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 |
| MediaTek (Rapporteur) | Chun-Fan (Felix) Tsai | chun-fan.tsai@mediatek.com |
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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…?).  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. |
| 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. |
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**Summary for Q1**: TBD

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. |
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**Summary for Q2**: TBD.

## 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. |
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**Summary for Q3**: TBD.

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. |
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**Summary for Q4**: TBD.

# 4 Conclusions

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

On Single Uplink Operation

On SCS of active DL/UL BWP

# 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