3GPP TSG RAN WG2 Meeting #119bis-e Draft R2-2210895

**Electronic meeting, Oct 10 – 19, 2022**

**Agenda item:** 6.11.1

**Source:** Intel Corporation

**Title:** Report of [AT119bis-e][408][POS] State change during positioning (Intel)

**Document for:**  Discussion and decision

# Introduction

This is the report of following offline discussion:

* [AT119bis-e][408][POS] State change during positioning (Intel)

Scope: Discuss the LS in R2-2209331 and related contributions (R2-2209611 / R2-2209610 / R2-2210119 / R2-2209437), conclude on whether the state transition needs to be supported, and draft a reply.

Intended outcome: Report and approvable LS

Deadline: Friday 2022-10-14 1000 UTC

Following documents are discussed in the offline discussion:

1. R2-2209331 LS on SRS-PosRRC-InactiveConfig configuration signalling (R3-225268; contact: Intel) RAN3
2. R2-2209610 UE RRC state transition during the positioning session for RAN3 LS (R2-2209331) Intel Corporation
3. R2-2209611 Draft Reply LS on SRS-PosRRC-InactiveConfig configuration signalling Intel Corporation
4. R2-2210119 Discussion on the LS on SRS-PosRRC-InactiveConfig configuration signalling Xiaomi
5. R2-2209437 Discussion on LS on SRS-PosRRC-InactiveConfig configuration signalling CATT

# Annex: companies’ point of contact

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| **Company** | **Point of contact** | **Email address** |
| Intel Corporation | Yi Guo | Yi.guo@intel.com |
| Xiaomi | Xiaolong Li | lixiaolong1@xiaomi.com |
| CATT | Jianxiang Li | lijianxiang@catt.cn |
| vivo | Xiang Pan | panxiang@vivo.com |

# Discussion

In RAN3 LS [1], RAN3 asked

“Regarding the deferred Low Power Periodic and Triggered 5GC-MT-LR procedures that RAN2 has defined for UL positioning measurements, RAN3 wonders whether a UE RRC state can be changed during the positioning session in Rel-17 (some example scenarios shown in Annex).”

Considering RAN3 already discussed potential impact to the procedure, Rapporteur suggest to focus the question directly, i.e. whether the UE RRC state can be changed during the positioning session in Rel-17.

[2], [4] and [5] discussed RAN3 question, and shown different opinion:

**Opinion 1 [2]: a UE RRC state can indeed be changed during the positioning session in Rel-17, i.e. Figures 1 and 2 in RAN3 LS R3-225268 are possible**

The reason provided in [2] is:

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| it should be left up network implementation the decision on when to move the UE to different RRC state, e.g.:   * The network may move a UE from RRC\_CONNECTED to RRC\_INACTIVE if the traffic is not that frequent, and/or the UE has power saving requirement;   + That’s the reason why the UE may be in RRC\_INACTIVE before event detected in Figure 6.7.4-1 of TS 23.273 [2];   + The same reason is also applicable for the Example 1, i.e. based on the UE’s traffic load (e.g. decrease of traffic load after event is detected), the network may move the UE to RRC\_INACTIVE to perform UL positioning;   **Observation 1: The network may move a UE from RRC\_CONNECTED to RRC\_INACTIVE after event is detected, e.g. if traffic load is decreased.**   * The network may move a UE from RRC\_INACTIVE to RRC\_CONNECTED for the cases, e.g. traffic load is increased for the UE, SDT is not configured, the message size exceeds the SDT limitation etc;   **Observation 2: The network may move a UE from RRC\_INACTIVE to RRC\_CONNECTED after event is detected, e.g. if traffic load is increased.** |

**Opinion 2 [4]: the scenario of UE RRC state change during positioning is not considered in R17.**

The reaons provided in [4] is:

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| **Observation 1: RAN2 hadn’t discussed the scenarios and procedures of UE RRC state change during the positioning session in R17.**  **Observation 2: There may be potential procedures, issues and enchantments if the scenario of UE state change during a positioning session is considered in R17.**  **Observation 3: It is not reasonable that the gNB decides to move the RRC connected UE into RRC inactive when the gNB still needs to send downlink data to the UE and a smart gNB should decide to keep the UE in the RRC connected in step 6.**  **Observation 4: The gNB can not configure the SRS to UE in the step 10 since the procedure described for steps 22-31 in clause 6.3.1 should be followed if the UE is not in RRC INACTIVE state when an event is detected.**  **Observation 5: If the gNB decides to move the UE to RRC CONNECTED in the step 10a, the gNB should generate the SRS configuration for RRC connected and send it to the LMF by NRPPa Positioning Information update message to indicate that the SRS configuration is changed.**  **In addition, the procedures in Figure 1 is not aligned with SA2 specifications (i.e. RRC Release message cannot be used for SRS configuration if UE is not in RRC\_INACTIVE state), and the procedures in Figure 2 is not valid (i.e. the gNB should send Positioning Information Update message to LMF after deciding sending UE to RRC\_CONNECTED state).** |

**Opinion 3 [5]: RAN2 recommend not performing state transition during positioning session, how to capture it is up to RAN3.**

The reason provided in [5] is:

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| In view of RAN2, the positioning session will be finished in magnitude of millisecond. However the judgement of RRC state is in magnitude of second. The demand for state transition during the positioning session is corner case. On the other hand, if the state transition is performed during the message flow, there will be signaling adjustment in Uu. |

**Discussion point 1: Regarding the deferred Low Power Periodic and Triggered 5GC-MT-LR procedures that RAN2 has defined for UL positioning measurements, could a UE RRC state be changed during a positioning session in Rel-17?**

***Option 1: yes, it is possible;***

***Option 2: No, state transition during a positioning session is not considered in Rel-17;***

***Option 3:No, state transition during a positioning session is forbidden;***

***Option 4: others?***

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| **Company’s name** | **Option 1, 2 or 3?** | **Comments, if any** |
| Intel | Option 1 | The signalling procedures for changing UE RRC state from one to another have been specified from the beginning but we have never specified at which specific conditions the network is “only” allowed to change RRC state of a UE. The network may decide to move a UE to different RRC state due to various reasons (e.g. load, etc) and the positioning task is just one of the possible services on top.  Regarding “**the procedures in Figure 1 is not aligned with SA2 specifications (i.e. RRC Release message cannot be used for SRS configuration if UE is not in RRC\_INACTIVE state),** ”, SA2 is not the right WG to discuss whether RRC Release message can be used for SRS configuration if UE is not in RRC\_INACTIVE state. SA2 figure is just to show a potential procedure.  Moreover, not every single possibility is captured in stage-2 and a statement that a certain procedure follows doesn't mean that UE RRC state cannot be changed during the session. For example, it is typical that our stage-2 doesn't capture failure procedures (e.g. HO failure, etc.). This does not mean that HO shall not be failed no matter what. Therefore the statement on “figure 1 is not aligned with SA2 spec” is not valid.  Regarding**” the procedures in Figure 2 is not valid (i.e. the gNB should send Positioning Information Update message to LMF after deciding sending UE to RRC\_CONNECTED state).”**  The gNB may move the UE to RRC\_CONNECTED when receive the resume request from UE. And please note that the figures in the LS is just for some example scenarios for the understanding of the issue, showing only the key steps relevant for discussions. The figures are not meant to have all the complete steps to be captured into specifications. In addition, the LS is not asking whether every single steps of the figures are correctly listed or not. The LS is simply asking whether a UE RRC state can be changed during the positioning session. As mentioned above, we should focus on the question directly.  Regarding the statement “However the judgement of RRC state is in magnitude of second. ”, to our understanding, it is pure network implementation, and we should avoid to judge the internal box processing of a gNB. |
| Xiaomi | Option 2 | We understand that the change of UE state is up to gNB implementation, however, RAN2 hadn’t discussed scenarios and positioning procedures for changing UE RRC state during the positioning session in Rel-17, so from RAN2 perspective, we suggest that state transition during a positioning session is not considered in Rel-17.  From technical point, we think there are some issues for the procedures in the LS from RAN3.  For the figure 1, the step 10 is not correct since the RRC release can’t be used to configure the SRS configuration since the step 2 in Figure 6.7.4-1 (TS23.273) said that if the UE is not in RRC INACTIVE state when an event is detected at step 22 or step 31 in clause 6.3.1, then the UE follows the procedure described for steps 22-31 in clause 6.3.1 to report the event to the LMF and to the LCS Client or AF. That means the UE follows the RRC connected procedure if the UE is not in RRC INACTIVE state when an event is detected. Actually, the procedure for RRC inactive UE positioning is defined by RAN2, thus the figure 1 is not aligned with RAN2 agreements.  Regarding the figure 2, we don’t think there is a problem that the in step 10a since gNB should generate the SRS configuration for RRC connected and send it to the LMF by NRPPa Positioning Information update message which indicates that a change in the SRS configuration has occurred.  Even if the figures in the LS are for information, we think RAN2 also can provide RAN2’s understanding for the example procedures.  Besides, other possible procedures may exist and may have impact on specification. At least, we should clearly state that RAN2 haven’t discussed the state transition during a positioning session in R17, which may have potential spec impact. |
| CATT | Option 1 | We observed that it is possible that there is a state transition during a positioning session, e.g. from RRC\_INACTIVE to RRC\_CONNECTED. For example, when there is an emergency call originated from the UE, then the state transition from RRC\_INACTIVE to RRC\_CONNECTED happens at once even during a positioning session.  From this point of view, RAN2 may further discuss the potential impacts to RAN2 specifications next meeting. |
| vivo | Option 1 | RAN2 only considered the RRC\_INACTIVE positioning without RRC state transition in Rel-17. The RRCRelease message was enhanced to include the configuration for SRS transmission in RRC\_INACTIVE. However, there is no restriction that the message can only be sent via SDT and cannot be sent when releasing the UE from CONNECTED to INACTIVE.  Besides, we think example 1 in the LS is beneficial for periodical deferred MT-LR. Specifically, the LMF may include the UE Reporting Information of deferred MT-LR in the POSITIONING INFORMATION REQUEST message, which includes the amount and interval of event reports. If the interval is quite long, e.g., 64 seconds, then the gNB can decide to release the UE to RRC\_INACTIVE with the SRS configuration.  In general, whether the RRC state can be changed is up to gNB implementation and seems inevitable as the service situation may change during the positioning session. |
| Nokia | Option 2 | It is unclear what the “No” in Option 2 refers to. Whether it is “No it is not possible for RRC state to change during positioning session” OR “No, RAN2 did not consider state transition in Rel-17”. We assume it is the latter and hence choose Option 2.  It is true that RRC state control is up to gNB implementation but, a gNB also must take into account an ongoing positioning session and how it handles that should also be up to NW implementation then. It is also true RAN2 did not discuss the scenarios identified by RAN3 and we can see that addressing this now would result in additional functional changes to a frozen Rel-17. We also tend to agree that this is a corner case that need not be addressed now in Rel-17. For something that is up to implementation, it is strange for RAN2 to recommend a particular option. |
| Huawei, HiSilicon | Option 1 |  |
| Ericsson | Option 1 | From Inactive to connected can happen for various reasons.  But for connected to inactive could be controlled by NW to some extent. |
| Qualcomm | Option 1 | The RAN3 understanding of "positioning session" is not quite clear, but a RRC state transition should happen already between Steps 1 and 2 of the "Low Power Periodic and Triggered 5GC-MT-LR Procedures" for UL-only positioning as shown in Figure 6.7.4-1 of TS 23.273 and for UL+DL positioning as shown in Figure 6.7.5-1 of TS 23.273.  But also during the "Event Reporting Phase" (Steps 3-13 in Figure 6.7.4-1 of TS 23.273 and Steps 3-20 in Figure 6.7.5-1 of TS 23.273 ) a RRC state transition can occur at any time.  It seems RAN3's understanding of "positioning session" is only the UL-SRS configuration signalling, but also here a RRC state transition could happen at any time (e.g., as shown in Figures of the LS). It is unclear why RAN3 needs RAN2 guidance on these aspects, which appear rather obvious. |
| Apple | Option 1 | This is entirely up to gNB, from standards perspective it is possible. |

**Summary: 9 companies provided inputs.**

All companies that RRC state control is up to gNB implementation. 7 companies think that state transition during a positioning session is possible for various reasons. However two companies think RAN2 did not discuss state transition in Rel-17 and therefore it should not be considered in Rel-17.

Therefore Rapporteur propose:

**Proposal : RAN2 understanding is that it is up to gNB implementation on when to change UE RRC state, and RRC state transition during a positioning session is possible for various reasons. There is no restriction in RAN2 on this although RAN2 have not discussed this in Rel-17.**

**Discussion point 2:**  If answer to question 1 is No, i.e. If during a positioning session, RRC state change between RRC\_CONNECTED and RRC\_INACTIVE shall not be allowed, where should we capture the restriction?:

***Option 1: Capture in stage 2, i.e. TS38.305;***

***Option 2: Leave it up to RAN3;***

***Option 3: others?***

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| **Company’s name** | **Option 1, 2 or 3?** | **Comments, if any** |
| Xiaomi | Option 2 | We don’t need to capture anything from RAN2 perspective, we just state the discussion situation in Rely LS. RAN3 could determine whether to enhance RAN3 spec to support UE RRC state transition during the positioning session based on the discussion situation in RAN2. |
| Nokia | Option 3 | RAN2 does not have to address the scenarios identified by RAN3 or update any RAN2 Rel-17 specifications for now. Can be addressed in a future release, if needed. |
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**Discussion point 3:**  If the answer to question 1 is yes, any comments on the draft reply to RAN3 LS?

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| RAN2 would like to thank RAN3 for the LS on SRS-PosRRC-InactiveConfig configuration signalling.  Regarding RAN3 question “whether a UE RRC state can be changed during the positioning session in Rel-17 (some example scenarios shown in Annex).”:  **Answer**: RAN2 understanding is that “The network may move a UE to different RRC state based on traffic situation, power saving requirement, SDT availability, etc, therefore a UE RRC state can be changed during the positioning session in Rel-17, i.e. RRC state transition shown in Figures 1 and 2 in RAN3 LS are possible.”  **2. Actions:**  **To RAN3 group.**  **ACTION:** RAN2 respectfully ask RAN3 to take into account of RAN2 feedback in their further work. |

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| **Company’s name** | **Comments, if any** |
| vivo | I’m not sure whether the network behavior is in RAN2 scope and prefer to remove ‘The network may move a UE to different RRC state based on traffic situation, power saving requirement, SDT availability, etc, therefore’ |
| Nokia | We think it is sufficient for RAN2 to answer as follows:  **Answer**: RAN2 understanding is that it is up to gNB implementation how and when it decides to move the UE to RRC\_INACTIVE. RAN2 have not discussed during Rel-17 positioning work about these RRC state transitions while there is an ongoing positioning session. RAN2 does not plan to address in Rel-17 these scenarios described in the RAN3 LS as the specification is now frozen. |
| Qualcomm | O.K. with the original Proposal, but also with Nokia’s Proposal with the following addition: The last sentence “RAN2 does not plan to address…” should be deleted, since RAN3 did not ask for any RAN2 spec modifications. RAN3 should be aware that Rel-17 is frozen anyhow. In addition, ‘RRC\_INACTIVE’ should be replaced by ‘RRC state transition’, since I understand this is the original question from RAN3. |
| Apple | Agree with Nokia’s version |
| Xiaomi | We are also fine with the Nokia’s version. |

**Summary:**

Try to update the answer based on comments:

**Answer**: RAN2 understanding is that “it is up to gNB implementation on when to change UE RRC state, and RRC state transition during a positioning session is possible for various reasons.” There is no restriction in RAN2 on this although RAN2 have not discussed this in Rel-17.

The updated answer is also shown in the draft LS.

**Discussion point 4:**  If the answer to question 1 is no, any comments on the draft reply to RAN3 LS?

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| RAN2 thanks RAN3 for their LS on SRS-PosRRC-InactiveConfig configuration signalling. In view of RAN2, the positioning session will be finished in magnitude of milliseconds. However the judgement of RRC state is in magnitude of seconds. The demand for state transition during the positioning session is corner case. On the other hand, if the state transition is performed during the message flow, there will be signaling adjustment in Uu.  It seems meaningless to support this. RAN2 recommend not performing state transition during positioning session in Rel-17, how to capture it is up to RAN3.  **2. Actions:**  **To WG RAN3:**  **ACTION:** RAN2 thanks RAN3 for their LS on SRS-PosRRC-InactiveConfig configuration signalling. RAN2 recommend not performing state transition during positioning session, how to capture this is up to RAN3. |

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| **Company’s name** | **Comments, if any** |
| Xiaomi | We suggest to provide the answer to RAN3 as below:  **Answer**: RAN2 understanding is that the network may move a UE to different RRC state based on network implementation. However, RAN2 didn’t discuss scenarios and positioning procedures for changing UE RRC state during the positioning session in Rel-17 and there may be potential spec impact for supporting UE RRC state transition during positioning session. Moreover, RAN2 think the example procedures are not valid. |
| Nokia | We think it is sufficient for RAN2 to answer as follows:  **Answer**: RAN2 understanding is that it is up to gNB implementation how and when it decides to move the UE to RRC\_INACTIVE. RAN2 have not discussed during Rel-17 positioning work about these RRC state transitions while there is an ongoing positioning session. RAN2 does not plan to address in Rel-17 these scenarios described in the RAN3 LS as the specification is now frozen. |
| Qualcomm | How is this action to RAN3 supposed to work:  "RAN2 recommend not performing state transition during positioning session"  Should the UE stay in RRC\_CONNECTED all the time? |
| Xiaomi | We are also fine with the Nokia’s version. |

# Summary report and proposals

**Proposal : RAN2 understanding is that it is up to gNB implementation on when to change UE RRC state, and RRC state transition during a positioning session is possible for various reasons. There is no restriction in RAN2 on this although RAN2 have not discussed this in Rel-17.**

# Reference

1. R2-2209331 LS on SRS-PosRRC-InactiveConfig configuration signalling (R3-225268; contact: Intel) RAN3
2. R2-2209610 UE RRC state transition during the positioning session for RAN3 LS (R2-2209331) Intel Corporation
3. R2-2209611 Draft Reply LS on SRS-PosRRC-InactiveConfig configuration signalling Intel Corporation
4. R2-2210119 Discussion on the LS on SRS-PosRRC-InactiveConfig configuration signalling Xiaomi
5. R2-2209437 Discussion on LS on SRS-PosRRC-InactiveConfig configuration signalling CATT