TEST REPORT

of

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

FCC ID: TQ8-ATB40F6AN

Equipment Under Test	:	DIGITAL CAR AVN SYSTEM
Model Name	:	ATB40F6AN
Applicant	:	Hyundai Mobis Co., Ltd.
Manufacturer	:	Hyundai Mobis Co., Ltd.
Date of Receipt	:	2019.03.20
Date of Test(s)	:	2019.03.20 ~ 2019.05.29
Date of Issue	:	2019.06.19

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

Tested By: **Nancy Park** **Date:** **2019.06.19**

Technical Manager: **Jungmin Yang** **Date:** **2019.06.19**

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

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.
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1.2. Details of Applicant

Applicant : Hyundai Mobis Co., Ltd.
Address : 203, Teheran-ro, Gangnam-gu, Seoul, South Korea, 135-977
Contact Person : Choe, Seung-hoon
Phone No. : +82 31 260 0098

1.3. Details of Manufacturer

Company : Same as applicant
Address : Same as applicant

1.4. Description of EUT

Kind of Product	DIGITAL CAR AVN SYSTEM
Model Name	ATB40F6AN
Power Supply	DC 14.4 V
Frequency Range	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth), 2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20), 5 180 ㎒ ~ 5 240 ㎒ (Band 1: 11a/n_HT20, 11ac_VHT20), 5 190 ㎒ ~ 5 230 ㎒ (Band 1: 11n_HT40, 11ac_VHT40), 5 210 ㎒ (Band 1: 11ac_VHT80), 5 260 ㎒ ~ 5 320 ㎒ (Band 2A: 11a/n_HT20, 11ac_VHT20), 5 270 ㎒ ~ 5 310 ㎒ (Band 2A: 11n_HT40, 11ac_VHT40), 5 290 ㎒ (Band 2A: 11ac_VHT80), 5 500 ㎒ ~ 5 720 ㎒ (Band 2C: 11a/n_HT20, 11ac_VHT20), 5 510 ㎒ ~ 5 710 ㎒ (Band 2C: 11n_HT40, 11ac_VHT40), 5 530 ㎒ ~ 5 690 ㎒ (Band 2C: 11ac_VHT80), 5 745 ㎒ ~ 5 825 ㎒ (Band 3: 11a/n_HT20, 11ac_VHT20), 5 755 ㎒ ~ 5 795 ㎒ (Band 3: 11n_HT40, 11ac_VHT40), 5 775 ㎒ (Band 3: 11ac_VHT80)
Modulation Technique	DSSS, OFDM, GFSK, π/4DQPSK, 8DPSK
Number of Channels	79 channel (Bluetooth), 11 channel (11b/g/n_HT20), 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), 9 channel (Band 2C: 11a/n_HT20, 11ac_VHT20), 4 channel (Band 2C: 11n_HT40, 11ac_VHT40), 2 channel (Band 2C: 11ac_VHT80), 5 channel (Band 3: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 3: 11n_HT40, 11ac_VHT40), 1 channel (Band 3: 11ac_VHT80)

Antenna Type	PCB pattern antenna
Antenna Gain	2 400 ㎒ ~ 2 483.5 ㎒: -1.79 ㏈i (Bluetooth), 2 400 ㎒ ~ 2 483.5 ㎒: 1.84 ㏈i (WLAN 2.4 G), 5 150 ㎒ ~ 5 250 ㎒: 2.75 ㏈i (WLAN 5G), 5 250 ㎒ ~ 5 350 ㎒: 2.75 ㏈ i (WLAN 5G), 5 470 ㎒ ~ 5 725 ㎒: -0.80 ㏈ i (WLAN 5G), 5 725 ㎒ ~ 5 850 ㎒: -1.24 ㏈ i (WLAN 5G)

1.5. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501/RF-RTL013844	2019.05.29	Initial
1	F690501/RF-RTL013844-1	2019.06.19	Corrected Maximum tune up tolerance of WWAN

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 (㎒)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (㎽/㎠)	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				
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
300-1 500	-	-	**f/1500**	**30**
1 500-100 000	-	-	**1.0**	**30**

2.1.1. Friis transmission formula: Pd = (Pout*G)/(4*pi*R^2)

Where Pd = power density in ㎽/㎠

Pout = output power to antenna in ㎽

G = gain of antenna in linear scale

Pi = 3.1416

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

Pd the limit of MPE, 1 ㎽/㎠. 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. Test information of Cable Loss and Antenna Gain

Test Item	Frequency (㎒)	Cable Loss (dB)	Antenna Gain (dB i)	Final Antenna Gain (dB i)
CDMA - BC0	824 ~ 849	-1.71	4.20	2.49
CDMA - BC1	1 850 ~ 1 910	-3.30	5.09	1.79
LTE - Band 2	1 850 ~ 1 910	-3.30	5.09	1.79
LTE - Band 4	1 710 ~ 1 755	-3.30	4.12	0.82
LTE - Band 5	824 ~ 849	-1.71	4.20	2.49
LTE - Band 13	777 ~ 787	-1.71	3.74	2.03

Note;

- Final Antenna Gain (㏈ i) = Cable Loss (㏈) + Antenna Gain (㏈ i)

2.1.4. Output Power into Antenna & RF Exposure Evaluation Distance

Bluetooth

- Maximum tune up tolerance

Frequency (㎒)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
2 402 ~ 2 480	4	-1.79	0.000 331	1

WLAN (2.4G)

- Maximum tune up tolerance

Frequency (㎒)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
2 412 ~ 2 462	10	1.84	0.003 039	1

WLAN (5G)

- Maximum tune up tolerance

Frequency (㎒)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
5 180 ~ 5 240	10	2.75	0.003 747	1
5 260 ~ 5 320	10	2.75	0.003 747	1
5 500 ~ 5 720	10	-0.80	0.001 655	1
5 745 ~ 5 825	10	-1.24	0.001 495	1

CDMA - BC0

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
824 ~ 849	25.7	2.49	0.131 138	0.55

CDMA - BC1

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
1 850 ~ 1 910	25.7	1.79	0.111 617	1

LTE - Band 2

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
1 850 ~ 1 910	25.7	1.79	0.111 617	1

LTE - Band 4

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
1 710 ~ 1 755	25.7	0.82	0.089 275	1

LTE - Band 5

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
824 ~ 849	25.7	2.49	0.131 138	0.55

LTE - Band 13

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
777 ~ 787	25.7	2.03	0.117 959	0.52

Note;

- The power density Pd (5th column) at a distance of 20 ㎝ calculated from the friis transmission formula is far below the limit of 1 ㎽/㎠.
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
- This equipment should be installed and operated with minimum 20 ㎝ between the radiator and your body.
- The antenna gain of this transmitter is less than 6 dBi and must not be collocated or operating in conjunction with any other antenna or transmitter unless authorized to do so by the FCC.

Simultaneous transmission of MPE test exclusion for worst case configuration.

Bluetooth: the ratio is 0.000 331 / 1
WLAN: the ratio is 0.003 747 / 1
WWAN: the ratio is 0.131 138 / 0.55

Confirm the sum result of individual MPEs ratio is ≤ 1.0;
Bluetooth + WLAN + WWAN: (0.000 331 / 1) + (0.003 747 / 1) + (0.131 138 / 0.55)
= 0.352 511 ≤ 1.0

So this device meets the KDB447498 D01 v06 section 7.2 requirement of “Simultaneous transmission MPE test exclusion”

- End of the Test Report -