**3GPP TSG-RAN WG4 Meeting #94-e *R4-2002796***

**Online, 24th Feb. – 6th Mar. 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-1** | **CR** | **0232** | **rev** | **1** | **Current version:** | **16.2.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | CR for TS38.101-1, Introduce Rx requirements for NR V2X |
|  |  |
| ***Source to WG:*** | CATT |
| ***Source to TSG:*** | RAN4 |
|  |  |
| ***Work item code:*** | 5G\_V2X\_NRSL-Core |  | ***Date:*** | 2020-2-3 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Introduce Rx requirements for NR V2X to TS 38.101-1 based on agreed TR38.886 v0.5.0. |
|  |  |
| ***Summary of change:*** | 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 |
|  |  |
| ***Consequences if not approved:*** | The Rx requirements for NR V2X will not be defined. |
|  |  |
| ***Clauses affected:*** | New sections: 7.3E, 7.4E, 7.5E, 7.6E, 7.7E, 7.8E |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.521-1 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

========================= First Change Request ===========================

## 7.3E Reference sensitivity for NR V2X

### 7.3E.1 General

The reference sensitivity power level PREFSENS\_V2X is the minimum mean power applied to each one of the UE antenna ports for V2X UE, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

### 7.3E.2 Minimum requirements

When UE is configured for NR V2X reception non-concurrent with NR uplink transmissions for NR V2X operating bands specified in Table 5.2E-1, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.x.x with parameters specified in Table 7.3E.2-1.

Table 7.3E.2-1: Reference sensitivity of NR V2X Bands (PC5)

|  |  |  |
| --- | --- | --- |
|  |  | Channel bandwidth / PREFSENS\_V2X(dBm) |
| NR V2XBand | SCSkHz | 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz | DuplexMode |
| n47 | 15 | TBD | TBD | TBD | TBD |  | HD |
| 30 | TBD | TBD | TBD | TBD |  | HD |
| 60 | TBD | TBD | TBD | TBD |  | HD |
| n38 | 15 | TBD | TBD | TBD | TBD |  | HD |
| 30 | TBD | TBD | TBD | TBD |  | HD |
| 60 | TBD | TBD | TBD | TBD |  | HD |
| NOTE 1: Reference measurement channel is defined in A.x.x.NOTE 2: The signal power is specified per antenna port. |

========================= Second Change Request ===========================

## 7.4E Maximum input level for NR V2X

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. The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexs A.x.x and A.x.x with parameters specified in Table 7.4E-1.

Table 7.4E-1: Maximum input level of NR V2X

|  |  |  |
| --- | --- | --- |
| Rx Parameter | Units  | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| Power in Transmission Bandwidth Configuration | dBm | TBD1 | TBD1 | TBD1 | TBD1 |  |
| TBD2 | TBD2 | TBD2 | TBD2 |  |
| NOTE 1: Reference measurement channel is FFS for 64 QAM.NOTE 2: Reference measurement channel is FFS for 256 QAM. |

========================= Third Change Request ===========================

## 7.5E Adjacent channel selectivity for NR V2X

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 is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

The UE shall fulfil the minimum requirements specified in Table 7.5E-1for NR V2X UE. These requirements apply for all values of an adjacent channel interferer up to [TBD] dBm and for any SCS specified for the channel bandwidth of the wanted signal. However, it is not possible to directly measure the ACS; instead the lower and upper range of test parameters are chosen as in Table 7.5E-2 and Table 7.5E-3 for verification of the requirements specified in Table 7.5E-1. For these test parameters, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.x.x.

In licensed band, the minimum requirements shall reuse the same ACS values with NR UE.

Table 7.5E-1: Adjacent channel selectivity for NR V2X

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| ACS | dB | 33.0 | 27.0 | 25.5 | 24.0 |  |

Table 7.5E-2: Test parameters for Adjacent channel selectivity for V2X, Case 1

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| Power in transmission bandwidth configuration | dBm | PREFSENS\_V2X + 14 dB |
| Pinterferer | dBm | PREFSENS\_V2X + 45.5 dB | PREFSENS\_V2X + 39.5 dB | PREFSENS\_V2X + 38.0 dB | PREFSENS\_V2X + 36.5 dB |  |
| 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 7.5E-3: Test parameters for Adjacent channel selectivity for V2X, Case 2

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| Power in transmission bandwidth configuration | dBm | [-53.5 ~ -56.5] | [-47.5 ~ -50.5] | [-46.0 ~ -49.0] | [-44.5 ~ -47.5] |  |
| Pinterferer | dBm | [-22 ~ -25] | [-22 ~ -25] | [-22 ~ -25] | [-22 ~ -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. |

========================= Fourth Change Request ===========================

## 7.6E Blocking characteristics for NR V2X

### 7.6E.1 General

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occurs.

### 7.6E.2 In-band blocking

The throughput of the wanted signal shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.x.x with parameters specified in Table 7.6E.2-1 and Table 7.6E.2-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.6E.2-1: In-band blocking parameters for NR V2X

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| Power in transmission bandwidth configuration | dBm | PREFSENS\_V2X + channel bandwidth specific value below |
| dB | 6 | 9 | 11 | 12 |  |
| BWinterferer | MHz | 10 |
| FIoffset, case 1 | MHz | 15 |
| FIoffset, case 2 | MHz | 25 |
| NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. |

Table 7.6E.2-2: In-band blocking for NR V2X

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Case 1 | Case 2 |
| n47 | Pinterferer | dBm | -44 | -44 |
| Finterferer (offset) | MHz | -BW/2 – FIoffset, case 1andBW/2 + FIoffset, case 1 | ≤ -BW/2 – FIoffset, case 2and≥ BW/2 + FIoffset, case 2 |
| Finterferer | MHz | NOTE 2 | FDL\_low – 30toFDL\_high + 30 |
| n38 | Pinterferer | dBm | -44 | -44 |
| Finterferer (offset) | MHz | -BW/2 – FIoffset, case 1andBW/2 + FIoffset, case 1 | ≤ -BW/2 – FIoffset, case 2and≥ BW/2 + FIoffset, case 2 |
| Finterferer | MHz | NOTE 2 | FDL\_low – 30toFDL\_high + 30 |
| NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band.NOTE 2: For each carrier frequency the requirement is valid for two frequencies:a. the carrier frequency -BW/2 – FIoffset, case 1 andb. the carrier frequency +BW/2 + FIoffset, case 1NOTE 3: FInterferer range values for unwanted modulated interfering signal are interferer center frequencies NOTE 4: 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. |

### 7.6E.3 Out-of-band blocking

For NR V2X bands out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range 15 MHz below or above the UE receive band. The throughput of the wanted signal shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.x.x with parameters specified in Table 7.6E.3-1 and Table 7.6E.3-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.6E.3-1: Out-of-band blocking parameters for NR V2X

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| Power in transmission bandwidth configuration | dBm | PREFSENS\_V2X + channel bandwidth specific value below |
| dB | 6 | 9 | 11 | 12 |  |
| NOTE: Reference measurement channel is FFS. |

Table 7.6E.3-2: Out of-band blocking for NR V2X

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Units | Range 1 | Range 2 | Range 3 |
| n47 | Pinterferer | dBm | -44 | -30 | -15 |
| Finterferer (CW) | MHz | FDL\_low -30 toFDL\_low -60 | FDL\_low -60 toFDL\_low -85  | FDL\_low -85 to1 MHz |
| FDL\_high +30 toFDL\_high + 60 | FDL\_high +60 toFDL\_high +85  | FDL\_high +85 to+12750 MHz |
| n38 | Pinterferer | dBm | -44 | -30 | -15 |
| Finterferer (CW) | MHz | FDL\_low -30 toFDL\_low -60 | FDL\_low -60 toFDL\_low -85  | FDL\_low -85 to1 MHz |
| NOTE 1: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 4400 MHz. |

========================= Fifth Change Request ===========================

## 7.7E Spurious response for NR V2X

Spurious response is a measure of the receiver’s ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency for which a response is obtained, i.e. for which the out-of-band blocking limit as specified in clause 7.6E.3 is not met.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.x.x with parameters for the wanted signal as specified in Table 7.7E-1 and Table 7.7E-2 for NR V2X bands. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.7E-1: Spurious response parameters for NR V2X

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| Power in transmission bandwidth configuration | dBm | PREFSENS\_V2X + channel bandwidth specific value below |
| dB | 6 | 9 | 11 | 12 |  |
| NOTE 1: Reference measurement channel is FFS. |

Table 7.7E-2: Spurious response for NR V2X

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| PInterferer (CW) | dBm | -44 |
| FInterferer | MHz | Spurious response frequencies |

========================= Sixth Change Request ===========================

## 7.8E Intermodulation characteristics for NR V2X

### 7.8E.1 General

Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

### 7.8E.2 Wide band Intermodulation

The wide band intermodulation requirement is defined using modulated NR carrier and a CW signal as interferer 1 and interferer 2 respectively. The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.x.x with parameters specified in Table 7.8E.2-1 for NR V2X bands. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.8E.2-1: Wide band intermodulation parameters for NR V2X

|  |  |  |  |
| --- | --- | --- | --- |
| NR band | Rx parameter | Units | Channel bandwidth |
| 10 MHz | 20 MHz | 30 MHz | 40 MHz | 50 MHz |
| n47 | Power in Transmission Bandwidth Configuration | dBm | PREFSENS\_V2X + channel bandwidth specific value below |
| 6 | 9 | 11 | 12 |  |
| PInterferer 1 (CW) | dBm | -46 |
| PInterferer 2 (Modulated) | dBm | -46 |
| BWInterferer 2 | MHz | 10 |
| FInterferer 1 (Offset) | MHz | -BW/2 – 15/+BW/2 + 15 |
| FInterferer 2 (Offset) | MHz | 2 \* FInterferer 1 |
| n38 | Power in Transmission Bandwidth Configuration | dBm | PREFSENS\_V2X + channel bandwidth specific value below |
| 6 | 9 | 11 | 12 |  |
| PInterferer 1 (CW) | dBm | -46 |
| PInterferer 2 (Modulated) | dBm | -46 |
| BWInterferer 2 | MHz | 10 |
| FInterferer 1 (Offset) | MHz | -BW/2 – 15/+BW/2 + 15 |
| FInterferer 2 (Offset) | MHz | 2 \* FInterferer 1 |
| NOTE 1: Reference measurement channel is FFSNOTE 2: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. |