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Source: **Nokia**

Title: **Proposed Enhanced IMEI Coding Format**

Agenda item: **5.8.1**

Document for: **APPROVAL**

Background

The current 15 digit IMEI format is structured in the following way:

- Type Approval Code (TAC): 6 digits. The first 2 digits constitute the code allocated to Notified Body, i.e., Reporting Body Identifier (1900 MHz phones in USA and test terminals have different coding)
- Final Assembly Code (FAC): 2 digits
- Serial Number: 6 digits
- Check digit

These digits have been presented in BCD coding format. This coding format has served well and no problems have been envisaged as far as an unambiguous terminal coding for GSM is concerned. New Type Approval Codes have been issued with a 6 BCD digit Serial Number set (one million units) is not sufficient any more. The introduction of the IMEI into 3G mobile terminal identification changes the situation as soon as a great variety of products manufactured in larger volumes will flow to market place. Nevertheless, any modification in the IMEI must not jeopardise smooth migration from one mobile generation to the next one.

Proposal

Given the strong reliance on the interoperability with legacy products no change to IMEI length or structure is considered feasible. In contrast, the coding format of the Serial Number is proposed to be modified. The new coding format is proposed to be included in 3GPP Release 99 specifications.

- Instead using BCD, a hexadecimal coding format is proposed. It would offer a capacity of 16.7 million units manufactured with one Type Approval Code.
- TAC would set a trigger for interpretation (Network would identify from which TAC number onwards a serial number would be interpreted as binary presentation), or
- Alternatively, a date could be set before which terminals should use the old IMEI coding format

Tasks

The following tasks have been identified to enhance the IMEI

- Infrastructure manufacturers have to comment on the feasibility of this enhancement
- CRs have to be introduced to specifications describing the IMEI, its coding format and the IMEI check digit calculation.
- A list of trigger TAC has to be established, or
- Alternatively, an earliest implementation date must be agreed

Cost/benefit analysis

This proposal will require modifications to network management system for both installed and new (GSM and 3G). If this modification is not implemented there is a risk that later on a more radical change is needed to be implemented due to the current method of using blocks of Type Approval Codes for larger production volumes.

Appendix 1

Currently active allocations for Type Approval Code (there are more codes allocated, but not in active use presently)

33	ART, France
44	BABT, UK
45	NTA, Denmark
49	RegTP (earlier BZT and BAPT), Germany (no new approvals granted by RegTP anymore)
50	BZT-ETS (Dr. Genz), Germany
51	BZT Privat, Germany
52	Cetecom, Germany
01	GSM1900 type certified phones in USA by PTCRB, PCS(GSM)1900 Type certification Review Board
0xxxyy	Test IMEIs in Europe based on MoU TWG doc TW.06 (see below) by operators
001	Test IMEIs in USA by PTCRB

Appendix 2

Draft CRs to GSM 22.016, 23.003, 24.008 and 25.331 (in four separate files).

3G TS 22.016 V3.1.0 (1999-12)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; International Mobile station Equipment Identities (IMEI) (3G TS 22.016 version 3.1.0)

Reference

DTS/TSGSA-0122016U

Keywords

3GPP, SA

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Contents

Foreword

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Version 3.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 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 specification;

1 Scope

The present document defines the principal purpose and use of International Mobile station Equipment Identities (IMEI).

TS 23.003 describes the technical manner of numbering, addressing and identification.

Note: The present document covers description for GSM only. The document needs to be updated to make it applicable to 3GPP.

1.1 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1999 document, references to GSM documents are for Release 1999 versions (version 8.x.y).

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms"

[2] TS 23.003: "Numbering, addressing and identification".

[3] ISO/IEC 7812 (1989): "Identification cards - Numbering system and registration procedure for issuer identifiers".

[4] TR 21.905: "Vocabulary for 3GPP Specifications".

1.2 Definitions and abbreviations

In addition to the following, abbreviations used in the present document are listed in GSM 01.04 [1] and TR 21.905 [4].

International Mobile Station Equipment Identity (IMEI) : An "International Mobile Station Equipment Identity" is a unique number which shall be allocated to each individual mobile station equipment in the PLMN and shall be unconditionally implemented by the MS manufacturer.

2 General

An MS can only be operated if a valid "International Mobile Subscriber Identity" (IMSI) is present. An IMSI is primarily intended for obtaining information on the use of the PLMN by subscribers for individual charging purposes.

Besides the IMSI, the implementation of IMEI is found necessary in order to obtain knowledge about the presence of specific mobile station equipment in the network, disregarding whatever subscribers are making use of these equipments.

The main objective is to be able to take measures against the use of stolen equipment or against equipment of which the use in the PLMN can not or no longer be tolerated for technical reasons.

The IMEI is incorporated in an MS module which is contained within the MS equipment. The IMEI shall not be changed after the ME's final production process. It shall resist tampering, i.e. manipulation and change, by any means (e.g. physical, electrical and software).

NOTE: This requirement is valid for new GSM Phase 2 and Release 96, 97, 98 and 99 MEs type approved after 1st June 2002. However, this requirement is applicable to all UEs of UMTS from start of production.

This implementation of each individual module should be carried out by the manufacturer who is also responsible for ascertaining that each IMEI is unique and keeping detailed records of produced and delivered MS.

3 Composition of IMEI

The composition of the IMEI shall be such that each individual mobile station equipment can be separately identified.

Information is contained in the IMEI by which the PLMN, after requesting it, can immediately decide whether or not to accept calls made by means of this equipment.

Secondly, the IMEI shall directly or indirectly contain all information which is necessary for the network operator to make relations through its administrative system to trace the equipment to its origin of production. TS 23.003 [2] describes the structure of the IMEI in detail.

The IMEI (14 digits) is complemented by a check digit. The check digit is not part of the digits transmitted at IMEI check occasions, as described below. The Check Digit shall avoid manual transmission errors, e.g. when customers register stolen MEs at the operators customer care desk. The Check Digit is defined according to modified~~the~~ Luhn formula, as defined in annex A.

NOTE: The Check Digit is not applied to the Software Version Number.

4 Use of the equipment identity register

A network operator can make administrative use of the IMEI in the following manner:

> Three registers are defined, known as "white lists", "grey lists" and "black lists". The use of such lists is at the operators' discretion.
>
> The **white list** is composed of all **number series** of equipment identities that are permitted for use.
>
> The **black list** contains all equipment identities that belong to equipment that need to be barred.
>
> Besides the black and white list, administrations have the possibility to use a **grey list**. Equipments on the grey list are not barred (unless on the black list or not on the white list), but are tracked by the network (for evaluation or other purposes).

5 Procedure

It shall be possible to perform the IMEI check at any access attempt, except IMSI detach, and during an established call at any time when a dedicated radio resource is available, in accordance with the security policy of the PLMN operator.

The network shall terminate any access attempt or ongoing call when receiving any of the answers "black-listed" (i.e., on the black list) or "unknown" equipment (i.e., not on the white list) from the EIR. An indication of "illegal ME" shall in these cases be given to the user. Furthermore this is equivalent to an authentication failure hence any call establishment or any location updating is forbidden for the MS, it cannot answer to paging, it is just allowed to perform Emergency Calls. Emergency calls must never be terminated as a result of the IMEI check procedure.

6 Use of IMEI in case of emergency calls

Emergency calls can in some PLMNs be made without having to send the subscriber identity (IMSI) to the network. In this case the misuse of MS equipments after placing invalid emergency calls can be restrained by using the equipment identity.

The network request for the equipment identity is sent to the MS after the emergency call has been set-up. The procedure is the same as for normal call set-up.

7 MS Software Version Number (SVN)

A Software Version Number (SVN) field shall be provided. This allows the ME manufacturer to identify different software versions of a given type approved mobile.

The SVN is a separate field from the IMEI, although it is associated with the IMEI, and when the network requests the IMEI from the MS, the SVN (if present) is also sent towards the network. It comprises 2 decimal digits.

The white list shall use the IMEI, The Black and Grey Lists may also use the SVN.

Annex A (normative): IMEI Check Digit computation

A.1 Representation of IMEI

The International Mobile station Equipment Identity and Software Version Number (IMEISV), as defined in TS 23.003, is a 16 digit hexadecimal number composed of four distinct elements:

- a 6 digit Type Approval Code (TAC);
- a 2 digit Final Assembly Code (FAC);
- a 6 digit Serial Number (SNR); and
- a 2 digit Software Version Number (SVN).

The IMEISV is formed by concatenating these four elements as illustrated below:

TAC	FAC	SNR	SVN

Figure A.1: Composition of the IMEISV

The IMEI is complemented by a check digit as defined in section 3. The Luhn Check Digit (CD) is computed on the 14 most significant decimal converted hexadecimal digits of the IMEISV, that is on the value obtained by ignoring the SVN digits. Note that this slightly modified Luhn check is compatible with the previously employed algorithm, since if none of the digits is >9, the algorithm is reduced to the ISO/IEC 7812.

The method for computing the Luhn check is defined in Annex B of the International Standard "Identification cards - Numbering system and registration procedure for issuer identifiers" (ISO/IEC 7812) [3].

In order to specify precisely how the CD is computed for the IMEI, it is necessary to label the individual digits of the IMEISV, excluding the SVN. This is done as follows:

The (14 most significant) digits of the IMEISV are labelled D14 D13 ... D1, where:

- TAC = D14 D13 ... D9 (with D9 the least significant digit of TAC);
- FAC = D8 D7 (with D7 the least significant digit of FAC); and
- SNR = D6 D5 ... D1 (with D1 the least significant digit of SNR).

Note: Even though all digits D1… D14 are changed to use hexadecimal coding, this has no effect to the previously assigned values of all fields when the fields were using BCD coding. The same code values can still be used for the previously assigned codes. The hexadecimal coding allows more codes to be used for all fields. Especially this applies to the SNR field, which has number space of 2^24 = 16,777,216 units – with BCD coding the number space is 1,000,000 units.

A.2 Computation of CD for an IMEI

Computation of CD from the IMEI proceeds as follows:

Step 1: Double the values of the odd labelled digits D1, D3, D5 ... D13 of the IMEI. Convert the result to decimal numbers.

Step 2: Add together the individual decimal digits of all the seven numbers obtained in Step 1, and then add this sum to the sum of all the even labelled hexadecimal to decimal converted digits D2, D4, D6 ... D14 of the IMEI.

Step 3: If the number obtained in Step 2 ends in 0, then set CD to be 0. If the number obtained in Step 2 does not end in 0, then set CD to be that number subtracted from the next higher decimal number which does end in 0.

A.3 Example of computation

IMEI (14 most significant digits):

TAC						FAC		SNR					
D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1
2	6	0	5	3	1	7	9	3	1	D~~1~~	3	E~~8~~	3

Step 1:

2	6	0	5	3	1	7	9	3	8~~1~~	13~~1~~	3	14~~8~~	3
	x2		x2		x2		x2		X2		x2		x2
	12		10		2		18		16~~2~~		6		6

Step 2:

2 + 1 + 2 + 0 + 1 + 0 + 3 + 2 + 7 + 1 + 8 + 3 + 1 + 6~~2~~ + 1 +3 + 6 + 1 +4~~8~~ + 6 = 58~~53~~

Step 3:

CD = 60 - 58~~3~~ = 2~~7~~

Annex B:
Change history

Change history						
TSG SA#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Jun 1999	GSM 02.16	7.0.0				Transferred to 3GPP SA1
SA#04	22.016				3.0.0	
SA#05	22.016	3.0.0	001	R99	3.0.1	Editorial update of references for GSM/3GPP use
SA#06	22.016	3.0.1	002	R99	3.1.0	Modification of section 2 to enhance IMEI security

History

Document history		
V3.0.0	August 1999	Transferred to TSG SA at ETSI SMG#29. Under TSG TSG SA Change Control.
V3.0.1	October 1999	CR approved at SA#05
V3.1.0	December 1999	Inclusion of CRs approved at SA#06.

3G TS 23.003 V3.3.0 (2000-01)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; Numbering, addressing and identification (3G TS 23.003 version 3.3.0)

Reference

DTS/TSGSN-0023003U

Keywords

Numbering, Addressing

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Contents

Foreword

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The present document defines the principal purpose and use of International Mobile station Equipment Identities (IMEI) within the digital cellular telecommunications system and the 3GPP system.

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- 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 specification;

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 MSs in the country of registration of the MS;

c) principles of assigning Mobile Station (MS) roaming numbers to visiting MSs;

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

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

f) principles of assigning international mobile equipment identities;

g) principles of assigning zones for regional subscription;

h) an identification plan for groups of subscribers to the Voice Group Call Service (VGCS) and to the Voice Broadcast Service (VBS); and identification plan for voice group calls and voice broadcast calls; an identification plan for group call areas;

i) principles for assigning Packet Data Protocol (PDP) addresses to mobile stations;

j) an identification plan for point-to-multipoint data transmission groups.

1.1 References

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[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 03.08: "Digital cellular telecommunications system (Phase 2+); Organization of subscriber data".

[3] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[4] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions Related to Mobile Station (MS) in Idle Mode".

[5] GSM 03.70: "Digital cellular telecommunications system (Phase 2+); Routeing of calls to/from Public Data Networks (PDN)".

[6] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[7] GSM 09.03: "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)".

[8] GSM 09.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[9] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

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

[11] CCITT Recommendation E.212: "Identification plan for land MSs".

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

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

[14] RFC 791: "Internet Protocol".

[15] RFC 1883: "Internet Protocol, Version 6 (IPv6) Specification".

1.2 Abbreviations

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

1.3 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 MSs 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 MS 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.

1.4 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 and SGSNs may allocate Temporary Mobile Subscriber Identities (TMSI) to visiting mobile subscribers. The VLR and SGSNs must be capable of correlating an allocated TMSI with the IMSI of the MS to which it is allocated.

An MS may be allocated two TMSIs, one for services provided through the MSC, and the other for services provided through the SGSN (P-TMSI for short).

For addressing on resources used for GPRS, a Temporary Logical Link Identity (TLLI) is used. The TLLI to use is built by the MS either on the basis of the P-TMSI (local or foreign TLLI), or directly (random TLLI).

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.

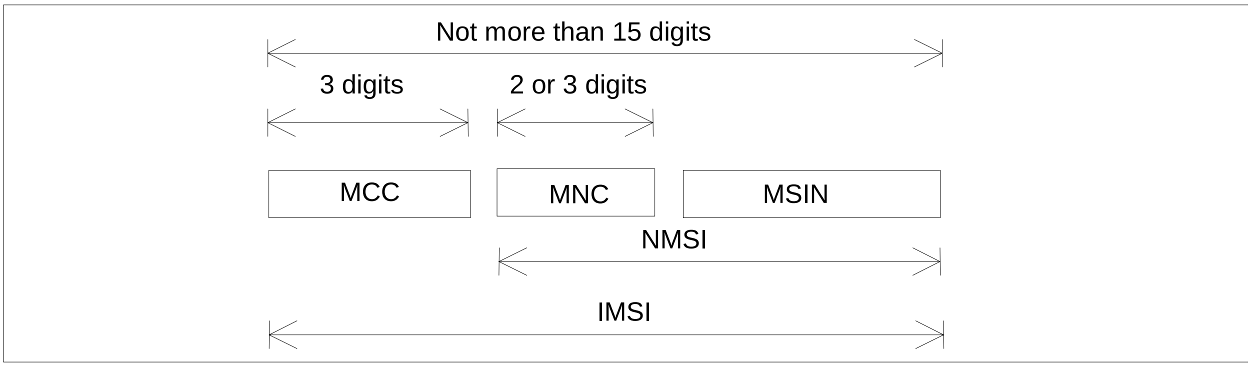

Figure 1: Structure of IMSI

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 or three digits for GSM applications. The MNC identifies the home GSM PLMN of the mobile subscriber. The length of the MNC (two or three digits) depends on the value of the MCC. A mixture of two and three digit MNC codes within a single MCC area is not recommended and is outside the scope of this specification. See GSM 03.22 Ref [3a] for more information.

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 a VLR and the area controlled by a VLR, or within an SGSN and the area controlled by an SGSN), 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 an allocating node, 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 allocating node has recovered from the restart.

In areas where both MSC-based services and SGSN-based services are provided, some discrimination is needed between the allocation of TMSIs for MSC-based services and the allocation of TMSIs for SGSN-based services. The discrimination shall be done on the 2 most significant bits, with values 00, 01, and 10 being used by the VLR, and 11 being used by the SGSN.

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

The network 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.

To allow for eventual modifications of the management of the TMSI code space management, MSs shall not check if an allocated TMSI belongs to the range allocated to the allocating node. MSs shall use an allocated TMSI according to the specifications, whatever its value.

2.5 Structure of LMSI

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

2.6 Structure of TLLI

A TLLI is built by the MS or by the SGSN either on the basis of the P-TMSI (local or foreign TLLI), or directly (random or auxiliary TLLI), according to the following rules.

The TLLI consists of 32 bits, numbered from 0 to 31 by order of significance, with bit 0 being the LSB.

A local TLLI is built by a MS which has a valid P-TMSI as follows:

bits 31 down to 30 are set to 1; and

bits 29 down to 0 are set equal to bits 29 to 0 of the P-TMSI.

A foreign TLLI is built by a MS which has a valid P-TMSI as follows:

bit 31 is set to 1 and bit 30 is set to 0; and

bits 29 down to 0 are set equal to bits 29 to 0 of the P-TMSI.

A random TLLI is built by an MS as follows:

bit 31 is set to 0;

bits 30 down to 27 are set to 1; and

bits 0 to 26 are chosen randomly.

An auxiliary TLLI is built by the SGSN as follows:

bit 31 is set to 0;

bits 30 down to 28 are set to 1;

bit 27 is set to 0; and

bits 0 to 26 can be assigned independently.

Other types of TLLI may be introduced in the future.

The structure of the TLLI is then summarised by the following table:

Table A: TLLI structure

31	30	29	28	27	26 to 0	Type of TLLI
1	1	T	T	T	T	Local TLLI
1	0	T	T	T	T	Foreign TLLI
0	1	1	1	1	R	Random TLLI
0	1	1	1	0	A	Auxiliary TLLI
0	1	1	0	X	X	Reserved
0	1	0	X	X	X	Reserved
0	0	X	X	X	X	Reserved

'T', 'R', 'A' and 'X' indicate bits which can take any value for the type of TLLI. More precisely, 'T' indicates bits derived from a P-TMSI, 'R' indicates bits chosen randomly, 'A' indicates bits chosen by the SGSN and 'X' bits in reserved ranges.

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. The network addresses used for packet data communication between a mobile station and a fixed (or mobile) station are also defined below.

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, i.e. the assignment of an MSISDN to a mobile station is mandatory.

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 MS in a GSM PLMN. This implies that ISDN numbers for MSs should comply with the ISDN numbering plan in each country.

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

It should be possible for each administration to develop its own independent numbering/addressing plan for MSs.

The numbering/addressing plan should not limit the possibility for MSs to roam among GSM PLMNs.

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

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

In principle, it should be possible for any fixed or mobile terminal to communicate with a mobile terminal using an IP v4 address.

3.3 Structure of MS international PSTN/ISDN number (MSISDN)

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

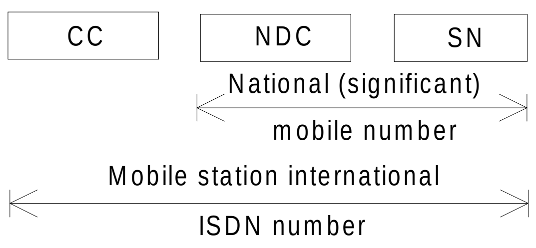

Figure 2: Number Structure of MSISDN

The number consists of:

- Country Code (CC) of the country in which the MS 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 MS 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 MS. 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, section 11.2 and 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 MS. On request from the Gateway MSC via the HLR it is temporarily allocated to a MS by the VLR with which the MS is registered it addresses the Visited MSC collocated with the assigning VLR. More than one MSRN may be assigned simultaneously to a MS.

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

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 (section 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 GSM 09.03).

3.5 Structure of Mobile Station International Data Number

The structure of MS 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. 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 GSM 03.70.

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.

3.7 Structure of an IP v4 address

One or more IP address domains could be allocated to each PLMN. The IP v4 address structure is defined in RFC 791.

An IP v4 address may be allocated to an MS either permanently or on a temporary basis during a connection with the network.

3.8 Structure of an IP v6 address

One or more IP address domains could be allocated to each PLMN. The IP v6 address structure is defined in RFC 1883.

An IP v6 address may be allocated to an MS either permanently or on a temporary basis during a connection with the network

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 or three 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 MS (see GSM 04.08 and GSM 11.11).

A specific GSM PLMN code (MCC + MNC) may be broadcast for non SoLSA compatible mobile stations that do not understand the exclusive access indicator (see GSM 03.73). The reserved value of the escape PLMN code is MCC = 901 and MNC = 08.

4.2 Composition of the Routing Area Identification (RAI)

The Routing Area Identification shall be composed as shown in figure 4:

```
€                  +-------+             +--------+
                   |  LAI  |             |   RAC  |
                   +-------+             +--------+
                   <-Routing Area Identification->
```

Figure 4: Structure of Routing Area Identification

The RAI is composed of the following elements:

- A valid Location Area Identity (LAI) as defined in section 4.1. Invalid LAI values are used in some special cases when no valid RAI exists in the mobile station (see GSM 04.08 and GSM 11.11).

- Routing Area Code (RAC) which is a fixed length code (of 1 octets) identifying a routing area within a location area.

4.3 Base station identification

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

The BSS and cell within the BSS is identified within a location or routing area by adding a Cell Identity (CI) to the location or routing area identification, as shown in figure 5. 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. Cell Identity must be unique within a location area.

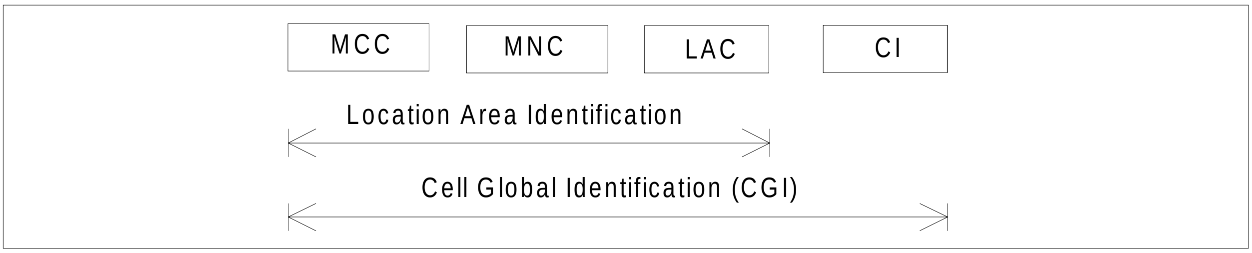

Figure 5: Structure of Cell Global Identification

4.3.2 Base Station Identify Code (BSIC)

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

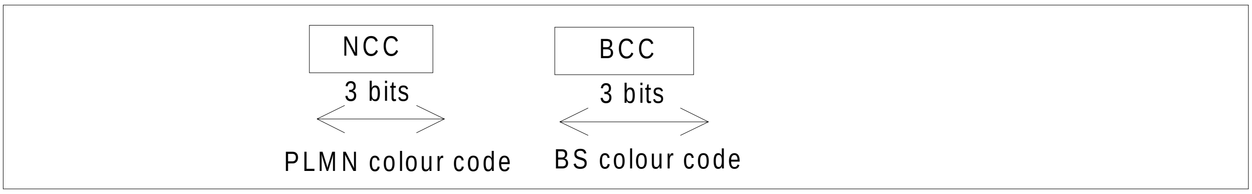

Figure 6: Structure of BSIC

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.

4.4 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 7.

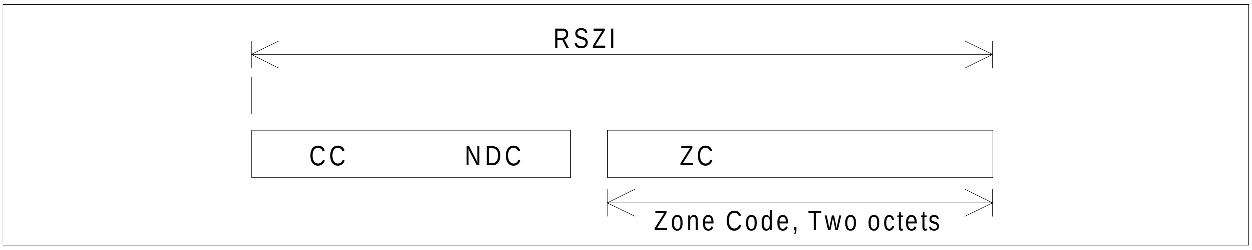

Figure 7: Structure of Regional Subscription Zone Identity (RSZI)

The elements of the regional subscription zone identity are:

1. the Country Code (CC) which identifies the country in which the GSM PLMN is located;
2. the National Destination Code (NDC) which identifies the GSM PLMN in that country;
3. 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 or SGSN number (see section 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 VPLMN operator. The zone code is evaluated in the VLR or SGSN by information stored in the VLR or SGSN as a result of administrative action. If a zone code is received by a VLR or SGSN during updating by the HLR and this zone code is related to that VLR or SGSN, the VLR or SGSN shall be able to decide for all its MSC or SGSN 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 GSM 03.08.

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

4.5 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 8. 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.

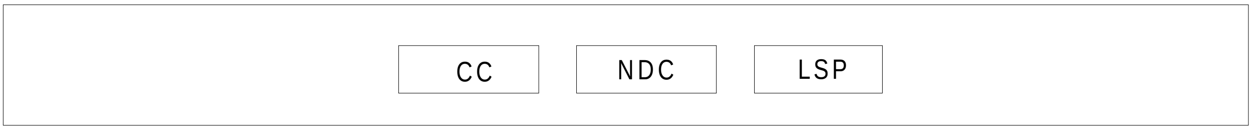

Figure 8: Location Number Structure

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, GSNs and location registers are identified by international PSTN/ISDN numbers and/or Signalling Point Codes ("entity number", i.e., "HLR number", "VLR number", "MSC number", “SGSN number” and “GGSN number”) in each GSM PLMN.

Additionally SGSN, GGSN are identified by GSN Addresses. These are the SGSN Address and the GGSN Address.

A GSN Address shall be composed as shown in figure 9.

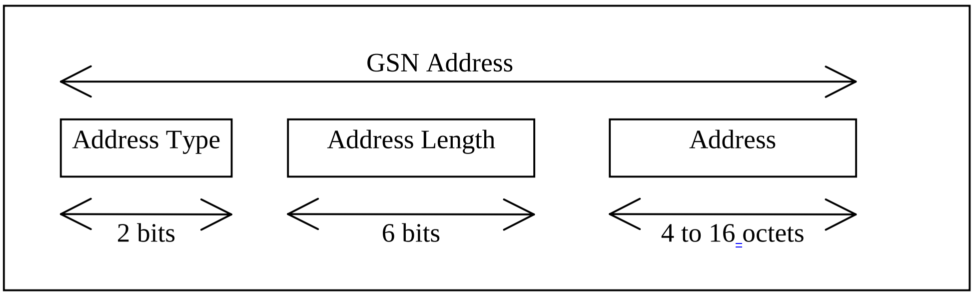

Figure 9: Structure of GSN Address

The GSN Address is composed of the following elements:

1. The Address Type which is a fixed length code (of 2 bits) identifying the type of address that is used in the Address field.
2. Address Length which is a fixed length code (of 6 bits) identifying the length of the Address field.
3. Address is a variable length field with either an IPv4 address or an IPv6 address.

Address Type 0 and Address Length 4 are used when Address is an IPv4 address.

Address Type 1 and Address Length 16 are used when Address is an IPv6 address.

The IP v4 address structure is defined in RFC 791.

The IP v6 address structure is defined in RFC 1883.

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 10.

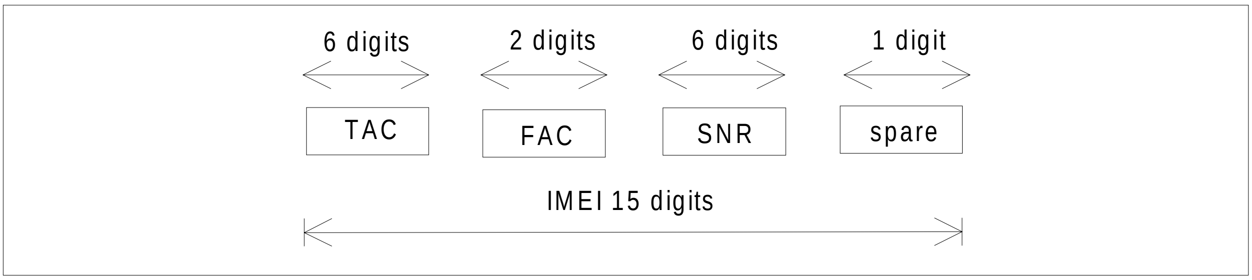

Figure 10: Structure of IMEI

The IMEI is composed of the following elements (each element shall consist of hexadecimal 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 MS.

The TAC, FAC and SNR shall be physically protected against unauthorized change (see GSM 02.09).

6.2.2 Composition of IMEISV

The International Mobile station Equipment Identity and Software Version Number (IMEISV) is composed as shown in figure 11.

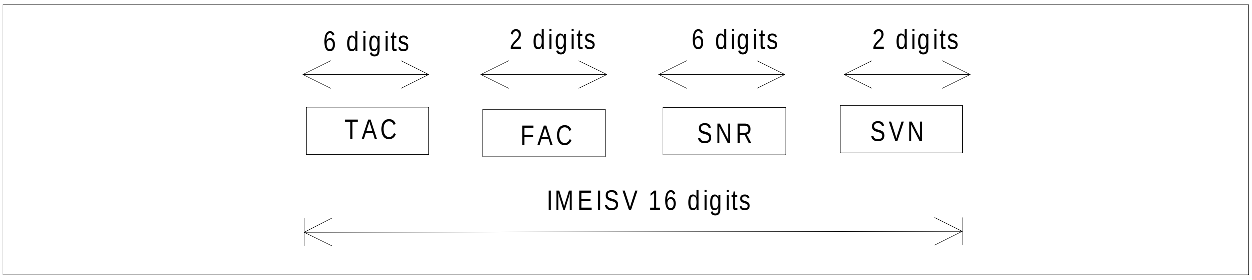

Figure 11: Structure of IMEISV

The IMEISV is composed of the following elements (each element shall consist of hexadecimal 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 TAC, FAC and SNR shall be physically protected against unauthorized change (see GSM 02.09); i.e. only the SVN part of the IMEISV can be modified.

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 authorization by the type approval authority. SVN value 99 is reserved for future use.

7 Identification of Voice Group Call and Voice Broadcast Call Entities

7.1 Group Identities

Logical groups of subscribers to the Voice Group Call Service or to the Voice Broadcast Service are known by a Group Identity (Group ID). Group IDs for VGCS are unique within a PLMN. Likewise, Group IDs for VBS are unique within a PLMN. However, no uniqueness is required between the sets of Group IDs. These sets may be intersecting or even identical, at the option of the network operator.

The Group ID shall be a binary number with a maximum value depending on the composition of the voice group call reference or voice broadcast call reference defined in section 7.3.

VGCS or VBS shall also be provided in case of roaming. If this applies, certain Group IDs shall be defined as supra-PLMN Group IDs which have to be co-ordinated between the network operators and which shall be known in the networks and in the SIM.

The formats of the Group ID is identical for VBS and VGCS.

7.2 Group Call Area Identification

Groupings of cells into specific group call areas occurs in support of both the Voice Group Call Service and the Voice Broadcast Service. These service areas are known by a "Group Call Area Identity" (Group Call Area Id). No restrictions are placed on what cells may be grouped into a given group call area.

The Group Call Area ID shall be a binary number uniquely assigned to a group call area in one network and with a maximum value depending on the composition of the voice group call reference or voice broadcast reference defined under 7.3.

The formats of the Group Call Area ID for VGCS and the Group Call Area ID for VBS are identical.

7.3 Voice Group Call and Voice Broadcast Call References

Specific instances of voice group calls (VGCS) and voice broadcast calls (VBS) within a given group call area are known by a "Voice Group Call Reference" or by a "Voice Broadcast Call Reference".

Each voice group call or voice broadcast call in one network is uniquely identified by its Voice Group Call Reference or Voice Broadcast Call Reference. The Voice Group Call Reference or Voice Broadcast Call Reference is composed of the group ID and the group call area ID. In the case where the routing of dispatcher originated calls is performed without the HLR (see GSM 03.68 for VGCS and GSM 03.69 for VBS), the Voice Group Call Reference or Voice Broadcast Call Reference shall have a maximum length of 4 octets. The composition of the group call area ID and the group ID can be specific for each network operator.

The format is given in figure 12.

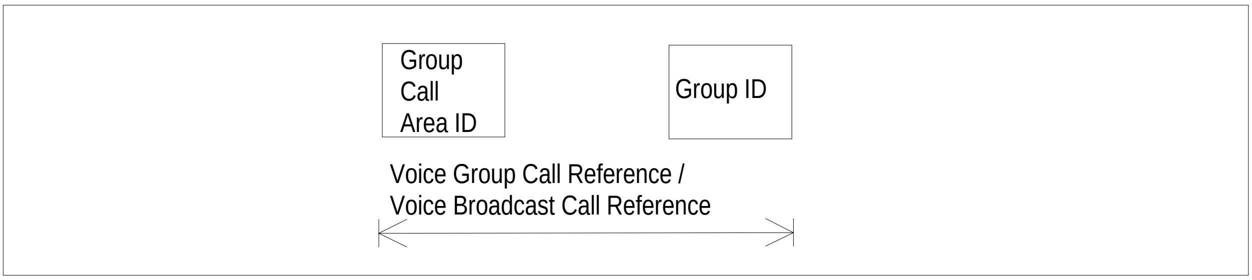

Figure 12: Voice Group Call Reference / Voice Broadcast Call Reference

8 SCCP subsystem numbers

Subsystem numbers are used to identify applications within network entities which use SCCP signalling. In GSM, subsystem numbers may be used between PLMNs, in which case they are taken from the globally standardised range (1 - 31) or the part of the national network range (129 – 150) reserved for GSM use between PLMNs, or within a PLMN, in which case they are taken from the part of the national network range (32 – 128 & 151 - 254) not reserved for GSM use between PLMNs.

8.1 Globally standardised subsystem numbers used for GSM

The following globally standardised subsystem numbers have been allocated for use by GSM:

0000 0110 HLR (MAP);

0000 0111 VLR (MAP);

0000 1000 MSC (MAP);

0000 1001 EIR (MAP);

0000 1010 is allocated for evolution (possible Authentication centre).

8.2 National network subsystem numbers used for GSM

The following national network subsystem numbers have been allocated for use within GSM networks:

1111 1010 BSC (BSSAP-LE)

1111 1011 MSC (BSSAP-LE)

1111 1100 SMLC (BSSAP-LE)

1111 1101 BSS O&M (A interface);

1111 1110 BSSAP (A interface).

The following national network subsystem numbers have been allocated for use within and between GSM networks:

1000 1110 RANAP;

1000 1111 RNSAP;

1001 0001 GMLC(MAP);

1001 0010 CAP;

1001 0011 gsmSCF(MAP);

1001 0100 SIWF(MAP);

1001 0101 SGSN(MAP);

1001 0110 GGSN(MAP);

9 Definition of Access Point Name

In the GPRS backbone, an Access Point Name (APN) is a reference to a GGSN. To support inter-PLMN roaming, the internal GPRS DNS functionality is used to translate the APN into the IP address of the GGSN.

9.1 Structure of APN

The APN is composed of two parts as follows:

- The APN Network Identifier which defines to which external network the GGSN is connected to. This part of the APN is mandatory.
- The APN Operator Identifier which defines in which PLMN GPRS backbone the GGSN is located. This part of the APN is optional.

The APN Operator Identifier is placed after the APN Network Identifier. An APN consisting of both the Network Identifier and Operator Identifier corresponds to a DNS name of a GGSN and has a maximum length of 100 octets.

The syntax of the APN shall follow the Name Syntax defined in RFC 2181 [14] and RFC 1035 [15]. The APN consists of one or more labels. Each label is coded as one octet length field followed by that number of octets coded as 8 bit ASCII characters. Following RFC 1035 [15] the labels should consist only of the alphabetic characters (A-Z and a-z), digits (0-9) and the dash (-). The case of alphabetic characters is not significant. The APN is not terminated by a length byte of zero.

NOTE: A length byte of zero is added by the SGSN at the end of the APN before interrogating a DNS server.

For the purpose of presentation, an APN is usually displayed as a string in which the labels are separated by dots (e.g. “Label1.Label2.Label3”).

9.1.1 Format of APN Network Identifier

The APN Network Identifier shall contain at least one label and shall have a maximum length of 63 octets. An APN Network Identifier shall not start with the strings “rac”, “lac” or “sgsn” and it shall not end in “.gprs”. It shall also not take the value “*”.

In order to guarantee uniqueness of APN Network Identifier within the GPRS PLMN(s), an APN Network Identifier containing more than one label corresponds to an Internet domain name. This name should only be allocated by the PLMN to an organisation that has officially reserved this name in the Internet domain. Other types of APN Network Identifiers are not guaranteed to be unique within the GPRS PLMN(s).

9.1.2 Format of APN Operator Identifier

The APN Operator Identifier is composed of three labels. The last label shall be “gprs”. The first and second labels together shall uniquely identify the GPRS PLMN (e.g. “<operator-name>.<operator-group>.gprs”).

For each operator, there is a default APN Operator Identifier (i.e. domain name). This default APN Operator Identifier is derived from the IMSI as follows:

“mnc<MNC>.mcc<MCC>.gprs”

where:

“mnc” and “mcc” serve as invariable identifiers for the following digits.

<MNC> and <MCC> are derived from the components of the IMSI defined in section 2.2.

This default APN Operator Identifier is used in inter-PLMN roaming situations when attempting to translate an APN consisting of Network Identifier only into the IP address of the GGSN residing in the HPLMN. The PLMN may provide DNS translations for other, more human-readable, APN Operator Identifiers in addition to the default Operator Identifier described above.

In order to guarantee inter-PLMN DNS translation possibility, the <MNC> and <MCC> coding to be used in the "mnc<MNC>.mcc<MCC>.gprs" format of the APN OI shall be:

- <MNC> = 3 digits
- <MCC> = 3 digits
- If there are less than 3 significant digits in MNC, one or more "0" digit(s) is/are inserted at the left side to fill the 3 digits coding of MNC in the APN OI.

As an example, the APN OI for MCC 345 and MNC 12 shall be coded in the DNS as mnc012.mcc345.gprs.

9.2 Definition of the Wild Card APN

The APN field in the HLR may contain a wild card APN if the HPLMN operator allows the subscriber to access any network of a given PDP Type. If an SGSN has received such a wild card APN, it may either choose the APN Network Identifier received from the Mobile Station or a default APN Network Identifier for addressing the GGSN when activating a PDP context.

9.2.1 Coding of the Wild Card APN

The wild card APN is coded as an APN with "*" as its single label, (i.e. a length octet with value one, followed by the ASCII code for the asterisks).

10 Identification of the Cordless Telephony System entities

10.1 General description of CTS-MS and CTS-FP Identities

Every CTS-FP broadcasts a local identity - the Fixed Part Beacon Identity (FPBI) - which contains an Access Rights Identity. Every CTS-MS has both a Access Rights Key and a CTS Mobile Subscriber Identity (CTSMSI). These operate as a pair. A CTS-MS is allowed to access any CTS-FP which broadcasts a FPBI that can be identified by any of the CTS-MS Access Rights Keys of that CTS-MS. The CTS-MS Access Rights Key contains the FPBI and the FPBI Length Indicator (FLI) indicating the relevant part of the FPBI used for controlling access.

10.2 CTS Mobile Subscriber Identities

10.2.1 General

Each CTS-MS has one or more temporary identities that are used for paging and access requesting. Below the structure and allocation principles of the CTS Mobile Subscriber Identities (CTSMSI) are defined.

10.2.2 Composition of the CTSMSI

```
bit No 22                                          1
       +-------------------------------------------+
       | | |                                       |
       +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
       Type|<-----------Significant Part---------->|

                      CTSMSI 22 bits
       <------------------------------------------->
```

Figure 13: structure of CTSMSI

The CTSMSI is composed of the following elements:

- CTSMSI Type. Its length is 2 bits;
- Significant Part. Its length is 20 bits.

The following CTSMSI Type value have been allocated for use by CTS:

00 Default Individual CTSMSI;

01 Reserved;

10 Assigned Individual CTSMSI;

11 Assigned Connectionless Group CTSMSI.

10.2.3 Allocation principles

Default Individual CTSMSI contains the least significant portion of the IMSI. This is the default CTS-MS identity.

Assigned CTSMSIs are allocated by the CTS-FP during enrolment, registration and other access procedures. Significant Part of the assigned CTSMSI shall be allocated in the range 00001-FFFFE. CTS-FP shall not allocate Significant Part equal to 00000 or to FFFFF and shall not allocate Assigned CTSMSI using Reserved Type value. Such assignments shall be ignored by the CTS-MS.

Assigned CTSMSIs are allocated in ciphered mode.

NOTE: The assigned individual CTSMSI should be updated whenever sent in clear text on the CTS radio interface during RR connection establishment.

The value FFFFF from the set of Assigned Connectionless Group CTSMSI shall be considered in all CTS-MS as the value of the Connectionless Broadcast Identifier.

10.2.4 CTSMSI hexadecimal representation

The 22 bits of CTSMSI are padded with 2 leading zeroes for having a 6 digits hexadecimal value.

EXAMPLE: binary CTSMSI value: 11 1001 0010 0000 1011 1100

hexadecimal CTSMSI value: 39 20 BC

10.3 Fixed Part Beacon Identity

10.3.1 General

Each CTS-FP has one Fixed Part Beacon Identity known by the enrolled CTS-MSs. The FPBI is periodically broadcast on the BCH logical channel so that the CTS-MSs are able to recognise the identity of the CTS-FP. The FPBI contains a Access Rights Identity.

Enrolled CTS-MSs shall store the FPBI to which their assigned CTSMSIs are related.

Below the structure and allocation principles of the Fixed Part Beacon Identity (FPBI) are defined.

10.3.2 Composition of the FPBI

10.3.2.1 FPBI general structure

```
bit No 19                                    1
      +--------------------------------------+
      |   |                                  |
      +-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-+
      Type|        Significant  Part         |

                  FPBI 19 bits
      <-------------------------------------->
```

Figure 14: general structure of FPBI

The FPBI is composed of the following elements:

- FPBI Type. Its length is 2 bits;
- FPBI Significant Part. Its length is 17 bits.

NOTE: The three LSBs bits of the FPBI form the 3-bit training sequence code (TSC). See GSM 05.56.

The following FPBI Type value have been allocated for use by CTS:

00 FPBI class A: residential and single-cell systems;

01 FPBI class B: multi-cell PABXs;

all other values are reserved and CTS-MSs shall treat these values as FPBI class A.

10.3.2.2 FPBI class A

This class is intended to be used for small residential and private (PBX) single cell CTS-FP.

```
bit No 19                                    1
      +--------------------------------------+
      |0 0|                                  |
      +-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-+
      Type|           FPN                    |

                  FPBI 19 bits
      <-------------------------------------->
```

Figure 15: structure of FPBI class A

The FPBI class A is composed of the following elements:

- FPBI Class A Type. Its length is 2 bits and its value is 00;
- Fixed Part Number (FPN). Its length is 17 bits. The FPN contains the least significant bits of the Serial Number part of the IFPEI.NOTE: The FPBI Length Indicator should be set to 19 for class A FPBI.

10.3.2.3 FPBI class B

This class is reserved for more complex private installation such as multi-cell PABXs.

```
bit No 19                                    1
      +--------------------------------------+
      |0 1|                                  |
      +-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-┴-+
      Type|        CNN + FPN + RPN           |

                  FPBI 19 bits
      <-------------------------------------->
```

Figure 16: structure of FPBI class B

The FPBI class B is composed of the following elements:

- FPBI Class B Type. Its length is 2 bits and its value is 01;
- CTS Network Number (CNN). Its length is defined by the manufacturer or the system installer;
- Fixed Part Number (FPN). Its length is defined by the manufacturer or the system installer;
- Radio Part Number (RPN) assigned by the CTS manufacturer or system installer. Its length is defined by the manufacturer or the system installer.

NOTE 1: RPN is used to separate a maximum of $2^{\text{RPN length}}$ different cells from each other. This define a cluster of cells supporting intercell handover. RPN length is submitted to a CTS-MS as a result of a successful attachment.

NOTE 2: The FPBI Length Indicator should be set to (2 + CNN Length) for class B FPBI.

10.3.3 Allocation principles

The FPBI shall be allocated during the CTS-FP initialisation procedure. Any change to the value of the FPBI of a given CTS-FP shall be considered as a CTS-FP re-initialisation; i.e. each enrolled CTS-MS needs to be enrolled again.

FPBI are not requested to be unique (i.e. several CTS-FP can have the same FPBI in different areas). Care should be taken for limiting CTS-MS registration attempts to a homonymous fixed part.

10.4 International Fixed Part Equipment Identity

10.4.1 General

Below the structure and allocation principles of the International Fixed Part Equipment Identity (IFPEI) are defined.

10.4.2 Composition of the IFPEI

```
    6 digits   2d     6 digits   2d
<-----------><---><-----------><--->
+-----------++---++-----------++---+
| | | | | | || | || | | | | | || | |
+-----------++---++-----------++---+
     TAC      FAC      SNR      SVN

           IFPEI 16 digits
<---------------------------------->
```

Figure 17: structure of IFPEI

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

- Type Approval Code (TAC). Its length is 6 decimal digits;
- Final Assembly Code (FAC). Its length is 2 decimal digits;
- Serial NumbeR (SNR). Its length is 6 decimal digits;
- Software Version Number (SVN) identifies the software version number of the fixed part equipment. Its length is 2 digits.

Regarding updates of the IFPEI: the TAC, FAC and SNR shall be physically protected against unauthorised change (see GSM 02.09); i.e. only the SVN part of the IFPEI can be modified.

10.4.3 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 unique serial numbers (SNR) in a sequential order.

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

10.5 International Fixed Part Subscription Identity

10.5.1 General

Below the structure and allocation principles of the International Fixed Part Subscription Identity (IFPSI) are defined.

10.5.2 Composition of the IFPSI

```
     No more than 15 digits
<-------------------------------->
  3d     3d
<-----><-----><------//-------->
+-----++-----++------//--------+
|     ||     ||                |
+-┴-┴-++-┴-┴-++-┴-┴-┴//┴-┴-┴-┴-+
  MCC    CON         FPIN

                NFPSI
      <------------------------>

             IFPSI
<———————————————————————————————>
```

Figure 18: structure of IFPSI

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

- Mobile Country Code (MCC) consisting of three digits. The MCC identifies the country of the CTS-FP subscriber (e.g. 208 for France);
- CTS Operator Number (CON). Its length is three digits;
- Fixed Part Identification Number (FPIN) identifying the CTS-FP subscriber.

The National Fixed Part Subscriber Identity (NFPSI) consists of the CTS Operator Number and the Fixed Part Identification Number.

10.5.3 Allocation principles

IFPSI shall consist of numerical characters (0 through 9) only.

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 CTS Operator Number (CON) and the structure of National Fixed Part Subscriber Identity (NFPSI) are the responsibility of each National Regulation Authority.

CTS Operator shall allocate unique Fixed Part Identification Number.

11 Identification of Localised Service Area

Cells may be grouped into specific localised service areas. These localised service areas are identified by a localised service area identity (LSA ID). No restrictions are placed on what cells may be grouped into a given localised service area.

The LSA ID can either be a PLMN significant number or a universal identity. This shall be known both in the networks and in the SIM.

The LSA ID consists of 24 bits, numbered from 0 to 23 by order of significance, with bit 0 being the LSB. Bit 0 indicates if the LSA is a PLMN significant number or a universal LSA. If the bit is set to 0 the LSA is a PLMN significant number and if it is set to 1 it is a universal LSA.

The LSA ID shall be composed as shown in figure 19.

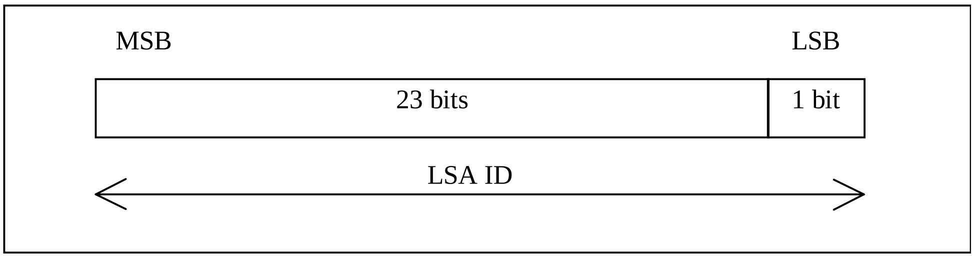

Figure 19: Structure of LSA ID

Annex A (informative): Colour Codes

A.1 Utilization 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 MSs which get the synchronization with this cell. The BSIC is used by the MS for several purposes, all aiming at avoiding ambiguity or interference which can arise when a MS in a given position can receive two cells *using the same BCCH frequency*.

Some of the utilizations of the BSIC relate to cases where the MS is attached to one of the cells. Other utilizations relate to cases where the MS is attached to a third cell, usually somewhere between the two cells in question.

The first category of utilizations 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 MSs on the access bursts. This aims to avoid that one cell decodes correctly access bursts sent to another cell.

The second category of utilizations includes:

- When in connected mode, the MSs 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 MS 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 MS 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 MS identifies a cell (for cell selection purposes) according to the cell identity broadcast on the BCCH and *not* by the BSIC.

A.2 Guidance for planning

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

> *If there exist places where MSs 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.

Recognizing 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 section A.3 of this annex.

This example can be used as basis for bilateral agreements. However, the usage of the NCCs allocated in section 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.

Annex B: Change history

Change history						
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Apr 1999	GSM 03.03	7.0.0				Transferred to 3GPP CN1
CN#03	23.003				3.0.0	Approved at CN#03
CN#04	23.003	3.0.0	001		3.1.0	Definition of escape PLMN code
CN#04	23.003	3.0.0	002r1		3.1.0	SSN reallocation for CAP, gsmSCF, SIWF, GGSN, SGSN,
CN#04	23.003	3.0.0	003		3.1.0	Correction of VGC/VBC reference
CN#04	23.003	3.0.0	004		3.1.0	Harmonisation of the MNC-length; correction of CR A019r1
CN#04	23.003	3.0.0	005		3.1.0	Correction to the MNC length
CN#05	23.003	3.1.3	007r1		3.2.0	ASCII coding of <MNC> and <MCC> in APN OI
CN#05	23.003	3.1.3	008		3.2.0	New SSN allocation for RANAP and RNSAP
CN#06	23.003	3.2.1	011		3.3.0	Support of VLR and HLR Data Restoration procedures with LCS

History

Document history		
V3.0.0	May 1999	Approved at TSGN #3. Under TSG TSG CN Change Control.
V3.1.0	August 1999	Approved by e-mail for TSGN #4.
V3.1.1	August 1999	Becase of editing mistake, the version is changed (no CR)
V3.1.2	September 1999	Some editorial corrections
V3.1.3	September 1999	New version created because of incomplete cR implementation
V3.2.0	October 1999	Vers. 3.2.0 approved by CN#05
V3.2.1	October 1999	V 3.2.1 created because of sections and figures misalignment
V3.3.0	December 1999	V3.3.0 approved by CN#06

Table 10.5.4/TS 24.008: *Mobile Identity* information element

```
+-----------------------------------------------------------+
| Type of identity (octet 3)                                 |
| Bits                                                       |
| 3 2 1                                                      |
| 0 0 1     IMSI                                             |
| 0 1 0     IMEI                                             |
| 0 1 1     IMEISV                                           |
| 1 0 0     TMSI/P-TMSI                                      |
| 0 0 0     No Identity  note 1)                             |
|                                                            |
| All other values are reserved.                             |
|                                                            |
| Odd/even indication (octet 3)                              |
| Bit                                                        |
| 4                                                          |
| 0         even number of identity digits and also when     |
|           the TMSI/P-TMSI is used                          |
| 1         odd number of identity digits                    |
|                                                            |
| Identity digits (octet 3 etc)                              |
| For the IMSI, IMEI and IMEISV this field is coded using BCD  coding.
| For the IMEI and IMEISV this field is coded using          |
| hexadecimal coding.                                        |
| If the number of identity digits is  even                  |
| then  bits  5 to 8 of the last octet shall  be  filled     |
| with an end mark coded as "1111".                          |
|                                                            |
| If the mobile identity is the TMSI/P-TMSI then bits 5      |
| to 8 of octet 3 are coded as "1111" and bit 8 of octet     |
| 4 is the most significant bit and bit 1 of the last        |
| octet the least significant bit. The coding of the         |
| TMSI/P-TMSI is left open for each administration.          |
+-----------------------------------------------------------+
```

NOTE 1: This can be used in the case when a fill paging message without any valid identity has to be sent on the paging subchannel.

3GPP RAN WG2 Meeting #11
Torino,Italy 28th Feb – 03rd March 2000

Document R2-00xxx2
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.331 **CR** **Xxx** Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG RAN#7	for approval	X	strategic	(for SMG
list expected approval meeting # here ↑		For information		non-strategic	Use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Nokia **Date:** 2000-01-15

Subject: Change to IMEI coding from BCD to hexadecimal

Work item: 7.11

Category:				**Release:**		
	F	Correction			Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature	X		Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:

The current IMEI structure is proposed to be changed to use hexadecimal coding instead of current BCD. The change is proposed in 3GPP TSG-CN,TSG-S, TSG-T and TSG-R to allow 16.7 million mobile terminals to be produced with one Type Approval Code. The current restriction for one million units per TAC is already a problem in the GSM terminal manufacturing and can only be predicted to worsen in the future. Change to use hexadecimal coding is most simple since it does not affect to existing message lengths in GSM air interface and network interfaces.
In case of RAN WG2, the change is only required to the Page Message Structure, where the coding is currently defined. The change does not affect to message length since BCD and hexadecimal digit coding consume equal amount of bits. In the TS25.331 the only effect is to not use any 'sanity' check for this information element and allow all binary values for all 15 digits of IMEI. The old IMEI's in GSM system are fully compatible with the changed coding.

Clauses affected: 10.2.1.4

Other specs Affected:				
	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

10.2.1.4 IMEI

This IE contains an International Mobile Equipment Identity.

Information Element/Group name	Presence	Range	IE type and reference	Semantics description
IMEI	M			Setting specified in [TS 23.003]
>IMEI digit		15	INTEGER(0..~~9~~15)	

1 References

[1] 3GPP TS 25.331 v3.1.0 , RRC Protocol Specification, Dec 1999