**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 |
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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. |
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**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. |
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* **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 |  |
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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

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}

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 |  |
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* **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. |
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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 |
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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** |
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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

 ...,

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

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}

-- TAG-FEATURECOMBINATIONPREAMBLES-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 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.**

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| **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. |
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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.**

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| **Company** | **Comments** |
| Ericsson | Yes |
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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** |
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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