**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

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| --- | --- |
| Company | Name and email address |
| Huawei, HiSilicon | Odile Rollinger (odile.rollinger@huawei.com) |
| OPPO | Haitao Li (lihaitao@oppo.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** |  |
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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** |  |

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** |  |

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 satelitte 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**

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| --- | --- | --- |
| **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** |  |

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**

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| --- | --- | --- |
| **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** |  |

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**

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| --- | --- | --- |
| **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. |
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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** |  |

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).**

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| --- | --- | --- |
| **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. |
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Rapporteur’ summary

## Paging delay incurred by the GNSS fix

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

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| --- | --- |
| 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**

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| --- | --- | --- |
| **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. |
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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**

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| --- | --- | --- |
| **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. |
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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]:

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| [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**

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| --- | --- | --- |
| **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. |
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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.**

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| **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. |

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**

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| --- | --- | --- |
| **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. |
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Rapporteur’ summary

## Other

### RRC Connection Release

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

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| --- | --- |
| 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.**

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| --- | --- | --- |
| **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 |

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** |  |

Rapporteur’ summary

### Preventing access by non-NTN capable UEs

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

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| --- | --- |
| 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**.

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| --- | --- | --- |
| **Company** | **yes/no** | **Detailed comments** |
| OPPO | **Yes** | As supported by the spec. |
| Lenovo, Motorola Mobility | **Yes** |  |
| Huawei, HiSilicon | **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** |  |
|  |  |  |

Rapporteur’ summary

### System information acquisition enhancements

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

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| --- | --- |
| 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**

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| --- | --- | --- |
| **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 |
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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