3GPP RAN WG2 Meeting #125 R2-2401590

Athens, Greece, February 26th – March 1st, 2024

Agenda Item: 7.7.4

Source: InterDigital (Rapporteur)

Title: Input on remaining proposals not related to RACH-less HO

Document for: Discussion, Decision

# Introduction

This document is intended address remaining issues not related to RACH-less HO proposed in the 7.7.4 agenda item, as per the following email discussion:

* [Post125][302][NR-NTN Enh] 38.321 CR (Interdigital)
* Scope: draft a MAC CR for other aspects than RACH-less HO, with meeting agreements/based on discussion on aspects marked for post meeting discussion
* Intended outcome: Agreed CR

This includes the following proposals (Note: other proposals submitted to 7.7.4 will be addressed in a long lost meeting discussion on RACH-less HO in [POST125][024]):

* [R2-2400810](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2400810.zip): Proposals 1-4
* [R2-2401281](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2401281.zip): Proposal 2

Please note the following deadlines:

* Deadline for input to this discussion document: **March 6th 2024, 10:00 UTC**
* Deadline for agreed CR (in R2-2401590): **March 7th 2024, 21:00 UTC**

To support the questions within this document, corresponding text proposals have been provided in [R2-2400810](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2400810.zip) and [R2-2401281](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2401281.zip). Depending on the feedback provided, some or all of these TPs will be used as baseline to incorporate input into the general corrections CR.

# Rel-18 NTN: Corrections to MAC

## Signalling completion of the satellite switch with re-sync

One potential issue for indicating completion of the satellite switch with resync is identified in [R2-2400810](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2400810.zip), described in the contribution as follows:

“*For both soft and hard switch procedure, if there is no immediately UL data transmission NW does not know when exactly UE has completed the switch, whether the switch is successful, or when to start to schedule UE from the new satellite. Although the aim is to perform a lower-layer switch without L3 involvement, NW should be aware of UE’s intra-cell inter-satellite mobility for NW control in RRC\_CONNECTED as there is a satellite switch. Therefore, UE should inform NW the completion of satellite switch with resync and unchanged PCI. Due to the nature of lower layer switch, it is appropriate to inform the completion in MAC procedure.”*

**Question 1a) Do you agree UE reports in MAC the completion of satellite switch with resync and unchanged PCI?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| CATT | Disagree | For hard switch procedure, the source satellite will leave and the target satellite will provide service after *t-Service*, considering the gap negligible. So there is no ambigurity on when the UE has been served by the target satellite.  For soft switch procedure, it has been agreed in RAN2#125 meeting that:  *“For soft satellite switch, UE shall apply the acquired DL timing and start accessing the target satellite with related operations (e.g. restart T430, reset N\_TA, resume UL operations) not before t-Service”*  So, the transmission can be performed after t-Service for hard and soft switch procedure.No need for an explicit completion report. |
| LGE | Disagree | As mentioned by CATT, whether to report the TAR was already discussed. Then, the conclusion is that there is no need to specify TAR report at the completion of satellite switch with resync. |
| Nokia | Disagree | For soft switching, RAN2 reached below agreement in this meeting. We assume the UEs should complete the satellite switching around the t-Service in. Therefore, there is no need for UE to indicate NW by a new SR.   * For soft satellite switch, UE shall apply the acquired DL timing and start accessing the target satellite with related operations (e.g. restart T430, reset N\_TA, resume UL operations) not before t-Service   For hard switching, there is no coverage overlap from source and target satellite hence no scheduling ambiguity issue. We think NW implementation can address the issue on when the UE has switched to target. |
| vivo | Disagree | No further optimization is needed as we agreed to reuse the existing mechanism for TAR triggering and reporting. We should have stopped rediscussed this issue again. |
| Qualcomm | Disagree | For TAR, it is likely the UE will trigger TA report as the RTT has changed drastically between old and new satellites. If TA report is not supported or SR would not be triggered, network should take into account the maximum sync interruption defined by RAN4. |
| ZTE | Disagree |  |
| Ericsson | Disagree | If all UE switch at the same time and we trigger confirmation, then some UEs will be delayed and the load may be too high. |
| Huawei | Disagree | Similar view with CATT. |
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[R2-2400810](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2400810.zip) further describes a possible solution for indicating completion of satellite switch with resync based on the existing MAC procedure:

“*One simple solution based on the existing MAC procedure is to make UE report TA to the new satellite as a signal of satellite switch completion. In the current TA report procedure, TAR is triggered due to upper layer indication or TA difference to the last report is larger than an offset, and scheduling request for TAR is configurable* [See Section 5.4.8 of TS 38.321]*. To signal the completion of satellite switch, TAR can be triggered towards the new satellite regardless of the TA difference to the last report or upper-layer configuration on TA report*.”

**Question 1b) Do you agree that if indication of uplink synchronization is received after indication of uplink synchronization loss due to satellite switch with re-synchronization, TA report is triggered (i.e., to indicate completion of re-sync procedure)?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| CATT | Disagree | TA report mechanism can follow the legacy procedure. |
| LGE | Disagree |  |
| Nokia | Disagree | See our response to Q1a.Furthermore, the TARs triggered by UEs may cause additional and uncecessary UL signalling if the TA change does not touch the threshold. And the TAR/SR burst may cause PUSCH congestion which is not good for system performance. |
| vivo | Disagree | Same comment as Q1. |
| Qualcomm |  | We are ok to trigger TA report upon switch but anyway if it does not trigger SR, then it does not help much. |
| ZTE | Disagree | Existing mechanism still works |
| Ericsson | Disagree | TA report is an optional feature. |
| Huawei | Disagree | Follow legacy. |
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To support a TAR-based indication of satellite switch with re-sync completion from Q1a/Q1b, [R2-2400810](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2400810.zip) further notes that the following changes to SR may also be necessary/useful:

“*In Rel-17, only if configured, SR can be triggered when there is no UL grant to accommodate the TAR. If* [Question 1] *is agreeable, another issue is whether the triggered the TAR can directly triggered SR, regardless of timeAdvanceSR. We think the SR should be triggered for TAR to inform the completion of satellite switch, if TAR has not been sent after the switch.*“

**Question 1c) Do you agree that if indication of uplink synchronization is received after indication of uplink synchronization loss due to satellite switch with re-synchronization, and the UE has not reported Timing Advance value after satellite switch with re-synchronization, SR is triggered if there is no UL grant for the triggered TAR?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| CATT | Disagree | Follow the legacy procedure. |
| LGE | Disagree |  |
| Nokia | Disagree |  |
| vivo | Disagree | Same comment as Q1. |
| ZTE | Disagree |  |
| Ericsson | Disagree |  |
| Huawei | Disagree |  |
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## HARQ buffer handling during satellite switch with re-sync

In current specification, upon indication of UL synchronization loss from upper layers the UE will follow the same procedure (including flushing HARQ buffers) whether it was due to R17 sync loss or R18 satellite switch with re-sync. In [R2-2401281](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2401281.zip), the following issue regarding flushing HARQ buffers is noted:

“*According to the current MAC specification, UE will flush all HARQ buffers* [during satellite switch with resync]*. In Rel-17, UE should flush all the HARQ buffers because the network does not know when the UE lost the uplink synchronization and there is a time gap between when the uplink synchronization is lost and when the uplink synchronization is resumed due to the acquisition of SIB19.*

*However, in unchanged PCI case, since the cell is not changed and the network knows when the UE loses the uplink synchronization and there is no time gap between when the uplink synchronization is lost and when the uplink synchronization is resumed, the network can still retransmit the UL/DL data for soft combination. If the UE flush all HARQ buffers, it will lead to decreasing of the transmission efficiency. Therefore, in this case, UE is not supposed to flush HARQ buffers.*”

**Question 2) Do you agree that upon indication of UL synchronization loss due to satellite switch with re-synchronization, UE doesn’t flush the HARQ buffers?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| CATT | - | We think there is no big issue for HARQ flushing. But we agree that transmission efficiency may be impacted if HARQ buffer is flushed. We could follow the majority's view. |
| LG | Disagree | The realiblity of the data for the RLC AM can be ensured by ARQ procedure and the loss of the data for RLC UM is not a big issue. Thus, we think there is no issue on flushing flush the HARQ buffer at satellite switch with re-synchronization. |
| Nokia | Disagree | In hard-switch, the switch gap can be long since the UE can start measuring the target satellite only after t-Service. We think the proposal is an optimization which is not needed. |
| vivo | Disagree | The HARQ buffer helps to flush the out-of-date MAC CE(s) so that UE can regenerate the new MAC CE for reporting in the target satellite. Also, we can rely on NW scheduling for handling the data loss. No critical issue is found. |
| Qualcomm | Agree | There is no need for HARQ flushing, UE is connected to source until t-Service and immediately after t-Service UE may be able to resume everything and continue with target satellite with early sync.  Network implementation can handle the scheduling as all UEs switch to target at t-Service. |
| Ericsson | Disagree | If UE specific Koffset is used before switch, the gNB cannot know when the switch takes place and after the switch the UE shall use the cell specific Koffset – then gNB cannot know which slot a HARQ feedback will be sent in. We think best is for the UE to flush the HARQ buffers. |
| Huawei | Proponent | We don’t quite understand Ericsson’s comment. HARQ buffer is refer to a HARQ process. Why the slot for the HARQ feedback matters?  As expliaind, we don’t see the necessity/benefit to flush the HARQ buffer in this case. On the contrary, it will lead to decreasing system performance.  BTW, since the default behaviour should be not flushing the buffer, flushing the buffer looks like an uncessary enhancement to us. If we don’t want any enhancement, the UE shouldn’t flush the HARQ buffer unless critical issue is found. |
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# Conclusions

<To be generated based on company input>

# References

1. [R2-2400810](file:///C:\Users\wattsdy\OneDrive%20-%20InterDigital%20Communications,%20Inc\3GPP\RAN2\125%20Athens\Review\tdocs_125\R2-2400810.zip) – Corrections on NTN MAC issues Samsung
2. [R2-2401281](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_125/Docs/R2-2401281.zip) – Discussion on MAC behaviours related to RACH-less HO and unchanged PCI Huawei, HiSilicon