**3GPP TSG-RAN2 Meeting #116-e R2-211xxxx**

**Online, November 1 – 11, 2021**

**Agenda Item: 9.2.4**

**Source: Huawei**

**Title: [AT116-e][030][IoT-NTN] CP Other (Huawei)**

**Document for: Discussion and decision**

# Introduction

This document summarises the following offline discussion:

* [AT116-e][030][IoT-NTN] CP Other (Huawei)

Scope: Ph1 Treat documents under 9.2.4, Related to RRC, related to provisioning of ephemeris, connected mode, connection setup/release, i.e. docs listed under Other below. Identify easy agreements, potential agreements (need discussion), potential alternatives, blocking points, Open issues. Pave the way for on-line Discussion.

Intended outcome: Report

Deadline: Ph1 Monday W2

Note that only the proposals related to RRC, provisioning of ephemeris, connected mode, connection setup/release are discussed in this offline. Other proposals in documents [1]- [8], related e.g. to Idle mode mobility, paging and Handling of Cell deployments and TA are not discussed here.

# Contact information

|  |  |
| --- | --- |
| Company | Name and email address |
| Huawei, HiSilicon | Odile Rollinger (odile.rollinger@huawei.com) |
| OPPO | Haitao Li (lihaitao@oppo.com) |
| MediaTek | Abhishek Roy (Abhishek.Roy@mediatek.com) |
| Qualcomm | Bharat Shrestha (bshrestha@qti.qualcomm.com) |
| ZTE | Ting Lu (lu.ting@zte.com.cn) |
| Xiaomi | Xiaolong Li (lixiaolong1@xiaomi.com) |
| Ericsson | Jonas Sedin (jonas.sedin@ericsson.com) |
| InterDigital | Brian Martin ([brian.martin@interdigital.com](mailto:brian.martin@interdigital.com)) |
| Nokia | Srinivasan Selvaganapathy(srinivasan.selvaganapathy@nokia.com) |
| Apple | Pavan Nuggehalli (pnuggehalli@apple.com) |
| Rakuten Mobile Inc | Pankaj Shete (pankaj.shete@rakuten,com) |
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# Discussion

## Satellite assistance information

The following proposals are made in documents [1]- [8]:

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| --- | --- |
| Tdoc | Proposals |
| [R2-2110480](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110480.zip) [4] | Proposal 7: The ephemeris information and common TA parameters are signalled in a new SIB.  Proposal 8: Update to the ephemeris information and common TA parameters can take place at any time and does not affect the system information value tag.  Proposal 9: The validity timer(s) is(are) signalled in the same SIB as satellite ephemeris and common TA parameters.  Proposal 10: RAN2 to consider having two separate validity timers for the ephemeris information and TA common parameters.  Proposal 12: The timing information on when a cell is going to stop serving the area for the quasi-earth fixed case is signalled in the same SIB as the ephemeris information. |
| [R2-2110072](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110072.zip) [5] | Observation 1: Ephemeris consists of different kinds of information which can change at different rates and have different sizes.  Proposal 1: NAS mechanisms be used for slowly changing ephemeris, and RRC signaling for rapidly changing ephemeris.  Proposal 2: System information modification procedure is not invoked for ephemeris related SIBs.  Proposal 3: A validity period is used to ensure that the ephemeris information used by the UE is valid. |
| [R2-2111030](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2111030.zip) [8] | Proposal 4: Broadcast of cell stop time in SIB is only applicable to quasi earth fixed cell (not to moving cell) and UE should start to perform intra-frequency or inter-frequency measurements before the cell stop time and the exact time to perform measurements is up to UE implementation |

### Ephemeris information

In documents [4] and [5], it is proposed to introduce a new SIB to signal the ephemeris information.

**Q1: Ephemeris information is signalled in a new SIB**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Yes** | Note that whether to use a new SIB to carry ephemeris info, common TA and K\_mac for NR-NTN is still discussed. We can use the same way as NR-NTN. |
| Lenovo, Motorola Mobility | **Yes** | We prefer to include ephemeris and other assistance information in a new SIB. Also we can wait for agreements in NR NTN. |
| Huawei, HiSilicon | **yes** |  |
| MediaTek | **Yes** |  |
| Qualcomm | **Yes** |  |
| ZTE | **Yes** | Considering that the ephemeris information is only used for IoT NTN case and it changes frequently, a new SIB is suitable. |
| Xiaomi | **yes** | It is better to introduce a new SIB to include the ephemeris data, we also can wait the conclusion from NR NTN and make the final decision. |
| Ericsson | **FFS** | WE can follow what is NR NTN unless technically it does not work. |
| Interdigital | **yes** | This is necessary particularly if new SIB can be updated at any time without SI update notification. |
| Nokia | **Yes** | The nature of contents and also the possibility of updates is different from other SIB. To enable different approach for reading this system information related changes, new SIB is preferred. |
| Apple | **Yes** | Can wait for NR NTN progress to determine if common TA and K\_mac is also carried in the new SIB. |
| Rakuten Mobile Inc | **Yes** | We think there should be New SIB which will NTN specific information |

Rapporteur’ summary

In documents [4] and [5], it is proposed that update to ephemeris information does not affect the system information value tag and does not trigger System information modification procedure

**Q2 : Update to ephemeris information does not affect the system information value tag and does not trigger System information modification procedure**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Agree** | If the ephemeris information and common TA changes quite frequently, UEs in IDLE mode are required to wake up more often to monitor for SI change indication, which would cause the UEs to consume more power. Therefore, we suggest using the similar manner as that for UTC to broadcast ephemeris info, as well as common TA. |
| Lenovo, Motorola Mobility | **See comments** | From UE power saving perspective we think that it is unnecessary to always trigger system information modification upon **any** ephemeris update. However we would like not to limit the possibility that network can indicate UE to update ephemeris with value tag. E.g. if significant changes occur to the ephemeris data, network may change the value tag so that UE can update. This can be NW implementation and has no spec impact. |
| Huawei, HiSilicon | **yes** |  |
| MediaTek | **Yes** |  |
| Qualcomm | **Yes** |  |
| ZTE | **Yes** | Considering the the ephemeris information may change frequently and for power saving purpose, UE can acquire it on demand, e.g., when initiating RRC connection establishment/resumption or upon expiration of validity timer, we also think the SI value tag should not be affected and system information modification procedure should not be triggered. |
| Xiaomi | **yes** | Since the ephemeris data will be changed continuously, and UE should not be required to check the ephemeris data when ephemeris data is changed. |
| Ericsson | **FFS** | Depends on the outcome of Q1 |
| Interdigital | **yes** |  |
| Nokia | **Yes** |  |
| Apple | **Yes** |  |
| Rakuten Mobile Inc | **Yes, with comment** | In initial deployment of NTN, there will be frequent change in ephemeris information. So SI value should not be affected ,otherwise there will be unnecessary power consumption. |

Rapporteur’ summary

In documents [4] it is proposed that that update to ephemeris information can take place at any time, i.e. not bound to the BCCH modification period

**Q3: Update to ephemeris information can take place at any time, i.e. not bound to the BCCH modification period**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Yes** |  |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | **yes** |  |
| MediaTek | **Yes** |  |
| Qualcomm | **Yes but** | It cannot change during SI window or any repetition period. |
| ZTE | **Yes** | At any SI scheduling occasion for the SI including the ephemeris information, new ephemeris information can be included. |
| Xiaomi | **Yes** |  |
| Ericsson | **FFS** | See comment on Q1 and Q2. We can wait for NR NTN on these details. |
| Interdigital | **yes** |  |
| Nokia | **Yes** |  |
| Apple | **Yes** |  |
| Rakuten Mobile Inc | **Yes** |  |

Rapporteur’ summary

In document [5], it is proposed to use a validity period is used to ensure that the ephemeris information used by the UE is valid. Note that RAN1 has agreed that a UL synchronisation validity timer signal by the network is used for atellite ephemeris.

In document [4], it is proposed that the ephemeris validity timer is signalled in the same SIB as satellite ephemeris

**Q4: The ephemeris validity timer is signalled in the same SIB as the satellite ephemeris**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **FFS** | We are not sure how the broadcasted validity timer can inform UEs of the valid time of ephemeris, e.g. when is the validity timer started? Whether all UEs will start the timer at the same time? |
| Lenovo, Motorola Mobility | **FFS** | It depends on result of Q2. We prefer to keep the value tag option for indicating update of ephemeris, and leave it to NW implementation. In this case the new timer is not needed and there is no spec impact. |
| Huawei, HiSilicon | **yes** |  |
| MediaTek | **Yes** |  |
| Qualcomm | **Yes** |  |
| ZTE | **Yes** | * According to RAN1 agreement, as mentioned by Rapporteur, we understand upon expiration of the UL synchronisation validity timer, UE can decide the [invalidation](https://dict.cn/invalidation) of the received satellite ephemeris via SIB. * Even such UL synchronisation validity timer is broadcast, it only indicates the length of the timer, the start of this timer in each UE can be “UE-specific”, e.g., it starts in UE when the UE receives the corresponding SIB.   No other timer (e.g., ephemeris validity timer) or validity period is needed. |
| Xiaomi | **Yes** | * If the timer means the validity timer agreed by RAN1, we think it should be signalled in the same SIB. |
| Ericsson | **No** | * We have not agreed to introduce an “ephemeris validity timer”. RAN1 has agreed to introduce a general timer for UL synchronization, not specifically for satellite ephemeris but also for common TA parameters. We should first discuss whether we need this timer or not. |
| Interdigital | **yes** |  |
| Nokia | **FFS** | * Need for the timer needs to be agreed. Can it be UE implementation or can it be linked to the timer related to uplink synchronisation also to be checked before this point. If common validity timer needed for the SIB content, including the validity timer in the same SIB may lead to UE using old validity timer value until it knows the change of validity timer. Eventhough the impact is not major it is clear to consider other SIB for this purpose. |
| Apple | **Yes** | * We believe this is consistent with RAN1 agreement as pointed out by the rapporteur, ZTE, and Xiaomi. |
| Rakuten Mobile Inc | **Yes** | * RAN1 agreed validity timer can be signalled in same SIB as the satellite ephemeris . |

Rapporteur’ summary

### Common TA parameters

In document [4], it is proposed that common TA parameters are signalled in the same SIB as the satellite ephemeris

**Q5: Common TA parameters are signalled in the same SIB as the satellite ephemeris**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Yes** | To use the new SIB for the NTN-specific parameters, i.e., ephemeris info, common TA. |
| Lenovo, Motorola Mobility | **Yes** | The new SIB is expected to be NTN-specific if introduced. |
| Huawei, HiSilicon | **Yes** |  |
| MediaTek | **Yes** |  |
| Qualcomm | **FFS** | It may not be good to use same SIB for different time varying paramaters, for example K\_mac and common TA. |
| ZTE | **Possible but may not always?** | According to the following RAN1 agreement:  “*A single validity duration for both serving satellite ephemeris and common TA related parameters is defined at least if serving satellite ephemeris and common TA parameters are signalled in the same SIB message*.”  We understand it’s possible that serving satellite ephemeris and common TA parameters are signalled in the same SIB message. But we think it may be also possible that serving satellite ephemeris or common TA parameters can be signalled alone. |
| Xiaomi | **Yes** | UE will use both satellite ephemeris data and common TA when performs RACH procedure, so it is better to include Common TA and ephemeris data in the same TA to reduce UE power consumption when UE acquires the SIB. |
| Ericsson | **FFS** | Agree with QC. We are not sure if the update frequency of the common TA and ephemeris can be assumed to be the same. |
| Interdigital | **Yes** |  |
| Nokia | **Yes** |  |
| Apple | **Maybe** | Need further guidance from RAN1 to figure out the periodicity requirements of ephemeris and common TA broadcast. If they turn out to be quite different, then it may not make sense to club them together in the same SIB. |
| Rakuten Mobile Inc | **Yes** |  |

Rapporteur’ summary

RAN1 has agreed “A single validity duration for both serving satellite ephemeris and common TA related parameters is defined at least if serving satellite ephemeris and common TA parameters are signalled in the same SIB message. In document [4], it is proposed to have two separate validity timers considering that the satellite ephemeris information may also be used for other purposes than initial access or connected mode , e.g. for location based cell (re)selection.

**Q6: Two separate validity timers are signalled for the ephemeris information and TA common parameters**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **FFS** | We can wait for more RAN1 input. |
| Lenovo, Motorola Mobility | **FFS** | Wait for RAN1 decision. |
| Huawei, HiSilicon | **yes** | We think it could be beneficial to have separate timers if the ephemeris is also used in RRC\_IDLE (up to UE implementation), e,g, for cell selection or other. No strong opinion. |
| MediaTek | **No** | Two separate validity timers are not needed for the same information. |
| Qualcomm | **FFS** | We can wait for RAN1. |
| ZTE | **No** | Even two timer are introduced, as either satellite ephemeris or common TA becomes invalid, UE needs to acquire the complete SIB. Hence, we are unclear what the benefit of two timers is.  Here we assume only one validity timer needs to be defined in the new SIB. When satellite ephemeris and common TA are broadcast together in this SIB, such timer can be used to decide the validation of both satellite ephemeris and common TA. If there is only satellite ephemeris in this SIB, such timer also needs to be provided (may be with different value) for determining the validation of the satellite ephemeris information.  We are open to discuss whether two SIBs are needed. |
| Xiaomi | **No** | If there are two separate validity timers, UE needs to check the SIB if one of timers is expired, thus only one timer can achieve the desired effect, so we think one validity timer for one new SIB including ephemeris data and common TA is enough, |
| Ericsson | **FFS** | We think that there needs to be more discussions on this. Our understanding is that the timer that RAN1 introduced is for the UL synchronization only. We are not sure if a validity timer for neighbouring cells is needed. It could be up to UE implementation to acquire the neighbouring ephemeris for instance. |
| Interdigital | **Yes** |  |
| Nokia | **FFS** | Require further discussion. In our view the purpose seems to be different. We can wait for RAN1 inputs |
| Apple | **Yes** | We think separate validity tiers makes sense because the information being broadcast can have very different periodicity requirements. |
| Rakuten Mobile Inc | **FFS** | Wait for RAN1 Input |

Rapporteur’ summary

### Timing information on when a cell is going to stop service

RAN2 has agreed ‘The timing information on when a cell is going to stop serving the area is broadcast at least for the quasi-earth fixed case. FFS details’.

In document [4], it is proposed that the timing is signalled in the same SIB as the ephemeris information.

**Q7: The timing information on when a cell is going to stop serving the area is broadcast** **in the same SIB as the ephemeris information**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Yes** |  |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | **yes** |  |
| MediaTek | **Yes** |  |
| Qualcomm | **FFS** | See our response in Q5. |
| ZTE | **Yes** | This information is useful and therefore needed. |
| Xiaomi | **Yes** |  |
| Ericsson | **Yes** |  |
| Interdigital | **yes** |  |
| Nokia | **Yes** |  |
| Apple | **Yes** |  |
| Rakuten Mobile Inc | **Yes** |  |

Rapporteur’ summary

In document [8], it is proposed that broadcast of cell stop time in SIB is only applicable to quasi earth fixed cell (not to moving cell) and UE should start to perform intra-frequency or inter-frequency measurements before the cell stop time and the exact time to perform measurements is up to UE implementation. Rapporteur thinks that how to start measurement should be discussed in offline-029 CP Idle mode Cell and TA related.

**Q8: Broadcast of the timing information on when a cell is going to stop serving the area is only applicable to quasi earth fixed cell (not to moving cell).**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Yes** | For Quasi-Earth Fixed satellite, the timing information on when a cell is going to stop serving the area is common for all UEs in a cell, it could be easily broadcasted for all UEs in a cell. However, for satellite with earth moving cell, it depends on UE’s location, so different solution might need to be considered. |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | **yes with comment** | At least for the continuous coverage case.  For the moving cell scenarios, the remaining time is different for UEs located at different regions of the cell. |
| MediaTek | **Yes** |  |
| Qualcomm | **Yes** |  |
| ZTE | **Yes** | Similar view as above that to broadcast stop timing seems infeasible for moving cell case. For moving cell case, we think ephemeris information would be enough and better to avoid complicated optimization. |
| Xiaomi | **Yes** | For earth moving cell, the timing information is different for different UEs in the cell, so it is more complicated for earth moving cells, we can consider the earth moving cell in the future. |
| Ericsson | **Yes with comment** | For the cell stop time in principle it should be used for quasi earth fixed cell only, but maybe there is no need to specify restrictions. |
| Interdigital | **yes** | It is needed for both the continuous and discontinuous coverage case for quasi-earth fixed only. |
| Nokia | **Yes** |  |
| Apple | **Yes** |  |
| Rakuten Mobile Inc | **Yes** | We think for moving cells, it would not be feasible to have single timing information over distributed UEs. It will be applicable for Quasi-Fixed Earth cell. |

Rapporteur’ summary

## Paging delay incurred by the GNSS fix

The following proposals are made in documents [1]- [8]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| [R2-2109967](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109967.zip) [1] | Proposal 1 Lower layers provide indication(s) to NAS about the availability of GNSS. NAS delays NAS message until the GNSS fix is available. This applies to both MO and MT (response to paging) scenarios.  Proposal 2 The value range of GNSS location delay can be determined by RAN1.  Proposal 3 Whether the UE requires a delay between paging reception and paging response in order to obtain a GNSS location is indicated to core network via a UE capability indication. FFS whether this capability is included in RRC capability message or NAS capability message.  Proposal 4 Send LS to other working groups (CT1 and SA2 including RAN3 and RAN1) to inform the issues and RAN2 agreements regarding GNSS fix delay for page response. |

In document [1], it is proposed that the lower layers provide indication(s) to NAS about the availability of GNSS and that NAS delays NAS message until the GNSS fix is available.

**Q9: The lower layers provide indication(s) to NAS about the availability of GNSS and NAS delays NAS message until the GNSS fix is available**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **No** | To avoid NAS timer expired, NW should configure a larger value for IoT NTN device. This can be discussed in CT1. |
| Lenovo, Motorola Mobility | **No** | This should be discussed in CT1. And in NR NTN there is a drafting LS for this. We can wait for the LS and its reply from other WGs. |
| Huawei, HiSilicon | **No** | We do not think it is needed. For initial access, NAS is informed when the RRC Connection is established (transition to RRC\_CONNECTED and before sending Initial UE message) so NAS can start the timer at this point. In connected mode, we expect the GNSS fix to be available. |
| MediaTek | **No** |  |
| Qualcomm | **Yes** | This is the only easy fix to this issue. We agree NAS timer may need extension but not by 100s (GNSS fix time for cold start).  Whether the AS NAS interaction is when fixing GNSS before RACH or when RRC connected is established (as Huawei proposed) can be up to CT1 and what solution to adopt, i.e., extend NAS timer or when to start NAS timer.  But what is in RAN2 scope is NAS can be informed of indication, which can be used to handle NAS timers. |
| ZTE | **No** | This can be left to UE implementation or handled by CT1. |
| Xiaomi | **No** | RAN1 is discussing the GNSS fix issue and we can wait the conclusion on how to resolve this issue from RAN1. |
| Ericsson | **No** | There is currently an on-going e-mail discussion in NR NTN on just this issue that has been treated online which was triggered based on an LS from CT1. I propose that we wait for the outcome of that and discuss this issue in IoT NTN. We would also need to consult with CT1 regarding the solution as the feasibility is very much up to CT1.  In R2-2110388 the issue is analyzed and a number of solutions are listed that I think that IoT NTN should consider along with the IoT use case. We do not think that there necessarily need to be the same solution for NR NTN and IoT NTN. |
| Interdigital | **-** | Not a RAN2 decision. |
| Nokia | **No** | GNSS operation is outside 3GPP PS operation. So any dependent operation based on the same need not be specified. |
| Apple | **No** | Agree with ZTE |
| Rakuten Mobil Inc | **No** | We wonder this topic does not belong to RAN2, but to CT. |

Rapporteur’ summary

In document [1], it is proposed that whether the UE requires a delay between paging reception and paging response in order to obtain a GNSS location is indicated to core network via a UE capability indication.

**Q10: Whether the UE requires a delay between paging reception and paging response in order to obtain a GNSS location is indicated to core network via a UE capability indication**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **No** |  |
| Lenovo, Motorola Mobility | **No** |  |
| Huawei, HiSilicon | **No** | We do not really see this is as a capability and we don’t expect the IOT UEs to perform a GNSS fix every time they wake up from long sleep to monitor paging.  NAS can define longer timer for paging over NTN cell the same way as they have defined longer timer for paging over NB-IOT. |
| MediaTek | **No** |  |
| Qualcomm | **Yes** | If there is no such capability, then there should be indication of low mobile and high mobile UE or UE keeps GNSS in warm state or cold state during IDLE mode. Based on this, network can set the paging strategy. |
| ZTE | **No** | Same view as Huawei. |
| Xiaomi | **No** | RAN1 is discussing the GNSS fix issue and we can wait the conclusion on how to resolve this issue from RAN1. |
| Ericsson | **No** | We do not see the need for this, but I think we need to take the considerations from the discussions in NR NTN on this and then discuss this more in IoT NTN. |
| Interdigital | **No** |  |
| Nokia | **No** | Specification changes not needed. |
| Apple | **No** | Agree with Huawei. |
| Rakuten Mobile Inc | **No with Comment** | We think this is not necessary in Rel17. But we see some benefits in paging strategies specially during discontinuous coverage. |

Rapporteur’ summary

In document [1], it is proposed that the value range of GNSS location delay can be determined by RAN1 and to send a LS other working groups to inform the issues and RAN2 agreements regarding GNSS fix delay for page response. Rapporteur thinks that it can be discussed later based on the outcome of the above discussion.

## Connected mode mobility

The following proposals are made in documents [1]- [8]:

|  |  |
| --- | --- |
| [R2-2109506](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109506.zip) [2] | Proposal 1 For CHO enhancement in eMTC NTN, RAN2 consider only timer based CHO triggering event, in addition to the legacy triggering events.  Proposal 2 Rel-17 enhancements to reduce the time taken for RRC re-establishment are not considered in Rel-17 NB-IoT NTN. |
| [R2-2110480](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110480.zip) [4] | Proposal 11: Upon expiry of the UL synchronisation (validity timer(s) and outdated GNSS position fix), the UE triggers RLF, reacquires system information / GNSS position fix and performs RRC Connection Re-establishment. No other mechanism is needed in R17. |
| [R2-2110770](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110770.zip) [6] | Proposal 3: Support CondEvent A4 for IoT NTN CHO  Proposal 4: not to support location-based trigger for IoT NTN CHO in Rel-17  Proposal 5: not to support timer-based trigger for IoT NTN CHO in Rel-17  Proposal 6: Timers and constants for RLF and RRC connection re-establishment procedures does not require extended value range.  Proposal 7: RAN2 discuss to have one of following solutions to avoid RLF/Handover during a short data transmission session:  • Option1: allow UE to delay a data transmission session initiation until finishing upcoming cell reselection  • Option2: allow UE to advance the upcoming cell reselection if there is data arrival for transmission |
| [R2-2110835](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110835.zip) [7] | Proposal 1 No procedural update is required to support RLF procedure in IoT NTN.  Proposal 2 No procedural update is required to support RRC connection re-establishment procedure in IoT NTN.  Proposal 3 No extension in UE specific RRC timers and constants is required to support RLF and RRC connection re-establishment in IoT NTN. |
| [R2-2111030](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2111030.zip) [8] | Proposal 1: For RLF trigger, UE can start/stop timer T310 based on the distance between UE and cell center.  Proposal 2: Network can provide assistance information to indicate the target cell of RRC re-establishment, which can include frequency information, PCI and so on.  Proposal 3: The target cell information can be provided to UE in a broadcast manner. |

### CHO

Document [2] proposes to support only timer based CHO triggering event, in addition to the legacy triggering events and document [6] propose not to support location-based and timer-based triggers for IoT NTN CHO in Rel-17 .

RAN2 has already agreed

‐ Rel-16 LTE CHO mechanism is supported for LTE-M devices in IoT NTN. FFS which CE Mode(s) to apply

‐ No procedural update is required to support connected mode mobility for LTE-M.

**Q11: No enhancement to R16 CHO are introduced in R17**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Disagree** | The use of location based triggering event in CHO would increase UE power consumption, which is against the low cost and low complexity requirement for eMTC device. However, timer-based CHO triggering event could be considered to support for eMTC NTN, since it benefits in the scenario such as feeder link switch. |
| Lenovo, Motorola Mobility | **Disagree** | Agree with OPPO’s view. At least timer-based CHO can be considered. |
| Huawei, HiSilicon | **Yes** | This is sufficient for R17. Optimisations can be discussed in R18. |
| MediaTek | **Yes** | Agree with Huawei that this is sufficient for the first release. |
| Qualcomm | **Yes** | Can be considered in Rel-18. |
| ZTE | **Yes** | Same view as Huawei. |
| Xiaomi | **No** | Location-based and timer-based CHO trigger can be considered for IoT NTN, which are more suitable for NTN system. |
| Ericsson | **Yes** |  |
| Interdigital | **no** | At least for the discontinuous coverage case, CHO would have to take into account the coverage gap otherwise will just get RLF. |
| Nokia | **Yes** | Mobility is not important criteria for IoT-NTN. Eventhough the enhancements to LTE spec is porting of NR changes, there is spec change and CR review involved. In Rel-17 it is not essential. Timer based option can be implemented using other configuration parameters of handover such as Time to Trigger.. |
| Apple | **Yes** | Agree with Huawei. |
| Rakuten Mobile Inc | **No** | We think there is requirement of timer based & location based CHO due to less variation of RSRP over NTN cell coverage. |

Rapporteur’ summary

### RLF and RRC connection Re-establishment

Document [2] proposes not to support Rel-17 NB-IoT RLF enhancements.

Document [4] proposes that upon expiry of the UL synchronisation (validity timer(s) and outdated GNSS position fix), the UE triggers RLF, reacquires system information / GNSS position fix and performs RRC Connection Re-establishment. Rapporteur thinks this is discussed in offline-028 User Plane Impact.

Document [6] proposes to discuss options to avoid RLF/Handover during a short data transmission session

Document [7] proposes no need for procedural update to RLF and RRC Connection Re-establishment

Document [8] proposes to introduce location-based RLF trigger and to provide assistance information on the target cell for connection re-establishment.

RAN2 has already agreed ‘Rel-16 RLF / connection re-establishment mechanisms are supported in IoT NTN assuming that minor adjustments to UE specific timers and constants would be sufficient.’

**Q12 No enhancement to R16 RLF and RRC connection Re-establishment procedures are introduced in R17. This does not consider handling of UL synchronisation loss discussed in the user plane.**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Agree** | Considering that the discussion on Rel-17 enhancements to reduce the time taken for RRC re-establishment is still ongoing, and we may not have enough time to discuss its applicability in NTN, we think that RLF/re-establishment enhancements can be considered in later release. |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | **Yes** | This is sufficient for R17. Optimisations can be discussed in R18. |
| MediaTek | **Yes** | Agree with Huawei. |
| Qualcomm | **Yes** |  |
| ZTE | **Yes** | Even for the issue of UL synchronization loss that is under discussion in the scope of user plane, we think changes to the RLF procedure can be avoided. Therefore, we agree no enhancement to R16 RLF and RRC connection Re-establishment procedures need to be introduced in R17. |
| Xiaomi | **No** | Because near-far effect is not obvious in NTN, location information need to be considered. |
| Ericsson | **Yes** |  |
| Interdigital | **No** | It would be better to take into account the coverage gap when performing re-establishment, however we are also fine to discuss in R18, existing RLF would still work but in a non-optimal way. |
| Nokia | **Yes** | Applicability of Rel-17 enhancements for IoT-NTN if really required can be considered when finalising the Rel-17 spec work for these enhancements. In our view this comes under ‘non essential’ category for IoT-NTN use-cases. |
| Apple | **Yes** | Agree with Huawei |
| Rakuten Mobile Inc | **No, With comment** | We think there should be minor enhancement to RLF procedure related to assistance information of target cell [Which is certain]. This will improve Re-Establishment procedure |

Rapporteur’ summary

Documents [6] and [7] propose no need for extension of timers and constants for RLF and RRC connection re-establishment.

**Q13 No extension to timers and constants is required for RLF and RRC connection Re-establishment**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Agree** |  |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | Yes with comment | We agree for the continuous coverage case. We wonder how RRC connection Re-establishment works in long discontinuous coverage scenario. |
| MediaTek | **Yes** |  |
| Qualcomm | **Yes** |  |
| ZTE | **Yes** | We also agree this for the continuous coverage case, e.g., the value ranges of T300 and T301 are enough in IoT NTN. |
| Xiaomi | **Yes** | The maximum value of related timers and constants are sufficient for IoT NTN system. |
| Ericsson | **Yes** |  |
| Interdigital | **Yes** | Timers may be paused/stopped when there is a coverage gap. |
| Nokia | **yes** |  |
| Apple | **Yes** |  |
| Rakuten Mobile Inc | **Yes** |  |

Rapporteur’ summary

## Other

### RRC Connection Release

The following proposals are made in documents [1]- [8]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| [R2-2110020](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110020.zip) [3] | Observation: the receipt of the RRCRelease message has been successfully acknowledged means that:  1. UE receives the HARQ ACK from eNB for UL RLC status report message for UEs other than NB-IOT/eMTC UEs, if eNB polls for RLC status report.  2. UE does not receive UL grant during drx-ULRetransmissionTimer after UE sends RLC status report for RRC release message for NB-IOT/eMTC case, if eNB polls for RLC status report.  a) Note: with asynchronous UL HARQ operation in NB-IoT, eMTC and LAA (unlicensed carrier), where there is no explicit HARQ ACK for uplink transmissions.  3. HARQ ACK has been sent for RRC release message if eNB does not polls for RLC status report for eMTC/NB-IOT.  Proposal 1 For the reception of RRC release, the 1.25s delay value should be extended for eMTC UEs.  Proposal 2 For the reception of RRC release, the 1.25s delay value is extended to 3.86s for eMTC UEs.  Proposal 3 For the reception of RRC release, the 10s delay value is not extended for NB-IOT UEs. |

**Q14 For the actions upon reception of RRC connection release, the 1.25s delay value is extended to 3.86s for eMTC UEs.**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Disagree** | Even though it is extended to 3.86s, it still has the risk of state mismatch. The enhancement for this issue could be considered in next release. |
| Lenovo, Motorola Mobility | **No** | Can be considered in the next release. |
| Huawei, HiSilicon | yes with comment | we agree that the value needs to be extended at least for the GEO scenario.  We are not sure what is the best way, define a new value or add the UE-eNB RTT to the existing value |
| MediaTek | No | Can be considered in the next release |
| Qualcomm | Disagree | 1.25s is more than enough for now. |
| ZTE | **Yes** | Similar view as Huawei. |
| Xiaomi | **Yes** | At least for GEO case, it should be extended for two reasons: 1. the RTT for GEO would be as large as 541ms, and 2. the channel condition for NTN would be worse than TN, much more repetitions and retransmissions are expected. If we do not extend the value, the possibility of UE not being able to successfully acknowledge the RRC release will be considerably high, resulting in high risk of state mismatch. |
| Ericsson | **FFS** | We also agree that there may always be issue of state mismatch. If UE can receive the RRC release then it should hopefully be in good coverage enough to complete it enough time. But I think we need some more analysis and the analysis in the contributions have some flaws. |
| Interdigital | Yes? | Agree with Huawei |
| Nokia | **No** | Can be considered in next release |
| Apple | **No** |  |
| Rakuten Mobile Inc | **Yes, with comment** | We think there is need to increase delay value to avoid state mismatch. However, we are not sure whether this will be only solution specially in case of discontinuous coverage |

Rapporteur’ summary

**Q15 For the actions upon reception of RRC connection release, the 10s delay value is not extended for NB-IOT UEs.**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Agree** |  |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | **Yes** |  |
| MediaTek | **Yes** |  |
| Qualcomm | **Yes** |  |
| ZTE | **Yes** |  |
| Xiaomi | **Yes** |  |
| Ericsson | **Yes** |  |
| Interdigital | **Yes** |  |
| Nokia | **Yes** |  |
| Apple | **Yes** |  |
| Rakuten Mobile Inc | **Yes** | We are not sure whether this will be only solution specially in case of discontinuous coverage |

Rapporteur’ summary

### Preventing access by non-NTN capable UEs

The following proposals are made in documents [1]- [8]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| [R2-2110835](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110835.zip) [7] | Observation 1 An explicit indication of TN or NTN cell would be needed for UEs that support both.  Observation 2 There has to be means for legacy UEs to avoid attempting to connect to a NTN  Proposal 4 RAN2 to address the case of preventing legacy TN UEs attempting to access NTN.  Proposal 5 A UE that supports NTN ignores the cellBarred parameter provided in SIB1 and checks a parameter introduced to indicate the barring status for UEs that support NTN instead. |

**Q16: Legacy UEs are barred from accessing a NTN cell by the legacy cellBarred parameter provided in SIB1**.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Yes** | As supported by the spec. |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | **yes** |  |
| MediaTek | **Yes, but** | All UEs can be barred by using the cellBarred parameter provided in SIB1 |
| Qualcomm | **Yes** | This must be for legacy UEs and TN only capable UEs. |
| ZTE | **Yes** | It’s easy to understand that the IoT UEs for TN (e.g., R17 earlier release IoT UE and R17 IoT UE without NTN capability) cannot access the IoT NTN network (as UE cannot perform the TA pre-compensation). Therefore, we should prevent such UEs from trying to connect to the IoT NTN cell. Any new network indication would be infeasible as it cannot be understood by legacy IoT UEs.  Then the straightforward way is to set the legacy *cellBarred* parameter in IoT NTN cell to “Barred” even if the network is not congested. By this way, all the legacy UEs would skip IoT NTN cell. |
| Xiaomi | **Yes with comment** | All UEs including IoT NTN and legacy UEs can be barred by this parameter. |
| Ericsson | **Yes** | This is needed to prevent non-NTN UEs from mistakenly accessing an NTN cell and is needed for operators to ensure that when attempting to deploy NTN and TN on same frequencies there are no problems. |
| Interdigital | **yes** |  |
| Nokia | **Yes** |  |
| Apple | **No** | If we assume that NTN frequencies are different from TN, then there is no need for an additional mechanism. |
| Rakuten Mobile Inc | **Yes** |  |

Rapporteur’ summary

**Q17: To access a NTN cell, a NTN-capable UE ignores** **the legacy cellBarred parameter provided in SIB1 and check a new barring parameter for the NTN cell.**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **No** | The legacy cellBarred parameter is sufficient and no need to introduce new one. |
| Lenovo, Motorola Mobility | **No** | We see no necessity. |
| Huawei, HiSilicon | **yes** |  |
| MediaTek | **No** | Legacy UEs can be barred to camp into NTN cell by virtiue of not supporting NTN bands. |
| Qualcomm | **Yes** | Even if TN and NTN bands are separate, the frequency can still be overlapped. Then there will be issue. We cannot just leave this issue with random assumption.  TN and NTN frequency never overlap? Can this be confirmed by RAN2? |
| ZTE | **Yes** | According to our answer of Q16, we assume legacy *cellBarred* parameter in IoT NTN cell should be always set “Barred” to avoid unnecessary access attempts from legacy IoT UEs.  If NTN-capable UEs also read this parameter, they have no chance to access the IoT NTN cell. Therefore, a NTN-capable UE should ignore this legacy *cellBarred* parameter and a new barring parameter for the IoT NTN cell needs to be introduced. This new parameter is used, e.g., to block NTN-capable UEs when network is congested and allow their accesses when network is not congested. |
| Xiaomi | **No** | The legacy cellBarred parameter also can be used to bar the IoT NTN UEs. |
| Ericsson | **Yes** |  |
| Interdigital | **yes** | Agree with QC that we cannot assume all current and future bands have no overlapping frequency.  It is then obviously needed otherwise NTN cell cannot bar legacy UEs while allowing NTN UEs. |
| Nokia | **Yes but** | Validity of scenario where NTN and TN UE operate in same frequency band to be confirmed. If possible, differentiation of the cell for TN UE is preferred. |
| Apple | **No** | If we assume that NTN frequencies are different from TN, then there is no need for an additional mechanism. |
|  |  |  |

Rapporteur’ summary

### System information acquisition enhancements

The following proposals are made in documents [1]- [8]:

|  |  |
| --- | --- |
| Tdoc | Proposals |
| [R2-2110835](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110835.zip) [7] | Observation 3 In a NTN when serving satellite is categorized as low earth orbit (LEO) or medium earth orbit (MEO) it is very likely tha the UE wakes up on a cell other than the serving cell when it wakes up to monitor for paging.  Observation 4 The UE would have to acquire a new set of system information every time it wakes up causing large UE power consumption.  Proposal 6 RAN2 intends to introduce a mechanism to reduce the need to acquire full system information after cell reselection unless UE intends to access the network.  Proposal 7 RAN2 to discuss how to indicate the ID of a cell group where parameters providing essential information are provided with the same configuration. |

**Q18: Introduce mechanism to reduce the need to acquire full system information after cell reselection unless UE intends to access the network**

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **No** | We don’t think this is essential for Rel-17 IoT NTN. |
| Lenovo, Motorola Mobility | **No** | Can be considered in the next release. |
| Huawei, HiSilicon | **No** | This is an optimisation and can be postponed to R18 |
| MediaTek | **No** | Agree with others that optimations can be discussed in later releases. |
| Qualcomm | **Yes** | UE may not need to acquire again SIB2/3/4/5 and epehemeris when it is just intra-satellite cell change and it is in the same TA. |
| ZTE | **No** | It has benefit but not so urgent. Can be considered in the next release. |
| Xiaomi | **NO** | It can be considered in the future release. |
| Ericsson | **Yes** | In LEO scenario it is expected that the UE would constantly need to read new SIBs and in order to reduce that burden, some mechanism would be needed to prevent this. The need to constantly acquire system information would quickly drain battery in LEO NTN. |
| Interdigital | **no** |  |
| Nokia | **Yes** | System information acquistion for stationary UE in moving cell scenario is one of the factor for increased power consumption. Some enhancements with minor spec change can still be considered in Rel-17. |
| Apple | **No** |  |
| Rakuten Mobile Inc | **No** | Can be consider next release. |

Rapporteur’ summary

### Other Enhancements

# Conclusion

# References

1. [R2-2109967](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109967.zip) GNSS fix and Paging response delay Qualcomm Incorporated

1. [R2-2109506](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109506.zip) Discussion on CP impact for IoT over NTN OPPO

1. [R2-2110020](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110020.zip) Consideration on RRC release for IOT NTN Beijing Xiaomi Mobile Software

1. [R2-2110480](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110480.zip) Control plane for IOT NTN Huawei, HiSilicon

1. [R2-2110072](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110072.zip) Provision of ephemeris Apple

1. [R2-2110770](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110770.zip) Analysis on Mobility Aspects for IoT NTN NEC Telecom MODUS Ltd.

1. [R2-2110835](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110835.zip) Control plane aspects of IoT NTN Ericsson

1. [R2-2111030](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2111030.zip) Discussion on control plane issues for IoT NTN Xiaomi Communications