**3GPP TSG-RAN WG4 Meeting #97-e *R4-2016883***

Electronic meeting, November 2nd – 13th, 2020

**Source:** Ericsson

**Title:** BS RF Requirements and System parameters - TP to TR 38.847

**Agenda item:** 10.28.2

**Document for:** Approval

# Introduction

In RAN#88e, a WID [1] to introduce the 47 GHz band was approved. The purpose of the WID is to specify NR operating band covering the entire 47.2-48.2 GHz in order to accommodate operations in any part of this range.

In last RAN4#96-e meeting, the impacts on BS RF requirements and system parameters ([2], [3], [4] and [5]) were agreed, re-using existing requirements from band n259/n260 as basis. This contribution is proposing a text proposal to TR 38.847 to capture those agreements.

# References

1. RP-201232, New WID on introduction of NR 47 GHz band, T-Mobile USA
2. R4-2011412, BS RF requirements for 47 GHz band, Nokia
3. R4-2010447, 47GHz band - Regulatory overview – Band plan - System parameters, Ericsson
4. R4-2010522, Band number and System parameters of 47 GHz band, Nokia
5. R4-2011873, Email discussion summary for [96e][135] NR\_47GHz\_Band

# Text Proposal

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# 2 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".

[6] World Radiocommunication Conference 2019 (WRC-19) Final Acts, ITU-R

[7] Title 47 of the Code of Federal Regulations (CFR) Part 30, FCC

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# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms 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].

Definition format (Normal)

**<defined term>:** <definition>.

## 3.2 Symbols

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

ΔFGlobal Global frequency raster granularity

ΔFRaster Channel raster granularity

FREF-Offs Offset used for calculating FREF

Fstep,X Frequency steps for the OTA transmitter spurious emissions

NREF NR Absolute Radio Frequency Channel Number (NR-ARFCN)

NREF-Offs Offset used for calculating NREF

## 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

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

## 4.1 ITU-R

As part of facilitating the development of 5G mobile networks, WRC-19 identified the 47 GHz frequency band (47.2-48.2 GHz) for International Mobile Telecommunications (IMT) under Footnote 5.553B of the ITU Radio Regulations for use in 71 nations across Africa, Europe, the Middle East and Asia Pacific (ITU Regions 1 and 3 respectively), in addition to the entire Americas Region (ITU Region 2, which consists of 35 nations) [6]. Table 4.1-1 is the extract of the Radio Regulations (XX) table of allocations providing the services allocated in the 47.2-48.2 GHz frequency range

Table 4.1-1: Allocation information in the 47.2-48.2 GHz frequency range

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 47.2-47.5 FIXED  FIXED-SATELLITE (Earth-to-space) 5.550C 5.552  MOBILE 5.553B  5.552A | | |
| 47.5-47.9  FIXED  FIXED-SATELLITE   (Earth-to-space) 5.550C 5.552  (space-to-Earth) 5.516B 5.554A  MOBILE 5.553B | 47.5-47.9  FIXED  FIXED-SATELLITE (Earth-to-space) 5.550C 5.552  MOBILE 5.553B | |
| 47.9-48.2 FIXED  FIXED-SATELLITE (Earth-to-space) 5.550C 5.552  MOBILE 5.553B  5.552A | | |

With the footnote 5.553B: In Region 2 and Algeria, Angola, Saudi Arabia, Australia, Bahrain, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Rep., Comoros, Congo (Rep. of the), Korea (Rep. of), Côte d’Ivoire, Djibouti, Egypt, United Arab Emirates, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Equatorial Guinea, India, Iran (Islamic Republic of), Iraq, Japan, Jordan, Kenya, Kuwait, Lesotho, Liberia, Libya, Lithuania, Madagascar, Malaysia, Malawi, Mali, Morocco, Mauritius, Mauritania, Mozambique, Namibia, Niger, Nigeria, Oman, Uganda, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Singapore, Slovenia, Somalia, Sudan, South Sudan, South Africa, Sweden, Tanzania, Chad, Togo, Tunisia, Zambia and Zimbabwe, the frequency band 47.2-48.2 GHz is identified for use by administrations wishing to implement 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 any priority in the Radio Regulations. Resolution 243 (WRC-19) applies. (WRC-19)

According to Resolution 243 (WRC-19) [6], IMT in 47.2-48.2 GHz may coexist with satellite services and IMT base stations may require some measure to protect the services by bilateral agreement and possibly with site engineering solutions. Such protection measure is not a scope of 3GPP work, therefore, no specific coexistence requirement is specified in 3GPP for the mobile and base stations to protect other services for example by having additional spurious emission requirements.

However, it cannot be excluded any requirement is introduced by individual administration in nation level in the future to protect the service in the same or adjacent bands. Current 3GPP framework is flexible enough to introduce additional requirement later by Network signaling mechanism. Therefore, this band can be reused even if additional coexistence requirement is introduced in future by some administrations.

## 4.2 FCC

The US FCC auctioned the 47 GHz band beginning in December 2019 as part of Auction 103. The 47 GHz band (47.2-48.2 GHz) was auctioned in 10 blocks of 100 megahertz in each PEA (Partial Economic Area) license. The auction was concluded on 3/5/2020.

The radio regulatory requirements in FCC rules are specified in CFR Title 47 Part 30 [7]. The channelization is 100 MHz starting from 47.2 GHz ending at 48.2 GHz. The emission requirements for both BS and UE are aligned with other FR2 bands in FCC, i.e., bands n260, and n261 in 3GPP.

The power limits and unwanted emissions for the transportable station (intended for CPE devices) are consistent with the existing UE power class 1 for FR2 bands. The ones for the mobile stations are consistent with the existing FR2 UE power class 2, 3, and 4.

Table 4.2-1 captures channel arrangement, power limits and unwanted emissions specified by FCC.

Table 4.2-1: FCC requirements

|  |  |
| --- | --- |
| Channel arrangement | 47.2-47.3 GHz; 47.3-47.4 GHz; 47.4-47.5 GHz; 47.5-47.6 GHz; 47.6-47.7 GHz; 47.7-47.8 GHz; 47.8-47.9 GHz; 47.9-48.0 GHz; 48.0-48.1 GHz; and 48.1-48.2 GHz |
| Power limit (EIRP) | Base station: +75 dBm/100MHz  Mobile station: +43 dBm  Transportable station: +55 dBm |
| Unwanted emissions | +5 dBm/MHz (within 10% of channel bandwidth separation)  +13 dBm/MHz (outside more than 10% of channel bandwidth apart) |

# 5 NR Frequency band definition

The new band 47.2-48.2 GHz is within the range of FR2 (24250 – 52600 MHz) and is proposed as a TDD band (Table 5-1). The first unused FR2 band number, n262, is proposed for this new band.

Table 5-1: New NR band in FR2

|  |  |  |  |
| --- | --- | --- | --- |
| **Band number** | **UL** | **DL** | **Duplex mode** |
| n262 | 47.2 – 48.2 GHz | 47.2 – 48.2 GHz | TDD |

# 6 Channel numbering and channel bandwidth

Though the channelization in FCC rules is 100 MHz, it is not precluded to use 50 MHz channel bandwidth. Allocation block size is still unknown in other administrations. For maximum flexibility, the channel bandwidths for NR band n262 is proposed to be aligned with the existing FR2 bands as shown in Table 6-1.

Table 6-1: NR channel bandwidth in the frequency range between 47.2-48.2 GHz

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | | Channel bandwidth | | | |
| Band number | data SCS(kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n262 | 60 | Yes | Yes | Yes |  |
| 120 | Yes | Yes | Yes | Yes |

NR-ARFCN parameters for the global frequency raster are presented in TS 38.104, table 6-2:

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 channel raster for n262 is also proposed to cover all the frequency with the 60/120 kHz channel raster aligned with the other F2 band as presented in Table 6-3.

Table 6-3: Applicable NR-ARFCN in the frequency range between 47.2-48.2 GHz

|  |  |  |
| --- | --- | --- |
| NR Operating Band | ΔFRaster  (kHz) | Uplink and Downlink  Range of NREF  (First – <Step size> – Last) |
| n262 | 60 | 2399166 – <1> – 2415832 |
| 120 | 2399167 – <2> – 2415831 |

The synchronization raster in the frequency range between 47.2-48.2 GHz is given in Table 6-4. The distance between applicable GSCN entries is given by the <Step size> indicated in Table 6-4 with the step size interval of 17.28 MHz.

Table 7-4: 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) |
| n262 | 120 kHz | Case D | 23586 – <1> – 23641 |
| 240 kHz | Case E | 23588 – <2> – 23640 |
| NOTE: SS Block pattern is defined in subclause 4.1 in TS 38.213. | | | |

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## 8.2 BS specific

### 8.2.1 Band agnostic requirements

The BS RF requirements summarized in Table 8.2.1-2 is band agnostic RF requirements for FR2 which are applicable for band n262 as well.

Table 8.2.1-2: 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 |  |
| 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 (cat A) |  |

### 8.2.2 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 n262.

#### 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 n262.

#### 8.2.2.3 Step frequencies for Tx spurious emission

The 47.2-48.2 GHz frequency range has not yet been regulated in Region where Category B limits are applicable. The Category B Tx spurious limits doesn’t have to updated (at least for the time being).



#### 8.2.2.4 Measurement uncertainty and test tolerance

8.2.3 Receiver characteristics

#### 8.2.3.1 Step frequencies for Rx spurious emission

The band n262 shall be added to Table 10.7.3-2 in TS 38.104 as proposed below.

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 |
| n262 | 37.2 | 45.2 | 45.7 | 49.7 | 50.2 | 58.2 |

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