3GPP TSG-RAN WG2 #116bis-bis R2-22xxxxx

Electronic meeting, 2022-01-17 - 2021-01-25

**Agenda item: 8.11.3**

**Source: Ericsson**

**Title: [AT116bis-e][617][POS] Remaining issues on positioning in RRC\_INACTIVE (Ericsson)**

**Document for: Discussion and Agreement**

# 1 Introduction

This document is to kick off the following email discussion:

* [AT116bis-e][617][POS] Remaining issues on positioning in RRC\_INACTIVE (Ericsson)

Scope: Discuss the remaining prioritised proposals from R2-2201068.

Intended outcome: Report to CB session

Deadline: Friday 2022-01-21 1600 UTC

The agreements so far in this area in RAN2#116bis-e have been provided below.

Agreements:

Proposal 1 (modified) To support UL positioning in RRC\_INACTIVE, reuse SDT TA timer mechanism (with a separate timer with similar function) for TA validation.

Proposal 2 To support UL positioning in RRC\_INACTIVE, reuse RSRP change based solution for TA validation

Proposal 3 The SRSp configuration is considered as invalid if TA is not valid.

Proposal 4 When cell reselection is performed and UE initiates RRC resume procedure to the cell which is different from the cell in which the SRSp is configured, the TA timer configuration for SRS should be released.

Proposal 5 (modified) The SRSp configuration is released when the UE sends RRCResumeRequest to a cell other than the cell where it is released to RRC\_INACTIVE state.

Proposal 6 BWP info together with the SRS-PosResourceSet IE is included in RRCRelease message for SRS configuration in RRC\_INACTIVE.

Proposal 7 RAN2 confirms RAN1 agreement that UE may be configured to transmit UL SRS for Positioning where the following parameters are additionally configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length.

Proposal 8 Add the restriction on AP SRS in the field description of resourceType “The aperiodic is not applicable for the UE in RRC\_INACTIVE.”.

FFS if the TA timer configuration is invalidated upon any cell reselection.

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).

# 2 Contact Information

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| Company | Contact: Name (E-mail) |
| Huawei, HiSilicon | Yinghao Guo (yinghaoguo@huawei.com) |
| Apple | Sasha Sirotkin <ssirotkin@apple.com> |
| Qualcomm | Sven Fischer (sfischer@qti.qualcomm.com) |
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# 3 Discussions

## 3.1 Stage 2 Details

### 3.1.1 For UL Positioning procedure when to provide Event Report Ack

As provided comparison in [12] for UL-only positioning the difference between the Procedure shown in Figure 1 [12] and the Procedure 2 (R2-2108383, Huawei et al.) is essentially only when the LCS Event Report Acknowledgement is provided to the UE. For Procedure 2, the LCS Event Report Acknowledgement is sent immediately after the LCS Event Report has been received by an LMF.

For the Procedure proposed in Figure 1 [12], the LCS Event Report Acknowledgement is provided once the UL-positioning has been successfully configured at the UE and TRPs. This allows the procedure more reliably be completed in RRC\_INACTIVE state.

[7] mentions that “it should be emphasized that the step 5 (event report ack) and 7 (POSITIONING INFORMATION REQUEST) are not strictly serialized. Step 7 does not necessarily need to be sent after Step 5. When the gNB receives POSITIONING INFORMATION REQUEST, it would know that the UE is performing RRC\_INACTIVE uplink positioning and would not send *RRCRelease* to the UE at that immediate moment.

There can be two alternatives to solve this deadlock:

* A note can be added in procedure proposed by [7] saying Step 5 may appear after step 7.
* It is agreed that event report ACK is provided once the UL-positioning has been successfully configured at the UE and TRPs

Question 1: Which one of the below options on when to provide Event Report Ack.

1. A note can be added in procedure proposed by [7] saying Step 5 may appear after step 7
2. It is agreed that event report ACK is provided once the UL-positioning has been successfully configured at the UE and TRPs

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| Company | Option A/B | Comments |
| Huawei, HiSilicon | OptionA | Under the framework of [6] event report ACK should be sent after the LMF receives the event report from the UE.  The original comment is as follows. The point is that the LMF can have a proper implementation to ensure that the network does not wrongly send an RRCRelease message to the UE before the LMF sends SRS configuration request (Positioning Information Request) to the serving gNB.   |  | | --- | | NOTE: Step 6 may not necessarily have to be performed after Step5. By proper implementation in the LMF, gNB can be timely acknowledged on the UE’s uplink positioning procedure by receiving POSITIONING INFORMATION REQUEST. | |
| Apple | Option A | Agree with Huawei |
| Qualcomm | Option B | Following the principles of the "Low Power Periodic and Triggered 5GC-MT-LR Procedures" in section 6.7 of TS 23.273, and the DL-only principles captured as baseline at RAN2#115-e, the Event Report ACK should normally be sent when the procedure is completed.  This would unify UL-only, DL-only and UL+DL. I.e., the SDT begins with an Event Report, and ends with an Event Report ACK.  However, if an implementation wants to send the Event Report ACK earlier, it is free to do so. Therefore, if a NOTE is needed, it should be the the other way around: The Event Report ACK may be provided before Step 13. However, this would mean that SDT is completed with the Event Report ACK, since there is no more data in the UE buffer to send and SRS configuration may have to happen in RRC\_CONNECTED state, as discussed in R2-2110823. |
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### 3.1.2 Assistance Data Delivery

[7] provides the view that how can the highlighted agreement be realized as there is no procedure to deliver this PRS to the UE during the SDT procedure.

Agreement:

Proposal 4 (modified): For positioning in RRC\_INACTIVE state, the positioning assistance data can be delivered to UE through the following ways:

- positioning system information, i.e. posSIB;(12/13)

- pre-configure assistance data when UE in RRC\_CONNECTED state;(11/13)

- send to UE in RRC\_INACTIVE during ongoing SDT procedure. (9/13)

Hence, it is proposed to discuss further which of the two options

* **Option1: Revert the previous agreement: positioning assistance data cannot be delivered to the UE in RRC\_INATIVE during SDT procedure**
* **Option2: Add the positioning assistance data delivery during SDT procedure to the stage2 procedure**

Question 2: Which option should RAN2 to select?

Option A: to revert the agreement to provide AD during ongoing SDT procedure

Option B: add the procedure in stage2.

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| Company | Option A/B | Comments |
| Huawei, HiSIlicon | OptionB | It is possible that the UE moved far away from its original location where the PRS configuration is delivered. So it is beneficial to allow the LMF to update the PRS AD when event is triggered. This is aligned with the current stage2 procedure for deferred MT-LR in TS 23.273 |
| Apple | Option B | Agree that such procedure is beneficial |
| Qualcomm | Modified Option B | As agreed, any LCS and LPP message can be transported using SDT. The additional assistance data request is of course possible, but usually not described in the overall positioning procedures (e.g., also not described in RRC\_CONNECTED). Instead, we propose to describe the LPP and LCS PDU transfer in RRC\_INACTIVE in 38.305, analogous to section 6.4.2 (and in R2-2108383). |
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[14] mention to revert the WA: pre-configure positioning SRS in RRC\_CONNECTED (9/13) that was made in RAN2#116-e.

Agreement:

Proposal 6: SRS for positioning in RRC\_INACTIVE state can be configured through the following ways:

- RRCRelease with SuspendConfig (13/13)

- SDT DL RRC message, i.e. Msg B / Msg 4 of RA-SDT (9/13)

- WA: pre-configure positioning SRS in RRC\_CONNECTED (9/13)

FFS detailed signalling for these approaches.

The paper says it is unclear as when the gNB will provide such configuration. UL SRS configuration for inactive depends upon several factors such as TA validity timer, RSRP thresholds, TA value and UL power to use for UL SRS Tx. It is beneficial if these configurations are provided as close as possible when UE is released to Inactive from connected mode. Further, there is already provision to provide UL SRS configuration via RRC Release message; in lieu of that and to minimize RRC specification impacts; there is no as such need to support pre-configuration of positioning SRS in RRC\_CONNECTED.

Question 3: Is the support of pre-configuration of positioning SRS in RRC\_CONNECTED needed?

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| Company | Yes/No | Comments |
| Huawei, HiSIlicon | No | Pre-configuring SRS can be studied in the future releases |
| Apple | No |  |
| Qualcomm | Yes | It is not crystal-clear what pre-configuration means. The Event Report may be sent in RRC\_CONNECTED (e.g., if SDT is not possible/allowed/supported), but the SRS config can still be provided when released to RRC\_INACTIVE (if the UE supports SRS transmission in RRC\_INACTIVE). This means in my understanding SRS configuration is (pre-)configured in RRC\_CONNECTED for use in RRC\_INACTIVE. |
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### 3.1.3 Stage 2 Specification

#### 3.1.3.1 How to capture the stage 2 details in specification

There are some proposals in this direction on how to specify DL, UL and UL+DL positioning in RRC Inactivate mode

1. It is not necessary to introduce the new positioning procedures in stage 2 specification for RRC inactive UE positioning [8]
2. Send LS to SA2 to let SA2 decide the spec impacts [12], [3]
3. Capture in TS 38.305 [12]

[12] further allows the UE to include in the LCS Event Report 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.

Question 4: How to capture the stage 2 details in specification

1. It is not necessary to introduce the new positioning procedures in stage 2 specification for RRC inactive UE positioning [8]
2. Send LS to SA2 to let SA2 decide the spec impacts [12, 3]. Use [R2-2200961] as baseline
3. Capture in TS 38.305 [12]

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| Company | A/B/C | Comments |
| Huawei, Hislicon | C | We think the stage2 procedure should be captured in the 38305 since it is very hard for SA2 spec to capture up to the details of RRCRelease with SRS configuration, etc. This is the scope of RAN stage2 to specify |
| Apple |  | No strong view, but we are not opposed to having it in 38.305 |
| Qualcomm | Other | The deferred MT-LR procedures can be send to SA2 for TS 23.273. The LPP/LCS PDU transport (baseline from RAN2#115-e) should be captured in TS 38.305.  However, we would also be O.K. to describe the deferred MT-LR procedures in TS 38.305. |
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#### 3.1.3.2 Baseline CR

If option C in section 3.1.3.1 is the preference, then companies are requested to provide further details

Question 5: If there is consensus to capture the stage 2 details in TS 38.305 then the baseline can be taken from [6] (Huawei et al.) paper.

Answer: Agree/Disagree

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| Company | Agree/Disagree | Comments |
| Huawei, HiSilicon | Agree | The comparison of the two solutions have been summarized by the following table. Due to the lack of time, we think it is better for R2 to support the solution in [6] as baseline. As can be seen in the comparison, solution 2.2 (in [6]) has no other stage3 impacts than supporting SRS transmission in RRC\_INACTIVE, which is common for all the solution for supporting UL positioning in RRC\_INACTIVE. Hence, we think the solution [6] has less spec impacts.  Features that have been proposed in [12] can be discussed in the future releases.  C:\Users\y00397895\AppData\Roaming\eSpace_Desktop\UserData\y00397895\imagefiles\originalImgfiles\FA1B23D6-0008-4BB9-B2A7-1CC4CDDE1ADB.png |
| Qualcomm | Disagree | The compromise proposal in [12] has also no additional Stage 3 impacts and allows the same UE procedure/behaviour independent on the positioning method, and the same NW procedures as in RRC\_CONNECTED. In particular, there is no need to send a LPP Request Location Information each time an (e.g., periodic) event is triggered, and the measurement reporting phase can be the same as in DL-only.  NOTE, Huawei compared and commented above on Qualcomm's original proposal in R2-2110823 but does not consider the compromise proposal in [12] submitted to this meeting. We think the procedure described in section 3 of [12] overcomes the problems of [6], in particular for UL+DL.  The compromise in [12] uses two Event Reports, one for UL and one for DL, where the DL part is the same as for DL-only methods. Therefore, UL+DL can be the "sum" of UL-only and DL-only, and the general SDT procedure is the same for all positioning methods and the NW procedures are the same as in RRC\_CONNECTED. |
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#### 3.1.3.3 Common flow or separate

[12] shows that UL and UL+DL positioning procedures can be depicted using one common flow whereas [7] captures using two separateflows**.**

Question 6: If there is consensus to capture the stage 2 details in TS 38.305 then RAN2 to decide whether a common flow is used to depict UL and UL+DL positioning or separate flow is used.

Option A: Common

Option B: Separate

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| Company | A/B | Comments |
| Huawei, HiSIlicon | A | OptionA is better from the spec impacts perspective but it would make the spec less readable.  OptionB would result in a lot of redundancies in the description in the spec.  We prefer OptionA. We think multi-RTT can include all the signalings while for UL/DL, some of the steps can be omitted |
| Apple | A | If we are to capture this flow, a common one is better |
| Qualcomm | B | No strong view, but since we currently have separate procedures for DL, UL, and UL+DL in 38.305, slightly prefer B.  If A is preferred, it should be a common procedure for DL-only, UL-only, and UL+DL. Not quite clear why UL+DL should be combined, but DL-only should be kept separate. |
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#### 3.1.3.4 LCS Event Report with an embedded UL-SRS Request for Multi-RTT positioning

Question 7: If there is consensus to capture the stage 2 details in TS 38.305 then RAN2 to decide whether UE can include in the LCS Event Report 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.

Option A: Yes, agree for such inclusion

Option B: No, not needed

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| Company | A/B | Comments |
| Huawei, HiSilicon | Option B | There is no need for the UE to request the positioning method to LMF, by requesting the AD for ul-SRS. The positioning method adopted should be decided by LMF as what has been done today.  Also, SRS configuration is configured to the UE by RRC, so it is not clear why we use LPP to request SRS.  The above two points means major shift of paradigm so we think it is not needed. |
| Apple | Option B |  |
| Qualcomm | A | This is already Rel-16 functionality. If a UE is configured with Multi-RTT (e.g., in the deferred MT-LR preparation phase), but has no SRS (e.g., when the periodic event is triggered), it may send a LPP *NR-Multi-RTT-RequestAssistanceData* with *nr-AdType-r16* set to ' ul-srs'.  And all UE-triggered LCS messages can have up to 3 LPP PDUs embedded (according to the 3 LPP transaction types defined); see e.g. 24.080.  Therefore, as already mentioned in Question 5, there are no Stage 3 impacts, other than the Event Report may be sent using SDT. |
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#### 3.1.3.5 LPP PDU and LCS Message Transfer

[12] further proposed; that the the LPP PDU and LCS message transfer procedures with SDT in RRC\_INACTIVE state are used as baseline. Since Stage 2 does currently not support LPP PDU and LCS message transfer in RRC\_INACTIVE state, the procedures should be captured in Stage 2 TS 38.305.

Question 8: [RAN2 to decide the need to capture LPP PDU and LCS message transfer procedures with SDT in RRC\_INACTIVE state in Stage 2 TS 38.305 [8].](#_Toc93136447)

Option A: Yes, agree to capture in TS 38.305

Option B: No, not needed

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| Company | A/B | Comments |
| Huawei, HiSilicon | OptionA | Transporting LPP/LCS message with SDT is new to the spec. it is better to give a stage2 description on these with the new UL/DL inactive positioning. |
| Apple | Maybe | No strong view; maybe a note would be sufficient? |
| Qualcomm | A | See also our comments to Questions 4. |
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## 3.2 Segmentation

[14] mentions that the LPP data should not be segmented by LPP layer to fit the content for using SDT. Segmentation in LPP is defined to overcome NAS limitations. It is function of RLC to perform segmentation based upon TBS.

[9] mentions the issue on the LPP segmentation considering SDT operation was also discussed in the last RAN2 #116-e meeting and prefers to select Option 1.

* **Option 1: The message size threshold for LPP segmentation is up to UE implementation and has no specification impact in RAN side.**
* **Option 2: The LMF provides segmentation configuration information to the UE for ensuring suitable LPP segmentation in RRC\_INACTIVE.**

Question 9: RAN2 to decide whether LPP Segmentation violates any architectural constrains (application layer segmenting data to enable a certain transport selection by lower layer) and if this should be allowed. Which of the option is preferred?

* **Option A: It is not allowed that LPP layer segments data to enable a certain transport selection by lower layer**
* **Option B: The message size threshold for LPP segmentation is up to UE implementation and has no specification impact in RAN side.**
* **Option C: The LMF provides segmentation configuration information to the UE for ensuring suitable LPP segmentation in RRC\_INACTIVE.**

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| Company | A/B | Comments |
| Huawei, HiSilicon | OptionB | We agree that there is no segmentation functionality in the NAS layer. We also prefer not to change the current UE behavior since it is hard for the LMF to give a reasonable size for the threshold of LPP segmentation. |
| Apple | Option B | Prefer to leave this for UE implementation |
| Qualcomm |  | Although, we prefer Option C, no further action is needed in this Release. The agreement from RAN2#115-e still holds.  Note, Option C is already supported in LPP for NB-IoT and eMTC, where the LMF can either provide the *MessageSizeLimitNB-r14* in *CommonIEsRequestLocationInformation*, or restrict the number of measurements to be reported in *OTDOA-RequestLocationInformation* (*maxNoOfRSTDmeas-r14*). |
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## 3.3 Scope of RRC Inactive

[1] proposes to support all location service types in SDT active period including MT-LR, MO-LR, NI-LR and deferred MT-LR.

Question 10: Which service types can be supported using SDT active period?

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| Company | List service types to be supported | Comments |
| Huawei, HiSilicon | Deferred MT-LR | For the other types, we may not have sufficient time for the discussion in R17. We can leave it for further releases. |
| Apple | Deferred MT-LR | Agree with Huawei that given the time constraints that is probably the only option |
| Qualcomm | Deferred MT-LR | We only see a user case for deferred MT-LR as described in section 6.7 of TS 23.273. However, the previous RAN2 agreements that any LPP and LCS message can be transported in RRC\_INACTIVE still holds. |
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[13], [15] provides Observation that UE-assisted DL NR E-CID measurements should be supported in RRC\_INACTIVE state at least in the case of SS-RSRP and SS-RSRQ measurements.

Question 11: Whether support of RRC\_INACTIVE reporting of RRM measurements along with other DL-based positioning methods is preferred?

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| Company | Yes (support): No (do not support) | Comments |
| Huawei, HiSilicon |  | We think DL E-CID can be beneficial and there might not be stage3 changes needed for this. However, the UE needs to support R16 eDCCA in order to report the RRM measurements and the application scenario for this is thus quite limited. |
| Apple |  | What’s the specification impact of this proposal? |
| Qualcomm |  | Similar to our response to Question 7, this is Release-16 functionality (assuming RRM means E-CID). It is up to the LMF which positioning method(s) to request in the deferred MT-LR preparation phase and depends on which measurements can be supported in RRC\_INACTIVE by RAN1/4. |
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## 3.4 State Transition

[1] expresses the need for network to give UE an indication on whether to continue transmitting the periodic SRS in RRC\_INACTIVE state for power savings. The indication can be a 1 bit parameter with value 0 or 1. with this indication, UE may follow NW’s guidance on transmitting SRS efficiently.

[14] mentions UE UL SRS configuration applicability in various RRC modes should be discussed; when UE states Transition while configured to transmit UL SRS. Can UE continue UL SRS Tx that was configured for inactive mode when UE switches from Inactive mode to Connected mode.

Question 12: RAN2 to discuss whether UE UL SRS configuration provided in one mode is applicable in other

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| Company | Yes (applicable): No (no needs to be released) | Comments |
| Huawei, HiSilicon | No | Based on the current stage2 that has been proposed, the above enhancements are not needed. We also think the current proposal is too generic that more details needs to be given |
| Apple | No |  |
| Qualcomm |  | This seems RAN4 business. |
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Question 13: RAN2 to decide further (provided that UE UL SRS configuration in one mode is applicable in other; i.e the answer selected to question 12 is Yes); then whether an indication can be used from NW to UE to support such continuity.

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| Company | Yes (UL SRS can be continued and NW indication is needed): No (no need for such indication) | Comments |
| Huawei, HISIlicon | No |  |
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# 4 Conclusion

Based on the discussion in the previous sections we propose the following:

# 5 References

[1] R2-2200257 Discussion on positioning in RRC INACTIVE state ZTE discussion

[2] R2-2200280 Support of UL&UL+DL positioning in RRC\_INACTIVE Intel Corporation discussion Rel-17 NR\_pos\_enh-Core

[3] R2-2200295 Impact on SA2 with DL NR positioning in RRC\_INACTIVE CATT, Ericsson discussion Rel-17 NR\_pos\_enh-Core

[4] R2-2200296 Discussion on UL NR Positioning in RRC\_INACTIVE state CATT discussion Rel- 17 NR\_pos\_enh-Core

[5] R2-2200327 Discussion on positioning in RRC\_INACTIVE vivo discussion Rel-17 NR\_pos\_enh-Core

[6] R2-2200424 Way-forward for RRC\_INACTIVE positioning Huawei, CATT, China Unicom, CMCC, Fraunhofer, Futurewei, HiSilicon, Intel Corporation, Spreadtrum Communications, OPPO, VIVO, Xiaomi, ZTE Corporation discussion Rel-17 NR\_pos\_enh-Core

[7] R2-2200425 Remaining issues on RRC\_INACTIVE DL Postioning Huawei, HiSilicon discussion Rel-17 NR\_pos\_enh-Core

[8] R2-2200710 Discussion on positioning for UE in RRC Inactive Xiaomi discussion

[9] R2-2200731 Discussion on the measurement reporting in RRC\_INACTIVE Samsung discussion Rel-17 NR\_pos\_enh-Core

[10] R2-2200781 Discussion on Positioning in RRC\_INACTIVE state OPPO discussion Rel-17 NR\_pos\_enh-Core

[11] R2-2200957 Remaining Details for RRC\_INACTIVE Positioning in Uplink Fraunhofer IIS; Fraunhofer HHI discussion Rel-17 R2-2110249

[12] R2-2200963 Remaining issues for positioning of UEs in RRC\_INACTIVE State Qualcomm Incorporated discussion

[13] R2-2200989 Remaining aspects on RRC\_INACTIVE Positioning Lenovo, Motorola Mobility discussion Rel-17

[14] R2-2201065 Discussion on RRC Inactive mode Positioning Ericsson discussion Rel-17

[15] R2-2201186 Discussion on Positioning in RRC INACTIVE state InterDigital, Inc. discussion Rel- 17 NR\_pos\_enh-Core

[16] R2-2201528 Positioning in RRC\_INACTIVE Nokia Germany discussion Rel-17