**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 8.4.4.2

**Source:** Moderator (CATT)

**Title:** Email discussion summary for RAN4#94e\_#14\_5G\_V2X\_NRSL\_UE\_RX

**Document for:** Information

# Introduction

During the previous RAN4 meetings, a great progress has been achieved on Rx RF requirements for NR V2X and most of Rx RF requirements have been agreed in principle. However, there are still some remaining issues on Rx RF requirements for NR V2X that need to be further discussed. This summary is to provide the associated observations and proposals from different companies for the upcoming email discussion. The agenda item involved is as follows:

8.4 5G V2X with NR sidelink [5G\_V2X\_NRSL]

8.4.4 UE RF requirements [5G\_V2X\_NRSL-Core]

8.4.4.2 Receiver characteristics

Indeed, companies are encouraged to bring arguments on your proposals and comments on other companies’ proposals based on this summary.

# Topic #1: Rx RF requirements

The remaining Rx RF requirements for NR V2X, including REFSENS, maximum input level and ACS, will be discussed in the following parts.

## 2.1 Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2000599](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000599.zip)  | CATT | Introduce Rx requirements for NR V2X to TS 38.101-1 based on agreed TR38.886 v0.5.0.Following Rx requirements for NR V2X are introduced to TS 38.101-1:7.3E Reference sensitivity for NR V2X7.4E Maximum input level for NR V2X7.5E Adjacent channel selectivity for NR V2X7.6E Blocking characteristics for NR V2X7.7E Spurious response for NR V2X7.8E Intermodulation characteristics for NR V2X |
| [R4-2000600](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000600.zip)  | CATT | Specifying Rx requirements for NR V2X inter band concurrent operation with NR license band in TS 38.101-3. |
| [R4-2000607](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000607.zip) | CATT | **Proposal 1: To keep 15kHz/30kHz/60kHz as the channel raster for NR V2X band n47.** **Proposal 2: The target SNR level should be derived from simulation results after the definition of reference measurement channel.****Proposal 3: The maximum input level for NR V2X should be -25dBm.** |
| [R4-2000966](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000966.zip) | LGE | **Proposal 1:**Revise the REFSENS equation for NR V2X sidelink including diversity gain [3]dB REFSENSV2X=*kTB* + SNRV2X +10log10(LCRB/NRB) +( NFV2X+ IM) - Diversity gain**Proposal 2:** Define the REFSENS levels and Tx configurations for NR V2X UE as shown in Table 2-1 and Table 2-2.Table 2‑1 Proposed RESENS for NR V2X (PC5)

|  |
| --- |
| **NR Operating band / SCS / Channel bandwidth / Duplex-mode** |
| **NR V2X Band** | **SCS****kHz** | **10MHz****(dBm)** | **20MHz****(dBm)** | **30MHz****(dBm)** | **40MHz****(dBm)** | **Duplex Mode** |
| n38 | 15 | -96.7 | -93.5 | -91.7 | -90.6 | TDD |
| 30 | -97.3 | -93.6 | -91.9 | -90.5 |
| 60 | -96.9 | -94.3 | -92.7 | -90.6 |
| n47 | 15 | -92.7 | -89.5 | -87.7 | -86.6 | TDD |
| 30 | -93.3 | -89.6 | -87.9 | -86.5 |
| 60 | -92.9 | -90.3 | -88.7 | -86.6 |

Table 2-2: Sidelink TX configuration for reference sensitivity of NR V2X Bands (PC5)

|  |
| --- |
| NR operating Band / SCS/ Channel bandwidth / NRB / Duplex mode |
| NR V2X Band | SCS (kHz) | 10 MHz(dBm) | 20 MHz(dBm) | 30 MHz(dBm) | 40 MHz(dBm) | Duplex Mode |
| n38 | 15 | 50 | 105 | 160  | 210 | TDD |
| 30 | 20 | 50 | 75 | 105 |
| 60 | 10 | 20 | 30 | 50 |
| n47 | 15 | 50 | 105 | 160 | 210 | TDD |
| 30 | 20 | 50 | 75 | 105 |
| 60 | 10 | 20 | 30 | 50 |

 |
| R4-2001224 | LG Electronics France | – Add suffix E for EN-V2X operation in 4.3 and include EN-V2X operating bands and channel bandwidths– Specified EN-V2X UE Tx/Rx requirements Specially, define ON/OFF time mask for EN-V2X TDM operation at n47 without dual PA modeWhen 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 [120] us and SL reception interruption is allowed during UL switching time masks. |
| [R4-2002029](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2002029.zip) | Huawei, HiSilicon | **Proposal 2: It is proposed to define the REFSENS as in Table 1.**

| Operating band / SCS / Channel bandwidth / Duplex-mode |
| --- |
| Operating Band | SCS kHz | 10MHz(dBm) | 20MHz(dBm) | 30 MHz (dBm) | 40MHz(dBm) | 50MHz(dBm) | Duplex Mode |
| n47 | 15 | -92.8 | -89.7 | -87.9 | -86.6 |  | HD |
| 30 | -93.1 | -89.9 | -88.0 | -86.7 |  |
| 60 | -93.5 | -90.1 | -88.1 | -86.9 |  |

**Proposal 3: It is proposed to define the maximum input level as -25dBm for NR-V.****Proposal 4: It is proposed to accept the changes for NR-V ACS requirement.**Table 2.2.3-1: Adjacent channel selectivity for V2X

|  |  |  |
| --- | --- | --- |
|  |  | Channel bandwidth |
| Rx Parameter | Units |  |  |  | 10MHz |  | 20MHz | 40 MHz |
| ACS | dB |  |  |  | 33.0 |  | 27.0 | 24.0 |

Table 2.2.3-2: Test parameters for Adjacent channel selectivity for V2X, Case 1

|  |  |  |
| --- | --- | --- |
| Rx Parameter | Units  | Channel bandwidth |
|  |  |  | 10 MHz |  | 20 MHz | 40 MHz |
| Power in Transmission Bandwidth Configuration | dBm | PREFSENS\_V2X + 14 dB |
| PInterferer | dBm |  |  |  | REFSENS +45.5dB |  | REFSENS +39.5dB | REFSENS +36.5dB |
| BWInterferer  | MHz |  |  |  | 10 |  | 10 | 10 |
| FInterferer (offset) | MHz |  |  |  | 10/-10 |  | 15/-15 | 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 V2X signal with 15 kHz SCS. |

Table 2.2.3-3: Test parameters for Adjacent channel selectivity for V2X, Case 2

|  |  |  |
| --- | --- | --- |
| Rx Parameter | Units  | Channel bandwidth |
|  |  |  | 10 MHz |  | 20 MHz | 40 MHz |
| Power in Transmission Bandwidth Configuration | dBm |  |  |  | -56.5 |  | -50.5 | -47.5 |
| PInterferer | dBm | -25 |
| BWInterferer  | MHz |  |  |  | 10 |  | 10 | 10 |
| FInterferer (offset) | MHz |  |  |  | 10/-10 |  | 15/-15 | 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 V2X signal with 15 kHz SCS. |

**Proposal 5: It is proposed to similar changes for other Rx requirements as those for ACS.** |
| [R4-2001214](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2001214.zip)  | LG Electronics France | TR 38.886 v0.5.0 V2X service based on NR; UE radio transmission and reception |

## 2.2 Open issues summary

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

### Sub topic 2-1: REFSENS

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-1-1: LCRB value**

* Proposals
	+ Option 1: L**CRB** = NRB (CATT)
	+ Option 2: L**CRB** = 50; NRB = 52 for 10MHz (LGE)
* Recommended WF
	+ Need more discussion

**Issue 2-1-2: Diversity gain**

* Proposals
	+ Option 1: 3dB (LGE)
	+ Option 2: no need to consider diversity gain (Huawei)
* Recommended WF
	+ Need more discussion

### 2.2.2 Sub topic 2-2: Maximun input level

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2-1: Maximum input level**

* Proposals
	+ Option 1: [-22~-25] dBm (LGE)
	+ Option 2: -25 dBm (CATT, Huawei)
* Recommended WF
	+ Agree option 2

### 2.2.3 Sub topic 2-3: ACS

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-3-1: Power in Transmission Bandwidth Configuration**

* Proposals
	+ Option 1: The power of wanted signal in case 2 shall be reduced by 3dB. (Huawei)
	+ Option 2: 3dB is not necessary. (LGE)
	+ Option 3: whether 3dB is necessary or not depends on the maximum input level. 3dB should be considered if the maximum input level is defined as -25dBm. (CATT)
* Recommended WF
	+ Need more discussion

## 2.3 Companies views’ collection for 1st round

### 2.3.1 Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  Qualcomm | Sub topic 2-1: **Issue 2-1-1: LCRB value*** + Option 2: LCRB has to be a factor of 5 or 10 for PUSCH/PUCCH in NR V2X. Permissible LCRB values**are:** Allowed LCRB allocations=[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]

**Issue 2-1-2: Diversity gain*** + Option 2: no need to consider diversity gain. The calculation should be the same as for LTE V2V which is documented in section7, TR36785-e00, v14.0.0.
	+ Huawei proposes not using the diversity gain (R4-2002029). However, for a SCS=15K, BW=10M reference sensitivity = -104 -1 -10log(50/52)-13-2.5= -89.7dBm. The value in table 1 of R4-2002029 is -92.8dBm. It seems that there is another factor that is being used in this reference sensitivity calculation which is not captured in the Tdoc.

Sub topic 2-2:**Issue 2-2-1: Maximum input level*** + In sect 7.4 of 38.101-1 the maximum input level is given as -22dBm for 64QAM. It has always been assumed that SL should have similar specs to the NR Uu link so we should keep -22dBm as the maximum input level.

Sub topic 2-3:**Issue 2-3-1: Power in Transmission Bandwidth Configuration*** + In sect 7.4 of 38.101-1 the maximum input level is given as -22dBm for 64QAM. It has always been assumed that SL should have similar specs to the NR Uu link so we should keep -22dBm as the maximum input level. So, ACS for V2X, case 2 we believe that the Pinterfer = -22dBm and the power of the wanted signal can remain as given in table 9.1.3-3 of TR38.886 V0.5.0.

….Others: |

### 2.3.2 CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [R4-2000599](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000599.zip) | Qualcomm:* Cannot approve
* In table 7.5E-3 ACS for V2X case 2 the Pinterferer level should be -22dBm
 |
| Company B |
|  |
| [R4-2000600](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000600.zip)  | Company A |
| Company B |
|  |
| R4-2001224 | Qualcomm:* Cannot approve
* In section 6.3E.1 we believe the NR to LTE transition time should be 210us for both contiguous and non-contiguous spectral allocations as outlined in R4-2000471.
 |
| Company B |
|  |
| [R4-2001214](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2001214.zip) | Qualcomm:* Cannot approve
* 5GAA 40MHz emissions mask is missing from section 8.1.10 “spectrum emission mask for V2X UE”
* Maximum input level, in section 9.1.2, should be -22dBm in keeping with section 7.4 of 38.101-1. The reason for this is that we want the SL to have the same performance as the Uu link.
* In Table 9.1.3-3 ACS for V2X case2 the Pinterferer should be -22dBm

In Table 10.1.1.13-1 the -30dBm/MHz requirements when NS\_XX is signaled should be removed |
| Company B |
|  |

## 2.4 Summary for 1st round

### 2.4.1 Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 2.4.2 CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## 2.5 Discussion on 2nd round (if applicable)

## 2.6 Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# 3 Topic #1: Title

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

## 3.1 Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-20xxxxx | Company A | Proposal 1:Observation 1: |

## 3.2 Open issues summary

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

### 3.2.1 Sub-topic 1-1

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ TBA

### 3.2.2 Sub-topic 1-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-2: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ TBA

## 3.3 Companies views’ collection for 1st round

### 3.3.1 Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |

### 3.3.2 CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 3.4 Summary for 1st round

### 3.4.1 Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 3.4.2 CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## 3.5 Discussion on 2nd round (if applicable)

## 3.6 Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |