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Variant of [94e-40-R17-IIoT-URLLC-WI] Version 0.0.2

RAN

3GPP TSG RAN Meeting #94-e RP-213617

Electronic Meeting, December 6 - 17, 2021

Agenda Item: 9.3.2.1

Source: Moderator (RAN1 VC, CMCC)

Title: Email discussion on [94e-40-R17-IIoT-URLLC-WI]

Document for: Discussion & Decision

1 Introduction

In RAN#94-e, contributions [1-12] are brought up for seeking guidance or confirmation from RAN on how to proceed with the open issues in RAN1. From these contributions, main points concentrate on the necessity of down-scoping in RAN#94-e, which issues to be left or prioritized if some exercise is highly motivated.

From these contributions, contribution [3, 5, 6, 7, 10] propose to deprioritize or down-scope Capability #3, and focus on Capability #1 in Rel-17 maintenance, contribution [4] lists company's view on critical issues without including Capability #3, contribution [1] proposes to proceed with closing all open issues in the coming quarter without down-scoping anything in this meeting. Contribution [8, 9] are quite supportive to continue the discussion on Capability #3 together with Capability #1, while [8] is proposing down-scoping most of the pending scenarios listed with more details in the contribution than the list of remaining open issue in SR[2]. Contribution [11] proposes RAN to facilitate the RAN1 work by either concluding the support or termination of some time-consuming issues, specifically, whole URLLC/IIoT Intra-UE multiplexing without differentiating Capability #1 and Capability #3. In addition, for some issues that achieved no consolidate agreement till now, [11] ask RAN for intervention in the decision on "support of the PUCCH format 2 for Rel-17 intra-UE multiplexing".

Contribution [11] also asks RAN to guide RAN1 to conclude the support of positioning SRS for RTT-based propagation delay compensation latest by the end of RAN1#107bis-e (Jan. 2022). Similarly, contribution [12] provides more detailed analysis of the sub-features, but in general, it suggests that RAN1 should strive to conclude the open issues in RAN January meeting, or otherwise those sub-features should be dropped.

Other proposals in [4, 7], such as "minimize RAN2 impacting decision", "strive for finishing at least issues having impact on ASN.1 in Q1 2022 have already been implemented in RAN1 as general principle and guideline, it should not be an issue from moderator's understanding.

Based on review of these contributions, and the summary above, moderator would like to propose to discuss these 5 issues in this meeting:

Issue 1: The supported UE capalibity/capabilities for Rel-17 Intra-UE multiplexing

Issue 2: The support of multiplexing of UCI of different PHY priorities also for PUCCH format 2

Issue 3: How to handle a few multiplexing details of UCI of different priorities on PUCCH/PUSCH?

Issue 4: How to handle joint operation of UCI multiplexing with different priorities and simultaneous PUCCH/ PUSCH transmission?

Issue 5: Necessity for RAN to guide RAN1 to set a deadline for some features?

2 Initial Round Disussion

2.1 Issue 1 - The supported UE capalibity/capabilities for Rel-17 Intra-UE multiplexing

Option 1: RAN to confirm the RAN1 working assumption on UE capability #3 support of the Rel-17 Intra-UE multiplexing framework.

- Support: Nokia, CATT, Intel, vivo

Option 2: RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 before Q1 2022 for Rel-17 intra-UE multiplexing framework.

- Support: Huawei, Qualcomm, Apple

Option 3: RAN to inform RAN1 to stop the work on Capability #3 for intra-UE multiplexing enhancements of different PHY priorities on PUCCH / PUSCH.

- Support: Ericsson, MTK

Option 4: RAN to inform RAN1 to stop the work on URLLC/IIoT Rel-17 Intra-UE multiplexing enhancements of different PHY priorities on PUCCH / PUSCH if working assumption on UE capability #3 is not confirmed in RAN

- Support: Nokia

Feedback Form 1: Could we confirm the support or the removal of Capability #3 in Rel-17?

1 – TELECOM ITALIA S.p.A.

Drop the overall Rel-17 Intra-UE multiplexing enhancements from Rel-17

According to the Status Report:

*earliest estimated completion by **RAN#96** (end of Q2/2022)*

This is absolutely not acceptable in terms of workplan and cross-WG impact.

2 – Sony Europe B.V.

Option 1: **Support Capability#3 and confirm the working assumption.**

It should be firstly noted that Capability #1 is a **step back (i.e. DEGRADATION)** from Rel-16 since when intra-UE mux is RRC enabled, the UE is unable to perform Rel-16 prioritisation, which was introduced for latency purpose. **Capability #1 basically removes the "LL" in URLLC** (Ultra Reliable & LOW LATENCY Communication).

Capability #3 is the only capability that is an improvement from Rel-16 has it keeps the Reliability and Low Latency aspects of URLLC. It should be noted that prior to Capability #3, there was a Capability #2 (RRC enable Rel-17 Intra-UE Mux and Rel-16 Intra-UE priortisation) and it was fiercely argued that it was too complicated because UE needs to keep track of timeline. In Capability #3, the timeline is a gNB's responsibility and such complexity has been removed. Hence we do not see any reason why Capability #3 cannot be introduced.

3 – KT Corp.

Option 4. Dropping Intra-UE multiplexing from Rel-17 seems to be only realistic considering the time left for Rel-17. Also agree with Telecom Italia that estimated completion has cross-WG impact.

4 – vivo Mobile Communication Co.

Option 1. We admit that some specification efforts are needed for Cap#3, but considering the benefits of Cap#3 compared to Cap#1 for URLLC, and less complexity for the UE implementation since Cap#3 does not require UE to do the timeline checking (all is under gNB's control), we think Cap#3 is a good compromise and we should confirm to support it.

5 – MediaTek Inc.

We support Option #3 (drop Capability#3) and we can accept Option#4 (drop Rel-17 Intra-UE multiplexing).

Capability#1 offers the possibility of multiplexing between HP and LP channels, with better protection/reliability for the HP traffic. In this sense, it is incorrect to say Capability#1 is a "degradation".

Given the following NR features introduced in R16/R17 for intra-UE multiplexing/prioritization, there is no essential benefits of Capability#3:

- R16 prioritization procedures
- R17 HARQ-ACK re-transmission procedures
- R17 multiplexing procedures
- R17 simultaneous PUCCH/PUSCH transmissions for different prioritise.

Also, with the amount of open issues with Capability#3 and the lack on consensus in RAN1 on how to address these issues, it will require a long period of time (1 year) to be finalized.

6 – Ericsson LM

As we commented during GTW, there are two aspects to consider: 1)Make realistic assessment of the remaining work 2)Invest time on feature brining meaningful values

Our understanding of the group interest from last RAN plenary discussion was eagerness to continue working on Intra-UE multiplexing. Based on that, if the group really insists to continue working, there is a chance to complete Cap#1. In that regard, Cap#3 doesnt stand a chance. **Hence, we proposed Option 3.**

However, as we mentioned in GTW, we really question why we have to spend resources on Cap#1 since Cap#3 is the feature that indeed brings additional value. Please note that with Cap#1 or Cap#3, basically we get LP UCI (specially HARQ-ACK) with HP UCI. All these troubles for receiving LP UCI with HP UCI is overkill. The most important LP UCI is HARQ-ACK that we can already request to be retransmitted by other features introduced in Rel-17. In other words, RAN1 has multiple features doing basically the same job. Therefore, it is not clear to us why at this late stage, we dont take the wise decision and admit that this is a complicated topic and better to leave it as it is. Please note that Maintenance of intra-UE multiplexing of Rel-16 is still on-going. So, the most sound decision would be to go with Option 4 and **drop Intra-UE multiplexing.**

7 – InterDigital Belgium. LLC

We prefer Option 1. In our understanding, a Capability#1 UE configured to enable multiplexing of LP and HP UCI cannot apply R16 prioritization for urgent URLLC traffic. Only a Capability#3 UE has the benefit of allowing LP and HP intra-UE multiplexing without losing the prioritization possibility from R16. In addition, we do not think that it would double the amount of work to specify both capabilities since the most complicated discussions on e.g. handling of more than two overlapping channels are common to both capabilities.

If Option 1 is not agreeable, we can accept Option 2 given that there are still valid use cases for Capability#1 UE. Assuming more time is available in January meeting to discuss this, completion by the end of Q2 (or even Q1) is possible at least for Capability#1 UE.

Option 4 would result in wasting 18 months of RAN1 work on this feature. In addition, the HARQ-ACK retransmission request feature would not properly replace the intra-UE multiplexing feature unless HP HARQ-ACK is transmitted very infrequently. Otherwise, the amount of required HARQ-ACK retransmissions may become unacceptable.

8 – Futurewei Technologies

We are OK to work on one more quarter for the RAN1 aspects, where the part (capability #3) that cannot fit per chair/GTW discussion is removed. We can accept either Option 2 or Option 3.

9 – Panasonic Corporation

We support Option 2 or Option 3 considering the amount of work load.

10 – Quectel

We support Option 2 or Option 3, although we have sympathy with proponents of Option 1. Capability #1 alone can still bring benefits in some scenarios. Per GTW discussion, it is still possible to complete the work if only Capability #1 is supported, so that the past RAN1 efforts are not wasted.

11 – DOCOMO Communications Lab.

We support Option 3 but can live with Option 4.

Firstly, we think down-coping is necessary at this RAN meeting because the estimated workload is too high to wrap-up in Q1. It will impact on other WGs without down-scoping. Therefore, we don't think Option 1, i.e. no down-scoping, is a realistic way as Capability#3 has several open issues and requires much efforts.

Regarding how to down-scope the intra-UE multiplexing discussion, we prefer Option 3. We share similar view on Capability#1 with MediaTek. Capability#1 offers the possibility of multiplexing between HP and LP channels with protection of HP channels, which could be identified as enhancement rather than degradation. Although Capability#1 is not appropriate for traffics with stringent latency requirement, we think it could be applied to traffics with more relaxed latency requirement such as AR/VR within the IIoT/URLLC scope.

On the other hand, we also agree that the gain from Capability#1 will be small. Therefore, if it is difficult to converge on Option 3, we can live with Option 4 since it is the only way that we go for in order to complete the IIoT/URLLC WI within Q1.

12 – ZTE Corporation

We support Option 1, and share with other companies views about the benefits of capability 3.

We think the main part of the working assumption for capability 3 without FFS is enough for the integrity of capability 3. For the FFS issues, some of them are the common issues for capability 1 and capability 3. For the issues specific to capability 3, we think RAN1 can continue the discussion and even if no consensus can be reached, we think many of them can be determined by RAN1 as error cases. So, we don't think the FFS points could be a stopper here.

13 – New H3C Technologies Co.

We slightly prefer Option 2 due to limited scheduled time and work load. If work scope or FFS of Cap#3 can be reduced or Cap#3 can be completed on time in Q1, 2022, we can live with Option 1.

14 – CATT

This is a controversial issue and a clear guidance from RAN is important. Among the options, we think option 2 is difficult to be followed in practice and we may spend additional RAN1 time to discuss cap#3 which is not supported in the end. We share the same view as other companies on the benefit of capability #3 and thus we prefer option 1. However, if that is not agreeable, we can live with option 3 to support at least capability #1 in Rel-17. Option 4 is clearly unfortunate which throw our efforts in the past 18 months away.

15 – Motorola Mobility UK Ltd.

Capability 1 allows Rel-16 prioritization and Rel-17 intra-UE multiplexing based on semi-static configuration (that is, there is an enhancement from Rel-16). Given that there are many open issues, RAN can provide guidance that RAN1 should prioritize discussions applicable to both capability 1 and capability 3 during Q1 2022. RAN can check the status of capability 3 in March 2022. If features for capability 3 are not complete in March 2022, RAN should remove capability 3 in Rel-17 (this principle should be applied not just for capability #3 but for all other incomplete features).

16 – OPPO

We are ok to either Option 2 or Option 3. Option 1 does not seem to align with the target that RAN chairman set as purpose for this discussion, which is to complete Rel-17 URLLC in time without interfering starting of Rel-18. Option-4 is clearly an over-tune given nearly 90% of RAN1 work (other than Capability #3) has been done for intra-UE.

17 – Apple Europe Limited

It is clear Option 1 is not practical: with many of the FFS points, and different understandings on the processing flow in general, it is hard to imagine with one or two meetings then convergence can be achieved, and the impact to the freeze of ASN.1 is real if Option 1 is taken. Being optimistic about little or no additional design choices with RRC impact is a hope but not a strategy we can follow through with.

Besides, NR design (even Rel-15 design) already provide a rich toolbox for the support of low latency, BWPs with different subcarrier spacings, the support of mini-slots for PDSCH/PUSCH, and the sub-slot HARQ feedback for both Type 1/Type 2, etc., prioritization is definitely not the only tool for low latency. Then with different coding rates for UCI types at HP and LP, unequal protection for HP UCI types can be supported, e.g. for traffic flows with different error requirements. We see Rel-17 intra-UE multiplexing provides two things 1) avoiding the dropping of LP HARQ-ACK, 2) avoiding the dropping of LP PUSCH. It is true for 1), there are alternative features: e.g. technology-1) HARQ retransmission with two flavors (e-Type 3 vs Type1/Type2), technology-2) PUCCH carrier switching and technology-3) simultaneous PUCCH/PUSCH Tx, however technology 2/3 requires inter-band CA, their use can be somewhat limited. However, none of those technology can handle 2) well. Hence we see value in the support of Cap. #1.

With discussions provided above from other companies, a clean decision following Option 3 is preferred, we are also fine with Option 2.

18 – Tejas Networks Ltd.

We support option#2 or #3 considering the workload.

19 – LG Electronics Inc.

We support Option 3, which is feasible way at this stage to ensure the completion of WI on time and is reasonable way in terms of supporting the multiplexing between LP and HP channels.

We also think Capability #1 would not be any degradation but bring benefits/gains in some cases, for example, operating with aggressive UE processing capability (e.g. PDSCH/PUSCH processing capability 2) or operating with relaxed latency requirement (as DOCOMO mentioned), and by enabling that, dropping LP channels (and retransmission overhead consumed for recovering them) could be avoided/minimized as much as possible.

For other cases (for example, operating with basic processing capability and tight latency requirement), the gNB could have flexibility to select between “enabling Rel-17 Capability #1” and “disabling Rel-17 Capability #1 (i.e., fallback to Rel-16 prioritization) + utilizing Rel-17 LP HARQ-ACK recovery schemes” according to traffic/system situation.

20 – HUAWEI TECHNOLOGIES Co. Ltd.

We prefer option 2 but can accept option 3 as well.

Rel-17 intra-UE multiplexing even only with Capability#1 is still useful. By offering the possibility of multiplexing HP and LP following the Rel-17 mechanisms, it improves at least reliability for HP compared to Rel-15 multiplexing mechanism by separate coding of HP and LP, and improves spectral efficiency for LP compared to Rel-16 prioritization by avoiding always dropping LP.

As captured in the RAN1 chairman notes, Capability 3 procedure is a super-set of Capability 1 procedure, which means Capability 1 related issues are kind of common aspects between Capability 1 and Capability 3, so we think it is reasonable to prioritize the discussions on Capability#1, which can ensure at least the

baseline branch completed in Q1 2022. Of course, meanwhile if possible we will also try to get Capability #3 done.

The major concern of confirming the WA on Capability#3 right now is that there are still many open issues with unclear details which still need technical analysis and discussions, thus there is no good judgement on whether to confirm it or not at this stage. Therefore, it is reasonable to give more time before making conclusion on whether to confirm the support or remove it. We can further check the status of Capability #3 in March and decided what to do.

Therefore, Option 2, i.e., prioritizing Capability#1, looks like the most promising way to move forward considering the current situations. However, if companies prefer very clear guidance from this RAN, we can accept option 3 as well.

21 – Spreadtrum Communications

We support Option 2 or Option 3. It basically does not pratical to finish Cap#3 within Q1 due to so many FFS points and different understandings awards some steps. With respect to our efforts in the past almost 2 years, let us finish Cap#1 to support intra-UE multiplexing in Rel-17 to support LP and HP multiplexin in a same UL channel.

22 – Intel Korea

We don't support removal of Cap#3. Support confirmation of Cap#3.

As was discussed in RAN WG1, the obvious downside of keeping only Cap#1 is that it cannot support time sensitive URLLC traffic, which is a huge step back from Rel-16. Supporting both Cap#1 and Cap#3 is the compromise way forward after several rounds of technical debates. RAN1 should equally treat Cap#1 and Cap#3 to provide a meaningful design for Rel-17 URLLC/IIOT.

23 – Qualcomm Incorporated

There is little motivation to continue work on Capability #3, given that its successful completion is unlikely. Even though the proposed working assumption is based on using the 2-step procedure for Capability #3, it is not our understanding that this is a workable solution. So some basic design decisions would have to be revisited for Capability #3, for which there is not enough time.

Therefore, we support Option 3, followed by Option 2.

The timeline limitations of multiplexing information associated with different UE processing time capabilities have been well known, even before Rel-17 started. We don't understand why now Sony, Intel et.al. claim this is something new that would negate the assumed benefits of multiplexing. Therefore Option 1 and Option 4 are not our preference.

24 – Nokia Germany

As already pointed out in our presentation in the GTW session, and as noted by Ericsson, we see little value of the overall Rel-17 Intra-UE multiplexing if we limit ourselves to the support of Capability #1 only. Therefore, **if RAN is serious about Rel-17 Intra-UE multiplexing Option 1 would need to be chosen** where the operation with different PHY priorities still makes sense in contrast to Option 2 / 3, where we are really wondering why the gNB/networks should operate with PHY priority in the first place (as the latency benefit and PHY priority overriding would not be supported).

But looking at the overall situation (the open issues independent of the UE capability #1/#3 discussions here), there are still soo many issues open for more than one year (independent of the chosen UE capabilities), we **suggest to drop the overall feature from Rel-17 by adopting Option 4**.

Several companies commented above that if we stop the work, the effort spent is lost – this is of course true. But we should be honest enough that RAN1 failed here to complete the work on this WI objective. We would like to note here again, that this objective has not been one of the 'study and if seen beneficial specify' but the support was clear from day 1. We had been rather quickly able to agree some what needs to be specified / supported (in Aug / Oct. 2020), but then we failed in RAN1 to provide tangible progress over the following remaining more than one year to agree the required details. Moreover, we have now in Rel-17 competing features in place that prevent LP HARQ-ACK dropping and therefore stopping the work / dropping the feature from Rel-17 from our perspective is not really having negative impact on the overall NR support for URLLC services (incl. PHY prioritization).

2.2 Issue 2: The support of multiplexing of UCI of different PHY priorities also for PUCCH format 2

Option 1: RAN to conclude to support the multiplexing of UCI of different PHY priorities also for PUCCH format 2.

- Support: Nokia

Feedback Form 2: Whether we can confirm the support of PUCCH format 2 for Rel-17 Intra-UE multiplexing?

1 – Sony Europe B.V.

Support PUCCH Format 2.

2 – vivo Mobile Communication Co.

Although PUCCH format 2 has been discussed for some meetings without a decision. But we think it is still possible for RAN1 to support it without any optimization.

3 – Ericsson LM

We support the proposal.

We should not create unnecessary fragmentation. We dont see much difference between PF3 and PF2 from coding point of view, while PUCCH format 2 is very crucial for operation on highband.

4 – InterDigital Belgium. LLC

Support the proposal.

5 – Panasonic Corporation

We also support PUCCH Format 2.

6 – Quectel

Support PUCCH format 2. It will not cost much time to conclude the design.

7 – DOCOMO Communications Lab.

Support the proposal.

8 – ZTE Corporation

Support the proposal. PUCCH format 2 for Rel-17 Intra-UE multiplexing is an important case. We don't see any strong technical concern in RAN1 discussion.

9 – New H3C Technologies Co.

Support this proposal.

10 – CATT

We support the proposal.

11 – Motorola Mobility UK Ltd.

In our view, existing RAN1 agreements for Rel-17 intra-UE multiplexing in PUCCH formats 3 and 4 can be reused for most of cases to support Rel-17 intra-UE multiplexing in PUCCH format 2. Nevertheless, we think the decision is up to RAN1 technical discussions.

12 – OPPO

We are ok with either way (support vs. not support). In fact, we think the decision could be left to RAN1 based on its progress in 2022'Q1, i.e., something like "supported if time allows"

13 – Samsung Electronics Romania

We strongly NOT support this proposal. This should be discussed and decided in RAN 1, not RAN. Actually, we think that this proposal is not seen as an issue that RAN intervention is required. Regarding technical benefits, if the resultant PUCCH format is PF2, there is no coverage issue in this scenario, short PUCCH formats can be used before multiplexing and gNB scheduling can avoid the collision to a large extent by scheduling in TDM manner. Furthermore, the proposal is an optimization which complicates the spec and implementation. The principle of UCI multiplexing of different priorities is to avoid increasing coding chain. Clearly, the proposal is against the principle.

14 – Apple Europe Limited

Since this is related to timely completion of Rel-17 URLLC, RAN intervention may be considered.

As there is not much restriction on the PUCCH resources configured under a PUCCH resource set, it may happen the resulted PUCCH resource from inter-priority UCI multiplexing is at PUCCH format 2 so it is natural to support PUCCH format 2. We support the proposal.

15 – Tejas Networks Ltd.

We support this proposal.

16 – LG Electronics Inc.

We support PUCCH format 2 for the multiplexing of LP and HP UCIs, since the PF2 is very likely to be used for HP UCI transmission in URLLC environments.

Dropping LP UCI PUCCHs just due to overlapping with HP PF2 should be avoided to minimize the re-transmission overhead for recovering the LP UCIs.

17 – HUAWEI TECHNOLOGIES Co. Ltd.

We support the proposal.

It is beneficial to support PF 2 for separate coding of HP HARQ-ACK and LP HARQ-ACK, since the PF 2 with up to 2OS length is a typical format for URLLC use cases, and other formats for >2 bits payload, i.e., PF 3/4, are both with >=4OS length. That means, if PF 3/4 are the only choices for carrying multiplexed HP and LP, the latency of HP after multiplexing would be impaired compared to HP only PUCCH which adopts PF 2.

18 – Nokia Germany

We support the proposal.

It should be noted here, that the RAN guidance would only be to support PF2 but not how to do this. The technical detail of course would be left to RAN1 (which seems to be miss-understood by some companies replies above). As already noted by some companies above, PF 2 is essential for the operation with 2OS sub-slot based PUCCH which is one of the essential overall URLLC related enhancements of Rel-16. Without the PF2 support, again, the overall value of the feature would even be further reduced.

19 – Intel Korea

We don't have strong preference, but overall feel this can be handled at WG level.

20 – Qualcomm Incorporated

We support the proposal, i.e. support including multiplexing of different priorities for PUCCH format 2 in Rel-17.

2.3 Issue 3: How to handle a few multiplexing details of UCI of different priorities on PUCCH/PUSCH

Option 1: RAN to guide RAN1 to stop the work on the pending scenarios for multiplexing details of UCI of different priorities on PUCCH/PUSCH, including

- LP PUSCH (UL-SCH only) + HP SR
- LP PUSCH + LP HARQ-ACK and/or CSI + HP SR
- All scenarios involving LP SR
- All scenarios involving LP CSI without LP HARQ-ACK

– Support: Vivo

Feedback Form 3: Do we need to step into these details in this RAN meeting? if yes, which pending scenarios are to be down-scoped? or could we leave it to RAN1 for the time being?

1 – TELECOM ITALIA S.p.A.

RAN1 clearly demonstrated they are not able to reach an agreement, therefore RAN must step in.

As stated before, we recommend to drop the overall Rel-17 Intra-UE multiplexing enhancements from Rel-17

2 – Sony Europe B.V.

I believe this scenario involves PUCCH Format 0 and 1, i.e. HP SR in either Format 0 or 1 and LP HARQ-ACK in Format 0 or 1, giving 4 combinations. There was a majority support for a single unifying solution in RAN1#107e, i.e.:

- If SR is positive, transmit LP HARQ-ACK using the HP SR PUCCH
- If SR is negative, transmit LP HARQ_ACK using LP PUCCH

Hence, we can complete this issue by taking the majority view.

3 – vivo Mobile Communication Co.

For the pending cases listed in Table 2 in RP-213258, there is no discussion held for supporting or not supporting them. Considering the timing, we thought it should be the common understanding that these cases will not be supported in Rel-17. It would be good to have explicit agreements to avoid the ambiguity and avoid further discussions on these cases.

4 – InterDigital Belgium. LLC

Agree that these can be deprioritized, but this may not need to be decided by RAN.

5 – Panasonic Corporation

We support the view from Sony.

6 – Quectel

We can accept this proposal. We are also OK to leave it to RAN1. We don't think this will cost much RAN1 time if we follow majority view.

7 – DOCOMO Communications Lab.

We agree with vivo and InterDigital. The cases can be deprioritized.

8 – ZTE Corporation

We can accept these cases to be dropped.

9 – New H3C Technologies Co.

we support this proposal

10 – CATT

We are not sure if any RAN guidance is needed. Our understanding is that the cases in the proposal are not supported since there are no agreements in RAN1 to support.

If any RAN discussion is needed, then we think we should discuss multiplexing of HP SR and LP HARQ-ACK as mentioned by Sony. This is the case we agreed to be supported in RAN1 but detailed solutions were extensively discussed but not agreed.

11 – Motorola Mobility UK Ltd.

In our view, multiplexing HP SR in LP PUSCH (the first and second scenarios) should be specified in Q1 2022, and other scenarios that are involved with LP SR and LP CSI should be deprioritized. Nevertheless, we think the decision is up to RAN1 technical discussions.

12 – OPPO

We share the same comment as from Sony that RAN1 already had the majority view on the solution. So we prefer a way other than Option 1, e.g., to leave RAN1 to progress upon the majority view.

13 – Samsung Electronics Romania

We understand that if RAN1 will not specify some scenario in extended work item period, then the scenario will not be supported and reused in existing behavior. In this sense, this proposal doesn't reduce remaining RAN1 workloads.

14 – Apple Europe Limited

It seems the discussion is centered on on SR. SR is important for dynamic grant based PUSCH transmission. And for URLLC, SR's periodicity can be small, and there can be multiple SR configurations; graceful handling of SR's collision with other channels should be supported.

We have the below agreements for a long time:

- Multiplexing a high-priority HARQ-ACK and a low-priority HARQ-ACK into a PUCCH in R17.
- Multiplexing a low-priority HARQ-ACK and a high-priority SR into a PUCCH for some HARQ-ACK/SR PF combinations (FFS applicable combinations).
- Multiplexing a low-priority HARQ-ACK, a high-priority HARQ-ACK and a high-priority SR into a PUCCH.

Their design should be quite straight-forward, and the benefit is quite clear.

We should be cautious in signing on new features, but for a feature we decide to develop, let us do a good job.

We don't support the proposal.

15 – LG Electronics Inc.

We think no RAN guidance is needed for this issue since it could be handled/discussed in RAN1.

16 – HUAWEI TECHNOLOGIES Co. Ltd. We do not have a strong view whether or not to down scope the detailed scenarios at RAN plenary. As there are no clear agreements to support these pending scenarios at RAN1, they will naturally not be supported unless new agreements are achieved at the maintenance phase. Ok to leave it to RAN1.
17 – Intel Korea Technical discussion of this level in RAN plenary may not be constructive, however we could agree to stop discussion on at least all scenarios involving SR. For CSI, we think there were agreements already on LP A-CSI, thus it is unclear whether the proposals are to also exclude the agreed cases or not.
18 – Nokia Germany **We may be fine to exclude the cases of PUSCH vs SR, but not the overall SR handling on PUCCH** (similar to the comment by Sony) We agree with Apple, that we have a decision from RAN1#102-e (Aug. 2020) to support the multiplexing on PUCCH but similar as for plenty of other pending issues on Intra-UE multiplexing, RAN1 was not able to proceed any further on the details in the following more than 1 year. Just RAN1 would need to make a decision on how to support (.. the possible solutions have been extensively discussed already) but this seems to be an overall issue for RAN1 there at the moment.
19 – Qualcomm Incorporated We don't think Plenary guidance is necessary for these details, the decision can be left to RAN1.
20 – Ericsson LM RAN plenary guidance for such detailed levels are not needed. However, these details are related to the outcome of Question 1 that whether to down-scope Intra-UE multiplexing or not. We suggest to focus the discussion on the first question.

2.4 Issue 4 - How to handle joint operation of UCI multiplexing with different priorities and simultaneous PUCCH/ PUSCH transmission

Option 1: For a PUCCH cell group, Simultaneous configuration of "UCI multiplexing with different priorities" and "Simultaneous PUCCH and PUSCH transmission within a PUCCH cell group on different CCs" is **NOT** supported in Rel-17 IIOT/URLLC WI

- Support: vivo, ZTE

Feedback Form 4: Could we agree in RAN that simultaneous configuration of "UCI multiplexing with different priorities" and "Simultaneous PUCCH and PUSCH transmission within a PUCCH cell group on different CCs" is NOT supported in Rel-17

1 – TELECOM ITALIA S.p.A.

RAN1 clearly demonstrated they are not able to reach an agreement, therefore RAN must step in.

As stated before, we recommend to drop the overall Rel-17 Intra-UE multiplexing enhancements from Rel-17

2 – vivo Mobile Communication Co.

The feature of UCI multiplexing with different priorities and the feature of simultaneous PUCCH/ PUSCH transmission for different priorities are duplicated functions. Even for each feature to work alone, there are some issues need to be solved. It is quite challenge and unnecessary to support them jointly.

3 – MediaTek Inc.

We don't support this proposal. These two features aim to avoid dropping of the LP traffic, and simultaneous configuration of these two features is essential for intra-UE multiplexing operation.

4 – Ericsson LM

Firstly, we dont support the proposal.

Secondly, as we mentioned for the previous question, RAN plenary guidance for such detailed levels are not needed. However, these details are related to the outcome of Question 1 that whether to down-scope Intra-UE multiplexing or not. We suggest to focus the discussion on the first question.

5 – InterDigital Belgium. LLC

This can be decided by RAN1.

6 – DOCOMO Communications Lab.

We share similar view with Ericsson. It is better to focus on the first issue about the down-scoping on intra-UE multiplexing. This issue can be discussed in RAN1 depending on the outcome of the down-scoping.

7 – ZTE Corporation

We do NOT support the proposal (Maybe we didn't provide clear position in our contribution)

As the two features both intend to protect the low priority transmission, it is reasonable and simpler to apply only one of them in a certain time unit. For example, if PUSCH and PUCCH are scheduled in different carriers in one slot, then they can both transmitted simultaneously. If PUSCH and PUCCH are scheduled in a the same carrier in one slot, then intra-UE multiplexing can be applied. If simultaneous configuration of the two features is not allowed, then it would imply gNB can only configure intra-UE multiplexing to accommodate above two examples. In other words, it would lost the meaning of supporting simultaneous PUCCH and PUSCH transmission.

So, our proposal is simultaneous RRC configuration of the two features is supported, while simultaneous use of the two features in a given time unit is not allowed.

8 – New H3C Technologies Co.

This issue should be discussed in RAN1.

9 – CATT

We think no RAN guidance is needed and the issue can be discussed and decided in RAN1.

10 – Motorola Mobility UK Ltd.

We think RAN can provide guidance whether to allow enabling two different features simultaneously to solve a similar problem (i.e. LP HARQ-ACK dropping).

We agree that simultaneous configuration of "UCI multiplexing with different priorities" and "simultaneous PUCCH and PUSCH transmissions of different priorities within a PUCCH cell group on different CCs" is **not** supported in Rel-17.

11 – OPPO

The decision can be made in RAN1.

12 – Samsung Electronics Romania

We don't agree this proposal. If Rel-17 intra UE multiplexing is not configured, the default behavior is Rel-16 prioritization. Joint operation of PUCCH+PUSCH and Rel-16 prioritization needs to be discussed anyway. A unified solution can be considered for Rel-16/Rel-17 intra UE multiplexing/prioritization and PUCCH+PUSCH. No additional spec impact is required. Further, supporting joint operation of Rel-17 intra UE multiplexing and PUCCH+PUSCH can provide additional scheduling flexibility and performance gain.

13 – Tejas Networks Ltd.

We recommend to drop the overall Rel-17 Intra-UE multiplexing enhancements from Rel-17.

14 – LG Electronics Inc.

We think no RAN guidance is needed for this issue since it could be handled/discussed in RAN1.

15 – HUAWEI TECHNOLOGIES Co. Ltd.

We are fine with proposal, but also ok to leave it to RAN1 to decide.

"UCI multiplexing with different priorities" and "Simultaneous PUCCH and PUSCH transmission" are viewed as individual solutions with the same target to enable the joint transmission of different priorities while avoiding the dropping of LP channel when introduced to Rel-17 WID. It will simplify the design of intra-UE multiplexing framework by not to support the joint operation (no need to embed the simultaneous PUCCH/PUSCH transmission related procedure into the unified procedure at Step 2 which is already sophisticated)

16 – Intel Korea

We don't think that the effort on combination of the two features is substantial. Anyway, it is better to be handled at RAN WG1 level.

17 – Nokia Germany

We agree with Ericsson, that the most important issue is actually Issue #1: Do we continue the overall work, and if so, for which UE capabilities. The joint operation support there is only a second level detail (and could be left to RAN1).

18 – Qualcomm Incorporated

We don't think Plenary guidance is necessary for this, the decision can be left to RAN1. In particular, it is unclear to us why these two features would be seen as interfering with each other rather than complementing each other, therefore we don't see any need for disabling using both.

2.5 Issue 5 - Necessity for RAN to guide RAN1 to set a deadline for some features?

Example 1: RAN to guide RAN1 to conclude on the support of positioning SRS for RTT-based propagation delay compensation latest by the end of RAN1#107bis-e (Jan. 2022).

Example 2: RAN to guide RAN1 to complete at least issues having impact on ASN.1 in Q1 2022 for multiplexing details of UCI of different priorities on PUCCH/PUSCH

Example 3: Minimize RAN2 impacting decisions in RAN1. If there are any RAN2 impacting decision, these should be made in RAN1#107bis meeting and informed to RAN2

Feedback Form 5: Is it necessary to guide RAN1 to set a deadline for support of some features? if yes, how to formulate the guidance for individual features? or could we leave it to RAN1?

1 – TELECOM ITALIA S.p.A.

RAN1 clearly demonstrated they are not able to reach an agreement, therefore RAN must step in.

In particular, in case of cross WG impact, the decision if keep in scope or remove should be taken at RAN#94.

Our recommendation is to remove from Rel 17 all the open issue swith cross WG impact.

2 – Ericsson LM

These issues should be left to RAN1.

3 – Futurewei Technologies

We prefer the issues to be left to RAN1, i.e. no guidance from RAN to RAN1 is necessary.

4 – DOCOMO Communications Lab.

These issues can be left to RAN1.

5 – New H3C Technologies Co.

These issues should be discussed in RAN1

6 – Motorola Mobility UK Ltd.

It should be a common understanding that any incomplete feature by Q1 2022 will be removed from Rel-17 spec. For detailed features, we think it is better to leave them to RAN1.

7 – Samsung Electronics Romania

We think that it is necessary to have RAN guidance on deadline to finish Rel-17 URLLC WID regardless of features. For example, all decision/features related to RAN2 impacts (e.g., RRC or MAC CE) should be finished until Jan. meeting. Other details related to RAN1 only should be finished until Feb. meeting. If some features will not finalized until the deadline, it should be assumed that those features are not supported in Rel-17 URLLC.

8 – LG Electronics Inc.

We think no RAN guidance is needed for this issue since it could be handled/discussed in RAN1.

9 – HUAWEI TECHNOLOGIES Co. Ltd.

We are fine not to set deadline for the issues listed here, we don't see the risk to complete these issues in Q12022.

10 – ZTE Corporation

For the support of positioning SRS for RTT-based PDC, RAN1 has not well discussed this issue before. So this should be discussed in RAN1 first. The guidance from RAN is not necessary.

We are ok to provide RAN guidance as proposed by example 2 and 3.

In addition, for the supported sub-features for HARQ-ACK feedback enhancements, there could be quite a lot of combinations/interactions among the sub-features even we only consider joint operation of 2 sub-features. If no guidance is provided for this aspect, we are afraid many many issues could potentially keep raising during a later phase and may result in a long tail of maintenance. So, we propose some guidance like: 'RAN tasks RAN1 to conclude the issues on interaction between sub-features for UE feedback enhancement for HARQ-ACK in Q1 2022 with minimum specification effort and minimum RAN2 impact. For those not concluded, they should be dropped in Rel-17'.

11 – Intel Korea

We are open to such level of guidance and agree in principle with all three examples. At the same time, especially points 2 and 3 look like a "business as usual" situation, common for all R17 work items.

12 – Nokia Germany

There may not be a need to have a timeline guidance per each individual open issue, but as also mentioned e.g. by Samsung **RAN should give some overall clear guidance, that features that are not finalized by the end of Q1/2022 are not be supported in Rel-17** (and potential already related existing description in the new Rel-17 specifications should be removed).
We also agree, that MAC CE & RRC impacts should be finalized in RAN1 in January 2022, to give RAN2 sufficient time to complete their work in time.

13 – Qualcomm Incorporated

Examples 2 and 3, are assumed to be known to RAN1, so no guidance would seem necessary. Example 1 would appear to be a consequence of Example 3, so again, doesn't seem that Plenary guidance is necessary.

14 – VODAFONE Group Plc

Our views are aligned with Telecom Italia and Samsung. If the technical discussion can be held at RAN1 for the features above without RAN guidance, we think that RAN should provide anyway clear guidance on the deadlines to complete them in order not to impact other WGs.

15 – Ericsson LM

We share the same view as Nokia and Samsung. We need to have a clear guideline endorsed by plenary as indicated by Chair in GTW that **any feature that is not completed by next plenary should be dropped.**

We are concern that companies reason on completion level being above 95% and argue to continue working on the feature. As an example, Intra-UE multiplexing is one of the features and its lack of completeness affects only few percent but the fact is that it requires huge amount of work. Therefore, to avoid yet another dispute in next plenary, it is very important to be very clear about expectations and consequences.

16 – Ericsson LM

Please note that our first comment was wrongly posted. So, our correct position is reflected by comment #15, and not#2. Sorry for inconvenience.

2.6 Other Issues: Any missing issues that are not listed as open ones?

Feedback Form 6: Any missing issues that are not listed as open ones?

2.7 Summary for the initial round discussion

2.7.1 Summary of Issue 1 - The supported UE capabilities for Rel-17 Intra-UE multiplexing

Option 1: RAN to confirm the RAN1 working assumption on UE capability #3 support of the Rel-17 Intra-UE multiplexing framework.

- **Support:** Nokia, CATT (1st), Intel, vivo, Sony, InterDigital (1st), ZTE, H3C,

Option 2: RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 before Q1 2022 for Rel-17 intra-UE multiplexing framework.

- **Support:** Qualcomm, Apple, InterDigital, Futurewei, Panasonic, Quectel, H3C (1st), OPPO, Tejas Networks, Apple(2nd), Huawei(1st), Spreadtrum, Qualcomm(2nd)

Option 3: RAN to inform RAN1 to stop the work on Capability #3 for intra-UE multiplexing enhancements of different PHY priorities on PUCCH / PUSCH.

- **Support:** Ericsson, MTK, Futurewei, Panasonic, Quectel, NTT DOCOMO, CATT, OPPO, Apple (1st) , Tejas Networks, LGE, Huawei(2nd), Spreadtrum, Qualcomm(1st)

Option 4: RAN to inform RAN1 to stop the work on URLLC/IIoT Rel-17 Intra-UE multiplexing enhancements of different PHY priorities on PUCCH / PUSCH if working assumption on UE capability #3 is not confirmed in RAN

- **Support:** Nokia, Telecom Italia, KT, MTK, Ericsson, NTT DOCOMO, Nokia

Summary for the initial phase:

The company positions are updated as above. Looking at the situation, it seems not agreeable to either confirm or remove Capability #3. It is expected that there would be strong concern to drop the whole Rel-17 intra-UE multiplexing also. One possible compromised way forward to go is to task RAN1 to deprioritize the discussion on Capability#3 specific issues, in details, e.g., it could be implemented by tasking RAN1 to allow email and GTW discussion on Capability#3 specific issues only in RAN1#108-e.

Offline Proposal 1

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework

2.7.2 Summary of Issue 2 - The support of multiplexing of UCI of different PHY priorities also for PUCCH format 2

undefined **Option 1:** RAN to conclude to support the multiplexing of UCI of different PHY priorities also for PUCCH format 2.

- **Support:** Nokia, Sony, vivo, Ericsson, InterDigital, Panasonic, Quectel, NTT DOCOMO, ZTE, H3C, CATT, OPPO (fine), Apple, Tejas Networks, Huawei, LGE, Nokia, Qualcomm

- **Up to RAN1:** Motorola Mobility, OPPO, Samsung

Summary for the initial phase:

There are strong majority companies to support the proposal, though a few companies shared the view that this should be up to RAN1. It is always good if we can achieve some progress and make clear guidance from RAN. Considering the support from strong majority companies, it is recommended to take the proposal unless there is very strong concern/objection to do this.

Offline Proposal 2

- RAN to conclude to support the multiplexing of UCI of different PHY priorities also for PUCCH format 2

2.7.3 Summary of Issue 3 - How to handle multiplexing details of UCI of different priorities on PUCCH/PUSCH

Option 1: RAN to guide RAN1 to stop the work on the pending scenarios for multiplexing details of UCI of different priorities on PUCCH/PUSCH, including

  - LP PUSCH (UL-SCH only) + HP SR
  - LP PUSCH + LP HARQ-ACK and/or CSI + HP SR
  - All scenarios involving LP SR
  - All scenarios involving LP CSI without LP HARQ-ACK

- **Support:** Vivo, Telecom Italia, Quectel, DOCOMO, ZTE, H3C
- **Up to RAN1:** Sony, InterDigital, Panasonic, Quectel (fine), CATT, Motorola, OPPO, Apple, LGE, Huawei (fine), Qualcomm, [Intel], Ericsson
- **Not support:** Apple, Samsung, Nokia

Summary for the initial phase:

There are quite many companies prefer to further discuss and decide in RAN1, or take some majority view discussed in RAN1 to be agreed here. Since the discussions looks too detailed, it is recommended to decide it in RAN1.

Offline Proposal 3

Leave it to RAN1 to decide whether/how to support the pending scenarios for multiplexing details of UCI of different priorities on PUCCH/PUSCH.

2.7.4 Summary of Issue 4 - How to handle joint operation of UCI multiplexing with different priorities and simultaneous PUCCH/ PUSCH transmission

Option 1: For a PUCCH cell group, Simultaneous configuration of "UCI multiplexing with different priorities" and "Simultaneous PUCCH and PUSCH transmission within a PUCCH cell group on different CCs" is NOT supported in Rel-17 IIOT/URLLC WI

- **Support:** vivo, Telecom Italia, Motorola Mobility, Tejas Networks,
- **Not support:** MTK, Ericsson, ZTE, Samsung
- **Up to RAN1:** InterDigital, NTT DOCOMO, H3C, CATT, OPPO, Huawei, LGE, Intel, Nokia, Qualcomm

Summary for the initial phase:

There are quite many companies prefer to discuss and decide in RAN1, and a few other companies shared strong concern to support this proposal. Since the discussions looks too detailed, it is recommended to decide it in RAN1.

Offline Proposal 4

Leave it to RAN1 to decide whether/how to support joint operation of UCI multiplexing with different priorities and simultaneous PUCCH/ PUSCH transmission.

2.7.5 Summary of Issue 5 - Necessity for RAN to guide RAN1 to set a deadline for some features?

Example 1: RAN to guide RAN1 to conclude on the support of positioning SRS for RTT-based propagation delay compensation latest by the end of RAN1#107bis-e (Jan. 2022).

Example 2: RAN to guide RAN1 to complete at least issues having impact on ASN.1 in Q1 2022 for multiplexing details of UCI of different priorities on PUCCH/PUSCH

Example 3: Minimize RAN2 impacting decisions in RAN1. If there are any RAN2 impacting decision, these should be made in RAN1#107bis meeting and informed to RAN2

Summary for the initial phase:

Among the companies who provided the views, most companies prefer to leave these issues to RAN1. A few companies prefer to set deadline to finish Rel-17 URLLC WID regardless features. Whether/what deadline to set for Rel-17 WIs not completed yet, seems not URLLC specific issues. At least for the issues listed under this question here, it is recommended to leave it to RAN1.

Offline proposal 5

For detailed features, it is proposed to leave them to RAN1

- Any URLLC related issues that are not completed by next RAN#95 should be dropped.

3 Intermediate Round Discussion

Based on the discussion in the initial round, it looks reasonable not to continue the discussion on Issue 2-5 to avoid repeated comments. In the intermediate round, moderator would like to propose to focus on Issue 1 only.

3.1 Issue 1: - The supported UE capalibity/capabilities for Rel-17 Intra-UE multiplexing

Moderator has renamed the offline proposal 1 as option 2' in this section, and would like to propose to focus on discussion on option 2' as below

option 2'

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework
  - Confirm the working assumption, and guide RAN1 to allow email and GTW discussion on Capability#3 specific issues only in RAN1#108-e

Feedback Form 7: Is it acceptable to take option 2' as way forward? if not, which option in section 2.1 will you persist in?

1 – Apple Europe Limited

Appreciate moderator's work leading the discussion. It seems a key difference between Option 2' and Option 2 is "Confirm the working assumption" in Option 2'. Whether to confirm the working assumption should be decided by RAN1 discussion; and given the complexity of Cap. #3, RAN cannot decide it works by decree. the original Option 2 is preferred.

2 – CMDI

From Moderator's point of view, the main difference of option 2' from original option 2 lies in two points, one is to expedite the discussion in RAN1 by confirming the working assumption, another one is to make it easy to implement the priority of Capability#1 and Capability#3 in RAN1.

3 – CATT

Thanks moderator for the efforts for coordinating the discussion. Now the proposal is to confirm the working assumption to support capability #3 but the discussion on capability #3 is only allowed in RAN1#108-e, i.e. RAN1 is tasked to complete the work to support capability #3 in a single RAN1 meeting. Moreover, the related RRC impact has to be finalized in the first half of the RAN1#108-e meeting as per the guidance from RAN1 chair. As the moderator in RAN1 for this topic, we do not think it is realistic and it is not expected that we can achieve that. So unfortunately we cannot support the current proposal. From our perspective, if we agree to confirm the working assumption to support capability #3, RAN1 should be allowed to work on it in the two RAN1 meetings in Q1'2022 especially in RAN1#107b-e considering that only selected topics will be treated.

4 – OPPO

We have the same comment as from Apple. It is not a good idea to confirm a working assumption for which RAN1 has only one meeting to make it completed (Remember Capability #3 has quite some FFS points). We prefer original Option 2 or Option 3, which has the largest support in initial round discussion.

The original Option 2 is already a compromise among all options in section 2.1. There is no need to take confirming working assumption as an another step for compromise. With Option 2, Capability #3 can be picked up in RAN1 in 2022'Q2 if time allows.

5 – Motorola Mobility UK Ltd.

We support prioritizing discussions on Capability#1 (Option 2). In the sub-bullet, we suggest to leave up to RAN1 to confirm the working assumption.

○ ~~Confirm the working assumption, and~~ guide RAN1 to allow email and GTW discussion on Capability#3 specific issues only in RAN1#108-e

6 – Futurewei Technologies

We still prefer the original Option 2 or Option 3. Given that capability 3 will take more than one quarter according to the group and chair estimates, it is clear from the previous responses that an exception would not be granted. Therefore, we should either stop working on capability 3 now, or at least deprioritize it. We could accept the moderator's proposal, except the aspect on confirming the working assumption on capability 3 as it should remain a working assumption to be confirmed by RAN1.

7 – InterDigital Belgium. LLC

We are ok with taking Option 2' or the original Option 2.

8 – Qualcomm Incorporated

Our preference was and still is to stop work on Capability #3. However, we did not object to the RAN1 proposed Working Assumption at the end of RAN1#107 and do not object to it now.

But the current Option 2' we cannot accept for the same reason other companies mentioned already. The Working Assumption should not be confirmed now but rather it should remain a Working Assumption to be confirmed later by RAN1.

In line with the above, the following modification would make the proposal acceptable to us:

Option 2"

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework
- ~~Confirm the working assumption, and~~ RAN to guide RAN1 to continue their work according to the Working Assumption but allow email and GTW discussion on Capability#3 specific issues only in RAN1#108-e

9 – Quectel

We still prefer the orginal Option 2 or Option 3, while we can also accept QC's udpates for Option 2'. We do not think it is realistic to complete the work on Capability#3 in only one RAN1 meeting. The most likely result would be to drop the whole intra-UE multiplexing feature if we open the discussion for Capability #3 by confirming the WA, considering no exception would be allowed according the GTW discussion.

10 – DOCOMO Communications Lab.

We still prefer Option 3 but could compromise to Option 2' with some modifications.

First of all, Option 2' is not acceptable to us with mainly two reasons. The first reason is due to the confirmation of the WA. The WA was made instead of agreement at the last minute on the last RAN1 meeting since Capability#3 was controversial and had many open issues, which require more time for technical discussion. Therefore, we don't think the WA can be confirmed by RAN guidance without technical discussion. Secondly, we don't think it is realistic to complete the Capability #3 discussion within only one RAN1 meeting. If we cannot complete the discussion in RAN#108-e, will we continue the discussion in Q2 2022 or stop the discussion to drop Capability#3? If the answer is the former, it will impact on other WGs and Rel-18 discussion. If the latter, it seems time consumption even though there are several other open issues to be discussed for intra-UE multiplexing agenda. We think it should be better to prioritize the other open issues rather than continue the Capability#3 discussion.

However, considering the situation, we understand that it would be difficult to converge on Option 3. Therefore, we could compromise to Option 2' with the following modifications (in bold) based on Option 2'' proposed by Qualcomm:

Option 2'''

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework
- ~~Confirm the working assumption, and~~ RAN to guide RAN1 to continue their work according to the Working Assumption but allow email and GTW discussion on Capability#3 specific issues only **if there are no other open issues for the Rel-17 intra-UE multiplexing agenda** in RAN1#108-e**. If RAN1 cannot complete the discussion on Capability#3 specific issues in RAN1#108-e, RAN1 will stop the discussion.**

11 – vivo Mobile Communication Co.

We are generally fine with the principle of the option 2'. We suggest **RAN to guide RAN1 to prioritize the discussion on the issues common for both Cap#1 and Cap#3 over the Cap#3 specific issues.**

Based on our understanding, there is no many issues specific for Cap#1 is left, and many issues actually are common for both Cap#1 and Cap#3, for example: the time unit to apply Rel-15 timeline; the set of PUSCH and PUCCH that eligible for Rel-15 multiplexing consideration etc. About Cap#3 specific issues, the main issue is the dynamic indication design. For other FFS listed under Cap#3, we share the views with ZTE that they can be treated as error case if we cannot solve the FFS e.g. FFS: UE does not expect to receive a dynamic indication resulting in demultiplexing of previously multiplexed PUCCHs/PUSCHs channels without any associated DCIs.

About the time allocation for the discussion, it is better determined by the moderator or RAN1 chair based on the contributions. It is sufficient for RAN to give the guidance on prioritizing the discussions on the common issues for both Cap#1 and Cap#3 over Cap#3 specific issues.

12 – Spreadtrum Communications

We support prioritizing Cap#1, and confirming the WA can be up to RAN1.

13 – Ericsson LM

We have concern the way the discussion goes and quite troubled honestly.

From our point of view, we have to be realistic. **It seems to us, proposals suggesting deprioritize Cap#3 or giving only time in RAN1#108e to Cap#3/only email discussion in RAN1#107b-e are equivalent to down-scoping Cap#3.**

If that is the intention, better be clear with that and save delegates from unnecessary waste of efforts. We really do not appreciate such approach.

As RAN1 Chairman indicated, URLLC would get more time in Jan meeting. Now, not giving time to Cap#3 where has many more open issues and still keep it on the list, is not understandable.

We expressed concern on this topic even last plenary and companies insisting it is manageable. We face same issue this meeting and the situation is the same. And surely will be the same in next plenary and eventually we will be dragged in a lengthy maintenance to fix the design. We find the arguments such as ”we spent so much time so far” quite unreasonable because for the same reason, we have to have the courage and acknowledge that we failed and not spending more time. That argument would make sense when there is little left to do.

The questions should put forwards to RAN leadership are the following:

- **Can we go only with Cap#1?**
- **Can we go only with Cap#3?**

If there is objection to any of above, the only outcome is to drop the topic or push for either Cap#1 or Cap#3.

It is troubling not to be honest with situation and dragging delegates to spent unnecessary time. And to our dear RAN1 delegates, discussing framework during maintenance is a bit too late IMHO.

Our time is valuable and can be better spent.

14 – Intel Korea

Option 2’ is unacceptable. Postponing Cap#3 discussion by one meeting effectively means putting it into the situation when it cannot be completed in time, which is no real difference with Option 3, i.e. dropping Cap#3. It was argued by multiple sources in RAN1 and RAN that intra-UE multiplexing w/o Cap#3 is not meaningful. In this situation, we prefer to either leave the situation as is (w/o RAN guidance) or to stop intra-UE multiplexing design (option 4).

15 – TELECOM ITALIA S.p.A.

We have a general concern in how this matter is managed, and somehow appreciate the comment from Ericsson above.

It is clear that moving back to RAN1 to decide we are just wasting time, impacting the overall release completion and in March we will face the same situation as today.

RAN must step in now and provide a clear guidance to RAN1.

16 – ZTE Corporation

Considering many remaining issues are common to Capability 1 and Capability 3, it may cause confusion or conflicts by prioritizing Capability 1 while deprioritizing Capability 3. In this sense, we share with vivo that it is sufficient to only guide RAN1 to prioritize the common issues between Capability 1 and Capability 3. Regarding the specific issues, it’s up to RAN1 how to proceed. In addition, it’s better to clarify that

the prioritization is mainly in the January 2022 meeting so that the specific issues can be handled in the February 2022 meeting. So, we suggest the following proposal (on top of vivo's version):

'RAN tasks RAN1 to prioritize the common issues for both Capability 1 and Capability 3 at least in January 2022 meeting'.

17 – TELECOM ITALIA S.p.A.

to be clear we re-state our position to stop intra-UE multiplexing design

18 – LG Electronics Inc.

We still prefer Option 3 since it is the only way to feasibly/reasonably complete the WI.

We also agree and share the same view with Apple, OPPO, Motorola, Futurewei, QC, DOCOMO, and can accept the original Option 2 (not new Option 2').

Prioritizing Capability 1 over Capability 3 should mean that the work on the Capability 3 could be proceeded in RAN1#108-e (by confirming WA) if no other intra-UE multiplexing issues are remained based on the progress on the Capability 1.

For this reason, the Option 2"' suggested by DOCOMO or the Option 2" suggested by QC is acceptable for us, and the updated Option 2' suggested by Motorola is also fine for us.

Option 2"'

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework.
- ~~Confirm the working assumption, and~~ RAN to guide RAN1 to continue their work according to the Working Assumption but allow email and GTW discussion on Capability#3 specific issues only if there are no other open issues for the Rel-17 intra-UE multiplexing agenda in RAN1#108-e. If RAN1 cannot complete the discussion on Capability#3 specific issues in RAN1#108-e, RAN1 will stop the discussion.

Option 2"

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework.
- ~~Confirm the working assumption, and~~ RAN to guide RAN1 to continue their work according to the Working Assumption but allow email and GTW discussion on Capability#3 specific issues only in RAN1#108-e.

Updated Option 2'

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework.
- ~~Confirm the working assumption, and~~ RAN to guide RAN1 to allow email and GTW discussion on Capability#3 specific issues only in RAN1#108-e.

19 – HUAWEI TECHNOLOGIES Co. Ltd.

Thank you very much for the great effort from the moderator! We are fine with option 2' in principle, however we still prefer to leave it to RAN1 to confirm the working assumption on capability #3, since there are still many open issues with unclear details which need technical analysis and discussions. We can accept to drop capability #3 as well considering there might be risk to complete all related issues before Q12022, though we think it would be worthy to give more time before making such kind of decision, since RAN1 finally made the working assumption and indeed it would provide more benefits at least from latency perspective compared to Capability #1 as long as there are some UEs can be able to support it.

In addition, looking at the comments from other companies, we want to clarify that prioritizing discussions on capability 1 is equal to prioritizing common aspects between capability 1 and capability 3, since Capability 3 procedure is a super-set of Capability 1 procedure, and in order to complete capability 3 anyway you need to complete capability 1. By the way, when we talk about issues related to capability 1, it also includes the details of multiplexing details of UCI of different priorities on PUCCH/PUSCH, not just the issues related to the framework.

Looking at the current situations, it seems majority companies would be ok to at least complete Rel-17 intra-UE multiplexing with capability 1, including details of multiplexing details of UCI of different priorities on PUCCH/PUSCH. Therefore, we think at least the following RAN guidance can be considered:

RAN to guide RAN1 to complete Rel-17 intra-UE multiplexing with Capability #1 before Q12022, including details of multiplexing details of UCI of different priorities on PUCCH/PUSCH.

20 – MediaTek Inc.

Thank you for the moderator' efforts for coordinating the discussion.

First, the Working Assumption on Capability#3 have many open issues and it shouldn't be confirmed until RAN1 discusses these issues. Secondly, finalizing the details of Capability#3 requires a lot of time in RAN1, thus, we don't see it realistic to finish it in one RAN1 meeting as proposed.

Considering the above, we still prefer Option#3 (drop Capability#3) or Option#4 (drop intra-MUX).

21 – Nokia Germany

Based on all companies comments above, it seems that that **new Option 2' does not really solve the issue**, as first confirming a working assumption to support something and at the same time preventing related discussions in RAN1#107bis-e (Jan 2022) seems rather counterproductive.

As is visible also from the discussions in the 1st round, we are NOW after the targeted RAN1 completion discussing the feature focus with rather diverse opinions within the group. This is a clear indication that we are very far from completing this objective and actually maintenance should be there to fix some minor pending issues or correct the specifications but not do the main feature design work (as is the case here compared to some other WIs having pending issues). Therefore, **to not waste even more time of RAN1 URLLC delegates (and the corresponding Intra-UE multiplexing FLs / moderators) in Q1, the Intra-UE multiplexing work should be stopped (i.e. Option 4).** It is of course hard to acknowledge that we as a group failed on this objective, but unfortunately it is a matter of fact!

22 – VODAFONE Group Plc

Our first preference is Option 4 and second preference Option 3. Updates for Option 2 proposed by some companies at least set the deadline to stop the discussion without interfering with the technical discussion

of the WA, however it seems there is not enough time to continue to pursue Capability 3 in parallel with other maintenance aspects that may appear

23 – Panasonic Corporation

We are ok with the proposal.

24 – Sony Europe B.V.

We think that RAN1 does need micro-management on what to prioritise and what not to prioritise. Hence we do not support the main bullet on prioritisation.

We think that RAN1 should confirm the working assumption, based on its normal procedures. This confirmation does not need to be done in RAN plenary.

This is an ”enhancements”-type WI. Capability#1 degrades functionality with respect to Rel-16. By supporting capability #3, the WI would achieve the objective of enhancing URLLC.

3.2 Summary for the intermediate round discussion

Option 2’

- RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework
  - Confirm the working assumption, and guide RAN1 to allow email and GTW discussion on Capability#3 specific issues only in RAN1#108-e

Concerns on option 2’: Apple, CATT, OPPO, Motorola Mobility, Futurewei, Qualcomm, Quectel, NTT DOCOMO, Spreadtrum, Ericsson, Intel, Telecom Italia, ZTE, LG

- Concern on confirming the working assumption on capability #3 at this stage: Apple, OPPO, Motorola Mobility, Futurewei, Qualcomm, NTT DOCOMO, Spreadtrum, Huawei
- Concern on discussion on Capability #3 not allowed in RAN1#107b-e: CATT, vivo, Intel, ZTE
- Should only pick either Capability #1 or Capability #3: Ericsson

Summary for the intermediate round:

The intention from the moderator to come up with option 2’ is to expedite the discussion in RAN1 by confirming the working assumption on capability #3 and also prioritize the discussion on Capability #1 as suggested by quite many companies. However, it seems option 2’ is not agreeable to most of the companies. At least 8 companies have concern on confirming capability #3 at this stage, and at least 4 companies have concern on not allowing discussion of capability #3 in RAN1#107-e. At least 2 companies prefer clear guidance from RAN, i.e. pick either capability #1 or capability #3. Moderartor would like to point out that option 2’ only preclude the Capablitity#3 specific features instead of all features of Capablitiy#3.

Considering the concern on confirming the working assmption in RAN, moderator would like to propose select one from the option 2 and the variant of option 2' (Qualcomm's version in the intermediate round) as RAN guidance on Issue 1 to RAN1

Offline proposal for Issue 1 from the intermediate round

Select one option from below 2 options as RAN guidance on Issue 1 to RAN1

- **Option 2:** RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 before Q1 2022 for Rel-17 intra-UE multiplexing framework.
- **Variant of Option 2':** RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework.
    - ~~Confirm the working assumption, and~~ RAN to guide RAN1 to continue their work according to the Working Assumption but allow email and GTW discussion on Capability#3 **specific** issues only in RAN1#108-e

3.3 Offline Proposals for Wednesday's GTW

For Issue 1, offline proposal

Select one option from below 2 options as RAN guidance on Issue 1 to RAN1

- **Option 2:** RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 before Q1 2022 for Rel-17 intra-UE multiplexing framework.
- **Variant of Option 2':** RAN to guide RAN1 to prioritize the discussions on Capabilility#1 and deprioritize Capability #3 in Q1 2022 for Rel-17 intra-UE multiplexing framework.
    - ~~Confirm the working assumption, and~~ RAN to guide RAN1 to continue their work according to the Working Assumption but allow email and GTW discussion on Capability#3 **specific** issues only in RAN1#108-e

For Issue 2, offline proposal

- RAN to conclude to support the multiplexing of UCI of different PHY priorities also for PUCCH format 2

For Issue 3, offline proposal

- Leave it to RAN1 to decide whether/how to support the pending scenarios for multiplexing details of UCI of different priorities on PUCCH/PUSCH.

For Issue 4, offline proposal

- Leave it to RAN1 to decide whether/how to support joint operation of UCI multiplexing with different priorities and simultaneous PUCCH/ PUSCH transmission.

For Issue 5, offline proposal

- Any URLLC related issues that are not completed by next RAN#95 should be dropped.

4 Final Round Discussion

5 Final Proposal

For Issue 1

6 Reference

[1] RP-212915, ”Scope and progress on Rel-17 URLLC/IIoT”, Intel Corporation

[2] RP-212953, ”SR for NR_IIoT_URLLC_enh”, Nokia(Rapporteur)

[3] RP-213000, ”On Rel-17 IIoT/URLLC”, Apple

[4] RP-213014, ”On the status of Rel-17 NR IIoT/URLLC work in RAN WG1”, Samsung

[5] RP-213054, ”Views on IIoT-URLLC Rel-17 conclusion”, Qualcomm Incorporated

[6] RP-213155, ”Views on Intra-UE multiplexing for IIoT/URLLC in Rel-17”, Ericsson

[7] RP-213157, ”Views on the status of Rel-17 NR URLLC enhancements WI”, Huawei, Hisilicon

[8] RP-213258, ”Downscope for Rel-17 IIoT/URLLC WI”, vivo

[9] RP-213307, ”On Rel-17 enhanced IIoT and URLLC”, CATT

[10] RP-213351, ”On the status of Rel-17 IIoT/URLLC WI”, MediaTek Inc.

[11] RP-213362, ”On RAN1 conpletion of the Rel-17 NR URLLC/IIoT WI”, Nokia, Nokia Shanghai Bell

[12] RP-213418, ”Discussion on progress of Rel-17 URLLC/IIoT”, ZTE, Sanechips