

# TEST REPORT

of

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

FCC ID: TQ8-ATC40F2AN

Equipment Under Test : DISPLAY CAR SYSTEM

Model Name : ATC40F2AN

Applicant : Hyundai MOBIS Co., Ltd.

Manufacturer : Hyundai MOBIS Co., Ltd.

Date of Test(s) : 2015.04.15 ~ 2015.04.22

Date of Issue : 2015.05.27

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

Tested By:



Jaeha Chung

Date:

2015.05.27

Approved By:



Hyunhae You

Date:

2015.05.27

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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 CAR SYSTEM
Model Name	ATC40F2AN
Power Supply	DC 14.4 V (Vehicle Battery)
Frequency Range	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)
Modulation Technique	DSSS, OFDM, GFSK, $\pi/4$ DQPSK, 8DPSK
Number of Channels	79 channel (BT), 11 channel (11b/g/n_HT20), 5 channel (Band 3: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 3: 11n_HT40, 11ac_VHT40), 1 channel (Band 3: 11ac_VHT80), 4 channel (Band 1: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 1: 11n_HT40, 11ac_VHT40), 1 channel (Band 1: 11ac_VHT80), 4 channel (Band 2A: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 2A: 11n_HT40, 11ac_VHT40), 1 channel (Band 2A: 11ac_VHT80), 8 channel (Band 2C: 11a/n_HT20, 11ac_VHT20), 3 channel (Band 2C: 11n_HT40, 11ac_VHT40), 1 channel (Band 2C: 11ac_VHT80)
Operation Temperature	-20 °C ~ 70 °C
Antenna Type	Internal type
Antenna Gain	2 402 MHz ~ 2 480 MHz: 2.29 dB i, 2 412 MHz ~ 2 462 MHz: 4.67 dB i, 5 180 MHz ~ 5 320 MHz: 2.89 dB i, 5 500 MHz ~ 5 700 MHz: 2.51 dB i, 5 745 MHz ~ 5 825 MHz: 5.78 dB i

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#### 1.4. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL008684	2015.04.29	Initial
1	F690501/RF-RTL008684-1	2015.05.27	Added calculation of Simultaneous transmission with WWAN module

#### 1.5. Declaration by the manufacturer

- WLAN & BT do not transmit simultaneously.

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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 <sup>2</sup> )	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 <sup>2</sup>	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				
0.3 – 1.34	614	1.63	*100	30
1.34 – 30	824/f	2.19/f	*180/f <sup>2</sup>	30
30 - 300	27.5	0.073	0.2	30
<b><u>300 – 1 500</u></b>	-	-	<b><u>f/1500</u></b>	<b><u>30</u></b>
<b><u>1 500 – 100 000</u></b>	-	-	<b><u>1.0</u></b>	<b><u>30</u></b>

#### 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/cm<sup>2</sup>

$P_{out}$  = 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

$P_d$  the limit of MPE, 1 mW/cm<sup>2</sup>. 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

BT

- Maximum tune up tolerance

Operating Frequency Range (MHz)	Maximum Average Output Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
2 402 ~ 2 480	4	2.29	0.000 847	1

WLAN (2.4G)

- Maximum tune up tolerance

Operating Frequency Range (MHz)	Maximum Average Output Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
2 412 ~ 2 462	18	4.67	0.036 790	1

WLAN (5G)

- Maximum tune up tolerance

Operating Frequency Range (MHz)	Maximum Average Output Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
5 180 ~ 5 825	14	5.78	0.018 912	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/cm<sup>2</sup>.

**Mode: CDMA 850\_Maximum tune up tolerance**

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB d)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
1 013	824.70	26	4.24	0.210 247	0.549 800

**Mode: CDMA 1 900\_Maximum tune up tolerance**

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
25	1 851.25	26	3.47	0.176 088	1

**Mode: LTE Band 4\_Maximum tune up tolerance**

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
20 175	1 710.7	25	0.22	0.066 181	1

**Mode: LTE Band 13\_Maximum tune up tolerance**

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB d)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
23 205	779.5	25	-0.90	0.051 136	0.519 667

**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 .

### Simultaneous transmission MPE test exclusion

CDMA 850 : the ratio is 0.210 247 / 0.549 80

LTE Band 13 : the ratio is 0.051 136 / 0.519 67

WLAN 802.11b : the ratio is 0.036 790 / 1

BT : the ratio is 0.000 847 / 1

Confirm the sum result of individual MPEs ratio is  $\leq 1.0$ ;

WLAN + WWAN =  $(0.210\ 247 / 0.549\ 80) + (0.051\ 136 / 0.519\ 67) + (0.036\ 790 / 1) = 0.517\ 597 \leq 1.0$

BT + WWAN =  $(0.210\ 247 / 0.549\ 80) + (0.051\ 136 / 0.519\ 67) + (0.000\ 847 / 1) = 0.481\ 654 \leq 1.0$

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

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