**3GPP TSG-CT WG1 Meeting #130-eC1-21xxxx**

**Electronic meeting, 20–28 May 2021 Revision of C1-213095**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **23.122** | **CR** |  | **rev** | **1** | **Current version:** | **17.2.0** |  |
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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:***  | The handling of wildcard CAG ID-solution#1 |
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| ***Source to WG:*** | China Mobile, China Unicom, Huawei, HiSilicon, ZTE, vivo, MediaTek Inc |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | 5GProtoc17 |  | ***Date:*** | 2021-04-28 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | In CT1#127e meeting, two editor’s notes were added for the operator’s PNI-NPN deployment demand raised in CT1 meetings in 2020:Editor's note (WI 5GProtoc17, CR#0611): It is FFS whether and how to enable the operators to configure the USIM so that the entry for HPLMN of the "CAG information list" stored in the USIM can contain an optional wild card CAG ID in the allowed CAG list or an optional PLMN selected range of allowed CAG IDs.Editor's note (WI 5GProtoc17, CR#0611): It is FFS whether and how to enable a wild card CAG ID or a PLMN selected range of the allowed CAG IDs to match the available CAG IDs of the HPLMN and how the NAS and the AS interact.In CT1#128e meeting, the wildcard CAG-ID was re-discussed in the discussion paper C1-210701 as a proposed solution.This CR is a suggested implementation of C1-210701.This CR is related to C1-213093, C1-213094, C1-213096 and C4-213160. |
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| ***Summary of change:*** | Add the requirement of wildcard CAG-ID to the automatic network selection mode: To consider wildcard CAG ID in the USIM to access CAG cells of HPLMN or EHPLMN and get its "CAG information list". |
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| ***Consequences if not approved:*** | 1. The demand from NPN customers cannot be met.
2. The demand from operators of decoupling USIM management and NPN design for practicality cannot be met.
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| ***Clauses affected:*** | 3.8, 4.4.3.1.1 |
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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 ...  |
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| ***Other comments:*** |  |
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| ***This CR's revision history:*** | 1. Add the description of the wildcard CAG-ID in text instead of in NOTE in subclause 3.8.
2. Update the description in subclause 4.4.3.1.1.
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## 3.8 CAG selection (N1 mode only)

The MS may support CAG.

If the MS supports CAG, the MS can be provisioned by the network with a "CAG information list", consisting of zero or more entries, each containing:

a) a PLMN ID;

b) an "Allowed CAG list". The "Allowed CAG list" contains zero or more CAG-IDs; and

c) an optional "indication that the MS is only allowed to access 5GS via CAG cells".

The "CAG information list" provisioned by the network is stored in the non-volatile memory of the ME, as specified in 3GPP TS 24.501 [64] annex C.

NOTE 1: When the MS is registering or registered to a PLMN other than the HPLMN or EHPLMN, then the HPLMN will send a "CAG information list" consisting of CAG subscription information related to the serving PLMN only. When the MS is registering or registered to the HPLMN or EHPLMN then the HPLMN or EHPLMN can send CAG subscription information related to any PLMN in the "CAG information list".

In addition, the MS can also be pre-configured with a "CAG information list" stored in the USIM (see 3GPP TS 31.102 [40]). A "CAG information list" stored in the USIM either has the same structure as the "CAG information list" provisioned by the network, or consists of an entry, containing:

a) a PLMN ID of the HPLMN or EHPLMN;

b) an "Allowed CAG list". The "Allowed CAG list" only contains a wildcard CAG-ID; and

c) an "indication that the MS is only allowed to access 5GS via CAG cells".

A wildcard CAG-ID is the prefix of a CAG-ID, representing a collection of CAG-ID that share the same prefix.

Editor's note (WI 5GProtoc17, CR#0611): "CAG information list" stored in the USIM is to be specified by CT6.

3GPP TS 24.501 [64] annex C specifies condition under which the "CAG information list" stored in the ME is deleted. Additionally, when a USIM is inserted, if:

- no "CAG information list" is stored in the non-volatile memory of the ME; or

- the SUPI from the USIM does not match the SUPI stored together with the "CAG information list" in the non-volatile memory of the ME;

and the MS has a "CAG information list" stored in the USIM (see 3GPP TS 31.102 [22]), the MS shall store the "CAG information list" from the USIM into the ME, as specified in 3GPP TS 24.501 [64] annex C.

NOTE 2: The MS ignores the "CAG information list" stored in the USIM except when the USIM is inserted.

If the MS supports CAG and a PLMN is selected as described in subclause 4.4.3.1.1, the automatic CAG selection is performed as part of subclause 4.4.3.1.1.

If the MS supports CAG and a PLMN is selected as described in subclause 4.4.3.1.2, the manual CAG selection is performed as part of subclause 4.4.3.1.2.

The NAS shall provide the AS with a "CAG information list", if available. If the contents of the "CAG information list" have changed, the NAS shall provide an updated "CAG information list" to the AS.

The "indication that the MS is only allowed to access 5GS via CAG cells" is not applicable in EPS.

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4.4.3.1.1 Automatic Network Selection Mode Procedure

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order) or stored in the ME (in priority order);

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

NOTE 1: High quality signal is defined in the appropriate AS specification.

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

When following the above procedure the following requirements apply:

a) An MS with voice capability shall ignore PLMNs for which the MS has identified at least one GSM COMPACT.

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 files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, the MS shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent.

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 files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, 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. No priority is defined for the preferred access technology and the priority is an implementation issue, but "HPLMN Selector with Access Technology" data file on the SIM may be used to optimise the procedure.

g) In i, an MS using a SIM without access technology information storage (i.e. the "HPLMN Selector with Access Technology" data file is not present) shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent. 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 2: For f) and g), the MS in automatic network selection mode can end the PLMN search procedure once the HPLMN or the highest priority EHPLMN is found on an access technology.

NOTE 3: For i, ii and iii, the MS can use location information to determine which PLMNs can be available in its present location.

h) In v, the MS shall order the PLMN/access technology combinations in order of decreasing signal quality within each access technology. The order between PLMN/access technology combinations with different access technologies is an MS implementation issue.

NOTE 4: 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 5: 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 file on the SIM.

i) In i to v, the MS shall not consider PLMNs where voice service was not possible as PLMN selection candidate, unless such PLMN is available in GERAN or UTRAN or no other allowed PLMN is available.

j) In i to v, if the MS only supports EMM-REGISTERED without PDN connection (see 3GPP TS 24.301 [23A]), the MS shall not consider PLMNs which do not advertise support of EMM-REGISTERED without PDN connection.

k) In i to v, if the MS only supports control plane CIoT EPS optimization (see 3GPP TS 24.301 [23A]) and the MS camps on a E-UTRA cell which is not NB-IoT cell (see 3GPP TS 36.304 [43], 3GPP TS 36.331 [42]), the MS shall not consider PLMNs which do not advertise support of EPS services with control plane CIoT EPS optimization.

l) In i to v, if the MS is in eCall only mode, the MS shall not consider PLMNs which do not advertise support for eCall over IMS, unless such PLMNs are available in GERAN or UTRAN.

NOTE 6: As an implementation option, an MS in eCall only mode that was not able to select any PLMN according to l) can perform a second iteration of i to v with no restriction.

m) In i to v, if the MS supports CAG and:

1) is provisioned with a non-empty "CAG information list", the MS shall consider a PLMN indicated by an NG-RAN cell only if:

A) the cell is a CAG cell and broadcasts a CAG-ID for the PLMN such that there exists an entry with the PLMN ID of the PLMN in the "CAG information list" and the CAG-ID is included in the "Allowed CAG list" of the entry;

Aa) the cell is a CAG cell and broadcasts a CAG-ID for the HPLMN or EHPLMN such that there exists an entry with the PLMN ID of the HPLMN or EHPLMN in the "CAG information list", and the CAG-ID matches the wildcard CAG-ID included in the "Allowed CAG list" of the entry; or

Editor's note (WI 5GProtoc17, CR#0714): The format of the wildcard CAG-ID is to be defined by CT4.

Editor's note (WI 5GProtoc17, CR#0714): The handling of the wildcard CAG-ID by the AS is to be specified in 3GPP TS 38.304 [61].

B) the cell is not a CAG cell and:

- there is no entry with the PLMN ID of the PLMN in the "CAG information list"; or

- there exists an entry with the PLMN ID of the PLMN in the "CAG information list" but the "indication that the MS is only allowed to access 5GS via CAG cells" is not included in the entry; or

2) is provisioned with an empty "CAG information list" or is not provisioned with a "CAG information list", the MS shall consider a PLMN indicated by an NG-RAN cell only if the cell is not a CAG cell.

n) In i to v, if the MS only supports control plane CIoT 5GS optimization (see 3GPP TS 23.501 [62]) and the MS camps on an E-UTRA cell connected to 5GCN, which is not NB-IoT cell (see 3GPP TS 36.304 [43], 3GPP TS 36.331 [42]), the MS shall not consider PLMNs which do not advertise support of 5GS services with control plane CIoT 5GS optimization.

o) In i to v, if the MS supports CIoT 5GS optimizations, the MS shall not consider the PLMN/access technology combinations for which the MS preferred CIoT network behaviour is not advertised as supported by the PLMN/access technology combination (see 3GPP TS 24.501 [64]).

NOTE 7: As an implementation option, the MS supporting CIoT 5GS optimizations that was not able to select any PLMN according to o) can perform a second iteration of i to v with no restriction.

p) In iii, the MS shall use the PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" stored in the ME, if the last received steering of roaming information contains the "list of preferred PLMN/access technology combinations"(see annex C) and is stored in the ME. Otherwise, the MS shall use the "Operator Controlled PLMN Selector with Access Technology" list retrieved from the SIM.

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

If registration cannot be achieved because no PLMNs are available and allowable, and the MS does not support access to RLOS, 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 any of the lists "forbidden location areas for roaming", "forbidden tracking areas for roaming", "5GS forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service", "5GS forbidden tracking areas for regional provision of service", or "CAG information list" prevented a registration attempt, the MS selects the first such PLMN again and enters a limited service state.

If:

- the MS supports access to RLOS;

- either the UICC containing the USIM is not present in the MS, or the UICC containing the USIM is present in the MS and the MCC part of the IMSI in the USIM is present in the RLOS allowed MCC list configured in the USIM (see 3GPP TS 31.102 [40]) or in the ME (see 3GPP TS 24.368 [50]);

- one or more PLMNs offering access to RLOS has been found;

- registration cannot be achieved on any PLMN; and

- the MS is in limited service state,

the MS shall select a PLMN offering access to RLOS as follows:

a) if at least one preferred PLMN exists based on the RLOS preferred PLMN list configured in the USIM (see 3GPP TS 31.102 [40]) or in the ME (see 3GPP TS 24.368 [50]) and the MCC part of the preferred PLMN ID is present in the RLOS allowed MCC list configured in the USIM (see 3GPP TS 31.102 [40]) or in the ME (see 3GPP TS 24.368 [50]), the MS shall select the preferred PLMN offering access to RLOS and indicate the selected preferred PLMN for access to RLOS; and

b) if none of the preferred PLMNs for access to RLOS is available, the MS shall evaluate the remaining PLMNs offering access to RLOS that are not in the RLOS preferred PLMN list. If the MCC part of a PLMN ID is present in the RLOS allowed MCC list configured in the USIM (see 3GPP TS 31.102 [40]) or in the ME (see 3GPP TS 24.368 [50]), the MS shall select this PLMN and indicate the selected PLMN for access to RLOS.

If registration cannot be achieved because no PLMNs are available and allowable, and if no PLMN offering access to RLOS has been found, or none of the PLMNs offering access to RLOS is allowed to be accessed according to the RLOS allowed MCC list configured in the USIM (see 3GPP TS 31.102 [40]) or in the ME (see 3GPP TS 24.368 [50]), or the MS does not support access to RLOS, the MS indicates "no service" to the user, waits until a new PLMN is available and then repeats the procedure.

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