3GPP TSG RAN WG1 #110bis-e R1-221xxxx

e-Meeting, October 10th – 19th, 2022

**Agenda item:** 8.14

**Source:** Moderator (MediaTek)

**Title:** Summary of [110bis-e-R17-IoT-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-IoT-NTN-01] Email discussion to determine maintenance issues to be handled in RAN1#110bis-e. There will be additional email discussions 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:

* **Functionality (F):** Items (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 time and frequency synchronization for IoT NTN

The issues related to time and frequency synchronization for IoT NTN are summarized in the table below:

**Table 1 – Issues on time and frequency synchronization for IoT NTN**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Issue#** | **Issue** | **References** | **FL initial assessment**  | **Company inputs (if any)**[Companies will provide their views here] |
| 1-1 | Clarify source of quantity $N\_{segment}^{precompensation}$ in higher layer configuration for eMTC and NB-IoT UE when the UE performs segmented pre-compensation.In RAN1#107-e, there was agreement.**Agreement**Support network re-configuration of UL transmission segment by dedicated RRC SignallingIn TS 36.213, “higher layer” is typically used for RRC parameters provided with common RRC signalling in SIB or dedicated RRC signalling. Moderator understanding is that the text in TS 36.213 Section 4.2.3 and 16.1.2 should be revised as “where the quantity $N\_{segment}^{precompensation}$ is provided by ~~system information~~ by higher layer, as specified in 3GPP TS 36.331” | [2,4] | E | [lenovo] agree with the update from moderator. E.g., use “higher layer” to take the place of “system information”[OPPO] agree with the update from moderator.ZTE：Agree[Qualcomm]: Agree, except that “by” seems to be written twice, and it should be “*is provided by the higher layers*”, in my opinion.[Nokia, NSB] We are ok for the update as there is “as specified in 3GPP TS 36.331”.[SONY] Agree that this needs changing. Agree with comments from Qualcomm[Sequans] Agree with FL update |
| 1-2 | Clarify UE behavior of dropping samples for NPRACH of NB-IoT UE when the UE performs segmented pre-compensation.The text proposal aims to clarify the UE behaviour for adjustment of the uplink transmission timing for NPRACH. This UE behaviour was discussed in RAN1 with following agreement in RAN1 107e. **Agreement**For NB-IoT, UE pre-compensation per segment of NPRACH is applied from one segment to the next segment by using one or more of the following methods if supported by UE implementation* UE may drop / Insert samples
* UE may blank subframe / repetition unit where UE drops a subframe / repetition unit
* The total transmission time is not changed
	+ FFS Details of method(s) to drop / insert samples / blank subframe / repetition unit
	+ FFS Specification impact

To the moderator understanding there was no RAN1 agreement for the text proposal below for UE behaviour for timing adjustment for NPRACH and the current specification is sufficient. When the UE's uplink NPRACH transmissions in preamble sequence repetition *n* for one segment and preamble sequence repetition *n*+1 for the next segment are overlapped due to the timing adjustment, the UE shall complete transmission of preamble sequence repetition *n* and not transmit the overlapped part of preamble sequence repetition *n*+1.To the moderator understanding there was no RAN1 agreement for this text proposal for UE behaviour for timing adjustment for NPRACH and the current specification is sufficient.  | [3,7] | N | [Lenovo] if the moderator believes there is no agreement to this issue, 110bis-e is the right time to discuss/clarify it, otherwise the Rel.17 WI can’t complete.ZTE：Agree[Qualcomm]: This is covered by existing text in NB-IoT specifications; no need to re-write for NPRACH[Nokia, NSB] For segments of NPRACH, there will be overlapping between the segments when the TA for the latter segment is larger than the TA for the former segment. In the agreement of 107e, we have agreed to define clear UE behavior so that there can be common understanding between UE and netowrk. **UE behavior shoud be defined, or Rel17 can not work.**[SONY] Agree with moderator view[Sequans] We agree that UE behaviour should be clear. If common understanding from Agreement and current spec is that “not transmit the overlapped part” is up to UE implementation, then it is fine to leave specification as is.  |
| 1-3 | Clarify that segmented uplink transmission gap is only applied when the timing advance of the next segment is longer than the previous, transmitted segment. To the moderator understanding there is no RAN1 agreement for the proposed text revision and the current specification is sufficient. “a transmission gap of $N\_{gap}^{precompensation}$ time units shall be counted for the PUSCH resource mapping but not used for transmission of the PUSCH of the next segment, if the timing advance of the next segment is longer than the timing advance of the transmitted segment,”. | [8] | N | ZTE：Agree with FL. No needs to further define the new behavior.[Qualcomm]: Agree with FL view.[Nokia, NSB] We think in RAN1 the gap is defined only for the case as when there is overlap as in RAN1 105-e meeting.The Target of the RAN1 agreement is not introduce a unnecessary gap resulting in a degraded perofrmance because of resource waste. **We propose to agreee the CR.**Agreement: * A specification change is needed for UL transmission with repetitions R>1.
* For segmented UE pre-compensation how the following is handled can be further discussed
	+ Phase discontinuity at subframe boundary when applying new pre-compensation
	+ Coherence time limitation due to delay/frequency drift rate during segment
	+ Signal overlapping between different TA segments
* FFS: Need for more frequent new UL gaps during long transmission
* FFS: Whether sampling frequency adjustment to avoid new UL gaps can be achieved by implementation
* FFS: Value of N for the number of time units and what is the time unit for the segmented UE pre-compensation

[SONY] We think the text proposal needs to be discussed. It seems obvious that if the timing advance of the next segment is shorter then an UL transmission gap would not be inserted. The gap insertion is only needed to take care of the case where one subframe / slot is timing advanced **into** another subframe / slot, not where a subframe / slot is timing advanced **away from** a subframe / slot. |
| 1-4 | NTN SIB AccummulationEricsson proposed the following:* Network to optionally indicate if NTN SIB accumulation across SI windows is allowed or not.
* For eMTC NTN with explicit epoch time indication, without introducing additional signalling, support NTN SIB accumulation at least for the following SI periodicities: {8, 16, 32, 64,128} frames
* For NB-IoT NTN with explicit epoch time indication, without introducing additional signalling, support NTN SIB accumulation at least for the following SI periodicities: {64,128} frames.
* For explicit epoch time indication, introducing additional signalling can help extend the SIB accumulation to even larger SI periodicities and/or optimize the UE behavior regarding SIB accumulation
* For IoT NTN, adopt the same definition for validity of assistance information as for NR NTN.

Nokia proposed in R1-2209244 Only explicit signaling of Epoch time for assistance information shall be specified for IoT NTN and RAN1 send LS to RAN2 to update SIB31 description in RRC specification to make the epochTime a mandatory field.As was discussed and captured in FL summary in RAN1#110 and summarised above, RAN2 has specified signalling for implicit Epoch time. This implies that SIB accumulation is not supported in Rel-17 since updating to serving cell ephemeris information does not affect the system information value. When epoch time is not explicitly indicated, the UE uses the starting time of the DL subframe corresponding to the end of the SI window during which the SI message carrying SIB31 is transmitted. SIB accumulation across SI windows is new functionality. There was no consensus in RAN1 that it is essential to specify SIB accumulation. It is not essential to specify SIB accumulation across SI windows. | [6,5] | N | [ERICSSON]We disagree with FL’s assessment that SIB accumulation cannot be supported in Rel-17. While it is true that it cannot be supported for implicit epoch time, it can still be supported for explicit epoch time, and that too with a minimal specification impact. Terrestrial NB-IoT/eMTC does support SIB accumulation and so should NTN. Otherwise, network will need to configure a prohibitively long SI window with many repetitions to cater to all UEs. Our proposals specifically treat the case of explicit epoch time. Therefore, we think the FL initial assessment should be “F” instead of “N”. ZTE: We are open to discuss it and propose to conclude it in this meeting since it has been discussed already in last meeting.[Qualcomm]: RAN2 specs already capture this SIB without accumulation. If required, the SI window size can be configured large, etc. There are sibs today that are not accumulated (e.g., the AB SIB). At this stage, we don’t support making this change to the specifications, especially since NTN link budgets don’t seem to be disastrously bad anyway.[Nokia, NSB] We think there is no agreement to say that SIB accumulation is not supported in Rel-17. In RAN2 discussion, only NR NTN agreement is simply followed without detail discussion and RAN2 has not considered specific issue of IoT NTN, i.e. UE may accumulate the SIB by implementation for good coverage. From RAN1 understanding, this is legacy UE behavior and will always supported for coverage of the UEs in the cell. Then based on the implicit signaling, legacy UE behavior can not have accumulation and cause UE not get the updated SIB and cause later synchronization issue. Then we should remove implicit signaling from IoT NTN. We think this is a Functional issue which should be solved in Rel17, i.e. only support explicit signaling for epoch time.[SONY] Agree with the Ericsson comment. This should be “F” instead of “N”. RAN1 is the correct place to talk about coverage. SIB accumulation has been supported in previous eMTC / NB-IoT releases and we do not support the removal of this SIB accumulation feature for IoT-NTN, especially given that the coverage of NTN is likely to be challenging. [Sequans] We are open to discuss SIB accumulation more at this meeting.  |
| 1-5 | Processing time for downlink receptionQualcomm raised a new issue for processing time for downlink reception. In terrestrial networks, eMTC/NB-IoT UEs typically require a certain amount of “minimum processing time” to process a downlink reception, before transmitting an associated uplink that may be triggered by the downlink reception. Examples include:* (N)PDSCH triggering HARQ-ACK
* (N)PDCCH triggering (N)PUSCH
* (N)PDCCH triggering PDCCH-ordered (N)PRACH

The moderator understanding is that Qualcomm analysis is correct. The network is required to set Koffset larger than TTA,NTN max to ensure these conditions for processing time for downlink reception for | [9] | F | [Lenovo] It is up to the eNB to configure the suitable Koffset to cover the cell range, which can be larger than TA. The motivation to specify the minimal processing time is not clear.[OPPO] we think the issue is valid and it can be handled by eNB implementation.ZTE: No support. The value is K\_offset is determined by eNB and no need to specify the restriction.[Qualcomm]: We cannot leave UE behavior undefined for a case that has not been ruled out. We need “some” definition in the specs—e.g., error case definitions/conditions, etc. As we have described, there may be cases where the processing time is lower than what the UE can support, due to an (e.g., inadvertent) network configuration that results in a pathological condition at a UE. [SONY] We think that the minimum processing time needs specification and cannot be left up to eNB implementation. The UE needs to be designed for the worst case minimum processing time and that minimum processing time should be defined. We think this is “F”.[Sequans]: Agree that we need to define minimum processing time. |

## Issues on timing relationships for IoT NTN

The issues related to timing relationships for IoT NTN are summarized in the table below:

**Table 2 – timing relationships for IoT NTN**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Issue#** | **Issue** | **References** | **FL initial assessment**  | **Company inputs (if any)** |
| 1-6 | Align Koffset parameter names in TS36.213 with names used in higher layer specs TS 36.331 and TS 36.321 | [10, 11] | E | FL: There are numerous clauses of TS 36.213 where the specification tries to define Koffset using parameter names *CellSpecificKoffset* and *UESpecificKoffset* which are not used by higher layer specifications such as TS 36.331 and TS 36.321. These specifications use instead the name *k-Offset* and *Differential Koffset* for the parameters in question. The clauses concerned are: 4.2.3, 5.1.1.1, 6.1.1, 7.2.3, 7.3, 8, 10, 16, 16.1.2 and 16.6.TPs that change the parameter names wherever they occur in TS36.213 such that the value of $K\_{offset}$ is defined using the actual names of the higher layer parameters in TS 36.331 and TS 36.321 have been proposed.ZTE: Agree, editorial changes.[Qualcomm]: No need to change anything. Specs look fine.[SONY] Agree, editorial changes.[Sequans]: Agree for editorial change. |
| 1-7 | Remove redundant definition of Kmac (clause 16.6) | [10] | E | FL: Clause 16.6 of TS36.213 commences with the general statement:“Throughout this clause, if a NB-IoT UE is configured with higher layer parameter *k-Mac*, *K*mac = *k-Mac* otherwise, *K*mac = 0.”But later in the clause, there is a further definition of Kmac within the text. One contributing company has made a CR to suppress this redundant definition.ZTE: Agree, editorial changes.[Qualcomm]: Insignificant [SONY] Agree, editorial changes. Even if insignificant, let’s get it perfect. |
| 1-8 | $K\_{offset}$ parameter is missing in the procedures described in Clause 7.3.1 of TS 36.213 v17.2.0 | [6, 12] | F | FL: In Clause 7.3.1 of TS36.213, on FDD HARQ-ACK reporting, one contributing company has spotted missing instances of Koffset between PDSCH subframes and the subframe in which their HARQ-ACK is transmitted. It was agreed during the WI that this timing relationship should be enhanced with Koffset. This is therefore an omission needing fixing.[Lenovo] OK to discuss, but it should be “E” editorial issue. Note the second K\_offset update is not needed[Ericsson] We support FL. It should be “F”.ZTE: Agree, editorial changes.[Qualcomm:] I don’t think any such omission is intentional. So it is editorial, but we can check, and add it, in legit places where it needs to be added.[Nokia, NSB] OK to update the editing.[SONY] Support considering this as “F”.[Sequans]: Agree it needs fixing as it can cause misinterpretation of spec. |
| 1-9 | In the clause 16.6 of TS 36.213, the descriptions about case 7~11 of NPDCCH monitoring restrictions should take the impact of the timing offset between the UL and DL frame at the eNB into consideration | [13] | F | FL: In RAN1#109e, TPs to **Clause 16.6 of TS36.213** were agreed which delt with the NPDCCH monitoring restriction cases 7 – 11. One contributing company thinks this is not adequate and proposes a CR related to the PDCCH monitoring restrictions for cases 7 – 11.ZTE: No need. [Qualcomm]: Existing specs look clear to me. |

## Conclusion

TBC

## References

1. RP-211601, “NB-IoT/eMTC support for NTN”, MediaTek, RAN#92-e, May 2021
2. R1-2208831, Draft CR on UE pre-compensation in segment, OPPO, RAN1#110-bis-e, October 2022
3. R1-2209242, Draft CR on correction of IoT NTN with dropping in pre-compensation per segment in 36.213, Nokia, Nokia Shanghai Bell, RAN1#110-bis-e, October 2022
4. R1-2209243, Draft CR on correction of IoT NTN with dropping in pre-compensation per segment in 36.213, Nokia, Nokia Shanghai Bell
5. R1-2209244, Maintenance on NB-IoT/eMTC support for Non-Terrestrial Network, , Nokia,Nokia Shanghai Bell, RAN1#110-bis-e, October 2022
6. R1-2209650, On SIB accumulation and Timing relationship enhancements in IoT NTN, Ericsson, RAN1#110-bis-e, October 2022
7. R1-2210020, Maintenance for IoT NTN, Lenovo, RAN1#110-bis-e, October 2022
8. R1-2210183, Draft CR on correction of IoT NTN with segment gap in 36.211, Nokia, Nokia Shanghai Bell, RAN1#110-bis-e, October 2022
9. R1-2210309, Maintenance on NB-IoT/eMTC support for Non-Terrestrial Network, Qualcomm, RAN1#110-bis-e, October 2022
10. R1-2208689, Corrections on timing relationship for IoT-NTN, ZTE, RAN1#110-bis-e, October 2022
11. R1-2210219, Correction on time relationship parameter for IoT NTN, Huawei, HiSilicon, RAN1#110-bis-e, October 2022
12. R1-2210070, DRAFT CR Missing Koffset in FDD HARQ-ACK reporting procedure, Ericsson, RAN1#110-bis-e, October 2022
13. R1-2210201, Corrections on NPDCCH monitoring restriction for IoT NTN, Huawei, HiSilicon, RAN1#110-bis-e, October 2022