**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

**Agreement: 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 and timing relationship enhancements  | 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
7. 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
8. 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
9. UE receives cell-specific K\_offset/K\_mac in system information
 |  | 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] |
|  ~~26. NR\_NTN\_solutions~~ | ~~26-3~~ | ~~Enhancement on the timing relationship~~ | 1. ~~FFS: delaying 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~~
2. ~~the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated~~
 | ~~[26-1][26-2]~~ | ~~No~~ | ~~No~~ | ~~Release 17 UE cannot 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 [NTN/ satellite/HAPS/ATG], UE must indicate this FG is supported.~~~~[Note: This UE feature group is applicable only for NR cell for NR NTN cell and ATG cell, for terrestrial cell except for ARG cell this feature is not supported]~~ |

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

~~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~~]~~ | ~~[~~[HARQ feedback disabling for] Type-1 HARQ codebook enhancement~~]~~ with HARQ disabling | 1. [Support of HARQ feedback disabling]
2. Support of ~~Enhancement on~~ Type-1 HARQ codebook enhancements for feedback-disabled HARQ processes ~~in NTN~~
3. ~~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 | [HARQ feedback disabling for] Type-3 HARQ codebook enhancement with HARQ disabling | 1. [Support of HARQ feedback disabling]
2. 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 | 26-5 | 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 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 | 26-8 | 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 | 26-4 | 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 | 26-9 | 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