# RF EXPOSURE EVALUATION

According to FCC 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 gain: 2dBi,
R=20cm

| Channel Freq. (MHz) | modulation | conducted power (dBm) | Tune-up power (dBm) | Max | | Antenna | | Evaluation result (mW/cm2 ) | Power density (mW/cm2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | tune-up power | | Gain | | | |
| | | | | (dBm) | (mW) | (dBi) | Numeric | | |
| 2402 | BLE | -2.38 | -3±1 | -2 | 0.631 | 2.00 | 1.58 | 0.0002 | 1 |
| 2440 | | -3.78 | -4±1 | -3 | 0.501 | 2.00 | 1.58 | 0.0002 | 1 |
| 2480 | | -4.05 | -4±1 | -3 | 0.501 | 2.00 | 1.58 | 0.0002 | 1 |

| Channel Freq. (MHz) | modulation | conducted power (dBm) | Tune-up power (dBm) | Max | | Antenna | | Evaluation result (mW/cm2 ) | Power density (mW/cm2) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | tune-up power | | Gain | | | |
| | | | | (dBm) | (mW) | (dBi) | Numeric | | |
| 2412 | 802.11b | 13.59 | 13±1 | 14 | 25.119 | 2.00 | 1.58 | 0.0079 | 1 |
| 2437 | | 13.67 | 13±1 | 14 | 25.119 | 2.00 | 1.58 | 0.0079 | 1 |
| 2462 | | 12.94 | 13±1 | 14 | 25.119 | 2.00 | 1.58 | 0.0079 | 1 |
| 2412 | 802.11g | 12.7 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2437 | | 12.41 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2462 | | 11.89 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2412 | 802.11n HT20 | 11.74 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2437 | | 11.94 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2462 | | 11.02 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2422 | 802.11n HT40 | 12.14 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2437 | | 11.43 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |
| 2452 | | 11.88 | 12±1 | 13 | 19.953 | 2.00 | 1.58 | 0.0063 | 1 |

Note: The WiFi/BLE does not support simultaneous transmission

**Conclusion:**
For the max result : 0.0079≤ 1.0 for Max Power Density, compliance RF exposure..



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