

TEST REPORT

of

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

FCC ID: TQ8-ATC410AAN

Equipment Under Test : DIGITAL CAR AVN SYSTEM
Model Name : ATC410AAN
Variant Model Names : ATC401VAN, ATC400AAN
Applicant : Hyundai Mobis Co., Ltd.
Manufacturer : Hyundai Mobis Co., Ltd.
Date of Receipt : 2019.11.18
Date of Test(s) : 2019.11.28 ~ 2019.12.20
Date of Issue : 2020.01.09

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

Tested By:



Nancy Park

Date:

2020.01.09

Technical
Manager:



Jungmin Yang

Date:

2020.01.09

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INDEX

<u>Table of Contents</u>	Page
1. General Information -----	3
2. RF Exposure Evaluation -----	6

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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

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1.4. Description of EUT

Kind of Product	DIGITAL CAR AVN SYSTEM
Model Name	ATC410AAN
Variant Model Names	ATC401VAN, ATC400AAN
Power Supply	DC 14.4 V
Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth) 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20) 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 ~ 5 720 MHz (Band 2C: 11a/n_HT20, 11ac_VHT20) 5 510 MHz ~ 5 710 MHz (Band 2C: 11n_HT40, 11ac_VHT40) 5 530 MHz ~ 5 690 MHz (Band 2C: 11ac_VHT80) 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)
Modulation Technique	DSSS, OFDM, GFSK, $\pi/4$ DQPSK, 8DPSK
Number of Channels	79 channels (Bluetooth) 11 channels (11b/g/n_HT20) 4 channels (Band 1: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 1: 11n_HT40, 11ac_VHT40) 1 channel (Band 1: 11ac_VHT80) 4 channels (Band 2A: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 2A: 11n_HT40, 11ac_VHT40) 1 channel (Band 2A: 11ac_VHT80) 9 channels (Band 2C: 11a/n_HT20, 11ac_VHT20) 4 channels (Band 2C: 11n_HT40, 11ac_VHT40) 2 channels (Band 2C: 11ac_VHT80) 5 channels (Band 3: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 3: 11n_HT40, 11ac_VHT40) 1 channel (Band 3: 11ac_VHT80)
Antenna Type	Pattern antenna
Antenna Gain	2 400 MHz ~ 2 483.5 MHz: -1.79 dB i (Bluetooth) 2 400 MHz ~ 2 483.5 MHz: 1.84 dB i (WLAN 2.4 G) 5 150 MHz ~ 5 250 MHz: 2.75 dB i (WLAN 5G) 5 250 MHz ~ 5 350 MHz: 2.75 dB i (WLAN 5G) 5 470 MHz ~ 5 725 MHz: -0.80 dB i (WLAN 5G) 5 725 MHz ~ 5 850 MHz: -1.24 dB i (WLAN 5G)

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1.5. Information of Variant Models

Model Names		Description	
		DIGITAL CAM	REAR CAM
Basic Model	ATC410AAN	O	X
Variant Models	ATC401VAN	O	X
	ATC400AAN	X	O

1.6. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000175	2020.01.09	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				
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
<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: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

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. Test information of Cable Loss and Antenna Gain

Test Item	Frequency (MHz)	Cable Loss (dB)	Antenna Gain (dB i)	Final Antenna Gain (dB i)
CDMA - BC0	824 ~ 849	-1.79	4.26	2.47
CDMA - BC1	1 850 ~ 1 910	-2.62	4.20	1.58
LTE - Band 2	1 850 ~ 1 910	-2.62	4.20	1.58
LTE - Band 4	1 710 ~ 1 755	-2.62	3.28	0.66
LTE - Band 5	824 ~ 849	-1.79	4.26	2.47
LTE - Band 13	777 ~ 787	-1.79	3.10	1.31

Note;

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

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2.1.4. Output Power into Antenna & RF Exposure Evaluation Distance

Bluetooth

- Maximum tune up tolerance

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

WLAN (2.4G)

- Maximum tune up tolerance

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

WLAN (5G)

- Maximum tune up tolerance

Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
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 (MHz)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
824 ~ 849	25.7	2.47	0.130 536	0.55

CDMA - BC1

- Maximum tune up tolerance

Frequency Range (MHz)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
1 850 ~ 1 910	25.7	1.58	0.106 348	1

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LTE - Band 2
- Maximum tune up tolerance

Frequency Range (MHz)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
1 850 ~ 1 910	25.7	1.58	0.106 348	1

LTE - Band 4
- Maximum tune up tolerance

Frequency Range (MHz)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
1 710 ~ 1 755	25.7	0.66	0.086 046	1

LTE - Band 5
- Maximum tune up tolerance

Frequency Range (MHz)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
824 ~ 849	25.7	2.47	0.130 536	0.55

LTE - Band 13
- Maximum tune up tolerance

Frequency Range (MHz)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
777 ~ 787	25.7	1.31	0.099 938	0.52

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.
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
- This equipment should be installed and operated with minimum 20 cm between the radiator and your body.
- The antenna gain of this transmitter is less than 6 dB i 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 RF Exposure test exclusion for worst case configuration.

Bluetooth: the ratio is 0.000 331 / 1

WLAN: the ratio is 0.003 747 / 1

WWLAN: the ratio is 0.130 536 / 0.55

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

Bluetooth + WLAN + WWLAN: $(0.000\ 331 / 1) + (0.003\ 747 / 1) + (0.130\ 536 / 0.55)$
 $= 0.241\ 416 \leq 1.0$

- End of the Test Report -

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