



## Shenzhen Huaxia Testing Technology Co., Ltd

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

Telephone: +86-755-26648640

Fax: +86-755-26648637

Website: [www.cqa-cert.com](http://www.cqa-cert.com)

Report Template Version: V04

Report Template Revision Date: 2018-07-06

# RF Exposure Evaluation Report

**Report No. :** CQASZ20210701102E-03

**Applicant:** Zhuhai Kaihao Electronics Co., Ltd

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

**Equipment Under Test (EUT):**

**Product:** 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-A3pro

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

**Date of Receipt:** 2021-7-16

**Date of Test:** 2021-7-16 to 2021-8-4

**Date of Issue:** 2021-8-4

**Test Result :** **PASS\***

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

**Tested By:**

*Lewis Zhou*

(Lewis Zhou)

**Reviewed By:**

*Rock Huang*

(Rock Huang)

**Approved By:**

*Jack Ai*

(Jack Ai)



## 1 Version

### Revision History Of Report

| Report No.           | Version | Description    | Issue Date |
|----------------------|---------|----------------|------------|
| CQASZ20210701102E-03 | Rev.01  | Initial report | 2021-8-4   |

## 2 Contents

|                                                             | Page |
|-------------------------------------------------------------|------|
| 1 VERSION.....                                              | 2    |
| 2 CONTENTS.....                                             | 3    |
| 3 GENERAL INFORMATION.....                                  | 4    |
| 3.1 CLIENT INFORMATION.....                                 | 4    |
| 3.2 GENERAL DESCRIPTION OF EUT.....                         | 4    |
| 4 RF EXPOSURE EVALUATION.....                               | 6    |
| 4.1 RF EXPOSURE COMPLIANCE REQUIREMENT.....                 | 6    |
| 4.1.1 Limits.....                                           | 6    |
| 4.1.2 Test Procedure.....                                   | 6    |
| 4.1.3 EUT RF Exposure Evaluation standalone operations..... | 7    |

### 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                                                                                                                                                                                                                                                                                                                                                                      |
| EUT Supports Radios application | Bluetooth Dual mode 2402-2480MHz<br>2.4GHz: Wi-Fi: 802.11b/g/n(HT20): 2412MHz ~2462 MHz;                                                                                                                                                                                                                                                                                   |
| Hardware Version:               | A3PPRO-V1.1                                                                                                                                                                                                                                                                                                                                                                |
| Software Version:               | A3PPRO-V1.2                                                                                                                                                                                                                                                                                                                                                                |
| Power Supply:                   | Battery voltage 14.4V= 3200mAh 2600mAh, Charge by adapter                                                                                                                                                                                                                                                                                                                  |
| Adapter:                        | Adapter Mode: CZH024190100USWM<br>INPUT: 100-240V~ 50/60Hz 0.8A Max<br>Output: 19.0V= 1000mA 19.0W<br>Adapter Mode: MX20W-1901000U<br>INPUT: 100-240V~ 50/60Hz 0.5A<br>OUTOUT: 19.0V= 1.0A 19.0W<br>Adapter Mode: MX20Z-1901000<br>INPUT: 100-240V~ 50/60Hz 0.5A<br>OUTOUT: 19.0V= 1.0A 19.0W                                                                              |
| Product Type:                   | <input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable <input type="checkbox"/> Fix Location                                                                                                                                                                                                                                                         |
| Test Software of EUT:           | RTL8821CU Tool (manufacturer declare )                                                                                                                                                                                                                                                                                                                                     |
| Antenna Type:                   | PCB Antenna                                                                                                                                                                                                                                                                                                                                                                |
| Antenna Gain:                   | 2.5 dBi                                                                                                                                                                                                                                                                                                                                                                    |

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 RF Exposure Evaluation

### 4.1 RF Exposure Compliance Requirement

#### 4.1.1 Limits

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 <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 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                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3–1.34 .....                                                 | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30 .....                                                  | 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

Friis Formula

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

Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = 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

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. 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 Evaluation standalone operations

##### 1) For BLE

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

| GFSK mode        |                            |                            |                       |       |
|------------------|----------------------------|----------------------------|-----------------------|-------|
| Test channel     | Peak Output Power<br>(dBm) | Tune up tolerance<br>(dBm) | Maximum tune-up Power |       |
|                  |                            |                            | (dBm)                 | (mW)  |
| Lowest(2402MHz)  | 2.02                       | 1.5±1                      | 2.5                   | 1.778 |
| Middle(2440MHz)  | 2.55                       | 2±1                        | 3                     | 1.995 |
| Highest(2480MHz) | 3.22                       | 2.5±1                      | 3.5                   | 2.239 |

The worst case:

| Maximum tune-up Power<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | Limit | Result |
|-------------------------------|-----------------------|--------------------------------------------------------|-------|--------|
| 2.239                         | 2.5                   | 0.0008                                                 | 1.0   | PASS   |

Note: 1) Refer to report No. CQASZ20200600577E-03 for EUT test Max Conducted Peak Output Power value.

2)  $P_d = (P_{out} * G) / (4 * \pi * R^2) = (2.239 * 1.78) / (4 * 3.1416 * 20^2) = 0.0008$

#### 4) 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      | Peak Output Power<br>(dBm) | Tune up tolerance<br>(dBm) | Maximum tune-up Power |        |
|                   |                            |                            | (dBm)                 | (mW)   |
| Lowest(2412MHz)   | 7.75                       | 7±1                        | 8                     | 6.310  |
| Middle(2437MHz)   | 9.16                       | 8.5±1                      | 9.5                   | 8.913  |
| Highest(2462MHz)  | 8.52                       | 8±1                        | 9                     | 7.943  |
| 802.11g mode      |                            |                            |                       |        |
| Test channel      | Peak Output Power<br>(dBm) | Tune up tolerance<br>(dBm) | Maximum tune-up Power |        |
|                   |                            |                            | (dBm)                 | (mW)   |
| Lowest(2412MHz)   | 9.18                       | 8.5±1                      | 9.5                   | 8.913  |
| Middle(2437MHz)   | 10.47                      | 9.5±1                      | 10.5                  | 11.220 |
| Highest(2462MHz)  | 9.97                       | 9±1                        | 10                    | 10     |
| 802.11n(HT20)mode |                            |                            |                       |        |
| Test channel      | Peak Output Power<br>(dBm) | Tune up tolerance<br>(dBm) | Maximum tune-up Power |        |
|                   |                            |                            | (dBm)                 | (mW)   |
| Lowest(2412MHz)   | 9.3                        | 8.5±1                      | 9.5                   | 8.913  |
| Middle(2437MHz)   | 10.52                      | 10±1                       | 11                    | 12.589 |
| Highest(2462MHz)  | 10.02                      | 9.5±1                      | 10.5                  | 11.220 |

The worst case:

| Maximum tune-up Power<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm²) | Limit | Result |
|-------------------------------|-----------------------|-------------------------------------------|-------|--------|
| 12.589                        | 2.5                   | 0.0045                                    | 1.0   | PASS   |

Note: 1) Refer to report No. CQASZ20200600577E-03 for EUT test Max Conducted Average Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (12.589 * 1.78) / (4 * 3.1416 * 20^2) = 0.0045$$