**3GPP TSG-RAN WG2 Meeting #114-e R2-21xxxxx**

**Online, May 19th – May 27th, 2021**

**Agenda item: 9.2.2**

**Source: MediaTek Inc.**

**Title: Summary 9.2.2 Open Issues not Covered by NR-NTN**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution is aimed at providing a summary of contributions regarding the open issues, not covered by NR-NTN and submitted in Section 9.2.2 of IoT-NTN. The following 12 contributions with are summarized:

1. [R2-2104818](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104818.zip), Discussion on impact of repetition transmission for IoT over NTN, OPPO
2. [R2-2104819](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104819.zip), Discussion on other open issues for IoT over NTN, OPPO.
3. [R2-2105369](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105369.zip), Specific issues of IoT NTN, ZTE Corporation, Sanechips
4. [R2-2105416](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105416.zip), Discussion on open issues not covered by NR NTN, Nokia, Nokia Shanghai Bell
5. [R2-2105429](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105429.zip), Recovery of synchronization in RRC\_CONNECTED, Qualcomm Inc.
6. [R2-2105559](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105559.zip), Discussion on open issues and essential enhancements for IoT-NTN, XIaomi
7. [R2-2105663](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105663.zip), Discussion on mobility enhancement for IoT NTN, Huawei, HiSilicon
8. [R2-2105821](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105821.zip), Considerations on power saving for idle mode in discontinuous coverage Lenovo, Motorola Mobility
9. [R2-2105822](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105822.zip), Considerations on RLF and re-establishment for IoT NTN Lenovo, Motorola Mobility
10. [R2-2105908](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105908.zip), On satellite pass predictions for UE wake-up management under discontinuous coverage Sateliot, Gatehouse, ESA
11. [R2-2106420](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106420.zip), Mobile-Termination with non-continuous coverage in NTN Gatehouse, Sateliot, Thales, ESA.
12. [R2-2105254](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105254.zip), On Discontinuous coverage in IoT-NTN, MediaTek Inc.

**Note-1**: RAN Plenary (RP) recommendations are to keep scope small and guidance in RP-210915 shall be taken into account when assessing the proposals, i.e. focus on essential enhancements. Non-essential enhancements should be considered only if impact is small.

* [Pre114-e][005][IoT NTN] Summary 9.2.2 Open issues not covered by NR NTN (MediaTek).

      Intended outcome: Report

 **Deadline for Submission: May 17 0700 UTC.**

**Note-2**: As TN-NTN mobility is out-of-scope of this Study Item, proposals corresponding to TN-NTN mobility are not discussed in this summary.

# 2 Contact Information

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# 3 User Plane Aspects

It has been observed in R2-2104818 that for allowing for half-duplex operation of NB-IoT UEs to maintain frequency synchronisation with the network, transmission gaps have been introduced and inserted during long UL transmissions. RAN1 has agreed to use gap for long UL transmission for UEs to do pre-compensation, and the definition and value of gap period N is FFS. The value of N mainly depends on the relative speed between serving satellite and UEs and would be more appropriate to be configured by the network. It has been also observed that for UL gap for both NPUSCH and NPRACH, the gap period X and gap length Y are fixed to 256ms and 40ms, respectively. It has been proposed that the value of N can be configured by the network ad RAN2 should wait for RAN1’s progress on UL gap before discussing the signalling details.

The solution overview for HARQ-RTT-Timer and UL-HARQ-RTT-Timer enhancement in IoT NTN has been captured in TR36.763, as below:

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| *Solution Overview*As the challenges associated with the expiry of MAC timers in NR NTN [3] remain the same in IoT NTN, it is assumed that the same solutions as NR NTN for the start of DL HARQ RTT Timer and UL HARQ RTT Timer can be reused as a baseline to support IoT NTN [10]. |

It has been observed in R2-2104819 that in NR-NTN, for a UE configured with DRX function, both drx-HARQ-RTT-TimerDL and drx-HARQ-RTT-TimerUL are configured by gNB and RAN2 has agreed to increase drx-HARQ-RTT-TimerDL length by an offset equal to UE-gNB RTT for the HARQ feedback enabled case in NR-NTN. Based on this observeation, it has been proposed that RAN2 to discuss how to adapt HARQ RTT Timer and UL HARQ RTT Timer based on UE-eNB RTT for the HARQ feedback case for NB-IoT and eMTC in NTN. However, as this is agreed in principle, the rapporteur believes that the details of the MAC spec changes and stage 3 signalling aspects should be discussed in Work Item phase.

**Proposal 1: The details of MAC (36.321) specification changes and other signalling aspects of HARQ will be discussed in Work Item phase.**

In R2-2105369, it has been proposed to support blind retransmissions mechanism and introduce the value “zero” for UL HARQ RTT timer for IoT over NTN. However, as repetitions are possible for NB-IoT and eMTC, with functionalities similar to blind retransmission, this is not considered as an essential necessity in this limited time (TU) budget. RAN2-2105416 has mentioned that throughput and latency requirement should be agreed first to decide HARQ enhancements for IoT NTN and RAN2 should study dedicated scheduling request for NB-IoT with HARQ feedback disabled. Similarly, R2-2105559 has expressed the opinion to clarify with RAN1 (sending an LS) about the definition of extreme coverage for IOT NTN, e.g. what MCL is assumed and disable HARQ feedback when MCL >= 144 dB. Hence, the rapporteur believes that RAN2 first needs to decide if delay-tolerant, intermittent packet transmissions are assumed, as for such delay-tolerant, intermittent transmissions are assumed.

**Proposal 2: RAN2 to confirm if delay-tolerant and intermittent packet transmissions will be used for R-17 IoT-NTN and if HARQ disabling is needed.**

R2-2105559 has mentioned to introduce an offset to be added to the start of pur-ResponseWindowTimer for compensating the high RTT of NTN. Based on this, the rapporteur suggests the following proposal:

**Proposal 3: RAN2 to agree that an offset is suggested to be added to the start of pur-ResponseWindowTimer. If the start of the pur-ResponseWindowTimer is accurately compensated by UE-gNB RTT, there is no need to extend pur-ResponseWindowTimer value range.**

# 4 Discontinuous Coverage and Power Savings

In the RAN2-113bis-e meeting, RAN2 endorsed below point to include enhancements on power saving in idle mode as essential parts of Rel-17.

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| (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. |

(7/12) contributions have mentioned about the usage of network and satellite assistance information is mentioned in R2-2105416, R2-2105559, R2-2105254, R2-2105663, R2-2105821, R2-2105908, R2-2106420 for managing discontinuous coverage, improving cell selection/re-selection. R2-2105908 has provided results demonstrating quite accurate prediction based on ephemeris assistance. Note that it was already agreed in RAN2-113 bis-e, with the agreement mentioned in the Table below:

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| --- |
| (modified P1) For handling of coverage holes or discontinuous satellite coverage in a power efficient way R2 assumes that satellite assistance information, e.g. ephemeris info, can be used. |

R2-2106420 and R2-2103511 has suggested UE detailed UE behaviour during discontinuous coverage. This includes adopting a scheme where the UE is alternating between eDRX and PSM based on the presence or outage of coverage, PSM/iDRX timer update in core-network for each UE based on predicted coverage and determination of paging windows. Before agreeing on these details the rapporteur believes it is necessary to agree on whether UE behaviour needs to be specified during such discontinuous coverage.

**Proposal 4(a): RAN2 to discuss about the possible format and type (e.g. ephemeris, time etc.) of the satellite and network assistance information provided for discontinuous coverage.**

**Proposal 4(b): RAN2 to discuss if UE behaviour needs to be specified during discontinuous coverage or will it be left for UE implementation.**

R2-2105416 has mentioned the usage of common system information across group of cells, which are tracked via separate value tag to minimize the impact of system information re-acquisition. The area-based system information concept introduced in NR for specific set of system information can be extended for IoT-NTN.

**Proposal 5: RAN2 to discuss if area-based concept introduced in NR for specific set of system information can be extended for IoT-NTN.**

In R2-2105369, it is mentioned that network can configure more stringent condition for triggering the neighbor cell measurement or provide tailored neighbor cell list according to the eDRX cycles. UE configured with eDRX cycle can apply the cell selection procedure immediately at the beginning of PTW in an eDRX cycle. However, these two enhancements can be performed by using network implementation and UE implementations respectively. It has also mentioned to consider the enhancements on Group Wake-Up Signal for NTN, such as applicability in the cases of moving cell and GNSS measurement gap when using GWUS. However, GNSS measurements are under discussion in RAN1 and RAN2 needs to wait for RAN1’s conclusion on this. Similarly, relaxed monitoring functionality

# 5 Other Aspects

Similarly, enhancements to measurements gaps, suggested in R2-2105369 is not needed, as unlike NR, in LTE synchronization signals (PSSN, SSSN) are sent in every 5ms. Hence, the synchronization always fit in measurement gaps and no further enhancement is needed.

**Observation 1: Unlike NR-NTN, enhancements to SMTC and measurement gaps are not needed in IoT-NTN, as in LTE synchronization signals (PSSN, SSSN) are sent in every 5ms.**

R2-2105822 has suggested conditional RRC re-establishment, which cannot be considered as a minor enhancement. RAI and Multiple transport block features, mentioned in R2-2104816 is baseline feature and needs no proposal. Similarly, fast coverage level reporting is not in scope of RAN2 and if RAN1 thinks coverage level will change based on RTT change, RAN2 can design corresponding signalling. Applicability of CHO for UE in CE Mode B is also mentioned in R2-2105822. However, before agreeing for CHO in CE-Mode-B, RAN2 need to discuss if CE Mode B will be supported in Rel-17. Hence, the rapporteur suggests the following proposal:

**Proposal 6: RAN2 to discuss if CE Mode B should be considered in Rel-17.**

R2-2105429 has discussed validity of synchronization, ephemeris and GNSS information and triggering of RLF on expiry of synchronization. However, RAN1 are discussing on this validity, i.e. how long UE can use the validity. Hence, the rapporteur suggests that RAN2 can decide on this based on the outcome of RAN1 in WI phase.

# 7 Conclusion

**Observation 1: Unlike NR-NTN, enhancements to SMTC and measurement gaps are not needed in IoT-NTN, as in LTE synchronization signals (PSSN, SSSN) are sent in every 5ms.**

**Proposal 1: The details of MAC (36.321) specification changes and other signalling aspects of HARQ will be discussed in Work Item phase.**

**Proposal 2: RAN2 to confirm if delay-tolerant and intermittent packet transmissions will be used for R-17 IoT-NTN and if HARQ disabling is needed.**

**Proposal 3: RAN2 to agree that an offset is suggested to be added to the start of pur-ResponseWindowTimer. If the start of the pur-ResponseWindowTimer is accurately compensated by UE-gNB RTT, there is no need to extend pur-ResponseWindowTimer value range.**

**Proposal 4(a): RAN2 to discuss about the possible format and type (e.g. ephemeris, time etc.) of the satellite and network assistance information provided for discontinuous coverage.**

**Proposal 4(b): RAN2 to discuss if UE behaviour needs to be specified during discontinuous coverage or will it be left for UE implementation.**

**Proposal 5: RAN2 to discuss if area-based concept introduced in NR for specific set of system information can be extended for IoT-NTN.**

**Proposal 6: RAN2 to discuss if CE Mode B should be considered in Rel-17.**

# 8 References

1. R2-2104818, Discussion on impact of repetition transmission for IoT over NTN, OPPO
2. R2-2104819, Discussion on other open issues for IoT over NTN, OPPO.
3. R2-2105369, Specific issues of IoT NTN, ZTE Corporation, Sanechips
4. R2-2105416, Discussion on open issues not covered by NR NTN, Nokia, Nokia Shanghai Bell
5. R2-2105429, Recovery of synchronization in RRC\_CONNECTED, Qualcomm Inc.
6. R2-2105559, Discussion on open issues and essential enhancements for IoT-NTN, XIaomi
7. R2-2105663, Discussion on mobility enhancement for IoT NTN, Huawei, HiSilicon
8. R2-2105821, Considerations on power saving for idle mode in discontinuous coverage Lenovo, Motorola Mobility
9. R2-2105822, Considerations on RLF and re-establishment for IoT NTN Lenovo, Motorola Mobility
10. R2-2105908, On satellite pass predictions for UE wake-up management under discontinuous coverage Sateliot, Gatehouse, ESA
11. R2-2106420 Mobile-Termination with non-continuous coverage in NTN Gatehouse, Sateliot, Thales, ESA
12. R2-2105254, On Discontinuous coverage in IoT-NTN, MediaTek Inc.