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	802.11n, Dual Band 2T2R Wireless USB Module
Trade Name	LITE-ON
Model Number	WN4501L
Frequency band (Operating)	☒ 802.11b/g/n HT20: 2.412GHz ~ 2.462GHz ☒ 802.11a/HT20: 5.150GHz ~ 5.250GHz ☒ 802.11a/HT20: 5.470GHz ~ 5.825GHz ☐ 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	PIFA Antenna, Antenna L: 2.4GHz Gain: 2.97 dBi, 5GHz Gain: 1.74 dBi, Antenna R: 2.4GHz Gain: 3.36 dBi, (Numeric gain: 2.17); 5GHz Gain: 1.74 dBi, (Numeric gain: 1.49)
Average output power	IEEE 802.11b : 12.89 dBm (19.454mW) IEEE 802.11g : 17.35 dBm (54.325mW) IEEE 802.11n HT20 : 16.00 dBm (39.811mW) IEEE 802.11n HT40 : 14.94 dBm (31.189mW) IEEE 802.11a : 11.83 dBm (15.241mW) IEEE 802.11a HT20 : 15.42 dBm (34.834mW) IEEE 802.11a HT40 : 16.01 dBm (39.902mW)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A
Remark: *The maximum average output power is 17.35dBm (54.325mW) at 2442MHz (without 2.0 numeric antenna gain.)*	

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 / cm²

IEEE 802.11b mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm²)
11	2462	19.454	2.17	20	0.0084	1

IEEE 802.11g mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm²)
6	2437	54.325	2.17	20	0.0235	1

IEEE 802.11n HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm²)
11	2462	39.811	2.17	20	0.0172	1

IEEE 802.11n HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm²)
3	2422	31.189	2.17	20	0.0135	1

IEEE 802.11a mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm²)
36	5180	15.241	1.49	20	0.0045	1

IEEE 802.11a HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm²)
116	5580	34.834	1.49	20	0.0103	1

IEEE 802.11a HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm²)
102	5510	39.902	1.49	20	0.0118	1