**3GPP TSG- Meeting # *09094***

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**Agenda item: 7.4.1**

**Source:** Moderator (Ericsson)

**Title:** Topic summary for [116][127] NR\_FR1\_7MHz\_BW

**Document for:** Information

# Introduction

The scope of this summary is the introduction of 7MHz Channel Bandwidth for n26 and n5 WI, summarizing contributions submitted under AI 7.4.2-4

Based on the agenda, this summary is divided in 2 topics: the first one handles the remaining UE A-MPR open issues while the second one is handling CRs.

The proposal for this meeting would be to reach agreement on the following remaining issues:

* Issue 1-1-1 (Release independence)
* Sub-topics 1-2 and 1-3 (A-MPR for NS\_12, NS\_13 and NS\_15).
* Sub-topic 2-1 (CRs approval)

# Topic #1: System parameters and UE RF

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2509544**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2509544.zip) | Apple | A-MPR proposals |
| [**R4-2509579**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2509579.zip) | Qualcomm Incorporated | A-MPR proposals |
| [**R4-2509942**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2509942.zip) | Nokia | A-MPR proposals |
| [**R4-2510464**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510464.zip) | Huawei, HiSilicon | A-MPR proposals |
| [**R4-2510510**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510510.zip) | Ericsson | A-MPR proposals |
| [**R4-2511315**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2511315.zip) | Nokia | Draft CR to 38.307 - Release independence of 7 MHz channel bandwidth |

## Open issues summary

### Sub-topic 1-1

*Sub-topic description: Release independence and general aspect related to A-MPR regions definition.*

**Issue 1-1-1: Release independence**

* Proposals: TS 38.307 shall clarify that the max/min bandwidth signaling with 7 MHz is only available from Rel-18 but is early implementable from Rel-15
	+ Agree (Nokia)
	+ Disagree
* Recommended WF
* Note that it was already confirmed that 7 MHz can’t be a minimum channel BW in a band, it would have RAN1 impacts.

**Issue 1-1-2: MPR regions mentioned in A-MPR tables**

* Proposals: Remove the texts “Outer/Inner”, “Outer” and “Edge/Inner” from the NS\_12, NS\_13, NS\_14 and NS\_15 A-MPR tables:
	+ Agree (Nokia)
	+ Disagree
* Recommended WF
* This should be agreeable and would avoid any confusion.

### Sub-topic 1-2

*Sub-topic description: PC3 A-MPR.*

The regions for all NSs and for PC3 were agreed in the last meeting, only the A-MPR values should be discussed.

It was also agreed that there is no need for A-MPR for NS\_14 and for PC3.

**Issue 1-2-1: NS\_12 A-MPR**

* Proposals: NS\_12 A-MPR definition for 7 MHz channel BW:
	+ Option 1 (Apple, Ericsson)
		- Confirm Regions A1 and A2 :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR  |
|  |  |  |  | AppleEricsson | Nokia | Qualcomm | Huawei |
| 7MHz | 817.5 ≤ Fc ≤ 820.5 | ≤1.8 | ≤0.72 | A2 | A3\_Nokia | A2 | A2\_H |
|  |  | ≤1.8 | >0.72 | A1 | A4\_Nokia | A3\_Qualcomm | A1\_H |
|  |  | >1.8 | >1.44 | A1 | A5\_Nokia | A2 | A1\_H |

Table 2: A-MPR for NS\_12 (PC3)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3\_Nokia | A4\_Nokia | A5\_Nokia | A3\_ Qualcomm | A1\_H | A2\_H |
|  | Outer/Inner | Outer/Inner |  |  |  | Outer/Inner |  |  |
| DFT-s-OFDM PI/2 BPSK | ≤ 5 | ≤ 4 | 2 | 3 | 1.5 | ≤ 5 | ≤ 5 | ≤ 4 |
| DFT-s-OFDM QPSK | ≤ 5 | ≤ 4.5 | 2 | 4 | 2 | ≤ 5 | ≤ 3.5 | ≤ 3.5 |
| DFT-s-OFDM 16 QAM | ≤ 5.5 | ≤ 4.5 | 2.5 | 4 | 2.5 | ≤ 5.5 | ≤ 4 | ≤ 3.5 |
| DFT-s-OFDM 64 QAM | ≤ 5.5 | ≤ 5 |  | 4 |  | ≤ 5.5 | ≤ 4 | ≤ 3.5 |
| DFT-s-OFDM 256 QAM | ≤ 9.5 | ≤ 5 |  |  |  | ≤ 6 |  |  |
| CP-OFDM QPSK | ≤ 7 | ≤ 6 | 3.5 | 5 |  | ≤ 7 | ≤ 6 | ≤ 5 |
| CP-OFDM 16 QAM | ≤ 7 | ≤ 6 | 3.5 | 5 |  | ≤ 7 | ≤ 6 | ≤ 5 |
| CP-OFDM 64 QAM | ≤ 7 | ≤ 6 |  | 5 |  | ≤ 7 | ≤ 6 | ≤ 5 |
| CP-OFDM 256 QAM | ≤ 9.5 |  |  |  |  | ≤ 7 |  |  |

* Recommended WF
	+ The difference between regions A1 and the new A3 from Qualcomm is the A-MPR value for 256QAM.
	+ Discuss offline how to finalize A-MPR values for each region, by averaging?

**Issue 1-2-2: NS\_13 A-MPR**

* Proposals: NS\_13 A-MPR definition for 7 MHz channel BW:
	+ Option 1 (Apple, Ericsson)
		- Confirm Regions A1 and A2 :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
|  |  |  |  | AppleEricsson | Nokia | Qualcomm | Huawei |
| 7MHz |  | ≤1.8 | <1.44 | A1 | A5\_Nokia | A2 | A1\_H |
|  | 820.5 = Fc | ≤1.8 | ≥1.44 | A2 | A6\_Nokia | A2 | A2\_H |
|  |  | >1.8 | ≥1.8 | A7 | A7\_Nokia | A5\_Qualcomm | A7\_H |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A7 | A5\_Nokia | A6\_Nokia | A7\_Nokia | A5\_Qualcomm | A1\_H | A2\_H | A3\_H |
|  | Outer/Inner | Outer/Inner | Outer/In |  |  |  | Outer/Inner |  |  |  |
| DFT-s-OFDM PI/2 BPSK | ≤ 3.5 | ≤ 4.5 | ≤ 3.5 | 2 | 2.5 | 1 | ≤ 3.5 | ≤ 3.5 | ≤ 4.5 | ≤ 3.5 |
| DFT-s-OFDM QPSK | ≤ 3.5 | ≤ 4.5 | ≤ 3.5 | 2 | 3.5 | 1.5 | ≤ 3.5 | ≤ 3 | ≤ 4 | ≤ 2.5 |
| DFT-s-OFDM 16 QAM | ≤ 3.5 | ≤ 5 | ≤ 3.5 | 2.5 | 3.5 |  | ≤ 3.5 | ≤ 3.5 | ≤ 4.5 | ≤ 3 |
| DFT-s-OFDM 64 QAM | ≤ 4.5 | ≤ 5 | ≤ 3.5 |  | 3.5 |  | ≤ 4.5 | ≤ 4.5 | ≤ 5 | ≤ 3.5 |
| DFT-s-OFDM 256 QAM | ≤ 8 | ≤ 6 | ≤ 3.5 |  |  |  | ≤ 5.5 | ≤ 8 | ≤ 6 | ≤ 3.5 |
| CP-OFDM QPSK | ≤ 5 | ≤ 6.5 | ≤ 4.5 | 3.5 | 4.5 |  | ≤ 5 | ≤ 4.5 | ≤ 5.5 | ≤ 4 |
| CP-OFDM 16 QAM | ≤ 5 | ≤ 6.5 | ≤ 4.5 | 3.5 | 4.5 |  | ≤ 5 | ≤ 5 | ≤ 5.5 | ≤ 4 |
| CP-OFDM 64 QAM | ≤ 6 | ≤ 6.5 | ≤ 4.5 |  | 4.5 |  | ≤ 6 | ≤ 5 | ≤ 5.5 |  |
| CP-OFDM 256 QAM | ≤ 8 | ≤ 8 | ≤ 4.5 |  |  |  | ≤ 8 |  |  |  |

* Recommended WF
	+ The main differences between regions A7 and the new A5 from Qualcomm are the A-MPR values for 64QAM and 256QAM.
	+ Discuss offline how to finalize A-MPR values for each region, by averaging?

**Issue 1-2-3: NS\_15: A-MPR regions**

* Proposals: NS\_15 A-MPR definition for 7 MHz channel BW:
	+ Qualcomm is proposing to redefine the following region:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 7MHz | 841.5 < Fc ≤ 845.5 | ≥4.5 | >0 | A1 |
| ≥2.16, <4.5 | ≥1.8 | A2 |
| ≤1.44 | ~~≤0.36~~ 🡪**>0** | A1 |
| 837 < Fc ≤ 841.5 | >0 | >2.7 | A2 |
| ≥5.94 | ≤2.7 | A7 |

* + A-MPR values

| Channel BW | Carrier Frequency, Fc, MHz | RBend\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
| --- | --- | --- | --- | --- |
|  |  |  |  | Apple | Nokia | Qualcomm | Huawei |
| 7 MHz | 841.5 < Fc ≤ 845.5 | ≥ 4.5 | > 0 | A7\_A | A7\_N | A1 | A7\_H |
| < 4.5, ≥ 2.16 | ≥ 1.8 | A2 | A8\_N | A2 | A2 |
| ≤ 1.44 | ≤ 0.36 | A3 | A9\_N | A1 | A3 |
| 838 < Fc ≤ 841.5 | > 0 | > 2.7 | A2 | A10\_N | A2 | A2 |
| ≥ 5.94 | ≤ 2.7 | A8\_A | MPR enough | A7\_Q | A3 or A8 |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A7\_A | A8\_A | A7\_N | A8\_N | A9\_N | A10\_N | A7\_Q | A7\_H |
|  |  |  |  |  |  |  |  |  |  |  |  |
| DFT-s-OFDM PI/2 BPSK | ≤ 9 | ≤ 5 | ≤ 4 | ≤ 7.0 | ≤ 1.5 | 10.5 | 5 | 1 | 1 | ≤ 2 | ≤ 7 |
| DFT-s-OFDM QPSK | ≤ 9 | ≤ 5 | ≤ 4 | ≤ 7.5 | ≤ 2.0 | 9 | 6 |  | 2 | ≤ 2 | ≤ 11.5 |
| DFT-s-OFDM 16 QAM | ≤ 9 | ≤ 5 | ≤ 4 | ≤ 8.0 | ≤ 2.5 | 9 | 5.5 |  | 3.5 | ≤ 2 | ≤ 11.5 |
| DFT-s-OFDM 64 QAM | ≤ 9 | ≤ 5 | ≤ 4 | ≤ 8.0 | ≤ 2.5 | 9 | 5.5 |  | 3.5 | ≤ 2 | ≤ 12 |
| DFT-s-OFDM 256 QAM | ≤ 9 | ≤ 5 | ≤ 9 | ≤ 8.0 | ≤ 4.5 | 9 | 5.5 |  |  | ≤ 2.5 | ≤ 12 |
| CP-OFDM QPSK | ≤ 10.5 | ≤ 6.5 | ≤ 4 | ≤ 9.0 | ≤ 3.0 | 9.5 | 6 |  | 4.5 | ≤ 3 | ≤ 12.5 |
| CP-OFDM 16 QAM | ≤ 10.5 | ≤ 6.5 | ≤ 4 | ≤ 9.0 | ≤ 3.0 | 9.5 | 6 |  | 4.5 | ≤ 3 | ≤ 12.5 |
| CP-OFDM 64 QAM | ≤ 10.5 | ≤ 6.5 | ≤ 4 | ≤ 9.0 | ≤ 4.5 | 9.5 | 6 |  | 4.5 | ≤ 3 | ≤ 13 |
| CP-OFDM 256 QAM | ≤ 10.5 | ≤ 6.5 | ≤ 9 | ≤ 9.0 | ≤ 6.5 | 9.5 | 6 |  |  | ≤ 3.5 | ≤ 13 |

* Recommended WF
	+ Qualcomm is proposing to redefine one of the regions but, as they have already been agreed in last meeting, it’s better to keep current agreed definition.
	+ Discuss offline how to finalize A-MPR values for each region, by averaging?

### Sub-topic 1-3

*Sub-topic description: PC2 A-MPR.*

The regions for all NSs and for PC2 were tentatively agreed in the last meeting and their exact definition shall be confirmed in this meeting.

It was agreed that there is no need for A-MPR for NS\_14 and for PC2.

**Issue 1-3-1: NS\_12 A-MPR for PC2**

* Proposals: NS\_12 A-MPR definition for 7 MHz channel BW and PC2:
	+ Option 1 (Apple)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR  |
| 7MHz | 817.5 ≤ Fc < 820.5 | ≤1.8 | ≤0.72 | A3 |
|  |  | ≤1.8 | >0.72 | A1 |
|  |  | >1.8 | >1.44 | A1 |

Table 3: A-MPR for NS\_12 (PC2), from [3]

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 |
|  | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 7.5 | 3 | ≤ 5.5 |
| DFT-s-OFDM QPSK | ≤ 7.5 | 3 | ≤ 6 |
| DFT-s-OFDM 16 QAM | ≤ 7.5 | 3.5 | ≤ 6 |
| DFT-s-OFDM 64 QAM | ≤ 7.5 | 4 | ≤ 6.5 |
| DFT-s-OFDM 256 QAM | ≤ 9.5 | 5.0 | ≤ 6.5 |
| CP-OFDM QPSK | ≤ 8.5 | 4.5 | ≤ 7.5 |
| CP-OFDM 16 QAM | ≤ 8.5 | 4.5 | ≤ 7.5 |
| CP-OFDM 64 QAM | ≤ 8.5 | 4.5 | ≤ 7.5 |
| CP-OFDM 256 QAM | ≤ 9.5 | 6.5 | ≤ 7.5 |

* + Option 2 (Qualcomm)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 7 MHz | 817.5 ≤ Fc < 820.5 | ≤1.8 | ≤0.72 | A3 |
| ≤1.8 | >0.72 | A4 |
| >1.8 | >1.44 | A3 |

| Modulation/Waveform | A1 | A2 | A3 | A4 |
| --- | --- | --- | --- | --- |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 7.5 | 3 | ≤ 5.5 | ≤ 7.5 |
| DFT-s-OFDM QPSK | ≤ 7.5 | 3 | ≤ 6 | ≤ 7.5 |
| DFT-s-OFDM 16 QAM | ≤ 7.5 | 4 | ≤ 6 | ≤ 7.5 |
| DFT-s-OFDM 64 QAM | ≤ 7.5 | 4.5 | ≤ 6.5 | ≤ 7.5 |
| DFT-s-OFDM 256 QAM | ≤ 9.5 | 6.0 | ≤ 6.5 | ≤ 8.5 |
| CP-OFDM QPSK | ≤ 9 | 5.0 | ≤ 7.5 | ≤ 8.5 |
| CP-OFDM 16 QAM | ≤ 9 | 5.0 | ≤ 7.5 | ≤ 8.5 |
| CP-OFDM 64 QAM | ≤ 9 | 5.0 | ≤ 7.5 | ≤ 8.5 |
| CP-OFDM 256 QAM | ≤ 11.5 | 7.0 | ≤ 7.5 | ≤ 9.5 |

* + Option 3 (Nokia)

Table 1: A-MPR regions for NS\_12 PC2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR  |
| 7MHz | 817.5 ≤ Fc < 820.5 | ≤1.8 | ≤0.72 | A3 |
|  |  | ≤1.8 | >0.72 | A1 |
|  |  | >1.8 | >2.7 | A2 |

Table 2: A-MPR values for NS\_12 PC2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 |
| DFT-s-OFDM | PI/2 BPSK | 6 | 2 | 2 |
| QPSK | 5 | 3.5 | 2.5 |
| 16 QAM | 6 | 3 | 3 |
| 64 QAM | 6 | 3 | 3.5 |
| 256 QAM | 6.5 |  |  |
| CP-OFDM | QPSK | 6.5 | 4 | 4 |
| 16 QAM | 6.5 | 4 | 4 |
| 64 QAM | 6.5 | 4 | 4 |
| 256 QAM |  |  |  |

* + Option 4 (Huawei)

Table 1: A-MPR regions for NS\_12 for 7MHz CBW (Power Class 2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR  |
| 7MHz | 817.5 ≤ Fc ≤ 820.5 | ≤2.34 | >0 | A3 |

Table 2: A-MPR for NS\_12 (Power Class 2)

|  |  |
| --- | --- |
| Modulation/Waveform | A3 |
|  | Outer/Inner |
| DFT-s-OFDM QPSK | ≤ 4 |
| DFT-s-OFDM 16 QAM | ≤ 5 |
| DFT-s-OFDM 64 QAM | ≤ 5 |
| DFT-s-OFDM 256 QAM |  |
| CP-OFDM QPSK | ≤ 6.5 |
| CP-OFDM 16 QAM | ≤ 6.5 |
| CP-OFDM 64 QAM | ≤ 6.5 |
| CP-OFDM 256 QAM |  |
| NOTE: for 256QAM MPR would suffice and no A-MPR is needed.  |

* Recommended WF

Discuss offline how to finalize A-MPR requirements specifications for PC2 and for NS\_12.

**Issue 1-3-2: NS\_13 A-MPR for PC2**

* Proposals: NS\_13 A-MPR definition for 7 MHz channel BW and PC2:
	+ Option 1 (Apple)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
| 7MHz |  | ≤1.8 | <1.44 | A1 |
|  | 820.5 ≤ Fc | ≤1.8 | ≥1.44 | A2 |
|  |  | >1.8 | ≥1.8 | A1 |

Table 6: A-MPR for NS\_13 (Power Class 2), from [3]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 |
|  | Outer/Inner | Outer/Inner | Outer | Outer |
| DFT-s-OFDM PI/2 BPSK | ≤ 5 | ≤ 6.5 | ≤ 4 | ≤ 3 |
| DFT-s-OFDM QPSK | ≤ 5 | ≤ 6.5 | ≤ 4 | ≤ 3 |
| DFT-s-OFDM 16 QAM | ≤ 5 | ≤ 6.5 | ≤ 4 | ≤ 3 |
| DFT-s-OFDM 64 QAM | ≤ 5 | ≤ 6.5 | ≤ 4 | ≤ 3 |
| DFT-s-OFDM 256 QAM | ≤ 5 | ≤ 7 |  |  |
| CP-OFDM QPSK | ≤ 7 | ≤ 7.5 | ≤ 5.5 | ≤ 4.5 |
| CP-OFDM 16 QAM | ≤ 7 | ≤ 7.5 | ≤ 5.5 | ≤ 4.5 |
| CP-OFDM 64 QAM | ≤ 7 | ≤ 7.5 | ≤ 5.5 | ≤ 4.5 |
| CP-OFDM 256 QAM | ≤ 8  | ≤ 8 |  |  |

* + Option 2 (Qualcomm)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 7MHz | Fc = 820.5 | ≤1.8 | <1.44 | A1 |
| ≤1.8 | ≥1.44 | A2 |
| >1.8 | ≥1.8 | A1 |

Table 10: A-MPR for NS\_13 (Power Class 2)

| Modulation/Waveform | A1 | A2 | A3 | A4 |
| --- | --- | --- | --- | --- |
|  | Outer/Inner | Outer/Inner | Outer | Outer |
| DFT-s-OFDM PI/2 BPSK | ≤ 5 | ≤ 6.5 | ≤ 4 | ≤ 3 |
| DFT-s-OFDM QPSK | ≤ 5 | ≤ 6.5 | ≤ 4 | ≤ 3 |
| DFT-s-OFDM 16 QAM | ≤ 5 | ≤ 7 | ≤ 4 | ≤ 3 |
| DFT-s-OFDM 64 QAM | ≤ 5 | ≤ 7.5 | ≤ 4.5 | ≤ 3 |
| DFT-s-OFDM 256 QAM | ≤ 8 | ≤ 8 | ≤ 6 |  |
| CP-OFDM QPSK | ≤ 7 | ≤ 8 | ≤ 5.5 | ≤ 4.5 |
| CP-OFDM 16 QAM | ≤ 7 | ≤ 8 | ≤ 5.5 | ≤ 4.5 |
| CP-OFDM 64 QAM | ≤ 7.5 | ≤ 8 | ≤ 5.5 | ≤ 4.5 |
| CP-OFDM 256 QAM | ≤ 10 | ≤ 10 | ≤ 7 |  |

* + Option 3 (Nokia)

Table 3: A-MPR regions for NS\_13 PC2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
| 7MHz |  | ≤1.8 | <1.44 | A1 |
|  | 820.5 ≤ Fc | ≤1.8 | ≥1.44 | A2 |
|  |  | >1.8 | ≥3.6 | A3 |

Table 4: A-MPR regions for NS\_13 PC2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 |
| DFT-s-OFDM | PI/2 BPSK | 2 | 6 | 1.5 |
| QPSK | 2.5 | 4.5 | 3 |
| 16 QAM | 3 | 4.5 | 2.5 |
| 64 QAM | 3 | 4.5 | 2.5 |
| 256 QAM |  |  |  |
| CP-OFDM | QPSK | 4 | 5.5 | 3.5 |
| 16 QAM | 4 | 5.5 | 3.5 |
| 64 QAM | 4 | 5.5 |  |
| 256 QAM |  |  |  |

* + Option 4 (Huawei)

Table 3: PC2 A-MPR regions for NS\_13

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel BW | Carrier Frequency, Fc, MHz | RBStart\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
| 7MHz | Fc = 820.5 MHz | ≤1.98 | >0 | A4 |

Table 4: PC2 A-MPR for NS\_13

|  |  |
| --- | --- |
| Modulation/Waveform | A4 |
|  |  |
| DFT-s-OFDM QPSK | ≤ 4.5 |
| DFT-s-OFDM 16 QAM | ≤ 5 |
| DFT-s-OFDM 64 QAM | ≤ 5 |
| DFT-s-OFDM 256 QAM |  |
| CP-OFDM QPSK | ≤ 6.5 |
| CP-OFDM 16 QAM | ≤ 6.5 |
| CP-OFDM 64 QAM | ≤ 6.5 |
| CP-OFDM 256 QAM |  |
| NOTE: for 256QAM MPR would suffice and no A-MPR is needed.  |

* Recommended WF

Discuss offline how to finalize A-MPR requirements specifications for PC2 and for NS\_13.

**Issue 1-3-3: NS\_15 A-MPR for PC2**

* Proposals: NS\_15 A-MPR definition for 7 MHz channel BW and PC2:
	+ Option 1 (Apple)

| Channel BW | Carrier Frequency, Fc, MHz | RBend\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
| --- | --- | --- | --- | --- |
| 7MHz | 841.5 < Fc ≤ 845.5 | ≥4.68 | >0 | [A1] |
|  |  | <4.68, ≥2.52 | ≥2.16 | [A2] |
|  |  | <4.68, ≥2.52 | <2.16, ≥1.44 | [A2] |
|  |  | <1.8 | ≤0.36 | [A3] |
|  | 837 < Fc ≤ 841.5 | ≥0 | ≥2.7 | [A2] |
|  |  | ≥5.94 | <2.7 | [A3] |

* Table 10: A-MPR for NS\_15 (Power Class 2), from [3]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 | A6 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 3 | ≤ 4 |
| DFT-s-OFDM QPSK | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 3 | ≤ 4 |
| DFT-s-OFDM 16 QAM | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 3 | ≤ 4.5 |
| DFT-s-OFDM 64 QAM | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 3 | ≤ 5 |
| DFT-s-OFDM 256 QAM | ≤ 12 | ≤ 6.5 | ≤ 9 | ≤ 13.5 | ≤ 4.5 | ≤ 5 |
| CP-OFDM QPSK | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 12 | ≤ 4.5 | ≤ 6 |
| CP-OFDM 16 QAM | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 12 | ≤ 4.5 | ≤ 6 |
| CP-OFDM 64 QAM | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 12 | ≤ 4.5 | ≤ 6 |
| CP-OFDM 256 QAM | ≤ 13.5 | ≤ 8 | ≤ 9 | ≤ 13.5 | ≤ 6.5 | ≤ 7 |

* + Option 2 (Qualcomm)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 7MHz | 841.5 < Fc ≤ 845.5 | ≥4.68 | >0 | A4 |
| ≥2.52, <4.68 | ≥2.16 | A2 |
| ≥2.52, <4.68 | ≥1.44, <2.16 | A6 |
| <1.8 | ~~≤0.36~~ 🡪**>0** | A1 |
| 837 < Fc ≤ 841.5 | ≥0 | ≥2.7 | A2 |
| ~~≥5.94~~🡪**≥5.58** | <2.7 | A5 |

Table 12: A-MPR for NS\_15 (Power Class 2)

| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Edge/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 3 | ≤ 4 | ≤ 3.5 |
| DFT-s-OFDM QPSK | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 3 | ≤ 4 | ≤ 4 |
| DFT-s-OFDM 16 QAM | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 3.5 | ≤ 4.5 | ≤ 4.5 |
| DFT-s-OFDM 64 QAM | ≤ 12 | ≤ 6.5 | ≤ 7 | ≤ 10.5 | ≤ 4 | ≤ 5 | ≤ 5 |
| DFT-s-OFDM 256 QAM | ≤ 12 | ≤ 6.5 | ≤ 9 | ≤ 13.5 | ≤ 4.5 | ≤ 5 | ≤ 5 |
| CP-OFDM QPSK | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 12 | ≤ 4.5 | ≤ 6 | ≤ 6 |
| CP-OFDM 16 QAM | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 12 | ≤ 5 | ≤ 6 | ≤ 6 |
| CP-OFDM 64 QAM | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 12 | ≤ 5 | ≤ 6 | ≤ 6 |
| CP-OFDM 256 QAM | ≤ 13.5 | ≤ 8 | ≤ 9 | ≤ 13.5 | ≤ 6.5 | ≤ 7 | ≤ 7 |

* + Option 3 (Nokia)

Table 5: A-MPR regions for NS\_15 PC2

| Channel BW | Carrier Frequency, Fc, MHz | RBend\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
| --- | --- | --- | --- | --- |
| 7MHz | 841.5 < Fc ≤ 845.5 | ≥4.68 | >0 | A1 |
|  |  | <4.68, ≥2.52 | ≥2.16 | A2 |
|  |  | <4.68, ≥2.52 | <2.16, ≥1.44 | A3 |
|  |  | <1.62 | ≤0.18 | A4 |
|  | 837 < Fc ≤ 841.5 | ≥0 | ≥3.6 | A5 |
|  |  | ≥5.94 | <2.7 | MPR is enough |

Table 6: A-MPR regions for NS\_15 PC2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 |
| DFT-s-OFDM | PI/2 BPSK | 11 | 5.5 |  | 4.5 | 3 |
| QPSK | 10 | 6.5 | 0.5 | 2 | 4 |
| 16 QAM | 10.5 | 6.5 |  | 4 | 4.5 |
| 64 QAM | 10.5 | 6.5 |  | 4.5 | 4.5 |
| 256 QAM | 10.5 | 6.5 |  |  | 5 |
| CP-OFDM | QPSK | 11.5 | 7.5 | 2.5 | 8.5 | 6 |
| 16 QAM | 11.5 | 7.5 | 2.5 | 8.5 | 6 |
| 64 QAM | 11.5 | 7.5 |  | 8.5 | 6 |
| 256 QAM | 11.5 | 7.5 |  | 8.5 |  |

* + Option 4 (Huawei)

Table 6: A-MPR regions for NS\_15 (Power Class 2)

| Channel BW | Carrier Frequency, Fc, MHz | RBend\*12\*SCS (MHz) | LCRB\*12\*SCS (MHz) | A-MPR |
| --- | --- | --- | --- | --- |
| 7MHz | 845 < Fc ≤ 845.5 | ≥4.86 | ≥2.7 (Zone1) | A1 |
| ≥2.7, ≤4.86 | ≥1.44(Zone2) | A2 |
| ≥4.86 | <2.7(Zone3) | A3 |
| ≤1.26 | ≤0.36(Zone4) | A4 |
| 838 < Fc ≤ 841.5 | ≥4.86 | ≥2.7 (Zone1) | A5 |

Table 7: A-MPR for NS\_15 (Power Class 2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM QPSK | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 9.5 | ≤ 5 |
| DFT-s-OFDM 16 QAM | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 9.5 | ≤ 5 |
| DFT-s-OFDM 64 QAM | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 9.5 | ≤ 5 |
| DFT-s-OFDM 256 QAM | ≤ 13.5 | ≤ 8 | ≤ 7 | ≤ 9.5 | ≤ 5 |
| CP-OFDM QPSK | ≤ 14.5 | ≤11 | ≤ 9 | ≤ 11 | ≤ 6.5 |
| CP-OFDM 16 QAM | ≤ 14.5 | ≤ 11 | ≤ 9 | ≤ 11 | ≤ 6.5 |
| CP-OFDM 64 QAM | ≤ 14.5 | ≤ 11 | ≤ 9 | ≤ 11 | ≤ 6.5 |
| CP-OFDM 256 QAM | ≤ 14.5 | ≤ 11 | ≤ 9 | ≤ 11 | ≤ 6.5 |

* Recommended WF

Discuss offline how to finalize A-MPR requirements specifications for PC2 and for NS\_15.

# Topic #2: CRs and draft Cs

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **UE** |
| [**R4-2509578**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2509578.zip) | Qualcomm Incorporated | Big CR on 7 MHz Channel Bandwidth for bands n5 and n26 Note: This should have been a CR, not a draft CR as we are supposed to close the WI in this meeting.  |
| **BS** |
| [**R4-2509389**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2509389.zip) | CATT | CR to TS 38.115-1 on 7MHz channel bandwidth Note: based on the endorsed draftCR R4-2507918 in RAN4#115 |
| [**R4-2509390**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2509390.zip) | CATT | draftCR to TS 38.104 on ACLR and blocking requirements for 7MHz channel bandwidth |
| [**R4-2509414**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2509414.zip) | Nokia | CR to 38.141-1 on introduction of RF requirements for 7MHz channel bandwidth |
| [**R4-2510405**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510405.zip) | ZTE Corporation, Sanechips | CR to TS37.104 Introduction of 7 MHz NR FR1 channel bandwidth |
| [**R4-2510406**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510406.zip) | ZTE Corporation, Sanechips | CR to TS37.141 Introduction of 7 MHz NR FR1 channel bandwidth Note: based on the endorsed draft CR R4-2507922 in RAN4#115 |
| [**R4-2510407**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510407.zip) | ZTE Corporation, Sanechips | CR to TS38.113 Introduction of 7 MHz NR FR1 channel bandwidth Note: based on the endorsed draft CR R4-2506325 in RAN4#115 |
| [**R4-2510511**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510511.zip) | Ericsson | Running CR to TS 38.104 - Introduction of 7 MHz channel BW Note: based on R4-2506151 endorsed in RAN4#115  |
| [**R4-2510512**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510512.zip) | Ericsson | CR to TS 38106 - 7 MHz channel BW clarification Note: based on R4-2506151 endorsed in RAN4#115  |
| [**R4-2510513**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2510513.zip) | Ericsson | CR to TS 37113 - Introduction of 7 MHz channel BW Note: based on R4-2506153 endorsed in RAN4#115  |
| [**R4-2511540**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2511540.zip) | Huawei, HiSilicon | CR to TS 37.105: 7MHz channel bandwidth introduction Note: based on R4-2507923 endorsed in RAN4#115 |
| [**R4-2511541**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2511541.zip) | Huawei, HiSilicon | CR to TS 37.145-1: 7MHz channel bandwidth introduction Note: based on R4-2507924 endorsed in RAN4#115 |
| [**R4-2511542**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2511542.zip) | Huawei, HiSilicon | CR to TS 37.145-2: 7MHz channel bandwidth introduction Note: based on R4-2507925 endorsed in RAN4#115 |
| [**R4-2511543**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2511543.zip) | Huawei, HiSilicon | CR to TS 38.141-2: 7MHz channel bandwidth introduction Note: based on R4-2507926 endorsed in RAN4#115 |
| [**R4-2511544**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116/Docs/R4-2511544.zip) | Huawei, HiSilicon | CR to TS 38.176-2: restriction of 7MHz channel bandwidth introduction Note: based on R4-2507927 endorsed in RAN4#115 |