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RF Exposure Evaluation Report

Report No. : CQASZ20210400025EX-04

Applicant: Protech International Group Co., Ltd

Address of Applicant: F2, Block A, Yonghua Industrial Park, #91 Makan South Road, Nanshan, Shenzhen, 518000 China

Manufacturer: Shenzhen Ranboda Technology Co., Ltd

Address of Manufacturer: Weishi Road No.2, Ailian, Longcheng Street, Longgang District, Shenzhen, Guangdong, China

Equipment Under Test (EUT):

Product: Air Quality Detector

All Model No.: PTH-8, PTH-1, PTH-2, PTH-3, PTH-3M, PTH-4, PTH-5, PTH-6, PTH-7, PTH-9, PTH-10, PTH-11, PTH-12, PTH-13, PTH-14, PTH-15, PT19D, PT19DE, PT19DB, PT19DW, PTH-16, PTH-17, PTH-18, PTH-19, PTH-20, PT201, PT201B, PT201C, PT20A, PT20B, PT20C, PTX-01, PTX-02

Test Model No.: PTH-8

Brand Name: /

FCC ID: 2AZMF-PROTECH

47 CFR Part 1.1307

Standards: 47 CFR Part 1.1310

KDB447498D01 General RF Exposure Guidance v06

Date of Test: Apr. 13, 2021 – Apr. 21, 2021

Date of Issue: Apr. 21, 2021

Test Result : PASS

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
CQASZ20210400025EX-04	Rev.01	Initial report	Apr. 21, 2021

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3 General Information

3.1 Client Information

Applicant:	Protech International Group Co., Ltd
Address of Applicant:	F2, Block A, Yonghua Industrial Park, #91 Makan South Road, Nanshan, Shenzhen, 518000 China
Manufacturer:	Protech International Group Co., Ltd
Address of Manufacturer:	F2, Block A, Yonghua Industrial Park, #91 Makan South Road, Nanshan, Shenzhen, 518000 China

3.2 General Description of EUT

Product Name:	Air Quality Detector
Test Model No.:	PTH-8
Trade Mark:	/
Hardware Version:	94V-0
Software Version:	V1.0
Product Type:	☐ Mobile ☐ Portable ☒ Fix Location
Power Supply:	DC 3.7V from battery Charging : DC 5.0V 1A

Note:

This equipment is a fixed carbon dioxide detector, which needs to be placed in a fixed position for normal use. A desktop stand is set on the back for convenient placement in a fixed position for continuous monitoring

3.3 General Description of BT

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	BT-V5.0
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, $\pi/4$ DQPSK, 8DPSK
Transfer Rate:	1Mbps/2Mbps/3Mbps
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Antenna Type:	PCB antenna
Antenna Gain:	0dBi

3.4 General Description of BLE

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	BLE
Modulation Type:	GFSK
Transfer Rate:	1Mbps
Number of Channel:	40
Antenna Type:	PCB antenna

Antenna Gain:	0dBi
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3.5 General Description of 2.4G WIFI

Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(H40): 2422MHz~2452MHz
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7
Channel Separation:	5MHz
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g : OFDM IEEE for 802.11n(HT20): OFDM IEEE for 802.11n(HT40): OFDM
Antenna Type	PCB antenna
Antenna Gain	0dBi

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 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 Evaluation standalone operations

1) For BT/BLE

Antenna Gain: 0dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.0 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

GFSK mode				
Test Channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	-2.827	-3±1	-2	0.631
Middle(2441MHz)	-2.756	-3±1	-2	0.631
Highest(2480MHz)	-3.380	-3±1	-2	0.631
π/4DQPSK mode				
Lowest(2402MHz)	-0.612	-1±1	0	1.00
Middle(2441MHz)	-0.605	-1±1	0	1.00
Highest(2480MHz)	-1.166	-1±1	0	1.00
8DPSK mode				
Lowest(2402MHz)	-0.025	-1±1	0	1.00
Middle(2441MHz)	-0.031	-1±1	0	1.00
Highest(2480MHz)	-0.658	-1±1	0	1.00

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
1	0	0.0002	1.0	PASS

Note: 1) Refer to report No. : CQASZ20210400025EX-01 and CQASZ20210400025EX-02for EUT test Max Conducted average Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (1.00 * 1.00) / (4 * 3.1416 * 20^2) = 0.0002 \text{ mW/cm}^2$

3) EUT Bluetooth module is more than 20cm away from the human body

BLE:

GFSK mode				
Test Channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	-0.839	0±1	1	1.259
Middle(2440MHz)	0.582	0±1	1	1.259
Highest(2480MHz)	-0.968	0±1	1	1.259

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
1.259	0	0.0003	1.0	PASS

Note: 1) Refer to report No. : CQASZ20210400025EX-01 and CQASZ20210400025EX-02 for EUT test Max Conducted average Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (1.259 * 1.00) / (4 * 3.1416 * 20^2) = 0.0003 \text{ mW/cm}^2$

3) EUT Bluetooth module is more than 20cm away from the human body

2)For WIFI:

Antenna Gain: 0dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.0 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

802.11b mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	13.12	13±1	14	25.119
Middle(2437MHz)	ANT1	13.21	13±1	14	25.119
Highest(2462MHz)	ANT1	12.26	13±1	14	25.119
802.11g mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	13.36	13±1	14	25.119
Middle(2437MHz)	ANT1	13.76	13±1	14	25.119
Highest(2462MHz)	ANT1	12.62	13±1	14	25.119
802.11n(HT20) SISO mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	10.40	10±1	11	12.589
Middle(2437MHz)	ANT1	9.48	10±1	11	12.589
Highest(2462MHz)	ANT1	9.59	10±1	11	12.589
802.11n(HT40) SISO mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2422MHz)	ANT1	9.54	9±1	10	10
Middle(2437MHz)	ANT1	9.16	9±1	10	10
Highest(2452MHz)	ANT1	9.27	9±1	10	10

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
25.119	0	0.005	1.0	PASS

Note: 1) Refer to report No. : CQASZ20210400025EX-03 for EUT test Max Conducted average Output Power value.

2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (25.119 \cdot 1.00) / (4 \cdot 3.1416 \cdot 20^2) = 0.005 \text{ mW/cm}^2$

3) EUT wifi2.4G module is more than 20cm away from the human body