**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

**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 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~~  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 | 27-1-2 | 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 | ~~[13-4, ]~~13-8 | Yes |  | UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the mitigation of UE Tx timing for the SRS for positioning~~”~~ and ~~“~~UE-TxTEGs for RTT is not supported and no assumption can be made on the mitigation of UE Tx timing for the SRS for positioning | ~~FFS:~~ per band ~~or per FS~~ | n/a | n/a | n/a | The candidate values are {~~[~~1, ~~]~~2, 3, 4, 6, 8}  If value=1 is indicated by the UE, the UE Tx timing errors differences between two SRS resources for positioning are within a margin only if the UE reports same ~~an~~ Tx-TEG-ID associated with the SRS resources for positioning, otherwise, no assumption can be made about the timing error differences between these SRS resources.  ~~[~~Need for location server to know if the feature is supported~~]~~  Note: 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: 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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| 27. NR\_pos\_enh | 27-1-2a | Support of UE-TxTEGs for Multi-RTT ~~[and/or UL TDOA]~~ 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 | ~~[~~per band ~~per FS]~~ | 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 supported  If UE supports this capability with the values > 1, and if ~~if~~ the UE does not include TxTEG-ID associated with a measurement, no assumption can be made on the mitigation of UE Tx timing delays for this SRS resource  ~~[~~If value=1 is indicated by the UE, the UE Tx timing errors differences between two SRS resources are within a margin only if the UE reports same ~~an~~ Tx-TEG-ID associated with the SRS resources, otherwise, no assumption can be made about the timing error differences between these SRS resources.~~]~~  ~~[Note: 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~~]~~ | Optional with capability signaling |

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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 ~~or~~ and 13-8~~]~~ | No |  | Mitigation of UE RxTx timing delays is not supported | per band | n/a | n/a | n/a | The candidate values are {~~[~~1, ~~]~~2, 4, 6, 8, 12, 16, 24, 32, 36, 48~~[~~, 64~~, 128, 256]~~}  Need for location server to know if the feature is supported  If UE supports this capability with the values > 1, and if the UE does not include RxTxTEG-ID associated with a measurement, no assumption can be made on the mitigation of UE RxTx timing delays for this measurement  ~~[~~If value=1 is indicated by the UE, the UE RxTx timing errors differences between two measurements are within a margin only if the UE reports an RxTx-TEG-ID associated with the 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 RxTxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTxTEG ID can span from 0, up to ~~63~~ ~~[~~255~~]~~ | Optional with capability signaling |

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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, 3, 4, 6, 8}~~]~~  Need for location server to know if the feature is supported. | Optional with capability signaling |

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| 27. NR\_pos\_enh | 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 RSRP of the first path for DL-AoD positioning method  2.) The maximum number of first path PRS RSRP per TRP | ~~[13-2 or 13-3, 13-4~~, 13-5~~, 13-8]~~ | No |  |  | ~~FFS:~~ Per UE ~~or per band~~ | 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 supported  The 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) | Optional with capability signaling |

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| 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~~, 13-2]~~ | No |  | UE report of more than 8 DL PRS-RSRP is not supported. | ~~FFS:~~ Per UE ~~or per band~~ | n/a | Yes | n/a | The candidate values are {~~[12, ]~~16, 24~~[, 32, 64]~~}  Need for location server to know if the feature is supported  The maximum number of reported DL PRS RSRP should be more than the maximum number of reported DL PRS RSRP of the first path | Optional with capability signaling |

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| 27. NR\_pos\_enh | 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 samples (instances) of a DL PRS resource set~~]~~ | ~~[~~13-1~~, 13-4, 13-8]~~ | No |  |  | ~~FFS: Per UE or~~ 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 supported | Optional with capability signaling |

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| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 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]~~  ~~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 | ~~[~~The candidate value are {hard value, soft value~~, both~~} ~~[0,1]]~~  Need for location server to know if the feature is supported | Optional with capability signaling |

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| 27. NR\_pos\_enh | 27-5-1 | ~~[~~UE-initiated~~]~~ on-demand PRS | ~~UE’s capability to~~ Support of UE-initiated on-demand DL PRS ~~[request signalling]~~ | ~~[~~13-1~~]~~ | No |  |  | Per UE | n/a | n/a | n/a | ~~FFS:~~ Need for location server to know if the feature is supported  For broadcast assistance data, LMF may not need to know if the feature is supported by the UE. | Optional with capability signaling |

[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