



Shenzhen CTL Testing Technology Co., Ltd.
Tel: +86-755-89486194 Fax: +86-755-26636041

TEST REPORT

FCC PART 2.1091

Report Reference No.: CTL1610188601-WI

Compiled by:
(position+printed name+signature)

Jacky Chen
(File administrators)

Jacky Chen

Tested by:
(position+printed name+signature)

Allen Wang
(Test Engineer)

Allen Wang

Approved by:
(position+printed name+signature)

Tracy Qi
(Manager)

Tracy Qi

Product Name.....: Audio infotainment unit

Model/Type reference: 2DF

List Model(s).....: N/A

Trade Mark: N/A

FCC ID: 2ACRL2DF

Applicant's name: Harman Automotive Electronic Systems (Suzhou) Co., Ltd

Address of applicant: No125 Fangzhou Rd, Suzhou SIP, Jiangsu, China

Test Firm: Shenzhen CTL Testing Technology Co., Ltd.

Address of Test Firm: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road,
Nanshan District, Shenzhen, China 518055

Test specification.....:

47 CFR FCC Part 2 §2.1091

Standard.....: **KDB447498 D01**

KDB865664 D02

TRF Originator: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF: Dated 2011-01

Date of Receipt.....: Sep. 19, 2016

Date of Test Date.....: Sep. 26, 2016–Oct. 10, 2016

Data of Issue.....: Oct. 10, 2016

Result.....: PASS

Shenzhen CTL Testing Technology Co., Ltd. All rights reserved.

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen CTL Testing Technology Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen CTL Testing Technology Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

TEST REPORT

Test Report No. : CTL1610188601-WI	Oct. 10, 2016 Date of issue
---	--------------------------------

Equipment under Test : **Audio infotainment unit**

Model /Type : 2DF

Listed Models : N/A

Applicant : **Harman Automotive Electronic Systems (Suzhou) Co., Ltd**

Address : No125 Fangzhou Rd, Suzhou SIP, Jiangsu, China

Manufacturer : **Harman Automotive Electronic Systems (Suzhou) Co., Ltd**

Address : No125 Fangzhou Rd, Suzhou SIP, Jiangsu, China

Test result	Pass *
--------------------	---------------

*In the configuration tested, the EUT complied with the standards specified page 5.

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

**** Modified History ****

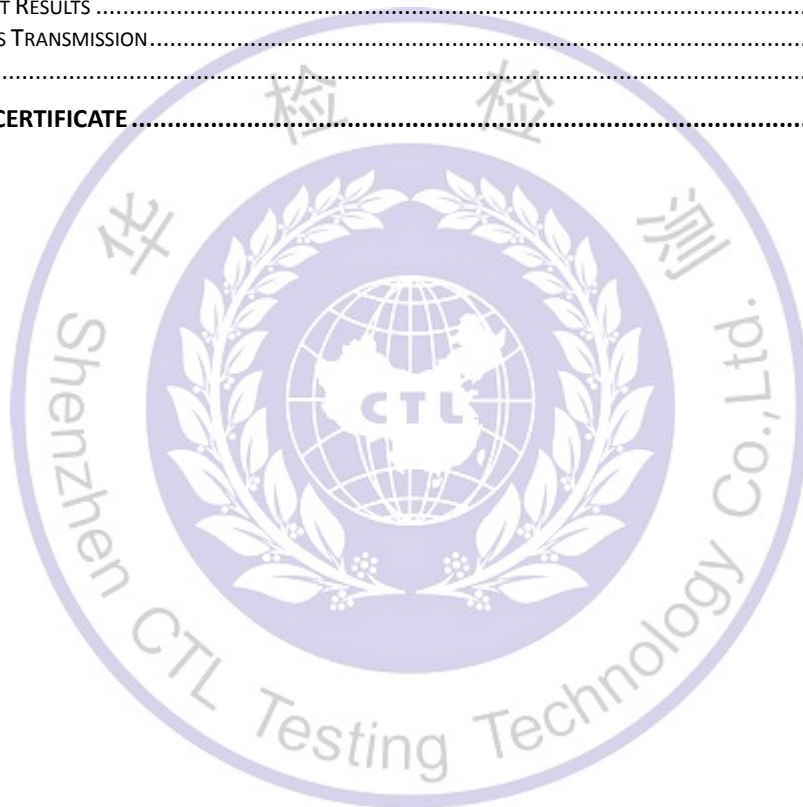
Revisions	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2016-10-18	CTL1610188601-WF	Tracy Qi



Table of Contents

Page

1. SUMMARY.....	5
1.1. TEST STANDARDS.....	5
1.2. GENERAL DESCRIPTION OF EUT.....	5
1.3. DESCRIPTION OF TEST MODES AND TEST FREQUENCY.....	5
1.4. MODIFICATIONS.....	6
1.5. ENVIRONMENTAL CONDITIONS.....	6
1.6. TEST FACILITY.....	7
1.7. STATEMENT OF THE MEASUREMENT UNCERTAINTY.....	7
2. MPE EVALUATION.....	8
2.1. EVALUATION METHOD.....	8
2.2. LIMITS FOR POPULATION/UNCONTROLLED EXPOSURE.....	8
2.3. CALCULATION METHOD.....	8
2.4. CONDUCTED POWER RESULTS.....	9
2.5. MANUFACTURING TOLERANCE.....	9
2.6. MEASUREMENT RESULTS.....	9
2.7. SIMULTANEOUS TRANSMISSION.....	9
2.8. CONCLUSION.....	10
3. ACCREDITATION CERTIFICATE.....	11



1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

[KDB447498 D01 General RF Exposure Guidance v06 \(October 23, 2015\)](#): Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

[FCC Part 2.1091 Radiofrequency Radiation Exposure Evaluation](#): Mobile Devices

[KDB865664 D02 RF Exposure Reporting \(October 23, 2015\)](#): RF Exposure Compliance Reporting and Documentation Considerations

1.2. General Description of EUT

Product Name	Audio infotainment unit
Model/Type reference	2DF
Power supply	DC 12.0V from battery
Hardware Version	PV Sample
Software Version	R10
Product Type	End Product
Exposure category	General population/uncontrolled environment
Device Type	Mobile Device
Bluetooth :	
Version:	Bluetooth Core Version 2.1 + EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Internal antenna
Maximum antenna peak gain:	0dBi

Note: For more details, please refer to the user's manual of the EUT.

1.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software (BIOS Control) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and typical mode (hopping mode) for test; we choose Channel 0 / 39 / 78 as default channels.

Operation Frequency :

Channel	Frequency(MHz)	Channel	Frequency(MHz)
0	2402	40	2442
1	2403	41	2443
2	2404	42	2444
3	2405	43	2445
4	2406	44	2446
5	2407	45	2447
6	2408	46	2448
7	2409	47	2449
8	2410	48	2450
9	2411	49	2451
10	2412	50	2452
11	2413	51	2453
12	2414	52	2454
13	2415	53	2455
14	2416	54	2456
15	2417	55	2457
16	2418	56	2458

17	2419	57	2459
18	2420	58	2460
19	2421	59	2461
20	2422	60	2462
21	2423	61	2463
22	2424	62	2464
23	2425	63	2465
24	2426	64	2466
25	2427	65	2467
26	2428	66	2468
27	2429	67	2469
28	2430	68	2470
29	2431	69	2471
30	2432	70	2472
31	2433	71	2473
32	2434	72	2474
33	2435	73	2475
34	2436	74	2476
35	2437	75	2477
36	2438	76	2478
37	2439	77	2479
38	2440	78	2480
39	2441		

1.4. Modifications

No modifications were implemented to meet testing criteria.

1.5. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

1.6. Test Facility

1.6.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and one line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4: 2014, CISPR 22/EN 55022 and CISPR16-1-4 SVSWR requirements.

1.6.2 Laboratory accreditation

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

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December 19, 2013.

1.7. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	2.20 dB	(1)
Occupied Bandwidth	0.01ppm	(1)
Radiated Emission 30~1000MHz	4.10dB	(1)
Radiated Emission Above 1GHz	4.32dB	(1)
Conducted Disturbance0.15~30MHz	3.20dB	(1)

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2. MPE Evaluation

2.1. Evaluation method

Systems operating under the provisions of FCC 47 CFR 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.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

2.2. Limits for Population/Uncontrolled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.3. Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the maximum gain of the used antenna is 0dBi, the RF power density can be obtained.

2.4. Conducted Power Results

Test Mode	Channel	Frequency (MHz)	Measured Output Peak Power (dBm)
GFSK	0	2402	2.328
	39	2441	3.151
	41	2480	3.519
$\pi/4$ DQPSK	0	2402	1.148
	39	2441	1.972
	41	2480	2.116
8DPSK	0	2402	1.269
	39	2441	2.314
	41	2480	2.516

2.5. Manufacturing tolerance

GFSK (Peak Power)			
Frequency (MHz)	2402	2441	2480
Target (dBm)	3.0	3.0	3.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
$\pi/4$ DQPSK (Peak Power)			
Frequency (MHz)	2402	2441	2480
Target (dBm)	2.0	2.0	2.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
8DPSK (Peak Power)			
Frequency (MHz)	2402	2441	2480
Target (dBm)	2.0	2.0	2.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

2.6. Measurement Results

Mode	Frequency (MHz)	Output power (Including tune-up tolerance) (dBm)	Output power (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
GFSK	2402	4.0000	2.5119	0.0	1.0000	0.0005	1.0000
	2441	4.0000	2.5119	0.0	1.0000	0.0005	1.0000
	2480	4.0000	2.5119	0.0	1.0000	0.0005	1.0000
$\pi/4$ DQPSK	2402	3.0000	1.9953	0.0	1.0000	0.0004	1.0000
	2441	3.0000	1.9953	0.0	1.0000	0.0004	1.0000
	2480	3.0000	1.9953	0.0	1.0000	0.0004	1.0000
8DPSK	2402	3.0000	1.9953	0.0	1.0000	0.0004	1.0000
	2441	3.0000	1.9953	0.0	1.0000	0.0004	1.0000
	2480	3.0000	1.9953	0.0	1.0000	0.0004	1.0000

2.7. Simultaneous Transmission

As the sample only with one Bluetooth transmitter modular and only one transmitter antenna, no need consider simultaneous transmit.

2.8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.



3. Accreditation Certificate



China National Accreditation Service for Conformity Assessment
LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L7497)

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan
District, Shenzhen, Guangdong, China

is accredited in accordance with 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 to undertake the service described in the schedule attached to this certificate.

The scope of accreditation is detailed in the attached schedule bearing the same registration number as above. The schedule form an integral part of this certificate.

Date of Issue: 2016-04-05
Date of Expiry: 2018-02-14
Date of Initial Accreditation: 2015-02-15

Signed on behalf of China National Accreditation Service for Conformity Assessment 

China National Accreditation Service for Conformity Assessment(CNAS) is authorized by Certification and Accreditation Administration of the People' s Republic of China (CNCA) to operate the national accreditation schemes for conformity assessment. CNAS is a signatory of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) and the Asia Pacific Laboratory Accreditation Cooperation Mutual Recognition Arrangement (APLAC MRA). The validity of the certificate can be checked on CNAS website at <http://www.cnas.org.cn/english/findanaccreditedbody/index.shtml>