3GPP TSG-RAN WG2 Meeting #117-eR2-2203949

**Electronic, February 21 – March 3, 2022**

**Title: [draft] LS on Positioning in RRC\_INACTIVE State**

**Release:** Rel-17

**Work Item:** NR\_pos\_enh-Core

**Source:** Qualcomm Incorporated (to be RAN2)

**To:** SA2

**Cc:** RAN3

**Contact Person:**

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**1. Overall Description:**

RAN2 has technically endorsed the attached "Low Power Periodic and Triggered 5GC-MT-LR Procedures with SDT" for DL-only and RAT-Independent positioning, for UL-only positioning, and for UL+DL positioning. These procedures are analogous to the "Low Power Periodic and Triggered 5GC-MT-LR Procedures" specified in clause 6.7 of TS 23.273 but making use of the NR Small Data Transmission (SDT) feature in TS 38.300 in RRC\_INACTIVE state instead of the LTE EDT feature in RRC\_IDLE state in TS 36.300 currently used in clause 6.7 of TS 23.273.

RAN2 believes that these procedures may be best captured in TS 23.273 as an alternative to Figure 6.7.1-1 when the Event Reports can be sent using NR SDT. Accordingly, RAN2 would like to ask SA2 whether support can be provided for the attached procedures in TS 23.273 and, if so, to add support to TS 23.273 as part of Release 17.

RAN2 would also like to inform SA2 about the following agreements made:

Agreements:

Exposure of the RRC state of the UE to the LPP layer of the UE for RRC\_INACTIVE UL and DL positioning will not be specified. This does not exclude cross-layer behaviour in implementations.

The RRC state of the UE is not exposed to the LMF for INACTIVE UL and DL positioning.

RAN2 will not make additional effort to make the gNB aware of when to transit the UE to RRC\_INACTIVE (left to gNB implementation and RAN3 solution).

**2. Actions:**

**To SA2 group.**

**ACTION:** RAN2 kindly asks SA2 to review the attached "Low Power Periodic and Triggered 5GC-MT-LR Procedures with SDT", determine whether support can be provided for the attached procedure in TS 23.273 and, if so, to add support to TS 23.273 as part of Release 17.

**3. Date of Next TSG-RAN2 Meetings:**

TSG-RAN2 Meeting #118-e 16-27 May 2022 Electronic Meeting

TSG-RAN2 Meeting #119-e 22-26 August 2022 Electronic Meeting

Annex A:

Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – DL-only and RAT-Independent positioning



**Figure A: Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT (DL-only and RAT-Independent positioning).**

1. Steps 1-21 for the deferred 5GC-MT-LR procedure for periodic or triggered location events specified in TS 23.273, clause 6.3.1 are performed.

 The receiving gNB then sends an *RRCRelease* with *suspendConfig* to move the UE to RRC\_INACTIVE state.

Editor's Note: After performing these steps, the UE would have been provided with the location request information (e.g., requested positioning method(s) and mode, QoS, etc.) and possibly any required assistance data. The UE may request/receive additional/updated assistance data via posSI and/or LPP Request Assistance Data during the Event Reporting Phase as usual.

2. The UE monitors for occurrence of the trigger or periodic event requested during step 1. The UE determines which positioning method(s) will be used for the detected event from the request in Step 1 (based on the position method(s) included in an LPP Request Location Information message carried in the LCS Periodic-Triggered Invoke Request during Step 1).
When the event is detected (or slightly before) the UE performs the location measurements.

3. The UE sends an RRC UL Information Transfer message containing an UL NAS Transport message along with the RRC Resume Request with Small Data Transmission.
The UE includes the LCS Event Report and LPP Provide Location Information (PLI) message in the payload container of the UL NAS Transport message, and the Deferred Routing Identifier received during Step 1 in the Additional Information of the UL NAS Transport message as defined in TS 24.501.

NOTE: The receiving gNB of the UE when UE performs step 3 might be the same or different from the last serving gNB where the UE is released to the RRC\_INACTIVE state.

4. The receiving gNB sends the SS Event Report with the LPP PLI message to the LMF (via serving AMF).

NOTE: If the anchor gNB is not changed from the last serving gNB to the receiving gNB, the LCS event report is forwarded from the receiving gNB to the last serving gNB via XnAP message *RRC TRANSFER* as in TS 38.423. Subsequent downlink/uplink messages are also forwarded between last serving gNB to the receiving gNB via XnAP message *RRC TRANSFER*.

5. Once all LPP PLI messages have been received, the LMF sends an SS Event Report Acknowledgement to the receiving gNB which then provides the SS Event Report Acknowledgement to the UE at Step 5b via Subsequent DL SDT.

6. The receiving gNB sends an *RRCRelease* message to the UE to release the UE to RRC\_INACTIVE state.

7. Steps 28-31 for the deferred 5GC-MT-LR procedure for periodic or triggered location events specified in TS 23.273, clause 6.3.1 are performed.

Annex B:

Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – UL-only positioning



**Figure B: Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT (UL-only positioning).**

1. Steps 1-21 for the deferred 5GC-MT-LR procedure for periodic or triggered location events specified in TS 23.273, clause 6.3.1 are performed.

 The UE is released by the last serving gNB from RRC\_CONECTED to RRC\_INACTIVE by *RRCRelease* with *SuspendConfig*.

2. The UE monitors for occurrence of the trigger or periodic event requested during step 1.

3. When an event is detected (or slightly before) the UE sends an RRC UL Information Transfer message containing an UL NAS Transport message along with the RRC Resume Request with SDT. The UE includes an LCS Event Report in the payload container of the UL NAS Transport message, and the Deferred Routing Identifier received during Step 1 in the Additional Information of the UL NAS Transport message as defined in TS 24.501.

NOTE: The receiving gNB of the UE when UE performs step 3 might be the same or different from the last serving gNB where the UE is released to the RRC\_INACTIVE state.

4. The receiving gNB sends the LCS Event Report in an NGAP Uplink NAS Transport message to the serving AMF. The AMF determines the LMF from the Deferred Routing Identifier received in the Additional Information IE of the UL NAS TRANSPORT message and forwards the LCS Event Report via triggering Namf\_Communication\_N1MessageNotify service operation towards the LMF. The AMF also includes the Payload Container Type and the Correlation Identifier set to the Deferred Routing Identifier.

NOTE: If the anchor gNB is not changed from the last serving gNB to the receiving gNB, the LCS event report is forwarded form the receiving gNB to the last serving gNB via XnAP message *RRC TRANSFER* as in TS 38.423. Subsequent downlink/uplink messages are also forwarded between last serving gNB to the receiving gNB via XnAP message *RRC TRANSFER*.

5. The LMF sends a NRPPa Positioning Information Request message to the receiving gNB to request UL-SRS for the target device.

6. The receiving gNB determines the resources available for UL-SRS.

7. The receiving gNB provides the UL-SRS configuration information to the LMF in a NRPPa *POSITIONING INFORMATION RESPONSE* message.

8. The LMF sends a NRPPa Measurement Request to a group of gNBs incl. the UL-SRS measurement configuration.

9. The LMF sends a SS LCS Event Report Acknowledgement to the receiving gNB. The receiving gNB then provides the SS Event Report Acknowledgement to the UE at Step 9b via Subsequent DL SDT.

10. The receiving gNB sends a *RRCRelease* message with *suspendConfig* to keep the UE in RRC\_INACTIVE state. The *RRCRelease* message includes the UL-SRS Configuration.

11. The UE transmits UL-SRS and the gNBs that have received the NRPPa message for measurement request perform the measurements of the UL-SRS transmitted by the UE.

12. After performing the UL-SRS measurements, the gNBs provide the UL measurements to the LMF in a NRPPa Measurement Response message.

13. Steps 28-31 for the deferred 5GC-MT-LR procedure for periodic or triggered location events specified in TS 23.273, clause 6.3.1 are performed.

Annex C:

Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – UL+DL only positioning



**Figure C: Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT (UL+DL positioning).**

1. Steps 1-21 for the deferred 5GC-MT-LR procedure for periodic or triggered location events specified in TS 23.273, clause 6.3.1 are performed.

 The LMF may perform one or more positioning procedures at Step 15 of TS 23.273, clause 6.3.1 to request and obtain the UE positioning capabilities or provide any necessary assistance data to the target device.

 The LCS Periodic-Triggered Location Invoke at Step 16 of TS 23.273, clause 6.3.1 includes an embedded LPP Request Location Information message which indicates the allowed or required Multi-RTT location measurements for each location event reported.

 The UE is released by the last serving gNB from RRC\_CONECTED to RRC\_INACTIVE by *RRCRelease* with *SuspendConfig*.

2. The UE monitors for occurrence of the trigger or periodic event requested during step 1.

3. When an event is detected (or slightly before) the UE sends an RRC UL Information Transfer message containing an UL NAS Transport message along with the RRC Resume Request with SDT. The UE includes an LCS Event Report in the payload container of the UL NAS Transport message, and the Deferred Routing Identifier received during Step 1 in the Additional Information of the UL NAS Transport message as defined in TS 24.501.

 The LCS Event Report includes an embedded LPP Request Assistance Data message with IE *NR-Multi-RTT-RequestAssistanceData* and *nr-AdType* set to '*ul-srs*' to request an UL-SRS for Multi-RTT positioning as specified in TS 37.355.

NOTE: The receiving gNB of the UE when UE performs step 3 might be the same or different from the last serving gNB where the UE is released to the RRC\_INACTIVE state.

4. The receiving gNB sends the LCS Event Report with the LPP Request Assistance Data message in an NGAP Uplink NAS Transport message to the serving AMF. The AMF determines the LMF from the Deferred Routing Identifier received in the Additional Information IE of the UL NAS TRANSPORT message and forwards the LCS Event Report with embedded LPP message via triggering Namf\_Communication\_N1MessageNotify service operation towards the LMF. The AMF also includes the Payload Container Type and the Correlation Identifier set to the Deferred Routing Identifier.

NOTE: If the anchor gNB is not changed from the last serving gNB to the receiving gNB, the LCS event report is forwarded form the receiving gNB to the last serving gNB via XnAP message *RRC TRANSFER* as in TS 38.423. Subsequent downlink/uplink messages are also forwarded between last serving gNB to the receiving gNB via XnAP message *RRC TRANSFER*.

5. The LMF sends a NRPPa Positioning Information Request message to the receiving gNB to request UL-SRS for the target device.

6. The receiving gNB determines the resources available for UL-SRS.

7. The receiving gNB provides the UL-SRS configuration information to the LMF in a NRPPa Positioning Information Response message.

8. The LMF sends a NRPPa Measurement Request to a group of gNBs incl. the UL-SRS measurement configuration.

9. The LMF sends a SS LCS Event Report Acknowledgement to the receiving gNB. The receiving gNB then provides the SS Event Report Acknowledgement to the UE at Step 9b via Subsequent DL SDT.

10. The receiving gNB sends a *RRCRelease* message with *suspendConfig* to keep the UE in RRC\_INACTIVE state. The *RRCRelease* message includes the UL-SRS Configuration.

11. The UE performs DL-PRS measurements and each configured TRP performs UL-SRS measurements.

12. The UE sends an RRC UL Information Transfer message containing an UL NAS Transport message along with the RRC Resume Request with SDT. The UE includes the LCS Event Report and LPP Provide Location Information message in the payload container of the UL NAS Transport message, and the Deferred Routing Identifier received during Step 1 in the Additional Information of the UL NAS Transport message as defined in TS 24.501.

13. The receiving gNB sends the LCS Event Report with the LPP Provide Location Information message in an NGAP Uplink NAS Transport message to the serving AMF. The AMF determines the LMF from the Deferred Routing Identifier received in the Additional Information IE of the UL NAS TRANSPORT message and forwards the LCS Event Report with embedded LPP message via triggering Namf\_Communication\_N1MessageNotify service operation towards the LMF. The AMF also includes the Payload Container Type and the Correlation Identifier set to the Deferred Routing Identifier.

14. After performing the UL-SRS measurements, the gNBs provide the UL measurements to the LMF in a NRPPa Measurement Response message.

15. When all LPP Provide Location Information messages have been received, the LMF sends a SS LCS Event Report Acknowledgement to the receiving gNB. The receiving gNB then provides the SS Event Report Acknowledgement to the UE at Step 15b via Subsequent DL SDT.

16. The receiving gNB sends a *RRCRelease* message with *suspendConfig* to keep the UE in RRC\_INACTIVE state.

17. Steps 28-31 for the deferred 5GC-MT-LR procedure for periodic or triggered location events specified in TS 23.273, clause 6.3.1 are performed.