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

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

**Agenda item:** 9.3.1

**Source:** Moderator (Huawei, HiSilicon)

**Title:** Email discussion summary for [100-e][127]NR\_RF\_FR1\_enh\_Part\_1\_HPUE\_ULMIMO

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

Thread [127] includes following topics:

1. Topic #1: Intra-band contiguous UL CA for FR1 power class 2 which is for agenda 9.3.2.4
2. Topic #2: Intra-band NC UL CA for FR1 power class 2 which is for agenda 9.3.2.5
3. Topic #3: Intra-band UL contiguous CA for UL MIMO which is for agenda 9.3.2.6
4. Topic #4: solution for Scell dropping which is for agenda 9.3.2.7.2
5. Topic #5: UL MIMO Bands which is for agenda 8.41

# Topic #1: PC2 intra-band contiguous UL CA

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2114493 | Huawei, HiSilicon | ***Observation 1: At least, the same MPR can be applied for contiguous CA with 1PA and 2PA architectures, if only forward IMD is considered.***  ***Proposal 1: For PC2 intra-band UL contiguous CA with 2PA architecture, adding 0.5dB delta MPR on outer1 and outer2 allocation based on the MPR defined for PC2 contiguous CA with 1PA architecture.***  ***Proposal 2: Adding the MPR value for intra-band contiguous CA with 2PA architecture with following style:***  ***Adding NOTE 2 for MPR table 6.2A.2.1-1a: For Bandwidth class C, MPR is increased by 0.5dB for outer allocation when UE indicates IE dualPA-Architecture supported.***  ***Adding NOTE 2 for MPR table 6.2A.2.1-3a: For Bandwidth class C, MPR is increased by 0.5dB for outer1 and outer2 allocation when UE indicates IE dualPA-Architecture supported.*** |
| R4-2114498 | Huawei, HiSilicon, Skyworks | Big CR for PC2 intra-band UL contiguous CA |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1: PC2 contiguous CA with 2PA architecture

*Sub-topic description:*

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

**Issue 1-1-1: MPR for PC2 contiguous UL CA with 2\*(23dBm/200MHz) PAs and 1LO**

* **Proposals：**
* **Option 1:**
* For inner allocation, reuse the MPR defined for PC2 contiguous CA with 1PA architecture
* For outer allocation(outer1 and outer2 for NC allocation, outer for C allocation), MPR is increased by 0.5dB.

Table 6.2A.2.1-1a: Contiguous RB allocation for Power Class 2 with 1Tx

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation | | MPR for bandwidth class B(dB) | | MPR for bandwidth class C(dB) | |
|  | | inner | Outer1 | inner | Outer2 |
| DFT-s-OFDM | Pi/2 BPSK | 2.0 | 4.01 | 2.5 | 7 |
|  | QPSK | 2.0 | 4.01 | 2.5 | 7 |
|  | 16QAM | 2.5 | 4.01 | 2.5 | 7 |
|  | 64QAM | 3.0 | 4.51 | 5 | 7 |
|  | 256QAM | 5.5 | 6.0 | 7 | 7.5 |
| CP-OFDM | QPSK | 2.5 | 5.01 | 3.5 | 8 |
|  | 16QAM | 3.0 | 5.01 | 3.5 | 8 |
|  | 64QAM | 3.5 | 5.01 | 5 | 8 |
|  | 256QAM | 6.5 | 6.5 | 7 | 8 |
| NOTE 1: When 1 RB or 2 RB are allocated at the lower edge of lowest CC or upper edge of upper CC, MPR for outer is [5.5] dB.  NOTE 2: For Bandwidth class C, MPR is increased by 0.5dB for outer allocation when UE indicates IE dualPA-Architecture supported. | | | | | |

Table 6.2A.2.1-3: non-contiguous RB allocation for Power Class 2 with 1Tx

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation | | MPR for bandwidth class B(dB) | | | MPR for bandwidth class C(dB) | | |
|  | | inner | Outer1 | Outer2 | inner | Outer11,2 | Outer22 |
| DFT-s-OFDM | Pi/2 BPSK | 31 | 6.5 | 13 | 31 | 7.5 | 13.5 |
|  | QPSK | 31 | 6.5 |  | 31 | 7.5 |  |
|  | 16QAM | 31 | 6.5 |  | 31 | 7.5 |  |
|  | 64QAM | 5 | 6.5 |  | 5 | 7.5 |  |
|  | 256QAM | 6.5 | 7 |  | 6.5 | 7.5 |  |
| CP-OFDM | QPSK | 3.51 | 7 | 14 | 3.51 | 8 | 14.5 |
|  | 16QAM | 3.51 | 7 |  | 3.51 | 8 |  |
|  | 64QAM | 5 | 7 |  | 5 | 8 |  |
|  | 256QAM | 7.5 | 7.5 |  | 7.5 | 8 |  |
| NOTE 1: the allowed MPR is [4]dB for aggregated allocation bandwidth < [2MHz].  NOTE 2: For Bandwidth class C, MPR is increased by 0.5dB for outer1 and outer2 allocation when UE indicates IE dualPA-Architecture supported. | | | | | | | |

* **Option 2:**

Others

* Recommended WF
  + TBA

**Issue 1-1-1: MPR requirement for PC2 contiguous UL CA with 2\*(23dBm/200MHz) PAs and 1LO**

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

### Sub-topic 1-2: Spec architecture

*Sub-topic description*

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

**Issue 1-2-1: Spec architecture for PC2 contiguous CA with 2PA**

* Proposals
  + Option 1:
* Define MPR for PC2 CA with 2PA in subclause 6.2A.2 of TS 38.101-1(UE maximum output power reduction for CA)
  + Adding a Note in the MPR tables for 2PA architecture
  + Option 2: Other
* Recommended WF
  + TBA

**Issue 1-2-1: Spec structure for PC2 contiguous CA with 2PA**

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

## Companies views’ collection for 1st round

### Open issues

Collect in 1.2.

### 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** |
| R4-2114498 | Company A |
| Company B |
|  |
| YYY | 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 #2: PC2 intra-band NC UL CA

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112022 | Nokia | **Observation 1: With 35 dB LO suppression the back-off envelope approaches the envelope of the reference scenario where LO is excluded.**  **Observation 2: With 37 dB LO suppression the back-off, considering all simulated allocations, approaches the envelope of the reference scenario where LO is excluded.**  We expect this LO effect to be similar also in asymmetric combinations.  In addition, regarding asymmetric CA combinations, it was observed that  **Observation 3: The ACLR effect of IQ image in asymmetric NC CA combinations depends on the CC allocations.**  **Observation 4: With unfavourable allocations, such as 1+100 RB in case of 20+40 MHz NC CA, IQ suppression of up to 32 dB can be necessary in order to achieve moderate MPR.**  Furthermore, it was observed that  **Observation 5: Relaxing the ACLR requirement could have a detrimental effect on the system performance as a whole**. |
| R4-2112893 | LGE | **Observation 1: For Case 1, it is not general use case for intra-band NC CA operation when NW is deployed in co-located scenarios (MRTD is less than 10~15 us).**  **Observation 2: For Case 2, it is corner case to configure Scell with maximum transmission power since the NW expected that the UE is located in cell boundary. So the Scell can be released.**  **Proposal 1: RAN4 do not need to define the additional swapping time requirements for #4 RF architecture (1x23dBm + 1x26dBm with 2LOs) for PC2 intra-band NC-CA UE.**  **Proposal 2: RAN4 will specify the one MPR Table to support the PC2 simultaneous UL CA + UL MIMO with 2 transmit for 1 LO RF architecture.**  **Proposal 3: RAN4 will specify the one MPR Table to support the PC2 intra-band NC-CA UE for 2 LOs RF architecture based on the #4 RF architecture.**  **Proposal 4: The required MPR values would ensure that the PC2 intra-band NC-CA UE is better performance than PC3 intra-band NC-CA UE.** |
| R4-2114494 | Huawei, HiSilicon | ***Observation 1: UEs with enhanced Image/leakage ability can reach in-gap requirement with reasonable MPR value. For gap BW which is less or equal to CBW1+CBW2, no MPR for image falling is needed.***  ***Proposal 1: No OOBE exception requirement for architecture #2 and #3, UE support intra-band NC CA with 1PA architecture can solve in-gap issue with additional MPR to reach the in-gap requirement which is less than or equal to 13dB for worst case***  ***Proposal 2: 15us of PA swap time for architecture #4 can be considered, the swap time is only allowed for the switching of:***   * ***case1 and case2/3,*** * ***case2 and case3***   ***where:***   * ***Case1 is that the transmission power for both CCs are ≤23dBm.*** * ***Case 2 is that the transmission power for CC1 is larger than 23dBm and for CC2 is ≤23dBm, while case 3 is that the transmission power for CC2 is larger than 23dBm and for CC1 is ≤23dBm.***   ***Proposal 3: It is proposed to use the worst case value across architectures to define MPR for non-contiguous CA.*** |
| R4-2114571 | Skyworks | **Proposal on architecture requiring in-gap exceptions:**   * **In-gap exceptions are only allowed for CC configurations where the gap bandwidth is less or equal than the two CC aggregated bandwidth thus SEM is -13dBm/MHz in gap and shall be met** * **3dB ACLR in gap relaxation is allowed and assumes** * **In-gap exceptions are only allowed for UEs also supporting UL MIMO or TxD together with NC UL CA** * **This architecture will use separate MPR values in the specification (table or delta) and address both TxD and UL MIMO modes.** * **FFS if carrier leakage may still need some management with -13dBm/MHz in gap SEM**   **Proposal on 2LO PC2+PC3 architecture requiring timing exceptions:**   * **A maximum swap time of 15us – MRTD is allowed** * **Both SCC and PCC shall be able to reach maximum power for equal PSD case with large allocation difference** * **General MPR table is based on the 2LO 2xPC2 PA architecture and a 1.5dB additional MPR allowed for 2LO PC3+PC2 architecture** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1: MPR comparison among architecture options

*Sub-topic description:*

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

*Copy the 4 architectures for intra-band UL NC CA under discussion:*

|  |  |
| --- | --- |
| Arch | description |
| #1 | 2x26dBm PA + 2LO with 100MHz BW |
| #2 | 1x26dBm PA + 1LO with 200MHz BW |
| #3 | 2x23dBm PA + 1LO with 200MHz BW |
| #4 | 1x23dBm+1x26dBm + 2LO with 100MHz BW |

**Issue 2-1-1: MPR comparison among architecture options**

*Data shown here also includes MPR proposed in the last meeting*

* Proposals

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **MPR** |  | **HW**  **R4-2114494** | | | | **Nokia**  **R4-2112022** | **LGE**  **R4-2109965** | | **Skyworks**  **R4-2104819** | | **Current**  **PC3**  **requirement** |
| IM3 region | B | **Archi#1** | **Archi#2** | **Archi#3** | **Archi#4** | **Archi#2** | **Achi#1** | **Achi#4** | **Achi#1** | **Achi#4** | **2PA Achi** |
| -30dBm/MHz | 0.72 | 14.5 | 15.1 | 15.6 | 14.7 | 14 | 15 | 16 | 5.1 | 7.1 | 15 |
| 1.44 | 11.3 | 12.8 | 13 | 11.4 | 14 | 15 | 4.9 | 6.7 | 14.5 |
| 2.88 | 11.2 | 12.5 | 12.5 | 11.4 | 14.4 | 12.5 | 14 | 4.3 | 6.3 | 13.5 |
| 5.76 | 10.7 | 11.2 | 11.3 | 10.8 | 12.5 | 10.5 | 12 | 3.5 @5.4M | 5.7@5.4M | 11.5 |
| 10.8 | 10.2 | 11 | 11.4 | 10.5 | 10.8 | 10 | 10.5 | 2.6 @11.52M | 4.9@11.52M | 10.5 |
| 23.04 | 9.2 | 10.5 | 10.7 | 9.5 | 6.7 | 8.5 | 9 |  |  | 9 |
| 46.08 | 8.8 | 9.4 | 9.7 | 8.9 | 5.6 | 4.7 | 6.8 |
| 92.16 | 8.5 | 8 | 8.3 | 8.7 | 4.78 | 1.7@77.7M | 4.5@77.7M |
| 97.92 | 8.3 | 8.9 | 9.3 | 8.5 | 4.67 |  |  |
| 103.68 | 8.1 | 9.5 | 9.9 | 8.3 | 4.57 |  |  |
| 116.64 | 7.5 | 8.3 | 8.7 | 7.8 | 4.33 |  |  |
| -13dBm/MHz | <0.54 | 7 | 8.5 | 8.3 | 7.2 |  |  | 9 |  |  | 9 |
| 0.54 | 6.8 | 8 | 7.5 | 7 |  |  | 8 |  |  | 8 |
| 1.08 | 6.5 | 8 | 7.5 | 6.8 |  |  | 7 |  |  | 7 |
| 2.16 | 6.5 | 7.5 | 7.2 | 6.6 |  |  | 6.5 |  |  | 6.5 |
| 3.24 | 6 | 7.3 | 7 | 6.3 |  |  | 5.5 |  |  | 5.5 |
| 5.4 | 5.5 | 6.4 | 5.7 | 5.8 |  |  | 4 |  |  | 4 |
| 10.8 | 3.2 | 4 | 3.8 | 3.3 |  |  | 4 |  |  | 4 |

**Question 1: Based on available MPR input, check whether to define one set of MPR requirement across 4 architectures?**

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

**Question 2: Can we choose the initial MPR value based on available input with the worst one?**

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

**12**

Moderator note: Architecture handling is considered together with MPR comparison across architectures in section 2-2

* + TBA

**Issue 2-2-3: architecture option(s) for intra-band UL NC CA**

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

### Sub-topic 2-2: Other requirement related to different architecture

**Issue 2-2-1: For 1x26dBm PA + 1LO with 200MHz BW and 2x23dBm PA + 1LO with 200MHz BW, how to handle in-gap requirement when LO or image fall inside?**

* Proposals
  + Option 1: No OOBE exception requirement for architecture #2 and #3, use moderateMPR to reach the in-gap requirement
    - Assume IQ suppression>=32dBc, LO leakage>=35dBc
  + Option 2:
    - **In-gap exceptions are only allowed for CC configurations where the gap bandwidth is less or equal than the two CC aggregated bandwidth thus SEM is -13dBm/MHz in gap and shall be met** *It means no exception is allowed?*
    - **3dB ACLR in gap relaxation is allowed and assumes**
    - **In-gap exceptions are only allowed for UEs also supporting UL MIMO or TxD together with NC UL CA**
* Recommended WF
  + TBA

**Issue 2-2-1: For 1x26dBm PA + 1LO with 200MHz BW and 2x23dBm PA + 1LO with 200MHz BW, how to handle in-gap requirement when LO or image fall inside?**

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

**Issue 2-2-2: For 1x23dBm + 1x26dBm PA + 2LO with 100MHz BW, how to handle the swap time between PAs?**

* Proposals
  + Option 1: 15us only for:
* ***case1 and case2/3,***
* ***case2 and case3***

***where:***

* ***Case1 is that the transmission power for both CCs are ≤23dBm.***
* ***Case 2 is that the transmission power for CC1 is larger than 23dBm and for CC2 is ≤23dBm, while case 3 is that the transmission power for CC2 is larger than 23dBm and for CC1 is ≤23dBm.***
  + Option 2: RAN4 do not need to define the additional swapping time requirements for #4 RF architecture. (Because it is corner case to configure Scell with maximum transmission power since the NW expected that the UE is located in cell boundary.)
  + Option 3: A maximum swap time of 15us – MRTD is allowed

Both SCC and PCC shall be able to reach maximum power for equal PSD case with large allocation difference

* Recommended WF
  + TBA

**Issue 2-2-2: For 1x23dBm + 1x26dBm PA + 2LO with 100MHz BW, how to handle the swap time between PAs?**

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

## Companies views’ collection for 1st round

### Open issues

Collect in 2.2

### 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 |
|  |
| YYY | 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: Intra-band UL contiguous CA for UL MIMO

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112324 | ZTE | **Proposal 1: Requirements specified in the examples of 2 contiguous CCs are also aimed to be applicable to the higher orders, so the signalling design should account for higher order cases with more than 2 contiguous CCs.**  **Proposal 2: Introduce a separate bandwidth class capability for UL-MIMO.** |
| R4-2113024 | vivo | **Observation 1:** In current spec, UL-MIMO is a per-CC capability, which is independent with CA.  **Observation 2:** In currently capability definition, if UL-MIMO support were reported in the CCs for CA, theoretically CA and UL-MIMO should be supported simultaneously unless stated otherwise.  **Observation 3:** There exists some architecture, though not necessarily typical, can support CA and UL-MIMO respectively but not simultaneously. These implementations are somewhat contradicting with current signalling scheme.  **Observation 4:** Keep current signalling unchanged may preclude some implementations which is not typical.  Based on the current situation, there is the following proposal:  **Proposal:** Discuss whether there is a need to develop new signalling for support of CA + UL-MIMO and the two tentative options are:  **Option 1:** Yes. Incorporate implementations with narrowband PA.  **Option 2:** No. Preclude implementation with narrowband PA |
| R4-2113898 | OPPO | ***Observation 1: ca-BandwidthClassUL-NR is a per-band capability used to report the supported aggregated CBW for intra-band contiguous UL CA.***  ***Observation 2: The aggregated CBW capability could be different when UE works under CA mode or under CA+UL MIMO mode, however, with one ca-BandwidthClassUL-NR capability reported this cannot be differentiated.***  ***Observation 3: RAN2 didn’t touch the UE aggregated CBW capability limitation in CA+UL MIMO.***  ***Observation 4: RAN2 assumes all the UE capability should be reported within a single band combination entry, and NW is not required to derive UE capability based on multiple band combination entries.***  ***Observation 5: Reporting different aggregated CBW in two band combinations for CA only and CA+UL MIMO is not feasible, and may lead to scheduling errors in UE configuration.***  ***Proposal 1: It is proposed to report the UE supported aggregated CBW for UL CA+UL MIMO feature to NW.*** |
| R4-2114491 | Huawei, HiSilicon | ***Proposal 1: For PC3 intra-band UL contiguous CA with UL MIMO, adding 0.5dB delta MPR on outer1 and outer2 allocation based on the MPR defined for PC3 contiguous CA.***  ***Proposal 2: For PC2 intra-band UL contiguous CA with UL MIMO,*** ***adding 0.5dB delta MPR on outer1 and outer2 allocation based on the MPR defined for PC2 contiguous CA with 1PA.*** |
| R4-2114470 | Huawei, HiSilicon | CR on contiguous CA with UL MIMO for PC3 |
| R4-2114564 | Skyworks | **Observation: a SD-CDD delay of 600ns is used for 15 kHz SCS measurements**  **Proposal: This paper will be revised with analysis of the data as a late contribution for consideration with interested companies.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1: RF requirements

**Issue 3-1-1: MPR requirement for PC3 UL contiguous CA +MIMO with 2 PC3 PA+1LO**

* Proposals
  + Option 1: Adding 0.5dB delta MPR on outer allocation(outer1 and outer2 for NC allocation, outer for C allocation) based on the MPR defined for PC3 contiguous CA.
  + Option 2: Other
* Recommended WF
  + TBA

**Issue 3-1-1:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| China Telecom | In CR R4-2114470, another option with no delta w.r.t. the MPR for PC3 contiguous CA without UL-MIMO is proposed, which is preferred by us. |

**Issue 3-1-2: MPR requirement for PC2 UL contiguous CA +MIMO with 2 PC2 PA+1LO or 2 PC3 PA+1LO**

* Proposals
  + Option 1: Adding 0.5dB delta MPR on outer1 and outer2 allocation based on the MPR defined for PC2 contiguous CA with 1PA.
  + Option 2: an additional 0.5 to 1dB MPR can be anticipated for PC2 contiguous UL CA realized with 1LO+2xPC3 PA compared to agreed MPR for 1LO/1PA PC2 case
  + Option 3: other
* Recommended WF
  + TBA

**Issue 3-1-2:**

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

*In WF R4-2107851, it is agreed to further discuss on UL timing alignment error and coherent UL MIMO requirements*

**Issue 3-1-3: UL timing alignment requirement**

* Proposals
  + This requirement applies as specified in 6.4D.3: The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors. For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.
* Recommended WF
  + TBA

**Issue 3-1-3:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| China Telecom | OK to reuse the single CC requirement. Maybe we need to clarify the requirements is applied per CC? |

**Issue 3-1-4: coherent UL MIMO requirement**

* Proposals
  + The coherent UL MIMO requirement are specified at each transmit antenna connector on each CC as in 6.4D.4.
* Recommended WF
  + TBA

**Issue 3-1-4:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| China Telecom | It seems the coherent UL MIMO requirement is applied per CC, but not per antenna connector? |

### Sub-topic 3-2 signalling

*Sub-topic description*

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

**Issue 3-2-1: Is there problem with current signalling on CA+MIMO capability?**

* Proposals: *Please provide your view for each observed problem*
* 1: In currently capability definition, if UL-MIMO support were reported in the CCs for CA, theoretically CA and UL-MIMO should be supported simultaneously unless stated otherwise. Is this Observation true?
* 2: There is only one ca-BandwidthClassUL-NR capability reported for each BC entry, and RAN2 NW is not required to derive UE capability based on multiple band combination entries. Is this Observation true?
* 3: Reporting different aggregated CBW in two band combinations for CA only and CA+UL MIMO is not feasible. Is this Observation true?
* Recommended WF
  + TBA

**Issue 3-2-1:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| China Telecom | For Point 1, agree, the support of CA + UL-MIMO can be reported by the existing signalling of per band ca-BandwidthClassUL-NR and per CC maxNumberMIMO-LayersCB-PUSCH.  For Point 2 and 3, currently two example BCs, i.e., n41C and n78C, are in the scope, not sure if we need to consider other bandwidthclass such as class B. |

**Issue 3-2-2: Signalling proposals**

* Proposals
* Option 1: Introduce a separate bandwidth class capability for UL-MIMO
* Option 2: Report the UE supported aggregated CBW for UL CA+UL MIMO feature to NW
* Option 3: Whether develop new signalling for support of CA + UL-MIMO drives by implementation:
  + - * Yes. Incorporate implementations with narrowband PA.
      * No. Preclude implementation with narrowband PA
    - Option 4: Other
* Recommended WF
  + TBA

**Issue 3-2-2:**

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

**Issue 3-2-3: LS to RAN2**

* Proposals:
  + Option 1: send LS as in R4-2113898
  + Option 2: revise the LS in R4-2113898 and send (Please provide your view on how to revise)
  + Option 3: Do not need to send the LS
* Recommended WF
  + TBA

**Issue 3-2-3:**

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

## Companies views’ collection for 1st round

### Open issues

Collect in 3.2.

### 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** |
| R4-2114470 | China Telecom: In general, the CR looks good. Need to clarify the Coherent UL MIMO requirement and TAE requirements are applied at per CC basis. |
| Company B |
|  |
| YYY | 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 #4: Scell dropping

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112383 | Apple | ***Observation 1****: There is a clear distinction between the conformance test and field operation under the maximum output power condition.*  ***Observation 2****: In conformance test, there is no UE power headroom (PHR) reporting back to the tester during the TPC “UP” processing.*  ***Observation 3****: In real network, the base station would adjust the TPC based on the UL signal SNR condition and UE’s PHR.*  ***Observation 4****: Even without the PCell prioritization rule, there should be a mechanism for network to deactivate SCell to maintain the PCell performance.*  ***Observation 5****: SCell deactivation by the network should be a better way to manage the network performance instead of leaving UE to drop SCell by itself where the SCell power scaling is essentially out of network’s control.*  ***Observation 6****: The new requirement as proposed in last RAN4 meeting by limiting the serving cell output power is virtually no difference with the existing TPC mechanism.*  ***Observation 7****: If the new requirement is to only solve the UL CA conformance test issue, it would not be necessary as it not only creates more RAN4 specifications workloads but also increases UE test burden.*  ***Proposal****: If SCell dropping in UL CA would be confirmed as a real field issue, RAN1 should be involved in any specification alteration on the intent to mitigate this issue.* |
| R4-2112826 | Ericsson | The solution proposed is applicable for all band combinations and both frequency ranges, its key characteristics:   * the configured maximum power Pcmax,f,c for the serving cells are modified by configured power limits, a straighforward change and RAN4 scope, no change of timing requirements or UE behaviour * no change of RAN1 specifications (including priority mechanism) * configured power limits are relative to account for the actual power back-off used (and the implementation- specific plane of reference for Pcmax,f,c for FR2), can be enabled/disabled by MAC/CE for fast adaptation to changing radio conditions and apply for concurrent transmissions * backwards compatible * the limits are under network control, can also be made absolute (similar to P-Max) * “equal” PSD can be achieved for the purpose of conformance testing   The solution requires RRC changes and a MAC-CE element for activating/deactivating the limits (RAN2 changes). |
| R4-2114468 | Huawei, HiSilicon | ***Observation 1: for FR1 inter-band and intra-band CA, mechanism to avoid scell dropping is needed when Pcmax,c1+Pcmax,c2>PCMAX,CA.***  ***Observation 2: For FR2 CA, it is not easy to limit UE output power on each CC in a relative accurate range in different directions. Solution for ‘scell dropping’ for FR2 CA could be studied in Rel-17, but is better with lower priority.***  ***Proposal 1: Adding new objective “solution to scell dropping for CA” into Rel-17 FR1 RF enhancement WI. FR2 CA is also studied within the scope, but with lower priority.***  ***Proposal 2: RAN4 should avoid to add additional test case when consider the solution to ‘scell dropping’ issue.*** |
| R4-2114551 | Qualcomm | **Observation 1: Adding a new limiting parameter to PCMax does not prevent UE from dropping cells with lower maximum power**  **Observation 2: To solve the problem of UE dropping scell and giving more control for the network, new parameter that indicates UE the preferred priority of cells is needed.**  **Proposal 1: Define new parameter to indicate priority between configured UL cells for the UE.**  **Proposal 2: Before agreeing to CR’s in RAN4 that alter UE behaviour regarding cell prioritization or scaling, RAN1 should be presented with the question if the chosen approach will create a conflict with RAN1 requirements** |
| R4-2113890  *Move from AI 6.1.10.2* | OPPO | ***Observation 1: The original issue was about the RAN5 testing problem to achieve equal PSD between CA in FR2 Pcmax requirement.***  ***Observation 2: RAN4 sent LS to RAN5 clarify the requirement and also the testing approaches, which confirms the power scaling UE behavior of 38.213.***  ***Observation 3: There is no conclusion on whether the low priority CC power scaling/dropping is a field problem and several issues need to be clarified for better understanding.***  ***Proposal 1: It is proposed to clarify the following aspects for better understanding the issue in the field.***  ***1) Whether power scaling/prioritization defined in 38.213 has problem, if it is then problem should be discussed in RAN1***  ***2) Why NW scheduling cannot prevent the low priority CC connection drop, e.g. by increase the low priority CC power and decrease the high priority CC power in close loop power control***  ***3) How NW decide to activate/deactivate Pmax in high priority CC and cause no problem in the linkage when UE is in the cell edge***  ***Observation 4: There is no fixed CC priority in CA, and the priority is determined by channels (PRACH, PUCCH, PUSCH, SRS), and NW indication with phy-PriorityIndex signaling.***  ***Proposal 2: It is proposed to put max power limit on the high priority CC instead of always on the PCC if this approach is to be further pursued in RAN4.***  ***Observation 5: If the prioritization/scaling is considered to be problematic, then RAN1 shall reconsider what they have defined.***  ***Proposal 3: It is proposed to further discuss the prioritization/scaling behavior in RAN1 if it is considered to be problematic. And RAN4 can inform RAN1 about the considerations on the potential field issue.*** |
| R4-2112816  *CAT F CR for TS 38.101-2* *(Rel-16)*  *Move from AI 6.1.9* | Ericsson | Draft CR for FR2:  Introduction of power limits for serving cells of UL CA |
| R4-2112816  *CAT A CR*  *Move from AI 6.1.9* | Ericsson |  |
| R4-2112813  *Move from AI 6.1.9* | Ericsson | LS on power limits for serving cells of UL CA:  Propose to send an LS to RAN2 to ask for specification appropriate IEs and MAC-CE as per the Draft LS attached below and ask RAN1 to confirm that there is no impact on the RAN1 specifications. |
| R4-2112811  *CAT F CR for TS 38.101-1 (Rel-16)*  *Move from AI 6.1.9* | Ericsson | Draft CR for FR1:  Introduction of power limits for serving cells of UL CA |
| R4-2112812  *CAT A CR*  *(Not submitted)*  *Move from AI 6.1.9* | Ericsson |  |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 4-1: Pre-discussions

*Sub-topic description:*

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

**Issue 4-1-1: Can Scell dropping can be solved by implementation solutions?**

* Proposals
  + 1: BS can increase the low priority CC power and decrease the high priority CC power in close loop power control
  + 2: The base station would adjust the TPC based on the UL signal SNR condition and UE’s PHR.
* Recommended WF
  + TBA

**Issue 4-1-1:**

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

**Issue 4-1-2: RAN1 or RAN4 driven?**

* Proposals
  + Option 1: If SCell dropping in UL CA would be confirmed as a real field issue, RAN1 should be involved in any specification alteration on the intent to mitigate this issue.
  + Option 2: RAN4 driven, but ask RAN1 to confirm that there is no impact on the RAN1 specifications.
* Recommended WF
  + TBA

**Issue 4-1-2:**

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

**Issue 4-1-3: Release issue**

* Proposals
  + Option 1: the solution targets for Rel-16
  + Option 2: the solution is newly studied in Rel-17.
* Recommended WF
  + TBA

**Issue 4-1-3:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| SoftBank | Option 1 is preferrable but we are fine with Option 2. |

**Issue 4-1-4: New objective in Rel-17**

* Proposals
  + Adding new objective “solution to scell dropping for CA” into Rel-17 FR1 RF enhancement WI. FR2 CA is also studied within the scope, but with lower priority.
* Recommended WF
  + TBA

**Issue 4-1-4:**

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

### Sub-topic 4-2: RAN4 solutions

**Issue 4-2-1: RAN4 driven solutions proposed**

* Proposals
  + Option 1: solution as in R4-2112826: RRC configuration +MAC activation onΔPCMAX,f,c , and introduce this config into Pcmax definition for SC and CA
  + Option 2: solution as in R4-2114551: new parameter that indicates UE the preferred priority of cells
  + Option 3: other
* Recommended WF
  + TBA

**Issue 4-2-1:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| SoftBank | We do not have strong opinion which options are more preferrable, but considering the background of this issue, it is helpful if some kinds of solution are made in Rel-17. |

**Issue 4-2-2: Pumax introduction and additional test case**

* Proposals
  + RAN4 should avoid to add additional test case when consider the solution to ‘scell dropping’ issue.
* Recommended WF
  + TBA

**Issue 4-2-2:**

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

**Issue 4-2-3: What is the frequency range that the solution should work for?**

* Proposals
  + Option1: Both FR1 and FR2
  + Option 2: FR1 with higher priority
  + Option 3: other
* Recommended WF
  + TBA

**Issue 4-2-3:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| SoftBank | Support Option 1. This issue does not depend on the frequency range, so fixing it with both FR1 and FR2 is important. |

## Companies views’ collection for 1st round

### Open issues

**Collect in 4.2**

### 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** |
| R4-2112811 | Company A |
| Company B |
|  |
| R4-2112816 | 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 #5: UL MIMO Bands

*This part includes contributions in Agenda 8.41.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2114523 | Huawei, HiSilicon | ***Observation 1: A-MPR requirement should be considered for NR bands supporting UL MIMO for power classes other than PC3, which is studied band by band***  ***Observation 2: Band specific A-MPR requirements for UL MIMO are considered additionally in clause 6.2.3 with A-MPR applicable to non-MIMO mode***  ***Observation 3: In the specification, it has example that same A-MPR requirements are applicable to both UL MIMO and TxD***  ***Proposal: It is proposed that the A-MPR requirements studied in the basket WI for UL MIMO bands are also applicable for transparent TxD in the same band with same power class.*** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 5-1: AMPR for UL MIMO bands

*Sub-topic description:*

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

*Copy the proposal on each RF requirement item from R4-2104956 and also referenced by R4-2109680*

**Issue 5-1-1: Applicability of AMPR requirement for UL MIMO bands**

* Proposals
  + AMPR defined for UL MIMO Bands can applicable for transparent TxD in the same band with same power class
* Recommended WF
  + TBA

**Issue 5-1-1: Applicability of AMPR requirement for UL MIMO bands**

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

## Companies views’ collection for 1st round

### Open issues

**Collect in 5.2**

### 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 |
|  |
| YYY | 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**

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

**Existing tdocs**

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

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