**3GPP TSG-CT WG1 Meeting #131-eC1-21xxxx was C1-214472**

**E-meeting, 19-27 August 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **23.122** | **CR** | **0750** | **rev** | **1** | **Current version:** | **16.10.0** |  |
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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 | **X** |

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|  |
| ***Title:***  | Miscellaneous changes on PLMN selection triggered by V2X communication in 5G |
|  |  |
| ***Source to WG:*** | CATT |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | eV2XARC |  | ***Date:*** | 2021-07-12 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *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)* |
|  |  |
| ***Reason for change:*** | 1. TS 24.588 is the reference that specifies the radio resources provided to the MS rather than TS 24.587.
2. A reference to V2X in 5G is missing.
3. PLMN selection triggered by V2X communication over PC5 is not refered.
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| ***Summary of change:*** | 1. Change TS 24.587 into TS 24.588 when referring to the reference that specifies the radio resources provided to the MS.
2. Add the reference to TS 24.587 which specifies the V2X communication over PC5 in 5G.
3. The suclause that specifies the PLMN selection triggereed by V2X communication over PC5 is refered.

**Backward compatibility analysis:**The paper is backward compatible as the main changes only refer to the correction of references.  |
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| ***Consequences if not approved:*** | Missing the information on the reference to V2X communication ove PC5 in 5G.  |
|  |  |
| ***Clauses affected:*** | 1.1, 3.1C, 3.5, 4.4.3.1.3.3 |
|  |  |
|  | **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:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\*\*\*\*\* change1 \*\*\*\*\*

## 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] Void.

[2] Void.

[3] Void.

[4] Void.

[5] Void.

[6] Void.

[7] Void

[8] Void.

[9] 3GPP TS 22.011: "Service accessibility".

[10] Void.

[11] Void.

[12] Void.

[13] Void.

[14] Void.

[15] Void.

[16] Void.

[17] Void.

[18] Void.

[19] Void.

[20] Void.

[21] Void.

[22] Void.

[22A] 3GPP TS 23.003: "Numbering, addressing and identification".

[23] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification, Core Network Protocols - Stage 3".

[23A] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[24] 3GPP TS 45.002: "Multiplexing and multiple access on the radio path".

[25] 3GPP TS 45.008: "Radio subsystem link control".

[26] Void.

[27] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[27A] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[28] Void.

[29] Void.

[30] Void.

[31] Void.

[32] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode".

[33] 3GPP TS 25.331: "RRC Protocol Specification".

[34] 3GPP TS 44.018:"Mobile radio interface layer 3 specification, Radio Resource Control Protocol".

[35] 3GPP TS 43.022: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

[35A] 3GPP TS 43.318: "Generic Access Network (GAN); Stage 2".

[35B] 3GPP TS 44.318: "Generic Access Network (GAN); Mobile GAN interface layer 3 specification; Stage 3".

[36] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[37] Void.

[38] 3GPP TS 21.111: "USIM and IC card requirements".

[39] 3GPP TS 44.060: "General Packet Radio Service (GPRS);Mobile Station (MS) - Base Station System (BSS) interface;Radio Link Control/Medium Access Control (RLC/MAC) protocol".

[40] 3GPP TS 31.102: "Characteristics of the USIM Application".

[41] 3GPP TS 31.111: "Universal Subscriber Identity Module (USIM), Application Toolkit (USAT)".

[42] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA) Radio Resource Control (RRC); Protocol specification".

[43] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".

[44] 3GPP2 C.S0016-D v1.0: "Over-the-Air Service Provisioning of Mobile Stations in Spread Spectrum Standards".

[45] 3GPP2 C.S0011-C v2.0: "Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations".

[46] 3GPP2 C.S0033-A v2.0: "Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Terminal".

[47] 3GPP TS 24.285: "Allowed Closed Subscriber Group (CSG) List Management Object (MO)".

[48] Void.

[49] 3GPP TS 22.220: "Service requirements for Home Node B (HNB) and Home eNode B (HeNB)".

[50] 3GPP TS 24.368: "Non-Access Stratum (NAS) configuration Management Object (MO)".

[51] 3GPP TS 24.334: "Proximity-services (ProSe) User Equipment (UE) to Proximity-services (ProSe) Function Protocol aspects; Stage 3".

[52] 3GPP TS 24.333: "Proximity-services (ProSe) Management Objects (MO)".

[53] 3GPP TS 24.105: "Application specific Congestion control for Data Communication (ACDC) Management Object (MO)".

[54] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities".

[55] 3GPP TS 43.064: "Overall description of the GPRS Radio Interface; Stage 2".

[56] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description".

[57] 3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions".

[58] 3GPP TS 23.401: "GPRS enhancements for E-UTRAN access".

[59] 3GPP TS 24.386: "User Equipment (UE) to V2X control function; protocol aspects; Stage 3".

[60] 3GPP TS 24.385: "V2X services Management Object (MO)".

[61] 3GPP TS 38.304: "New Generation Radio Access Network; User Equipment (UE) procedures in Idle mode".

[62] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[63] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[64] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[65] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[66] 3GPP TS 33.501: "Security architecture and procedures for 5G System".

[67] 3GPP TS 31.115: "Secured packet structure for (Universal) Subscriber Identity Module (U)SIM Toolkit applications".

[68] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and Functional Description".

[69] 3GPP TS 23.221: "Architectural requirements".

[70] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS)".

[71] 3GPP TS 29.544: "5G System (5GS); Secured Packet Application Function (SP-AF) services; Stage 3".

[72] 3GPP TS 29.571: "5G System (5GS); Common Data Types for Service Based Interfaces; Stage 3".

[73] ETSI TS 102 225: "Smart Cards; Secured packet structure for UICC based applications".

[74] 3GPP TS 24.587: "Vehicle-to-Everything (V2X) services in 5G System (5GS); Stage 3".

[xx] 3GPP TS 24.588: "Vehicle-to-Everything (V2X) services in 5G System (5GS); User Equipment (UE) policies; Stage 3".

\*\*\*\*\* change2 \*\*\*\*\*

## 3.1C PLMN selection triggered by V2X communication over PC5

If the MS supports V2X communication over E-UTRA-PC5 or NR-PC5 and needs to perform PLMN selection for V2X communication over PC5 as specified in 3GPP TS 24.386 [59] or 3GPP TS 24.587 [75], then the MS shall proceed as follows:

i) the MS shall store a duplicate value of the RPLMN and a duplicate of the PLMN selection mode that were in use before PLMN selection due to V2X communication over PC5 was initiated, unless this PLMN selection due to V2X communication over PC5 follows another PLMN selection due to V2X communication over PC5 or a manual CSG selection as specified in clause 4.4.3.1.3.3;

 ii) the MS shall enter into Automatic mode of PLMN selection as specified in clause 4.4 taking into account the additional requirements in items iii) to x) below;

iii) Among the PLMNs advertised by the E-UTRA or NG-RAN cell operating in the radio resources provisioned to the MS for V2X communication over PC5 as specified in 3GPP TS 24.385 [60], 3GPP TS 24.588 [xx] or 3GPP TS 31.102 [40], the MS shall choose one allowable PLMN which meets:

1) the following:

- provides radio resources for V2X communication over PC5;

- is in the list of authorised PLMNs for V2X communication over PC5 as specified in 3GPP TS 24.386 [59] or 3GPP TS 24.587 [75]; and

- is not in the list of "PLMNs with E-UTRAN not allowed" as specified in clause 3.1; or

2) the following:

- provides radio resources for V2X communication over PC5;

- is in the list of authorised PLMNs for V2X communication over PC5 as specified in 3GPP TS 24.386 [59] or 3GPP TS 24.587 [75];

- is not in the list of PLMNs where the N1 mode capability was disabled due to IMS voice not available and the MS's usage setting was "voice centric" as PLMNs where voice service was not possible; and

- is not in the 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" in N1 mode as specified in clause 3.1;

 if condition 1) or 2) above are met then the MS shall attempt to register on that PLMN. If none of the PLMNs meet condition 1) or 2) above, the MS shall return to the stored duplicate PLMN selection mode and use the stored duplicate value of RPLMN for further action;

iv) if the registration fails due to "PLMN not allowed" or "EPS services not allowed" as specified in 3GPP TS 24.386 [59], or due to "PLMN not allowed" or "5GS services not allowed" as specified in 3GPP TS 24.587 [75], or both, then the MS shall update the appropriate list of forbidden PLMNs as specified in clause 3.1, and shall:

A) if the PLMN provides common radio resources needed by the MS to do V2X communication over PC5 as specified in 3GPP TS 36.331 [42] or 3GPP TS 38.331 [65], perform V2X communication over PC5 on the selected PLMN in limited service state. In this case the MS shall not search for available and allowable PLMNs during the duration of V2X communication over PC5;

B) return to the stored duplicate PLMN selection mode and use the stored duplicate value of RPLMN for further action; or

C) perform the action described in iii) again with the choice of PLMNs further excluding the PLMNs on which the MS has failed to register.

 Whether the MS performs A), B) or C) above is left up to MS implementation.

v) if the registration fails due to causes other than "PLMN not allowed" or "EPS services not allowed" or "5GS services not allowed", the MS shall:

- if the handling of the failure requires updating a list of forbidden PLMNs, update the appropriate list (as specified in 3GPP TS 24.301 [23A] or 3GPP TS 24.501 [64]); and

- if the handling of the failure does not require updating a list of forbidden PLMNs (as specified in 3GPP TS 24.301 [23A] or 3GPP TS 24.501 [64]), remember the PLMN as a PLMN on which the MS has failed to register;

NOTE 1: How long the MS memorizes the PLMNs on which it has failed to register is implementation dependent.

 and the MS shall:

A1) return to the stored duplicate PLMN selection mode and use the stored duplicate value of RPLMN for further action;

B1) perform the action described in iii) again with the choice of PLMNs further excluding the PLMNs on which the MS has failed to register; or

C1) perform V2X communication over PC5 in limited service state on a PLMN advertised by the cell operating in the radio resources provisioned to the MS for V2X communication over PC5 as specified in 3GPP TS 24.385 [60], 3GPP TS 24.588 [xx] or 3GPP TS 31.102 [40], if registration on this PLMN has previously failed due to "PLMN not allowed" or "EPS services not allowed" as specified in 3GPP TS 24.386 [59], or due to "PLMN not allowed" or "5GS services not allowed" as specified in 3GPP TS 24.587 [75], or both, and if this PLMN provides common radio resources needed by the MS to do V2X communication over PC5 as specified in 3GPP TS 36.331 [42] or 3GPP TS 38.331 [65]. In this case the MS shall not search for available and allowable PLMNs during the duration of V2X communication over PC5;

 Whether the MS performs A1), B1) or C1) above is left up to MS implementation.

vi) if the MS is no longer in the coverage of the selected PLMN, then the MS shall:

A2) perform V2X communication over PC5 procedures for MS to use provisioned radio resources as specified in 3GPP TS 24.386 [59] or 3GPP TS 24.587 [75]; or

B2) return to the stored duplicate PLMN selection mode and use the stored duplicate value of RPLMN for further action.

 Whether the MS performs A2) or B2) above is left up to MS implementation.

vii) if the MS is unable to find a suitable cell on the selected PLMN as specified in 3GPP TS 24.386 [59] or 3GPP TS 24.587 [75], then the MS shall:

A3) if the PLMN provides common radio resources needed by the MS to do V2X communication over PC5 as specified in 3GPP TS 36.331 [42] or 3GPP TS 38.331 [65], perform V2X communication over PC5 on the selected PLMN in limited service state. In this case the MS shall not search for available and allowable PLMNs during the duration of V2X communication over PC5; or

B3) return to the stored duplicate PLMN selection mode and use the stored duplicate value of RPLMN for further action.

 Whether the MS performs A3) or B3) above is left up to MS implementation.

viii) if the MS is switched off while on the selected PLMN and switched on again, the MS shall use the stored duplicate value of RPLMN as RPLMN and behave as specified in clause 4.4.3.1;

ix) if the user initiates a PLMN selection while on the selected cell, the MS shall delete the stored duplicate value of PLMN selection mode, use the stored duplicate value of RPLMN as RPLMN and follow the procedures (as specified for switch-on or recovery from lack of coverage) in clause 4.4.3.1. The MS shall delete the stored duplicate value of RPLMN once the MS has successfully registered to the selected PLMN; and

x) if the MS no longer needs to perform V2X communication over PC5, the MS shall return to the stored duplicate PLMN selection mode and use the stored duplicate value of RPLMN for further action.

NOTE 2: If the MS returns to the RPLMN due to a failure to register in the selected PLMN, the upper layers of the MS can trigger PLMN selection again to initiate V2X communication over PC5.

If the PLMN selected for V2X communication over PC5 is a VPLMN, the MS shall not periodically scan for higher priority PLMNs during the duration of V2X communication over PC5.

The solution to prevent potential ping-pong between the RPLMN and the PLMN selected for V2X communication over PC5 is MS implementation specific.

\*\*\*\*\* change3 \*\*\*\*\*

## 3.5 No suitable cell (limited service state)

There are a number of situations in which the MS is unable to obtain normal service from a PLMN or SNPN. These include:

a) Failure to find a suitable cell of the selected PLMN or of the selected SNPN;

b) No SIM in the MS or the "list of subscriber data" with no valid entry;

c) A "PLMN not allowed", "Requested service option not authorized in this PLMN" or "Serving network not authorized" response in case of PLMN or a "Temporarily not authorized for this SNPN" or "Permanently not authorized for this SNPN" response in case of SNPN when an LR is received;

d) An "illegal MS" or "illegal ME" response when an LR is received (Any SIM or the corresponding entry of the "list of subscriber data" in the ME is then considered "invalid");

e) An "IMSI unknown in HLR" response when an LR is received (Any SIM in the ME is then considered "invalid" for non-GPRS services);

f) A "GPRS services not allowed" response when an LR of a GPRS MS attached to GPRS services only is received (The cell selection state of GPRS MSs attached to GPRS and non-GPRS depends on the outcome of the location updating), or an "EPS services not allowed" response is received when an EPS attach, tracking area update or service request is performed, or a "5GS services not allowed" response is received when a registration or service request is performed;

g) Power saving mode (PSM) is activated (see 3GPP TS 23.682 [27A]); or

h) Mobile initiated connection only (MICO) mode is activated (see 3GPP TS 23.501 [62] and 3GPP TS 23.502 [63]).

i) MS supporting CAG is camped on a CAG cell belonging to a PLMN, the CAG-ID of the CAG cell is not manually selected by the user and none of the CAG-ID(s) of the CAG cell are present in the "Allowed CAG list" associated with that PLMN in the "CAG information list";

j) MS supporting CAG is camped on a non-CAG cell belonging to a PLMN, the PLMN ID of the non-CAG cell without a CAG-ID is not manually selected by the user and the UE is configured with "indication that the MS is only allowed to access 5GS via CAG cells" for that PLMN in the "CAG information list"; and

k) MS supporting CAG is camped on a CAG cell belonging to a PLMN, the CAG-ID of the CAG cell is not manually selected by the user and the "CAG information list" does not contain an entry for the PLMN (e.g. because the UE is not (pre-)configured with a "CAG information list").

(In automatic PLMN selection mode, items a, c and f would normally cause a new PLMN selection, but even in this case, the situation may arise when no PLMNs are available and allowable for use).

(In automatic SNPN selection mode, items a, c, d, and f would normally cause a new SNPN selection if there are two or more entries in the "list of subscriber data", but even in this case, the situation may arise when no SNPNs are available and allowable for use).

For the items a to f, if the MS does not operate in SNPN access mode, the MS attempts to camp on an acceptable cell, irrespective of its PLMN identity, so that emergency calls or access to RLOS can be made if necessary, with the exception that an MS operating in NB-S1 mode, shall never attempt to make emergency calls or to access RLOS. When in the limited service state with a valid SIM, the MS shall search for available and allowable PLMNs in the manner described in clause 4.4.3.1 and when indicated in the SIM also as described in clause 4.4.3.4. For an MS that is not in eCall only mode, with the exception of performing GPRS attach or EPS attach for emergency bearer services, performing an initial registration for emergency services, or performing EPS attach for access to RLOS, no LR requests are made until a valid SIM is present and either a suitable cell is found or a manual network reselection is performed. For an MS in eCall only mode, no LR requests are made except for performing EPS attach for emergency bearer services or an initial registration for emergency services. When performing GPRS attach or EPS attach for emergency bearer services, an initial registration for emergency services, or performing EPS attach for access to RLOS, the PLMN of the current serving cell is considered as the selected PLMN for the duration the MS is attached for emergency bearer services, registered for emergency services, or attached for access to RLOS. In the limited service state the presence of the MS need not be known to the PLMN on whose cell it has camped.

For the items a, c, d and f, if the MS operates in SNPN access mode and the UE has a valid entry in the "list of subscriber data", the MS shall search for available and allowable SNPNs in the manner described in clause 4.9.3.1. For the item b, if the MS operates in SNPN access mode, the MS attempts to camp on an acceptable cell. When in the limited service state, no LR requests are made until a valid entry of the "list of subscriber data" is present and either a suitable cell is found or a manual network reselection is performed. In the limited service state the presence of the MS need not be known to the SNPN on whose cell it has camped.

There are also other conditions under which only emergency calls or access to RLOS may be made if the MS does not operate in SNPN access mode. These are shown in table 2 in clause 5. ProSe direct communication and ProSe direct discovery for public safety use can be initiated if necessary (see 3GPP TS 24.334 [51]) when in the limited service state due to items a) or c) or f). V2X communication over PC5 can be initiated if necessary (see 3GPP TS 24.386 [59] or 3GPP TS 24.587 [75]) when in the limited service state due to items a) or c) or f).

\*\*\*\*\* change4 \*\*\*\*\*

###### 4.4.3.1.3.3 Manual CSG selection in a PLMN different from the RPLMN

If the user selects a CSG in a PLMN that is different from the RPLMN, then the following applies:

i) The MS shall store a duplicate of the RPLMN and a duplicate of the PLMN selection mode that were in use before the manual CSG selection was initiated, unless this manual CSG selection follows another manual CSG selection or a PLMN selection triggered by ProSe direct communication as specified in clause 3.1B or a PLMN selection triggered by V2X communication over PC5 as specified in clause 3.1C;

ii) The MS shall enter into Manual mode of PLMN selection in state M4 (Trying PLMN) as defined in clause 4.3.1.2;

iii) The MS shall select the PLMN corresponding to the CSG and attempt to register on the selected CSG cell in the PLMN. For such a registration, the MS shall ignore the contents of the "forbidden location areas for roaming", "forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service", "forbidden PLMNs for GPRS service" and "forbidden PLMNs" lists. If the registration is successful the MS remains in manual CSG selection mode, until the user selects automatic CSG selection mode, the MS is switched off or the condition of any of items iv) to viii) below is fulfilled;

iv) If the registration fails or the MS is no longer in the coverage of the selected CSG, then the MS shall return to the stored duplicate PLMN selection mode and automatic CSG selection mode and use the stored duplicate value of RPLMN for further action;

v) If the MS is switched off while on the selected CSG and switched on again, the MS should return to the stored duplicate PLMN selection mode, unless the MS provides the optional feature of user preferred PLMN selection operating mode at switch on. Additionally, the MS shall use the stored duplicate value of RPLMN and automatic CSG selection mode for further action;

vi) If the user initiates a PLMN selection while on the selected CSG, the MS shall delete the stored duplicate PLMN selection mode, use the stored duplicate value of RPLMN as RPLMN, return to automatic CSG selection mode and follow the procedures (as specified for switch-on or recovery from lack of coverage) in clause 4.4.3.1. The MS shall delete the stored duplicate value of RPLMN once the PLMN selection has been completed successfully;

vii) If the MS's E-UTRA capability is disabled as a result of successful registration (as described in 3GPP TS 24.301 [23A] clauses 5.5.1.3.4.2, 5.5.1.3.4.3, 5.5.3.3.4.2 and 5.5.3.3.4.3) and the selected CSG is not available on UTRAN radio access technology, the MS shall re-enable the E-UTRA capability, return to the stored duplicate PLMN selection mode and automatic CSG selection mode and use the stored duplicate value of RPLMN for further action; and

viii) If the MS's E-UTRA capability is disabled as a result of performing the service request procedure (as described in 3GPP TS 24.301 [23A] clause 5.6.1.5), the selected CSG is not available on UTRAN radio access technology and the MS performed a CS call, then after the end of the call, the MS shall re-enable the E-UTRA capability, return to the stored duplicate PLMN selection mode and automatic CSG selection mode and use the stored duplicate value of RPLMN for further action.

\*\*\*\*\*end of change \*\*\*\*\*