3GPP TSG-RAN WG2 Meeting #117-e ***R2-22xxxxx***

Electronic Meeting, February 21 – March 3, 2022

**Agenda item:** 8.11.2.2

**Source:** Qualcomm Incorporated

**Title:** Summary of [AT117-e][629][POS] LS to SA2 on RRC\_INACTIVE positioning (Qualcomm)

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion:

* [AT117-e][629][POS] LS to SA2 on RRC\_INACTIVE positioning (Qualcomm)

Scope: Draft an LS to SA2 indicating our agreements on Low Power Periodic and Triggered 5GC-MT-LR Procedures with SDT for DL-only and RAT-Independent positioning (based on agreed baseline from RAN2#115-e), for UL-only positioning, and for UL+DL positioning (baseline based on R2-2203443) and asking them to take it into account. Include also the information that we have agreed to have RRC state not visible to LMF.

Intended outcome: Approved LS (preferably without CB)

Deadline: Wednesday 2022-03-02 0200 UTC

At RAN2#115-e, the following agreements were made:

Agreements:

LPP PDU and LCS message transfer:

Proposal 1: The LPP PDU Transfer Procedure in Annex A is used as baseline for further work.

NOTE 1: Some details may depend on further progress of the SDT work item.

NOTE 2: Whether such a procedure needs to be captured in Stage 2 specification or not can be decided later when the procedure has been fully developed/agreed. That is, the procedure can be considered as "running baseline".

Proposal 2: The LCS Message Transfer Procedure in Annex B is used as baseline for further work.

NOTE 1: Some details may depend on further progress of the SDT work item.

NOTE 2: Whether such a procedure needs to be captured in Stage 2 specification or not can be decided later when the procedure has been fully developed/agreed. That is, the procedure can be considered as "running baseline".

Proposal 3: UL LPP message segmentation can also be used by the UE in RRC\_INACTIVE state; i.e., a LPP message body can be sent in several shorter LPP messages instead of one long LPP message by using the SDT "Subsequent Data Transmission" phase. FFS spec impact.

DL and RAT-independent positioning:

Proposal 4: The Deferred 5GC-MT-LR Procedure with SDT for DL-only and RAT-independent positioning in Annex C is used as baseline for further work.

NOTE 1: Some details may depend on further progress of SDT work item.

NOTE 2: Whether such a procedure needs to be captured in Stage 2 specification or not can be decided later when the procedure has been fully developed/agreed. That is, the procedure can be considered as "running baseline".

NOTE 3: Once the procedure is stable from RAN2 perspective, send an LS to SA2 including the baseline procedure.

Note, the Annexe mentioned in the agreement above refer to the email discussion summary in R2-2108383 [1].

At RAN2#117-e, the following agreements were made:

Agreements:

Proposal 2: Agree on Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT (in R2-2203443) for UL-only and UL+DL positioning in RRC\_INACTIVE as baseline for Stage 2 discussion

Proposal 1: Add clarification note (as below) in Stage 2 specification:

Note: Positioning may be performed when a UE is in RRC\_INACTIVE state. Any uplink LCS or LPP message can be transported in RRC\_INACTIVE. If the UE initiated data transmission using UL SDT, the network can send DL LCS, LPP message and RRC message (e.g. to configure SRS for positioning, if UL positioning is supported) to the UE.

Agreement:

Send LS to SA2 to let SA2 decide the spec impacts on Low Power Periodic and Triggered 5GC-MT-LR Procedures with SDT for DL-only and RAT-Independent positioning (based on agreed baseline from RAN2#115-e), for UL-only positioning, and for UL+DL positioning (baseline based on R2-2203443)

##### References:

[1] R2-2108383, "Summary of [Post114-e][602][POS] Stage 2 procedure for deferred MT-LR in RRC\_INACTIVE", Qualcomm Incorporated.

[2] R2-2203443, "Remaining issues for positioning of UEs in RRC\_INACTIVE State", Qualcomm Incorporated.

[3] R2-2202601, "Remaining Issues on RRC\_INACTIVE Positioning" , Huawei, HiSilicon.

# 2. Stage 2 Procedures

## 2.1 DL-only and RAT-Independent positioning

The "Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – DL-only and RAT-Independent positioning" from R2-2108383 [1] is copied in Annex A.

The following modifications are proposed (shown with change bars):

- At Step 3, the possibility of a MAC CE Buffer Status Report is mentioned. However, this may be too "RAN2-centric" for SA2 and is proposed to be deleted.

**Question 1:** Do you agree with the procedure description in Annex A to be send to SA2 as baseline for "Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – DL-only and RAT-Independent positioning"?

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Nokia | Yes | The references to step 1 and step 2 could be made clear as to whether it refers to the steps in this call flow or the one in 23.273. May be the steps from other specifications can be explicitly stated as “step x in 23.273” or “step x in 24.501”  [Rap: Step 1 already refers to Steps1-21 in clause 6.3.1 TS 23.273] |
| Huawei, HiSilicon | Yes, with comments | 1/ 5a and 5b should be shown as optional in the figure.  [Rap: Changed to dashed line (should also be clear from the text)]  2/ Some editorial revisions made below. The main change is to change “serving gNB” to “receiving gNB” to align with the currently adopted nomenclature in RAN3 SDT session. |
| Intel | Yes | We did not discuss without anchor relocation case. Therefore should not mention it in the procedure and the LS. |
| vivo | Yes with comments | The procedure and description about LPP segmentation can be removed for the following reasons:  - We already agreed that the 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. Thus, we think the transmission of LPP segmentation via SDT is up to UE implementation.  - The segmentation procedure can happen in RRC\_CONNECTED state but not reflected in SA2 spec.  - We already discussed about the potential segmentation issue of LPP message (e.g., ProvideLocationInformation) in LCS message and concluded that it was out of WI scope. |
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## 2.2 UL-only positioning

The "Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – UL-only positioning" from R2-2203443 [2] is copied in Annex B. Note, only the UL-only part of the procedure in [2] is shown.

The following modifications are proposed (shown with change bars):

- Step 1b is deleted since the status in RAN3 is unclear. If RAN3 adds a new procedure, this would have to be captured in 38.305 later.

- Steps 6b, 8-10 are deleted. As described in [3], SRS configuration can only be delivered to the UE by RRC Release message.

- RACH/SDT details are deleted in Step 3 to align with DL-only description.

**Question 2:** Do you agree with the procedure description in Annex B to be send to SA2 as baseline for "Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – UL-only positioning"?

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| Company | Yes/No | Comments |
| Nokia | Yes | In step 1, we also delete the following sentence: “*The UE may be configured with CG-SDT or RA-SDT for small data transmission*”.  [Rap: deleted]  In step 9, should we say LMF sends the message to anchor gNB which forwards it to serving gNB?  [Rap: Changed by HW to "receiving gNB"  Step 10: Can RRC Release with suspendConfig be sent to UE already in RRC\_INACTIVE state?  [Rap: This should be per SDT (38.300):  Once initiated, the SDT procedure is either:  - successfully completed after the UE is directed to RRC\_IDLE (via *RRCRelease*) or RRC\_INACTIVE (via *RRCRelease or RRCReject*) or to RRC\_CONNECTED (via *RRCResume or RRCSetup*); or  Step 11: In the figure it says UL-PRS. Should be changed to UL-SRS  [Rap: Changed.] |
| Huawei, HiSIlicon | Yes | 1/ in step10, current RRC spec does not support the gNB to send DL Information Transfer with RRCRelease message. For this, actually, the network does not need to send the event report ACK to the UE together with SRS config. The LCS event report ACK can be sent before RRCRelease message as a subsequent SDT DL message.  [Rap: Changed in all Figures.] |
| Intel | Yes | We did not discuss with/without anchor relocation case. Therefore we should avoid to mention the details on this in the figure and also should not mention it in the LS.  [HW] Agree |
| vivo | Yes with comments | In step 3, analogous to the UL+DL positioning, the LCS Event Report shall include an embedded LPP Request Assistance Data message to request an UL-SRS. Then the LMF can configure it in step 5. The stage 3 enhancement of LPP is needed to support SRS configuration request for UL-Only positioning. |
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## 2.3 UL+DL positioning

The "Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – UL+DL positioning" from R2-2203443 [2] is copied in Annex C.

This is the sum of the DL and UL procedures in section 2.1 and 2.2, respectively.

**Question 3:**  Do you agree with the procedure description in Annex C to be send to SA2 as baseline for "Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT – UL+DL positioning"?

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| Company | Yes/No | Comments |
| Nokia | Yes | Some of our comments on Q1 and Q2 applies to this Q3 also.  [Rap; Applied the changes also here] |
| Huawei, HiSIlicon | Yes | Same comments are those for UL and DL. Also one question inlined in the bubble comment below. |
| Intel | Yes | We did not discuss with/without anchor relocation case. Therefore we should avoid to mention the details on this in the figure and also should not mention it in the LS.  [HW] Agree |
| vivo | Yes |  |
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## 2.4 LS to SA2

A draft LS (based on R2-2203444) is provided in the drafts folder for this email discussion. Please provide any comments on the draft LS in the Table below.

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| Company | Comments |
| Nokia | The LS is fine. One comment on the RRC state exposure to LMF agreement itself that is captured in the LS. Instead of being specific about UL and DL positioning, shouldn’t this have been about RRC\_INACTIVE positioning in general? |
| Huawei, HiSilicon | LS is fine in general. Additionally, we have added a question to RAN3 |
| Intel | We did not discuss with/without anchor relocation case. Therefore we should avoid to mention the details on this in the figure and also should not mention it in the LS.  In addition, it would be good to include below agreements if RAN3 is in CC.  Agreement:  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).  [HW] OK not to remove it from the LS in this version |
| vivo | Fine with the LS. |
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# 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. The embedded LPP PLI may include the *moreMessagesOnTheWay* flag [TS 37.355].

NOTE: The *moreMessagesOnTheWay* flag would be included when not all the location measurements obtained at step 2 can be included in the LPP PLI message.

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. If the receiving gNB is the same as the anchor gNB, either RA-SDT or CG-SDT can be performed; if the receiving gNB is different from the anchor gNB, only RA-SDT can be performed, and the network side may or may not change the anchor gNB from the last serving gNB to the receiving gNB.

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 form the receiving gNB to the last serving gNB via NG-AP message *RRC TRANSFER* as in TS 38.423. Subsequent downlink/uplink messages are also forwarded between last serving gNB to the receiving gNB via NG-AP message *RRC TRANSFER*.

5. If the *moreMessagesOnTheWay* flag was provided in step3, the UE sends the additional LPP PLI message segments in the SDT subsequent data transmission phase.

6. If step 5 occurred, the receiving gNB sends the LPP PLI message to the LMF (via serving AMF).

7. If step 3 did not include the *moreMessagesOnTheWay* flag or if step 3 did include the *moreMessagesOnTheWay* flag and once the *noMoreMessages* flag in an LPP PLI has been received, the LMF sends an SS Event Report Acknowledgement. The receiving gNB then provides the SS Event Report Acknowledgement to the UE at Step 7b via Subsequent DL SDT.

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

9. 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. If the receiving gNB is the same as the anchor gNB, either RA-SDT or CG-SDT can be performed; if the receiving gNB is different from the anchor gNB, only RA-SDT can be performed and the network side may or may not change the anchor gNB from the last serving gNB to the receiving gNB.

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 NG-AP message *RRC TRANSFER* as in TS 38.423. Subsequent downlink/uplink messages are also forwarded between last serving gNB to the receiving gNB via NG-AP 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. If the receiving gNB is the same as the anchor gNB, either RA-SDT or CG-SDT can be performed; if the receiving gNB is different from the anchor gNB, only RA-SDT can be performed and the network side may or may not change the anchor gNB from the last serving gNB to the receiving gNB.

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 NG-AP message *RRC TRANSFER* as in TS 38.423. Subsequent downlink/uplink messages are also forwarded between last serving gNB to the receiving gNB via NG-AP 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.