TEST REPORT

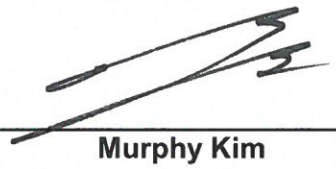
of

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

FCC ID: TQ8-ATC31F6AN

Equipment Under Test	:	DIGITAL CAR AVN SYSTEM
Model Name	:	ATC31F6AN
Variant Model Name	:	ATC30F6AN
Applicant	:	Hyundai Mobis Co., Ltd.
Manufacturer	:	Hyundai Mobis Co., Ltd.
Date of Receipt	:	2019.03.20
Date of Test(s)	:	2019.03.21 ~ 2019.05.14
Date of Issue	:	2019.05.29

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

Tested By:  **Date:** **2019.05.29**

Murphy Kim

Technical Manager:  **Date:** **2019.05.29**

Jungmin Yang

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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

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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	ATC31F6AN
Variant Model Name	ATC30F6AN
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)

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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-RTL013879	2019.05.29	Initial

1.6. Information of Variant Models

Model Name		Description
Basic Model	ATC31F6AN	- Basic model - SVM camera(Surround View) is installed
Variant Model	ATC30F6AN	- Same to basic model except the specification of camera - RVM camera(Rear View) is installed

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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 (㎒)	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.

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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. Test Information of Cable Loss and Antenna Gain

Test Item	Frequency (㎒)	Cable Loss (㏈)	Antenna Gain (㏈i)	Final Antenna Gain (㏈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)

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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	2.49	0.111 617	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	1.79	0.095 001	1

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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	24	1.79	0.075 462	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	24	0.82	0.060 357	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	24	2.49	0.088 660	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	24	2.03	0.079 750	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.

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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 0.111 617 / 0.55

Confirm the sum result of individual MPEs ratio is ≤ 1.0;
Bluetooth + WLAN + WWAN: (0.000 331 / 1) + (0.003 747 / 1) + (0.111 617 / 0.55)
= 0.207 018 ≤ 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 -

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