**3GPP TSG RAN WG2#121-bis-e R2-2304271**

**Online, 17th – 26th April, 2023**

Title: LS on RACH-less Handover

Response to: -

Release: Release 18

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

Source: RAN2

To: RAN1

Cc: RAN4

**Contact Person:**

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**Send any reply LS to: 3GPP Liaisons Coordinator,** **mailto:3GPPLiaison@etsi.org**

Attachments: None

**1. Overall Description:**

For mobility enhancement in Rel-18 NR NTN, RAN2 has discussed NTN RACH-less HO and made the following agreements.

Agreements RAN2#121:

1. Support RACH-less Handover in Rel-18.
2. RACH-less Handover in NR NTN is a L3 mobility procedure (FFS if this is combined with the unchanged PCI approach, if supported) and uses the LTE’s RACH-less Handover procedure as a baseline. FFS on TA acquisition
3. In NTN RACH-less handover, network indicates (implicitly or explicitly) whether NTA in the target cell is identical to the source cell or explicitly provided by the NW.
4. Support dynamic grant from the target cell for RACH-less PUSCH transmission to reduce random access congestion in the target cell. FFS whether to limit the solution to same feeder link/gateway scenario

Agreements RAN2#121bis-e:

1. In Rel-18 we don’t aim at RACH-less HO for NTN-TN mobility
2. For initial UL transmission in RACH-less HO, support pre-allocated grant in RACH-less HO command
3. NTN RACH-less HO is supported for Intra-satellite handover with the same feeder link. i.e., with same gateway/gNB;
4. NTN RACH-less HO can be supported for intra-satellite handover with different feeder links, i.e., with gateway/gNB switch, inter-satellite handover with gateway/gNB switch, and inter-satellite handover with same gateway/gNB.
5. RAN2 confirms the general UE procedure for NTN RACH-less HO

 1. receive a RACH-less HO command which can include pre-allocated grant optionally. FFS N\_TA is optional. (RRC)

 2. start timer T304 for the target cell (RRC)

 3. perform DL and UL synchronization, and start timer T430. FFS how to perform RACH-less UL synchronization to NTN target cell. (RRC, MAC)

 4. start time alignment timer (MAC)

 5. monitor target cell PDCCH for dynamic grant if pre-allocated grant is not configured in RACH-less HO command (MAC, PHY)

 6. send initial UL transmission including RRCReconfigurationComplete message using the available UL grant (RRC, MAC, PHY)

 7. consider RACH-less HO is completed upon receiving NW confirmation. FFS how to confirm RACH-less HO is successfully completed. (RRC, MAC)

 8. stop timer T304 for the target cell. (RRC)

 FFS whether to release UL grant if pre-allocated after RACH-less HO completion

 FFS RACH-less HO failure handling, e.g. whether UE fallback to RACH-based HO to the target cell

 FFS procedure for RACH-less HO combined with PCI unchanged or CHO if supported

4. The pre-allocated grant is provided as type-1 CG

5. At least for pre-allocated grant, for the confirmation of RACH-less HO completion we reuse of LTE approach, i.e., UE Contention Resolution Identity MAC CE is used but UE ignores the content of this field. FFS if anything else is needed for dynamic grant

6. Consider to support combining RACH-less HO with time-based CHO for NTN, taking into account the 1) validity of pre-allocated grant and potential waste of reserved resource; 2) when/how to provide dynamic grant in PDCCH.

RAN2 has also identified some issues which are more relevant to RAN1 and would like to check RAN1 views on the following aspects for NTN RACH-less HO.

 1. Regarding the pre-allocated grant for initial UL transmission, considering the similarity to Msg1 in RACH and the similarity to the initial UL transmission in CG-SDT, where PRACH/PUSCH resource is mapped to SSBs, whether the pre-allocated grant is provided with association to SSB(s)? If yes, whether a RSRP threshold is needed for SSB selection for initial UL transmission?

 2. To monitor target cell PDCCH for dynamic grant for initial UL transmission, whether beam selection is needed (e.g., performed by NW with selected beam(s) indicated, or performed by UE)?

 3. Regarding the power control for initial UL transmission, whether it follows the rules specified for PUSCH scheduled by Random Access grant or by configured grant or others?

**2. Actions:**

**To** **RAN1**

**ACTION:** RAN2 respectfully asks RAN1 to take the agreements into consideration for the future work and provide responses to above questions.

**To RAN4**

**ACTION:** RAN2 respectfully asks RAN4 to take the agreements into consideration for the future work.

**3. Date of Next RAN2 Meetings:**

TSG-RAN WG2#122 2023-05-22 to 2023-05-26 Incheon, KR

TSG-RAN WG2#123 2023-08-21 to 2023-08-25 Toulouse, FR