3GPP TSG-RAN WG2 #113bis-e R2-210xxxx

eMeeting, 12th – 20th April, 2021

Agenda Item: 5.4.3

Source: MediaTek Inc.

**Title: Report of e-mail discussion [AT113bis-e][012][NR15] UE caps IV (Mediatek)**

Document for: Discussion and decision

# 1 Introduction

This is report for the following AT113bis-e mail discussion.

* [AT113bis-e][012][NR15] UE caps IV (Mediatek)

Scope: Treat R2-2102644, R2-2104084, R2-2104087, R2-2104029, R2-2103633, R2-2102623, R2-2104098, R2-2104101, R2-2103115, R2-2103116, R2-2103634, R2-2103635, R2-2103791, R2-2103792, R2-2104021, R2-2104022

Phase 1, determine agreeable parts, Phase 2, for agreeable parts Work on CRs.

Intended outcome: Report and Agreed-in-principle CRs.

Deadline: Schedule A

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

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| --- | --- | --- | --- |
| Company | Name | Email Address | |
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# 3 Discussion

## 3.1 Single Uplink Operation

The issue is triggered by the LS R2-2102644 form RAN4 [1] which indicates that the SUO capability (*singleUL-Transmission*) is not sufficient in some case.

RAN4 would like to inform RAN2 that the UE capability *singleUL-Transmission* is reported per band combination and may not be sufficient for UE to indicate dual UL in one UL CC pair and single UL in another CC pair in one band combination. RAN4 agree that it is left to RAN2 on whether and how to resolve this issue.

There are several proposals in response to the issue raised by RAN4 as below

* [2] Proposal 1: RAN2 confirm that *singleUL-Transmission* could not indicate dual UL in one UL CC pair and single UL in another CC pair in one band combination. UE shall report this kind of BC twice with different supported UL pairs and different *singleUL-Transmission* value. RAN2 does not intent to have further optimization on this.
* [4] Proposal: RAN2 confirms that with the legacy signalling, UE is able to indicate dual UL transmission capability in one UL CC pair and single UL transmission capability in another CC pair in different band combination entries. No impacts on RAN2 specification.
* [5] Proposal 1: RAN2 to reply to RAN4 that there is already a solution to the claimed single UL issue since Rel-15 and RAN2 does not plan to implement additional solutions.

The rapporteur thinks the proposals are quite aligned. Basically, companies agree that current signaling could solve the issue raised by RAN4 and there is no intention to have additional change. Therefore, it is suggested to check with companies whether we could have the following way forward as RAN2 agreement.

* RAN2 confirm that *singleUL-Transmission* could not indicate dual UL in one UL CC pair and single UL in another CC pair in one band combination. However, with the ASN.1 signalling from Rel-15, UE is able to indicate dual UL transmission capability in one UL CC pair and single UL transmission capability in another CC pair in different band combination entries. RAN2 does not plan to implement additional solutions.

**Question 1: Do companies agree the following proposal**

* **RAN2 confirms that *singleUL-Transmission* could not indicate dual UL in one UL CC pair and single UL in another CC pair in one band combination. However, with the ASN.1 signalling from Rel-15, UE is able to indicate dual UL transmission capability in one UL CC pair and single UL transmission capability in another CC pair in different band combination entries. RAN2 does not plan to implement additional solutions.**

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| **Company** | **Agree or not** | **Comments** |
| MediaTek | Agree |  |
| Nokia, Nokia, Shanghai Bell | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Apple | Agree, but needs some clarification | It is our understanding that when RAN4 mentioned that certain BCs the UE is allowed to report *singleUL-Transmission* it is already expected that which CCs are affected and hence for which CCs that UE is expected to perform the SUO operation. So in case of a BC with more than one UL (more than one CC with UL), it is known for which CC pair the UE will perform SUO operation. If so, then it should be already clear…?  Or is it that RAN4 intends to define BCs where the SUO operation can be possible on more than 1 CC pair. (for eg, a hypothetic combination DC\_1A\_2A\_77A\_n2A\_n77A, where UE has problems performing dual UL on 2A\_n2A and/or 77A\_n77A, and here if the UE can support SUO on 2A\_n2A, but no problem with 77A\_n77A, it cannot report this…?).  [MediaTek] Yes , that is the case that RAN4 mentioned.  We agree that the signalling BC more than once can resolve (some of ) this, but wanted to check about our concern, as this the proposed signaling cannot address this.  [MediaTek] Yes, we also understand while the UE supports more than 2 UL CC simultaneously with some CC pair requests SUO, it is still not possible to indicate by current signalling. However, we understand that RAN4 does not intent to address this scenario and prefer not to resolve this (maybe unpractical) case for now. Hope that it is acceptable. |
| Intel | Agree |  |
| ZTE | Agree |  |
| Ericsson | Agree |  |
| Qualcomm Incorporated |  | We had the same question as Apple’s above.  If the intention is to allow “the SUO operation on more than 1 CC pair”, the proposal above does not address this. It should not result in network looking at UE capabilities from multiple band combinations and try to use them simultaneously.  [MediaTek] See also our comment to OPPO and Apple. We understand the proposal does not solve all cases but assume it would be enough for now.  In additional, the solution does NOT request NW to look different BC entry and try to use them simultaneously. The rapporteur understands no companies propose that kind of behavior and some companies would like clarify this in the reply LS. (See also the discussion in Q2). |
| Samsung | Agree |  |
| vivo | Agree | We share the same understanding with the rapporteur. |
| CATT | Agree |  |
| OPPO | Agree | We also think in case there are more than 2 UL CCs, then still current signalling may not work properly  [MediaTek] Yes, we also understand while the UE supports more than 2 UL CC simultaneously with some CC pair requests SUO, it is still not possible to indicate by current signalling. However, we understand that RAN4 does not intent to address this scenario and prefer not to resolve this (maybe unpractical) case for now. Hope that it is acceptable. |
| LG | Agree | RAN4 intention is not crystal clear, but the proposal suggested by Rappoteur can address the LS anyway. Any further work from RAN2 can be considered after RAN2 further clarify their intention, if any. We can add something in reply LS to address this potential RAN4 clarification. |
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**Summary for Q1**: Alomost all companies agree the proposal. Some companies mentioned that the solution may not solve for the case that the UE supports more than 2 UL CC simultaneously with some CC pair requests SUO. However, RAN4 is not asking for this kind of combination in rapporteur’s understanding and we have somehow identify the limitation of current signaling. Therefore, it is suggested to agree the proposal.

**Proposa l: RAN2 confirms that *singleUL-Transmission* could not indicate dual UL in one UL CC pair and single UL in another CC pair in one band combination. However, with the ASN.1 signalling from Rel-15, UE is able to indicate dual UL transmission capability in one UL CC pair and single UL transmission capability in another CC pair in different band combination entries. RAN2 does not plan to implement additional solutions.**

The rapporteur assumes that RAN2 will send reply LS to RAN4 based on the result of Q1. Two companies [3][5] already provide the draft reply LS to RAN4. Any comment/suggestion on the reply LS content is welcome.

**Question 2: Do companies have further comments/suggestions on the draft reply LS [3][5] to RAN4?**

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| **Company** | **Comments** |
| MediaTek | We would suggest to update R2-2104087 based on the result of Q1.  Regarding to the fallback aspect mentioned by Nokia draft LS [5]  “UE can always indicate the fallback BC with "better" capabilities separately to allow network to know in which fallback BCs UE doesn't require single UL”  It is true that UE could indicate fallback BC with better capabilities. However, we understand that this does not solve the issue completely. The issue is caused by different SUO capability in different supported UL pairs within a BC. They are not fallback BC with each other. So, we suggest not to mention the fallback aspect to RAN4. |
| Nokia, Nokia, Shanghai Bell | As reply to MediaTek: In our understanding, not being required to use SUO is "better" capability but we are fine not to mention fallback BCs in the LS reply to avoid confusing RAN4: The LS can just indicate that RAN2 has a solution from Rel-15 without any changes needed. |
| Huawei, HiSilicon | We agree no need to mention fallback. Simply saying Rel-15 signaling has already supported the requirement is sufficient. |
| Apple | We agree to not mention fallback. Also, depending on the outcome on the topic we raised, we might need to include the outcome in the LS as well. |
| Intel | Agree with MediaTek that the issue is not just related to fallback but also on the different SUO capability in different supported UL pairs within a BC.  Hence we also prefer R2-2104087 as the baseline for further updates, if any. |
| ZTE | We are generally ok with the Reply LS in the [3], but we don’t think the below sentence is necessary.   * It is mandatory to report singleUL-Transmission field for BCs where only single switched UL transmission is allowed as defined in TS 38.101-3.   Meanwhile, we share the same view as Nokia that to indicate that RAN2 has a solution from Rel-15 without any changes needed.  “Regarding to the question raised by RAN4, RAN2 also understands that *singleUL-Transmission* could not indicate dual UL in one UL CC pair and single UL in another CC pair in one band combination. However, RAN2 can solve this issue from Rel-15 without any changes needed, e.g. as indicating in above agreement, the UE can report this kind of BC twice with different supported UL pairs and different *singleUL-Transmission* value. .” |
| Ericsson | It may be beneficial to also clarify that this does not mean that both BCs can be taken into account simultaneously e.g. “This does not imply that both of those band combinations entries can be taken into account simultaneously to derive the support of this feature for a band combination”, we already told RAN4 this in R2-2102495 (see excerpt below) for another issue, but maybe it also fits as a clarification in this case.  “the UE capability signalling does not account for the indication of support of a feature that needs to be derived from multiple band combinations” |
| Qualcomm Incorporated | See our comment to Q1, which we think should be clarified with RAN4. |
| Nokia v2 | We think the Ericsson intent is good but this may be confusing to RAN4: We would propose a slight alteration to the wording in the same spirit:  “the UE capability signalling is considered per BC when deciding RRC configuration. Network is not required to derive UE configuration for a BC based on multiple band combination capabilities." |
| Samsung | We agree just indicating the RAN2 understanding/solution without anything further. |
| vivo | We can just simply indicating the RAN2 agreements, confirming the understanding, and tell the RAN2 solution. So we are generally fine with draft reply LS in [3]. |
| CATT | Agree with MTK and HW. |
| OPPO | We agree with ZTE that the sentence “**It is mandatory to report *singleUL-Transmission* field for BCs where only single switched UL transmission is allowed as defined in TS 38.101-3**” is not relevant closely and hence could be deleted in the LS.  And we would also like to confirm that the issue raised by RAN4 is to address two UL CCs at most. If there are more than 2 UL CCs in the same featureset of same BC, then current signalling is still not feasible. |
| LG | ZTE’s rewording seems fine. Also, Ericsson’s addition to prevent a possible behaviour of combining two reported BCs seems beneficial. |
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**Summary for Q2**: Most companies seems aligned on the reply LS content. The main point is to confirm there is an issue and R15 signaling could solve this (at this for some cases). Some companies want to emphasize that NW is not required to derive UE configuration for a BC based on multiple band combination capabilities. It seems reasonable from rapporteur’s point of view. It is proposed to continue the LS content discussion in phase 2.

**Proposal 2: Send LS to RAN4 based on the conclusion in P1. Detail content to be discussed in phase 2.**

## 3.2 SCS of active DL/UL BWP

The issue is triggered by the LS R2-2102623 form RAN1 [6] which the following description:

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RAN1 has identified that there is inconsistency between the description of FG6-4 BWP adaptation with different numerology in TR38.822 and the definition of UE capability parameter *bwp-DiffNumerology* in TS38.306. It triggers the discussion for the following issue in RAN1.

* Whether a UE can assume the same SCS and CP length for its active DL BWP and active UL BWP in a serving cell except for SUL at a given time

After discussion, RAN1 achieves the following conclusion.

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| **Conclusion**   * It’s RAN1’s understanding that for both paired spectrum and unpaired spectrum UE may assume the same SCS and CP length for its active DL BWP and active UL BWP in a serving cell except for SUL at a given time   + No RAN1 CR is needed |

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Several companies proposed CR to clarify this BWP operation issue. There are basically two different approaches. One is to clarify this in field description of capability *bwp-DiffNumerology* (and *bwp-SameNumerology*), the other is to clarity this in description of the IE *BWP*. So, the key difference is that whether the RAN1 conclusion “*same SCS and CP length*” is limited to the UE that supports *bwp-DiffNumerology*. Is it possible to have different SCS on active DL and UL BWP if the UE only support one dedicated BWP (FG 6-1 UE)? It would be good to check with companies understanding on this.

**Question 3: Do companies agree that the RAN1 conclusion “*same SCS and CP length for its active DL BWP and active UL BWP in a serving cell except for SUL at a given time*” applies to general BWP operation for all UEs (i.e. not limited to UEs that support *bwp-DiffNumerology* and/or *bwp-SameNumerology*)?**

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| **Company** | **Agree or not** | **Comments** |
| MediaTek | Agree | We understand the RAN1 discussion is triggered by FG6-4 UE but the conclusion is not limited to FG 6-4 UE. For UE supports only one dedicated BWP, the SCS of DL and UL should also be the same.  In addition, for UE that supports *bwp-SameNumerology* (FG6-2, FG6-3 UEs), it is unclear whether “same Numerology” applies to DL and UL separation. We understand that the original intention is to say same SCS for all DL/UL BWPs.  We therefore propose to have general clarification on the description of IE *BWP* in 38.331. |
| Nokia, Nokia Shanghai Bell | Agree | First, this is more about what UE can support than what signalling allows, hence we think this is about UE capabilities.  Second, we agree that it would be good to ensure that everyone shares the understanding that currently UE can NOT indicate that it would support e.g. UL BWP with 15 kHz and DL BWP with 30 kHz. That is, **even if** UE indicates *bwp-DiffNumerology*, this doesn't mean UE would support such a configuration. This was our understanding but would be good to make sure as that would impact how the change is reflected in the CRs (e.g. we would expect clarification to both *bwp-SameNumerology* and *bwp-DiffNumerology*). |
| Huawei, HiSilicon | Agree | The RAN1 LS is a bit confusing, it says UE may assume the same SCS and CP length, but in our understanding the UE only assumes the same SCS and CP length. Our original CR was also to add restriction on the UE capability side, however it is a bit unclear whether in the future the UE would support different SCS or CP for UL/DL BWPs. Thus the way to have network configuration restriction would be OK by us. In any case, we also understand this is a general restriction regardless how FG 6-4 is set. |
| Apple | Agree with MediaTek’s views. |  |
| Intel | Agree with MediaTek’s views. |  |
| ZTE | Agree | Considering that the restriction is applicable to all UEs, we agree with MediaTek’s CR, but suggest to modify the CR as below:  ‘The network ensures same subcarrier spacing and cyclic prefix length for active DL BWP and active UL BWP in a serving cell except for SUL at a given time.’  Because the UE’s active BWP can be switched by DCI, it is not only a configuration issue. |
| Ericsson | Agree | We are fine with the clarification to 38.331. But we have some sympathy to also clarify this in 38.306 since ultimately this is the TS where it should be specified what the UE actually supports. |
| Qualcomm Incorporated | Agree | We support the proposed clarification in 38.331. |
| Nokia (v2) |  | **We would like to note that this question is about RAN1 conclusion and not about whether 38.331 CR is needed! So would be good if we focus on the intention in this question, NOT on which CR is used.** |
| Samsung | Agree |  |
| vivo | Agree | We also agree that this RAN1 understanding is applicable to general BWP operation. |
| CATT | Agree | And yes Nokia comment v2 is useful… |
| OPPO | Agree | Active BWP can be switched either by RRC signalling, DCI and MAC operation (RACH procedure). For UE supporting *bwp-SameNumerology* , the numerology of all BWP including UL and DL are the same, hence naturally numerology of active DL and UL BWP are always the same. For UE supporting *bwp-DiffNumerology* numerology among BWP pairs (DL and UL BWP with same ID) could be different but numerology in a BWP pairs should be the same considering UE will switch to initial BWP pair or BWP pair with same ID when RACH procedure is initiated. |
| LG | Agree | We share the view with MTK, i.e. the restriction is generic. We also think it is useful to clarify this in 331. |

**Summary for Q3**: All companies agree that the conclusion from RAN1 applies to all UEs. There are some debate on how to capture this but this could be discussed later. It is proposed to confirm the common understanding first.

**Proposal 3: RAN2 understands that “same SCS and CP length for UE’s active DL BWP and active UL BWP in a serving cell except for SUL at a given time” applies to general BWP operation for all UEs.**

Besides for the two different approaches discussed in Q3, companies are invited to provide further comment/suggestion on the proposed CRs [7][8][9][10][11].

**Question 4: Any further comment/suggestion on the proposed CRs [7][8][9][10][11]?**

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| **Company** | **Comments** |
| MediaTek | We think that some CR does not address the point that CP length should be the same for DL and UL active BWP (in addition to SCS). This is another reason that we think it is more suitable to clarify this in general description of BWP IE. |
| Nokia, Nokia Shanghai Bell | It seems far more logical to have the change clarified (only) in the UE capability descriptions of 38.306.  On proposed RRC CRs, we would note that RAN2 does not normally capture network configuration limitations in IE descriptions, for instance: If we ever use the configuration differently, we would have issues with what [7] proposes. Generally, this is related to what UE supports, not what network configures. We assume network always configures UE based on its capabilities. |
| Huawei, HiSilicon | As explained above, we think in any case, the restriction is general for UL and DL except for SUL. So we think it should be a general correction. |
| Apple | We have the same view as MediaTek and it’s better to capture this in 38.331 as mentioned in MediaTek’s CR. |
| Intel | Same view as MediaTek. Just updating the BWP switching capability will only clarify for the case when BWP switching occurs. But this does not cover the configuration case (i.e. the non-BWP switching case). This can only be done on the general description of BWP IE in TS38.331 (as in MediaTek CR [7]). Once this is done, we do not see the need to update the field description for the BWP switching capabilities. |
| ZTE | See our views on Q3 above. |
| Ericsson | As said in Q3, fine to go with the 38.331 CR in [7], but as also said above we would like to know companies views on whether anything may be needed for 38.306 – if yes, [9] seems more complete and one may just need to add the CP length clarification. |
| Qualcomm Incorporated | We support the proposed clarification in 38.331. |
| Nokia (v2) | We don't normally add statements that say "network shall take UE capabilities into account" to RRC - that is the genral principle network must always follow and we need not state it everywhere. That's why we still think it's more than sufficient to only correct this in 38.306. So far nobody has explained why this should be done to 38.331 instead of 38.306. This is NOT a network or RRC configuration issue but **UE (in)capability** issue so we don't really understand why we focus on 38.331 instead of 38.306. To us the 38.331 change seems is close to NBC change, which is why we wanted to be careful and stick to 38.306 changes.  In summary: We cannot accept only 38.331 correction and would like to insist on ensuring that the issue is correctly reflected in at least 38.306. If a correction to 38.331 is needed in addition, RAN2 should follow normal RRC practices and update field descriptions and/or conditions and NOT the IE descriptions. |
| Samsung | We share the view from Nokia that it seems better to add general correction in the 38.306. |
| vivo | We are wondering whether it is possible to capture this universal understanding in stage-2 CR (i.e. 38.300 section 6.10)?  [MediaTek] Thanks for the suggestion, we think that stage 3 has more visibility and companies now seems converge to have 2 CR. So we suggest to progress both RRC and capability CR. |
| CATT | We agree with Nokia v2 comment in general. |
| OPPO | We think both 331 CR and 306 CR are needed. The 331 CR is to address network’s behaviour since active DL/UL BWP switch can be controlled by network. and we agree with ZTE to change the “configure” to be “ensure”  306 CR is also necessary to address the fact that for the paired and unpaired spectrum, DL and UL BWP with same ID should have same numerology always. We can add one note for both IEs:”the numerology of DL and UL BWP with same *bwp-id* shall be always same” |
| LG | We do not have a strong view in which spec the clairification is included. But it would be good to avoid duplication, i.e., only one place should be sufficient.  [MediaTek] Based on the discussion, it seems now that both 331 and 306 CR are needed to clarify different aspects. So, we will propose to have both CR. Hope that it is acceptable. |
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**Summary for Q4**: There is majories support to clarify this in 38.331 as proposed in [7]. The main reason is that UE support only one BWP also requires the clarification. Some companies suggest to capture restrictions in field descriptions, not IE descriptions. This could be further discussed in phase 2. On the other hand, some companies insist to have 306 CR in additional to 331 CR since this is related to UE capability. Therefore, it is suggested to pursue both 38.331 and 38.306 CR and taking above suggestions into consideration.

**Proposal 4: Clarify the BWP operation concluded in P3 in both 38.331 and 38.306. Taking 38.331 CR R2-2104098 and 38.306 CR R2-2103634 as baseline.**

# 4 Conclusions

Base on the discussion in section 3, we have the following proposals:

On Single Uplink Operation

**Proposa l: RAN2 confirms that *singleUL-Transmission* could not indicate dual UL in one UL CC pair and single UL in another CC pair in one band combination. However, with the ASN.1 signalling from Rel-15, UE is able to indicate dual UL transmission capability in one UL CC pair and single UL transmission capability in another CC pair in different band combination entries. RAN2 does not plan to implement additional solutions.**

**Proposal 2: Send LS to RAN4 based on the conclusion in P1. Detail content to be discussed in phase 2.**

On SCS of active DL/UL BWP

**Proposal 3: RAN2 understands that “same SCS and CP length for UE’s active DL BWP and active UL BWP in a serving cell except for SUL at a given time” applies to general BWP operation for all UEs.**

**Proposal 4: Clarify the BWP operation concluded in P3 in both 38.331 and 38.306. Taking 38.331 CR R2-2104098 and 38.306 CR R2-2103634 as baseline.**

# 5 References

[1] R2-2102644, “LS to RAN2 on single-uplink operation in more than one band pair of a band combination (R4-2103144; contact: MediaTek)”, RAN4

[2] R2-2104084, “Discussion on SUO capability in more than one band pair of a BC”, MediaTek

[3] R2-2104087, “Reply LS on single-uplink operation in more than one band pair of a band combination”, MediaTek

[4] R2-2104029, “Discussion on single-uplink operation in more than one band pair of a BC”, Huawei, HiSilicon

[5] R2-2103633, “Support of more than one singleUL per band combination”, Nokia, Nokia Shanghai Bell

[6] R2-2102623, “LS on numerology for active DL and UL BWPs (R1-2102152; contact: MediaTek)”, RAN1

[7] R2-2104098, “Clarification on SCS of active DL and UL BWP”, MediaTek

[8] R2-2103115, “Correction on Numerology for Active DL and UL BWPs Rel-15”, CATT

[9] R2-2103634, “Correction to BWP capabilities”, Nokia

[10] R2-2103791, “Correction on bwp-DiffNumerology”, ZTE

[11] R2-2104021, “CR on numerology for active DL and UL BWPs”, Huawei, HiSilicon