



MPE Calculation

Applicant:	Kunshan Lantuo Intelligent Robot Co., Ltd
Address:	2F, Room 2, No. 179, Waihejing Road, Kunshan Development Zone Comprehensive Bond, Kunshan, Jiangsu, China
Product:	Intelligent Lawn Mower
FCC ID:	2BTDL-S1ULTRAS1PRO
Model No.:	S1 Pro, S1 Ultra
Reference RF report #	709502501599-00B, 709502501599-00C, 709502501599-00D, EFTA25090045-IE-02-R1,
Remark	According to the client's declaration, all models are the power supply, electrical principle, PCB layout and electrical structure used in Model S1 Pro and model S1 Ultra are the same, but the battery pack capacity is different. So model S1 Ultra was chosen to perform all the tests, other model S1 Pro is deemed to fulfill all the requirement without further testing.

According to subpart 15.247(i) and subpart §1.1307(b)(1), 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 level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1,500	/	/	f/1500	30
1,500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4 \pi R^2$ = power density (in appropriate units, e.g. mW/cm²);



P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

2.4G BLE for 709502501599-00B Calculated Data: FPC antenna

Maximum peak output power at antenna input terminal (dBm):	7
Maximum peak output power at antenna input terminal (mW):	5.01
tune-up conducted power(dBm):	8
tune-up conducted power(mW):	6.31
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	5.12
Maximum Antenna Gain (numeric):	3.2509
The worst case is power density at predication frequency at 20 cm (mW/cm ²):	0.00408
MPE limit for general population exposure at prediction frequency (mW/cm ²):	1.00

Note: The tune-up conducted power (8 dBm) was declared by the manufacturer.

The max power density 0.00408 (mW/cm²) < 1 (mW/cm²)

2.4G EDR for 709502501599-00C Calculated Data: FPC antenna

Maximum peak output power at antenna input terminal (dBm):	7.71
Maximum peak output power at antenna input terminal (mW):	5.90
tune-up conducted power(dBm):	8.5
tune-up conducted power(mW):	7.08
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	5.12
Maximum Antenna Gain (numeric):	3.2509
The worst case is power density at predication frequency at 20 cm (mW/cm ²):	0.00458
MPE limit for general population exposure at prediction frequency (mW/cm ²):	1.00

Note: The tune-up conducted power (8.5 dBm) was declared by the manufacturer.

The max power density 0.00458 (mW/cm²) < 1 (mW/cm²)



2.4G Wi-Fi for 709502501599-00D Calculated Data: FPC antenna

Maximum peak output power at antenna input terminal (dBm):	23.68
Maximum peak output power at antenna input terminal (mW):	233.35
tune-up conducted power(dBm):	24.5
tune-up conducted power(mW):	281.84
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	5.12
Maximum Antenna Gain (numeric):	3.2509
The worst case is power density at predication frequency at 20 cm (mW/cm ²):	0.18228
MPE limit for general population exposure at prediction frequency (mW/cm ²):	1.00

Note: The tune-up conducted power (24.5 dBm) was declared by the manufacturer.
The max power density 0.18228 (mW/cm²) < 1 (mW/cm²)

LTE Band2 for EFTA25090045-IE-02-R1 Calculated Data: FPC antenna

Maximum peak output power at antenna input terminal (dBm):	23.31
Maximum peak output power at antenna input terminal (mW):	214.29
tune-up conducted power(dBm):	24
tune-up conducted power(mW):	251.19
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	3.20
Maximum Antenna Gain (numeric):	2.0893
The worst case is power density at predication frequency at 20 cm (mW/cm ²):	0.10441
MPE limit for general population exposure at prediction frequency (mW/cm ²):	1

Note: The tune-up conducted power (24 dBm) was declared by the manufacturer.
The max power density 0.09305 (mW/cm²) < 1 (mW/cm²)



LTE Band4 for EFTA25090045-IE-02-R1 Calculated Data: FPC antenna

Maximum peak output power at antenna input terminal (dBm):	23.33
Maximum peak output power at antenna input terminal (mW):	215.28
tune-up conducted power(dBm):	24
tune-up conducted power(mW):	251.19
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	3.44
Maximum Antenna Gain (numeric):	2.2080
The worst case is power density at predication frequency at 20 cm (mW/cm ²):	0.11034
MPE limit for general population exposure at prediction frequency (mW/cm ²):	1

Note: *The tune-up conducted power (24 dBm) was declared by the manufacturer.*

The max power density 0.11034 (mW/cm²) < 1 (mW/cm²)

**Co-Located Transmitters transmission table:**

Transmitter type	Transmitter type that can transmit at the same time
2.4G Wi-Fi or BLE for EDR	LTE Band 2 or LTE Band 4
LTE Band 2 or LTE Band 4	2.4G Wi-Fi or BLE or EDR

Simultaneous Transmission MPE:

Frequency Band	MPE (mw/cm2)	Limit (mw/cm2)	Evaluated Distance (cm)	Worst-Case MPE Ratios	Worst-Case Transmitter type MPE Ratios	Worst-Case Sum of MPE Ratios	Limit	Result
Worst Case								
2.4G Wi-Fi	0.18228	1	20	18.23%	18.23%	29.26%	100%	Pass
BLE	0.00408	1	20	0.41%				
EDR	0.00458	1	20	0.46%				
LTE Band 2	0.10441	1	20	10.44%	11.03%			
LTE Band 4	0.11034	1	20	11.03%				

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

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