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

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

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

**Title: Session Notes of AI 8.16.5**

**Agenda Item:** **8.16.5**

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



#### 8.16.5 UE features for NR positioning enhancements

[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

**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 | 27-6 | DL PRS processing capabilities in RRC inactive state | 1. DL PRS buffering capability  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  3. Max number of DL PRS resources that UE can process in a slot under it […] | FFS | No |  |  | Per band | 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} ms  N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms  Component 3 candidate values:  FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz  Need for location server to know if the feature is supported  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 |

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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 |
| 27. NR\_pos\_enh | 27-16a | OLPC for positioning SRS in RRC\_INACTIVE state | Same as  LPP  OLPC-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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| 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 RRC\_INACTIVE state | 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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| 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 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-TDOA  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.  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. |
| 27. NR\_pos\_enh | 27-18b | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD | Support of PRS measurement 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-AoD  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.  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. |
| 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  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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| 27. NR\_pos\_enh | 27-15 | ~~Support of~~ Positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP | 1. Max number of SRS Resource Sets for positioning supported by UE  2. Max number of ~~[~~P/SP~~]~~ SRS Resources for positioning  3. Max number of ~~[~~P/SP~~]~~ SRS Resources for positioning per slot  4. Max number of periodic SRS Resources for positioning  5. Max number of periodic SRS Resources for positioning per slot  ~~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~~ |  | 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}  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  Need for location server to know if the feature is supported  ~~FFS: outside initial BWP~~ | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-15b | 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 3. Max number of periodic SRS Resources for positioning 4. Max number of periodic SRS Resources for positioning per slot 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] 7. Max number of P/SP SRS Resources for positioning 8. Max number of P/SP SRS Resources for positioning per slot 9. FFS: center frequenecy | 27-15 | Yes |  |  | Per band |  |  |  | Component 1 candidate values: FFS  Component 2 candidate values: {1, 2, 4, 8, 12, 16}  Component 3 candidate values: {1,2,4,8,16,32,64}  Component 4 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}  Component 5 candidate values: FFS  Component 6 candidate values: FFS  Component 7 candidate values: FFS  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 6 is not signaled, the UE supports only SRS BW that include the BW of the CORESET #0 and SSB.]  [Need for location server to know if the feature is supported] | Optional with capability signaling |

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| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capability  a) Type 1 – sub-slot/symbol level buffering  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 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 3  R16 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} ms  b) 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, 60kHz  FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz  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  Note: This capability is applicable to RRC Connected only. | Optional with capability signaling |

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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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| 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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| 27. NR\_pos\_enh | 27-17 | Support of positioning in RRC\_INACTIVE state | 1. Support of PRS processing in RRC\_INACTIVE  2. 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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| 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 method  2.) 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, 2,4,8,16,24  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)  ~~[~~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 |

[R1-2200925](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2200925.zip) Remaining issues of Rel-17 positioning UE feature Huawei, HiSilicon

[R1-2201123](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201123.zip) Discussion on UE features for NR positioning enhancements vivo

[R1-2201200](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201200.zip) UE features for NR positioning enhancements ZTE

[R1-2201245](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201245.zip) UE features for NR positioning enhancements OPPO

[R1-2201347](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201347.zip) Remaining issues on Rel-17 UE features for NR Positioning enhancements CATT

[R1-2201412](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201412.zip) On UE features for NR positioning enhancements Nokia, Nokia Shanghai Bell

[R1-2201447](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201447.zip) UE features for Rel-17 NR positioning enhancements China Telecom

[R1-2201505](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201505.zip) Discussion on Rel-17 UE features for NR positioning enhancements NTT DOCOMO, INC.

[R1-2201730](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201730.zip) UE features for Rel.17 NR positioning enhancements Intel Corporation

[R1-2201795](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201795.zip) Views on UE features for NR positioning enhancements Apple

[R1-2201883](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201883.zip) Discussion on UE features for NR positioning enhancement CMCC

[R1-2201953](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2201953.zip) Discussion on UE features for NR Positioning Enhancements Xiaomi

[R1-2202042](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2202042.zip) UE features for NR positioning enhancements Samsung

[R1-2202169](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2202169.zip) UE features for NR positioning enhancements Qualcomm Incorporated

[R1-2202388](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_108-e\Docs\R1-2202388.zip) Views on NR positioning enhancements UE features Ericsson