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

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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
Date of Receipt:	2018-05-23
Date of Test:	2018-06-05 to 2018-07-11
Date of Issue:	2018-08-21
Test Result :	**Pass***

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

Keny Xu
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.

2 Version

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

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

3 Contents

4 General Description of EUT

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

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.

For 5G WIFI:

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	IEEE 802.11n/ac 20MHz	5180-5240	4
		IEEE 802.11n/ac 40MHz	5190-5230	2
		IEEE 802.11ac 80MHz	5210	1
	UNII Band II-A	IEEE 802.11n/ac 20MHz	5260-5320	4
		IEEE 802.11n/ac 40MHz	5270-5310	2
		IEEE 802.11ac 80MHz	5290	1
	UNII Band II-C	IEEE 802.11n/ac 20MHz	5500-5700	11
		IEEE 802.11n/ac 40MHz	5510-5670	5
		IEEE 802.11ac 80MHz	5530-5610	2
	UNII Band III	IEEE 802.11n/ac 20MHz	5745-5825	5
		IEEE 802.11n/ac 40MHz	5755-5795	2
		IEEE 802.11ac 80MHz	5775	1
Type of Modulation:	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			
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			
DFS Function:	Master with Radar detection			
Antenna Type:	Integral Antenna			
Antenna Gain:	1dBi			

For SWS997SD 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			
DFS Function:	Slave without Radar detection			
Antenna Type:	Integral Antenna			
Antenna Gain:	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.			

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.

• **VCCI**

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.

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

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.

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 (including tune-up tolerance) (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	MPE Ratios	Result
8.55	7.16	0.002	1.0	0.002	PASS

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/cm^2)	Limit	MPE Ratios	Result
26.12	409.261	0.129	0.276	1.0	0.276	PASS
26.43	439.542	0.147				

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/cm^2)	Limit	MPE Ratios	Result
16.78	47.643	0.026	0.053	1.0	0.053	PASS
16.91	49.091	0.027				

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

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 (including tune-up tolerance) (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	MPE Ratios	Result
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 (including tune-up tolerance) (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	MPE Ratios	Result
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 -