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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Special Mobile Group (SMG).

The present document defines the plans and principles of numbering, addressing and identification within the European digital cellular telecommunications system (Phase 2). The present document corresponds to GSM Technical Specification (GSM-TS) GSM 03.03 version 4.9.0.

The specification from which the present document has been derived was originally based on CEPT documentation, hence the presentation of the present document may not be entirely in accordance with the ETSI/PNE rules.

Reference is made within the present document to GSM-TSs (NOTE).

NOTE: TC-SMG has produced documents which give the technical specifications for the implementation of the European digital cellular telecommunications system. Historically, these documents have been identified as GSM Technical Specifications (GSM-TSs). These TSs may have subsequently become I-ETSs (Phase 1), or ETSs (Phase 2), whilst others may become ETSI Technical Reports (ETRs). GSM-TSs are, for editorial reasons, still referred to in GSM ETSs.

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1 Introduction

1.1 Scope

The present document defines:

a) an identification plan for mobile subscribers in the GSM system;

b) principles of assigning telephone and ISDN numbers to mobile stations in the country of registration of the mobile station;

c) principles of assigning mobile station roaming numbers to visiting mobile stations;

d) an identification plan for location areas and base stations in the GSM system;

e) an identification plan for MSCs and location registers in the GSM system;

f) principles of assigning international mobile equipment identities;

g) principles of assigning zones for regional subscription.

1.2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04 (ETR 100): "European digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".

[2] GSM 03.08 (ETS 300 526): "European digital cellular telecommunications system (Phase 2); Organisation of subscriber data".

[3] GSM 03.20 (ETS 300 534): "European digital cellular telecommunications system (Phase 2); Security related network functions".

[4] GSM 03.70 (ETS 300 541): "European digital cellular telecommunications system (Phase 2); Routeing of calls to/from Public Data Networks (PDN)".

[5] GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".

[6] GSM 09.03 (ETS 300 600): "European digital cellular telecommunications system (Phase 2); Signalling requirements on interworking between the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) and the Public Land Mobile Network (PLMN)".

[7] GSM 11.11 (ETS 300 608): "European digital cellular telecommunications system (Phase 2); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[8] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[9] CCITT Recommendation E.212: "Identification plan for land mobile stations".

[10] CCITT Recommendation E.213: "Telephone and ISDN numbering plan for land mobile stations in public land mobile networks (PLMN)".

[11] CCITT Recommendation X.121: "International numbering plan for public data networks".

1.3 Definitons and abbreviations

Abbreviations used in the present document are listed in GSM 01.04.

1.4 General comments to references

The identification plan for mobile subscribers defined below is that defined in CCITT Recommendation E.212.

The ISDN numbering plan for mobile stations and the allocation of mobile station roaming numbers is that defined in CCITT Recommendation E.213. Only one of the principles for allocating ISDN numbers is proposed for GSM PLMNs. Only the method for allocating mobile station roaming numbers contained in the main text of CCITT Recommendation E.213 is recommended for use in GSM PLMNs. If there is any difference between this Technical Specification and the CCITT Recommendations, the former shall prevail.

For terminology, see also CCITT Recommendations E.164 and X.121.

1.5 Conventions on bitordering

The following conventions hold for the coding of the different identities appearing in this Technical Specification and in other GSM Technical Specifications if not indicated otherwise:

- the different parts of an identity are shown in the figures in order of significance;
- the most significant part of an identity is on the left part of the figure and the least significant on the right.

When an identity appears in other Technical Specifications, the following conventions hold if not indicated otherwise:

- digits are numbered by order of significance, with digit 1 being the most significant;
- bits are numbered by order of significance, with the lowest bit number corresponding to the least significant bit.

2 Identification of mobile subscribers

2.1 General

A unique International Mobile Subscriber Identity (IMSI) shall be allocated to each mobile subscriber in the GSM system.

NOTE: This IMSI is the concept referred to by CCITT as "International Mobile Station Identity".

In order to support the subscriber identity confidentiality service the VLRs may allocate a unique Temporary Mobile Subscriber Identity (TMSI) to visiting mobile subscribers. The VLR must be capable of correlating the IMSI of an MS and the current TMSI for that MS.

In order to speed up the search for subscriber data in the VLR a supplementary Local Mobile Station Identity (LMSI) is defined.

The LMSI may be allocated by the VLR at location updating and is sent to the HLR together with the IMSI. The HLR makes no use of it but includes it together with the IMSI in all messages sent to the VLR concerning that MS.

2.2 Composition of IMSI

IMSI is composed as shown in figure 1.

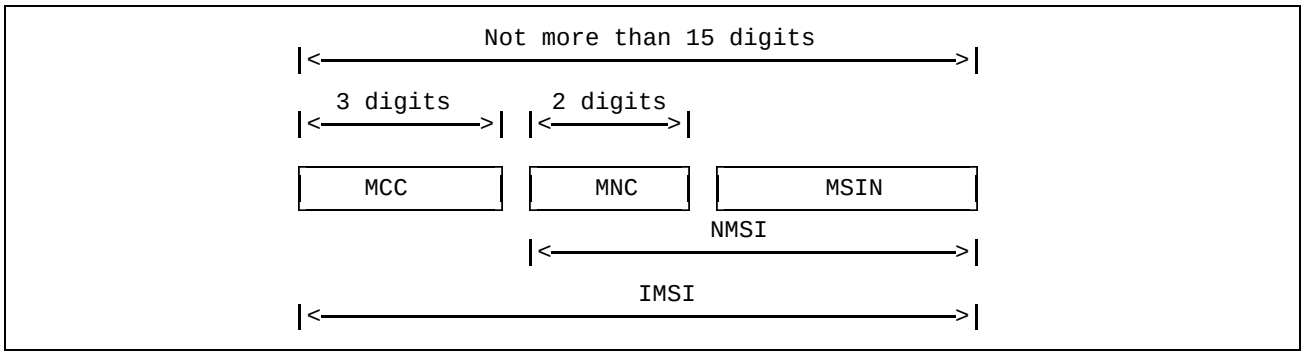

Figure 1: Structure of IMSI

IMSI is composed of three parts:

i) Mobile Country Code (MCC) consisting of three digits. The MCC identifies uniquely the country of domicile of the mobile subscriber;

ii) Mobile Network Code (MNC) consisting of two digits for GSM applications. The MNC identifies the home GSM PLMN of the mobile subscriber;

iii) Mobile Subscriber Identification Number (MSIN) identifying the mobile subscriber within a GSM PLMN.

The National Mobile Subscriber Identity (NMSI) consists of the Mobile Network Code and the Mobile Subscriber Identification Number.

2.3 Allocation principles

IMSI shall consist of numerical characters (O through 9) only.

The overall number of digits in IMSI shall not exceed 15 digits.

The allocation of Mobile Country Codes (MCCs) is administered by the CCITT and is given in Annex A to CCITT Blue Book Recommendation E.212.

The allocation of National Mobile Subscriber Identity (NMSI) is the responsibility of each administration.

If more than one GSM PLMN exist in a country, a unique Mobile Network Code should be assigned to each of them.

The allocation of IMSIs should be such that not more than the digits MCC + MNC of the IMSI have to be analysed in a foreign GSM PLMN for information transfer.

2.4 Structure of TMSI

Since the TMSI has only local significance (i.e. within the VLR and the area controlled by the VLR), the structure and coding of it can be chosen by agreement between operator and manufacturer in order to meet local needs.

The TMSI consists of 4 octets. It can be coded using a full hexadecimal representation.

In order to avoid double allocation of TMSIs after a restart of a VLR, some part of the TMSI may be related to the time when it was allocated or contain a bit field which is changed when the VLR has recovered from the restart.

The TMSI shall only be allocated in ciphered form. See also Technical Specification GSM 03.20.

The newtwork shall not allocate a TMSI with all 32 bits equal to 1 (this is because the TMSI must be stored in the SIM, and the SIM uses 4 octets with all bits equal to 1 for indicating that no valid TMSI is available.

2.5 Structure of LMSI

The LMSI consists of 4 octets and may be allocated by the VLR.

3 Numbering plan for mobile stations

3.1 General

Below the structure of the numbers used by a subscriber of a fixed (or mobile) network for calling a mobile station of a GSM PLMN is defined.

Also the structure of mobile station roaming numbers is defined.

One or more numbers of the ISDN numbering plan shall be assigned to a mobile station to be used for all calls to that station.

There may be a need for Mobile Stations (MS) to have a X.121 number. Because the MS has to have in any case a number from the ISDN numbering plan, the X.121 number will be in addition. Implications on numbering interworking functions which may need to be provided by the PLMN (if the use of X.121 numbers is required) are indicated in Technical Specification GSM 03.70.

NOTE: For card operated stations the ISDN number should be assigned to the holder of the card (personal number).

3.2 Numbering plan requirements

In principle, it should be possible for any subscriber of the ISDN or PSTN to call any mobile station in a GSM PLMN. This implies that ISDN numbers for mobile stations should comply with the ISDN numbering plan in each country.

The ISDN numbers of mobile stations should be composed in such a way that standard ISDN/PSTN charging can be used for calls to mobile stations.

It should be possible for each administration to develop its own independent numbering plan for mobile stations.

The numbering plan should not limit the possibility for mobile stations to roam among GSM PLMNs.

It should be possible to change the IMSI without changing the ISDN number allocated to a mobile station and vice versa.

In principle, it should be possible for any subscriber of the CSPDN/PSPDN to call any Mobile Station (MS) in a GSM PLMN. This implies that it may be necessary for an MS to have a X.121 number.

3.3 Structure of mobile station international PSTN/ISDN number (MSISDN)

The mobile station international ISDN numbers are allocated from the CCITT Recommendation E.164 numbering plan, see also CCITT Recommendation E.213. The mobile station international ISDN number will then be as shown in figure 2.

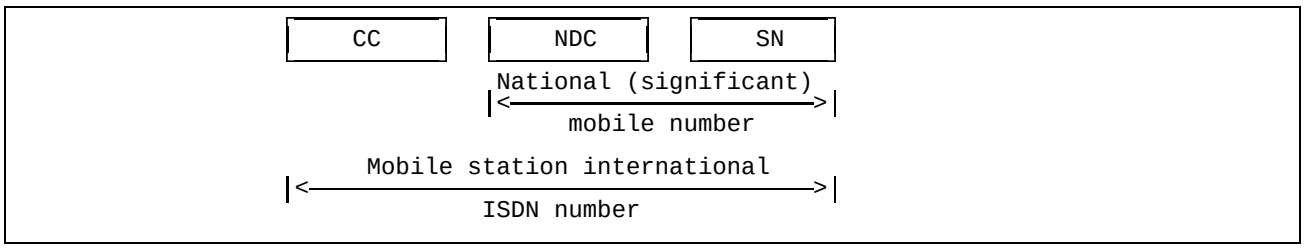

Figure 2: Number Structure of MSISDN

The number consists of:

- Country Code (CC) of the country in which the mobile station is registered, followed by
- National (significant) mobile number which consists of National Destination Code (NDC) and Subscriber Number (SN).

For GSM applications, a National Destination Code is allocated to each GSM PLMN. In some countries more than one NDC may be required for each GSM PLMN.

The composition of the mobile station international ISDN number should be such that it can be used as a global title address in the Signalling Connection Control Part (SCCP) for routing messages to the home location register of the mobile station. The country code (CC) and the national destination code (NDC) will provide such routing information. If further routing information is required, it should be contained in the first few digits of the subscriber number (SN).

A sub-address may be appended to an ISDN number for use in call setup and in supplementary service operations where an ISDN number is required (see CCITT Recommendations E.164, clause 11.2 & X.213 Annex A). The sub-address is transferred to the terminal equipment denoted by the ISDN number.

The maximum length of a sub-address is 20 octets, including one octet to identify the coding scheme for the sub-address (see CCITT Recommendation X.213, Annex A). All coding schemes described in CCITT Recommendation X.213, Annex A are supported in GSM.

3.4 Mobile Station Roaming Number (MSRN) for PSTN/ISDN routeing

The Mobile Station Roaming Number (MSRN) is used to route calls directed to a Mobile Station. On request from the Gateway MSC via the HLR it is temporarily allocated to a Mobile Station by the VLR with which the Mobile Station is registered it addresses the Visited MSC collocated with the assigning VLR. More than one MSRN may be assigned simultaneously to a Mobile Station.

The MSRN is passed by the HLR to the Gateway MSC for routing calls to the mobile station.

The Mobile Station Roaming Number for PSTN/ISDN routing shall have the same structure as international ISDN numbers in the area in which the roaming number is allocated, i.e.:

- the country code of the country in which the visitor location register is located;
- the national destination code of the visitor GSM PLMN or numbering area;
- a subscriber number with the appropriate structure for that numbering area.

The MSRN must not be used for subscriber dialling. It should be noted that the MSRN can be identical to the MSISDN (clause 3.3) in certain circumstances. In order to discriminate between subscriber generated access to these numbers and rerouting performed by the network, rerouting or redirection indicators or other signalling means should be used, if available (see Technical Specification GSM 09.03).

3.5 Structure of Mobile Station International Data Number

The structure of mobile station international data numbers should comply with the data numbering plan of CCITT Recommendation X.121 as applied in the home country of the mobile subscriber.

3.6 Handover Number

The handover number is used for establishment of a circuit between MSCs to be used for a call being handed over. The handover number may be reused in the same way as the MSRN.

4 Identification of location areas and base stations

4.1 Composition of the Location Area Identification (LAI)

The Location Area Identification shall be composed as shown in figure 3:

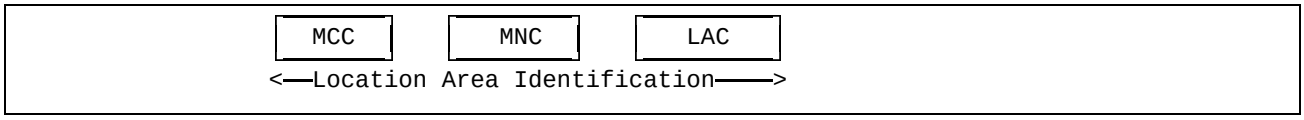

Figure 3: Structure of Location Area Identification

The LAI is composed of the following elements:

- Mobile Country Code (MCC) identifies the country in which the GSM PLMN is located. The value of the MCC is the same as the three digit MCC contained in international mobile subscriber identity (IMSI);
- Mobile Network Code (MNC) is a code identifying the GSM PLMN in that country. The MNC takes the same value as the two digit MNC contained in IMSI;
- Location Area Code (LAC) which is a fixed length code (of 2 octets) identifying a location area within a GSM PLMN. This part of the location area identification can be coded using a full hexadecimal representation except for the following reserved hexadecimal values:

  0000, and

  FFFE

  These reserved values are used in some special cases when no valid LAI exists in the mobile station (see Technical Specifications GSM 04.08 and GSM 11.11).

4.2 Base station identification

4.2.1 Cell Identity (CI) and Cell Global Identification (CGI)

The BSS and cell within the BSS is identified within a location area by adding a Cell Identity (CI) to the location area identification, as shown in figure 4. The CI is of fixed length with 2 octets and it can be coded using a full hexadecimal representation.

The Cell Global Identification is the concatenation of the Location Area Identification and the Cell Identity.

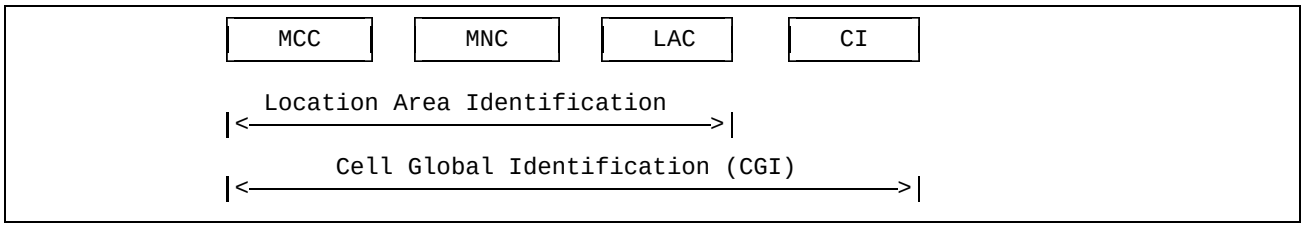

Figure 4: Structure of Cell Global Identification

4.2.2 Base Station Identify Code (BSIC)

The base station identity code is a local colour code that allows a mobile station to distinguish between different neighbouring base stations. BSIC is a 6 bit length code which is structured in the following way.

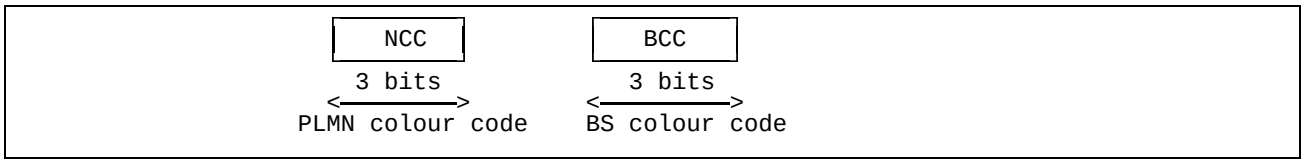

Figure 5: Structure of BSIC

In the definition of the NCC, care needs to be taken to ensure that the same NCC is not used in adjacent PLMNs which may use the same BCCH carrier frequencies in neighbouring areas. Therefore, to prevent potential deadlocks, a definition of the NCC appears in Annex A. This Annex will be reviewed in a co-ordinated manner when a PLMN is created.

4.3 Regional Subscription Zone Identity (RSZI)

A PLMN specific regional subscription defines unambiguously for the entire PLMN the regions in which roaming is allowed. It consists of one or more regional subscription zones. The regional subscription zone is identified by Regional Subscription Zone Identity (RSZI). A regional subscription zone identity is composed as shown in figure 6.

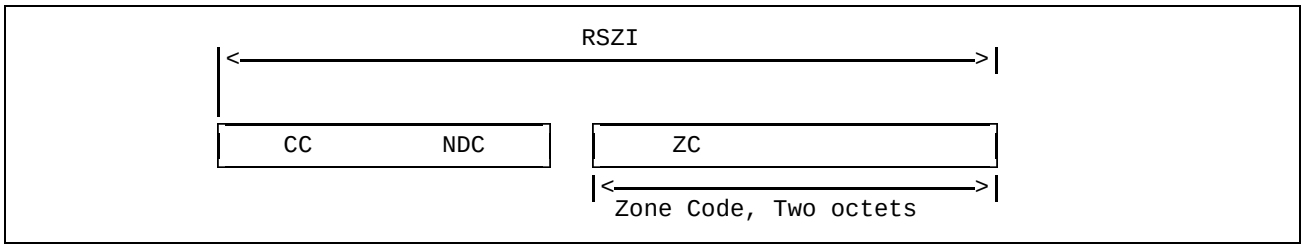

Figure 6: Structure of Regional Subscription Zone Identity (RSZI)

The elements of the regional subscription zone identity are:

- the Country Code (CC) which identifies the country in which the GSM PLMN is located;
- the National Destination Code (NDC) which identifies the GSM PLMN in that country;
- the Zone Code (ZC) which identifies a regional subscription zone as a pattern of allowed and not allowed location areas uniquely within that PLMN.

CC and NDC are those of a CCITT E.164 VLR number (see clause 5.1) of the PLMN and are coded with a tailing filler, if required. ZC has fixed length of two octets and is coded in full hexadecimal representation.

RSZIs including the zone codes are assigned by the VLR operator. The zone code is evaluated in the VLR by information stored in the VLR as a result of administrative action. If a zone code is received by a VLR during updating by the HLR and this zone code is related to that VLR, the VLR shall be able to decide for all its MSC areas and all its location areas whether they are allowed or not allowed.

For details of assignment of RSZI and of ZC as subscriber data see TS GSM 03.08.

For selection of RSZI at location updating by comparison with the leading digits of the VLR number and for transfer of ZC from the HLR to VLR see TS GSM 09.02.

4.4 Location Number

A location number is a number which defines a specific location within a GSM PLMN. The Location number is formatted according to CCITT Recommendation E.164, as shown in figure 7. The country code (CC) and national destination code (NDC) fields of the location number are those which define the GSM PLMN of which the location is part.

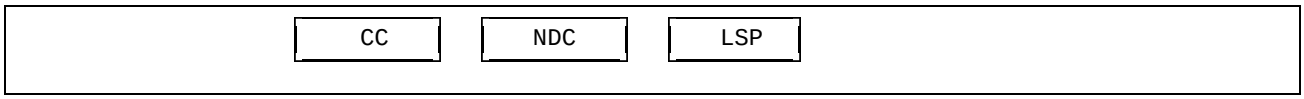

Figure 7: Location Number Structure

The structure of the locally significant part (LSP) of the location number is a matter for agreement between the PLMN operator and the national numbering authority in the PLMN's country. It is desirable that the location number can be interpreted without the need for detailed knowledge of the internal structure of the PLMN; the LSP should therefore include the national destination code in the national numbering plan for the fixed network which defines the geographic area in which the location lies.

The set of location numbers for a GSM PLMN must be chosen so that a location number can be distinguished from the MSISDN of a subscriber of the PLMN. This will allow the PLMN to trap attempts by users to dial a location number.

5 Identification of MSCs and location registers

5.1 Identification for routing purpose

MSCs and location registers are identified by international PSTN/ISDN numbers and/or Signalling Point Codes ("entity number", ie. "HLR number", "VLR number", "MSC number") in each GSM PLMN.

5.2 Identification of HLR for HLR restoration application

HLR may also be identified by one or several "HLR id(s)", consisting of the leading digits of the IMSI (MCC + MNC + leading digits of MSIN).

6 International mobile station equipment identity and software version number

6.1 General

Below the structure and allocation principles of the International Mobile station Equipment Identity and Software Version Number (IMEISV) and the International Mobile Station Equipment Identity (IMEI) are defined.

The Mobile Station Equipment is uniquely defined by the IMEI or the IMEISV.

6.2 Composition of IMEI and IMEISV

6.2.1 Composition of IMEI

The International Mobile station Equipment Identity (IMEI) is composed as shown in figure 8.

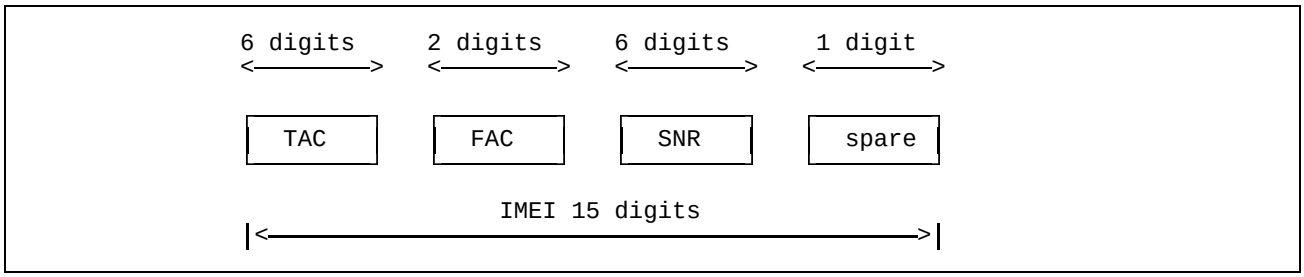

Figure 8: Structure of IMEI

The IMEI is composed of the following elements (each element shall consist of decimal digits only):

- Type Approval Code (TAC). Its length is 6 digits;
- Final Assembly Code (FAC) identifies the place of manufacture/final assembly. Its length is 2 digits;
- Serial Number (SNR) is an individual serial number uniquely identifying each equipment within each TAC and FAC. Its length is 6 digits.
- Spare digit: this digit shall be zero, when transmitted by the Mobile Station.

The security requirements of the IMEI are defined in TS GSM 02.16.

6.2.2 Composition of IMEISV

The International Mobile station Equipment Identity and Software Version Number (IMEISV) is composed as shown in figure 9.

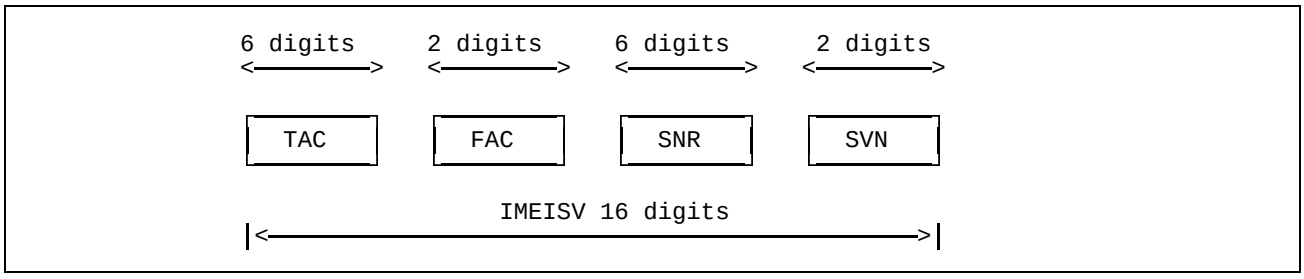

Figure 9: Structure of IMEISV

The IMEISV is composed of the following elements (each element shall consist of decimal digits only):

- Type Approval Code (TAC). Its length is 6 digits;
- Final Assembly Code (FAC) identifies the place of manufacture/final assembly. Its length is 2 digits;
- Serial Number (SNR) is an individual serial number uniquely identifying each equipment within each TAC and FAC. Its length is 6 digits.
- Software Version Number (SVN) identifies the software version number of the mobile equipment. Its length is 2 digits.

Regarding updates of the IMEISV: the security requirements of TS GSM 02.16 apply only to the TAC, FAC and SNR, but not to the SVN part of the IMEISV.

6.3 Allocation principles

The Type Approval Code (TAC) is issued by a central body.

The place of final assembly (FAC) is encoded by the manufacturer.

Manufacturers shall allocate individual serial numbers (SNR) in a sequential order.

For a given ME, the combination of TAC, FAC and SNR used in the IMEI shall duplicate the combination of TAC, FAC and SNR used in the IMEISV.

The Software Version Number is allocated by the manufacturer after authorisation by the type approval authority. SVN value 99 is reserved for future use.

Annex A (informative): Colour Codes

A.1 Utilisation of the BSIC

To each cell is allocated a BSIC, within 64 values. In each cell its BSIC is broadcast in each burst sent on the SCH, and is then known by all mobile stations which get the synchronisation with this cell. The BSIC is used by the mobile station for several purposes, all aiming of avoiding ambiguity or interference which can arise when a mobile station in a given position can receive two cells *using the same BCCH frequency*.

Some of the utilisations of the BSIC relate to cases where the mobile station is attached to one of the cells. Other utilisations relates to cases where the mobile station is attached to third cell, usually somewhere between the two cells in question.

The first category of utilisations includes:

- The three least significant bits of the BSIC indicate which of the 8 training sequences is used in the bursts sent on the downlink common channels of the cell. Different training sequences allow for a better transmission in case of interference. The group of the three least significant bits of the BSIC is called the BCC (Base station Colour Code).

- The BSIC is used to modify the bursts sent by the mobile stations on the access bursts. This aims to avoid one cell decoding correctly access bursts sent to another cell.

The second category of utilisations includes:

- When in connected mode, the mobile stations measure and report the level they receive on a number of frequencies, corresponding to the BCCH frequencies of neighbouring cells in the same network as the used cell. Along with the measurement result, the mobile station provides the network with the BSIC it has received on the frequency. This enables the network to discriminate between several cells happening to use the same BCCH frequency. Bad discrimination might result in faulty handovers.

- The contents of the measurement report messages is limited to 6 neighbour cells. It is then useful to limit the reported cells to those to which handovers are accepted. To this avail, each cell provides a list of the values of the three most significant bits of the BSICs that are allocated to the cells that are useful to consider for handovers (usually excluding cells in other PLMNs). This information enables the mobile station to put aside cells with non-conformant BSIC and not to report about them. The group of the three most significant bits of the BSIC is called the NCC (Network Colour Code).

It should be noted that when in idle mode, the mobile station identifies a cell (for cell selection pruposes) according to the cell identity broadcast on the BCCH and *not* by the BSIC.

A.2 Guidance for planning

From these utilisations, the following planning rule can be derived:

> *If there exist places where mobile stations can receive two cells, whether in the same PLMN or in different ones, that use the same BCCH frequency, it is highly preferable that these two cells have different BSICs.*

Where the coverage areas of two PLMNs overlap, the rule above is respected if:

i) The PLMNs uses different sets of BCCH frequencies. This is in particular the case if no frequency is common to the two PLMNs. This usually holds for PLMNs in the same country.

ii) The PLMNS use different sets of NCCs.

iii) BSIC and BCCH frequency planning is co-ordinated.

Recognising that method iii) is more cumbersome than method ii), and that method i) is too constraining, it is suggested that overlapping PLMNs using common part of spectrum agree on different NCCs to be used in overlapping area. As an example, a preliminary NCC allocation for countries in the European region can be found in clause A.3 of this annex.

This example can be used as basis for bilateral agreements. However, the usage of the NCCs allocated in clause A.3 is not compulsory. PLMN operators can agree on different BSIC allocation rules in border areas. The usage of BSICs is not constrained in non overlapping areas, or if ambiguities are resolved by using different sets of BCCH frequencies.

A.3 Example of PLMN Colour Codes (NCCs) for the European region

Austria	:	0
Belgium	:	1
Cyprus	:	3
Denmark	:	1
Finland	:	0
France	:	0
Germany	:	3
Greece	:	0
Iceland	:	0
Ireland	:	3
Italy	:	2
Liechtenstein	:	2
Luxembourg	:	2
Malta	:	1
Monaco	:	3 (possibly 0(=France))
Netherlands	:	0
Norway	:	3
Portugal	:	3
San Marino	:	0 (possibly 2(= Italy))
Spain	:	1
Sweden	:	2
Switzerland	:	1
Turkey	:	2
UK	:	2
Vatican	:	1 (possibly 2(=Italy)
Yugoslavia	:	3

This allows for each country a second operator by allocating the colour codes n (in the table) and n + 4. More than 2 colour codes per country may be used provided that in border areas only the values n and/or n+4 are used.

History

Document history			
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V4.11.0	August 2000	One-step Approval Procedure	OAP 20001201: 2000-08-02 to 2000-12-01
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