

## Maximum Permissible Exposure (MPE) & Exposure evaluation

**Report identification number: 1-1467/20-04-09 Exemption / MPE (FCC)**

| Certification numbers and labeling requirements |            |
|-------------------------------------------------|------------|
| FCC ID                                          | 2AHPPAPX01 |

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## 1. EUT technologies

| Cellular Technology | Frequency Band [MHz] |      | Output Power [dBm] |      | Corrected EIRP for RF Exposure [dBm] | Referenced Document |
|---------------------|----------------------|------|--------------------|------|--------------------------------------|---------------------|
|                     | Min.                 | Max. | Max Rated          | EIRP |                                      |                     |
| LTE Band 2          | 1850                 | 1910 | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 4          | 1710                 | 1755 | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 5          | 824                  | 849  | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 7          | 2500                 | 2570 | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 12         | 699                  | 716  | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 13         | 777                  | 787  | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 14         | 788                  | 798  | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 25         | 1850                 | 1915 | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 26         | 814                  | 849  | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 66         | 1710                 | 1780 | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |
| LTE Band 71         | 663                  | 698  | 24.0               | 30.0 | <b>30.0</b>                          | <b>A, B</b>         |

### Referenced Documents:

| # | Results from:                                                                    |
|---|----------------------------------------------------------------------------------|
| A | RC7611 Module MPE Evaluation (Module's MPE, FCC ID: N7NRC76B)                    |
| B | airprime_wp76xx_product_technical_specification_rev11_0.pdf provided by customer |

| SRD Technology    | Frequency Band [MHz] |      | Output Power Radiated (Average) |      | EIRP for RF Exposure [dBm] | Referenced Document |
|-------------------|----------------------|------|---------------------------------|------|----------------------------|---------------------|
|                   | Min.                 | Max. | ERP                             | EIRP |                            |                     |
| Bluetooth Classic | 2402                 | 2480 | N/A                             | 8.2  | <b>8.2</b>                 | <b>C</b>            |
| Bluetooth LE      | 2402                 | 2480 | N/A                             | 6.6  | <b>6.6</b>                 | <b>D</b>            |
| WLAN 2.4 GHz      | 2412                 | 2462 | N/A                             | 23.8 | <b>23.8</b>                | <b>E</b>            |

### Referenced Documents:

| # | Results from:                                                       |
|---|---------------------------------------------------------------------|
| C | Test Report 1-1467 20-04-05 (CTC)                                   |
| D | Test Report 1-1467 20-04-06 (CTC)                                   |
| E | MPE SA151228C18B (taken from original module with FCC ID: VPYLB1DX) |

| SRD<br>Technology | Frequency Band<br>[MHz] |       | Output Power<br>[dBm] |       | Power for RF<br>Exposure<br>[dBm] | Referenced<br>Document |
|-------------------|-------------------------|-------|-----------------------|-------|-----------------------------------|------------------------|
|                   | Min.                    | Max.  | Cond.                 | EIRP  |                                   |                        |
| RFID<br>13.56 MHz | 13.56                   | 13.56 | 19.7                  | -29.6 | <b>19.7</b>                       | <b>F</b>               |

Note:

- According to section 4.3 of 447498 D01 v06 SAR test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel.
- Conducted output power provided by customer (see Annex A):  $P = U I = 3.1 \text{ V} \times 30 \text{ mA} = 19.7 \text{ dBm}$
- Radiated output power measured in lab (see Annex B, C): 55.22 dBμV @ 10 m

Referenced Documents:

| # | Results from:               |
|---|-----------------------------|
| F | Test Report 1-1467_20-04-02 |

## 2. MPE at given distance (KDB 447498 D01 General RF Exposure Guidance v06)

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

where: S = Power density  
P = Power input to the antenna  
G = Antenna gain  
R = Distance to the center of radiation of the antenna  
PG = Output Power including antenna gain

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled "Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure"

| Frequency Range (MHz) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------------|--------------------------|
| 300 -1500             | f/1500                              | 30                       |
| 1500 - 100000         | 1.0                                 | 30                       |

where f = Frequency (MHz)

Declared minimum safety distance: **20 cm**

| Cellular Technology | Frequency Band [MHz] |      | Distance [cm] | EIRP for RF Exposure [dBm] | Power Density [mW/cm <sup>2</sup> ] |       | Share of Limit [%] |
|---------------------|----------------------|------|---------------|----------------------------|-------------------------------------|-------|--------------------|
|                     | Min.                 | Max. |               |                            | Caculated                           | Limit |                    |
| LTE Band 2          | 1850                 | 1910 | 20            | 30.0                       | 0.20                                | 1.00  | <b>19.90%</b>      |
| LTE Band 4          | 1710                 | 1755 | 20            | 30.0                       | 0.20                                | 1.00  | <b>19.90%</b>      |
| LTE Band 5          | 824                  | 849  | 20            | 30.0                       | 0.20                                | 0.55  | <b>36.23%</b>      |
| LTE Band 7          | 2500                 | 2570 | 20            | 30.0                       | 0.20                                | 1.00  | <b>19.90%</b>      |
| LTE Band 12         | 699                  | 716  | 20            | 30.0                       | 0.20                                | 0.47  | <b>42.71%</b>      |
| LTE Band 13         | 777                  | 787  | 20            | 30.0                       | 0.20                                | 0.52  | <b>38.43%</b>      |
| LTE Band 14         | 788                  | 798  | 20            | 30.0                       | 0.20                                | 0.53  | <b>37.89%</b>      |
| LTE Band 25         | 1850                 | 1915 | 20            | 30.0                       | 0.20                                | 1.00  | <b>19.90%</b>      |
| LTE Band 26         | 814                  | 849  | 20            | 30.0                       | 0.20                                | 0.54  | <b>36.68%</b>      |
| LTE Band 66         | 1710                 | 1780 | 20            | 30.0                       | 0.20                                | 1.00  | <b>19.90%</b>      |
| LTE Band 71         | 663                  | 698  | 20            | 30.0                       | 0.20                                | 0.44  | <b>45.03%</b>      |

| SRD Technology    | Frequency Band [MHz] |      | Distance [cm] | EIRP for RF Exposure [dBm] | Power Density [mW/cm <sup>2</sup> ] |       | Share of Limit [%] |
|-------------------|----------------------|------|---------------|----------------------------|-------------------------------------|-------|--------------------|
|                   | Min.                 | Max. |               |                            | Caculated                           | Limit |                    |
| Bluetooth Classic | 2402                 | 2480 | 20            | 8.2                        | 0.00                                | 1.00  | <b>0.13%</b>       |
| Bluetooth LE      | 2402                 | 2480 | 20            | 6.6                        | 0.00                                | 1.00  | <b>0.09%</b>       |
| WLAN 2.4 GHz      | 2412                 | 2462 | 20            | 23.8                       | 0.05                                | 1.00  | <b>4.77%</b>       |

### 3. SAR test exclusion according to KDB447498 (General RF Exposure Guidance v06)

Equation from Chapter 4.3.1: Standalone SAR test exclusion considerations page 11 and ff and tables in Annex C.

(c) (1) Standalone SAR test exclusion below 100 MHz at test separation distances > 50mm and < 200mm

$$(\text{Threshold}_{100\text{MHz} > 50\text{mm}}) \times (1 + \log(100/f))$$

where

$\text{Threshold}_{1-g;10-g}$  is 3 for 1-g; 7.5 for 10-g  
 $d_{\text{separation}}$  is the min. test separation distance ( >50mm and <200mm )  
 $f$  is the RF channel transmit frequency  
 $\text{Threshold}_{50\text{mm}; 100\text{MHz} < 50\text{mm}}$  is  $\text{Threshold}_{1-g;10-g} \times d / f^{0.5}$   
 with  $f = 100\text{MHz}$  and  $d=50\text{mm}$   
 $\text{Threshold}_{100\text{MHz} > 50\text{mm}}$  is  $(\text{Threshold}_{50\text{mm}; 100\text{MHz} < 50\text{mm}}) + (d_{\text{separation}} - 50\text{mm}) \times f / 150$   
 with  $f = 100\text{MHz}$

The table below gives the calculated maximal power that could be used for source based time averaged conducted power, adjusted for tune up tolerance. If this is below the calculated value SAR testing is excluded.

| SRD<br>Technology | Frequency Band<br>[MHz] |       | Distance<br>[mm] | EIRP for RF<br>Exposure<br>[dBm] | Power<br>[mW] |         | Share of<br>Limit<br>[%] |
|-------------------|-------------------------|-------|------------------|----------------------------------|---------------|---------|--------------------------|
|                   | Min.                    | Max.  |                  |                                  | Calculated    | Limit   |                          |
| RFID<br>13.56 MHz | 13.56                   | 13.56 | 199              | 19.7                             | 93.33         | 1071.48 | <b>8.71%</b>             |

#### 4. Collocation overview:

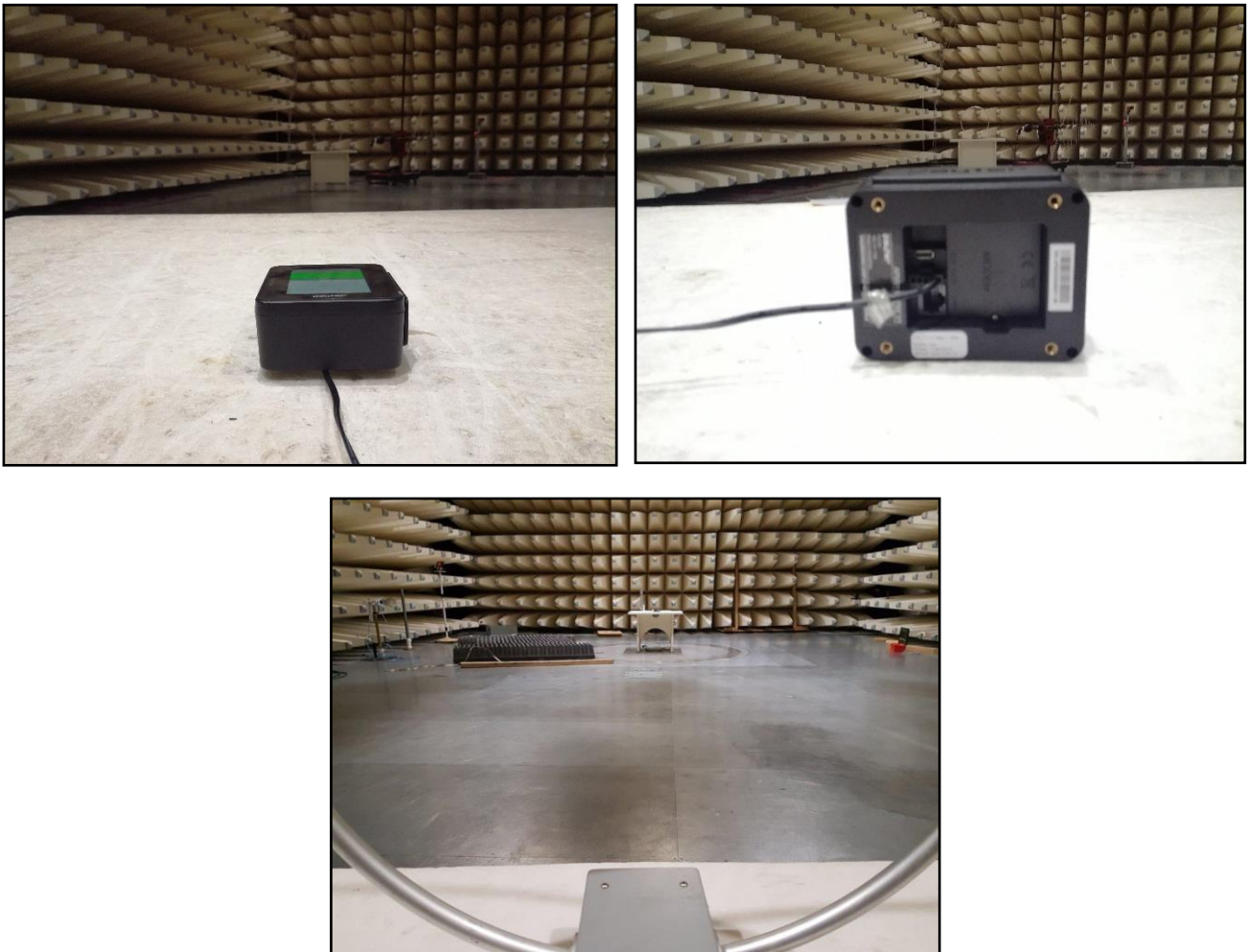
| Technology                 | Share of Limit<br>[%] |
|----------------------------|-----------------------|
| LTE<br>Band 71             | 45.03%                |
| Bluetooth/<br>WLAN 2.4 GHz | 4.77%                 |
| RFID<br>13.56 MHz          | 8.71%                 |
| Sum                        | <b>58.52%</b>         |

**This prediction demonstrates the following:**

The power levels for FCC at a distance of 20 cm are below the maximum levels allowed by regulations.

**Annex A: Conducted output power RFID 13.56 MHz**

| pins TX1 and TX2 |                              |                                                                                 |                            |   |     |    |
|------------------|------------------------------|---------------------------------------------------------------------------------|----------------------------|---|-----|----|
| V <sub>OH</sub>  | high-level output voltage    | pins TX1 and TX2;<br>T <sub>VDD_IN</sub> = 3.1 V and<br>I <sub>OH</sub> = 30 mA | V <sub>TVDD_IN</sub> – 150 | - | -   | mV |
| V <sub>OL</sub>  | low-level output voltage     | pins TX1 and TX2;<br>T <sub>VDD_IN</sub> = 3.1; I <sub>TX</sub> = 30 mA         | -                          | - | 200 | mV |
| R <sub>OL</sub>  | low-level output resistance  | V <sub>TX</sub> = V <sub>TVDD</sub> – 100 mV;<br>CWGsN = 01h                    | -                          | - | 80  | Ω  |
|                  |                              | V <sub>TX</sub> = V <sub>TVDD</sub> – 100 mV;<br>CWGsN = 0Fh                    | -                          | - | 10  | Ω  |
| R <sub>OH</sub>  | high-level output resistance | V <sub>TX</sub> = V <sub>TVDD</sub> – 100 mV                                    | -                          | - | 10  | Ω  |

**Annex B: Pictures of the EIRP measurement for 13.56MHz with 10m distance**

**LoopAntenna: EMCO 6502A (Correction factor @ 13.56MHz +9.5 dB)**

