**3GPP TSG-CT WG1 Meeting #141eC1-23xxxx**

**Online 17– 21 April 2023 was C1-232085**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **23.122** | **CR** | **1061** | **rev** | **2** | **Current version:** | **18.2.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:***  | Handling of forbidden PLMN lists when MS is in manual mode |
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| ***Source to WG:*** | OPPO |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | TEI18 |  | ***Date:*** | 2023-04-17 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | In the description about when to add a VPLMN to a list of "forbidden PLMNs" or a list of "forbidden PLMNs for GPRS service", there is a statement that the MS is in automatic mode. This leads a reader to think that a VPLMN rejecting the MS for #11 or #7 can only be added to the forbidden PLMN lists in automatic mode and not when MS is in manual mode.We consider that even in manual mode, it is better to add the VPLMN to the FPLMN list if that manually attempted PLMN access has been rejected with #11 or #7.This is because, should the MS be switched back to automatic mode, having that VPLMN listed in the FPLMN will prevent unnecessary access to that VPLMN – which would otherwise reject the MS with #11 or #7.Note: There is no harm to future manaul attempts to that VPLMN as manaul attempts allows the user to choose availble PLMNs even if the VPLMN is in the FPLMN list. Additionally, attempts by the MS for disaster roaming service is unaffected as attempts for disaster roaming ignores entries in the FPLMN list.Extract from TS 23.122, subclause 3.1 …..*A VPLMN is added to a list of "forbidden PLMNs" in the SIM and thereafter that VPLMN will not be accessed except for disaster roaming services, by the MS when in automatic mode if a message with cause value "PLMN not allowed" or "Requested service option not authorized in this PLMN" or "Serving network not authorized" is received by an MS in response to an LR request from that VPLMN and:**………**If a message with cause value "GPRS services not allowed in this PLMN" or "EPS services not allowed in this PLMN" is received by an MS in response to an GPRS attach, routing area update, EPS attach or tracking area update request or received in a network initiated GPRS detach or EPS detach request (see 3GPP TS 24.008 [23] and 3GPP TS 24.301 [23A]) 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 except for disaster roaming services, 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:*Further note: The NW is never aware if a LR access by the MS is by automatic selection or by manaul selection. |
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| ***Summary of change:*** | Clarify that a VPLMN is added to forbidden PLMN lists if a message with specific reject cause value is received by an MS in response to an LR request from that VPLMN, no matter MS is in automatic mode or manual mode.  |
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| ***Consequences if not approved:*** | It is unsure that a VPLMN rejecting an MS with #11 or #7 will get put on the FPLMN list if that MS attempt is by manual mode PLMN selection.Wasted access attempts by MS to a VPLMN that has rejected the MS with #11 or #7 will continue when MS is switched back to automatic mode. |
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| ***Clauses affected:*** | 3.1 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
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| ***This CR's revision history:*** | CR rev 1: In rev 0 of CR (C1-230702) the proposed change has an error. The proposed deletion in rev 0 has inadvertently implied that the VPLMN added to the FPLMN list is locked out for maual network selection. CR rev 1 corrects that mistake. |

**\* \* \* \* First Change \* \* \* \***

## 3.1 PLMN selection and roaming

The MS normally operates on its home PLMN (HPLMN) or equivalent home PLMN (EHPLMN). 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 PLMN/access technology combinations in priority order. The highest priority PLMN/access technology combination 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.

To prevent repeated attempts to have roaming service on a not allowed area (i.e. LA or TA), when the MS is informed that an area is forbidden, the LA or TA is added to a list of "forbidden location areas for roaming" or "forbidden tracking areas for roaming" respectively which is stored in the MS. These lists, if existing, are deleted when the MS is switched off or when the SIM is removed, and periodically (with period in the range 12 to 24 hours). LA area restrictions are always valid for complete location areas independent of possible subdivision into GPRS routing areas. The structure of the routing area identifier (see 3GPP TS 23.003 [22A]) supports area restriction on LA basis.

To prevent repeated attempts to obtain service on a PLMN through satellite NG-RAN or satellite E-UTRAN access technology, when the MS receives an integrity protected reject message with cause value #78 "PLMNs not allowed to operate at the present UE location" from a satellite NG-RAN cell or a satellite E-UTRAN cell, the MS maintains a list of "PLMNs not allowed to operate at the present UE location" in which it stores the PLMN ID of the rejecting PLMN, the current geographical location, if known by the MS. A timer is started when the PLMN ID of the rejecting PLMN is added to the list of "PLMNs not allowed to operate at the present UE location". If the geographical location exists, a MS implementation specific distance value needs to be stored. An entry in the list is deleted if the timer associated to the entry expires or the MS successfully registers to the PLMN stored in the entry. An entry in the list may be deleted if the current UE location is known, a geographical location is stored for the entry of this PLMN, and the distance to the current UE location is larger than a UE implementation specific value. For details see 3GPP TS 24.501 [64] and 3GPP TS 24.301 [23A].

NOTE 1: The list of "PLMNs not allowed to operate at the present UE location" is provided to the AS, see 3GPP TS 38.304 [61].

In automatic PLMN selection mode, if the MS detects a PLMN in satellite NG-RAN access technology which is part of the list of "PLMNs not allowed to operate at the present UE location" the MS shall consider the PLMN as PLMN selection candidate for satellite NG-RAN access technology only if the current MS location is known, a geographical location is stored for the entry of this PLMN, and the distance to the current MS location is larger than a MS implementation specific value.

This does not prevent selection of such a PLMN if it is available in another RAT.

A timer is started when the PLMN ID of the rejecting PLMN is added to the list of "PLMNs not allowed to operate at the present UE location".

In automatic PLMN selection mode, if the MS detects a PLMN in satellite E-UTRAN access technology which is part of the list of "PLMNs not allowed to operate at the present UE location" the MS shall consider the PLMN as PLMN selection candidate for satellite E-UTRAN access technology only if the current MS location is known, a geographical location is stored for the entry of this PLMN, and the distance to the current UE location is larger than a UE implementation specific value.

This does not prevent selection of such a PLMN if it is available in another RAT.

If a message with cause value #15 (see 3GPP TS 24.008 [23], 3GPP TS 24.301 [23A] and 3GPP TS 24.501 [64]) is received by an MS, then the MS shall take the following actions depending on the access technology in which the message was received:

GSM, GSM COMPACT or UTRAN:

 The location area is added to the list of "forbidden location areas for roaming" which is stored in the MS. The MS shall then search for a suitable cell in the same PLMN but belonging to an LA or TA which is not in the "forbidden location areas for roaming" or "forbidden tracking areas for roaming" list respectively.

E-UTRAN:

 The tracking area is added to the list of "forbidden tracking areas for roaming" which is stored in the MS. The MS shall then search for a suitable cell in the same PLMN but belonging to a TA or LA which is not in the "forbidden tracking areas for roaming" or "forbidden location areas for roaming" list respectively

NG-RAN:

 The tracking area is added to the list of "5GS forbidden tracking areas for roaming" which is stored in the MS. The MS shall then search for a suitable cell in the same PLMN but belonging to a tracking area which is not in the "5GS forbidden tracking areas for roaming" list.

In manual or automatic mode, a VPLMN is added to a list of "forbidden PLMNs" in the SIM and thereafter that VPLMN will not be accessed except for disaster roaming services, by the MS when in automatic mode if a message with cause value "PLMN not allowed" or "Requested service option not authorized in this PLMN" or "Serving network not authorized" is received by an MS in response to an LR request from that VPLMN and:

- the MS is configured to use timer T3245 as defined in 3GPP TS 24.008 [23], 3GPP TS 24.301 [23A], and 3GPP TS 24.501 [64];

- the MS is not configured to use timer T3245 and the message is integrity-protected;

- the MS is not configured to use timer T3245, the message is not integrity-protected and the MS does not maintain a list of PLMN-specific attempt counters; or

- the MS is not configured to use timer T3245, the message is not integrity-protected, the MS maintains a list of PLMN-specific attempt counters and the value of the PLMN-specific attempt counter for that VPLMN is equal to the MS implementation specific maximum value as defined in 3GPP TS 24.008 [23], 3GPP TS 24.301 [23A] and 3GPP TS 24.501 [64].

If:

- after a subsequent manual selection of that PLMN, there is a successful LR not for disaster roaming services, then the PLMN is removed from the "forbidden PLMNs" list;

- the MS is configured to use timer T3245 and the timer T3245 expires, then the PLMN is removed from the "forbidden PLMNs" list ; or

- the MS is not configured to use timer T3245 and:

1) the MS maintains a list of PLMN-specific attempt counters, the value of the PLMN-specific attempt counter for that PLMN is greater than zero and less than the MS implementation specific maximum value, and timer T3247 expires, then the PLMN is removed from the "forbidden PLMNs" list stored in memory as defined in 3GPP TS 24.301 [23A] and 3GPP TS 24.501 [64]; or

2) the MS does not maintain a list of PLMN-specific attempt counters, the PLMN is stored in the "forbidden PLMNs" list in the SIM, and the timer T3247 expires, then the PLMN is removed from the "forbidden PLMNs" list in the SIM as defined in 3GPP TS 24.301 [23A].

This list is retained when the MS is switched off or the SIM is removed. The HPLMN (if the EHPLMN list is not present or is empty) or an EHPLMN (if the EHPLMN list is present) 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 PLMNs" list. The contents of the extension of the list shall be deleted when the MS is switched off or the SIM is removed.

A VPLMN may be stored in the extension of the "forbidden PLMNs" list if a message with cause value "PLMN not allowed" or "Requested service option not authorized in this PLMN" or "Serving network not authorized" is received by an MS in response to an LR request from that VPLMN, and the following is valid:

- the MS is not configured to use timer T3245, the message is not integrity-protected, the MS maintains a list of PLMN-specific attempt counters and the value of the PLMN-specific attempt counter for that VPLMN is less than an MS implementation specific maximum value as defined in 3GPP TS 24.008 [23], 3GPP TS 24.301 [23A] and 3GPP TS 24.501 [64].

If a message with cause value "GPRS services not allowed in this PLMN" or "EPS services not allowed in this PLMN" is received by an MS in response to an GPRS attach, routing area update, EPS attach or tracking area update request or received in a network initiated GPRS detach or EPS detach request (see 3GPP TS 24.008 [23] and 3GPP TS 24.301 [23A]) 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 except for disaster roaming services, 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, routing area update, EPS attach, tracking area update or registration procedure (see 3GPP TS 24.501 [64]);

- the MS is configured to use timer T3245 and timer T3245 expires; or

- the MS is not configured to use timer T3245, the MS maintains a list of PLMN-specific PS-attempt counters as specified in 3GPP TS 24.008 [23] and 3GPP TS 24.301 [23A], the value of the PLMN-specific PS-attempt counter for that PLMN has a value greater than zero and less than the MS implementation-specific maximum value as defined in clause 5.3.7b in 3GPP TS 24.301 [23A], and T3247 expires.

The maximum number of possible entries in this list is implementation dependant, but must be at least one entry. The HPLMN (if the EHPLMN list is not present or is empty) or an EHPLMN (if the EHPLMN list is present) shall not be stored on the list of "forbidden PLMNs for GPRS service".

An MS that is attaching for emergency bearer services or for access to RLOS, or is attached for emergency bearer services or for access to RLOS, may access PLMNs in the list of "forbidden PLMNs" or the list of "forbidden PLMNs for GPRS service". The MS shall not remove any entry from the list of "forbidden PLMNs" or the list of "forbidden PLMNs for GPRS service" as a result of such accesses.

An MS that is registered for disaster roaming services, may access PLMNs in the list of "forbidden PLMNs" or the list of "forbidden PLMNs for GPRS service" following the criteria as specified in clause 4.4.3.1.1 and shall not remove any entry from the list of "forbidden PLMNs" or the list of "forbidden PLMNs for GPRS service" as a result of such accesses.

A UE capable of S101 mode maintains a list "forbidden PLMNs for attach in S101 mode"; the properties and handling in NAS signalling is defined in clause 5.3.3 of 3GPP TS 24.301 [23A].

If the MS is in GAN mode and a "Location not allowed" message is received (see 3GPP TS 44.318 [35B]), then the MS may attempt to select another PLMN so that further GAN registrations may again be attempted. The selection of the PLMN either automatically or manually is implementation dependent.

If an MS that has disabled its E-UTRA capability re-enables it when PLMN selection is performed, then the MS of which usage setting is "voice centric":

- should, for duration of timer TD, memorize the PLMNs where E-UTRA capability was disabled as PLMNs where voice service was not possible in E-UTRAN. The number of PLMNs where voice service was not possible in E-UTRAN that the MS can store is implementation specific, but it shall be at least one. The value of timer TD is MS implementation specific, but shall not exceed the maximum possible value of background scanning timer T as specified in clause 4.4.3.3.1.

- in automatic PLMN selection, shall not consider PLMNs where voice service was not possible in E-UTRAN as PLMN selection candidates for E-UTRA access technology, unless no other PLMN is available. This does not prevent selection of such a PLMN if it is available in another RAT; and

- shall delete stored information on PLMNs where voice service was not possible in E-UTRAN when the MS is switched off, the USIM is removed, timer TD expires or MS voice domain configuration changes so that E-UTRA capability disabling is no longer necessary.

The MS may support "E-UTRA Disabling for EMM cause #15" as specified in 3GPP TS 24.301 [23A]. If the MS supports "E-UTRA Disabling for EMM cause #15" and the "E-UTRA Disabling Allowed for EMM cause #15" parameter as specified in 3GPP TS 24.368 [50] or 3GPP TS 31.102 [40] is present and set to enabled:

- the MS shall maintain a list of "PLMNs with E-UTRAN not allowed";

- when the MS disables its E-UTRA capability on a PLMN due to E-UTRAN not allowed, it shall add the PLMN to the "PLMNs with E-UTRAN not allowed" list, and start timer TE if timer TE is not already running;

- the number of PLMNs that the MS can store in the "PLMNs with E-UTRAN not allowed" list is implementation specific, but it shall be at least one;

- the value of timer TE is MS implementation specific, but it shall not exceed the maximum possible value of background scanning timer T (8 hours or 240 hours for MSs supporting EC-GSM-IoT, Category M1 or Category NB1 as defined in 3GPP TS 36.306 [54])) as specified in clause 4.4.3.3.1;

- in automatic PLMN selection the MS shall not consider PLMNs included in the "PLMNs with E-UTRAN not allowed" list as PLMN selection candidates for E-UTRAN access technology, unless no other PLMN is available. This does not prevent selection of such a PLMN if it is available in another RAT; and

- the MS shall delete stored information in the "PLMNs with E-UTRAN not allowed" list when the MS is switched off, the USIM is removed or timer TE expires.

The MS should maintain a list of PLMNs where the N1 mode capability was disabled because IMS voice was not available and the MS's usage setting was "voice centric" as PLMNs where voice service was not possible in N1 mode. When the MS disables its N1 mode capability because IMS voice was not available and the MS's usage setting was "voice centric":

- the MS should add the identity of the PLMN to the list of PLMNs where voice service was not possible in N1 mode and should start timer TF if timer TF is not already running. The number of PLMNs that the MS can store where voice services is not possible is implementation specific, but it shall be at least one. The value of timer TF is MS implementation specific, but shall not exceed the maximum possible value of background scanning timer T as specified in clause 4.4.3.3.1;

- in automatic PLMN selection the MS shall not consider PLMNs where voice service was not possible in N1 mode as PLMN selection candidates for NG-RAN access technology, unless no other PLMN is available. This does not prevent selection of such a PLMN if it is available in another RAT; and

- the MS shall delete stored information on PLMNs where voice service was not possible in N1 mode when the MS is switched off, the USIM is removed, timer TF expires or the MS's usage setting changes so that N1 mode capability disabling is no longer necessary.

The MS should maintain a list of PLMNs where the N1 mode capability was disabled due to receipt of a reject from the network with 5GMM cause #27 "N1 mode not allowed", as PLMNs where N1 mode is not allowed for 3GPP access. When the MS disables its N1 mode capability due to receipt of a reject from the network with 5GMM cause #27 "N1 mode not allowed":

- the MS should add the identity of the PLMN to the list of PLMNs where N1 mode is not allowed for 3GPP access and should start timer TG if timer TG is not already running. The number of PLMNs that the MS can store where N1 mode is not allowed for 3GPP access is implementation specific, but it shall be at least one. The value of timer TG is MS implementation specific, but shall not exceed the maximum possible value of background scanning timer T as specified in clause 4.4.3.3.1;

- in automatic PLMN selection the MS shall not consider PLMNs where N1 mode is not allowed for 3GPP access as PLMN selection candidates for NG-RAN access technology, unless no other PLMN is available. This does not prevent selection of such a PLMN if it is available in another RAT;

- if the MS is not configured to use timer T3245, the MS maintains a list of PLMN-specific N1 mode attempt counters for 3GPP access as specified in 3GPP TS 24.501 [64] and T3247 expires, then the MS removes for each PLMN-specific N1 mode attempt counter for 3GPP access that has a value greater than zero and less than the MS implementation-specific maximum value the respective PLMN from the list of PLMNs where N1 mode is not allowed for 3GPP access, as specified in clause 5.3.20.2 in 3GPP TS 24.501 [64]; and

- the MS shall delete stored information on PLMNs where N1 mode is not allowed for 3GPP access when the MS is switched off, the USIM is removed or timer TG expires.

NOTE 2: The expiry of timer TG does not cause a reset of the PLMN-specific N1 mode attempt counters for 3GPP access (see 3GPP TS 24.501 [64]).

The MS in NB-S1 mode may maintain a list of "PLMNs with NB-IoT not allowed" where the NB-IoT capability was disabled due to receipt of a reject from the network with EMM cause #15 "no suitable cells in tracking area" and an Extended EMM cause IE with value "NB-IoT not allowed", as PLMNs where NB-S1 mode is not allowed. When the MS disables its NB-IoT capability due to receipt of a reject from the network with EMM cause #15 "no suitable cells in tracking area" and an Extended EMM cause IE with value "NB-IoT not allowed":

- the MS may add the identity of the PLMN to the list of "PLMNs with NB-IoT not allowed" and start timer TH if timer TH is not already running. The number of PLMNs that the MS can store in the "PLMNs with NB-IoT not allowed" list is implementation specific, but it shall be at least one. The value of timer TH is MS implementation specific, but shall not exceed the maximum possible value of background scanning timer T as specified in clause 4.4.3.3.1;

- in automatic PLMN selection the MS shall not consider PLMNs included in the "PLMNs with NB-IoT not allowed" list as PLMN selection candidates for NB-IoT access technology, unless no other PLMN is available. This does not prevent selection of such a PLMN if it is available in another RAT; and

- the MS shall delete stored information in the "PLMNs with NB-IoT not allowed" list when the MS is switched off, the USIM is removed or timer TH expires.

**\* \* \* \* End of Changes \* \* \* \***