3GPP TSG-RAN WG Meeting #90 Electronic [RP-20xxxx](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Docs/RP-20xxxx.zip)

Online, 7 – 11 December 2020

**Agenda item: 14**

**Source: Nokia (rapporteur)**

**Title: Summary of [90E][40][BWCS\_reporting]**

**WID/SID: NR\_NewRAT-Core - Release 15**

**Document for: Discussion and Decision**

# 1 Introduction

This discussion handles the following document:

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| **Tdoc** | **Title** | **Source** |
| [RP-202514](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Docs/RP-202514.zip) | BWCS reporting of intra-band parts of inter-band EN-DC | TELUS, Bell Mobility, Samsung |

The document content which is related to the RAN2#112 discussion on the same subject:

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| New InputR2-2011044 Clarification on BWCS for inter-ENDC BC with intra-ENDC band combination Bell Mobility, Telus, Nokia, Nokia Shanghai BellDISCUSSION- Oppo wonder if the problem is that UEs in the field don’t apply the CR. Is that the issue? Nokia confirms, and have some additional questions. Oppo winder if this is mandatory for the UE. Yes this is how Nokia understands the R2 TS, but think this understanding is not for everyone. - Ericsson wonder if we really need to clarify, the field descr seems to indicate that the UE shall report. Ericsson think we might need to check wider. - ZTE wonders if there is other cases than 3A 3A. Nokia think this is one example, not sure there are more. ZTE are also ok to postpone.- Apple are ok with email, but also ok to just postpone. - Huawei are ok with intention, but need time to check ok to postpone, - vivo wonder if UE doesn't support 3A 3A what to report. Nokia think we need to check UL configuration,- Nokia suggest 1 week email to clarify the intentions, maybe no CR is needed. * [Post112-e][052][NR15] BWCS for inter-ENDC BC with intra-ENDC band combination (Nokia)

 Scope: Based on R2-2011044, collect comments, determine agreeable clarifications.  Intended outcome: Report, possibly draft CR, (unclear what ambition level can be possible).  Deadline: short email discussion (not for RP). => Postponed |

As per the guidance, the goal of this disucssion is generate an agreeable way forward. To that end, section 2 first summarizes the technical background of [RP-202514](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Docs/RP-202514.zip), whereas the section 3 is used for the questions and company responses that are used to generate the way forward.

# 2 Background

The discussion in [RP-202514](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Docs/RP-202514.zip) boils down to a simple question: **Does what UE supports for UL for an EN-DC band combination determine whether the band combination can be characterized as an intra-band EN-DC?**

More specifically, the document highlights the example band combination DC\_2A-7A-7A-66A-n66A, which is shown below:



Figure 1: Illustration of example intra-band EN-DC band combination with additional inter-band NR/LTE CA component

As is typical with such EN-DC band combinations (with multiple bands), the support of UL can be on multiple parts. In particular, the above example requires UE to support UL on either 2A+n66A, 7A+66A or 66A+n66A, but NOT necessarily on all of those, as per the figure below (illustrating how to interpret the excerpt from 38.101-3):



Figure 2: Illustration of possible UL capabilities for the example band combination

According to RAN2 fallback BC definition, if UE supports BC DC\_**2A**-7A-7A-66A-**n66A**(with UL support using shown with **bolding**), UE shall support also all band combinations that arise from dropping away SCell, UL part of an SCell or SCG. Since RAN2 agreed CRs [R2-2002390](http://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109_e/Docs/R2-2002390.zip) & [R2-2002127](http://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109_e/Docs/R2-2002127.zip) mandate the reporting of the capability supportedBandwidthCombinationSetIntraENDC for band combinations involving intra-band EN-DC with additional inter-band NR/LTE CA component, it needs to be clear whether a UE indication BC DC\_**2A**-7A-7A-66A-**n66A** is counted as intra-band EN-DC with additional inter-band NR/LTE CA component or not when UE does NOT support

Finally, we note (for discussion reference) that the document [RP-202514](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Docs/RP-202514.zip) makes the following observations and one proposal based on those:

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| **Observation 1: The reporting of the supportedBandwidthCombinationSetIntraENDC is mandatory for an intra-band EN-DC combination with an additinal inter-band NR/LTE CA component.****Observation 2: The current RAN2 CRs unnecessarily impose constraints on deployed UE’s only supporting the inter-band EN-DC and future UEs which do not intend to support the intra-band EN-DC portion of the bigger combination.****Proposal 1: Only if the UE supports the intra-band EN-DC and can additionally support the larger inter-band EN\_DC, then the UE and the NW can view the DC combination as an intra-band EN-DC with inter-band components. The network assumes the intra-band EN-DC is not supported if the IE:supportedBandwidthCombinationSetIntraENDC is not reported, and the network is allowed to configure the larger inter-band EN-DC part (including the fallback BCs) for this band combination. .** |

# 3 Discussion

The discussion in this section focuses on attempting to find out how to characterize the intra-band EN-DC band combinations, and what are the implications of the decision.

## Question 1 (concrete example band combination)

**Question 1 (concrete example band combination)**: If UE supports the band combination DC\_**2A**-7A-7A-66A\_**n66A**, so that UL (for DC) is only supported for 2A and n66A (i.e. UE does NOT support UL on 66A and n66A). Should UE indicate the capability *supportedBandwidthCombinationSetIntraENDC* (which is mandatory for intra-band EN-DC band combinations) in its capabilities for that band combination?

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| Answers to Question 1 |
| Company | Yes/No | Technical Arguments |
| Apple | No | With no uplink on 66A, the UE cannot do intra-band EN-DC with 66A\_n66A. So *supportedBandwidthCombinationSetIntraENDC* is not applicable and so requiring the UE to mandatorily report the BWCS is ambiguous. When the mandatory requirement was introduced in RAN2, it was RAN2 assumption that UE is expected to support intra-band EN-DC in a combination that has same LTE and NR bands, but this assumption is not valid anymore with some RAN4 inter-band DC combinations that can have some intra-band components where the support of intra-band EN-DC for these is not mandatory at the UE. |
| TELUS | No | This is the root cause of the problems we have in the field. The network expects the EN-DC combo to be intra-band band type simply because of the string parsing and ignores the fact that the intra-band non-mandatory UL combo does not work at all. Agree with Apple’s view.  |
| AT&T |  | AT&T Response: We acknowledge the concern with the recent RAN2 CRs dealing with BWCS. We therefore recommend that this issue be resolved in RAN2 at the working group level. |
| T-Mobile USA |  | We agree with AT&T - This is a fairly complex problem that is best addressed by RAN2 and RAN4 before plenary decides on a solution.  |
| vivo |  | Generally we agree with Apple, however we should discuss this issue in RAN2 group.  |
| Huawei, HiSilicon | No and See comments | We understand *supportedBandwidthCombinationSetIntraENDC* does not differ UL and DL, it is a per BC reporting. We are fine that in this case the UE does not report BWCS for intra-band EN-DC part, but then in this case we should clarify this means the DL for the intra-band EN-DC part is not supported as well, i.e. the fall back of intra-band EN-DC DC\_66A\_n66A is not supported in the higher order DC band combination for the example combination in Q1.  |
| Bell Mobility | No  | The UE should report *supportedBandwidthCombinationSetIntraENDC* only if it does support the intra-band EN-DC portion of the combination. Agree with Apple |
| OPPO |  | In our understanding, the core problem here is for these type of UE, even though they do not support **UL** on 66A and n66A, in case they do support **DL** on 66A and n66A, how for the network to derive the bandwidth combination, if *supportedBandwidthCombinationSetIntraENDC* is not reported.We are fine to handle this in WG level, as commented above. |
| Futurewei | No | Given the discrepancy between RAN2’s assumption when signalling was designed and current RAN4’s agreement of allowing optionality of intra-band components in inter-band DC combinations, the meaning of supportedBandwidthCombinationSetIntraENDC should be revisited in RAN2. |
| Samsung | No | We think the top level principle should be keeping the fallback definition which is defined in RAN2 specifications i.e. intra-band EN-DC without supporting uplink would not be the exception.Agree with Apple. |
| Qualcomm Incorporated | No | Under the current specification, *supportedBandwidthCombinationSetIntraENDC* indeed indicates BWCSs of intra-band EN-DC band combination as defined in RAN4 specification. |
| Nokia | Unclear, see comments | Agree with Huawei that the RAN2 discussions did not comprehensively touch upon the dependency of the UL in the intra-band EN-DC discussion introducing the new capability. That implies that the terminology is rather unclear and needs further discussion in WG’s.From our point of view, i.e. network, it is important to just have all the UE vendors align to a common understanding of the terminology, that is unambiguous, so that the network may be able to align to that understanding for the future. |
| MediaTek | No | Agree with companies above that this discussion should take place in WG.With that said, our understanding is UE simply report BWCSs of intra-band EN-DC in *supportedBandwidthCombinationSetIntraENDC* according to R4 spec. |
| Intel | See comments | We share the similar view 1) UE may or may not support 66A\_n66A in uplink in this problem case; 2) *supportedBandwidthCombinationSetIntraENDC* is common for DL and UL, and hence it is not clear how to handle this case in UE capability signalling if the UE supports intra-band EN-DC band in DL but doesn’t support intra-band EN-DC band in UL. Based on this observation, we agree that more discussion/clarification is needed. We prefer to have further discussion in WG (RAN4/2). |
| Skyworks |  | Question for clarification: should intra-band ENDC be considered for cases where it can be implemented with full or dual duplexer like for band 71? It may have impact on aggregated BW for contiguous CCs and CC+gap BW for non-contiguous case |
| Ericsson | We think this topic can be sorted out in the WGs. But here is our input:No | We understand that the bandwidth restrictions defined in 38.101-3 Table 5.3B.1.2-1 and Table 5.3B.1.3-1 apply only for configurations with at least one LTE UL Cell (PCell) and one NR UL Cell (PSCell) in the common band. Hence, we expect that the UE only includes supportedBandwidthCombinationSetIntraENDC in band combinations that support at least one LTE UL and one NR UL in the same band. The example above does not fulfil that; hence the UE does not include this field. |

**Summary 1**: The detailed views differ but generally, several companies think the particular example band combination DC\_2A-7A-7A-66A-n66A does not count as an "intra-band EN-DC band combination" unless UE support UL on both 66A and n66A. However, the BCS reporting is common for UL and DL, but UL part was not discussed in RAN2 when the CRs are agreed, nor is it clear from RAN4 specifications as to which combinations shuold be considered as "intra-band EN-DC band combination". It seems at least RAN2 specifications may require clarifications, the details of which seem to fall outside the scope of RANP discussion.

**Proposal 1: RANP tasks RAN2 to clarify by RAN#91e on whether band combinations such as DC\_2A-7A-7A-66A-n66A are counted as intra-band EN-DC with additional inter-band NR/LTE CA component for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC*.**

## Question 2 (general definition)

**Question 2 (general definition)**: Does the support of UL on intra-band parts determine whether UE considers a band combination as "intra-band EN-DC with additional inter-band NR/LTE CA component"?

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| Answers to Question 2 |
| Company | Yes/No | Technical Arguments |
| Apple | No and we are open to views | We think we do not have to associate UL capability as a clear indication of support of intra-band EN-DC. We like to see it the other-way around, in that UEs reporting *supportedBandwidthCombinationSetIntraENDC* indicate that they support intra-band EN-DC, and essentially view the DC combination as intra-band EN-DC with inter-band components. Our assumption is that RAN4 DC combinations where intra-band EN-DC is possible, will have BWCS defined in RAN4 spec (and we can request this be ensured). This way, there is no need to change the spirit of the current RAN2 spec 38.306.If the UE does not report *supportedBandwidthCombinationSetIntraENDC*, the UE views/supports the DC combination as inter-band EN-DC with some same LTE and NR bands and the BWCS for these is taken from the RAN4 spec: union of LTE and NR CA BWCS. |
| TELUS | No | Agree with Apple’s view that only if the *supportedBandwidthCombinationSetIntraENDC* is reported, a combination should be considered "intra-band EN-DC with additional inter-band NR/LTE CA component". This way, the intra-band support is explicitly signalled, rather than being assumed.  |
| T-Mobile USA |  | This should be sent to RAN2 and RAN4 for comment/resolution before Plenary adopts a technical solution.  |
| vivo |  | We agree with T-Mobile USA. |
| Huawei, HiSilicon | No and See comments | As we explained above, if the UE reports support of BWCS for intra-band ENDC part, the network would assume the UE supports intra-band ENDC. Otherwise, in our understanding this can be interpreted as not supported for both UL and DL. We want to confirm this is the common understanding so that there is no inter-operability issue in the future. In any case, we think the network is still allowed to configure the inter-band ENDC part irrespective whether the intra-band ENDC is supported or not, and the BCS for the DC band combination relies on the bandwidth combinations by LTE inter/intra CA BCS as well as NR intra-CA BCS.What we also want to mention here is that the support of UL is not only dependent on the BWCS reporting. We understand DC\_**2A**-7A-7A-66A\_**n66A** and DC\_2A-7A-7A-**66A**\_**n66A** are two different BCs as their UL combination is different, and would lead to different UL fallback BCs. |
| Bell Mobility | No | Agree with Apple. If *supportedBandwidthCombinationSetIntraENDC* is reported the combination is considered intra-band EN-DC with additional inter-band NR/LTE CA component. If s*upportedBandwidthCombinationSetIntraENDC* is not reported the combination is inter-band EN-DC. |
| OPPO |  | As replied to Q1, in our understanding, the root problem is how to handle the DL part. After that is answered, we can come back to check the terminology / definition of intra-band EN-DC. |
| Futurewei | No | RAN2 should look into the signalling to allow the differentiation of UL capabilities in DC\_**2A**-7A-7A-66A\_**n66A** and DC\_2A-7A-7A-**66A**\_**n66A.** |
| Samsung | No | Agree with Apple and TELUS. |
| Qualcomm Incorporated |  | The wording was introduced by RAN2, and we do not think the lack of UL support in both RATs in intra-band EN-DC was not carefully considered by RAN2. |
| Nokia | Needs further discussion | Precisely same understanding as Qualcomm and what we already said for Q1.From network point of view, as long as we have a consistent understanding of how to interpret the BC with intra-band EN-DC part in the DL (as the problem scenario) we are open to discuss, even if that means a change in terminology of what exactly an intra-band EN-DC means and if it is conditional to the support of single UL. |
| MediaTek | No | Agree with companies above that this discussion should take place in WG. |
| Intel | See comments |  We are not sure how to handle it. First we need to understand what is the exact RAN4 assumption in applying BWCS when band combination is different in DL and UL. We prefer to have further discussion in WG (RAN4/2). |
| Ericsson | Yes, but… | … of course, the UE must support at least one additional carrier supporting at least a downlink serving cell in another band.We disagree with Apple that the *supportedBandwidthCombinationSetIntraENDC* determines what sort of band combination the UE supports. It is rather so that the BandParameters (band-number; DL BWC, optional UL BWC) and the linked Feature Sets determine in which bands the UE supports how many contiguous and non-contiguous serving cells with DL and optional UL. In principle the BWC characters and the FeatureSetsPerCC also indicate the bandwidths that the UE supports for each of those carriers. However, the (up to) three BWCS IDs that the UE sends in each BC point to the corresponding RAN4 tables which **restrict** the carrier bandwidths that the NW may actually configure. What remains to be discussed is for which band combinations the UE should report the *supportedBandwidthCombinationSetIntraENDC* and for which resulting serving cell configurations the NW should respect those additional restrictions. As mentioned above, the intention in RAN4 was that the restrictions apply only for **configurations** with at least one UL LTE cell and at least one UL NR cell in the same band (intra-band).  |
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**Summary 2**: Many companies think the subject requires WG discussion: The combination of DL and UL part of the BC was not discussed in RAN2 or RAN4 earlier. Since the topic mainly involves signalling, RAN2 discussion seems reasonable starting point.

**Proposal 2: RANP tasks RAN2 to resolve the general question of classification of intra-band EN-DC band combinations according to UL support by RAN#91e.**

## Question 3 (field issue)

**Question 3 (field issue):** If UE doesn't indicate *supportedBandwidthCombinationSetIntraENDC* for a band combination that is intra-band EN-DC with additional inter-band NR/LTE CA component, how is the UE support of BCS for the intra-band EN-DC downlink band entries determined?

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| Company | Explanation |
| Apple | Pls see comments to Q2. We think that we should not run into cases where the UE actually supports intra-band EN-DC but does not provide *supportedBandwidthCombinationSetIntraENDC.* We had quite a bit of discussion in RAN2 when the CRs were introduced and so any NBC issues then were not flagged by companies in RAN2. We expect all UEs to have implemented the CRs which require the UE which supports intra-band EN-DC to report *supportedBandwidthCombinationSetIntraENDC.*  We can discuss this if we see companies believe that some UE implementations exist without the CR. |
| TELUS | Agree with Apple’s view.  |
| T-Mobile USA | This should be sent to RAN2 and RAN4 for comment/resolution before Plenary adopts a technical solution.  |
| vivo | We agree with T-Mobile USA. |
| Huawei, HiSilicon | See our answer in Q2. In general if companies want to more time to check in WG meetings, we think RAN plenary should mainly task RAN2 to have an agreeable solution as this is relevant to signalling reporting and interpretation, and the agreeable solution should be done by RAN#91e as this seems an urgent requirement from operators.  |
| Bell Mobility | See answer to Q2. Agree with Apple’s view. The case where an UE in fact does support "intra-band EN-DC with additional inter-band NR/LTE CA component" the IE must be reported and there should be no NBC issues. |
| OPPO | As replied in Q1, this is exactly the root problem (maybe the problem can be reformulated, to avoid coupling with the terminology issue of “intra-band EN-DC with additional inter-band NR/LTE CA component”) |
| Futurewei | RAN should task RAN2 to work on this issue with the goal of providing solution by RAN#91. |
| Samsung | Agree with Apple’s view.Suggested way forward from Huawei and Futurewei seems reasonable. |
| Qualcomm Incorporated | One possibility is to rely on the following requirements in 38.101-3, section 4.2.*A terminal which supports an EN-DC configuration shall support:** *If any subsets of the EN-DC configuration do not specify its own bandwidth combination sets in 5.3B, then the terminal shall support the same E-UTRA bandwidth combination sets it signals the support for in E-UTRA CA configuration part of E-UTRA – NR DC and shall support the same NR bandwidth combination sets it signals the support for in NR CA configuration part of E-UTRA – NR DC.*

Additional clarification will be necessary when the NR side of the EN-DC band combination is non-CA, where the NR bandwidth combination sets are not signalled. |
| Nokia | There seems to be, at least, two solution directions proposed at least now, * Solution 1 would be to consider the intra-band EN-DC in the DL part of a super set inter-band EN-DC BC and in that way the legacy NR BCS is used
* Solution 2 would be to have a default BCS understanding at network to workaround the issue that the network does not know the BCS of the intra-band EN-DC DL part

We need some time to discuss in the WG and the best thing would be to request RAN plenary to task the WG to come up with a consistent terminology and resolve the RAN2 signalling aspects if needed. |
| MediaTek | Agree with companies above that this discussion should take place in WG. |
| Intel | We agree that further discussion is needed in RAN4 and RAN2.  |
| Ericsson | **The question is not clear:**Does it intend to say this?**Question 3 (field issue)**: If UE doesn't indicate *supportedBandwidthCombinationSetIntraENDC* for a band combination that ~~is intra-band EN-DC~~ allows for at least one LTE and at least one NR UL in the same band with additional inter-band NR/LTE CA component, how is the UE support of BCS for the intra-band EN-DC downlink band entries determined?This case should not happen since the UE shall indicated the *supportedBandwidthCombinationSetIntraENDC* for such BCs.Or does it intend to say this?**Question 3 (field issue)**: If UE doesn't indicate *supportedBandwidthCombinationSetIntraENDC* for a band combination that ~~is intra-band EN-DC~~ allows for at most one UL in the common band with additional inter-band NR/LTE CA component, how is the UE support of BCS for the intra-band EN-DC downlink band entries determined?For this case, the network will determine the carrier bandwidths only based on the Bandwidth Classes, FeatureSets the supportedBandwidthCombinationSet (BWCS table in 38.101-1) and supportedBandwidthCombinationSetEUTRA (BWCS defined in 36.101). It does **not** take *supportedBandwidthCombinationSetIntraENDC* into account. |
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**Summary 3**: There is some confusion on the exact question as well as when or for which BCs UE should report the field (as evidenced by Q1 and Q2). Resolving those questions requires discussion in RAN2.

**Proposal 3: RANP tasks RAN2 to resolve how to clarify what UE supports when it doesn't indicate the field *supportedBandwidthCombinationSetIntraENDC* for a band combination by RAN#91e.**

## Intermediate round: Way forward

To progress the discussion, it should be discussed if the above proposals are agreeable or whether additional considerations need to be taken. Companies are invited to provide feedback on all of the proposals as per question 4 below (for reference, the proposals are also copied below):

* **Proposal 1:** RANP tasks RAN2 to clarify by RAN#91e whether band combinations such as DC\_2A-7A-7A-66A-n66A are counted as intra-band EN-DC with additional inter-band NR/LTE CA component for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC*.
* **Proposal 2:** RANP tasks RAN2 to resolve the general question of classification of intra-band EN-DC band combinations according to UL support by RAN#91e.
* **Proposal 3:** RANP tasks RAN2 to resolve how to clarify what UE supports when it doesn't indicate the field *supportedBandwidthCombinationSetIntraENDC* for a band combination by RAN#91e.

**Question 4 (way forward)**: Are proposals 1-3 agreeable as way forward, or are there aspects or wording that should be further clarified?

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| Answers to Question 4 |
| Company | Yes/No | Comments |
| Apple | Some comments/ suggestions for edits | * **Proposal 1:** RANP tasks RAN2 to clarify by RAN#91e whether band combinations such as DC\_2A-7A-7A-66A-n66A are counted as intra-band EN-DC with additional inter-band NR/LTE CA component for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC*.

Instead of saying combinations such as …., we can task RAN2 to clearly define what are intra-band EN-DC combinations with inter-band components and what are not…?**Suggestion**: **Proposal 1:** RANP tasks RAN2 to clarify by RAN#91e what intra-band EN-DC combinations with inter-band components are, for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC** **Proposal 2:** RANP tasks RAN2 to resolve the general question of classification of intra-band EN-DC band combinations according to UL support by RAN#91e.

An intra-band EN-DC combination should have uplink on both LTE and NR, otherwise we cannot have EN-DC, and so we are trying to understand what intra-band EN-DC with DL part mean here. Even the tables 5.3B.1.2-1 and 5.3B.1.3-1 all have uplink parts for the intra-band EN-DC.We have similar views as Intel, in that we need input from RAN4 on their view on DL-only aspect and whether the UE can support the BWCS for intra-band EN-DC when it does not support the UL (and hence does not support the actual EN-DC operation). We understand from NW perspective it would be useful to know if the UE supports the DL BWs even when intra-band EN-DC is not supported, but from UE perspective, if the UE does not support intra-band EN-DC, does the corresponding BWCS has any significance?Since RAN4 input would be important, with only one WG meeting before RAN-91e, can RAN2 resolve this before RAN-91e? Can something be assigned to RAN4 to help with this? * **Proposal 3:** RANP tasks RAN2 to resolve how to clarify what UE supports when it doesn't indicate the field *supportedBandwidthCombinationSetIntraENDC* for a band combination by RAN#91e.

While we think that the suggested change to proposal-1 should already define when the UE should and should not indicate the field, and what is to be understood by the network based on the UE signalling, we understand from RAN2 email discussion on the possibility of UEs in the field which have not implemented the earlier RAN2 CRs, could also be a factor in this discussion. So we are ok with this proposal.  |
| AT&T |  |

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| The point made by Apple is well taken in that with only one RAN2 meeting before RAN91e, RAN4 input may be difficult to get prior to RAN#91e. Proposal 3, would maybe be clearer by removing the “how” resulting in: RANP tasks RAN2 to resolve to clarify what the UE supports when it doesn’t indicate the field. |

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| T-Mobile USA |  | We think that RAN4 should be asked which band combinations need to report a BCS. (Pardon me for using the RAN4 acronym “BCS” instead of “BWCS.) “For instance, does a UE that supports DC\_2A-71A\_n71A need to report a BCS for DC\_71A\_n71A whether or not the UE supports UL DC\_71A\_n71A? We think it is important to have RAN4 weigh in on this. Above Apple says “we need input from RAN4 on their view on DL-only aspect and whether the UE can support the BWCS for intra-band EN-DC when it does not support the UL.” We agree that we need input from RAN4, but we have a different view on what RAN4 should be asked. T-Mobile has band combinations like DC\_2A-71A\_n71A where we are not asking vendors to support DC\_71A\_n71A on the UL because of RF challenges, only DC\_2A\_n71A on the UL. So the UE does not support DC\_71A\_n71A. However, there may still be RF or implementation constraints that prevent a UE from being able to support all possible channel BWs for B71 and n71 in DC\_2A-71A\_n71A. We would like to ask RAN4 experts if an intra-band EN-DC BCS needs to be reported in the UE capabilities for such a combination. So we think that the question isn’t if this combination can support the BWCS for intra-band EN-DC, but if the intra-band EN-DC BCS that the UE supports needs to be reported to the network to let the network know what bandwidths that the UE does support for the Band 71 and n71 CCs in DC\_2A-71A\_n71A. It may turn out that all bandwidths for both B71 and n71 are supported in the combination, but we think that RAN4 UE RF experts need to weigh in if the a BCS needs to be reported as a UE capability for such a combination. So, we propose adding the following proposal: **Proposal 4: RANP tasks RAN4 to consider for a UE that supports an EN-DC band combination like DC\_2A-71A\_n71A, does the UE always need to report an intra-band BCS for DC\_71A\_n71A even if the UE does not support UL DC\_71A\_n71A and thus not DC\_71A\_n71A? If the UE does support DC\_2A-71A\_n71A but does not report an intra-band BCS for DC\_71A\_n71A can the network assume that the UE supports all possible combinations of Band 71 and n71 channel bandwidths in the combination DC\_2A-71A\_n71A? Does the need for the UE to report a BCS depend on the band combination? For instance, does DC\_2A-66A\_n66A always need to report a BCS?**  |
| Intel | See comments | We think that both RAN2 and RAN4 need to discuss. But it would be more efficient if RAN4 can provide feedback/confirmation on what we observed/assumed in this discussion as summarized below before RAN2 discuss. * Understandings on Table 5.5B.4.3-1
	+ “EN-DC configuration” in the table indicates “DL” EN-DC configuration. That is. DC\_2A-7A-7A-66A-n66A means the UE supports inter-band EN-DC with intra-band EN-DC in downlink. In uplink, the UE supports band combination listed in the column of UL EN-DC configuration.
	+ The UE may not support all the uplink EN-DC configurations in each EN-DC configuration. If the UE does not support DC\_66A-n66A, the UE doesn’t support intra-band EN-DC in UL, while the UE supports intra-band EN-DC in DL for DC\_2A-7A-7A-66A-n66A.
* Understanding on BWCS
	+ RAN4 defined a common BWCS for both Downlink and Uplink intra-band BC. However, it doesn’t mean that the UE supports both DL and UL all the time. For example, it is allowed to support DL only intra-band CA in a certain BC. In this case, BWCS information is still needed for DL only.

If the above understanding is correct, the condition “It is mandatory if the band combination is an intra-band EN-DC combination with additional inter-band NR/LTE CA component” is still valid but RAN2 needs to clarify it is from DL configuration (or either DL configuration or UL configuration for the case where RAN4 introduce UL heavy EN-DC band combination). |
| Bell Mobility |  | We are OK with proposal 1-3 and Apple wording is also acceptable. We also acknowledge RAN4 input is important. We agree to include a proposal 4 to request input from RAN4 but want to reiterate the ask to solve the issue by RAN #91e meeting since we have real issues on the field to be solved. |
| OPPO |  | We are in general agree with solving this issue at WG level.* P1 and P2 are essentially the same issue, i.e., to clarify the definition of “intra-band EN-DC”.
* And we agree that RAN4 needs to be involved in all the questions above.
 |
| Huawei, HiSilicon | Yes | We are in general fine with solving this issue in RAN2. We think the exact wording does not differ much at this stage as companies seem on the same page on what to be solved. Regarding whether RAN4 needs to be involved, we think this is mainly the clarification in RAN2 signalling, and if really needed RAN4 could probably confirm the understanding. However in this case it is a bit risky to conclude by RANP#91-e as we only have one e-meeting at the same time for RAN2/RAN4, perhaps RAN2 can try to send early questions to RAN4 if any, and expect the early feedback from RAN4. Thus there is still chance to conclude in RAN2 timely in the end. |
| vivo |  | For proposal 1, We prefer Apple’s version. We also would like to involve RAN4, however we shall also ask more general question for RAN4 because RAN plenary should not go much technical discussion.  |
| ZTE |  | We also think some input from RAN4 is needed to clarify the understanding on the BWCS for the DL-only aspect (e.g. whether the bandwidth restrictions defined in 38.101-3 Table 5.3B.1.2-1 and Table 5.3B.1.3-1 are applicable for this case. If not, then how to understand the DL BWCS for the intra-band component carriers in such case).Considering some guideline from RAN4 is needed, we think the issues mentioned in proposal 2 and 3 shall be tasked to RAN4 as well. |
| Skyworks |  | We support T-Mobile US input that RAN4 should also discuss cases like DC\_2-71\_n71 where DC\_71\_n71 UL configuration is not supported. In that case there are full or dual duplexer implementations for band 71 which has an impact on the supported BWs and constraints for B71 LTE and n71 NR CCs to be received simultaneously. It may be that is mean that BCS needs to be signalled. |
| MediaTek |  | Send the discussion back to WG. RAN4 tasked to provide feedback in a timely fashion for RAN2 to conclude in Q1. |
| Ericsson |  | **Proposal 1**: RAN4 introduced BCS tables which in one way or another restrict what the UE supports according to the BandwidthClasses and FeatureSets that it signals explicitly. How can RAN2 clarify for which cases these restrictions apply? Only RAN4 can do that. So the proposal should probably be:*Proposal 1: RAN plenary tasks RAN4 to clarify for which configurations (configured DL and/or UL serving cells in same and/or different bands) the carrier bandwidth restrictions defined in 38.101-3 Table 5.3B.1.2-1 and Table 5.3B.1.3-1 apply. RAN4 should inform RAN2 so that RAN2 can decide how to update field descriptions in 38.306.*If RAN plenary tasks RAN2 to clarify the above, RAN2 would have to send an LS to RAN4 who sends a reply LS to RAN2 who then should clarify. So we save one more round-trip if we task RAN4 to clarify what **their** table mean.**Proposal 2**: This seems covered by Proposal 1 already. We don’t think Proposal 2 adds anything meaningful. Or are there any not-so-obvious-meaning behind proposal 2 which makes it necessary? We would be happy to understand what that would be, otherwise we think we can remove proposal 2.**Proposal 3**: The wording could be understood as the field is optional. We think it is conditionally mandatory to include. Perhaps Proposal 3 can be removed since for the discussion related to Proposal 1 it will already be discussed when the UE includes the field and not**.** |
| TELUS |  | We like Ericsson’s proposal to have both RAN4 and RAN2 involved in a timely fashion so that issue can be resolved by RANP #91. We would like proposal 2 to say, however as we seem to have lost track of the original issue: what really constitutes an intra-band combo given that all the possible fallbacks are not mandatory. Our view is that Proposal 3 should stay.  |
| Nokia, Nokia Shanghai Bell | Yes with modifications  | The work split between RAN2 and RAN4 should be made clear: It's important that RAN2 and RAN4 do not discuss the same question and come to different conclusions, as that would simply waste time. For that reason, e.g. the formulation proposed by TMO seems to make sense. We also agree with Ericsson that RANP should task RAN4 to clarify some aspects and reply to RAN2 during the first meeting week, and then RAN2 would continue from that. |
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**Summary 4**: Most companies agree with the intent of the proposals but think that RAN4 must be involved in addition to RAN2, with clear work split. The exact wording of the proposals could still be revised as well. It has also been commented that it should be ensured the work can be completed in RAN#91e since this concerns a real deployment issue.

**Proposal 4: Send LS to RAN4 and RAN2, tasking them to according to the following proposal as per below to finish the work in RAN#91e:**

* **RANP tasks RAN4, for RAN#91e, to:**
	+ **A) Clarify which band combinations are "intra-band EN-DC combinations with inter-band components", for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC*. For example, for DC\_2A-71A\_n71A, does the UE always need to report an intra-band BCS for DC\_71A\_n71A even if the UE does not support UL DC\_71A\_n71A and thus not DC\_71A\_n71A? If the UE does support DC\_2A-71A\_n71A but does not report an intra-band BCS for DC\_71A\_n71A can the network assume that the UE supports all possible combinations of Band 71 and n71 channel bandwidths in the combination DC\_2A-71A\_n71A? Does the need for the UE to report a BCS depend on the band combination? For instance, does DC\_2A-66A\_n66A always need to report a BCS?**
	+ **B) Resolve the general question of classification of intra-band EN-DC band combinations according to UL support. If the UE doesn't support UL on intra-band EN-DC part of a band combination, is band combination classified as "intra-band EN-DC band combination"?**
	+ **C) Indicate the RAN4 understanding on A) and B) to RAN2 by the end of the first meeting week of RAN4#98e (to allow RAN2 to finalize their work).**
	+ **D) Agree (if necessary) CRs taking the conclusions of A) and B) into account.**
* **RANP tasks RAN2, for RAN#91e, to:**
	+ **1) Clarify what UE supports when it doesn't indicate the field *supportedBandwidthCombinationSetIntraENDC* for a band combination. For example, if UE supporting DC\_2A-7A-7A-66A-n66A does not include the capability field *supportedBandwidthCombinationSetIntraENDC*, how should network interpret UE capabilities?**
	+ **2) Clarify, based on RAN4 feedback to A) and B), the usage of "intra-band EN-DC combinations with inter-band components" (A) and "intra-band EN-DC" (B) in RAN2 specifications.**
	+ **3) Agree (if necessary) CRs taking the conclusions of 1) and 2) into account.**

## Final round: Way forward and LS to RAN2/4

For the fine-tuning round, it is proposd that companies comment directly on the proposal 4 and LS indicating the decisions to RAN2/4.

**Question 5 (LS text and actions to RAN2 and RAN4):** Are there suggestions how to improve the proposed actions and work split between RAN4 and RAN2 as per proposal 4?

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| Company | Proposals |
| TELUS | We are concerned that we now have two examples that are quite the opposites of each other. We do not believe DC\_2A-66A\_n66A has to report an intra-band EN-DC BCS, but the TMO and Skyworks state that DC\_2A-71A\_n71A may be needed due to hardware constraints. In our view, this is rather an exception due to implementation issue, and the solution should be more general. The proposal 4 is okay, but the lengthy text about the DC\_2A-71A\_n71A takes the centre stage and takes the attention away from the original problem statement, which is summarized in Observation 2: *The current RAN2 CRs unnecessarily impose constraints on deployed UE’s only supporting the inter-band EN-DC and future UEs which do not intend to support the intra-band EN-DC portion of the bigger combination.*Our proposal for the part A is the following: * + **A) Clarify which band combinations are "intra-band EN-DC combinations with additional inter-band NR/LTE CA components", for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC*.**

**For example, is the 2A-7A-7A-66A-n66A (with UL support using shown in red), considered an intra-band EN-DC combination with additional inter-band NR/LTE CA component if the combo in question does not intend to use the EN-DC intra-band portion? Another example is DC\_2A-71A\_n71A, where an UE may need to report an intra-band BCS for DC\_71A\_n71A even if the UE does not support UL DC\_71A\_n71A due to hardware constraints. What is the mechanism to differentiate these two scenarios?** |
| T-Mobile USA | We are concerned that the questions about which bands are "intra-band EN-DC combinations with additional inter-band NR/LTE CA components" is a bit philosophical and doesn’t really reflect the real RAN4 issue, only the current wording in the RAN2 specs. The real issue from our perspective is whether or not the network needs to know an intra-band BCS for higher order EN-DC combinations that have the equivalent band both on the LTE side and NR side, regardless of what they are called.  Our proposal for part A is the following: **A) Clarify if higher order EN-DC band combinations with the equivalent band on the LTE and NR side such as 2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A need to report a BCS, even if the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively. If the UE does not report a BCS for such a combination, what can the network assume about the configuration limitations for the equivalent bands in the combination?**  |
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**Summary 5**: TBA.

# 4 Conclusion

The following intermediate proposals were made for concluding the discussed matter:

**Proposal 1: RANP tasks RAN2 to clarify by RAN#91e whether band combinations such as DC\_2A-7A-7A-66A-n66A are counted as intra-band EN-DC with additional inter-band NR/LTE CA component for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC*.**

**Proposal 2: RANP tasks RAN2 to resolve the general question of classification of intra-band EN-DC band combinations according to UL support by RAN#91e.**

**Proposal 3: RANP tasks RAN2 to resolve how to clarify what UE supports when it doesn't indicate the field *supportedBandwidthCombinationSetIntraENDC* for a band combination by RAN#91e.**

**Proposal 4: Send LS to RAN4 and RAN2, tasking them to according to the following proposal as per below to finish the work in RAN#91e:**

* **RANP tasks RAN4, for RAN#91e, to:**
	+ **A) Clarify which band combinations are "intra-band EN-DC combinations with inter-band components", for the purposes of including the capability field *supportedBandwidthCombinationSetIntraENDC*. For example, for DC\_2A-71A\_n71A, does the UE always need to report an intra-band BCS for DC\_71A\_n71A even if the UE does not support UL DC\_71A\_n71A and thus not DC\_71A\_n71A? If the UE does support DC\_2A-71A\_n71A but does not report an intra-band BCS for DC\_71A\_n71A can the network assume that the UE supports all possible combinations of Band 71 and n71 channel bandwidths in the combination DC\_2A-71A\_n71A? Does the need for the UE to report a BCS depend on the band combination? For instance, does DC\_2A-66A\_n66A always need to report a BCS?**
	+ **B) Resolve the general question of classification of intra-band EN-DC band combinations according to UL support. If the UE doesn't support UL on intra-band EN-DC part of a band combination, is band combination classified as "intra-band EN-DC band combination"?**
	+ **C) Indicate the RAN4 understanding on A) and B) to RAN2 by the end of the first meeting week of RAN4#98e (to allow RAN2 to finalize their work).**
	+ **D) Agree (if necessary) CRs taking the conclusions of A) and B) into account.**
* **RANP tasks RAN2, for RAN#91e, to:**
	+ **1) Clarify what UE supports when it doesn't indicate the field *supportedBandwidthCombinationSetIntraENDC* for a band combination. For example, if UE supporting DC\_2A-7A-7A-66A-n66A does not include the capability field *supportedBandwidthCombinationSetIntraENDC*, how should network interpret UE capabilities?**
	+ **2) Clarify, based on RAN4 feedback to A) and B), the usage of "intra-band EN-DC combinations with inter-band components" (A) and "intra-band EN-DC" (B) in RAN2 specifications.**
	+ **3) Agree (if necessary) CRs taking the conclusions of 1) and 2) into account.**

Out of these, the following final proposal was agreed as way forward:

**TBA**

# Annex – Contact Points

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

|  |  |  |
| --- | --- | --- |
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