

TEST REPORT

of

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

FCC ID: TQ8-AT140C2AN

Equipment Under Test : DISPLAY AUDIO SYSTEM
Model Name : AT140C2AN
Applicant : Hyundai MOBIS Co., Ltd.
Manufacturer : Hyundai MOBIS Co., Ltd.
Date of Test(s) : 2015.03.02 ~ 2015.03.04
Date of Issue : 2015.03.04

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

Tested By:


Jungmin Yang

Date:

2015.03.04

Approved By:


Hyunchae You

Date:

2015.03.04

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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 31 688 0901

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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-Hoon

Phone No. : + 82 31 260 0098

1.3. Description of EUT

Kind of Product	DISPLAY AUDIO SYSTEM
Model Name	AT140C2AN
Power Supply	DC 14.4 V (Vehicle Battery)
Frequency Range	824.70 MHz ~ 848.31 MHz (CDMA850), 1 851.25 MHz ~ 1 908.75 MHz (CDMA1 900), 1 710.7 MHz ~ 1 754.3 MHz (LTE BAND 4_1_4 MHz), 1 711.5 MHz ~ 1 753.5 MHz (LTE BAND 4_3 MHz), 1 712.5 MHz ~ 1 752.5 MHz (LTE BAND 4_5 MHz), 1 715.0 MHz ~ 1 750.0 MHz (LTE BAND 4_10 MHz), 1 717.5 MHz ~ 1 747.5 MHz (LTE BAND 4_15 MHz), 1 720.0 MHz ~ 1 745.0 MHz (LTE BAND 4_20 MHz), 779.5 MHz ~ 784.5 MHz (LTE BAND 13_5 MHz), 782 MHz (LTE BAND 13_10 MHz), 2 402 MHz ~ 2 480 MHz (BT), 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20), 5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20, 11ac_VHT20), 5 755 MHz ~ 5 795 MHz (Band 3: 11n_HT40, 11ac_VHT40), 5 775 MHz (Band 3: 11ac_VHT80), 5 180 MHz ~ 5 240 MHz (Band 1: 11a/n_HT20, 11ac_VHT20), 5 190 MHz ~ 5 230 MHz (Band 1: 11n_HT40, 11ac_VHT40), 5 210 MHz (Band 1: 11ac_VHT80), 5 260 MHz ~ 5 320 MHz (Band 2A: 11a/n_HT20, 11ac_VHT20), 5 270 MHz ~ 5 310 MHz (Band 2A: 11n_HT40, 11ac_VHT40), 5 290 MHz (Band 2A: 11ac_VHT80), 5 500 MHz ~ 5 700 MHz (Band 2C: 11a/n_HT20, 11ac_VHT20), 5 510 MHz ~ 5 670 MHz (Band 2C: 11n_HT40, 11ac_VHT40), 5 530 MHz (Band 2C: 11ac_VHT80)
Antenna Gain	824.70 MHz ~ 848.31 MHz : 4.75 dB i, 1 851.25 MHz ~ 1 908.75 MHz : 5.68 dB i, 1 710.7 MHz ~ 1 754.3 MHz : 3.27 dB i, 779.5 MHz ~ 784.5 MHz : 2.90 dB i, 2 402 MHz ~ 2 480 MHz : 2.29 dB i, 2 412 MHz ~ 2 472 MHz : -0.09 dB i, 5 180 MHz ~ 5 320 MHz : 4.77 dB i, 5 500 MHz ~ 5 700 MHz : 1.68 dB i, 5 745 MHz ~ 5 805 MHz : 2.78 dB i

1.4. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL008471	2015.03.04	Initial

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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

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/Controlled Exposure				
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 – 1 500	-	-	f/300	6
1 500 – 100 000	-	-	5	6
(B) Limits for General Population/Uncontrolled Exposure				
<u>0.3 – 1.34</u>	614	1.63	*100	30
<u>1.34 – 30</u>	824/f	2.19/f	*180/f ²	30
<u>30 - 300</u>	27.5	0.073	0.2	30
<u>300 – 1 500</u>	-	-	<u>f/1500</u>	<u>30</u>
<u>1 500 – 100 000</u>	-	-	<u>1.0</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 = 3.1416

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.

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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

Mode: CDMA850_Maximum tune up tolerance

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)
1013	824.70	26	4.75	100	0.236 445	0.549 80

Mode: CDMA1 900_Maximum tune up tolerance

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)
25	1 851.25	26	5.68	100	0.292 907	1

Mode: LTE Band 4_Maximum tune up tolerance

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)
20175	1 732.5	25	3.27	100	0.133 577	1

Mode: LTE Band 13_Maximum tune up tolerance

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)
23205	779.5	25	2.90	100	0.122 668	0.519 67

Note :

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

BT

- Maximum tune up tolerance

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)
0	2 402	4	2.29	77	0.001 100	1

WLAN (2.4G)

- Maximum tune up tolerance

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)
1	2 412	18	-0.09	99	0.012 419	1

WLAN (5G)

- Maximum tune up tolerance

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)
36	5 180	14	4.77	93	0.016 116	1

Note :

1. 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.

Simultaneous transmission MPE test exclusion

CDMA850: the ratio is 0.236 445 / 0.549 80

LTE band13: the ratio is 0.122 668 / 0.519 67

WLAN: the ratio is 0.016 116 / 1

BT: the ratio is 0.001 100 / 1

Confirm the sum result of individual MPEs ratio is ≤ 1.0 ;

$$(0.236\ 445 / 0.549\ 80) + (0.122\ 668 / 0.519\ 67) + (0.016\ 116 / 1) + (0.001\ 100 / 1) = 0.683\ 322 \leq 1.0$$

So this device meets the KDB447498 D01 v05r02 section 7.2 requirement of "Simultaneous transmission MPE test exclusion".

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