|  |  |
| --- | --- |
| 3GPP TR 38.887 V16.0.0 (2020-06) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Network;  NR;  New frequency range for NR (39.5 - 43.5 GHz)  (Release 16) | |
|  | |
|  |  |
|  | |
| The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP. The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented. This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification. Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices. | |

|  |
| --- |
|  |
| ***3GPP***  Postal address  3GPP support office address  650 Route des Lucioles - Sophia Antipolis  Valbonne - FRANCE  Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16  Internet  http://www.3gpp.org |
| ***Copyright Notification***  No part may be reproduced except as authorized by written permission. The copyright and the foregoing restriction extend to reproduction in all media.  © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).  All rights reserved.  UMTS™ is a Trade Mark of ETSI registered for the benefit of its members  3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners LTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners  GSM® and the GSM logo are registered and owned by the GSM Association |

Contents

Foreword 4

1 Scope 6

2 References 6

3 Definitions, symbols and abbreviations 6

3.1 Definitions 6

3.2 Symbols 6

3.3 Abbreviations 7

4 Background 7

4.1 Regulatory situation 8

4.2 Outcome of WRC-19 for 37-43.5 GHz spectrum range 9

5 NR Frequency band definition 9

6 Channel numbering and channel bandwidth 10

7 Configurations for intra-band contiguous CA 11

8 RF requirements for band n259 12

8.1 UE specific 12

8.1.1 Transmitter characteristics 12

2.1.1.1 Multiband Relaxation 15

2.1.1.2 Beam Correspondence 16

8.1.2 Receiver characteristics 16

8.2 BS specific 19

8.2.1 Radiated transmitter characteristics 20

8.2.2.1 Adjacent Channel Leakage Ratio (ACLR) 20

8.2.2.2 OTA operating band unwanted emissions 20

8.2.2.3 Definition of ΔfOBUE and ΔfOOB 20

8.2.2.4 Step frequencies for Tx spurious emission 20

8.2.2.5 Measurement uncertainty and test tolerance 20

2.1.2 Radiated receiver characteristic 21

2.1.2.1 Definition of ΔfOBUE and ΔfOOB 21

9 RRM Requirements 21

9.1 Frequency bands grouping 22

9.2 Conditions for RRM requirements applicability for operating bands 22

9.2.1 Minimum SSB\_RP values for Rx Beam Peak angle of arrival 23

9.2.2 Minimum SSB\_RP values for angle of arrival within Spherical coverage 23

10 Required changes to NR, E-UTRA, UTRA and MSR specifications 29

Annex A: Change history 29

# Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# Scope

The present document is a technical report for Work Item on New Radio (NR) Access Technology, covering the new frequency range between 39.5- 43.5 GHz for NR.

# 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 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".

[3] 3GPP TS 38.133: "NR; Radio Resource Control (RRC); Protocol specification".

[4] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone"

[5] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**Operating band:** frequency range in which NR operates (paired or unpaired), that is defined with a specific set of technical requirements.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

ΔfOOB Δ Frequency of Out Of Band emission

ΔMBP,n Allowed relaxation to each, minimum peak EIRP and reference sensitivity due to support for multi-band operation, per band in a combination of supported bands

ΔMBS,n Allowed relaxation to each, EIRP spherical coverage and EIS spherical coverage due to support for multi-band operation, per band in a combination of supported bands

∑MBP Total allowed relaxation to each, minimum peak EIRP and reference sensitivity due to support for multi-band operation, for all bands in a combination of supported bands

∑MBS Total allowed relaxation to each, EIRP spherical coverage and EIS spherical coverage due to support for multi-band operation, for all bands in a combination of supported bands

NRACLR NR ACLR

NRB Transmission bandwidth configuration, expressed in units of resource blocks

PCMAX The configured maximum UE output power

PTMAX,f,c The measured total radiated power for carrier *f* of serving cell *c*

PUMAX The measured configured maximum UE output power

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

ACLR Adjacent Channel Leakage Ratio

ACS Adjacent Channel Selectivity

BS Base Station

BW Bandwidth

EIRP Effective Isotropic Radiated Power

EIS Equivalent Isotropic Sensitivity

FR Frequency Range

GSCN Global Synchronization Channel Number

ICS In-Channel Selectivity

ITU‑R Radiocommunication Sector of the International Telecommunication Union

NR New Radio

NR-ARFCN NR Absolute Radio Frequency Channel Number

OTA Over The Air

RF Radio Frequency

RX Receiver

SCS Sub-Carrier Spacing

TDD Time division Duplex

# 4 Background

WRC-19 agenda item 1.13, Resolution **238** (WRC-15)identifies 37-40.5 GHz, 42.5-43.5 GHz, which have allocations to the mobile service on a primary basis; and 40.5-42.5 GHz which may require additional allocations to the mobile service on a primary basis, among other as IMT candidate bands. Consequently, after WRC-15 there have been extensive discussions and studies on the suitability of these bands for IMT allocation in different regulatory organizations. From the WRC-19 preparations, it is evident that many administrations across all ITU regions are interested in the IMT allocation of the whole or part of the 37-43.5 GHz frequency ranges. The position of regulatory bodies and regional forums regarding these ranges are summarized below:

APT (Asia-Pacific Telecommunity) members support identification of the frequency bands 37-40.5 GHz, 40.5-42.5 GHz and 42.5-43.5 GHz, or portions thereof, for IMT considering that protection of the incumbent services in these and adjacent frequency bands should be ensured. APT Members recognize that different administrations would implement IMT in different portions of the 37-43.5 GHz frequency range for IMT, and a global identification for IMT in the 37-43.5 GHz band, or portions thereof, would allow each country/region to implement IMT in different portions of the band in accordance with their national/regional considerations, while still facilitating the benefits of economies of scale.

Mobile Primary allocation

No Mobile allocation

ASMG (Arab Spectrum Management Group): supports IMT identification within the frequency bands 40.5-42.5GHz and 42.5-43.5GHz.

CEPT (European Conference of Postal and Telecommunications): proposes an IMT identification for 40.5-43.5 GHz. This is a priority band for CEPT and already specified for future harmonization in Europe. Whilst CEPT will not propose IMT identification at WRC-19 and has no intention of using 37-40.5 GHz for IMT, CEPT will not oppose a global IMT identification for the full 37-43.5 GHz range.

Some countries in CITEL including the US, Canada and Brazil support IMT identification for part of 37-43.5 GHz spectrum range.

Position of the RCC (Regional Commonwealth in the field of Communications) administrations on frequency bands 37.0−40.5 GHz and 40.5−42.5 GHz included in Resolution 238 (WRC-15): to be specified taking into account the need to protect both passive and active services.

ATU (African Telecommunications Union) supports the 40GHz band (37-40.5, 40.5-42.5 and 42.5-43.5 GHz frequency range) for IMT identification under Resolution 238 (WRC15).

## 4.1 Regulatory situation

Table 4.1-1 is the extract of the Radio Regulation (RR) table of allocations providing the services allocated in the 36-47 GHz frequency range.

Table 4.1.1 Allocation information in the 36-47GHz frequency range [2]

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 36-37 EARTH EXPLORATION-SATELLITE (passive)  FIXED  MOBILE  SPACE RESEARCH (passive)  5.149 5.550A | | |
| 37-37.5 FIXED  MOBILE except aeronautical mobile  SPACE RESEARCH (space-to-Earth)  5.547 | | |
| 37.5-38 FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE except aeronautical mobile  SPACE RESEARCH (space-to-Earth)  Earth exploration-satellite (space-to-Earth)  5.547 | | |
| 38-39.5 FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE  Earth exploration-satellite (space-to-Earth)  5.547 | | |
| 39.5-40 FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE  MOBILE-SATELLITE (space-to-Earth)  Earth exploration-satellite (space-to-Earth)  5.547 | | |
| 40.5-41  FIXED  FIXED-SATELLITE  (space-to-Earth)  MOBILE  BROADCASTING  BROADCASTING-SATELLITE  Mobile  5.547 | 40.5-41  FIXED  FIXED-SATELLITE  (space-to-Earth) 5.516B  MOBILE  BROADCASTING  BROADCASTING-SATELLITE  Mobile  Mobile-satellite (space-to-Earth)  5.547 | 40.5-41  FIXED  FIXED-SATELLITE  (space-to-Earth)  MOBILE  BROADCASTING  BROADCASTING-SATELLITE  Mobile  5.547 |
| 41-42.5 FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE  BROADCASTING  BROADCASTING-SATELLITE  Mobile  5.547 5.551F 5.551H 5.551I | | |
| 42.5-43.5 FIXED  FIXED-SATELLITE (Earth-to-space) 5.552  MOBILE except aeronautical mobile  RADIO ASTRONOMY  5.149 5.547 | | |
| 43.5-47 MOBILE 5.553  MOBILE-SATELLITE  RADIONAVIGATION  RADIONAVIGATION-SATELLITE  5.554 | | |

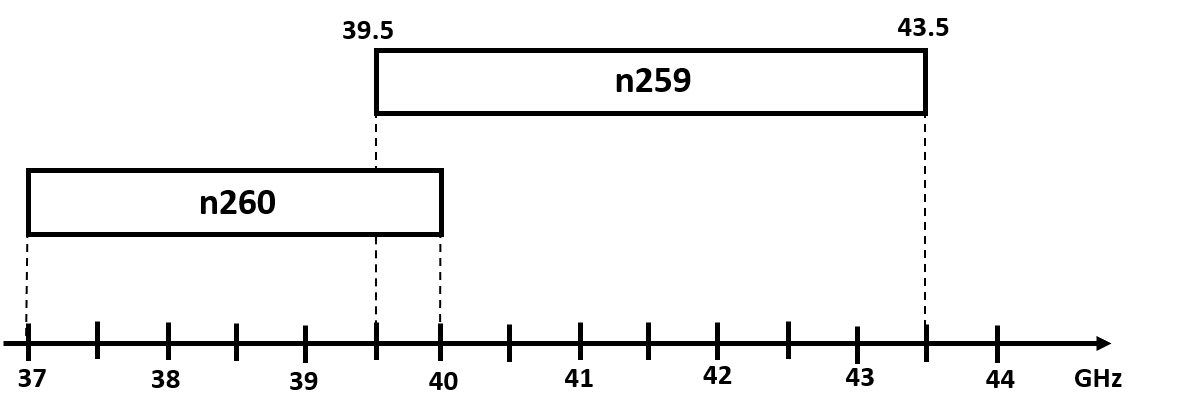
## 4.2 Outcome of WRC-19 for 37-43.5 GHz spectrum range

WRC-19 was held 28 October-22 November in Sharm El-Sheikh, Egypt and concluded the following decision for spectrum range 37-43.5 GHz:

“For frequency range 37-43.5 GHz he frequency band 37-43.5 GHz, or portions thereof, is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Because of the potential deployment of FSS earth stations within the frequency range 37.5-42.5 GHz and high-density applications in the fixed-satellite service in the bands 39.5-40 GHz in Region 1, 40-40.5 GHz in all Regions and 40.5-42 GHz in Region 2 (see No. 5.516B), administrations should further take into account potential constraints to IMT in these bands, as appropriate. Resolution COM4/9 (WRC-19) applies.”

# 5 NR Frequency band definition

The Band plan for 37-43.5 GHz frequency range is shown in Figure below. Two bands are defined in this range, existing band n260 (37-40 GHz) and the new band n259 (39.5-43.5 GHz).



Band definition in the frequency range 37- 43.5 GHz

Summary of the new NR band is provided in Table 5-1.

Table 5-1: New NR band in FR2

|  |  |  |  |
| --- | --- | --- | --- |
| **Band number** | **UL** | **DL** | **Duplex mode** |
| n259 | 39.5 – 43.5 GHz | 39.5 - 43.5 GHz | TDD |

# 6 Channel numbering and channel bandwidth

BS channel bandwidth for FR2 has been defined in TS 38.104. They are captured to support at least 50 MHz as a minimum channel bandwidth and up to 400 MHz as the maximum channel bandwidth. In order to apply the same requirement for Band n259, the same bandwidths as other FR2 bands are proposed as shown in table 6-1.

Table 6-1: NR channel bandwidth in the frequency range between 39.5 – 43.5 GHz

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | | Channel bandwidth | | | |
| Band number | data SCS(kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n259 | 60 | Yes | Yes | Yes |  |
| 120 | Yes | Yes | Yes | Yes |

NR-ARFCN parameters for the global frequency raster are presented in TS 38.104, table 7-2:

Table 6-2: NR-ARFCN parameters for the global frequency raster

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency range (MHz) | ΔFGlobal (kHz) | FREF-Offs (MHz) | NREF-Offs | Range of NREF |
| 0 – 3000 | 5 | 0 | 0 | 0 – 599999 |
| 3000 – 24250 | 15 | 3000 | 600000 | 600000 – 2016666 |
| 24250 – 100000 | 60 | 24250.08 | 2016667 | 2016667 – 3279165 |

Using information above and the equation FREF = FREF-Offs + ΔFGlobal (NREF – NREF-Offs), The NR-ARFCN that are applicable in the frequency range 39.5-43.5 GHz can be calculated as in table 6-3:

Table 6-3: Applicable NR-ARFCN in the frequency range between 39.5-43.5 GHz

|  |  |  |
| --- | --- | --- |
| NR Operating Band | ΔFRaster  (kHz) | Uplink and Downlink  Range of NREF  (First – <Step size> – Last) |
| n259 | 60 | 2270832 – <1> – 2337499 |
| n259 | 120 | 2270832 – <2> – 2337499 |

The synchronization raster in the frequency range between 39.5-43.5 GHz is given in Table 7-4. The distance between applicable GSCN entries is given by the <Step size> indicated in Table 7-4 with the step size interval of 17.28MHz.

Table 6-4: Applicable SS raster entries in the frequency range between 39.5-43.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| NR Operating Band | SS Block SCS | SS Block pattern1 | Range of GSCN  (First – <Step size> – Last) |
| n259 | 120 kHz | Case D | 23140 – <1> – 23369 |
| 240 kHz | Case E | 23142 – <2> – 23368 |
| NOTE: SS Block pattern is defined in subclause 4.1 in TS 38.213. | | | |

# 7 Configurations for intra-band contiguous CA

Table 5.5A.1-1( NR CA configurations, bandwidth combination sets, and fallback group defined for intra-band contiguous CA) in 38.101-2 should be updated to include the following configurations for band n259 intra-band contiguous CA.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configurations | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | Maximum aggregated BW(MHz) | BCS | Fallback group |
| CA\_n259B | CA\_n259B | 50, 100, 200, 400 | 400 |  |  |  |  |  |  | 800 | 0 | 3 |
| CA\_n259C | CA\_n259B | 50, 100, 200, 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 |
| CA\_n259G | CA\_n259G | 50, 100 | 100 |  |  |  |  |  |  | 200 | 0 |
| CA\_n259H | CA\_n259G  CA\_n259H | 50, 100 | 100 | 100 |  |  |  |  |  | 300 | 0 |
| CA\_n259I | CA\_n259G  CA\_n259H  CA\_n259I | 50, 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 |
| CA\_n259J | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J | 50, 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 |
| CA\_n259K | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J  CA\_n259K | 50, 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 |
| CA\_n259L | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J  CA\_n259K  CA\_n259L | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 |
| CA\_n259M | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J  CA\_n259K  CA\_n259L  CA\_n259M | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 |

# 8 RF requirements for band n259

## 8.1 UE specific

For introduction of band n259 only RF requirements for power class 3 has been considered.

### 8.1.1 Transmitter characteristics

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The requirement is verified with the test metric of total component of EIRP (Link=Beam peak search grids, Meas=Link angle).

Table 8.1.1-1: UE minimum peak EIRP for power class 3

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n259 | 18.7 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |

The maximum output power values for TRP and EIRP are found on the Table 8.1.1-2. The max allowed EIRP is derived from regulatory requirements. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction) in beam locked mode and the total component of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 8.1.1-2: UE maximum output power limits for power class 3

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n259 | 23 | 43 |

The minimum EIRP at the 50th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 8.1.1-3 below. The requirement is verified with the test metric of the total component of EIRP (Link=Beam peak search grids, Meas=Link angle).

Table 8.1.1-3: UE spherical coverage for power class 3

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50%-tile CDF (dBm) |
| n259 | 5.8 |
| NOTE 1: Minimum EIRP at 50 %-tile CDF is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are verified only under normal temperature conditions. | |

It is also necessary to consider the band specific requirements besides the minimum peak EIRP, maximum output power and spherical coverage. The following part will give the required changes for introducing band n259 into the requirements in TS 38.101-2: PUMAX tolerance, minimum output power, transmit OFF power, adjacent channel leakage ratio, and spurious emission band UE co-existence.

**Required changes for TS 38.101-2**

Table 6.2.4-1: PUMAX,f,c tolerance

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n257, n258, n259, n260, n261 | P = 0 | 0 |
| 0 < P ≤ 2 | 1.5 |
| 2 < P ≤ 3 | 2.0 |
| 3 < P ≤ 4 | 3.0 |
| 4 < P ≤ 5 | 4.0 |
| 5 < P ≤ 10 | 5.0 |
| 10 < P ≤ 15 | 7.0 |
| 15 < P ≤ X | 8.0 |
| NOTE: X is the value such that Pumax,f,c lower bound, PPowerclass - P – T(P) = minimum output power specified in subclause 6.3.1 | | |

Table 6.2A.4-1: PUMAX tolerance

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n257, n258, n259, n260, n261 | P = 0 | 0 |
| 0 < P ≤ 2 | 1.5 |
| 2 < P ≤ 3 | 2.0 |
| 3 < P ≤ 4 | 3.0 |
| 4 < P ≤ 5 | 4.0 |
| 5 < P ≤ 10 | 5.0 |
| 10 < P ≤ 15 | 7.0 |
| 15 < P ≤ X | 8.0 |
| NOTE: X is the value such that Pumax lower bound, PPowerclass - P – T(P) = minimum output power specified in subclause 6.3A.1 | | |

Table 6.3.1.2-1: Minimum output power for power class 2, 3, and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n259, n260, n261 | 50 | -13 | 47.52 |
| 100 | -13 | 95.04 |
| 200 | -13 | 190.08 |
| 400 | -13 | 380.16 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4. | | | |

Table 6.3.2-1: Transmit OFF power

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n259, n260, n261 | -35 | -35 | -35 | -35 |
| 47.52 MHz | 95.04 MHz | 190.08 MHz | 380.16 MHz |

Table 6.3A.1.2-1: Minimum output power for CA for power class 2, 3, and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n259, n260, n261 | 50 | -13 | 47.52 |
| 100 | -13 | 95.04 |
| 200 | -13 | 190.08 |
| 400 | -13 | 380.16 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4. | | | |

Table 6.3A.2-1: Transmit OFF power for CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n259, n260, n261 | -35 | -35 | -35 | -35 |
| 47.52 MHz | 95.04 MHz | 190.08 MHz | 380.16 MHz |

Table 6.5.2.3-1: General requirements for NRACLR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / NRACLR / Measurement bandwidth | | | |
| 50  MHz | 100  MHz | 200  MHz | 400  MHz |
| NRACLR for band n257, n258, n261 | 17 dB | 17 dB | 17 dB | 17 dB |
| NRACLR for band n259, n260 | 16 dB | 16 dB | 16 dB | 16 dB |
| NR channel measurement bandwidth | 47.52 MHz | 95.04 MHz | 190.08 MHz | 380.16 MHz |
| Adjacent channel centre frequency offset (MHz) | +50  /  -50 | +100.0  /  -100.0 | +200  /  -200 | +400  /  -400 |

Table 6.5.3.1-1: Requirements

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR Band | Spurious emission | | | | | |
| Protected band/frequency range | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) |
| n257 | NR Band n259 | FDL\_low | - | FDL\_high | -2 | 100 |
| NR Band n260 | FDL\_low | - | FDL\_high | -2 | 100 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |
| n258 | Frequency range | 57000 | - | 66000 | 2 | 100 |
| n259 | NR Band 257 | FDL\_low | - | FDL\_high | -5 | 100 |
| NR Band 261 | FDL\_low | - | FDL\_high | -5 | 100 |
| Frequency range | 36000 | - | 37000 | 7 | 1000 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |
| n260 | NR Band 257 | FDL\_low | - | FDL\_high | -5 | 100 |
| NR Band 261 | FDL\_low | - | FDL\_high | -5 | 100 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |
| n261 | NR Band 259 | FDL\_low | - | FDL\_high | -2 | 100 |
| NR Band 260 | FDL\_low | - | FDL\_high | -2 | 100 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |
| NOTE 1: FDL\_low and FDL\_high refer to each NR frequency band specified in Table 5.2-1  NOTE 2: Void | | | | | | |

Table 6.5A.2.3-1: General requirements for CA NRACLR

|  |  |
| --- | --- |
|  | CA bandwidth class / CA NRACLR / Measurement bandwidth |
| Any CA bandwidth class |
| CA NRACLR for band n257, n258, n261 | 17 dB |
| CA NRACLR for band n259, n260 | 16 dB |
| NR channel measurement bandwidth1 | BWChannel\_CA – GBChannel(1) - GBChannel(2) |
| NOTE 1: The GBChannel(i) is the minimum guard band of the component carriers at the lower edge Fedge, low and the upper edge Fedge,high of the sub-block respectively. | |

Table 6.5A.3-1: Requirements for CA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| UL CA for any CA bandwidth class | Spurious emission | | | | | | |
| Protected band / frequency range | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| CA\_n257 | NR Band n259 | FDL\_low | - | FDL\_high | -2 | 100 |  |
| NR Band n260 | FDL\_low | - | FDL\_high | -2 | 100 |  |
| Frequency range | 23600 | - | 24000 | -8 | 200 | 2 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |  |
| CA\_n258 | Frequency range | 23600 | - | 24000 | -8 | 200 | 2 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |  |
| CA\_n259 | NR Band 257 | FDL\_low | - | FDL\_high | -5 | 100 |  |
| NR Band 261 | FDL\_low | - | FDL\_high | -5 | 100 |  |
| Frequency range | 36000 | - | 37000 | 7 | 1000 |  |
| Frequency range | 57000 | - | 66000 | 2 | 100 |  |
| CA\_n260 | NR Band 257 | FDL\_low | - | FDL\_high | -5 | 100 |  |
| NR Band 261 | FDL\_low | - | FDL\_high | -5 | 100 |  |
| Frequency range | 23600 | - | 24000 | -8 | 200 | 2 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |  |
| CA\_n261 | NR Band 259 | FDL\_low | - | FDL\_high | -2 | 100 |  |
| NR Band 260 | FDL\_low | - | FDL\_high | -2 | 100 |  |
| Frequency range | 23600 | - | 24000 | -8 | 200 | 2 |
| Frequency range | 57000 | - | 66000 | 2 | 100 |  |
| NOTE 1: FDL\_low and FDL\_high refer to each NR frequency band specified in Table 5.2-1  NOTE 2: The protection of frequency range 23600 - 2400 MHz is meant for protection of satellite passive services. | | | | | | | |

#### 8.1.1.1 Multiband Relaxation

RAN4 agreed on enhancement of multiband relaxation framework for Rel-16 by Replacing cumulative relaxations with equivalent per-band relaxations according to Table 1:

**Table1 :UE multi-band relaxation factors for power class 3**

|  |  |  |
| --- | --- | --- |
| Band | MBP,n (dB) | MBS,n (dB) |
| n257 | 0.73 | 0.73 |
| n258 | 0.6 | 0.7 |
| **n259** | **0.5** | **0.4** |
| n260 | 0.51 | 0.41 |
| n261 | 0.52,4 | 0.74 |
| Note 1: n260 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n260  Note 2: n261 peak relaxation is 0 dB for UE that exclusively supports n261+n260  Note 3: n257 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257  Note 4: n261 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257 | | |

#### 8.1.1.2 Beam Correspondence

Rel-15 beam correspondence mechanism can be reused for n259 with the following value for beam correspondence tolerance for PC3:

Table 2-1: UE beam correspondence tolerance for power class 3

|  |  |
| --- | --- |
| Operating band | Max ∆EIRPBC at 85th %-tile ∆EIRPBC CDF (dB) |
| N257 | 3.0 |
| N258 | 3.0 |
| N259 | 3.2 |
| N260 | 3.2 |
| N261 | 3.0 |
| NOTE: The requirements in this table are verified only under normal temperature conditions as defined in Annex E.2.1 | |

The BC requirement will be updated to reflect the outcome of the Rel-16 BC discussion in UE RF FR2 WI once the discussion is concluded

### 8.1.2 Receiver characteristics

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels with peak reference sensitivity specified in Table 8.1.2-1. The requirement is verified with the test metric of EIS (Link=Beam peak search grids, Meas=Link Angle).

Table 8.1.2-1: Reference sensitivity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n259 | -84.7 | -81.7 | -78.7 | -75.7 |

The maximum EIS at the 50th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 8.1.2-2 below. The requirement is verified with the test metric of EIS (Link=Beam peak search grids, Meas=Link angle).

Table 8.1.2-2: EIS spherical coverage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating band** | **EIS at 50th %-tile CCDF (dBm) / Channel bandwidth** | | | |
| **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** |
| n260 | -71.9 | -68.9 | -66.1-65.9 | -63.1-62.9 |
| NOTE 1: The transmitter shall be set to PUMAX.  NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions. | | | | |

It is also necessary to consider the band specific requirements besides the reference sensitivity and EIS spherical coverage. The following part will give the required changes for introducing band n259 into the requirements in TS 38.101-2: adjacent channel selectivity and in-band blocking.

**Required changes for TS 38.101-2**

Table 7.5-1: Adjacent channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating band | Units | Adjacent channel selectivity / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n261 | dB | 23 | 23 | 23 | 23 |
| n259, n260 | dB | 22 | 22 | 22 | 22 |

Table 7.5A-1: Adjacent channel selectivity for CA

|  |  |  |
| --- | --- | --- |
| Operating band | Units | Adjacent channel selectivity / CA bandwidth class |
| All CA bandwidth class |
| n257, n258, n261 | dB | 23 |
| n259, n260 | dB | 22 |

Table 7.6.2-1: In band blocking requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rx parameter | Units | Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + 14 dB | | | |
| BWInterferer | MHz | 50 | 100 | 200 | 400 |
| PInterferer  for bands n257, n258, n261 | dBm | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB |
| PInterferer  for band n259, n260 | dBm | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB |
| FIoffset | MHz | ≤ -100 & ≥ 100  NOTE 5 | ≤ -200 & ≥ 200  NOTE 5 | ≤ -400 & ≥ 400  NOTE 5 | ≤ -800 & ≥ 800  NOTE 5 |
| FInterferer | MHz | FDL\_low + 25  to  FDL\_high - 25 | FDL\_low + 50  to  FDL\_high - 50 | FDL\_low + 100  to  FDL\_high - 100 | FDL\_low + 200  to  FDL\_high - 200 |
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1. TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE2: The REFSENS power level is specified in Section 7.3.2, which are applicable according to different UE power classes.  NOTE 3: The wanted signal consists of the reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE 4: FIoffset is the frequency separation between the center of the channel bandwidth and the center frequency of the Interferer signal.  NOTE 5: The absolute value of the interferer offset FIoffset shall be further adjusted (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.  NOTE 6: FInterferer range values for unwanted modulated interfering signals are interferer center frequencies. | | | | | |

Table 7.6A.2-1: In band blocking minimum requirements for intra-band contiguous CA

|  |  |  |
| --- | --- | --- |
| Rx Parameter | Units | All CA bandwidth classes |
| Power in Transmission Bandwidth Configuration, per CC |  | REFSENS + 14 dB |
| Pinterferer for band n257, n258, n261 | dBm | Aggregated power + 21.5 |
| Pinterferer for band n259, n260 | dBm | Aggregated power + 20.5 |
| BWInterferer | MHz | BWChannel\_CA |
| FIoffset | MHz | +2\*BWChannel\_CA / -2\*BWChannel\_CA  NOTE 5 |
| FInterferer | MHz | FDL\_low + 0.5\*BWChannel\_CA  To  FDL\_high - 0.5\*BWChannel\_CA |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1. and set-up according to Annex C.  NOTE 2: The REFSENS power level is specified in Table 7.3.2-1.  NOTE 3: The wanted signal consists of the reference measurement channel specified in Annex A.3.3.2 QPSK, R=1/3 with one sided dynamic OCNG pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE 4: The FInterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal.  NOTE 5: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 6: FInterferer range values for unwanted modulated interfering signals are interferer center frequencies. | | |

## 8.2 BS specific

Based on current BS specification, at least the following requirements needed to be considered for introduction of Band n259.

**Table 8.2-1: Required changes in TS 38.104 for n259**

|  |  |  |
| --- | --- | --- |
| Section | Requirement | Required changes in TS 38.104 |
| 5.2 | Operating bands | Operating band of n259 shall be added in to Table Table 5.2-2. |
| 5.3.5 | BS channel bandwidth per operating band | Channel bandwidths and corresponding SCS for n259 shall be added in Table 5.3.5-2. |
| 5.4.2.3 | Channel raster entries for each operating band | Applicable NR-ARFCN for n259 shall be added into Table 5.4.2.3-2 once the lower frequency limit for n259 is determined. |
| 5.4.3.3 | Synchronization raster entries for each operating band | Applicable SS raster entries for n259 shall be added into Table 5.4.3.3-2 once the lower frequency limit for n259 is determined. |

The BS RF requirements summarized in Table 8.2-2 is band agnostic RF requirements for FR2 which are applicable for band n259 as well.

Table 8.2-2: Summary on band agnostic of BS RF requirements for FR2

|  |  |
| --- | --- |
| **BS TX side capture in TS 38.104** | **BS RX side capture in TS 38.104** |
| 9.2 Radiated transmit power | 10.3 OTA reference sensitivity level |
| 9.3 OTA Base station output power | 10.5 OTA In-band selectivity and blocking |
| 9.4 OTA Output power dynamics | 10.7 OTA Receiver spurious emissions |
| 9.5 OTA Transmit ON/OFF power | 10.9 OTA In-channel selectivity |
| 9.6 OTA Transmitted signal quality |  |
| 9.7.2 OTA Occupied bandwidth |  |
| 9.7.5 OTA Transmitter spurious emissions |  |

In the following sections BS specific requirements for band n259 are presented.

### 8.2.1 Radiated transmitter characteristics

#### 8.2.2.1 Adjacent Channel Leakage Ratio (ACLR)

The BS OTA ACLR limit for spectrum range 37 – 52.6 GHz has been defined in TS 38.104. This is also applicable for Band n259.

#### 8.2.2.2 OTA operating band unwanted emissions

The BS OTA operating band unwanted emission for spectrum range 37 – 52.6 GHz has been specified in TS 38.104, section 9.7. Those limits are applicable for Band n259.

#### 8.2.2.3 Definition of ΔfOBUE and ΔfOOB

In TS 38.104, the definition of ΔfOBUE and ΔfOOB applies to 3250 MHz operating bandwidth while for band n259 the operating bandwidth is FDL,high – FDL,low == 4000 MHz. For ΔfOBUE and ΔfOOB to be applicable for band n259 the following tables in TS 38.104 should be modified as follows:

*Table 9.7.1-1: Maximum offset ΔfOBUE outside the downlink operating band*

|  |  |  |
| --- | --- | --- |
| *BS type* | *Operating band characteristics* | *ΔfOBUE (MHz)* |
| *BS type 1-O* | *FDL,high – FDL,low  < 100 MHz* | *10* |
| *100 MHz ≤ FDL,high – FDL,low  ≤ 900 MHz* | *40* |
| *BS type 2-O* | *FDL,high – FDL,low ≤ 4000 MHz* | *1500* |

The same modification should be performed to Table 6.7.1-1: *Maximum offset ΔfOBUE outside the downlink operating band* in TS 38.141-2.

#### 8.2.2.4 Step frequencies for Tx spurious emission

It is also needed to add band n259 to Table 9.7.5.3.2.3-2 in TS 38.104 thus Table 9.7.5.3.2.3-2 should be modified as below to include band n259.

*Table 9.7.5.3.2.3-2: Step frequencies for defining the BS radiated Tx spurious emission limits in FR2 (Category B)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Operating band* | *Fstep,1 [GHz]* | *Fstep,2 [GHz]* | *Fstep,3 [GHz] (Note 2)* | *Fstep,4 [GHz] (Note 2)* | *Fstep,5 [GHz]* | *Fstep,6 [GHz]* |
| *n258* | *18* | *21* | *22.75* | *29* | *30.75* | *40.5* |
| *n259* | 23,5 | 35,5 | 38 | 45 | 47,5 | 59,5 |
| *NOTE 1:   Fstep,X are based on ERC Recommendation 74-01 [19], Annex 2.*  *NOTE 2:   Fstep,3 and Fstep,4 are aligned with the values for ΔfOBUE in Table 9.7.1-1.* | | | | | | |

#### 8.2.2.5 Measurement uncertainty and test tolerance

For introduction of band n259 the following updates are needed in TS 38.141-2:

- Update the frequency range in the TT table (Table C.1-2: Derivation of test requirements (FR2 OTA transmitter tests)) as below:

- Radiated transmit power:

- 2.0 dB (37 – 43.5 GHz) for normal condition

- 3.3 dB (37 – 43.5 GHz) for extreme condition.

- OTA base station output power:

- 2.4 dB (37 – 43.5 GHz)

- OTA transmitter OFF power:

- 3.3 dB (37 – 43.5 GHz)

- OTA ACLR

- 2.6 dB (37 – 43.5 GHz) for relative ACLR

- 2.7 dB (37 – 43.5 GHz) for absolute ACLR

- OTA operating band unwanted emissions

- 2.7 dB (37 – 43.5 GHz)

- Update the frequency range of the test requirements for “radiated transmit power”, “OTA base station output power” and “OTA transmitter transient period” from “37 GHz < f ≤ 40 GHz” to “37 GHz < f ≤ 43.5 GHz”

### 8.2.2 Radiated receiver characteristic

The BS OTA Receiver characteristics have been specified in TS 38.104. The requirements are either band agnostic or are defined for spectrum range 37 – 52.6 GHz. Those limits are applicable for Band n259.

#### 8.2.2.1 Definition of ΔfOBUE and ΔfOOB

In TS 38.104, the definition of ΔfOBUE and ΔfOOB applies to 3250 MHz operating bandwidth while for band n259 the operating bandwidth is FDL,high – FDL,low == 4000 MHz. For ΔfOBUE and ΔfOOB to be applicable for band n259 the following tables in TS 38.104 should be modified as follows:

*Table 10.5.2.3-0: ΔfOOB offset for NR operating bands in FR2*

|  |  |  |
| --- | --- | --- |
| *BS type* | *Operating band characteristics* | *ΔfOOB (MHz)* |
| *BS type 2-O* | *FUL\_high – FUL\_low ≤ 4000 MHz* | *1500* |

The same modification should be performed inTable 7.5.2.5.3-0: *ΔfOOB offset for NR operating bands in FR2* in TS 38.141-2.

#### 8.2.2.2 Step frequencies for Rx spurious emission

It is also needed to add band n259 to Table 10.7.3-2in TS 38.104 thus Table 10.7.3-2should be modified as below to include band n259.

Table 10.7.3-2: Step frequencies for defining the radiated Rx spurious emission limits for *BS type 2-O*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Operating band | Fstep,1 (GHz) | Fstep,2 (GHz) | Fstep,3 (GHz) | Fstep,4 (GHz) | Fstep,5 (GHz) | Fstep,6 (GHz) |
| n257 | 18 | 23.5 | 25 | 31 | 32.5 | 41.5 |
| n258 | 18 | 21 | 22.75 | 29 | 30.75 | 40.5 |
| n259 | 23,5 | 35,5 | 38 | 45 | 47,5 | 59,5 |
| n260 | 25 | 34 | 35.5 | 41.5 | 43 | 52 |
| n261 | 18 | 25.5 | 26.0 | 29.85 | 30.35 | 38.35 |

# 9 RRM Requirements

For introduction of band n259 the following sections in TS 38.133 need to be updated to include RRM band specific requirements for band n259:

1) 3.5 Frequency bands grouping

2) Annex B (normative): Conditions for RRM requirements applicability for operating bands

## 9.1 Frequency bands grouping

The frequency bands grouping for FR2 presented in Table 3.5.3-1 is derived based on UE REFSENS requirements and assuming 0.5 dB step between the neighbour groups. The groups are defined in the order of increasing REFSENS, i.e., the group A has the smallest REFSENS among the groups.

UE REFSENS for band n259 is defined in TR 38.887 [1] as follows:

Table 8.1.2-1: Reference sensitivity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n259 | -84.7 | -81.7 | -78.7 | -75.7 |

In Table 3.5.3-2, Group Y which includes n260 PC3 with REFSENS of -85.7/50 MHz, Table 7.3.2.3-1 in TS 38.101-2 , corresponds to UE REFSENS of -85.5.

Since REFSENS for band n259 is -84.7 dBm/50 MHz, we need to introduce two new groups considering the 0.5 dB steps between two groups. The two new groups are presented in Table 3.5.3-1.

Table 3.5.3-1: NR frequency band groups for FR2

|  |  |  |
| --- | --- | --- |
| Group | Band group notation | Operating bands |
| A | NR\_TDD\_FR2\_A | n2571, n2581, n2611 |
| B | NR\_TDD\_FR2\_B | n2574, n2584, n2614 |
| C | NR\_TDD\_FR2\_C |  |
| D | NR\_TDD\_FR2\_D |  |
| E | NR\_TDD\_FR2\_E |  |
| F | NR\_TDD\_FR2\_F | n2604 |
| G | NR\_TDD\_FR2\_G | n2601 |
| H | NR\_TDD\_FR2\_H |  |
| I | NR\_TDD\_FR2\_I |  |
| J | NR\_TDD\_FR2\_J |  |
| K | NR\_TDD\_FR2\_K |  |
| L | NR\_TDD\_FR2\_L | n2572, n2582, n2612 |
| M | NR\_TDD\_FR2\_M |  |
| N | NR\_TDD\_FR2\_N |  |
| O | NR\_TDD\_FR2\_O |  |
| P | NR\_TDD\_FR2\_P |  |
| Q | NR\_TDD\_FR2\_Q |  |
| R | NR\_TDD\_FR2\_R |  |
| S | NR\_TDD\_FR2\_S |  |
| T | NR\_TDD\_FR2\_T | n2573, n2583, n2613 |
| U | NR\_TDD\_FR2\_U |  |
| V | NR\_TDD\_FR2\_V |  |
| W | NR\_TDD\_FR2\_W |  |
| X | NR\_TDD\_FR2\_X |  |
| Y | NR\_TDD\_FR2\_Y | n2603 |
| Z | NR\_TDD\_FR2\_Z |  |
| AA | NR\_TDD\_FR2\_AA | n2593 |
| NOTE 1: UE power class 1.  NOTE 2: UE power class 2.  NOTE 3: UE power class 3.  NOTE 4: UE power class 4. | | |

## 9.2 Conditions for RRM requirements applicability for operating bands

Derivation of Minimum SSB\_RP values for FR2 is defined in Annex B.2 in TS 38.133 as follows:

### 9.2.1 Minimum SSB\_RP values for Rx Beam Peak angle of arrival

Minimum SSB\_RP values are based on Reference sensitivity for the Operating band and for the UE power class, taking a baseline of UE Power class 3 in Band n260 with 50 MHz channel bandwidth.

The calculated Minimum SSB\_RP value for the baseline of UE power class 3 in Band n260 is (-109.5+ΣMBP) dBm/120kHz for intra-frequency measurements and (-107.5+ΣMBP) dBm/120kHz for inter-frequency measurements.

The following methodology to define the Minimum SSB\_RP level for power class X (PC\_X) and operating band Y (Band\_Y) is used:

For Intra-frequency: Minimum SSB\_RP (PC\_X, Band\_Y) = -109.5 dBm/120kHz + Refsens PC\_X, Band\_Y, 50MHz – Refsens PC3, n260, 50MHz + Y PC\_X – Y PC3 +****MBP,

For Inter-frequency: Minimum SSB\_RP (PC\_X, Band\_Y) = -107.5 dBm/120kHz + Refsens PC\_X, Band\_Y, 50MHz – Refsens PC3, n260, 50MHz + Y PC\_X – Y PC3 +****MBP.

Using the formulas above will result in following values for band n259:

For Intra-frequency: Minimum SSB\_RP (3, n259) = -108 dBm/120kHz

For Inter-frequency: Minimum SSB\_RP (3, n259) = -106 dBm/120kHz

### 9.2.2 Minimum SSB\_RP values for angle of arrival within Spherical coverage

Minimum SSB\_RP values are based on EIS spherical coverage for the Operating band and for the UE power class, taking a baseline of UE power class 3 in Band n260 with 50 MHz channel bandwidth.

The calculated Minimum SSB\_RP value for the baseline of UE power class 3 in Band n260 is (-96.9+ΣMBS) dBm/120kHz for intra-frequency measurements and is (-94.9+ΣMBS) dBm/120kHz for inter-frequency measurements.

The following methodology to define the Minimum SSB\_RP level for power class X (PC\_X) and operating band Y (Band\_Y) is used:

For Intra-frequency: Minimum SSB\_RP (PC\_X, Band\_Y) = (-103.9+ΣMBS +Z) dBm/120 kHz + Refsens PC\_X, Band\_Y, 50MHz – Refsens PC3, n260, 50MHz + Z PC\_X – Z PC3 +****MBS,

For Inter-frequency: Minimum SSB\_RP (PC\_X, Band\_Y) = (-101.9+ΣMBS +Z) dBm/120 kHz + Refsens PC\_X, Band\_Y, 50MHz – Refsens PC3, n260, 50MHz + Z PC\_X – Z PC3 +MBS

Using the formulas above will result in following values for band n259:

For Intra-frequency: Minimum SSB\_RP (3, n259) = -95.3 dBm/120kHz

For Inter-frequency: Minimum SSB\_RP (3, n259) = -93.3 dBm/120kHz

The following tables in TS 38.133 should be upated based on the calculations above.

**Table B.1.2-2: Conditions for intra-frequency cell re-selection in FR2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Angle of arrival** | **NR operating bands** | **Minimum SSB\_RP Note 2, Note 3** | | | | | **SSB Ês/Iot** |
| **dBm / SCSSSB** | | | | | **dB** |
| **SCSSSB = 120 kHz** | | | | **SCSSSB = 240 kHz** |
| **UE Power class** | | | | **UE Power class** |
| **1** | **2** | **3** | **4** | **1, 2, 3, 4** |
| Conditions | Rx Beam Peak | n257 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-4 |
| n258 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 |
| n259 |  |  | -105.5 |  |
| n260 | -122.3+Y1 |  | -106.5 | -122.8+Y4 |
| n261 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 |
| Spherical coverage Note 1 | n257 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-4 |
| n258 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 |
| n259 |  |  | -92.7 |  |
| n260 | -114.3+Z1 |  | -93.9 | -110.8+Z4 |
| n261 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.  NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ****MBP and Spherical coverage values are increased by ****MBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | |

Table B.2.2-2: Conditions for intra-frequency measurements in FR2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2, Note 3 | | | | | SSB Ês/Iot |
| dBm / SCSSSB | | | | | dB |
| SCSSSB = 120 kHz | | | | SCSSSB = 240 kHz |
| UE power class | | | | UE power class |
| 1 | 2 | 3 | 4 | 1, 2, 3, 4 |
| **Conditions** | Rx Beam Peak | n257 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-6 |
| n258 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 |
| n259 |  |  | -108.5 |  |
| n260 | -125.3+Y1 |  | -109.5 | -125.8+Y4 |
| n261 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 |
| Spherical coverage **Note 1** | n257 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-6 |
| n258 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 |
| n259 |  |  | -95.7 |  |
| n260 | -117.3+Z1 |  | -96.9 | -113.8+Z4 |
| n261 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 |
| Note 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  Note 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.  Note 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ****MBP and spherical coverage values are increased by ****MBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | |

**Table** B.2.3-2**: Conditions for inter-frequency measurements in FR2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2, Note 3 | | | | | SSB Ês/Iot |
| dBm / SCSSSB | | | | | dB |
| SCSSSB = 120 kHz | | | | SCSSSB = 240 kHz |
| UE power class | | | | UE power class |
| **1** | **2** | **3** | **4** | **1, 2, 3, 4** |
| **Conditions** | Rx Beam Peak | n257 | -126.3+Y1 | -111.8 | -110.1 | -125.8+Y4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-4 |
| n258 | -126.3+Y1 | -111.8 | -110.1 | -125.8+Y4 |
| n259 |  |  | -106.5 |  |
| n260 | -123.3+Y1 |  | -107.5 | -123.8+Y4 |
| n261 | -126.3+Y1 | -111.8 | -110.1 | -125.8+Y4 |
| Spherical coverage **Note 1** | n257 | -118.3+Z1 | -100.8 | -99.2 | -116.8+Z4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-4 |
| n258 | -118.3+Z1 | -100.8 | -99.2 | -116.8+Z4 |
| n259 |  |  | -93.7 |  |
| n260 | -115.3+Z1 |  | -94.9 | -111.8+Z4 |
| n261 | -118.3+Z1 | -100.8 | -99.2 | -116.8+Z4 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.  NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ****MBP and Spherical coverage values are increased by ****MBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | |

**Table** **B.2.4.1-2: Conditions for SSB based L1-RSRP measurements in FR2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Angle of arrival** | **NR operating bands** | **Minimum SSB\_RP Note 2, Note 3** | | | | | **SSB Ês/Iot** |
| **dBm / SCSSSB** | | | | | **dB** |
| **SCSSSB = 120 kHz** | | | | **SCSSSB = 240 kHz** |
| **UE power class** | | | | **UE power class** |
| **1** | **2** | **3** | **4** | **1, 2, 3, 4** |
| **Conditions** | Rx Beam Peak | n257 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-3 |
| n258 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 |
| n259 |  |  | -105.5 |  |
| n260 | -122.3+Y1 |  | -106.5 | -122.8+Y4 |
| n261 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 |
| Spherical coverage **Note 1** | n257 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-3 |
| n258 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 |
| n259 |  |  | -92.7 |  |
| n260 | -114.3+Z1 |  | -93.9 | -110.8+Z4 |
| n261 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.  NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ****MBP and Spherical coverage values are increased by ****MBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | |

**Table B.2.4.2-2: Conditions for CSI-RS based L1-RSRP measurements in FR2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Angle of arrival** | **NR operating bands** | **Minimum CSI-RS\_RP Note 2, Note 3** | | | | | **CSI-RS Ês/Iot** |
| **dBm / SCSCSI-RS** | | | | | **dB** |
| **SCSCSI-RS = 60 kHz** | | | | **SCSCSI-RS = 120 kHz** |
| **UE power class** | | | | **UE power class** |
| **1** | **2** | **3** | **4** | **1, 2, 3, 4** |
| **Conditions** | Rx Beam Peak | n257 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 | (Value for SCSCSI-RS = 60 kHz) +3dB | ≥-3 |
| n258 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 |
| n259 |  |  | -108.5 |  |
| n260 | -125.3+Y1 |  | -109.5 | -125.8+Y4 |
| n261 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 |
| Spherical coverage **Note 1** | n257 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 | (Value for SCSCSI-RS = 60 kHz) +3dB | ≥-3 |
| n258 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 |
| n259 |  |  | -95.7 |  |
| n260 | -117.3+Z1 |  | -96.9 | -113.8+Z4 |
| n261 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise.  NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ****MBP and Spherical coverage values are increased by ****MBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | |

Table B.2.5-2: Conditions for RRC connection release with redirection to NR in FR2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Angle of arrival** | **NR operating bands** | **Minimum SSB\_RP Note 2, Note 3** | | | | | **SSB Ês/Iot** |
| **dBm / SCSSSB** | | | | | **dB** |
| **SCSSSB = 120 kHz** | | | | **SCSSSB = 240 kHz** |
| **UE power class** | | | | **UE power class** |
| **1** | **2** | **3** | **4** | **1, 2, 3, 4** |
| **Conditions** | Rx Beam Peak | n257 | -126.3+Y1 | -111.8 | -110.1 | -125.8+Y4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-4 |
| n258 | -126.3+Y1 | -111.8 | -110.1 | -125.8+Y4 |
| n259 |  |  | -106.5 |  |
| n260 | -123.3+Y1 |  | -107.5 | -123.8+Y4 |
| n261 | -126.3+Y1 | -111.8 | -110.1 | -125.8+Y4 |
| Spherical coverage **Note 1** | n257 | -118.3+Z1 | -100.8 | -99.2 | -116.8+Z4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-4 |
| n258 | -118.3+Z1 | -100.8 | -99.2 | -116.8+Z4 |
| n259 |  |  | -93.7 |  |
| n260 | -115.3+Z1 |  | -94.9 | -111.8+Z4 |
| n261 | -114.3 | -100.8 | -99.2 | -116.8+Z4 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.  NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ****MBP and spherical coverage values are increased by ****MBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | |

Table B.2.6.1-2: Conditions for SSB based UE transmit timing in FR2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Angle of arrival** | **NR operating bands** | **Minimum SSB\_RP Note 2, Note 3** | | | | | **SSB Ês/Iot** |
| **dBm / SCSSSB** | | | | | **dB** |
| **SCSSSB = 120 kHz** | | | | **SCSSSB = 240 kHz** |
| **UE power class** | | | | **UE power class** |
| **1** | **2** | **3** | **4** | **1, 2, 3, 4** |
| **Conditions** | Rx Beam Peak | n257 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-3 |
| n258 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 |
| n259 |  |  | -105.5 |  |
| n260 | -122.3+Y1 |  | -106.5 | -122.8+Y4 |
| n261 | -125.3+Y1 | -110.8 | -109.1 | -124.8+Y4 |
| Spherical coverage **Note 1** | n257 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 | (Value for SCSSSB = 120 kHz) +3dB | ≥-3 |
| n258 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 |
| n259 |  |  | -92.7 |  |
| n260 | -114.3+Z1 |  | -93.9 | -110.8+Z4 |
| n261 | -117.3+Z1 | -99.8 | -98.2 | -115.8+Z4 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.  NOET 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ****MBP and Spherical coverage values are increased by ****MBS, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | |

# 10 Required changes to NR, E-UTRA, UTRA and MSR specifications

The required changes to the 3GPP specifications for the NR band n259 are summarised in a Table 8-1.

Table 8-1: Overview of 3GPP specifications with required changes

|  |  |  |  |
| --- | --- | --- | --- |
| Affected existing specifications | | | |
| Spec No. | Subject of the CR | Comments | CR/TP (Tdoc) |
| 38.141-2 | Introduction of band n259 |  | R4-2007796 |
| 38.104 | Introduction of band n259 |  | R4-2008975 |
| 38.101-2 | Introduction of band n259 |  | R4-2009153 |
| 38.133 | Introduction of band n259 |  | R4-2008911 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Annex A:  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| 04/2019 | RAN4#90bis | R4-17xxxx |  |  | TR skeleton | N/A | 0.0.0 |
| 05/2019 | RAN4#91 | R4-1907101 |  |  | TP on General issues |  | 0.1.0 |
| 05/2019 | RAN4#91 | R4-1906861 |  |  | On frequency range for NR band n259 |  | 0.1.0 |
| 05/2019 | RAN4#91 | R4-1907786 |  |  | Regulatory situation in 37-43.5 GHz frequency range |  | 0.1.0 |
| 08/2019 | RAN4#92 | R4-1909915 |  |  | BS RF requirements |  | 0.2.0 |
| 11/2019 | RAN4#92bis | R4-1912187 |  |  | Band plan for NR band 259 |  | 0.3.0 |
| 11/2019 | RAN4#93 | R4-1916055 |  |  | Channel numbering and channel bandwidth for band n259 |  | 0.3.0 |
| 11/2019 | RAN4#93 | R4-1916035 |  |  | UE RF requirements for n259 |  | 0.3.0 |
| 03/2020 | RAN4#94-e | R4-2001961 |  |  | TP on General issues |  | 0.4.0 |
| 03/2020 | RAN4#94-e | R4-2002838 |  |  | TP on BS RF requirement for band n259 |  | 0.4.0 |
| 06/2020 | RAN4#95-e | R4-2007792 |  |  | TP on BS RF requirement for band n259 |  | 0.5.0 |
| 06/2020 | RAN4#95-e | R4-2007793 |  |  | TP on Remaining issues on UE RF for Introduction of band n259 |  | 0.5.0 |
| 06/2020 | RAN4#95-e | R4-2008910 |  |  | TP on RRM requirements for band n259 |  | 0.5.0 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-06 | RAN#88 |  |  |  |  | Approved by plenary – Rel-16 spec under change control | 16.0.0 |