TEST REPORT

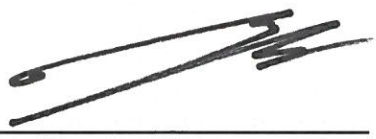
of

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

FCC ID: TQ8-ADC400AAN

Equipment Under Test	:	DISPLAY CAR SYSTEM
Model Name	:	ADC400AAN
Variant Model Name	:	ADC401VAN
Applicant	:	Hyundai Mobis Co., Ltd.
Manufacturer	:	Hyundai Mobis Co., Ltd.
Date of Receipt	:	2019.11.12
Date of Test(s)	:	2019.11.28 ~ 2019.12.26
Date of Issue	:	2019.12.31

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

Tested By:  **Date:** **2019.12.31**

Murphy Kim

Technical Manager:  **Date:** **2019.12.31**

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

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	DISPLAY CAR SYSTEM
Model Name	ADC400AAN
Variant Model Name	ADC401VAN
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 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 ㎒ ~ 2 483.5 ㎒: -0.18 ㏈i (Bluetooth) 2 400 ㎒ ~ 2 483.5 ㎒: -0.01 ㏈i (WLAN 2.4 G) 5 150 ㎒ ~ 5 250 ㎒: -0.61 ㏈i (WLAN 5G) 5 250 ㎒ ~ 5 350 ㎒: -0.18 ㏈i (WLAN 5G) 5 470 ㎒ ~ 5 725 ㎒: -0.77 ㏈i (WLAN 5G) 5 725 ㎒ ~ 5 850 ㎒: -0.18 ㏈i (WLAN 5G)

1.5. Information of Variant Model

Model Names		Description								
		BT/WIFI	FM/AM Code	INTERNAL /EXTERNAL	USB	RDS	DAB	SXM	HD	RHD/LHD
Basic Model	ADC400AAN	BT/WIFI/LTE	A2	EXTERNAL	O	O	X	O	O	LHD
Variant Model	ADC401VAN	BT/WIFI/LTE	A2	EXTERNAL	O	O	X	O	O	LHD

CODE	BAND	FREQUENCY RANGE	STEP	LOCAL
A2	FM	87.5-107.9 ㎒	200 ㎑	NA/GEN
	AM	530-1710 ㎑	10 ㎑	

1.6. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000162	2019.12.31	Initial

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	-1.79	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)

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	-0.18	0.000 479	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	12	-0.01	0.003 146	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	-0.61	0.001 729	1
5 260 ~ 5 320	10	-0.18	0.001 909	1
5 500 ~ 5 720	10	-0.77	0.001 666	1
5 745 ~ 5 825	10	-0.18	0.001 909	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	2.47	0.111 104	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	1.58	0.090 517	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	24	1.58	0.071 900	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	0.66	0.058 174	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	2.47	0.088 253	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	1.31	0.067 566	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 RF Exposure test exclusion for worst case configuration.

Bluetooth: the ratio is 0.000 479 / 1
WLAN: the ratio is 0.003 146 / 1
WWLAN: the ratio is 0.111 104 / 0.55

Confirm the sum result of individual MPEs ratio is ≤ 1.0;
Bluetooth + WLAN + WWLAN: (0.000 479 / 1) + (0.003 146 / 1) + (0.111 104 / 0.55)
= 0.205 632 ≤ 1.0

- End of the Test Report -