**3GPP TSG-RAN WG2 Meeting #117 electronic R2-22xxxxx**

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

**Agenda item: 8.1.3.2**

**Source: Nokia**

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

**Document for: Discussion and Decision**

# Introduction

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

Scope: 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.

Intended outcome: Report

Deadline: W1 Thursday (for online CB W1 Friday).

[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**

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# 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].

|  |
| --- |
| 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

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

R2-2203345 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.

The common RRC structure would be beneficial for F1/E1 signalling and could be also used for a group reconfiguration over Uu [R2-2202332] when parameters common to all UEs are changed such as CFR configuration (i.e. reconfiguration to wider/narrower CFR), search space configuration, SPS configuration, PUCCH for HARQ NACK-only, RLC bearer for PTM leg, etc.

But there was also arguments that changes to ASN.1 of the current running CR can be quite significant.

It was also commented that common RRC structure could be introduced in Rel-18. However, if having a common RRC structure is seen beneficial then it should be introduced in Rel-17 because delaying the introduction to Rel-18 may have even more impacts on the network as the network will have to be dealing with UEs supporting quite different ways of signalling.

**Q1: Do you agree that it would be technically possible to introduce common RRC structure for lower layer configuration of PTM transmission for MBS multicast session?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (at least if you think it is not feasible could you provide details why not?)** |
| Nokia | Yes | Technically it is possible – Almost anything is possible in ASN.1 although structure of ASN.1 would need to be changed quite a bit. |
| Huawei, HiSilicon | No | Not everything can be part of common configuration, e.g. different UEs are receiving different G-RNTIs, can have different HARQ feedback configuration etc. |
| Qualcomm | No | Same view as Huawei. Additionally different UEs may join Multicast at different times and CU has to provide Multicast bearer configuration for these UEs at different times. This can’t reduce any F1/E1 signalling overhead. ASN.1 changes are quite significant and different UEs will have different L1 configuration and different PTP link configuration. |
| MediaTek | No | Same view as Huawei and Qualcomm. |
| Lenovo | No | In most of cases, UE dedicated configuration should be provided e.g. HARQ, PTP related configuration. For this point of view, we don’t see it can reduce F1/E1 signalling overhead. |
| CATT | No | Agree with above companies that it is not feasible to construct a common lower layer configuration of multicast. In the typical case, different UEs have interest in different multicast services. Then the lower layer multicast configuration for different multicast services are different (e.g. there are per G-RNTI configuration in *MAC-CellGroupConfig*,there are per G-CS-RNTI in *PhysicalCellGroupConfig*). |
| Kyocera | Yes |  |
| Sharp | No | As said by other companies, UE dedicated configuration is also needed. |
| Samsung | No | There are UE specific configuration for multicast, as mentioned by Huawei |

**Q2: Do you think it is beneficial considering complexity (if feasible per Q1) of defining common RRC structure and benefits it can provide in F1/E1 signaling?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (at least if you think it is not feasible could you provide details why not?)** |
| Nokia | Yes | Common RRC structrue will cause some extra overhead as some information is probably sent multiple times per UE. But benefit in F1/E1 seems quite high thus we see that is is worth the effort. |
| Huawei, HiSilicon | No | We think it is a very bad idea to try to optimize signalling over F1/E1 interfaces at the expense of resource efficiency and configuration delay on Uu interface. E.g. most of the UEs will have to be configured using two consecutive RRCReconfiguration messages, one for common part and the other one for UE specific part. From stability point of view, such major redesign of RRC signalling is also very dangerous at this stage. |
| Qualcomm | No | Same view as Huawei. Uu interface overhead is higher priority than F1/E1 interface. Even with common structure, still delta info has to be provided to different UEs and it does not help to reduce overhead. |
| MediaTek | No | Same view as Huawei and Qualcomm. |
| Lenovo | No | In most of cases, UE dedicated configuration should be provided e.g. HARQ, PTP related configuration. For this point of view, we don’t see it can reduce F1/E1 signalling overhead. |
| CATT | No | Since multicast configurations are sent to UEs separately via RRC dedicate signalling, a common lower layer multicast configuration does not bring any benefit on resource efficiency over Uu. |
| Kyocera | No | We think it’s the common understanding that the multicast configuration is one-by-one manner, i.e., reusing legacy RRC Reconfiguration. In addition, we’re not sure how many issues RAN2 has to solve, e.g., what happens if some of UEs fail to decode the group reconfiguration, in order to support the common RRC structure. So, we don’t think it’s feasible to be completed in Rel-17 timeframe. |
| Sharp | No | Same view as Huawei. |
| Samsung | No | We think a common lower layer configuration for multicast is not useful, since UE specific configuration will be most likely followed. |

# MRB ID uniqueness

RAN3 informed RAN2 about the preference for the scope of MRB ID and asked RAN2 to comment on this proposal in the LS [R3-221469].

|  |
| --- |
| Scope of MRB ID:  E1 and F1 interface functions would benefit from the MRB ID to be unique only in the scope of an MBS session, but not within the scope of an UE. This would allow the use the same MRB ID for all UEs.  **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** |

Follwing papers considered this aspect in the LS:

[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

R2-2202368 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

R2-2203156 Discussion on open issues for NR MBS LG Electronics Inc. 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

Rapporteur understanding is that RAN3 proposal is that the same value of MRB ID could be used for different sessions. The consequence is MRB ID itself is not sufficient to uniquely identify MRB and must be always signalled together with MBS Session ID, i.e. TMGI. For example, let us consider an example scenario in which two UEs, UE 1 and UE 2, join MBS multicast identified by TMGI 100 and TMGI 200, respectively. Each UE joined only one MBS multicast session. Assuming the network decides to configure one MRB for each MBS session. The CU must select the value of MRB ID. The CU may select the same value, e.g. MRB ID = 31, for both MRBs and uses this MRB ID in signalling towards the DU and the UEs as illustrated on figure.



Figure 1: Same MRB ID used for UEs joining different MBS sessions.

If one of the UEs joins another MBS multicast session for which the same value of MRB ID is already used would cause a issue.

Samsung (R2-2202684) states that RB ID has been unique within a UE, irrespective of type of RB, i.e. SRB/DRB/MRB. RAN3 LS mentioned that unique MRB ID within an MBS session allows the use the same MRB ID for all UEs. However, it is still possible under unique MRB ID within a UE. For instance, same MRB ID = x can be commonly used for a particular multicast service served in a cell. They see that gNB can coordinate the MRB ID space to keep the same MRB for all UEs in the cell. The current RRC specification uses MRB ID for mapping between RLC bearer and PDCP entity. Samsung also notes that one possibility is to include TMGI as part of MRB id to ensure uniqueness.

Following papers consider that we can keep current RRC signalling and issue is not severe:

**MRB id unique within UE (like in current RRC CR):**

R2-2202644 Support of split NR-RAN architecture for NR MBS Intel Corporation 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

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

Note that R2-2202684 also softly says that if something is needed simplest would be to extend MRB ID space.

**G-RNTIs/G-CS-RNTIs identify different MBS sessions over Uu. Therefore, different MBS sessions can use same MRB IDs over F1 and E1, which will not lead to the confusion of MRB ID over Uu.**

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

Then these papers consider that something is needed to resolve RAN3 concern either by:

**MRB id separate from DRB ID space:**

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

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

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

**Extend existing MRB Id space**

[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

**Q3: Do you think current RRC signaling for MRB ID is sufficient to satisfy RAN3?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Nokia | No |  |
| Huawei, HiSilicon | Yes | RAN3 mentioned they can benefit from per session MRB ID, but this is not something that they require to make the signalling work. Actually RAN3 has discussed some alternatives to handle the signalling which can be utilized without having to change RB handling principles in RAN2. |
| Qualcomm | No |  |
| MediaTek | No |  |
| Lenovo | Yes | Same view with Huawei |
| CATT | No |  |
| Kyocera | No |  |
| Sharp | No |  |
| Samsung | - | The question is not so clear what satisfies RAN3.  It’s clear that the current RRC signalling mandates unique MRB ID within a UE, i.e. UE is not configured with multiple MBS sessions sharing the same MRB ID. If it is kept, the benefit indicated by RAN3 can be met.  If RAN3 wants to share the same MRB ID for different MBS sessions within a UE, the current spec does not support it. |

**Q4: If you answered no to Q3 in which way it should be solved?**

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| --- | --- | --- |
| **Company** |  | **Comments** |
| Nokia | Extend MRB id space | Simplest seems to be just to extend existing MRB id space. That would require minimal changes to existing CRs.  Although we are likely OK to make separate DRB/MRB ID spaces as well. |
| Huawei, HiSilicon |  | In our understanding, RAN3 asked for a per session MRB ID, not for global MRB ID. In any case, we find both solution infeasible:   1. Global MRB ID would require a very long MRB ID space of at least >2000. Furthermore the configuration of MRB IDs has to be coordinated across the network and it is unclear how this is achieved (is it provided from OAM, from CN or via coordination between gNBs?). Also, the MBS flow to MRB mapping has to be coordinated throughout the network. 2. If we introduce per session MRB ID, as requested by RAN3, then the following issues can happen:  * issues with reconfiguration if UE joins a new session which was allocated the same ID as another session of the UE * issues during handover, i.e. different gNBs may have assigned the same MRB ID to different sessions which requires release and addition of the MRB and leads to data loss   Both these scenarios would require release and addition of MRB which causes data loss and service interruption. |
| Qualcomm |  | MRB ID is part of RadioBearerConfig IE and is sent to UE in dedicated RRCReconfig message. It is possible for GNB to allocate MRB ID specific to MBS session (i.e. common to all UEs in that cell) and can be conveyed to UE in dedicated signaling, within each UE, MRB ID can be unique but is common one from GNB perspective. MRB ID space is different from DRB ID Space. It is upto GNB to provide common MRB ID for a given MBS session in a given cell. Following changes need to be considered.   1. When UE moves from one cell to another cell, we need allow RRC enhancements to change MRB ID without releasing and adding MRB. 2. Also like Nokia commented, we can extend MRB ID space beyond 32 limit and upto 256 or 512. |
| MediaTek |  | 1. The MRB ID assignment is a gNB implementation. We agree with Qualcomm on that it is up to gNB to provide common MRB ID for a given MBS session in a given cell. 2. We assume different gNB may configure different MRB-ID for the same MBS session since global MRB ID is not possible. 3. MRB ID reconfiguration may happen during the handover for the UE receiving Multicast. 4. We think same MRB ID can be reused across the MBS sessions, since G-RNTIs/G-CS-RNTIs identify different MBS sessions over Uu. |
| Lenovo |  | gNB can coordinate the MRB ID space to keep the same MRB for all UEs in the cell. |
| CATT |  | We think MBR ID space should be separated from DRB ID space.  In addition to that MRB ID is unique within the MBS session, using a common MRB ID among gNBs is more beneficial on minimizing the multicast data loss during handover. If the same MRB ID is used in source and target cell, delta configuration can be used.  But if MRB ID is unique within the MBS session, the complexity of network implementation may be increased to avoid the confliction between DRB ID and MRB ID in the case of DRB ID and MRB ID share the same value space. Moreover, it is harder to align the MRB IDs between gNBs if shared RB ID space is used. |
| Kyocera | Separate ID space | We think it’s cleaner to define MRB ID space which is separated from DRB ID space. |
| Sharp |  | We prefer to define separate MRB ID space from DRB ID space |
| Samsung | Prefer no enhancement  If needed, ok with extend MRB ID space | We think from RAN2 perspective, all options, e.g. increasing MRB ID space, association with RNTI/TMGI do not have any benefit in Uu but breaks the existing RBID configuration rule and increases complexity. We do not support any enhancement for this.  If companies really want to have a solution, we think MRB ID space extension is the simplest.  From RAN2 perspective focusing on configuration between gNB and UE, the current 32 MRBs are enough. The gain of increasing MRB ID or combination with TMGI/G-RNTI does not have any benefit but rather increase overhead/complexity. |

# MBS support in MR-DC other aspects

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

Above paper notes that WI states:

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| Restrictions and assumptions:  Architecture: it is the one in Figure 4.1-1 in TR 23.757 v0.2.0: High level MBS architecture, with the further restriction that only NR in NG-RAN (i.e. connected to 5GC) is considered as RAT. Consequently, in addition to in NR SA, there should be no reasons preventing the use of the feature standardized in this WI in case of MR DC configurations in the MCG when the MN is a gNB (NE-DC, NR DC). |

i.e. The MBS in NR MCG can be supported if the NR-MBS mechanism in NR-SA can be applied without any addition spec effort.

And the paper states that in order to support cross carrier scheduling would require extra work and thus should not be done.

Also the paper also states to support multiple PTM transmissions over multiple serving cells has the extra spec effort.

Additionally paper states that RAN2 agreed that the multicast MRB can be configured with one PTM link and one PTP link in previous meeting. In the MCG with CA configuration, the PTP transmission may be via the same or different serving cell from the PTM transmission. To avoid the extra spec effort, we should stick to the agreement that the MRB is only supported via one PTP link and one PTM link.

**Q5**: **Do you agree proposals in the paper R2-2202555 i.e.**

1. **The cross-carrier scheduling is not supported for the PTM transmission on SCell**
2. **the multicast MRB is at most configured with one PTP link and/or one PTM link in CA**

**If yes – do you agree TP for 38.300 in the R2-2202555?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No (for a and b proposals)** | **Comments** |
| Nokia | No strong view | No time to optimize these as of now so probably best to go with Apple proposals.  Also TP to 38.300 looks fine although maybe not critical try to agree now. And likely we can just have first sentence from the TP. |
| Huawei, HiSilicon | Both aspects are up to RAN1 to decide and are already being discussed there |  |
| Qualcomm | 1. Yes 2. Yes | For A) RAN1 already agreed not to support cross carrier scheduling of MBS in SCell. |
| MediaTek | Yes with but | We think there may be not enough time to discuss this at Rel-17.  Meanwhile we also think that the cross carrier scheduling issue should be discussed at RAN1. |
| Lenovo | See comments. | In general, although RAN1 is still discussing the multicast reception in SCell, we would prefer to allow multicast reception in SCell from signalling point of view. Regardless RAN1’s agreement, RAN2’s spec should be future proof e.g. to provide G-RNTI configuration per serving cell.  a) and b) should be decided by RAN1. |
| Kyocera | - | We think it’s out of RAN2 scope, i.e., it’s discussed in RAN1. |
| Sharp |  | It is up to RAN1. |
| Samsung | a) Yes  b) Yes | a) We can just follow RAN1 |

# Summary