**3GPP TSG-RAN WG4 Meeting # 104-e R4-22XXXXX**

**Electronic Meeting, 15– 26 August 2022**

**Agenda item:** 11.11.3

**Source:** KDDI

**Title:** Email discussion summary for [104-e] [135] NonCol\_intraB

**Document for:** Information

# Introduction

This part includes contributions in agenda 11.11.1 and 11.11.2.

Classify the contents into three topics:

1. Topic #1: Work Plan
2. Topic #2: "NR-CA Type-2 UE" for 2 layer MIMO case (intra-band non-collocated non-contiguous) as in 11.11.2
3. Topic #3: "New Type UE" for 4 layer MIMO case (non-collocated non-contiguous intra-band NR-CA and inter-band EN-DC) and contiguous case as in 11.11.2

Candidate target of email discussion are as below:

* 1st round:
  + Make agreement on work plan for RF part and RRM part
  + Reach consensus on UE RF architecture for NR-CA Type-2 UE (2 layer/2 Rx Chain per CC)
  + Reach consensus on RF requirements for NR-CA Type-2 UE
  + Reach consensus on guideline of RRM requirements for NR-CA Type-2 UE
  + Reach consensus on "New Type UE" for 4 layer MIMO case and contiguous case
* 2nd round:
  + Approve on work plan
  + Approve on the WF for NR-CA Type-2 UE

It is appreciated that the delegates for this topic put their contact information in the table below.

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|  |  |  |
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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)

# Topic #1: Work plan for Rel-18 Support of intra-band non-collocated EN-DC/NR-CA deployment

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211795 | KDDI | This paper provides Work Plan on Rel-18 Support of intra-band non-collocated EN-DC/NR-CA deployment according to the time budget agreed in RAN#96 meeting. |

## Open issues summary

### Sub-topic 1-1 : Work Plan on Rel-18 Support of intra-band non-collocated EN-DC/NR-CA deployment

**Issue 1-1: Work Plan**

* Proposals
  + **Agree on the work plan for RF part and RM part in R4-2016540**
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Issue 1-1: Work Plan

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | We are fine with rapporteur’s work plan. |
| ZTE | It seems there is no need to say ‘Agree on the work plan except for RD Perf’ and ‘Agree on the work plan of RD Perf’ seperately, due to the contribution itself is work plan including RF and RRM part. |
| SoftBank | We are fine with the proposed work plan. |
| Apple | Agree with the work plan by rapporteur. |
| vivo | We are ok with the work plan |
| Huawei | We support the work plan |
| Nokia | We support the work plan |

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

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

### 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: "NR-CA Type-2 UE" for 2 layer MIMO case (intra-band non-collocated non-contiguous)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211752 | SoftBank Corp. | Observation: The possible UE architecture for DC\_42\_n77/78 would be that for n77/78 intra-band non-contiguous CA.  Proposal 1: The power imbalance requirements specified for DC\_42\_n77/78 are the baseline of those for n77/78 intra-band non-contiguous CA.  Proposal 2: If there are some updates of possible UE architecture, it should be clarified, and their impacts on the power imbalance requirements should be reflected. |
| R4-2211796 | KDDI | Observation 1: There are needs from operators to deploy non-collocated EN-DC/NR-CA.  Observation 2: There are needs from operators to deploy both non-contiguous and contiguous non-collocated EN-DC/NR-CA.  Proposal 1：Use reference UE architecture and RF requirements of EN-DC Type-2 UE for intra-band non-contiguous NR-CA Type-2 UE.  Proposal 2：Discuss the following aspects about RF specification impacts 2-1) Add note to Table 5.5A.2-1 Configurations for inter-band CA (two bands) of 38.101-1 2-2) Define in-band blocking requirements same as EN-DC Type-2 UEfor intra-band non-contiguous NR-CA adding a new section for them in 38.101-1 7.6A.2 according to 38.101-3 7.6B.2.6 2-3) Define a table of NR-CA band combinations in the new section of 7.6A.2, ex) CA\_n78(2A), CA\_n77(2A) and CA\_n77(3A)  Observation 3: Current MRTD requirement for intra-band non-contiguous NR-CA is too short to deploy non-collocated scenario.  Proposal 3：Discuss the following aspects about RRM specification impacts 3-1) A new IE for intra-band non-contiguous NR-CA Type-2 3-2) Consider relaxation of MRTD, ex) reusing MRTD for inter-band NR-CA |
| R4-2211914 | Apple | Proposal 1: Consider 25dB power imbalance as the starting point for intra-band non-co-located CA and further check the performance degradation.  - It’s more preferred to reduce the power imbalance value to a reasonable level.  Proposal 2: If 25dB power imbalance has to be kept for CA case, we should also give UE the freedom on whether to supporting such case or not. E.g.  - Consider introducing UE capability to differentiate UE supporting different requirements (implicitly corresponding to different implementation), and,  Observation: Power imbalance is defined between carriers which is not related to the supported MIMO layers on each CCs. |
| R4-2212011 | Samsung | Observation 1: Based on WID, the possible discussion points on UE reference architecture, MRTD requirements and power imbalance assumption for 2-layer and 4-layer MIMO case are provided as below.  Proposal 1: Similar to EN-DC counterpart, for FR1 intra-band non-contiguous NR-CA, the term “Type-2 UE” is used to indicate UE supporting non-collocated deployment with maximum 2 layer per CC.  Proposal 2: RF requirements and architecture for Type-2 EN-DC could be reused to Type-2 intra-band NR CA.  1) Add note to Table 5.5A.2-1 of 38.101-1  2) Define in-band blocking requirements (25dB power imbalance, 1dB REFSENS relaxation)  3) Dedicated new IE needed for Type-2 intra-band NR CA  Proposal 3: FFS the necessity of requiring UE to support async CA operation for NR-CA Type-2.  Proposal 4: FR1 intra-band contiguous EN-DC/NR-CA case should only be studied after RAN4 complete the standardization works for non-contiguous case. |
| R4-2212098 | Skyworks Solutions, Inc. | Proposal for non-collocated scenario support: • Default support is 2Rx per band (4Rx total) with 25dB imbalance • Support of >2Rx per band is optional, with signalling of 4Rx support per band  o If no compromises on receiver performance/dynamic range are feasible, this will require additional RF/antenna paths  o If some compromises are feasible on receiver performance/dynamic range, it can be studied whether the impact on the number of RF/antenna paths can be reduced |
| R4-2212147 | Qualcomm Incorporated | Observation 1: The RF architecture is with a shared antenna and LNA among all the aggregated CCs.  Observation 2: Handling of power imbalance and large MRTD(>CP) are the challenges in intra-band non-collocated deployments.  Observation 3: the RF front end still has to handle the power imbalance irrespective of the number of receivers used for each CC.  Observation 4: Splitting the receivers among different CCs enables handling of larger receive time difference at the UE.  Observation 5: RTD should be within the CP to enable 4Rx on each CC.  Observation 6: Performance degradation due to LNA signal distortion is difficult to characterize. |
| R4-2212717 | ZTE Corporation | Observation: Non-co-located scenario for intra-band non-contiguous ENDC is impossible if the work is limited to CA/EN-DC for EN-DC/NR-CA for bands 42, n77/n78, instead it should be inter-band EN-DC.  Proposal 1. The objectives needs to be updated.  Proposal 2. For 2 layer MIMO case for intra-band non-contiguous CA supporting non-collocated deployment, 25dBc power imbalance of inter-band ENDC type 2 UE which corresponding to 1dB REFSEN degradation can be reused. |
| R4-2212792 | vivo | Observation 1: UE under intra-band CA and EN-DC have similar condition from either RF architecture and ACS/IBB requirement.  Observation 2: The ACS/IBB requirements of intra-band NC CA are various which depends on the CA bandwidth class.  Observation 3: Only separate Rx chain has the possibility to withstand up to 25 dB power imbalance.  Proposal 1: Reuse Type 2 UE power imbalance requirement to intra-band NC CA that each sub-block with CA bandwidth class A.  Proposal 2: Operators need to clarify whether CA bandwidth class B, C, D for each sub-block in n77/n78 also need be considered.  Proposal 3: For 4Rx UE under high power imbalance, only up to 2-layer MIMO can be achieved and all other 4Rx requirement should be invalid.  Proposal 4: A new capability to indicate UE can support MRDC > 3us under intra-band CA should be define, and UE should further indicate whether it can support 2-layer MIMO or 4-layer MIMO. |
| R4-2213133 | Huawei | Proposal 1: Introduce type-1 and type-2 UE configurations for non-collocated NR CA as it was requested for MR-DC in Rel-16  Proposal 2: Two methods are possible to introduce intra-band non-collocated MRDC/NR CA behavior via UE capabilities  2-1- Add a new UE capability, *intraBandNonContiguousMRDC-NRCA-NonColocated-r18* , which indicates the UEs that support intra-band NR CA configurations for non-collocated scenarios, starting Rel-18  2-2- Request RAN2 to update the interBandMRDC-WithOverlapDL-Bands-r16 UE capability description in order to include the intra-band non-contiguous MRDC/NR CA, starting Rel-18  Observation 1: 25dB power imbalance is enough to cover the whole cell in a LOS scenario. Moreover, it does not induce a Tx-Rx self-interference.  Obesrvation 2: 25dB power imbalance, is NOT enough in a NLOS scenario and the network should not set the UE on a non-collocated configuration, when the UE 3D distance from one of the gNbs/eNbs is above 203m.  Proposal 3: The following architectures can be considered in the discussion: (a) UE architecture for MRDC with DL overlapping bands {B42, n77, n78} with a 2x2 MIMO configuration. (b) UE architecture for intra-band non-contiguous NR CA {n77, n78}. |
| Ericsson | R4-2212904 | Observation 1: In NR up to and including release-17 intra-band non-contiguous EN-DC/NR-CA is collocated.  Observation 2: In LTE up to and including release-17 intra-band non-contiguous is allowed to be non-colocated. A UE should cope with a relative propagation delay difference up to 30 µs among the component carriers to be aggregated in both intra-band non-contiguous and inter-band non-contiguous CA.  Observation 3: NR DC has a total time budget. If TAE is larger it can be compensated with smaller and vice versa.  Proposal 1: Set MRTD for intra-band non-collocated EN-DC/NR-CA the same as for LTE, or NR CA inter band, or NR DC synchronous inter band, i.e., around 30 µs.  Proposal 2: Let MRTD be the total budget to be managed freely. This means that there is no need to specify TAE for intra-band non-collocated EN-DC/NR-CA. |
| Nokia | R4-2213760 | Although for 2-layer MIMO the REL17 EN-DC power imbalance is assumed to be reused the REL18 use case is NR-CA therefore there is a need to introduce UE type 2 requirements for 38.101-1 in addition to 38.101-3. It would be attractive to reuse EN-DC type 2 UE requirement structure as defined in clause 7.6B.2.6 of [2]. If RAN4 agrees to re-use type 2 UE requirement structure from [2] into NR-CA then work on 4-layer MIMO can start. |

## Open issues summary

### Sub-topic 2-1 : Objectives of WID

**Issue 2-1-1: Update objectives of WID**

* Proposals
  + Option 1: Update and correct objectives of WID as follows
    - Inter-band non-collocated EN-DC
    - Intra-band non-collocated NR-CA
  + Option 2: Discuss to update objectives in next RAN#97 meeting
* Recommended WF
  + TBA

### Sub-topic 2-2 : UE RF architecture baseline

**Issue 2-2-1: UE RF architecture**

* Proposals
  + Option 1: Reuse UR RF architecture of inter-band non-contiguous DC\_42\_n77/78 EN-DC Type-2 (i.e. 2 layer/2 Rx Chain per CC)
  + Option 2: If there are some updates of possible UE architecture, it should be clarified, and their impacts on the power imbalance requirements should be reflected.
* Recommended WF
  + TBA

**Issue 2-2-2: CA bandwidth class**

* Proposals
  + Option 1: Clarify requirements on CA bandwidth class B/C/D for each sub-blocks in n77/78 by operators
  + Option 2: No need to clarify requirements on CA bandwidth class currently
* Recommended WF
  + TBA

### Sub-topic 2-3 : RF requirements

**Issue 2-3-1: Power Imbalance and in-band blocking**

* Proposals
  + Option 1: Power imbalance and in-band blocking requirements specified for DC\_42\_n77/78 EN-DC Type-2 UE are the baseline of those for n77/78 intra-band non-contiguous NR-CA.
    - 25dB power imbalance, 1dB REFSENS relaxation
  + Option 2: Study other requirements different from DC\_42\_n77/78
* Recommended WF
  + TBA

### Sub-topic 2-4 : Guidelines for RRM requirements

**Issue 2-4-1: Guidelines for RRM requirements on MRTD**

* Proposals
  + Option 1: Support async CA operation MRTD (same as EN-DC Type-2 UE, ex) SCG=SCS/30kHz, 250us) for NR-CA Type-2 UE
  + Option 2: Set MRTD for intra-band non-collocated EN-DC/NR-CA the same as for LTE, or NR CA inter band, or NR DC synchronous inter band, i.e., around 30 µs.
  + Option 3: Support current intra-band non-contiguous NR-CA MRTD (FR1, 3us)
* Recommended WF
  + TBA

### Sub-topic 2-5 : UE Capability

**Issue 2-5-1: Clarify Type-1 and Type-2 UE configurations for non-collocated NR CA**

* Proposals
  + Option 1: Introduce Type-1 and Type-2 UE configurations for non-collocated NR-CA as it was requested for MR-DC in Rel-16/17
  + Option 2: No need to introduce and define UE configurations
* Recommended WF
  + TBA

**Issue 2-5-2: Introduce intra-band non-collocated MR-DC/NR-CA behaviour via UE capabilities**

* Proposals
  + Option 1: Add a new UE capability, *intraBandNonContiguousMRDC-NRCA-Noncollocated-r18*, which indicates the UEs that support intra-band NR-CA configurations for non-collocated scenarios, starting Rel-18
  + Option 2: Request RAN2 to update the *interBandMRDC-WithOverlapDL-Bands-r16* UE capability description in order to include the intra-band non-contiguous MR-DC/NR-CA, starting Rel-18
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Issue 2-1-1: Update objectives of WID

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| **Company** | **Comments** |
| Samsung | Although we understand the wording “Intra-band non-collocated EN-DC” in current WID actually means “Inter-band non-collocated EN-DC with overlapping or partially overlapping DL bands” which is essentially regarded as Intra-band EN-DC, but for sake of more clear scope, we are fine to update and correct the wording.  Generally we think below wording could be used, while it could be further clarified or explained in Justification or Objective that “inter-band ENDC” is “inter-band ENDC with overlapping or partially overlapping DL bands”   * + - Inter-band non-collocated EN-DC     - Intra-band non-collocated NR-CA |
| ZTE | Option 1 but the revised WID should be discussed in RAN plenary  We think some ambiguities existed in the existing objectives, so at least some updates in option 1 should be included. |
| Apple | We support to make the WID scope clearer in terms of intra-band NR CA and inter-band EN-DC. So, fine with the proposal from moderator.  Further, it is also suggested to add a clarification in the scope that “simultaneous Rx/Tx for UE shall be avoided e.g. either by network configuration of UL/DL config or by limiting the MRTD to a reasonable value” |
| KDDI | Option 1: but details for revising WID should be discussed in RAN plenary. |
| vivo | Ok with option 1 but the WID should be discussed in RAN plenary. |
| Skyworks | In fact the more accurate description would be intra-band non-collocated NR-CA and overlapped inter-band non-collocated EN-DC. But we are fine with proposal if a sub-bullet is added to Inter-band non-collocated EN-DC that clarifies that the bands are overlapped |
| Huawei | We agree with the WID clarification as mentioned by Skyworks, after approval during the next RAN Plenary.  On the other hand, we agree with Apple on the prohibition of having “simultaneous TX/RX” behaviour, as we raised our concern in our contribution (R4-2213133), too. |
| Ericsson | This scope of the WID is intra-band EN-DC/CA with non-collocation. Overlapping TDD bands could also be covered (non-collocation possible but without simultaneous Rx-Tx). The existing specifications already cover inter-band EN-DC with non-collocation. |
| Meta | We are similar view with Ericsson. The inter-band EN-DC with non-collocation is already covered in current specification. We think that the scope of the WID is the intra-band non-contiguous DC/CA with non-collocated scenario. |
| Nokia | Shouldn’t we address the both following cases for MR-DC?  Inter-band non-collocated EN-DC, e.g, DC\_42-n78(but requirements are based on intra band)  Intra-band non-collocated EN-DC, e.g., DC\_41-n41 |

Issue 2-2-1: UE RF architecture

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| **Company** | **Comments** |
| Samsung | Option 1, power imbalance and UE architecture has mutual impact, at present we see no reason to revisit the power imbalance of Type-2 intra-band NC NR-CA, which is 25dB captured in the WID, thus UE architecture of DC\_42\_n77/78 could be reused, i.e., 2Rx Chain per cc. |
| ZTE | Basically agree with Option 1: to reuse UR RF architecture of inter-band non-contiguous DC\_42\_n77/78 EN-DC Type-2 for intra-band non-contigous NRCA type 2.  However, one question for clarification, for “i.e. 2 layer/2 Rx Chain per CC”, it looks like the total Rx chains are 2\*n if the CC number is n. So would it be more clear to say “i.e. 2 layer/total 4 Rx Chain”? |
| SoftBank | Support Option 1. |
| Apple | Option 1 can be a good starting point for CA case. Of course, if reducing the power imbalance don’t help to alleviate the implementation complexity, e.g. separate RF chain is still needed, then it can be the same as that for EN-DC. While it is better to further check and conclude in the next meeting. |
| KDDI | Option 1: we also support proposal from ZTE on adding the wording meaning “total 4 Rx Chain”. |
| vivo | Option 1 as baseline, and we agree with ZTE, total Rx chain number is 4. |
| Skyworks | Option one as baseline but I’d like clarification on number of Rx chains: it it meant as number of antenna/RF paths or is it 4 paths from antenna to BB. The latest would not allow separate LO. Beyond baseline we can look at further options that key the antenna count to 4 (for example with restriction on the dynamic range for which the imbalance is supported. |
| Huawei | We agree with option 1. In section 7.2 of 38.101-1, it is mentioned that 4 antenna ports are needed for bands n71 and n78. This mean (2 RF chains in the main path and two in the diversity path). Hence we agree with 2 RF chains per CC for these bands.  On a side topic, we were wondering what would be the network/UE behaviour for cell edge UEs with non-collocated gNB/eNB in the case of NLOS situation (cells in the forest or dense cities ). As shown in R4-2213133 observation 2, a 25 dB imbalance in NLOS scenario means, the UEs that are placed between 203m to 500 of the cell will not be able to communicate with the non-collocated gNBs/eNBs since their power imbalance will be more than 25dB. |
| Ericsson | Option 1 the starting point but amendments should be allowed (Option 2). |
| Meta | Support option 1 |

Issue 2-2-2: CA bandwidth class

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| **Company** | **Comments** |
| Samsung | Option 2, in our view only CA bandwidth class A for each sub-block in n77/n78 is under consideration in this WID. If operators have interest in B/C/D for each sub-block, according to the current procedure they shall firstly define such kind of band combinations (at least for co-located) through basket WI of band combination. |
| ZTE | Option 2.  Similar view with Samsung. Only 1CC in each sub-block configuration for n77/n78 are supported in current spec, for example n77(2A). |
| Apple | We share similar view that the focus of this WI should be bandwidth class A in each sub-block or in each band for n 77/n78 and the maximum CCS are up to 2 in total.  It’s premature to consider mixture of contiguous and non-contiguous aggregation in the context of this feature for the time being. Other Bandwidth classes should be requested after the completion of this WI. |
| KDDI | We think that firstly RAN4 should focus on non-contiguous case, but also it would be better to hear operators’ requirements. |
| Vivo | Our concern here is the ACS/IBB requirements are various for different CA bandwidth class, which will lead to different impacts under 25 dB power imbalance. We are ok with focus on class A in R18, but it should be clearly clarified that the requirement only applies to one component carrier in each sub-block when we introduce the power imbalance requirement into spec. |
| Skyworks | By CA BW class a I assume this is restricted to intra-band NRCA. Since both contiguous and non-contiguous cases may exist I would assume that A/B/C and 2A are in scope. If rstriction to A only means non-contiguous only maybe the question needs further clarification. In any case we agree that we restrict to a total of two CC for the study. |
| Ericsson | Start with non-contiguous and Class A. The case of a single sub-block of more than one carrier may need a separate capability (for the contiguous case and within any sub-block). |
| Meta | We are same page with Samsung and Apple. the 1CC in a carrier for intra-band non-contiguous CA is baseline to study the RF requirements. |

Issue 2-3-1: Power Imbalance and in-band blocking

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| **Company** | **Comments** |
| Samsung | Option 1, as commented in Issue 2-2-1, power imbalance is 25 dB which is captured in the WID and we see no reason to revisit it, while most likely the UE architecture is still 2Rx Chain per cc, therefore we think the in-band blocking requirement of Type-2 EN-DC could be reused, i.e. 25dB power imbalance with 1dB relaxation. |
| ZTE | Option 1 is fine to us. |
| Murata | Option 1. 25dB imbalance with 1dB relaxation in REFSENS. |
| SoftBank | Support Option 1. |
| Apple | 25dB seems too large for CA from deployment scenario point of view as analyzed in our paper R4-2211914. We recommend further studies into the feasibility of this value (or other values). |
| KDDI | Option 1 : Power imbalance is 25 dB which is captured in the WID. |
| Vivo | Option 1 if we confirm reuse the RF architecture in ENDC in issue 2-2-1 |
| Skyworks | The 25dB imbalance can be used as a starting point but we believe that we should study potential architecture simplifications by restricting the imbalance to a range of input power or reducing the imbalance. |
| MediaTek | Fine with 25dB imbalance and note 1&2 in TS38.101-3, Table 7.6B.2.6-1 shall also apply here:  NOTE 1: For NR carrier, the transmitter shall be set to 24dB below PCMAX\_L,f,c,NR at the minimum uplink configuration specified in Table 7.3.2-3 [2] with PCMAX\_L,f,c,NR as defined in clause 6.2B.4.  NOTE 2: For E-UTRA carrier, the transmitter shall be set to 24 dB below PCMAX\_L\_E-UTRA,c at the minimum uplink configuration specified in Table 7.3.1-2 [4] with PCMAX\_L\_E-UTRA,c as defined in clause 6.2B.4 for single carrier. |
| Huawei | We agree with option 1.  @Apple: The link level studies for the LOS urban case are performed usually with a 500 inter-site distance (36.942 , etc.). However, if multiple operators indicate that they **always** implement the cells with inter-site distances much smaller than 500m, then we can consider reducing the power imbalance.  On the other hand, we agree with the observation in your tdoc (R4-2211914). It is misleading to talk about MIMO layers when we really mean multiple RF chains. MIMO layers are defined per CC and established on baseband level. |
| Ericsson | Option 1 as a starting point. |
| Meta | The 25dB imbalance can be used as a starting point. The Power imbalance level can be decided by several factors such as frequency gap between 2CCs. So we can determine the basic simultation parameters for power imbalance study at first. |

Issue 2-4-1: Guidelines for RRM requirements on MRTD

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| **Company** | **Comments** |
| Samsung | In our view, there are two things need to be discussed as moderator summarized.   1. The necessity of requiring UE to support async operation for NR-CA scenario.   In all existing CA deployment, sync operation is always assumed, while async operation is for some of DC scenarios. At least based on our current analysis, we see no necessity of requiring UE to support async operation for NR-CA scenario, but we are open to hear companies’ views as well, especially the practical deployment request from operators.   1. MRTD Requirement in terms of sync operation   RRM session is responsible for discussing and defining the specific values, but as common practice from Rel-15, main session (i.e., RF session) involved with more experts from operators usually need to discuss and provide the necessity of a certain deployment scenario, as emphasized above. In short, the necessity of requiring UE to support async operation for NR-CA scenario needs to be clarified and discussed firstly. |
| Apple | Option 4. Propose to determine after we conclude the scenario and the power imbalance since it is highly depends on the applicable scenario. A MRTD with reasonable level is preferred. |
| KDDI | We support above Samsung’s proposal which discuss the necessity of requiring UE to support async operation for NR-CA scenario firstly. |
| Huawei | We support option 2. Since it is non-collocated scenario, non-zero propagation delay difference shall be considered. The propagation delay difference assumed for FR1 inter-band CA and sync NR-DC can be used as starting point. |
| Ericsson | Option 2, Set MRTD for intra-band non-collocated EN-DC/NR-CA the same as for LTE, or NR CA inter band, or NR DC synchronous inter band, i.e., around 30 µs. |
| Nokia | This should be discussed in RRM when TU becomes available. We are very confused since many companies supported the proposed work plan while they started breaking the work plan immediately…. |

Issue 2-5-1: Clarify Type-1 and Type-2 UE configurations for non-collocated NR CA

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| **Company** | **Comments** |
| Samsung | If this means adding similar note of EN-DC (Note11) to NR-CA, in table 5.5A.2-1 of 38.101-1, we agree. Otherwise, please the proponent company helps to clarify.  BTW, we submit a cat F Rel-16 F CR (R4-2212012) of 38.101-3 to correct the error in Note 11, experts can check and comment in thread [101] if any. |
| ZTE | Type 1 (i.e. co-located with 6dB power imbalance) have already been specified. So only type 2 (and new type) UE should be specified for non-co-located NR CA. |
| Murata | Option 1. Define Type 1 (default) and Type 2 for non-collocated NRCA. |
| SoftBank | Support Option 1. |
| Apple | It’s a good idea to address different implementations and the complexity in general. It’s a good starting point for further discussion. |
| KDDI | Support Option 1. |
| vivo | Ok with option 1 |
| Skyworks | Option is a starting point we may find that other types are needed to reflect different architecture and/or feature support. |
| Huawei | We support option 1 |
| Ericsson | Option 1: need to distinguish Type 2 receivers in the field, Type 1 should be legacy. |
|  |  |

Issue 2-5-2: Introduce intra-band non-collocated MR-DC/NR-CA behaviour via UE capabilities

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | Option 1, we think a dedicated new IE needed and we see the problem for Option 2 which may causing existing Rel-16/17 Type 2 UE only supporting non-collocated EN-DC be mistakenly interpreted as the one also supporting non-collocated NR CA. |
| ZTE | Option 1. It is straingforward to add a new capability. |
| Murata | Option 1. |
| SoftBank | Support Option 1. |
| Apple | We don’t see the need to mix-up MRDC and NR CA in the same set of signaling. They are referring to different set of requirements and addressing different deployment scenarios. Existing signaling can leave as is for EN-DC scenario. Separate signaling should be considered for NR CA if necessary.  Prefer to revisit the capability after the feasibility phase. |
| KDDI | Support Option 1. |
| vivo | Support option 1, new capability is clearer. |
| Skyworks | At this point we do not know what capability granularity may be needed, may be this should come from the set of agreed implementation options. In any case specific non-collocated capability(ies) will be needed |
| Huawei | We support option 1 |
| Ericsson | Option 1: this must be a new capability (one or more fields) |
| Meta | Support option 1 |

### 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** |
| XXX | Company A |
| Company B |
|  |

## 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: ”New Type UE” for 4 layer MIMO case (non-collocated non-contiguous intra-band NR-CA and inter-band EN-DC) and contiguous case

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2212011 | Samsung | Observation 1: Based on WID, the possible discussion points on UE reference architecture, MRTD requirements and power imbalance assumption for 2-layer and 4-layer MIMO case are provided as below.  Proposal 4: FR1 intra-band contiguous EN-DC/NR-CA case should only be studied after RAN4 complete the standardization works for non-contiguous case. |
| R4-2212098 | Skyworks Solutions, Inc. | Proposal: to enable higher >2Rx/band support without increase of antenna/RFFE complexity, the following aspect are studied at a 25dB PSD imbalance:  • Relaxed requirement in maximum power for largest signal, and QPSK REFSENS   • Clarify modulation order and MIMO support  • Design of the appropriate tests scenarios  • ACS and blocking tests are not performed at 25dB imbalance, check if 6dB imbalance is appropriate. |
| R4-2212147 | Qualcomm Incorporated | Observation 1: The RF architecture is with a shared antenna and LNA among all the aggregated CCs.  Observation 2: Handling of power imbalance and large MRTD(>CP) are the challenges in intra-band non-collocated deployments.  Observation 3: the RF front end still has to handle the power imbalance irrespective of the number of receivers used for each CC.  Observation 4: Splitting the receivers among different CCs enables handling of larger receive time difference at the UE.  Observation 5: RTD should be within the CP to enable 4Rx on each CC.  Observation 6: Performance degradation due to LNA signal distortion is difficult to characterize. |
| R4-2212717 | ZTE Corporation | Proposal 3. To support non-collocated deployment for intra-band non-contiguous CA:  - New signaling(s) should be introduced  - Rx requirements for four Rx ports are applied  - Whether or not supporting Rx requirements for 8 RX ports is FFS |
| R4-2212792 | vivo | Proposal 4: A new capability to indicate UE can support MRDC > 3us under intra-band CA should be define, and UE should further indicate whether it can support 2-layer MIMO or 4-layer MIMO. |
|  |  |  |

## Open issues summary

### Sub-topic 3-1 :

**Issue 3-1-1: UE RF architecture and RF requirements on new Type UE for 4 layer MIMO case**

* Proposals
  + Option 1: Focus on NR-CA Type-2 UE in this Aug. meeting and begin discussions on “New Type UE” and contiguous case from next Oct. meeting based on work plan proposed by the rapporteur
  + Option 2: Make progress both NR-CA Type-2 UE and new Type UE in parallel anyway
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Issue 3-1-1: UE RF architecture and RF requirements on new Type UE for 4 layer MIMO case

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | 1. **For New Type (Type-3? If confirmed)**   Generally we agree with what Skyworks illustrated of Type-3, in next meeting we would also provide some possible Type-3 UE architectures for the group to discuss, with consideration on how many Rx chains/ antennas, maximum layer number of each cc, frequency separation limitation, dynamic range, power imbalance(with or without performance relaxation) and UE implementation difficulty.  However in this meeting, we suggest to focus on Type-2 in the first place as rapporteur planned, and start the Type3 discussion in next meeting which is also aligned with the objective.   * + - * + NOTE 3: RAN4 is recommended to start the work on 2-layer first and after that start 4-layer work based on the conclusion of 2-layer work.   **2. For contiguous case**  Our initial proposal is “FR1 intra-band contiguous EN-DC/NR-CA case should only be studied after RAN4 complete the standardization works for non-contiguous case.”  The objective says, “Investigate the additional impacts of contiguous case, if time units are available”. From our side firstly focus on non-contiguous case is preferred. In general, we see the priority of contiguous case is lower than non-contiguous case. |
| ZTE | Option 1 is fine to us.  Also, it would be better to name/confirm new Type UE for 4\*4 MIMO as ‘Type 3 UE’ for convenience. |
| SoftBank | We are fine with Option 1. Thank you very much for bringing the helpful information for 4Rx. |
| Apple | Option 1. |
| KDDI | Option 1. |
| Skyworks | We are fine to postpone discussion of other architectures beyond type 2 but as we study type 2 limitations it will be useful to look further. Our focus is to emphasize on solutions that only require 4 antennas. |
| MediaTek | Question for understanding: n77 is mandatory 4Rx thus no matter what MIMO level is, there shall be four Rx antennas for the band. B42 is two Rx by default, no mandatory for 4Rx. Does type 2 UE here means 6 Rx antennas is the UE architecture baseline? |
| Ericsson | Option 1 |
| Meta | Option 1. We focus on the Type-2 UE, then we can further discuss the new type UE and others. |

### 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** |
| XXX | Company A |
| Company B |
|  |

## 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**

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

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

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** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | 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