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.

**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)
	+ 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.

###  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.

# 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 CR for introducing CA MPR for FR2-1 UL 256 QAM  |
| [**R4-2319027**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319027.zip) | MediaTek (Shenzhen) Inc. | Draft CR for Rel-18 TS 38.101-2 to specify FR2-1 UL 256 QAM intra-band CA MPR requirements  |

## 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