**3GPP TSG RAN WG4 Meeting #95-e R4-2006746**

**Electronic meeting, 25th May – 05th June 2020**

### **Agenda Item: 6.4.3**

### **Source: LG Electronics**

### **Title: TP on remaining issues for NR V2X UE RF requirements**

**Document for: Approval**

1. **Introduction**

In the last RAN4 #94-e meetings, RAN4 agreed the NR V2X endorsed draft CR and most UE RF core requirements are agreed for single CC V2X operating and inter-band con-current V2X operating for 5G V2X service.

Based on last RAN4 e-meeting, the following items are listed up to cover the open issues for NR V2X UE RF requirements.

* **Position of Switching period between LTE SL and NR SL at n47**
  + - * **Candidate options**
    - Option 1: Switching period is placed at the NR slot
    - Option 2: The whole switching time including switching period as well as transient periods shall be placed at the previous E-UTRA sub-frame or NR slot.
    - Option 3: The switching time can be located on guard period symbol at the end of slot and lower priority RAT signal slot. If there is no priority or same priority, two continuous slots of two RATs should share the part of switching time period minus guard period symbol.
      * **Suggested WF on switching period position**
    - Alt. 1: Option1 is chosen
    - Alt. 2: Option 2 is chosen
    - In next RAN4 meeting, RAN4 shall decide the switch period position
* **A-MPR for PSSCH/PSCCH transmission: Merged with max. A-MPR values**
* **A-MPR for simultaneous PSFCH transmission: Merged with max. A-MPR values**
* **MPR/A-MPR for S-SSB transmission: Merged with max. MPR/A-MPR values**
* **Maximum input levels**
* **Remove [ ] in the concreted RF requirements**

So, we propose updated TP contents to reflect the above agreements.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of the TP in clause 8 of TR38.886 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

# 8 Transmitter characteristics

*<Unchanged sections are omitted>*

#### 8.1.2.1 MPR for Power class 3 V2X UE

For contiguous allocation of PSCCH and PSSCH simultaneous transmission, the allowed MPR for the maximum output power for NR V2X physical channels PSCCH and PSSCH shall be specified as inner/outer RB allocations in Table 8.1.2.1-1 for power class 3.

Table 8.1.2.1-1: 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 | ≤ [4.5] | ≤ [2.5] |
| 16 QAM | ≤ [4.5] | ≤ [2.5] |
| 64 QAM | ≤ [4.5] | |
| 256 QAM | ≤ [7.0] | |

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 in TS38.101-1.

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.

The RB allocation is an Outer RB allocation for all other allocations which are not an Inner RB allocation.

For single V2X UE’s PSFCH transmission for PC3 NR V2X UE, the required MPR is defined as follow

MPR\_PSFCH = [3.5] dB

For contiguous and non-contiguous allocation for simultaneous PSFCH transmission for PC3 NR V2X UE, the required MPR are specified as follow

MPR\_PSFCH = CEIL {MA\_PSFCH, 0.5}

Where MA is defined as follows

MA\_PSFCH = 7.5 ; 0.00< NGap/NRB ≤ 0.55

= 12.0 ; 0.55< NGap/NRB ≤1.0

Where

NGap is the gap RB amount between RBstart and RBend for contiguous and non-contiguous allocation simultaneous PSFCH transmission. (NGap = RBend - RBstart)

CEIL{MA, 0.5} means rounding upwards to closest 0.5dB.

The allowed MPR for the maximum output power for V2X physical channels on S-SSB transmission are specified as follow

Table 8.1.2.1-2: Maximum Power Reduction (MPR) for S-SSB transmission for power class 3 NR V2X



|  |  |  |
| --- | --- | --- |
| **Channel** | **MPR (dB)** | |
| **Outer RB allocations1** | **Inner RB allocations1** |
| S-SSB | ≤ [4.5] | ≤ [2.5] |
| NOTE 1: Inner and Outer RB allocations are defined in section 8.1.2.1 | | |

8.1.3 UE maximum output power with additional requirements

To comply the EN 302 571 standard emission mask, RAN4 need to derive A-MPR requirements considering with the additional A-SEM and A-SE requirements in EN 302 571 standard as shown in Table 8.1.3-1 and Table 8.1.3-2.

NR V2X UE shall satisfy the additional SEM and additional SE requirements when NS\_33 is configured from pre-configured radio parameters or the cell and the indication from upper layers has indicated was informed.

Table 8.1.3-1: Additional SEM requirements for 10MHz channel bandwidth

|  |  |  |
| --- | --- | --- |
| Spectrum emission limit (dBm EIRP)/ Channel bandwidth | | |
| ΔfOOB  (MHz) | 10 MHz | Measurement bandwidth |
| ± 0-0.5 | [] | 100 kHz |
| ± 0.5-5 | [] | 100 kHz |
| ± 5-10 | [] | 100 kHz |

NOTE 1: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE 2: Additional SEM for V2X overrides any other requirements in frequency range 5855-5950MHz.

NOTE 3: The EIRP requirement is converted to conducted requirement depend on the supported post antenna connector gain Gpost connector declared by the UE following the principle described in annex G in TS38.101-1.

Table 8.1.3-2: Additional SE requirements

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| n47 | E-UTRA Band 1, 3, 5, 7, 8, 22, 26, 28, 34, 39, 40, 41, 42, 44, 45, 65, 68, 72, 73  NR band n77, n78 , n79 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| Frequency range | 5925 | - | 5950 | -30 EIRP | 1 | 38, 40, 43 |
| Frequency range | 5815 | - | 5855 | -30 EIRP | 1 | 38, 43 |
| NOTE 38: Applicable when NS\_33 or NS\_34 is configured by the pre-configured radio parameters.  NOTE 40: In the frequency range x-5950MHz, SE requirement of -30dBm/MHz should be applied; where x = max (5925, fc + 15), where fc is the channel centre frequency.  NOTE 43: The EIRP requirement is converted to conducted requirement depend on the supported post antenna connector gain Gpost connector declared by the UE following the principle described in annex I. | | | | | | | |

Also, FCC had regulatory requirements for 40MHz in ITS spectrum as shown in Table 8.1.3-3

Table 8.1.3-3: Additional SEM requirements for 40MHz channel bandwidth (fc =5885 MHz)

|  |  |  |
| --- | --- | --- |
| ΔfOOB (MHz) | Emission Limit (dBm) | Measurement Bandwidth |
| ±0 - 2 | -32 | 100kHz |
| ±2-10 | -36 | 100kHz |
| ±10-20 | -38 | 100kHz |
| ±20-40 | -43 | 100kHz |
| ±40 - 100 | -50 | 100kHz |

To comply the regional regulatory requirements, RAN4 specify the A-MPR requirements according to different network signalling by pre-configured radio parameters or the cell and the indication from upper layers has indicated to NR V2X UE.

The allowed additional Maximum Power Reduction (A-MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) will be specified in TS38.101-1 as below.

Table 8.1.3-4: Additional Maximum Power Reduction (A-MPR) for NR V2X

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Network Signalling value | Requirements (subclause) | NR Band | Channel bandwidth (MHz) | Resources Blocks (*N*RB) | A-MPR (dB) |
| NS\_33 | Table 8.1.3-1  (A-SEM)  Table 8.1.3-2  (A-SE) | n47 | 10 | Table 8.1.3.1-1  Table 8.1.3.1-2  Table 8.1.3.1-3  Table 8.1.3.1-4 | |
| NS\_52 | Table 8.1.3-3  (A-SEM) | n47 | 40 | Table 8.1.3.2-1  Table 8.1.3.2-2  Table 8.1.3.2-3 | |
| NS\_53 | Table 8.1.3-1  (A-SEM) | n47 | 10 | Table 8.1.3.3-1  Table 8.1.3.3-2  Table 8.1.3.3-3 | |

#### 8.1.3.1 AMPR for NS\_33

When NS\_33 is indicated by the network or pre-configured radio parameters for NR V2X UE, the additional maximum output power reduction specified as

A-MPR = CEIL {MA, 0.5}

Where MA is defined as follows

MA = A-MPRBase + Gpost connector\* A-MPRStep

CEIL{MA, 0.5} means rounding upwards to closest 0.5dB.

A-MPRBase which is specified for PSCCH and PSSCH transmission\S-SSB\PSFCH below is allowed when network signalling value is provided*.* A-MPRBase is the default A-MPR value when no Gpost connector is declared. The supported post antenna connector gain Gpost connector is declared by the UE following the principle described in 38.101-1.

Table 8.1.3.1-1: A-MPR for PSSCH/PSCCH by NS\_33 (at Fc =5860MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Carrier frequency(MHz)** | **Resources Blocks (*L*CRB)** | **Start Resource**  **Block** | **A-MPRbase (dB)** | | | **A-MPRstep (dB)** |
| **QPSK/16QAM** | **64QAM** | **256QAM** |
| 5860 | ≥ 10 and ≤ 15 | 0 | ≤ 24 | | | 1.0 |
| ≥ 1 and ≤ 3 | ≤19 | | |
| ≥ 10 and ≤ 15 | ≥ 26 and ≤ 38 | ≤6 | | |
| ≥ 10 and ≤ 20 | ≥ 12 and ≤ 14 | ≤11 | | |
| ≥ 15 and ≤ 19 | ≤9.5 | | |
| ≥ 20 and ≤ 25 | ≤7.5 | | |
| ≥ 10 and ≤ 30 | ≥ 4 and ≤7 | ≤ 16 | | |
| ≥ 8 and ≤ 11 | ≤ 13.5 | | |
| ≥ 20 and ≤ 30 | ≥ 0 and ≤ 3 | ≤ 22 | | |
| 25 and 30 | ≥ 16 and ≤ 21 | ≤ 9.5 | | |
| ≥ 22 and ≤ 27 | ≤ 7.5 | | |
| ≥ 25 and ≤ 40 | ≥ 12 and ≤ 15 | ≤ 12 | | |
| 40 and 45 | 0 and 1 | ≤ 19 | | |
| ≥ 2 and ≤ 5 | ≤ 16 | | |
| ≥ 6 and ≤ 11 | ≤ 13.5 | | |
| ≥ 50 | ≥ 0 | ≤ 16 | | |



Table 8.1.3.1-2: A-MPR for PSSCH/PSCCH by NS\_33 at other carrier frequency

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Carrier frequency(MHz)** | **RB allocations** | **A-MPRbase (dB)** | | | | **A-MPRstep (dB)** |
| **QPSK** | **16QAM** | **64QAM** | **256QAM** |
| 5870, 5880, 5890, 5900, 5910, 5920 | Inner | ≤ 3.0 | | ≤ 5.0 | ≤ 6.0 | 0.5 |
| Outer | ≤ 4.5 | |
| NOTE 1: Inner and Outer RB allocations are defined in section 8.1.2.1 | | | | | | |



For the simultaneous PSFCH transmission when NS\_33 is indicated by the network or pre-configured radio parameters for NR V2X UE, the NR UE allow the follow A-MPR requirements

Table 8.1.3.1-3: A-MPR for simultaneous PSFCH by NS\_33

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Channel Bandwidth, MHz** | **Center Frequency** | **A-MPRbase (dB)** | | | **A-MPRstep (dB)** | **Number of RBs** |
| 0 ≤ NGap / NRB < 0.15 | 0.15≤ NGap / NRB < 0.3 | 0.3≤ NGap / NRB ≤ 1 |
| 10 | 5860 | 19.0 | | | 1.0 | 1 |
| 22.0 | | | 1.0 | >1 |
| 5870, 5880, 5890,5900,5910,5920 | 5 | | | 0.8 | 1 |
| 14 | 7.0 | 18.5 | 0.8 | >1 |
| NOTE 1: NGap is the gap (in units of RBs) between RBstart and RBend for simultaneous PSFCH transmission with contiguous and non-contiguous RB allocation. (NGap = RBend - RBstart) | | | | | | |

For the S-SSB transmission when NS\_33 is indicated by the network or pre-configured radio parameters for NR V2X UE, the NR UE allow the follow A-MPR requirements

Table 8.1.3.1-4: A-MPR for S-SSB transmission by NS\_33

|  |  |  |  |
| --- | --- | --- | --- |
| **Carrier Frequency (MHz)** | **RBStart \* 12\*SCS**  **[MHz]** | **A-MPRBase (dB)** | **AMPRStep (dB)** |
| 5860 | ≤0.54 | ≤ 25 | 1.0 |
| >0.54 and ≤3.06 | ≤ 17 |
| >3.06 and ≤3.24 | ≤ 11 |
| >3.24 and ≤3.6 | ≤ 8 |
| >3.6 and ≤7.2 | ≤ 7 |
| 5870, 5880, 5890, 5910, 5920 | ≤0.36 | ≤ 6.5 | 0.5 |
| >0.36 and ≤1.44 | ≤ 5.5 |
| >1.44 and ≤2.16 | ≤ 4.0 |
| >2.16 and ≤3.24 | ≤ 3.0 |
| >3.24 and ≤4.32 | ≤ 5.5 |
| >4.32 and ≤7.2 | ≤ 6.5 |

#### 8.1.3.2 AMPR for NS\_52

When NS\_52 is indicated by the network or pre-configured radio parameters for NR V2X UE, the additional maximum output power reduction specified as

A-MPR = CEIL {MA, 0.5}

Where MA is defined as follows

MA = A-MPR

CEIL{MA, 0.5} means rounding upwards to closest 0.5dB.

Table 8.1.3.2-1: A-MPR for PSSCH/PSCCH by NS\_52

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Carrier frequency(MHz)** | **Modulation** | **A-MPR(dB)** | | |
| **Edge RB allocations** | **Outer RB allocations** | **Inner RB allocation** |
| 5885 | QPSK | ≤ (10.0 + ΔNote1) | ≤ 8.0 | ≤ 3.5 |
| 16QAM | ≤ 8.0 | ≤ 3.5 |
| 64QAM | ≤ 8.5 | ≤ 4.5 |
| 256QAM | ≤ 8.5 | ≤ 6.0 |
| Note1: Δ is 0, 3, and 5 for 60kHz, 30kHz, and 15kHz SCS, respectively. | | | | |

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 [3].

RBStart,Low = max(1, floor(NRB /3.5))

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/3.5)

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

An Edge RB allocation is the one for which the RB(s) is (are) allocated at the lowermost or uppermost edge of the channel with LCRB ≤ floor(NRB\*0.2) RBs.

The RB allocation is an Outer RB allocation for all other allocations which are not an Inner RB allocation or Edge RB allocation.

For the simultaneous PSFCH transmission when NS\_52 is indicated by the network or pre-configured radio parameters for NR V2X UE, the NR UE allow the follow A-MPR requirements

Table 8.1.3.2-2: A-MPR for simultaneous PSFCH by NS\_52

|  |  |  |
| --- | --- | --- |
| **Channel Bandwidth, MHz** | **Center Frequency** | **A-MPR (dB)** |
| 40 | 5885 | 23.5 |

For the S-SSB transmission when NS\_52 is indicated by the network or pre-configured radio parameters for NR V2X UE, the NR UE allow the follow A-MPR requirements

Table 8.1.3.2-3: A-MPR for S-SSB transmission by NS\_52

|  |  |  |
| --- | --- | --- |
| **Carrier Frequency (MHz)** | **RBStart \* 12\*SCS**  **[MHz]** | **A-MPR (dB)** |
| 58851 | ≤ 6 | ≤ 15 |
| > 6 and ≤ 9 | ≤ 9.5 |
| > 9 and ≤ 27 | ≤ 4.0 |
| > 27 and ≤ 30.24 | ≤ 9.5 |
| > 30.24 | ≤ 15 |
| NOTE 1: Applies only when NS\_52 is signalled | | |

#### 8.1.3.3 AMPR for NS\_53

When NS\_53 is indicated by the network or pre-configured radio parameters for NR V2X UE, the additional maximum output power reduction specified as

A-MPR = CEIL {MA, 0.5}

Where MA is defined as follows

MA = A-MPRBase + Gpost connector\* A-MPRStep

CEIL{MA, 0.5} means rounding upwards to closest 0.5dB.

A-MPRBase which is specified for PSCCH and PSSCH transmission\S-SSB\PSFCH below is allowed when network signalling value is provided*.* A-MPRBase is the default A-MPR value when no Gpost connector is declared. The supported post antenna connector gain Gpost connector is declared by the UE following the principle described in 38.101-1.

Table 8.1.3.3-1: A-MPR for PSSCH/PSCCH by NS\_53

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Carrier frequency(MHz)** | **RB allocations** | **A-MPRbase (dB)** | | | | **A-MPRstep (dB)** |
| **QPSK** | **16QAM** | **64QAM** | **256QAM** |
| 5860, 5870, 5880, 5890, 5900, 5910, 5920 | Inner | ≤ 3.0 | | ≤ 5.0 | ≤ 6.0 | 0.5 |
| Outer | ≤ 4.5 | |
| NOTE 1: Inner and Outer RB allocations are defined in section 8.1.2.1 | | | | | | |

For the simultaneous PSFCH transmission when NS\_53 is indicated by the network or pre-configured radio parameters for NR V2X UE, the NR UE allow the follow A-MPR requirements

Table 8.1.3.3-2: A-MPR for simultaneous PSFCH by NS\_53

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Channel Bandwidth, MHz** | **Center Frequency** | **A-MPRbase** **(dB)** | | | **A-MPRstep (dB)** | **Number of RBs** |
| 0 ≤ NGap / NRB < 0.15 | 0.15≤ NGap / NRB < 0.3 | 0.3≤ NGap / NRB ≤ 1 |
| 10 | 5860, 5870, 5880, 5890,5900,5910,5920 | 5.0 | | | 0.8 | 1 |
| 14.0 | 7.0 | 18.5 | 0.8 | >1 |
| NOTE 1: NGap is the gap (in units of RBs) between RBstart and RBend for simultaneous PSFCH transmission with contiguous and non-contiguous RB allocation. (NGap = RBend - RBstart) | | | | | | |

For the S-SSB transmission when NS\_53 is indicated by the network or pre-configured radio parameters for NR V2X UE, the NR UE allow the follow A-MPR requirements

Table 8.1.3.3-3: A-MPR for S-SSB transmission by NS\_53

|  |  |  |  |
| --- | --- | --- | --- |
| **Carrier Frequency (MHz)** | **RBStart\* 12\*SCS**  **[MHz]** | **A-MPRBase (dB)** | **AMPRStep (dB)** |
| 5860, 5870, 5880, 5890, 5910, 5920 | ≤0.36 | ≤ 6.5 | 0.5 |
| >0.36 and ≤1.44 | ≤ 5.5 |
| >1.44 and ≤2.16 | ≤ 4.0 |
| >2.16 and ≤3.24 | ≤ 3.0 |
| >3.24 and ≤4.32 | ≤ 5.5 |
| >4.32 and ≤7.2 | ≤ 6.5 |
| NOTE 1: Applies only when NS\_53 is signalled | | | |

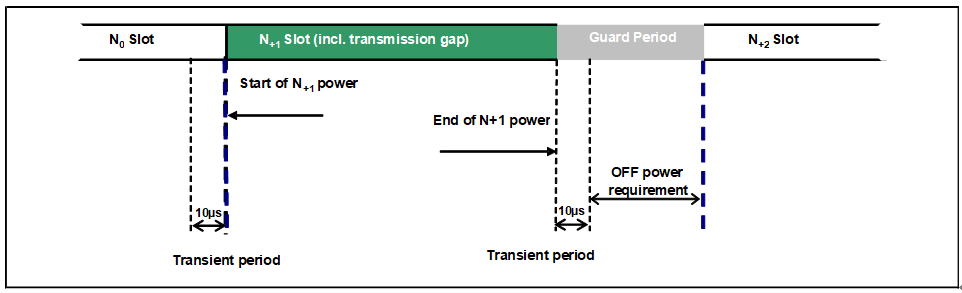
*<Unchanged sections are omitted>*

### 8.1.7 ON/OFF time mask for NR V2X UE

For NR V2X service, additional requirements on ON/OFF time masks for V2X physical channels and signals are specified in this clause.

8.1.7.1 General time mask for NR V2X UE

The General ON/OFF time mask defines the observation period between the Transmit OFF and ON power and between Transmit ON and OFF power for PSCCH, and PSSCH transmissions in a subframe wherein the last symbol is punctured to create a guard period.

**Figure 8.1.7.1-1: General PSCCH/PSSCH time mask for NR V2X UE**

8.1.7.2 S-SSB time mask

The S-SSB time mask for NR V2X UE defines the observation period between transmit OFF and ON S-PSS power and between transmit ON PSBCH and OFF power in a slot, with last symbol punctured to create a guard period.

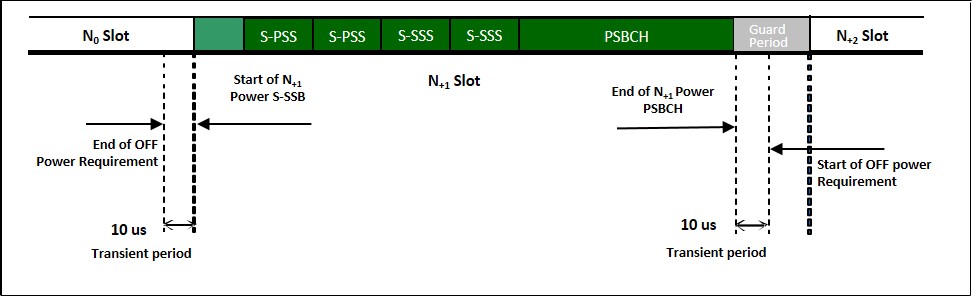


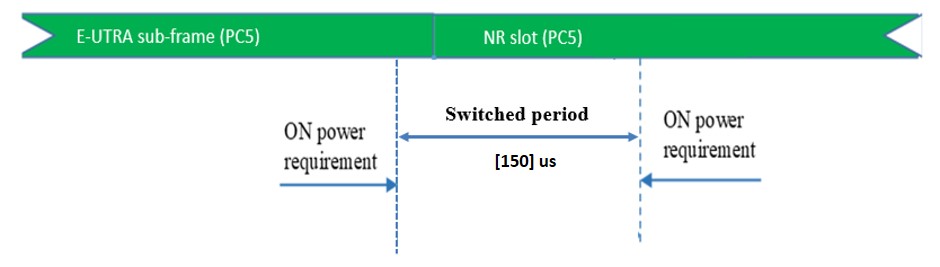
Figure 8.1.7.2-1: S-SSB time mask for NR V2X UE

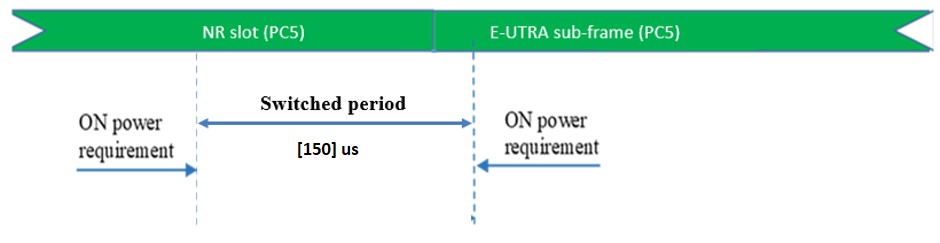
8.1.7.3 Additional Time mask for TDM operation between NR SL and LTE SL at n47

When a NR V2X UE is operated with TDM between NR SL and LTE SL at n47 without dual PA capability, the maximum UL switching time is defined as 150 us and SL reception interruption is allowed during UL switching time masks in Figure 8.1.7.3-1 and Figure 8.1.7.3-2 shall apply.

Based on the justification in NR V2X WID, the NR transmission will be used for complement LTE V2X for advanced V2X services and support interworking with LTE V2X.

Therefore, the switching period allocate in the NR slot as shown in Figure 8.1.7.3-1 and Figure 8.1.7.3-2.

**Figure 8.1.7.3-1: E-UTRA V2X to NR V2X switching time mask at n47 without dual PA capability**

****

**Figure 8.1.7.3-2: NR V2X to E-UTRA V2X switching time mask at n47 without dual PA capability**

*<Unchanged sections are omitted>*

9.1.2 Maximum input level

Maximum input level is defined as the maximum mean power received at the UE antenna port, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

For V2X, the requirement are defined for 10MHz, 20MHz, 30MHz and 40MHz. The parameters of reference measurement channel shall be changed according to the physical layer design specific to NR V2X UE in Table 8.1-1.

Table 9.1.2-1: Maximum input level for V2X

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rx Parameter | Units | Channel bandwidth | | | | | | |
|  |  |  | 10 MHz | 20  MHz | 30 MHz | 40 MHz |
| Power in Transmission Bandwidth Configuration | dBm |  |  |  | -252 | -252 | -232 | -222 |
|  |  |  | -273 | -273 | -253 | -243 |
| NOTE 1: Reference measurement channel is FFS  NOTE 2: Applicable for 64 QAM.  NOTE 3: Applicable for 256 QAM. | | | | | | | | |

9.1.3 Adjacent Channel Selectivity (ACS)

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive an NR signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel.

ACS reflects the digital domain filter attenuation capability, which is model together with ACLR in ACIR. Based on PRR metric. In co-existence study, the existing NR ACS requirement reuse for both NR UE to V2X UE and DSRC UE to V2X UE urban interference scenarios, PRR loss is less than 5%. Therefore, it is proposed that the same ACS values shall be kept unchanged for V2X UE at n47.

In licensed band, RAN4 shall reuse the same ACS values since there was legacy NR or LTE system.

As 10MHz is typical channel bandwidth used in the V2X band, the interferer bandwidth shall be used with 10MHz for NR V2X operating bands in Table 8.1-1.

Table 9.1.3-1: Adjacent channel selectivity for V2X

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Channel bandwidth | | | | | | | |
| Rx Parameter | Units | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 30 MHz | 40 MHz |
| ACS | dB |  |  |  | 33.0 |  | 27.0 | 25.5 | 24.0 |

Table 9.1.3-2: Test parameters for Adjacent channel selectivity for V2X, Case 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rx Parameter | Units | Channel bandwidth | | | | | | | |
| 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 30 MHz | 40 MHz |
| Power in Transmission Bandwidth Configuration | dBm | PREFSENS\_V2X + 14 dB | | | | | | | |
| PInterferer | dBm |  |  |  | REFSENS +45.5dB |  | REFSENS +39.5dB | REFSENS +38.0 dB | REFSENS +36.5dB |
| BWInterferer | MHz |  |  |  | 10 |  | 10 | 10 | 10 |
| FInterferer (offset) | MHz |  |  |  | 10  /  -10 |  | 15  /  -15 | 20  /  -20 | 25  /  -25 |
| NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used.  NOTE 2: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. | | | | | | | | | |

Table 9.1.3-3: Test parameters for Adjacent channel selectivity for V2X, Case 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rx Parameter | Units | Channel bandwidth | | | | | | | |
| 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 30 MHz | 40 MHz |
| Power in Transmission Bandwidth Configuration | dBm |  |  |  | -56.5 |  | -50.5 | -49.0 | -47.5 |
| PInterferer | dBm | -25 | | | | | | | |
| BWInterferer | MHz |  |  |  | 10 |  | 10 | 10 | 10 |
| FInterferer (offset) | MHz |  |  |  | 10  /  -10 |  | 15  /  -15 | 20  /  -20 | 25  /  -25 |
| NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used.  NOTE 2: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. | | | | | | | | | |

### Rx requirements for inter-band con-current NR V2X operation

#### REFSENS

For the V2X UE RF receiver requirements, RAN4 can refer the 2DL inter-band CA to define general UE RF Rx requirements for inter-band con-current V2X UE.

The legacy REFSENS requirement will be applied on each CC of NR licensed bands if there was no self-interference problems in own receiver frequency band by own uplink and sidelink transmission.

Table 10.2.2.1-1 and Table 10.2.2.1-2 propose the uplink test configurations for inter-band con-current V2X REFSENS requirements. For the uplink configuration, RAN4 consider 10MHz Channel bandwidth.

Table 10.2.2.1-1: Uplink configuration for reference sensitivity of V2X UE (PC5)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Inter-band V2X con-current band configuration** | | **LTE or NR UL band / Channel BW / NRB / Duplex mode** | | | |
| **V2X band (PC5)** | **LTE or NR band (Uu)** | **LTE or NR UL band** | **Channel Bandwidth (MHz)** | **NRB** | **Duplex Mode** |
| n38 | B20 | B20 | 10 | 50 | FDD |

Table 10.2.2.1-2: SL Tx configuration for reference sensitivity of V2X UE (Uu)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Inter-band V2X con-current band configuration** | | **LTE or NR UL band / Channel BW / NRB / Duplex mode** | | | |
| **V2X band (PC5)** | **LTE or NR band (Uu)** | **NR V2X band (PC5)** | **Channel Bandwidth (MHz)** | **NRB** | **Duplex Mode** |
| n38 | B20 | n38 | 10 | [52] | HD |

Table 10.2.2.1-3 is proposed the REFSENS requirements with inter-band con-current V2X UE reception.

Table 10.2.2.1-3: Reference sensitivity for V2X QPSK PREFSENS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Inter-band V2X reception | | Channel bandwidth | | | | | | | | |
| V2X Band | LTE or NR V2X band (Uu) | LTE or NR Band | SCS (kHz) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | 30 MHz (dBm) | 40 MHz (dBm) | Duplex Mode |
| n38 | B20 | B20 | 15 | -97 | -94 | -91.2 | -90 |  |  | FDD |
| n38 | 15 |  | [-96.8] |  | [-93.8] |  | [-90.6] | HD |
| 30 |  | [-97.1] |  | [-94.0] |  | [-90.7] |
| 60 |  | [-97.5] |  | [-94.2] |  | [-90.9] |

Table 10.1.2.2-4 is proposed additional Rx insertion loss according to harmonic trap filter to reduce the harmonic problem based on specific self desense analysis according to specific NR V2X inter-band con-current operation.

Table 10.2.2.1-4: ΔRIB,c (two bands)

|  |  |  |  |
| --- | --- | --- | --- |
| V2X inter-band con-current band Combination | V2X operating Band | ΔRIB,c [dB] | Note |
| V2X\_20\_n38 | 20 | 0.2 | 3rd harmonic from B20 impact into n38. Harmonic trap filter used to reduce the self desense for reception of NR Band n38 |

*<End of Changes>*