**SA WG2 Meeting #S2-165S2-2411114**

**14 - 18 October, 2024, Hyderabad, India (revision of S2-2410186/S2-2410819)**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.502** | **CR** | **5067** | **rev** | **2** | **Current version:** | **19.1.0** |  |
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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 |  | Radio Access Network | **x** | Core Network | **x** |

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| ***Title:*** | Procedure of supporting additional ULI | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | ZTE, Ericsson, Samsung | | | | | | | | | |
| ***Source to TSG:*** | SA WG2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | VMR\_Ph2 | | | | |  | ***Date:*** | | | 2024-9-30 |
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| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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 can be 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:*** | | The supporting of additional ULI is applied to MWAB (23.501 clause 5.49.4).  This CR reflects this change to 23.502 procedure. | | | | | | | | |
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| ***Summary of change:*** | | Adding a new clause about Additional ULI with MWAB. Clarifying the RAN location report and AOI for MWAB. | | | | | | | | |
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| ***Consequences if not approved:*** | | The additional ULI of MWAB is not implemented in TS 23.502. | | | | | | | | |
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| ***Clauses affected:*** | | 4.2.7.X (new), 4.10, D.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

*FIRST CHANGE*

4.2.7.X Additional User Location Information with Mobile gNB with wireless access backhauling (MWAB)

When a UE is being served by an MWAB-gNB cell, for any N2 messages sent by NG-RAN to AMF, if the User Location Information is included, the N2 message shall also include the Additional ULI as described in clause 5.49.4 of TS 23.501 [2].

*Next CHANGE*

4.10 NG-RAN Location reporting procedures

This procedure is used by an AMF to request the NG-RAN to report where the UE is currently located when the target UE is in CM-CONNECTED state. The need for the NG-RAN to continue reporting ceases when the UE transitions to CM-IDLE or the AMF sends cancel indication to NG-RAN. This procedure may be used for services that require accurate cell identification (e.g. emergency services, lawful intercept, charging), or for subscription to the service by other NFs. When Dual Connectivity is activated, PSCell information is only reported if requested by the AMF.

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**Figure 4.10-1: NG-RAN Location Reporting Procedure**

1. AMF to NG-RAN: Location Reporting Control (Reporting Type, Location Reporting Level, (Area Of Interest, Request Reference ID)).

The AMF sends a Location Reporting Control message to the NG-RAN. The Location Reporting Control message shall identify the UE for which reports are requested and shall include Reporting Type and Location Reporting Level. The Location Reporting Control message may also include Area Of Interest and Request Reference ID. Location Reporting Level could be TAI+ Cell Identity. Reporting Type indicates whether the message is intended to trigger a single standalone report about the current Cell Identity serving the UE or start the NG-RAN to report whenever the UE changes cell, or ask the NG-RAN to report whenever the UE moves out or into the Area Of Interest. If the Reporting Type indicates to report whenever the UE changes cell and if PScell reporting is requested and Dual Connectivity is in use, the Master RAN node shall also report to the AMF whenever the PSCell changes. If the Reporting Type indicates to start the NG-RAN to report when UE moves out of or into the Area Of Interest, the AMF also provides the requested Area Of Interest information in the Location Reporting Control message. The AMF may include a Request Reference ID in the Location Report Control message to identify the request of reporting for an Area Of Interest. If multiple Areas Of Interest are included in the message, the Request Reference ID identifies each Area of Interest.

NOTE 1: Requesting reports whenever the UE changes cell can increase signalling load on multiple interfaces. Requesting reports for all changes in PSCell ID can further increase signalling load. Hence it is recommended that any such reporting is only applied for a limited number of subscribers.

2. NG-RAN to AMF: Location Report (UE Location, UE Presence in Area Of Interest, Request Reference ID, Timestamp).

The NG-RAN sends a Location Report message informing the AMF about the location of the UE which shall be represented as the requested Location Reporting Level. If PSCell reporting is requested and Dual Connectivity is activated, then the Master NG-RAN node shall also include the PSCell ID. With NR satellite access, cell and TAI reporting by NG-RAN refer to a fixed cell and fixed TA in which a UE is geographically located. As part of the User Location Information, NG\_RAN also reports one or more TACs for the Selected PLMN as described in TS 38.413 [10], but it is not guaranteed that the UE is always located in one of these TACs.

When UE is in CM-CONNECTED with RRC\_INACTIVE state, if NG-RAN has received Location Reporting Control message from AMF with the Reporting Type indicating single stand-alone report, the NG-RAN shall perform NG-RAN paging before reporting the location to the AMF. The NG-RAN should send the Location Report promptly and shall not wait to attempt to create a Dual Connectivity configuration. However, if PSCell reporting is requested and the PSCell ID is known to the Master RAN node, then it shall be included in the Location Report. In the case of RAN paging failure, the RAN reports UE's last known location with time stamp.

When UE is in CM-CONNECTED with RRC\_INACTIVE state, if NG-RAN has received Location Reporting Control message from AMF with the Reporting Type indicating continuous reporting whenever the UE changes cell, the NG-RAN shall send a Location Report message to the AMF including the UE's last known location with time stamp. If the UE was using Dual Connectivity immediately before entering CM-CONNECTED with RRC\_INACTIVE state and PSCell reporting is requested, then the Location Report shall also include the PSCell ID.

When UE is in CM-CONNECTED, if NG-RAN has received Location Reporting Control message from AMF with the Reporting Type of Area Of Interest based reporting, the NG-RAN shall track the UE presence in Area Of Interest and send a Location Report message to AMF including the UE Presence in the Area Of Interest (i.e. IN, OUT, or UNKNOWN) as described in clause D.2 and the UE's current location (including the PSCell ID if PSCell reporting is requested and Dual Connectivity is activated) when the UE is in RRC\_CONNECTED state, or, when the UE is in RRC\_INACTIVE state, the UE's last known location (including the PSCell ID if PSCell reporting is requested and the UE was using Dual Connectivity immediately before entering CM-CONNECTED with RRC\_INACTIVE state) with time stamp if the NG-RAN perceives that the UE presence in the Area Of Interest is different from the last one reported. When the NG-RAN detects that the UE has moved out of or into multiple areas of interest, it sends multiple pairs of UE Presence in the Area Of Interest and the Request Reference ID in one Location Report message to AMF. If UE transitions from RRC\_INACTIVE state to RRC\_CONNECTED state, NG-RAN shall check the latest location (including the PSCell ID if PSCell reporting is requested and Dual Connectivity is activated) of UE and follow the rules when UE is in RRC\_CONNECTED.

The AMF may receive Location Report even if the UE presence in Area Of Interest is not changed. The AMF stores the latest received PSCell ID with its associated timestamp. The AMF stores the latest received PSCell ID with its associated timestamp, when available.

In addition to the above, if the UE is served by an authorized MSBR and the AMF serving this UE receives the Location Report including the TAI/NR CGI for the MBSR that UE is accessing, the AMF shall, if supported, update the corresponding Warning Area List NG-RAN specified in TS 23.041 [86]

In addition to the above, if the UE is served by an MWAB-gNB and ULI reporting is configured at the MWAB-gNB for a UE, the MWAB-gNB shall report ULI and Additional ULI as specified in the 4.2.7.X.

In addition to the above, if the UE is served by an MWAB-gNB and the AMF serving this UE receives the Location Report including the TAI/NR CGI for the MWAB that UE is accessing, the AMF shall, if supported, update the corresponding Warning Area List NG-RAN specified in TS 23.041 [86].

3. AMF to NG-RAN: Cancel Location Report (Reporting Type, Request Reference ID).

The AMF can send a Cancel Location Reporting message to inform the NG-RAN that it should terminate the location reporting for a given UE corresponding to the Reporting Type or the location reporting for Area Of Interest indicated by Request Reference ID. This message is needed when the reporting type was requested for continuously reporting or for the Area Of Interest. The AMF may include the Request Reference ID which indicates the requested Location Reporting Control for the Area Of Interest, so that the NG-RAN should terminate the location reporting for the Area Of Interest.

NOTE 2: Location reporting related information of the source NG-RAN node is transferred to the target NG-RAN node during Xn handover.

In this release the location reporting procedure is applicable only to 3GPP access.

*Next CHANGE*

D.1 Determination of UE presence in Area of Interest by AMF

If the AMF has requested NG-RAN location reporting as specified in clause 4.10 for the Area Of Interest and UE is in CM-CONNECTED state, including RRC\_CONNECTED and RRC\_INACTIVE state, the AMF determines the UE presence in the Area of Interest as the reported value from the NG-RAN, as specified in clause D.2.

In the case the UE is served by a MBSR, the AMF may consider the additional ULI provided by the NG-RAN node (as defined in clause 5.35A.6 of TS 23.501 [2]) when determining the UE presence in Area of Interest.

In the case the UE is served by a MWAB-gNB, the AMF may consider the Additional ULI provided by the MWAB-gNB (as defined in clause 5.49.4 of TS 23.501 [2]) when determining the UE presence in Area of Interest.

If the AMF has requested N2 Notification as specified in clause 4.8.3, the AMF determines the UE presence in Area Of Interest as follows, taking N2 Notification from NG-RAN into consideration:

- IN:

- if the UE is in CM-CONNECTED with RRC\_CONNECTED state and if the last received User Location Information for the UE is inside the Area Of Interest service area; or

NOTE 1: The above is valid e.g. under the condition that Area Of Interest border coincides with NG-RAN node service area border(s).

- if the UE is in CM-CONNECTED and if the UE is inside a Registration Area which is completely contained within the Area Of Interest.

- OUT:

- if the UE is in CM-CONNECTED with RRC\_CONNECTED state and if the last received User Location Information for the UE is outside the Area Of Interest; or

NOTE 2: The above is valid e.g. under the condition that Area Of Interest border coincides with NG-RAN node service area border(s).

- if the UE is in CM-CONNECTED and if UE is inside a Registration Area which does not contain any part of Area Of Interest.

- UNKNOWN:

if none of above conditions for IN or OUT is met.

Otherwise, AMF determines the UE presence of Area Of Interest as follows:

- IN:

- if the UE is inside the Area Of Interest service area and if the UE is in CM-CONNECTED state; or

- if the Area Of Interest service area is indicated as a RAN node identity and the Parameter Type with value "RAN timing synchronization status change event" is included and the UE has indicated a support for registration update procedure due to RAN timing synchronization status as described in clause 5.3.4.4 of TS 23.501 [2] and the most recent N2 connection for the UE is via a RAN Node that is included in the Area Of Interest service area; or

- if the Parameter Type with value "Adjust AoI based on RA" is included and the UE is inside a Registration Area which contains at least one Tracking Area that is contained within the Area Of Interest; or

- if the UE is inside a Registration Area which is contained within the Area Of Interest.

- OUT:

- if the UE is outside the Area Of Interest in CM-CONNECTED and the Parameter Type with value "Adjust AoI based on RA" is not included; or

- if the Area Of Interest service area is indicated as a RAN node identity and the Parameter Type with value "RAN timing synchronization status change event" is included and the UE has indicated a support for registration update procedure due to RAN timing synchronization status as described in clause 5.3.4.4 of TS 23.501 [2] and the most recent N2 connection for the UE is via a RAN Node that is not included in the Area Of Interest service area; or

- if UE is inside a Registration Area which does not contain any part of Area Of Interest.

- UNKNOWN:

if none of above conditions for IN or OUT is met.

*END OF CHANGES*