ETSI TS 143 020 V15.3.0 (2024-04)

Digital cellular telecommunications system (Phase 2+) (GSM);
Security related network functions
(3GPP TS 43.020 version 15.3.0 Release 15)

Reference
RTS/TSGS-0343020vf30

Keywords
GSM

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

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

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under https://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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

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

0 Scope

This Technical Specification specifies the network functions needed to provide the security related service and functions specified in 3GPP TS 42.009.

This specification does not address the cryptological algorithms that are needed to provide different security related features. This topic is addressed in annex C. Wherever a cryptological algorithm or mechanism is needed, this is signalled with a reference to annex C. The references refers only to functionalities, and some algorithms may be identical or use common hardware.

0.1 References

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

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

[1] 3GPP TS 21.905: “Vocabulary for 3GPP Specifications".

[2] 3GPP TS 41.061: " GPRS ciphering algorithm requirements".

[3] Void

[4] 3GPP TS 42.009: " Security aspects".

[5] 3GPP TS 42.017: " Subscriber Identity Modules (SIM) Functional characteristics".

[6] 3GPP TS 42.056: " GSM Cordless Telephone System (CTS) Phase 1; Service Description; Stage 1".

[7] 3GPP TS 22.060: “General Packet Radio Service (GPRS); Service description; Stage 1".

[8] 3GPP TS 23.003: "Numbering, addressing and identification".

[9] GSM 03.56: "Digital cellular telecommunications system (Phase 2+); GSM Cordless Telephone System (CTS), Phase 1; CTS Architecture Description; Stage 2".

[10] 3GPP TS 23.060: " Service description; Stage 2".

[11] 3GPP TS 24.008: “Mobile radio interface layer 3 specification".

[12] Void

[13] 3GPP TS 45.001: “Physical layer on the radio path; General description”.

[14] 3GPP TS 45.002: “Multiplexing and multiple access on the radio path”.

[15] 3GPP TS 45.003: “Channel coding”.

[16] 3GPP TS 29.002: " Mobile Application Part (MAP) specification".

[17] 3GPP TS 51.011: " Specification of the Subscriber Identity Module- Mobile Equipment (SIM-ME) interface".

[18] 3GPP TS 33.102: "Technical Specification Group Services and System Aspects; 3G Security; Security architecture ".

[19] 3GPP TS 24.301: "Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS)".

[20] 3GPP TS 44.064: "Technical Specification Group Core Network and Terminals; Mobile Station - Serving GPRS Support Node (MS-SGSN); Logical Link Control (LLC) layer specification".

[21] 3GPP TS 55.226: " Technical Specification Group Services and System Aspects; 3G Security; Specification of the A5/4 encryption algorithms for GSM and ECSD, and the GEA4 encryption algorithm for GPRS".

[22] 3GPP TS 33.220: " Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA)".

[23] Void

[24] 3GPP TS 33.102: " 3G security; Security architecture".

[25] 3GPP TS 55.251: "Specification of the GEA5 encryption and GIA5 integrity algorithms for GPRS; GEA5 and GIA5 algorithm specification".

[26] 3GPP TS 55.241: "Specification of the GIA4 integrity algorithm for GPRS; GIA4 specification".

0.2 Abbreviations

Abbreviations used in this specification are listed in 3GPP TS 21.905.

Specific abbreviations used in annex A are listed in clause A.3.

Specific CTS related abbreviations used in annex E are listed in clause E.1.3.

Specific VCGS and VBS related abbreviations used in annex F are listed in clause F.1.3.

Throughout this specification, the abbreviation Kc_{128} is used to indicate a 128-bit ciphering key as derived by UMTS AKA [18]. The abbreviation Kc_{128} is only used where it matters that the ciphering key is 128 bits long; the abbreviation Kc is used in all other places.

1 General

The different security related services and functions that are listed in 3GPP TS 42.009 are grouped as follows:

- Subscriber identity confidentiality;
- Subscriber identity authentication;
- Signalling information element and connectionless user data confidentiality and data confidentiality for physical connections (ciphering).

It shall be possible to introduce new authentication and ciphering algorithms during the systems lifetime. The fixed network may support more than one authentication and ciphering algorithm.

The security procedures include mechanisms to enable recovery in event of signalling failures. These recovery procedures are designed to minimize the risk of a breach in the security of the system.

General on figures in this specification:

- In the figures below, signalling exchanges are referred to by functional names. The exact messages and message types are specified in 3GPP TS 24.008 and 3GPP TS 29.002.
- No assumptions are made for function splitting between MSC (Mobile Switching Centre), VLR (Visitor Location Register) and BSS (Base Station System). Signalling is described directly between MS and the local network (i.e. BSS, MSC and VLR denoted in the figures by BSS/MSC/VLR). The splitting in annex A is given only for illustrative purposes.

- Addressing fields are not given; all information relates to the signalling layer. The TMSI allows addressing schemes without IMSI, but the actual implementation is specified in the GSM 04-series.
- The term HPLMN in the figures below is used as a general term which should be understood as HLR (Home Location Register) or AuC (Authentication Centre).
- What is put in a box is not part of the described procedure but it is relevant to the understanding of the figure.

2 Subscriber identity confidentiality

2.1 Generality

The purpose of this function is to avoid the possibility for an intruder to identify which subscriber is using a given resource on the radio path (e.g. TCH (Traffic Channel) or signalling resources) by listening to the signalling exchanges on the radio path. This allows both a high level of confidentiality for user data and signalling and protection against the tracing of a user's location.

The provision of this function implies that the IMSI (International Mobile Subscriber Identity), or any information allowing a listener to derive the IMSI easily, should not normally be transmitted in clear text in any signalling message on the radio path.

Consequently, to obtain the required level of protection, it is necessary that:

- a protected identifying method is normally used instead of the IMSI on the radio path; and
- the IMSI is not normally used as addressing means on the radio path (see 3GPP TS 42.009);
- when the signalling procedures permit it, signalling information elements that convey information about the mobile subscriber identity must be ciphered for transmission on the radio path.

The identifying method is specified in the following subclause. The ciphering of communication over the radio path is specified in clause 4.

2.2 Identifying method

The means used to identify a mobile subscriber on the radio path consists of a TMSI (Temporary Mobile Subscriber Identity). This TMSI is a local number, having a meaning only in a given location area; the TMSI must be accompanied by the LAI (Location Area Identification) to avoid ambiguities. The maximum length and guidance for defining the format of a TMSI are specified in 3GPP TS 23.003.

The network (e.g. a VLR) manages suitable data bases to keep the relation between TMSIs and IMSIs. When a TMSI is received with an LAI that does not correspond to the current VLR, the IMSI of the MS must be requested from the VLR in charge of the indicated location area if its address is known; otherwise the IMSI is requested from the MS.

A new TMSI must be allocated at least in each location updating procedure. The allocation of a new TMSI corresponds implicitly for the MS to the de-allocation of the previous one. In the fixed part of the network, the cancellation of the record for an MS in a VLR implies the de-allocation of the corresponding TMSI.

To cope with some malfunctioning, e.g. arising from a software failure, the fixed part of the network can require the identification of the MS in clear. This procedure is a breach in the provision of the service, and should be used only when necessary.

When a new TMSI is allocated to an MS, it is transmitted to the MS in a ciphered mode. This ciphered mode is the same as defined in clause 4.

The MS must store its current TMSI in a non volatile memory, together with the LAI, so that these data are not lost when the MS is switched off.

2.3 Procedures

This subclause presents the procedures, or elements of procedures, pertaining to the management of TMSIs.

2.3.1 Location updating in the same MSC area

This procedure is part of the location updating procedure which takes place when the original location area and the new location area depend on the same MSC. The part of this procedure relative to TMSI management is reduced to a TMSI re-allocation (from TMSIo with "o" for "old" to TMSIn with "n" for "new").

The MS sends TMSIo as an identifying field at the beginning of the location updating procedure.

The procedure is schematized in figure 2.1.

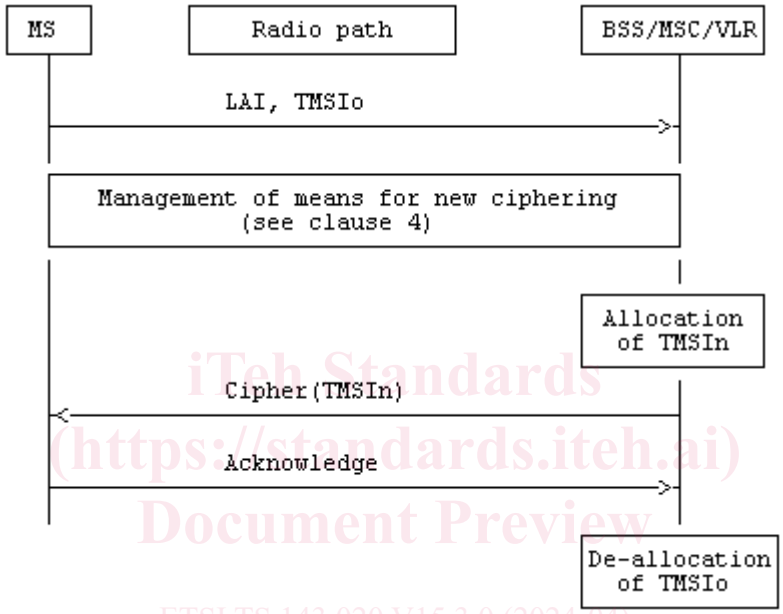


Figure 2.1: Location updating in the same MSC area

Signalling Functionalities:

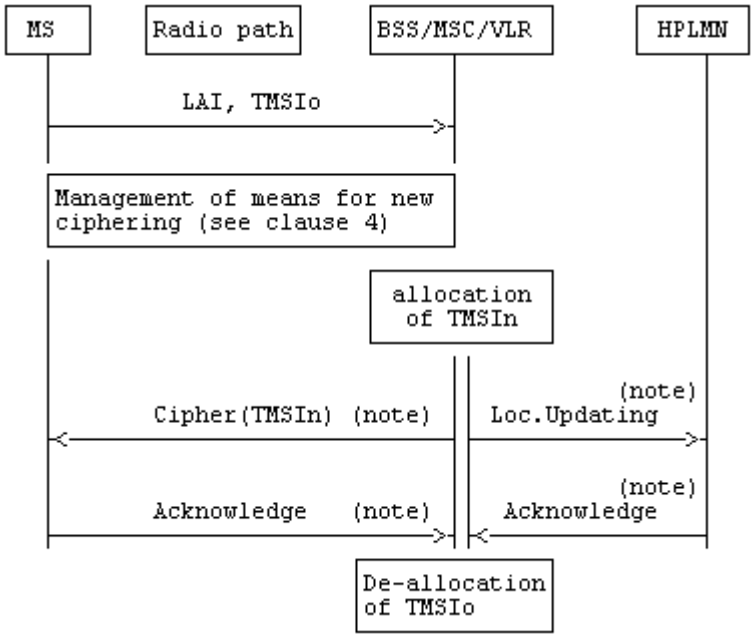
Management of means for new ciphering:

The MS and BSS/MSC/VLR agree on means for ciphering signalling information elements, in particular to transmit TMSIn.

2.3.2 Location updating in a new MSCs area, within the same VLR area

This procedure is part of the location updating procedure which takes place when the original location area and the new location area depend on different MSCs, but on the same VLR.

The procedure is schematized on figure 2.2.



NOTE: From a security point of view, the order of the procedures is irrelevant.

Figure 2.2: Location updating in a new MSCs area, within the same VLR area

Signalling functionalities:

Loc.Updating:

stands for Location Updating

The BSS/MSC/VLR indicates that the location of the MS must be updated.

2.3.3 Location updating in a new VLR; old VLR reachable

This procedure is part of the normal location updating procedure, using TMSI and LAI, when the original location area and the new location area depend on different VLRs.

The MS is still registered in VLRo ("o" for old or original) and requests registration in VLRn ("n" for new). LAI and TMSIo are sent by MS as identifying fields during the location updating procedure.

The procedure is schematized in figure 2.3.