# 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

| | | | |
|---|---|---|---|
| **EUT** | 150Mbps Wireless N ADSL2+ Modem Router | | |
| **Model** | DL4312; DL4312D | | |
| **RF Module** | Realtek | Model: | RTL8188ER-CG |
| **Model Discrepancy** | All the model numbers (list on this report) are identical, just for marketing purpose only except Antenna.<br>**Model Number** / **Antenna**<br>DL4312 / Fixed<br>DL4312D / Detachable | | |
| **Frequency band (Operating)** | ☒ 802.11b/g/n HT20: 2.412GHz ~ 2.462GHz<br>802.11n HT40: 2.422GHz ~ 2.452GHz<br>☐ Others | | |
| **Device category** | ☐ Portable (<20cm separation)<br>☒ Mobile (>20cm separation)<br>☐ Others | | |
| **Exposure classification** | ☐ Occupational/Controlled exposure (S = 5mW/cm2)<br>☒ General Population/Uncontrolled exposure (S=1mW/cm2) | | |
| **Antenna Specification** | 2.4GHz: Antenna Gain : 5.00 dBi (Numeric gain 3.16) | | |
| **Maximum Average output power** | IEEE 802.11b Mode: 12.43 dBm (17.498 mW)<br>IEEE 802.11g Mode: 13.86 dBm (24.322 mW)<br>IEEE 802.11n HT 20 Mode: 13.67 dBm (23.281 mW)<br>IEEE 802.11n HT 40 Mode: 13.66 dBm (23.227 mW) | | |
| **Maximum Tune up Power** | IEEE 802.11b Mode: 13.00 dBm (19.953 mW)<br>IEEE 802.11g Mode: 15.00 dBm (31.623 mW)<br>IEEE 802.11n HT 20 Mode: 14.00 dBm (25.119 mW)<br>IEEE 802.11n HT 40 Mode: 15.00 dBm (31.623 mW) | | |
| **Evaluation applied** | ☒ MPE Evaluation*<br>☐ SAR Evaluation<br>☐ N/A | | |

Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | 2014/04/28 | Initial Issue | ALL | Scott Hsu |

## 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:

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

Changing to units of mW and cm, using:

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

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

Yields

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

*Where d = Distance in cm*
*P = Power in mW*
*G = Numeric antenna gain*
*S = Power density in mW / cm$^2$*

## 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$^2$*

### IEEE 802.11b mode:

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm$^2$ | Limit (mW/cm2) |
|---|---|---|---|---|---|---|
| 11 | 2462 | 19.953 | 3.16 | 20 | 0.0125 | 1 |

### IEEE 802.11g mode:

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm$^2$ | Limit (mW/cm2) |
|---|---|---|---|---|---|---|
| 6 | 2437 | 31.623 | 3.16 | 20 | 0.0199 | 1 |

### IEEE 802.11n HT20 mode:

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm$^2$ | Limit (mW/cm2) |
|---|---|---|---|---|---|---|
| 6 | 2437 | 25.119 | 3.16 | 20 | 0.0158 | 1 |

### IEEE 802.11n HT40 mode:

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm$^2$ | Limit (mW/cm2) |
|---|---|---|---|---|---|---|
| 6 | 2437 | 31.623 | 3.16 | 20 | 0.0199 | 1 |