

## 4 FCC §2.1091, §15.407(f) - RF Exposure

### 4.1 Applicable Standards

According to FCC §2.1091 and §15.407(f), Radio frequency devices operating under the provisions of this part are subject to the radio frequency radiation exposure requirements specified in §§1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a “general population/uncontrolled” environment. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to KDB 447498 Section (7.2), “simultaneous transmission of MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is  $\leq 1.0$ . The MPE ratio of each antenna is determined at the minimum *test separation distance* required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency.

#### 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) |
|-----------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
| 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                       |

Where: f = frequency in MHz

\* = Plane-wave equivalent power density

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field.

### 4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

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

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

### 4.3 MPE Results

#### 5 GHz WiFi

Worst Case: 802.11ac40, 5795 MHz

Maximum output power at antenna input terminal (dBm): 24.25

Maximum output power at antenna input terminal (mW): 266

Prediction distance (cm): 20

Prediction frequency (MHz): 5795

Maximum Directional Antenna Gain, typical (dBi): 7.61

Maximum Antenna Gain (numeric): 5.768

Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>): 0.305

FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>): 1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.305 mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

#### Radio Co-location

2.4 GHz Wi-Fi and 5 GHz Wi-Fi simultaneous transmission is not supported.

#### Worst case colocation 5 GHz Wi-Fi and 2.4 GHz Classic Bluetooth:

| Frequency Band     | Max Conducted Power(dBm) | Evaluated Distance (cm) | Worst-Case MPE (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Worst-Case MPE Ratios | Sum of MPE Ratios | Limit |
|--------------------|--------------------------|-------------------------|--------------------------------------|---------------------------------|-----------------------|-------------------|-------|
| Worst Case         |                          |                         |                                      |                                 |                       |                   |       |
| 5 GHz Wi-Fi        | 24.25                    | 20                      | 0.305                                | 1.0                             | 30.5%                 | 31.6%             | 1     |
| 2.4 GHz Classic BT | 14.58                    | 20                      | 0.011                                | 1.0                             | 1.1%                  |                   |       |