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

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

**Agenda Item: 8.16.14**

**Source: Moderator (AT&T)**

**Title: Summary of UE features for IoT over NTN**

**Document for:** **Discussion/Decision**

# Introduction

This document presents the summary of email discussion/approval [108-e-R17-UE-features-IoT-NTN-01] during RAN1 #108-e. According to the Chairman’s Notes:

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| [108-e-R17-UE-features-IoT-NTN-01] Email discussion on UE features for IoT over NTN – Ralf (AT&T)   * 1st check point: February 25 * Final check point: March 3 |

The following was discussed and/or agreed during RAN1 #108-e within the scope of [108-e-R17-UE-features-IoT-NTN-01]. All proposals are based on the latest RAN1 UE features list for Rel-17 NR in [1].

# Summary of Contributions Submitted to RAN1 #108-e

The following is the moderator’s summary of contributions submitted to RAN1 #108-e in this agenda item.

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1 | Basic IoT over NTN support | 1. UE derives its position based on its GNSS measurements  [1-1. UE report the validity duration of GNSS]  2. Receive serving satellite ephemeris in either state vector format or orbital element format  4. UE specific TA calculation in RRC\_IDLE and RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris  6. UE applies common TA in RRC\_IDLE and RRC\_CONNECTED according to the parameters provided by the network (UE considers common TA as 0 if the parameter is not provided)  [7. 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]  8. In RRC\_IDLE and RRC\_CONNECTED state, UE calculates frequency pre-compensation to counter shift the Doppler experienced on the service link [in DL] [and] [in UL]  10. Support a validity timer of UL synchronization is configured by the network  13. UE applies cell specific K\_offset in timing relationship enhancements  14.UE estimates UE-gNB RTT  [15. delaying the starts of ra-ResponseWindow]  [16. UE receives cell specific K\_mac]  17. In RRC\_IDLE state and RRC\_CONNECTED state, pre-compensate the calculated frequency offset and TA in uplink transmissions |  | Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [per UE/per band] | No | No | FFS: whether this feature group needs to be separate for eMTC and NB-IoT | Optional with capability signalling  For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] |

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| Company | Summary |
| Huawei/HiSilicon [2] | Separate UE feature groups should be defined for eMTC and NB-IoT, which is already the case for terrestrial network.  ***Proposal 1****: Define separate UE feature groups for NB-IoT and eMTC over NTN.*   1. On component 1-1: Remove [1-1. UE report the validity duration of GNSS] since there is no further RAN2 support of this. 2. On component 6: Change “UE applies” to “UE calculates” since it focus on calculation of common TA (corresponding to UE-specific TA calculation in component 4). 3. On component 7: Remove the bracket to align with NR NTN UE feature description. 4. On component 15: Remove the bracket and change it to “Support of estimating UE-gNB RTT and delaying the starts of ra-ResponseWindow by UE-gNB RTT” to align with NR NTN UE feature description. 5. On component 16: Remove the bracket and change to “Delay the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated” to align with NR NTN UE feature description. 6. This FG is a per UE capability.  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1 | Basic IoT over NTN support | 1. UE derives its position based on its GNSS measurements  ~~[1-1. UE report the validity duration of GNSS]~~  2. Receive serving satellite ephemeris in either state vector format or orbital element format  4. UE specific TA calculation in RRC\_IDLE and RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris.  6. UE ~~applies~~ calculates common TA in RRC\_IDLE and RRC\_CONNECTED according to the parameters provided by the network (UE considers common TA as 0 if the parameter is not provided)  ~~[~~7. 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~~]~~  10. Support a validity timer of UL synchronization is configured by the network  12. UE receives cell specific K\_offset  13. UE applies K\_offset in timing relationship enhancements  14.UE estimates UE-gNB RTT  ~~[~~15. Support of estimating UE-gNB RTT and delaying the starts of ra-ResponseWindow by UE-gNB RTT ~~]~~  ~~[~~16. Delay the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated ~~UE receives cell specific K\_mac]~~  17. In RRC\_IDLE state and RRC\_CONNECTED state, pre-compensate the calculated frequency offset and TA in uplink transmissions |  | Yes | N/A | Release 17 UE cannot access ~~[~~NTN/satellite~~]~~ | ~~[~~Per UE~~/per band]~~ | No | No | ~~FFS: whether tThis feature group needs to be separate for eMTC and NB-IoT~~ | Optional with capability signalling  For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported  ~~[~~Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] | |
| MediaTek Inc. [3] | * Component 1-1 can be kept without yellow highlight considering agreemens in RAN1 107e [2].  |  | | --- | | **Agreement**  The UE autonomously determines its GNSS validity duration X and reports information associated with this valid duration to the network via RRC signalling.   * X = {10s, 20s, 30s, 40s, 50s, 60s, 5 min, 10 min, 15 min, 20 min, 25 min, 30 min, 60 min, 90 min, 120 min, infinity} |  * Component 7 can be kept without yellow highlight considering taking NR NTN UE features [3] as baseline. * Component 8 should delete the description of “[in DL] [and] [in UL]”. * Component 14 and Component 15 should be merged to “Start of ra-ResponseWindow is delayed by an offset. The RA-window start offset is defined as sum (current offset, UE-eNB RTT) and current offset is defined in TS36.321 (FFS if applicable to NB-IoT 41ms offset)”, in order to align with RAN2 agreements [4] on start of RAR window.  |  | | --- | | **Agreement(RAN2 115e)**  Start of ra-ResponseWindow is delayed by an offset. Postpone discussion on the offset value until further agreements regarding RACH are made in RAN1.  **Agreement(RAN2 116e)**  The ra window start offset is defined as sum (current offset, UE-eNB RTT) and current offset is defined in TS36.321 (FFS if applicable to NB-IoT 41ms offset) |  * Component 16 can be kept without yellow highlight considering agreemens in RAN1 agreements.  |  | | --- | | **Agreement**  For IoT NTN, the information of K\_mac is carried in system information. |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1 | Basic IoT over NTN support | 1. UE derives its position based on its GNSS ~~implementation~~ measurements  1-1. UE report the validity duration of GNSS  ~~2. [Indicate/receive] serving Satellite position state vector X,Y,Z in ECEF (m) and serving Satellite velocity state vector VX,VY,VZ in ECEF (m/s)~~  ~~[2-1. Derive epoch time of serving satellite ephemeris from implicit epoch time]~~  ~~3. Receive ephemeris orbital parameter for the serving satellite~~  2. Receive serving satellite ephemeris in either state vector format or orbital element format  4. UE specific TA calculation in RRC\_IDLE and RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris.  ~~5. UE specific TA calculation [in [RRC\_IDLE and RRC\_CONNECTED state] based on its GNSS-acquired position and the serving satellite ephemeris.~~  6. UE applies common TA ~~[~~in RRC\_IDLE and RRC\_CONNECTED~~]~~ according to the parameters provided by the network (UE considers common TA as 0 if the parameter is not provided) ~~(if any)~~  7. 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  ~~X. [Common TA estimation is based on indication of common TA drift rate]~~  ~~8. In RRC\_IDLE state calculate frequency pre-compensation to counter shift the Doppler experienced on the service link.~~  ~~9. in RRC\_CONNECTED state, calculate frequency pre-compensation to counter shift the Doppler experienced on the service link.~~  8. In RRC\_IDLE and RRC\_CONNECTED state, UE calculates frequency pre-compensation to counter shift the Doppler experienced on the service link ~~[in DL] [and] [in UL]~~  10. Support a validity timer of UL synchronization is configured by the network  ~~11. Support segment duration configuration is by the network [and updating time and frequency pre-compensation between segments but not within segments during UL repetition]~~  ~~12. UE receives cell specific K\_offset~~  13. UE applies cell specific K\_offset in timing relationship enhancements  14. Start of ra-ResponseWindow is delayed by an offset. The RA-window start offset is defined as sum (current offset, UE-eNB RTT) and current offset is defined in TS36.321 (FFS if applicable to NB-IoT 41ms offset).  ~~UE estimates of UE-gNB RTT~~  ~~[15. delaying the starts of ra-ResponseWindow]~~  16. UE receives cell specific K\_mac  17. In RRC\_IDLE state and RRC\_CONNECTED state, pre-compensate the calculated frequency offset and TA in uplink transmissions |  | ~~[No]~~ Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [Per UE/per band] | No | No | FFS: whether this feature group needs to be separate for eMTC and NB-IoT  ~~FFS: Serving satellite ephemeris Epoch time is implicitly known as a reference time defined by the starting time of a DL slot and/or frame. FFS: Whether this starting time is given by predefined rule or it is indicated by the network~~  ~~FFS: differentiation based on orbits such as LEO/MEO/GEO~~ | Optional with capability signalling  For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] | |
| OPPO [4] | In RAN1#107-e meeting, FG 2-1 was discussed as a basic feature for NTN-IOT, where the highlighted in yellow 7 is a bit strange to make it as a basic UE feature for NTN, as the combination of open loop and close loop does not introduce additional UE behavior to open loop TA control. Thus, it would be more reasonable to only mention open loop. But we suggest to replace open loop TA control with the text aligned with NR-NTN, I.e.   |  | | --- | | 1. UE specific TA calculation based on its GNSS-acquired position and the serving satellite ephemeris 2. UE applies common TA according to the parameters provided by the network |   **Proposal 1: for FG2-1 component 7, replace the yellow highlighted text with UE specific TA calculation based on its GNSS-acquired position and the serving satellite ephemeris and UE applies common TA according to the parameters provided by the network.**  For the component 13. UE applies cell specific K\_offset in timing relationship enhancements  The basic feature should be applied only for Msg3 transmission and PUCCH transmission. While for the rest of the uplink transmission, the UE capability with signaling should be allowed. Thus, we suggest that in the FG2-1 component 13 only takes UE applies cell specific K offset in timing relationship enhancement for PUCCH and PUSCH transmission. Then introduce a new FG2-1a for other uplink transmission where UE applies cell specific K offset, for which UE may report its capability.  **Proposal 2: for FG2-1 component 13, only keep that UE applies cell specific K offset in timing relationship enhancement for PUCCH and PUSCH transmission**  **Proposal 3: introduce FG2-1a for other uplink transmission than PUCCH and PUSCH where UE applies cell specific K offset, for which UE may report its capability.** |
| Nokia, Nokia Shanghai Bell [5] | * + ”Need for the eNB to know if the feature is supported” should be ”yes”   + Notes for all FGs can be removed, they are not essential information for specifications   + Remove components 12 and 13 as they are duplicated in FG 2-2.   + Confirm component 16 on K\_mac support (see related agreements below).   Agreement:  For NB-IoT, if the UE has initiated an NPUSCH transmission using pre-configured uplink resources ending in subframe n, the UE shall start or restart to monitor the NPDCCH from DL subframe n+4+K\_mac (where K\_mac is defined as in NR-NTN).    Agreement:  For eMTC, if the UE has initiated an PUSCH transmission using pre-configured uplink resources ending in subframe n, the UE shall start or restart to monitor the MPDCCH from DL subframe n+4+K\_mac (where K\_mac is defined as in NR-NTN). |
| Intel Corporation [6] | * For Component 1-1 in FG 2-1, brackets can be removed since indication of validity duration was agreed in RAN1. * Word Satellite can be removed since it is already clear that operation with satellite is assumed for NTN. * UE capability for NTN can be indicated per band to allow more flexibility for UE implementation. * Separate signaling of UE capabilities for eMTC and NB-IoT can be used to allow more flexibility for UE implementation. |
| Apple [7] | In UE feature 2-1, components 15 and 16 are open. We think these two components belong to the feature “Basic IoT over NTN support”. Actually, these two components are closely correlated and can be merged to a single component “UE applies K\_mac in delaying the starts of ra-ResponseWindow”.  In UE feature 2-1, the component 7 is open. We think this component belongs to the feature 2-1, since it was agreed that UE in IoT NTN needs to support both open and closed loop TA control.  ***Proposal 1:*** *In feature 2-1,*   * *conform component 7 “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”.* * *merge components 15 and 16 to “UE applies K\_mac in delaying the starts of ra-ResponseWindow”.*   It is open the granularity of the features 2-1, 2-1a, 2-2 and 2-3. We think these features only apply on the band for NTN operations. Hence, it is natural these features are defined per band.  ***Proposal 6:*** *The features 2-1, 2-1a, 2-2 and 2-3 are defined per band.* |
| Ericsson Hungary Ltd [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1 | Basic IoT over NTN support | 1. UE derives its position based on its GNSS measurements  1-1. UE reports the validity duration of GNSS  2. UE receives serving satellite ephemeris in either state vector format or orbital element format  4. UE calculates UE specific TA in RRC\_IDLE and RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris  6. UE calculates common TA in RRC\_IDLE and RRC\_CONNECTED according to the parameters provided by the network (UE considers common TA as 0 if the parameter is not provided)  7. For TA update in RRC\_CONNECTED state, UE uses a combination of both open (i.e. UE autonomous TA estimation, and common TA estimation) and closed (i.e., received TA commands) control loops  8. In RRC\_IDLE and RRC\_CONNECTED state, UE calculates frequency pre-compensation to counter shift the Doppler experienced on the service link in DL and in UL  10. UE supports a validity timer of UL synchronization that is configured by the network  13. UE applies cell specific K\_offset in timing relationship enhancements  14.UE estimates UE-gNB RTT  15. UE delays the starts of ra-ResponseWindow  16. UE receives cell specific K\_mac  17. In RRC\_IDLE state and RRC\_CONNECTED state, UE pre-compensates the calculated frequency offset and TA in uplink transmissions |  | Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [per UE/per band] | No | No | FFS: whether this feature group needs to be separate for eMTC and NB-IoT | Optional with capability signalling  For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] | |
| Qualcomm Incorporated [9] | Currently, the FG 2-1 corresponding to “Basic IoT over NTN support” mentions the following as a component:   * *“…6. UE applies common TA ~~[~~in RRC\_IDLE and RRC\_CONNECTED~~]~~ according to the parameters provided by the network (UE considers common TA as 0 if the parameter is not provided) ~~(if any)~~* …”   The common TA parameters in general include the parameters *TACommon, TACommonDrift* and *TACommonDriftVariation,* with the latter two indicating adjustments related to the common TA drift. However, in GEO NTNs (which is the intended base case corresponding to FG 2-1), the drift/variation in the common TA is negligible. To this end, for simplified operation over GEO NTNs, we propose to modify the requirements on applying common TA to only include the common TA (i.e., the term *TACommon*), and not the drift/variation parameters.  ***Proposal 1*: For GEO NTNs, a UE applies common TA only in accordance with the common TA term, *TACommon*, and is not required to process the drift/variation parameters *TACommonDrift* and *TACommonDriftVariation.***  ***Proposal 2*: A UE’s support of NTN should be a “per band” capability.**  NB-IoT and eMTC capabilities are captured separately by RAN2. While for the feature list discussion, it may be OK to discuss these together, eventually, these need to be captured separately for eMTC and NB-IoT.  ***Proposal 3*: Capture IoT-NTN capabilities separately for eMTC and NB-IoT**  For the three capabilities (2-1, 2-2 and 2-3), the “Mandatory/Optional” column contains the following text:  “*For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported*”  For 2-1, this text is anyway true, and is not adding anything new. We therefore propose that this text be removed from 2-1.  For 2-2 and 2-3, however, given that these are features dependent on the mother feature (2-1), a UE supporting 2-1 and NOT supporting 2-2 and/or 2-3 can also communicate with an NTN cell. Additionally, if it possible that initial NTN IOT deployments do not implement features 2-2 and 2-3, and thus there would be a lack of IODT opportunities to test these features. As a result, we propose to remove the quoted text from 2-2 and 2-3.  ***Proposal 4*: Remove the text “*For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported*” from the “Mandatory/Optional” column for FG 2-1, 2-2 and 2-3.** |
| ZTE [10] | * For component 7, it’s preferred to remove the bracket ~~[~~7. 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 ~~]~~. Because according to the agreement in RAN1#106e[2],combination of both open and closed control loops are supported in NR-NTN and the relevant agreements from NR NTN are re-used for IoT NTN as working assumption. * For component8, the bracket for “~~[~~in DL~~] [~~and~~] [~~in UL~~]~~” can be removed. According to the agreement in RAN1#107e[3], the pre-compensation for the DL Doppler experienced in service link is not supported in NR-NTN. In this case, the correction of experienced Doppler should include the impacts for both DL and UL. * For components 10, an additional UE feature, i.e. A UE starts/restarts the validity timer at the epoch time of the assistance information, can be added to capture the agreements in RAN1#106bis [4]. * For component 15, it’s preferred to remove the bracket ~~[~~15.delaying the starts of ra-ResponseWindow~~]~~ to capture the IoT-NTN related agreements “start of ra-ResponseWindow is delayed by an offset” in RAN2#115e[5]. Since the legacy ra-ResponseWindow range may not be enough to cover different UEs in the IoT-NTN, the UE may determine the starts of ra-ResponseWindow with an offset after Msg 1 transmission, where the value of offset varies based on whether the UE can have access to the situation information(e.g.,location of the UE, an ephemeris of a satellite or a trajectory of a HAPS used by a BS, and a payload type of the satellite or the HAPS used by the BS). * For FG 2-1, it’s preferred to add an additional component 17, i.e. UE applies cell specific K\_mac in timing relationship enhancements, since the cell specific K\_mac should also be applied in timing relationship enhancement similar as the cell specific K\_offset. Besides, the sequence number of legacy component 17 should be correspondingly updated as component 18.  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1 | Basic IoT over NTN support | ~~[~~7. 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~~]~~  8.In RRC\_IDLE and RRC\_CONNECTED state, UE calculates frequency pre-compensation to counter shift the Doppler experienced on the service link ~~[~~in DL~~] [~~and~~] [~~in UL~~]~~  10. Support a validity timer of UL synchronization is configured by the network.  A UE starts/restarts the validity timer at the epoch time of the assistance information.  ~~[~~15.delaying the starts of ra-ResponseWindow~~]~~   1. UE receives cell specific K\_mac]   UE applies cell specific K\_mac in timing relationship enhancements  ~~17.~~18. In RRC\_IDLE state and RRC\_CONNECTED state, pre-compensate the calculated frequency offset and TA in uplink transmissions |  | Yes | Release 17 UE cannot access [NTN/satellite] | [per UE/per band] | No | No | FFS: whether this feature group needs to be separate for eMTC and NB-IoT | Optional with capability signalling  For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] | |

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | Segment duration configuration | Support segment duration configuration by the network |  | Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [Per UE/per band] | No | No | For UEs support NSGO scenarios, it must indicate this FG is supported. | Optional with capability signalling  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] |

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| Company | Summary |
| Huawei/HiSilicon [2] | 1. The “Prerequisite feature groups” for FG2-1a should be FG2-1 2. This FG is a per UE capability.  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | Segment duration configuration | Support segment duration configuration by the network | 2-1 | Yes | N/A | Release 17 UE cannot access ~~[~~NTN/satellite~~]~~ | ~~[~~Per UE~~/per band]~~ | No | No | For UEs support NSGO scenarios, it must indicate this FG is supported. | Optional with capability signalling  ~~[~~Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported~~]~~ | |
| MediaTek Inc. [3] | * The component can be change to “Support segment duration configuration by the network for NGSO”, considering only agreements for NGSO have been made.  |  | | --- | | **Agreement**  UL Segmented transmission NPRACH/NPUSCH for NB-IoT is not supported in GEO based on UE feature. |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | ~~Basic IoT over NTN support for NSGO scenarios~~  Segment duration configuration | ~~1. In RRC\_IDLE and RRC\_CONNECTED state, UE calculates frequency pre-compensation to counter shift the Doppler experienced on the service link~~  ~~2.~~ Support segment duration configuration by the network for NGSO. |  | Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [Per UE/per band] | No | No | For UEs support NSGO scenarios, it must indicate this FG is supported. | Optional with capability signalling  ~~For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported~~  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] | |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * + Notes for all FGs can be removed, they are not essential information for specifications |
| Intel Corporation [6] | * Word Satellite can be removed since it is already clear that operation with satellite is assumed for NTN. * UE capability for NTN can be indicated per band to allow more flexibility for UE implementation. |
| Apple [7] | A new UE feature 2-1a “Segment duration configuration” was introduced. This feature is about uplink transmission segment for long uplink transmission. Since all the uplink transmissions have to pre-compensate frequency offset and TA, the pre-requisite of feature 2-1a is feature 2-1.  ***Proposal 2:*** *The pre-requisite of feature 2-1a is feature 2-1.*  It is open the granularity of the features 2-1, 2-1a, 2-2 and 2-3. We think these features only apply on the band for NTN operations. Hence, it is natural these features are defined per band.  ***Proposal 6:*** *The features 2-1, 2-1a, 2-2 and 2-3 are defined per band.* |
| Ericsson Hungary Ltd [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | Segmented UL transmission | UE applies segmented uplink transmission according to duration configuration by the network | 2-1 | Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [Per UE/per band] | No | No | For UEs support NSGO scenarios, it must indicate this FG is supported. | Optional with capability signalling  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] | |
| Qualcomm Incorporated [9] | ***Proposal 2*: A UE’s support of NTN should be a “per band” capability.** |
| ZTE [10] | W.r.t the FG 2-1a, an additional UE feature “ The same value is used for segment durations for all PRACH preambles.” can be added according to the agreements in RAN1#106bis [4].  Moreover, according to the agreements in RAN1#107-e[3], UE can support the segment pre-compensation using two methods by UE implementation. In order to capture the relevant agreement[3], an additional component 2 should be added in FG2-1a to illustrate how to achieve the segmented pre-compensation. And the name of FG 2-1a can be revised as “segment pre-compensation”.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | Segment ~~duration configuration~~ pre-compensation | 1.Support segment duration configuration by the network  The same value is used for segment durations for all PRACH preambles.  2.Support segment pre-compensation by using one of followings methods:  1)UE can drop/insert samples and puncture OFDM symbols  2)UE can blank subframes, slots, and repetition units |  | Yes | Release 17 UE cannot access [NTN/satellite] | [Per UE/per band] | No | No | For UEs support NSGO scenarios, it must indicate this FG is supported. | Optional with capability signalling  [Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] | |

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-2 | Enhancing timing relationships using a time offset | UE applies UE specific K\_offset in timing relationship enhancements | 2-1 [, 2-3] | Yes | N/A | UE does not know the offset to apply for UL transmission | [per UE/per band] | No | No | The K\_offset is a scheduling offset used for the identified timing relationships that need to be modified for IoT NTN.  For IoT NTN, support cell-specific Koffset configuration for use during initial access.  For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.  FFS: whether this feature group needs to be separate for eMTC and NB-IoT  FFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signalling  FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported |

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| Company | Summary |
| Huawei/HiSilicon [2] | Separate UE feature groups should be defined for eMTC and NB-IoT, which is already the case for terrestrial network.  ***Proposal 1****: Define separate UE feature groups for NB-IoT and eMTC over NTN.*   1. The “Prerequisite feature groups” for FG2-2 should be FG2-1 and FG2-3 2. Remove “FFS: differentiation based on orbits such as LEO/MEO/GEO” since there is no need to differentiate scenarios 3. Remove “FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported” since it is not a basic UE feature for IoT-NTN 4. This FG is a per UE capability.  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-2 | Enhancing timing relationships using a time offset | UE applies UE specific K\_offset in timing relationship enhancements | 2-1 ~~[~~, 2-3~~]~~ | Yes | N/A | UE does not know the offset to apply for UL transmission | ~~[~~Per UE~~/per band]~~ | No | No | The K\_offset is a scheduling offset used for the identified timing relationships that need to be modified for IoT NTN.  For IoT NTN, support cell-specific Koffset configuration for use during initial access.  For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.  ~~FFS: whether this feature group needs to be separate for eMTC and NB-IoT~~  ~~FFS: differentiation based on orbits such as LEO/MEO/GEO~~ | Optional with capability signalling  ~~FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported~~ | |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * + Per UE, for UEs supporting IOT over NTN   + In principle a single FG for NB-IOT and eMTC is enough.   + Notes for all FGs can be removed, they are not essential information for specifications |
| Intel Corporation [6] | * For FG 2-2 and FG 2-3, differentiation based on orbits such as LEO/MEO/GEO is not needed since the corresponding UE feature may be supported or not for a band without considering particular deployment characteristics. Also, in our view the corresponding FGs should be supported for all UEs supporting NB-IoT/eMTC NTN since UE-specific slot offset and reporting of UE’s TA are important features to enable half-duplex FDD devices. * Word Satellite can be removed since it is already clear that operation with satellite is assumed for NTN. * UE capability for NTN can be indicated per band to allow more flexibility for UE implementation. * Separate signaling of UE capabilities for eMTC and NB-IoT can be used to allow more flexibility for UE implementation. |
| Apple [7] | The feature 2-2 is that UE applies UE specific K\_offset in timing relationship enhancements. The UE specific K\_offset is received only after UE reports its TA value. Hence, the pre-requisite of feature 2-2 includes feature 2-3.  ***Proposal 3:*** *The pre-requisite of feature 2-2 includes feature 2-3.*  The UE’s TA reporting and the application of UE specific K\_offset in timing relationship enhancements are not basic feature group of IoT over NTN. If a UE does not report TA and does not apply UE specific K\_offset in timing relationship enhancements, the UE can still use cell specific K\_offset in timing relationship enhancements.  ***Proposal 5:*** *The features 2-2 and 2-3 are not the basic feature groups for IoT over NTN.*   * *Remove “FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported” from the notes of these two features.*   It is open the granularity of the features 2-1, 2-1a, 2-2 and 2-3. We think these features only apply on the band for NTN operations. Hence, it is natural these features are defined per band.  ***Proposal 6:*** *The features 2-1, 2-1a, 2-2 and 2-3 are defined per band.* |
| Ericsson Hungary Ltd [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-2 | Enhancing timing relationships using a time offset | UE applies UE specific K\_offset in timing relationship enhancements | 2-1, 2-3 | Yes | N/A | UE does not know the offset to apply for UL transmission | [per UE/per band] | No | No | The K\_offset is a scheduling offset used for the identified timing relationships that need to be modified for IoT NTN.  For IoT NTN, support cell-specific Koffset configuration for use during initial access.  For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.  FFS: whether this feature group needs to be separate for eMTC and NB-IoT  FFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signalling  FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported | |
| Qualcomm Incorporated [9] | ***Proposal 2*: A UE’s support of NTN should be a “per band” capability.**  NB-IoT and eMTC capabilities are captured separately by RAN2. While for the feature list discussion, it may be OK to discuss these together, eventually, these need to be captured separately for eMTC and NB-IoT.  ***Proposal 3*: Capture IoT-NTN capabilities separately for eMTC and NB-IoT**  For the three capabilities (2-1, 2-2 and 2-3), the “Mandatory/Optional” column contains the following text:  “*For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported*”  For 2-1, this text is anyway true, and is not adding anything new. We therefore propose that this text be removed from 2-1.  For 2-2 and 2-3, however, given that these are features dependent on the mother feature (2-1), a UE supporting 2-1 and NOT supporting 2-2 and/or 2-3 can also communicate with an NTN cell. Additionally, if it possible that initial NTN IOT deployments do not implement features 2-2 and 2-3, and thus there would be a lack of IODT opportunities to test these features. As a result, we propose to remove the quoted text from 2-2 and 2-3.  ***Proposal 4*: Remove the text “*For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported*” from the “Mandatory/Optional” column for FG 2-1, 2-2 and 2-3.** |
| ZTE [10] | W.r.t the FG 2-2, it’s preferred to keep the component “UE receives UE specific K\_offset” since the action of UE receiving is needed in the specification.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-2 | Enhancing timing relationships using a time offset | 1.UE receives UE specific K\_offset  2.UE applies UE specific K\_offset in timing relationship enhancements | 2-1 [, 2-3] | Yes | UE does not know the offset to apply for UL transmission | [per UE/per band] | No | No | The K\_offset is a scheduling offset used for the identified timing relationships that need to be modified for IoT NTN.  For IoT NTN, support cell-specific Koffset configuration for use during initial access.  For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.  FFS: whether this feature group needs to be separate for eMTC and NB-IoT  FFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signalling  FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported | |

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-3 | UE specific TA pre-compensation reporting | [Support reporting of information about the UE specific TA pre-compensation] | 2-1 | Yes | No | UL scheduling for FDD-HD: Use of UE-specific TA and/or K\_offset to avoid UL-DL collisions in FDD-HD | [per UE/per band] | No | No | UE-specific TA reporting is supported in IoT-NTN  FFS: Detailed contents of report  FFS: whether this feature group needs to be separate for eMTC and NB-IoT  FFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signalling  FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported |

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| Company | Summary |
| Huawei/HiSilicon [2] | Separate UE feature groups should be defined for eMTC and NB-IoT, which is already the case for terrestrial network.  ***Proposal 1****: Define separate UE feature groups for NB-IoT and eMTC over NTN.*   1. Remove bracket in the the component description 2. Remove “FFS: Detailed contents of report” since there is no need to list the exact content of UE reporting in UE feature 3. Remove “FFS: differentiation based on orbits such as LEO/MEO/GEO” since there is no need to differentiate scenarios 4. Remove “FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported” since it is not a basic UE feature for IoT-NTN 5. This FG is a per UE capability.   All the other change as well as the the corresponding changes according to the above analysis are highlighted in red in the appendix A  ***Proposal 2:*** *Agree on the upadated UE features in the Appendix.*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-3 | UE specific TA pre-compensation reporting | ~~[~~Support reporting of information about the UE specific TA pre-compensation~~]~~ | 2-1 | Yes | No | UL scheduling for FDD-HD: Use of UE-specific TA and/or K\_offset to avoid UL-DL collisions in FDD-HD | ~~[~~Per UE~~/per band]~~ | No | No | UE-specific TA reporting is supported in IoT-NTN  ~~FFS: Detailed contents of report~~  ~~FFS: whether this feature group needs to be separate for eMTC and NB-IoT~~  ~~FFS: differentiation based on orbits such as LEO/MEO/GEO~~ | Optional with capability signalling  ~~FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported~~ | |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * + Per UE, for UEs supporting IOT over NTN   + In principle a single FG for NB-IOT and eMTC is enough, but it should be optional for eMTC UE, as it may support full-duplex as well. |
| Intel Corporation [6] | * For FG 2-2 and FG 2-3, differentiation based on orbits such as LEO/MEO/GEO is not needed since the corresponding UE feature may be supported or not for a band without considering particular deployment characteristics. Also, in our view the corresponding FGs should be supported for all UEs supporting NB-IoT/eMTC NTN since UE-specific slot offset and reporting of UE’s TA are important features to enable half-duplex FDD devices. * For FG 2-3, many aspects of UE reporting of information about the UE specific TA pre-compensation were defined in RAN2 including reporting of TA during initial access and in RRC\_CONNECTED state and reporting of UE location information. Thus, in our view RAN2 can define the details on the UE capability signaling for the exact content of UE reporting of information about the UE specific TA pre-compensation. * UE capability for NTN can be indicated per band to allow more flexibility for UE implementation. * Separate signaling of UE capabilities for eMTC and NB-IoT can be used to allow more flexibility for UE implementation. |
| Apple [7] | The component of feature 2-3 is open. We think that the component “support reporting of information about the UE specific TA pre-compensation” can be confirmed.  ***Proposal 4:*** *In feature 2-1, confirm the component “support reporting of information about the UE specific TA pre-compensation”.*  The UE’s TA reporting and the application of UE specific K\_offset in timing relationship enhancements are not basic feature group of IoT over NTN. If a UE does not report TA and does not apply UE specific K\_offset in timing relationship enhancements, the UE can still use cell specific K\_offset in timing relationship enhancements.  ***Proposal 5:*** *The features 2-2 and 2-3 are not the basic feature groups for IoT over NTN.*   * *Remove “FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported” from the notes of these two features.*   It is open the granularity of the features 2-1, 2-1a, 2-2 and 2-3. We think these features only apply on the band for NTN operations. Hence, it is natural these features are defined per band.  ***Proposal 6:*** *The features 2-1, 2-1a, 2-2 and 2-3 are defined per band.* |
| Ericsson Hungary Ltd [8] | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-3 | UE specific TA pre-compensation reporting | [Support reporting of information about the UE specific TA pre-compensation] | 2-1 | Yes | No | UL scheduling for FDD-HD: Use of UE-specific TA and/or K\_offset to avoid UL-DL collisions in FDD-HD | [per UE/per band] | No | No | UE-specific TA reporting is supported in IoT-NTN  FFS: Detailed contents of report, including reporting of UE location  FFS: whether this feature group needs to be separate for eMTC and NB-IoT  FFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signalling  FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported | |
| Qualcomm Incorporated [9] | ***Proposal 2*: A UE’s support of NTN should be a “per band” capability.**  NB-IoT and eMTC capabilities are captured separately by RAN2. While for the feature list discussion, it may be OK to discuss these together, eventually, these need to be captured separately for eMTC and NB-IoT.  ***Proposal 3*: Capture IoT-NTN capabilities separately for eMTC and NB-IoT**  For the three capabilities (2-1, 2-2 and 2-3), the “Mandatory/Optional” column contains the following text:  “*For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported*”  For 2-1, this text is anyway true, and is not adding anything new. We therefore propose that this text be removed from 2-1.  For 2-2 and 2-3, however, given that these are features dependent on the mother feature (2-1), a UE supporting 2-1 and NOT supporting 2-2 and/or 2-3 can also communicate with an NTN cell. Additionally, if it possible that initial NTN IOT deployments do not implement features 2-2 and 2-3, and thus there would be a lack of IODT opportunities to test these features. As a result, we propose to remove the quoted text from 2-2 and 2-3.  ***Proposal 4*: Remove the text “*For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported*” from the “Mandatory/Optional” column for FG 2-1, 2-2 and 2-3.** |
| ZTE [10] | W.r.t the FG 2-3, according to the latest agreement [3], i.e. NR NTN solutions are a baseline for the following UE-specific TA handling issues, the following component similar as the NR-NTN can be added in the FG 2-3: (1)The granularity of the reported TA is a slot.(2) As for the frequency of reports, the TA is reported when the offset between current information about UE specific TA and the last successfully reported information about UE specific TA is over the threshold.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2. LTE\_NBIOT\_eMTC\_NTN | 2-3 | UE specific TA pre-compensation reporting | [Support reporting of information about the UE specific TA pre-compensation]   * The granularity of the reported TA is a slot.   As for the frequency of reports, the TA is reported when the offset between current information about UE specific TA and the last successfully reported information about UE specific TA is over the threshold. | 2-1 | Yes | UL scheduling for FDD-HD: Use of UE-specific TA and/or K\_offset to avoid UL-DL collisions in FDD-HD | [per UE/per band] | No | No | UE-specific TA reporting is supported in IoT-NTN  FFS: Detailed contents of report  FFS: whether this feature group needs to be separate for eMTC and NB-IoT  FFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signalling  FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported | |

**Others**

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| Company | Summary |
| Huawei/HiSilicon [2] |  |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] |  |
| Intel Corporation [6] |  |
| Apple [7] |  |
| Ericsson Hungary Ltd [8] |  |
| Qualcomm Incorporated [9] | RAN1 should discuss how to determine the applicability of all terrestrial network (TN) features up to Rel16 for the case of NTN. This may involve a feature-by-feature determination of applicability to NTNs from the (legacy) feature list for TNs up to Rel16. A default assumption on applicability may be made, which may then be overridden on a case-by-case basis, as appropriate.  ***Proposal 5*: RAN1 to discuss the determination of applicability of Terrestrial Network (TN) features up to Release 16 to IoT-NTN in Release 17.**   * **A default assumption may be that a legacy IoT TN feature is applicable for IoT-NTN, unless it is explicitly demonstrated that it cannot be supported/is not applicable to IoT-NTN.** * **For the features that are applicable to IOT-NTN, a new capability indication (separate from the TN one) is introduced.** |
| ZTE [10] |  |

# Discussion/Approval Items during RAN1 #108-e — First Checkpoint

After review of contributions submitted to RAN1 #108-e in this agenda item, the following topics were identified by the moderator for discussion/approval during RAN1 #108-e.

**General comments**

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| Company | Comments/Questions/Suggestions |
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# Issue 1: FG 2-1

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1 | Basic IoT over NTN support | 1. UE derives its position based on its GNSS measurements  ~~[~~1-1. UE reports the validity duration of GNSS~~]~~  2. UE receives serving satellite ephemeris in either state vector format or orbital element format  4. UE calculates UE specific TA ~~calculation~~ in RRC\_IDLE and RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris  6. UE ~~applies~~ calculates common TA in RRC\_IDLE and RRC\_CONNECTED according to the parameters provided by the network (UE considers common TA as 0 if the parameter is not provided)  ~~[~~7. For TA update in RRC\_CONNECTED state, UE uses a combination of both open (i.e. UE autonomous TA estimation, and common TA estimation) and closed (i.e., received TA commands) control loops~~]~~  8. In RRC\_IDLE and RRC\_CONNECTED state, UE calculates frequency pre-compensation to counter shift the Doppler experienced on the service link ~~[~~in DL~~] [~~and~~] [~~in UL~~]~~  10. UE supports a validity timer of UL synchronization that is configured by the network  13. UE applies cell specific K\_offset in timing relationship enhancements  ~~14.UE estimates UE-gNB RTT~~  ~~[~~15. UE estimates UE-gNB RTT and delays~~ing~~ the starts of ra-ResponseWindow by UE-gNB RTT~~]~~  ~~[~~16. ~~UE receives cell specific K\_mac]~~ Delay the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated  17. In RRC\_IDLE state and RRC\_CONNECTED state, UE pre-compensates the calculated frequency offset and TA in uplink transmissions |  | Yes | N/A | Release 17 UE cannot access ~~[~~NTN/satellite~~]~~ | ~~[per UE/~~per band~~]~~ | No | No | ~~FFS: whether this feature group needs to be separate for eMTC and NB-IoT~~ | Optional with capability signalling  For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported  ~~[~~Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported~~]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 2: FG 2-1a

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | Segmented UL transmission ~~duration configuration~~ | 1. ~~Support~~ UE applies segmented UL transmission according to duration configuration by the network for NGSO  The same value is used for segment durations for all PRACH preambles.  2.Support segment pre-compensation by using one of followings methods:  2-1) UE can drop/insert samples and puncture OFDM symbols  2-2) UE can blank subframes, slots, and repetition units | 2-1 | Yes | N/A | Release 17 UE cannot access ~~[~~NTN/satellite~~]~~ | ~~[Per UE/~~per band~~]~~ | No | No | For UEs support NSGO scenarios, it must indicate this FG is supported. | Optional with capability signalling  ~~[~~Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported~~]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 3: FG 2-2

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-2 | Enhancing timing relationships using a time offset | UE receives and applies UE specific K\_offset in timing relationship enhancements | 2-1 ~~[~~, 2-3~~]~~ | Yes | N/A | UE does not know the offset to apply for UL transmission | ~~[per UE/~~per band~~]~~ | No | No | The K\_offset is a scheduling offset used for the identified timing relationships that need to be modified for IoT NTN.  For IoT NTN, support cell-specific Koffset configuration for use during initial access.  For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.  ~~FFS: whether this feature group needs to be separate for eMTC and NB-IoT~~  ~~FFS: differentiation based on orbits such as LEO/MEO/GEO~~ | Optional with capability signalling  ~~FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 4: FG 2-3

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

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| 2. LTE\_NBIOT\_eMTC\_NTN | 2-3 | UE specific TA pre-compensation reporting | 1. ~~[~~Support reporting of information about the UE specific TA pre-compensation~~]~~   The granularity of the reported TA is a slot.  As for the frequency of reports, the TA is reported when the offset between current information about UE specific TA and the last successfully reported information about UE specific TA is over the threshold. | 2-1 | Yes | No | UL scheduling for FDD-HD: Use of UE-specific TA and/or K\_offset to avoid UL-DL collisions in FDD-HD | ~~[per UE/~~per band~~]~~ | No | No | UE-specific TA reporting is supported in IoT-NTN  ~~FFS: Detailed contents of report~~  ~~FFS: whether this feature group needs to be separate for eMTC and NB-IoT~~  ~~FFS: differentiation based on orbits such as LEO/MEO/GEO~~ | Optional with capability signalling  ~~FFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 5: Define separate UE feature groups for NB-IoT and eMTC over NTN

After review of contributions submitted to RAN1 #108-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Define separate UE feature groups for NB-IoT and eMTC over NTN**

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| Company | Comments/Questions/Suggestions |
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# Discussion/Approval Items during RAN1 #108-e — Second Checkpoint

Based on the comments/questions/suggestions received by the first checkpoint, the following are the revised proposals and/or proposed agreements by the moderator. Companies submitted the following views on the moderator’s proposals.

***[Please submit all comments/questions/suggestions here, late comments/questions/suggestions submitted in Section 3 will not be considered]***

**General comments**

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| Company | Comments/Questions/Suggestions |
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# Issue 1: FG

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

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# Discussion/Approval Items during RAN1 #108-e — Third Checkpoint

Based on the comments/questions/suggestions received by the second checkpoint, the following are the revised proposals and/or proposed agreements by the moderator. Companies submitted the following views on the moderator’s proposals.

***[Please submit all comments/questions/suggestions here, late comments/questions/suggestions submitted in Section 4 will not be considered]***

**General comments**

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| Company | Comments/Questions/Suggestions |
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# Issue 1: FG

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

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# Summary of Final Proposals for Agreements

This Section summarizes the final proposals for agreement in RAN1 #108-e by email. There are no tables for comments.

***[All comments must be directly made on the RAN1 email reflector]***

Companies can continue to update their comments in the previous Sections, however, these are no longer monitored by the moderator. Any such comments will be for archival purposes only and will not influence the outcome of this email discussion. Any objection to any of the proposals in this Section must be voiced directly on the RAN1 email reflector.

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

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# Conclusion

After further discussion on the RAN1 email reflector the following was agreed as part of this email discussion:

# References

1. R1-2200780, Updated RAN1 UE features list for Rel-17 NR after RAN1 #108-e, Moderators (AT&T, NTT DOCOMO, INC.)
2. R1-2200943, Rel-17 UE features for IoT over NTN, Huawei/HiSilicon
3. R1-2201221, UE features for IoT over NTN, MediaTek Inc.
4. R1-2201304, Discussion on UE features for NTN-IoT, OPPO
5. R1-2201421, On UE features for IoT over NTN, Nokia/Nokia Shanghai Bell
6. R1-2201726, On UE features for IOT over NTN, Intel Corporation
7. R1-2201802, Views on Rel-17 IoT over NTN UE Features, Apple
8. R1-2201811, On UE features for IoT over NTN, Ericsson Hungary Ltd
9. R1-2202178, UE features for IoT over NTN, Qualcomm Incorporated
10. R1-2202213, Discussion on UE feature for IoT-NTN, ZTE