# FCC ID: 2BTFE-BQ4

## RF EXPOSURE EVALUATION

According to Standard(s) :
FCC Rules 47 CFR §2.1091
KDB 447498 D01 General RF Exposure Guidance v06
FCC Rules 47 CFR § 1.1310

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm$^2$) | Averaging time (minutes) |
|---|---|---|---|---|
| (A) Limits for Occupational/Controlled Exposure | | | | |
| 0.3-3.0 | 614 | 1.63 | *100 | 6 |
| 3.0-30 | 1842/f | 4.89/f | *900/f$^2$ | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1,500 | | | f/300 | 6 |
| 1,500-100,000 | | | 5 | 6 |
| (B) 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$^2$ | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1,500 | | | f/1500 | 30 |
| 1,500-100,000 | | | 1.0 | 30 |

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

### MPE Calculation Method

E (V/m) = $\frac{\sqrt{30 * P * G}}{d}$

Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 * P * G}{377 * D^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

Measurement Result

Operation Frequency: BT: 2402-2480MHz, WIFI: 2412-2462MHz
Power density limited: 1mW/ $cm^2$
Antenna Type: PCB Antenna
Antenna gain: 2.04dBi,
R=20 cm

| Channel Freq. (MHz) | modulation | conducted power (dBm) | Tune-up power (dBm) | Max tune-up power (dBm) | Max tune-up power (mW) | Antenna Gain (dBi) | Antenna Gain Numeric | Evaluation result (mW/cm2 ) | Power density Limits (mW/cm2) |
|---|---|---|---|---|---|---|---|---|---|
| 2402 | BLE 1M | -2.08 | -1.5±1 | -0.5 | 0.891 | 2.04 | 1.60 | 0.00028 | 1 |
| 2440 | | -1.3 | -1.5±1 | -0.5 | 0.891 | 2.04 | 1.60 | 0.00028 | 1 |
| 2480 | | -0.84 | -1±1 | 0 | 1.000 | 2.04 | 1.60 | 0.00032 | 1 |
| 2402 | BLE 2M | -1.12 | -1.5±1 | -0.5 | 0.891 | 2.04 | 1.60 | 0.00028 | 1 |
| 2440 | | -0.37 | -1.5±1 | -0.5 | 0.891 | 2.04 | 1.60 | 0.00028 | 1 |
| 2480 | | 0.09 | -1±1 | 0 | 1.000 | 2.04 | 1.60 | 0.00032 | 1 |
| 2412 | 802.11b | 14.44 | 15±1 | 16 | 39.811 | 2.04 | 1.60 | 0.01267 | 1 |
| 2437 | | 15.48 | 15±1 | 16 | 39.811 | 2.04 | 1.60 | 0.01267 | 1 |
| 2462 | | 15.67 | 15±1 | 16 | 39.811 | 2.04 | 1.60 | 0.01267 | 1 |
| 2412 | 802.11g | 12.01 | 13±1 | 14 | 25.119 | 2.04 | 1.60 | 0.00799 | 1 |
| 2437 | | 12.94 | 13±1 | 14 | 25.119 | 2.04 | 1.60 | 0.00799 | 1 |
| 2462 | | 13 | 13±1 | 14 | 25.119 | 2.04 | 1.60 | 0.00799 | 1 |
| 2412 | 802.11n | 12.06 | 13±1 | 14 | 25.119 | 2.04 | 1.60 | 0.00799 | 1 |
| 2437 | | 12.98 | 13±1 | 14 | 25.119 | 2.04 | 1.60 | 0.00799 | 1 |
| 2462 | | 12.99 | 13±1 | 14 | 25.119 | 2.04 | 1.60 | 0.00799 | 1 |

**Conclusion:**
For the max result : 0.01267≤ 1.0 for Max Power Density, compliance RF exposure.

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