

RF EXPOSURE REPORT



Report No.: 16040115-FCC-H

Applicant	Panasonic corporation of North America	
Product Name	Car Audio System with Bluetooth and Wi-Fi	
Model No.	AH1801	
Serial No.	N/A	
Test Standard	FCC 2.1091:2015	
Test Date	April 25 to May 31, 2016	
Issue Date	October 15, 2016	
Test Result	☒ Pass ☐ Fail	
Equipment complied with the specification ☒		
Equipment did not comply with the specification ☐		
<i>Winnie Zhang</i>	<i>David Huang</i>	
Loren Luo Test Engineer	David Huang Checked By	
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only		

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

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Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
16040115-FCC-H	Original	NONE	October 1, 2016
16040115-FCC-H	V1	Charging antenna gain	October 15, 2016

2. Customer information

Applicant Name	Panasonic corporation of North America
Applicant Add	Two Riverfront Plaza, 9th Floor, Newark, New Jersey NJ07102-5490 USA
Manufacturer	Panasonic Automotive Systems de Mexico S.A. de C.V.
Manufacturer Add	88785 Mike Allen1231, Parque Industrial Reynosa, Reynosa Tamaulipas, Mexico.

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	718246
IC Test Site No.	4842E-1
Test Software	Labview of SIEMIC version 2.0

4. Equipment under Test (EUT) Information

Description of EUT:	Car Audio System with Bluetooth and Wi-Fi
Main Model:	AH1801
Serial Model:	N/A
Antenna Gain:	Bluetooth(2.4G): -0.53 dBi WIFI(2.4G): -0.53 dBi WIFI(5150-5350MHz): -0.98 dBi WIFI(5470-5725MHz): -0.26 dBi WIFI(5725-5850MHz): -0.63 dBi (Note: The AH1801will be sold without antenna, this antenna only used for DFS or radiated spurious emission test.)
Input Power:	DC 13.2V, 5A
Trade Name :	Panasonic
Type of Modulation:	Bluetooth: GFSK, $\pi/4$DQPSK, 8DPSK 802.11b: DSSS 802.11a/g/n20/n40/ac20/ac40/ac80: OFDM
RF Operating Frequency (ies):	Bluetooth: 2402-2480 MHz 802.11b/g: 2412-2462 MHz (TX/RX) 802.11n20: 2412-2462MHz ;5180-5320 MHz; 5500-5700 MHz; 5745-5825 MHz; (TX/RX) 802.11n40: 2422-2452 MHz (TX/RX); 5190-5310 MHz; 5510-5710 MHz;5755-5795 MHz; (TX/RX) 802.11 a: 5180-5320 MHz; 5500-5700 MHz; 5745-5825 MHz (TX/RX) 802.11ac 20: 5180-5320 MHz; 5500-5700 MHz; 5745-5825 MHz; (TX/RX) 802.11ac 40: 5190-5310 MHz; 5510-5710 MHz; 5755-5795 MHz; (TX/RX) 802.11ac 80: 5210-5290 MHz; 5530-5690 MHz; 5775 MHz; (TX/RX)
Number of Channels:	Bluetooth: 79CH

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WIFI :802.11b/g: 11CH

WIFI :802.11a: 24CH

WIFI :802.11n20: 11CH(2.4GHz); 24CH(5GHz)

WIFI :802.11n40: 9CH(2.4GHz); 12CH(5GHz)

WIFI :802.11ac20: 24CH

WIFI :802.11ac40: 12CH

WIFI :802.11ac80: 6CH

FCC ID:

ACJAH1801

5. FCC §2.1091 - Maximum Permissible exposure (MPE)

5.1 Applicable Standard

According to §1.1307(b)(1), systems operating under the provisions of this 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.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
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

* = Plane-wave equivalent power density

5.2 Test Result

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

Where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator,
the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

BT:

Type	Modulation	CH	Frequency (MHz)	Conducted Power (dBm)	Tune up Power tolerant
Output power	GFSK	Low	2402	0.799	0±1
		Mid	2441	1.727	1±1
		High	2480	2.389	2±1
	π /4 DQPSK	Low	2402	-0.096	0±1
		Mid	2441	0.898	1±1
		High	2480	1.605	2±1
	8-DPSK	Low	2402	0.259	0±1
		Mid	2441	1.248	1±1
		High	2480	1.957	2±1

2.4G WIFI:

Type	Test mode	CH	Frequency (MHz)	Conducted Power (dBm)	Tune up Power tolerant
Output power	802.11b	Low	2412	14.75	15±1
		Mid	2442	14.89	15±1
		High	2472	14.90	15±1
	802.11g	Low	2412	14.72	15±1
		Mid	2442	18.76	19±1
		High	2472	18.70	19±1
	802.11n (20M)	Low	2412	13.71	14±1
		Mid	2442	17.55	17±1
		High	2472	16.88	17±1
	802.11n (40M)	Low	2422	12.97	14±1
		Mid	2442	16.22	16±1
		High	2462	16.61	16±1

5G WIFI:

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Conducted Power with D.F(dBm)	Tune up Power tolerant
820.11a	5150-5250	Low	5180	8.18	8±1
		Middle	5220	8.38	8±1
		High	5240	8.38	8±1
	5250-5350	Low	5260	8.28	8±1
		Middle	5300	8.38	8±1
		High	5320	8.58	8±1
	5470-5725	Low	5500	8.58	8±1
		Mid	5600	8.18	8±1
		High	5700	8.38	8±1
	5725-5850	Low	5745	7.88	8±1
		Mid	5785	6.08	6±1
		High	5825	5.88	6±1
802.11n (20M)	5150-5250	Low	5180	7.38	7±1
		Middle	5220	7.48	7±1
		High	5240	7.48	7±1
	5250-5350	Low	5260	7.18	7±1
		Middle	5300	7.58	7±1
		High	5320	7.68	7±1
	5470-5725	Low	5500	7.78	7±1
		Mid	5600	7.38	7±1
		High	5700	7.58	7±1
	5725-5850	Low	5745	6.98	7±1
		Mid	5785	7.18	7±1
		High	5825	7.18	7±1
802.11n (40M)	5150-5250	Low	5190	7.66	7±1
		High	5230	7.76	7±1
	5250-5350	Low	5270	7.66	7±1
		High	5310	7.86	7±1
	5470-5725	Low	5510	7.96	7±1
		Mid	5590	7.66	7±1

		High	5670	7.66	7±1
		Straggle	5710	7.56	7±1
	5725-5850	Low	5755	7.36	7±1
		High	5795	7.46	7±1
802.11ac (20M)	5150-5250	Low	5180	7.28	7±1
		Middle	5200	7.28	7±1
		High	5240	7.48	7±1
	5250-5350	Low	5260	7.38	7±1
		Middle	5300	7.58	7±1
		High	5320	7.68	7±1
	5470-5725	Low	5500	7.68	7±1
		Mid	5600	7.38	7±1
		High	5700	7.58	7±1
	5725-5850	Low	5745	6.98	7±1
		Mid	5785	7.18	7±1
		High	5825	7.18	7±1
802.1ac (40M)	5150-5250	Low	5190	7.66	7±1
		High	5230	7.66	7±1
	5250-5350	Low	5270	7.66	7±1
		High	5310	7.86	7±1
	5470-5725	Low	5510	7.96	7±1
		Mid	5590	7.76	7±1
		High	5670	7.66	7±1
		Straggle	5710	7.76	7±1
	5725-5850	Low	5755	7.26	7±1
		High	5795	7.46	7±1
802.11ac (80M)	5150-5250	One	5210	5.21	5±1
	5250-5350	One	5290	5.11	5±1
	5470-5725	Low	5530	5.21	5±1
		High	5610	0.46	0±1
		Straddle	5690	5.01	5±1
	5725-5850	Low	5775	5.01	5±1

MPE:

Frequency bands	Max. Turn-up Conducted power (dBm)	Max. allow antenna gain (dBi)	Max. ERP/EIRP	Exemption Limit of RF Exposure Evaluation	Result(if Exemption or not)
5150-5250MHz WIFI	9	-0.98	8.02	34.77	Yes
5250-5350 WIFI	9	-0.98	8.02	34.77	Yes
5470-5725 WIFI	9	-0.26	8.74	34.77	Yes
5725-5850 WIFI	9	-0.63	8.37	34.77	Yes

Note:

FCC Part2.1091 Radiofrequency radiation exposure evaluation: mobile devices.

(c) (2) Unlicensed personal communications service devices, unlicensed millimeter wave devices and unlicensed NII devices authorized under §§15.253(f), 15.255(g), 15.257(g), 15.319(i), and 15.407(f) of this chapter are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if their ERP is 3 watts or more or if they meet the definition of a portable device as specified in §2.1093(b) requiring evaluation under the provisions of that section.

2.4G WIFI:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

Where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 20.00dBm)

Maximum output power at antenna input terminal: 100.00mW)

Prediction distance: >20 (cm)

Predication frequency: 2442 (MHz) High frequency

Antenna Gain (typical): -0.53 (dBi)

The worst case is power density at predication frequency at 20 cm: 0.018(mW/cm²)

MPE limit for general population exposure at prediction frequency: 1.0 (mW/cm²)

0.018(mW/cm²) < 1.0 (mW/cm²)

Result: Pass

BT:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

Where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 3.00dBm)

Maximum output power at antenna input terminal: 1.995 (mW)

Prediction distance: >20 (cm)

Predication frequency: 2480 (MHz) High frequency

Antenna Gain (typical): -0.53 (dBi)

The worst case is power density at predication frequency at 20 cm: 0.0004 (mW/cm²)

MPE limit for general population exposure at prediction frequency: 1.0 (mW/cm²)

0.0004(mW/cm²) < 1.0 (mW/cm²)

Result: Pass