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| 3GPP TR 38.852 V0.2.0 (2022-01) |
| Technical Report |
| 3rd Generation Partnership Project;Technical Specification Group Radio Access Network;Introduction of 1900MHz NR band for Europe for Rail Mobile Radio (RMR)(Release 17) |
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# 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:

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where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

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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.

# 1 Scope

The present document is a technical report deals with the use of the Rail Mobile Radio spectrum in the 1900MHz frequency band, which was assigned by the ECC Decision (20)02 [1] for the use by the railways in Europe.The purpose is to gather the relevant background information and studies in order to address all the necessary precautions to make the unpaired spectrum of 1900-1910MHz usable for 5G NR.

# 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] ECC Decision (20)02: "Harmonised use of the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz and of the unpaired frequency band 1900-1910 MHz for Railway Mobile Radio (RMR) ".

[2] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[3] RP‑211496 Introduction of 1900MHz NR band for Europe for Rail Mobile Radio (RMR), WID

[4] 3GPP TS 38.104: " NR; Base Station (BS) radio transmission and reception".

# 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].

## 3.2 Symbols

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

<symbol> <Explanation>

## 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].

RMR Rail Mobile Radio

# 4 Regulatory background

Editor´s Note: To be developed!

# 5 Frequency band arrangement

The new RMR band is within the range of FR1 and is proposed as TDD band (Table 5-1).

Table 5-1: New NR RMR band in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | Uplink (UL) *operating band*BS receive / UE transmitFUL,low – FUL,high | Downlink (DL) *operating band*BS transmit / UE receiveFDL,low – FDL,high | Duplex mode |
| n101 | 1900 MHz – 1910 MHz | 1900 MHz – 1910 MHz | TDD |

# 6 NR system parameters

The following system parameters are defined for RMR 1900MHz band:

Table 6-1: RMR 1900 - Channel bandwidth

| NR Band | SCS (kHz) | *BS channel bandwidth* (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
|  | 15 | [5] | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n101 | 30 |  | 10 |  |  |  |  |  |  |  |  |  |  |  |
|  | 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |

Table 6-2: RMR 1900 - applicable NR-ARFCN

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| n101 | 100 | 380000 – <20> – 382000 | 380000 – <20> – 382000 |

Table 6-3: RMR 1900 – applicable SS raster entries

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | SS Block SCS | SS Block pattern(NOTE 1) | Range of GSCN(First – <Step size> – Last) |
| n101 | [15 kHz] | [Case A] | [4754 – <1> – 4768] |

# 7 RF requirements

## 7.1 BS specific requirements

### 7.1.1 General

The BS RF work for RMR1900 was limited to the Wide Area Base Stations, only.

Referring to the ECC Decision 20(02) in [1], one can observe that related analyses were done for the non-AAS BS architectures, only. Therefore the RAN4 requirements derivation was limited to the BS type 1-C requirements, only.

As the EIRP limits were defined in the ECC Decision (20)02 [1], consideration of non-AAS BS architecture required to convert those EIRP limits into the conducted requirements. It was agreed to perform EIRP-to-conducted limits conversion assuming a fixed antenna gain value of 18 dBi, assuming internal losses (feeder, etc.) of 0 dB.

### 7.1.2 Transmitter characteristics

#### 7.1.2.1 BS maximum output power

Based on ECC Decision (20)02 [1], the BS maximum output power for BS operating in band n101 in [uncoordinated deployment], shall not exceed the Prated,c,AC of 47 dBm/10MHz.

#### 7.1.2.2 Unwanted emissions

##### 7.1.2.2.1 General

Only Category B emission requirements are applicable to NR operation in RMR1900 band.

Editor´s Note: To be developed!

##### 7.1.2.2.2 Tx spurious emissions

It was agreed to capture additional Tx spurious emissions requirement for band n100 in 3GPP TS 38.104 [4], based on conversion of the EIRP limits from ECC Decision (20)02 [1], as in table 7.1.2.2.2-1:

Table 7.1.2.2.2-1: Additional Tx spurious emissions requirement derivation for n101

|  |  |  |
| --- | --- | --- |
| Spurious frequency range | *Basic limit* | *Measurement bandwidth* |
| 1920 MHz – 1980 MHz | -61 dBm (NOTE) | 5 MHz |
| NOTE: Assuming a 18 dBi antenna gain. |

### 7.1.3 Receiver characteristics

It was agreed that RAN4 will not specify any requirement to capture the BS enhanced selectivity (band n1) assumption.

Editor´s Note: To be developed!

#### 7.1.3.2 Rx blocking

It was agreed to capture Rx blocking requirement for band n101 in 3GPP TS 38.104 [4], based on conversion of the EIRP limits from ECC Decision (20)02 [1], as in table 7.1.3.2-1.

Editor´s Note: Interfering signal characteristic is FFS.

Table 7.1.3.2-1: Rx blocking requirement derivation for n101

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Center Frequency of Interfering Signal (MHz) | Type of interfering signal |
| [5], 10 | PREFSENS + 3 dB | Wide Area BS: -20 | 1807.5 MHz to 1877.5 MHz | 5 MHz NR or LTE signal |

## 7.2 UE specific requirements

### 7.2.1 Transmitter characteristics

Table 7.2.1-1: UE Power Class

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NRband | Class 1 (dBm) | Tolerance (dB) | Class 1.5 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) |
| n101 |  |  |  |  |  |  | 23 | ±2 |

Table 7.2.1-2: Requirements for spurious emissions for UE co-existence

| NR Band | Spurious emission for UE co-existence |
| --- | --- |
|  | Protected band | Frequency range (MHz) | Maximum Level (dBm) | MBW (MHz) | NOTE |
| n101 | E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 33, 34, 38, 40, 41, 42, 43, 50, 51, 52, 65, 67, 68, 69, 72, 74, 75, 76 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| NR Band n77, n78 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| Frequency range | 758 | - | 788 | -50 | 1 |  |

### 7.2.2 Receiver characteristics

The following 3GPP TS 38.101-1 [2] receiver characteristics changes are expected due to introduction of 1900MHz RMR band:

**Table 7.2.2-1: Two antenna port reference sensitivity QPSK PREFSENS for TDD, SDL and FDD with variable duplex operation bands**

|  |
| --- |
| **Operating band / SCS / Channel bandwidth / REFSENS** |
| **Operating band** | **SCS****kHz** | **Channel bandwidth (MHz)** | **REFSENS (dBm)8** | **Duplex Mode** |
| n101 | 15 | 5, 10 | -100 + 10log10(NRB/25) | TDD |
| 30 | 10 | -97.1 + 10log10(NRB/24) |

Table 7.2.2-2: Uplink configuration for reference sensitivity

| Operating band / SCS (kHz) / Channel bandwidth (MHz) / Duplex mode |
| --- |
| Operating Band | SCS | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 60 | 70 | 80 | 90 | 100 | Duplex Mode |
| n100 | 15 | 25 | 50 |  |  |  |  |  |  |  |  |  |  |  |  |  | FDD |
| 30 |  | 24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Table 7.2.2-3: In-band blocking for NR bands with FDL\_high < 2700 MHz and FUL\_high < 2700 MHz

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Case 1 | Case 2 | Case 3 | Case 4 |
|  | Pinterferer | dBm | -56 | -44 | -15 | -38 |
|  | Finterferer (offset) | MHz | -BWChannel/2 – FIoffset, case 1andBWChannel/2 + FIoffset, case 1 | ≤ -BWChannel/2 – FIoffset, case 2and≥ BWChannel/2 + FIoffset, case 2 |  | -BWChannel/2-11 |
| n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n25, n26, n28,n34, n38,n39, n40, n41, n483, n50, n51, n53, n65, n66, n67, n70, n74, n75, n76, n85, n91, n92, n93, n94, n101 | Finterferer | MHz | NOTE 2 | FDL\_low – 15toFDL\_high + 15 |  |  |

Table 7.2.2-4: Out of-band blocking for NR bands with FDL\_high < 2700 MHz and FUL\_high < 2700 MHz

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
| n1, n2, n3, | Pinterferer | dBm | -44 | -30 | -15 |
| n5, n7, n8, n12, n13, n14, n18, n20, n24, n25, n26, n28, n30, n34, n38, n39, n40, n41, n485, n50, n51, n536, n65, n66, n67, n70, n71, n74, n75, n76, n85, n91, n92, n93, n94, n101 | Finterferer (CW) | MHz | -60 < f – FDL\_low < -15or15 < f – FDL\_high < 60 | -85 < f – FDL\_low ≤ -60or60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 85orFDL\_high + 85 ≤ f≤ 12750 |

Table 7.2.2-5: Narrow Band Blocking

|  |  |  |  |
| --- | --- | --- | --- |
| NR band | Parameter | Unit | Channel Bandwidth (MHz) |
|  |  |  | 5 | 10 | 15 | 20 | 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |
| n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n25, n26, n28, n30, n34, n38, n39, n40, n41, n48, n50, n51, n53, n65, n66, n67, n70, n71, n74, n75, n76, n85, n101 | Pw | dBm |  | PREFSENS + channel-bandwidth specific value below |
|  |  | 16 | 13 | 14 | 16 | 16 |
| Puw (CW) | dBm | -55 |
| Fuw (offset SCS= 15 kHz) 4 | MHz | $$\left(\left⌊\frac{\frac{BW\_{Channel}}{2}+0.2}{SCS}+0.5\right⌋+0.5\right)SCS$$ | NA |
| Fuw (offset SCS= 30 kHz)4 | MHz | NA | $$\left(\left⌊\frac{\frac{BW\_{Channel}}{2}+BW\_{GB,Channel}}{SCS}+0.5\right⌋+0.5\right)SCS$$ |

# 8 Performance requirements

The High Speed Train (HST) BS demodulation requirements are to be transparently applied for the NR operation in the RMR1900 operating band.

# 9 Deployment aspects

In was agreed that in principle, RMR base stations are not expected to be co-located with MFCN BSs. Nevertheless, in a coordinated approach co-location is of interest and need to be considered in 3GPP spec.

# 10 Conclusion

Editor´s Note: To be developed!

Annex A:
<Informative annex title for a Technical Report>

Informative annexes in Technical Reports do not use "(informative") in the title, since all annexes in TRs are informative. Use style "Heading 9" in TRs.

Annex B (informative):
Bibliography

The Bibliography is optional. If it exists, it shall follow the last technical annex in the document.

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

Bibliography format

<Publication>: "<Title>".

Annex C (informative):
Change history

|  |
| --- |
| **Change history** |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2021-08 | RAN4#100-e |  |  |  |  | Initial baseline | 0.0.1 |
| 2021-11 | RAN4#101e | R4-2114886 |  |  |  | TP to 38.852 on 1900MHz RMR RAN4 system parameters | 0.1.0 |
| 2022-01 | RAN4@101-bis-e | R4-2120042 |  |  |  | TP to 38.852 on 1900MHz RMR RAN4 system parameters | 0.2.0 |
| 2022-01 | RAN4@101-bis-e | R4-2120044 |  |  |  | TP to 38.852 on 1900MHz RMR RAN4 UE RF requirements | 0.2.0 |
| 2022-01 | RAN4@101-bis-e | R4-2120681 |  |  |  | TPs to TR 38.853: BS RF related agreements for RMR1900 | 0.2.0 |