



## APPENDIX I

### RADIO FREQUENCY EXPOSURE

#### LIMIT

According to §15.247(i), 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)(1) of this chapter.

#### EUT Specification

|                                     |                                                                                                                                                                                             |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EUT</b>                          | 802.11 b/g/n Wi-Fi module                                                                                                                                                                   |
| <b>Model</b>                        | QFM-2202, QFM-2202-A                                                                                                                                                                        |
| <b>Model Discrepancy</b>            | The difference of suffix “-A” is for it contains MFi IC .                                                                                                                                   |
| <b>Frequency band (Operating)</b>   | <input checked="" type="checkbox"/> 802.11b/g/n HT20: 2.412GHz ~ 2.462GHz<br><input type="checkbox"/> Others                                                                                |
| <b>Device category</b>              | <input type="checkbox"/> Portable (<20cm separation)<br><input checked="" type="checkbox"/> Mobile (>20cm separation)<br><input type="checkbox"/> Others                                    |
| <b>Exposure classification</b>      | <input type="checkbox"/> Occupational/Controlled exposure ( $S = 5\text{mW/cm}^2$ )<br><input checked="" type="checkbox"/> General Population/Uncontrolled exposure ( $S=1\text{mW/cm}^2$ ) |
| <b>Antenna Specification</b>        | 2.4GHz: Antenna Gain : 1.84 dBi (Numeric gain 1.53)                                                                                                                                         |
| <b>Maximum Average output power</b> | IEEE 802.11b Mode: 22.30 dBm (169.824 mW)<br>IEEE 802.11g Mode: 22.40 dBm (173.780 mW)<br>IEEE 802.11n HT 20 Mode: 22.40 dBm (173.780 mW)                                                   |
| <b>Maximum Tune up Power</b>        | IEEE 802.11b Mode: 24.00 dBm (251.189 mW)<br>IEEE 802.11g Mode: 24.00 dBm (251.189 mW)<br>IEEE 802.11n HT 20 Mode: 24.00 dBm (251.189 mW)                                                   |
| <b>Evaluation applied</b>           | <input checked="" type="checkbox"/> MPE Evaluation*<br><input type="checkbox"/> SAR Evaluation<br><input type="checkbox"/> N/A                                                              |



## Revision History

| Rev. | Issue Date | Revisions     | Effect Page | Revised By  |
|------|------------|---------------|-------------|-------------|
| 00   | 2015/02/17 | Initial Issue | ALL         | Angel Cheng |



## **TEST RESULTS**

**No non-compliance noted.**

### **Calculation**

Given  $E = \frac{\sqrt{30 \times P \times G}}{d}$  &  $S = \frac{E^2}{377}$

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:

$$S = \frac{30 \times P \times G}{377d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P / 1000) \times G}{377 \times (d / 100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \textbf{Equation 1}$$

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:

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

Where  $P$  = Power in mW

$G$  = Numeric antenna gain

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

**IEEE 802.11b mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm2) |
|-----|-----------|---------|-------------|--------|---------------------------------------|----------------|
| 6   | 2437      | 251.189 | 1.53        | 20     | 0.0765                                | 1              |

**IEEE 802.11g mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm2) |
|-----|-----------|---------|-------------|--------|---------------------------------------|----------------|
| 6   | 2437      | 251.189 | 1.53        | 20     | 0.0765                                | 1              |

**IEEE 802.11n HT20 mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm2) |
|-----|-----------|---------|-------------|--------|---------------------------------------|----------------|
| 6   | 2437      | 251.189 | 1.53        | 20     | 0.0765                                | 1              |