**3GPP TSG-CN Plenary Meeting #12**
**Stockholm, Sweden, 13th - 15th June 2001**

***Tdoc NP-010343***

*CR-Form-v3*

# CHANGE REQUEST

⌘ **24.008** **CR** **427** ⌘ rev **1** ⌘ Current version: **3.7.0** ⌘

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

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

| | | |
|---|---|---|
| ***Title:*** | ⌘ | Alignment of 24.008 authentication procedures with 33.102 |
| ***Source:*** | ⌘ | Vodafone, Samsung, Lucent Technologies, Nokia |
| ***Work item code:*** | ⌘ | Security ***Date:*** ⌘ 07-06-2001 |
| ***Category:*** | ⌘ | **F** ***Release:*** ⌘ R99 |

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

*Use one of the following releases:*

| | |
|---|---|
| *2* | *(GSM Phase 2)* |
| *R96* | *(Release 1996)* |
| *R97* | *(Release 1997)* |
| *R98* | *(Release 1998)* |
| *R99* | *(Release 1999)* |
| *REL-4* | *(Release 4)* |
| *REL-5* | *(Release 5)* |

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| ***Reason for change:*** | ⌘ | Following the liaison statements between SA3 and T3 concerning "SIM/USIM Internal and External Interworking Aspects" CN1 has identified a need to bring 24.008 into line with what is currently specified in 33.102. In 24.008 there is a need to ensure that an R99 or newer UE, with a USIM inserted, being served by UTRAN shall not accept a 2G authentication challenge. |
| ***Summary of change:*** | ⌘ | It is proposed that when the R99 or newer UE has a USIM inserted and is served by UTRAN, then the UE must ensure that only 3G authentication challenges are processed. The UE checks each AUTHENTICATION (& CIPHERING) REQUEST for an AUTN. If the AUTN is not present, then the UE sends the AUTHENTICATION (& CIPHERING) FAILURE message, with a new cause - 'GSM authentication unacceptable'.<br><br>The network may use this new cause to decide on how to proceed. The mobile behaves in the same way as it would have done, had it sent the 'MAC failure' cause. This means that the network has the option to try and authenticate the MS again, but at worst, it could do nothing, and timers will expire in the MS, causing it to bar the cell. |
| ***Consequences if not approved:*** | ⌘ | System vulnerability as identified by TSG SA3 |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | 4.3.2b, 4.3.2.5.1, 4.3.2.6, 4.3.2.6.1, 4.7.7b, 4.7.7.5.1, 4.7.7.6, 4.7.7.6.1, 9.2.2.1, 9.4.9.3, 10.5.3.6, 10.5.5.14, 11.2, 11.2.2, G.3 |
| ***Other specs affected:*** | ⌘ | ☐ Other core specifications ⌘<br>☐ Test specifications<br>☐ O&M Specifications |
| ***Other comments:*** | ⌘ | The new cause code is seen as one that should only ever be received by the |

| | |
|---|---|
| | network due to a real security attack. It should not be sent in error. The handling of the new cause by the network is an implementation choice. |

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

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

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

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

## 4.3.2 Authentication procedure

### 4.3.2a Authentication procedure used for a UMTS authentication challenge

The purpose of the authentication procedure is fourfold (see 3GPP TS 33.102):

First to permit the network to check whether the identity provided by the mobile station is acceptable or not;

Second to provide parameters enabling the mobile station to calculate a new UMTS ciphering key.

Third to provide parameters enabling the mobile station to calculate a new UMTS integrity key.

Fourth to permit the mobile station to authenticate the network

The cases where the authentication procedure should be used are defined in 3GPP TS 33.102.

The UMTS authentication procedure is always initiated and controlled by the network. However, there is the possibility for the MS to reject the UMTS authentication challenge sent by the network. UMTS authentication challenge shall be supported by a MS supporting the UMTS authentication algorithm.

Note: According to 3GPP TS 33.102, a ME supporting only A/Gb mode need not support the USIM interface and in consequence need not support the UMTS authentication algorithm.

A UMTS security context is established in the MS and the network when a UMTS authentication challenge is performed in GSM or in UMTS. After a successful UMTS authentication, the UMTS ciphering key, the UMTS integrity key, the GSM ciphering key and the ciphering key sequence number, are stored both in the network and the MS.

## 4.3.2b Authentication Procedure used for a GSM authentication challenge

The purpose of the authentication procedure is twofold (see GSM 03.20):

First to permit the network to check whether the identity provided by the mobile station is acceptable or not;

Second to provide parameters enabling the mobile station to calculate a new GSM ciphering key.

The cases where the authentication procedure should be used are defined in GSM 02.09.

The authentication procedure is always initiated and controlled by the network. GSM authentication challenge shall be supported by a ME supporting GSM or UMTS radio access.

A GSM security context is established in the MS and the network when a GSM authentication challenge is performed in GSM or in UMTS. However, in UMTS an MS which supports the UMTS authentication algorithm ~~and ME with a USIM inserted that is currently being served by the UTRAN~~ shall not accept a GSM authentication challenge. ~~-~~After a successful GSM authentication, the GSM ciphering key and the ciphering key sequence number, are stored both in the network and the MS.

### 4.3.2.1 Authentication request by the network

The network initiates the authentication procedure by transferring an AUTHENTICATION REQUEST message across the radio interface and starts the timer T3260. The AUTHENTICATION REQUEST message contains the parameters necessary to calculate the response parameters (see GSM 03.20 (in case of GSM authentication challenge) and 3GPP TS 33.102 (in case of an UMTS authentication challenge)). In a GSM authentication challenge, the AUTHENTICATION REQUEST message also contains the GSM ciphering key sequence number allocated to the key which may be computed from the given parameters. In a UMTS authentication challenge, the AUTHENTICATION REQUEST message also contains the ciphering key sequence number allocated to the key set of UMTS ciphering key, UMTS integrity key and GSM ciphering key which may be computed from the given parameters.

### 4.3.2.2 Authentication response by the mobile station

The mobile station shall be ready to respond upon an AUTHENTICATION REQUEST message at any time whilst a RR connection exists. With exception of the cases described in 4.3.2.5.1, it shall process the challenge information and send back an AUTHENTICATION RESPONSE message to the network.

A MS which does not support the UMTS authentication algorithm shall ignore the Authentication Parameter AUTN IE if included in the AUTHENTICATION REQUEST message and shall proceed as in case of a GSM authentication challenge. It shall not perform the authentication of the network described in 4.3.2.5.1.

In a GSM authentication challenge, the new GSM ciphering key calculated from the challenge information shall overwrite the previous GSM ciphering key and any previously stored UMTS ciphering key and UMTS integrity key shall be deleted. The new GSM ciphering key shall be stored on the SIM together with the ciphering key sequence number.

In a UMTS authentication challenge, the new UMTS ciphering key, the new GSM ciphering key and the new UMTS integrity key calculated from the challenge information shall overwrite the previous UMTS ciphering key, GSM ciphering key and UMTS integrity key. The new UMTS ciphering key, GSM ciphering key and UMTS integrity key are stored on the SIM together with the ciphering key sequence number.

The SIM will provide the mobile station with the authentication response, based upon the authentication challenge given from the ME. A UMTS authentication challenge will result in the SIM passing a RES to the ME. A GSM authentication challenge will result in the SIM passing a SRES to the ME.

A mobile station supporting UMTS authentication challenge may support the following procedure:

In order to avoid a synchronisation failure, if the same RAND is received twice, the mobile station shall store the received RAND and the RES returned from the SIM in the volatile memory and compare it with any subsequently received RAND values, until the RAND value stored in the mobile station is deleted. If the stored RAND value is equal to the new received value in the AUTHENTICATION REQUEST message, then the mobile station shall not pass the RAND to the SIM, but shall immediately send the AUTHENTICATION RESPONSE message with the stored RES. If there is no valid stored RAND in the mobile station or the stored RAND is different from the new received value in the AUTHENTICATION REQUEST message, the mobile station shall pass the RAND to the SIM, shall override any previously stored RAND and RES with the new ones and reset and restart timer T3218.

The RAND and RES values stored in the mobile station shall be deleted:

- upon receipt of a SECURITY MODE COMMAND (Iu mode only), CIPHERING MODE COMMAND (A/Gb mode only) or AUTHENTICATION REJECT message;
- upon expiry of timer T3218; or
- if the mobile station enters the MM state MM IDLE or NULL.

### 4.3.2.3 Authentication processing in the network

Upon receipt of the AUTHENTICATION RESPONSE message, the network stops the timer T3260 and checks the validity of the response (see GSM 03.20 in case of a GSM authentication challenge respective 3GPP TS 33.102 in case of an UMTS authentication challenge).

Upon receipt of the AUTHENTICATION FAILURE message, the network stops the timer T3260. In Synch failure case, the core network may renegotiate with the HLR/AuC and provide the MS with new authentication parameters.

### 4.3.2.4 Ciphering key sequence number

The security parameters for authentication and ciphering are tied together in sets.In a GSM authentication challenge, from a challenge parameter RAND both the authentication response parameter SRES and the GSM ciphering key can be computed given the secret key associated to the IMSI. In a UMTS authentication challenge, from a challenge parameter RAND, the authentication response parameter RES and the UMTS ciphering key and the UMTS integrity key can be computed given the secret key associated to the IMSI. In addition, a GSM ciphering key can be computed from the UMTS ciphering key and the UMTS integrity key by means of an unkeyed conversion function.

In order to allow start of ciphering on a RR connection without authentication, the ciphering key sequence numbers are introduced. The ciphering key sequence number is managed by the network in the way that the AUTHENTICATION

REQUEST message contains the ciphering key sequence number allocated to the GSM ciphering key (in case of a GSM authentication challenge) or the UMTS ciphering key and the UMTS integrity key (in case of a UMTS authentication challenge) which may be computed from the RAND parameter carried in that message.

The mobile station stores the ciphering key sequence number with the GSM ciphering key (in case of a GSM authentication challenge) and the UMTS ciphering key and the UMTS integrity key (in case of a UMTS authentication challenge) and indicates to the network in the first message (LOCATION UPDATING REQUEST, CM SERVICE REQUEST, PAGING RESPONSE, CM RE-ESTABLISHMENT REQUEST) which ciphering key sequence number the stored GSM ciphering key (in case of a GSM authentication challenge) or set of UMTS ciphering, UMTS integrity and derived GSM ciphering keys (in case of a UMTS authentication challenge) has.

When the deletion of the ciphering key sequence number is described this also means that the associated GSM ciphering key, the UMTS ciphering key and the UMTS integrity key shall be considered as invalid (i.e. the established GSM security context or the UMTS security context is no longer valid).

In GSM, the network may choose to start ciphering with the stored GSM ciphering key (under the restrictions given in GSM 02.09) if the stored ciphering key sequence number and the one given from the mobile station are equal.

In UMTS, the network may choose to start ciphering and integrity with the stored UMTS ciphering key and UMTS integrity key (under the restrictions given in GSM 02.09 and 3GPP TS 33.102) if the stored ciphering key sequence number and the one given from the mobile station are equal.

NOTE: In some specifications the term KSI (Key Set Identifier) might be used instead of the term ciphering key sequence number.

#### 4.3.2.5 Authentication not accepted by the network

If authentication fails, i.e. if the response is not valid, the network may distinguish between the two different ways of identification used by the mobile station:

- the TMSI was used;
- the IMSI was used.

If the TMSI has been used, the network may decide to initiate the identification procedure. If the IMSI given by the mobile station then differs from the one the network had associated with the TMSI, the authentication should be restarted with the correct parameters. If the IMSI provided by the MS is the expected one (i.e. authentication has really failed), the network should proceed as described below.

If the IMSI has been used, or the network decides not to try the identification procedure, an AUTHENTICATION REJECT message should be transferred to the mobile station.

After having sent this message, all MM connections in progress (if any) are released and the network should initiate the RR connection release procedure described in section 3.5.of 04.18 (GSM) or in 3GPP TS 25.331 (UMTS).

Upon receipt of an AUTHENTICATION REJECT message, the mobile station shall set the update status in the SIM to U3 ROAMING NOT ALLOWED, delete from the SIM the stored TMSI, LAI and ciphering key sequence number. The SIM shall be considered as invalid until switching off or the SIM is removed.

If the AUTHENTICATION REJECT message is received in the state IMSI DETACH INITIATED the mobile station shall follow section 4.3.4.3.

If the AUTHENTICATION REJECT message is received in any other state the mobile station shall abort any MM specific, MM connection establishment or call re-establishment procedure, stop any of the timers T3210 or T3230 (if running), release all MM connections (if any), start timer T3240 and enter the state WAIT FOR NETWORK COMMAND, expecting the release of the RR connection. If the RR connection is not released within a given time controlled by the timer T3240, the mobile station shall abort the RR connection. In both cases, either after a RR connection release triggered from the network side or after a RR connection abort requested by the MS-side, the MS enters state MM IDLE, substate NO IMSI. If the MS has a separate ongoing RR connection to a different core network node, it shall consider this separate connection as still being good.

#### 4.3.2.5.1 Authentication not accepted by the MS

In a UMTS authentication challenge, the authentication procedure is extended to allow the MS to check the authenticity of the core network. Thus allowing, for instance, detection of false base station.

Following a UMTS authentication challenge, the MS may reject the core network, on the grounds of an incorrect AUTN parameter (see 3GPP TS 33.102). This parameter contains two possible causes for authentication failure:

a) MAC code failure

If the MS considers the MAC code (supplied by the core network in the AUTN parameter) to be invalid, it shall send an AUTHENTICATION FAILURE message to the network, with the reject cause "MAC failure". The MS shall then follow the procedure described in section 4.3.2.6 (c).

b) SQN failure

If the MS considers the SQN (supplied by the core network in the AUTN parameter) to be out of range, it shall send a AUTHENTICATION FAILURE message to the network, with the reject cause "Synch failure" and a re-synchronization token AUTS provided by the SIM (see 3GPP TS 33.102). The MS shall then follow the procedure described in section 4.3.2.6 (d).

In UMTS~~Iu mode~~, an MS which supports the UMTS authentication algorithm~~with a USIM inserted may~~ shall reject the authentication challenge ~~on the grounds that~~ if no Authentication Parameter AUTN IE was present in the AUTHENTICATION REQUEST message~~at all~~ (i.e. a GSM authentication challenge has been received when the MS expects a UMTS authentication challenge). ~~In~~ In such a case, the MS shall send the AUTHENTICATION FAILURE message to the network, with the reject cause 'GSM authentication unacceptable~~No AUTN~~'. ~~The~~ The MS shall then follow the procedure described in section 4.3.2.6 (c).

### 4.3.2.6 Abnormal cases

(a) RR connection failure:

Upon detection of a RR connection failure before the AUTHENTICATION RESPONSE is received, the network shall release all MM connections (if any) and abort any ongoing MM specific procedure.

(b) Expiry of timer T3260:

The authentication procedure is supervised on the network side by the timer T3260. At expiry of this timer the network may release the RR connection. In this case the network shall abort the authentication procedure and any ongoing MM specific procedure, release all MM connections if any, and initiate the RR connection release procedure described in section 3.5.

(c) Authentication failure (reject cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable'):

The MS shall send an AUTHENTICATION FAILURE message, with reject cause 'MAC failure' or '~~No~~ ~~AUTN~~GSM authentication unacceptable' according to section 4.3.2.5.1, to the network and start timer T3214. Upon receipt of an AUTHENTICATION FAILURE message from the MS, with reject cause 'MAC failure~~,~~' or '~~No AUTN~~GSM authentication unacceptable' the network may initiate the identification procedure described in section 4.3.3. This is to allow the network to obtain the IMSI from the MS. The network may then check that the TMSI originally used in the authentication challenge corresponded to the correct IMSI. Upon receipt of the IDENTITY REQUEST message from the network, the MS shall send the IDENTITY RESPONSE message.

~~I~~If the TMSI/IMSI mapping in the network was incorrect, the network should respond by sending a new AUTHENTICATION REQUEST message to the MS. Upon receiving the second AUTHENTICATION REQUEST message from the network, the MS shall stop the timer T3214, if running, and then process the challenge information as normal.

When the first AUTHENTICATION REQUEST message containing an invalid MAC has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (i.e. T3210, T3220 or T3230).

Upon successfully validating the network (an AUTHENTICATION REQUEST that contains a valid MAC is received), the MS shall send the AUTHENTICATION RESPONSE message to the network and shall start any

retransmission timers (e.g. T3210, T3220 or T3230) , if they were running and stopped when the MS received the first AUTHENTICATION REQUEST message containing an invalid MAC.

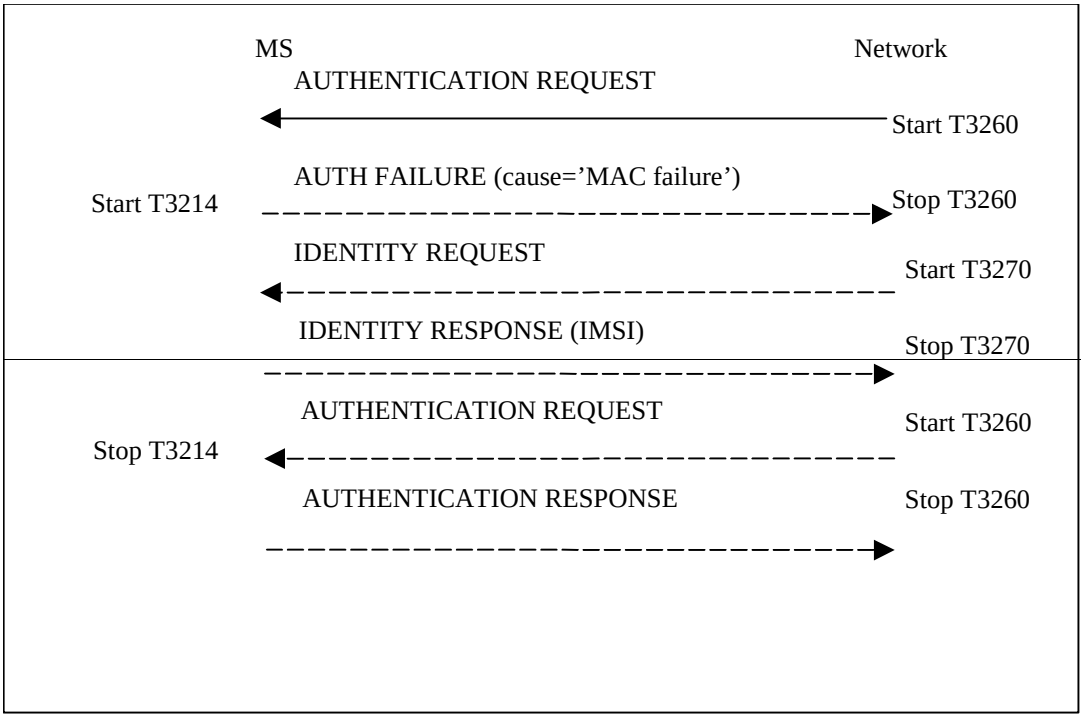
It can be assumed that the source of the authentication challenge is not genuine (authentication not accepted by the MS) if any of the following occur:

- After sending the AUTHENTICATION FAILURE message with the reject cause 'MAC failure' or '~~No~~ ~~AUTN~~GSM authentication unacceptable' the timer T3214 expires;

- Upon receipt of the second AUTHENTICATION REQUEST while T3214 is running and the MAC value cannot be resolved

- The second AUTHENTICATION REQUEST which is received while T3214 is running is a GSM authentication challenge (i.e. no AUTN parameter was received).

When it has been deemed by the MS that the source of the authentication challenge is not genuine (i.e. authentication not accepted by the MS), the MS shall behave as described in section 4.3.2.6.1.




**~~Figure 4.2/3GPP TS 24.008: Authentication Failure Procedure (reject cause 'MAC failure')~~**

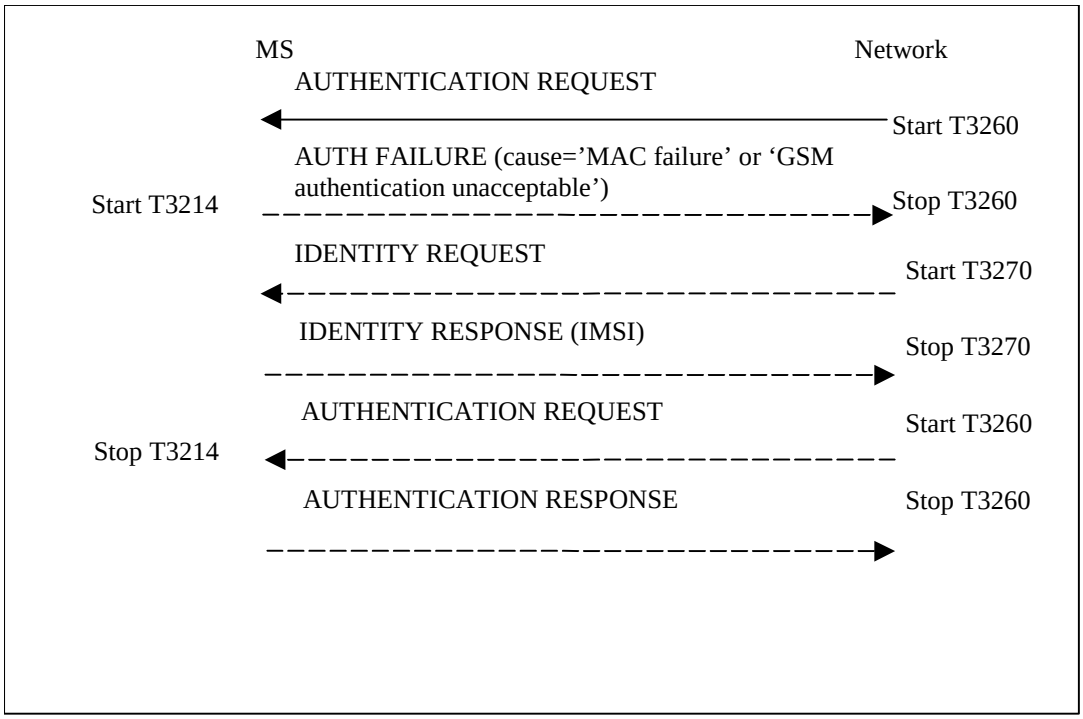



**Figure 4.2/3GPP TS 24.008: Authentication Failure Procedure (reject cause 'MAC failure' or '~~No~~ ~~AUTN~~GSM authentication unacceptable')**

(d) Authentication failure (reject cause 'synch failure'):

The MS shall send an AUTHENTICATION FAILURE message, with reject cause 'synch failure,' to the network and start the timer T3216. Upon receipt of an AUTHENTICATION FAILURE message from the MS with the reject cause 'synch failure,' the network shall use the returned AUTS parameter from the authentication failure parameter IE in the AUTHENTICATION FAILURE message, to re-synchronise. The re-synchronisation procedure requires the VLR/MSC to delete all unused authentication vectors for that IMSI and obtain new vectors from the HLR. When re-synchronisation is complete, the network shall initiate the authentication procedure. Upon receipt of the AUTHENTICATION REQUEST message, the MS shall stop the timer T3216, if running.

When the first AUTHENTICATION REQUEST message containing an invalid SQN has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (i.e. T3210, T3220 or T3230).

Upon successfully validating the network (a second AUTHENTICATION REQUEST is received which contains a valid SQN) while T3216 is running, the MS shall send the AUTHENTICATION RESPONSE message to the network and shall start any retransmission timers (e.g. T3210, T3220 or T3230), if they were running and stopped when the MS received the first AUTHENTICATION REQUEST message containing an invalid SQN.

If the MS receives a second AUTHENTICATION REQUEST which contains an invalid SQN or GSM AUTHENTICATION REQUEST while T3216 is running, then the MS shall behave as described in section 4.3.2.6.1.

If the timer T3216 expires, then the MS shall behave as described in section 4.3.2.6.1.

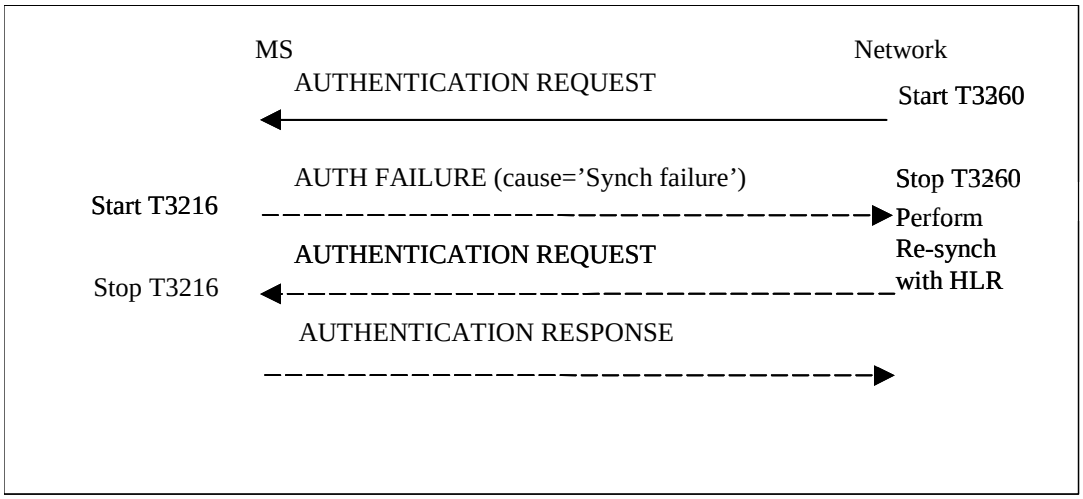



**Figure 4.2a/3GPP TS 24.008: Authentication Failure Procedure (reject cause 'Synch failure')**

#### 4.3.2.6.1 MS behaviour towards a network that has failed the authentication procedure

If the MS deems that the network has failed the authentication check, then it shall treat the cell where the AUTHENTICATION REQUEST message which lead to sending of AUTHENTICATION FAILURE was received as barred, until refresh of system information data. The MS shall start any retransmission timers (e.g. T3210, T3220 or T3230), if they were running and stopped when the MS received the first AUTHENTICATION REQUEST message containing an invalid MAC or invalid SQN, ~~(~~or no AUTN~~)~~ when a UMTS authentication challenge was expected.

### 4.3.2.7 Handling of keys at intersystem change from UMTS to GSM

At intersystem change from UMTS to GSM, ciphering may be started (see GSM 04.18) without any new authentication procedure. Deduction of the appropriate security key for ciphering in GSM, depends on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the GSM ciphering key according to Table 4.3.2.7.1.

**Table 4.3.2.7.1/3GPP TS 24.008: Intersystem change from UMTS to GSM**

| | |
|---|---|
| Security context established in MS and network in UMTS | At intersystem change to GSM: |
| GSM security context | An ME shall apply the GSM cipher key received from the GSM security context residing in the SIM. |
| UMTS security context | An ME shall apply the GSM cipher key derived by the SIM from the UMTS cipher key and the UMTS integrity key. |

NOTE A SIM with UMTS security context, passes the UMTS cipher key, the UMTS integrity key and the derived GSM cipher key to the ME independent on the current radio access being UMTS or GSM.

### 4.3.2.7a Use of established security contexts

In GSM, in the case of an established GSM security context, the GSM ciphering key shall be loaded from the SIM and taken into use by the ME when any valid CIPHERING MODE COMMAND is received during an RR connection (the definition of a valid CIPHERING MODE COMMAND message is given in GSM 04.18 section 3.4.7.2).

In GSM, in the case of an established UMTS security context, the GSM ciphering key shall be loaded from the SIM and taken into use by the MS when a valid CIPHERING MODE COMMAND is received during an RR connection (the definition of a valid CIPHERING MODE COMMAND message is given in GSM 04.18 section 3.4.7.2). The network shall derive a GSM ciphering key from the UMTS ciphering key and the UMTS integrity key by using the conversion function named "c3" defined in 3GPP TS 33.102.

In UMTS, in the case of an established GSM security context, the ME shall derive a UMTS ciphering key and a UMTS integrity key from the GSM ciphering key by using the conversion functions named “c4” and “c5” defined in 3GPP TS 33.102. The GSM ciphering key shall be loaded from the SIM and the derived UMTS ciphering key and UMTS integrity key shall be taken into use by the MS when a valid SECURITY MODE COMMAND indicating CS domain is received during an RR connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331). The network shall derive a UMTS ciphering key and a UMTS integrity key from the GSM ciphering key by using the conversion functions named “c4” and “c5” defined in 3GPP TS 33.102.

In UMTS, in the case of an established UMTS security context, the UMTS ciphering key and UMTS integrity key shall be loaded from the SIM and taken into use by the MS when a valid SECURITY MODE COMMAND indicating CS domain is received during a RR connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331).

NOTE: In UMTS and GSM, during an ongoing, already ciphering and/or integrity protected RR connection, the network might initiate a new Authentication procedure in order to establish a new GSM/UMTS security context. The new keys are taken into use in the MS when a new valid SECURITY MODE COMMAND indicating CS domain in UMTS, or a new valid CIPHERING MODE COMMAND in GSM, is received during the RR connection.

### 4.3.2.8 Handling of keys at intersystem change from GSM to UMTS

At intersystem change from GSM to UMTS, ciphering and integrity may be started (see 3GPP TS 25.331) without any new authentication procedure. Deduction of the appropriate security keys for ciphering and integrity check in UMTS, depend on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the UMTS cipher key and the UMTS integrity key according to Table 4.3.2.8.1.

**Table 4.3.2.8.1/3GPP TS 24.008: Intersystem change from GSM to UMTS**

| Security context established in MS and network in GSM | At intersystem change to UMTS: |
|---|---|
| GSM security context | An ME shall derive the UMTS cipher key and UMTS integrity key from the GSM cipher key provided by the SIM. The conversion functions named "c4" and "c5" in 3GPP TS 33.102 are used for this purpose. |
| UMTS security context | An ME shall apply the UMTS ciphering key and the UMTS integrity key received from the UMTS security context residing in the SIM. |

NOTE A SIM with UMTS security context, passes the UMTS cipher key, the UMTS integrity key and the derived GSM cipher key to the ME independent on the current radio access being UMTS or GSM.

## 4.7.7 Authentication and ciphering procedure

### 4.7.7a Authentication and ciphering procedure used for UMTS authentication challenge.

The purpose of the authentication and ciphering procedure is fourfold (see 3GPP TS 33.102):

- to permit the network to check whether the identity provided by the MS is acceptable or not;
- to provide parameters enabling the MS to calculate a new GPRS UMTS ciphering key and a new GPRS UMTS integrity key.

- to let the network set the GSM ciphering mode (ciphering /no ciphering ) and GSM ciphering algorithm; and
- to permit the mobile station to authenticate the network.

In UMTS, and in the case of a UMTS authentication challenge, the authentication and ciphering procedure can be used for authentication only.

The cases in which the authentication and ciphering procedure shall be used are defined in 3GPP TS 33.102 and GSM 02.09 [5].

The authentication and ciphering procedure is always initiated and controlled by the network. However, in the case of a UMTS authentication challenge, there is the possibility for the MS to reject the network.

UMTS authentication challenge shall be supported by a MS supporting UMTS authentication algorithm .

Note: According to 3GPP TS 33.102, a ME supporting only A/Gb mode need not support the USIM interface and in consequence need not support the UMTS authentication challenge.

The authentication and ciphering procedure can be used for either:

- authentication only;
- setting of the GSM ciphering mode and the GSM ciphering algorithm only; or
- authentication and the setting of the GSM ciphering mode and the GSM ciphering algorithm.

In GSM, the network should not send any user data during the authentication and ciphering procedure.

A UMTS security context is established in the MS and the network when a UMTS authentication challenge is performed in GSM or in UMTS. After a successful UMTS authentication, the GPRS UMTS ciphering key, the GPRS UMTS integrity key, the GPRS GSM ciphering key and the GPRS ciphering key sequence number, are stored both in the network and the MS.

### 4.7.7b Authentication and ciphering procedure used for GSM authentication challenge

The purpose of the authentication and ciphering procedure is threefold (see GSM 03.20 [13]):

- to permit the network to check whether the identity provided by the MS is acceptable or not;
- to provide parameters enabling the MS to calculate a new GPRS GSM ciphering key; and
- to let the network set the GSM ciphering mode (ciphering/no ciphering) and GSM ciphering algorithm.

The authentication and ciphering procedure can be used for either:

- authentication only;
- setting of the GSM ciphering mode and the GSM ciphering algorithm only; or
- authentication and the setting of the GSM ciphering mode and the GSM ciphering algorithm.

The cases in which the authentication and ciphering procedure shall be used are defined in GSM 02.09 [5].

In GSM, the authentication and ciphering procedure is always initiated and controlled by the network. It shall be performed in a non ciphered mode because of the following reasons:

- the network cannot decipher a ciphered AUTHENTICATION AND CIPHERING RESPONSE from an unauthorised MS and put it on the black list; and
- to be able to define a specific point in time from which on a new GPRS GSM ciphering key should be used instead of the old one.

GSM authentication challenge shall be supported by a ME supporting GSM or UMTS radio access.

In GSM, the network should not send any user data during the authentication and ciphering procedure.

A GSM security context is established in the MS and the network when a GSM authentication challenge is performed in GSM or in UMTS. However, in UMTS an MS which supports the UMTS authentication algorithm ~~andME with a USIM inserted that is currently being served by the UTRAN~~ shall not accept a GSM authentication challenge. After a successful GSM authentication challenge, the GPRS GSM ciphering key and the GPRS ciphering key sequence number, are stored both in the network and the MS.

#### 4.7.7.1 Authentication and ciphering initiation by the network

The network initiates the authentication and ciphering procedure by transferring an AUTHENTICATION AND CIPHERING REQUEST message across the radio interface and starts timer T3360. The AUTHENTICATION AND CIPHERING REQUEST message shall contain all parameters necessary to calculate the response parameters when authentication is performed (see GSM 03.20 [13] and 3GPP TS 33.102).

If authentication is requested, then the AUTHENTICATION AND CIPHERING REQUEST message shall contain either:

- In a GSM authentication challenge, the GPRS ciphering key sequence number, allocated to the GPRS GSM ciphering key and the RAND, or
- In a UMTS authentication challenge, the GPRS ciphering key sequence number, allocated to the GPRS UMTS ciphering and GPRS UMTS integrity keys, the RAND and the AUTN.

In GSM, if authentication is not requested, then the AUTHENTICATION AND CIPHERING REQUEST message shall not contain neither the GPRS ciphering key sequence number, the RAND nor the AUTN.

In GSM, if ciphering is requested, in a GSM authentication challenge or in a UMTS authentication challenge, then the AUTHENTICATION AND CIPHERING REQUEST message shall indicate the GPRS GSM ciphering algorithm.

The network includes the A&C reference number information element in the AUTHENTICATION AND CIPHERING REQUEST message. Its value is chosen in order to link an AUTHENTICATION AND CIPHERING REQUEST in a RA with its RESPONSE. The A&C reference number value might be based on the RA Colour Code value.

Additionally, the network may request the MS to include its IMEISV in the AUTHENTICATION AND CIPHERING RESPONSE message.

#### 4.7.7.2 Authentication and ciphering response by the MS

In GSM, a MS that is attached to GPRS shall be ready to respond upon an AUTHENTICATION AND CIPHERING REQUEST message at any time.

In UMTS, an MS that is attached to GPRS shall be ready to respond upon an AUTHENTICATION AND CIPHERING REQUEST message at any time whilst a PS signalling connection exists.

A MS which does not support the UMTS authentication algorithm shall ignore the Authentication Parameter AUTN IE if included in the AUTHENTICATION AND CIPHERING REQUEST message and perform the GSM authentication challenge. It shall not perform the authentication of the network described in 4.7.7.5.1.

In a GSM authentication challenge, if the AUTHENTICATION AND CIPHERING REQUEST message includes the authentication parameters RAND and GPRS CKSN, then upon receipt of the message, the MS processes the challenge information and sends an AUTHENTICATION AND CIPHERING RESPONSE message to the network. The value of the received A&C reference number information element shall be copied into the A&C reference number information element in the AUTHENTICATION AND CIPHERING RESPONSE message. A GSM authentication challenge will result in the SIM passing a SRES and a GPRS GSM ciphering key to the ME. The new GPRS GSM ciphering key calculated from the challenge information shall overwrite the previous one and any previously stored GPRS UMTS ciphering and GPRS UMTS integrity keys shall be deleted. The calculated GSM ciphering key shall be stored on the SIM together with the GPRS ciphering key sequence number before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted.

In a UMTS authentication challenge, if the AUTHENTICATION AND CIPHERING REQUEST message includes the UMTS authentication parameters GPRS CKSN, RAND and AUTN, then upon receipt of the message, the MS verifies the AUTN parameter and if this is accepted, the MS processes the challenge information and sends an AUTHENTICATION AND CIPHERING RESPONSE message to the network. The value of the received A&C reference number information element shall be copied into the A&C reference number information element in the

AUTHENTICATION AND CIPHERING RESPONSE message. A UMTS authentication challenge will result in the SIM passing a RES, a GPRS UMTS ciphering key, a GPRS UMTS integrity key and a GPRS GSM ciphering key to the ME. The new GPRS UMTS ciphering key, GPRS UMTS integrity key and GPRS GSM ciphering key calculated from the challenge information shall overwrite the previous ones. The new GPRS UMTS ciphering key, GPRS UMTS integrity key and GPRS GSM ciphering key shall be stored on the SIM together with the GPRS ciphering key sequence number before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted.

In UMTS, an MS capable of UMTS only shall ignore the Ciphering Algorithm IE in the AUTHENTICATION AND CIPHERING REQUEST message. An MS capable of both UMTS and GSM shall store the received value in the Ciphering Algorithm IE in the AUTHENTICATION AND CIPHERING REQUEST message in order to use it at an inter system change from UMTS to GSM.

If the AUTHENTICATION AND CIPHERING REQUEST message does not include neither the GSM authentication parameters (RAND and GPRS CKSN) nor the UMTS authentication parameters (RAND, AUTN and GPRS CKSN), then upon receipt of the message, the MS replies by sending an AUTHENTICATION AND CIPHERING RESPONSE message to the network.

In GSM, the GMM layer shall notify the LLC layer if ciphering shall be used or not and if yes which GSM ciphering algorithm and GPRS GSM ciphering key that shall be used (see GSM 04.64 [76]).

A mobile station supporting UMTS authentication challenge shall support the following procedure:

In order to avoid a synchronisation failure, if the same RAND is received twice, the mobile station shall store the received RAND and the RES returned from the SIM in the volatile memory and compare it with any subsequently received RAND values, until the RAND value stored in the mobile station is deleted. If the stored RAND value is equal to the new received value in the AUTHENTICATION & CIPHERING REQUEST message, then the mobile station shall not pass the RAND to the SIM, but shall immediately send the AUTHENTICATION & CIPHERING RESPONSE message with the stored RES. If there is no valid stored RAND in the mobile station or the stored RAND is different from the new received value in the AUTHENTICATION & CIPHERING REQUEST message, the mobile station shall pass the RAND to the SIM, shall override any previously stored RAND and RES with the new ones and reset and restart timer T3316.

The RAND and RES values stored in the mobile station shall be deleted:

- upon receipt of a SECURITY MODE COMMAND (Iu mode only) or AUTHENTICATION & CIPHERING REJECT message;
- upon expiry of timer T3316; or
- if the mobile station enters the GMM states GMM-DEREGISTERED or GMM-NULL.

#### 4.7.7.3 Authentication and ciphering completion by the network

Upon receipt of the AUTHENTICATION AND CIPHERING RESPONSE message, the network stops the timer T3360 and checks the validity of the response (see GSM 03.20 [13] and 3GPP TS 33.102). For this, it may use the A&C reference number information element within the AUTHENTICATION AND CIPHERING RESPONSE message to determine whether the response is correlating to the last request that was sent.

In GSM, the GMM layer shall notify the LLC sublayer if ciphering shall be used or not and if yes which algorithm and GPRS GSM ciphering key that shall be used (see GSM 04.64 [76]).

Upon receipt of the AUTHENTICATION AND CIPHERING FAILURE message, the network stops the timer T3360. In Synch failure case, the core network may renegotiate with the HLR/AuC and provide the MS with new authentication parameters.

#### 4.7.7.4 GPRS ciphering key sequence number

The security parameters for authentication and ciphering are tied together in sets. In a GSM authentication challenge, from a challenge parameter RAND both the authentication response parameter SRES and the GPRS GSM ciphering key can be computed given the secret key associated to the IMSI. In a UMTS authentication challenge, from a challenge parameter RAND, the authentication response parameter RES and the GPRS UMTS ciphering key and the GPRS UMTS integrity key can be computed given the secret key associated to the IMSI.

In order to allow start of ciphering on a logical link without authentication, GPRS ciphering key sequence numbers are introduced.

The GPRS ciphering key sequence number is managed by the network such that the AUTHENTICATION AND CIPHERING REQUEST message contains the GPRS ciphering key sequence number allocated to the GPRS GSM ciphering key (in case of a GSM authentication challenge) or the GPRS UMTS ciphering key and the GPRS UMTS integrity key (in case of a UMTS authentication challenge) which may be computed from the RAND parameter carried in that message.

The MS stores the GPRS ciphering key sequence number with the GPRS GSM ciphering key (in case of a GSM authentication challenge) and the GPRS UMTS ciphering key and the GPRS UMTS integrity key (in case of a UMTS authentication challenge),and includes the corresponding GPRS ciphering key sequence number in the ROUTING AREA UPDATE REQUEST , SERVICE REQUEST and ATTACH REQUEST messages.

If the GPRS ciphering key sequence number is deleted, the associated GPRS GSM ciphering key , GPRS UMTS ciphering key and GPRS UMTS integrity key shall be deleted (i.e. the established GSM security context or the UMTS security context is no longer valid).

In UMTS, the network may choose to start ciphering and integrity checking with the stored GPRS UMTS ciphering key and the stored GPRS UMTS integrity key (under the restrictions given in GSM 02.09 and 3GPP TS 33.102) if the stored GPRS ciphering key sequence number and the one given from the MS are equal.

In GSM, the network may choose to start ciphering with the stored GPRS GSM ciphering key (under the restrictions given in GSM 02.09) if the stored GPRS ciphering key sequence number and the one given from the MS are equal and the previously negotiated ciphering algorithm is known and supported in the network. When ciphering is requested at GPRS attach, the authentication and ciphering procedure shall be performed since the MS does not store the ciphering algorithm at detach.

Upon GPRS attach, if ciphering is to be used, an AUTHENTICATION AND CIPHERING REQUEST message shall be sent to the MS to start ciphering.

If the GPRS ciphering key sequence number stored in the network does not match the GPRS ciphering key sequence number received from the MS in the ATTACH REQUEST message, then the network should authenticate the MS.

In GSM, the MS starts ciphering after sending the AUTHENTICATION AND CIPHERING RESPONSE message. The network starts ciphering when a valid AUTHENTICATION AND CIPHERING RESPONSE is received from the MS.

In UMTS, the MS starts ciphering and integrity checking according to the conditions specified in specification 3GPP TS 25.331.

In GSM, as an option, the network may decide to continue ciphering without sending an AUTHENTICATION AND CIPHERING REQUEST message after receiving a ROUTING AREA UPDATE REQUEST message with a valid GPRS ciphering key sequence number. Both the MS and the network shall use the latest ciphering parameters. The network starts ciphering when sending the ciphered ROUTING AREA UPDATE ACCEPT message to the MS. The MS starts ciphering after receiving a valid ciphered ROUTING AREA UPDATE ACCEPT message from the network.

NOTE: In some specifications the term KSI (Key Set Identifier) is used instead of the term GPRS ciphering key sequence number.

#### 4.7.7.5 Authentication not accepted by the network

If authentication and ciphering fails, i.e. if the response is not valid, the network considers whether the MS has used the P-TMSI or the IMSI for identification.

- If the P-TMSI has been used, the network may decide to initiate the identification procedure. If the IMSI given by the MS differs from the one the network had associated with the P-TMSI, the authentication should be restarted with the correct parameters. If the IMSI provided by the MS is the expected one (i.e. authentication has really failed), the network should proceed as described below.

- If the IMSI has been used, or the network decides not to try the identification procedure, an AUTHENTICATION AND CIPHERING REJECT message should be transferred to the MS.

Upon receipt of an AUTHENTICATION AND CIPHERING REJECT message, the MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED and shall delete the P-TMSI, P-TMSI signature, RAI and GPRS

ciphering key sequence number stored. If available, also the TMSI, LAI and ciphering key sequence number shall be deleted and the update status shall be set to U3 ROAMING NOT ALLOWED. The SIM shall be considered as invalid until switching off or the SIM is removed.

If the AUTHENTICATION AND CIPHERING REJECT message is received, the MS shall abort any GMM procedure, shall stop the timers T3310, T3317 and T3330 (if running) and shall enter state GMM-DEREGISTERED.

#### 4.7.7.5.1 Authentication not accepted by the MS

In a UMTS authentication challenge, the authentication procedure is extended to allow the MS to check the authenticity of the core network. Thus allowing, for instance, detection of false base station.

Following a UMTS authentication challenge, the MS may reject the core network, on the grounds of an incorrect AUTN parameter (see 3GPP TS 33.102). This parameter contains two possible causes for authentication failure:

a) MAC code failure

If the MS considers the MAC code (supplied by the core network in the AUTN parameter) to be invalid, it shall send a AUTHENTICATION AND CIPHERING FAILURE message to the network, with the GMM cause "MAC failure'. The MS shall then follow the procedure described in section 4.7.7.6 (f).

b) SQN failure

If the MS considers the SQN (supplied by the core network in the AUTN parameter) to be out of range, it shall send a AUTHENTICATION AND CIPHERING FAILURE message to the network, with the GMM cause "Synch failure' and the re-synchronization token AUTS provided by the SIM (see 3GPP TS 33.102). The MS shall then follow the procedure described in section 4.7.7.6 (g).

In UMTS~~Iu mode~~, an MS which supports the UMTS authentication algorithm~~MS with a USIM inserted may~~ shall reject the authentication challenge~~ on the grounds that~~ if no ~~AUTN~~ Authentication ~~p~~Parameter AUTN IE was present in the AUTHENTICATION REQUEST message~~ at all~~ (i.e. a GSM authentication challenge has been received when the MS expects a UMTS authentication challenge). In such a case, the MS shall send the AUTHENTICATION AND CIPHERING FAILURE message to the network with the GMM cause '~~No AUTN~~GSM authentication unacceptable'. The MS shall then follow the procedure described~~obed~~ in section 4.7.7.6 (f).

### 4.7.7.6 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Lower layer failure

Upon detection of a lower layer failure before the AUTHENTICATION AND CIPHERING RESPONSE is received, the network shall abort the procedure.

b) Expiry of timer T3360

The network shall, on the first expiry of the timer T3360, retransmit the AUTHENTICATION AND CIPHERING REQUEST and shall reset and start timer T3360. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3360, the procedure shall be aborted.

c) Collision of an authentication and ciphering procedure with a GPRS attach procedure

If the network receives an ATTACH REQUEST message before the ongoing authentication procedure has been completed and no GPRS attach procedure is pending on the network (i.e. no ATTACH ACCEPT/REJECT message has to be sent as an answer to an ATTACH REQUEST message), the network shall abort the authentication and ciphering procedure and proceed with the new GPRS attach procedure.

d) Collision of an authentication and ciphering procedure with a GPRS attach procedure when the authentication and ciphering procedure has been caused by a previous GPRS attach procedure

If the network receives an ATTACH REQUEST message before the ongoing authentication procedure has been completed and a GPRS attach procedure is pending (i.e. an ATTACH ACCEPT/REJECT message has still to be sent as an answer to an earlier ATTACH REQUEST message), then:

- If one or more of the information elements in the ATTACH REQUEST message differs from the ones received within the previous ATTACH REQUEST message, the network shall not treat the authentication any further and proceed with the GPRS attach procedure ; or

- If the information elements do not differ, then the network shall not treat any further this new ATTACH REQUEST.

Collision of an authentication and ciphering procedure with a GPRS detach procedure

GPRS detach containing cause "power off":

If the network receives a DETACH REQUEST message before the ongoing authentication and ciphering procedure has been completed, the network shall abort the authentication and ciphering procedure and shall progress the GPRS detach procedure.

GPRS detach containing other causes than "power off":

If the network receives a DETACH REQUEST message before the ongoing authentication and ciphering procedure has been completed, the network shall complete the authentication and ciphering procedure and shall respond to the GPRS detach procedure as described in section 4.7.4.

e) Collision of an authentication and ciphering procedure with a routing area updating procedure

If the network receives a ROUTING AREA UPDATE REQUEST message before the ongoing authentication procedure has been completed, the network shall progress both procedures.

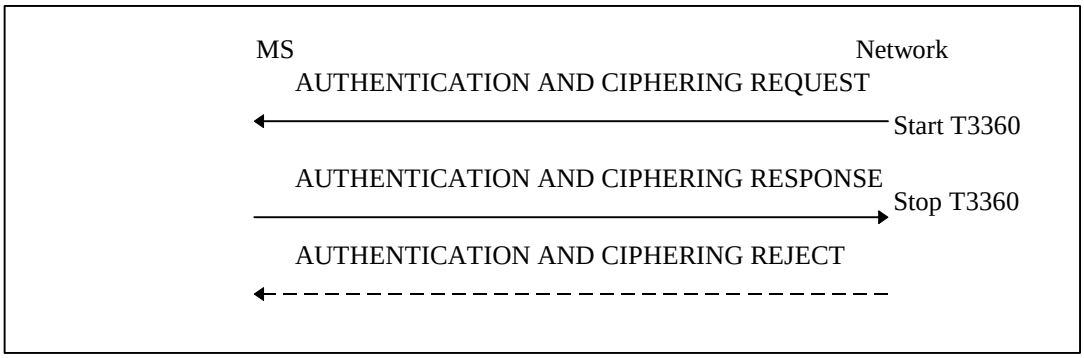



**Figure 4.7.7/1 3GPP TS 24.008: Authentication and ciphering procedure**

(f) Authentication failure (GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable')

The MS shall send an AUTHENTICATION & CIPHERING FAILURE message, with GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable' according to section 4.7.7.5.1, to the network and start timer T3318. Upon receipt of an AUTHENTICATION & CIPHERING FAILURE message from the MS with GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable' the network may initiate the identification procedure described in section 4.7.8. This is to allow the network to obtain the IMSI from the MS. The network may then check that the P-TMSI originally used in the authentication challenge corresponded to the correct IMSI. Upon receipt of the IDENTITY REQUEST message from the network, the MS shall send the IDENTITY RESPONSE message.

~~I~~If the P-TMSI/IMSI mapping in the network was incorrect, the network should respond by sending a new AUTHENTICATION & CIPHERING REQUEST message to the MS. Upon receiving the second AUTHENTICATION & CIPHERING REQUEST message from the network, the MS shall stop timer T3318, if running, and then process the challenge information as normal.

When the first AUTHENTICATION & CIPHERING REQUEST message containing an invalid MAC has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (e.g. T3310, T3321, T3330 or T3317).

Upon successfully validating the network, (an AUTHENTICATION & CIPHERING REQUEST message that contains a valid MAC is received), the MS shall send the AUTHENTICATION & CIPHERING RESPONSE message to the network and shall start any retransmission timers (i.e. T3310, T3321, T3330 or T3317) , if they were running and stopped when the MS received the first AUTHENTICATION AND CIPHERING REQUEST message containing an invalid MAC.

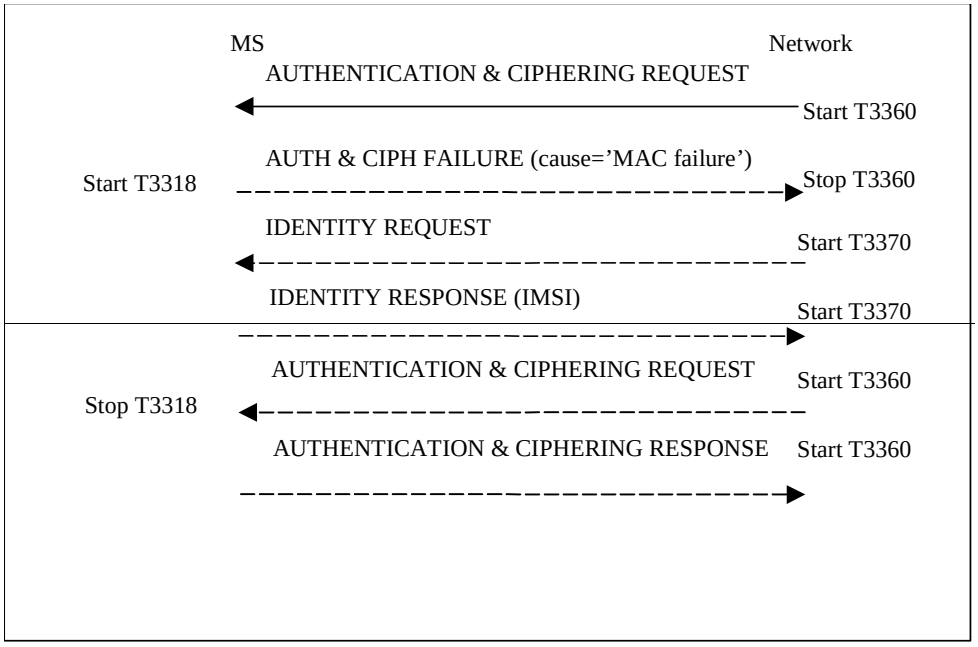
It can be assumed that the source of the authentication challenge is not genuine (authentication not accepted by the MS) if any of the following occur:

- After sending the AUTHENTICATION & CIPHERING FAILURE message with GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable' the timer T3318 expires;

- Upon receipt of the second AUTHENTICATION & CIPHERING REQUEST message from the network while the T3318 is running ~~and~~ the MAC value cannot be resolved.

- The second AUTHENTICATION REQUEST & CIPHERING REQUEST which is received in UMTS while T33~~2~~18~~4~~ is running is a GSM authentication challenge (i.e. no AUTN parameter was received).

When it has been deemed by the MS that the source of the authentication challenge is not genuine (authentication not accepted by the MS), the MS shall behave as described in section 4.7.7.6.1.




**~~Figure 4.7.7a/1 3GPP TS 24.008: Authentication failure cause 'MAC failure'~~**

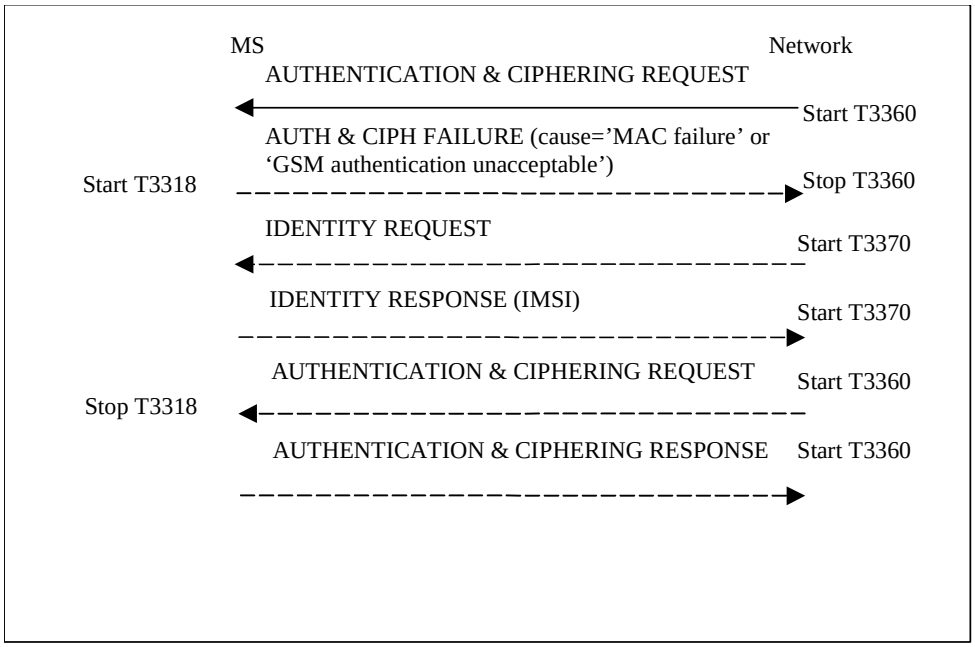



**Figure 4.7.7a/1 3GPP TS 24.008: Authentication failure cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable'**

(g) Authentication failure (GMM cause 'Synch failure'):

The MS shall send an AUTHENTICATION & CIPHERING FAILURE message, with the GMM cause 'Synch failure,' to the network and start the timer T3320. Upon receipt of an AUTHENTICATION & CIPHERING message from the MS with the GMM cause 'synch failure,' the network shall use the returned AUTS parameter from the authentication & ciphering failure parameter IE in the AUTHENTICATION & CIPHERING FAILURE message, to re-synchronise. The re-synchronisation procedure requires the SGSN to delete all unused authentication vectors for that IMSI and obtain new vectors from the HLR. When re-synchronisation is complete, the network shall initiate the authentication & ciphering procedure. Upon receipt of the AUTHENTICATION & CIPHERING REQUEST message, the MS shall stop timer T3320, if running.

When the first AUTHENTICATION & CIPHERING REQUEST message containing an invalid SQN has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (e.g. T3310, T3321, T3330 or T3317).

Upon successfully validating the network, (a second AUTHENTICATION & CIPHERING REQUEST message is received which contains a valid SQN) while T3320 is running, the MS shall send the AUTHENTICATION & CIPHERING RESPONSE message to the network and shall start any retransmission timers (i.e. T3310, T3321, T3330 or T3317), if they were running and stopped when the MS received the first AUTHENTICATION AND CIPHERING REQUEST message containing an invalid SQN.

If the MS receives a second AUTHENTICATION & CIPHERING REQUEST message which contains an invalid SQN while T3320 is running, then the MS shall behave as described in section 4.7.7.6.1.

If the timer T3320 expires, the MS shall behave as described in section 4.7.7.6.1.

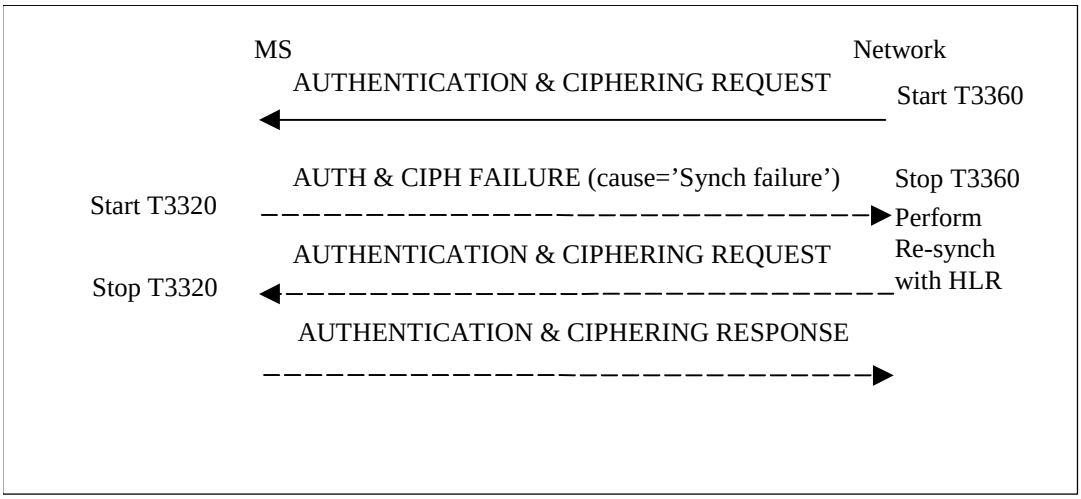



**Figure 4.7.7b/1 3GPP TS 24.008: Authentication failure cause 'Synch failure'**

#### 4.7.7.6.1 MS behaviour towards a network that has failed the authentication procedure

If the MS deems that the network has failed the authentication check, then it shall treat the cell where the AUTHENTICATION & CIPHERING REQUEST message was received as barred, until refresh of system information data. The MS shall start any retransmission timers (i.e. T3310, T3321, T3330 or T3317), if they were running and stopped when the MS received the first AUTHENTICATION AND CIPHERING REQUEST message containing an invalid MAC or invalid SQN, ~~(~~or no AUTN~~)~~ when a UMTS authentication challenge was expected.

### 4.7.7.7 Use of established security contexts

In GSM, in the case of an established GSM security context, the GPRS GSM ciphering key shall be taken into use by the MS before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted.

In GSM, in the case of an established UMTS security context, the GPRS GSM ciphering key shall be taken into use by the MS before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted. The network shall derive a GPRS GSM ciphering key from the GPRS UMTS ciphering key and the GPRS UMTS integrity key, by using the conversion function named "c3" defined in 3GPP TS 33.102.

In UMTS, in the case of an established GSM security context, the ME shall derive a GPRS UMTS ciphering key and a GPRS UMTS integrity key from the GPRS GSM ciphering key by using the conversion functions named "c4" and "c5" defined in 3GPP TS 33.102. The derived GPRS UMTS ciphering key and GPRS UMTS integrity key shall be taken into use by the MS when a valid SECURITY MODE COMMAND indicating PS domain is received during an RR connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331). The network shall derive a GPRS UMTS ciphering key and a GPRS UMTS integrity key from the GPRS GSM ciphering key by using the conversion functions named "c4" and "c5" defined in 3GPP TS 33.102.

In UMTS, in the case of an established UMTS security context, the GPRS UMTS ciphering key and the GPRS UMTS integrity key shall be taken into use by the MS when a valid SECURITY MODE COMMAND indicating PS domain is received during an PS signalling connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331).

NOTE: In UMTS, during an ongoing, already ciphering/integrity protected PS signalling connection, the network might initiate a new Authentication and ciphering procedure in order to establish a new GSM/UMTS security context. The new GPRS UMTS ciphering key and GPRS UMTS integrity key are taken into use by the MS, when a new valid SECURITY MODE COMMAND indicating PS domain is received during the PS signalling connection.

### 4.7.7.8 Handling of keys at intersystem change from UMTS to GSM

At an intersystem change from UMTS to GSM, ciphering may be started (see GSM 04.64 [76]) without any new authentication and ciphering procedure. Deduction of the appropriate security key for ciphering in GSM, depends on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the GPRS GSM ciphering key according to Table 4.7.7.8.1.

Before any initial GMM message is sent in the new cell in GSM, the GMM layer in the MS shall notify the LLC layer if ciphering shall be used or not. If yes, the GPRS GSM ciphering key and the applicable ciphering algorithm according to the stored *Ciphering Algorithm IE* in the MS shall also be indicated to the LLC layer (see GSM 04.64 [76]).

**Table 4.7.7.8.1/3GPP TS 24.008: Intersystem change from UMTS to GSM**

| | |
|---|---|
| Security context established in MS and network in UMTS | At intersystem change to GSM: |
| GSM security context | An ME shall apply the GPRS GSM cipher key received from the GSM security context residing in the SIM. |
| UMTS security context | An ME shall apply the GPRS GSM cipher key derived by the SIM from the GPRS UMTS cipher key and the GPRS UMTS integrity key. |

NOTE A SIM with UMTS security context, passes the GPRS UMTS ciphering key, the GPRS UMTS integrity key and the derived GPRS GSM ciphering key to the ME independent on the current radio access being UMTS or GSM.

### 4.7.7.9 Handling of keys at intersystem change from GSM to UMTS

At an intersystem change from GSM to UMTS, ciphering and integrity may be started (see 3GPP TS 25.331) without any new authentication and ciphering procedure. Deduction of the appropriate security keys for ciphering and integrity check in UMTS, depend on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the GPRS UMTS cipher key and the GPRS UMTS integrity key according to Table 4.7.7.9.1.

**Table 4.7.7.9.1/3GPP TS 24.008: Intersystem change from GSM to UMTS**

| | |
|---|---|
| Security context established in MS and network in GSM | At intersystem change to UMTS: |
| GSM security context | An ME shall derive the GPRS UMTS cipher key and GPRS UMTS integrity key from the GPRS GSM cipher key provided by the SIM. The conversion functions named "c4" and "c5" in 3GPP TS 33.102 are used for this purpose. |
| UMTS security context | An ME shall apply the GPRS UMTS ciphering key and the GPRS UMTS integrity key received from the UMTS security context residing in the SIM. |

NOTE: A SIM with UMTS security context, passes the GPRS UMTS ciphering key, the GPRS UMTS integrity key and the derived GPRS GSM ciphering key to the ME independent on the current radio access being UMTS or GSM.

## 9.2.2 Authentication request

This message is sent by the network to the mobile station to initiate authentication of the mobile station identity. See table 9.2.3/3GPP TS 24.008.

Message type: AUTHENTICATION REQUEST

Significance: dual

Direction: network to mobile station

**Table 9.2.3/3GPP TS 24.008: AUTHENTICATION REQUEST message content**

| IEI | Information element | Type / Reference | Presence | Format | Length |
|---|---|---|---|---|---|
| | Mobility management protocol discriminator | Protocol discriminator 10.2 | M | V | 1/2 |
| | Skip Indicator | Skip Indicator 10.3.1 | M | V | 1/2 |
| | Authentication Request message type | Message type 10.4 | M | V | 1 |
| | Ciphering key sequence number | Ciphering key sequence number 10.5.1.2 | M | V | 1/2 |
| | Spare half octet | Spare half octet 10.5.1.8 | M | V | 1/2 |
| | Authentication parameter RAND (UMTS challenge or GSM challenge) | Auth. parameter RAND 10.5.3.1 | M | V | 16 |
| 20 | Authentication Parameter AUTN | Auth. parameter AUTN 10.5.3.1.1 | O | TLV | 18 |

### 9.2.2.1 Authentication Parameter AUTN

This IE shall be present if and only if the authentication challenge is a UMTS authentication challenge.The presence or absence of this IE defines- in the case of its absence- a GSM authentication challenge or- in the case of its presence- a UMTS authentication challenge.

The MS shall ignore the IE if it does not support UMTS authentication algorithm.

In UMTS, the MS shall reject the AUTHENTICATION REQUEST message as specified in subclause 4.3.2.5.1 if this IE is not present and the MS supports UMTS authentication algorithm.

## 9.4.9 Authentication and ciphering request

This message is sent by the network to the MS to initiate authentication of the MS identity. Additionally, the ciphering mode is set, indicating whether ciphering will be performed or not. See table 9.4.9/GSM 24.008.

Message type: AUTHENTICATION AND CIPHERING REQUEST

Significance: dual

Direction: network to MS

**Table 9.4.9/GSM 24.008: AUTHENTICATION AND CIPHERING REQUEST message content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|---|---|---|---|---|---|
| | Protocol discriminator | Protocol discriminator 10.2 | M | V | 1/2 |
| | Skip indicator | Skip indicator 10.3.1 | M | V | 1/2 |
| | Authentication and ciphering request message identity | Message type 10.4 | M | V | 1 |
| | Ciphering algorithm | Ciphering algorithm 10.5.5.3 | M | V | 1/2 |
| | IMEISV request | IMEISV request 10.5.5.10 | M | V | 1/2 |
| | Force to standby | Force to standby 10.5.5.7 | M | V | 1/2 |
| | A&C reference number | A&C reference number 10.5.5.19 | M | V | 1/2 |
| 21 | Authentication parameter RAND | Authentication parameter RAND 10.5.3.1 | O | TV | 17 |
| 8- | GPRS ciphering key sequence number | Ciphering key sequence number 10.5.1.2 | C | TV | 1 |
| 28 | Authentication parameter AUTN | Authentication parameter AUTN 10.5.3.1.1 | O | TLV | 18 |

### 9.4.9.1 Authentication Parameter RAND

This IE shall only be included if authentication shall be performed.

### 9.4.9.2 GPRS ciphering key sequence number

This IE is included if and only if the *Authentication parameter RAND* is contained in the message.

### 9.4.9.3 Authentication Parameter AUTN

This IE shall be present if and only if the authentication challenge is a UMTS authentication challenge.The presence or absence of this IE defines- in the case of its absence- a GSM authentication challenge or- in the case of its presence- a UMTS authentication challenge.

The MS shall ignore the IE if it does not support UMTS authentication algorithm.

In UMTS, the MS shall reject the AUTHENTICATION & CIPHERING REQUEST message as specified in subclause 4.7.7.5.1 if this IE is not present and the MS supports UMTS authentication algorithm.

## 10.5.3.6 Reject cause

The purpose of the *Reject Cause* information element is to indicate the reason why a request from the mobile station is rejected by the network.

The *Reject Cause* information element is coded as shown in figure 10.5.81/3GPP TS 24.008 and table 10.5.95/3GPP TS 24.008.

The *Reject Cause* is a type 3 information element with 2 octets length.

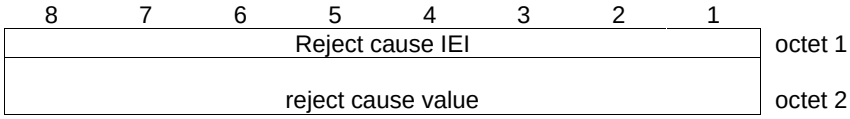



**Figure 10.5.81/3GPP TS 24.008 *Reject Cause* information element**

**Table 10.5.95/3GPP TS 24.008: *Reject Cause* information element**

Reject cause value (octet 2)

| Bits 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | IMSI unknown in HLR |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Illegal MS |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | IMSI unknown in VLR |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | IMEI not accepted |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Illegal ME |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | PLMN not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Location Area not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | Roaming not allowed in this location area |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Network failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | MAC failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | Synch failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | Congestion |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | ~~No AUTN~~GSM authentication unacceptable |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Service option not supported |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Requested service option not subscribed |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | Service option temporarily out of order |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | Call cannot be identified |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | } |
| to | | | | | | | | } retry upon entry into a new cell |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | } |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | Semantically incorrect message |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Invalid mandatory information |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Message type non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Message type not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Information element non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | Conditional IE error |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | Message not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | Protocol error, unspecified |

Any other value received by the mobile station shall be treated as 0010 0010, 'Service option temporarily out of order'. Any other value received by the network shall be treated as 0110 1111, 'Protocol error, unspecified'.

NOTE: The listed reject cause values are defined in Annex G.

## 10.5.5.14 GMM cause

The purpose of the GMM cause information element is to indicate the reason why a GMM request from the mobile station is rejected by the network.

The GMM cause information element is coded as shown in figure 10.5.129/3GPP TS 24.008 and table 10.5.147/3GPP TS 24.008.

The GMM cause is a type 3 information element with 2 octets length.

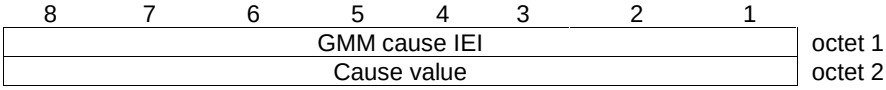



**Figure 10.5.129/3GPP TS 24.008: GMM cause information element**

**Table 10.5.147/3GPP TS 24.008: GMM cause information element**

Cause value (octet 2)
Bits

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | IMSI unknown in HLR |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Illegal MS |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Illegal ME |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | GPRS services not allowed |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GPRS services and non-GPRS services not allowed |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | MS identity cannot be derived by the network |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | Implicitly detached |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | PLMN not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Location Area not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | Roaming not allowed in this location area |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | GPRS services not allowed in this PLMN |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | MSC temporarily not reachable |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Network failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | MAC failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | Synch failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | Congestion |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | ~~No AUTN~~GSM authentication unacceptable |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | No PDP context activated |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | } |
| | | | to | | | | | } retry upon entry into a new cell |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | } |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | Semantically incorrect message |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Invalid mandatory information |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Message type non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Message type not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Information element non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | Conditional IE error |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | Message not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | Protocol error, unspecified |

Any other value received by the mobile station shall be treated as 0110 1111, 'Protocol error, unspecified'. Any other value received by the network shall be treated as 0110 1111, 'Protocol error, unspecified'.

NOTE: The listed reject cause values are defined in Annex G.

## 11.2 Timers of mobility management

**Table 11.1/3GPP TS 24.008: Mobility management timers - MS-side**

| TIMER NUM. | MM ST AT | TIME OUT VAL. | CAUSE FOR START | NORMAL STOP | AT THE EXPIRY |
|---|---|---|---|---|---|
| T3210 | 3 | 20s | - LOC_UPD_REQ sent | - LOC_UPD_ACC<br>- LOC_UPD_REJ<br>- AUTH_REJ<br>- Lower layer failure | Start T3211 |
| T3211 | 1<br>2 | 15s | - LOC_UPD_REJ with cause#17 netw. failure<br>- lower layer failure or RR conn. released after RR conn. abort during loc. updating | - Time out<br>- cell change<br>- request for MM connection establishment<br>- change of LA | Restart the Location update proc. |
| T3212 | 1,<br>2 | Note 1 | - termination of MM service or MM signalling | - initiation of MM service or MM signalling | initiate periodic updating |
| T3213 | 1<br>2<br>11 | 4s | - location updating failure | - expiry<br>- change of BCCH parameter | new random attempt |
| T3214 | 3<br>5<br>7 | 20s | AUTHENT FAILURE<br>Cause = 'MAC failure' or 'GSM authentication unacceptable' sent | AUTHENT REQ<br>- received | Consider the network as 'false' (see 4.3.2.6.1) |
| T3216 | 3<br>5<br>7 | 15s | AUTHENT FAILURE<br>Cause = Synch failure sent | AUTHENT REQ received | Consider the network as 'false' (see 4.3.2.6.1) |
| T3218 | 3<br>5<br>7 | 20s | RAND and RES stored after receipt of a UMTS authentication challenge | - Cipher mode setting (A/Gb mode only)<br>- Security mode setting (Iu mode only)<br>- AUTHENT REJ received<br>- enter MM IDLE or NULL | Delete the stored RAND and RES |
| T3220 | 7 | 5s | - IMSI DETACH | - release from RM-sublayer | enter Null or Idle, ATTEMPTING TO UPDATE |
| T3230 | 5 | 15s | - CM SERV REQ<br><br>CM REEST REQ | - Cipher mode setting<br>- CM SERV REJ<br>- CM SERV ACC | provide release ind. |
| T3240 | 9<br>10 | 10s | see section 11.2.1 | see section 11.2.1 | abort the RR connection |

NOTE 1: The timeout value is broadcasted in a SYSTEM INFORMATION message

**Table 11.2/3GPP TS 24.008: Mobility management timers - network-side**

| TIMER NUM. | MM STAT | TIME OUT VAL. | CAUSE FOR START | NORMAL STOP | AT THE EXPIRY | AT THE SECOND EXPIRY |
|---|---|---|---|---|---|---|
| T3250 | 6 | 12s | TMSI-REAL-CMD or LOC UPD ACC with new TMSI sent | TMSI-REALL-COM received | Optionally Release RR connection | |
| T3255 | | Note | LOC UPD ACC sent with"Follow on Proceed" | CM SERVICE REQUEST | Release RR Connection or use for mobile station terminating call | |
| T3260 | 5 | 12s | AUTHENT-REQUEST sent | AUTHENT-RESPONSE received<br><br>AUTHENT-FAILURE received | Optionally Release RR connection | |
| T3270 | 4 | 12s | IDENTITY REQUEST sent | IDENTITY RESPONSE received | Optionally Release RR connection | |

NOTE 2: The value of this timer is not specified by this recommendation.

## 11.2.1 Timer T3240

Timer T3240 is started in the mobile station when:

- the mobile station receives a LOCATION UPDATING ACCEPT message completing a location updating procedure in the cases specified in section 4.4.4.6 and 4.4.4.8;
- the mobile station receives a LOCATION UPDATING REJECT message in the cases specified in section 4.4.4.7;
- the mobile station has sent a CM SERVICE ABORT message as specified in section 4.5.1.7;
- the mobile station has released or aborted all MM connections in the cases specified in 4.3.2.5, 4.3.5.2, 4.5.1.1, and 4.5.3.1.

Timer T3240 is stopped, reset, and started again at receipt of an MM message.

Timer T3240 is stopped and reset (but not started) at receipt of a CM message that initiates establishment of an CM connection (an appropriate SETUP, REGISTER, or CP-DATA message as defined in 3GPP TS 24.008, 3GPP TS 24.010 or GSM 04.11).

## 11.2.2 Timers of GPRS mobility management

**Table 11.3/3GPP TS 24.008: GPRS Mobility management timers - MS side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON THE 1st, 2nd, 3rd, 4th EXPIRY Note 3 |
|---|---|---|---|---|---|
| T3310 | 15s | GMM-REG-INIT | ATTACH REQ sent | ATTACH ACCEPT received<br>ATTACH REJECT received | Retransmission of ATTACH REQ |
| T3311 | 15s | GMM-DEREG ATTEMPTING TO ATTACH or<br>GMM-REG ATTEMPTING TO UPDATE | ATTACH REJ with other cause values as described in chapter 'GPRS Attach'<br>ROUTING AREA UPDATE REJ with other cause values as described in chapter 'Routing Area Update'<br>Low layer failure | Change of the routing area | Restart of the Attach or the RAU procedure with updating of the relevant attempt counter |
| T3316 | 30s | GMM-REG-INIT<br>GMM-REG<br>GMM-DEREG-INIT<br>GMM-RA-UPDATING-INT<br>GMM-SERV-REQ-INIT (Iu mode only) | RAND and RES stored after receipt of a UMTS authentication challenge | Security mode setting (Iu mode only)<br>AUTHENTICATION & CIPHERING REJECT received<br>Enter GMM-DEREG or GMM-NULL | Delete the stored RAND and RES |
| T3318 | 20s | GMM-REG-INIT<br>GMM-REG<br>GMM-DEREG-INIT<br>GMM-RA-UPDATING-INT<br>GMM-SERV-REQ-INIT (UMTS only) | AUTHENTICATION & CIPHERING FAILURE (cause='MAC failure' or 'GSM authentication unacceptable') sent | AUTHENTICATION & CIPHERING REQUEST received | On first expiry, the MS should consider the network as false (see 4.7.7.6.1) |
| T3320 | 15s | GMM-REG-INIT<br>GMM-REG<br>GMM-DEREG-INIT<br>GMM-RA-UPDATING-INT<br>GMM-SERV-REQ-INIT (UMTS only) | AUTHENTICATION & CIPHERING FAILURE (cause=synch failure) sent | AUTHENTICATION & CIPHERING REQUEST received | On first expiry, the MS should consider the network as false (see 4.7.7.6.1) |
| T3321 | 15s | GMM-DEREG-INIT | DETACH REQ sent | DETACH ACCEPT received | Retransmission of the DETACH REQ |

| | | | | | |
|---|---|---|---|---|---|
| T3330 | 15s | GMM-ROUTING-UPDATING-INITIATED | ROUTING AREA UPDATE REQUEST sent | ROUTING AREA UPDATE ACC received<br><br>ROUTING AREA UPDATE REJ received | Retransmission of the ROUTING AREA UPDATE REQUEST message |

**Table 11.3a/3GPP TS 24.008: GPRS Mobility management timers – MS side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON EXPIRY |
|---|---|---|---|---|---|
| T3302 | Default 12 min<br>Note 1 | GMM-DEREG<br>or<br>GMM-REG | At attach failure and the attempt counter is greater than or equal to 5.<br>At routing area updating failure and the attempt counter is greater than or equal to 5. | At successful attach<br><br>At successful routing area updating | On every expiry, initiation of the<br>GPRS attach procedure<br>or<br>RAU procedure |
| T3312 | Default 54 min<br>Note1 | GMM-REG | In GSM, when READY state is left.<br>In UMTS, when PMM-CONNECTED mode is left. | When entering state GMM-DEREG | Initiation of the Periodic RAU procedure |
| T3314<br>READY<br>(GSM only) | Default 44 sec<br>Note 2 | All except GMM-DEREG | Transmission of a PTP PDU | Forced to Standby | No cell-updates are performed |
| T3317<br>(UMTS only) | 10s | GMM-SERVICE-REQUEST-INITIATED | SERVICE REQ sent | Security mode control procedure is completed,<br>SERVICE ACCEPT received, or<br>SERVICE REJECT received | Abort the procedure |

NOTE 1: The value of this timer is used if the network does not indicate another value in a GMM signalling procedure.

NOTE 2: The default value of this timer is used if neither the MS nor the Network send another value, or if the Network sends this value, in a signalling procedure.

NOTE 3: Typically, the procedures are aborted on the fifth expiry of the relevant timer. Exceptions are described in the corresponding procedure description.

**Table 11.4/3GPP TS 24.008: GPRS Mobility management timers - network side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON THE 1st, 2nd, 3rd, 4th EXPIRY Note 3 |
|---|---|---|---|---|---|
| T3322 | 6s | GMM-DEREG-INIT | DETACH REQ sent | DETACH ACCEPT received | Retransmission of DETACH REQUEST |
| T3350 | 6s | GMM-COMMON-PROC-INIT | ATTACH ACCEPT sent with P-TMSI and/or TMSI<br>RAU ACCEPT sent with P-TMSI and/or TMSI<br>P-TMSI REALLOC COMMAND sent | ATTACH COMPLETE received<br>RAU COMPLETE received<br>P-TMSI REALLOC COMPLETE received | Retransmission of the same message type, i.e. ATTACH ACCEPT, RAU ACCEPT or REALLOC COMMAND |
| T3360 | 6s | GMM-COMMON-PROC-INIT | AUTH AND CIPH REQUEST sent | AUTH AND CIPH RESPONSE received<br>AUTHENT- AND CIPHER- FAILURE received | Retransmission of AUTH AND CIPH REQUEST |
| T3370 | 6s | GMM-COMMON-PROC-INIT | IDENTITY REQUEST sent | IDENTITY RESPONSE received | Retransmission of IDENTITY REQUEST |

**Table 11.4a/3GPP TS 24.008: GPRS Mobility management timers - network side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON EXPIRY |
|---|---|---|---|---|---|
| T3313 | Note1 | GMM_REG | Paging procedure initiated | Paging procedure completed | Network dependent |
| T3314 READY (GSM only) | Default 44 sec Note 2 | All except GMM-DEREG | Receipt of a PTP PDU | Forced to Standby | The network shall page the MS if a PTP PDU has to be sent to the MS |
| Mobile Reachable | Default 4 min greater than T3312 | All except GMM-DEREG | In GSM, change from READY to STANDBY state<br>In UMTS, change from PMM-CONNECTED mode to PMM-IDLE mode. | PTP PDU received | Network dependent but typically paging is halted on 1st expiry |

NOTE 1: The value of this timer is network dependent.

NOTE 2: The default value of this timer is used if neither the MS nor the Network send another value, or if the Network sends this value, in a signalling procedure. The value of this timer should be slightly shorter in the network than in the MS, this is a network implementation issue.

NOTE 3: Typically, the procedures are aborted on the fifth expiry of the relevant timer. Exceptions are described in the corresponding procedure description.

## G.3 Causes related to PLMN specific network failures and congestion / Authentication Failures

Cause value = 20 MAC failure

This cause is sent to thenetwork if the SIM detects that the MAC in the authentication request message is not fresh (see 3GPP TS 33.102)

Cause value = 21 Synch failure

This cause is sent to the network if the SIM detects that the SQN in the authentication request message is out of range (see 3GPP TS 33.102)

Cause value = 17 Network failure

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

Cause value = 22 Congestion

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

Cause value = 23 GSM authentication unacceptable

This cause is sent to the network in UMTS if the MS supports the UMTS authentication algorithm and there is no Authentication Parameter AUTN IE present in the AUTHENTICATION REQUEST message.

**3GPP TSG-CN Plenary Meeting #12**
**Stockholm, Sweden, 13th - 15th June 2001**

***Tdoc NP-010343***

*CR-Form-v3*

# CHANGE REQUEST

⌘ **24.008** **CR** **428** ⌘ rev **1** ⌘ Current version: **4.2.0** ⌘

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

***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☒ Radio Access Network ☐ Core Network ☒

| | | |
|---|---|---|
| ***Title:*** | ⌘ | Alignment of 24.008 authentication procedures with 33.102 |
| ***Source:*** | ⌘ | Vodafone, Samsung, Lucent Technologies, Nokia |
| ***Work item code:*** | ⌘ | SEC1 — ***Date:*** ⌘ 07-06-2001 |
| ***Category:*** | ⌘ | **A** — ***Release:*** ⌘ REL-4 |

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

*Use one of the following releases:*

| | |
|---|---|
| *2* | *(GSM Phase 2)* |
| *R96* | *(Release 1996)* |
| *R97* | *(Release 1997)* |
| *R98* | *(Release 1998)* |
| *R99* | *(Release 1999)* |
| *REL-4* | *(Release 4)* |
| *REL-5* | *(Release 5)* |

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | Following the liaison statements between SA3 and T3 concerning "SIM/USIM Internal and External Interworking Aspects" CN1 has identified a need to bring 24.008 into line with what is currently specified in 33.102. In 24.008 there is a need to ensure that an R99 or newer UE, with a USIM inserted, being served by UTRAN shall not accept a 2G authentication challenge. |
| ***Summary of change:*** | ⌘ | It is proposed that when the R99 or newer UE has a USIM inserted and is served by UTRAN, then the UE must ensure that only 3G authentication challenges are processed. The UE checks each AUTHENTICATION (& CIPHERING) REQUEST for an AUTN. If the AUTN is not present, then the UE sends the AUTHENTICATION (& CIPHERING) FAILURE message, with a new cause - 'GSM authentication unacceptable'.<br><br>The network may use this new cause to decide on how to proceed. The mobile behaves in the same way as it would have done, had it sent the 'MAC failure' cause. This means that the network has the option to try and authenticate the MS again, but at worst, it could do nothing, and timers will expire in the MS, causing it to bar the cell. |
| ***Consequences if not approved:*** | ⌘ | System vulnerability as identified by TSG SA3 |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | 4.3.2b, 4.3.2.5.1, 4.3.2.6, 4.3.2.6.1, 4.7.7b, 4.7.7.5.1, 4.7.7.6, 4.7.7.6.1, 9.2.2.1, 9.4.9.3, 10.5.3.6, 10.5.5.14, 11.2, 11.2.2, G.3 |
| ***Other specs affected:*** | ⌘ | ☐ Other core specifications ⌘<br>☐ Test specifications<br>☐ O&M Specifications |
| ***Other comments:*** | ⌘ | The new cause code is seen as one that should only ever be received by the |

| | |
|---|---|
| | network due to a real security attack. It should not be sent in error. The handling of the new cause by the network is an implementation choice. |

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

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

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

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

## 4.3.2 Authentication procedure

### 4.3.2a Authentication procedure used for a UMTS authentication challenge

The purpose of the authentication procedure is fourfold (see 3GPP TS 33.102):

First to permit the network to check whether the identity provided by the mobile station is acceptable or not;

Second to provide parameters enabling the mobile station to calculate a new UMTS ciphering key.

Third to provide parameters enabling the mobile station to calculate a new UMTS integrity key.

Fourth to permit the mobile station to authenticate the network

The cases where the authentication procedure should be used are defined in 3GPP TS 33.102.

The UMTS authentication procedure is always initiated and controlled by the network. However, there is the possibility for the MS to reject the UMTS authentication challenge sent by the network. UMTS authentication challenge shall be supported by a MS supporting the UMTS authentication algorithm.

Note: According to 3GPP TS 33.102, a ME supporting only A/Gb mode need not support the USIM interface and in consequence need not support the UMTS authentication algorithm.

A UMTS security context is established in the MS and the network when a UMTS authentication challenge is performed in GSM or in UMTS. After a successful UMTS authentication, the UMTS ciphering key, the UMTS integrity key, the GSM ciphering key and the ciphering key sequence number, are stored both in the network and the MS.

## 4.3.2b Authentication Procedure used for a GSM authentication challenge

The purpose of the authentication procedure is twofold (see GSM 03.20):

First to permit the network to check whether the identity provided by the mobile station is acceptable or not;

Second to provide parameters enabling the mobile station to calculate a new GSM ciphering key.

The cases where the authentication procedure should be used are defined in GSM 02.09.

The authentication procedure is always initiated and controlled by the network. GSM authentication challenge shall be supported by a ME supporting GSM or UMTS radio access.

A GSM security context is established in the MS and the network when a GSM authentication challenge is performed in GSM or in UMTS. However, in UMTS an MS which supports the UMTS authentication algorithm ~~and ME with a USIM inserted that is currently being served by the UTRAN~~ shall not accept a GSM authentication challenge. ~~-~~After a successful GSM authentication, the GSM ciphering key and the ciphering key sequence number, are stored both in the network and the MS.

### 4.3.2.1 Authentication request by the network

The network initiates the authentication procedure by transferring an AUTHENTICATION REQUEST message across the radio interface and starts the timer T3260. The AUTHENTICATION REQUEST message contains the parameters necessary to calculate the response parameters (see GSM 03.20 (in case of GSM authentication challenge) and 3GPP TS 33.102 (in case of an UMTS authentication challenge)). In a GSM authentication challenge, the AUTHENTICATION REQUEST message also contains the GSM ciphering key sequence number allocated to the key which may be computed from the given parameters. In a UMTS authentication challenge, the AUTHENTICATION REQUEST message also contains the ciphering key sequence number allocated to the key set of UMTS ciphering key, UMTS integrity key and GSM ciphering key which may be computed from the given parameters.

### 4.3.2.2 Authentication response by the mobile station

The mobile station shall be ready to respond upon an AUTHENTICATION REQUEST message at any time whilst a RR connection exists. With exception of the cases described in 4.3.2.5.1, it shall process the challenge information and send back an AUTHENTICATION RESPONSE message to the network.

A MS which does not support the UMTS authentication algorithm shall ignore the Authentication Parameter AUTN IE if included in the AUTHENTICATION REQUEST message and shall proceed as in case of a GSM authentication challenge. It shall not perform the authentication of the network described in 4.3.2.5.1.

In a GSM authentication challenge, the new GSM ciphering key calculated from the challenge information shall overwrite the previous GSM ciphering key and any previously stored UMTS ciphering key and UMTS integrity key shall be deleted. The new GSM ciphering key shall be stored on the SIM together with the ciphering key sequence number.

In a UMTS authentication challenge, the new UMTS ciphering key, the new GSM ciphering key and the new UMTS integrity key calculated from the challenge information shall overwrite the previous UMTS ciphering key, GSM ciphering key and UMTS integrity key. The new UMTS ciphering key, GSM ciphering key and UMTS integrity key are stored on the SIM together with the ciphering key sequence number.

The SIM will provide the mobile station with the authentication response, based upon the authentication challenge given from the ME. A UMTS authentication challenge will result in the SIM passing a RES to the ME. A GSM authentication challenge will result in the SIM passing a SRES to the ME.

A mobile station supporting UMTS authentication challenge may support the following procedure:

In order to avoid a synchronisation failure, if the same RAND is received twice, the mobile station shall store the received RAND and the RES returned from the SIM in the volatile memory and compare it with any subsequently received RAND values, until the RAND value stored in the mobile station is deleted. If the stored RAND value is equal to the new received value in the AUTHENTICATION REQUEST message, then the mobile station shall not pass the RAND to the SIM, but shall immediately send the AUTHENTICATION RESPONSE message with the stored RES. If there is no valid stored RAND in the mobile station or the stored RAND is different from the new received value in the AUTHENTICATION REQUEST message, the mobile station shall pass the RAND to the SIM, shall override any previously stored RAND and RES with the new ones and reset and restart timer T3218.

The RAND and RES values stored in the mobile station shall be deleted:

- upon receipt of a SECURITY MODE COMMAND (Iu mode only), CIPHERING MODE COMMAND (A/Gb mode only) or AUTHENTICATION REJECT message;
- upon expiry of timer T3218; or
- if the mobile station enters the MM state MM IDLE or NULL.

### 4.3.2.3 Authentication processing in the network

Upon receipt of the AUTHENTICATION RESPONSE message, the network stops the timer T3260 and checks the validity of the response (see GSM 03.20 in case of a GSM authentication challenge respective 3GPP TS 33.102 in case of an UMTS authentication challenge).

Upon receipt of the AUTHENTICATION FAILURE message, the network stops the timer T3260. In Synch failure case, the core network may renegotiate with the HLR/AuC and provide the MS with new authentication parameters.

### 4.3.2.4 Ciphering key sequence number

The security parameters for authentication and ciphering are tied together in sets.In a GSM authentication challenge, from a challenge parameter RAND both the authentication response parameter SRES and the GSM ciphering key can be computed given the secret key associated to the IMSI. In a UMTS authentication challenge, from a challenge parameter RAND, the authentication response parameter RES and the UMTS ciphering key and the UMTS integrity key can be computed given the secret key associated to the IMSI. In addition, a GSM ciphering key can be computed from the UMTS ciphering key and the UMTS integrity key by means of an unkeyed conversion function.

In order to allow start of ciphering on a RR connection without authentication, the ciphering key sequence numbers are introduced. The ciphering key sequence number is managed by the network in the way that the AUTHENTICATION

REQUEST message contains the ciphering key sequence number allocated to the GSM ciphering key (in case of a GSM authentication challenge) or the UMTS ciphering key and the UMTS integrity key (in case of a UMTS authentication challenge) which may be computed from the RAND parameter carried in that message.

The mobile station stores the ciphering key sequence number with the GSM ciphering key (in case of a GSM authentication challenge) and the UMTS ciphering key and the UMTS integrity key (in case of a UMTS authentication challenge) and indicates to the network in the first message (LOCATION UPDATING REQUEST, CM SERVICE REQUEST, PAGING RESPONSE, CM RE-ESTABLISHMENT REQUEST) which ciphering key sequence number the stored GSM ciphering key (in case of a GSM authentication challenge) or set of UMTS ciphering, UMTS integrity and derived GSM ciphering keys (in case of a UMTS authentication challenge) has.

When the deletion of the ciphering key sequence number is described this also means that the associated GSM ciphering key, the UMTS ciphering key and the UMTS integrity key shall be considered as invalid (i.e. the established GSM security context or the UMTS security context is no longer valid).

In GSM, the network may choose to start ciphering with the stored GSM ciphering key (under the restrictions given in GSM 02.09) if the stored ciphering key sequence number and the one given from the mobile station are equal.

In UMTS, the network may choose to start ciphering and integrity with the stored UMTS ciphering key and UMTS integrity key (under the restrictions given in GSM 02.09 and 3GPP TS 33.102) if the stored ciphering key sequence number and the one given from the mobile station are equal.

NOTE: In some specifications the term KSI (Key Set Identifier) might be used instead of the term ciphering key sequence number.

#### 4.3.2.5 Authentication not accepted by the network

If authentication fails, i.e. if the response is not valid, the network may distinguish between the two different ways of identification used by the mobile station:

- the TMSI was used;
- the IMSI was used.

If the TMSI has been used, the network may decide to initiate the identification procedure. If the IMSI given by the mobile station then differs from the one the network had associated with the TMSI, the authentication should be restarted with the correct parameters. If the IMSI provided by the MS is the expected one (i.e. authentication has really failed), the network should proceed as described below.

If the IMSI has been used, or the network decides not to try the identification procedure, an AUTHENTICATION REJECT message should be transferred to the mobile station.

After having sent this message, all MM connections in progress (if any) are released and the network should initiate the RR connection release procedure described in section 3.5.of 04.18 (GSM) or in 3GPP TS 25.331 (UMTS).

Upon receipt of an AUTHENTICATION REJECT message, the mobile station shall set the update status in the SIM to U3 ROAMING NOT ALLOWED, delete from the SIM the stored TMSI, LAI and ciphering key sequence number. The SIM shall be considered as invalid until switching off or the SIM is removed.

If the AUTHENTICATION REJECT message is received in the state IMSI DETACH INITIATED the mobile station shall follow section 4.3.4.3.

If the AUTHENTICATION REJECT message is received in any other state the mobile station shall abort any MM specific, MM connection establishment or call re-establishment procedure, stop any of the timers T3210 or T3230 (if running), release all MM connections (if any), start timer T3240 and enter the state WAIT FOR NETWORK COMMAND, expecting the release of the RR connection. If the RR connection is not released within a given time controlled by the timer T3240, the mobile station shall abort the RR connection. In both cases, either after a RR connection release triggered from the network side or after a RR connection abort requested by the MS-side, the MS enters state MM IDLE, substate NO IMSI. If the MS has a separate ongoing RR connection to a different core network node, it shall consider this separate connection as still being good.

#### 4.3.2.5.1 Authentication not accepted by the MS

In a UMTS authentication challenge, the authentication procedure is extended to allow the MS to check the authenticity of the core network. Thus allowing, for instance, detection of false base station.

Following a UMTS authentication challenge, the MS may reject the core network, on the grounds of an incorrect AUTN parameter (see 3GPP TS 33.102). This parameter contains two possible causes for authentication failure:

a) MAC code failure

If the MS considers the MAC code (supplied by the core network in the AUTN parameter) to be invalid, it shall send an AUTHENTICATION FAILURE message to the network, with the reject cause "MAC failure". The MS shall then follow the procedure described in section 4.3.2.6 (c).

b) SQN failure

If the MS considers the SQN (supplied by the core network in the AUTN parameter) to be out of range, it shall send a AUTHENTICATION FAILURE message to the network, with the reject cause "Synch failure" and a re-synchronization token AUTS provided by the SIM (see 3GPP TS 33.102). The MS shall then follow the procedure described in section 4.3.2.6 (d).

In UMTS~~Iu mode~~, an MS which supports the UMTS authentication algorithm~~with a USIM inserted may~~ shall reject the authentication challenge ~~on the grounds that~~ if no Authentication Parameter AUTN IE was present in the AUTHENTICATION REQUEST message~~at all~~ (i.e. a GSM authentication challenge has been received when the MS expects a UMTS authentication challenge). ~~In~~ In such a case, the MS shall send the AUTHENTICATION FAILURE message to the network, with the reject cause 'GSM authentication unacceptable~~No AUTN~~'. ~~The~~ The MS shall then follow the procedure described in section 4.3.2.6 (c).

### 4.3.2.6 Abnormal cases

(a) RR connection failure:

Upon detection of a RR connection failure before the AUTHENTICATION RESPONSE is received, the network shall release all MM connections (if any) and abort any ongoing MM specific procedure.

(b) Expiry of timer T3260:

The authentication procedure is supervised on the network side by the timer T3260. At expiry of this timer the network may release the RR connection. In this case the network shall abort the authentication procedure and any ongoing MM specific procedure, release all MM connections if any, and initiate the RR connection release procedure described in section 3.5.

(c) Authentication failure (reject cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable'):

The MS shall send an AUTHENTICATION FAILURE message, with reject cause 'MAC failure' or '~~No~~ ~~AUTN~~GSM authentication unacceptable' according to section 4.3.2.5.1, to the network and start timer T3214. Upon receipt of an AUTHENTICATION FAILURE message from the MS, with reject cause 'MAC failure~~,~~' or '~~No AUTN~~GSM authentication unacceptable' the network may initiate the identification procedure described in section 4.3.3. This is to allow the network to obtain the IMSI from the MS. The network may then check that the TMSI originally used in the authentication challenge corresponded to the correct IMSI. Upon receipt of the IDENTITY REQUEST message from the network, the MS shall send the IDENTITY RESPONSE message.

~~I~~If the TMSI/IMSI mapping in the network was incorrect, the network should respond by sending a new AUTHENTICATION REQUEST message to the MS. Upon receiving the second AUTHENTICATION REQUEST message from the network, the MS shall stop the timer T3214, if running, and then process the challenge information as normal.

When the first AUTHENTICATION REQUEST message containing an invalid MAC has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (i.e. T3210, T3220 or T3230).

Upon successfully validating the network (an AUTHENTICATION REQUEST that contains a valid MAC is received), the MS shall send the AUTHENTICATION RESPONSE message to the network and shall start any

retransmission timers (e.g. T3210, T3220 or T3230) , if they were running and stopped when the MS received the first AUTHENTICATION REQUEST message containing an invalid MAC.

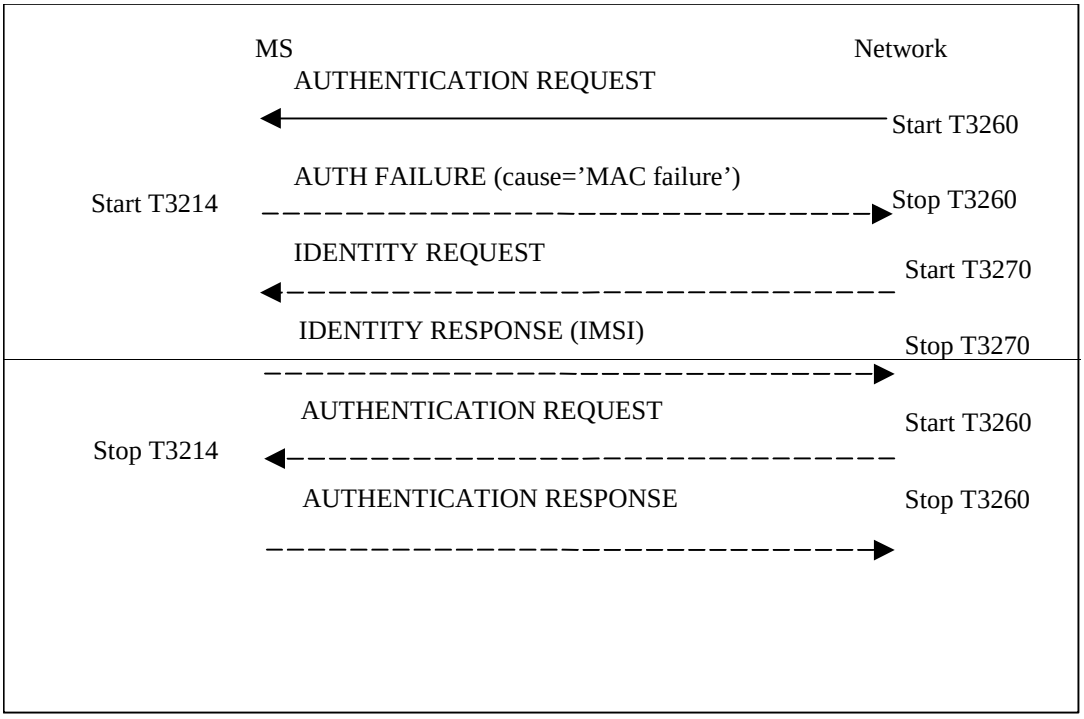
It can be assumed that the source of the authentication challenge is not genuine (authentication not accepted by the MS) if any of the following occur:

- After sending the AUTHENTICATION FAILURE message with the reject cause 'MAC failure' or '~~No~~ ~~AUTN~~GSM authentication unacceptable' the timer T3214 expires;

- Upon receipt of the second AUTHENTICATION REQUEST while T3214 is running and the MAC value cannot be resolved

- The second AUTHENTICATION REQUEST which is received while T3214 is running is a GSM authentication challenge (i.e. no AUTN parameter was received).

When it has been deemed by the MS that the source of the authentication challenge is not genuine (i.e. authentication not accepted by the MS), the MS shall behave as described in section 4.3.2.6.1.




**~~Figure 4.2/3GPP TS 24.008: Authentication Failure Procedure (reject cause 'MAC failure')~~**

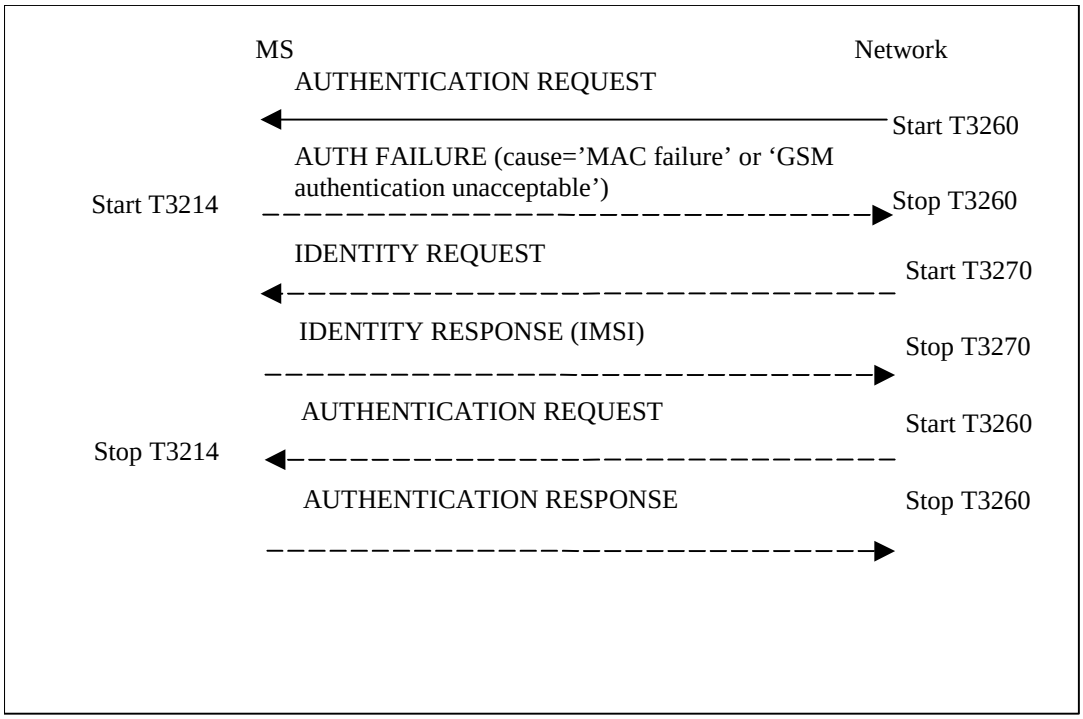



**Figure 4.2/3GPP TS 24.008: Authentication Failure Procedure (reject cause 'MAC failure' or '~~No~~ ~~AUTN~~GSM authentication unacceptable')**

(d) Authentication failure (reject cause 'synch failure'):

The MS shall send an AUTHENTICATION FAILURE message, with reject cause 'synch failure,' to the network and start the timer T3216. Upon receipt of an AUTHENTICATION FAILURE message from the MS with the reject cause 'synch failure,' the network shall use the returned AUTS parameter from the authentication failure parameter IE in the AUTHENTICATION FAILURE message, to re-synchronise. The re-synchronisation procedure requires the VLR/MSC to delete all unused authentication vectors for that IMSI and obtain new vectors from the HLR. When re-synchronisation is complete, the network shall initiate the authentication procedure. Upon receipt of the AUTHENTICATION REQUEST message, the MS shall stop the timer T3216, if running.

When the first AUTHENTICATION REQUEST message containing an invalid SQN has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (i.e. T3210, T3220 or T3230).

Upon successfully validating the network (a second AUTHENTICATION REQUEST is received which contains a valid SQN) while T3216 is running, the MS shall send the AUTHENTICATION RESPONSE message to the network and shall start any retransmission timers (e.g. T3210, T3220 or T3230), if they were running and stopped when the MS received the first AUTHENTICATION REQUEST message containing an invalid SQN.

If the MS receives a second AUTHENTICATION REQUEST which contains an invalid SQN or GSM AUTHENTICATION REQUEST while T3216 is running, then the MS shall behave as described in section 4.3.2.6.1.

If the timer T3216 expires, then the MS shall behave as described in section 4.3.2.6.1.

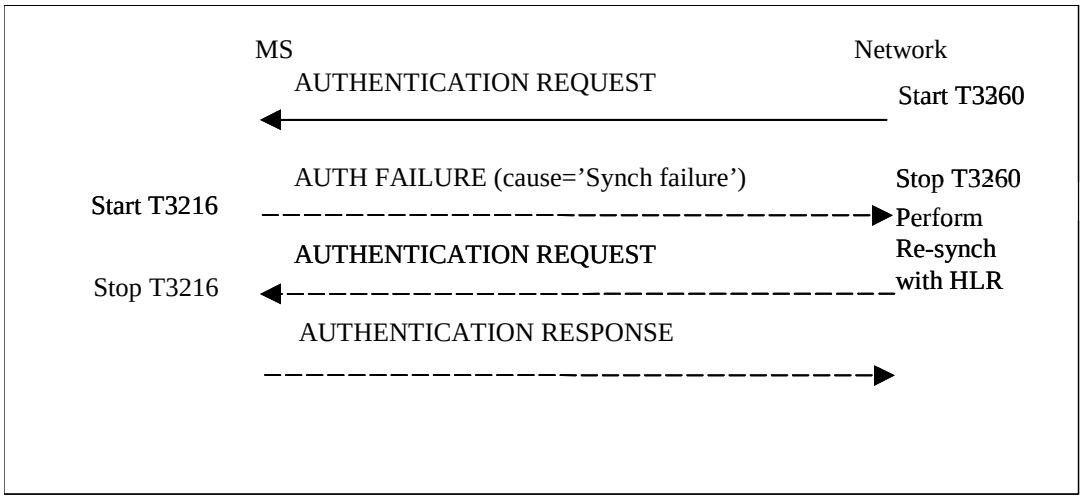



**Figure 4.2a/3GPP TS 24.008: Authentication Failure Procedure (reject cause 'Synch failure')**

#### 4.3.2.6.1 MS behaviour towards a network that has failed the authentication procedure

If the MS deems that the network has failed the authentication check, then it shall treat the cell where the AUTHENTICATION REQUEST message which lead to sending of AUTHENTICATION FAILURE was received as barred, until refresh of system information data. The MS shall start any retransmission timers (e.g. T3210, T3220 or T3230), if they were running and stopped when the MS received the first AUTHENTICATION REQUEST message containing an invalid MAC or invalid SQN, ~~(~~or no AUTN~~)~~ when a UMTS authentication challenge was expected.

### 4.3.2.7 Handling of keys at intersystem change from UMTS to GSM

At intersystem change from UMTS to GSM, ciphering may be started (see GSM 04.18) without any new authentication procedure. Deduction of the appropriate security key for ciphering in GSM, depends on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the GSM ciphering key according to Table 4.3.2.7.1.

**Table 4.3.2.7.1/3GPP TS 24.008: Intersystem change from UMTS to GSM**

| | |
|---|---|
| Security context established in MS and network in UMTS | At intersystem change to GSM: |
| GSM security context | An ME shall apply the GSM cipher key received from the GSM security context residing in the SIM. |
| UMTS security context | An ME shall apply the GSM cipher key derived by the SIM from the UMTS cipher key and the UMTS integrity key. |

NOTE A SIM with UMTS security context, passes the UMTS cipher key, the UMTS integrity key and the derived GSM cipher key to the ME independent on the current radio access being UMTS or GSM.

### 4.3.2.7a Use of established security contexts

In GSM, in the case of an established GSM security context, the GSM ciphering key shall be loaded from the SIM and taken into use by the ME when any valid CIPHERING MODE COMMAND is received during an RR connection (the definition of a valid CIPHERING MODE COMMAND message is given in GSM 04.18 section 3.4.7.2).

In GSM, in the case of an established UMTS security context, the GSM ciphering key shall be loaded from the SIM and taken into use by the MS when a valid CIPHERING MODE COMMAND is received during an RR connection (the definition of a valid CIPHERING MODE COMMAND message is given in GSM 04.18 section 3.4.7.2). The network shall derive a GSM ciphering key from the UMTS ciphering key and the UMTS integrity key by using the conversion function named "c3" defined in 3GPP TS 33.102.

In UMTS, in the case of an established GSM security context, the ME shall derive a UMTS ciphering key and a UMTS integrity key from the GSM ciphering key by using the conversion functions named “c4” and “c5” defined in 3GPP TS 33.102. The GSM ciphering key shall be loaded from the SIM and the derived UMTS ciphering key and UMTS integrity key shall be taken into use by the MS when a valid SECURITY MODE COMMAND indicating CS domain is received during an RR connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331). The network shall derive a UMTS ciphering key and a UMTS integrity key from the GSM ciphering key by using the conversion functions named “c4” and “c5” defined in 3GPP TS 33.102.

In UMTS, in the case of an established UMTS security context, the UMTS ciphering key and UMTS integrity key shall be loaded from the SIM and taken into use by the MS when a valid SECURITY MODE COMMAND indicating CS domain is received during a RR connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331).

NOTE: In UMTS and GSM, during an ongoing, already ciphering and/or integrity protected RR connection, the network might initiate a new Authentication procedure in order to establish a new GSM/UMTS security context. The new keys are taken into use in the MS when a new valid SECURITY MODE COMMAND indicating CS domain in UMTS, or a new valid CIPHERING MODE COMMAND in GSM, is received during the RR connection.

### 4.3.2.8 Handling of keys at intersystem change from GSM to UMTS

At intersystem change from GSM to UMTS, ciphering and integrity may be started (see 3GPP TS 25.331) without any new authentication procedure. Deduction of the appropriate security keys for ciphering and integrity check in UMTS, depend on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the UMTS cipher key and the UMTS integrity key according to Table 4.3.2.8.1.

**Table 4.3.2.8.1/3GPP TS 24.008: Intersystem change from GSM to UMTS**

| Security context established in MS and network in GSM | At intersystem change to UMTS: |
|---|---|
| GSM security context | An ME shall derive the UMTS cipher key and UMTS integrity key from the GSM cipher key provided by the SIM. The conversion functions named "c4" and "c5" in 3GPP TS 33.102 are used for this purpose. |
| UMTS security context | An ME shall apply the UMTS ciphering key and the UMTS integrity key received from the UMTS security context residing in the SIM. |

NOTE A SIM with UMTS security context, passes the UMTS cipher key, the UMTS integrity key and the derived GSM cipher key to the ME independent on the current radio access being UMTS or GSM.

## 4.7.7 Authentication and ciphering procedure

### 4.7.7a Authentication and ciphering procedure used for UMTS authentication challenge.

The purpose of the authentication and ciphering procedure is fourfold (see 3GPP TS 33.102):

- to permit the network to check whether the identity provided by the MS is acceptable or not;
- to provide parameters enabling the MS to calculate a new GPRS UMTS ciphering key and a new GPRS UMTS integrity key.

- to let the network set the GSM ciphering mode (ciphering /no ciphering ) and GSM ciphering algorithm; and
- to permit the mobile station to authenticate the network.

In UMTS, and in the case of a UMTS authentication challenge, the authentication and ciphering procedure can be used for authentication only.

The cases in which the authentication and ciphering procedure shall be used are defined in 3GPP TS 33.102 and GSM 02.09 [5].

The authentication and ciphering procedure is always initiated and controlled by the network. However, in the case of a UMTS authentication challenge, there is the possibility for the MS to reject the network.

UMTS authentication challenge shall be supported by a MS supporting UMTS authentication algorithm .

Note: According to 3GPP TS 33.102, a ME supporting only A/Gb mode need not support the USIM interface and in consequence need not support the UMTS authentication challenge.

The authentication and ciphering procedure can be used for either:

- authentication only;
- setting of the GSM ciphering mode and the GSM ciphering algorithm only; or
- authentication and the setting of the GSM ciphering mode and the GSM ciphering algorithm.

In GSM, the network should not send any user data during the authentication and ciphering procedure.

A UMTS security context is established in the MS and the network when a UMTS authentication challenge is performed in GSM or in UMTS. After a successful UMTS authentication, the GPRS UMTS ciphering key, the GPRS UMTS integrity key, the GPRS GSM ciphering key and the GPRS ciphering key sequence number, are stored both in the network and the MS.

### 4.7.7b Authentication and ciphering procedure used for GSM authentication challenge

The purpose of the authentication and ciphering procedure is threefold (see GSM 03.20 [13]):

- to permit the network to check whether the identity provided by the MS is acceptable or not;
- to provide parameters enabling the MS to calculate a new GPRS GSM ciphering key; and
- to let the network set the GSM ciphering mode (ciphering/no ciphering) and GSM ciphering algorithm.

The authentication and ciphering procedure can be used for either:

- authentication only;
- setting of the GSM ciphering mode and the GSM ciphering algorithm only; or
- authentication and the setting of the GSM ciphering mode and the GSM ciphering algorithm.

The cases in which the authentication and ciphering procedure shall be used are defined in GSM 02.09 [5].

In GSM, the authentication and ciphering procedure is always initiated and controlled by the network. It shall be performed in a non ciphered mode because of the following reasons:

- the network cannot decipher a ciphered AUTHENTICATION AND CIPHERING RESPONSE from an unauthorised MS and put it on the black list; and
- to be able to define a specific point in time from which on a new GPRS GSM ciphering key should be used instead of the old one.

GSM authentication challenge shall be supported by a ME supporting GSM or UMTS radio access.

In GSM, the network should not send any user data during the authentication and ciphering procedure.

A GSM security context is established in the MS and the network when a GSM authentication challenge is performed in GSM or in UMTS. However, in UMTS an MS which supports the UMTS authentication algorithm ~~andME with a USIM inserted that is currently being served by the UTRAN~~ shall not accept a GSM authentication challenge. After a successful GSM authentication challenge, the GPRS GSM ciphering key and the GPRS ciphering key sequence number, are stored both in the network and the MS.

#### 4.7.7.1 Authentication and ciphering initiation by the network

The network initiates the authentication and ciphering procedure by transferring an AUTHENTICATION AND CIPHERING REQUEST message across the radio interface and starts timer T3360. The AUTHENTICATION AND CIPHERING REQUEST message shall contain all parameters necessary to calculate the response parameters when authentication is performed (see GSM 03.20 [13] and 3GPP TS 33.102).

If authentication is requested, then the AUTHENTICATION AND CIPHERING REQUEST message shall contain either:

- In a GSM authentication challenge, the GPRS ciphering key sequence number, allocated to the GPRS GSM ciphering key and the RAND, or
- In a UMTS authentication challenge, the GPRS ciphering key sequence number, allocated to the GPRS UMTS ciphering and GPRS UMTS integrity keys, the RAND and the AUTN.

In GSM, if authentication is not requested, then the AUTHENTICATION AND CIPHERING REQUEST message shall not contain neither the GPRS ciphering key sequence number, the RAND nor the AUTN.

In GSM, if ciphering is requested, in a GSM authentication challenge or in a UMTS authentication challenge, then the AUTHENTICATION AND CIPHERING REQUEST message shall indicate the GPRS GSM ciphering algorithm.

The network includes the A&C reference number information element in the AUTHENTICATION AND CIPHERING REQUEST message. Its value is chosen in order to link an AUTHENTICATION AND CIPHERING REQUEST in a RA with its RESPONSE. The A&C reference number value might be based on the RA Colour Code value.

Additionally, the network may request the MS to include its IMEISV in the AUTHENTICATION AND CIPHERING RESPONSE message.

#### 4.7.7.2 Authentication and ciphering response by the MS

In GSM, a MS that is attached to GPRS shall be ready to respond upon an AUTHENTICATION AND CIPHERING REQUEST message at any time.

In UMTS, an MS that is attached to GPRS shall be ready to respond upon an AUTHENTICATION AND CIPHERING REQUEST message at any time whilst a PS signalling connection exists.

A MS which does not support the UMTS authentication algorithm shall ignore the Authentication Parameter AUTN IE if included in the AUTHENTICATION AND CIPHERING REQUEST message and perform the GSM authentication challenge. It shall not perform the authentication of the network described in 4.7.7.5.1.

In a GSM authentication challenge, if the AUTHENTICATION AND CIPHERING REQUEST message includes the authentication parameters RAND and GPRS CKSN, then upon receipt of the message, the MS processes the challenge information and sends an AUTHENTICATION AND CIPHERING RESPONSE message to the network. The value of the received A&C reference number information element shall be copied into the A&C reference number information element in the AUTHENTICATION AND CIPHERING RESPONSE message. A GSM authentication challenge will result in the SIM passing a SRES and a GPRS GSM ciphering key to the ME. The new GPRS GSM ciphering key calculated from the challenge information shall overwrite the previous one and any previously stored GPRS UMTS ciphering and GPRS UMTS integrity keys shall be deleted. The calculated GSM ciphering key shall be stored on the SIM together with the GPRS ciphering key sequence number before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted.

In a UMTS authentication challenge, if the AUTHENTICATION AND CIPHERING REQUEST message includes the UMTS authentication parameters GPRS CKSN, RAND and AUTN, then upon receipt of the message, the MS verifies the AUTN parameter and if this is accepted, the MS processes the challenge information and sends an AUTHENTICATION AND CIPHERING RESPONSE message to the network. The value of the received A&C reference number information element shall be copied into the A&C reference number information element in the

AUTHENTICATION AND CIPHERING RESPONSE message. A UMTS authentication challenge will result in the SIM passing a RES, a GPRS UMTS ciphering key, a GPRS UMTS integrity key and a GPRS GSM ciphering key to the ME. The new GPRS UMTS ciphering key, GPRS UMTS integrity key and GPRS GSM ciphering key calculated from the challenge information shall overwrite the previous ones. The new GPRS UMTS ciphering key, GPRS UMTS integrity key and GPRS GSM ciphering key shall be stored on the SIM together with the GPRS ciphering key sequence number before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted.

In UMTS, an MS capable of UMTS only shall ignore the Ciphering Algorithm IE in the AUTHENTICATION AND CIPHERING REQUEST message. An MS capable of both UMTS and GSM shall store the received value in the Ciphering Algorithm IE in the AUTHENTICATION AND CIPHERING REQUEST message in order to use it at an inter system change from UMTS to GSM.

If the AUTHENTICATION AND CIPHERING REQUEST message does not include neither the GSM authentication parameters (RAND and GPRS CKSN) nor the UMTS authentication parameters (RAND, AUTN and GPRS CKSN), then upon receipt of the message, the MS replies by sending an AUTHENTICATION AND CIPHERING RESPONSE message to the network.

In GSM, the GMM layer shall notify the LLC layer if ciphering shall be used or not and if yes which GSM ciphering algorithm and GPRS GSM ciphering key that shall be used (see GSM 04.64 [76]).

A mobile station supporting UMTS authentication challenge shall support the following procedure:

In order to avoid a synchronisation failure, if the same RAND is received twice, the mobile station shall store the received RAND and the RES returned from the SIM in the volatile memory and compare it with any subsequently received RAND values, until the RAND value stored in the mobile station is deleted. If the stored RAND value is equal to the new received value in the AUTHENTICATION & CIPHERING REQUEST message, then the mobile station shall not pass the RAND to the SIM, but shall immediately send the AUTHENTICATION & CIPHERING RESPONSE message with the stored RES. If there is no valid stored RAND in the mobile station or the stored RAND is different from the new received value in the AUTHENTICATION & CIPHERING REQUEST message, the mobile station shall pass the RAND to the SIM, shall override any previously stored RAND and RES with the new ones and reset and restart timer T3316.

The RAND and RES values stored in the mobile station shall be deleted:

- upon receipt of a SECURITY MODE COMMAND (Iu mode only) or AUTHENTICATION & CIPHERING REJECT message;
- upon expiry of timer T3316; or
- if the mobile station enters the GMM states GMM-DEREGISTERED or GMM-NULL.

#### 4.7.7.3 Authentication and ciphering completion by the network

Upon receipt of the AUTHENTICATION AND CIPHERING RESPONSE message, the network stops the timer T3360 and checks the validity of the response (see GSM 03.20 [13] and 3GPP TS 33.102). For this, it may use the A&C reference number information element within the AUTHENTICATION AND CIPHERING RESPONSE message to determine whether the response is correlating to the last request that was sent.

In GSM, the GMM layer shall notify the LLC sublayer if ciphering shall be used or not and if yes which algorithm and GPRS GSM ciphering key that shall be used (see GSM 04.64 [76]).

Upon receipt of the AUTHENTICATION AND CIPHERING FAILURE message, the network stops the timer T3360. In Synch failure case, the core network may renegotiate with the HLR/AuC and provide the MS with new authentication parameters.

#### 4.7.7.4 GPRS ciphering key sequence number

The security parameters for authentication and ciphering are tied together in sets. In a GSM authentication challenge, from a challenge parameter RAND both the authentication response parameter SRES and the GPRS GSM ciphering key can be computed given the secret key associated to the IMSI. In a UMTS authentication challenge, from a challenge parameter RAND, the authentication response parameter RES and the GPRS UMTS ciphering key and the GPRS UMTS integrity key can be computed given the secret key associated to the IMSI.

In order to allow start of ciphering on a logical link without authentication, GPRS ciphering key sequence numbers are introduced.

The GPRS ciphering key sequence number is managed by the network such that the AUTHENTICATION AND CIPHERING REQUEST message contains the GPRS ciphering key sequence number allocated to the GPRS GSM ciphering key (in case of a GSM authentication challenge) or the GPRS UMTS ciphering key and the GPRS UMTS integrity key (in case of a UMTS authentication challenge) which may be computed from the RAND parameter carried in that message.

The MS stores the GPRS ciphering key sequence number with the GPRS GSM ciphering key (in case of a GSM authentication challenge) and the GPRS UMTS ciphering key and the GPRS UMTS integrity key (in case of a UMTS authentication challenge),and includes the corresponding GPRS ciphering key sequence number in the ROUTING AREA UPDATE REQUEST , SERVICE REQUEST and ATTACH REQUEST messages.

If the GPRS ciphering key sequence number is deleted, the associated GPRS GSM ciphering key , GPRS UMTS ciphering key and GPRS UMTS integrity key shall be deleted (i.e. the established GSM security context or the UMTS security context is no longer valid).

In UMTS, the network may choose to start ciphering and integrity checking with the stored GPRS UMTS ciphering key and the stored GPRS UMTS integrity key (under the restrictions given in GSM 02.09 and 3GPP TS 33.102) if the stored GPRS ciphering key sequence number and the one given from the MS are equal.

In GSM, the network may choose to start ciphering with the stored GPRS GSM ciphering key (under the restrictions given in GSM 02.09) if the stored GPRS ciphering key sequence number and the one given from the MS are equal and the previously negotiated ciphering algorithm is known and supported in the network. When ciphering is requested at GPRS attach, the authentication and ciphering procedure shall be performed since the MS does not store the ciphering algorithm at detach.

Upon GPRS attach, if ciphering is to be used, an AUTHENTICATION AND CIPHERING REQUEST message shall be sent to the MS to start ciphering.

If the GPRS ciphering key sequence number stored in the network does not match the GPRS ciphering key sequence number received from the MS in the ATTACH REQUEST message, then the network should authenticate the MS.

In GSM, the MS starts ciphering after sending the AUTHENTICATION AND CIPHERING RESPONSE message. The network starts ciphering when a valid AUTHENTICATION AND CIPHERING RESPONSE is received from the MS.

In UMTS, the MS starts ciphering and integrity checking according to the conditions specified in specification 3GPP TS 25.331.

In GSM, as an option, the network may decide to continue ciphering without sending an AUTHENTICATION AND CIPHERING REQUEST message after receiving a ROUTING AREA UPDATE REQUEST message with a valid GPRS ciphering key sequence number. Both the MS and the network shall use the latest ciphering parameters. The network starts ciphering when sending the ciphered ROUTING AREA UPDATE ACCEPT message to the MS. The MS starts ciphering after receiving a valid ciphered ROUTING AREA UPDATE ACCEPT message from the network.

NOTE: In some specifications the term KSI (Key Set Identifier) is used instead of the term GPRS ciphering key sequence number.

#### 4.7.7.5 Authentication not accepted by the network

If authentication and ciphering fails, i.e. if the response is not valid, the network considers whether the MS has used the P-TMSI or the IMSI for identification.

- If the P-TMSI has been used, the network may decide to initiate the identification procedure. If the IMSI given by the MS differs from the one the network had associated with the P-TMSI, the authentication should be restarted with the correct parameters. If the IMSI provided by the MS is the expected one (i.e. authentication has really failed), the network should proceed as described below.

- If the IMSI has been used, or the network decides not to try the identification procedure, an AUTHENTICATION AND CIPHERING REJECT message should be transferred to the MS.

Upon receipt of an AUTHENTICATION AND CIPHERING REJECT message, the MS shall set the GPRS update status to GU3 ROAMING NOT ALLOWED and shall delete the P-TMSI, P-TMSI signature, RAI and GPRS

ciphering key sequence number stored. If available, also the TMSI, LAI and ciphering key sequence number shall be deleted and the update status shall be set to U3 ROAMING NOT ALLOWED. The SIM shall be considered as invalid until switching off or the SIM is removed.

If the AUTHENTICATION AND CIPHERING REJECT message is received, the MS shall abort any GMM procedure, shall stop the timers T3310, T3317 and T3330 (if running) and shall enter state GMM-DEREGISTERED.

#### 4.7.7.5.1 Authentication not accepted by the MS

In a UMTS authentication challenge, the authentication procedure is extended to allow the MS to check the authenticity of the core network. Thus allowing, for instance, detection of false base station.

Following a UMTS authentication challenge, the MS may reject the core network, on the grounds of an incorrect AUTN parameter (see 3GPP TS 33.102). This parameter contains two possible causes for authentication failure:

a) MAC code failure

If the MS considers the MAC code (supplied by the core network in the AUTN parameter) to be invalid, it shall send a AUTHENTICATION AND CIPHERING FAILURE message to the network, with the GMM cause "MAC failure'. The MS shall then follow the procedure described in section 4.7.7.6 (f).

b) SQN failure

If the MS considers the SQN (supplied by the core network in the AUTN parameter) to be out of range, it shall send a AUTHENTICATION AND CIPHERING FAILURE message to the network, with the GMM cause "Synch failure' and the re-synchronization token AUTS provided by the SIM (see 3GPP TS 33.102). The MS shall then follow the procedure described in section 4.7.7.6 (g).

In UMTS~~Iu mode~~, an MS which supports the UMTS authentication algorithm~~MS with a USIM inserted may~~ shall reject the authentication challenge~~ on the grounds that~~ if no ~~AUTN~~ Authentication ~~p~~Parameter AUTN IE was present in the AUTHENTICATION REQUEST message~~ at all~~ (i.e. a GSM authentication challenge has been received when the MS expects a UMTS authentication challenge). In such a case, the MS shall send the AUTHENTICATION AND CIPHERING FAILURE message to the network with the GMM cause '~~No AUTN~~GSM authentication unacceptable'. The MS shall then follow the procedure described~~obed~~ in section 4.7.7.6 (f).

### 4.7.7.6 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Lower layer failure

Upon detection of a lower layer failure before the AUTHENTICATION AND CIPHERING RESPONSE is received, the network shall abort the procedure.

b) Expiry of timer T3360

The network shall, on the first expiry of the timer T3360, retransmit the AUTHENTICATION AND CIPHERING REQUEST and shall reset and start timer T3360. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3360, the procedure shall be aborted.

c) Collision of an authentication and ciphering procedure with a GPRS attach procedure

If the network receives an ATTACH REQUEST message before the ongoing authentication procedure has been completed and no GPRS attach procedure is pending on the network (i.e. no ATTACH ACCEPT/REJECT message has to be sent as an answer to an ATTACH REQUEST message), the network shall abort the authentication and ciphering procedure and proceed with the new GPRS attach procedure.

d) Collision of an authentication and ciphering procedure with a GPRS attach procedure when the authentication and ciphering procedure has been caused by a previous GPRS attach procedure

If the network receives an ATTACH REQUEST message before the ongoing authentication procedure has been completed and a GPRS attach procedure is pending (i.e. an ATTACH ACCEPT/REJECT message has still to be sent as an answer to an earlier ATTACH REQUEST message), then:

- If one or more of the information elements in the ATTACH REQUEST message differs from the ones received within the previous ATTACH REQUEST message, the network shall not treat the authentication any further and proceed with the GPRS attach procedure ; or

- If the information elements do not differ, then the network shall not treat any further this new ATTACH REQUEST.

Collision of an authentication and ciphering procedure with a GPRS detach procedure

GPRS detach containing cause "power off":

If the network receives a DETACH REQUEST message before the ongoing authentication and ciphering procedure has been completed, the network shall abort the authentication and ciphering procedure and shall progress the GPRS detach procedure.

GPRS detach containing other causes than "power off":

If the network receives a DETACH REQUEST message before the ongoing authentication and ciphering procedure has been completed, the network shall complete the authentication and ciphering procedure and shall respond to the GPRS detach procedure as described in section 4.7.4.

e) Collision of an authentication and ciphering procedure with a routing area updating procedure

If the network receives a ROUTING AREA UPDATE REQUEST message before the ongoing authentication procedure has been completed, the network shall progress both procedures.

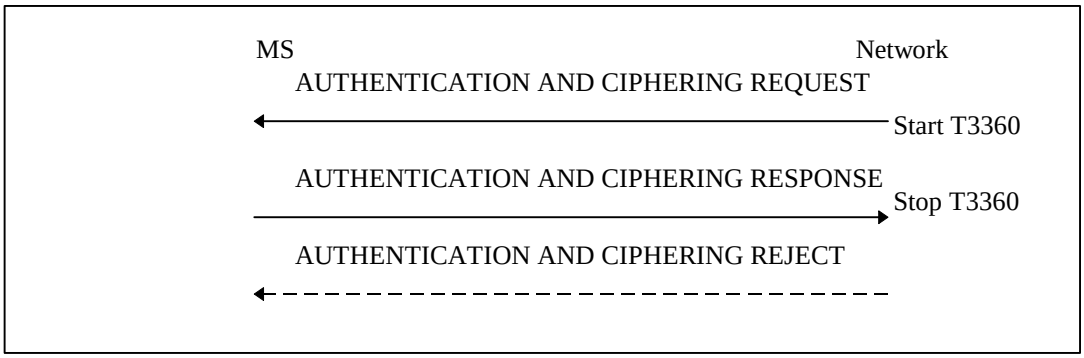



**Figure 4.7.7/1 3GPP TS 24.008: Authentication and ciphering procedure**

(f) Authentication failure (GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable')

The MS shall send an AUTHENTICATION & CIPHERING FAILURE message, with GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable' according to section 4.7.7.5.1, to the network and start timer T3318. Upon receipt of an AUTHENTICATION & CIPHERING FAILURE message from the MS with GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable' the network may initiate the identification procedure described in section 4.7.8. This is to allow the network to obtain the IMSI from the MS. The network may then check that the P-TMSI originally used in the authentication challenge corresponded to the correct IMSI. Upon receipt of the IDENTITY REQUEST message from the network, the MS shall send the IDENTITY RESPONSE message.

~~I~~If the P-TMSI/IMSI mapping in the network was incorrect, the network should respond by sending a new AUTHENTICATION & CIPHERING REQUEST message to the MS. Upon receiving the second AUTHENTICATION & CIPHERING REQUEST message from the network, the MS shall stop timer T3318, if running, and then process the challenge information as normal.

When the first AUTHENTICATION & CIPHERING REQUEST message containing an invalid MAC has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (e.g. T3310, T3321, T3330 or T3317).

Upon successfully validating the network, (an AUTHENTICATION & CIPHERING REQUEST message that contains a valid MAC is received), the MS shall send the AUTHENTICATION & CIPHERING RESPONSE message to the network and shall start any retransmission timers (i.e. T3310, T3321, T3330 or T3317) , if they were running and stopped when the MS received the first AUTHENTICATION AND CIPHERING REQUEST message containing an invalid MAC.

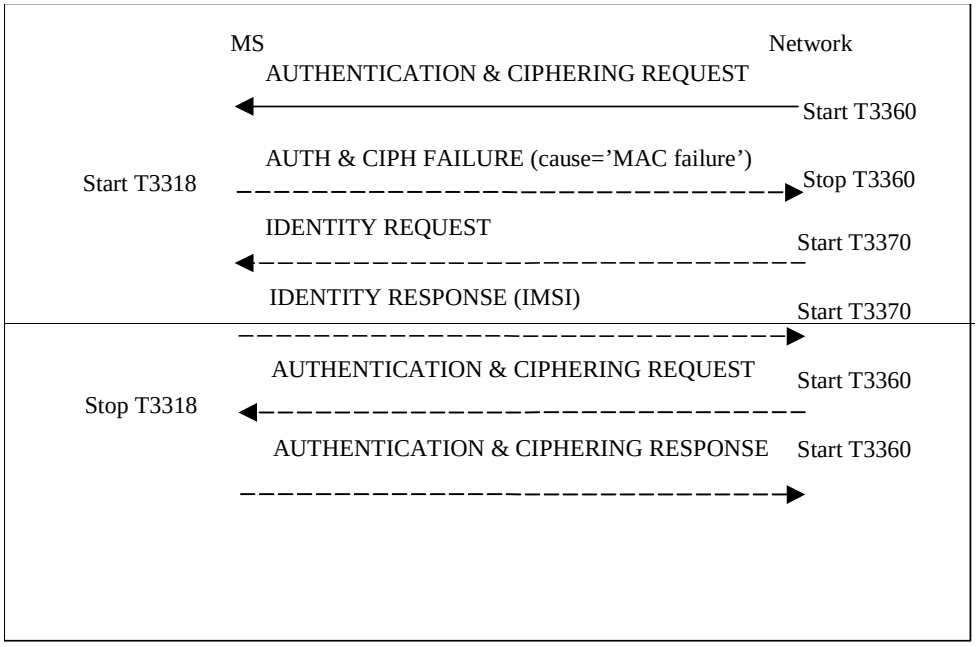
It can be assumed that the source of the authentication challenge is not genuine (authentication not accepted by the MS) if any of the following occur:

- After sending the AUTHENTICATION & CIPHERING FAILURE message with GMM cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable' the timer T3318 expires;

- Upon receipt of the second AUTHENTICATION & CIPHERING REQUEST message from the network while the T3318 is running ~~and~~ the MAC value cannot be resolved.

- The second AUTHENTICATION REQUEST & CIPHERING REQUEST which is received in UMTS while T33~~2~~18~~4~~ is running is a GSM authentication challenge (i.e. no AUTN parameter was received).

When it has been deemed by the MS that the source of the authentication challenge is not genuine (authentication not accepted by the MS), the MS shall behave as described in section 4.7.7.6.1.




**~~Figure 4.7.7a/1 3GPP TS 24.008: Authentication failure cause 'MAC failure'~~**

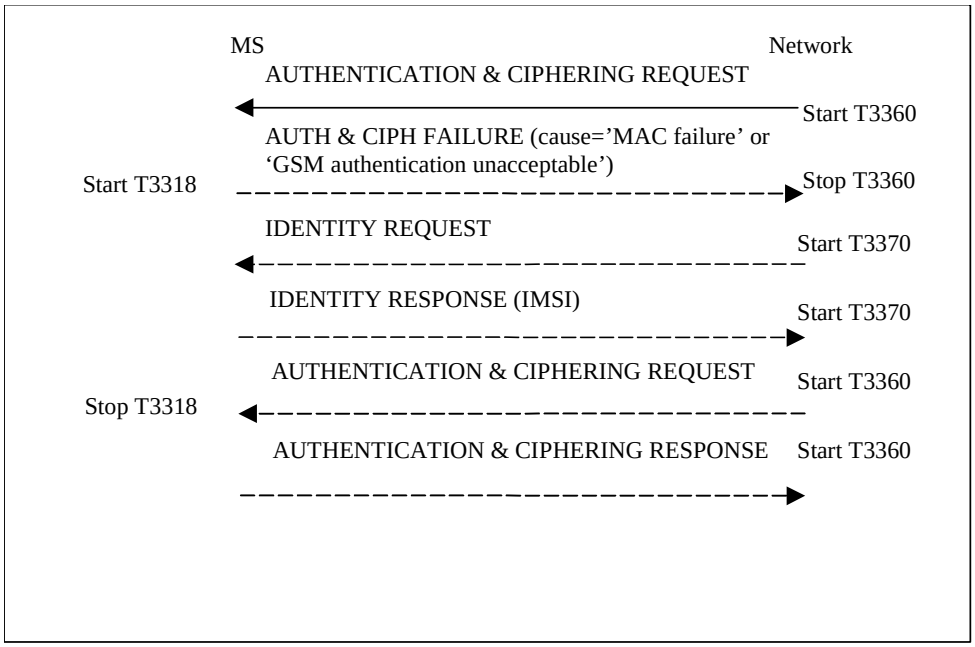



**Figure 4.7.7a/1 3GPP TS 24.008: Authentication failure cause 'MAC failure' or '~~No AUTN~~GSM authentication unacceptable'**

(g) Authentication failure (GMM cause 'Synch failure'):

The MS shall send an AUTHENTICATION & CIPHERING FAILURE message, with the GMM cause 'Synch failure,' to the network and start the timer T3320. Upon receipt of an AUTHENTICATION & CIPHERING message from the MS with the GMM cause 'synch failure,' the network shall use the returned AUTS parameter from the authentication & ciphering failure parameter IE in the AUTHENTICATION & CIPHERING FAILURE message, to re-synchronise. The re-synchronisation procedure requires the SGSN to delete all unused authentication vectors for that IMSI and obtain new vectors from the HLR. When re-synchronisation is complete, the network shall initiate the authentication & ciphering procedure. Upon receipt of the AUTHENTICATION & CIPHERING REQUEST message, the MS shall stop timer T3320, if running.

When the first AUTHENTICATION & CIPHERING REQUEST message containing an invalid SQN has been received by the MS from the network, the MS shall stop any of the retransmission timers that are running (e.g. T3310, T3321, T3330 or T3317).

Upon successfully validating the network, (a second AUTHENTICATION & CIPHERING REQUEST message is received which contains a valid SQN) while T3320 is running, the MS shall send the AUTHENTICATION & CIPHERING RESPONSE message to the network and shall start any retransmission timers (i.e. T3310, T3321, T3330 or T3317), if they were running and stopped when the MS received the first AUTHENTICATION AND CIPHERING REQUEST message containing an invalid SQN.

If the MS receives a second AUTHENTICATION & CIPHERING REQUEST message which contains an invalid SQN while T3320 is running, then the MS shall behave as described in section 4.7.7.6.1.

If the timer T3320 expires, the MS shall behave as described in section 4.7.7.6.1.

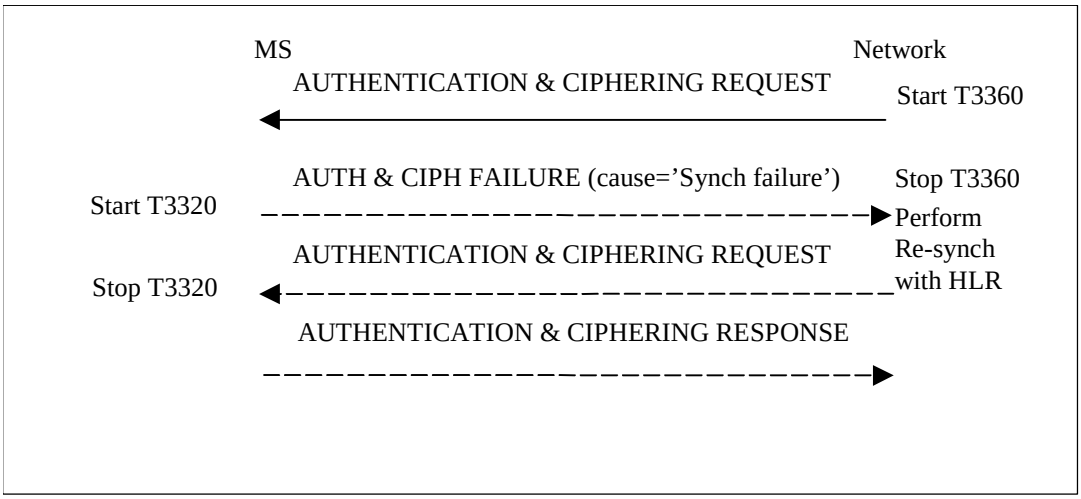



**Figure 4.7.7b/1 3GPP TS 24.008: Authentication failure cause 'Synch failure'**

#### 4.7.7.6.1 MS behaviour towards a network that has failed the authentication procedure

If the MS deems that the network has failed the authentication check, then it shall treat the cell where the AUTHENTICATION & CIPHERING REQUEST message was received as barred, until refresh of system information data. The MS shall start any retransmission timers (i.e. T3310, T3321, T3330 or T3317), if they were running and stopped when the MS received the first AUTHENTICATION AND CIPHERING REQUEST message containing an invalid MAC or invalid SQN, ~~(~~or no AUTN~~)~~ when a UMTS authentication challenge was expected.

### 4.7.7.7 Use of established security contexts

In GSM, in the case of an established GSM security context, the GPRS GSM ciphering key shall be taken into use by the MS before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted.

In GSM, in the case of an established UMTS security context, the GPRS GSM ciphering key shall be taken into use by the MS before the AUTHENTICATION AND CIPHERING RESPONSE message is transmitted. The network shall derive a GPRS GSM ciphering key from the GPRS UMTS ciphering key and the GPRS UMTS integrity key, by using the conversion function named "c3" defined in 3GPP TS 33.102.

In UMTS, in the case of an established GSM security context, the ME shall derive a GPRS UMTS ciphering key and a GPRS UMTS integrity key from the GPRS GSM ciphering key by using the conversion functions named "c4" and "c5" defined in 3GPP TS 33.102. The derived GPRS UMTS ciphering key and GPRS UMTS integrity key shall be taken into use by the MS when a valid SECURITY MODE COMMAND indicating PS domain is received during an RR connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331). The network shall derive a GPRS UMTS ciphering key and a GPRS UMTS integrity key from the GPRS GSM ciphering key by using the conversion functions named "c4" and "c5" defined in 3GPP TS 33.102.

In UMTS, in the case of an established UMTS security context, the GPRS UMTS ciphering key and the GPRS UMTS integrity key shall be taken into use by the MS when a valid SECURITY MODE COMMAND indicating PS domain is received during an PS signalling connection (the definition of a valid SECURITY MODE COMMAND message is given in 3GPP TS 25.331).

NOTE: In UMTS, during an ongoing, already ciphering/integrity protected PS signalling connection, the network might initiate a new Authentication and ciphering procedure in order to establish a new GSM/UMTS security context. The new GPRS UMTS ciphering key and GPRS UMTS integrity key are taken into use by the MS, when a new valid SECURITY MODE COMMAND indicating PS domain is received during the PS signalling connection.

### 4.7.7.8 Handling of keys at intersystem change from UMTS to GSM

At an intersystem change from UMTS to GSM, ciphering may be started (see GSM 04.64 [76]) without any new authentication and ciphering procedure. Deduction of the appropriate security key for ciphering in GSM, depends on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the GPRS GSM ciphering key according to Table 4.7.7.8.1.

Before any initial GMM message is sent in the new cell in GSM, the GMM layer in the MS shall notify the LLC layer if ciphering shall be used or not. If yes, the GPRS GSM ciphering key and the applicable ciphering algorithm according to the stored *Ciphering Algorithm IE* in the MS shall also be indicated to the LLC layer (see GSM 04.64 [76]).

**Table 4.7.7.8.1/3GPP TS 24.008: Intersystem change from UMTS to GSM**

| | |
|---|---|
| Security context established in MS and network in UMTS | At intersystem change to GSM: |
| GSM security context | An ME shall apply the GPRS GSM cipher key received from the GSM security context residing in the SIM. |
| UMTS security context | An ME shall apply the GPRS GSM cipher key derived by the SIM from the GPRS UMTS cipher key and the GPRS UMTS integrity key. |

NOTE A SIM with UMTS security context, passes the GPRS UMTS ciphering key, the GPRS UMTS integrity key and the derived GPRS GSM ciphering key to the ME independent on the current radio access being UMTS or GSM.

### 4.7.7.9 Handling of keys at intersystem change from GSM to UMTS

At an intersystem change from GSM to UMTS, ciphering and integrity may be started (see 3GPP TS 25.331) without any new authentication and ciphering procedure. Deduction of the appropriate security keys for ciphering and integrity check in UMTS, depend on the current GSM/UMTS security context stored in the MS and the network.

The ME shall handle the GPRS UMTS cipher key and the GPRS UMTS integrity key according to Table 4.7.7.9.1.

**Table 4.7.7.9.1/3GPP TS 24.008: Intersystem change from GSM to UMTS**

| | |
|---|---|
| Security context established in MS and network in GSM | At intersystem change to UMTS: |
| GSM security context | An ME shall derive the GPRS UMTS cipher key and GPRS UMTS integrity key from the GPRS GSM cipher key provided by the SIM. The conversion functions named "c4" and "c5" in 3GPP TS 33.102 are used for this purpose. |
| UMTS security context | An ME shall apply the GPRS UMTS ciphering key and the GPRS UMTS integrity key received from the UMTS security context residing in the SIM. |

NOTE: A SIM with UMTS security context, passes the GPRS UMTS ciphering key, the GPRS UMTS integrity key and the derived GPRS GSM ciphering key to the ME independent on the current radio access being UMTS or GSM.

## 9.2.2 Authentication request

This message is sent by the network to the mobile station to initiate authentication of the mobile station identity. See table 9.2.3/3GPP TS 24.008.

Message type: AUTHENTICATION REQUEST

Significance: dual

Direction: network to mobile station

**Table 9.2.3/3GPP TS 24.008: AUTHENTICATION REQUEST message content**

| IEI | Information element | Type / Reference | Presence | Format | Length |
|---|---|---|---|---|---|
| | Mobility management protocol discriminator | Protocol discriminator 10.2 | M | V | 1/2 |
| | Skip Indicator | Skip Indicator 10.3.1 | M | V | 1/2 |
| | Authentication Request message type | Message type 10.4 | M | V | 1 |
| | Ciphering key sequence number | Ciphering key sequence number 10.5.1.2 | M | V | 1/2 |
| | Spare half octet | Spare half octet 10.5.1.8 | M | V | 1/2 |
| | Authentication parameter RAND (UMTS challenge or GSM challenge) | Auth. parameter RAND 10.5.3.1 | M | V | 16 |
| 20 | Authentication Parameter AUTN | Auth. parameter AUTN 10.5.3.1.1 | O | TLV | 18 |

### 9.2.2.1 Authentication Parameter AUTN

This IE shall be present if and only if the authentication challenge is a UMTS authentication challenge.The presence or absence of this IE defines- in the case of its absence- a GSM authentication challenge or- in the case of its presence- a UMTS authentication challenge.

The MS shall ignore the IE if it does not support UMTS authentication algorithm.

In UMTS, the MS shall reject the AUTHENTICATION REQUEST message as specified in subclause 4.3.2.5.1 if this IE is not present and the MS supports UMTS authentication algorithm.

## 9.4.9 Authentication and ciphering request

This message is sent by the network to the MS to initiate authentication of the MS identity. Additionally, the ciphering mode is set, indicating whether ciphering will be performed or not. See table 9.4.9/GSM 24.008.

Message type: AUTHENTICATION AND CIPHERING REQUEST

Significance: dual

Direction: network to MS

**Table 9.4.9/GSM 24.008: AUTHENTICATION AND CIPHERING REQUEST message content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|---|---|---|---|---|---|
| | Protocol discriminator | Protocol discriminator<br>10.2 | M | V | 1/2 |
| | Skip indicator | Skip indicator<br>10.3.1 | M | V | 1/2 |
| | Authentication and ciphering request message identity | Message type<br>10.4 | M | V | 1 |
| | Ciphering algorithm | Ciphering algorithm<br>10.5.5.3 | M | V | 1/2 |
| | IMEISV request | IMEISV request<br>10.5.5.10 | M | V | 1/2 |
| | Force to standby | Force to standby<br>10.5.5.7 | M | V | 1/2 |
| | A&C reference number | A&C reference number<br>10.5.5.19 | M | V | 1/2 |
| 21 | Authentication parameter RAND | Authentication parameter RAND<br>10.5.3.1 | O | TV | 17 |
| 8- | GPRS ciphering key sequence number | Ciphering key sequence number<br>10.5.1.2 | C | TV | 1 |
| 28 | Authentication parameter AUTN | Authentication parameter AUTN<br>10.5.3.1.1 | O | TLV | 18 |

### 9.4.9.1 Authentication Parameter RAND

This IE shall only be included if authentication shall be performed.

### 9.4.9.2 GPRS ciphering key sequence number

This IE is included if and only if the *Authentication parameter RAND* is contained in the message.

### 9.4.9.3 Authentication Parameter AUTN

This IE shall be present if and only if the authentication challenge is a UMTS authentication challenge.The presence or absence of this IE defines- in the case of its absence- a GSM authentication challenge or- in the case of its presence- a UMTS authentication challenge.

The MS shall ignore the IE if it does not support UMTS authentication algorithm.

In UMTS, the MS shall reject the AUTHENTICATION & CIPHERING REQUEST message as specified in subclause 4.7.7.5.1 if this IE is not present and the MS supports UMTS authentication algorithm.

## 10.5.3.6 Reject cause

The purpose of the *Reject Cause* information element is to indicate the reason why a request from the mobile station is rejected by the network.

The *Reject Cause* information element is coded as shown in figure 10.5.81/3GPP TS 24.008 and table 10.5.95/3GPP TS 24.008.

The *Reject Cause* is a type 3 information element with 2 octets length.

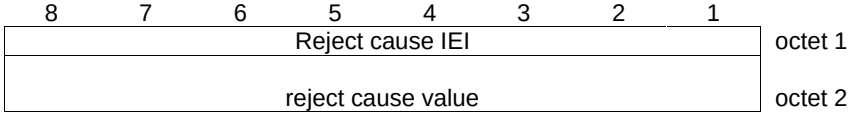



**Figure 10.5.81/3GPP TS 24.008 *Reject Cause* information element**

**Table 10.5.95/3GPP TS 24.008: *Reject Cause* information element**

Reject cause value (octet 2)

| Bits 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | IMSI unknown in HLR |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Illegal MS |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | IMSI unknown in VLR |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | IMEI not accepted |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Illegal ME |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | PLMN not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Location Area not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | Roaming not allowed in this location area |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Network failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | MAC failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | Synch failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | Congestion |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | ~~No AUTN~~GSM authentication unacceptable |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Service option not supported |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Requested service option not subscribed |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | Service option temporarily out of order |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | Call cannot be identified |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | } |
| to | | | | | | | | } retry upon entry into a new cell |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | } |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | Semantically incorrect message |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Invalid mandatory information |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Message type non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Message type not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Information element non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | Conditional IE error |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | Message not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | Protocol error, unspecified |

Any other value received by the mobile station shall be treated as 0010 0010, 'Service option temporarily out of order'. Any other value received by the network shall be treated as 0110 1111, 'Protocol error, unspecified'.

NOTE: The listed reject cause values are defined in Annex G.

## 10.5.5.14 GMM cause

The purpose of the GMM cause information element is to indicate the reason why a GMM request from the mobile station is rejected by the network.

The GMM cause information element is coded as shown in figure 10.5.129/3GPP TS 24.008 and table 10.5.147/3GPP TS 24.008.

The GMM cause is a type 3 information element with 2 octets length.

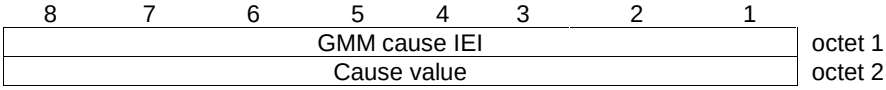



**Figure 10.5.129/3GPP TS 24.008: GMM cause information element**

**Table 10.5.147/3GPP TS 24.008: GMM cause information element**

Cause value (octet 2)
Bits

| **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | IMSI unknown in HLR |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Illegal MS |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Illegal ME |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | GPRS services not allowed |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GPRS services and non-GPRS services not allowed |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | MS identity cannot be derived by the network |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | Implicitly detached |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | PLMN not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Location Area not allowed |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | Roaming not allowed in this location area |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | GPRS services not allowed in this PLMN |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | MSC temporarily not reachable |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Network failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | MAC failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | Synch failure |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | Congestion |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | ~~No AUTN~~GSM authentication unacceptable |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | No PDP context activated |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | } |
| | | | to | | | | | } retry upon entry into a new cell |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | } |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | Semantically incorrect message |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Invalid mandatory information |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Message type non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Message type not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Information element non-existent or not implemented |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | Conditional IE error |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | Message not compatible with the protocol state |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | Protocol error, unspecified |

Any other value received by the mobile station shall be treated as 0110 1111, 'Protocol error, unspecified'. Any other value received by the network shall be treated as 0110 1111, 'Protocol error, unspecified'.

NOTE: The listed reject cause values are defined in Annex G.

## 11.2 Timers of mobility management

**Table 11.1/3GPP TS 24.008: Mobility management timers - MS-side**

| TIMER NUM. | MM ST AT | TIME OUT VAL. | CAUSE FOR START | NORMAL STOP | AT THE EXPIRY |
|---|---|---|---|---|---|
| T3210 | 3 | 20s | - LOC_UPD_REQ sent | - LOC_UPD_ACC<br>- LOC_UPD_REJ<br>- AUTH_REJ<br>- Lower layer failure | Start T3211 |
| T3211 | 1<br>2 | 15s | - LOC_UPD_REJ with cause#17 netw. failure<br>- lower layer failure or RR conn. released after RR conn. abort during loc. updating | - Time out<br>- cell change<br>- request for MM connection establishment<br>- change of LA | Restart the Location update proc. |
| T3212 | 1,<br>2 | Note 1 | - termination of MM service or MM signalling | - initiation of MM service or MM signalling | initiate periodic updating |
| T3213 | 1<br>2<br>11 | 4s | - location updating failure | - expiry<br>- change of BCCH parameter | new random attempt |
| T3214 | 3<br>5<br>7 | 20s | AUTHENT FAILURE<br>Cause = 'MAC failure' or 'GSM authentication unacceptable' sent | AUTHENT REQ<br>- received | Consider the network as 'false' (see 4.3.2.6.1) |
| T3216 | 3<br>5<br>7 | 15s | AUTHENT FAILURE<br>Cause = Synch failure sent | AUTHENT REQ received | Consider the network as 'false' (see 4.3.2.6.1) |
| T3218 | 3<br>5<br>7 | 20s | RAND and RES stored after receipt of a UMTS authentication challenge | - Cipher mode setting (A/Gb mode only)<br>- Security mode setting (Iu mode only)<br>- AUTHENT REJ received<br>- enter MM IDLE or NULL | Delete the stored RAND and RES |
| T3220 | 7 | 5s | - IMSI DETACH | - release from RM-sublayer | enter Null or Idle, ATTEMPTING TO UPDATE |
| T3230 | 5 | 15s | - CM SERV REQ<br><br>CM REEST REQ | - Cipher mode setting<br>- CM SERV REJ<br>- CM SERV ACC | provide release ind. |
| T3240 | 9<br>10 | 10s | see section 11.2.1 | see section 11.2.1 | abort the RR connection |

NOTE 1: The timeout value is broadcasted in a SYSTEM INFORMATION message

**Table 11.2/3GPP TS 24.008: Mobility management timers - network-side**

| TIMER NUM. | MM STAT | TIME OUT VAL. | CAUSE FOR START | NORMAL STOP | AT THE EXPIRY | AT THE SECOND EXPIRY |
|---|---|---|---|---|---|---|
| T3250 | 6 | 12s | TMSI-REAL-CMD or LOC UPD ACC with new TMSI sent | TMSI-REALL-COM received | Optionally Release RR connection | |
| T3255 | | Note | LOC UPD ACC sent with"Follow on Proceed" | CM SERVICE REQUEST | Release RR Connection or use for mobile station terminating call | |
| T3260 | 5 | 12s | AUTHENT-REQUEST sent | AUTHENT-RESPONSE received<br><br>AUTHENT-FAILURE received | Optionally Release RR connection | |
| T3270 | 4 | 12s | IDENTITY REQUEST sent | IDENTITY RESPONSE received | Optionally Release RR connection | |

NOTE 2: The value of this timer is not specified by this recommendation.

## 11.2.1 Timer T3240

Timer T3240 is started in the mobile station when:

- the mobile station receives a LOCATION UPDATING ACCEPT message completing a location updating procedure in the cases specified in section 4.4.4.6 and 4.4.4.8;
- the mobile station receives a LOCATION UPDATING REJECT message in the cases specified in section 4.4.4.7;
- the mobile station has sent a CM SERVICE ABORT message as specified in section 4.5.1.7;
- the mobile station has released or aborted all MM connections in the cases specified in 4.3.2.5, 4.3.5.2, 4.5.1.1, and 4.5.3.1.

Timer T3240 is stopped, reset, and started again at receipt of an MM message.

Timer T3240 is stopped and reset (but not started) at receipt of a CM message that initiates establishment of an CM connection (an appropriate SETUP, REGISTER, or CP-DATA message as defined in 3GPP TS 24.008, 3GPP TS 24.010 or GSM 04.11).

## 11.2.2 Timers of GPRS mobility management

**Table 11.3/3GPP TS 24.008: GPRS Mobility management timers - MS side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON THE 1st, 2nd, 3rd, 4th EXPIRY Note 3 |
|---|---|---|---|---|---|
| T3310 | 15s | GMM-REG-INIT | ATTACH REQ sent | ATTACH ACCEPT received<br>ATTACH REJECT received | Retransmission of ATTACH REQ |
| T3311 | 15s | GMM-DEREG ATTEMPTING TO ATTACH or<br>GMM-REG ATTEMPTING TO UPDATE | ATTACH REJ with other cause values as described in chapter 'GPRS Attach'<br>ROUTING AREA UPDATE REJ with other cause values as described in chapter 'Routing Area Update'<br>Low layer failure | Change of the routing area | Restart of the Attach or the RAU procedure with updating of the relevant attempt counter |
| T3316 | 30s | GMM-REG-INIT<br>GMM-REG<br>GMM-DEREG-INIT<br>GMM-RA-UPDATING-INT<br>GMM-SERV-REQ-INIT (Iu mode only) | RAND and RES stored after receipt of a UMTS authentication challenge | Security mode setting (Iu mode only)<br>AUTHENTICATION & CIPHERING REJECT received<br>Enter GMM-DEREG or GMM-NULL | Delete the stored RAND and RES |
| T3318 | 20s | GMM-REG-INIT<br>GMM-REG<br>GMM-DEREG-INIT<br>GMM-RA-UPDATING-INT<br>GMM-SERV-REQ-INIT (UMTS only) | AUTHENTICATION & CIPHERING FAILURE (cause='MAC failure' or 'GSM authentication unacceptable') sent | AUTHENTICATION & CIPHERING REQUEST received | On first expiry, the MS should consider the network as false (see 4.7.7.6.1) |
| T3320 | 15s | GMM-REG-INIT<br>GMM-REG<br>GMM-DEREG-INIT<br>GMM-RA-UPDATING-INT<br>GMM-SERV-REQ-INIT (UMTS only) | AUTHENTICATION & CIPHERING FAILURE (cause=synch failure) sent | AUTHENTICATION & CIPHERING REQUEST received | On first expiry, the MS should consider the network as false (see 4.7.7.6.1) |
| T3321 | 15s | GMM-DEREG-INIT | DETACH REQ sent | DETACH ACCEPT received | Retransmission of the DETACH REQ |

| | | | | | |
|---|---|---|---|---|---|
| T3330 | 15s | GMM-ROUTING-UPDATING-INITIATED | ROUTING AREA UPDATE REQUEST sent | ROUTING AREA UPDATE ACC received<br><br>ROUTING AREA UPDATE REJ received | Retransmission of the ROUTING AREA UPDATE REQUEST message |

**Table 11.3a/3GPP TS 24.008: GPRS Mobility management timers – MS side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON EXPIRY |
|---|---|---|---|---|---|
| T3302 | Default 12 min<br>Note 1 | GMM-DEREG<br>or<br>GMM-REG | At attach failure and the attempt counter is greater than or equal to 5.<br>At routing area updating failure and the attempt counter is greater than or equal to 5. | At successful attach<br><br>At successful routing area updating | On every expiry, initiation of the<br>GPRS attach procedure<br>or<br>RAU procedure |
| T3312 | Default 54 min<br>Note1 | GMM-REG | In GSM, when READY state is left.<br>In UMTS, when PMM-CONNECTED mode is left. | When entering state GMM-DEREG | Initiation of the Periodic RAU procedure |
| T3314<br>READY<br>(GSM only) | Default 44 sec<br>Note 2 | All except GMM-DEREG | Transmission of a PTP PDU | Forced to Standby | No cell-updates are performed |
| T3317<br>(UMTS only) | 10s | GMM-SERVICE-REQUEST-INITIATED | SERVICE REQ sent | Security mode control procedure is completed,<br>SERVICE ACCEPT received, or<br>SERVICE REJECT received | Abort the procedure |

NOTE 1: The value of this timer is used if the network does not indicate another value in a GMM signalling procedure.

NOTE 2: The default value of this timer is used if neither the MS nor the Network send another value, or if the Network sends this value, in a signalling procedure.

NOTE 3: Typically, the procedures are aborted on the fifth expiry of the relevant timer. Exceptions are described in the corresponding procedure description.

**Table 11.4/3GPP TS 24.008: GPRS Mobility management timers - network side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON THE 1st, 2nd, 3rd, 4th EXPIRY Note 3 |
|---|---|---|---|---|---|
| T3322 | 6s | GMM-DEREG-INIT | DETACH REQ sent | DETACH ACCEPT received | Retransmission of DETACH REQUEST |
| T3350 | 6s | GMM-COMMON-PROC-INIT | ATTACH ACCEPT sent with P-TMSI and/or TMSI<br>RAU ACCEPT sent with P-TMSI and/or TMSI<br>P-TMSI REALLOC COMMAND sent | ATTACH COMPLETE received<br>RAU COMPLETE received<br>P-TMSI REALLOC COMPLETE received | Retransmission of the same message type, i.e. ATTACH ACCEPT, RAU ACCEPT or REALLOC COMMAND |
| T3360 | 6s | GMM-COMMON-PROC-INIT | AUTH AND CIPH REQUEST sent | AUTH AND CIPH RESPONSE received<br>AUTHENT- AND CIPHER- FAILURE received | Retransmission of AUTH AND CIPH REQUEST |
| T3370 | 6s | GMM-COMMON-PROC-INIT | IDENTITY REQUEST sent | IDENTITY RESPONSE received | Retransmission of IDENTITY REQUEST |

**Table 11.4a/3GPP TS 24.008: GPRS Mobility management timers - network side**

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON EXPIRY |
|---|---|---|---|---|---|
| T3313 | Note1 | GMM_REG | Paging procedure initiated | Paging procedure completed | Network dependent |
| T3314 READY (GSM only) | Default 44 sec Note 2 | All except GMM-DEREG | Receipt of a PTP PDU | Forced to Standby | The network shall page the MS if a PTP PDU has to be sent to the MS |
| Mobile Reachable | Default 4 min greater than T3312 | All except GMM-DEREG | In GSM, change from READY to STANDBY state<br>In UMTS, change from PMM-CONNECTED mode to PMM-IDLE mode. | PTP PDU received | Network dependent but typically paging is halted on 1st expiry |

NOTE 1: The value of this timer is network dependent.

NOTE 2: The default value of this timer is used if neither the MS nor the Network send another value, or if the Network sends this value, in a signalling procedure. The value of this timer should be slightly shorter in the network than in the MS, this is a network implementation issue.

NOTE 3: Typically, the procedures are aborted on the fifth expiry of the relevant timer. Exceptions are described in the corresponding procedure description.

## G.3 Causes related to PLMN specific network failures and congestion / Authentication Failures

Cause value = 20 MAC failure

This cause is sent to thenetwork if the SIM detects that the MAC in the authentication request message is not fresh (see 3GPP TS 33.102)

Cause value = 21 Synch failure

This cause is sent to the network if the SIM detects that the SQN in the authentication request message is out of range (see 3GPP TS 33.102)

Cause value = 17 Network failure

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

Cause value = 22 Congestion

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

Cause value = 23 GSM authentication unacceptable

This cause is sent to the network in UMTS if the MS supports the UMTS authentication algorithm and there is no Authentication Parameter AUTN IE present in the AUTHENTICATION REQUEST message.