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Report Template Version: V04

Report Template Revision Date: 2018-07-06

RF Exposure Evaluation Report

Report No.: CQASZ20210300189E-04
Applicant: FUZHOU EMAX ELECTRONIC CO., LTD.
Address of Applicant: Building #12-#16, Cangshan Industrial Area, Juyuanzhou, Jinshan District, Fuzhou, China.
Equipment Under Test (EUT):
EUT Name: Professional weather station
Model No.: W6
Brand Name: N/A
FCC ID: WEC-W6
Standards: 47 CFR Part 1.1307
47 CFR Part 2.1093
KDB447498D01 General RF Exposure Guidance v06
Date of Receipt: 2021-3-2
Date of Test: 2021-3-2 to 2021-4-28
Date of Issue: 2021-4-28
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
CQASZ20210300189E-04	Rev.01	Initial report	2021-4-28

2 Contents

	Page
1 VERSION.....	2
2 CONTENTS.....	3
.....	3
3 GENERAL INFORMATION.....	4
3.1 CLIENT INFORMATION.....	4
3.2 GENERAL DESCRIPTION OF EUT.....	4
3.3 GENERAL DESCRIPTION OF WIFI.....	5
3.4 GENERAL DESCRIPTION OF BLE.....	5
3.5 GENERAL DESCRIPTION OF 433.92MHZ.....	5
4 MPE EVALUATION.....	6
4.1 RF EXPOSURE COMPLIANCE REQUIREMENT.....	6
4.1.1 Limits.....	6
4.1.2 EUT RF Exposure.....	7
4.1.3 EUT RF Exposure Evaluation simultaneous transmission operations.....	10

3 General Information

3.1 Client Information

Applicant:	FUZHOU EMAX ELECTRONIC CO., LTD.
Address of Applicant:	Building #12-#16, Cangshan Industrial Area, Juyuanzhou, Jinshan District, Fuzhou, China.
Manufacturer:	FUZHOU EMAX ELECTRONIC CO., LTD.
Address of Manufacturer:	Building #12-#16, Cangshan Industrial Area, Juyuanzhou, Jinshan District, Fuzhou, China.
Factory:	FUZHOU EMAX ELECTRONIC CO., LTD.
Address of Factory:	Building #12-#16, Cangshan Industrial Area, Juyuanzhou, Jinshan District, Fuzhou, China.

3.2 General Description of EUT

Product Name:	Professional weather station
Model No.:	W6
Trade Mark:	N/A
Hardware Version:	V1.0
Software Version:	V1.0
Power Supply:	EUT is powered by 2*AA size batteries Adapter Model: GQ07-050120-AUU Input: AC100-240V~ 50/60Hz 0.3A Max Output: DC5V 1.2 A 6.0W

3.3 General Description of WIFI

Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels
Channel Separation:	5MHz
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g : OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(HT20) : OFDM (64QAM, 16QAM,QPSK,BPSK)
Transfer Rate:	IEEE for 802.11b: 1Mbps/2Mbps/5.5Mbps/11Mbps IEEE for 802.11g : 6Mbps/9Mbps/12Mbps/18Mbps/24Mbps/36Mbps/48Mbps/54Mbps IEEE for 802.11n(HT20) : 6.5Mbps/13Mbps/19.5Mbps/26Mbps/39Mbps/52Mbps/58.5Mbps/65Mbps
Product Type:	☐ Mobile ☐ Portable ☒ Fix Location
Antenna Type:	PCB antenna
Antenna Gain:	0dBi

3.4 General Description of BLE

Operation Frequency:	2402MHz~2480MHz
Modulation Type:	GFSK
Transfer Rate:	1Mbps
Number of Channel:	40
Product Type:	☐ Mobile ☐ Portable ☒ Fix Location
Antenna Type:	PCB antenna
Antenna Gain:	0dBi

3.5 General Description of 433.92MHz

Frequency Range:	433.92MHz
Modulation Type:	PSK
Number of Channels:	1
Product Type:	☐ Mobile ☐ Portable ☒ Fix Location
Antenna Type:	PCB antenna
Antenna Gain:	0dBi

4 MPE 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 EUT RF Exposure

1) For BLE

Antenna Gain: 0 dBi

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)	-2.29	-3±1	-2	0.631
Middle(2440MHz)	-1.95	3±1	-2	0.631
Highest(2480MHz)	-1.91	-3±1	-2	0.631

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
0.631	0	0.00012553	1	PASS

Note: 1) Refer to report No. CQASZ20210300189E for EUT test Max Conducted Peak Output Power value.

2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (0.631 \cdot 1.0) / (4 \cdot 3.1416 \cdot 20^2) = 0.00012553$

Remark: The Max Conducted Peak Output Power data refer to report Report No.: CQASZ20210300189E-01

2) For 2.4G WiFi

Antenna Gain: 0 dBi

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	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	3.48	2.5±1	3.5	2.239
Middle(2437MHz)	4.43	3.5±1	4.5	2.818
Highest(2462MHz)	3.85	3±1	4	2.512

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm²)	Limit	Result
2.818	0	0.00056062	1.0	PASS

Note: 1) Refer to report No. CQASZ20210200189E for EUT test Max Conducted Peak Output Power value.

2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (2.818 \cdot 1.0) / (4 \cdot 3.1416 \cdot 20^2) = 0.00056062$

Remark: The Max Conducted Peak Output Power data refer to report Report No.: CQASZ20210300189E-02
BDR and BLE can not simultaneous transmitting at same time.

3)EUT RF Exposure

pt = transmitter output power in watts,
gt = numeric gain of the transmitting antenna (unitless),
E = electric field strength in V/m, $10^{((dB\mu V/m)/20)/10^6}$,
d = measurement distance in meters (m)---3m,

The worst case (refer to report CQASZ20201001281E-01) is below:

Antenna polarization: Horizontal		
Frequency (MHz)	Level (dBuV/m)	Polarization
433.92	83.84	Peak
433.92	57.84	Average

Antenna polarization: Vertical		
Frequency (MHz)	Level (dBuV/m)	Polarization
433.92	81.79	Peak
433.92	55.79	Average

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
0.073	0	0.00001452	0.28928	PASS

Note: 1) Refer to report No. CQASZ20210300189E-03 for EUT test Max Conducted Peak Output Power value.
2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (0.073 \cdot 1.0) / (4 \cdot 3.1416 \cdot 20^2) = 0.00001452$
3) $Limit = f / 1500 = 433.92 / 1500 = 0.28928$

For 433.92MHz wireless:

Field strength = 83.84dBuV/m @3m

Ant. gain 0dBi; so Ant numeric gain=1.0

So $pt = \{ [10^{(83.84/20)} / 10^6 \cdot 3]^2 / 30 / 1.0 \} \cdot 1000mW = 0.073mW$

4.1.3 EUT RF Exposure Evaluation simultaneous transmission operations

According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits :

Simultaneous transmission mode	The sum of the ratios	Result
2.4G WIFI + BLE + 433.92	$0.00012553/1 + 0.00056062/1 + 0.00001452/0.28928$	$=0.00073634 < 1$