**3GPP TSG-RAN WG2 Meeting #117 electronic R2-220xxxx**

**Online, February 21 – March 3, 2022**

**Agenda item: 8.1.3.2**

**Source: Nokia**

**Title: [AT117-e][043][MBS] Invited tdocs open Issues CP - PART2 (Nokia)**

**Document for: Discussion and Decision**

# Introduction

* [AT117-e][043][MBS] Invited tdocs open Issues CP (Nokia)

Scope: PH1: Take into account submitted tdocs. Address the questions in R3-221469 LS on NR RRC to support split NR-RAN architecture for NR MBS. Determine agreeable part, pave the way for on-line agreement. CLOSED

PH2: Continue offline discussion on P2, clarify the intentions (one/two messages, determine the coverage of the part that could be common = same between UEs).

Intended outcome: Report

Deadline: PH2 in time for on-line CB W2 Wednesday

[R2-2202141](file:///C:/Users/mtk65284/Documents/3GPP/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202141.zip) LS on NR RRC to support split NR-RAN architecture for NR MBS (R3-221469; contact: Ericsson) RAN3 LS in Rel-17 To:RAN2

[R2-2203226](file:///C:/Users/mtk65284/Documents/3GPP/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203226.zip) Common RRC Structure for MBS Multicast Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_MBS-Core

[R2-2202782](file:///C:/Users/mtk65284/Documents/3GPP/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202782.zip) MRB ID Scope and Uniqueness Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_MBS-Core

R2-2202267 Discussion on Questions for Split NR-RAN Architecture from RAN3 LS CATT discussion Rel-17 NR\_MBS-Core

R2-2202334 Discussion on MBS split NR-RAN architecture based on RAN3 LS MediaTek inc. discussion Rel-17 NR\_MBS-Core

[R2-2202335](file:///C:/Users/mtk65284/Documents/3GPP/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202335.zip) Draft LS on the support of MBS split NR-RAN architecture MediaTek inc. LS out Rel-17 NR\_MBS-Core To:RAN3

R2-2202368 Discussion on LS on NR RRC to support split NR-RAN architecture for NR MBS TD Tech, Chengdu TD Tech discussion Rel-17

R2-2202426 Discussion on Supporting split NR-RAN architecture for NR MBS Spreadtrum Communications discussion Rel-17

R2-2202625 Discussion on RRC to support split NR-RAN architecture for NR MBS CMCC discussion Rel-17 NR\_MBS-Core

R2-2202644 Support of split NR-RAN architecture for NR MBS Intel Corporation discussion Rel-17 NR\_MBS-Core

R2-2202684 Discussion on MBS RRC Configuration for Split RAN Samsung discussion Rel-17 NR\_MBS-Core

R2-2202978 Discussion on NR RRC to Support Split NR-RAN Architecture for NR MBS vivo discussion Rel-17 NR\_MBS-Core

R2-2203156 Discussion on open issues for NR MBS LG Electronics Inc. discussion Rel-17 NR\_MBS-Core

R2-2203312 NR RRC to support split NR-RAN architecture for NR MBS ZTE, Sanechips discussion Rel-17 NR\_MBS-Core

R2-2203345 Discussion on RRC support of split NR-RAN architecture for NR MBS Huawei, HiSilicon discussion Rel-17 NR\_MBS-Core Late

R2-2202555 Support of MBS in MR-DC Apple discussion Rel-17 NR\_MBS-Core

**Contact List**

|  |  |  |
| --- | --- | --- |
| Company | Name | Email |
| Huawei, HiSilicon | Dawid Koziol | dawid.koziol@huawei.com |
| Qualcomm | Prasad | pkadiri@qti.qualcomm.com |
| MediaTek | Xuelong Wang | xuelong.wang@mediatek.com |
| Lenovo | Mingzeng Dai | daimz4@lenovo.com |
| CATT | Rui Zhou | zhourui@catt.cn |
| Kyocera | Masato Fujishiro | masato.fujishiro.fj@kyocera.jp |
| Sharp | Fangying xiao | Fangying.xiao@cn.sharp-world.com |
| Samsung | Sangkyu Baek | sangkyu.baek@samsung.com |
| Apple | Fangli XU | fangli\_xu@apple.com |
| vivo | Yitao Mo (Stephen) | yitao.mo@vivo.com |
| Sony | Vivek Sharma | Vivek.sharma@sony.com |
| ZTE | Tao QI | qi.tao3@zte.com.cn |
| Ericsson | Henrik E | Henrik.enbuske@ericsson.com |
| LGE | Seong Kim | [sj117.kim@lge.com](mailto:sj117.kim@lge.com) |
| CMCC | Xiaoman Liu | liuxiaoman@chinamobile.com |
| Futurewei | Jialin Zou | Jialinzou88@yahoo.com |
| Intel | Yujian Zhang | yujian.zhang@intel.com |
| OPPO | Shukun Wang | wangshukun@oppo.com |
| Spreadtrum | Lifeng han | lifeng.han@unisoc.com |
| xiaomi | Yumin Wu | wuyumin@xiaomi.com |
| TCL communication Ltd. | Ahmed Mikaeil | [ahmed.mikaeil@tcl](mailto:ahmed.mikaeil@tcl).com |

# Support of split NR-RAN architecture for NR MBS

RAN3 asked about feasibility of a common RRC structure which would enable the network to use the same Lower Layer configuration for PTM leg for more than one UE in a cell [R3-221469].

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| Common Lower Layer Configuration for multicast MRBs  F1 interface functions could benefit from lower layer RRC configuration (e.g. CellGroupConfig) that all UEs could be configured with exactly the same RRC configuration, so that the CU when receiving such information could reconfigure all Ues with that RRC configuration, while Ues that would need specific MRB configurations could be delta-configured thereafter.  F1 interface function could benefit if this would be possible for ptm-only and split MRBs.  **2. Actions:**  **To RAN2 group.**  **ACTION: RAN3 asks RAN2 to 1/ comment on the uniqueness of MRB ID in the scope of an MBS session instead of UE scope  2/ to comment on the feasibility to define a CellConfigInfo RRC structure which enables the network to use exactly the same Lower Layer (PHY/MAC/RLC ) configuration for more than one UE in a cell for Rel-17 NR MBS** |

[R2-2202141](file:///C:/Users/mtk65284/Documents/3GPP/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202141.zip) notes following observations:

***Observation 1****: The signalling of CFR as proposed in the running CR to 38.331 cannot be used in a common RRC structure as it is linked to UE’s configured DL BWP. Significant rework of the RRC structure seems necessary to allow for a common RRC structure.*

***Observation 2****: Using a common RRC structure for Ues introduces overhead in some scenarios, e.g. CFR configuration is the same as Ues dedicated BWP or multiple MBS multicast sessions are provided in the same CFR, and this overhead may be difficult to eliminated.*

Support common:

[R2-2203226](file:///C:/Users/mtk65284/Documents/3GPP/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203226.zip) Common RRC Structure for MBS Multicast Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_MBS-Core

R2-2202368 Discussion on LS on NR RRC to support split NR-RAN architecture for NR MBS TD Tech, Chengdu TD Tech discussion Rel-17

R2-2203156 Discussion on open issues for NR MBS LG Electronics Inc. discussion Rel-17 NR\_MBS-Core

R2-2203312 NR RRC to support split NR-RAN architecture for NR MBS ZTE, Sanechips discussion Rel-17 NR\_MBS-Core

Not support common:

R2-2202267 Discussion on Questions for Split NR-RAN Architecture from RAN3 LS CATT discussion Rel-17 NR\_MBS-Core

R2-2202334 Discussion on MBS split NR-RAN architecture based on RAN3 LS MediaTek inc. discussion Rel-17 NR\_MBS-Core

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R2-2203345 Discussion on RRC support of split NR-RAN architecture for NR MBS Huawei, HiSilicon discussion Rel-17 NR\_MBS-Core Late

Based on the inputted papers it does not seem infeasible (technically not possible) to introduce common RRC structure.

But it should be also understood that introduction of a common RRC structure for lower layer configuration of PTM transmission for MBS multicast session requires rework of ASN.1 and will likely introduce inefficiencies as some information may be transmitted to UEs multiple times.

So generally common RRC configuration would split information into two parts:

* the UE specific part.
* the per MBS session part.

If the per MBS session part of the configuration can be grouped in a per session signaling, there are benefits from different perspective:

* avoid the common lower layer configuration duplicated transmission on F1 per UE, especially in the case of network is about to update such common configuration;
* clear structure of signaling definition, to separate the per UE and per group configuration.

On the details on what parts of configuration could be common following aspects were brought out:

* CFR - CFR is currently being linked to dedicated DL BWP configuration. For example, when determining the location and bandwidth of CFR, the subcarrier spacing is derived from the associated BWP. It is also possible to not signal the location and bandwidth of CFR to the UE causing the UE to apply the same parameter as for the BWP in which the CFR is signalled. It would be required to signal CFR with subcarrier spacing as any other BWP. Also, locationAndBandwidthMulticast parameter will have to be always present and signal to UE because UEs may be configured with different BWPs that comprise the CFR. This means that even though for some UEs the configured BWP may have the same location and bandwidth allocation as a configured DL BWP, the UE will receive the same parameters twice, thus leading to overhead..
* PCCH related configuration including e.g. DRX configuration
* PDSCH related configuration
* SPS configuration
* PUCCH for HARQ NACK-only i.e. pucch-ConfigurationListMulticast1 which is further associated with BWP-UplinkDedicated. It might be UE specific feedback resource which allows ACK/NACK feedback, or one common feedback resource for one group or a sub-group of UE.
* RLC bearer for PTM

For those configurations that are common to all UEs that share the same PTM configuration of the MBS session, would be included a common RRC structure (e.g. CellGroupConfig-PTM) provided per MBS multicast session.

**Q1: Any comments which parameters would not be possible to be part of common RRC structure or which parameters are missing (no need to list every single field here)?**

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| **Company** | **Comments on possible / not possible parameters for common RRC structure** |
| ZTE | moderator has made an excellent summary of the status, appreciate it very much.  We will focus on CFR here (firstly we confirm that the frequency range and starting point calculation of CFR is indeed associated with per UE BWP, mentioned by moderator), assume one possible configuration structure about CFR calculation:  - in the common part: the values to calculate the starting PRB and bandwidth relative to Point A (same for one group of UEs)  - in the per UE part: the association between the CFR and per UE BWP (identified by BWP ID, for example, which might be different for UEs);  since for the UE in the same PTM group, the *subcarrierSpacing* will, for sure, be the same (even the per UE BWP config is different, e.g, different BWP ID, position/bandwidth). A UE based on the received the RRC Reconfiguration which includes both parts, is always able to get the same absolute frequency range for the PTM transmission.  Other UE specific config:  - RLC bearer ID (agreed in RAN2 as per UE space)  - UE specific HARQ feedback resources |
| Qualcomm | It is efficient to configure CFR associated with dedicated BWP instead of providing separately, HARQ configuration, PTP configuration etc. |
| MediaTek | UE specific config：  Parts of HARQ/L1 configuration  PTP/unicast configuration |
| CATT | (1)G-RNTI list that UE is monitoring  (2)G-CS-RNTI list that UE is monitoring  (3)HARQ configuration |
| CATT | HARQ configuration including UE-specific PUCCH resource for HARQ feedbacks  PTP leg for split MRB architecture. |
| Huawei, HiSilicon | Agree with the summary from the rapporteur in general and IEs mentioned by the companies above. Other than that, the following should be considered:   * Other than CFR, also TDRA table (PDSCH time domain allocation list) will have to be signaled unnecessarily for each UE * Since common configuration will not be part of UE-specific signaling, then for the latter, DU will have to indicate some mapping between common configuration parts and the UE ID/cell ID/BWP ID, e.g. UE to MBS session/MRB mapping, UE to G-RNTI mapping   We understand each UE may need to be configured with multiple common configurations, i.e. one for each MBS session the UE is receiving |
| vivo | Additionally, the configuration fdmed-Reception-Multicast cannot be included in the common part as it is per UE configuration based on ue-specific capability |
| Intel | Parameters that can be UE specific:   * PTP leg configuration * Part of HARQ / L1 configuration |
| Lenovo | Besides the above as indicated by companies, the unicast DRX RTT and retransmission timers may also be configured per UE for PTM retransmission. |
| Kyocera | We agree with the rapporteur’s summary and IEs the companies mentioned above such as PTP configuration and HARQ configuration.  We share Huawei’s last comment that in some scenarios, the UE, which is interested in multiple MBS services, needs to receive multiple common configurations. |
| TCL communication Ltd. | In our view other parameters that can be UE specific are PTP leg configuration for split bearer and HARQ / L1 configuration part configuration  For G-RNTI/G-CS-RNTI; assuming one-to-one G-RNTI/G-CS-RNTI and MBS session mapping, a common configuration per MBS session is possible for a group of UEs who are interested in joining the same session (i.e., same G-RNTI / G-CS-RNTI) at the same time. However, for one-to-many mapping between G-RNTI/G-CS-RNTI and MBS sessions, this require that all of UEs in the group to be interested in the same set of MBS sessions at the same time. |
| Rapporeteur(Nokia) | **Splitting between common/dedicated parts:**  Common:   * CFR - CFR is currently being linked to dedicated DL BWP configuration. For example, when determining the location and bandwidth of CFR, the subcarrier spacing is derived from the associated BWP. It is also possible to not signal the location and bandwidth of CFR to the UE causing the UE to apply the same parameter as for the BWP in which the CFR is signalled. It would be required to signal CFR with subcarrier spacing as any other BWP. Also, locationAndBandwidthMulticast parameter will have to be always present and signal to UE because UEs may be configured with different BWPs that comprise the CFR.   + This means that even though for some UEs the configured BWP may have the same location and bandwidth allocation as a configured DL BWP, the UE will receive the same parameters twice, thus leading to overhead * also TDRA table (PDSCH time domain allocation list) may need to be signaled unnecessarily for each UE * PDCCH related configuration including e.g. DRX configuration * PDSCH related configuration * SPS configuration * PUCCH for HARQ NACK-only i.e. pucch-ConfigurationListMulticast1 which is further associated with BWP-UplinkDedicated. It might be UE specific feedback resource which allows ACK/NACK feedback, or one common feedback resource for one group or a sub-group of UE. * RLC bearer for PTM   UE specific:   * Parts of HARQ/L1 configuration * PTP/unicast configuration * G-RNTI list that UE is monitoring * G-CS-RNTI list that UE is monitoring * UE specific HARQ configuration * PTP leg for split MRB architecture * RLC bearer ID (agreed in RAN2 as per UE space) * Additionally, the configuration fdmed-Reception-Multicast cannot be included in the common part as it is per UE configuration based on ue-specific capability * unicast DRX RTT and retransmission timers may also be configured per UE for PTM retransmission.   **“mapping between common/dedicated parts”**  It was pointed out that since common configuration will not be part of UE-specific signaling, then for the latter, DU will have to indicate some mapping between common configuration parts and the UE ID/cell ID/BWP ID, e.g. UE to MBS session/MRB mapping, UE to G-RNTI mapping. **Rapporeteur wonders whether it would be ASN.1 coding that ensures that “dedicated” part will override common part – similarly to any other existing signaling? Or is something extra really needed?**  **Multiple configurations:**  It was also pointed out that each UE may need to be configured with multiple common configurations, i.e. one for each MBS session the UE is receiving. Rapporteur agrees with this and same would be required even if we do not have common configuration – one would need to configure via dedicated signaling parameters for each MBS session. **So probably there is no real difference on this aspect?** |

Benefits of common configuration are especially valid in case of start of MBS session i.e. multiple UEs start the session reception same time and MBS session modification case when multiple UEs need to be updated with parameters simultaneously. In case of a new UE joins the session there is no benefit of common structure unless multiple UEs join same time.

**Q2: Any comments scenarios where the common RRC structure is beneficial/not beneficial?**

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| **Company** | **Comments on the scenarios for the usage of common RRC structure** |
| ZTE | I assume it is about F1 benefits (since it is always the same info is sent over Uu, no benefits but no hurt either on Uu), there are benefits too for newly joined UE:  - if the PTM config is re-used for such UE, DU wont send the common part configuration to CU (only if update is needed). |
| Qualcomm | It may be benefial in some cases for F1/EI interface, i.e DU can provide common PTM onfiguration once to CU at the time of MRB establishment. But it does not add any benefit for Uu and in case of CFR to be provided twice as rapporteur mentioned in summary *“Also, locationAndBandwidthMulticast parameter will have to be always present and signal to UE because UEs may be configured with different BWPs that comprise the CFR. This means that even though for some UEs the configured BWP may have the same location and bandwidth allocation as a configured DL BWP, the UE will receive the same parameters twice, thus leading to overhead.”*  Adds additional ASN.1 complexity. It seems, overall benefits are not significant (especillay for Uu) but adds additional ASN.1 complexity. Even for F1/E1 interface benefits are limited to few scenarios like PTM configuration change. |
| MediaTek | (Assuming a single RRC message will be used)  It might benefit for F1 interface, but then the RRC message will be generated and sent separately from gNB-CU to gNB-DU, then reassembled at gNB-DU and send to UE. This is very different from current specs since RRCReconfiguration message is now generated and encapsulates by gNB-CU while gNB-DU has no RRC function. This modification will lead to great changes in current specs.  Besides, it is also difficult to align the signals for multiple UEs since UE may join multicast at different times. In this case, F1/E1 interface benefits are limited.(No Uu interface benefit neither) |
| CATT | Do not see any benefits from RAN2 point of view |
| Xiaomi | No benefit is observed from Uu, but extra complexity would be required for both the UE and the gNB to implementing a RRC signaling including a common part and a UE-specific part of the MRB configuration. Agree with the rapporteur’s observation that the same parameters for CFR will be received twice if common configuration of CFR is used. |
| Huawei, HiSilicon | Firstly, our understanding is that with the RAN3 proposal the RRC message would be encoded in the CU, but looking at comments from other companies, it seems this is not so clear. If we still follow the existing rule that RRC is encoded in CU, then the message will include both common part and UE specific part, which means the common part only decreases the overhead in DU to CU direction.  In consequence, regardless of the scenarios, the common RRC structure results in the following:   * Overhead of DU to CU signalling is **decreased** (as we have common part signalled together for all UEs) * Overhead of CU to DU signalling is **increased** (as there are extra parameters that have to be signalled for each UE in common part, e.g. CFR as mentioned above by the rapporteur, but also TDRA table, i.e. pdsch-TimeDomainAllocationList while the message in CU to DU direction is still per UE even for common part) * Overhead of DU to UE signalling is **increased** (as there are extra parameters that have to be signalled for each UE in common part, similarly as in the bullet above)   We are wondering how much can we save on F1 interface in DU to CU direction so that it justifies increasing the overhead over Uu interface (and on F1 in CU to DU direction)? Was this analysed? |
| vivo | We are also aware that no Uu interface benefit can be obtained. |
| Intel | 1. There can be additional signalling overhead in Uu interface. RAN2 has agreed that there can be one-to-many mapping between G-RNTI / G-CS-RNTI to MBS session. Therefore it is possible that one G-RNTI (or G-CS-RNTI) configuration corresponds to multiple MBS sessions. Current ASN.1 structure is organized with separate configuration for G-RNTI / G-CS-RNTI and RLC bearer configuration. For common RRC structure, the same G-RNTI configuration needs to included in multiple MBS session configurations, which would be signalling overhead. 2. Additional RRC signalling and procedure complexity with common RRC structure. In current MBS RRC running CR, the general framework of add/mod/release list is used for the separate management of RLC bearer, G-RNTI, G-CS-RNTI etc. For common RRC structure per MBS session, RRC needs to still define add/mod/release list for MBS session management of UE. In addition, in MBS RRC running CR, all the MBS related configuration is inside IE *CellGroupConfig*, which is a container generated by gNB-DU and is sent to gNB-CU. This is consistent with CU-DU split architecture. Common RRC structure should be placed outside *CellGroupConfig*, and needs to be designed to support the existing CU-DU split model (gNB-DU generates container and sends to gNB-CU), as well as to support the add/mod/release structure for UE. This significantly deviates from RAN2’s way to organize RRC IEs. 3. One general comment is that we would prefer proponents of common RRC structure to have concrete text proposal to show how commone RRC structure can be implemented in ASN.1 so that RAN2 can discuss pros and cons of common RRC structure on a readily-available TP instead of guess what common RRC structure looks like. We prefer to have stable ASN.1 for MBS before upcoming ASN.1 review meeting. |
| Lenovo | 1) we don’t think F1 overhead is a problem. As Huawei said, taking the UE specific configuration, per UE RRCReconfiguration including both common and UE specific configurations, the benefits to reduce F1 overhead is very limited. Signalling overhead is not an isse on wireless transport.  2) As other compianes commented, there is no any benefit on Uu interface.  3) it will cause gNB-CU implementation complexity to combine the common configuration and UE specific configutaion into a RRCReconfiguration message. |
| Kyocera | We see no benefit from Uu point of view. We also share Huawei’s comment that there is a limited gain in F1 signalling exchanges. We also wonder if DU needs a new functionality, i.e., reassembly of RRC message as MediaTek commented, if a single RRC Reconfiguration is transferred over Uu. |
| TCL communication Ltd. | The benefit that can be obtained by Uu interface is only for the scenario where multiple UEs are joining a same multicast session together. In this case, not only F1 but some signalling overhead could be reduced in Uu interfaces as well, as a single RRCrecofiguration message to be sent over Uu in downlink for a group of UEs has less overhead (or more resources efficient) than sending multiples messages to each UE individually (assuming that some configurations could be shared among these UEs ). |
| Rapporteur  (Nokia) | It seems many companies focused here more on not getting benefits in E1/F1 interfaces although it seems to be really RAN3 business area and they have concluded to request common RRC structure – so I would not like to rediscuss here that aspect. But what are important aspects from RAN2 point of view is e.g.  Basically all the companies agree on **Uu interface** there is no benefit but in some scenarios CFR (and possibly TDRA table) may need to be sent “twice” to UE and there will be overhead  Intel has good points that making the ASN.1 will have big impacts and rapporteur welcomes any comments on Intel points on how to actually make ASN.1 |
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It was claimed that one would need to send multiple (two) RRC messages to UE if we introduce common configuration. But it was not really clear why that would be the case as it was also commented that single RRC message can include both common and dedicated part of configuration.

**Q3: Do you think multiple RRCReconfiguration messages would be needed if we introduce common RRC configuration?**

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| **Company** | **Yes/No** | **Comments on why you think multiple message is needed or not?** |
| ZTE | No | A single message that contains different IEs (e.g., common part + UE part) |
| Qualcomm | No | Our understanding is one dedicated RRC siganling message can have both common and UE specific IEs for PTM configuration. But there is no benefit for Uu and infact adds addition overhead for Uu when CFR has to be explicitly configured without linking to dedicated BWP. |
| MediaTek | No | Two RRC messages will bring extra latency to UE. RAN3 needs to clarify whether single or multiple RRC message will be used based on this assumption. |
| CATT | Maybe | Multiple messages are needed if we do not mandate gNB-DU’s behavior on reassembling the common configuration parts and UE specific parts into one RRC message. |
| Xiaomi | No | Single RRC message containing both the common part configuration and the UE part configuration seems workable. However the benefit is questionable as the RRC message generated by the gNB-CU would anyway be forwarded from the CU to the DU. |
| Huawei, HiSilicon |  | In our understanding, there are two possibilities:  **Option 1:**   1. DU provides the common part to the CU. 2. CU sends the common configuration to the UE. 3. DU provides the UE-specific part to the CU. 4. CU send the UE-specific configuration to the UE.   **Option 2:**   1. DU provides the common part to the CU. 2. DU provides the UE-specific part to the CU. 3. CU encodes these two together and sends to the UE (in a single message).   Probably option 2 was assumed by the companies, but it would be good to clarify this. E.g. is it clear that there is always both common and UE-specific part of configuration? So does the CU always wait for the UE-specific part from DU before sending the configuration to the UE? Or are there situations where there is only common configuration part and it should be sent to some UEs right-away (how can the gNB-CU know about this?). |
| vivo | No | From RAN2 point of view, one RRC message with common and ue-specific configuration anyway will be delivered as a result (i.e. the MBS reception cannot be performed without any part of configuration). |
| Intel | No | A single RRC message can include both common and UE specific part. But this adds additional RRC siganlling and procedure complexity. |
| Lenovo | No | Our understanding is a signle RRC reconfiguration message includes both common and UE specific message. If there are two separate messages, there is timing gap between the two configurations. How the UE handles the timing gap is not clear. |
| Kyocera | - | We have the same view with CATT that multiple RRC messages may be needed according to the current specification for DU. We agree with Huawei about the two options with their concerns, and it’s unclear which option RAN3 assumes. |
| TCL communication Ltd. | No | A single message containing different IEs (e.g., common part + UE part) is needed. |
| Rapporteur  (Nokia) |  | It seems most companies consider option 2 in the Huawei comment above i.e. we need two separate F1 messages (one for CU to fetch the common part from DU, and a second F1 message to fetch the ue dedicated part) but then CU sending only one RRC message to UE.  **Regarding coordination:**  In our understanding CU will always have to wait for the ue-specific part of DU before sending the RRC reconfiguration message. There is no situation where only the common configuration part to be sent to the UE right away to our knowledge. **Of course this is more RAN3 aspect but good to discuss and see if there are different views?** |

**Q4: Other aspects ?**

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| **Company** | **Comment** |
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# Summary