

## FCC RF Exposure Evaluation

### 1. Product Information

FCC ID	2AUN8WVP58021
Product Name	bObsweep PetHair Vision Plus Robot Vacuum Cleaner
Test Model	WVP58021, XR411
Power Supply	Adapter 1: Model: DBS012A-1900600U Input: 100-240V~, 50/60Hz, 0.35A Output: 19V---0.6A Adapter 2: Model: GQ12-190060-AU Input: 100-240V~, 50/60Hz, 0.4A MAX Output: 19V---600mA
Modulation Type	802.11b: DSSS 802.11g/802.11n(H20)/802.11n(H40): OFDM IEEE 802.11a/n: OFDM
Antenna Type	PIFA Antenna
Antenna Gain	2.0dBi
Frequency Range	2412 – 2462 MHz / 5180 – 5240 MHz / 5745 – 5825 MHz
Exposure Category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

### 2. Evaluation Method and Limit

Systems operating under the provisions of FCC 47 CFR 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.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is  $\leq 1.0$ . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

### 3. Refer Evaluation Method

[ANSI C95.1–1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1093](#): Radiofrequency radiation exposure evaluation: portable devices

### 3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f <sup>2</sup> )*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f <sup>2</sup> )*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

\*=Plane-wave equivalent power density

### 4. MPE Calculation Method

Predication of MPE limit at a given distance  
Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S=PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

### 5. Antenna Information

WVP58021 and XR411 can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Note
PIFA Antenna	2000 MHz – 2500 MHz	2.0dBi	WLAN Antenna
PIFA Antenna	5000 MHz – 6000 MHz	2.0dBi	WLAN Antenna

**6. Conducted Power Results****[2.4GWIFI Max Conducted Power]**

Mode	Channel	Frequency(MHz)	Max Conducted Power(dBm)
IEEE 802.11b	1	2412	18.72
	6	2437	18.98
	11	2462	18.89
IEEE 802.11g	1	2412	24.14
	6	2437	24.42
	11	2462	24.33
IEEE 802.11n HT20	1	2412	24.19
	6	2437	24.47
	11	2462	24.39
IEEE 802.11n HT40	3	2422	24.94
	6	2437	25.08
	9	2452	25.01

**[5.2GWIFI Max Conducted Power]**

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	36	5180	15.58
	40	5200	16.01
	48	5240	16.35
11N20 SISO	36	5180	15.62
	40	5200	16.04
	48	5240	16.26
11N40 SISO	38	5190	16.29
	46	5230	16.64

**[5.8WIFI Max Conducted Power]**

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	149	5745	9.39
	157	5785	8.68
	165	5825	8.22
11N20 SISO	149	5745	9.44
	157	5785	8.74
	165	5825	8.21
11N40 SISO	151	5755	10.05
	159	5795	9.14

**7.Manufacturing Tolerance****<2.4GWLAN >**

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	24.0	24.0	24.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	24.0	24.0	24.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	24.0	25.0	25.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

**<5.2GWLAN >**

11A (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	15.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	15.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 (Peak)			
Channel	Channel 38	Channel 46	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	

## &lt;5.8G WLAN&gt;

11A (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 SISO (Peak)			
Channel	Channel 151	Channel 159	
Target (dBm)	10.0	9.0	
Tolerance $\pm$ (dB)	1.0	1.0	

**8. Evaluation Results****8.1 Standalone MPE**

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance,  $r=20\text{cm}$ , as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

## 2.4G

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE ( $\text{mW}/\text{cm}^2$ )	MPE Limits ( $\text{mW}/\text{cm}^2$ )
	dBm	mW					
IEEE 802.11b	19.0	79.4328	2.0	1.5849	100%	0.0250	1.0000
IEEE 802.11g	25.0	316.2278	2.0	1.5849	100%	0.0997	1.0000
IEEE 802.11n HT20	25.0	316.2278	2.0	1.5849	100%	0.0997	1.0000
IEEE 802.11 n HT40	26.0	398.1072	2.0	1.5849	100%	0.1255	1.0000

## 5.2G

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE ( $\text{mW}/\text{cm}^2$ )	MPE Limits ( $\text{mW}/\text{cm}^2$ )
	dBm	mW					
IEEE 802.11a	17.0	50.1187	2.0	1.5849	100%	0.0158	1.0000
IEEE 802.11 n HT20	17.0	50.1187	2.0	1.5849	100%	0.0158	1.0000
IEEE 802.11 n HT40	17.0	50.1187	2.0	1.5849	100%	0.0158	1.0000

## 5.8G

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE ( $\text{mW}/\text{cm}^2$ )	MPE Limits ( $\text{mW}/\text{cm}^2$ )
	dBm	mW					
IEEE 802.11a	10.0	10.0000	2.0	1.5849	100%	0.0032	1.0000
IEEE 802.11 n HT20	10.0	10.0000	2.0	1.5849	100%	0.0032	1.0000
IEEE 802.11 n HT40	11.0	12.5893	2.0	1.5849	100%	0.0040	1.0000

**Remark:**

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

## 8.2 Simultaneous Transmission MPE

The sample support one modular and share same antenna, 2.4G WLAN /5GWLAN can be active at the same time, but only with interleaving of packages switched on board level. That means that they don't transmit at the same time. No need consider simultaneous transmission;

## 9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

.....THE END OF REPORT.....