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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
Numbering, Addressing and Identification
(3GPP TS 23.003 version 5.6.0 Release 5)**

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

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Foreword

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

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

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

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Foreword

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

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.

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

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

1 Scope

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.

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;

k) an identification plan for CN domain, RNC and service area in the UTRAN system.

1.1 References

1.1.1 Normative references

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

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

[1] 3GPP TS 21.905: "3G Vocabulary".

[2] 3GPP TS 23.008: "Organization of subscriber data".

[3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2"

[4] 3GPP TS 23.070: "Routeing of calls to/from Public Data Networks (PDN)".

[5] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".

[6] 3GPP TS 29.060: "GPRS Tunnelling protocol (GPT) across the Gn and Gp interface".

[7] 3GPP TS 43.020: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[8] void

[9] 3GPP TS 51.011: " Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[10] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[11] ITU-T Recommendation E.212: "The international identification plan for mobile terminals and mobile users".

[12] ITU-T Recommendation E.213: "Telephone and ISDN numbering plan for land Mobile Stations in public land mobile networks (PLMN)".

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

[14] RFC 791: "Internet Protocol".

[15] RFC 2373: "IP Version 6 Addressing Architecture".

[16] 3GPP TS 25.401: "UTRAN Overall Description".

[17] 3GPP TS 25.413: "UTRAN Iu Interface RANAP Signalling".

[18] RFC 2181: "Clarifications to the DNS Specification".

[19] RFC 1035: "Domain Names - Implementation and Specification".

[20] RFC 1123: "Requirements for Internet Hosts -- Application and Support".

[21] RFC 2462: "IPv6 Stateless Address Autoconfiguration".

[22] RFC 3041: "Privacy Extensions for Stateless Address Autoconfiguration in IPv6".

[23] 3GPP TS 23.236: "Intra Domain Connection of RAN Nodes to Multiple CN Nodes".

[24] 3GPP TS 23.228: "IP Multimedia (IM) Subsystem – Stage 2"

[25] RFC 2486: "The Network Access Identifier"

[26] RFC 3261: "SIP: Session Initiation Protocol"

[27] 3GPP TS 31.102: "Characteristics of the USIM Application."

[28] void

[29] 3GPP TS 44.118: "Radio Resource Control (RRC) Protocol, Iu Mode".

[30] 3GPP TS 23.073: "Support of Localised Service Area (SoLSA); Stage 2"

[31] 3GPP TS 29.002: "Mobile Application Part (MAP) specification"

[32] 3GPP TS 22.016: "International Mobile Equipment Identities (IMEI)"

[33] 3GPP TS 43.068: "Voice Group Call Service (VGCS); Stage 2"

[34] 3GPP TS 43.069: "Voice Broadcast service (VBS); Stage 2"

[35] 3GPP TS 45.056: "CTS-FP Radio Sub-system"

[36] 3GPP TS 42.009: "Security aspects" [currently not being raised to rel-5 – Pete H. looking into it]

[37] 3GPP TS 25.423: "UTRAN Iur interface RNSAP signalling"

[38] 3GPP TS 25.419: "UTRAN Iu-BC interface: Service Area Broadcast Protocol (SABP)"

[39] 3GPP TS 25.410: "UTRAN Iu Interface: General Aspects and Principles"

[40] ISO/IEC 7812: "Identification cards - Numbering system and registration procedure for issuer identifiers"

[41] 3GPP TS 31.102 "Characteristics of the USIM Application"

[42] 3GPP TS 33.102 "3G security; Security architecture"

[43] 3GPP TS 43.130: "Iur-g interface; Stage 2"

[45] RFC 2806: "URLs for Telephone Calls"

1.1.2 Informative references

[44] "COMPLEMENT TO ITU-T RECOMMENDATION E.212 (11/98)", Annex to ITU Operational Bulletin No. 741 – 1.VI.200; This is published on the ITU-T website, whose home page is at http://www.itu.int/ITU-T/

1.2 Abbreviations

For the purposes of the present document, the abbreviations defined in 3GPP TS 21.905 apply.

1.3 General comments to references

The identification plan for mobile subscribers defined below is that defined in ITU-T Recommendation E.212.

The ISDN numbering plan for MSs and the allocation of mobile station roaming numbers is that defined in ITU-T Recommendation E.213. Only one of the principles for allocating ISDN numbers is proposed for PLMNs. Only the method for allocating MS roaming numbers contained in the main text of ITU-T Recommendation E.213 is recommended for use in PLMNs. If there is any difference between the present document and the ITU-T Recommendations, the former shall prevail.

For terminology, see also ITU-T Recommendations E.164 and X.121.

1.4 Conventions on bit ordering

The following conventions hold for the coding of the different identities appearing in the present document 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/UMTS system.

NOTE: This IMSI is the concept referred to by ITU-T 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.

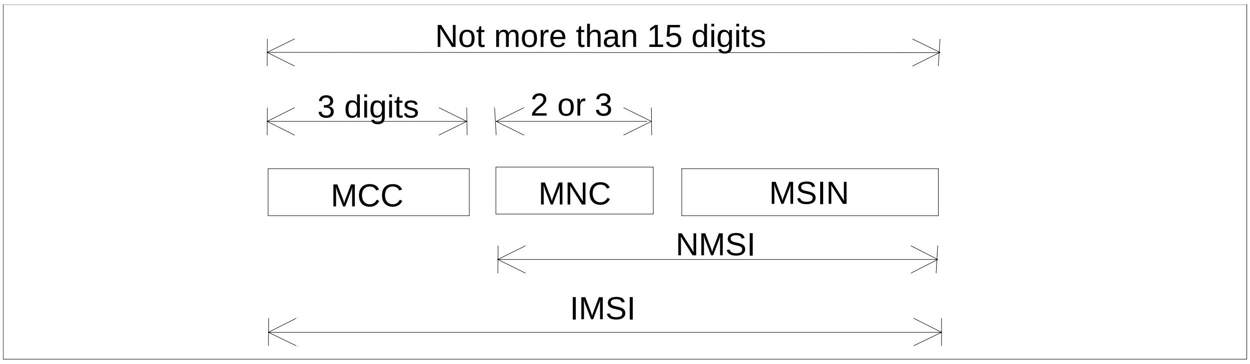

Figure 1: Structure of IMSI

IMSI is composed of three parts:

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

2) Mobile Network Code (MNC) consisting of two or three digits for GSM/UMTS applications. The MNC identifies the home 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.

3) Mobile Subscriber Identification Number (MSIN) identifying the mobile subscriber within a 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 decimal digits (0 through 9) only.

The number of digits in IMSI shall not exceed 15.

The allocation of Mobile Country Codes (MCCs) is administered by the ITU-T. The current allocation is given in the COMPLEMENT TO ITU-T RECOMMENDATION E.212 [44].

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

If more than one PLMN exists in a country, the same Mobile Network Code should not be assigned to more than one PLMN.

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 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.

If intra domain connection of RAN nodes to multiple CN nodes as described in 3GPP TS 23.236 [23] is applied in the MSC/VLR or SGSN, then the NRI shall be part of the TMSI. The NRI has a configurable length of 0 to 10 bits. A configurable length of 0 bits indicates that the NRI is not used and this feature is not applied in the MSC/VLR or SGSN. The NRI shall be coded in bits 14 to 23. The most significant bit of the NRI field is bit 23.

The TMSI shall be allocated only in ciphered form. See also 3GPP TS 43.020 [7] and 3GPP TS 33.102 [42].

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 to indicate 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. The VLR shall not allocate the value zero. The value zero is reserved to indicate that an LMSI parameter sent from the HLR to the VLR shall not be interpreted.

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 an 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 an 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.

Part of the TLLI codespace is re-used in GERAN to allow for the inclusion of the GERAN Radio Network Temporary Identifier in RLC/MAC messages. The G-RNTI is defined in 3GPP TS 44.118 [29].

The structure of the TLLI is summarised in table 1.

Table 1: 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	0	0	G	G	Part of the assigned G-RNTI
0	0	0	1	R	R	Random G-RNTI

'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, 'G' indicates bits derived from the assigned G-RNTI and 'X' indicates bits in reserved ranges.

2.7 Structure of P-TMSI Signature

The P-TMSI Signature consists of 3 octets and may be allocated by the SGSN.

The network shall not allocate a P-TMSI Signature with all 24 bits equal to 1 (this is because the P-TMSI Signature must be stored in the SIM, and the SIM uses 3 octets with all bits equal to 1 to indicate that no valid P-TMSI signature is available.

3 Numbering plan for mobile stations

3.1 General

The structure of the following numbers is defined below:

- the number used by a subscriber of a fixed (or mobile) network to call a mobile station of a PLMN;
- the network addresses used for packet data communication between a mobile station and a fixed (or mobile) station;
- mobile station roaming numbers.

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 at least one 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 PLMN. This implies that ISDN numbers for MSs should comply with the ISDN numbering plan in the home country of the MS.

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 PLMNs.

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

In principle, it should be possible for any subscriber of the CSPDN/PSPDN to call any MS in a 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 or IP v6 address.

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

MS international ISDN numbers are allocated from the ITU-T Recommendation E.164 numbering plan; see also ITU-T Recommendation E.213. The structure of the MS international ISDN number will then be as shown in figure 2.

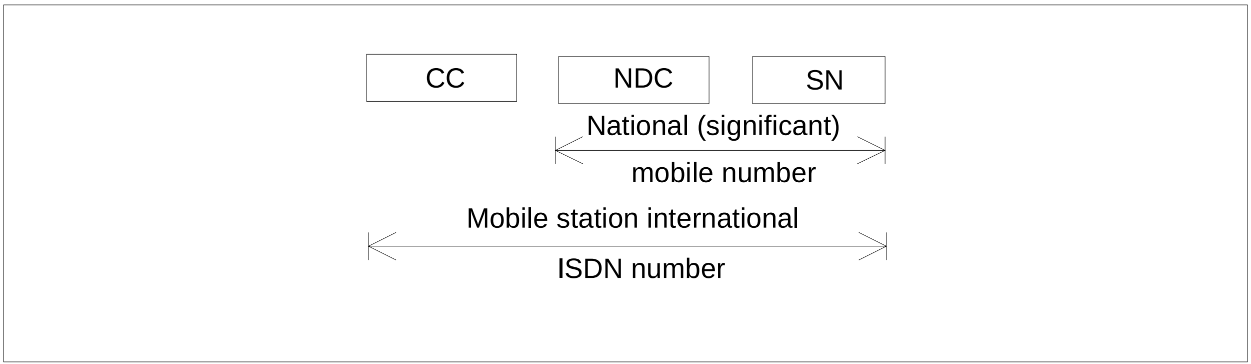

Figure 2: Number Structure of MSISDN

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/UMTS applications, a National Destination Code is allocated to each PLMN. In some countries more than one NDC may be required for each 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 routeing messages to the home location register of the MS. The country code (CC) and the national destination code (NDC) will provide such routeing information. If further routeing 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 ITU-T Recommendations E.164, clause 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 ITU-T Recommendation X.213, annex A). All coding schemes described in ITU-T Recommendation X.213, annex A are supported in GSM and UMTS.

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

The Mobile Station Roaming Number (MSRN) is used to route calls directed to an MS. On request from the Gateway MSC via the HLR it is temporarily allocated to an 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 an MS.

The MSRN is passed by the HLR to the Gateway MSC to route 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 visited PLMN or numbering area;
- a subscriber number with the appropriate structure for that numbering area.

The MSRN shall 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 re-routeing performed by the network, re-routeing or redirection indicators or other signalling means should be used, if available.

3.5 Structure of Mobile Station International Data Number

The structure of MS international data numbers should comply with the data numbering plan of ITU-T Recommendation X.121 as applied in the home country of the mobile subscriber. Implications for numbering interworking functions which may need to be provided by the PLMN (if the use of X.121 numbers is required) are indicated in 3GPP TS 23.070 [4].

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 structure of the handover number is the same as the structure of the MSRN. 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 may be allocated to each PLMN. The IP v4 address structure is defined in RFC 791 [14].

An IP v4 address may be allocated to an MS either permanently or temporarily 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 2373 [15].

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

If the dynamic IPv6 stateless address autoconfiguration procedure is used, then each PDP context, or group of PDP contexts sharing the same IP address, is assigned a unique prefix as defined in 3GPP TS 23.060 [3].

As described in RFC 2462 [21] and RFC 3041 [22], the MS can change its interface identifier without the GPRS network being aware of the change.

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:

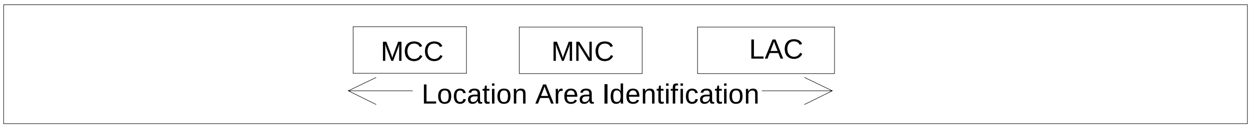

Figure 3: Structure of Location Area Identification

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) is a fixed length code (of 2 octets) identifying a location area within a 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 3GPP TS 24.008 [5], 3GPP TS 31.102 [41] and 3GPP TS 51.011 [9]).

A specific GSM PLMN code (MCC + MNC) may be broadcast for mobile stations which are not compatible with SoLSA and which do not understand the exclusive access indicator (see 3GPP TS 23.073 [30]). 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:

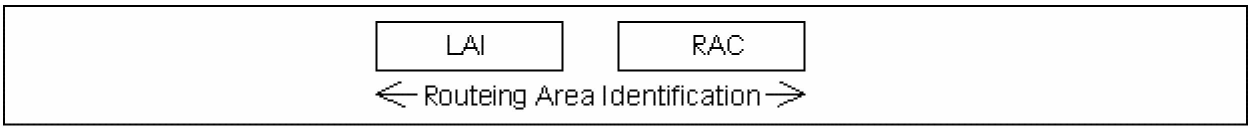

Figure 4: Structure of Routing Area Identification

The RAI is composed of the following elements:

- A valid Location Area Identity (LAI) as defined in clause 4.1. Invalid LAI values are used in some special cases when no valid RAI exists in the mobile station (see 3GPP TS 24.008 [5], 3GPP TS 31.102 [41] and 3GPP TS 51.011 [9]).
- Routeing Area Code (RAC) which is a fixed length code (of 1 octet) identifying a routeing 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 are identified within a location area or routeing area by adding a Cell Identity (CI) to the location area or routeing 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 shall be unique within a location area.

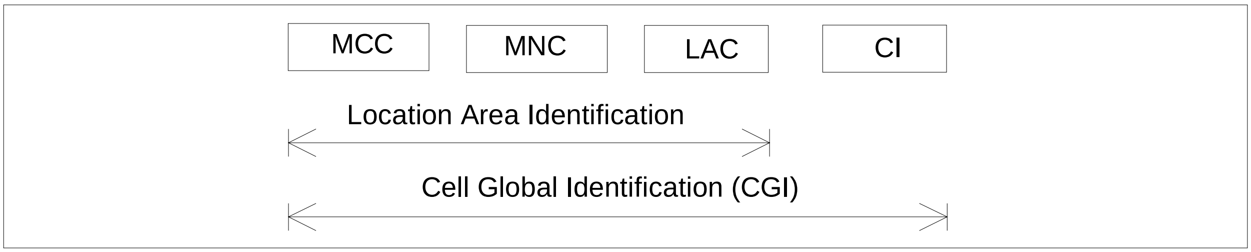

Figure 5: Structure of Cell Global Identification

4.3.2 Base Station Identify Code (BSIC)

The base station identity code is a local colour code that allows an MS to distinguish between different neighbouring base stations. BSIC is a 6 bit code which is structured as shown in Figure 6.

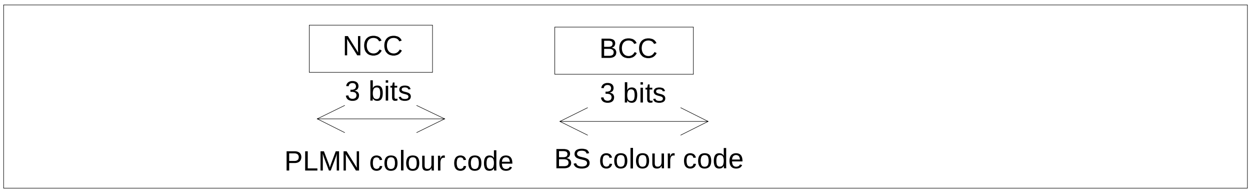

Figure 6: Structure of BSIC

In the definition of the NCC, care should 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 a Regional Subscription Zone Identity (RSZI). A regional subscription zone identity is composed as shown in figure 7.

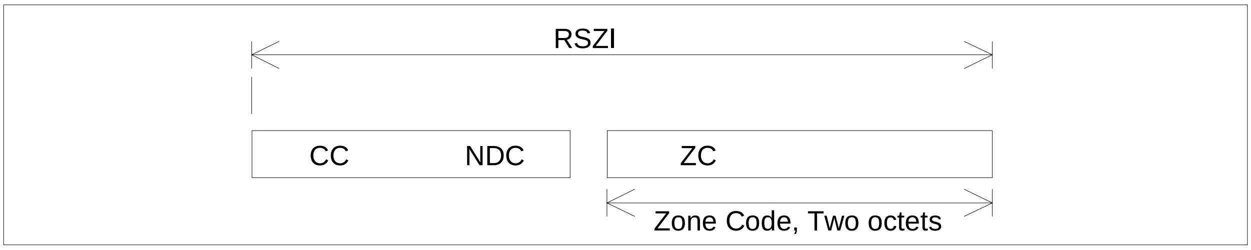

Figure 7: Structure of Regional Subscription Zone Identity (RSZI)

The elements of the regional subscription zone identity are:

1) the Country Code (CC) which identifies the country in which the PLMN is located;

2) the National Destination Code (NDC) which identifies the 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 an ITU-T E.164 VLR or SGSN number (see clause 5.1) of the PLMN; they are coded with a trailing 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 3GPP TS 23.008 [2].

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 3GPP TS 29.002 [31].

4.5 Location Number

A location number is a number which defines a specific location within a PLMN. The location number is formatted according to ITU-T 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 PLMN of which the location is part.

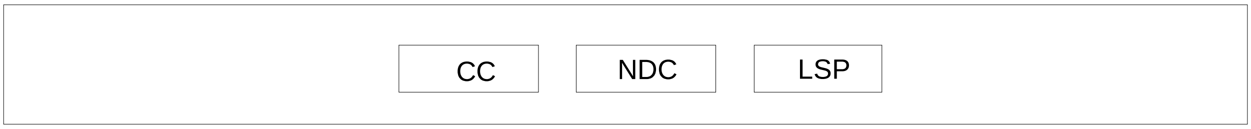

Figure 8: Location Number Structure

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 PLMN shall 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.

4.6 Composition of the Service Area Identification (SAI)

Void (see subclause 12.5).

5 Identification of MSCs, GSNs and location registers

5.1 Identification for routeing purposes

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 PLMN.

Additionally SGSNs and GGSNs 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.

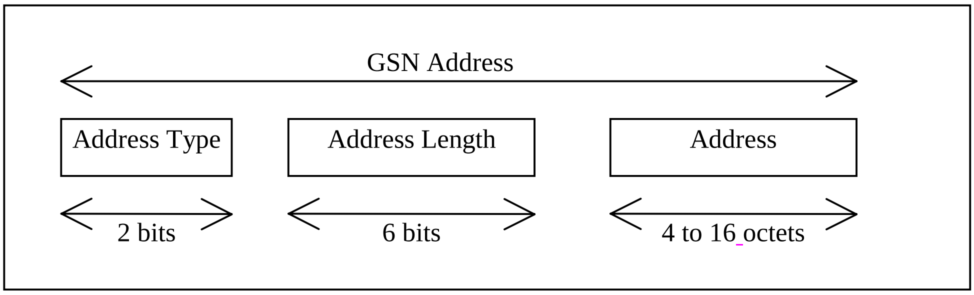

Figure 9: Structure of GSN Address

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) The Address Length, which is a fixed length code (of 6 bits) identifying the length of the Address field.

3) The Address, which is a variable length field which contains 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 [14].

The IP v6 address structure is defined in RFC 2373 [15].

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

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 below.

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.

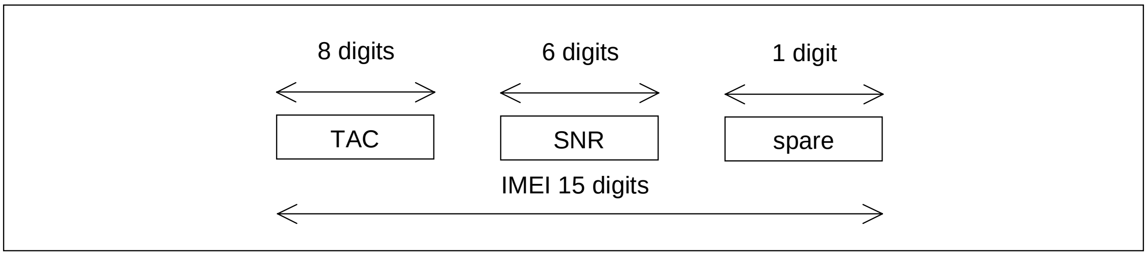

Figure 10: Structure of IMEI

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

- Type Allocation Code (TAC). Its length is 8 digits;
- Serial Number (SNR) is an individual serial number uniquely identifying each equipment within the TAC. Its length is 6 digits;
- Spare digit: this digit shall be zero, when transmitted by the MS.

The IMEI (14 digits) is complemented by a check digit. The check digit is not part of the digits transmitted when the IMEI is checked, as described below. The Check Digit is intended to avoid manual transmission errors, e.g. when customers register stolen MEs at the operator's customer care desk. The Check Digit is defined according to the Luhn formula, as defined in annex B.

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

The security requirements of the IMEI are defined in 3GPP TS 22.016 [32].

6.2.2 Composition of IMEISV

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

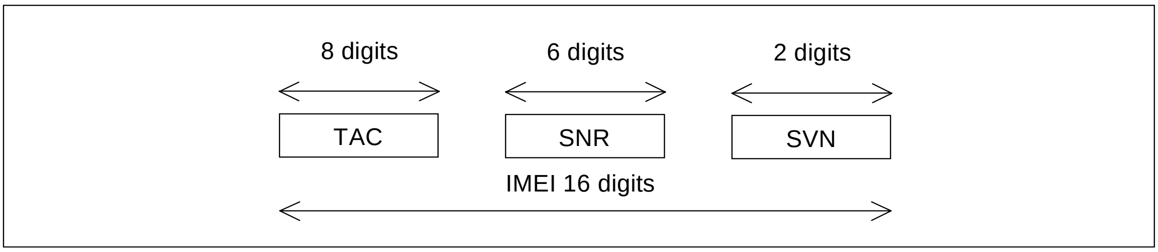

Figure 11: Structure of IMEISV

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

- Type Allocation Code (TAC). Its length is 8 digits;
- Serial Number (SNR) is an individual serial number uniquely identifying each equipment within each TAC. 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 3GPP TS 22.016 [32] apply only to the TAC and SNR, but not to the SVN part of the IMEISV.

6.3 Allocation principles

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

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

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

The Software Version Number is allocated by the manufacturer. 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 identified 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 subclause 7.3.

VGCS or VBS shall also be provided for 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 format of the Group ID is identical for VBS and VGCS.

7.2 Group Call Area Identification

Grouping 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 in subclause 7.3.

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

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 identified 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. Where the routeing of dispatcher originated calls is performed without the involvement of the HLR (see 3GPP TS 43.068 [33] for VGCS and 3GPP TS 43.069 [34] 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.

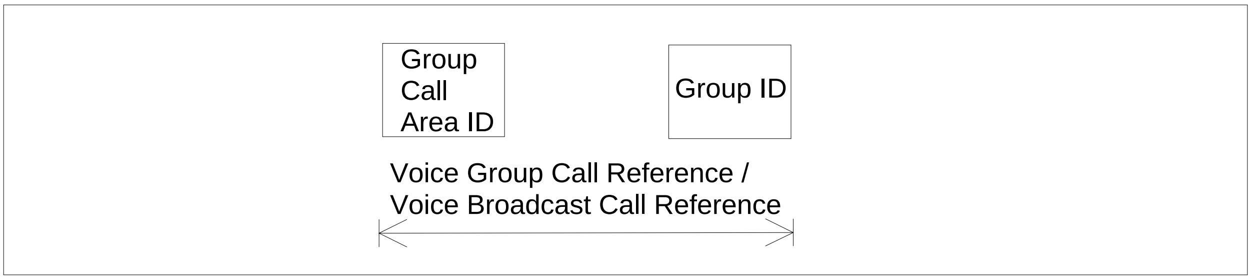

Figure 12: Voice Group Call Reference / Voice Broadcast Call Reference

8 SCCP subsystem numbers

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

8.1 Globally standardized subsystem numbers used for GSM/UMTS

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

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/UMTS

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

1111 1001 PCAP;

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/UMTS networks:

1000 1110 RANAP;

1000 1111 RNSAP;

1001 0001 GMLC (MAP);

1001 0010 CAP;

1001 0011 gsmSCF (MAP) or IM-SSF (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; this defines to which external network the GGSN is connected and optionally a requested service by the MS. This part of the APN is mandatory.
- The APN Operator Identifier; this 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; it has a maximum length of 100 octets.

The syntax of the APN shall follow the Name Syntax defined in RFC 2181 [18], RFC 1035 [19] and RFC 1123 [20]. The APN consists of one or more labels. Each label is coded as a one octet length field followed by that number of octets coded as 8 bit ASCII characters. Following RFC 1035 [19] the labels shall consist only of the alphabetic characters (A-Z and a-z), digits (0-9) and the hyphen (-). Following RFC 1123 [20], the label shall begin and end with either an alphabetic character or a digit. 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 any of the strings "rac", "lac", "sgsn" or "rnc", and it shall not end in ".gprs". Further, it shall not take the value "*".

In order to guarantee uniqueness of APN Network Identifiers within 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 which has officially reserved this name in the Internet domain. Other types of APN Network Identifiers are not guaranteed to be unique within GPRS PLMN(s).

An APN Network Identifier may be used to access a service associated with a GGSN. This may be achieved by defining:

- an APN which corresponds to a DNS name of a GGSN, and which is locally interpreted by the GGSN as a request for a specific service, or
- an APN Network Identifier consisting of 3 or more labels and starting with a Reserved Service Label, or an APN Network Identifier consisting of a Reserved Service Label alone, which indicates a GGSN by the nature of the requested service. Reserved Service Labels and the corresponding services they stand for shall be agreed among operators.

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 subclause 2.2.

This default APN Operator Identifier is used in inter-PLMN roaming situations when attempting to translate an APN consisting only of a Network Identifier into the IP address of the GGSN 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 used in the "mnc<MNC>.mcc<MCC>.gprs" format of the APN OI shall be:

- <MNC> = 3 digits
- <MCC> = 3 digits
- If there are only 2 significant digits in the MNC, one "0" digit is 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 asterisk).

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 an 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 an FPBI which 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 to control access.

10.2 CTS Mobile Subscriber Identities

10.2.1 General

Each CTS-MS has one or more temporary identities which are used for paging and to request access. The structure and allocation principles of the CTS Mobile Subscriber Identities (CTSMSI) are defined below.

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 values 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

The 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 it is 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 to give a 6 digit 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 an 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 3GPP TS 45.056 [35].

The following FPBI Type values 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.

The FPBI Length Indicator shall be set to 19 for a 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: RPN is used to separate a maximum of $2^{\text{RPN length}}$ different cells from each other. This defines a cluster of cells supporting intercell handover. RPN length is submitted to a CTS-MS as a result of a successful attachment.

The FPBI Length Indicator shall be set to (2 + CNN Length) for a 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 required to be unique (i.e. several CTS-FP can have the same FPBI in different areas). Care should be taken to limit CTS-MS registration attempts to a fixed part with the same FPBI as another fixed part.

10.4 International Fixed Part Equipment Identity

10.4.1 General

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

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 3GPP TS 42.009 [36]); 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

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

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 decimal characters (0 to 9) only.

The allocation of Mobile Country Codes (MCCs) is administered by the ITU-T.

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 Operators shall allocate unique Fixed Part Identification Numbers.

11 Identification of Localised Service Area

Cells may be grouped into specific localised service areas. Each localised service area is 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, with bit 0 being the LSB. Bit 0 indicates whether 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; if it is set to 1 it is a universal LSA.

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

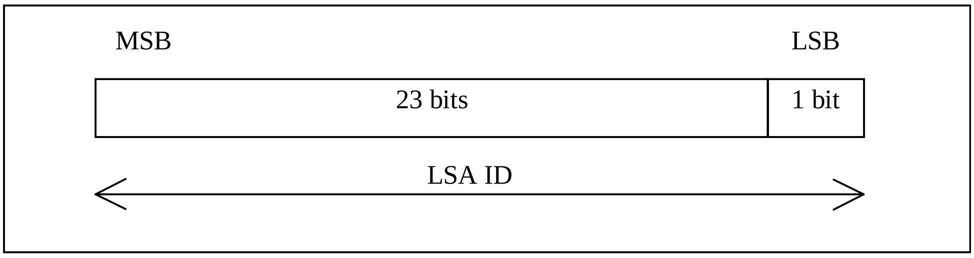

Figure 19: Structure of LSA ID

12 Identification of PLMN, RNC, Service Area, CN domain and Shared Network Area

The following clauses describe identifiers which are used by both the CN and the UTRAN across the Iu interface. For identifiers which are solely used within the UTRAN, see 3GPP TS 25.401 [16].

NOTE: in the following subclauses, the double vertical bar notation || indicates the concatenation operator.

12.1 PLMN Identifier

A Public Land Mobile Network is uniquely identified by its PLMN identifier. PLMN-Id consists of Mobile Country Code (MCC) and Mobile Network Code (MNC).

- **PLMN-Id = MCC || MNC**

The MCC and MNC are predefined within a UTRAN, and set in the RNC via O&M.

12.2 CN Domain Identifier

A CN Domain Edge Node is identified within the UTRAN by its CN Domain Identifier. The CN Domain identifier is used over UTRAN interfaces to identify a particular CN Domain Edge Node for relocation purposes. The CN Domain identifier for Circuit Switching (CS) consists of the PLMN-Id and the LAC, whereas for Packet Switching (PS) it consists of the PLMN-Id, the LAC, and the RAC of the first accessed cell in the target RNS.

The two following CN Domain Identifiers are defined:

- **CN CS Domain-Id = PLMN-Id || LAC**
- **CN PS Domain-Id = PLMN-Id || LAC || RAC**

The LAC and RAC are defined by the operator, and set in the RNC via O&M.

For the syntax description and the use of this identifier in RANAP signalling, see 3GPP TS 25.413 [17].

12.3 CN Identifier

A CN node is uniquely identified within a PLMN by its CN Identifier (CN-Id). The CN-Id together with the PLMN identifier globally identifies the CN node. The CN-Id together with the PLMN-Id is used as the CN node identifier in RANAP signalling over the Iu interface.

Global CN-Id = PLMN-Id || CN-Id

The CN-Id is defined by the operator, and set in the nodes via O&M.

For the syntax description and the use of this identifier in RANAP signalling, see 3GPP TS 25.413 [17].

12.4 RNC Identifier

An RNC node is uniquely identified by its RNC Identifier (RNC-Id). The RNC-Id of an RNC is used in the UTRAN, in a GERAN which is operating in GERAN Iu mode and between them. A BSC which is part of a GERAN operating in Iu mode is uniquely identified by its RNC Identifier (RNC-Id). The RNC-Id of a BSC is used in a GERAN which is operating in GERAN Iu mode, in the UTRAN and between them. RNC-Id together with the PLMN identifier globally identifies the RNC. The RNC-Id on its own or the RNC-Id together with the PLMN-Id is used as the RNC identifier in the UTRAN Iub, Iur and Iu interfaces. The SRNC-Id is the RNC-Id of the SRNC. The C-RNC-Id is the RNC-Id of the controlling RNC. The D-RNC-Id is the RNC Id of the drift RNC.

- **Global RNC-Id = PLMN-Id || RNC-Id**

The RNC-Id is defined by the operator, and set in the RNC via O&M

For the syntax description and the use of this identifier in RANAP signalling, see 3GPP TS 25.413 [17].

For the usage of this identifier on Iur-g, see 3GPP TS 43.130 [43].

12.5 Service Area Identifier

The Service Area Identifier (SAI) is used to identify an area consisting of one or more cells belonging to the same Location Area. Such an area is called a Service Area and can be used for indicating the location of a UE to the CN.

The Service Area Code (SAC) together with the PLMN-Id and the LAC constitute the Service Area Identifier.

- **SAI = PLMN-Id || LAC || SAC**

The SAC is defined by the operator, and set in the RNC via O&M.

For the syntax description and the use of this identifier in RANAP signalling, see 3GPP TS 25.413 [17].
3GPP TS 25.423 [37] and 3GPP TS 25.419 [38] define the use of this identifier in RNSAP and SABP signalling.

A cell may belong to one or two Service Areas. If it belongs to two Service Areas, one is applicable in the Broadcast (BC) domain and the other is applicable in both the CS and PS domains.

The Broadcast (BC) domain requires that its Service Areas each consist of only one cell. This does not limit the use of Service Areas for other domains. Refer to 3GPP TS 25.410 [39] for a definition of the BC domain.

12.6 Shared Network Area Identifier

The Shared Network Area Identifier (SNA-Id) is used to identify an area consisting of one or more Location Areas. Such an area is called a Shared Network Area and can be used to grant access rights to parts of a Shared Network to a UE in connected mode (see 3GPP TS 25.401 [39]).

The Shared Network Area Identifier consists of the PLMN-Id followed by the Shared Network Area Code (SNAC).

- **SNA-Id = PLMN-Id || SNAC**

The SNAC is defined by the operator.

For the syntax description and the use of this identifier in RANAP signalling, see 3GPP TS 25.413 [17].

13 Numbering, addressing and identification within the IP multimedia core network subsystem

13.1 Introduction

This clause describes the format of the parameters needed to access the IP multimedia core network subsystem. For further information on the use of the parameters see 3GPP TS 23.228 [24].

13.2 Home network domain name

The home network domain name shall be in the form of an Internet domain name, e.g. operator.com, as specified in RFC 1035 [19].

If there is no ISIM application, the UE shall derive the home network domain name from the IMSI as described in the following steps:

1. take the first 5 or 6 digits, depending on whether a 2 or 3 digit MNC is used (see 3GPP TS 31.102 [27]) and separate them into MCC and MNC with ".";
2. reverse the order of the MCC and MNC. Append to the result: ".IMSI.3gppnetwork.org"

An example of a home network domain name is:

IMSI in use: 234150999999999;

Where:

MCC = 234;

MNC = 15;

MSIN = 0999999999, which gives

home domain name: 15.234.IMSI.3gppnetwork.org.

13.3 Private user identity

The private user identity shall take the form of an NAI, and shall have the form username@realm as specified in clause 3 of RFC 2486 [25].

NOTE: It is possible for a representation of the IMSI to be contained within the NAI for the private identity.

If there is no ISIM application, the private user identity is not known. In this case, the private user identity is derived from the IMSI.

The following steps show how to build the private user identity out of the IMSI:

1. use the whole string of digits as the username part of the private user identity;
2. convert the leading digits of the IMSI, i.e. MNC and MCC, into a domain name, as described in subclause 13.2.

The result will be a private user identity of the form imsi@mnc.mcc."IMSI.3gppnetwork.org". For example: If the IMSI is 234150999999999 (MCC = 234, MNC = 15), the private user identity then takes the form 234150999999999@15.234.IMSI.3gppnetwork.org

13.4 Public user identity

The public user identity shall take the form of either a SIP URI (see RFC 3261 [26]) or a tel URL (see RFC 2806 [45]). A SIP URI shall take the form "sip:user@domain".

If there is no ISIM application to host the public user identity, a temporary public user identity shall be derived, based on the IMSI. The temporary public user identity shall be of the form "user@domain" and shall therefore be equal to the private user identity. The private user identity is derived as described in subclause 13.2. That is, the private user identity will be appended to the string "sip:"

EXAMPLE: "sip:234150999999999@15.234.IMSI.3gppnetwork.org".

Annex A (informative): Colour Codes

A.1 Utilization of the BSIC

A BSIC is allocated to each cell. A BSIC can take one of 64 values. In each cell the BSIC is broadcast in each burst sent on the SCH, and is then known by all MSs which synchronise with this cell. The BSIC is used by the MS for several purposes, all aiming at avoiding ambiguity or interference which can arise when an MS in a given position can receive signals from two cells *using the same BCCH frequency*.

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

The first category of uses 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 if there is 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 one cell correctly decoding access bursts sent to another cell.

The second category of uses 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 sends to the network the BSIC which it has received on that frequency. This enables the network to discriminate between several cells which happen to use the same BCCH frequency. Poor discrimination might result in faulty handovers.

- The content of the measurement report messages is limited to information for 6 neighbour cells. It is therefore useful to limit the reported cells to those to which handovers are accepted. For this purpose, each cell provides a list of the values of the three most significant bits of the BSICs which are allocated to the cells which are useful to consider for handovers (usually excluding cells in other PLMNs). This information enables the MS to discard information for cells with non-conformant BSICs and not to report 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 uses, the following planning rule can be derived:

If there exist places where MSs can receive signals from two cells, whether in the same PLMN or in different PLMNs, which 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:

1) The PLMNs use different sets of BCCH frequencies (In particular, this is the case if no frequency is common to the two PLMNs. This usually holds for PLMNs in the same country), or

2) The PLMNS use different sets of NCCs, or

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

Recognizing that method 3) is more cumbersome than method 2), and that method 1) is too constraining, it is suggested that overlapping PLMNs which use a common part of the spectrum agree on different NCCs to be used in any overlapping areas. 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 a basis for bilateral agreements. However, the use of the NCCs allocated in clause A.3 is not compulsory. PLMN operators can agree on different BSIC allocation rules in border areas. The use 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 a second operator for each country 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 (normative): IMEI Check Digit computation

B.1 Representation of IMEI

The International Mobile station Equipment Identity and Software Version number (IMEISV), as defined in clause 6, is a 16 digit decimal number composed of three distinct elements:

- an 8 digit Type Allocation Code (TAC);
- a 6 digit Serial Number (SNR); and
- a 2 digit Software Version Number (SVN).

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

TAC	SNR	SVN

Figure A.1: Composition of the IMEISV

The IMEI is complemented by a check digit as defined in clause 3. The Luhn Check Digit (CD) is computed on the 14 most significant digits of the IMEISV, that is on the value obtained by ignoring the SVN digits.

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 ... D7 (with D7 the least significant digit of TAC);
- SNR = D6, D5 ... D1 (with D1 the least significant digit of SNR).

B.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.

Step 2: Add together the individual digits of all the seven numbers obtained in Step 1, and then add this sum to the sum of all the even labelled 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 number which does end in 0.

B.3 Example of computation

IMEI (14 most significant digits):

TAC								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	1	3	8	3

Step 1:

2	6	0	5	3	1	7	9	3	1	1	3	8	3
	x2		x2		x2		x2		x2		x2		x2
	12		10		2		18		2		6		6

Step 2:

2 + 1 + 2 + 0 + 1 + 0 + 3 + 2 + 7 + 1 + 8 + 3 + 2 + 1 + 6 + 8 + 6 = 53

Step 3:

CD = 60 - 53 = 7

Annex C (normative): Naming convention

A naming convention which will make it possible for DNS servers to translate logical names for GSNs and RAs to physical IP addresses is described in this normative annex. The use of logical names is optional, but if the option is used, it shall comply with the naming convention described in this annex.

C.1 Routing Area Identities

A possible way to support inter-PLMN roaming is discussed very briefly in this clause.

When an MS roams between two SGSNs within the same PLMN, the new SGSN finds the address of the old SGSN by the association old RA - old SGSN. Thus, each SGSN knows the address of every other SGSN in the PLMN.

When an MS roams from an SGSN to an SGSN in another PLMN, the new SGSN may not itself have access to the address of the old SGSN. Instead, the SGSN transforms the old RA information to a logical name of the form:

RACxxxx.LACyyyy.MNCzzzz.MCCwwww.GPRS

x and y shall be Hex coded digits; z and w shall be encoded as single digits (in the range 0-9)..

If there are less than 4 significant digits in xxxx, yyyy, zzzz or wwww, one or more "0" digit(s) is/are inserted at the left side to fill the 4 digit coding.

> As an example, the logical name for RAC 123A, LAC 234B, MCC 167 and MNC 92 shall be coded in the DNS as *RAC123A.LAC234B.MNC0092.MCC0167.GPRS.*

The SGSN may then acquire the IP address of the old SGSN from a DNS server, using the logical address. Each PLMN should include at least one DNS server. Note that these DNS servers are GPRS internal entities, unknown outside the GPRS system.

The above implies that at least MCC || MNC || LAC || RAC (= RAI) is sent as RA parameter over the radio when an MS roams to another RA.

If for any reason the new SGSN fails to obtain the address of the old SGSN, the same actions are taken as when the corresponding event occurs within one PLMN.

Introducing the DNS concept in GPRS gives a general possibility to use logical names instead of IP addresses when referring to (e.g.) GSNs, thus providing flexibility in addressing PLMN nodes.

Another way to support seamless inter-PLMN roaming is to store the SGSN IP addresses in the HLR and request them when necessary.

If Intra Domain Connection of RAN Nodes to Multiple CN Nodes (see 3GPP TS 23.236 [23]) is applied then the Network Resource Identifier (NRI) identifies uniquely a given SGSN node out of all the SGSNs serving the same pool area.

If the new SGSN is not able to extract the NRI from the old P-TMSI, it shall retrieve the address of the default SGSN (see 3GPP TS 23.236 [23]) serving the old RA, using the logical name described earlier in this section. The default SGSN in the old RA relays the GTP signalling to the old SGSN identified by the NRI in the old P-TMSI unless the default SGSN itself is the old SGSN.

If the new SGSN is able to extract the NRI from the old P-TMSI, then it shall attempt to derive the address of the old SGSN from the NRI and the old RAI. NRI-to-SGSN assignments may be either configured (by O&M) in the new SGSN, or retrieved from DNS. If DNS is used, it shall be queried using the following logical name, derived from the old RAI and NRI information:

NRIxxxx.RACyyyy.LACzzzz.MNCvvvv.MCCwwww.GPRS x, y and z shall be Hex coded digits, v and w shall be encoded as single digits (in the range 0-9). If there are less than 4 significant digits in xxxx, yyyy, zzzz, vvvv or wwww, one or more "0" digit(s) is/are inserted at the left side to fill the 4 digit coding.

As an example, the logical name for NRI 3A, RAC 123A, LAC 234B, MCC 167 and MNC 92 shall be coded in the DNS as *NRI003A.RAC123A.LAC234B.MNC0092.MCC0167.GPRS*.

If for any reason the new SGSN fails to obtain the address of the old SGSN using this method, then as a fallback method it shall retrieve the address of the default SGSN serving the old RA.

C.2 GPRS Support Nodes

In this clause a naming convention for GSNs is described.

It shall be possible to refer to a GSN by a logical name which shall then be translated into a physical IP address. This clause proposes a GSN naming convention which would make it possible for an internal GPRS DNS server to make the translation.

An example of how a logical name of an SGSN could appear is:

SGSNxxxx.MNCyyyy.MCCzzzz.GPRS

x, y and z shall be Hex coded digits, y and z shall be encoded as single digits (in the range 0-9)..

If there are less than 4 significant digits in xxxx, yyyy, zzzz, one or more "0" digit(s) is/are inserted at the left side to fill the 4 digits coding.

As an example, the logical name for SGSN 1B34, MCC 167 and MNC 92 shall be coded in the DNS as *SGSN1B34. MNC0092.MCC0167.GPRS*.

C.3 Target ID

In this clause a possible way to support SRNS relocation is described.

In UMTS, when an SRNS relocation is executed, a target ID which consists of MCC, MNC and RNC ID is used as routeing information to route to the target RNC via the new SGSN. An old SGSN shall resolve a new SGSN IP address by a target ID to send the Forward Relocation Request message to the new SGSN.

It shall be possible to refer to a target ID by a logical name which shall be translated into an SGSN IP address to take inter-PLMN handover into account. The old SGSN transforms the target ID information to a logical name of the form:

RNCxxxx.MNCyyyy.MCCzzzz.GPRS; x shall be Hex coded digits; y and z shall be encoded as single digits (in the range 0-9). Then, for example a DNS server is used to translate the logical name to an SGSN IP address.

If there are less than 4 significant digits in xxxx, yyyy, zzzz, one or more "0" digit(s) is/are inserted at the left side to fill the 4 digits coding.

As an example, the logical name for RNC 1B34, MCC 167 and MNC 92 shall be coded in the DNS as RNC*1B34. MNC0092.MCC0167.GPRS*.

Annex D (informative): 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	R99	3.1.0	Definition of escape PLMN code
CN#04	23.003	3.0.0	002r1	R99	3.1.0	SSN reallocation for CAP, gsmSCF, SIWF, GGSN, SGSN,
CN#04	23.003	3.0.0	003	R99	3.1.0	Correction of VGC/VBC reference
CN#04	23.003	3.0.0	004	R99	3.1.0	Harmonisation of the MNC-length; correction of CR A019r1
CN#04	23.003	3.0.0	005	R99	3.1.0	Correction to the MNC length
CN#05	23.003	3.1.3	007r1	R99	3.2.0	ASCII coding of <MNC> and <MCC> in APN OI
CN#05	23.003	3.1.3	008	R99	3.2.0	New SSN allocation for RANAP and RNSAP
CN#06	23.003	3.2.1	011	R99	3.3.0	Support of VLR and HLR Data Restoration procedures with LCS
CN#07	23.003	3.3.0	014	R99	3.4.0	Necessity of the function of the calculation of an SGSN IP address from the target ID
CN#07	23.003	3.3.0	016	R99	3.4.0	Definition of Service Area Identification
CN#07	23.003	3.3.0	017r2	R99	3.4.0	Modification of clause 6.2 to enhance IMEI security
CN#07	23.003	3.3.0	018	R99	3.4.0	Coding of a deleted P-TMSI signature
CN#07	23.003	3.4.0	013r2	R99	3.4.1	Introduction of Reserved Service Labels in the APN
CN#08	23.003	3.4.1	019	R99	3.5.0	Missing UTRAN identifiers
CN#08	23.003	3.4.1	021r1	R99	3.5.0	Editorial Modification of clause 6.2.2.
CN#08	23.003	3.4.1	022	R99	3.5.0	IMEI Formats and Encoding
CN#09	23.003	3.5.0	023	R99	3.6.0	Alignment of 23.003 with text from 25.401
CN#10	23.003	3.6.0	024	R99	3.7.0	Moving informative Annex A from 3G TS 29.060 and making it normative.
CN#11	23.003	3.7.0	025	R99	3.8.0	Clarification to Definition of Service Area Identifier
CN#11	23.003	3.7.0	026	R99	3.8.0	Forbidden APN network identifier labels
CN#11	23.003	3.8.0		Rel-4	4.0.0	Updated from R99 to Rel-4 after CN#11
CN#12	23.003	4.0.0	028r1	Rel-4	4.1.0	Remove reference to TS23.022
CN#12	23.003	4.1.0	029r1	Rel-5	5.0.0	New Subsystem Number for the Position Calculation Application Part on the Iupc interface
CN#13	23.003	5.0.0	032	Rel-5	5.1.0	Clarification on APN labels that begin with a digit
CN#13	23.003	5.0.0		Rel-5	5.1.0	Editorial clean up
CN#14	23.003	5.1.0	033	Rel-5	5.2.0	Rules for TMSI partitioning
CN#14	23.003	5.1.0	035	Rel-5	5.2.0	Introduction of Global CN-ID definition
CN#16	23.003	5.2.0	037r1	Rel-5	5.3.0	IuFlex support for determining old SGSN during handover/relocation
CN#16	23.003	5.2.0	038	Rel-5	5.3.0	Allocation of unique prefixes to IPv6 terminals
CN#16	23.003	5.2.0	041r2	Rel-5	5.3.0	Use of a temporary public user identity
CN#16	23.003	5.2.0	044	Rel-5	5.3.0	Restructuring the IMEI to combine the TAC and FAC
CN#16	23.003	5.2.0	045	Rel-5	5.3.0	Use of the TLLI codespace in GERAN Iu mode
CN#17	23.003	5.3.0	048r3	Rel-5	5.4.0	Clarification on the definition of DNS
CN#17	23.003	5.3.0	050r1	Rel-5	5.4.0	Support for Shared Network in connected mode: definition of SNA
CN#17	23.003	5.3.0	053r1	Rel-5	5.4.0	Restructuring the IMEI to combine the TAC and FAC in Annex B
CN#17	23.003	5.3.0	054	Rel-5	5.4.0	SCCP sub-system Number for IM-SSF
CN#18	23.003	5.4.0	055r1	Rel-5	5.5.0	Iur-g Introduction
CN#18	23.003	5.4.0	056r2	Rel-5	5.5.0	Editorial clean-up
CN#18	23.003	5.4.0	057	Rel-5	5.5.0	Correction of the private user identity's form
CN#18	23.003	5.4.0	058	Rel-5	5.5.0	Addition of a reference to the ITU-T RECOMMENDATION E.212 for Mobile Country Codes
CN#18	23.003	5.4.0	059	Rel-5	5.5.0	Correction to the form of public user identity

Change history						
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
CN#18	23.003	5.4.0	062	Rel-5	5.5.0	Fix miss-interworking for LMSI handling (LMSI definition)
CN#18	23.003	5.5.0		Rel-5	5.5.1	Corrupted figures 13 – 18 fixed
CN#20	23.003	5.5.1	065	Rel-5	5.6.0	Correction to Annex C.3 – Target ID

History

Document history		
V5.2.0	December 2001	Publication
V5.3.0	June 2002	Publication
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