**3GPP TSG-RAN2 Meeting #114-e R2-21xxxx**

**Online, May 19 – 27, 2021**

**Agenda Item: 9.2.1**

**Source: RAN2 Chairman (MediaTek)**

**Title: [AT114-e][032][IoT NTN] TR Essential Features**

**Document for: Discussion and decision**

# Introduction

This document Continues on [0] R2-2106468 [Pre114-e][004][IoT NTN] Summary of 9.2.1 Essential Parts by Huawei, from which main parts are copy-pasted below.

Aim to make decisions offline if possible.

2. Contact Information

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# Discussion

## User Plane

### HARQ

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

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| --- | --- |
| 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. |

***[0] 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:** Disabling of HARQ feedback is not essential.

**Further Reasoning:** From NR NTN and TR 38.821: 1. Disabling of HARQ feedback could give some power consumption benefits in connected mode. 2. Having a number of HARQ processes without feedback could be a practical enabler to increase the number of HARQ processes (for long delays) to enable higher data rate at long delays. Chairman: None of these benefits are considered significant to the prioritized IoT traffic model of intermittent sparse data. Some companies seems to have interest in the purpose of high data rate.

**Observations potentially related to RAN1 HARQ discussions:** RRC configured HARQ feedback disable (e.g. per HARQ process or otherwise as decided by RAN1) could still be considered feasible in RAN2 (low/limited impact). RAN2 has not considered HARQ changes with MAC impact which may require more time for discussion in RAN2.

**COMMENT ON P1:** Disabling of HARQ feedback is not essential.

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| --- | --- | --- |
| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable |  |
| Apple | Acceptable |  |
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### 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. |

***[0] Observation 4:*** *During discussions at RAN2#113bis-e [9], the majority of views was that coverage enhancements should be decided by RAN1: Coverage enhancements and CE-Mode B should be decided by RAN1 (14/21)*

**Proposal 2:** No need has been identified in RAN2 for further R17 IoT NTN enhancement regarding eMTC and NB-IoT Coverage Enhancement features. They are assumed applicable to NR NTN. L1 issues if any are assumed addressed by RAN1.

**Further Reasoning:** The only technical issue brought up to discussion is that RSRP would not be a good criterion to determine Coverage Enhancement Level as measured RSRP is less varying for NTN deployment. As the objective of repetitions is to overcome high coupling loss, and RSRP can be seen as a measurement of exactly that, the issue would need further explanation/evidence, and none was given, so it was not shown that any enhancement is needed.

**COMMENT ON P2:** No need has been identified in RAN2 for further R17 IoT NTN enhancement regarding eMTC and NB-IoT Coverage Enhancement features. They are assumed applicable to NR NTN. L1 issues if any are assumed addressed by RAN1.

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| --- | --- | --- |
| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable |  |
| Apple | Acceptable |  |
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### PDCP

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

***[0] 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:** Enhancement to PDCP discard timer is not essential, but can be considered anyway as RAN2 impact is very small.

Rapporteur assumes no comments are required for this proposal (can be agreed).

## Control Plane

### Idle mode mobility

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

|  |  |
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| 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. |

***[0] 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,*

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

NOTE: Below the Already made agreements for Tracking Area Handling:

* *[035] 14: RAN2 will use earth-fixed Tracking Area concept of NR-NTN in eMTC/NB-IoT NTN.*
* *[035] 15: RAN2 should wait until agreements regarding TAU are made in the NR-NTN WI, and use those for eMTC/NB-IoT over NTN, if applicable.*
* *(modified P2) The NR-NTN agreements, where the network may broadcast more than one TACs per PLMN in a cell is considered for IoT NTN (other options not excluded for now)*

*Enhancements to tracking area management are essential.*

**Proposal 4:** No additional agreements on “earth-moving cell” are needed in The SI for Tracking Area Handling, as this is included in the already made agreements.

**Proposal 5 (Rapporteur proposal):** Referring to previous agreement, Remove the text “*(other options not excluded for now)”* from previous agreement.

**Proposal 6 (Rapporteur proposal):** Referring to previous agreement, TAU details based on agreements regarding TAU made in the NR-NTN WI is handled in the IoT NTN WI as a part of using the earth-fixed TA concept.

**COMMENTS ON TA: P4, P5, P6 (see above)**

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| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable |  |
| Apple | Acceptable |  |
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NOTE: Below Already made agreement for Idle Mode Mobility:

* *[035] 12: RAN2 will use cell selection/reselection for NR-NTN as the baseline and discuss further about the detailed solutions in eMTC/NB-IoT NTN.*

Now, R2-2106168 [7] proposes to not regard NR-NTN enhancements as essential.

**Proposal 7:** Support of legacy (R16) cell selection/reselection mechanisms without major enhancements is considered essential. Minor adjustments to existing mobility mechanisms, such as a new parameter values, change to timing etc. can be considered to adapt functionality to NTN. New mechanisms as for NR-NTN are considered not essential.

**Reasoning:** NR NTN TR 38.821 provides neither descriptions why the addressed issues are seen as problems nor which objective characteristics are enhanced by the proposed enhancements, and also no evidence that legacy mechanisms doesn’t work, and this has also not been shown in this SI, so it makes sense to follow proposal in [7].

**COMMENTS ON Idle Mode Mobility: P7:** Support of legacy (R16) cell selection/reselection mechanisms without major enhancements is considered essential. Minor adjustments to existing mobility mechanisms, such as a new parameter values, change to timing etc. can be considered to adapt functionality to NTN. New mechanisms as for NR-NTN are considered not essential.

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| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable |  |
| Apple | Acceptable |  |
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### Idle mode power saving enhancements

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

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| --- | --- |
| 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. |

* (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.

**Proposal 8:** 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 9:** Discuss to what extent the above is applicable also to LEO, and/or to periods when a UE is in coverage in a discontinuous coverage deployment.

**COMMENTS ON Idle Mode Power Saving: P8 P9 above (expect to CB on-line as this was quite unclear)**

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| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable\* | It should be clear that discontinuous/intermittent coverage scenario shall be addressed for both LEO/NGSO and GEO/GSO |
| Lenovo | Acceptable |  |
| Apple | Acceptable |  |
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**Proposal 10:** Support of discontinuous coverage without excessive UE power consumption and without excessive failures / recovery actions, is essential, Expectation that this need to be taken into account at least for Idle mode.

**COMMENTS ON P10 above**

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| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable |  |
| Apple | Acceptable |  |
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### Connected mode mobility enhancements

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

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| --- | --- |
| 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. |

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

***[0] 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.*

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

* 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 11:** Support of legacy (R16) Handover (incl CHO) and RLF/reestablishment mechanisms without major enhancements is considered essential. Minor adjustments to existing mobility mechanisms, such as a new parameter values, change to timing etc. can be considered to adapt functionality to NTN. New mechanisms or new triggers as for NR-NTN are considered not essential.

**Reasoning:** NR NTN TR 38.821 provides neither descriptions why the addressed issues are seen as problems nor which objective characteristics are enhanced by the proposed enhancements, and also no evidence that legacy mechanisms doesn’t work, and this has also not been shown in this SI, so it makes sense to follow proposals in [7].

Details: P2 in R2-2104855 P5 in R2-2105415 should be evaluated according to Proposal 10 above, no need for this further detail in the SI. Rapporteur opinion: On CHO, the most notable benefit is that it removes the need for real time signalling in the source cell, and this benefit is present also without any NTN specific enhancements.

**COMMENTS ON P11:** Support of legacy (R16) Handover (incl CHO) and RLF/reestablishment mechanisms without major enhancements is considered essential. Minor adjustments to existing mobility mechanisms, such as a new parameter values, change to timing etc. can be considered to adapt functionality to NTN. New mechanisms or new triggers as for NR-NTN are considered not essential.

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| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable | For discontinuous coverage, our understanding is that “without excessive failures / recovery actions” as in P10 can be implemented by “change to timing”. Based on this understanding we think P11 is acceptable and further details can be discussed. |
| Apple | Acceptable |  |
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### 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. |

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.

**Proposal 12:** Enhancements for power saving in connected mode power are not essential. Minor adaptations to enable support in NTN deployment of existing features e.g. EDT, PUR in GEO, Multi-TB scheduling and PDCCH-based HARQ in LEO may be considered in WI phase. (NOTE that no major adaptation is assumed).

**COMMENTS on P12 above**

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| --- | --- | --- |
| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable | For discontinuous coverage we think connected mode enhancement could be useful. As this has been captured in P10 and P11, we are OK with P12. |
| Apple | Acceptable |  |
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## Other

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

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| --- | --- |
| 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 NTNProposal 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. |

**Proposal 13:** Enhancements for LEO for SON and channel quality reporting are not essential

**Reasoning:** The WI is expected to be very resource limited. It is not possible to prioritise such enhancements without a more solid justification.

**Proposal 14:** Cell beam is not applicable to NB-IoT or eMTC

**Reasoning:** The WI is expected to be very resource limited. As the concept of common beams doesn’t exist for EUTRA, such change seems very fundamental and cannot be done.

**COMMENTS ON P12 P14 above**

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| --- | --- | --- |
| Company | Acceptable / not acceptable | Comments |
| Huawei, HiSilicon | Acceptable |  |
| MediaTek | Acceptable |  |
| Inmarsat | Acceptable |  |
| Lenovo | Acceptable |  |
| Apple | Acceptable |  |
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**Proposal 15:** Q: Shall R17 IoT NTN support 5GC? Discuss what is the additional effort to support essential enhancements for 5GC additional to those for EPC?

**COMMENTS ON P15 above**

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSilicon | Neutral | It is not essential for Rel-17. However, we do not see any additional effort from RAN2 point of view apart from potential duplication of ASN.1 changes in EPC and 5GC, e.g. in SIB1, thus there is no reason to exclude from RAN2 point of view. |
| MediaTek | Neutral | It is not essential for Rel-17. |
| Inmarsat | Neutral | We agree it is not essential for Rel-17. |
| Lenovo | Neutral | Not essential for Rel-17. |
| Apple | Neutral | Perhaps consider as deprioritized. |
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# SI conclusion

**Proposal 16:** The SI can be closed from RAN2 perspective.

If you disagree please indicate which essential open issues you see that would block the closing. Note that we expect to treat the remaining points under AI 9.2.3, and update the TR with this meetings agreements.

**COMMENTS ON P16 (will CB also on-line).**

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| --- | --- | --- |
| Company | Yes No | Comments |
| Huawei, HiSilicon | Yes |  |
| MediaTek | Yes |  |
| Inmarsat | Yes |  |
| Lenovo | Yes |  |
| Apple | Yes |  |
|  |  |  |
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# Conclusions

# References

1. R2-2106468 [Pre114-e][004][IoT NTN] Summary of 9.2.1 Essential Parts Huawei
2. [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