3GPP TSG-RAN WG2 #116-e Tdoc R2-210xxxx

E-meeting, 1st – 12th November 2021

Agenda Item: 8.24.1

Source: OPPO

Title: Summary of [AT116-e][020][NR17] MIMO-dependent BW class (OPPO)

Document for: Discussion, Decision

# Introduction

This contribution is to discuss:

* [AT116-e][020][NR17] MIMO-dependent BW class (OPPO) – Qianxi

Scope: Treat R2-2109354, R2-2109393, R2-2109394. Determine agreeable parts, including agreeable Reply LS.

Intended outcome: Ph1 Report, Ph2 Approved LS

Deadline: Ph1 Friday W1, CB online if needed, otherwise just offline approval.

Contact person(s) for each participating company:

|  |  |
| --- | --- |
| **Company** | **Email** |
| Ericsson | lian.araujo@ericsson.com |
| Apple | naveen.palle@apple.com |
| Huawei, Hisilicon | shatong3@hisilicon.com |
| Qualcomm Incorporated | mkitazoe@qti.qualcomm.com |
| Samsung | seungri.jin@samsung.com |
| ZTE | li.wenting@zte.com.cn |
| MediaTek | chun-fan.tsai@mediatek.com |
| Nokia | amaanat.ali@nokia.com |
| vivo | Yangxiaodong5g@vivo.com |

# Discussion

## Q1

In the LS from R4 in R4-2114754,

Whether current signalling can support UE’s different CA bandwidth class capabilities or different frequency separation class capabilities for UL CA with and without UL MIMO for the same band?

For example:

– when maxNumberMIMO-LayersCB-PUSCH = 1, the UE can support CA\_ n77C;

– when maxNumberMIMO-LayersCB-PUSCH = 2, the UE can support CA\_ n77B;

where maxNumberMIMO-LayersCB-PUSCH is defined as per-CC feature set capability, while BW class is defined per-BC-per-band-entry capability. So

* In a single BC entry, it cannot indicate per-MIMO-layer BW class;
* In two BC entries, it can implement: 1) in one BC-entry, it can indicate the BW class for UL CA (e.g. CA\_ n77B) w/ UL-MIMO and 2) in the other BC-entry, it can indicate the BW class for UL CA (e.g. CA\_ n77C) w/o UL-MIMO.

So in [2], it is proposed that

P1: RAN2 reply Q1 as Yes, i.e., current signalling can support UE’s different CA bandwidth class capabilities or different frequency separation class capabilities for UL CA with and without UL MIMO for the same band.

**Q1: For Q1 in the LS, do you agree with the proposal of P1 above?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| Ericsson | Yes (proponent) |  |
| Apple | Yes | We agree that the UE can report with diff BC. |
| Huawei, Hisilicon | Yes | It is OK to inform RAN4 about the signalling design in RAN2. |
| Qualcomm Incorporated | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes (proponent) |  |
| MediaTek | Yes |  |
| Nokia | Yes | We agree UE reporting is supported by separate BC and it would be good to clearly tell RAN4 how RAN2 signalling works. |
| vivo | Yes |  |

## Q2

In the LS from R4 in R4-2114754,

Is UE allowed to indicate the capabilities separately in two different band combination entries?

* If yes, whether gNB take account on the different capabilities across different Band combination entries?

If the answer to the above question**s** is no, RAN4 respectfully ask RAN2 to consider designing new signalling to differentiate such different UE capabilities in UL CA with and without UL MIMO.

To “take into account”, in the context above, meant whether the gNB would be able to reconfigure the UE based on the different reported BCs. As an example (considering the BC 1) and BC 2) defined in the section above), the gNB would “take into account” both band combinations if it could first configure the UE according to the BC 2) and later reconfigure the UE according to the BC 1). Not take into account would imply that e.g. once the gNB configured the UE according to BC 2), it could never consider to configure the UE according to BC 1), and the UE would thus lose the possibility to be configured with UL MIMO.

Therefore, the request above highlight that the “gNB take account on the different capabilities across different Band combination entries”.

However, this does not mean RAN4 tends to put a restriction on the gNB implementation, i.e., force the gNB implementation to “combine” the two entries to define the configurable parameter for a specific BC.

I.e., the intention does not collide with the behavior that expressed in R4-2107621,

In addition, RAN2 would like to point out that 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.

It should be noted, however, that it is up to the network on how to configure the UE. Hence, while replying yes to the first question in the RAN4 LS (i.e. that the UE can indicate support of different CA bandwidth class capabilities or different frequency separation class capabilities for UL CA with and without UL MIMO for the same band), it already implies that the network may take such capabilities into account when configuring the UE. But to address the concern raised. So [2] proposed

P2: RAN2 reply Q2 as “The network may configure the UE according to a band combination entry, and it may later reconfigure the UE according to another band combination entry” to avoid concern by RAN4.

**Q2: For Q2 in the LS, do you agree with the proposal of P2 above?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| Ericsson | Yes (proponent) |  |
| Apple | Yes, but… | This is technically a gNB implementation detail, in that the gNB might not look at other BC at all. In that sense, do we state in the spec that gNB is allowed to …? The main point is RAN4 is asking specifically for this, as they see the case where diff MIMO with diff BW class need to be reported, and RAN2 says the signaling is already present for this. But this signalling does NOT guarantee that the gNB would know that UE’s capability the way RAN4 intended.  While we do agree that this is upto gNB, maybe a NOTE stating somewhere the gNB has the option to look at different BCs to derive the capabilities for BCs where (for eg) other BCs with might have diff capabilities than what the fallback capabilities imply? |
| Huawei, Hisilicon | Yes | We agree with Apple that it is up to network implementation. The network could take into account UE capability on different BC entries and choose any one entry at a time when configuring UE. Thus we suggest to update the reply to Q2 as: As usual, the network takes UE capability into account and it is up to network implementation on exact reconfiguration. It is possible that the network may configure the UE according to a band combination entry, and it may later reconfigure the UE according to another band combination entry.  [Ericsson] Agree with Huawei suggestion above. |
| Qualcomm Incorporated | Yes |  |
| Samsung | Yes | The suggested text seems imply all possibilities for gNB implementations (i.e. The network “may” configure ….).  We are also fine with the suggestion from Huawei. |
| Ericsson | Yes (proponent) |  |
| MediaTek | Yes | The suggestion from Huawei is also fine |
| Nokia | Yes | As long as network sticks to the UE capability that was signalled there should be no issue and we definitely agree network is not required to mix and match different BC entries before doing something. In that sense a BC + FSC is uniquely configurable. |
| vivo | Yes | Huawei’s suggestion is fine. |

# Conclusion

Based on the discussion in section 2 we propose the following:

[Proposal 1 RAN2 reply Q1 as Yes, i.e., current signalling can support UE’s different CA bandwidth class capabilities or different frequency separation class capabilities for UL CA with and without UL MIMO for the same band.](#_Toc85723830)

[Proposal 2 RAN2 reply Q2 as “The network may configure the UE according to a band combination entry, and it may later reconfigure the UE according to another band combination entry” to avoid concern by RAN4.](#_Toc85723831)

# References

1. R2-2109354 LS on signalling for intra-band CA with UL-MIMO (R4-2114754; contact: OPPO) RAN4 LS in Rel-17 NR\_RF\_FR1\_enh To:RAN2
2. R2-2109393 Discussion on MIMO-dependent bandwidth class and frequency separation OPPO, Ericsson, ZTE Corporation, Sanechips discussion Rel-17 NR\_RF\_FR1\_enh
3. R2-2109394 Reply LS on signalling for intra-band CA with UL-MIMO OPPO LS out Rel-17 NR\_RF\_FR1\_enh To:RAN4