**3GPP TSG-RAN Meeting # 90-e RP-20XXX**

**Electronic Meeting, December 7-11, 2020**

**Agenda item:** 9.1.4

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [90E][13][BCS4]

**Document for:** Information

# Introduction

The documents intent to capture companies’ comments on documents related to the WID on Introduction of BCS4 [1-3]. This is spectrum related WI proposal.

# Comments on Introduction of BCS4

## Topics for discussion

* Sub-topic 1-1: Objectives of WID ([**RP-202256**](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_90e/Docs/RP-202256.zip))
* Sub-topic 1-2: Proposed recommendation to basket WIs
* Sub-topic 1-3: Timeline e.g. number of meetings
* Sub-topic 1-4: Any other issue

## Companies’ views collected

### Sub-topic 1-1: Objectives of WID ([RP-202256](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_90e/Docs/RP-202256.zip))

Please provide comments, if any, on the following WID objectives:

1. Introduce BCS 4 for inter-band and intra-band NR-CA, which shall indicate that for the band combination the UE supports all of the possible combinations of bandwidths based on the bandwidths the UE supports for each band as indicated in the UE capabilities and restricted by the notes in Table 5.3.5-1 in 38-101-1, and the maximum bandwidth for the band in the band combination as indicated in the UE capabilities. The BCS table does not need to fill in the channel bandwidths for BCS4 for new band combinations.
2. Ensure that all required analysis including MSD, MPR/A-MPR, etc. be performed for BCS4 for every existing band combination configuration (up to 3 bands)
3. Technically confirm what each of the following two enhancements can realize and compare the cost versus the benefits and discuss its necessity. The candidate methods are the original BCS4, two enhanced BCS4 methods are: One is BCS4 with additional minimum channel bandwidth for each CC in NR band within a band combination via UE capability signalling, and the other is BCS4 with UE signalling multiple feature sets with different maximum and minimum channel bandwidth supporting on each CC for the same band combination.
4. To ease the concerns of vendors concerned that IoDT will increase with BCS4, RAN4 shall allow new BCSs to be created as requested for band combinations, but BCSs will not be required for new band combinations.
5. Future band combinations may include BCSs, but they will not be required to have any other than BCS4.

Note: Please indicate objective number (e.g. 1) for which comments are provided.

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| **Company** | **Comments** | |
| Apple | We have the following questions for clarifications:   1. Is the BCS4 WID intended to handle the missing MSD and A-MPR requirements for all channel BWs supported by its constituent bands for the existing band combinations? 2. Was there an estimation on how much work is expected to complete the missing MSD and A-MPR requirements for the existing band combinations? 3. How to divide the above work among companies if the workload is expected to be heavy? 4. If BCS4 is agreed, is it the only BCS for any new combination, or it would be the default BCS and smaller subsets such as BCS0 can still be proposed? 5. Will the 35MHz and 45MHz requirements in the combinations be handled in the BCS4 WID (if approved) or in the existing NR\_bands\_R17\_BWs WID? | |
| Samsung | As the email discussion during RAN4 97e, we’d like to clarify to come to the consensus that BCS4 doesn't implicit any BW mandatory or optional in the set. Instead of that, it depends on UE's capability and RAN4’s relative existed or future specs. | |
| Intel | Support of BCS4 may have impact on UE baseband capabilities. Support of all possible CBW combinations may not always be possible from BB perspective. Recommend to rephrase objective 3 as follows: *Study and define UE capabilities signalling framework for BCS4 to address UE RF and baseband implementation constraints.*  Also, just a recommendation that BCS4 is more like a RAN4 acronym. For the WI it could be more clear to call it differently (e.g. support of full or extended bandwidth combination set) | |
| ZTE | 1. Clarification : is BCS4 only intended for NR CA and NR DC band combos, not for SUL band combos? 2. Furthermore, if it happens in the middle of a release, e.g., that a new channel bandwidth Q for operating band X in Rel-A.(a+1), while BCS4 is already defined for all of band combos consisting of band X, then how to differentiate Rel-A.a UE and Rel-A.(a+1) UE regarding the support of channel bandwidth Q for operating band X? 3. The variant of “Enhanced BCS4” #2 introduces multiple feature set with different max. and min. channel bandwidth, and actually it looks like another “high-order” BCS concept. Might need further discussion. 4. For the bullet 1): “The BCS table does not need to fill in the channel bandwidths for BCS4 for new band combinations.”, a question for clarification, what does “new band combination” refer to? In our understanding, currently BCS4 have not been introduced into the spec, which means the original BCSs should be used untill the BCS4 have been introduced. During this period, there will be lots of new rquested band combiantion in the WID, and also lots of TPs/draft CRs to introduce new band combiantion into the spec (Comparing with the existing band combinations in the spec, these band combinations are new.). Therefore, a time threshold may be needed for the “new band combiantion”. 5. For bullet 2), We understand this sentence “Ensure that all required analysis including MSD, MPR/A-MPR, etc. be performed for BCS4 for every existing band combination configuration (up to 3 bands)” is based on the agreements in the last meeting, but could it possible make it more general to capture all the existing NR CA basket WID, i.e. up to 5 bands? 6. For bullet 4) and 5), although we prefer to use BCS4 for combinations requesting in future meetings, it seems either BCS4 or original BCSs are allowed, pending on the proponent according to the e-mail dicussion in the last meeting. | |
| Qualcomm | For the third bullet of objective, the current version is to compare the cost versus the benefits and discuss its necessity for two enhanced methods which is not in line with the agreed RAN4 WF of R4-2017843. We should technically confirm and compare three methods including original BCS4, and two enhanced methods. With that, we prefer to use the wording in the agreed RAN4 WF, i.e., “Technically confirm what each of the following three methods can realize and compare the cost versus the benefits. The candidate methods are the original BCS4, two enhanced BCS4 methods: One is BCS4 with additional minimum channel bandwidth for each NR band within a band combination via UE capability signalling, and the other is BCS4 with UE signalling multiple feature sets with different maximum and minimum channel bandwidth supporting on each CC for the same band combination.”  How to ensure if MSD is proper to specify when a new CBW is added in a band is missing in the WID. If it is not to be solved in this WI, the guidance from RAN is also needed when this WI got approved. | |
| Huawei | The objectives seem aligned with the agreed way forward, but seems not clear to us as a WID. We would like to propose the following modifications.  Firstly, we also would like to cover SUL band combinations since they follow the same logical as for NR CA.  Secondly, we should make is clear which band combinations will be impacted by this WI. In our understanding, there would be three reasons for the need of BCS4:   1. Rel-16 WIs to introduce the additional channel bandwidth for NR bands, but the bandwidth combinations were not updated timely 2. Rel-17 WIs of basket WI adding new channel bandwidth(s) support to existing NR bands, Rel-17 WI Introduction of channel bandwidths 35MHz and 45MHz for NR, and the bandwidth combinations should be updated correspondingly 3. For some band combination, the maximum bandwidth combinations are intentionally skipped to limit UE complexity.   So RAN4 needs deal with   1. The existing band combination in the specification, for which the bandwidth(s) on the certain band(s) are missing. 2. The band combinations which are included in the Rel-17 basket WIs and uncompleted. 3. The potential hole caused by the newly introduced bandwidth for a certain band in future.   For 1) we would like to clearly capture it, i.e., all the existing band combinations until now should be checked one by one. For 2) we can follow the proposals in revised RP-202677 and finalize the work in the separate basket WIDs. For 3) we need create a Table to list all the potential impacted band combination after a certain additional channel bandwidth is introduced for a band.  The core part of WID include:   * Investigate and specify BCS4 for inter-band NR-CA, intra-band NR-CA and SUL band combinations, considering the following optional approaches   + Option 1 (Original BCS4): BCS4 shall indicates that for a band combination the UE supports all of the possible combinations of bandwidths based on     - The bandwidths the UE supports for each band as indicated in the UE capabilities and restricted by the notes in Table 5.3.5-1 in 38.101-1,     - and the maximum bandwidth for the band in the band combination as indicated in the UE capabilities   + Option 2: Original BCS4 with additional minimum channel bandwidth for each CC in NR band within a band combination via UE signaling   + Option 3: Original BCS4 with UE signaling multiple feature sets with different maximum and minimum channel bandwidth supporting on each CC for the same band combination. * Investigate and specify the necessary requirements, including MSD, MPR/A-MPR etc., to support BCS4 for the inter-band NR-CA, intra-band NR-CA and SUL band combinations   + The band combinations include the existing inter-band, intra-band NR-CA and SUL band combinations specified in TS38.101-1 h.1.0.   + The band combinations provided in the Table below…(Note: the table will be updated to include all the impacted band combinations after an additional channel bandwidth is introduced into the existing band)   [Table …]  NOTE 1: To ease the concerns of vendors concerned that IoDT will increase with BCS4, RAN4 shall allow new BCSs to be created as requested for band combinations, but BCSs will not be required for new band combinations.  NOTE 2: Future band combinations may include BCSs, but they will not be required to have any other than BCS4. | |
| Skyworks | More clarification would be needed so that channel BW supported by “BCS4” is unambiguous for a given release: ie: are 35/45MHZ part of a release 17 BCS4 (or later?), are irregular BW part of R17 BSC4 or rather R18….This is especially important to gage the work needed and insure that no requirement if forgotten | |
| T-Mobile USA | To Apple:  Q1: Yes  Q2: We did offline up through Rel-16, but didn’t submit it. One has to just look at the existing tables to find where there are band combinations with MSD, and then look where additional channel BWs have been added.  Q3: Coordination would be helpful to prevent duplication.  Q4: BCS would be available for every NR CA and NR DC combination, but other BCSs could optionally be proposed.  Q5: No. 35 and 45 MHz requirements would be handled in the basket WID that adds 34 and 45 MHz channel BWs to a band.  To Samsung: We agree, BCS4 doesn’t change anything with regard to mandatory or optional channel BWs. UE capabilities still indicate channel BWs per band, and maximum channel BW per band in the band combination.  To Intel: BCS4 does not have any impact on UE baseband capabilities. UE capabilities still indicate channel BWs per band, and maximum channel BW per band in the band combination.  Also, BCS4 was chosen because of compatibility with existing signalling.  To ZTE:  Q1: We don’t have a strong view on SUL. Would leave that to SUL experts  Q2: The UE will declare support for BCS4 or not for each higher order band combination.  Q3 Multiple feature sets was Qualcomm’s proposal.  Q4: Our revision of RP-202677 proposes how to handle existing combinations during the transition  Q5: Our understanding is that RAN4 has agreed to only study combinations up to 3 bands. Is this not the case?  Q6: We originally proposed no new BCSs other than BCS4 be allowed, but offered to allow other BCSs optionally to ease the concerns about IoDT  To Qualcomm:  OK on using the wording from the WF.  When a new channel BW is added for a band, all combinations with the band which have MSD needs to be checked. |
| Nokia | Are there any specific reasons not to adopt the content of the approved WF in the last RAN4? | |
| Ericsson | The objective is aligned with the RAN4 approved WF and this WID is about starting the actual work. The main work in this WI is about filling in the missing columns in the MSD tables that is created by adding channel BWs. This work is rather straight forward and we should not overcomplicate this work. Note that most combinations do not even have MSD issues to consider.  Regarding HW proposal to add SUL to the scope: we are fine.  Regarding 35/45 MHz channel BW: this is on going work in another WI so they cannot be included in BCS4 now. But if needed they can be added within the scope of BCS4 later when they are completed.  Regarding irregular channel BW: There feasibility under SI is discussed, so they cannot be in the scope of BCS4 WI.  ZTE suggested up to 5 bands. But MSD is only defined up to 3 bands. So > 3 bands are not relevant for this WI. | |
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### Sub-topic 1-2: Proposed recommendation to basket WIs ([RP-202256](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_90e/Docs/RP-202256.zip))

Please provide comments if any on the proposed recommendation to the basket WIs in the WID:

1. In order to ensure that MSD analysis is complete for BCS4 for NR CA and NR DC band combinations that have already been requested but CRs have not yet been agreed by RAN4, the TPs and draft CRs and CRs with those band combinations shall include MSD analysis for all channel bandwidths for each band in the band combination.
2. Since BCS4 was not agreed to when already requested NR CA and NR DC band combinations were requested, it should be up to the proponents for whether TPs and draft CRs include the BCS(s) that were requested and recorded in the WID, or if the TPSs and draft CRs only include BCS4.

Note: Please indicate the recommendation number (e.g. 1) for which comments are provided.

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| **Company** | **Comments** |
| T-Mobile USA | We had some offline discussions with ZTE and Ericsson, and as a result have a draft revisions updated RP-202677 in the [90E][13][BCS4] to address the combinations that have already been requested, but do not yet have TPs or draft CRs or real CRs. |
| Bell Mobility | Support T-Mobile, ZTE and Ericsson proposal on RP-202677 |
| ZTE | 1. Since BCS4 indicates the support of all possible channel bandwidth combinations for a band combo, if adding a new channel bandwidth to an existing band with the support of BCS4 already, then MSD analysis should be done for any band combos including the band with the new channel bandwidth, this should be stated in the WID clearly. 2. It seems there exits a bit discrepance between bullet 1) and 2). In our understanding, only the original BCSs should be used untill the BCS4 is agreed in the specification, which means the original ways should be used where the MSD analysis for the requested channel bandwidths, not for all channel bandwidths. The bullet 1) is valid after the BCS4 is agreed in the specification. Also it should clearly differentate the MSD work between BCS4 WID and basket WID to avoid possible overlapping work. |
| Qualcomm | Clarifications on P2 in draft revisions: RAN4 need to solve all the issues and finalize the WI before to agree BCS4 CR(s). |
| Huawei | We can follow the revised RP-202677.  One clarification from our side: what is the BCS4 CR? In our view, it should be the definition of BCS4. If that is the correct understanding, all the cases for the basket WIs could be categorized into three cases:   1. Case1: In Rel-17 basket WIs for NC-CA and SUL, the band combination is added and completed before BCS4 CR is agreed. 2. Case 2: In Rel-17 basket WIs for NC-CA and SUL, the band combination is added before BCS4 CR is agreed but completed after BCS4 is agreed. 3. Case 3: In Rel-17 basket WIs for NC-CA and SUL, the band combination is added after BCS4 is agreed.   For Case 1, we can think about how to deal with it. Either we can add the impacted band combination to the list of Table in this WI, or we can re-add the band combination for BCS4 in the basket WI (the previous work for the band combination is regarded as completion)  For Case 2, we can follow proposal 2 and proposal 3  For Case 3, it is expected that BCS4 will be used for the requested band combinations.  In our view, we do not need to capture the about recommendation in this WID. We can have a way forward as guidance for future work. |
| Skyworks | To ensure proper review of the additional requirements for new BW should there be an associated TR? |
| AT&T | We support Proposal 1 and the updated Proposal 2 in the draft revision of RP-202677. |
| Ericsson | We support updated RP-202677. |

### Sub-topic 1-3: Timeline e.g. number of meetings

Please provide comments on the proposed time i.e. target completion date (RAN4#93).

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| **Company** | **Comments** |
| Huawei | There seems a huge work for it because there are so many band combinations. So we propose that the target date should be the end of Rel-17. |
| Skyworks | We agree with Huawei, also we should make sure that BCS4 does not become a by default approach since there are combinations that are only valid for some region/operator where some BW combinations are not possible. These should use the normal BCS approach. |
| AT&T | We support the target date aligning with the end of Rel-17. |
| T-Mobile USA | The amount of work is limited by the amount of combinations that currently have MSD. We would be OK with the end of Rel-17 if all combinations going forward include the MSD analysis required for BCS4. |
| Ericsson | We don’t see the need to set timeline till end of R17 since work is not so huge. But we are ok to have 2-3 quarters at most since this work needs to be done rather sooner. |
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### Sub-topic 1-4: Any other issue

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| **Company** | **Comments** |
| Huawei: | We want to clarify the relation between some related work items and how to organize the work.  In our understanding, there would be three reasons for the need of BCS4:   1. Rel-16 WIs to introduce the additional channel bandwidth for NR bands, but the bandwidth combinations were not updated timely 2. Rel-17 WIs of basket WI adding new channel bandwidth(s) support to existing NR bands, Rel-17 WI Introduction of channel bandwidths 35MHz and 45MHz for NR, and the bandwidth combinations should be updated correspondingly 3. For some band combination, the maximum bandwidth combinations are intentionally skipped to limit UE complexity.   Regarding the relation to 35MHz/45MHz WI, and how to capture the proposal 7 in the way forward, i.e., *for 35 and 45 MHz, the WID should be updated so that MSD analysis is performed for all of the band combinations for each band that 35 and/or 45 MHz are added to*, we would like to share our view and the related work should be done in a pipeline like below:  Step 1: Finalize WI for 35MHz and 45MHz. The WI for channel bandwidths 35 and 45MHz is just to introduce those channel bandwidths in general.  Step 2: After it is completed, the 35 and 45MHz will be added to Rel-17 WI adding new channel bandwidth(s) support to existing NR bands.  Step 2a: after finalizing the work for example bands in WI for 35 and 45MHz, we could add the potential impacted band combinations in the table of this WI.  Step 3: after finalizing the work to introduce 35/45MHz for more bands in WI adding new channel bandwidth(s) support to existing NR bands, we can add the potential impacted band combinations in the table of this WI. |
| Skyworks | Should clarify that irregular channel BW is not in the scope of BCS4 at least in Release 17 since these are very specific to some deployments. |
| MTK | There are other WIs in which RAN4 is working on some new channel bandwidths at the same time. Whether and how to handle these new channel bandwidths are considered in the BCS4 framework needs to be clarified. |
| Ericsson | As stated earlier: 35/45 MHz and irregular channel BW should not be within the scope of BCS4 WI. We are OK to clarify this in BCS4 WI |
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## Initial summary of discussion

* **The WID objectives:**

Based on the comments received from the WID objectives need to be updated to include SUL within the scope. The new channel bandwidths 35 MHz and 45 MHz, which are part of another WI are not within the scope of this WI. Similarly, irregular BWs studied under separate SI are not within the scope of this WI. Such clarification is needed either in the WID or in separate WF.

There is preference to align objective # 3 with the wording used in the WF on BCS4 approved in RAN4#97e.

Whether A-MPR is needed for BCS4 need further discussion.

One company prefers to call BCS4 as full or extended bandwidth combination set.

It was suggested by one company to include up to 5 bands. But MSD is for up to 3 bands. This issue can further be discussed in the next round.

* **Relation of BCS4 to basket WIs:**

Several companies support the recommendation for basket WI but there is no consensus on exact wording. One company prefers not to add recommendations for basket WI in the BCS4 WID rather include them in a WF. The starting text of the proposals, which need further alignment can be:

* Proposal 1: In order to ensure that MSD analysis is complete for BCS4 for NR CA and NR DC band combinations that have already been requested but CRs have not yet been agreed by RAN4, the TPs and draft CRs and CRs with those band combinations shall include MSD analysis for all channel bandwidths for each band in the band combination.
* Proposal 2: Until BCS4 CR(s) are agreed, TPs and Draft CRs should include the BCSs that were requested for already requested band combinations. After BCS4 CR(s) are agreed, it should be up to the proponents whether TPs and draft CRs include the BCS(s) that were requested and recorded in the WID, or if the TPs and draft CRs only include BCS4. If BCS4 is preferred, the exceptional case of inconsistent information between the basket WID and the TPs/draft CRs is acceptable.
* Proposal 3: BCS4 CRs should be agreed as soon as possible, preferably in Q1 2020 to avoid the situation where traditional BCSs are still required. All MSD analysis should be completed by the end of Rel-17. To facility the adoption of BCS4 prior to the completion of MSD analysis, MSD for missing channel BWs shall be listed as infinity until the MSD analysis is complete.
* **Completion target date:**

There is preference to have much longer target completion date than RAN#93. Some companies prefer to keep target completion date until end of Rel-17. This needs further discussion in the next round.

## Topics for discussion in 2nd round

* Sub-topic 1-5: Updated WID on BCS4
* Sub-topic 1-6: Relation of BCS4 to basket WIs

## Companies’ views collected in 2nd round

### Sub-topic 1-5: Updated WID on BCS4

Please directly comment on the objectives and timeline in updated WID on BCS4 when available in the draft folder.

### Sub-topic 1-6: Relation of BCS4 to basket WIs

Please provide comments on the following proposals:

* Proposal 1: In order to ensure that MSD analysis is complete for BCS4 for NR CA and NR DC band combinations that have already been requested but CRs have not yet been agreed by RAN4, the TPs and draft CRs and CRs with those band combinations shall include MSD analysis for all channel bandwidths for each band in the band combination.
* Proposal 2: Until BCS4 CR(s) are agreed, TPs and Draft CRs should include the BCSs that were requested for already requested band combinations. After BCS4 CR(s) are agreed, it should be up to the proponents whether TPs and draft CRs include the BCS(s) that were requested and recorded in the WID, or if the TPs and draft CRs only include BCS4. If BCS4 is preferred, the exceptional case of inconsistent information between the basket WID and the TPs/draft CRs is acceptable.
* Proposal 3: BCS4 CRs should be agreed as soon as possible, preferably in Q1 2020 to avoid the situation where traditional BCSs are still required. All MSD analysis should be completed by the end of Rel-17. To facility the adoption of BCS4 prior to the completion of MSD analysis, MSD for missing channel BWs shall be listed as infinity until the MSD analysis is complete.

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| **Company** | **Comments** |
| T-Mobile USA | Sub-topic 1-5: We think that it should be possible to agree initial RAN4 CRs in Q1 that will introduce the BCS4 text above each relevant table and set the missing MSD to infinity as a placeholder for the final MSD analysis. An early draft CR can be found in R4-2016454. It would be incorporate revised wording to be agreed by RAN as well as the MSD placeholders. Then MSD analysis could be completed by the completion of Rel-17. It would be ideal if a formula could be agreed to translate the existing MSD in a given row of the tables to fill in the missing cells.  Sub-topic 1-6: We agree with Proposal 1-3. |
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# References

1. RP-202255 Motivation for WID on BCS4 Ericsson
2. RP-202256 WID for introduction of BCS4 Ericsson
3. RP-202677 Proposal for handling BCS4 for already requested Band Combinations T-Mobile USA, Ericsson