**3GPP TSG RAN WG1 #108-e R1-22xxxxx**

**e-Meeting, February 21st – March 3rd, 2022**

**Agenda Item: 8.8.1.3**

**Source: Moderator (China Telecom)**

**Title: [108-e-R17-CovEnh-06] Summary of email discussion for incoming LS on Stage 2 description for Coverage Enhancements**

**Document for: Discussion**

1. Introduction

RAN2 has sent an LS [1] to RAN1. RAN2 asks RAN1 to check the stage 2 CR in [2] and then inform RAN2 whether the stage 2 CR can be endorsed from RAN1’s perspective or not, and provide a RAN1-endorsed revision of the CR if necessary. The stage 2 CR in [2] is as follows.

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| 18 Support for NR coverage enhancementsTo improve NR uplink coverage for both FR1 and FR2 as well as TDD and FDD, the following enhancements on PUSCH, PUCCH and MSG3 PUSCH are supported: - For PUSCH repetition Type A, the maximum number of repetitions is increased up to 32, applicable to both PUSCH transmission with and without dynamic grant. In addition, counting based on available slots is supported, the increased maximum number of repetitions for counting based on available slots and counting based on physical slots are both 32.- TB processing over multi-slot is supported for PUSCH transmission with and without dynamic grant. For a single transmission of TB processing over multi-slot PUSCH, the TB size is based on all the allocated REs across the multiple slots, and the number of slots is counted based on the available slots for UL transmission. In addition, repetition of TB processing over multi-slot PUSCH is also supported.- DMRS bundling is supported for PUSCH repetition Type A scheduled by DCI format 0\_1 or 0\_2, for PUSCH repetition Type A with configured grant, for PUSCH repetition Type B, for TB processing over multi-slot PUSCH and for PUCCH repetitions of PUCCH format 1, 3, 4. - Dynamic PUCCH repetition factor indication configured per PUCCH resource is introduced, applicable to all PUCCH formats. - PUSCH repetition Type A for MSG3 transmission is supported on both NUL and SUL, applicable to 4-step CBRA. If configured, the UE requests MSG3 repetition via separate PRACH resource when the RSRP of DL path-loss reference is lower than a configured threshold. Editor’s Note: The support for repetition of CFRA PUSCH is FFS, depending on whether the work assumption made in RAN1#107-e meeting that support repetition for CFRA PUSCH is confirmed in RAN1 or not.  |

This contribution is a summary of the following email discussion.

[108-e-R17-CovEnh-06] Email discussion for incoming LS on Stage 2 description for Coverage Enhancements ([R1-2200879](file:///D%3A%5C%E6%88%91%E7%9A%84%E6%96%87%E6%A1%A3%5C11142583%5CDocuments%5CDocs%5CR1-2200879.zip)) by February 25 – Jianchi (China Telecom)

1. Email discussion (1st round)

## Structure of the stage 2 CR

[8] has following proposals on the structure of the CR.

* the first bullet (PUSCH repetition type A) and the forth bullet (dynamic PUCCH repetition factor indication) are not necessary for stage 2 specification;
* the second bullet (TB processing over multiple slots PUSCH) can be added into Clause 5.3.1 of TS 38.300 as a new UL transmission scheme;
* the third bullet (DMRS bundling) can be added into Clause 5.3.1 of TS 38.300;
* the fifth bullet (PUSCH repetition Type A for MSG3 transmission) can be added into Clause 9.2.6 of TS 38.300 as enhanced PRACH procedure.

**FL comments:** From FL understanding, the structure of the CR depends on RAN2. RAN2 has already endorsed the stage 2 CR. RAN2 is asking RAN1 whether the functionalities of Rel-17 coverage enhancements are correctly captured from technical point of view. Therefore FL suggests not to revise the structure of current stage 2 CR from RAN2.

Do you agree with FL’s view?

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| **Companies** | **Comments** |
| vivo | Agree |
| CMCC | Support |
| Intel | Agree. |
| Huawei, HiSilicon | In the LS, RAN1 is clearly asked to check the RAN2 stage 2 CR, including whether the CR can be endorsed.R1-2200879:**ACTION:** RAN2 respectfully asks RAN1 to check the stage 2 CR as attached and then inform RAN2 whether the stage 2 CR can be endorsed from RAN1’s perspective or not, and provide a RAN1-endorsed revision of the CR if necessary.Therefore, we feel RAN1 can comment on the structure as well.For example, PUSCH repetition type A/B has been captured in S5.3.1 of TS 38.300, any enhancement on top of it would be better to be captured into the same subclause. TBoMS can be captured there as well, since it is basically a new transmission scheme with multiple slots. |
| Samsung | While we respect RAN2 endorsement, we share the view from Huawei regarding the CR structure. We may not necessarily need to create a new section 18 dedicated for coverage enhancement. In addition, checking the latest 38.300, it has skipped describing PUSCH repetition type A/B (which are the functionalities introduced in previous releases). However, current CR explains the “enhancement” of PUSCH repetition type A. Therefore, such details can be left for stage 3 specs rather than 38.300.  |
| Panasonic | Agree |
| ZTE | Agree |
| Sharp | Agree |
| CATT | Agree |

## PUSCH repetition Type A

For PUSCH repetition Type A, [4][6][7] propose some revisions.

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| - For PUSCH repetition Type A, the maximum number of repetitions is increased up to 32, applicable to both PUSCH transmission with dynamic grant scheduled by DCI format 0\_1 and 0\_2, and configured grant. In addition, counting based on available slots is supported for PUSCH repetition Type A with dynamic grant and configured grant. The maximum number of repetitions for counting based on available slots and counting based on physical slots are both 32. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| vivo | TS 38.300 provides overall description. Detailed descriptions of each feature are supposed to be captured in RAN1 spec, e.g. TS38.213, TS 38.214, so we prefer not to have any change as the text provided by RAN2 is correct in principle. |
| CMCC | It seems that specific DCI formats and the same symbol allocation across multiple slots are too detailed for TS38.300. dynamic grant and configured grant is sufficient.  |
| Intel | It seems not necessary to mention scheduled by DCI format 0\_1 and 0\_2. Here is our suggested change:- For PUSCH repetition Type A, the maximum number of repetitions is increased ~~up~~ to 32, applicable to both PUSCH transmission with ~~and without~~ dynamic grant and configured grant. In addition, counting based on available slots is supported for PUSCH repetition type A with dynamic grant and configured grant. ~~, t~~The increased maximum number of repetitions for counting based on available slots and counting based on physical slots are both 32. |
| Huawei, HiSilicon | In our understanding, the TP in the RAN2 LS has too many stage 3 details and thus looks like a WI summary which is supposed to be captured in TR 21.917.As commented by CMCC, we feel this paragraph is not needed because it is all about performance enhancement with stage 3 details.  |
| Samsung | As commented above, this seems beyond stage 2 description.  |
| Panasonic | We agree that specific DCI formats are too detailed for TS38.300. The suggestion from Intel is fine. |
| ZTE | Prefer not to do any micro optimization.  |
| Sharp | As the original text is correct, we prefer making no change. |
| CATT | Agree with CMCC that no need to mention to much details on DCI format. Intel’s version if fine. |

## TBoMS

For TBoMS, [4][6] propose some revisions.

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| - TB processing over multi-slot is supported for both PUSCH transmission with dynamic grant scheduled by DCI format 0\_1 and 0\_2, and configured grant. For a single transmission of TB processing over multi-slot PUSCH, the TB size is determined based on all the allocated REs across the multiple slots, the number of slots is counted based on the available slots for UL transmission, and same symbol allocation is applied across the multiple slots. In addition, repetition of TB processing over multi-slot PUSCH is supported. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| vivo | TS 38.300 provides overall description. Detailed descriptions of each feature are supposed to be captured in RAN1 spec, e.g. TS38.213, TS 38.214, so we prefer not to have any change as the text provided by RAN2 is correct in principle. |
| CMCC | It seems that specific DCI formats and the same symbol allocation across multiple slots are too detailed for TS38.300. dynamic grant and configured grant is sufficient.  |
| Intel | It seems not necessary to mention scheduled by DCI format 0\_1 and 0\_2. Here is our suggested change:- TB processing over multi-slot is supported for PUSCH transmission with ~~and without~~ dynamic grant and configured grant. For a single transmission of TB processing over multi-slot PUSCH, the TB size is determined based on all the allocated REs across the multiple slots, ~~and~~ the number of slots is counted based on the available slots for UL transmission, and same symbol allocation is applied across the multiple slots. In addition, repetition of TB processing over multi-slot PUSCH is ~~also~~ supported. |
| Huawei, HiSilicon | In our understanding, the TP in the RAN2 LS has too many stage 3 details and thus looks like a WI summary which is supposed to be captured in TR 21.917. Focus on stage 2 description, we propose,***Proposal:*** *only capture the following in TS 38.300 for TBoMS**TB processing over multiple slots is supported for PUSCH transmission with and without dynamic grant. In addition, repetition of TB processing over multiple slots PUSCH is also supported.* |
| Samsung | There is a relevant description in section 5.3.1 of 38.300:“Aggregation of multiple slots with TB repetition is supported.”We may need to add a brief description of TB processing over multiple slots in section 5.3.1. In addition, we don’t see the need to mention specific DCI formats. |
| Panasonic | We agree that specific DCI formats are too detailed for TS38.300. |
| ZTE | Prefer not to do any micro optimization.  |
| Sharp | As the original text is correct, we prefer making no change. |
| CATT | Fine if we remove the detailed DCI formats. |

## DMRS bundling

For DMRS bundling, [4] proposes some revisions.

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| - DMRS bundling and inter-slot frequency hopping with inter-slot bundling are supported for PUSCH repetition Type A scheduled by DCI format 0\_1 or 0\_2, for PUSCH repetition Type A with configured grant, for PUSCH repetition Type B, for TB processing over multi-slot PUSCH and for PUCCH repetitions of PUCCH format 1, 3, 4.  |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| vivo | TS 38.300 provides overall description. Detailed descriptions of each feature are supposed to be captured in RAN1 spec, e.g. TS38.213, TS 38.214, so we prefer not to have any change as the text provided by RAN2 is correct in principle. |
| CMCC | Though the updates are technically correct, we are not sure the inter/intra slot frequency hopping bring addition functional information to RAN2.  |
| Intel | We are fine with the revision.  |
| Huawei, HiSilicon | In our understanding, the TP in the RAN2 LS has too many stage 3 details and thus looks like a WI summary which is supposed to be captured in TR 21.917. Focus on stage 2 description, DCI format is not needed, and we propose,***Proposal:*** *only capture the following in TS 38.300 for DMRS bundling**DMRS bundling is supported for PUSCH repetition Type A, for PUSCH repetition Type B, for TB processing over multi-slot PUSCH and for PUCCH repetitions of PUCCH format 1, 3, 4.* |
| Samsung | If needed, a brief description can be added in Section 5.3.1 and 5.3.3 in 38.300. No need to mention specific DCI formats and frequency hopping. |
| Panasonic | We support the Huawei’s proposal. |
| ZTE | Prefer not to do any micro optimization.  |
| Sharp | As the original text is correct, we prefer making no change. |
| CATT | Fine to add ‘inter-slot frequency hopping with inter-slot bundling’ since it is important, which cannot be deduced from ‘DMRS bundling’ only. But again, the DCI formats are too detailed. |

## Dynamic PUCCH repetition factor indication

For dynamic PUCCH repetition factor indication, [7] proposes some revisions.

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| - Dynamic PUCCH repetition factor indication configured per PUCCH resource a PUCCH with associated scheduling DCI is introduced, applicable to all PUCCH formats.  |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| vivo | TS 38.300 provides overall description. Detailed descriptions of each feature are supposed to be captured in RAN1 spec, e.g. TS38.213, TS 38.214, so we prefer not to have any change as the text provided by RAN2 is correct in principle. |
| Intel | It seems not necessary for the change, but we are fine if majority support the revision.  |
| Huawei, HiSilicon | In our understanding, the TP in the RAN2 LS has too many stage 3 details and thus looks like a WI summary which is supposed to be captured in TR 21.917. We feel this paragraph is not needed because it is all about performance enhancement with stage 3 details.  |
| Samsung | The original text is fine. It can be added in Section 5.3.3 in 38.300.  |
| Panasonic | We think no change is necessary. |
| ZTE | Prefer not to do any micro optimization.  |
| Sharp | As the original text is correct, we prefer making no change. |
| CATT | Fine with this one. |

## Msg3 repetition

For Msg3 repetition, [4][5][6] propose some revisions.

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| - PUSCH repetition Type A for MSG3 initial transmission and retransmission is supported on both NUL and SUL, applicable to 4-step CBRA. If supported, the UE requests MSG3 repetition via separate PRACH resource when the RSRP of DL path-loss reference is lower than a configured threshold.  |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| vivo | TS 38.300 provides overall description. Detailed descriptions of each feature are supposed to be captured in RAN1 spec, e.g. TS38.213, TS 38.214, so we prefer not to have any change as the text provided by RAN2 is correct in principle. |
| CMCC | General fine with the current updates. Current statement brings additional information that retransmission of MSG3 is also supported. Though it seems in 38.300, “MSG3 (re)transmissions” is usually used, we can leave it to RAN2 experts. In addition, since the MSG3 repetition is requested through MSG1 before RRC configuration, we think “supported” is more proper compared with “configured”. Share similar views with vivo. We should not introduce too much RAN1’s details into TS 38.300. |
| Intel | We are fine with the revision.  |
| Huawei, HiSilicon | In our understanding, the TP in the RAN2 LS has too many stage 3 details and thus looks like a WI summary which is supposed to be captured in TR 21.917. Focus on stage 2 description, we propose,***Proposal:*** *only capture the following in TS 38.300 for Msg3 repetitions**PUSCH repetition Type A for MSG3 transmission is supported on both NUL and SUL, applicable to 4-step CBRA. If configured, the UE requests MSG3 repetition via separate PRACH resource when the RSRP of DL path-loss reference is lower than a configured threshold.* |
| Samsung | If needed, a brief description can be added in Section 9.2.6 in 38.300. |
| Panasonic | We support Huawei’s proposal. |
| ZTE | Prefer not to do any micro optimization. Our understanding about using ‘configured’ is it refers to the PRACH resources. If a UE supports Msg3 repetition while separate PRACH resources are not configured, the UE cannot request Msg3 repetition.  |
| Sharp | As the original text is correct, we prefer making no change. As for “If configured”, we are not sure if it should be replaced by “If supported”, because the sentence also says “a configured threshold” anyway. |
| CATT | Generally OK. Not sure the ‘if configured’ means PRACH resource for Msg3 repetition or something else. If so, ‘supported’ should be reverted back to ‘configured’. |

## Editor’s Note

For Editor’s Note, [7] proposes some revisions.

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| Editor’s Note: The support for repetition of CFRA PUSCH is a working assumption made in RAN1#107-e meeting. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
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1. Email discussion (2nd round)

## Structure of the stage 2 CR

**FL comments:** As commented in 1st round, from FL understanding, the structure of the CR depends on RAN2. Given the majority agree with FL’s views, no further discussion on the structure is needed.

## PUSCH repetition Type A

**FL comments:** The majority think specific DCI formats are too detailed. As mentioned by Ericsson, counting based on available slots is a new feature in Rel-17, “increased” is deleted. Some revisions by Intel are incorporated, which seem clearer.

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| - For PUSCH repetition Type A, the maximum number of repetitions is increased up to 32, applicable to both PUSCH transmission with dynamic grant and configured grant. In addition, counting based on available slots is supported for PUSCH repetition Type A with dynamic grant and configured grant. The maximum number of repetitions for counting based on available slots and counting based on physical slots are both 32. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| Samsung | With the understanding of avoiding the restructure of RAN2 CR, we have following question/comment:- What is ‘PUSCH repetition Type A’ in the context of stage 2 description? The notion has been missing from Rel-15 38.300 in light with focusing on the high level description. If we want to add above text, don’t we need to first explain what is ‘PUSCH repetition Type A’ so that we can further state the Rel-17 enhancement thereof?- We would like to suggest to make the text as simple as possible throughout the entire TP as long as the essence is kept. The subsequent details should be found in stage 3 specs. - Addition of “for PUSCH repetition Type A with dynamic grant and configured grant” looks redundant. |
| Intel | We are fine with the update  |
| Ericsson | We have similar concerns as Samsung about the consistency of the terminology used in the CR with what is used at present in 38.300. Our understanding is that PUSCH repetition type A is identified in 38.300 section 5.3.1 with “Aggregation of multiple slots with TB repetition is supported.” So we’d suggest using this terminology.Another way to write this could be:Enhanced aggregation of multiple slots with TB repetition is supported for both dynamic and configured grants. The duration is measured according to a number of consecutive slots or slots available for PUSCH transmission. |

## TBoMS

**FL comments:** Details are removed. Some revisions by Intel are incorporated, which seem clearer.

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| - TB processing over multi-slot is supported for both PUSCH transmission with dynamic grant and configured grant. For a single transmission of TB processing over multi-slot PUSCH, the TB size is determined based on all the allocated REs across the multiple slots, and the number of slots is counted based on the available slots for UL transmission. In addition, repetition of TB processing over multi-slot PUSCH is also supported. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| Samsung | Just having the first sentence would be good enough. TBS determination part is too specific for 38.300 (How to determine TBS in Rel-15 (even for high level) is missing in 38.300) |
| Intel | We are fine with the update  |
| Ericsson | Agree with Samsung that the proposal has more detail than is customary for 38.300. However, the TB size determination is what differentiates TBoMS from Type A repetition, and so we think at least that is needed. Something like the following may be sufficient:TB processing over multiple slots where transport block size scales with the number of slots is supported for both PUSCH transmission with dynamic grant and configured grant. In addition, repetition of a TB processed over multi-slot PUSCH is also supported. |

## DMRS bundling

**FL comments:** Details are removed. Since inter-slot frequency hopping with inter-slot bundling is an additional feature on top of DMRS bundling, it is kept.

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| - DMRS bundling and inter-slot frequency hopping with inter-slot bundling are supported for PUSCH repetition Type A, for PUSCH repetition Type B, for TB processing over multi-slot PUSCH and for PUCCH repetitions of PUCCH format 1, 3, 4.  |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
| Samsung | Not OK with adding “inter-slot frequency hopping with inter-slot bundling”  |
| Intel | We are fine with the update  |
| Ericsson | DMRS bundling is not defined in 38.300, and so the term should be clarified. Similarly, the description of repetition is not consistent with what is presently in 38.300. Suggest: DMRS bundling where the UE maintains phase continuity and power consistency across PUSCH or long PUCCH repetitions to enable improved channel estimation is supported. Inter-slot frequency hopping enhancements are supported with DMRS bundling. |

## Dynamic PUCCH repetition factor indication

**FL comments:** Details are removed. The original text from RAN2 is kept.

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| - Dynamic PUCCH repetition factor indication configured per PUCCH resource is introduced, applicable to all PUCCH formats.  |

Any further comments?

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| **Companies** | **Comments** |
| Intel | We are fine with this. |
| Ericsson | While we think this misses an important behavior of the feature, e.g. that only dynamically indicated PUCCH is supported, we do not object. |
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## Msg3 repetition

**FL comments:** Details are removed. It seems most companies prefer “configured” to “supported”. The original text from RAN2 is kept.

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| - PUSCH repetition Type A for MSG3 transmission is supported on both NUL and SUL, applicable to 4-step CBRA. If configured, the UE requests MSG3 repetition via separate PRACH resource when the RSRP of DL path-loss reference is lower than a configured threshold.  |

Any further comments?

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| **Companies** | **Comments** |
| Intel | In our view, it would be good to mention “initial and retransmission for MSG3”, which is essential feature for Msg3 repetition  |
| Ericsson | The terminology for PUSCH repetition Type A should be aligned with what is in 38.300. Suggest:Aggregation of multiple slots with TB repetition is supported for MSG3 transmission on both NUL and SUL, applicable to 4-step CBRA. If configured, the UE requests MSG3 repetition via separate PRACH resource when the RSRP of DL path-loss reference is lower than a configured threshold |
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## Editor’s Note

**FL comments:** For Editor’s Note, it seems everyone is fine with the following revision.

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| Editor’s Note: The support for repetition of CFRA PUSCH is a working assumption made in RAN1#107-e meeting. |

1. Email discussion (3rd round)

## PUSCH repetition Type A

**FL comments:** Based on Samsung and Ericsson’s comments, it is updated as follows.

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| - Enhanced aggregation of multiple slots with TB repetition is supported for both PUSCH transmission with dynamic and configured grant. In addition, counting based on available slots is supported. The maximum number of repetitions for counting based on available slots and counting based on physical slots are both 32. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
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## TBoMS

**FL comments:** Based on Samsung and Ericsson’s comments, some details are removed.

@Samsung, as commented by Ericsson, TB size determination is what differentiates TBoMS from Type A repetition.

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| - TB processing over multi-slot is supported for both PUSCH transmission with dynamic grant and configured grant. For a single transmission of TB processing over multi-slot PUSCH, the TB size is determined based on multiple slots. In addition, repetition of TB processing over multi-slot PUSCH is also supported. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
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## DMRS bundling

**FL comments:** Based on Ericsson’s comments, clarification on DMRS bundling is clarified and description is updated to keep consistent with 38.300. Some details are removed.

@Samsung, inter-slot frequency hopping with inter-slot bundling is stated in the WID and it is an additional feature on top of DMRS bundling.

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| - DMRS bundling where the UE maintains phase continuity and power consistency across PUSCH transmissions or PUCCH repetitions to enable improved channel estimation is supported. Inter-slot frequency hopping with DMRS bundling is supported. |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
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## Dynamic PUCCH repetition factor indication

**FL comments:** Since no concerns, it is stable.

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| - Dynamic PUCCH repetition factor indication configured per PUCCH resource is introduced, applicable to all PUCCH formats.  |

## Msg3 repetition

**FL comments:** Based on Ericsson’s comments, description is updated to keep consistent with 38.300.

@Intel, As commented by some companies in the 1st round, details are not necessary in stage 2 CR.

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| - Aggregation of multiple slots with TB repetition for MSG3 transmission is supported on both NUL and SUL, applicable to 4-step CBRA. If configured, the UE requests MSG3 repetition via separate PRACH resource when the RSRP of DL path-loss reference is lower than a configured threshold.  |

Companies are encouraged to provide comments on the above revisions.

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| **Companies** | **Comments** |
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## Editor’s Note

**FL comments:** We can revisit it after the progress in AI 8.8.3.

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| Editor’s Note: The support for repetition of CFRA PUSCH is a working assumption made in RAN1#107-e meeting. |

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| **Companies** | **Comments** |
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1. Reference
2. 3GPP R2-2201784, LS on Stage 2 description for Coverage Enhancements, RAN2, China Telecom, RAN2#116bis-e, Jan 17th - 25th, 2022.
3. 3GPP R2-2201963, Running 38300 CR for NR coverage enhancements, China Telecom, RAN2#116bis-e, Jan 17th - 25th, 2022.
4. 3GPP R1-2201157, [Draft] Reply LS on Stage 2 description for Coverage Enhancements, ZTE, February 21st – March 3rd, 2022.
5. 3GPP R1-2201675, Discussion on Stage 2 description for Coverage Enhancements, Intel, February 21st – March 3rd, 2022.
6. 3GPP R1-2201843, Discussion on RAN2 LS on Stage 2 description for Coverage Enhancements, CMCC, February 21st – March 3rd, 2022.
7. 3GPP R1-2201928, Discussion on RAN2 LS on Stage 2 description for Coverage Enhancements, Xiaomi, February 21st – March 3rd, 2022.
8. 3GPP R1-2202415, Draft Reply LS on Stage 2 Description for Coverage Enhancements, Ericsson, February 21st – March 3rd, 2022.
9. 3GPP R1-2202463, Discussion on LS on Stage 2 description for Coverage Enhancements, Huawei, HiSilicon, February 21st – March 3rd, 2022.