**3GPP T****SG-RAN WG2 Meeting #115-e R2-21xxxxx**

**Electronic, 9th – 27th Aug, 2021**

**Agenda item: 8.11.3**

**Source: ZTE, Sanechips**

**Title: Summary of AI 8.11.3 for RRC\_INACTIVE positioning**

**Document for: Discussion and Decision**

# Introduction

In this contribution, the following papers submitted to AI 8.11.3 are summarized:

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| [R2-2107092](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107092.zip) | Discussion on positioning in RRC INACTIVE state | ZTE |
| [R2-2107142](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107142.zip) | Discussion on Positioning for UEs in RRC\_INACTIVE state | CATT |
| [R2-2107149](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107149.zip) | Considerations on positioning in RRC\_INACTIVE mode | Fraunhofer IIS; Fraunhofer HHI |
| R2-2107358 | Discussion on positioning in RRC\_INACTIVE state | Spreadtrum Communications |
| [R2-2107643](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107643.zip) | Enhancement of DL positioning in RRC\_INACTIVE | vivo |
| [R2-2107644](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107644.zip) | Configuration of UL positioning in RRC\_INACTIVE | vivo |
| [R2-2107671](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107671.zip) | Support of Positioning in RRC\_INACTIVE | Intel Corporation |
| [R2-2107683](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107683.zip) | Discussion on Positioning in RRC INACTIVE state | InterDigital, Inc. |
| [R2-2107684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107684.zip) | Discussion on reporting of Positioning Information with SDT | InterDigital, Inc. |
| [R2-2107829](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107829.zip) | Supporting positioning in RRC\_INACTIVE state | OPPO |
| [R2-2107830](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107830.zip) | Discussion on UL Positioning methods in RRC\_INACTIVE state | OPPO |
| [R2-2108068](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108068.zip) | Considerations on positioning RRC Inactive | Sony |
| [R2-2108128](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108128.zip) | On Positioning in RRC\_INACTIVE state | Lenovo, Motorola Mobility |
| [R2-2108173](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108173.zip) | Discussion on positioning for UEs in RRC Inactive | Xiaomi |
| [R2-2108394](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108394.zip) | Inactive mode Positioning | Ericsson |
| [R2-2108703](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108703.zip) | Considerations on positioning in RRC\_INACTIVE | Nokia, Nokia Shanghai Bell |
| [R2-2108772](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108772.zip) | On message segmentation for transmitting in Inactive state | Samsung Electronics |

As the WID[1][2] specifies, the DL positioning is specified as the first priority while the UL/UL+DL positioning is specified as second priority. Therefore, this summary mainly aims at summarizing views and generating proposals for DL positioning(section 2), for which RAN2 is desired to make some progress within the limited meeting time in RAN2#115e. The common aspects of UL and DL(section 3) is treated as medium priority, UL/UL+DL positioning(section 4) and others(section 5) are treated as low priority for RAN2#115e meeting.

In addition, stage 2 procedure in RRC\_INACTIVE is not included in this summary.

# DL Positioning (High priority)

The following company contributions provide their views towards DL positioning in RRC\_INACTIVE:

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| [R2-2107829](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107829.zip) | Supporting positioning in RRC\_INACTIVE state | OPPO |
| [R2-2108173](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108173.zip) | Discussion on positioning for UEs in RRC Inactive | Xiaomi |
| [R2-2107142](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107142.zip) | Discussion on Positioning for UEs in RRC\_INACTIVE state | CATT |
| [R2-2107149](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107149.zip) | Considerations on positioning in RRC\_INACTIVE mode | Fraunhofer IIS; Fraunhofer HHI |
| R2-2107358 | Discussion on positioning in RRC\_INACTIVE state | Spreadtrum Communications |
| [R2-2107671](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107671.zip) | Support of Positioning in RRC\_INACTIVE | Intel Corporation |
| [R2-2107683](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107683.zip) | Discussion on Positioning in RRC INACTIVE state | InterDigital, Inc. |
| [R2-2107684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107684.zip) | Discussion on reporting of Positioning Information with SDT | InterDigital, Inc. |
| [R2-2108068](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108068.zip) | Considerations on positioning RRC Inactive | Sony |
| [R2-2108128](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108128.zip) | On Positioning in RRC\_INACTIVE state | Lenovo, Motorola Mobility |
| [R2-2108703](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108703.zip) | Considerations on positioning in RRC\_INACTIVE | Nokia, Nokia Shanghai Bell |
| [R2-2108772](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108772.zip) | On message segmentation for transmitting in Inactive state | Samsung Electronics |
| [R2-2107643](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107643.zip) | Enhancement of DL positioning in RRC\_INACTIVE | vivo |

Based on the input, the summary of DL positioning in RRC\_INACTIVE is divided into several aspects:

* RAT independent method
  + This chapter discusses about whether to support RAT independent method in RRC\_INACTIVE.
* Alignment between positioning measurement and SDT
  + This chapter focuses on the alignment enhancement between SDT and positioning measurement, including the alignment of periodicity and data size.
* DL PRS configuration
  + This chapter focuses on some consideration when configuring DL PRS configuration, including the mobility and the validity conditions (e.g. time validity, area validity).
* DL assistance data transfer
  + This chapter discusses about where to configure DL assistance data and how to transmit DL assistance data.
* Measurement report reporting
  + This chapter focuses on enhancing the UE measurement report, including the measurement report with mobility.
* Assistance information from UE to network
  + This chapter focuses on additional assistance information from UE to network, in order to ensure network can configure appropriate SDT resource and period of PRS transmission.
* Segmentation of LPP message
  + This chapter discusses about feasibility of segmenting LPP message in order to satisfy the data volume threshold of SDT.

## RAT independent method

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| **Intel**  Proposal 1: All RAT independent positioning methods, including Barometric pressure sensor, WLAN, Bluetooth, TBS, Motion Sensor, A-GNSS, etc can be supported in RRC\_INACTIVE.  Proposal 2: To confirm, the agreements on using SDT and RRC state transparent are applied for RAT independent positioning methods.  **Lenovo**  Proposal 2: Support the following the RAT-independent UE-assisted and UE-based positioning methods in RRC\_INACTIVE state: A-GNSS, Motion Sensor, WLAN, TBS and Bluetooth (UE-assisted).  **ZTE**  Proposal 1: If RAN2 time budget is allowed, both RAT-independent positioning methods and RAT-dependent positioning method including ECID-positioning, UL/DL+UL positioning can be specified. |

Rapporteur’s comments

Intel, Lenovo and ZTE proposed that RAT independent positioning methods should be supported in RRC\_INACTIVE state. From rapporteur’s point of view, this is a straightforward proposal. However, since it may need further study that whether the signalling and procedures of supporting RAT independent positioning methods is different from the signalling and procedures of supporting RAT dependent positioning methods, the only concern is the time limit of RAN2.

***Proposal 1: Support all the RAT independent positioning methods in RRC\_INACTIVE state.***

## Alignment between positioning measurement and SDT configuration

About optimizing the measurement report, company contributions provided their views as follows:

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| **Spreadtrum**  Proposal 2: The LMF can adjust configuration for positioning data report to adjust the data size considering the SDT data volume threshold.  Proposal 3: gNB should inform LMF the SDT data volume threshold.  Proposal 4: LMF should indicate gNB the estimated data size of measurement reports or location estimates.  **vivo**  Proposal 3: The data size optimization of ProvideLocationInformation should be considered.  Proposal 4: Introduce differential report to optimize the data size of report in deferred MT-LR.  **Lenovo**  Proposal 4: The LMF reporting intervals in RRC\_INACTIVE state are aligned with the CG SDT configuration for low latency delivery of the positioning measurement reports.  **Sony**  Proposal 1: Specify configuration of UE locations measurements in RRC Inactive state for DL based measurements, and the possibility to use small data uplink transmission (SDT) and/or PUR for positioning measurement reporting.  **OPPO**  Proposal 3: No optimization is introduced for positioning measurement report. |

For optimizing the SDT configuration, the company contribution provided their views as follows:

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| **Spreadtrum**  Proposal 1: Considering the data size of positioning reports in RRC\_INACTIVE state, either RAN2 can optimize the data size of positioning reports or RAN2 can modify the SDT data volume threshold.  Proposal 5: RAN2 can modify the SDT data volume threshold which can be discussed in SDT session.  **InterDigital**  Proposal 6: Support configuration of CG for SDT with parameters (e.g. periodicity) aligned with measurement reporting occasions in INACTIVE.  **InterDigital**  Proposal 11: Support configuring of CGs that are valid across different cells for sending periodic measurement report/location estimates when in INACTIVE.  **Nokia**  Proposal 1: RAN2 to discuss whether to specify standardized triggering criteria as to when an RRC\_INACTIVE UE can initiate UL SDT transmission for signaling to the LMF and also how to control how frequently the UE can trigger signaling to LMF using UL SDT.  **Xiaomi**  Proposal 2: Whether use SDT or transition to RRC connected to send uplink LCS and LPP messages is depended on the SDT mechanism.  **Ericsson**  Proposal 1: LMF provides the configured measurement periodicity and positioning requirements to gNB.  Proposal 2: RAN2 to send an LS to RAN3 to include additional information of positioning requirements in NRPPa.  **CATT**  Proposal 1: LMF can provide period of Deferred positioning to assist the gNB to decide whether to release the UE into RRC\_INACTIVE, configure SDT for SRB2, or configure CG resource for SDT. |

Rapporteur’s comments

Firstly, it reached a consensus that if the measurement report is transmitted using SDT in RRC\_INACTIVE state, it requires a transmission data size smaller than the data volume threshold. The purpose is to align the period and data volume threshold of SDT with the period and data size of measurement report. Whether to enhance measurement report or SDT needs further discussion:

* If the measurement report is to be enhanced, some company contributions proposed to optimize the data size UE measurement report in order to align with the SDT data volume threshold. Furthermore, company contributions provided different views on whether the data size of UE measurement report is determined by UE itself or by the network.
  + If it is determined by the network, Spreadtrum pointed out that gNB may need to inform LMF the SDT data volume threshold.
  + If it is determined by UE, vivo proposed to introduce differential report to optimize the data size of report in deferred MT-LR.
  + OPPO proposed that no optimization should be introduced for positioning measurement report.
* If the SDT is to be enhanced, Spreadtrum proposed that RAN2 can modify the data volume threshold of SDT.

Another issue is to ensure appropriate SDT configuration for positioning in RRC\_INACTIVE. Considering mobility when UE in RRC\_INACTIVE state, InterDigital proposed to configure CGs for SDT that are valid across different cells. It is also proposed that gNB needs to consider the period of measurement report when configuring SDT period in order to align them. Ericsson and CATT proposed to send measurement periodicity and positioning requirements(such as response time) from LMF to gNB, in order to guide the SDT configuration at gNB side. From rapporteur’s point of view, if gNB acquires the measurement periodicity and positioning requirements, it is benefit for gNB to configure SDT resources or PRS/SRS configuration which is suitable for RRC\_INACTIVE state.

In addition, it reached a consensus that RAN2 should discuss the alignment. It may be further determined whether to discuss this issue in SDT agenda or positioning agenda.

Based on the summary, we have the following proposal for discussion:

***Proposal 2: For the alignment between the positioning measurement and the SDT configuration, support the following alternatives:***

* ***Alt 1: Support LMF to inform gNB the estimate data size of measurement report***
* ***Alt 2: Support LMF to inform gNB the measurement periodicity***
* ***Alt 3: Support LMF to inform gNB the positioning requirements***
* ***Alt 4: Support gNB to inform LMF the SDT data volume threshold***

***FFS: Whether to discuss this issue in SDT agenda or positioning agenda.***

## DL PRS configuration

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| **Fraunhofer**  Proposal 1: Support providing UE with assistance data describing the DL-PRS available within the RNA, some of which may be outside the hearability region of the UE at its current location (i.e. redundant assistance data).  FFS: Whether the A/D received with a larger area scope (e.g. positioning system area) can be divided into A/D applicable to smaller area scope (e.g. cell-level), so that the AD corresponding to the area where the UE is camped can be triggered via SDT mechanism.  **InterDigital**  Proposal 1: Support transmission of network-initiated DL indication to UE for initiating measurement of preconfigured PRS when in INACTIVE.  Proposal 2: Support configuring PRS configurations which are intended to be used by UE when operating in RRC INACTIVE state.  Proposal 3: The PRS configurations intended for usage during RRC INACTIVE state should ensure that at least a minimum positioning accuracy requirement (i.e. required by positioning service/LCS client) is satisfied.  Proposal 4: The PRS configurations intended for usage during RRC INACTIVE state should take into acount of the parameters of SDT configuration (e.g. RA-SDT/CG-SDT resources, data volume threshold) possibly configured in UE.  Proposal 5: Support configurating validity conditions (e.g. time validity, area validity) when configuring PRS configurations intended to be used by UE during RRC INACTIVE state.  Proposal 8: Support alignment between the DL-PRS reception/measurements and DRX configuration.  **vivo**  Proposal 2: Introduce validity criteria for PRS configuration in RRC\_INACTIVE received in RRC\_CONNECTED. |

Rapporteur’s comments

In the aspect of DL PRS configuration, considering the mobility that UE may suffer during the RRC\_INACTIVE state, several company contributions suggested to differ DL PRS configuration in RRC\_INACTIVE state and DL PRS configuration in RRC\_CONNECTED state. For example, Fraunhofer proposed that support providing UE with assistance data describing the DL-PRS available within the RNA. InterDigital proposed to configure PRS which are intended to be used by UE when operating in RRC INACTIVE state, including configuration requirements and validity conditions (e.g. time validity, area validity). vivo also suggested to introduce validity criteria for PRS configuration in RRC\_INACTIVE.

Based on the above analysis, we have the following proposal for discussion:

***Proposal 3: Support to configure the PRS configuration used for RRC\_INACTIVE state. Considering the following aspects:***

* ***Configure RNA information in the PRS configuration***
* ***Configure validity conditions (e.g. time validity, area validity) in the PRS configuration***

## DL assistance data transfer

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| **OPPO**  Proposal 1: For positioning in RRC\_INACTIVE state, the positioning assistance data can be delivered to UE in the following ways: a) positioning system information, b) pre-configured when UE in RRC\_CONNECTED state; c) send to UE during ongoing SDT procedure.  **Xiaomi**  Proposal 3: gNB determine how to send DL LCS, LPP message and RRC message to inactive UE, either triggers UE to transition to RRC connected or sends the message to UE directly if there is ongoing SDT.  Proposal 4: The positioning assistance data for RRC Inactive UE can be provided when UE in RRC inactive or in RRC Connected, and the following options can be considered for different cases:  Option 1: The existing deferred MT-LR procedure  Option 2: The existing LPP provide assistance data message with additional indication  Option 3: The gNB broadcasts posSIB  Option 4: The existing LPP provide assistance data message sent to UE directly when there is ongoing SDT  Proposal 5: The following options can be considered for sending the request location information message to RRC Inactive UE:  Option 1: The existing deferred MT-LR procedure  Option 2: RequestLocationInformation with additional indication sent to UE in RRC Connected  Option 3: The network send the location information request message to UE directly when there is ongoing SDT  **CATT**  Proposal 2: The UE performs DL location measurements in RRC\_INACTIVE based on stored assistance data. If the stored assistance data is not valid, the UE in RRC\_INACTIVE can acquire valid assistance data based on existing mechanism.  **Fraunhofer**  Proposal 2: Support providing the UE with assistance data during the RRC\_CONNECTED state, which is applicable to the RRC\_INACTIVE state.  FFS: How is the assistance data structured  FFS: LPP enhancements needed for providing valid assistance data during the RRC\_INACTIVE state  FFS: How are the resources downselected from the “redundant” assistance data provided (e.g. via SDT signaling or via measurement / configurations) |

Rapporteur’s comments

This section focuses on how the assistance data is transmitted to UE in RRC\_INACTIVE state. It is proposed by OPPO and Xiaomi that there are several options for transmitting assistance data in RRC\_INACTIVE state:

* Option 1: The existing deferred MT-LR procedure
* Option 2: positioning system information, i.e. posSIB
* Option 3: pre-configured assistance data when UE in RRC\_CONNECTED state
* Option 4: ongoing SDT procedure

In addition, Xiaomi also proposed that the *RequestLocationInformation* message can be delivered using the same way as the assistance data transfer(except for the posSIB).

So we have the following proposal for discussion:

***Proposal 4: Support to deliver the positioning assistance data to UE via the following options:***

* ***Option 1: The existing deferred MT-LR procedure***
* ***Option 2: positioning system information, i.e. posSIB***
* ***Option 3: pre-configured assistance data when UE in RRC\_CONNECTED state***
* ***Option 4: ongoing SDT procedure***

## Measurement reporting

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| **InterDigital**  Proposal 10: Support sending of measurement reports/location estimates which are aligned with the transmission of RNA updates.  **Lenovo**  Proposal 1: RAN2 to support RRC\_INACTIVE reporting of RRM measurements along with other DL-based positioning methods. |

Rapporteur’s comments

Another issue worth to be discussed is that, some company contributions mentioned to specify configuration of UE locations measurements in RRC\_INACTIVE state, for example, InterDigital proposed that different measurement report may be needed, i.e., support sending of measurement reports/location estimates which are aligned with the transmission of RNA updates. Based on the above summary, we have the following proposal for discussion:

***Proposal 5: Further study on whether to associate UE location measurement report with RNA update.***

## Assistance information from UE to gNB

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| **InterDigital**  Proposal 9: Support transmission of assistance information from UE to gNB for aligning DL-PRS reception and DRX on-duration during INACTIVE.  **InterDigital**  Proposal 1: Support transmission of assistance information from UE to gNB for ensuring suitable SDT resources (e.g. RA-SDT/CG-SDT) and data volume threshold is configured in UE.  Proposal 2: The assistance information sent by UE to gNB when supporting positioning in INACTIVE includes at least type of reporting (e.g. periodic, aperiodic), and payload size of LPP message (e.g. measurement report/location estimates).  Proposal 3: Support transmission of an indication (e.g. SDT-BSR) for requesting resource grants for transmitting NAS PDUs (e.g. containing LPP messages) in SDT-SRB2 when the payload size of the NAS PDUs is greater than the configured data volume threshold.  Proposal 7: Support transmission of assistance information from UE to gNB for indicating start timing, measurement duration and reporting periodicity such that the CG-SDT parameters can be configured to align with the positioning measurement reporting occasions. |

Rapporteur’s comments

It is proposed by InterDigital that an assistance information from UE to the network is needed to ensure network can configure appropriate SDT resource and period of PRS transmission. From Rapporteur’s point of view, since this is only proposed by one company, it may be depriorized due to the limit of discussion time.

***Proposal 6: Further study the assistance information transmitted from UE to gNB. The assistance information may include following aspects:***

* ***type of reporting (e.g. periodic, aperiodic)***
* ***payload size of LPP message (e.g. measurement report/location estimates)***
* ***start timing***
* ***measurement duration***
* ***reporting periodicity***

## Segmentation of LPP message

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| **InterDigital**  Proposal 4: Support segmentation and transmission of segmented LPP messages (i.e. with suitable identifiers) over multiple SDT subsequent transmission occasions.  Proposal 5: Support LMF providing the UE with segmentation configuration information consisting of indications (e.g. IDs, flag, end-marker) and sequence numbers to use when segmenting and transmitting the segmented LPP messages.  **Lenovo**  Proposal 3: LMF can configure UE segmentation of the measurement report for large measurement report size exceeding the data volume threshold size to support SDT transmissions in RRC\_INACTIVE state based on a set of criteria. FFS threshold and segmentation criteria for the measurement report and whether to capture these aspects in Stage 2 specifications. This can also be applicable to other UL LCS messages.  **Samsung**  Proposal 1: There is no need to specify the BSR operation to accommodate the LPP segmentation for LPP uplink transmission in inactive state. |

Rapporteur’s comments

In RRC\_INACTIVE state, if UE is in an ongoing SDT, both DL and UL transmission are restricted by data volume threshold of SDT. That is to say, if data size of the LPP message is larger than the threshold, the segmentation may be needed. Some company thinks the segmentation of LPP message should be indicated to perform, rather than implementation. InterDigital and Lenovo proposed that network should set criteria for segmentation, and network should configure the criteria to UE for guidance of segmentation.

Based on the summary, we have the following proposal for discussion:

***Proposal 7: Support LMF to provide segmentation configuration information to UE. The segmentation configuration information includes:***

* ***the segmentation criteria***
* ***indications (e.g. IDs, flag, end-marker) and sequence numbers***

# Common aspects of UL and DL positioning(medium priority)

In this section, the following company contributions provided their view about common aspects of UL and DL positioning in RRC\_INACTIVE:

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| [R2-2107092](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107092.zip) | Discussion on positioning in RRC INACTIVE state | ZTE |
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| [R2-2107149](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107149.zip) | Considerations on positioning in RRC\_INACTIVE mode | Fraunhofer IIS; Fraunhofer HHI |
| [R2-2107643](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107643.zip) | Enhancement of DL positioning in RRC\_INACTIVE | vivo |
| [R2-2107683](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107683.zip) | Discussion on Positioning in RRC INACTIVE state | InterDigital, Inc. |
| [R2-2107684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107684.zip) | Discussion on reporting of Positioning Information with SDT | InterDigital, Inc. |
| [R2-2108068](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108068.zip) | Considerations on positioning RRC Inactive | Sony |
| [R2-2108128](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108128.zip) | On Positioning in RRC\_INACTIVE state | Lenovo, Motorola Mobility |
| [R2-2108173](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108173.zip) | Discussion on positioning for UEs in RRC Inactive | Xiaomi |
| [R2-2108394](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108394.zip) | Inactive mode Positioning | Ericsson |

Based on the input, the summary of DL positioning in RRC\_INACTIVE is divided into several aspects:

* Supported positioning type
  + This chapter discusses about which kind of positioning types should be supported in RRC\_INACTIVE, including MO-LR, MT-LR and deferred MT-LR.
* Mobility and validity
  + This chapter focuses on the mobility and validity in RRC\_INACTIVE for both DL and UL configurations. There is no proposal for discussion.
* Signalling configuration
  + This chapter discussed about general signalling configuration of DL and UL. There is no proposal for discussion.

## Supported positioning type

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| **Xiaomi**  Proposal 1: Both MO-LR, MT-LR and deferred MT-LR can be supported for RRC inactive UE.  **vivo**  Proposal 1: LS to SA2 to confirm whether positioning in RRC\_INACTIVE is restrict to specific location type (e.g. low power periodic and triggered 5GC-MT-LR).  **ZTE**  Proposal 4: Support all location service types from RAN2 perspective including MT-LR, MO-LR, NI-LR and deferred MT-LR. |

Rapporteur’s comments

Xiaomi and ZTE proposed to support multiple kinds of positioning type, including MO-LR, MT-LR, deferred MT-LR and NI-LR. vivo also proposed to ask SA2 to determine the supported positioning type. In RAN2#114e, we had reached an agreement that:

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| Agreement:  Any uplink LCS or LPP message can be transported in RRC\_INACTIVE from RAN2 perspective.  Follow Rel-17 SDT framework for INACTIVE UL and DL positioning:  If the UE initiated data transmission using UL SDT, the network can send DL LCS, LPP message and RRC message (e.g. to configure SRS (TBD on what message is used), if UL positioning supported) to the UE.  Otherwise, if UE did not initiate UL SDT, rely on legacy operation, i.e. the network shall transition the UE to RRC\_CONNECTED, e.g. based on RAN paging. |

From rapporteur’s point of view, since MO-LR and deferred MT-LR are both triggered by UE, so they may work at RRC\_INACTIVE with UL SDT based on the agreement above. For MT-LR, it may have concern that this is the network triggered type, which should be based on RRC\_CONNECTED. Based on the summary, we have the following proposal for discussion:

***Proposal 8: Support MO-LR, MT-LR and deferred MT-LR for RRC\_INACTIVE state.***

## Mobility and validity

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| **InterDigital**  Proposal 8: For UE-based positioning, support transmission of multiple buffered location estimates determined in RRC INACTIVE after transitioning to RRC CONNECTED.  **InterDigital**  Proposal 12: Support mechanism for ensuring usage of PRS/SRS configurations in INACTIVE that are valid across different cells/gNBs for making DL-PRS measurements and/or SRS transmission during mobility.  **Lenovo**  Proposal 6: Support new additional positioning-specific cell reselection indication for UEs performing RRC\_INACTIVE positioning. |

Rapporteur’s comments

Considering the mobility that UE may suffer during the RRC\_INACTIVE state, some pre-configured signaling or resources in RRC\_CONNECTED state may not be timely appropriate, such as assistance data(mentioned in section 2.1/2.2), CG resources, SRS configuration, etc. Therefore, InterDigital suggested to support mechanism for ensuring usage of PRS/SRS configurations that are valid across different cells/gNBs. InterDigital proposed that support to configure CGs that are valid across multiple cells, and UE reports multiple buffered location estimate results in RRC\_INACTIVE state to gNB when the UE is transitioning to RRC\_CONNECTED state. Lenovo proposed to add new additional positioning-specific cell re-selection indication. From rapporteur’s point of view, since this section is a general description, no proposal will be generate in this section. Please refer to 2.3 for DL configuration and 4.2 for UL configuration, respectively.

## Signalling configuration

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| **Sony**  Proposal 5: The positioning configuration for positioning in RRC inactive is obtained when the UE is still in RRC-Connected mode.  **Fraunhofer**  Proposal 2: UE shall receive several configurations during the RRC\_CONNECTED state, each with a validity scope and the UE shall be configured to determine the applicable configuration corresponding to its coarse location.  FFS: Whether the configurations are full configurations or partial configurations (supplemented e.g. by suspendConfig or SDT).  FFS: Delivery mechanism (e.g. broadcast, SDT, unicast)  FFS: Trigger mechanism |

Rapporteur’s comments

This section is a general description including UL and DL configurations in RRC\_INACTIVE state. For specific view please find section 2.3 for DL configuration and section 4.2 for UL configuration, respectively. So this is not going to generate a proposal for discussion.

# UL/UL+DL Positioning(Low priority)

In this section, the following company contributions provided their view about UL/UL+DL positioning in RRC\_INACTIVE:

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| [R2-2107092](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107092.zip) | Discussion on positioning in RRC INACTIVE state | ZTE |
| [R2-2107142](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107142.zip) | Discussion on Positioning for UEs in RRC\_INACTIVE state | CATT |
| [R2-2107149](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107149.zip) | Considerations on positioning in RRC\_INACTIVE mode | Fraunhofer IIS; Fraunhofer HHI |
| [R2-2107644](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107644.zip) | Configuration of UL positioning in RRC\_INACTIVE | vivo |
| [R2-2107671](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107671.zip) | Support of Positioning in RRC\_INACTIVE | Intel Corporation |
| [R2-2107683](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107683.zip) | Discussion on Positioning in RRC INACTIVE state | InterDigital, Inc. |
| [R2-2107830](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107830.zip) | Discussion on UL Positioning methods in RRC\_INACTIVE state | OPPO |
| [R2-2108068](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108068.zip) | Considerations on positioning RRC Inactive | Sony |
| [R2-2108128](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108128.zip) | On Positioning in RRC\_INACTIVE state | Lenovo, Motorola Mobility |

Based on the input, the summary of DL positioning in RRC\_INACTIVE is divided into several aspects:

* UE capability of SRS transmission
  + This chapter discussed about UE capability of SRS transmission(aperodic, semi-persistent and periodic SRS), both at RRC\_INACTIVE with ongoing SDT and RRC\_INACTIVE without ongoing SDT.
* SRS configuration
  + This chapter discussed about where to configure SRS used in RRC\_INACTIVE, and whether different SRS parameters are needed to be configured.
* UE request SRS configuration
  + This chapter focuses on the request that UE sends to the network, in order to ask for suitable SRS configuration in RRC\_INACTIVE.

## UE capability of SRS transmission

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| **Lenovo**  Proposal 7: RAN2 to confirm if the capability information among UEs performing RRC\_CONNECTED or RRC\_INACTIVE positioning will be different and whether special RRC\_INACTIVE capability indication is necessary.  **ZTE**  Proposal 3: If UL/DL+UL positioning methods are supported in RRC INACTIVE, it should be clarified whether SRS transmission can be allowed outside SDT active period.  **CATT**  Proposal 6: When UL positioning in RRC\_INACTIVE is triggered while the UE has valid UL pos-RS configuration, the UE in RRC\_INACTIVE transmits UL pos-RS signal. Otherwise, the UE in RRC\_INACTIVE sends request for UL pos-RS configuration.  **Intel**  Proposal 4: The UE can transmit SRS (aperiodic, semi-persistent, periodic SRS) in RRC\_INACTIVE if configured by the network.  Proposal 5: Follow Rel-17 SDT framework for INACTIVE UL and DL positioning:  If the UE initiated data transmission using UL SDT, the network can send SRS activation command (MAC CE, DCI), if UL positioning supported) to the UE.  Otherwise, if UE did not initiate UL SDT, rely on legacy operation, i.e. the network shall transition the UE to RRC\_CONNECTED, e.g. based on RAN paging.  **OPPO**  [Proposal 3: Only periodic SRS is supported for positioning in RRC\_INACTIVE.](#_Toc79139106)inactive只支持周期SRS UL |

Rapporteur’s comments

For UL-TDOA/UL-AoA/multi-RTT positioning method, UL SRS should be sent from UE to gNB to perform measurements. However in RRC\_INACTIVE state, it is not clear whether UE can transmit SRS like in RRC\_CONNECTED state. Lenovo and ZTE think this issue should be clarified, while CATT, Intel and OPPO proposed that at least periodic SRS can be transmitted in RRC\_INACTIVE state. Since semi-persistent and aperiodic SRS need to be triggered by MAC-CE or DCI, whether and how to support these kind of SRS may need further discussion. ZTE further mentioned that it should be discussed separately for RRC\_INACTIVE state without SDT and RRC\_INACTIVE state with ongoing SDT.

Based on the above analysis, we have the following proposal for discussion:

***Proposal 9: Support at least periodic SRS in RRC\_INACTIVE state.***

***FFS: whether it should be discussed separately for RRC\_INACTIVE state without SDT and RRC\_INACTIVE state with ongoing SDT***

***FFS: whether and how to support semi-persistent and aperiodic SRS in RRC\_INACTIVE state***

## SRS configuration

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| **CATT**  Proposal 4: Support the gNB sends UL pos-RS configuration within RRC Release message to the UE for UL positioning in RRC\_INACTIVE.  Proposal 5: The received UL pos-RS configuration in RRC Release message is valid only in the cell which releases the UE into RRC\_INACTIVE.  **InterDigital**  Proposal 6: Support the use of pre-configured SRS configuration received by UE during RRC CONNECTED for SRS transmission when in INACTIVE.  Proposal 7: Support transmission of SRS configuration via RRCRelease message (e.g. with SuspendConfig) or indication to UE for initiating SRS transmission when in INACTIVE.  Proposal 13: Support mechanism for ensuring timing alignment maintenance in INACTIVE when transmitting SRS to different TRPs/gNBs during mobility.  **OPPO**  [Proposal 1: SRS can be configured in RRC\_CONNECTED or RRC\_INACTIVE state.](#_Toc79139104)  [Proposal 2: Similar as in RRC\_CONNECTED mode, SRS is configured by RRC signalling.](#_Toc79139105)  [Proposal 4: To support UL positioning in RRC\_INACTIVE, reuse SDT TA timer for TA validation.](#_Toc79139107)  [Proposal 5: To support UL positioning in RRC\_INACTIVE, reuse RSRP change based solution for TA validation.](#_Toc79139108)  [Proposal 6: The SRS configuration is considered as invalid if TA is not valid.](#_Toc79139109)  **SONY**  proposal 3: Specify configuration for UE transmission of SRS for UL positioning during RRC Inactive.  **vivo**  Proposal 2: SRS configuration for positioning received in RRC\_CONNECTED can be used in RRC\_INACTIVE UL positioning.  Proposal 3: The UE shall regard the SRS configuration for positioning as valid within a specific area and period.  Proposal 4: The SRS configuration and the validity criteria can be delivered in RRCRelease message.  **ZTE**  Proposal 2: Support SRS configuration carried by:   * SDT DL RRC message   + Message B or 4 can be considered in the case when 2 or 4 step RACH based access is chosen for SDT * RRCRelease with SuspendConfig * SRS configuration in RRC\_CONNECTED   **Fraunhofer**  Proposal 3: RAN2 shall send an LS to RAN1 to consider the following issues regarding transmission of SRS in RRC\_INACTIVE state:   * Power control * Determining timing advance * Triggering mechanism for activating and deactivating SRS   **Intel**  Proposal 6: The issues on how transfer UL reference signalling, e.g. power control, TA, etc, should be resolved by the same solution on UL data transmission via CG-SDT, and therefore should not be discussed in positioning WI. |

Rapporteur’s comments

This section focuses on how to configure SRS used in RRC\_INACTIVE, and whether some SRS parameter configuration need to be reconsidered or not. Several company contributions supported to put SRS configuration into *RRCRelease* message. some company contributions proposed to reuse SRS configuration in RRC\_CONNECTED. Fraunhofer and Intel also pointed out that RAN2 should consider some SRS parameters determination, such as power control and TA. From rapporteur’s point of view, all possible ways of configuring SRS for RRC\_INACTIVE can be further discussed. Whether Power control and TA should be determined by RAN2 or other WG, e,g. RAN1, can be further discussed.

Based on the summary, we have the following proposal for discussion:

***Proposal 10: Support SRS configuration carried by:***

* ***SDT DL RRC message***
* ***Message B or 4 can be considered in the case when 2 or 4 step RACH based access is chosen for SDT***
* ***RRCRelease with SuspendConfig***
* ***SRS configuration in RRC\_CONNECTED***
* ***FFS: whether power control and TA should be discussed by RAN2***

## UE request SRS configuration

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| **CATT**  Proposal 7: RAN2 discuss which option is adopted for the UE in RRC\_INACTIVE to request UL pos-RS configuration.   * Option 1: The UE in RRC\_INACTIVE sends request for UL pos-RS configuration via RRC message. * Option 2: The UE in RRC\_INACTIVE sends request for UL pos-RS configuration via LPP message.   **vivo**  Proposal 5: UE can initiate update request of SRS configuration for positioning in RRC\_INACTIVE. |

Rapporteur’s comments

CATT and vivo proposed that UE can request SRS configuration in RRC\_INACTIVE state. Based on the summary, we have the following proposal for discussion:

***Proposal 11: Support UE to update request of SRS configuration for positioning in RRC\_INACTIVE state.***

* ***Option 1: the request is sent via RRC message***
* ***Option 2: the request is sent via LPP message***

# Others(low priority)

This section collects some single proposals that are proposed by single company, which are not much relevant to the main proposals. Since the meeting time is limit and issues in this section are treated as low priority, for the meeting progress, this section is not going to generate proposals for discussion.

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| **OPPO**  Proposal 2: No additional information is needed to differentiate the assistance information for RRC\_INACTIVE and RRC\_CONNECTED.  **Ericsson**  Proposal 3: Upper layers can provide information to the lower layer to decide the RRC mode of transmission for delivering positioning data.  Proposal 4: Send a LS to SA2 to allow repetition of LCS Periodic Trigger.  Proposal 5: Support of posSIB retrieval using SDT in Inactive mode is supported along with unicast tag.  **Lenovo**  Proposal 5: RAN2 to consider updating the UE of a change in the posSIB via a paging DCI in cases where the posSIB changes too frequently or the low latency notification of a posSIB change.  **Sony**  Proposal 4: Support initiation of DL and UL based positioning triggered via paging the UE to either start and/or for configuration of respective Positioning in RRC inactive. |

# 6 Conclusion

In this section, we summary all the proposals for discussion:

***Proposal 1: Support all the RAT independent positioning methods in RRC\_INACTIVE state.***

***Proposal 2: For the alignment between the positioning measurement and the SDT configuration, support the following alternatives:***

* ***Alt 1: Support LMF to inform gNB the estimate data size of measurement report***
* ***Alt 2: Support LMF to inform gNB the measurement periodicity***
* ***Alt 3: Support LMF to inform gNB the positioning requirements***
* ***Alt 4: Support gNB to inform LMF the SDT data volume threshold***

***FFS: Whether to discuss this issue in SDT agenda or positioning agenda.***

***Proposal 3: Support to configure the PRS configuration used for RRC\_INACTIVE state. Considering the following aspects:***

* ***Configure RNA information in the PRS configuration***
* ***Configure validity conditions (e.g. time validity, area validity) in the PRS configuration***

***Proposal 4: Support to deliver the positioning assistance data to UE via the following options:***

* ***Option 1: The existing deferred MT-LR procedure***
* ***Option 2: positioning system information, i.e. posSIB***
* ***Option 3: pre-configured assistance data when UE in RRC\_CONNECTED state***
* ***Option 4: ongoing SDT procedure***

***Proposal 5: Further study on whether to associate UE location measurement report with RNA update.***

***Proposal 6: Further study the assistance information transmitted from UE to gNB. The assistance information may include following aspects:***

* ***type of reporting (e.g. periodic, aperiodic)***
* ***payload size of LPP message (e.g. measurement report/location estimates)***
* ***start timing***
* ***measurement duration***
* ***reporting periodicity***

***Proposal 7: Support LMF to provide segmentation configuration information to UE. The segmentation configuration information includes:***

* ***the segmentation criteria***
* ***indications (e.g. IDs, flag, end-marker) and sequence numbers***

***Proposal 8: Support MO-LR, MT-LR and deferred MT-LR for RRC\_INACTIVE state.***

***Proposal 9: Support at least periodic SRS in RRC\_INACTIVE state.***

***FFS: whether it should be discussed separately for RRC\_INACTIVE state without SDT and RRC\_INACTIVE state with ongoing SDT***

***FFS: whether and how to support semi-persistent and aperiodic SRS in RRC\_INACTIVE state***

***Proposal 10: Support SRS configuration carried by:***

* ***SDT DL RRC message***
* ***Message B or 4 can be considered in the case when 2 or 4 step RACH based access is chosen for SDT***
* ***RRCRelease with SuspendConfig***
* ***SRS configuration in RRC\_CONNECTED***
* ***FFS: whether power control and TA should be discussed by RAN2***

***Proposal 11: Support UE to update request of SRS configuration for positioning in RRC\_INACTIVE state.***

* ***Option 1: the request is sent via RRC message***
* ***Option 2: the request is sent via LPP message***

# 7 Reference

1. RP-210903, Revised WID on NR Positioning Enhancements, Intel Corporation, CATT.
2. R2-2104921, Clarification on work scope of Rel-17 positioning enhancement, Intel Corporation.