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*Technical Specification*

## **Digital cellular telecommunications system (Phase 2+); Performance requirements on mobile radio interface (3GPP TS 44.013 version 4.0.0 Release 4)**



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# Foreword

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

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# 1 Scope

The present document specifies measurable performance requirements for signalling aspects of Mobile Stations (MS)s. To allow implementation flexibility it has been chosen to specify requirements on the whole Mobile Station rather than to specify requirements on each "OSI layer". As a consequence the performance requirements do not fit conveniently in specifications such as GSM 04.08 [4] (layer 3 only) or GSM 04.06 [3] (layer 2 only).

The main aim of the present document is to provide the justification for testing of requirements that are not included in other GSM specifications. Where specific requirements are included in other GSM specifications they are not duplicated here.

MSs have to perform a wide variety of functions. As a consequence most performance measurements have to be made under a set of defined conditions: where necessary, these are included in the present document.

Where necessary certain assumptions are made about the interaction times between the mobile equipment and the SIM. If the (test) SIM does not respond within the assumed time then appropriate allowances shall be made.

Additionally, it is intended that the present document should contain sufficient requirements to enable some undefined network timers in GSM 04.08 [4] to be calculated.

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# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".
- [3] GSM 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".
- [4] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".
- [5] GSM 04.86: "Digital cellular telecommunications system (Phase 2+); Advice of Charge (AoC) supplementary services - Stage 3".
- [6] GSM 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".
- [7] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

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## 3 Abbreviations and definitions

### 3.1 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04 [1].

### 3.2 Definitions

For the purposes of the present document, the following definition applies:

**ready to transmit:** in the present document the phrase "ready to transmit the message before time x" is defined to mean that the MS shall transmit part of that message no later than the first burst of the first TCH or control channel block that occurs after time x.

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## 4 Default conditions

Unless otherwise stated, throughout the present document the following conditions are associated with the requirements:

- ideal radio link with an insignificant bit error rate;
- no other signalling is in progress on the main DCCH;
- messages sent by the network are correctly formed;
- the only established data link (or the only data link to be established) is on SAPI 0;
- any Starting Time IE that is included in a message sent by the network does not require the action to be delayed;
- cells are not barred and all access classes are allowed;
- the layer 2 performance of the network shall satisfy the "System Performance Requirements" of subclause 5.9 of GSM 04.06 [3];
- messages sent by the network may contain any set of optional IEs, and any permitted set of conditional IEs;
- the mobile has a valid SIM inserted, is powered on, and the SIM's update status is "updated"; and
- on the CCCH, the Page Mode IE is not set to "paging reorganization" or "same as before".

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## 5 Requirements

### 5.1 General requirements

#### 5.1.1 Response to layer 3 message

The requirements of subclause 5.1.1 apply if there are no specific requirements for a layer 3 message in other parts of clause 5.

If the last timeslot of the message block containing a network command occurs at time T, then the MS shall be ready to transmit the response before time T + 500 ms.

## 5.1.2 Response to an erroneous layer 3 message

If the last timeslot of the message block containing an erroneous RR, MM or CC message occurs at time T and if GSM 04.08 [4] requires a status message to be returned to the network then the MS shall be ready to transmit the RR-STATUS or MM-STATUS or STATUS message before  $T + 500$  ms.

## 5.2 Layer 3 Radio Resource signalling

### 5.2.0 Paging

If access to the network is allowed and the MS has been camped on a suitable cell for at least 2 seconds and if the last timeslot of the message block containing a PAGING REQUEST message addressing the MS occurs at time T, then the MS shall be ready to transmit the CHANNEL REQUEST message before  $T + 0,7$  seconds.

### 5.2.1 Paging and cell reselection after channel release

If the last timeslot of the message block containing a CHANNEL RELEASE message occurs at time T the MS shall respond to PAGING REQUEST messages sent later than  $T + 1,0$  seconds.

### 5.2.2 Paging commands and immediate assignment rejection (Timer T3122)

If the last timeslot of the message block containing an IMMEDIATE ASSIGNMENT REJECT message is sent at time T and contains a Wait Indication of W seconds then the MS shall at least respond to PAGING REQUEST messages sent later than  $T + (W + 1)$  seconds.

### 5.2.3 Immediate assignment (Timer T3101)

If the last timeslot of the message block containing an IMMEDIATE ASSIGNMENT (or IMMEDIATE ASSIGNMENT EXTENDED) message is transmitted at time T then, the MS shall be ready to transmit the SABM frame with its information field before  $T + 25$  ms. This requirement shall apply for assignment to TCH/F, TCH/H and SDCCH.

### 5.2.4 Channel assignment

If the last timeslot of the message block containing an ASSIGNMENT COMMAND occurs at time T, then the MS shall be ready to transmit the ASSIGNMENT COMPLETE message before  $T + 600$  ms.

If the last timeslot of the message block containing an ASSIGNMENT COMMAND occurs at time T and this ASSIGNMENT COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the ASSIGNMENT FAILURE message on the old channel before  $T + 2$  seconds.

If the last timeslot of the message block containing an ASSIGNMENT COMMAND occurs at time T and this ASSIGNMENT COMMAND is such that the MS shall not attempt to establish a layer 2 link on the new channel, then the MS shall be ready to transmit any ASSIGNMENT FAILURE message on the old channel before  $T + 500$  ms.

### 5.2.5 Channel mode modify

If the last timeslot of the message block containing a CHANNEL MODE MODIFY message occurs at time T, then the MS shall be ready to transmit the CHANNEL MODE MODIFY ACKNOWLEDGE message before  $T + 300$  ms. In the case that the call is a voice group or voice broadcast call the MS shall be ready to transmit the CHANNEL MODE ACKNOWLEDGE message before  $T + 50$  ms.



## 5.2.6 Handover access

### 5.2.6.1 Finely, pseudo and pre synchronized cases

If the last timeslot of the message block containing a HANOVER COMMAND message to a full rate TCH occurs at time T, then the MS shall be ready to transmit the HANOVER COMPLETE message before T + 650 ms.

If the last timeslot of the message block containing a HANOVER COMMAND message to a half rate TCH occurs at time T, then the MS shall be ready to transmit the HANOVER COMPLETE message before T + 900 ms.

If the last timeslot of the message block containing a HANOVER COMMAND message to an SDCCH occurs at time T, then the MS shall be ready to transmit the HANOVER COMPLETE message before T + 1,5 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to a full rate TCH occurs at time T and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old full rate TCH before T + 2 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to a full rate TCH occurs at time T and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old SDCCH before T + 2,5 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to a half rate TCH occurs at time T and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old half rate TCH before T + 3 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to a half rate TCH occurs at time T and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old SDCCH before T + 3 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to an SDCCH occurs at time T and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old SDCCH before T + 5 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND occurs at time T and this HANOVER COMMAND is such that the MS shall not attempt to establish a layer 2 link on the new channel, then the MS shall be ready to transmit any HANOVER FAILURE message on the old channel before T + 500 ms.

### 5.2.6.2 Non synchronized case

If the last timeslot of the message block containing the (one and only) PHYSICAL INFORMATION message occurs at time T, then on a full rate TCH the MS shall be ready to transmit the HANOVER COMPLETE message before T + 500 ms.

If the last timeslot of the message block containing the (one and only) PHYSICAL INFORMATION message occurs at time T, then on a half rate TCH the MS shall be ready to transmit the HANOVER COMPLETE message before T + 750 ms.

If the last timeslot of the message block containing the (one and only) PHYSICAL INFORMATION message occurs at time T, then on an SDCCH the MS shall be ready to transmit the HANOVER COMPLETE message before T + 1,5 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to either a full rate or a half rate TCH occurs at time T and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old TCH before T + 1,1 seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to an SDCCH occurs at time T and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus

reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old SDCCH before  $T + 2$  seconds.

If the last timeslot of the message block containing a HANOVER COMMAND to either a full rate or a half rate TCH occurs at time  $T$  and this HANOVER COMMAND is such that the MS tries but fails to establish a layer 2 link on the new channel and thus reverts to the old channel, then the MS shall be ready to transmit the HANOVER FAILURE message on the old SDCCH before  $T + 1,7$  seconds.

If the last timeslot of the message block containing a HANOVER COMMAND occurs at time  $T$  and this HANOVER COMMAND is such that the MS shall not attempt to establish a layer 2 link on the new channel, then the MS shall be ready to transmit any HANOVER FAILURE message on the old channel before  $T + 500$  ms.

## 5.2.7 Encryption

If the last timeslot of the message block containing a CIPHERING MODE COMMAND message occurs at time  $T$ , then the MS shall be ready to transmit the CIPHERING MODE COMPLETE message before  $T + 500$  ms.

## 5.2.8 Classmark change

While the MS has an active RR connection, any change in the MS's capabilities that are indicated in the Mobile Station Classmark 2 or 3 IEs shall cause a CLASSMARK CHANGE message to be sent to the network. The MS shall be ready to transmit the CLASSMARK CHANGE message not later than 1 second after the change in capabilities.

## 5.2.9 Classmark interrogation

If the last timeslot of the message block containing a CLASSMARK ENQUIRY message occurs at time  $T$ , then the MS shall be ready to transmit the CLASSMARK CHANGE message before  $T + 300$  ms.

## 5.2.10 Release (Timer T3110)

If the last timeslot of the message block carrying the CHANNEL RELEASE message occurs at time  $T$ , then the MS shall cease transmissions on all channels before  $T + 500$  ms.

## 5.2.11 Early sending of the CLASSMARK CHANGE message

During a contention resolution procedure, if the last timeslot of the block containing a Layer 2 UA frame, occurs at time  $T$ , then the MS shall be ready to transmit the CLASSMARK CHANGE message, if applicable (see GSM 04.06 [3] and GSM 04.08 [4]), before  $T + 40$  ms.

# 5.3 Layer 3 Mobility Management signalling

## 5.3.1 Periodic location updating timer

When the T3212 time-out value is set to the non-zero value  $P$  and the last timeslot of the message block containing a CHANNEL RELEASE message is transmitted at time  $T$  then, assuming the next event shall be the periodic location update, the next CHANNEL REQUEST message shall be transmitted between time  $T + P$  decihours - 15 seconds and time  $T + P$  decihours + 15 seconds.

## 5.3.2 Identification

If the last timeslot of the message block containing an IDENTITY REQUEST message occurs at time  $T$ , then the MS shall be ready to transmit the IDENTITY RESPONSE message before  $T + 600$  ms. This requirement assumes that the ME has to wait less than 100 ms to obtain any necessary responses from the SIM.

### 5.3.3 Authentication

If the last timeslot of the message block containing an AUTHENTICATION REQUEST message occurs at time T, then the MS shall be ready to transmit the AUTHENTICATION RESPONSE message before T + 1 second. This requirement assumes that the ME has to wait less than 500 ms to obtain any necessary responses from the SIM.

### 5.3.4 T3240 expiry

If the last timeslot of the message block containing an AUTHENTICATION REJECT message; or a LOCATION UPDATING ACCEPT message (without a Follow On Proceed IE); or a LOCATION UPDATING REJECT message; or a CM SERVICE REJECT message (and no other MM connection is active) occurs at time T, and the network does not send a CHANNEL RELEASE message but does maintain the RR connection, then the MS shall cease transmission on all channels before T + 12 seconds.

### 5.3.5 TMSI reallocation

If the last timeslot of the message block containing either a TMSI REALLOCATION COMMAND, or a LOCATION UPDATING ACCEPT with a TMSI in the Mobile Identity IE, occurs at time T, then the MS shall be ready to transmit the TMSI REALLOCATION COMPLETE message before T + 500 ms.

### 5.3.6 IMSI detach

The requirements of this subclause only apply if the network indicates on the BCCH that IMSI detach shall be used.

If it is possible to switch the mobile off, or if it is possible to remove the SIM whilst the mobile is powered on, then when such an action is performed in idle mode at time T, the first CHANNEL REQUEST message for the IMSI Detach procedure shall be transmitted before T + 2 seconds.

If it is possible to switch the mobile off, or if it is possible to remove the SIM whilst the mobile is powered on, then when such an action is performed in the Active (U10) state of a call at time T, the MS shall be ready to transmit the IMSI DETACH INDICATION message before T + 1 second.

If the last timeslot in which the IMSI DETACH message is sent occurs at time T then the MS shall cease transmission on all channels before T + 6 seconds.

### 5.3.7 Location updating with random access failure

In an environment with only one suitable cell (see GSM 03.22 [2] for the definition of a "suitable cell"), if a location updating attempt suffers a random access failure (see GSM 04.08 [4]) with the last CHANNEL REQUEST message being transmitted at time T, then the first re-attempt shall result in a CHANNEL REQUEST message being transmitted before T + 15 seconds.

### 5.3.8 Follow on call

If the last timeslot of the message block containing a LOCATION UPDATING ACCEPT message with a Follow on Proceed IE occurs at time T and the MS has a CM application request pending, then the MS shall be ready to the CM SERVICE REQUEST message before T + 500 ms.

## 5.4 Layer 3 Call Control signalling

### 5.4.1 Time to send SETUP message

In the case of a MS originated call, if the last timeslot of the message block containing a CM SERVICE ACCEPT message occurs at time T then the MS shall be ready to transmit the SETUP message before T + 500 ms. In the case that the call is a voice group or voice broadcast call the MS shall be ready to transmit the SETUP message before T + 50 ms.

In the case of a MS originated call, if the last timeslot of the message block containing a CIPHERING MODE COMMAND message occurs at time T, then the MS shall be ready to transmit the SETUP message before T + 750 ms. In the case that the call is a voice group or voice broadcast call the MS shall be ready to transmit the SETUP message before T + 50 ms.

In the case of a MS originated call, if the last timeslot of the message block containing a MM GO ON message occurs at time T, then the MS shall be ready to transmit the SETUP message before T + 50 ms. In the case that the call is a voice group or voice broadcast call the MS shall be ready to transmit the SETUP message before T + 50 ms.

## 5.4.2 Response times to CC messages

For the commands and responses listed in table 1, the following shall apply:

- if the last timeslot of the message block in which the "command" message is sent occurs at time T, then the MS shall be ready to transmit any one of the possible "responses" before time T + W.

In table 1, the second figure, where provided, represents the time that must be achieved in the case of a voice group or voice broadcast call.

**Table 1: Call Control message response times**

command (network --> MS)	response(s) (MS --> network)	W
CONNECT	CONNECT ACKNOWLEDGE	500 ms, 50 ms
SETUP	(as first response message) CALL CONFIRMED or ALERTING or CONNECT or RELEASE COMPLETE	1 second, 50 ms
SETUP	(as second response message) ALERTING or CONNECT or DISCONNECT	2 seconds
SETUP	(as third response message) CONNECT	no requirement
DISCONNECT	RELEASE	500 ms
RELEASE	RELEASE COMPLETE	500 ms
STATUS ENQUIRY	STATUS	500 ms

## 5.4.3 User alerting

If the MS has some form of user alerting and if for a mobile terminating call the MS sends the ALERTING message before the CONNECT message then:

- if the last timeslot carrying a SETUP message containing the Signal IE occurs at time T, the user alerting shall be initiated before time T + 1 second.

## 5.4.4 Call establishment

If the MS's service indication indicates that service is available (see GSM 03.22 [2]) and after the entry of suitable number digits, then if the "SEND" or "Emergency SEND" function on the MS is activated at time T, the first CHANNEL REQUEST message shall be transmitted before time T + 2 second.

## 5.4.5 Call reestablishment

The requirement of this subclause relates to the following environment and conditions:

- the MS is the active (U10) state of a speech call on cell A;
- the NCC of cell B is indicated as permitted in the SYSTEM INFORMATION messages of cell A, but cell B may be in a different location area;
- cells A and B are the only cells which have  $C1 > 0$  (see GSM 05.08 [7]);
- cell B is in at least the BA(SACCH) list of cell A;
- cell B allows call reestablishment.

If the transmissions from cell A are disrupted such that the MS shall detect a radio link failure at time T then the MS shall transmit a CHANNEL REQUEST message to cell B before time T + 3 second.

## 5.4.6 In call modification

For network originated in call modification, if the MS transmits the last timeslot of the message block containing the MODIFY message at time T then the MS shall be ready to transmit the MODIFY COMPLETE message before time T + 500 ms.

## 5.4.7 DTMF

This requirement applies when the MS's DTMF function is not disabled.

When the first number key is pressed on the MS during the Active (U10) state of a call at time T, then the MS shall be ready to transmit the START DTMF message before time T + 500 ms.

# 5.5 Supplementary service signalling

## 5.5.1 Advice of Charge Charging (AoCC)

The following requirements only apply to mobile stations that support the Advice of Charge Charging supplementary service defined in GSM 04.86 [5].

If the last timeslot of the message block in which a Call Control message with a Facility information element containing the operation ForwardChargeAdvice with the SS code set to AoCC occurs at time T, then the MS shall be ready to transmit a message with a Facility information element containing a Return result with the same Invoke ID before time T + 1 second.

# 5.6 Short Message Services Point-to-Point

These requirements relate to signalling using SAPI 3.

## 5.6.1 CP-DATA

If the last timeslot of the message block containing a CP-DATA message occurs at time T, then the MS shall be ready to transmit the CP-ACK message before T + 500 ms.

## 5.6.2 RP-DATA

If the last timeslot of the message block containing a RP-DATA message which will be stored in the ME and for which the ME has storage room available occurs at time T, then the MS shall be ready to transmit the RP-ACK message before time T + 1 second.

If the last timeslot of the message block containing a RP-DATA message whose destination is the SIM and for which the SIM has storage room available occurs at time T, then the ME shall start to send the short message on the ME - SIM interface before time T + 250 ms.

If the last timeslot of the message block containing a RP-DATA message whose destination is the TE occurs at time T, then the ME shall start to send the short message on the ME - TE interface before time T + 250 ms.

In the case of a short message supplied to the SIM, if the response from the SIM that triggers the sending of the RP-ACK message is completed on the SIM-ME interface at time T, then the MS shall be ready to transmit the RP-ACK message before time T + 250 ms.

In the case of a short message supplied to the TE, if the response from the TE that triggers the sending of the RP-ACK message is completed on the TE-ME interface at time T, then the MS shall be ready to transmit the RP-ACK message before time T + 250 ms.

## Annex A (informative): Change Request History

Change history					
SMG No.	TDoc. No.	CR. No.	Section affected	New version	Subject/Comments
SMG#14				4.0.2	ETSI Publication
SMG#15	414/95	A002 A003		4.1.0	Performance requirement on early sending of the CLASSMARK CHANGE message Erroneous release time requirement
SMG#16	584/95	001 002 003		4.2.0	PE Comments
SMG#20				5.0.2	Release 1996 version
SMG#21	054/97	A006		5.1.1	CR on GSM 04.13 on Time response to RP-DATA with an RP-ACK
SMG#27				6.0.0	Release 1997 version
SMG#28				6.0.1	ETSI Publication
SMG#29				7.0.0	Specification version 6.0.1 upgrade to Release 1998 version 7.0.0
				7.0.1	Version update to 7.0.1 for Publication
SMG#31				8.0.0	Specification upgrade to Release 1999
				8.0.1	Version update to 8.0.1 for Publication
CN#11				4.0.0	Release 4 version after CN#11

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## History

<b>Document history</b>		
V4.0.0	March 2001	Publication