3GPP TSG RAN WG1 #110bis-e R1-22xxxxx

e-Meeting, October 10th – 19th, 2022

**Agenda item:** 8.4

**Source:** Moderator (Thales)

**Title:** Summary of [110bis-e-R17-NR-NTN-01] Email discussion to determine maintenance issues to be handled in RAN1#110bis-e

**Document for:** Discussion and Decision

## Introduction

This document is the summary of [110bis-e-R17-NR-NTN-01] Email discussion to determine maintenance issues to be handled in RAN1#110bis-e.

Additional email discussions will be set up once the maintenance issues for RAN1#110bis-e are determined.

The issues in contributions submitted to RAN1#110bis-e are summarized in the tables of section 2 and 3. An initial assessment on each of the maintenance issues is provided based on the following classification:

**High priority (H):** high-priority item (essential, pending issues, broken spec components) and proposed editorial changes that either enhance the clarity of the specs or correct mistakes,

**Non-essential (N):** all other purposes such as spec optimization and low priority issues,

**Editorial (E):** editorial issues that will be handled as editorial CRs (to be communicated to the editors/chairs).

## Issues on UL time/frequency sync and timing relationship

The issues related to UL time/frequency sync and timing relationship are summarized in the following table:

**Table 1 – Issues on UL time/frequency sync and timing relationship**

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| --- | --- | --- | --- | --- |
| **Issue#** | **Issue** | **References** | **FL initial assessment**  | **Company inputs (if any)**[Companies will provide their views here] |
| 1-1  | UE backward propagation of the orbit and common TA:The following proposal about backward propagation of the orbit and Common TA was discussed in last RAN1 meeting but no consensus could be achieved: **Network may expect that assistance information given by the SIB19 can be applied by the UE upon SIB19 acquisition.**Within the contributions submitted to current RAN1 meeting: There are 4 contributions with conflicting views on support of backward propagation :* It is proposed in [1]: RAN1 to inform RAN2 that no backward propagation is supported for SIB19 acquisition.
* It is proposed in [8]: The assistance information given by the SIB19 is applied by the UE at the epoch time.
* It is proposed in [6]: The UE should consider assistance information valid as soon as it is received
* It is proposed in [9]: The UE may apply the information obtained from SIB19 prior to the Epoch time. The gNB may assume that the UE supports backwards propagation of the serving satellite ephemeris information.
 | [1, 6, 8, 9] | H | Oppo: First off, it is not reasonable to mandate the UE implementation in particular when many UE vendors expressed concerns in last meeting. Secondly, as discussed in RAN1#110 meeting, gNB does not have a precise knowledge on the exact time for acquiring SIB19 for each of the UEs in a cell. Thus, it surely will end up having the case where some UE use backward propagation and some others use forward propagation. As the error directions are opposite, the relative error is doubled, which eventually would lead the gNB to reduce the validity duration in order to compensate for this error. As a result, the claimed benefit by forcing UE to implement backward propagation vanishes. Last but not least, to mandate the UE to implement backward propagation would also require RAN1 to have much of spec impact, such as to define new UE behavior during the period between the end of the validity expiry and the next epoch time. Further, more RAN2 change would also needed. Given we are already at the end of the maintenance phase, this optimization is not needed at all. LG: NEricsson: We agree with the FL initial assessment. The specification currently does not mention or restrict determination of the satellite orbit (or common TA) to before or after the epoch time. On the contrary, 38.331 implies that assistance info is valid when received. We do not support introducing such restriction, considering e.g. the drawbacks of increased initial access latency and increased SIB19 acquisition rate (or UL transmission gaps). The support for indicating an epoch time in the future was agreed at RAN1#107-e and RAN1#110 (for implicit and explicit epoch time, respectively). Regarding OPPO's reasoning that the error will be doubled due to opposite error directions when some UEs are using forward propagation and some backward propagation, we disagree. The error direction can be positive or negative regardless of propagation direction, and opposite error directions are equally possible for two UEs both performing forward propagation, both performing backward propagation, or one in each direction.[Nokia, NSB] Agree with FL that this should be a high priority topic to discuss.MediaTek: NWe do not see a need for additional specification:. * UE can calculate TA and Doppler shift to apply for pre-compensation from epoch time in future to time it reads ephemeris on SIB19. UE can subsequently apply pre-compensation forwards immediately after reading ephemeris on SIB19 even if Epoch time is in the future.
* UE and gNB can have same understanding for start of validity duration at Epoch time based on RAN1 agreement “*NTN ephemeris validity timer should be started/restarted with configured timer validity duration at the epoch time of the assistance information (i.e. serving satellite ephemeris data)*”

QC: N We fully agree with MediaTek’s comments. |
| 1-2 | Ambiguity in interpretation SFN indicating epoch time:This issue has been intensively discussed at RAN1#109 and RAN1#110 meetings.The following agreement was made at the online session on 25th of august:**Agreement**For serving cell if EpochTime is indicated explicitly by a SFN and subframe number, the UE considers this frame to be the current SFN or the next upcoming SFN after the frame where the message indicating the Epoch time is received. For neighbor cell if EpochTime is indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame nearest to the frame where the message indicating the Epoch time is received.In [1, 8], it was proposed to revert RAN1#110 agreement. Following proposal was proposed instead:Proposal If indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame which is nearest to the frame where the message is received. | [1, 8] | N | LG: NWe can agree with FL. It is already agreed issue.Ericsson: We agree with the FL initial assessment. The agreement from RAN1#110 should not be reverted.[Nokia, NSB] Agree with FL that this is non-essential. Actually, according to our understanding this aspect has already been resolved as per the agreement from 25th of August.MediaTek: We can agree with FL initial assessment. We see no need to revert RAN1#110 agreement.QC: We agree with FL’s initial assessment. |
| 1-3 | **Draft CR on interpretation SFN indicating epoch time:****Reason for change:**1. In RAN1 meeting #107e, the following agreement on epoch time determination was made and was not reflected in the specification.Agreement• When explicitly provided through SIB, Epoch time of assistance information (i.e. Serving satellite ephemeris and Common TA parameters) is the starting time of a DL sub-frame, indicated by a SFN and a sub-frame number signaled together with the assistance information. • Otherwise, when indicated in SIB (other than SIB1), epoch time of assistance information (i.e. Serving satellite ephemeris and Common TA parameters) is implicitly known as the end of the SI window during which the SI message is transmitted.• When provided through dedicated signaling, epoch time of assistance information (i.e. Serving satellite ephemeris and Common TA parameters) is the starting time of a DL sub-frame, indicated by a SFN and a sub-frame number.2. How to interpret the SFN indicating epoch time is unclear.**Summary of change:*** Clarify the epoch time can be explicitly indicated by a SFN and a sub-frame number or be implicitly determined by the end of SI window based on the agreement.
* Clarify the interpretation of SFN indicating epoch time, i.e., the SFN indicates a frame which is nearest to the frame where the ephemeris message is received.

**Consequences if not approved:*** Missing agreement on epoch time determination.
* Potential ambiguity in interpretation SFN indicating epoch time.
 | [2] | H | LG: HWe think the following agreements in RAN1 #110 meeting can be reflected in the specification.**Agreement**For serving cell if EpochTime is indicated explicitly by a SFN and subframe number, the UE considers this frame to be the current SFN or the next upcoming SFN after the frame where the message indicating the Epoch time is received. For neighbor cell if EpochTime is indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame nearest to the frame where the message indicating the Epoch time is received.Ericsson: Epoch time is defined in 38.331 and we see no need to duplicate the definition in 38.213. A reference to 38.331 is better. Regarding definition of explicit epoch time, the draft CR contradicts the agreement from RAN1#110.[Nokia, NSB] OK to discuss if we need to capture definition of Epoch time in 38.213. Only in case we find that such definition is needed, we can discuss the way of formulation. The proposal given in [2] is not OK to us.MediaTek: This CR contradicts the RAN1 agreement as discussed in 1-2 above and is not needed. Further RAN2 has already specified epoch time determination in TS 38.331.

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| ***epochTime*** *Indicate the epoch time for assistance information (i.e. Serving satellite ephemeris in IE ephemerisInfo and Common TA parameters). When explicitly provided through SIB, or through dedicated signaling, EpochTime is the starting time of a DL sub-frame, indicated by a SFN and a sub-frame number signaled together with the assistance information.The reference point for epoch time of the serving satellite ephemeris and Common TA parameters is the uplink time synchronization reference point. If this field is absent, the epoch time is the end of SI window where this SIB19 is scheduled. This field is mandatory present when provided in dedicated configuration. If this field is absent in ntn-Config provided via NTN-NeighCellConfig the UE uses epoch time from the serving satellite ephemeris. In case of handover, this field is based on the timing of the target cell, i.e. the SFN and sub-frame number indicated in this field refers to the SFN and sub-frame of the target cell. This field is excluded when determining changes in system information, i.e. changes of epochTime should neither result in system information change notifications nor in a modification of valueTag in SIB1.* QC: We don’t see the need of duplicate definition in 38.213. |

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| 1-4 | 38.213- Correction on timing relationship parameter for NR NTN:**Reason for change:** The name of the scheduling offset provided by network if downlink and uplink frame timing are not aligned at gNB is called K-Mac in TS 38.213. While in TS 38.331, the name of the scheduling offset is called kmac. It is better to align the name in TS 38.213 and TS 38.331. **Summary of change:** Align the name of scheduling offset provided by network if downlink and uplink frame timing are not aligned at gNB in TS 38.213 with the parameter name used in TS 38.331. **Consequences if not approved**: Misaligned parameter name between TS 38.213 and TS 38.331. | [7] | E | LG: EEricsson: We agree with the FL initial assessment. We are fine with the change proposed in the CR.[Nokia, NSB]: We agree with FL initial assessment that this is purely editorial aspect. An obvious typo correction which can be captured in editor CR.MediaTek: We agree with the FL initial assessment.QC: Agree. |
| 1-5 | Draft CR for 38.213 to capture correct validity timer expiry behavior for UL synchronization:**Reason for change**: One agreement from RAN1#106b-e states that the UE assumes that is has lost uplink synchronization if no new or additional assistance information is available when validity timer expires. This need to be captured in RAN1 specifications. **Summary of change:** The change will instruct the UE to consider itself to have lost UL synchronization in case of expiry of the validity timer which is associated to the serving satellite ephemeris information, and UE is instructed to follow procedures for recovery as provided in 38.321. **Consequences if not approved:** UE may perform UL transmissions for the situation that its serving satellite ephemeris information validity timer has expired, and cause UL transmissions that does not fulfill the requirements with respect to timing advance and Doppler frequency compensation. | [9, 11] | N | LG: NEricsson: We agree with the FL initial assessment. This CR is not needed – already captured in 38.321/38.331.[Nokia, NSB]: Respectfully disagree with FL assessment. We think that this is a topic that need capturing in PHY specifications such that we ensure that UE behavior is clear and unambiguous. This should be a high-priority topic.MediaTek: We agree with the FL initial assessment. RAN2 specified validity timing expiry behaviour in 38.321/38.331QC: Agree with FL’s assessment. We should not duplicate RAN2 specification in RAN1. |
| 1-6 | Draft CR for 38.213 to clarify calculation and application of timing advance values for common TA and UE specific TA:**Reason for change:** Promote unique expected timing advance correction by the UE in NTN **Summary of change:** Introduce the points of application for the common delay and UE specific delay components in the timing advance. Clarify calculation aspects on the common delay and UE specific delay components in the timing advance. **Consequences if not approved:** UEs may implement different solutions in compliance with the text, but yielding to different behaviour, making the conformance testing and gNB development more difficult. | [9, 12] | H | LG: NRegarding the UE specific TA, following conclusion was already made in RAN1#107e. Therefore, we think it is not essential issue.**Conclusion**$N\_{TA,UE-specific} $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.Ericsson: We agree with the FL initial assessment. We are fine with the proposed changes except the addition "provided that the UE has a running validity timer for this parameter" – whether or not the UE determines its pre-compensation when it is not allowed to transmit can be left to UE implementation.[Nokia, NSB]: Agree that this is a topic for clarification at this meeting.MediaTek: [N]We understand the intention of the draft CR to describe method to derive common delays from the broadcast common TA parameters. We do not however see a need for the CR. The method can be up to the UE implementation and does not require additional RAN1 specification.QC: We don’t see the need of clarification. The physical meaning of the common TA is clear in the current spec. Exact method of calculation of common TA should be up to UE implementation. |
| 1-7 | Draft CR for 38.211 to ensure correct interworking between open and closed loop TA:**Reason for change:** As described in R1-2210045 there is a potential problem with “double correction” from the UE autonomous timing advance calculations if applied in combination with closed loop timing advance from the gNB side. When using serving satellite ephemeris and common TA related parameters, there will be an accumulation of systematic errors during the satellite fly-over, and when applying new (and more accurate) ephemeris information and common TA parameters, the systematic error changes, which causes a jump in UE transmit timing, which may cause the UE’s UL transmissions to be positioned outside the cyclic prefix at the gNB receiver. **Summary of change:** The UE is instructed to subtract any systematic errors that are detected between old and new assistance information (serving satellite ephemris information and common TA related parameters). **Consequences if not approved:** The signals transmitted from the UE may experience quite large time jumps which cause the received signals at gNB to be outside the cyclic prefix, thereby causing significant interference in the system. | [9, 10] | N | LG: NEricsson: We agree with the FL initial assessment.[Nokia, NSB]: Respectfully disagree with FL assessment. We think that this is a topic that need capturing in PHY specifications such that we ensure that UE behavior is clear and unambiguous. This should be a high-priority topic.MediaTek: We agree with the FL initial assessment. Combination of open loop and closed loop has been extensively discuss in RAN1 and RAN4. Additional specification is non essential.QC: We agree with FL’s assessment. The issue was discussed extensively. The proposed CR specifies one specific mechanism that has been discussed and was not agreed. |

## Issues on HARQ

The issues related to HARQ enhancements are summarized in the following table:

**Table 2 – Issues on HARQ**

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| **Issue#** | **Issue** | **References** | **FL initial assessment**  | **Company inputs (if any)** |
| 2-1  | **38.213-Draft CR on the indication of downlink disabled HARQ feedback for NR NTN**:**Reason for change:**For HARQ feedback disabling related descriptions in TS38.213 v17.3.0, there are several typos for the parameter donwlinkHARQ-FeedbackDisabled, which is inconsistent with the higher layer parameter downlinkHARQ-FeedbackDisabled in TS38.331 v17.1.0.**Summary of change**:Replace donwlinkHARQ-FeedbackDisabled with downlinkHARQ-FeedbackDisabled.**Consequences if not approved:**Inconsistent parameter names would be used between TS38.213 v17.3.0 and TS38.331 v17.1.0. | [3] | E | LG: SupportEricsson: We agree with the FL initial assessment. We are fine with the changes proposed in the CR.[Nokia, NSB]: We agree with FL initial assessment that this is purely editorial aspect. An obvious typo correction which can be captured in editor CR.QC: Agree |
| 2-2 | **38.213- Correction on determination of the number of HARQ-ACK information bits for NTN:****Reason for change:** DAI value is defined based on PDSCH receptions, excluding PDSCH receptions that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if donwlinkHARQ-FeedbackDisabled is provided. The total number of DCI formats (i.e., U\_"DAI,c" ) used for calculating the number of HARQ-ACK information bits n\_"HARQ-ACK" for PUCCH power control should also exclude the DCI formats scheduling PDSCH receptions without associated HARQ-ACK information.**Summary of change:** The DCI formats scheduling PDSCH receptions without associated HARQ-ACK information are excluded for the calculation of the total number of DCI formats (i.e., U\_"DAI,c" ) for PUCCH power. **Consequences if not approved:** The UE may use an underestimated power to transmit PUCCH. | [4] | H | LG: NThis issue was discussed during WI phase, but it was not agreed. This issue is kind of optimization, so we don’t want to discuss this issue again in this maintenance phase.Ericsson: We agree with the FL initial assessment. We are fine with the changes proposed in the CR.[Nokia, NSB]: OK to discuss during the e-meeting.QC: Agree |
| 2-3 | **38.213- Correction on Type-2 HARQ-ACK codebook in PUSCH for NTN.****Reason for change:** UE has to always multiplex HARQ-ACK information for PDSCH receptions with disabled HARQ-ACK information in PUSCH even if UL DAI value $V\_{T-DAI}^{UL}=4$ when the UE has received a PDCCH scheduling PDSCH receptions with disabled HARQ-ACK information.**Summary of change:** Change the condition for disabling multiplexing HARQ-ACK information in PUSCH transmission in case UL DAI value $V\_{T-DAI}^{UL}=4 $by excluding the PDCCH scheduling PDSCH receptions with disabled HARQ-ACK information.**Consequences if not approved:** UL DAI value V$V\_{T-DAI}^{UL}=4$"T-DAI" ^"UL" =4 cannot disable the multiplexing of HARQ-ACK information for PDSCH receptions with disabled HARQ-ACK information in PUSCH. | [5] | H | Ericsson: We agree with the FL initial assessment. We are fine with the changes proposed in the CR.[Nokia, NSB]: OK to discuss during the e-meeting.QC: Agree with the proposed changes. |

## Conclusion

TBC

## References

1. R1-2208829 Discussion on remaining issue for NTN-NR OPPO
2. R1-2208830 Draft CR on interpretation SFN indicating epoch time OPPO
3. R1-2208886 Draft CR on the indication of downlink disabled HARQ feedback for NR NTN vivo
4. R1-2208993 Correction on determination of the number of HARQ-ACK information bits for NTN Langbo
5. R1-2208994 Correction on Type-2 HARQ-ACK codebook in PUSCH for NTN Langbo
6. R1-2209654 On the validity of assistance information for R17 NR NTN Ericsson
7. R1-2209823 Correction on timing relationship parameter for NR NTN Huawei, HiSilicon
8. R1-2210019 Remaining issues on solutions for NR to support NTN Lenovo
9. R1-2210045 Additional aspects of Rel-17 maintenance for NR over NTN Nokia, Nokia Shanghai Bell
10. R1-2210046 Draft CR for 38.211 to ensure correct interworking between open and closed loop TA Nokia, Nokia Shanghai Bell
11. R1-2210047 Draft CR for 38.213 to capture correct validity timer expiry behavior for UL synchronization Nokia, Nokia Shanghai Bell
12. R1-2210048 Draft CR for 38.213 to clarify calculation and application of timing advance values for common TA and UE specific TA Nokia, Nokia Shanghai Bell