3GPP TSG-RAN WG2 #114 electronic R2-200xxxx

Electronic Meeting, May 19 – 27, 2021

Agenda Item: 5.4.3

Source: Ericsson

Title: Summary of offline 011 Rel-15 UE caps II

Document for: Discussion, Decision

# 1 Introduction

This contribution summarizes the following discussion:

* [AT114-e][011][NR15] UE Cap II (Ericsson)

Scope: Treat R2-2105983, R2-2105984, R2-2105406, R2-2105407, R2-2105408, R2-2106393, R2-2106394, R2-2106124, R2-2106125

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

Intended outcome: Report and Agreed CRs.

Deadline: Schedule A

# 2 Discussion

## 2.1 Part 1: Intended to determine agreeable parts

The proposals listed in this subsection 2.1 are merely extracted from discussion TDocs to facilitate the discussion and follow the numbering of the corresponding TDoc from which they were extracted (i.e. they do not represent actual proposals from this TDoc, which should be listed in subsection 2.2).

### 2.1.1 L1 related contributions

In [3], the following proposals are made:

**Proposal 1: It needs RAN2 to discuss that if the UE supports *multipleCORESET* and CORESET0 is not configured or associated in one BWP, how many CORESETs can be configured in this BWP. There are two options to be discussed:**

**Option 1.1: If the UE supports *multipleCORESET* and CORESET0 is not configured or associated in one BWP, up to three CORESETs can be configured in this BWP.**

**Option 1.2: If the UE supports *multipleCORESET* and CORESET0 is not configured or associated in one BWP, up to two CORESETs can be configured in this BWP.**

**Proposal 1.1: Add clarification to the current field description of *multipleCORESET* based on option 1.1.**

**Proposal 2: It needs RAN2 to discuss that if the UE does not support *multipleCORESET* and CORESET0 is not configured or associated in one BWP, how many CORESETs can be configured in this BWP. There are two options to be discussed:**

**Option 2.1: If the UE does not support *multipleCORESET* and CORESET0 is not configured or associated in one BWP, up to two CORESETs can be configured in this BWP.**

**Option 2.2: If the UE does not support *multipleCORESET* and CORESET0 is not configured or associated in one BWP, up to one CORESET can be configured in this BWP.**

**Proposal 2.1: Add clarification to the current field description of *multipleCORESET* based on option 2.1.**

**Proposal 3: Based on proposal1.1 and proposal2.1, agree the CRs in [3][4].**

We think it may be beneficial to collect views for Proposal 1 and 2 together, since they are related. Companies are invited to express which of the options above is preferred for each proposal.

**Q1 Which of the options listed above is preferred for Proposal 1 and 2?**

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| --- | --- | --- |
| **Company** | **Option preferred for each proposal** | **Comments** |
| Apple | We this no change is needed and no discussion is needed. | We think ist two CORESETs along with CORESET0. Not 3 in total without CORESET0. And the current text reflects this. |
| Qualcomm Incorporated | 1.2 and 2.2 | But it is already clear in the current specification text. |
| Huawei, HiSilicon | No CR is needed | 1.2 and 2.2, we think the current text is already clear. |
| MediaTek | 1.2 and 2.2 | We also think current text already clearly indicate this. |
| ZTE |  | For option 1.2 and 2.2, we are ok.  If majority companies think option 1.2 and 2.2 are reasonable, we suggest to capture the consensus in chairman notes. |
| Nokia | Nothing is broken, please read the explanation | We agree with the intent but CR is simply not necessary: If we say "UE supports A in addition to B", there is no ambiguity in what UE supports if B is not configured: UE supports just A. One can understand the confusion in this case but this was already discussed earlier. That said, as network we would be okay to capture this in Chair notes but we cannot agree that this is an essential correction. |
| Intel | 1.2 and 2.2 and no change is needed | It is clear from the current field description that the number of additional CORESET is up to two irrespective of CORESET#0. |
| Ericsson | None | Agree with Apple. |
| Samsung | Option 1.2 and Option 2.2 |  |
| CATT | 1.2 and 2.2 | agree with company views |
| vivo | Option 1.2 and 2.2 | Agree with company views. |
| OPPO |  | Share the same view as above for 1.2 and 2.2, and CR is not necessary. We are open to clarify using Chairman notes. |
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Proposal 3 from [3] is to agree on CRs in [4] and [5]. Whether to agree or not on the CRs depend on the discussion on the question above, but if there are any immediate comments to the CRs, they can be provided below.

**Q2 Any comments on the CRs in [4] and [5]?**

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| **Company** | **Comments** |
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The CRs in [6] and [7] intend to correct the capability on maximum number of TCI-state for PDSCH, to allow the UE to report higher values than 64 (current field description states that “The UE is mandated to set the value to 64”).

**Q3 Do companies agree with the intention of the CRs above?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Apple | Yes | We are ok with this CR. |
| Qualcomm Incorporated | Yes |  |
| Huawei, HiSilicon | Paritally | We originally thought the change meant 64 is the mandated set value, and 128 is optional. But based on what Nokia commented below, we think the change may lead to the confusion that value 128 is mandatory. So we agree the intention but we think the wording should be changed to clearly reflect RAN1 agreement, e.g. value of 128 is optionally supported by the UE? |
| MediaTek | Yes (Proponent) |  |
| ZTE | Yes |  |
| Nokia | Yes | Seems correct that the mandatory amount can be also exceeded. |
| Intel | Yes |  |
| Ericsson | Yes |  |
| Samsung | Yes | It seems correct to change the description. |
| CATT | Yes | This CR seems inline with what R1 has agreed. |
| vivo | Yes |  |
| OPPO | Yes |  |
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### 2.1.2 Others

In [1], the following proposals are made:

**Proposal 1 Confirm that the union of the bandwidths of the configured (initial + dedicated) BWPs may exceed the maximum channel bandwidth supported by the UE.**

**Proposal 2 Discuss whether and how a UE supports switching to a BWP which is not within the configured channel bandwidth (down-/uplinkChannelBW-PerSCS-List).**

**Q4 Do companies agree with Proposal 1 above?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Apple | Yes to P1 with comments | The UE is not required to anyway perform any checks on union of BWPs, it operates on the active BWP while using the RAN4 requirements for Rx/Tx on the active BWP using the supported and configured CH BW.  From this perspective, as long as each of the UE configured BWPs have a CH BW configured, it shoud be ok. |
| Qualcomm Incorporated | No | We do not expect that the UE is required to move the BW placement upon BWP switch outside the configured channel BW.  Note that the BW placement of the UE is not known precisely by the network when the channel BW in SIB1 is larger than the channel BW supported by the UE (TS38.331, 5.2.2.4.2). In this case, our expectation is that the network configures UE specific channel BW so that channel BW placement is clear and configure dedicated BWP within the UE specific channel BW. No need to do this if the network only uses the initial BWP. |
| ZTE(LiuJing) | Yes to P1 | Regarding UE specific channel BW and BWP configuration, we think there should be no problem as long as long network ensures:   1. The BW of configured UE specific channel BW is supported by UE capability. (note: even if dedicated UE specific channel BW field is not explicitly provided, it just means the same value of cell specific channel BW in SIB1 is applied) 2. The **active** BWP is located within configured UE specific channel BW.   If network wants to move UE to a BWP that is outside the previous configured UE channel BW, then network has to reconfigure the UE channel BW to ensure “2” is fulfilled. |
| Huawei, HiSilicon | Yes to P1 with comments | We think proposal 1 is already allowed by the current specification and RAN4 BWP switching delay has already taken into account the RF retuning delay.  The issue raised from P2 is unclear to us, clarification is appreciated from the proponent. |
| MediaTek | Yes, but | From SPEC point of view, we would agree with Apple that UE does not check the union of BWP, so we think this kind of configuration seems not violating UE capability. However, as mentioned in this paper, it creates some ambigulity. We are not so sure whether this is intended use case. See also our comment in Q5. |
| Nokia | See comments | O1: Actually there is no choice here: The CBW configuration has to cover ALL BWPs that are configured. Still, that was the original intention when we created the dedicated CBW signalling.  P1: As there is only one active BWP, we would agree P1  P2: Fine to discuss but we think network has to ensure CBW contains the BWP. So network can take care of this by configuration. |
| Ericsson | Yes | We had the same expectation as Apple (Proposal 1).  To QC: We could agree that the NW should configure the „UE specific channel BW“ so that it matches the configured BWP (Proposal 2). But this requirement does not imply that the union of BWP#0 and BWP#1 is within the range of that „UE specific channel BW“. |
| Samsung | No | We have conservative view on it. There could be an implementation issue, e.g. higher H/W requirement could be needed when BWPs are swithced so dynamically.  If needed, RAN2 may ask RAN4 opinion. |
| CATT | see comments | P1 seems allowed by the current spec as some already mentioned.  P2 is not very clear. After access network may configure via dedicated singaling the CH BW to a given UE and that is based on UE capability. This shall cover the BWP BW that NW intends to configure for the same UE. So not sure what is the issue P2 is about. |
| vivo | Yes | For proposal 1, we also understand that this kind of configuration may happen because there is no limitation in spec for this. But we can further discuss if there exists any problem in case of such configuration. |
| OPPO | Yes | We think current spec actually allow P1 |
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Proposal 2 is split into 2 questions below. As discussed in [1], for such switching the network should provide the downlinkChannelBW-PerSCS-List in the RRCReconfiguration message in which it configures this BWP and in which it commands the UE to switch to this BWP. It is not clear if DCI or timer based BWP switching are applicable to this case.

**Q5 Do companies agree that, when configuring a UE with a dedicated BWP that is not within the channel bandwidth that the UE applied when acquiring SIB1, the network should configure the downlinkChannelBW-PerSCS-List and/or uplinkChannelBW-PerSCS-List appropriately?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Apple | Yes |  |
| Qualcomm Incorporated | ? | As in our ccomment to Q4, there are cases where the network does not know the placement of channel BW by the UE. So the condition “*with a dedicated BWP that is not within the channel bandwidth that the UE applied when acquiring SIB1*“, may not be known to the netwok.  But assuming the network knows, the network should make sure all BWP are contained within the channel BW. |
| ZTE(LiuJing) | Yes with comments | It is unclear why “when acquiring SIB1“ is emphysized here, our understanding is:  “when configuring a UE with a dedicated BWP that is not within the channel bandwidth that the UE applied ~~when acquiring SIB1~~, the network should configure the downlinkChannelBW-PerSCS-List and/or uplinkChannelBW-PerSCS-List appropriately“  Regarding the comment from QC, we think network always knows the placement of channel BW used by UE. Based on TS 38.331, UE channel BW should be mandatory configured, even if downlinkChannelBW-PerSCS-List or uplinkChannelBW-PerSCS-List (in ServingCellConfig) is not included, it just means the same configuration of cell specific channel BW (in SIB1) is applied for UE channel BW. The SPEC does not support a UE without configuring any UE channel BW.  *If absent, UE uses the configuration indicated in scs-SpecificCarrierList in DownlinkConfigCommon / DownlinkConfigCommonSIB.* |
| Huawei, HiSilicon |  | The channel bandwidth is configured by the network according to the UE capability. If the channel BW broadcast in system information is not supported by the UE, the network can reconfigure the supported BWP according to the UE capability. Again the current specification allows such implementation and we do not see any problem. |
| MediaTek | No sure | The dedicate signalgin *downlinkChannelBW-PerSCS-List* is **per UE** (not per BWP) controlled signaling. It should matched the UE capability no matter operating in which BWP. |
| Nokia |  | Agree with Huawei and MTK |
| Ericsson | Yes | As said above, we could accept that the gNB should configure the „UE specific channel BW“ so that it matches the active BWP. But we do not see the need that the union of all BWPs must be within this „UE specific channel BW“. |
| CATT |  | Agree with Huawei and MTK |
| vivo |  | We don’t see any problem here as anyway the network should configure the BW based on UE capability. |
| OPPO | Not sure | As pointed out in [1] that UE applies a channel bandwidth at least covering initial BWP during initial access but less than(or equal to) broadcasted channel bandwidth in SIB1, so it is possible network actually doesn’t know the exact applied channel bandwidth apart from initial BWP. In case network configure a dedicated BWP which doesn’t match current applied channel bandwidth, then UE need switch BWP otherwise BWP is not switched automatically. |
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**Q6 Companies are also invited to provide their views on the DCI and timer based BWP switching applicability to this case and, if applicable, how those should be handled.**

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| **Company** | **Comments** |
| Apple | DCI/timer based BWP switching is ok, as long as the UE does not have any ambiguity on the CH BW to apply for the BWP it is switching into. But since the CH BW is based on the SCS, if the source and the target BWPs both have the same SCS, then DCI based switching is not possible if the CH BW needs to be changed for the target BWP. |
| Qualcomm Incorporated | We do not expect any BWP configuration outside UE’s channel BW. |
| ZTE(LiuJing) | For the scenario described in [1], we think network has to reconfigure UE specific channel BW in order to switch the BWPs, otherwise BWP is outside UE’s channel BW. So RRCReconfiguration is anyway needed, then DCI and timer based BWP switching are not applicable. |
| Huawei, HiSilicon | See our comments above. |
| MediaTek | This kind of configuration will make DCI swiching or timer based swiching not possbile. So, maybe it is not a good idea to have it. We probably need more time to think about this. |
| Nokia | Agree with QC that UE does not expect any BWP configuration outside UE’s channel BW. If this is the case the network should reconfigure the channel BW to accomodate this. We see no issue there. |
| Ericsson | It depends of course on the outcome of the previous discussion points. But if it was agreed that the union of BWP#0 and BWP#1 may exceed the channel BW supported by the UE and if it was agreed that the NW should configure the „UE specific channel BW“ so that it matches the currently active BWP, this seems to preclude DCI- and timer based BWP switching for such cases (since the NW would anyway need to tell the UE how to re-position the „UE specific channel BW“). |
| CATT | we see no issues here. |
| vivo | Agree with Ericsson’s comment. |
| OPPO | If dedicated BWP shared same channel bandwidth, then DCI based and timer based BWP switch should be still allowed. Otherwise the only way to switch BWP is via RRC signaling. |
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In [2], the following proposal is made:

1. Discuss how to correct or remove the inheritance of ca-ParametersNR for NR-DC.

Two options are outlined in [2] (please refer to [2] for further details on each option):

**Option 1**: Each extension to CA parameters for NR-DC is handled independently. If the UE supports a feature in CA but not in NR-DC, it shall include the parent ca-ParametersNR-ForDC(-vXXXX) but omit the capability parameter of the feature therein.

**Option 2**: The UE always reports its supported CA features for NR-DC within the NR-DC branch for CA parameters.

* **Option 2a:**
* If the capability for NR-DC is exactly the same as NR-CA, as captured in the spec, ca-ParametersNR-forDC (with and without suffix) are not included; (this has already been described in 38.331)
* If at least one capability for NR-DC is different with NR-CA, UE includes all ca-ParametersNR-forDC (with and without suffix), even if some features for NR-DC and NR-CA are the same.

**Q7 Which of the options listed above is preferred?**

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| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| Qualcomm Incorporated | Option 1 | We understand this is subject to NBC depending on how UE is implemented today. But it has isolated impact to the case where the UE supports the same band combination for CA and NR-DC, and the UE supports different capabilities between CA and NR-DC. |
| Huawei, HiSilicon | Option 2a | The network may have different interpretation for option 1, whether the absence of one particular capability for NR-DC is the same as NR-CA, or it is not supported by NR-DC. Option 3 is safer that the network would not have any ambuiguity on NR-DC capabilities. |
| MediaTek | Option 1 |  |
| ZTE | Option 1 |  |
| Nokia | Neither Option 1 or Option 2 | Agree that there is problem. Neither of solutions proposed is good. Problem only arises in case in post R15 extension are included by UE but none of R15 extension is. So solution probably is easiest to do so that in case post R15 extension is included by UE for band combination also R15 extension(s) should be included. Would that be acceptable? |
| Intel | Option 1 | Maybe some update to the second sentence of the field description will align with Option 1:    If ~~no~~a version of this field (i.e., with and without suffix) is absent~~present~~ for a band combination, the *ca-ParametersNR* field of that version~~s~~ (with and without suffix) in *BandCombination* are applicable to the UE configured with NR-DC for the band combination |
| Ericsson | Option 1 but | We prefer option 1 but option 2 would also have a benefit to not depend on the inheretance behavior, which would avoid confusion also in the future, despite somewhat additional signaling. In any case, as described by Intel above, the changes to capture option 1 may be quite easy, so think we could go for such solution. |
| Samsung | Option 1 | Option2 seems NBC |
| CATT | Option 1 | Option 2 seems NBC and more signalling overhead. |
| vivo | Option 1 |  |
| OPPO | Option 1 |  |
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The CRs in [8] and [9] intend to correct the capability on supported Number of TAGs, indicating that CC(s) without UL configuration do not need to be configured to the same TAG ID of other CC(s) within the same frequency band.

**Q8 Do companies agree with the intention of the CRs above?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes | The scenario addressed by the CR seems a minor case where intra-band cells in CA are non-collocated. |
| Huawei, HiSilicon | Yes | Proponent.  Example 1, CA\_**band A**\_**band A**\_band B with 2 CCs with UL configuration on band A, the CC on band B is DL only, UE supports 2 TAGs.  Based on current restriction, 2 CCs with UL on band A belong to TAG 1, 1 DL only CC on band B belongs to TAG 2. However, we understand 2 CCs with UL on the band A assigned to different TAGs will be more accurate for uplink timing, it is beneficial for system performance, and it is unnecessary to assign a separate TAG to 1 DL only CC on band B.  Example 2, CA\_**band A**\_**band B**\_band B with 1 PCC with UL configuration on band A and 1 SCC with UL configuration on band B, the other SCC on band B is DL only, UE supports 2 TAGs.  Based on current restriction, 1 PCC on band A belongs to TAG 1, two SCCs on band B belong to TAG 2. However, the NW may deactivate 1SCC with UL on band B using MAC CE, then only the SCC which is DL only on band B exists in TAG 2 and not sure if NW will have such configuration. Or the NW may need a RRC reconfiguration to configure only one TAG for PCC on band A and DL only SCC on band B, it cost more RRC reconfiguration message. It is beneficial that the PCC on band A and DL only DCC on band B belong to same TAG, and SCC with UL on band B belongs to another TAG. |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |
| Intel | Yes |  |
| Ericsson | No | We agree with QC that non-collocated intra-band cells is not a typical deploment case.  Furthermore, the change would create ambiguity: The modified text refers to the „*band entries configured with UL*“, which refers to BandParameters that have an UL BWC. However, a UE that supports the example configuration in this paper n1A-n1A-n2A with at most 2 UL serving cells (1A-1A or 1A-2A) could advertise this in a single band combination. Therein all three BandParameters would contain an UL BWC (A). The different FeatureSetEntries would then restrict that at most two of those may be configured as UL cell at the same time. In this case the number of supported TAGs (here 2) would be less than the „band entries configured with UL“ (here 3). How should the gNB interpret this? Should it also look at the non-zero FeatureSetUplink in the FeatureSetEntries? What if different FeatureSetEntries have different number of non-zero FeatureSetUplink?  To avoid such complexity and ambiguity, we suggest to leave the current specification as is.  Huawei, HiSilicon: we did not see problem raised by Ericsson. The network always apply the number of TAGs to the case where the UE support the same or larger number of UL bands according to the current description, irrespective how many featuresets are supported by the UE. |
| Samsung | Yes | We need to consider only CC(s) with UL |
| CATT | Yes |  |
| vivo | Yes |  |
| OPPO | Yes | We agree with Huawei’s intention. But I also think the ambiguity issue pointed out by E/// should be fixed. |
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## 2.2 Part 2: Intended to progress discussion on agreeable parts

- To be updated after discussion on part 1 -

# 3 Conclusion

- To be updated after discussion on part 1 -

# 4 References

1. R2-2105983 Allowed bandwidth in BWP configuration Ericsson, RAN2 #114-e, May 19 – 27, 2021
2. R2-2105984 Use of CA-Parameters extensions for NR-DC Ericsson, RAN2 #114-e, May 19 – 27, 2021
3. R2-2105406 Discussion on multipleCORESET ZTE Corporation, Sanechips, RAN2 #114-e, May 19 – 27, 2021
4. R2-2105407 Correction on multipleCORESET ZTE Corporation, Sanechips, CR Rel-15, RAN2 #114-e, May 19 – 27, 2021
5. R2-2105408 Correction on multipleCORESET ZTE Corporation, Sanechips, CR Rel-16, RAN2 #114-e, May 19 – 27, 2021
6. R2-2106393 Clarification on maximum number of TCI-state for PDSCH MediaTek Inc., CR Rel-15, RAN2 #114-e, May 19 – 27, 2021
7. R2-2106394 Clarification on maximum number of TCI-state for PDSCH MediaTek Inc., CR Rel-16, RAN2 #114-e, May 19 – 27, 2021
8. R2-2106124 Further clarification on supportedNumberTAG Huawei, HiSilicon, Apple., CR Rel-15, RAN2 #114-e, May 19 – 27, 2021
9. R2-2106125 Further clarification on supportedNumberTAG Huawei, HiSilicon, Apple., CR Rel-16, RAN2 #114-e, May 19 – 27, 2021