**3GPP TGS-RAN WG4 Meeting #101bis-e R4-2203078
Electronic Meeting, January 17 – 25, 2022**

**Agenda item: 7.1.2.1.4**

**Source: Intel Corporation**

**Title: TP to TR 38. 884 on extension of NR test methods to FR2-2**

**Document for: Approval**

# 1 Introduction

In this contribution we provide a TP to TR 38.884 on the extension of test methods to FR2-2 covering the following aspects:

1. UE RF permitted test methods
2. UE RF testing methodology enhancements
3. RRM testing methodology enhancements
4. UE Demodulation testing methodology enhancements
5. Propagation conditions

This TP version is a revision of R4-2201873.

# 2 Text Proposal

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# References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.101-2: "User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[3] 3GPP TR 38.810: "NR; Study on test methods".

[4] 3GPP TS 38.211: "NR; Physical channels and modulation".

[5] 3GPP TS 38.212: "NR; Multiplexing and channel coding".

[6] 3GPP TS 38.521-2: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone".

[7] 3GPP TR 38.903: " Derivation of test tolerances and measurement uncertainty for User Equipment (UE) conformance test cases".

[8] L. Anttila, A. Brihuega, M. Valkama. On Antenna Array Out-of-Band Emissions, IEEE Wireless Communications Letters, Dec 2019

[9] H. Li, X. Li, C. Wei, The analysis of the performance of multi-beamforming in memory nonlinear power amplifier, EURASIP Journal on Advances in Signal Processing, 2014

[10] 3GPP TS 38.508-1: "5GS; User Equipment (UE) conformance specification; Part 1: Common test environment".

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[x] <doctype> <#>[ ([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

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5.6 Extension of frequency applicability for FR2-2

*Editor’s note: extension of frequency applicability of the permitted methods and enhanced test methods is captured in this clause*

5.6.1 Permitted test methods

Unless otherwise stated, FR2-2 will follow the baseline UE RF methodology detailed in TR 38.810. This includes the extension of frequency applicability of permitted test methods in clause 5.2.

5.6.2 Enhanced test methods

5.6.2.1 High DL power and low UL power

5.6.2.2 Polarization basis mismatch between the TE and DUT

5.6.2.3 Inter-band (FR2+FR2) CA

5.6.2.4 Extreme temperature conditions

5.6.2.5 Test time reduction

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# 6 UE RRM testing methodology enhancements

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## 6.2 Extension of frequency applicability for FR2-2

Editor’s note: extension of frequency applicability of the permitted methods and enhanced test methods is captured in this clause

6.2.1 General

Unless otherwise stated, all test methods and measurement setup for FR2 RRM methodology defined in TR 38.810 [3] Clause 6 and in TS 38.508-1 [10] Clause 7 are applicable for FR2-2.

6.2.2 Noc methodology

The Noc level for Scenario 1 (1AoA RX beam peak) for Type 1 Requirements ("Fine" RX beams) and Mode 1 Configuration (S+N) described in TR 38.810 Clause 6.2.1.4.3 need to be adjusted and can be derived similar to the Noc level for UE demodulation test methods described in Clause 7.2.2.

6.2.3 Maximum SNR derivation

Following the derivation of band-dependent parameters provided in Clause 7.2 and reusing the assumptions from Clause 6.2.1.4 of TR 38.810 related to AoA scenarios and requirement types, the maximum achievable SNR for the RRM test setups can be summarized as shown in Table 6.2.3-1.

Table 6.2.3-1: Maximum SNR preliminary extension to band n263

|  |  |  |  |
| --- | --- | --- | --- |
| RRM test setup | UE | CBW (MHz) | Max SNR (dB) [n263] |
| Scenario 1 (1AoA RX beam peak) for Type 1 Requirements (“Fine” RX beams) and Mode 1 Configuration (S+N) | Single band UE | 100 | TBD |
| 400 | TBD |
| Multi-band UE | 100 | TBD |
| 400 | TBD |
| Scenario 1 (1AoA RX beam peak) for Type 2 Requirements (“Rough” RX beams) and Mode 1 Configuration (S+N) | Single band UE | 100 | TBD |
| 400 | TBD |
| Multi-band UE | 100 | TBD |
| 400 | TBD |
| Scenario 2 (1AoA RX non-beam peak) for Type 1 Requirements (“Fine” RX beams) and Mode 1 Configuration (S+N) | Single band UE | 100 | TBD |
| 400 | TBD |
| Multi-band UE | 100 | TBD |
| 400 | TBD |
| Scenario 2 (1AoA RX non-beam peak) for Type 2 Requirements (“Rough” RX beams) and Mode 1 Configuration (S+N) | Single band UE | 100 | TBD |
| 400 | TBD |
| Multi-band UE | 100 | TBD |
| 400 | TBD |

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# 7 UE demodulation testing methodology enhancements

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## 7.2 Extension of frequency applicability for FR2-2

Editor’s note: extension of frequency applicability of the permitted methods and enhanced test methods is captured in this clause

7.2.1 General

Unless otherwise stated, all test methods and measurement setup for FR2 UE demodulation and CSI testing methodology defined in TR 38.810 Clause 7 [3] are applicable for FR2-2.

7.2.2 Noc methodology

The following methodology to define the minimum Noc level for power class X (PC\_X) and operating band Y (Band\_Y) is used for the single carrier case and a single band device:

* Noc (PC\_X, Band\_Y) = RESFENSPCX, BandY -10log10(SCSREFSENS x PRBREFSENS x 12) - SNRREFSENS + ∆thermal
* REFSENSPCX, BandY is the REFSENS value in dBm specified for Power Class X UE in band Y for [100MHz] channel bandwidth
* SCSREFSENS is [120 kHz].
* PRBREFSENS is NRB associated with subcarrier spacing SCSREFSENS for [100MHz] channel bandwidth
* 12 is the number of subcarriers in a PRB
* SNRREFSENS = -1 dB is the SNR used for simulation of REFSENS
* ∆thermal is the amount of dB that the wanted noise is set above UE thermal noise, giving a rise in total noise of **∆BB**. ∆thermal = 6dB, giving a rise in total noise of 1dB**.**

*Note: Further confirmation of used parameters is needed based on core requirements definition.*

7.2.3 Maximum SNR derivation

Editor’s note: This clause will include informational assessment of testable DL SNR range for FR2-2 for maximum frequency (~71GHz) using TR38.810 methodology.

Annex B.3 in TR38.810 describes the detailed calculations of the maximum achievable SNR by the demodulation test setup. As an informative assessment, calculation of the maximum testable DL SNR for band n263 is performed below. IFF test method is are considered.

Demodulation test system setup parameters required for SNR calculation are summarized in Table 7.2.3-1.

Table 7.2.3-1: Demodulation test setup SNR calculation parameters for band n263

|  |  |
| --- | --- |
| Parameter | Comment |
|
| REFSENS | Using REFSENS agreed for band n263 |
| Multi-band relaxation |  |
| [TE amplifier 1dB ]compression |  |
| Backoff from P1dB |  |
| [Cable loss] |  |
| [FS path loss] |  |
| TE DL absolute power setting uncertainty |  |
| [Probe antenna gain] |  |
| Beam peak search procedure error |  |

The maximum achievable DL SNR is summarized in Table 7.2.3-2.

Table 7.2.3-2: Maximum DL testable SNR preliminary extension for band n263

|  |  |  |
| --- | --- | --- |
|  | CBW (MHz) | Test method |
| IFF |
| Single band UE | 100 |  |
| 400 |  |
| 800 |  |
| 1600 |  |
| 2000 |  |
| Multi band UE | 100 |  |
| 400 |  |
| 800 |  |
| 1600 |  |
| 2000 |  |

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# 9 Propagation conditions

## 9.1 Extension of frequency applicability for FR2-2

Editor’s note: extension of frequency applicability of propagation conditions is captured in this clause

Unless otherwise stated, the propagation condition methodology defined in TR 38.810 Clause 8 [3] is applicable for FR2-2:

- Static propagation conditions

- Model is described in TR 38.810 clause 8.3.

- Applicable to the UE RRM testing methodology and UE Demodulation and CSI testing methodology.

- Multi-path fading propagation conditions

- Fading propagation conditions between the DUT and the emulated gNB sources are modelled as Single probe channel models as described in TR 38.810 clause 8.2.

- Applicable to the UE RRM testing methodology and UE Demodulation and CSI testing methodology.

- For FR2-2 measurement system is expected to support modelling of multi-path fading for single carrier scenarios with channel bandwidth of at least TBD MHz.

- For FR2-2 single carrier scenarios with channel bandwidth up to TBD MHz, the Fsample is defined as TBD MHz and ∆T ≤ TBD ns.

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