



FCC 47 CFR MPE REPORT

Shenzhen Free Dynamics Development Co., Ltd.

Robot Vacuum Cleaner

Model Number: M30

Additional Model: M30 Pro, MS1, MS1 Max

FCC ID: 2AT7J-M30PRO

Applicant:	Shenzhen Free Dynamics Development Co., Ltd.
Address:	2101 Block A, Huizhi Development Center, Longteng
	Community, Xixiang Street, Bao'an District, Shenzhen, China
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
Tel: 86-769-83081888-808	

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Maximum Permissible Exposure

1. Applicable Standards

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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

1.1. Limits for Maximum Permissible Exposure (MPE)

(a) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-10000			5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-10000			1.0	30

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

1.2. MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

2. Conducted Power Result

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)
BLE 1M	2402	4.65	2.917
	2440	4.4	2.754
	2480	3.71	2.350
IEEE 802.11b	2412	18.41	69.343
	2437	18.21	66.222
	2462	18.25	66.834
IEEE 802.11g	2412	19.63	91.833
	2437	19.57	90.573
	2462	19.81	95.719
IEEE 802.11n HT20	2412	19.78	95.060
	2437	19.33	85.704
	2462	19.38	86.696
IEEE 802.11n HT40	2422	20.65	116.145
	2437	20.75	118.850
	2452	20.67	116.681

3. Calculated Result and Limit

Mode	Peak output power (dBm)	Target power (dBm)	MAX Target power (dBm)	Antenna gain		Power Density (S) (mW /cm2)	Limited of Power Density (S) (mW /cm2)	Test Result
				(dBi)	(Linear)			
2.4G Band								
BLE	4.65	4±1	5	1.8	1.514	0.00095	1	Complies
IEEE 802.11b	18.41	18±1	19	1.8	1.514	0.02392	1	Complies
IEEE 802.11g	19.81	19±1	20	1.8	1.514	0.03011	1	Complies
IEEE 802.11n HT20	19.78	19±1	20	1.8	1.514	0.03011	1	Complies
IEEE 802.11n HT40	20.75	20±1	21	1.8	1.514	0.03791	1	Complies

End of Test Report