**TSG RAN Meeting #90 (e-meeting) RP-20xxxx**

**7-11 December 2020, Electronic meeting**

**Source: Nokia, Nokia Shanghai Bell (Moderator)**

**Title: Summary of [90E][26][IIOT\_scope] email discussion**

**Agenda Item: TBD**

Scope refinement for NR Release-17 IIoT/URLLC

# Introduction

In this document comments from different companies are collected from email discussion from RAN#90-e.

This document captures the feedback provided on the email discussion on different rounds. (if one round becames big, different rounds may use different documents)

# IIoT/URLLC scope refinement, initial round:

## Handling overlap with PUCCH repetitions

The following was suggested (RP-202355, 2669, 2679 & 2646):

1. **Enhanced PUCCH repetition is handled in a single WI among one of Release 17 eURLLC/IIoT or CovEnh**

**Dynamic PUCCH repetition factor indication is handled in the same WI as the enhanced PUCCH repetition**

1. **The studies and potential specification of PUCCH repetition enhancements under Rel-17 IIoT/URLLC should focus on single-TRP only** (Multi-TRP in MIMO)
2. *For PUCCH repetition enhancement, IIoT/URLLC WI and CE WI should focus on enhancement for single TRP operation and feMIMO WI should focus on multi-TRP operation only.*
3. *Dynamic indication at least for the number of repetitions is specified in one WI.* 
   1. **The studies and potential specification of PUCCH repetition enhancements under Rel-17 IIoT/URLLC should focus on single-TRP only.**
      1. **This may include overlapping items such as the support of dynamic repetition indication, intra-slot repetition, and short PUCCH formats for single-TRP operation.**
4. **The studies and potential specification of M-TRP PUCCH repetition/transmission schemes under Rel-17 feMIMO should focus on multi-TRP only**

* **Alt.1: Rel-17 feMIMO WI focuses on multiple TRP and Rel-17 URLLC/IIOT WI focuses on single TRP**
* **Alt.2:**
* **Rel-17 feMIMO WI focusing on TDMed PUCCH repetition should include repetitions for sub-slot PUCCH and/or short PUCCH formats for both multiple TRPs and a single TRP.**
* **Rel-17 Coverage enh. WI should handle the PUSCH repetition type-B like PUCCH repetition, if it is included in the WID objectives**

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| Company | Comments: Please add you view on the overlap handling, would it be fine for handle all PUCCH repetition (single TRP) in **eURLLC/IIoT WI (or alternatively in Coverage Enhancements) and then leave all multi-TRP related issue for Fe-MIMO** |
| FUTUREWEI | We are fine with this arrangement of work. |
| Samsung | Prefer to address PUCCH repetition enhancements in the CovEnh WI. MIMO can focus on multi-TRP aspects. IIoT can consider single TRP aspects for ‘sub-slots’. |
| ZTE | We are supportive that IIoT/URLLC WI and CE WI should focus on enhancement for single TRP operation. But it seems no need to handle all PUCCH repetition enhancements (single TRP) in one WI. Samsung’s split of the work is fine for us. |
| Lenovo, Motorola Mobility | We don’t see strong benefit of PUSCH repetition type-B like PUCCH repetition for a single TRP, while time and efforts for specification are expected to be significant. Rel-17 feMIMO WI can include sub-slot PUCCH repetition for multiple TRPs, which would be beneficial for URLLC/IIoT scenarios. The existing slot-based PUCCH repetition can be used for coverage enhancement. |
| Intel | As we commented in 2355, for single-TRP (basic framework) our preference is to restrict PUCCH repetition enhancement + dynamic PUCCH repetition indication to either eURLLC/IIoT or CovEnh, potentially based on final scope size of CovEnh WI. Note that in this case it is important that the objective takes into account all technical requirements from eURLLC/IIOT, CovEnh, and Fe-MIMO. Fe-MIMO can continue designing multi-TRP specifics but may require “early” completion of PUCCH enhancement to align on the details with single-TRP framework. |
| Apple | As a general principle, we think it makes sense for eIIoT/URLLC and/or CovEnh to handle single-beam based PUCCH repetition enhancements, and FeMIMO to handle multi-beam related enhancements under mTRP. For single-beam based PUCCH repetition enhancements, we prefer all the related enhancements are handled within a single WI. We do not see strong motivation to support repetition Type B-like PUCCH repetition from coverage enhancement perspective. In addition, given that eIIoT/URLLC is discussing sub-slot-based PUCCH repetition, we prefer that sub-slot-based PUCCH repetition, repetition Type B-like PUCCH repetition, and dynamic indication of the number of repetitions (if one or more are agreed to be supported) are handled in the eIIoT/URLLC WI altogether. |
| Panasonic | We support the view from Samsung. |
| DOCOMO | We are generally supportive that PUCCH repetition (single TRP) in eURLLC/IIoT WI and then leave all multi-TRP related issue for Fe-MIMO. Aspects dedicated to CovEnh (e.g., DMRS bundling across PUCCH repetitions) can be discussed in CovEnh WI as long as overlapping is avoided. |
| vivo | We are generally fine with above overlap handling and share Samsung’s views on IIoT can enhance ‘sub-slot’ based PUCCH repetitions for single TRP. |
| OPPO | Generally we are fine that PUCCH repetition for single TRP is handled by Eurllc/IIoT WI and/or CovEnh WI and PUCCH repetition for multiple TRPs is handled by Fe-MIMO.  For single-TRP, PUCCH repetition enhancement and dynamic PUCCH repetition indication are handled by Eurllc/IIoT and/or CovEnh, potentially based on final scope size of CovEnh WI. |
| Qualcomm | We would prefer all PUCCH repetition to be in a single WI in FeMIMO. However, we can accept other arrangements. |
| Nokia, NSB | We do not see the need to specify extra PUCCH repetition support under coverage enhancements WID, given the outcome captured in the corresponding TR. Hence, we are fine to handle the single TRP PUCCH repetition cases already identified in the eURLLC/IIOT WI in this same WI. All Multi-TRP issues are then left for Fe-MIMO WI. |
| CATT | We are generally fine with the principle to handle PUCCH repetition enhancements for single TRP in CE and/or IIoT WI while FeMIMO handles multi-TRP specific enhancements. The coverage improvement of repetition Type B-like PUCCH repetition is not justified so at least it should not be included in CE WI. |
| Huawei, HiSilicon | 1. We are fine to handle “PUCCH repetition enhancements + dynamic PUCCH repetition” for single TRP in one single WI to strive for uniform solution as much as possible, either in eURLLC/IIoT WI or in coverage WI is fine with us, slightly prefer to handle it in eURLLC/IIoT WI considering the discussion for sub-slot based PUCCH repetition already started there. Note that “PUSCH-repetition-Type-B like PUCCH repetition” needs to be justified first from coverage enhancement perspective, if it will be supported we would prefer to preclude the enhancements for PUCCH segmentation crossing slot boundary, since it will increase much complexity due to several factors, e.g. the potential change of PUCCH formats.  2. We are fine that Fe-MIMO focuses on multi-TRP specific enhancements. If possible, the design for multi-TRP can take the enhancements for single TRP in other WI (i.e. either eURLLC/IIoT or CE WI) into account as much as possible. The enhancements for single TRP in other WI (i.e. either eURLLC/IIoT or CE WI) should be prioritized in the following meetings, in order to get the design ready as early as possible, to give a chance for Fe-MIMO WI to consider the design for single TRP as much as possible for multi-TRP specific design. |
| Xiaomi | Agree in general to leave the sTRP designs in URLLC/IIoT or CE, and handle the mTRP designs in FeMIMO. But for FeMIMOs, the sTRP scenarios cannot be avoided for mTRP discussions before URLLC/IIoT or CE can draw a conclusion. Thus we also share the same view with Lenovo/Mot, that Rel-17 feMIMO WI can include sub-slot PUCCH repetition for mTRPs, which would be applicable for URLLC/IIoT scenarios too. |
| Sony | We agree to the 1st proposal that enhanced PUCCH repetition is dealt with in ***either*** eURLLC/IIoT or CovEnh. Dynamic indication of repetition for PUCCH should be handled in the same WI that is handling PUCCH repetition. We prefer that all PUCCH repetition aspects are handled in a single WI rather than split into two different WIs.  We agree to the 3rd proposal that PUCCH repetition with single TRP is dealt with in either eURLLC/IIoT or CovEnh whilst that for multie TRP is dealt with in feMIMO.  PUSCH Repetition Type-B was introduced to reduce latency rather than improve coverage. If PUSCH repetition Type-B is not considered for PUCCH then ***all*** PUCCH repetition enhancements for single TRP should be dealt with in CovEnh otherwise they should be dealt with in eURLLC/IIoT. |
| LG | We think single-TRP intra-slot type PUCCH repetition should be handled in eURLLC/IIoT first. Multi-TRP inter-slot type PUCCH repetition should be handled in feMIMO. In the later stage, interaction between those two topics could be adjusted. For other |
| Ericsson | We are supportive the enhancements for PUCCH repetition to be discussed within one WI, in order to maintain the unified framework. mTRP specific enhancements need the expertise in FeMIMO group. However, it should be applied on top of the enhancements of the framework including enabling dynamic repetition.  We could consider either eURLLC or Coverage enhancements for single TRP. And then consider mTRP specific enhancements on top in FeMIMO. Few comments for proceeding with this approach:   * The enhancements should focus on PUCCH repetition (the commonality among different WI), and not any PUCCH enhancements in general. * If we decide on enhancements in eURLLC, we should consider the enhanced framework for PUCCH repetition is applicable to other UCI that HARQ-ACK. * If we decide on enhancements in Cov. Enh, we should consider the enhanced framework is applicable to sub-slot too (basically the framework irrespective of slot/sub-slot). * We need to ensure alignments between FeMIMO and any of eURLLC/Cov. Enh. Perhaps, with timing offset between the corresponding work in FeMIMO and any of eURLLC/Cov. Enh.   If we decide to perform all the work in FeMIMO, the above comments are still valid, that is the PUCCH repetition enhancements should be applicable to sub-slot, and UCI other than HARQ-ACK. |
| MediaTek | We agree on the principle to limit the scope of the discussion in IIoT/URLLC and CE WI on single-TRP only, and the feMIMO on multi-TRP.  However, some of the proposed PUCCH repetitions (such as sub-slot repetitions) are not technically justified. The discussion in the corresponding WIs should be whether to introduce such types of PUCCH repetitions.  Thus, a generic sentence should be sufficient to address any possible overlap (e.g. “*Rel-17 feMIMO WI focuses on multiple TRP and Rel-17 URLLC/IIOT WI focuses on single TRP*”) |

## UE feedback

The following options have been proposed in RP-202645 & 2669:

1. Proposal: To ensure the timely completion of Rel-17 URLLC/IIOT WI, RAN to agree 2021Q1 as the target completion date for the “study phase” for the following objectives

* UE feedback enhancements for HARQ-ACK [RAN1]
* CSI feedback enhancements to allow for more accurate MCS selection [RAN1] Support for multiple active BWPs

1. Proposal : *Clarify that A-CSI feedback on PUCCH should be specified in URLLC/IIoT WI.*
2. Proposal : *The following candidate topics should be prioritized for A-CSI enhancement.*

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| Company | Comments: Please add you view on the feedback handling, should we provide some guidance at this point in time to RAN WG level (RAN1 mainly), and if so, what guidance should be given |
| FUTUREWEI | We do not see the need for RAN to decide this. RAN1 should continue technical discussion. |
| Samsung | No need for RAN to make any decision. The rapporteur can handle the flow of targeted agreements/progress and WGs can make technical decisions. |
| ZTE | Yes, we expect RAN plenary to provide some guidance to accelerate the progress of RAN1 discussion. For instance, if possible, RAN can clarify whether Rel-17 URLLC/IIOT WI should specify A-CSI feedback on PUCCH as the discussion in RAN1 have proceeded for two meetings without any consensus and it is expected to be difficult to conclude on this in future RAN1 meetings. |
| Lenovo, Motorola Mobility | Support for A-CSI on PUCCH has been discussed sufficiently in Rel-16 and Rel-17 with no conclusion. RAN plenary should make a decision on whether A-CSI on PUCCH is supported in Rel-17 for efficient use of WI Tus in RAN1.  For other proposals, we think RAN1 can decide based on technical discussions and no decision is needed at this point. |
| Intel | We are in principle fine with the point 1, assuming this may encourage more focused discussion in RAN1#104-e with respect to contentious study phase items.  We are not in favor of point 2 (and consequently point 3), which does not reflect the status of technical discussion in RAN1, i.e. there is no consensus yet to specify A-CSI on PUCCH. |
| Apple | We think whether and how to support A-CSI feedback on PUCCH should be discussed & decided by RAN1. |
| DOCOMO | We share the view with FUTUREWEI and Samsung. RAN1 should handle these aspects appropriately. |
| Vivo | We think it is necessary and quite beneficial to have the first proposal to let RAN give the clear deadline for the “Study” completion time.  We agree the technical details should be discussed in RAN1, but without the “study” deadline, enhancements with less support will be proposed repeatedly or the new enhancement will be proposed every meeting. It has the risk that the WI with many “studies” cannot be finished on time. Based on the experience of Rel-16 URLLC/IIoT, leaving many details in the maintenance phase is not an efficient or good way. Therefore, it is necessary to have some RAN guidance on the “Study” completion time. |
| OPPO | We share the view with FUTUREWEI and Samsung. These aspects can be handled by RAN1. |
| Qualcomm | If consensus can be reached at RAN on A-CSI on PUCCH then making a RAN level decision could help. For the other topics, RAN1 should discuss further and decide. |
| Nokia, NSB | We think that all proposals above can be managed internally in RAN1 without a need for further RAN Plenary decisions, as long as companies show willingness to compromise and a good collaboration spirit in the discussions. |
| CATT | We see the benefit of proposal 1 and thus are fine with the proposal. For the other proposals, it can be continued to be discussed in RAN1. |
| Huawei, HiSilicon | 1. We are fine in principle with point 1 above to give a deadline for the study phase, however we feel that 2021Q1 might be a little bit rushed, considering the candidate schemes under both HARQ-ACK feedback enhancements and CSI feedback enhancements are many. Probably RAN1 can strive for concluding it in RAN1#104bis-e, to give more discussion on the candidate schemes before making a decision.  2. We agree with point 2 on A-CSI feedback on PUCCH also. During the discussion of Rel-17 IIoT/URLLC scope, it is the main candidate enhancement to be considered for CSI feedback, though in the end the WID only use CSI feedback enhancements to cover more other potential enhancements. There are other detailed reasons/evaluations to support A-CSI on PUCCH also as discussed in RAN1, however it seems no point to repeat all discussion in RAN1 here. |
| InterDigital | Some clarification of the WI scope for CSI enhancement in RAN plenary will be helpful but not sure having deadline for study phase will accelerate any progress in RAN1 considering that there is no detailed guideline or expected outcome.  Currently in RAN1, two enhancement schemes (A-CSI on PUCCH and CSI for PDCCH) are under discussion whether it is under the WI scope or not. At least RAN could clarify whether those are under the scope or not to save time in RAN1 discussion. Other than that, RAN1 could down-select scheme based on the technical discussion. |
| Xiaomi | We are fine with proposal 1. It is beneficial to push the process of RAN1 work if RAN can give a clear deadline for the “study phase” completion time. As for proposal 2 and 3, we think RAN1 can further discuss whether to support and specify A-CSI on PUCCH in RAN1#104-e. If there is still no consensus, it can be clarified by RAN. |
| Sony | We support the 1st proposal to have a deadline on the “study phase” as there are a lot of options to be considered and having a deadline at 2021Q1 is therefore useful.  We do not support 2nd proposal but it would be helpful that RAN clarifies whether A-CSI on PUCCH is part of the objective as this was disputed during the RAN1 discussion. |
| LG | For the first proposal, we don’t see a very good need for agreeing with that. RAN1 still can handle the discussion.  For the second proposal, we don’t think RAN1 has reached a general consensus with that. |
| Ericsson | On proposal 1, we think it is beneficial to have a deadline by next RAN plenary for finalizing investigation of the candidate enhancement schemes and make a decision. The FLs made a great effort to focus the corresponding discussions as much as possible. The pros and cons of different schemes are discussed in length to make a sound decision by RAN1.  On proposal 2, we are supportive of the proposal. It has been discussed sufficiently without any conclusion. |
| MediaTek | In our view, all the above proposals can be handled by RAN1 without a need for RAN Plenary decisions. |

## Moderator summary after initial discussion

The following outcome is proposed based in the initial discussion based on the views expressed on how to handle the PUCCH repetitions in RAN WG1 and on the other hand on the UE feedback and A-CSI on PUCCH. There was in general no desire to enter technical discussions on A-CSI on PUCCH in RAN level (at this point in time at least).

For handling of the repetitions is proposed to proceed as follows:

* + 1. Cover the PUCCH repetition enhancements + dynamic PUCCH repetition for single TRP in one single WI, which would be IIoT/URLLC WID (in-line with the existing scope). PUCCH repetition issues with multi-TRP to be handled in Fe-MIMO WI.
    2. For the UE feedback RAN1 work to continue, including discussion if A-CSI on PUCCH if included or not, status to be checked in March if any RAN level guidance needed.

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| **Company** | **Comments: Please add your company view whether you can accept the above way forward** |
| Apple | We support the proposal in principle. It would be good to clarify that whether to support the enhancements for single TRP will be further discussed in the IIoT/URLLC WI. |
| vivo | We are generally fine with the proposals. For the PUCCH repetition enhancements + dynamic PUCCH repetition for single TRP in **one single WI**, we would like to clarify whether it also covers PUCCH repetition enhancements in Cov-Enh WI such as “PUSCH-repetition-Type-B like PUCCH repetition”?  If it is concluded in [90E][05][Coverage\_WI\_scoping] that PUSCH-repetition-Type-B like PUCCH repetition is not considered as one objective for Cov-Enh WI, then whether it also implies that IIoT/URLLC WI does not need to discuss PUSCH-repetition-Type-B like PUCCH repetition? |
| Qualcomm | We support both proposals.  Our understanding is that PUSCH-repetition-Type-B like PUCCH repetition is part of repetition enhancements, so if agreed in the current scoping discussions, should also be in IIoT/URLLC. We would support doing this work in IIoT/URLLC. |
| DOCOMO | We support the proposal |
| CATT | For the first proposal, our understanding of the intention is to study the related PUCCH enhancements for single TRP in IIoT/URLLC WI but whether or not a specific technique is supported or not is up to RAN1 discussion similar as other HARQ-ACK enhancement candidate techniques in the same WI. Therefore, we propose to change “cover” to “study” to avoid potential misunderstandings.  For the second proposal, it is not clear whether UE feedback refers to UE CSI feedback or both HARQ-ACK and CSI feedback enhancements. In addition, we would like to delete “including discussion if A-CSI on PUCCH if included or not” since a conclusion at RAN level as such may imply that it is acknowledged that A-CSI on PUCCH may not be included in the WI.  So we propose the following updates to the latest proposal.  For handling of the repetitions is proposed to proceed as follows:   * + 1. ~~Cover~~Study the PUCCH repetition enhancements + dynamic PUCCH repetition for single TRP in one single WI, which would be IIoT/URLLC WID (in-line with the existing scope). PUCCH repetition issues with multi-TRP to be handled in Fe-MIMO WI.     2. For the UE CSI/HARQ-ACK feedback enhancements RAN1 work to continue, ~~including discussion if A-CSI on PUCCH if included or not,~~ status to be checked in March if any RAN level guidance needed. |
| Nokia, NSB | We support the proposal. |
| ZTE | For the first bullet, we support the last sentence, i.e., PUCCH repetition issues with multi-TRP to be handled in Fe-MIMO WI. For single TRP operation, objectives for PUCCH repetition enhancements are being discussed in CE WI scoping now. We prefer to make the decision after finalizing a more stable scope for CE WI.  For the second bullet, if more companies prefer to leave one more RAN1 meeting for A-CSI on PUCCH discussion, we are fine with the proposed way forward. |
| LG | We are generally fine with single TRP in URLLC and multi-TRP in MIMO. To be clearer, PUCCH repetition frame work (e.g. type-B repetition) should be discussed in URLLC first and only multi-TRP specific issues should be discussed in MIMO to avoid further overlaps.  Regarding proposal on A-CSI on PUCCH, we are fine with that. |
| Intel | For the first bullet, we are supportive of providing clear guidance to RAN1 on resolving scope overlaps. At this point we prefer PUCCH repetitions enhancement + dynamic repetition indication to be handled in CovEnh, with URLLC/IIOT WI as a second preference. If CovEnh WID scoping ends up with no PUCCH repetition objective, then we fully support continuation of study/work on this in URLLC/IIOT.  Regardless of where PUCCH repetitions objective ends up, we suggest including requirements from the other WI/SI to guide design targets. For example, if URLLC/IIOT continues work on this, then PUSCH-repetition-type-B like design should be considered as an input from CovEnh scope.  Support the second bullet. |
| Ericsson | On the first bullet, we are supportive in general. If it is included in eURLLC, the decision from RAN would be equivalent as updating the WID. Also, since the current eURLLC WID for the first objective is very open, a lot of time in RAN1 is spent to discuss whether to support an enhancement or not. In addition, since eURLLC would be responsible for the enhancements for cov. Enh, we think at least we could agree on “Support of PUCCH repetition enhancements including enabling dynamic PUCCH repetition”. In that sense, the WG can focus the discussion on the design and whether as part of details, support Type-B like or sub-slot repetition.  On the second bullet, it is not clear to us why A-CSI on PUCCH is singled out. In fact, this feature had the most support. Some companies expressed concern whether it is in scope or not. Although when the eURLLC WID was agreed in plenary, A-CSI PUCCH was explicitly mentioned as an example during the online session as a candidate enhancement. Therefore, it is in scope. A guidance from RAN in that regard would be helpful for A-CSI on PUCCH. The issue for down-scoping is more related to other cases, specially Case 1 and Case 2 for new reporting where Case 1 has 5 sub-cases.  Based on the above, we suggest the following proposal (including CATT suggestion for the second bullet) where we find a guidance from WG wold help the progress in WG1.  For handling of the repetitions is proposed to proceed as follows:   * + 1. Cover the support of PUCCH repetition enhancements + dynamic PUCCH repetition for single TRP in one single WI, which would be IIoT/URLLC WID (in-line with the existing scope). PUCCH repetition issues with multi-TRP to be handled in Fe-MIMO WI.     2. For the UE CSI/HARQ-ACK feedback enhancements RAN1 work to continue, ~~including discussion if A-CSI on PUCCH if included or not,~~ status to be checked in March if any RAN level guidance needed.     3. The study of A-CSI on PUCCH is within the scope of eURLLC WID. |
| MediaTek | For the first bullet, given that the discussion is on resolving the overlap between different WIs, the proposal should be rephrased to only address this issue. The proposal shouldn’t be misinterpreted as the introduction of PUCCH repetition. The technical discussion is still going on in RAN1. Thus, we support the following modification from CATT:   1. ~~Cover~~Study the PUCCH repetition enhancements + dynamic PUCCH repetition for single TRP in one single WI, which would be IIoT/URLLC WID (in-line with the existing scope). PUCCH repetition issues with multi-TRP to be handled in Fe-MIMO WI.   We support the second bullet. |
| OPPO | We support the proposal in principle.  For the first bullet, it is not clear for us whether dynamic PUCCH repetition is restricted to a specific PUCCH repetition enhancement scheme. To be specific, if only sub-slot based PUCCH repetition is enhanced, dynamic PUCCH repetition can be applied for sub-slot based PUCCH repetition only or dynamic PUCCH repetition can be applied for sub-slot based and slot based PUCCH repetition? To reduce the duplicated work, slot based PUCCH repetition should also be considered to cover Coverage Enhancement. Moreover, benefit from PUCCH repetition enhancement and dynamic PUCCH repetition are different. So we think that PUCCH repetition enhancements and dynamic PUCCH repetition are decoupled.  For PUSCH-repetition-type-B like design, we think it is up to RAN1 discussion. |