

No. 1 Workshop, M-10, Middle section, Science & Technology Park,

Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053 Report No.: SZEM180500434406

RF Exposure Evaluation Report

Application No.: SZEM1805004344CR(GZEM1805002644CR)

Applicant: Harman International Industries, Inc.

Address of Applicant: 8500 Balboa Boulevard, Northridge, California, 91329, United States

Manufacturer: Harman International Industries, Inc.

Address of Manufacturer: 8500 Balboa Boulevard, Northridge, California, 91329, United States

Factory: Guoguang Electric Co., Ltd.

Address of Factory: No.8 Jinghu Road, Xinya Street, Huadu Reg, Guangzhou, China

EUT Name: A Stereo Pair of Tower Speaker

Model No.: CITATION TOWER TX
FCC ID: APIHKTOWERTX
Trade mark: harman/kardon
Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310

2018-05-23

Date of Test: 2018-06-05 to 2018-07-11

Date of Issue: 2018-08-21

Test Result : Pass*

Date of Receipt:



EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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



Report No.: SZEM180500434406

Page: 2 of 10

2 Version

Revision Record						
Version	Version Chapter Date Modifier					
01		2018-08-21		Original		

Authorized for issue by:		
	Bonson Wang	
	Benson Wang /Project Engineer	
	EvicFu	
	Eric Fu /Reviewer	



Shenzhen Branch

Report No.: SZEM180500434406

Page: 3 of 10

3 Contents

		Page
1	COVER PAGE	1
2	VERSION	2
3	CONTENTS	3
4	GENERAL DESCRIPTION OF EUT	4
	4.1 Test Location	7
	4.2 TEST FACILITY	7
	4.3 DEVIATION FROM STANDARDS	7
	4.4 ABNORMALITIES FROM STANDARD CONDITIONS	7
	4.5 OTHER INFORMATION REQUESTED BY THE CUSTOMER	7
5		
	5.1 RF EXPOSURE COMPLIANCE REQUIREMENT	8
	5.1.1 Limits	
	5.1.2 Test Procedure	8
	5.1.3 EUT RF Exposure Evaluation	9-10



Shenzhen Branch

Report No.: SZEM180500434406

Page: 4 of 10

4 General Description of EUT

Power supply:	Powered by AC 120V
Cable:	AC cable: 182cm unshielded

For AP6398S module:

For AP6398S module:	
For BT:	
Operation Frequency	2402MHz to 2480MHz
Bluetooth Version:	BT4.2 dual mode
Modulation Type	GFSK, π/4DQPSK, 8DPSK
Spectrum Spread Technology	Frequency Hopping Spread Spectrum(FHSS)
Channel Spacing	1MHz
Number of Channels	79
Antenna Type	PIFA Antenna
Antenna Gain	2.26dBi
For BLE:	
Operation Frequency	2402MHz to 2480MHz
Bluetooth Version:	BT4.2 dual mode
Modulation Type	GFSK
Channel Spacing	2MHz
Number of Channels	40
Antenna Type	PIFA Antenna
Antenna Gain	2.26dBi
For 2.4G WIFI:	
Modulation Type	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n(HT20):
Number of Channels	802.11b/g/n(HT20):11
Operation Frequency	802.11b/g/n(HT20): 2412MHz to 2462MHz
Channel Spacing	5MHz
Antenna Type	PIFA Antenna
Antenna Gain	Antenna 1: 1.99dBi; Antenna 2: 2.26dBi Two antennas can simultaneous transmission.



Report No.: SZEM180500434406

Page: 5 of 10

For 5G WIFI:					
	Band	Mode	Frequency Range(MHz)	Number of	
				channels	
	UNII Band	IEEE 802.11n/ac 20MHz	5180-5240	4	
	I	IEEE 802.11n/ac 40MHz	5190-5230	2	
		IEEE 802.11ac 80MHz	5210	1	
	UNII Band	IEEE 802.11n/ac 20MHz	5260-5320	4	
Operation Frequency:	II-A	IEEE 802.11n/ac 40MHz	5270-5310	2	
		IEEE 802.11ac 80MHz	5290	1	
	UNII Band	IEEE 802.11n/ac 20MHz	5500-5700	11	
	II-C	IEEE 802.11n/ac 40MHz	5510-5670	5	
		IEEE 802.11ac 80MHz	5530-5610	2	
	UNII Band	IEEE 802.11n/ac 20MHz	5745-5825	5	
	III	IEEE 802.11n/ac 40MHz	5755-5795	2	
		IEEE 802.11ac 80MHz	5775	1	
Type of Modulation:	802.11n: OF	802.11a: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)			
DFS Function	Slave without	Radar detection			
Antenna type:	PIFA Antenna	a			
Antenna gain		Antenna 1: 4.36dBi; Antenna 2: 4.38dBi Two antennas can simultaneous transmission.			

For SWM908SD module:

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels	
	Band I	802.11a	5180-5240	4	
	Band II-A	802.11a	5260-5320	4	
	Band II-C	802.11a	5500-5700	11	
	Band III	802.11a	5745-5825	5	
Modulation Type:	802.11a: OFDM	(64QAM, 16QAM, QPSK, BPSK)	•		
Channel Spacing:	802.11a: 20MHz	02.11a: 20MHz			
DFS Function:	Master with Rada	Master with Radar detection			
Antenna Type:	Integral Antenna				
Antenna Gain:	1dBi		•		

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Report No.: SZEM180500434406

Page: 6 of 10

For SWS997SD module:

1 01 0000337 3D 111000	1 of 5W5937 5D filodule.					
Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels		
	Band I	802.11a	5180-5240	4		
	Band II-A	802.11a	5260-5320	4		
	Band II-C	802.11a	5500-5700	11		
	Band III	802.11a	5745-5825	5		
Modulation Type:	802.11a: OFDM	(64QAM, 16QAM, QPSK, BPSK)				
Channel Spacing:	802.11a: 20MHz					
DFS Function:	Slave without Ra	dar detection				
Antenna Type:	Integral Antenna	Integral Antenna				
Antenna Gain:	1dBi	1dBi				
	The four antennas and match circuit are the identical and only one antenna is selected for use at any one time, through the on-board Transmit-receive/Diversity RF switch.					



Shenzhen Branch

Report No.: SZEM180500434406

Page: 7 of 10

4.1 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

· CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC

Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

· VCC

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.3 Deviation from Standards

None.

4.4 Abnormalities from Standard Conditions

None.

4.5 Other Information Requested by the Customer

None.

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Shenzhen Branch

Report No.: SZEM180500434406

Page: 8 of 10

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/cm²)	Averaging time (minutes)			
(A) Limits for Occupational/Controlled Exposures							
0.3–3.0 3.0–30 30–300 300–1500 1500–100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 6			
(B) Limits	for General Populati	on/Uncontrolled Exp	oosure				
0.3–1.34	614 824/f 27.5	1.63 2.19/f 0.073	*(100) *(180/f²) 0.2 f/1500 1.0	30 30 30 30 30			

F= Frequency in MHz

Friis Formula

Friis transmission formula: $Pd = (Pout*G)/(4*Pi*R^2)$

Where

Pd = power density in mW/cm2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Pd id 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.



Shenzhen Branch

Report No.: SZEM180500434406

Page: 9 of 10

5.1.3 EUT RF Exposure Evaluation

Remark: AP6398S module, SWM908SD module and SWS997SD module can simultaneous transmission at the same time.

AP6398S module:

For BT/BLE

Antenna: 2.26dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.68 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Max Conducted Output Power	Output Power	Power Density	Limit	MPE	Result
(including tune-up tolerance)	to Antenna	at R = 20 cm		Ratios	
(dBm)	(mW)	(mW/cm²)			
	` '	` '			

For 2.4G WIFI

Antenna 1: 1.99dBi; Antenna 2: 2.26dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.58 / 1.68 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Max Conducted Output Power (including tune-up tolerance) (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Sum of Power Density (mW/cm²)	Limit	MPE Ratios	Result
26.12	409.261	0.129	0.276	1.0	0.276	PASS
26.43	439.542	0.147	0.276	1.0	0.276	FASS

For 5G WIFI

Antenna 1: 4.36dBi; Antenna 2: 4.38dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.73 / 2.74 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Max Conducted Output Power (including tune-up tolerance) (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Sum of Power Density (mW/cm²)	Limit	MPE Ratios	Result
16.78	47.643	0.026	0.050	1.0	0.050	PASS
16.91	49.091	0.027	0.053	1.0	0.053	FA33

The distancer (3RD column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



Shenzhen Branch

Report No.: SZEM180500434406

Page: 10 of 10

SWM908SD module:

Antenna: 1dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.26 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Max Conducted Output Power	Output Power	Power Density	Limit	MPE	Result
(including tune-up tolerance)	to Antenna	at R = 20 cm		Ratios	
(dBm)	(mW)	(mW/cm²)			
14	25.119	0.006	1.0	0.006	PASS

The distancer (3RD column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

SWS997SD module:

Antenna: 1dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.26 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Max Conducted Output Power	Output Power	Power Density	Limit	MPE	Result
(including tune-up tolerance) (dBm)	to Antenna (mW)	at R = 20 cm (mW/cm ²)		Ratios	
14	25.119	0.006	1.0	0.006	PASS

The distancer (3RD column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

exposure conditions for simultaneous transmission operations

The EUT has three modules: AP6398S module, SWM908SD module and SWS997SD module, they can simultaneous transmission at the same time.

For AP6398S module:

- 1. The Bluetooth only support one antenna to transmit.
- 2. The WIFI has two antenns to transmit and they can simultaneous transmission.
- 3. The antenna of Bluetooth and antennas of WIFI can't simultaneous transmission.

For SWM908SD module: There is only one antenna to transmit.

For SWS997SD module: The four antennas and match circuit are the identical and only one antenna is selected for use at any one time, through the on-board Transmit-receive/Diversity RF switch.

So, Simultaneous transmission SAR test is not required, because the Max. sum of the MPE ratios is 0.276+0.006+0.006=0.288<1.

- End of the Report -

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