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

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

**Agenda Item: 8.16.4**

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

**Title: Summary of UE features for NR NTN**

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

# Introduction

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

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| [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
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The following was discussed and/or agreed during RAN1 #108-e within the scope of [108-e-R17-UE-features-NR-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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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time pre-compensation | 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 [(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]

Support of frequency pre-compensation to counter shift the Doppler experienced on the service link |  | No | No | Release 17 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE/per band] | No | No |  | An NTN UE is required to at least support UE specific TA calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | 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 NTN cell and ATG cell, for terrestrial cell except for ARG cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] | * **Comment 1:** For component 2,
	+ Change “UE applies” to “UE calculates” since it focus on calculation of common TA (corresponding to UE-specific TA calculation in component 1).
	+ Remove bracket for “[(UE considers common TA as 0 if the parameter is not provided)]”
* **Comment 2:** For component 4, remove FFS for “UE pre-compensates the calculated TA in its uplink transmissions”
* **Comment 3:** For component 5, remove bracket for “[by UE-gNB RTT]”
* **Comment 4:** Remove brackets for [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ARG cell this feature is not supported]
* **Comment 5:** This FG is a per UE capability.

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| 26. NR\_NTN\_solutions | 26-1 | Uplink Time 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 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE/per band] | No | No |  | An NTN UE is required to at least support UE specific TA calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | 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 NTN cell and ATG cell, for terrestrial cell except for ARG cell this feature is not supported~~]~~ |

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| MediaTek Inc. [3] | * Component 2 can be kept without yellow highlight considering saving signalling for the case, where RP is set on the satellite.
* Component 4 can be kept without yellow highlight and with “FFS” removed.
* Component 5 can be kept without yellow highlight considering the agreements.

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| **Agreement(RAN 105e)**The starts of ra-ResponseWindow and msgB-ResponseWindow are delayed by an estimate of UE-gNB RTT. * The estimate of UE-gNB RTT is equal to the sum of UE’s TA and K\_mac.

Note 1: The UE’s TA is based on the RAN1#104bis-e agreement on Timing Advance applied by an NR NTN UE given by  . The estimate of gNB-satellite RTT is equal to the sum of and K\_mac.  How to treat and can be further discussed.Note 2: According to the RAN1#104bis-e agreement: When UE is not provided by network with a K\_mac value, UE assumes K\_mac = 0.Note 3: The accuracy of the estimated UE-gNB RTT with respect to the true UE-gNB RTT can be further discussed.Note 4: Other options of determining the estimate of UE-gNB RTT can be further discussed. |

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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time pre-compensation | 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 ~~[~~(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~~]~~

Support of frequency pre-compensation to counter shift the Doppler experienced on the service link |  | No | No | Release 17 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE/per band] | No | No |  | An NTN UE is required to at least support UE specific TA calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | 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 NTN cell and ATG cell, for terrestrial cell except for ARG cell this feature is not supported] |

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| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * On consequences if features not supported, in general the FGs in this WID are targetted for satellite operation, and UEs that access satellite bands should support at least FG 26-1 (and potentially other basic FGs depending on how the table ends up organized). However, these are not required for HAPS/ATG, even if FG 26-1 and others can be used by a UE supporting HAPS/ATG in general. Hence, related fields in the table should be revised to:
	+ Release 17 UE cannot access ~~[~~NTN/ satellite~~/HAPS/ATG]~~
* 26-1, 26-3, 26-6, 26-6a, 26-8, 26-9are basic features for UEs supporting NR over NTN.” Hence, they should be combined into a single FG.
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| NTT DOCOMO, INC. [6] |  |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.
* For Component 2 in FG 26-1, it is not necessary to describe UE behavior when common TA is not provided. So, we propose to delete the text in yellow.
* Component 4 in FG 26-1 is not needed considering that other components in this FG cover support of UE-specific TA, Common TA and combination of open-loop and closed-loop TA.

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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time pre-compensation | 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 ~~[(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~~]~~

Support of frequency pre-compensation to counter shift the Doppler experienced on the service link |  | No | No | Release 17 UE cannot access ~~[~~NTN/ ~~satellite/HAPS/~~ATG~~]~~ | ~~[Per UE/~~per band~~]~~ | No | No |  | An NTN UE is required to at least support UE specific TA calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | 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 NTN cell and ATG cell, for terrestrial cell except for A~~R~~TG cell this feature is not supported~~]~~ |

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| Apple [8] | The feature 26-1 was agreed [3] as baseline for NR NTN as uplink pre-compensation. It was agreed that an NR NTN UE, in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED state, pre-compensates time advance in any uplink transmissions including PRACH. It is open whether “UE pre-compensates the calculated TA in its uplink transmissions” is a component in feature 26-1. In our view, the existing agreed components in feature 26-1 are about TA calculation, including UE specific TA, common TA, and combination of open and closed TA control loops. They do not describe that UE should use the calculated TA value in its uplink transmissions. Hence, it is necessary to include the component of “UE pre-compensates the calculated TA in its uplink transmissions” in feature 26-1 to align with the nature of this feature. ***Proposal 1:*** *Feature 26-1 includes the component of “UE pre-compensates the calculated TA in its uplink transmissions”.*It is open whether feature 26-1 is defined per UE or per band. In our view, the NR NTN operations are based on NTN bands, and a UE supporting NR NTN features does not apply the time or frequency pre-compensation when operating on non-NTN bands. Even for NTN bands, we prefer to have the flexibility that UE pre-compensates time and frequency in some of the NTN bands, while not on other NTN bands. Hence, feature 26-1 should be defined per band.***Proposal 2:*** *Feature 26-1 is defined per band.* |
| Ericsson Hungary Ltd [9] |

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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time pre-compensation | 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
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. 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

Support of frequency pre-compensation to counter shift the Doppler experienced on the service link |  | No | No | Release 17 UE cannot access satellite | [Per UE/per band] | No | No |  | An NTN UE is required to at least support UE specific TA calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | Optional with capability signalling For UE supports NR satellite, UE must indicate this FG is supported.[Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Samsung [10] | The current version has mandatory for FG26-1/26-2/26-3. Since Rel-16, all features are basically optional. Instead, the following changes can be made. Also, FG26-4 “UE reporting of information about the UE specific TA pre-compensation” should be one of the basic FG because the gNB needs to know its value in order to schedule with proper offset.

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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time pre-compensation | 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 [(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
 | ~~Mandatory~~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 NTN cell, for terrestrial cell this feature is not supported]This is the basic FG for NTN. |

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| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**
* UE specific TA and common TA cannot be calculated separately. Consequently, items 1 and 2 should be merged as:
1. ***UE specific TA and common TA calculation calculation based on its GNSS-acquired position, the serving satellite ephemeris, and common TA parameters. UE considers common TA as 0 if the parameter is not provided.***
* Existing Item 4 is not needed as Item 3 already implies it.
* The FG should be identified as “ UL time & frequency pre-compensation”.
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| ZTE [12] | W.r.t FG 26-1, following revise is suggested:For component 2, according to the agreement and working assumption in RAN1#106e [2], the UE will apply common TA according to the parameters provided by the network (if any). In addition,  with value of 0 is supported. Therefore this component should be updated by removing the bracket ~~[~~(UE considers common TA as 0 if the parameter is not provided)~~]~~. Moreover, for the type column of FG 26-1, 26-3, 26-4 and FG 26-6a, the type column should be updated to [Per UE~~/per band~~].

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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time pre-compensation | 1. UE specific TA calculation in RRC\_IDLE and RRC\_INACTIVE states based on its GNSS-acquired position and the serving satellite ephemeris.
2. UE applies common TA according to the parameters provided by the network~~[~~(UE considers common TA as 0 if the parameter is not provided)~~]~~.
 |  | No | Release 17 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE~~/per band~~] | No | No |  | An NTN UE is required to at least support UE specific TA calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |  26. NR\_NTN\_solutions |

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| LG Electronics [13] | * Regarding component 2, whether to remove highlighted sentence can be upto RAN2 decision, since RAN1 only agreed support of N\_TA,common = 0. However, it seems most recent TS 38.211 (R1-2112921) already reflect this.
* Remove component 4. It was concluded in RAN1#107-e that How the UE calculate N\_TA\_UE-specific is upto UE implementation.

**Conclusion**  is UE self-estimated TA to pre-compensate for the service link delay, which is calculated using the UE position and the serving satellite ephemeris. * How the UE calculates/updates NTA, UE-specific is left to UE implementation.

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|  26. NR\_NTN\_solutions | 26-1 | Uplink Time pre-compensation | 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 [(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 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE/per band] | No | No |  | An NTN UE is required to at least support UE specific TA calculation based at least on its GNSS-acquired position and the serving satellite ephemeris | 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 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 | 26-3 | 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. FFS: delaying the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated

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 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE/per band] | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] | * **Comment 1:** Merge FG 26-3 with FG 26-1
	+ For component 1, remove FFS in the beginning; change “delaying” to “Delay”; add “if it is indicated” in the end
	+ For component 2, remove FFS in the beginning; change “delaying” to “Delay”
	+ Remove component 3

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| 26. NR\_NTN\_solutions | 26-3 | Enhancement on the timing relationship | 1. ~~FFS: delaying~~ Delay 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~~ Delay the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated
3. ~~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 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE/per band] | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| MediaTek Inc. [3] |  |
| OPPO [4] | It should be noted that before UE reporting capability the UE has to perform Msg1 transmission, Msg3 transmission, and PUCCH transmission. In this case, it would be reasonable to at least make delaying the scheduling for PUSCH and PUCCH with cell-specific K offset as a basic feature without UE capability signaling. While for PDCCH ordered PRACH, CSI reference source and AP SRS, as well as type 2 CG activation. The UE should be allowed to report capability with capability signaling. **Proposal 1: for FG 26-3 separate delaying PUSCH, PUCCH with cell-specific K offset from the others and set delaying PUSCH, PUCCH as a basic feature without capability signaling**

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| 1. **NR-NTN-solutions**
 | **26-3** | **Enhancement on the timing relationship** | **Delaying the scheduling of PUSCH and PUCCH with cell-specific K offset** | **Optional without capability signaling** |
|  | **26-3a** | **Enhancement on the timing relationship** | **Delaying PDCCH ordered PRACH, CSI reference resource, transmission of AP SRS activation of TA command, first PUSCH transmission in CG type 2 with K offset** | **Optional with capability signaling** |

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| Nokia, Nokia Shanghai Bell [5] | * On consequences if features not supported, in general the FGs in this WID are targetted for satellite operation, and UEs that access satellite bands should support at least FG 26-1 (and potentially other basic FGs depending on how the table ends up organized). However, these are not required for HAPS/ATG, even if FG 26-1 and others can be used by a UE supporting HAPS/ATG in general. Hence, related fields in the table should be revised to:
	+ Release 17 UE cannot access ~~[~~NTN/ satellite~~/HAPS/ATG]~~
* 26-1, 26-3, 26-6, 26-6a, 26-8, 26-9are basic features for UEs supporting NR over NTN.” Hence, they should be combined into a single FG.
 |
| NTT DOCOMO, INC. [6] |  |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.
* FG 23-3 can be merged with FG 23-1 since timing relationship enhancements are essential part of NTN operation.
	+ For Components 1 and 2 in FG 23-3, FFS can be removed.
	+ Component 3 in FG 23-3 can be removed.

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|  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. ~~FFS:~~ delaying the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated

~~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 UE cannot access [NTN/ ~~satellite/HAPS/~~ATG] | ~~[Per UE/~~per band~~]~~ | No | No |  | ~~FFS: whether this FG gets merged with FG 26-1~~Merge this FG 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported~~]~~ |

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| Apple [8] | A potential feature 26-3 is named as “enhancement on the timing relationship”. The potential components of this feature include “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 ” and “delaying the UE action and assumption on the downlink configuration carried by MAC CE command by . if it is indicated”. It is open whether this feature group needs to be defined and whether this feature group needs to be split. In our view, this feature group is related to timing relationship enhancement in NR NTN. It is an important basic feature in supporting NR NTN operations. Hence, this feature should be remained, and the two potential components of this feature needs be confirmed. The first component uses cell-specific to enhance the timing relationship of uplink scheduling slot, which is generally related to uplink transmissions. The second component uses to enhance the timing relationship of downlink configuration activation, which is related to downlink receptions. Hence, it is preferred to split feature 26-3 into two features, one based on cell-specific and one based on . Furthermore, it was recently agreed that is used in beam failure recovery procedure to enhance the RAR window offset for monitoring beam failure recovery response. This agreement could be captured by modifying the component for .***Proposal 3:*** *Split feature 26-3 to two features:** *feature of “enhancing on the timing relationship with cell specific ” with component of “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 ”.*

* *feature of “enhancing on the timing relationship with ” with component of “delaying the UE action and assumption on a downlink configuration carried by MAC CE command, and the RAR window offset in beam failure recovery procedure by if it is indicated”.*

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| Ericsson Hungary Ltd [9] |

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|  26. NR\_NTN\_solutions | 26-3 | Enhancement on the timing relationship | 1. 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
2. Determining timing of the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated
 | [26-1] | No | No | Release 17 UE cannot access satellite | [Per UE/per band] | No | No |  | FFS: whether this FG gets merged with FG 26-1 | Optional with capability signalling For UE supports NR satellite, UE must indicate this FG is supported[Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

 |
| Samsung [10] | The current version has mandatory for FG26-1/26-2/26-3. Since Rel-16, all features are basically optional. Instead, the following changes can be made. Also, FG26-4 “UE reporting of information about the UE specific TA pre-compensation” should be one of the basic FG because the gNB needs to know its value in order to schedule with proper offset.

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|  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. FFS: delaying the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated
3. FFS: separate FGs for cell specific Koffset and Kmac/UE-gNB RTT estimation/delay of RAR/MsgB response window
 | 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 NTN cell, for terrestrial cell this feature is not supported]This is the basic FG for NTN. |

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| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**

The FG does not have pre-requisites.  |
| ZTE [12] | W.r.t FG 26-3, it’s preferred to add a new component “UE receives cell-specific K\_offset in system information”, which is agreed in RAN2#116bis-e [3] and also applies to the component in the UE features for IoT-NTN. Moreover, for the type column of FG 26-1, 26-3, 26-4 and FG 26-6a, the type column should be updated to [Per UE~~/per band~~].

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| 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

 UE receives cell-specific K\_offset1. FFS: delaying the UE action and assumption on a downlink configuration carried by MAC CE command by K\_mac if it is indicated

FFS: separate FGs for cell specific Koffset and Kmac/UE-gNB RTT estimation/delay of RAR/MsgB response window | [26-1][26-2] | No | Release 17 UE cannot access [NTN/ satellite/HAPS/ATG] | [Per UE~~/per band~~] | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature  | 26. NR\_NTN\_solutions |

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| LG Electronics [13] |  |

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|  26. NR\_NTN\_solutions | 26-4 | UE reporting of information about the UE specific TA pre-compensation | Support UE reporting of information about 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] | Yes | No |  | [Per UE/Per band] | No | No |  |  | Optionalwith capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] | * **Comment 1:** Remove **“**[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.]” since there is no need to list the exact content of UE reporting.
* **Comment 3:** This FG is a per UE capability.

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| 26. NR\_NTN\_solutions | 26-4 | UE reporting of information about the UE specific TA pre-compensation | Support UE reporting of information about 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] | Yes | No |  | ~~[~~Per UE~~/Per band]~~ | No | No |  |  | Optionalwith capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| MediaTek Inc. [3] | * The component text starting with “*FFS Report its UE location for any reason at any time*” and text crossed and highlighted in yellow can be removed as it is not necessary to include this level of details and UE location can wait until SA3 decision as per agreement in RAN2#116b-e.

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| **Agreements (RAN2 116b-e)**1. For the TA report triggering event which uses the offset threshold between current information about UE specific TA and the last successfully reported information about UE specific TA, no hysteresis or time to trigger is needed.
2. UE reports Full TA (i.e., T\_TA as defined in the UE’s TA formula). The size of the TA report MAC CE is fixed to two octets.
3. If SA3 will confirm that NTN-specific user consent will the available in Rel-17, the network could at least ask the UE to report its UE location for any reason at any time. FFS if we define an event-triggered reporting of UE location for TA reporting purposes.
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|  26. NR\_NTN\_solutions | 26-4 | UE reporting of information about the UE specific TA pre-compensation | Support UE reporting of information about the UE specific TA pre-compensation 1. Report full TA by event triggered used the offset threshold between current information about UE specific TA and the last successfully reported information about UE specific TA.
2. [FFS: Report its UE location for any reason at any time]

~~[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] | Yes | No |  | [Per UE/Per band] | No | No |  |  | Optionalwith capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * + Component 1: It is unclear what is signalled here. We propose to change the text to “Support UE reporting of information related to the UE specific TA pre-compensation”
 |
| NTT DOCOMO, INC. [6] |  |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.
* For FG 26-4, many aspects for 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.

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|  26. NR\_NTN\_solutions | 26-4 | UE reporting of information about the UE specific TA pre-compensation | Support UE reporting of information about the UE specific TA pre-compensation ~~[~~The UE capability signalling for ~~T~~the exact content of UE reporting of information about the UE specific TA pre-compensation is up to RAN2 ~~e.g., frequency of the reports, granularity of the reported conten, etc.]~~ | [26-1] | Yes | No |  | ~~[Per UE/~~Per band~~]~~ | No | No |  |  | Optional with capability signalling ~~[~~Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported~~]~~ |

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| Apple [8] | The feature 26-4 has name of “UE reporting of information about the UE specific TA pre-compensation”. According to RAN2’s recent agreement, the TA reported by UE is the full TA, rather than UE specific TA. Hence, the name of this feature is misleading. We propose to update the name of this feature to “UE reporting of information about TA pre-compensation”. Similarly, the component of this feature should be updated accordingly. ***Proposal 4:*** *Update the name of feature 26-4 to “UE reporting of information about TA pre-compensation” and update the component of feature 26-4 to “Support UE reporting information about TA pre-compensation.”* |
| Ericsson Hungary Ltd [9] |

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|  26. NR\_NTN\_solutions | 26-4 | UE reporting of information about the UE specific TA pre-compensation | Support UE reporting of information about 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 | Yes | No |  | [Per UE/Per band] | No | No |  |  | Optionalwith capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Samsung [10] | The current version has mandatory for FG26-1/26-2/26-3. Since Rel-16, all features are basically optional. Instead, the following changes can be made. Also, FG26-4 “UE reporting of information about the UE specific TA pre-compensation” should be one of the basic FG because the gNB needs to know its value in order to schedule with proper offset.

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|  26. NR\_NTN\_solutions | 26-4 | UE reporting of information about the UE specific TA pre-compensation | Support UE reporting of information about the UE specific TA pre-compensation 1. [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.]
 | ~~[~~Optional~~]~~ with capability signalling [Note: This UE feature group is applicable only for NR NTN cell, for terrestrial cell this feature is not supported]This is the basic FG for NTN. |

 |
| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**
 |
| ZTE [12] | W.r.t FG 26-4, the component 3 can be updated based on the agreement in RAN1#107e [4], i.e. The granularity of the reported TA is slot. Besides, according to the RAN2’s agreement [5], UE triggers a TA reporting upon reception of configuration or reconfiguration of TA reporting trigger event, and 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.Moreover, for the type column of FG 26-1, 26-3, 26-4 and FG 26-6a, the type column should be updated to [Per UE~~/per band~~].

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|  26. NR\_NTN\_solutions | 26-4 | UE reporting of information about the UE specific TA pre-compensation | Support UE reporting of information about the UE specific TA pre-compensation ~~FFS: [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 content, etc.]~~* The granularity of the reported TA is a slot with 15 kHz reference SCS.

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. | [26-1] | Yes |  | [Per UE~~/Per band~~] | No | No |  |  | Optionalwith capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |  26. NR\_NTN\_solutions |

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| LG Electronics [13] | * For the sub bullet, the related agreement was made in RAN1#107-e,

**Agreement**15 kHz is used as the reference subcarrier spacing value for the unit of TA reported in FR1.**Agreement**The reported TA is the least integer number of slots greater than or equal to the corresponding TA value. |

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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 | ~~[~~Per band or per FSPC or per UE] | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] |  |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * + Consequence if not supported needs to be more specific to NR NTN, as there are similar extensions done for other WIDs as well.
 |
| NTT DOCOMO, INC. [6] | There is one important discussion on this issue – whether this FG is merged with other FG from other WI. In FR2-2 WI, the same mechanism was agreed and there are corresponding FGs as FGs 24-8/24-9. In addition, it seems that the discussion includes another big issue behind, which is whether maximum of 32 HARQ processes can be applied to cell other than NTN/FR2-2. In short, our view is that the feature should not be applicable for other cases and correspondingly there is no need to merge the FGs.For the applicability perspective, there are two rationales:* No agreements in any WIs. The 32 HARQ processes feature was agreed in NTN WI and FR2-2 WI for these purposes, but not for other purposes. Without certain agreements at appropriate WG or TEI, such an expansion should not be allowed.
* UE burden or signaling overhead. If this feature is applicable for any cell/band and corresponding FG is per UE, then UE that would like to indicate “support” shall support this feature for any cell/band. In our view, there is motivation of this FG only for NTN/FR2-2, so the excessive support is not preferable. Alternatively if this feature is applicable for any cell/band and corresponding FG is per band, then UE needs to report support/not support for all the bands that the UE supports including bands without any motivation of this feature, which is meaningless overhead.

Then with this direction, for merging perspective, each WI should make corresponding FG separately since the detailed part is different. Pre-requisites will be different, and especially for FR2-2, there would be some other issues specific to the WI. For example, how to define this capability for 120 kHz SCS seems likely to be controversial. Separate definition of this feature can avoid mixing up such WI-specific issues. Moreover, separate FG does not lead to any issue, e.g. no overhead increase.**Proposal 2:*** *Maximum of 32 HARQ processes is applicable only for NTN and FR2-2.*
* *FG 26-5 is not merged with FGs 24-8/24-9.*
 |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.

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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 | ~~[~~Per band or per FSPC or per UE] | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

 |
| Apple [8] | Feature 26-5 mentions that the maximal supported HARQ process number is X for UL and Y for DL. The granularity of this feature is open. In our view, this maximum HARQ process number could be defined per FSPC. UE could have different maximal HARQ process numbers on different carriers, depending on whether NR NTN is supported or not.***Proposal 5:*** *Features 26-5 is defined per FSPC.* |
| Ericsson Hungary Ltd [9] |

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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 | ~~[~~Per band or or per UE] | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Samsung [10] | It is proposed that the type of FG 26-5 should be per FSPC.

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|  26. NR\_NTN\_solutions | 26-5 | Increasing the number of HARQ processes | 1. The maximal supported HARQ process number is 32 for both UL and DL
 | Per FSPC |

 |
| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**
 |
| ZTE [12] | W.r.t FG 26-5, the type column can be updated to [~~Per band or per FSPC or~~ per UE], since supporting up to 16 HARQ process is a type of basic feature based on the granularity of per UE in the legacy Rel-15.

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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 | Increased number of HARQ processes is not supported | ~~[Per band or per FSPC or~~ per UE] | 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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |  26. NR\_NTN\_solutions |

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| LG Electronics [13] |  |

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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]

FFS: UE supports HARQ disabling |  | Yes | No |  | [Per UE/per band] | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] | * **Comment 1:** For component 1, remove “[for feedback-disabled HARQ processes]” to make it more generic.
* **Comment 2:** For component 2, remove FFS since HARQ disabling is a pre-requisit for HARQ-ACK codebook enhancement.
* **Comment 3:** This FGs is a per UE capability.

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| 26. NR\_NTN\_solutions | 26-6 | Type-2 HARQ-ACK codebook Enhancement | 1. Support of type-2 HARQ-ACK codebook enhancements ~~[for feedback-disabled HARQ processes]~~
2. ~~FFS:~~ UE supports HARQ disabling
 |  | Yes | No |  | ~~[~~Per UE~~/per band]~~ | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| MediaTek Inc. [3] |  |
| OPPO [4] | In R17 NTN-NR, the WID scope does not include carrier aggregation. Thus, it is too early and risky to decide that the increasing HARQ process number capability reporting is per UE or per band. The reason is that when no CA case, per band and per FSPC are identical. But when considering CA, it would depend on the details of the CA and the number of CCs to be supported. Thus, it is not a right time to make this capability reporting as per UE or per band. We strongly suggest that per FSPC should be decided. **Proposal 2: For FG 26-6, per FSPC should be adopted.**  |
| Nokia, Nokia Shanghai Bell [5] | * 26-1, 26-3, 26-6, 26-6a, 26-8, 26-9are basic features for UEs supporting NR over NTN.” Hence, they should be combined into a single FG.
* It is not clear what enhancement the FG refers to. We propose to change the text to: ”Support feedback disabled HARQ processes and associated enhancements for type-1 and type-2 HARQ codebook”, and merge it with FG 26-6a (and FG 26-1).
 |
| NTT DOCOMO, INC. [6] | Here, there is an FFS on whether “UE supports HARQ disabling” is added as a new component or not. We do not think the new component is necessary since the 1st component cover this feature. In our understanding, the enhanced part for NR NTN is only related to HARQ feedback disabling. This means that the two are saying the same thing.Rather, it seems that companies’ intention is to merge the feedback disabling feature with some FGs from other WI (e.g. MBS). In our view, merging them is not a good way. They are different and corresponding spec text is put in different sections. In addition, if merged, the note with yellow becomes quite controversial. Separate FG would be much better.**Proposal 3:*** *Remove brackets in the 1st component of FG 26-6.*
* *Remove the 2nd component from FG 26-6.*
* *FG 26-6 is not merged into any FG from other WI.*
 |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.
* For FG 26-6 and FG 26-6a, Component 2 should be supported since HARQ disabling feature have impact not only for the HARQ codebook construction but also for the restrictions to receive the PDSCH with the same HARQ process ID before the corresponding ACK-NACK feedback.
* For Component 1 in FG 26-6 and FG 26-6a, the HARQ codebook enhancements are supported only for disabled HARQ processes, so it can be stated in the component description.

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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~~]~~

~~FFS:~~ UE supports HARQ disabling |  | Yes | No |  | ~~[Per UE/~~per band~~]~~ | No | No |  |  | Optional with capability signalling ~~[~~Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported~~]~~ |

 |
| Apple [8] | It was agreed to define feature 26-6 independently. The component of “UE supports HARQ disabling” is open for this feature. In our understanding, this potential component is related to PDCCH reception timeline restriction. Specifically, RAN1 agreed that a UE is not expected to receive PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback, after after the reception of the last PDSCH or slot-aggregated PDSCH for the given HARQ process. We prefer to capture this agreement in this feature. ***Proposal 6:*** *In feature 26-6, introduce a component of “receiving PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process.”* |
| Ericsson Hungary Ltd [9] |

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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

UE supports HARQ disabling |  | Yes | No |  | [Per UE/per band] | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

 |
| Samsung [10] |  |
| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**

The FG is needed only when UE supports DL HARQ feedback disabling, which is a RAN2 feature. We may have the FG description as:1. ***Support of type-2 HARQ codebook enhancements when per HARQ process feedback disabling is supported***
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| ZTE [12] |  |
| LG Electronics [13] | * + - Remove the bracket and subbullet

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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~~]~~
2. ~~FFS: UE supports HARQ disabling~~
 |  | Yes | No |  | [Per UE/per band] | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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|  26. NR\_NTN\_solutions | [26-6a] | [Type-1 HARQ codebook enhancement]  | 1. Enhancement on Type-1 HARQ codebook in NTN

FFS: HARQ disabling | [26-1, 26-2] | Yes | No |  | [Per UE/per band] | No | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]  | 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 NTN cell, for terrestrial cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] | * **Comment 1:** FG 26-6a can be a separate FG from FG 26-1 to ease UE implementation.
* **Comment 2:** For component 2, remove FFS since HARQ disabling is a pre-requisit for HARQ-ACK codebook enhancement.
* **Comment 3:** Remove ~~[For UE supports NR [NTN/ satellite/HAPS/ATG], UE must indicate this FG is supported]~~ in the last column since it is not a basic UE feature for NTN.
* **Comment 4:** This FGs is a per UE capability.

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| 26. NR\_NTN\_solutions | ~~[~~26-6a~~]~~ | ~~[~~Type-1 HARQ-ACK codebook enhancement] | 1. Enhancement on Type-1 HARQ-ACK codebook ~~in NTN~~
2. ~~FFS:~~ UE supports HARQ disabling
 | [26-1, 26-2] | Yes | No |  | ~~[~~Per UE~~/per band]~~ | No | No | ~~[support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]~~ | 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 NTN cell, for terrestrial cell this feature is not supported] |

 |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * 26-1, 26-3, 26-6, 26-6a, 26-8, 26-9are basic features for UEs supporting NR over NTN.” Hence, they should be combined into a single FG.
 |
| NTT DOCOMO, INC. [6] | Based on the agreements so far, this component for type-1 HARQ-ACK CB enhancement is necessary. The same approach as for FG 26-6 would be valid.**Proposal 4:*** *Support at least four left columns of FG 26-6a for type-1 HARQ-ACK CB enhancement.*
	+ *Remove the 2nd component from FG 26-6a.*
	+ *FG 26-6a is not merged into any FG from other WI.*
 |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.
* For FG 26-6 and FG 26-6a, Component 2 should be supported since HARQ disabling feature have impact not only for the HARQ codebook construction but also for the restrictions to receive the PDSCH with the same HARQ process ID before the corresponding ACK-NACK feedback.
* For Component 1 in FG 26-6 and FG 26-6a, the HARQ codebook enhancements are supported only for disabled HARQ processes, so it can be stated in the component description.
* For FG 26-6a, in our view HARQ disabling can be an optional feature for UE supporting NTN. So, there is no need to merge it with FG 26-1.
* Enhancements for Type-3 HARQ codebook with disabled HARQ feedback were introduced at the last RAN1 meeting. Thus, new FG 23-6b should be introduced.

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|  26. NR\_NTN\_solutions | ~~[~~26-6a~~]~~ | ~~[~~Type-1 HARQ codebook enhancement~~]~~  | 1. Enhancement on Type-1 HARQ codebook in NTN for feedback-disabled HARQ processes

~~FFS:~~ UE supports HARQ disabling | [26-1, 26-2] | Yes | No |  | ~~[Per UE/~~per band~~]~~ | No | No | [support mixture of FDD/TDD ~~(for HAPS and/or ATG)~~ and/or FR1/FR2]  | ~~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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported~~]~~ |
|  26. NR\_NTN\_solutions | 26-6b | Type-3 HARQ codebook enhancement | 1. Enhancement on Type-3 HARQ codebook in NTN for feedback-disabled HARQ processes

UE supports HARQ disabling | [26-1, 26-2] | Yes | No |  | per band | No | No | [support mixture of FDD/TDD and/or FR1/FR2]  |  | Optional with capability signalling Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported |

 |
| Apple [8] | In [4], feature 26-6a was discussed but no agreement has been reached. It was agreed in RAN1 that for Type-1 HARQ codebook, the UE will consistently report NACK-only for the feedback-disabled HARQ process regardless of decoding results of corresponding PDSCH. Hence, we think the feature 26-6a in [4] could be defined as an independent feature. One component of this feature is “support of Type-1 HARQ codebook enhancements for feedback-disabled HARQ processes” and the other component of this feature is “receiving PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process”. ***Proposal 7:*** *Introduce a new feature 26-6a “Type-1 HARQ codebook enhancement”, with components:** *support of Type-1 HARQ codebook enhancements for feedback-disabled HARQ processes.*
* *receiving PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process.*

It was agreed in RAN1 that for Type-3 HARQ codebook in NTN, the UE should skip the codebook feedback for a feedback-disabled HARQ processes. Similar to Type-1 and Type-2 HARQ codebook enhancements, we could introduce a new feature 26-6b “Type 3 HARQ codebook enhancement”. One component of this feature is “support of Type-3 HARQ codebook enhancements for feedback-disabled HARQ processes” and the other component of this feature is “receiving PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process”.***Proposal 8:*** *Introduce a new feature 26-6b “Type-3 HARQ codebook enhancement”, with components:** *support of Type-3 HARQ codebook enhancements for feedback-disabled HARQ processes.*
* *receiving PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process.*
 |
| Ericsson Hungary Ltd [9] | Our detailed comments on the endorsed list of UE features for NR NTN are in the table below (with Track Changes).In particular, we propose to remove the misleading text “support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2”. * The issue related to “The capability interpretation for mixture of FDD/TDD and/or FR1/FR2” was asked in RAN2 LS [5], to which RAN1 answered in [6].
* Specifically, the issue occurs when there are multiple serving cells. This is however not the case for the NTN UE features defined in the table below. Therefore, the misleading text “support mixture of FDD/TDD (for HAPS) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2” should be removed.
1. Remove the misleading text “support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2”.

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|  26. NR\_NTN\_solutions | 26-6a | Type-1 HARQ codebook enhancement | 1. Enhancement on Type-1 HARQ codebook in NTN

HARQ disabling |  | Yes | No |  | [Per UE/per band] | No | 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 [Note: This UE feature group is applicable only for NR NTN cell, for terrestrial cell this feature is not supported] |

 |
| Samsung [10] |  |
| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**
* The FG is needed only when UE supports DL HARQ feedback disabling, which is a RAN2 feature. We may have the FG description as:
1. ***Enhancement on Type-1 HARQ codebook when per HARQ processes feedback disabling is supported***
* This FG should not merge with FG 26-6 as a UE may support one but not the other.
* This FG does not have pre-requisites.
 |
| ZTE [12] | W.r.t FG 26-6a, the component 2 can be updated based on the agreement in RAN1#107e [4],i.e. UE consistently reports NACK-only for the feedback-disabled HARQ process regardless of decoding results of corresponding PDSCH.Moreover, for the type column of FG 26-1, 26-3, 26-4 and FG 26-6a, the type column should be updated to [Per UE~~/per band~~].

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|  26. NR\_NTN\_solutions | [26-6a] | [Type-1 HARQ codebook enhancement]  | 1. Enhancement on Type-1 HARQ codebook in NTN
2. ~~FFS: HARQ disabling~~

2.UE consistently reports NACK-only for the feedback-disabled HARQ process regardless of decoding results of corresponding PDSCH | [26-1, 26-2] | Yes |  | [Per UE~~/per band~~] | No | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]  | 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 NTN cell, for terrestrial cell this feature is not supported] |  26. NR\_NTN\_solutions |

 |
| LG Electronics [13] | * + - To align with FG26-6, revise component 1 as “Support of type-1 HARQ codebook enhancements for feedback-disabled HARQ processes”
		- Add new row for Type-3 HARQ-ACK codebook which agreed in RAN1#107-e.

**Agreement**For Type-3 HARQ codebook in NTN, the UE should skip the codebook feedback for a feedback-disabled HARQ processesNote: The Type-3 codebook size is reduced by excluding the bit positions of disabled HARQ processes

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|  26. NR\_NTN\_solutions | [26-6a] | [Type-1 HARQ codebook enhancement]  | 1. Support of type-1 HARQ codebook enhancements for feedback-disabled HARQ processes ~~Enhancement on Type-1 HARQ codebook in NTN~~
2. ~~FFS: HARQ disabling~~
 | [26-1, 26-2] | Yes | No |  | [Per UE/per band] | No | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2] | ~~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 NTN cell, for terrestrial cell this feature is not supported] |
|  26. NR\_NTN\_solutions | 26-6b | Type-3 HARQ codebook enhancement  | Support of type-3 HARQ codebook enhancements for feedback-disabled HARQ processes  | [26-1, 26-2] | Yes | No |  | [Per UE/per band] | No | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2] |  | 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 NTN cell, for terrestrial cell this feature is not supported] |

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|  26. NR\_NTN\_solutions | [26-7] | [NTN Performance enhancement] | 1. The maximum number of supported aggregation factor (i.e., pdsch-AggregationFactor) for DL PDSCH is [X]

FFS: X = 16 or 32 |  | Yes | No |  | [Per UE/per band/Per BC] | [No] | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2] |  | Optional with capability signalling[Note: This UE feature group is applicable only for NR NTN cell, for terrestrial cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] |  |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * + Actually there was no consensus to support additional downlink aggregation in NR over NTN. Propose to remove this FG.
 |
| NTT DOCOMO, INC. [6] |  |
| Intel Corporation [7] | * FG 26-7 can be deleted since enhancements for the PDSCH repetition are not supported for Rel-17 NR NTN.

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|  ~~26. NR\_NTN\_solutions~~ | ~~[26-7]~~ | ~~[NTN Performance enhancement]~~ | 1. ~~The maximum number of supported aggregation factor (i.e., pdsch-AggregationFactor) for DL PDSCH is [X]~~

~~FFS: X = 16 or 32~~ |  | ~~Yes~~ | ~~No~~ |  | ~~[Per UE/per band/Per BC]~~ | ~~[No]~~ | ~~No~~ | ~~[support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]~~ |  | ~~Optional with capability signalling~~~~[Note: This UE feature group is applicable only for NR NTN cell, for terrestrial cell this feature is not supported]~~ |

 |
| Apple [8] |  |
| Ericsson Hungary Ltd [9] | Our detailed comments on the endorsed list of UE features for NR NTN are in the table below (with Track Changes).In particular, we propose to remove the misleading text “support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2”. * The issue related to “The capability interpretation for mixture of FDD/TDD and/or FR1/FR2” was asked in RAN2 LS [5], to which RAN1 answered in [6].
* Specifically, the issue occurs when there are multiple serving cells. This is however not the case for the NTN UE features defined in the table below. Therefore, the misleading text “support mixture of FDD/TDD (for HAPS) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2” should be removed.
1. Remove the misleading text “support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2”.

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| Samsung [10] | In order to clarify, the following changes are proposed. Also, it does not need value 8 since it is already supported.

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|  26. NR\_NTN\_solutions | [26-7] | [NTN Performance enhancement] Increased PDSCH aggregation factor | 1. The maximum number of supported aggregation factor (i.e., pdsch-AggregationFactor) for DL PDSCH is [X]FFS: X =16 or 32 |

 |
| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**
 |
| ZTE [12] |  |
| LG Electronics [13] | * + - Remove FG 26-7. If there is no further agreement on X=32, this FG is not needed.

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|  26. NR\_NTN\_solutions | ~~[26-7]~~ | ~~[NTN Performance enhancement]~~ | 1. ~~The maximum number of supported aggregation factor (i.e., pdsch-AggregationFactor) for DL PDSCH is [X]~~

~~FFS: X = 16 or 32~~ |  | ~~Yes~~ | ~~No~~ |  | ~~[Per UE/per band/Per BC]~~ | ~~[No]~~ | ~~No~~ | ~~[support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]~~ |  | ~~Optional with capability signalling~~~~[Note: This UE feature group is applicable only for NR NTN cell, for terrestrial 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. 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] | [Per UE/Per band] | No | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2] | [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 NTN cell, for terrestrial cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] | * **Comment 1:** Remove component 2 since it has already been covered by the component 1 hence can be removed.
* **Comment 2:** This is not a basic feature for NTN and there is no need to merge it with FG26-1. The notes in the second last column and last columncan be removed.
* **Comment 3:** The feature is about reception of the polarization signaling hence **t**he value for component 1 should be “support” or “not support” instead of the polarization applied at the UE.
* **Comment 4:** This FG is a per UE capability.

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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. ~~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] | ~~[~~Per UE~~/Per band]~~ | No | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2] | ~~[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 NTN cell, for terrestrial cell this feature is not supported] |

 |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * + 26-1, 26-3, 26-6, 26-6a, 26-8, 26-9are basic features for UEs supporting NR over NTN.” Hence, they should be combined into a single FG.
	+ FG name is misleading, as the FG should not be about the signalling, but about the UE being able to apply the information it receives in the signalling. The following conclusion has been reached in RAN1:
		- **Conclusion:** (RAN1#107-e)
		- No further enhancement is considered for polarization signaling in NTN-NR R17.
		- No consensus on UE reporting polarization capability.
		- No consensus on UE behavior for selecting polarization mode for DL reception and UL transmission.
	+ Hence, one can say that at the very least there is no benefit of gNB knowing if UE supports this functionality or not, especially as a separate capability. It is actually contradictory that RAN1 is indicating gNB doesn’t need to know if the UE supports this FG or not, but at the same time it is proposed to have its own capability signaling. Propose to remove this FG.
 |
| NTT DOCOMO, INC. [6] |  |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.
* For Component 2 in FG 26-8, there is no UE behavior specified by RAN1 for indication of polarization in SI. So, the corresponding component in RAN1 UE feature list is not needed. In our view the indication of polarization supported by the UE is not mandatory for NTN UE. Regarding the consequence if the feature is not supported by the UE, there is no need to specify particular assumption on UE polarization in case this FG is not reported.

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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. ~~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]~~ | ~~[Per UE/~~Per band~~]~~ | No | No | [support mixture of FDD/TDD ~~(for HAPS and/or ATG)~~ and/or FR1/FR2] | ~~[~~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 NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported~~]~~ |

 |
| Apple [8] |  |
| Ericsson Hungary Ltd [9] | Our detailed comments on the endorsed list of UE features for NR NTN are in the table below (with Track Changes).In particular, we propose to remove the misleading text “support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2”. * The issue related to “The capability interpretation for mixture of FDD/TDD and/or FR1/FR2” was asked in RAN2 LS [5], to which RAN1 answered in [6].
* Specifically, the issue occurs when there are multiple serving cells. This is however not the case for the NTN UE features defined in the table below. Therefore, the misleading text “support mixture of FDD/TDD (for HAPS) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2” should be removed.
1. Remove the misleading text “support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2” in the column “Capability interpretation for mixture of FDD/TDD and/or FR1/FR2”.

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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
 |  | No | No | It is assumed by the network that UE supports at least linear polarization | [Per UE/Per band] | No | 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 satellite, UE must indicate this FG is supported[Note: This UE feature group is applicable only for NR NTN cell, for terrestrial cell this feature is not supported] |

 |
| Samsung [10] |  |
| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**
* The feature is only intended for enhancement of operation and is not needed for basic operation. The consequence if the feature is not supported should be:

***UE is not able to take the advantage of polarization information to save power.**** UE does not have to support it to access NTN. The related statement should be removed.
 |
| ZTE [12] |  |
| LG Electronics [13] | * + - Remove component 2. It seems second component is already covered by component 1.

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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. ~~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] | [Per UE/Per band] | No | No | [support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2] | [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 NTN cell, for terrestrial 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 |  | FFS | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

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| Company | Summary |
| Huawei, HiSilicon [2] | * **Comment 1:** For component 2: remove brackets for [and PDCCH ordered PRACH]; add “if it is indicated.” at the end.
* **Comment 2:** This FG is a per UE capability.

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| 26. NR\_NTN\_solutions | 26-9 | UE-specific K\_offset  | 1. Reception of UE-specific K\_offset via MAC-CE
2. 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 |  | ~~FFS~~ Per UE | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

 |
| MediaTek Inc. [3] | * Component 2 can delete the yellow highlight “and PDCCH ordered PRACH” considering agreements in RAN1 agreements.

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| **Agreement(RAN1 107e)**The K\_offset value signaled in system information is always used for PDCCH ordered PRACH timing relationship. |

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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 |  | FFS | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

 |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] | * 26-1, 26-3, 26-6, 26-6a, 26-8, 26-9are basic features for UEs supporting NR over NTN.” Hence, they should be combined into a single FG.
 |
| NTT DOCOMO, INC. [6] |  |
| Intel Corporation [7] | * Words Satellite and HAPS can be removed since it is already clear that operation with satellite or HAPS is assumed for NTN.
* UE capability for NTN can be indicated per band to allow more flexibility for UE implementation.
* For Component 2 in FG 26-9, UE-specific K\_offset for PDCCH ordered PRACH 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 |  | FFS | No | No |  |  | Optional with capability signalling ~~[~~Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported~~]~~ |

 |
| Apple [8] |  |
| Ericsson Hungary Ltd [9] |

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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, 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 |  | [Per UE/Per band] | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

 |
| Samsung [10] |  |
| Qualcomm Incorporated [11] | Since NTN is designed with the assumption that legacy NR features are supported in NTN whenever needed, NR container should be used for NTN features. As such, NTN features should by default be per band or per band combination. * **NTN UE features should be at least per band differentiated so that NTN and non-NTN capabilities can be independently set.**
 |
| ZTE [12] | W.r.t FG 26-9, for component 2 in FG 26-9, the PDCCH ordered PRACH should be removed since only cell-specific K\_offset is applied for PDCCH ordered PRACH.

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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 |  | FFS | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |  26. NR\_NTN\_solutions |

 |
| LG Electronics [13] | * + - Remove PDCCH order in component 2 as only cell-specific K\_offset is agreed to be supported for PDCCH ordered PRACH Tx.

**Agreement**The K\_offset value signaled in system information is always used for PDCCH ordered PRACH timing relationship.

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|  26. NR\_NTN\_solutions | 26-9 | UE-specific K\_offset  | 1. Reception of UE-specific K\_offset via MAC-CE
2. 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 |  | FFS | No | No |  |  | Optional with capability signalling [Note: This UE feature group is applicable only for NR NTN cell and ATG cell, for terrestrial cell except for ATG cell this feature is not supported] |

 |

**Others**

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| --- | --- |
| Company | Summary |
| Huawei, HiSilicon [2] |  |
| MediaTek Inc. [3] |  |
| OPPO [4] |  |
| Nokia, Nokia Shanghai Bell [5] |  |
| NTT DOCOMO, INC. [6] | One important discussion is whether FGs for NR NTN are basic FGs for HAPS/ATG. After careful checking, currently we believe that they should not basic FGs at least for HAPS. Cell size of HAPS would not so large, then TN might be possible to be applied to HAPS NW. In this case, if all FGs shall be supported for HAPS NW, it means that the existing UEs are not allowed to access the HAPS NW though some HAPS NW does not use NTN-specific features. From similar reason, we guess those FGs should not be basic FGs for ATG as well.In addition, the above text and the note in the same column have terminologies of ‘NTN/NTN cell’ ‘satellite’ ‘HAPS’ ‘ATG/ATG cell’ ‘terrestrial cell’, but it seems that they are not terminologies on the same level. Without sufficient clarification, some misunderstanding might occur. For example, at least the following interpretations would be possible:* Interpretation 1
	+ NTN: communications via satellite/HAPS or with ATG BS, by using its specific features
	+ TN: communications of conventional deployments or via HAPS or with ATG BS, without using its specific features
* Interpretation 2
	+ NTN: communications via satellite/HAPS, regardless of with/without its specific features
	+ TN: communications of conventional deployments or with ATG BS, regardless of with/without its specific features

To avoid misunderstanding, we believe that NTN/TN terminologies should not be used in any FG for NR NTN. Satellite/HAPS/ATG are much better.Based on these, we propose the following.**Proposal 1:*** *Update the following texts in all FGs for NR NTN, if any.*
	+ *For UE supports NR communications via ~~[NTN/~~ satellite~~/HAPS/ATG]~~, UE must indicate this FG is supported*
	+ *Release 17 UE cannot do NR communication via ~~access [NTN/~~ satellite~~/HAPS/ATG]~~*
	+ *~~[~~Note: This UE feature group is applicable only for NR cell for communications via satellite/HAPS or with ATG gNB as specified in TS 38.101-X; ~~NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell, ~~except for ATG cell~~ this feature is not supported~~]~~*
 |
| Intel Corporation [7] |  |
| Apple [8] |  |
| Ericsson Hungary Ltd [9] |  |
| Samsung [10] |  |
| Qualcomm Incorporated [11] | How to indicate the support of legacy UE features in NTN is an important question concerning NTN UE features and capability signalling. NR NTN is developed with the assumption that any legacy NR feature, if needed, is supported. However, not all legacy UE features are applicable. Two options are:* If a separate NTN container is used, legacy features applicable to NTN need to be identified. This approach however does not promote the sharing of UE features between TN and NTN networks.
* If NR container is used, all NTN features must be per band or per band combination by default. Some legacy per-UE features may require different capability indications in NTN or may not be applicable to NTN. In such case, we may create a separate column in UE feature table such as /TN/NTN differentiation; or declare some of the features not applicable to NTN bands.

To answer the above questions, we have the following proposal:**Proposal 1:** * **NTN uses the NR capability container.**
* **Legacy NR features are applicable to NTN by default and exceptions are handled only when requested.**
 |
| ZTE [12] |  |
| LG Electronics [13] |  |

# 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 |
|  |  |

# Issue 1: FG 26-1

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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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  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~~]~~

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 |  | An NTN UE is required to at least support UE specific TA 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 or with ATG gNB as specified in TS 38.101-X; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 2: FG 26-3

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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|  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
3. UE receives cell-specific K\_offset 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 |  | 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 or with ATG gNB as specified in TS 38.101-X; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 3: FG 26-4

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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|  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~~]~~ | 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 |  | Note: The exact content of UE reporting of information about the UE specific 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 or with ATG gNB as specified in TS 38.101-X; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 4: FG 26-5

 ***[This proposal is discussed in the following separate email discussion. Please provide comments/questions/suggestions there]***

[108-e-R17-UE-features-32HARQ] Email discussion on UE features for 32 HARQ processes – Ralf (AT&T)

* Check point on February 23
	+ If there is no consensus at the Feb 23 check point, email thread will be closed

# Issue 5: FG 26-6

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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|  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~~ Receive PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process |  | Yes | No | Type-2 HARQ codebook enhancement is not supported for NR communication via satellite | ~~[Per UE/~~per band~~]~~ | No | No |  |  | Optional with capability signalling ~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite or with ATG gNB as specified in TS 38.101-X; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 6: FG 26-6a

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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|  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~~

~~FFS: HARQ disabling~~ Receive PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process | ~~[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]~~ | ~~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 or with ATG gNB as specified in TS 38.101-X; ~~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.

Receive PDCCH carrying the DCI for a HARQ process with disabled HARQ feedback with time gap from the last PDSCH for the same HARQ process. |  | Yes | No | Type-3 HARQ codebook enhancement is not supported for NR communication via satellite | per band | No | No |  |  | Optional with capability signalling Note: This UE feature group is applicable only for NR cell for communication via satellite or with ATG gNB as specified in TS 38.101-X; for any other cell this feature is not supported |

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| Company | Comments/Questions/Suggestions |
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# Issue 7: FG 26-7

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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|  ~~26. NR\_NTN\_solutions~~ | ~~[26-7]~~ | ~~[NTN Performance enhancement]~~ | 1. ~~The maximum number of supported aggregation factor (i.e., pdsch-AggregationFactor) for DL PDSCH is [X]~~

~~FFS: X = 16 or 32~~ |  | ~~Yes~~ | ~~No~~ |  | ~~[Per UE/per band/Per BC]~~ | ~~[No]~~ | ~~No~~ | ~~[support mixture of FDD/TDD (for HAPS and/or ATG) and/or FR1/FR2]~~ |  | ~~Optional with capability signalling~~~~[Note: This UE feature group is applicable only for NR NTN cell, for terrestrial cell this feature is not supported]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 8: FG 26-8

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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|  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. ~~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]~~ | ~~[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 or with ATG gNB as specified in TS 38.101-X; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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| Company | Comments/Questions/Suggestions |
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# Issue 9: FG 26-9

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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|  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 |  |  | Optional with capability signalling ~~[~~Note: This UE feature group is applicable only for NR cell for communication via satellite or with ATG gNB as specified in TS 38.101-X; ~~NR NTN cell and ATG cell,~~ for ~~terrestrial~~ any other cell ~~except for ARG cell~~ this feature is not supported~~]~~ |

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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 |
|  |  |

# 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 |
|  |  |

# 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. R1-2200940, Rel-17 UE features for NR NTN, Huawei/HiSilicon
3. R1-2201222, UE features for NR NTN, MediaTek Inc.
4. R1-2201303, Discussion on UE features for NTN-NR, OPPO
5. R1-2201411, On UE features for NR NTN, Nokia/Nokia Shanghai Bell
6. R1-2201504, Discussion on Rel.17 UE features for NR NTN, NTT DOCOMO, INC.
7. R1-2201729, On UE features for NR NTN, Intel Corporation
8. R1-2201794, Views on Rel-17 NR NTN UE Features, Apple
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