**3GPP TSG-RAN WG2 Meeting #124 *R2-231xxxx***

**Chicago, USA, Nov. 13th – 17th, 2023**

Agenda Item: x.x.x

Source: Huawei, HiSilicon

Title: Summary of [POST123bis][851][CE\_enh] CP running CR and open issues (Huawei)

Document for: Decision

# 1 Introduction

This document aims at discussing the following RAN2#123bis Post discussion.

* [POST123bis][851][CE\_enh] CP running CR and open issues (Huawei)

 Scope and intended outcome:

*1.     Update the running CR with agreements from the meeting*

*2.     Rapporteur to propose resolutions for straightforward open issues which can already be included in the running CR*

*3.     For Stage 3 running CRs, get input on stage-3 issues that require further input from companies to make a decision:*

* *Focus on stage-3 issues which are better handled via offline, e.g. signaling details, parameter values/ranges, NOT functionality discussion. For these issues, if any, the CR rapporteur should submit a separate report with proposals to the next meeting by the submission deadline, while input via company Tdocs should be avoided*

*4.     Identify the remaining open issues that need to be solved for WI completion in the next meeting:*

* *Company Tdocs for the next meeting should focus on these issues*

 Deadline: Long (until next meeting)

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| --- | --- | --- |
| **Company** | **Name** | **Email** |
| Ericsson  | Oskar Myrberg | oskar.myrberg@ericsson.com |
| Samsung | Anil Agiwal | anilag@samsung.com |
| Qualcomm | Sherif ElAzzouni | selazzou@qti.qualcomm.com |
| ZTE | LiuJing | liu.jing30@zte.com.cn |
| Huawei, Hisilicon | You Chunhua | youchunhua@huawei.com |
| LGE | Hanseul Hong | hanseul.hong@lge.com |
| China Telecom | Pei Lin | linp@chinatelecom.cn |
| CATT | Haocheng Wang | wanghaocheng@catt.cn |
| vivo | Yitao Mo (Stephen) | yitao.mo@vivo.com |
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# 2 Remaining open issues

2.1 Parameter configuration

* **groupBconfigured, rsrp-ThresholdSSB**

RAN2 discussed how to configure parameters for different repetition number:

* + From RAN2 CE perspective, deltaPreamble IE in FeatureCombinationPreambles are common for repetition number 2, 4 and 8 - FFS for groupBconfigured, rsrp-ThresholdSSB

The moderator tend to think there can be benefit/flexible to allow separate configurations of groupBconfigued, rsrp-ThresholdSSB for different repetition number. An EN has been also added.

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| Editor’s Note1: FFS on separate *groupBconfigure*, *rsrp-ThresholdSSB* for different repetition number. |

Companies are encouraged to provide views if you are fine with this proposal.

**Question 1: Do companies agree that groupBconfigured can be separately configured for different repetition number?**

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| **Company** | **Options (Y or N)** | **Comments** |
| Ericsson | N | In order to keep the specification impact smaller we prefer that groupBconfigured is same for all repetitions. We think the added benefit from this configured separately for each repetition factor is low. |
| Samsung | N | Its not needed. Its going to create more issues. For example, if ra-Msg3SizeGroupA is different, preamble group reselection and Msg3 MAC PDU generation (rebuilding) needs to be performed again when UE fallbacks from lower to higher repetition. |
| Qualcomm | No | Not needed. Group B if configured can use the same repetition factor of group A. No issues foreseen.  |
| ZTE | Yes with comments |  groupBconfigured-r17 SEQUENCE { ra-SizeGroupA-r17 ENUMERATED {b56, b144, b208, b256, b282, b480, b640, b800, b1000, b72, spare6, spare5,spare4, spare3, spare2, spare1}, messagePowerOffsetGroupB-r17 ENUMERATED { minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18}, numberOfRA-PreamblesGroupA-r17 INTEGER (1..64) } OPTIONAL, -- Need RgroupBConfigured has 3 sub IEs, in our view, only numberOfRA-PreamblesGroupA-r17 can be different for different repetition numbers. Since we use separate featureCombinationPreambles IEs to configure RACH resources for different repetition numbers, considering the different amount of UEs at cell edge, the network may reserve different number of preamble indexes for different repetition numbers. For example, 8 preamble indexes for Num 2, 4 preamble indexes for Num4, but only 2 preamble indexes for Num 8. In this case, it does not make sense to apply the same numberOfRA-PreamblesGroupA for different repetition numbers.In our understanding, different numberOfRA-PreamblesGroupA does not bring additional impact to MAC spec.  |
| Huawei, Hisilicon | Y | Agree with the moderator. However comon configuration is acceptable to us if the majority prefer it. |
| LGE | Y | Given that it is agreed to separatedly configure *featureCombinationPreables* IE for each repetition number, there is no impact on the RRC structure to configure separated *groupBconfigured* for each repetition number.Agree that there is no need to configure separated ra-Msg3SizeGroupA, but at least numberOfRA-PreamblesGroupA, i.e., separate parameters for each repetition number are needed since the number of preambles for each repetition number could be different, as in ZTE’s comment. |
| China Telecom | Y | Share same view as ZTE and LGE. At least numberOfRA-PreamblesGroupA could be different between different repetition numbers. |
| CATT | Y | Since fallback is supported for shared RO, the preambles configuration for different repeititon number should be different. Therefore, at least *numberOfRA-PreamblesGroupA* should be different for each repetition number. |
| Xiaomi | No | Share the same view as samsung regarding the ra-msg3SizeGroupA. For numberOfRA-PreamblesGroupA, we don’t see strong motivation to configure different value for different repetition. In general the number of preamble is determined based on the UE numbers using the RACH resources, it is hard to say that the number of UEs using RACH resources of repetition number 2 would be much different from RACH resources of repetition number 4/8 to justify a different configuration. |
| vivo | Yes | As Alt2.3 is adopted (Reusing the multiple Rel-17 separate partition to configure preambles for repetition 2,4,8), then it is feasible to use different number. The previous agreement was made before agreeing on the Alt 2.3. We prefer to allow separate configuration. Otherwise, more spec impact will be impacted while performance degrades. |

Summary: There is no consensus whether to configure separate parameter or not. It seems the focus is *numberOfRA-PreamblesGroupA*. For the other two parameters, it seems companies are okay with a common value to different repetition number. For example, different value of ra-SizeGroupA may cause problem in MSG3 rebuilding.

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| **[Online discussion] Proposal 1(7/10): RAN2 to discuss if *numberOfRA-PreamblesGroupA* can be configured separately for different repetition number.** **WA: To discuss it online, company tdoc is encouraged.** |

**Question 2: Do companies agree that rsrp-ThresholdSSB can be separately configured for different repetition number?**

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| **Company** | **Options (Y or N)** | **Comments** |
| Ericsson | N | As the current running CR for MAC looks, we fail to see the use of separate rsrp-ThresholdSSB for when 5.1.2 in MAC specification is run again. If the SSB selection does not find any SSB above the threshold the UE will any way select “any SSB” so we think this will be enough.  |
| Samsung | N | Benefit is unclear. |
| Qualcomm | No | No clear motivation for RSRP SSB threshold to depend on repetition number. RSRP threshold will be set conservatively to allow enough signal for no repetition case, and lower than that repetition thresholds can cover.  |
| ZTE | N | Same view as Ericsson. |
| Huawei, Hisilicon | Y | Agree with the moderator. However comon configuration is acceptable to us if the majority prefer it. |
| LGE | No strong view | It seems that there is no impact on RRC structure to configure separated rsrp-ThresholdSSB for each repetition number, but we are okay to configure common *rsrp-ThresholdSSB* for each repetition number, if majority supports. |
| China Telecom | N | No clear need to configure separate rsrp-ThresholdSSB. |
| CATT | N | If rsrp-ThresholdSSB is separately configured for different repetition number, the UE behaviour could be rather complex. |
| Xiaomi | No | We have agreed that the criterion on change of repetition number from low to high doesn’t include RSRP because the fail of RACH is due to interference instead of low RSRP value. So there is no impact of SSB RSRP to the repetition number. |
| vivo | Yes | Different reprtition generally is associated with differen radio condition. It is natural to have separate threshold for SSB selection. Manwhile, Alt 2.3 allows this. If it is not allowed, more spec impact will be impacted while performance degrades. |

Summary: There is clear majority to support common value of *rsrp-ThresholdSSB* for different repetition number.

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| **[Potential agreement] Proposal 2 (9/10): The value of *rsrp-ThresholdSSB* for MSG1 repetition is common to different repetition number.** **WA: To confirm it online, company tdoc can be avoided.** |

* **MSG3 repetition parameters in relation with MSG1 repetition**

In the previous meeting, the moderator observes some proposals on MSG1 and MSG3 co-existence, and think there is no discussions on this point from CP prespective. Some companies argue that it would be beneificial to distinguish Msg3 parameters w/wo Msg1 repetition. Therefore, the moderator would like to see company’s views on this. Companies are encouraged to provide views on the following question. An EN has been also added.

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| Editor’s Note3: FFS on separate *numberOfMsg3-RepetitionsList*, *mcs-Msg3-Repetitions* when MSG1 repetition is applicable. |

**Question 3: Do companies think if separate Msg3 repetition parameter (e.g. numberOfMsg3-RepetitionsList and mcs-Msg3-Repetitions) should be configured if Msg 1 repetition is applicable to distinguish that from the case when Msg1 repetition is not applicable.**

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| **Company** | **Options (Y or N)** | **Comments** |
| Ericsson | N | We think we don’t have to separate the cases to reduce complexity. |
| Samsung | N |  |
| Qualcomm | No | Side note: If a partition is configured with Msg1/Msg3 based repetition, we think there is some value in Msg 1 repetition automatically triggering Msg3 repetition.  |
| ZTE | N | This looks like an optimization, not sure if we should check with RAN1 first. |
| Huawei, Hisilicon | Y | Agree with the moderator. The MSG3 repeition number value in MSG1 + MSG3 repetition for R18 should be different from the R17 since differnet coverage level are assumed in R18. |
| LGE | N | We think that existing Msg3 reptition parameter is enough and no further optimization is needed to couple the Msg1 repetition and Msg3 repetition. |
| China Telecom | N |  |
| CATT | N |  |
| Xiaomi | N |  |
| vivo | No | Unless requested by RAN1, we don’t see the necessity. |

Summary: There is clear majority to not support separate MSG3 repetition parameters when MSG1 repetition is applicable.

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| **[Potential agreement] Proposal 3(9/10): Separate MSG3 repetition parameter (e.g. numberOfMsg3-RepetitionsList and mcs-Msg3-Repetitions) when MSG1 repetition is applicable is not supported.** **WA: To confirm it online, company tdoc can be avoided.** |

2.2 Value ranges

* **The values of the threshold of fallback from lower number to higher number**

RAN2 agreed to introduce a RRC configured threshold to control the fallback, which is common for different repetition number. However, the value needs to be determined. An EN has been also added.

* + Introduce a RRC configured threshold (e.g. TransMax-Msg1RepNum), the field is used for deciding whether to trigger fallback from with lower number to higher number when the number of Msg1 transmission exceeds this threshold. This parameter is common for different repetition numbers configured in one RACH partition.

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| Editor’s Note4: FFS on values of *msg1-RepetitionTransMax*. |

Regarding the values, the moderator suggest to adtop the same values of 2-step switch to 4-step, i.e. n1, n2, n4, n6, n100, n200. In case this filed is absent, the switch from lower number to higher number is not allowed.

 msgA-TransMax-r16 ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200} OPTIONAL, -- Need R

The suggested TP is as follows.

***BWP-UplinkCommon* information element**

-- ASN1START

-- TAG-BWP-UPLINKCOMMON-START

BWP-UplinkCommon ::= SEQUENCE {

 genericParameters BWP,

 rach-ConfigCommon SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M

 pusch-ConfigCommon SetupRelease { PUSCH-ConfigCommon } OPTIONAL, -- Need M

 pucch-ConfigCommon SetupRelease { PUCCH-ConfigCommon } OPTIONAL, -- Need M

 ...,

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 rach-ConfigCommonIAB-r16 SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M

 useInterlacePUCCH-PUSCH-r16 ENUMERATED {enabled} OPTIONAL, -- Need R

 msgA-ConfigCommon-r16 SetupRelease { MsgA-ConfigCommon-r16 } OPTIONAL -- Cond SpCellOnly2

 ]],

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 enableRA-PrioritizationForSlicing-r17 BOOLEAN OPTIONAL, -- Cond RA-PrioSliceAI

 additionalRACH-ConfigList-r17 SetupRelease { AdditionalRACH-ConfigList-r17 } OPTIONAL, -- Cond SpCellOnly2

 rsrp-ThresholdMsg3-r17 RSRP-Range OPTIONAL, -- Need R

 numberOfMsg3-RepetitionsList-r17 SEQUENCE (SIZE (4)) OF NumberOfMsg3-Repetitions-r17 OPTIONAL, -- Cond Msg3Rep

 mcs-Msg3-Repetitions-r17 SEQUENCE (SIZE (8)) OF INTEGER (0..31) OPTIONAL -- Cond Msg3Rep

 msg1-RepetitionTransMax-r18 ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200} OPTIONAL -- Cond Msg1Rep1

 ]]

}

AdditionalRACH-ConfigList-r17 ::= SEQUENCE (SIZE(1..maxAdditionalRACH-r17)) OF AdditionalRACH-Config-r17

AdditionalRACH-Config-r17 ::= SEQUENCE {

 rach-ConfigCommon-r17 RACH-ConfigCommon OPTIONAL, -- Need R

 msgA-ConfigCommon-r17 MsgA-ConfigCommon-r16 OPTIONAL, -- Need R

 ...

}

NumberOfMsg3-Repetitions-r17::= ENUMERATED {n1, n2, n3, n4, n7, n8, n12, n16}

-- TAG-BWP-UPLINKCOMMON-STOP

-- ASN1STOP

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| ***msg1-RepetitionTransMax***Max number of transmissions of MSG1 repetitions number (2, 4 and 8) performed before switching to higher repetition number (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when more than 2 repetition numbers are configured in shared RO. If the field is absent, switching from lower repetition number to higher repetition number is not allowed. |

**Question 4: Do companies agree the values of *msg1-RepetitionTransMax*, which is used to decide whether to trigger fallback from with lower number to higher number when the number of Msg1 transmission exceeds this threshold can be {** **n1, n2, n4, n6, n100, n200} ?**

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| **Company** | **Options (Y or N)** | **Comments** |
| Ericsson | Y | Proposed values seems ok. |
| Samsung | Y |  |
| Qualcomm | Yes |  |
| ZTE | Yes |  |
| Huawei, Hisilicon | Yes |  |
| LGE | Yes |  |
| China Telecom | Yes |  |
| CATT | Yes |  |
| Xiaomi | Yes |  |
| vivo | Yes |  |

Summary: All the company agree with the proposal from the moderator. However, there is a typo in the values where n8, n10, n20 and n50 are missing from the proposal, which are included in 2-step switch to 4-step, so these values should be kept as well. The moderator also note that the parameter name is not aligned with MAC CR, and think we can change the name as defined in MAC spec (but keep the full “repetition”).

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| **[Potential agreement] Proposal 4(10/10): The values of *preambleTransMax-Msg1Repetition* are { n1, n2, n4, n6, n8, n10, n20, n50, n100, n200}.** **WA: To confirm it online, company tdoc can be avoided.** |

* **The number of RACH configurations**

Currently there is a limitation of maximum 16 of RACH configurations in the RRC spec as follows. However, considering Msg1 repetition can be combinated with any feature, which would at most 3 times the number of RACH configurations (e.g. separate RO). Therefore, the moderator would like to see if there is a need to extend this limitation. Two ENs has been also added.

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| Editor’s Note5: FFS on limitation of the max number of entries of *additionalRACH-ConfigList* |

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| ***additionalRACH-ConfigList***List of feature or feature combination-specific RACH configurations, i.e. the RACH configurations configured in addition to the one configured by *rach-ConfigCommon* and by *msgA-ConfigCommon*. The network associates all possible preambles of an additional RACH configuration to one or more feature(s) or feature combination(s). The network does not configure this list to have more than 16 entries. If both *rach-ConfigCommon* and *msgA-ConfigCommon* are configured for a specific *FeatureCombination*, the network always provides them in the same *additionalRACH-Config*. |

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| Editor’s Note6: FFS on limitation of the max number of entries of *featureCombinationPreamblesList* |

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| *RACH-ConfigCommon* field descriptions |
| ***featureCombinationPreamblesList***Specifies a series of preamble partitions each associated to a combination of features and 4-step RA. The network does not configure this list to have more than 16 entries. |

**Question 5: Do companies think if the limitation of 16 entries for RACH configurations should be extended for MSG1 repetition. If yes, what would be your suggested number of entries of RACH configurations.**

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| **Company** | **Options (Y or N)** | **Comments (If you indicate Y, pls also indicate your suggested number of entries, e.g. 3\*16=48?)** |
| Ericsson | Comments | In principle we agree that we need to expand this. Suggested value is 32 since it seems unlikely that networks will configure partitions equal for all repetition factors and featurecombinations. |
| Samsung | Comments | It is unlikely that network will configure all features/feature combinations simultaneously. We are ok to keep the maximum number to 16. |
| Qualcomm | No strong view |  |
| ZTE | Yes | We propose 16\* (3+1) = 64. (1 for without repetition, 3 for repetition Num2,4,8) |
| Huawei, Hisilicon | Y | Agreed with Ericsson, 32 is fine. |
| LGE | OK to discuss | Since there are additional RACH partitioning features in Rel-18 (including Msg1 repetition and eRedCap), we are OK to discuss the extension of number of RACH configuration (e.g., up to 64). |
| China Telecom | No strong view |  |
| CATT | Comments | We share the same concern whether the network configures all feature/feature combinations together. |
| Xiaomi | Y | Same view as ZTE, 64 should be enough |
| vivo | No strong view |  |

Summary: Quite a few companies think the maximum number of RACH configuration can be extended. But the views on the exact value is diverging between 32 and 64.

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| **[Online discussion] Proposal 5(6/10): From RAN2 CE perspective, the maximum number of RACH configuration that the network is allowed to configure can be extended. To decide the maximum value between 32 and 64.****WA: To discuss it online, company tdoc can be avoided.**  |

2.3 CHO support

RAN2 discussed the support of CHO for CFRA with MSG1 repetition, and no consensus is made.

CHO support

[Online]Proposal 4 [6/9]: RAN2 to discuss and confirm that for CHO, if multiple repetition number configuration and UE selection is not considered, i.e. no further optimization is needed in R18.

Discussion

* Samsung: network doesn’t know the exact repetition number at the time of configuration so, it is better not to support this. But one repetition number is supported.

The moderator think we can try again to see if we can converge on this point given that CHO with MSG1 repetition can come for free based on previous agreement on CFRA. The further optimization can be discussed in TEI or R19. Note that only a large majority view support this direction, the proposal can be maded. Otherwise, it should go to online discussion for the next meeting. An EN has been also added.

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| Editor’s Note7: FFS on support of CFRA with MSG1-repetition for CHO |

**Question 6: Do companies is okay with the proposal that the previous agreement on CFRA is applied to CHO, i.e. no additional optimization for CFRA is needed for CHO.**

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| **Company** | **Options (Y or N)** | **Comments** |
| Ericsson | Y with comments | For CHO we whink it is enough with one configured repetition factor. |
| Samsung | N | In case of CFRA configuration for CHO case CFRA configuration is provided in advance and this configuration is used much later when certain conditions (CHO execution condition) are met. So just indication of one repetition number for CHO case is not sufficient. Multiple repetitions number, different CFRA configuration for each of these repetition number and selection based on RSRP seems needed for CHO case. This requires additional work. So as agreed for BFR, we propose to not support CFRA with Msg1 repetitions for CHO |
| Qualcomm | Yes | As the moderator says, it comes for free, so we see no strong reasons to deliberately restrict it. It should be treated as a normal HO of which we allow the NW to indicate a single msg1 repetition number. Also we are not convinced that the NW not knowing the exact UE measurements are an issue, the UE executes HO when a (possibly RSRP) condition is true, most of the time the RSRP measured by the UE would be very close to the configured condition. If NW has a great deal of variability it may choose not to allow this feature. |
| ZTE | N | We are fine to not support CFRA with Msg1 repetition for CHO. we understand usually CHO is triggered when the target cell is good enough. Msg1 repetition seems not so essential. If it is going to be supported, we have strong willingness to only support one repetition number. There is no need to consider pre-configuring multiple repetition numbers, and it will requires more discussion on how to support the fallback in MAC spec.  |
| Huawei, Hisilicon | Yes | Agree with Ericsson.If there is only one repetition number, CHO execution condition parameters (e.g. threshold for CHO events A5) can be linked to RSRP threshold for selecting single multiple repetition number. However if there are multiple repetition number, we wonder how the execution condition parameter is linked to thresholds for multiple repetition numbers. |
| LGE | Yes | Given that one meeting is left for this WI, further enhancement for CHO causes a lot of MAC impacts and additional issue in order to define selection procedure of the repetition number for CFRA cases.Alternatively, we are also okay to not support CFRA with Msg1 repetition for CHO case. |
| China Telecom | No | We see no strong need to support CHO with Msg1 repetition. But if majority view is to support it, we suggest just restricting to configure a single repetition number and no further optimizition is needed. |
| CATT | Comments | We think the channel condition may vary. So the Msg1 repetition number configured may be not suitable when the UE performs CFRA to the target cell. Therefore, reserving RACH resources for multiple Msg1 repetition number seems a bit of resource waste. So, we tend not to agree Msg1 repetition with CHO, especially for multiple repetition number. But if majority companies agree, we think one signal repetition number is enough. |
| Xiaomi | Yes | The same view as QC |
| vivo | Yes | Fine to only have a repetition configuration for CHO. |

Summary: 6 companies explicit support CFRA configured with one MSG1 repetition number, and 3 more companies are okay to compromise with this direction. So there is a clear majority view.

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| **[Potential agreement] Proposal 6(9/10): CFRA configured with one MSG1 repetition number can be applied to CHO. No further optimization of CFRA is needed in this case.** **WA: To confirm it online, company tdoc can be avoided.** |

2.4 Other issues

In case if any company see any other critical issue worthy to be discussed in “remaining open issues”, please provide it by below.

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| **Company** | **Issue** | **Comments** |
| LGE | Repetition number determination for SI request. | According to the current procedure for Msg1-based SI request, some back and forth operation between MAC and RRC is expected as follows:Step 1) In RRC, it determines whether the dedicated RA resource for SI request with Msg1 repetition is configured(e.g., *si-RequestConfig-MSG1-Repetition*)Step 2) In MAC, pre-check is performed (as if RA is triggered) and Msg1 repetition number is selected based on:RSRP of the downlink pathloss reference; andConfigured repetition number, e.g., in *si-RequestConfig-MSG1-Repetition*Step 3) In RRC again, Random Access for Msg1-based SI request is triggered with **the selected Msg1 repetition number** and corredponding RA resource for SI request (e.g., the PRACH preamble(s) and PRACH resource(s) associated **with the selected MSG1 repetition number** in *si-RequestConfig-MSG1-Repetition*)Step 4) In MAC, the Msg1 repetition **number is re-determined again**, even though the SI-request with selected Msg1 repetition number is triggeredIn addition, in MAC specification, RA procedure for Msg1-based SI request is described as follows :if the Random Access procedure was initiated for SI request (as specified in TS 38.331 [5]); and if the Random Access Resources for SI request have been explicitly provided by RRC Considering this, in Step 2) above, it is ambiguous which RA resource for SI request is indicated from RRC to MAC among followings:RA resources in *si-RequestConfig-MSG1-Repetition* for all repetition number; orRA resources in *si-RequestConfig-MSG1-Repetition* and RA resources in *si-RequestConfig*; orRA resources in *si-RequestConfig-MSG1-Repetition* for one repetition number;Therefore, in our view, current procedure to determine Msg1 repetition number for SI request is not correct and the details should be discussed further (e.g. in next meeting). In our view, one method to simplify the UE procedure is to determine Msg1 repetition number for SI request in RRC.[ZTE] Good question, as the rapporteur of MAC CR, different from normal CBRA, for SI request, the UE does not need to select the RACH resources by considering the feature priority of other features. As long as UE determines the scenario (NUL, SUL, RedCap), the UE can select corresponding RACH resource set. For how to determine the applicable repetition number (in MAC or RRC), if the UE does not fulfil any threshold and is going to select Msg1-based SI request without repetition or Msg3-based SI request, then it seems better to describe all of them in one place (RRC). However, if we do like this, RRC needs to inform MAC that Msg1 repetition is applicable, so fallback from lower number to higher number can be applied.[Moderator] We have some sympathy on this imperfect interaction between MAC and RRC. However, I want to note that SUL selection have the same situation in the legacy procedure and we don't see any ambiguity so far. From our understanding, RRC spec just call the functionality of carrier selection and repetition number selection which are specified in RA initialization in MAC spec, not the whole procedure. To put all (carrier selection, repetition number selection) in RRC spec would cause more complex and dependency, e.g. RRC should inform the result of carrier selection and repetition number to MAC, and logically it is strange since RRC should not be aware of lower layer RSRP, which is normally handled by MAC in RA procedure. In general, we would like to keep the currect TP as it is considering it is not funcationlity discussion, but it is welcomed if a TP for both RRC and MAC can be provided by the proponent company, and we can further discuss how to optimize it during CR review. |
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# 3 Running CR implementation issues

3.1 RA framework

**Agreement**

* + Adopt Alt 2.3 for Msg1 repetition framework
	+ Separate RO for different number is supported;
		- * For sharedRO and separateRO case, different repetition numbers are configured via separate featureCombinationPreamble IEs only for CE.
			* RACH resources of RACH partitions that are configured with the same “featureCombination” are considered to be within the same set of RACH resources;
			* Fallback from lower number to higher number is performed within the selected set of RACH resources.
			* Alt1: Fallback is only supported for sharedRO case

Regarding how to implement the agreed RA framework, the RRC rapporteur propose the following TP with changes:

1) Adding MSG1 repetition number to the corresponding *FeatureCombinationPreambles*, and whether separate RO or shared RO for different repetition number is configured is up to NW to configure the different *FeatureCombinationPreambles* (corresponding to different repetition number) under one or different *rach-ConfigCommon*, which is illustrated in the following figure from [Post123][801] email discussion.



2) Meanwhile, the restriction that one *FeatureCombinationPreambles* is associated with a given feature combination per RA type should be also updated.

3) Regarding **Alt1: Fallback is only supported for sharedRO case**, the RRC rapporteur thinks the parameters of the threshould for fallback should reflect this agreement, and thus it can be captured into the corresponding field description.

– *FeatureCombinationPreambles*

The IE *FeatureCombinationPreambles* associatesa set of preambles with a feature combination. For parameters which can be provided in this IE, the UE applies this field value when performing Random Access using a preamble in this featureCombinationPreambles, otherwise the UE applies the corresponding value as determined by applicable Need Code, e.g. Need S. On a specific BWP, there can be at most one set of preambles associated with a given feature combination per RA Type (i.e. 4-step RACH or 2-step RACH) per MSG1 repetition number.

***FeatureCombinationPreambles* information element**

-- ASN1START

-- TAG-FEATURECOMBINATIONPREAMBLES-START

FeatureCombinationPreambles-r17 ::= SEQUENCE {

 featureCombination-r17 FeatureCombination-r17,

 startPreambleForThisPartition-r17 INTEGER (0..63),

 numberOfPreamblesPerSSB-ForThisPartition-r17 INTEGER (1..64),

 ssb-SharedRO-MaskIndex-r17 INTEGER (1..15) OPTIONAL, -- Need S

 groupBconfigured-r17 SEQUENCE {

 ra-SizeGroupA-r17 ENUMERATED {b56, b144, b208, b256, b282, b480, b640,

 b800, b1000, b72, spare6, spare5,spare4, spare3, spare2, spare1},

 messagePowerOffsetGroupB-r17 ENUMERATED { minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18},

 numberOfRA-PreamblesGroupA-r17 INTEGER (1..64)

 } OPTIONAL, -- Need R

 separateMsgA-PUSCH-Config-r17 MsgA-PUSCH-Config-r16 OPTIONAL, -- Cond MsgAConfigCommon

 msgA-RSRP-Threshold-r17 RSRP-Range OPTIONAL, -- Need R

 rsrp-ThresholdSSB-r17 RSRP-Range OPTIONAL, -- Need R

 deltaPreamble-r17 INTEGER (-1..6) OPTIONAL, -- Need R

 ...,

 [[

 msg1-RepetitionNum-r18 ENUMERATED {2, 4, 8} OPTIONAL, -- Cond Msg1Rep2

 ]]

}

-- TAG-FEATURECOMBINATIONPREAMBLES-STOP

-- ASN1STOP

|  |
| --- |
| ***msg1-RepetitionTransMax***Max number of transmissions of MSG1 repetitions number (2, 4 and 8) performed before switching to higher repetition number (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when more than 2 repetition numbers are configured in shared RO. If the field is absent, switching from lower repetition number to higher repetition number is not allowed. |

**Question 7: Do companies agree with above 3 changes to implement the RA framework of MSG1 repetition, and if not, please indicate your detailed suggestions in the following table.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Seems like this solution forces many parameters to be defined “per repetition factor” like rsrp-ThresholdSSB etc. Alternative is to define msg1-RepetitionNum in such a way so that it can support one or several repetition factors (like msg1-RepetitionNum-2 {supported} and signal preamble range within the IE.. At least for the case where all repetition factors are on shared RO or all are on separate RO then there will be no duplicate values. Otherwise we need a discussion about how the duplicate parameters should be treated.[Moderator] The further optimization to signalling can be discussed late r(e.g. in ASN.1 session) after RAN2 consensus on how many parameters are common or separate.  |
| Xiaomi | Should be: only applicable when 2 or more repetition numbers are configured in shared RO[Moderator] Agree, it will be fixed in RRC CR.  |
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3.2 SI request framework

* + Separate SI-RequestResources is configured for different repetition number (2,4,8), under a common SI-RequestConfig which is different from legacy SI-RequestConfig

Regarding how to implement the SI request framework as agreed above which is illustrated in the following feature. The RRC rapporteur propose a TP with the following changes..



1) Extending si-RequestResources to a list to include the configurations of individual repetition number si-RequestResourcesList-MSG1-Repetition-r18

2) Adding msg1-RepetitionNum to the configuration of RA configuations for each repetition number

– *SI-RequestConfig*

The IE *SI-RequestConfig* contains configuration for Msg1 based SI request.

***SI-RequestConfig* information element**

-- ASN1START

-- TAG-SI-REQUESTCONFIG-START

SI-RequestConfig ::= SEQUENCE {

 rach-OccasionsSI SEQUENCE {

 rach-ConfigSI RACH-ConfigGeneric,

 ssb-perRACH-Occasion ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}

 } OPTIONAL, -- Need R

 si-RequestPeriod ENUMERATED {one, two, four, six, eight, ten, twelve, sixteen} OPTIONAL, -- Need R

 si-RequestResources SEQUENCE (SIZE (1..maxSI-Message)) OF SI-RequestResources

}

SI-RequestResources ::= SEQUENCE {

 ra-PreambleStartIndex INTEGER (0..63),

 ra-AssociationPeriodIndex INTEGER (0..15) OPTIONAL, -- Need R

 ra-ssb-OccasionMaskIndex INTEGER (0..15) OPTIONAL -- Need R

}

SI-RequestConfig-v18xy ::= SEQUENCE {

 si-RequestResources-r18 SEQUENCE (SIZE (1..maxSI-Message)) OF SI-RequestResourcesForMSG1-Repetition-r18

}

SI-RequestResourcesForMSG1-Repetition-r18 ::= SEQUENCE {

 si-RequestResourcesList-MSG1-Repetition-r18 SEQUENCE (SIZE (1.. maxNrofMSG1-Repetitions-r18)) OF SI-RequestResourcesForMSG1-RepetitionNum-r18

}

SI-RequestResourcesForMSG1-RepetitionNum-r18 ::= SEQUENCE {

 si-RequestResources-r18 SI-RequestResources,

 msg1-RepetitionNum-r18 ENUMERATED {2, 4, 8}

}

-- TAG-SI-REQUESTCONFIG-STOP

-- ASN1STOP

**Question 8: Do companies agree with above changes to implement the SI framework of MSG1 repetition, and if not, please indicate your detailed suggestions in the following table.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Yes |
| Samsung | **No**Issue 1: si-RequestResources (without suffix) will be unecessary signalled as it will be ignored by UE. Please see red and yellow highlighted text below.SI-RequestConfig-r18 ::=         SEQUENCE {    si-RequestConfigForMSG1-Repetition-r18               SI-RequestConfig,    si-RequestConfig-v18xy                               SI-RequestConfig-v18xy} SI-RequestConfig ::=                SEQUENCE {    rach-OccasionsSI                    SEQUENCE {        rach-ConfigSI                       RACH-ConfigGeneric,        ssb-perRACH-Occasion                ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}    }                                                                OPTIONAL,   -- Need R    si-RequestPeriod                    ENUMERATED {one, two, four, six, eight, ten, twelve, sixteen}       OPTIONAL,   -- Need R    si-RequestResources                 SEQUENCE (SIZE (1.maxSI-Message)) OF SI-RequestResources}SI-RequestConfig-v18xy ::=            SEQUENCE {    si-RequestResources-r18               SEQUENCE (SIZE (1.maxSI-Message)) OF SI-RequestResourcesForMSG1-Repetition-r18} SI-RequestResourcesForMSG1-Repetition-r18 ::=             SEQUENCE {    si-RequestResourcesList-MSG1-Repetition-r18               SEQUENCE (SIZE (1. maxNrofMSG1-Repetitions-r18)) OF SI-RequestResourcesForMSG1-RepetitionNum-r18} SI-RequestResourcesForMSG1-RepetitionNum-r18 ::=             SEQUENCE {    si-RequestResources-r18                 SI-RequestResources,    msg1-RepetitionNum-r18                  ENUMERATED {2, 4, 8}} Issue 2: SI-RequestConfig-r18 calls the legacy IE SI-RequestConfig with same name. Not sure if this is ok.Issue 3: si-RequestResources-r18 have two definitions in the CR. Is this ok?o   si-RequestResources-r18               SEQUENCE (SIZE (1.maxSI-Message)) OF SI-RequestResourcesForMSG1-Repetition-r18o   si-RequestResources-r18                 SI-RequestResources |
|  | Suggestion to define as follows:SI-SchedulingInfo-v18xy ::=         SEQUENCE {    si-RequestConfig-MSG1-Repetition-r18          SI-RequestConfig-r18                  OPTIONAL,   -- Cond MSG-1    si-RequestConfigRedCap-MSG1-Repetition-r18    SI-RequestConfig-r18                  OPTIONAL,   -- Cond SUL-MSG-1    si-RequestConfigSUL-MSG1-Repetition-r18       SI-RequestConfig-r18                  OPTIONAL    -- Cond REDCAP-MSG-1} SI-RequestConfig-r18 ::=         SEQUENCE {    si-RequestConfigForMSG1-Repetition-r18               SI-RequestConfigRepetitions,} SI-RequestConfigRepetitions::=            SEQUENCE {   rach-OccasionsSI-r18                    SEQUENCE {        rach-ConfigSI-r18                       RACH-ConfigGeneric,        ssb-perRACH-Occasion-r18                ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}    }                                          OPTIONAL,   -- Need R    si-RequestPeriod-r18         ENUMERATED {one, two, four, six, eight, ten, twelve, sixteen}       OPTIONAL,   -- Need R       si-RequestResourcesRepetitions-r18               SEQUENCE (SIZE (1.maxSI-Message)) OF SI-RequestResourcesForMSG1-Repetition-r18} SI-RequestResourcesForMSG1-Repetition-r18 ::=             SEQUENCE {    si-RequestResourcesList-MSG1-Repetition-r18           SEQUENCE (SIZE (1. maxNrofMSG1-Repetitions-r18)) OF SI-RequestResourcesForMSG1-RepetitionNum-r18} SI-RequestResourcesForMSG1-RepetitionNum-r18 ::=             SEQUENCE {    si-RequestResources-r18                 SI-RequestResources,    msg1-RepetitionNum-r18                  ENUMERATED {2, 4, 8}}[Moderator] Let us go for it, which will be reflected in RRC CR.But personally I still believe the critical extension will add complex to the ASN,1 structure with redundant IE definition.Pls check updated RRC CR. |
| LGE2 | Prefer Samsung’s suggestion, as it removes unnecessary IE container and simplifies RRC structure.[Moderator] Let us go for it, which will be reflected in RRC CR.But personally I still believe the critical extension will add complex to the ASN,1 structure with redundant IE definition. Pls check updated RRC CR. |
| ZTE | We are also fine with Samsung’s proposal. It looks cleaner and more readable. [Moderator] Let us go for it, which will be reflected in RRC CR.But personally I still believe the critical extension will add complex to the ASN,1 structure with redundant IE definition. Pls check updated RRC CR. |
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3.3 Other issues

In case if any company see any other critical issue worthy to be discussed in “remaining open issues”, please provide it by below.

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| --- | --- | --- |
| **Company** | **Issue** | **Comments** |
| Qualcomm | separate RSRP thresholds for different UE power classes. | In our view, the framework of msg1 repetition needs to separate the repetition criteria between UE power classes, as FWA UEs can go to a much higher max EIRP than normal/handheld UEs, it should be possible for the NW to restrict repetition of such UEs since they have a much higher power limit they can ramp up to without congesting the RACH resources especially on shared ROs, in fact we assume the NW may want to discourage such UEs from using Coverage enhancements ROs so as to not worsen coverage of other UEs.[Moderator] Thanks for consistently prompting this. However, still no more replies from companies. The moderator tend to think it is optimization, not fundament issue, and it do will involve check with RAN1 and RAN4. So the moderator suggest the proponent to discuss it in TEI.  |
| LGE2 | Network restriction for *msg1-RepetitionNum* | In RAN2#123bis meeting, for HO case, fallback CFRA with Msg1 repetition to CBRA with Msg1 repetition within the same Msg1 repetition number is supported* + Upon fallback from CFRA with repetition to CBRA with repetition, the UE only selects the RACH resources that associated the same repetition number that indicated for CFRA.

However, it has not been determined whether fallback CFRA with Msg1 repetition to CBRA **without** Msg1 repetition is supported.Therefore, it should be discussed as an open issue whether fallback CFRA with Msg1 repetition to CBRA **without** Msg1 repetition is supported or not. If it should not be supported, a network restriction is needed in order to allow the CFRA with Msg1 repetition only if the CBRA resource with the same repetition number is configured. For example, in the field decription of *msg1-RepetitionNum*, clarifying words could be added in order to ensure that *msg1-RepetitionNum* is only configured if set of RA resource associated with Msg1 repetition is configured with the same Msg1 repetition number.[ZTE] In our understanding, the network needs to ensure CBRA resources with same Msg1 repetition number must be configured if the network wants to enable CFRA with Msg1 repetition in this BWP. So, we can add some restriction to RRC spec. By doing this, fallback from CFRA with Msg1 repetition to CBRA without Msg1 repetition **won’t** happen. This is also aligned the latest MAC CR.[Moderator] This issue was discussed in RAN2#121bis, so no need to re-open the discussion. Regarding the further clarification in the field description, we are fine to add it in RRC CR (in the condition presence).Pls check in the updated RRC CR.* RAN2 will not support the fallback from legacy RA to Msg1 repetition and vice versa; Other fall back scenarios are FFS
 |
| LGE2 | Whether/how to handle the common parameter for each repetition number. | In RAN2#123bis, it is agreed that deltaPreamble IE in FeatureCombinationPreambles are common for all repetition number.* + From RAN2 CE perspective, deltaPreamble IE in FeatureCombinationPreambles are common for repetition number 2, 4 and 8 - FFS for groupBconfigured, rsrp-ThresholdSSB

On the other hand, it is agreed to configure separated FeatureCombinationPreambles IE for each repetition number.* + Separate RO for different number is supported;
		- * For sharedRO and separateRO case, different repetition numbers are configured via separate featureCombinationPreamble IEs only for CE.

That is, according to current RRC structure, sepeated parameters can be configured for common parameters, e.g., for deltaPreamble IE in featureCombinationPreamble IE.Therefore, it should be determined * 1) whether the common parameters (e.g., deltaPreamble IE) can be absent from featureCombinationPreamble IE except for one repetition number within same FeatureCombination, to support the common configuration, and
* 2) if 1) is allowed, i.e. can be absent, how to find the reference point of the common parameter (e.g., deltaPreamble IE).

[ZTE] Prefer to allow the network to configure the parameters in each relevant featureCombinationPreamble IE, and specify in FD that the fields must be set to the same value for different repetition numbers.[Moderator] Same view as ZTE. This issue is not new to RAN2. Normally the way to handle this is to clarify in the field description that “This field is set to the same value for different ……… ” see one example below. For common parameter to 2 step and 4 step, we can simply consider 4 step as the default/reference point. However, it is no longer applicable to MSG1 repetition because we don't have such a default/reference point. Thus the moderator think it is sufficient to handle this like the legacy operations and not complex the signalling structure.

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| ***mtch-SSB-MappingWindowIndex***Indicates the index of *MTCH-SSB-MappingWindowCycleOffset* configuration entry in *MTCH-SSB-MappingWindowList*. The value 0 corresponds to the first entry in *MTCH-SSB-MappingWindowList*, the value 1 corresponds to the second entry in *MTCH-SSB-MappingWindowList* and so on. This field is set to the same value for all MBS sessions mapped to the same G-RNTI. |

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# 4 Conclusions

# 5 References

1. R2-2309776 Remaining control plane issues of further NR Coverage Enhancements Samsung Electronics Co., Ltd discussion Rel-18 NR\_cov\_enh2-Core
2. R2-2310284 Discussion on the remaining CP issues for CE NEC Corporation. discussion Rel-18 NR\_cov\_enh2-Core
3. R2-2310198 Remaining issues of CP aspects for CE Huawei, HiSilicon discussion NR\_cov\_enh2-Core