3GPP TSG-RAN WG2 Meeting #117 Electronic R2-2204031

Elbonia, February 2022

**Agenda item:**

**Source: Ericsson**

**Title: [AT117-e][101][NTN] RRC open issues (Ericsson)**

**WID/SID: NR\_NTN\_solutions\_Core**

**Document for: Discussion and Decision**

# Introduction

**[AT117-e][101][NTN] RRC open issues (Ericsson)**

Final scope:

1.     Continue the discussion on remaining RRC open issues and FFS (including the 2 from UP discussion - offline 103)

2.     Update the RRC CR

Final intended outcome: Summary of the offline discussion with list of proposals and updated RRC CR

Deadline (for companies' feedback): Wednesday 2022-03-02 2000 UTC

Deadline (for rapporteur's summary in R2-2204031): Thursday 2022-03-03 0500 UTC

Deadline (for RRC CR in R2-2203549): Thursday 2022-03-03 1000 UTC

Status: Ongoing

RAN2 agreements from first round

Agreements:

1. use CommonLocationInfo from 38.331 for NTN location reporting
2. The ellipsoid-Point IE specified in TS 36.331, TS 37.355 (and TS 23.032) is reused for definitions of reference locations in NR NTN. FFS if ellipsoidPointWithAltitude-r10
3. RAN2 to agree for value range for parameter distanceThresFromReferencex-r17 “Option 2 X bits to cover (0, z km) with linear granularity”.
4. RAN2 to adopt for HysteresisLocation-r17 ”INTEGER (0..32768)” with a granularity of 10 meters, i.e. the actual value is the field value \* 10 meters.
5. Configure a parameter OffsetThresholdTA in IE MAC-CellGroupConfig. FFS name of parameter
6. RAN2 to adopt as values for sr-ProhibitTimerExt-r17: {ms192, ms256, ms320, ms384, ms448, ms512, ms576, ms640}. FFS to add 2xRTT, 2x542 ms.
7. RRC processing delay is not impacted
8. The HARQ-feedbackEnablingforSPSactive-r17 is per BWP.
9. RAN2 should wait RAN1 response before progressing on discussing SIB1 NTN specific content.
10. Current SIBxx serving cell content can be adopted as baseline and RAN2 should wait RAN1 response before progressing on discussing further SIBxx NTN specific content.
11. At least neighbour cell Ephemeris information shall be broadcast. FFS on other information about neighbour cells
12. ntnUlSyncValidityDuration applies both to connected mode and idle mode

RAN2 agreements from second round

**Agreements via email - from offline 101 - second round:**

1.     The ellipsoid-Point IE specified in TS 36.331, TS 37.355 (and TS 23.032) is reused for definitions of reference locations in NR NTN.

2.     The following for entering and leaving conditions are agreed:

      Inequality D1-1 (Entering condition 1)

      Ml1-Hys>Thresh1

      Inequality D1-2 (Entering condition 2)

      Ml2+Hys>Thresh2

      1>     consider the leaving condition for this event to be satisfied when condition D1-3 or D1-4 is fulfilled;

      Inequality D1-3 (Leaving condition 1)

      Ml1+Hys<Thresh1

      Inequality D1-4 (Leaving condition 2)

      Ml2-Hys>Thresh2

3.     Largest value for OffsetThresholdTA should not be larger than 16 ms. FFS Include values smaller than 1ms

4.     DiscardTimerExt2 has value 2000ms and 2-3 spare values

5.     Values for sr-ProhibitTimerExt-r17: {ms192, ms256, ms320, ms384, ms448, ms512, ms576, ms640, ms1082}.

6.     Introduce the RLC t-ReassemblyExt field with values {ms210, ms220, ms340, ms350, ms550, ms1100, ms1650, ms2200}.

7.   Introduce an OPTIONAL field configuredGrantTimer-r17 with 8 bits representing values 66, 68, …, 574, 576.

8.   Add “The network does not configure the configuredGrantTimer-r17 simultaneously with configuredGrantTimer (without suffix).” to the field description of configuredGrantTimer.

9.   Capture the following: For SIBxx field description for ephemeris and common TA:

      “This field is excluded when determining changes in system information, i.e. changes of XXX should neither result in system information change notifications nor in a modification of valueTag in SIB1.”

[R2-2203565](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2203565%20%5BAT117-e%5D%5B101%5D%5BNTN%5D%20RRC%20open%20issues%20%28Ericsson%29_phase3_conclusions.docx)    [offline-101] RRC open issues - third round            Ericsson           discussion        Rel-17   NR\_NTN\_solutions-Core

List of proposals for agreement

Proposal 1 remove FFS from field description condExecutionCond and revise the added sentence as below.

If network configures condEventD1 or condEventT1 for a candidate cell network shall configure a second triggering event  condEventA3, condEventA4 or condEventA5.

**  Agreed**

Proposal 2 Z = 3000 km, X = 16 bits if integer with linear granularity

**  Agreed**

Proposal 3 Range for OffsetThresholdTA is 0.5ms to 15ms

**  Agreed, adding spare bits**

New open item:

For the agreement “The ntnUlSyncValidityDuration applies to the whole SIBX”, one issue is that: since the start time of ntnUlSyncValidityDuration is indicated by epochTime, does it means that epochTime is also applied to the whole SIBX? In current running CR, in the field description of epochTime, it says that “ Indicate the epoch time for assistance information (i.e. Serving satellite ephemeris in IE ephemerisInfo and Common TA parameters)”, i.e. epochTime applies to only ephemerisInfo and Common TA. Then the question is what is the epoch time of other parameters?

-       QC is not sure there is an issue here.

**  Continue offline**

**Agreements via email - from offline 101 - third round:**

1.     remove FFS from field description condExecutionCond and revise the added sentence as: "If network configures condEventD1 or condEventT1 for a candidate cell network shall configure a second triggering event  condEventA3, condEventA4 or condEventA5."

2.     Z = 3000 km, X = 16 bits if integer with linear granularity

3.     Range for OffsetThresholdTA is 0.5ms to 15ms, with spare bits

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Helka-Liina Määttänen | Helka-liina.maattanen@ericsson.com |
| CATT | Xiangdong Zhang | zhangxiangdong@catt.cn |
| ASUSTeK | Erica Huang | Erica\_Huang@asus.com |
| Samsung | Shiyang Leng | shiyang.leng@samsung.com |
| vivo | Xiao XIAO | xiao.xiao@vivo.com |
| Xiaomi | Xiaowei jiang | jiangxiaowei@xiaomi.com |
| Huawei, HiSilicon | Lili Zheng | zhenglili4@huawei.com |
| Apple | Pavan Nuggehalli | pnuggehalli@apple.com |
| Lenovo | Min Xu | xumin13@lenovo |
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# 3 System information

During phase 3, the below issues have been raised:

For the agreement “The ntnUlSyncValidityDuration applies to the whole SIBX”, one issue is that: since the start time of ntnUlSyncValidityDuration is indicated by epochTime, does it means that epochTime is also applied to the whole SIBX?

In current running CR, in the field description of epochTime, it says that “ Indicate the epoch time for assistance information (i.e. Serving satellite ephemeris in IE ephemerisInfo and Common TA parameters)”, i.e. epochTime applies to only ephemeris Info and Common TA. Then the question is what is the epoch time of other parameters?

**Q1: Please give your view whether Epoch time applies to the whole SIBxx as RAN2 agreed that ntnUlSyncValidityDuration is applied to the whole SIBxx and Epoch time should mark the start time of ntnUlSyncValidityDuration?**

|  |  |  |
| --- | --- | --- |
| Company | Yes / no | Comments |
| ASUSTeK |  | We think the text (as in Q5) of 5.x.x.x is sufficient. |
| Qualcomm | In fact No | It is no because the SIBxx also contains other parameters that require SI change notification to get updated.Epoch time applies to only ephemeris and common TA parameters. Since the validity timer is started after updating the ephemeris, it is obvious the ntnUlSyncValidityDuration should start at the epoch time.However, the other parameters should be updated as any other parameters in other SIBs, i.e., first send notification of SI change and those parameters will be updated in the SIBxx that is scheduled at or after the beginning of the next modification boundary.The SI modification period can be way smaller than the ntnUlSyncValidityDuration. |
| Samsung | No | So far we have agreed t-Service and cell reference location in SIBx, neither needs epoch time.  |
| vivo | No | According to RAN1’s agreement, ntnUlSyncValidityDuration and epoch time is for serving satellite ephemeris and common TA instead of other parameters. Besides, ntnUlSyncValidityDuration and epoch time is mainly used for UL sync. So we think ntnUlSyncValidityDuration and epoch time don’t need to apply to the whole SIBxx. |
| Xiaomi | No | There might be issue for parameters other than ephemeris and common TA to apply the epoch time and validity duration mechanism. This is because that network may not be able to know the currently applied values. It will cause problem when UE initiates RACH. For example, for Koffset, If UE updates Koffset based on epoch time and validity duration. As network may not know when the validity timer will be outdated, network doesn’t know which broadcast Koffset is applied by UE. If UE initiates RACH, network doesn’t know which parameter should apply. Thus, we think epoch time and validity duration is not applied to parameters other than ephemeris and common TA. The change of these parameters is controlled by SI change indication. So, when UE receives SIBx, UE will applies parameters other than ephemeris and common TA immediately, but will apply ephemeris and common TA when epoch time arrives if epoch time indicates a future time. |
| Huawei, HiSilicon | No | Similar view as Samsung, parameters that will not change with time does not require epoch time. |
| Apple | No | But then we wonder whether ntnUlSyncValidityDuration needs to apply to the whole SIB or just the ephemeris and common TA parameters. For parameter that do not use epoch time, ntnUlSyncValidityDuration seems meaningless. |
| CATT | See comments | For simply, the Epoch time and ntnUlSyncValidityDuration can be applied to the whole SIBX, and the update of the SIBX should base on the Epoch time and ntnUlSyncValidityDuration, which does not affect the value tag and does not trigger SI modification procedure. This way can make it simply for NW implementation. If the echo time is only applied to the ephemerisInfo and Common TA parameters, the update of the SIBX should base on two mechanisms.* For the update of ephemerisInfo and Common TA parameters, UE and NW should base on the Epoch time and ntnUlSyncValidityDuration. NW need to update the ephemerisInfo and Common TA parameters upon the time of T(Epoch time + ntnUlSyncValidityDuration), and UE reacquire the updated SIBX after the time of T(Epoch time + ntnUlSyncValidityDuration).
* For the update of other parameters, paging mechanism and SI modification period should be used.

This way may bring complexity for NW implementation.Anyway both of the 2 options can work. |
| Lenovo | No |  |
| Nokia | No | Epoch time should only apply to the very dynamic parameters such as serving satellite ephemeris and Common TA related parameters. As pointed out by Qualcomm the ntnUlSyncValidityDuration should only start at the Epoch time. |
| Ericsson |  | We think the original agreement was confusing. Epoch time and nonUlSyncValidityDuration only has a meaning with the ephemeris and common TA. Starting the uplink sync validity timer is triggered by reading the SIBxx, but it is started as indicated by the epochtime.  |
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**Q2: If yes, Epoch time applies to the whole SIBxx,and the follow up question is: should the description of Epoch time be changed?**

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| Company | Value for z and corresponding description | Comments |
| CATT | Yes, it is applied to the whole SIBX. |  |
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**Q3: If no, Epoch time applies only to Ephemeris and common TA parameters, the follow up question is: When is ntnUlSyncValidityDuration started?**

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| Company | Answer | Comments |
| Qualcomm | At epoch time | Since the validity timer is started after updating the ephemeris, it is obvious the ntnUlSyncValidityDuration should start at the epoch time. |
| Samsung | At epoch time | This has been discussed in RAN1-107e and reached an agreement that “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)”. We can confirm this. |
| vivo | AT the subframe (explicitly or implicitly) indicated by *epochTime*  |  |
| Xiaomi | At epoch time |  |
| Huawei, HiSilicon | At epoch time |  |
| Apple | At epoch time |  |
| CATT | At epoch time | The epoch time is the starting time of the validity of the SIBx, epoch time+ntnUlSyncValidityDuration should be the boundary time when the NW will broadcast the updated Ephemeris and common TA parameters |
| Lenovo | At epoch time |  |
| Nokia | At epoch time |  |
| Ericsson |  As indicated by the parameter epoch time |  |
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# 4 Uplink synchronization

## 4.1 Uplink synchronization failure

In the online discussion the problem of uplink synchronization timer was discussed (*ntnUlSyncValidityDuration*) and since it was agreed that this action is to be modelled in RRC, the discussion will take place here.

It has so far been agreed that the UE shall try to re-acquire SIBxx before the end of the of expiry of the timer and that upon validity timer expiry the UE shall suspend uplink transmissions and re-acquire SI:

* **8.     Upon validity timer expiry, UE shall suspend uplink transmission and re-acquire SI (FFS whether or not UE needs to flush HARQ buffer)**
* **Agreed as: "The following NOTE is captured: “UE should attempt to re-aquire SIBxx prior to validity timer expiry by UE implementation.”**

Three issues were discussed which are 1) whether the UE needs to perform RACH after having re-gained uplink sync, 2) whether the UE shall flush its HARQ buffers, 3) performing RACH after having regained synch and 4) whether RLF shall be performed.

There are thus four options (some of them non-exclusive) possible:

1. **No other action**. This means that the UE suspends uplink transmissions and re-acquires the SI with no further limit on the duration that the UE can attempt to re-acquire the SIBxx. This may also assume that other RLF conditions may handle the failure cases.
2. **Flush HARQ buffer.** The reasoning here is to avoid HARQ state mismatch, i.e what behaviour that the network can expect from the UE after the UE have regained sync, whether NDI=0 or NDI=1 is scheduled for a HARQ process.
3. **Release all resource configurations**. The reason here is to mimic the behaviour of the timeAlignmentTimer, where upon expiry the UE releases all the uplink and downlink resources to ensure that nothing is transmitted when the UE is out of synch.
4. **Performing RACH.** Once again the understanding is to mimic the behaviour of the timeAlignmentTimer, where the UE has to perform RACH in order to re-synchronize.
5. **Radio Link Failure.** The motivation of this is that since the UE is expected to re-acquire SIBxx, the expiry of the uplink sync validity timer should be a relatively rare phenomena that should give away that there are some serious issue with the UE, thus the UE triggering RLF is considered to be the correct action.

In the e-mail discussion there support for the options above where A: 3, B: 2, C: 3, D: 3, and 8 for nothing further being needed.

**Q4: Please state the needed action beyond the currently agreed:**

1. **No other action**
2. **Flush HARQ buffer**
3. **Release all resource configurations**
4. **Performing RACH**
5. **Radio Link Failure**
6. **Other action upon expiry**

Rapporteur notes that given that the outcome of the e-mail discussion was option A, there would need to be strong reasons for any action other than A.

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| Company | Supported actions  | Comments |
| ASUSTeK | A | We think that the validity timer indicates the time when to update the SIB and other actions are not needed upon validity timer expiry. |
| Qualcomm | A + E | There is no need to take any action until a certain duration. This can be same as triggering RLF timer T310.This is probably a temporary interruption for which MAC has to take no action.But if it turns out to be a large interruption, there is some problem, and the UE should follow RLF procedure.For B, we are not sure. With option B, is there guarantee there will be no HARQ state mismatch as network would not know the UE flushed the HARQ buffer? Anyway RLC is there for recovery.[Xiaomi] If network doesn’t receive UL transmission corresponding to UL grant after validity timer expiry, network will know that UE may suffer from UL unsync. We think that network knows the timing of validity timer expiry, only doesn’t know whether UE can acquire the new SIBx before timer expiry. |
| Samsung | A | We think UE can quickly resume operation if UE can reacquire SI successfully so no need to flush HARQ buffer nor release resources, otherwise if UE fails to reacquire SI or out-of-sync for long, TAT would expire or RLF would be triggered as legacy. RACH is triggered for re-sync when there is a need for DL/UL data (i.e. as legacy when UE lost UL sync). RLF is controlled by N310 T310 as legacy if UE has radio link issue to acquire or reacquire SI, it’s possible T310 is already running at validity timer expiry so no need to take other actions.[Xiaomi] In general, UE in average require periodicity/2 to acquire a SIB. It is a long time. Then it would be more beneficial to flush HARQ buffer. |
| vivo | B | In our understanding, when the validity timer expires, there may be MAC PDU carrying MAC CE in HARQ buffer. To avoid UE reporting the outdated MAC CE to NW after the UL sync recovers later, UE needs to flush HARQ buffer upon validity timer expiry. However, at this stage, we’re fine to follow the majority’s view. |
| Xiaomi | At least B, we are also ok with C, D | If HARQ buffer is not flushed, when UE comes back after acquiring SIBx, it may miss many UL grants, leading to the NDI status at UE and network side different. Then network would have difficulty to schedule new UL transmission. By flushing HARQ buffer, network can ensure that new transmission is performed at UE when UE receives UL grant after coming back. This is different from out-of-sync, where UE may only experience out-of-sync very shortly, no need to flush the HARQ. Here, UE has already not be able to acquire SIBx before timer expiry, so will probably spend a lot of time to acquire the SIBx, it is then more beneficial to flush HARQ buffer. |
| Huawei, HiSilicon | A | The validity timer is used to control some RRC parameters. When the timer expires, it simply means the acquired parameters are outdated. Any other action can be triggered by legacy mechanism. |
| Apple | A | We note that this is a rare event, so need to super-optimize. |
| CATT | A | Since the UE will re-acquire SIB immediately after validity timer expiry, no other action should be introduced. We want to clarify that the expiry *ntnUlSyncValidityDuration* should be the boundary of NW broadcast updated SIBX, it triggers NW to broadcast updated SIBX and triggers UE to acquire updated SIBX. In order to avoid the problem of no valid Ephemeris and common TA used for UE before UE require the updated SIBX after the expiry of *ntnUlSyncValidityDuration*. We can decouple the valid of the SIBX and the boundary time of SIBX updated. One option is that, the valid of the Ephemeris and common TA is indicated by the epoch time only, i.e. the epoch time(n) in SIBX(version n) indicate that the SIBX (n) is valid from the epoch time(n), and from the time of epoch time(n) +*ntnUlSyncValidityDuration*(n), NW will broadcast SIBX(version n+1), and after UE acquire the SIBX(n+1), the epoch time(n+1) in SIBX(n+1) indicate that the SIBX (n+1) is valid from the epoch time(n+1), before the time of epoch time(n+1), the SIBX(n) is valid. epoch time(n+1) should be late than the time of epoch time(n) +*ntnUlSyncValidityDuration*(n).The gap between the valid time and the boundary of update SIBX can make it possible for UE to acquire new SIBX before the old SIBX invalid. |
| ZTE | A | Since UE can attempt to reacquire SIB while still kept in RRC\_CONNECTED state in NR, thus it is not common UE will be in out of sync for a very long time, and anyway we will have legacy mechanism to trigger RLF or RACH. And for the TA jump issues caused due to combined open and close loop TA adjustment, RAN1 has sent the LS asking RAN4 if they can handle this. And RAN4 has reply in R1-2200870 (R4-2120417) that this issue can be addressed by them properly and they are discussing possible solutions. Therefore to avoid duplicated discussion we can trust RAN4 on their solution, if there will be any further action need to be done in RAN2 it can be triggered by RAN4 by LS. |
| Lenovo | A |  |
| Nokia | At least D, we can accept B,C. | Upon validity timer expiry, UE’s action for the scenario where UE read the new SIBXX successfully before RLF should be discussed. We think a RACH should be triggered for TA alignment and informing gNB that UE is in a state where it may be able to operate with UL sync. The reason behind is that, there is a TA jump issue after UE re-acquire the SIBXX for UL TA estimation. The TA jump issue may happen when UE all of a sudden (e.g. after timer expiry and re-acquire new SI after a while) corrects Common TA parameters and satellite's position to re-evaluate feeder link and service link delays. After UE applies the TA based on new estimations, there will be a jump in transmit time. However, the UE is at the same time still applying old accumulated TA commands. If the TA jump is large enough (e.g. up to 1us), then UE may not send PUCCH/PUSCH directly since it cannot ensure that UE’s signal arrival to gNB at the right time and within the cyclic prefix. Instead a RACH is needed for TA adjustment by NW (via RAR and following TAC MAC CE).In our understanding, though RAN4 has discussed UL time synchronization requirements, but they did not address the TA jump issue but left it to RAN1/RAN2. To properly address the TA jump issue, we think a RACH is needed.For whether UE should flush HARQ buffer or release UL resource, it is a separate issue. We are open for the solution but slightly prefer to keep it simple to just follow TAT timer expiry handling (i.e. flush buffer and release resource) to have less specification impact. |
| Ericsson | A (+ E) | Our preference would be E as this should really not happen that often and if it does then UE should do something to recover, which we usually use RLF for. But to progress we are fine with A.  |
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Another discussion was related to how to clarify in the specification of how the UE shall re-acquire the SIBxx before validity timer:

**  Agreed as: "The following NOTE is captured: “UE should attempt to re-aquire SIBxx prior to validity timer expiry by UE implementation.” Details of NOTE (potentially including additional clarification if needed) may be finalized in Stage 3. FFS whether this is captured in MAC specification (e.g. Section 5.2), RRC specification (e.g. Section 5.2.2.x), or Stage 2"**

We propose that the above is captured in RRC as a note when the timer is started as it is rapporeur’s understanding that it will not be specified exactly when acquiring the SIBxx should be performed. An example text in RRC CR that showcases how the validity duration is started as well as the note to capture the agreement above can be as follows:

#### 5.x.x.x Actions upon reception of *SystemInformationBlockTypeXX*

Upon receiving *SystemInformationBlockTypeXX* (*SystemInformationBlockTypeXX*), the UE shall:

1> instruct the lower layers to start or restart *TXXX* with the duration *ntnUlSyncValidityDuration* from the subframe indicated by *epochTime*;

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

**Q5: Please indicate whether the note is sufficient to satisfy the agreement**

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| --- | --- | --- |
| Company | Yes/No  | Comments |
| ASUSTeK | Yes |  |
| Qualcomm | Yes | Because it says “by UE implementation”. |
| Samsung | Yes |  |
| vivo | Yes |  |
| Xiaomi | No | The UL sync timer should be maintained in RRC instead of MAC.Besides, we think the note should be captured in 5.2.2.3 Acquisition of System Information. And we should clearly define the meaning of epochTime to cover both explicit indication and implicit indication. |
| Huawei, HiSilicon | Yes |  |
| Apple | Yes |  |
| CATT | See comment | Same comment as Q4, we have some concern that the UE has to re-acquire SIBxx blindly which is harmful for UE power saving, if the UE has no information when the network will broadcast the updated SIBxx.We want to clarify that the expiry *ntnUlSyncValidityDuration* should be the boundary of NW broadcast updated SIBX, it triggers NW to broadcast updated SIBX and triggers UE to acquire updated SIBX. In order to avoid the problem of no valid Ephemeris and common TA used for UE before UE require the updated SIBX after the expiry of *ntnUlSyncValidityDuration*. We can decouple the valid of the SIBX and the boundary time of SIBX updated. One option is that, the valid of the Ephemeris and common TA is indicated by the epoch time only, i.e. the epoch time(n) in SIBX(version n) indicate that the SIBX (n) is valid from the epoch time(n), and from the time of epoch time(n) +*ntnUlSyncValidityDuration*(n), NW will broadcast SIBX(version n+1), and after UE acquire the SIBX(n+1), the epoch time(n+1) in SIBX(n+1) indicate that the SIBX (n+1) is valid from the epoch time(n+1), before the time of epoch time(n+1), the SIBX(n) is valid. epoch time(n+1) should late than the time of epoch time(n) +*ntnUlSyncValidityDuration*(n).The gap between the valid time and the boundary of update SIBX can make it possible for UE to acquire new SIBX before the old SIBX invalid. |
| Lenovo | Yes |  |
| Nokia | Yes |  |
| Ericsson | Yes | We think that this is the correct way to capture the timer. We do not have the same understanding as CATT as right now, the network cannot be sure when the UE has acquired SIBxx, so there should not be any requirements on the network. And the UE acquiring the SIBxx by UE implementation is the way that we have already gone with. If there is a requirement on the network that it should signal this, then what would be the purpose of the timer in the first place?We understand that the network would have to broadcast the SIBxx sufficiently often given the ntnUlSyncValidityDuration, but it is still up to network.  |

# 5 RRC CR review

**RRC CR is updated after Tue W2, please review. (this is the stage-3 discussion)**

**Q4: Please review the RRC CR for NTN and give any needed corrections if any**

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| --- | --- |
| Company | Answer |
| ASUSTeK | It has been agreed in RAN2#112 that: “The Location-based measurement event, in combination with the existing measurement event in NR, should be supported in NTN for both moving cell and fixed cell scenarios.” However, current reportConfig cannot be configured with multiple measurement events. The measurement report triggering with combination of location and radio event should also be captured in procedural text of section 5.5.4.1. |
| Qualcomm | We can provide further comments later. But some quick comments.sr-ProhibitTimerExt-r17 has 9 values so we can add spare values.We don’t get it why these are versions. As they are not configured together with legacy values, they can be “r17”.harq-ProcID-Offset-v17 INTEGER (16..31) OPTIONAL, -- Need M harq-ProcID-Offset2-v17xy INTEGER (16..31) OPTIONAL, -- Need M configuredGrantTimer-v17xy  |
| Xiaomi | 1. For idle/inactive UE, UE should always ensure having a valid version of SIBx (due to SI change indication or validity timer expiry). This is because UE needs SIBx for cell reselection. Thus, we need to capture this requirement in 5.2.2.1 as follow:

|  |
| --- |
| 1. 5.2.2.1 General UE requirements

**Figure 5.2.2.1-1: System information acquisition**The UE applies the SI acquisition procedure to acquire the AS, NAS- and positioning assistance data information. The procedure applies to UEs in RRC\_IDLE, in RRC\_INACTIVE and in RRC\_CONNECTED.The UE in RRC\_IDLE and RRC\_INACTIVE shall ensure having a valid version of (at least) the *MIB*, *SIB1* through *SIB4,* *SIB5* (if the UE supports E-UTRA), *SIB11* (if the UE is configured for idle/inactive measurements), *SIB12* (if UE is capable of NR sidelink communication and is configured by upper layers to receive or transmit NR sidelink communication), and *SIB13*, *SIB14* (if UE is capable of V2X sidelink communication and is configured by upper layers to receive or transmit V2X sidelink communication), *SIBx* (if UE is accessing NR via satellite access). |

2. In 5.2.2.2.2 SI change indication and PWS notification: “and satellite ephemeris” should be modified to include “TA common”.3. Naming issue: e.g. “tainfo-r17” should be “ta-Info-r17”, “ntnPolarizationDL-r17” should be “ntn-PolarizationDL-r17”4. ***ta-Report: “***Indicates whether UE specific TA reporting is enabled ta-Report” is modified to “Indicates whether UE specific TA reporting is enabled during initial access(see TS 38.321 [3], clause x.x.x).”5. ***offsetThresholdTA ：“***Offset for UE-specifc TA reporting as specified in TS 38.321.”=> “Offset for TA reporting as specified in TS 38.321.”***6. uplinkHARQ-mode: ”***Used to set the DRX-LCP mode per HARQ process ID,”=>” Used to set the HARQ mode per HARQ process ID,”***7.* It is unclear whether UE stops UL validity timer or suspend the timer if UE acquires the new SIBx before timer expiry, and whether UE applies the parameter immediately or until epoch time.** |
| Xiaomi | 1. In 5.5.5.1, the UE location reporting is captured as following. Does it mean the UE should report its location when eventD1 is configured even if *includeCommonLocationInfo* is not configured? 1> if *reportConfig* associated with the *measId* that triggered the measurement reporting is set to *eventTriggered* and *eventID* is set to *eventD1*:2> set the content of *commonLocationInfo* of the *locationInfo* as follows:3> include the locationTimestamp;3> include the locationCoordinate, if available;3> include the velocityEstimate, if available;3> include the locationError, if available;3> include the locationSource, if available;In RAN2#115e, we made agreements as follows:1. After AS security is established, gNB can obtain a GNSS-based location information from the UE using existing signalling method, i.e., by configuring includeCommonLocationInfo in the corresponding reportConfig. It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN. RAN2 discuss whether to send LS to SA3

So we think the includeCommonLocationInfo configuration is needed for enventD1 and the existing procedure in 5.5.5.1 as following already includes event D1, and the new added procedure is not needed.1> if the *includeCommonLocationInfo* is configured in the corresponding *reportConfig* for this *measId* and detailed location information that has not been reported is available, set the content of *commonLocationInfo* of the *locationInfo* as follows:2> include the *locationTimestamp*;2> include the *locationCoordinate*, if available;2> include the *velocityEstimate*, if available;2> include the *locationError*, if available;2> include the *locationSource*, if available;2> if available, include the *gnss-TOD-msec*,2.In 6.3.2, we are wondering why the NTN-Config is included in DownlinkConfigCommonSIB. In our understanding, the NTN-config is the SIBx not SIB1, so it should not be captured in DownlinkConfigCommonSIB. If the intention is for handover, it may be captured in DownlinkConfigCommon.DownlinkConfigCommonSIB ::= SEQUENCE { frequencyInfoDL FrequencyInfoDL-SIB, initialDownlinkBWP BWP-DownlinkCommon, bcch-Config BCCH-Config, pcch-Config PCCH-Config, ..., [[ ntn-Config-r17 NTN-Config-r17 OPTIONAL -- Need R ]] |
| Nokia | Will we have any one-week (or longer) post-meeting thread to review the CR? It is a bit cumbersome to do it properly until tomorrow morning…  |
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# 6 Conclusion

Annex agreements

List of RAN2 agreements that are foreseen as most relevant to this running CR.

RAN2#111

Agreements via email - from offline 107

1. From RAN2 perspective, an offset is applied to the start of ra-ResponseWindow in NTN for both LEO and GEO scenarios.
2. An offset to the start of the ra-ContentionResolutionTimer is introduced for both LEO and GEO scenarios.
3. Modification of drx-LongCycleStartOffset, drx-StartOffset, drx-ShortCycle, drx-ShortCycleTimer, drx-onDurationTimer, drx-SlotOffset and drx-InactivityTimer is not needed in Rel-17 NTN.
4. From a RAN2 perspective, for DL, HARQ feedback can be enabled/disabled in Rel-17 NTN, but HARQ processes remain configured. The criteria and decision to enable/disable HARQ feedback is under network control and is signalled to the UE via RRC in a semi-static manner. FFS for UL

Agreements via email - from offline 107:

1. At least the following methods to enhance UL scheduling are further studied in NTN: configured grant and BSR over 2-step RACH. **(other solutions to enhance UL scheduling are not precluded)**

Agreements:

1. The satellite ephemeris should be provided to UE, at least for Satellite/HAPS ephemeris based cell selection and reselection (FFS what the term satellite/HAPS ephemeris actually means).

Agreements via email - from offline 106:

1. The network type (i.e. TN or NTN) should be known to UE. FFS whether to achieve this in an implicit or explicit way.

RAN2#112

Agreements:

1. RAN2 working assumption (for RRC idle. FFS for Inactive/Connected): Rel-17 UE with pre-compensation capability obtains UE specific UE-gNB RTT based on its GNSS in LEO/GEO. FFS how this is calculated and what/if anything needs to be broadcasted for the different pre-compensation methods (e.g. common TA) to help the UE to obtain the full UE-gNB RTT.
2. If the UE-gNB RTT is pre-compensated, preamble ambiguity is not an issue in Rel-17 NTN (i.e. no enhancements are necessary). FFS how and by whom the possibly multiple components of UE-gNB RTT are pre-compensated
3. From RAN2 perspective, for UE with UE-specific pre-compensation as a baseline it is up to gNB implementation to ensure sufficient time on UE side for the Msg3 transmission.
4. For UE with pre-compensation capability (at least for the HARQ-feedback enabled case. FFS for HARQ-feedback disabled, if supported), drx-HARQ-RTT-TimerDL is offset by UE-specific RTT (UE-gNB delay) in LEO/GEO. FFS if offset is applied to: 1) the start of the timers or 2) the timer value range (i.e. existing values within value range increased by offset)

Agreement from Friday CB session:

1. From RAN2 perspective, for dynamic grant, one possibility for "enabling"/"disabling" HARQ uplink retransmission at UE transmitter is without introducing an additional mechanism (i.e. gNB can send grant with NDI not toggled/toggled without waiting for decoding result of previous PUSCH transmission). FFS on the handling of RTT timers. Other solutions for enabling/disabling HARQ UL reTX are not precluded

Agreements via email - offline 103:

1. If the start of the ra-ResponseWindow and msgB-ResponseWindow is accurately compensated by UE-gNB RTT, ra-ResponseWindow and msgB-ResponseWindow are not extended in LEO/GEO.
2. At least the following are FFS in Rel-17 NTN:
* Report UE-calculated TA in e.g. msg3/msg5/msgA
* Enhancements to RSRP-based selection mechanism of 2-step vs. 4-step RACH
* LCP impact caused by disabling HARQ UL retransmission

Agreements online:

1. RAN2 decision on starting ra-ContentionResolutionTimer, ra-ResponseWindow and msgB-ResponseWindow is postponed until further progress in RAN1 regarding UE pre-compensation method and TA estimation accuracy.

Agreements:

1. RLC t-Reassembly timer needs to be extended in NR-NTN.
2. There is no need to extend t-PollRetransmit Timer in NR-NTN.
3. There is no need to extend t-statusProhibit Timer in NR-NTN.
4. There is no need to extend RLC SN length in NR-NTN
5. There is no need to extend PDCP SN length in NR-NTN

Agreements:

1. Existing cell reselection principles are considered as baseline and that information about when a cell is going to stop serving the area and information about new upcoming cell can be further considered. In which form and how this is exactly implemented in the cell reselection principles is FFS.

Agreements

1. Reconfiguration with sync is the baseline for connected mode mobility in NTN (the use of legacy RLF and re-establishment mechanism are not excluded)
2. The CHO can be used in NTN for both moving cell and fixed cell scenarios, and the CHO procedure and execution condition defined in Rel-16 is the baseline for NTN CHO.

3. NTN specific CHO execution condition can be further discussed.

4. The existing measurement framework (e.g. measurement configuration, execution and reporting) is the baseline, and all the existing measurement criteria and event can be used in NTN. Support for new measurement is not excluded.

5. Legacy SSB periods (as in TN) shall be supported in NTN

Agreements via email - offline 105:

1. Time or timer based CHO triggering event, in combination with the existing R16 CHO measurement based event, should be introduced for both moving cell and fixed cell scenario. FFS on how to configure the time or timer based CHO triggering event. Also FFS how to consider the feeder/service link switch timing.
2. DAPS HO for NTN is de-prioritized in this release.
3. Location based CHO triggering event, in combination with the existing R16 CHO measurement based event, should be introduced for both moving cell and fixed cell scenario. FFS on how to configure the location based CHO triggering event. FFS if location based CHO triggering event only (not in combination with other events) can also be considered.
4. The Location-based measurement event, in combination with the existing measurement event in NR, should be supported in NTN for both moving cell and fixed cell scenarios. FFS on how to configure the location based measurement event.

Agreements via email - offline 106:

1. RAN2 understanding that UE shall not be forced to detect the SSB burst outside the corresponding configured SMTC window in NTN, just like the principle in TN.

Agreements:

1. SMTC and gap configuration in NTN are configured based on the timing of PCell
2. RAN2 can first identify the scenarios and discuss how serious the impact is before addressing any enhancement for SMTC configuration in NTN.
3. RAN2 can’t assume that the network will always have UE accurate location info for SMTC window configuration in NTN
4. UE along with the network in NTN should also have the same understanding of the timing, including the timing for measurement gap, to avoid any un-synchronized scheduling between UE and the network, just like the way we have in TN

RAN2#113

Agreements:

1. Both Type 1 and Type 2 configured grant are feasible in NTN.
2. From RAN2’s perspective, no need to modify parameter periodicity of IE ConfiguredGrantConfig to support NTN.
3. No need to modify maxNrofConfiguredGrantConfig-r16 and maxNrofConfiguredGrantConfigMAC-r16 to support NTN.
4. UE in NTN can have both 2-step RACH and configured grant configurations at the same time.

Agreements via email - from offline [103]:

1. For HARQ processes with DL HARQ feedback disabled, drx-HARQ-RTT-TimerDL is not started.
2. FFS: method(s) to support blind retransmission for HARQ processes with HARQ feedback disabled.

Agreements online:

1. From RAN2 perspective, for HARQ processes where gNB can sends UL grant without waiting for decoding result of previous PUSCH transmission, no new network scheduling restrictions are introduced to schedule subsequent grants (i.e. up to network implementation. (Can come back if we don't find an agreement on p8)
2. For HARQ processes with DL HARQ feedback enabled, drx-HARQ-RTT-TimerDL length is increased by offset (i.e. existing values within value range increased by offset). RAN2 working assumption: offset is equal to UE-gNB RTT (if RAN1 decides something that requires to change this we can revisit it)

Agreements:

1. The NTN ephemeris is divided into serving cell’s ephemeris and neighbour’s ephemeris. FFS how would they differ regarding e.g. the required accuracy or signalling impact.
2. Consider pre-configuration in uSIM, NAS, SIB and RRC signalling for providing the NTN ephemeris. Further discussion depends on the agreed ephemeris contents.

Agreements:

1. RAN2 thinks that a UE needs to know whether the network is a TN or NTN no later than SIB1 reception
2. The information on when a cell is going to stop serving the area and/or the timing information (e.g. timer or absolute time) about new upcoming cell is supported at least in Earth-fixed NTN scenario. FFS if both types of information are needed. FFS if this is known from system information and/or the ephemeris.

Agreements:

1. Support A4 event for NTN CHO. FFS whether other triggers need to be combined with this.

RAN2#113bis

Agreements:

1. Legacy mechanism for RA type selection based on RSRP threshold is the baseline for NTN. Optimizations can still be suggested, showing the gain (in any case, any method needs to be combined with RSRP based approach)
2. Reuse legacy RA type switching mechanism
3. Extend the timer length of sr-ProhibitTimer (FFS on the details)

Agreements:

1. RAN2 wait for RAN1’s feedback on UE obtaining UE-gNB RTT.

Agreements - via email (from offline [103]):

1. RAN2 wait for RAN1’s progress and postpone the discussion on how to broadcast parameters, if any, for TA pre-compensation.
2. RAN2 send an LS to RAN1, focusing on below aspects:

 - Ask RAN1 to prioritize the TA pre-compensation work on whether and/or what parameters to broadcast for TA pre-compensation, and when broadcasted, how often the broadcasted parameters are expected to change over time;

 - RAN2 has agreed to use UE-gNB RTT as the offset to start some UP timers (e.g. drx-HARQ-RTT-TimerDL). Ask RAN1 to provide inputs on (i) how UE acquires UE-gNB RTT and (ii) what additional information needs to be broadcasted other than that for TA pre-compensation, if any.

Agreements:

1. At least for uplink scheduling adaptations, the UE may report information about the UE specific TA pre-compensation. The exact information and frequency of reports depend on RAN1 outcome. FFS on when/how to report.
2. ~~The UE reports the UE specific TA pre-compensation during RACH procedure using MAC CE (FFS if this needs to be configured). Actual content is FFS and also depends on further RAN1 input.~~
3. It is FFS whether the UE reports the UE specific TA pre-compensation at the RACH procedure (MSG3 or MSG5) using a MAC CE. Actual content is FFS and also depends on further RAN1 input. Configurability is FFS

Agreements:

1. It is NW scheduling strategy to avoid NTN UE in HARQ stalling state. From RAN2 perspective, the NW can continuously schedule the UE using one or a combination of scheduling strategies, such as without HARQ retransmissions, or with blind retransmissions, or with HARQ retransmissions based on DL HARQ feedback (or UL decoding result).
2. RAN2 confirms that in NTN if the UE is in DRX Active Time for any reason, the UE should monitor the PDCCH regardless of whether drx-HARQ-RTT-TimerUL or drx-HARQ-RTT-TimerDL is running or not. No specification change is needed.
3. RAN2 confirms that in NTN using the value= “zero” for drx-HARQ-RTT-TimerUL and drx-RetransmissionTimerUL is possible. No specification change is needed.

4. In NTN, The drx-HARQ-RTT-TimerUL is configured per UE DRX group and the behaviour can be configured per HARQ process. FFS the different behaviours and how to indicate the behaviour to the UE and the number of behaviours (e.g., two or more behaviours).

5. LCP restrictions should be further considered for an UL HARQ process in NTN. FFS if no further LCP restrictions are needed, or if (R16) existing LCP restrictions can be re-used or if new LCP restriction shall be defined for this purpose.

Agreements:

1. The UE utilizes the t-Reassembly timer value that does not depend on the time-varying UE-gNB delay.
2. The value range of t-Reassembly shall be extended. The following set of values are possibly added for t-Reassembly timer: {ms210, ms220, ms340, ms350, ms550, ms1100, ms1650, ms2200}. Any other values are FFS.
3. The network can configure the values of PDCP discardTimer and PDCP t-Reordering timer greater than the RLC t-Reassembly timer.
4. Extend the range of the PDCP discardTimer and the PDCP t-reordering timer. One option is to enlarge the set of allowed values for the PDCP discardTimer and the PDCP t-reordering timer. The exact values FFS

Agreements:

1. When the network stops broadcasting a TAC, the UE needs to know it (FFS on further details)

Agreements:

1. For Rel-17 NTN, Rel-17 NR operation is enhanced (e.g. the SMTC configuration and UE measurement gap onfiguration) aiming to address the issues associated with the different/larger propagation delays, and the satellites (considering e.g. their deployment, mobility, height, minimum elevation and prioritizing typical NTN scenarios).
2. Rel-17 NTN will not rely only on network implementation to address the issue explained in agreement 1.
3. Enhancements of the SMTC configuration is supported for Rel-17 NTN.
4. Optional new UE assistance is defined in Rel-17 NTN for network to properly (re)configure the SMTC and/or measurement gap

Agreements - via email (from offline [106])

1. For Rel-17 NTN, one or more SMTC configuration(s) associated to one frequency can be configured. FFS solution details.

- The SMTC configuration can be associated with a set of cells (e.g., per satellite or any other suitable set per gNB determination).

- The multiple SMTC configurations are enabled by introducing different new offsets in addition to the legacy SMTC configuration. FFS how the offsets will be managed/signalled.

FFS the following open questions:

 (a) can the UE be configured with multiple SMTCs per carrier and use them all in parallel?

 (b) How the NW knows which SMTC (incl. offsets/periodicity, etc.) is relevant for a particular UE?

 (c) Is there any validity: in time or for certain location only, foreseen in such multiple SMTC configuration?

 (d) What is the potential impact on the signalling, assuming this delay is a dynamic value?

 (e) What about the feeder link delay? Is it considered anywhere?

1. The configuration of one or multiple offsets is left up to the network implementation.
2. It is up to network to update the SMTC configuration of the UE to accommodate the different propagation delays.

Agreements online:

1. Measurement gaps enhancements should be supported. FFS on the details

Agreements:

1. Timing information in CHO execution triggering for NTN describes the time after which the UE is allowed to execute CHO to the candidate target cell.

2. Working assumption: the timing information for CHO execution triggering in NTN is defined in the form of a timer/timers. This can be revised and a solution based on UTC/system frame number can be considered if problems are found (e.g. if the timer lacks accuracy due to RTT in NTN).

3. The location in location-based CHO execution triggering for NTN describes the distance between the UE and the reference location of the cell (serving cell or the target cell). FFS what the reference location of the cell is (e.g cell center or other) and how this is provided to the UE

RAN2#114

Agreement:

1. If enabled by the network, the UE reports information about UE specific TA pre-compensation at the random access procedure (MSGA/MSG3 or MSG5) using a MAC CE. Actual content is FFS and also depends on further RAN1 input (we can revise this whole agreement if RAN1 come to a different conclusion in terms of what needs to be conveyed to the NW)

Agreements:

1. The following options are supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer set to zero and/or 3) Timer disabled (i.e. not started). FFS if this is based on explicit configuration or not. We can also come back to see whether both 2 and 3 are needed.

Agreements via email (from offline 103):

1. RAN2 working assumption: Offset for drx-HARQ-RTT-TimerUL is equal to UE-gNB RTT (if RAN1 decides something that requires to change this we can revisit it).
2. drx-RetransmissionTimerDL timer length is not extended in NTN

Agreements online:

1. The drx-HARQ-RTT-TimerUL behaviour applied for each HARQ process is up to the network (e.g. to support NW scheduling strategy to avoid HARQ stalling).
2. RAN2 Working Assumption: No new CG-specific LCP restriction is introduced for NTN. If a new LCP restriction is agreed for dynamic grant, the proposal does not preclude future discussion on whether it may also apply to configured grant
3. Repetition transmission based HARQ retransmission is always allowed and is explicitly indicated per HARQ process via DCI (as in legacy).
4. At least the following options for LCP in NTN are further studied: 1) allowedPHY-PriorityIndex is re-used; and 2) A new LCP restriction is introduced to map LCH to one or more HARQ process(es). FFS if HARQ processes can be classified as having retransmission “enabled” or “disabled” in this case.

Agreements:

1. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is needed to assist cell reselection in NTN for earth fixed scenario.
2. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is used to decide when to perform measurement on neighbor cells.
3. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area for earth fixed scenario is broadcast to UE via system information.

Agreements via email (from offline 104):

1. Support CHO location trigger as the distance between UE and a reference location which may be configured as the serving cell reference location or the candidate target cell reference location. FFS if combination can be allowed.
2. The reference location for the event description is defined as cell center.

Agreements online:

1. For CHO, joint configuration of location and RSRP as well as time and RSRP triggers are supported.
2. For idle mode reselection, based on configuration NTN UE can prioritise TN over NTN. Configuration details FFS

Agreements via email (from offline 104 - second round):

1. CHO time trigger event is defined as time duration [t1, t2] associated for each CHO candidate cell. The UE shall execute CHO to that candidate cell during the time duration, if all other configured CHO execution conditions will apply and there is only one triggered candidate cell.
2. Same CHO trigger conditions and RRM events can be used within NTN and NTN-TN mobility provided these are supported by the UE. NTN-TN means both “from NTN to TN (hand-in)” and “from NTN to TN (hand-in) and from TN to NTN (hand-out)". FFS for enhancements.

Agreements via email - from offline 108:

1. RAN2 will work on a solution to ensure that the CGI constructed by NG-RAN corresponds to a fixed geographical area with a size comparable with a cell for TN including connected mode and initial access.

Agreements via email (from offline 108 - second round)

1. RAN2 will work on a solution to ensure that the CGI constructed by NG-RAN can correspond to a fixed geographical area comparable with a TN cell with a radius of ~2km or more.

RAN2#115

Agreements:

1. UE specific TA reporting during RACH procedure is enabled/disabled by SI (FFS for RACH in connected mode)

Agreements:

1. In the MAC specification section 5.1.5, delay the start of ra-ContentionResolutionTimer by the UE-gNB RTT (i.e. sum of UE's TA and K\_mac)

Agreements via email - from offline 106:

1. The content of UE specific TA pre-compensation reported in RA procedure using MAC CE is UE specific TA (this can be revisited after receiving RAN1 response).
2. Reporting on the information about UE specific TA in connected mode is supported, FFS via RRC signalling or MAC CE
3. Event-triggers for reporting on the information about UE specific TA in connected mode is supported. FFS on the details. Confirmation by RAN1 is also needed
4. If configured, the UE shall report information of the UE specific TA pre-compensation to the target cell during the random access. FFS if a new indication in RRC reconfiguration with sync is needed or not (besides the SIB indication carried in HO command on whether TA report is enabled/disabled in the target cell).
5. Information about UE specific TA pre-compensation is not reported in RA procedures triggered due to “Request for Other SI”

Agreements via email - from offline 106 second round:

1. The event-triggers for reporting information about UE specific TA are based on TA values (confirmation from RAN1 is needed)
2. A TA offset threshold can be used for event-triggered reporting, at least the offset threshold can be between current information about UE specific TA and the last successfully reported information about UE specific TA
3. The event-triggers for reporting information about UE specific TA based on time threshold is not supported in NTN.
4. No new indication in RRC reconfiguration with sync is needed to configure the UE to report information about UE specific TA in handover procedure (besides the SIB indication carried in HO command on whether TA report is enabled/disabled in the target cell).

Agreements via email - from offline 106 third round:

1. Under the work assumption "the UE location information cannot be reported in connected mode", the content of UE specific TA reported in connected mode is UE specific TA pre-compensation(for the details of the TA value, confirmation from RAN1 is needed).
2. If the reported content of information about UE specific TA is UE location information in connected mode, RRC signalling is used to report.

Agreements online:

1. Under the work assumption "the UE location information can be reported in connected mode", for TA reporting purposes in connected mode, the network can configure the UE to send either the UE specific TA pre-compensation (for the details of the TA value, confirmation from RAN1 is needed) or the UE location information

Working Assumption:

1. If the reported content of information about UE specific TA is TA pre-compensation value in connected mode, MAC CE is used to report

Agreements:

1. Confirm the RAN2 working assumption that offset to drx-HARQ-RTT-TimerUL length is equal to UE-gNB RTT (i.e. sum on UE's TA and K\_mac).
2. Confirm the RAN2 working assumption that for HARQ processes with DL HARQ feedback enabled, the drx-HARQ-RTT-TimerDL length is increased by an offset equal to UE-gNB RTT (i.e. sum on UE's TA and K\_mac).
3. No new LCP restrictions are introduced for exisiting UL MAC CEs (if new MAC CEs will be introduced we can revisit this)
4. For dynamic grants, each LCH can optionally be semi statically configured (by RRC) to be mapped to one or more HARQ processes (FFS if it's possible to map to more than one HARQ process/ process type. FFS on mapping method). If there is no RRC configuration for this, this mapping has no effect (legacy behaviour applies).
5. Agreements via email - from offline 101:
6. 1a. For at least dynamic grants, the network may optionally configure an UL HARQ retransmission state per HARQ process. Two UL HARQ retransmission states are defined in NTN: HARQ state A and HARQ state B (FFS whether "HARQ state A" and "HARQ state B" should be renamed)
7. 1b. HARQ state A/B are defined as follows:
8. - HARQ state A: length of drx-HARQ-RTT-TimerUL is extended by UE-gNB RTT (i.e. UE PDCCH monitoring is optimized to support UL retransmission grant based on UL decoding result).
9. - HARQ state B: drx-HARQ-RTT-TimerUL is not started.
10. 2. Configuration of UL HARQ retransmission state is semi-static, signalled via RRC, and the decision and criteria to configure UL HARQ retransmission state is under network control.
11. 3. For dynamic grants, each LCH can be optionally mapped to an UL HARQ retransmission state via semi-static RRC configuration. If there is no configuration, the mapping has no effect (legacy behaviour applies).
12. 4. If HARQ process has not been configured with an UL HARQ retransmission state, new LCH mapping rule has no effect (i.e. UE applies legacy behaviour).
13. 5. The following behaviours are supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer disabled (i.e. not started)
14. 6. UE determines drx-HARQ-RTT-TimerUL behaviour per HARQ process based on configured UL HARQ retransmission state.
15. 7. For HARQ process(es) not configured with an UL HARQ retransmission state, drx-HARQ-RTT-TimerUL and drx-RetransmissionTimerUL behave as per legacy.

Agreements via email - from offline 101 second round:

1. An UL HARQ retransmission state is configured per HARQ process to support new LCH mapping restriction and proper configuration of drx-HARQ-RTT-TimerUL behaviour.

2. The network may consider delay and reliability characteristics of ongoing services when choosing to configure an UL HARQ retransmission state.

3. Alternative naming for HARQ state A/B can be further considered during stage 3, however UE behaviour in each state should be defined in specification.

4. RAN2 understanding is that UE behaviour in HARQ state A (i.e. extending the drx-HARQ-RTT-TimerUL by UE-gNB RTT) best supports reception of UL retransmission grant based on UL decoding result. (No RAN2 specification impact)

5. RAN2 understanding is that UE behaviour in HARQ state B (i.e. not starting drx-HARQ-RTT-TimerUL) best supports no UL retransmission and/or blind UL retransmission. (No RAN2 specification impact)

Agreements online:

1. For HARQ state B, FFS to run drx-RetransmissionTimerUL for blind UL retransmission
2. UE configured with an UL HARQ retransmission state (i.e. A or B) will always act as indicated in a grant/assignment provided during a valid occasion (i.e. subject to legacy restrictions in e.g. MAC and RAN1 specifications). (No RAN2 specification impact)

Agreements:

1. Introduce a new t-ReassemblyExt-r17 IE, which is optional present for NTN network scenario.
2. Introduce a new discardTimerExt-r17 IE with a new value ms2000 and several spare bits for future extension.
3. RAN2 consider not to extend PDCP t-Reordering timer or use several spare bits in legacy IE to add several greater values up to 4400ms.

Agreements:

1. If SA3 replies with concern on reporting UE location with any granularity during initial access, RAN2 will revisit agreement/solution for reporting UE location during initial access.
2. UE coarse location information refers to coarse GNSS coordinates (FFS on the details, e.g. X MSB bits out of 24 bits of longitude/latitude or GNSS coordinates with ~2km accuracy). FFS if any enhancements to validate the UE’s coarse location information is needed. FFS whether this is only used in initial access or also in connected

Agreements via email - via offline 102:

1. If SA3 has no concern reporting coarse location during initial access, the coarse location information is reported in Msg5, i.e., via RRCSetupComplete/RRCResumeComplete message.
2. For coarse UE location reporting during initial access, the location granularity is not indicated to UE via SIB
3. Enhancements to validate the UE ’s coarse location information is not needed from RAN2 perspective. Whether this is needed by the network is up to other WGs.
4. After AS security is established, gNB can obtain a GNSS-based location information from the UE using existing signalling method, i.e., by configuring includeCommonLocationInfo in the corresponding reportConfig. It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN. RAN2 discuss whether to send LS to SA3
5. Aperiodic location reporting (e.g., via DCI) is not supported.

Working assumption:

1. Event triggered-based UE location reporting are configured by gNB to obtain UE location update of mobile UEs in RRC\_CONNECTED

Agreements via email - from offline 102 second round:

1. Send new LS to SA3 for the need of NTN specific user consent for obtaining UE location by gNB."

Agreements online:

1. If accepted by SA3, if the gNB has user consent to obtain UE location in NTN, reporting of finer location information/full GNSS coordinates in RRC\_CONNECTED can be supported after AS security is enabled
2. Periodic location reporting can also be configured by gNB to obtain UE location update of mobile UEs in RRC\_CONNECTED. RAN2 discuss whether it is part of existing periodic measurement report configuration or a new configuration for periodic reporting of UE location.

Agreements via email - from offline 107:

1. RAN2 confirms AS indicates to NAS layer all received TACs per PLMN.
2. RAN2 responds to CT1 and SA2 with the confirmation that AS indicates to NAS layer all received TACs per PLMN. In addition it is stated that TACs in NTN are fixed to geographical location on Earth and UE’s location information can be used for TAI selection. Final decision on which criteria to apply (e.g. UE location information or other) is anyway up to CT1 and SA2 judgement

Agreements via email - from offline 108:

1. Broadcast of cell stop time in SIB is only applicable to quasi earth fixed cell (not to moving cell). No further work in this release to address any moving cell specific details on using the cell stop time to assist measurements or cell reselection
2. For quasi-earth fixed cell, the reference location of the cell (serving cell or the neighbor cells) is broadcast in system information

Agreements via email - from offline 108 third round:

1. For quasi-earth fixed cell, UE should start measurements on neighbour cells before the serving cell stops covering the current area.
2. For quasi-earth fixed cell, the broadcast “timing information on when a cell is going to stop serving the area” refers to the time when a cell stops covering the current area.
3. For quasi-earth fixed cell, specify that UE should start measurements on neighbour cells before the broadcast stop time of the serving cell, i.e. the time when the serving cell stops covering the current area, and the exact time to start measurements is up to UE implementation.

Working Assumption:

1. Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information, which means location acquisition will not be triggered at UE side only for location assisted cell reselection. FFS on the details.

Working Assumptions:

1. Combination of serving and target cell reference location is supported for location report trigger event and for CHO location trigger
2. Specify that measurement reports can be configured to be piggybacked with location report when location based event triggers it

Agreements via email - from offline 103:

1. The following event is supported: condEvent L4: Distance between UE and the PCell’s reference location becomes larger than absolute threshold1 AND the distance between UE and the Conditional reconfiguration candidate becomes shorter than absolute threshold2.

 FFS other options

1. Specify hysteresis and time to trigger for the location event for RRM and CHO
2. Timing information from RRCReconfiguration message in RRC running CR is removed
3. UE is allowed to perform HO only during T1 to T2
4. Agree to limit to A or B and continue discussion between options A and B

 Option A: UTC time + duration/timer, e.g. 00:00:01 + 40s

 Option B: Two UTC time to indicate the start (T1) and end time (T2) of the candidate cell, e.g. 00:00:01 + 00:00:41

Agreements via email - from offline 103 second round:

1. RAN2 adopts Option 1: UTC time + duration/timer, e.g. 00:00:01 + 40s for representing T1 and T2 for CHO time event.

2. RAN2 adopts options C: location and RRM and D: time and RRM to be configuration options for CHO

3. RAN2 down priorities further enhacnements for connected mode for Rel-17 for TN-NTN mobility

4. RAN2 continue discussing the exact solution for TN priorization over NTN for idle mode

Agreements via email - from offline 112:

1. The specific maximum number of SMTC configuration in one measurement object with the same ssbFrequency can be 4. And a LS will be sent to RAN4 to confirm the conclusion.
2. In NTN, NW-based solution is supported, i.e. the final SMTC/measurement gap configuration is generated and provided by NW in NTN to a given UE (based on the propagation delay difference between at least one target cell and the serving cell of a given UE). FFS whether UE-based solution is supported or not.
3. In NTN, it is necessary of the UE to report assistant information to the NW (which can be configured by NW or upon NW’s request) to assist NW calculating the offset for SMTC/GAP configurations. FFS the detailed information.

Agreements:

1. The UE can be configured with multiple SMTCs per carrier. FFS if the UE can use only a partial set or all of them in parallel, and in case FFS whether based on network configuration or UE implementation

RAN2#116

Agreements:

1. Enhancements for RA type selection in NTN will not be pursued in Rel-17. FFS for BSR

Agreements via email - from offline 106:

1. Do not mandate Msg3/MsgA or Msg5 to include TA report MAC CE, and whether it can be included depends on the TB size of Msg3/MsgA or Msg5. No spec change is needed for this
2. Reserved LCID is used for the TA report MAC CE.
3. Postpone the discussion on the size of the TA report MAC CE until RAN2 concludes on the content of TA report.
4. RAN2 do not pursue any enhancements to allow inclusion of TA information without extending Msg3 size.
5. Logical channel priority of the TA report MAC CE should be lower than that of “C-RNTI MAC CE or data from UL-CCCH” and higher than that of “data from any Logical Channel, except data from UL-CCCH”.

Agreements via email - from offline 106 (second round):

1. Do not introduce additional enhancement on BSR over 2-step RACH in Rel-17.

Agreements online:

1. RAN2 further discuss the exact priority of the TA report MAC CE between “C-RNTI MAC CE or data from UL-CCCH” and “MAC CE for BSR, with exception of BSR included for padding
2. If the reported content of information about UE specific TA is TA pre-compensation value in connected mode, MAC CE is used to report
3. In case UE location information can be reported to network, dedicated signaling is used to configure UE to report the UE location and/or the UE specific TA information for the purpose of TA reporting in connected mode. FFS if both mechanisms are needed in parallel

Agreements:

1. The extended values for sr-ProhibitTimer in NTN can include values less than UE-gNB RTT (as in legacy). FFS on the actual values and how this is extended
2. RRC parameter “allowedHARQ-DRX-LCP” is included in LogicalChannelConfig (FFS on the actual name of the parameter)
3. configuredGrantTimer can be extended in NTN. FFS details of when extension is applicable and method of extention.
4. The ConfiguredGrantConfiguration shall allow for up to 32 in nrofHARQ-Processes, and up to 31 in harq-ProcID-Offset and harq-ProcID-Offset2.
5. The SPS-Config shall allow up to 32 for nrofHARQ-Processes, and up to 31 in harq-ProcID-Offset.
6. HARQ feedback shall always be sent for SPS deactivation (i.e. regardless of HARQ feedback enabled/disabled).

Agreements via email - from offline 101:

1. For HARQ process(es) not configured with DL HARQ feedback enabled/disabled, drx-HARQ-RTT-TimerDL behaves as per legacy.
2. Introduce a new sr-ProhibitTimerExt-r17 IE. Values FFS
3. If uplinkHARQ-DRX-LCP-Mode-r17 is configured, a HARQ process may be mapped to either ‘HARQ mode A’ or ‘HARQ mode B’.
4. uplinkHARQ-DRX-Mode shall be included in PUSCH-ServingCellConfig.
* Agreements via email - from offline 101 (second round):
* 1. If uplinkHARQ-DRX-LCP-Mode-r17 is configured, the following LCH to HARQ process mapping rules are supported:
* 1) LCH is mapped only to a HARQ process configured with HARQ mode A;
* 2) LCH is mapped only to a HARQ process configured with HARQ mode B;
* 3) If an LCH is not configured with a mapping rule, it may be mapped to any HARQ process (HARQ mode A or B).
* 2. downlinkHARQ-FeedbackDisabled shall be included in PDSCH-ServingCellConfig.

RAN2 assumption:

1. There will be max 12 TACs per NR NTN cell, including same or different PLMNs.

Agreements:

1. Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell. FFS on how UE performs location acquisition.

Agreements via email - from offline 102:

1. When UE uses location based cell reselection enhancements, it's up to UE implementation to guarantee that a valid location information is available
2. For quasi-earth fixed cell, same as legacy, UE shall perform neighbour cell measurements of “higher priority NR inter-frequency or inter-RAT frequencies” regardless of the distance between UE and serving cell reference location.

Agreements via email - from offline 102 - second round:

1. For quasi-earth fixed cell, UE should start measurements on neighbour cells before the serving cell stops covering the current area, regardless of (the distance between UE and serving cell reference location) or (if legacy Srxlev/Squal condition is met, i.e., serving cell’s Srxlev/Squal is better than a threshold).

Agreements online:

1. Distance based cell reselection criteria for quasi-earth fixed cell is supported
2. For quasi-earth fixed cell, the cell stop time of neighbour cell(s) is NOT broadcast

Agreements:

1. We don't introduce new mechanisms (e.g. based on MAC CE) to activate/deactivate SMTCs for NTN neighbour measurements. Which SMTCs the UE will consider is only based on RRC configuration (UE based solutions are not excluded by this)

Agreements via email - from offline 103:

1. RAN2 will decide which option to choose for NTN assistance information for SMTC/MG once SA3 feedback on user consent is received.
2. If propagation delay based UE assistance information for NTN SMTC is agreed, it is defined in the form of propagation delay difference.
3. RAN2 assumes FL delay is known to and compensated by the network. RAN2 also assumes the UE needs to have neighbour cell ephemeris for the propagation delay estimation.
4. In NW-based SMTC solution the UE is not allowed to apply shifts to configured SMTCs.
5. Measurement gap related aspects for Rel-17 NTN will be addressed in Rel-17 NTN WI. Coordination and avoiding overlap with other WIs and WGs is recommended.
6. RAN2 will reuse at least the SMTC agreements made for UE assistance information reporting also in the area of measurement gaps for NTN

Agreements via email - from offline 103 (second round):

1. UE assistance information for NTN SMTC adjustments is event-triggered. Details of the triggering event are FFS (pending the decision on supported assistance information type).
2. RAN2 aims to minimize the number of configurable measurement gaps required for monitoring configured SMTCs in NTN. At least gap length and UE capabilities impact the number of required measurement gaps.
3. UE-based solution for SMTC adjustments in NTN is supported for IDLE/INACTIVE UEs. FFS how does the UE perform the necessary shifts in SMTC.

Agreements:

1. In NW-based solution, the network can configure up to 2 SMTCs in parallel and the UE uses all of them, i.e. there is no switching between or activation/deactivation of configured SMTCs. FFS whether this (UE support for 2 SMTCs) requires a UE capability. A UE can optionally indicate support for 4 SMTCs (in this case the NW can configure up to 4 SMTCs in parallel)

RAN2#116bis

Agreements:

1. Do not support allocating dedicated RA preamble for the RACH procedure triggered by TA reporting.
2. UE does not start or restart the timeAlignmentTimer after the UE reports its TA.
3. NTN specific parameters, e.g. ephemeris, K\_mac, common TA, cell-specific Koffset, network enable/disable TA report, etc., are provided in the new NTN-specific SIB.
4. The MAC CE for differential UE-specific K\_offset has a fixed size of a single octet.
5. Use an eLCID for the MAC CE for differential UE-specific K\_offset

Agreements via email - from offline 101 - second round:

1. priority of the TA report MAC CE is lower than LBT failure MAC CE and higher than MAC CE for SL-BSR prioritized.
2. UE triggers a TA reporting upon reception of configuration or reconfiguration of TA reporting trigger event if the UE has not reported TA before.
3. Other than event-triggered TA reporting, no more triggers are introduced for TA reporting in connected mode.

Agreements via email - from offline 107:

1. uplinkHARQ-DRX-Mode-r17 controls the DRX behaviour of HARQ processes in the same way for configured grants as for dynamic grants.

Agreements online:

1. It is up to network implementation to ensure proper configuration of HARQ feedback (i.e. enabled or disabled) for HARQ processes used by an SPS configuration (no Stage 3 specification impact). FFS if a note in Stage 2 is needed
2. It is up to network implementation to ensure proper configuration of HARQ mode for HARQ processes used by a CG configuration (no Stage 3 specification impact). FFS if a note in Stage 2 is needed
3. For HARQ process(es) configured with HARQ Mode B, blind retransmission relies on UE being in DRX Active Time via other means (i.e. drx-RetransmissionTimerUL is not started).
4. For HARQ process(es) configured with disabled HARQ feedback, blind retransmission relies on UE being in DRX Active Time via other means (i.e. drx-RetransmissionTimerDL is not started).

RAN2 understanding:

1. RAN2 understanding is that: in general, all HARQ processes used by an SPS configuration are configured with the same HARQ feedback enabled/disabled state. No specification impact.
2. RAN2 understanding is that: in general, all HARQ processes used by a CG configuration are configured with the same HARQ state (e.g. A or B). No specification impact

Agreements:

1. A new NTN-specific SIB is introduced (SIBx), scheduled by SIB1
2. Introduce the following serving cell information to the corresponding SIBx (scheduled by SIB1):

 - Ephemeris;

 - common TA parameters;

 - validity duration for UL sync information;

 - t-Service;

 - cell reference location;

 - Epoch time.

 Also send a LS to RAN1 asking whether some parameters might be sent more frequently

1. For quasi-earth fixed cell, same as legacy, UE shall perform neighbour cell measurements of “higher priority NR inter-frequency or inter-RAT frequencies” regardless of the remaining serving time
2. RRC\_INACTIVE mode is supported for NTN

Agreements via email - from offline 102 - second round:

1. Regarding UE-based solution for SMTC adjustments, UE autonomously adjust the SMTCs based on location and ephemeris. FFS whether NW assistance information is provided.
2. UE can know the NW type implicitly no later than SIB1 reception, there is no explicit NW type indication in SIB1.
3. No LS is sent to RAN3 on the support of RRC\_INACTIVE.

Agreements:

1. define one single NR NTN UE capability to encompass essential features to support NTN, and UE can further indicate other optional capabilities.
2. gnss-Location-r16 is conditionally mandatory when UE indicates the support of NR NTN access, and update the field description to cover NTN case.
3. consider the following differentiation of user plane enhancements as baseline:

 Essential sub-features include:

 1) the adaptations of RACH;

 2) DRX HARQ RTT timer extension;

 3) the timer extension to accommodate long RTT for other MAC timers (e.g., extended sr-ProhibitTimer);

 4) the timer extension to accommodate long RTT in RLC and PDCP layers (FFS for LEO)

 Optional sub-features include:

 1) TA reporting (TA reporting during RACH using MAC CE, and Event-triggers for TA reporting in connected mode);

 2) disabling HARQ feedback for downlink transmission;

 3) new HARQ state for uplink transmission and the corresponding new LCP mapping rule for dynamic grants.

4. consider the following differentiation of control plane enhancements as baseline:

 Essential sub-features include (for NGSO, FFS for GEO):

 1) soft TAC update;

 2) SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel);

 Optional sub-features include:

 1) cell stop-time based neighbour cell measurements;

 2) location based cell reselection criteria;

 3) SMTC enhancements (4 SMTC in parallel and UE based solution in idle/inactive);

 4) CHO enhancements (location based CHO).

 FFS if CHO enhancements (time based and Event A4 based CHO) is essential or optional

1. Postpone the UE capability discussion on location reporting

Working Assumption (further check if anything can be per band):

1. the granularities of all the optional RAN2 determined sub-features with capability signalling are per UE.