**3GPP TSG-RAN WG4 Meeting # 102-e R4-220xxxx**

**Electronic Meeting, February 21 – March 3, 2022**

**Agenda item: 10.5.2.3**

**Source: CMCC**

**Title: TP to TS 38.106 conducted EVM and input IMD**

**Document for: Discussion**

1. Introduction

In this contribution, we provide the text proposals for conducted EVM and input IMD requirements in final.

2 Text Proposal to TS 38.106

**--------------Start of text proposal -------------**

# 6 Conducted transmitter characteristics

## 6.6 Error Vector Magnitude

### 6.6.1 Downlink Error vector magnitude

#### 6.6.1.1 General

The Error Vector Magnitude (EVM) is a measure of the difference between the symbols provided at the input of repeater and the measured signal symbols at the output of the repeater after the equalization by the measurement equipment. This difference is called the error vector. Details about how the EVM is determined are specified in TS 38.104 Annex B for FR1. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power expressed in percent.

The EVM requirement is applicable for a repeater operating at an input power in the range from what is required to reach the maximum output power to the minimum power level in table 6.6.1.1-1.

**Table 6.6.1.1-1: Minimum input power for EVM**

|  |  |
| --- | --- |
| Repeater DL class | Minimum input power spectral density (dBm/MHz) |
| QPSK, 16 QAM, 64QAM | 256QAM1 |
| WA | -82 | -75 |
| MR | -77 | -70 |
| LA | -74 | -67 |
| Note 1: support of 256QAM is based on the declaration |

#### 6.6.1.2 Minimum requirement

The EVM levels for different modulation schemes outlined in table 6.6.1.2-1 shall be met using the frame structure described in clause 6.6.1.3.

**Table 6.6.1.2-1: EVM requirements**

|  |  |
| --- | --- |
| **Parameter** | **Required EVM** |
| QPSK, 16QAM, 64QAM | 8 % |
| 256QAM | 3.5 % 1 |
| Note 1: support of 256QAM is based on the declaration. |

#### 6.6.1.3 EVM frame structure for measurement

The input signals for the EVM requirement shall have the same frame structure as defined for the BS is 38.104 [xx].

### 6.6.2 Uplink Error vector magnitude

#### 6.6.2.1 General

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in TS 38.101-1 clause 6.4.2.4. For DFT-s-OFDM waveforms, the EVM result is defined after the front-end FFT and IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in one slot in the time domain. The EVM measurement interval is reduced by any symbols that contains an allowable power transient in the measurement interval, as defined in TS 38.101-1 clause 6.3.3.

The EVM requirement is applicable for a repeater operating at an input power in the range from what is required to reach the maximum output power to the minimum power level in table 6.6.2.1-1.

**Table 6.6.2.1-1: Minimum input power for EVM**

|  |  |
| --- | --- |
| Repeater UL class | Minimum input power spectral density (dBm/MHz) |
| QPSK, 16 QAM, 64QAM | 256QAM1 |
| WA | -82 | -75 |
| LA | -74 | -67 |
| Note 1: support of 256QAM is based on the declaration |

#### 6.6.2.2 Minimum requirement

The RMS average of the basic EVM measurements over 10 subframes for the average EVM case for the different modulation schemes shall not exceed the values specified in Table 6.6.2.2-1.

**Table 6.6.2.2-1: Requirements for Error Vector Magnitude**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Average EVM Level** |
| QPSK, 16 QAM, 64QAM | % | 8 |
| 256 QAM | % | 3.5 1 |
| Note 1: support of 256QAM is based on the declaration. |

## 6.7 Input intermodulation

### 6.7.1 General requirement

#### 6.7.1.1 General

The input intermodulation is a measure of the capability of the repeater to inhibit the generation of interference in the pass band, in the presence of interfering signals on frequencies other than the pass band.

The following requirement applies for interfering signals depending on the repeaters pass band.

This requirement applies to the uplink and downlink of the repeater.

#### 6.7.1.2 Minimum requirement

For the parameters specified in table 6.7.1.1-1, the power in the pass band shall not increase with more than 10 dB at the output of the repeater as measured with 1MHz measurement bandwidth, compared to the level obtained without interfering signals applied.

The core requirement is applicable for all frequency separation possibilities between the two interfering signals that cause the 3rd order intermodulation product to fall into the pass band.

Table 6.7.1.2-1 specifies the parameters for two interfering signals, where:

- f1 offset is the offset from the channel edge frequency of the first or last channel in the pass band of the closer carrier.

**Table 6.7.1.2-1: Input intermodulation requirement**

|  |  |  |  |
| --- | --- | --- | --- |
| **f1 offset** | **Interfering Signal Levels** | **Type of signals** | **Measurement bandwidth** |
| 1 MHz | -40 dBm | 2 CW carriers | 1 MHz |

### 6.7.2 Co-location with BS/repeater in other systems

#### 6.7.2.1 General

This additional input intermodulation requirement may be applied for the protection of NR repeater receivers when GSM, CDMA, UTRA, E-UTRA, NR BS or repeater operating in a different frequency band are co-located with a NR repeater.

The following requirement applies for interfering signals depending on the repeaters pass band.

This requirement applies to the uplink and downlink of the repeater. If the BS side is declared to meet co-location requirements, then it should meet input intermodulation co-location requirements for the downlink. If the UE side is declared to meet co-location requirements, then it should meet input intermodulation co-location requirements for the uplink.

#### 6.7.2.2 Minimum requirement

For the parameters specified in table 6.7.2.2-1 for DL and 6.7.2.2-2 for UL, the power in the pass band shall not increase with more than 10 dB at the output of the repeater as measured with 1MHz measurement bandwidth, compared to the level obtained without interfering signals applied.

The core requirement is applicable for all frequency separation possibilities between the two interfering signals that cause the 3rd order intermodulation product to fall into the pass band.

**Table 6.7.2.2-1: input intermodulation requirement for NR repeater DL when co-located with BS/repeater in other frequency bands.**

| **Frequency range of interfering signal** | **Interfering signal mean power for repeater with WA UE side (dBm)** | **Interfering signal mean power for repeater with MR UE side(dBm)** | **Interfering signal mean power for repeater with LA UE side(dBm)** | **Type of interfering signals** |
| --- | --- | --- | --- | --- |
| Frequency range of co-located BS’s downlink operating band or located repeater’s passband | +16 | +8 | x (Note 1) | 2 CW carriers |
| NOTE 1: x = -7 dBm for NR repeater co-located with Pico GSM850 or Pico CDMA850x = -4 dBm for NR repeater co-located with Pico DCS1800 or Pico PCS1900x = -6 dBm for NR repeater co-located with UTRA bands or E-UTRA bands or NR bandsNOTE 2: The requirement does not apply when the interfering signal falls within the passband.NOTE 3: For unsynchronized base stations or repeaters (except in band n46 and n96), special co-location requirements may apply that are not covered by the 3GPP specifications. |

**Table 6.7.2.2-2: input intermodulation requirement for NR repeater UL when co-located with BS/repeater in other frequency bands.**

| **Frequency range of interfering signal** | **Interfering signal mean power for repeater with WA BS side(dBm)** | **Interfering signal mean power for repeater with LA BS side(dBm)** | **Type of interfering signals** |
| --- | --- | --- | --- |
| Frequency range of co-located BS’s downlink operating band or located repeater’s passband | +16 | Prated,out\_AC -30 | 2 CW carriers |
| NOTE 1: The requirement does not apply when the interfering signal falls within the passband.NOTE 2: For unsynchronized base stations or repeaters (except in band n46 and n96), special co-location requirements may apply that are not covered by the 3GPP specifications. |

 **--------------End of text proposal -------------**