**3GPP TSG RAN WG1 #107bis-e R1-200xxxx**

**e-Meeting, January 17th – 25th, 2022**

**Source: Ad-Hoc Chair (AT&T)**

**Title: Session Notes of AI 8.15.5**

**Agenda Item:** **8.15.5**

**Document for:** **Endorsement**



#### 8.15.5 UE features for NR positioning enhancements

[107bis-e-R17-UE-features-ePos-01] Email discussion UE features for NR positioning enhancements – Ralf (AT&T)

* 1st check point: January 20
* Final check point: January 25

**Agreement: 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 | 27-1-1 | ~~Support of~~ 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 positioning  2. 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 mitigation of UE Rx timing delays for the measurements | [per band or FS] | 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}  ~~The~~ Component 2 candidate values: ~~are~~ {~~[~~1,~~]~~ 2,[ 3,] 4, 6, 8~~[, 12, 16, 24, 32]~~}  Note: a single value is reported when both multi-RTT and DL-TDOA are supported.  Need for location server to know if the feature is supported  ~~FFS: Separate row for “Support of UE-RxTEG reporting for DL-TDOA”, and “Support of UE-RxTEG reporting for M-RTT”~~  ~~If UE supports this capability with the values > 1, and~~ if the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the mitigation of UE Rx timing delays for this measurement  ~~[If value=1 is indicated by the UE, the UE Rx timing errors differences between two measurements are within a margin only if the UE reports the same Rx-TEG-ID associated with both measurements, otherwise, no assumption can be made about the timing error differences between these measurements.]~~  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 | 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 ~~priority~~ 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 ~~priority~~ window~~]~~  ~~Candidate values: {Type 1A, Type 1B, Type 2}.~~  Note:   * Type 1A refers to the determination of prioritization between DL PRS and ~~being prioritized over~~ other DL signals/channels in all OFDM symbols within the PRS processing ~~priority~~ window. The DL signals/channels from all DL CCs (per UE) are affected across NR and LTE * Type 1B refers to the determination of prioritization between DL PRS and ~~being prioritized over~~ other DL signals/channels in all OFDM symbols within the PRS processing ~~priority~~ window. The DL signals/channels from a certain band ~~DL CCs~~ are affected (FFS FR2) * Type 2 refers to the determination of prioritization between DL PRS and ~~being prioritized over~~ other DL signals/channels only in DL PRS symbols within the PRS processing ~~priority~~ 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 options  ~~[~~Note: 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~~]~~ | ~~FFS~~ Yes |  |  | ~~FFS: Per UE or~~ 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 supported  Note: A UE that supports FG 27-3-2 also needs to support FG 27-3-2a  ~~FFS: Separate feature group for a UE to declare support of each of the Type-1A, Type-1B, Type-2” capabilities~~ | Optional with capability signalling |
| 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 |  |  | FFS | 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 | Optional with capability signaling |

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

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| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG – buffering capability | 1. DL PRS buffering capability: Type 1 or Type 2  a) Type 1 – sub-slot/symbol level buffering ~~T: [{8, 16, 20, 30, 40, 80, 160, 320, 640, 1280}] ms~~  b) 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 ~~every T ms~~ assuming maximum DL PRS bandwidth in MHz, ~~which is supported and reported by UE~~ such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol, where  ~~a) T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms Type 1 – sub-slot/symbol level buffering~~  ~~b) N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms~~  ~~a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} ms~~  ~~b) T: {N+4, N+5, N+6, N+8} ms~~]  3. Max number of DL PRS resources that UE can process in a slot under it  a) FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  b) 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 | ~~FFS: Separate feature group for a UE to declare PRS processing capabilities of each of the Type-1A, Type-1B, Type-2” capabilities~~  [Candidate 2 component values:  a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} ms  b) T: {N+4, N+5, N+6, N+8} ms]  Need for location server to know if the feature is supported  Note: 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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| 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 method  Need for location server to know if the feature is supported | Optional with capability signaling |

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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 ~~periodic~~ SRS Resource Sets for positioning supported by UE ~~per BWP.~~  ~~Values = {1, 2, 4, 8, 12, 16}.~~  2. Max number of [P/SP] ~~periodic~~ SRS Resources for positioning ~~per BWP.~~  ~~Values = {1,2,4,8,16,32,64}~~  3. Max number of [P/SP] ~~periodic~~ SRS Resources for positioning ~~per BWP~~ per slot~~.~~  ~~Values = {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}~~  4. Max number of periodic SRS Resources for positioning  5. Max number of periodic SRS Resources for positioning per slot  ~~4. FFS: Applicability for SRS outside initial BWP~~  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. ~~Note:~~ 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}  ~~Component 4 candidate values: {initial BWP, any BWP}~~  [Need for location server to know if the feature is supported]  ~~Note: if component 4 is not reported, the UE only supports Periodic SRS for Positioning~~  FFS: outside initial BWP | Optional with capability signaling |
| 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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| 27. NR\_pos\_enh | 27-17 | Support of positioning ~~[PRS measurement processing~~ in RRC\_INACTIVE~~]~~ | 1. Support of PRS ~~measurement~~ processing in RRC\_INACTIVE  [2. Support of positioning SRS transmission in RRC\_INACTIVE state]  ~~[3. Support of reporting location information in RRC\_INACTIVE]~~  Note: UE supporting this feature may support at least one from DL RSTD, DL PRS-RSRP, or UE Rx – Tx time difference measurement | [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.]  ~~[Note: A UE may support component 1 without supporting component 3, but not the reverse]~~  Note: RAN1 understands reporting location information in RRC\_INACTIVE using control plane SDT is expected to be covered by SDT feature. | Optional with capability signaling. |

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| 27. NR\_pos\_enh | 27-10 | Support of UL MAC CE based MG activation request for PRS ~~positioning~~ measurements | 1. Support of using UL MAC CE to request measurement gap for PRS ~~positioning~~ 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 MG  2. 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 ~~PRS~~ measurement gap for PRS ~~positioning~~ 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 |

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| 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 ID  2. 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. |

**Proposal: Introduce the following new FG**

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| 27. NR\_pos\_enh | 27-6 | DL PRS processing capabilities in RRC inactive state | 1. DL PRS buffering capability: Type 1 or Type 2  a) Type 1 – sub-slot/symbol level buffering  b) Type 2 – slot level buffering  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.  a) Type 1 – sub-slot/symbol level buffering  b) N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms  3. Max number of DL PRS resources that UE can process in a slot under it  a) FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  b) FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz |  |  |  |  |  |  |  |  | Note: 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 |

**Proposal: Introduce the following new FG**

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| 27. NR\_pos\_enh | 27-7 | Maximum number of measurement instances which can be included in a single measurement report | Maximum number of measurement instances which can be included in a single measurement report |  |  |  |  |  |  |  |  |  |  |

**Proposal: Introduce the following new FG**

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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  ~~Note: Other PRS capabilities follows the same as the RRC\_CONNECTED state for DL-TDOA.~~ |  | No |  |  | Per UE | No | No | No | Need for location server to know if the feature is supported.  Note: 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.  Note: Applicable for both UE-assisted and UE-based DL-TDOA | Optional with capability signaling. |

**Proposal: Introduce the following new FG**

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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  ~~Note: Other PRS capabilities follows the same as the RRC\_CONNECTED state for DL-AoD.~~ |  | No |  |  | Per UE | No | No | No | Need for location server to know if the feature is supported.  Note: 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.  Note: Applicable for both UE-assisted and UE-based DL-AoD | Optional with capability signaling. |

**Proposal: Introduce the following new FG**

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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.  ~~Note: Other PRS capabilities follows the same as the RRC\_CONNECTED state for Multi-RTT.~~ |  | 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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| 27. NR\_pos\_enh | 27-16 | OLPC for positioning SRS in RRC\_INACTIVE state | Same as  LPP  OLPC-SRS-Pos-r16  RRC  OLPC-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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| 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 |

[R1-2200036](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200036.zip) Rel-17 UE features for positioning enhancements Huawei, HiSilicon

[R1-2200058](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200058.zip) UE features for NR positioning enhancements ZTE

[R1-2200101](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200101.zip) Discussion on UE features for NR positioning enhancements vivo

[R1-2200139](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200139.zip) Remaining issues on Rel-17 UE features for NR Positioning enhancements CATT

[R1-2200219](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200219.zip) UE features for Pos enh Samsung

[R1-2200250](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200250.zip) Discussion on Rel-17 UE features for NR positioning enhancements NTT DOCOMO, INC.

[R1-2200271](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200271.zip) Discussion on UE Features for Positioning Enhancements CAICT

[R1-2200314](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200314.zip) UE features for NR positioning enhancements Qualcomm Incorporated

[R1-2200342](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200342.zip) UE features for NR positioning enhancements OPPO

[R1-2200457](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200457.zip) Discussion on UE features for NR Positioning Enhancements xiaomi

[R1-2200476](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200476.zip) UE features for NR positioning enhancements Intel Corporation

[R1-2200490](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200490.zip) UE features for Rel-17 NR positioning enhancements China Telecom

R1-2200583 UE features for Rel-17 positioning MediaTek Inc.

Late submission

[R1-2200612](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200612.zip) Discussion on Rel-17 UE features for NR positioning LG Electronics

[R1-2200625](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200625.zip) On UE features for NR positioning enhancements Nokia, Nokia Shanghai Bell

[R1-2200663](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107b-e\Docs\R1-2200663.zip) Views on NR positioning enhancements UE features Ericsson