**3GPP TSG-RAN2 Meeting #114-e R2-2106468**

**Online, May 19 – 27, 2021**

**Agenda Item: 9.2.1**

**Source: Huawei**

**Title: [Pre114-e][004][IoT NTN] Summary of 9.2.1 Essential Parts (Huawei)**

**Document for: Discussion and decision**

# Introduction

This document summarises the contributions related to essential parts submitted to AI 9.2.1.

# Discussion

## User Plane

### HARQ

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

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2104817 [1] | Proposal 1 Enhancements to disabling HARQ are not essential for IoT over NTN in Rel-17. |
| R2-2105415 [4] | Proposal 2: The necessity of HARQ enhancement in Rel-17 depends on data rate requirement for IoT NTN. |
| R2-2105428 [5] | Proposal 5 Capture in TR that HARQ feedback/HARQ retransmission can be disabled to avoid HARQ stalling state in GEO cell. |
| R2-2105664 [6] | Proposal 4: Disabling of HARQ feedback is not essential. |
| R2-2106168 [7] | Proposal 2 The necessity of HARQ enhancements for IoT NTN should be studied considering the reduction in link throughput. |

Rapporteur’ summary

Proposal 5 in [5] is about detailed feature analysis. The interpretation of the proposal here is that the feature is considered as essential.

Disabling HARQ was discussed at RAN2#113bis-e without conclusion [9]:

***Observation 1****: Majority of companies think that enhancements to disable HARQ are not essential (18/24). There is small interest (4/24) to support disabling HARQ for GEO scenario and suggestions (2/24) to wait for RAN1 conclusion.*

**Proposal 1:** [To Discuss] Wait for RAN1 conclusion before deciding whether enhancements to disable HARQ feedback/ HARQ retransmission are essential for IOT NTN.

### Coverage enhancements

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

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2104817 [1] | Proposal 2 Coverage enhancements are essential for IoT over NTN in Rel-17. |
| R2-2105364 [3] | Proposal 1: From RAN2 perspective, if coverage enhancement is supported for IoT over NTN, it’s essential to discuss whether and how multiple CELs can be supported. |
| R2-2106168 [7] | Proposal 4 Enhancements to coverage and spectral efficiency functionalities are not essential. |

Rapporteur’ summary

During discussions at RAN2#113bis-e [9], the majority of views was that coverage enhancements should be decided by RAN1:

***Observation 4:*** *Coverage enhancements and CE-Mode B should be decided by RAN1 (14/21)*

**Proposal 2:** [To discuss] Support of coverage enhancements is to be decided by RAN1.

**Proposal 2a:** [To discuss] Whether essential enhancements to CEL handling are needed from RAN2 point of view.

### PDCP

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| --- | --- |
| Tdoc | Proposals |
| R2-2105664 [6] | Proposal 5: Enhancement to PDCP discard timer is not essential. |

Rapporteur’ summary

This was discussed at RAN2#113bis-e without conclusion [9]. The view was that the enhancement, if any, would be small:

***Observation 3****: Majority of companies think that enhancements to PDCP discard timer are not essential (16/23).There is some interest (7/23) in enhancements to PDCP discard timer, especially considering that the change will be very small.*

**Proposal 3:** [To discuss] Enhancement to PDCP discard timer is not essential for IOT NTN.

## Control Plane

### Idle mode mobility

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

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2106168 [7] | Proposal 5 Minor adjustments to existing mobility mechanisms, such as a new parameter, parameter values, timers, timing etc. are considered essential enhancements to adapt functionality to NTN.  Proposal 6 No new mobility mechanisms or major enhancements to existing mechanisms are introduced in Rel-17 for IoT NTN. |
| R2-2106359 [8] | Proposal 2 Earth moving cell scenario and enhancements for TAC update are considered as essential minimum functionality.  Proposal 3 Enhancements to cell selection/re-selection follow NR NTN are considered as essential minimum functionality. |

Rapporteur’ summary

Idle mode mobility enhancements were discussed at RAN2#113bis-e without conclusions [9]:

***Observation 5****: There is small interest (4/24) in study additionally the impact of discontinuous coverage and cell moving scenario in TA handling for NTN IOT,*

***Observation 7****: There is some interest (5/23) for reusing NR idle mobility enhancements.*

It is proposed that RAN2 discuss the proposals below.

**Proposal 4:** [To discuss] Adjustments to existing mobility mechanisms to adapt functionality to NTN are essential.

**Proposal 5:** [To discuss] Earth moving cell scenario and enhancements for TAC update are considered as essential.

**Proposal 6:** [To discuss] Enhancements to cell selection/re-selection as agreed in NR NTN are considered as essential.

### Idle mode power saving enhancements

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

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2104817 [1] | Proposal 3 Idle mode power saving enhancements are essential for IoT over NTN in Rel-17. FFS on which set of power saving enhancements. |
| R2-2104855 [2] | Observation 1: For GEO, the existing PSM mechanisms e.g. eDRX, relaxed monitoring, SI acquisition and WUS could be reused without any further enhancement.  Observation 2: For LEO with continuous coverage, the existing PSM scheme e.g., eDRX, relaxed monitoring, SI acquisition and WUS could be reused with some minor adjustment to search for the new cell according to the ephemeris data to monitor the WUS/Paging signalling.  Observation 3: Coverage holes may not appear regularly for LEO with discontinuous coverage scenario, which may bring the complexity for eDRX cycle configuration.  Proposal 1: eDRX/PSM is not necessary for LEO with discontinuous coverage scenario, the ephemeris data could be the most essential info for a UE to do proper network selection when a satellite comes, and the UE could sleep down or power off when the satellite is gone. |
| R2-2105415 [4] | Observation 1: Power consumption related to Idle mode mobility related procedures can be significantly improved for discontinuous coverage scenario with additional enhancements.  Proposal 4: RAN2 to prioritise the enhancements to the idle mode procedures applicable for discontinuous coverage scenario in Rel-17. |
| R2-2105428 [5] | Proposal 6 Capture in TR that relaxed monitoring is supported without further enhancement in GEO cell. |
| R2-2105664 [6] | Proposal 1: Enhancements for handling of coverage holes or discontinuous coverage in Idle mode in a power efficient way are essential. |
| R2-2106168 [7] | Observation 3 There is no need for generic enhancements for UE power consumption, e.g., to compensate for power consumption due to GNSS, only cases specific to IoT NTN may need to be addressed depending on the adopted concept.  Proposal 3 If enhancements are needed for UE power consumption, it should not be generic but rather justified case by case with a study to conclude whether it would be beneficial to address a particular case specific to IoT NTN. |
| R2-2106359 [8] | Proposal 1 Enhancements for power saving in idle mode for NTN IOT devices, e.g. enhancements to eDRX/PSM (discontinuous coverage) and to relaxed monitoring, SI acquisition and WUS, are considered as essential minimum functionality. |

Rapporteur’ summary

Proposal 6 in [5] is about detailed feature analysis. The interpretation of the proposal here is that the feature is considered as essential.

Power saving enhancements in idle mode were discussed at RAN2#113bis-e [9] and the following was captured in the chair’s minutes:

* (22/25) There is significant interest for Power saving in idle mode for NTN IOT devices, e.g. there is significant interest for enhancements to eDRX/PSM (discontinuous coverage) and to relaxed monitoring, SI acquisition and WUS.

It is proposed that RAN2 agree the proposals below.

**Proposal 7:** For GEO, the existing power saving mechanisms e.g. PSM, eDRX, relaxed monitoring, SI acquisition and WUS can be reused without any further enhancement.

**Proposal 8:** Enhancements for handling of discontinuous coverage in idle mode are essential.

### Connected mode mobility enhancements

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

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2104855 [2] | Proposal 2: For discontinuous coverage scenario, if RLF is caused by the coverage hole, the handling of RLF in the UE should be adjusted. E.g., abort the cell selection and reestablishment, and retry the cell selection when the next satellite cell is coming if necessary. |
| R2-2105415 [4] | Observation 2: Awareness of coverage continuity for connected mode UE may be beneficial in some scenarios.  Proposal 5: Minor changes to connected mode functionality for discontinuous coverage can be considered for Rel-17. |
| R2-2105664 [6] | Proposal 2: For LEO cell moving scenarios, enhancements using time/location for connected mode mobility are essential. |
| R2-2106168 [7] | Proposal 5 Minor adjustments to existing mobility mechanisms, such as a new parameter, parameter values, timers, timing etc. are considered essential enhancements to adapt functionality to NTN.  Proposal 6 No new mobility mechanisms or major enhancements to existing mechanisms are introduced in Rel-17 for IoT NTN. |
| R2-2106359 [8] | Proposal 4 Enhancements to CHO in eMTC based NTN follow NR NTN can be considered as essential minimum functionality for R17 IOT NTN.  Proposal 5 RLF enhancement is not considered as essential minimum functionality for R17 IOT NTN. |

Rapporteur’ summary

Connected mode mobility enhancements were discussed at RAN2#113bis-e without conclusions [9]:

***Observation 8****: For NB-IoT, majority of companies think that enhancements to existing connected mode mobility mechanisms are not essential (14/20). There is small interest (6/20) to introduce RLF enhancements.*

***Observation 9****: For eMTC, there is significant interest (11/21) to introduce CHO enhancements.*

It was also agreed

* For enhancements to CHO, e.g. location and time based triggering events related to CHO in eMTC-based NTN should follow NR-NTN.

It is proposed that RAN2 discuss the proposals below.

**Proposal 9:** [To discuss] Minor changes to connected mode functionality for discontinuous coverage can be considered.

**Proposal 10:** [To discuss] For LEO cell moving scenarios, enhancements using time/location for connected mode mobility are essential.

**Proposal 11:** [To discuss] Enhancements to CHO in eMTC NTN similar to NR NTN are essential.

### Connected mode power saving enhancements

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

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2104817 [1] | Proposal 4 Connected mode power saving enhancements are not essential for IoT over NTN in Rel-17. |
| R2-2104855 [2] | Observation 4: for GEO scenarios and LEO with continuous coverage scenario, enhancements for power saving in connected mode are not essential for NTN IOT devices. |
| R2-2105415 [4] | Proposal 3: RAN2 to agree EDT (without additional specification changes compared to RACH) as essential part for IoT NTN in Rel-17. |
| R2-2105428 [5] | Proposal 1 Capture in TR that EDT is supported in NTN without additional changes compared to random access procedure.  Proposal 2 Capture in TR that PUR in GEO is feasible with minor enhancement to PUR response window and validation criteria.  Proposal 3 Capture in TR that PDCCH-based HARQ ACK can be supported in LEO scenario with minor enhancement.  Proposal 4 Capture in TR that multiple TB scheduling can be supported without needing further enhancement. |
| R2-2105664 [6] | Proposal 3: Enhancements for power saving in connected mode are not essential. |
| R2-2106168 [7] | Proposal 3 If enhancements are needed for UE power consumption, it should not be generic but rather justified case by case with a study to conclude whether it would be beneficial to address a particular case specific to IoT NTN. |

Rapporteur’ summary

Proposal1 1..4 in [5] are about detailed feature analysis. The interpretation of the proposals here is that the features are considered as essential.

Power saving enhancements in connected mode were discussed at RAN2#113bis-e [9] and the following was captured in the chair’s minutes:

* Chair: Most companies think Enhancements for power saving in connected mode are not essential for NTN IOT devices.

It is proposed that RAN2 discuss the proposal below.

**Proposal 12:** [To discuss] Enhancements for power saving in connected mode power are not essential. Minor adaptations for features e.g. EDT, PUR in GEO, Multi-TB scheduling and PDCCH-based HARQ in LEO can be considered in WI phase.

## Other

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

|  |  |
| --- | --- |
| Tdoc | Proposals |
| R2-2105364 [3] | Observation 1a: If one satellite is mapped to one cell, the network capacity will be limited; if one satellite beam is mapped to one cell, the UE mobility performance and access performance will be negatively impacted.  Observation 1b: In NR NTN, cell beam (e.g. NR SSB) can deal with the contradiction between the mobility performance and cell capacity.  Proposal 2: It’s essential to evaluate whether the current SON report mechanism is still useful for NB-IoT moving cell over LEO NTN.  Proposal 3: It’s essential to discuss whether the channel quality reports in Msg3 and in RRC\_CONNECTED state is still applicable/useful for UE in IoT over LEO NTN  Proposal 4: It’s essential to discuss whether and how to support cell beam (e.g. similar NR SSB) for IoT over NTN.  Proposal 5: If cell beam can be supported for NB-IoT/eMTC over NTN, RAN2 need to further consider how to provide the cell beam related information in system information. |
| R2-2105415 [4] | Proposal 1: 5GC connectivity is not essential functionality for the listed scenarios. |
| R2-2106168 [7] | Observation 1 It is not clear whether use cases other than intermittent delay-tolerant small packet transmissions require significant effort.  Proposal 1 Use cases that can be addressed with minimal effort should not be excluded. |

Rapporteur’ summary

For proposals 2 and 3 in [3] and proposal 1 in [4], the agreement is that all features are supported unless issues are found. The documents do not highlight technical issues.

For proposals 4 and 5 in [3], SSB is not supported in IOT and there has been no discussion on supporting SSB in NTN IOT.

For proposal 1 in [7], use cases for the discussion are defined in RP-210915.

It is proposed that RAN2 discuss the proposals below.

**Proposal 13:** [To discuss] Whether essential enhancements for SON for LEO NTN are needed?

**Proposal 14:** [To discuss] Whether essential enhancements for channel quality reporting for LEO NTN are needed?

**Proposal 15:** [To discuss] Whether essential enhancements to support cell beam are needed?

**Proposal 16:** [To discuss] Whether essential enhancements for 5GC additional to those for EPC are needed?

# Conclusion

Based on the contributions submitted to AI 9.2.1, the following proposals are made:

**For potential agreements:**

**Proposal 7:** For GEO, the existing power saving mechanisms e.g. PSM, eDRX, relaxed monitoring, SI acquisition and WUS can be reused without any further enhancement.

**Proposal 8:** Enhancements for handling of discontinuous coverage in idle mode are essential.

**For discussion:**

**Proposal 1: [**To Discuss] Wait for RAN1 conclusion before deciding whether enhancements to disable HARQ feedback/ HARQ retransmission are essential for IOT NTN.

**Proposal 2:** [To discuss] Support of coverage enhancements is to be decided by RAN1.

**Proposal 2a:** [To discuss] Whether essential enhancements to CEL handling are needed from RAN2 point of view.

**Proposal 3:** [To discuss] Enhancements to PDCP discard timer are not essential for IOT NTN.

**Proposal 4:** [To discuss] Adjustments to existing mobility mechanisms to adapt functionality to NTN are essential.

**Proposal 5:** [To discuss] Earth moving cell scenario and enhancements for TAC update are considered as essential.

**Proposal 6:** [To discuss] Enhancements to cell selection/re-selection as agreed in NR NTN are considered as essential.

**Proposal 9:** [To discuss] Minor changes to connected mode functionality for discontinuous coverage can be considered.

**Proposal 10:** [To discuss] For LEO cell moving scenarios, enhancements using time/location for connected mode mobility are essential.

**Proposal 11:** [To discuss] Enhancements to CHO in eMTC NTN similar to NR NTN are essential.

**Proposal 12:** [To discuss] Enhancements for power saving in connected mode power are not essential. Minor adaptations for features e.g. EDT, PUR in GEO, Multi-TB scheduling and PDCCH-based HARQ in LEO can be considered in WI phase.

**Proposal 13:** [To discuss] Whether essential enhancements for SON for LEO NTN are needed?

**Proposal 14:** [To discuss] Whether essential enhancements for channel quality reporting for LEO NTN are needed?

**Proposal 15:** [To discuss] Whether essential enhancements to support cell beam are needed?

**Proposal 16:** [To discuss] Whether essential enhancements for 5GC additional to those for EPC are needed?

**Detailed study aspects:**

**Proposal 17:** [To discuss] To capture the following in the TR:

* EDT is supported in NTN without additional changes compared to random access procedure.
* PUR in GEO is feasible with minor enhancement to PUR response window and validation criteria.
* PDCCH-based HARQ ACK can be supported in LEO scenario with minor enhancement.
* Multiple TB scheduling can be supported without needing further enhancement.
* HARQ feedback/HARQ retransmission can be disabled to avoid HARQ stalling state in GEO cell.
* Relaxed monitoring is supported without further enhancement in GEO cell.

# References

1. [R2-2104817](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104817.zip) Discussion on essential features of IoT over NTN OPPO

1. [R2-2104855](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104855.zip) Further Consideration on PSM for IoT NTN CATT

1. [R2-2105364](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105364.zip) Further discussion on essential parts of IoT NTN ZTE Corporation

1. [R2-2105415](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105415.zip) Further discussion on essential parts for IoT-NTN functionality for Rel-17 Nokia, Nokia Shanghai Bell

1. [R2-2105428](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105428.zip) Essential features for SI TR Qualcomm Incorporated

1. [R2-2105664](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105664.zip) Discussion on essential parts for IOT NTN Huawei, HiSilicon

1. [R2-2106168](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106168.zip) Essential functionality in IoT NTN Ericsson

1. [R2-2106359](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106359.zip) Essential Functionality related to power saving & mobility Beijing Xiaomi Mobile Software
2. R2-2104552 [Offline-027] IOT NTN essential parts (Huawei), RAN2#113bis-e, April 2021