



APPENDIX I RADIO FREQUENCY EXPOSURE

LIMIT

According to §15.407(f), U-NII devices are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

EUT Specification

| | | | | | |
|---|---|-------------------------------|------------------------------|---------------------------|--------------------------|
| EUT | Dual-Band Wireless VPN Router with GbE Switch | | | | |
| Frequency band (Operating) | <input type="checkbox"/> WLAN: 2412 MHz ~ 2462 MHz <input checked="" type="checkbox"/> WLAN: 5150 MHz ~ 5250 MHz <input type="checkbox"/> WLAN: 5500 MHz ~ 5700 MHz <input type="checkbox"/> WLAN: 5725 MHz ~ 5850 MHz | | | | |
| Device category | <input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others: _____ | | | | |
| Exposure classification | <input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²) | | | | |
| Antenna diversity | <input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input checked="" type="checkbox"/> Tx/Rx diversity | | | | |
| Max. output power | | Mode | Frequency Range (MHz) | Output Power (dBm) | Output Power (mw) |
| | UNII Band I | IEEE 802.11a | 5180 – 5240 | 14.06 | 25.46830 |
| | | draft 802.11n Standard-20 MHz | 5180 – 5240 | 15.99 | 39.71915 |
| | | draft 802.11n Wide-40 MHz | 5190 ~ 5230 | 15.04 | 31.91538 |
| Antenna gain (Max) | 1. Dipole Antenna / 2 dBi (Numeric gain: 1.58) MIMO: 2dBi + 10 log (2) = 5 dBi (Numeric gain: 3.16) 2. PIFA Antenna / 6.6 dBi (RX only) | | | | |
| Evaluation applied | <input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A | | | | |
| Remark: | | | | | |
| 1. The maximum output power is 15.99dBm (39.71mW) at 5200MHz (with 1.58 numeric antenna gain.) | | | | | |
| 2. For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm ² even if the calculation indicates that the power density would be larger. | | | | | |

TEST RESULTS

No non-compliance noted.

RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm, except when the device operates:

- at or above 1.5 GHz and the e.i.r.p. of the device is equal to or less than 5 W.

Remark: Please refer to the Annex A -B RF Technical Brief Cover Sheet.

MPE EVALUATION

Not applicable.



Calculation

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

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:

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

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

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 / cm²

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 / cm²



Test mode: IEEE 802.11a mode / 5180 ~ 5240MHz

EUT output power = 25.46830mW

Numeric Antenna gain = 1.58

→ Power density = 0.008008 mW / cm²

Test mode: draft 802.11n Standard-20 MHz Channel mode / 5180 ~ 5240MHz

EUT output power = 39.71915 mW

Numeric Antenna gain = 3.16

→ Power density = 0.024977 mW / cm²

Test mode: draft 802.11n Wide-40 MHz Channel mode / 5190 ~ 5230MHz

EUT output power = 31.91538 mW

Numeric Antenna gain = 3.16

→ Power density = 0.020070 mW / cm²

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.)