**3GPP TSG-RAN WG2 Meeting #121bis-e *R2-2304274***

**e-Meeting, 17th – 26th April, 2023**

Title: DRAFT LS on HARQ Enhancements

Response to: -

Release: Release 18

**Work Item:**  IoT\_NTN\_enh-Core

Source: OPPO (to be RAN2)

To: RAN1

Cc: -

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Attachments: -

**1. Overall Description:**

For Rel-18 IoT NTN’s HARQ enhancements, RAN2 has agreed to introduce HARQ mode A and HARQ mode B for UL HARQ operation. For an UL HARQ process configured with HARQ mode A, UE does not expect to receive (N)PDCCH for the given HARQ process before a period of UE-eNB RTT has passed since (N)PUSCH transmission, as supported in Rel-17 IoT NTN. For an UL HARQ process configured with HARQ mode B, UE can expect to receive (N)PDCCH for the given HARQ process within the period of UE-eNB RTT. Relevant RAN2 agreements are given below.

Agreement in RAN2#119e:

1. For UL HARQ operation, introduce two HARQ modes, i.e., HARQ mode A and HARQ mode B in IoT NTN (both NB-IoT and eMTC NTN), similarly to NR NTN.

Agreements in RAN2#119bis-e:

1. HARQ mode A/B for uplink transmission may be configured per UL HARQ process at least via UE specific RRC signalling for eMTC and NB-IOT NTN. We can also revert this decision if requested by RAN1.
2. RAN2 agree to take R17 NR NTN DRX solution as baseline for IoT NTN, e.g. for HARQ process in HARQ mode B, the UE will not start the corresponding UL HARQ RTT timer.
3. For NB-IoT NTN with single HARQ process in HARQ mode B, the UE will start/restart drx-inactivity timer in the subframe containing the last repetition of the corresponding PUSCH transmission (can still check whether other alternatives also work).

Agreement in RAN2#120:

1. RAN2 understands that something needs to be added to consider the processing time also for inactivity timer of HARQ mode B.

To facillate RAN2’s work, RAN2 would like to seek answers from RAN1 for the following questions.

**Question 1a**: For an UL HARQ process with HARQ mode B for NB-IoT UEs, what is the minimum time between the end of NPUSCH transmission and the start of NPDCCH monitoring for the same HARQ process?

**Question 1b**: For an UL HARQ process with HARQ mode B for eMTC UEs, what is the minimum time between the end of PUSCH transmission and the start of MPDCCH monitoring for the same HARQ process?

**Question 2**: For UL multiple TB scheduling, which of the following HARQ mode combinations does RAN1 intend to support for eMTC and NB-IoT?

* Case 1: all HARQ processes corresponding to the scheduled multiple TBs are configured with HARQ mode A
* Case 2: all HARQ processes corresponding to the scheduled multiple TBs are configured with HARQ mode B
* Case 3: some HARQ processes corresponding to the scheduled multiple TBs are configured with HARQ mode A and the others are configured with HARQ mode B

For the below RAN1 agreement, companies in RAN2 have different understandings regarding whether it is for the same HARQ process or for all HARQ processes.

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| **Agreement**  For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH in a period of Y=12(ms) from the end of reception of the NPDSCH. |

**Question 3**: For the above RAN1 agreement, which is the correct understanding?

* Understanding 1: For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH for the same HARQ process in a period of Y=12(ms) from the end of reception of the NPDSCH.
* Understanding 2: For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH for all the HARQ processes in a period of Y=12(ms) from the end of reception of the NPDSCH.

**2. Actions:**

**To RAN1**

**ACTION:** RAN2 respectfully asks RAN1 to take above information into account and to provide answers to the above questions.

**3. Date of Next TSG-RAN WG2 Meetings:**

TSG-RAN WG2 Meeting #122 22th – 26th May 2023 Incheon, KR

TSG-RAN WG2 Meeting #123 21th - 25th August 2023 Toulouse, FR