**3GPP TSG-RAN WG4 Meeting #98-e R4-21xxxxx**

**Electronic Meeting, 25 January – 5 February 2021**

**Agenda item:** 9.30.1

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [98e][128] NR\_BCS4

**Document for:** Information

# Introduction

This email discussion is for Rel-17 NR BCS4 which was approved in WI [RP-202832](ftp://ftp.3gpp.org/TSG_RAN/TSG_RAN/TSGR_90e/Docs/RP-202832.zip) at RAN “90.

# Topic #1: General

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [R4-2101817](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101817.zip) | General discussion on introduction of BCS4 | Huawei, HiSilicon | Observation 1: In order to reduce the unnecessary work for AMPR/REFSENS, RAN4 can consider not to introduce BCS4 for all the intra-band CA band combinations temporarily.  Observation 2: When RAN4 introduce BCS4, the impact of specification listed above can be considered for inter-band CA and SUL band combinations.  Observation 3: RAN4 need to consider how to indicate BCS4 in the band combination configurations according to option 1, option 2 or other solutions.  Observation 4: From the perspective of standards and industry, it’s very important to introduce BCS4 as soon as possible. |
| [R4-2102187](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102187.zip) | Templates for BCS4 configurations for inter-band NR CA | ZTE Corporation | Proposal 1. Using the templates in Table 1-3 and Table 1-4, Table 1-5 and Table 1-6 for xUL/2DL and 1UL/3DL&/2UL/3DL NR CA/DC BCS4 band combination configurations requesting, respectively.  Proposal 2. For the same band combination, in case of both BCS0/1/2/3 and BCS4 are existed in the WID, TP and draft CRs for BCS4 is enough, and BCS0/1/2/3 combinations are completed by default after BCS4 combinations TP/draft CR are approved.  Proposal 3. It is needed to include BCS4 configurations in configurations tables in the 38.101-1 (clause 5.5A.3.1) and TS38.101-3(clause 5.5A.1). The templates in Table 1-4 and Table 1-6 without SCS column can be applied |
| [R4-2102150](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102150.zip) | Discussion on BCS4 | T-Mobile USA | Proposal 5: RAN4 to discuss the need for A-MPR analysis for the new channel bandwidths in the BCS4 configurations.  Proposal 6: RAN4 needs to decide on how to handle the documentation of support for BCS4 for NR CA and SUL band combinations. |
| [R4-2100088](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100088.zip) | Required changes to the original BCS4 idea | Nokia, Nokia Shanghai Bell | Observation 1: Optional CBWs for a NR band is explicitly defined in TS38.101-1. The other CBWs are mandatory support for the NR band.  Observation 2: There is no agreement that the 5MHz/10MHz is supported by default for all the band configurations.  Observation 3: In order for a UE to support a certain CBW for a band within a band configuration, the UE shall support the CBW for the band for single band operation, but the converse is not true  Observation 4: Method 3(Feature Set with BCS4 + Max and Min CBWs) is the most flexible and can realize what Method 3(traditional BCS + Max CBW) can do. Method 2(BCS4 + Max and Min CBWs) is the next flexible method and Method 1(the original BCS4 + Max CBW) is the least flexible.  Observation 6: Introduction of Method 3(Feature Set with BCS4 + Max and Min CBWs) requires that of Method 2(BCS4 + Max and Min CBWs). |
| [R4-2102502](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102502.zip) | Discussion on candidate methods for BCS4 | Qualcomm Incorporated | Observation 2: The supported CBW configurations for the bands in a band combination are per request from the proponents which means the supported CBW by UE in the single operation shall be supported in the band combination.  Observation 3: With Method 1, RAN4 will allow new BCSs to be created as requested for band combinations to ease IoDT efforts. That will lead to more RAN4 workload in which both original BCSs and BCS4 might be requested by proponents.  Observation 4: Method 2 can provide more flexible CBW reporting than Method 1 which can kind of solving the concerns on IoDT efforts. But Method 2 doesn’t work for the case if some of CBWs between maximum and minimum CBW are not supported in a band combination. |

## Open issues summary

### Sub-topic 1-1: BCS4 for all combinations or only requested combinations

* + Discuss and agree if BSC4 should be introduced for all combinations or if only for requested combinations

### Sub-topic 1-2: Configuration tables

* Proposals
  + Proposal 1. Using the templates in Table 1-3 and Table 1-4, Table 1-5 and Table 1-6 for xUL/2DL and 1UL/3DL&/2UL/3DL NR CA/DC BCS4 band combination configurations requesting, respectively.
  + Proposal 2. For the same band combination, in case of both BCS0/1/2/3 and BCS4 are existed in the WID, TP and draft CRs for BCS4 is enough, and BCS0/1/2/3 combinations are completed by default after BCS4 combinations TP/draft CR are approved.
  + Proposal 3. It is needed to include BCS4 configurations in configurations tables in the 38.101-1 (clause 5.5A.3.1) and TS38.101-3(clause 5.5A.1). The templates in Table 1-4 and Table 1-6 without SCS column can be applied
* Recommended WF
  + Agreement on proposal 1, 2 and 3 above

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| **Company** | **Comments** |
| ZTE | Out intention is to provide some guidance for future BCS4 configurations requesting/TP/draft CR. |
| YYY |  |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

Moderator: No CRs/TPs in this AI

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: MSD

## Companies’ contributions summary

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| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [R4-2102928](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102928.zip) | Cross-band MSD for ENDC and NR-CA BCS4 | Skyworks Solutions Inc. | Proposal 1: Adopt the following general guidelines for Xband isolation MSD and UL configuration specifications   |  |  |  | | --- | --- | --- | |  | Uplink Aggressor Band | Downlink Victim Band | | Channel Bandwidth | EN-DC and NR-CA BCS4:  Highest CBW specified for the aggressor band  NR-CA BCS<4:  Highest CBW specified for the aggressor band in the CA BCS table. | EN-DC and NR-CA BCS4:  MSD and UL configuration to be specified for all victim’s band specified CBW.  NR-CA BCS<4:  MSD and UL configuration to be specified for all victim’s band CBW specified in CA BCS table. | | RB allocation | Highest possible Lcrb that is compatible with the DFT-s-OFDM 2,3,5 radix rule for the highest UL CBW, ie. fully allocated UL configuration. | Fully allocated DL configuration | | SCS | SCS should be the smallest SCS that is compatible with the highest UL CBW | | | Carrier Frequency | The UL and DL carrier frequencies should be configured to minimize the gap separating the DL victim carrier to the UL carrier frequency. | |   Proposal 2: Xband isolation MSD specifications shall be revisited systematically whenever a new CBW is agreed in any band for the case of EN-DC combinations. For the case of NR-CA, these specifications should be reviewed systematically a new CBW is introduced in the combination BCS table, be it from BCS 0,1 range or for the new BCS4 concept.  Proposal 3: Remove ambiguity on NR-CA UL aggressor band UL CBW and DL victim band SCS by correcting/adding footnotes in a similar fashion similar as was agreed for EN-DC [3].  If proposal 3 is agreed, we propose to file corresponding CR either during this meeting or at the next meeting.  Proposal 4: In case new CBW are introduced in a given NR band, or new BCS 4 concept is agreed, review systematically all other MSD cases that might be impacted, for example MSD due to harmonic relation.  Proposal 5: Further study if Proposal 1 is sufficient to prevent the introduction of additional MSD TP as suggested in WF [2].  Proposal 6: Adoption of BCS4 for NR-CA should be carefully evaluated on a combination per combination basis in order to prevent triggering excessive workload on evaluating requirements that may no longer reflect the reality of commercial network deployments/cell configurations. |
| [R4-2101816](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101816.zip) | Discussion on how to simplify MSD definition using bandwidth-agnostic approach | Huawei, HiSilicon | Observation 1: As the channel bandwidths are increasing, it’s necessary to simplify the MSD exception tables in TS 38.101-1.  Observation 2: Generally, RAN4 use the minimum channel bandwidth of victim bands to evaluate the MSD value and derive values of other channel bandwidth.  Observation 3: Currently, there is a strong demand to use unified derivation method to fill up the missing MSD requirements.  Proposal 1: The equation-based representation without explicitly writing down the number for each channel bandwidth can be used for the MSD exception tables due to harmonic interference and cross band isolation.  Proposal 2: It’s proposed to use equation (4) to derive the MSD values of other channel bandwidths.  Proposal 3: It’s proposed to reconstruct the MSD requirements based on the table 1, table 2 and table 3 for the exceptions due to UL harmonic, harmonic mixing and cross band isolation.  Proposal 4: It’s proposed to reconstruct the MSD requirements based on the table 4 and table 5 for the SUL exceptions due to UL harmonic and cross band isolation. |
| [R4-2102150](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102150.zip) | Discussion on BCS4 | T-Mobile USA | Proposal 1: The RAN4 CR(s) for adding BCS4 can be independent of any signalling changes that we decide on for additional BCS4 parameters.  Proposal 2: Instead of infinite channel BW as a placeholder for MSD, RAN4 can use the MSD of the next smaller channel BW.  Proposal 3: Endorse the Draft CR in R4-2102151.  Proposal 4: RAN4 to discuss how to handle potential new MSD for combinations that have not previously been identified as having MSD. |
| [R4-2102151](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102151.zip) | Draft CR for 38.101-1: Introduction of BCS4 | T-Mobile USA, MediaTek | Draft CR for the introduction of BCS4 |
| [R4-2100088](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100088.zip) | Required changes to the original BCS4 idea | Nokia, Nokia Shanghai Bell | Observation 5: Once Method 3(Feature Set with BCS4 + Max and Min CBWs) is introduced, MSD issues due to the introduction of new CBWs will not become a BCS4 specific issue. |

## Open issues summary

### Sub-topic 2.1: MSD requirements

* Proposals
  + Endorse the draft CR R4-2102151 from T-Mobile that fills in MSD gaps
  + Implement the equation-based MSD calculation method proposed in R4-2101816 from Huawei
  + Adopt the general guidelines in R4-2102928 from Skyworks
* Recommended WF
  + Discuss if to change MSD method and representation or whether to use existing MSD tables and fill in the gaps
  + Adopt the general guidelines proposed
  + Agree on scope of CR
  + Based on outcome of discussions, possibly endorse CR filling in MSD gaps

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| **Company** | **Comments** |
| ZTE | Different companies have different proposals, how to converge?  We prefer to use a simple way to define/derive the MSD value:  1; For R4-2102151, it looks simple, but we would like to understand the principle to derive the values. For example, why 1.5dB for 40MHz for n1-n3 which is same with 30MHz. It seems the values should be scaled by the BW.   1. For R4-2101816, actually the equation (1) is not always for all bands, for FDD bands, duplexer gap needs to be considered to derive the REFSEN requirements(also for some band, the equation may not applicable considering CIM3/5 problem), and also for some new addition CBWs for a certain band, the REFSEN cannot be derived by a equation. And for equation (2), How to derive or define PI? does it total interference after MRC? We think it is no need to define PI in the spec, it is not the minimum RF requirement.   Last, we would like to remind that there are already some draft CR to add BCS1/2 configuration in basket WID agenda, where the cross band isolation MSD values are not included just waiting for the consensus in this thread. If the MSD values are not approved in this meeting, how to treat these draft CR? |
| YYY |  |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Title** | **Company** | **Comments collection** |
| R4-2102151 | Draft CR for 38.101-1: Introduction of BCS4 | T-Mobile USA, MediaTek | ZTE: It seems the description is only for A-A type configurations, how about high order configuration such as A-C type?  What does it mean "BCS4 is an available for every CA combinations"? Does it means it is no need to submit any Tdoc for the exising band combinations although there are many running TPs in this meeting? |
| Company B |
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|  |  |  | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: Signalling

## Companies’ contributions summary

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| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [R4-2102150](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102150.zip) | Discussion on BCS4 | T-Mobile USA | Proposal 1: The RAN4 CR(s) for adding BCS4 can be independent of any signalling changes that we decide on for additional BCS4 parameters. |
| [R4-2101371](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101371.zip) | The signalling for BCS4 | Xiaomi | Proposal 1: introduce a new UE signalling with BCS4 in IE *FeatureSetDownlinkPerCC, i.e., channelBWs-UL-ca/channelBWs-DL-ca.* The signalling allows UE report the channel bandwidths it supports by bitmap on one carrier of a band of a band combination, and absence of the signalling for a CC means that the UE supports all channel bandwidths in this CC as singe carrier operation.  Proposal 2: sent LS to RAN2 to ask introduce the new signalling as the annex. |
| [R4-2102188](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102188.zip) | Discussion on UE capabilities signalling to enable BCS4 | ZTE Corporation | Observation 1. The UE supported channel bandwidths for each band are limited by the signalling of channelBWs-DL and channelBWs-UL  Proposal. Signalling of BCS4 support per band combination. |
| [R4-2102502](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102502.zip) | Discussion on candidate methods for BCS4 | Qualcomm Incorporated | Observation 1: Except for original BCSs, there is no specific signalling to indicate the supported CBW for the bands in a band combination.  Observation 5: Method 3, i.e., BCS4 signalling with additional minimum channel bandwidth supporting on each carrier via multiple feature sets reporting is the best approach.  Proposal 1: RAN4 to agree to use the method of BCS4 signalling with additional minimum channel bandwidth supporting on each CC for the band combination reporting via multiple feature sets.  Proposal 2: Send an LS to RAN2 to inform above RAN4 agreement. RAN2 to introduce the signalling for minimum channel bandwidth supporting on each CC for the band combination and to allow UE signalling maximum and minimum channel bandwidth supporting on each CC for the same band combination via multiple feature sets |
| [R4-2100088](ftp://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100088.zip) | Required changes to the original BCS4 idea | Nokia, Nokia Shanghai Bell | Proposal: Introduce a new capability for a UE to indicate the supported minimum CBW per SCS per CC per NR band within a band configuration and allow the UE to indicate supported CBW combinations for a CA configuration via Feature Sets.  Proposal 2: Send an LS to inform RAN2 of a necessity of the new capability mentioned in Proposal 1 and a relevant feature set(s) to have an equivalent functionality that the traditional BCS has. |

## Open issues summary

### Sub-topic 3.1: Signalling

* Proposals

**Option 1**

* + R4-2101371 by Xiaomi, introduce a new UE signalling with BCS4 in IE FeatureSetDownlinkPerCC, i.e., channelBWs-UL-ca/channelBWs-DL-ca. The signalling allows UE report the channel bandwidths it supports by bitmap on one carrier of a band of a band combination, and absence of the signalling for a CC means that the UE supports all channel bandwidths in this CC as single carrier operation. Send LS to RAN2 to ask for introduction of such signalling.

**Option 2**

* + R4-2102188 by ZTE, Signalling of BCS4 support per band combination

**Option 3**

* + R4-2102502 by Qualcomm, RAN4 to agree to use the method of BCS4 signalling with additional minimum channel bandwidth supporting on each CC for the band combination reporting via multiple feature sets. Send an LS to RAN2 to inform above RAN4 agreement. RAN2 to introduce the signalling for minimum channel bandwidth supporting on each CC for the band combination and to allow UE signalling maximum and minimum channel bandwidth supporting on each CC for the same band combination via multiple feature sets

**Option 4**

* + R4-2100088 by Nokia, introduce a new capability for a UE to indicate the supported minimum CBW per SCS per CC per NR band within a band configuration and allow the UE to indicate supported CBW combinations for a CA configuration via Feature Sets. Send an LS to inform RAN2 of a necessity of the new capability mentioned in Proposal 1 and a relevant feature set(s) to have an equivalent functionality that the traditional BCS has

**Option 5**

* + R4-2101817 by Huawei, The first candidate method (original BCS4 method) without “minimum channel bandwidth” capability can be chosen by RAN4.
* Recommended WF
  + Converge on type of capability signalling to be used.
  + Discuss the content of LS to RAN2 asking about possibility for such signalling.

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| **Company** | **Comments** |
| ZTE | For clarification, our proposal (i.e. Option 2) is also adopt the original BCS4 method, i.e. no minimum channel bandwidth capability should be selected. So actually option 2 is similar with Option 5.  In our understanding, before RAN4 introduce a 'BCS4' concept, there are no any difference for BCS01/2/3/4 from RAN2 perspective. Also the IoDT issue have already been considered when RAN2 introduced the channelBWs-DL and channelBWs-UL(i.e. IoDT bit capabilities) according to RP-181443 and R2-1810907. Therefore, we think the current RAN2 signalling can work, i.e. no need to introduce new signalling. |
| YYY |  |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

Moderator: No CRs/TPs in this AI

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |