3GPP TSG CN Plenary **Tdoc NP-010168**
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Source: **TSG CN WG 1**

Title: **CR to R99 on Work Item GPRS**

Agenda item: **7.13**

Document for: **APPROVAL**

Introduction:

This document contains **1** CR on **R99** Work Item **"GPRS"**, that has been agreed by **TSG CN WG1**, and is forwarded to TSG CN Plenary meeting **#11** for approval.

Tdoc	Title	Spec	CR#	Rev	CAT	Rel	C_Ver
N1-010224	Roaming restrictions for GPRS service	23.122	016	1	F	R99	3.5.0

3GPP TSG-CN1 Meeting #15

Tdoc N1-010224
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15-19 January 2001, Beijing, China

CR-Form-v3

CHANGE REQUEST

⌘ **23.122** **CR** 016 ⌘ rev **1** ⌘ Current version: **3.5.0** ⌘

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

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

Title:	⌘	Roaming restrictions for GPRS service
Source:	⌘	Siemens AG
Work item code:	⌘	GPRS
Date:	⌘	2001-01-15
Category:	⌘	**F**
Release:	⌘	R99

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

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	Experience from the deployment of GPRS in live networks brought out that some existing roaming scenarios and configurations does not work. In the case when operator has only roaming agreement for CS services but not for PS service (GPRS) there is no suitable cause value with which PS attach can be rejected without impact on both the GSM roaming and the GPRS services in other networks. More detail description of the problem can be found from TSG CN Plenary #14 Tdoc NP-000697 and TSG SA Pleanary #10 Tdoc SP-000666.
Summary of change:	⌘	In order to solve the problem it is proposed to introduce a new rejection cause value "GPRS services not allowed in this PLMN"(#14) that could be indicated to the MS during GPRS attach, detach and RAU in a PLMN which does not offer GPRS roaming to that MS. When MS receives this cause code it shall not attempt new GPRS attach before entering a new PLMN on which it hasn't be rejected with the same cause after the last switch on. In order to memorise the PLMNs on which the MS is already rejected with #14, a new PLMN list is introduced, which should be deleted when the MS is switched off. The list is introduced in order to avoid subsequent registration attempts which could occur if either the MS(in class C mode), or the user(in class A/B mode) triggers a PLMN reselection after reception of #14.
Consequences if not approved:	⌘	If no roaming agreement is established for GPRS or the SGSN has no knowledge about the HLR of the roaming subscriber, depending on the SGSN implementation either #11 or #7 will probably send to the MS which disables in minimum the PS until the MS is switched off. The only other possibility would be that the network sends a cause code not listed explicitly, with the consequence that the MS will try to register "forever" (5 re-attempts after each T3302 expiry) which causes a considerable network load and results in a unacceptable behaviour from the users point of view(long term no service and battery

	consumption)

Clauses affected:	⌘	3.1; 3.7; 4.3.4; 4.4.3.1; 4.5; 4.6.2			
Other specs affected:	⌘	☐	Other core specifications	⌘	
		☐	Test specifications		
		☐	O&M Specifications		
Other comments:	⌘				

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

[2] 3GPP TS 22.001: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Principles of circuit telecommunication services supported by a Public Land Mobile Network (PLMN)".

[3] 3GPP TS 22.002: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; Bearer Services (BS) supported by a GSMPublic Land Mobile Network (PLMN)".

[4] 3GPP TS 22.003: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; Circuit Teleservices supported by a Public Land Mobile Network (PLMN)".

[5] 3GPP TS 22.004: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; General on supplementary services".

[6] 3GPP TS 02.06: "Digital cellular telecommunications system (Phase 2+); Types of Mobile Stations (MS)".

[7] 3GPP TS 02.07: "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) features".

[8] 3GPP TS 02.09: "Digital cellular telecommunications system (Phase 2+); Security aspects".

[9] 3GPP TS 22.011: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Service accessibility".

[10] 3GPP TS 22.016: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; International Mobile station Equipment Identities (IMEI)".

[11] 3GPP TS 02.17: "Digital cellular telecommunications system (Phase 2+); Subscriber identity modules Functional characteristics".

[12] 3GPP TS 22.024: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Description of Charge Advice Information (CAI)".

[13] 3GPP TS 22.030: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects;Man-Machine Interface (MMI) of the User Equipment (UE)".

[14] 3GPP TS 02.40: "Digital cellular telecommunications system (Phase 2+); Procedures for call progress indications".

[15] 3GPP TS 22.041: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Operator Determined Barring (ODB)".

[16] 3GPP TS 22.081: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Line identification Supplementary Services;Stage 1".

[17] 3GPP TS 22.082: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects;Call Forwarding (CF) supplementary services - Stage 1".

[18] 3GPP TS 22.083: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; Call Waiting (CW) and Call Holding (HOLD); Supplementary Services - Stage 1".

[19] 3GPP TS 22.084: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; MultiParty (MPTY) Supplementary Services - Stage 1".

[20] 3GPP TS 22.085: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; Closed User Group (CUG) Supplementary Services - Stage 1".

[21] 3GPP TS 22.086: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Advice of Charge (AoC) Supplementary Services - Stage 1".

[22] 3GPP TS 22.088: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; Call Barring (CB) Supplementary Services - Stage 1".

[23] 3GPP TS 24.008: "3rd Generation Partnership Project;Universal Mobile Telecommunications System; Mobile radio interface layer 3 specification, Core Network Protocols - Stage 3".

[24] 3GPP TS 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".

[25] 3GPP TS 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[26] 3GPP TS 22.060: "3rd Generation Partnership Project;Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description, Stage 1".

[27] 3GPP TS 23.060: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description;Stage 2".

[28] 3GPP TS 03.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS Radio Interface; Stage 2".

[29] 3GPP TS 02.56: "Digital cellular telecommunications system (Phase 2+); GSM Cordless Telephony System (CTS); Service Description; Stage 1".

[30] 3GPP TS 03.56: "Digital cellular telecommunications system (Phase 2+); GSM Cordless Telephony System (CTS); CTS Architecture Description; Stage 2".

[31] 3GPP TS 25.101: "3rd Generation Partnership Project (3GPP) Technical Specification Group (TSG) RAN WG4 UE Radio transmission and Reception (FDD)".

[32] 3GPP TS 25.304: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; UE Procedures in Idle Mode".

[33] 3GPP TS 25.331: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; RRC Protocol Specification".

[34] 3GPP TS 04.18:"Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification, Radio Resource Control Protocol".

[35] 3GPP TS 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".

[36] 3GPP TS 21.905: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects Vocabulary for 3GPP Specifications".

[37] 3GPP TS 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

1.2 Definitions and abbreviations

For the purposes of the present document the abbreviations given in 3GPP TS 01.04 and 3GPP TS 21.905 apply.

(A/Gb mode only): Indicates this clause or subclause applies only to GSM system. For multi system case this is determined by the current serving radio access network.

(Iu mode only): Indicates this clause or subclause applies only to UMTS system. For multi system case this is determined by the current serving radio access network.

Acceptable Cell: This is a cell that the MS may camp on to make emergency calls. It must satisfy criteria which is defined for A/Gb mode in 3GPP TS 03.22 and for Iu mode in 3GPP TS 25.304.

Access Technology: The access technology associated with a PLMN. The MS uses this information to determine what type of radio carrier to search for when attempting to select a specific PLMN (e.g., GSM, UMTS or GSM COMPACT). A PLMN may support more than one access technology.

Allowable PLMN: In the case of a MS operating in MS operation mode A or B, ~~T~~this is a PLMN which is not in the list of forbidden PLMNs in the MS.
In the case of a MS operating in MS operation mode C, this is a PLMN which is not in the list of forbidden PLMNs or in the list of "forbidden PLMNs for GPRS service"in the MS

Available PLMN: This is a PLMN where the MS has found a cell that satisfies conditions (ii) and (iv) of subclause 3.2.1 in 3GPP TS 03.22. For Iu mode the criteria is specified in 3GPP TS 25.304.

Camped on a cell: The MS (ME if there is no SIM) has completed the cell selection/reselection process and has chosen a cell from which it plans to receive all available services. Note that the services may be limited, and that the PLMN may not be aware of the existence of the MS (ME) within the chosen cell.

Current serving cell: This is the cell on which the MS is camped.

CTS MS: An MS capable of CTS services is a CTS MS.

GPRS MS: An MS capable of GPRS services is a GPRS MS.

MS operation mode See GSM 03.60[27].

Home PLMN: This is a PLMN where the MCC and MNC of the PLMN identity match the MCC and MNC of the IMSI. Matching criteria are defined in Annex A.

In A/Gb mode,...: Indicates this paragraph applies only to GSM System. For multi system case this is determined by the current serving radio access network.

In Iu mode,...: Indicates this paragraph applies only to UMTS System. For multi system case this is determined by the current serving radio access network.

Localised Service Area (LSA): A localised service area consists of a cell or a number of cells. The cells constituting a LSA may not necessarily provide contiguous coverage.

Location Registration (LR): An MS which is IMSI attached to non-GPRS services only performs location registration by the Location Updating procedure. A GPRS MS which is IMSI attached to GPRS services or to GPRS and non-GPRS services performs location registration by the Routing Area Update procedure only when in a network of network operation mode I. Both procedures are performed independently by the GPRS MS when it is IMSI attached to GPRS and non-GPRS services in a network of network operation mode II or III (see 3GPP TS 23.060).

MS: Mobile Station. This specification makes no distinction between MS and UE.

Network Type: The network type associated with HPLMN or a PLMN on the PLMN selector (see GSM 11.11). The MS uses this information to determine what type of radio carrier to search for when attempting to select a specific PLMN. A PLMN may support more than one network type.

Registered PLMN (RPLMN): This is the PLMN on which certain LR outcomes have occurred (see table 1).

Registration: This is the process of camping on a cell of the PLMN and doing any necessary LRs.

Registration Area: A registration area is an area in which mobile stations may roam without a need to perform location registration. The registration area corresponds to location area (LA) for performing location updating procedure and it corresponds to routing area for performing the routing area update procedure.

The PLMN to which a cell belongs (PLMN identity) is given in the system information transmitted on the BCCH (MCC + MNC part of LAI).

Selected PLMN: This is the PLMN that has been selected according to subclause 3.1, either manually or automatically.

SIM: Subscriber Identity Module (see 3GPP TS 02.17). This specification makes no distinction between SIM and USIM.

SoLSA exclusive access: Cells on which normal camping is allowed only for MS with Localised Service Area (LSA) subscription.

Suitable Cell: This is a cell on which an MS may camp. It must satisfy criteria which is defined for A/Gb mode in 3GPP TS 03.22 and for Iu mode in 3GPP TS 25.304.

Visited PLMN of home country: This is a PLMN, different from the home PLMN, where the MCC part of the PLMN identity is the same as the MCC of the IMSI.

3.1 PLMN selection and roaming

The MS normally operates on its home PLMN (HPLMN). However a visited PLMN (VPLMN) may be selected, e.g., if the MS loses coverage. There are two modes for PLMN selection:

i) Automatic mode - This mode utilizes a list of PLMNs in priority order. The highest priority PLMN which is available and allowable is selected.

ii) Manual mode - Here the MS indicates to the user which PLMNs are available. Only when the user makes a manual selection does the MS try to obtain normal service on the VPLMN.

There are two cases:

- International Roaming - This is where the MS receives service on a PLMN of a different country than that of the HPLMN.

- National Roaming - This is where the MS receives service from a PLMN of the same country as that of the HPLMN, either anywhere or on a regional basis. The MS makes a periodic search for the HPLMN while national roaming.

To prevent repeated attempts to have roaming service on a not allowed LA, when the MS is informed that an LA is forbidden, the LA is added to a list of "forbidden LAs for roaming" which is stored in the MS. This list is deleted when the MS is switched off or when the SIM is removed. Such area restrictions are always valid for complete location areas independent of possible subdivision into GPRS routing areas. The structure of the routing area identifier (3GPP TS 23.003) supports area restriction on LA basis.

If a "PLMN not allowed" message is received by an MS in response to an LR request from a VPLMN, that VPLMN is added to a list of "forbidden PLMNs" in the SIM and thereafter that VPLMN will not be accessed by the MS when in automatic mode. A PLMN is removed from the "forbidden" list if, after a subsequent manual selection of that PLMN, there is a successful LR. This list is retained when the MS is switched off or the SIM is removed. The HPLMN shall not be stored on the list of "forbidden PLMNs".

In A/Gb mode, an ME not supporting SoLSA may consider a cell with the escape PLMN code (see 3GPP TS 23.073) to be a part of a PLMN belonging to the list of "forbidden PLMNs".

Optionally the ME may store in its memory an extension of the forbidden PLMN list. The contents of the extension of the list shall be deleted when the MS is switched off or the SIM is removed.

If a "GPRS services not allowed in this PLMN" message is received by an MS in response to an GPRS attach, GPRS detach or routing area update request from a VPLMN, that VPLMN is added to a list of "forbidden PLMNs for GPRS service" which is stored in the MS and thereafter that VPLMN will not be accessed by the MS for GPRS service when in automatic mode. This list is deleted when the MS is switched off or when the SIM is removed. A PLMN is removed from the list of "forbidden PLMNs for GPRS service" if, after a subsequent manual selection of that PLMN, there is a successful GPRS attach. The maximum number of possible entries in this list is implementation dependant, but must be at least one entry. The HPLMN shall not be stored on the list of "forbidden PLMNs for GPRS service".

4.3.3 List of states for location registration (figure 4)

The states are entered depending on responses to location registration (LR) requests. Independent update states exist for GPRS and for non-GPRS operation in MSs capable of GPRS and non-GPRS services.

L1 Updated - The MS enters this state if an LR request is accepted. The update status is set to "updated". The GPRS and the non-GPRS update state of a MS may enter "updated“ as a result of combined signalling or as a result of individual signalling depending on the capabilities of the network.

L2 Idle, No IMSI - The MS enters this state if an LR request is rejected with cause:

a) IMSI unknown in HLR;

b) illegal ME;

c) illegal MS;

d) GPRS services and non-GPRS services not allowed;

or if there is no SIM. All update states of a MS enter this state regardless whether received by individual or combined signalling for events b) and c). Event a) has no influence on the GPRS update state. Events b), c) and d) results in "Roaming not allowed“ for the GPRS update state.

If a SIM is present, the non-GPRS update status of the SIM is set to "Roaming not allowed".

L3 Roaming not allowed - The MS enters this state if it receives an LU reject message with the cause:

a) PLMN not allowed;

b) Location area not allowed;

c) Roaming not allowed in this location area.

d) GPRS services not allowed in this PLMN

Exept from event d) a~~A~~ll update states of the MS are set to "Roaming not allowed" regardless whether received by individual or combined signalling. Event d) results in "Roaming not allowed" for the GPRS update state only. Event d) has no influence on the non-GPRS update state. The behaviour of the MS in the roaming not allowed state is dependent on the LR reject cause as shown in table 2 in clause 5. Additionally:

- in automatic mode, "PLMN not allowed" and "roaming not allowed in this location area" cause the Automatic Network Selection procedure of subclause 4.4.3.1.1 to be started; it is also caused by ~~"GPRS not allowed“~~"GPRS services not allowed in this PLMN" when received by a GPRS MS operating in MS operation mode C~~capable of GPRS only~~;

- in manual mode, "PLMN not allowed" and "roaming not allowed" cause the Manual Network Selection procedure of subclause 4.4.3.1.2 to be started; it is also caused by ~~"GPRS not allowed“~~ "GPRS services not allowed in this PLMN" when received by a GPRS MS operating in MS operation mode C~~capable of GPRS only~~.

L4 Not updated - The MS enters this state if any LR failure not specified for states L2 or L3 occurs, in which cases the MS is not certain whether or not the network has received and accepted the LR attempt. The non-GPRS update status on the SIM and/or the GPRS update status are set to "not updated" depending on the specific location registration procedure and their outcome.

NOTE This clause does not describe all the cases. For more details refer to 3GPP TS 24.008 [23]

4.4.3.1 At switch-on or recovery from lack of coverage

At switch on, the MS selects the registered PLMN (if it is available) using all access technologies that the MS is capable of and attempts to perform a Location Registration. The MS shall start its search using the access technology type stored in the "RPLMN Last Used Access Technology" data field on the SIM. If the "RPLMN Last Used Access Technology" is not available then an MS capable of GSM access technology shall start its search using GSM access technology.

On recovery from lack of coverage, the MS selects the registered PLMN (if it is available) using all access technologies that the MS is capable of and, if necessary (see subclause 4.5.2) attempts to perform a Location Registration.

EXCEPTION: In A/Gb mode or GSM COMPACT, an MS with voice capability, shall not search for CPBCCH carriers, unless the "RPLMN Last Used Access Technology" field is available in the SIM and indicates GSM COMPACT. In A/Gb mode or GSM COMPACT, an MS not supporting packet services shall not search for CPBCCH carriers.

If successful registration is achieved, the MS indicates the selected PLMN.

If there is no registered PLMN, or if registration is not possible due to the PLMN being unavailable or registration failure, the MS follows one of the following two procedures depending on its operating mode.

EXCEPTION: If registration is not possible on recovery from lack of coverage due to the registered PLMN being unavailable, a MS attached to GPRS services may, optionally, continue looking for the registered PLMN for an implementation dependent time.

NOTE 1: A MS attached to GPRS services should use the above exception only if one or more PDP contexts are currently active.

4.4.3.1.1 Automatic Network Selection Mode Procedure

The MS selects and attempts registration on other PLMNs, if available and allowable, in the following order:

i) HPLMN (if not previously selected);

ii) each PLMN in the "User Controlled PLMN Selector with Access Technology" data field in the SIM (in priority order);

iii) each PLMN in the "Operator Controlled PLMN Selector with Access Technology" data field in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

When following the above procedure the following requirements apply:

a) In A/Gb mode or GSM COMPACT, an MS with voice capability shall ignore PLMNs for which the MS has identified at least one cell that do not offer voice service. (In A/Gb mode, this is indicated by the CELL_BAR_QUALIFY_2 parameter).

b) In A/Gb mode or GSM COMPACT, an MS with voice capability , or an MS not supporting packet services shall not search for CPBCCH carriers.

c) In ii and iii, the MS should limit its search for the PLMN to the access technology or access technologies associated with the PLMN in the appropriate PLMN Selector with Access Technology list (User Controlled or Operator Controlled selector list). An MS using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data fields are not present) shall instead use the "PLMN Selector" data field, for each PLMN in the "PLMN Selector" data field, the MS shall search for all access technologies it is capable of and shall assume GSM access technology as the highest priority radio access technology.

d) In iv and v, the MS shall search for all access technologies it is capable of, before deciding which PLMN to select.

e) In ii, and iii, a packet only MS which supports GSM COMPACT, but using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator

Controlled PLMN Selector with Access Technology" data fields are not present) shall instead use the "PLMN Selector" data field, for each PLMN in the "PLMN Selector" data field, the MS shall search for all access technologies it is capable of and shall assume GSM COMPACT access technology as the lowest priority radio access technology.

f) In i, the MS shall search for all access technologies it is capable of. The MS shall start its search using the access technologies stored in the "HPLMN Selector with Access Technology" data field on the SIM in priority order as defined in section 4.4.3 (i.e. the PLMN/access technology combinations are listed in priority order, if an entry includes more than one access technology then no priority is defined for the preferred access technology and the priority is an implementation issue).

g) In i, an MS using a SIM without access technology information storage (i.e. the "HPLMN Selector with Access Technology" data field is not present) shall search for all access technologies it is capable of and shall assume GSM access technology as the highest priority radio access technology. A packet only MS which supports GSM COMPACT using a SIM without access technology information storage shall also assume GSM COMPACT access technology as the lowest priority radio access technology.

NOTE: Requirements a) and b) apply also to requirement d), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if capable of GSM COMPACT.

NOTE: Requirements a) and b) apply also to requirement f), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if this is the only access technology on the "HPLMN Selector with Access Technology" data field on the SIM. Also PLMNs not offering voice services should be ignored by voice capable GSM mobiles.

NOTE: High quality signal is defined in the appropriate AS specification.

If successful registration is achieved, the MS indicates the selected PLMN.

If registration cannot be achieved because no PLMNs are available and allowable, the MS indicates "no service" to the user, waits until a new PLMN is available and allowable and then repeats the procedure.

If there were one or more PLMNs which were available and allowable, but an LR failure made registration on those PLMNs unsuccessful or an entry in a forbidden LAI list prevented a registration attempt, the MS selects the first such PLMN again and enters a limited service state.

4.4.3.1.2 Manual Network Selection Mode Procedure

The MS indicates whether there are any PLMNs, which are available using all supported access technologies. This includes "Forbidden PLMNs" and PLMNs which only offer services not supported by the MS. An MS which supports GSM COMPACT shall also indicate GSM COMPACT PLMNs (which use PBCCH).

If displayed, PLMNs meeting the criteria above are presented in the following order:

i)- HPLMN;

ii)- PLMNs contained in the " User Controlled PLMN Selector with Access Technology " data field in the SIM (in priority order);

iii)- PLMNs contained in the "Operator Controlled PLMN Selector with Access Technology" data field in the SIM (in priority order);

iv)- other PLMN/access technology combinations with received high quality signal in random order;

v)- other PLMN/access technology combinations in order of decreasing signal quality.

In ii and iii, an MS using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data fields are not present) shall instead present the PLMNs contained in the "PLMN Selector" data field in the SIM (in priority order).

In A/Gb mode or GSM COMPACT, if a PLMN does not support voice services then this shall be indicated to the user.

The user may select his desired PLMN and the MS then initiates registration on this PLMN using the access technology chosen by the user for that PLMN or using the highest priority available access technology for that PLMN, if the

associated access technologies have a priority order. (This may take place at any time during the presentation of PLMNs). For such a registration, the MS shall ignore the contents of the forbidden LAI lists, "forbidden PLMNs for GPRS service" lists and forbidden PLMN lists.

NOTE: It is an MS implementation option whether to indicate access technologies to the user. If the MS does display access technologies, then the access technology used should be the access technology chosen by the user for that PLMN. If the MS does not display access technologies, then the access technology chosen for a particular PLMN should be the highest priority available access technology for that PLMN, if the associated access technologies have a priority order.

If the user does not select a PLMN, the selected PLMN shall be the one that was selected before the PLMN selection procedure started. If no such PLMN was selected or that PLMN is no longer available, then the MS shall attempt to camp on any acceptable cell and enter the limited service state.

NOTE: High quality signal is defined in the appropriate AS specification.

4.5.2 Initiation of Location Registration

An LR request indicating Normal Updating is made when, in idle mode,

- the MS changes cell while being in the update state NOT UPDATED; (for MS capable of GPRS and non-GPRS services when at least one of both update states is NOT UPDATED)
- the MS detects that it has entered a new registration area, i.e., when the received registration area identity differs from the one stored in the MS, and the LAI or the PLMN identity is not contained in a list of forbidden LAIs, "forbidden PLMNs for GPRS service" or forbidden PLMN identities respectively, while being in one of the following update states:
  - UPDATED;
  - NOT UPDATED;
  - ROAMING NOT ALLOWED.
- the Periodic Location Updating Timer expires while being in the non-GPRS update state NOT UPDATED (triggers Location Updating);
- the Periodic Routing Area Update timer expires while being in the GPRS update state NOT UPDATED (triggers Routing Area Update);
- a manual network reselection has been performed, an acceptable cell of the selected PLMN is present, and the MS is not in the UPDATED state on the selected PLMN.

An LR request indicating Periodic Location Updating is made when, in idle mode, the Periodic Location Updating timer expires while being in the non-GPRS update state UPDATED.

An LR request indicating Periodic Routing Area Update is made when the Periodic Routing Area Update timer expires while being in the GPRS update state UPDATED.

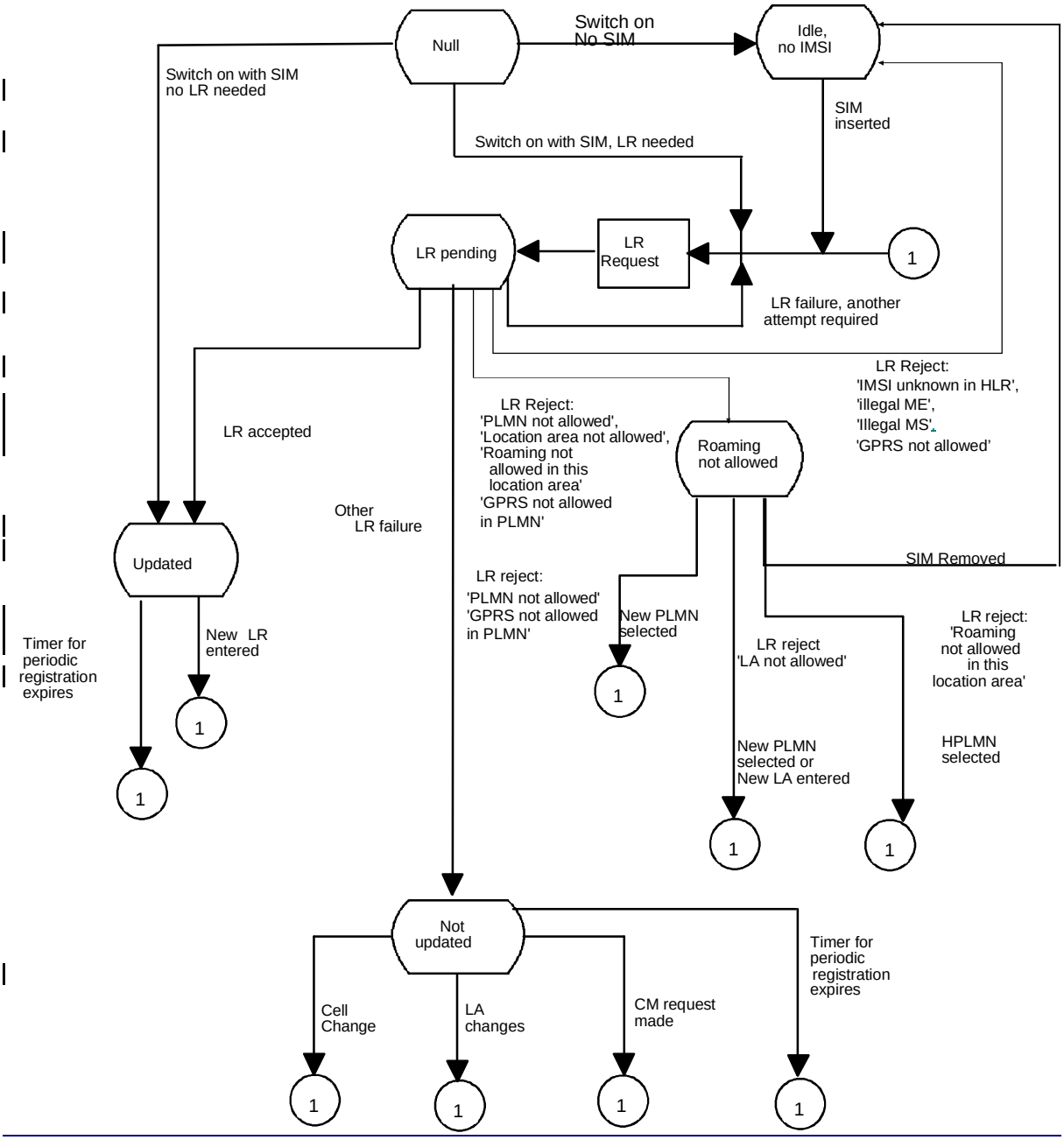
An LR request indicating IMSI attach is made when the MS is activated in the same location area in which it was deactivated while being in the non-GPRS update state UPDATED, and the system information indicates that IMSI attach/detach shall be used.

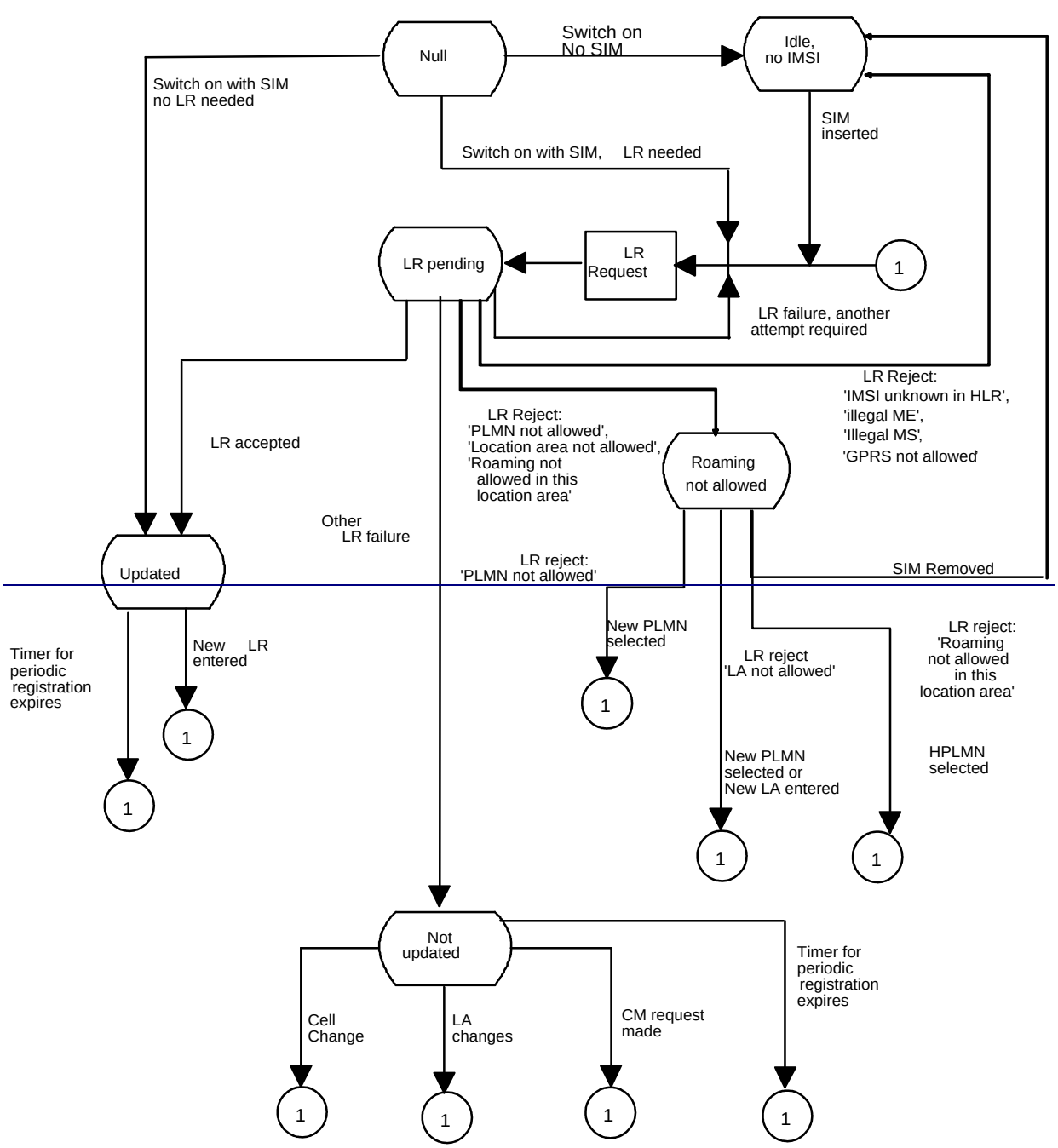
A GPRS attach is made by a GPRS MS when activated and capable of services which require registration. A GPRS attach may only performed if the selected PLMN is not contained in the list of "forbidden PLMNs for GPRS service". Depending on system information about GPRS network operation mode MSs operating in MS operation mode A or B~~capable of GPRS and non-GPRS services~~ perform combined or non-combined location registration procedures. When the combined routing area update or GPRS attach is accepted with indication "MSC not reachable“ or is not answered the MS performs also the corresponding location updating procedure or falls back to a GPRS only MS. When the combined routing area update or GPRS attach is rejected with cause "GPRS not allowed“ the GPRS update state is "IDLE, NO IMSI“ and the MS performs the corresponding location updating procedure ~~or falls back to a GPRS only MS~~.

Furthermore, an LR request indicating Normal Location Updating is also made when the response to an outgoing request shows that the MS is unknown in the VLR or SGSN, respectively.

Table 2 in clause 5 summarizes the events in each state that trigger a new LR request. The actions that may be taken while being in the various states are also outlined in table 2.

A GPRS MS which is both IMSI attached for GPRS and non-GPRS services and which is capable of simultaneous operation of GPRS and non-GPRS services shall perform Routing Area Update in connected mode when it has entered a new routing area which is not part of a LA contained in the list of forbidden LAIs.


Null
Switch on
No SIM
Idle,
no IMSI
Switch on with SIM
no LR needed
SIM
inserted
Switch on with SIM, LR needed
LR pending
LR
Request
1
LR failure, another
attempt required
LR Reject:
'IMSI unknown in HLR',
'illegal ME',
'Illegal MS',
'GPRS not allowed'
LR Reject:
'PLMN not allowed',
'Location area not allowed',
'Roaming not
allowed in this
location area'
'GPRS not allowed
in PLMN'
Roaming
not allowed
LR accepted
Other
LR failure
Updated
SIM Removed
LR reject:
'PLMN not allowed'
'GPRS not allowed
in PLMN'
New PLMN
selected
LR reject:
'Roaming
not allowed
in this
location area'
Timer for
periodic
registration
expires
New LR
entered
LR reject
'LA not allowed'
New PLMN
selected or
New LA entered
HPLMN
selected
Not
updated
Timer for
periodic
registration
expires
Cell
Change
LA
changes
CM request
made



NOTE 1: Whenever the MS goes to connected mode and then returns to idle mode again the MS selects appropriate state.

NOTE 2: A MS capable of GPRS and non-GPRS services has two Task State machines one for GPRS and one for non-GPRS operation.

Figure 3: Location Registration Task State diagram