RF Exposure Evaluation

FCC ID: 2BBNB-BT84B

1. Client Information

Applicant	:	Shenzhen James Audio Technology Co., Ltd
Address	:	401, Building A, JMR Industrial Park, No.2 Guiyuan Road,Guixiang Community, Guanlan Town, Longhua District, Shenzhen, China
Manufacturer	:	Shenzhen James Audio Technology Co., Ltd
Address	:	401, Building A, JMR Industrial Park, No.2 Guiyuan Road,Guixiang Community, Guanlan Town, Longhua District, Shenzhen, China

2. General Description of EUT

EUT Name	:	Bluetooth FM Transmitter	
Model(s) No.	:	BT84B, 20088	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is different customers, different model name.	
Product Description	:	Operation Frequency:	Bluetooth V5.3: 2402MHz~2480MHz
		RF Output Power:	BT: 3.628dBm
		Antenna Gain:	-0.68dBi PCB Antenna
		Operation Frequency:	FM: 88.1-107.9 MHz
		Number of Channel:	199(Channel spacing 100KHz)
		Antenna Gain:	-0.58dBi spring Antenna
Power Supply	:	Input: DC 12V/24V	
Software Version	:	2023-03-27-(4EBD-B7C4BDB9)-(GadJet AU23)-JMS-BT84—6956C4-V0.0.7	
Hardware Version	:	BT84_6956C+8027_V1.1	
Remark: The antenna gain provided by the applicant, the adapter and verified for the RF conduction test and adapter provided by TOBY test lab.			

Note: More test information about the EUT please refer the RF Test Report.

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The RF Exposure Evaluation for FCC:

SAR Test Exclusion Calculations

1. FCC: According to KDB 447498 D01 Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies v06.

(1) Clause 4.3: General SAR test reduction and exclusion guidance

Sub clause 4.31: Standalone SAR test exclusion considerations

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6GHz at test separation distance≤5 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation, mm)]*[√$f_{(GHz)}$] ≤3.0 for 1-g SAR

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation, mm)]*[√$f_{(GHz)}$] ≤7.5.0 for 10-g SAR

2. Summary simultaneous transmission for SAR Exclusion

The SAR exemption limits outlined in clause 4.3.2(b) of KDB 447498 have been derived based on an approximate SAR value of 0.4 W/kg using half-wave dipole antennas Footnote 1. As such, when simultaneous transmitter SAR evaluations include transmitters that have been exempt from routine SAR evaluation, the SAR must be estimating based on the ratio between the maximum tune-up tolerance limit of the transmitter that has been exempt and the exemption limit at the specific distance and frequency for that transmitter. This ratio must be multiplied by 0.4 W/kg(2.0 W/kg for controlled use and 1.0 W/kg for limb worn devices) in order to calculate the estimated SAR level.

The estimate SAR value is calculated based the following equation:

(maximum power level including tune-up tolerance for transmitter A / maximum power level of exemption at the same frequency and distance) * 0.4W/kg

1) [(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)]·[$\sqrt{f_{(GHz)}}/x$] W/kg, for *test separation distances* ≤ 50 mm;

where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distance* is > 50 mm.[37]

The [Σ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + [Σ of MPE ratios] is ≤ 1.0.

The SAR to peak location separation ratios of all simultaneously transmitting antenna pairs operating in portable device exposure conditions are all ≤ 0.04, and the [Σ of MPE ratios] is ≤ 1.0.

Calculation:

Test separation: 5mm						
Bluetooth Mode (GFSK)						
Frequency (GHz)	**Conducted Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**Max power of tune up tolerance (mw)**	**Calculation Value**	**Threshold Value**
2.402	2.71	3±1	4	2.512	0.779	**3.0**
2.441	2.364	2±1	3	1.995	0.623	**3.0**
2.480	1.995	1±1	2	1.585	0.499	**3.0**
Bluetooth Mode (Pi/4-DQPSK)						
Frequency (GHz)	**Conducted Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**Max power of tune up tolerance (mw)**	**Calculation Value**	**Threshold Value**
2.402	3.224	3±1	4	2.512	0.779	**3.0**
2.441	2.948	2±1	3	1.995	0.623	**3.0**
2.480	2.556	2±1	3	1.995	0.628	**3.0**
Bluetooth Mode (8-DPSK)						
Frequency (GHz)	**Conducted Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**Max power of tune up tolerance (mw)**	**Calculation Value**	**Threshold Value**
2.402	3.628	3±1	4	2.512	0.779	**3.0**
2.441	3.305	3±1	4	2.512	0.785	**3.0**
2.480	2.861	2±1	3	1.995	0.628	**3.0**

$$E = EIRP - 20\log D + 104.8$$

where:

E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

EIRP=E-104.8+20logD=56.59-104.8+20log3 = -38.67dBm
EIRP=E-104.8+20logD=49.02-104.8+20log3 = -46.24dBm
EIRP=E-104.8+20logD=55.66-104.8+20log3 = -39.60dBm

Frequency (MHz)	Measured Power (dBm)	Tune up Tolerance ± (dB)	Calculation Value	Threshold Value
88.1	-38.67	-38±1	0.00001184	3.0
98.1	-46.24	-46±1	0.00000198	3.0
107.9	-39.60	-39±1	0.00001041	3.0
Note: At separation distance of ≤5 mm				

Summary simultaneous transmission results

Simultaneous Transmission for SAR Exclusion

The sample support one BT modular and one FM modular, they supports difference antenna, need consider simultaneous transmission;
∑ of (the highest measured or estimated SAR_{BT}+SAR_{FM})/1.6 = (0.779/7.5+0.00001184/7.5)/1.6 =0.064917653 < 1.0;

Conclusion:

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06, No SAR is required.

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