**3GPP TSG-RAN WG2 Meeting #130R2-250xxxx**

**St.Julians, Malta, May 19th – 23rd, 2025**

**Agenda item:** 8.11.2

**Source:** Samsung

**Title:** [AT130][209][SBFD] Proposals to address MAC-2 and MAC-3 (S`amsung)

**Document for:** Discussion and Decision

# 1 Introduction

This document aims to collect views from companies for the following offline discussion:

* [AT130][209][SBFD] Proposals to address MAC-2 and MAC-3 (Samsung)

Intended outcome: Summary with proposals in R2-2504743 to address MAC-2 and MAC-3.

Deadline: before Friday CB

We propose the following process:

1. **Initial Input:** Please review this document and provide your input by 11:00 AM on Thursday.
2. **Next Steps:** Based on the input received, a summary will be prepared. If consensus cannot be reached, we plan to hold an offline discussion @ BO3 (17:00–17:30 on Thursday). Please note that this discussion may be canceled depending on the progress made.

And please provide your contact information when responding.

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# 2 Discussion

During the SBFD session, there have been a discussion related to ‘MAC-2’ and ‘MAC-3’ as follows:

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| [Issue MAC-2: RA Resource Set Reselection at RO Type Switching]  R2-2504223 Views on random access for SBFD Qualcomm Incorporated discussion NR\_duplex\_evo-Core   * Noted   *Proposal 7: When RO type switches from one type of RO to the other type of RO, UE should evaluate the set of RACH resources of the feature combinations configured in the other type of RO.*  *Proposal 8: For RACH fallback from one type of RO to the other type of RO, at least UE is allowed to switch the type of RO configured with the same feature combinations. FFS the case of no same feature combination configured on the other type of RO when performing RACH fallback.*  R2-2503477 Remaining issues on Random Access procedure for SBFD LG Electronics Inc. discussion Rel-19 NR\_duplex\_evo-Core   * Noted   *Proposal 4. For PRACH transmission re-attempt in one RA procedure, UE is allowed to switch between SBFD RO and non SBFD-RO only in the same feature combination and the same repetition number.*  R2-2504169 Remaining issues for RACH in SBFD Apple discussion Rel-19 NR\_duplex\_evo-Core   * Noted   *Proposal 2: Feature specific RACH resource set configurations are independent between SBFD and non-SBFD RO types. Once UE switches to a different RO type, RACH resource set selection is re-started.*  Discussion  - Samsung, Ericsson support LG E proposal. Samsung think P2 from Apple is complex.  - Ericsson think we can start with P8 from QC, and it can be left to NW implementation to ensure those configurations are the same.  - CATT think ‘same feature combination’ is important. CATT see benefit of keeping ‘same or higher’ repetition number. ZTE share this view.  - ZTE, CMCC agree with P8 from QC.  - Apple think with the 1st half of QC P8, it means NW should configure the same feature set combination for both RO types. QC confirms this understanding. CATT think there is no NW restriction.  - LG E do not want the complexity of choosing different feature set comb for different ROs.  - QC open to discuss UE behavor if NW configures different FSC for different ROs.  - Xiaomi agree with Apple. Charter share this view.  *?? For RACH fallback from one type of RO to the other type of RO, at least UE is allowed to switch the type of RO configured with the same feature combinations.*  *?? FFS the case of no same feature combination configured on the other type of RO when performing RACH fallback.*  [Issue MAC-3: Msg 1 Repetition Number Fallback with SBFD RO]  R2-2503423 Random Access in SBFD symbols CATT discussion Rel-19 NR\_duplex\_evo-Core   * Noted   *Proposal 7: (MAC-3) Msg1 repetition number fallback can be supported within SBFD RO.*  *Proposal 8: Once RO type fallback condition is met, UE should first perform RO type fallback and determine the Msg1 repetition number based on the new RO type.*  R2-2503379 Impacts on the random access by the evolution of duplex operation Huawei, HiSilicon discussion Rel-19 NR\_duplex\_evo-Core   * Noted   *Proposal 5: After the RO type switching with preamble repetition, UE needs to select RACH resource set with same or higher Msg1 repetition number, i.e. fallback to lower Msg1 repetition number should be avoided.*  Discussion P7 of CATT paper  - Samsung, LG E, Lenovo support CATT P7. Samsung prefer the repetition # should be the same in case of fallback.  - Ericsson think UE should check rsrp threshold as well.  - LG E think after RO switch UE can further increase repetition # based on the threshold.   * Msg1 repetition number fallback can be supported within SBFD RO.   Discusison P8 of CATT paper  - LG has concern on UE complexity.  - ZTE not sure how it works, since UE should base on the repetition number that UE uses before RO type switching. Samsung also wonders. Lenovo share view form ZTE. CATT agree and think another alternative is for UE to determine the repetition number solely based on rsrp threshold.  - Nokia support P8 from CATT, and think after RO type switch the link condition may be quite different, so it is not obvious the same repetition # is still needed.  - Ericsson think it possible to consider both old repetition number and also the rsrp threshold for new RO type.  ?? Once RO type fallback condition is met, UE should first perform RO type fallback and determine the Msg1 repetition number based on the new RO type.   * Once the conditions for both RO type fallback and Msg1 repetition number fallback are met, UE should perform RO type switch. FFS the Msg1 repetition number after RO type switch in this case. |

During the discussions, we discussed several topics including the combination of features, the Msg1 repetition number, and the associated MAC behavior. To ensure clarity and progress, we would like to propose continuing this discussion in a structured, step-by-step manner through this e-mail.

As a starting point, we suggest focusing on whether the feature combinations and Msg1 repetition number should be considered when evaluating RO type fallback mechanisms.

## **Issue 1: Consideration of feature combinations and Msg1 repetition # for RO type fallback.**

During the session, two different perspectives emerged regarding the relevance of feature combinations and Msg1 repetition number in the context of RO type switching/fallback. These are also linked to the MAC layer behavior, whether the UE should re-initiate RACH resource set selection upon switching the RO type.

At this stage, we would like to gather the views of companies on this matter, specifically, which direction you support and the reasons.

**Discussion 1: whether the feature combinations and Msg1 repetition number need to be considered for RO type switching.**

* **Option 1) Yes, they should be considered.**
* **Option 2) No, RO type switching is independent of these factors, and the UE should re-start RACH resource set selection upon switching.**

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| **Company** | **Preferred option** | **Comments** |
| LGE | Option 1 | As we commented in the yesterday’s session, re-selection of the set of Random Access resources would cause a lot of complexity, e.g., fallback from SDT procedure to non-SDT procedure.  Note that the same issue was discussed in many items (i.e., R17 SDT, R17 RACH partitioning, R18 CovEnh), but it was not agreed to change the feature combination due to potential additional issues considering various feature combination cases.  Given that only one meeting is left for SBFD WI, it is really important to avoid the further discussion points and issues in order to finish the SBFD WI properly. |
| Interdigital | Option 1 | RAN2 needs to minimize other impact related RACH operation after RO type switching for feasible SBFD operation and specification load.  In addition, if RAN2 agreed new operation related RACH operation after RO switching, it may be some impacts to RAN1 group which is not desirable direction at this moment. |
| CATT | Option 1 | Agree with LG, at least feature combination should be considered. Regarding to the msg1 repetition number, it depends on the discussion of Issue 3. |
| Lenovo | Option 1 | We have similar understanding as LGE. Additionally, since we also agreed RO type fallback in both directions, we think such consideration is necessary to reduce the failure probability when switching from non-SBFD RO type to SBFD RO type. |
| ZTE | Option 1 | Even if the RO type can switch, it is still within one RA procedure. The one RA procedure should follow the feature combination which was selected at the beginning. |
| Qualcomm | Option 1 with comments | The feature combination (including the feature of Msg1 repetition) should be considered (i.e., whether the same feature is configured in other type of RO). But the number of Msg1 repetition is no need to be considered. |
| vivo | Option 1 with feature combination only. (Msg1 repetition number should be discussed in issue 3) | Take Msg1-reptition for example, considering RAN1 has agreed that for SBFD operation the UE can be configured with separate Msg1-repetition configuration (including parameters like *startPreambleForThisPartition*, *numberOfPreamblesPerSSB-ForThisPartition*, *numberOfRA-PreamblesGroupA* and *msg1-RepetitionTimeOffsetROGroup* parameters), it is likely the UE needs to reselect the RACH resource set anyway and initialize the parameters anyway.  If we go with Option 1, basically it means we rely on the NW to configure the same the feature combinations and Msg1 repetition number (even including the detailed parameters in the separate Msg1 repetition configuration) for both RO types. Otherwise, the RO type fall-back mechanism is useless. |
| Nokia | Option 1 | We support Option 1, but Msg1 repetition number in the other type of RO based on its evaluation of RSRP |
| Huawei, HiSilicon | Option 1 with comments | We think the RO type switch is preferrablly limited to same feature combination, concidering the complexity otherwise.  On whether restart/reselect resource set, our think is that the base line is to follow the behaviour of msg1 repetion number fallback including reselection of parameters *startPreambleForThisPartition, numberOfPreamblesPerSSB-ForThisPartition, numberOfRA-PreamblesGroupA and msg1-RepetitionTimeOffsetROGroup* since now msg1 repetition fallback is to be supported with SBFD, those parameters need to be reselected at least.  However we are not targeting restart back to 5.1.1b. |
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**[Summary] TBD**

## **Issue 2: Supported feature combinations**

As a continuation of the RO type fallback discussion, we would like to address the topic of supported feature combinations. During the session, the following points were discussed as an initial approach for determining valid combinations in the context of RO type fallback:

*?? For RACH fallback from one type of RO to the other type of RO, at least UE is allowed to switch the type of RO configured with the same feature combinations.*

*?? FFS the case of no same feature combination configured on the other type of RO when performing RACH fallback.*

We would like to gather companies' views on these aspects — in particular, which direction you support and the reason behind.

**Discussion 2: In the context of RACH fallback from one RO type to another, should the UE be allowed to switch to an RO type that is configured with the same feature combinations?**

*Note: Msg1 repetition number remains FFS.*

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| **Company** | **Preference** | **Comments** |
| LGE | Yes |  |
| Interdigital | Yes | We should made specification as simple as we can. |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes | The same feature combination is the feature combination that the UE finally selected (e.g., based on feature priority) on the previous RO type. |
| Qualcomm | Yes | The switch of different feature combinations was not supported for some features. |
| vivo | Yes | It’s straight forward. |
| Nokia | Yes |  |
| Huawei, HiSilicon | Yes |  |
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**[Summary] TBD**

Following discussion3 considers the case where, during RACH fallback, there is no RO configured with the same feature combination on the target RO type. The question is whether the UE should be allowed to switch to an RO configured with a different feature combination.

**Discussion 3: In case if there is no RO with the same feature combination configured on the fallback RO type, should the UE be allowed to switch to an RO configured with different feature combinations?**

*Note: Msg1 repetition number remains FFS.*

* **Option 1) UE is allowed to switch to an RO type configured with different feature combinations.**
* **Option 2) UE is not allowed to switch to an RO type configured with different feature combinations.**

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| **Company** | **Preferred option** | **Comments** |
| LGE | Option 2 | See our responses in Discussion 1. |
| Interdigital | Option 2 | We should made specification as simple as we can. |
| CATT | Option 2 |  |
| Lenovo | Option 2 |  |
| ZTE | Option 2 | We want to emphasize that this does not mean gNB should mandatory configure all the feature combinations to be the same on two RO types (especially for SBFD RACH configuration option 2).  gNB will try its best to allocate proper RACH partition configuration on those two RO types (e.g., to facilitate fallback) by implementation. |
| Qualcomm | Option 2 | Different feature combinations switch was not supported before. |
| vivo | Option 2 | The spec impact is big if we allow it. |
| Nokia | Option 2 | MAC impact is minimum with Option 2 |
| Huawei, HiSilicon | Option 2 |  |
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**[Summary] TBD**

## **Issue 3: Supported Msg1 repetition number when fallback**

This issue addresses how the Msg1 repetition number should be determined when RO type fallback occurs.

It has been proposed that, once the condition for RO type fallback is met, the UE should first perform the fallback and then determine the appropriate Msg1 repetition number based on the newly selected RO type.

?? Once RO type fallback condition is met, UE should first perform RO type fallback and determine the Msg1 repetition number based on the new RO type.

* Once the conditions for both RO type fallback and Msg1 repetition number fallback are met, UE should perform RO type switch. FFS the Msg1 repetition number after RO type switch in this case.

This discussion addresses how the Msg1 repetition number should be determined when the UE performs RACH fallback from one RO type to another, assuming that the fallback RO type is configured with supported feature combinations (as per Issue 2).

We would now like to gather views on the following specific cases regarding the allowed Msg1 repetition number when fallback occurs.

**Discussion 4: Selection of Msg1 repetition number during RO type fallback**

* **Option 1: The UE is not allowed to switch to an RO type configured with a lower Msg1 repetition number.**
* **Option 2: The UE is allowed to switch to an RO type configured with the same Msg1 repetition number.**
* **Option 3: The UE is allowed to switch to an RO type configured with a higher Msg1 repetition number.**
* **Option 4: The UE is allowed to switch to an RO type with a Msg1 repetition number based on its own implementation.**

Please indicate which options (could be multiple) your company supports and provide your reasons. This will help clarify expected UE behavior and support alignment across implementations.

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| **Company** | **Preferred options** | **Comments** |
| LGE | Option 1, Option 2 | First we would like to note that set of Random Access resources for different repetition number is considered as different RACH partition. Therefore, if the different repetition number is allowed to be selected, there are sonly two option to implement this operation:   * Option 1: re-select the set of Random Access resources, i.e., perform 5.1.1b again after the RO type switch * Option 2: define additional step/operation to select the Msg1 repetition number after the RO type switch.   For option 1, given that current operation to select the set of RA resources is defined to select feature combination and Msg1 repetition number simultaneously, it is hard to define additional procedure to only re-select the Msg1 repetition number while feature combination is kept. As in our response in Discussion 1, re-selecting the feature combination would cause additional issues, which should be avoided.  For option 2, there would be additional discussions to define how to re-select the Msg1 repetition number. Based on comments in the online session, if it is allowed to re-select the Msg1 repetition number, additional conditions would be further discussed, e.g., current Msg1 repetition number, RSRP, whether the lower Msg1 repetition number is allowed, etc. However, it should be emphasized that we have only one meeting for this WI, so further discussion points should be avoided as much as possible at this late stage.  Therefore, at this late stage, it would be better to simplify the procedure to finish the WI properly, rather than further optimization with additional discussion.  Anyway, based on the current Msg1 repetition fallback procedure, Msg1 repetition number can be increased after the RO type switch anyway without any further work. |
| Interdigital | Option 2 |  |
| CATT | See comment | In RAN1#119 meeting, the following agreements were reached regarding to msg1 repetition:   |  | | --- | | **Agreement**  For RACH configuration Option 2, support separate configuration of *rsrp-ThresholdMsg1-RepetitionNum2/4/8* and *msg1-RepetitionNum* for PRACH transmission with preamble repetitions within additional-ROs and PRACH transmission with preamble repetitions within legacy-ROs.   * *msg1-RepetitionNum* is configured in RACH-ConfigCommon in current specification, i.e., forRACH configuration Option 2, *msg1-RepetitionNum* can already be separately configured for legacy-ROs and additional-ROs.   **Agreement**  For RACH configuration Option 1, support separate configuration of *rsrp-ThresholdMsg1-RepetitionNum2/4/8* for PRACH transmission with preamble repetitions within additional-ROs and PRACH transmission with preamble repetitions within legacy-ROs.   * Same *msg1-RepetitionNum* is used for PRACH transmission with preamble repetitions within additional-ROs and PRACH transmission with preamble repetitions within legacy-ROs. |   Based on the above agreement, the *rsrp-ThresholdMsg1-RepetitionNum2/4/8* can be different for additional RO and legacy RO. Hence, even if the RSRP of UE kept unchanged during RO type switch, it can re-evaluate the msg1 repetition number after RO type switch. |
| Lenovo | Option 2 | We think while switching RO type, the UE selects a RACH Resource set with the same Msg1 repetition number and then can follow Msg1 repetition fallback as per legacy mechanism after the initial RO type switch. |
| ZTE | Option 1, option 3 | Only reaching to a higher Msg1 repetition number brings more benefit for ensuring the RA success.  UE can assume more than one Msg1 repetition number to be available for the same feature combination. Since same feature combination should be ensured, we think the UE can select a higher Msg1 repetition number within the same feature combination.  So, there is no need to re-discuss the Msg1 repetition number selecting rule after RO type fallback, it will be simple that UE selects **a next higher Msg1 repetition number within the same feature combination**, which is the same as R18 Msg1 repetition number fallback rule on legacy symbols. |
| Qualcomm | Option 4 | UE selects the Msg1 repetition number in the other type of RO based on its evaluation (RSRP) no matter the value is lower/higher.  Similar as CATT has pointed out, the *rsrp-ThresholdMsg1-RepetitionNum2/4/8* can be different for additional RO and legacy RO. Thus, UE has to re-evaluate the appropriate number of Msg1 repetition. |
| vivo | None | As we comment in issue 1, we think RO type switching is independent from the Msg1 repetition number before/after switching, i.e. the UE is allowed to switch RO type regardless of Msg1 repetition number.  **We’d like to propose an Option 5:**  **After the RO type switching, if the UE is configured with the same or higher Msg1 repetition number, it will use the same or higher Msg1 repetition number. Otherwise, the UE selects the highest Msg1 repetition number of the target RO type after RO type switching.**  We don’t think let it to be UE implementation (Option 4) is a good way forward. For instance, if the current repetition number with legacy RO is 8 and the applicable repetition number with SBFD RO is 2 and 4, when the UE performs RO type switching (say it switch from legacy RO to SBFD RO), the UE should determine the latest Msg1 repetition number to be 4, rather than 2. |
| Nokia | Option 4 | Same view as Qualcomm and CATT |
| Huawei, HiSilicon | Option 1, 2, 3 | We think using same msg1 repetition number would be the natural choice if the same msg1 repetition is available and we agree the higher number should be used.  When the transmission fails and leads to RO type switch, it is logic to benefit from RO type switching. In this case, if the lower msg1 repetition number is used, it might offset the gain from the RO type switch. The higher resource usage by higher repetition number would be a potential cost however to ensure the success of current transmission of this RACH procedure is realistic requirement not a potential requirement. From this consideration, we think it is desired to use same (if applicable) and higher msg1 repetition number rather than the lower msg1 repetition number. We understand supporting Option 2, 3 is equivalent to support Option 1 and against Option 4. |
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**[Summary] TBD**

# 3 Conclusion

Based on company feedback, the following is proposed: