

## RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

FCC ID: 2ARZX-LDSM8

### EUT Specification

<b>EUT</b>	Robot Vacuum Cleaner
<b>Frequency band (Operating)</b>	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5825GHz <input checked="" type="checkbox"/> Others: 433.6MHz
<b>Device category</b>	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others ____
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm <sup>2</sup> ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm <sup>2</sup> )
<b>Antenna diversity</b>	<input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
<b>Max. output power</b>	WIFI:21.95 dBm (0.157W);433.6MHz:84.44dBuV/m(0.0001W)
<b>Antenna gain (Max)</b>	SRD: 2dBi 2.4G WIFI: 1dBi
<b>Evaluation applied</b>	<input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation

Limits for Maximum Permissible Exposure(MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm <sup>2</sup> )	Average Time
<b>(A) Limits for Occupational/Control Exposures</b>				
300-1500	--	--	<b>F/300</b>	<b>6</b>
1500-100000	--	--	<b>5</b>	<b>6</b>
<b>(B) Limits for General Population/Uncontrol Exposures</b>				
300-1500	--	--	<b>F/1500</b>	<b>6</b>
1500-100000	--	--	<b>1</b>	<b>30</b>

## Friis transmission formula: $P_d = \frac{P_{out} * G}{4 * \pi * R^2}$

Where

$P_d$  = Power density in  $mW/cm^2$

$P_{out}$  = output power to antenna in Mw

$G$  = gain of antenna in linear scale

$\pi = 3.1416$

$R$  = distance between observation point and center of the radiator in cm

$P_d$  the limit of MPE,  $1mW/cm^2$ . If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

## Measurement Result

2.4G WIF

Operating Mode	Channel Frequency (MHz)	Maximum output power (dBm)	Tune up tolerance (dBm)	Max. Tune up Power (dBm)	Antenna Gain (dBi)	Power density at 20cm (mW/ cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )
802.11b	2412	21.74	21.74 ± 1	22.74	1	0.0471	1
	2437	21.32	21.32 ± 1	22.32	1	0.0428	1
	2462	21.95	21.95 ± 1	22.95	1	0.0494	1
802.11g	2412	20.66	20.66 ± 1	21.66	1	0.0367	1
	2437	21.13	21.13 ± 1	22.13	1	0.0409	1
	2462	19.96	19.96 ± 1	20.96	1	0.0313	1
802.11n (HT20)	2412	20.75	20.75 ± 1	21.75	1	0.0375	1
	2437	19.48	19.48 ± 1	20.48	1	0.0280	1
	2462	20.02	20.02 ± 1	21.02	1	0.0317	1

433.6MHz:

Channel (MHz)	Antenna Gain (dBi)	Max Output Power (dBuV/m)	Max Output power (dBm)	Tolerance	Max Tune-UP power (mW)	Power density at 20cm (mW/ cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )
433.6	2	84.44	-10.82	± 1	0.104	0.00003	1

$$E = \text{EIRP} - 20\log D + 104.8$$

where:

E = electric field strength in dB $\mu$ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

$$\text{EIRP} = E - 104.8 + 20\log D = 84.44 - 104.8 + 20\log 3 = -10.82\text{dBm}$$

Worst case:

2.4G WIFI+433.6MHz:

$$0.0494 + 0.00003 = 0.04943 < 1$$

The SAR measurement is not necessary.