**3GPP TSG RAN WG4 meeting #94-e R4-2002762**

**E-meeting, 24th Feb. – 06th March, 2020**

### **Source: LG Electronics**

### **Title: Revised MPR simulation results for PSSCH/PSCCH NR V2X UE**

### **Agenda Item: 8.4.4.1**

### **Document for: Approval**

# Introduction

After RAN4 #93 meeting and e-mail discussion, the general MPR simulation assumptions for NR V2X were agreed. In this contribution, we propose our simulation results to define new maximum output power reduction (MPR) for NR V2X in Rel-16.

# Simulation assumptions for MPR

After the e-mail discussion, detail MPR simulation assumptions were agreed and they are shown in Table 1 and 2.

Table 1: MPR simulation assumptions for NR V2X

|  |  |
| --- | --- |
| **parameter** | **Assumption** |
| center frequency | 2.7GHz/5.9GHz |
| Bandwidth | 10/20/30/40MHz |
| Maximum output power | 23dBm |
| Numerology | 15 kHz/30kHz/60kHz |
| Modulation | QPSK/16QAM/64QAM/256QAM |
| Waveform | CP-OFDM |
| Carrier leakage | 25dBc |
| IQ image | 25dBc |
| CIM3 | 45 or 60 dBc |
| PA calibration | PA calibrated to deliver -30dBc ACLR for a fully allocated RB in 20MHz QPSK DFT-S-OFDM waveform at 1 dB MPR.  This is based on assumption to share PA between LTE V2X and NR V2X at 5.9GHz as worst case. |

Table 2: MPR simulation assumptions based on RAN1’s agreement

|  |  |
| --- | --- |
| **Items** | **Assumption** |
| Allowed sub-channel sizes | • Support {10, 15, 20, 25, 50, 75, 100} PRBs for possible sub-channel size. |
| Allowed LCRB allocation | 10,15,20,25,30,40,45,50,60,70,75,80,90,100,105,110,120,130,135,140,150,160,165,170,175,180,190,195,200,210 |
| Regarding PSCCH / PSSCH multiplexing |  |
| PSCCH size | 10RB\*3symbol |
| PSD offset of X dB between PSCCH and PSSCH | 0dB |

# MPR simulation results for NR V2X

To specify new MPR requirements for NR V2X in Rel-16, new MPR simulation results are provided based on the assumptions that are listed in Table 1. For CIM3, the value of 60 dBc was chosen and all the modulations (QPSK, 16QAM, 64QAM, and 256QAM) have been performed. More details of the simulation results are plotted in figures below.

**<10 MHz>**

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 1 10MHz 15 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 2 10MHz 30 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 3 10MHz 60 kHz SCS

**<20 MHz>**

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 4 20MHz 15 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 5 20MHz 30 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 6 20MHz 60 kHz SCS

**<30 MHz>**

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 7 30MHz 15 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 8 30MHz 30 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 9 30MHz 60 kHz SCS

**<40 MHz>**

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 10 40MHz 15 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 11 40MHz 30 kHz SCS

|  |  |  |
| --- | --- | --- |
|  |  |  |

Figure 12 40MHz 60 kHz SCS

According to the simulation results of 64QAM, it can be noted that 64QAM is also limited by SEM and ACLR and inner/outer allocation of NR can be reused for 64QAM modulation. On the other hands, it is found that 256QAM is limited by EVM regardless of the inner/outer allocations. For inner/outer allocation, the following parameters [2] considered as follows:

Where the following parameters are defined to specify valid RB allocation ranges for Outer and Inner RB allocations:

NRB is the maximum number of RBs for a given Channel bandwidth and sub-carrier spacing defined in Table 5.3.2-1. RBStart,Low = max(1, floor(LCRB/2))

where max() indicates the largest value of all arguments and floor(x) is the greatest integer less than or equal to x.

RBStart,High = NRB – RBStart,Low – LCRB

The RB allocation is an Inner RB allocation if the following conditions are met

RBStart,Low ≤ RBStart ≤ RBStart,High,and

LCRB ≤ ceil(NRB/2)

where ceil(x) is the smallest integer greater than or equal to x.

An edge RB allocation is considered as the outer RB allocation range.

**Observation 1: 64QAM is also limited by SEM and ACLR and the inner/outer allocation method of NR can be reused for QPSK, 16QAM, and 64QAM modulation orders.**

**Observation 2: It is clear that 256QAM modulation order is limited by EVM.**

**Proposal 1: The inner/outer allocation method of NR can be reused for QPSK, 16QAM, and 64QAM modulation orders in NR V2X MPR requirement.**

**Proposal 2: An edge RB allocation can be considered as the outer RB allocation range for NR V2X MPR requirement.**

# Conclusion

According to our MPR simulation results in the section 3, we propose a new MPR requirement for NR V2X in Rel-16. It can be noted that 1dB implementation margin is added to the MPR simulation results.

Table 3. Maximum Power Reduction (MPR) for power class 3 NR V2X   
(Contiguous PSCCH and PSSCH transmission)

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **Channel bandwidth/MPR (dB)** | |
| **Outer RB allocations** | **Inner RB allocations** |
| CP-OFDM | QPSK/ 16QAM | ≤ 4.0 | ≤ 2.0 |
| 64 QAM | ≤ 4.5 | ≤ 3.5 |
| 256 QAM | ≤ 6.0 | |

**Proposal 1: The inner/outer allocation method of NR can be reused for QPSK, 16QAM, and 64QAM modulation orders in NR V2X MPR requirement.**

**Proposal 2: An edge RB allocation can be considered as the outer RB allocation range for NR V2X MPR requirement.**

**Proposal 3: It is proposed to take the table 3 as NR V2X MPR requirement in Rel-16.**

# Reference

[1] R4-2001218, “TP on revised MPR simulation assumptions and updated NR requirements to cover open issue” LG Electronics

[2] TS38.101-1 v16.2.0