**Technical Document**

# GSM PROTOCOL STACK

# MESSAGE SEQUENCE CHARTS

# RR

| | |
|---|---|
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## Important Notice



## Change History

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**Notes:**

1. Initial version: "MPH_BSIC_IND" replaced by "MPH_BSIC_CNF"
2. Extended Measurement Procedure

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**[ISO 9000:2000]** International Organization for Standardization. Quality management systems - Fundamentals and vocabulary. December 2000

## 1.1 References

[1] Mobile radio interface layer 3 specification
3GPP TS 04.18 V8.11.0 (2001-09)

[2] Radio subsystem link control
3GPP TS 04.18 V8.11.0 (2001-09)

[3] Functions related to Mobile Station (MS) in idle mode and group receive mode;
3GPP TS 03.22 V8.5.0 (2001-06)

[4] NAS Functions related to Mobile Station (MS) in idle mode
3GPP TS 23.122 V4.1.0 (2001-06)

Abbreviations

| | |
|---|---|
| AGCH | Access Grant Channel |
| BCCH | Broadcast Control Channel |
| BS | Base Station |
| BSIC | Base Station Identification Code |
| CBCH | Cell Broadcast Channel |
| CBQ | Cell Bar Qualify |
| CC | Call Control |
| CCCH | Common Control Channel |
| CCD | Condat Coder Decoder |
| CKSN | Ciphering Key Sequence Number |
| C/R | Command / Response |
| C1 | Path Loss Criterion |
| C2 | Reselection Criterion |
| DCCH | Dedicated Control Channel |
| DISC | Disconnect Frame |
| DL | Data Link Layer |
| DM | Disconnected Mode Frame |
| EA | Extension Bit Address Field |
| EL | Extension Bit Length Field |
| EMMI | Electrical Man Machine Interface |
| EMO | Extended Measurement Order |
| F | Final Bit |
| FACCH | Fast Associated Control Channel |
| FHO | Forced Handover |
| GP | Guard Period |
| GSM | Global System for Mobile Communication |
| HPLMN | Home Public Land Mobile Network |
| I | Information Frame |
| IMEI | International Mobile Equipment Identity |
| IMSI | International Mobile Subscriber Identity |
| Kc | Authentication Key |
| L | Length Indicator |
| LAI | Location Area Information |
| LPD | Link Protocol Discriminator |
| M | More Data Bit |
| MCC | Mobile Country Code |
| MM | Mobility Management |
| MMI | Man Machine Interface |
| MNC | Mobile Network Code |
| MS | Mobile Station |
| NCC | National Colour Code |
| NECI | New Establishment Causes Included |
| N(R) | Receive Number |
| N(S) | Send Number |
| OTD | Observed Time Difference |

| | |
|---|---|
| P | Poll Bit |
| PCH | Paging Channel |
| PDU | Protocol Description Unit |
| P/F | Poll / Final Bit |
| PL | Physical Layer |
| PLMN | Public Land Mobile Network |
| RACH | Random Access Channel |
| REJ | Reject Frame |
| RNR | Receive Not Ready Frame |
| RR | Radio Resource Management |
| RR | Receive Ready Frame |
| RTD | Real Time Difference |
| SABM | Set Asynchronous Balanced Mode |
| SACCH | Slow Associated Control Channel |
| SAP | Service Access Point |
| SAPI | Service Access Point Identifier |
| SDCCH | Slow Dedicated Control Channel |
| SIM | Subscriber Identity Module |
| SMS | Short Message Service |
| SMSCB | Short Message Service Cell Broadcast |
| SS | Supplementary Services |
| TCH | Traffic Channel |
| TCH/F | Traffic Channel Full Rate |
| TCH/H | Traffic Channel Half Rate |
| TDMA | Time Division Multiple Access |
| TMSI | Temporary Mobile Subscriber Identity |
| UA | Unnumbered Acknowledgement Frame |
| UI | Unnumbered Information Frame |
| VPLMN | Visiting Public Land Mobile Network |
| V(A) | Acknowledgement State Variable |
| V(R) | Receive State Variable |
| V(S) | Send State Variable |

## 1.2 Terms

| | |
|---|---|
| Entity: | An entity is a program which executes the functions of a layer. |
| Message: | A message is a data unit which is transferred between the entities of one layer (peer-to-peer) of one component (mobile station or infrastructure). Message is used as a synonym to Protocol Data Unit (PDU). A message may contain several information elements. |
| Primitive: | A primitive is a data unit which is transferred between layers of one component (mobile station or infrastructure). The primitive has an operation code which identifies the primitive and its parameters. |
| Service Access Point: | A Service Access Point is a data interface between two layers of one component (mobile station or infrastructure). |

# 2 Overview

This section offers a brief description of the different layers which constitute the mobile station Protocol Stack. It is also intended to offer an overview of the intersystem interface. The Protocol Stacks are used to define the functionality of the GSM protocols for interfaces. The GSM specifications are normative when used to describe the functionality of interfaces, but the stacks and the subdivision of protocol layers do not imply or restrict any implementation.

The base of the Protocol Stack rests on the Physical Layer.

The Data Link Layer (DL) is used to handle an acknowledged connection between the mobile and base stations. The LAPDm protocol is used.

Radio Resource (RR) manages the resources of the air-interface, meaning the configuration of the Physical Layer, cell selection and reselection, data transfer, and RR-Connection handling.

Mobility Management (MM) handles registration aspects for the mobile station. It detects changes of location areas and updates a mobile station into the new location area.

Call Control (CC) provides the call functionality. This includes call establishment and call maintenance procedures like Hold, Retrieve, and Modify and call disconnection.

Supplementary Services (SS) handles all call-independent supplementary services like call forwarding or call barring.

Short Message Services (SMS) is used for sending and receiving point-to-point short messages. Additionally included, is the reception of Cell Broadcast Short Messages.

The Man Machine Interface (MMI) is the interface to the user. Normally, it is connected with a keypad as the input device and a display as the output device.

Data interfaces are defined between the several entities. These data interfaces are called Service Access Points (SAPs), which indicate that an upper layer is using the services of a lower layer.

The GSM specifications do not set out any implementation of the Protocol Stack. The following diagrams show the implementation for the mobile station as described in all of these documents. All entities, except the Man Machine Interface and Physical Layer, are implemented as part of the Protocol Stack.

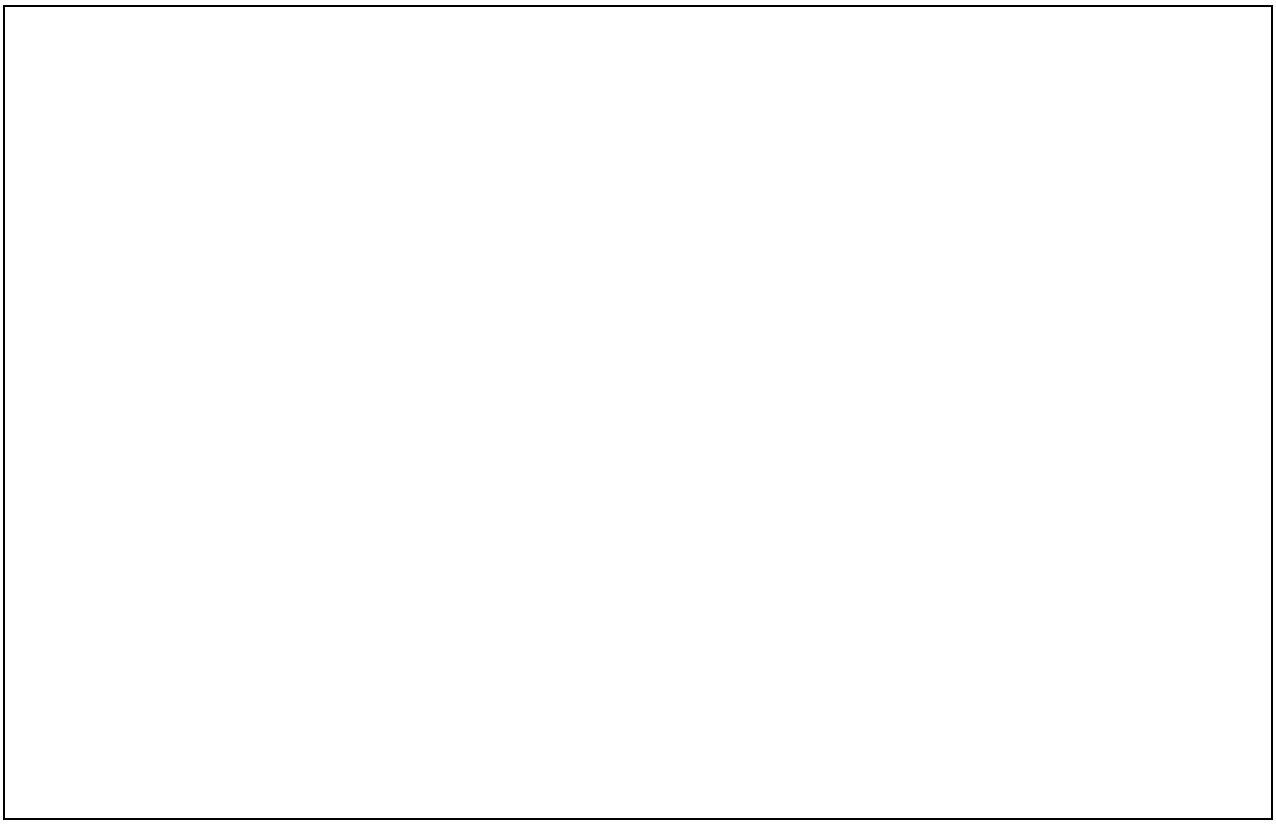


Figure 1: Mobile-station protocol architecture

This document describes the services offered by the Radio Resource management.

# 3 Introduction

## 3.1 Dynamic Configuration

Dynamic configurations are defined for Radio Resource (RR). It is possible to change RR's behaviour at run time by sending a character string from a test device to RR.
RR uses a keyword table to interpret the strings. The strings have the following general format:
<keyword> = (parameter 1, parameter 2, ...)
Keywords without parameters are defined by using the keyword only. The parentheses are not required for keywords with only one parameter.
The following table contains an overview of the possible configurations:

| Keyword | Parameter |
|---|---|
| TIMER_SET | name value unit |
| TIMER_RESET | name |
| TIMER_SPEED_UP | name factor |
| TIMER_SLOW_DOWN | name factor |
| TIMER_SUPPRESS | name |
| FCR | |
| SCR | |
| DLE | |
| FCA | |
| FRL | |
| FHO | |
| NCK | |
| IHO | Value |
| SHIELD | Values |

The keywords **TIMER_SET**, **TIMER_RESET**, **TIMER_SPEED_UP**, **TIMER_SLOW_DOWN**, and **TIMER_SUPPRESS** are used to set the timers. The various timers are identified by their names. The time used by the next start of the timer is set according to the dynamic configuration.
The configuration **FCR** starts a fast cell reselection in idle mode. It reduces immediately the reported fieldstrength of the serving cell to zero. RR starts cell reselection after five seconds.
**SCR** is the configuration for slow cell reselection. All five seconds the fieldstrength of the serving cell is lowered by 2 dB. RR starts a cell reselection for C2 (neighbour cell ) > C2 (serving cell).
A downlink failure in idle mode is simulated with the configuration **DLE**.
Resumption of a layer 2 connection is processed during handover or channel assignment. With the configuration **FCA** a failure and the reconnection to the old channel is produced.
A radio link failure is stimulated with the configuration **FRL**.
The configuration **FHO** is used to configure Forced Handover. If the mobile station has established a connection to the base station, RR sends measurement reports to the base station with each SACCH frame. Interpreting the measurement reports in the base station forces a Handover if necessary. A Handover is a cell change during an established connection. Using the configuration above, a measurement report with fieldstrength zero for the serving cell is sent to the base station. This is called a Forced Handover.
The configuration **NCK** is used to configure the Ciphering Ciphering mode setting procedure in the special case when no Ciphering Key is provided by the Network. In this abnormal cases and with NCK active a Ciphering Mode Complete message is sent (instead of a RR_STATUS message).

The configuration **IHO** is used to test the AMR codec-to-bandwith-adaption, in this special case the MS will stick in to a current camping cell. If this IHO is configured, the MS would ignore the Handover/Assignment commands and will stay on the current camping cell. It also ignores the Radio Link failures.

The configuration **SHIELD** is used to configure the networks to be shielded during cell selection. The Mobile Country Code values, which are used during “Software Shielding”, made persistent (stored in / read from Flash File System). Software Shielding works with up to four MCC values. "Software Shielding" will be in effect when a Test SIM is inserted. The new FFS value stored under directory name /gsm/l3/shield.

## 3.2 Timer Modi

It is possible to determine a mode by a dynamic configuration for each of RR's timers. If a timer is started by RR, the given start value is set according to the timer mode.
The timer mode **TIMER_SET** defines a new timer value as opposed to the original start value.
The default timer mode is **TIMER_RESET** which does not set the start value.
**TIMER_SPEED_UP** is used to speed up a timer by a given factor. The start value is divided by the factor. The minimum time is one unit.
The opposite mode is **TIMER_SLOW_DOWN**. The start value is then multiplied by the given factor.
**TIMER_SUPPRESS** is used to suppress the timer start.

## 3.3 Frequency Bands

RR supports different frequency bands for the mobiles:

- GSM 900
- DCS 1800
- PCS 1900
- Dualband GSM 900 / DCS 1800
- Dualband Extended GSM 900 / E-GSM / DCS 1800

The different frequency ranges need some different algorithms and different storing of channel lists. To define the used frequency range a global variable **std** is introduced. The value of this variable is set in the PCM driver module. The following dependency exists:

| Frequency Range | std |
|---|---|
| GSM 900 | 1 |
| PCS 1900 | 3 |
| DCS 1800 | 4 |
| Dualband GSM 900 / DCS 1800 | 5 |
| Dualband Extended<br>GSM 900 / E-GSM / DCS 1800 | 6 |

All channel lists in RR are organized as bitmaps for memory efficiency. This channel lists have the following layout depending on the supported frequency range:

GSM 900
channels 1 to 124 = 124 channels

| Byte / Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | --- | --- | --- | --- | 124 | 123 | 122 | 121 |
| 1 | 120 | 119 | 118 | 117 | 116 | 115 | 114 | 113 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 14 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| 15 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

DCS 1800
channels 512 to 885 = 374 channels

| Byte / Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | --- | --- | 885 | 884 | 883 | 882 | 881 | 880 |
| 1 | 879 | 878 | 877 | 876 | 875 | 874 | 873 | 872 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 45 | 527 | 526 | 525 | 524 | 523 | 522 | 521 | 520 |
| 46 | 519 | 518 | 517 | 516 | 515 | 514 | 513 | 512 |

PCS 1900
channels 512 to 810 = 299 channels

| Byte / Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | --- | --- | --- | --- | --- | 810 | 809 | 808 |
| 1 | 807 | 806 | 805 | 804 | 803 | 802 | 801 | 800 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 36 | 527 | 526 | 525 | 524 | 523 | 522 | 521 | 520 |
| 37 | 519 | 518 | 517 | 516 | 515 | 514 | 513 | 512 |

Dualband GSM 900 / DCS 1800
channels 1 to 124 = 124 channels
channels 512 to 885 = 374 channels
total 498 channels

| Byte / Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | --- | --- | --- | --- | 124 | 123 | 122 | 121 |
| 1 | 120 | 119 | 118 | 117 | 116 | 115 | 114 | 113 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 14 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| 15 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 16 | --- | --- | 885 | 884 | 883 | 882 | 881 | 880 |
| 17 | 879 | 878 | 877 | 876 | 875 | 874 | 873 | 872 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 61 | 527 | 526 | 525 | 524 | 523 | 522 | 521 | 520 |
| 62 | 519 | 518 | 517 | 516 | 515 | 514 | 513 | 512 |

Dualband Extended GSM 900 / E-GSM / DCS 1800
channels 1 to 124 = 124 channels
channels 512 to 885 = 374 channels
channels 975 to 1023 plus 0 = 50 channels
total 548 channels

| Byte / Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | --- | --- | --- | --- | 124 | 123 | 122 | 121 |
| 1 | 120 | 119 | 118 | 117 | 116 | 115 | 114 | 113 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 14 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| 15 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 16 | --- | --- | --- | --- | --- | --- | 0 | 1023 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 22 | 982 | 981 | 980 | 979 | 978 | 977 | 976 | 975 |
| 23 | --- | --- | 885 | 884 | 883 | 882 | 881 | 880 |
| 24 | 879 | 878 | 877 | 876 | 875 | 874 | 873 | 872 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 68 | 527 | 526 | 525 | 524 | 523 | 522 | 521 | 520 |
| 69 | 519 | 518 | 517 | 516 | 515 | 514 | 513 | 512 |

## 3.4 Mobile Station Configuration

RR reads several records of the permanent memory configuration to get the actual configuration. The following records are read:

- IMEI the international mobile equipment identity of the mobile station
- MSCAP the mobile station capabilities
- CLASS2 the mobile station classmark 2 element
- CLASS3 the mobile station classmark 3 element.

For details refer to the driver specification for PCM. In the PCM specification the structure and the use of the permanent memory configuration is described.

# 4 Cell Selection

MM requests one of the following services:

**Full PLMN Search**

A SIM card is inserted and a suitable cell of the requested PLMN is searched by RR. If this cell selection is successful, all services of the upper layers are allowed.

**Limited Search**

If no SIM card is inserted or a procedure in the upper layer decides that the SIM card is not suitable in the infrastructure, MM requests Limited Search. A suitable cell is selected to allow emergency calls.

**Net Search**

MM requests a list of the available PLMNs. This list of PLMNs may be used by the MMI to select a PLMN for Full PLMN Search.

The result of a Cell Selection from the view of RR is:

**Full Service**

A suitable cell for all service of upper layer is found. This is the PLMN requested by MM or the HPLMN.

**Limited Service**

The normal services of the upper layer are not allowed, but the selected cell allows emergency calls.

**No Service**

No suitable cell was found neither for full service nor for limited service.

The following table shows the the procedure in RR after the end of cell selection depending of the requested service by MM and the actual service in RR

| Requested MM Service / Actual RR Service | Full PLMN Search | Limited Search | Net Search |
|---|---|---|---|
| No Service | Start timer No Service Mode, restart Full PLMN Search after timeout | Start Timer No Service Mode, restart limited Service after timeout | Return to previous MM requested Mode (Full PLMN Search or Limited Search) |
| Limited Service | Start timer Limited Service Mode, restart Full PLMN Search after timeout | - | Return to previous MM requested Mode (Full PLMN Search or Limited Search) |
| Full Service | Start timer HPLMN Search Mode if VPLMN in the HPLMN country, restart HPLMN Search after timeout | - | Return to previous MM requested Mode (Full PLMN Search) |

The timer is started depending on the n th failed attempt and the actual RR service.

No Service Mode — The timer is started after no service condition is signalled to MM. After timeout RR starts a PLMN or limited search (depending on existence of the SIM card). The timer values are:

| | |
|---|---|
| 1st - 4th attempt | 10 Seconds |
| 5th - 8th attempt | 20 Seconds |
| 12th - 16th attempt | 30 Seconds |
| 17th - 20th attempt | 60 Seconds |
| 21st - 24th attempt | 120 Seconds |
| above | 360 Seconds |

Limited Service Mode — The timer is started after limited service condition is signalled to MM. After timeout RR starts a PLMN search. The timer values are:

| | |
|---|---|
| 1st - 4th attempt | 10 Seconds |
| 5th - 8th attempt | 20 Seconds |
| 12th - 16th attempt | 30 Seconds |
| 17th - 20th attempt | 60 Seconds |
| 21st - 24th attempt | 120 Seconds |
| above | 360 Seconds |

| | |
|---|---|
| Full Service Mode | The timer is started if the selected PLMN is unequal the HPLMN but the MCC is equal to the MCC of the HPLMN. The value is a multiple of six minutes and stored on the SIM card. |

The timer is stopped and the attempt counter is cleared whenever a reselection has occurred.
Both timer tables are independent and can be configured with the custom specific header.

For Radio Resource the SDL-Process Cell Search is implemented with the following events:

| | |
|---|---|
| Start_scan: | The process starts a fieldstrength measurement procedure with interruption of PCH listening (state NULL) or without interruption of PCH listening (state IDLE). |
| Start_sync: | The process starts synchronisation attempts in decreasing fieldstrength order. |
| Del_list: | The forwarded list is used to delete the channels from the list of possible BCCH channels. This will be made with the neighbour cell list of a non-suitable PLMN. The channels are not really deleted, but they will be used only if the rest has not matched. |
| Set_list: | The forwarded list is used to set the list of possible BCCH channels. This will be made for example for limited service list or low priority list. The channels of the list are used first. |
| Set_all: | This signal sets all BCCH carrier for the next synchronisation attempt. |
| Get_list: | This signal is used to get a neighbour cell list calculated from the fieldstrength measurements for limited mode. |
| Sync_next: | This signal starts the BCCH synchronisation attempt for the strongest BCCH carrier. |
| Set_null: | The signal indicates that the stored information shall be deleted and the process enters NULL state. |
| Bsic_ind: | After a successful synchronisation attempt the data (channel, bsic, fieldstrength) are forwarded to RR attachment process. |
| No_bsic_ind: | Indicates that no suitable BCCH carrier was found. |

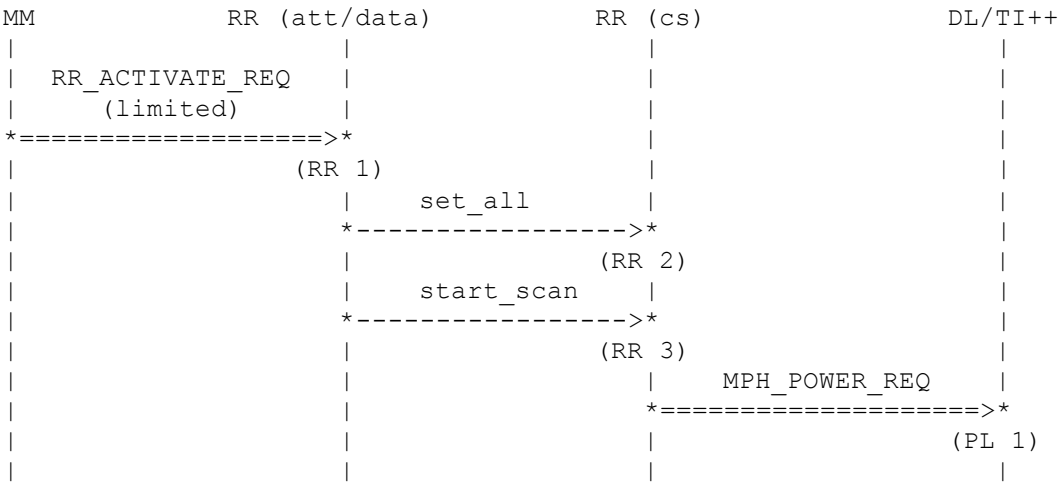
After each activation all possible channels have a medium priority (event set_all). This priority will be set to high priority with the event set_list and will be set to low priority with the event del_list.
The synchronisation attempts are carried out in the order high, middle and low priority in decreasing fieldstrength order. RR clears the emergency cell list and the low priority list at the start of each Cell Selection attempt.
A failed Cell Selection produces a list of available PLMNs which will be used by MM.

## 4.1 Cell Selection Limited Service Mode

The Cell Selection for Limited Service Mode is started if no SIM card is inserted.

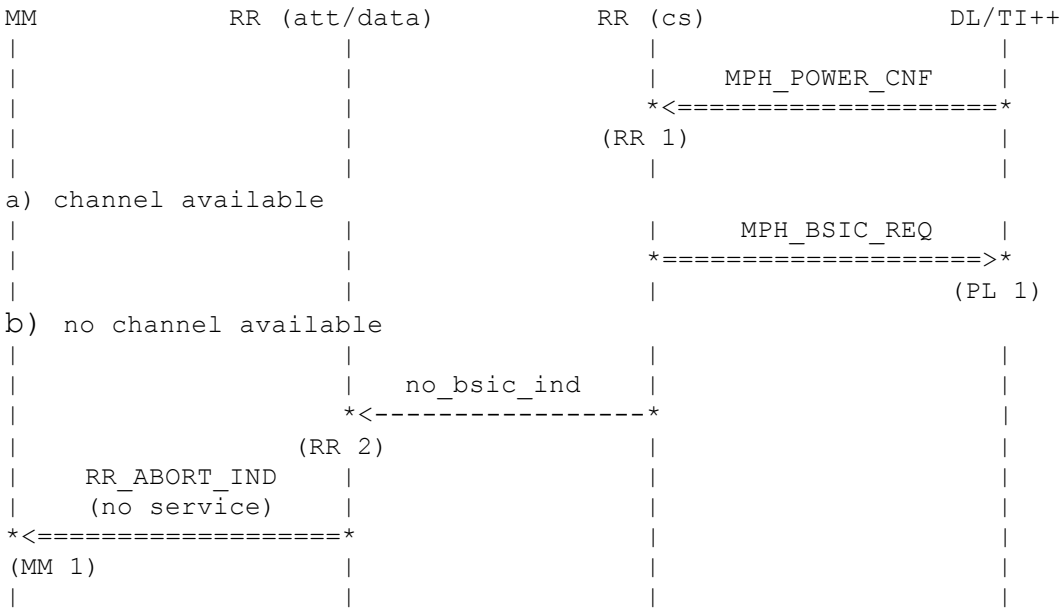
### 4.1.1 Activation without previous Attempts

This happens if no SIM card is inserted. RR has stored no limited service cell list.



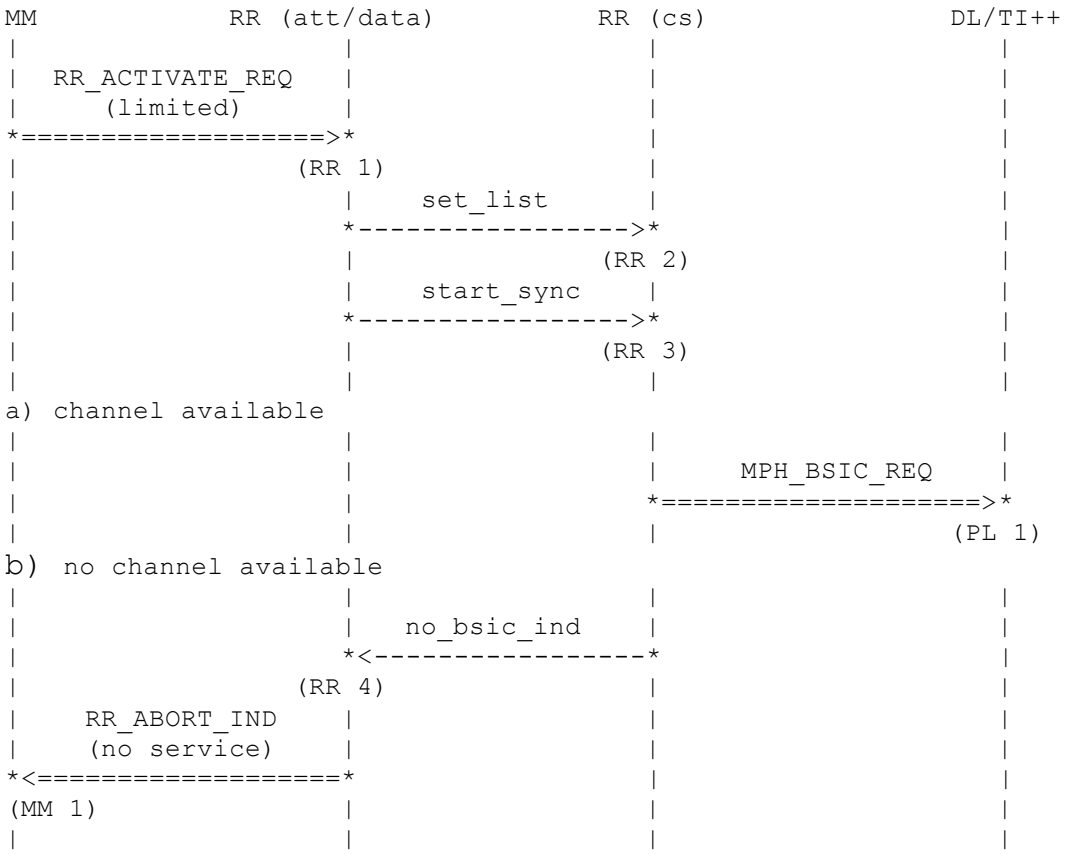

(RR 1)
MM starts the cell selection for limited service mode.
(RR 2)
RR has no information stored about limited service cells. It sends the signal „set_all“ to the cell select process. The information is stored in the process. It means that the next synchronisation attempt is started for the strongest BCCH carrier without pre-conditions.
(RR 3)
RR sends the signal „start_scan“ to the cell select process. The cell select process starts the fieldstrength measurements in layer 1.
(PL 1)
The upper layer has requested fieldstrength measurement with or without interrupting PCH listening.

### 4.1.2 Receiving Fieldstrength Samples



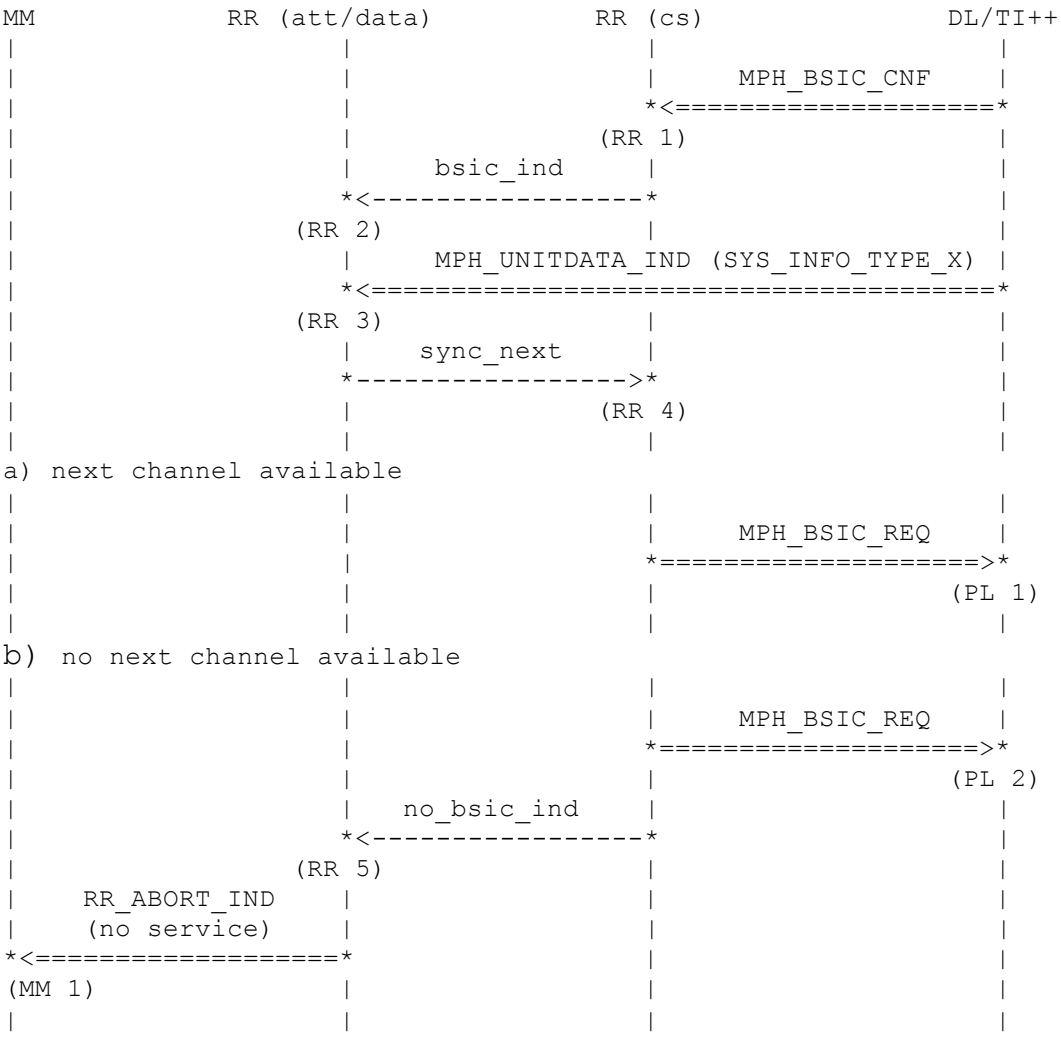

(RR 1)
The lower layer delivers the fieldstrength samples for the n best channels of the requested frequency bands in decreasing order. Only channels with a minimum fieldstrength are signalled.
(PL 1)
The BCCH synchronisation attempt is started for the channel with the fieldstrength.
(RR 2)
If no suitable channel is signalled from PL the event no_bsic_ind is send to the RR attachment process.
(MM 1)
MM is informed about the no service condition. A timer is started in RR to trigger the PLMN search during no service Mode.

### 4.1.3 Activation after previous Attempts




(RR 1)
MM starts the cell selection for limited service mode.
(RR 2)
RR has information stored about limited service cells. It sends the event „sef_list" to the cell select process to define high priority channels for the subsequent synchronisation attempt.
(RR 3)
RR sends the event „start_sync" to the cell select process. The cell select process starts the synchronisation attempt in layer 1.
(PL 1)
The upper layer has requested BCCH search for the indicated channel.
(RR 4)
If no channel has a fieldstrength higher then the threshold value the signal no_bsic_ind is send to the RR attachment process.
(MM 1)
MM is informed about the no service condition. A timer is started in RR to trigger the PLMN search during no service Mode.

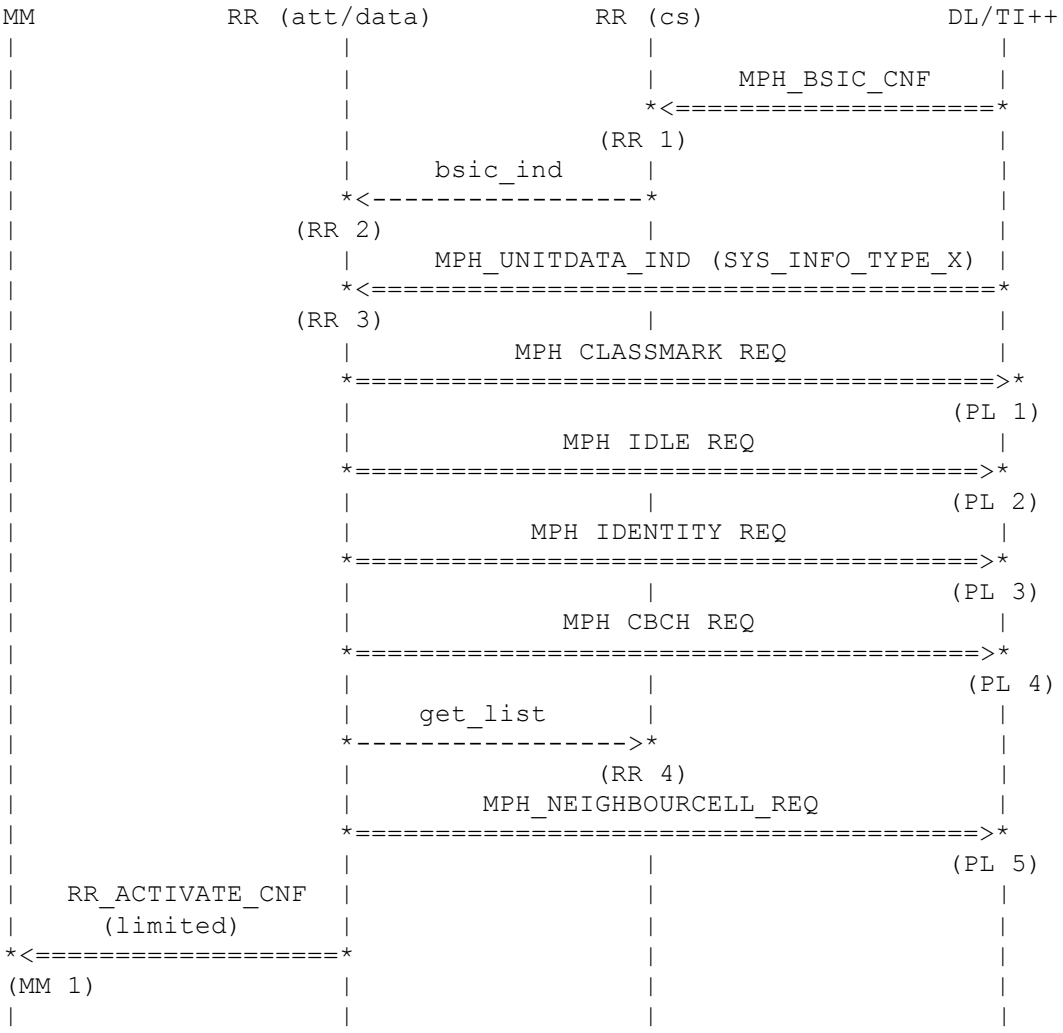
### 4.1.4 BCCH Carrier found, but not suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment pro cess.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(RR 4)
The BCCH carrier is not suitable (C1 < 0 or cell barred). RR attachment process request synchronisation to the next strongest BCCH carrier.
(PL 1)
It is another channel available for a synchronisation attempt. RR requests the synchronisation to layer 1.
(PL 2)
The cell selection process has tried all suitable channels. BCCH reading in layer 1 is stopped by sending a bsic request to the "channel numer" 0xFFFF.

(RR 5)
The cell selection process has tried all suitable channels. A no_bsic_ind event is send to the RR attachment process.
(MM 1)
MM is informed about the no service condition. A timer is started in RR to trigger the PLMN search during no service Mode.

### 4.1.5 BCCH Carrier found, suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment process.
(RR 3)
RR receives the system information messages for this BCCH carriers.

(PL 1)

If all tests are successful, RR sets PL in the idle mode. RR sends the power classes with the primitive MPH CLASSMARK REQ.

(PL 2)

RR configures the idle mode parameter like channel combination or paging group. (Paging Group is set to 0 for limited service and BS_PA_MFRMS is set to 9 to save as much as possible power).

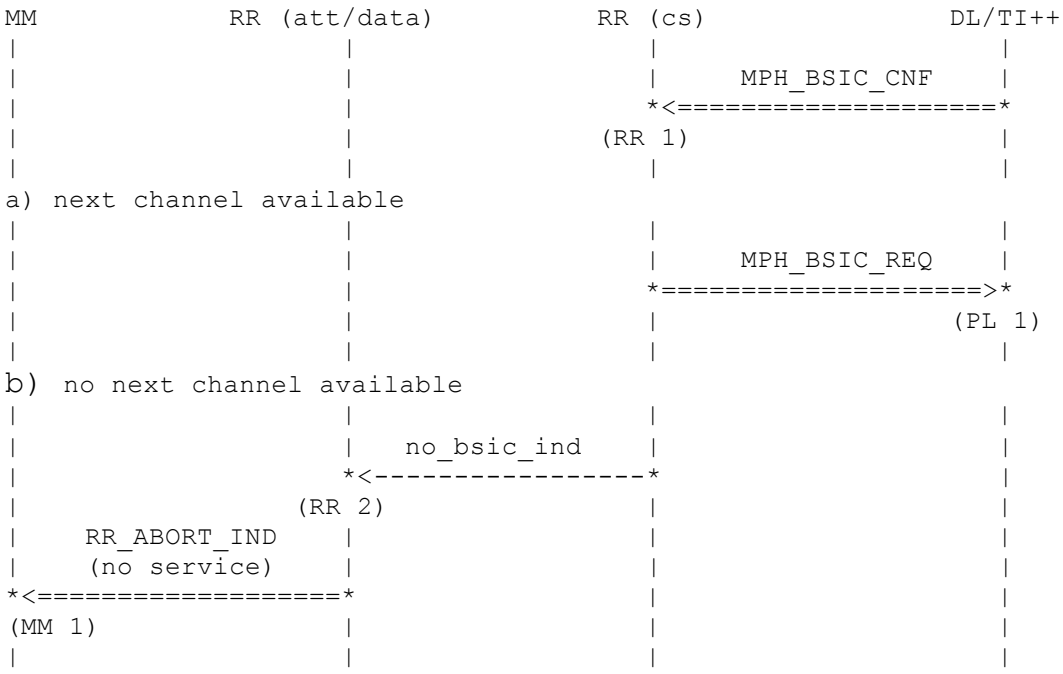
(PL 3)

RR forwards its identities to layer 1 for paging recognition. (This is cleared for limited service).

(PL 4)

RR configures the CBCH channel. (In limited mode the CBCH is switched off).
(RR 4)
RR attachment process requests a neighbour cell list from the RR cell search process. This neighbour cell list is build from the fieldstrength information of the last fieldstrength measurements.
(PL 2)
This neighbour cell list is forwarded to PL.
(MM 1)
MM is informed about the limited service condition. A timer is started in RR to trigger the PLMN search during limited service mode.

### 4.1.6 No BCCH Carrier found

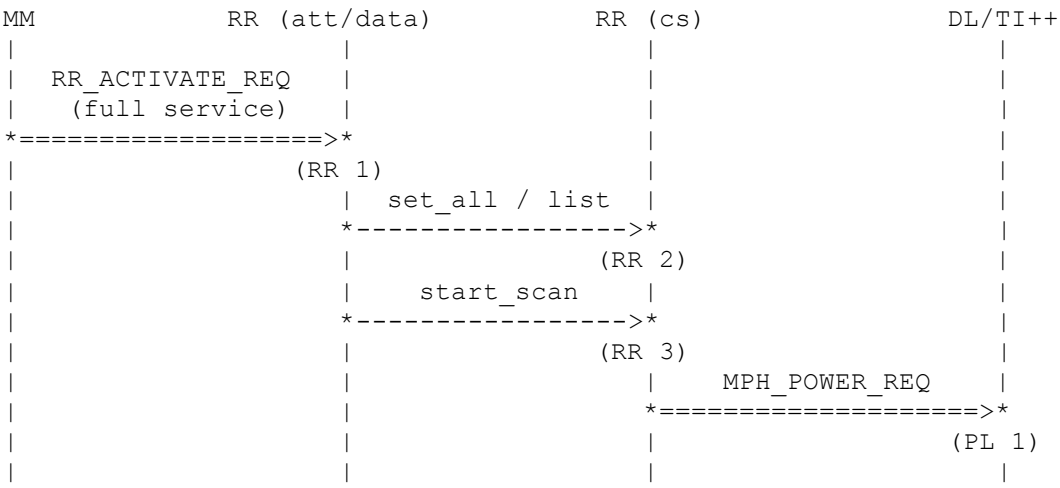



(RR 1)
Layer 1 indicates that the synchronisation attempt has failed.
(PL 1)
If another channel is available for a synchronisation attempt, RR triggers the procedure.
(RR 2)
Else the no_bsic_ind event is sent to the RR attachment process.
(MM 1)
MM is informed about the no service condition. A timer is started in RR to trigger the PLMN search during no service Mode.

## 4.2 Cell Selection Full Service Mode

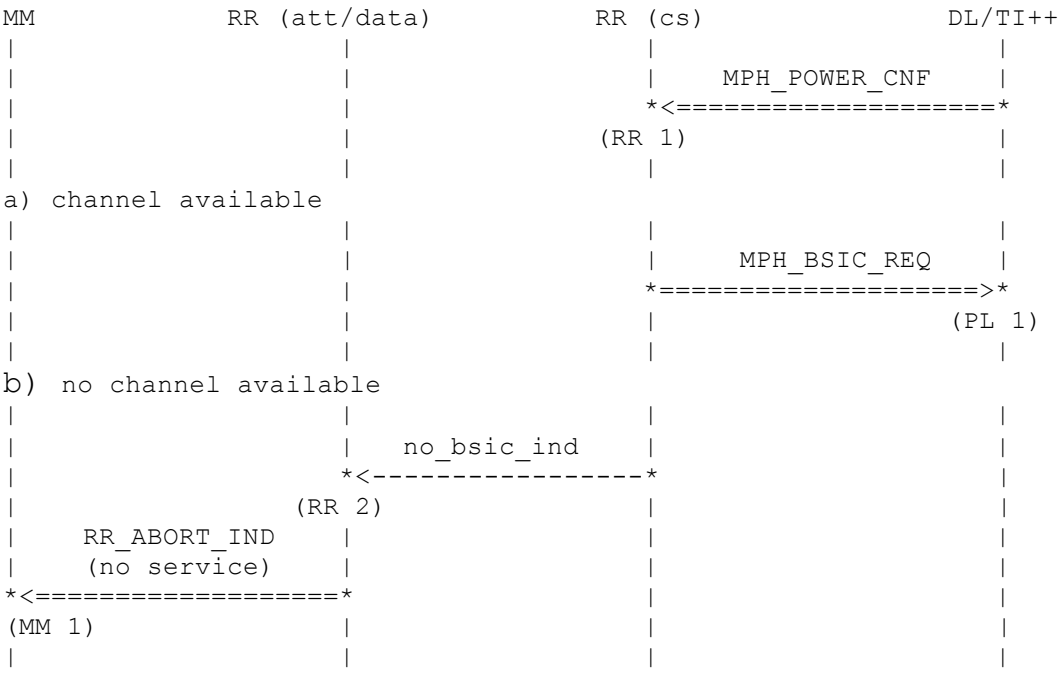
The cell selection for full service mode is started after SIM insertion or after initiation by MMI.

### 4.2.1 Activation without previous Attempts



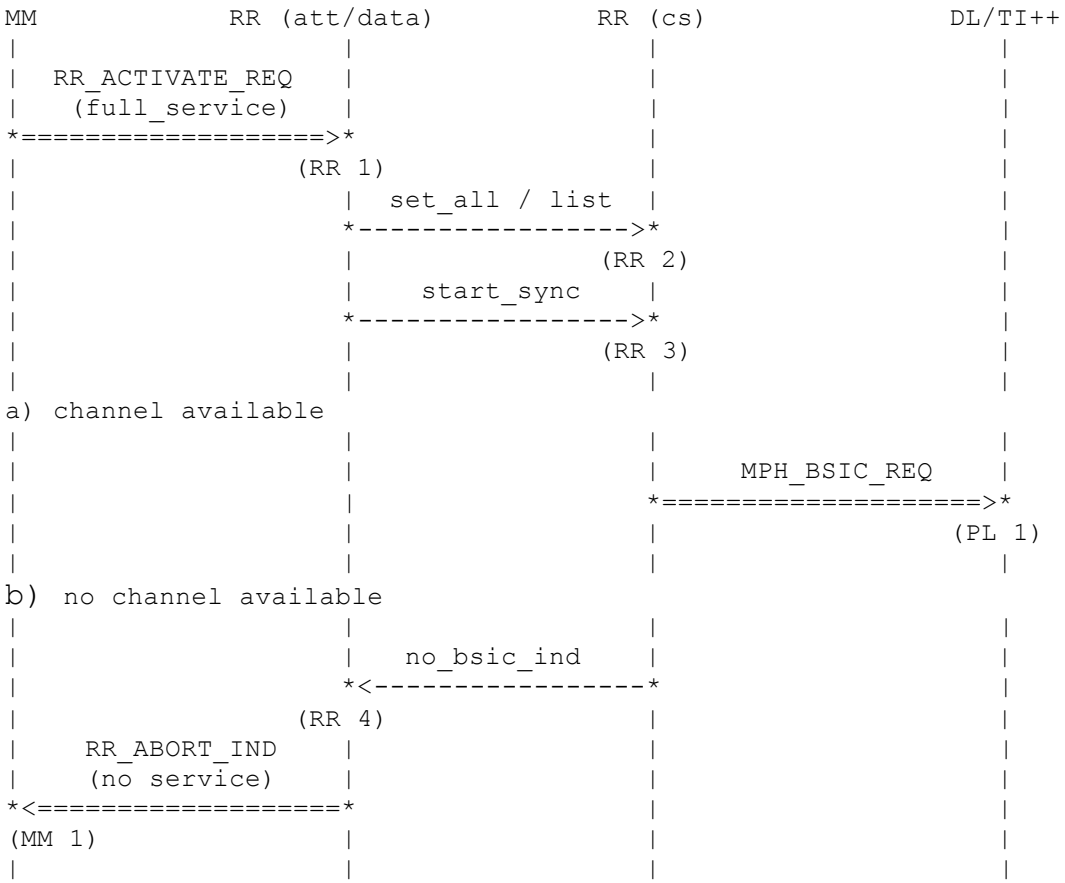

(RR 1)
MM starts the cell selection for full service mode.
(RR 2)
If RR has no information about channel lists it sends the event „set_all“ to the cell select process, else it sends the event „set_list“. The information is stored in the cell select process.
(RR 3)
RR sends the event „start_scan“ to the cell select process. The cell select process starts the field strength measurements in layer 1.
(PL 1)
The upper layer has requested field strength measurement with or without interrupting PCH listening.

### 4.2.2 Receiving Fieldstrength Samples



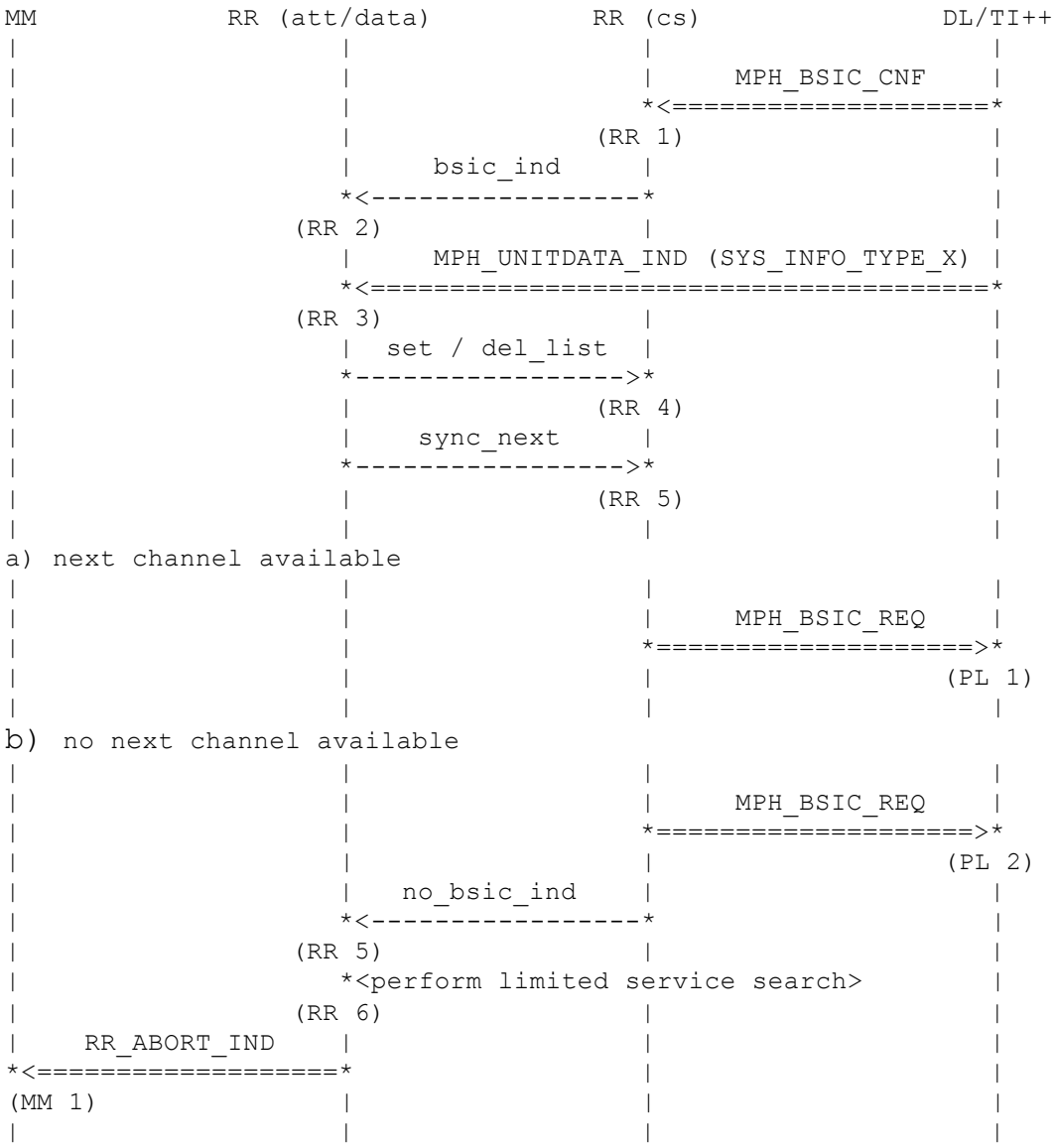

(RR 1)
The lower layer delivers the fieldstrength for the n best channels of the frequency bands. The channel list is sorted in decreasing fieldstrength order and the channel must have a fieldstrength value higher than a lower threshold value.
(PL 1)
The BCCH synchronisation attempt is started for the channel with the highest fieldstrength.
(RR 3)
If no channel is available the event no_bsic_ind is send to the RR attachment process.
(MM 1)
MM is informed about the no service condition. A timer is started in RR to trigger the PLMN search during no service Mode. If low priority cells are stored, they are used for a second syncronisation attempt before indicating no service condition.

### 4.2.3 Activation after previous Attempts




(RR 1)
MM starts the cell selection for full service mode.
(RR 2)
If RR has information about full service cells it sends the event „set_list“ else it sends the event „set_all“ to the cell select process.
(RR 3)
RR sends the event „start_sync“ to the cell select process. The cell select process starts the synchronisation attempt in layer 1.
(PL 1)
The upper layer has requested BCCH search for the indicated channel.
(RR 4)
If no channel is available the event no_bsic_ind is send to the RR attachment process.
(MM 1)
MM is informed about the no service condition. A timer is started in RR to trigger the PLMN search during no service Mode. If low priority cells are stored, they are used for a second synchronisation attempt before indicating no service condition.

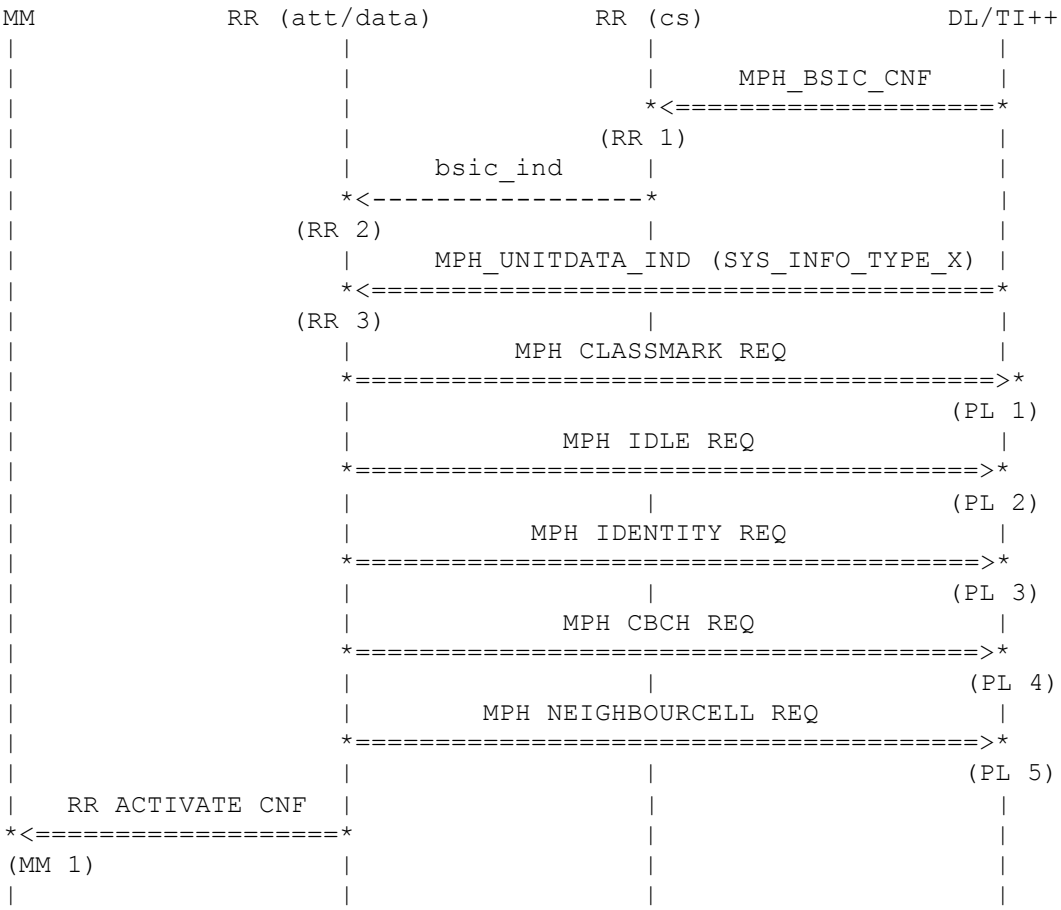
### 4.2.4 BCCH Carrier found, but not suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment process.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(RR 4)
The BCCH carrier is not suitable (C1 < 0, low priority or or cell barred). RR attachment process request synchronisation to the next strongest BCCH carrier. Low priority cells are stored in the low priority list and the emergency cell list.

(RR 5)
The neighbour cell list is send to the cell select process with the event „set_list“ if it is the high priority cell search and the PLMN is okay. The neighbour cell list is send to the cell select process with the event „del_list“ if the PLMN is wrong. Else no event is send. The events change the priorities of channels and may lead to a different order of synchronisation attempts.
(PL 1)
It is another channel available for a synchronisation attempt. RR requests the synchronisation to layer 1.
(PL 2)
The cell selection process has tried all suitable channels. A MPH BSIC REQ with the "channel number" 0xFFFF stops BCCH reading in layer 1.
(RR 5)
The cell selection process has tried all suitable channels. A no_bsic_ind event is send to the RR attachment process. If low priority cells are stored, they are used for a second synchronisation attempt on all low priority cells.
(RR 6)
If emergency cells are available, synchronisation attempts on this cells are processed
(MM 1)
MM is informed about the no service condition (if no emergency cell was found) or limited service condition (if an emergency cell was selected) . A timer is started in RR to trigger the PLMN search during no service / limited service Mode.

### 4.2.5 BCCH Carrier found, suitable




(RR 1)

PL scans a BCCH carrier and RR receives the channel number, the BSIC, and the field strength of the cell. The channel number is stored in the BCCH found list.

Now, RR listens to the BCCH System Information messages. A timer is started to control the reception of the messages.

(RR 2)

The first system information messages are received by RR. The reception of the messages may be in any order. The table shows the dependencies.

| Message | Remark |
|---|---|
| SYSTEM INFO TYPE 1 | not necessary to decode if there is no CBCH or CBCH without Frequency Hopping (SYSTEM INFO TYPE 4) |
| SYSTEM INFO TYPE 2 | decode each time |
| SYSTEM INFO TYPE 2 bis | not necessary to decode if the MS supports no extension band or if the ext ind bit of the neighbour cell description (SYSTEM INFO TYPE 2) determines that the neighbour cell list is complete. |
| SYSTEM INFO TYPE 2 ter | not necessary to decode if the MS supports no multi band or if the 2ter bit of the rest octets (SYSTEM INFO TYPE 3) determines that the message is not available. |
| SYSTEM INFO TYPE 3 | decode each time |
| SYSTEM INFO TYPE 4 | decode each time |
| SYSTEM INFO TYPE 7 | cell selection: not necessary to decode<br>cell reselection: not necessary to decode if cell selection parameters declare that no additional information is necessary (SYSTEM INFORMATION TYPE 4) |
| SYSTEM INFO TYPE 8 | cell selection: not necessary to decode<br>cell reselection: not necessary to decode if cell selection parameters declare that no additional information is necessary (SYSTEM INFORMATION TYPE 4) |

Depending on the cell selection type, the PLMN identification and the channel number are stored in various lists and different tests are performed. While processing the net request, no tests are carried out and only the PLMN identification is stored in the PLMN found list.

The following table shows the tests that are carried out depending on the cell selection type:

| Test | Search PLMN | Search Cell |
|---|---|---|
| Cell Barred | yes | yes |
| C1 > 0 | yes | yes |
| PLMN | yes | no |
| Priority | yes / no | no |

The tests are carried out after the reception of all needed system information messages.

Cell Barred The cell barred flag of the random access control parameter is checked. This parameter is included in each system information message. If the cell is barred, the cell is not suitable. If the cell is not barred, the test was successful.

C1 > 0 The path loss criterion (C1) determines whether or not the sending power and the receive level are sufficient. A value greater than zero is acceptable; otherwise the test has failed.

PLMN The search PLMN identification [Mobile Country Code (MCC) and Mobile Network Code (MNC)] is compared with the PLMN system information messages identification found. If they are equal, the test is successful. Otherwise, the cell is not suitable.

Priority In a first pass, RR searches for high priority cells. If the parameter PI in the information element SI x rest octets (x = 3,4,7, or 8) is set to zero, the cell is a high priority cell. If the parameter PI is set to one, RR decodes the information element and checks the parameter CBQ (cell bar qualify). If CBQ is equal to zero, the cell is a high priority cell. Otherwise, it is a low priority cell.

In the first pass, low priority cells are not suitable. However, they are stored in the low priority cell list for a possible second pass.

(PL 1)

If all tests are successful, RR sets PL in the idle mode. If PL has not received earlier information about the power classes of the mobile, RR sends the power classes with the primitive MPH CLASSMARK REQ.

(PL 2)

RR configures the idle mode parameter like channel combination or paging group.

(PL 3)

RR forwards it´s identities to layer 1 for paging recognition.

(PL 4)

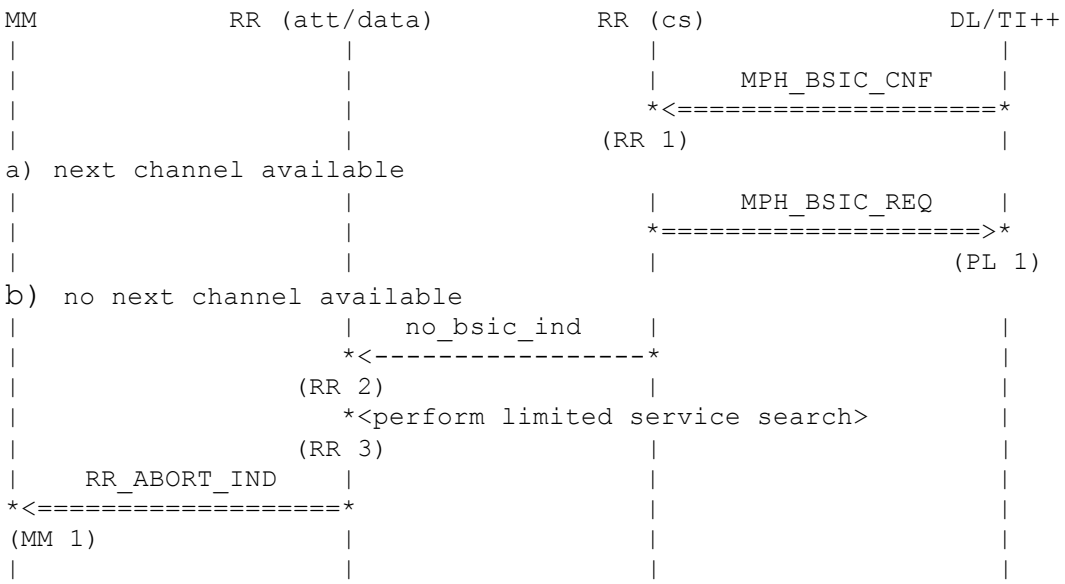
RR configures the CBCH channel.

(PL 5)

The neighbour cell list is created from the system information messages and forwarded to layer 1.

(MM 1)
MM is informed about the full service condition. A timer is started in RR to trigger the HPLMN search if the PLMN is a VPLMN in the HPLMN country. The timeout-value is known from the SIM card.

### 4.2.6 No BCCH Carrier found

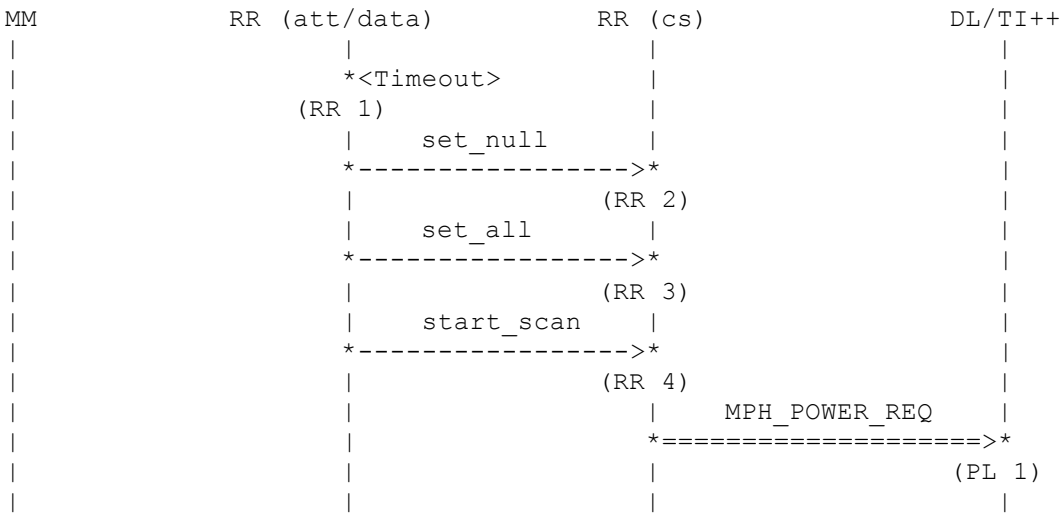



(RR 1)
Layer 1 indicates that the synchronisation attempt has failed.
(PL 1)
If another channel is available for a synchronisation attempt, RR triggers the procedure.
(RR 2)
Else the no_bsic_ind event is sent to the RR attachment process. If low priority cells are stored, they are used for a second synchronisation attempt on all low priority cells.
(RR 3)
If emergency cells are available, synchronisation attempts on this cells are processed
(MM 1)
MM is informed about the no service condition (if no emergency cell was found) or limited service condition (if an emergency cell was selected) . A timer is started in RR to trigger the PLMN search during no service / limited service Mode.

## 4.3 PLMN Search

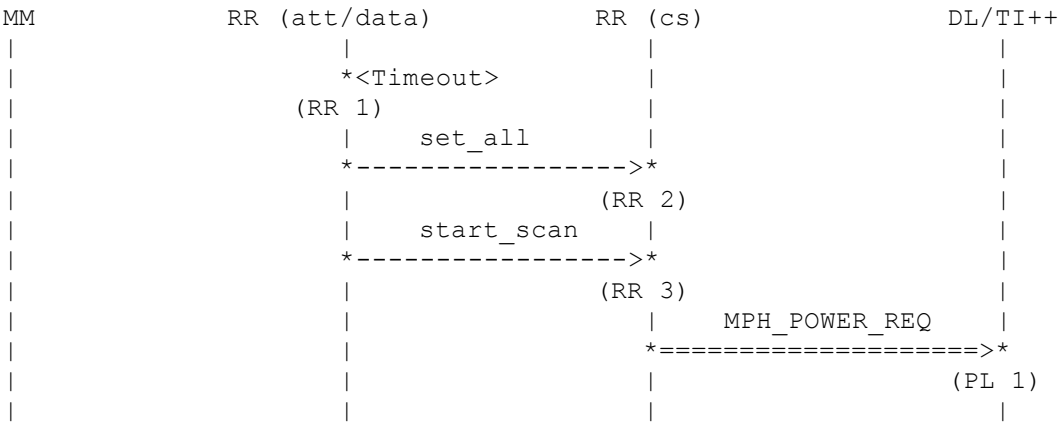
In no service and limited service mode RR starts in regular periods the search attempts for a suitable cell.

### 4.3.1 Activation No Service Mode



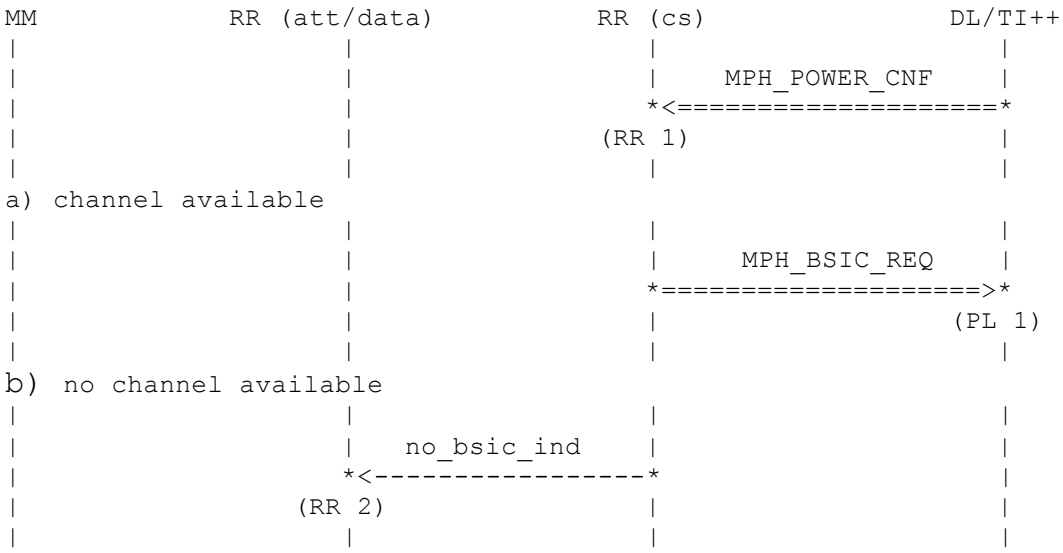

(RR 1)
The periodic PLMN timer has a time-out.
(RR 2)
The cell select process is initialised. In consequence it starts a fieldstrength measurement procedure with interrupting PCH listening.
(RR 3)
RR sends the event „set_all“ to the cell select process. The information is stored in the process. It means that the next synchronisation attempt is started for the strongest BCCH carrier without pre-conditions.
(RR 4)
RR sends the event „start_scan“ to the cell select process. The cell select process starts the fieldstrength measurements in layer 1.
(PL 1)
The upper layer has requested fieldstrength measurement with or without interrupting PCH listening.

### 4.3.2 Activation Limited Service Mode



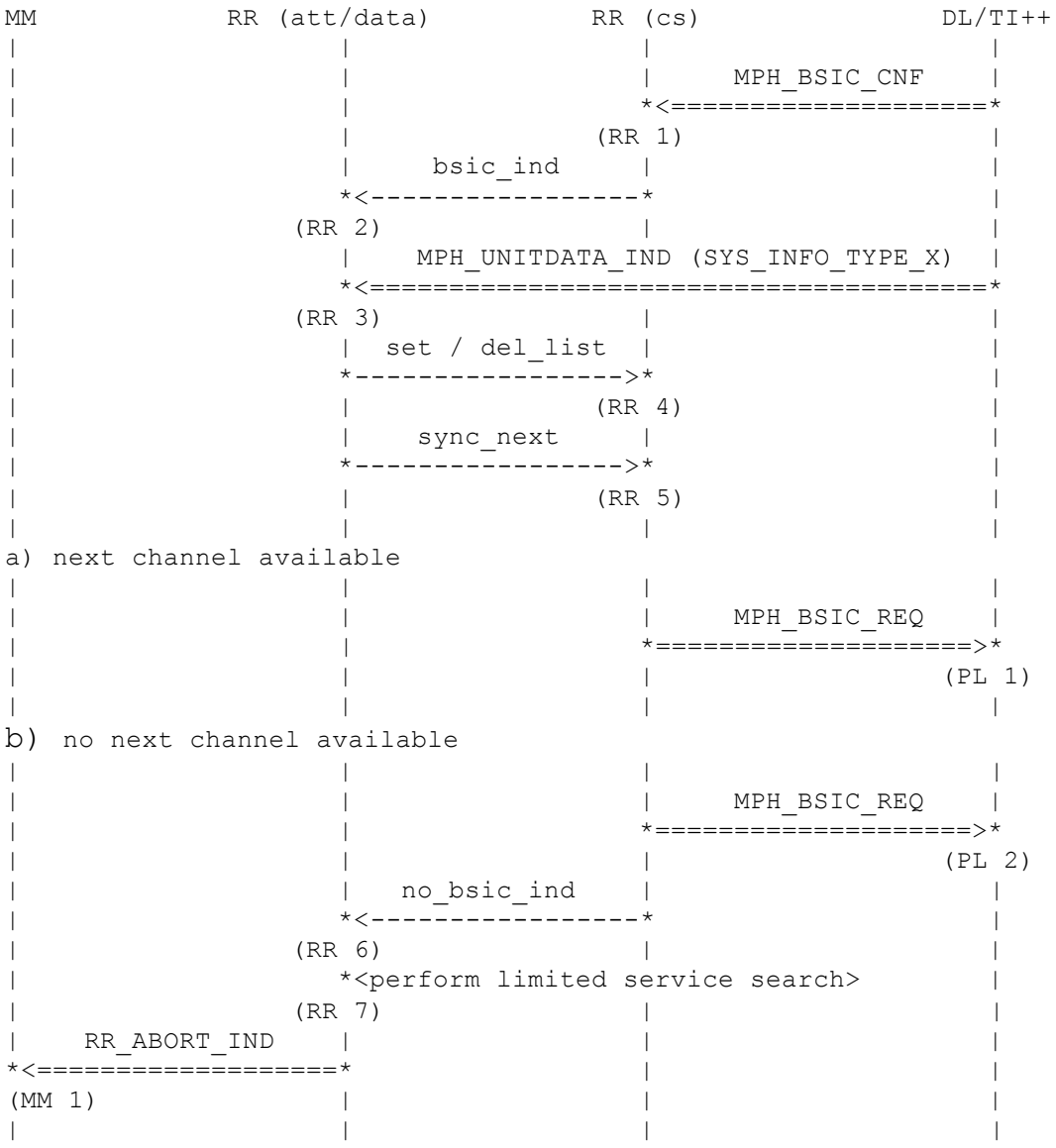

(RR 1)
The periodic PLMN timer has a time-out.
(RR 2)
RR sends the event „set_all“ to the cell select process. The information is stored in the process. It means that the next synchronisation attempt is started for the strongest BCCH carrier without pre-conditions.
(RR 3)
RR sends the event „start_scan“ to the cell select process. The cell select process starts the field strength measurements in layer 1.
(PL 1)
The upper layer has requested field strength measurement with or without interrupting PCH listening.

### 4.3.3 Receiving Fieldstrength Samples




(RR 1)
The lower layer delivers the fieldstrength for the n best channels of the frequency bands.
(PL 1)
The BCCH synchronisation attempt is started for the channel with the highest fieldstrength.
(RR 2)
If no suitable channel has been found the event no_bsic_ind is send to the RR attachment process. A timer is started in RR to trigger the PLMN search during no service Mode.

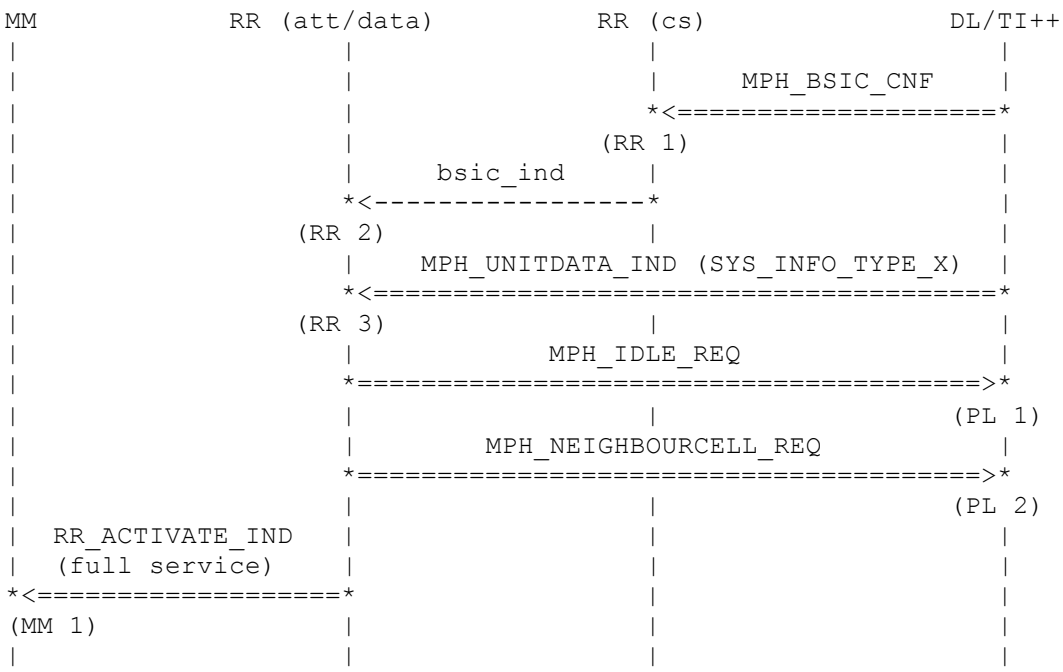
### 4.3.4 BCCH Carrier found, but not suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment pro cess.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(RR 4)
The BCCH carrier is not suitable. RR attachment process request synchronisation to the next strongest BCCH carrier. Low priority cells are stored in the low priority list and the emergency cell list.

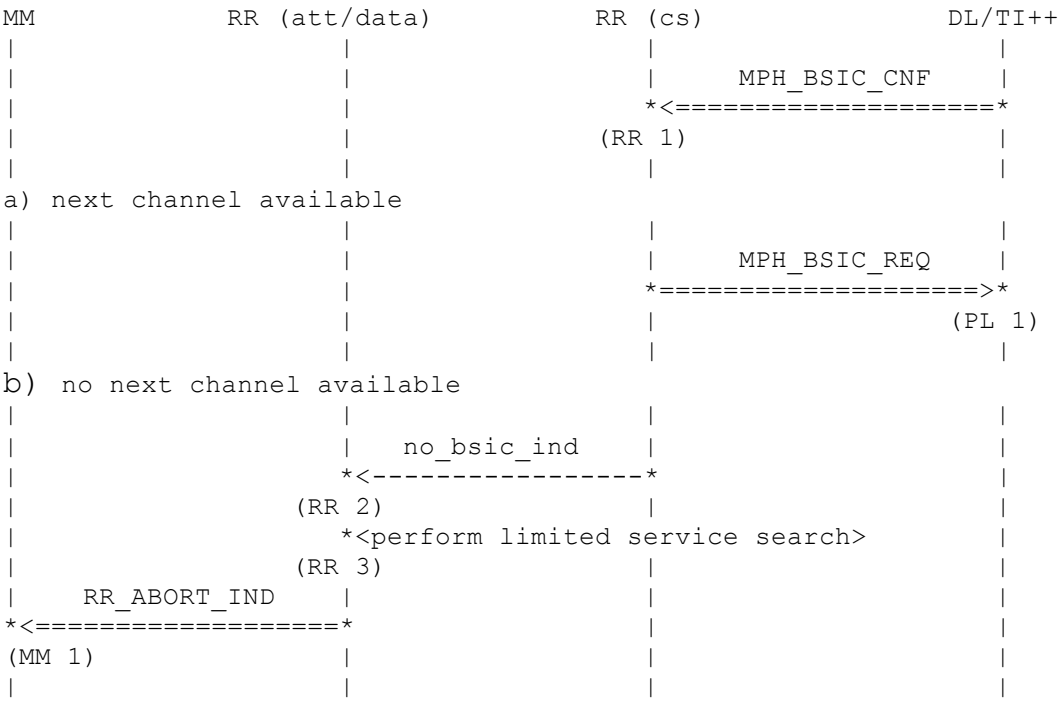
(RR 5)
The neighbour cell list is send to the cell select process with the event „set_list“ if it is the high priority cell search and the PLMN is okay. The neighbour cell list is send to the cell select process with the event „del_list“ if the PLMN is wrong. Else no signal is send. The priority of channels may lead to a different order of synchronisation attempts.
(PL 1)
It is another channel available for a synchronisation attempt. RR requests the synchronisation to layer 1.
(PL 2)
The cell selection process has tried all suitable channels. A MPH BSIC REQ with the "channel number" 0xFFFF stops BCCH reading in layer 1.
(RR 6)
The cell selection process has tried all suitable channels. A no_bsic_ind event is send to the RR attachment process. If low priority cells were found a second synchronisation attempt is started on this cells.
(RR 7)
If emergency cells are available, a new synchronisation attempt is started on this cells.
(MM 1)
If an emergency cell is suitable, MM is informed with RR_ABORT_IND and the cause limited service. The timer is started in RR to trigger the PLMN search during no service / limited service Mode.

### 4.3.5 BCCH Carrier found, suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment pro cess.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(PL 1)
The BCCH carrier is suitable for limited service mode. RR configures the idle mode.
(PL 2)
This neighbour cell list build from the system information messages is forwarded to PL.
(MM 1)
MM is informed about the full service condition. A timer is started in RR to trigger the HPLMN search if the PLMN is a VPLMN in the HPLMN country.

### 4.3.6 No BCCH Carrier found

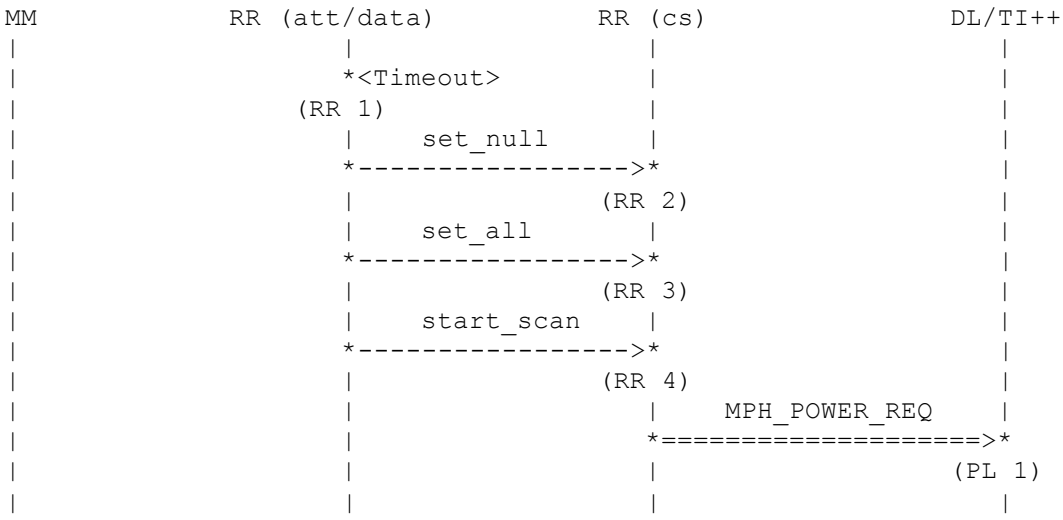



(RR 1)
Layer 1 indicates that the synchronisation attempt has failed.
(PL 1)
If another channel is available for a synchronisation attempt, RR triggers the procedure.
(RR 2)
Else the no_bsic_ind signal is sent to the RR attachment process. If low priority cells are stored, they are used for a second synchronisation attempt.
(RR 3)
If emergency cells are available, a new synchronisation attempt is started on this cells.
(MM 1)
If an emergency cell is suitable, MM is informed with RR_ABORT_IND and the cause limited service. The timer is started in RR to trigger the PLMN search during no service / limited service Mode.

## 4.4 Limited Service Search

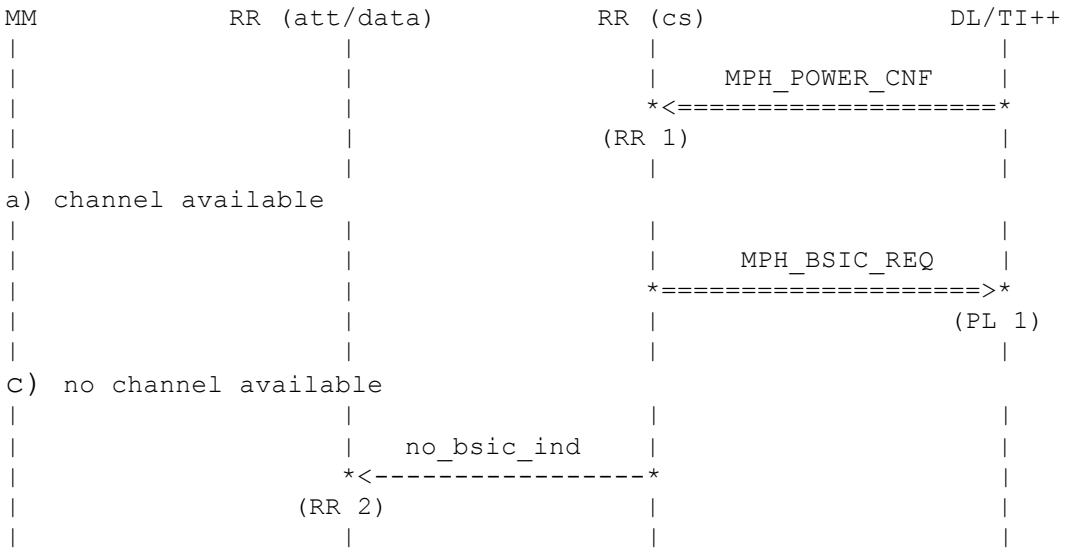
In no service mode RR starts in regular periods the search attempts for a suitable cell for limited service if no SIM card is inserted.

### 4.4.1 Activation No Service Mode




(RR 1)
The periodic Limited Service Search timer has a time-out.
(RR 2)
The cell select process is initialised. In consequence it starts a field strength measurement procedure with interrupting PCH listening.
(RR 3)
RR sends the event „set_all“ to the cell select process. The information is stored in the process. It means that the next synchronisation attempt is started for the strongest BCCH carrier without pre-conditions.
(RR 4)
RR sends the event „start_scan“ to the cell select process. The cell select process starts the field strength measurements in layer 1.
(PL 1)
The upper layer has requested field strength measurement with or without interrupting PCH listening.

### 4.4.2 Receiving Fieldstrength Samples



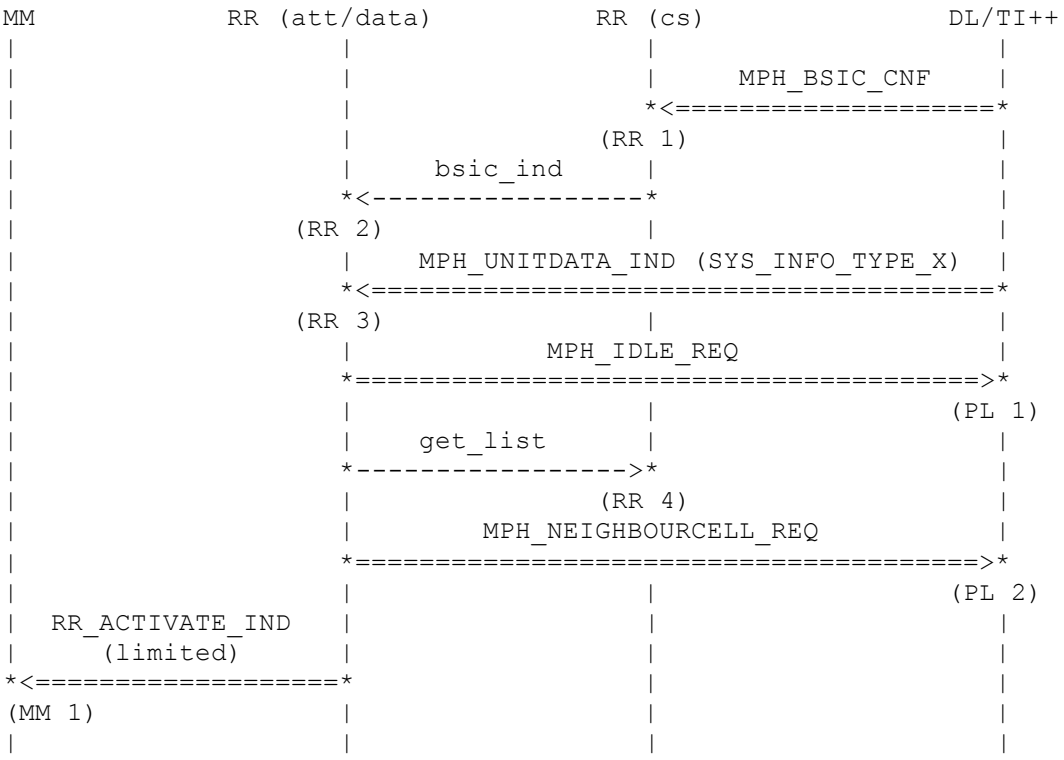

(RR 1)
The lower layer delivers the fieldstrength for the n best channels of the frequency bands.
(PL 1)
The BCCH synchronisation attempt is started for the channel with the highest fieldstrength.
(RR 2)
If no suitable channel has been found the event no_bsic_ind is send to the RR attachment process. A timer is started in RR to trigger the limited service search during no service Mode.

### 4.4.3 BCCH Carrier found, but not suitable


(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment process.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(RR 4)
The BCCH carrier is not suitable. RR attachment process request synchronisation to the next strongest BCCH carrier. Low priority cells are stored in the low priority list and the emergency cell list.
(RR 5)
The neighbour cell list is send to the cell select process with the event „set_list“ if it is the high priority cell search and the PLMN is okay. The neighbour cell list is send to the cell select process with the event „del_list“ if the PLMN is wrong. Else no signal is send. The priority of channels may lead to a different order of synchronisation attempts.
(PL 1)
It is another channel available for a synchronisation attempt. RR requests the synchronisation to layer 1.

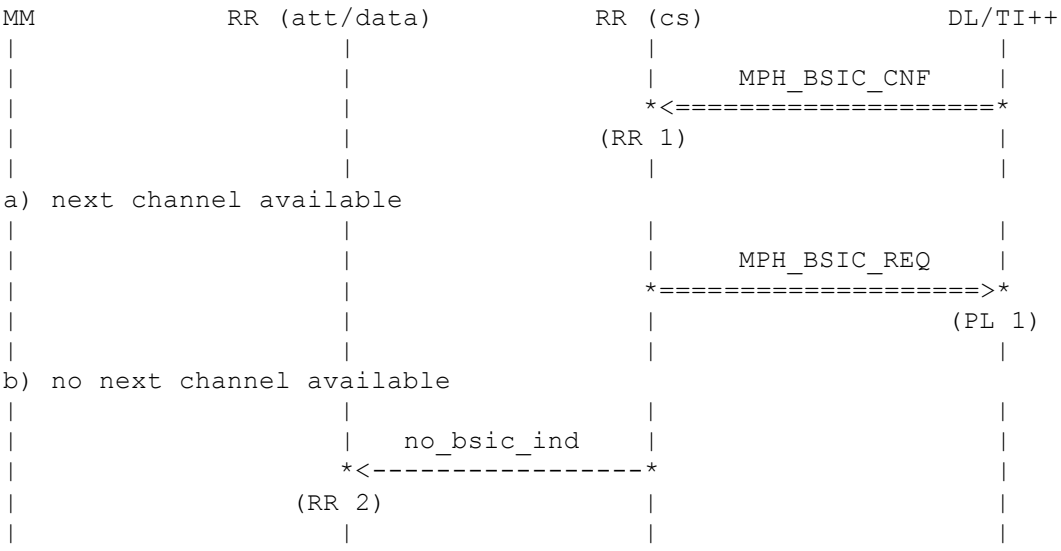
(PL 2)
The cell selection process has tried all suitable channels. A MPH BSIC REQ with the "channel number " 0xFFFF is used to stop BCCH reading.
(RR 5)
The cell selection process has tried all suitable channels. A no_bsic_ind event is send to the RR attachment process. A timer is started in RR to trigger the limited search during no service Mode.

### 4.4.4 BCCH Carrier found, suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment process.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(PL 1)
The BCCH carrier is suitable for limited service mode. RR configures the idle mode.
(RR 4)
RR attachment process requests a neighbour cell list from the RR cell search process. This neighbour cell list is build from the fieldstrength information of the last fieldstrength measurements.
(PL 2)
This neighbour cell list is forwarded to PL.
(MM 1)
MM is informed about the limited condition.

### 4.4.5 No BCCH Carrier found

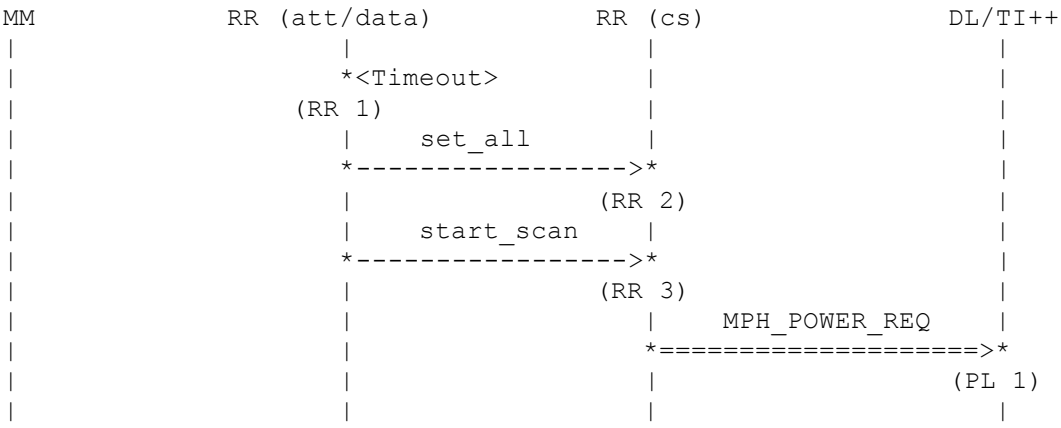



(RR 1)
Layer 1 indicates that the synchronisation attempt has failed.
(PL 1)
If another channel is available for a synchronisation attempt, RR triggers the procedure.
(RR 2)
Else the no_bsic_ind signal is sent to the RR attachment process. A timer is started in RR to trigger the limited service search during no service Mode.

## 4.5 HPLMN Search

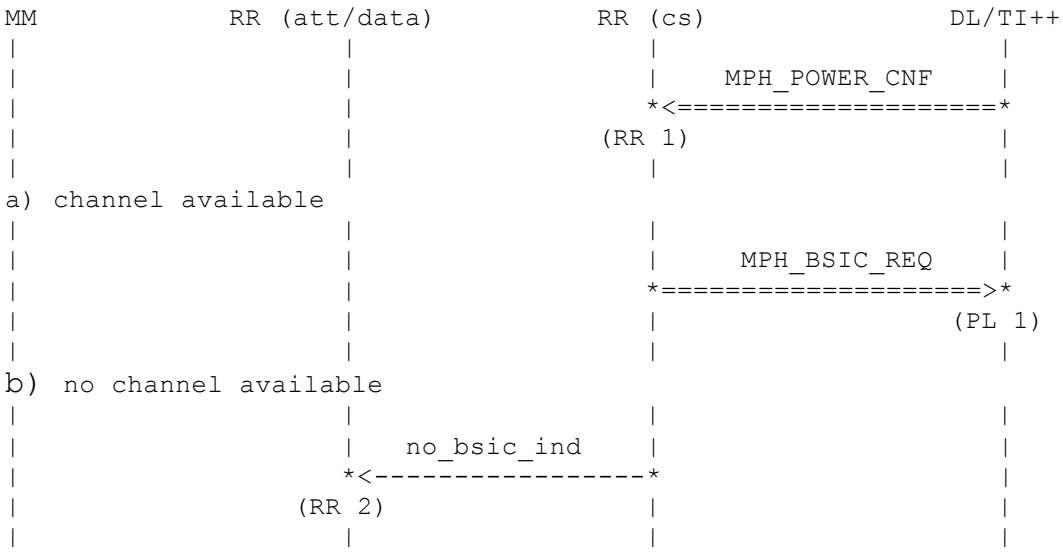
In full service mode RR starts in regular periods the search attempts for the HPLMN if the mobile is registered in a VPLMN of the HPLMN country.

### 4.5.1 Activation



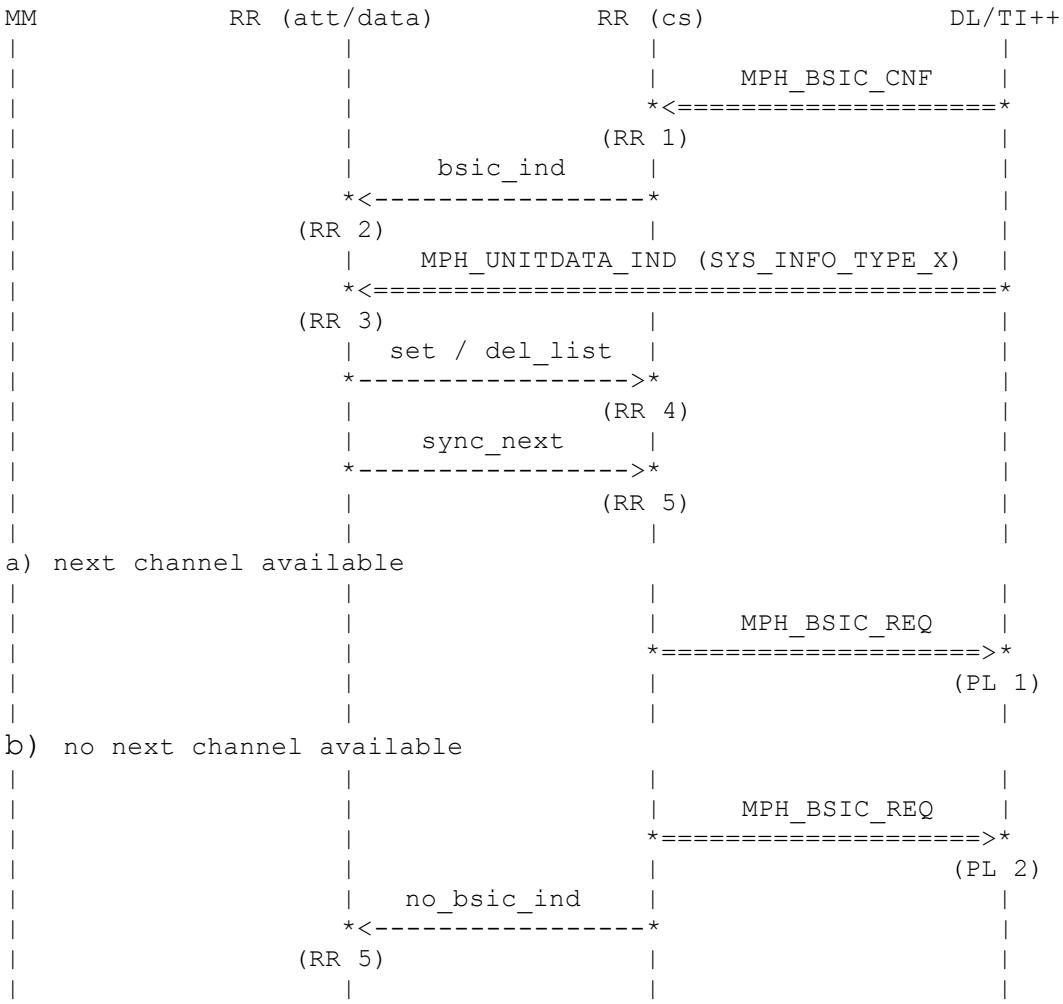

(RR 1)
The HPLMN timer has a time-out.
(RR 2)
RR sends the event „set_all“ to the cell select process. The information is stored in the process. It means that the next synchronisation attempt is started for the strongest BCCH carrier without pre-conditions.
(RR 3)
RR sends the event „start_scan“ to the cell select process. The cell select process starts the field strength measurements in layer 1. The measurements are made without interrupting PCH listening.
(PL 1)
The upper layer has requested field strength measurement without interrupting PCH listening.

### 4.5.2 Receiving Fieldstrength Samples




(RR 1)
The lower layer delivers the channels list of the frequency bands in decreasing fieldstrength order.
(PL 1)
The BCCH synchronisation attempt is started for the channel with the highest fieldstrength and priority.
(RR 2)
If no channel has a fieldstrength higher then the threshold value the event no_bsic_ind is send to the RR attachment process. A timer is started in RR to trigger the HPLMN search.

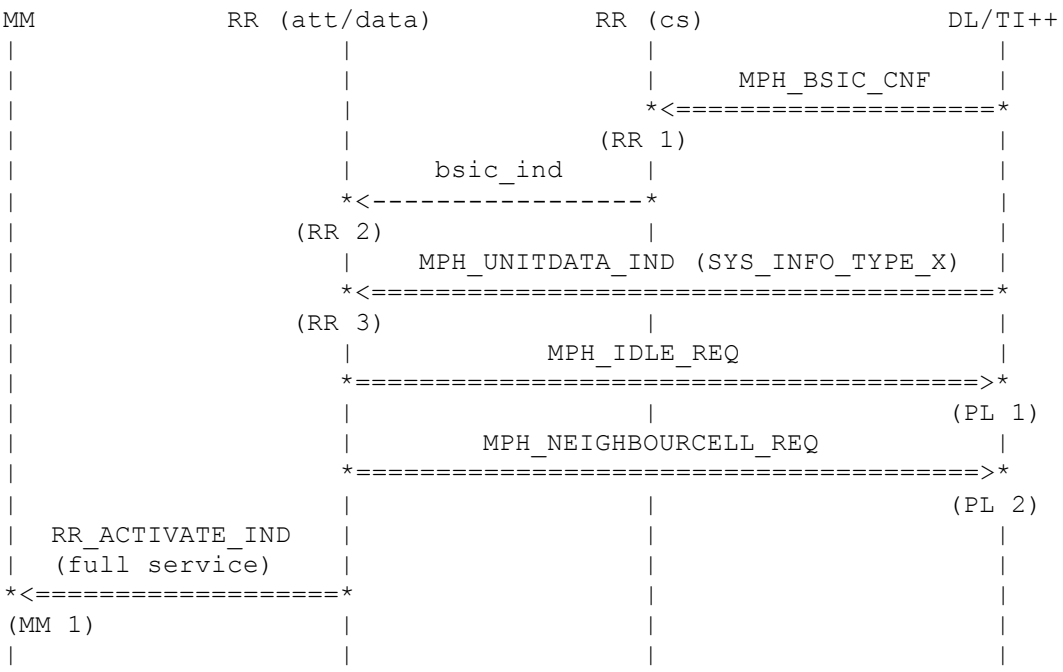
### 4.5.3 BCCH Carrier found, but not suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment process.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(RR 4)
The BCCH carrier is not suitable. RR attachment process request synchronisation to the next strongest BCCH carrier. Low priority cells are stored in the low priority list and the emergency cell list.
(RR 5)
The neighbour cell list is send to the cell select process with the event „set_list“ if it is the high priority cell search and the PLMN is okay. The neighbour cell list is send to the cell select process with the event „del_list“ if the PLMN is wrong. Else no signal is send. The events change the priorities of channels and may lead to a different order of synchronisation attempts.

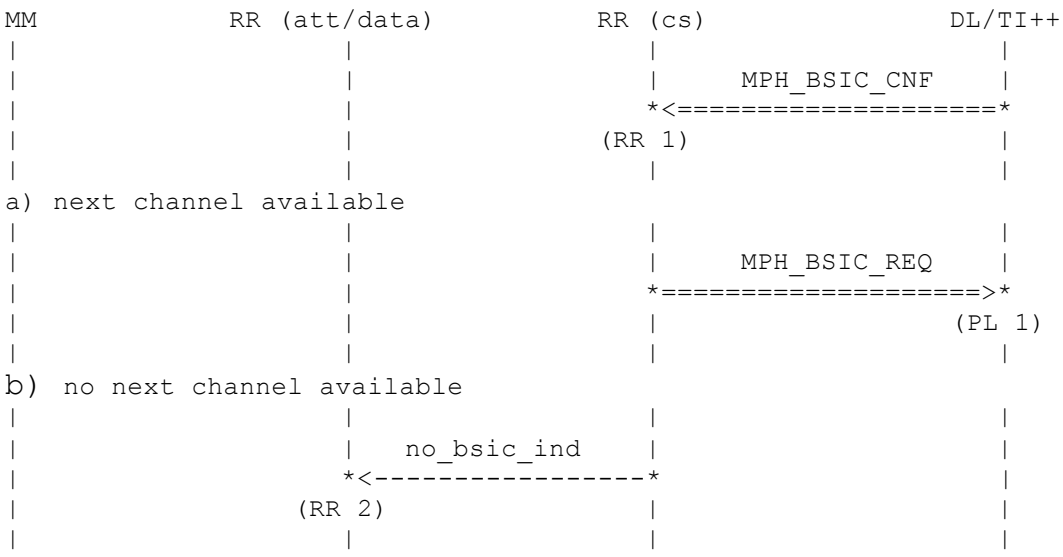
(PL 1)
It is another channel available for a synchronisation attempt. RR requests the synchronisation to layer 1.
(PL 2)
The cell selection process has tried all suitable channels. A MPH BSIC REQ with the "channel number" 0xFFFF is used to stop BCCH reading.
(RR 5)
The cell selection process has tried all suitable channels. A no_bsic_ind event is send to the RR attachment process. A timer is started in RR to trigger the HPLMN search. If low priority cells are stored, they are used for a second synchronisation attempt before restarting the timer.

### 4.5.4 BCCH Carrier found, suitable




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment process.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(RR 4)
The BCCH carrier indicated the HPLMN. RR configures the idle mode.
(PL 2)
This neighbour cell list is forwarded to PL.
(MM 1)
MM is informed about the full service condition.

### 4.5.5 No BCCH Carrier found

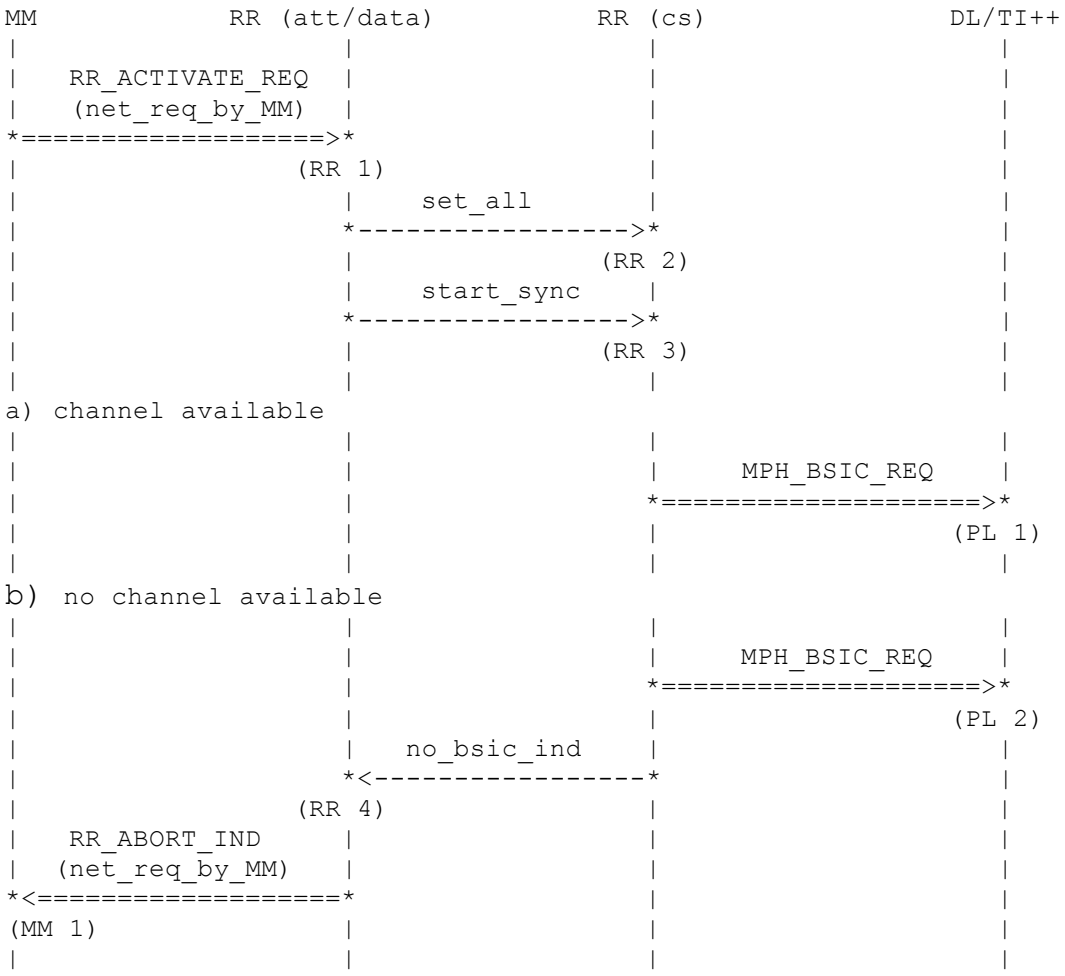



(RR 1)
Layer 1 indicates that the synchronisation attempt has failed.
(PL 1)
If another channel is available for a synchronisation attempt, RR triggers the procedure.
(RR 2)
Else the no_bsic_ind event is sent to the RR attachment process. A timer is started in RR to trigger the HPLMN search. If low priority cells are stored, they are used for a second synchronisation attempt before restarting the timer.

## 4.6 PLMN Available List Search triggered by MM

MM or MMI may request a list of available PLMN s. MM will do this during automatic registration after MM detected problems if the HPLMN / LPLMN is not available and MMI will do that for manual registration.

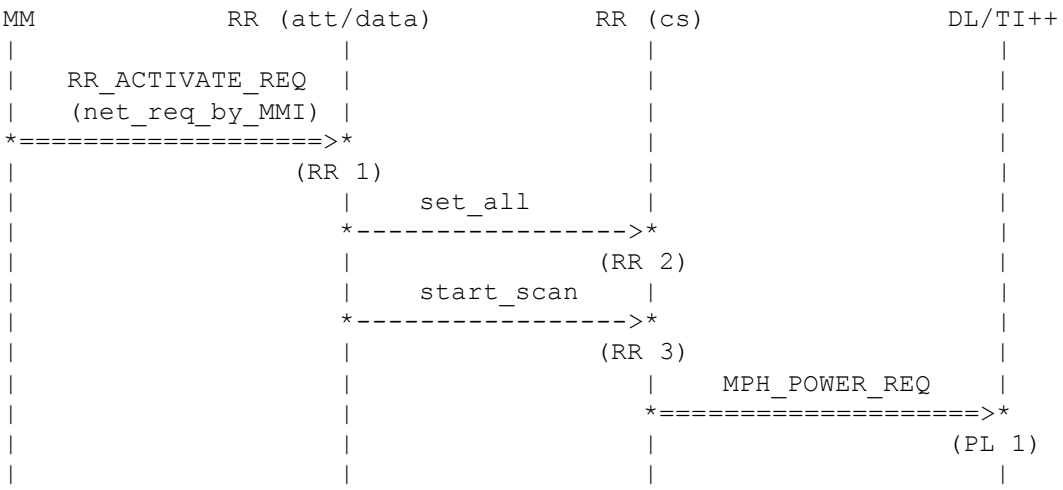
### 4.6.1 Activation by MM




(RR 1)
MM start a PLMN search request typical during registration. If a (H)PLMN timer is running the timer is stopped.
(RR 2)
RR sends the event „set_all“ to the cell select process. The information is stored in the process. It means that the next synchronisation attempt is started for the strongest BCCH carrier without pre-conditions.
(RR 3)
RR starts the search for BCCH s with the event „start_sync“.
(PL 1)
The BCCH synchronisation attempt is started for the channel with the highest fieldstrength.

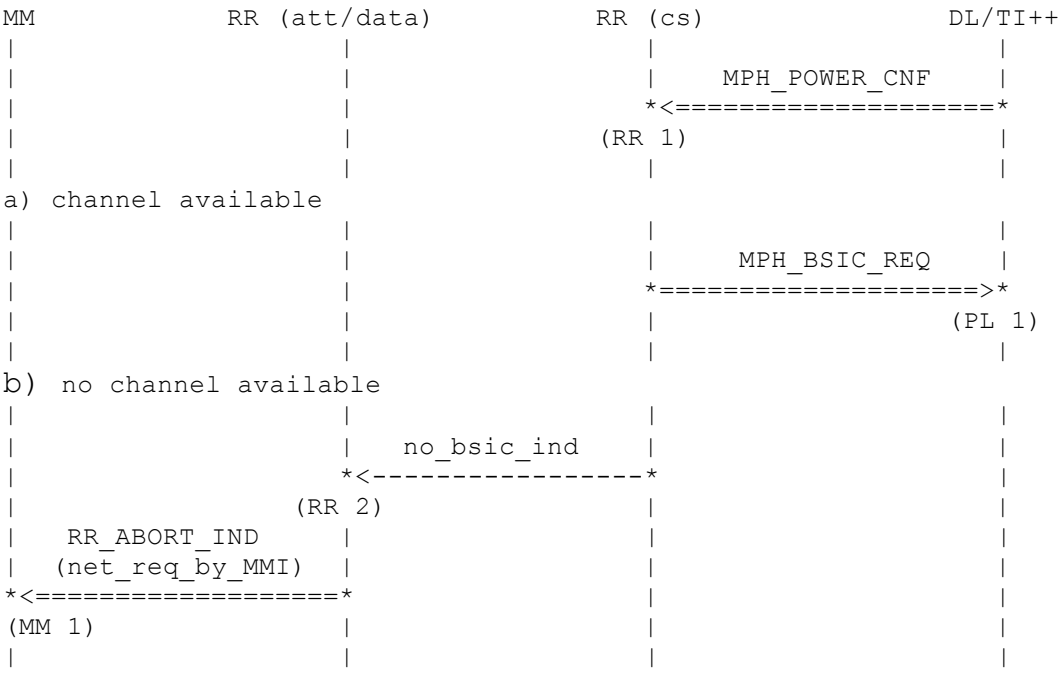
(PL 2)
No further channels are available. BCCH reading of the last requested BCCH carrier is stopped with a MPH BSIC REQ using the "channel number" 0xFFFF.
(RR 4)
If no channel has a fieldstrength higher then the threshold value the event no_bsic_ind is send to the RR attachment process.
(MM 1)
The PLMN list is forwarded to MM. A timer is started in RR to trigger the (H)PLMN search if necessary.

### 4.6.2 Activation by MMI



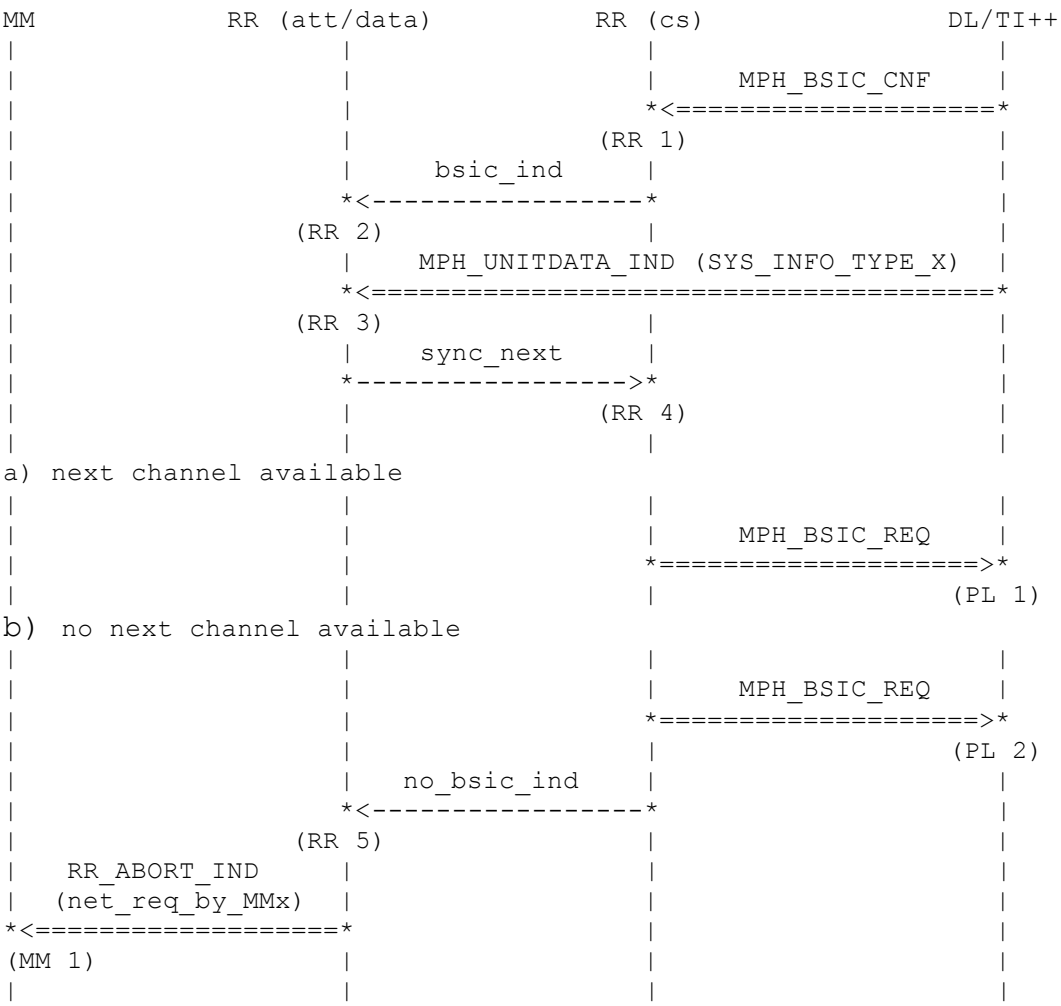

(RR 1)
MMI requests the PLMN available list search. If a (H)PLMN timer is running the timer is stopped.
(RR 3)
RR sends the event „set_all“ to the cell select process. The information is stored in the process. It means that the next synchronisation attempt is started for the strongest BCCH carrier without pre-conditions.
(RR 4)
RR sends the event „start_scan“ to the cell select process. The cell select process starts the fieldstrength measurements in layer 1.
(PL 1)
The upper layer has requested fieldstrength measurement without interrupting PCH listening.

### 4.6.3 Receiving Fieldstrength Samples




(RR 1)
The lower layer delivers the fieldstrength for all suitable channels of the frequency bands.
(PL 1)
The BCCH synchronisation attempt is started for the channel with the fieldstrength.
(RR 3)
If no channel has a fieldstrength higher then the threshold value the event no_bsic_ind is send to the RR attachment process. A timer is started in RR to trigger the PLMN search during no service Mode.
(MM 1)
The PLMN list is forwarded to MM. A timer is started in RR to trigger the (H)PLMN search if necessary.

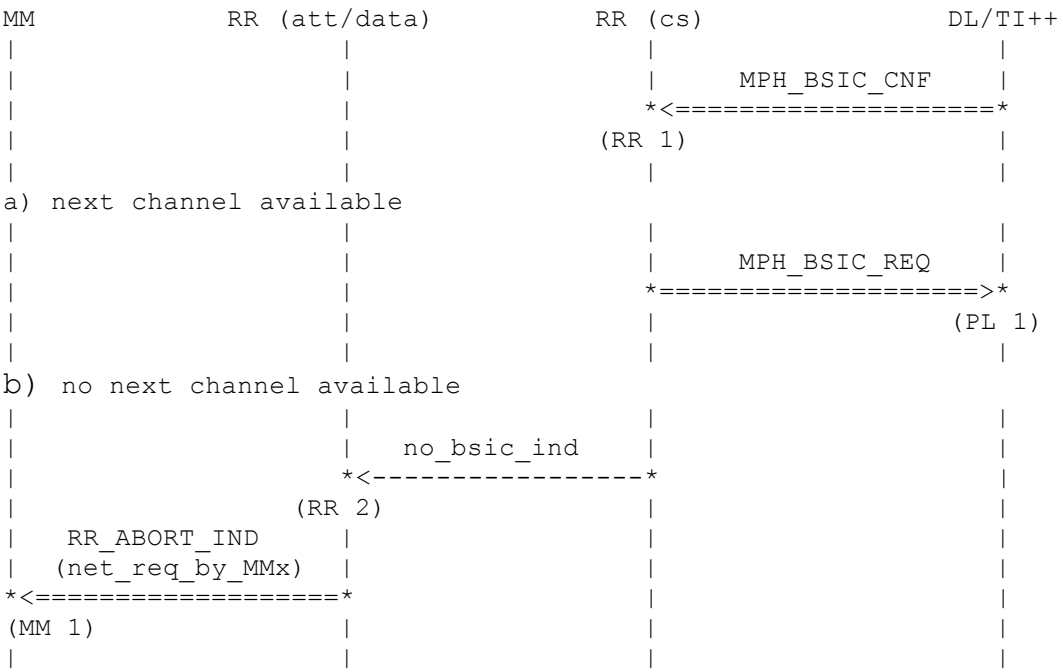
### 4.6.4 BCCH Carrier found




(RR 1)
A BCCH carrier was detected by layer 1.
(RR 2)
The data of this BCCH carrier (channel, bsic, fieldstrength) are forwarded to the RR attachment pro cess.
(RR 3)
RR receives the system information messages for this BCCH carriers.
(RR 4)
The PLMN identification is stored. The channel is stored in the emergency cell list.
(PL 1)
It is another channel available for a synchronisation attempt. RR requests the synchronisation to layer 1.

(PL 2)
The cell selection process has tried all suitable channels. A MPH BSIC REQ using the "channel number" 0xFFFF is used to stop BCCH reading.
(RR 5)
The cell selection process has tried all suitable channels. A no_bsic_ind event is send to the RR attachment process.
(MM 1)
The PLMN list is forwarded to MM. A timer is started in RR to trigger the (H)PLMN search if necessary.

### 4.6.5 No BCCH Carrier found




(RR 1)
Layer 1 indicates that the synchronisation attempt has failed.
(PL 1)
If another channel is available for a synchronisation attempt, RR triggers the procedure.
(RR 2)
Else the no_bsic_ind event is sent to the RR attachment process.
(MM 1)
The PLMN list is forwarded to MM. A timer is started in RR to trigger the (H)PLMN search if necessary.

# 5 Idle Mode Procedures

## 5.1 Path Loss Criterion C1

The path loss criterion C1 is a value which determines the receiving and sending quality of a mobile station in a cell. The mobile station is only able to measure the field strength. Along with some cell parameters read from the BCCH, the path loss criterion is calculated:

C1 = [(A - Max (B, 0)]

with

A = received field strength - minimum receive field strength (RXLEV_ACCESS_MIN)

B = maximum sending power (MAX_TX_POWER) - available sending power (MS_CLASS)

except for the class 3 DCS 1800 MS with

B = maximum sending power (MAX_TX_POWER) + power offset - available sending power (MS_CLASS)

The calculated value A is the mobile station receiving path reserve. The value B is the sending path reserve. The difference of A and B is the path loss criterion C1.

If the C1 value is greater than zero, the mobile station has enough reserves for the sending and receiving paths.

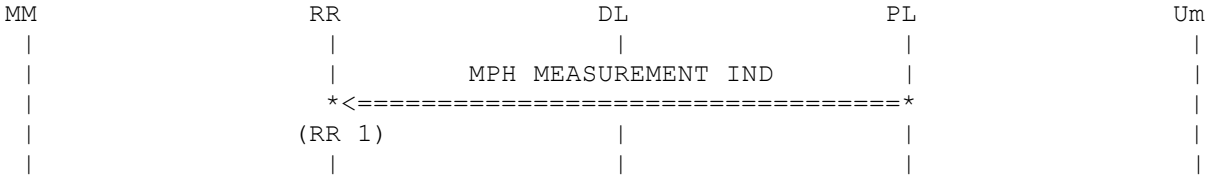
The following power classes are supported by the software:

| GSM 900 | DCS 1800 PCS 1900 |
|---|---|
| | Class 1 (1 W, 30 dBm) |
| Class 2 (8 W, 39 dBm) | Class 2 (0.25 W, 24 dBm) |
| Class 3 (5 W, 37 dBm) | Class 3 (4 W (DCS) and 2 W (PCS), 36 and 33 dBm) |
| Class 4 (2 W, 33 dBm) | |
| Class 5 (0.8 W, 29 dBm) | |

If no Test SIM Card is inserted an offset of 4 is added to the calculated value. This offset ensures a better availability of the MS.

## 5.2 Monitoring of received level

In Idle mode, PL tries to synchronise itself with the neighbour cells it previously received from RR. The field strengths of the neighbour cells are reported to RR and are the basis for RR's cell reselection decisions.




(RR 1)

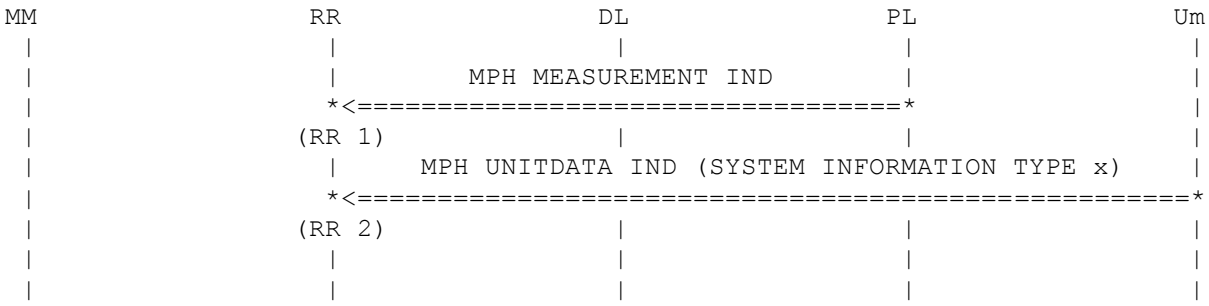
In regular attempts, RR receives measurement reports from PL. These reports include field strength values for the serving cell and up to six neighbour cells. At the end of cell selection, during idle mode configuration, a neighbour cell list is sent to PL. This list includes the cells that PL will measure.

The six strongest cells on this list are relayed to RR. A cell is only relayed, if PL has synchronised with it. That means, that this is possible each time that RR switches to this neighbour cell.

For each neighbour cell, RR gets the channel number, the base station identification colour code (BSIC), the field strength, and the timing advance of the serving cell.

The NCC permitted check is processed in the layer 1. Only cells which has passed the NCC permitted check are member of the measurement report.
The time for each neighbour cell is stored in the measurement report. New measurement report data is compared with the stored neighbour cell data.

## 5.3 Monitoring of Neighbour cells




(RR 1)

RR receives a list of neighbour cells in the measurement report.

(RR 2)

Layer 1 sends after first occurence in the measurement report and then at least all five minutes the BCCH parameter for the neighbour cell to RR.

RR needs the cell selection and reselection parameters for calculating the path loss criterion C1 and the reselection criterion C2. This parameters are send with the SYSTEM INFORMATION TYPE 3,4,7 and 8 messages. It is possible, that not all messages are available on the air-interface. Depending on the content of the messages one or more of the messages is to be read:

| Message | Remark |
|---|---|
| SYSTEM INFORMATION TYPE 3 | contains all information |
| SYSTEM INFORMATION TYPE 4 | contains all information, if add_info flag is cleared |
| SYSTEM INFORMATION TYPE 7 | necessary to decode, if add_info flag in SYSTEM INFORMATION TYPE 4 is set |
| SYSTEM INFORMATION TYPE 8 | necessary to decode, if add_info flag in SYSTEM INFORMATION TYPE 4 is set |

## 5.4 Reselection Criterion C2

The reselection criterion C2 is a value which determines the mobile station's receiving and sending qualities for a neighbour cell. The mobile station is able to measure only the field strength. With some cell parameters read from the BCCH, the reselection criterion is calculated as follows:

C2 = C1 + CELL_RESELECT_OFFSET - TEMPORARY_OFFSET * (H(PENALTY_TIME-T)

for PENALTY_TIME <> 11111

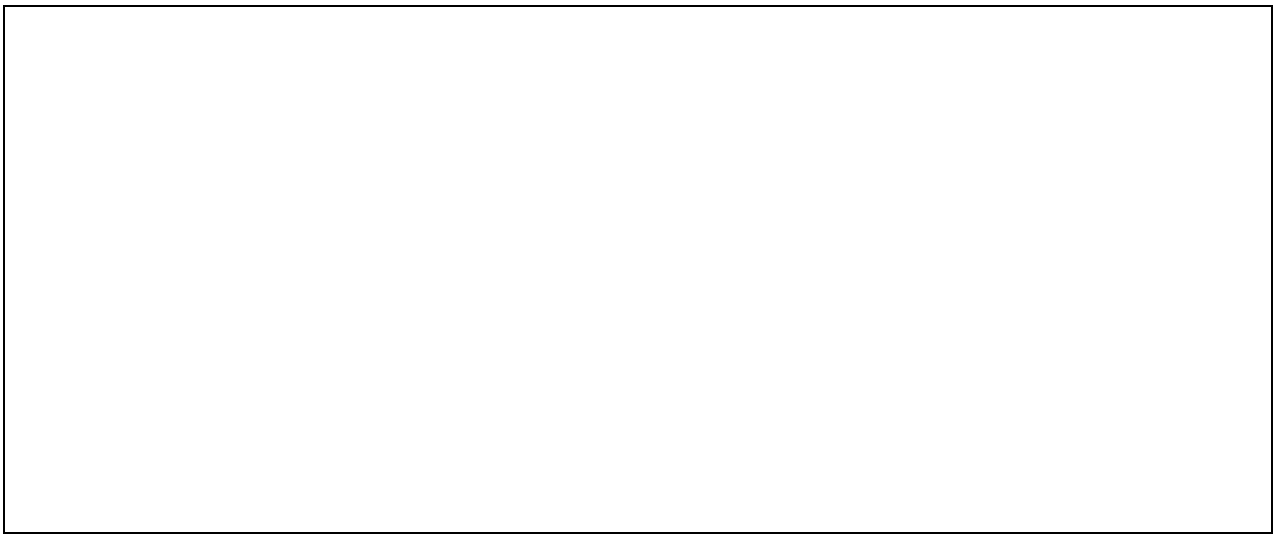
C2 = C1 - CELL_RESELECT_OFFSET

for PENALTY_TIME = 11111

| | | |
|---|---|---|
| with | H(x) | = 0 for x < 0 |
| | | = 1 for x >= 0 |
| | T | time, since the neighbour cell is included in the measurement report |
| | CELL_RESELECT_OFFSET | Cell reselection offset |
| | TEMPORARY_OFFSET | Decreasing value for C2 during penalty time |
| | PENALTY_TIME | time for which TEMPORARY_OFFSET is valid |

By choosing the parameters, a specific profile is developed for each neighbour cell. It is possible to define a simple or a difficult way to the neighbour cell by cell reselection.

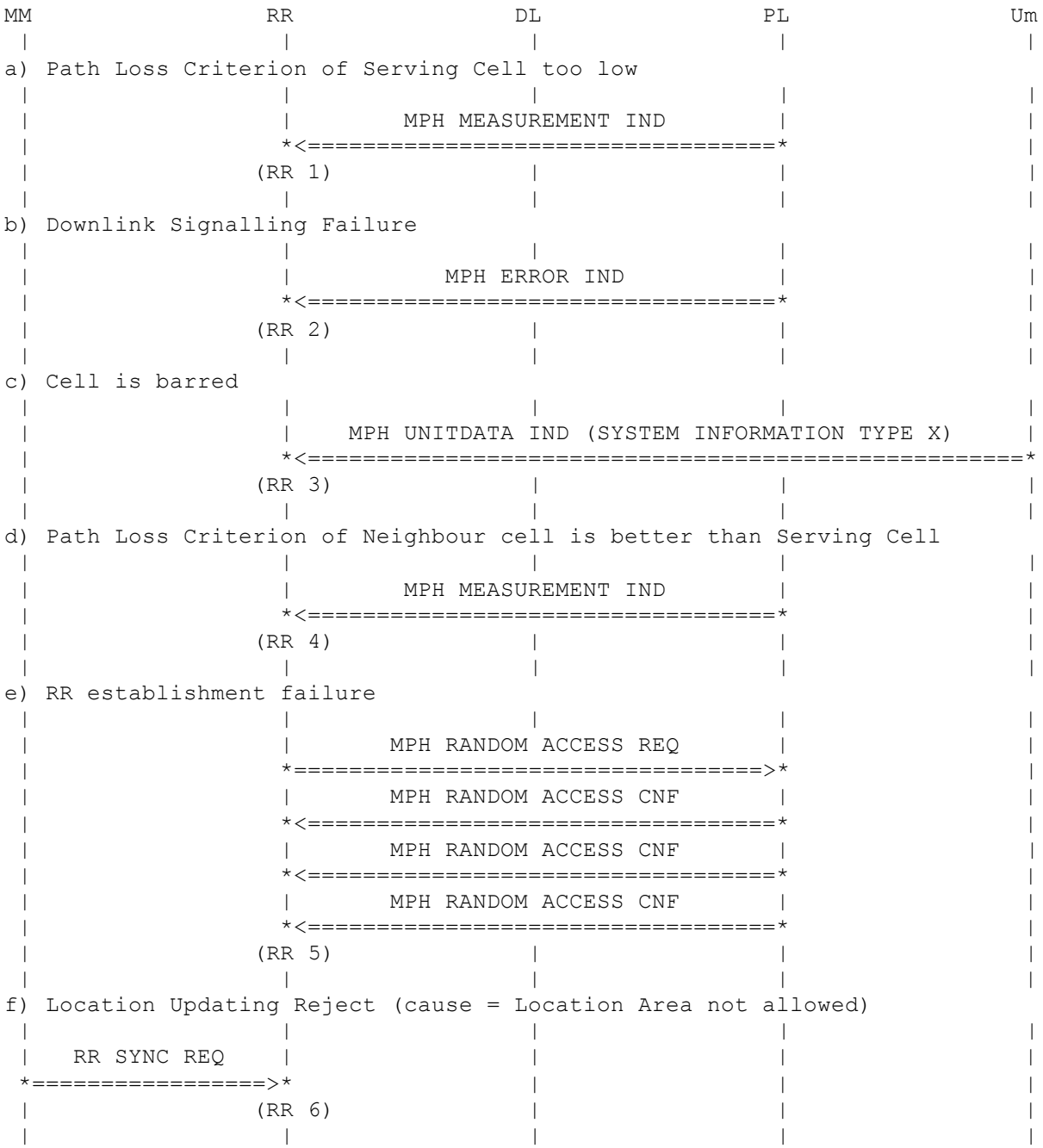
The next figure shows the reselection criterion C2 depending on time and with constant field strength.



**Cell Reselection Criterion C2**

## 5.5 Cell Reselection

### 5.5.1 Initiation



If the mobile station is registered for a network, it is possible that it must change to another cell. This procedure is called Cell Reselection. The following events trigger a cell reselection.

(RR 1)

The serving cell path loss criterion C1 is less than zero for more than five seconds.

(RR 2)

PL detects a downlink signalling failure.

(RR 3)

The serving cell is barred. This is detected by RR by testing the RANDOM ACCESS CONTROL parameters of the SYSTEM INFORMATION messages.

(RR 4)

The neighbour cell cell reselection criterion C2 is greater than the serving cell cell reselection criterion C2 for more than five seconds if both neighbour cell and serving cell are members are of the same location or if no SIM card is inserted (limited service state). If both cells are members of different location areas, a cell reselection is initiated only if the cell reselection criterion C2 of the neighbour cell is increasing the cell reselection criterion C2 of the serving cell by CELL RESELECT HYSTERESE for more than five seconds.

The following table shows the calculations:

| | |
|---|---|
| no SIM card available | delta = C2 (neighbour cell) - C2 (serving cell) |
| SIM card available, same location area | delta = C2 (neighbour cell) - C2 (serving cell) |
| SIM card available, different location area | delta = C2 (neighbour cell) - C2 (serving cell)<br>- CELL RESELECT HYSTERESE (neighbour cell) |

If delta is negative for more than five seconds, a cell reselection is initiated. If the last cell reselection has occurred within the last fifteen seconds, no new cell reselection is initiated.

(RR 5)

The establishment attempt has failed, because the base station is failing to answer with a channel assignment after MAX RETRANS + 1 random bursts.

(RR 6)

A location updating in MM is rejected with the cause "location area not allowed". RR stores the location area identification.

All of these events are signalled in idle mode and lead to a cell reselection.

### 5.5.2 Find New Cell

RR searches for a new serving cell. Therefore, all stored neighbour cells with decoded BCCHs are tested in the decreasing order of the cell reselection criterion C2.

A cell must fulfil certain conditions to be a potential new serving cell. The old cell is barred for five seconds if another cell is available.

The cell reselection C2 of the new serving cell must be positive and not barred.

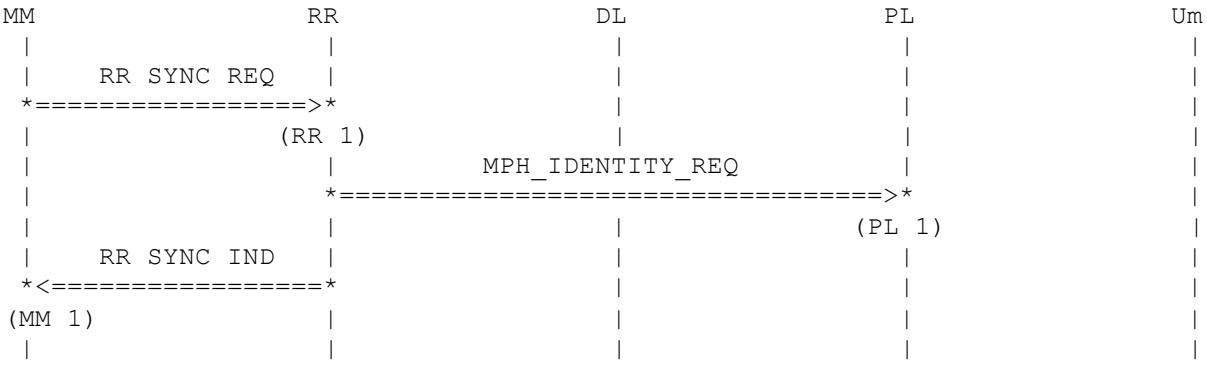
If the old serving cell and the potential new serving cell are members of different location areas, the difference of both cell reselection criteria must exceed CELL RESELECT HYSTERESE. The threshold avoids jumping between location areas.

If a suitable new serving cell is found, the BCCH of this cell is reread. This is done to recheck the cell criteria (path loss criterion C1 > 0, cell barred etc.). Measurement reports during the checking of the new cell are ignored. After the new cell is checked, it is configured by RR.

If the cell reselection is not finished within ten seconds, a cell selection without BCCH carrier information is started.

## 5.6 Synchronisation RR <-> MM

Sometimes it is necessary for RR and MM to synchronise each other; in other words, RR informs MM about events relevant to MM occurring within RR and vice versa.




(RR 1)

MM synchronises RR with the primitive RR SYNC REQ in the following cases:

- As a result of the authentication procedure, a new ciphering key sequence number (CKSN) and Kc value are now valid.
- If a new TMSI is assigned (TMSI reallocation procedure), RR is informed about the new TMSI.
- If MM is informed by the network about an authentication failure, the TMSI, CKSN, and Kc are invalid. The possibility of paging in RR is dependent on the authentication failure.
- After the reception of a LOCATION UPDATING ACCEPT message, it may be possible to delete the TMSI.
- After reception of a LOCATION UPDATING REJECT message with the cause "location area not allowed", it is necessary to store the actual location area identification in the restricted LAI list.
- After a successful location updating, the actual location area identification is removed from the restricted LAI list.

(PL 1)

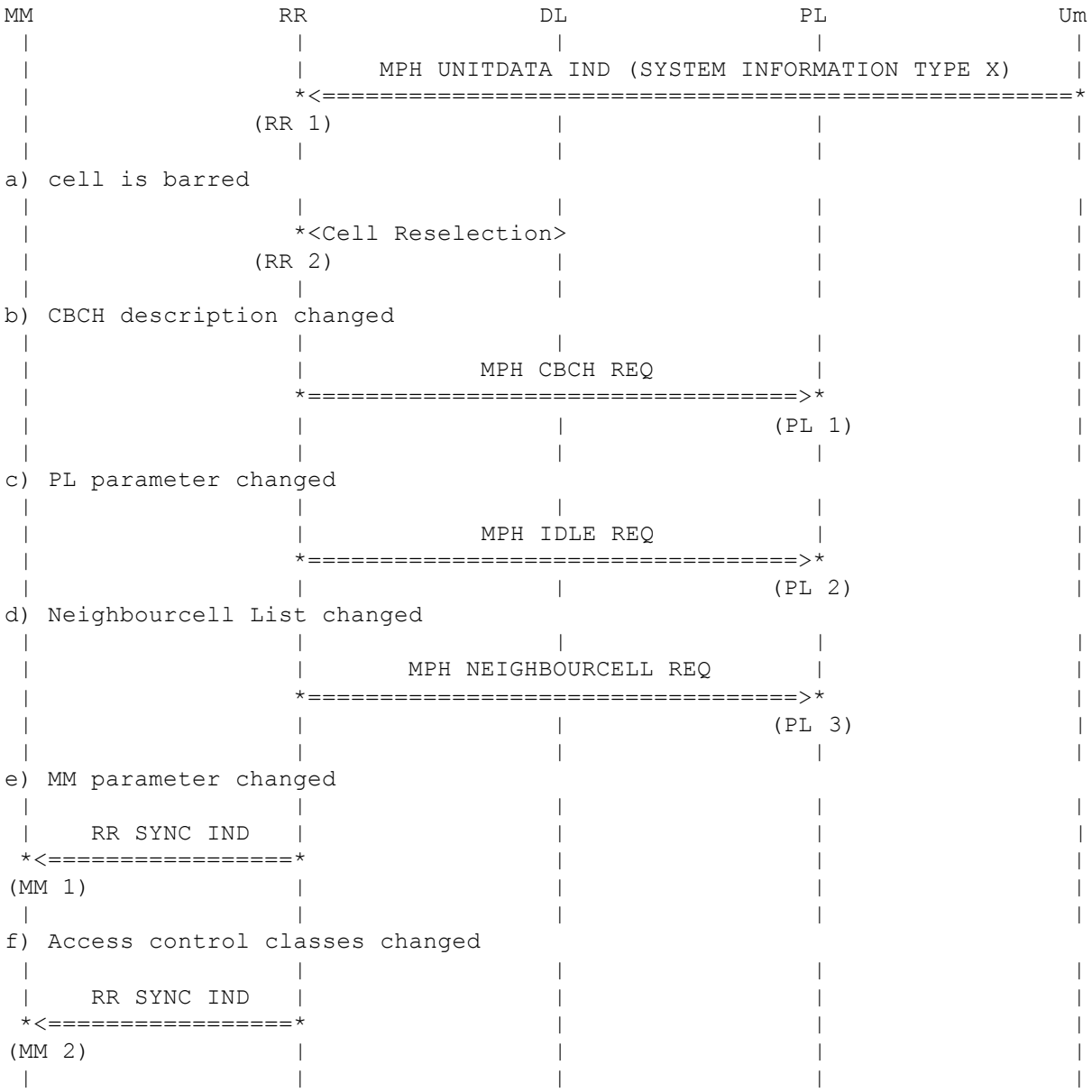
If a mobile identity has changed, PL is informed about the new valid mobile identities.

(MM 1)

RR synchronises MM with the primitive RR SYNC IND in the following cases:

- After channel mode modify or during channel assignment, handover, or channel mode modify procedure, the new channel mode is signalled to MM.
- The resulting cipher mode of the ciphering mode procedure is sent to MM.
- Changes in the SYSTEM INFORMATION messages concerning MM or changes of the access classes are sent to MM.
- If the timer T3122 is started after IMMEDIATE ASSIGNMENT REJECT message reception times-out, MM is informed.
- If the serving cell has made a fieldstrength jump of more than 6 dBm since the last location updating attempt. This is may used by MM for another location updating attempt.

## 5.7 System Information Broadcasting (Idle Mode)




(RR 1)

A SYSTEM INFORMATION message is received and will be decoded by RR.

(RR 2)

The cell barred flag is set and a cell reselection will be initiated.

(PL 1)

A channel description change for the CBCH (Cell Broadcast Channel) has occurred. The new channel description is forwarded to PL.

(PL 2)

PL parameter have changed (paging parameter, channel combination). They are forwarded to PL.

(PL 3)

A change in the neighbour cell list is forwarded to PL.

(MM 1)

Changes of the IMSI attach flag, the periodic updating time, the re-establishment flag, or the neighbour cell list will be signalled to MM.

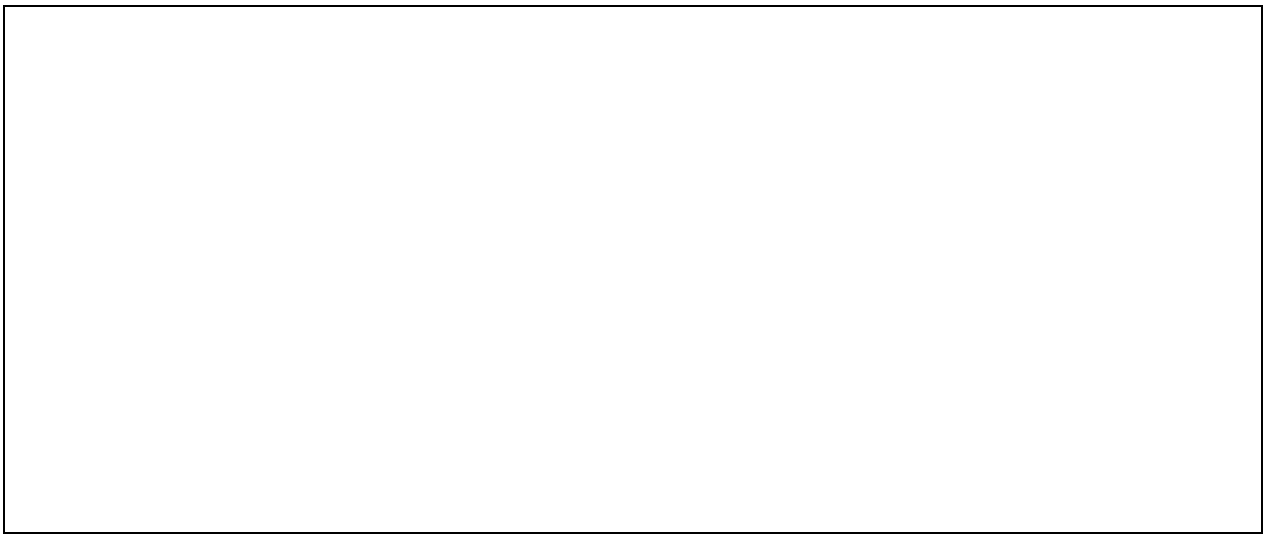
(MM 2)

Access Control Class changes are sent to MM.

# 6 Connection Establishment

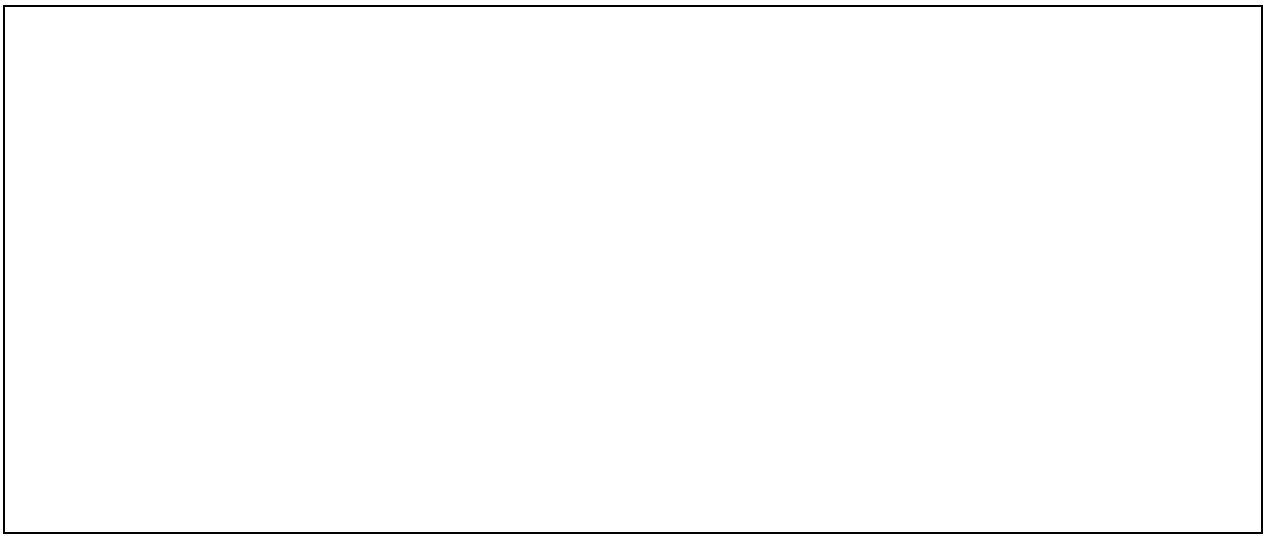
## 6.1 Access Control

All subscribers with SIM cards inserted are members of one or more of the ten normal access classes which are numbered from zero to nine. Additionally, the subscriber is possibly a member of one or more special access classes, numbered from eleven to fifteen. The special access classes are only valid if the subscriber is camped on a cell of the HPLMN or the HPLMN country.

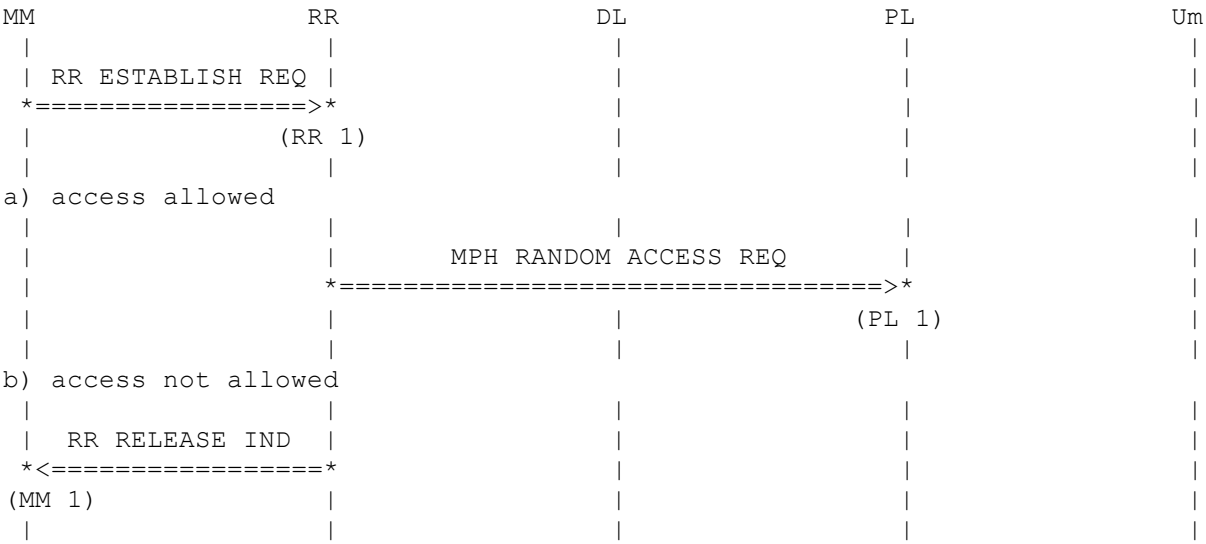


**Access Classes Mobile Station**

The base station sends its access classes along with the BCCH information the same way. The third and fourth bytes of the RACH control parameters include the bitmap. This bitmap is divided into normal and special access classes. On the mobile station bit ten is unused. On the base station bit ten is used to declare whether or not emergency calls are allowed in the cell. The base station access classes' coding is determined in the opposite way.



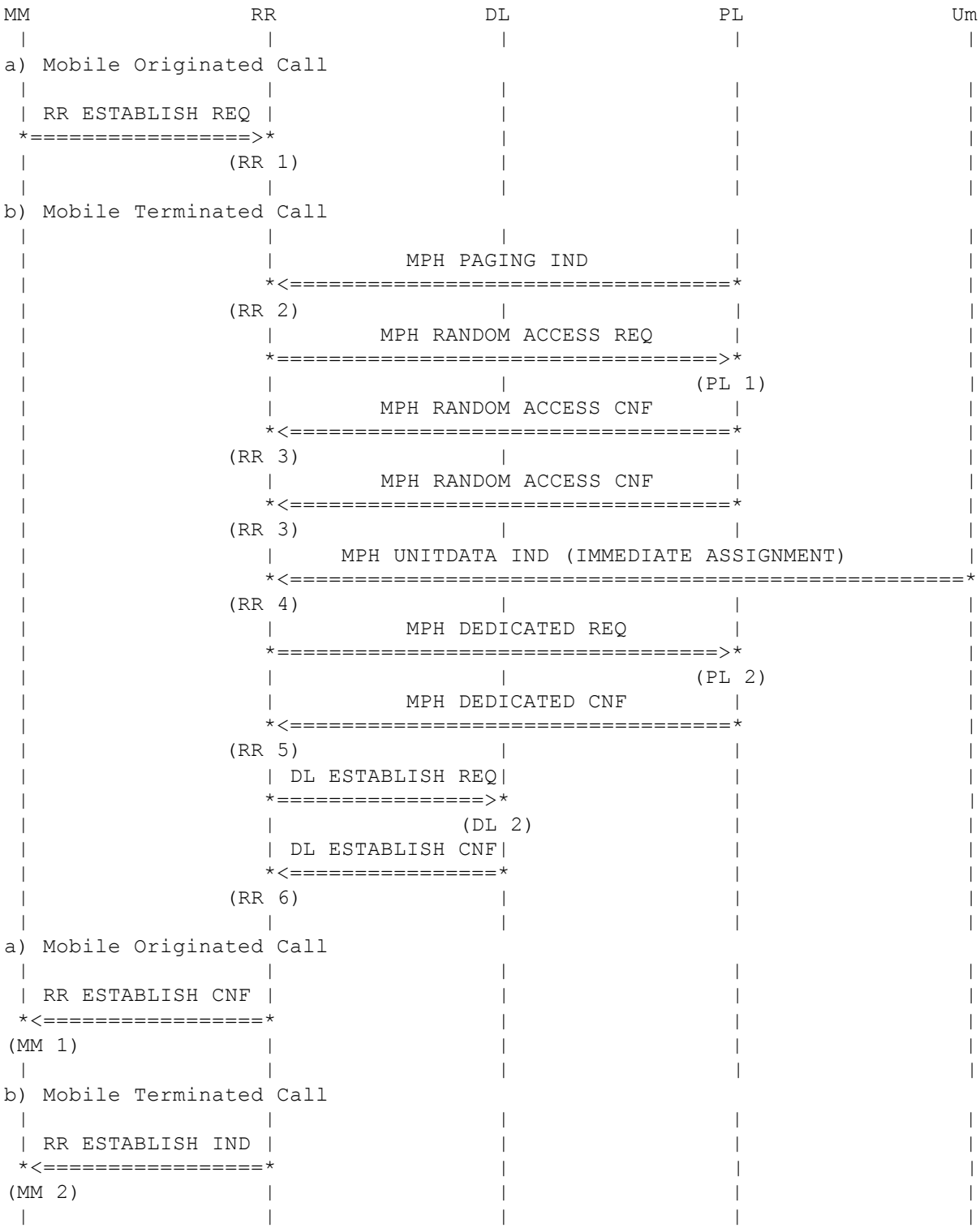
**Access Classes Base Station**




(RR 1)
A mobile originated call is started. The access classes are checked. For a non-emergency call, the mobile station must be member of one or more normal or special classes, which are also valid for the base station. For an emergency call, the base station must allow emergency calls (bit ten) or the mobile station must be member of one or more special classes, which are also valid for the base station.
If RR is camped in a restricted location area, only non-emergency calls are allowed.
(PL 1)
If the access control class check is successful, call establishment is started.
(MM 1)
If the access control class check fails, the abort is forwarded to MM with the cause "access barred".

## 6.2 Immediate Assignment

### 6.2.1 Successful Case



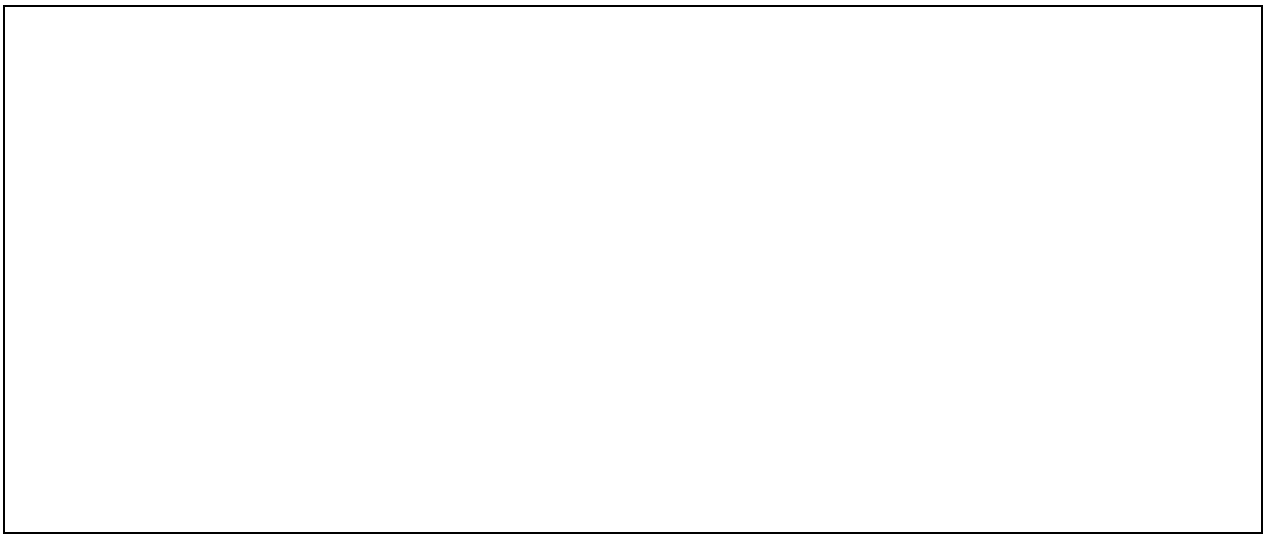
(RR 1)
A mobile originated call is started.
(RR 2)
The mobile terminated call is started with a PAGING REQUEST message by the infrastructure. This message includes the IMSI or TMSI of a paged mobile station. If the layer 1 of the mobile station finds its own IMSI or TMSI in a paging message, the immediate assignment procedure is started by RR. RR is informed with the primitive MPH PAGING IND.
(PL 1)
RR calculates the random time between two CHANNEL REQUEST messages and the content of the CHANNEL REQUEST messages for all MAX RETRANS + 1 sending attempts and sends this information to PL. Time control for the sending attempts is under the supervision of PL and is based on frame numbers. The time base in RR is not accurate enough.
The time from the reception of the primitive to the sending of the first CHANNEL REQUEST message is a random value in the interval [0, max (T,8)-1]. The time between two sending attempts is a random value in the interval [S,S+T-1]. The random value has the unit frames.
T is the TX-Integer value, which is broadcast with the BCCH information.
S is a value dependent on CCCH configuration and the parameter TX-Integer.

| TX-Integer | non combined CCCH | combined CCCH |
|---|---|---|
| 3,8,14,50 | S= 55 | S = 41 |
| 4,9,16 | S = 76 | S = 52 |
| 5,10,20 | S = 109 | S = 58 |
| 6,11,25 | S = 163 | S = 86 |
| 7,12,32 | S = 217 | S = 115 |

The content of a CHANNEL REQUEST message is an eight bit value consisting of two parts: the establishment cause and a random value. The coding of the content (also called the random reference) is carried out according to the following table. The x's are replaced by the random value.

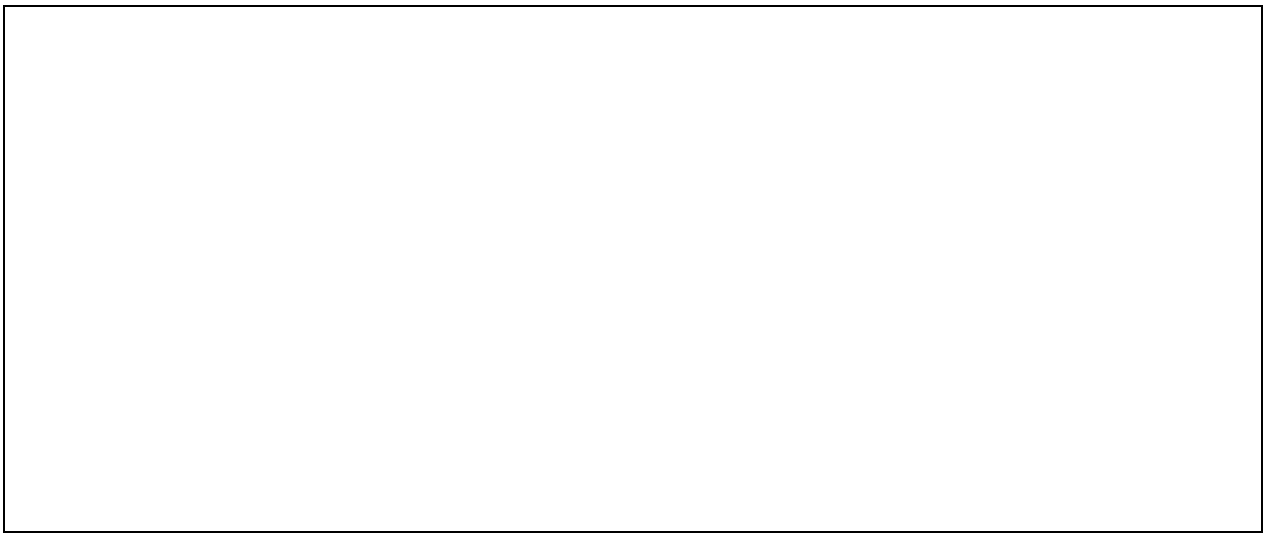
| CHANNEL_REQUEST content | Meaning of Establishment Cause |
|---|---|
| 1 0 1 x x x x x | Emergency Call |
| 1 1 0 x x x x x | Call Reestablishment, TCH/F was in use or<br>TCH/H was in use and NECI = 0 |
| 0 1 1 0 1 0 x x | Call Reestablishment, TCH/H was in use and NECI = 1 |
| 1 0 0 x x x x x | Paging, any channel or ms capability is full rate only and paging is<br>not equal to SDCCH |
| 0 0 1 0 x x x x | Paging TCH/F and ms capability are dual rate |
| 0 0 1 1 x x x x | Paging TCH/H or TCH/F and ms capability are dual rate |
| 0 0 0 1 x x x x | Paging SDCCH and ms capability are SDCCH only |
| 1 1 1 x x x x x | MS originated call and TCH/F are requested or MS originated call<br>and NECI = 0 |
| 0 1 0 0 x x x x | MS originated Speech Call from dual rate MS, TCH/H is sufficient<br>and NECI = 1 |
| 0 1 0 1 x x x x | MS originated Data Call from dual rate MS, TCH/H is sufficient<br>and NECI = 1 |
| 0 0 0 0 x x x x | Location Updating (SDCCH is needed) |
| 0 0 0 1 x x x x | Procedure which needs only SDCCH (IMSI detach, SMS, SS) |
| 0 1 1 0 0 x x x | reserved |
| 0 1 1 1 x x x x | reserved |

CHANNEL REQUEST messages are sent over the air interface as random access bursts. Random access burst differs from normal burst by a long guard period.



**Structure Burst Types**

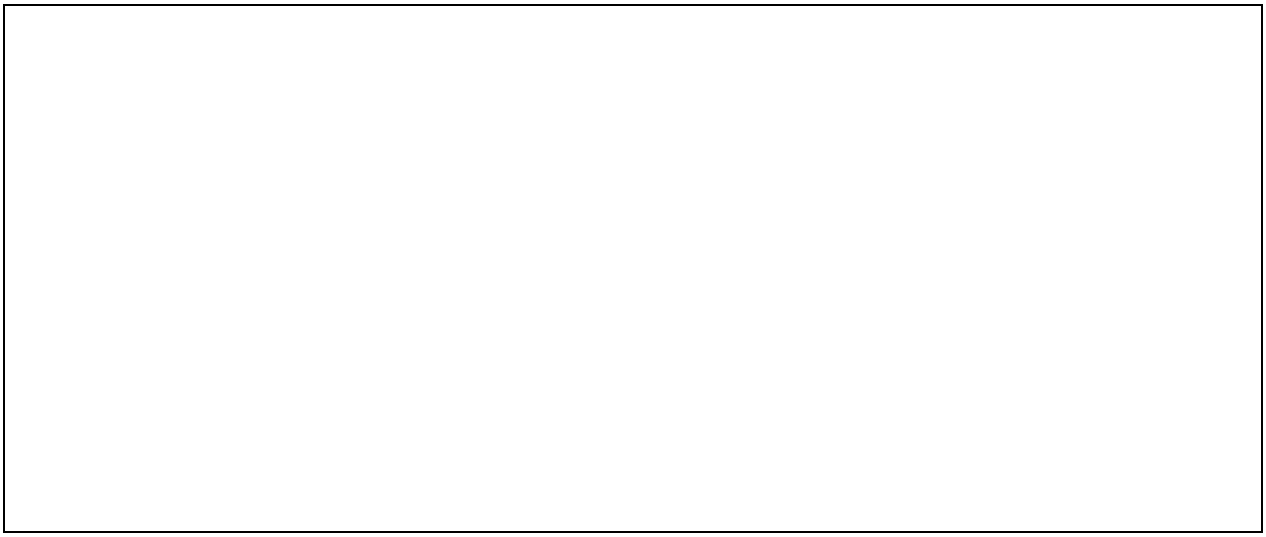
Normal Bursts use the guard period to compensate small delay differences. With random bursts, the guard period is used to measure the timing advance in the base station.
The mobile station is synchronised with and sends a random access burst to the base station. Using the random access bursts' extra long guard period, the base station measures the time when receiving the random access burst. This time is equal to two times the timing advance between mobile and base stations.



**Timing Advance Mobile to Base Station**

The random access burst content is an eight bit value, consisting of an establishment cause and a random value.
(RR 3)
After each sending attempt, RR receives the frame number at which the message was sent. The last three CHANNEL REQUEST message combinations and frame number are stored in RR.

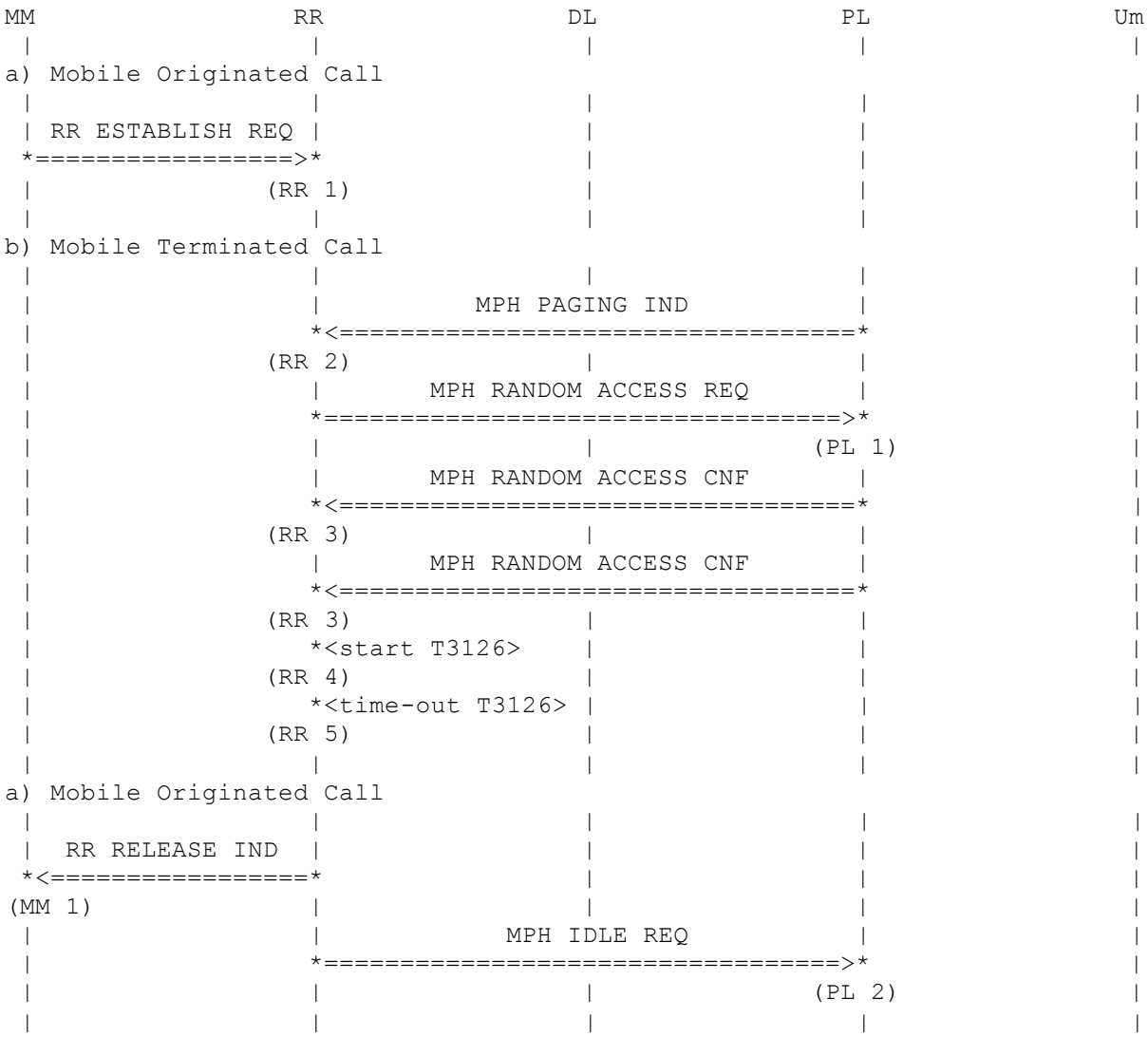
(RR 4)
After the reception of a channel assignment (IMMEDIATE ASSIGNMENT message or IMMEDIATE ASSIGNMENT EXTENDED message), RR checks whether or not the channel assignment is valid for the mobile station. Therefore, the messages include the random reference and the frame number when the random access burst was received in the base station. The last three CHANNEL REQUEST messages are compared.



**Immediate Assignment Check**

(PL 2)
If the channel assignment is valid for a mobile station, PL is configured to the channel (SDCCH or FACCH) and DL and PL stop the sending of CHANNEL REQUEST messages. The timing advance measured by the base station is configured. The channel mode is "signalling only".
(RR 5)
PL confirms the dedicated mode configuration.
(DL 1)
RR tries to establish the Set Asynchronous Balanced Mode (SABM). This mode is the acknowledged data transfer mode between the mobile and base stations.
(RR 6)
DL confirms the establishment.
(MM 1)
In the case of mobile originated call, MM is informed with the primitive RR ESTABLISH CNF.
(MM 2)
In the case of mobile terminated call, MM is informed with the primitive RR ESTABLISH IND.

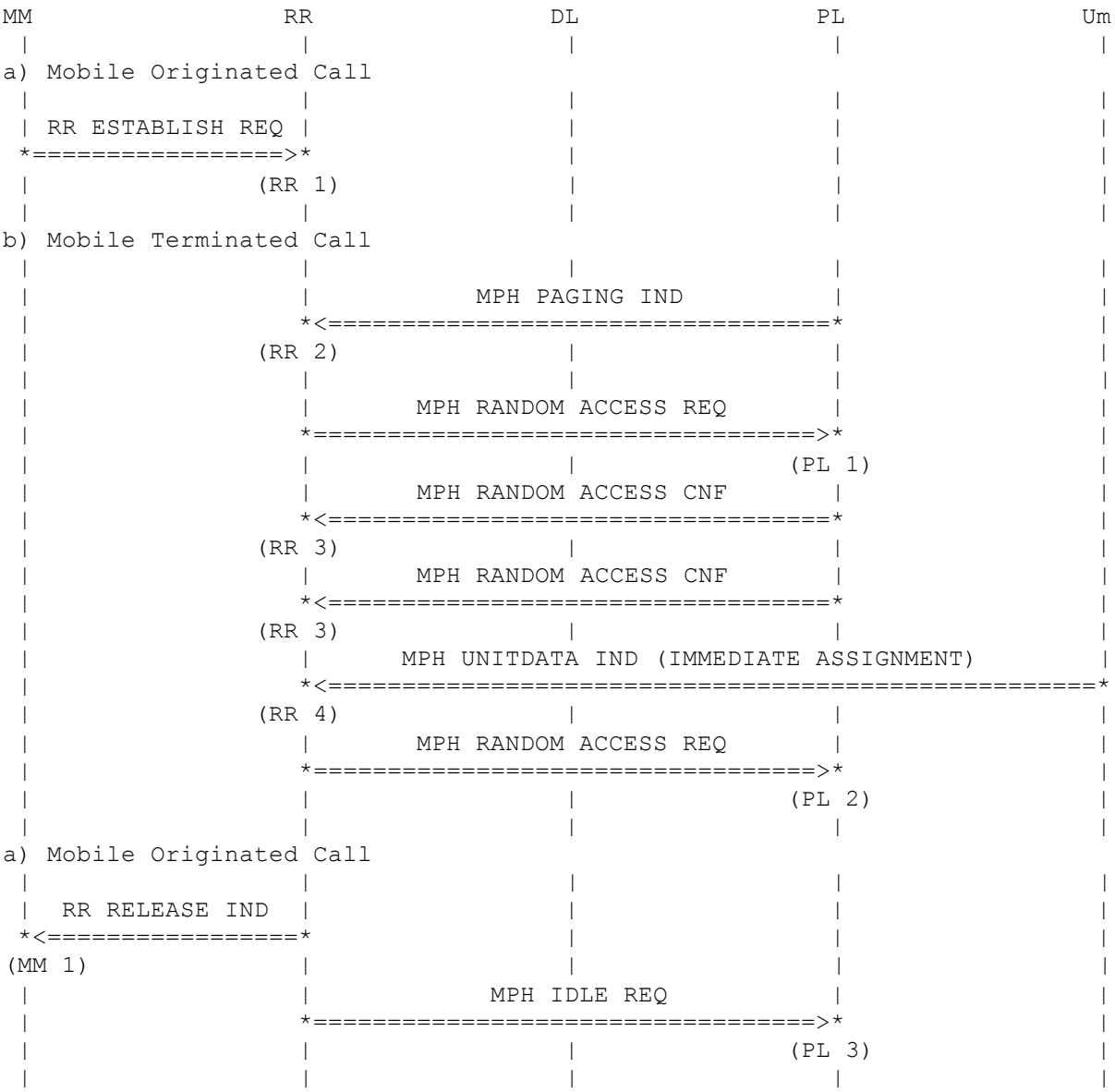
### 6.2.2 No answer from the network




(RR 1)
The mobile originated call is started by MM with the primitive RR ESTABLISH REQ.
(RR 2)
The mobile terminated call is initiated after the reception of a paging message for the mobile station.
(PL 1)
RR calculates the times between CHANNEL REQUEST messages and the contents of the CHANNEL REQUEST messages for all MAX_RETRANS + 1 sending attempts and forwards the information to PL.

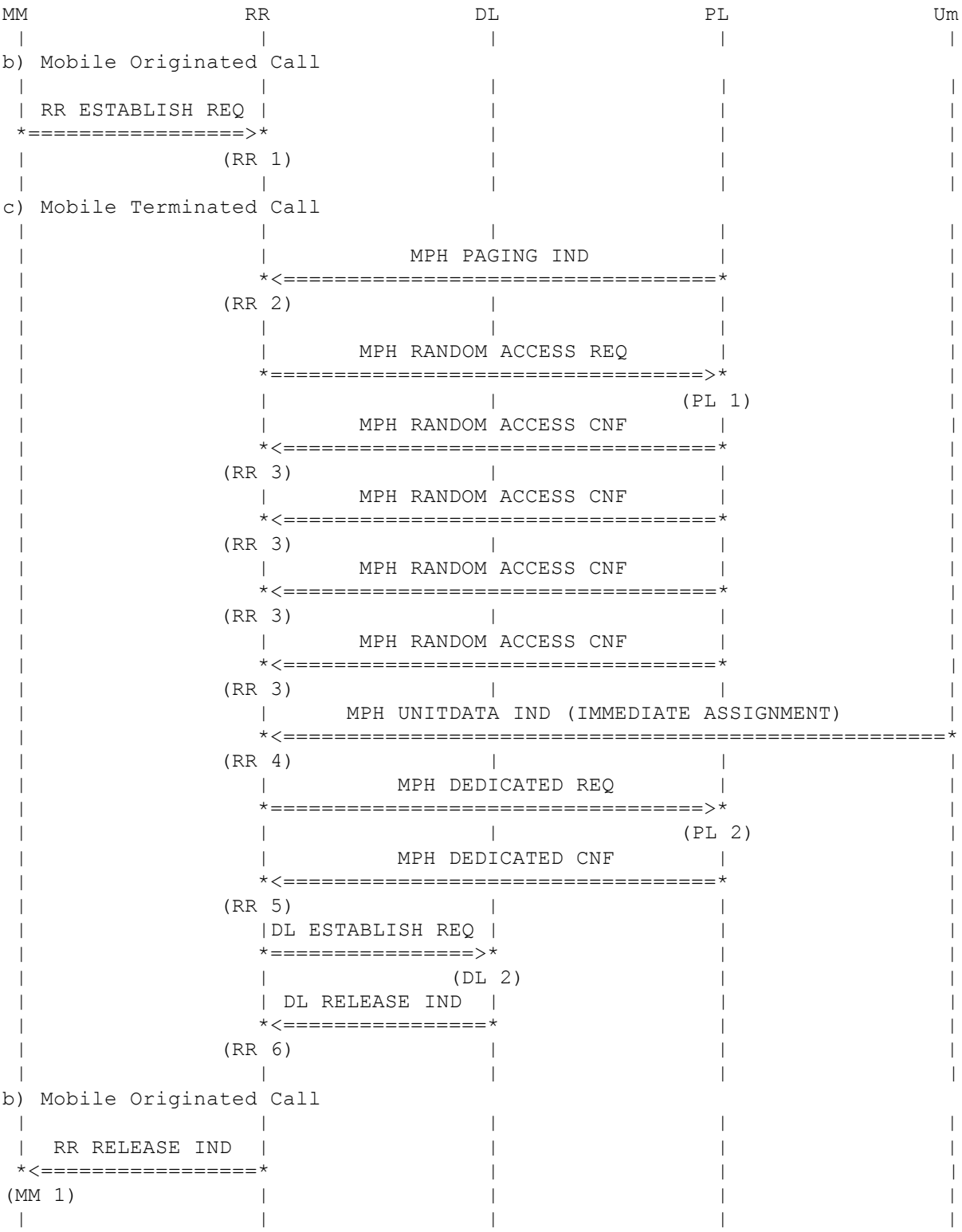
(RR 3)
After each sending attempt, the frame number at which the CHANNEL REQUEST message was sent is given to RR. The last three message content combinations and frame number are stored.
(RR 4)
After sending the last CHANNEL REQUEST message, RR starts the timer T3126. The timer defines a time for the base station to send a channel assignment.
(RR 5)
Timer T3126 times-out and no channel assignment was received by the mobile station. The establishment is aborted.
(MM 1)
If it is a mobile originated call, MM is informed about the failed procedure.
(PL 2)
A cell reselection is initiated. The best possible cell is then configured.

### 6.2.3 Hopping in more than one Frequency Band



(RR 1)
The mobile originated call is started by MM with the primitive RR ESTABLISH REQ.
(RR 2)
The mobile terminated call is initiated after the reception of a paging message for the mobile station.
(PL 1)
RR calculates the times between CHANNEL REQUEST messages and the contents of the CHANNEL REQUEST messages for all MAX RETRANS + 1 sending attempts and forwards the information to PL.
(RR 3)
After each sending attempt, the frame number at which the CHANNEL REQUEST message was sent is given to RR. The last three message content combinations and frame number are stored.
(RR 4)
The mobile station receives an IMMEDIATE ASSIGNMENT message. The assigned channel contains hopping frequencies belonging to more than one frequency band (e.g. EGSM and DSC1800). The Access procedure cannot be continued.
(PL 2)
The Random Access procedure is stopped.
(MM 1)
If it is a mobile originated call, MM is informed.
(PL 3)
The mobile station enters Idle Mode.

### 6.2.4 Information Field Mismatch



(RR 1)
The mobile originated call is started by MM with the primitive RR ESTABLISH REQ.
(RR 2)
The mobile terminated call is initiated after the reception of a paging message for the mobile station.
(PL 1)
RR calculates the times between CHANNEL REQUEST messages and the contents of the CHANNEL REQUEST messages for all MAX RETRANS + 1 sending attempts and forwards the information to PL.
(RR 3)
After each sending attempt, the frame number at which the CHANNEL REQUEST message was sent is given to RR. The last three message content combinations and frame number are stored.
(RR 4)
The mobile station receives an IMMEDIATE ASSIGNMENT message.
(PL 2)
If the channel assignment is valid for a mobile station, PL is configured to the channel (SDCCH or FACCH) and DL and PL stop the sending of CHANNEL REQUEST messages. The timing advance measured by the base station is configured. The channel mode is "signalling only".
(RR 5)
PL confirms the dedicated mode configuration.
(DL 1)
RR tries to establish the Set Asynchronous Balanced Mode (SABM). This mode is the acknowledged data transfer mode between the mobile and base stations.

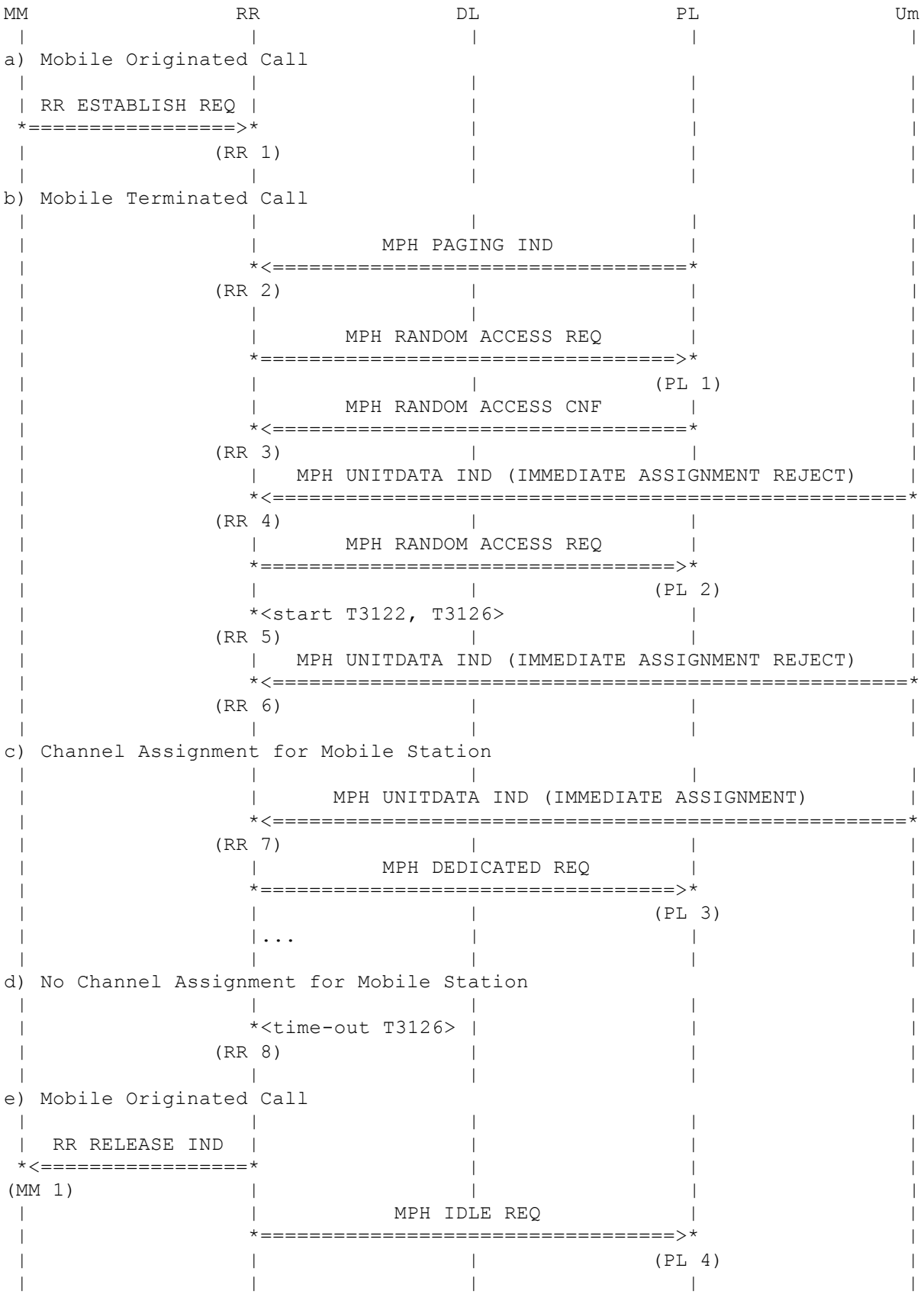
(RR 6)

DL indicates that the SABM command content is not equal to the received UA response content. RR starts a repetition of the immediate assignment procedure at point (DL 1). If the repetition also fails or DL indicates another lower layer failure, the immediate assignment procedure has failed.

(MM 1)

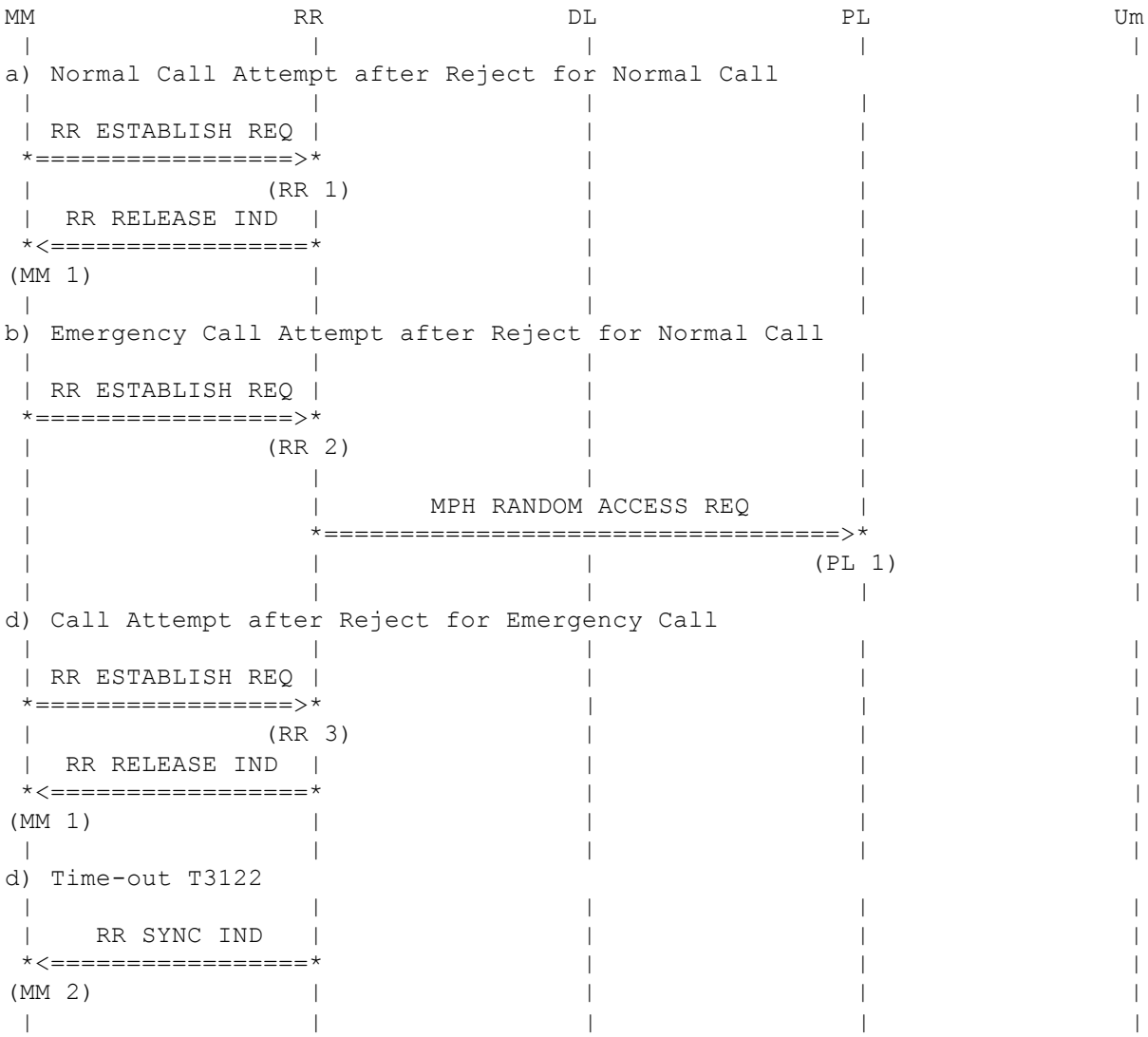
If it is a mobile originated call, MM is informed.

### 6.2.5 Immediate Assignment Reject



(RR 1)
The mobile originated call is started by MM with the primitive RR ESTABLISH REQ.
(RR 2)
The mobile terminated call is initiated after the reception of a paging message for the mobile station.
(PL 1)
RR calculates the times between CHANNEL REQUEST messages and the contents of the CHANNEL REQUEST messages for all MAX RETRANS + 1 sending attempts and forwards the information to PL.
(RR 3)
After each sending attempt, the frame number at which the CHANNEL REQUEST message was sent is given to RR. The last three message content combinations and frame number are stored.
(RR 4)
If no channel is available for assignment, the network may send an IMMEDIATE ASSIGNMENT REJECT message to the mobile station. RR checks the message. The content and sending time of the previously sent CHANNEL REQUEST messages are used by RR to identify the message that belongs to the mobile station.
The message also includes a value for the timer T3122.
(PL 2)
The sending of CHANNEL REQUEST messages for the lower layers is stopped. There is no confirmation expected. DL listens to the Uplink CCCH.
(RR 5)
RR starts timer T3122 with the value from the message (information element wait indication) and timer T3126, if it is not already running.
(RR 6)
If T3126 is running, IMMEDIATE ASSIGNMENT REJECT messages are additionally ignored.
(RR 7)
RR receives an IMMEDIATE ASSIGNMENT which fulfils the conditions of one of the last three CHANNEL REQUEST messages, T3122 and T3126 are stopped, and the procedure is running as described for normal functioning.
(PL 3)
The dedicated mode is configured.
(RR 8)
If the timeout T3126 times-out, RR starts a cell reselection and goes back into idle mode.
(PL 4)
The cell reselection starts.

### 6.2.6 Timer T3122




(RR 1)
After the reception of an IMMEDIATE ASSIGNMENT REJECT message for a normal call, MM starts another normal call attempt.
(MM 1)
MM receives a rejection, because Timer T3122 is running in RR.
(RR 2)
After the reception of a normal call IMMEDIATE ASSIGNMENT REJECT message, MM starts another attempt, this time for an emergency call.

(PL 1)

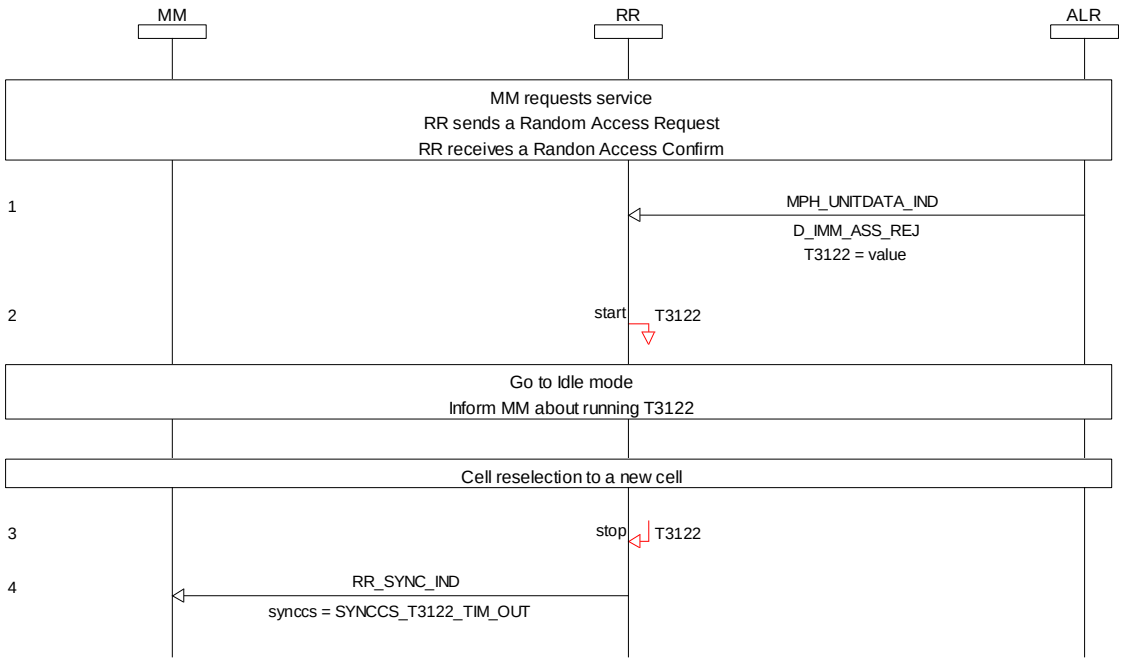
RR stops timer T3122 and starts the emergency call immediate assignment procedure.

(RR 3)
After the reception of an emergency call IMMEDIATE ASSIGNMENT REJECT message, MM starts another call attempt.

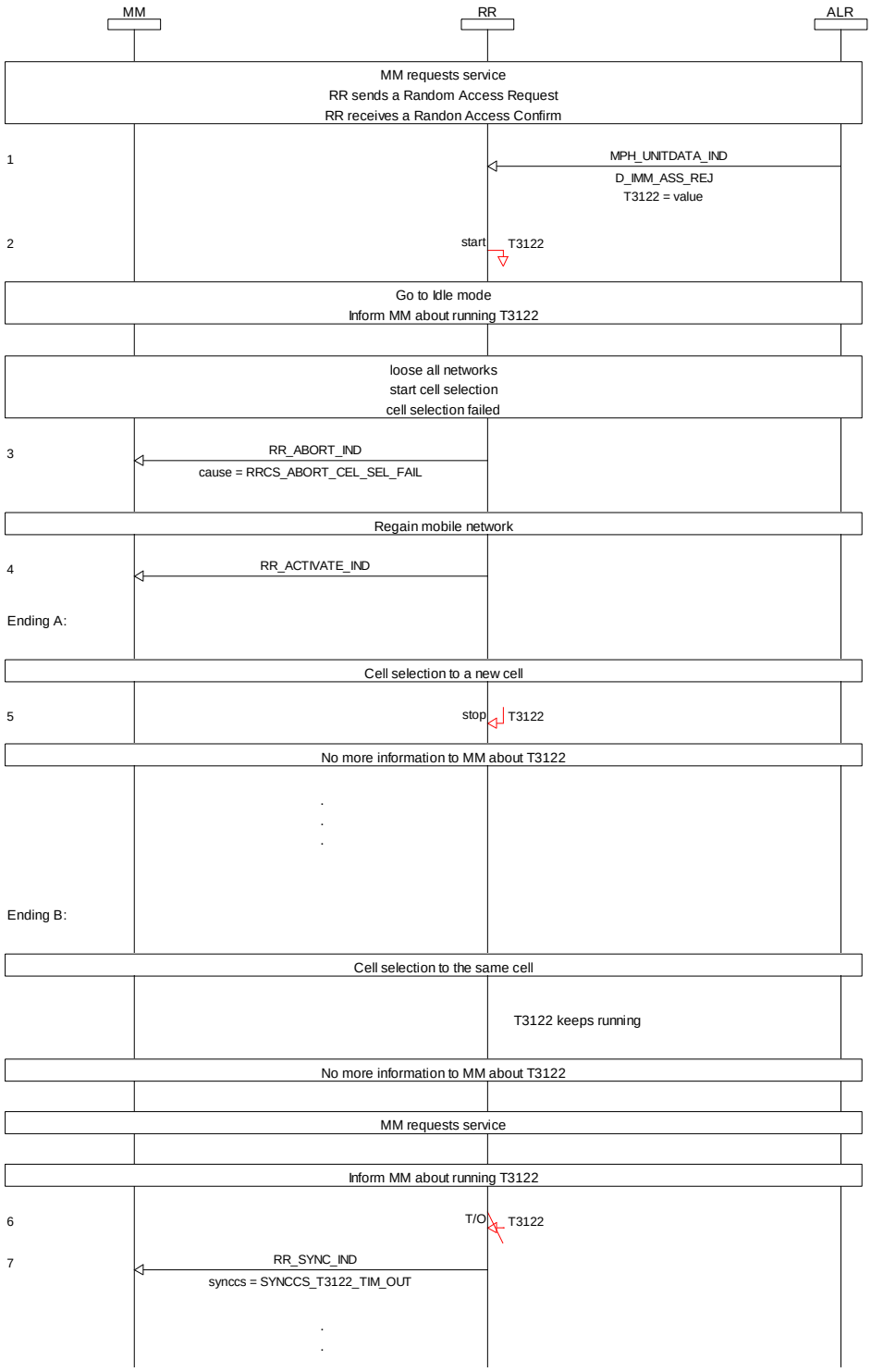
(MM 2)

The time-out of timer T3122 is signalled to MM.

### 6.2.7 Timer T3122 combined with cell (re-)selection



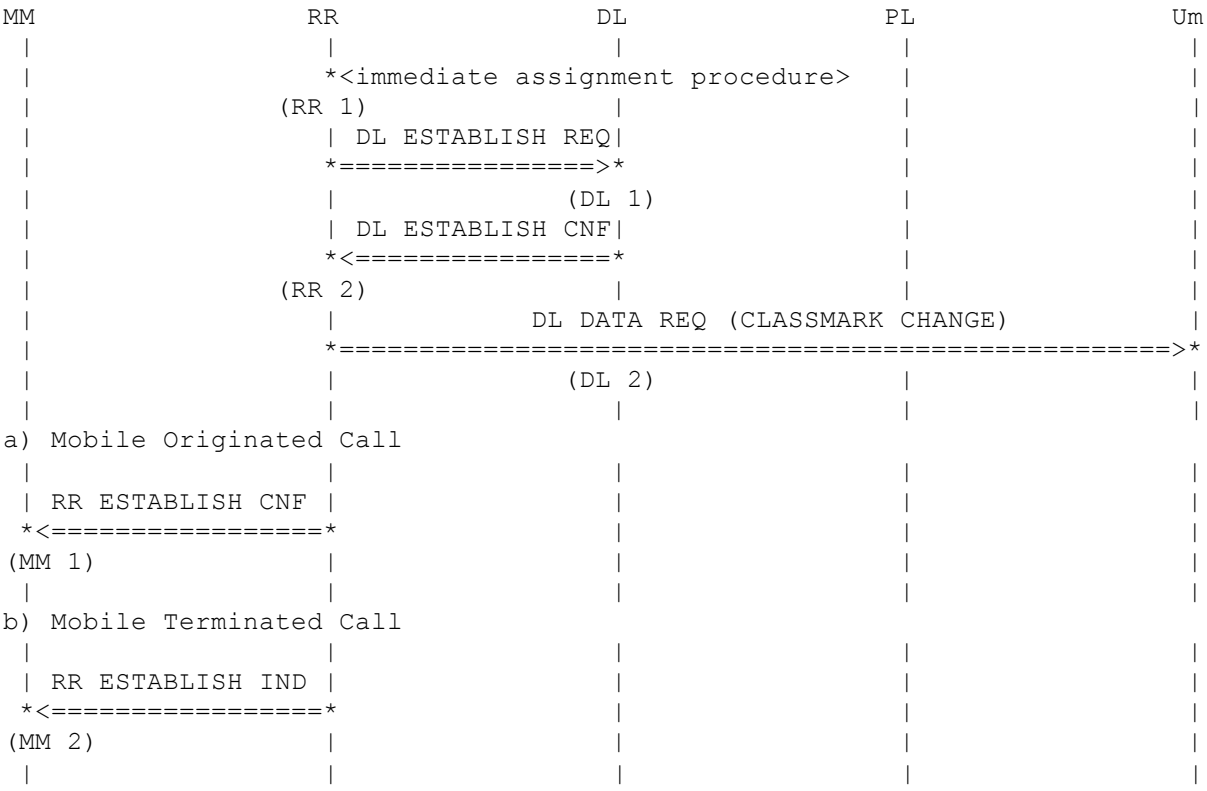

If T3122 and the mobile performs a cell reselection T3122 is stopped and MM is informed.




If cell selection fails MM is informed. If the mobile reattach to the network again MM is not informed about T3122.

- If the mobile has found new cell, T3122 is stopped.
- If the mobile is back at the old cell, T3122 continue. If MM request service before T3122 expires, MM is informed about running T3122. If T3122 expires before MM requests service, a RR_SYNC_IND is sent.

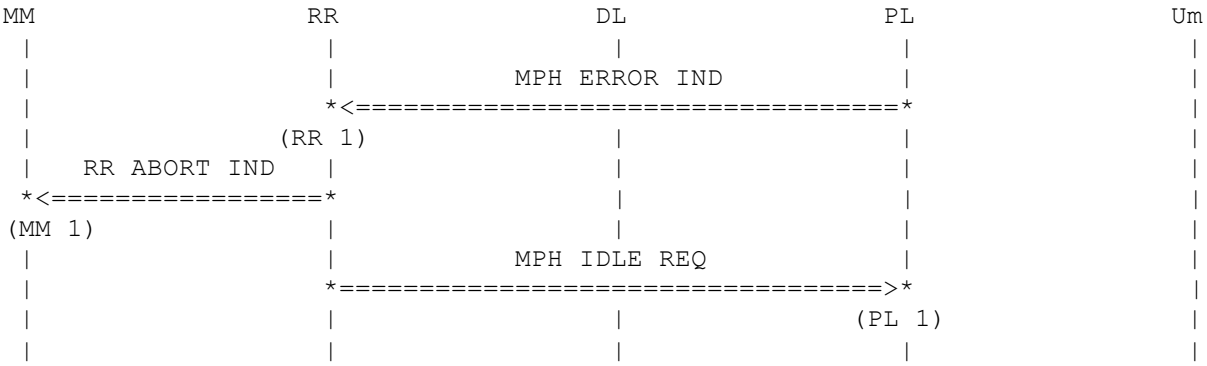
## 6.3 Early Classmark Sending




(RR 1)
The immediate assignment procedure is processed.
(DL 1)
The layer 2 connection will be established.
(RR 2)
DL confirms the successful establishment of the layer 2 connection.
(DL 2)
If the mobile station supports the „early classmark sending“ option and the cell indicates in the SYSTEM INFORMATION message, that early classmark sending is explicitly accepted, RR codes the CLASSMARK CHANGE message and forwards it to the network. The message contains the supported frequency band and the associated power classes of the mobile station.
(MM 1)
For the mobile originated call RR informs MM about the successful connection establishment.
(MM 2)
RR informs MM about the mobile terminated establishment.

# 7 Dedicated Procedures

## 7.1 Radio Link Failure




(RR 1)

Radio link failure means that there is an insufficient quality on the downlink SACCH. This channel transports the SYSTEM INFORMATION TYPE 5, 5 bis, 5 ter and 6 messages from the base to the mobile station. The quality control is located in PL. RR initialises the control by configuring the dedicated configuration and, in the error case, receives the primitive MPH ERROR IND with the cause "radio link failure".

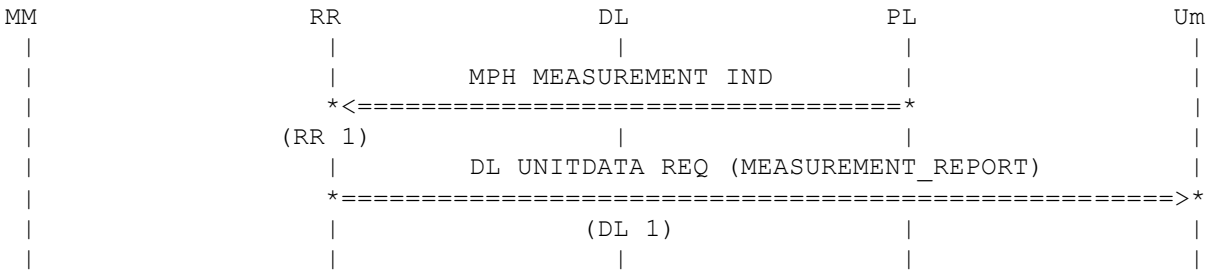
(MM 1)

MM is informed about the connection abort. The upper layer may have the possibility to re-establish the link.

(PL 1)

RR returns to idle mode.

## 7.2 Measurement Report




(RR 1)

RR receives measurement values for the serving cell and neighbour cells. These values are stored in RR for forced handover purposes.

If the test facility "forced handover" is activated, the measurement values previously received from PL are set. If the measurement values from PL contain cells which are not allowed according to the NCC permitted information element, these cells will be removed.

(DL 1)

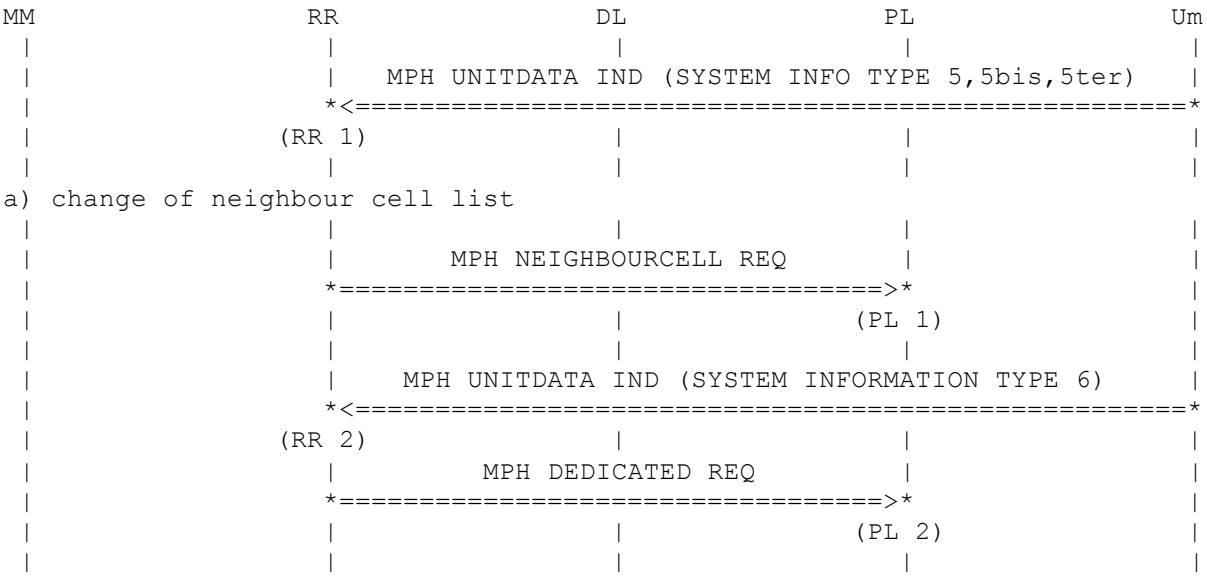
The MEASUREMENT REPORT message sending is carried out in unacknowledged mode.

## 7.3 Forced Handover

Forced handover is a test facility triggered by the dynamic configuration mechanism. The measurement report is set according to given configurations. The set values are stored in RR. The set MEASUREMENT REPORT messages are sent until a handover is processed.

The function of the force handover is to trigger a handover in the base station. The decision to process a handover is made in the base station on the basis of the incoming MEASURMENT REPORT messages.

## 7.4 System Information Broadcasting (Dedicated Mode)




(RR 1)

After the reception of a SYSTEM INFORMATION TYPE 5, 5 bis or 5 ter message, RR decodes the messages and checks whether or not a neighbour cell list change has occurred.

It is the decision of the network operator whether or not to use different neighbour cell allocations for the idle and dedicated Modes. The default allocation is the idle mode allocation.

(PL 1)

A neighbour cell list change is forwarded to PL.

(RR 2)

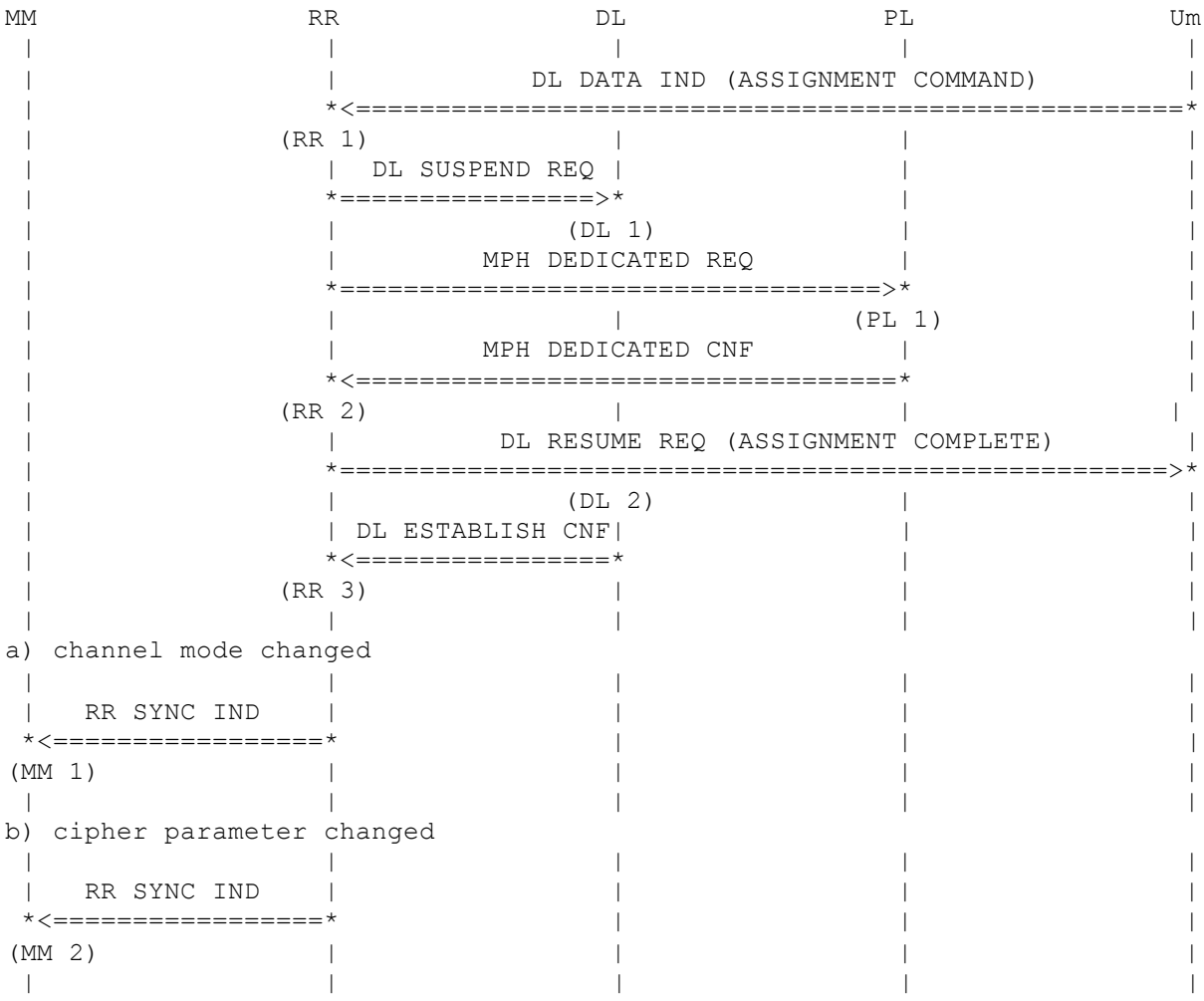
RR receives a SYSTEM INFORMATION TYPE 6 message.

(PL 2)

Changed Cell Options if any (i.e. Discontinuous Transmission, the measurement method in PL (PWRC flag), the radio link timeout valuen or the NCC permitted field) are forwarded to PL.

## 7.5 Channel Assignment

### 7.5.1 Successful Case



(RR 1)

RR receives an ASSIGNMENT COMMAND message in dedicated mode. The old and new channels' data are stored. Data which are not set in the message are taken, unchanged, from the old channel.

(DL 1)

The connection is locally released by DL.

(PL 1)

RR configures PL to the new channel.

(RR 2)

PL confirms the new channel configuration.

(DL 2)

RR tries to resume the Set Asynchronous Balanced Mode (SABM) for the new channel. Therefore, the primitive DL RESUME REQ along with the ASSIGNMENT COMPLETE message and the cause Normal Event are used.

(RR 3)

If the resume attempt is successful, RR is informed and the channel assignment procedure has finished.

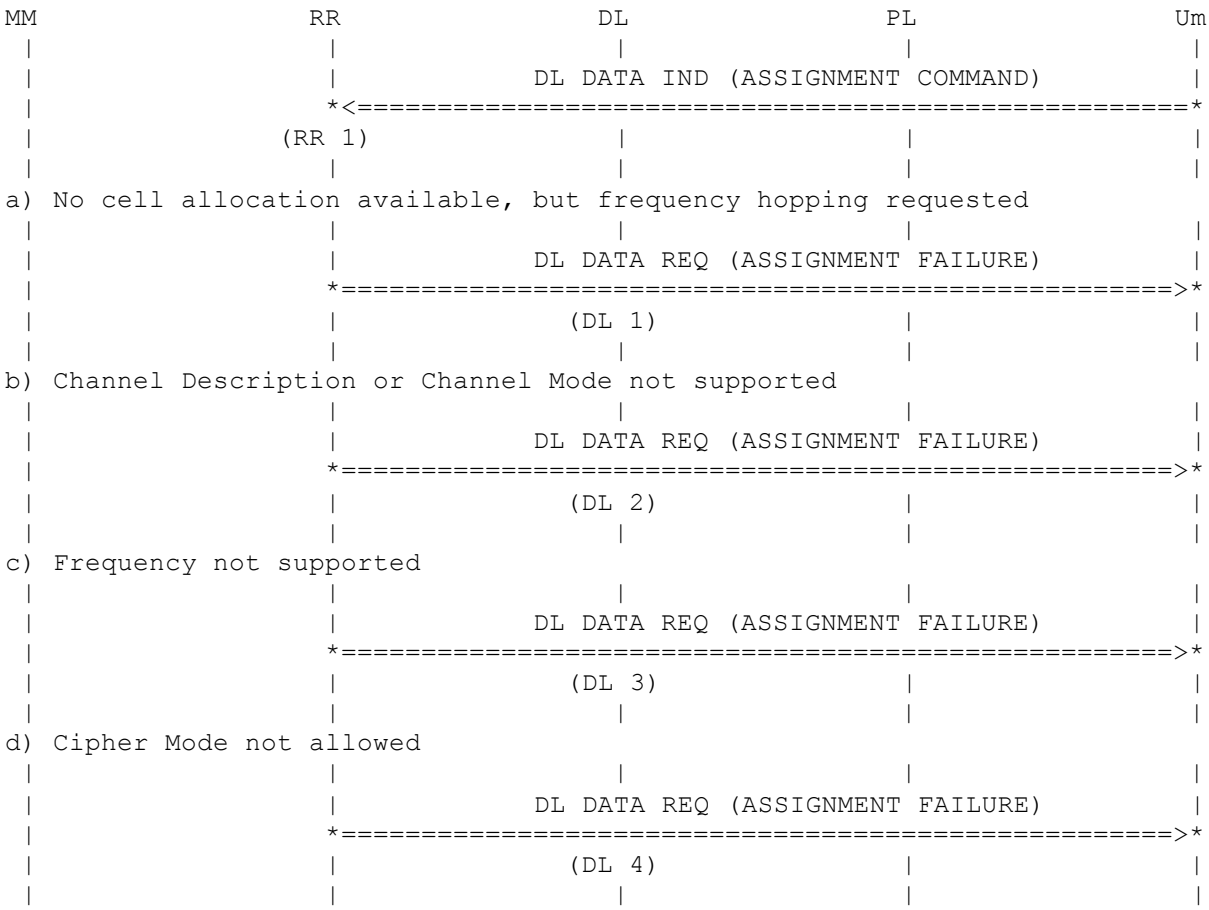
(MM 1)

If the channel mode has changed during the channel assignment procedure, MM is informed about the new channel mode.

(MM 2)

If cipher mode has changed during channel assignment procedure, MM is informed about the new cipher mode.

### 7.5.2 Error Cases




(RR 1)

RR receives an ASSIGNMENT COMMAND message in dedicated mode.

(DL 1)

The message requests the new channel configuration, frequency hopping. There is no cell allocation available for the cell. This is needed to calculate the frequency hopping channels. RR sends an ASSIGNMENT FAILURE message on the old channel with the cause "cell allocation not available".

This will happen, for example, after a previous handover without frequency hopping. A cell allocation is not needed in such a cell, because there, no frequency hopping is used.

(DL 2)

If the message contains a channel description (e.g. TCH/H) or a channel mode (e.g. data services) which is not supported by the mobile station, RR sends an ASSIGNMENT FAILURE message with the cause "channel mode unacceptable".

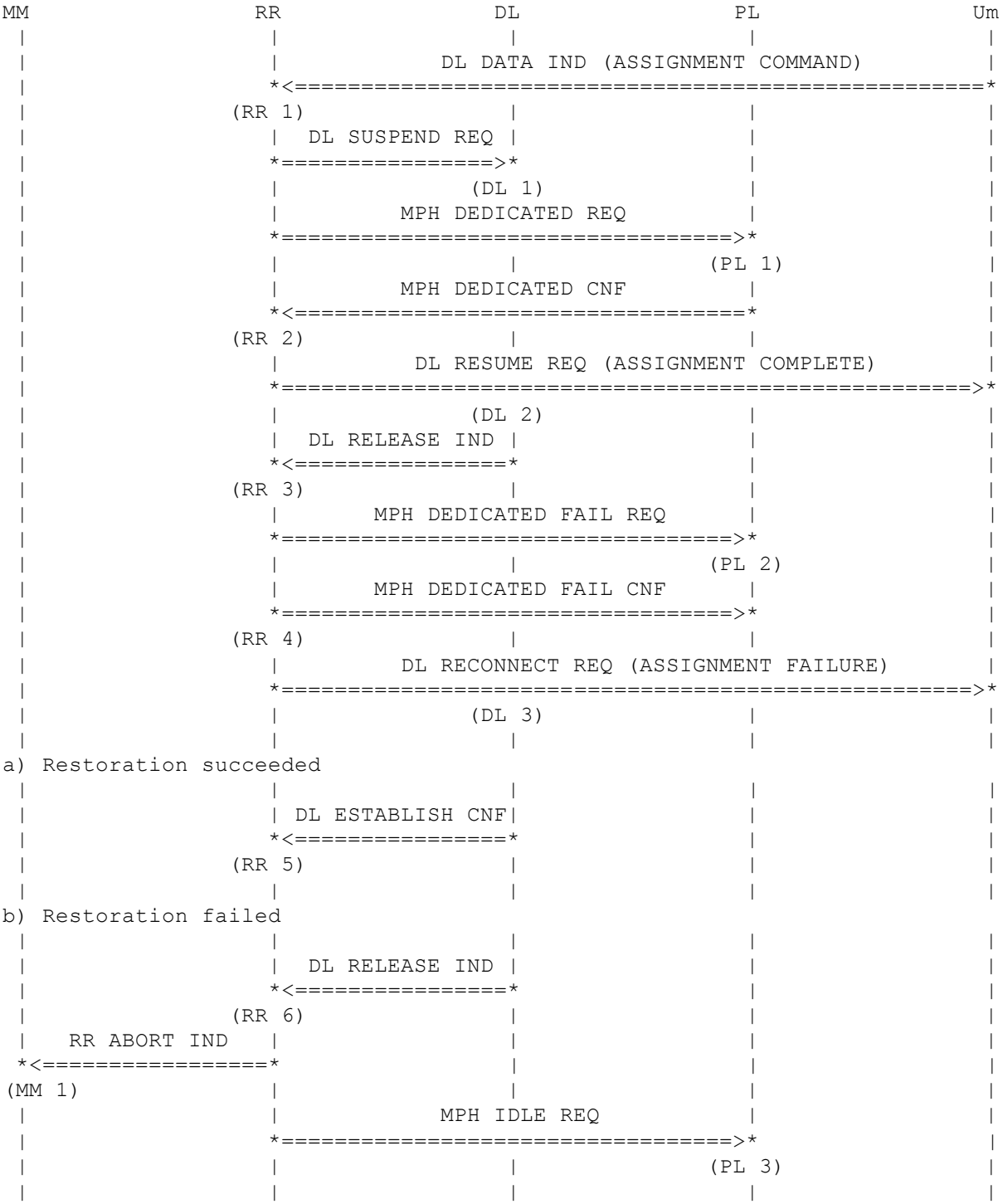
(DL 3)

If the ASSIGNMENT COMMAND message uses channel numbers (e.g. for frequency hopping) which are not supported by the mobile station, RR sends an ASSIGNMENT FAILURE message with the cause "frequency not implemented".

(DL 4)

If ciphering was active for the old channel and will be requested again for the new channel, RR sends an ASSIGNMENT FAILURE message with the cause "semantically incorrect content error".

### 7.5.3 Channel Assignment failed



(RR 1)

RR receives an ASSIGNMENT COMMAND message in dedicated mode.

(DL 1)

The old connection is suspended locally.

(PL 1)

RR configures the new channel configuration.

(RR 2)

RR confirms the new channel configuration.

(DL 2)

RR starts an attempt to resume the new channel configuration connection in Set Asynchronous Balanced mode (SABM). The message ASSIGMENT COMPLETE with the cause "normal event" is used.

(RR 3)

DL signals that resumption of the new connection was not possible.

(PL 2)

RR reconfigures the old channel configuration.

(RR 4)

PL confirms the change to the old channel configuration.

(DL 3)

RR starts an attempt to reconnect the old channel configuration in Set Asynchronous Balanced mode (SABM). The message ASSIGMENT FAILURE with the cause "normal event" is used.

(RR 5)

Reconnection was successful and RR is in dedicated mode.

(RR 6)

The old channel configuration reconnection failed.

(MM 1)

MM is informed about the connection abort. The upper layers may start a connection re-establishment.

(PL 3)

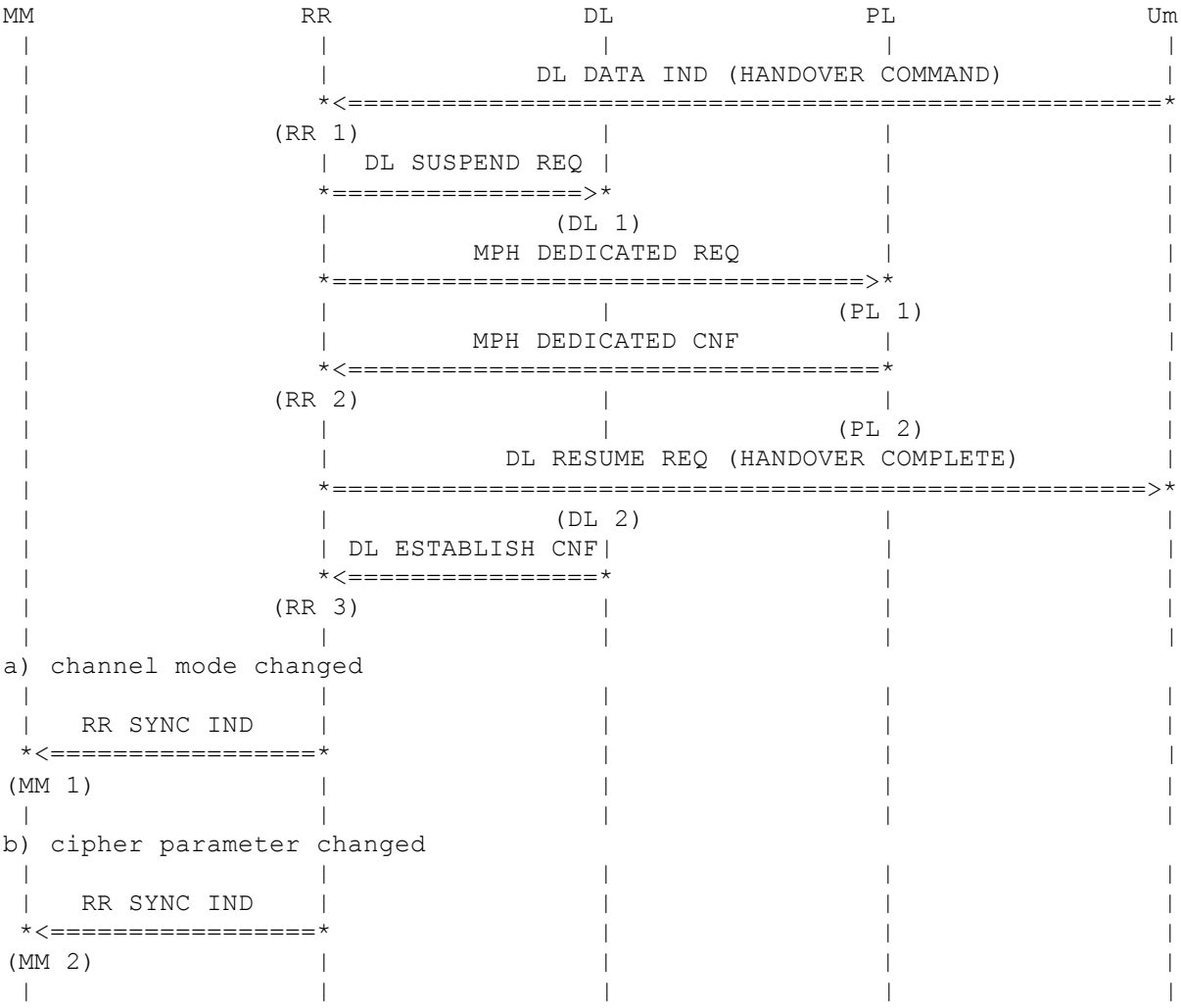
A cell reselection to return to idle mode is initiated.

## 7.6 Handover

Handover is a cell change procedure used during an existing connection. It is initiated by the base station on the basis of measurement reports received from the mobile station.
Four handover types are defined:

- Finally-synchronised Handover,
- Non-synchronised Handover,
- Pseudo-synchronised Handover, and
- Pre-synchronised Handover.

The processing of Handover is time-critical. Therefore the execution is done in PL.



(RR 1)

RR receives a HANDOVER COMMAND message in dedicated mode. The old and new channel data are stored. Data which are not set in the message are taken, unchanged, from the old channel.

(DL 1)

The connection is released locally by DL.

(PL 1)

RR configures the new channel configuration for PL in handover state. The handover is processed in PL.

(RR 2)

PL confirms the successful execution of handover and the new channel configuration.

(DL 2)

RR tries to resume the Set Asynchronous Balanced mode (SABM) connection for the new channel configuration. The message HANDOVER COMPLETE and the cause "normal event" are sent to DL along with the DL RESUME REQ primitive. If the base station has requested, the observed time difference is also sent with the message.

(RR 3)

After successful resumption, the handover procedure is finished and RR remains in dedicated mode.

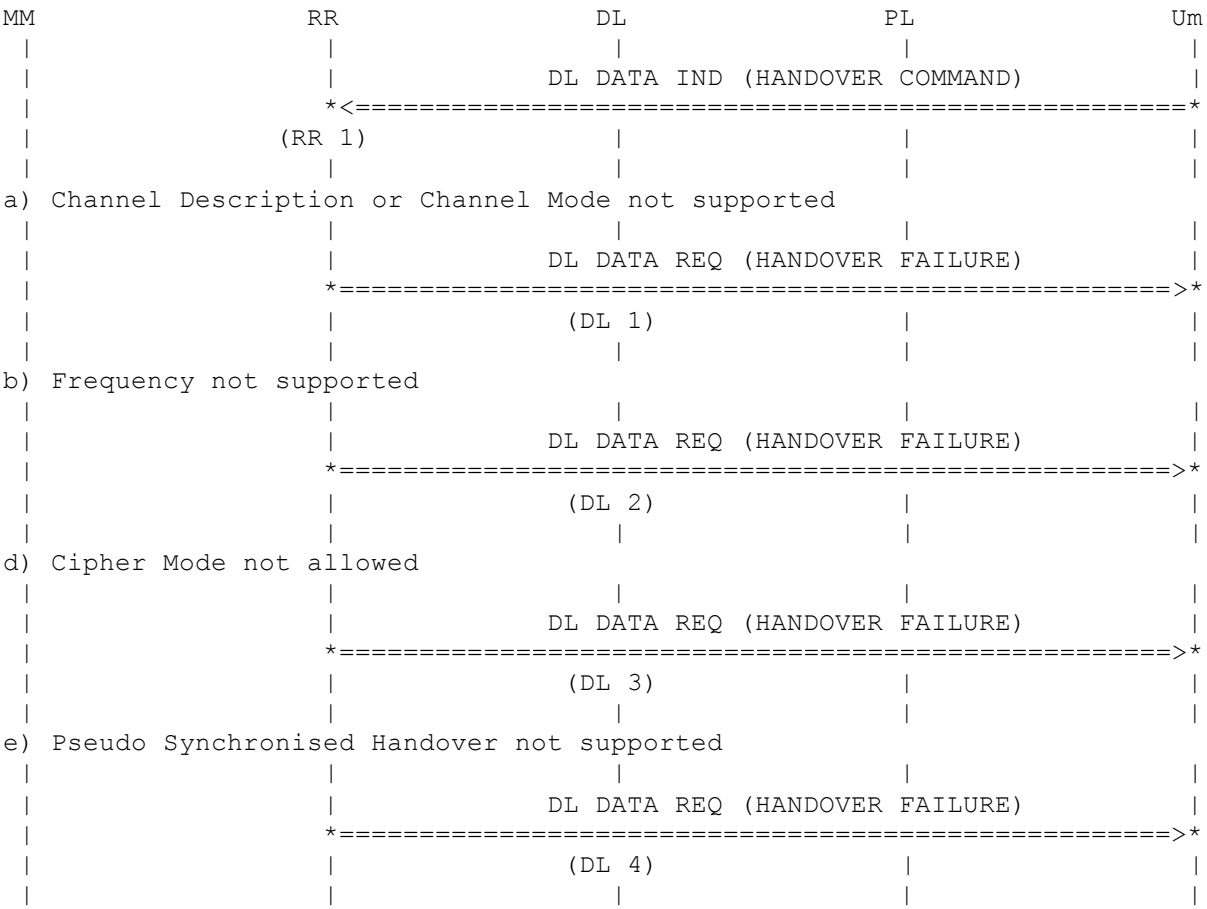
(MM 1)

A channel mode change during handover procedure is signalled to MM.

(MM 2)

If the cipher mode has changed, MM is informed.

### 7.6.1 Error Cases




(RR 1)

RR receives a HANDOVER COMMAND message in dedicated mode.

(DL 2)

If the message contains a channel description (e.g. TCH/H) or a channel mode (e.g. data services) which is not supported by the mobile station, RR sends a HANDOVER FAILURE message with the cause "channel mode unacceptable".

(DL 3)

If the HANDOVER COMMAND message uses channel numbers (e.g. for frequency hopping) which are not supported by the mobile station, RR sends a HANDOVER FAILURE message with the cause "frequency not implemented".

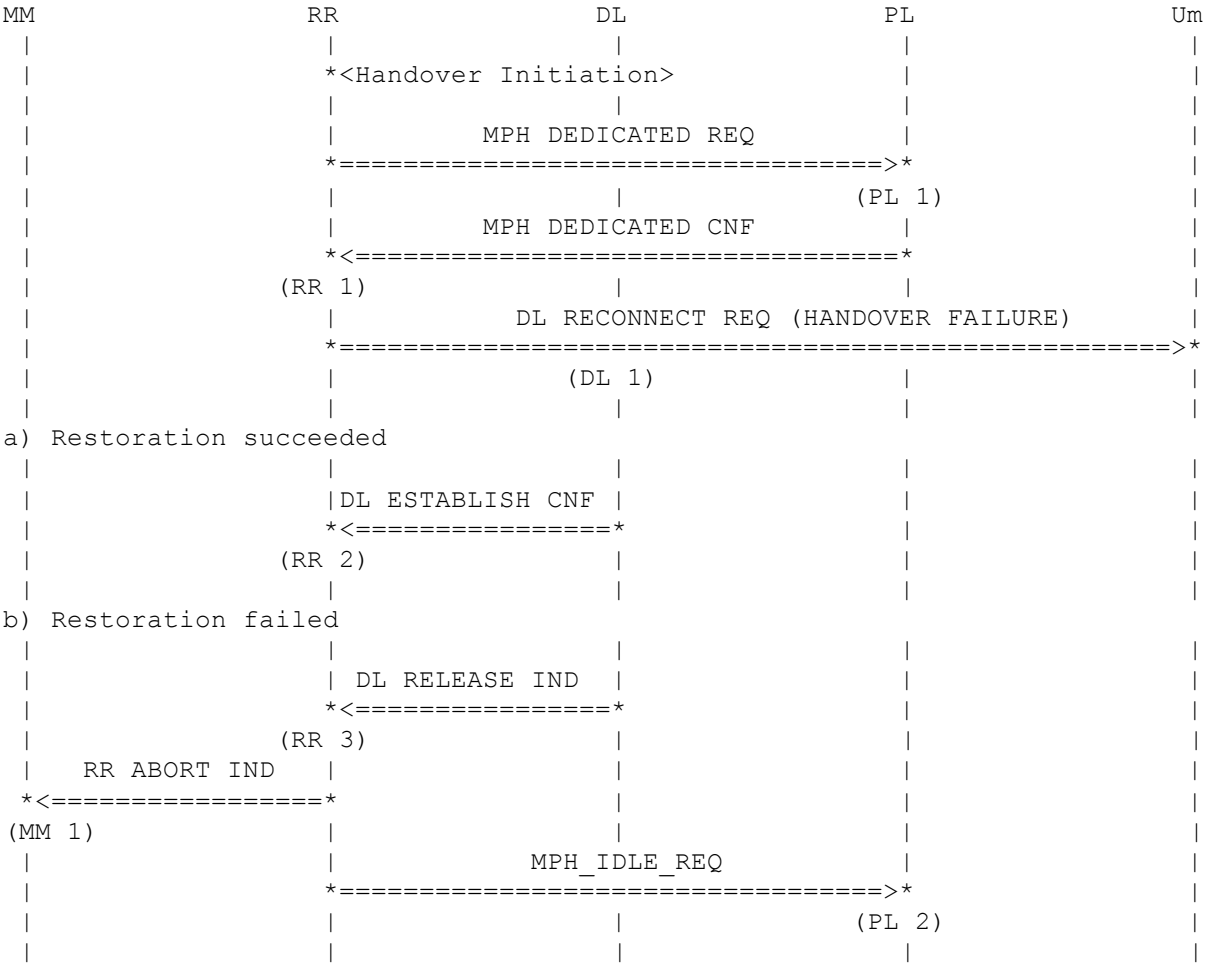
(DL 4)

If ciphering was active for the old channel and will again be requested for the new channel, RR sends a HANDOVER FAILURE message with the cause "semantically incorrect content error".

(DL 5)

If the HANDOVER COMMAND message requests pseudo-synchronised handover and the mobile station does not support this handover mode, RR sends a HANDOVER FAILURE message with the cause "abnormal event unspecified".

### 7.6.2 Timing Advance out of Range




(PL 1)

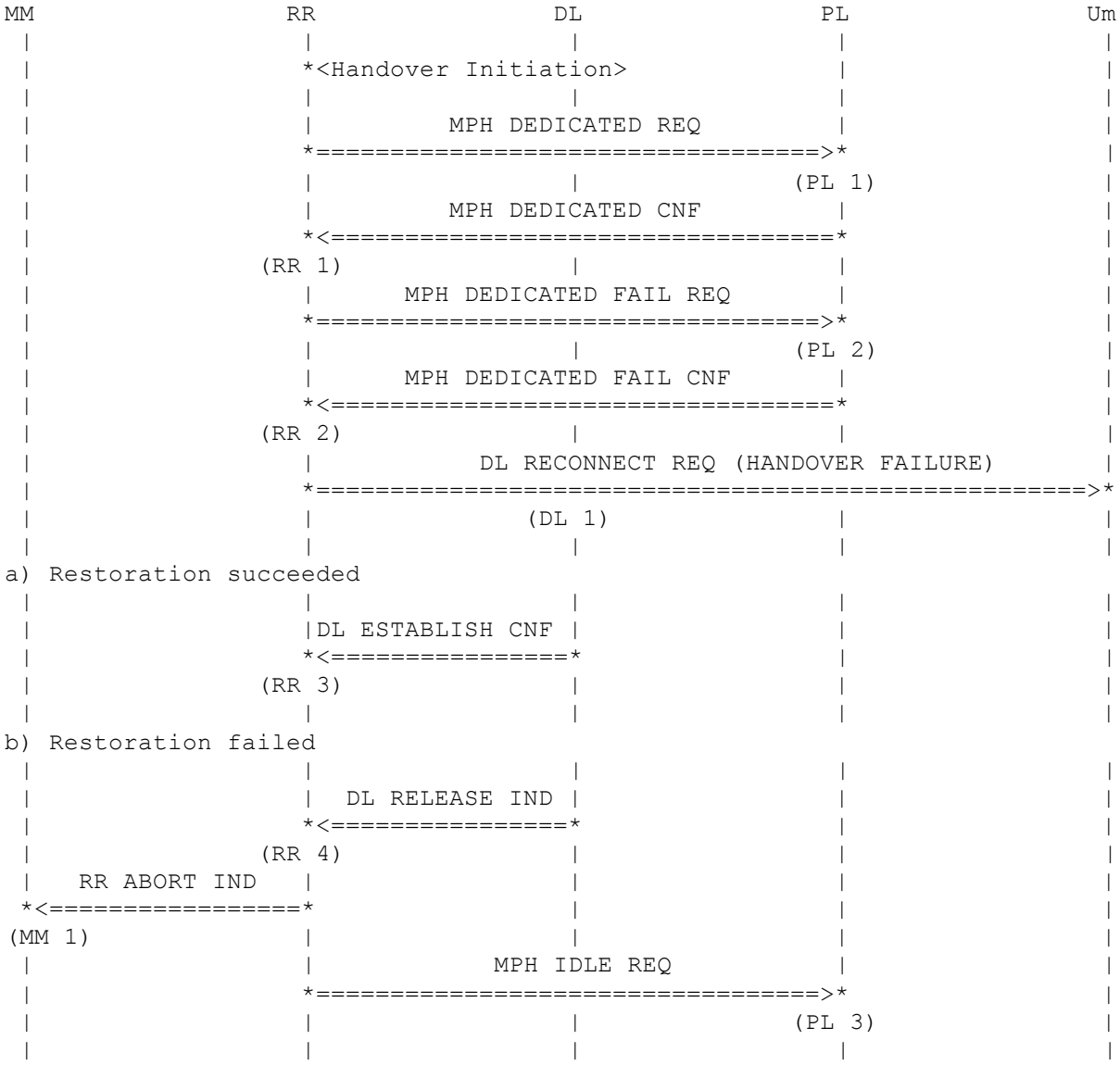
RR configures, in handover state, the new PL channel configuration.

(RR 1)

PL indicates that the timing advance is out of range. For synchronised handover, the new timing advance is checked in order to be sure that it is less than the equaliser range (0-4 bit). For pseudo-synchronised handover, the calculated timing advance is checked in order to be sure that it is in the configurable range (0-63).
(DL 1)

If the possible range is not met and the HANDOVER COMMAND does not allow out of range values, RR sends a HANDOVER FAILURE message with the cause "handover impossible, timing advance out of range" to the base station and aborts handover procedure.
(RR 2)
The link on the old channel configuration is established successfuly. RR remains in dedicated mode.
(RR 3)
It is not possible to reconnect the link on the old channel configuration.
(MM 1)
MM is informed that the connection is aborted. The upper layer may request a re-establishment.
(PL 2)
A cell reselection is initiated to find a new cell for the idle mode.

### 7.6.3 Timeout T3124




(PL 1)

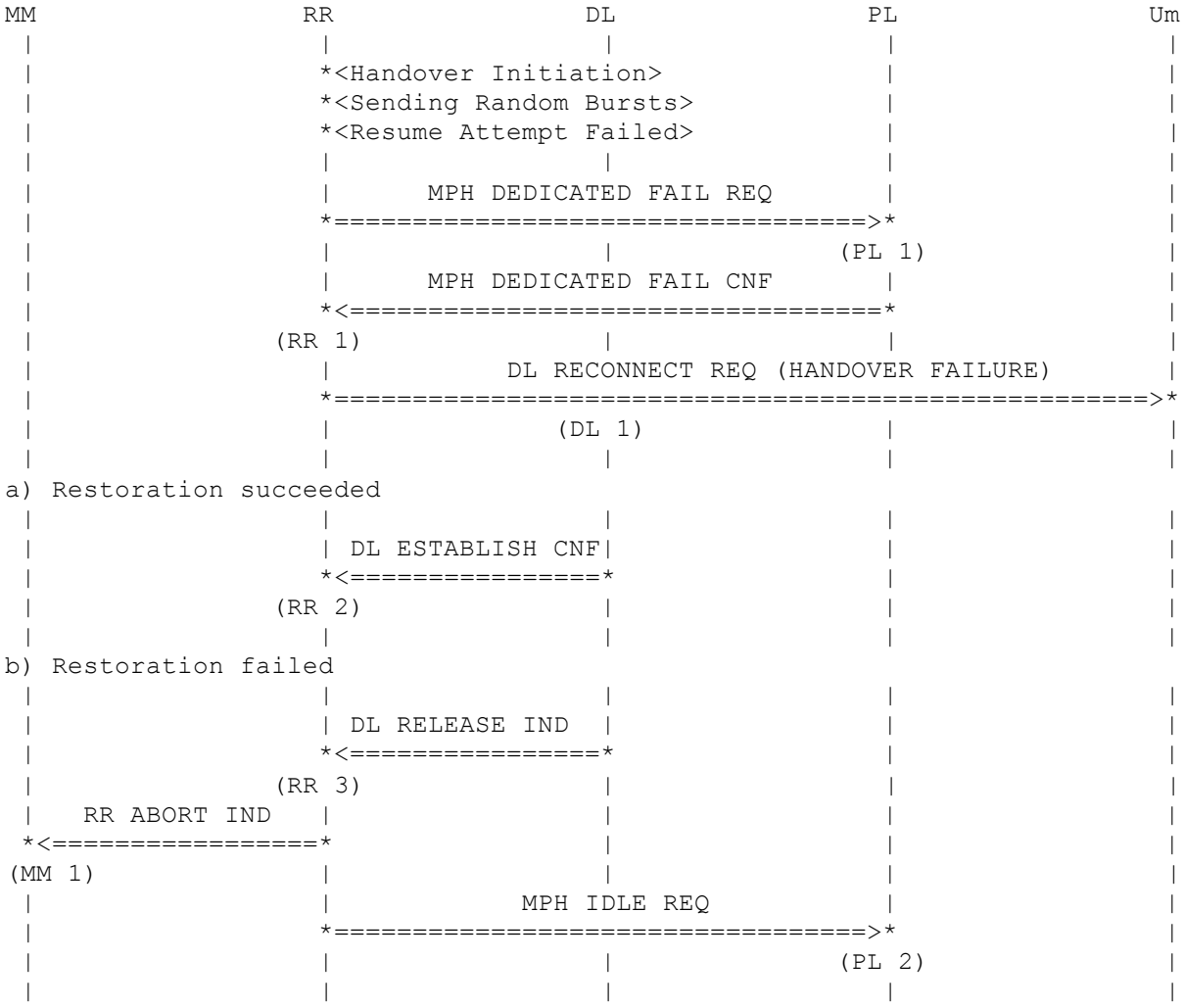
RR configures, in handover state, the new PL channel configuration.

(RR 1)

PL indicates the T3124 timeout during processing the asynchronous handover.
(PL 2)
RR reconfigures the old channel configuration.
(RR 2)
PL confirms the configuration of the old channel configuration.

(DL 1)
An attempt is started by RR to reconnect the link to base station with the primitive DL RECONNECT REQ. The message HANDOVER FAILURE with the cause "abnormal release, timer expired" is sent to DL.
(RR 3)
The link on the old channel configuration is established successfuly. RR remains in dedicated mode.
(RR 4)
It is not possible to reconnect the link on the old channel configuration.
(MM 1)
MM is informed that the connection is aborted. The upper layer may request a re-establishment.
(PL 3)
A cell reselection is initiated to find a new cell for the idle mode.

### 7.6.4 Lower Layer Failure

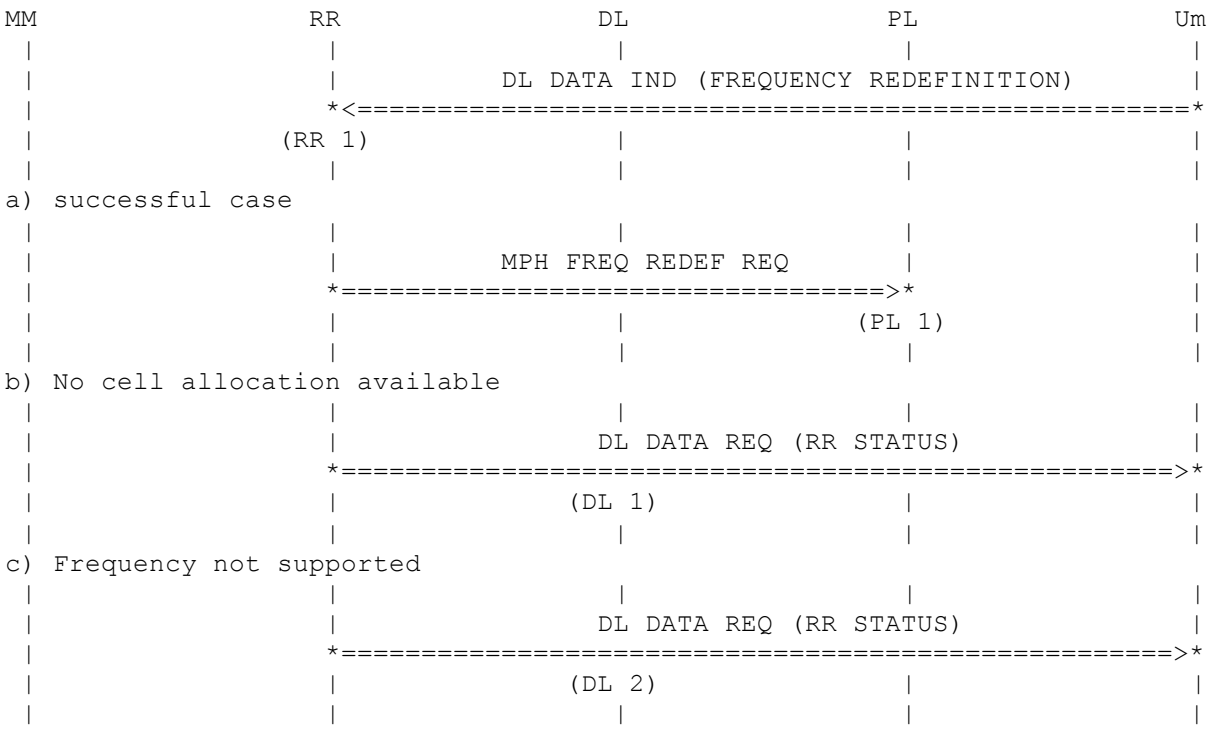



(PL 1)
RR reconfigures the old channel configuration.
(RR 1)
PL confirms configuration of the old channel configuration.
(DL 1)
An attempt to reconnect the link to base station is started by RR with the primitive DL RECONNECT REQ. The message HANDOVER FAILURE with the cause "abnormal release, unspecified" is sent to DL.
(RR 2)
The link on the old channel configuration is established successfuly. RR remains in dedicated mode.
(RR 3)
It is not possible to reconnect the link on the old channel configuration.
(MM 1)
MM is informed that the connection is aborted. The upper layer may request a re-establishment.
(PL 2)
A cell reselection will be initiated to find a new cell for the idle mode.

# 7.7 Frequency Hopping

Using frequency hopping, the logical channels are mapped to different physical channels with each time slot set according to a specific algorithm. The mapping to the frequencies is carried out in PL. The function of frequency hopping is to get a higher link quality average. RR sends PL a list of frequency hopping channels. This hopping list is sent to PL when entering the dedicated mode, if the channel configuration uses frequency hopping.

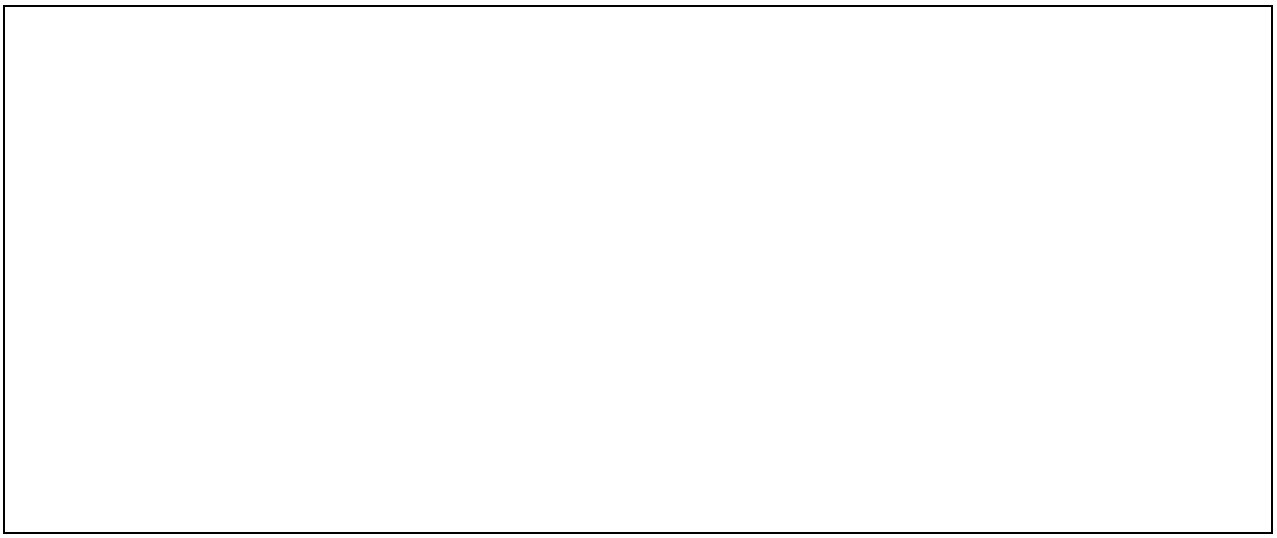
## 7.7.1 Frequency Redefinition




(RR 1)
During an existing link, the hopping list may change. RR receives a FREQUENCY REDEFINITION message from the base station.
(PL 1)
RR sends the new hopping list to PL.
(DL 1)
The FREQUENCY REDEFINITION message contains no cell channel description and none is stored in RR for the cell. RR answers with a RR STATUS message and the cause "cell allocation not available".
(DL 2)
The calculated hopping list contains frequencies which are not supported by the mobile station. RR answers with a RR STATUS message and the cause "frequency not implemented".

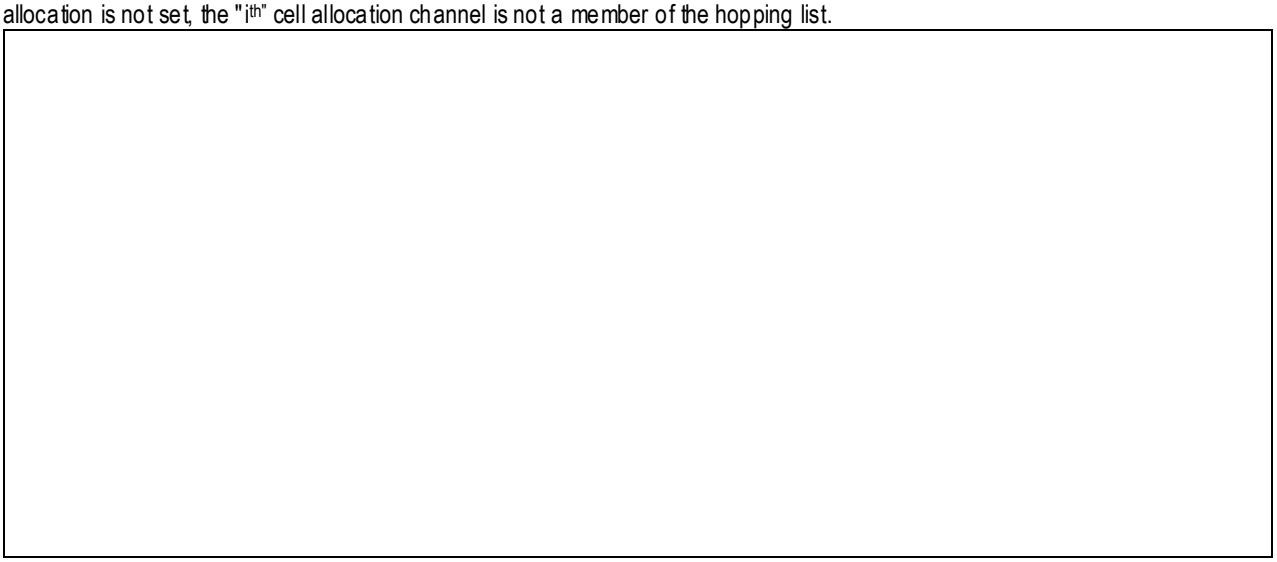
### 7.7.2 Calculating Frequency Hopping List

Changes to the frequency hopping list are signalled by the base station with a FREQUENCY REDEFINITION, ASSIGNMENT COMMAND, or HANDOVER COMMAND message.
Hopping frequencies are signalled to the mobile station as either mobile allocation or as frequency channel sequence.
The frequency channel sequence contains as the first entry, an absolute channel number. The further entries are delta values to the previous entry. A compressed form is achieved by using the frequency channel sequence.



**Frequency Channel Sequence**

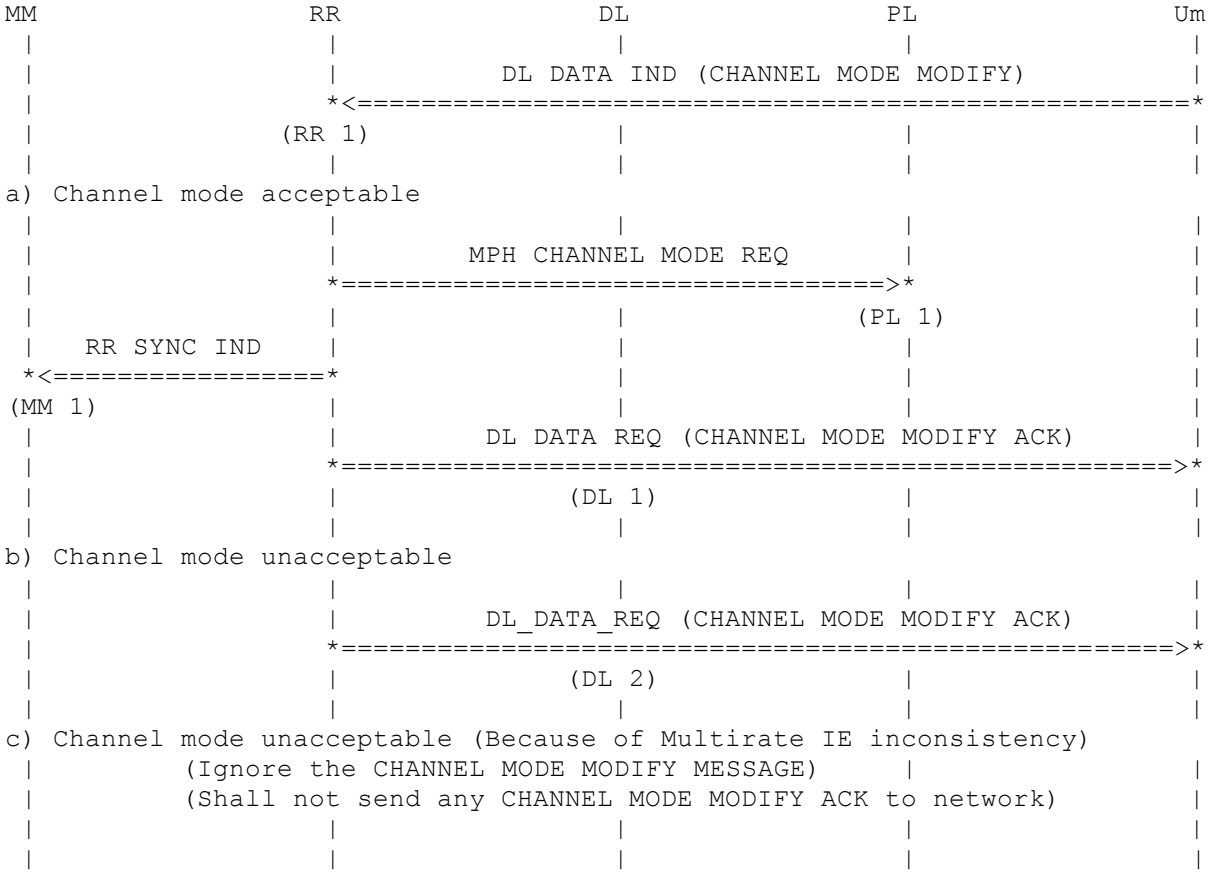
Using mobile allocation for the definition of the hopping list allows a more compressed definition form. A cell allocation must be available in the mobile station. It contains all channels used in the cell. The mobile allocation is a bitmap which determines which cell allocation channels are also members of the hopping list.
If bit "i" of the mobile allocation is set, the "$i^{th}$" cell allocation channel is a member of the hopping list. If bit "i" of the mobile allocation is not set, the "$i^{th}$" cell allocation channel is not a member of the hopping list.



**Mobile Allocation**

## 7.8 Channel Mode Modify

The channel mode modify procedure is used to change the channel mode during an existing connection without changing the channel configuration (channel number, time-slot).




(RR 1)
RR receives the CHANNEL MODE MODIFY message from the base station.
(PL 1)
RR configures PL with the new channel mode.
(MM 1)
MM is informed about the new channel mode.
(DL 1)
RR sends the CHANNEL MODE MODIFY ACK message to the base station. The message contains the new channel mode.
(DL 2)
The mobile station checks the new channel mode. If it is not acceptable (e.g. requiring data services which are not supported by the mobile station), RR sends a CHANNEL MODE MODIFY ACK message with the old channel mode.
(DL 3)
The mobile station checks the new channel mode is AMR. If it is not acceptable because of inconsistent Multirate IE present in the CHANNEL MODE MODIFY procedure, RR shall not send a CHANNEL MODE MODIFY ACK message to the base station.

The channel mode is checked in RR. Depending on the capabilities of the mobile station RR decides to accept the new channel mode or not.

| Channel Mode Coding | Meaning | Accepted by |
|---|---|---|
| 0x03 | Data 12 k | Data Mobiles |
| 0x0B, 0x0F | Data 6 k | Data Mobiles |
| 0x13, 0x17 | Data 3.6 k | Data Mobiles |
| 0x21 | Enhanced Full Rate | Enhanced Full Rate Mobiles |
| 0x05 | Speech Half Rate | Half Rate Mobiles |
| 0x00, 0x01 | Signalling only, Speech Full Rate | all Mobiles |
| 0x0F | Data 14.4 | Data Mobiles |

Notes on missing MPH_CHANNEL_MODE_CNF:

Q1. L23 will send a MPHC_CHANNEL_MODIFY_REQ and the L1 will configure the new channel mode and then send a MPHC_CHANNEL_MODIFY_CON to L23.
What happens if there is an uplink data opportunity during this configuration? Will the L1 call the functions dll_read_sacch() or dll_read_dcch() ?

The network initiates the Channel Mode Modify procedure when it needs to change the channel mode of the TCH (the physical channel cannot be changed with this procedure!),
e.g.:
- to connect an already activated TCH: signaling only to TCH speech or data (as for instance in a very early call procedure)
- to change the data rate of a already connected TCH

The Channel Mode Modify (NW to MS) and Channel Mode Modify Ack (MS to NW) are both sent of the FACCH.

On reception of a MPHC_CHANNEL_MODIFY_REQ message, L1 Asynchronous saves the new channel mode and send back a MPHC_CHANNEL_MODIFY_CON to L23.
It is only as from the following TDMA frame that the new channel mode configuration value will be use by L1 Synchronous: if there is a uplink data opportunity on this TDMA frame, L1 Sync will call the function dll_read_sacch() for SACCH block and dll_read_dcch() for FACCH block.

Q2. If this is the case the message "CHANNEL MODE MODIFY ACK" might be send to the network before the actual channel mode has been changed, also with which channel mode would it be send?

Since the "CHANNEL MODE MODIFY ACK" message is sent on FACCH, the channel mode should have no effect:
according to s922 section 25, the behaviour of L23 on call to dll_read_dcch() is different only in case there is no FACCH block to transmit. The channel mode affects only the TCH blocks: speech or data.

Q3. The issue for L23 is, if L23 should wait for the _CON or if it does not need to (if the functions are not called in between).

According to the answer given for Q2, L23 does not need to wait for the _CON.

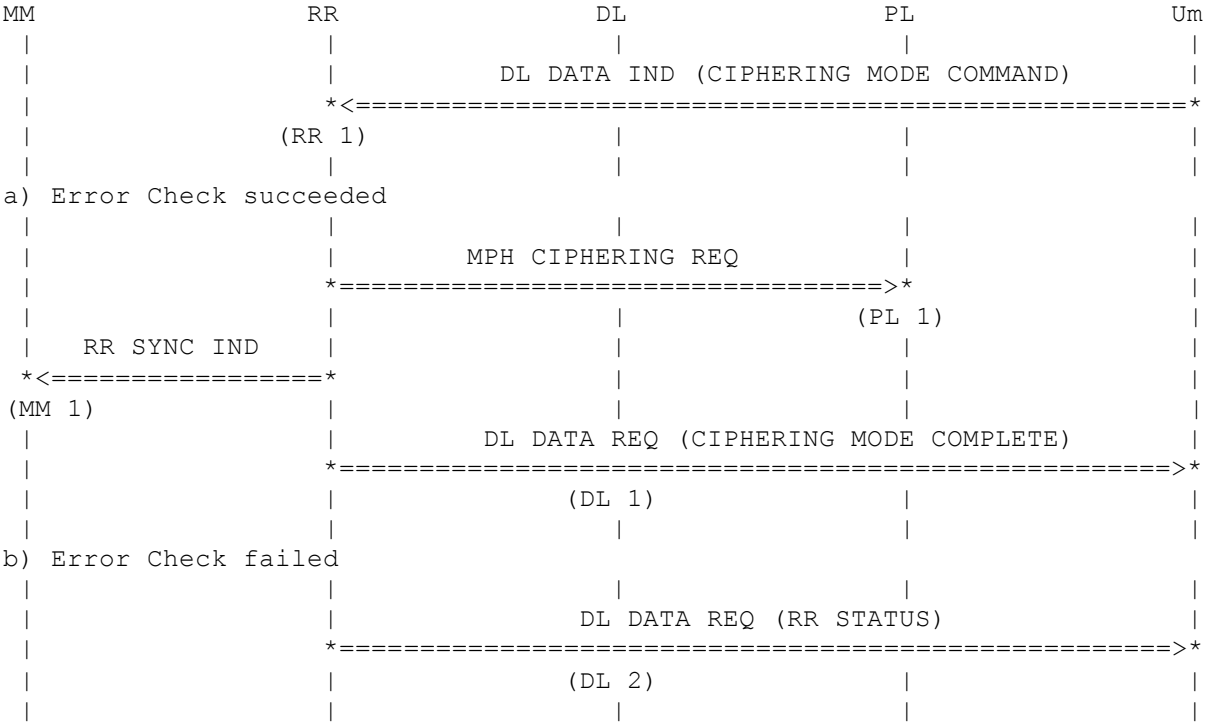
Q4. The same questions also apply for the ciphering procedure.

The Network can enable/disable ciphering (Not change between various ciphering mode!) by sending CIPHERING COMMAND message. The Network starts reception in the new ciphering mode after the message has been sent.
The MS must start transmission and reception in the new mode on reception of the CIPHERING COMMAND message. Finally the Network starts transmitting in the new mode after a CIPHERING COMMAND COMPLETE (MS to NW) or any other correct layer 2 frame, which was sent in the new mode, has been received.

On reception of a MPHC_SET_CIPHERING_REQ message, L1 Asynchronous saves the new ciphering mode and send back a MPHC_SET_CIPHERING_CON to L23. It is only as from the following TDMA frame that the new ciphering mode is loaded by L1 Synchronous to the DSP, and therefore come to effect.

## 7.9 Cipher Mode Setting

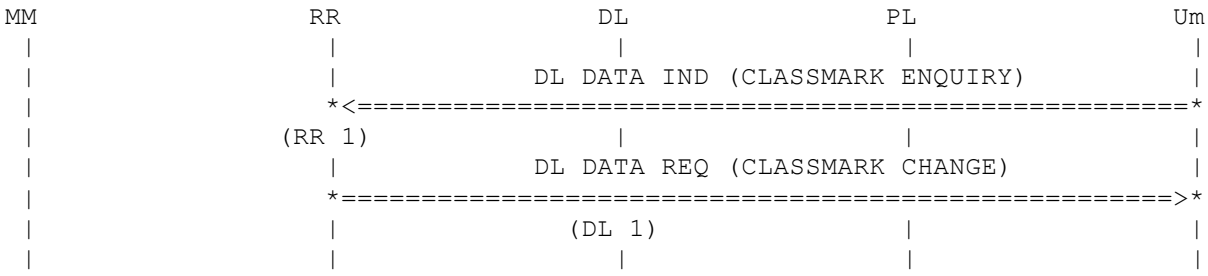
The cipher mode setting procedure is used to switch ciphering on or off.




(RR 1)
RR receives the CIPHERING MODE COMMAND message from the base station.
(PL 1)
RR configures PL with the Kc-Value, the cipher algorithm, and the information whether ciphering is to be switched on or off.
(MM 1)
MM is informed about the ciphering.
(DL 1)
RR sends the CIPHERING MODE COMPLETE message to the base station. If requested, the message contains the mobile station IMEI.
(DL 2)
If the base station requests ciphering although ciphering is already on, RR ignores the message and sends a RR STATUS message with the cause "semantically incorrect content error".

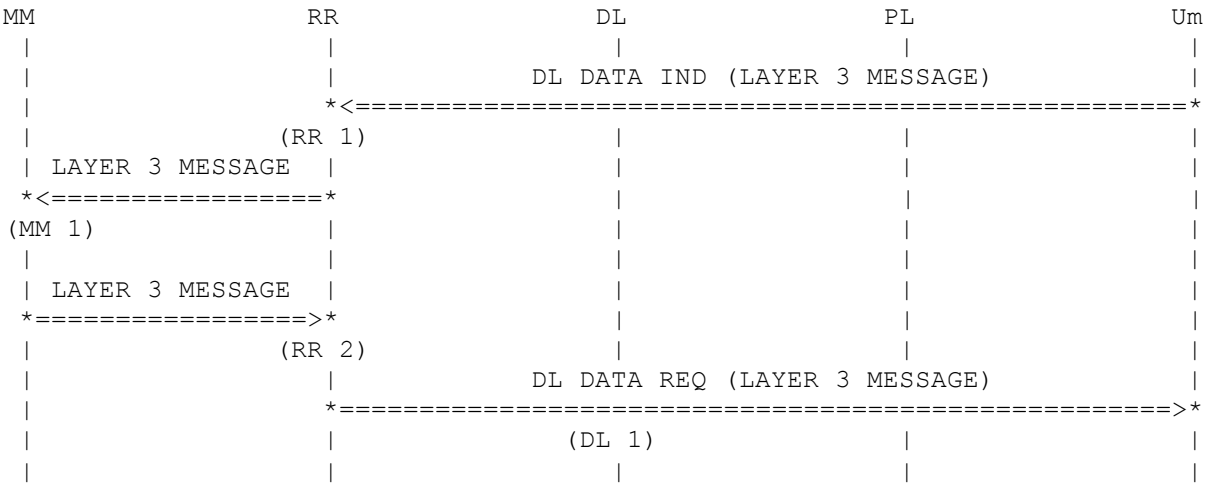
See the notes for Channel Mode Modify for an explanation of the missing MPH_CIPERING_CNF.

## 7.10 Classmark Interrogation




(RR 1)
If the base station needs information about the mobile station power class, it uses the CLASSMARK ENQUIRY message to request the data.
(DL 1)
RR responds with a CLASSMARK CHANGE message.

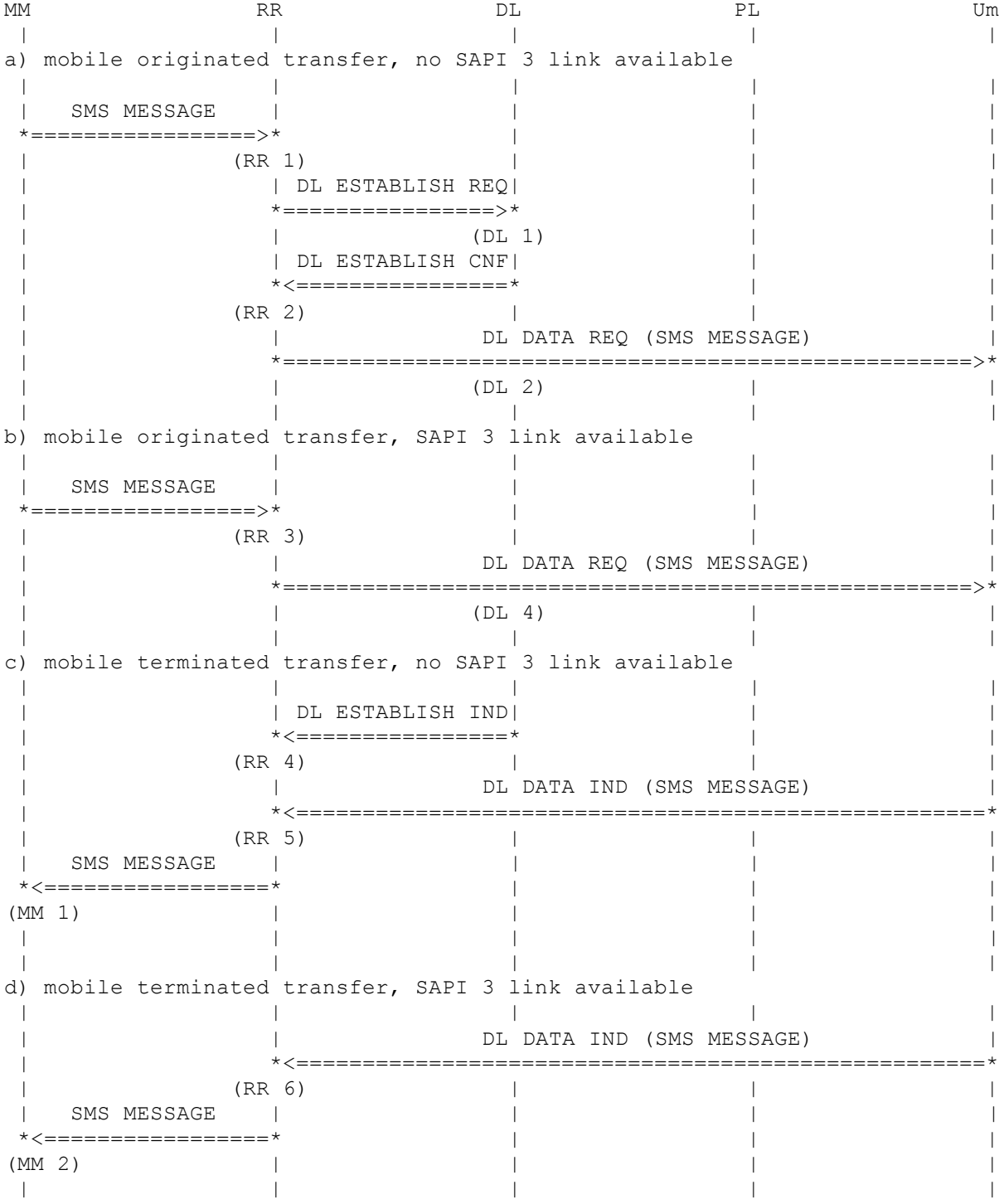
## 7.11 MM, CC, or SS Messages




(RR 1)
RR receives a message (MM, CC, or SS) for the upper layers.
(MM 1)
RR forwards the messages to MM with the primitive RR DATA IND.
(RR 2)
If the upper layer (MM, CC, or SS) wants send a message to the network, MM sends the message to RR with the primitive RR DATA REQ.
(DL 1)
RR adds the channel (SDCCH or TCH) and the alternating changed send sequence number N(SD) to the message. The message is forwarded to DL with the primitive DL DATA REQ.

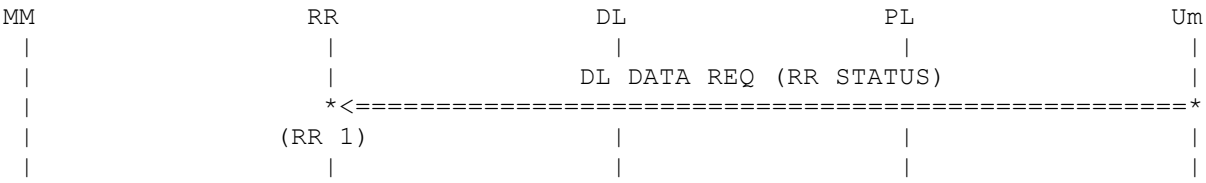
## 7.12 SMS Messages

Short Message Service Messages using Service Access Point Identifier 3 is an additional logical link to the base station.



(RR 1)
RR receives an SMS message. There is no SAPI 3 link available.
(DL 1)
DL receives the primitive DL ESTABLISH REQ for SAPI 3 from RR without a message. The channel is SDCCH if no TCH is available or SACCH if a TCH is available. DL starts the link establishment to the base station.
(RR 2)
After the successful link establishment, RR receives the DL ESTABLISH CNF from DL. The SAPI 3 link is now available for the next channel assignment or handover, until channel release.
(DL 2)
The SMS message is sent via the appropriate channel.
(RR 3)
RR receives an SMS message. A SAPI 3 link is available.
(DL 3)
The SMS message is sent via the appropriate channel.
(RR 4)
The network wants to send an SMS message to the mobile station. There is no SAPI 3 link available yet. The network establishes the SAPI 3 link and RR is informed by the primitive DL ESTABLISH IND. The SAPI 3 link is available until channel release or the next channel assignment or handover.
(RR 5)
RR receives an SMS message from the network.
(MM 1)
RR forwards the messages to MM with the primitive RR DATA IND.
(RR 6)
The network wants to send an SMS message to the mobile station. There is an SAPI 3 link available and RR receives the SMS message.
(MM 2)
RR forwards the messages to MM with the primitive RR DATA IND.

## 7.13 Status

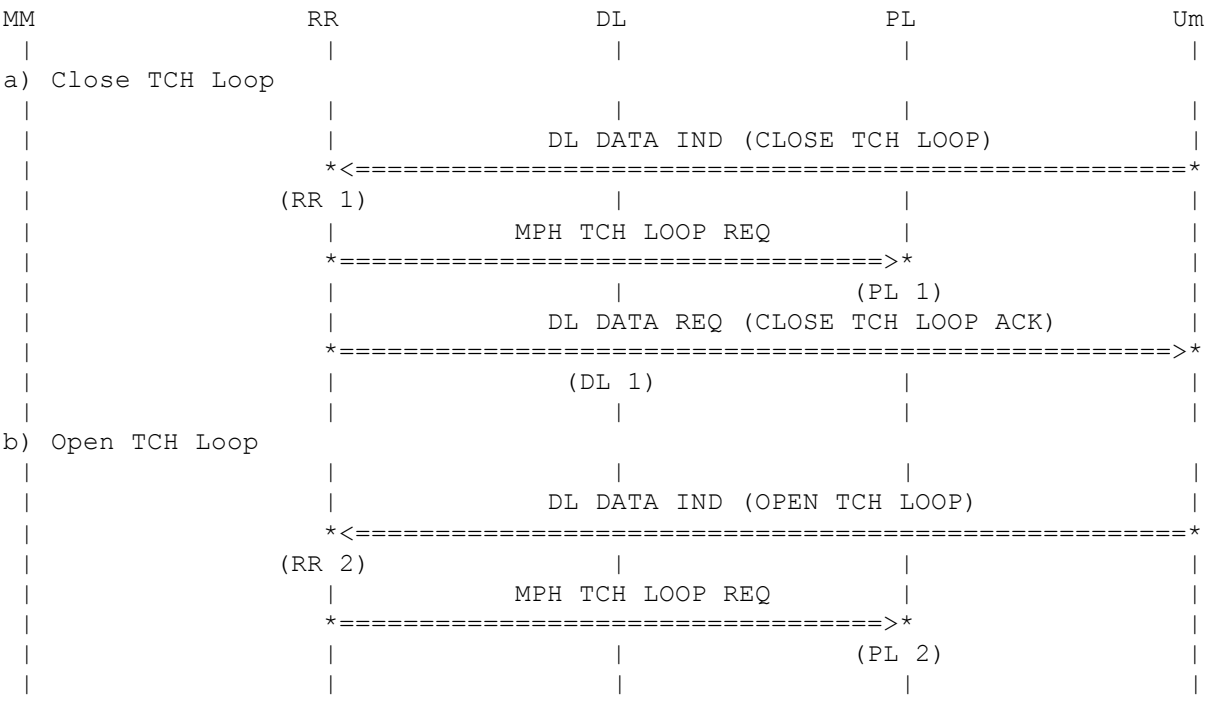



(RR 1)
RR receives an RR STATUS message. It will be ignored.

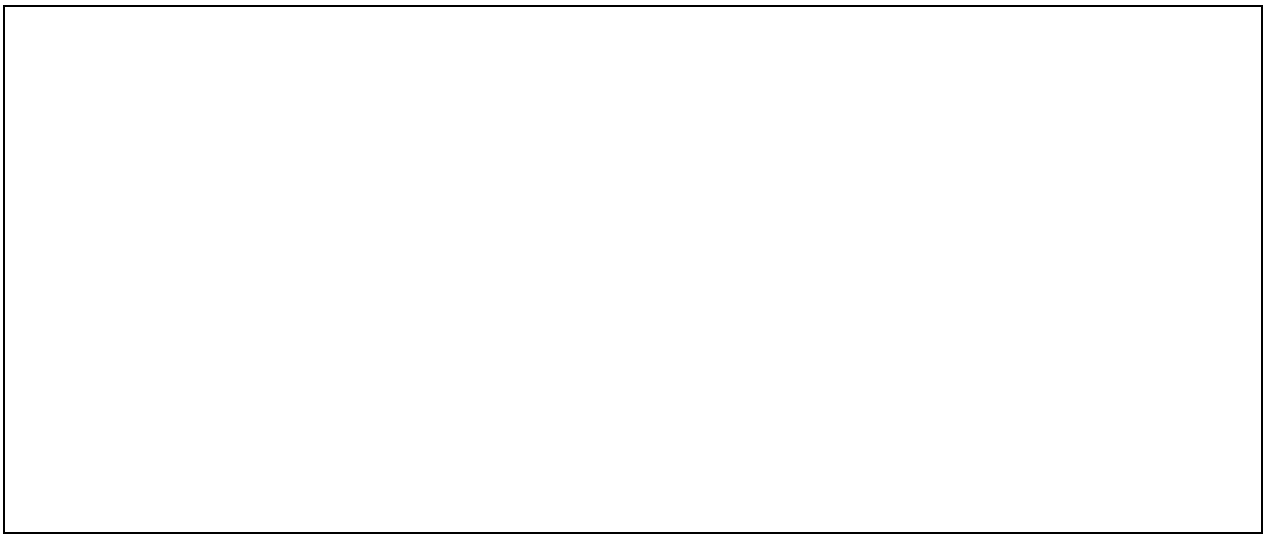
## 7.14 Test Functions

During an existing connection, the mobile station may process various test procedures. A special test SIM card must be inserted. If a SIM card is not inserted, the test messages are ignored.
The test functions are used to test the mobile station via the air-interface. Therefore, a loop is closed in the mobile station. By analysing the response of the mobile station, an external device is able to check the quality the mobile station.

### 7.14.1 TCH Loop

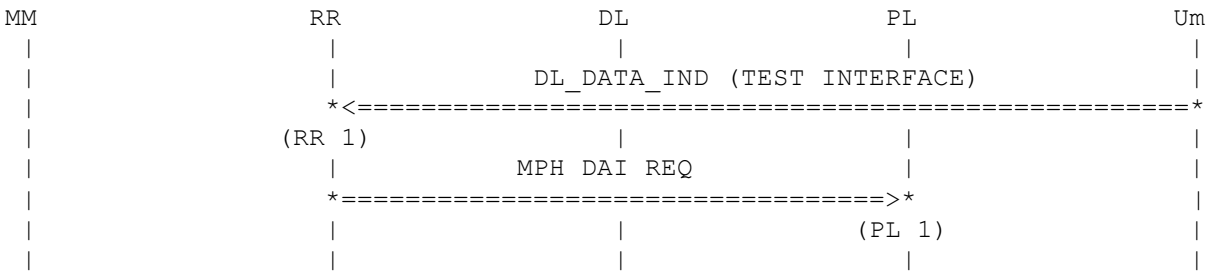


(RR 1)
RR receives the CLOSE TCH LOOP message.
(PL 1)
RR closes the TCH loop in PL. The TCH loop state is stored in RR.
(DL 1)
In response, a CLOSE TCH LOOP ACK message is sent to the base station.
(RR 2)
If the TCH loop is to be reopened, the base station sends an OPEN TCH LOOP message to RR.
(PL 2)
RR opens the TCH loop. The TCH loop state is stored in RR. There is no response to the base station.



**TCH Loop**

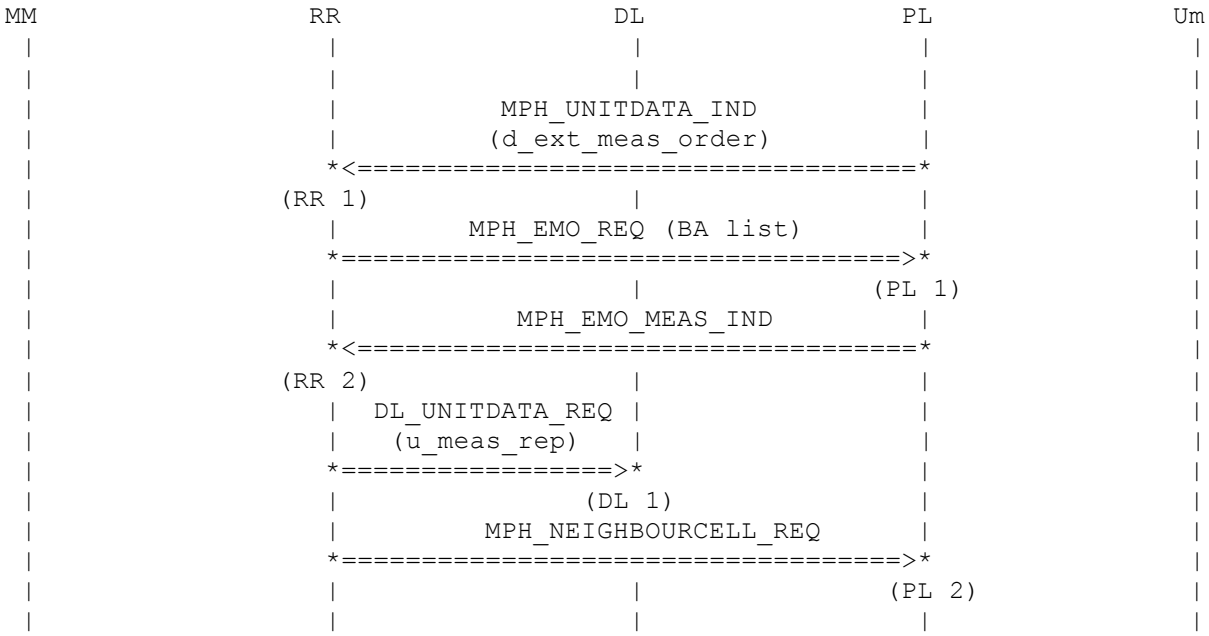
### 7.14.2 Test Interface




(RR 1)
RR receives the TEST_INTERFACE message.
(PL 1)
The message content is forwarded to PL.

## 7.15 Extended Measurement Report

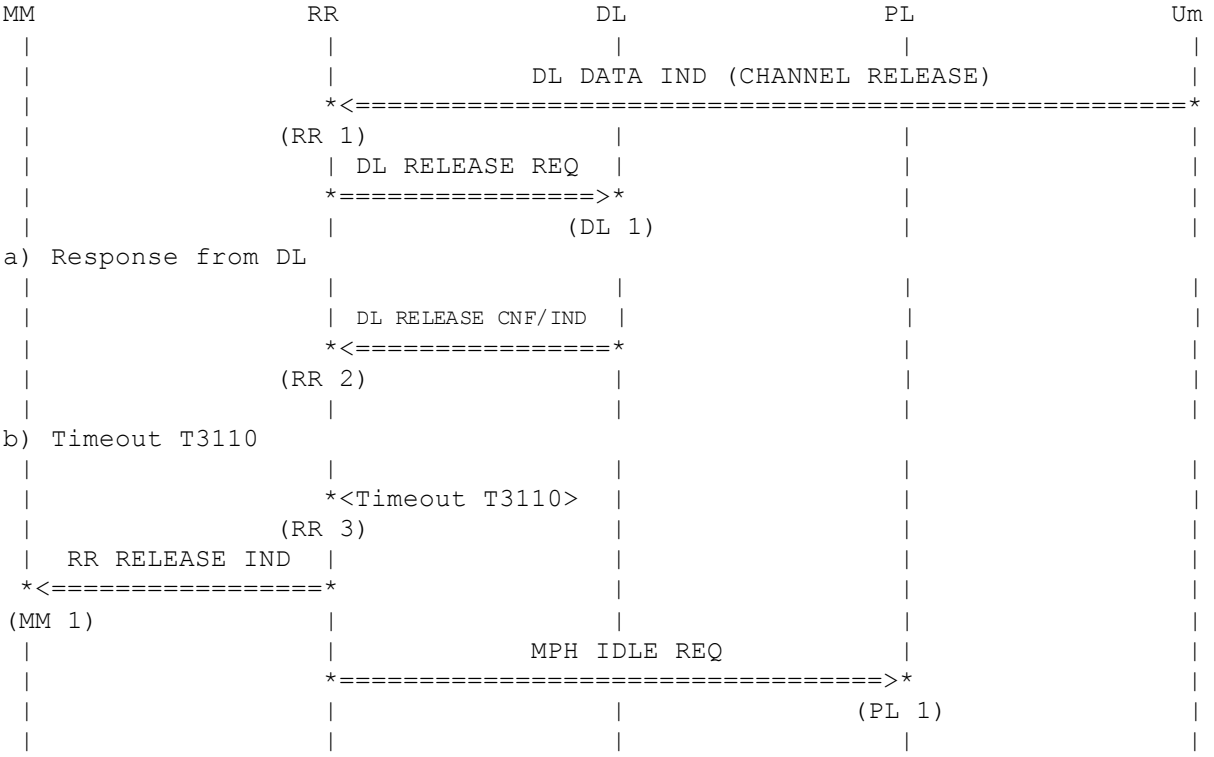
In Dedicated Mode the Network may request a MS to perform measurements on frequencies specified in the EXTENDED MEASUREMENT ORDER (EMO). The MS shall try to perform power measurements on these frequencies during the one reporting period. The result of these measurements are reported in a EXTENDED MEASURMENT REPORT. An ongoing Extended Measurements shall be aborted due to a successful channel change or the reception of another EXTENDED MEASUREMENT ORDER with a different sequence number. If the measurements cannot be performed within 10 seconds, no report shall be sent to the network. Further details are defined in 3GPP TS 04.18.




(RR 1)
RR receives the message EXTENDED MEASUREMENT ORDER (EMO) on the SACCH in unacknowledged mode. RR decodes the sequence number and the frequency list from this message.
(PL 1)
RR requests PL to change the list of frequencies which should be monitored. RR allocates an new BA_ID (range 128 .. 255) and requests PL to use this BA_ID.
(RR 2)
PL performs measurments on the requested frequencies for one reporting period and sends measurement results (MPH_EMO_MEAS_IND) to RR. The result contains the BA_ID which identifies the frequency list used. RR ignores all measurement results from PL which do not contain the expected BA_ID.
(DL 1)
RR constructs an EXTENDED MEASUREMENT REPORT message and send requests DL to send this message on the SACCH.
(PL 2)
RR requests PL to use the frequencies for the "normal" neighour cell monitoring, the EMO procedure is stopped.

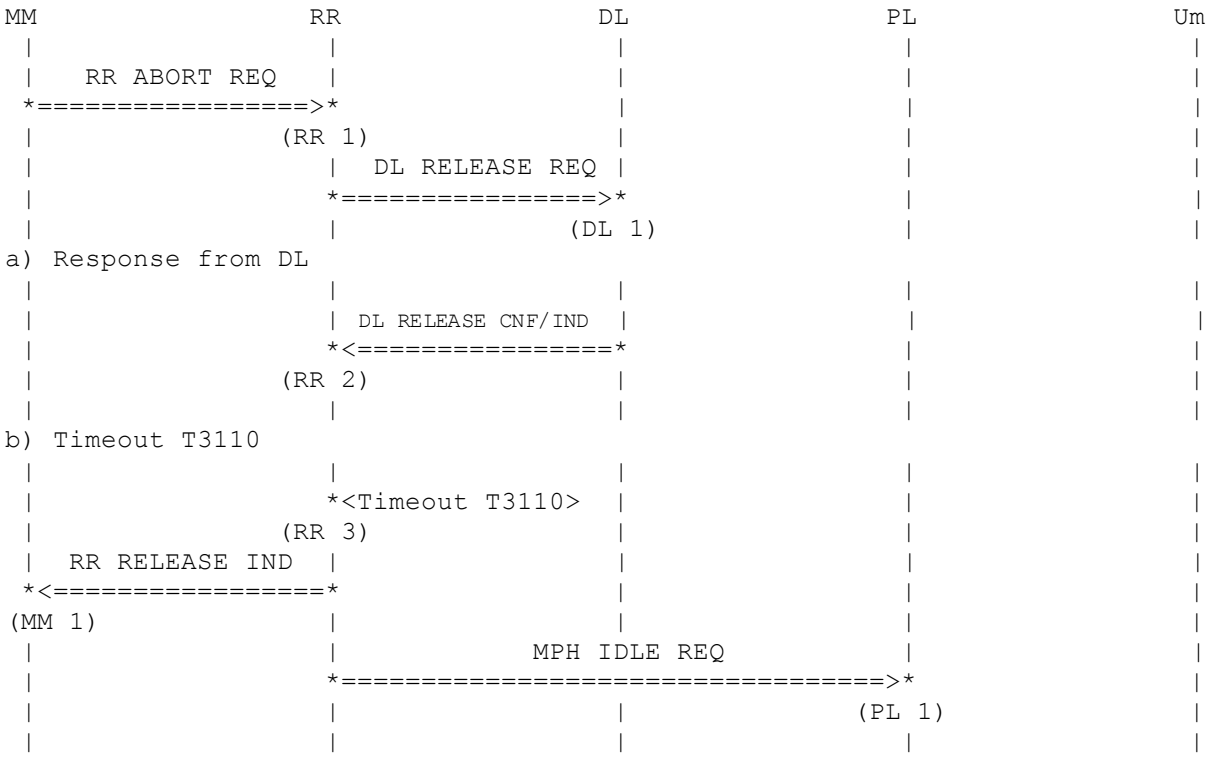
# 8 Release / Abort / Deactivation

## 8.1 Channel Release



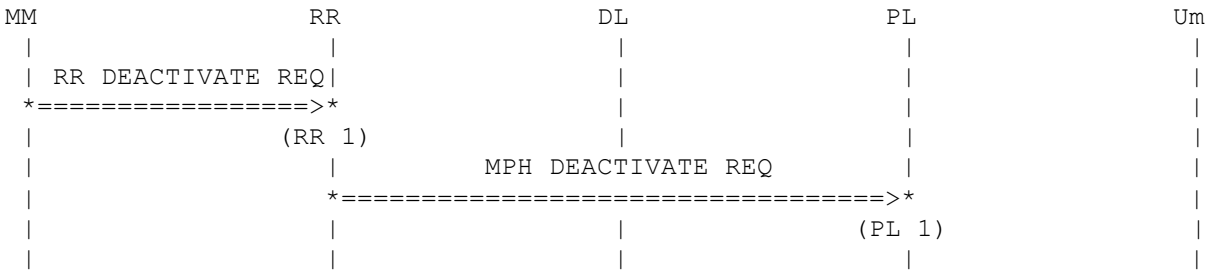

(RR 1)
The base station starts a normal channel release by sending a CHANNEL RELEASE message.
(DL 1)
DL is requested to release the link. The timer T3110 is started.
(RR 2)
DL confirms the link release. T3110 is stopped or...
(RR 3)
...timer T3110 times-out.
(MM 1)
MM is informed about the connection release.
(PL 1)
A cell reselection is initiated in order to find a cell for the idle mode.

## 8.2 Abort




(RR 1)
MM aborts the connection. This is only processed if the SIM card is removed or if the mobile station is switched off.
(DL 1)
DL is requested to release the link. The timer T3110 is started.
(RR 2)
DL confirms the link release. T3110 is stopped or...
(RR 3)
...timer T3110 times-out.
(MM 1)
MM is informed about the connection release.
(PL 1)
A cell reselection is initiated in order to find a cell for the idle mode.

## 8.3 Deactivation




(RR 1)
MM signals the switching off of the mobile station.
(PL 1)
RR deactivates PL and enters the NULL state.

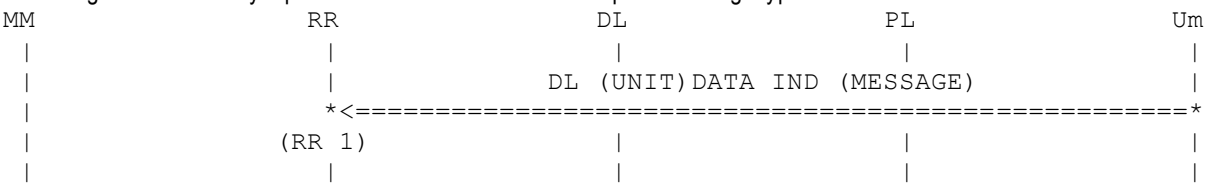
# 9 Error handling

The behaviour of air-interface messages in error situations is defined by GSM. The following errors are listed in order of decreasing priority:

- Message too short
- Unforeseen skip indicator
- Unknown or unforeseen message type
- Non-semantic mandatory information element errors
- Unknown or unforeseen Ies in the non-imperative message part
- Non-imperative message part errors
- Semantically incorrect contents

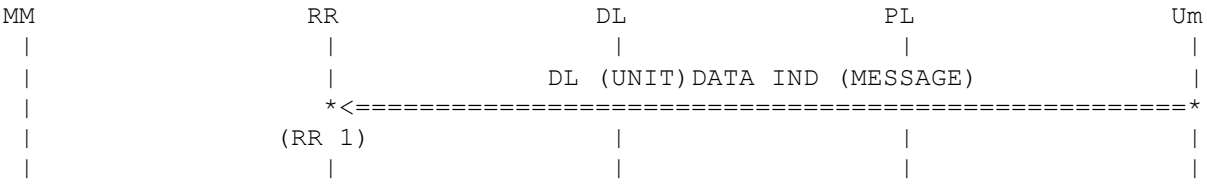
## 9.1 Message too short

A message which has only a protocol discriminator and no complete message type information element



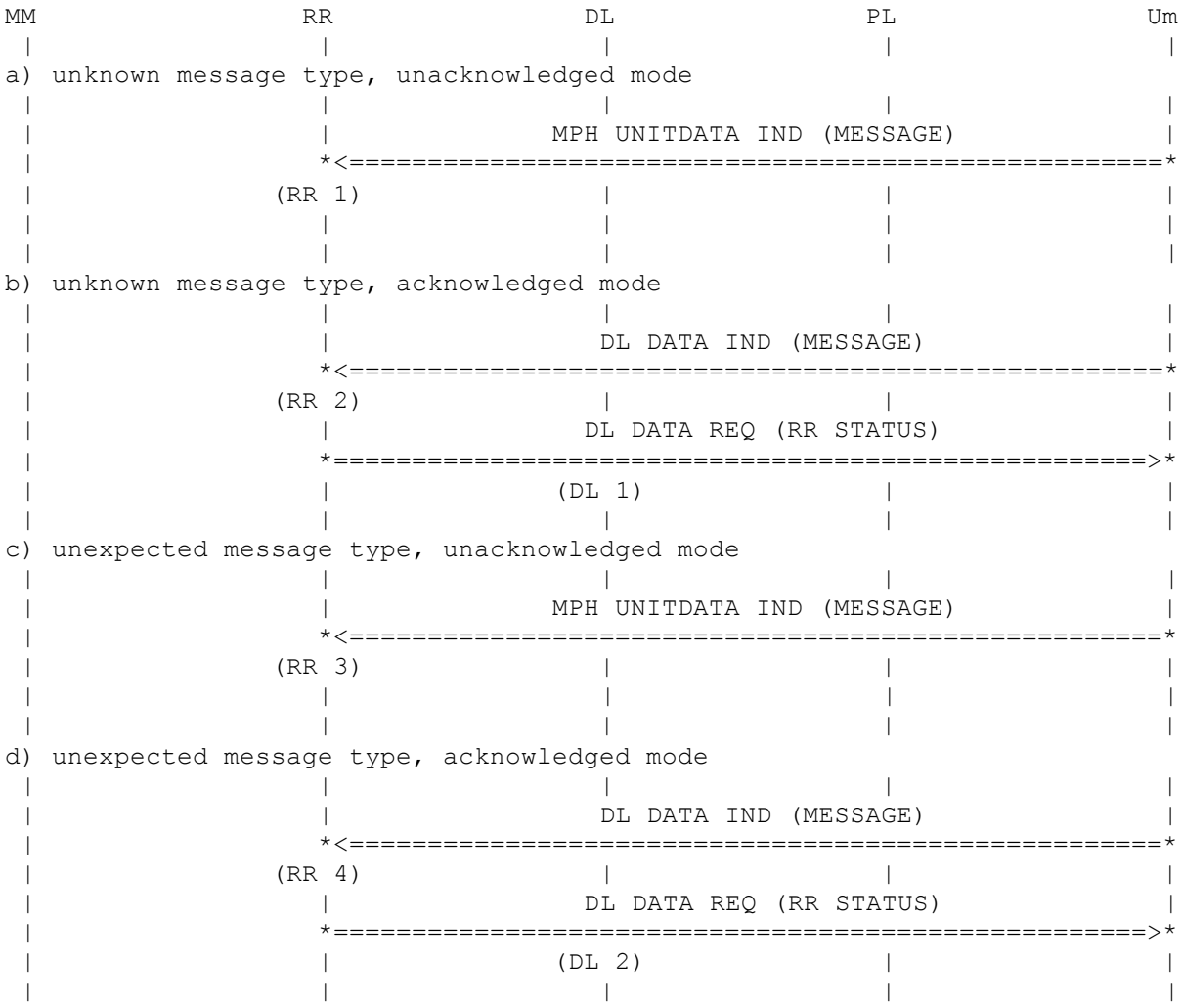

(RR 1)
RR receives a message containing a protocol discriminator only. The message is ignored.

## 9.2 Unforeseen skip indicator




(RR 1)
RR receives a message containing a skip indicator that does not equal zero. The message is ignored.

## 9.3 Unknown or unforeseen message type




(RR 1)
RR receives a non-defined or non-implemented message in unacknowledged mode. The message is ignored.
(RR 2)
RR receives a non-defined or non-implemented message in acknowledged mode. The message is ignored.
(DL 1)
The network receives an RR STATUS message with the cause "#97 message type non-existent or not implemented".
(RR 1)
RR receives a message in unacknowledged mode. The message is recognised by RR and implemented, but at the moment, RR can not process it. The message is ignored.
(RR 2)
RR receives a message in unacknowledged mode. The message is recognised by RR and implemented, but at the moment, RR can not process it. The message is ignored.
(DL 1)
The network receives an RR STATUS message with the cause "#98 message type not compatible with protocol state".

## 9.4 Non-semantic mandatory information element errors

A non-semantic mandatory information element error may occur when:

- missing mandatory information element

An information element is missing in the mandatory part of a message.

- syntactically incorrect mandatory information element

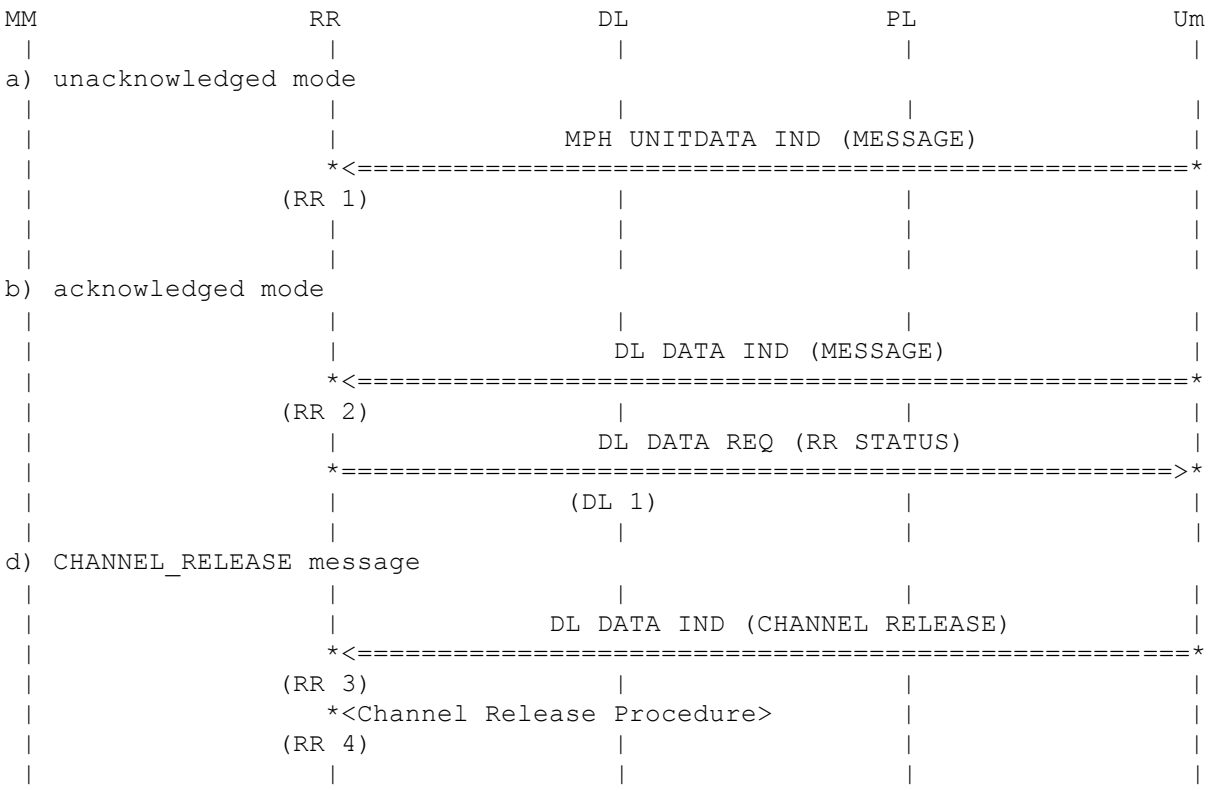
The parameters of an information element are set to reserved values or the internal structure of information element is failing.

- Information element unknown in the message encoded as compression required

An unexpected optional information element is found in a message. The information element's information element identifier (the first byte of an optional information element) contains only "zero" in the four upper bits. This is called "compression required". These identifiers have a reserved function for future extensions.

- Out of sequence information element encoded as compression required

Optional information elements are being detected in an improper order. The identifier of such an information element is "compression required".




(RR 1)
RR receives a message in unacknowledged mode with a non-semantic mandatory information element error. The message is ignored.
(RR 2)
RR receives a message in acknowledged mode with a non-semantic mandatory information element error. The message is ignored.
(DL 1)
RR sends an RR STATUS message with the cause "#96 invalid mandatory information as response to the network".
(RR 3)
RR receives a CHANNEL RELEASE message in acknowledge mode. Although the message contains a non-semantic mandatory information element error, the channel release procedure is initiated.

## 9.5 Unknown or unforeseen IEs in the non-imperative message part

An "unknown or unforeseen information elements in the non-imperative message part" error may occur if:

- Information element identifier unknown in the message

The message includes unexpected optional information elements and the information element identifier is not "compression required". These information elements are ignored by RR.

- Out of sequence information element identifier

RR ignores all information elements, which are not "compression required" and which are detected in an improper order.

- Repeated information elements

If more information elements than specified are repeated into a message, the information element first encountered will be processed and all others will be ignored.

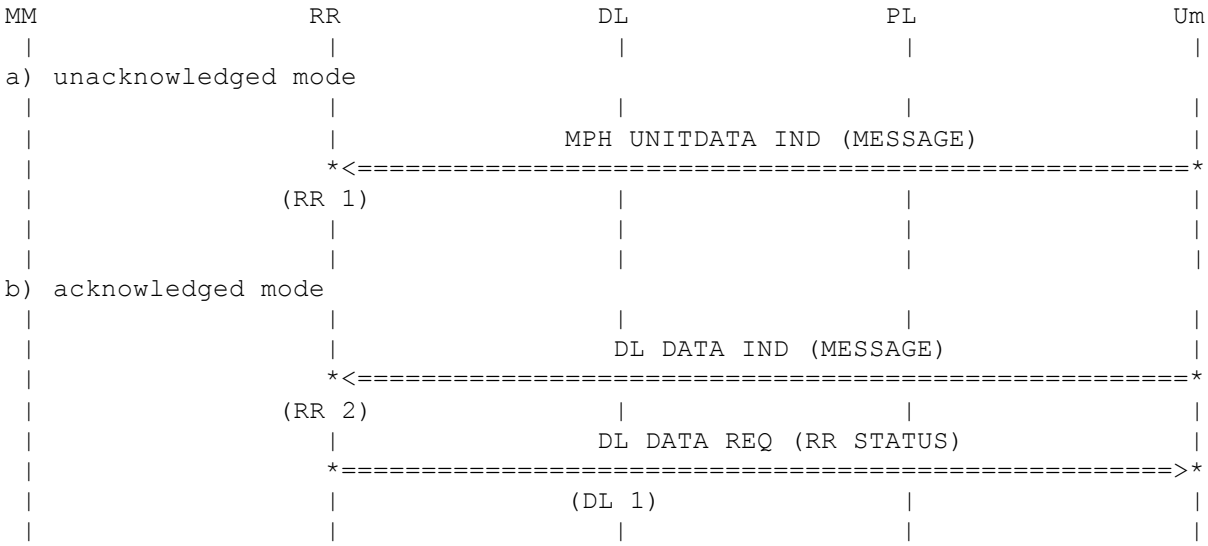
## 9.6 Non-imperative message part errors

A non-imperative message part error may occur if:

- Syntactically incorrect optional information element

The message contains optional information elements, which are not "compression required". They are ignored by RR.

- Conditional information element error



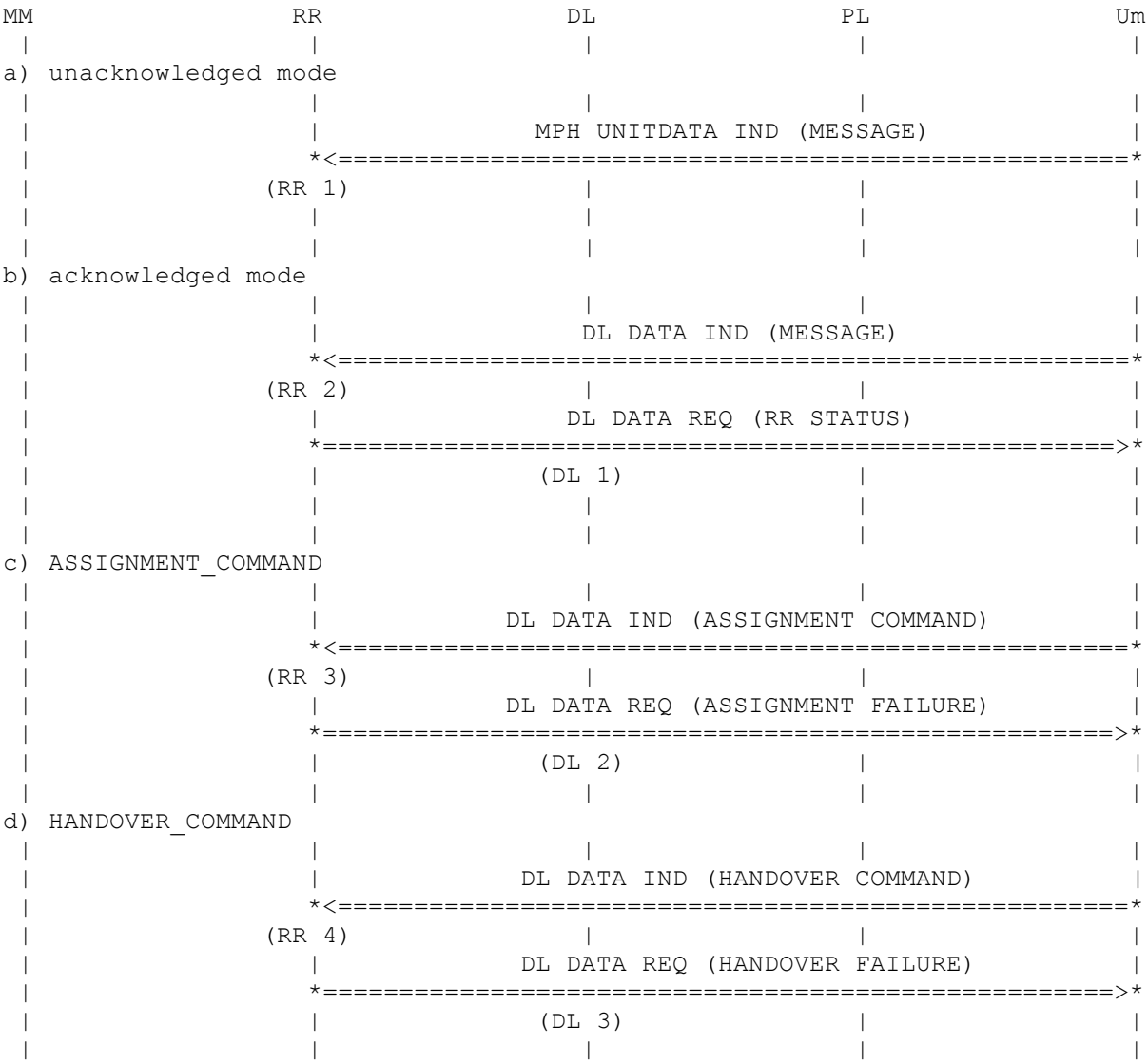

(RR 1)
RR receives a message in unacknowledged mode. A missing, unexpected, or syntactically wrong conditional information element is detected. The message is ignored.
(RR 2)
RR receives a message in acknowledged mode. A missing, unexpected, or syntactically wrong conditional information element is detected. The message is ignored.
(DL 1)
RR sends an RR STATUS message to the network with the cause "#100 Conditional information element error".

For the detection of errors in conditional information elements, the following tests are processed by RR:

| Message | Condition | Action |
|---|---|---|
| ASSIGNMENT_COMMAND | Channel description indicates frequency hopping, but no frequency list or mobile allocation is included. | Ignore message, RR_STATUS message with cause #100 |
| | Channel description indicates frequency hopping and both frequency list and mobile allocation are included. | Ignore message, RR_STATUS message with cause #100 |
| HANDOVER_COMMAND | Channel description indicates frequency hopping, but no frequency list, frequency short list, mobile allocation, or frequency channel sequence is included. | Ignore message, RR_STATUS message with cause #100 |
| | Channel description indicates frequency hopping, but more than one frequency list, frequency short list, mobile allocation, and frequency channel sequence is included. | Ignore message, RR_STATUS message with cause #100 |
| | Channel description indicates frequency hopping, mobile allocation is available, but no cell channel description. | Ignore message, RR_STATUS message with cause #100 |
| | Real time difference is not included, but handover mode is pseudo-synchronised. | Ignore message, RR_STATUS message with cause #100 |
| SYSTEM_INFO_TYPE_4 | CBCH channel description indicated frequency hopping, CBCH mobile allocation is not included. | Ignore CBCH channel description |

## 9.7 Semantically incorrect contents

A semantically incorrect contents error occurs if the mobile station is unable to use the requested resources or the contents are not acceptable to the state of the mobile station.
RR checks each frequency list as to whether or not the included frequencies are supported by the mobile station (e.g. frequencies in the extension band) and the channel modes as to whether or not they are supported (e.g. TCH half-rate).
When starting the cipher mode procedure, it is checked to see whether or not ciphering is already switched on.



(RR 1)
RR receives a message in unacknowledged mode and a semantically incorrect contents error is detected. The message is ignored.
(RR 2)
RR receives a message in acknowledged mode and a semantically incorrect contents error is detected. The message is ignored.
(DL 1)
RR sends an RR STATUS message to the network with the cause "#95 Semantically incorrect message".
(RR 3)
RR receives an ASSIGNMENT COMMAND message and detects a semantically incorrect contents error. The message is ignored.
(DL 2)
RR sends an ASSIGNMENT FAILURE message with the cause "#95 Semantically incorrect message".
(RR 4)
RR receives a HANDOVER COMMAND message and detects a semantically incorrect contents error. The message is ignored.
(DL 3)
RR sends a HANDOVER FAILURE message with the cause "#95 Semantically incorrect message".

# Appendices

## A. Acronyms

**DS-WCDMA** Direct Sequence/Spread Wideband Code Division Multiple Access

## B. Glossary

**International Mobile Telecommunication 2000 (IMT-2000/ITU-2000)** Formerly referred to as FPLMTS (Future Public Land-Mobile Telephone System), this is the ITU's specification/family of standards for 3G. This initiative provides a global infrastructure through both satellite and terrestrial systems, for fixed and mobile phone users. The family of standards is a framework comprising a mix/blend of systems providing global roaming. <URL: http://www.imt-2000.org/>