**3GPP TSG RAN meeting #96-e RP-220XXX**

**Budapest, Hungary, June 6-9, 2022**

## Status Report to TSG

**Agenda item:** 10.2.1 IoT (Internet of Things) NTN (non-terrestrial network) enhancements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WI / SI Name** |  | | | | |
| included in this status report | Study Item:  No | Core part:  Yes | Performance part:  Yes | | Testing part:  - |
| **Acronym** | IoT\_NTN\_enh | | | | |
| **Unique ID** | 941004 | | | | |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-220979 | | | | |
| **Target Completion Date**  **(indicate if changed)** | Study Item: | Core part:  09/2023 | Performance part:  12/2023 | Testing part: - | |
| **Overall Completion level** | Study Item: | Core part:  Overall: XX%  For information  RAN1: XX%  RAN2: 0%  RAN4: 0% | Performance Part: | Testing part: - | |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |  |
| --- | --- | --- |
| **Leading WG** | | RAN2 |
| **Rapporteur** | **Name** | Abhishek Roy |
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| **Secondary WG** | | RAN2 |

## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.  
 One time unit (TU) corresponds to ~ 2 hours in the meeting.  
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.  
 Note: If no Excel table is attached, then this means no time budget change.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

**RAN1#109-e, May 9th – 20th, 2022, e-meeting**

**Agreements on “9.12.2 Disabling of HARQ feedback for IoT NTN”**

**Agreement**

For IoT NTN, to configure/indicate enabling/disabling on HARQ feedback for downlink transmission, one or more of the following options can be considered:

* Option 1: per HARQ process via UE specific RRC signaling
* Option 2: per HARQ process via SIB signaling
* Option 3: explicitly indicated by DCI (e.g., new field or reusing existing field)
* Option 4: implicitly determined by existing configured/indicated parameter(s) (e.g., repetition number, TBS)
* Option 5: per HARQ process via MAC CE
* Other options or combinations are not excluded

Note: Option(s) for eMTC and NBIoT can be separately discussed.

**Agreement**

For IoT NTN, further study the potential issues due to enabling/disabling on HARQ feedback for downlink transmission

* Issue A: SPS PDSCH
* Issue B: (N)PDSCH/(N)PDCCH scheduling restriction
* Issue C: HARQ feedback for scheduling multiple TB
* Issue D: HARQ bundling for eMTC HD-FDD
* Issue F: NPRACH capacity
* Issue G: Serving cell/satellite change during data transfer (FFS: for eMTC and/or NB-IoT)
* Other issues are not excluded

Note: The “Issues” in common for eMTC and NB-IoT can be separately discussed.

**Agreements on “9.12.3 Improved GNSS operations for IoT NTN”**

**Conclusion**

IoT NTN UE may need to re-acquire a valid GNSS position fix in long connection time.

* FFS: Whether and how to update or reduce the need to update GNSS position fix in long connection time

**Agreement**

Closed loop time and frequency correction, with potential enhancements, for IoT-NTN is considered to reduce the need for UE to update GNSS position fix in long connection time

**Agreement**

At least the following options can be considered on GNSS measurement in connected for potential enhancements for improved GNSS operations:

* Option 1: UE re-acquires GNSS position fix during RLF procedure
* Option 2: UE re-acquires GNSS position fix with a new gap

Note: this does not imply that a Rel-18 IoT NTN UE is mandated to support one or both of the options.

R1-2205553 Feature lead summary#2 of AI 9.12.3 on improved GNSS operations Moderator (MediaTek)

**Agreement**

UE reports additional GNSS assistance information and further study the detailed GNSS assistance information, including e.g. GNSS position fix measurement time

* Note: Since RAN1 agreed that GNSS validity duration is reported by UE in Rel-17, it is already included in GNSS assistance information.

**Agreement**

Further study on whether there is a need for potential enhancements on the following for long connection time

* UE triggered GNSS measurement.
* Network triggered GNSS measurement.

#### Remaining Open issues

Objective 1 (IoT-NTN Performance Enhancements in Rel-18 to address remaining issues from Rel-17):

- Disabling of HARQ feedback to mitigate impact of HARQ stalling on UE data rates.

- Study and specify, if needed, improved GNSS operations for a new position fix for UE pre-compensation during long connection times and for reduced power consumption.

## 2.2 RAN2

#### 2.2.1 Agreements

The work has not started yet.

#### 2.2.2 Remaining Open issues

Objective 1 (IoT-NTN Performance Enhancements in Rel-18 to address remaining issues from Rel-17):

- RAN2 aspects for: Disabling of HARQ feedback to mitigate impact of HARQ stalling on UE data rates.

Objective 2 (mobility enhancements):

- Support of neighbour cell measurements and corresponding measurement triggering before RLF, using Rel-17 (TN) NB-IoT, eMTC as a baseline.

- Re-use the solutions introduced in Rel-17 NR NTN for mobility enhancements for eMTC, with minimum necessary changes to adapt them to eMTC.

*Objective 3 (further enhancement to discontinuous coverage): to be revisited at RAN#96e / June 2022.*

## 2.3 RAN3

#### 2.3.1 Agreements

#### 2.3.2 Remaining Open issues

## 2.4 RAN4

#### 2.4.1 Agreements:

The work has not started yet.

#### 2.4.2 Remaining Open issues:

*NOTE: The need for RAN4 Core requirements for this objective will be identified after the conclusion on the need for improvements*

1. Specify UE RRM performance requirements to support the agreed mobility enhancements for NB-IoT/eMTC [RAN4]
2. Specify UE and Base Station demodulation requirements for operation with disabled HARQ feedback for NB-IoT/eMTC [RAN4]

*NOTE: The need for Performance requirements for improved GNSS operations will be established once the need for specification work has been decided.*

## 2.5 RAN5

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

## 4.1 RAN1

**RAN1#109-e, May 9th – 20th, 2022, e-meeting**

Submitted TDocs to AI 9.12.2

* **R1-2204935** On disabling HARQ feedback for IOT-NTN Mavenir
* **R1-2203160** Discussion on disabling of HARQ feedback for IoT NTN Huawei, HiSilicon
* **R1-2203805** Discussion on HARQ operation for IoT NTN xiaomi
* **R1-2204080** On disabling HARQ feedback for IoT NTN Ericsson
* R1-2203241 Discussion on disabling of HARQ feedback for IoT-NTN ZTE
* R1-2203351 Discussion on disabling of HARQ feedback for IoT NTN Spreadtrum Communications
* R1-2203390 Disabling of HARQ for IoT NTN MediaTek Inc.
* R1-2203392 Disabling of HARQ for IoT NTN Lockheed Martin
* R1-2203747 On disabling HARQ feedback for IoT-NTN Sony
* R1-2203755 Disabling of HARQ feedback for IoT NTN Nordic Semiconductor ASA
* R1-2203758 HARQ feedback disabling for IoT NTN CATT
* R1-2203840 Disabling of HARQ feedback for NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* R1-2203930 Disabling of HARQ feedback for IoT NTN Samsung
* R1-2203937 Disabling of HARQ feedback for IoT NTN NEC
* R1-2204012 Discussion on disabling of HARQ feedback for IoT NTN OPPO
* R1-2204268 On disabling of HARQ feedback for IoT NTN Apple
* R1-2204329 Discussion on disabling of HARQ feedback for IoT NTN CMCC
* R1-2204516 Disabling of HARQ feedback for IoT NTN Lenovo
* R1-2204646 Discussions on Disabling of HARQ feedback for IoT NTN Sharp
* R1-2205059 Disabling HARQ Feedback for IoT-NTN Qualcomm Incorporated
* R1-2205415 Feature lead summary #1 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* **R1-2205473** Feature lead summary #2 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* R1-2205555 Feature lead summary #3 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)

Submitted TDocs to AI 9.12.3

* **R1-2203391** Improved GNSS operations for IoT NTN MediaTek Inc.
* **R1-2203841** Enhancements for long connections in NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* **R1-2203931** Improved GNSS operations for IoT NTN Samsung
* **R1-2205060** Improved GNSS Operations for IoT-NTN Qualcomm Incorporated
* R1-2203161 Discussion on improved GNSS operations for IoT NTN Huawei, HiSilicon
* R1-2203242 Discussion on improved GNSS operation for IoT-NTN ZTE
* R1-2203352 Discussion on improved GNSS operations for IoT NTN Spreadtrum Communications
* R1-2203759 GNSS operation issues for IoT NTN CATT
* R1-2203806 Discussion on improved GNSS operation for IoT NTN xiaomi
* R1-2203933 Improved GNSS operations for IoT NTN Nordic Semiconductor ASA
* R1-2204013 Discussion on improved GNSS operations for IoT NTN OPPO
* R1-2204269 On improved GNSS operations for IoT NTN Apple
* R1-2204330 Discussion on improved GNSS operations for IoT NTN CMCC
* R1-2204517 Improved GNSS operations for IoT NTN Lenovo
* R1-2204827 On improved GNSS operation for IoT NTN Ericsson Telecomunicazioni SpA
* **R1-2205203** Feature lead summary#1 of AI 9.12.3 on improved GNSS operations Moderator (MediaTek)
* R1-2205553 Feature lead summary#2 of AI 9.12.3 on improved GNSS operations Moderator (MediaTek)

# 5 Others

***END***