

CR-Form-v3

## CHANGE REQUEST

⌘ **23.122 CR 022** ⌘ 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  Radio Access Network  Core Network

<b>Title:</b>	⌘ Equivalent handling of PLMNs with different PLMN codes		
<b>Source:</b>	⌘ Motorola, Telia, Vodafone		
<b>Work item code:</b>	⌘ GSM-UMTS INTERWORKING	<b>Date:</b>	⌘ 5 March 2001
<b>Category:</b>	⌘ <b>F</b>	<b>Release:</b>	⌘ R99
	<i>Use one of the following categories:</i> <b>F</b> (essential correction) <b>A</b> (corresponds to a correction in an earlier release) <b>B</b> (Addition of feature), <b>C</b> (Functional modification of feature) <b>D</b> (Editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.		<i>Use one of the following releases:</i> <b>2</b> (GSM Phase 2) <b>R96</b> (Release 1996) <b>R97</b> (Release 1997) <b>R98</b> (Release 1998) <b>R99</b> (Release 1999) <b>REL-4</b> (Release 4) <b>REL-5</b> (Release 5)

<b>Reason for change:</b>	⌘ In the new regulatory and commercial situation with both GSM and UMTS networks, it will be necessary for a mobile station to treat selected PLMNs with different PLMN codes as equivalent to each other at PLMN selection, handover, cell re-selection, etc. This was discussed at the SA adhoc meeting on UE in idle mode in Helsinki February 7-8, 2001. The solution proposed here was agreed in principle together with a mechanism for background scan for preferred PLMNs.
<b>Summary of change:</b>	⌘ A list of equivalent PLMNs will be downloaded to the mobile station with the LOCATION UPDATING ACCEPT, (GPRS) ATTACH ACCEPT and ROUTING AREA UPDATE ACCEPT messages. This list is used in th PLMN selection process.
<b>Consequences if not approved:</b>	⌘ The new regulatory and commercial situation for UMTS will not be supported.

<b>Clauses affected:</b>	⌘ 4.4.3, 4.4.3.1, 4.4.3.3	
<b>Other specs affected:</b>	⌘ <input checked="" type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications	⌘ 22.011, 24.008
<b>Other comments:</b>	⌘ The REL-4 version of the specification is not available.	

### How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: [http://www.3gpp.org/3G\\_Specs/CRs.htm](http://www.3gpp.org/3G_Specs/CRs.htm). Below is a brief summary:

- 1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
- 2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under <ftp://www.3gpp.org/specs/> For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

- 3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

## 4.4 PLMN selection process

### 4.4.1 Introduction

There are two modes for PLMN selection, automatic and manual. These are described in subclauses 4.4.3 below and illustrated in figures 2a to 2b in clause 5.

### 4.4.2 Registration on a PLMN

The MS shall perform registration on the PLMN if the MS is capable of services which require registration. In both automatic and manual modes, the concept of registration on a PLMN is used. An MS successfully registers on a PLMN if:

- a) The MS has found a suitable cell of the PLMN to camp on; and
- b) An LR request from the MS has been accepted in the registration area of the cell on which the MS is camped (see table 1).

### 4.4.3 PLMN selection

The registration on the selected PLMN and the location registration are only necessary if the MS is capable of services which require registration. Otherwise, the PLMN selection procedures are performed without registration.

The “HPLMN Selector with Access Technology”, “User Controlled PLMN Selector with Access Technology” and “Operator Controlled PLMN Selector with Access Technology” data fields in the SIM include associated access technologies for each PLMN entry, see GSM 11.11 [32]. 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.

The Mobile Equipment stores a list of "equivalent PLMNs". This list is replaced or deleted at the end of each location update procedure, routing area update procedure and GPRS attach procedure. The stored list consists of a list of equivalent PLMNs as downloaded by the network plus the PLMN code of the network that downloaded the list. All PLMNs in the stored list are regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover.

The MS shall not use the PLMN codes contained in the “HPLMN Selector with Access Technology” data field.

NOTE: To allow provision for multiple HPLMN codes, the HPLMN access technologies are stored on the SIM together with PLMN codes. This version of the specification does not support multiple HPLMN codes and the “HPLMN Selector with Access Technology” data field is only used by the MS to get the HPLMN access technologies. The HPLMN code is the PLMN code included in the IMSI.

NOTE: Different GSM frequency bands (eg. 900, 1800, 1900, 400) are all considered GSM access technology. An MS supporting more than one band should scan all the bands it's supports when scanning for GSM frequencies. However GSM COMPACT systems which use GSM frequency bands but with the CBPCCH broadcast channel are considered as a separate access technology from GSM.

#### 4.4.3.1 At switch-on or recovery from lack of coverage

At switch on, the MS selects the registered PLMN or equivalent 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 or equivalent 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 CPBCCCH 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 CPBCCCH 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 CPBCCCH 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 and 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.

#### 4.4.3.2 User reselection

At any time the user may request the MS to initiate reselection and registration onto an available PLMN, according to the following procedures, dependent upon the operating mode.

##### 4.4.3.2.1 Automatic Network Selection Mode

The MS selects and attempts registration on PLMNs, if available and allowable, in all of its bands of operation in accordance with 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) excluding the previously selected PLMN;
- iii) PLMNs contained in the "Operator Controlled PLMN Selector with Access Technology" data field in the SIM (in priority order) excluding the previously selected PLMN;
- iv) other PLMN/access technology combinations with the received high quality signal in random order excluding the previously selected PLMN;
- v) other PLMN/access technology combinations, excluding the previously selected PLMN in order of decreasing signal quality or, alternatively, the previously selected PLMN may be chosen ignoring its signal quality;
- vi) The previously selected PLMN.

The previously selected PLMN is the PLMN which the MS has selected prior to the start of the user reselection procedure.

NOTE: If the previously selected PLMN is chosen, and registration has not been attempted on any other PLMNs, then the MS is already registered on the PLMN, and so registration is not necessary.

When following the above procedure the requirements a), b), c), e), f), g) in section 4.4.3.1.1 apply: Requirement d) shall apply as shown below:

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

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

##### 4.4.3.2.2 Manual Network Selection Mode

The Manual Network Selection Mode Procedure of subclause 4.4.3.1.2 is followed.

##### 4.4.3.3 In VPLMN of home country

If the MS is in a VPLMN and the HPLMN is not in the stored list of equivalent PLMNs, the MS shall periodically attempt to obtain service on its HPLMN by scanning in accordance with the requirements that are applicable to i) as defined in the Automatic Network Selection Mode in clause 4.4.3.1.1. For this purpose, a value T minutes may be stored in the SIM, T is either in the range 6 minutes to 8 hours in 6 minute steps or it indicates that no periodic attempts shall be made. If no value is stored in the SIM, a default value of 30 minutes is used.

The attempts to access the HPLMN shall be as specified below:

- a) The periodic attempts shall only be performed in automatic mode when the MS is roaming in its home country;
- b) After switch on, a period of at least 2 minutes and at most T minutes shall elapse before the first attempt is made;

- c) The MS shall make an attempt if the MS is on the VPLMN at time T after the last attempt;
- d) Periodic attempts shall only be performed by the MS while in idle mode;
- e) If the HPLMN is not found, the MS shall remain on the VPLMN.

#### 4.4.3.4 Investigation Scan for higher prioritized PLMN

The support of this procedure is mandatory if the ME supports GSM COMPACT and otherwise optional.

A MS capable of both GSM voice and packet service shall, when indicated in the SIM, investigate if there is service from a higher prioritized PLMN not offering GSM voice service, either HPLMN or a PLMN in a "PLMN Selector with Access Technology " data field on the SIM.

The MS shall scan for PLMNs in accordance with the requirements described for automatic network selection mode in subclause 4.4.3.1.1 that are applicable to i), ii) and iii) with the exception of requirement a) and b) in subclause 4.4.3.1. Requirement a) and b) that are specified for automatic network selection mode in subclause 4.4.3.1 shall be ignored during the investigation scan.

If indicated on the SIM, the investigation scan shall be performed:

- i) After each successful PLMN selection and registration is completed, when the MS is in idle mode. This investigation scan may rely on the information from the already performed PLMN selection and may not necessarily require a rescan
- ii) When the MS is unable to obtain normal service from a PLMN, (limited service state) see subclause 3.5.

The investigation scan is restricted to automatic selection mode and shall only be performed by an MS that is capable of both voice and packet data. It shall only be performed if the selected PLMN is not already the highest prioritized PLMN in the current country. (HPLMN in home country, otherwise according to PLMN selector lists)

The MS shall return to RPLMN after the investigation scan is performed.

If a higher prioritized PLMN not offering GSM voice service is found, this shall be indicated to the user. The MS shall not select the PLMN unless requested by the user.

#### 4.4.4 Abnormal cases

If there is no SIM in the MS, if there is an authentication failure, or if the MS receives an "IMSI unknown in HLR", "illegal ME" or "illegal MS" response to an LR request, then effectively there is no selected PLMN ("No SIM" state). In these cases, the states of the cell selection process are such that no PLMN selection information is used. No further attempts at registration on any PLMN are made until the MS is switched off and on again, or a SIM is inserted.

When in Automatic Network Selection mode and the MS is in the "not updated" state with one or more suitable cells to camp on; then after the maximum allowed unsuccessful LR requests (controlled by the specific attempt counters) the MS may continue (or start if it is not running) the user reselection procedure of 4.4.3.2 1.