# 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** | Unified Access Gateway |
| **Model** | UAG50 |
| **Trade Name** | ZyXEL |
| **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/cm$^2$)<br>☒ General Population/Uncontrolled exposure (S=1mW/cm$^2$) |
| **Antenna Specification** | Dipole Antenna × 2 (A8-A003-00071)<br>2.4GHz: Antenna 0 Gain : 5.00 dBi (Numeric gain 3.16)<br>2.4GHz: Antenna 1 Gain : 5.00 dBi (Numeric gain 3.16)<br>Dipole Antenna × 2 (A8-A003-00110)<br>2.4GHz: Antenna 0 Gain : 2.00 dBi (Numeric gain 1.58)<br>2.4GHz: Antenna 1 Gain : 2.00 dBi (Numeric gain 1.58) |
| **Maximum Average output power** | IEEE 802.11b Mode: 19.12 dBm (81.658 mW)<br>IEEE 802.11g Mode: 24.73 dBm (297.167 mW)<br>IEEE 802.11n HT 20 Mode 24.66 dBm (292.415 mW)<br>IEEE 802.11n HT 40 Mode 24.09 dBm (256.448 mW) |
| **Evaluation applied** | ☒ MPE Evaluation*<br>☐ SAR Evaluation<br>☐ N/A |

# Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | 2015/05/27 | Initial Issue | ALL | Michelle Chiu |

# 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:

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

Changing to units of mW and cm, using:

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

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

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***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 / cm²*

**IEEE 802.11b mode:**

| Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm² | Limit (mW/cm²) |
|---|---|---|---|---|---|
| 2412 | 81.658 | 3.16 | 20 | 0.0513 | 1 |

**IEEE 802.11g mode:**

| Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm² | Limit (mW/cm²) |
|---|---|---|---|---|---|
| 2437 | 297.167 | 3.16 | 20 | 0.1869 | 1 |

**IEEE 802.11n HT20 mode:**

| Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm² | Limit (mW/cm²) |
|---|---|---|---|---|---|
| 2437 | 292.415 | 3.16 | 20 | 0.1839 | 1 |

**IEEE 802.11n HT40 mode:**

| Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm² | Limit (mW/cm²) |
|---|---|---|---|---|---|
| 2437 | 256.448 | 3.16 | 20 | 0.1613 | 1 |