FCC RF Exposure Evaluation

1. Product Information

FCC ID	:	2AIY2-MINI-SONO
Product name	:	Bluetooth Speaker
Test Model	:	MINI SONO
Power supply	:	Input: DC 5V, 1000mA DC 3.7V by Rechargeable Li-ion Battery, 4000mAh
Operation frequency	:	2402MHz-2480MHz
Channel Number	:	79 Channels for Bluetooth V5.0 (DSS) 40 channels for Bluetooth V5.0(DTS)
Channel Spacing	:	1MHz for Bluetooth V5.0 (DSS) 2MHz for Bluetooth V5.0 (DTS)
Modulation Type	:	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V5.0 (DSS) GFSK for Bluetooth V5.0(DTS)
Bluetooth Version	:	V5.0
Antenna Type	:	PCB Antenna
Antenna Gain	:	0dBi(Max.)
Hardware version	:	FF023 MAIN V1.1 FF023 KEY V1.0
Software version	:	BK3266.P32L.4M_FF023_(Mini Sono)_RY_MIC_NOTF_NOUSB_(ff023eaudio 20191225B)YYEQ_MFB.XX_BUCK_V2.1_20200224_CRC_(d319).bin
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Mobile Device

2. Evaluation method and Limit

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is $\leqslant$ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3. Refer Evaluation Method

3. 1 Refer Evaluation Method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1093: Radiofrequency radiation exposure evaluation: portable devices

3. 2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
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

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

*=Plane-wave equivalent power density

4. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

5. Antenna Information

ZJ-MWIR-RGB can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Note
Antenna	PCB Antenna	2000 MHz – 2500 MHz	0dBi	BT Antenna

6.Conducted Power Results

<BT>

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	-2.602
	39	2441	-3.708
	78	2480	-0.462
π/4DQPSK	0	2402	-0.232
	39	2441	-1.532
	78	2480	-0.441
8DPSK	0	2402	0.306
	39	2441	-1.103
	78	2480	-2.823

<BT LE>

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	0.115
	19	2440	-1.191
	39	2480	-2.957

7.Manufacturing Tolerance

<BT>

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	-2.0	-3.0	0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0	-1.0	0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0	-1.0	-2.0
Tolerance ±(dB)	1.0	1.0	1.0

<BT LE>

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	0	-1.0	-2.0
Tolerance ±(dB)	1.0	1.0	1.0

8.Evaluation Results

8.1 Standalone MPE

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, r =20cm, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

<BT >

Modulation Type	Output power		Antenna Gain (dBi)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
GFSK	1.0	1.2589	0	100%	0.0003	1.0000
π/4DQPSK	1.0	1.2589	0	100%	0.0003	1.0000
8DPSK	1.0	1.2589	0	100%	0.0003	1.0000

<BT LE>

Modulation Type	Output power		Antenna Gain (dBi)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
GFSK	1.0	1.2589	0	100%	0.0003	1.0000

Remark:

1. Output power including tune-up tolerance;

2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

8.2 Simultaneous Transmission MPE

The sample support one BT modular and one antenna, no need consider simultaneous transmission;

9.Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

.....THE END OF REPORT.....