**3GPP TSG-RAN WG2 Meeting #121bis-e R2-23xxxx**

**e-meeting, April 17- 26, 2023**

**Source: Qualcomm Incorporated**

**Title: [Draft] Summary of email discussion [Post121][043][NR17] Intraband ENDC UE cap (QC)**

**Document for: Decision**

**Agenda Item: x.x**

# Introduction

This document provides a summary for the following email discussion.

* [Post121][043][NR17] Intraband ENDC UE cap (QC)

Scope: Starting point R2-121 agreement discussion R2-2300142. Take into account BW and FW compatibility, can consider R4 discussion aspect if needed. Discuss, allow review/check, Conclude agreeable solution and LS out, alt identify points for discussion / decision.

Intended outcome: Report, draft LS out (to R4)

Deadline: Long

Companies are invited to provide their contact information for this email discussion.

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| **Company** | **Delegate name** | **Email address** |
| OPPO | Qianxi Lu | qianxi.lu@oppo.com |
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# Discussion

This email discussion builds on top of the RAN2#121 discussion and agreement below.

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| [R2-2300142](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/Docs/R2-2300142.zip) Discussion on UE capability ‘intraBandENDC-Support’ Qualcomm Incorporated discussion Rel-17 TEI17  [R2-2301611](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/Docs/R2-2301611.zip) Discussion on intra-band EN-DC combination Huawei, HiSilicon discussion TEI17   * Both noted   DISCUSSION  - TMO support a new cap IE  - Apple think R4 has defined both for the current signalling. Think we can just follow the LS.  - MTK agree with P1, think that R4 proposal can be considered on top of current. Has concerns with new separation  - ZTE prefers proposal from QC to redefine current for DL and new for UL, think the new cap can be only  - Nokia think that introducing a new cap would make it easier. Wonder if we could avoid to support the mixed case. QC think it doesn’t exist.  - QC think that R4 solution is not forward compatible,  - Apple think R4 has analyzed and made the best solution. Nokia disagrees, think R4 didn’t have a good discussion on UE cap.  - MTK think that also FW compatibility is considered by RAN4.  - TMO think a non-backward change is risku but also think R4 are not the experts on UE cap signalling.  - ZTE think that with Huawei proposal we need two new capabilities.   * We introduce a new capability for UL *intraBandENDC-Support-UL,* and restrict the existing capability to DL. |

* 1. Definitions

In this document, we use the following definitions.

**Contiguous intra-band EN-DC**

* + Intra-band EN-DC band combination where one LTE band entry and one NR band entry within the EN-DC band combination are contiguous.
  + Some examples below. The UE uses the number of band entries and bandwidth class signalling to differentiate those cases.
    - DC\_48A\_(n)48AA
    - DC\_(n)48AA
    - DC\_(n)48AC\_n48A

**Non-contiguous intra-band EN-DC**

* + Intra-band EN-DC band combination where there is no pair of LTE band entry and NR band entry that is contiguous.

**NOTE:** Moderator ruled out the concept of “mixed” case as discussed in [2] based on offline comments from multiple companies.

* 1. New signalling solution

With the addition of new UE capability parameter for UL, say *intraBandENDC-Support****-UL***, the following combinations of UE capabilities can be indicated.

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| *intraBandENDC-Support* (for DL) | *intraBandENDC-Support****-UL*** (for UL, new) | UE supports in DL/UL |
| Absent (Contiguous) | Contiguous | * Contiguous/Contiguous |
| Absent (Contiguous) | Non-contiguous | * Contiguous/Non-contiguous |
| Non-contiguous | Contiguous | * Non-contiguous/Contiguous |
| Non-contiguous | Non-contiguous | * Non-contiguous/Non-contiguous |
| Both | Contiguous | * Contiguous/Contiguous * Non-contiguous/Contiguous |
| Both | Non-contiguous | * Contiguous/Non-contiguous * Non-contiguous/Non-contiguous |
| Absent (Contiguous) | Both | * Contiguous/Contiguous * Contiguous/Non-contiguous |
| Non-contiguous | Both | * Non-contiguous/Contiguous * Non-contiguous/Non-contiguous |
| Both | Both | *Further discussed below* |

RAN2 can discuss whether there is any missing case or whether there is any invalid combination, e.g. DL: Non-contiguous / UL: Contiguous, which can result in UL carrier without paired DL. One could have preference to keep the UE capability signalling generic to cover any potential cases.

**Q1:** Any invalid or missing case in the tables above?

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| **Company** | **Any invalid or missing case? (Yes/No)** | **Comments / Additional explanation** |
| OPPO | See comment | In our understanding, since the old field is for DL only, it means absence of the new field (as in legacy) = no restriction on UL, which can be interpreted for some BC:s as ‘both’, e.g., case-4 in R2-2300060 – as clarified in R2-2300141    Figure Possible configuration of DC\_48A\_(n)48AA+DC\_(n)48AA,DC\_48A\_n48A  So we wonder whether the final 3 rows of the table above are really needed.  Besides, we wonder if the combo of “DL = Non-contiguous, UL=Contiguous’ really exists? And due to the same reason, whether it is unnecessary to have ‘DL=both, UL=contiguous’ given ‘DL = contiguous, UL=contiguous’ is already there. |
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When the UE indicates “both” for DL and UL, the following 4 cases are applicable. [2] discussed whether the UE may support only a subset of the cases; e.g. supports case 1 and case 2, but not others.

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| **Case1** | Contiguous/Contiguous |
| **Case2** | Non-contiguous/Non-contiguous |
| **Case3** | Contiguous/Non-contiguous |
| **Case4** | Non-contiguous/Contiguous |

**Q2:** Can the UE support only a subset of the cases; e.g. supports case 1 and case 2, but not others.

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| **Company** | **Yes/No** | **Comments / Additional explanation** |
| OPPO | See comment | Firstly, if DL = non-contiguous, we wonder if case-4 really exist?  Secondly, if DL = contiguous, considering the case-3 in R2-2300060 is for the case where UE support UL = non-contiguous but not UL = contiguous (since otherwise, if UE will always support both, there is no need to introduce a UL-specific field), it seems reasonable to assume a UE supporting case-3 but not supporting case-1.  Then in case we understand there exists UE support case-3 but not case-1, just wonder how to solve the NBC issue, since legacy NW would not see the new UL field, may assume the UE supporting both case-1 and 3. |
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[2] concluded that it is indeed a possible UE implementation to support only a subset of the cases. One may argue that different cases can be signalled by different EN-DC band combination entries. However, RAN2 has been trying to avoid cases where duplicated band combination signalling is needed.

[2] further proposed to introduce a UE capability parameter of bitmap format to indicate the support for those 4 cases individually. The use of the bitmap parameter by the UE should be limited to the case where the UE indicates “both” for DL and UL.

**Q3:** Do companies agree to introduce a UE capability parameter of bitmap format to indicate the support for those 4 cases individually?

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| **Company** | **Yes/No** | **Comments / Alternative solutions** |
| OPPO | No | In practice, we understand typically either DL = contiguous or DL = non-contiguous for a BC, so not see it as a critical issue to optimize signaling overhead. |
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* 1. Other discussion points

**Q4:** Companies are invited to raise other discussion points.

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| **Company** | **Comments** |
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* 1. LS to RAN4

TBD

# Conclusion

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# References

[1] [R2-2300060](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/Docs/R2-2300060.zip) LS on intraBandENDC-Support RAN4

[2] [R2-2300142](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/Docs/R2-2300142.zip) Discussion on UE capability ‘intraBandENDC-Support’ Qualcomm Incorporated