APPENDIX I
RADIO FREQUENCY EXPOSURE

LIMIT

According to H46-2/99-237E, 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.

EUT Specification

EUT	802.11a/b/g/n/ac, 2T2R Wireless LAN USB2.0 Module		
Model	WN4510L		
RF Module	Realtek	Model:	RTL8812AU
Frequency band (Operating)	☒ 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 802.11AC HT80: 5170 ~ 5330 MHZ / 5490 ~ 5815 MHZ ☐ Others		
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others		
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)		
Antenna Specification	5GHz: Antenna Gain : 1.74 dBi (Numeric gain 1.49) 2.4GHz: Antenna Gain : 3.36 dBi (Numeric gain 2.17)		
Maximum Average output power	IEEE 802.11b Mode: 17.60 dBm (57.544 mW) IEEE 802.11g Mode: 17.70 dBm (58.884 mW) IEEE 802.11n HT 20 Mode: 16.81 dBm (47.973 mW) IEEE 802.11n HT 40 Mode: 17.14 dBm (51.761 mW) IEEE 802.11a Mode: 19.60 dBm (91.201 mW) IEEE 802.11n HT20 Mode: 18.15 dBm (65.313 mW) IEEE 802.11n HT40 Mode: 18.14 dBm (65.163 mW) IEEE 802.11ac HT80 Mode: 17.80 dBm (60.256 mW)		

Maximum Tune up Power	IEEE 802.11b Mode: 19.00 dBm (79.433 mW) IEEE 802.11g Mode: 19.00 dBm (79.433 mW) IEEE 802.11n HT 20 Mode: 18.00 dBm (63.096 mW) IEEE 802.11n HT 40 Mode: 19.00 dBm (79.433 mW) IEEE 802.11a Mode: 20.00 dBm (100.000 mW) IEEE 802.11n HT20 Mode: 20.00 dBm (100.000 mW) IEEE 802.11n HT40 Mode: 20.00 dBm (100.000 mW) IEEE 802.11ac HT80 Mode: 19.50 dBm (89.125 mW)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2014/04/29	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)
6	2437	79.433	2.17	20	0.0343	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	79.433	2.17	20	0.0343	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	63.096	2.17	20	0.0272	1

IEEE 802.11n HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm^2	Limit (mW/cm2)
9	2437	79.433	2.17	20	0.0343	1

IEEE 802.11a mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm^2	Limit (mW/cm2)
64	5320	100	1.49	20	0.0297	1

IEEE 802.11a HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm^2	Limit (mW/cm2)
64	5320	100	1.49	20	0.0297	1

IEEE 802.11a HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm^2	Limit (mW/cm2)
110	5550	100	1.49	20	0.0297	1

IEEE 802.11ac HT80 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm^2	Limit (mW/cm2)
106	5530	89.125	1.49	20	0.0264	1