

3GPP TSG-RAN Meeting #98e RP-223504 Electronic Meeting, December 12 - 16, 2022

Source: Moderator (Balazs Bertenyi, Nokia)

Title: Moderator's Summary on "[RAN98e-07-R18-XR]"

Document for: Endorsement

1 Initial Phase - now closed

Based on the relevant input contributions and the discussions during the Opening GTW session on Monday, it is proposed to discuss and seek conclusion on the following items:

1.1 SID/WID management

- 1) Should the SID be left open to conclude on the open items regarding XR Awareness, or should we close the SID and address open items in the early stage of the WID phase?
- 2) Any RAN4 study needed for any of the topics?

Please provide feedback below:

Feedback Form 1: SID/WID management

<p>1 – TELECOM ITALIA S.p.A.</p> <p>We should defer the approval of the Work Item at RAN#99, since the objectives, in particular in RAN2, are not yet achieved</p>
<p>2 – AT&T</p> <p>We are OK to continue the SID for another quarter to complete the RAN2 objectives related to XR Awareness that are still incomplete with the understanding that the priority and scope of the related objectives remains the same.</p>
<p>3 – VODAFONE Group Plc</p> <p>I think we should first clarify what are the open issues exactly.</p> <p>If those issues are restricted to the questions RAN WG2 asked by SA2 during the last meeting via LS R2-2213351, then I think we do not need to keep the SI open, just because of this. If there are more questions</p>

open and those issues are over multiple groups, we should list these topics and extend the SI phase for 1 cycle.

4 – T-Mobile USA Inc.

WID must not start until Application awareness is completed. In the SR status discussions leading up to plenary it was obvious that there are several interpretations of the SA decisions. SA-2 meets in January which gives RAN2 sufficient time to complete the SID before the March plenary.

5 – InterDigital

Our preference is for the WI phase to start in Q1 2023 and to conclude the open items on XR awareness in RAN2 in the early stage of WI phase. Since RAN1 and RAN2 have concluded the SI on the power savings and capacity objectives, both RAN1 and RAN2 can start the WI in Q1 2023 to avoid any delays.

6 – Apple GmbH

On 1) The objectives of XR awareness, power saving and capacity are reasonably independent. Therefore, in our view, it is possible to continue just the objective of XR-awareness in an extended SI for one quarter. Other objectives may proceed to WI phase which may help complete the work on time (e.g., in RAN1 and RAN2). Any possible update to the scope of the WI (following SI completion) can be considered in a revised WI in March, including the addition of XR-awareness to the WI objectives. With that in mind, we would be ok to start a WI.

On 2) If work on RRM enhancements is supported by a majority of companies (e.g., along the lines of measurement gaps / scheduling restrictions / prioritization of PDCCH/PDSCH decoding) then this would also require RAN4 involvement.

7 – vivo Communication Technology

1) The continued study of XR awareness should not affect the start of normative work for the XR power saving and capacity enhancement, for which the study have been completed in both RAN1 and RAN2. Therefore a work item shall start in 2023Q1 with power saving and capacity objectives. XR awareness can either be included in the work item as an objective with study phase (RAN#99 as a check point to convert to normative work), or continue study in the SI, i.e. keep the SI open in parallel with the above mentioned work item. We slightly prefer the former case (WI only) but can also be fine with the latter case (SI+WI in parallel).

2) The question seems unclear, does it mean that the current SI will be kept open and more RAN4 led objective is added? We do not support if this is the case, as this will be an upscoping of an ongoing SI (which was not able to complete on the due time).

8 – Futurewei

In our view, we should close the SID and start the WI phase without further delay, to stay aligned with the approved schedule.

9 – Beijing Xiaomi Mobile Software

We should close the SID and address open items in the early stage of the WID phase.

After checking the SA2 latest progress, SA2 SI study (FS_XRM) is complete 100% (S2-2211189, FS_XRM status after SA2#154). And SA2 has confirmed that different types of PDU sets can be from one QoS flow and they also identified the information provisioning to RAN for PDU set packet handling. SA2 has resolved most of the issues.

So we think there is already sufficient work to be done for XR awareness objective and hence this should be included in the WID of XR.

10 – Meta Ireland

Both XR-specific power saving and XR-specific capacity improvements were completed and are ready for moving into the work item phase. Also, the corresponding options for XR-awareness are also well-understood after SA2 concluded the study phase. Hence, we prefer to keep the timeline intact, approve the Rel. 18 XR over NR Enhancement WID.

11 – Verizon UK Ltd

1) XR awareness part of the study should continue for one more quarter to get to better alignment with SA2 and common understanding within RAN2 of SA2 decisions. This is very important to do early on so we can deliver quality specifications and avoid misalignment patch work later on.

2) We are open to start WI in parallel for XR capacity and power savings enhancements.

12 – Samsung Research America

The SI can close. Issues related to XR awareness may be addressed by RAN2 in Q1 2023.

13 – MediaTek Inc.

1) We share the same view as vivo: "XR awareness can either be included in the work item as an objective with study phase (RAN#99 as a check point to convert to normative work), or continue study in the SI, i.e. keep the SI open in parallel with the above mentioned work item. We slightly prefer the former case (WI only) but can also be fine with the latter case (SI+WI in parallel)."

2) We do not think a RAN4 study is necessary. Even for the RRM measurement enhancement mentioned by Apple, in Rel-17 positioning enhancement, RAN1 developed MAC-CE activation/deactivation for measurement gap(s) for latency improvement of positioning. Details can be found in 38.214 V17.3.0 5.1.6.5 with corresponding agreement made in RAN1 #107 8.5.4. Hence, RAN1/RAN2 can lead the work, and RAN4 comes in later in requirement phase, just like normal procedure.

14 – Intel Corporation (UK) Ltd

Question 1) We support that RAN2 concludes the remaining study of the open items on XR awareness. We are ok with both options understanding that the intention is the same i.e. for RAN2 to conclude the study work update the editor's note of the TR 38.835 based on the corresponding agreements/conclusions.

Question 2) Current conclusions of TR 38.835 and proposed WID objectives in section 1.2 below do not seem to require RAN4 work.

15 – CATT

Question 1: We support the conclusion of XR study with the remaining issues of XR awareness to be addressed in the work item. The UE power saving and XR capacity improvement objectives had been completed. SA2 had agreed the XR PDU set related information and PDU handling in S2-2211405. The XR PDU set(s) size and sequencing agreed in S2-2211405 should be sufficient for RAN to finalize the remaining issue of XR-awareness study.

Question 2: RAN4 study is not needed in the UE power saving, XR capacity improvement, and XR-awareness objectives.

16 – New H3C Technologies Co.

we should close the SID and open items can be addressed at the early stage of WID.

17 – OPPO

In our understanding, only one specific item of XR awareness (i.e., PDU handling differentiation) is now pending due to late conclusion in SA2; the other two items of XR awareness discussion, including PDU prioritization and PDU discarding, are almost concluded in RAN2. Therefore, the overall progress is more promising than what the SR reported as 80% completed, and the small gap to 100% completeness does not justify one-quarter delay of starting of WI. In fact, the most (if not all) RAN #98e contributions discussing Rel-18 XR show a strong preference in starting WI on time. So we believe the first conclusion for this discussion thread should be starting XR WI as originally scheduled. With this in mind:

For Question 1), we prefer the 2nd choice, i.e., close the SID and address the open items in WID with a short study stage.

For Question 2), whether RAN4 study is needed in WI may depend on detailed solutions adopted in RAN2/RAN1, for example, different solutions handling power saving may or may not need RAN4 involvement. Therefore the RAN4 involvement in WID (at least core part) could be updated on-the-go.

18 – QUALCOMM JAPAN LLC.

1) At least RAN2 should continue their study. We propose to use the full 2 TUs which are already allocated for RAN2's extended study on not only XR awareness, but also other study objectives, for which all proposed solutions have not been sufficiently covered so far.

2) This depends on the scope of WI. In RAN2 study, some proposals on RRM related enhancements were submitted, which if agreed, may require RAN4 work.

19 – LG Electronics Inc.

Q1: Everybody agrees that the SI is not completed at least from XR awareness point of view. Then, it is right procedure to extend the SI until the study is completed. Closing the SID and addressing open items in the early stage of the WID phase is a temporary expedient, and 3GPP should avoid such expediency.

Q2: At this moment, we don't see a need for RAN4 involvement.

20 – Fujitsu Limited

Our preference is to close the SID and address open items in the early stage of the WID phase. The allocated time for this item is very limited and delaying the start time will squeeze our discussion time. Also, RAN1 has completed their study and at least they may begin the WI phase. So we don't think the extension of SI is an optimum approach.

21 – CTSI

[China Telecom]: We prefer to close the SID and address open items in the early stage of the WID phase. And we can set a check point (e.g., RAN#99) to see whether to revise the WID based on the discussion on XR awareness objectives.

22 – Orange

We would prefer to keep the SI open for one quarter in order to properly complete the SI on XR awareness, which is the most important feature out of the XR SI from our perspective. It is essential that clear TUs are dedicated to this task, which could be more blurry if treated as a study phase within a WI.

23 – Spreadtrum Communications

- (1) We prefer to close the SI and address XR-awareness in early stage of the WID phase.
- (2) RAN4 study is unnecessary because the objectives what we had agreed in WI phase can be handled by RAN1/2 itself.

24 – HuaWei Technologies Co.

- 1) As many companies already commented, we see no reason to extend the study. The power saving and capacity enhancements have already completed the study, for XR awareness the corresponding candidate solutions have been included into the RAN TR, and SA2 also 100% completed the study and the corresponding WID in S2-2211465 has been approved by SA2. The remaining part for RAN is to select the suitable solutions to align with SA2's conclusion and to us this is straight forward, and can be directly taken into account into the normative work. It is also worth mentioning that per the schedule agreed in yesterday's GTW, we should leave sufficient time for RAN WGs for a qualified normative work, and starting WI from Q1 can have 9 months for RAN1 and 12 months for RAN2/RAN3, which is helpful to stabilize the feature.
- 2) The question is a bit ambiguous. If this is a generic question, we think we can do it as usual that the core requirements and performance requirements need to be defined, if needed, according to the specific solutions. This can be done in WI phase. If it refers to some specific technical directions, this needs to be first clarified what they are, and discuss them case by case.

25 – Panasonic Holdings Corporation

We support to close the SID and start WI but XR Awareness can be studied in WI.
RAN4 involvement depends on RRM aspect is included or not.

26 – KDDI Corporation

- 1. Our preference is keep the study still open considering the XR awareness remaining issues, but we are also fine with completing those study in work item phase if the majority prefer to have only WI.

2. We also agree that we need RAN4 involvement, if we work on RRM enhancements.

27 – Motorola Mobility España SA

1. In our view, it is good to extend the SI to conclude the study on XR awareness.

It should be noted that some aspects of DRX enhancements such as multiple DRX configurations, have not been discussed in detail during the SI phase so far. In order to have a well-defined WI phase scope it would be good to conclude on those aspects during the extended SI phase.

2. Based on the scope of the WID, we can decide whether any RAN4 study is needed (e.g., if measurement gap skipping goes to the WID)

28 – Sony Europe B.V.

We think XR awareness parts needs to be continued as the study is not finished. The UE power and capacity parts can be progressed as in a workitem.

29 – Telia Company AB

1. Keep the study open only for remaining XR awareness issues (SA2 work), but it is possible to start WI for other completed parts.

2. TBD if RRM work is needed, probably not.

30 – ZTE Corporation

1) For WID/SID:

Firstly it is important that all the objectives that are stable and complete from the SI perspective are moved into WID phase. Then, we think that there are no open issues as far as RAN1 is concerned and hence, the SID should be closed given the stringent schedule in RAN1. From this perspective, a WID should be opened for XR.

Then, the question is whether we continue the SID in parallel with the WID to just discuss the remaining issues for XR awareness or whether to progress these under the WID itself. We prefer to avoid having parallel WID and SID and hence we prefer that any open issue is progressed in the WID itself.

For the open issues for XR awareness (specifically whether to map DRB data to multiple LCHs or not), we believe that what is left is really a decision to be made in RAN2 (based on the SA2 feedback) rather than extensive study to be done again for the XR awareness. So, we think the open issues can be combined into a well contained objective and absorbed into the WI scope (with a “study and specify if needed” requirement in the WID which can be revisited for progress check by RAN in March 2023)

2) On RAN4 Involvement:

We believe the question is mainly about RRM requirements. As noted above, there should be no further study in RAN1 on the RRM aspects of XR. Further, we don't see any urgent need for RAN4 involvement for most objectives, and for enhancement/relaxation of scheduling restriction of SMTC window/measurement gap, the work can be pursued with a requirement for RAN4 to analyse the feasibility as part of the WI.

31 – Apple GmbH

On 2), as an extension to our comment above, we would like to add that XR has never been discussed/studied in RAN4 from RRM perspective, e.g. measurement gap and scheduling restriction. From RAN4 perspective, if RRM aspects are considered in Rel-18, at least a study phase is needed to allow RAN4 investigate the benefit and feasibility related to measurement gap and scheduling restriction. Another alternative is to extend the study item objectives and introduce new RAN4 scope.

32 – Google Inc.

1) Both RAN1 and RAN2 concluded on the SI objectives on power saving and capacity enhancements and can move to the WI phase. Some of the items of the XR awareness in RAN2 are still open (mainly the handling of the PDU Set importance indication) and can be concluded in the early stage of the WI phase. Remaining XR awareness items like PDU prioritization and discarding are already finalized. The XR awareness open items are totally independent from the power saving and capacity enhancements objectives. Therefore, we support a start of the WI phase in Q1 2023 with a potential update to the WI scope in March to include the remaining XR awareness objectives. Also, alternatively, XR awareness can be included in the WI as an objective with a study phase as suggested by vivo.

2) RAN4 study depends on the adopted solutions in RAN1/RAN2. RAN4 involvement is needed for any possible work on RRM enhancements if there is consensus to support any solution in the RAN1/RAN2 WI with RRM impact. This is not urgent and can be discussed further and decided in RAN#99.

33 – NEC Telecom MODUS Ltd.

We prefer to leave the SID open for another quarter.

Especially, RAN2 have not completed XR-awareness objective, this requests more discussion after receiving reply from SA2/SA4. On power saving and capacity enhancement aspects, more discussion would benefit to down scope the WI objectives.

34 – NTT DOCOMO INC.

There should be two possible ways forward in our view. a) close the SID and address open issues on XR awareness in the early stage of the WID phase, b) remain open the SID for open issues on XR awareness and, in parallel, start the WID phase for completed items (i.e., power saving and capacity). We slightly prefer (b) because it sounds more natural not to close the SID as there is a remaining item (i.e., XR-awareness). However, we would be fine with (a) as long as work on the completed items (i.e., power saving and capacity) will not be delayed.

35 – Deutsche Telekom AG

Yes, keep it open - inline with the operators message in 915 discussed yesterday !

36 – Nokia Corporation

1) The SID should be kept open for one quarter only for the XR awareness objective as proposed by the rapporteurs. The WID should be started with capacity enhancement and power saving objectives for which studies were already completed in RAN1 and RAN2.

2) In addition, RAN4 should be tasked by RAN#98e to investigate enhancements on RRM to relax scheduling restriction for at least for intra-frequency RRM without MGs in FR2 and for inter-frequency RRM with MGs as this area could not be concluded in RAN1 as these RRM measurements aspects are more RAN4 area.

37 – Ericsson LM

We think that the objectives of the SID are completed including XR-awareness.

The objectives for XR awareness were: 1) Study and identify the XR traffic (both UL and DL) characteristics, QoS metrics, and application layer attributes beneficial for the gNB to be aware of, 2) Study how the above information aids XR-specific traffic handling. It has been shown by simulations that there are no gains doing any PDU set differentiation, but there may rather be losses. SA2 response will not change this fact and RAN2 should not agree on solutions, as simple as they may be, that reduce the system performance.

Based on that, we think that RAN2 will not achieve any further progress based on technical merits and, thus, there is no point to continue the discussions. The WID can start with the recommendations RAN1 and RAN2 provided. Waiting for LS response does not justify extension of the SI while the outcome of SA2 study can be found in their corresponding TR 23.700-60.

In case the SI would be extended, it needs to focus only on the remaining issues related to XR awareness and not expand the study scope on power saving and capacity enhancements any further. In this case, we should start the WI with the power saving and capacity objectives.

38 – BT plc

XR-awareness has not been studied in RAN2 so SI should remain open. RAN2 has concluded power saving and capacity topics but there is only one meeting before RAN#99. In consequence, RAN should give RAN2 enough time to discuss XR-awareness during February meeting, otherwise it is impossible to conclude it with expected quality.

As we were mentioning yesterday, quality in Rel-18 is our priority therefore, our proposal is to allocate all TUs to conclude RAN XR SI and discuss the WI scope in RAN#99.

39 – Futurewei Technologies

On 2), involvement of RAN4 in WI should be business as usual if RAN4 work is needed for agreed objective. The SI should be closed instead of extending its scope to involve RAN4 at this point.

1.2 WID Objectives

It is proposed to be strict with the WID scope and only include those items that achieved clear conclusion in the SID phase:

Specify the enhancements related to power saving:

- *DRX support of XR frame rates corresponding to non-integer periodicities (RAN2)*
- *RRC pre-configuration and switching of configurations of DRX (RAN2)*

Specify the enhancements related to capacity:

- *BSR enhancements including new BS Table(s) (RAN2);*
- *Delay reporting of buffered data (RAN2);*
- *UE assistance information (e.g. periodicity) (RAN2);*
- *PDU Set Discard operation (RAN2);*
- *Dynamic indication of unused CG PUSCH occasion(s) based on UCI by UE (RAN1);*
- *Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);*

Note that XR awareness aspects would need to be taken into account depending on conclusions to 1.1 above.

Feedback to the Objectives above and any potential refinement proposals can be made here:

Feedback Form 2: WID Objectives

1 – Apple GmbH

We also prefer the following objective

- **PDCCH skipping enhancement with PDSCH retransmission (RAN1)**

We believe this is an important left over from Rel-17 UE power saving and can ensure best trade off between power consumption and reliability/latency of XR services. This enhancement allows the pre-emption of PDCCH skipping under PDSCH retransmission to ensure the robustness of the packet and to reduce latency which is very crucial for XR. Furthermore, the scope of this objective is small since it is a left over from Rel-17.

2 – TELECOM ITALIA S.p.A.

As stated in the previous question, we believe it is premature to start the Work Item at this plenary. And we do not agree to further extend the scope. On the contrary, the objectives should be down scoped to ensure a manageable work load. As such, we suggest to down scope the objectives involving RAN1

3 – VODAFONE Group Plc

The conclusion of 38.835 does not say anything about UE assistance information. The conclusion simply states: Provision of XR traffic assistance information for DL and UL (e.g. periodicity); This does not mean

it has to come from the UE. In my view, we should focus on conclusions from 38.835 first and on top of it clarify if there are topics which need more study (e.g. related to measurements or PDU awareness, etc).

4 – InterDigital

We are ok with the proposed WID scope as baseline as it allows for reasonable workload in RAN1 and RAN2, and aligns well with the conclusions made in the SI up to now. Any further update to the WID scope can be considered during RAN#99 based on the conclusion of the remaining SI objective on XR awareness.

5 – KT Corp.

KT supports moderator proposal on WID objective.

6 – Apple GmbH

On the general WID scope as proposed by the moderator looks good as a starting point, with the inclusion of the additional objective we have already mentioned above.

On Vodafone’s note on UE assistance, in our understanding the TR conclusion includes assistance information from the UE while CN assistance is more in RAN3/SA2 domain. An XR application server may assist the RAN with information about XR-specific characteristics of a traffic flow where the provision of such information happens through the CN. Nevertheless, the accuracy of this information is gated by factors such as the refresh interval that can be applied for each UE and traffic flow, the available signalling capacity, and the delay within the CN. Certain characteristics, such as arrival of critical information, jitter, buffer residency time, may suddenly change at either side of the connection. In some cases, signalling of feedback/adjustment information via the application layer from the UE to the server and then back from the server to the RAN may simply take too long. We support the WID objective on UE assistance information.

7 – Futurewei

In our view, the following WID objectives can be added:

Specify the support for XR-awareness in RAN (RAN2, RAN3):

- Provisioning of XR traffic information from CN to gNB and UE (RAN3, RAN2, with cooperation from SA2/CT1);
- Select/down-select PDU Set to QoS flow to DRB mapping model(s) for the following scenarios (RAN2):
 - 1) support of only in-sequence delivery is required,
 - 2) support of only differentiated QoS handling is required,
 - 3) support of both is required;
- Resolve the question on whether to support DC-like splitting DRB to multiple LCHs (RAN2).

8 – Beijing Xiaomi Mobile Software

For UE power saving objective, we think the objective of PDCCH monitoring enhancement (e.g., PDCCH skipping) should be added since it is beneficial for XR UE power saving.

On capacity enhancement, we share the same view with Vodafone that UE assistance should not be added. According to RAN2#120, TSCAI is the baseline. And UE assistance information did not get enough support.

9 – Samsung Research America

OK with the proposal by the moderator.

Also OK to add the objective mentioned by Apple related to PDCCH skipping and PDSCH retransmission.

10 – Intel Corporation (UK) Ltd

On power saving topics: we support both objectives and suggest the following updates:

- (1.2) **Support a mechanism to configure RRC pre-configuration multiple DRX configurations via RRC and enable switching between those of configurations of DRX (RAN2).**

This objective (1.2) might require RAN1 involvement considering how to switch between those pre-configured configurations of DRX is still open. We suggest adding RAN1 as a potential impacted WG.

On capacity related enhancements: we support all objectives and suggest the following updates:

- To the BSR related enhancements, another objective should also be included related to PDU discard and/or XR information that was agreeable by majority of companies in RAN2 as captured in the TR 38.835. This would be to define new trigger conditions considering PDU discard and/or PDU set/data burst information available in UE. In addition, it seems preferable to define a little more concrete objectives based on RAN2 agreements. In summary, we suggest updating the objectives as follow:

(2.1) Support BSR enhancements [RAN2] including

- (2.1.1) New BS Table(s) to reduce quantisation errors of the reporting.

- (2.1.2) UE reporting of delay information of the buffered data (e.g. remaining time).

- (2.1.3) Define new trigger conditions considering PDU discard and/or PDU set/data burst information available in UE.

We support enabling assistance information specific to XR although we understand that this objective needs to be extended to also consider the new signaling required between CN and RAN. Therefore, suggest updating this objective as:

“(2.2) Enable means to expose XR specific information (as captured in clause 5.1.1 of TR 38.835) from CN to RAN and from UE to RAN (RAN2, RAN3);

For the enhancements of the discard operation, we suggest the following clarification considering the related agreement:

- (2.3) Enhance Discard operation for PDU sets, including e.g. new timer-based event and when PDUs of a PDU set are lost (RAN2);

We are fine with the RAN1-led capacity enhancement objectives on the CG enhancement. We suggest to not include any further proposals for capacity enhancement.

In addition, for power saving enhancement, especially for PDCCH monitoring adaptation, we suggest also adding support of more than 3 skipping durations and non-scheduling DCI to indicate PDCCH skipping, if there is room.

11 – vivo Communication Technology

We would like to emphasize the importance of **PDCCH skipping enhancement for XR services**

1) Based on the RAN1 and RAN2 study, PDCCH skipping is generally understood as the most effective solution for UE power saving, with and without C-DRX. This has been proved by many evaluation results submitted to RAN1 and RAN2.

2) PDCCH skipping was designed in Rel-17, when the main target was general eMBB traffic, and the XR traffic with stringent reliability and latency target was not considered. The current design of PDCCH skipping will make it very difficult for gNB to handle the potential PDSCH retransmission so that the XR capacity will be decreased dramatically.

3) The potential enhancements was discussed in RAN1 extensively, no consensus was reached unfortunately. The opposing companies keep arguing that the PDSCH retransmission issues can be handled by proper gNB implementation. However, as analyzed in our joint paper as below, the possible gNB implementation methods will either decrease the XR capacity, or increase the UE power, which is undesirable.

RP-223098 Power saving techniques for Rel-18 XR WI vivo, Google, MediaTek, Apple, Ericsson

Therefore we strongly believe the following objective should be added to XR WI (power saving objective) in order to make the PDCCH skipping feature robust enough for XR services.

- **Support PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts**

12 – MediaTek Inc.

– For the moderator proposed WID scope, we are generally fine while **we think ” Multiple CG PUSCH transmission occasions” should be led by RAN2, as the spec impact would mostly be on 38.331.**

– On **XR power**, we share similar view with Apple/Samsung/Xiaomi that **PDCCH skipping enhancement is a low hanging fruit and can be supported.**

– On **XR capacity**, we think **RRM enhancement can be supported** because:

(1) Just like **unmatched CDRX period and XR traffic period (Ex. 16.6ms) significantly deteriorate the XR capacity** due to the **scheduling unavailability in DRX_OFF duration**, the **scheduling restriction of SMTC window or measurement gap (MG) also significantly deteriorate the XR capacity**. Since **SSB period can not be changed to match XR traffic**, the only solution we see now is a **dynamic activation/deactivation of the SMTC/MG measurement by DCI or MAC-CE**.

(2) **Simulation/analysis results in RAN1** by Nokia/MTK/QC **verifies the argument above.**

(3) In **Rel-17 positioning enhancement**, **RAN1 developed MAC-CE activation/deactivation for positioning measurement gap(s) for latency improvement**. Details can be found in 38.214 V17.3.0 5.1.6.5 with corresponding agreement made in RAN1 #107 8.5.4. Hence, we do not see a reason why RAN1 (or RAN2) can not lead this feature.

13 – vivo Communication Technology

Based on the TR conclusion section (RP-223187), the following objectives should be used as the starting point for WID drafting (prefer to stick to the text from the conclusions). While the handling of XR awareness part can be discussed based on the outcome of discussion point 1.1, the power saving and capacity enhancements part should start the normative work already now.

For XR Awareness:

- Provisioning of XR traffic information from CN to RAN as per TR 23.700-60 [9].

For Power Saving:

- DRX support of XR frame rates corresponding to non-integer periodicities (through at least semi-static mechanisms e.g. RRC signalling). (RAN2)

For Capacity Enhancements:

- Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration; (RAN1, RAN2)
- Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE; (RAN1, RAN2)
- BSR enhancements including at least new BS Table(s); (RAN2)
- Delay reporting of buffered data in uplink; (RAN2)
- Provision of XR traffic assistance information for DL and UL (e.g. periodicity); (RAN2)
- Discard operation of PDU Sets. (RAN2)

Anything beyond the above will need separate discussion. We see the following additional features may potentially be added

- 1) PDCCH skipping enhancements for retransmission handling (RAN1, RAN2) (justification provided by the previous comment)
- 2) Reducing scheduling restrictions due to RRM measurements (RAN4, RAN2, RAN1) (justification provided by Nokia and MediaTek contributions)

14 – New H3C Technologies Co.

fine with FL's proposal

15 – OPPO

For Power saving, all RAN1 conclusions made so far has already excluded most of candidates except the “semi-static manner support of non-integer periodicities for XR traffic”. We support to include only this candidate in WID for power saving.

The 2nd task under power saving (switching between multiple pre-configurations of DRX) is not clear to us on whether such switching is dynamic or not and whether such switching is triggered by gNB-to-UE signaling or based on configured switching pattern without PDCCH/MAC-CE signaling. We expect big RAN1/RAN4 spec impacts if such switching is dynamically triggered by PDCCH/MAC-CE while the idea has not been studied/agreed in RAN1/RAN4. In fact, we do not think the RAN2 #119bis conclusion, which says “At least RRC pre-configuration and switching of configurations of DRX could be considered for enhancements of XR power saving”, can be taken as a firm WI recommendation, due to its tone of “could be considered”. In short, at this stage we do not support the 2nd bullet under power saving.

For capacity enhancement, RAN1 does not assume the last two bullets as two independent items, given “multiple CG-PUSCH occasions” is a necessary condition for “indication of unused CG-PUSCH occasion”. So it looks more logical to move the second-from-last bullet as a sub-bullet of the last bullet, i.e.,

- Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);

- Dynamic indication of unused CG PUSCH occasion(s) based on UCI by UE (RAN1);

We also support including the first two bullets (BSR enhancement and Delay reporting) under capacity.

In addition, although we support to include “PDU discarding” in WID, we think it should belong to XR awareness, not “capacity”; and “**timer-based** PDU discarding” is a better wording to exactly match RAN2 agreement.

16 – CATT

We don’t see any work needed for UE power saving. From SA2 LS XR and Media Service to RAN1/RAN2 in S2-2209979/R1-2210826, the core network will provide RAN a list of XR PDU set information with each XR packet consists of one or PDU sets. The XR PDU provided by Core network from SA2 LS does not show the XR packet generation cycle with non-integer interval. Thus, the objective of “DRX support of XR frame rates corresponding to non-integer periodicities” does not align with the inter-arrival of XR PDUs from SA2 LS. In addition, there is no agreement in RAN2 to support the “RRC pre-configuration and switching of configurations of DRX”.

Thus, we don’t think the first bullet item “DRX support of XR frame rates corresponding to non-integer periodicities” and “RRC pre-configuration and switching of configuration of DRX” has shown clear power saving gain with the incomplete of XR-awareness and SA2 replied LS on XR and media service.

We are Ok with the bullets in capacity enhancement.

17 – Verizon UK Ltd

As we stated in answer to question 1.1, at least XR awareness part of the study should continue for one more quarter for better alignment with SA2 and within RAN2 of SA2 decisions.

Moderator’s proposal here is a good starting point to start the WI in parallel for XR capacity/power saving aspects. Many techniques for capacity enhancement and power savings for XR were proposed in the SI phase. While some good solutions are captured here, some are not and some solutions need resolution of dependencies with XR awareness part. Further refinement of the SI conclusions and WID scope over the next quarter would certainly help focus the WI better. So prefer to start with a minimal set and with the understanding that it would be refined further in the next RAN plenary.

18 – QUALCOMM JAPAN LLC.

On top of the objectives proposed by the moderator, we propose the following additions as RAN1-led items.

- Indication of fractional use of CG PUSCH occasion

- **Increase the maximum number of PDCCH duration values to be larger than 3.**
- **PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts. The feature is enabled and disabled by RRC configuration.**
- **Non-scheduling DCI based PDCCH skipping indication**

19 – LG Electronics Inc.

We are generally fine with moderator proposal.

But, regarding power saving, RAN2 spent very few time to discuss DRX enhancement and no clear agreement was made.

Thus, we think the SI should be extended and RAN2 should focus on clear scope of DRX enhancement in the next quarter.

From RAN1 perspective, during the SI phase, some of the enhancement techniques on PDCCH monitoring have shown meaningful power saving gain without sacrificing XR capacity, so we think the following objectives on PDCCH monitoring enhancements for XR can be added.

- “PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts” (RAN1)
- “PDCCH skipping duration enhancements” (RAN1)

20 – Meta Ireland

In general, we are supportive to moderator’s proposals. On top of it, we would like to support the proposal on ”PDCCH monitoring resuming if UE transmits NACK after PDCCH skipping starts”.

21 – Spreadtrum Communications

Generally, we are ok for the proposed scope of power saving and capacity.

For power saving, we think that PDCCH monitoring enhancement (e.g. PDCCH skipping) is beneficial for handling the issue of jitter and non-integer periodicity. It should also be studied in the WID scope.

-PDCCH monitoring enhancement (RAN1)

22 – HuaWei Technologies Co.

We also support to consider PDCCH monitoring enhancements, which get support from a considerable number of companies and also showed benefits for power saving during RAN1’s study.

- Specify the following PDCCH monitoring enhancements [RAN1]:

- o **PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts**
- o **PDCCH skipping duration enhancements, e.g., additional PDCCH skipping durations, PDCCH skipping till the start of next potential data arrival, etc.**

For the below objective, there is no clear recommendation from RAN2 to have it, RAN1 seems also not agree to have it as it’s unclear what issue it tries to resolve, e.g., periodicity mismatch issue, or jitter issue, or multi-flow issue. As per RAN1 conclusions/agreements, RAN1 does not assume jitter is predictable, nor fps or data rate will dynamic switch. So support of multiple configuration and switching of configurations of DRX is not motivated and there is no consensus. TR 38835 Conclusion section also does not capture

this mechanism. Semi-static approach is sufficient to meet XR requirements and we suggest to remove this objective.

~~RRC pre-configuration and switching of configurations of DRX RAN2~~

We also agree with some other companies that UE assistance information was not concluded in RAN2, and should not be included in the objective. There would be some need on assistance information, but this can come from the CN side and is relevant to XR awareness, there is no such agreement that UE assistance information is needed for capacity enhancements. We think the below objective shall be removed.

~~UE assistance information (e.g. periodicity) (RAN2);~~

On the other hand, the following objective captured in the TR conclusions is missing. It can be fully performed by RAN3 and there is no need to continue a study on it regardless of the approach taken (i.e. WID only or SID+WID):

- Provisioning of XR traffic information from CN to RAN as per TR 23.700-60 [9].

One thing completely missing is the congestion control. We understand SA2 led this discussion and both RAN2/RAN3 confirmed this is feasible and replied to SA2. As per SA2 conclusions, congestion information signaling from RAN to CN should be specified, so we need to include relevant objective in our work. Therefore we think this objective can also be added as sth. like below:

~~Specify congestion information signaling from gNB to CN [RAN3]~~

We in general agree with Intel's reformulation of BSR enhancements, which seems more generic to reflect RAN2's conclusion.

23 – Panasonic Holdings Corporation

We support the proposal.

24 – KDDI Corporation

If we move it forward to work item phase, we are ok with the current objectives.

25 – Motorola Mobility España SA

1. In our opinion, items that have been extensively discussed during the SI with no consensus should not be included in the WID.

2. Although RAN3 impact is mainly related to XR awareness aspects, we should keep in mind that RAN3 TU should be reserved for XR WI e.g. to support XR QoS related signaling over NG, F1, Xn and E1 interfaces.

26 – Sony Europe B.V.

For XR awareness we should postpone to include these part and wait conclusion of study item.

For power save we support the proposed objectives.

For capacity, we generally support but like to stress dynamic indication of the unused CG PUSCH occasion(s) based on UCI (e.g., CG-UCI or a new UCI) by the UE, as well as dynamic indication from the UE for adjusted CG parameters (e.g., MCS, number of symbols, number of PRBs, number of layers) to improve XR capacity performance.

27 – ZTE Corporation

We think all the stable parts of XR-awareness in RAN should also be included in WID. Besides, we think it is essential to specify one solution to improve the power saving gain for some realistic DL video traces with instantaneous jitter, thus we also add one sub-bullet under power saving:

Then the updated version can be as follows:

Specify the enhancements related to power saving:

- *DRX support of XR frame rates corresponding to non-integer CDRX periodicities (RAN2)*
- *RRC pre-configuration and switching of configurations of DRX (RAN2)*
- *CDRX onDuration dynamic adjustment for DL jitter; (RAN2)*

Specify the enhancements related to capacity improvement for XR:

- *BSR enhancements including new BS Table(s) (RAN2);*
- *Delay reporting of buffered data (RAN2);*
- *UE assistance information (e.g. periodicity) (RAN2);*
- ~~*PDU Set Discard operation (RAN2);*~~
- *Dynamic indication of unused CG PUSCH occasion(s) based on UCI by UE (RAN1);*
- *Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);*

Objectives on XR-awareness in RAN (RAN2, RAN3):

- *Specify mechanisms to deliver PDU Set related parameters over control plane and user plane for UL and DL operation.*
- *Specify mechanisms to enable discarding of all the PDCP SDUs belonging to a PDU Set*
- *Finalise the details of QoS flow to DRB mapping including whether or not to enable mapping DRB traffic to multiple LCHs based on SA2 input (Note: RAN plenary to check on the progress of this objective in March 2023)*

In addition to the above, based on the evaluation in SI, the enhancement on PDCCH skipping for retransmission also provides UE power saving gain. From our perspectives, we are also open to consider it for XR power saving in WI scope.

For the enhancement on RRM measurement gap, the evaluation results in SI phase also shows capacity improvement for XR traffic if the measurement gap can be used for data scheduling. In this sense, we are

supportive to include the measurement gap enhancement for XR in WI scope but only with a feasibility analysis performed upfront by RAN4.

28 – NEC Telecom MODUS Ltd.

We can discuss the WID in next RANP if it is agreed to leave the SI open.

Regarding the draft objectives, it is a good start point because it indeed lists the items that achieved clear conclusion as of now; On the other hand, some items are not in the list just because we did not discuss it much e.g., terminate/extend OnDuration of DRX. Some items are included in the list, but the necessity or feasibility is not clear yet e.g., UE assistance information, PDU set discard and delay reporting of buffered data. All in all, giving more time for SI may be helpful.

29 – Google Inc.

Our preference is to also include PDCCH monitoring enhancement, mainly the two proposals below:

- PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts
- PDCCH skipping duration enhancements by additional PDCCH skipping durations (>3)

The two proposals above for PDCCH skipping enhancement had strong support from majority of companies during the SI. It was also shown during the SI that they offer good power saving and capacity gain for the XR service and come with very little specification impact.

30 – Deutsche Telekom AG

Can be discussed in March 2023 when the WI is potentially approved !

31 – NTT DOCOMO INC.

We are ok with the proposed WID objective. For capacity; we support to include the aspect of UE assistance information. TSCAI is agreed as a starting point, but RAN2 concluded that we can discuss the necessity of something additional on top of that.

32 – Nokia Corporation

We support the objectives proposed by the rapporteurs in RP-222936

Additionally, we would see it beneficial to specify means for avoiding scheduling restrictions due to intra-frequency and inter-frequency RRM measurements as PDSCH scheduling restrictions due to SMTC (in FR2) or MG (in FR1 and FR2) have large impact to the XR capacity as shown e.g. in our simulation results. RAN#98e could task RAN4 to evaluate the proposals to minimize scheduling restrictions in relation to the existing RAN4 UE RRM measurement requirements and mobility performance implications as already shortly discussed in Monday's GTW and commented by Apple . This could e.g. be done as Apple commented by first allowing RAN4 investigate the benefit and feasibility related to measurement gap and scheduling restriction. RAN4 could be tasked to evaluate the following two solutions;

- 1) for FR2, UE based indication to inform network that the scheduling availability restrictions within SMTC can be lifted, and PDSCH scheduled during the SMTC without restrictions

2) for FR1 and FR2, as indicated by MediaTek, dynamic indication based method to enable gNb to indicate UE to skip measurement gap or scheduling restrictions and prioritize PDCCH/PDSCH reception (or PUSCH transmission) to avoid interruption in data.

Regarding proposals on PDCCH skipping, if any bullet is added for power saving context, it should be well contained and focused to keep the workload manageable. There have been numerous evaluations carried out by RAN1, and there was no consensus on the matters. For the merit of PDCCH skipping enhancement for resuming monitoring upon transmitting NACK, it would need to be considered also how the UL re-transmission monitoring would be handled. I.e. enabling longer skipping duration by avoiding DL re-transmission scheduling would not remove the necessity of monitoring UL re-transmission. It was proposed by some companies to extent the HARQ process specific re-transmission disabling introduced in NTN to address this, but it is not clear if this is being also considered in this context. Thus, we would like to better understand how the proposed enhancement address both, UL and DL. For other PDCCH skipping enhancements we have not seen convincing justification in terms of power saving enhancement over existing functionality, thus would not be supportive of them.

33 – Ericsson LM

For RAN1 related objectives:

We are fine with the RAN1 related objectives. On the comment by OPPO to consider last proposed objective (6th) as sub-bullet of previous one (5th), we disagree as the 5th bullet can be applicable for legacy CG. No need to bundle these two together.

Regarding QC comment to study further objectives for power saving and capacity, we disagree since extensive studies have been done and more time does not change the outcome. As also discussed during Monday GTW, and instructed by the moderator above, we should keep `_strict_` scope and only specify features where gains have been shown.

Regarding including power saving objective based on PDCCH skipping, we are only supportive of the objective proposed by vivo in RP-223098 (see below).

- Support PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts.

We do not support other PDCCH skipping proposals. Reasons were communicated during SI, and can be repeated here if needed.

Regarding RRM enhancements proposal, we are neutral. If there is consensus to support this enhancement, the objective should clearly clarify the tasks on different WGs, and ensure the measurement requirements and mobility performance are not affected.

For RAN2 related objectives:

We agree with other objectives but:

RRC pre-configuration and switching of configurations of DRX (RAN2)

This was not recommended or by the WGs and should be removed.

Further, for the BSR related objective we think it needs to be clarified. RAN2 agreed new tables should be introduced but it is to be discussed further how. Now it sounds like a more generic BSR objective. Example suggestion on re-wording:

- BSR enhancements: Specifically, introducing: - 1) new BS tables (e.g. fixed, dynamic, RRC configured, etc.). - 2) If required, relevant triggering mechanisms for XR traffic and BSR formats. 3) Update the BSR procedures correspondingly.

For RAN3 related objectives:

There doesn't seem to be any RAN3 impact in the proposed WID, however RAN3 needs to provide signaling support for some of the features. We think RAN3 should be added at least to the non-integer DRX and PDU discard objectives.

Additionally, we propose to add the following to include signaling support for the parameters which are considered useful in RAN:

- Signaling support to allow XR awareness and XR Power Saving enhancement in NG-RAN architecture [RAN2, RAN3]:

o Specify the support of the functionalities related to work item objectives that impact RAN3, as needed [RAN3]

34 – BT plc

As we mention before, quality should be Rel-18 goal so our proposal is to keep SI open and discuss WID in RAN#99. No more discussion about this is required in this meeting

1.3 2Rx for XR devices

Let's find a way forward to address the notion of supporting a new XR device type that is only mandated to support 2Rx antenna ports.

GTW discussions suggest more clarifications are needed for the motivation (form factor, etc...) of supporting 2Rx XR devices.

Please use the feedback form below for further questions/comments, and for providing further motivation:

Feedback Form 3: 2Rx for XR devices

1 – Apple GmbH

Firstly, we believe 3GPP should avoid discussion or making decision on the industry design of the consumer device and leave this topic for the device companies and trust the device companies. For example, we hear the some explanation during Monday GTW that there is no issue of putting 4 Rx antenna in an XR glass which we believe is different from the reality. It is true that there might be enough space to put 4 Rx antenna for one band for NR/LTE, however, that device will provide no acceptable user experience since 4Rx without any other components delivers no performance. For industrial design of a device that can be launched globally and deliver satisfactory/best user experience, the device must support multiple bands and the antenna cannot be shared among all the bands, the device must support other RAT than what 3GPP specified, for example, Bluetooth, WIFI, etc.. The device must support other RF/BB component, modem, processors etc. The device also needs to support many other components including sensors etc.. In the end, we do not believe 3GPP is the right place to make decision on industrial design, instead, 3GPP shall listen to the opinion from device companies especially the ones with proven track record of delivering devices that consumers are willing to enjoy, and can open new market that benefits operators as well.

Secondly, regarding the concern of the misuse of the 2Rx relaxation by the unintended devices such as low-end smart phones, we are fully supportive of having mechanism to address this concern. The intention of 2Rx relaxation is only for XR wearable, and not for any other devices including smart phone. We believe this concern needs to be addressed, and the solution can be based on vehicular solution as baseline, i.e., special SPID, and potentially some restrictive description in RAN4 (38.101).

Thirdly, regarding whether we need to enhance from RedCap side. We do not have strong opinion. In the end, as engineer, it achieves the same goal. Therefore, we encourage companies to be more flexible from big picture of view, without hindering the positive goal with different flavors of the same solutions.

In the end, we think there is 2Rx relaxation needed for at least some XR wearables which is undeniable. Therefore, one way forward could be

We agree that 2Rx relaxation is needed for at least some XR wearables. Then we can spend more time on resolving/studying the following issues

1. Which XR wearable devices can have 2Rx relaxation

2. How to identify/differentiate those XR wearable devices and provide operators tools to prevent the misuse of the 2Rx relaxation by the unintended devices (e.g., smart phones)

Again, the goal of this proposal is to allow device company some design flexibility to come up with the best industrial design (the most capable device) that consumers are willing to purchase. This may help create a new market that will impact consumers in the positive way, equally importantly, drive up the true demand for 5G/6G. This will benefit everyone in this eco-system, not only UE vendor, infra-vendor, more importantly, the operators.

We strongly believe we share the common interest with operators and we can work out details since the goal is beneficial for everyone. We hope operators can provide more details about how to progress this important topic. We really appreciate the discussion and feedback.

2 – VODAFONE Group Plc

As stated in the GTW session, the proponents of 2rx need to explain their problems. Simply stating "form factor" is not easy to accept when a normal pair of spectacles has two arms that are over 10cm long, an orthogonal linkage across the lenses over 10 cm long, and the opportunity for a vertical element of 2.5 cm long... and the 100 MHz bandwidth of the study implies a frequency band above 3 GHz where a half wavelength dipole would be less than 5 cm long. Coupled with the isolation between the spectacle arms provided by the user's head, overall, spectacles seem an IDEAL form factor for 4 rx!

3 – Apple GmbH

@Vodafone, thank you for the question. We believe we address your concern in our response provided above. In summary, the glass has many different components to deliver satisfactory user experience to the consumers with a global launch across operators in different regions/continents. 4Rx for a single band is only a small part of the components that a commercially successful glass needs. We have many bands to support include low/mid/high which is evident if you check the current RAN4 specification. Furthermore, device may also need to support other RAT including WIFI/Bluetooth, etc. Once you consider the complexity of glass, it should be understandable that 2Rx relaxation is needed. We hope our explanation here and above can address your concern. In the end, it is in the best interest of both UE vendor and operators that we can have the most capable device in the sense that the device can provide the best user experience so consumer would be convinced to use. We would really be appreciated that you could trust our industry design ability and understand the difficulty of designing the most capable consumer device with the true limitation of "form factor"

Please let us know if you need any further clarifications.

4 – MediaTek Inc.

- MediaTek supports defining 2Rx relaxation in 4Rx mandated bands for a specific new UE type, as part of the XR WI, in order to drive adoption of high-end XR services.
- We agree that it is important to clearly distinguish this UE type from "smartphones/normal UEs" and from "RedCap UEs", and believe that the Apple proposals 1 and 2 **commented above** are reasonable objectives for that goal.
- We would NOT like 3GPP to associate such a UE type with "RedCap" (or apply any similar extension of that term), as we believe it would cause unnecessary industry confusion about RedCap, which is not at all helpful if we want the existing Rel-17 RedCap UE ecosystem to flourish.
- 3GPP should target a single device type to avoid market fragmentation – with 2Rx with large required channel bandwidth capability (100MHz) and optional CA support being our preference as baseline (also highlighted by proponents of RP-223208).

5 – TELECOM ITALIA S.p.A.

We still have strong concerns on the proposal, which is not taking the poor user experience it can be expected in a network designed for 4 Rx-capable devices. Please note that the already deployed networks have been designed by considering a sensitivity level based on 4 Rx.

Moreover, this proposal is causing a serious increase in overall energy consumption (increase of # of base stations to provide better coverage to poor performing devices), network congestion (poor devices requiring more resources than good performing devices) and overall increased costs which will be reflected in customers experience.

A poor performing device will not likely be able to achieve the advertised data rates, and therefore the current Redcap devices could be sufficient to provide a good user experience.

Finally, a smartphone could be used to provide connectivity to the XR device, without the need to support a dedicate NR radio.

6 – Spark NZ Ltd

we support the views of Apple as the relaxation for 2 Rx is only intended for **some** XR devices and as long as it is not made as a **relaxation** for mandatory support of 4Rx for smart phones. A way forward suggested by Apple in bold is also a good way forward.

7 – AT&T

At a theoretical level we understand that form-factor limitations can impact device complexity and power consumption, including some potential XR wearable devices, and also we agree that from the 3GPP studies the UL has been typically shown to be the bottleneck for XR user experience compared to DL, especially in low-band, outdoor deployments.

However we do have significant concerns with the proposal since 2Rx may only be relevant for a small subset of XR UEs, so a 1:1 correspondence to a new XR device type is overly broad and should be avoided in any agreements or specification text. Also, the higher frequency bands within FR1 where larger bandwidths per carrier are possible (e.g. 100MHz) are expected to have less constraints on the antenna size, so we don't believe a 1:1 correspondence with bands where V2X or RedCap devices currently have 2Rx exceptions should be taken as a given either.

As a potential compromise, we would be open to a very specific and narrow form-factor description and a limitation to only essential bands where 4Rx cannot be supported. Otherwise we believe the correct approach is for 3GPP to evaluate a range of potential device requirements (e.g. bandwidth/CA/MIMO) to balance performance and complexity tradeoffs with 2Rx XR devices in realistic network deployment scenarios.

8 – KT Corp.

KT support to have 2Rx for XR device. For Release-18, XR devices are likely to be XR glasses and/or HMD(Head Mounted Device). This case not like smartphone or other device type, you need to "wear" which devices will directly contact with your face/skin. Device needs to be heat sensitive and considering the form factor of the device, there is not much room left where it does not directly contacted with face/skin. As an operator, yes of course KT would like to have full performance support however considering the reality and availability on the device side 2Rx for XR device seems to be the best compromise we can make for this Release.

9 – Futurewei

First, we would like to understand whether this form factor issue exists (or is critical) only on smart glass type of AR devices or on any head mounted display (HMD) devices for any XR application.

We have a concern about potential impact on system capacity.

In any case, we prefer not to mix this with RedCap.

10 – vivo Communication Technology

Relaxation the 4Rx to 2Rx for XR devices (for higher band of FR1) is important for the product design of lightweight XR wearable devices (e.g. XR glasses), as it is very challenging to implement 4Rx from antenna placement point of view.

We fully understand the concern from operators, therefore a clear definition of the intended device should be worked out in order to avoid any potential misuse of the 2Rx to other unintended devices. We believe such exercise should be done at RAN plenary level, no need to involve working groups.

11 – Meta Ireland

We support the 2RX XR type devices. We fully agree that for some XR lightweight wearable devices, such as AR glasses, the size and formfactor limitation makes it not possible to fit 4Rx in some of those devices in FR1 high bands. While one can argue that currently Rel. 17 RedCap already supports up to 2RX, some of the restrictions such as 20MHz bandwidth limitation, makes it unlikely to support some high data rates AR applications without further enhancements, such as 100MHz and CA/DC support. Hence, we strong agree on the support of 2RX for FR1 high bands supporting high data rates XR type devices. We agree with some comments from we don't need to tied XR device type with eMBB or RedCap. Instead, we should focus on the lightweight, small form factor, high data rate XR services support.

12 – Verizon UK Ltd

Verizon supports 2Rx XR type devices. This enables lightweight XR wearables where it might be challenging to implement 4Rx. We are open to further study on how to differentiate such devices etc. We would not like to limit/tie such UE type to RedCap as it adds other undesirable restrictions (eg 20 MHz bandwidth).

13 – Samsung Research America

We support having UEs with 2 Rx antennas in bands where 4 Rx antennas is currently mandated. We also share the same opinions as MediaTek, Verizon, and other similar opinions stated above (and will not repeat here).

14 – Beijing Xiaomi Mobile Software

As a device company, we are open to discuss the need of 2RX. We see the potential difficulties when we consider the form factor restriction in the further.

But we prefer not to mixed with Redcap. If we introduce a wider bandwidth of Redcap, we need to consider the spec impact by a wider Redcap UE. And people would be very confused on a wider Redcap and the R18 Redcap.

15 – New H3C Technologies Co.

We support having UEs with 2 Rx antennas in bands where 4 Rx antennas is currently mandated.

16 – Qualcomm Incorporated

We fully support the proposal.

We believe that the relaxation is only needed for the subset of the XR devices that have the challenging form factor limitation. How to define and differentiate these devices from other XR devices in 3GPP may not be straightforward, but this should not be an obstacle preventing agreeing to the proposal.

One option is to apply RedCap limitations, such as no CA or DC support, to at least differentiate from NR smartphones. At the same time, we don't believe 20MHz will be sufficient for every XR device category (while it is sufficient for some XR device categories) with the challenging form factors, so some extension on top of existing RedCap would be still needed.

Lastly, applying other limitations, as proposed by AT&T, could be further explored.

17 – Telstra Limited

We are sympathetic to the potential challenges of supporting 4Rx in a relatively small form factor XR device.

Therefore Rel-17 Redcap already offers a solution to this challenge through optional 2Rx support so XR devices can simply leverage this capability.

From TR 38.835, we can see Rel-17 Redcap can address most XR evaluation scenarios and therefore we see no need to create another Redcap variant or further relaxation of specifications in this release.

18 – CATT

We are fully supportive of XR-specific antenna configuration of mandatory 2 Rx antenna for XR-devices only in the given band. The key criteria of explore XR services with good user experience is the practicality of XR devices. If 4 Rx antenna is mandatory for XR devices, the rollout of XR devices might be delayed. If the rollout of the XR devices is delayed, the XR in 5G network might be replaced by other network, such as WiFi.

19 – China Mobile Com. Corporation

We should carefully study the 2Rx XR device especially the misuse issue of low-end smartphone to avoid the impact on network performance. As the comment in GTW, we think to introduce a extended RedCap UE, e.g., 40MHz 2Rx RedCap UE is a good compromise to address both the UE vendors and operators' concerns without any other RAN1 spec impacts, that is the current specifications for Rel-17 RedCap UE are still applied for new 40MHz RedCap UE. For example, it is not necessary to differentiate 20MHz RedCap and 40MHz RedCap during the initial access procedure and the same separate initial DL/UL BWP can be used for both 20MHz and 40MHz RedCap. And after the initial access procedure, larger UE-specific BWP can be configured for 40MHz RedCap UE to serve XR service in RRC_CONNECTED mode. In the end, we think a detailed study on 2Rx issue is also needed before we draw the conclusion to support 2Rx XR device, including the maximum BW of 2Rx UE, the UE type definition, the system impact and how to conduct the network control/differentiation...

20 – LG Electronics Inc.

We are ok to support 2Rx device for XR. However, we don't want to consider a mechanism specific to 2Rx device.

21 – LG Uplus

Although we still have concerns to 2Rx XR deviceS would be reduced NW capacity, but we understand there are limitation to implement 4Rx device for XR Galasses or Head Mount type device. So we support 2Rx XR device and 3GPP should clarify what type of XR Devices and frequency bands will be support 2Rx.

22 – Panasonic Holdings Corporation

We support the proposal.

23 – KDDI Corporation

We support 2Rx XR type devices, we admit that for some cases 4Rx implementation seems to be challenging and beneficial to allow 2Rx for those cases.

24 – China Unicom

During the online discussion, we have strong concerns on introducing 2Rx for XR devices impacting on a long list of related frequency bands. For 'form factor', it is related with industry design and this is not only limited with 3GPP access technologies as well as other non-3GPP technologies. If operators have to provide with good network quality for the new coming XR service, we have done a lot of RAN1 evaluations for 4Rx. It has been proven that 5G network can provide the service quality to XR device with 30~40Mbps. Unfortunately, there isn't any evaluations for 2Rx XR device in any RAN working group by now. Considering the type of data traffic of XR device is mainly video, reducing Tx branch would obviously degrade the user experience. How can we have a common understanding about the 5G network service quality and make sure that we can reach a good balance between the cost and efficiency only if the 2Rx XR device has been carefully evaluated.

As there is no answer for the feasibility evaluation of supporting 2Rx XR device by now, there is no sense to discuss whether to support this new device. And we don't support further discuss the new device type relate with 2Rx XR device at this stage.

25 – Motorola Mobility España SA

In our opinion, such a relaxation can bring more devices to the eco-system.

26 – Orange

We have strong concerns on the relaxation to 2 Rx antennas for XR devices, and we agree on the comments made by Telecom Italia and AT&T in particular.

Introducing 2 Rx for XR will have a significant negative impact on XR performance and network capacity. We don't even think we need detailed analysis on the matter, as this is a well-know issue. Allowing such degradation also seems paradoxical when at the same time the industry is striving to optimise the

performance of XR (notably with the other proposals in the WI) and develop "XR-ready" networks. While we understand some degree of flexibility may be desired when designing XR devices (e.g. glasses), we also believe as stated by AT&T that this should only target a small sub-set of XR devices. The scope of XR is wide, and we don't believe fitting 4 Rx would be an issue on large form factors such as XR helmets. If eventually a manufacturer still decides to implement 2 Rx within an XR device, this can be mapped to the RedCap category. We don't think we should jeopardise the whole development of the XR ecosystem for the sake of facilitating a few exceptions.

27 – Sony Europe B.V.

We are open to discuss support for 2Rx, but don't think this is a discussion related to only XR topic, but should be handled on RAN plenary level, and potentially generally for different types of devices. So it needs to be considered whether this can be a general relaxation for any device and indicated via capability and not part of RedCap UE definition.

28 – ZTE Corporation

We understand the benefits of relaxation 4Rx to 2Rx for XR wearable devices from form factors perspectives. However, if it is supported, the following two issues should be discussed:

- How to identify XR UEs. The relaxation of number of Rx antenna ports should be restricted only to XR devices to avoid applying it to smart phones
- The band requirements for this new devices. Applying this new device type to the bands that are not commercialized yet is not preferred. A threshold value of band frequency can be considered for the applicable bands of the new devices. For example, if the band frequency is larger than a threshold value, XR devices (FFS device definition) with 2Rx antenna ports can be supported.

29 – Telia Company AB

We agree with concerns raised by Orange, Vodafone, CMCC, TIM and AT&T on the network performance, capacity and energy consumption if 2RX relaxation for "XR device type" would be allowed. We understand that there are challenges in the "XR device" implementation and design of user-friendly devices, but we believe it is not 3GPP matter to consider. Definition of XR-device should be defined more specifically if possible to not enable misuse of 2RX in the bands that 4RX is mandatory. Maybe extension of RedCap having already 2RX relaxation could be utilised in the solution for XR devices, TBD?

30 – Deutsche Telekom AG

We share the same concerns as raised by the other operators on network performance and network energy consumption of allowing 2 Rx.

We can not accept this being added as part of a WI as there was no study on the impacts, side effects, additional power consumption and so on.

Without knowing the required data rates we are not willing to go beyond what was already compromised by the operators for RedCap.

31 – NTT DOCOMO INC.

We have a concern if we have not maturely evaluated the degradation of performance resulted from the relaxation, i.e. 4Rx to 2Rx. We should start with evaluating simulation results on that. From workload point of view, it is better to assume the 2Rx XR UE is based on RedCap, because evaluations can be done easier.

32 – Google Inc.

We support the 2 Rx relaxation and we agree with Apple’s view and with many views of other companies. We agree with Apple statement that 3GPP should avoid discussion on industrial design and trust the device companies. It is difficult to have the full picture as it is much more complicated than only the modem design. This relaxation is needed for some XR lightweight devices to have small form factor and provide comfortable experience for users to wear these devices for a long period of time, this means designing devices that are more appealing for consumers and with better adoption. It was also shown in the Rel-17 RAN1 SI that the UL is the bottleneck for system capacity for the AR devices (and not the DL).

As proposed by multiple companies, we are also in favour of defining a new UE type for this set of XR devices (2Rx with 100MHz support) to distinguish them from smartphones and RedCap UEs.

33 – HuaWei Technologies Co.

From our observation, we see potential difficulty to have 4Rx for some particular form factor of XR wearable devices, typically glasses; and on the other hand, not all form factors for XR devices have such limitation, and also understand the worry from operators of potential impact on the mandatory 4RX support for smart phones. Therefore we think a proper study in 3GPP could be helpful, which aims to clearly define and identify the XR devices with a specific form factor which cannot support 4Rx, and to also avoid overlapping with smart phones form factors.

34 – CHTTL

We also share the similar concern as other operators regarding the network performance, also we would like to understand the difference between the new device type (XR) and the term of ”XR wearables”, and the target performance ex: data rate of this type of device, as wearable is also in the scope of the R17 RedCap.

35 – BT plc

Whilst we recognise that some device types may have limitations on accommodating 4Rx, we are concerned that any exemption that is agreed for those devices may be applied to other devices which would be capable of accommodating 4Rx. So, a 2RX XR capable device should be strictly limited and defined before we do agree an exemption for certain XR devices.

2 Intermediate phase - now closed

2.1 WID Objectives and SID handling

Based on the comments there is no obvious majority opinion emerging on the WID/SID handling.

A reasonable way forward representing a middle ground is to:

- 1) Approve a WID at this TSG with the objectives concluded in the SID on power saving and capacity enhancements. Normative work on these aspects can start.
- 2) Keep the SID open for RAN2 until March to conclude on XR awareness.
- 3) Update the WID in March to include RAN2's conclusions on XR awareness, as needed.
- 4) Add potential RAN3 impacts to the WID in March, as needed.
- 5) Capture in the RAN meeting minutes that *"the delay of the start of the normative work on XR awareness is not foreseen or have an impact on the Release 18 completion schedule."*
- 6) Stick to the original list of objectives for the WID, as proposed in the Initial phase in Section 1.2 above. Neither any of the additional PDCCH monitoring enhancement mechanisms, nor the RRM enhancement proposal carries sufficient support to risk fitting the WID into the allocated TUs.

Any final comments can be made in the form below, but please avoid re-iterating comments already made during the Initial Phase.

Feedback Form 4: Final comments on WID Objectives and SID handling

1 – VODAFONE Group Plc

If we go the way proposed by moderator and start normative work on power saving and capacity enhancements, but keep the study on XR awareness for 3 months, we would like to list points which need additional clarification for XR awareness. Without such a list, there is no scope and justification for additional study.

On RRM enhancement proposal, we understand that this might be an important feature and we believe it is good to allow corresponding companies to get more support and treat it as part of a study item for the next 3 months.

2 – AT&T

We are generally OK with the proposed way forward. However we believe that in addition to power saving and capacity improvements, the WID should already include a high-level objective to support XR-awareness in RAN (RAN2-led) based on the final conclusions of the SI in March. Without any reference to or support of XR awareness in Rel-18, the other WID objectives cannot really be implemented since they are based on the assumption that characteristics of the XR DL/UL traffic are available within the network.

3 – KT Corp.

Moderator's compromise is acceptable to us.

4 – vivo Communication Technology

1. Fine with point 1) -5) from moderator
2. Regarding 6), as we commented before, the listed objectives in section 1.2 is NOT consistent with TR conclusion, therefore should not be used. The following is copy-paste from TR conclusion section, which

should be used for drafting.

For Power Saving:

- **DRX support of XR frame rates corresponding to non-integer periodicities (through at least semi-static mechanisms e.g. RRC signalling).**

For Capacity Enhancements:

- **Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration;**
- **Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE;**
- **BSR enhancements including at least new BS Table(s);**
- **Delay reporting of buffered data in uplink;**
- **Provision of XR traffic assistance information for DL and UL (e.g. periodicity);**
- **Discard operation of PDU Sets.**

3. Regarding additional objectives on PDCCH skipping enhancements for retransmission and RRM enhancements, it seems no objection from the initial round discussion. We therefore suggest to add them to the WID.

5 – InterDigital

We are generally fine with the way forward proposed by the moderator, specifically on bullets 1 to 5.

On bullet 6 related to the list of objectives for the WID, we are supportive of the change to the wording proposed by Intel under power saving objective:

- **Support a mechanism to configure RRC pre-configuration multiple DRX configurations via RRC and enable switching between those of configurations of DRX (RAN2).**

We are also ok to include the following PDCCH monitoring enhancement techniques under the power saving objective in WID:

- PDCCH skipping duration enhancements by additional PDCCH skipping durations (RAN1)
- PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts (RAN1)

These techniques were discussed during RAN1 SI phase and have shown adequate gains in terms of power savings.

To keep the WID more focused and to avoid additional workload, we prefer excluding RRM enhancement techniques in the WID. The solutions related to RRM enhancements were discussed extensively in RAN1 during SI phase and there was no convincing justification in terms of capacity improvement for reaching consensus.

6 – New H3C Technologies Co.

we are fine with FL proposal in general.

7 – CATT

We are OK with moderator's proposals 1 to 5 as way forward. However, we would like to comment on the objectives,

During the XR study in RAN1, the power saving gain from non-integer interval of C-DRX is based on the XR frame inter-arrival at the gNB scheduler similar to the XR frame generation cycle. When XR frame maps to one or more PDU sets as described in SA2 LS XR and media service to RAN1/RAN2 in S2-2209979/R1-2210826, the XR frame from application layer is a data burst within a duration. A data burst consists one or more PDU sets. The gNB scheduler would only see the inter-arrival of XR PDU set(s) from the Core Network. Thus, the interarrival of PDU set does not equal to the XR frame generation cycle. Moreover, each PDU set would also have its delay and delay jitter during the network transport. The power saving scheme of non-integer periodicity has the strong dependency on the mapping of XR frame to the PDU set(s) in the XR-awareness. The power saving objective of DRX support of XR frame rates corresponding to non-integer periodicity needs to wait for the conclusion of XR-awareness in RAN2.

DRX support of XR frame rates corresponding to non-integer periodicities (RAN2) -> **pending on the conclusion of XR-awareness on the XR frame mapping to the PDU set(s).**

For the RRC pre-configuration and switching of configuration of DRX, there is no RAN2 agreements on this objective. The agreement in **RAN2#119bis-e** is as follows,

At least RRC pre-configuration and switching of configurations of DRX could be considered for enhancements of XR power saving. Other solutions are not precluded and can be further discussed.

RAN2 Vice Chair who chaired this session clarified the agreement as follows,

The former agreement exemplifies two possible solution directions, but others are not precluded, either. So we can't say there was consensus in RAN2 to go for one direction above others. [...] For the TR, stating that the "RRC pre-configuration and DRX configuration switching" are still possible is according to RAN2 agreements. But stating those are recommended or the only possible directions would not be correct.

Since the XR power saving by non-integer periodicities of C-DRX to aligned with the XR frame generation duration would depend on the mapping of XR frame to PDU set(s) in the XR-awareness, the RRC pre-configuration and switching the configuration of DRX would also depend on the outcome of the XR-awareness.

The UE power saving objectives for XR should be re-visited in RAN#99 once the study of the XR-awareness is completed.

8 – Intel Corporation (UK) Ltd

We are ok with points (1) to (5). Regarding point (6), we are ok with moderator's proposal not to consider PDCCCH monitoring enhancement mechanisms, nor the RRM enhancement in order to limit the scope of the WID.

We suggest that the objectives of this new WID are updated to clarify the intended scope considering the agreements already taken by RAN2 during Rel-18 XR SI. Therefore, companies' inputs provided on this regard during the initial phase of this email discussion should also be considered.

9 – OPPO

We are generally ok to 1) to 5). For the detailed WI objectives listed in 6), we share the view with other companies that the following objective should be removed, because the (dynamic) switching of DRX on-the-fly (based on either PDCCH or MAC-CE) does not seem to have RAN2 spec impact only, and RAN1 already concluded to have no consensus on dynamic-based solution for XR power saving.

~~–RRC pre-configuration and switching of configurations of DRX (RAN2)~~

10 – KDDI Corporation

We can agree the Moderator's compromise. Just two minor comments.

1. We are wondering how to manage time units for RAN2, each time unit for WI and SI separately allocated or just allocate combined time units covering both WI and SI.
2. We think that list points which need additional clarification for XR awareness proposed by Vodafone is a good idea. But at the same time I guess it may not be feasible to develop the list during this plenary week without RAN2 experts involvement, I'm afraid.

11 – QUALCOMM JAPAN LLC.

We support moderator's proposal with some additions below.

The RAN2 study on XR awareness may not consume the full 2 TUs allocated for XR in Q1. We propose to allow RAN2 to discuss other objectives with the condition that absolute priority is given to the completion of XR awareness study. With that, we support Vodafone's proposal to allow discussion on RRM enhancements and treat it as part of a study item for the next 3 months.

To other companies' comment on DRX enhancements, we propose to stick to moderator's proposal which includes the switching between pre-configured DRX configurations. It is truly based on RAN2 agreement below, and it does not make sense at all to remove the objective.

12 – Futurewei

On 1), we agree that WI should begin, at least for these two objectives.

On 2), we believe that the XR traffic identification aspect of the objective on XR awareness has been completed. On the aspect of how the XR traffic information aids XR-specific traffic handling, we think the following key issues can be further discussed: 1) The details of QoS flow to DRB mapping plus whether or not to enable splitting DRB to multiple LCHs; 2) Whether/how PDU Set Integrity Indication (PSII) is used in PDU discarding for Rel-18. We believe (and our preference is) that they can be done in the normative phase. However, if the group decide that the SI on XR awareness is to be kept open for another quarter, we should focus on resolving these two issues.

On 6), we are fine with not adding any new objective, unless, on a case-by-case basis, there is consensus.

13 – Meta Ireland

We are generally fine with the moderator proposals. However, we think it's important to reconsider the possibility of adding PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts.

14 – MediaTek Inc.

1. Fine with point 1) -5) from moderator
2. For 6), we agree with vivo that the listed objectives in section 1.2 is not fully consistent with TR conclusion, and the copy-paste from TR conclusion section by vivo may provide more accurate wording. For example, we also do not see "RRC pre-configuration and switching of configurations of DRX" recommended from TR conclusion.
3. Also for 6), regarding additional objectives on PDCCH skipping enhancements for retransmission and RRM enhancements, we agree with vivo to add them to the RAN1 WID, as we do not see strong objection from the initial round discussion, and currently RAN1 only has one dynamic CG-UCI enhancement in R18 XR.

15 – CTSI

[China Telecom]: We are fine with moderator's proposal.

16 – Spreadtrum Communications

1. We can accept the points (1) to (5).
2. As for the scope of power saving, what we captured in the TR is to use at least semi-static mechanisms e.g. RRC signaling.
From our view, it may include the second bullet (i.e., RRC pre-configuration and switching of configurations of DRX). It also means that other solutions are not precluded. Thus we agree with other companies to remove the second bullet.
"Specify the enhancements related to power saving:
- DRX support of XR frame rates corresponding to non-integer periodicities (RAN2)
~~-RRC pre-configuration and switching of configurations of DRX (RAN2)"~~

17 – TELECOM ITALIA S.p.A.

- We can accept the moderator's compromise, but:
- we support AT&T statement: *the WID should already include a high-level objective to support XR-awareness in RAN (RAN2-led)*
 - in RAN2 priority should be given to the conclusion of the study
 - on 6) we believe the objectives should better reflect the TR conclusions
 - on 5) we don't see the need for this statement. It is business as usual

18 – LG Electronics Inc.

Considering diverged views from companies, we are ok with the moderator proposals 1) to 5).
For 6) on WID objectives, more specifically on the objectives for XR PS, based on the level of support from companies during the SI phase, we suggest to add the following two PDCCH monitoring enhancements and remove the RRM enhancements.

- PDCCH monitoring resume if UE transmits NACK after PDCCH skipping starts (RAN1)
- PDCCH skipping duration enhancements (RAN1)

19 – Verizon UK Ltd

We agree in general with the moderator’s proposals 1-6 as a good way forward.

We are fine with AT&T’s proposal to have a high-level objective on XR awareness that could be elaborated further based on the XR awareness study outcome in next three months.

We also recognize from the discussion above there is some ambiguity on power saving objectives (whether to add PDCCH skipping/monitoring, whether to keep RRC pre-config/switching and XR awareness dependency for non-integer DRX support). So it would be good to allow for refinement of PS objectives till the study for XR awareness concludes.

20 – Fujitsu Limited

We are fine with the moderator’s proposal to start a new WI while keeping the existing SI open.

21 – HuaWei Technologies Co.

For the sake of progress, although we don’t see need to keep XR awareness for another quarter study, we could accept the way forward suggested by the moderator in 1), 2), 3), 5).

For 4), it is a bit unclear what it refers to, we understand RAN3 impacts are mainly for XR awareness and congestion management, and if this is the intention, we think 4) can be further clarified. For example, for congestion management, SA2 has already approved the WID in S2-2211465 with obj#3, if there are LSS coming to trigger RAN3 work in Q1, we don’t see such work needs to be delayed to Q2. Similarly, SA2 WID contains objective on “5GS enhancement to provide assistant information to NG-RAN via NGAP message and GTP-U header” and RAN2 TR captures it in the conclusion:

“- For XR Awareness:

- Provisioning of XR traffic information from CN to RAN as per TR 23.700-60 [9].”

Hence these RAN3 objectives can start in Q1 already.

For 6), we agree the scoping should be fitting into the TU. However we disagree that the original list can be kept without modification. If the rationale here is to only pursue the objectives that have recommendation and other techniques without consensus are not considered, the below two objectives shall be removed as there is no such recommendation from both RAN1 and RAN2. Otherwise we hope the principle of formulating the list can be clarified.

~~**-RRC pre-configuration and switching of configurations of DRX (RAN2)**~~

~~**-UE assistance information (e.g. periodicity) (RAN2);**~~

We also agree that we need to be more specific about the scope of the extended SI and clarify it is to analyze the impacts of PDU Set Importance to RAN and conclude on L2 protocol stack.

22 – Beijing Xiaomi Mobile Software

We agree with 1) to 5). For 6):

RRC pre-configuration and switching of configurations of DRX (RAN2);

Provision of XR traffic assistance information for DL and UL (e.g. periodicity);

They are not recommended or concluded by RAN2 and should be removed.

And **“Discard operation of PDU Sets” is more reasonable to remove to the XR awareness.**

23 – Sony Europe B.V.

We are generally ok with the proposal from the moderator

24 – ZTE Corporation

We can also accept in general the compromise and the points proposed by the moderator in 1) to 5) with the understanding that the SI is open only for the XR awareness aspects that are not yet concluded. i.e. all the XR awareness related aspects that are stable and concluded (e.g. provisioning of XR traffic information for CN etc) should not be re-discussed in the continued phase of the SI). It would be worth clarifying this in the updated SI.

For 6), we share the views from others above that the TR conclusions should be respected.

Specifically, the conclusion in the TR *“- Provisioning of XR traffic information from CN to RAN as per TR 23.700-60 [9].”* seems to be not reflected in the objectives. We wonder why this is the case. We should add this as specific objective (for RAN3) as also mentioned by other companies and this work should not be unnecessarily delayed.

Then, for RRM/measurement gap enhancements, we think some RRM requirements and related enhancements is something that would be needed in general for a WI of this nature and this could be added (e.g. as a generic RRM requirements for XR objective for RAN4). It is a bit hard to say that none of the XR enhancements would impact the RRM.

So, we propose to add the following objectives:

- ***Provisioning of XR traffic information from CN to RAN as per TR 23.700-60 [9] – [RAN3]***
- ***RRM requirements to support XR operation (if required) [RAN4]***

In addition to the above, we are also okay to add the PDCCH monitoring enhancements which seems to be supported by a few other companies above.

25 – Panasonic Holdings Corporation

We support the moderator proposal.

26 – Google Inc.

We generally agree with the way forward proposed by the moderator, mainly for bullets 1 to 5.

For bullet 6, we prefer to stick to the SI TR conclusion and RAN1/RAN2 agreements for the WI objectives as emphasized also by many other companies.

We also still see great benefit in including PDCCH skipping enhancements as there was no strong objection from companies in the previous round.

We also think that the extension of the SI for XR awareness should be well scoped to ensure the SI is concluded in Q1.

27 – Motorola Mobility España SA

We agree with the proposals by the moderator. In our view, the DRX enhancement aspects need further discussion in RAN2, and hence, it is premature to remove the bullet regarding multiple DRX configurations and switching between them (We are fine with Interdigital's wording suggestion on that aspect). As for adding items discussed in RAN1 with no conclusion, we think they should not be re-opened even though we ourselves are supportive of more PDCCH skipping values.

28 – TCL Communication Ltd.

Fine with the moderator's proposals from 1) to 5), however, for 6), PDCCH skipping enhancements for retransmission and RRM enhancements can be added to RAN1 WID.

29 – Ericsson LM

We are in general supportive of moderator's proposal considering the situation. However, on points (3), (4) and (6) we have the following comments:

On 3). We also agree with Vodafone and other companies who commented that we should list the open items to clarify the scope for the remaining study. Concretely, the scope should be narrowed to resolve the question sent to SA2 and, to show and prove how the information provides a benefit and how, as this was the scope of the SID for XR awareness. In XR awareness item, RAN2 did not discuss protocol enhancements and enhancements in this agenda should not be discussed. Those were treated under capacity or battery savings and these two items are completed.

On 4) (and 6)), as was pointed out by number of companies in the replies during the initial round, the XR awareness objective is nearly complete and we should include the XR awareness objectives for which the study has concluded already. For example, for the DRX alignment, traffic periodicity and its variations must be known. This is something RAN3 needs to work on. Thus we should also include the RAN3 impact for the agreed goals already now. We propose to add the following to include signaling support for the parameters which are considered useful in RAN:

- *Signaling support to allow XR awareness and XR Power Saving [RAN2, RAN3]:*

- *Specify the support of the functionalities related to work item objectives that impact RAN3, as needed [RAN3]*

On 6), on top of adding XR awareness objectives, we share same view as other companies that this objective should be removed as it is not a recommendation in the TR :

~~RRC pre-configuration and switching of configurations of DRX~~

Our understanding is that the discussion on sharpening the RAN2 (and hopefully RAN3) objectives takes place in the final round when the scope is stable.

30 – China Unicom

We support moderator's proposals.

31 – NTT DOCOMO INC.

We are fine with the moderator's proposals.

32 – Apple GmbH

We generally support the way forward proposed by the moderator in above points 1) to 5).

On point 6), given companies' responses in the initial round, the original WID proposal in section 1.2 seems preferred: the scope is well rounded and close to the conclusions in the TR. We have following additional comments:

- On RRM enhancements, we share Vodafone's view to develop a better understanding, but in order to gauge gains and implementation effort we'd prefer to study the RAN4 impact first.
- Regarding a potential additional WID objective on PDCCH skipping enhancements for retransmission, we support companies above.
- On the DRX enhancement aspects we disagree to remove the bullet for multiple DRX configurations and switching proposed by companies above. While other solutions were not precluded in RAN2, those solutions emerged as main directions for further discussion. It is therefore ok to include them in the WID.

33 – Telia Company AB

We support moderator's proposal.

34 – Nokia Corporation

We support moderator's proposal. We agree with Qualcomm's comment that the DRX enhancement objective is according to the RAN2 agreements. There were some last minute proposals for making the TR wording general but there was not intent to change any of the earlier RAN2 agreements. Therefore, we would support to keep the WID wording as proposed by the rapporteur.

We also support AT&T's proposal to include general objective on XR awareness to the WID already now and then define more detailed objectives after finalizing the remaining study aspects in March.

In our view it is also ok to include more detailed objectives for the remaining XR awareness study part. In our the remaining XR awareness study aspects could be clarified as follows;

Remaining XR awareness study until March 2023:

Study both UL and DL PDU set handling in AS for XR traffic based on SA2 SI conclusions, considering at least

- how DRB(s) is/are mapped to LCH(s) for each of the DRB mapping alternatives
- whether jitter is applicable to XR traffic in UL
- impact of PDU set integrated information (PSII) for PDU discard
- whether there is need for treating the PDU Sets of the same QoS flow differently over the air interface
- whether in-sequence delivery to higher layers is needed for PDU sets

We also support to allow RRM studies for the next 3 months as proposed by Vodafone. The study should be done by RAN2 and RAN4.

We do not support addition of PDCCH skipping to the WID objectives especially as still it has not been clarified how UL re-transmission would be handled. Enabling longer skipping duration by avoiding DL re-transmission scheduling would not remove the necessity of UE monitoring UL re-transmissions. The implications also to UL (not only DL) would be good to understand if resuming of PDCCH monitoring is considered (when skipping is applied).

2.2 2Rx for XR devices

From the Initial round of comments the main issues around the proposal are:

- 1) What type of XR devices can have 2Rx relaxation, what are the exact physical (e.g form factor) limitations that make such a relaxation for these XR devices important?
- 2) How to identify these XR devices in the network?
- 3) How to prevent mis-use of the 2Rx relaxation by other devices (e.g. smartphones)?
- 4) Is any further relaxation foreseen to be needed for these devices, e.g. on BW?

Given that this is a commercially sensitive topic, and that there is no major technical work implied, the best way forward at this point is to allow the companies to continue exchanging views this week and until the next TSG meeting. We shall check the status of the discussions again in March to see if a way forward can be found.

To continue the constructive discussions still this week, please use the feedback form below to exchange views on the 4 points above (or any other point seen relevant to the discussion):

Feedback Form 5: Further comments on 2Rx for XR based on the points above

1 – Apple GmbH

Based on the first round discussion, we are still optimistic that all companies can acknowledge the need of 2Rx relaxation for at least some XR wearable devices. However, we do observe many concerns raised which we try to address as below.

@Telecom Italia

Giovanni raised a very good point about the potentially performance loss from 4Rx to 2Rx for XR services. One thing we want to point out is that XR performance has been extensively studied in RAN1, and captured in TR38.838. Based on the evaluation, for XR services, the DL coverage is much better than UL coverage. Even for XR traffic with extremely light UL traffic, the DL coverage is 6dB+ better than the UL coverage. For moderate XR traffic, the DL coverage is 15dB+ better than UL coverage. This observation is in line with previous RAN1 coverage evaluation for other purposes, i.e., UL is always the limiting factor, mainly due to the transmission power difference between a UE and base station. Therefore, the past evaluation already demonstrated that 2Rx relaxation will not noticeably impact the XR performance.

@AT&T

We are open to very specific and narrow form-factor description. In our proposal below, we also add the bullet about the BW consideration. In terms of frequency bands, among the 6 frequency bands (n7, n38, n41, n77, n78, n79) that UE is mandated to support 4Rx, the wavelength difference is not dramatic, between 6-12cm, therefore, we believe the 2Rx relaxation is needed for all the current above 2.5GHz frequency bands. However, we agree that any new frequency band has to be discussed separately which is captured in the note below in our proposal

@Futurewei

In our proposal, we do not bullet to cover the differentiation of different XR wearables.

@Telstra

We agree that RedCap can address some/many XR services. However, RedCap cannot address all the XR services. Fundamentally, RedCap can only access single CC with 20MHz spectrum which is Rel-8 LTE like. In TR38.838, we have some XR traffic that requires DL data rate above 60Mbps which will make RedCap very inefficient. In reality, there can also be XR traffic that requires higher DL data rate.

@China Mobile

We think China Mobile raised some good point. Regarding whether to extend RedCap, in the end, we do not think it makes much engineering difference. Regarding 40MHz, we have the bullet in our propose later to address it

@China Unicom

One thing to clarify that the intention is not to the reduce Tx branch. From the above explanation to TIM, we do have evaluation results in the TR38.838 to show that DL has at least 6dB, or typically 15dB+, coverage/performance margin compared to UL. Hopefully, this can address CU concern. We also add three bullets to further study.

@Orange

Since largely Orange comments are aligned with AT&T, hopefully our response to AT&T can help address the concern from Orange.

Regarding RedCap for XR, we provided the response to @Telstra above.

@Sony

We think plenary level discussion is a good way forward

@ZTE

ZTE raised a very good point, we put the note in our proposal below to make sure separate discussion is needed for any new frequency bands

@Telia

See our response to Orange, Vodafone, CMCC, TIM and AT&T

@Deutsche Telekom

We hope the three bullets of study can address the concern from DT

@NTT Docomo

Regarding RedCap for XR, we hope our response to @Telstra above can help

@Huawei

We added the bullets to address Huawei's concern, i.e., differentiation of different XR device, and no impact to other devices such as smart phones

@CHTTL

We added the bullets, hopefully can address the concern

@BT

We added the bullets, hopefully can address the concern

To move things forward, we have the following proposal, hopefully can achieve good compromise and use as the baseline for all companies

Agree that 2Rx relaxation is needed for at least some XR wearable devices. Further discussion/study/address the following issues

1. Which XR wearable devices can have 2Rx relaxation

2. How to identify/differentiate those XR wearable devices and provide operators tools to prevent the misuse of the 2Rx relaxation by the unintended devices (e.g., smart phones)

3. The further restrictions on total BW including maximum BW per CC and/or CA

Note: The 2Rx relaxation does not apply to any other device type including smart phones

Note: The 2Rx relaxation does not automatically apply to any new frequency band. Independent discussion of number of Rx requirement is required for every new frequency band in the future.

2 – AT&T

We agree that the moderator has captured the main issues that need to be resolved for this topic. We also appreciate Apple's proposal for a baseline to try and address some of the concerns, especially from operators. However, we **cannot agree that 2Rx relaxation is needed without first making significant progress on the issues, especially issues 1) and 2)**. We would also like to clarify that we understand any form factor or device type definition would need to be generic to cover a range of possible implementations and what is more important than exact product details would be capturing key characteristics over a range or extreme points (e.g. min/max) of the dimensions and/or volume. Once that can be better understood by 3GPP and made more specific, we believe the ensuing discussions about the exact BW requirements and mechanisms for device identification would be much more productive in future meetings.

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4 – Apple GmbH

We would also raise the following information to the attention which might help the discussion. In terms of how to identify/differentiate the device that can have 2Rx relaxation, the solutions have been identified during the study of 2Rx relaxation for vehicular devices, captured in TR38.826, quoted below

”Conclusion 1: Declare and differentiate 2 RX Vehicular UE through 3GPP compliance testing via GCF/other certification organizations [9].

a. 3GPP do not need to consider UE outside 3GPP compliance.

Conclusion 2: RAN 4 agree on existing UE capability signaling for # of MIMO layers to differentiate 2 RX UE from 4 RX UE.

Conclusion 3: Definition of Vehicular UE in TS 38.101-1 [3] is needed.

Vehicular UE: A UE which is integrated in a vehicle with externally radiating antennas for NR operating bands

Note: Integrated UE does not refer to other UE form factors placed inside the vehicle.

Conclusion 4: For Vehicular UE, network based identification is required for authorization purposes. The actual implementation of network based identification method does not impact 3GPP decision on 2 RX exception.

a. A possible solution to implement conclusion 2 is based on SPID value in 36.300[14] / 38.300 (Annex I), targeting rel-15 and beyond, to be captured in TR 38.826.

b. Other network based identification proposals in 3GPP are not precluded.

c. RAN 4 recommends RAN to consider other network based identification proposals without additional RAN signaling.

Final Conclusion: 2 RX Vehicular UE can be distinguished based on conclusion 1+2+3+4”

The above is for information only, in case it can help the progress of this difficult topic. In the end, having restriction of dimension/volume etc., may not offer the flexibility that operators want and hard to converge on.

5 – CATT

For XR devices, the network could have XR-specific configuration for 2 Rx antenna, such as CSI-RS and MIMO layer, and XR-specific services. The XR device could also has its own UE capability with the 2 Rx antenna as mandatory. The device conformance test could also provide the XR device test case.

6 – Qualcomm Incorporated

Again, we fully support the proposal to introduce 2Rx support.

We believe that there could be a principle agreement at this meeting that the issues listed in (1) - (3) will be addressed.

The relaxation is only needed for the subset of XR devices that have the form factor limitation. The need to define and differentiate these devices from other XR devices in 3GPP should not be an obstacle preventing agreeing to the proposal.

One particular comment in response to Telstra: We don't believe 20MHz will be sufficient for every XR device category with the challenging form factors (while it is sufficient for some XR device categories), so some extension on top of existing RedCap would be needed. However, we are open to define 2Rx 100MHz devices as RedCap.

Lastly, we are open to applying other limitations, as proposed by AT&T, if that facilitates agreement.

7 – vivo Communication Technology

We agree with Qualcomm's comment above. A working assumption can be made in this meeting for 4Rx->2Rx relaxation, with the condition that the issues listed by moderator will be addressed in the next meeting.

8 – vivo Communication Technology

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9 – KT Corp.

Again KT support having 2Rx for XR devices. As Apple mentioned above, similar to what has been done for vehicular UEs, we can apply this to XR wearable device which certainly has a form factor limitations.

10 – KDDI Corporation

We agree moderator's proposal, continue exchanging views this week and until the next TSG meeting. In addition to the moderator lists 4 points, we may want to identify network side impacts (including operation/configuration change) caused by accommodating 2Rx XR devices.

11 – Futurewei

We are OK with the moderator's proposal to continue the discussion until the next meeting. We think there is no definite agreement that 2Rx relaxation is needed yet. It is also premature to make it a WA at this point.

12 – Futurewei

We are OK with the moderator's proposal to continue the discussion until the next meeting. We think there is no definite agreement that 2Rx relaxation is needed yet. It is also premature to make it a WA at this point.

13 – Verizon UK Ltd

Agree with QC's statement that there could be a principle agreement at this meeting that 2Rx can proceed with the issues listed in (1) - (3) to be addressed. As an operator we also want identification and differentiation for proper network control. And agree the relaxation is only needed for a subset of XR devices for form factor reason only. Apple suggestion is a good starting point at least showing the feasibility - that issue (1) to (3) can be addressed. We don't think it should be tied to or considered as a RedCap device though.

14 – Meta Ireland

Again we would like to continue our support on the 2RX XR types UEs. We think it's important to at least principally agreeing at the proposals. We are open to adding restrictions to make sure that the type of devices are intended for the XR use cases and properly address the Q1-Q3 as one of the objectives to be addressed.

15 – Deutsche Telekom AG

This is a clear UPSCOPING of the Rel-18 work and it is not acceptable at all that this is continued to be discussed under Rel-18 !

RAN WGs are totally overloaded, the quality of specification work suffers and companies continue to try to add more things ...

If there is a desire to do something, please propose a Rel-19 SI in due time and then based on a well structured SI we might have a WI.

Thank you.

16 – TELECOM ITALIA S.p.A.

We tend to agree with AT&T and are concerned with the work load (similar view as DT).

Therefore the current proposal from the moderator seems a good way forward (continue the discussion and see if we can conclude at next plenary). For example, the proposal from China Mobile to have a Redcap category supporting up to 40 MHz could be a starting point.

And thanks to Apple to provide some feedback on my questions in the first round. Now I am concerned with uplink performance (**topic not related to 2Rx**, sorry) since in commercial networks, designed with 4Rx DL performance and strong DL:UL imbalance due to regulations, UL performance are not likely to meet the stated XR requirements

17 – Samsung Electronics Co.

Again, we fully support the proposal to introduce 2-RX antenna for XR devices and believe that such relaxation needs to be applied only for the subset of XR devices, e.g., glass-type of devices. Also, these XR devices should be differentiated from RedCap UEs and smartphones (i.e, eMBB type of devices).

18 – Orange

We do agree with AT&T view and believe the current scope is too vague to have any agreement at this plenary. A proper way to address the issue would be as suggested by AT&T to clearly define the subset of XR devices requiring 2 Rx, and detail the correspondance performance requirements. This would help defining the required technical capabilities (e.g. bandwidth), which could lead for instance to an adaptation of RedCap. And again, no agreement can be reached before a clear segmentation between "normal XR devices with 4Rx" and "exception XR devices with 2 Rx" is described. We would suggest to the proponents to come back to the next plenary with a clearer scope description.

19 – China Mobile Com. Corporation

We are fine to further discuss this issue in next TSG meeting and also fine with Apple's updated proposals to include BW restriction. Regarding the tie with RedCap, as we commented in the first round, we think an extended RedCap as 2Rx XR device is a simple solution without other spec impacts to slove the differentiate issue via early identification, and the extended RedCap can further report its maximum BW. Companies can take this aspect into account for further discussion.

20 – VODAFONE Group Plc

We agree with the moderator that more time is needed for bilateral discussions on this topic. We also tend to agree with AT+T.

Some differentiation between "mainly uplink traffic" lightweight AR glasses, and, "heavy downlink traffic" VR headsets may be useful. On the coverage imbalance between UL and DL reported in TR38.838, the solution is not to degrade the downlink but is to improve the uplink, e.g. by using CA with a lower frequency band - but I accept that that increases the form factor demands.

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24 – Beijing Xiaomi Mobile Software

We are fine to further discuss this issue in next TSG meeting.

25 – Sony Europe B.V.

We are OK to study as suggested by the moderator. However, would this would be a new study , either RAN plenary study, or maybe more relevantly a RAN4 lead study, or just a discussion to be followed up a next plenary meeting?

26 – MediaTek Inc.

We support to continue the discussion to find a way forward, but we would like to be very clear that such a new UE type shall not be linked to the "RedCap" term. This will cause confusion in the industry about what RedCap is, which is completely unnecessary and avoidable.

We would propose to add a bullet to Apple's proposal that such a UE type shall not be defined in 3GPP as RedCap or an extension of it.

We would also like to avoid fragmentation, so would still **propose to use 100MHz max BW and CA as the starting point.**

27 – Panasonic Holdings Corporation

We support the moderator proposal.

28 – Telstra Limited

We support comments from AT&T and Orange as a way forward.

29 – NTT DOCOMO INC.

We still have some concerns, e.g., 2Rx XR UE has not been evaluated (even though DL is not the bottleneck, we would like to recognize how much the performance degrades), and legacy gNBs cannot consider such less-sensible UEs. The moderator's proposal to continue discussion until March is fine for us.

30 – Google Inc.

Again, we are still supportive of this proposal and we support an initial generic agreement to support 2RX XR devices and capture the need to address issues 1) to 4) listed by the moderator. We can then continue the discussion exchanging views on these issues until the next TSG. We also agree that differentiation from RedCap UEs and smartphones is needed.

Also, this relaxation doesn't require a major technical work hence no strong concern for the work load in this release.

31 – China Unicom

We support the comments from DT, Orange, TIM, AT&T, CMCC and NTT DCM. We agree with moderator to continue the discussion if we can find a way forward in next RAN plenary. But it is premature to have a agreement or WA on 2Rx XR device at this meeting. The evaluation for 2R XR device is really needed before we learn the impacts on network performance, capacity and power consumption, etc. We understand the requirements from the industry design to limit from 4RX to 2RX as one wearable device similar as defined in Redcap. At this stage, we do not think it is really needed to define one new device type for 2RX XR device, and we can discuss this under the Redcap topic in the future.

We support moderator's 1st proposal to help us to know the motivation of the needs for this new type device first.

For the other proposals, from our view, it is no need to discuss in this meeting.

32 – MediaTek Inc.

Just to add that the Apple proposals, with MediaTek proposals (above) added, seem to be a reasonable baseline for the further discussion in our view to find a way forward to enable such 2Rx relaxations.

33 – BT plc

We agree with AT&T, Vodafone.

This is not a technical discussion and therefore, there is no need to involve WGs yet. We are fine to start to evaluate if it is feasible to have XR devices with 2Rx.

3 Final round

Based on the GTW session on Wednesday, there are two drafting exercises remaining for XR:

1) Create a new WID with the Objectives mirroring the endorsed way forward in RP-223493.

As all open questions have been concluded in Wednesday's GTW session pertaining to the WID objectives, there is no further NWM discussion needed, the Moderator will submit the WID for formal approval.

2) Revise the SID objectives to clarify what exact elements of XR awareness are still outstanding for the study that is to be extended until March. The latest approved SID is in RP-220285, the proposal below is shown as a revision against the relevant objective there (additions shown in **bold**):

.....

Objectives on XR-awareness in RAN (RAN2):

- Study and identify the XR traffic (both UL and DL) characteristics, QoS metrics, and application layer attributes beneficial for the gNB to be aware of.
- Study how the above information aids XR-specific traffic handling.
- Study both UL and DL PDU set handling in AS for XR traffic based on SA2 SI conclusions, considering at least:**

- **DRB mapping to LCH(s);**
- **UL jitter for XR traffic;**
- **Impact of PDU set Integrated Information (PSII) for PDU discard;**
- **Treating of PDU sets of the same QoS flow;**
- **Whether in-sequence delivery of PDU sets is needed.**

.....

Please provide feedback on the SID additions proposed above:

Feedback Form 6: Feedback on proposed SID additions on XR awareness

1 – Futurewei

Comment #1: On the first level-1 bullet, there is no need to further study the DL aspect, because SA2 has completed the work. Suggest adding a Note to guide a focused study, as the following:

- Study and identify the XR traffic (both UL and DL) characteristics, QoS metrics, and application layer attributes beneficial for the gNB to be aware of.

Note: The DL aspect is complete. Further study should be focused on how to reuse DL approaches for UL PDU Set identification.

Comment #2: The second (original) level-1 bullet and the third (new) level-1 bullet should be merged into one, as the new level-two sub-bullets should be all under a single study on traffic handling. We should not leave an impression that they are two separated study topics.

2 – Intel Corporation (UK) Ltd

Regarding the WID (topic 1), we are ok with the items listed in slide 6 of RP-223493. One missing item is the specification of “RRC pre-configuration and switching of configurations of DRX (RAN2)” understanding that it is included in the TR and during the email discussion, 17 companies are ok with keeping it vs 7 companies that prefer not to consider it. As related text captured in TR 38.835 is “RRC pre-configuration and switching of configurations of DRX can be considered for enhancements of XR power saving.”. Therefore, we should include e.g., “To specify a mechanism to configure multiple DRX config via RRC and enable switching between those configurations (RAN2).”

Regarding SID (topic 2), we do not think it is essential for RAN2 to update the SID scope when related Editor's notes are already captured in TR 38.835. So, we could refer to the related editor's notes of TR 38.835. However, if the majority wants, we could accept the moderator's proposal. In this case, we think that there is no need to keep "Study how the above information aids XR-specific traffic handling" as it would be a broader scope on the same area of study.

3 – vivo Mobile Communication Co.

Regarding the SID revision,

1. All the added sub-bullets (shown in **bold**) should be under the original bullet#2, i.e. all the examples are details on how to aid XR-specific traffic handling.
2. RAN2 also consult SA2 in the previous LS about how to map QoS flows and PDU set type(s) to DRB. This is assumed as the part of essential model, so it is better to include it, even RAN2 already had some initial conclusions on this part.
3. Besides, PDU set prioritization is also being discussed in RAN2. We think it should be also included here, e.g. delay-aware LCP.

Another alternative is to keep the original SID objectives as it is. We only need to agree a high level guidance, e.g. RAN2 study on XR awareness should focus on the open issues being discussed. While in RAN2, it is up to Vice Chair (also Rapporteur Nokia) to handle which topics are open issues.

4 – MediaTek Inc.

For the SID contents of RAN awareness, we prefer to keep the original SID objectives as it is. RAN2 already had some agreements and we do not think RAN2 needs further RAN guidance on the detailed SID items.

Besides, for the WI scope endorsed in annex of way forward RP-223493, we think we still need to discuss the leading WG(s) for each item.

5 – Meta Ireland

We share similar view that we don't need to revise the SID. The specific topic highlighted are already under RAN2 discussion and seems further guidelines from RAN is not necessary.

6 – NTT DOCOMO INC.

We support the updates on SID objectives suggested by the moderator.

7 – QUALCOMM JAPAN LLC.

We are fine with moderator's proposal.

At the same time, we are also fine to keep the current SID text. With brief text like SID objectives, it is anyway difficult to capture in detail what RAN2 found to be open issues and how SA2 conclusion interacts with those open issues. We have TRs as a placeholder to capture these details. Having long discussion on the new SID objective text at RAN does not seem to provide much benefit.

8 – KDDI Corporation

We think revised SID objectives help future RAN2 discussion, but at the same time we think that people will submit contributions/chair will facilitate discussion based on the above listed objectives without any RAN plenary agreement. In that sense, we are fine not revise the SID.

9 – Apple GmbH

We share the view from other companies that a listing of sub-topics is optional. The earlier high-level SID objectives have been sufficient to guide RAN2 on the XR-awareness discussion so far, and we expect no major change of direction in this regard. At the same time, if companies prefer to list remaining areas of study, we think the "Layer 2 structure for XR" is a key element to add, as well as "Whether differentiated treatment of PDU sets is needed on the same DRB". Moreover, it is also good to keep both DL and UL in the description, since the general QoS mapping of PDU sets to DRBs and LCHs is in scope of RAN2 (including the downlink).

10 – ZTE Corporation

In short, we are fine with the new set of objectives from the moderator.

We think the main goal of the revised SID is to narrow down the scope of the RAN2 work to only those items that are pending SA2 feedback and to ensure that discussion doesn't expand to all topics of XR awareness which have already been concluded.

We don't have strong view on how this is ensured (e.g. via a revised set of objectives as proposed by the moderator or with some generic wording to modify the existing objective to cover just the open issues pending SA2 feedback). We are also fine with the revised set of objectives from the moderator in this regard.

With respect to the original objectives we think these can now be replaced with the new ones (since these are largely settled now - especially the provisioning of XR information from CN to RAN, for which we now have a conclusion).

So, based on this, we propose the following set as the revised objectives.

~~–Study and identify the XR traffic (both UL and DL) characteristics, QoS metrics, and application layer attributes beneficial for the gNB to be aware of.~~

~~–Study how the above information aids XR-specific traffic handling~~

-Study both UL and DL PDU set handling in AS for XR traffic based on SA2/SA4 SI conclusions, considering at least

- **DRB mapping to LCH**
- **UL jitter for XR traffic;**
- **Impact of PDU set Integrated Information (PSII) for PDU discard;**
- **Treating of PDU sets of the same QoS flow;**
- **Whether in-sequence delivery of PDU sets is needed.**

11 – Beijing Xiaomi Mobile Software

We are also fine to keep the current SID text. If people think revised SID objectives help future RAN2 discussion, we are also fine.

2 questions:

1) For the revised SID objectives, I do not remember that we need to discuss the uplink jitter. Based on the WG contributions, people generally think we do not need to consider the uplink jitter.

2) We are generally ok with the items listed in slide 6 of RP-223493.

However, we noticed that for the objectives of capacity enhancement, there is a bullet "Discard operation of PDU Sets.". Should this move to XR awareness?

12 – Panasonic Holdings Corporation

We are ok with the moderator proposal.

13 – Google Inc.

We are fine with the moderator's proposal for the revised SID. It is important to clarify the scope of the remaining study. If we leave the scope of the study too broad, it will make it difficult to conclude in Q1 and may result in lack of focus in our conclusions.

The second bullet point is very broad (Study how the above information aids XR-specific traffic handling) and is already covered by the third (new) bullet point. We suggest to remove it or merge it with the third (new) bullet point.

14 – HuaWei Technologies Co.

Thanks for the moderator's proposal. It is a bit unclear whether the added bullet is an additional objective in parallel with the existing two objectives for XR awareness. In our understanding this is the remaining study list rather than a new objective. Therefore we suggest to add a note instead of adding a new objective to avoid any confusion here. In addition the UL jitter part in our view only has one remaining issue on the applicability of the jitter to UL as captured into the TR. Thus we think it can be refined a bit (Alternatively ZTE's proposal to remove the previous two objectives could also be OK).

Objectives on XR-awareness in RAN (RAN2):

- Study and identify the XR traffic (both UL and DL) characteristics, QoS metrics, and application layer attributes beneficial for the gNB to be aware of.
- Study how the above information aids XR-specific traffic handling.

NOTE: the remaining issue of XR awareness for further study are considering the following:

- DRB mapping to LCH(s);
- **Applicability of the jitter information to UL jitter for XR traffic;**
- Impact of PDU set Integrated Information (PSII) for PDU discard;
- Treating of PDU sets of the same QoS flow;
- Whether in-sequence delivery of PDU sets is needed.

It would also be appreciated if the finalized WID proposal can be shared in advance so that companies can check the justification part and the leading/involving WGs for each objective.

15 – NEC Telecom MODUS Ltd.

These points listed here are exact what we are discussing in RAN2, we do not see strong need to update the SID. But If majority wants to , the text proposed by moderator is fine to us.

16 – Ericsson LM

As some other companies, we also think it may be difficult to converge on agreed set of detailed sub-bullets which everybody agrees with and which are not ambiguous. For example, in the last item about in-sequence delivery, it is to SA4 to reply whether that is needed and then up to RAN2 to act based on the SA4 reply (and not for RAN2 to discuss whether it is needed), thus the current list is not fully OK to us.

Therefore, we suggest to have a generic bullet based on the added first-level bullet instead. Also it is important that RAN2 specifies only solutions which are useful and have gains, and these gains need to be shown:

Based on SA2 SI conclusions and depending on the SA2 and SA4 LS replies to R2-2213351, study (or not) both UL and DL PDU set handling in AS for XR traffic:

- *For any solutions to be specified, it should be shown that there are observable gains and the complexity of the techniques is justifiable.*

The existing SID bullets can be removed in case a new bullet is added (considering the new one should cover for any remaining overlap from the existing ones).

However, we also understand it is up to the session chair in RAN2 to guide the discussion and we trust the extended discussion only covers the issues related to XR awareness which are pending SA2/4 feedback.

17 – Motorola Mobility España SA

- Regarding the SI scope, the second and third main bullets can be merged. The content seems to be actually the same.
- Regarding the WI scope, as Intel suggested we prefer to add back “To specify a mechanism to configure multiple DRX config via RRC and enable switching between those configurations (RAN2).” according to the agreement in RAN2#119bis-e meeting.

18 – Nokia Corporation

For us either the moderator’s proposal for detailed study objectives or the original study objectives are ok. In the TR it is anyway already clear what further work needs to be done.

RAN2 has already concluded that XR awareness is beneficial and justified. This is also visible in the TR conclusions already. What RAN2 needs to study further are the remaining details for XR awareness. Therefore, we do not support Ericsson's proposal *"For any solutions to be specified, it should be shown that there are observable gains and the complexity of the techniques is justifiable."*

19 – Sony Europe B.V.

We are fine to keep the original SID objectives, and just continue finalize the open issues and capture in the TR. For the WID, we agree with the endorsed objectives.

20 – VODAFONE Group Plc

Regarding SI scope, RAN WG2 sent an LS R2-2213225 to SA2 out of the last RAN WG2 meeting with 3 Questions:

- ”1. Can PDU sets have different characteristics
2. Can different types of PDU sets be mapped to the same QoS flow and if so whether RAN should have the ability to treat those differently over the air interface. VF: This already includes the question of the DRBs raised by Apple in my view.
3. In-Sequence Delivery to Upper Layers”

There is in my view, only one meeting before the next plenary and I think it will be hard to clarify anything more with other groups before next plenary, but I also believe that the clarification of these 3 questions answers most of the questions listed by moderator

4 Proposed Conclusions

4.1 Way Forward on SID and WID

1) Copy-paste the conclusion from TR 38.835 v1.0.0 as is into the Objectives of the new WID (RP-223502), and in addition add the following placeholder objective on XR Awareness:

“For XR-awareness in RAN (RAN2, further clarified at and started only after RAN#99): TBD”

2) Keep the SI open, only for XR awareness, until March.

No need to update the SID, the open items on XR awareness are well understood (as also shown in the several different FFS Editor's Notes in the TR).

3) Update the WID in March: for XR Awareness, as needed.

4) Impacts to RAN3 will be assessed in March.

5) Clarify in the RAN#98e meeting minutes that:

“The delay of the start of the normative work on XR awareness is not foreseen to have an impact on the Release 18 completion schedule”

4.2 Way Forward on 2Rx for XR devices

- 1) Keep the discussion in RAN plenary – no WG discussions
- 2) Allow companies more time to bilaterally and multilaterally discuss the key aspects until March, e.g.:
 - What type of XR devices can have 2Rx relaxation, what are the exact physical (e.g form factor) limitations that make such a relaxation for these XR devices important?
 - How to identify these XR devices in the network?
 - How to prevent mis-use of the 2Rx relaxation by other devices (e.g. smartphones)?
 - Is any further relaxation foreseen to be needed for these devices, e.g. on BW?
 - etc..
- 3) Come back at RAN#99 in March and try to define a way forward.