3GPP TSG-RAN WG4 Meeting #109 R4-2318135

Chicago, US, November 13 – 17, 2023

**Agenda item:** 8.6.5

**Source:** Moderator (Xiaomi)

**Title:** Topic summary for [109][129]FR2\_enh\_req\_Ph3\_part2

**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.*

The contributions for the following agenda items are summarised in this document:

8.6.2 UL 256QAM

# Topic #1: MPR and PTRS

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2318392**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318392.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1: The single CC MPR for PC1 in 256QAM operation shall be 3 dB more than that of 64QAM.****Proposal 2: The single CC MPR for PC2 in 256QAM operation shall be 3 dB more than that of 64QAM.****Proposal 3: The single CC MPR for PC5 in 256QAM operation shall be 3 dB more than that of 64QAM.****Proposal 4: The single CC MPR for PC1/2/5 in 256QAM operation shall be 4 dB more than that of 64QAM for 39 GHz band.****Proposal 5: Specify △MPR of 1dB for 39GHz in a new table in the specification.****Proposal 6: Introduce a new table into related clause of PC2 6.2.2.2 for 256QAM** **which can then be referred to for 256QAM with PC5.****Proposal 7: No further discussion** on **how to capture no PTRS in EVM test.****Proposal 8: No need to specify the EVM with limit MCS for UL256QAM in RAN4 specification.****Proposal 9:** **Intra-band CA MPRs for both, contig. and NC, and for PC1/2/5 in 256QAM operation are increased from their respective 64QAM values by 3 dB for 29 GHz and 4 dB for 39 GHz.** |
| [**R4-2318769**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318769.zip) | Qualcomm Incorporated | **Proposal 1: Intra-band CA MPRs for both, contig. and NC, and for both PC1 and PC5 in 256QAM operation are increased from their respective 64QAM values by 3 dB as shown in table below:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Contig. and NC CA, PC1 and PC5, MPR (dB) |  | < 400 | < 800 | < 1400 | < 2400 |
| DFT-s | 64 QAM | 9 | 10.7 | 11.2 | 11.7 |
|  | 256 QAM | 9+3 | 10.7+3 | 11.2+3 | 11.7+3 |
|  |  |  |  |  |  |
| CP- | 64 QAM | 9 | 10.7 | 11.2 | 11.7 |
|  | 256 QAM | 9+3 | 10.7+3 | 11.2+3 | 11.7+3 |

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| [**R4-2318875**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318875.zip) | Xiaomi | **Proposal 1:** **The MPR of both intra-band contiguous and non-contiguous CA for PC1/2/5 in 256QAM operation shall be 3 dB more than that of intra-band CA in 64QAM operation for 29GHz bands.**

|  |  |
| --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth (CABW) |
|  | < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM/CP-OFDM | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
|  | 256 QAM1 | ≤ 12 | ≤ 13.7 | ≤ 14.2 | ≤ 14.7 |
| NOTE 1: Refer to clause 6.1 for 256 QAM applicability. |

**Proposal 2: The MPR of both intra-band contiguous and non-contiguous CA for PC1/2/5 in 256QAM operation shall be 4 dB more than that of intra-band CA in 64QAM operation for 39GHz bands.**

|  |  |
| --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth (CABW) |
|  | < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM/CP-OFDM | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
|  | 256 QAM1 | ≤ 13 | ≤ 14.7 | ≤ 15.2 | ≤ 15.7 |
| NOTE 1: Refer to clause 6.1 for 256 QAM applicability. |

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| [**R4-2318979**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318979.zip) | vivo | **Proposal: For intra-band CA, same delta value compared to 64QAM can be used, i.e., 3 dB for 28GHz and 4 dB for 39GHz.** |
| [**R4-2319015**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319015.zip) | MediaTek (Shenzhen) Inc. | **Observation 1:** **Single CC MPRs for Power Classes 1/2/5 at 28GHz were approved, based on existing MPR values that are 3dB larger than the MPR values for 64QAM. In addition, MPRs for Power Classes 1/2/5 at 39GHz have a 1dB margin compared to those at 28GHz.****Proposal 1: Based on the above analysis, we propose the FR2-1 UL 256QAM MPR values for intra-band contiguous and non-contiguous CA for Power Classes 1/2/5 at 28GHz, as shown in Tables 1-4.** |
| [**R4-2319290**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319290.zip) | LG Electronics France | **Proposal** : Need further discussion on the delta MPR value of 3 dB for intra-band CA. |
| [**R4-2319442**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319442.zip) | ZTE Corporation | **Observation 1: It is not preferred to have significant degradation on MPR for 256QAM** **considering network performance such as UL coverage issue. This kind of requirement still exists in CA configurations.****Proposal 1: The MPR requirements of intra-band contiguous CA and non-contiguous CA for UL 256QAM are 3 dB more than that of 64QAM, as shown in Table 2-1 and Table 2-2, respectively.**Table 2-1: MPRWT\_C\_CA for UE power class 1/2/5 in FR2-1

|  |  |
| --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth |
|  | < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
|  | 256QAM | ≤ 12.0 | 13.7 | 14.2 | ≤ 14.7 |
| CP-OFDM | 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
|  | 256 QAM | ≤ 12.0 | 13.7 | 14.2 | ≤ 14.7 |

Table 2-2: MPRNC\_CA for UE power class 1/2/5 in FR2-1

|  |  |
| --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth |
|  | < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
|  | 256QAM | ≤ 12.0 | 13.7 | 14.2 | ≤ 14.7 |
| CP-OFDM | 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
|  | 256 QAM | ≤ 12.0 | 13.7 | 14.2 | ≤ 14.7 |

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| [**R4-2319675**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319675.zip) | Huawei, HiSilicon | **Observation 1**: It's challenging and critical to meet the EVM requirements and associated MPR requirements for UL 256QAM even for single carrier case.**Observation 2:** More study and evaluation are needed to define 256QAM for intra-band contiguous CA and non-contiguous CA.**Proposal 1:** It is proposed not to define 256QAM requirements for intra-band contiguous CA and non-contiguous CA in Rel-18 WI. |
| [**R4-2320820**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320820.zip) | Ericsson India Private Limited | **Proposal 1: For 256QAM, the MPR for both contiguous and NC intra-band CA and for PC1/2/5 should be increased from their respective 64QAM values by 3 dB.** |

## Open issues summary

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

### Sub-topic 1-1 MPR requirement

**Issue 1-1-1: MRP requirements for intra-band CA of 29GHz**

* Proposals
	+ Option 1: The MPR of both intra-band contiguous and non-contiguous CA for PC1/2/5 in 256QAM operation shall be 3 dB more than that of intra-band CA in 64QAM operation for 29GHz bands. (Nokia, Qualcomm, Xiaomi, vivo, MediaTek, ZTE, Ericsson)
	+ Option 2: Need further discussion on the delta MPR value of 3 dB for intra-band CA. (LGE)
	+ Option 3: Don’t define 256QAM requirements for intra-band contiguous CA and non-contiguous CA in Rel-18 WI. (Huawei)
* Recommended WF
	+ FFS.

LGE: We are OK with Option 1 with [].

Huawei: for intra-band CA case, compared to single carrier, wider channel bandwidth is the worst situation for PA. We need more time to study the exact MPR value. In wide channel bandwidth, the lower EIRP may the case useless. We prefer not to define the requirements for intra-band CA case. It won’t impact the completion of Rel-18 work.

Sony: Our first preference is to go with Option 1. It is meaning less to leave it out of scope. It is better to finish the work now.

Qualcomm: we are OK with option 1. We can talk about the higher MPR.

Mediatek: we propose option 1 but we are OK with higher MPR.

Huawei: in that case we compromise the relaxed MPR value.

Ericsson: we prefer to Option 1 without the relaxation.

Agreement:

* The MPR of both intra-band contiguous and non-contiguous CA for PC1/2/5 in 256QAM operation shall be [3.5 or 4] dB more than that of intra-band CA in 64QAM operation for 29GHz bands.

**Issue 1-1-2: MRP requirements for intra-band CA of 39GHz**

* Proposals
	+ Option 1: The MPR of both intra-band contiguous and non-contiguous CA for PC1/2/5 in 256QAM operation shall be 4 dB more than that of intra-band CA in 64QAM operation for 39GHz bands. (Nokia, Xiaomi, vivo, MediaTek, Qualcomm, ZTE, Ericsson)
	+ Option 2: Need further discussion on the delta MPR value of 3 dB for intra-band CA. (LGE)
	+ Option 3: Don’t define 256QAM requirements for intra-band contiguous CA and non-contiguous CA in Rel-18 WI. (Huawei)
* Recommended WF
	+ FFS.

Agreement:

* The MPR of both intra-band contiguous and non-contiguous CA for PC1/2/5 in 256QAM operation shall be [4.5 or 5] dB more than that of intra-band CA in 64QAM operation for 39GHz bands.

###  Sub-topic 1-2 Other

**Issue 1-2-1: Further confirm the tentative agreements in last meeting WF R4-2317596:**

* Proposals
	+ Proposal 1: The single CC MPR for PC1 in 256QAM operation shall be 3 dB more than that of 64QAM.
	+ Proposal 2: The single CC MPR for PC2 in 256QAM operation shall be 3 dB more than that of 64QAM.
	+ Proposal 3: The single CC MPR for PC5 in 256QAM operation shall be 3 dB more than that of 64QAM.
	+ Proposal 4: The single CC MPR for PC1/2/5 in 256QAM operation shall be 4 dB more than that of 64QAM for 39 GHz band.
	+ Proposal 5: Specify △MPR of 1dB for 39GHz in a new table in the specification.
	+ Proposal 6: Introduce a new table into related clause of PC2 6.2.2.2 for 256QAM which can then be referred to for 256QAM with PC5.
	+ Proposal 7: No further discussion on how to capture no PTRS in EVM test.
	+ Proposal 8: No need to specify the EVM with limit MCS for UL256QAM in RAN4 specification.
* Recommended WF
	+ Keep the same agreements with last meeting.

Agreement:

* Keep the same agreements with last meeting.

# Topic #2: TP and CR

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2318873**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318873.zip) | Xiaomi | The TP to capture the MPR simulation results from different companies and introduce the general description including implementation impact for UE and Specification impact into TR 38.891 |
| [**R4-2318874**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318874.zip) | Xiaomi, Nokia, vivo, LG Electronics, ZTE, Qualcomm, Sony, MediaTek, Huawei, Apple, Ericsson | Formal CR to introduce FR2-1 UL 256 QAM RF requirements into 38.101-2 |
| [**R4-2318876**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318876.zip) | Xiaomi | This TP to correct some simulation results for phase noise profile |
| [**R4-2318980**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318980.zip) | vivo | Draft  |
| [**R4-2319027**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319027.zip) | MediaTek (Shenzhen) Inc. | Draft  |

## Open issues summary

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

### Sub-topic 2-1 TP and CR

**Issue 2-1-1: Approve TP in R4-2318873 to capture the MPR simulation results from different companies and introduce the general description including implementation impact for UE and Specification impact.**

* Proposals
	+ Option 1: Yes
	+ Option 2: Modification is needed
* Recommended WF
	+ TBA

**Issue 2-1-2: Approve TP in R4-2318876 to correct some simulation results for phase noise profile from Xiaomi.**

* Proposals
	+ Option 1: Yes
	+ Option 2: Modification is needed
* Recommended WF
	+ TBA

**Issue2-1-3: CR to introduce FR2-1 UL 256 QAM RF requirements into 38.101-2 for PC1/2/5.**

* Proposals
	+ Option 1: Merge R4-2318980 and R4-2319027 into formal CR R4-2318874.
	+ Option 2: Other.
* Recommended WF
	+ TBA