**3GPP TSG-RAN WG2 Meeting #113-eR2-210xxxx**

**Electronic, 25th Jan– 05th Feb, 2021**

**Source: Huawei, HiSilicon**

**Title: [AT113-e][609][POS] Continued discussion of positioning in idle/inactive (Huawei)**

**Agenda item: 8.11.2.2**

**Document for:** **Discussion and Decision**

Introduction

During RAN2#113-e, the following email discussion has been planned for positioning in IDLE/INACTIVE.

* [AT113-e][609][POS] Continued discussion of positioning in idle/inactive (Huawei)

Scope: Continue discussion of the issues from R2-2101230, and converge to an agreeable TP, taking as a baseline the principle that positioning in inactive is supported as recommended by RAN1. R2-2101229 to be taken into account.

Intended outcome: Endorsable TP

Deadline: Tuesday 2021-02-02 1200UTC

In this email discussion, first, we would have yet another review for the related agreements made in RAN1 on IDLE/INACTIVE positioning during the SI phase and its impacts on RAN2; second, we proceed to the text proposal for the easy agreements made in [POST112-e][609]; and finally, we continue the discussion for the “to further discuss” part of the proposals in [POST112-e][609].

Contact Information

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# RAN1 agreement on IDLE/INACTIVE positioning

In the following, the agreements in RAN1 on IDLE/INACTIVE positioning would be reviewed by observations.

RAN1#102e

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| Agreement:   * NR positioning for Ues in RRC\_IDLE state and Ues in RRC\_INACTIVE state will be investigated in Rel-17, including the benefits on latency, network/UE efficiency and UE power consumption * FFS: which positioning methods to be supported, e.g., DL positioning, UL positioning, DL+UL positioning and/or Multi-RTT * FFS: the details of how to enable the UE positioning in RRC\_IDLE state and RRC\_INACTIVE state   + Reference signals (e.g., based on DL PRS signals, UL SRS signals, both of them, etc.)   + Signaling and procedures (e.g., based on PRACH procedure, paging triggered UL SRS transmission, etc.) |

***Observation1: The above agreement is mainly for the sake of progress and does not provide substantial contents.***

RAN1#103e

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| Agreement:  Capture the following observations (Editorial modifications and updates to references to be made when capturing in the TR):   * The results for the UE efficiency (power saving) in the RRC\_IDLE/RRC\_INACTIVE states were analyzed by 2 sources (Huawei/HiSi, vivo) out of 17 sources (assumptions may be different between the different sources) * In one source (Huawei/HiSi), the following observations were made:   + RRC\_IDLE/RRC\_INACTIVE state positioning can save about 7%-40% power consumption compared to C-DRX configuration * In one source (vivo), the following observations were made:   + Positioning report in the RRC\_IDLE state can provide 44.32 % of power saving gain compared to the report in the RRC\_CONNECTED state   + Positioning measurement and report in the RRC\_IDLE state can provide at least 48.38 % of power saving gain compared to the measurement and report in the RRC\_CONNECTED state |

***Observation2: The simulation results from the two sources show the gain in power saving for IDLE/INACTIVE positioning.***

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| Agreement:   * NR positioning for Ues in RRC\_INACTIVE state is recommended for normative work, including   + DL, UL and DL+UL positioning methods   + UE-based and UE-assisted positioning solutions   + Support of UE positioning measurements for Ues in RRC\_inactive state     - Options that can be considered include DL-PRS or DL-PRS and SSB   + Support of gNB positioning measurements for Ues in RRC\_inactive state * The details of how to enable the UE positioning in RRC\_INACTIVE state can be further discussed during normative work. These details may include, but are not limited to the following aspects:   + UL reference signals (e.g., SRS for positioning, PRACH preambles) for UL measurements   + Signalling and procedures for support the assistance data delivery, DL-PRS configuration, UL reference signals for positioning resource configuration, measurement reporting), which may be developed based on the enhancements of existing signalling and procedures (e.g., existing 2-step and/or 4-step PRACH procedures, paging procedure, small data transmission). |

***Observation3: The above two bullets are recommended for normative work and listed for future study, respectively, for positioning in RRC\_INACTIVE. They may serve as the baseline for the study of RRC\_INACTIVE positioning in RAN2.***

Agreement:

Capture the following in the TR:

From a physical layer perspective, it is feasible for a UE to perform DL positioning measurement in RRC\_IDLE state.

* Note: This does not imply that measurements have to be reported in RRC\_IDLE state.

Conclusion:

It is up to RAN2 to decide whether to support the enhancements of NR positioning reporting of DL positioning measurements and/or positioning estimates for RRC\_IDLE Ues.

***Observation4: The above agreement and conclusion may serve as the baseline for the study of RRC \_IDLE positioning in RAN2. Note that only DL positioning is considered for future study in IDLE. So, UL positioning in IDLE is not considered within the scope of study.***

#### Question1: Do companies concur that RAN1 has already make the following recommendation/conclusion of feasibility as a conclusion of the study item for the TSG RAN?

* Positioning in RRC\_INACTIVE
  + DL, UL and DL+UL positioning methods
  + UE-based and UE-assisted positioning solutions
  + Support of UE positioning measurements for Ues in RRC\_INACTIVE state
    - Options that can be considered include DL-PRS or DL-PRS and SSB
  + Support of gNB positioning measurements for Ues in RRC\_INACTIVE state
* Positioning in RRC\_IDLE
  + It is feasible for a UE to perform DL positioning measurement in RRC\_IDLE state.

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| **Company** | **Y/N** | **Comment** |
| Ericsson | Y but | We understand above agreement is merely from measurement perspective and not considering signalling aspects. For example; if RAN2 finds that signalling of AD could not be provided for the UE to perform measurement in Inactive/Idle state then there is no value of above recommendation. So, we need to consider that above agreement is from physical layer measurement perspective where it is already taken for granted that UE has been provided with all the needed AD.  For DL based measurements; AD can be also provided by broadcast; hence we agree it should be possible. Besides we have also deferred MT-LR based procedure.  The problem we see is mainly for UL Inactive state Positioning. How will UE obtain AD in Inactive State? Can the AD validity be only for short duration (i.e when the condition is similar to last connected state)? Is this only applicable for stationary or slow moving Ues?  It would be good to do some prioritization between DL and UL Inactive Positioning. Clearly DL PRS based measurement should be prioritized over UL SRS based Inactive Positioning. |
| Intel | Y for INACTIVE  N for IDLE | RAN1 did not recommend Positioning in IDLE in their SI phase.  It is up to RAN2 to decide whether to support the enhancements of NR positioning reporting of DL positioning measurements and/or positioning estimates for RRC\_IDLE Ues. |
| vivo | Y | In our understanding, RAN1 has recommended on both measurement and report for inactive positioning. RAN2 should follow RAN1 progress. |
| Qualcomm | Y |  |
| CATT | Y | We understand that RAN1 reach the conclusion from RAN1’s perspective. And RAN2 will study the feasibility from RAN2’s perspective. |
| Xiaomi | Y | For RRC IDLE, RAN1 only achieve the agreement for measurement, RAN2 need to further study the feasibility for signalling aspect. |
| Huawei, HiSilicon | Y |  |
| oppo | Y |  |
| Lenovo, Motorola Mobility | Y | RAN2 should confirm RAN1’s conclusion from RAN2 perspective. |

Continue discussion for [Post112-e][906]

Based on the email discussion [Post112-e][906], we have proposed the following. In this section, we discuss the TP for each proposal:

Easy Agreement => Discussion for TP

### Scope of IDLE/INACTIVE positioning

**Proposal 1: The following UE positioning procedures are under the scope of RRC\_IDLE/INACTIVE positioning if any of them are performed when the UE is in RRC\_IDLE/INACTIVE. (13/14)**

* **Service layer support**
  + **LCS messages defined in Clause 4.1.2 for location services in TS 24.571**
  + **LPP signaling for positioning (e.g., Capability transfer, Assistance data transfer, Location information transfer)**
* **NRPPa**
  + **E-CID information transfer (UE-associated)**
  + **Positioning information transfer (UE-associated)**
  + **Measurement information transfer (non-UE-associated)**
* **Uu Signaling and procedure**
  + **RRC signaling for positioning (e.g., posSRS configuration)**
  + **MAC procedure/L1 signalling (e.g., activation/deactivation for semi-persistent/aperiodic posSRS)**
  + **Transmission of posSRS and reception of DL-PRS**
  + **Reception for assistance information broadcast**

Based on the above proposal, we propose the following TP:

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| =================================CHANGE BEGINS=============================== 2 References The following documents contain provisions which, through reference in this text, constitute provisions of the present document.  - References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.  - For a specific reference, subsequent revisions do not apply.  - For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.  [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".  [2] RP-193237: "new SID on NR Positioning Enhancements".  [3] 3GPP TR 38.855: "Study on NR Positioning (Release 16)".  [4] R1-2009433 Evaluation results for Rel-16 positioning and Rel-17 enhancement Huawei, HiSilicon  [5] R1-2007665 Evaluation of NR positioning performance vivo  [6] R1-2007720 Evaluation of achievable positioning accuracy BUPT  [7] R1-2007754 Evaluation of achievable accuracy and latency ZTE  [8] R1-2007859 Discussion of evaluation of NR positioning performance CATT  [9] R1-2007908 NLOS Identification and Mitigation FUTUREWEI  [10] R1-2009390 Update of Evaluation Results for NR Positioning Performance in I-IoT Scenarios Intel Corporation  [11] R1-2007997 NR Positioning Latency Evaluations Lenovo, Motorola Mobility  [12] R1-2008225 Evaluation of NR positioning in IIOT scenario OPPO  [13] R1-2009555 Results on evaluation of achievable positioning accuracy and latency Nokia, Nokia Shanghai Bell  [14] R1-2009502 Discussion on Performance evaluation of Rel-17 positioning Sony  [15] R1-2008416 Discussions on evaluation of achievable positioning accuracy and latency for NR positioning LG Electronics  [16] R1-2008489 Evaluation of achievable positioning latency InterDigital, Inc.  [17] R1-2009708 Evaluation of achievable Positioning Accuracy & Latency Qualcomm Incorporated  [18] R1-2009428 Evaluation of positioning enhancements Fraunhofer IIS, Fraunhofer HHI  [19] R1-2008720 Positioning evaluation results on potential enhancements for additional use cases CeWiT  [20] R1-2008764 Evaluation of achievable positioning accuracy and latency Ericsson  [21] R1-2008765 Potential positioning enhancements Ericsson  [22] R1-2007666 Discussion on potential positioning enhancements vivo  [23] R1-2005380 Evaluation of achievable positioning accuracy and latency vivo  [24] 3GPP TS 22.261 Service requirements for the 5G system; Stage 1 (Release 17)  [25] RP-202094 Revised SID: Study on NR Positioning Enhancements CATT, Intel Corporation  [26] 3GPP TS 38.901 Study on channel model for frequencies from 0.5 to 100 GHz (Release 16)  [xx] 3GPP TS 24.571 Control plane Location Services (LCS) procedures (Release 16)  ======================================NEXT CHANGE=================================== 7 Studied NR positioning enhancements The following enhancements have been considered during this study:   * Partial staggering and non-staggering RE mapping of SRS for positioning with different combinations of comb-factors and symbol lengths, including the methods/signalling for addressing potential time-domain aliasing due to the partial/non-staggering RE mapping. * Semi-persistent and a-periodic transmission and reception of DL PRS   + Semi-persistent means MAC-CE triggered   + Aperiodic would correspond to DCI-triggered * On-demand transmission and reception of DL PRS   + On-demand corresponds to the UE-initiated or network-initiated request of PRS and/or SRS, i.e. UE or LMF request/suggesting/recommending specific PRS pattern, ON/OFF, periodicity, BW, etc. * Multipath mitigation techniques including but not limited to the following:   + The applicable scenarios and performance benefits of multipath mitigation techniques   + The methods/measurement/signaling for the LOS/NLOS detection and identification   + The measurements for supporting the multipath mitigation/utilization   + The procedure and signaling for supporting the multipath mitigation/utilization   + Implementation-based solutions (e.g., outlier rejection) without the need of any additional specified method/measurements/procedures/signaling.   + Note: The above study applies to DL only, UL only, DL+UL positioning solutions for UE-based and UE-assisted positioning. * NR positioning for UEs in RRC\_IDLE state and UEs in RRC\_INACTIVE state, including the benefits on latency, network/UE efficiency and UE power consumption. The following UE positioning procedures are under the scope of RRC\_IDLE/RRC\_INACTIVE positioning if any of them are performed when the UE is in RRC\_IDLE/RRC\_INACTIVE. * Service layer support   + LCS messages defined in Clause 4.1.2 for location services in TS 24.571 [xx]   + LPP signaling for positioning (e.g., Capability transfer, Assistance data transfer, Location information transfer) * NRPPa   + E-CID information transfer (UE-associated)   + Positioning information transfer (UE-associated)   + Measurement information transfer (non-UE-associated) * Uu Signaling and procedure   + RRC signaling for positioning (e.g., posSRS configuration)   + MAC procedure/L1 signaling (e.g., activation/deactivation for semi-persistent/aperiodic posSRS)   + Transmission of UL-PRS and reception of DL-PRS   + Reception for assistance information broadcast * For reducing NR positioning latency, more efficient signaling & procedures enabling a device to request and report positioning information, which may include, but not limited to, the following aspects:   + DL PRS/SRS configuration, activation or triggering.   + The request for positioning information (the assistance data, etc.).   + The report of positioning information (the measurement report, etc.).   + Note: It is not within RAN1 scope to analyze positioning architecture enhancements to enable such more efficient signaling & procedures.   + Note: RAN1 does not make any assumptions on whether the LCS architecture specified in TS 23.273 is enhanced or not. * Simultaneous transmission by the UE and reception by the gNB of the SRS for positioning across multiple CCs and multiple slots, including   + The scenarios and performance benefits of the enhancement   + The impact of channel spacing, TA and timing offset, phase offset, frequency error, and power imbalance across slots or CCs to the positioning performance for intra-band contiguous/ non-contiguous and inter-band scenarios * Scenario, benefits, and methods for improving the accuracy of the UL AoA and DL-AoD methods for both UE-based and network-based (including UE-assisted) positioning * Scenario, benefits, methods and signaling for improving positioning accuracy in the presence of the UE Rx/Tx transmission delays, and/or gNB Rx/Tx transmission delays for UE-based and network-based (including UE-assisted) positioning. * Aggregating multiple DL positioning frequency layers of the same or different bands for improving positioning performance for both intra-band and inter-band scenarios * The scenarios and performance benefits of aggregating multiple DL positioning frequency layers * The impact of channel spacing, timing offset, phase offset, frequency error, and power imbalance among CCs to the positioning performance for intra-band contiguous/ non-contiguous and inter-band scenarios * UE complexity considerations   ================================SECOND CHANGE======================================= |

#### Question2: Do companies think the above TP faithfully reflects the proposal for the scope of IDLE/INACTIVE positioning?

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| **Company** | **Y/N** | **Comment** |
| Intel | Y |  |
| vivo | Y |  |
| Qualcomm | Y, but… | …we think LPP is not a "Service Layer" protocol; it is still Layer 3 (similar to RRLP). LPP should also be at main bullet indentation (similar to NRPPa).  [Rapp Comment]  The definition for “service layer protocol” seems to be a bit vague and ambiguous. I would like to change it into “NAS-transported positioning signalling”   * NSA-transported positioning signalling   + LCS messages defined in Clause 4.1.2 for location services in TS 24.571 [xx]   + LPP signaling for positioning (e.g., Capability transfer, Assistance data transfer, Location information transfer) |
| CATT | Y | UL-PRS should be posSRS |
| Xiaomi | Y |  |
| Huawei, HiSilicon | Y |  |
| oppo | Y |  |
| Lenovo, Motorola Mobility | Y |  |

### Downlink Positioning

Then, for downlink positioning, we have proposed the following

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| **Proposal6: *RequestCapabilities/ProvideCapbilities* for PRS cannot be sent in RRC\_IDLE/INACTIVE (0/14, 3/13, 0/14, 2/14)**  **Proposal7: *RequestAssistanceData* for DL-PRS cannot be sent for UE in RRC\_IDLE/INACTIVE. (0/14, 3/14)**  **Proposal8: Current stage3 spec has already supported assistance data delivery for DL positioning during RRC\_CONNECTED and on-demand SI request in RRC\_IDLE/ INACITVE for IDLE/INACTIVE positioning. (14/14)**  **Proposal9: DL-PRS configuration delivery to the UE in RRC\_IDLE/INACTIVE is not supported. (0/14, 2/11)**  **Proposal10: Current stage3 spec already supports the transfer of *RequestLocationInformation* in RRC\_CONNECTED for PRS measurement in IDLE/INACTIVE. (14/14)**  **Proposal11: Transfer of *RequestLocationInformation* when the UE is in RRC\_IDLE/INACTIVE is not supported (0/14, 2/11)**  **Proposal12: The report of PRS measurement performed in RRC\_IDLE/INACTIVE when the UE is in RRC\_INACTIVE is supported, not supported when the UE is in IDLE. (0/13, 10/12)**  **Proposal13: The report of PRS measurement performed in RRC\_IDLE/INACTIVE when the UE is in RRC\_CONNECTED is supported. (14/14)** |

During online, some companies have raised the concern over proposal 12 on using small data to transport the PRS measurement report. While during the email discussion, most of the participating companies think that this can be based on enhancing the framework of small data transmission which is on-going in R17.

The rapporteur thus would like to ask the following question on the recommendation for normative work on how to transport this PRS measurement report from the UE to the network in RRC\_INACTIVE.

#### Question3: Do companies think that the PRS measurement report sent from the UE to the gNB in RRC\_INACTIVE by enhancing small data transmission in RRC\_INACTIVE should be recommended for normative work?

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| **Company** | **Y/N** | **Comment** |
| Ericsson | N | There are several issues for SDT CP solution. Lack of CP solution, No Integrity protection, measurement report size for positioning may not fit in SDT. Further alternate to CP SDT framework; i.e using UP SDT should be studied by SA2. Since data is already there in UPF; thus, UPF should provide it to LMF. SA2 needs to study this. We see the inclusion of SDT will make the study/WI large.  TS 36.300 can be checked where EDT solution for CP and UP are provided. There is no Integrity Protection support for CP based solution. Hence, measurement reporting which would need IP is not supported by CP solution. An example from TS 36.300  The purpose of SON/ANR reporting in NB-IoT is network optimisation. The measurements are performed when the UE is in RRC\_IDLE and reported next time the UE enters RRC\_CONNECTED. ANR measurement reporting is not supported when the UE uses the Control Plane CIoT EPS Optimisation. |
| Intel | Y | R17 NR SDT solution is different from LTE EDT solution.  Based on SDT conclusion “For both RACH and CG based solutions, upon initiating RESUME procedure for SDT initiation (i.e. for first SDT transmission), the UE shall re-establish at least the SDT PDCP entities and resume the SDT DRBs that are configured for small data transmission (along with the SRB1).”, the UE will reestablish SRB1 and resume the security functions.  To support SRB2 over SDT, the only additional efforts should be to allow the UE to resume SRB2. And SRB2 should be integrity/ciphering protected based on the NCC provided in release message. Therefore we do not see the problem on integrity issue. |
| vivo | Y | LTE can transmit NAS message in idle and NR can use similar mechanism with little modification to support positioning report in inactive state.  To answer Ericsson:   1. For UE-based method, UE doesn’t need to report result. So, it doesn’t need integrity. 2. CP data can also be integrity protected. LTE doesn’t protect msg3 is to avoid refusion of random access, but other NAS message can be integrity protected, so it is not correct to say CP doesn’t support integrity. Only initial message not. NR only needs to do minor CP enhancement to support integrity of positioning. 3. Positioning messages to be sent are not always larger than 1000 bits, e.g. messages are usually small for wearable devices. For large message, we can study methods how to optimize data in WI phase. |
| Qualcomm | Y, but… | …this should not be restricted to "PRS measurement report"; it is equally applicable to any positioning measurement report, incl. location estimate report.  [Rapp Comment]  Can change “PRS measurement report” to “PRS measurement report and positon estimate” |
| CATT |  | Currently, there are mainly two potential methods to support the LPP signalling transmission in RRC\_IDLE/IANCTIVE, e.g., SDT or CIOT 5GS Optimization (supported in LTE).  **For SDT:**  We are fine to support SDT if the scope of SDT will be updated to support signalling optimization in RRC\_IDLE/INACTIVE state. We can take a note, e.g. depending on the progress of SDT.  **For CIOT 5GS Optimization:**  We observed that Control plane CIoT optimisation with EDT is supported in LTE. So NAS signalling direct transmission in not only in RRC\_IDLE, but also in INACTIVE state is supported in LTE, applicable to positioning.  But EDT with signaling isn’t supported in NR Rel-16 yet.  Considering the limited time budget, we think positioning measurement reporting in IDLE/IANCTIVE can be further enhanced in Rel-18 with Control plane CIoT optimisation with EDT. |
| Xiaomi | Y | The RRC INACTIVE positioning measurement report can be sent to network by using SDT mechanism.  Moreover, we agree with CATT that a note can be added. |
| Ericsson |  | If companies insist on adding SDT; then a Note should be added.  The Note should include the items that SDT WI need to discuss  a) If SRB based Trigger can be added for SDT framework as currently it is only for DRBs  b) Small Data framework need to evaluate if positioning measurement report can be sent without segmentation as the intention is to reduce latency.  c) Integrity Protection is supported for transporting positioning measurement data |
| Huawei, HiSilicon | Y | SDT session would not discuss on the transport of LPP/LCS with small data by itself since it is out of their scope to discuss on this. POS session needs to first establish the requirement and then let SDT session to make proper adaptation to fulfil the requirement.  We notice that R2-2100295 has also proposed the following proposal in the small data session, which i think is perfectly aligned with what we are talking here in the POS session.  **Proposal 4: The UE sends the *ULInformationTransfer* message which contains UL NAS message directly when new NAS event is triggered during subsequent SDT.** |
| oppo | Y | SDT mechanism is viewed as a potential candidate solution to be further investigated in WI phase |
| Lenovo, Motorola Mobility | Y | The current ongoing SDT discussions can be used as a starting framework to enable measurement reporting in RRC\_INACTIVE state. We are open to add any notes that will clarify/motivate any positioning-specific signalling features that we may require, which will help make progress towards supporting positioning measurement reporting during the SDT discussions. |

Furthermore, the above proposals lack the “recommended for normative work” wording. Hence, we would like to reformulate the proposals as follows:

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| **Proposal: For DL positioning in IDLE/INACTIVE, RAN2 recommends the following for normative work:**   * **The report of PRS measurement performed in RRC\_IDLE/INACTIVE when the UE is in RRC\_INACTIVE is supported (10/12)** * **The report of PRS measurement performed in RRC\_IDLE/INACTIVE when the UE is in RRC\_CONNECTED is supported. (14/14)**   **Proposal: For DL positioning in IDLE/INACTIVE, the followings are not supported:**   * ***RequestCapabilities/ProvideCapbilities* for PRS cannot be sent in RRC\_IDLE/INACTIVE (0/14, 3/13, 0/14, 2/14)** * ***RequestAssistanceData* for DL-PRS cannot be sent for UE in RRC\_IDLE/INACTIVE. (0/14, 3/14)** * **DL-PRS configuration delivery to the UE in RRC\_IDLE/INACTIVE is not supported. (0/14, 2/11)** * **The report of PRS measurement performed in RRC\_IDLE/INACTIVE is not supported when the UE is in IDLE. (0/13).** * **Transfer of *RequestLocationInformation* when the UE is in RRC\_IDLE/INACTIVE is not supported (0/14, 2/11)**   **Proposal: For DL positioning in IDLE/INACTIVE, the followings are already supported for the current spec and can be reused:**   * **Current stage3 spec has already supported assistance data delivery for DL positioning during RRC\_CONNECTED and on-demand SI request in RRC\_IDLE/ INACITVE for IDLE/INACTIVE positioning. (14/14)** * **Current stage3 spec already supports the transfer of *RequestLocationInformation* in RRC\_CONNECTED for PRS measurement in IDLE/INACTIVE. (14/14)** |

For the above proposals for DL positioning in INACTIVE, we have proposed the following TP

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| The following procedures are recommended for normative work for DL positioning methods in RRC\_INACTIVE:   * + Reporting of PRS measurement performed in RRC\_INACTIVE when the UE is in RRC\_INACTIVE/RRC\_CONNETED.     - The reporting of PRS measurement performed in RRC\_INACTIVE when the UE is in RRC\_INACTIVE is enabled by enhancing the small data transmission framework in RRC\_INACTIVE.   NOTE: The following procedures are considered to have already been supported by UE and can be reused for positioning in RRC\_INACTIVE   * + - On-demand SI request in RRC\_INACTIVE for assistance data delivery by broadcast in RRC\_INACTIVE     - *ProvideAssistanceData* in RRC\_CONNECTED for RRC\_INACTIVE downlink positioning     - *RequestLocationInformation* can be sent in RRC\_CONNECTED for PRS measurement in RRC\_INACTIVE |

#### Question4a: Do companies think the above text proposal faithfully reflects the proposals for DL positioning in RRC\_INACTIVE?

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| **Company** | **Y/N** | **Comment** |
| Ericsson | N | SDT should be removed.  Positioning measurement Information cannot be provided without IP. NW needs to trust the sender.  Only when it is confirmed that there is IP support the framework can be used.  Besides SDT current framework using UP should be prioritized. That is SA2 provides mechanism of providing the content from UPF to LMF. |
| Intel | Y with comments | * + Reporting of PRS measurement performed in RRC\_INACTIVE when the UE is in RRC\_INACTIVE/RRC\_CONNETED.   “RRC\_CONNETED” should be removed from recommendation. We should focus on the reporting in INACTIVE instead of RRC\_CONNECTED. Our understanding is, the UE can report the results when transit to CONNECTED only if no additional specification efforts are needed.  [Rapp Comment]  For INACTIVE, RAN1 has already recommended the PRS measurement as below:  Agreement:   * NR positioning for Ues in RRC\_INACTIVE state is recommended for normative work, including   + DL, UL and DL+UL positioning methods   + UE-based and UE-assisted positioning solutions   + Support of UE positioning measurements for Ues in RRC\_inactive state     - Options that can be considered include DL-PRS or DL-PRS and SSB   + Support of gNB positioning measurements for Ues in RRC\_inactive state   From our understanding, there would not be stage3 impact to the spec. We feel there is a need to make a recommendation that this should be clarified this can be supported because the measurement in INACTIVE is new for R17 and this is more a recommendation from the stage2 perspective. The following proposal in the email discussion also agrees on this from the opinions of the most of the companies.  **Current stage3 spec already supports the transfer of *RequestLocationInformation* in RRC\_CONNECTED for PRS measurement in IDLE/INACTIVE. (14/14)** |
| vivo | Y | SDT can be supported, see answer Q3. |
| Qualcomm | Y, but… | …this should not be restricted to "PRS measurement report"; it is equally applicable to any positioning measurement report, incl. location estimate report.  We don't see a need for the NOTE in the TP.  Also agree with Intel, that RRC\_CONNECTED should be removed.  [Rapp comments]  Can be changed to “PRS measurement report and location estimate”. For the note, we think they are the results of our study and it does not harm to include them in the TR. For the issue with “RRC\_CONNECTED” see the reply to INTEL |
| CATT | Y but | Please clarify what the meaning of Reporting of PRS measurement performed in RRC\_INACTIVE when the UE is in RRC\_CONNETED is.  [Rapp Comment]  It means the UE performs the PRS measurement in INACTIVE and report the measurement to the network when the UE is in RRC\_CONNECTED. |
| Xiaomi | Y | We think PRS measurement performed in RRC INACTIVE can be reported network with SDT if SDT support to transmit CP data, or the measurement report can be sent to network when the RRC INACTIVE UE transit to RRC CONNECTED. |
| Ericsson |  | If companies insist on adding SDT; then a Note should be added.  The Note should include the items that SDT WI need to discuss  a) If SRB based Trigger can be added for SDT framework as currently it is only for DRBs  b) Small Data framework need to evaluate if positioning measurement report can be sent without segmentation as the intention is to reduce latency.  c) Integrity Protection is supported for transporting positioning measurement data |
| Huawei, HiSilicon | Y |  |
| oppo | Y but | Agree with Intel and CATT |
| Lenovo, Motorola Mobility | Y with TP edits | Suggested a possible rewording to take into account the concerns of the Rapporteur and companies:  *Support the UE reporting of PRS measurements performed during RRC\_INACTIVE (UE-assisted) and UE reporting of location estimate (UE-based) for the following cases:*  *1) when the UE remains in RRC\_INACTIVE state*  *-* *The reporting of PRS measurement performed in RRC\_INACTIVE when the UE is in RRC\_INACTIVE is enabled by enhancing the small data transmission framework in RRC\_INACTIVE.*  *2) when the UE transitions to RRC\_CONNETED state from RRC\_INACTIVE state*  *NOTE: 2) is already deemed feasible*  2) is already supported and no extra stage 3 work may be necessary. A note can be added to further clarify this point. |

For the above proposals for DL positioning in IDLE, we have proposed the following TP

|  |
| --- |
| The following procedures are recommended for normative work for DL positioning methods in RRC\_IDLE:  Reporting of PRS measurement performed in RRC\_IDLE when the UE is in RRC\_CONNETED.  NOTE: The following procedures are considered to have already been supported by UE and can be reused for positioning in RRC\_IDLE   * + - On-demand SI request in RRC\_IDLE for assistance data delivery by broadcast in RRC\_IDLE     - *ProvideAssistanceData* can be sent in RRC\_CONNECTED for RRC\_IDLE downlink positioning     - *RequestLocationInformation* can be sent in RRC\_CONNECTED for PRS measurement in RRC\_IDLE |

#### Question4b: Do companies think the above text proposal faithfully reflects the proposals for DL positioning in RRC\_IDLE?

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comment** |
| Intel | N | Some companies commented in previous email discussion that the UE can report the results when transit to CONNECTED only if no additional specification efforts are needed.  To our understanding majority companies do not support reporting in IDLE. And then we should not spend efforts to optimize other aspects for IDLE mode UE.  [Rapp comments]  Note that we have made the following proposal during the email discussion.  **Current stage3 spec already supports the transfer of *RequestLocationInformation* in RRC\_CONNECTED for PRS measurement in IDLE/INACTIVE. (14/14)**  But indeed, RAN1 has not made recommendation on the measurement for IDLE, and only consider it as feasible as shown by the follows:  Capture the following in the TR:  From a physical layer perspective, it is feasible for a UE to perform DL positioning measurement in RRC\_IDLE state.   * Note: This does not imply that measurements have to be reported in RRC\_IDLE state.   We think the TP can be adapted as follows:  The following procedures are considered as feasible for DL positioning methods in RRC\_IDLE:   * + Reporting of PRS measurement performed in RRC\_IDLE when the UE is in RRC\_CONNETED. |
| vivo |  | With modification. We only need to mention position measurement is supported in RRC IDLE and don’t need to limit the method how we report. Change to:  —Support PRS measurements for UEs in RRC\_IDLE state. |
| Qualcomm | N | Same understanding as Intel. In addition, we think this is in principle already supported anyhow. |
| CATT |  | Agree with vivo. |
| Xiaomi | N | Based on the existing Deferred MT-LR procedure, Rel-16 positioning has already supported that RRC IDLE UE can perform PRS measurement and report it to network when the UE is in RRC CONNECTED. So we think it is not necessary to further study RRC IDLE UE positioning in Rel-17. |
| Huawei, HiSilicon | Y, but with comments. | See the comments above |
| oppo | N | Agree with Intel |
| Lenovo, Motorola Mobility | Y | Agree with the Rapporteur’s intention of the proposal, where RAN2 can align and confirm RAN1’s conclusion even though it may be already supported. Agree with the Rapporteur’s updated wording ‘*can be considered feasible*’. |

### RAT-Independent Positioning

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| --- |
| **Proposal22: Support RAT-Independent positioning in RRC\_IDLE/INACTIVE. FFS the procedures that can be supported. (13/14)** |

For the above proposal, we have proposed the following text proposal:

|  |
| --- |
| 10.1.c RAT-Independent positioning RAT-Independent positioning in RRC\_IDLE/INACTIVE is recommended for normative work. The exact procedures that can be supported for RAT-Independent positioning in RRC\_IDLE/INACTVE can be further studied. |

#### Question5: Do companies think the above text proposal faithfully reflects the proposals for RAT-independent positioning?

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comment** |
| Intel | Y for INACTIVE  N for IDLE | TO our understanding, majority companies do not support reporting in IDLE. And then we should not spend efforts to optimize other aspects for IDLE mode UE.  [Rapp Comment]  In Section 3.1.1, we have given a definition for IDLE/INACTIVE positioning and this is where this definition would be useful. RAT-independent positioning can be called RAT-independent positioning if any of the procedure happen in IDLE/INACTIVE, e.g, GNSS measurement. So, if we say N for IDLE, does it mean that we do not support GNSS measurement in RRC\_IDLE? |
| vivo | Y | RAT-independent positioning can be supported when SDT CP enhancement. |
| Qualcomm | Y, but… | …we don't think the 2nd sentence is needed. The reporting of measurements/location estimate is a general LPP Provide Location Information message, and therefore, there should be no different procedures needed for RAT-Independent.  Also, the list of items in the TP for Question2 is independent on the positioning method and mode.  Also agree with Intel that RRC\_IDLE should be removed.  [Rapp Comment]  See the reply to INTEL. The reason why we add the second sentence is that we think various procedure have not been discussed, such as is it possible to send location estimation by GNSS to the network in IDLE? We think we can discuss on what can be supported and not supported during WI phase. |
| CATT | N | Depend on whether UL/DL NAS signalling in IDLE/IANCTIVE can be supported in R17. Prefer to set lower priority on RAT-Independent positioning. |
| Xiaomi | Y with comment | We suggest only study RAT-Independent positioning in RRC INACTIVE in Rel-17. |
| Huawei, HiSilicon | Y |  |
| Lenovo, Motorola Mobility | Y with comment | Perhaps we can further clarify if the intention is to do (i) RAT-independent measurements and (ii) reporting while in either RRC\_INACTIVE or RRC\_IDLE state. Measurements can be applicable to RRC\_INACTIVE/RRC\_IDLE state while reporting for RRC\_INACTIVE state. |

To further discuss => Continued Discussion

The following proposals need to be further discussed in the meeting, while we can work on the text proposals for these proposals in parallel. NOTE that the exact text proposals are still subject to the further discussion during the meeting.

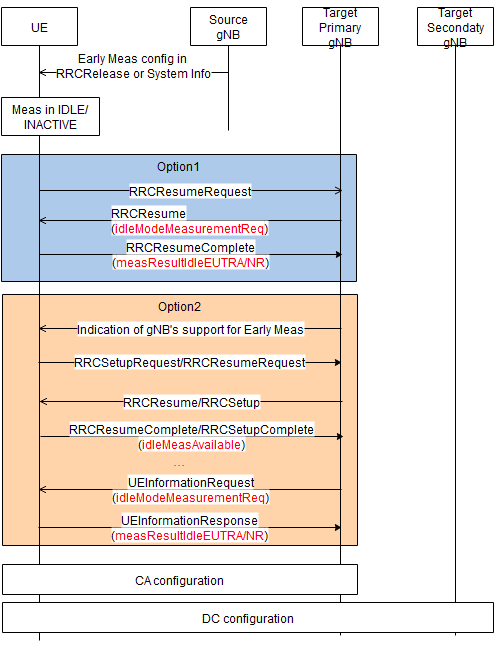
### E-CID positioning

|  |
| --- |
| **Proposal4: Reporting of RRM measurement performed in RRC\_INACTIVE in LPP should be supported by the UE in RRC\_INACTIVE. (9/14)**  **Proposal5: RAN2 should discuss whether UE can report the RRM measurement performed in RRC\_INACTIVE to the network in RRC message for UL E-CID. UL E-CID procedure has already been supported by NRPPa for the UE in RRC\_INACTIVE. (7/14)** |

For proposal 5, it has not been discussed during online and we can continue the discussion in the next session. On the support of UL E-CID procedure for NRPPa in RRC\_INACTIVE, this is more of RAN3 issue and is also related to proposal 20 in section 3.2.3 for general NAS transport. We can send an LS to RAN3, which can further analyse it.

In addition to the above proposal, as supported the current framework for eDCCA, the measurement report for measurement performed in IDLE/INACTIVE can already be reported when the UE is in RRC\_CONNECTED. There are two options for the UE to transfer the measurements to the network, as shown in the figure below:

* **Option1:** 
  + **For UE in RRC\_INACTIVE**, NW sends *RRCResume* to the UE, after the reception of which, the UE transits to the RRC\_CONNECTED. NW indicates the request for early measurement based on whether the UE supports early measurement in UE context for RRC\_INACTIVE. Then, the UE reports the measurement report in the *RRCResumeComplete*
* **Option2:**
  + **For UE in either IDLE or INACTIVE,** the UE can indicate the availability of early measurement in *RRCSetupCompelte* or *RRCResumeComplete*. After the reception of the indication, the NW can request the report of the early measurement in *UEInformationRequest* and the UE responds with *UEInformationResponse*.



**Figure 1, Early Measurement for RRC\_IDLE/INACTIVE**

From the understanding of the rapporteur, we think the current LPP spec can already support sending RRM measurement performed IDLE/INACTIVE in RRC\_CONNECTED and the current RRC spec can already support sending RRM measurement performed in IDLE/INACTIVE in CONNECTED.

#### Question6: Do companies think that the following are correct?

* The current LPP spec can already support sending RRM measurement performed IDLE/INACTIVE in RRC\_CONNECTED;
* The current RRC spec can already support sending RRM measurement performed in IDLE/INACTIVE in CONNECTED

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **LPP(Y/N)** | **RRC(Y/N)** | **Comment** |
| Intel | Y with comments | Y with comments | For LPP, based on assumption that no additional efforts are needed;  RRC current supports the UE to send the RRM measurement, but it is unrelated to positioning method. |
| vivo | Y | Y | RRC measurement in idle/inactive state can be reported in connection mode. But we also want to notice that these measurement result also can be reported in idle/inactive state without state translate. |
| Qualcomm | Y |  | In general, E-CID provides the measurements "already available". Typically, we think the measurements would have been performed in idle mode anyhow. |
| CATT | Y | Y | Agree with Intel. |
| Xiaomi | Y |  | For LPP, the existing Deferred MT-LR procedure implies that RRM measurement performed in IDLE/INACTIVE can be reported in RRC\_CONNECTED; |
| Huawei, HiSilicon | Y | Y |  |
| oppo | Y | Y | RRC measurement performed in idle/inactive state can be reported in connected. But only RRC measurement performed in inactive state can be reported without state transition. |
| Lenovo, Motorola Mobility | Y | Y |  |

### Uplink Positioning

For the following proposals for uplink positioning, the online discussion was unable to touch on this part while the rapporteur cannot think of any update we can have on these proposals. Hence, these proposals can be kept as they are and discussed in the next session.

|  |
| --- |
| **Proposal14: Reporting of SRS capability for UE in INACTIVE is not supported. (4/11)**  **Proposal15: Delivery of SRS configuration for UE SRS transmission in INACTIVE when the UE is in CONNECTED if SRS transmission is supported in RRC\_INACTIVE. (9/13)**  **Proposal16: Delivery of SRS configuration for UE SRS transmission when the UE is in INACTIVE is not supported if SRS transmission is supported in RRC\_INACTIVE. (4/12)**  **Proposal17: RAN2 should discuss whether the current stage3 spec already supports the NRPPa message for uplink positioning for UE in RRC\_INACTIVE. (6/12)** |

It should be noted that there are two schemes for uplink positioning (1) based on SRS transmission (2) based on PRACH transmission. For PRACH, there is nothing much for RAN2 to discuss since the PRACH configuration is cell specific and broadcasted in the system information. We can only discuss on the related issues on SRS transmission. Hence, the above proposals are based on the assumption that SRS transmission is supported in RRC\_INACTIVE. It should be up to RAN1 to decide in the SI phase which scheme to support for UL positioning in INACTIVE.

The rapporteur hence would like to reformulate the proposal as follows:

|  |
| --- |
| **Proposal: If SRS transmission is supported in RRC\_INACTIVE, RAN2 to discuss on the following:**   * **Reporting of SRS capability for UE in INACTIVE is not supported. (4/11)** * **Delivery of SRS configuration for UE SRS transmission in INACTIVE when the UE is in CONNECTED. (9/13)** * **Delivery of SRS configuration for UE SRS transmission when the UE is in INACTIVE is not supported. (4/12)** * **The current stage3 spec already supports the NRPPa message for uplink positioning for UE in RRC\_INACTIVE. (6/12)** |

### MO-LR/General NAS transport

***MO-LR***

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| --- |
| **Proposal2: RAN2 should discuss whether MO-LR request in INACTIVE should be supported by the UE in RRC\_INACTIVE. (6/11)**  **Proposal3: MO-LR response for MO-LR response in RRC\_IDLE/INACTIVE is not supported. (0/11&4/11)** |

***General NAS transport***

|  |
| --- |
| **Proposal18: The transport of UL NAS message in INACTIVE is supported for INACTIVE positioning. (7/9)**  **Proposal19: The transport of DL NAS message in IDLE/INACTIVE for IDLE/INACTIVE positioning is not supported. (5/13)** |

While for the discussion above we mainly focus on the transport of LPP message, in the above four proposals, we discuss whether MO-LR request and response should be supported and more general, the transport of UL/DL NAS message for positioning, which include both LPP message and LCS message.

While for LCS message, in addition to the MO-LR, according to Control Plane Location Service procedures in TS 24.571, the following procedures are also defined for LCS message:

- Messages for MO-LR operations (see 3GPP TS 24.080 [5])

- Messages for LocationNotification operations (see 3GPP TS 24.080 [5])

- Messages for EventReport operations (see 3GPP TS 24.080 [5])

- Messages for PeriodicTriggeredInvoke operations (see 3GPP TS 24.080 [5])

- Messages for CancelDeferredLocation operations (see 3GPP TS 24.080 [5])

- Messages for MSCancelDeferredLocation operations (see 3GPP TS 24.080 [5])

- Messages for LocationPrivacySetting operations (see 3GPP TS 24.080 [5])

Hence, the discussion should be more than just MO-LR request/response, but should be generalized to the LCS message. The rapporteur would like to replace the question in proposal 2/3 with the following question:

#### Question7a: Do companies think we should support transmitting the uplink LCS messages defined in 24.571 in RRC\_INACTIVE?

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comment** |
| Intel | Y | Do not see the problem to do so if SRB2 via SDT is supported; |
| vivo | Y | These messages can be supported by CP enhancement. |
| Qualcomm | Y, but… | …we think this is only sensible for LCS Event Reports. However, this can be further studied in WI phase. |
| CATT |  | Depend on whether UL/DL NAS signalling in IDLE/IANCTIVE can be supported in R17.  [Rapp Comment]  The question is quite clear that this is only for uplink LCS message |
| Xiaomi |  | We think RAN2 only focus on positioning measurement reporting in RRC INACTIVE in previous meeting, for these uplink LCS messages, we can discuss it in WI phase. |
| Ericsson | N | Agree with CATT and Xiaomi, we cannot conclude on SDT yet. |
| Huawei, HiSilicon | Y | SDT can provide general transport for NAS signallling. But what LCS message can be supported can be further discussed during the WI phase, similar to what have already done for LPP message. |
| OPPO | Y | Further discuss details in WI phase |
| Lenovo, Motorola Mobility | Y | Depending on the SDT progress, but we can agree that is a need to support it. |

Another question is that what downlink LCS message to support in RRC\_INACTIVE. For the downlink, there are generally two types of DL LCS signalling messages: (a) unsolicited DL LCS message, e.g., LocationNotification; (b) solicited DL LCS message, e.g., MO-LR response in LCS

Note that for small data, it does not support MT-data in R17 and it would be a major shift of paradigm if we wants it to support MT-data, which corresponds to the case of un-solicited DL LCS message. For MO-Data, small data supports the subsequent DL transmission in response to the UL data. One example is the TCP traffic as we can see below, and this case can correspond to the case of solicited DL LCS message.



**Figure 2: Typical Traffic for Instant Message between UE and server**

The rapporteur thus would like to ask the following question:

#### Question7b: Do companies think we should support transmitting the downlink LCS messages defined in 24.571 in RRC\_INACTIVE?

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Solicited (Y/N)** | **Un-solicited (Y/N)** | **Comment** |
| Intel |  | Y | We agree the response could be easily supported in INACTIVE. |
| Vivo | N | N | It is complicated to support MT data, we don’t need to support downlink LCS message transmission. |
| Qualcomm | Y | Y | It would be needed for (at least) the LCS Event Report ACK.  (It’s not clear whether the ACK is considered solicited or unsolicited in this context) |
| CATT | N | N | See comment in Question7a. |
| Xiaomi | N | N |  |
| Ericsson | N | N |  |
| Huawei, HiSilicon | Y | N | It would be difficult to support un-solicited DL LCS message, given the situation in SDT that MT-data is not supported. We should not support un-solicited DL LCS message similar to what we have disused for LPP message  While, for solicited, they can be supported similar to what we have supported in SDT for subsequent DL in response to the UL. |
| oppo | N | N | Agree with vivo |
| Lenovo, Motorola Mobility | N | N | Depends on if we can increase the WI scope of the SDT discussions to support MT data for the transmission DL LCS messages, which at this point in time seems unlikely. |

Then, for proposal 18/19, as of now, rapporteur thinks there is no need to discuss/propose them anymore. This is because for LPP alone, we can see a lot of companies do not want to support UE transmitting *ReqeustAssistanceData* for uplink positioning. Hence, as long as a single LPP/LCS message is not supported, the proposal that we support the general transport of UL NAS message for positioning will no longer hold. Same rationale for the DL NAS message. Hence, we would like to ask the following question:

#### Question8: Do companies think it is still necessary to discuss on the general support of transport of UL/DL NAS message?

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comment** |
| Intel | Y | We do not see the need to restrict the usage of SRB2 via SDT. But would be fine to not discuss the general support of UL/DL NAS. |
| vivo |  | We don’t think it is necessary to discuss this issue, but this doesn’t mean that we don’t support it. If we enhance CP transmission in inactive state, we could use this method to send any information including NAS. While if we are not able to support CP enchantment, then NAS transmission in inactive state is naturally not supported. |
| Qualcomm | Y | Not quite clear what the comment/question means. For transmitting an LCS Event Report (with embedded LPP message) and corresponding LCS ACK, an UL/DL NAS message is needed.  Note also, even for a "plain" LPP message, an LPP ACK may be needed.  [Rapp Comment]  From our previous understanding, if make a general agreement that we support the UL/DL transport that can include all the positioning signalings for LCS/LPP. While for the current situation, this does not seem necessary, since for example, most of the companies think  For the issue with LPP ACK, i agree with you, but i think this is related to the question 7b. LPP ACK for Uplink LPP message is a solicited downlink LPP message and should be supported. |
| CATT |  | See answer of Question3 |
| Xiaomi |  | This may be out of the positioning scope. |
| Huawei, HiSilicon | N | We need to discuss the support of each LCS/LPP message case by case. |
| oppo | N | Agree with Huawei |

### NG-AP transport

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| --- |
| **Proposal20: Transport of UE-associated NRPPa message in RRC\_INACTIVE for RRC\_INACTIVE positioning has already been supported. This should be further verified by RAN3.  (8/14)**  **Proposal21: RAN2 doesn’t need to discuss the transport of non-UE-associated NRPPa message in IDLE/INACTIVE for IDLE/INACTIVE positioning (14/14)** |

Finally for the transport in NG-AP for IDLE/INACTIVE positioning, they are more of RAN3 issues. RAN2 can send an LS to RAN3 after discussing them online.

Conclusions

Proposal 1:

References

[1] TS 38.305, Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN, 3GPP