

## Maximum permissible exposure (MPE)

### 1.1

For test instruments and accessories used see section 6 Part **CPC 2**.

#### 1.1.1 Description of the test location

Test location:                   Shielded room S5

#### 1.1.2 Applicable standard

According to FCC Part 15, Section 15.247(i):

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

#### 1.1.3 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, the MPE can be calculated in a defined distance away from the product.

$$\text{Friis transmission formula: } P_d = \frac{P_{out} * G}{4 * \Pi * r^2}$$

where

$P_d$  = power density (mW/cm<sup>2</sup>)

$P_{out}$  = output power to antenna (mW)

$G$  = gain of antenna (linear scale)

$r$  = distance between antenna and observation point (cm)

## ATTACHMENT B to File No.: T38208-00-00HU

### 1.1.4 Test result

- a.) Power setting 30.0 dBm  
= Antenna gain: < 6.0 dBi

| Type                  | Order-No. | Shortened designation   |
|-----------------------|-----------|---|
| MiRa FCC              | 52010083  | Mid Range Antenna FCC, 902-928 MHz, 100° circular (2.5 dBic)              |
| S-MiRa ETSI/FCC       | 52010172  | Short-Mid Range Antenna ETSI/FCC, 865-928 MHz, 100° circular (-10.0 dBic) |
| U-LoRa ETSI/FCC       | 52010092  | Ultra Low Range Antenna ETSI/FCC, 865-928 MHz (-30.0 dBi)                 |
| LoRa FCC              | 52010085  | Low Range Antenna FCC, 902-928 MHz (-15.0 dBi)                            |
| SMSH-30-30-KRAI-Slave | 52010197  | Smart Shelf Antenna, 865-928 MHz (-7.0 dBic)                              |

To show the compliance with the standard the antenna gain from the **MiRa FCC (2.5 dBic, Order No. 52010083)** was used for calculation.

| Channel No. | Frequency | Max power output to antenna |         | Antenna gain | Power density         | Limit of power density |
|-------------|-----------|-----------------------------|---------|--------------|-----------------------|------------------------|
|             | (MHz)     | (dBm)                       | (mW)    | (dBi)        | (mW/cm <sup>2</sup> ) | (mW/cm <sup>2</sup> )  |
| 1           | 902.75    | 29.74                       | 941.890 | 2.5          | 0.3332                | 0.602                  |
| 26          | 914.75    | 29.82                       | 959.401 | 2.5          | 0.3394                | 0.610                  |
| 50          | 927.25    | 29.41                       | 872.971 | 2.5          | 0.3088                | 0.618                  |

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device.  
The EUT is designed to be used that radiating structures are more than 20 cm outside of the body of the user. ( $r = 20$  cm).

**ATTACHMENT B to File No.: T38208-00-00HU**

b.) Power setting 25.5 dBm  
= Antenna gain: > 6.0 dBi

| Type              | Order-No. | Shortened designation  |
|-------------------|-----------|--|
| WiRa 30° FCC      | 52010087  | Wide Range-Antenna FCC, 902-928 MHz, 30° circular (10.5 dBi) |
| WiRa 70° FCC      | 52010079  | Wide Range Antenna FCC, 902-928 MHz, 70° circular (8.3 dBi)  |
| WiRa-70°-KRAI-FCC | 52010194  | Wide Range KRAI Antenna FCC, 902-928 MHz (7.5 dBi)           |

To show the compliance with the standard the antenna gain from the **WiRa 30° FCC (10.5 dBi, Order No. 52010087)** was used for calculation.

| Channel No. | Frequency | Max power output to antenna |         | Antenna gain | Power density         | Limit of power density |
|-------------|-----------|-----------------------------|---------|--------------|-----------------------|------------------------|
|             | (MHz)     | (dBm)                       | (mW)    | (dBi)        | (mW/cm <sup>2</sup> ) | (mW/cm <sup>2</sup> )  |
| 1           | 902.75    | 25.18                       | 329.610 | 10.5         | 0.5844                | 0.602                  |
| 26          | 914.75    | 25.35                       | 342.768 | 10.5         | 0.6078                | 0.610                  |
| 50          | 927.25    | 24.90                       | 309.030 | 10.5         | 0.5479                | 0.618                  |

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device.  
The EUT is designed to be used that radiating structures are more than 20 cm outside of the body of the user. (r = 20 cm).

Limits for maximum permissible exposure (MPE):

| Frequency Range (MHz)  | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(B) Limits for General Population / Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3 – 3.0  | 614                           | 1.63                          | 100                                 | 30                       |
| 3.0 – 30   | 824/f                         | 2.19/f                        | 180/ f <sup>2</sup>                 | 30                       |
| 30 - 300   | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| <b>300-1500</b>  | ---                           | ---                           | <b>f/1500</b>                       | <b>30</b>                |
| 1500-100000  | ---                           | ---                           | 1.0                                 | 30                       |

f = Frequency (MHz)

Note: The manufacturer shall state in the manual the minimum cable length for each antenna. Additionally this shall be stated on the label of the EuT.

The requirements are **FULFILLED**.

Remarks:

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