**3GPP TSG RAN WG1 #108-e R1-2nnnnn**

**e-Meeting, February 21st – March 3rd, 2022**

**Agenda Item: 8.16.5**

**Source: Moderator (AT&T)**

**Title: Summary of UE features for NR positioning enhancements**

**Document for:** **Discussion/Decision**

# Introduction

This document presents the summary of email discussion/approval [108-e-R17-UE-features-ePos-01] during RAN1 #108-e. According to the Chairman’s Notes:

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| [108-e-R17-UE-features-ePos-01] Email discussion UE on features for NR positioning enhancements – Ralf (AT&T)* 1st check point: February 25
* Final check point: March 3
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The following was discussed and/or agreed during RAN1 #108-e within the scope of [108-e-R17-UE-features-ePos-01]. All proposals are based on the latest RAN1 UE features list for Rel-17 NR in [1].

# Summary of Contributions Submitted to RAN1 #108-e

The following is the moderator’s summary of contributions submitted to RAN1 #108-e in this agenda item.

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|  27. NR\_pos\_enh | 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | 1. Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning2. The maximum number of UE-RxTEG, which is supported and reported by UE for UE assisted DL TDOA and/or Multi-RTT positioning | 13-1, one or more of {13-3, 13-4} | No |  | UE-RxTEG reporting is not supported and no assumption can be made on the UE Rx timing errors for the measurements | per band | n/a | n/a | n/a | Component 1 candidate values: [One or more of] {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Component 2 candidate values: {1, 2, 3, 4, 6, 8}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supportedIf the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to 31 | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | 1. Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning2. The maximum number of UE-RxTEG, which is supported and reported by UE for UE assisted DL TDOA and/or Multi-RTT positioning | 13-1, one or more of {13-3, 13-4} | No |  | UE-RxTEG reporting is not supported and no assumption can be made on the UE Rx timing errors for the measurements | per band | n/a | n/a | n/a | Component 1 candidate values: One or more of {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Component 2 candidate values: {1, 2, 3, 4, 6, 8}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supportedIf the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to 31 | Optional with capability signaling. |

FG 27-1-1* No need to further refine component 1. RAN2 can figure out how to capture it.
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| Vivo  |  |
| ZTE  | **Comment:** The yellow part in the second last column for component 1 should be removed as the candidate has included ‘UE-assisted DL TDOA and Multi-RTT positioning**’.*****Proposal 1****: For FG 27-1-1, remove the yellow part in component 1.*  |
| OPPO  | In Rel-17, in order to mitigate the Tx and Rx timing errors, a new concept of TEG (timing error group) is introduced. Based on TEGs, several enhanced solutions are introduced for DL TDOA, UL TDOA and multi-RTT positioning methods. In the current version of UE feature list, the related FGs are relatively stable. We have some suggestion for minor corrections.***Proposal 1: Adopt the following updates (RED part) for UE FG 27-1-1, 27-1-2, 27-1-2a, 27-1-3.***

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| 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | 1. Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning2. The maximum number of UE-RxTEG, which is supported and reported by UE for UE assisted DL TDOA and/or Multi-RTT positioning | UE-RxTEG reporting is not supported and no assumption can be made on the UE Rx timing errors for the measurements | Component 1 candidate values: ~~[One or more of]~~ {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Component 2 candidate values: {1, 2, 3, 4, 6, 8}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supportedIf the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to 31 |

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| CATT  | For this FG, we think the candidate values of Component 1 of this FG should be one or more of {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}.Based on the above discussions, our proposal on FG27-1-1 as follows,*Proposal 1: Adopt the following modifications marked as red colour to FG 27-1-1 based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | 1. Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning2. The maximum number of UE-RxTEG, which is supported and reported by UE for UE assisted DL TDOA and/or Multi-RTT positioning | 13-1, one or more of {13-3, 13-4} | No |  | UE-RxTEG reporting is not supported and no assumption can be made on the UE Rx timing errors for the measurements | per band | n/a | n/a | n/a | Component 1 candidate values: ~~[~~One or more of~~]~~ {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Component 2 candidate values: {1, 2,3, 4, 6, 8}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supportedIf the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0 up to 31 | Optional with capability signaling |

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| Nokia, Nokia Shanghai Bell  | * + Confirm component values as
		- Component 1 candidate values: One or more of {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}
	+ There is an existing RAN1 agreement to support PCO for TEGs. Since a new FG to cover this aspect has not seen to be agreeable, we propose to capture it as a component of 27-1-1, 27-1-2 and 27-1-3 instead. Without this component it is not clear if the UE is considering the PCO impacts which then impacts how useful the TEG assocations are to the LMF. The RAN1 agreement is clear that this may possibly be included and it should be captured in the FG somehow.
		- Component x: Support of PCO calibration as part of timing error calibration

Agreement: (RAN1#104-e) (highlight ours)The following definitions are used for the purpose of discussion of internal timing errors (these terms are not agreed to be included in the specifications):* **Tx timing error**: From a signal transmission perspective, there will be a time delay from the time when the digital signal is generated at baseband to the time when the RF signal is transmitted from the Tx antenna. For supporting positioning, the UE/TRP may implement an internal calibration/compensation of the Tx time delay for the transmission of the DL PRS/UL SRS signals, which may also include the calibration/compensation of the relative time delay between different RF chains in the same TRP/UE. The compensation may also possibly consider the offset of the Tx antenna phase center to the physical antenna center. However, the calibration may not be perfect. The remaining Tx time delay after the calibration, or the uncalibrated Tx time delay is defined as *Tx timing error*.
* **Rx timing error**: From a signal reception perspective, there will be a time delay from the time when the RF signal arrives at the Rx antenna to the time when the signal is digitized and time-stamped at the baseband. For supporting positioning, the UE/TRP may implement an internal calibration/compensation of the Rx time delay before it reports the measurements that are obtained from the DL PRS/UL SRS signals, which may also include the calibration/compensation of the relative time delay between different RF chains in the same TRP/UE. The compensation may also possibly consider the offset of the Rx antenna phase center to the physical antenna center. However, the calibration may not be perfect. The remaining Rx time delay after the calibration, or the uncalibrated Rx time delay is defined as Rx timing error.
* **UE Tx ‘timing error group’ (UE Tx TEG):** A UE Tx TEG is associated with the transmissions of one or more UL SRS resources for the positioning purpose, which have the Tx timing errors within a certain margin.
* **TRP Tx ‘timing error group’ (TRP Tx TEG):** A TRP Tx TEG is associated with the transmissions of one or more DL PRS resources, which have the Tx timing errors within a certain margin.
* **UE Rx ‘timing error group’ (UE Rx TEG):** A UE Rx TEG is associated with one or more DL measurements, which have the Rx timing errors within a certain margin.
* **TRP Rx ‘timing error group’ (TRP Rx TEG):** A TRP Rx TEG is associated with one or more UL measurements, which have the Rx timing errors within a margin.
* **UE RxTx ‘timing error group’ (UE RxTx TEG):** A UE RxTx TEG is associated with one or more UE Rx-Tx time difference measurements, and one or more UL SRS resources for the positioning purpose, which have the ‘Rx timing errors+Tx timing errors’ within a certain margin.
* **TRP RxTx ‘timing error group’ (TRP RxTx TEG):** A TRP RxTx TEG is associated with one or more gNB Rx-Tx time difference measurements and one or more DL PRS resources, which have the ‘Rx timing errors+Tx timing errors’ within a certain margin.
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| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-1-1: UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning
	+ Regarding note, “[One or more of]” can be removed.
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| Intel Corporation  | The values for component 1 (Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning) are still under discussion and it needs to be determined whether [one or more] of the following values are signaled:* {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}

It needs to be clarified whether “bitmap” or “choice” is expected to be signaled. In our view, if bitmap is considered then its size can be reduced to {UE-assisted DL TDOA, Multi-RTT positioning} and it can cover all options. Oppositely if “choice” is considered then support of two choices is sufficient:* DL TDOA (max number of Rx TEGs is applicable to DL TDOA only, e.g. RxTx TEGs are used for Multi-RTT)
* DL TDOA and Multi-RTT (max number of Rx TEGs is applicable to both DL TDOA and Multi-RTT)

The motivation to have Multi-RTT choice is unclear since the same number of Rx TEGs can be applied for both Multi-RTT and DL TDOA if DL TDOA is supported.1. * **Select one of the following alternatives for FG 27-1-1 UE RxTEGs for component 1 values:**
		+ **Alt.1: Bitmap {UE-assisted DL TDOA, Multi-RTT positioning}**
		+ **Alt.2: Choice {UE-assisted DL TDOA, UE-assisted DL TDOA and Multi-RTT positioning}**
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| Apple  |  |
| CMCC  | For mitigating UE Tx/Rx timing errors for DL+UL positioning, it was agreed that subject to UE capability, either one or both of the following options are supported:* Option 1: Reporting of a TRP RxTx TEG ID, and optionally a TRP Tx TEG ID
* Option 2: Reporting of a TRP Rx TEG ID and a TRP Tx TEG ID

A UE may only be capable of reporting TRP RxTx TEG ID. In this sense, we prefer to split two rows for “Support of UE TxTEGs for DL-TDOA” and “Support of UE TxTEGs for Multi-RTT”.**Proposal 1: Split two rows for “Support of UE TxTEGs for DL-TDOA” and “Support of UE TxTEGs for Multi-RTT”.** |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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|  27. NR\_pos\_enh | 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | 1. Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning2. The maximum number of UE-RxTEG, which is supported and reported by UE for UE assisted DL TDOA and/or Multi-RTT positioning | 13-1, one or more of {13-3, 13-4} | No |  | UE-RxTEG reporting is not supported and no assumption can be made on the UE Rx timing errors for the measurements | per band | n/a | n/a | n/a | Component 1 candidate values: {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Component 2 candidate values: {1, 2, 3, 4, 6, 8}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supportedIf the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to 31 | Optional with capability signaling |

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| Ericsson  | One of the open issues on this FG row is whether one or more values need to be reported for Component 1. The candidate values for Component 1 are given as follows:{UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Since the UE can report UE-assisted DL TDOA, Multi-RTT positioning, or both UE-assisted DL TDOA and Multi-RTT positioning, there is no need to report more than one component value. Hence, we propose to delete ‘[One or more of]’ from the description of Component 1.A second issue is regarding the following note:“Note: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to 31” Note that currently, the maximum candidate value supported for Component 2 is 8. Hence, the number ‘31’ in the above note needs to be replaced by the value ‘7’.Our proposed changes are shown below:

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| 27. NR\_pos\_enh | 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | … | Component 1 candidate values: {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Component 2 candidate values: {1, 2, 3, 4, 6, 8}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supportedIf the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to 7 | Optional with capability signaling |

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|  27. NR\_pos\_enh | 27-1-2 | Support of UE-TxTEGs for UL TDOA  | The maximum number of UE-TxTEG for SRS resource for positioning, which is supported and reported by UE for UL TDOA  | 13-8 | Yes |  | UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the [mitigation of] UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedNote: It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA Note: If the UE does not include TxTEG-ID associated with a SRS resource for positioning, no assumption can be made on the UE Tx timing error for this SRS resource for positioning.  | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-1-2 | Support of UE-TxTEGs for UL TDOA  | The maximum number of UE-TxTEG for SRS resource for positioning, which is supported and reported by UE for UL TDOA  | 13-8 | Yes |  | UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedNote: It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA Note: If the UE does not include TxTEG-ID associated with a SRS resource for positioning, no assumption can be made on the UE Tx timing error for this SRS resource for positioning.  | Optional with capability signaling. |

FG 27-1-2* “mitigation of” may be removed.
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| Vivo  |  |
| ZTE  |  |
| OPPO  | In Rel-17, in order to mitigate the Tx and Rx timing errors, a new concept of TEG (timing error group) is introduced. Based on TEGs, several enhanced solutions are introduced for DL TDOA, UL TDOA and multi-RTT positioning methods. In the current version of UE feature list, the related FGs are relatively stable. We have some suggestion for minor corrections.***Proposal 1: Adopt the following updates (RED part) for UE FG 27-1-1, 27-1-2, 27-1-2a, 27-1-3.***

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| --- | --- | --- | --- | --- |
| 27-1-2 | Support of UE-TxTEGs for UL TDOA  | The maximum number of UE-TxTEG for SRS resource for positioning, which is supported and reported by UE for UL TDOA  | UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the ~~[mitigation of]~~ UE Tx timing error for the SRS resource for positioning | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedNote: It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA Note: If the UE does not include TxTEG-ID associated with a SRS resource for positioning, no assumption can be made on the UE Tx timing error for this SRS resource for positioning.  |

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| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * **27-1-2:**
	+ There is an existing RAN1 agreement to support PCO for TEGs. Since a new FG to cover this aspect has not seen to be agreeable, we propose to capture it as a component of 27-1-1, 27-1-2 and 27-1-3 instead. Without this component it is not clear if the UE is considering the PCO impacts which then impacts how useful the TEG assocations are to the LMF. The RAN1 agreement is clear that this may possibly be included and it should be captured in the FG somehow.
		- Component x: Support of PCO calibration as part of timing error calibration

Agreement: (RAN1#104-e) (highlight ours)The following definitions are used for the purpose of discussion of internal timing errors (these terms are not agreed to be included in the specifications):* **Tx timing error**: From a signal transmission perspective, there will be a time delay from the time when the digital signal is generated at baseband to the time when the RF signal is transmitted from the Tx antenna. For supporting positioning, the UE/TRP may implement an internal calibration/compensation of the Tx time delay for the transmission of the DL PRS/UL SRS signals, which may also include the calibration/compensation of the relative time delay between different RF chains in the same TRP/UE. The compensation may also possibly consider the offset of the Tx antenna phase center to the physical antenna center. However, the calibration may not be perfect. The remaining Tx time delay after the calibration, or the uncalibrated Tx time delay is defined as *Tx timing error*.
* **Rx timing error**: From a signal reception perspective, there will be a time delay from the time when the RF signal arrives at the Rx antenna to the time when the signal is digitized and time-stamped at the baseband. For supporting positioning, the UE/TRP may implement an internal calibration/compensation of the Rx time delay before it reports the measurements that are obtained from the DL PRS/UL SRS signals, which may also include the calibration/compensation of the relative time delay between different RF chains in the same TRP/UE. The compensation may also possibly consider the offset of the Rx antenna phase center to the physical antenna center. However, the calibration may not be perfect. The remaining Rx time delay after the calibration, or the uncalibrated Rx time delay is defined as Rx timing error.
* **UE Tx ‘timing error group’ (UE Tx TEG):** A UE Tx TEG is associated with the transmissions of one or more UL SRS resources for the positioning purpose, which have the Tx timing errors within a certain margin.
* **TRP Tx ‘timing error group’ (TRP Tx TEG):** A TRP Tx TEG is associated with the transmissions of one or more DL PRS resources, which have the Tx timing errors within a certain margin.
* **UE Rx ‘timing error group’ (UE Rx TEG):** A UE Rx TEG is associated with one or more DL measurements, which have the Rx timing errors within a certain margin.
* **TRP Rx ‘timing error group’ (TRP Rx TEG):** A TRP Rx TEG is associated with one or more UL measurements, which have the Rx timing errors within a margin.
* **UE RxTx ‘timing error group’ (UE RxTx TEG):** A UE RxTx TEG is associated with one or more UE Rx-Tx time difference measurements, and one or more UL SRS resources for the positioning purpose, which have the ‘Rx timing errors+Tx timing errors’ within a certain margin.
* **TRP RxTx ‘timing error group’ (TRP RxTx TEG):** A TRP RxTx TEG is associated with one or more gNB Rx-Tx time difference measurements and one or more DL PRS resources, which have the ‘Rx timing errors+Tx timing errors’ within a certain margin.
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| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-1-2: Support of UE-TxTEGs for UL TDOA
	+ “[mitigation of]” can be removed.
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| Intel Corporation  | The wording for consequence if the FGs are not supported is under discussion:* “UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the [mitigation of] UE Tx timing error for the SRS resource for positioning”
* “UE-TxTEGs for Multi-RTT is not supported and no assumption can be made on the [mitigation of] UE Tx timing error for the SRS resource for positioning”

The TEG concept is introduced to facilitate mitigation of UE/gNB timing errors at LMF. We prefer to keep mitigation.1. * **Keep the wording “mitigation of” in FGs 27-1-2/a (i.e., remove brackets)**
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| Apple  |  |
| CMCC  | The mechanisms of reporting Tx TEGs for UL-TDOA and Multi-RTT are different, and when both UL-TDOA and Multi-RTT, or UL-TDOA and DL-TDOA are used, the UE should provide the association information of UL SRS resources for positioning with Tx TEGs, the UE should report the Tx TEG to the entity that initiates the request. Hence, for UL-TDOA, the LMF also needs to know if the feature is supported. The following notes should be kept in both rows:* Need for location server to know if the feature is supported.
* Note (for FG 27-1-2): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA [if UL TDOA is supported by UE]
* [Note (for FG 27-1-2a): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA]
* [Note: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE]

**Proposal 2: The following notes should be kept in both rows of FG 27-1-2 and FG 27-1-2a.*** **Need for location server to know if the feature is supported.**
* **Note (for FG 27-1-2): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA [if UL TDOA is supported by UE]**
* **[Note (for FG 27-1-2a): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA]**
* **[Note: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE]**
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| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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|  27. NR\_pos\_enh | 27-1-2 | Support of UE-TxTEGs for UL TDOA  | The maximum number of UE-TxTEG for SRS resource for positioning, which is supported and reported by UE for UL TDOA  | 13-8 | Yes |  | UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedNote: It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA Note: If the UE does not include TxTEG-ID associated with a SRS resource for positioning, no assumption can be made on the UE Tx timing error for this SRS resource for positioning.  | Optional with capability signaling |

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| Ericsson  |  |

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|  27. NR\_pos\_enh | 27-1-2a | Support of UE-TxTEGs for Multi-RTT positioning | The maximum number of UE-TxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4, 13-8 | No |  | UE-TxTEGs for Multi-RTT positioning is not supported and no assumption can be made on the [mitigation of] UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedIf the UE does not include TxTEG-ID associated with a measurement, no assumption can be made on the [mitigation of] UE Tx timing errors for this SRS resource for positioningNote: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-1-2a | Support of UE-TxTEGs for Multi-RTT positioning | The maximum number of UE-TxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4, 13-8 | No |  | UE-TxTEGs for Multi-RTT positioning is not supported and no assumption can be made on the UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedIf the UE does not include TxTEG-ID associated with a measurement, no assumption can be made on the UE Tx timing errors for this SRS resource for positioningNote: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE | Optional with capability signaling. |

FG 27-1-2a* “mitigation of” may be removed.
 |
| Vivo  |  |
| ZTE  |  |
| OPPO  | In Rel-17, in order to mitigate the Tx and Rx timing errors, a new concept of TEG (timing error group) is introduced. Based on TEGs, several enhanced solutions are introduced for DL TDOA, UL TDOA and multi-RTT positioning methods. In the current version of UE feature list, the related FGs are relatively stable. We have some suggestion for minor corrections.***Proposal 1: Adopt the following updates (RED part) for UE FG 27-1-1, 27-1-2, 27-1-2a, 27-1-3.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 27-1-2a | Support of UE-TxTEGs for Multi-RTT positioning | The maximum number of UE-TxTEG, which is supported and reported by UE for Multi-RTT positioning | UE-TxTEGs for Multi-RTT positioning is not supported and no assumption can be made on the ~~[mitigation of]~~ UE Tx timing error for the SRS resource for positioning | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedIf the UE does not include TxTEG-ID associated with a measurement, no assumption can be made on the ~~[mitigation of]~~ UE Tx timing errors for this SRS resource for positioningNote: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE |

 |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-1-2a: Support of UE-TxTEGs for Multi-RTT positioning
	+ “[mitigation of]” can be removed.
 |
| Intel Corporation  | The wording for consequence if the FGs are not supported is under discussion:* “UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the [mitigation of] UE Tx timing error for the SRS resource for positioning”
* “UE-TxTEGs for Multi-RTT is not supported and no assumption can be made on the [mitigation of] UE Tx timing error for the SRS resource for positioning”

The TEG concept is introduced to facilitate mitigation of UE/gNB timing errors at LMF. We prefer to keep mitigation.1. * **Keep the wording “mitigation of” in FGs 27-1-2/a (i.e., remove brackets)**
 |
| Apple  |  |
| CMCC  | The mechanisms of reporting Tx TEGs for UL-TDOA and Multi-RTT are different, and when both UL-TDOA and Multi-RTT, or UL-TDOA and DL-TDOA are used, the UE should provide the association information of UL SRS resources for positioning with Tx TEGs, the UE should report the Tx TEG to the entity that initiates the request. Hence, for UL-TDOA, the LMF also needs to know if the feature is supported. The following notes should be kept in both rows:* Need for location server to know if the feature is supported.
* Note (for FG 27-1-2): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA [if UL TDOA is supported by UE]
* [Note (for FG 27-1-2a): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA]
* [Note: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE]

**Proposal 2: The following notes should be kept in both rows of FG 27-1-2 and FG 27-1-2a.*** **Need for location server to know if the feature is supported.**
* **Note (for FG 27-1-2): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA [if UL TDOA is supported by UE]**
* **[Note (for FG 27-1-2a): It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA]**
* **[Note: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE]**
 |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  27. NR\_pos\_enh | 27-1-2a | Support of UE-TxTEGs for Multi-RTT positioning | The maximum number of UE-TxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4, 13-8 | No |  | UE-TxTEGs for Multi-RTT positioning is not supported and no assumption can be made on the UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedIf the UE does not include TxTEG-ID associated with a measurement, no assumption can be made on the UE Tx timing errors for this SRS resource for positioningNote: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE | Optional with capability signaling |

 |
| Ericsson  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  27. NR\_pos\_enh | 27-1-3 | Support of UE-RxTxTEGs for Multi-RTT | The maximum number of UE-RxTxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4 and 13-8 | No |  | UE RxTx for Multi-RTT is not supported and no assumption can be made on the UE RxTx timing [error/delays] for the measurement | per band | n/a | n/a | n/a | The candidate values are {1, 2, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64}Need for location server to know if the feature is supportedIf the UE does not include RxTxTEG-ID associated with a measurement, no assumption can be made on the UE RxTx timing [errors/delays] for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTxTEG ID can span from 0, up to 255 | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-1-3 | Support of UE-RxTxTEGs for Multi-RTT | The maximum number of UE-RxTxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4 and 13-8 | No |  | UE RxTx for Multi-RTT is not supported and no assumption can be made on the UE RxTx timing error for the measurement | per band | n/a | n/a | n/a | The candidate values are {1, 2, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64}Need for location server to know if the feature is supportedIf the UE does not include RxTxTEG-ID associated with a measurement, no assumption can be made on the UE RxTx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTxTEG ID can span from 0, up to 255 | Optional with capability signaling. |

FG 27-1-3* Keep error
 |
| Vivo  |  |
| ZTE  |  |
| OPPO  | In Rel-17, in order to mitigate the Tx and Rx timing errors, a new concept of TEG (timing error group) is introduced. Based on TEGs, several enhanced solutions are introduced for DL TDOA, UL TDOA and multi-RTT positioning methods. In the current version of UE feature list, the related FGs are relatively stable. We have some suggestion for minor corrections.***Proposal 1: Adopt the following updates (RED part) for UE FG 27-1-1, 27-1-2, 27-1-2a, 27-1-3.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 27-1-3 | Support of UE-RxTxTEGs for Multi-RTT | The maximum number of UE-RxTxTEG, which is supported and reported by UE for Multi-RTT positioning | UE RxTx for Multi-RTT is not supported and no assumption can be made on the UE RxTx timing ~~[~~error~~/delays]~~ for the measurement | The candidate values are {1, 2, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64}Need for location server to know if the feature is supportedIf the UE does not include RxTxTEG-ID associated with a measurement, no assumption can be made on the UE RxTx timing ~~[~~error~~/delays]~~ for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTxTEG ID can span from 0, up to 255 |

 |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-1-3: Support of UE-RxTxTEGs for Multi-RTT
	+ We prefer to keep “error” (i.e. “delays” can be removed).
 |
| Intel Corporation  | The wording for consequence if the FG is not supported is under discussion:“UE RxTx TEGs for Multi-RTT is not supported and no assumption can be made on the UE RxTx timing [error/delays] for the measurement”We prefer to have a wording consistent with the one used for FG 27-1-2/a, therefore we have following proposal:1. * **Use the following wording for FG 27-1-3**
		+ **UE RxTx for Multi-RTT ~~is~~ are not supported and** no **assumption can be made on the UE RxTx timing ~~[~~error~~/delays] for the measurement~~ mitigation”**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  27. NR\_pos\_enh | 27-1-3 | Support of UE-RxTxTEGs for Multi-RTT | The maximum number of UE-RxTxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4 and 13-8 | No |  | UE RxTx for Multi-RTT is not supported and no assumption can be made on the UE RxTx timing error/ for the measurement | per band | n/a | n/a | n/a | The candidate values are {1, 2, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64}Need for location server to know if the feature is supportedIf the UE does not include RxTxTEG-ID associated with a measurement, no assumption can be made on the UE RxTx timing errorsfor this measurementNote: The “per band” reporting on this capability does not imply, that the RxTxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTxTEG ID can span from 0, up to 255 | Optional with capability signaling |

 |
| Ericsson  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-1-4 | Support of UE Rx TEGs for measuring the same DL PRS resource | The maximum number of different UE-RxTEGs that a UE can support to measure the same DL PRS of a TRP | 27-1-1 | No |  | Up to 1 RxTEG is used to measure the same DL PRS resource of a TRP |  per band | n/a | n/a | n/a | The candidate values are {2, 3, 4, 6, 8}Need for location server to know if the feature is supported | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-1-4a | Support of UE Rx TEGs for measuring the same DL PRS resource simultaneously | The maximum number of UE Rx TEGs for measuring the same DL PRS resource simultaneously | 27-1-4 | No |  |  | Per band | n/a | n/a | n/a | The candidate values are {1,2,34,6,8}Need for location server to know if the feature is supported. | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  | If a UE has multiple Rx TEGs, to mitigate the timing error difference between different Rx TEGs, the UE can be requested to optionally measure the same DL PRS resource of a TRP with N different UE Rx TEGs and report the corresponding multiple RSTD measurements. The timestamp of the multiple RSTD measurements in the same measurement report can be the same or different. It indicates that the UE may be capable of measuring the same DL PRS resource with N different Rx TEGs at the same time, or the UE can only measure the same DL PRS resource from different repetitions or occasions. Therefore, a separate capability of simultaneously measure the same DL PRS resource with different Rx TEGs is required.**Proposal 3: Keep the FG 27-1-4a.** |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-2-1 | DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of measuring and reporting the PRS RSRPP of the first path for DL-AoD positioning method2.) The maximum number of first path PRS RSRPP per TRP | 13-5 or 27-2-2  | No |  |  | FFS: Per UE or per band | n/a | n/a | n/a | Component 2 candidate values: 2,4,8,16,24Need for location server to know if the feature is supportedThe maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP (27-2-2)[Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource] | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-2-1 | DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of measuring and reporting the PRS RSRPP of the first path for DL-AoD positioning method2.) The maximum number of first path PRS RSRPP per TRP | 13-5 or 27-2-2  | No |  |  | Per UE | No | Yes | No | Component 2 candidate values: 2,4,8,16,24Need for location server to know if the feature is supportedThe maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP (27-2-2)Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource | Optional with capability signaling. |

FG 27-2-1* For type: we think it should be per UE with FR1/FR2 differentiation.
* The Note could be kept.
 |
| Vivo  |

|  |
| --- |
| **Agreement**For reporting of DL PRS RSRPP and PRS RSRP in UE-A DL-AODThe maximum number of DL PRS RSRPP M is a UE capability and its candidate values include {2,4,8,16,24}.The capabilities for DL PRS RSRPP (M value) and DL PRS RSRP (N values) are such that M is less than or equal to N  |

Firstly, for the capability type of the 27-2-1, we prefer the capability type should be the same as 27-2-2. So, we propose it is per UE capability. Secondly, we prefer the note with yellow highlighted can be removedLastly, the candidate value of 13-5 includes the {1,2,3,4,5,6,7,8} and the candidate value of 27-2-2 includes the {16, 24} so that the N can be {1,2,3,4,5,6,7,8, 16, 24}. However, M only includes [2,4,8,16,24]. So, in some cases, the path RSRP capability may be larger than PRS RSRP capability. However, the above agreement requires that M is less than or equal to N. Therefore, the current candidate value is not enough, at least 1 should be added in candidate value to satisfy the agreement condition.So, we propose* ***Modify the 27-2-1 as follows.***
* ***Suggest the capability type as per UE***
* ***Include value of 1 as the candidate value for the first path RSRPP***
* ***Remove the note highlighted in yellow***
 |
| ZTE  | **Comments:*** It should be per UE basis to align with FG 13-5 and 27-2-2.
* The yellow note in the second last column should be removed as Rel-16 RSRP is mandatorily reported for DL-AOD positioning method.

***Proposal 2:*** *For 27-2-1** *It should be per UE basis*
* *The yellow note in the second last column should be removed*
 |
| OPPO  | We have the following updated FG 27-2-1 for DL-AoD method:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 27-2-1 | ~~[UE-assisted]~~ DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of ~~[~~measuring and reporting the~~]~~ PRS RSRPP of the first path for DL-AoD positioning method2.) The maximum number of first path PRS RSRPP per TRP | ~~[13-2 or 13-3, 13-4~~, 13-5~~, 13-8]~~ or 27-2-2 | No |  |  | FFS: Per UE or per band |

One FFS point is whether 27-2-2 shall be the prerequisite for 27-2-1. In our view, it should not be because FG 27-2-2 is for the feature of supporting more DL PRS RSRP measurement reporting. For the granularity, we propose to use per band.Proposal 3: On FG 27-2-1:* The 13-5 is prerequisite. 27-2-2 is not.
* It is per band
 |
| CATT  | For the FG, we think it should be per UE and there is a need to keep the note of “Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource”.Based on the above discussions, our proposal on FG27-2-1 as follows,*Proposal 9: Adopt the following modifications marked as red colour to FG 27-2-1 based on the agreement in RAN1#107bis-e:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-2-1 | DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of measuring and reporting the PRS RSRPP of the first path for DL-AoD positioning method2.) The maximum number of first path PRS RSRPP per TRP | 13-5 or 27-2-2 | No |  |  | Per UE | n/a | n/a | n/a | Component 2 candidate values: {2,4,8,16,24}Need for location server to know if the feature is supportedThe maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP (27-2-2)~~[~~Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource~~]~~ | Optional with capability signaling |

 |
| Nokia, Nokia Shanghai Bell  | * + Per band

Remove the bracket in “Component 2 candidate values: [2,4,8,16,24] as it was agreed at RAN1 #107e.It is not clear if the note means that FG 27-2-2 is always supported by UEs supporting 27-2-1, or if the note applies only if 27-2-1 is supported. Clarification is needed here.The yellow highlighted note is confusing, and in principle something to resolved in the main session, not in UE features session. Propose to remove it.  |
| China Telecom  | For the FG 27-2-1, we prefer to support the granularity being “per UE”, we think the feature is expected to be consistent across all the bands(i.e. per UE) and there is no foreseeable benefits with “per band”. And since there is no need to report the PRS-RSRPP before reporting the PRS-RSRPP for the first path, we think the note can be keeped here. Therefore, we propose***Proposal 1:*****For the FG 27-2-1*** ***The report granularity should be per UE.***
* ***Keep the note on having FG 13-5 as the prerequisite FG.***

The FG can be modified as follows,

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-2-1 | DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of measuring and reporting the PRS RSRPP of the first path for DL-AoD positioning method2.) The maximum number of first path PRS RSRPP per TRP | 13-5 or 27-2-2  | No |  |  | ~~FFS:~~ Per UE ~~or per band~~ | n/a | n/a | n/a | Component 2 candidate values: 2,4,8,16,24Need for location server to know if the feature is supportedThe maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP (27-2-2)~~[~~Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource~~]~~ | Optional with capability signaling |

 |
| NTT DOCOMO, INC.  | * FG 27-2-1: DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD
	+ Type should be per UE.
	+ Regarding note, the bracket can be removed.
 |
| Intel Corporation  | Discussion on per UE or per band signaling for this FG is still open. Our preference is to support per band signaling.In addition, the following note is under discussion:* [Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource]

Our understanding for PRS-RSRPP reporting is aligned with the meaning of the note. We assume it is a common understanding and if it is the case the note may be removed.1. * **Define per band signaling for FG 27-2-1 (DL PRS-RSRPP for DL-AOD)**
	* **Remove brackets from the Note for FG 27-2-1**
 |
| Apple  |  |
| CMCC  | Since no DL PRS RSRP measurement is required to be reported to the LMF for UE-based positioning, the “UE-assisted” should be kept in the name of the FG.**Proposal 4: Keep “UE-assisted” in the name of the FG 27-2-1.** |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated | **Proposal 1: FG 27-2-1 should be reported per band**This is a new feature related to earliest path measurement that was introduced in NR Rel-17 and may have RAN4 minimum requirements. A UE may have a single software block to perform the first-path RSRPP estimation which indeed may be applicable across all bands; however, whether it can meet or not the requirements on a band, is a different topic. It depends on the RAN4 requirements, the RAN5 test setup, and whether there are actual deployments that have this feature enabled in order to perform inter-operability tests.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-2-1 | DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of measuring and reporting the PRS RSRPP of the first path for DL-AoD positioning method2.) The maximum number of first path PRS RSRPP per TRP | 13-5 or 27-2-2  | No |  |  | per band | n/a | n/a | n/a | Component 2 candidate values: 2,4,8,16,24Need for location server to know if the feature is supportedThe maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP (27-2-2)Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource | Optional with capability signaling |

 |
| Ericsson  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-2-2 | DL PRS RSRP reporting for more than 8 measurements for UE-assisted DL-AoD positioning | Support reporting K> 8 DL PRS RSRP measurements per TRP.Note: Multiple RSRPs corresponding to same or different Rx Beam index should be able to be reported for a given PRS resource for different timestamps.  | 13-5 | No |  | UE report of more than 8 DL PRS-RSRP is not supported.  | Per UE | n/a | Yes | n/a | The candidate values are {16, 24}Need for location server to know if the feature is supportedThe maximum number of reported DL PRS RSRP in the capability signaling should be no less than the maximum number of reported DL PRS RSRPP of the first path in the capability signaling | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-3-1 | M-sample measurements | The capability to support reporting a measurement based on measuring M=1 samples (instances) of a DL PRS resource set | 13-1 | No |  |  | per band | n/a | n/a | n/a | The candidate values are {1 [FFS others]}If the UE does not provide the capability, the UE is assumed to support M=4 only.Need for location server to know if the feature is supportedNote: The sample number M=1 does not account for the potential AGC sampleNote: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  | Regarding the candidate values, for us, candidate values of M needs to be maintained as a yellow highlight and waiting for the conclusion of RAN4.So, we propose* ***For FG 27-3-1, keep ‘FFS others’ value open and wait for RAN4 conclusion.***
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| ZTE  |  |
| OPPO  | For M-sample PRS measurement, we have the latest FG 27-3-1:

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| 27-3-1 | M-sample measurements ~~[of DL PRS measurement on single DL PRS period/occasion]~~ | ~~[~~The capability to support reporting a measurement based on measuring M=1 samples (instances) of a DL PRS resource set~~]~~ | ~~[~~13-1~~, 13-4, 13-8]~~ | No |  |  | ~~FFS: Per UE or~~ per band |

One FFS part for 27-3-1 is other candidate values. During the RAN1 discussion, only M =1 was agreed as in the following agreement. The other possible values are 2 or 3. There is no clear use case for them. Therefore, we suggest not to add other candidate values.

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| Agreement:For the PRS processing sample number M, at least M = 1 is supported. |

Proposal 5: On FG 27-3-1, the candidate value only has 1, no other values. |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  | For candidate values of the FG 27-3-1, 1 sample measurement can reduce the latency of positioning, however, with candidate value {2,3} can improve the accurancy compared with the 1-sample and also reduce the latency compared with 4-sample. So we think add {2,3} to the candidate may benefical to balance the accuracy and latency of positioning. ***Proposal 2:******For the FG 27-3-1, the candidate values should be {1,2,3}***The FG 27-3-1 can be modified as follow:

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| 27. NR\_pos\_enh | 27-3-1 | M-sample measurements | The capability to support reporting a measurement based on measuring M=1 samples (instances) of a DL PRS resource set | 13-1 | No |  |  | per band | n/a | n/a | n/a | The candidate values are {1 ~~[FFS others],~~ 2, 3}If the UE does not provide the capability, the UE is assumed to support M=4 only.Need for location server to know if the feature is supportedNote: The sample number M=1 does not account for the potential AGC sampleNote: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |

 |
| NTT DOCOMO, INC.  | * FG 27-3-1: M-sample measurements
	+ Support the current FG 27-3-1
 |
| Intel Corporation  | There is an FFS for candidate values of value M are {1 [FFS others]}. In our understanding, only M = 1 was agreed so far. The FFS for other values can be removed. We assume that UE also supports M = 4 but it does not need to be reported to LMF as M = 4 is an option predefined by R16 specification.1. * **Keep M = 1 only for components values of M sample measurements (i.e., remove FFS for other values)**
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| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-3-1 | M-sample measurements | The capability to support reporting a measurement based on measuring M=1 samples (instances) of a DL PRS resource set | 13-1 | No |  |  | per band | n/a | n/a | n/a | The candidate values are {1}If the UE does not provide the capability, the UE is assumed to support M=4 only.Need for location server to know if the feature is supportedNote: The sample number M=1 does not account for the potential AGC sampleNote: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |

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| Ericsson  |

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| 27. NR\_pos\_enh | 27-3-1 | M-sample measurements | The capability to support reporting a measurement based on measuring M=1 samples (instances) of a DL PRS resource set | … | If the UE does not provide the capability, the UE is assumed to support M=4 only.Need for location server to know if the feature is supportedNote: The sample number M=1 does not account for the potential AGC sampleNote: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |

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| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window - processing types | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing windowNote:* Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR
* Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected (FFS FR2)
* Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window [The DL signals/channels from all DL CCs (per UE) are affected (FFS FR2)]

Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability optionsNote: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP | 13-1 | Yes |  |  | per band | n/a | n/a | n/a | Component 1 candidate values: [One or more of] {Type 1A, Type 1B, Type 2}Need for location server to know if the feature is supportedNote: A UE that supports FG 27-3-2 also needs to support FG 27-3-2a | Optional with capability signaling |

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| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window2. Support of priority handing options of PRS: Option1, Option2 or Option3* 1. Option 1: UE may indicates support of two priority states.
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS
		2. State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS
	2. Option 2: UE may indicate support of three priority states
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS
		2. State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS
			1. Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.
		3. State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS
	3. Option 3: UE may indicate support of single priority state
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS

Note:* Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR
* Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected
* Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window

Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability optionsNote: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP | 13-1 | Yes |  |  | per band | n/a | n/a | n/a | Component 1 candidate values: One of {Type 1A, Type 1B, Type 2}Component 2 candidate values: {option1, option2, option3}Need for location server to know if the feature is supportedNote: A UE that supports FG 27-3-2 also needs to support FG 27-3-2a | Optional with capability signaling. |

FG 27-3-2* No need to keep the yellow text. The details should be kept in the procedure text.
* Do not support reporting multiple types per band.
* FG 27-3-2a should be merged into the component.
 |
| Vivo  |

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| --- | --- |
| **Agreement*** + For capability 1A as per working assumption made in RAN1#106-e, the DL signalings/channels in a per UE fashion (i.e. both across NR & LTE) inside the PRS processing window are dropped if the DL PRS is determined to be higher priority.
	+ For capability 1B as per working assumption made in RAN1#106-e, only the DL signalings/channels from a certain band inside the PRS processing window are dropped if the DL PRS is determined to be higher priority.

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| Working assumption:Subject to UE capability, support PRS measurement outside the MG, within a PRS processing window, and UE measurement inside the active DL BWP with PRS having the same numerology as the active DL BWP.Inside the PRS processing window, subject to the UE determining that DL PRS to be higher priority, support the following UE capabilities: Capability 1: PRS prioritization over all other DL signals/channels in all symbols inside the window. Cap. 1A: The DL signals/channels from all DL CCs (per UE) are affected. Cap. 1B: Only the DL signals/channels from a certain band/CC are affected. FFS: band or CCCapability 2: PRS prioritization over other DL signals/channels only in the PRS symbols inside the window A UE shall be able to declare a PRS processing capability outside MG. FFS: Details of capability signalling (e.g., per UE or per band, etc.) |

 |

Firstly, we prefer removing FFS for “FFS FR2”, we acknowledge the single beam receiving case may be impacted by PRS reception even with capability 1B considering UE needs to receive PRS based on neighboring cell QCL information and receive DL signalings/channels based on serving cell QCL information. But, if the UE priority capability is per band, and only a single beam is supported in FR2, the UE can directly indicate that capability1b is not supported. So, we don’t think additional enhancement for the case is needed, it is can be solved by UE capability reporting.Secondly, we suggest Type 2 is per cc capability, that is, only the DL signalings/channels from a certain carrier in the PRS symbols inside the PRS processing window are dropped if the DL PRS is configured to be a higher priority for Type 2Lastly, we are open to one or more types for candidate value, but considering the tight timeline, we can accept only a single type is supported for a band in Rel-17.So, we propose* ***The FG 27-3-2 can be modified as the following.***
* ***Delete the ‘(FFS FR2)’***
* ***For Type 2, The DL signals/channels from a certain band are affected.***
* ***Single Type for a band***
 |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + The notes in feature description can be removed completely, as they are about definitions and procedures, which do not belong to UE features at all.
	+ Add 27-3-2a as pre-requisite and remove corresponding note.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-3-2: DL PRS measurement outside MG and in a PRS processing window - processing types
	+ Regarding note, the bracket can be removed (i.e. keep “One or more of”).
	+ Regarding note of Type 1B in components, FFS part can be removed.
	+ Regarding note of Type 2 in components, we can consider the following candidate approaches for FFS part:
		- Alt.1: divide Type 2 into two sub-types (e.g. Type 2A as per UE gap, and Type 2B as per FR gap), and replace Type 2 by Type 2A and Type 2B for candidate values of component 1
		- Alt.2: specify Type2 as either per UE gap or per FR gap (in this case, we prefer per FR gap approach)
 |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  | According to the agreements in RAN1-107 e-meeting [1] listed below, for Cap. 2, we prefer to keep “The DL signals/channels from all DL CCs (per UE) are affected (FFS FR2)”. While for the component 1 candidate value, we prefer only one value of {Type 1A, Type 1B, Type 2}.***RAN1-107 e-meeting Agreement****For capability 1A as per working assumption made in RAN1#106-e, the DL signalings/channels in a per UE fashion (i.e. both across NR & LTE) inside the PRS processing window are dropped if the DL PRS is determined to be higher priority.**For capability 1B as per working assumption made in RAN1#106-e, only the DL signalings/channels from a certain band inside the PRS processing window are dropped if the DL PRS is determined to be higher priority.*

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| *Working assumption:**Subject to UE capability, support PRS measurement outside the MG, within a PRS processing window, and UE measurement inside the active DL BWP with PRS having the same numerology as the active DL BWP.** *Inside the PRS processing window, subject to the UE determining that DL PRS to be higher priority, support the following UE capabilities:*
	+ *Capability 1: PRS prioritization over all other DL signals/channels in all symbols inside the window.*
		- *Cap. 1A: The DL signals/channels from all DL CCs (per UE) are affected.*
		- *Cap. 1B: Only the DL signals/channels from a certain band/CC are affected.*
			* *FFS: band or CC*
	+ *Capability 2: PRS prioritization over other DL signals/channels only in the PRS symbols inside the window*
	+ *A UE shall be able to declare a PRS processing capability outside MG.*
		- *FFS: Details of capability signalling (e.g., per UE or per band, etc.)*
 |

***Proposal 2: For FG27-3-2, prefer to keep “The DL signals/channels from all DL CCs (per UE) are affected (FFS FR2)” for Type 2 in the 3rd bullet of note. And prefer only one value of {Type 1A, Type 1B, Type 2} for the component 1 candidate value.*** |
| Samsung  |  |
| Qualcomm Incorporated | With regards to MG-less PRS processing, if the UE reports a Type-1A MG-less PRS capability it could be able to report the highest PRS processing capability for a given latency, or vice versa, the shortest latency for a given number of PRS resources per slot, since the UE would have all the processing/memory resources of the modem to finish the processing. On the other hand, for Type-1B or Type-2, the UE would have to share the modem processing/memory resources with other functionalities, which will increase the latency or decrease the PRS processing capabilities. Depending on the use-case, it may be more appropriate for the UE to be allowed to report that it is capable of multiple of such PRS processing, and let the LMF recommend to the serving gNB which one is needed on different scenarios. ***Observation 1: Allowing the UE to report the capability of multiple PRS processing window types, it would enable to increase network flexibility to pick the most appropriate window type depending on the overhead & latency trade-off.*** ***Proposal 2: A UE should be able to report multiple of the Type-1A, Type-1B, Type-2 MG-less PRS processing capabilities, each one associated with a different PRS processing capability, to the LMF.*** ***Note: It will be network’s decision which type of PPW shall be activated***In FR2, it is generally known that a single beam may be used across the FR2 bands, and therefore, if a UE is performing PRS reception with PRS-specific beam in one FR2 band, the regular reception in the remaining bands would also be interrupted. ***Observation 2: In FR2 Positioning, MG-less PRS processing in one band would interrupt the DL reception of other FR2 band(s) when a common beam management framework is used.******Proposal 3: Add the following Note: For Type-1A/2 PRS processing time, the PRS processing in one FR2 band may affect the downlink receiving in a second FR2 band***

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| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window - processing types | * Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window

Note:* Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR
* Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected
* Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window
* For Type-1A/2 PRS processing time, the PRS processing in one FR2 band may affect the downling receiving in a second FR2 band

Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability optionsNote: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP | 13-1 | Yes |  |  | per band | n/a | n/a | n/a | Component 1 candidate values: One or more of {Type 1A, Type 1B, Type 2}Need for location server to know if the feature is supportedNote: A UE that supports FG 27-3-2 also needs to support FG 27-3-2a | Optional with capability signaling |

 |
| Ericsson  | One of the open issues of this FG row is whether DL signals/channels from all DL CCs (per UE) are affected when DL PRS is prioritized over other DL signals/channels. In our understanding, this condition is only applicable to Capability Type 1A and should not apply to Capability Type 2. Hence, we propose to delete the condition ‘[The DL signals/channels from all DL CCs (per UE) are affected (FFS FR2)]’ from Type 2 capability component description.Another open issue if multiple candidate values should be reported for Component 1. In our view, it is sufficient that the UE reports capability for one of Type 1A, Type 1B, or Type 1C.We make the following proposed changes to this FG row

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| --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window - processing types | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing windowNote:* Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR
* Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected (FFS FR2)
* Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window

Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability optionsNote: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP | … | Component 1 candidate values: {Type 1A, Type 1B, Type 2}Need for location server to know if the feature is supportedNote: A UE that supports FG 27-3-2 also needs to support FG 27-3-2a | Optional with capability signaling |

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| 27. NR\_pos\_enh | 27-3-2a | Support of priority handing of PRS when PRS measurement is outside MG | Support of priority handing options of PRS: Option1, Option2 or Option3* 1. Option 1: UE may indicates support of two priority states.
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS
		2. State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS
	2. Option 2: UE may indicate support of three priority states
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS
		2. State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS
			1. Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.
		3. State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS
	3. Option 3: UE may indicate support of single priority state

State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS | [27-3-3] | Yes |  |  | Per band  | No | No | No | Candidate values: {option1, option2, option3}Note: A UE that supports FG 27-3-2a also needs to support FG 27-3-2Note: if the FFS in FG 27-2a gets resolved as “per band’, FG 27-2a will be deleted and becomes a component of FG 27-3-2 | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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FG 27-3-2a* The Note should be implemented, and it should be merged into FG 23-3-2.
 |
| Vivo  |  |
| ZTE  |  |
| OPPO  | For PRS processing outside MG, we have updated FGs 27-3-2, 27-3-2a and 27-3-3. One FFS point in FG 27-3-2a is the granularity. In our view, it shall be per band since the PDSCH transmission feature is configured per band and FG 27-3-2a is about the priority of PRS w.r.t other DL transmission. Considering different band might have different PDSCH transmission features, this FG shall be per band.Proposal 6: FG 27-3-2a is per band. |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | The FG 27-3-2a can be defined as a component of FG 27-3-2 as it is also suggested by the following note:* Note: if the FFS in FG 27-2a gets resolved as “per band’, FG 27-2a will be deleted and becomes a component of FG 27-3-2

The note can be removed.1. * **Define FG 27-3-2a (priority handing of PRS outside MG) as a component of FG 27-3-2 (DL PRS measurement outside MG and in a PRS processing window) and remove the note**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering[2. Maximum duration of DL PRS symbols N in units of ms a UE can process in the first part of a PRS processing window assuming maximum DL PRS bandwidth in MHz, such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol] 3. Max number of DL PRS resources that UE can process in a slot under it | 27-3-2 | No |  |  | Per band | n/a | n/a | n/a |  Component 1 candidate values: {Type 1, Type 2}[Candidate 2 component values:a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} msb) T: {N+4, N+5, N+6, N+8} ms]Component 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHzNeed for location server to know if the feature is supportedNote: A UE may declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a band | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.3. Max number of DL PRS resources that UE can process in a slot under it | 27-3-2 | No |  |  | Per band | n/a | n/a | n/a |  Component 1 candidate values: {Type 1, Type 2}Candidate 2 component values:a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} msb) T: [{8, 16, 20, 30, 40, 80, 160, 320, 640, 1280}] msComponent 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHzNeed for location server to know if the feature is supportedNote: A UE may declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a band | Optional with capability signaling. |

FG 27-3-3* The original proposal should be agreed as part of the basic FG.
* Any advanced buffering capability should be introduced based on this.
 |
| Vivo  | For component 2, we don't think this is a great way that the value of T to be defined as N+5, when it is actually used, the processing time is T-N. In actuality, the processing time is also {4,5,6,8}, so, why don't we just define the processing time directly? For us, we prefer reusing component 3 in FG 13-1 and only discuss the candidate value in FG 27-3-3.

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| 13. NR Positioning | 13-1 | Common DL PRS Processing Capability | 1. Maximum DL PRS bandwidth in MHz, which is supported and reported by UE.

a) FR1 bands: {5, 10, 20, 40, 50, 80, 100}b) FR2 bands: {50, 100, 200, 400}1. DL PRS buffering capability: Type 1 or Type 2
2. Type 1 – sub-slot/symbol level buffering
3. Type 2 – slot level buffering
4. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.
5. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
6. N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms
7. Max number of DL PRS resources that UE can process in a slot under it
	1. FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz
	2. FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz

Note: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) of no more than 30%. |

* ***The FG 27-3-3 can be modified as the following.***
* ***Suggest modifying the candidate value of T as specific values***
* ***Reusing the description of FG 13-1 in component 2***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.3. Max number of DL PRS resources that UE can process in a slot under it | 27-3-2 | No |  |  | Per band | n/a | n/a | n/a |  Component 1 candidate values: {Type 1, Type 2}[Candidate 2 component values:a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} msb) T: {4, 5, 6, 8} ms]Component 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHzNeed for location server to know if the feature is supportedNote: A UE may declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a band |

 |
| ZTE  | **Comment:**In Rel-16, during the measurement window, the N ms of PRS symbols may be located in anywhere within the duration of T ms as shown in following figures.Figure 1a Figure 1b Figure 1cAs defined in the formula of TS 38.133 for the measurement period, the component Tlast is the measurement duration for the last PRS sample, including the sampling time and processing time. The Tlast is to consider the cases that PRS resources from different sets are not concentrated on the same MG instance or PRS resources appear in the end of the processing window (e.g. Figure 1c shown above). This component leads to additional latency for the sampling and processing of the last PRS sample. As we are trying to reduce the latency as much as possible, it’s not acceptable to take additional time after the end of the PRS processing window. In order to reduce the latency for DL PRS measurement in the PRS processing window outside MG, the location information report should be ready right after the end of the PRS processing window. That is, UE has to finish all the DL PRS receiving and computation in the PRS processing window to make full use of its hardware resources. Otherwise, there is no reason to drop other signals including PDSCH, PDCCH, CSI-RS etc. during the window in the case of PRS with higher priority for processing Type 1A and 1B. As discussed in RAN1#107e meeting, we propose the following UE PRS processing capability in PRS processing window outside MG.**PRS processing capability** is shown in the Figure 2 below, a PRS processing window is divided into a PRS buffering window and a PRS computation window. UE is only expected to receive the DL PRS in the PRS buffering window. Then, based on the buffered DL PRS, UE can compute/process the DL PRS in the PRS computation window to get ready for a location information report by the end of PRS processing window. According to this understanding, UE has to report its capability with combinations of {N, T} under the following interpretations, where T is equal to N+X, * A PRS processing window (with duration L) is divided into a PRS buffering window with duration L-(T-N) and a PRS computation window with duration T-N. The PRS computation window starts right after the end of the PRS buffering window.
* UE shall take T-N ms of time to process up to N ms of symbols containing PRS resources received by UE in the PRS buffering window
* UE is not expected to be configured a PRS processing window with duration smaller than T-N.

Figure 2 Type 1 PRS processing capabilityIn summary, we propose to confirm the yellow text in the above table.***Proposal 3****: In FG 27-3-3, adopt the yellow text as component 2.*  |
| OPPO  | The formulation of component 2 with “in the first part of PRS processing window…” is not aligned with previous RAN1 discussion and agreement. The feature of PRS processing window is to support processing PRS resource outside MG with a given processing priority. Defining “in the first part” would change the UE behavior and also specification, which is not preferred. Therefore, it is suggested to formulate component 2 as follows:

|  |
| --- |
| 2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.1. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
2. N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms
 |

Proposal 7: In FG 27-3-3, the component 2 shall be:

|  |
| --- |
| 2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.1. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
2. N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms
 |

 |
| CATT  | For this FG, we prefer that T should be a function of N to emphasize the low-latency of this feature. Therefore, the texts with yellow highlighting can be confirmed.Based on the above discussions, our proposal on FG27-3-3 as follows,*Proposal 2: Adopt the following modifications marked as red colour to FG 27-3-3 based on the agreement in RAN1#107bis-e:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG – buffering capability | 1. DL PRS buffering capability: Type 1 or Type 2a) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering~~[~~2. Maximum duration of DL PRS symbols N in units of ms a UE can process in the first part of a PRS processing window assuming maximum DL PRS bandwidth in MHz, such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol~~, where]~~3. Max number of DL PRS resources that UE can process in a slot under ita) FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzb) FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz | 27-3-2 | No |  |  | Per band | n/a | n/a | n/a | Candidate 2 component values:a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} msb) T: {N+4, N+5, N+6, N+8} msNeed for location server to know if the feature is supportedNote: A UE may declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a band | Optional with capability signaling |

 |
| Nokia, Nokia Shanghai Bell  | * + Original formulation of component 2 was more appropriated, and it had the benefit of being aligned with the Rel-16 PRS processing capability.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  | FG 27-3-3, which is about DL PRS Processing Capability outside MG, was discussed in RAN1#107b-e where the agreement in the appendix of this contribution was achieved in [1]. The second component of the FG 27-3-3 is concerned about the maximum duration of DL PRS symbols N in units of ms that a UE can process in the first part of a PRS processing window, assuming maximum DL PRS bandwidth in MHz, such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol. Here it should be noted that, aligned with common understanding, the whole T ms processing of PRS measurement is still within the PRS processing window. Figure 1 shows an example, where UE is not expected that any portion of T-N msec PRS processing after the last PRS symbol lies outside the PRS processing window. **Figure 1**: T is supposed to be within the PRS processing windowBased on the above discussion, we have the following proposal:**Proposal 1**: UE is not expected that any portion of T-N msec PRS processing after the last PRS symbol lies outside the PRS processing window. |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  | In R16 UE capability, the component 3 in 13-1 Common DL PRS Processing Capability is described as follows:

|  |
| --- |
| 1. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.
2. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
3. N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms
 |

In our view, for low latency positioning, the PRS processing time need to be smaller than the values in R16. Thus for the set of values of T in component 2, we suggest to include some smaller value in T, e.g., {1,2,4}ms. And we find it’s not necessary to build fixed dependence on N for T, as it is sufficient that UE can choose to report the suitable value from the value sets.***Proposal 1: Support smaller numbers for T in the existing UE PRS processing capability (N, T).*** 1. T: {1, 2, 4, 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
 |
| Qualcomm Incorporated |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering2. Maximum duration of DL PRS symbols N in units of ms a UE can process in the first part of a PRS processing window assuming maximum DL PRS bandwidth in MHz, such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol3. Max number of DL PRS resources that UE can process in a slot under it | 27-3-2 | No |  |  | Per band | n/a | n/a | n/a |  Component 1 candidate values: {Type 1, Type 2}Candidate 2 component values:a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} msb) T: {N+4, N+5, N+6, N+8} msComponent 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHzNeed for location server to know if the feature is supportedNote: A UE may declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a bandNote: This capability is applicable to RRC Connected only. | Optional with capability signaling |

 |
| Ericsson  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF 2. LOS/NLOS indicator granularity | one of 13-5,13-6, or 13-11 | No |  |  | Per UE | n/a | n/a | n/a | [Component 1 candidate values: {hard value, soft value[, both]}]Component 2 candidate values: {trpSpecific, resourceSpecific[, both]}[Note: a single value is reported when both multi-RTT and DL-TDOA are supported]FFS: signalling per methodNeed for location server to know if the feature is supported | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF 2. LOS/NLOS indicator granularity | one of 13-5,13-6, or 13-11 | No |  |  | Per UE | No | No | No | Component 1 candidate values: {hard value, soft value[, both]}Component 2 candidate values: {trpSpecific, resourceSpecific, both}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supported | Optional with capability signaling. |

FG 27-4-1* We support the existing candidate values for component 1.
* We support both for the candidate values for component 2.
* We support the Note on the single value for both methods if supported.
* No need to keep the FFS
 |
| Vivo  | In RAN1 #107-bis e-meeting, the capability of LOS/NLOS indicator has been agreed as following.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF ~~[for RSTD and UE Rx-Tx time difference measurements to LMF for DL and DL+UL positioning]~~2. LOS/NLOS indicator granularity~~FFS: whether to have separate capability component/FG for RSTD and UE Rx-Tx time difference measurements~~~~FFS: whether to have separate capability component for hard and soft indication~~ | one of 13-5,13-6, or 13-11 | No |  |  | ~~FFS:~~ Per UE ~~or per band~~ | n/a | n/a | n/a | [Component 1 candidate values: ~~[~~candidate value {hard value, soft value[, both]} ~~[0,1]~~]Component 2 candidate values: {trpSpecific, resourceSpecific[, both]}[Note: a single value is reported when both multi-RTT and DL-TDOA are supported]FFS: signalling per methodNeed for location server to know if the feature is supported | Optional with capability signaling |

For LoS/NLoS indicators, it has been agreed in last RAN1 #107 meeting that both soft values and hard values are supported for LoS/NLoS indicator reporting.

|  |
| --- |
| **Agreement*** Support the following two options of values for LoS/NLoS indicator reporting from UE/TRP:
	+ Soft values: [0, 0.1, …, 0.9, 1] (in steps of 0.1)
	+ Hard values: [0, 1]
* The values correspond to the likelihood of LoS, with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS
 |

It has been agreed to support reporting LoS/NLoS indicator type to LMF, but the candidate value for component 1 needs further discussion. As far as we are concerned, if a UE supports LOS/NLOS indicator of soft value type, it will of course support the hard value 0 and 1. That is, no matter a UE is supportive of hard value only or soft value, it can firstly identify whether a measurement is LoS or NLoS, then UE supportive of soft value type can further report the soft value to indicate the probability. Therefore, for component 1 candidate values, only supporting soft value LOS/NLOS indicator is not needed.

|  |
| --- |
| Agreement:* For UE-based positioning, support the following options for LoS/NLoS indicators within positioning assistance data:
	+ Option 1 (Working assumption): LMF associates UE-based LoS/NloS indicators with each DL PRS resource for each TRP
	+ Option 2: LMF associates UE-based LoS/NloS indicators with each TRP
* Note: For option 1, one LoS/NloS indicator is associated with one DL-PRS resource

**Agreement**Confirm the working assumption on UE-based LoS/NloS indicators option 1 with the following revision:* Option 1: LMF associates UE-based LoS/NloS indicators with each DL PRS resource for each TRP, provided the LMF can give different values for Los/NLos indicators of different DL PRS resource of one TRP.
 |

For component 2 candidate values, in RAN1 #106-bis and #107 e-meeting, two options are both agreed. For option1, it means which beam direction associated with each PRS DL PRS resource for each TRP is LoS or NLoS. For option2, it means whether each TRP has a LoS link or not. We think both the trpSpecific and resourceSpecific should be supported to indicate different granularity of LoS/NloS indicators.In the RAN1 #106 meeting, it has already been agreed that LoS/NLoS indicators reporting is supported for DL and DL+UL positioning measurements taken at UE. That is, whether the LoS/NLoS indicators is for RSTD (which is the measurement in DL positioning) and for UE Rx-Tx time difference (which is the measurement in DL+UL positioning), it should be both supported. However, it has also been agreed that for LoS/NLoS detection method(s), there is no additional measurement IEs or assistance data outside of LoS/NLoS indicator reporting (i.e., Option 6 from prior agreement). That is to say, how UE determines LoS/NloS indicator completely depends on UE implementation, if a UE can do LoS/NLoS detection for DL positioning, it can also do LoS/NLoS detection for DL+UL positioning. Therefore, we think there is no need to have separate capability component for RSTD and UE Rx-Tx time difference measurements.

|  |
| --- |
| Agreement:* Support LoS/NLoS indicators which are reported to the LMF for DL and DL+UL positioning measurements taken at UE for UE-assisted positioning or UL and DL+UL measurements at the TRP for NG-RAN assisted positioning.
	+ Reporting from UE is subject to UE capability
* Positioning assistance data from LMF is enhanced for UE-based positioning by including LoS/NLoS indicators.
* FFS: Other kinds of positioning assistance data enhancements
* For LoS/NLoS detection method(s), there is no additional measurement IEs or assistance data outside of LoS/NloS indicator reporting (i.e., Option 6 from prior agreement).
* Note 1: No RAN4 requirements are expected for the LoS/NLoS indicators in RAN1’s understanding
* Note 2: LoS/NLoS indicators can be complementary to outlier rejection algorithms.
 |

* ***For UE’s capability to support reporting LoS/NLoS indicator (FG27-4-1),***
	+ ***support component 1 candidate value {hard value, both hard value and soft value}***
	+ ***support component 2 candidate value {trpSpecific, resourceSpecific, both}***
	+ ***not support reporting LoS/NLoS indicator*** ***per method***
 |
| ZTE  |  |
| OPPO  | There is no use case to include ‘both’ as candidate value for LOS/NLOS indicator type. ‘both’ would mean the UE supports both softvalue and hardvalue, which is not practical. If a UE is capable of supporting softvalue, it is not technically feasible for him to report supporting hardvalue. Furthermore, if a UE reporting support ‘both’, indicating a value of 0 or 1 would cause ambiguity. The UE would not know if the indicated value 0 or 1 is from a softvalue or hardvalue set. Regarding the LOS/NLOS indicator granularity, we also propose not to include the candidate value “both”. ***Proposal 9: For FG 27-4-1: do not include ‘both’ in candidate values of LOS/NLOS indicator type*** |
| CATT  | For this FG, we think the candidate values of Component 1 of this FG should include {hard value, soft value, both}, and the candidate values of Component 2 of this FG should include {trpSpecific, resourceSpecific, both}. And the note of “Note: a single value is reported when both multi-RTT and DL-TDOA are supported” should be kept.Based on the above discussions, our proposal on FG27-4-1 as follows,*Proposal 3: Adopt the following modifications marked as red colour to FG 27-4-1 based on the agreement in RAN1#107bis-e:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF2. LOS/NLOS indicator granularity | one of 13-5,13-6, or 13-11 | No |  |  | Per UE | n/a | n/a | n/a | [Component 1 candidate values: ~~candidate value~~ {hard value, soft value~~[~~, both~~]~~}Component 2 candidate values: {trpSpecific, resourceSpecific~~[~~, both~~]~~}~~[~~Note: a single value is reported when both multi-RTT and DL-TDOA are supported~~]~~~~FFS: signalling per method~~Need for location server to know if the feature is supported | Optional with capability signaling |

 |
| Nokia, Nokia Shanghai Bell  | * + Given that supporting to LoS/NLoS indication in itself is not dependent on measurement type, there is no need to report it separately for measurement type either.
	+ No need to signal candidate values, as UE should be able to support reports with either hard or soft values.
 |
| China Telecom  | In RAN1#107e, the following agreement has been reached.

|  |
| --- |
| **Agreement*** Support the following two options of values for LoS/NLoS indicator reporting from UE/TRP:
	+ Soft values: [0, 0.1, …, 0.9, 1] (in steps of 0.1)
	+ Hard values: [0, 1]
* The values correspond to the likelihood of LoS, with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS
 |

For FG 27-4-1, based on the discussion in RAN1#107bis-e and the agreement, we don’t think it is needed for report both the soft value and hard value at the same time. The meaning of candidate value {both} for component 1 should be clarified. If it just means the UE can support both the two type indicator at the same time, we support to add a note “the candidate value {both} for component 1 doesn’t mean the UE need to report the two types indicators at the same time”; otherwise we think the candidate value both should be removed here. The meaning of candidate value {both} for component 2 should also be clarified for the same reason.***Proposal 3:******For FG 27-4-1, the meaning of candidate value {both} needs clarified,**** ***Support to add {both} as a candidate value for component 1 only if the note “UE only needs to select one type of indicator to report even if the candidate value {both} is supported.” is added.***
* ***Support to add {both} as a candidate value for component2 only if the note “UE only needs to select one granularity of indicator to report even if the candidate value {both} is supported.” is added.***

The FG 27-4-1 can be modified as follows,

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF 2. LOS/NLOS indicator granularity | one of 13-5,13-6, or 13-11 | No |  |  | Per UE | n/a | n/a | n/a | [Component 1 candidate values: {hard value, soft value~~[~~, both~~]~~}]Note: UE only needs to select one type of indicator to report even if the candidate value {both} is supported. Component 2 candidate values: {trpSpecific, resourceSpecific~~[~~, both~~]~~}Note: UE only needs to select one granularity of indicator to report even if the candidate value {both} is supported. ~~[~~Note: a single value is reported when both multi-RTT and DL-TDOA are supported~~]~~FFS: signalling per methodNeed for location server to know if the feature is supported | Optional with capability signaling |

 |
| NTT DOCOMO, INC.  | * FG 27-4-1: LOS/NLOS Indicator for UE-assisted positioning
	+ Regarding component 1 candidate values, assuming the support of hard value type is a subset of the support of soft value type, “both” would not be necessary.
	+ Regarding component 2 candidate values, we prefer to keep “both”.
	+ Regarding note, [Note: a single value is reported when both multi-RTT and DL-TDOA are supported] can be removed.
	+ Regarding note, FFS part can be removed.
 |
| Intel Corporation  | The values of component 1 (Support reporting LoS/NLoS indicator type to LMF) are still under discussion. In our view UE can indicate a choice of the following options: {hard value, soft value, hard and soft value}. In addition, the values of component 2 (LOS/NLOS indicator granularity) also need to be finalized. We think that UE can also indicate a choice of the following values: {trpSpecific, resourceSpecific, trpSpecific and resourceSpecific}. Finally, we suggest defining LOS/NLOS indicator signaling per positioning method.* + **For FG 27-4-1 (LOS/NLOS Indicator for UE-assisted positioning), support**
		- **Define the following Component 1 values for UE selection:**
			* **{hard value, soft value, hard and soft value}**
		- **Define the following Component 2 values for UE selection:**
			* **{trpSpecific, resourceSpecific, trpSpecific and resourceSpecific}**
	+ **Split FG 27-4-1 per positioning method**
		- **LOS/NLOS Indicator for UE-assisted positioning DL TDOA positioning**
		- **LOS/NLOS Indicator for UE-assisted positioning DL AOD positioning**
		- **LOS/NLOS Indicator for UE-assisted positioning Multi-RTT positioning**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  | There are two options for LoS/NLoS indicator including soft values and hard values. Thus for FG27-4-1&27-12, we prefer to not support ‘both’ for the component candidate value since soft value is the super set of the hard value.***RAN1-107 e-meeting Agreement**** *Support the following two options of values for LoS/NLoS indicator reporting from UE/TRP:*
	+ *Soft values: [0, 0.1, …, 0.9, 1] (in steps of 0.1)*
	+ *Hard values: [0, 1]*
* *The values correspond to the likelihood of LoS, with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS*

***Proposal 3: For FG27-4-1&27-12, prefer to not support ‘both’ for the component candidate value.*** |
| Samsung  | According to the RAN1 #107 agreement, the LOS/NLOS indicators can be either soft values or hard values.

|  |
| --- |
| **Agreement*** Support the following two options of values for LoS/NLoS indicator reporting from UE/TRP:
	+ Soft values: [0, 0.1, …, 0.9, 1] (in steps of 0.1)
	+ Hard values: [0, 1]
* The values correspond to the likelihood of LoS, with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS
 |

A UE could support one of these options (either soft reporting or hard reporting). However, we did not find much motivation for supporting both (soft and hard reporting). For an advanced UE, if it’s capable of having soft values, it can choose to report hard or soft value, while the hard value is the only choice for a less advanced UE. But if “both” is indicated, which means UE gives the right to gNB to decide which type to be reported. While gNB or LMF did not have to choose since it’s the fact that soft value is more useful than hard value. Thus, we support including either hard or soft values for component 1.For component 2, “both” is useful because the two types are not exclusive. Thus, “both” is supported.***Proposal 2：Support the following statements regarding LOS/NLOS indicators for feature 27-4-1:**** ***Component 1 candidate values: {hard value, soft value}***
* ***Component 2 candidate values: {trpSpecific, resourceSpecific, both}***
 |
| Qualcomm Incorporated | ***Proposal 4: Add the following 2 Notes:*** * ***Note: This capability should be reported per method (multi-RTT, DL-TDOA, DL-AoD).***
* ***Note: the same value is reported when this feature is supported for multiple methods***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF 2. LOS/NLOS indicator granularity | one of 13-5,13-6, or 13-11 | No |  |  | Per UE | n/a | n/a | n/a | Component 1 candidate values: {hard value, soft value[, both]}Component 2 candidate values: {trpSpecific, resourceSpecific, both}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNote: This capability should be reported per method (multi-RTT, DL-TDOA, DL-AoD). Need for location server to know if the feature is supported | Optional with capability signaling |

 |
| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-6 | DL PRS processing capabilities in RRC inactive state | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE3. Max number of DL PRS resources that UE can process in a slot under it |  |  |  |  |  |  |  |  | Component 1 candidate values: {Type 1, Type 2}Component 2 candidate values:T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} msN: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} msComponent 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHzNote: Having the PRS processing capabilities in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state [, but instead LMF may set the response time assuming a specific RRC state during the PRS measurement and inform the gNB on the assumed RRC state, while the actual RRC state is still determined by UE/gNB that take the response time requirement and assumed RRC state into account.] | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-6 | DL PRS processing capabilities in power efficiency mode | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE3. Max number of DL PRS resources that UE can process in a slot under it |  |  |  |  |  |  |  |  | Component 1 candidate values: {Type 1, Type 2}Component 2 candidate values:T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} msN: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} msComponent 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz | Optional with capability signaling. |

FG 27-6* We propose to modify “RRC inactive state” to “power efficiency mode” to hide the RRC state from the LMF
 |
| Vivo  | We think FG27-6 should be left in UE feature list with the following reasons.* In inactive state, in order to maintain lower power consumption and complexity, the UE may turn off some functions and modules, the processing resources for positioning may be limited, so that the PRS processing capability can be different with connected state. Such different PRS processing capability should be declared by UE at least for the purpose of testing.
* UE reporting this capability helps LMF to perform corresponding steps for enabling the UE to meet latency requirement. Based on latest RAN4 agreementas the following, it can be seen that DRX cycle is considered in the positioning measurement delay requirement, e.g. DRX cycle is used to calculate available PRS period via LCM(DRX cycle, PRS period). Considering that the value of the DRX cycle is relatively large, such as a typical value of 1280ms, this will cause a large delay in the PRS measurement in inactive state. Then, for some positioning services with specific latency requirements, the influence of inactive DRX cycle on the latency should be considered. For example, if the inactive DRX cycle very likely causes the UE to fail to meet the latency requirement(e.g. response time), it is necessary to avoid the UE from entering the inactive state as much as possible or set a suitable latency requirement; and if the impact of the inactive DRX cycle on the latency is not enough to affect the latency requirement, there is no need to intervene in the state of the UE. Specifically, the LMF may obtain inactive DRX configurations(e.g. DRX cycle, etc.) from cells, PRS processing capability in advance; then, considering these informations and other factors (e.g. QoS requirement, etc.), it may indicate some assistance information to the serving gNB (e.g. assistance information to keep UE in connected state for positioning), or set a suitable latency requirement, which enables UE to meet latency requirement.

|  |
| --- |
| Agreement* DRX cycle should be considered in the positioning measurement delay requirements in RRC\_INACTIVE state.
 |

Therefore, we propose* ***Support FG27-6 (DL PRS processing capabilities) in the UE feature list.***
* ***Need for location server to know if the feature is supported.***
 |
| ZTE  | **Comments:*** It is important to determine if this UE capability should be reported to gNB or LMF firstly. Because RAN2 has agreed UE RRC state is transparent to LMF, we believe this UE capability should be reported to gNB rather than LMF for aligning RAN2’s guidance. Hence, 27-6 is not needed as gNB is not aware of PRS processing capability.
* We think one FG is enough for different positioning methods, and the prerequisite of this FG can be Rel-16 UE capability including 13-2, 13-3 and 13-4 for support of DL-AoD, DL-TDOA and Multi-RTT respectively. For example, if UE supports this new FG, and also supports Rel-16 DL-TDOA (13-3), it naturally supports DL-TDOA measurement in RRC\_INACTIVE state as well. Hence, there is no need to have separate FGs for different positioning methods.

***Proposal 5：****Support the new FG 27-17 on PRS measurement in RRC\_INACTIVE state** *The FG 2-17 is reported to gNB rather than LMF*
* *The report granularity is per UE*
* *The prerequisite is 13-2, 13-3 and 13-4*
* *The FG is common for DL-TDOA, DL-AoD, Multi-RTT.*
* *Other FGs including FG 27-6, 18a, 18b and 18c are not needed*
 |
| OPPO  | According to RAN2 design, LMF is not aware of the given UE’s RRC state. In RAN3#114bis-e meeting, there was proposal to support suggested RRC state from LMF to gNB as below [2]:

|  |
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| * Option A, include *Deferred Positioning Periodicity* in the non-UE associated message e.g. ASSISTANCE INFORMATION CONTROL message ([2] and [4])
* Option B, include *Deferred Positioning Periodicity* in the UE associated message e.g. POSITIONING INFORMATION REQUEST message ([3] and [6])
* Option C, include *End Indication* in the POSITIONING INFORMATION REQUEST message and POSITIONING ACTIVATION REQUEST messages ([3])
* Option D, include *Suggested RRC State* in the POSITIONING INFORMATION REQUEST message messages ([4])
 |

However, it was not agreed in RAN3. As a result, a separate PRS capability for RRC\_INACTIVE is useless. Similarly, it is not useful for LMF to know whether some other FGs are supported or not. ***Proposal 10: Remove UE FG 27-6, 27-18a, 27-18b, 27-18c.*** |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + Need to wait for more clear agreements before this FG can be confirmed
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | In our view, it is reasonable to assume that UE in RRC\_INACTIVE state will have more limited DL PRS processing capabilities comparing to UE in RRC\_CONNECTED state as there is no low latency requirement support and UE may switch to power saving mode. Therefore, we are supportive to define such capabilities in Rel.17 with the understanding captured by the following note if it is defined to implement this in capability signaling to LMF:* Note: Having the PRS processing capabilities in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state

Alternatively, it may be considered to define FG 27-6 as a component of FG 27-17 (Support of positioning in RRC\_INACTIVE state).* + **Support FG 27-6 (DL PRS processing capabilities in RRC inactive state) with the following note:**
		- **Note: Having the PRS processing capabilities in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state**
	+ **Define FG 27-6 as a component of FG 27-17 (Support of positioning in RRC\_INACTIVE state)**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-7 | Multiple measurement instances which can be included in a single measurement report | Support of mutiple measurement instances which can be included in a single measurement reportFFS: 2. Maximum number of measurement instances which can be included in a single measurement report |  |  |  |  |  |  |  |  | FFS: Component 2 candidate values | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-7 | Multiple measurement instances which can be included in a single measurement report | Support of mutiple measurement instances which can be included in a single measurement report |  | No |  | Multiple measurement instances in a single measurement report is not supported | Per UE | No | No | No |  | Optional with capability signaling. |

FG 27-7* No need to keep component 2.
 |
| Vivo  |  |
| ZTE  |  |
| OPPO  | Regarding the report of multiple measurement instances in a measurement report, there is still one remaining part for the corresponding UE feature groups: whether the maximum number of measurement instance is needed to be reported or not? In our understanding, how many measurement instances in a measurement report are mainly depending on the LMF configuration. Thus, we don’t think the related component is needed.***Proposal 2: Adopt the following updates (RED part) for UE FG 27-7.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 27-7 | Multiple measurement instances which can be included in a single measurement report | Support of ~~mutiple~~ multiple measurement instances which can be included in a single measurement report~~FFS: 2. Maximum number of measurement instances which can be included in a single measurement report~~ | ~~FFS: Component 2 candidate values~~ | Optional with capability signaling |

 |
| CATT  | For this FG, we support the introduction of Component 2 and the candidate values of Component 2 should be FFS, based on the following RAN1 agreement:

|  |
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| Agreement:Support enabling* A UE to report one or more measurement instances (of RSTD, DL RSRP, and/or UE Rx-Tx time difference measurements) in a single measurement report to LMF for UE-assisted positioning, and
* A TRP to report one or more measurement instances (of RTOA, UL RSRP, and/or gNB Rx-Tx time difference measurements) in a single measurement report to LMF, and
* Each measurement instance is reported with its own timestamp
	+ FFS: The measurement instances are within a [configured] measurement time window
* FFS: Each UE measurement instance can be configured with N instances of the DL-PRS Resource Set
	+ FFS: N (including N=1)
* FFS: Each TRP measurement instance can be configured with M SRS measurement time occasions
	+ FFS: M (including M=1)
* FFS: details of signalling, procedures, and UE capability if any
* FFS: whether and how to consider the additional enhancement related to measurement reporting of multi-paths and quality metric
* Note 1: A measurement instance refers to one or more measurements, which can either be the same or different types, which are obtained from the same DL PRS resource(s), or the same UL SRS resource(s).
* Note 2: This enhancement has no intention to change the mapping of measurement types to Rel-16 positioning techniques and no intention to introduce new positioning techniques either.
 |

 Based on the above discussions, our proposal on FG27-7 as follows,*Proposal 5: Adopt the following modifications marked as red colour to FG 27-7 based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-7 | Multiple measurement instances which can be included in a single measurement report | 1. Support of multiple ~~Maximum number of~~ measurement instances which can be included in a single measurement report~~FFS:~~ 2. Maximum number of measurement instances which can be included in a single measurement report |  |  |  |  |  |  |  |  | ~~FFS:~~ Component 2 candidate values: FFS | Optional with capability signaling |

 |
| Nokia, Nokia Shanghai Bell  | * + There is no need to define a range of capability values here. The UE supporting this FG should support up to a maximum value, e.g. 16.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | The FG 27-7 support of multiple measurement instances which can be included in a single measurement report was agreed to be introduced despite many FFS aspects in the original agreement. In general, we do not see strong justification and motivation behind the feature and do not consider it as essential for completion of NR positioning work. However, for the sake of progress and considering agreement to define FG, we propose to define that UE can support up to 4 measurement instances in a single measurement report. This is consistent with the Rel.16 assumption that UE needs to process four DL PRS periods before reporting measurement results.* + **Maximum number of measurement instances which can be included in a single measurement report is up to 4, i.e., selected by UE from the set {1, 2, 3, 4}**
	+ **Clarify definition of the measurement instance as a single DL PRS transmission period occasion**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-7 | Multiple measurement instances which can be included in a single measurement report | Support of mutiple measurement instances which can be included in a single measurement report |  |  |  |  |  |  |  |  |  | Optional with capability signaling |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-8 | Support of PRS TEG association information for UE-based DL-TDOA | Support of reception of association between PRS and TRP Tx TEG for UE-based positioning | 13-1 | No |  | Positioning calculation assistance data containing association between PRS and TRP Tx TEG is not supported by UE | Per UE | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-9 | Support of lower Rx beam sweeping factor | 1. Support of the lower Rx beam sweeping factor than 8 for FR22. Number of Rx beam sweeping factors |  | No |  | UE only supports 8 as the Rx beam sweeping factor defined by RAN4. | Per band | n/a | n/aFR2 only | n/a | Component 2 candidate values: FFSNeed for location server to know if the feature is supported | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-9 | Support of lower Rx beam sweeping factor | 1. Support of the lower Rx beam sweeping factor than 8 for FR22. Number of Rx beam sweeping factors |  | No |  | UE only supports 8 as the Rx beam sweeping factor defined by RAN4. | Per band | n/a | n/aFR2 only | n/a | Component 2 candidate values: {1,2,4,6}Need for location server to know if the feature is supported | Optional with capability signaling. |

FG 27-9* The candidate value can be {1,2,4,6} according to RAN4 LS.
 |
| Vivo  |

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| LS R4-2202678* RAN4 confirm that it is feasible to introduce a new UE capability on lower Rx beam sweeping factor (<8) to reduce the PRS measurement latency for FR2 positioning frequency layers.
* Reduced Rx beam sweeping factor (<8) capability can be applicable without any additional conditions
	+ No impact on positioning measurement accuracy requirements for UEs supporting the capability
	+ Positioning measurement period requirements will be reduced for UEs supporting the capability
* The following Rx beam sweep numbers are supported for reduced Rx beam sweeping factor (<8) UE capability: {1, 2, 4, 6}.
* RAN4 will further study whether UE needs to be configured by LMF to perform measurements with a reduced Rx beam sweeping factor.
 |

Based on the LS from RAN4 [5] above, the lower Rx beam sweep numbers are {1, 2, 4, 6}.* ***For FG27-9, the candidate value of Rx beam sweep numbers are {1, 2, 4, 6}.***
 |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + This is mostly fine, but the definition of supported values need to wait for outcome of RAN1 maintenance discussion and related incoming RAN4 LS.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-9: Support of lower Rx beam sweeping factor
	+ Regarding number of Rx beams sweeping factors, we think clarification of interpretation of candidate value is needed.
 |
| Intel Corporation  | RAN1 received response LS from RAN4 on support of lower Rx beam sweeping factor in [R1-2200899].

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| --- |
| * RAN4 confirm that it is feasible to introduce a new UE capability on lower Rx beam sweeping factor (<8) to reduce the PRS measurement latency for FR2 positioning frequency layers.
* Reduced Rx beam sweeping factor (<8) capability can be applicable without any additional conditions
	+ No impact on positioning measurement accuracy requirements for UEs supporting the capability
	+ Positioning measurement period requirements will be reduced for UEs supporting the capability
* The following Rx beam sweep numbers are supported for reduced Rx beam sweeping factor (<8) UE capability: {1, 2, 4, 6}.
* RAN4 will further study whether UE needs to be configured by LMF to perform measurements with a reduced Rx beam sweeping factor.
 |

Based on above reply from RAN4 the candidate values for reduced Rx beam sweeping factor capability are {1,2,4,6} therefore we have the following proposal* + **The candidate values for component 2 of the FG 27-9 are {1, 2, 4, 6}**
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| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-9 | Support of lower Rx beam sweeping factor | 1. Support of the lower Rx beam sweeping factor than 8 for FR22. Number of Rx beam sweeping factors |  | No |  | UE only supports 8 as the Rx beam sweeping factor defined by RAN4. | Per band | n/a | n/aFR2 only | n/a | Component 2 candidate values: {1,2,4,6}Need for location server to know if the feature is supported | Optional with capability signaling |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-10 | Support of UL MAC CE based MG activation request for PRS measurements | 1. Support of using UL MAC CE to request measurement gap for PRS measurements: The information in the UL MAC CE for MG activation request by the UE can be one ID associated with the preconfiguration of the MG2. Support of preconfiguration of MGs in RRC signaling for PRS measurements: Each MG in the preconfiguration is associated with an ID | 27-11 | Yes |  | Using UL MAC CE to indicate measurement gap for PRS measurements to the gNB is not supported. | Per UE | No | No | No |  | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  | For the FGs, we think there is the need for location server to know if the feature is supported.Based on the above discussions, our proposal on FG27-10/11 as follows,*Proposal 6: Adopt the following modifications marked as red colour to FG 27-10/11 based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-10 | Support of UL MAC CE based MG activation request for PRS measurements | 1. Support of using UL MAC CE to request measurement gap for PRS measurements: The information in the UL MAC CE for MG activation request by the UE can be one ID associated with the preconfiguration of the MG2. Support of preconfiguration of MGs in RRC signaling for PRS measurements: Each MG in the preconfiguration is associated with an ID | 27-11 | Yes |  | Using UL MAC CE to indicate measurement gap for PRS measurements to the gNB is not supported. | Per UE | No | No | No | ~~[~~Need for location server to know if the feature is supported~~]~~ | Optional with capability signaling |

 |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-10a | Low latency MG activation request for PRS measurements  | support of low latency MG activation request for PRS measurements | [27-10] | No |  | Low latency MG activation request for PRS measurements is not supported | Per UE | No | No | No | Need for location server to know if the feature is supported | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-10a | Low latency MG activation request for PRS measurements  | support of low latency MG activation request for PRS measurements |  | No |  | Low latency MG activation request for PRS measurements is not supported | Per UE | No | No | No | Need for location server to know if the feature is supported | Optional with capability signaling. |

FG 27-10a* No need to keep the prerequisite FG, since they are reported to different nodes.
 |
| Vivo  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 27. NR\_pos\_enh | 27-10a | Low latency MG activation request for PRS measurements  | support of low latency MG activation request for PRS measurements | [27-10] | No |  | Low latency MG activation request for PRS measurements is not supported | Per UE | No | No | No | Need for location server to know if the feature is supported |

We prefer to remove the [27-10] as a prerequisite feature group considering FG 27-10 is for gNB and FG 27-10a is for LMF.* ***For FG27-10a, remove the [27-10] as a prerequisite feature group.***
 |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + Confirm 27-10 as pre-requisite.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | We assume this FG is defined to inform LMF that UE supports low latency MG activation request functionality. The pre-requisites for this FG are under discussion. In our view, two pre-requisites can be used for this FG:* FG 27-10: UL MAC CE based MG activation request
* FG 27-11: DL MAC CE based MG activation request
	+ **Either of the following FGs: (1) FG 27-10 (UL MAC CE) or (2) FG 27-11 (DL MAC CE) can be used as a pre-requisite for FG 27-10a**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-10a | Low latency MG activation request for PRS measurements  | support of low latency MG activation request for PRS measurements | 27-10 | No |  | Low latency MG activation request for PRS measurements is not supported | Per UE | No | No | No | Need for location server to know if the feature is supported | Optional with capability signaling |

 |
| Ericsson  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-11 | Support of DL MAC CE based MG activation request for PRS measurements | 1. Support of preconfiguration of MGs in RRC signaling for PRS measurements: Each MG in the preconfiguration is associated with an ID2. Support of using DL MAC CE to activate the MG for PRS measurements: The DL MAC CE for MG activation indicates the ID associated with the preconfigured MG |  | Yes |  | Using DL MAC CE to activate the preconfigured MG for PRS measurements is not supported | Per UE | No | No | No |  | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  | For the FGs, we think there is the need for location server to know if the feature is supported.Based on the above discussions, our proposal on FG27-10/11 as follows,*Proposal 6: Adopt the following modifications marked as red colour to FG 27-10/11 based on the agreement in RAN1#107bis-e:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-11 | Support of DL MAC CE based MG activation request for PRS positioning measurements  | 1. Support of preconfiguration of MGs in RRC signaling for PRS positioning measurements: Each MG in the preconfiguration is associated with an ID2. Support of using DL MAC CE to activate the MG for PRS positioning measurements: The DL MAC CE for MG activation indicates the ID associated with the preconfigured MG |  | Yes |  | Using DL MAC CE to activate the preconfigured MG for PRS positioning measurements is not supported | Per UE | No | No | No | ~~[~~Need for location server to know if the feature is supported~~]~~ | Optional with capability signaling. |

 |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-12 | LOS/NLOS indicator for UE-based positioning assistance data | Support reception of the assistance data containing the LOS/NLOS indicator.1. LOS/NLOS indicator type2. LOS/NLOS indicator granularity |  | No |  |  | Per UE | No | No | No | [Component 1 candidate values: {softValue, hardValue, both}]Component 2 candidate values: {resourceSpecific, trpSpecific[, both]}Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-12 | LOS/NLOS indicator for UE-based positioning assistance data | Support reception of the assistance data containing the LOS/NLOS indicator.1. LOS/NLOS indicator type2. LOS/NLOS indicator granularity |  | No |  |  | Per UE | No | No | No | Component 1 candidate values: {softValue, hardValue, both}Component 2 candidate values: {resourceSpecific, trpSpecific, both}Need for location server to know if the feature is supported. | Optional with capability signaling. |

FG 27-12* We support all the existing candidate values, including “both”.
 |
| Vivo  | For FG 27-12, similar to FG27-4-1, we think the component 1 candidate value should be {hard value, both hard value and soft value}, and component 2 candidate value should be {trpSpecific, resourceSpecific, both}.* ***For UE’s capability to support LOS/NLOS indicator for UE-based positioning assistance data (FG27-12), support the following:***
	+ ***support component 1 candidate value {hard value, both hard value and soft value};***
	+ ***support component 2 candidate value {trpSpecific, resourceSpecific, both}.***
 |
| ZTE  |  |
| OPPO  | There is no need for support ‘both’ as candidate value for component 1 of LOS/NLOS indicator type. Similarly, there is no need to include ‘both’ as candidate value for component 2 of LOS/NLOS indicator granularity. If a UE can support resourceSpecific, it does not make sense for the LMF to provide trpSpecific configuration.***Proposal 8: For FG 27-12: do not include ‘both’ as candidate value for component 1 and do not include ‘both’ in candidate value for component 2.*** |
| CATT  | For this FG, we think the candidate values of Component 1 of this FG should include {hard value, soft value, both}, and the candidate values of Component 2 of this FG should include {trpSpecific, resourceSpecific, both}. Based on the above discussions, our proposal on FG 27-12 as follows,*Proposal 10: Adopt the following modifications marked as red colour to FG 27-12 based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-12 | LOS/NLOS indicator for UE-based positioning assistance data | Support reception of the assistance data containing the LOS/NLOS indicator.1. LOS/NLOS indicator type2. LOS/NLOS indicator granularity  |  | No |  |  | Per UE | No | No | No | ~~[~~Component 1 candidate values: {softValue, hardValue, both}~~]~~Component 2 candidate values: {resourceSpecific, trpSpecific~~[~~, both~~]~~}Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| Nokia, Nokia Shanghai Bell  | * + Component 1 definition should follow how 27-4-1 is going to be defined.
 |
| China Telecom  | Since the FG 27-12 and 27-4-1 have the same motivation, the candidate value for FG 27-12 should be the same as that of FG 27-4-1.***Proposal 4：******The candidate value of FG 27-12 should keep the same as that of FG 27-4-1.***The FG 27-12 can be modified as follows,

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| 27. NR\_pos\_enh | 27-12 | LOS/NLOS indicator for UE-based positioning assistance data | Support reception of the assistance data containing the LOS/NLOS indicator.1. LOS/NLOS indicator type2. LOS/NLOS indicator granularity |  | No |  |  | Per UE | No | No | No | [Component 1 candidate values: {hard value, soft value~~[~~, both~~]~~}]Note: UE only needs to select one type of indicator to report even if the candidate value {both} is supported. Component 2 candidate values: {trpSpecific, resourceSpecific~~[~~, both~~]~~}Note: UE only needs to select one granularity of indicator to report even if the candidate value {both} is supported. Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| NTT DOCOMO, INC.  | * FG 27-12: LOS/NLOS indicator for UE-based positioning assistance data
	+ Regarding component 1 candidate values, assuming the support of hard value type is a subset of the support of soft value type, “both” would not be necessary.
	+ Regarding component 2 candidate values, we prefer to keep “both”.
 |
| Intel Corporation  | The values of component 1 (LoS/NLoS indicator type) are still under discussion. In our view UE can indicate a choice of the following options for UE assistance information: {hard value, soft value, hard and soft value}. In addition, the values of component 2 (LOS/NLOS indicator granularity) also need to be finalized. We think that UE can also indicate a choice of the following values for UE assistance information: {trpSpecific, resourceSpecific, trpSpecific and resourceSpecific}.* + **For FG 27-4-1 (LOS/NLOS Indicator for UE-based positioning assistance data)**
		- **Define the following Component 1 values for UE selection:**
			* **{hard value, soft value, hard and soft value}**
		- **Define the following Component 2 values for UE selection:**
			* **{trpSpecific, resourceSpecific, trpSpecific and resourceSpecific}**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  | There are two options for LoS/NLoS indicator including soft values and hard values. Thus for FG27-4-1&27-12, we prefer to not support ‘both’ for the component candidate value since soft value is the super set of the hard value.***RAN1-107 e-meeting Agreement**** *Support the following two options of values for LoS/NLoS indicator reporting from UE/TRP:*
	+ *Soft values: [0, 0.1, …, 0.9, 1] (in steps of 0.1)*
	+ *Hard values: [0, 1]*
* *The values correspond to the likelihood of LoS, with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS*

***Proposal 3: For FG27-4-1&27-12, prefer to not support ‘both’ for the component candidate value.*** |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-12 | LOS/NLOS indicator for UE-based positioning assistance data | Support reception of the assistance data containing the LOS/NLOS indicator.1. LOS/NLOS indicator type2. LOS/NLOS indicator granularity |  | No |  |  | Per UE | No | No | No | Component 1 candidate values: {softValue, hardValue, both}Component 2 candidate values: {resourceSpecific, trpSpecific, both}Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-13 | Additional path reporting for UE-assisted DL-TDOA | 1. Support of additional detected path timing reporting for K>2 additional paths for UE-assisted DL-TDOA2. Support of RSRPP reporting for additional paths | 13-13a | No |  |  | Per UE | No | No | No | Component 1 candidate values: [{4, 6, 8}]Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-13 | Additional path reporting for UE-assisted DL-TDOA | 1. Support of additional detected path timing reporting for K>2 additional paths for UE-assisted DL-TDOA2. Support of RSRPP reporting for additional paths if UE supports FG 27-13a. |  | No |  |  | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}Need for location server to know if the feature is supported. | Optional with capability signaling. |

FG 27-13* We support all the existing candidate values.
* The prerequisite FG, which also seems to be typo (13-13a 🡪 27-13a?) should be removed, since support of additional path reporting should have no relevance with support of first path RSRPP.
* We could add the condition for component 2 on the dependency with FG 27-13a
 |
| Vivo  | As the maximum number of additional paths agreed is no larger than 8, the UE capability of additional path reporting should also be no larger than 8. Therefore, we suggest component 1 candidate values can be [{4, 6, 8}].* ***For UE’s capability to support additional path reporting (FG27-13/14),*** ***support component 1 candidate value [{4, 6, 8}].***
 |
| ZTE  |  |
| OPPO  |  |
| CATT  | For the FG 27-13, we think the candidate values of Component 1 should include {4, 6, 8}. For the FG 27-13a, it should be per UE.Based on the above discussions, our proposal on FG27-13/13a as follows,*Proposal 7: Adopt the following modifications marked as red colour to FG 27-13/13a based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-13 | Additional path reporting for UE-assisted DL-TDOA | ~~[~~1. Support of additional detected path timing reporting for K > 2 additional paths for UE-assisted DL-TDOA 2. Support of RSRPP reporting for additional paths~~.~~ | 13-13a | No |  |  | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | The values for component 1 (additional detected path timing reporting for K>2 additional paths) are still under discussion: [{4, 6, 8}]. In our view, all values up to 8 should be supported.* + **Define the following candidate values for component 1 of the FG 27-13 {3, 4, 5, 6, 7, 8}**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-13 | Additional path reporting for UE-assisted DL-TDOA | 1. Support of additional detected path timing reporting for K>2 additional paths for UE-assisted DL-TDOA2. Support of RSRPP reporting for additional paths | 13-13a | No |  |  | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-13a | First path reporting for UE-assisted DL-TDOA | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | FFS: Per UE or per band | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-13a | First path reporting for UE-assisted DL-TDOA | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | Per UE | No | Yes | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

FG 27-13a* For type, we support per UE with FR1/FR2 differentiation.
 |
| Vivo  |  |
| ZTE  | **Comment:** As it has been agreed that RSRPP reporting for additional path is per UE for FG 27-13 and 27-14, we suggest the reporting granularity for 27-13a and 27-14a is per UE as well. ***Proposal 4：****For FG* 27-*13a and* 27-*14a, the report granularity is per UE.* |
| OPPO  |  |
| CATT  | For the FG 27-13, we think the candidate values of Component 1 should include {4, 6, 8}. For the FG 27-13a, it should be per UE.Based on the above discussions, our proposal on FG27-13/13a as follows,*Proposal 7: Adopt the following modifications marked as red colour to FG 27-13/13a based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-13a | First path reporting for UE-assisted DL-TDOA | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | Per UE | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| Nokia, Nokia Shanghai Bell  | * + Per UE
 |
| China Telecom  | The FG 27-13a should have the same granuilarity as FG-13, and we don’t see the need to report RSRPP per band. So we propose,.***Proposal 5：******The granularity of FG 27-13a should be per UE.***

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| 27. NR\_pos\_enh | 27-13a | First path reporting for UE-assisted DL-TDOA | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | ~~FFS:~~ Per UE ~~or per band~~ | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| NTT DOCOMO, INC.  | * FG 27-13a: First path reporting for UE-assisted DL-TDOA
	+ Type should be per UE.
 |
| Intel Corporation  | The per UE signaling type was already agreed for additional path reporting for DL-TDOA FG 27-13. The same signaling type can be used for the first path for consistency.* + **Define per UE signaling type for the FG 27-13a (First path RSRPP for DL-TDOA)**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated | **Proposal 1: FG 27-13a should be reported per band**This is a new feature related to earliest path measurement that was introduced in NR Rel-17 and may have RAN4 minimum requirements. A UE may have a single software block to perform the first-path RSRPP estimation which indeed may be applicable across all bands; however, whether it can meet or not the requirements on a band, is a different topic. It depends on the RAN4 requirements, the RAN5 test setup, and whether there are actual deployments that have this feature enabled in order to perform inter-operability tests.

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| 27. NR\_pos\_enh | 27-13a | First path reporting for UE-assisted DL-TDOA | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | per band | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-14 | Additional path reporting for Multi-RTT | 1. Support of additional detected path timing reporting for K>2 additional paths for Multi-RTT2. Support of RSRPP reporting for additional paths  | 13-14a | No |  |  | Per UE | No | No | No | Component 1 candidate values: [{4, 6, 8}]Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-14 | Additional path reporting for Multi-RTT | 1. Support of additional detected path timing reporting for K>2 additional paths for Multi-RTT2. Support of RSRPP reporting for additional paths if UE supports FG 27-14a | 13-14a | No |  |  | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}Need for location server to know if the feature is supported. | Optional with capability signaling. |

FG 27-14* We support all the existing candidate values.
* The prerequisite FG, which also seems to be typo (13-14a 🡪 27-14a?) should be removed, since support of additional path reporting should have no relevance with support of first path RSRPP.
* We could add the condition for component 2 on the dependency with FG 27-14a
 |
| Vivo  | As the maximum number of additional paths agreed is no larger than 8, the UE capability of additional path reporting should also be no larger than 8. Therefore, we suggest component 1 candidate values can be [{4, 6, 8}].* ***For UE’s capability to support additional path reporting (FG27-13/14),*** ***support component 1 candidate value [{4, 6, 8}].***
 |
| ZTE  |  |
| OPPO  |  |
| CATT  | For the FG 27-14, we think the candidate values of Component 1 should include {4, 6, 8}. For the FG 27-14a, it should be per UE.Based on the above discussions, our proposal on FG27-14/14a as follows,*Proposal 8: Adopt the following modifications marked as red colour to FG 27-14/14a based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-14 | Additional path reporting for Multi-RTT | 1. Support of additional detected path timing reporting for K > 2 additional paths for Multi-RTT2. Support of RSRPP reporting for additional paths | 13-14a | No |  |  | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| Nokia, Nokia Shanghai Bell  | * + OK to confirm the FG
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | The values for component 1 (additional detected path timing reporting for K>2 additional paths) are still under discussion: [{4, 6, 8}]. In our view, all values up to 8 should be supported.* + **Define the following candidate values for component 1 of the FG 27-14 {3, 4, 5, 6, 7, 8}**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-14 | Additional path reporting for Multi-RTT | 1. Support of additional detected path timing reporting for K>2 additional paths for Multi-RTT2. Support of RSRPP reporting for additional paths  | 13-14a | No |  |  | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-14a | First path reporting for Multi-RTT | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | FFS: Per UE or per band | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-14a | First path reporting for Multi-RTT | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | Per UE | No | Yes | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

FG 27-14a* For type, we support per UE with FR1/FR2 differentiation.
 |
| Vivo  |  |
| ZTE  | **Comment:** As it has been agreed that RSRPP reporting for additional path is per UE for FG 27-13 and 27-14, we suggest the reporting granularity for 27-13a and 27-14a is per UE as well. ***Proposal 4：****For FG* 27-*13a and* 27-*14a, the report granularity is per UE.* |
| OPPO  |  |
| CATT  | For the FG 27-14, we think the candidate values of Component 1 should include {4, 6, 8}. For the FG 27-14a, it should be per UE.Based on the above discussions, our proposal on FG27-14/14a as follows,*Proposal 8: Adopt the following modifications marked as red colour to FG 27-14/14a based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-14a | First path reporting for Multi-RTT | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | Per UE | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| Nokia, Nokia Shanghai Bell  | * + Per UE
 |
| China Telecom  | The FG 27-14a should have the same granuilarity as FG-14, and we don’t see the need to report RSRPP per band. So we propose,.***Proposal 6：******The granularity of FG 27-14a should be per UE.***

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| 27. NR\_pos\_enh | 27-14a | First path reporting for Multi-RTT | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | ~~FFS:~~ Per UE ~~or per band~~ | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

 |
| NTT DOCOMO, INC.  | * FG 27-14a: First path reporting for Multi-RTT
	+ Type should be per UE.
 |
| Intel Corporation  | The per UE signaling type was already agreed for additional path reporting for Multi-RTT: FG 27-14. For consistency, the same signaling type can be used for the first path.* + **Define per UE signaling type for the FG 27-14a (First path RSRPP for Multi-RTT)**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated | **Proposal 1: FG 27-14a should be reported per band**This is a new feature related to earliest path measurement that was introduced in NR Rel-17 and may have RAN4 minimum requirements. A UE may have a single software block to perform the first-path RSRPP estimation which indeed may be applicable across all bands; however, whether it can meet or not the requirements on a band, is a different topic. It depends on the RAN4 requirements, the RAN5 test setup, and whether there are actual deployments that have this feature enabled in order to perform inter-operability tests.

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| 27. NR\_pos\_enh | 27-14a | First path reporting for Multi-RTT | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | per band | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-15 | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP | 1. Max number of SRS Resource Sets for positioning supported by UE2. Max number of [P/SP]SRS Resources for positioning3. Max number of [P/SP]SRS Resources for positioning per slot4. Max number of periodic SRS Resources for positioning 5. Max number of periodic SRS Resources for positioning per slotNote: OLPC for SRS for positioning based on SSB from the last serving cell (the cell that releases UE from connection) is part of this FG. No dedicated capability signaling is intended for this component |  | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 4, 8, 12, 16}Component 2 candidate values: {1,2,4,8,16,32,64}Component 3 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Component 4 candidate values: {1,2,4,8,16,32,64}Component 5 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}[Need for location server to know if the feature is supported]FFS: outside initial BWP | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-15 | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP | 1. Max number of SRS Resource Sets for positioning supported by UE2. Max number of SRS Resources for positioning3. Max number of SRS Resources for positioning per slot4. Max number of periodic SRS Resources for positioning 5. Max number of periodic SRS Resources for positioning per slotNote: OLPC for SRS for positioning based on SSB from the last serving cell (the cell that releases UE from connection) is part of this FG. No dedicated capability signaling is intended for this component |  | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 4, 8, 12, 16}Component 2 candidate values: {1,2,4,8,16,32,64}Component 3 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Component 4 candidate values: {1,2,4,8,16,32,64}Component 5 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14} | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-15b | Support of positioning SRS transmission in power efficiency mode for initial BWP | 1. Max number of SRS Resource Sets for positioning supported by UE2. Max number of SRS Resources for positioning3. Max number of periodic SRS Resources for positioning Note: OLPC for SRS for positioning based on SSB from the last serving cell (the cell that releases UE from connection) is part of this FG. No dedicated capability signaling is intended for this component |  | No |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 4, 8, 12, 16}Component 2 candidate values: {1,2,4,8,16,32,64}Component 3 candidate values: {1,2,4,8,16,32,64}Need for location server to know if the feature is supported | Optional with capability signaling |

FG 27-15* [P/SP] can be removed, and the FG can be used in future if AP was introduced.
* The FG can be split into two (one for gNB and one for LMF), and the one reported to LMF could use “power efficiency mode” instead of “RRC\_INACTIVE state”.
* A separate FG is required for SRS outside initial BWP.

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| 27. NR\_pos\_enh | 27-15d | Support of positioning SRS transmission in RRC\_INACTIVE state outside initial BWP | 1. SRS switching time (DL and UL)2. Supported numerology for SRS3. SRS bandwidth4. SRS bandwidth with initial DL BWP | 27-15 | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {0us, 30us, 100us, 140us, 200us, 300us, 500us, 900us} for DL and UL, respectivelyComponent 2 candidate values: {sameAsInitialUL-BWP, sameAsOrDifferentFromInitialUL-BWP}Component 3 candidate values: bitmap to indicate support of { 5MHz, 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 45MHz, 50MHz, 60MHz, 70MHz, 80MHz, 90MHz, 100MHz}.Component 4 candidate values: {srsBW-ContainsIntialDL-BWP, noRestriction} | Optional with capability signalling |
| 27. NR\_pos\_enh | 27-15e | Support of positioning SRS transmission in power efficiency mode outside initial BWP | SRS bandwidth | 27-15b | No |  |  | Per band | n/a | n/a | n/a | Candidate values: bitmap to indicate support of { 5MHz, 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 45MHz, 50MHz, 60MHz, 70MHz, 80MHz, 90MHz, 100MHz}.Need for location server to know if the feature is supported. | Optional with capability signalling |

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| Vivo  | Firstly, for FG27-15, we are OK to leave [P/SP] in component 2 and 3, as similar approach is used in FG13-8 including P/SP/AP SRS Resources for positioning. Besides, regarding ‘need for location server to know’, we think capabilities of positioning SRS transmission in inactive state may be reported to the LMF. For example, for Multi-RTT, the UE can support PRS processing in inactive state, but cannot support positioning SRS transmission in inactive state, which causes the UE cannot support Multi-RTT measurement in inactive state, then the LMF may indicate the serving gNB assistance information to keep the UE in connected state for Rx-Tx measurement .* ***Support FG27-15(Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP) in the UE feature list.***
* ***Leave [P/SP] in component 2 and 3***
* ***Need for location server to know if this feature is supported.***

In RAN1#107e, the following agreement was made regarding SRS transmission inside and outside initial UL BWP.

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| **Agreement*** The following options are supported for SRS for positioning transmission by RRC\_INACTIVE UEs:
	+ Option 1:
		- Subject to UE capability (which is a prerequisite for option 2), a UE may be configured with an SRS for Positioning associated with the initial UL BWP and transmitted, during the RRC\_INACTIVE state, inside the initial UL BWP with the same CP and SCS as configured for initial UL BWP.
	+ Option 2:
		- Subject to UE capability, a UE may be configured with an SRS for Positioning where the following parameters are additionally configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length.
			* The UE shall not transmit the SRS for Positioning when it is expected to perform UL transmissions in the initial UL BWP in RRC\_INACTIVE state.
* RAN1 assumes that
	+ SRS for positioning for UEs in RRC\_INACTIVE state is configured using the *SRS-PosResourceSet* IE
* Send LS to RAN2 to define signaling for SRS for positioning configuration for RRC\_INACTIVE UEs
 |

It can be seen that, for UE which supports of positioning SRS transmission in inactive state, the UE should at least support SRS transmission inside the initial UL BWP with the same CP and SCS as configured for initial UL BWP, that is, Option 1 above. Then, based on this prerequisite feature, the UE can additionally support SRS transmission with its own frequency location and bandwidth, SCS, CP length (outside the initial UL BWP), that is, Option 2 above. Regardless of whether SRS is transmitted inside the initial UL BWP or outside the initial UL BWP, we believe that there is no difference between other SRS capabilities. For example, for capabilities of component 1 to 5 in FG27-15, the value should be the same regardless of SRS is transmitted inside the initial UL BWP or outside the initial UL BWP. Therefore, if the UE can support positioning SRS transmission inside and outside intial UL BWP, additional note should be added: Positioning SRS transmission capabilities (component 1,2,3,4,5) in FG27-15 are the same as FG27-nn if UE supports positioning transmission in RRC\_INACTIVE STATE outside initial UL BWP.In addition, regarding ‘support of semi-persistent positioning SRS in inactive state’, from our point of view, if semi-persistent positioning SRS is supported in initial UL BWP and positioning SRS transmission outside initial UL BWP is also supported, semi-persistent positioning SRS outside intial UL BWP is naturally supported and the corresponding component values should be the same. Based on the discussion above, we propose* ***Add additional FG for SRS transmission for positioning outside the initial UL BWP.***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-nn | Support of positioning SRS transmission in RRC\_INACTIVE state outside initial UL BWP | 1.Support of SRS for Positioning with additional parameters configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length | 27-15 | Yes |  |  | Per UE | n/a | n/a | n/a | Note: Positioning SRS transmission capabilities (component 1,2,3,4,5) in FG27-15 are the same as FG27-nn if UE supports positioning transmission in RRC\_INACTIVE STATE outside initial UL BWP.Note: positioning SRS transmission in RRC\_INACTIVE state outside initial BWP with semi-persistent SRS is naturally supported with the same component values if UE supports FG27-15b and FG 27-nn. | Optional with capability signaling |

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| ZTE  | **Comments:** As RRC state is transparent to LMF, we don’t think the FG should let LMF know.***Proposal 6：****It is unnecessary to let LMF know FG 27-15.*  |
| OPPO  | In RAN1#106bis-e meeting, it is agreed that for RRC\_INACTIVE UEs, SRS for positioning bandwidth, SCS and CP type are configured by RRC and can be different from that of initial UL BWP. This agreement should not mandate all UE to support this feature. Accordingly, we prefer to have separate UE features for SRS transmission within initial BWP and out of initial BWP. Thus, we have the following proposal:***Proposal 12: In additional to UE feature 27-15 and 27-15a, introduce additional UE feature(s) to indicate the support of SRS transmission outside of initial BWP.***  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + Given the RAN4 reply, we need to consider operation outside BWP as well.
	+ No need for LMF to know the RRC state of the UE.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-15: Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP
	+ Considering FG 13-8 in Rel-16 UE features list, we prefer to keep “P/SP” in both component 2 and component 3.
	+ “[Need for location server to know if the feature is supported]” can be removed.
	+ Regarding whether to divide this feature into two FGs for initial BWP and outside initial BWP, it may be better to separate component in FG 27-15 (i.e. single FG is enough).
 |
| Intel Corporation  | The following FGs 27-15 and 27-15a define support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP for periodic and semi-persistent SRS transmission.RAN1 also agreed that SRS for positioning transmission can be supported outside of the initial BWP with different location, SCS, CP than for initial BWP.

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| **Agreement*** The following options are supported for SRS for positioning transmission by RRC\_INACTIVE UEs:
	+ Option 1:
		- Subject to UE capability (which is a prerequisite for option 2), a UE may be configured with an SRS for Positioning associated with the initial UL BWP and transmitted, during the RRC\_INACTIVE state, inside the initial UL BWP with the same CP and SCS as configured for initial UL BWP.
	+ Option 2:
		- Subject to UE capability, a UE may be configured with an SRS for Positioning where the following parameters are additionally configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length.
			* The UE shall not transmit the SRS for Positioning when it is expected to perform UL transmissions in the initial UL BWP in RRC\_INACTIVE state.
 |

Considering above agreement, we propose to split FG 27-15/27-15a as follows:* FG 27-15-1 – Support of periodic SRS for positioning in RRC\_INACTIVE state inside initial BWP
* FG 27-15-1a – Support of semi-persistent SRS for positioning in RRC\_INACTIVE state inside initial BWP
* FG 27-15-2 – Support of periodic SRS for positioning in RRC\_INACTIVE state inside outside initial BWP
* FG 27-15-2a – Support of semi-persistent SRS for positioning in RRC\_INACTIVE state outside initial BWP
	+ **SRS for positioning transmission inside initial UL BWP**
		- **FG 27-15-1 – Support of P-SRS for positioning in RRC\_INACTIVE state inside initial BWP**
		- **FG 27-15-1a – Support of SP-SRS for positioning in RRC\_INACTIVE state inside initial BWP**
	+ **SRS for positioning transmission outside initial UL BWP**
		- **FG 27-15-2 – Support of P-SRS for positioning in RRC\_INACTIVE state outside initial BWP**
		- **FG 27-15-2a – Support of SP-SRS for positioning in RRC\_INACTIVE state outside initial BWP**
	+ **Reuse components of P-SRS and SP-SRS resources from Rel.16 FGs 13-8/13-8b**
	+ **FGs 27-15-1/27-15-1a are pre-requisites for FGs 27-15-2/27-15-2a respectively**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  | According to the agreements in RAN1-107 e-meeting [1], we think two separate capabilities for SRS transmission inside the initial UL BWP or additional configured frequency location and bandwidth, SCS, CP length.*RAN1-107 e-meeting Agreement** *The following options are supported for SRS for positioning transmission by RRC\_INACTIVE UEs:*
	+ *Option 1:*
		- *Subject to UE capability (which is a prerequisite for option 2), a UE may be configured with an SRS for Positioning associated with the initial UL BWP and transmitted, during the RRC\_INACTIVE state, inside the initial UL BWP with the same CP and SCS as configured for initial UL BWP.*
	+ *Option 2:*
		- *Subject to UE capability, a UE may be configured with an SRS for Positioning where the following parameters are additionally configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length.*
			* *The UE shall not transmit the SRS for Positioning when it is expected to perform UL transmissions in the initial UL BWP in RRC\_INACTIVE state.*

***Proposal 4: Separate capabilities for SRS transmission inside the initial UL BWP or with additional configured frequency location and bandwidth, SCS, CP length.*** |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-15 | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP | 1. Max number of SRS Resource Sets for positioning supported by UE2. Max number of P/SP SRS Resources for positioning3. Max number of P/SP SRS Resources for positioning per slot4. Max number of periodic SRS Resources for positioning 5. Max number of periodic SRS Resources for positioning per slotNote: OLPC for SRS for positioning based on SSB from the last serving cell (the cell that releases UE from connection) is part of this FG. No dedicated capability signaling is intended for this component |  | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 4, 8, 12, 16}Component 2 candidate values: {1,2,4,8,16,32,64}Component 3 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Component 4 candidate values: {1,2,4,8,16,32,64}Component 5 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Need for location server to know if the feature is supported | Optional with capability signaling |

In NR Rel-15, there are separate capabilities during the BWP signaling framework to be able to report the support of: * + SRS operation without restriction on the BW: BW of the SRS may not include BW of the CORESET#0 and SSB (FG 6-1a)

* + Different numerology between the BWPs is supported (FG 6-4).

Such capabilities should be included in the new SRS-only BWP that is defined for the new feature. Therefore, we make the following proposal:***Proposal 6: For the SRS configuration with dedicated non-initial BWP in RRC Inactive (SRS-Only BWP), A UE should be able to report whether:**** ***Different numerology between the SRS-only BWP and the initial UL BWP is supported.***
* ***SRS operation without restriction on the BW is supported: BW of the SRS-only BWP may not include BW of the CORESET#0 and SSB***

***Proposal 7: Based on other signalled UE capabilities, the UE supports at least one connected mode configuration where a hypothetical BWP defined by this SRS is the active BWP and switching between this active BWP and the initial BWP is supported.******Proposal 8: Support reporting the capability of supporting SRS configuration outside initial BWP in a “per-band” fashion.***

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| 27. NR\_pos\_enh | 27-15b | Support of positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP  | 1. Support of SRS for Positioning configured outside initial UL BWP1. Maximum SRS bandwidth supported for each SCS that UE supports within a single CC.
2. Max number of SRS Resource Sets for positioning supported by UE. Values = {1, 2, 4, 8, 12, 16}
3. Max number of periodic SRS Resources for positioning. Values = {1,2,4,8,16,32,64}
4. Max number of periodic SRS Resources for positioning per slot. Values = {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}
5. Different numerology between the SRS and the initial UL BWP is supported.
6. SRS operation without restriction on the BW: BW of the SRS may not include BW of the CORESET#0 and SSB
 | 27-15 | Yes |  |  | Per band |  |  |  | Need for location server to know if the feature is supported.* Note 1: The SRS should have a locationAndBandwidth, SCS, CP, defined the same way as a legacy BWP.
* Note 2: Based on other signalled UE capabilities, the UE supports at least one connected mode configuration where a hypothetical BWP defined by this SRS is the active BWP and switching between this active BWP and the initial BWP is supported.
* Note 3: If component 5 is not signaled, the UE only supports same numerology between the SRS and the initial UL BWP

Note 4: If component 7 is not signaled, the UE supports only SRS BW that include the BW of the CORESET #0 and SSB.  | 27-15b |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-15a | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP with semi-persistent SRS | 1. Max number of semi-persistent SRS Resources for positioning 2. Max number of semi-persistent SRS Resources for positioning per slot | 27-15 | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,4,8,16,32,64}Component 2 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}[Need for location server to know if the feature is supported]FFS: outside initial BWP | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-15a | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP with semi-persistent SRS | 1. Max number of semi-persistent SRS Resources for positioning 2. Max number of semi-persistent SRS Resources for positioning per slot | 27-15 | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,4,8,16,32,64}Component 2 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14} | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-15c | Support of positioning SRS transmission in power efficiency mode for initial BWP with semi-persistent SRS | 1. Max number of semi-persistent SRS Resources for positioning  | 27-15b | No |  |  |  |  |  |  | Component 1 candidate values: {1,2,4,8,16,32,64}Need for location server to know if the feature is supported | Optional with capability signaling |

FG 27-15a* The FG can be split into two (one for gNB and one for LMF), and the one reported to LMF could use “power efficiency mode” instead of “RRC\_INACTIVE state”.
* A separate FG is required for SRS outside initial BWP.
 |
| Vivo  | In RAN1#107e, the following agreement was made regarding SRS transmission inside and outside initial UL BWP.

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| **Agreement*** The following options are supported for SRS for positioning transmission by RRC\_INACTIVE UEs:
	+ Option 1:
		- Subject to UE capability (which is a prerequisite for option 2), a UE may be configured with an SRS for Positioning associated with the initial UL BWP and transmitted, during the RRC\_INACTIVE state, inside the initial UL BWP with the same CP and SCS as configured for initial UL BWP.
	+ Option 2:
		- Subject to UE capability, a UE may be configured with an SRS for Positioning where the following parameters are additionally configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length.
			* The UE shall not transmit the SRS for Positioning when it is expected to perform UL transmissions in the initial UL BWP in RRC\_INACTIVE state.
* RAN1 assumes that
	+ SRS for positioning for UEs in RRC\_INACTIVE state is configured using the *SRS-PosResourceSet* IE
* Send LS to RAN2 to define signaling for SRS for positioning configuration for RRC\_INACTIVE UEs
 |

It can be seen that, for UE which supports of positioning SRS transmission in inactive state, the UE should at least support SRS transmission inside the initial UL BWP with the same CP and SCS as configured for initial UL BWP, that is, Option 1 above. Then, based on this prerequisite feature, the UE can additionally support SRS transmission with its own frequency location and bandwidth, SCS, CP length (outside the initial UL BWP), that is, Option 2 above. Regardless of whether SRS is transmitted inside the initial UL BWP or outside the initial UL BWP, we believe that there is no difference between other SRS capabilities. For example, for capabilities of component 1 to 5 in FG27-15, the value should be the same regardless of SRS is transmitted inside the initial UL BWP or outside the initial UL BWP. Therefore, if the UE can support positioning SRS transmission inside and outside intial UL BWP, additional note should be added: Positioning SRS transmission capabilities (component 1,2,3,4,5) in FG27-15 are the same as FG27-nn if UE supports positioning transmission in RRC\_INACTIVE STATE outside initial UL BWP.In addition, regarding ‘support of semi-persistent positioning SRS in inactive state’, from our point of view, if semi-persistent positioning SRS is supported in initial UL BWP and positioning SRS transmission outside initial UL BWP is also supported, semi-persistent positioning SRS outside intial UL BWP is naturally supported and the corresponding component values should be the same. Based on the discussion above, we propose* ***Add additional FG for SRS transmission for positioning outside the initial UL BWP.***

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| 27. NR\_pos\_enh | 27-nn | Support of positioning SRS transmission in RRC\_INACTIVE state outside initial UL BWP | 1.Support of SRS for Positioning with additional parameters configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length | 27-15 | Yes |  |  | Per UE | n/a | n/a | n/a | Note: Positioning SRS transmission capabilities (component 1,2,3,4,5) in FG27-15 are the same as FG27-nn if UE supports positioning transmission in RRC\_INACTIVE STATE outside initial UL BWP.Note: positioning SRS transmission in RRC\_INACTIVE state outside initial BWP with semi-persistent SRS is naturally supported with the same component values if UE supports FG27-15b and FG 27-nn. | Optional with capability signaling |

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| ZTE  |  |
| OPPO  | In RAN1#106bis-e meeting, it is agreed that for RRC\_INACTIVE UEs, SRS for positioning bandwidth, SCS and CP type are configured by RRC and can be different from that of initial UL BWP. This agreement should not mandate all UE to support this feature. Accordingly, we prefer to have separate UE features for SRS transmission within initial BWP and out of initial BWP. Thus, we have the following proposal:***Proposal 12: In additional to UE feature 27-15 and 27-15a, introduce additional UE feature(s) to indicate the support of SRS transmission outside of initial BWP.***  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + No need for LMF to know the RRC state of the UE.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | The following FGs 27-15 and 27-15a define support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP for periodic and semi-persistent SRS transmission.RAN1 also agreed that SRS for positioning transmission can be supported outside of the initial BWP with different location, SCS, CP than for initial BWP.

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| **Agreement*** The following options are supported for SRS for positioning transmission by RRC\_INACTIVE UEs:
	+ Option 1:
		- Subject to UE capability (which is a prerequisite for option 2), a UE may be configured with an SRS for Positioning associated with the initial UL BWP and transmitted, during the RRC\_INACTIVE state, inside the initial UL BWP with the same CP and SCS as configured for initial UL BWP.
	+ Option 2:
		- Subject to UE capability, a UE may be configured with an SRS for Positioning where the following parameters are additionally configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length.
			* The UE shall not transmit the SRS for Positioning when it is expected to perform UL transmissions in the initial UL BWP in RRC\_INACTIVE state.
 |

Considering above agreement, we propose to split FG 27-15/27-15a as follows:* FG 27-15-1 – Support of periodic SRS for positioning in RRC\_INACTIVE state inside initial BWP
* FG 27-15-1a – Support of semi-persistent SRS for positioning in RRC\_INACTIVE state inside initial BWP
* FG 27-15-2 – Support of periodic SRS for positioning in RRC\_INACTIVE state inside outside initial BWP
* FG 27-15-2a – Support of semi-persistent SRS for positioning in RRC\_INACTIVE state outside initial BWP
	+ **SRS for positioning transmission inside initial UL BWP**
		- **FG 27-15-1 – Support of P-SRS for positioning in RRC\_INACTIVE state inside initial BWP**
		- **FG 27-15-1a – Support of SP-SRS for positioning in RRC\_INACTIVE state inside initial BWP**
	+ **SRS for positioning transmission outside initial UL BWP**
		- **FG 27-15-2 – Support of P-SRS for positioning in RRC\_INACTIVE state outside initial BWP**
		- **FG 27-15-2a – Support of SP-SRS for positioning in RRC\_INACTIVE state outside initial BWP**
	+ **Reuse components of P-SRS and SP-SRS resources from Rel.16 FGs 13-8/13-8b**
	+ **FGs 27-15-1/27-15-1a are pre-requisites for FGs 27-15-2/27-15-2a respectively**
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| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-15a | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP with semi-persistent SRS | 1. Max number of semi-persistent SRS Resources for positioning 2. Max number of semi-persistent SRS Resources for positioning per slot | 27-15 | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,4,8,16,32,64}Component 2 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Need for location server to know if the feature is supported | Optional with capability signaling |

In NR Rel-15, there are separate capabilities during the BWP signaling framework to be able to report the support of: * + SRS operation without restriction on the BW: BW of the SRS may not include BW of the CORESET#0 and SSB (FG 6-1a)

* + Different numerology between the BWPs is supported (FG 6-4).

Such capabilities should be included in the new SRS-only BWP that is defined for the new feature. Therefore, we make the following proposal:***Proposal 6: For the SRS configuration with dedicated non-initial BWP in RRC Inactive (SRS-Only BWP), A UE should be able to report whether:**** ***Different numerology between the SRS-only BWP and the initial UL BWP is supported.***
* ***SRS operation without restriction on the BW is supported: BW of the SRS-only BWP may not include BW of the CORESET#0 and SSB***

***Proposal 7: Based on other signalled UE capabilities, the UE supports at least one connected mode configuration where a hypothetical BWP defined by this SRS is the active BWP and switching between this active BWP and the initial BWP is supported.******Proposal 8: Support reporting the capability of supporting SRS configuration outside initial BWP in a “per-band” fashion.***

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| 27. NR\_pos\_enh | 27-15c | Support of positioning SRS transmission in RRC\_INACTIVE state with semi-persistent SRS configured outside initial UL BWP | 1. Max number of semi-persistent SRS Resources for positioning 2. Max number of semi-persistent SRS Resources for positioning per slot | 27-15b | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,4,8,16,32,64}Component 2 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Need for location server to know if the feature is supported | Optional with capability signaling |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-16 | OLPC for positioning SRS in RRC\_INACTIVE state | Same asLPPOLPC-SRS-Pos-r16RRCOLPC-SRS-Pos-r16 |  | Yes |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-16 | OLPC for positioning SRS in RRC\_INACTIVE state | Same asRRCOLPC-SRS-Pos-r16 |  | Yes |  |  | Per band | n/a | n/a | n/a |  | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-16a | OLPC for positioning SRS in power efficiency mode | Same asLPPOLPC-SRS-Pos-r16 |  | No |  |  |  |  |  |  | Need for location server to know if the feature is supported. | Optional with capability signaling |

FG 27-16* The FG is needed, but for LPP, “power efficiency mode” could be replace “RRC\_INACTIVE state”.
 |
| Vivo  | From our point of view, the capability structure of OLPC and spatial relation for positioning SRS in RRC\_INACTIVE state may be same as RRC\_CONNECTED state, but the values may be different for different states. For example, the pathloss maintenance capabilities may be different for different states. We put the capabilities of RRC\_CONNECTED state below. Considering UEs in RRC\_INACTIVE state needs to maintain lower power consumption and complexity, the UE may not be able to maintain as many pathloss estimates as RRC\_INACTIVE state. The similar reduced capabilities can also be used in capabilities of spatial relation maintenance.

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| 13. NR Positioning | 13-9e | PathLoss estimate maintenance per serving cell | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions”
	* Candidate values are {1, 4, 8, 16}
	* Note: SRS in “PUSCH/PUCCH/SRS” refers to SRS configured by SRS-Resource
 |
| 13. NR Positioning | 13-9f | PathLoss estimate maintenance across all cells | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions”
	* Candidate values are {1, 4, 8, 16}
	* Note: SRS in “PUSCH/PUCCH/SRS” refers to SRS configured by SRS-Resource
 |

* ***Support FG 27-16 and 27-19 for OLPC and spatial relation for positioning SRS in RRC\_INACTIVE state.***
 |
| ZTE  |  |
| OPPO  | According to RAN2 design, LMF is not aware of the given UE’s RRC state. In RAN3#114bis-e meeting, there was proposal to support suggested RRC state from LMF to gNB as below [2]:

|  |
| --- |
| * Option A, include *Deferred Positioning Periodicity* in the non-UE associated message e.g. ASSISTANCE INFORMATION CONTROL message ([2] and [4])
* Option B, include *Deferred Positioning Periodicity* in the UE associated message e.g. POSITIONING INFORMATION REQUEST message ([3] and [6])
* Option C, include *End Indication* in the POSITIONING INFORMATION REQUEST message and POSITIONING ACTIVATION REQUEST messages ([3])
* Option D, include *Suggested RRC State* in the POSITIONING INFORMATION REQUEST message messages ([4])
 |

However, it was not agreed in RAN3. As a result, a separate PRS capability for RRC\_INACTIVE is useless. Similarly, it is not useful for LMF to know whether some other FGs are supported or not. ***Proposal 10: Remove UE FG 27-6, 27-18a, 27-18b, 27-18c.******Proposal 11: Support UE FG 27-16 and 27-19 with the following modifications (RED part)***

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| 27. NR\_pos\_enh | 27-16 | OLPC for positioning SRS in RRC\_INACTIVE state | Same asLPPOLPC-SRS-Pos-r16RRCOLPC-SRS-Pos-r16 |  | Yes |  |  | Per band | n/a | n/a | n/a | ~~Need for location server to know if the feature is supported~~. | Optional with capability signaling |

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| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + Support in principle.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-16: OLPC for positioning SRS in RRC\_INACTIVE state
	+ Support the current FG 27-16
 |
| Intel Corporation  | The following FGs were defined to support OLPC for RRC\_CONNECTED UEs in Rel.16.

|  |  |
| --- | --- |
| 13-9 | OLPC for SRS for positioning based on PRS from the serving cell |
| 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells |
| 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells |
| 13-9e | PathLoss estimate maintenance per serving cell |
| 13-9f | PathLoss estimate maintenance across all cells |

For UEs in RRC\_INACTIVE state, power consumption may be considered as an optimization metric and thus UEs in this state may not support all OLPC positioning capabilities defined for RRC\_CONNECTED state. The max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning in RRC\_INACTIVE state can be different. In addition, OLPC based on signals from neighbor cells may not be supported. Based on discussion we propose to support FG 27-16 and apply relevant components from Rel.16 OLPC FGs.* + **Define FG 27-16: OLPC for SRS for positioning in RRC\_INACTIVE state**
		- **For FG 27-16, use components from the Rel.16 FGs 13-9/9e**
		- **Add a note: Support of OLPC in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state**
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| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-17 | Support of positioning in RRC\_INACTIVE state | Support of PRS processing in RRC\_INACTIVE | [13-1, 13-2, 13-3, 13-4] | FFS |  |  | FFS | FFS | FFS | FFS | [Need for location server to know if the feature is supported.]FFS: separate UE capability for location information reporting in RRC\_INACTIVE state using SDTNote: UE supporting this feature may support at least one from DL RSTD, DL PRS-RSRP, or UE Rx – Tx time difference measurement | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-17 | Support of positioning in RRC\_INACTIVE state | Support of PRS processing in RRC\_INACTIVE |  | Yes |  |  | Per UE | No | No | No | Note: UE supporting this feature may support at least one from DL RSTD, DL PRS-RSRP, or UE Rx – Tx time difference measurement | Optional with capability signaling. |

FG 27-17* No need to have any prerequisite FG.
* Need for gNB to know.
* Reporting type is per UE.
* No need for the location server to know.
* No need to keep the FFS
 |
| Vivo  | This FG still needs to be updated with the following issues addressed.* + **Issue 1: Whether this feature should be reported to LMF or serving gNB?**
* If FG27-6 (DL PRS processing capabilities in RRC inactive state) with detailed values reported to LMF is supported, there is no need to report FG27-17 with duplicated capability to LMF. We think only declaring a brief capability including whether to support PRS processing in inactive state to serving gNB is enough.
	+ **Issue 2: Which FG should be the prerequisite feature groups of the FG?**
* We support FG13-1(common DL PRS processing capability). PRS processing capability in the connected state should be the most basic DL positioning capability. Without this capability, the inactive processing capability should also not exist.
	+ **Issue 3: Whether to include component of support location information reporting in inactive state using SDT?**
* No need. We think support of location reporting in inactive state is up to support of SDT and should be part of SDT capability which can be listed along with SDT features.
* ***Support FG27-17 (Support of positioning in RRC\_INACTIVE state) in the UE feature list.***
* ***This FG is reported to serving gNB.***
* ***No need for location server to know this FG if FG 27-6(DL PRS processing capabilities in RRC inactive state) reported to LMF is supported.***
* ***The prerequisite feature groups of the FG is 13-1 (common DL PRS processing capability).***
* ***No need to include component of support location information reporting in inactive state using SDT.***
 |
| ZTE  | **Comments:*** It is important to determine if this UE capability should be reported to gNB or LMF firstly. Because RAN2 has agreed UE RRC state is transparent to LMF, we believe this UE capability should be reported to gNB rather than LMF for aligning RAN2’s guidance. Hence, 27-6 is not needed as gNB is not aware of PRS processing capability.
* We think one FG is enough for different positioning methods, and the prerequisite of this FG can be Rel-16 UE capability including 13-2, 13-3 and 13-4 for support of DL-AoD, DL-TDOA and Multi-RTT respectively. For example, if UE supports this new FG, and also supports Rel-16 DL-TDOA (13-3), it naturally supports DL-TDOA measurement in RRC\_INACTIVE state as well. Hence, there is no need to have separate FGs for different positioning methods.

***Proposal 5：****Support the new FG 27-17 on PRS measurement in RRC\_INACTIVE state** *The FG 2-17 is reported to gNB rather than LMF*
* *The report granularity is per UE*
* *The prerequisite is 13-2, 13-3 and 13-4*
* *The FG is common for DL-TDOA, DL-AoD, Multi-RTT.*
* *Other FGs including FG 27-6, 18a, 18b and 18c are not needed*
 |
| OPPO  | For this FG, we think it should be per UE, and there is the need for location server to know if the feature is supported. No need to introduce a separate UE capability for location information reporting in RRC\_INACTIVE state using SDT.Based on the above discussions, our proposal on FG27-17 as follows,*Proposal 4: Adopt the following modifications marked as red colour to FG 27-17 based on the agreement in RAN1#107bis-e:*

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| 27. NR\_pos\_enh | 27-17 | Support of positioning in RRC\_INACTIVE state | 1. Support of PRS processing in RRC\_INACTIVE | 13-1, 13-2, 13-3, 13-4 | Yes  |  |  | Per UE  | No  | No  | No  | Need for location server to know if the feature is supported.~~FFS: separate UE capability for location information reporting in RRC\_INACTIVE state using SDT~~Note: UE supporting this feature may support at least one from DL RSTD, DL PRS-RSRP, or UE Rx – Tx time difference measurement | Optional with capability signaling. |

 |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + Add a component on SRS transmission in RRC\_INACTIVE:
		- 2. Support of positioning SRS transmission in RRC\_INACTIVE state.
	+ Add 13-8 as pre-requisite (SRS resources).
	+ gNB needs to know if supported
	+ Per UE
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-17: Support of positioning in RRC\_INACTIVE state
	+ We prefer to keep “[Need for location server to know if the feature is supported]”.
	+ Type should be per UE.
	+ Need of FDD/TDD differentiation should be No if type is per UE.
	+ Need of FR1/FR2 differentiation should be No if type is per UE.
	+ Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 should be No if type is per UE.
	+ Regarding note, FFS part can be removed.
 |
| Intel Corporation  | In general, we prefer to define positioning support in RRC\_INACTIVE state per positioning method as described in the next section.One of the FFS related points for FG-27-17 is SDT support for location report. In our view, SDT related capabilities for NR positioning enhancements can be defined by RAN2 and there is no need to discuss it in RAN1.* + **Discussion on the need to introduce new FG or component related to SDT support for NR positioning is left up to RAN2**
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| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |

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| 27. NR\_pos\_enh | 27-17 | Support of positioning in RRC\_INACTIVE state | Support of PRS processing in RRC\_INACTIVE | 13-1, 13-2, 13-3, 13-4 | Yes |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.Note: UE supporting this feature may support at least one from DL RSTD, DL PRS-RSRP, or UE Rx – Tx time difference measurement | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-18a | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA |  | FFS |  |  | FFS | FFS | FFS | FFS | [Need for location server to know if the feature is supported.]Note: Applicable for both UE-assisted and UE-based DL-TDOANote: PRS capabilities for DL-TDOA measurement and reporting described in FGs in 13-3, 13-3a, 13-3b, 13-6, 13-13 are the same for RRC Inactive. | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-18a | Support of PRS measurement in power efficiency mode for DL-TDOA | Support of PRS measurement in power efficiency mode for DL-TDOA |  | No |  |  | Per UE | No | No | No | Need for location server to know if the feature is supported.Note: Applicable for both UE-assisted and UE-based DL-TDOANote: PRS capabilities for DL-TDOA measurement and reporting described in FGs in 13-3, 13-3a, 13-3b, 13-6, 13-13 are the same for power efficiency mode | Optional with capability signaling. |

FG 27-18a* The FGs are needed, and “RRC\_INACTIVE state” can be replaced by “power efficiency mode”.
* No need for the gNB to know.
* Reporting type is per UE.
* Need for the location server to know.
 |
| Vivo  | At least for the purpose of testing, the above PRS processing capabilities should be decared by UE.In addition, it is no needed to reported these FGs to the serving gNB, as the serving gNB does not know which positioning measurement the UE performs and this information is useless to the serving gNB.Besides, these FGs may be reported to LMF, as it may help LMF to perform corresponding steps for enabling the UE to meet latency requirement for specific positioning method. For example, if the UE supports PRS processing in inactive state, but doesn’t support RSTD measurement in inactive state. And if the LMF determines the positioning method is DL-TDOA, in order to ensure that the UE can meet the latency requirements, the LMF may indicate the serving gNB assistance information to keep the UE in connected state for positioning. Furthermore, regarding FG27-18c, the component 2 is not needed, as we can simply put FGs of SRS transmission in inactive state as one of the prerequisite feature groups to replace the function of component 2, which is similar to the mechanism used in connected state as the following.

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| 13. NR Positioning | 13-11 | UE Rx-Tx Measurement Report for Multi-RTT | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

Value for component 1: {1,2,3,4}Note: DL PRS resource/sets are on the same frequency layerNote: the number of UE Rx – Tx time difference measurements refers to the measurements for a single TRP1. Support RSRP measurements. Values = {0, 1}

Note: If the UE reports value 1 for component 2, same number of RSRP measurements supported as UE Rx-Tx measurements for component 1 | 13-4 and 13-8 |

Therefore, we propose* ***Support FG27-18a/18b/18c (Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA/DL-AOD/Multi-RTT) in the UE feature list.***
* ***Need for location server to know these FGs if these features are supported.***
* ***No need for serving gNB to know these FGs.***
* ***For FG27-18c, the component 2 is not needed and can be replaced by add FGs(e.g. FG27-15) of SRS transmission in inactive state as one of the prerequisite feature groups.***
 |
| ZTE  | **Comments:*** It is important to determine if this UE capability should be reported to gNB or LMF firstly. Because RAN2 has agreed UE RRC state is transparent to LMF, we believe this UE capability should be reported to gNB rather than LMF for aligning RAN2’s guidance. Hence, 27-6 is not needed as gNB is not aware of PRS processing capability.
* We think one FG is enough for different positioning methods, and the prerequisite of this FG can be Rel-16 UE capability including 13-2, 13-3 and 13-4 for support of DL-AoD, DL-TDOA and Multi-RTT respectively. For example, if UE supports this new FG, and also supports Rel-16 DL-TDOA (13-3), it naturally supports DL-TDOA measurement in RRC\_INACTIVE state as well. Hence, there is no need to have separate FGs for different positioning methods.

***Proposal 5：****Support the new FG 27-17 on PRS measurement in RRC\_INACTIVE state** *The FG 2-17 is reported to gNB rather than LMF*
* *The report granularity is per UE*
* *The prerequisite is 13-2, 13-3 and 13-4*
* *The FG is common for DL-TDOA, DL-AoD, Multi-RTT.*
* *Other FGs including FG 27-6, 18a, 18b and 18c are not needed*
 |
| OPPO  | According to RAN2 design, LMF is not aware of the given UE’s RRC state. In RAN3#114bis-e meeting, there was proposal to support suggested RRC state from LMF to gNB as below [2]:

|  |
| --- |
| * Option A, include *Deferred Positioning Periodicity* in the non-UE associated message e.g. ASSISTANCE INFORMATION CONTROL message ([2] and [4])
* Option B, include *Deferred Positioning Periodicity* in the UE associated message e.g. POSITIONING INFORMATION REQUEST message ([3] and [6])
* Option C, include *End Indication* in the POSITIONING INFORMATION REQUEST message and POSITIONING ACTIVATION REQUEST messages ([3])
* Option D, include *Suggested RRC State* in the POSITIONING INFORMATION REQUEST message messages ([4])
 |

However, it was not agreed in RAN3. As a result, a separate PRS capability for RRC\_INACTIVE is useless. Similarly, it is not useful for LMF to know whether some other FGs are supported or not. ***Proposal 10: Remove UE FG 27-6, 27-18a, 27-18b, 27-18c.***  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + No need for separate FGs, they can be considered as part of 27-17 if needed.
 |
| China Telecom  | For the support of PRS measurement in RRC\_INACTIVE state, we think the feature should be similar with that in the RRC\_CONNECTED state. So we propose the UE FGs to be modified as follows,

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| 27. NR\_pos\_enh | 27-18a | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA | 13-6 | No |  |  | Per UE | No | No | No | [Need for location server to know if the feature is supported.]Note: Applicable for both UE-assisted and UE-based DL-TDOANote: PRS capabilities for DL-TDOA measurement and reporting described in FGs in 13-3, 13-3a, 13-3b, 13-6, 13-13 are the same for RRC Inactive. | Optional with capability signaling. |

 |
| NTT DOCOMO, INC.  | * FG 27-18a: Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA
	+ Need for the gNB to know if the feature is supported should be No.
	+ Type should be per UE.
	+ Need of FDD/TDD differentiation should be No if type is per UE.
	+ Need of FR1/FR2 differentiation should be No if type is per UE.
	+ Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 should be No if type is per UE.
 |
| Intel Corporation  | One of the opens is whether to indicate support of PRS measurements in RRC\_INACTIVE state per positioning method or rely on Rel.16 FGs for RRC\_CONNECTED UEs and assume that corresponding FGs are applicable to Rel.17 FGs. In general, this approach may work but it has significant disadvantage as it may imply that UE processing / measurement capabilities in RRC\_INACTIVE and RRC\_CONNECTED state are the same. Considering that positioning requirements, e.g., latency and power saving considerations, accuracy may be different, it is also reasonable to assume that UE capabilities are different for RRC\_INACTIVE state. In future releases, RAN1 may continue discussion on NR positioning optimizations in terms of UE power saving, therefore from forward compatibility perspective it seems valid to introduce new UE capabilities for DL PRS processing in RRC-INACTIVE state per positioning method. Based on discussion, we propose to support PRS measurement in RRC\_INACTIVE state per positioning method. In addition, the note reflecting that such capabilities do not imply new LMF procedures targeting specific RRC state can be added.* + **Define FGs 27-18a/b/c: Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA/DL-AOD/Multi-RTT**
		- **Note: Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated | Our understanding is that an LMF is expected to have enough information to make educated decisions at least with regards to the following aspects:* Which positioning technology to use (e.g., NR, LTE , GPS, sensors, wifi , etc)
* Which positioning method(s) within NR technologies to use (DL-TDOA , RTT , DL-AoD , UL-AOD, UL-TDOA , ECID )
* What SRS properties to request from the gNB
* What PRS properties to request from the gNB for on demand PRS
* What response time to use

All the above are within the context of a variety of positioning metrics, including the 3 which is the focus of this WI: accuracy, latency, power consumption. For the LMF to make good decisions in the above, having knowledge of the RRC Inactive capabilities is crucial:* A Rel-17 UE may put the extra effort to optimize RRC Inactive positioning (e.g. switching ON/OFF RF blocks, optimizing/simplifying processing algorithms) compared to a Rel-16 UE or a UE not supporting RRC Inactive Positioning. An LMF may determine that Rel-16 is too power hungry, so for a Rel-16 UE, it prefers to use other technology instead of NR Positioning, or, it may determine that a Rel-17 UE supporting RRC inactive Positioning is actually more power efficient than the other technologies, or Rel-17 Positioning in RRC connected state. If the LMF is NOT aware of the optimized UE capabilities during RRC inactive, it cannot make the decision of which technology to use based on a power consumption KPI.
* Furthremore, a UE may support RSTD in RRC inactive, but not UE Rx-Tx measurements , or vice versa, or may or may not support SRS transmission in RRC inactive. An LMF that takes into account the power consumption KPI may want to know whether it should trigger TDOA , RTT , or AoD , or UL-AoA, UL-TDOA. However, if it doesn’t know what the UE supports, it cannot make that decision according to power consumption considerations.
* We already agreed that a UE can support different SRS capabilities. Imagine a UE supports 8 SRS sets in RRC connected, but 1 SRS set in RRC inactive. The LMF is the entity that requests of SRS transmission properties. If it wants to take power consumption into account, it would have to know how many sets it should request. In this example, if it doesn’t know that the UE can only do 1 SRS set in RRC inactive, it may request of 2 sets, and by mistake, leading to the gNB keeping the UE to RRC connected. If it knew that this UE can only do 1 SRS set in RRC inactive, then it has a \*chance/opportunity\* to request a single SRS set, and hope that the gNB will keep the UE to RRC inactive.
* Similar argument to the above, with regards to PRS processing capabilities and LMF optimizing the PRS configuration and assistance data based on power consumption considerations. With regards to DL PRS processing, similar to the SRS transmission, a UE may be capable of different number of PRS resources per slot, different maximum PRS resource configurations, different group delay calibration for RSTD measurement (related to RAN4 margins for RSTD measurements).
* Lastly, in RAN4 it has been agreed that the measurement period shall be a function of DRX cycle. If the LMF cannot provide what is the “assumed RRC state”, then the measurement period will not be consistent. The LMF would be asking for “faster response” than what is really possible in RRC inactive state.

***Proposal 5: A per-band DL positioning capability should be defined for RRC inactive state, which includes at least**** ***DL PRS processing capability in RRC inactive state (FG 27-6)***
* ***UE Rx-Tx measurement reporting (FG 27-18c)***
* ***DL RSTD measurement reporting (FG 27-18a)***
* ***RSRP measurement reporting (FG 27-18b)***

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| 27. NR\_pos\_enh | 27-18a | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA |  | Yes |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.Note: Applicable for both UE-assisted and UE-based DL-TDOANote: PRS capabilities for DL-TDOA measurement and reporting described in FGs in 13-3, 13-3a, 13-3b, 13-6, 13-13 are the same for RRC Inactive. | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-18b | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD |  | FFS |  |  | FFS | FFS | FFS | FFS | [Need for location server to know if the feature is supported.]Note: Applicable for both UE-assisted and UE-based DL-AoDNote: PRS capabilities for DL-AOD measurement and reporting described in FGs 13-2, 13-2a, 13-2b, 13-5, 13-13 are the same for RRC Inactive. | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-18b | Support of PRS measurement in power efficiency modefor DL-AoD | Support of PRS measurement in power efficiency mode for DL-AoD |  | No |  |  | Per UE | No | No | No | Need for location server to know if the feature is supported.Note: Applicable for both UE-assisted and UE-based DL-AoDNote: PRS capabilities for DL-AOD measurement and reporting described in FGs 13-2, 13-2a, 13-2b, 13-5, 13-13 are the same for power efficiency mode. | Optional with capability signaling. |

FG 27-18b* The FGs are needed, and “RRC\_INACTIVE state” can be replaced by “power efficiency mode”.
* No need for the gNB to know.
* Reporting type is per UE.
* Need for the location server to know.
 |
| Vivo  | At least for the purpose of testing, the above PRS processing capabilities should be decared by UE.In addition, it is no needed to reported these FGs to the serving gNB, as the serving gNB does not know which positioning measurement the UE performs and this information is useless to the serving gNB.Besides, these FGs may be reported to LMF, as it may help LMF to perform corresponding steps for enabling the UE to meet latency requirement for specific positioning method. For example, if the UE supports PRS processing in inactive state, but doesn’t support RSTD measurement in inactive state. And if the LMF determines the positioning method is DL-TDOA, in order to ensure that the UE can meet the latency requirements, the LMF may indicate the serving gNB assistance information to keep the UE in connected state for positioning. Furthermore, regarding FG27-18c, the component 2 is not needed, as we can simply put FGs of SRS transmission in inactive state as one of the prerequisite feature groups to replace the function of component 2, which is similar to the mechanism used in connected state as the following.

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| 13. NR Positioning | 13-11 | UE Rx-Tx Measurement Report for Multi-RTT | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

Value for component 1: {1,2,3,4}Note: DL PRS resource/sets are on the same frequency layerNote: the number of UE Rx – Tx time difference measurements refers to the measurements for a single TRP1. Support RSRP measurements. Values = {0, 1}

Note: If the UE reports value 1 for component 2, same number of RSRP measurements supported as UE Rx-Tx measurements for component 1 | 13-4 and 13-8 |

Therefore, we propose* ***Support FG27-18a/18b/18c (Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA/DL-AOD/Multi-RTT) in the UE feature list.***
* ***Need for location server to know these FGs if these features are supported.***
* ***No need for serving gNB to know these FGs.***
* ***For FG27-18c, the component 2 is not needed and can be replaced by add FGs(e.g. FG27-15) of SRS transmission in inactive state as one of the prerequisite feature groups.***
 |
| ZTE  | **Comments:*** It is important to determine if this UE capability should be reported to gNB or LMF firstly. Because RAN2 has agreed UE RRC state is transparent to LMF, we believe this UE capability should be reported to gNB rather than LMF for aligning RAN2’s guidance. Hence, 27-6 is not needed as gNB is not aware of PRS processing capability.
* We think one FG is enough for different positioning methods, and the prerequisite of this FG can be Rel-16 UE capability including 13-2, 13-3 and 13-4 for support of DL-AoD, DL-TDOA and Multi-RTT respectively. For example, if UE supports this new FG, and also supports Rel-16 DL-TDOA (13-3), it naturally supports DL-TDOA measurement in RRC\_INACTIVE state as well. Hence, there is no need to have separate FGs for different positioning methods.

***Proposal 5：****Support the new FG 27-17 on PRS measurement in RRC\_INACTIVE state** *The FG 2-17 is reported to gNB rather than LMF*
* *The report granularity is per UE*
* *The prerequisite is 13-2, 13-3 and 13-4*
* *The FG is common for DL-TDOA, DL-AoD, Multi-RTT.*
* *Other FGs including FG 27-6, 18a, 18b and 18c are not needed*
 |
| OPPO  | According to RAN2 design, LMF is not aware of the given UE’s RRC state. In RAN3#114bis-e meeting, there was proposal to support suggested RRC state from LMF to gNB as below [2]:

|  |
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| * Option A, include *Deferred Positioning Periodicity* in the non-UE associated message e.g. ASSISTANCE INFORMATION CONTROL message ([2] and [4])
* Option B, include *Deferred Positioning Periodicity* in the UE associated message e.g. POSITIONING INFORMATION REQUEST message ([3] and [6])
* Option C, include *End Indication* in the POSITIONING INFORMATION REQUEST message and POSITIONING ACTIVATION REQUEST messages ([3])
* Option D, include *Suggested RRC State* in the POSITIONING INFORMATION REQUEST message messages ([4])
 |

However, it was not agreed in RAN3. As a result, a separate PRS capability for RRC\_INACTIVE is useless. Similarly, it is not useful for LMF to know whether some other FGs are supported or not. ***Proposal 10: Remove UE FG 27-6, 27-18a, 27-18b, 27-18c.***  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + No need for separate FGs, they can be considered as part of 27-17 if needed.
 |
| China Telecom  | For the support of PRS measurement in RRC\_INACTIVE state, we think the feature should be similar with that in the RRC\_CONNECTED state. So we propose the UE FGs to be modified as follows,

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| 27. NR\_pos\_enh | 27-18b | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD | 13-5 | No |  |  | Per UE | No | No | No | [Need for location server to know if the feature is supported.]Note: Applicable for both UE-assisted and UE-based DL-AoDNote: PRS capabilities for DL-AOD measurement and reporting described in FGs 13-2, 13-2a, 13-2b, 13-5, 13-13 are the same for RRC Inactive. | Optional with capability signaling. |

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| NTT DOCOMO, INC.  | * FG 27-18b: Support of PRS measurement in RRC\_INACTIVE state for DL-AoD
	+ Need for the gNB to know if the feature is supported should be No.
	+ Type should be per UE.
	+ Need of FDD/TDD differentiation should be No if type is per UE.
	+ Need of FR1/FR2 differentiation should be No if type is per UE.
	+ Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 should be No if type is per UE.
 |
| Intel Corporation  | One of the opens is whether to indicate support of PRS measurements in RRC\_INACTIVE state per positioning method or rely on Rel.16 FGs for RRC\_CONNECTED UEs and assume that corresponding FGs are applicable to Rel.17 FGs. In general, this approach may work but it has significant disadvantage as it may imply that UE processing / measurement capabilities in RRC\_INACTIVE and RRC\_CONNECTED state are the same. Considering that positioning requirements, e.g., latency and power saving considerations, accuracy may be different, it is also reasonable to assume that UE capabilities are different for RRC\_INACTIVE state. In future releases, RAN1 may continue discussion on NR positioning optimizations in terms of UE power saving, therefore from forward compatibility perspective it seems valid to introduce new UE capabilities for DL PRS processing in RRC-INACTIVE state per positioning method. Based on discussion, we propose to support PRS measurement in RRC\_INACTIVE state per positioning method. In addition, the note reflecting that such capabilities do not imply new LMF procedures targeting specific RRC state can be added.* + **Define FGs 27-18a/b/c: Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA/DL-AOD/Multi-RTT**
		- **Note: Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated | Our understanding is that an LMF is expected to have enough information to make educated decisions at least with regards to the following aspects:* Which positioning technology to use (e.g., NR, LTE , GPS, sensors, wifi , etc)
* Which positioning method(s) within NR technologies to use (DL-TDOA , RTT , DL-AoD , UL-AOD, UL-TDOA , ECID )
* What SRS properties to request from the gNB
* What PRS properties to request from the gNB for on demand PRS
* What response time to use

All the above are within the context of a variety of positioning metrics, including the 3 which is the focus of this WI: accuracy, latency, power consumption. For the LMF to make good decisions in the above, having knowledge of the RRC Inactive capabilities is crucial:* A Rel-17 UE may put the extra effort to optimize RRC Inactive positioning (e.g. switching ON/OFF RF blocks, optimizing/simplifying processing algorithms) compared to a Rel-16 UE or a UE not supporting RRC Inactive Positioning. An LMF may determine that Rel-16 is too power hungry, so for a Rel-16 UE, it prefers to use other technology instead of NR Positioning, or, it may determine that a Rel-17 UE supporting RRC inactive Positioning is actually more power efficient than the other technologies, or Rel-17 Positioning in RRC connected state. If the LMF is NOT aware of the optimized UE capabilities during RRC inactive, it cannot make the decision of which technology to use based on a power consumption KPI.
* Furthremore, a UE may support RSTD in RRC inactive, but not UE Rx-Tx measurements , or vice versa, or may or may not support SRS transmission in RRC inactive. An LMF that takes into account the power consumption KPI may want to know whether it should trigger TDOA , RTT , or AoD , or UL-AoA, UL-TDOA. However, if it doesn’t know what the UE supports, it cannot make that decision according to power consumption considerations.
* We already agreed that a UE can support different SRS capabilities. Imagine a UE supports 8 SRS sets in RRC connected, but 1 SRS set in RRC inactive. The LMF is the entity that requests of SRS transmission properties. If it wants to take power consumption into account, it would have to know how many sets it should request. In this example, if it doesn’t know that the UE can only do 1 SRS set in RRC inactive, it may request of 2 sets, and by mistake, leading to the gNB keeping the UE to RRC connected. If it knew that this UE can only do 1 SRS set in RRC inactive, then it has a \*chance/opportunity\* to request a single SRS set, and hope that the gNB will keep the UE to RRC inactive.
* Similar argument to the above, with regards to PRS processing capabilities and LMF optimizing the PRS configuration and assistance data based on power consumption considerations. With regards to DL PRS processing, similar to the SRS transmission, a UE may be capable of different number of PRS resources per slot, different maximum PRS resource configurations, different group delay calibration for RSTD measurement (related to RAN4 margins for RSTD measurements).
* Lastly, in RAN4 it has been agreed that the measurement period shall be a function of DRX cycle. If the LMF cannot provide what is the “assumed RRC state”, then the measurement period will not be consistent. The LMF would be asking for “faster response” than what is really possible in RRC inactive state.

***Proposal 5: A per-band DL positioning capability should be defined for RRC inactive state, which includes at least**** ***DL PRS processing capability in RRC inactive state (FG 27-6)***
* ***UE Rx-Tx measurement reporting (FG 27-18c)***
* ***DL RSTD measurement reporting (FG 27-18a)***
* ***RSRP measurement reporting (FG 27-18b)***

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| 27. NR\_pos\_enh | 27-18b | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD |  | Yes |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.Note: Applicable for both UE-assisted and UE-based DL-AoDNote: PRS capabilities for DL-AOD measurement and reporting described in FGs 13-2, 13-2a, 13-2b, 13-5, 13-13 are the same for RRC Inactive. | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-18c | Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT | 1. Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT[2. Support of positioning SRS transmission in RRC\_INACTIVE state] |  | FFS |  |  | FFS | FFS | FFS | FFS | [Need for location server to know if the feature is supported.]Note: PRS capabilities for Multi-RTT measurement and reporting described in FGs in 13-4, 13-4a, 13-4b, 13-11, 13-11a, 13-14 are the same for RRC Inactive | Optional with capability signaling. |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-18c | Support of PRS measurement in power efficiency mode for Multi-RTT | 1. Support of PRS measurement in power efficiency mode for Multi-RTT2. Support of positioning SRS transmission in power efficiency mode |  | No |  |  | Per UE | No | No | No | Need for location server to know if the feature is supported.Note: PRS capabilities for Multi-RTT measurement and reporting described in FGs in 13-4, 13-4a, 13-4b, 13-11, 13-11a, 13-14 are the same for power efficiency mode | Optional with capability signaling. |

FG 27-18c* The FGs are needed, and “RRC\_INACTIVE state” can be replaced by “power efficiency mode”.
* No need for the gNB to know.
* Reporting type is per UE.
* Need for the location server to know.
 |
| Vivo  | At least for the purpose of testing, the above PRS processing capabilities should be decared by UE.In addition, it is no needed to reported these FGs to the serving gNB, as the serving gNB does not know which positioning measurement the UE performs and this information is useless to the serving gNB.Besides, these FGs may be reported to LMF, as it may help LMF to perform corresponding steps for enabling the UE to meet latency requirement for specific positioning method. For example, if the UE supports PRS processing in inactive state, but doesn’t support RSTD measurement in inactive state. And if the LMF determines the positioning method is DL-TDOA, in order to ensure that the UE can meet the latency requirements, the LMF may indicate the serving gNB assistance information to keep the UE in connected state for positioning. Furthermore, regarding FG27-18c, the component 2 is not needed, as we can simply put FGs of SRS transmission in inactive state as one of the prerequisite feature groups to replace the function of component 2, which is similar to the mechanism used in connected state as the following.

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| 13. NR Positioning | 13-11 | UE Rx-Tx Measurement Report for Multi-RTT | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

Value for component 1: {1,2,3,4}Note: DL PRS resource/sets are on the same frequency layerNote: the number of UE Rx – Tx time difference measurements refers to the measurements for a single TRP1. Support RSRP measurements. Values = {0, 1}

Note: If the UE reports value 1 for component 2, same number of RSRP measurements supported as UE Rx-Tx measurements for component 1 | 13-4 and 13-8 |

Therefore, we propose* ***Support FG27-18a/18b/18c (Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA/DL-AOD/Multi-RTT) in the UE feature list.***
* ***Need for location server to know these FGs if these features are supported.***
* ***No need for serving gNB to know these FGs.***
* ***For FG27-18c, the component 2 is not needed and can be replaced by add FGs(e.g. FG27-15) of SRS transmission in inactive state as one of the prerequisite feature groups.***
 |
| ZTE  | **Comments:*** It is important to determine if this UE capability should be reported to gNB or LMF firstly. Because RAN2 has agreed UE RRC state is transparent to LMF, we believe this UE capability should be reported to gNB rather than LMF for aligning RAN2’s guidance. Hence, 27-6 is not needed as gNB is not aware of PRS processing capability.
* We think one FG is enough for different positioning methods, and the prerequisite of this FG can be Rel-16 UE capability including 13-2, 13-3 and 13-4 for support of DL-AoD, DL-TDOA and Multi-RTT respectively. For example, if UE supports this new FG, and also supports Rel-16 DL-TDOA (13-3), it naturally supports DL-TDOA measurement in RRC\_INACTIVE state as well. Hence, there is no need to have separate FGs for different positioning methods.

***Proposal 5：****Support the new FG 27-17 on PRS measurement in RRC\_INACTIVE state** *The FG 2-17 is reported to gNB rather than LMF*
* *The report granularity is per UE*
* *The prerequisite is 13-2, 13-3 and 13-4*
* *The FG is common for DL-TDOA, DL-AoD, Multi-RTT.*
* *Other FGs including FG 27-6, 18a, 18b and 18c are not needed*
 |
| OPPO  | According to RAN2 design, LMF is not aware of the given UE’s RRC state. In RAN3#114bis-e meeting, there was proposal to support suggested RRC state from LMF to gNB as below [2]:

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| * Option A, include *Deferred Positioning Periodicity* in the non-UE associated message e.g. ASSISTANCE INFORMATION CONTROL message ([2] and [4])
* Option B, include *Deferred Positioning Periodicity* in the UE associated message e.g. POSITIONING INFORMATION REQUEST message ([3] and [6])
* Option C, include *End Indication* in the POSITIONING INFORMATION REQUEST message and POSITIONING ACTIVATION REQUEST messages ([3])
* Option D, include *Suggested RRC State* in the POSITIONING INFORMATION REQUEST message messages ([4])
 |

However, it was not agreed in RAN3. As a result, a separate PRS capability for RRC\_INACTIVE is useless. Similarly, it is not useful for LMF to know whether some other FGs are supported or not. ***Proposal 10: Remove UE FG 27-6, 27-18a, 27-18b, 27-18c.***  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + No need for separate FGs, they can be considered as part of 27-17 if needed.
 |
| China Telecom  | For the support of PRS measurement in RRC\_INACTIVE state, we think the feature should be similar with that in the RRC\_CONNECTED state. So we propose the UE FGs to be modified as follows,

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| 27. NR\_pos\_enh | 27-18c | Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT | 1. Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT[2. Support of positioning SRS transmission in RRC\_INACTIVE state] | 13-4 | No |  |  | Per UE | No | No | No | [Need for location server to know if the feature is supported.]Note: PRS capabilities for Multi-RTT measurement and reporting described in FGs in 13-4, 13-4a, 13-4b, 13-11, 13-11a, 13-14 are the same for RRC Inactive | Optional with capability signaling. |

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| NTT DOCOMO, INC.  | * FG 27-18c: Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT
	+ Need for the gNB to know if the feature is supported should be No.
	+ Type should be per UE.
	+ Need of FDD/TDD differentiation should be No if type is per UE.
	+ Need of FR1/FR2 differentiation should be No if type is per UE.
	+ Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 should be No if type is per UE.
 |
| Intel Corporation  | One of the opens is whether to indicate support of PRS measurements in RRC\_INACTIVE state per positioning method or rely on Rel.16 FGs for RRC\_CONNECTED UEs and assume that corresponding FGs are applicable to Rel.17 FGs. In general, this approach may work but it has significant disadvantage as it may imply that UE processing / measurement capabilities in RRC\_INACTIVE and RRC\_CONNECTED state are the same. Considering that positioning requirements, e.g., latency and power saving considerations, accuracy may be different, it is also reasonable to assume that UE capabilities are different for RRC\_INACTIVE state. In future releases, RAN1 may continue discussion on NR positioning optimizations in terms of UE power saving, therefore from forward compatibility perspective it seems valid to introduce new UE capabilities for DL PRS processing in RRC-INACTIVE state per positioning method. Based on discussion, we propose to support PRS measurement in RRC\_INACTIVE state per positioning method. In addition, the note reflecting that such capabilities do not imply new LMF procedures targeting specific RRC state can be added.* + **Define FGs 27-18a/b/c: Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA/DL-AOD/Multi-RTT**
		- **Note: Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated | Our understanding is that an LMF is expected to have enough information to make educated decisions at least with regards to the following aspects:* Which positioning technology to use (e.g., NR, LTE , GPS, sensors, wifi , etc)
* Which positioning method(s) within NR technologies to use (DL-TDOA , RTT , DL-AoD , UL-AOD, UL-TDOA , ECID )
* What SRS properties to request from the gNB
* What PRS properties to request from the gNB for on demand PRS
* What response time to use

All the above are within the context of a variety of positioning metrics, including the 3 which is the focus of this WI: accuracy, latency, power consumption. For the LMF to make good decisions in the above, having knowledge of the RRC Inactive capabilities is crucial:* A Rel-17 UE may put the extra effort to optimize RRC Inactive positioning (e.g. switching ON/OFF RF blocks, optimizing/simplifying processing algorithms) compared to a Rel-16 UE or a UE not supporting RRC Inactive Positioning. An LMF may determine that Rel-16 is too power hungry, so for a Rel-16 UE, it prefers to use other technology instead of NR Positioning, or, it may determine that a Rel-17 UE supporting RRC inactive Positioning is actually more power efficient than the other technologies, or Rel-17 Positioning in RRC connected state. If the LMF is NOT aware of the optimized UE capabilities during RRC inactive, it cannot make the decision of which technology to use based on a power consumption KPI.
* Furthremore, a UE may support RSTD in RRC inactive, but not UE Rx-Tx measurements , or vice versa, or may or may not support SRS transmission in RRC inactive. An LMF that takes into account the power consumption KPI may want to know whether it should trigger TDOA , RTT , or AoD , or UL-AoA, UL-TDOA. However, if it doesn’t know what the UE supports, it cannot make that decision according to power consumption considerations.
* We already agreed that a UE can support different SRS capabilities. Imagine a UE supports 8 SRS sets in RRC connected, but 1 SRS set in RRC inactive. The LMF is the entity that requests of SRS transmission properties. If it wants to take power consumption into account, it would have to know how many sets it should request. In this example, if it doesn’t know that the UE can only do 1 SRS set in RRC inactive, it may request of 2 sets, and by mistake, leading to the gNB keeping the UE to RRC connected. If it knew that this UE can only do 1 SRS set in RRC inactive, then it has a \*chance/opportunity\* to request a single SRS set, and hope that the gNB will keep the UE to RRC inactive.
* Similar argument to the above, with regards to PRS processing capabilities and LMF optimizing the PRS configuration and assistance data based on power consumption considerations. With regards to DL PRS processing, similar to the SRS transmission, a UE may be capable of different number of PRS resources per slot, different maximum PRS resource configurations, different group delay calibration for RSTD measurement (related to RAN4 margins for RSTD measurements).
* Lastly, in RAN4 it has been agreed that the measurement period shall be a function of DRX cycle. If the LMF cannot provide what is the “assumed RRC state”, then the measurement period will not be consistent. The LMF would be asking for “faster response” than what is really possible in RRC inactive state.

***Proposal 5: A per-band DL positioning capability should be defined for RRC inactive state, which includes at least**** ***DL PRS processing capability in RRC inactive state (FG 27-6)***
* ***UE Rx-Tx measurement reporting (FG 27-18c)***
* ***DL RSTD measurement reporting (FG 27-18a)***
* ***RSRP measurement reporting (FG 27-18b)***

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| 27. NR\_pos\_enh | 27-18c | Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT | 1. Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT | 27-15 | Yes |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.Note: PRS capabilities for Multi-RTT measurement and reporting described in FGs in 13-4, 13-4a, 13-4b, 13-11, 13-11a, 13-14 are the same for RRC Inactive | Optional with capability signaling. |

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| Ericsson  |  |

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| 27. NR\_pos\_enh | 27-19 | Spatial relation for positioning SRS in RRC\_INACTIVE state | Same as*LPP**SpatialRelationsSRS-Pos-r16**RRC**SpatialRelationsSRS-Pos-r16* |  | Yes |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signalling |

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| Company | Summary |
| Huawei, HiSilicon  |

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| 27. NR\_pos\_enh | 27-19 | Spatial relation for positioning SRS in RRC\_INACTIVE state | Same as*RRC**SpatialRelationsSRS-Pos-r16* |  | Yes |  |  | Per band | n/a | n/a | n/a |  | Optional with capability signalling |
| 27. NR\_pos\_enh | 27-19a | Spatial relation for positioning SRS in power efficiency mode | Same as*LPP**SpatialRelationsSRS-Pos-r16* |  | No |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signalling |

FG 27-19* The FG is needed, but for LPP, “power efficiency mode” could be replace “RRC\_INACTIVE state”.
 |
| Vivo  | From our point of view, the capability structure of OLPC and spatial relation for positioning SRS in RRC\_INACTIVE state may be same as RRC\_CONNECTED state, but the values may be different for different states. For example, the pathloss maintenance capabilities may be different for different states. We put the capabilities of RRC\_CONNECTED state below. Considering UEs in RRC\_INACTIVE state needs to maintain lower power consumption and complexity, the UE may not be able to maintain as many pathloss estimates as RRC\_INACTIVE state. The similar reduced capabilities can also be used in capabilities of spatial relation maintenance.

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| --- | --- | --- | --- |
| 13. NR Positioning | 13-9e | PathLoss estimate maintenance per serving cell | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions”
	* Candidate values are {1, 4, 8, 16}
	* Note: SRS in “PUSCH/PUCCH/SRS” refers to SRS configured by SRS-Resource
 |
| 13. NR Positioning | 13-9f | PathLoss estimate maintenance across all cells | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions”
	* Candidate values are {1, 4, 8, 16}
	* Note: SRS in “PUSCH/PUCCH/SRS” refers to SRS configured by SRS-Resource
 |

* ***Support FG 27-16 and 27-19 for OLPC and spatial relation for positioning SRS in RRC\_INACTIVE state.***
 |
| ZTE  |  |
| OPPO  | According to RAN2 design, LMF is not aware of the given UE’s RRC state. In RAN3#114bis-e meeting, there was proposal to support suggested RRC state from LMF to gNB as below [2]:

|  |
| --- |
| * Option A, include *Deferred Positioning Periodicity* in the non-UE associated message e.g. ASSISTANCE INFORMATION CONTROL message ([2] and [4])
* Option B, include *Deferred Positioning Periodicity* in the UE associated message e.g. POSITIONING INFORMATION REQUEST message ([3] and [6])
* Option C, include *End Indication* in the POSITIONING INFORMATION REQUEST message and POSITIONING ACTIVATION REQUEST messages ([3])
* Option D, include *Suggested RRC State* in the POSITIONING INFORMATION REQUEST message messages ([4])
 |

However, it was not agreed in RAN3. As a result, a separate PRS capability for RRC\_INACTIVE is useless. Similarly, it is not useful for LMF to know whether some other FGs are supported or not. ***Proposal 11: Support UE FG 27-16 and 27-19 with the following modifications (RED part)***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-19 | Spatial relation for positioning SRS in RRC\_INACTIVE state | Same as*LPP**SpatialRelationsSRS-Pos-r16**RRC**SpatialRelationsSRS-Pos-r16* |  | Yes |  |  | Per band | n/a | n/a | n/a | ~~Need for location server to know if the feature is supported~~. | Optional with capability signalling |

 |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  | * + It is OK to confirm the FG, but the definitions need more discussion, including the pontential need for a component on validity criteria.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  | * FG 27-19: Spatial relation for positioning SRS in RRC\_INACTIVE state
	+ Support the current FG 27-19
 |
| Intel Corporation  | The following FGs were defined to support spatial relation for RRC\_CONNECTED UEs in Rel.16.

|  |  |
| --- | --- |
| 13-10 | Spatial relation for SRS for positioning based on SSB from the serving cell |
| 13-10a | Spatial relation for SRS for positioning based on CSI-RS from the serving cell |
| 13-10b | Spatial relation for SRS for positioning based on PRS from the serving cell |
| 13-10c | Spatial relation for SRS for positioning based on SRS |
| 13-10d | Spatial relation for SRS for positioning based on SSB from the neighbouring cell |
| 13-10e | Spatial relation for SRS for positioning based on PRS from the neighbouring cell |
| 13-10f | Spatial relation maintenance |

For UEs in RRC\_INACTIVE state, power consumption may be considered as an optimization metric and thus UEs in this state may not support all spatial relation positioning capabilities defined for RRC\_CONNECTED state. The max number of spatial relations that the UE can maintain for positioning in RRC\_INACTIVE state can be different. In addition, spatial relation based on signals from neighbor cells may not be supported. Based on discussion, we propose to support FG 27-19 and apply relevant components of Rel.16 FGs.* + **Define FG 27-19: Spatial relation for SRS for positioning in RRC\_INACTIVE state**
		- **For FG 27-19, use components from the Rel.16 FGs 13-10/10b/10f**
		- **Add a note: Support of spatial relation in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-20 | PRS subset association for UE assisted DL-AoD | 1. Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource for the purpose of prioritization of DL-AoD reporting.[2. Supported resource set relationship for the target PRS resource and the associated subset[3. Support associated subset measurement reporting] |  | No |  | PRS subset association for DL-AoD is not supported by the UE. | Per UE | n/a | n/a | n/a | [Component 2 candidate values: {sameSet, DifferentSet, sameOrDifferentSet}][Component 3 candidate values: {associated subset only, the target PRS resource and the associated subset}]Need for location server to know | Optional with capability signaling. |

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-20 | PRS subset association for UE assisted DL-AoD | 1. Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource for the purpose of prioritization of DL-AoD reporting.2. Supported resource set relationship for the target PRS resource and the associated subset3. Support associated subset measurement reporting with or without the target PRS |  | No |  | PRS subset association for DL-AoD is not supported by the UE. | Per UE | No | No | No | Component 2 candidate values: {sameSet, DifferentSet, sameOrDifferentSet}Need for location server to know | Optional with capability signaling. |

FG 27-20* Support the current component 2
* For component 3, we think UE supporting this feature should support reporting with or without the target PRS, and network may choose whether the target PRS is requested. No need to have candidate values for component 3.
 |
| Vivo  | In the RAN1#107-e meeting, the above agreement was reached. It can be found the PRS measurement for the subset of the PRS has been supported and can be provided by the UE based on the request. So, we think the UE capability that “supporting the PRS measurement for the subset for the PRS” should be provided before the UE is requested PRS measurement for the subset of the PRS, so that the LMF can know whether it can request to report measurement.

|  |
| --- |
| **Agreement** For UE-assisted DL-AOD positioning method, to enhance the signaling to the UE for the purpose of PRS resource(s) reporting, the LMF may indicate in the assistance data (AD), one or both the following: * option 1: subject to UE capability, for each PRS resource, a subset of PRS resources for the purpose of prioritization of DL-AOD reporting:
	+ a UE may include the requested PRS measurement for the subset of the PRS in the DL-AoD additional measurements if the requested PRS measurement of the associated PRS is reported
		- The requested PRS measurement can be DL PRS RSRP and/or path PRS RSRP.
	+ UE may report PRS measurements only for the subset of PRS resources.
	+ Note: The subset associated with a PRS resource can be in a same or different PRS resource set than the PRS resource
* option 2: subject to UE capability, for each PRS resource, the boresight direction information.
* Note: Either case does not imply any restriction on UE measurement

FFS: prioritization of the PRS resources and resource subsets to be measured  |

Considering only enhancing the assistance data cannot make sure the subset will be requested or reported, we prefer to add component 3 for subset reportings* ***Modify the 27-20 as follows.***
* ***Remove the bracket of Component 3 at least for subset reporting***
 |
| ZTE  |  |
| OPPO  | One new FG 27-20 was introduced for the function of associated subset of PRS resources:

|  |  |  |
| --- | --- | --- |
| 27-20 | PRS subset association for UE assisted DL-AoD | 1. Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource for the purpose of prioritization of DL-AoD reporting.[2. Supported resource set relationship for the target PRS resource and the associated subset~~: {sameSet, DifferentSet, sameOrDifferentSet}~~][3. Support associated subset measurement reporting] |

In our view, the component 3 is not needed. As in previous RAN1 agreement, the UE may report the RSRP measurement of PRS resources in the associated subset if the UE reports the RSRP measurement of the target PRS resource. But when the UE does not report the RSRP measurement of the target PRS resource, the UE still can report the RSRP measurement of PRS resources in the subset, which is a normal DL AoD measurement reporting. Thus such case shall not be included in this FG.***Proposal 4: Do not include component 3 in FG 27-20.*** |
| CATT  | For this FG, we think the Component 2 and Component 3 are needed. The candidate values of Component 2 of this FG should include {sameSet, DifferentSet, sameOrDifferentSet}, and the candidate values of Component 3 of this FG should include {associated subset only, the target PRS resource and the associated subset}. Based on the above discussions, our proposal on FG27-20 as follows,*Proposal 11: Adopt the following modifications marked as red colour to FG 27-20 based on the agreement in RAN1#107bis-e:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-20 | PRS subset association for UE assisted DL-AoD | 1. Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource for the purpose of prioritization of DL-AoD reporting.~~[~~2. Supported resource set relationship for the target PRS resource and the associated subset~~[~~3. Support associated subset measurement reporting~~]~~ |  | No |  | PRS subset association for DL-AoD is not supported by the UE. | Per UE | n/a | n/a | n/a | ~~[~~Component 2 candidate values: {sameSet, DifferentSet, sameOrDifferentSet}~~]~~~~[~~Component 3 candidate values: {associated subset only, the target PRS resource and the associated subset}~~]~~Need for location server to know | Optional with capability signaling. |

 |
| Nokia, Nokia Shanghai Bell  | * + Signalling of candidate values for component 2 is not needed because both same and different sets should be supported by a UE supporting 27-20. One possibility to simplify the definition is also to remove component 2 and incorporate the following in component 1:
		- Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource and support of associated subset measurement reporting
	+ Component 3 is not needed.
 |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | The RAN WG1 discussed the prioritization of the DL PRS resources measurement for the UE-assisted DL-AOD positioning, and the following agreement has been made at the RAN WG1#107e meeting:

|  |
| --- |
| Agreement:* For UE-assisted DL-AOD positioning method, to enhance the signaling to the UE for the purpose of PRS resource(s) reporting, the LMF may indicate in the assistance data (AD), one or both the following:
	+ Option 1: subject to UE capability, for each PRS resource, a subset of PRS resources for the purpose of prioritization of DL-AOD reporting:
		- a UE may include the requested PRS measurement for the subset of the PRS in the DL-AoD additional measurements if the requested PRS measurement of the associated PRS is reported
			* The requested PRS measurement can be DL PRS RSRP and/or path PRS RSRP.
		- UE may report PRS measurements only for the subset of PRS resources.
			* Note: The subset associated with a PRS resource can be in a same or different PRS resource set than the PRS resource
	+ Option 2: subject to UE capability, for each PRS resource, the boresight direction information.
		- Note: Either case does not imply any restriction on UE measurement
		- FFS: prioritization of the PRS resources and resource subsets to be measured
 |

In option 1, a UE may include the requested PRS measurement for the subset of the PRS in the DL-AOD additional measurements if the requested PRS measurement of the associated PRS is reported. Alternatively, a UE may report PRS measurements only for the subset of PRS resources. The subset associated with a PRS resource can be in a same or different PRS resource set than the PRS resource. The requested PRS measurement can be the DL PRS-RSRP and/or the DL PRS-RSRPP. Considering the above agreement, we suggest defining the components 2, 3 and 4 in addition to already agreed component 1 as follows:* + **For FG 27-20 (PRS subset association for UE-assisted DL-AOD)**
		- **Define the following Component 2 (Supported resource set relationship for the target PRS resource and the associated subset) values for UE selection:**
			* **{sameSet, DifferentSet, sameOrDifferentSet}**
		- **Define the following Component 3 (Support associated subset measurement reporting) values for UE selection:**
			* **{associated subset only, the target PRS resource and the associated subset}**
		- **Define the following Component 4 (Supported PRS measurements) values for UE selection:**
			* **{DL PRS-RSRP only, DL PRS-RSRPP only, DL PRS-RSRP and DL PRS-RSRPP}**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  | According to the agreement in RAN1-107 e-meeting [1], we prefer to keep the component 2 and component 3, and support the candidate value of component 2 and component 3.***RAN1-107 e-meeting Agreement****For UE-assisted DL-AOD positioning method, to enhance the signaling to the UE for the purpose of PRS resource(s) reporting, the LMF may indicate in the assistance data (AD), one or both the following:* * *option 1: subject to UE capability, for each PRS resource, a subset of PRS resources for the purpose of prioritization of DL-AOD reporting:*
	+ *a UE may include the requested PRS measurement for the subset of the PRS in the DL-AoD additional measurements if the requested PRS measurement of the associated PRS is reported*
		- *The requested PRS measurement can be DL PRS RSRP and/or path PRS RSRP.*
	+ *UE may report PRS measurements only for the subset of PRS resources.*
	+ *Note: The subset associated with a PRS resource can be in a same or different PRS resource set than the PRS resource*
* *option 2: subject to UE capability, for each PRS resource, the boresight direction information.*
* *Note: Either case does not imply any restriction on UE measurement*
* *FFS: prioritization of the PRS resources and resource subsets to be measured*

***Proposal 1: Prefer to keep the component 2 and component 3, and support the candidate value of component 2 and component 3 in FG27-20.*** |
| Samsung  |  |
| Qualcomm Incorporated |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-20 | PRS subset association for UE assisted DL-AoD | 1. Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource for the purpose of prioritization of DL-AoD reporting.2. Supported resource set relationship for the target PRS resource and the associated subset |  | No |  | PRS subset association for DL-AoD is not supported by the UE. | Per UE | n/a | n/a | n/a | Component 2 candidate values: {sameSet, DifferentSet, sameOrDifferentSet}Need for location server to know | Optional with capability signaling. |

 |
| Ericsson  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-21 | PRS boresight direction for UE-assisted DL-AoD | Support of assistance data enhancement to indicate the boresight direction of a PRS resource for UE-assisted DL-AoD. |  | No |  | UE-assisted DL-AoD with boresight direction of each DL-PRS is not supported. | Per UE | n/a | n/a | n/a | Need for location server to know | Optional with capability signaling. |

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-22 | PRS beam pattern for UE-based DL-AoD | Support of PRS beam pattern for DL-AoD |  | No |  | UE-based DL-AoD with PRS beam pattern is not supported. | Per UE | n/a | n/a | n/a | Need for location server to know | Optional with capability signaling. |

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  |  |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  |  |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

**Others**

|  |  |
| --- | --- |
| Company | Summary |
| Huawei, HiSilicon  |  |
| Vivo  | * **Periodical Tx TEG association information report for UL-TDOA**

In RAN1#107e, the following agreement was achieved regarding Tx TEG association information report.

|  |
| --- |
| **Agreement*** For UL-TDOA, supporting the following for the serving gNB to request a UE to report the Tx TEG association information between UE Tx TEG IDs and SRS resources for positioning, subject to UE capability of supporting UE Tx TEG:
	+ Based on a configured periodicity, a UE may report the UE Tx TEG association for the SRS resources for positioning that have already been transmitted during the configured period
		- It is up to RAN2 to decide how to indicate the change of the Tx TEG association during the configured period (e.g., using the timestamps)
		- It is up to RAN4 to decide when the Tx TEG association is changed
	+ The values of the configurable periodicities are up to RAN2
	+ Note: Tx TEG association information reporting by single request/response mode is assumed already supported with the previous agreement.
* Send an LS to RAN2/RAN4 (cc: RAN3)
	+ to RAN2, including the following RAN1’s agreement related to the reporting of the UE Tx TEG, for RAN2 to work on the signaling
	+ to RAN4 for checking the agreement and work on how to decide when the Tx TEG association is changed
 |

This feature is similar to the UE feature of ‘periodical report’ in DL-TDOA in TS37.355 as shown below.

|  |
| --- |
| -- ASN1STARTNR-DL-TDOA-ProvideCapabilities-r16 ::= SEQUENCE { nr-DL-TDOA-Mode-r16 PositioningModes, nr-DL-TDOA-PRS-Capability-r16 NR-DL-PRS-ResourcesCapability-r16, nr-DL-TDOA-MeasurementCapability-r16 NR-DL-TDOA-MeasurementCapability-r16, nr-DL-PRS-QCL-ProcessingCapability-r16 NR-DL-PRS-QCL-ProcessingCapability-r16, nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16, additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL, periodicalReporting-r16 PositioningModes OPTIONAL, ...}-- ASN1STOP |

Therefore, we believe new FG of ‘periodical Tx TEG association information report’ should be supported. In addition, this capability needs to be known by both gNB and LMF as FG 27-1-2 (support of UE-TxTEGs for UL TDOA).* ***Add new FGs of periodical Tx TEG association information report for UL-TDOA.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-1-xx | Support of periodically Tx TEG association information report for UL-TDOA | Support of periodically Tx TEG association information report for UL-TDOA | 27-1-2 | Yes |  | UE does not support periodically report Tx TEG association information for UL-TDOA | Per UE | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |

* **‘Correction information’ supported by UE-based DL-TDOA**

Based the LS [3] from RAN2, it can be seen that some issues related ‘correction information’ obtained from PRU measurements as the following will be discussed by RAN1 and RAN2.

|  |
| --- |
| RAN2 kindly asks RAN1 whether the LMF determined "correction information" obtained from PRU measurements need to be provided to target UEs for UE-based mode of operation, and if so, kindly asks RAN1 to provide further details on the specific "correction information" which need to be provided to target UEs. |

Therefore, the UE feature for ‘correction information’ reception for UE-based positioning is very likely to be introduced. So, we propose:* ***If ‘correction information’ obtained from PRU is agreed to be provided to target UEs for UE-based mode, the corresponding UE capability of reception such ‘correction information’ for UE-based mode should be introduced.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-1-xx | Support of ‘correction information’ from PRU for UE-based positioning | Support of ‘correction information’ from PRU for UE-based positioning |  | No |  |  | Per UE | n/a | n/a | n/a | Need for location server to know if the feature is supported.Candidate values {FFS} | Optional with capability signalling |

 |
| ZTE  |  |
| OPPO  |  |
| CATT  |  |
| Nokia, Nokia Shanghai Bell  |  |
| China Telecom  |  |
| NTT DOCOMO, INC.  |  |
| Intel Corporation  | Sharing of the antenna orientation information to LMF is not expected to be supported by normal UEs and is also expected to be optional capability for PRU-UEs. To reflect this aspect, the new UE feature groups need to be defined. Therefore, we have following proposal:* + **Introduce the following UE capability/feature groups for PRU support:**
		- **FG x1: Support of the PRU functionality**
			* **UE may be requested by the LMF to provide its own known location coordinate information to the LMF to facilitate mitigation of UE/gNB TX/RX timing delay mitigation**
		- **FG x2: Support of the PRU with antenna orientation information reporting**
			* **UE may be requested by the LMF to provide antenna orientation information**
	+ **FG x1 is a pre-requisite of the FG x2**

LMF correction information is expected to be signaled by LMF to facilitate UE-based positioning with UE/gNB TX/RX timing errors mitigation, which is under discussion in RAN1 triggered by LS from RAN2 ([R1-2200857](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_108-e/Docs/R1-2200857.zip)).* + **Introduce new FG x3: Support of LMF correction information for UE-based positioning with TX/RX timing error mitigation**
 |
| Apple  |  |
| CMCC  |  |
| Xiaomi  |  |
| Samsung  |  |
| Qualcomm Incorporated |  |
| Ericsson  |  |

# Discussion/Approval Items during RAN1 #108-e — First Checkpoint

After review of contributions submitted to RAN1 #108-e in this agenda item, the following topics were identified by the moderator for discussion/approval during RAN1 #108-e.

**General comments**

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
|  |  |

# Issue 1: FG 27-1-1

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  27. NR\_pos\_enh | 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | 1. Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning2. The maximum number of UE-RxTEG, which is supported and reported by UE for UE assisted DL TDOA and/or Multi-RTT positioning | 13-1, one or more of {13-3, 13-4} | No |  | UE-RxTEG reporting is not supported and no assumption can be made on the UE Rx timing errors for the measurements | per band | n/a | n/a | n/a | Component 1 candidate values: ~~[One or more of]~~ {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}Component 2 candidate values: {1, 2, 3, 4, 6, 8}Note: a single value is reported when both multi-RTT and DL-TDOA are supportedNeed for location server to know if the feature is supportedIf the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to ~~31~~7 | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
|  |  |

# Issue 2: FG 27-1-2

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  27. NR\_pos\_enh | 27-1-2 | Support of UE-TxTEGs for UL TDOA  | 1. The maximum number of UE-TxTEG for SRS resource for positioning, which is supported and reported by UE for UL TDOA 2. Support of PCO calibration as part of timing error calibration | 13-8 | Yes |  | UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the ~~[mitigation of]~~ UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedNote: It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA Note: If the UE does not include TxTEG-ID associated with a SRS resource for positioning, no assumption can be made on the UE Tx timing error for this SRS resource for positioning.  | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
|  |  |

# Issue 3: FG 27-1-2a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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|  27. NR\_pos\_enh | 27-1-2a | Support of UE-TxTEGs for Multi-RTT positioning | The maximum number of UE-TxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4, 13-8 | No |  | UE-TxTEGs for Multi-RTT positioning is not supported and no assumption can be made on the ~~[mitigation of]~~ UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}Need for location server to know if the feature is supportedIf the UE does not include TxTEG-ID associated with a measurement, no assumption can be made on the ~~[mitigation of]~~ UE Tx timing errors for this SRS resource for positioningNote: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 4: FG 27-1-3

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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|  27. NR\_pos\_enh | 27-1-3 | Support of UE-RxTxTEGs for Multi-RTT | The maximum number of UE-RxTxTEG, which is supported and reported by UE for Multi-RTT positioning | 13-4 and 13-8 | No |  | UE RxTx for Multi-RTT is not supported and no assumption can be made on the UE RxTx timing ~~[~~error~~/delays]~~ for the measurement | per band | n/a | n/a | n/a | The candidate values are {1, 2, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64}Need for location server to know if the feature is supportedIf the UE does not include RxTxTEG-ID associated with a measurement, no assumption can be made on the UE RxTx timing ~~[~~errors~~/delays]~~ for this measurementNote: The “per band” reporting on this capability does not imply, that the RxTxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTxTEG ID can span from 0, up to 255 | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 5: FG 27-1-4

After review of contributions submitted to RAN1 #108-e in this agenda item, nothing is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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| Company | Comments/Questions/Suggestions |
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# Issue 6: FG 27-1-4a

After review of contributions submitted to RAN1 #108-e in this agenda item, nothing is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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| Company | Comments/Questions/Suggestions |
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# Issue 7: FG 27-2-1

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-2-1 | DL PRS RSRP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of measuring and reporting the PRS RSRPP of the first path for DL-AoD positioning method2.) The maximum number of first path PRS RSRPP per TRP | 13-5 ~~or 27-2-2~~  | No |  |  | ~~FFS:~~ Per UE ~~or per band~~ | n/a | ~~n/a~~ Yes | n/a | Component 2 candidate values: 1, 2,4,8,16,24Need for location server to know if the feature is supportedThe maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP (27-2-2)~~[~~Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource~~]~~ | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
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# Issue 8: FG 27-2-2

After review of contributions submitted to RAN1 #108-e in this agenda item, nothing is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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| Company | Comments/Questions/Suggestions |
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# Issue 9: FG 27-3-1

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-3-1 | M-sample measurements | The capability to support reporting a measurement based on measuring M=1 samples (instances) of a DL PRS resource set | 13-1 | No |  |  | per band | n/a | n/a | n/a | ~~The candidate values are {1 [FFS others]}~~If the UE does not provide the capability, the UE is assumed to support M=4 only.Need for location server to know if the feature is supportedNote: The sample number M=1 does not account for the potential AGC sampleNote: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 10: FG 27-3-2

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window ~~- processing types~~ | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window2. Support of priority handing options of PRS: Option1, Option2 or Option3* 1. Option 1: UE may indicates support of two priority states.
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS
		2. State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS
	2. Option 2: UE may indicate support of three priority states
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS
		2. State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS
			1. Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.
		3. State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS
	3. Option 3: UE may indicate support of single priority state
		1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS

Note:* Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR
* Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected ~~(FFS FR2)~~
* Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window ~~[The DL signals/channels from all DL CCs (per UE) are affected (FFS FR2)]~~
* For Type 2 PRS processing time, the PRS processing in one FR2 band may affect the downling receiving in a second FR2 band

Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability optionsNote: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP | 13-1 | Yes |  |  | per band | n/a | n/a | n/a | Component 1 candidate values: ~~[One or more of]~~ {Type 1A, Type 1B, Type 2}Component 2 candidate values: {option1, option2, option3}Need for location server to know if the feature is supported~~Note: A UE that supports FG 27-3-2 also needs to support FG 27-3-2a~~ | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 11: FG 27-3-2a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| ~~27. NR\_pos\_enh~~ | ~~27-3-2a~~ | ~~Support of priority handing of PRS when PRS measurement is outside MG~~ | ~~Support of priority handing options of PRS: Option1, Option2 or Option3~~* 1. ~~Option 1: UE may indicates support of two priority states.~~
		1. ~~State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS~~
		2. ~~State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS~~
	2. ~~Option 2: UE may indicate support of three priority states~~
		1. ~~State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS~~
		2. ~~State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS~~
			1. ~~Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.~~
		3. ~~State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS~~
	3. ~~Option 3: UE may indicate support of single priority state~~

~~State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS~~ | ~~[27-3-3]~~ | ~~Yes~~ |  |  | ~~Per band~~  | ~~No~~ | ~~No~~ | ~~No~~ | ~~Candidate values: {option1, option2, option3}~~~~Note: A UE that supports FG 27-3-2a also needs to support FG 27-3-2~~~~Note: if the FFS in FG 27-2a gets resolved as “per band’, FG 27-2a will be deleted and becomes a component of FG 27-3-2~~ | ~~Optional with capability signaling~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 12: FG 27-3-3

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering~~[2. Maximum duration of DL PRS symbols N in units of ms a UE can process in the first part of a PRS processing window assuming maximum DL PRS bandwidth in MHz, such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol]~~ Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.3. Max number of DL PRS resources that UE can process in a slot under it | 27-3-2 | No | Keep 3R16 5 |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {Type 1, Type 2}~~[~~Candidate 2 component values:a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} msb) T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ~~N+4, N+5, N+6, N+8~~} ms~~]~~ Component 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHzNeed for location server to know if the feature is supportedNote: A UE may declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a bandNote: This capability is applicable to RRC Connected only. | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 13: FG 27-4-1

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF 2. LOS/NLOS indicator granularity | one of 13-5,13-6, or 13-11 | No |  |  | Per UE | n/a | n/a | n/a | ~~[~~Component 1 candidate values: {hard value, both hard value and soft value~~[, both]~~}~~]~~Component 2 candidate values: {trpSpecific, resourceSpecific~~[~~, both~~]~~}~~[~~Note: a single value is reported when both multi-RTT and DL-TDOA are supported~~]~~~~FFS: signalling per method~~Need for location server to know if the feature is supported | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 14: FG 27-6

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal:**

* **Alt. 1: Remove FG 27-6**
* **Alt. 2: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**
* **Alt. 3: Define FG 27-6 as a component of FG 27-17**

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| 27. NR\_pos\_enh | 27-6 | DL PRS processing capabilities in ~~RRC inactive state~~ power efficiency mode | 1. DL PRS buffering capabilitya) Type 1 – sub-slot/symbol level bufferingb) Type 2 – slot level buffering2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE3. Max number of DL PRS resources that UE can process in a slot under it | FFS | FFS |  |  | FFS | FFS | FFS | FFS | Component 1 candidate values: {Type 1, Type 2}Component 2 candidate values:T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} msN: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} msComponent 3 candidate values:FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHzFR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHzNeed for location server to know if the feature is supportedNote: Having the PRS processing capabilities in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state ~~[, but instead LMF may set the response time assuming a specific RRC state during the PRS measurement and inform the gNB on the assumed RRC state, while the actual RRC state is still determined by UE/gNB that take the response time requirement and assumed RRC state into account.]~~ | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 15: FG 27-7

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-7 | Multiple measurement instances which can be included in a single measurement report | Support of multiple measurement instances which can be included in a single measurement report~~FFS: 2. Maximum number of measurement instances which can be included in a single measurement report~~ |  |  |  |  |  |  |  |  | ~~FFS: Component 2 candidate values~~ | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 16: FG 27-8

After review of contributions submitted to RAN1 #108-e in this agenda item, nothing is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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| Company | Comments/Questions/Suggestions |
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# Issue 17: FG 27-9

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-9 | Support of lower Rx beam sweeping factor | 1. Support of the lower Rx beam sweeping factor than 8 for FR22. Number of Rx beam sweeping factors |  | No |   | UE only supports 8 as the Rx beam sweeping factor defined by RAN4. | Per band | n/a | n/aFR2 only | n/a | Component 2 candidate values: {1,2,4,6} ~~FFS~~Need for location server to know if the feature is supported | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 18: FG 27-10

After review of contributions submitted to RAN1 #108-e in this agenda item, nothing is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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| Company | Comments/Questions/Suggestions |
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# Issue 19: FG 27-10a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-10a | Low latency MG activation request for PRS measurements  | support of low latency MG activation request for PRS measurements | ~~[~~27-10~~]~~ or 27-11 | No |   | Low latency MG activation request for PRS measurements is not supported | Per UE | No | No | No | Need for location server to know if the feature is supported | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 20: FG 27-11

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-11 | Support of DL MAC CE based MG activation request for PRS measurements | 1. Support of preconfiguration of MGs in RRC signaling for PRS measurements: Each MG in the preconfiguration is associated with an ID2. Support of using DL MAC CE to activate the MG for PRS measurements: The DL MAC CE for MG activation indicates the ID associated with the preconfigured MG |  | Yes |  | Using DL MAC CE to activate the preconfigured MG for PRS measurements is not supported | Per UE | No | No | No | Need for location server to know if the feature is supported | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 21: FG 27-12

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-12 | LOS/NLOS indicator for UE-based positioning assistance data | Support reception of the assistance data containing the LOS/NLOS indicator.1. LOS/NLOS indicator type2. LOS/NLOS indicator granularity |  | No |  |  | Per UE | No | No | No | ~~[~~Component 1 candidate values: {both hard value and softValue, hardValue~~, both~~}~~]~~Note: UE only needs to select one type of indicator to report even if the candidate value {both} is supported.Component 2 candidate values: {resourceSpecific, trpSpecific~~[~~, both~~]~~}Note: UE only needs to select one granularity of indicator to report even if the candidate value {both} is supported.Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 22: FG 27-13

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-13 | Additional path reporting for UE-assisted DL-TDOA | 1. Support of additional detected path timing reporting for K>2 additional paths for UE-assisted DL-TDOA2. Support of RSRPP reporting for additional paths if UE supports FG 27-13a. | ~~13-13a~~ | No |  |  | Per UE | No | No | No | Component 1 candidate values: ~~[~~{4, 6, 8}~~]~~Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 23: FG 27-13a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-13a | First path reporting for UE-assisted DL-TDOA | 1. Support of RSRPP reporting for first path | 13-1 | No |  |  | ~~FFS:~~ Per UE ~~or per band~~ | No | No | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 24: FG 27-14

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-14 | Additional path reporting for Multi-RTT | 1. Support of additional detected path timing reporting for K>2 additional paths for Multi-RTT2. Support of RSRPP reporting for additional paths if UE supports FG 27-14a | ~~13-14a~~ | No |  |  | Per UE | No | No | No | Component 1 candidate values: ~~[~~{4, 6, 8}~~]~~Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 25: FG 27-14a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-14a | First path reporting for Multi-RTT | 1. Support of RSRPP reporting for first path | 13-1 | No |  |   | ~~FFS:~~ Per UE ~~or per band~~ | No | ~~No~~ Yes  | No | Need for location server to know if the feature is supported. | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 26: FG 27-15

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-15 | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP | 1. Max number of SRS Resource Sets for positioning supported by UE2. Max number of ~~[~~P/SP~~]~~ SRS Resources for positioning3. Max number of ~~[~~P/SP~~]~~ SRS Resources for positioning per slot4. Max number of periodic SRS Resources for positioning 5. Max number of periodic SRS Resources for positioning per slotNote: OLPC for SRS for positioning based on SSB from the last serving cell (the cell that releases UE from connection) is part of this FG. No dedicated capability signaling is intended for this component |  | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 4, 8, 12, 16}Component 2 candidate values: {1,2,4,8,16,32,64}Component 3 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Component 4 candidate values: {1,2,4,8,16,32,64}Component 5 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}~~[Need for location server to know if the feature is supported]~~The FG shall be implemented as one FG for gNB and one FG for LMF, and the one reported to LMF indicates “power efficiency mode” instead of “RRC\_INACTIVE state”~~FFS: outside initial BWP~~ | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-15b | Support of positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP  | 1. Maximum SRS bandwidth supported for each SCS that UE supports within a single CC.
2. Max number of SRS Resource Sets for positioning supported by UE. Values = {1, 2, 4, 8, 12, 16}
3. Max number of periodic SRS Resources for positioning. Values = {1,2,4,8,16,32,64}
4. Max number of periodic SRS Resources for positioning per slot. Values = {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}
5. Different numerology between the SRS and the initial UL BWP is supported.
6. SRS operation without restriction on the BW: BW of the SRS may not include BW of the CORESET#0 and SSB
 | 27-15 | Yes |  |  | Per band |  |  |  | Note 1: The SRS should have a locationAndBandwidth, SCS, CP, defined the same way as a legacy BWP. Note 2: Based on other signalled UE capabilities, the UE supports at least one connected mode configuration where a hypothetical BWP defined by this SRS is the active BWP and switching between this active BWP and the initial BWP is supported.Note 3: If component 5 is not signaled, the UE only supports same numerology between the SRS and the initial UL BWPNote 4: If component 6 is not signaled, the UE supports only SRS BW that include the BW of the CORESET #0 and SSB. The FG shall be implemented as one FG for gNB and one FG for LMF, and the one reported to LMF indicates “power efficiency mode” instead of “RRC\_INACTIVE state” | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 27: FG 27-15a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-15a | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP with semi-persistent SRS | 1. Max number of semi-persistent SRS Resources for positioning 2. Max number of semi-persistent SRS Resources for positioning per slot | 27-15 | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,4,8,16,32,64}Component 2 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}~~[Need for location server to know if the feature is supported]~~The FG shall be implemented as one FG for gNB and one FG for LMF, and the one reported to LMF indicates “power efficiency mode” instead of “RRC\_INACTIVE state”~~FFS: outside initial BWP~~ | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-15c | Support of positioning SRS transmission in RRC\_INACTIVE state with semi-persistent SRS configured outside initial UL BWP | 1. Max number of semi-persistent SRS Resources for positioning 2. Max number of semi-persistent SRS Resources for positioning per slot | 27-15b | Yes |  |  | Per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,4,8,16,32,64}Component 2 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}The FG shall be implemented as one FG for gNB and one FG for LMF, and the one reported to LMF indicates “power efficiency mode” instead of “RRC\_INACTIVE state” | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 28: FG 27-16

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-16 | OLPC for positioning SRS in RRC\_INACTIVE state | Same as~~LPP~~~~OLPC-SRS-Pos-r16~~RRCOLPC-SRS-Pos-r16 |  | Yes |  |  | Per band | n/a | n/a | n/a | ~~Need for location server to know if the feature is supported.~~ | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-16a | OLPC for positioning SRS in power efficiency mode | Same asLPPOLPC-SRS-Pos-r16 |  | No |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.Support of OLPC in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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# Issue 29: FG 27-17

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-17 | Support of positioning in RRC\_INACTIVE state | 1. Support of PRS processing in RRC\_INACTIVE2. Support of positioning SRS transmission in RRC\_INACTIVE state | ~~[~~13-1, 13-2, 13-3, 13-4~~]~~, 13-8 | ~~FFS~~ Yes |  |  | ~~FFS~~ Per UE  | ~~FFS~~ No | ~~FFS~~ No | ~~FFS~~ No | [Need for location server to know if the feature is supported.]~~FFS: separate UE capability for location information reporting in RRC\_INACTIVE state using SDT~~Note: UE supporting this feature may support at least one from DL RSTD, DL PRS-RSRP, or UE Rx – Tx time difference measurement | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 30: FG 27-18a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-18a | Support of PRS measurement in power efficiency mode ~~RRC\_INACTIVE state~~ for DL-TDOA | Support of PRS measurement in power efficiency mode ~~RRC\_INACTIVE state~~ state for DL-TDOA |  | ~~FFS~~ No |  |  | ~~FFS~~ Per UE | ~~FFS~~ No | ~~FFS~~ No | ~~FFS~~ No | ~~[~~Need for location server to know if the feature is supported.~~]~~Note: Applicable for both UE-assisted and UE-based DL-TDOANote: PRS capabilities for DL-TDOA measurement and reporting described in FGs in 13-3, 13-3a, 13-3b, 13-6, 13-13 are the same for RRC Inactive.Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 31: FG 27-18b

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-18b | Support of PRS measurement in power efficiency mode ~~RRC\_INACTIVE state~~ state for DL-AoD | Support of PRS measurement in power efficiency mode ~~RRC\_INACTIVE state~~ for DL-AoD |  | ~~FFS~~ No |  |  | ~~FFS~~ Per UE | ~~FFS~~ No | ~~FFS~~ No | ~~FFS~~ No | ~~[~~Need for location server to know if the feature is supported.~~]~~Note: Applicable for both UE-assisted and UE-based DL-AoDNote: PRS capabilities for DL-AOD measurement and reporting described in FGs 13-2, 13-2a, 13-2b, 13-5, 13-13 are the same for RRC Inactive.Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 32: FG 27-18c

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-18c | Support of PRS measurement in power efficiency mode ~~RRC\_INACTIVE state~~ for Multi-RTT | 1. Support of PRS measurement in power efficiency mode ~~RRC\_INACTIVE state~~ for Multi-RTT~~[2. Support of positioning SRS transmission in RRC\_INACTIVE state]~~ |  | ~~FFS~~ No |  |  | ~~FFS~~ Per UE | ~~FFS~~ No | ~~FFS~~ No | ~~FFS~~ No | ~~[~~Need for location server to know if the feature is supported.~~]~~Note: PRS capabilities for Multi-RTT measurement and reporting described in FGs in 13-4, 13-4a, 13-4b, 13-11, 13-11a, 13-14 are the same for RRC InactiveSupport of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 33: FG 27-19

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-19 | Spatial relation for positioning SRS in RRC\_INACTIVE state | Same as*~~LPP~~**~~SpatialRelationsSRS-Pos-r16~~**RRC**SpatialRelationsSRS-Pos-r16* |  | Yes |  |  | Per band | n/a | n/a | n/a | ~~Need for location server to know if the feature is supported.~~ | Optional with capability signalling |
| 27. NR\_pos\_enh | 27-19a | Spatial relation for positioning SRS in power efficiency mode | Same as*LPP**SpatialRelationsSRS-Pos-r16* |  | No |  |  | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.Support of spatial relation in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
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# Issue 34: FG 27-20

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-20 | PRS subset association for UE assisted DL-AoD | 1. Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource for the purpose of prioritization of DL-AoD reporting.~~[~~2. Supported resource set relationship for the target PRS resource and the associated subset~~[~~3. Support associated subset measurement reporting~~]~~ |  | No |  | PRS subset association for DL-AoD is not supported by the UE. | Per UE | n/a | n/a | n/a | ~~[~~Component 2 candidate values: {sameSet, DifferentSet, sameOrDifferentSet}~~]~~~~[~~Component 3 candidate values: {associated subset only, the target PRS resource and the associated subset}~~]~~Need for location server to know | Optional with capability signaling. |

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| Company | Comments/Questions/Suggestions |
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# Issue 35: FG 27-21

After review of contributions submitted to RAN1 #108-e in this agenda item, nothing is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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| Company | Comments/Questions/Suggestions |
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# Issue 36: FG 27-22

After review of contributions submitted to RAN1 #108-e in this agenda item, nothing is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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| Company | Comments/Questions/Suggestions |
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# Issue 37: New FGs

The following new FGs were proposed in contributions submitted to RAN1 #108-e in this agenda item. **Please indicate in the table below which of these proposed FGs should be discussed during RAN1 #108-e.**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-1-xx | Support of periodically Tx TEG association information report for UL-TDOA | Support of periodically Tx TEG association information report for UL-TDOA | 27-1-2 | Yes |  | UE does not support periodically report Tx TEG association information for UL-TDOA | Per UE | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-1-yy | Support of ‘correction information’ from PRU for UE-based positioning | Support of ‘correction information’ from PRU for UE-based positioning |  | No |  |  | Per UE | n/a | n/a | n/a | Need for location server to know if the feature is supported.Candidate values: FFS | Optional with capability signalling |
| 27. NR\_pos\_enh | 27-1-zz | Support of LMF correction information for UE-based positioning with TX/RX timing error mitigation | Support of LMF correction information for UE-based positioning with TX/RX timing error mitigation |  |  |  |  |  |  |  |  |  | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
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# Discussion/Approval Items during RAN1 #108-e — Second Checkpoint

Based on the comments/questions/suggestions received by the first checkpoint, the following are the revised proposals and/or proposed agreements by the moderator. Companies submitted the following views on the moderator’s proposals.

***[Please submit all comments/questions/suggestions here, late comments/questions/suggestions submitted in Section 3 will not be considered]***

**General comments**

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| Company | Comments/Questions/Suggestions |
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# Issue 1: FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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# Discussion/Approval Items during RAN1 #108-e — Third Checkpoint

Based on the comments/questions/suggestions received by the second checkpoint, the following are the revised proposals and/or proposed agreements by the moderator. Companies submitted the following views on the moderator’s proposals.

***[Please submit all comments/questions/suggestions here, late comments/questions/suggestions submitted in Section 4 will not be considered]***

**General comments**

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| Company | Comments/Questions/Suggestions |
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# Issue 1: FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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# Summary of Final Proposals for Agreements

This Section summarizes the final proposals for agreement in RAN1 #108-e by email. There are no tables for comments.

***[All comments must be directly made on the RAN1 email reflector]***

Companies can continue to update their comments in the previous Sections, however, these are no longer monitored by the moderator. Any such comments will be for archival purposes only and will not influence the outcome of this email discussion. Any objection to any of the proposals in this Section must be voiced directly on the RAN1 email reflector.

**Possible Agreement: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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# Conclusion

After further discussion on the RAN1 email reflector the following was agreed as part of this email discussion:

# References

1. R1-2200780, Updated RAN1 UE features list for Rel-17 NR after RAN1 #108-e, Moderators (AT&T, NTT DOCOMO, INC.)
2. R1-2200925, Remaining issues of Rel-17 positioning UE feature, Huawei/HiSilicon
3. R1-2201123, Discussion on UE features for NR positioning enhancements, vivo
4. R1-2201200, UE features for NR positioning enhancements, ZTE
5. R1-2201245, UE features for NR positioning enhancements, OPPO
6. R1-2201347, Remaining issues on Rel-17 UE features for NR Positioning enhancements, CATT
7. R1-2201412, On UE features for NR positioning enhancements, Nokia/Nokia Shanghai Bell
8. R1-2201447, UE features for Rel-17 NR positioning enhancements, China Telecom
9. R1-2201505, Discussion on Rel-17 UE features for NR positioning enhancements, NTT DOCOMO, INC.
10. R1-2201730, UE features for Rel.17 NR positioning enhancements, Intel Corporation
11. R1-2201795, Views on UE features for NR positioning enhancements, Apple
12. R1-2201883, Discussion on UE features for NR positioning enhancement, CMCC
13. R1-2201953, Discussion on UE features for NR Positioning Enhancements, Xiaomi
14. R1-2202042, UE features for NR positioning enhancements, Samsung
15. R1-2202169, UE features for NR positioning enhancements, Qualcomm Incorporated
16. R1-2202388, Views on NR positioning enhancements UE features, Ericsson