**3GPP TSG-RAN WG2 Meeting #121bis-eR2-23xxxxx**

Electronic, 17th – 26th April, 2023

**Agenda Item: 6.6.1**

**Source: OPPO**

**Title: Summary of  [AT121bis-e][111][NR NTN] Stage 2 corrections (OPPO)**

**Document for: Discussion and Decision**

# Introduction

This document aims to collect companies’ views for the following offline discussion and provide the summary report.

* [AT121bis-e][111][NR NTN] Stage 2 corrections (Oppo)

Initial scope: Discuss Stage 2 CRs for NR NTN and IoT NTN

Initial intended outcome: Summary of the offline discussion with list of agreeable corrections/CRs

Deadline for companies' feedback: Friday 2023-04-21 08:00 UTC

Deadline for rapporteur's summary (in R2-2304251): Friday 2023-04-21 10:00 UTC

Proposals marked "for agreement" in R2-2304251 not challenged until Monday 2023-04-24 10:00 UTC will be declared as agreed via email by the session chair (for the rest the discussion might continue online).

# 2. Contact information

|  |  |
| --- | --- |
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# Discussion

## 3.1 Stage-2 corrections

Similar changes have been proposed to 38.300 and 36.300 as follows.

In [1],

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| 16.14.2.1 Scheduling and Timing DL and UL are frame aligned at the uplink time synchronization reference point (RP) with an offset given by NTA,offset (see clause 4.3 of TS 38.211 [52]).  To accommodate the propagation delay in NTNs, several timing relationships are enhanced by a Common Timing Advance (Common TA) and two scheduling offsets and :  - is a configured timing offset that is equal to the RTT between the RP and the NTN payload.  - is a configured scheduling offset that needs to be larger or equal to the sum of the service link RTT and the Common TA.  - is a configured scheduling offset that approximately corresponds to the RTT between the RP and the gNB.  The offset is used to delay the application of a downlink configuration indicated by a MAC CE command on PDSCH, see TS 38.213 [38], and in estimation of UE-gNB RTT, see TS 38.321 [6]. It may be provided by the network when downlink and uplink frame timing are not aligned at gNB. The is also used in the random access procedure, to determine the start time of RAR window/MsgB window after a Msg1/MsgA transmission (see TS 38.213 [38]).  The Service link RTT, Feeder link RTT, the RP, the common TA and TTA (see claus 16.14.2.2) are illustrated in Figure 16.14.2.1-1. |

In [2],

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| --- |
| 23.21.2.1 Scheduling timing DL and UL are frame aligned at the uplink time synchronization reference point (RP) with an offset given by (see clause 8 of TS 36.211 [4]).  To accommodate the long propagation delays in NTN, several timing relationships are enhanced and two scheduling offsets: and are introduced:  - is a configured timing offset equal to the RTT between the RP and the NTN payload.  - is a configured scheduling offset that needs to be larger or equal to the sum of the service link RTT and the common TA.  - is a configured offset approximately corresponding to the RTT between the RP and the eNB.  The Service link RTT, Feeder link RTT, the RP, the Common TA and TTA (see clause 23.21.2.2) are illustrated in Figure 23.21.2.1-1.    Figure 23.21.2.1-1 Timing relationship parameters |

The intention of this offline discussion is to align the stage-2 text between IoT NTN and NR NTN. **To make it simple, rapporteur would like companies to check whether the 38.300 CR in [1] is ok, and then rapporteur will implement the agreeable changes also to 36.300 in the summary phase.**

Note that there is an offline comment that in 38.300 CR [1], the RP’s reference to “clause 4.3 of TS 38.211 [52]” should be corrected to “clause 4.2 of TS 38.213 [38]” and this will be included in the CR update.

**Question 1: For 38.300 CR in [1], do companies agree to all changes? If not, please indicate which change is not agreeable.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Vivo | Agree |  |
| ZTE | Agree with comments | Missing e in clause.  The Service link RTT, Feeder link RTT, the RP, the common TA and TTA (see claus 16.14.2.2) are illustrated in Figure 16.14.2.1-1. |
| Intel | Agree | And similar comment to 36.300 CR, i.e., The reference of RP is in fact “cluse 4.2 of TS 36.213”. |
| Qualcomm | Disagree | All the editorial changes are not necessary.  Changes to common TA and Koffset are fine.  Depending on outcome of SMTC offset discussion, if option 2 is adopted, then Kmac definition must be changed to  -     is a configured offset that needs to be ~~larger or~~ approximately equal to the RTT between the RP and the gNB.  Also the Kmac becomes no long scheduling offset, as it will be used in measurement as per option 2.  In addition, the definition of feeder link should be updated, the Kmac is between RP and gNB (not RP and gateway). The figure shows gateway, that is not correct. Either correct or remove the figure. |
| Thales | Agree |  |
| Samsung | Agree |  |
| MediaTek | No strong view | For Kmac, we need to converge on the decision of the SMTC discussion.  One typo is in “see claus 16.14.2.2”.  For the coversheet, we wonder if this CR belongs to category “F”? (maybe “D”?) |
| Ericsson | Agree (proponent) | Kmac cannot be configured equal to RP-gNB RTT (except when RP is in gNB or maybe in GEO if you are lucky). It is reasonable to assume gNB will configure Kmac approximately corresponding to the RP.gNB RTT, but that is nothing we can/need to decide. |
| Huawei, HiSilicon | Agree | For Kmac, “approximately corresponding to” should be fine. |
| Google | No strong view | For the Kmac description, either the change provided in [1], or the change suggested by QC is fine with us. |
| OPPO | Agree | Typo should be fixed. |
| Xiaomi | Agree |  |
| Nokia | See comments | - is a configured timing offset that is equal to the RTT between the RP and the NTN payload.  For Common TA, we don’t think it is necessary to change “corresponds” to “is equal to” because the TA prediction accuracy may not exactly same as the RTT between the RP and the NTN payload. We prefer to the original wording (i.e. “corresponds”). |
| Lenovo | Agree |  |

[3] proposals following changes, i.e. scheduling offset changed to slot offset. Note that the figure update has been included in [1].

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| 16.14.2.1 Scheduling and Timing To accommodate the propagation delay in NTNs, several timing relationships are enhanced by a Common Timing Advance (Common TA) and two slot offsets and illustrated in Figure 16.14.2.1-1:  - is a configured offset that corresponds to the RTT between the Reference Point (RP) and the NTN payload.  - is a configured scheduling offset that need to be larger or equal to the sum of the service link RTT and the Common TA.  - is a configured slot offset that need to be larger or equal to the RTT between the RP and the gNB. |

**Question 2: For CR in [3], do companies agree to the above changes to 38.300?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| vivo | Disagree | According to the filed description of and in TS 38.331, the wording “scheduling offset” is used, the stage 2 spec should align with TS 38.331. |
| ZTE | No needed | The original text is not wrong and more future proofing in case other granularity may introduced in the future. The detailed granularity is specified in stage 3. |
| Intel | Disagree | Same view with Vivo |
| Qualcomm | Disagree |  |
| Thales | Agree (proponent) | It is a question of unit homogeneity, “slot” refers to a time unit, as RTT, when offset refers to a number. |
| Samsung | Disagree | No need to change, the current wording is aligned with context and other specs. |
| MediaTek | Disagree |  |
| Ericsson | Disagree |  |
| Huawei, HiSilicon | Disagree |  |
| Google | Disagree |  |
| OPPO | Disagree |  |
| Xiaomi | Disagree |  |
| Nokia | Disagree |  |
| Lenovo | Disagree |  |

In [4], following reasons are given for the changes.

|  |  |
| --- | --- |
| 1. In RAN2#118-e meeting, the following agreements were made on SMTC adjustment for idle/inactive UE.   |  | | --- | | Agreements via email – from offline 106 – second round:   1. Neighbour cell assistance information for NTN, including SMTC assistance information, is provided via SIB19. 2. Common TA parameters and Kmac of the neighbour cell are used to support IDLE/Inactive UEs in NTN to perform SMTC adjustments. |   However, Kmac is not specified in subclause 16.14.3.3 currently: “The network can configure assistance information (e.g., ephemeris, Common TA parameters) provided in SIB19 for UE to perform measurement on neighbour cells in RRC\_IDLE/RRC\_INACTIVE/RRC\_CONNECTED.”  2. Subclause 16.14.3.3 specifies “For a UE in Idle/Inactive mode it's up to UE implementation whether to perform NTN neighbour cell measurements on a cell indicated in SIB4 but not included in SIB19.” But both SIB3 and SIB4 can include neighbouring cell related information, where SIB3 contains neighbouring cell related information for intra-cell cell reselection and SIB4 contains neighbouring cell related information for inter-cell cell reselection. So SIB3 should be added. |

And following changes are proposed:

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| 16.14.3.3 Measurements The same principle as described in 9.2.4 applies to measurements in NTN unless hereunder specified.  The network can configure:  - multiple SMTCs in parallel per carrier and for a given set of cells depending on UE capabilities;  - measurement gaps based on multiple SMTCs;  - assistance information (e.g., ephemeris, Common TA parameters, , etc.) provided in SIB19 for UE to perform measurement on neighbour cells in RRC\_IDLE/RRC\_INACTIVE/RRC\_CONNECTED.  NW-controlled adjustment of SMTCs can be based on UE assistance information reported in RRC\_CONNECTED. A UE in RRC\_IDLE/RRC\_INACTIVE can adjust SMTCs based on its location and assistance information in SIB19.  UE assistance information consists of the service link propagation delay difference(s) between serving the cell and neighbour cell(s).  For a UE in Idle/Inactive mode it's up to UE implementation whether to perform NTN neighbour cell measurements on a cell indicated in SIB3/SIB4 but not included in SIB19.  For a UE in Connected mode, it's up to UE implementation whether to perform NTN neighbour cell measurements on a cell included in the measurement configuration but not included in SIB19.  In the quasi-earth fixed cell scenario, UE can perform time-based and location-based measurements on neighbour cells in RRC\_IDLE/RRC\_INACTIVE:  - The timing and location information associated to the serving cell is provided in SIB19;  - Timing information refers to the UTC time when the serving cell stops serving the current geographical area;  - Location information refers to the reference location of the serving cell and a distance threshold to the reference location.  Measurement rules for cell re-selection based on timing information and location information are specified in clause 5.2.4.2 in TS 38.304 [10]. |

For the change on Kmac, rapporteur understands that this might also relate to another offline #112 on whether Kmac is compensated by UE or by NW for the SMTC adjustment.

Proposal 1: On handling the feeder link delay difference of SMTC in SIB2/4, RAN2 to choose from the following options:

- Option 2: Feeder link delay (including common TA parameters and Kmac) difference is compensated by the UE

- Option 4: Kmac part of the feeder link delay is compensated by the NW, and the time variant part (i.e. common TA) of feeder link delay difference is compensated by the UE.

- Huawei indicates that we have now reduced the options to option 2 and 4 and we need to decide.

- Oppo thinks option 2 is what we agreed. MTK, ZTE, Samsung agree with Oppo. Also Intel supports p2

- Google prefers option 4 but can accept to go for option 2

- QC thinks we need to consider the behaviour specified in the current specs and then don’t think they can agree with option 2. LGE agrees

- Apple think option 4 is easier from UE side. On the other hand, Kmac needs to be very accurate if we go for option 2. If this is confirmed, Apple can accept to go for option 2

- Ericsson think that option 2 is the only thing we can do as the NW may need to set Kmac for other reasons the SMTC alignment.

- HW thinks option 2 takes only one additional step in the UE calculation on top of option 4 so there should be no real problem for the UE.

* Continue in offline 112

**Question 3: For CR in [4], do companies agree to the above changes to 38.300?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| vivo | Agree |  |
| ZTE | Agree with first one | As for SIB3, I think the situation is a bit different from SIB4 since it is for intra-frequency which means the satellite ephemeris information, common TA and etc is always available for this frequency, which means UE is capable to do the neighboring cell measurement. |
| Intel | Agree |  |
| Qualcomm | Disagree | It depends on the outcome of SMTC offset offline discussion.  This is needed only if Option 2 is adopted. |
| Thales | Agree |  |
| Samsung | Agree | For intra-frequency, it may still possible neighbour cell is from a different satellite. |
| MediaTek | Partially agree | The second change can be agreed.  The first change shall wait for the decision of SMTC discussion. |
| Ericsson | Partly agree | Fist change is not needed, it already says e.g. = exempli gratia = for example, thus there is no need to add more examples to a list of examples, and definitely no need to add “et cetera” = ”and so on” at the end of a list of examples. The interested reader can find all details in the stage 3 spec.  The second change is correct. |
| Huawei, HiSilicon | Partially agree | Agree with the 2nd change.  The first change is not essential as it is anyway “e.g.,”. Besides, as also indicated by others, this may depend on the discussion of SMTC. |
| Google | 1st change depends on the SMTC offline; 2nd change is not needed | We think the 2nd change is not needed, as skipping a neighbour cell measurement on the intra-frequency does not have much gain compared to skipping a neighbour cell measurement on the inter-frequency (UE still needs to conduct the intra-frequency measurement based on the SMTC given in SIB2 anyway). |
| OPPO | Partially agree | 2nd change is ok, 1st change depends on SMTC discussion. |
| Xiaomi | Partially agree | Agree with the first change.  For the second change, we think UE always need to measure the intra-frequency neighbour cells. |
| Nokia | 2nd change OK | 1st change is redundant. |
| Lenovo | Agree on the 2nd change | The 1st change depends on the SMTC offline outcome. |

In [5], following reason is mentioned.

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| --- |
| In connected mode, the UE shall continuously update the Timing Advance and frequency pre-compensation, but the UE is not expected to perform GNSS acquisition. Thus, the GNSS position will be outdated after some time. Then the UE has to move to idle state afterward. If the UE enters the connected mode for dialing the emergency call over NTN, emergency call may be unexpectedly disconnected due to outdated GNSS position |

Proposed change is:

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| --- |
| 23.21.2.2 Timing Advance and Frequency Pre-compensation [Unchanged parts ommited]  In connected mode, the UE shall continuously update the Timing Advance and frequency pre-compensation, but the UE is not expected to perform GNSS acquisition except that the emergency call is ongoing. In connected mode, upon outdated ephemeris and common Timing Advance, the UE shall acquire the broadcasted parameters and upon outdated GNSS position the UE shall move to idle mode. |

**Question 4: For CR in [5], do companies agree to the above changes to 36.300?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| vivo | Disagree | UE is not expected to perform GNSS acquisition in connected mode doesn't mean that UEs are not allowed to acquire GNSS, it can be up to UE implementation to perform GNSS acquisition. |
| ZTE | Disagree | It seems the intention of this change is that, if UE is performing emergency call, UE can reacquire GNSS when it becomes outdated. But as GNSS reacquisition would cause servicing interruption, if UE does so, we don’t know how the emergency call can continue. The change seems infeasible.  We assume the emergency call may be short, then it may be very rare case that GNSS becomes outdated during emergency call. |
| Intel | Disagree | Smart UE implementation can handle this. |
| Thales | Disagree | The spec does not avoid GNSS acquisition in connected mode while emergency ongoing. UE implementation can handle this. |
| Samsung | Disagree | This is quite a change in how IoT NTN GNSS validity duration operates. It is discussed in [101] and our view is the same as in that discussion. While the discussion is yet to have concluded, we see little support for this. |
| MediaTek | Disagree |  |
| Ericsson | Disagree |  |
| Huawei, HiSilicon | Disagree | Same view with ZTE. The emergence service will be interrupted either way. |
| Google | Disagree |  |
| OPPO | Disagree |  |
| Xiaomi | Disagree | We think the intention of the change is that UE performs GNSS measurement before the GNSS positioning becoming outdate, but current spec don’t forbidden UE to do this. |
| Nokia | Disagree | Just leave it to UE implementation (e.g., keep in RRC connected if emergency call is ongoing) |
| Lenovo | Disagree | UE implementation is OK |

## 3.2 TDD support for IoT NTN

Till now, correction to 36.213 on NB-IoT/eMTC support for NTN in R1-2205665 has been approved in RAN plenary#96 meeting, in which all references to K\_offset from the TDD clauses are removed, and the reasons are given as below.

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| ***Reason for change:***  Corrections needed on time synchronization and timing relationship enhancement features of Rel-17 NB-IoT/eMTC support for NTN:   1. The formula for that provides how a UE interprets/uses the Common TA related parameters and computes the is missing in clause 4.2.3 for eMTC, and clause 16.1.2 for NB-IoT. 2. As TDD was not treated during the IoT NTN WI, TDD clauses in the spec should not be changed because of NTN. 3. Clarify how to calculate indices for subframes that UE is not required to monitor for NPDCCH in NTN. |

In the last RAN2 meeting, RAN2 has agreed to the stage-2 CR that IoT NTN is only applicable to FDD system.

In [6], company proposed to remove TDD part that has been added in the MAC spec for IoT NTN, to align with stage-2 spec and RAN1 spec.

|  |
| --- |
| For BL UEs and UEs in enhanced coverage, when single TB is scheduled by PDCCH the HARQ RTT Timer corresponds to 7 + N subframes plus DLoffset, where N is the used PUCCH repetition factor, where only valid (configured) UL subframes as configured by upper layers in *fdd-UplinkSubframeBitmapBR* are counted for N. In case of TDD, HARQ RTT Timer corresponds to 3 + k + N subframes, where k is the interval between the last repetition of downlink transmission and the first repetition of the transmission of associated HARQ feedback, and N is the used PUCCH repetition factor, where only valid UL subframes are counted for N as indicated in clauses 10.1 and 10.2 of TS 36.213 [2].  <unchanged part>  Except for NB-IoT and for HARQ processes scheduled using Short Processing Time and for short TTI, UL HARQ RTT Timer length is set to 4 subframes plus RTToffset for FDD and Frame Structure Type 3, and set to kULHARQRTT subframes for TDD, where kULHARQRTT equals to the kPHICH value indicated in Table 9.1.2-1 of TS 36.213 [2] if the UE is not configured with upper layer parameter *symPUSCH-UpPts* for the serving cell, otherwise the kPHICH value is indicated in Table 9.1.2-3. |

**Question 5: For CR in [6], do companies agree to the changes to 36.321?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| vivo | Agree |  |
| ZTE | Disagree | The change “plus RTToffset” introduced from R17 is also fine to TN network. Now we see it as a general way to enhance the timer length definition, e.g., to take into account the UE-eNB RTT of the network, no matter TN or NTN network, or TDD or FDD.  This change doesn’t imply TDD would be used for NTN network. In this MAC spec, it just ensures the timer length is correct in any applicable scenario. Whether TDD can be used for NTN network can mainly refer to 36.300.  Finally, since there is nothing wrong, we’d better not modify anything. |
| Intel | Agree |  |
| Qualcomm | Agree | Cleaner to remove it. |
| Thales | Agree |  |
| Samsung | Agree, no strong view | Fine to remove it |
| MediaTek | Agree but no strong view | Anyway, the outcome seems to remain the same, so better to remove it for a cleaner version. |
| Ericsson | Disagree | There is nothing broken in the MAC spec. It is very easy to see in stage 2 what is supported:  “In this release of the specification, NTN is only applicable to FDD system.” |
| Huawei, HiSilicon | Agree | Better to align with Stage 2 CR. |
| Google | Agree |  |
| OPPO | Agree | We should always aim at consistency among specifications. |
| Xiaomi | Agree |  |
| Nokia | Disagree | Share ZTE’s view. |
| Lenovo | Agree |  |

# 4. Summary and Proposals

This section summarizes the main proposals:

# 5. References

1. R2-2302540 NTN Stage-2 correction OPPO, Ericsson, Thales CR Rel-17 38.300 17.4.0 0647 - F NR\_NTN\_solutions-Core
2. R2-2303832 Correction for R17 IoT NTN Ericsson CR Rel-17 36.300 17.4.0 1383 - F LTE\_NBIOT\_eMTC\_NTN
3. R2-2302765 Corrections to 38.300 related to Section Scheduling and Timing THALES CR Rel-17 38.300 17.4.0 0630 2 D NR\_NTN\_solutions-Core R2-2302654
4. R2-2303764 Correction on Stage-2 descriptions for NR NTN Samsung CR Rel-17 38.300 17.4.0 0659 - F NR\_NTN\_solutions-Core
5. R2-2302677 Stage-2 Corrections for Supporting Emergency Calls in IoT NTN MediaTek Inc CR Rel-17 36.300 17.4.0 1382 - F LTE\_NBIOT\_eMTC\_NTN-Core
6. R2-2302530 MAC correction on TDD support for IoT NTN OPPO CR Rel-17 36.321 17.4.0 1560 2 F LTE\_NBIOT\_eMTC\_NTN R2-2300358