**3GPP TSG RAN WG2 Meeting #119bis-e**   **R2-220xxxx**

**E-Meeting, 10th – 19th October 2022**

**Agenda Item:** **6.0.2**

**Source:**  **Intel Corporation**

**Title:** **Report of [AT119b-e][004][NR17] UE caps Main (Intel)**

**Document for:** **Discussion/Decision**

# Introduction

This document aims to initiate the following offline discussion:

* [AT119bis-e][004][NR17] UE caps Main (Intel)

Scope: Treat R2-2210660, R2-2210661, R2-2210565, R2-2210585 (if / when updated R1 feature list is available). Take into account updates to R1 and R4 feature lists, if they become available during the meeting. Determine agreeable parts, for agreeable parts capture in CRs,

Intended outcome: Report, Agreed-in-principle CRs (rapporteur can choose if to merge into mega CRs at current or next meeting).

Deadline: Schedule 1, or modifications by Rapporteur

# Companies’ point of contact

|  |  |  |
| --- | --- | --- |
| **Company** | **Point of contact** | **Email address** |
| Intel Corporation | Seau Sian Lim | seau.s.lim@intel.com |
| Xiaomi | Yumin Wu | wuyumin@xiaomi.com |
| Qualcomm Incorporated | Masato KITAZOE | mkitazoe@qti.qualcomm.com |
| OPPO | Qianxi Lu | qianxi.lu@oppo.com |
| MediaTek | Felix Tsai | Chun-fan.tsai@mediatek.com |
| ZTE | Wenting Li | Li.wenting@zte.com.cn |
| Huawei, HiSilicon | Tong Sha | shatong3@hisilicon.com |
| Ericsson | Håkan Palm | Hakan.l.palm@ericsson.com |
| LGE | SungHoon Jung | SungHoon.Jung@lge.com |
| Sequans | Olivier Marco | omarco@sequans.com |
| Vivo | Chenli | Chenli5g@vivo.com |

# NTN support by RedCap UE

The CR [1] has the following reason for change:

In 4.2.21.1,feature group not supported by RedCap UE are explicitly listed, and other features not listed there are assumed to be supproted by RedCap UEs, as specified below.

CA, MR-DC, DAPS, CPAC and IAB (i.e., the RedCap UE is not expected to act as IAB node) related UE features and corresponding capabilities are not supported by RedCap UEs. All other feature groups or components of the feature groups as captured in TR 38.822 [24] as well as capabilities specified in this specification remain applicable for RedCap UEs same as non-RedCap UEs, unless indicated otherwise.

It would be difficult for RedCap UE to support NTN becaue link budget of NTN link would be insufficient for RedCap UEs and NTN requires extra capabilities to enable NTN on top of TN capabilities, which is not acceptable for RedCap UE.

**Q1 Do companies agree with the proposed changes in the CR? If not, please provide your reasons in the comment column.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Intel | Yes |  |
| Xiaomi | Yes |  |
| Qualcomm Incorporated | No | From RAN2 perspective, we have not identified any blocking issue for supporting RedCap UEs supporting NTN access. Link budget is essentially deployment issue, and no quantitative analysis was provided by the CR proponent. |
| MediaTek | No | Similar view as QC, we cannot find blocking issue that prevents Redcap UE from using NTN functionality. Link budget could be challenging, but Redcap UE choosing to implement NTN should already take this into consideration. |
| ZTE(Liujing) | Yes |  |
| Huawei, HiSilicon | No | Not sure whether this is essential to be discussed as it is anyway optional. |
| Ericsson | No | The CR claims that It would be difficult for a RedCap UE to support NTN due to insufficient link budget. This may be correct yet there seems to be no discussions/evaluiations so far to prove that this may be the case. We think it would not be appropriate to capture in the specifications that a RedCap UE cannot support NTN until it is shown otherwise.  The CR also states that additional capabilities are required for an NR UE to support NTN and those capabilities are not “acceptable” for a RedCap UE. This is a subjective opinion and it is not something that has been discussed in RAN2 with the use case scenarios in mind. It is of course up to RedCap UE implementation to support such additional capabilities for NTN similar to any other NR UE implementation. |
| LGE | Open to hear companies view | [Proponent] It is true that RAN2 have not identified an outstanding blocking issue to prevent RedCap UE from supportnig NTN access. But we are not sure about the use cases that NTN network accepts UEs with reduced capabilities (e.g. only 1 RX antenna) in the currently considered NTN bands (but acknolwedge that NTN at much lower bands in future may be more favorable to RedCap UEs) and whether some RAN4 requirements for RedCap UE (e.g., relaxed measurements for stationary and non-cell-edge UEs-) are also applicable to UEs served by NTN cell as well. |
| Sequans | No | We don't see a RAN2 rationale to add this restriction. |
| vivo | No | As we agreed before for RedCap, if there is no explicit conclusion on which feature is not supported by RedCap, it is assumed RedCap UE could support such feature.  We are not sure any problem for RedCap UEs to support NTN. |

*Rapporteur summary:*

*10 companies responded and 3 companies are ok with the CR while 6 companies do not think the CR is to be pursued and 1 company open to hear companies view. The main point from the 6 companies that do not think the CR is to be pursued are that the proponent of the CR has not identified any blocking issue for supporting RedCap UEs accessing NTN. They also think that link budget of NTN may not be sufficient by RedCap UE, which is one of the justification given by the proponent, is a deployment issue and there is no discussion/evaluations so far to prove that it is insufficient. And for other NTN capabilities that need to be supported by the RedCap, they are anyway optional and RedCap UE that supports NTN will have to implement these optional features if it needs to access NTN but this is all up to RedCap UE.*

*In view of this, rapporteur proposed that the CR is not pursued in this meeting. Proponent can bring in more justification/evaluation to support the CR (and gather more view) in future meetings*

***Proposal 1: CR (R2-2210565) is not pursued***

# Clarification on the MBS feature 33-1-2 and 33-3-2

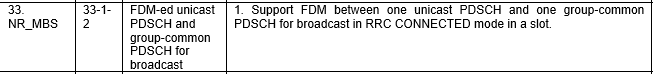
The CR [2] has the following reason for change:

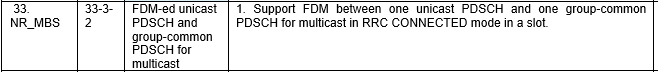
In the RAN1#109-e meeting, RAN1 made the following agreements:

For FDM between one unicast PDSCH and one group-common PDSCH in a slot, only case 1 in the following cases is supported.

* Case 1: the unicast PDSCH and the group-common PDSCH in a slot are partially or fully overlapping in time domain and non-overlapping in frequency domain
* Case 2: the unicast PDSCH and the group-common PDSCH in a slot are non-overlapping in time domain and non-overlapping in frequency domain
* Case 3: the unicast PDSCH and the group-common PDSCH in a slot are non-overlapping in time domain and overlapping in frequency domain

The corresponding RAN1 features are as follows:





According to the RAN#97-e meeting discussion, two CRs (i.e. RP-222552 and RP-222553) related to MBS feature 33-1-2 and 33-3-2 are reserved. According to the 38.306 CR in RP-222552, it is still unclear whether the FDM capability covers the case that two PDSCHs can be partially or fully overlapping in time domain.

**Q2 Do companies agree with the proposed changes in the CR? If not, please provide your reasons in the comment column.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Intel | No | This should be discussed in RAN1 first and if this is the correct understanding, the R1 feature list should be updated to reflect on this before RAN2 update 38.306. Proponent of the CR can bring this to RAN1 directly to discuss it as part of the feature list update. |
| Xiaomi | Yes | Since this FDM feature has been agreed by RAN1 several meetings ago, we think that companies can double check with their RAN1 colleagues on the correct understanding on the MBS feature 33-1-2 and 33-3-2. I would also agree that the RAN1 feature list does not provide the detailed description on the agreed Case 1. If companies think that the feature list needs to be updated to capture the RAN1 agreements correctly, we can send an LS to RAN1. |
| Qualcomm Incorporated | Yes | In general, it is preferred to act only based on RAN1 input. But our internal check with RAN1 colleagues suggests that the proposed change is agreeable. |
| MediaTek | Yes | We also think the clarificaiton is correct and aligned with RAN1’s intention. |
| Huawei, HiSilicon | No | We agree with Intel that this is a part of RAN1 feature which should be discussed in RAN1. But we can follow the majority view. |
| Ericsson | See comment | We are not sure what the reason is to check with RAN1 again, when RAN1 has already made an explicity agreement about this. We also checked with our RAN1 colleague and this correction seems to be fine.  PS: we do not understand why the co-sourcing companies of the agreed CR [RP-222552](http://www.3gpp.org/ftp//tsg_ran/TSG_RAN/TSGR_97e/Docs//RP-222552.zip) did not make this clarification in the first place.  [**RP-222552**](http://www.3gpp.org/ftp//tsg_ran/TSG_RAN/TSGR_97e/Docs//RP-222552.zip) **38.306 CR for introduction of MBS PDSCH FDM capabilities**  ***Huawei, HiSilicon, CBN, CMCC, CATT, Spreadtrum, MediaTek, vivo, Xiaomi, OPPO, Lenovo***  Replaces company CR; CR was not submitted to RAN2; introduction of FDM capability between MBS and unicast (33-1-2/33-3-2); decision  [RP-222474](http://www.3gpp.org/ftp//tsg_ran/TSG_RAN/TSGR_97e/Docs//RP-222474.zip) on these UE feature groups was not reached in RAN1 and RAN2  moved from AI 9.9 to AI 9.11; handled in discussion [97e-30-UE-Capabilities]  The document was approved. |
| vivo | See comments | We also prefer to discuss this in RAN1 first.  Regarding the change, the intention is correct. But the current wording has some ambiguity. We suggest to keep FDM, e.g. FDM (partially or fully overlapping in time domain….) |

*Rapporteur summary:*

*7 companies responded and 4 companies are ok with the CR. 3 companies think the procedure is that it should be corrected on the RAN1 feature list before adding this in 38306. However, 2 companies think technically fine with the change, although 1 company think current wording is ambiguous. With this, it is proposed to pursue the CR:*

***Proposal 2: CR (R2-2210585) is to be pursued.***

# Clarification on the ue-PowerClassPerBandPerBC-r17

The discussion paper [3] and the corresponding CR [4] attempt to provide the dependencies related to the new UE capability ue-PowerClassPerBandPerBC-r17 with the existing power class UE capabilities in Rel-15 and 16. The following proposals are provided in the discussion paper:

**Proposal 1: For MR-DC BCs containing only single CC or intra-band CA in NR side, the*ue-PowerClassPerBandPerBC-r17*shall be aligned to the corresponding *powerClassNRPart-r16*.**

**Proposal 2: If the ue-PowerClassPerBandPerBC-r17 was reported, the minimum value of ue-PowerClassPerBandPerBC-r17 and powerClass(powerClass-v1610) determines maximum TX power available in the corresponding band.**

**Proposal 2a: If the ue-PowerClassPerBandPerBC-r17 was not reported, the minimum value of ue-PowerClass(-v1610/1700) and powerClass(powerClass-v1610) determines maximum TX power available in the corresponding band.**

Rapporteur noticed that the note in the latest R4 feature list R4-2215143 (R4 16-8) is removed but the note for ue-PowerClassPerBandPerBC-r17 seems to have been left or included mistakenly as follow:

| ***ue-PowerClassPerBandPerBC-r17***  Indicates the UE power class per band per band combination.  NOTE: It is not applicable to the case when UL-MIMO and intra-band UL CA are in operation at the same time. | FS | No | N/A | FR1 only |
| --- | --- | --- | --- | --- |

**Q3 Do companies agree with the proposals above in [4]?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **Proposal 1 (yes/no)** | **Proposal 2**  **(yes/no)** | **Proposal 2a**  **(yes/no)** | **Comments** |
| Intel | See comment | See comment | See comment | We think that whether to add these kind of dependencies or restriction should be first discussed in RAN4.  Our understanding is that the proposals are related to the the applicability of the feature to intra-band and inter-band UL CA. As the rapporteur indicated, in the last RAN4 meeting the note in the R4 feature list related to intra-band UL CA is removed. Therefore, whether to add additional dependencies should be first discussed in RAN 4.  If the proposals are supported by majority, we could check with RAN4 whether the proposals on the dependencies are correct and asked them to include them to the feature list table. |
| Qualcomm Incorporated | See comment | See comment | See comment | Interaction among different power class parameters has been difficult topic which RAN2 could not resolve themselves in the past. Better to check with RAN4. |
| OPPO | No | Check with R4 | Check with R4 | For P1, according to our R4 colleagues, the new P17 IE is mainly for CA case, and the deletion of    Is just to avoid the limitation to either intra- or inter-band CA, but no intention to extend it to EN/NE-DC where the powerClassNRPart-r16 is applied. And please note that the two IEs are of different value range, so infeasible to align the value setting.      For P2 and P3, safer to check with R4, for the relationship between the 3 classes, per-band, per-BC and per-FS. |
| MediaTek | No | See comment | See comment | FG R4 16-8 is only applicable for inter-band UL CA therefore we do not agree to link it to FG R2 2-23.  For P2 and P2a, we share the same view as Intel and think the RAN2/RAN4 mutual check is needed before adding such dependencies. |
| ZTE(Wenting) | Yes(proponent) | Yes(proponent) | Yes(proponent) | We are also OK to ask RAN4 for clarification. Based on companies comments, it seems that at least the below issues need to be confirmed by RAN4:   1. Whether the R4 16-8 is only applicable for inter-band UL CA 2. The Interaction among different power class parameters |
| Huawei, HiSilicon | No | See comment | See comment | For P1, we share the same understanding with MTK that the new capability is defined for inter-band UL CA but not intended for EN-DC. These two features should not be coupled together.  For P2, the assumption is that the Tx power reported in perbandperBC capability is always no more than that reported in the perBand capability (i.e. ue-powerClass). Otherwise, the maximum Tx power should be determined based on these three values.  We think it is better to check with RAN4 on P2 and P2a. |
| Ericsson | See Comments | See Comments | See Comments | We agree better to ask RAN4, same motivation as raised by Qualcomm above. Further, on P1, the wording “shall be aligned” seems a bit unclear in a specification, in particular when the value ranges of the fields are not the same. Better to state UE shall (as with all these power class fields) include and set the value that the UE supports, and the spec need to be clear on when field applies. |
| Vivo | See Comments | See Comments | See Comments | We think such dependency or restriction should be determined in RAN4 firstly.  As rapporteur said, the note in the feature list related to intra-band UL CA has been removed by RAN4. We think whether need to add such dependency should be also discussed in RAN4. |

**Q4 If the proposals are agreeable from RAN2 perspective, do companies agree to send a LS to RAN4 to check the proposals?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Intel | Yes |  |
| Xiaomi | Yes |  |
| Qualcomm Incorporated | See comment | Support sending LS to RAN4. We do not need to make any RAN2 agreement and should just focus on asking questions for clarification. |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| ZTE(Wenting) | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Ericsson | Yes |  |
| Vivo | Yes |  |

**Q5 Do companies agree to remove the note as below in *ue-PowerClassPerBandPerBC-r17* to align with R4 feature list?**

NOTE: It is not applicable to the case when UL-MIMO and intra-band UL CA are in operation at the same time.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Intel | Yes | To align with the latest R4 list until the next one is received. |
| Qualcomm Incorporated | Yes |  |
| OPPO | Yes |  |
| MediaTek | Yes | On the other hand, RAN2 could consider to add applicability description for FG 16-8 since it had been clarified in the title of corresponding RAN4 CR (38.101-1 CR1113r1): “Increasing the maximum power limit for inter-band UL CA” |
| ZTE(Wenting) | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Ericsson | Yes |  |
| Vivo | Yes |  |

*Rapporteur summary:*

*For Q3,8 companies responded.*

*For Proposal 1, 3 companies do not think the new capability is applicable to EN-DC and NE-DC and is only for inter-band UL CA. Only 1 company supports the proposal; but is ok to check with RAN4.*

*For Proposal 2 and 2a, all companies think that we should check with RAN4. 2 companies think that interaction among different power class parameters has been difficult topic which RAN2 could not resolve themselves in the past. One company think the Tx power reported in perbandperBC capability is always no more than that reported in the perBand capability (i.e. ue-powerClass). Otherwise, the maximum Tx power should be determined based on these three values.*

*For Q4, all companies, as per Q3, agree to check with RAN4 via a LS. One company think RAN2 do not need to make any RAN2 agreement and should just focus on asking questions for clarification.*

*For Q5, all companies agreed to remove the following note from* *ue-PowerClassPerBandPerBC-r17 to align with R4 feature list:*

*NOTE: It is not applicable to the case when UL-MIMO and intra-band UL CA are in operation at the same time.*

*One company think that we can add applicability description for FG 16-8. From rapporteur’s view, since the applicability was discussed in RAN4 in the last meeting and the decision was to remove all notes on applicability, it would be good to wait for RAN4 to update the feature list related to this.*

*Based on the above, it is proposed:*

***Proposal 3: Send a LS to RAN4 to check the following for R4 16-8(the details can be further refined in the LS):***

* ***Whether R4 16-8 is applicable to (NG)EN-DC and NE-DC?***
* ***What is the interaction between R4 16-8 with the existing power class capabilities (i.e.*** ***ue-PowerClass(-v1610/1700), powerClassNRPart-r16 <if R4 16-8 is also applicable to other than inter-band CA> and powerClass(powerClass-v1610)) ?***

***Proposal 4: Include in the mega CR on the removal of the note below in ue-PowerClassPerBandPerBC-r17 to align with R4 feature list:***

***NOTE: It is not applicable to the case when UL-MIMO and intra-band UL CA are in operation at the same time.***

# Conclusion

**Phase 1 summary:**

***Proposal 1: CR (R2-2210565) is not pursued***

***Proposal 2: CR (R2-2210585) is to be pursued.***

***Proposal 3: Send a LS to RAN4 to check the following for R4 16-8 (the details can be further refined in the LS):***

* ***Whether R4 16-8 is applicable to inter-band CA?***
* ***What is the interaction between R4 16-8 with the existing power class capabilities (i.e.*** ***ue-PowerClass(-v1610/1700), powerClassNRPart-r16 <if R4 16-8 is also applicable to other than inter-band CA> and powerClass(powerClass-v1610)) ?***

***Proposal 4: Include in the mega CR on the removal of the note below in ue-PowerClassPerBandPerBC-r17 to align with R4 feature list:***

***NOTE: It is not applicable to the case when UL-MIMO and intra-band UL CA are in operation at the same time.***

# References

[1] R2-2210565 Corrections to NTN capabilities LG Electronics CR Rel-17 38.306 17.2.0 0817 - F NR\_NTN\_solutions-Core, NR\_redcap-Core

[2] R2-2210585 Clarification on the MBS feature 33-1-2 and 33-3-2 Xiaomi draftCR Rel-17 38.306 17.2.0 F NR\_MBS-Core

[3] R2-2210660 Clairificaiton on the ue-PowerClassPerBandPerBC-r17 ZTE Corporation, Sanechips discussion Rel-17 NR\_RF\_FR1\_enh

[4] R2-2210661 CR on the ue-PowerClassPerBandPerBC-r17 ZTE Corporation, Sanechips CR Rel-17 38.306 17.2.0 0820 - F NR\_RF\_FR1\_enh