

MPE TEST REPORT

of

FCC CFR 47 part 1, 1.1307(b), 1.1310

FCC ID : TQ8-AC1C1DFEE

Equipment Under Test : DIGITAL CAR AUDIO SYSTEM

Model Name : AC1C1DFEE (Alt.: AC1C0DFEE, AC113DFEE, AC112DFEG,
AC112DFGG, AC112DFGN, AC112DFGE, AC112DFGL,
AC112DFUG)

Applicant : Hyundai MOBIS Co., Ltd.

Manufacturer : Hyundai MOBIS Co., Ltd.

Date of Test(s) : 2014. 08. 25 ~ 2014. 08. 29

Date of Issue : 2014. 09. 01

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

Tested By:



Alvin Kim

Date:

2014.09.01

Approved By:



Hyunchoe You

Date:

2014.09.01

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

-Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-837

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : +82 31 428 5700

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1.2. Details of Applicant

Applicant : Hyundai MOBIS Co., Ltd.

Address : 203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea

Contact Person : Choi, Seung-Hun

Phone No. : +82 31 260 0098

1.3. Description of EUT

Kind of Product	DIGITAL CAR AUDIO SYSTEM
Model Name	AC1C1DFEE (Alt. : AC1C0DFEE, AC113DFEE, AC112DFEG, AC112DFGG, AC112DFGN, AC112DFGE, AC112DFGL, AC112DFUG)
Power Supply	DC 14.4 V (Vehicle Battery)
Frequency Range	2 402 MHz ~ 2 480 MHz
Modulation Technique	GFSK, $\pi/4$ DQPSK, 8DPSK
Number of Channels	79
Antenna Type	Internal type
Antenna Gain	3.5 dBi

1.4. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL007985	2014.09.01	Initial

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1.5. Alternative models

Model name		Specification
Basic model	AC1C1DFEE	R+CD+MP3+RDS+DAB+BT+VR H/W: Europe KNOB, B/T spec (9552A2), NAND 2G S/W: Europe region, Frequency 9615A3, Logic on
Alternative model	AC1C0DFEE	R+CD+MP3+RDS+DAB+BT H/W: Europe KNOB, B/T spec (9552A1), NAND 1G S/W: Turkey region, Frequency 9615A3, Logic on
	AC113DFEE	R+CD+MP3+RDS+BT+VR H/W: Europe KNOB, B/T spec (9552A2), NAND 2G S/W: Europe region, Frequency 9615A3, Logic on
	AC112DFEG	R+CD+MP3+BT+VR H/W: Europe KNOB, B/T spec (9552A2), NAND 2G S/W: Europe region, Frequency 9615A1, Logic on
	AC112DFGG	R+CD+MP3+BT H/W: General KNOB, B/T spec (9552A1), NAND 1G S/W: General region, Frequency 9615A1
	AC112DFGN	R+CD+MP3+BT H/W: General KNOB, B/T spec (9552A1), NAND 1G S/W: General region, Frequency 9615A2
	AC112DFGE	R+CD+MP3+BT H/W: Europe KNOB, B/T spec (9552A1), NAND 1G S/W: General region, Frequency 9615A3
	AC112DFGL	R+CD+MP3+BT H/W: General KNOB, B/T spec (9552A1), NAND 1G S/W: General(Colombia) region, Frequency 9615A5
	AC112DFUG	R+CD+MP3+BT H/W: Europe KNOB, B/T spec (9552A1), NAND 1G S/W: Australia region, Frequency 9615A1

* 9552A1 : Not support B/T Voice recognition

* 9552A2 : Support B/T Voice recognition

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2. RF Exposure Evaluation

2.1. Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

According to FCC 1.1310 : 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 §1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500	--	--	F/300	6
1 500 – 100 000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300 – 1 500	--	--	F/1500	30
<u>1 500 – 100 000</u>	--	--	<u>1</u>	<u>30</u>

2.1.1. Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.141 6

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

P_d 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 where the MPE limit is reached.

2.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data

Test Mode : Normal Operation

2.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

GFSK

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
Low	2 402	-0.86	3.50	77	0.000 475	1
Middle	2 441	0.44	3.50	77	0.000 640	1
High	2 480	0.13	3.50	77	0.000 596	1

$\pi/4$ DQPSK

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
Low	2 402	-1.29	3.50	77	0.000 430	1
Middle	2 441	-0.33	3.50	77	0.000 536	1
High	2 480	-1.13	3.50	77	0.000 446	1

8DPSK

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
Low	2 402	-1.29	3.50	77	0.000 430	1
Middle	2 441	-0.30	3.50	77	0.000 540	1
High	2 480	-1.18	3.50	77	0.000 441	1

Channel	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Maximum tune up tolerance	4.00	3.50	77	0.001 119	1

Note :

- The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit of 1 mW/cm².

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