

## 5. RF EXPOSURE EVALUATION

### 5.1 FCC SAR test exclusion

#### 5.1.1 Applicable Standard

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

#### 5.1.2 Measurement Result

For BLE:

The max conducted power including tune-up tolerance is 5.0 dBm (3.16 mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$   
 $= 3.16/5 \cdot (\sqrt{2.480}) = 1.0 < 3.0$

**Result: Compliant. The stand-alone SAR evaluation is not necessary.**

## 5.2 Exemption limits for Routine Evaluation – SAR Evaluation

### 5.2.1 Applicable Standard

According to RSS-102 § (2.5.1):

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.

**Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance<sup>45</sup>**

| Frequency (MHz) | Exemption Limits (mW)                 |                                 |                                 |                                 |                                 |
|-----------------|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                 | At separation distance of $\leq 5$ mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| $\leq 300$      | 71 mW                                 | 101 mW                          | 132 mW                          | 162 mW                          | 193 mW                          |
| 450             | 52 mW                                 | 70 mW                           | 88 mW                           | 106 mW                          | 123 mW                          |
| 835             | 17 mW                                 | 30 mW                           | 42 mW                           | 55 mW                           | 67 mW                           |
| 1900            | 7 mW                                  | 10 mW                           | 18 mW                           | 34 mW                           | 60 mW                           |
| 2450            | 4 mW                                  | 7 mW                            | 15 mW                           | 30 mW                           | 52 mW                           |
| 3500            | 2 mW                                  | 6 mW                            | 16 mW                           | 32 mW                           | 55 mW                           |
| 5800            | 1 mW                                  | 6 mW                            | 15 mW                           | 27 mW                           | 41 mW                           |

| Frequency (MHz) | Exemption Limits (mW)           |                                 |                                 |                                 |                                        |
|-----------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------------|
|                 | At separation distance of 30 mm | At separation distance of 35 mm | At separation distance of 40 mm | At separation distance of 45 mm | At separation distance of $\geq 50$ mm |
| $\leq 300$      | 223 mW                          | 254 mW                          | 284 mW                          | 315 mW                          | 345 mW                                 |
| 450             | 141 mW                          | 159 mW                          | 177 mW                          | 195 mW                          | 213 mW                                 |
| 835             | 80 mW                           | 92 mW                           | 105 mW                          | 117 mW                          | 130 mW                                 |
| 1900            | 99 mW                           | 153 mW                          | 225 mW                          | 316 mW                          | 431 mW                                 |
| 2450            | 83 mW                           | 123 mW                          | 173 mW                          | 235 mW                          | 309 mW                                 |
| 3500            | 86 mW                           | 124 mW                          | 170 mW                          | 225 mW                          | 290 mW                                 |
| 5800            | 56 mW                           | 71 mW                           | 85 mW                           | 97 mW                           | 106 mW                                 |

### 5.2.2 Measurement Result:

For BLE:

The max tune-up conducted power is 5.0 dBm (3.16 mW), Antenna Gain: -2.54 dBi,  
EIRP: 2.46 dBm (1.76mW)

For limb-worn devices, the exemption power (P) limits for routine evaluation in 2402-2480MHz is:  
 $(2480-2450)/(3500-2450)=(P-4)/(2-4)$

$$\Rightarrow 2.5 \cdot P = 2.5 \cdot 3.94 = 9.85 \text{ mW}$$

$$> 1.76 \text{ mW}$$

**So the stand-alone SAR evaluation can be exempted.**