**3GPP TSG-RAN WG2 Meeting #122 R2-230xxxx**

**Incheon, Korea, 22 – 26 May, 2023**

**Agenda Item: 6.1.3.2**

**Source: Huawei, HiSilicon**

**Title: Summary of intra-band ENDC UE Cap**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following email discussion.

* [Post122][050][NR15] intraband ENDC UE cap (Huawei)

Scope: Take into account: Comments, LS from RAN4 (late LS), and update the CRs accordingly. If Conclusions can be made, agree the CRs for TSG RAN.

Intended Outcome: Agreed CRs

Deadline: Short

# Contact from companies

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# Background

In RAN#97, it was tasked to RAN2 and RAN4 on the following discussion.

* Conclusion:
* RAN tasks RAN4 and RAN2 to have more discussion in Q4 to check the inconsistency issue described in RP-222513. At least, two issues should be addressed.
* Whether configurations in Case 3 and Case 4 are valid from RAN4 and RAN2 point of view respectively.
* In the case of configuration in Case 3 and/or in case of configuration in Case 4 are(is) confirmed as valid, whether a solution is necessary in RAN2 to address the ambiguity issue for configurations on some intra-band EN-DC band combinations with more than 2 carriers from Rel-15.

Case 3: All CCs are contiguous in DL but neither carrier is contiguous to each other in UL, including

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| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration** |
| DC\_(n)48CA | DC\_48A\_n48A |
| DC\_(n)48DA | DC\_48A\_n48A |

Case 4: One of LTE carriers and the NR carrier are contiguous in DL, contiguous and non-contiguous are both supported in UL:

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| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration** |
| DC\_48A\_(n)48AA | DC\_(n)48AA  DC\_48A\_n48A |

In previous RAN2 meetings, there are following agreements.

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| RAN2 Agreement  RAN2#119-bis   * RAN2 concludes that the discussed cases are not currently supported by signalling and new signalling is needed. * Case validity is up to RAN4, and if RAN4 concludes they are valid, RAN2 can then attempt to find a signalling solution. RAN4 can also develop a preference as to what release should be applicable.   RAN2#120   * R2 interpretation: *Both* means both contiguous BC and non-contiguous BC with the same band Entries are supported.   RAN2#121   * We introduce a new capability for UL *intraBandENDC-Support-UL,* and restrict the existing capability to DL.   RAN2#121-bis   * R2 agrees that early implementation from Rel-15 shall be supported * LS is revised to additional capture the agreement on early impl, final version is approved unseen in R2-2304431 * CR Postpone (expect to revise/agree when reply from R4 has been received) |

Based on the agreement above, a new capability for UL *intraBandENDC-Support-UL* is introduced to address the inconsistency issue. When the new capability is not included, the legacy capability indicates the capability for DL when the intra-band EN-DC is only supported in DL, or the common capability for both DL and UL when intra-band EN-DC is supported in DL and UL. The new capability is only signalled when UL capability is different from DL, in which case the legacy capability is restricted to DL.

Different cases are summarized as follows.

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| **Scenario** | ***intraBandENDC-Support*** | ***intraBandENDC-Support-UL*** | **UE supports in DL / UL**  **(if applicable)** |
| 1 | Absent (Contiguous) | Absent | * Contiguous/Contiguous |
| 2 | Absent (Contiguous) | Non-contiguous | * Contiguous/Non-contiguous   NOTE: “Case 3” |
| 3 | Non-contiguous | Absent | * Non-contiguous/Non-contiguous |
| 4 | Both | Absent | * Contiguous/contiguous * Non-contiguous/Non-contiguous |
| 5 | Both | Non-contiguous | * Contiguous/Non-contiguous * Non-contiguous/Non-contiguous |
| 6 | Absent (Contiguous) | Both | * Contiguous/Contiguous * Contiguous/Non-contiguous   NOTE: “Case 4” |
| 7 | Both | Both | * Contiguous/Contiguous * Non-contiguous/Non-contiguous * Contiguous/Non-contiguous |

In RAN2#122, the 38.306 and 38.331 CRs are provided based on the agreement so far [1][2][3][4][5][6]. To keep consistency between different releases, the new capability signalling is introduced from Rel-15 in the CRs. The 38.331 CRs[4][5][6] are the revisions with the ASN.1 mistake corrected according to companies’ comments.

# Discussion

In RAN4#107, the reply LS R4-2310501, response to R2-2304431, was approved. In the reply RAN4 LS, RAN4 checked with RAN2 whether the contiguity of intra-band EN-DC depends on the contiguity of adjacent LTE carrier and NR carrier no matter whether PCC or SCC.

Rapp thought the understanding in RAN4’s LS is consistent with the RAN2 agreement above. It was agreed that for case4 (i.e. DL DC\_48A\_(n)48AA, UL DC\_(n)48AA and DC\_48A\_n48A), the legacy signalling for DL capabiltiy (i.e. *intraBandENDC-Support****)*** is set to ‘absent(contiguous)’ and the new capability signalling for UL capability (i.e.*intraBandENDC-Support-UL****)*** is set to ‘both’. In this case, the capability signalling indicates the contiguity between adjecent LTE carrier and NR carrier, and the contiguity within one RAT could be signalled through different band entries if the intra-RAT carriers are non-contiguous.

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| 6 | Absent (Contiguous) | Both | * Contiguous/Contiguous * Contiguous/Non-contiguous   NOTE: “Case 4” |

Q1. Do companies agree with the understanding in the RAN4’s LS, i.e. the contiguity of intra-band EN-DC depends on the contiguity of adjacent LTE carrier and NR carrier no matter whether PCC or SCC? Besides, do companies think any spec change is needed according to the RAN4 LS ? If yes, please provide you comments to the CRs.

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| Company | Yes or No  (agree with RAN4 understanding) | Yes or No  (spec change is needed) | Comments |
| Huawei, HiSilicon | Yes | See comments | We understand from signalling perspective, the existing signalling structure has allowed the UE to indicate whether the intra-band carriers are contiguous or not within one RAT through corresponding band entries. The new signalling is only for contiguity capability between adjacent LTE and NR carriers, which is consistent with the signalling solution we have agreed in the LS out R2-2304431. The capability signalling for all possible cases is captured clearly in the CR cover sheet.  However, if majority companies prefer to make it more clear in the spec, we can have some description like following:  ***intraBandENDC-Support***  Indicates whether the UE supports intra-band (NG)EN-DC with only non-contiguous spectrum, or with both contiguous and non-contiguous spectrum between the adjacent LTE carrier and NR carrier for the (NG)EN-DC combination as specified in TS 38.101-3 [4].  ***intrabandENDC-Support-UL***  Indicates whether the UE supports intra-band (NG)EN-DC in UL with only non-contiguous spectrum, or with both contiguous and non-contiguous spectrum between the adjacent LTE carrier and NR carrier for the intra-band (NG)EN-DC combination as specified in TS 38.101-3 [4]. |
| OPPO | Yes | No strong view |  |
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Q2. Do companies think the (revised) CRs can be endorsed from RAN2 perspective?

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| Company | Yes or No | Comments |
| Huawei, HiSilicon | Yes | We think RAN2 has reached the consensus on signalling design, and the CRs are ready to be agreed in principle from RAN2 perspective. |
| OPPO | Yes | Just one Q, since R16 331 CR is not simply the shadow of R15 331 CR (due to the additional change of tx switching BC list), whether it should be cat-B?  Rapp: We understand the Rel-16/17 331 CRs have no functional/technical corrections or additions compared with Rel-15 CR, so we would prefer to keep it as cat-A. |
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**Summary:**

There is limited comment received from companies on the RAN4 LS. Based on the comments received so far, all the companies support the understanding from RAN4. Rapporteur considers RAN2 can confirm the understanding in the RAN4 LS is correct, i.e. the contiguity of intra-band EN-DC depends on the contiguity of adjacent LTE carrier and NR carrier no matter whether PCC or SCC. The conclusion is intended for RAN4/RAN information to make the final decision on the feasibility.

Since majority of companies are the proponent of the current version of RAN2 CRs, no additional spec changes are needed. For the way forward, the rapp thinks the CRs[1][2][3][4][5][6] can be agreed from RAN2 perspective, waiting to be approved in RAN planery.

Based on above, there are following proposals:

**Proposal 1: RAN2 confirms the understanding in the RAN4 LS is correct, i.e. the contiguity of intra-band EN-DC depends on the contiguity of adjacent LTE carrier and NR carrier no matter whether PCC or SCC.**

**Proposal 2: The CRs[1][2][3][4][5][6] are agreed for TSG RAN.**

# Conclusions

**Proposal 1: RAN2 confirms the understanding in the RAN4 LS is correct, i.e. the contiguity of intra-band EN-DC depends on the contiguity of adjacent LTE carrier and NR carrier no matter whether PCC or SCC.**

**Proposal 2: The CRs[1][2][3][4][5][6] are agreed for TSG RAN.**

# References

1. R2-2306507 Introduction of intra-band EN-DC contiguous capability for UL Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, Intel Corporation, ZTE Corporation, Sanechips, MediaTek inc CR Rel-15 38.306 15.20.0 0927 - B TEI17, NR\_newRAT-Core
2. R2-2306508 Introduction of intra-band EN-DC contiguous capability for UL Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, Intel Corporation, ZTE Corporation, Sanechips, MediaTek inc CR Rel-16 38.306 16.12.0 0928 - A TEI17, NR\_newRAT-Core
3. R2-2306509 Introduction of intra-band EN-DC contiguous capability for UL Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, Intel Corporation, ZTE Corporation, Sanechips, MediaTek inc CR Rel-17 38.306 17.4.0 0929 - A TEI17, NR\_newRAT-Core
4. R2-2306885 Introduction of intra-band EN-DC contiguous capability for UL Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, Intel Corporation, ZTE Corporation, Sanechips, MediaTek inc CR Rel-15 38.331 15.21.0 4156 1 B TEI17, NR\_newRAT-Core
5. R2-2306886 Introduction of intra-band EN-DC contiguous capability for UL Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, Intel Corporation, ZTE Corporation, Sanechips, MediaTek inc CR Rel-16 38.331 16.12.0 4157 1 A TEI17, NR\_newRAT-Core
6. R2-2306887 Introduction of intra-band EN-DC contiguous capability for UL Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, Intel Corporation, ZTE Corporation, Sanechips, MediaTek inc CR Rel-17 38.331 17.4.0 4158 1 A TEI17, NR\_newRAT-Core