**3GPP TSG-RAN WG2 Meeting #113bis-e R2-2104598**

**Online, April 12 – April 20, 2021**

**Agenda Item: 5.4.3**

**Source: Huawei, HiSilicon**

**Title: Summary of [AT113bis-e][009][NR15] UE caps BCS EN-DC (Huawei)**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following offline discussion.

**[AT113bis-e][009][NR15] UE caps BCS EN-DC (Huawei)**

START ONLY AFTER ON-line Monday

Scope: Taking into account on-line agreements, Treat R2-2104025, R2-2103061, R2-2104030, R2-2104212, R2-2104213, R2-2104214, R2-2104026, R2-2104027, R2-2104028,

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

Intended outcome: Report and Agreed-in-principle CRs, Approved LS if agreeable.

Deadline: Schedule A

# Contact from companies

|  |  |
| --- | --- |
| Company | Email |
| Apple | naveen.palle@apple.com |
| ZTE | li.wenting@zte.com.cn |
| Huawei, HiSilicon | kuangyiru@huawei.com |
| MediaTek | Chun-fan.tsai@mediatek.com |
| OPPO | qianxi.lu@oppo.com |
| Qualcomm Incorporated | mkitazoe@qti.qualcomm.com |
| Samsung | seungri.jin@samsung.com |
| Ericsson | Hakan.l.palm@ericsson.com |
| Intel | Youn.hyoung.heo@intel.com |
| T-Mobile USA | brett.christian@t-mobiledotcom |
| CATT | erlin.zeng@catt.cn |
| Nokia | amaanat.ali@nokia.com |
|  |  |

# Discussion (Phase 1)

## Clarification on the BCS and its fallback

[R2-2104025](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113bis-e/Docs/R2-2104025.zip) Discussion on BCS of a fallback band combination Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core

[R2-2104212](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113bis-e/Docs/R2-2104212.zip) Further Clarification on the supportedBandwidthCombinationSet ZTE Corporation, Sanechips discussion Rel-15 NG\_RAN\_PRN-Core

### 3.1.1 BCS of a fallback band combination (online)

**Companies are invited to provide the comments directly to the draft LS (once available).**

[Ericsson] Since the concept of fallback band combinations and the specification thereof is RAN2’s responsibility, we should discuss the matter more carefully before involving other groups (if at all).

For the reasons listed below we believe that **the current RAN2 specifications unambiguously enforce that the channel bandwidths of a fallback BC are determined by the bandwidth combination set (BCS) that the UE supports for the explicitly signalled parent BC** (this is what [R2-2104025](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_113bis-e/Docs//R2-2104025.zip) refers to as second option).

1) 38.306 defines fallback band combinations as follows: “*A Uu band combination that would result from another Uu band combination* ***by releasing at least one SCell*** *or uplink configuration of SCell, or SCG. ... An intra-band non-contiguous band combination is not considered to be a fallback band combination of an intra-band contiguous band combination*”. Hence, any carrier bandwidths that are allowed when the NW configures all carriers supported by the parent BC are also allowed when the NW configures just a subset (“fallback”) of those carriers. In our view this definition is sufficiently clear and leaves no room for any other interpretation.

2) RAN2 discussed the same issue recently in “[Post113-e][206][LTE] Clarification to Fallback band combination definition” and concluided the following:

* *RAN2 confirms that fallback band combination supports the carriers’ bandwidth(s) that are the same as the carriers’ bandwidth(s) of the signaled parent band combination.*

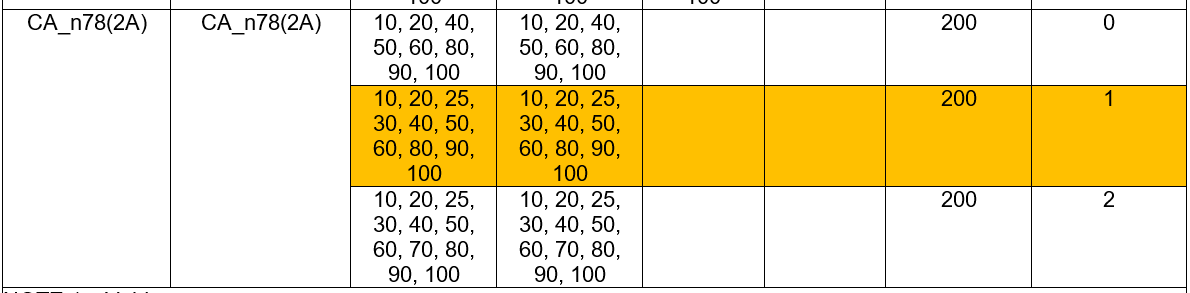
NR inherited the “fallback concept” from LTE. Hence the same should apply for NR.

[Huawei] For 1) and 2), we share the same view that **UE is required to support the same BWs for each carrier in a fallback BC as the parent BC**, this is from the UE capability point of view. The issue here is how to report the BWs capability for the fallback BC (explicitly or implicitly from parent BC), or in other words, how the UE and NW understand the supported BWs for fallback BC regarding the BCS.

3) The BCS IDs defined in 38.101-1/2/3 do not have a consistent meaning across parent and fallback combinations. This is the natural consequence of how band combinations are defined and hardly avoidable. In the following example the BCS#**0** of the parent BC CA\_n2A-n78(2A) inherits the BCS#**1** of the inner BC CA\_n78(2A):



… where the inner BC is defined as follows:



If UE reports support for CA\_n2A-n78(2A) BCS#0 it thereby indicates that it supports the bandwidths [10, 20, 25, 30, 40, 50, 60, 80, 90, 100] on the two n78 carriers (BCS#1). The network may configure those two n78 carriers in combination with the n2 carrier. But, because of the fallback rules, it may also configure only the two n78 carriers. And also in that case the UE shall still support the same carrier bandwdiths [10, 20, 25, 30, 40, 50, 60, 80, 90, 100]. In other words, the BCS ID (#0) given by the UE in its signalled parent BC cannot be used to lookup supported carrier bandwidths in the RAN4 row of the implicit fallback combinations (CA\_n78(2A) BCS#1).

[Huawei] We agree that UE shall still support the same carrier bandwdiths [10, 20, 25, 30, 40, 50, 60, 80, 90, 100] for CA\_n78(2A). In this case, actually UE supports BCS#0 (same fallback) and BCS#1 for CA\_n78(2A), so UE needs to explicitly signal BCS#0 and BCS#1 for fallback BC CA\_n78(2A). That’s the intention of Proposal 2 in our paper.

*“Proposal 2: If the supported channel bandwidths for a band of the fallback BC corresponding to the same BCS ID are less than that in the super BC, UE reports a different fallback BC with more BCS ID(s) according to the channel bandwidths of the super BC”.*

[Ericsson2] This implies that the UE can choose whether or not it fulfils the requirement to support all fallback BCs with same carrier bandwidths. Even if the UE intends to support them, there is a significant risk that it is forgotten to report the required fallback BCs with the necessary additional BCS IDs. And avoiding such error cases and avoiding was one of the reasons why we introduced the fallback concept in Rel-10. And finally, to our knowledge there is currently no UE signalling those fallback BCs with additional BCS IDs explicitly as your proposal 2 requires. Adding such signalling requirement now is certainly NBC.

[OPPO] For P2 above, we wonder what is the harmful result if UE does not report BCS#0/1 for CA\_n78(2A), isn’t that so that the network can already derive the support of BCS#0/1 BW combos based on the support of CA\_n2A-n78(2A) BCS#0?It should be noted that also the opposite is true if RAN4 defined a BCS ID for a BC but did not (yet) define that BCS ID for all of its child BCs. If the interpretation 1 promoted in [R2-2104025](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_113bis-e/Docs//R2-2104025.zip) was applied, the UE would be mandated to support a BCS (i.e., carrier bandwidths) of the child combination which RAN4 has not yet defined. And if RAN4 defines that BCS ID for the child BC later, it would expect also legacy UEs to support those bandwidths. Obviously, this is NBC. For example, a (parent) BC may today have a BCS#0 and BCS#1 defined, but the fallback only has BCS#0 defined, with interpretation 1 a UE built today which supports BSC#1 for the parent band combination would have to support (the currently non-existing) BCS#1 for the fallback. RAN2 has already concluded that the UE cannot indicate support for a yet-not-defined BW, and similarly, the UE cannot indicate support for a yet-not-defined BCS. Just imagine if later RAN4 actually defines BCS#1 for the fallback BC and they define it differently from what the UE vendor anticipated/hoped when implemented. It just doesn't work.

[Huawei] We agree there might be such case, so BCS#1 should not be considered as supported for the fallback BC since it is not defined in RAN4. Thus, Proposal 1 in our paper we state that “*defined in RAN4 for the fallback BC*”, the NW considers that BSC#1 is not supported for the fallback BC. Besides, maybe UE can explicitly signal BCS#0 (without BCS#1) for fallback BC since the supported BCS ID is not the same between parent and fallback BC, it is reporting principle and we are not sure if any clarification for this part is needed. Open to discuss more.

*Proposal 1: The supported channel bandwidths for a specific band of a fallback BC regarding the BCS are determined by the supported BCS ID(s)* ***(defined in RAN4 for the fallback BC)*** *of the fallback BC, in which the BCS ID(s) is explicitly signalled for the super BC.*

[Ericsson2] The bold part in P2 destroys the forward compatibility: A UE implemented based on a version X of the specification in which the BCS#2 is defined for a parent BC but not for all fallback BCs assumes that it does not need to support BCS#2 of the child BC (since it is not defined in the tables). But if RAN4 introduces BCS#2 for the child BC in version Y of the specification, a network implemented based on that version will assume that the old UE supports it, which it of course does not.

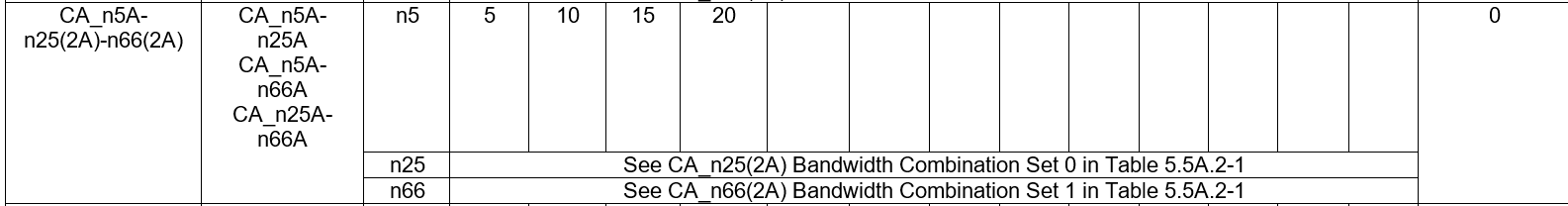
[OPPO] Same view as Ericsson, UE does not have a way to express the spec version it basing on..

And even if a BCS ID is defined for both the parent BC and for all its child BCs, some of the latter may comprise additional carrier bandwidhts which the UE is not able to support. With the interpretation 1 promoted in [R2-2104025](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_113bis-e/Docs//R2-2104025.zip) such constellations would prevent UEs from advertising the parent BC (with more carriers) just because it cannot support all carrier bandwidhts implied by the same BCS ID for one child BC.

[Huawei] Indeed, there is the restriction on the UE side. We understand it is related to the BCS definition in RAN4, so that’s why we would like to send LS to RAN4.

To some degree RAN4 could possibly have tried to avoid such inconsistencies. But it would have complicated the maintenance of the BC/BCS tables in 38.101 even further. And in addition it would have increased the overhead by defining additional BCS rows only to ensure consistency with fallback BCs: In the above-mentioned CA\_n2A-n78(2A) one would have had to introduce a BCS#0 inheriting the BCS#0 of the child BC CA\_n78(2A). And in addition, one would have had to introduce a BCS#1 inheriting the BCS#1 of the child BC.

For a BC inheriting two or more child BCs it would also require defining a new BCS ID for all child BCs with the same bandwidths as another BCS of that child BC just to ensure consistency of the BCS IDs across all fallbacks. Take CA\_n5A-n25(2A)-n66(2A) as an example:



Instead of introducing only the BCS#**0** (referring to CA\_n25(2A) BCS#**0** and CA\_n66(2A) BCS#**1**) one would have had to define a BCS#1 version of CA\_n25(2A) with the same carrier bandwidths as the BCS#0 version. And then one could have introduce a CA\_n5A-n25(2A)-n66(2A) BCS#1 (referring to CA\_n25(2A) BCS#**1** and CA\_n66(2A) BCS#1).

Besides being a lot more complex and heavy in overhead, doing such changes now would also be non-backwards compatible.

For the reasons mentioned above the only possible interpretation is that **the channel bandwidths of a fallback BC are determined by the bandwidth combination set (BCS) that the UE supports for the explicitly signalled parent BC**. In other words, the NW interprets a BCS ID only in combination with the row in the 38.101 tables identified exactly all band parameters that the UE signals in its BC.

Of course, a UE may in addition signal a child BC with the same or different BCS IDs than for a parent BC and thereby offer **additional** carrier bandwidths for that child BC. But in accordance with the definition of fallback BCs, it cannot withdraw carrier bandwidths when configured only according to a fallback BC. These principles are possible and enforced by the interpretation stated above in bold.

[Huawei] The above interpretation may be safer, but it leads to more signalling overhead since the UE needs to explicitly signal fallback BC in order to report additional BWs, otherwise additional BW will be lost and the performance is degraded. For example:

* For BC n3A-n78C, UE supports the channel bandwidth {50,60,80,100} MHz for n78 based on BCS0
* For BC n3A-n78A, UE supports the channel bandwidth {10,15,20,40,50,60,80,90,100} MHz for n78 based on BCS0

UE needs to explicitly signals support for BCS#0 for fallback BC n3A-n78A, which introduces more signaling overhead. Otherwise, the {10,15,20,40,90} MHz cannot be configured for n78 of fallback BC n3A-n78A. **There may even be the case that UE reports a fallback BC with all the capability parameters that are exactly the same as the parent BC**. It is a bit strange, as UE reports support BCS#0 and other capability parameters for BC n3A-n78C, and additionally reports the same BCS#0 and the same other capability parameters for BC n3A-n78A.

[Ericsson2] Yes, due to the sparse bandwidth combinations that RAN4 defined initially for some intra-band BCs (like CA\_n3A-n78C), UEs that support the additional bandwidth combinations of CA\_n3A-n78A must report the fallback BC explicitly. That is natural, required and allowed by the current RRC specification: The UE should signal fallback combinations explicitly in which it supports “more” than in the signalled parent BC. In this case “more” is “more bandwidth combinations”.

RAN4 could avoid this by defining higher order BCs consistently with their lower order fallbacks. RAN4 did that for FR2 but didn’t follow the same thought-through logic for FR1. Anyway, it can be improved in a fully backwards compatible manner if deemed necessary.

Vivo： we agree that we should go to parent based fallback. i.e,

*RAN2 confirms that fallback band combination supports the BCS that are the same as the BCS of the signaled parent band combination.*

[Huawei] We try to summarize the two interpretations:

* Interpretation 1: the channel BWs of a fallback BC are determined by the BCS of the fallback BC
* Interpretation 2: the channel BWs of a fallback BC are determined by the BCS of explicitly signalled parent BC

|  |  |  |
| --- | --- | --- |
|  | Interpretation 1 | Interpretation 2 |
| BWs for BCS#ID of fallback BC are **more than** that of parent BC, e.g.  BCS#0 of parent BC: {A,B} MHz  BCS#0 of fallback BC: {A,B,C} MHz  *[Most common case]* | UE signals support of BCS#0 for parent BC, and does not need to explicitly signal fallback BC.  The NW checks BCS#0 for parent BC and fallback BC separately. | UE signals support of BCS#0 for parent BC, and need to explicitly signals support of BCS#0 for fallback BC.  The NW checks BCS#0 for parent BC and fallback BC separately. |
| BWs for BCS#ID of fallback BC are **less than** that of parent BC, e.g.  BCS#0 of parent BC: {A,B,C} MHz  BCS#0 of fallback BC: {A,B} MHz  BCS#1 of fallback BC: {A,B,C} MHz  *[Rare case]* | UE signals support of BCS#0 for parent BC, and need to explicitly signals support of BCS#0 and BCS#1 for fallback BC.  The NW checks BCS#0 for parent BC and BCS#0 & #1 for fallback BC separately. | UE signals support of BCS#0 for parent BC, and does not need to explicitly signal fallback BC.  The NW checks BCS#0 for parent BC, and consider the BWs applies to parent BC and fallback BC. |
| BWs for BCS#ID of fallback BC are **different (not fully contained)** that of parent BC, e.g.  BCS#0 of parent BC: {A,B} MHz  BCS#0 of fallback BC: {B,C} MHz  BCS#1 of fallback BC: {A,B,C} MHz  *[Not sure if such case exists]* | UE signals support of BCS#0 for parent BC, and need to explicitly signals support of BCS#0 and BCS#1 for fallback BC?  *[Not sure if we need to consider this case]* | UE signals support of BCS#0 for parent BC, and need to explicitly signals support of BCS#0 for fallback BC?  *[Not sure if we need to consider this case]*  [OPPO] we assume BCS#1 of fallback BC also needs to be reported here? |

### 3.1.2 Intra-band (NG)EN-DC/NE-DC BC with only single NR carrier

The observations and proposals are listed as below:

|  |
| --- |
| Observation 1: Based on the current field description the BCS for the Intra-band Part of a “Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier” shall be reported in the *supportedBandwidthCombinationSetIntraENDC*.  Observation 2: The *supportedBandwidthCombinationSetIntraENDC* was introduced for the case that can’t be covered by *supportedBandwidthCombinationSet*. From this point of view, the BCS for the Intra-band Part of a “Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier” shall be reported in the *supportedBandwidthCombinationSet*.  Proposal 1: Ran2 to confirm which capability element (*SupportedBandwidthCombinationSet* or *supportedBandwidthCombinationSetIntraENDC*) shall be adopted to report the intra-band Part of “Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”.  Proposal 1.1: If RAN2 confirm that the *SupportedBandwidthCombinationSet* shall be reported, agree the related change in the draft CR [5][6] |

**Q1-1 Which capability element (*SupportedBandwidthCombinationSet* or *supportedBandwidthCombinationSetIntraENDC*) shall be adopted to report the intra-band Part of “Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”.**

|  |  |  |
| --- | --- | --- |
| **Company** | ***SupportedBandwidthCombinationSet* or *supportedBandwidthCombinationSetIntraENDC*** | **Comments** |
| Apple | We are not yet sure about the issue, but our view is that with NR single carrier, there is no need for NR part of BCS and so is ***SupportedBandwidthCombinationSet*** sufficient…? |  |
| ZTE | ***SupportedBandwidthCombinationSet*** | 1. @Apple We share the same view that for the case of **“**Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”, there is no need for NR part of BCS so the ***SupportedBandwidthCombinationSet***  is sufficient, which means the UE shall report the BCS for the intra-band EN-DC part in the ***SupportedBandwidthCombinationSet*** instead of the ***supportedBandwidthCombinationSetIntraENDC.*** 2. Furthermore, the original intention of the “***supportedBandwidthCombinationSetIntraENDC***” was introduced to cover the cases that can’t be covered by the “***SupportedBandwidthCombinationSet*** ”, but for the case of “**“**Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”, as described above, it can be covered by “***SupportedBandwidthCombinationSet*** ” 3. Then back to the current spec, in the “***supportedBandwidthCombinationSetIntraENDC***”, it said “ It is mandatory if the band combination is an intra-band (NG)EN-DC/NE-DC combination supporting both UL and DL intra-band (NG)EN-DC/NE-DC parts with additional inter-band NR/LTE CA component.”   obviously, the **“**Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier” would be also mandatory to report the “*supportedBandwidthCombinationSetIntraENDC*’”  That’s why we want to have a clarification on this issue. |
| Huawei, HiSilicon | ***supportedBandwidthCombinationSetIntraENDC*** | We understand the intention is that UE use *supportedBandwidthCombinationSet* only for “intra-band (NG)EN-DC/NE-DC **without additional inter-band NR and LTE CA component**”. So for the case “Intra-band (NG)EN-DC/NE-DC BC **with LTE inter-band CA**”, *supportedBandwidthCombinationSetIntraENDC* should be used. |
| MediaTek | ***supportedBandwidthCombinationSetIntraENDC*** | This is current SPEC and it was the original intention of the agreed option 1 from R2-1913696. |
| Nokia | ***supportedBandwidthCombinationSetIntraENDC*** | ***supportedBandwidthCombinationSetIntraENDC***  Defines the supported bandwidth combination set for a band combination that allows configuration of at least one EUTRA serving cell and at least one NR serving cell in the same band, as defined in the TS 38.101-3 [4], table 5.3B.1.2-1 and table 5.3B.1.3-1.  - For intra-band (NG)EN-DC with additional inter-band CA component(s) of LTE **and/or** NR |
| OPPO | ***supportedBandwidthCombinationSetIntraENDC*** | we believe this case falls into the scope of “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.”, so should be covered by ***supportedBandwidthCombinationSetIntraENDC*** |
| Qualcomm Incorporated | ***supportedBandwidthCombinationSetIntraENDC*** | The field description of supportedBandwidthCombinationSetIntraENDC says "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." |
| Samsung | ***supportedBandwidthCombinationSetIntraENDC*** | Same understanding with Qualcomm that the current description for supportedBandwidthCombinationSetIntraENDC cover this case as well. |
| Ericsson | ***supportedBandwidthCombinationSetIntraENDC for all ENDC BCs*** | The existing (odd) use of *supportedBandwidthCombinationSetIntraENDC* and *supportedBandwidthCombinationSetIntraENDC* was selected because the clean solution to always indicate ENDC BCS in *supportedBandwidthCombinationSetIntraENDC* was seen as having big NBC impacts.  Since we have now discovered problems on how to interpret the existing specification text, we propose we introduce the clean solution (always use *supportedBandwidthCombinationSetIntraENDC* for indicating ENDC BCS, and never use *supportedBandwidthCombinationSet* for this purpose |
| Intel | ***supportedBandwidthCombinationSetIntraENDC*** | Same understanding with MTK that RAN2 agreed to use option 1 in which new field is used for intra-band EN-DC without inter-band NR can and with inter-band LTE CA. |
| vivo | ***supportedBandwidthCombinationSetIntraENDC*** | Agree the RAN2 specification is clear already. |
| CATT | ***supportedBandwidthCombinationSetIntraENDC*** | *supportedBandwidthCombinationSetIntraENDC* defined the supported bandwidth combinations for the intra-band (NG)EN-DC/NE-DC component for intra-band (NG)EN-DC/NE-DC with additional inter-band CA component(s) of LTE and/or NR. Thus, we think the referred supported intra-band part for intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA only can already been coved by *supportedBandwidthCombinationSetIntraENDC*. |

**Q1-2 Based on the Q1-1, do companies think any clarifications are needed in the specification?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| Apple | No strong preference | If companies feel any additional clarification (using NOTE) is needed, we are ok with it. |
| ZTE | Yes(Proponent) | As comment in the question 1,for the case of **“**Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”, the UE shall report the BCS for the intra-band EN-DC part in the ***SupportedBandwidthCombinationSet .***  Based on this, the current specification have 2 problems:   1. As comments in the question 1, the UE was required to report ***supportedBandwidthCombinationSetIntraENDC*** also for the case of **“**Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”. 2. For the following 2 cases, as agreed in the last meeting:  * It is mandatory if it supports both UL and DL intra-band (NG)EN-DC/NE-DC parts (e.g. DC\_1A- **(n)41AA);** * It is optional if it doesn’t support UL in both the bands of the intra-band (NG)EN-DC/NE-DC UL part.(e.g. DC**\_1A-(n)41A**A)   Thus if RAN2 confirm that **“**Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”, the UE shall report the BCS for the intra-band EN-DC part in the ***SupportedBandwidthCombinationSet ,*** the following clarification shall be added to the ***SupportedBandwidthCombinationSet*** : (together with some other minor modifications)  For the intra-band (NG)EN-DC/NE-DC BC with additional LTE CA component but no NR CA   * It is mandatory if it supports both UL and DL intra-band (NG)EN-DC/NE-DC parts * It is optional if it doesn’t support UL in both the bands of the intra-band (NG)EN-DC/NE-DC UL part. If not included, the network assumes the UE supports BCS0 as defined in TS 38.101 TS 38.101-3 [4], table 5.3B.1.2-1 and table 5.3B.1.3-1 for the intra-band (NG)EN-DC/NE-DC. |
| Huawei, HiSilicon | No strong preference |  |
| MediaTek | Seems not |  |
| Nokia | No | The spec is clear and we see no need to say anything more. |
| OPPO | No |  |
| Qualcomm Incorporated | No | It is already clear in the current specification. |
| Samsung | No |  |
| Ericsson | Yes | See response to Q1-1. |
| Intel | No |  |
| vivo | No |  |
| CATT | No | Already support the referred case, and the current spec is clear. |

### 3.1.2 90M limitation

To determine whether the UE supports a channel bandwidth of 90 MHz, the network shall also validate *SupportedBandwidthCombinationSetEN-DC*, though currently it only happens for the BC with the band 41. The proposal are listed as below:

|  |
| --- |
| Proposal 3: To determine whether the UE supports a channel bandwidth of 90 MHz, the network shall also validate *SupportedBandwidthCombinationSetEN-DC*. |

**Q1-3 Do companies generally agree with the above Proposal?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| Apple | Yes but | We think this is already implied? |
| ZTE | Yes(Proponent) | In the last meeting, the similar CR (R2-2102401/2402)was agreed, but when we go through the RAN4’s BC and BCS table, we find that for the 90 MHz bandwidth, the same modification was also needed (though currently it only happens for the BC with the band 41). Thus we add this clarification together with other issues with the intention to avoid unnecessary confusion. |
| Huawei, HiSilicon | Yes |  |
| MediaTek | Yes |  |
| Nokia | Yes |  |
| OPPO | Yes |  |
| Qualcomm Incorporated | Yes |  |
| Samsung | Yes |  |
| Ericsson | Yes |  |
| Intel | Yes |  |
| vivo | Yes |  |
| CATT | Yes | Any changes required at all? |

## Reported BCS when IE intraBandENDC-support is set to “both” (online)

[R2-2103061](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113bis-e/Docs/R2-2103061.zip) Reported BCS when IE intraBandENDC-support is set to “both” T-Mobile USA Inc. discussion Rel-16 38.306 TEI16

The observations and proposals are listed as below:

|  |  |  |
| --- | --- | --- |
| Observation 1: When a UE reports a value of “both” in IE *intraBandENDC-support* the reported BCS in IE *supportedBandwidthCombinationSetIntraENDC* is ambiguous.  Observation 2: Current specification allows the UE’s supporting both intraband contiguous and intraband non-contiguous ENDC to report different intraband BCS values using two different band combination sets. Option 1: Change “Both” in IE intraBandENDC-support to “dummy” in 38.331 Release 15 and Release 16. And modify the definition in 38.306 MRDC-Parameters ::= SEQUENCE {  singleUL-Transmission ENUMERATED {supported} OPTIONAL,  dynamicPowerSharingENDC ENUMERATED {supported} OPTIONAL,  tdm-Pattern ENUMERATED {supported} OPTIONAL,  ul-SharingEUTRA-NR ENUMERATED {tdm, fdm, both} OPTIONAL,  ul-SwitchingTimeEUTRA-NR ENUMERATED {type1, type2} OPTIONAL,  simultaneousRxTxInterBandENDC ENUMERATED {supported} OPTIONAL,  asyncIntraBandENDC ENUMERATED {supported} OPTIONAL,  ...,  [[  dualPA-Architecture ENUMERATED {supported} OPTIONAL,  intraBandENDC-Support ENUMERATED {non-contiguous, dummy} OPTIONAL,  ul-TimingAlignmentEUTRA-NR ENUMERATED {required} OPTIONAL  ]]  Change to 38.306   | ***intraBandENDC-Support***  Indicates whether the UE supports intra-band (NG)EN-DC with only non-contiguous spectrum, for the (NG)EN-DC combination as specified in TS 38.101-3 [4].  If the UE does not include this field for an intra-band (NG)EN-DC combination the UE only supports the contiguous spectrum for the intra-band (NG)EN-DC combination. | | --- |  Option 2: Add a note to the definition of IE intraBandENDC-support in 38.306 Release 15 and Release 16 Given observation 2 it is unnecessary for a UE to report a intraband BCS value when IE intraBandENDC support is set to “both”. We aren’t aware of any current implementations supporting both intraband contiguous and intraband non-contiguous spectrum which makes it unlikely that the introduction of the note will cause problems for legacy UE’s.   | ***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 for the (NG)EN-DC combination as specified in TS 38.101-3 [4].  If the UE does not include this field for an intra-band (NG)EN-DC combination the UE only supports the contiguous spectrum for the intra-band (NG)EN-DC combination.  Note: If the value of intraBandENDC-Support is set to “both” the UE shall not report a intraband BCS value in IE *supportedBandwidthCombinationSetIntraENDC*. A UE supporting both intraband contiguous and intraband non-contiguous (NG)EN-DC shall report the appropriate intraband (NG)EN-DC BCS value (found in 38.101-3) using two separate (NG)EN-DC band combinations, one (NG) EN-DC band combination for intraband contiguous and a separate (NG)EN-DC band combination for intraband non-contiguous. | | --- |   Proposal 1 - RAN2 to endorse one of the options listed above |

**Q2-1 Do companies think any clarifications in the specification or in the chairman’s note is needed, according to the GTW online discussion?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments** | **Specification or chairman’s note** |
| Apple | The NOTE says that UE can report ‘both’ with a restriction, the next next sentence says the UE should report BC twice…we think the wording needs clarification. | We are ok with clarifying this either in the NOTE or in chairman’s notes. |
| ZTE | We generally agree that “A UE supporting both intraband contiguous and intraband non-contiguous (NG)EN-DC shall report the appropriate intraband (NG)EN-DC BCS value (found in 38.101-3) using two separate (NG)EN-DC band combinations, one (NG) EN-DC band combination for intraband contiguous and a separate (NG)EN-DC band combination for intraband non-contiguous. ” But for the first sentence in the note part, we have different views. | We prefer to include it in the chairman note |
| Huawei, HiSilicon | The clarification can be: If the UE supports intra-band (NG)EN-DC with contiguous and non-contiguous, and the BCS for contiguous and non-contiguous are the same, the UE can signal “both” in *intraBandENDC-Support* with associated BCS value. If the BCS for contiguous and non-contiguous are different, the UE can signal two BC entries and set “contiguous” and “non-contiguous” separately, with associated BCS value respectively. | Chairman notes |
| MediaTek | We are fine with the wording provided by Huawei. | Chairman notes |
| Nokia | Okay with the above + if no BCS is signalled then the BCS0 is assumed for “both” signalled case | Chairman notes sounds good unless someone has really strong view on spec. |
| OPPO | We are fine with the wording provided by Huawei. | Chairman notes |
| Qualcomm Incorporated | We share the same understanding as Huawei. | Chairman notes |
| Samsung | We share the same understanding as Huawei. | Chairman notes |
| Ericsson | Wording by Huawei fine | Chairman notes |
| Intel | We are ok with Huawei’s suggestion | Chairman notes |
| T-Mobile USA | If consensus is to address only in Chairman notes, then we suggest RAN4 needs to be informed. |  |
| vivo | Some wordings in chairman notes are ok. |  |
| CATT | We generally agree with Huawei comments. Exact wording might be refined a bit. | Chairman notes |

## Contiguous and non-contiguous for intra-band EN-DC

[R2-2104030](file:///D:/Documents/3GPP/tsg_ran/WG2/TSGR2_113bis-e/Docs/R2-2104030.zip) Discussion on contiguous and non-contiguous for intra-band EN-DC Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core

The observation and proposals are listed as below:

|  |
| --- |
| Observation 1: With the legacy IE intraBandENDC-support, UE cannot indicate the support of contiguous or non-contiguous for UL and DL separately.  Proposal 1: Introduce new capability signalling indicating contiguous, non-contiguous or both for UL and DL separately.  Proposal 2: Discuss the release (e.g. Rel-15, Rel-16) to introduce the new capability signalling. |

**Q3-1 Do companies generally agree with the above Proposal 1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| Apple | No | We think RAN4 needs to confirm if such combinations are valid. The DC\_(n)41AB has only DC\_41A\_n41A UL. Maybe we can send an LS to RAN4 to see if there will be cases where UE has options in supporting diff UL configs. Adding a capability before their view is a bit premature in our view. |
| ZTE | No | We think this issue has been assigned to RAN4 to discuss first in the plenary meeting, and there was an on-going discussion in RAN4, thus we prefer to wait for RAN4’s RSP. |
| Huawei, HiSilicon | Proponent | As companies commented RAN4 inputs are needed and RAN4 is discussing it, we are ok to wait for RAN4 conclusion. |
| MediaTek | Prefer to Wait R4 |  |
| Nokia | Await RAN4 | This is discussion in RAN4 currently and we would prefer to just wait for their discussion to conclude. |
| OPPO | Prefer to Wait R4 |  |
| Qualcomm Incorporated | Wait for RAN4 | Clear guidance from RAN plenary to let RAN4 continue the discussion. |
| Samsung | Wait for RAN4 |  |
| Ericsson | Wait for RAN4 |  |
| Intel | Wait for RAN4 | If we look at signaling only, separate signaling might be needed. But as Apple said, if there is no such BC allowing both contiguous and non-contiguous in uplink, there would be not much need to define a separate signaling. |
| vivo | Wait for RAN4 |  |
| CATT | wait for RAN4 |  |

**Q3-2 Do companies generally agree with the above Proposal 2?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| ZTE | No | See Q3-1 |
| Huawei, HiSilicon | Proponent | As companies commented RAN4 inputs are needed and RAN4 is discussing it, we are ok to wait for RAN4 conclusion. |
| MediaTek | Prefer to Wait R4 |  |
| OPPO | Prefer to Wait R4 |  |
| Qualcomm Incorporated | Wait for RAN4 | Clear guidance from RAN plenary to let RAN4 continue the discussion. |
| Samsung | Wait for RAN4 |  |
| Ericsson | Wait for RAN4 |  |
| Intel | Wait for RAN4 |  |
| vivo | Wait for RAN4 |  |
| CATT | Wait for RAN4 |  |

## Summary of Phase 1

### Clarification on the BCS and its fallback

For Q1-1, 12 companies joined the discussion, 10 companies thought *supportedBandwidthCombinationSetIntraENDC* is correct, 1 company thought *SupportedBandwidthCombinationSet* is correct. 1 company preferred to use *supportedBandwidthCombinationSetIntraENDC* for all ENDC BCs, rapporteur understands this issue has been discussed when defining the new BCS *supportedBandwidthCombinationSetIntraENDC*, it is NBC change if *SupportedBandwidthCombinationSet* is used for intra-band (NG)EN-DC/NE-DC without additional inter-band NR and LTE CA component. Since the majority of companies support *supportedBandwidthCombinationSetIntraENDC*, it is suggested to confirm that *supportedBandwidthCombinationSetIntraENDC* is signalled to report the intra-band part of “Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier”.

**Proposal 1: RAN2 confirms that *supportedBandwidthCombinationSetIntraENDC* is signalled to report the intra-band part of “Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier” in the chairman notes.**

For Q1-2, 12 companies joined the discussion, 10 companies thought the current specification is clear and clarifications are not needed in the specification.

**Proposal 2: Clarifications for Proposal 1 are not needed in the specification.**

For Q1-3, all companies joined the discussion agrees with the following proposal, 1 company asked if any changes are required.

Proposal 3: To determine whether the UE supports a channel bandwidth of 90 MHz, the network shall also validate *SupportedBandwidthCombinationSetEN-DC*.

**Proposal 3: RAN2 confirms that to determine whether the UE supports a channel bandwidth of 90 MHz, the network shall also validate *SupportedBandwidthCombinationSetEN-DC*. The CRs can be discussed in Phase 2.**

### Reported BCS when IE intraBandENDC-support is set to “both”

For Q2-1, 13 companies joined the discussion, 12 companies preferred to clarify something in the chairman notes and 1 company was ok with NOTE or chairman notes. 9 companies are fine with the following understanding:

If the UE supports intra-band (NG)EN-DC with contiguous and non-contiguous, and the BCS for contiguous and non-contiguous are the same, the UE can signal “both” in *intraBandENDC-Support* with associated BCS value. If the BCS for contiguous and non-contiguous are different, the UE can signal two BC entries and set “contiguous” and “non-contiguous” separately, with associated BCS value respectively.

1 company suggested to add “if no BCS is signalled then the BCS0 is assumed for “both” signalled case”, 1 company suggested RAN4 needs to be informed, 1 company mentioned the exact wording might be refined a bit.

**Proposal 4: Clarify the following understanding in the chairman notes:**

**If the UE supports intra-band (NG)EN-DC with contiguous and non-contiguous, and the BCS for contiguous and non-contiguous are the same, the UE can signal “both” in *intraBandENDC-Support* with associated BCS value. If the BCS for contiguous and non-contiguous are different, the UE can signal two BC entries and set “contiguous” and “non-contiguous” separately, with associated BCS value respectively. If no BCS is signalled then the BCS0 is assumed for “both” signalled case.**

**Proposal 5: Continue the discussion in Phase 2 on whether we need to inform the above understanding to RAN4, e.g. this part can be included in the LS for BCS fallback. (To be CB online based on Phase 2 discussion)**

### Contiguous and non-contiguous for intra-band EN-DC

For Q3-1 and Q3-2, all companies joined the discussion prefer to wait for RAN4. Thus, it is suggested to postpone this discussion until RAN4 has the conclusion.

**Proposal 6: Postpone the R2-2104030 and wait for RAN4 conclusion.**

## Summary of Phase 2

Based on Proposal 3 during the Phase 1 discussion, the CRs were discussed in Phase 2.

**Proposal 3a: The CRs are agreed in principle in R2-2104546 and R2-2104547.**

The consensus of online discussion was to generate an LS to RAN4 with open questions, but some companies commented during Phase 2 discussion that they prefer to consolidate the views on interpretation 1/2 before sending the LS to other WG. It seems to re-visit the online conclusion.

**Thus, the following issues are proposed to be discussed during on-line CB:**

1. **whether the LS to RAN4 on BCS fallback issue is needed in this meeting**
2. **whether we need to inform RAN4 the RAN2 understanding on BCS for contiguous and non-contiguous intra-band (NG)EN-DC**

# Conclusions

**Proposal 1: RAN2 confirms that supportedBandwidthCombinationSetIntraENDC is signalled to report the intra-band part of “Intra-band (NG)EN-DC/NE-DC BC with LTE inter-band CA and NR single carrier” in the chairman notes.**

**Proposal 2: Clarifications for Proposal 1 are not needed in the specification.**

**Proposal 3: RAN2 confirms that to determine whether the UE supports a channel bandwidth of 90 MHz, the network shall also validate *SupportedBandwidthCombinationSetEN-DC*. The CRs can be discussed in Phase 2.**

**Proposal 3a: The CRs are agreed in principle in R2-2104546 and R2-2104547.**

**Proposal 4: Clarify the following understanding in the chairman notes:**

**If the UE supports intra-band (NG)EN-DC with contiguous and non-contiguous, and the BCS for contiguous and non-contiguous are the same, the UE can signal “both” in *intraBandENDC-Support* with associated BCS value. If the BCS for contiguous and non-contiguous are different, the UE can signal two BC entries and set “contiguous” and “non-contiguous” separately, with associated BCS value respectively. If no BCS is signalled then the BCS0 is assumed for “both” signalled case.**

**Proposal 5: Continue the discussion in Phase 2 on whether we need to inform the above understanding to RAN4, e.g. this part can be included in the LS for BCS fallback. (To be CB online based on Phase 2 discussion)**

**Proposal 6: Postpone the R2-2104030 and wait for RAN4 conclusion.**

**To be discussed during on-line CB:**

1. **whether the LS to RAN4 on BCS fallback issue is needed in this meeting**
2. **whether we need to inform RAN4 the RAN2 understanding on BCS for contiguous and non-contiguous intra-band (NG)EN-DC**

# References

1. R2-2104025 Discussion on BCS of a fallback band combination Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core
2. R2-2103061 Reported BCS when IE intraBandENDC-support is set to “both” T-Mobile USA Inc. discussion Rel-16 38.306 TEI16
3. R2-2104030 Discussion on contiguous and non-contiguous for intra-band EN-DC Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core
4. R2-2104212 Further Clarification on the supportedBandwidthCombinationSet ZTE Corporation, Sanechips discussion Rel-15 NG\_RAN\_PRN-Core
5. R2-2104213 CR on the supportedBandwidthCombinationSet-R15 ZTE Corporation, Sanechips CR Rel-15 38.306 15.13.0 0565 - F NR\_newRAT-Core
6. R2-2104214 CR on the supportedBandwidthCombinationSet-R16 ZTE Corporation, Sanechips CR Rel-16 38.306 16.4.0 0566 - A NR\_newRAT-Core
7. R2-2104026 Clarification on BCS of a fallback band combination Huawei, HiSilicon CR Rel-15 38.306 15.13.0 0563 - F NR\_newRAT-Core
8. R2-2104027 Clarification on BCS of a fallback band combination Huawei, HiSilicon CR Rel-16 38.306 16.4.0 0564 - A NR\_newRAT-Core
9. R2-2104028 Draft LS on BCS of a fallback band combination Huawei, HiSilicon LS out Rel-16 NR\_newRAT-Core To:RAN4