**3GPP TSG-RAN WG2 Meeting #119bise R2-220xxxx**

**Online, October, 2022**

**Agenda Item: 6.10.4.2**

**Source: OPPO**

**Title: Summary of [AT119bis-e][114][NR NTN] Validity of assistance information (OPPO)**

**Document for: Discussion and Decision**

# Introduction

This document is to kick off the following offline discussion.

* [AT119bis-e][114][NR NTN] Validity of assistance information (Oppo)

Initial scope: Discuss proposals in [R2-2210092](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2210092%20BP%20issue.doc) and [R2-2210760](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2210760%20-%20R17%20NR%20NTN%20epoch%20time%20and%20validity.docx)

Initial intended outcome: Summary of the offline discussion and possible draft LS to RAN1

Deadline (for companies' feedback): Thursday 2022-10-13 14:00 UTC

Deadline (for rapporteur's summary in R2-2210856 and draft LS in R2-2210857): Thursday 2022-10-13 16:00 UTC

# 2. Contact information

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# Discussion

## 3.1 Current specification status

As stated in [3], following specification texts are related to validity of satellite assistance information.

##### 5.2.2.4.21 Actions upon reception of *SIB19*

Upon receiving *SIB19*, the UE shall:

1> start or restart T430 for serving cell with the timer value set to *ntn-UlSyncValidityDuration* from the subframe indicated by *epochTime*;

NOTE: UE should attempt to re-acquire *SIB19* before the end of the duration indicated by *ntn-UlSyncValidityDuration* and *epochTime* by UE implementation.

***ntn-UlSyncValidityDuration***

A validity duration configured by the network for assistance information (i.e. Serving and/or neighbour satellite ephemeris and Common TA parameters) which indicates the maximum time during which the UE can apply assistance information without having acquired new assistance information.

The unit of *ntn-UlSyncValidityDuration* is second. Value *s5* corresponds to 5 s, value *s10* indicate 10 s and so on. This parameter applies to both connected and idle mode UEs. If this field is absent in *ntn-Config* provided via *NTN-NeighCellConfig,* the UE uses validity duration from the serving cell assistance information. This field is excluded when determining changes in system information, i.e. changes of *ntn-UlSyncValidityDuration* should neither result in system information change notifications nor in a modification of *valueTag* in *SIB1*. *ntn-UlSyncValidityDuration* is only updated when at least one of *epochTime*, *ta-Info*, *ephemerisInfo* is updated.

Above texts mean that T430 starts at epoch time and T430’s length (i.e. *ntn-UlSyncValidityDuration*) covers the maximum time during which satellite assistance information is considered as valid without having acquired new assistance information. Company in [3] thinks that the highlighted field description is not good for UE to use assistance information before epoch time and would like to add “duration after the *epochTime*” after “maximum time”.

Regarding this, rapporteur would like to remind that the highlighted field description is exactly the same as the below RAN1#106-e agreements and therefore RAN2 should not change it unless really necessary and confirmed by RAN1.

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| RAN1#106-e Agreement:* A validity duration configured by the network for satellite ephemeris data indicates the maximum time during which the UE can apply the satellite ephemeris without having acquired new satellite ephemeris.
	+ FFS: Associated UE behaviour if the UE does not read the ephemeris within the validity duration.
* FFS: Whether the same validity duration can be applied for Common TA.
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For RRC-MAC interaction, following are captured in 38.331 and 38.321.

#### 5.2.2.6 T430 expiry

The UE shall:

1> if T430 for serving cell expires and if in RRC\_CONNECTED:

2> inform lower layers that UL synchronisation is lost;

2> acquire *SIB19* as defined in clause 5.2.2.3.2;

2> upon successful acquisition of *SIB19*:

3> inform lower layers that UL synchronisation is obtained;

## 5.2a Maintenance of UL Synchronization

The MAC entity shall:

1> if an indication of Serving Cell uplink synchronization has been received from upper layers (see clause 5.2.2.6 of TS 38.331 [5]):

2> allow uplink transmission on the corresponding Serving Cell.

1> if an indication of Serving Cell uplink synchronization loss is received from upper layers:

2> flush all HARQ buffers;

2> not perform any uplink transmission on the corresponding Serving Cell

In both [1] and [3], companies think that above text seems to presume that backward propagation is supported before epoch time, which however has not been concluded by RAN1 yet. Meanwhile, rapporteur would to remind the following RAN2#118-e agreements.

RAN2#118-e Agreements via email – from offline 104:

1. The text proposals from corrections 3 and 8 in [R2-2206194](file:///C%3A%5CData%5C3GPP%5CRAN2%5CInbox%5CR2-2206194.zip) are adopted and included in a TS 38.321 Rapporteur CR.

2. T\_TA shall be updated to TTA in “5.4.8 Timing Advance Reporting”.

3. Do not introduce an explicit configuration to support blind Msg3 retransmission in NTN.

4. Upon validity timer expiry in NR NTN, UE shall suspend uplink transmission and acquire SIB-19, flushing HARQ buffers.

5. A new T3XX timer is introduced in RRC specification with duration ntn-UlSyncValidityDuration. Details of timer handling to be addressed in CP discussion

6. RRC indicates to lower layers when T3XX timer has expired or is restarted.

It seems that the current RRC spec text does not correctly capture the above RAN2 agreement and the exact timing to inform lower layer of UL synchronization should be when T430 is restarted.

In summary, the existing RRC spec is inconsistent on the support of backward propagation, i.e. some text seems to support BP, while some seems not.

## 3.1 Proposals from companies

In [1], company thinks that whether to support backward propagation or not is still being discussed in RAN1 and the conclusion from RAN1 may eventually impact the RRC spec regarding when RRC informs MAC of UL synchronisation. For example, if backward propagation is not supported, it means that satellite assistance information is only valid after the Epoch time, in which case RRC should inform MAC of UL synchronization upon starting T430 instead of upon SIB19 acquisition. If backward propagation is supported, RAN1 may still need to provide information on how long before the Epoch time can be supported for the backward propagation so that RRC can use that BP duration to determine when to indicate UL synchronization to MAC. As the whole concept of epoch time and valid timer comes from RAN1 and BP issue is also under RAN1’s discussion, [1] proposes to check with RAN1 on the final conclusion of BP’s support to proceed with the RRC spec change.

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| 1. Send LS to RAN1 asking whether backword propagation is supported or not.
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In [3], company thinks that supporting BP is beneficial for reducing the access latency if epoch time is a future time. Therefore, company proposes that RAN2 agrees to support BP and informs RAN1 of this agreement.

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| [Proposal 1 The UE should consider assistance information valid as soon as it is received.](#_Toc115429520)[Proposal 2 Consider the text proposals below for 38.331:](#_Toc115429521)[Proposal 3 Send an LS to RAN1 to inform them of the agreement that the UE should consider assistance information valid as soon as it is received. Due to parallel RAN1/RAN2 meetings, the LS should be sent as soon as possible during the RAN2 meeting.](#_Toc115429522) |

Please note that, the validity issue was discussed in the last RAN2#119e meeting and RAN2 agrees to wait for RAN1 to conclude regarding when ephemeris/common TA is considered as valid.

At this stage, rapporteur would like to leave out the RRC text proposals and first check companies’ views on the content of LS as both companies in [1] and [3] suggest sending LS to RAN1.

**Question 1: Which proposal do companies agree to for the LS to be sent to RAN1?**

* **Option 1: Send LS to RAN1 asking whether backword propagation is supported or not (in R2-2210092).**
* **Option 2: Send LS to RAN1 to inform them of the agreement that the UE should consider assistance information valid as soon as it is received (in R2-2210760).**

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| **Company** | **Option ½?** | **Additional comments** |
| Nokia | Option 2 is better | We think it would be RAN2 role to agree that backwards propagation of the timer is beneficial (use case: epoch time in the future while the current validity info expires) and ask RAN1 to work on the corresponding changes. Otherwise, RAN1 may say there was no such need identified, so they cannot progress. |
| MediaTek | Option 1 | As RAN2 has already agreed to wait for RAN1 to conclude regarding when ephemeris/common TA is considered as valid, it is better to send an LS to RAN1 asking if backward propagation is supported.  |
| OPPO | Option 1 | BP’s feasibility issue, e.g. accuracy, BP’s duration, etc. is totally under RAN1’s scope. Therefore, RAN2 cannot make any decision on the support of BP. We should only ask for RAN1’s decision. |
| ITRI | Option 1 | Since BP issue is under RAN1 discussion and RAN2 agreed to wait for RAN1 input, sending an LS to RAN1 is feasible. |
| Xiaomi | Option 1 | For option 2: The minimum validity duration is 5 seconds, the maximum epoch time is 10.24 seconds. It means that, when UE applying backward propagation, the earliest validity time of the new SIB19 is 5 seconds after UE receiving the SIB19. Besides, the error for backward propagation may not be the same as forward propagation, as UE predicts more accurately based on history satellite information. Then, the question is: how can gNB ensure that the error by applying the new SIB19 when receiving it is below the allowed threshold.Even gNB can ensure it. As UE performs backward propagation, the error accumulates. There is a point that, before the point, using old SIB19 has less error, after the point, using new SIB19 has less error. Then it would be better to left to UE implementation to decide when to applying new SIB19.But we are ok to let RAN1 to decide on this since it is RAN1’s area. |
| Intel | Option 1 |  |
| Qualcomm | None | RAN1 themselves is discussing and no conclusion have been made. That means RAN1 do not see the need for backward propagation. There is no need for the LS.[OPPO]: We fully understand QC’s above observation. Since QC also thinks no conclusion has been made so far in RAN1, it is not acceptable that RAN2 is kept in waiting for RAN1’s formal agreement. Procedure-wise, it is reasonable to check with RAN1 on the final conclusion at this meeting otherwise RRC spec will be risky for big change in future. |
| Vivo | No LS to RAN1; RAN2 decide. | We think the LS is not needed since assistance information related description/procedure is in RRC Spec, RAN1 can know the agreement by reviewing RRC Spec, if RAN2 concludes this issue. Furthermore, in [AT119bis-e][113][NR-NTN], the same issue was discussed, we think RAN2 can decide when ephemeris/common TA is considered as valid by itself, the UE should consider assistance information valid as soon as it is received and the existing procedure of reception of SIB19 and T430 expiry does not need to be modified. Some companies commented in the last meeting that RAN1 were discussing this issue, but finally there was no RAN1 agreement there at all. The current situation seems that RAN1 guys realized this issue but had no strong desire to solve it. Since companies in RAN2 showed feasible solutions in their contributions, to avoid further LS correspondence RTT and considering the quite late stage of Rel-17, we think RAN2 should/need conclude it ASAP.  |
| Lenovo | Option 1 | The issue is in RAN1 scope. |
| CMCC | Option 1 with comments | RAN2 has agreed to wait for RAN1 to conclude regarding when ephemeris/common TA is considered as valid in last meeting. Therefore, it is better to send LS to RAN1 to request inputs about BP. And we could inform RAN1 about RAN2 preference, e.g.assistance information valid as soon as possible is beneficial. |
| Huawei, HiSilicon | Option 2, or no LS | We agree with Nokia/vivo that RAN1 is not motivated to solve the issue, and RAN2 can try to decide. |
| Samsung | Option 1 with comment  | Seems LS is necessary to formally ask RAN1 and get reply, but we should not wait for RAN1’s reply to solve the issue since we all know RAN1 has made no conclusion. Option 2 implies an agreement which has not been made yet.At the same time, we think RAN2 should try to make progress and inform RAN1 in the LS if any RAN2 progress.  |
| CATT | Option 1 | RAN2 cannot make decision for RAN1, but we can illustrate the demand from RAN2 in the LS. |
| Apple | Option 2? | To speed up the progress, RAN2 can make the assumption first and let RAN1 further confirm.  |
| Ericsson | Option 2 | We cannot expect that RAN1 understands and resolves the RAN2 issues.As RAN1 have decide that explicit epoch time can only be indicated in the future (up to 10.24 s into the future) and implicit epoch time at the end of SI window which will be in the future (up to 1.28 s) – this has strong RAN2 related implications:1. Initial access delay will increase while the UE waits to reach the epoch time
2. Handover delay for the cases where the UE needs to acquire SIB19 of the target will increase
3. RRC reestablishment delay for the cases where the UE needs to acquire SIB19 of the target will increase
4. UE power consumption is higher as the UEs can not utilize the time before the epoch time which means a higher reacquisition rate
	1. As NW will need to provide epoch times short into the future to mitigate 1 to 3, the total time each assistance information is valid will be lower

This will affect the following KPIs, see 28.554:* Registration success rate
* PDU session establishment success rate
* PDU session establishment time
* NG-RAN handover success rate
* Mean time of inter-gNB handover execution
* Success rate of mobility registration update
* NG-RAN handover success rate for all handover types
* DRB Retainability

Therefore, this need to be discussed by RAN2. There is nothing in RAN1 spec today that prohibit backwards propagation. RAN1 discussed BW propagation, and could not conclude that it is not supported nor that it is supported. |
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For option 1, company has provided a draft LS in [2] and included questions to be checked with RAN1.

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| **1. Overall Description:**RAN2 has discussed the RRC-MAC interaction issue regarding when RRC informs MAC that UL synchronization is obtained and RAN2 believes that this is related to RAN1’s decision on whether backward propagation of ephemeris and common TA is supported or not. Therefore, RAN2 would like to ask following questions to RAN1:Question 1:Will RAN1 support the backward propagation of ephemeris and common TA in Rel-17 NR NTN?Question 2:If supported, how long before the Epoch time can be supported for the backward propagation?**2. Actions:****To** **RAN1****ACTION:** RAN2 respectively requests RAN1 to provide answers to the above questions. |

**Question 2: If option 1 is preferred, do companies agree to the above questions to be checked with RAN1? Companies can comment if you have different views.**

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| **Company** | **Agree/disagree** | **Additional comments** |
| MediaTek | Agree |  |
| OPPO | Agree |  |
| ITRI | Agree |  |
| Xiaomi | Partially agree | We should also ask if backward propagation is supported, it is by UE implementation to do it or by network configuration. |
| Intel | Agree |  |
| Qualcomm | Disagree | Backward propagation is not supported as per RAN1 discussion so far. |
| vivo | Prefer no LS |  |
| Lenovo | Agree |  |
| CMCC | Agree with comments | In addition, We could also inform RAN1 about RAN2 preference, e.g.assistance information valid as soon as possible is beneficial. |
| Samsung | Agree with comments | Agree with Xiaomi  |
| CATT | Partially agree | Similar view with CMCC. |

**Question 3: If option 2 is preferred, do companies agree that RAN2 just informs RAN1 of the agreement that the UE should consider assistance information valid as soon as it is received? Companies can comment if you have different views.**

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| **Company** | **Agree/disagree** | **Additional comments** |
| Nokia | Agree, but | As we have suggested in our answer to Q1, we shall indicate the need and describe the scenario. Please note this does not necessarily mean that assistance information shall be always applied directly from the moment of reception.  |
| vivo | Prefer no LS |  |
| CMCC | Agree with comments | In addition, We could also inform RAN1 about RAN2 preference, e.g.assistance information valid as soon as possible is beneficial. |
| Huawei, HiSilicon | Agree with comments | RAN2 can inform RAN1 that we consider it feasible to use the SIB19 upon acquisition, even if epoch time points to a future frame. |
| Apple | Agree with comments | Agree with Huawei and Nokia, we should indicate the scenario in the LS.  |
| Ericsson | Agree | Share same view as Nokia |
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# 4. Summary and Proposals

To be updated…

# 5. References

1. R2-2210092 Discussion on validity issue of satellite assistance information OPPO
2. R2-2210093 DRAFT LS on the support of backward propagation in NTN OPPO LS out Rel-17 NR\_NTN\_solutions-Core To:RAN1
3. R2-2210760 R17 NR NTN epoch time and validity Ericsson