3GPP TSG RAN WG4 Meeting #94-e-Bis TDoc R4-2008924

Electronic Meeting, 20 – 30 April, 2020

**Title: LS on Parameters of terrestrial component of IMT for sharing and compatibility studies in preparation for WRC-23 (below 5 GHz)**

**Response to: LS RP-200042 on Parameters of terrestrial component of IMT for sharing and compatibility studies in preparation for WRC-23 from ITU-R Working Party 5D**

**Release: -**

**Work Item: -**

**Source: TSG RAN WG4**

**To: ITU-R WP5D**

**Cc:**

**Contact person: Johan Sköld**



**Send any reply LS to: 3GPP Liaisons Coordinator,** [**mailto:3GPPLiaison@etsi.org**](mailto:3GPPLiaison@etsi.org)

**Attachments:** -

# 1 Overall description

RAN WG4 received the incoming LS from ITU-R Working Party 5D on Parameters of terrestrial component of IMT for sharing and compatibility studies in preparation for WRC-23 ([Att. 7.4 to 5D/134](https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-0134!H07!MSW-E.docx)) and would like to thank for the opportunity to give input in this topic. In the first LS response from TSG RAN ([RP-200514](http://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_87e/Docs/RP-200514.zip)) it is noted that 3GPP has specified bands for NR and LTE between 470 MHz and 4990 MHz and that RAN WG4 will develop a response. This LS response concerns those specific bands. RAN WG4 may forward additional information at a later stage.

The bands within 470 MHz to 4990 MHz is part of what in 3GPP is defined as *Frequency Range 1* (FR1) and the 5G RF parameters for the bands are specified in 3GPP specifications [TS 38.104](http://www.3gpp.org/ftp/Specs/archive/38_series/38.104/38104-g30.zip) for the BS and [TS 38.101-1](http://www.3gpp.org/ftp/Specs/archive/38_series/38.101-1/38101-1-g30.zip) for the UE. The recommended IMT-2020 technology related parameters are given in Annex 1 of this LS with references to those two specifications. The following should be noted:

* Where AAS and non-AAS limits may be expressed differently, there are separate entries in table 1. AAS limits always apply Over-the-Air (OTA).
* In the BS specification TS 38.104, non-AAS BS are identified as *BS Type 1-C*, while AAS BS are identified as *BS Type 1-O* for the bands.
* Deployment related parameters are documented in [ITU-R M.2292](http://www.itu.int/pub/R-REP-M.2292).

The recommended IMT-2020 antenna characteristics are given in Annex 2 of this LS. The following should be noted:

* There is no beam forming assumed for the UE in the frequency ranges covered. UEs are therefore not included in the table.
* There is no beamforming assumed for BS below 1.7 GHz. Parameters are therefore applicable for AAS BS in the range 1710 to 4990 MHz
* For fixed beam antennas, antenna parameters in [ITU-R M.2292](http://www.itu.int/pub/R-REP-M.2292) apply.

# 2 Actions

**To ITU-R WP5D**

**ACTION:** 3GPP TSG RAN asks ITU-R WP 5D to take the above information on IMT system parameters for its consideration.

# 3 Dates of next TSG RAN WG 4 meetings

<meeting\_identity> <start\_date> - <end\_date> <town>, <country>

<meeting\_identity> <start\_date> - <end\_date> <town>, <country>

ANNEX 1

IMT-2020 technology-related and deployment-related parameters for bands between 470 and 4990 MHz

TABLE 1

IMT-2020 technology related parameters in 470 – 4990 MHz

|  |  | IMT | | |
| --- | --- | --- | --- | --- |
| **No.** | **Parameter** | **Base station  (non-AAS)** | **Base station (AAS)** | **Mobile station** |
| **1** | **Duplex Method** | FDD / TDD  See [1], § 5.2. | | FDD / TDD  See [2], § 5.2. |
| **2** | **Channel bandwidth (MHz)** | See [1], § 5.3.5. | | See [2], § 5.3.5. |
| **3** | **Signal bandwidth (MHz)** | See [1], § 5.3.2.  Signal bandwidth = NRB x SCS x 12. | | See [2], § 5.3.2.  Signal bandwidth = NRB x SCS x 12. |
| **4** | **Transmitter characteristics** |  | |  |
| 4.1 | Power dynamic range (dB) | See [1], § 6.3.3. | | See [2], § 6.2.1  (UE max output power) and §6.3.1 (UE min output power). |
| 4.2 | Spectral mask (dB) | See [1], § 6.6.4. | See [1], § 9.7.4. | See [2], § 6.5.2.2. |
| 4.3 | ACLR | See [1], § 6.6.3. | | See [2], § 6.5.2.4. |
| 4.4 | Spurious emissions | See [1], § 6.6.4. | | See [2], § 6.5.3. |
| 4.5 | Maximum output power | See [1], § 6.2. | See [1], § 9.3. | See [2], § 6.2.1. |
| **5** | **Receiver characteristics** |  |  |  |
| 5.1 | Noise figure (dB) | 5 dB (Wide Area BS)  10 dB (Medium Range BS)  13 dB (Local Area BS)  For BS class definitions,  see [1], § 4.4 | | 9 dB |
| 5.2 | Sensitivity (dBm) | See [1], § 7.2.2. | See [1], § 10.3.2. | See [2], § 7.3. |
| 5.3 | Blocking response | See [1], § 7.5  and § 7.4.2. | See [1], § 10.6 and § 10.5.2. | See [2], § 7.6  and § 7.7. |
| 5.4 | ACS | See [1], § 7.4.1. | See [1], § 10.5.1. | See [2], § 7.5. |
| 5.5 | SINR operating range (dB) | See below “SINR operating range and mapping function” | | |

References used in the Table:

[1] [3GPP TS 38.104 v.16.3.0](http://www.3gpp.org/ftp/Specs/archive/38_series/38.104/38104-g30.zip), “NR; Base Station (BS) radio transmission and reception”.

[2] [3GPP TS 38.101-1 v.16.3.0](http://www.3gpp.org/ftp/Specs/archive/38_series/38.101-1/38101-1-g30.zip). “NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone”

## SINR operating range and mapping function

The following equations approximate the throughput over a channel with a given SNIR, when using link adaptation:



Where:

S(SNIR) Shannon bound, S(SNIR) =log2(1+SNIR) [bps/Hz]  
α Attenuation factor, representing implementation losses  
SNIRMIN Minimum SNIR of the code set, dB  
SNIRMAX Maximum SNIR of the code set, dB

The parameters α, SNIRMIN and SNIRMAX can be chosen to represent different modem implementations and link conditions. The parameters proposed in table 5.2.2-1 represent a baseline case, which assumes:

* 1:1 antenna configurations
* AWGN channel model
* Link Adaptation (see table 8 for details of the highest and lowest rate codes)
* No HARQ

Table Parameters describing baseline Link Level performance for 5G NR

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **DL** | **UL** | **Notes** |
| α | 0.6 | 0.4 | Represents implementation losses |
| SNIRMIN, dB | -10 | -10 | Based on QPSK, 1/8 rate (DL) & 1/5 rate (UL) |
| SNIRMAX, dB | 30 | 22 | Based on 256QAM 0.93(DL) & 64QAM 0.93 (UL) |

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ANNEX 2

Antenna characteristics for IMT-2020 AAS base stations   
for bands between 1710 and 4990 MHz

TABLE 2

**Beamforming antenna characteristics for IMT in 1710 – 4990 MHz**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Rural | Macro suburban | Macro urban | Small cell outdoor/ Micro urban | Small cell indoor/ Indoor urban | |
| **1** | **Base station Antenna Characteristics** | | | | | | | |
| 1.1 | Antenna pattern | Refer to Recommendation [ITU-R M.2101](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2101-0-201702-I!!PDF-E.pdf) | | | | | N/A | |
| 1.2 | Element gain (dBi) (Note 2) | 7.1 | 7.1 | 6.4 | 6.4 | N/A | |
| 1.3 | Horizontal/vertical 3 dB beam width of single element (degree) | 90º for H 54º for V | 90º for H 54º for V | 90º for H 65º for V | 90º for H 65º for V | N/A | |
| 1.4 | Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V | 30 for both H/V | 30 for both H/V | 30 for both H/V | N/A | |
| 1.5 | Antenna polarization | Linear ±45º | Linear ±45º | Linear ±45º | Linear ±45º | N/A | |
| 1.6 | Antenna array configuration (Row × Column)  (Note 4) | 8 × 8 elements | 8 × 8 elements | 8 × 8 elements | 8 × 8 elements | N/A | |
| 1.7 | Horizontal/Vertical radiating element spacing | 0.5 of wavelength for H, 0.9 of wavelength for V | 0.5 of wavelength for H, 0.9 of wavelength for V | 0.5 of wavelength for H, 0.7 of wavelength for V | 0.5 of wavelength for H, 0.7 of wavelength for V | N/A | |
| 1.8 | Array Ohmic loss (dB) (Note 2) | 2 | 2 | 2 | 2 | N/A | |
| 1.9 | Conducted power (before Ohmic loss) per antenna element (Note 3) | 25 | 25 | 25 | 16 | N/A | |
| 1.10 | Base station maximum coverage angle in the horizontal plane (degrees) | 120 | 120 | 120 | 120 | N/A | |
| 1.11 | Base station vertical coverage range (degrees) (Note 1) | 90-100 | 94-104 | 90-120 | 90-120 | N/A | |

Note 1: The range vertical coverage range is given for the elevation angle θ, defined between 0° and 180° as   
in [ITU-R M.2101](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2101-0-201702-I!!PDF-E.pdf). Numbers include any mechanical downtilt.

Note 2: The element gain in row 1.2 includes the loss given in row 1.8.

Note 3: The conducted power per element assumes 8x8x2 elements (i.e. power per H/V polarized element).

Note 4: The given antenna array configuration could include sub-arrays architecture, e.g. 2 vertical elements could be combined in a 2x1 sub-array.

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