**3GPP TSG-RAN WG2 Meeting #114-e R2-210xxxx**

**Online, May 17-27, 2021**

**Agenda Item: 5.4.3**

**Source: Huawei, HiSilicon**

**Title: Summary of [AT114-e][010][NR15] UE cap I - BCS for fallback BC (Huawei)**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following offline discussion.

* **[AT114-e][010][NR15] UE cap I - BCS for fallback BC (Huawei)**

Scope: Await on-line, then treat remaining parts of R2-2105941, R2-2106119, R2-2105171, R2-2105066, R2-2106120, R2-2106121, R2-2106122, R2-2106123, R2-2106360, R2-2105173

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

Intended outcome: Report and Agreed CRs.

Deadline: Schedule A

# Contact from companies

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# Discussion

## CR on the BCS fallback

[R2-2106120](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106120.zip) Clarification on BCS of a fallback band combination Huawei, HiSilicon CR Rel-15 38.306 15.13.0 0595 - F NR\_newRAT-Core

[R2-2106121](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106121.zip) Clarification on BCS of a fallback band combination Huawei, HiSilicon CR Rel-16 38.306 16.4.0 0596 - A NR\_newRAT-Core

According to current TS 38.306, in order to determine the channel bandwidths of a band for a BC, the network should validate the BCS ID for the corresponding BC. However, based on the agreement reached online, **the NW only validates the BCS ID for the BCs that explicitly signalled by the UE**, i.e. for the fallback BC which is derived from the signalled parent, the BCS ID does not need to be interpreted for the fallback BC. **So the CRs are intended to clarify that the BCS ID is only used for the band combination explicitly signalled by the UE.**

| ***supportedBandwidthDL***  Indicates maximum DL channel bandwidth supported for a given SCS that UE supports within a single CC (and in case of intra-frequency DAPS handover for the source and target cells), which is defined in Table 5.3.5-1 in TS 38.101-1 [2] for FR1 and Table 5.3.5-1 in TS 38.101-2 [3] for FR2.  For FR1, all the bandwidths listed in TS38.101-1 Table 5.3.5-1 for each band shall be mandatory with a single CC unless indicated optional. For FR2, the set of mandatory CBW is 50, 100, 200 MHz. When this field is included in a band combination with a single band entry and a single CC entry (i.e. non-CA band combination), the UE shall indicate the maximum channel bandwidth for the band according to TS 38.101-1 [2] and TS 38.101-2 [3].  NOTE: To determine whether the UE supports a channel bandwidth of 90 MHz, the network may ignore this capability and validate instead the *channelBW-90mhz* and the *supportedBandwidthCombinationSet*. For serving cell(s) with other channel bandwidths the network validates the *channelBWs-DL*, the *supportedBandwidthCombinationSet*, the *supportedBandwidthCombinationSetIntraENDC*, the *asymmetricBandwidthCombinationSet* (for a band supporting asymmetric channel bandwidth as defined in clause 5.3.6 of TS 38.101-1 [2]) and *supportedBandwidthDL*. |
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| ***channelBWs-DL***  Indicates for each subcarrier spacing the UE supported channel bandwidths. Absence of the *channelBWs-DL* (without suffix) for a band or absence of specific scs-XXkHz entry for a supported subcarrier spacing means that the UE supports the channel bandwidths among [5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 100] and [50, 100, 200] that were defined in clause 5.3.5 of TS 38.101-1 version 15.7.0 [2] and TS 38.101-2 version 15.7.0 [3] for the given band or the specific SCS entry. For IAB-MT, to determine whether the IAB-MT supports a channel bandwidth of 100 MHz, the network checks c*hannelBW-DL-IAB-r16*.  For FR1, the bits in *channelBWs-DL* (without suffix) starting from the leading / leftmost bit indicate 5, 10, 15, 20, 25, 30, 40, 50, 60 and 80MHz. For FR2, the bits in *channelBWs-DL* (without suffix) starting from the leading / leftmost bit indicate 50, 100 and 200MHz. The third / rightmost bit (for 200MHz) shall be set to 1. For IAB-MT the third / rightmost bit (for 200MHz) is ignored. To determine whether the IAB-MT supports a channel bandwidth of 200 MHz, the network checks *channelBW-DL-IAB-r16*.  For FR1, the leading/leftmost bit in *channelBWs-DL-v1590* indicates 70MHz, the second leftmost bit indicates 45MHz, the third leftmost bit indicates 35MHz and all the remaining bits in *channelBWs-DL-v1590* shall be set to 0.  NOTE: To determine whether the UE supports a specific SCS for a given band, the network validates the *supportedSubCarrierSpacingDL* and the *scs-60kHz*. To determine whether the UE supports a channel bandwidth of 90 MHz, the network may ignore this capability and validate instead the *channelBW-90mhz* and the *supportedBandwidthCombinationSet*. For serving cell(s) with other channel bandwidths the network validates the *channelBWs-DL*, the *supportedBandwidthCombinationSet*, the *supportedBandwidthCombinationSetIntraENDC*, the *asymmetricBandwidthCombinationSet* (for a band supporting asymmetric channel bandwidth as defined in clause 5.3.6 of TS 38.101-1 [2]) and *supportedBandwidthDL*. |
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The corrections are listed as below.

| ***supportedBandwidthCombinationSet***  Defines the supported bandwidth combination set for a band combination signalled by the UE as defined in TS 38.101-1 [2], TS 38.101-2 [3] and TS 38.101-3 [4]. For NR SA CA, NR-DC, inter-band (NG)EN-DC without intra-band (NG)EN-DC component, inter-band NE-DC without intra-band NE-DC component and intra-band (NG)EN-DC/NE-DC with additional inter-band NR CA component, the field defines the bandwidth combinations for the NR part of the band combination. For intra-band (NG)EN-DC/NE-DC without additional inter-band NR and LTE CA component, the field indicates the supported bandwidth combination set applicable to intra-band (NG)EN-DC/NE-DC band combination.  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 38.101-1 [2], TS 38.101-2 [3] and 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 has more than one NR carrier (at least one SCell in an NR cell group) or is an intra-band (NG)EN-DC/NE-DC combination or both. | BC | CY | N/A | N/A |
| --- | --- | --- | --- | --- |
| ***supportedBandwidthCombinationSetIntraENDC***  Defines the supported bandwidth combination set for a band combination signalled by the UE 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, 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 both UL and DL intra-band (NG)EN-DC/NE-DC parts 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 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 38.101-3 [4], table 5.3B.1.2-1 and table 5.3B.1.3-1 for the intra-band (NG)EN-DC/NE-DC. | BC | CY | N/A | N/A |
| ***supportedBandwidthCombinationSetEUTRA***  Indicates the set of supported bandwidth combinations signalled by the UE for the LTE part for inter-band (NG)EN-DC without intra-band (NG)EN-DC component, inter-band NE-DC without intra-band NE-DC component and intra-band (NG)EN-DC/NE-DC with additional inter-band LTE CA component. The field is encoded as a bit map, where bit N is set to "1" if UE support Bandwidth Combination Set N for this band combination. 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. The UE shall neither include the field for a (NG)EN-DC/NE-DC combination which has only one LTE carrier, nor for a (NG)EN-DC/NE-DC combination which has more than one LTE carrier for which the UE only supports Bandwidth Combination Set 0 for the LTE part. If the inter-band (NG)EN-DC/NE-DC has more than one LTE carrier, the UE shall support at least one bandwidth combination for the supported LTE part. | BC | CY | N/A | N/A |

**Q1-1 Do companies think the CRs are necessary? If the answer is Yes (CRs are necessary), do companies agree the changes in the CRs or any comments for the contents of the CRs?**

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| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| MediaTek | Maybe | The current proposed CR does not really clearly reflect the agreement. We are not sure whether anything is needed. Perhaps we should have an informative NOTE saying that same BCS values does not apply to fallback BC. The network determines the channel BW of fallback based on the BCS table of parent BC (with one or more carrier removed). We are open for discussion. |
| CATT | maybe yes | If we have changes then it should better be crystal clear. Maybe we could add a note after each filed, for the sake of clarity, i.e., something like  Note: The filed only applies for the band combination, but it does not apply for its fallback band combination(s). |
| ZTE | FFS | We share the same understanding with MTK and CATT, maybe some clarification is needed but not in the current CR’s way, maybe a note can be added to include the on-line agreement, we are also open for discussion on whether and how to add such kind of notes |
| Intel | Yes | Agreed with the rapporteur that the online agreement is referring to bandwidth of the parent BC for the fallback BC and this has to be made clear in the specification. However, we are not sure just specifying ‘signalled by the UE’ is enough.  We were thinking more like adding the following in Section 3.1 Definition as in LTE TS36.306:      **Fallback band combination:** 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. A PC5 band combination that would result from another PC5 band combination by releasing at least one sidelink carrier. An intra-band non-contiguous band combination is not considered to be a fallback band combination of an intra-band contiguous band combination. A fallback band combination and the parent band combination support the same bandwidths for each band of the fallback band combination |
| OPPO | No strong view | We are fine with the proposal as above of adding a NOTE in a form more aligned with the online minutes. |
| Nokia | Maybe yes | Would be okay with the suggestion from Intel that aligns to the LTE behavior. |
| Nokia | No | Our understanding is that this will be NBC:   * The fallback of a band combination is just another band combination or band with smaller number of CC’s but with exactly the same capabilities as the parent. * A band with 2 CC if it fallback to 1 CC should support the same channel bandwidths of the parent. So here lower capabilities changes the meaning completely here.   The understanding for Feature Set Combinations is different as the same or lower implies that for the feature set combination a UE may not be able to support the same capabilities in a fallback case due to UE implementation restriction. |
| Samsung | No | It seems sufficient to indicate the RAN2 clarification in the chairman’s minute. Furthermore, it is less clear for the suggested change to reflect the RAN2 understanding. |
| Qualcomm Incorporated | No | To us, it is already clear from the definition of fallback band combination. |
| Ericsson | Yes, but diffferently | We agree to the approach proposed by Intel. But the change should use the wording from the IPA CR in [R2-2105473](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_114-e/Docs/R2-2105473.zip):  A fallback band combination supports the same channel bandwidths for each carrier as its parent band combination. |
| Apple | No | If needed, a note can be added as suggested by Ericsson/Intel. |
| Huawei, HiSilicon | Yes (Proponent) | We do think the BCS fallback creates confusion, that’s why it takes us two meetings to clarify this issue. OK to take above suggestions on the contents of the CR to reflect the agreement precisely.  Generally adding a NOTE for clarification is ok to us. For Intel’s comments, we understand the BWs supported by fallback BC can be different with the BWs supported by parent BC, e.g. more BWs can be supported for a band of a fallback BC. However, the BWs supported by the fallback BC should cover all the BWS supported by the parent BC. So if companies think some clarifications for this are needed, Ericsson’s suggestion is ok to us, to capture what we clarified in LTE spec:  A fallback band combination supports the same channel bandwidth(s) for each carrier as its parent band combination. |

## CR on the fallback Band Combination Removing

[R2-2106360](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106360.zip) CR on the fallback Band Combination Removing-R15 ZTE Corporation, Sanechips CR Rel-15 38.306 15.13.0 0606 - F NR\_newRAT-Core

[R2-2105173](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105173.zip) CR on the fallback Band Combination Removing-R16 ZTE Corporation, Sanechips CR Rel-16 38.306 16.4.0 0580 - A NR\_newRAT-Core

In the current spec, when remove the fallback band combination from the “candidate band combinations”, only the fallback band combination with the same capabilities of another band combination included in the list of "candidate band combinations" was mentioned. The fallback band combination with the lower capabilities was not mentioned.

2> if it is regarded as a fallback band combination with the same capabilities of another band combination included in the list of "candidate band combinations", and

2> if this fallback band combination is generated by releasing at least one SCell or uplink configuration of SCell according to TS 38.306 [26]:

3> remove the band combination from the list of "candidate band combinations";

But when set the candidate feature set combinations, it clearly said the “ excluding entries (rows in feature set combinations) for fallback band combinations with same or lower capabilities;”

2> compile a list of "candidate feature set combinations" referenced from the list of "candidate band combinations" excluding entries (rows in feature set combinations) for fallback band combinations with same or lower capabilities;

The corrections are listed as below.

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| The UE shall:  1> compile a list of "candidate band combinations" according to the filter criteria in *capabilityRequestFilterCommon* (if included), only consisting of bands included in *frequencyBandListFilter*, and prioritized in the order of *frequencyBandListFilter* (i.e. first include band combinations containing the first-listed band, then include remaining band combinations containing the second-listed band, and so on), where for each band in the band combination, the parameters of the band do not exceed *maxBandwidthRequestedDL*, *maxBandwidthRequestedUL*, *maxCarriersRequestedDL*, *maxCarriersRequestedUL*, *ca-BandwidthClassDL-EUTRA* or *ca-BandwidthClassUL-EUTRA*, whichever are received;  1> for each band combination included in the list of "candidate band combinations":  2> if the network (E-UTRA) included the *eutra-nr-only* field, or  2> if the requested *rat-Type* is *eutra*:  3> remove the NR-only band combination from the list of "candidate band combinations";  NOTE 4: The (E-UTRA) network may request capabilities for *nr* but indicate with the *eutra-nr-only* flag that the UE shall not include any NR band combinations in the *UE-NR-Capability*. In this case the procedural text above removes all NR-only band combinations from the candidate list and thereby also avoids inclusion of corresponding feature set combinations and feature sets below.  2> if it is regarded as a fallback band combination with the same or lower capabilities of another band combination included in the list of "candidate band combinations", and  2> if this fallback band combination is generated by releasing at least one SCell or uplink configuration of SCell according to TS 38.306 [26]:  3> remove the band combination from the list of "candidate band combinations"; |

**Q2-1 Do companies think the CRs are necessary? If the answer is Yes (CRs are necessary), do companies agree the changes in the CRs or any comments for the contents of the CRs?**

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| **Company** | **Yes or No** | **Comments** |
| MediaTek | No | UE should be allowed to indicate different capability for different BC. Otherwise, NW might configure the resource exceed UE's capability. The change here is NBC for us and it is not acceptable. |
| CATT | maybe yes | The intention of these CRs seems correct to us. |
| ZTE | Yes (proponent) | To MTK, our understanding is that with this CR, the UE is still allowed to indicate different capability for different BC as specified in 38331  NOTE 1: The UE may advertise fallback band-combinations in which it supports additional functionality explicitly in two ways: Either by setting FeatureSet IDs to zero (inter-band and intra-band non-contiguous fallback) and by reducing the number of FeatureSet-PerCC Ids in a Feature Set (intra-band contiguous fallback). Or by separate *BandCombination* entries with associated *FeatureSetCombinations*.  Here we add “or lower” just to keep it align with the other places. E.g.  But when set the candidate feature set combinations, it clearly said the “ excluding entries (rows in feature set combinations) for fallback band combinations with same or lower capabilities;”  2> compile a list of "candidate feature set combinations" referenced from the list of "candidate band combinations" excluding entries (rows in feature set combinations) for fallback band combinations with same or lower capabilities; |
| OPPO | Good to check RAN2 understanding on the related issue first | We tend to agree there are at least something to clarify in RAN2:  E.g., assume child-BC is N1A+N2A, while parent-BC is N1A+N2A+N3A, when evaluating  2>     compile a list of "candidate **feature set combinations**" referenced from the list of "candidate band combinations" excluding entries (rows in feature set combinations) for fallback band combinations with **same or lower** capabilities;  […]  2>     include into ***featureSets*** the feature sets referenced from the "candidate feature set combinations" excluding entries (feature sets per CC) for fallback band combinations with **same or lower** capabilities and may exclude the feature sets with the parameters that exceed any of *maxBandwidthRequestedDL*, *maxBandwidthRequestedUL*, *maxCarriersRequestedDL* or *maxCarriersRequestedUL*, whichever are received;  we understood   * “same” means for N1A and N2A, the FSC in child-BC refers to the same FS, as referred by FSC in parent-BC * “lower” means for N1A and N2A, the FSC in child-BC refers to a FS with less-capable capability, compared with FS referred by FSC in parent-BC   Based on the assumption/understanding above, there are two questions for RAN2 to clarify is   1. Firstly, is there a case where a child-BC **only** support **lower** capability than parent-BC (i.e., does **not** support **same** capability as parent-BC); 2. In case answer to Q1 is yes, is there a need to report the said child-BC, and thus surely together with the related FSC and FS entrie(s);   If RAN2 can align the understanding of the Q1/2 above, the CR issue can be solved easily.  (actually, when it comes to **bandwidth**, we understood the answer to Q1/2 is clear – **Yes to Q1 and No to Q2**, while our question is more for the capability **other than bandwidth**, whether it is possible to answer Q1/2 differently) |
| Samsung | Yes | It seems valid because there would be fallback BC with lower capabilities, e.g. less bandwidth |
| Qualcomm Incorporated | Yes, but | To us, it is better to delete the “or lower” from the existing text than adding it as proposed by the CRs. In the definition of fallback band combination, the UE shall support the same capability between parent and fallback. The current text “same or lower” is against the principle. |
| Ericsson | No | The original intention of the current specification text was to ensure that the UE does not include/signal BCs that NW anyway can derive from the signalled parent BR. With that in mind, it would be fine to say “same or lower”.  But such an addition would in fact contradict the definition of a “fallback band combination” which must, according to 38.306, support the same capabilities as its parent BC. An alternative text could be:  2> if it is regarded as a fallback band combination according to TS 38.306 [26]of another band combination included in the list of "candidate band combinations  3> remove the band combination from the list of "candidate band combinations"; |
| Apple | Maybe, but | We think Ericsson’s suggestion seems reasonable. |
| Huawei, HiSilicon | Maybe | Technically we understand the fallback BC with “same or lower” capabilities does not to be explicitly signaled by the UE, but not sure if we need any spec change. Generally, for a BC, the lower capability does not need to be signaled. If the fallback BC with same capability is not signaled, such fallback BC with lower capability won’t be signalled.  For the Ericsson’s suggestion, we think it is not aligned with original intention. The definition of fallback BC defined in 38.306 includes: *by releasing at least one SCell or uplink configuration of SCell, or SCG*. Here the original text it about that “*by releasing at least one SCell or uplink configuration of SCell*” to exclude “*by releasing SCG*”. |
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# Conclusions

*To be added…*

# References

1. R2-2105941 BCS fallback behaviour Ericsson discussion Rel-15 NR\_newRAT-Core
2. R2-2106119 Discussion on BCS of a fallback band combination Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core
3. R2-2105171 Further Discussion on the BCS with Different Supported Bandwidths ZTE Corporation, Sanechips discussion Rel-15
4. R2-2105066 Left issue on fallback BC OPPO discussion Rel-15 NR\_newRAT-Core
5. R2-2106120 Clarification on BCS of a fallback band combination Huawei, HiSilicon CR Rel-15 38.306 15.13.0 0595 - F NR\_newRAT-Core
6. R2-2106121 Clarification on BCS of a fallback band combination Huawei, HiSilicon CR Rel-16 38.306 16.4.0 0596 - A NR\_newRAT-Core
7. R2-2106122 Introduction of indication for BCS of a fallback band combination Huawei, HiSilicon CR Rel-15 38.306 15.13.0 0597 - F NR\_newRAT-Core
8. R2-2106123 Introduction of indication for BCS of a fallback band combination Huawei, HiSilicon CR Rel-15 38.331 15.13.0 2668 - F NR\_newRAT-Core
9. R2-2106360 CR on the fallback Band Combination Removing-R15 ZTE Corporation, Sanechips CR Rel-15 38.306 15.13.0 0606 - F NR\_newRAT-Core
10. R2-2105173 CR on the fallback Band Combination Removing-R16 ZTE Corporation, Sanechips CR Rel-16 38.306 16.4.0 0580 - A NR\_newRAT-Core