) **B-location**
Bit:
P.....EDCBA
Coding is a national option

2.10.15 Gateway Enquiry Initial Message (GEI)

The basic format of the GEI is shown in the following figure:

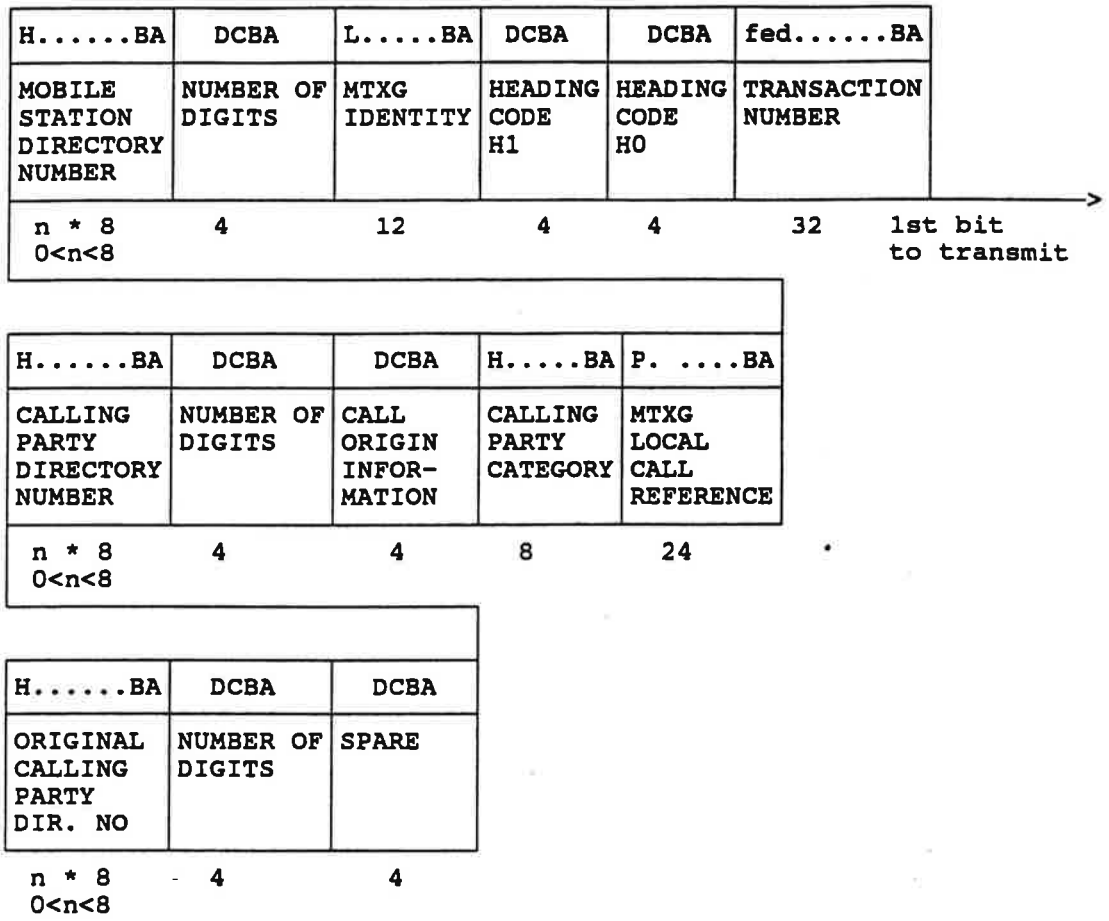


Figure 2.10.15 Gateway Enquiry Initial Message (GEI)

The following codes are used in the fields of the Gateway Enquiry Initial Message (GEI):

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 0101

c) **Heading code H1**
H1 is coded 0001.

d) **MTXG identity.**
See paragraph 2.4.1.e.

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Directory Number.**
Coding of these digits as in paragraph 2.5.2.f.

g) **MTXG Local Call Reference**
The local call reference is a 24-bit binary coded number that is sent to the HLR/MTXH to uniquely point out an outgoing call setup in the MTXG. The MTXG local call reference is sent further on to the MTXV as a global call reference. The global call reference consists of the MTXG identity followed by the MTXG local call reference. An MTXG local call reference might be reused when the call is terminated.

h) **Calling Party Category**
Coded according to CCITT blue book, volume VI, facile VI,8, Req Q.763.

i) **Call origin information**
Bit DCBA:

0000	Unknown origin
0001	Origin is Intelligent network

(The remaining codes are spare)

j) **Number of digits**
See paragraph 2.4.1.f.

k) **Calling party directory number**
Coding of these digits as in paragraph 2.5.2.f.

l) **Spare**

m) **Number of digits**
See paragraph 2.4.1.f.

n) **Original calling party directory number**
Coding of these digits as in paragraph 2.5.2.f.

2.10.16 Gateway Routing Message (GRM)

The basic format of the GRM is shown in the following figure:

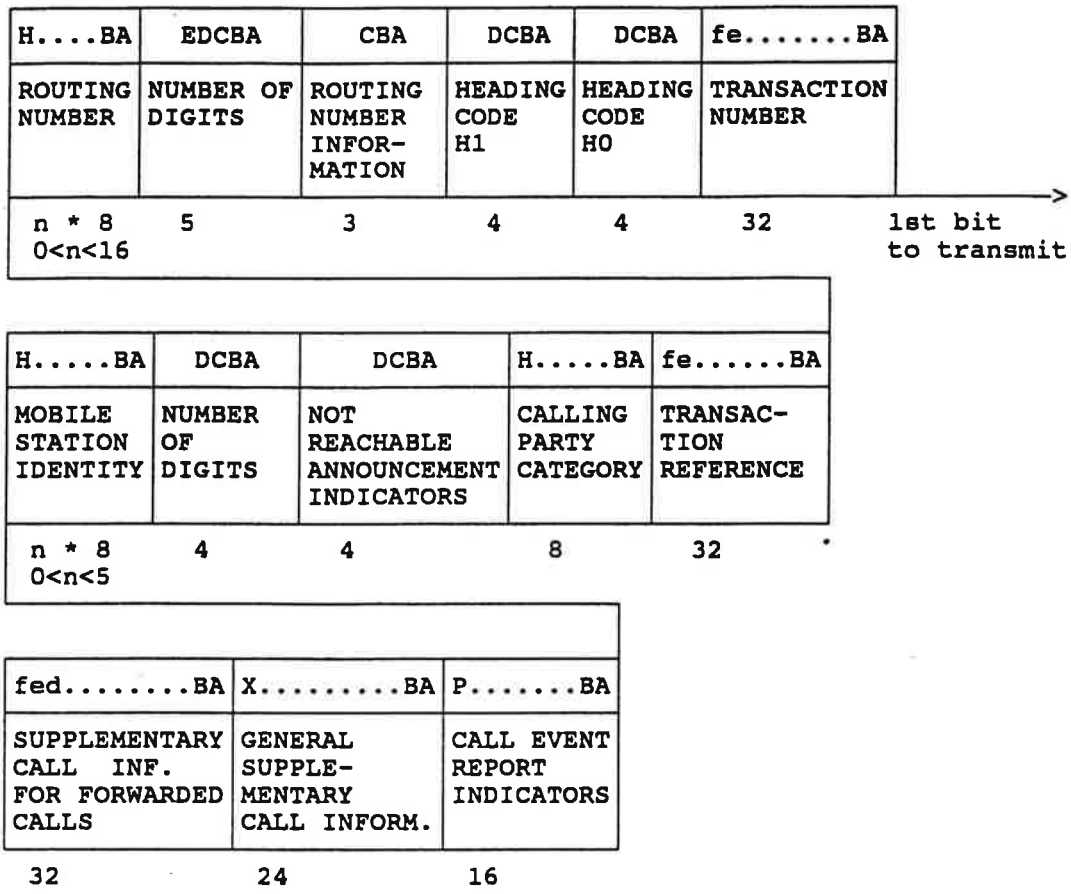


Figure 2.10.16 Gateway Routing Message (GRM)

The following codes are used in the fields of the Gateway Routing Message (GRM):

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1010.

c) **Heading code H1**
H1 is coded 0010.

d) **Routing number**

The coding of these indicators have the following meaning:

Bit A: 0: The included number is a national significant number.
1: The included number is an international number.

Bit CB: 00: MSRN is included
01: Diversion number is included
10: Other routing number
11: The MSRN is a homing number

If no number is transferred, bit CBA is coded 000

e) **Number of digits.**

See paragraph 2.4.1.f.

f) **Routing Number**

Coding of these digits as in paragraph 2.5.2.f.

g) **Transaction reference**

This is a binary number used to link the two messages Gateway Routing Message (GRM) and Gateway Subsequent Enquiry Message (GSE) which is considered one transaction. A transaction reference can be reused when the transaction has been successfully completed.

h) **Calling Party Category**

Coded according to CCITT blue book, volume VI, facile VI,8, Req Q.763.

i) **Not reachable announcement indicators**

Provide announcement means that if the conditions for one of the following events are fulfilled, an appropriate announcement will be played in the MTXG.

Bit A: No answer
0: Do not provide announcement
1: Provide announcement

Bit B: No page response
0: Do not provide announcement
1: Provide announcement

Bit C: Busy
0: Do not provide announcement
1: Provide announcement

Bit D: Base station congestion
0: Do not provide announcement
1: Provide announcement

j) **Number of digits.**
See paragraph 2.4.1.f.

k) **Mobile Station Identity.**
See paragraph 2.4.1.g.

l) **Call event report indicators**
When the MTXG detects an event that the HLR/MTXH has marked in the "call event report indicators" a Gateway Subsequent Enquiry Message is sent to the HLR/MTXH where further action is decided.

Bit A: No answer
0: Event not to be reported
1: Event to be reported

Bit B: No page response
0: Event not to be reported
1: Event to be reported

Bit C: Busy
0: Event not to be reported
1: Event to be reported

Bit D: Base station congestion
0: Event not to be reported
1: Event to be reported

Bit E: Ringing started
0: Event not to be reported
1: Event to be reported

Bit F: B-answer
0: Event not to be reported
1: Event to be reported

Bit G: A-termination
0: Event not to be reported
1: Event to be reported

Bit H: B-termination
0: Event not to be reported
1: Event to be reported

Bit PONMLKJI:
Spare

m) General supplementary call information

Bit DCBA:

Duration of alerting:

0000	Use default value
0001	5 seconds alerting
0010	10 " "
0011	15 " "
0100	20 " "
0101	25 " "
0110	30 " "
0111	35 " "
1000	40 " "
1001	45 " "
1010	50 " "
1011	55 " "
1100	60 " "
1101	65 " "
1110	70 " "
1111	75 seconds alerting

Bit HGFE:

Information for charge determination

0000	No charging
0001	Charge determination code no. 1
.	
.	
1111	Charge determination code no. 15

Note: These codes are used by the MTXG to determine charging of the called party for the distance from the MTXG to the destination indicated by the routing number (field f). The meaning of the codes are defined in ANNEX-1 of this document.

Bit I: Immediate billing output

0 Service not activated

1 Service activated

Bit J: Malicious call tracing indicator

0 Service not activated

1 Service activated

Bit K: Calling line identification restriction

0 Service not activated

1 Service activated

Bit XWVUTSRQPONML:

Spare

n) **Supplementary call information for forwarded calls**

Bit FEDCBA:

Call forwarding announcement codes.

000000 No announcement
000001 Announcement code no.1

.
.

111111 Announcement code no.63

Note: These codes are used by the MTXG to determine the announcement to send to the calling subscriber. The meaning of the codes are defined in Annex-1 of this document.

Bit HG:

Start of announcement

00 Provide announcement before the forwarding is initiated.
00 Provide announcement and initiate the forwarding simultaneously.
00 Provide announcement during the alerting.
11 Spare

Bit LKJI:

Diverted call barred indicator

Coding as for outgoing call barred indicator in paragraph 2.5.1.f.

This codes are used by the MTXG to determine whether the call should be barred or not.

Bit baZXWVUTSRQPONM:

Information Field for IN-Services

See paragraph 2.5.1.k for explanation and coding.

Bit fedc:

Spare

2.10.17 Gateway Subsequent Enquiry Message (GSE)

The basic format of the GSE is shown in the following figure:

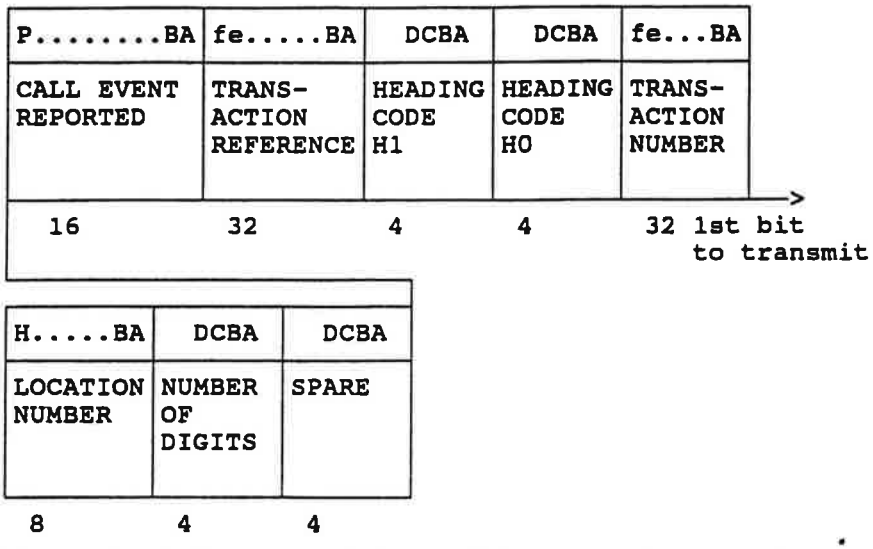


Figure 2.10.17 Gateway Subsequent Enquiry Message (GSE)

The following codes are used in the fields of the Gateway Subsequent Enquiry Message (GSE)

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1010

c) **Heading code H1**
H1 is coded 0011

d) **Transaction reference**
See paragraph 2.10.16.g

e) **Call event report indicators**
See paragraph 2.10.16.1

f) **Spare**

g) **Number of digits**
See paragraph 2.4.1.f.

h) **Location number**
Coded as in paragraph 2.4.1.g

2.10.18 Gateway Enquiry Terminate Message (GET)

The basic format of the GET is shown in the following figure:

H.....BA	H.....BA	DCBA	DCBA	fe...BA
ADDITIONAL INFORMATION	REASON FOR TERMI-NATION	HEADING CODE H1	HEADING CODE H0	TRANS-ACTION NUMBER
8	8	4	4	32

32 1st bit to transmit

H.....BA	DCBA	DCBA	H.....BA	EDCBA	CBA
MOBILE STATION IDENTITY	NUMBER OF DIGITS	INFO FOR CHARGE DETERM.	ROUTING NUMBER	NUMBER OF DIGITS	ROUTING NUMBER INFOR-MATION
n * 8 0<n<5	4	4	N * 8 0<n<16	5	3

Figure 2.10.18 Gateway Enquiry terminate Message (GET)

The following codes are used in the fields of the Gateway Routing Message (GRM):

a) **Transaction number.**

See paragraph 2.2

b) **Heading code H0**

H0 is coded 1010.

c) **Heading code H1**

H1 is coded 0100

d) **Reason for termination**

Bit DCBA:

0000	Termination of procedure
0001	Rejected by technical reason
0010	Unpermitted traffic case
0011	Barring for terminating traffic
0100	Don't disturb service
0101	Interception service
0110	Call transfer protection
0111	Absent subscriber service
1000	Subscriber controlled absent subscriber service

The remaining codes are spare. For detailed information regarding the reason codes, see the additional information field.

Bit HGFE:

Spare

e) **Additional information**

The meaning of the codes are defined in Annex-1 of this document.

f) **Routing number information**

The coding of these indicators have the following meaning:

Bit A: 0 The included number is a national significant number.
1 The included number is an international number.

Bit CB: 00 MSRN is included
01 Not used
10 Other routing number
11 The MSRN is a homing number

If no routing number is transferred, bit CBA is coded 000

g) **Number of digits.**

See paragraph 2.4.1.f.

h) **Routing Number**

Coding of these digits as in paragraph 2.5.2.f.

i) **Information for charge determination**

Bit DCBA:

0000 No charging
0001 Charge determination code no. 1
.
.
1111 Charge determination code no. 15

Note: These codes are used by the MTXG to determine charging of the called party for the distance from the MTXG to the destination indicated by the routing number (field h). The meaning of the codes are defined in ANNEX-1 of this document.

j) **Number of digits.**

See paragraph 2.4.1.f.

k) **Mobile Station Identity.**

See paragraph 2.4.1.g.

2.10.19 HLR Routing Enquiry Message (HRE)

The basic format of the HRE is shown in the following figure:

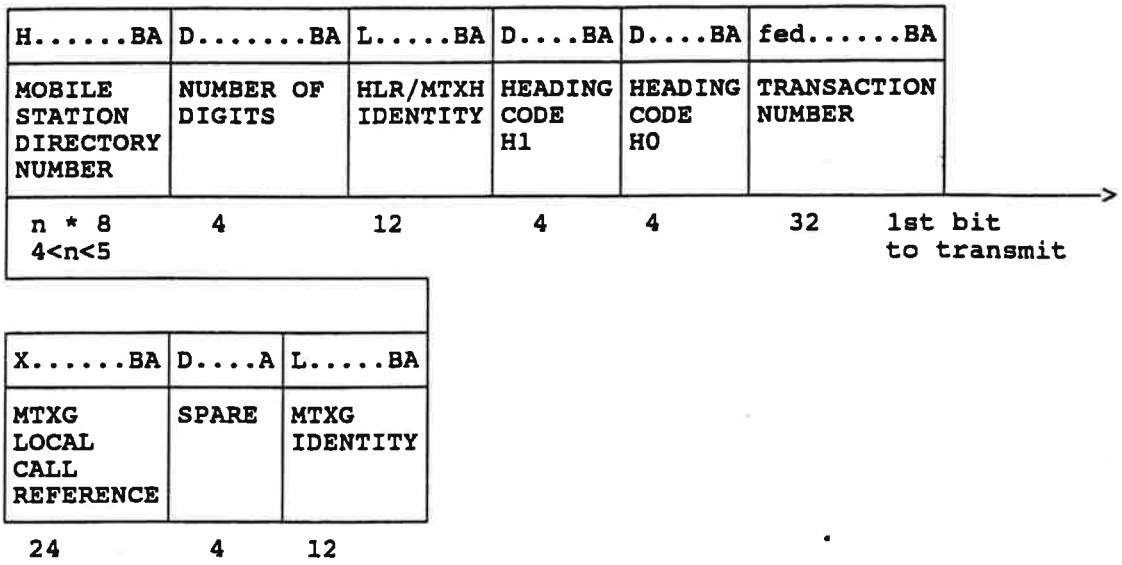


Figure 2.10.19 HLR Routing Enquiry Message (HRE)

The following codes are used in the fields of the HLR Routing Enquiry Message (HRE)

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1011

c) **Heading code H1**
H1 is coded 0001.

d) **HLR/MTXH identity.**
See paragraph 2.4.1.e.

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Mobile Station Identity.**
Coding of these digits as in paragraph 2.4.1.g

g) **MTXG identity.**
See paragraph 2.4.1.e.

h) **Spare**

i) **MTXG Local Call Reference**
See paragraph 2.10.15.g

2.10.20 HLR Routing Message (HRM)

The basic format of the GRM is shown in the following figure:

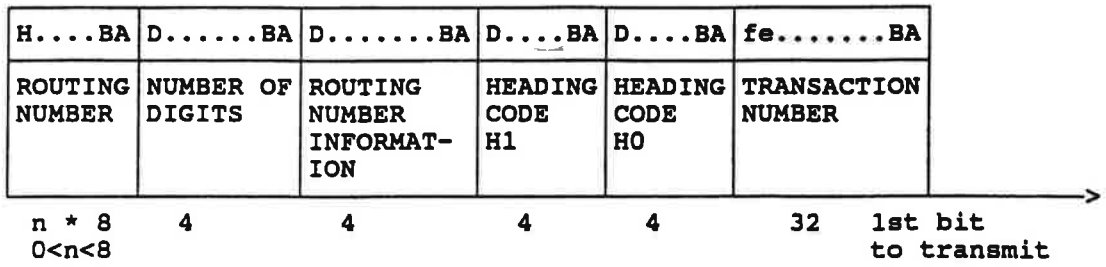


Figure 2.10.20 HLR Routing Message (HRM)

The following codes are used in the fields of the HLR Routing Message (HRM):

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1011.

c) **Heading code H1**
H1 is coded 0010.

d) **Routing number information**
The coding of these indicators have the following meaning:
Bit A: 0 The included number is a national significant number.
1 The included number is an international number.
Bit DCB:
Spare

e) **Number of digits.**
See paragraph 2.4.1.f.

f) **Routing Number**
The number is normally the "mobile station roaming number"
Coding of these digits as in paragraph 2.5.2.f.

2.10.21 HLR Routing Rejected Message (HRR)

The basic format of the HRR is shown in the following figure:

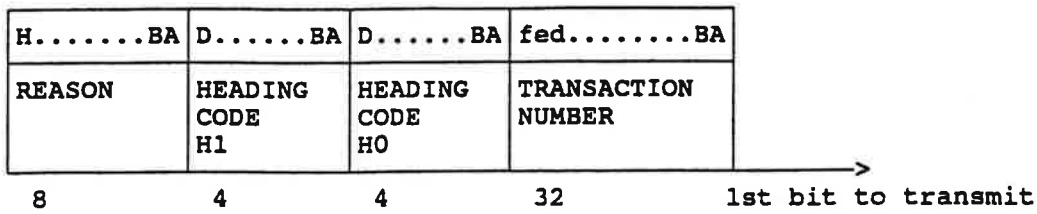


Figure 2.10.21 HLR Routing Rejected Message.

The following codes are used in the fields of the HLR Routing Rejected Message (HRR):

a) **Transaction number.**

See paragraph 2.2

b) **Heading code H0**

H0 is coded 1011

c) **Heading code H1**

H1 is coded 0011.

d) **Reason:**

Bit DCBA:

0000	No free MSRN
0001	MS identity unknown
0010	Spare
0011	Spare
0100	Spare
0101	Spare
0110	Spare
0111	Miscellaneous
.	Spare
.	
.	Spare
0001	No page response
1111	The called subscriber is busy

Bit HGFE:

Spare

2.10.22 Serving Exchange Message (SEM)

The basic format of the SEM is shown in the following figure:

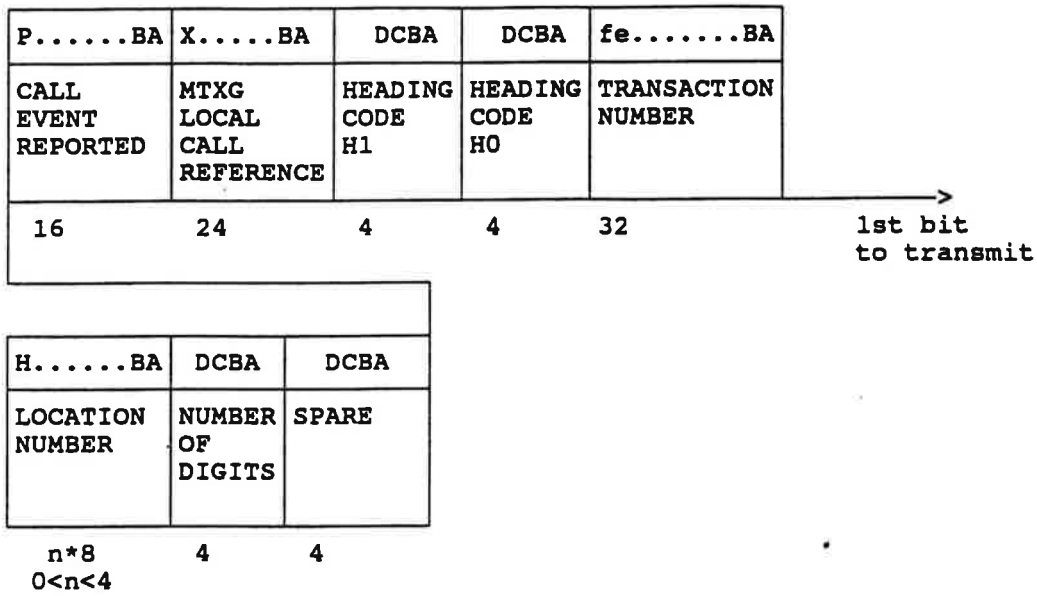


Figure 2.10.22 Serving Exchange Message (SEM)

The following codes are used in the fields of the Serving Exchange Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1010

c) **Heading code H1**
H1 is coded 0101

d) **MTXG Local Call Reference**
See paragraph 2.10.15.g

e) **Call event report indicators**

One of the following events are reported to the MTXG from the MTXV:

Bit A: No answer
- 0 Event not detected
- 1 Event detected

Bit B: No page response
- 0 Event not detected
- 1 Event detected

Bit C: Not used

Bit D: Base station congestion
- 0 Event not detected
- 1 Event detected

Bit E: Ringing started
- 0 Event not detected
- 1 Event detected

Bit F: Not used

Bit G: Not used

Bit H: Not used

Bit PONMLKJI:
Spare

f) **Spare**

g) **Number of digits.**

See paragraph 2.4.1.f.

h) **Location number**

Coding of these digits as in paragraph 2.4.1.g

2.10.23 Serving Exchange Acknowledgement Message (SEA)

The basic format of the SEA is shown in the following figure:

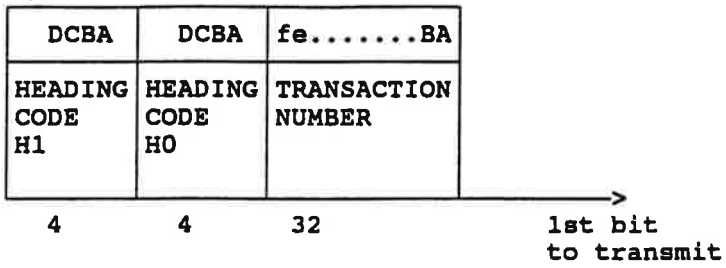


Figure 2.10.23 Serving Exchange Message (SEA)

The following codes are used in the fields of the Serving Exchange Message:

a) **Transaction number.**
See paragraph 2.2

b) **Heading code H0**
H0 is coded 1010

c) **Heading code H1**
H1 is coded 0110

2.11 Information element codings

2.11.1 Format principles for MUP

The MUP generated information is divided into a number of subfields which may be either of fixed or variable length. For a given message type identified by a unique message heading, the presence of a given subfield may be either mandatory or optional.

2.11.1.1 Mandatory Subfields

Subfields which have been declared mandatory for a given message type appear in all messages of that type. If no explicit declaration is made, the field type is to be interpreted as mandatory.

2.11.1.2 Optional Subfields

Subfields which have been declared optional for a given message type only appear when required in messages of that type. The presence or absence of each optional fields is indicated by the state of a field indicator located in an indicator field, which in this case is a mandatory subfield.

2.11.2 Fixed Length Subfields

Subfields which have been declared fixed length for a given message type contain the same number of bits in all messages of that type.

2.11.3 Variable Length Subfields

For subfields which have been declared variable length for a given message type the number of bits may vary between messages of that type. The size of a variable length subfield is indicated in an immediately preceding fixed length subfield.

2.11.4 Order of Subfield Transmission

For a given type of message the various types of subfields are transmitted in the following order:

i) mandatory subfields
ii) optional subfields

Within each of these two classes, the order of subfield transmission is, in general, as follows:

a) fixed length subfields
b) variable length subfields

2.11.5 Order of Bit transmission

Within each defined subfield the information is transmitted with the least significant bit first.

2.11.6 Coding of Spare Bits

Spare bits are coded 0 unless indicated otherwise.

3 PROCEDURES

3.1 General

The MUP applies normally the principle that an MTX initiating a trans action will receive a RESPONSE from the addressed MTX or AR receiving an acknowledgement (positive or negative) and possible other updating information.
The transaction number (TN) is used as a communication reference to uniquely define the communication i.e. the signalling procedure, as outlined in figure 3.1.

When sending a MESSAGE, the MTX will select a transaction identifier included in the TN which is used to identify the RESPONSE. The MTX or AR receiving a MESSAGE shall use the received TN when sending RESPONSE.

The transaction identifier is a binary code of 16 bits, which gives a possibility of 65536 different identifications.

When a message is received, the receiving MTX or AR must see to it that the response is not delayed so much that a timeout may occur at the originating MTX.

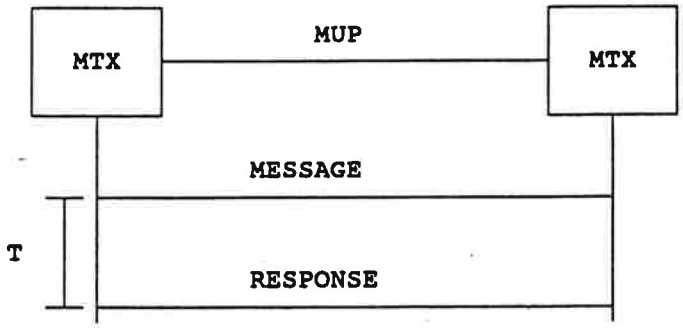


Figure 3.1. Normal MUP signalling procedure.

3.2 Location Updating procedure

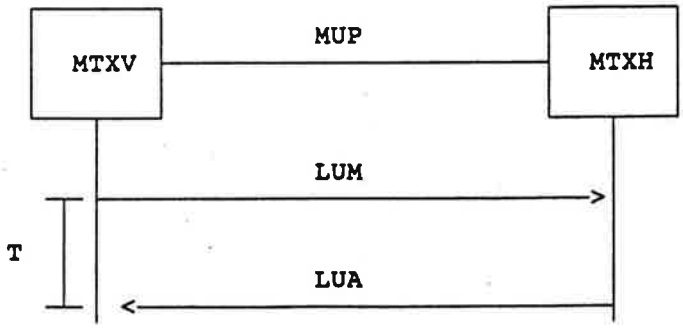


Figure 3.2 Location Updating procedure.

Location Updating is initiated when a mobile station performs the first registration in a visited MTX area. The MTXV sends a Location Updating Message, LUM, to the MTXH. The LUM contains the MS identity, the MTXV identity and the MTXV restrictions.

The MTXH responds with either Location Updating Accepted Message, LUA, or Location Updating Rejected Message, LUR, see fig. 3.2. The LUR contains the reason for the rejection.

If the MTXV does not allow roaming for mobile stations without Added Security, it indicates this in the "MTXV restrictions" field in the LUM. If this is the case, and the MS is not equipped with Added Security, the MTXH responds with LUR.

An updating signalling procedure ending with the updating message being accepted, causes the following registers to be updated in MTXV and MTXH.

- MTXV updates its visitors register, using the category information contained in the LUA.
- MTXH updates the Location information in its roamer register.

The "Additional Information" field in the LUA indicates if more information may be transferred to the MTXV.

When receiving LUM, MTXH checks the MTXV identity. If transfer of the Secret Authentication Key is allowed to this MTX, this is indicated in the "Additional Information" field in the LUA.

If MTXV receives an LUA indicating that transfer of the SAK is allowed, and the "Added Mobile Identity Security" bit in the MS categories field indicates that the MS is equipped with Added Security, it may initiate the procedure for fetching the Secret Authentication Key (SAK) (see paragraph 3.6.1).

If the MS Directory Number is allowed transferred outside the PLMN, this number is also included in the LUA message.

If MTXV and MTXH do not both belong to the same country, MTXH shall always convert a national (significant) MS Directory Number to an international number before transferring it to MTXV.

If a LUR message is received, the Location Updating procedure will take place every time the MS make a new contact with the network. The exception

is when the reason for rejection is set to "Incorrect security code" which shall be handled as specified in NMT DOC 2.

The Nordic NMT system will initially have the same set of categories and supplementary services implemented in all the involved countries. Thus, there is no need for procedures following the Location Updating procedure to handle different sets of categories and/ or supplementary services.

However, it is foreseen that such procedures may be required in the future, and may therefore be included in a future update of this MUP specification.

3.3 Location Cancellation procedure

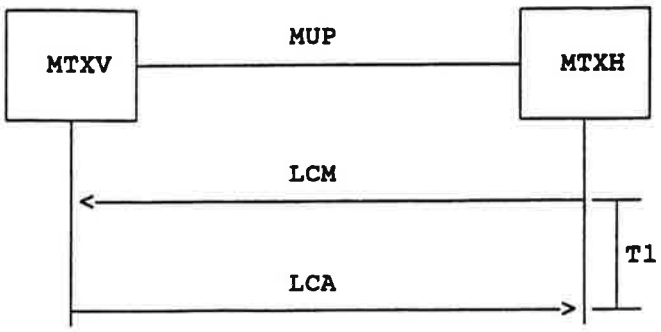


Figure 3.3. Location Cancellation procedure.

A roaming mobile station which has left an MTX area and entered another area, shall automatically send an updating information to the new MTX. MTXH is either updated through a LUM from the new MTXV or through the registration in MTXH.

The MTXH informs the old MTXV by sending a Location Cancellation Message, LCM. The old MTXV answers by sending a Location Cancellation Accepted Message, LCA. This signalling makes it possible to clear data related to roamers that have left the MTX area in the visitors register of the old MTXV. See fig. 3.3.

3.4 Category/ Supplementary Services Signalling procedure

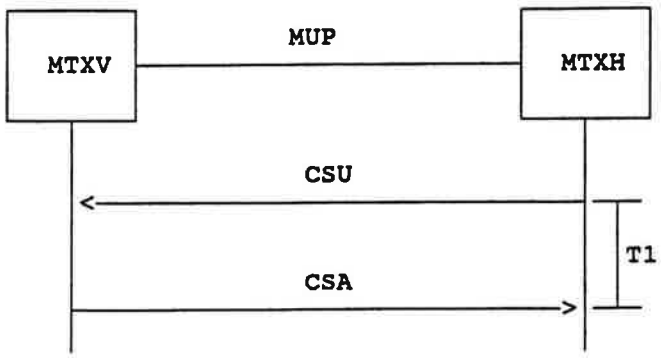


Figure 3.4. Category/ Supplementary Services procedure.

The MTXH stores subscriber data for its subscribers. These data consist of subscriber categories and supplementary services information. For a roamer this information is sent to the MTXV, using the Category/ Supplementary Services Updating Message (CSU).

The category/ supplementary services information can be updated in MTXH regardless of whether the mobile station is roaming or not. The Category/ Supplementary Services Updating Message, CSU, is used to update MTXV when changes are made in MTXH. MTXV answers by using Category/ Supplementary Services Accepted Message, CSA, see fig. 3.4.

3.5 Supplementary Services Registration/ Cancellation Signalling procedure

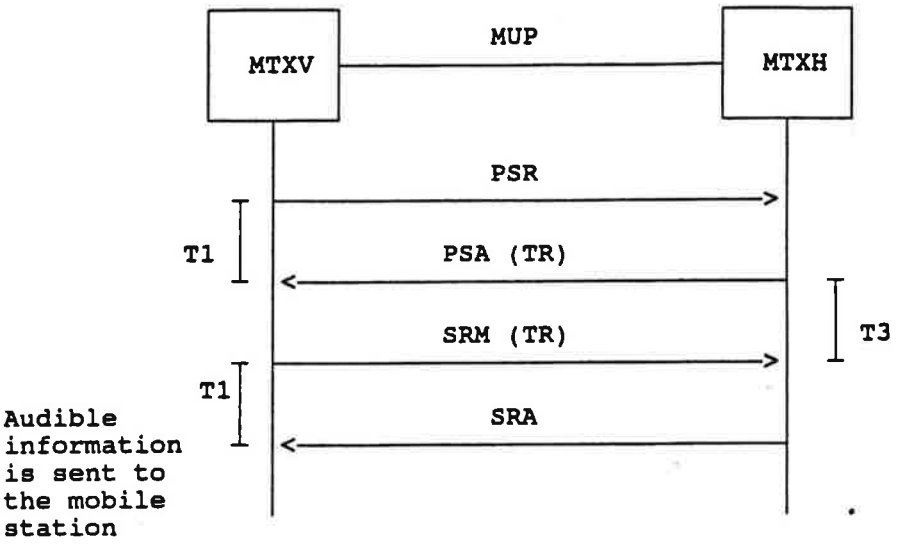


Figure 3.5.a Supplementary Services Registration/ Cancellation procedure

A mobile subscriber can activate or deactivate subscriber controlled supplementary services using his mobile station.
Data about activated supplementary services is stored in MTXH.
Activation or deactivation of supplementary services may be done when mobile station is roaming.
Signalling using:

- PSR Pre-Supplementary Services Registration/ Cancellation message,
- PSA Pre-Supplementary Services Registration/ Cancellation Acknowledgement message,
- SRM Supplementary Services Registration/ Cancellation Message and
- SRA Supplementary Services Registration/ Cancellation Acknowledgement message, is applied.

When MTXV receives supplementary services registration/ cancellation information from a roaming mobile station, the information is sent transparently to MTXH, i.e. the information is coded into the PSR and the SRM messages.

The PSA/ SRM messages are linked together as one transaction by means of the Transaction Reference field and the Transaction Number in the PSA and the SRM, the same Transaction Reference and Transaction Number is used in both the PSA and the SRM.

- In the case where no Category/ Supplementary Services updating of MTXV is necessary, send PSA in response to PSR and

- in response to SRM send SRA including information about which audible information is to be sent by MTXV to the mobile station, (fig. 3.5.a) or

- In the case where Category/ Supplementary Services updating of MTXV is necessary, initiate the category/ supplementary services procedure as described in paragraph 3.4, before sending the SRA (fig. 3.5.b).

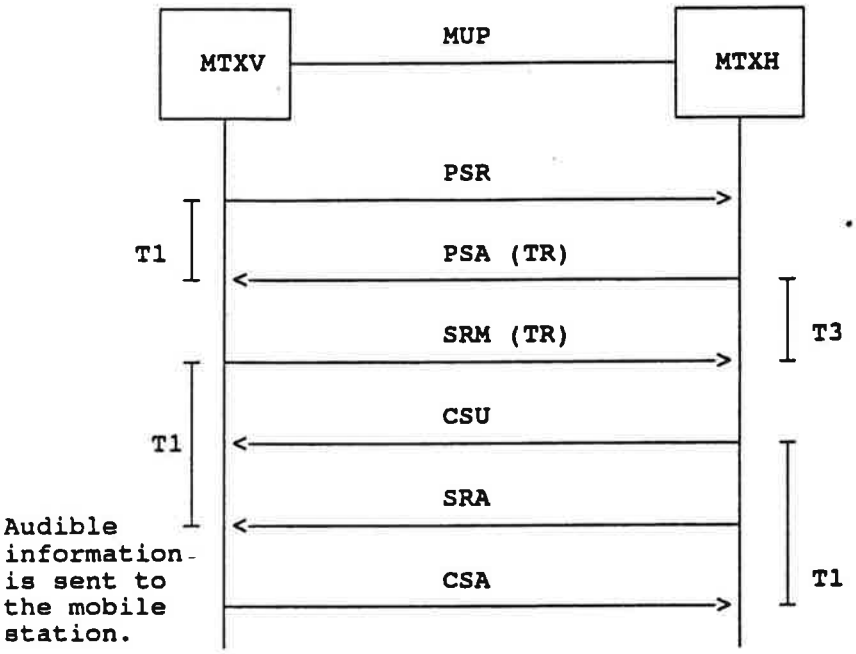


Figure 3.5.b **Supplementary Services Registration/ Cancellation and Category/ Supplementary Services signalling procedures.**

When sending the PSA a timer T3 is started.
If the SRM is not received before T3 expires, the PSR already received shall be discarded and the procedure in the MTXH terminates.

3.6 Transfer of Authentication Data

If the mobile station is equipped with Added Security, both the MTXH and, if the MS is roaming, also the MTXV must store some authentication data.

Authentication data for the MS is generated either in MTXH or in an external AR where the MS has been introduced (solution depending on the national implementation).

If MTXH is not able to generate authentication data by itself, the data is transferred to MTXH from the AR.

In case of MTXV, authentication data is transferred from MTXH.

3.6.1 Transfer of Secret Authentication Key between MTXV and MTXH

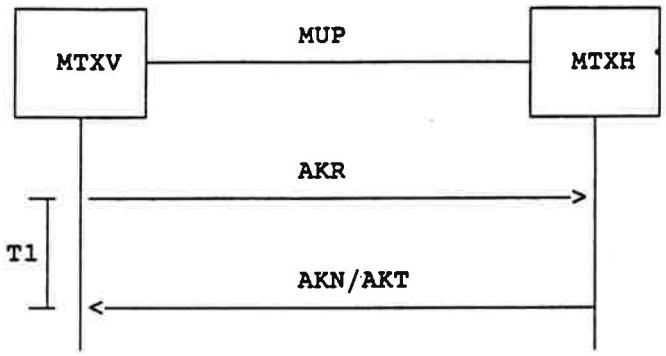


Figure 3.6.1 Transfer of the Secret Authentication Key.

If MTXH allows transfer of the Secret Authentication Key (SAK) to the MTXV, this is indicated in the Location Updating Accepted Message when the MS updates its position in MTXV.

When the SAK is to be transferred from the MTXH to the MTXV, MTXV sends the Authentication Key Request Message (AKR) to the MTXH.

When receiving AKR, MTXH checks if the SAK is allowed to be transferred to this MTXV. If it is allowed, and the SAK is available, it is transferred in the Authentication Key Transfer Message (AKT).

If the SAK is not available, or if it is not allowed to be transferred, MTXH responds with the Authentication Key Not Available Message (AKN) and terminates the procedure.

The procedure is illustrated in figure 3.6.1.

3.6.2 Transfer of Authentication Data between MTXV and MTXH

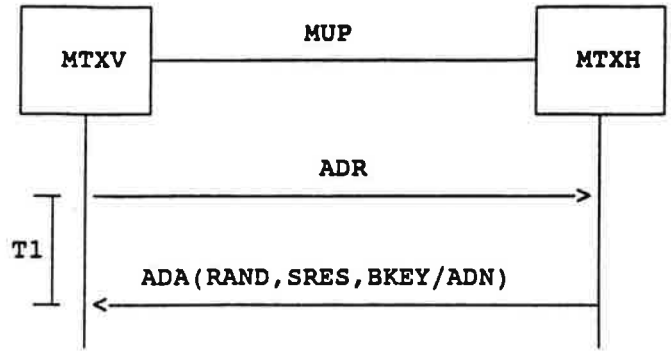


Figure 3.6.2 Transfer of authentication Data.

If MTXH does not allow storing of the SAK in the MTXV, the set of Random Number (RAND), Signed Response (SRES) and key for decryption of the B-number (BKEY) must be transferred from the MTXH to the MTXV.

When MTXV is in need of new sets (e.g. after Location Updating), it sends the Authentication Data Request Message (ADR) to the MTXH which responds by sending the Authentication Data Request Acknowledge Message (ADA). Each ADA transfers one set of authentication data.

The MTXV must be able to store some sets of the Authentication Data. When the number of sets left is reduced below a certain limit, "k", new sets must be fetched from the MTXH. The value of "k" must be changeable by means of MML commands in the range between 2 and 10.

If MTXH is not able to provide any new sets of Authentication Data, it returns the Authentication Data Not Available Message (ADN).

An MTXV receiving the ADN in response to the ADR shall use the stored data sets until all sets have been used.

If an ADN has been received, and the number of stored sets therefore are less than "k", MTXV shall try to fetch new sets, by sending ADR, every time the subscriber initiates any action which requires the authentication procedure to be performed. If the MTXV now receives the ADA in response to the ADR it shall repeat fetching new sets until k sets have been stored. The procedure is shown in figure 3.6.2

3.6.3 Transfer of Authentication Data between MTXH and AR

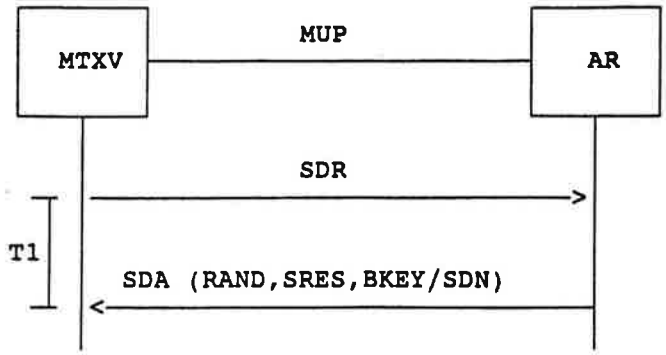


Figure 3.6.3 Transfer of authentication data between MTXH and AR.

When MTXH is in need of Authentication data and not able to generate the data by itself, the data has to be fetched from the AR.

Transfer of Authentication data between MTXH and AR is a national matter and may be achieved in several ways, e.g. using the X.25 protocol.

As a national option also MUP may be used for this data transfer. This paragraph describes the procedure to be used if MUP is applied.

When MTXH is in need of more Authentication data from the AR it sends the Security Data Request message (SDR) to the AR connected to it.

If the AR is able to provide the requested data it responds with a Security Data Available message (SDA) containing a set of Random Number (RAND), Signed Response (SRES) and key for decryption of the B-number (BKEY).

If the AR is not able to provide the requested data it responds with the Security Data not Available message (SDN) with the appropriate reason set.

The procedure is illustrated in fig. 3.6.3.

3.7 Procedure for fetching routing information from MTXV

If the MTXH receives a call or a request for routing information for a subscriber which is updated in an MTXV, MTXH has to fetch the information from MTXV in order to set up the call through the PSTN. MTXH therefore sends the Roaming Number Enquiry Message (RNE) to MTXV.

Included in the RNE is the MS identity and the "Preferred Language" information. The "Preferred Language" information indicates to the MTXV about the preferred language to be used if announcements is to be sent to

the calling subscriber when later on the call is received. When sending RNE a timer T4 is started.

When receiving this message, MTXV allocates a Mobile Station Roaming Number (MSRN), starts a timer T7, and sends the number in the Roaming Number Message (RNM).

If this is not possible, MTXV responds with a Roaming Number Rejected Message (RNR) and terminates the procedure. If receiving RNR, MTXH performs the necessary signalling towards the PSTN and terminates the procedure.

The Mobile Station Roaming Number is a number belonging to the national numbering plan. When allocated, it is tied to one of the MS identities served by this MTX. The number is used for routing the call through the PSTN, and when received at the MTXV it also identifies the MS identity.

If MTXV and MTXH does not both belong to the same country, MTXV shall always convert the MSRN to an international number before transferring it to MTXH.

When receiving the RNM, MTXH either sets up the call using the MSRN, or it sends the MSRN backwards in the network (see section 3.9).

When MTXV receives the call which is using this MSRN, it stops the timer T7 and sets up the call to the MS identity tied to this MSRN. The MSRN may now be released and used for another call.

If T4 expires before RNM/ RNR is received, MTXH performs the necessary signalling towards the PSTN and terminates the procedure.

If T7 expires before the call is received, the MSRN is released and may then be allocated for another call.

If a call is received using an MSRN which is not tied to an MS identity, the MTX returns an unsuccessful backward signal and terminates the procedure.

If more RNEs are received for the same MS while T7 is running, an RNM should be returned for each RNE received.

If the MS identity in the received RNE does not exist in the Visitor Register of MTXV, MTXV shall initiate the Location Updating procedure before sending RNM.

The recorded data in MTXV shall be stored for this MS on temporary basis, only to enable correct processing of the call.

When sending LUM a timer T8 is started. If LUA/ LUR is not received before T8 expires, the MTXV sends RNR with the reason set to "MS id. unknown".

If page response with the correct MS identity is received, the MS location has thus been confirmed and the Visitor Register can be permanently updated.

Otherwise, if no page response is received, the MS data shall be deleted from the Visitor Register.

If the call already has been treated by the "IN" when received in MTXH, MTXH may send this information to MTXV using "Call routed via "IN" in the RNE message.

In which way the MTXH will recognize that the call already has been routed via IN is a national option.

In MTXV a possible "call routed via IN" received in RNE will be stored until the call arrives in MTXV. This information is then connected to the call and used when deciding how to handle an unsuccessful call set-up.

The procedure is illustrated in the following figures.

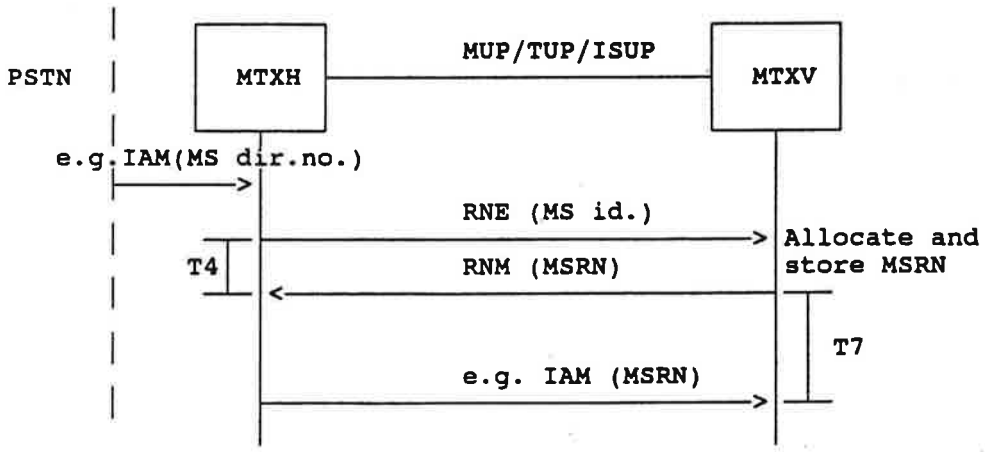


Figure 3.7.a Roaming Number Enquiry, successful procedure.

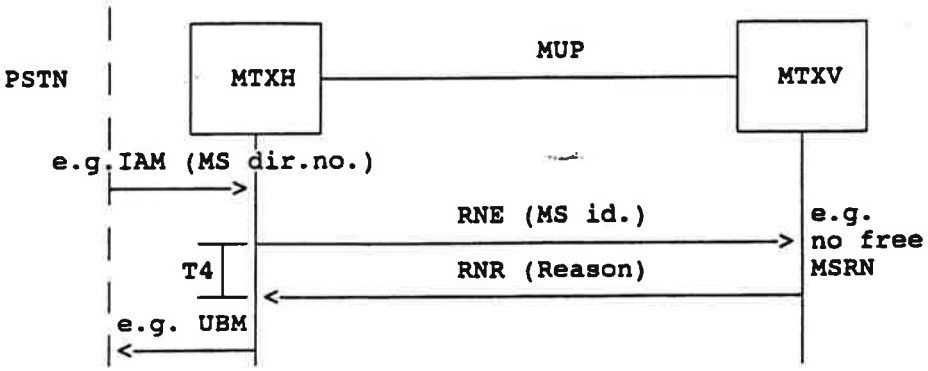


Figure 3.7.b **Roaming Number Enquiry, unsuccessful procedure.**

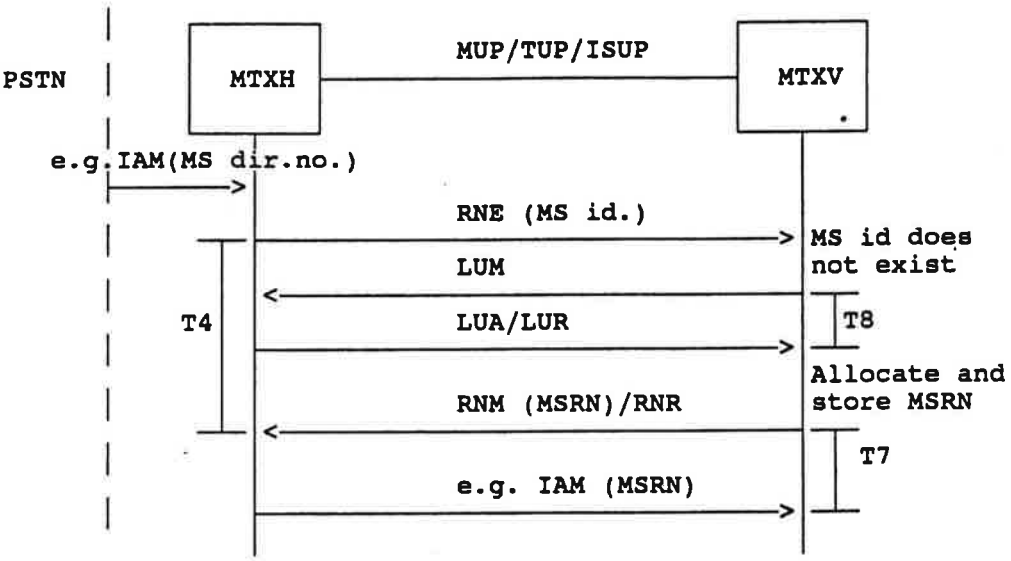


Figure 3.7.c **Roaming Number Enquiry, MS id. does not exist in the visitor register.**

3.8 Handling of Call forwarding services when MS is updated in MTXV

3.8.1 Unconditional Call Transfer

If an MTXH receives a call to a subscriber which has activated any of the unconditional call services, e.g. the "Immediate Call Transfer", the call transfer is performed by the MTXH.

If an MTXH receives a request for routing information for a subscriber which has activated any of the unconditional call transfer services, MTXH allocates one of its own Mobile Station Roaming Numbers and returns this as routing data (see section 3.9).

The procedure described above will then apply when the call later on is received.

3.8.2 Conditional Call Transfer

If an MTXH receives a call to a roaming subscriber which has activated any of the conditional call transfer services, e.g. conditional call transfer on no page response, the call is forwarded or rerouted to the MTXV.

MTXV will receive information about the status of the call forwarding services during Location Updating (LUA) or when updating the category/-supplementary services (CSU).

When receiving a call to a subscriber which has any of the conditional call transfer services activated, MTXV will therefore have the knowledge of the status of the service, and is able to handle the procedure locally.

MTXV has to fetch the C-number to be used from MTXH. It therefore sends the Conditional call transfer enquire message (CTE) to MTXH. If the duration of alerting included in CTA should be used towards the B-party, CTE must be sent at the same time as alerting of the B-party is started. The field "Type of call transfer" in CTE should in this case always be coded to the value "Conditional call transfer on no answer".

If the duration of alerting is not needed, CTE may be sent when the condition for call transfer becomes true.

If an announcement is to be sent to the calling subscriber, the information about the preferred language to be used has previously been received in the RNE.

When MTXH receives the CTE it checks if it is possible to send the requested C-number. If it is impossible it returns the Conditional Call

Transfer Rejected Message (CTR) with the appropriate reason set and terminates the procedure.

When receiving the CTR, MTXV performs the necessary signalling towards the PSTN and terminates the procedure.

If MTXH is able to transfer the requested C-number, it is transferred in the Conditional Call Transfer Accepted Message (CTA) together with the information about the position of the C-number in the list of C- numbers if fetched from a list. If the C-number is an arbitrary number, this is also indicated.

If MTXV and MTXH do not both belong to the same country, MTXH shall always convert a national (significant) C-number to an international number before transferring it to MTXV.
When receiving the CTA, MTXV sets up the call to the C-number given in the message. If necessary, according to the service, MTXV may repeat the procedure in order to fetch the next C-number in a list of C-numbers.

If T5 expires before CTA/ CTR is received, MTXV performs the necessary signalling towards the PSTN and terminates the procedure.

The procedure is illustrated in the following figures.

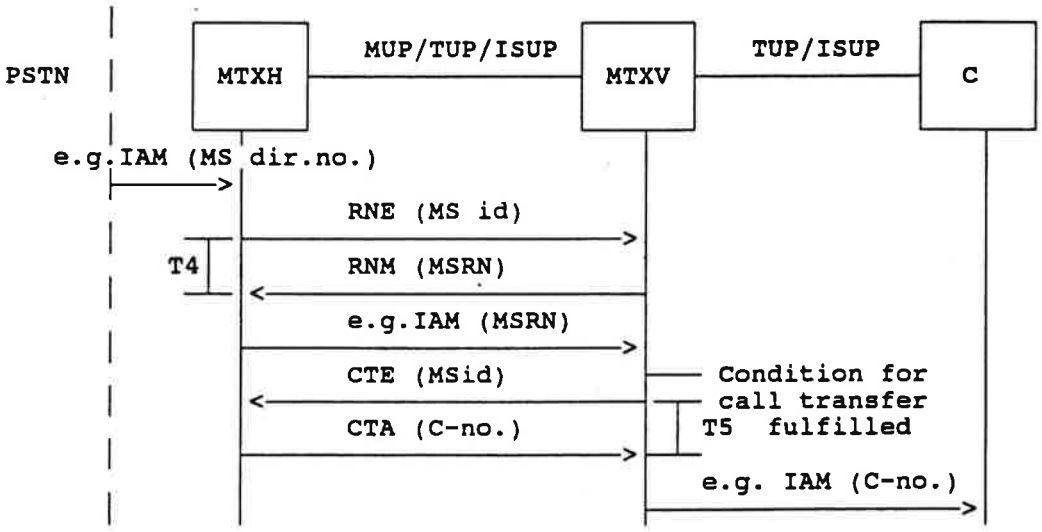


Figure 3.8.2.a **Conditional Call Transfer in MTXV, successful procedure.**

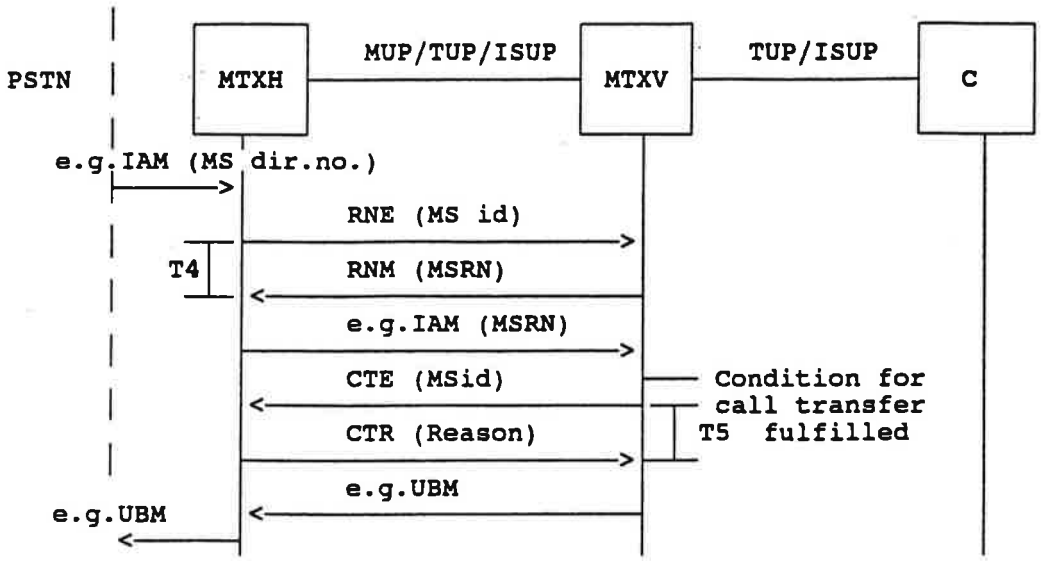


Figure 3.8.2.b Conditional Call Transfer in MTXV, unsuccessful procedure.

3.8.3 Personal number service

Personal number service means a conditional call transfer service activated by administration (in MTX). No announcement is given for the A subscriber, when the transfer is made.

When the personal number transfer is made, no indication of this transfer is set for the forward address messages. Also already transferred call is rerouted as normal and the indication of transfer is not changed.

3.9 Routing Enquire/ Response procedure

In order to get a more flexible handling of the telephone traffic destinated to the NMT network an additional procedure (Routing Enquire/Response) to request and obtain the position of a mobile station is required.

All calls destinated for a national NMT-number is always routed in the PSTN to the nearest MTX. This MTX then acts as a Gateway MTX (MTXG) which interrogates the MTXH in order to fetch the routing information for routing the call directly to the MTXV.

For calls destinated to an international NMT-number, the call will be routed to the International Switching Centre (ISC) in the normal way.

If the ISC is able to analyze the digits beyond the country code, and identifies the Called Party Address as an NMT-number, it routes the call to its International MTXG (IMTXG).

The IMTXG will then interrogate the MTXH in the normal way and forward the call to the MTXV.

This procedure may change according to the solution chosen for the GSM system.

3.9.1 Requirements to the telephone/ signalling network

The requirements described in this section is not a part of the MUP specification, and should only be looked upon as guidelines for the national implementation.

The telephone/ signalling network is responsible for routing all calls destinated to one of its national mobile stations to the nearest MTX in the network. This MTX then acts as the MTXG.

When all transit exchanges in the telephone/ signalling network are programmed to route all traffic to national MSs to its nearest MTX, there

is a risk that when a call/ message is sent from the MTXG to either MTXV or MTXH, any transit nodes may route this call/ message to its nearest MTX.

How this is avoided is a national matter. However the following methods are identified:

- All transit exchanges in the network carrying traffic between MTXs is able to analyze when a message is generated in an MTX and when it is not. A message generated in an MTX should not be routed to the nearest MTX.

- When an MTX sends a message to another MTX, an overdecadic digit is placed in the beginning of the address information. All transit exchanges carrying traffic between MTXs must be able to analyze this digit, and when present the call/ message is not routed to the nearest MTX.

  The international transit exchange must be able to insert this digit when receiving a call/message to one of its national MTXs from the international network, and it must be able to remove it when receiving a call/ - message from its national network.

- When a No. 7 IAM message is sent to an MTX, the originating or Gateway MTX sets the "Nature of Address" indicator in the "Message Indicators" field to the value 01 (this value is reserved for national use). The normal value generated in the PSTN is 10 (national message).

  The message may then logically be regarded as belonging to a NMT network, and any transit exchange should not perform routing to its nearest MTX when this value is set to 01, only when set to 10.

  The international exchange must be able to change this indicator to 01 when receiving a call/ message to one of its national MTXs from the international network, and it must be able to change the value from 01 to 11 (international number) when receiving a message from its national network.

- The MSRNs may not be a NMT number but belong to the numbering plan of the PSTN.

3.9.2 Minimum MUP configuration

The full implementation of the Routing Enquire/ Response procedure is regarded as a national matter.

In the minimum MUP configuration any MTX must be able to receive a REM and respond with a RIM with the following fixed content:

- The Address Indicators set to:
  Bit A: 0 (national number)
  Bit B: 0 (MSRN is not included)

- No MSRN is transferred.
  When receiving this message the MTXG will route the call to the MTXH, using the dialled MS directory number.
  MTXH will handle the call in the same way as if no Gateway MTX was involved in the call (the MTXG will, seen from the MTXH, act as a normal transit exchange in the PSTN).

3.9.3 Actions at the Gateway MTX (MTXG)

When a call arrives at an MTXG, which could also be the MTXH or the MTXV, the MTXG takes the actions described in the following paragraphs.

The action depend on whether the MTXG has the direct knowledge of the position of the called mobile station (MTXG acts as the MTXH) or if it has to make a request to the MTXH to get this information.

3.9.3.1 The MTXG acts as the MTXH

If the MTXG acts as the MTXH for the called mobile station, the call will be handled in the normal way for an MTXH receiving a call, e.g:
- Set up the call if the position of the MS is MTXH.
- Forward the call to MTXV if the position of the MS is MTXV.
- Set up the connection to a C-number according to the call transfer services activated.

3.9.3.2 The MTXG does not act as the MTXH

If the MTXG does not act as the MTXH, the gateway exchange sends a Routing Enquire Message (REM) to MTXH including the MS directory number dialled by the calling subscriber. When sending REM a timer T6 is started.

Depending on which message the MTXG receives and the rerouting address included in this message, different actions are taken.

The MTXG acts as the MTXV.

If the routing information in the RIM contains the address of the MTXG, the MTXG is the MTXV.
The MTXG then initiates the normal call setup, e.g.:
- In the case where the mobile station is free it is paged. When answering the call is set up.

- In the case where the mobile station is busy, MTXG performs the necessary signalling towards the PSTN, or it may perform a call forwarding service if conditional call transfer on busy is activated (see section 3.8.2).

- In the case where the mobile station is unavailable (no call acknowledgement from the MS), MTXG performs the necessary signalling towards the PSTN, or it may perform a call forwarding service if conditional call transfer on no page response is activated (see section 3.8.2).

The MTXG does not act as the MTXV.
If the routing information in the RIM does not contain the address of the MTXG, MTXG forwards the call to the address given in the RIM (using the MSRN as address).

The MTXG receives a Routing Information Reject Message (RIR), or T6 expires before RIM/RIR is received.
If the MTXG receives the (RIR), it may, depending on the reason in the RIR, send an appropriate announcement and then perform the necessary signalling towards the PSTN. The procedure is then terminated.
The same procedure is followed if T6 expires before RIM/ RIR is received.

3.9.4 Actions at the MTXH

When the MTXH receives a REM, it examines the MS directory number in the message. If the number is incomplete or unallocated it returns the RIR with the appropriate reason set.

If the number is accepted it then examines if the position of the MS is MTXH. Depending on position, different actions are taken.

The position of the MS is MTXH
If the position of the MS is MTXH, MTXH allocates a MSRN (which now will act as a "homing" number), and returns the information in the RIM. When sending RIM a timer T7 is started.

When MTXH later on receives the call using this MSRN, it stops the timer T7 and sets up the call. The MSRN is then released and may be used for another call.

If T7 expires before the call is received, the MSRN is released and may be used for another call.

The position of the MS is not MTXH
If the position of the MS is not MTXH, MTXH checks if conditions in MTXH requires routing via MTXH. This may be the case e.g. if the circuit between

MTXH and MTXV is to be extra charged, if MTXV has not MUP implemented or if the subscriber has activated any of the unconditional call transfer services. If routing via MTXH is required, MTXH allocates one of its own MSRNs and sends it to MTXG. The call will then be routed via MTXH which will forward it to MTXV.

If this is not the case, MTXH performs the procedure described in section 3.7 for fetching a MSRN from the MTXV by sending the RNE to MTXV.

If an RNM is received as a response, the MSRN is copied to the RIM and sent to the MTXG. MTXH then terminates the procedure.

If an RNR is received as a response, a RIR is sent to the MTXG using the reason received in the RNR. MTXH then terminates the procedure.

3.9.5 Rerouting of calls to IN

As a national option, the procedure in 3.9.3. and 3.9.4 may be modified in the following way:

The signal REM sent from MTXG to MTXH is in all procedures replaced by REM2 which in addition to the information of REM contain information whether the call already has been rerouted to IN.

As a national option a special coding of RIR may be used to contain rerouting information. In this case RIR will replace IRI in the following description.

3.9.5.1 Original rerouting

When a call arrive in the MTXG it will send a request for routing information to MTXH, using the REM2 message with "No suppression". If the MTXG acts as MTXH the procedure will be replaced by request within the MTX.

When MTXH receives the REM2 message with "No suppression" the MTXH will check if the subscriber has any terminating IN-services active. The check may be based on permanent subscriber data and information about where the subscriber is roaming.

If there is no active terminating IN-service the MTX will respond to the REM2 message in the way described in 3.9.3 and 3.9.4.

If there is an active terminating IN-service, the MTXH will respond to the REM2 message with IRI, which contain information on where to reroute "IN-pointer " and where the subscriber is roaming (B-location).

When the MTXG receives the IRI it will reroute the call according to the "IN-pointer" and send the "B-location" to the IN-node. How this is done is a national option but it may be done by adding "IN-pointer" and "B-location" as prefix to the originally received B-number.

3.9.5.2 Overriding the rerouting

After the rerouting of the call to IN, one of the possible outcomes of the treatment in IN is that the call shall be terminated at the originally called mobile station. In this case rerouting to IN (described in 3.9.5.1) must be suppressed. This procedure is described below.

When a call arrives in the MTXG, MTXG may recognize the call as a call that already has been treated in "IN". How this is done is a national option.

If the call has been treated by IN, MTXG will send a REM2 message with "Suppress terminating IN-category".

When receiving REM2 with "Suppress terminating IN-category", MTXH will ignore a possible active terminating IN-service and the call will from this point be handled as described in 3.9.3 and 3.9.4 after that MTXH has received a REM message.

The procedure is illustrated in the following figures.

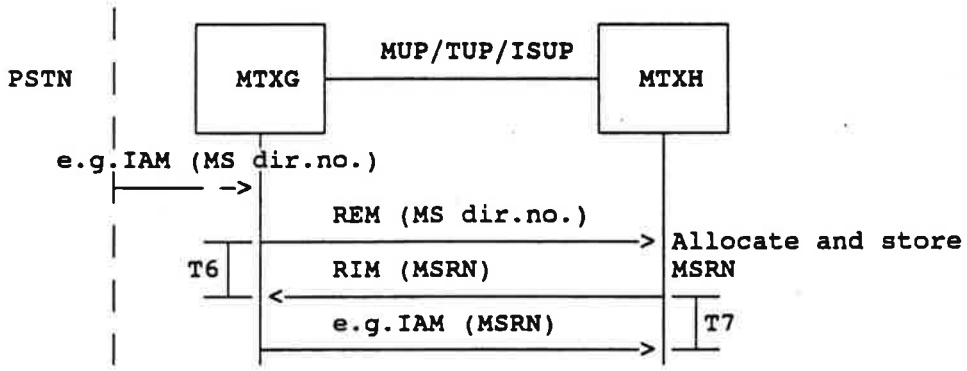


Figure 3.9.5.2.a Routing Enquire/ Response procedure, MS updated in MTXH - successful procedure.

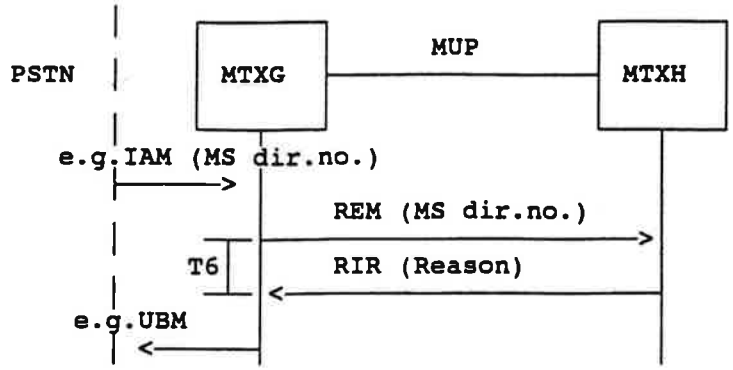


Figure 3.9.5.2.b **Routing Enquire/ Response procedure, unsuccessful procedure in MTXH.**

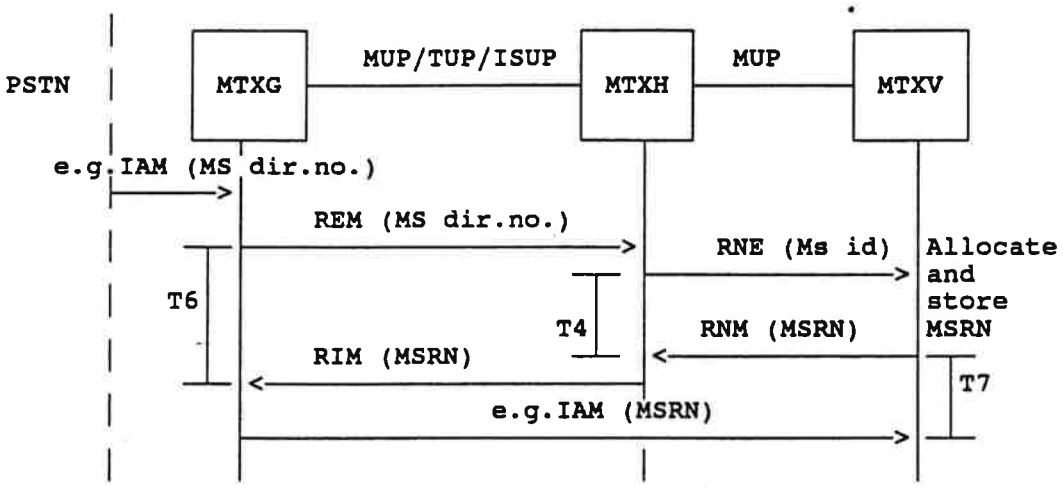


Figure 3.9.5.2.c **Routing Enquire/ Response procedure, MS updated in MTXV - successful procedure.**

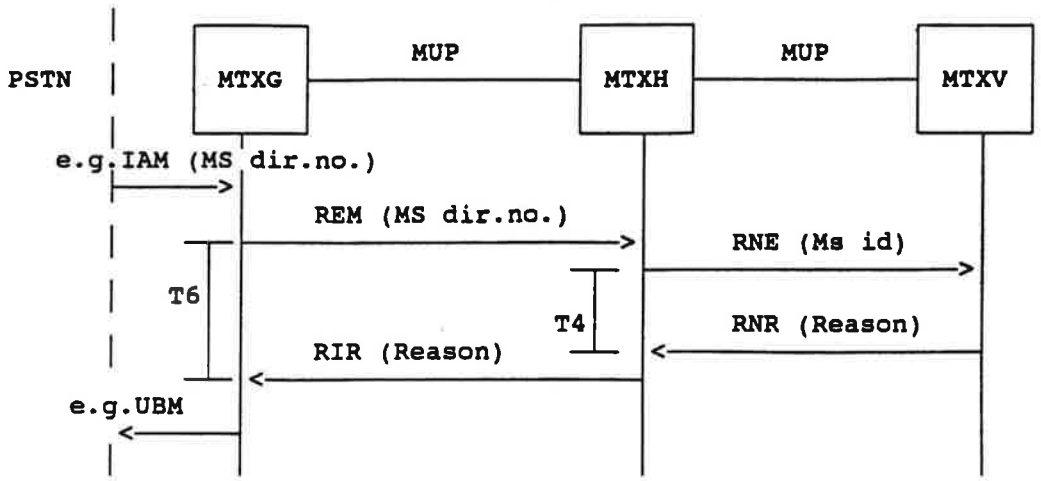


Figure 3.9.5.2.d **Routing Enquire/ Response procedure, MS updated in MTXV - unsuccessful procedure.**

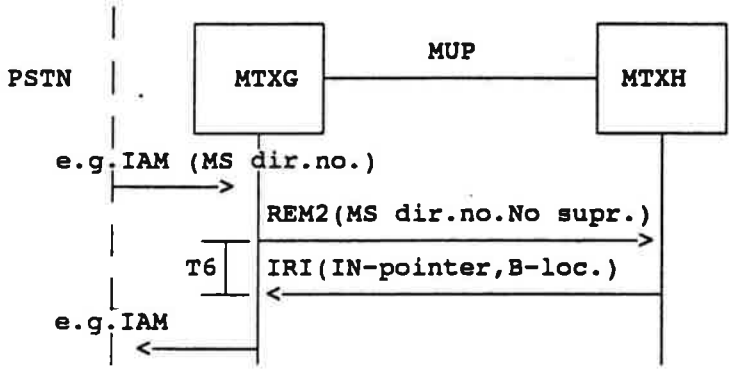


Figure 3.9.5.2.e **Rerouting of terminating call to IN: MS has active terminating IN service - successful procedure.**

3.10 Alternative procedure for fetching routing information from MTXV

In case of a call or request for routing information for a subscriber which is updated in an MTXV, information has to be fetched from the MTXV in order to set up the call through the network. HLR/MTXH therefore sends the message HRE to MTXV.

Included in the HRE is the MS identity and the global call reference. The global call reference is used to be able to address the call control point in the MTXG or MTXH and inform about predefined actions during the call. The global call reference consists of the MTXG identity and the MTXG local call reference. When sending HRE a timer T11 is started.

When receiving message HRE MTXV allocates an MSRN,starts a timer T7 and returns the MSRN in the message HRM. If sending of HRM is not possible MTXV responds with HRR and terminates the procedure. Reason for not sending HRM might be "no free MSRN", "MS identity unknown" or "The called subscriber is busy".

If MTXV and HLR\MTXH does not belong to the same country, MTXV shall always convert the MSRN to an international number before transferring it to HLR\MTXH.

If the MS-identity in the received HRE does not exist in the visitor register of MTXV a location updating procedure as described in chapter 3.7 must be initiated.

When HRM is received by HLR/MTXH ,the timer T11 is stopped. MTXH either sets up the call using MSRN or sends the MSRN backwards in the network. HLR always sends the call backwards in the network.

When MTXV receives the call which is using this MSRN, it stops the timer T7 and sets up the call to the MS identity tied to this MSRN. The MSRN may now be released and used for another call.

The call setup is continued and in case of "No page response", "Basestation congestion" or when ringing is started in the mobile station, the message SEM is sent according to the global call reference received in HRE. SEM is supervised by timer T13 and acknowledged by SEA.

When SEM is received in MTXH or MTXG the call is disconnected (either in normal way or with specific messages to IN), an appropriate announcement is played or one of the conditional call forwarding services are initiated. Disconnection of the leg towards MTXV is initiated before SEA is sent towards MTXV.

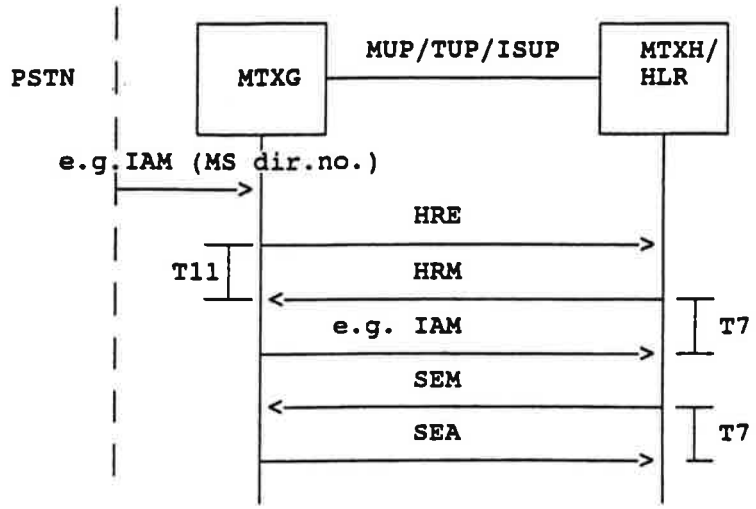


Figure 3.10.a HLR routing enquiry - successful procedure

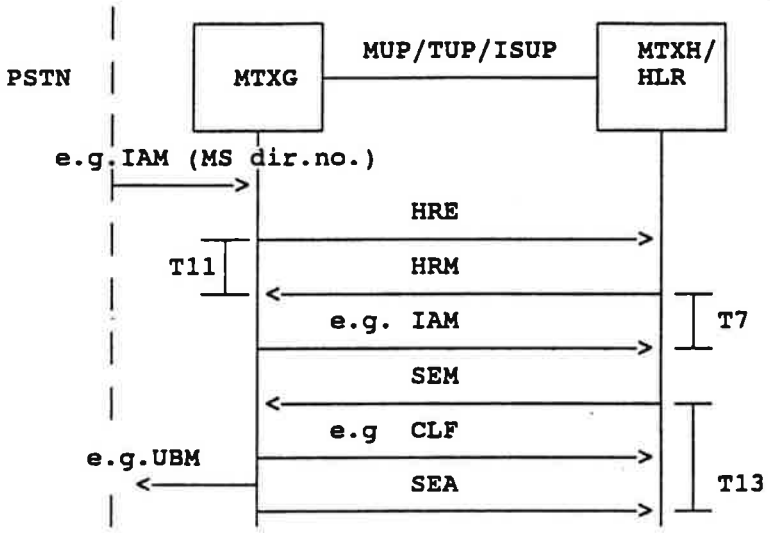


Figure 3.10.b HLR routing enquiry - unsuccessful procedure

3.10.1 Handling of call forwarding services

Unconditional call forwarding is handled in MTXH.
Conditional call forwarding might be handled in the MTXH or in the MTXV.
The procedure is to be decided by the operator.

3.10.1.1 Conditional call forwarding handled by MTXH

The activities for he conditional call forwarding services are not sent to the MTXV as the call forwarding is to be controlled by the MTXH.

A call to a subscriber is routed to the MTXV as described in chapter. 3.7.

The call is controlled by the MTXH and the conditions for call forwarding is supervised according to the following table.

Type of forwarding	Trigged by
Diversion on "Busy"	Telephony signal or information in message HRR
Diversion on "BS congestion"	Information in SEM message
Diversion on "No page response"	Information in SEM /HRR message
Diversion on "No reply"	Timer in MTXH. The timer is started when telephony signal address complete is received or if message SEM is received. If SEM is received when the timer is running, the timer is restarted.

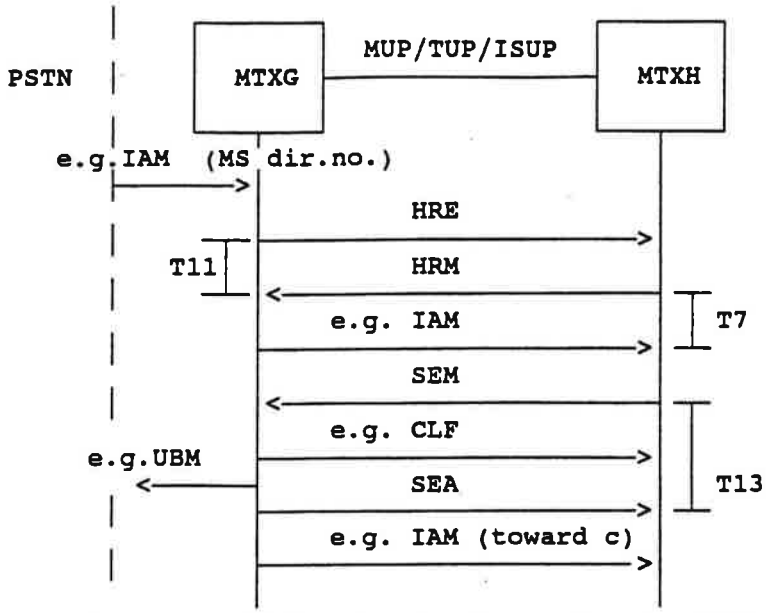


Figure 3.10.1.1 Conditional call forwarding in MTXH - successful procedure

3.10.1.2 Conditional call forwarding handled by MTXV

The activities for he conditional call forwarding services are sent to the MTXV as the call forwarding is to be controlled there.

A call to a subscriber is routed to the MTXV as described in chapter 3.10.

MTXV has to fetch data for duration of alerting and relevant C-number to be used from HLR/MTXH. It therefore sends the Conditional call transfer enquire message (CTE) to MTXH.

If the duration of alerting included in CTA should be used towards the B-party, CTE must be sent at the same time as alerting of the B-party is started. The field "Type of call transfer" in CTE should in this case always be coded to the value "Conditional call transfer on no answer".

If the duration of alerting is not needed, CTE may be sent when the condition for call transfer becomes true.

When HLR/MTXH receives the CTE it checks if it is possible to send the requested C-number. If it is impossible it returns the Conditional Call Transfer Rejected Message (CTR) with the appropriate reason set and terminates the procedure.

When receiving the CTR, MTXV performs the necessary signalling towards the PSTN and terminates the procedure.

If MTXH is able to transfer the requested C-number, it is transferred in the Conditional Call Transfer Accepted Message (CTA) together with the information about the position of the C-number in the list of C- numbers if fetched from a list. If the C-number is an arbitrary number, this is also indicated.

If MTXV and MTXH do not both belong to the same country, MTXH shall always convert a national (significant) C-number to an international number before transferring it to MTXV.

When receiving the CTA, MTXV sets up the call to the C-number given in the message. If necessary, according to the service, MTXV may repeat the procedure in order to fetch the next C-number in a list of C-numbers.

If T5 expires before CTA/ CTR is received, MTXV performs the necessary signalling towards the PSTN and terminates the procedure.

The procedure is illustrated in the following figures.

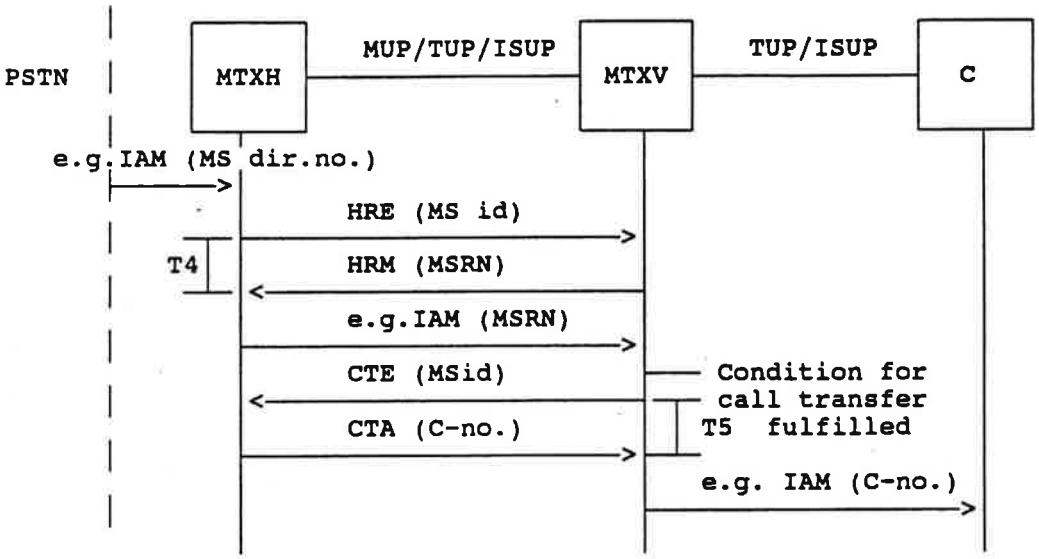


Figure 3.10.1.2.a **Conditional Call Transfer in MTXV, successful procedure.**

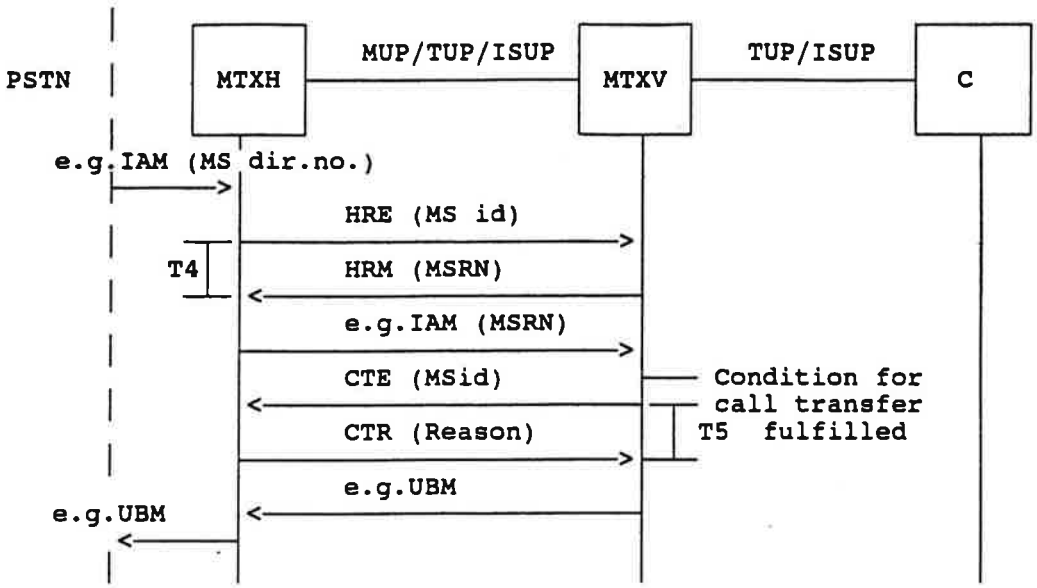


Figure 3.10.1.2.b Conditional Call Transfer in MTXV, unsuccessful procedure.

3.11 Improved rerouting procedure

3.11.1 Basic procedure

A new call setup from the MTXG is received in the HLR/MTXH at reception of a message GEI. When sending GEI a timer T10 is started in MTXG.

Included in the message GEI is the mobile station directory number which is used for addressing the called subscriber and the MTXG identity and the MTXG local call reference witch together form the global call reference. The global call reference is used by the exchanges that sends SEM for addressing the call setup in the correct MTXG.

Calling party category and calling party number is sent to HLR/MTXH to ensure that detection of unpermitted traffic cases or call screening can lead to disconnection.

If called subscriber is roaming an MSRN is fetched from MTXV by the messages HRE/HRM. If the HLR/MTXH is not going to process the call setup any further (The call might for instance be routed via the MTXH or towards the called party without any more processing by the HLR/MTXH), message GET is returned to MTXG with a routing number. When GET is received in the MTXG, timer T10 is stopped.

To be able to charge the call in the MTXG, information for charge determination and the mobile station identity is sent to the MTXG.

When GET is sent to MTXG, the procedure in the HLR/MTXH is terminated.

If message SEM is received, message SEA is returned without reporting to the HLR/MTXH.

The procedure is illustrated in the following figure:

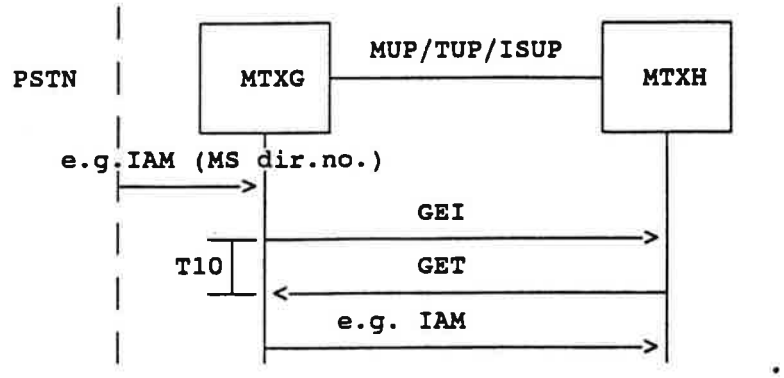


Figure 3.11.1 Improved rerouting, basic procedure.

3.11.2 Unsuccessful procedure

A new call setup from the MTXG is received in the HLR/MTXH at reception of a message GEI. Timer T10 is started in MTXG when GEI is sent to HLR/MTXH. If the HLR/MTXH by any reason is going to terminate the call setup attempt, message GET is returned to MTXG with a proper call termination code. Timer T10 is stopped in MTXG when GET is received.

When GET is sent to the MTXG, the procedure in the HLR/MTXH is terminated.

The procedure is illustrated in the following figure:

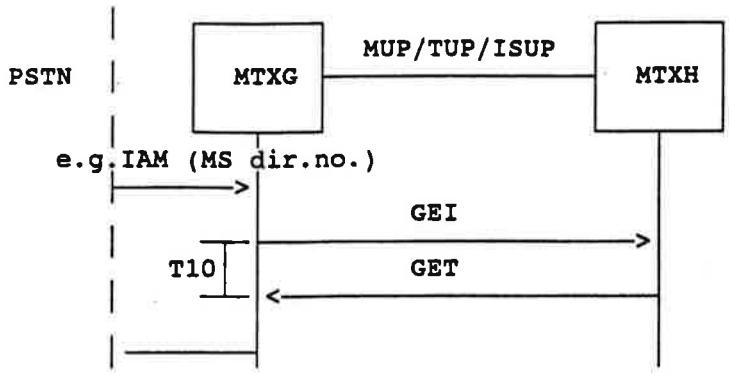


Figure 3.11.2 Improved rerouting, unsuccessful procedure.

Examples on action in MTXG when message GET is received:

Code in GET	Action in MTXG
No free MSRN	Normal disconnection e.g. UBM
Unpermitted traffic case	Normal disconnection e.g. UBM
Don't disturb service	Appropriate announcement

3.11.3 Normal procedure

A new call setup from the MTXG is received in the HLR/MTXH at reception of a message GEI. Timer T10 is started when GEI is sent.

Included in the message GEI is the mobile station directory number which is used for addressing of the called subscriber, and the MTXG identity and the MTXG local call reference which together form the global call reference, and is used for addressing the correct call setup in the MTXG when the GEI is answered.

If the called subscriber is roaming, an MSRN is fetched from MTXV by the messages HRE/HRM. When the MSRN is fetched by the HLR/MTXH, message GRM is returned to the MTXG, as the HLR/MTXH wants further control of the call.

The transaction reference is used to link the GRM sent to the MTXG together with the message GSE. The GSE is sent from the MTXG when one of the call event report indicators previously indicated from the HLR/MTXH becomes true.
The call event report indicators are set according the subscribers services. The call event report indicators "disconnection/termination before B-answer" and "B-answer" are always reported to the HLR/MTXH.

The announcement indicators returned in GRM are set according to the services of the subscriber in question. The call origin information received in GEI can be used to decide whether announcement is to be played or not (may be relevant if the call is coming from IN).

The fact that the routing number may be destined to IN, where a routing prefix and a location number is a part of the number, makes it necessary to have up to 32 digits in the routing number.

To be able to charge the call in the MTXG, information for charge determination and the mobile station identity is sent to the MTXG:

When GRM is sent from HLR/MTXH, the timer T12 is started. When GRM is received in the MTXG, the timer T10 is terminated.

If an MSRN is used, the call is set up towards an MTXV. Message SEM is sent when one of the report indicators are detected in MTXV. If no page response or base station congestion is received in SEM, an appropriate announcement is played or an IN-specific message is sent further on backwards in the network. SEM is acknowledged by SEA.

If a call event reported indicator in SEM is set, but the corresponding call event report indicator in GRM is not, SEM is acknowledged by SEA without any further action in the MTXG.

When B-answer is received in MTXG, the message GSE is sent towards the HLR/MTXH to report that the call setup is completed. Timer T10 is started in MTXG when GSE is sent. When GSE is received in the HLR/MTXH, the timer T12 is terminated. If the subscriber in question does not have any active service, the call setup is from the HLR/MTXH point if view finished, and GET is sent towards MTXG. Timer T10 is stopped in MTXG when GET is received.
When GET is sent to the MTXG, the procedure in the HLR/MTXH is terminated.

Examples on call events reported to MTXG.

Call event reported:	**Trigged by:**
No answer	Timer in MTXG. The timer is started when telephony signal address complete is received or if message SEM is received. If SEM is received when the timer is running, the timer is restarted.
No page response	Information in SEM message.
Busy	Telephony signal.
Base station congestion	Information in SEM message.
Ringing started	Information in SEM message.
B-answer	Telephony signal.
A-termination	Telephony signal. Appropriate national telephony signals indication clearing from the A-subscriber side are regarded as A-termination.
B-termination	Telephony signal. Appropriate national telephony signals indication clearing from the B-subscriber side are regarded as B-termination.

The procedure is illustrated in the following figures.

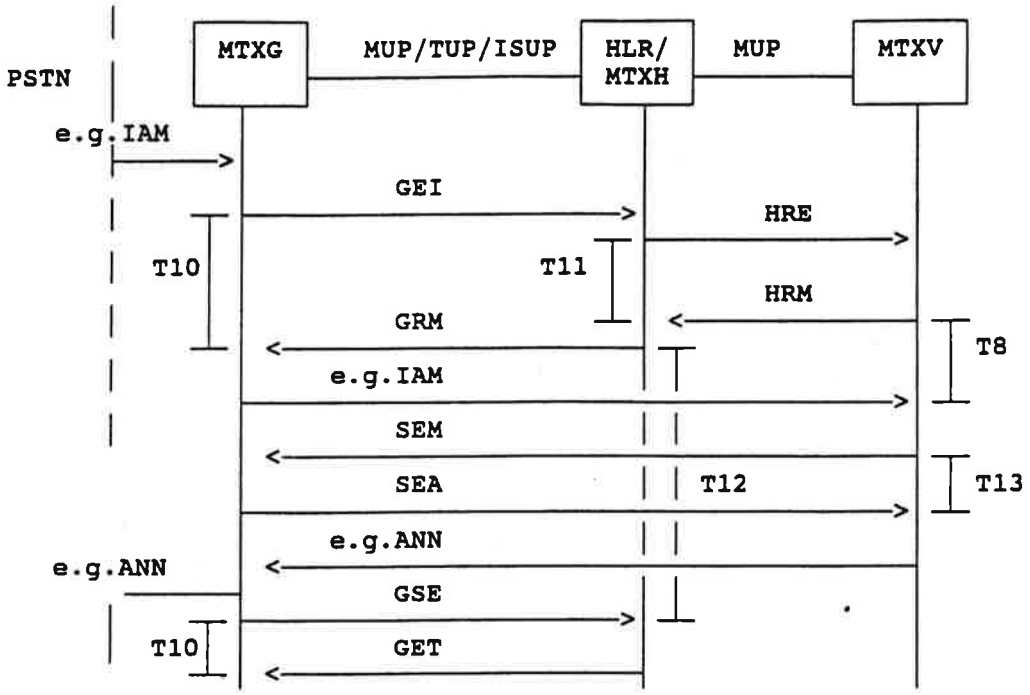


Figure 3.11.3.a **Improved rerouting, MS updated in MTXV, successful procedure.**

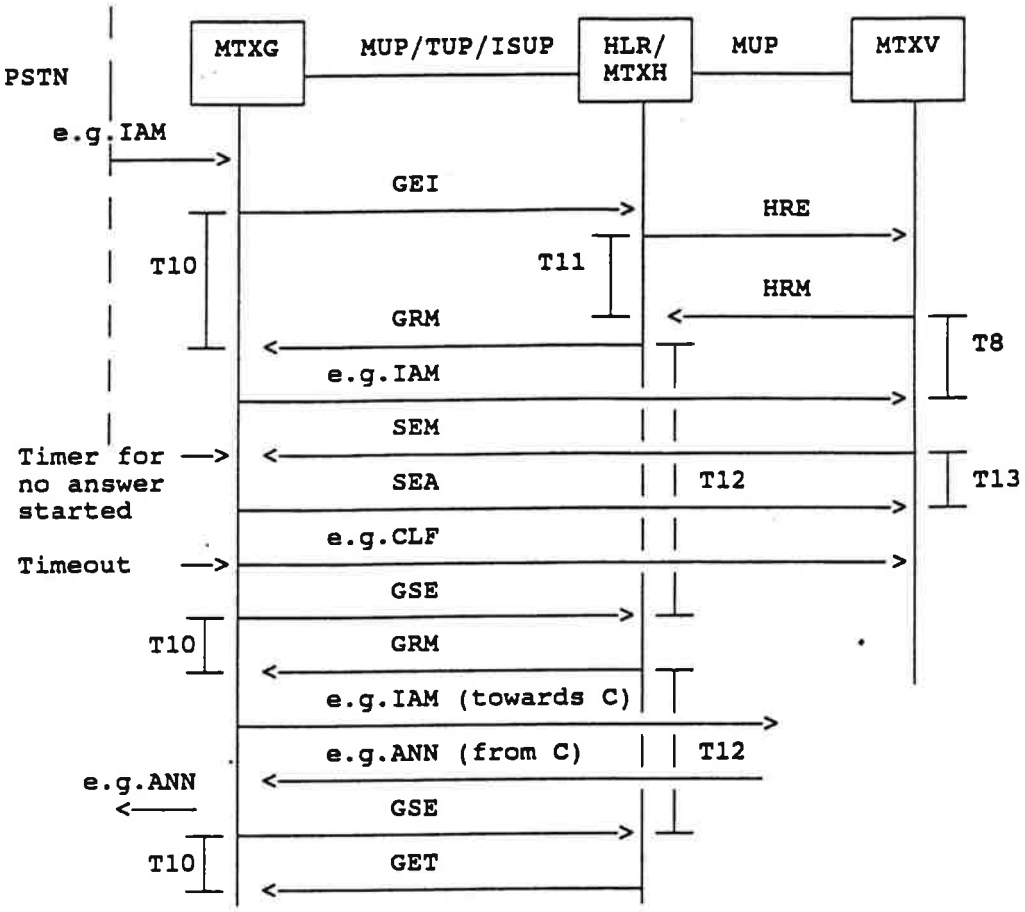


Figure 3.11.3.b **Improved rerouting, call forwarding, successful procedure.**

3.12 Business group number information enquire/ response procedure

For business group subscribers the prefix for calls outside the business group, the trunk prefix, has previously been transferred in the LUA message or CSU message.
When an MTXV receives a call from a roaming subscriber which has category "Business group subscriber", the dialled code is either a called subscriber number, if the trunk prefix is included, or a short number for a call inside the business group.

If the dialled code is the short number, it should be converted to the corresponding called subscriber number before setting up the call.

After receiving a short number from business group subscriber the MTXV fetches the called subscriber number from MTXH.

It therefore sends the Business Group Number Enquiry Message (BNE) to MTXH. The message includes MTXV identity, mobile station identity and dialled short code. When sending BNE a timer T9 is started.

When MTXH receives the BNE is searches for the requested called subscriber number. If a valid number is found, it is sent in the Business Group Number Message (BNM) to MTXV.

If MTXH is not able to find the requested called subscriber number or wants to restrict the call in the MTXV, it returns the Business Group Number Rejected Message (BNR) with the appropriate reason set and terminates the procedure.

When receiving the BNR, MTXV performs the necessary signalling towards the MS and terminates the procedure.

By receiving the requested number in the BNM the MTXV stops timer T9 and continues the call setup normally using the received number.

If MTXV and MTXH do not both belong to the same country, MTXH shall convert a national number to an international number before transferring it to MTXV.

If T9 expires before BNE/ BNR is received, MTXV performs the necessary signalling towards the MS and terminates the procedure.

The procedure is illustrated in the following figure.

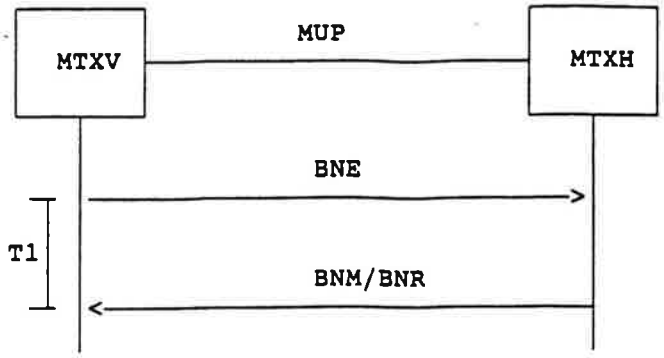


Figure 3.12 **Business group number information enquiry/ response procedure.**

3.13 Restart procedure

In the NMT system, where the positions of the mobile stations are maintained in memory, there may be occasions (e.g. restarts) when the memory becomes mutilated. In such a case the positions of mobile stations for which the affected exchange acts as an MTXH must be retrieved.

Since the affected exchange does not know the positions of its own mobile stations it sends a Restart Information Message (RES) to all MTXs in the NMT network connected with No. 7 signalling.

The affected exchange resets the position of all its own mobile stations to the last known one.

The RES message might also be used in case all subscribers roaming from an MTX to a particular cooperating MTX (MTXV) are to be removed from the visiting register.

The MTXH that send RES will set the position of the subscriber in question to the last known position.

The exchanges receiving the reset signal will take the following actions:

i) It acknowledges the receipt of the RES by sending a Restart Acknowledgement Message (REA) to the affected exchange.

ii) It deletes the mobile stations, for which the affected exchange acts as MTXH, from the visiting register.

Note: The location Updating procedure is initiated in case of restart in MTXH, i.e. The MTX receiving RES is an MTXV.

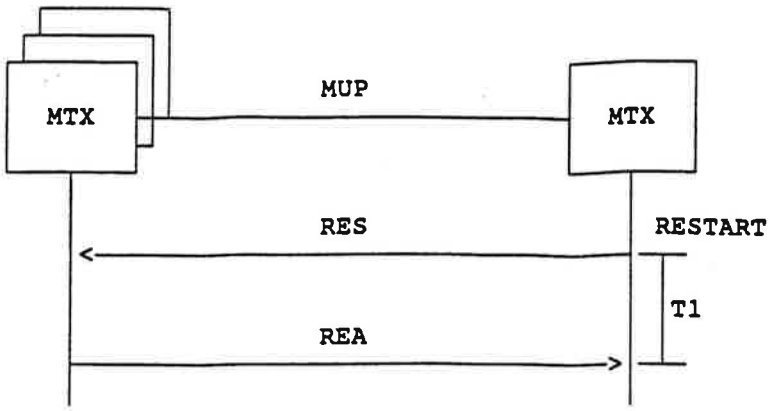


Fig. 3.13 Restart Signalling procedure.

3.14 MUP-gateway function

The purpose of the MUP-gateway function is to make inter-national roaming with MUP easier and to avoid errors when changes are made in network-configurations and numbering is rearranged between MTXs.

The gateway function is implemented in the MTX that serves as international signalling point.

Initial international MUP-messages are addressed to the Gateway MTX (by using the Global title of MTXG) where MUP handles the national rerouting. This means that exact national configuration is known only by gateway MTX and not by cooperating networks. In this way international roaming might be addressed by Z of the subscriber identity.

When a MUP message is received from a cooperating network and the sub-scriber identity does not correspond to the MTX's own numbering the MUP reroutes the message to the proper MTXH.

3.15 Timers

3.15.1 Timers for non call related procedures

The following timers are applied for supervising non call related procedures:

Timer	Started when	Normally terminated when	Actions after time release	Proposed value (seconds)	Possible range (seconds)
T1	ADR sent AKR sent CSU sent LCM sent LUM sent PSR sent RES sent SDR sent SRM sent	ADA/ADN received AKT/AKN received CSA received LCA received LUA/LUR received PSA received REA received SDA/SDN received SRA received	Repeat the message	10	4...15
T2	T1 is started for the first time	T1 is reset due to normal received response	Terminate the procedure	60	0...300
T3	PSA sent	SRM received	Discard the PSR received. Terminate procedure	80	0...320

3.15.2 Timers for Roaming Signalling procedures

The following timers are applied for supervising the call related procedures.

Timer	Started when	Normally terminated when	Actions after time release	Proposed value (seconds)	Possible range (seconds)
T4	RNE sent	RNM rec. RNR rec	Terminate procedure	15	10...30
T5	CTE sent	CTA rec. CTR rec.	Terminate procedure	10	4...15
T6	REM sent	RIM rec. RIR rec.	Terminate procedure	15	4...30
T7	MSRN allocated	The call using this MSRN is received	Release the MSRN	20	4...30
T8	LUM sent	LUA rec. LUR rec.	Send RNR	10	4...15

Note: Timer T8 is used for supervising the LUM/ LUA/ LUR for the Location Updating procedure performed if the MS identity in a received RNE does not exist. The normal Location Updating procedure is supervised by timer T1 and T2.

3.15.3 Timer for Business group number information enquire/ response procedure

Timer	Started when	Normally terminated when	Actions after time release	Proposed value (seconds)	Possible range (seconds)
T9	BNE sent	BNM/BNR received	Terminate procedure	10	4...15

3.15.4 Timer for Call related procedures

Timer	Started when	Normally terminated when	Actions after time release	Recommended value (seconds)	Possible range (seconds)
T10	GEI/GSE sent	GRM/GET received	Terminate procedure	5	4...30
T11	HRE sent	HRM/HRR received	Terminate procedure	5	4...30
T12	GRM sent	GSE received	Discard the GRM received	see note	4...36000
T13	SEM sent	SEA received	Terminate procedure	10	4...15

Note that the value range of T12 depends on whether events that may appear after B-answer is indicated or not. If only events that may appear during the call setup are indicated in the event report indicators, recommended value of T12 is 5 seconds longer than the maximum time for waiting for B-answer.

3.16 Signalling procedures for handling of abnormal cases

3.16.1 General principles for handling of abnormal cases

In this paragraph the procedures for handling of abnormal cases are specified. This includes actions when

- messages are lost in the signalling network,
- messages are received abnormally, and
- messages are received including inconsistent information.

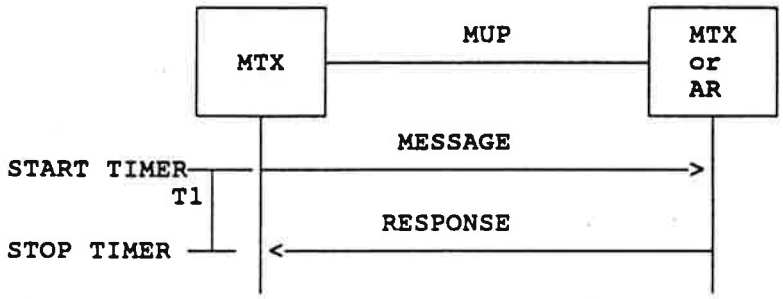
The actions to be taken at receipt of information from the Network Service Part at congestion or prohibited destination, are specified in the specification for SCCP for MUP.

In general, messages received abnormally or received including inconsistent information shall be discarded.

3.16.2 Non call related procedures

The general procedures for handling of abnormal cases for non call related procedures are outlined in figure 3.19. The MUP applies normally the principle that an MTX initiating a transaction will receive a RESPONSE from the addressed MTX and AR including an acknowledgement (positive or negative) and possible other updating information.

Normal case:



Failure case:

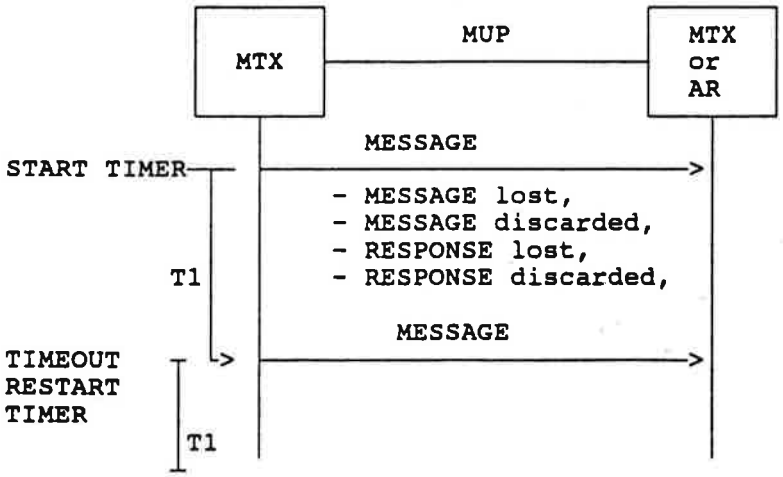


Figure 3.16.2.a Handling of abnormal cases, timeout T1.

An MTX sending a non call related MESSAGE starts two timers, T1 and T2. If no RESPONSE is received before timer T1 expires, the MTX shall repeat the MESSAGE and restart the timer.

If no RESPONSE is received before timer T2 expires, the MTX shall stop sending the MESSAGE, stop timer T1 if running, and give information to the operation and maintenance system in the exchange.

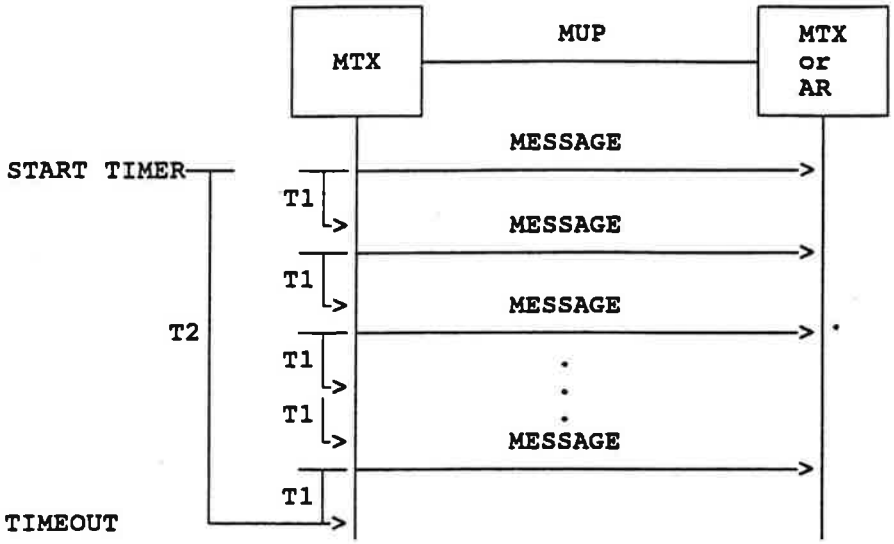


Figure 3.16.2.b Handling of abnormal cases, timeout T2.

A MTX or AR receiving a MESSAGE more than once because the RESPONSE sent for the first MESSAGE is lost or discarded, shall update its memory according to each MESSAGE received,

No consistency check shall be made between the messages. Both messages shall be acknowledged in the normal way.

3.16.3 Signalling procedures used when receiving abnormal or unreasonable signalling information

The Network Service Part of the signalling system will avoid missequencing, or double delivery, of messages with high reliability.
However, undetected errors at the signalling link level and exchange malfunctions may produce signalling information in messages that are either ambiguous or inappropriate.
An abnormal message is a message received in a state where it should normally not be received. In general, as stated earlier, messages received abnormally shall be discarded.
This is the case if messages other than those indicated in the normal procedures are received.

If an SRM is received without first having received a PSR (and sent a PSA in response), the SRM shall be regarded as abnormal and discarded.

If a message containing unreasonable information is received, it shall be discarded. Unreasonable information in a message can be:

- unknown MTX identity,
- inconsistencies in the coding of the heading codes and the length of the message.

4 FUNCTIONS FOR OPERATION AND MAINTENANCE OF THE MUP

4.1 General

This chapter defines a basic set of functions needed for operation, maintenance and management of the MUP. This includes functions for handling of exchange data related to the MUP, and also means to perform supervision and verification of the procedures applied by the MUP.

The functions given in this section shall only be looked upon as guidelines for what the implementation shall aim at with regard to O&M functions for MUP.

4.2 Administration and operation functions

The implementation shall fulfil the operation and maintenance requirements for administration and operation functions, as specified in NMT Doc. 900-2.

4.3 Handling of data related to the MUP

The exchange system shall have functions to allow handling of data related to the MUP. This requirement implies that such data is to be regarded as exchange data to be handled (i.e. created, modified, investigated, activated, deactivated or removed) via the normal I/ O routines including the necessary MML functions, of the exchange.

The table below indicates the different procedures that must be implemented in the exchange for handling of data related to the MUP:

The following abbreviations are used:

- c means "creation",
- m means "modification",
- i means "investigation",
- a means "activation",
- d means "deactivation",
- r means "removal".

Item	Procedure					
	c	m	i	a	d	r
Handling of routing data	x	x	x	x	x	x
Threshold values for generating alarms/printouts		x	x			

The values of all timers specified must be controllable in a simple way. The recommended value and the possible range is given in section 3.11.

4.4 Supervision functions

The MUP applies timers T1 .. T7 for securing the signalling procedures. At timeout of T2 and T3, information is given to the operation and maintenance system of the exchange.

Expiration of timer T2 and T3 shall be supervised. The operation and maintenance system shall include a quotient counter for this timers per known MTX. Alarms/ fault printouts shall be generated in the exchanges at defined thresholds.

The operation and maintenance system shall include a quotient counter per known MTX for each of the following situations:

- a message or signal received abnormally, and
- a message received containing unreasonable information.

When a defined threshold value is reached, an alarm should be given to O&M personnel.

The exchange system shall have functions for monitoring MUP transactions. It shall be possible to monitor transactions originated or received to/ from specified exchanges, for which timing and contents of all MUP messages involved in the transactions shall be obtainable.

4.5 Statistics and measurements

The exchange shall have possibilities of providing statistics and measurements data as specified below. These data shall be collected and presented to the environment according to the same principles as specified for other statistics information from the exchange, ref. NMT Doc. 900-2.

Recording of statistics shall be performed per known MTX for each of the following situations:

- Timeout of all timers.
- All messages with a "Reason" field included. Each type of reason shall be recorded separately.
- Abnormal messages and signals received, and
- Messages received containing unreasonable information.

Statistics of MUP traffic interests and traffic volume shall be recorded. Statistics should be collected for the number of messages to/ from each of the other MTXs known.

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Automatic Cellular Mobile Telephone System

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NMT - 900

Technical specification for signalling system no. 7

ANNEX 1 TO MOBILE USER PART, ADDITIONAL INFORMATION

This document gives additional information about the coding of certain fields in the MUP-messages. The document is an Annex to the NMT Doc. 900 - 2, Annex 3-I ,MOBILE USER PART.

CONTENTS

2.5.1.f Supplementary services activation indicators.

Input document: NMT-MTX Doc. 94-216, Rev. A, 94-03-24.

Bits DCBA: Outgoing call barred indicator

Code	Meaning
0000	No service restriction
0001	Barring of all outgoing calls, except emergency numbers and customer care of VPLMN
0010	Barring of all national and international calls except calls to HPLMN
0011	Barring of all international calls outside Europe/Outer Area *) and premium rate numbers
0100	Barring of premium rate numbers and all international calls outside Nordic countries (Neighbouring countries + HPLMN)
0101	Barring of premium rate numbers and all international calls except calls to HPLMN
0110	Barring of premium rate numbers
0111	Barring of entertainment premium rate numbers
1000	Reserved for the future international use, currently interpreted as 0001
1001	Reserved for the future international use, currently interpreted as 0001
1010	Reserved for the future international use, currently interpreted as 0001
1011	Reserved for the national use, currently interpreted as 0001
1100	Reserved for the national use, currently interpreted as 0001
1101	Reserved for the national use, currently interpreted as 0001
1110	Reserved for the national use, currently interpreted as 0001
1111	Reserved for the national use, currently interpreted as 0001

Note 1) Calls to emergency numbers and customer care of the VPLMN are always permitted.

Note 2) Entertainment service, when technically separable from information service, are barred for roamers in all cases, except when no restrictions at all (0000).

Note 3) The accepting of incoming calls is decided and up to HPLMN.

Note 4) Operator service for roamers are open only when they have no service restrictions.

*) Deviation can be made if the price level is not significantly higher than to countries inside the defined area. The areas are listed in annexes of the bilateral Roaming agreements.

2.10.16.m General supplementary call information

Bit DCBA:

Code	Meaning
0000	No charging
0001	Normal charging of roaming forwarding leg
0010	Normal charging of roaming forwarding leg and charging of received calls
0011	Not defined
:	:
1111	Not defined

2.10.16.n Supplementary call information for forwarded calls

Bit FEDCBA:

Code	Meaning
000000	No announcement
000001	Announcement for the service "Call forwarding, unconditional"
000010	Announcement for the service "Call forwarding on no reply or no page responce"
000011	Announcement for the service "Call forwarding on busy or basestation congestion"
000100	Not defined
:	:
111111	Not defined

2.10.18.e Reason for termination

The following codes are valid if the reason for termination (2.10.18.d) is "Termination of procedure"

Bit HGFEDCBA:

Code	Meaning
00000000	Not defined
:	:
11111111	Not defined

The following codes are valid if the reason for termination (2.18.10.d) is "Rejected by technical reason".

Bit HGFEDCBA:

Code	Meaning
00000000	No fre MSRN
00000001	MS identity unknown
00000010	Spare
00000011	Spare
00000100	Mobile Station Directory Number incomplete
00000101	Unallocated directory number
00000110	Not used
00000111	Miscellaneous
00001000	Loop-Back protection counter exceeded
00001001	Barred for other reason
00001010	Not defined
:	:
11111111	Not defined

2.10.18.i Information for charge determination

For coding see 2.10.16.m