**3GPP TSG RAN Meeting #92-e RP-21xxxx**

e-Meeting, June 14th – 18th, 2021

Agenda Item: 9.7.2.1

Title: Moderator's summary for email discussion [92-e-15-IIoT-URLLC-Scope]

Source: Samsung (RAN1 Chairman)

Document for: Discussion and Decision

# Introduction

As part of Rel-17 NR, there is an ongoing work item on *Enhanced Industrial Internet of Things (IoT) and ultra-reliable and low latency communication (URLLC) support for NR*. The work item is due for stage-3 completion by Q4 of 2021 in RAN1 and Q1 of 2022 in other working groups. For RAN1, there are only three WG meetings until the deadline of the stage-3 completion.

A number of companies have submitted contributions [1] ~ [10] discussing the potential downscoping of the work item considering the limited time until the completion deadline and the level of progress in the relevant working groups. The status report [11] on the work item also indicates that progress is behind schedule and RAN plenary intervention may be needed. In particular, all companies who submitted on this issue suggest downscoping of some sort on the RAN1-led objectives. One company [1], [2] discusses downscoping of RAN2-led objectives as well.

The purpose of the email thread [92-e-15-IIoT-URLLC-Scope] is to collect company views and if possible, converge on a way forward on how to downscope the Rel-17 work item on *Enhanced Industrial Internet of Things (IoT) and ultra-reliable and low latency communication (URLLC) support for NR*.

# Initial phase

To kick off the initial discussion, the following sub-sections provide general questions for collecting views on the downscoping of the Rel-17 work item on Enhanced IIoT and URLLC. The views collected will be used to come up with moderator recommendations to focus the follow up discussions in the next phase to more specific issues.

For your reference, the detailed objectives in the WID [12] are provided below:

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| 1. Study, identify and specify if needed, required Physical Layer feedback enhancements for meeting URLLC requirements covering
	* + UE feedback enhancements for HARQ-ACK [RAN1]
		+ CSI feedback enhancements to allow for more accurate MCS selection [RAN1]

Note: DMRS-based CSI feedback is not in scope of this WI 1. Uplink enhancements for URLLC in unlicensed controlled environments [RAN1, RAN2]:
	1. Specify support for UE-initiated COT for FBE with minimum specification effort
	2. Harmonizing UL configured-grant enhancements in NR-U and URLLC introduced in Rel-16 to be applicable for unlicensed spectrum
2. Intra-UE multiplexing and prioritization of traffic with different priority based on work done in Rel.16 [RAN1]:
3. Specify multiplexing behavior among HARQ-ACK/SR/CSI and PUSCH for traffic with different priorities, including the cases with UCI on PUCCH and UCI on PUSCH.
4. Specify PHY prioritization of overlapping dynamic grant PUSCH and configured grant PUSCH of different PHY priorities on a BWP of a serving cell including the related cancelation behavior for the PUSCH of lower PHY priority, taking the solution developed during Rel-16 as the baseline
5. Enhancements for support of time synchronization:
6. RAN impacts of SA2 work on uplink time synchronization for TSN, if any. [RAN2]
7. Propagation delay compensation enhancements (including mobility issues, if any). [RAN2, RAN1, RAN3, RAN4]
8. RAN enhancements based on new QoS related parameters if any, e.g. survival time, burst spread, decided in SA2. [RAN2, RAN3]
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## Company views on whether downscoping on Enhanced IIoT and URLLC is necessary in RAN#92-e

**Question1: Considering the latest progress in working groups, is it necessary for RAN to provide guidance, including possible downscoping, for the Rel-17 work item on Enhanced IIoT and URLLC in RAN#92-e? It should be assumed that Rel-17 schedule will be maintained as previously endorsed (stage-3 completion for RAN1 by Q4 of 2021 and other working groups by Q1 of 2022).**

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| **Company** | **Views** |
| Nokia, NSB | **Yes, necessary**As detailed in our contribution in RP-211112 (also presented during the early topics GTW call), from rapporteurs’ perspective we think some action need to be taken during RAN#92 to guarantee the timely completion of the WI.  |
| OPPO | We think the plenary guidance is needed for CSI, for which RAN1 cannot proceed with the majority view. But for remaining URLLC items, plenary can wait for another quarter to get clearer view of situation. |
| Ericsson | Yes. It is necessary. |
| InterDigital | Yes, it is necessary for CSI enhancement. But, for other topics, we can wait until September plenary so that RAN1 may discuss potential down-scoping in the next quarter or progress enough to cover all the identified schemes in Rel-17 |
| FUTUREWEI | Ok to downscope. |
| Samsung | Progress in RAN1 can benefit from RAN guidance. In particular, for CSI enhancements, RAN may guide subsequent RAN1 work based on the proposal in the Chairman’s minutes from RAN1#105-e (without discussing potential fine tuning of the wording – guidance for the direction of further RAN1 discussions would be sufficient).  |
| Huawei, HiSilicon | Guidance on the focus of CSI feedback enhancements from RAN plenary would be helpful. Based on the discussions in RAN1, there are too many candidate solutions and it seems really a deadlock on what direction to take for CSI enhancements. Therefore, some guidance on the focused direction would be helpful and then RAN1 can achieve more progress in the following meetings. Some guidance from RAN plenary on propagation delay compensation enhancements would be good also if possible. Even though we have achieved agreements on it, it is mostly on evaluation assumptions and so far not being able to touch the technical enhancements. The challenge for this topic is that it is relevant to several working groups, i.e. RAN2 and RAN4, and with only 3 e-meetings left it seems no sufficient time to exchanges views among different working groups on the potential enhancements we can do in Rel-17.For HARQ-ACK feedback enhancements and intra-UE multiplexing and prioritization, it seems not that critical/urgent for this RAN plenary, since sufficient agreements have achieved in RAN1 to move forward, and we can reassess in next RAN plenary.  |
| Apple | URLLC features have big impacts on modem implementation, and consequential decision on them should be taken with care. Focusing features with well-defined use cases and finishing their design with high quality is key.RAN plenary guidance can be helpful for CSI feedback. Since the technical discussions with all the details can be better handled in RAN1, RAN plenary can decide whether CSI feedback is pursued further in RAN1 or not, selecting a specific solution or a combination of solutions may require taking all the technical discussions to RAN. Following the same reasoning, if HARQ-ACK enhancements need to be down-scoped, it is better to exclude the whole HARQ skipping feature rather than making secondary choice such as whether to support bundling/compression under RAN. As for intra-UE multiplexing & prioritization enhancements, UCI multiplexing has progressed reasonably well in recent meetings. It seems DG/CG enhancements can be a first candidate for downscoping: DG/CG enhancements have to be built over the Rel-16 design. Yet the UL skipping with L1/L2 prioritization has been discussed at Rel-16 maintenance for multiple meetings (including DG/CG behavior in Rel-16), and issues involving RAN1/RAN2 design have been revealed in the process, and it is clear companies hold fundamentally different understandings on some issues. It is increasingly elusive when the design on UL skipping with L1/L2 prioritization can be finalized. We should avoid rushing into adding another floor to a building while its foundation is shaky. |
| Telecom Italia | Downscoping at RAN#92 is essential to ensure timely completion of Rel 17 (and hopefully good quality of the specifications) |
| CATT | Yes, RAN guidance at least for CSI enhancements is needed. |
| Qualcomm | Some decisions should be made, in particular for CSI, to reduce the time spent on CSI scoping discussion in RAN1. We agree with the rapporteur’s proposals on TSN. But in the other areas, no further down-scoping is necessary before September.  |
| Quectel | OK to downscope for CSI enhancements. For other topics, we can wait until next plenary.  |
| vivo | Yes, at least for CSI feedback enhancements.  |
| LG | Yes, it is necessary for some topic under each sub-agenda. |
| Sony | Yes, especially on CSI feedback enhancements.  |
| ZTE | Yes. The progress is behind schedule especially for CSI enhancements, and RAN guidance is needed.  |
| Intel | Yes, down-scoping is desirable. We see delayed progress in all items except unlicensed. |
| MediaTek | Downscoping some of the work could help in streamline the remaining work in RAN1. Although the downscoping could have been done in RAN1 by eliminating the schemes with minimum support. |
| Xiaomi | Yes, we think CSI feedback can be down-scoping. |
| CMCC | Yes, at least for CSI enhancement is needed. |

## Company views on potential areas for downscoping

For those companies who have indicated that downscoping of the Rel-17 work item on Enhanced IIoT and URLLC in RAN#92-e is necessary, please provide additional details by answering the following question.

**Question2: Which objectives in the Rel-17 work item on Enhanced IioT and URLLC would need to be downscoped in RAN#92-e? And how?**

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| **Company** | **Views** |
| Nokia, NSB | 1. **CSI feedback enhancements (High need):** As pointed out in our contribution in RP-211112 and also pointed out by other companies – there is a need for down-scoping to guarantee some enhancement to be specified in Rel-17. We propose to focus on case-1 reporting – and (i) exclude the case-2 reporting (as this is also not in line with the WI objective) and exclude the study area of new triggering methods for A-CSI and/or SRS
2. **Intra-UE multiplexing & prioritization enhancements (High need):** We are now 1 year into the WI, this objective was clearly spelled out in the WID and still there had only be very minor progress. Therefore, we think there is little to no chance of completing the 3 different features of this objectives in Rel-17. As explained in RP-211112, we suggest excluding ‘*Specify multiplexing behavior among HARQ-ACK/SR/CSI and PUSCH for traffic with different priorities, including the cases with UCI on PUCCH and UCI on PUSCH*’ from the WID and RAN1 to stop the related work. RAN1 to instead focus its future work as part of RAN1 AI 8.3.3 on the two remaining items of simultaneous PUCCH/PUSCH of different PHY priorities (at least for inter-band CA) and overlapping CG and DG PUSCH enhancements.
3. **Propagation delay compensation enhancements (High need):** All companies agree that at least some enhancements will be needed to fulfil the requirements of the targeted Rel-17 use cases. Two different methods (TA-based and Rx-TX based PDC) are discussed which hampers the progress due to the different opinions of the two camps on which seem is to be selected in the end. From rapporteur perspective, we therefore think RAN should take some action to sort out the current deadlock and thereby enabling the support of such TSN services based on Rel-17 specifications.

As discussed in Sec. 3.1 of RP-211112, we therefore suggest as a compromise to support baseline TA-based propagation delay compensation based on the Rel-15 / 16 timing advance procedure (i.e. Alt. 1) in Rel-17 without changes on existing TA requirements as well as Rx-Tx measurement based propagation delay compensation in Rel-17. Moreover, it is suggested to focus the further work on propagation delay compensation performed at the UE side (i.e. UE-based propagation delay compensation).1. **UE feedback enhancements for HARQ-ACK (Medium need):** First, there is definitely much less need for RAN down-scoping of this objective (especially compared to the three others above). So, this could maybe be left to RAN#93 based on the RAN1#106 progress.
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| OPPO | For HARQ-ACK, the question is whether/how to down-scope the last sub-bullet in the following remaining issues listed in SR (RP-211111): * **UE feedback enhancements for HARQ-ACK** (RAN1 AI 8.3.1.1)
	+ Remaining details of deferral of dropped SPS HARQ-ACK due to cancelled PUCCH for TDD
	+ Remaining details of HARQ-ACK re-transmission
	+ Remaining details of (sub-slot based) PUCCH repetition enhancements
	+ Remaining details of Type 1 HARQ-ACK codebook for sub-slot PUCCH
	+ Remaining details of PUCCH carrier switching for HARQ-ACK feedback
	+ Study and specify if needed method(s) to enable the following:
		- SPS HARQ-ACK skipping for ‘skipped’ SPS PDSCH
		- SPS HARQ-ACK payload size reduction

If down-scoping on HARQ-ACK is indeed desired by majority, we prefer to remove the whole scope of the last sub-bullet on “study and specify if needed” (highlighted), given RAN1 is already tasked with 5 items as shown above for the next three RAN1 meetings; otherwise the decision should be made in RAN1. For CSI, we support RAN1 FL proposal in RP-211297, to narrow down to one solution for case-1 and one solution for case-2, given that is clearly the majority view in RAN1.For intra-UE multiplexing/prioritization:It seems the Rapporteur’s suggestion is to remove the item for which RAN1 spent most of focus and time, and meanwhile to add new item of “simultaneous transmission” that is not yet in current WID scoping. Our preference is not to add anything if the intention of this discussion is down-scoping. Another thing to note is that, the RAN1 progress on overlapping CG/DG enhancement is somehow depending on some RAN1 decisions for Rel-16 URLLC, such as PUSCH skipping, which was not yet fully solved as of RAN1 May meeting in maintenance agenda. So if there should be something to be down-scoped for Rel-17, we think it would rather be the one that RAN1 has not fully started and meanwhile has more difficulties to move forward due to uncertainties coming from the earlier release. For PDC: We are ok to remove TA-based PDC for Rel-17, but we do not agree to settle down on RTT-based PDC only. Currently there is another solution called implicit PDC proposed in both RAN1 (R1-2102396) and RAN2 (R2-2105565). In our view, RTT-based PDC still has the risk to generate new impacts to UE hardware requirements in RAN4 and meanwhile to potentially have more RAN1 spec impacts even than TA-based. The following two issues were raised in RAN1 but not fully discussed to justify the RTT-based PDC. * One is that the RTT\_based PDC is effectively a 2-step solution including PD estimation and PD compensation, both of which generate timing errors. RAN1 is still in discussion to determine how close to each other in time these two steps are controlled to lower the total timing error to its minimum; in contrast, implicit PDC has only one step and accesses Tx/Rx timings in gNB/UE only once, and therefore avoid the corresponding issue in RTT-based PDC.
* The 2nd issue is the RTT-based PD estimation. It has not been discussed in RAN1 how to ensure the avoidance of RTT measurement sync-up issue (e.g. the RTT measurements at gNB and UE do not happen at the same time, especially one can happen before TA interval change and the other after TA interval change), which could generate new needs of spec impacts. This RTT measurement sync-up issue does not exist for implicit PDC by nature.

So it is our concern that selecting RTT-based PDC in plenary may risk to lock on more potential WGs work and more unnecessary UE hardware implementation impacts. Our suggestion is to leave the technical decision to WG level and to wait for one more quarter, given RAN1 has two weeks in Aug meeting comparing to zero TU for PDC in May meeting.  |
| Ericsson | CSI enhancements:* **Down-scoping in this plenary is essential.**
* We are supportive of FL proposal (InterDigital) in [RP-211297](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_92e/Docs/RP-211297.zip)

PDC:* Guidance from RAN plenary would be helpful to progress the work.
* We are supportive of Nokia’s proposal **that Rx-Tx based method should be the (main) Rel-17 PDC enhancement,** since TA-based method cannot satisfy the requirements of all targeted scenarios. For TA-based method, minimum work related to signaling aspect to support Rel-15/16 can be done.

Other topics (HARQ-ACK enhancements and Intra-UE multiplexing)* We are supportive of Nokia’s proposal. Guidance from RAN plenary would be helpful to progress the work.
	+ However, potential down scoping of these topics can be deferred to Sept plenary if it is preferred by majority of companies.
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| InterDigital | CSI enhancements:* Support the WF ([RP-211297](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_92e/Docs/RP-211297.zip)) to confirm the RAN1 proposal as the guidance
* RAN should not reopen the discussion whether case 2 and A-CSI on PUCCH triggered by DL DCI need to be excluded or not in the WID.

HARQ-ACK enhancement/Intra-UE multiplexing:* Any down-scoping for these topics could be discussed in RAN1 if necessary based on some technical analysis
* RAN can revisit in September whether any guidance/down-scoping is needed for these topics based on the progress in the next RAN1 meeting
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| FUTUREWEI | For CSI enhancement, the proposed scheme(s) need to be first justified by performance benefits. As we detailed in our contribution RP-211430 and based on the Feature Lead summary in RAN1 (R1-2106177), case 1-1/1-3 provides significant performance benefits, case 1-8 provides little to no gain or even loss for majority cases, and case 2-3 provides little to no gain and in some cases even results in performance loss. RAN should not just count supporting companies while ignoring evaluation results that RAN1 agreed to perform. Therefore, our proposal is to have RAN1 continue investigating case 1-1 and 1-3 so that we can potentially specify something useful in Rel-17. |
| Samsung | 1. For CSI enhancements, we support for RAN1 to continue by focusing (not necessarily specifying) on the schemes identified by the proposal in the RAN1#105-e chairman minutes (and in [RP-211297](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_92e/Docs/RP-211297.zip)).
2. For intra-UE multiplexing, Samsung was a primary proponent for supporting simultaneous PUSCH and PUCCH transmissions as it is a simple mechanism to avoid dropping LP PUSCH/PUCCH due to overlapping with HP PUCCH/PUSCH and as a general enhancement for NR to match the LTE functionality. However, in Rel-17, potential support will be too limited to be beneficial (only for UEs supporting UL CA and only when LP/HP collisions happen under inter-band CA). Therefore, the feature can be considered for down-scoping, particularly if it would have non-trivial specification impact, and may be more broadly revisited in Rel-18.
3. For HARQ-ACK enhancements, we generally support some down-scoping but it is probably better to revisit the whole objective in RAN#93-e, based on the status after RAN1#106-e, than to discuss some minimal/trivial down-scoping now.
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| Huawei, HiSilicon | As shown in our reply above, if possible some guidance on CSI feedback enhancements and propagation delay compensation enhancements would be good.For CSI feedback enhancements, based on the discussion in RAN1, it seems the proposal from RAN1#105-e meeting is the most promising direction to go for progress. However, from RAN plenary perspective, we think it is sufficient to give guidance on high-level direction and leave details for each direction to RAN1. An example of the potential guidance as below: Potential guidance on CSI feedback enhancements from RAN#92-e *(i.e.* *WF* [*RP-211297*](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_92e/Docs/RP-211297.zip) *with removing the last sub-bullet on the details of how to calculate delta-MCS):****RAN1 to further investigate the following for CSI enhancements for IIoT/URLLC:**** ***Increasing the number of bits used for the reported subband CQI (3-bits differential subband CQI or 4-bits CQI)***
* ***Reporting of delta-MCS:***
	+ ***Report consists of delta-MCS for a TB received with MCS index IMCS***

For propagation delay compensation enhancements, for TA-based PDC enhancements and RTT-based PDC enhancements, though RAN1 are still assessing whether TA-based PDC enhancements is able to meet the budget for control-to-control case, it is expected that it would be challenging since much reduction are needed for Te (e.g. down to 1/4) and TA command indication granularity, which actually also needs RAN4 and/or RAN2 to check the feasibility. Therefore, considering much work from all working groups on TA-based PDC enhancements and also there might be some risk that in the end the conclusion is that even with enhancements TA-based PDC is impossible to meet the budget for control-to-control case, probably we can consider to stop the related enhanced work for TA-based PDC enhancements and focus on RTT-based PDC enhancements in the following 3 RAN1 meetings. An example of the potential guidance as below:*Potential guidance on propagation delay compensation enhancements from RAN#92-e:* **For propagation delay compensation enhancements,** * **Support TA-based propagation delay compensation based on the Rel-15 / 16 timing advance procedure in Rel-17 without changes on existing TA requirements/procedures.**
* **RAN1/2/4 focus on RTT-based propagation delay compensation enhancements in Rel-17.**

If we are not able to preclude TA-based PDC in this RAN plenary, companies should be more constructive when we discuss in RAN1 on the potential LSs to ask other working groups to check the feasibility of reducing Te and TA command indication granularity for TA-based PDC enhancements, this kind of LSs were under discussion for 2 RAN1 meetings but no consensus achieved due to strong concern from a few companies. Probably RAN can give some guidance to RAN1 on the deadline to send the LS, then other working groups can have sufficient time to check and discuss. Some example can be: **For propagation delay compensation enhancements, RAN1 should send out the LS(s) if any in RAN1#106-e on the issues that need feedback or inputs from other working groups, e.g. LS to ask RAN4 to check the feasibility and potential enhanced value for Te and TA command indication granularity.**  |
| Apple | URLLC features have big impacts on modem implementation, and consequential decision on them should be taken with care. Focusing features with well-defined use cases and finishing their design with high quality is key.RAN plenary guidance can be helpful for CSI feedback. Since the technical discussions with all the details can be better handled in RAN1, RAN plenary can decide whether CSI feedback is pursued further in RAN1 or not, selecting a specific solution or a combination of solutions may require taking all the technical discussions to RAN. Following the same reasoning, if HARQ-ACK enhancements need to be down-scoped, it is better to exclude the whole HARQ skipping feature rather than making secondary choice such as whether to support bundling/compression under RAN. As for intra-UE multiplexing & prioritization enhancements, we share a similar understanding as OPPO. UCI multiplexing has progressed reasonably well in recent meetings. It seems DG/CG enhancements can be a first candidate for downscoping: DG/CG enhancements have to be built over the Rel-16 design. Yet the UL skipping with L1/L2 prioritization has been discussed at Rel-16 maintenance for multiple meetings (including DG/CG behavior in Rel-16), and issues involving RAN1/RAN2 design have been revealed in the process, and it is clear companies hold fundamentally different understandings on some issues. It is increasingly elusive when the design on UL skipping with L1/L2 prioritization can be finalized. We should avoid rushing into adding another floor to a building while its foundation is shaky. |
| Telecom Italia | We are in general supportive of the Nokia proposal.As a minimum, all the “study and specify if needed” objectives should be removed from the WID |
| CATT | For CSI enhancements, we support the proposal from the feature lead in [RP-211297](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_92e/Docs/RP-211297.zip).For HARQ-ACK enhancements, we think that RAN1 should discuss SPS HARQ skipping & payload size reduction only if time allows after the completion of the agreed HARQ-ACK enhancements.For intra-UE multiplexing & prioritization, we do not think down-scoping is needed at this point.For propagation delay compensation, we think we can leave it to RAN1/RAN2 for further discussion. |
| Qualcomm | We disagree with most of the rapporteur’s proposals, except for TSN. * For CSI, the RAN decision on down-scoping should be made in line with the feature lead’s proposal to this meeting. This down-scopes the work to a single scheme for Case 1 and Case 2.
* For SPS HARQ-ACK skipping, first target for potential down-scoping should be HARQ-ACK bundling/compression. Down-scoping of the whole feature should be secondary consideration only.
* For intra-UE multiplexing, we don’t agree with down-scoping. After spending most time on this during the release so far, we don’t understand the rationale for the down-scoping now.
* For TSN, we agree to focus on UE-based propagation delay compensation, without any work on changing existing TA requirements.
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| Quectel | **For CSI enhancements**: we support FL proposal in [RP-211297](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_92e/Docs/RP-211297.zip) as majority companies are OK with this proposal based on RAN1 discussions (as captured in chairman’s notes).**For Intra-UE multiplexing**: we see a good progress in the past RAN1 meetings and we don’t think down-scoping is needed. We can revisit the scope in September if the progress is not as expected then. |
| vivo | **For CSI feedback enhancements,** Down-scoping in this plenary meeting is necessary, RAN1 has already fully discussed the schemes but cannot make the decision. Given the remaining available WI time, it is better to decide whether and which scheme(s) to be specified rather than continue studying or investigating. **For intra-UE multiplexing & prioritization,**We understand the involved complexity for many combinations of the UCI multiplexing with different priorities on PUCCH or PUSCH. But it is not good to remove the cases that have explicit agreement to support them. We think at least the case of LP HARQ and HP HARQ-ACK can be supported given the key decisions needed for supporting this case were already made in RAN1 May meeting for the total payload size larger than or not exceeding 2 bits. For simultaneous PUCCH/PUSCH of different PHY priorities (at least for inter-band CA), we support to add it in the objective for intra-UE multiplexing & prioritization since we already have agreements to support this feature.**For HARQ-ACK feedback enhancements,** Frist, the WID scope should be made clear by explicitly listing the features that will be specified for HARQ-ACK feedback enhancements based on the agreements. This helps people to have clear targets and also prevent any new enhancements being proposed; Second, for HARQ-ACK skipping, given May meeting does not allocate any discussion time for this feature and the involved specification efforts for NACK/ACK/HARQ-ACK skipping is rather small, similar as other features, it is fair to given one more WG meeting time to make the decision. **For propagation delay compensation enhancements**For TA-based method: According to observation in previous RAN1 meeting, Rel-16 TA-based propagation delay compensation is sufficiently to be used as propagation delay estimation for the smart grid scenario with no enhancements needed. For control-to-control communication scenario, some companies provide analyses that TA-based PDC with the reduced Te and/or TA command indication granularity can meet the time synchronization accuracy, which is related to RAN4 and/or RAN2 work. If the enhancements can be done in RAN 4 and/or RAN2 groups, TA-based method can be used for PDC in Rel-17. It is early to preclude TA-based method for PDC at present. For RTT-based method: RTT-based method is used for positioning procedure. It is unclear whether URLLC UEs with propagation delay compensation capability must support positioning capability. The more details need to be discussed, for example, resource allocation of reference signal and the signaling overhead for triggering RTT-based propagation delay measurement.On the other hand, the views on the equation is very diverse to calculate the overall time synchronization error over Uu interface for RTT-based PDC from RAN1 aspect. There is no evidence show current Rel-16 RTT-based PDC can definitely meet the time synchronization accuracy without any enhancements. The further study is needed. It is early to conclude that RTT-based method is only available method for Rel-17 PDC. We suggest that the discussion can be further proceeded in RAN1 meeting and the potential down-scoping can be discussed in RAN#93 if needed. |
| LG | **HARQ-ACK feedback enhancement**There are many of remaining issue on HARQ-ACK feedback enhancement and discussions on further details is necessary. Given that situation, we would like to suggest down-scope this item, to be specific, to focus only on what we have agreed; SPS HARQ-ACK deferral, PUCCH carrier switching, HARQ-ACK re-transmission, sub-slot repetition and sub-slot Type-1 CB. Considering Rel-17 schedule, we should focus to finalize only those issues from now on. **CSI feedback enhancement**Down-scoping on CSI feedback enhance would be necessary to finalize WI with current schedule. In this context, we are not objective to WF of RP-211297 since the proposal is to down-scope our discussion within two of schemes, which could be a baseline for future discussion, then RAN1 may discuss on whether to support each scheme based on performance benefit. On the other hand, if there is no consensus on the WF in RP-211297, we are fine with Nokia’s proposal by considering given Rel-17 schedule for URLLC since it would be beneficial to focus Case-1 CSI schemes, which have less concerns comparing to Case-2 schemes.Meanwhile, there was a discussion on new CSI triggering method such as A-CSI on PUCCH but not concluded yet. Since we already spend considerable time to discuss and this is also related to Case-2 CSI scheme so it may slow down our future discussion. We think it is helpful to confirm any of new CSI triggering method is not in WI scope as the plenary guidance. **Intra-UE multiplexing/prioritization**It seems to start and is expected to make more progress after deciding the encoding coding for multiplexing of UCIs with different priorites, and thus, there seems no need to down-scope this item, except for simultaneous PUCCH+PUSCH transmission, which was initially agreed to support intra-UE multplexing indirectly by allowing the simultaneous transmission. However, since the progress on this feature itself is quite slow due to different consideration on it among the companies and this feature would affect overall UL multiplexing procedure which is expected to make complication and consume much time and argument, it is suggested to exclude (or deprioritize) it from Rel-17 scope considering the remaining schedule. **Propagation delay compensation**From the discussion so far, it was identified that PDC based on Rel-16 TA with current parameter assumption cannot satisfy error budget requirement in some scenario and some contributions show RTT-based may be beneficial to estimate PD error more accurately. If TA based method with enhanced UE capability (Alt. 1B) can be supported, it is clear that there is no need to down-scope since estimated error budget with reduced error component could meet requirement only with less specification effort. Otherwise, a guidance in the next RAN plenary would helpful to progress, such as focusing the RTT-based mechanism for PDC. |
| Sony | **CSI Enhancement**We support the proposal made by the FL in RP-211297, which was almost agreed in RAN1#105e.**HARQ-ACK Enhancement**There are at least 4 schemes on the table (*NACK skipping, ACK skipping, RRC configure HARQ-ACK skipping, HARQ-ACK compression*) for HARQ-ACK Payload Size Reduction, where each scheme has some companies’ objection. The benefit of this feature is questionable and hence we suggest that this feature is removed. |
| ZTE | For CSI enhancements, we suggest focusing on Case 2 CSI reporting for new reporting based on the technical discussion in RAN1. We would be also ok with the FL proposal in RP-211297, which is supported by the majority in RAN1.For other agendas, no need to down-scope at this moment, and we suggest further discussing in respective WGs. If any guidance needed, it could be further discussed in Sept. RAN meeting. * Regarding intra-UE multiplexing, we have similar view as OPPO and Apple. We have put lots of effort on specifying the multiplexing rules and the overall progress is good. Replacing by another objective is not a reasonable request. Needless to say, the added item “simultaneous transmission” from rapporteur can only apply to inter-band CA case, which is not most typical scenario.
* Regarding propagation delay compensation, the discussion in previous RAN1 meeting mainly focused on TA-based solution. The evaluation results in RAN1 show that the synchronization accuracy of Uu interface based on TA-based enhancement can fulfil target. So, further study on TA-based solution is needed and RAN1 can make the decision on which solution is selected.
 |
| Intel | The most urgent topics for RAN plenary intervention in our view are CSI and Intra-UE multiplexing. The other topics progressed better and/or require more technical discussion to progress further.For CSI, we do NOT support the latest FL proposal from RAN1#105-e also copied to RP-211297. There were strong technical arguments for objection which remain unresolved thus it is not constructive to re-state the objected proposal.From this perspective, we suggest taking the latest Nokia/rapporteur proposal from RAN1#105-e regarding Case-1 and continue from there.* *Enhance the sub-band CQI reporting with extra configurability on reporting content and sub-band CQI granularity.*
	+ *Sub-band CQI reporting granularity is increased to 3 (differential CQI) and 4 bits (4 bits can represent actual CQI).*
	+ *Reported content is based on sub-band CQIs which can be configured as reporting of all sub-band CQIs, minimum (for all or sub-set of sub-bands) CQI, or average (for all or sub-set of sub-bands) CQI.*
	+ *Network configured channel and interference measurement interval can enable the reported CQIs to capture frequency domain and time domain interference variation.*

We also understand that RAN is not the best place to go deep into the technical details of the WG discussion. From that perspective, as the last resort the whole CSI objective may be removed from WID.For intra-UE multiplexing, we suggest the following candidates for down-scoping:* Simultaneous PUSCH and PUCCH transmission on different carriers. It was agreed in one of the first meetings, although it is not explicitly in the scope. There was also no progress so far, thus it is a straightforward candidate to remove.
* UCI multiplexing on PUSCH. We understand that both UCI on PUCCH and PUSCH are important, but the latter one was progressed a little, and may be left for future releases to reduce the workload.

For PDC, we think the progress could be achieved if a bit more online time is allocated for this topic. So far, we did not have thorough technical discussion in GTW on this which may help a lot to progress this agenda.For HARQ, the remaining study point may be checked in RAN#93.For Unlicensed, we don’t see major progress issues. |
| MediaTek | 1. **CSI:** As explained in our contribution RP-211462, some of the proposed schemes have small support and majority objection (highlighted with yellow in the table below). Hence, at least these schemes need to be down-scoped.

|  |  |  |
| --- | --- | --- |
| **Proposed enhancement** | **Support** | **Concerns** |
| Statistical CQI | 6 | 13 |
| Interference standard deviation | 2 | 15 |
| Minimum CQI (in time and frequency) | 9 | 11 |
| Increased granularity of subband CQI | 10 | 5 |
| CQI-only update (with CSI processing time reduction) | 9 | 11 |
| CQI-only update (without CSI processing time reduction) | 6 | 13 |

1. **Propagation delay compensation:** RAN1 evaluation is still going on, and it is already shown that TA-based method (without any enhancements) can meet the requirements for the smart-grid scenario. Also, with some possible enhancements, TA-based method could meet the requirement for the control-2-control scenario. Thus, we object the proposal from Nokia to bypass the technical discussion and specify Rx-Tx method.
2. **HARQ-ACK Enhancement:** The benefits of the schemes for SPS HARQ-ACK skipping and size reduction are questionable and it could have negative system impact. We support removing this feature.
3. **Intra-UE multiplexing/prioritization:** We support the explicit addition of “simultaneous PUSCH and PUCCH transmissions” as it is already agreed in RAN1. We are fine with some down-scoping for some of the intra-UE multiplexing/prioritization cases, simply it is not feasible to specify all the cases considered in RAN1.
 |
| Xiaomi | 1. For CSI enhancements, we support the proposal from the feature lead in [RP-211297](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_92e/Docs/RP-211297.zip)
2. For Propagation delay compensation, we have the similar view with Huawei
 |
| CMCC | **For propagation delay compensation enhancements**RTT-based method is used for positioning procedure which requires UEs/gNBs performing special measurement on signals for positioning and signalling exchange between UE and network. It seems that the current NAS signaling for positioning needs to be adapted into AS signaling for the TSC PDC, which will require significant discussion for details. From our perspective, RTT-based PDC method is not so simple that can reduce the work load of the WID. Additionally, although RAN1 had evaluation on the feasibility of meeting the high time synchronization accuracy of both TA-based PDC enhancements and RTT-based PDC enhancements, RAN4 haven’t been involved in the discussion. Therefore, we prefer not to so rush to preclude the TA-based PDC solution in RAN plenary and continue the evaluation and discussion in RAN1/4/2.  |

## Summary of initial phase

Based on the inputs from 20 companies, the following observations are made:

* **Observation1:** All companies who have provided inputs to [92-e-15-IIoT-URLLC-Scope] are supportive of downscoping and/or guidance for a more focused discussion in future working group discussions would be necessary.
* **Observation2:** Companies proposed the following areas for downscoping and/or guidance for a more focused discussion
	+ *CSI feedback enhancement [RAN1]*
		- In general, all companies were supportive of downscoping or having RAN guidance in RAN#92-e to focus on a subset of candidate solutions in future meetings.
		- Majority of companies have indicated support for limiting next RAN1 discussions to the two schemes identified by the proposal in the chairman's notes from RAN1#105-e and in RP-211297.
		- However, concerns were raised by Nokia/NSB, Futurewei, and Intel on the proposal in RP-211297. Furthermore, Apple prefers to keep the RAN level discussions to deciding whether Rel-17 enhancement on CSI feedback is removed or not without touching on technical aspects for selection of certain schemes.
	+ *HARQ-ACK enhancement [RAN1]*
		- A number of companies indicated support for no further discussions on SPS HARQ-ACK skipping and size reduction.
		- A number of companies indicated preference to defer the decision to RAN#93-e.
	+ *Propagation delay compensation enhancements [RAN2, RAN1, RAN3, RAN4]*
		- Nokia/NSB, Ericsson, Huawei, Qualcomm, and Xiaomi were explicitly supportive of having RAN guidance in RAN#92-e to focus on a subset of candidate solutions in future meetings.
		- OPPO indicated preference to defer the decision but can accept removing TA-based PDC enhancement in Rel-17. A number of other companies also indicated preference to defer the decision to RAN#93-e.
	+ *Intra-UE multiplexing* *and prioritization [RAN1]*
		- Nokia/NSB, OPPO, Ericsson, Samsung, Apple, LGE, Intel, and MTK were explicitly supportive of downscoping in RAN#92-e. However, the views on how to do the downscoping were divided.
		- A number of companies indicated preference to defer the decision to RAN#93-e.

# Intermediate phase

Based on the observations from the initial phase, the following set of recommendations are made from the moderator for further discussion in the intermediate phase.

* **Recommendation1**: Provide the following RAN guidance on *CSI feedback enhancement [RAN1]*
	+ Focus subsequent working group discussions on the schemes proposed in RP-211297.
* **Recommendation2**: Provide the following RAN guidance on *HARQ-ACK enhancement [RAN1]*
	+ No further discussions on SPS HARQ-ACK skipping and size reduction.
* **Recommendation3**: Provide the following RAN guidance on *Propagation delay compensation enhancements [RAN2, RAN1, RAN3, RAN4]*
	+ Support TA-based propagation delay compensation based on the Rel-15/16 timing advance procedure in Rel-17 without changes on existing TA requirements/procedures.
	+ RAN1/2/4 to focus on RTT-based propagation delay compensation enhancements in Rel-17.
* **Recommendation4**: Defer the discussion/decision on downscoping for *Intra-UE multiplexing* *and prioritization [RAN1]* to RAN#93-e.

Companies are invited to provide their views on the four recommendations listed above. When providing their views, each company should carefully consider the current status of Rel-17 work item on Enhanced IIoT and URLLC. As of now, the work item is behind schedule and without any downscoping in RAN#92-e, there could be serious issues in ensuring timely completion of the work item.

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| **Company** | **Views** |
| OPPO | We are ok with Recommendations {1,2,4} but oppose Recommendation 3 saying to focus on RTT-based PDC. As mentioned in initial round, it is our observation that RTT-based PDC still has several issues not discussed yet in RAN1 to justify it as a promising PDC solution over the others. The earlier RAN1 time was mainly spent on TA-based PDC. It is quite risky to lock on RTT-based solution without any technical discussion. We strongly suggest to wait for another quarter. BTW, the initial round options from companies on Rel-17 PDC, as summarized below, do not seem to show the majority preference on RTT-based PDC as single way-forward. Narrow-down on RTT-based PDC (7): Nokia/NSN, Ericsson, Huawei/HiSi, Telecom Italia, Xiaomi, Leaving to WG study/till next RAN (8): OPPO, CATT, vivo, LG, ZTE, Intel, MediaTek, CMCC |
| FUTUREWEI | On recommendation 1, we do not agree of the proposal. RAN plenary should provide guidance to WG on how to properly conduct their work instead of selecting specific technical solutions. During RAN1 discussions, evaluation methodology was agreed in order to compare proposals. Companies made a lot of efforts to provide evaluation results based on the agreed methodology. However, these results were largely bypassed during the discussions. Proposals with significant performance gains shown by the companies are put down with the excuse of standards impacts. The FL way forward includes proposals even the supporting companies cannot show performance benefit. Note that 2-3 in the WF also has significant amount of standards impacts even though no performance benefit was shown. Interested companies can read the Feature Lead summary in RAN1 (R1-2106177). In addition, we agree with Nokia that 2-3 is not even within the scope of this work item. |
| InterDigital | We support the Recommendations {1, 4}For the Recommendations {2}, we still prefer to let RAN1 discuss further on SPS HARQ-ACK skipping and size reduction and revisit again if needed in RAN #93e. But, if majority support downscoping in this meeting, we won’t object it. |
| Qualcomm | * **Recommendation1**: We support the proposal.
* **Recommendation2**: We prefer to keep SPS HARQ-ACK skipping without HARQ-ACK bundling/compression.
* **Recommendation3**: We support the proposal.
* **Recommensdation4**: We support the proposal.
 |
| vivo | We are OK with Recommendations {1, 4}. For Recommendations {2}, based on the initial round discussion, we observed that * Nokia, NSB, Ericsson, InterDigital, Samsung, QC, Intel, vivo support to check the status in RAN#93.
* Sony, MTK, CATT, LG explicitly suggest down-scoping or de-prioritizing the SPS HARQ-ACK skipping and size reduction.

Note that RAN1#105-e meeting did not allocate any time for discussing the SPS HARQ-ACK skipping and size reduction. It does not need to be down-scoped at this point.For Recommendation {3}, we share the views and observations with OPPO. It can be left to WG study/till next RAN. |
| Samsung | OK with Recommendations 1 and 2.For Recommendation 2, it is clear that further discussion on the proposals will not be a good use of RAN1 time and HARQ-ACK has many more important issues to resolve.For Recommendation 3, it is premature to decide one between TA based and RTT based in this RAN plenary since RAN1 hasn’t conclude whether RTT based can satisfy the requirement or not yet.  For Recommendation 4, we think that some down-scoping for intra-UE multiplexing would be very beneficial as the number of open design issues is very large. Several such issues can be considered for down-scoping, as also proposed by others, including the support for simultaneous PUSCH and PUCCH transmissions that will not result to any realistic benefit under the Rel-17 restrictions. |
| Huawei, HiSilicon | 1. Agree with recommendation 1 with some modification for clarification as below. In our understanding, the main point for recommendation 1 is to give guidance that RAN1 will focus on the two schemes (i.e. *increasing the number of bits used for the reported subband CQI* & *reporting of delta-MCS)*, as to the details like how to calculate delta-MCS, it can be up to further discussion in RAN1. Therefore, some further clarification as below is necessary to make it clearer, especially the proposal in RP-211297 also includes some bullet for the details which may cause different understanding to people on the scope of this recommendation 1.  * **Recommendation1**: Provide the following RAN guidance on *CSI feedback enhancement [RAN1]*
	+ Focus subsequent working group discussions on the schemes proposed in RP-211297. Note that details, e.g. how to calculate delta-MCS, are up to further working group discussions.

2. We don't agree with recommendation 2. It is not that critical to give guidance in this RAN plenary for HARQ-ACK enhancements. If we really want some guidance, we agree with the proposal in RP-211112 from the rapporteur to preclude SPS HARQ-ACK bundling/compression, which obviously will need much standard effort. For SPS HARQ-ACK skipping, it is expected that the standard effort is very limited and also it is beneficial for different scenarios. Therefore, if we really want to do some down-scoping here, SPS HARQ-ACK bundling/compression should be taken out instead of SPS HARQ-ACK skipping. Therefore, we prefer to modify recommendation 2 as below:* **Recommendation2**: Provide the following RAN guidance on *HARQ-ACK enhancement [RAN1]*
	+ No further discussions on SPS HARQ-ACK bundling/compression ~~skipping and size reduction~~.

3. Agree with recommendation 3. If we cannot achieve consensus on recommendation 3 unfortunately, we can consider some guidance below to help achieve more progress in the further discussions.**For propagation delay compensation enhancements, RAN1 should send out the LS(s) if any in RAN1#106-e on the issues that need feedback or inputs from other working groups, e.g. LS to ask RAN4 to check the feasibility and potential enhanced value for Te and TA command indication granularity.** 4. Agree with recommendation 4. |
| Moderator | First, seems I have misunderstood the comment from OPPO. I stand corrected.Based on the inputs so far and my own assessment, it is clear that RAN guidance to better focus the efforts in the working groups would be very important. Without this, we run the risk of not being able to support any enhancements in Rel-17 for some of the key objectives in the work item.I understand that each company might be supportive of some of the recommendations but, at the same time, have strong negative views on the other ones. However, rather than trying to pick your favourite recommendation and remove the rest, I request that everyone consider taking all 4 recommendations as a package. And if there are any revisions that you would like to offer on the 4 recommendations, please so do.In RAN#92-e, we have a chance to refocus the work in a modest manner. If we fail to do so, the decisions that we might need to take in future meetings could be more drastic. |
| DOCOMO | Agree with the Recommendations 1, 3, and 4.For the Recommendation 2, we share similar view with HW/HiSi that the proposal in RP-211112 from the rapporteur is preferable. SPS HARQ-ACK bundling/compression will require much standard efforts, while SPS HARQ-ACK skipping will not. Therefore, we support the updates from HW/HiSi. |
| CATT | **Recommendation 1**: Support.**Recommendation 2**: Support. The views on ACK skipping, NACK skipping and HARQ-ACK skipping for SPS HARQ-ACK were divergent in the previous RAN1 meetings. It is unlikely that RAN1 can make a quick decision to support those schemes. In addition, considering that it is already very challenging to finalize the agreed five HARQ-ACK enhancement schemes, recommendation 2 is a reasonable proposal.**Recommendation 3**: Do not agree. As commented by other companies, it is still under discussion in RAN1 whether/how to meet the requirement based on TA-based enhancements. It is pre-mature to preclude the solution which is simpler with less specification impact.**Recommendation 4**: Support. |
| OPPO-2 | **Recommendation3:** We understand the purpose of this discussion is to ensure WGs (especially RAN1) can finish the URLLC objectiveness in time. However, for propagation delay compensation, locking on RTT-based PDC that has not been fully discussed would raise the risk against that purpose. In addition, the URLLC rapporteur once asked right before RAN1 #105e to add email discussion threads for PDC, but the decision at that time was to leave PDC fully away from RAN1 #105e handling because it was believed the PDC agenda was still on the right track. It is then somehow surprising the down-scoping becomes necessary after RAN1 #105e.The comments posted so far shows a roughly 50-50 between companies preferring and companies not preferring making down-selection in this plenary. So would the following be considered a compromise for Recommendation 3?* **Recommendation3**: Provide the following RAN guidance on *Propagation delay compensation enhancements [RAN2, RAN1, RAN3, RAN4]*
	+ Support TA-based propagation delay compensation based on the Rel-15/16 timing advance procedure in Rel-17 without changes on existing TA requirements/procedures.
	+ RAN1/2/4 to focus on ~~RTT-based~~UE-based propagation delay compensation enhancements in Rel-17.
	+ RAN1 strives to narrow-down enhancement candidates in RAN1 #106e. Revisit in RAN #93e if necessary.
 |
| Intel | We can support Recommendations 2,3,4 to move forward, although for Recommendation 2 it is not our preference, but we can accept as is.For Recommendation 1, it is a sensitive topic which received a sustained objection in RAN1#105-e. We don’t think the situation is as simple as to push again to agree on what was objected in RAN1#105-e. We agree with Futurewei that RAN should guide how to resolve the issue, e.g. to make decision based on evaluation results.By the way, the suggested way forward cited by us in the initial round was never seriously considered in discussion, and we hope it can receive support since covers the latest FL proposal. |
| Ericsson | In general, we support the recommendations above to ensure timely completion of the work item. Please find some additional comments below:**Recommendation1**Focusing on schemes in RP-211297 is the most reasonable RAN guidance. This respects the best compromise achieved after extensive debate in RAN1, and was clearly supported by majority companies in RAN1 discussion. We disagree with Intel suggestion for discussing Case-1 schemes, which raises many technical questions and lead to repeating RAN1 debate in RAN.**Recommendation2**We can support recommendation 2. It’s also acceptable to defer the decision to September plenary.**Recommendation3**For TA-based, suggest adding “for the smart grid scenario”. That is, “For the smart grid scenario, support TA-based propagation delay compensation based on…”We support the bullet for RTT-based method. |
| MediaTek | * **Recommendation-1:** We can accept it, although we have concern on the usefulness and the spec impact of Case-2.
* **Recommendation-2:** Support.
* **Recommendation-3:** Object. As we mentioned before, this is against the technical discussion in RAN1. If TA-based can meet the requirements with some enhancements, there is no need to define another solution (i.e. RTT-based).
* **Recommendation-4:** We are fine with deferring the discussion to RAN#93-e.
 |
| Apple | From earlier comments from other companies, it seems we have run into a deadlock on CSI enhancements. If all companies can agree with a WF, we are okay to continue the discussion in RAN1. If that is not achievable, then removing CSI enhancements totally should be considered, that at least can leave more GTW time for other topics under Rel-17 eIIoT/URLLC. We support recommendations 2 and 4. |
| Nokia, NSB | **Recommendation 1: Oppose** The initial agreements reached on CSI enhancements stated that down-selection of proposed schemes should be made based on technical benefits, specification and implementation impacts. The count of supporting companies, while important, cannot substitute the agreed down selection criteria. We don’t think that the arguments and simulation results provided in WG discussion, justify recommendation 1. We are aware that RAN is not the best place to go deep into the technical details of the WG discussions. However, for the sake of example, we can highlight that simulation results of Case-2 show little gain or even a performance loss compared to the baseline (see e.g. the evaluation in R1-2105472), whereas majority of companies have shown clear benefits for many of the Case 1 proposals that are currently on the table. Similarly, for Case 1 schemes, there are no technical reasons on why *increased sub-band CQI reporting granularity* should be preferred over other schemes such as *minimum/worst-CQI reporting:* both offer similar gains in terms of link adaptation accuracy, both have a small specification effort, but the *minimum/worst-CQI reporting* can provide significantly lower CQI reporting overhead. As Futurewei pointed out above, case 2-3 is based on our understanding not even in the WI scope.We share Intel’s support for the following proposal, from RAN1#105-e [R1-2106177],* *Enhance the sub-band CQI reporting with extra configurability on reporting content and sub-band CQI granularity.*
	+ *Sub-band CQI reporting granularity is increased to 3 (differential CQI) and 4 bits (4 bits can represent actual CQI).*
	+ *Reported content is based on sub-band CQIs which can be configured as reporting of all sub-band CQIs, minimum (for all or sub-set of sub-bands) CQI, or average (for all or sub-set of sub-bands) CQI.*
	+ *Network configured channel and interference measurement interval can enable the reported CQIs to capture frequency domain and time domain interference variation.*

And we highlight the necessity to prioritize technical criteria for schemes down slection. **Recommendation 2:** We **prefer the changes proposed by Huawei/HiSi** **as also suggested by Qualcomm & DoCoMo** (to keep the HARQ-ACK skipping, but remove bundling / compression only) **but would not object to recommendation 2.** **Recommendation 3:** **Support.** As HW/HiSi pointed suggested, if recommendation 3 cannot be agreed it would be good to at least guide RAN1 to finally send the discussed LSs to RAN4. **Recommendation 4**: **Support.** Although we would have preferred some down scoping but can accept to come back (if needed) at RAN#93.  |
| ZTE | We are fine with Recommendations {1,2,4}, while have concerns on Recommendation 3. As we commented in initial phase, the discussion in previous RAN1 meetings mainly focused on TA-based solution, and the evaluation results in RAN1 have already showed that TA-based solution can fulfil the synchronization target. For TA-based solution, specification effort is still needed in Rel-17 to reduce the component error, e.g., reduced TA granularity. This specification effort is expected to be minor compared to RTT based solution which needs signalling exchange between UE and network, configuration and measurement of reference signal etc., as commented by many companies. Therefore, we think we should focus on the spec effort on TA-based solution first instead. |
| Sony | We are supportive of all 4 recommendations.On Recommendation 2 (that we fully support), we share similar view with Samsung & CATT. The views are very diverged and in each scheme, we have more than 1 company’s objection. Also, the benefit of HARQ-ACK skipping/size reduction is dubious at best and more likely to create issues. We should not spend more time on these topics since there are more beneficial topics to discuss under HARQ-ACK and we are running out of time. |

## Revised recommendations based on intermediate phase

Based on the discussions in the initial phase and the comments received on the four recommendations in the intermediate phase, the revised recommendations are provided below.

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| --- |
| * **Revised Recommendation1**: Provide the following RAN guidance on *CSI feedback enhancement [RAN1]*
	+ Focus subsequent working group discussions on the schemes proposed in RP-211297.
		- Details (e.g. how to calculate delta-MCS) are up to further working group discussions.
 |

Having to rely on RAN for down-selecting technical schemes is certainly something that is not preferred. However, RAN1 has spent too much time and effort without making any progress on this issue. **Recommendation1** is the best course of action that can be suggested at this time. Note that **Recommendation1** has been modified by adding the wording from Huawei. Although this should be common understanding even without the additional text, there is no harm in having the text.

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| --- |
| * **Revised Recommendation2**: Provide the following RAN guidance on *HARQ-ACK enhancement [RAN1]*
	+ No further discussions on SPS HARQ-ACK ~~skipping and size reduction~~bundling/compression.
 |

**Recommendation2** has now been revised to only stop the work on SPS HARQ-ACK bundling/compression.

**Recommendation3** is now removed given the concerns raised by multiple companies. Depending on the progress made in working groups in Q3, RAN might need to revisit the issue in RAN#93-e.

In general, there has not been serious concerns raised on **Recommendation4**. However, since there is not going be any decision in RAN#92-e with regards to downscoping of *Intra-UE multiplexing and prioritization [RAN1]*, we do not need further discussion on **Recommendation4**. Again, depending on the progress that the working groups make in Q3, RAN might need to revisit the issue in RAN#93-e.

In summary, the following are the revised recommendations after the intermediate round of discussions.

* **Revised Recommendation1**: Provide the following RAN guidance on *CSI feedback enhancement [RAN1]*
	+ Focus subsequent working group discussions on the schemes proposed in RP-211297.
		- Details (e.g. how to calculate delta-MCS) are up to further working group discussions.
* **Revised Recommendation2**: Provide the following RAN guidance on *HARQ-ACK enhancement [RAN1]*
	+ No further discussions on SPS HARQ-ACK ~~skipping and size reduction~~bundling/compression.

## Outcome of GTW session (Wednesday)

During the GTW session the following recommendations with further revisions were endorsed.

* **Revised Recommendation1**: Provide the following RAN guidance on *CSI feedback enhancement [RAN1]*
	+ Focus subsequent working group discussions on the schemes proposed in RP-211297.
		- Details ~~(e.g. how to calculate delta-MCS)~~ are up to further working group discussions.
* **Revised Recommendation2**: Provide the following RAN guidance on *HARQ-ACK enhancement [RAN1]*
	+ No further discussions on SPS HARQ-ACK skipping and size reduction~~bundling/compression~~.

In addition, the guidance from RAN chair was to focus on Recommendation3 (*Propagation delay compensation enhancements [RAN2, RAN1, RAN3, RAN4]*) in the final round of email discussions.

# Final phase

During the GTW session on Wednesday, the guidance from RAN chair was to focus on Recommendation3 (*Propagation delay compensation enhancements [RAN2, RAN1, RAN3, RAN4]*) for the final phase. Recommendation3 from the intermediate phase is provided below.

* **Recommendation3**: Provide the following RAN guidance on *Propagation delay compensation enhancements [RAN2, RAN1, RAN3, RAN4]*
	+ Support TA-based propagation delay compensation based on the Rel-15/16 timing advance procedure in Rel-17 without changes on existing TA requirements/procedures.
	+ RAN1/2/4 to focus on RTT-based propagation delay compensation enhancements in Rel-17.

As of now, Intel, Sony, Nokia/NSB, Qualcomm, Huawei/HiSi, Ericsson (with slight rewording), and DOCOMO have indicated that they can accept Recommendation3. On the other hand, ZTE, MTK, OPPO, CATT, vivo, and Samsung have indicated that it is premature to take Recommendation3 at this time.

Given the guidance from the RAN chair, it would be appreciated if companies can provide suggestions on how to provide RAN guidance (e.g. by revising Recommendation 3) to the working groups for *Propagation delay compensation enhancements [RAN2, RAN1, RAN3, RAN4]* rather than indicating preference to defer the discussions.

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| --- | --- |
| **Company** | **Views** |
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# Conclusions

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# References

[1] RP-211112 Rapporteur views on Rel-17 URLLC/IIoT WI focus Nokia, Nokia Shanghai Bell

[2] RP-211113 Revised WID: Enhanced Industrial Internet of Things (IoT) and ultra-reliable and low latency communication (URLLC) support for NR Nokia, Nokia Shanghai Bell

[3] RP-211154 Discussion on Rel-17 enhanced NR IIoT/URLLC progress and WID scope revision vivo

[4] RP-211210 Discussion on scope of Rel-17 enhanced IIoT and URLLC CATT

[5] RP-211257 On CSI Feedback Enhancements for Enhanced URLLC/IIoT Ericsson

[6] RP-211297 Way forward on CSI feedback enhancements for enhanced URLLC/IIoT InterDigital, Inc., Ericsson, Motorola Mobility, OPPO, Qualcomm, Samsung, SONY, Spreadtrum

[7] RP-211430 On CSI feedback enhancements for URLLC/ IIoT Futurewei

[8] RP-211436 Views on WI scope of Rel-17 Enhanced IIoT and URLLC ZTE, Sanechips

[9] RP-211462 Discussion on CSI feedback enhancements for URLLC/IIoT MediaTek Inc.

[10] RP-211187 Discussion on status of Rel 17 work Samsung

[11] RP-211111 Status report for WI: Enhanced Industrial Internet of Things (IoT) and ultra-reliable and low latency communication (URLLC) support for NR RAN2

[12] RP-210854 Revised WID: Enhanced Industrial Internet of Things (IoT) and ultra-reliable and low latency communication (URLLC) support for NR Nokia, Nokia Shanghai Bell