**3GPP TSG- RAN WG4 Meeting # 102-e *R4-2207492***

 **Electronic meeting, February 21 - March 3, 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.141-1** | **CR** |  | **rev** | **-** | **Current version:** | **16.10.0** |  |
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| *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 |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Big CR for TS 38.141-1 Maintenance RF part (Rel-16, CAT F) |
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| ***Source to WG:*** | MCC, CATT |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Perf, NR\_unlic |  | ***Date:*** | 2022-3-6 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Re-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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | This big CR merges the multiple endorsed draft CRs. The reason for change in each endorsed draft CR is copied below.**R4-2205151, Draft CR to 38.141-1: Clarification on unwanted emission testing**RMS detection mode is defined while the required measurement duration is not clarified in current specifications.**R4-2205198, Draft CR to 38.141-1 with addition of absolute values to NR-U masks and clarifications for NR-U bands**This draft CR introduces following updates related to NR-U Rel-16:1. In specified Rel-16 masks for NR-U bands n46 and n96 the -40dBm/100kHz limit applies only for offsets ≥N, and there is no absolute limit defined for offsets <N.

As the actual relative limits for offsets up to N do not comprise a floor (like e.g. ACLR), it could be quite a challenge for the required TX dynamic range. As Prated,x  in table 6.6.4.5.5A-2 is the rated power per carrier, the level of variation between a single carrier operation and a fully occupied band operation can be significant. For example: Up to 59x20MHz carriers are possible in 5925 to 7125MHz range (band n96): 1x20MHz carrier at Prated,x  BS vs 59x20MHz carriers Prated,x BS – 10LOG(59) ≈ +18dB dynamic range extension. Also it should be noted that according to EN303687, the spectrum mask shall be limited by a floor, i.e. the spurious emission limit (see section 4.3.4.3.2 of EN303687). The spurious emission limit in 1GHz to 26GHz range is defined as -30dBm/MHz and this aligns with the -40dBm/100kHz limit (same as depicted in TS38.104 for offsets >N).Addition of clarifications that there are no requirements for BS type 1-H for n46. |
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| ***Summary of change:*** |  The summary of change in each each endorsed draft CR is copied below.**R4-2205151, Draft CR to 38.141-1: Clarification on unwanted emission testing**Clarification on required average time for emission test is added in clause 6.6 and 6.7.**R4-2205198, Draft CR to 38.141-1 with addition of absolute values to NR-U masks and clarifications for NR-U bands**1. Addtion of absolute values for offsets <N for OBUE mask in table 6.6.4.5.5A-1 and 6.6.4.5.5A-2.
2. Clarification in clause 6.1.2 that there are no requirements specified for BS type 1-H for n46.
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| ***Consequences if not approved:*** | The consequences if not approved for each endorsed draft CR are copied below.**R4-2205151, Draft CR to 38.141-1: Clarification on unwanted emission testing**The general rule for required average time for emission test is missing.**R4-2205198, Draft CR to 38.141-1 with addition of absolute values to NR-U masks and clarifications for NR-U bands**Without absolute limits for NR-U mask for offsets <N there will exist only relative limits for these offsets, that would be challenge for Tx dynamic range.It would be unclear for NR-U for which BS types and bands requirements are specified.  |
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| ***Clauses affected:*** | The clauses affected in each endorsed draft CR are copied below.**R4-2205151, Draft CR to 38.141-1: Clarification on unwanted emission testing**6.6.4.4.2, 6.6.5.4.2, 6.7.4.2**R4-2205198, Draft CR to 38.141-1 with addition of absolute values to NR-U masks and clarifications for NR-U bands**6.1.2, 6.6.4.5.5A, |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **x** |  |  Other core specifications  | TS 38.104 ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

## **<Start of Change 1>**

## 6.1 General

### 6.1.1 BS type 1-C

General test conditions for conducted transmitter tests are given in clause 4, including interpretation of measurement results and configurations for testing. BS configurations for the tests are defined in clause 4.5.

If a number of *single-band connectors*, or *multi-band connectors* have been declared equivalent (D.32), only a representative one is necessary to be tested to demonstrate conformance.

### 6.1.2 BS type 1-H

General test conditions for conducted transmitter tests are given in clause 4, including interpretation of measurement results and configurations for testing. BS configurations for the tests are defined in clause 4.5.

If a number of *single-band connectors*, or *multi-band connectors* have been declared equivalent (D.32), only a representative one is necessary to be tested to demonstrate conformance.

In clause 6.6.3.5.4, if representative *TAB connectors* are used then per connector criteria (i.e. option 2) shall be applied.

The manufacturer shall declare the minimum number of supported geographical cells (i.e. geographical areas). The minimum number of supported geographical cells (Ncells,D.24) relates to the BS setting with the minimum amount of cell splitting supported with transmission on all *TAB connectors* supporting the *operating band*. The manufacturer shall also declare *TAB connector TX min cell groups* (D.34). Every *TAB connector* supporting transmission in an *operating band* shall map to one *TAB connector TX min cell group* supporting the same *operating band.* The mapping of *TAB connector*s to cells is implementation dependent.

The number of *active transmitter units* that are considered when calculating the emissions limit (NTXU, counted) for *BS type 1-H* is calculated as follows:

 NTXU, counted = *min(NTXU,active, 8·Ncells)*

Further:

 NTXU,countedpercell = NTXU,counted/Ncells

 NTXU,countedpercell is used for scaling the *basic limits* as described in clause 6.6.

NOTE: NTXU,active depends on the actual number of *active transmitter unit*s and is independent to the declaration of Ncells.

For *BS type 1-H* there is no requirement specified for band n46.

## **<End of Change 1>**

## **<Start of Change 2>**

##### 6.6.4.4.2 Procedure

For *BS type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment as shown in annex D.1.1 for *BS type 1-C* or in annex D.3.1 for *BS type 1-H*. All connectors not under test shall be terminated.

 As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity, efficiency and avoiding e.g. carrier leakage, 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.

 The measurement device characteristics shall be:

- Detection mode: True RMS.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1.

2) For a connectors declared to be capable of single carrier operation only, set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 at *rated carrier output power* Prated,c,AC for *BS type 1-C* and Prated,c,TABC for *BS type 1-H* (D.21). Channel set-up shall be according to NR-FR1-TM 1.1.

 For a connector under test declared to be capable of multi-carrier and/or CA operation set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

3) Step the centre frequency of the measurement filter in contiguous steps and measure the emission within the specified frequency ranges with the specified measurement bandwidth. For connector under test declared to operate in multiple bands or non-contiguous spectrum, the emission within the *Inter RF Bandwidth* or *sub-block gap* shall be measured using the specified measurement bandwidth from the closest RF Bandwidth or sub block edge.

4) Repeat the test for the remaining test cases, with the channel set-up according to NR-FR1-TM 1.2.

In addition, for *multi-band connectors*, the following steps shall apply:

5) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

## **<End of Change 2>**

## **<Start of Change 3>**

##### 6.6.4.5.5A Basic limits for Local Area and Medium Range BS for band n46 and n96 (Category A and B)

For Local Area and Medium Range BS operating in Band n46, basic limits for 10 MHz channel bandwidth are specified in table 6.6.4.5.5A-1. For Local Area and Medium Range BS operating in Band n46 and Band n96, basic limits for 20 MHz, 40 MHz, 60 MHz and 80 MHz channel bandwidth are specified in table 6.6.4.5.5A-2. The nominal bandwidth N = BWChannel of the transmitted carrier. For one non-transmitted channel basic limits are specified in table 6.6.4.5.5A-3, and for two non-transmitted channels basic limits are specified in table 6.6.4.5.5A-4.

Table 6.6.4.5.5A-1: Medium Range BS and Local Area BS operating band unwanted emission limits for 10 MHz channel bandwidth for band n46

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Basic limits (Note 1) | Measurement bandwidth  |
| 0 MHz ≤ Δf < 0.5 MHz | 0.05 MHz ≤ f\_offset < 0.55 MHz |  | 100 kHz  |
| 0.5 MHz ≤ Δf < 5 MHz | 0.55 MHz ≤ f\_offset < min(5.05 MHz, f\_offsetmax) |  | 100 kHz  |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) |  | 100 kHz  |
| 10 MHz ≤ Δf < min(85 MHz, Δfmax) | 10.05 MHz ≤ f\_offset < min(85.05 MHz, f\_offsetmax) | Max(Prated,x – 57.3dB, -40dBm) | 100 kHz |
| 85 MHz ≤ Δf < min(103 MHz, Δfmax) | 85.05 MHz ≤ f\_offset < min(103.05 MHz, f\_offsetmax) | Max(Prated,x – 59.3dB, -40dBm) | 100 kHz  |
| 103 MHz ≤ Δf ≤ Δfmax | 103.05 MHz ≤ f\_offset < f\_offsetmax | Max(Prated,x – 64.3dB, -40dBm) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any operating band, the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10 MHz from both adjacent sub blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be Max Max(Prated,x – 57.3dB, -40dBm)/100kHz. |

Table 6.6.4.5.5A-2: Medium Range BS and Local Area BS operating band unwanted emission limits for 20 MHz, 40 MHz, 60 MHz and 80 MHz channel bandwidth for band n46 and n96

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Basic limits (Note 1) | Measurement bandwidth  |
| 0 MHz ≤ Δf < 1 MHz | 0.05 MHz ≤ f\_offset < 1.05 MHz |  | 100 kHz  |
| 1 MHz ≤ Δf < min(0.5N MHz, Δfmax) | 1.05 MHz ≤ f\_offset < min((0.5N+0.05) MHz, f\_offsetmax) |  | 100 kHz  |
| 0.5N MHz ≤ Δf < min(N MHz, Δfmax) | (0.5N+0.05) MHz ≤ f\_offset < min((N+0.05) MHz, f\_offsetmax) |  | 100 kHz  |
| N MHz ≤ Δf < min(8.5N MHz, Δfmax) | (N+0.05) MHz ≤ f\_offset < min((8.5N+0.05) MHz, f\_offsetmax) |  | 100 kHz |
| 8.5N MHz ≤ Δf < min(10.3N MHz, Δfmax) | (8.5N+0.05) MHz ≤ f\_offset < min((10.3N+0.05) MHz, f\_offsetmax) |  | 100 kHz  |
| 10.3N MHz ≤ Δf ≤ Δfmax | (10.3N+0.05) MHz ≤ f\_offset < f\_offsetmax |  | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any operating band, the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ N MHz from both adjacent sub blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be . |

In the case of one or two non-transmitted 20 MHz channels between transmitted channels, when a NR-U channel bandwidth of 60 MHz or 80 MHz have been assigned, the spectrum emission mask for non-transmitted channels specified in Table 6.6.4.5.5A-3 and Table 6.6.4.5.5A-4 applies for one and two non-transmitted channels respectively. The spectrum emission mask for non-transmitted channels apply to frequencies (ΔfBE\_offset) starting from the edge of the last transmitted channel of the channels assigned for NR-U channel bandwidth. The relative power of any BS emission shall not exceed the most stringent levels given by Table 6.6.4.5.5A-2 and Table 6.6.4.5.5A-3 in the case of non-transmitted channels between transmitted channels.

Table 6.6.4.5.5A-3: Medium Range BS operating band unwanted emission limits for one non-transmitted channel for 60 MHz and 80MHz channel bandwidth for band n46 and n96

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, ΔfBE\_offset | Frequency offset of measurement filter centre frequency, f\_BE\_offset | *Basic limits* | Measurement bandwidth  |
| 0 MHz  fBE\_offset < 1 MHz | 0.05 MHz  f\_BE\_offset < 1.05 MHz |  | 100 kHz |
| 1 MHz  fBE\_offset < 10 MHz | 1.05 MHz  f\_BE\_offset < 10.05 MHz |  | 100 kHz |
| 10 MHz  fBE\_offset < 19 MHz | 10.05 MHz  f\_BE offset < 19.05 MHz |  | 100 kHz |
| 19 MHz  fBE\_offset < 19.9 MHz | 19.05 MHz  f\_BE\_offset < 19.95 MHz |  | 100 kHz |

Table 6.6.4.5.5A-4: Medium Range BS and Local Area BS operating band unwanted emission limits for two non-transmitted channels of 80 MHz channel bandwidth for band n46 and n96

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, fBE\_offset | Frequency offset of measurement filter centre frequency, f\_BE\_offset | *Basic limits* | Measurement bandwidth  |
| 0 MHz  fBE\_offset < 1 MHz | 0.05 MHz  f\_BE\_offset < 1.05 MHz |  | 100 kHz |
| 1 MHz  fBE\_offset <10 MHz | 1.05 MHz  f\_BE\_offset < 10.05 MHz |  | 100 kHz |
| 10 MHz  fBE\_offset <30 MHz | 10.05 MHz  f\_BE offset < 30.05 MHz |  | 100 kHz |
| 30 MHz  fBE\_offset < 39 MHz | 30.05 MHz  f\_BE\_offset < 39.05 MHz |  | 100 kHz |
| 39 MHz  fBE\_offset < 39.9 MHz | 39.05 MHz  f\_BE\_offset < 39.95 MHz |  | 100 kHz |

In the case of non-transmitted 20 MHz channel(s) on the edges of an assigned NR-U channel bandwidth the general spectrum emission mask specified in Table 6.6.4.5.5A-2 is applied to the remaining transmitted channels to form an additional spectrum emission mask. The additional spectrum emission mask is applied to the total bandwidth of the remaining transmitted channels.

The additional spectrum emission mask is floored a t .

The relative power of any BS emission shall not exceed the most stringent levels given by the initial general spectrum emission mask with full channel bandwidth and the additional spectrum emission mask with the channel bandwidth of the transmitted channels in the case of non-transmitted channels at the edge of an assigned NR-U channel bandwidth.

## **<End of Change 3>**

## **<Start of Change 4>**

##### 6.6.5.4.2 Procedure

For *BS type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment as shown in annex D.1.1 for *BS type 1-C* and in annex D.3.1 for *BS type 1-H*. All connectors not under test shall be terminated.

2) Measurements shall use a measurement bandwidth in accordance to the conditions in clause 6.6.5.5.

 The measurement device characteristics shall be:

- Detection mode: True RMS.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1.

3) For a connectors declared to be capable of single carrier operation only (D.16), set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 at *rated carrier output power* (Prated,c,AC, or Prated,c,TABC, D.21). Channel set-up shall be according to NR-FR1-TM 1.1.

 For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

4) Measure the emission at the specified frequencies with specified measurement bandwidth.

In addition, for *multi-band connectors*, the following steps shall apply:

5) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

## **<End of Change 4>**

## **<Start of Change 5>**

#### 6.7.4.2 Procedure

For *BS type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment as shown in annex D.1.2 for *BS type 1-C* and in annex D.3.2 for *BS type 1-H*. All connectors not under test shall be terminated.

2) The measurement device characteristics shall be:

- Detection mode: True RMS.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1.

3) For a connectors declared to be capable of single carrier operation only (D.16), set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 at *rated carrier output power* Prated,c,AC for *BS type 1-C* and Prated,c,TABC for *BS type 1-H* (D.21). Channel set-up shall be according to NR-FR1-TM 1.1.

 For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

4) Generate the interfering signal according to NR-FR1-TM-1.1, as defined in clause 4.9.2, with the minimum channel bandwidth (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5 of TS 38.104 [2] and a centre frequency offset from the lower/upper edge of the wanted signal or edge of sub-block inside a sub-block gap , for n = 1, 2 and 3, but exclude interfering frequencies that are outside of the allocated downlink operating band or interfering frequencies that are not completely within the sub-block gap or within the *Inter RF Bandwidth gap*.

5) Adjust ATT attenuator (as in the test setup in annex D.1.2 for *BS type 1-C* and in annex D.3.2 for *BS type 1-H*) so that level of the interfering signal is as defined in clause 6.7.5.

6) Perform the unwanted emission tests specified in clauses 6.6.3 and 6.6.4 for all third and fifth order intermodulation products which appear in the frequency ranges defined in clauses 6.6.3 and 6.6.4. The width of the intermodulation products shall be taken into account.

7) Perform the transmitter spurious emissions test as specified in clause 6.6.5, for all third and fifth order intermodulation products which appear in the frequency ranges defined in clause 6.6.5. The width of the intermodulation products shall be taken into account.

8) Verify that the emission level does not exceed the required level in clause 6.7.5 with the exception of interfering signal frequencies.

9) Repeat the test for the remaining interfering signal centre frequency offsets according to step 4.

10) Repeat the test for the remaining test signals defined in clause 6.7.5 for additional requirements and for *BS type 1-H* intra-system requirements.

In addition, for *multi-band connectors*, the following steps shall apply:

11) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

NOTE: The third order intermodulation products are centred at 2F1±F2 and 2F2±F1. The fifth order intermodulation products are centred at 3F1±2F2, 3F2±2F1, 4F1±F2, and 4F2±F1 where F1 represents the test signal centre frequency or centre frequency of each sub-block and F2 represents the interfering signal centre frequency. The widths of intermodulation products are:

- (n\*BWF1 + m\* BWF2) for the nF1±mF2 products;

- (n\* BWF2 + m\* BWF1) for the nF2±mF1 products;

 where BWF1 represents the test wanted signal RF bandwidth or channel bandwidth in case of single carrier, or sub-block bandwidth and BWF2 represents the interfering signal channel bandwidth.

## **<End of Change 5>**