3GPP RAN WG2 Meeting #124 R2-231xxxx

Chicago, United States, November 13th – 17th, 2023

Agenda Item: 7.7.1

Source: InterDigital, Samsung

Title: Open issues from [Post124][312][NR-NTN Enh/mIAB] MAC CR on RACH-less HO (InterDigital, Samsung)

Document for: Discussion, Decision

# Introduction

**This document is intended as a compliment to the MAC CR review to allow companies to provide feedback on identified open issues.**

**General note: If a comment is more relevant for a particular feature, please highlight this.**

**To ensure sufficient time to incorporate comments please input by: Thursday 2023-11-30 1000 UTC**

# Remaining open issues for RACH-less handover

## OI1: Name of RACH-less handover procedure

“RACH-less handover procedure” has been used throughout the current MAC CR, however the term “handover” is not typically used in legacy specification except in reference to DAPS. Alternatively, LTM uses the term “LTM cell switch procedure”.

**Question 1: What is the preferred terminology for the RACH-less procedure?**

* **Option 1: “RACH-less *handover* procedure” (currently used in CR)**
* **Option 2: “RACH-less *cell switch* procedure” (similar to LTM)**
* **Option 3: Other, please describe**

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| **Company** | **Preferred Option** | **Additional comments** |
| OPPO | Option 1 |  |
| Samsung | Option 1 or Option 3 | Option 1 is ok if it’s majority view.  Or, to be consistent with “reconfiguration with sync” currently used in MAC, “RACH-less reconfiguration with sync procedure” can be used despite the long terminology. |
| Xiaomi | Option 1 |  |
| Thales | Option 1 or Option 3 | No problem with the Option 1 but agree with Samsung that we can gain in consistency in MAC procedures by re-using the “reconfiguration with sync”. The option 2 has the same limitation as Option 1. |
| Qualcomm | Option 1 |  |
| Huawei, HiSilicon | Option 1 | We shouldn’t use LTM terminology since it is a different procedure. |
| Apple | Option 1 |  |
| ZTE | Option 1 |  |
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| **Rapporteur summary:**  Based on consensus support, the CR will continue to refer to the procedure as “RACH-less handover procedure” |

## OI2: Retransmission on any CG configuration with same TBS

In Section 5.4.2.2 of the MAC CR, the following text is captured for CG-SDT:

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| If cg-SDT-RetransmissionTimer is configured, retransmission for the initial CG-SDT transmission with the same HARQ process may be performed on any configured grant configuration if the configured grant configurations have the same TBS |

If adopted, the above text implies that multiple CG configurations can be configured/used for RACH-less handover, which does not apply to RACH-less LTM. It should be decided whether the above behaviour is supported in the general RACH-less handover case for mIAB and NTN, or to follow LTM and not specify anything.

**Question 2: Can retransmission for the initial transmission of RACH-less handover be performed on any configured grant configuration if it has the same TBS?**

* **Option 1: Yes, follow CG-SDT (i.e., the above text is copied for RACH-less handover)**
* **Option 2: No, follow LTM (i.e., the above text is not captured for RACH-less handover)**

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| **Company** | **Preferred Option** | **Additional comments** |
| OPPO | Option 2 | We understand multiple CG configurations mainly be used to accommodate different services. For RACH-less handover, CG is mainly used for the first initial transmission, so there seems no need to support multiple CG configurations in this case. |
| Samsung | Option 2 | For RACH-less HO, there is only one CG configuration. The above text for CG-SDT should not be applied. |
| Xiaomi | Option 2 | We think there is only one CG configuration for RACH-less HO. |
| Thales | Option 2 | The CG is mainly used for the first initial transmission, then, there is no need to support multiple CG configurations. Keep it simple and follow the RACH-less LTM behaviour. |
| Qualcomm | Option 2 |  |
| Huawei, HiSilicon | Option 2 |  |
| Apple | Option 2 | Agree with OPPO. No use case for multiple CG configuration in RACH-less HO. |
| ZTE | Option 2 |  |
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| **Rapporteur summary:**  Based on consensus support, the CR will follow LTM and the above text will not be captured for the general RACH-less HO |

## OI3: *configuredGrantTimer* expiry

In Section 5.4.2.2 of MAC, if a *configuredGrantTimer* expires for a HARQ process, the following behaviour is specified:

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| If the *configuredGrantTimer* expires for a HARQ process, the HARQ process shall:  1> stop the *cg-RetransmissionTimer*, if running;  1> stop the *cg-SDT-RetransmissionTimer*, if running.  1> if a PDCCH addressed to the MAC entity's C-RNTI has not been received after initial transmission for the CG-SDT with CCCH message to which the *configuredGrantTimer* corresponds:  2> indicate failure to perform SDT procedure to the upper layer. |

Under current MAC CR, there is no indication to upper layers that RACH-less handover has failed. The UE would either trigger RACH (e.g., if no suitable SSB associated with the CG is available) or rely on other legacy mechanisms like T304 expiry. The latest LTM CR has not captured any text regarding impacts of *configuredGrantTimer* expiry other than to stop the *cg-LTM-RetransmissionTimer*.

**Question 3: Apart from stopping *cg-RACH-less-RetransmissionTimer*, is any other new behaviour needed when the *configuredGrantTimer* expires?**

* **Option 1: Yes (please describe in the “Additional comments” section)**
* **Option 2: No, like LTM**

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| **Company** | **Preferred Option** | **Additional comments** |
| OPPO | Option 1 | In legacy, configuredGrantTimer is the maximum time UE waits for the response from NW for the CG transmission, and the expiry of configuredGrantTimer implies network has successfully received the CG transmission and CG for the same HARQ process can be used for another UL TB transmission. Following this principle, in RACH-less handover, the expiry of configuredGrantTimer means NW has successfully received the first UL transmission. So we think the following UE behaviour needs to be specified.  **if the *configuredGrantTimer* expires, UE considers RACH-less handover as successful.** |
| Samsung | Option 2 | We can follow LTM conclusion: **No need to support “UE considers RACH-less LTM failure, if the *configuredGrantTimer* expires before LTM completion/T304 expiry.”**  Since there is already T304 to control the HO failure, tangling two timers for HO failure control is not necessary. NW can configure the configuredGrantTimer long enough if NW wants UE to keep using the configured grant for retransmission. Or NW can still provide DG in PDCCH for retransmission when the configuredGrantTimer becomes expired and no need to declare HO failure. |
| Xiaomi | Option 2 | T304 expired means the RACH-less HO is failure, there is no need to use an additional timer to indicate RACH-less HO failure. |
| Thales | Option 2 | T304 is in control of the HO failure, we may rely on it and does not introduce an additional timer. |
| Qualcomm | Option 2 | Agree with others |
| Huawei, HiSilicon | Option 2 |  |
| Apple | Option 2 | Relying on T304 is sufficient. No need to introduce extra UE behavior in last minute. |
| ZTE | Option 2 | Existing T304 is sufficient |
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| **Rapporteur summary:**  All companies but one support Option 2. Based on large majority support, the CR will follow LTM and no other new behaviour is specified for when the configuredGrantTimer expires. |

## OI4: PDCCH monitoring during RACH-less handover

In RAN2#124, the following agreement was made for RACH-less LTM cell switch:

* *During on-going RACH-less LTM cell switch the UE monitors PDCCH, e.g. despite DRX configuration and/or measurement gap configuration*

This agreement has been captured in the LTM CR in Section 5.7 as follows:

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| When DRX is configured, the Active Time for Serving Cells in a DRX group includes the time while:  - *drx-onDurationTimer* or *drx-InactivityTimer* configured for the DRX group is running; or  - *drx-RetransmissionTimerDL*, *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerSL* is running on any Serving Cell in the DRX group; or  - *ra-ContentionResolutionTimer* (as described in clause 5.1.5) or *msgB-ResponseWindow* (as described in clause 5.1.4a) is running; or  - a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4 or 5.22.1.5). If this Serving Cell is part of a non-terrestrial network, the Active Time is started after the Scheduling Request transmission that is performed when the *SR\_COUNTER* is 0 for all the SR configurations with pending SR(s) plus the UE-gNB RTT; or  - a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the Random Access Preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in clauses 5.1.4 and 5.1.4a); or  - there is an ongoing RACH-less LTM cell switch. |

And in Section 5.14 as follows:

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| During an activated measurement gap, the MAC entity shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by *measGapConfig* as specified in TS 38.331 [5]:  1> not perform the transmission of HARQ feedback, SR, and CSI;  1> not report SRS;  1> not transmit on UL-SCH except for Msg3 or the MSGA payload as specified in clause 5.4.2.2;  1> if the *ra-ResponseWindow* or the *ra-ContentionResolutionTimer* or the *msgB-ResponseWindow* is running, or if there is an ongoing RACH-less LTM cell switch:  2> monitor the PDCCH as specified in clauses 5.1.4 and 5.1.5. |

Considering the long RTT, this agreement may not be suitable in NTN as it would cause long and unnecessary monitoring of PDCCH. Furthermore, NTN has made the following agreement, which seemingly contradicts the LTM agreement:

* *If CG for initial UL transmission is configured, UE starts to monitor PDCCH according to existing DRX behaviour on the selected SSB from RACH-less HO configuration after initial UL transmission.*

However, the RTT in mIAB is more like LTM than NTN, so differentiated behaviour for mIAB may be desired.

**Question 4: For mIAB, how should UE monitor PDCCH during RACH-less HO procedure?**

* **Option 1: Following existing DRX/measurement gap configuration (like NTN)**
* **Option 2: Ignore DRX/measurement gap configuration (like LTM)**

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| **Company** | **Preferred Option** | **Additional comments** |
| Samsung | Option 2 | mIAB does not have the long RTT that NTN would have. |
| Qualcomm | Option 2 | It can be same as LTM.  Then the new section 5.xx PDCCH monitoring action is not need for mIAB. |
| Huawei, HiSilicon | Option 2 |  |
| Apple | Option 2 |  |
| ZTE | Option 2 |  |
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| **Rapporteur summary:**  Based on consensus support, mIAB will follow LTM (instead of NTN) on how the UE should monitor PDCCH during RACH-less HO. The text from the latest LTM CR will be used as baseline |

# Conclusions

Based on company input, the following will be captured in the running CR:

1. the CR will continue to refer to the procedure as “RACH-less handover procedure”
2. the CR will follow LTM and the text on support for multiple CG configurations for RACH-less HO will not be captured for the general RACH-less HO.
3. the CR will follow LTM and no other new behaviour is specified for when the configuredGrantTimer expires.
4. mIAB will follow LTM (instead of NTN) on how the UE should monitor PDCCH during RACH-less HO. The text from the latest LTM CR will be used as baseline

# References

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