**3GPP TSG-RAN WG4 Meeting # 98-e R4-200XXXX**

**Electronic Meeting, 25 Jan – 5 Feb, 2021**

**Agenda item:** 11.2.2.5

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary for [98e][137] NR\_RF\_FR1\_enh\_Part\_3

**Document for:** Information

# Introduction

The scope of this discussion is the NC UL CA for PC2 according to WI [1]

* *HPUE for TDD intra-band contiguous and non-contiguous UL CA*
	+ *Take n41, n77 and n78 intra-band contiguous UL CA for examples*
		- *The two example intra-band contiguous UL CA configurations are under considerations*
			* *CA\_n41C, CA\_n78C, CA\_n77C*
	+ *Take n77 intra-band non-contiguous UL CA for example*
		- *One example intra-band non-contiguous UL CA configuration is under considerations: CA\_n77(2A)*
	+ *Investigate and specify the 26dBm power class for n41and n78 intra-band contiguous, and n77 intra-band contiguous/non-contiguous UL CA*
		- *Identify the impact of different UE architectures on the requirements*
			* *Power class relation between single CC and intra-band contiguous/non-contiguous CA on HPUE band is clarified if any*
		- *Specify the mechanism to meet SAR requirements if necessary*
			* *Mechanism for HPUE on single carrier can be a start point considering the same UL-DL configuration assumption*
		- *A-MPR requirement*
	+ *Specify MPR requirements*

Discussion are split in to two main parts:

* Topic 1: simulation assumptions and detailed requirements for the MPR simulations
* Topic 2: Other requirements for NC UL CA

# Topic #1: Simulation assumptions

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** |  | **Company** | **Proposals / Observations** |
| [**R4-2100289**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100289.zip) | MPR/A-MPR initial simulation assumptions for PC2 NR intra-band NC CA | LG Electronics France, LG Uplus | **Proposal 1: RAN4 should consider 2PA/2LO RF architecture as baseline for PC2 NR intra-band non-contiguous CA same as PC3 intra-band non-contiguous CA UE to derive MPR/A-MPR requirements in Rel-17****Proposal 2: RAN4 evaluate PC2 MPR requirements based on above [2] simulation assumptions in section2 in Rel-17.**[2] R4-2005661, “WF on intra-band UL non-contiguous CA MPR,” Skyworks, Huawei, Qualcomm**Proposal 3: RAN4 encourage to share the specific regional requirements in n77 for PC2 NR intra-band NC CA UE to derive A-MPR requirements** |
| [**R4-2100572**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100572.zip) | PC2 non-contiguous UL CA UE Architecture and MPR/A-MPR evaluation | Skyworks Solutions Inc. | **Observations:*** **PC3 contiguous UL CA -25dBm/MHz IM3 has lower back-off than -30dBm/MHz IM5 specifications which is not logical**
* **PC2 contiguous UL CA non-contiguous allocations back-off similar to PC3 but NS04 1.5dB worse than WC MPR**
* **2xPC3 PA 1RB+1RB worst case back-off is 1-2dB worse than 1xPC3 PA equivalent**
* **PC3 non-contiguous UL CA MPR/NS04 AMPR is similar than PC2 non-contiguous ENDC which is not consistent**
* **R16 38.101-1 is missing NS04 A-MPR for 2xPC3 PA**

**Proposal 1: for PC2 baseline architecture and requirements:*** **PC3 non-contiguous UL CA SEM requirement applicable to PC2**
* **PC3 ACLR definition is applicable to PC2 with 31dB ACLR instead of 30 dB**
* **MPR and A-MPR values are derived from a two PC2 PAs and antennas each supporting one of the CC**

**Proposal 2 on consistency checks:** * **While PC2 UL CA contiguous and non-contiguous UL CA cases are evaluated, the PC3 numbers should further be verified for consistency.**
* **Missing PC3 non-contiguous UL CA NS04 A-MPR for two PC3 PA architecture is evaluated (input exists in R4-2010301)**

**Proposal 3 for PC2 MPR/A-MPR evaluation:** * **Antenna isolation is 10dB and 4dB post-PA losses**
* **Usual PC2 calibration for each PA**
* **Equal PSD and Equal back-off power split**
* **The detailed list of scenarios above are used for PC2 non-contiguous UL CA MPR and NS04 A-MPR evaluation**
 |
| [**R4-2102185**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102185.zip) | Discussion on PC2 intra-band non-contiguous NR CA | ZTE Corporation | **Observation 1: P-MPR solution can be used as basedline SAR solution** **Proposal 1. Capability of MaxUplinkDutyCycle: Reuse the capability for single carrier case****Proposal 2: Pcmax: Use the same power class fallback mechanism as for single carrier****Proposal 3: No changed for the spectrum emission mask, additional spurious emission requirements, UE-to-UE coexistence requirements.** **Proposal 4: The UE maximum output power is 26dBm+ +/-3dB, regardless of the RF implementation architectures.** **Proposal 5: ACLR=31dB for PC2 intra-band non-contiguous UL CA** |

## Open issues summary

### Sub-topic 1-1

Simulation assumptions

It seems companies are aligned with many issues

* PA architecture is 2PA/2LO
* Isolation between antenna ports: 10 dB
* Post PA loss: 4 dB
* Use of equal PSD and equal back off
* ACLR = 31 dBc
* Each PA calibrated for 31dBc ACLR at 26dBm with 20MHz 100RB0 DFT-s-OFDM QPSK waveform
* Spurious emissions, SEM and UE-to-UE co-ex same as PC3 NC UL CA

**Issue 1-1: Simulation assumptions**

Proposals

Use the assumptions above

* Option 1: Yes
* Option 2: No
* Option 3: Yes but add also [provide input in comments]

Recommended 1st round discussion is to gather more input on assumptions

### Companies comments on sub-topic 1-1

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

### Sub-topic 1-2

Simulation scenarios to be evaluated from Skyworks contribution

Scenarios evaluated:

* Since same MPR is targeted CP-OFDM is used in each carrier but both CP-OFDM and DFT-s-OFDM can be evaluated
* Worst case back-off IMD3 at -13dBm/MHz and -30dBm/MHz for 1RB+1RB at 15kHz and 30kHz SCS for MPR with 31dBc ACLR and
* Worst case back-off IMD3 at -13dBm/MHz and -25dBm/MHz for 1RB+1RB at 15kHz and 30kHz SCS for NS04 A-MPR
* 1RB+1RB separation of ~100, 200, 600MHz to cover variation across BW separation classes
* Other allocations sizes are recommended but the MPR vs allocation BW behavior from PC3 MPR can also be reused
* 20MHz channel 15kHz SCS and 40MHz channel 15kHz SCS with a gap of 20MHz (100MHz class and in gap ACLR)
* 40MHz channel 15kHz SCS and 40MHz channel 15kHz SCS with a gap of 120MHz (200MHz class)
* 100MHz channel 30kHz SCS and 100MHz channel 30kHz SCS with a gap of 400MHz (600MHz class)

**Issue 1-2: Scenarios to be evaluated**

Proposals

* Option 1: Use list from [**R4-2100572**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100572.zip) **(Skyworks)**
* Option 2: Use list from R4-2005661
* Option 3: Provide more input

Recommended WF:

It is advised to consider the Skyworks list since it is more updated with the new spec for NC UL CA.

We will collect comment on this issue. Companies are encouraged to considered if there is a need to evaluate mixed numerology and mixed waveform type cases (DFT-s and COP-OFDM)

### Companies comments on sub-topic 1-2

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |
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## Summary for 1st round

### Open issues

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

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

*Recommendations on WF/LS assignment*

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

## 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 #2: Other requirements

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

## Companies’ contributions summary

List of documents is the same as in Topic#1

## Open issues summary

In addition to the MPR simulation assumptions, numerous other issues need to be agreed for the NC UL CA PC2 case. In this section some of the issues are identified

### Sub-topic 2-1

Sub-topic description:

SAR management and use of MaxUplinkDutyCycle. If two points that were applied to contiguous UL CA, can be applied for NC UL CA,

* no need to consider different power class configuration of each CC,
* adopt same UL/DL configuration and synchronized condition.

Then **MaxUplinkDutyCycle** can be used in similar fashion as contiguous UL CA

**Issue 2-1: Use of MaxUplinkDutyCycle**

Proposals

* Option 1: Use **MaxUplinkDutyCycle** as it is defined for contiguous UL CA
* Option 2: Other possibilities? Please be specific in comments

Recommended WF

Apply **MaxUplinkDutyCycle**

### Companies comments on sub-topic 2-1

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

### Sub-topic 2-2

Sub-topic description: Pcmax : Re-use of Pcmax from PC3 NC UL CA and fallback as single carrier PC2

**Issue 2-2-1: Re-use of Pcmax from PC3 NC UL CA**

Proposals

* Option 1: Re-use Pcmax from PC3 NC UL CA
* Option 2: Other possibilities? Please be specific

**Issue 2-2-2: Fallback behavior as single carrier PC2**

Proposals

* Option 1: Define same fallback behavior as single carrier PC2
* Option 2: Other possibilities? Please be specific

### Companies comments on sub-topic 2-2

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| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-2-1:Issue 2-2-2:  |
|  |  |

### Sub-topic 2-3

Sub-topic description: Power class tolerance +/- 3 dB

**Issue 2-3: Define power class tolerance +/- 3 dB**

Proposals

* Option 1: Define +/- 3 dB as tolerance for power class
* Option 2: Other values. Please justify why

### Companies comments on sub-topic 2-3

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

## 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:* |

*Suggestion on WF/LS assignment*

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

## 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”* |

# References

[1] RP-202799, “WID revision: RF requirements enhancement for NR frequency range 1”, Huawei, 3GPP TSG-RAN Meeting #90-e, Electronic Meeting, 7th – 11th Dec, 2020