**3GPP TSG-RAN WG4 Meeting # 100-e R4-211XXXX**

**Electronic Meeting, 16th – 27th August, 2021**

**Agenda item:** 8.33

**Source:** Dominique Brunel (Skyworks)

**Title:** Email discussion summary for [100-e][112] NR\_Baskets\_Part\_1 Round 1

**Document for:** Information

# Introduction

Email discussion for contributions submitted under agenda item 8.6 Issues arising from basket WIs but not subject to block approval, and additional documents submitted to NR band combination baskets that require discussion.

List of candidate target of email discussion for 1st round and 2nd round

* 1st round: Discussion and potential and approval of CRs. Proposals for way forward.
* 2nd round: Finalization of CRs and way forwards.

Topics:

1. LB-LB-LB and LB-LB combinations
2. Improved MSD study
3. Band combinations corrections for FR1 and FR2
4. NR-U contiguous UL CA
5. NR intra-band UL CA

V02: addition of n5B MSD paper, addition of one “low MSD” paper

# Topic #1: LB-LB-LB and LB-LB combinations and IMD due to intra-band UL CA

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2111731**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111731.zip)  DC\_8A\_20A\_n28A MSD | Qualcomm Incorporated | based on 3LB antenna architecture. **Proposal 1: Use 23.5dB MSD as shown in Table 1.** |
| [**R4-2112018**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112018.zip)  Further discussion on MSD due to UL IMD for DC\_8A-20A\_n28A | MediaTek Inc | based on 3LB antenna architecture, **MSD (5MHz BW) 23.7 dB"** |
| [**R4-2113404**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113404.zip)  Discussion on DC\_8A-20A\_n28A | Huawei, HiSilicon | based on 3LB antenna architecture, **MSD B8 (5MHz BW) 14.8 dB** |
| [**R4-2113405**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113405.zip)  TP for TR 37.717-21-11: DC\_8A-20A\_n28A | Huawei, HiSilicon | Moderator comment: can revise and co-author the TP based on agreements between companies |
| [**R4-2114582**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114582.zip)  DC\_8-20\_n28 and other LB-LB-LB RF-FE challenges | Skyworks Solutions Inc. | **Proposal: Consider restriction of DC\_8-20\_n28 operation to FWA form factor devices only. FFS which of architecture #1 or architecture #2 provides the best complexity / performance trade-off and completion of B8 MSD due to IMD3.**  Observation 4: Further clarification is needed for requested operation of CA\_n5-n8-n28, in particular how n5 Rx band overlap with n8 Tx band can be resolved. |
| [**R4-2113344**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113344.zip)  Discussion on UE RF requirements for DC\_20-38\_n8 | VODAFONE Group Plc | **No additional MSD required for 2nd order harmonic hit on band 38 compared to CA\_8A-20A-38A in 36101.**  Need input on IMD3 hit on band 38 from DC\_20\_n8 UL. IMD5 hits on bands 8 and n38 require no additional MSD compared to DC\_8\_n41.  Need input on band 20 IMD3 hit from DC\_38\_n8 UL. |
| [**R4-2112017**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112017.zip) Further discussion on MSD due to IMD5 for CA\_n41C-n66A | MediaTek Inc. | **Moderator: adding missed contribution**  **Propose to revise MSD for separate antenna at [32.5]** |

## Open issues summary

### Sub-topic 1-1

**Issue 1-1a: DC\_8A-20A\_n28A IMD3 related B8 MSD**

* Proposals
  + Qualcomm (R4-2111731) and MediaTek (R4-2112018): 23.5/23.7dB respectively
  + Huawei (R4-2113404): 14.8dB
* Recommended WF
  + Two companies have very close values
  + Agree on assumptions and MSD value

**Issue 1-1b: DC\_8A-20A\_n28A restriction to FWA and valid architectures (R4-2114582)**

* Proposals:
  + Consider restriction of DC\_8-20\_n28 operation to FWA form factor devices only
  + Which architecture to specify: 3 low band antenna only or 2 LB antenna also?
* Recommended WF
  + Agree on how to capture restriction to FWA and/or architecture assumptions

### Sub-topic 1-2

**Issue 1-2: CA\_n5-n8-n28 (R4-2114582)**

* Proposals: Clarify operation of CA\_n5-n8-n28, in particular how n5 Rx band overlap with n8 Tx
* Recommended WF
  + Proponent to provide input

### Sub-topic 1-3

**Issue 1-3: CA\_DC\_20-38\_n8 (R4-2113344)**

* Proposals:
  + No additional MSD required for 2nd order harmonic hit on band 38 compared to CA\_8A-20A-38A in 36101.
* Recommended WF
  + Agree on H2 MSD
  + Encourage companies to provide input on IMD3 MSD to B38 and B20 for WF/TP

### Sub-topic 1-4

**Issue 1-4: CA\_n41C-n66A (R4-2112017)**

* Proposals:
  + Change IMD5 MSD to [32.5] dB
  + Keep existing value
* Recommended WF
  + Companies to provide input on proposal

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1

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| --- | --- |
| **Company** | **Comments** |
| Skyworks | **Issue 1-a**: MSD values are very close, could agree to either.  R4-2112018: question for clarification: Is block diagram meant to represent quadplexing of B8 and B20?  R4-2113404: question for clarification: in Table 3, is -73.47 dBm the combined REFSENS due to IMD3 ? In which case, the level is very close to R4-2111731 and to R4-2112018 and so the MSD should also be very close to 23.5dB.  **Issue 1-b:**   * Restriction to FWA-like large form factor for DC\_8-20\_n28 operation * For FWA large form factor, penta-plexer may be realizable and should be further studied to evaluate the performance of each architecture. |
| Huawei | **Issue 1-a**: To Skyworks, -73.47 dBm is the total interference for main path or diversity path. Considering MRC gain, 20dB MSD can be considered.  Issue 1-b: Not sure whether it’s meaningful to restrict the FWA-like large form factor for DC\_8-20\_n28 in RAN4’s spec since all the band combination can be reported by UE capability without implementation restriction. |
| MediaTek | **Issue 1-a**: To Skyworks, yes, the block diagram was using Quadplexer of B8 and B20.  **Issue 1-b:** Not sure the restriction for FWA device is needed. Three LB antennas is possible for larger form factor devices such as > 6-inch screen smart phone. For < 6-inch screen devices, agree with observations in R4-2114582. |

Sub topic 1-2

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| **Company** | **Comments** |
| XXX |  |

Sub topic 1-3

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| **Company** | **Comments** |
| Skyworks | **Issue 1-3: CA\_****DC\_20-38\_n8 (R4-2113344)**  For B38 MSD due to B20 Tx harmonics. There is a typo in TP as the harmonic order is not H2 but H3. The B38 MSD due to B20 H3 is already captured for DC\_20\_n38 in 38.101-3. So, this MSD does not need to be specified.  MSD analysis can be presented at next meeting for IMD3 related MSDs of B38 and B20. |
| Huawei | **Issue 1-3: CA\_DC\_20-38\_n8 (R4-2113344)**  The MSD due to IMD for DC\_7A-20A\_n8A in Table 7.3B.2.3.5.2-1 can be reused for DC\_20-38\_n8. |

Sub topic 1-4

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| **Company** | **Comments** |
| MediaTek | As discussion in our contribution, RAN4 spec need to accommodate different implementation. We suggest change IMD5 MSD to [32.5] dB |

### CRs/TPs comments collection

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

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2113405**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113405.zip)  TP for TR 37.717-21-11: DC\_8A-20A\_n28A | Moderator input: review in round 1 for structure/text, will be used in Rd2 to collect agreements on MSD and FWA/architecture restrictions |
| Skyworks: In addition to REFSENS proposals of sub-topic 1-1, restriction of operation to FWA-like large form factor needs to be captured in TP for TR. |
| MediaTek: Antenna design and device form factor are implementation dependent. Agree with Skyworks that such consideration need to be captured in the TP for TR. |

## 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 #1.1** | *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: Improved MSD Study

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112381**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112381.zip)  Views on defining “low MSD” for CA and DC | Apple | Observation 1: It would not be uncommon to observe a randomly selected phone to have a substantially better performance than the specified MSD requirement under typical condition as the 3GPP MSD requirement would be at the tail end of the statistical distribution.  Observation 2: To reduce MSD caused by Tx 2nd order harmonic to below 10 dB, the antenna isolation needs to be better than 20 dB in conjunction with PCB isolation higher than 85 dB.  Observation 3: MSD in the range of 20 to 30 dB does not only appear in certain CA or DC combinations. In some FDD bands, such as n8 and n71, the desensitization level can very well be above 20 dB for wider channel BW.  Observation 4: With defining two sets of MSD requirements and only a subset of UEs is expected to support the optional set, the performance gain for the network is uncertain.  Observation 5: Maintaining one set of requirements with practical MSD improvement would motivate UE vendors to tighten but not outstretch their device performance which could potentially provide better overall link performance and shall benefit the entire cellular network ecosystem in the long run.  **Proposal 1: Further clarifications are needed on how network would handle UE differently before the consideration of UE capability introduction.**  **Proposal 2: Keep one set of MSD requirements and specify MSD with practical device performance improvement for the new combinations going forward.** |
| [**R4-2112572**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112572.zip)  Discussion on low MSD feasibility | Samsung | Observation 1: CA and DC between band 2/3 (1.8/1.9GHz) and 77/78 (3.5GHz) is a possible candidate as example band combinations which addresses MSD due to both harmonic and IMD. **Proposal 1: low MSD feasibility should be confirmed by both conductive measurement and radiative measurement.** |
| [**R4-2112587**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112587.zip)  Views on Low MSD indicator for IMD | SoftBank Corp. | [Observation-1] A NodeB is expected to utilize the low MSD indicator for scheduling RB combination under high MSD, with controlling Tx powers of 2UL. Otherwise, the low MSD indicator would be meaningless. [Observation-2] Better coupling loss could be archived for some combos. [Observation-3] The impedance matching/PA gain at an aggressor frequency would be worse. [Observation-4] The MSD fluctuations discussed here might differ implementation by implementation and hard to estimate during standardization process or minimum requirement context. [Observation-5] It looks pragmatic to define “low MSD” as a UE capability. [Observation-6] Having said that, as an operator, we will highly appreciate any efforts seeking for MSD improvement. |
| [**R4-2113015**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113015.zip) Discussion on "Low MSD" for CA and DC | vivo | **Proposal: Though already feasible to have significant MSD improvement for some type of interference in certain band combination, it is still not that feasible to specify general “low MSD” requirements for large number of CA and DC band combinations.** |
| [**R4-2114223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114223.zip)  Signaling low MSD for CA and DC combinations | Qualcomm Incorporated | **Proposal: “Low MSD” is specified as [6] dB for those band combinations where the current MSD is 10 dB or higher and [0] dB for those band combinations where the current MSD is below 10 dB. Proposal: Low MSD capability signaling is per band combination.** |
| [**R4-2114567**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114567.zip)  Discussion on the feasibility of MSD improvement | Huawei, HiSilicon | **Proposal 1: RAN4 needs to further clarify and agree on the scope and methodology of the study.** |
| [**R4-2114570**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114570.zip) Discussion on defining ”low MSD” for NR CA and DC band combinations | CHTTL | In general, based on the discussion above, we think **defining “low MSD” with an additional optional per band combination capability is feasible, and whether per MSD type is also needed under per band combination can be further discussed.** |
| [**R4-2114578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114578.zip)  Selection Criteria for CA/DC candidates eligible to improved MSD | Skyworks Solutions Inc. | **Proposal: To reduce workload associated with possible MSD improvements studies, CA or DC combinations should at least fulfil the following conditions. Only consider CA/DC combinations for which: - MSD exceeds 20dB and impacts an operator real-world deployment configuration, - MSD is dominated by PCB isolation or harmonic rejection. Any text proposal that proposes an improved MSD should not be subject to the automatic basket approval process.** Observation 2: A technical report capturing the improved MSD levels for eligible CA/DC candidates may be sufficient to address the concerns raised on the topic “low MSD” for CA and DC. |
| [**R4-2113906**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113906.zip)  R17 MSD improvement | OPPO | Observation 1: MSD reporting is meaningful only if the improvement is large, otherwise, doesn’t change status in the field.  Observation 2: No officially defined component values in MSD calculation, and improve the MSD by review the component performance might not be easy.  Observation 3: If 1:1 gain can be derived from PCB isolation improvement, then the discussion can focus on how much PCB isolation can be achieve in commercial UE design.  **Proposal 1: It is proposed to review the PCB isolation that commercial UEs can achieve by measurements or other justifications.**  **Proposal 2: It is proposed to agree on how much MSD improvements could be considered as meaningful improvement and deserve the MSD reporting.** |

## Open issues summary

Moderator input: In general it seems that better common understanding about the scope, the definition and operation of ”low MSD” and/or its associated capability is needed to progress in the topic before entering in the ”low MSD” numbers.

In round one these needs to be clarified and agreed. Only after that need and definition of capability is discussed

### Sub-topic 2-1

**Issue 2-1: Scope of “low/improved” MSD**

* Proposals (moderator input, based on the different proposals but enlarged to look at the entire scope)
  + Only CA/DC
  + PC3 and/or PC2
  + “low MSD” should be applicable/confirmed for both conducted and radiated measurements
  + Harmonics, harmonic mixing, IMD, triple beat, cross band related
  + Only MSD above 20dB corresponding to real world deployment dominated by PCB isolation or harmonic rejection
  + Only large (meaningful) MSD improvement should be considered based on improved PCB isolation assessment
  + Only new combinations
  + Any combination with a default “low MSD” value depending on the reference MSD
  + Any other input on scope
* Recommended WF
  + Companies provide their view on their preferred approach in round1 in view of a WF in round 2
  + Specific feedback on values and/or threshold proposed is welcomed but can be captured in 2-5

### Sub-topic 2-2

**Issue 2-1: Specification of “low/improved” MSD**

* Proposals (moderator input, list based on the different proposals)
  + Keep one set of MSD requirements and specify MSD with practical device performance improvement for the new combinations going forward.
  + Technical report capturing the improved MSD levels for eligible CA/DC candidates
  + A default “low MSD” is defined versus an MSD threshold
  + Any other input on how to specify
* Recommended WF
  + Companies provide their view on their preferred approach in round1 in view of a WF in round 2

### Sub-topic 2-3

**Issue 2-3a: Network use of “low MSD”**

* Aspects to be clarified (moderator input, list based on the different documents)
  + Will the network use the indication to enabled scheduler restrictions
    - For allocations for “reference MSD” UEs
    - To restrict the use of combinations to For allocations for “reference MSD” UEs
    - Any other input on how “reference MSD” and “low MSD” UEs will be treated by the network
  + Is the indication useful if only a limited set of UEs support the improved MSD
  + Is the indication useful if only a majority of UEs support the improved MSD
  + NodeB is expected to utilize the low MSD indicator for scheduling RB combination under high MSD, with controlling Tx powers of 2UL
  + Any other input on how the network will operate the two types of UEs
* Recommended WF
  + Companies provide their view on how the network deals with “low MSD” and “reference MSD” UEs in round1 in view of a WF in round 2

**Issue 2-3b: Signalling of “low MSD”**

* Proposals (moderator input, list based on the different proposals)
  + Signalling is not needed:
    - Good UEs will perform well in network
    - Risk of excluding “nominal” UEs even below max power or any allocations
  + If defined, signalling is:
    - per band combination
    - if needed also per MSD type
  + Signalling is based on:
    - Default MSD value versus reference MSD threshold
  + Any other signalling related input
* Recommended WF
  + Companies provide their view on need and definition of signalling including specific criteria in round1 in view of a WF in round 2

### Sub-topic 2-4

**Issue 2-4: Candidates for study**

* Proposals (moderator input, list based on the different proposals)
  + CA and DC between band 2/3 (1.8/1.9GHz) and 77/78 (3.5GHz)
  + Any other
* Recommended WF
  + Companies provide their view but it may be better to have fully agreed on the scope before picking one (or more) example case for the study

### Sub-topic 2-5

**Issue 2-4: Comments to documents**

* Recommended WF
  + Companies can provide their comments to documents in this topic by adding document number as headline

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1

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| **Company** | **Comments** |
| OPPO | **Issue 2-1: Scope of “low/improved” MSD**  Below can be considered.   * + Only CA/DC   + PC3 and/or PC2   + “low MSD” should be applicable/confirmed for both conducted and radiated measurements   + Harmonics, harmonic mixing, IMD, triple beat, cross band related   + Only MSD above 20dB corresponding to real world deployment dominated by PCB isolation or harmonic rejection   + Only large (meaningful) MSD improvement should be considered based on improved PCB isolation assessment   + Only new combinations |
| Skyworks | **Issue 2-1: Scope of “low/improved” MSD**   * + Only MSD above 20dB corresponding to real world deployment dominated by PCB isolation or harmonic rejection   + Only large (meaningful) MSD improvement should be considered based on improved PCB isolation assessment. |
| Nokia | * “low MSD” should be applicable/confirmed for both conducted and radiated measurements   🡪”radiated measurements” should be out of scope unless 3gpp has the MSD requirements for NOT low MSD based on radiated measurements.   * Only MSD above 20dB corresponding to real world deployment dominated by PCB isolation or harmonic rejection   🡪we don’t think that we need to limit the scope of MSD > 20 dB. As far as we can establish the mechanism of signalling lower MSD values, the information shall be allowed to be reported. For instance, if a band combination with current specified MSD of 10dB can has 0 MSD, it must be allowed to be reported to a network.   * Only large (meaningful) MSD improvement should be considered based on improved PCB isolation assessment   🡪we don’t think this limitation is necessary. We have not proposed to re-evaluate MSD, rather to introduce signalling mechanism to allow UE to different MSD values better than the specified ones.   * Only new combinations   🡪No need this limitation.   * Any combination with a default “low MSD” value depending on the reference MSD   🡪again, we have not proposed to re-valuate MSD for every band combination, but rather introduce signalling mechanism so that if a band combination has better MSD than the specified one, it is up to UE vendors if the UE reports lower MSD values to be considered by NW. UE can choose not to signal as capability, if it wants to do so. |
| Samsung | **Issue 2-1: Scope of “low/improved” MSD**  Following could be considered for “low/improved” MSD study:   * + Only CA/DC   + PC3 and/or PC2   + “low MSD” should be applicable/confirmed for both conducted and radiated measurements   + Harmonics, harmonic mixing, IMD, triple beat, cross band related   + Only MSD above 20dB corresponding to real world deployment dominated by PCB isolation or harmonic rejection   + Only large (meaningful) MSD improvement should be considered   But first of all, we would like low MSD proponents clarify on the practical measurement results. It was claimed only several dB MSD is observed in practical measurement for some practical UE, did those measurements performed in conductive or radiative way?  If radiated measurements is out of scope, how could we define a new capability to only indicate its conductive performance applying to radiative real network? so we think low MSD feasibility should also be based on radiative measurement, other than low MSD only observed in conductive test. |
| MediaTek | **Issue 2-1: Scope of “low/improved” MSD**   * + Only CA/DC   + PC3 and/or PC2   + Harmonics, harmonic mixing, IMD, triple beat, cross band related   For one CA/DC combination, all MSD mechanisms need to be considered together when characterizing MSD improvement.  Radiated measurement is out of scope since RAN4 only specify conductive MSD requirements |
| SoftBank | We share the similar views as Nokia, while we do not stop UE vendors’s re-evaluating some MSDs if they think feasible. |
| Xiaomi | **Issue 2-1: Scope of “low/improved” MSD**   * + “low MSD” should be applicable/confirmed for both conducted and radiated measurements   + Harmonics, harmonic mixing, IMD, triple beat, cross band related   + Only MSD above 20dB corresponding to real world deployment dominated by PCB isolation or harmonic rejection   + Only large (meaningful) MSD improvement should be considered based on improved PCB isolation assessment |
| vivo | First of all, we were not fully convinced the capability signalling, and the following is only views for every listed scope of “Low MSD”:   * + Only CA/DC   --This should be enough;   * + PC3 and/or PC2   --“and” is more reasonable   * + “low MSD” should be applicable/confirmed for both conducted and radiated measurements   --This is Theoretically attractive, since antenna coupling is also an important factor. However, considering the difficulties of testing and current situation, only conductive test seems possible;   * + Harmonics, harmonic mixing, IMD, triple beat, cross band related   --Since they are quite different, we do not suppose all of them can be covered.   * + Only MSD above 20dB corresponding to real world deployment dominated by PCB isolation or harmonic rejection   --This is the most typical scenario and we suppose it can be considered in the first stage, if we decide to consider.   * + Only large (meaningful) MSD improvement should be considered based on improved PCB isolation assessment   --This is similar to previous one, and can be considered in the first stage, if we decide to consider.   * + Only new combinations   --Only consider improved MSD for all new combinations may also be a way.   * + Any combination with a default “low MSD” value depending on the reference MSD   --Not clear the meaning of this. |
| CHTTL | We share the similar views as Nokia. |

Sub topic 2-2

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| **Company** | **Comments** |
| OPPO | **Issue 2-1: Specification of “low/improved” MSD**  Below can be considered. And in our understanding the MSD specified in spec should be the minimum requirements which is the target of RAN4 specification. Opening the door of specifying the requirements for better performance UE may have the risk of burdening RAN4 by more and more “better requirements” people claiming with the intention of classify good and bad UE even both can met RAN4 requirements which is not within RAN4 scope.   * + Keep one set of MSD requirements and specify MSD with practical device performance improvement for the new combinations going forward.   + Technical report capturing the improved MSD levels for eligible CA/DC candidates |
| Skyworks | **Issue 2-1: Specification of “low/improved” MSD**  As pointed out in our brief survey of the high number of CA MSD test points specified, and the hundreds of new MSDs introduced in basket approval process at every meeting, it is essential that before any discussion takes place, RAN 4 agrees on clear set of selection criteria to evaluate/re-evaluate “low MSD”. WF resulting from issue 2-1 is key to achieve this goal. Then eligible CA/DC candidates with improved/low MSD could be captured in a Technical report.   * Technical report capturing the improved MSD levels for eligible CA/DC candidates * Considering the high number of MSD test points, any text proposal that proposes an improved MSD should not be subject to the automatic basket approval process. |
| Nokia | None of the proposals. NW does not care how UE meets low MSD and/or what the practical device performance is and/or if new band combo or old band combo. We just specify MSD in a conventional manner for each band combination if any and that becomes reference. And we allow UE to indicate the delta between the specified MSD and the MSD the UE can meet. The granularity is FFS. |
| Samsung | **Issue 2-2: Specification of “low/improved” MSD**  If RAN4 confirms the feasibility of “low/improved” MSD, the following proposal is doable.   * + Technical report capturing the improved MSD levels for eligible CA/DC candidates   About “default MSD value versus reference MSD threshold”, RAN4 need firstly achieves consensus on whether introducing low MSD capability. |
| MediaTek | **Issue 2-1: Specification of “low/improved” MSD**   * Proposals (moderator input, list based on the different proposals)   + Keep one set of MSD requirements and specify MSD with practical device performance improvement for the new combinations going forward.   + Technical report capturing the improved MSD levels for eligible CA/DC candidates   RAN4 specify MSD in a conventional manner for each band combination. Any improved MSD requirements shall be optional. |
| SoftBank | We share the similar views as Nokia, while we do not stop UE vendors’s re-evaluating some MSDs if they think feasible. |
| Xiaomi | **Issue 2-1: Specification of “low/improved” MSD**   * + Technical report capturing the improved MSD levels for eligible CA/DC candidates   If RAN4 confirms the feasibility of “low/improved” MSD, the improved MSD shall be optional requirements |
| vivo | Our preferences are:   * Keep one set of MSD requirements and specify MSD with practical device performance improvement for the new combinations going forward. * Technical report capturing the improved MSD levels for eligible CA/DC candidates   As we have discussed, our first preference is keeping one set of MSD. If really consider the specification of “Low MSD”, the different types of interference scenario have to be considered to have a reasonable level of improvement. A single threshold for all cases seems simple and attractive, but things may not easy for different interference type. |
| CHTTL | We share the similar views as Nokia. |

Sub topic 2-3

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| --- | --- |
| **Company** | **Comments** |
| OPPO | **Issue 2-3a: Network use of “low MSD”**  MSD is only specified under the worst case in terms of Tx power, RB allocation, etc. And in the NW actually most of the time UE is under better conditions in which the MSD is much less than the RAN4 requirements. Current NW handling of MSD better to be clarified from NW vendors to better understand the situation in the real NW. And in our view the MSD should not be the only condition to determine a band combination could not be applied in the NW.  Besides, whether the introduction low MSD indication means large MSD UE will not be even scheduled in the NW also need to be clarified from the proponent of low MSD.  **Issue 2-3b: Signalling of “low MSD”**  MSD signalling is rely on the above issues, and how NW to use this low MSD indication. And the concern of excluding “nominal” UEs even below max power or any allocations is shared with the introduction of signalling here. If defined, per band combination is ok. |
| Skyworks | **Issue 2-3b: Signalling of “low MSD”**  Signalling is not needed:   * Good UEs will perform well in network even without the signalling capability. * Risk of excluding “nominal” UEs even below max power or any allocations – in particular how would network handle UEs that do not report the capability is unclear. |
| Nokia | Issue 2.3a:  How network uses the indication is implementation issue and not sure the intention of the questions. Why is the handling of band combinations with large MSD changed by the introduction of the capability? And a question of “Is the indication useful if only a limited set of UEs support the improved MSD” and “Is the indication useful if only a majority of UEs support the improved MSD” are not worth discussing. This is a chicken-and-egg debate. If we do this discussion, we have to do this for every single option for any features to be introduced in 3GPP.  Issue 2.3b  Not sure “Risk of excluding “nominal” UEs even below max power or any allocations”. This is not related to the discussion. We don’t know what reference MSD threshold mean in “Default MSD value versus reference MSD threshold”, but if it means delta from the default MSD, that is the way to signal. And the delta for harmonic/cross band isolation and IMD due to 2UL must be handled separately. |
| Samsung | **Issue 2-3a: Network use of “low MSD”**  All the aspects listed by moderator are meaningful to be clarified for further proceeding.  **Issue 2-3b: Signalling of “low MSD”**  Agree with OPPO that necessity of signalling rely on above issue. And if RAN4 confirms the low MSD feasibility and a low MSD would be anyway be derived, it is preferred to maintain reference MSD as minimum requirement unchanged. Low MSD should not replace previous minimum requirement on MSD, if so, signalling could be considered. |
| SoftBank | **For “Signalling is not needed”:**  We cannot understand the notion that “Good UEs will perform well in network” since, to identify a good UE in terms of 2UL IMD, it seems a gNB should attempt to schedule RBs causing IMD intentionally and see what’s happens. It turns out be a waste of network resource. Without the flag, is there a way to find the good UEs in terms of MSD from IMD or Hn? |
| Xiaomi | **Issue 2-3a: Network use of “low MSD”**  Besides the listed aspects shall be clarified, it is better to have a clarification on whether the UE not indicating the “low MSD” can be able to use CA/DC or not when the Tx power is not large (e.g. UEs in cell center or small cell) or DL power is large enough.  **Issue 2-3b: Signalling of “low MSD”**  If the improved MSD requirement is specified, it shall as optional feature to signal to NW. |
| vivo | **Issue 2-3a: Network use of “low MSD”**  It is helpful for those questions to be clarified, since this may have major impact on the meaning of the entire scope, or it might be possible that the whole work is not useful.  **Issue 2-3b: Signalling of “low MSD”**  Prefer: Signalling is not needed;  If really defined, signalling need to be per band combination, and per-MSD type. If the latter is not considered, then reasonable threshold do not seem possible. |
| CHTTL | **Issue 2-3b: Signalling of “low MSD”**  We share the same view as Softbank. Though ”Good UEs will perform well in network” but the network will not know unless the BS attempt the scheduling that cause IMD to the UE. |

Sub topic 2-4

|  |  |
| --- | --- |
| **Company** | **Comments** |
| OPPO | **Issue 2-4: Candidates for study**  CA and DC between band 2/3 (1.8/1.9GHz) and 77/78 (3.5GHz) is ok. |
| Skyworks | Candidate(s) for study should allow evaluation of the different types of MSD that are considered eligible for MSD improvement. The types of MSD (harmonic, IMD etc..) should be part of selection criteria and should captured in a WF based on sub topic 2.1 inputs. We propose to study only MSD due to harmonics or driven by PCB isolation. |
| Samsung | **Issue 2-4: Candidates for study**  We think CA and DC between band 2/3 (1.8/1.9GHz) and 77/78 (3.5GHz) is a good example for low MSD study which is well aligned with RAN plenary guidance. |
| Xiaomi | **Issue 2-4: Candidates for study**  CA and DC between band 2/3 (1.8/1.9GHz) and 77/78 (3.5GHz) |
| vivo | It is doubtful whether one example band combination can help to define the whole scheme and setting new requirements.  If really one example selected, we support Skyworks’ proposal to study only MSD due to harmonics or driven by PCB isolation, for CA and DC between band 2/3 (1.8/1.9GHz) and 77/78 (3.5GHz). |

Sub topic 2-5

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | R4-2112381 has a text saying that “Furthermore, if the “low” MSD requirement is defined as 5 dB, wouldn’t it unfair for UEs with 5.5dB MSD to be excluded from using the combination?”. At a first glance, we understand it but even now, this situation exits for instance some requirements for switching time have three options for ULTxSwitchingBandPair-r16 where 35, 140 or 210us is allowed. If the UE’s switching time is 145us, the UE report 210us. The issue is not specific to this discussion. The UE vendors have a choice to do extra efforts to shorten it by 5us and signal 140us OR leave it as it is and signal 210us. |

## 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#2.1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

## 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: Band combinations corrections for FR1 and FR2

Moderator input: CR are commented directly

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112904.zip) | ZTE Corporation | Discussion on inter-band CA Tx RF requirements  Observation 1. Different types of UL CA configurations are supported for inter-band NR CA band combination in different releases of TS38.101-1.  Observation 2. Some of the Tx requirements are only defined for ‘nXA-nYA’ type of UL CA configurations, which means for inter-band NR CA Tx requirements in TS38.101-1:   * Requirements for ‘-’ type of UL CA configurations are missing in Rel-15 /Rel-16/Rel-17 specs. * Requirements for ‘nXC’ type of UL CA configurations are missing in Rel-16/Rel-17 specs. * Requirements for ‘nX(2A)’ and ‘nXA-nYB’ types of UL CA configurations are missing in Rel-17 spec.   **Proposal 1. To agree the companion CRs provided in [2~7].** |
| [**R4-2112910**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112910.zip) | ZTE Corporation | CR to TS38.101-1: Inter-band NR CA Tx requirement including intra-band non-contiguous CA and combinations of intra-band and inter-band CA UL configuration corresponding to [**R4-2112910**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112910.zip) |
| [**R4-2112723**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112723.zip) | ZTE Corporation | On configurations for SUL band combination with inter-band CA  Observation 1: In the configuration table for SUL band combination *with inter-band CA*, the supported channel bandwidth is redundant with the configuration tables for SUL band combination with single carrier, intra-band contiguous CA or intra-band non-contiguous CA.  **Proposal 1: It is proposed that for SUL band combination with inter-band CA (Table 5.5C-4), the channel bandwidth for NR band in SUL band combination should directly refer to the configuration tables for SUL band combination with single carrier (Table 5.5C-1), intra-band contiguous CA (Table 5.5C-3) or intra-band non-contiguous CA (Table 5.5C-2).** |
| [**R4-2112724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112724.zip) | ZTE Corporation | CR to TS 38.101-1 on corrections to configuration for SUL bands corresponding to [**R4-2112723**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112723.zip) |
| [**R4-2113573**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113573.zip) | Ericsson | Rel-17 draft CR 38.101-1, band combination corrections  **Corrections:**   * **UL rows to be merged into just one row for CA\_n41A-n71(2A), CA\_n41A-n71B, CA\_n41(2A)-n71 and Band CA\_n41C-n71B** * **Add missing C in UL for CA\_n2A-n30A-n66(2A)** * **Add missing A in UL for CA\_n25A-n29A-n66A** * **Add missing A in UL for CA\_n25(2A)-n66(2A)-n77A** * **Remove not defined 5 MHz in band n77 from CA\_n25A-n77A** * **Remove not defined 5 MHz in band n78 from CA\_n25(2A)-n78A** * **Remove not defined 70 MHz in band n40 from CA\_n34A-n40A** * **Remove emply rows after CA\_n38A-n78(2A)** * **Remove not defined 25 MHz in band n41 from CA\_n41A-n77(2A)** * **Merge the two rows in the first column for CA\_n46N-n48B** * **Remove not defined 25, 30 and 40 MHz in band n5 from CA\_n5A-n25A-n66(2A)** * **Correct the 20 MHz channel BW for CA\_n5A-n25A-n77A** * **Remove not defined 50, 60, 80, 90 and 100 MHz in band n66 from CA\_n25A-n48A-n66A** * **Remove not defined 70 and 90 MHz in band n79 from CA\_n1A-n8A-n78A-n79A and CA\_n1A-n8A-n78(2A)-n79A** |
| [**R4-2113574**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113574.zip) | Ericsson | Rel-17 draft CR 38.101-2, band combination corrections  **Correcting n262 channel BW definition to BW instead of Yes** |
| [**R4-2113575**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113575.zip) | Ericsson | Rel-17 draft CR 38.101-3, band combination corrections  **Corrections:**   * **Adding missing band combinations in Table 5.2A.1-1 and Table 5.2A.1-2** * **Adding missing UL for CA\_n28A-n77A-n257D** * **Adding missing A in definition of DC\_29A-30-66A\_n260A** |
| [**R4-2112721**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112721.zip) | ZTE Corporation | Optimization to NR FR2 configurations for intra-band non-contiguous CA  Observation 1: Too many columns of sub-block are redundant in the configuration table for intra-band non-contiguous CA which contain no additional information.  **Proposal 1: To optimize the configuration table for intra-band non-contiguous CA in FR2, Option 2 of no column for sub-blocks is suggested. Take CA\_n260(2G-3O) as an example, the suggested optimization for the configuration can be as follows.** |
| [**R4-2112722**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112722.zip) | ZTE Corporation | CR to TS 38.101-2 on corrections to intra-band non-contiguous CA corresponding to [**R4-2112721**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112721.zip) |
| [**R4-2112352**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112352.zip) | Apple | CR for TS 38.101-1: Correcting CA frequency setup for 2UL interband reference sensitivity  **The frequency setup for CA\_n71-n77 and CA\_n71-n78 to check for IMD5 are false. UL and DL frequency are not matching for n78 and UL/DL frequency need to be adjusted so that IMD5 falls into n71 downlink** |
| [**R4-2112353**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112353.zip) | Apple | CR for TS 38.101-3: Correcting DC frequency setup for 2UL interband reference sensitivity  **The frequency setup for CA\_n71A-n78A to check for IMD5 is false. UL and DL frequency are not matching for n78** |
| [**R4-2112358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112358.zip) | Apple | CR for TS 38.101-1 Rel-17: Applying n40 and n41 spurious emissions on CA  **With the recent agreement on n40 and n41 single band emission requirements, the emission limits for CA combinations require an update to match new conditions.** |

## Open issues summary

Moderator input: CR are commented directly in 3.3.2

### Sub-topic 3-1

**Issue 3-1: SUL band combination with inter-band CA**

* Proposals
  + **Proposal 1: It is proposed that for SUL band combination with inter-band CA (Table 5.5C-4), the channel bandwidth for NR band in SUL band combination should directly refer to the configuration tables for SUL band combination with single carrier (Table 5.5C-1), intra-band contiguous CA (Table 5.5C-3) or intra-band non-contiguous CA (Table 5.5C-2).**
* Recommended WF
  + Discuss proposal in the review of associated [**R4-2112724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112724.zip)CR

### Sub-topic 3-2

**Issue 3-2: Optimization to NR FR2 configurations**

* Proposals
  + **Proposal 1: It is proposed that for SUL band combination with inter-band CA (Table 5.5C-4), the channel bandwidth for NR band in SUL band combination should directly refer to the configuration tables for SUL band combination with single carrier (Table 5.5C-1), intra-band contiguous CA (Table 5.5C-3) or intra-band non-contiguous CA (Table 5.5C-2).**
* Recommended WF
  + Discuss proposal in the review of associated [**R4-2112722**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112722.zip)CR

### Sub-topic 3-3

**Issue 3-3: inter-band CA Tx RF requirements**

* Proposals
  + **Proposal on missing Tx configurations**
* Recommended WF
  + Discuss proposal in the review of associated [**R4-2112910**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112910.zip)CR

## 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2112910**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112910.zip) | Company A |
| Company B |
|  |
| [**R4-2112722**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112722.zip) | Company A |
| Company B |
|  |
| [**R4-2112724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112724.zip) | Huawei: For table 5.5C-4, it's unnecessary to make such changes. It's clearer to specify the channel bandwidth for each band instead of using reference. |
| ZTE: Reply to Huawei: Thanks for the comments. The information of supported channel bandwidths with inter-band CA in Table 5.5C-4 is duplicated with the information for SUL band combination in Table 5.5C-1, Table 5.5C-2 and Table 5.5C-3. In addition to the duplicated content among the CA configuration tables, what is more important is that the duplication will increase the risk of inconsistency among these tables. If in case a combination with inter-band CA in Table 5.5C-4 uses the channel bandwidth which is not defined in Table 5.5C-1, Table 5.5C-2 or Table 5.5C-3 for the certain SUL band combination, is this a legal case for the channel bandwidth in Table 5.5C-4? Furthermore, if the duplication of channel bandwidth in Table 5.5C-4 is for the purpose of clearer specification, why we also use CA\_n41C, CA\_n78C, etc. as reference? |
|  |
| [**R4-2113573**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113573.zip) | Company A |
| Company B |
|  |
| [**R4-2113574**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113574.zip) | Company A |
| Company B |
|  |
| [**R4-2113575**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113575.zip) | Company A |
| Company B |
|  |
| [**R4-2112352**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112352.zip) | Company A |
| Company B |
|  |
| [**R4-2112353**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112353.zip) | Company A |
| Company B |
|  |
| [**R4-2112358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112358.zip) | Huawei: 90/100MHz haven’t be introduced into spec for these CA combinations CA\_n1-n40, CA\_n3-40, CA\_n8-n40, CA\_n28-n40, CA\_n39-n40, CA\_n40-n78, CA\_n40-n79. There is no need to list n41 in separate row. |
| Xiaomi: in the cover page, it says apply note 20 to n41, actually, it should be note 22.  To Huawei, the exceptions for 90 and 100 MHz channel bandwidth are for n41 to protect 90MHz and 100Mhz of n41 when 2UL CA are configured. It is no matter with the channel bandwidth of CA combinations |
|  |

## Summary for 1st round

### Open issues

### 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)

## 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”* |

# Topic #4: NR-U contiguous UL CA

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112304**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112304.zip)  NRU ULCA including wideband operation | Skyworks Solutions Inc. | **Proposal on NR-U ULCA cases:**   * **#1 Wideband operation in each CC is restricted to cases where transmitted sub-bands are contiguous across the two CCs** * **#2 Same waveform type is used in each CC: CP-OFDM+CP-OFDM or DFT-s-OFDM+DFT-s-OFDM** * **#3 Same allocation type is used in each CC:**   + **#3a Full+Full or Interlace+Interlace with same number of RB per 10RB in each CC, furthermore, RB start positions are chosen such that the lower edge of the highest allocated RBs in lower CC and the lower edge of the lowest allocated RBs in upper CC is ≥ 1.8MHz**   + **#3b For MPR/A-MP evaluation purpose, it is further restricted to RB start positions are chosen such that the lower edge of the highest allocated RBs in lower CC and the lower edge of the lowest allocated RBs in upper CC is the closest to 1.8MHz** * **#4 All channel bandwidth combination should be considered but it should meet the channel bonding rule such that the aggregated channel BW is contained with the WIFI channel of same or higher channel BW.**   + **Low priority on >160MHz aggregated bandwidth aligning with 320MHz 802.11be half-overlapping channels in n96 (not applicable in n46)**   + **Consider limitations for 60+60 and 100+100 cases and potential limitations for 40+100/100+40/60+100/100+60 cases** * **#5 Prioritize the study of the general case and NS-28/29/30/31 in n46 and NS-53/54 for the introduction of NR-U contiguous ULCA feature**   + **Other NS can be studied within the already agreed spectrum specific NR-U WIs or as a second priority once the single CC related work is finalized** |

## Open issues summary

### Sub-topic 4-1

**Issue 4-1: NR-U contiguous UL CA configurations**

* Proposals
* #1 Wideband operation in each CC is restricted to cases where transmitted sub-bands are contiguous across the two CCs
* #2 Same waveform type is used in each CC: CP-OFDM+CP-OFDM or DFT-s-OFDM+DFT-s-OFDM
* #3 Same allocation type is used in each CC:
  + #3a Full+Full or Interlace+Interlace with same number of RB per 10RB in each CC, furthermore, RB start positions are chosen such that the lower edge of the highest allocated RBs in lower CC and the lower edge of the lowest allocated RBs in upper CC is ≥ 1.8MHz
  + #3b For MPR/A-MP evaluation purpose, it is further restricted to RB start positions are chosen such that the lower edge of the highest allocated RBs in lower CC and the lower edge of the lowest allocated RBs in upper CC is the closest to 1.8MHz
* #4 All channel bandwidth combination should be considered but it should meet the channel bonding rule such that the aggregated channel BW is contained with the WIFI channel of same or higher channel BW.
  + Low priority on >160MHz aggregated bandwidth aligning with 320MHz 802.11be half-overlapping channels in n96 (not applicable in n46)
  + Consider limitations for 60+60 and 100+100 cases and potential limitations for 40+100/100+40/60+100/100+60 cases
* #5 Prioritize the study of the general case and NS-28/29/30/31 in n46 and NS-53/54 for the introduction of NR-U contiguous ULCA feature
  + Other NS can be studied within the already agreed spectrum specific NR-U WIs or as a second priority once the single CC related work is finalized
* Recommended WF
  + Each proposal are commented with proposal number as header

## Companies views’ collection for 1st round

### Open issues

Sub topic 4-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | #1  #2  #3a  #3b  #4  #5 |

### CRs/TPs comments collection

## 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#4.1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

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

### CRs/TPs

## 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”* |

# Topic #5: n5B UL CA

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2114579**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114579.zip)  CA\_n5B MSD Measurements | Skyworks Solutions Inc. | **Proposal: Adopt CA\_n5B MSD Levels proposed in Table 3 for Table 7.3A.2.1-1 (subclause 7.3A).**  Table 3: Proposed changes to Table 7.3A.2.1-1 to capture CA\_n5B MSD.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | CA configuration | SCS  (PCC/SCC)  (kHz) | Aggregated channel bandwidth (PCC+SCC) | UL PCC allocation  (LCRB) | UL SCC allocation  (LCRB) | PCC ΔRIBNC (dB) | SCC ΔRIBNC (dB) | Duplex mode | | CA\_n5B | 15/15 | 15MHz + 10MHz | 12 (RBstart = 67) | 8 (RBstart = 0) | [27] | [42.5] | FDD | | 15MHz + 10MHz | 20 (RBstart = 58) | N/A | 0 | [5.2] | | 15MHz + 5MHz | 15 (RBstart = 64) | 5 (RBstart = 0) | [29.5] | [25.5] | | 15MHz + 5MHz | 20 (RBstart = 58) | N/A | 0 | [5.2] | | NOTE 1: All combinations of channel bandwidths defined in Table 5.5A.1-1.  NOTE 2: The carrier centre frequency of PCC in the UL operating band is configured closer to the DL operating band.  NOTE 3: The transmitted power over both PCC and SCC shall be set to PUMAX as defined in subclause 6.2A.4. | | | | | | | |   **The single uplink MSD test points are copied from DC\_(n)5AA Table 7.3B.2.1-1.** |

## Open issues summary

### Sub-topic 5-1

**Issue 5-1: n5B MSD proposal**

* **Proposal: Adopt CA\_n5B MSD Levels proposed in Table 3 for Table 7.3A.2.1-1 (subclause 7.3A).**

Table 3: Proposed changes to Table 7.3A.2.1-1 to capture CA\_n5B MSD.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS  (PCC/SCC)  (kHz) | Aggregated channel bandwidth (PCC+SCC) | UL PCC allocation  (LCRB) | UL SCC allocation  (LCRB) | PCC ΔRIBNC (dB) | SCC ΔRIBNC (dB) | Duplex mode |
| CA\_n5B | 15/15 | 15MHz + 10MHz | 12 (RBstart = 67) | 8 (RBstart = 0) | [27] | [42.5] | FDD |
| 15MHz + 10MHz | 20 (RBstart = 58) | N/A | 0 | [5.2] |
| 15MHz + 5MHz | 15 (RBstart = 64) | 5 (RBstart = 0) | [29.5] | [25.5] |
| 15MHz + 5MHz | 20 (RBstart = 58) | N/A | 0 | [5.2] |
| NOTE 1: All combinations of channel bandwidths defined in Table 5.5A.1-1.  NOTE 2: The carrier centre frequency of PCC in the UL operating band is configured closer to the DL operating band.  NOTE 3: The transmitted power over both PCC and SCC shall be set to PUMAX as defined in subclause 6.2A.4. | | | | | | | |

**The single uplink MSD test points are copied from DC\_(n)5AA Table 7.3B.2.1-1.**

* Recommended WF
  + Companies to verify test points and proposed MSD
  + If acceptable discuss if a CR can be generated and if brackets are necessary.

## Companies views’ collection for 1st round

### Open issues

Sub topic 5-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

## 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#5.1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

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

### CRs/TPs

## 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”* |

# 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** |
| *LB-LB-LB and LB-LB combinations* | | | | |
| [**R4-2111731**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111731.zip) | DC\_8A\_20A\_n28A MSD | Qualcomm Incorporated | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| [**R4-2112018**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112018.zip) | Further discussion on MSD due to UL IMD for DC\_8A-20A\_n28A | MediaTek Inc |  |  |
| [**R4-2113404**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113404.zip) | Discussion on DC\_8A-20A\_n28A | Huawei, HiSilicon |  |  |
| [**R4-2113405**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113405.zip) | TP for TR 37.717-21-11: DC\_8A-20A\_n28A | Huawei, HiSilicon |  |  |
| [**R4-2114582**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114582.zip) | DC\_8-20\_n28 and other LB-LB-LB RF-FE challenges | Skyworks Solutions Inc. |  |  |
| [**R4-2113344**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113344.zip) | Discussion on UE RF requirements for DC\_20-38\_n8 | VODAFONE Group Plc |  |  |
| *Improved MSD Study* | | | | |
| [**R4-2112381**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112381.zip) | Views on defining “low MSD” for CA and DC | Apple |  |  |
| [**R4-2112572**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112572.zip) | Discussion on low MSD feasibility | Samsung |  |  |
| [**R4-2112587**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112587.zip) | Views on Low MSD indicator for IMD | SoftBank Corp. |  |  |
| [**R4-2113015**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113015.zip) | Discussion on "Low MSD" for CA and DC | vivo |  |  |
| [**R4-2114223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114223.zip) | Signaling low MSD for CA and DC combinations | Qualcomm Incorporated |  |  |
| [**R4-2114567**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114567.zip) | Discussion on the feasibility of MSD improvement | Huawei, HiSilicon |  |  |
| [**R4-2114570**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114570.zip) | Discussion on defining ”low MSD” for NR CA and DC band combinations | CHTTL |  |  |
| [**R4-2114578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114578.zip) | Selection Criteria for CA/DC candidates eligible to improved MSD | Skyworks Solutions Inc. |  |  |
| [**R4-2113906**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113906.zip) | R17 MSD improvement | OPPO |  |  |
| *Band combinations corrections for FR1 and FR2* | | | | |
| [**R4-2112904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112904.zip) | Discussion on inter-band CA Tx RF requirements | ZTE Corporation |  |  |
| [**R4-2112910**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112910.zip) | CR to TS38.101-1: Inter-band NR CA Tx requirement including intra-band non-contiguous CA and combinations of intra-band and inter-band CA UL configuration | ZTE Corporation |  |  |
| [**R4-2112723**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112723.zip) | On configurations for SUL band combination with inter-band CA | ZTE Corporation |  |  |
| [**R4-2112724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112724.zip) | CR to TS 38.101-1 on corrections to configuration for SUL bands | ZTE Corporation |  |  |
| [**R4-2113573**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113573.zip) | Rel-17 draft CR 38.101-1, band combination corrections | Ericsson |  |  |
| [**R4-2113574**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113574.zip) | Rel-17 draft CR 38.101-2, band combination corrections | Ericsson |  |  |
| [**R4-2113575**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113575.zip) | Rel-17 draft CR 38.101-3, band combination corrections | Ericsson |  |  |
| [**R4-2112721**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112721.zip) | Optimization to NR FR2 configurations for intra-band non-contiguous CA | ZTE Corporation |  |  |
| [**R4-2112722**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112722.zip) | CR to TS 38.101-2 on corrections to intra-band non-contiguous CA | ZTE Corporation |  |  |
| [**R4-2112352**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112352.zip) | CR for TS 38.101-1: Correcting CA frequency setup for 2UL interband reference sensitivity | Apple |  |  |
| [**R4-2112353**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112353.zip) | CR for TS 38.101-3: Correcting DC frequency setup for 2UL interband reference sensitivity | Apple |  |  |
| [**R4-2112358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112358.zip) | CR for TS 38.101-1 Rel-17: Applying n40 and n41 spurious emissions on CA | Apple |  |  |
| *NR-U contiguous UL CA* | | | | |
| [**R4-2112304**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112304.zip) | NRU ULCA including wideband operation | Skyworks Solutions Inc. |  |  |
| *n5B UL CA* | | | | |
| [**R4-2114579**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114579.zip) | CA\_n5B MSD Measurements | Skyworks Solutions Inc. |  |  |

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** |
| Skyworks Solutions Inc. | Dominique Brunel | [Dominique.brunel@skyworksinc.com](mailto:Dominique.brunel@skyworksinc.com) |
| Skyworks Solutions Inc. | Laurent Noel | [laurent.noel@skyworksinc.com](mailto:laurent.noel@skyworksinc.com) |
| Samsung | Bozhi Li | Bozhi.li@samsung.com |
| ZTE | Zhifeng Ma | ma.zhifeng@zte.com.cn |
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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)