



RF EXPOSURE EVALUATION

EUT Specification

EUT	Robot Vacuum Cleaner
Model Number	V20
FCC ID	2ATOQ-V20
Antenna gain (Max)	3dBi
Operation Frequency	WLAN: 2.412GHz ~ 2.462GHz
Input Rating	DC 19V 600mA 24W
Max. output power	802.11b: 17.77dBm 802.11g: 16.77dBm 802.11n(HT20): 17.41dBm

Test Requirement:

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)

Limits for Maximum Permissible Exposure (MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm²)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	--	--	F/300	6
1500-100000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300-1500	--	--	F/1500	6
1500-100000	--	--	1	30

11.1 Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

P_d = Power density in mW/cm²

P_{out} =output power to antenna in mW

G = Numeric gain of the antenna relative to isotropic antenna

π =3.1416

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



Find the limit of MPE, $1\text{mW}/\text{cm}^2$. 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.

11.2 Measurement Result

Antenna gain: 3 dBi

WIFI:

Operating Mode	Test Channel	Tune up tolerance (dBm)	Max tune up conducted power (dBm)	Output Peak power (mW)	Ant. Gain (dBi)	Ant. Gain (numeric)	Power density at 20cm (mW/cm^2)	Power density Limits (mW/cm^2)
802.11b	1	18 ± 1	19	79.433	3	1.995	0.031530	1
	6	18 ± 1	19	79.433	3	1.995	0.031530	1
	11	16 ± 1	17	50.119	3	1.995	0.019894	1
802.11g	1	17 ± 1	18	63.096	3	1.995	0.025045	1
	6	16 ± 1	17	50.119	3	1.995	0.019894	1
	11	16 ± 1	17	50.119	3	1.995	0.019894	1
802.11n (HT20)	1	17 ± 1	18	63.096	3	1.995	0.025045	1
	6	17 ± 1	18	63.096	3	1.995	0.025045	1
	11	16 ± 1	17	50.119	3	1.995	0.019894	1

Signature:

Alan He

Date: 2020-09-10