



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	IEEE802.11n 2.4GHz 2x2 repeater
Frequency band (Operating)	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input type="checkbox"/> Others
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 ($S = 5\text{mW}/\text{cm}^2$) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ($S=1\text{mW}/\text{cm}^2$)
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	IEEE 802.11b mode: 19.65 dBm (92.26 mW) IEEE 802.11g mode: 19.75 dBm (94.41 mW) IEEE 802.11n HT 20 MHz mode: 20.93 dBm (123.88 mW) IEEE 802.11n HT 40 MHz mode: 20.98 dBm (125.31 mW)
Antenna gain (Max)	Dipole Antenna / Gain: 2.33 dBi (Numeric gain: 1.71) MIMO Mode: Total ANT $=10*\text{LOG}(((10^{(\text{ANT0}/20)}+10^{(\text{ANT2}/20)})^2)/2)$ $=5.34\text{ dBi}$ (Numeric gain: 3.42)
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A

Remark:

The maximum output power is 20.98dBm (125.31mW) at 2442MHz (with 3.42 numeric antenna gain.)

MPE EVALUATION

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:

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

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

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 / 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



IEEE 802.11b mode:

EUT output power = 92.26 mW

Numeric Antenna gain = 1.71

\rightarrow Power density = 0.0314 mW / cm²

IEEE 802.11g mode:

EUT output power = 94.41 mW

Numeric Antenna gain = 3.42

\rightarrow Power density = 0.0321 mW / cm²

IEEE 802.11n HT 20 MHz mode:

EUT output power = 123.88 mW

Numeric Antenna gain = 3.42

\rightarrow Power density = 0.0843 mW / cm²

IEEE 802.11n HT 40 MHz mode:

EUT output power = 125.31 mW

Numeric Antenna gain = 3.42

\rightarrow Power density = 0.0853 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.)