**3GPP TSG-RAN WG4 Meeting # 102-e R4-220XXXX**

**Electronic Meeting, 21st February– 3rd March, 2022**

**Agenda item:** 9.27 and 9.28

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [102-e][114] NR\_BCS4\_MSD\_Inter\_Band\_ENDC

**Document for:** Information

# Introduction

This email discussion handles the contributions submitted to agenda item 9.27 and 9.28 for NR\_BCS4 and MSD\_Inter\_Band\_ENDC. The scope of this email discussion covers the maximum aggregated bandwidth for intra-band CA with BCS4/BCS5, Improvements to MSD table, and some CRs. There are three topics listed as below in this email discussion and multiple sub-topics within each of them.

#1 The maximum aggregated bandwidth for intra-band CA with BCS4/BCS5

#2 Improvements to MSD table

#3 Discussion on CRs

# Topic #1: The maximum aggregated bandwidth for intra-band CA with BCS4/BCS5

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2204486 | Nokia, Nokia Shanghai Bell | **Proposal 1: RAN4 Send an LS to RAN2 to find out the best resolution among the followings.**   1. Use the current IEs: supportedBandwidthUL/DL and channelBWs-DLUL. 2. UE provides multiple feature sets for those BCs, covering all possible CBW aggregation below the supported max limit. Problem: it increases the UE-Capability message size 3. Add a new UE capability which indicates the max aggregated CBW that the UE supports   **Proposal 2: When BCS4 or 5 for intra band CA is requested, max aggregated CBW shall be provided.** |
| R4-2204509 | Qualcomm Incorporated | **Observation 1: Multiple feature sets approach will introduce a huge amount of signalling overhead and the note that allowing the change for maximum aggregated CBW in future release will make the spec inconsistent.**  **Proposal 1: Introduce a new signalling for BCS4 and BCS5 to report the maximum aggregated bandwidth for intra-band CA per band combination.**  **Proposal 2: If the Proposal 1 is agreed in RAN4, RAN4 should further discuss in which release BCS4 can be introduced.** |
| R4-2205117 | Xiaomi | **Proposal 1: Intra-band non-contiguous CA has not the issue whose maximum aggregated bandwidth is below the theoretically possible max aggregated CBW.**  **Proposal 2: From the view of UE Spec**   * **Solution 1: the proponent should solve all the issues including the degradation due to larger CBW, if they request BCS4/BCS5 for the intra-band contiguous CA.** * **Solution 2: the maximum aggregated bandwidth should be defined as the theoretically possible max aggregated CBW and it allows to introduce one note as the maximum aggregated bandwidth is XX MHz in Rel-XX.**  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR CA configuration / Bandwidth combination set | | | | | | | | | | NR CA configuration | Uplink CA configurations or single uplink carrier5 | Channel bandwidths for carrier (MHz) | Channel bandwidths for carrier (MHz) | Channel bandwidths for carrier (MHz) | Channel bandwidths for carrier (MHz) | Channel bandwidths for carrier (MHz) | Maximum aggregated  bandwidth (MHz) | Bandwidth combination set | | CA\_n5B | CA\_n5B | See n5 channel bandwidths in Table 5.3.5-1 for each carrier2 | |  |  |  | 25x | 4 and 5 | | Note x: the maximum aggregated bandwidth is 20MHz in Rel-XX. | | | | | | | | |   **Proposal 3: modify the constraint condition for intra-band contiguous CA as**  **min{n\*max channel bandwidth of each carrier, BWChannel\_CA of each CA bandwidth class, floor(Maximum frequency range of each band/5MHz)\*5MHz} for intra-band contiguous CA.**  **Proposal 4: From the network perspective:**   * **Option1: Introduce new UE capability to report the maximum aggregated bandwidth of intra-band CA per BC.** * **Option 2: The network could store the information of the actual maximum aggregated bandwidth for BCS 4/5 indicated in the Note for those intra-band CA.**   **Proposal 5: if apply Option 1 in proposal 4, which release the new UE capability should be release independent need FFS.** |
| R4-2205118 | Xiaomi | This contribution is a text proposal for TR 38.862 v0.5.0 to modify the rule of the maximum aggregated bandwidth for intra-band CA with BCS4/BCS5. |

## Open issues summary

### Sub-topic 1-1

*Sub-topic description:*

**Issue 1-1-1: Is text proposal (R4-2205118) for TR 38.862 approved?**

* Proposals
  + Option 1: Agree this proposal (The corresponding TP R4-2205118 can be approved)
  + Option 2: Do not agree this proposal (The corresponding TP R4-2205118 can be noted)
  + Option 3: The proposal need to be revised with suggestions (The corresponding TP R4-2205118 can be revised)
* Recommended WF
  + TBA

**Issue 1-1-2: Discussion on whether the maximum aggregated bandwidth can be changed for intra-band contiguous CA with BCS4/5 in the later release or not:**

Proposals

* + Option 1: Yes, it’s allowed.
  + Option 2: No, it may cause spec inconsistency.
  + Option 3: Other views.
* Recommended WF
  + TBA

**Issue 1-1-3: If the maximum aggregated bandwidth can be changed for intra-band contiguous CA with BCS4/5 in the later release, the following solutions can be discussed to solve the inconsistency issue among different spec releases:**

Proposals

* + Option 1: Use the current IEs: supportedBandwidthUL/DL and channelBWs-DLUL.
  + Option 2: UE provides multiple feature sets for those BCs, covering all possible CBW aggregation below the supported max limit.
  + Option 3: Add a new UE capability which indicates the max aggregated CBW for intra-band CA per band combination with BCS4/5
    - Option 3a: RAN4 should further discuss in which release BCS4 can be introduced.
    - Option 3b: which release the new UE capability should be release independent need FFS
    - Option 3C: Other proposals are not precluded.
  + Option 4: it allows to introduce one note as the maximum aggregated bandwidth for intra-band CA with BCS4/5 is XX MHz in Rel-XX. And the network could store the information of the actual maximum aggregated bandwidth for BCS 4/5 indicated in the Note for those intra-band CA.
  + Option 5: Other solutions.
* Recommended WF

TBA

**Issue 1-1-4: If the maximum aggregated bandwidth can’t be changed for intra-band contiguous CA with BCS4/5 in the later release, it will not cause the spec inconsistency issue. The following principles can be discussed.**

Proposals

* + Option 1: When BCS4 or 5 for intra band CA is requested/specified, max aggregated CBW shall be provided and can’t be changed in later release.
  + Option 2: The theoretically possible max aggregated CBW for intra-band contiguous CA with BCS4/5 should be specified, and the proponent should solve all the issues including the degradation due to larger CBW, if they request BCS4/BCS5 for the intra-band contiguous CA.
  + Option 3: Other solutions.
* Recommended WF

TBA

## Companies views’ collection for 1st round

### Open issues

Sub-topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | **Issue 1-1-1:**  For all the existing channel bandwidths, they are all multiple of 5MHz. So the max. Agg CBW is indeed as 5x.  However, if smaller than 5MHz CBW are introduced in future, then the formula cannot be applied. So why not keep the existing wording as ‘Maximum frequency range of each band’ since it can cover all the possibilities.  **Issue 1-1-2:**  Option 1: Yes, it’s allowed.  If the max. Supported channel bandwidth are changed for a certain band, then the max. Agg BW could be changed for BCS4/5 intra-band C CA.  **Issue 1-1-3:**  We are interesting in Option 3. We are wondering if option 3 is adopted, then the previous agreements would be overtruned since BCS4 cannot be released independent from Rel-15 anymore. Also, if option 3 is adopted, why RAN4 needs both BCS4 and BCS5 at the same time?  For Option 4, how the NW distingurish the different Max.agg BW for the same BCS4/5?  In addition, in terms of the discussion, it seems it become more difficult to apply BCS4/5 to intra-band, so is it possible to exclude BCS4/5 for intra-band? i.e. just apply BCS4/5 to inter-band.  Also, we would ask a question, considering this meeting is the last R17 meeting, so if no agreements are achieved in this meeting, then how to consider BCS4/5 in Rel-17 or what is the next step? Due to inter-band NR CA also include the intra-band CA in the uplink with BCS4/5, so it would impact intra-band and inter-band CA as a package. |
| Qualcomm | **Issue 1-1-1:**  Why we need this change? The original text is the theoretical maximum aggregated CBW which is always correct.  **Issue 1-1-2:**  Option 1 is OK if a new signalling for maximum aggregated CBW is introduced. Otherwise, the network could not identify the maximum aggregated CBW of earlier and later release UEs with BCS4/5 if the maximum aggregated CBW can is changed in later release.  **Issue 1-1-3:**  We support Option 3. We have concerns about Option 2 since it will lead to huge overhead. We have the similar view as ZTE that if a new signalling is introduced, BCS4 could not be release independent. In that case, why we need to identify BCS4 and BCS5? |
| Nokia | **Issue 1-1-1**  Whichever is selected, we should not spend our time on this. There is no additional benefit from this discussion…  **Issue 1-1-2**  Option 1  We have no choice but allowing to change maximum aggregated bandwidth and this cannot be avoided even if RAN4 decides to specify all the possible aggregated CBW with the existing CBW as far as RAN4 allows the introduction of a new CBW. As ZTE commented, if a wider CBW is introduced into a band, it is likely that maximum aggregated bandwidth changes if the band has intra band CA.  **Issue 1-1-3**  We respectfully disagree with Option 4. Regarding the others, i.e., 1, 2 and 3, we should ask RAN2 for which one the best is.  Regarding Option 4, this must not be the option. What is the additional meaning to just capture pass bandwidth as max aggregated CBW? We are ok to capture currently available/specified max aggregated CBW itself, but we don’t agree with this proposal. Store or not store does not matter. Network needs measures to distinguish UEs with different maximum aggregated bandwidth…  For Option 1, this indirectly means postponing the issue now. This is because the current signaling does not allow UEs to express what the max aggregated CBW whose requirements are available is unless multiple feature set per CC is used. In the future, we need to introduce a new capability to differentiate the legacy UE without the capability and UE with the capability if multiple feature set per CC is not used.  Regarding option 3, we’d like to correctly understand the comment from Qualcomm and ZTE that “*if a new signalling is introduced, BCS4 could not be release independent*”. Is the precondition of the comment that the new signaling is introduced from Rel-17, right? If the new signaling is introduced, it would be introduced from Release 17 together with BCS5 as we introduced a min channel bandwidth. So, BCS4 must be still release independent from Rel-15, mustn’t it?  **Issue 1-1-4**  We don’t agree with all the options. We’d like to better understand the motivation of the question. The question and provided options are not directly related to each other.  For option 1, What does it mean “can’t be changed in later release”. If so, we may need to stop applying BCS4/5 to intra band CA. As we commented, in the previous inquiry, there is a possibility to define wider maximum aggregated CBW if a wider new CBW is introduced later anyway. There is no point to discuss change or can’t change it.  For Option 2, in our understanding, the benefit of this option is it can delay the problem until a new wider CBW is introduced into a band. The side effect is UE may need to meet requirements for ever not to be used and RAN4 needs to spend our time on them. Also, when an operator wants a wider CBW in a band together with intra band CA in the beginning of a certain release, they need to wait for the end of the release to get RAN2 specification. So, the product may not be able to be delivered in a timely manner. |
| Ericsson | **Issue 1-1-1**  We firstly need to decide how the specification is to be written before we discuss this.  **Issue 1-1-2**  If there are absolutely no way to inform the NW about max aggregated BW, then this information cannot be changed in the specification, i.e. option 2.  If we find a solution in issue 1-1-3, we can reconsider our answer on issue 1-1-2.  **Issue 1-1-3**  Option 3 is out of the question. RAN4 already agreed after lengthy discussions that BCS4 is without signaling and we are not in favour of a considerable delay of BCS4. We are very surprised this discussion is restarted.  We are in favour of using existing signaling possibilities, which is close to option 2 (where we see option 1 as a subset of option 2, as supportedBandwidthDL/UL is the key IE to vary over the feature sets per CC). Already today UEs with limited throughput capability may need to limit the aggregated BW in the band combinations and feature set combination as it cannot support the full channel BW on each of the carriers simultaneously. So UEs’ already today tell the NW about their limitation using feature set combinations, e.g 100+40, 90+50, 80+60, 70+70. There is no other solution for this problem in specs today as there is no IE to signal an maximum aggregated BW over the entire BC. So the extra signaling that is discussed here is already happening and apparently this is acceptable as no work is ongoing to change this. To us it seems very strange if we at this point are to introduce a “max aggregated BW intra-band” IE just for BCS4 when this has been an issue all along.  This is more for RAN2 to answer, but as a side note we agree that if UE has to resort to indicating aggregated BW limitations via supportedBandwidth in FSpCC then this will increase the capability signaling to some extent. However, we are not sure this is a large problem is in practice. But suggest to let RAN2 comment that instead of us speculating.  **Issue 1-1-4**  If there are no agreement on issue 1-1-3, we have to use option 1. i.e. no change on max aggregated BW.  Also it can be noted that it is not relevant to discuss in which release the change is done. The NW don’t know when a UE signals the release it support whether it supports and early or a late specification in that release, and the max aggregated BW can have been changed in the middle of a release. |
| T-Mobile USA | **Issue 1-1-1**  We don’t think this change is needed  **Issue 1-1-2**  Option 2: We think it may never be necessary to change the maximum aggregated BW for BCS4/5. Some things to consider:   1. We think that this is only a potential issue for some intra-band combinations, but not others. For instance, for CA\_n41C and CA\_n41(2A) BCS4 the maximum aggregated bandwidth is 190 MHz and cannot be increased. For other combinations, including CA\_n71B, CA\_n25(2A), CA\_n25(3A), CA\_n66(2A), CA\_n71(2A) we have requested the full bandwidth of the band, so max aggregated bandwidth could never increase. 2. The maximum aggregated bandwidth does not necessarily have to change just because new carrier bandwidths are added. The UE indicates which BCS is supports and also what bandwidths that it supports for each band. So if the maximum BW for a band is 20 MHz and the total bandwidth for the band is 50 MHz, BCS4 could be defined with a maximum bandwidth of 50 MHz, and the UE would only have to implement up to 20+20 MHz if it only supports 20 MHz carriers. If 25 MHz carriers are later added, UEs could use the same BCS but now report that they also support 25 MHz for the band, so 50 MHz for the combination. Now, if we ever defined channel BWs > 100 MHz for FR1 then maybe a new maximum aggregated BW would be needed for CA\_n77C, but we’re not sure how realistic of a possibility this is. 3. The example that Nokia gave for CA\_n7B may never cause problems if 50 MHz is sufficient for CA\_n7B and no operator every request support for > 50 MHz. It is not clear if any operator would every have more than 50 MHz of contiguous spectrum to require such an increase of the maximum aggregated BW.   If there is a reasonable solution in 1-1-3, then we can reconsider our answer on issue 1-1-2.  **Issue 1-1-3**  We prefer Option 2. We understand it would add a lot of signalling overhead, but we’re not sure it is worth pursuing a solution for a theoretical problem that may never impact the specs if there turns out to be no reason to change the maximum aggregated bandwidth.  On Option 1, If we go with new signalling, we should leave the details up to RAN2. supportedBandwidthUL/DL and channelBWs-DLUL are not currently signalled for aggregated bandwidth. It is not clear if these could be re-used, but if they can be, re-using the IE for a different purpose would likely still have an impact on the ASN.1.  **If Option 3 is chosen, the new capability signal can only apply to BCS5.** There are already intra band CA combinations like CA\_n41(2A) and CA\_n41C that have the maximum possible aggregated bandwidth and would not be impacted by any new signalling. We have also requested BCS4 for many other intra-band combinations that use the maximum possible aggregated bandwidth, so there’re would be no reason to increase it in the future.  **Issue 1-1-3**  We prefer Option 2. That is what we have chosen for all of the BCS4 combinations we have requested. |
| Xiaomi | **Issue 1-1-1:**  The intention is to help those bands whose frequency range is not multiple of 5MHz decide the real max aggregated BW, like the frequency range of n41 is 194MHz, but the max aggregated BW of CA\_n41 C is 190MHz not 194MHz.  **Issue 1-1-2**  The value cannot be changed If there is no singling to inform the NW about the max aggregated BW.  **Issue 1-1-3**  If there need a capability for UE to inform the NW about the max aggregated BW, we prefer Option 3. |
| Huawei | **Issue 1-1-1:**  I don’t think we need this change. The original text is the theoretical maximum aggregated CBW which is always correct.  **Issue 1-1-2:**  Option 2, since it will cause some inconsistency in spec among different releases, maximum aggregated bandwidth can’t be changed for intra-band contiguous CA with BCS4/5 in the later release.  To response ZTE and Nokia’s concerns, if the max. Supported channel bandwidth are changed for a certain band, a new BCS can be introduced for this intra-band combination. This BCS can be a traditional BCS with clear bandwidth combination set. This BCS can also be 20/21 which have the same meaning with BCS4/5 but with a larger maximum aggregated CBW. Since RAN2 has reserved 32 bits BCS for us, we can reuse these capability elements as soon as possible instead of introducing new capabilities for this concern case.  **Issue 1-1-3**  I agree with Ericsson. There is no need to open this controversial discussion in the end of Rel-17. Furthermore, we can have a simple solution by assuming maximum aggregated bandwidth can’t be changed for intra-band contiguous CA with BCS4/5 in the later release. Thus, there is no need to further discuss this issue.  **Issue 1-1-4**  Both option 1 and option 2 are OK and feasible.  To ease the concerns raised by ZTE and Nokia for some potential corner case, we can also have option 3 as below.  Option 3.  If the max. Supported channel bandwidth are changed for a certain band, a new BCS can be introduced for this intra-band combination. This BCS can be a traditional BCS with clear bandwidth combination set. This BCS can also be 20/21 which have the same meaning with BCS4/5 but with a larger maximum aggregated CBW. Since RAN2 has reserved 32 bits BCS for us, we can reuse these capability elements as soon as possible instead of introducing new capabilities for this concern case. |

## 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.*

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

### CRs/TPs

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

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **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)

# Topic #2: Improvements to MSD table

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2204053 | CHTTL | **Proposal 1: When considering MSD table improvement for the harmonic or cross-band isolation (>ACLR2), two MSD requirements for a given MSD type and a given band combination can be considered at least, one for the minimum victim downlink channel bandwidth and the other for the largest victim downlink channel bandwidth.** |
| R4-2205280 | Huawei, HiSilicon | **Observation 1: the WF guideline can be applicable to ENDC band combinations from R17, since the impact on ENDC combos for R17 is limited based on the summary above.**  **Proposal 1: More than one MSD test point can be introduced for a given band combination based on the reasonable judgement, but the maximum number of MSD test point can be five and it’s allowed to test only one configuration.**  **Proposal 2: The MSD test point for CA\_n18-n28 is proposed as below.**   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **X band interference source** | | **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** | | n18 | n28 | 822.5 | 15 | 15 | 18 (RBstart=0) | 785.5 | 5 | 2.6 | >ACLR2 |   **Proposal 3: the MSD test point for CA\_n1-n3 and CA\_n1-n40 due to the “ACLR1/ACLR2” interference is proposed as below.**   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **X band interference source** | | **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** | | n1 | n3 | 1945 | 50 | 15 | 270 (RBstart=0) | 1877.5 | 5 | 22.5 | ACLR1/2 | | n40 | n1 | 2340 | 80 | 30 | 270 (RBstart=0) | 2167.5 | 5 | TBD | ACLR1/2 |   **Proposal 4: To use the same format for both Tx harmonic interference table and Rx harmonic mixing table.**  **Proposal 5: Option 2 can be used as the format of MSD table due to harmonics.**  **Option 2:**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** | | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** | | nX | nY | 5 | 15 | 25 (RBstart=0) | 10 | 23.5 | Note1 | UL2/DL1 | | Note 1: The requirements should be verified for UL EARFCN or NR ARFCN of the aggressor (lower) band (superscript LB) such that in MHz and  with carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the lower band. | | | | | | | | | |
| R4-2206142 | Skyworks Solutions Inc. | **Proposal 1: Introduce simplifications to NR-CA MSD tables due to Cross-band isolation and due to Harmonics (UL or Rx harmonic mixing) in Release 17. Companies are encouraged to bring CRs at next meeting once the number of test points per type of MSD is agreed at this meeting.**  **Proposal 2: For MSD due to cross-band isolation, keep 1 test point per NR-CA combination, and optionally, on a case-by-case basis, evaluate the necessity to retain one additional test point to account for C-IM interference. The guidelines for configuring both the UL band and the DL affected band carrier configurations can be found in WF [2] and in agenda item 9.6.1 at this meeting. A generic table format is proposed in Table 1 below.**  Table 1: Proposal to simplify MSD tables due to Cross-band isolation for NR-CA.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **X band interference source** | | **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** | | nX | nY | Fc,UL,X | CBWX | SCSx | LCRB,X1 RBstart,X1 | Fc,DL,Y | CBWY | [TBD] | >ACLR(1 or 2) | | nX | nY | Fc,UL,X | CBWX | SCSx | LCRB,x2 RBstart,X2 | Fc,DL,Y | CBWY | [TBD] | C-IM (optional) |   **Proposal 3: For MSD due to harmonic interference, keep 1 test point per NR-CA combination for direct harmonic hit, and 1 test point for near miss cases based on WF [1] option 1 table format as shown in Table 2 below**  Table 2: Proposal to simplify MSD tables due to harmonic interference for NR-CA.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **UL/DL harmonic order** | | **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** | | nX | nY | TBD | 5 | 15 | 25 (RBstart=0) | TBD | 5 | 23.5 | UL2/DL1 | |
| R4-2205282 | Huawei, HiSilicon | **Summary of change:**  **1. To replace the MSD test configurations by using new format table for CA\_n3-n74/CA\_18-n28/CA\_n3-n34/CA\_n46-n78/CA\_n41-n77.**  **2. To specify the MSD for CA\_n1-n3 and CA\_n1-n40 due to the “ACLR1/ACLR2” interference.** |

## Open issues summary

### Sub-topic 2-1

*Sub-topic description: Based on the approved WF R4-2202287, companies provided their views on the open issues in this meeting. We’d like to discuss them and make some progress in this meeting.*

*Open issues and candidate options before e-meeting:*

**Issue 2-1-1: How many test points should be restricted for a given MSD type and a given band combination?**

* Proposals
  + Option 1: When considering MSD table improvement for the harmonic or cross-band isolation (>ACLR2), two MSD requirements for a given MSD type and a given band combination can be considered at least, one for the minimum victim downlink channel bandwidth and the other for the largest victim downlink channel bandwidth.
  + Option 2: More than one MSD test point can be introduced for a given band combination based on the reasonable judgement, but the maximum number of MSD test point can be five and it’s allowed to test only one configuration.
  + Option 3:
    - For MSD due to cross-band isolation, keep 1 test point per NR-CA combination, and optionally, on a case-by-case basis, evaluate the necessity to retain one additional test point to account for C-IM interference.
    - For MSD due to harmonic interference, keep 1 test point per NR-CA combination for direct harmonic hit, and 1 test point for near miss cases
  + Option 4: Others
* Recommended WF
  + TBA

**Issue 2-1-2: The general table format for MSD due to cross band isolation is proposed as below.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **X band interference source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| nX | nY | Fc,UL,X | CBWX | SCSx | LCRB,X1 RBstart,X1 | Fc,DL,Y | CBWY | [TBD] | >ACLR(1 or 2) |
| nX | nY | Fc,UL,X | CBWX | SCSx | LCRB,x2 RBstart,X2 | Fc,DL,Y | CBWY | [TBD] | C-IM (optional) |

* Proposals
  + Option 1: Yes, it’s similar to what we have agreed in WF R4-2202287.
  + Option 2: Others
* Recommended WF
  + TBA

**Issue 2-1-3: Further discuss on candidate options for the format of MSD table due to harmonics.**

* Proposals
  + Option 1:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **UL/DL harmonic order** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| nX | nY | TBD | 5 | 15 | 25 (RBstart=0) | TBD | 5 | 23.5 | UL2/DL1 |
|  | | | | | | | | | |

* + Option 2:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| nX | nY | 5 | 15 | 25 (RBstart=0) | 10 | 23.5 | Note1 | UL2/DL1 |
| Note 1: The requirements should be verified for UL EARFCN or NR ARFCN of the aggressor (lower) band (superscript LB) such that in MHz and  with carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the lower band. | | | | | | | | |

* Recommended WF
  + TBA

**Issue 2-1-4: Discuss whether the same table format can be used for both Tx harmonic interference table and Rx harmonic mixing table**

* Proposals
  + Option 1: Yes, the same table format can be used.
  + Option 2: No, it should be discussed separately.
* Recommended WF
  + TBA

### Sub-topic 2-2

*Sub-topic description: The specific MSD values and configurations should be discussed for some band combinations.*

*Open issues and candidate options before e-meeting:*

**Issue 2-2-1: MSD due to cross-band isolation (>ACLR2) for CA\_n18-n28**

* Proposals
  + Option 1: The proposed MSD test point:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **X band interference source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n18 | n28 | 822.5 | 15 | 15 | 18 (RBstart=0) | 785.5 | 5 | 2.6 | >ACLR2 |

* + Option 2: Others.
* Recommended WF
  + TBA

**Issue 2-2-2: MSD due to cross-band isolation (ACLR1) for CA\_n1-n3**

* Proposals
  + Option 1: The proposed MSD test point:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **X band interference source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n1 | n3 | 1945 | 50 | 15 | 270 (RBstart=0) | 1877.5 | 5 | 22.5 | ACLR1/2 |

* + Option 2: Others.
* Recommended WF
  + TBA

**Issue 2-2-3: MSD due to cross-band isolation (ACLR2) for CA\_n1-n40**

* Proposals
  + Option 1: The proposed MSD test point:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **X band interference source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n40 | n1 | 2340 | 80 | 30 | 270 (RBstart=0) | 2167.5 | 5 | TBD | ACLR1/2 |

* + Option 2: Others.
* Recommended WF
  + TBA

### Sub-topic 2-3

*Sub-topic description: Based on the approved WF R4-2202287, there is an open issue that how to implement these changes. And in this meeting, company proposed to introduce simplifications to NR-CA MSD tables due to Cross-band isolation and due to Harmonics (UL or Rx harmonic mixing) in Release 17 and companies are encouraged to bring CRs at next meeting. In this topic, we need to discuss this topic.*

**Issue 2-3-1: Discuss how to introduce simplifications to NR-CA MSD tables due to Cross-band isolation and due to Harmonics (UL or Rx harmonic mixing) in Release 17 once the table format and the number of test points per type of MSD is agreed**

* Proposals
  + Option 1: Introduce simplifications to NR-CA MSD tables due to Cross-band isolation and due to Harmonics (UL or Rx harmonic mixing) in Release 17. Companies are encouraged to bring CRs at next meeting once the number of test points per type of MSD is agreed at this meeting.
  + Option 2: Other specific suggestions.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | **Issue 2-1-1:**  We think option 1 is reasonable. For Option 2, what’s the reason for maximum 5 number MSD test points?  In addition, if the new channel bandwidths, expecially the new CBW> existing max.CBW, or new CBW< existing min. CBW, then does it mean the MSD test point would be revised accordingly?  **Issue 2-1-2 and 2-1-3:**  How the template reflect the test point as discussed in issue 2-1-1 of more than 1 MSD test point are adopted?  **Issue 2-1-4:**  Option 2: No, it should be discussed separately.  We don’t think the simplification/template we discuss here is going to change the structure of the MSD type, that is in current specficiation, different tables are used for harmonic, Rx harmonic mixing, cross-band isolation MSD. |
| Qualcomm | **Issue 2-1-1:**  Option 3.  **Issue 2-1-2:**  Option 1.  **Issue 2-1-3:**  Option 1 without the footnotes.  **Issue 2-1-4:**  Option 2. |
| Huawei | **Issue 2-1-1:**  Seems that we didn’t see the difference between option 1 and option 3. If companies have concerns on option 2, we are OK to go with option 3.  **Issue 2-1-2:**  Option 1. To ZTE, it’s just like what we do in Table 7.3A.2.2-1 from TS 38.101. Different rows can be used to specify more than one MSD test points.  **Issue 2-1-3:**  Option 1.  **Issue 2-1-4:**  Option 1. Generally, the same table format can be reused by both Tx and Rx harmonic MSD. |

Sub topic 2-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | **Issue 2-2-1/ Issue 2-2-2**  We think the two issues are related to issue 2-1-1.  In addtion, for **issue 2-2-2:**  Currently, the cross band isolation MSD for band n1-n3 are defined as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR Band / Channel bandwidth of the affected DL band | | | | | | | | | | | | | | | | UL band | DL band | 5 MHz (dB) | 10 MHz (dB) | 15 MHz (dB) | 20 MHz (dB) | 25 MHz (dB) | 30 MHz (dB) | 40 MHz (dB) | 50 MHz (dB) | 60 MHz (dB) | 70  MHz  (dB) | 80 MHz (dB) | 90 MHz (dB) | 100 MHz (dB) | | n1 | n3 | 3 | 2.2 | 1.9 | 1.7 | 1.6 | 1.5 | 1.4 |  |  |  |  |  |  |   However, 22.5dB MSD was proposed in Option 1, it is ~7x larger. What’s the reason? |
| MediaTek | Shall CA\_n18-n28 be removed since it’s being discussed in thread [109]? |
| Qualcomm | **Issue 2-2-1**  CA\_n18-n28 is being discussed in thread [109]. Also, where did 2.6dB MSD come from? For DL in lower sub block of n28A, the MSD is 4.5dB for 18RBs configured in the UL of band n18. For the upper sub-block n28B, MSD = 31dB for 18RBs.  **Issue 2-2-2**  2 Test points could be considered.  As per our contribution in [R4-2117294](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_101-e/Docs/R4-2117294.zip), CA\_n1-n3 MSD is 23.7dB for full UL configuration.  As per 38.101-3 (DC\_1\_n3), use MSD=17dB for maximum UL bandwidth and limited UL configuration.  **Issue 2-2-3**  2 Test points could be considered.  As per our contribution in [R4-2117294](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_101-e/Docs/R4-2117294.zip), CA\_n1-n40 MSD is 32.7dB for full UL configuration.  As per 38.101-3 (DC\_1\_n40), use MSD=21.5dB for maximum UL bandwidth and limited UL configuration. |
| Huawei | **Issue 2-2-1**  I’m OK to follow the outcome in thread [109].  **Issue 2-2-2**  To ZTE, just BCS0 is considered for current MSD requirements for CA\_n1-n3. For BCS1, band n1 can support 50MHz, so the 1st adjacent channel of band n1 may have an impact on band n3 Rx. That’s why we need so larger MSD.  To Qualcomm, two test points can be considered.  **Issue 2-2-3**  To Qualcomm, two test points can be considered. |

Sub topic 2-3

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Still, it is unclear to us how to treat the running TPs/draft CR. Obviousely, it is not easy to convert the tables using the new MSD test point. It seems it would confict with the basket WID work. We need to come up with method to avoid the conflicts first. |
| Qualcomm | The top priority is to make sure the UL configuration and previous MSD values have not changed or at least the same test point be used in the new format. |
| Huawei | To ZTE and Qualcomm, since we have agreed to evolve MSD table smoothly and the MSD requirements for R16 and R15 band combinations can’t be changed right now, we have to use different table format for the MSD. For R15 and R16 band combinations, the original table should be used. For R17 forward band combination, new format table can be used. For basket WIs, since the TP template has been agreed in Rel-17, there is no need to convert it right now. The new table format can be used in R18 for basket WIs.  Step 1: At least, in this meeting, we can specify the new table format with some exemplary R17 band combinations.  Step 2: In May meeting, we can convert all other R17 band combinations into the new table format.  Step 3: As for when we can convert other R15/R16 band combinations into the new table format and use a unified table for a certain kind of MSD, it can be discussed in R18. |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2205282 | ZTE: What’s the relationship between the new added table and the existing table? Shouldn’t only keep the new added table? |
| Qualcomm: It looks strange having 2 different formatted crossband noise tables. The top priority is to make sure the MSD values are correct. |
| To ZTE and Qualcomm, since we have agreed to evolve MSD table smoothly and the MSD requirements for R16 and R15 band combinations can’t be changed right now, we have to use different table format for the MSD. For R15 and R16 band combinations, the existing table should be used. For R17 forward band combination, new format table can be used. For basket WIs, since the TP template has been agreed in Rel-17, there is no need to convert it right now. The new table format can be used in R18 for basket WIs.  Step 1: At least, in this meeting, we can specify the new table format with some exemplary R17 band combinations.  Step 2: In May meeting, we can convert all other R17 band combinations into the new table format.  Step 3: As for when we can convert other R15/R16 band combinations into the new table format and use a unified table for a certain kind of MSD, it can be discussed in R18. |

## 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.*

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

### CRs/TPs

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

|  |  |
| --- | --- |
| **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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: Discussion on CRs

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2203997 | ZTE Corporation | **Reason:**  BCS4/5 are allowed to be applied to new band combinations in RAN4 which indicate UE to support up to all of the channel bandwidths for the band in the band combination. BCS4 is release independent from Rel-15 while BCS5 is functionally equivalent to BCS4 except that the new Rel-17 signalling such as the limitation to the supporting channel bandwidth in each band within the band combination would apply. Note that the CRs for introduction of BCS4 and BCS5 have been agreed in RAN2 and RAN4, in order to capture the agreements related to the release independence for BCS4/5, a common text is suggested to be added for the configurations of NR-CA, NR-DC and SUL.  **Summary:**  Add a common text to clause 4 for NR-CA, NR-DC and SUL configurations to indicate the release independence of BCS4 and BCS5. |
| R4-2205281 | Huawei, HiSilicon | **Reason:**  In RAN4#101e meeting, RAN4 has agreed that BCS5 can’t be release independent from R15 from RAN4 perspective. Thus, the release independent method for BCS4 and BCS5 can be introduced.  Since BCS4/BCS5 is not applicable to intra-band ENDC, a clarification in clause 4 for general part may cause some amibiguity about applicability.  It’s better to clarify it in each sub-clause.  **Summary:**  Adds a note for NR-CA, NR-DC and SUL to indicate that configurations with BCSs other than BCS5 are release independent from Rel-15. However, configurations with BCS5 are Release independent from Rel-17. |
| R4-2205283 | Huawei, HiSilicon | **Reason:**  Since 70MHz for band n40 and 10/20/30/70/90 for band n79 were introduced into the spec, the MSD requirements for missing bandwidths should be introduced based on the latest WID revision Rp-213140.  The corresponding draft CR R4-2201253 has been endorsed in RAN4#101bis-e meeting.  **Summary:**  To introduce 10/20/30/70/90 MHz MSD due harmonic for DC\_8\_n79.  To introduce 70 MHz MSD due cross band isolation for DC\_1\_n40.  To introduce 70 MHz MSD due cross band isolation for DC\_7\_n40 |
|  |  |  |
|  |  |  |

## Companies views’ collection for 1st round

### CRs/TPs comments collection

*Companies can comment the CR directly.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2203997  VS  R4-2205281 | Qualcomm: support to have a general text to descript the BCS4/5 in TS38.307., i.e., R4-2203997. In addition, it depends on the discission in Topic#1.  ZTE2: During the discussion in last meeting, some companies raised their concerns if duplicated text is needed in multiple tables. Based on companies’ feedback, we move the content to common part in section 4. Regarding to the concern in Huawei’s CR R4-2205281, we suggest to add a wording to mention that BCS4/BCS5 is not applicable to intra-band EN-DC. Thus the note in common part will be simpler and without ambiguity. The suggested common text could be as follows:  “Configurations with BCSs other than BCS5 are release independent from Rel-15, where the BCSs for configurations are defined in TS 38.101-1 [2] and/or TS 38.101-3 [4]. Configurations with BCS5 are release independent from Rel-17, and BCS5 with signalling is allowed for early implementation from Rel-15. Note that BCS4/BCS5 is not applicable to intra-band EN-DC configurations.”  Huawei: OK with ZTE’s revision. |
| Company B |
|  |
| R4-2205283 |  |
|  |
|  |
|  |

## 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.*

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

### CRs/TPs

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

|  |  |
| --- | --- |
| **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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2203997 | CR to TS 38.307 on Release independence of BCS4 and BCS5 | ZTE Corporation |  |  |
| R4-2204053 | Discussion on the number of test points for the MSD table improvement | CHTTL |  |  |
| R4-2204486 | Max aggregated CBW for BCS4/5 | Nokia, Nokia Shanghai Bell |  |  |
| R4-2204509 | Discussion on maximum aggregated channel bandwidth for BCS4/5 | Qualcomm Incorporated |  |  |
| R4-2205117 | Discussion on the maximum aggregated bandwidth of intra-band CA for BCS4/5 | Xiaomi |  |  |
| R4-2205118 | TP for TR 38.862 to correct the maximum aggregated bandwidth for intra-band C CA with BCS4/BCS5 | Xiaomi |  |  |
| R4-2205280 | Discussion on simplifying extended MSD table | Huawei, HiSilicon |  |  |
| R4-2205281 | CR for 38.307 to introduce release independent method for BCS4/5 | Huawei, HiSilicon |  |  |
| R4-2205282 | Draft CR for 38.101-1 to introduce new tables for MSD due to cross band isolation | Huawei, HiSilicon |  |  |
| R4-2206142 | MSD Tables Simplification Proposal for BCS4 | Skyworks Solutions Inc. |  |  |
| R4-2205283 | CR for 38.101-3 to introduce MSD requirements for missing bandwidths. | Huawei, HiSilicon |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Huawei | Peng (Henry) Zhang | zhangpeng169@Huawei.com |
| Qualcomm | Bin Han | binhan@qti.qualcomm.com |
| MediaTek | Huanren | huanren.fu@mediatek.com |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)