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RF Exposure Evaluation Report

Report No. : CQASZ20180700090E-03

Applicant: TECH-AUDIO CO., LTD

Address of Applicant: NO.3, TungShih li, Ping Cheng Tao Yuan, Taiwan.

Manufacturer: Atlantic Technology

Address of Manufacturer: 343 Vanderbilt Avenue, Norwood, MA 02062-5060

Factory: Xiamen Tech-Sound CO.,Ltd

Address of Factory: NO.170, Ji Yin Road, Tong An District, Xiamen, China.

Equipment Under Test (EUT):

Product: Wireless Bookshelf Speaker

Model No.: FS-252

Brand Name: N/A

FCC ID: 2AABM-FS252

Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310
KDB447498D01 General RF Exposure Guidance v06

Date of Test: 2018-07-31 to 2018-09-20

Date of Issue: 2018-09-20

Test Result : **PASS***

Tested By:

(Martin Lee)

Reviewed By:

(Jack Ai)

Approved By:

(Jack Ai)



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

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

2 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20180700090E-03	Rev.01	Initial report	2018-09-20

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4 General Information

4.1 Client Information

Applicant:	TECH-AUDIO CO., LTD
Address of Applicant:	NO.3, TungShih li, Ping Cheng Tao Yuan, Taiwan.
Manufacturer:	Atlantic Technology
Address of Manufacturer:	343 Vanderbilt Avenue, Norwood, MA 02062-5060
Factory:	Xiamen Tech-Sound CO., Ltd
Address of Factory:	NO.170, Ji Yin Road, Tong An District, Xiamen, China.

4.2 General Description of EUT

Product Name:	Wireless Bookshelf Speaker
Model No.:	FS-252
Trade Mark:	N/A
Hardware Version:	V01B
Software Version:	V4.0
Sample Type:	portable production
Power Supply:	120V/60Hz

4.3 General Description of BT

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	V4.0
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, $\pi/4$ DQPSK, 8DPSK
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Test Software of EUT:	Blue test 3 (manufacturer declare)
Antenna Type:	PCB antenna
Antenna Gain:	4.0dBi

4.4 General Description of SKAA

Operation Frequency:	2403.5MHz~2477.3MHz
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	FSK
Number of Channel:	49
Hopping Channel Type:	Adaptive Frequency Hopping systems
Sample Type:	Mobile production
Test Software of EUT:	SKAA (manufacturer declare)
Antenna Type:	Integral antenna
Antenna Gain:	3.3dBi

5 RF Exposure Evaluation

5.1 RF Exposure Compliance Requirement

5.1.1 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.

5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

5.2 1.1.3 EUT RF Exposure Evaluation

1) For BT

Antenna Gain: 4dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.51 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)	2.10	2±1	3.0	1.995
Middle(2441MHz)	2.84	2±1	3.0	1.995
Highest(2480MHz)	3.06	2.5±1	3.5	2.239
π/4DQPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	-0.67	0±1	1.0	1.259
Middle(2441MHz)	0.22	0±1	1.0	1.259
Highest(2480MHz)	0.41	0±1	1.0	1.259
8DPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	0.00	0±1	1.0	1.259
Middle(2441MHz)	0.71	0±1	1.0	1.259
Highest(2480MHz)	0.89	0±1	1.0	1.259

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
2.239	4	0.001	1.0	PASS

Note: 1) Refer to report No. CQASZ20180500081E-01 for EUT test Max Conducted Peak Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (2.239 * 2.51) / (4 * 3.1416 * 20^2) = 0.001$$

2) For SKAA

Antenna Gain: 3.3dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.14 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(2403.5MHz)	11.59	11±1	12	15.849
Middle(2438.9MHz)	11.15	11±1	12	15.849
Highest(2477.3MHz)	11.43	11±1	12	15.849

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
15.849	3.3	0.007	1.0	PASS

Note: 1) Refer to report No. CQASZ20180500081E-02 for EUT test Max Conducted Peak Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (15.849 * 2.14) / (4 * 3.1416 * 20^2) = 0.007$$

2) For SKAA+BT

if SKAA and BT transmitters can be transmitted at the same time

BT Power Density at R = 20 cm (mW/cm ²)	SKAA Power Density at R = 20 cm (mW/cm ²)	BT+SKAA Power Density at R = 20 cm (mW/cm ²)	Limit	Result
0.001	0.007	0.008	1.0	PASS