3GPP TSG-RAN WG2 Meeting #113 Electronic R2-210xxxx

25 January – 05 February 2021

**Agenda item: 5.4.3**

**Source: Nokia**

**Title: Summary of [AT113-e][009][NR15] UE Capabilites EN-DC BCS (Nokia)**

**WID/SID: NR\_newRAT-Core**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

### 5.4.3 UE capabilities and Capability Coordination

* [AT113-e][009][NR15] UE Capabilites EN-DC BCS (Nokia)

Wait: Do not start email discussion until LS from R4 is available,

Scope: Treat Incoming LS from R4. [R2-2100065](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100065.zip), [R2-2100949](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100949.zip), [R2-2101664](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101664.zip), [R2-2100388](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100388.zip), [R2-2100481](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100481.zip), [R2-2101562](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101562.zip), [R2-2101563](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101563.zip), [R2-2101564](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101564.zip), [R2-2101565](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101565.zip),

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

Intended outcome: Report and Agreed CRs.

Deadline: Schedule A

EN-DC BCS

R2 Treatment: Wait for R4 progress, If R4 LS becomes available, treat by email (Rapporteur to kick off email discussion) take into account RP LS, R4 LS and input tdocs: conclude whether any change to R2 TS is needed, 2: if needed

Moved from 5.1:

[R2-2100065](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100065.zip) LS on BCS reporting and support for intra-band EN-DC band combinations (RP-202935; contact: Nokia) RAN LS in Rel-15 NR\_newRAT-Core To:RAN2, RAN4

[R2-2100949](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100949.zip) Clarifying BCS for inter-band EN-DC band combination with intra-band EN-DC components Nokia, Nokia Shanghai Bell discussion Rel-15 NR\_newRAT-Core

[R2-2101664](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101664.zip) Discussion on BCS for intra-band EN-DC BC with inter-band component Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core

[R2-2100388](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100388.zip) Clarification on BCS reporting and support for intra-band EN-DC band combinations Intel Corporation discussion Rel-15 NR\_newRAT-Core

[R2-2100481](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100481.zip) BCS reporting for intra-band EN-DC band combination Qualcomm Incorporated discussion Rel-15 NR\_newRAT-Core

[R2-2101562](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101562.zip) Clarification on the Intra-band and Inter-band EN-DC Capabilities ZTE Corporation, Sanechips discussion Rel-15 NR\_newRAT-Core

[R2-2101563](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101563.zip) CR on the Intra-band and Inter-band EN-DC Capabilities - R15 ZTE Corporation, Sanechips CR Rel-15 38.306 15.12.0 0517 - F NR\_newRAT-Core

[R2-2101564](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101564.zip) CR on the Intra-band and Inter-band EN-DC Capabilities - R16 ZTE Corporation, Sanechips CR Rel-16 38.306 16.3.0 0518 - A NR\_newRAT-Core

[R2-2101565](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101565.zip) Draft LS on the Intra-band and Inter-band EN-DC Capabilities ZTE Corporation, Sanechips LS out Rel-15 NR\_newRAT-Core To:RAN4/RAN1

* [AT113-e][009][NR15] UE Capabilites EN-DC BCS (Nokia)

Wait: Do not start email discussion until LS from R4 is available,

Scope: Treat Incoming LS from R4. [R2-2100065](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100065.zip), [R2-2100949](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100949.zip), [R2-2101664](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101664.zip), [R2-2100388](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100388.zip), [R2-2100481](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2100481.zip), [R2-2101562](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101562.zip), [R2-2101563](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101563.zip), [R2-2101564](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101564.zip), [R2-2101565](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113-e/Docs/R2-2101565.zip),

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

Intended outcome: Report and Agreed CRs.

Deadline: Schedule A

RAN4 has discussed and sent LS to RAN2 in [R2-2102403](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/LSin/R2-2102403.zip) ([R4-2102149](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_98_e/Inbox/R4-2102149.zip))

# 2 **Discussion**

**Topic 1: BCS reporting and support for intra-band EN-DC band combinations**

Based on the LS, the following aspects impact RAN2 specifications.

**Aspect 1:** Based on answer to Question A.1, a BCS is not required to be signalled by the UE for higher order band combinations for intra-band EN-DC (as defined in 38.101-3, section 5.3B.1), even if the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively.

* BCS reporting is optional
* BCS, if signalled, must be taken into account by network

**Aspect 2:** If a UE supports a combination that has an intra-band EN-DC component and the UE does not report an intra-band EN-DC BCS, the network may assume either a default BCS or default bandwidth combination capabilities (which of these holds is still under discussion in RAN4 and RAN2 will be subsequently informed of the decision).

**Aspect 3:** If the UE does not support UL on the intra-band EN-DC part of a band combination, then the combination is defined as a downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC.

**Aspect 4:** For the band combination in Aspect 3 clarified as downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC, signalling of BCS is optional as mentioned already in Aspect 1.

**Question 1**: Do companies have a common understanding of the above listed aspects?

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| Answers to Question 1 | | |
| Company | Yes/No | Comments |
| Apple | Yes with comments | For A1: we are not sure how to interpret ‘even’. It is clearer with removing 'even', where it means that UEs which do not support intra-band UL DC are not required to signal a BCS for intra-band EN-DC.  A3: we were not very convinced on the meaning of a DL-only intra-band EN-DC (EN-DC as such requires UL on LTE and NR). It appears RAN4 understood that RAN2 thinks in terms of inter-band EN-DC, intra-band EN-DC and intra-band EN\_DC with inter-band components. And it’s the last one that had the potential to create ambiguities. In our view, RAN2 can follow RAN4’s definition of considering the last one as inter-band EN-DC with intra-band components (where the support of intra-band part is optional). And do we have to define this as inter-band and intra-band EN-DC with UL (instead of just considering this as inter-band EN-DC with intra-band optional component?). We would like to get other companies views.  A2: If we consider that intra-band parts of inter-band EN-DC as optional, then it would be easier to close the ambiguities once RAN4 provides further feedback on signaling (using BCS0 etc..). We think it’s better to discuss A2 after RAN4 concludes.  A4: Ok. |
| Intel | Yes | Agree with Apple on A1.  Regarding A3, we are ok to follow RAN4 terminology “downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC”. We understand that the terminology we have been using is a bit ambiguous e.g. although we call one BC as inter-band CA BC, the UE may or may not support UL inter-band CA because we allow different downlink and uplink CA capability. Adding “downlink” and “uplink” in the context might be sufficient although it might cause additional question on the general terminologies of BC. |
| Qualcomm Incorporated | Yes | A1: Agree with Apple.  A2: Looks better to wait for RAN4 before RAN2 takes any action on this.  A3: We see some risks that the new terminology “downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC” can cause additional confusion into the already confusing BCS definitions in 38.306.  It looks sufficient from 38.306 perspective to just say it is mandatory for the UE to report BCS if the UE supports UL in both RATs in intra-EN-DC component and otherwise optional.  A4: See above on the terminology issue. Fine with the optionality. |
| ZTE | Yes | A1: Agree with Apple  A2: Agree to wait for RAN4’s conclusion  A3: Seems there are 2 options:  Option 1: Introduce the new terminology “downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC” for the case that only DL intra-band EN-DC was supported  Option 2: No new terminology , and distinguish the 2 cases with the wording of “intra-band (NG)EN-DC/NE-DC combination supporting both DL and UL intra-band EN-DC’ and “intra-band (NG)EN-DC/NE-DC combination without supporting UL”  We think the option 2 has less spec impact, so slightly prefer option 2.  A4: OK |
| T-Mobile USA | No | A1: In the LS the use of DC\_66A\_n66A and DC\_71A\_n71A are used to illustrate a point . Need to replace “even if the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively.” With” irregardless of the UL EN-DC configurations supported by the UE”  A1: RAN4 needs to define how the network uses the BCS if it is reported, this is a special case were the BCS can be DL only depending on the UL configuration. RAN2 needs to reference 38.101-3 to define any restrictions on the use of the BCS by the network.  A2: With IE SupportedBandwidthCombinationSetIntraENDC as an optional IE the default configuration must be determined before CR’s are approved. As far as RAN2 goes the text for SupportedBandwidthCombinationSetIntraENDC should reference 38.101-3 for the default behaviour.  A2 (con’t): T-Mobile has UE’s that don’t support all the channel BW’s and thus we need to define a default BCS, however that BCS may vary by band. This is easily handled in RAN4 specifications.  A3: Agreed  A4: Agreed |
| OPPO |  | For A1, same view as Apple  For A2, we understand it holds under the condition of: not only “supports a combination that has an intra-band EN-DC component and the UE does not report an intra-band EN-DC BCS”, but also the UE support the DL part of the intra-band EN-DC component but not support the UL part of the intra-band EN-DC component, i.e., limit to the specific case here. And agree we can wait for RAN4  For A3, we are somehow in the middle, i.e., although RAN4 statement / terminology is a bit too restrictive so not very generalized, but at least state explicitly in the terminology on DL and UL capability can clarify this in a larger extent, so tend to go to the direction somehow like suggested by ZTE. |
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**Summary 1**: TBD.

**Proposal 1**: TBD.

Based on the above the RAN2 specification changes are proposed as follows to align with RAN4 decision.

| ***supportedBandwidthCombinationSetIntraENDC***  Defines the supported bandwidth combination for the band combination set as defined in the TS 38.101-3 [4]. For intra-band (NG)EN-DC with additional inter-band CA component(s) of LTE and/or NR, the field defines the bandwidth combinations for the intra-band (NG)EN-DC component. For intra-band NE-DC with additional inter-band CA component(s) of LTE and/or NR, the field defines the bandwidth combinations for the intra-band NE-DC component. Field encoded as a bit map, where bit N is set to "1" if UE support Bandwidth Combination Set N for this band combination as defined in the TS 38.101-3 [4]. The leading / leftmost bit (bit 0) corresponds to the Bandwidth Combination Set 0, the next bit corresponds to the Bandwidth Combination Set 1 and so on.   * It is mandatory if the band combination is an intra-band (NG)EN-DC/NE-DC combination supporting the intra-band UL part as defined in TS 38.101-3 [4] with additional inter-band NR/LTE CA component. * It is optional if the band combination is an intra-band (NG)EN-DC/NE-DC combination without supporting the intra-band UL part as defined in TS 38.101-3 [4]. Such a band combination is considered inter-band in the DL and the intra-band (NG)EN-DC/NE-DC part of the band combination is considered inter-band EN-DC in the UL. | BC | No | N/A | N/A |
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**Question 2**: Do companies think the above text proposal for TS 38.306 correctly reflects the RAN4 provided understanding?

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| Answers to Question 2 | | |
| Company | Yes/No | Comments to the text proposal above. |
| Apple | No, but we are open to discuss | In our view this field should be optional altogether. Only UEs which support (atleast) the DL intra-band EN-DC, as part of a larger inter-band EN-DC should signal this. Obviously, UEs which also support UL intra-band EN-DC as part of larger inter-band EN-DC would have to signal the BCS as well.  In combination with the BCS signalling as well as the featureSetUL/DL, the NW would know the combination of capabilities the UE should support.  This implies that the UE would have to report the same DC combination twice in some cases, but that would be a side effect of such signaling.  But we understand that this can changed based on the RAN4 feedback on A2 above. |
| Intel | Need to some update | Although it is not essential, the spec description would be good to be complete. In that sense, not only “supporting the intra-band UL part” but also “DL part” should be included.  *- It is mandatory if the band combination is an intra-band (NG)EN-DC/NE-DC combination supporting both DL and UL intra-band EN-DC part as defined in TS 38.101-3 [4] with additional inter-band NR/LTE CA component.*  In the first sentence, shouldn’t we use RAN4 recommended term or any term RAN2 will agree?  *It is optional if the band combination is downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC as defined in TS 38.101-3 [4].*  The second sentence in the last bullet point looks redundant. |
| Qualcomm Incorporated |  | Suggestions below. Again, we do not see the introduction of the new terminology is essential from 38.306 perspective.   * It is mandatory if the band combination is an intra-band (NG)EN-DC/NE-DC combination supporting UL and DL in the intra-band (NG)EN-DC/NE-DC part as defined in TS 38.101-3 [4] with additional inter-band NR/LTE CA component. * It is optional if the band combination is an intra-band (NG)EN-DC/NE-DC combination without supporting UL in all bands of the intra-band (NG)EN-DC/NE-DC part as defined in TS 38.101-3 [4]. |
| ZTE |  | We are ok with the wording of Qualcomm. |
| T-Mobile USA | No | With RAN4 defining a default value in A:2 SupportedBandwidthCombinationSetIntraENDC is optional. The bullets at the bottom of the text aren’t necessary. However text needs to be added stating “If this field isn’t present refer to 38.101-3 for the default configuration or BCS value” |
| OPPO |  | same view as Intel and QC that the last sentence is not needed, and the clarification on the first sentence for the 2nd bullet can refer to our answer to Q1. |
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**Summary 2**: TBD.

**Proposal 2**: TBD.

According to the RAN4 LS *“If the UE does not support UL on the intra-band EN-DC part of a band combination, then the combination is downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC. But the UE is allowed to optionally report intra-band EN-DC BCS as answered in Question A. This may not fit into the current RAN2 signalling framework, therefore we would like RAN2 to consider it and provide feedback with RAN2 views.”*

**Q3: Do companies understand that there is no new capability implied by the statement above? To be more clear, that the current RAN2 signalling framework allows a UE to signal the BCS of a band combination which is of this type “downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC”?**

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| Answers to Question 3 | | |
| Company | Yes/No | Comments |
| Apple | RAN2 signalling allows this. No new capability field needs to be added | But we are not sure about the statement “*This may not fit into the current RAN2 signalling framework, therefore we would like RAN2 to consider it and provide feedback with RAN2 views”*  While we can provide details on how RAN2 concluded with signalling, we think there is no ambiguity that requires feedback to RAN4 as such (and anyway RAN4 has to comeback for A2).  We think based on our reasoning provided for Q2 above, the current signalling can take care of this, if we remove the mandatory requirement (and we think this can be done without any NBC…unless we missed something).  We invite company views on this. |
| Intel | Yes | We guess that RAN4’s intention is this RAN4 feedback is not aligned with the current field description that the UE mandatorily report BCS.  We agree with Apple that we can still use current signaling and just need to clarify in the field description. |
| Qualcomm Incorporated | Yes | But RAN2 specifications works without introducing “**downlink inter-band and intra-band EN-DC with uplink inter-band EN-DC**”. |
| ZTE | Yes | The signalling is ok, just need to give some clarification to the field description. |
| T-Mobile USA | No | RAN2 signalling doesn’t allow the UE to signal a different BCS values when the UE supports both intraband contiguous and intra-band non-contiguous ENDC in IE intraBandENDC-Support. The current UE capability structure only supports a single BCS value which works if the UE only supports either intraband contiguous or intraband non-contiguous. A new capability field needs to be added to differentiate between different BCS values for contiguous and non-contiguous intraband EN-DC |
| OPPO | Yes | Same view as Intel. |
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**Summary 3**: TBD.

**Proposal 3**: TBD.

# 4 Conclusion

Always echo the list of observations and proposals.

# Annex A – Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Nokia | Amaanat (Rapporteur) | amaanat.ali@nokia.com |
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