

## 5. RF EXPOSURE EVALUATION

### 5.1 Maximum Permissible Exposure

#### 5.1.1 Applicable Standard

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

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| (B) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency Range (MHz)                                   | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
| 0.3–1.34                                                | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30                                                 | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30–300                                                  | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500                                                | /                             | /                             | f/1500                              | 30                       |
| 1500–100,000                                            | /                             | /                             | 1.0                                 | 30                       |

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

#### 5.1.2 Calculation formula

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

#### 5.1.3 Calculated Result

| Operating Mode | Frequency (MHz) | Antenna Gain |           | Conducted output power including Tune-up Tolerance |       | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|----------------|-----------------|--------------|-----------|----------------------------------------------------|-------|--------------------------|-------------------------------------|---------------------------------|
|                |                 | (dBi)        | (numeric) | (dBm)                                              | (mW)  |                          |                                     |                                 |
| BLE            | 2402-2480       | 4            | 2.51      | 9.5                                                | 8.91  | 20.00                    | 0.004                               | 1.0                             |
| WIFI           | 2412-2462       | 4            | 2.51      | 18.5                                               | 70.79 | 20.00                    | 0.035                               | 1.0                             |

Note: the Conducted output power including Tune-up Tolerance was declared by manufacturer. BLE and WIFI can't transmit simultaneously.

**Result: Compliant,** The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance  $\geq 20$  cm.