3GPP TSG RAN Meeting #93e RP-21xxxx

Electronic Meeting, Sept. 13 - 17, 2021

Agenda Item: 9.3.2.4

Source: 3GPP RAN1 WG Vice-Chair

Title: Moderator's summary for email discussion [93e-19-MBS-WI]

Document for: Discussion

# 1 Introduction

The purpose of the email thread for which this document serves as a summary is to address the contributions on Rel-17 MBS.

# 2 Initial Round Discussion

To kick off the initial discussion, the following sub-sections provide general questions for collecting views on the issues brought up in the contributions. The views expressed can then be used to potentially discuss specific proposals in the next phase.

## 2.1 Rel-17 NR MBS Scalability Issues

The following observations were made in [1].

**Observation 1:** With growing numbers of UEs, signaling and processing the candidate UE lists for paging may consume valuable time.

**Observation 2:** With growing numbers of UEs, establishment of associated PDU Session Resources will consume valuable time.

**Observation 3:** With growing numbers of UEs, per-UE RRCReconfiguration for MBS resources will consume valuable time in highly populated cells/gNBs.

**Observation 4:** It is expected that multicast traffic reception in RRC\_IDLE/INACTIVE will enable to further improve 5GS responsiveness for multicast NR MBS.

**Observation 5:** With growing numbers of UEs, obligatory establishment of associated PDU Session Resources - just to provide joining information to RAN - 5GS capacity will be wasted.

**Observation 6:** With growing numbers of UEs it can be expected that paging resources might be blocked for more than one (complete) DRX cycle.

**Observation 7:** The Rel-17 MBS WID mentions transmission areas within a single gNB-DU, which in turns limits the number of cells and of UEs to be considered. This is the likely reason why scalability did not seem to be a concern so far. However, if and when the single gNB-DU limitation is lifted, the scalability issue will be very evident.

**Observation 8:** It would be beneficial to re-visit current concepts to ensure that mechanisms that are only applicable for interworking with non-supporting NG-RAN nodes do not have to be executed in case of homogenous NR MBS deployment.

Based on these observations, the following was proposed.

**Proposal 2.1-1:** We therefore propose for RAN to discuss the observations made in chapter 2 acknowledging the scalability issues described. Depending on the outcome of the discussion, it might be appropriate to draft an LS to the appropriate WGs to make them aware of these findings.

The following questions invite views on this aspect.

**Q1: Please provide your views on the following in the table below**

1. **General views on the observations listed above from** [1]**.**
2. **Based on the observations, is an LS to the appropriate WGs necessary?**
3. **If an LS is necessary, which WGs should the LS be sent to?**

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| --- | --- |
| **Company** | **Views** |
| Huawei, HiSilicon | Multicast, is intend to be introduced to ensure high QoS and good service experience, therefore the network must be able to perform special handling for each UE when required, e.g. using PTP transmission, support handover, etc.  We do not see the need to send LS to any WGs, as all these observations have already been taken into account during the discussion in related groups.  For the listed observations, our views are:  Ob1, Ob2，different solutions were discussed in RAN2/RAN3/SA2, the selection of the solution was made after comparing of different solutions. Note that it was agreed in RAN3#113-e: RAN3 continue the work based on current SA2 agreements, if any issues identified in RAN3 later, LS coordination or companies’ internal coordination with other groups are allowed.  Ob3, the configuration of PTP transmission should be set at per UE granularity, per UE RRC Reconfiguration is the best/only way to achieve that and there were no other ways proposed in WG discussions.  Ob4, it‘s a common understanding that the Multicast traffic reception in non-RRC\_CONNECTED will be discussed in R18 as there is no time to achieve this in Rel-17.  Ob5, the relationship between MBS Session ID and the UE context has to be provided to RAN anyway. Furthermore, this issue is completely outside RAN scope and there is no reason not to follow the conclusions and outcome of SA2 SI and WI.  Ob6, we do not understand the concern, is it assumed there will be simultaneous MBS session activation for a lot of MBS Sessions? Note that evaluation has already been made and takes into account before making the decision in RAN2.  Ob7: the R17 WID only limits the SFN to intra-gNB-DU case, there is no limitation for the transmission areas and inter-gNB mobility is supported in R17.  Ob8: we do not understand the concern, the following agreement was made in RAN3#112-e: Acknowledge that MBS related information within the associated PDU Session Resource Context may not include associated QoS flow information if interworking with non-supporting RAN nodes is not required; st3 details are FFS. |
| Intel | For observation 1, 2, 5, and 8, our understanding is that related decisions are within SA2 domain, and any related discussion on potential scalability issues should take place in SA2. There is no need for RAN to send LS to SA2.  For observation 3 and 4, our understanding is that they are related to multicast support for RRC\_INACTIVE. There is substantial support to specify multicast support for RRC\_INACTIVE in Rel-18 timeframe. We’re also OK to specify multicast support for RRC\_INACTIVE in Rel-17 if majority of companies agree. In that case, we prefer that multicast support for RRC\_INACTIVE is based on solution for broadcast to minimize the needed work.  For observation 6, our understanding is that RAN2 made decision on group paging after extension discussion, and we don’t see much need to reopen the discussion at this late stage of Rel-17.  For observation 7, we are not sure whether the intention is to change the intra-gNB-DU SFN condition in WID. It might not be desirable to broaden the deployment scenarios at this late stage of Rel-17. |
| Interdigital | With regard tot he observations, we agree that observations 1,2,3,5,and 6 are valid indeed and we support that they should be discussed in RAN2/3, time permitting. Otherwise, they can be discussed as optimizations in rel-18  As Huawei has indicated, the concerns raised in observations 4 and 7 (MBS support in IDLE/INACTIVE and SFN) seem to be within the rel-18 scope and there were a majority support for them in the pre-meeting R18 email discussion. So we don’t think we should discuss them in the R17 context  We are neutral with regard to the sending of the LSs. If they are to be sent, then RAN1/2/3 and SA2 seem the relevant ones. |
| MediaTek | We share the views with Huawei. We did not see the need to send LS to any WGs, as the issues pointed out in the document RP-212093 was discussed at WG level.  Specific to the scalability for supporting growing numbers of UEs for multicast services, RAN2 discuseed the possiblity to support the delivery of the multicast services to RRC\_Inactive/RRC\_Idle mode UEs, which was depriortized for Rel-17 and may be revisited again at Rel-18, accoring to the Rel-18 email discussion for NR MBS enhancement. |
| Samsung | O1/2/3/5/6: agree with observation in general. However, regarding those observations, RAN2 already discussed the scalability issue and concluded Rel-17 does not support multicast in Idle/Inactive. Considering efficiency of discussion and remaining meeting time, it would not be better to revisit in Rel-17. Ongoing Rel-18 discussion also covers multicast in Idle/Inactive, we are fine to work in the next release.  We think this issue is well-known in WGs. LS is not necessary. |
| Lenovo, Motorola Mobility | We do not see the need to send LS to any WGs, as all these observations have already been taken into account during the discussion in related groups.  We should respect the SA2 decision and agreement.  In RAN3#113e, it has already agreed tha ***RAN3 continue the work based on current SA2 agreements, if any issues identified in RAN3 later.*** |
| CATT | For the observations, it seems those have been discussed in the WGs previously. In general we don’t think the analysis in the paper is unreasoanble. That being said, we are not sure about the need to send LS to SA or RAN WGs. The main reason is that this is already relatively late stage in R17 (especially in SA2, R1, etc.), and the previous agreements were made based on effort in those WGs. We are not quite sure if the LS is really useful in this stage. |
| CMCC | Share similar view with Huawei. There’s no need to send LS for other WGs to revisit, since the remaining time of the WI is limited, and most observations related issue has been discussed in different WGs.  In our understanding, the mentioned per UE RAN signalling design in observation 1/2/5/8 is based on the SA2 conclusion (i.e. based on which scheme: SMF-based scheme and/or AMF-based scheme), which is not RAN scope, moreover, as all these observations have already been taken into account during the discussion in related RAN WGs. As to Observation 3/4, it is related to multicast reception in RRC\_Idle and RRC\_Inactive, deprioritized in RAN2 R17 discussion, while Observation 7 is about SFN, and both two topics seem to be included in R18 work scope. |
| vivo | Regarding a), for RAN and RAN2 has reached consensus to support multicast for INACTIVE UE in R18. And multicast for IDLE UE is FFS now in RAN2.  Regarding b), no LS is needed. |
| ZTE | Scalability shall be one of the greatest concern in design of MBS. We agree with the intention proposed here, although some of the observation is not 100% valid to us. Some of the observations made is only for SA2/NG-C signaling, and will only be resolved in corresponding WGs.  However, it might be worth trying so (the LS), as a guidance but not to reverse any existing agreements. It might be helpful for some of the undetermined arguments.  If the LS is to be sent out,  - SA2/RAN3 would better be notified, as a guidance for the rest of Rel-17.  - the content of the LS might need to be reflected as a note to Rel-18 NR MBS in both SA/RAN, to take scalability into consideration, as in OB 3 and 4. |
| Ericsson | 1. We support the observations 2. Yes, considering the importance of the matter 3. RAN1, RAN2, RAN3 |
| Spreadtrum | We generally agree with the observation1,2,3,4 although frame work for Multicast is decided in SA2, e.g. Multicast Session Activation and establishment of associated PDU Session. And for observation4, the multicast reception in RRC\_IDLE/INACTIVE may be discussed in R18.  For observation 5, we think if only PTM is configured for one UE, the 5GS capacity will be wasted slightly.  For observation 6, we think the paging for multicast activation will use the same POs for unicast, the paging capacity will be influenced. Whether the paging resources will be blocked will depend on the final mechanism which is still being discussed in RAN2.  It is not needed to consider the issue in observation7 in R17.  Observation8 is more related to SA2 also.  We did not see the need to LS to any WGs. |
| Vodafone | We also agree with observations above  RAN2 Signalling solution should be based on the SA2’s solution  No need to send LS out to other working groups. |
| Qualcomm | In our view, the contribution addresses some of the system design aspects of multicast in terms of overhead. We would like to highlight the following points:  1.- Most of the obseravtions are related to decisions made in SA2 based on extensive discussions during SA2 Study and WI phase, RAN does not seem to be the group to discuss these topics.  2.- For a given service, if the defining features of multicast are not needed (very accurate transmission area, switching between unicast and multicast, reliability) , the network can use broadcast mode.  3. For group paging based Multicast activation, RAN2 already discussed and concluded to use unicast POs to reduce UE power consumption and to simplify idle mode DRX design.  Thus, we do not see any need to send LS to other WGs. |
| Nokia, Nokia Shanghai Bell | We agree with the comments above from Huawei and others, that these aspects have already been thoroughly discussed in RAN3, RAN2 and SA2 and taken into account in the design decisions that have been made.  In more detail, regarding observations 1-4, the time taken is very small in the overall time budget. Moreover, MBS reception in RRC\_IDLC/INACTIVE is under discussion for Rel-18.  We disagree with observation 6: the more UEs in the cell, the more likely that a single paging in a PO reaches multiple UEs. The RAN2 solution is efficient and avoids the scalability issue.  Regarding observation 7: the single gNB-DU constraint applies only to SFN; a service area can already span multiple DUs.  We disagree with observation 8 and with the proposal, as these aspects have already been thoroughly discussed in the WGs and taken into account in the design decisions that have been made. |
| Apple | For O4-6, support of MBS in IDLE/INACTIVE can be discussed in R18.  We don’t see the need to send LS to WG. |
| LG2 | We don’t see the need to send LS to any WGs.  Ob1/6: If the service continuity mechanism that RAN2 is discussing for broadcast session is used also for multicast session, UE will move to MBS-supporting node, if possible. This should be discussed first in RAN2.  Ob3: Basically, the configuration for PTP transmission should be per UE. However, as the group notification for multicast activation was introduced, the per-UE configuration, e.g. BWP configuration/switching, needs to be improved when numerous UEs simultaneously enter RRC\_CONN in response to the group notification. This issue can be discussed in RAN2.  Ob4: The multicast reception in RRC\_IDLE/INACTIVE was already deprioritized in RAN2 and can be discussed in R18.  Ob7: SFN in R17 is limited to single gNB-DU. Further SFN enhancements should not be discussed in R17. |
| AT&T | AT&T supports proposal 2.1. In particular we agree with Observations 2,3,7 and 8. |

## 2.2 Intra-DU SFN for Rel-17 NR MBS

Stating that intra-DU SFN for broadcast cannot be purely left up to network implementation and some essential components have to be specified to enable support of intra-DU SFN for broadcast, [2] proposed the following.

**Proposal 2.2-1:** To facilitate WG discussions,

* Revising the WID to include RAN1 into the relevant objective:
  + *Study the support for dynamic control of the Broadcast/Multicast transmission area within one gNB-DU and specify what is needed to enable it, if anything [RAN1, RAN2, RAN3]*
* Alternatively, confirm the support of intra-DU SFN in Rel-17 NR MBS and specify necessary components to enable its support.

**Q2: Please indicate your support or lack thereof for each of the following**

1. **Add RAN1 as a responsible working group for the objective relevant to intra-DU SFN as in the first bullet of proposal 2.2-1 above.**
2. **Agree in RAN#93e to confirm the support of intra-DU SFN in Rel-17 NR MBS and specify necessary components to enable its support as proposed in the second bullet of proposal 2.2-1 above.**

**Reasons, views in general and any alternate proposals in case you don’t support either of the above proposals may also be provided.**

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| **Company** | **Views** |
| LG1 | We do not support adding this proposal due to the following reasons:   * In WID, it is stated that *no standardized support specifically for SFN is provided in this WI. Any SFN operation is transparent to the UE, and any related synchronization is left to network implementation. The existing QCL framework (based on SSB and CSI-RS) is reused.* Thus, this restriction and assumption should be removed to support standard impact from intra-DU SFN for broadcast. * We wonder if the objective of dynamic control of the Broadcast/Multicast transmission area is really related to SFN because MBSFN is semi-statically configured in LTE MBMS. Dynamic control of the area seems related to dynamic cell on/off for non-SFN broadcast/multicast for RAN2/3. * We are reluntant to add more work at the last moment of this WI phase.   Alternatively, we think that standard work necessary for intra-DU SFN (as well as inter-DU SFN, if supported) could be considered in Rel-18 WI. |
| Huawei, HiSilicon | We support the proposal.  WID (RP-201038) implies support intra-DU SFN by transparent transmission and up to network implementation. We agree that the support of intra-DU SFN can be such that the UE is not aware of the SFN transmission, and thus that specifications don’t need to explicitly mention SFN transmission.  However, as shown in RAN1#106e, this does not mean that intra-DU SFN for broadcast can be supported without specification work, and in fact RAN1 contributions showed that it cannot be purely left up to network implementation and some essential components have to be specified to enable support of intra-DU SFN for broadcast for UEs in idle or inactive state, including：  - Configurable scrambling sequence initialization for PDCCH/PDSCH and DMRS sequence generator initialization for PDCCH/PDSCH for broadcast transmission for broadcast (as supported for RRC\_CONNECTED UE).  - Configuring TRS as QCL sources for broadcast transmission (as supported for RRC\_CONNECTED UE).  RAN plenary should at least allow specification work for the support of intra-DU SFN, with a WID revision at least in the justification part, which ambiguously implies that no specification works is needed for intra-DU SFN. |
| TCL communication Ltd. | We support the proposals.  Intra-DU SFN operation for broadcast in R17 MBS requires some specification work which may need the involvement of RAN1 WG. Therefore,we agree to confirm the support of intra-DU SFN in Rel-17 NR MBS and to add RAN1 responsibility to the WG objective related to intra-DU SFN. |
| Intel | We don’t think RAN1 should be added, and introducing additional work at this late stage is not good. Any leftovers can be handled in Rel-18. |
| Interdigital | Similar to LG, we are not very supportive of adding extra specification work for enabling intra-DU SFN so late in R17. |
| MediaTek | We share the same view as LG. It was assumed to support intra-DU SFN by only network implementation during Rel-17 WID discussion.  We propose to postpone the support of intra-DU SFN to Rel-18 if physical layer change is a must.  The work load of Rel-17 MBS is high and we should not add new work load on top of current scope. |
| CBN | We support the proposal.  SFN is of great significance to solve the coverage problem and improve spectral efficiency. According to the actual deployment requirements of the network, we think it is necessary to make sure that intra-DU SFN is working in Rel-17 NR MBS. |
| Huawei, HiSilicon | We would like to have a second response to further explain our consideration.  We’d like first to clarify that intra-DU SFN for RRC\_CONNECTED UEs for mulitcast is already supported in Rel-17 with no standardized support specifically for SFN (i.e. align with WID). However, for MBS broadcast, some essential components (e.g., the srambling ID and TRS as QCL source configured by MCCH) was overlooked during WID drafting and were just identified in recent RAN1 meetings.. Such specification change is trivial. For example, RAN1 has agreed to configure an scrambling ID for the second DCI format and to support TRS as QCL source for power savings for RRC\_IDLE/INACTIVE UEs, all the remaining changes needed are to have an configurable scrambling ID for the first DCI format and reusing the same design from power saving feature or just moving the TRS configuration as for RRC\_CONNECTED UE into SIB/MCCH.  On the other hand, forward compatibility shall be secured, which has been stated in the WID:  *Any design decisions taken for this WI in Release 17 shall not prevent introducing the following features in future Releases:*   * *Standardised support of SFN over multiple cells above gNB-DU level;*   Not fully specifying the targeted support for intra-DU SFN in Rel-17 and leaving some of the work to Rel-18 (pending further agreement) would bring forward compatibility issue for Rel-18 inter-DU SFN and make the network deployment more complex and less efficient, e.g., network will have to transmit the SFN broadcast to Rel-18 UEs and transmit an additional copy to Rel-17 UEs which does not support intra-DU SFN in idle/inactive state....  Overall, we suggest RAN to allow spec work for intra-DU SFN for idle/inactive UEs, including:  *- Configurable scrambling sequence initialization for PDCCH/PDSCH and DMRS sequence generator initialization for PDCCH/PDSCH for broadcast transmission for broadcast (as supported for RRC\_CONNECTED UE).*  *- Configuring TRS as QCL sources for broadcast transmission (as supported for RRC\_CONNECTED UE).* |
| Samsung | Not support.  There are many issues remaining in order to complete MBS in Rel-17 and expanding the RAN1 scope at this time should be avoided. If any issue is identified, it should be handled in Rel-18 together with other Rel-17 leftovers. |
| CATT | We support the proposal. We think support of intra-DU SFN in Rel-17 is necessary and important. The issues identified in RP-212267 are essential to support intra-DU SFN and they are simple extensions which can be handled in RAN1.  We also think forward compatibility should be taken into account. If the related work cannot be done in Rel-17, it will complicate the network deployment in future. |
| CMCC | As the WID saying “*no standardized support specifically for SFN is provided in this WI. Any SFN operation is transparent to the UE, and any related synchronization is left to network implementation. ” ,* it seems different companies have different understandings on this, thus we prefer RAN plenary should give a clarification on whether intra-DU SFN should be supported in Rel-17 or not, otherwise, different companies will argue again in the WG level, which is not helpful for the completion of Rel-17 NR MBS on time. The forward compatibility mentioned by some companies can be taken into account when RAN plenary make the decision. |
| vivo | Regarding a), we think ‘dynamic control of the Broadcast/Multicast transmission area within one gNB-DU’ is not equivalent to ‘intra-DU SFN’. To our knownledge, there is no specifc work identified for the previous one in RAN2 and 3 in Rel-17, instead, it is left to network implementation. We don’t see the motivation of RAN1 specific effort for dynamic control of MBS transmission area.  Regarding b), we are open to intra-DU SFN, but we are not sure whether the RAN1 related work can be completed in Rel-17 with only two meetings left. |
| ZTE | Rel-18 MBS WI discussion already includes SFN and it gains wide support from companies. If companies couldn't converge on whether to support SFN in Rel-17 via specification or the time is not sufficient in Rel-17 for such discussion, we can take it to Rel-18. It is also beneficial by combining intra-DU and inter-DU SFN discussion together in Rel-18 to have consistent design for them. |
| Ericsson | 1. Support 2. Support. Any additional specification work only needs to address the Uu interface |
| Spreadtrum | Not support to revist WID.  The WID has clearly claimed:  *SFN provides synchronized delivery of user plane packets over the air from different cells. No standardized support specifically for SFN, is provided in this WI. Any SFN operation is transparent to the UE, and any related synchronization is left to network implementation. The existing QCL framework (based on SSB and CSI-RS) is reused.*  We have spent much time to discuss the scope during WID approval. We should avoid to come back to reconsider it again at this stage, where only 2 RAN1 meetings are left, and many essential issues has not solved. |
| Vodafone | Intra-DU handover and mobility would be essential for the future applications.  No need to add further complexity at this stage and we should aim to complete the Rel17 features completely. |
| Qualcomm | In our understanding, the work item allows for *implementation-based SFN*, in the sense that there are no defined protocol enahncements to enable joint transmission across multiple nodes.  The wording in the WID uses the carefully selected sentence *The existing QCL* ***framework*** *(based on SSB and CSI-RS) is reused*. The intention of this wording is to say that we can use SSB/CSI-RS to enable transparent SFN operation in broadcast/multicast.  In RAN1, we have agreed to have the scrambling sequence based on configured virtual cell ID for MBS GC-PDCCH/PDSCH for multicast. They should be extended to broadcast.  Thus, we would support RAN1 to include both TRS and VCID-based scrambling for broadcast, but we do not think a WID update is needed at this stage – note that the discussed enhancements do not apply only to SFN, but also to other features (e.g. reception of MBS from a neighboring cell). One possibility to guide RAN1 would be for RAN to conclude that the following two items are in scope of the WID:  - Configurable scrambling sequence initialization for PDCCH/PDSCH and DMRS sequence generator initialization for PDCCH/PDSCH for broadcast transmission for broadcast (as supported for RRC\_CONNECTED UE).  - Configuring TRS as QCL sources for broadcast transmission (as supported for RRC\_CONNECTED UE). |
| Nokia, Nokia Shanghai Bell | The WID is very clear, “No standardized support specifically for SFN, is provided in this WI. Any SFN operation is transparent to the UE, and any related synchronization is left to network implementation. The existing QCL framework (based on SSB and CSI-RS) is reused.”  Moreover, the cited objective relates specifically to dynamic control, which is not related to the potential RAN1 impacts mentioned.  We are also aware that IDLE/INACTIVE\_mode CSI-RS configuration is being discussed in the UE power saving WI, so it may be best to review after the completion of Rel-17 whether anything is actually missing for support of intra-DU SFN, in order to avoid duplication of solutions between WIs, especially considering the limited time remaining in Rel-17. |
| Apple | We agree the forward compatible is important. It’s better RAN plenary gives the guidance whether RAN1 effort is required to support intra-DU SFN.  For the TRS as QCL source, just remind there is no census in RAN1 whether the TRS configuration for idle/inactive UE define in another WI could directly re-use by MBS. |
| OPPO | a) No, as it was clearly mentioned in the WID that “ No standardized support specifically for SFN“, to add RAN1 for the objective only cannot address the controversy.  b) No, there is only 2 meeting left in RAN1 for the WI, we prefer no to expand the scope at this stage. |
| AT&T | AT&T supports proposal 2.2. In particular we support Q2 a) and b). |

## 2.3 Common Frequency Resource (CFR) for Broadcast

The issue of common frequency resource (CFR) for broadcast has been discussed for many meetings in RAN1. To make further progress, the following is proposed in [2].

**Proposal 2.3-1 (from RAN1#106e):** Support the following proposal from RAN1 chair notes:

Proposal:

For a configured/defined CFR for GC-PDCCH/PDSCH carrying MCCH and MTCH for broadcast reception with UEs in RRC IDLE/INACTIVE state.

* + Support Case-C
  + Working assumption: Support at least one of Case D and Case E.
    - Down-selection to be made at RAN1#106b-e
  + Note: Case C, D and E are defined in previous agreements

The following is an alternate proposal from [3] on the same issue.

**Proposal 2.3-2**: For a configured/defined CFR for GC-PDCCH/PDSCH carrying MCCH and MTCH for broadcast reception with UEs in RRC IDLE/INACTIVE state, Rel-17 MBS supports all of the following cases with a common configuration framework to accommodate different broadcast services with different requirements.

* The CFR is larger than the initial DL BWP configured by SIB1.
* The CFR is the same as the initial DL BWP configured by SIB1
* The CFR is larger than CORESET#0 but smaller than the initial DL BWP configured by SIB1.

Note: The CFR fully contains CORESET#0.

**Q3: Please provide your answers to each of the following in the table below**

1. **Do you support the proposal 2.3-1 above?**
2. **Do you support the proposal 2.3-2 above?**

**Reasons, views in general and any alternate proposals in case you don’t support either of the above proposals may also be provided.**

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| **Company** | **Views** |
| LG1 | We generally support both proposals for progress. RAN1 already spent much time on this topic. If possible, we could change to one of the following alternative Proposal 2.3-1:  *Alt 1:*   * + *~~Working assumption:~~ Support at least one of Case D and Case E.*      - *Down-selection to be made at RAN1#106b-e*   *Alt 2:*   * + *~~Working assumption:~~ Support ~~at least one of~~ Case D and Case E.*      - *~~Down-selection to be made at RAN1#106b-e~~* |
| Huawei, HiSilicon | We support proposal 2.3-1 (from RAN1#106e).  “The common configuration framework“ in proposal 2.3-2 needs more WG discussion. The common ground of the discussion in RAN1 is proposal 2.3-1 which should be more agreeable within the group. |
| NTT DOCOMO | We support both proposals. For the proposal 2.3-1, we are fine with LG’s suggestion to make further progress as sufficient discussion has already been done in RAN1 for this issue. |
| TCL Communication Ltd. | We support both 2.3-1 and 2.3-2 proposals. We are also fine with LG’s suggestion as well. |
| Intel | We support Proposal 2.3-1. RAN1 has already spent an inoridante amount of time debating this issue and this Proposal 2.3-1 (which is already a compromise) should be agreeable to the group.  Additionally, companies have debated at length about Case C vs. Case E and our view is that by configuring a wider initial BWP for MBS-capable UEs (e.g., via MBS specific SIBx), the use case of Case E can already be handled under the signaling paradigm of Case A, C. Furthermore, when CFR is smaller than initial BWP, i.e., Case D, appropriate FDRA can be used to schedule the MCCH/MTCH using Case A/C based configuration. So we do not support Case D.  We do not support Proposal 2.3-2. |
| Interdigital | We support both proposals. |
| MediaTek | We support proposal 2.3-1 (from RAN1#106e).  One additonal comment is we did not see the need to couple the CFR with initial BWP, even though the CFR should be overlapped with Coreset0. Then our proposal is to discuss the size of CFR independently.  **New Proposal: CFR can be configured with any size as long as it covers Coreset0.** |
| Samsung | Proposal 2.3-1: Support. We see the necessity of supporting C and either Case D or E or both in order to support high data rate as well as scheduling flexibility to the gNB.  Proposal 2.3-2: Not support. This is related to Case D or E. If Case D is not supported, the case that the CFR is larger than the initial DL BWP configured by SIB1 is not necessary. We think, if Proposal 2.3-1 is agreed, Proposal 2.3-2 is not needed to discuss. |
| Lenovo, Motorola Mobility | For sake of progress, we can compromise to Proposal 2.3-1.  How to make down-selection can be left to RAN1.  In addition, we do not support Proposal 2.3-2 and proposal from MTK. CFR configuration can’t be decoupled with initial DL BWP as anyway BWP is needed for transmission/reception in current NR framework. |
| CATT | We support proposal 2.3-1 (from RAN1#106e) which has been extensively discussed in previous RAN1 meeting and should be the most agreeable proposal for now. |
| CMCC | We do not support proposal 2.3.2, as the comment in Monday’s GTW session, we think this technique discussion should be done in RAN1 not in RAN Plenary. We think the best we can do in RAN plenary is to agree **Proposal 2.3-1 (from RAN1#106e),** which has been discussed and supported by almost all companies. But we don’t support **Proposal 2.3-2** or any **New Proposal**, we have some concerns about case E, in addition, the original agreements about definition of Case C/D/E is clear enough about the CFR size and how to configure the CFR, the proposal 2.3-2 is not needed if we agree proposal 2.3-1. |
| vivo | We support proposal 2.3-2.  There is a need to provide network flexibility to configure CFR without impacting legacy UEs not supporting MBS services, case E and D can provide such flexibility over case C. The proposal does not preclude every cases from deployment persepective and clearly each case has its own merits. Considering a common configuration frame work can be used for case C,D,and E, and no extra spec work is required to support the three cases compared with supprting case C only, hence case C, D, and E should be supported so that network can take the flexibility to configure the CFR depending on the practical requirements. |
| ZTE | From our perspective, it is crucial and beneficial for companies to address this issue in this meeting so that we can save more time for working group discussion. Otherwise, it will drag on the working group discussion and jeopardize the completion of MBS WI.  For the two alternatives above, our preference is Proposal 2.3-2, i.e., support all the three cases together. The reasons are as the following.  1) Case C, Case D and Case E can be supported by a common framework without any additional specification/implementation work. As long as the CFR is fully contained by a BWP, the only difference between these cases is just the size of CFR.  2) If Proposal 2.3-1 is adopted, RAN1 still needs to debate whether to support Case D or Case E in addition to Case C, which will still be time-consuming and drag on the RAN1 discussion.  3) If all the three cases are supported together, network can choose the desired case based on the MBS deployment requirements flexibily.  Also, we want to emphasize that, RAN1 has discussed this issue extensively, only supporting Case C (CFR must be equal to SIB-1 configured initial BWP) is too restrictive for MBS deployment and network implementation. It may also delay the MBS depoyment.  Regarding the comments raised online, we would like to response with the following example. Let’s say carrier bandwidth is 100MHz and CORESET#0 is 20MHz, if the SIB-1 configured initial BWP is set as 100MHz, we agree that only Case C and Case D should be sufficient. However, if SIB-1 configured initial BWP is set as some value smaller than 100MHz (e.g., 20MHz or 40MHz), Case C and Case D is not sufficient because MBS can’t fully use the 100MHz bandwidth if Case E is not supported. Please note that, in Case E, CFR configuration will still be confined within the carrier bandwidth.  Both Case C and Case E can configure 100MHz for CFR. We don’t understand why company claimed that Case E will impact UE only supporting small bandwidth but Case C won’t. This comment rasied online is not valid from our perspective.  Thus, we suggest to agree on Proposal 2.3-2. |
| Ericsson | 1. Support 2. Support. This is our preferred option, which allows for large flexibility within a common framework. Also beneficial to avoid possibly time-consuming discussions at RAN1#106bis, which may still happen with 2.3-1 only. |
| Spreadtrum | For the majority, we could be fine with Proposal 2.3-1, although we still don’t undetstand why we package case C, case D and case E.  In our understanding, if Proposa 2.3-1 is supported, there is no need to discuss Proposal 2.3-2. |
| Vodafone | We do not support Proposal 2.3-2 and agree with comments above.  We support Proposal 2.3-1 |
| Qualcomm | This topic has been heavily discussed for many RAN1 meetings. It is indeed necessary to have some RAN guidance on how to solve this issue. We support proposal 2.3-2 (we would also be OK with 2.3-1 as a further step forward) |
| Nokia, Nokia Shanghai Bell | We agree that RAN1 has already spent too much time on this topic. Only one company prevented agreement of proposal 2.3-1 in RAN1#106e, so, as a minimum, proposal 2.3-1 should be formally agreed. However, it would be far better to make further progress, by agreeing Proposal 2.3-2. As a compromise, we could also agree LG’s suggestions, among which we prefer Alt 2. |
| Apple | Our original preference is Proposal 2.3-1. But considering the SIB1 indicated initial downlink BWP is not mandatory configured, if it’s not configured, then Case C, Case D and Case E are not valid. So from this point, MTK’s proposal makes sense. |
| OPPO | Proposal 2.3-1 can be supported rather than Proposal 2.3-2.   1. Support.   First of all, Case C works. Case C and Case A (agreed) can cover majority cases for MBS reception in RRC\_IDLE/INACTIVE state. Supporting case D/E is considered as an optimization to the basic cases C and A, but whether/how to support case D/E can be left to RAN1 discussion and make decision.   1. Not support.   The corresponding details may need more technical discussion in RAN1 and then make decision. Proposal 2.3-1 is preferred. |
| AT&T | AT&T supports the CFR larger than the initial DL BWP configured by SIB1. |
| Convida Wireless | We support Proposal 2.3-2 for flexibility in system. We are open for Proposal 2.3-1. |

## 2.4 Lossless HO for Rel-17 MBS

Lossless HO support for Rel-17 MBS is discussed in [4] with the following observations.

**Observation 1 No comprehensive evaluation on PDCP SN sync’s impacts to RAN and SA WGs.**

**Observation 2 No consensus achieved on PDCP SN sync’s impacts in RAN2/RAN3 so far.**

**Observation 3 PDCP SN sync brings significant architectural impacts, e.g., violating existing QoS modeling, NG-U tunnel design.**

**Observation 4 There are still variations for PDCP SN sync even it is agreed.**

**Observation 5 SA2 does not pursue lossless mobility from the architectural perspective.**

**Observation 6 Only basic mobility support is pursued for Rel-17 WI of NR MBS.**

**Observation 7 Overall implementation impact should be limited, in order to facilitate implementation and deployment for Rel-17 WI of NR MBS.**

**Observation 8 Only seamless handover where packet loss is allowed but service reception is continued, is pursued for Mission Critical Services over 5G MBS.**

**Observation 9 In SA1 spec that defines 5G MBS requirement TS 22.261, lossless HO support is not found either.**

**Observation 10 Reliable Multicast (without packet loss) is still a problem unsolved and won’t be solved in the short term in IP world.**

**Observation 11 Requirement on lossless HO support for NR MBS is not clear, and results in unnecessary and no-so-productive discussion in WGs.**

Based on these observations the following is proposed in [4].

**Proposal 2.4-1:** Rel-17 NR MBS does not pursue lossless handover.

**Q4: Please indicate your support or lack thereof for pursuing lossless handover in Rel-17 NR MBS in the table below. Reasons and general views related to this topic may also be provided.**

|  |  |
| --- | --- |
| **Company** | **Views** |
| Huawei, HiSilicon | We do support lossless handover in R17, by supporting PDCP SN sync and supporting data fowarding between MBS supporting nodes.  The “lossless handover“ mentioned in this topic, is to address data loss caused by different deliever pogress between different gNBs for a MBS service. This is a different purpose than for MBSFN, since for NR, inter-gNB SFN is not supported in R17 and different gNBs schedule the same MBS service data seperately. As the radio conditions, cell load, service priority among the ongoing services are different in different gNBs/cells, if we do not support “lossless handover“, once a UE moves from one gNB to another, there could be a human perceivable packet loss. Furthermore, in some cases the communication is not between human, e.g. V2X, which has higher relaibility requirement. The issue that is mentioned about misalignement of QoS flows mapping to MRBs has been raised and discussed already in WG discussions. It can be easily avoided by proper network configuration and implementation and the flexibility of QoS flows mapping is of much lesser importance in this case than avoiding the data loss during mobility.  SA2 also clearly states in their specifications that minimization of data loss has to be achieved with details to be decided by RAN WGs.  **It has already been agreed in RAN2 and RAN3 to support PDCP SN sync, together with some details of the solution:**   * RAN3#110-e meeting agreement:   + For multicast, in order to allow the UE to detect loss of data or duplication of data, RAN3 shall continue discussing solutions to support alignment of PDCP SNs in between gNBs.   + RAN3 will work on concepts to enable coordinated assignment of PDCP SNs to MBS user data packets within a gNB and between gNBs (to be coordinated with RAN2 if needed). Details FFS. * RAN2#112-e meeting agreement:   + In order to support the lossless handover for 5G MBS services, at least DL PDCP SN synchronization and continuity between the source cell and the target cell should be guaranteed by the network side to realize. The design of specific approach to realize this can be involved with WG RAN3. * RAN3#113-e meeting agreement:   + Source and target gNBs derive synchronized PDCP SN from sequence number and the solution is FFS.   And it has alreday been agreed in RAN2 to support data forwarding:   * RAN2#112-e meeting agreement:   From network side, the source gNB may forward the data to the target gNB and the target gNB will deliver the forwarding data. Meanwhile, the SN STATUS TRANSFER should be extended to cover the PDCP SN for MBS data; Then (TBD after or in parallel) the UE receives the MBS in the target cell by the target cell according to target configuration. |
| TCL communication Ltd | We support the proposals.  There is a clear requirement to support minimization of data loss during MBS mobility in SA2 ;on the top of that, there is also a good progress in lossless handover topic in both RAN2 and RAN3. Therefore, we support lossless handover in Rel-17 NR MBS |
| Intel | We support pursuing lossless handover in Rel-17 NR MBS, at least for lossless handover between MBS-supporting gNBs. Such support does not require much additional RAN2 work, while RAN3 needs to agree on solutions PDCP SN synchronization across source and target gNBs. The QoS mapping aspect discussed in [4] can be ensured by implementation e.g. data from one TMGI is always mapped to one MRB (instead of split to multiple MRBs which can cause PDCP SN async among gNBs). Discussion might be needed on whether to support lossless handover during handover between MBS-supporting gNB and non-MBS-supporting gNB. |
| Interdigital | We do not support the proposal and think that avoiding/minimizing lossless HO is essential for some MBS use cases. Also, as Huawei has indicated, we already have agreements from several previous meetings and it makes more sense to discuss/agree on any remaining aspect to avoid/minimize lossless handover in the coming few WG meetings, rather than revert these agreements. |
| MediaTek | We think lossless handover for MBS can be supported at some scenarios in a easy way. For example, if PTP can be configured for a UE at both source gNB and target gNB, the lossless handover for that MBS service may be supported via legacy unicast HO mechanism.  We propose to discuss the issue at WG level and identify the cases to support lossless handover for MBS for Rel-17. |
| CBN | We support lossless handover in Rel-17 NR MBS.  We think that multicast should be a reliable transmission to avoid service continuity problems caused by UE mobility. Lossless handover should be an important requirement for multicast. Moreover, RAN2/3 has agreed to support this feature, and the technical scheme is relatively simple and effective. So it is necessary to standardize lossless handover between gNBs in Rel-17 NR MBS. |
| Samsung | There was already some progress in WGs. Also, we share the view with Huawei that considering inter-DU SFN is not supported in NR MBS, lossless may be more important. We do not think such downscoping is necessary in this Plenary. |
| Lenovo, Motorola Mobility | We do support lossless handover for MBS in Rel-17.   1. As described in the WID, NR MBS covers multicast service with high reliability requirements, e.g. MBS can be used for industry, V2X and critical mission related service. Lossless handover is definitely important for these services.   Minimizing data loss during handover for MBS has been agreed by RAN2, RAN3 and SA2 several meetings ago. RAN1 also agreed to support HARQ feedback and retransmission for high reliability multicast service. We should follow the agreement we have made in WGs. |
| CATT | We also think this can be done in Rel-17. Some WG already made progress on the topic. Agree with many points already mentioned by companies. |
| CMCC | We think lossless HO should be supported in R17 MBS.  According to MBS WID, this WI aims to provide the support in RAN for Objective A, which is about enabling general MBS services over 5GS and the uses cases identified that could benefit from this feature include (but are not limited to) public safety and mission critical,. V2X applications, transparent IPv4/IPv6 multicast delivery, IPTV, software delivery over wireless, group communications and IoT applications. And for mission critical and V2X services, lossless HO is important to ensure the performance.  Besides, as mentioned by Huawei, lossless HO was discussed in the previous RAN2 and RAN3 meetings, and there was already some progress. How could we just revert the works and agreements, but not complete the solution based on the current progress? |
| vivo | From the perspective of QoS requirement, service continuity and lossless is very important for reliability metric and experience. Hence lossless handover should be supported, especially for AM mode services.  PDCP SN sync is a feasible and simpler way to guarantee lossless handover with limited impacts. And RAN3 had the following agreement:  **Source and target gNBs derive synchronized PDCP SN from sequence number and the solution is FFS.**  We support PDCP SN sync mechanism and detailed solutions can be discussed and concluded in RAN3 and RAN2. |
| ZTE | We support the proposal of course.  **# scenarios**  No human perceivable packet loss does not equal lossless. It means packet loss is allowed.  There is no such requirement that asks for no single packet loss for multicast services, even in IP layer.  For those kind of high reliability V2X services, it is only fulfilled by Uu interface and only in unicast: do you trust a self-driving car commanded through multicast or PC5 interface?  **# WG agreements**  As far as we know, no anticipated coordination has been done inter WGs to really evaluate the systematic impacts.  Some of the impacts does not only exist in the architecture (limiting QoS flow mapping), in transport layer (to number PDUs in all Multicast QoS flow as we do to duplicated URLLC QoS flows) but also in air interface. For example, for one multicast session if there is 10 QoS flow, do we have to use 10 RBs to carry the data bits, will it be a limiting factor in real deployments for existing gNBs?  **# Lessons learnt from eMBMS**  It is more important to have an easily deployable technique, rather than perfecting the solution that only poses limitation in deployment. |
| Ericsson | Support. We prefer category 2 in Table 1 in [4]: “Common PDCP entity (among RAN nodes)” |
| Spreadtrum | We support lossless handover in Rel-17 NR MBS.  We think the lossless handover is helpful and necessary for some MBS services, e.g. software delivery over wireless included in WID RP-201038. Besides, there was already some progress on the lossless handover. |
| Vodafone | Loss-less handover is a useful feature to have and we support this, however we are concerned with the over complexity of the solution in the network and this should not put unnecessarily load or complexity on the network nor signalling |
| Qualcomm | We support having lossless handover (including data forwarding and PDCP SN synchronization) supported in Rel-17. As mentioned by Huawei, this has been already discussed in RAN2/3, and some agreements have been made. Note that RAN2 already agreed, UE can send PDCP status reports and use PTP RLC link for re-transmissions. So, there is no showstopper in RAN2 for lossless handover support.  SA2 also requires minimizing data loss during handover, as shown below.  TS 23.247  During the mobility from a NG-RAN node that supports MBS to a target NG-RAN node that supports MBS, or from a NG-RAN node that supports MBS to a target NG-RAN node that does not support MBS, minimization of data loss should be supported.  Editor's note: How to support the minimization of data loss is for RAN WG to decide.  It is RAN WG responsibility to define mechanims for preventing loss of data during Multicast HO for SA2 requirement ”minimization of data loss should be supported”. Service continuity, L2 reliability and preventing loss of data based on lossless handover in multicast mode are the differentiation features of 5G Multicast compared with 4G eMBMS/SC-PTM Broadcast. Multicast HO is intended to prevent loss of data at RAN level to meet Multicast service QoS requirements (which are same as Unicast QoS). |
| Nokia, Nokia Shanghai Bell | Truly lossless handover can be achieved only with RLC AM, which in Rel-17 can be considered when UE is configured with a PTP leg with RLC AM. For PTM, a seamless PTM-PTM handover should be supported for Rel-17 MBS. A seamless handover is not only about packet loss but also about duplicate discarding when a UE moves between cells, which can be achieved with PDCP SN synchronization. In the IP world, multicast is not lossless but also duplicates are not expected. |
| Apple | We support lossless handover in Rel-17 NR MBS.  The lossless handover is very important for the delivery of the MBS service with high reliability QoS requirement during the connected mode mobility. |
| LG2 | We think that lossless HO can be supported in a specific case where a UE is configured with a PTP leg and the PTP RLC entity is configured with RLC AM before HO and after HO. The cases supporting lossless HO can be discussed further at WG level. |
| AT&T | AT&T supports observation #8 for work related to item 2.4. Support of lossless handover is not strictly necessary for Public Safety. |
| Xiaomi | We think that the lossless handover can be supported for Rel-17 MBS, and RAN2 already agreed to support the PDCP status report during mobility to support the PDCP retransmission. |

# 3 Intermediate Round Discussion

This section provides some further proposals based on the feedback in the initial round.

## 3.1 Rel-17 NR MBS Scalability Issues

Based on the feedback it seems that the observations and concerns in [1] are not shared by most companies. There isn’t adequate support for sending an LS to any WGs on the issues raised in [1]. The moderator proposes to capture this in the conclusions section of the moderator’s summary (final version of this document) when this email discussion ends.

If there are any further comments on this topic, they may be provided in the table below.

|  |  |
| --- | --- |
| **Company** | **Views** |
| Futurewei | Support moderator’s proposal. |
| Qualcomm | Support the proposal. |
| ZTE | Support the LS. |

## 3.2 Intra-DU SFN for Rel-17 NR MBS

The views on whether specification changes should be supported for intra-DU SFN for Rel-17 NR MBS seem quite split. As Nokia points out, the WID states that “No standardized support specifically for SFN, is provided in this WI”. However, as Huawei points out, “Not fully specifying the targeted support for intra-DU SFN in Rel-17 and leaving some of the work to Rel-18 (pending further agreement) would bring forward compatibility issue for Rel-18 inter-DU SFN and make the network deployment more complex and less efficient, e.g., network will have to transmit the SFN broadcast to Rel-18 UEs and transmit an additional copy to Rel-17 UEs which does not support intra-DU SFN in idle/inactive state....”

It is not clear to the moderator if this potential compatibility issue between Rel-17 and Rel-18 UEs has been sufficiently discussed. While many companies cite the workload as an issue for Rel-17 and refer to Rel-18 discussions where SFN is being discussed, if such potential compatibility issues can be avoided with a simple change to the specs, it seems that it is worthwhile discussing this further in the intermediate round discussions. The moderator therefore requests feedback on the following questions.

**Q5.1 Are there any compatibility issues between Rel-17 and Rel-18 if no specification changes are made to enable support of intra-DU SFN for broadcast in Rel-17?**

**Q5.2 If so, do you support an agreement in RAN clarifying that the following are within the scope of the WID?**

* **Configurable scrambling sequence initialization for PDCCH/PDSCH and DMRS sequence generator initialization for PDCCH/PDSCH for broadcast transmission for broadcast (as supported for RRC\_CONNECTED UE).**
* **Configuring TRS as QCL sources for broadcast transmission (as supported for RRC\_CONNECTED UE).**

Please provide your answers to the above questions in the table below.

|  |  |
| --- | --- |
| **Company** | **Views** |
| Qualcomm | We support Q5.2 – it would be useful to note that these two items are in scope. |

## 3.3 Common Frequency Resource (CFR) for Broadcast

Based on the feedback, while some companies think more progress can be made by agreeing to more than the proposal from RAN1#106e, most companies are fine with the proposal from RAN1#106e as a compromise. Therefore, it is suggested to agree to this proposal and feedback on this course of action is requested below.

**Q6: Do you support the following proposal from RAN1#106e?**

**Proposal (from RAN1#106e):**

For a configured/defined CFR for GC-PDCCH/PDSCH carrying MCCH and MTCH for broadcast reception with UEs in RRC IDLE/INACTIVE state.

* + Support Case-C
  + Working assumption: Support at least one of Case D and Case E.
    - Down-selection to be made at RAN1#106b-e
  + Note: Case C, D and E are defined in previous agreements

Please provide your views in the table below.

|  |  |
| --- | --- |
| **Company** | **Views** |
| Futurewei | Support |
| Qualcomm | Support |
| Convida Wireless | We are ok with the proposal. |
| Intel | Support |
| ZTE | While our preference is to support all the three cases together to avoid further discussion in RAN1. But if companies prefer to go with the previous proposal, we would suggest the following updates, i.e., removing “working assumption”. This can avoid the situation that company keeps objecting one case and RAN1 has to overturn the working assumption.  **Proposal:**  For a configured/defined CFR for GC-PDCCH/PDSCH carrying MCCH and MTCH for broadcast reception with UEs in RRC IDLE/INACTIVE state.   * + Support Case-C   + ~~Working assumption:~~ Support at least one of Case D and Case E.     - Down-selection to be made at RAN1#106b-e   + Note: Case C, D and E are defined in previous agreements |

## 3.4 Lossless HO for Rel-17 MBS

It seems that there is overwhelming support to keep lossless HO functionality in Rel-17 NR MBS. The moderator proposes to capture this in the conclusions section of the moderator’s summary (final version of this document) when this email discussion ends.

If there are any further comments on this topic, they may be provided in the table below.

|  |  |
| --- | --- |
| **Company** | **Views** |
| Futurewei | Share the majority view that this can be kept in Rel-17 scope. |
| Qualcomm | We agree that lossless HO should be kept in scope. |
| ZTE | One the other side of the overwhelming support, concerns from operators / vendors / industries shall not be ignored:  - 3GPP serves the real / emergent industry need.  - complexity in deployments / specs is harmful to the technique itself.  Some of the across WGs coordination have to be taken among WGs:  - RAN2 has not started the evaluation of the solutions yet.  - SA2 has not been notified yet, however MBS in SA2 is to be frozen in Sep. 2021 (this month!).  As we are approaching the end of WI,  - we should focus on stage 3 design now.  - spending more time on the feature will only raise the possibility of delay of the WI.  For now it is the right time to drop the support of Lossless HO for Rel-17 MBS. |

# 4 Final Round Discussion

## 4.1 Moderator summary

# 5 Conclusion

# 6 References

1. RP-212093 The State of Rel-17 NR MBS Ericsson, AT&T
2. RP-212267 Discussion on the progress of Rel-17 NR MBS Huawei (rapporteur)
3. RP-212414 Discussion on CFR configuration for Rel-17 MBS ZTE, Nokia, Nokia Shanghai Bell, Qualcomm, vivo, Convida Wireless
4. RP-212415 Views on lossless HO for Rel-17 MBS ZTE, Sanechips