**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 8.16.4**

**Agenda Item:** **8.16.4**

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

1.

#### 8.16.4 UE features for NR NTN

[108-e-R17-UE-features-NR-NTN-01] Email discussion on UE features for NR-NTN – Ralf (AT&T)

* 1st check point: February 25
* Final check point: March 3

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

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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time and Frequency pre-compensation | 1. UE specific TA calculation based on its GNSS-acquired position and the serving satellite ephemeris.
2. UE ~~applies~~ calculates common TA according to the parameters provided by the network ~~[~~(UE considers common TA as 0 if the parameter is not provided)~~]~~
3. For TA update in RRC\_CONNECTED state, combination of both open (i.e. UE autonomous TA estimation, and common TA estimation) and closed (i.e., received TA commands) control loops
4. ~~FFS:~~ UE pre-compensates the calculated TA in its uplink transmissions
5. Support of estimating UE-gNB RTT and delaying the start of RAR window ~~[~~by UE-gNB RTT~~]~~
6. Support of frequency pre-compensation to counter shift the Doppler experienced on the service link
 |  | No | No | Release 17 NR UE cannot communicate via ~~access [NTN/~~ satellite~~/HAPS/ATG]~~ | ~~[Per UE/~~per band~~]~~ | No | No | No | An NTN UE is required to at least support UE specific TA and frequency calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | Optional with capability signalling For UE supports NR communication via ~~[NTN/~~ satellite~~/HAPS/ATG]~~, UE must indicate this FG is supported.~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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|  26. NR\_NTN\_solutions | 26-3 | Enhancement on the timing relationship | 1. ~~FFS: delaying~~ Determining timing of the scheduling of PUSCH, PUCCH and PDCCH ordered PRACH, CSI reference resource, transmission of aperiodic SRS activation of TA command, first PUSCH transmission in CG Type 2 with cell-specific K\_offset if indicated
2. ~~FFS: delaying~~ Determining timing of the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated and determining the timing of PDCCH monitoring in recovery search space using K-mac during beam failure recovery procedure
3. UE receives cell-specific K\_offset/K\_mac in system information

~~FFS: separate FGs for cell specific Koffset and Kmac/UE-gNB RTT estimation/delay of RAR/MsgB response window~~ | ~~[26-1][26-2]~~ | No | No | Release 17 NR UE cannot communicate via ~~access [NTN/~~ satellite~~/HAPS/ATG]~~ | ~~[Per UE/~~per band~~]~~ | No | No | No | ~~FFS: whether this FG gets merged with FG 26-1~~ | Optional with capability signalling For UE supports NR communication via ~~[NTN/~~ satellite~~/HAPS/ATG]~~, UE must indicate this FG is supported.~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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|  26. NR\_NTN\_solutions | 26-4 | UE reporting of information ~~about~~ related to ~~the UE specific~~ TA pre-compensation | Support UE reporting of information ~~about~~ related to ~~the UE specific~~ TA pre-compensation ~~[The exact content of UE reporting of information about the UE specific TA pre-compensation e.g., frequency of the reports, granularity of the reported conten, etc.]~~ | ~~[~~26-1~~]~~, 26-3 | Yes | No | UE does not support reporting of information related to TA pre-compensation for NR communication via satellite  | ~~[Per UE/~~per band~~]~~ | No | No | No | Note: The exact content of UE reporting of information about the TA pre-compensation is up to RAN2 | Optionalwith capability signalling ~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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|  26. NR\_NTN\_solutions | 26-5 | Increasing the number of HARQ processes | The maximal supported HARQ process number is X for UL and Y for DL |  | Yes | No | Increased number of HARQ processes is not supported for NR communication via satellite | ~~[Per band or~~ per FSPC ~~or per UE]~~ | No | No | No | Candidate component values for (X,Y): {(16,32),(32,16),(32,32)} | Optional with capability signalling~~[~~Note: This UE feature group is applicable only for NR cell communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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|  26. NR\_NTN\_solutions | 26-6 | Type-2 HARQ codebook Enhancement | 1. Support of type-2 HARQ codebook enhancements ~~[for feedback-disabled HARQ processes]~~ when per HARQ process feedback disabling is supported

~~FFS: UE supports HARQ disabling~~ |  | Yes | No | Type-2 HARQ codebook enhancement is not supported for NR communication via satellite | ~~[Per UE/~~per band~~]~~ | No | No | No |  | Optional with capability signalling ~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |
|  26. NR\_NTN\_solutions | ~~[~~26-6a~~]~~ | ~~[~~Type-1 HARQ codebook enhancement~~]~~  | 1. Support of ~~Enhancement on~~ Type-1 HARQ codebook enhancements for feedback-disabled HARQ processes ~~in NTN~~
2. ~~FFS: HARQ disabling~~
 | ~~[26-1, 26-2]~~ | Yes | No | Type-1 HARQ codebook enhancement is not supported for NR communication via satellite | ~~[Per UE/~~per band~~]~~ | No | No | ~~[support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]~~No | ~~FFS: whether this FG gets merged with FG 26-1 if the note “For UE supports NR [NTN/ satellite/HAPS/ATG], UE must indicate this FG is supported” is confirmed in the positive~~ | Optional with capability signalling ~~[For UE supports NR [NTN/ satellite/HAPS/ATG], UE must indicate this FG is supported.]~~~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |
|  26. NR\_NTN\_solutions | 26-6b | Type-3 HARQ codebook enhancement | 1. Support of Type-3 HARQ codebook enhancements for feedback-disabled HARQ processes.
 |  | Yes | No | Type-3 HARQ codebook enhancement is not supported for NR communication via satellite | per band | No | No | No |  | Optional with capability signalling Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; for any other cell this feature is not supported |

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|  26. NR\_NTN\_solutions | 26-8 | Support of polarization ~~[~~signalling~~/ information/reception]~~ in NR NTN | 1. Support polarization indication reception in SIB indicating DL and/or UL polarization information using respective polarization type parameters to indicate: RHCP or LHCP or linear
2. Support polarization signalling for target serving cell in handover command message
3. Support polarization signalling for non-serving cell in RRM measurement configuration
4. ~~FFS: polarization information for DL is indicated in SIB by the network~~
 |  | No | No | ~~[It is assumed by the network that UE supports at least linear polarization]~~ UE is not able to take the advantage of polarization information to save power | ~~[Per UE/~~Per band~~]~~ | No | No | ~~[support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]~~ No | ~~[Value range for component 1: {(RHCP, LHCP, Linear), (RHCP, LHCP), (RHCP), (LHCP), (Linear)}]~~~~FFS: whether this FG gets merged with FG 26-1 if the note “For UE supports NR [NTN/ satellite/HAPS/ATG], UE must indicate this FG is supported” is confirmed in the positive~~ | Optional with capability signalling [For UE supports NR [NTN/ satellite/HAPS/ATG], UE must indicate this FG is supported]~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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|  26. NR\_NTN\_solutions | 26-9 | UE-specific K\_offset  | 1. Reception of UE-specific K\_offset via MAC-CE

Determining the timing of PUSCH, PUCCH ~~[and PDCCH ordered PRACH]~~, CSI reference resource, transmission of aperiodic SRS, activation of TA command, first PUSCH transmission in CG Type 2 with UE-specific Koffset | 26-3, 26-4 | Yes | No | UE-specific K\_offset reception is not supported for NR communication via satellite | ~~FFS~~ Per band | No | No | No |  | Optional with capability signalling ~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite/HAPS as specified in TS 38.101-5 or TS 38.104; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

[R1-2200940](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2200940.zip) Rel-17 UE features for NR NTN Huawei, HiSilicon

[R1-2201222](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2201222.zip) UE features for NR NTN MediaTek Inc.

[R1-2201303](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2201303.zip) Discussion on UE features for NTN-NR OPPO

[R1-2201411](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2201411.zip) On UE features for NR NTN Nokia, Nokia Shanghai Bell

[R1-2201504](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2201504.zip) Discussion on Rel.17 UE features for NR NTN NTT DOCOMO, INC.

[R1-2201729](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2201729.zip) On UE features for NR NTN Intel Corporation

[R1-2201794](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2201794.zip) Views on Rel-17 NR NTN UE Features Apple

[R1-2201807](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2201807.zip) On UE features for NR NTN Ericsson Hungary Ltd

[R1-2202041](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2202041.zip) UE features for NR NTN Samsung

[R1-2202168](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2202168.zip) UE features for NR NTN Qualcomm Incorporated

[R1-2202212](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2202212.zip) Discussion on UE feature for NR-NTN ZTE

[R1-2202290](file:///C%3A%5CUsers%5Cyouns%5COneDrive%5CDocuments%5C3GPP%5CRAN1%20tdocs%5CTSGR1_108-e%5CDocs%5CR1-2202290.zip) Discussion on Rel-17 UE feature for NR NTN LG Electronics