



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	802.11ac/b/g/n USB module
Model	WUBM-273ACN
Frequency band (Operating)	<input checked="" type="checkbox"/> 802.11b/g/n HT20: 2.412GHz ~ 2.462GHz 802.11n HT40: 2.422GHz ~ 2.452GHz 802.11a: 5150 ~ 5250MHz / 5725 ~ 5850MHz 802.11 HT20: 5150 ~ 5250MHz / 5725 ~ 5850MHz 802.11 HT40: 5150 ~ 5250MHz / 5725 ~ 5850MHz <input type="checkbox"/> 802.11ac HT80: 5170 ~ 5330 MHz / 5775 MHz <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 = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna Specification	5GHz: SparkLAN / WUBM-273ACN Antenna Gain : 1.68 dBi (Numeric gain: 1.47) LCT / DFE_ACBSMA-BGP Antenna Gain : 5.00 dBi (Numeric gain: 3.16) 2.4GHz: SparkLAN / WUBM-273ACN Antenna Gain : 0.23 dBi (Numeric gain: 1.05) LCT / DFE_ACBSMA-BGP Antenna Gain : 3.00 dBi (Numeric gain: 2.00)
Maximum Average output power	IEEE 802.11b Mode: 22.10 dBm (162.181 mW) IEEE 802.11g Mode: 14.95 dBm (31.261 mW) IEEE 802.11n HT 20 Mode: 19.21 dBm (83.368 mW) IEEE 802.11n HT 40 Mode: 14.96 dBm (31.333 mW) IEEE 802.11a Mode: 20.62 dBm (115.345 mW) IEEE 802.11n HT20 Mode: 22.10 dBm (162.181 mW) IEEE 802.11n HT40 Mode: 18.77 dBm (75.336 mW) IEEE 802.11ac HT80 Mode: 17.32 dBm (53.951 mW)



Maximum Tune up Power	IEEE 802.11b Mode: 24.00 dBm (251.189 mW) IEEE 802.11g Mode: 16.00 dBm (39.811 mW) IEEE 802.11n HT 20 Mode: 21.00 dBm (125.893 mW) IEEE 802.11n HT 40 Mode: 16.50 dBm (44.668 mW) IEEE 802.11a Mode: 21.50 dBm (141.254 mW) IEEE 802.11n HT20 Mode: 23.00 dBm (199.526 mW) IEEE 802.11n HT40 Mode: 20.00 dBm (100.000 mW) IEEE 802.11ac HT80 Mode: 19.00 dBm (79.433 mW)
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A



Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2015/01/07	Initial Issue	ALL	Kelly 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

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

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:

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

Where P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

IEEE 802.11b mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
6	2437	251.189	2	20	0.1000	1

IEEE 802.11g mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
6	2437	39.811	2	20	0.0158	1

IEEE 802.11n HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1	2412	125.893	2	20	0.0501	1

IEEE 802.11n HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
6	2437	44.668	2	20	0.0178	1

IEEE 802.11a mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
165	5825	141.254	3.16	20	0.0888	1

IEEE 802.11a HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
165	5825	199.526	3.16	20	0.1255	1

IEEE 802.11a HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
46	5230	100	3.16	20	0.0629	1

IEEE 802.11ac HT80 Mode

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
155	5775	79.433	3.16	20	0.0500	1