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RF Exposure Evaluation Report

Report No.: CQASZ20210300215E-02

Applicant: Zhuhai Kaihao Electronics Co., Ltd

Address of Applicant: 2nd Floor, Building C, No.3 Pinggongyi Road, Zhuhai, Guangdong, China.

Equipment Under Test (EUT):

EUT Name: Robot Vacuum Cleaner

Model No.: A3, A3-SWT, A3-SBL, A3-SGY, A3-SSV, A3-SMR, A3-SMS, A3-WGD, A3-WWT, A3-WBL, A3-WGY, A3-WSL, A3-WMR, A3-WMS, A3-CBL, A3-CWT, A3-CGY, A3-CSL, A3-CTB, A3-CTW, A3-CTG, A3-CTS, S2-SWT, S2-SBL, S2-SGY, S2-SSV, S2-SGE, S2-SPN, S2-WWT, S2-WBL, S2-WGY, S2-WSV, S2-WGE, S2-WPN, S3-WWT, S3-WBL, S3-WGY, S3-WSV, S3-WGE, S3-WPN, S3-SWT, S3-SBL, S3-SGY, S3-SSV, S3-SGE, S3-SPN

Test Model No.: A3

Brand Name: IMASS

FCC ID: 2AOIA-A3

Standards: 47 CFR Part 1.1307 47 CFR Part 1.1310
KDB447498D01 General RF Exposure Guidance v06

Date of Test: 2021-3-6 to 2021-3-16

Date of Issue: 2021-3-16

Test Result: **PASS***

*In the configuration tested, the EUT complied with the standards specified above

Tested By:

Jun Li

(Jun Li)

Reviewed By:

Ares Liu

(Ares Liu)

Approved By:

Sheek Luo

(Sheek Luo)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20210300215E-02	Rev.01	Initial report	2021-3-16

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3 General Information

3.1 Client Information

Applicant:	Zhuhai Kaihao Electronics Co., Ltd
Address of Applicant:	2nd Floor, Building C, No.3 Pinggongyi Road, Zhuhai, Guangdong, China.
Manufacturer:	Zhuhai Kaihao Electronics Co., Ltd
Address of Manufacturer:	2nd Floor, Building C, No.3 Pinggongyi Road, Zhuhai, Guangdong, China.
Factory:	Zhuhai Kaihao Electronics Co., Ltd
Address of Factory:	2nd Floor, Building C, No.3 Pinggongyi Road, Zhuhai, Guangdong, China.

3.2 General Description of EUT

Product Name:	Robot Vacuum Cleaner
Model No.:	A3, A3-SWT, A3-SBL, A3-SGY, A3-SSV, A3-SMR, A3-SMS, A3-WGD, A3-WWT, A3-WBL, A3-WGY, A3-WSL, A3-WMR, A3-WMS, A3-CBL, A3-CWT, A3-CGY, A3-CSL, A3-CTB, A3-CTW, A3-CTG, A3-CTS, S2-SWT, S2-SBL, S2-SGY, S2-SSV, S2-SGE, S2-SPN, S2-WWT, S2-WBL, S2-WGY, S2-WSV, S2-WGE, S2-WPN, S3-WWT, S3-WBL, S3-WGY, S3-WSV, S3-WGE, S3-WPN, S3-SWT, S3-SBL, S3-SGY, S3-SSV, S3-SGE, S3-SPN
Test Model No.:	A3
Trade Mark:	IMASS
Hardware version:	A3.0
Software version:	A3.1
Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422 MHz to 2452MHz
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n(HT40): 7 Channels
Channel Separation:	5MHz
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11 g/n(HT20)/n(HT40) : OFDM
Product Type:	☒ Mobile ☐ Portable ☐ Fix Location
Test Software of EUT:	AmebaD_mptool_2V1
Antenna Type	PCB Antenna
Antenna Gain	2.5dBi
Power Supply:	AC100-240V 50/60HZ Battery voltage 14.4V 2500mAh

Model No.: A3, A3-SWT, A3-SBL, A3-SGY, A3-SSV, A3-SMR, A3-SMS, A3-WGD, A3-WWT, A3-WBL, A3-WGY, A3-WSL, A3-WMR, A3-WMS, A3-CBL, A3-CWT, A3-CGY, A3-CSL, A3-CTB, A3-CTW, A3-CTG, A3-CTS, S2-SWT, S2-SBL, S2-SGY, S2-SSV, S2-SGE, S2-SPN , S2-WWT, S2-WBL, S2-WGY, S2-WSV, S2-WGE, S2-WPN,
S3-WWT, S3-WBL, S3-WGY, S3-WSV, S3-WGE, S3-WPN, S3-SWT, S3-SBL, S3-SGY, S3-SSV, S3-SGE, S3-SPN

Only the model A3, was tested, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, with difference being color of appearance and model name.

4 MPE Evaluation

4.1 RF Exposure Compliance Requirement

4.1.1 Limitst

According to FCC Part1.1310: 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 part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	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

Friis Formula

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 = gain of antenna in linear scale

π = 3.1416

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

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.1.3 EUT RF Exposure

1) For 2.4G WIFI

Antenna Gain: 2.5dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.78 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

802.11b mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	3.44	2.5±1	3.5	2.239
Middle(2437MHz)	5.16	4±1	5	3.162
Highest(2462MHz)	5.08	4±1	5	3.162
802.11g mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	-0.17	-1±1	0	1
Middle(2437MHz)	1.13	0±1	1	1.259
Highest(2462MHz)	1.05	0±1	1	1.259
802.11n(HT20)mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	-0.46	-0.5±1	0.5	1.122
Middle(2437MHz)	1.03	0±1	1	1.259
Highest(2462MHz)	0.76	0±1	1	1.259
802.11n(HT40)mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2422MHz)	0.67	0±1	1	1.259
Middle(2437MHz)	1.13	0±1	1	1.259
Highest(2452MHz)	1.12	0±1	1	1.259

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
5	2.5	0.0011	1.0	PASS

Note: 1) Refer to report No. CQASZ20210300215E-01 for EUT test Max Conducted Average Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (3.162 * 1.78) / (4 * 3.1416 * 20^2) = 0.0011$