

## FCC RF Exposure Evaluation

### 1. Product Information

FCC ID	2BD5N-SURFERS1M1
Product Name	ROBOTIC POOL SKIMMER
Model Number	Aiper Surfer S1,Aiper Surfer M1
Model Declaration	/
Test Model	Aiper Surfer S1
Power Supply	AC100-240V~ 50/60Hz 0.8A from adapter or DC 10.8V from battery
Modulation Type	<b>2.4G WIFI:</b> 802.11b: DSSS 802.11g/802.11n(H20)/802.11n(H40): OFDM
Antenna Type	PCB Antenna
Antenna Gain	4.81dBi
Frequency Range	802.11b/802.11g/802.11n(H20): 2412MHz~2462MHz 802.11n(H40): 2422MHz~2452MHz
Channel Number	802.11b/802.11g/802.11n(H20): 11 802.11n(H40): 7
Exposure Category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

### 2. Evaluation Method and Limit

According to KDB447498 D01 General RF Exposure Guidance v06 Section 4.3.1 Standalone SAR test exclusion considerations: "Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.<sup>22</sup> The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc. "

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f} (\text{GHz})] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where:}$

- $f$  (GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation

distance is < 5 mm, a distance of 5 mm according to f) in section 4.1 is applied to determine SAR test exclusion.

When one of the following test exclusion conditions is satisfied for all combinations of simultaneous transmission configurations, further equipment approval is not required to incorporate transmitter modules in host devices that operate in the mixed mobile and portable host platform exposure conditions. The grantee is responsible for documenting this according to Class I permissive change requirements. Antennas that qualify for standalone SAR test exclusion must apply the estimated standalone SAR to determine simultaneous transmission test exclusion.

- a) The  $[\sum \text{ of } (\text{the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance}) / 1.6 \text{ W/kg}] + [\sum \text{ of MPE ratios}]$  is  $\leq 1.0$ .
- b) The SAR to peak location separation ratios of all simultaneously transmitting antenna pairs operating in portable device exposure conditions are all  $\leq 0.04$ , and the  $[\sum \text{ of MPE ratios}]$  is  $\leq 1.0$ .

### 3. Limit

#### 3.1 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 2.1091](#): Radiofrequency radiation exposure evaluation: mobile 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

### 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

100043851 can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Note
PCB Antenna	2412 MHz – 2462 MHz	4.81dBi	WiFi Antenna

### 6. Conducted Power Results

#### 2.4G WiFi

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11b	SISO	2412	10.65
		2437	11.32
		2462	11.09
802.11g	SISO	2412	9.94
		2437	10.44
		2462	10.21
802.11n (HT20)	SISO	2412	8.95
		2437	9.32
		2462	9.17
802.11n (HT40)	SISO	2422	9.18
		2437	9.65
		2452	9.71

### 7. Manufacturing Tolerance

**<2.4GHz WiFi >**

802.11b (Peak)			
Channel	Channel1	Channel 6	Channel 11
Target (dBm)	11	11	11
Tolerance $\pm$ (dB)	1.0	1.0	1.0
802.11g (Peak)			
Channel	Channel1	Channel 6	Channel 11
Target (dBm)	10	10	10
Tolerance $\pm$ (dB)	1.0	1.0	1.0
802.11n(HT20) (Peak)			
Channel	Channel1	Channel 6	Channel 11
Target (dBm)	9	9	9
Tolerance $\pm$ (dB)	1.0	1.0	1.0
802.11n(HT40) (Peak)			
Channel	Channel1	Channel 6	Channel 11
Target (dBm)	9	10	10
Tolerance $\pm$ (dB)	1.0	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.

### 2.4GHz WiFi

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW					
802.11b	12	15.85	4.81	3.0269	100%	0.0095	1.0000
802.11g	11	12.59	4.81	3.0269	100%	0.0076	1.0000
802.11n(HT20)	10	10.00	4.81	3.0269	100%	0.0060	1.0000
802.11n(HT40)	11	12.59	4.81	3.0269	100%	0.0076	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 supports a modular, 1 antennas, No need to 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.....