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RF Exposure Evaluation Report

Report No.: CQASZ20210600916E-02
Applicant: AFCCO Inc.
Address of Applicant: 122 Gayoso Ave Memphis, TN 38103 USA
Equipment Under Test (EUT):
EUT Name: MARINE
Model No.: SMC3, MXASB35V3
Test Model No.: SMC3
Brand Name: MEMPHIS
FCC ID: QWI-SMC3
Standards: 47 CFR Part 1.1307
47 CFR Part 2.1091
KDB447498D01 General RF Exposure Guidance v06
Date of Receipt: 2021-06-25
Date of Test: 2021-06-25 to 2021-07-06
Date of Issue: 2021-07-06
Test Result : PASS*

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

Tested By:

Lewis Zhou

(Lewis Zhou)

Reviewed By:

Jun Li

(Jun Li)

Approved By:

Jack Ai

(Jack Ai)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20210600916E-02	Rev.01	Initial report	2021-07-06

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3 General Information

3.1 Client Information

Applicant:	AFCO Inc.
Address of Applicant:	122 Gayoso Ave Memphis, TN 38103 USA
Factory:	Eastern Partner Limited
Address of Factory:	Room 1413, ICC Tower, Fuhau San Road, Futian CBD, Shenzhen 518048, China

3.2 General Description of EUT

Product Name:	MARINE
Model No.:	SMC3, MXASB35V3
Test Model No.:	SMC3
Trade Mark:	MEMPHIS
Hardware Version:	SMC3_C200_V1.01_210423
Software Version:	SMC3-V1.01
EUT Supports Radios application:	Bluetooth dual mode: 2402-2480MHz
Power Supply:	DC 12V

3.3 General Description of BT Classic

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	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
Product Type:	☐ Mobile ☐ Portable ☒ Fix Location
Test Software of EUT:	RF test (manufacturer declare)
Antenna Type:	PCB antenna
Antenna Gain:	-0.58 dBi
Power Supply:	DC12.0V

Note:

All model:SMC3,MXASB35V3

Only the model SMC3 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 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.

1) For BT Classic

Antenna Gain: -0.58dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.87 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)	0.330	-0.5±1.0	0.5	1.122
Middle(2441MHz)	-0.070	-1±1.0	0	1
Highest(2480MHz)	-0.760	-2.5±1.0	-0.5	1.228
π/4DQPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	2.580	2±1.0	3	1.995
Middle(2441MHz)	2.170	1.5±1.0	2.5	1.778
Highest(2480MHz)	1.440	0.5±1.0	1.5	1.413
8DPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	3.150	2.5±1.0	3.5	2.239
Middle(2441MHz)	2.710	2±1.0	3	1.995
Highest(2480MHz)	1.960	1±1.0	2	1.585

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
2.239	-0.58	0.00039	1.0	PASS

Note: 1) Refer to report No. CQASZ20210600916E-01 for EUT test Max Conducted Peak Output Power value.

2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (2.239 \cdot 0.87) / (4 \cdot 3.1416 \cdot 20^2) = 0.00039$

BDR and BLE can not simultaneous transmitting at same time.