

## RADIO FREQUENCY EXPOSURE

### LIMIT

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 levels in excess of the Commission's guidelines. See § 1.1307(b) of this chapter.

### EUT Specification

<b>EUT</b>	MC1001
<b>Frequency band (Operating)</b>	<input type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.15GHz ~ 5.25GHz <input type="checkbox"/> WLAN: 5.25GHz ~ 5.35GHz <input type="checkbox"/> WLAN: 5.47GHz ~ 5.725GHz <input type="checkbox"/> WLAN: 5.725GHz ~ 5.85GHz <input checked="" type="checkbox"/> Bluetooth: 2.402GHz ~ 2.480GHz <input type="checkbox"/> Others
<b>Device category</b>	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure ( $S = 5\text{mW/cm}^2$ ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ( $S=1\text{mW/cm}^2$ )
<b>Antenna diversity</b>	<input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
<b>Max. tune up AVG Output power</b>	BLE 4.2: 2402-2480: 0 dBm
<b>Antenna gain (Max)</b>	Antenna gain:0dBi (Numeric gain:1)
<b>Evaluation applied</b>	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A

**Remark:**

1. The maximum tune up output power is 0dBm (1mW) at 2402MHz (with 1 numeric antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm<sup>2</sup> even if the calculation indicates that the power density would be larger.

## **TEST RESULTS**

No non-compliance noted.

### **Calculation**

Given  $E = \frac{\sqrt{30 \times P \times G}}{d}$  &  $S = \frac{E^2}{3770}$

Where  $E$  = Field strength in Volts / meter

$P$  = Power in Watts

$G$  = Numeric antenna gain

$d$  = Distance in meters

$S$  = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770d^2}$$

Changing to units of mW and cm, using:

$P$  (mW) =  $P$  (W) / 1000 and

$d$  (cm) =  $d$ (m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where  $d$  = Distance in cm

$P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>

### **Maximum Permissible Exposure**

Substituting the MPE safe distance using  $d = 20$  cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where  $P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>

**For Bluetooth:**

Modulation Mode	Frequency band (MHz)	Max. tune up power(dBm) (dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
BLE4.2	2402-2480	0	0	20	0.000199	1

**Note:**

The formula of bluetooth calculated MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + .....etc. < 1

CPD = Calculation power density

LPD = Limit of power density

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm<sup>2</sup> even if the calculation indicates that the power density would be larger.)