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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.

2019.12.31 Tested By: **Murphy Kim Technical** 2019.12.31 Date: Manager: 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
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- 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 Braduot	DICDLAY CAD CYCTEM
Kind of Product	DISPLAY CAR SYSTEM
Model Name	ADC400AAN
Variant Model Name	ADC401VAN
Power Supply	DC 14.4 V
Frequency Range	2 402 Mb ~ 2 480 Mb (Bluetooth) 2 412 Mb ~ 2 462 Mb (11b/g/n_HT20) 5 180 Mb ~ 5 240 Mb (Band 1: 11a/n_HT20, 11ac_VHT20) 5 190 Mb ~ 5 230 Mb (Band 1: 11n_HT40, 11ac_VHT40) 5 210 Mb (Band 1: 11ac_VHT80) 5 260 Mb ~ 5 320 Mb (Band 2A: 11a/n_HT20, 11ac_VHT20) 5 270 Mb ~ 5 310 Mb (Band 2A: 11n_HT40, 11ac_VHT40) 5 290 Mb (Band 2A: 11ac_VHT80) 5 500 Mb ~ 5 720 Mb (Band 2C: 11a/n_HT20, 11ac_VHT20) 5 510 Mb ~ 5 710 Mb (Band 2C: 11n_HT40, 11ac_VHT40) 5 530 Mb ~ 5 690 Mb (Band 2C: 11ac_VHT80) 5 745 Mb ~ 5 825 Mb (Band 3: 11a/n_HT20, 11ac_VHT40) 5 775 Mb (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 2A: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 2A: 11a/n_HT20, 11ac_VHT40) 1 channel (Band 2A: 11n_HT40, 11ac_VHT40) 1 channel (Band 2C: 11a/n_HT20, 11ac_VHT20) 4 channels (Band 2C: 11a/n_HT20, 11ac_VHT40) 2 channels (Band 2C: 11a_VHT80) 5 channels (Band 3: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 3: 11a/n_HT20, 11ac_VHT40) 1 channel (Band 3: 11ac_VHT80)
Antenna Type	Pattern antenna
Antenna Gain	2 400 Mb ~ 2 483.5 Mb: -0.18 dB i (Bluetooth) 2 400 Mb ~ 2 483.5 Mb: -0.01 dB i (WLAN 2.4 G) 5 150 Mb ~ 5 250 Mb: -0.61 dB i (WLAN 5G) 5 250 Mb ~ 5 350 Mb: -0.18 dB i (WLAN 5G) 5 470 Mb ~ 5 725 Mb: -0.77 dB i (WLAN 5G) 5 725 Mb ~ 5 850 Mb: -0.18 dB i (WLAN 5G)

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1.5. Information of Variant Model

		Description								
Model	Names	BT/WIFI	FM/AM Code	INTERNAL /EXTERNAL	USB	RDS	DAB	SXM	HD	RHD/LHD
Basic Model	ADC400AAN	BT/WIFI/LTE	A2	EXTERNAL	0	0	Х	0	0	LHD
Variant Model	ADC401VAN	BT/WIFI/LTE	A2	EXTERNAL	0	0	Х	0	0	LHD

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

1.6. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000162	2019.12.31	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 (쌘)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (ﷺ/ﷺ)	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 Ger	neral Population/Unco	ntrolled 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>	-	-	1.0	<u>30</u>	

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

Where Pd = power density in mW/cm²

Pout = 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

Pd 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 (Mb)	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 (飐)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (ﷺ/ﷺ)	Limits (mW/cm²)
2 402 ~ 2 480	4	-0.18	0.000 479	1

WLAN (2.4G)

- Maximum tune up tolerance

Frequency (脏)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (ﷺ/ﷺ)	Limits (mW/cm²)
2 412 ~ 2 462	12	-0.01	0.003 146	1

WLAN (5G)

- Maximum tune up tolerance

Frequency (Mb)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (ﷺ/ﷺ)	Limits (mW/cm²)
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 (썐)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (ﷺ/ﷺ)	Limits (nW/cn²)
824 ~ 849	25	2.47	0.111 104	0.55

CDMA - BC1

- Maximum Tune Up Tolerance

Frequency Range (쌘)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (㎡/cᡤ)	Limits (nW/cn²)
1 850 ~ 1 910	25	1.58	0.090 517	1

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LTE - Band 2

- Maximum Tune Up Tolerance

Frequency Range (싼)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (㎡/c㎡)	Limits (mW/cm²)
1 850 ~ 1 910	24	1.58	0.071 900	1

LTE - Band 4

- Maximum Tune Up Tolerance

Frequency Range (싼)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (㎡/c㎡)	Limits (nW/cn²)
1 710 ~ 1 755	24	0.66	0.058 174	1

LTE - Band 5

- Maximum Tune Up Tolerance

Frequency Range (싼)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (₪//cπ/)	Limits (nW/cn²)
824 ~ 849	24	2.47	0.088 253	0.55

LTE - Band 13

- Maximum Tune Up Tolerance

Frequency Range (싼)	Output Average Power to Antenna (dB m)	Final Antenna Gain (dB i)	Power Density at 20 cm (㎡/c㎡)	Limits (mW/cm²)
777 ~ 787	24	1.31	0.067 566	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 $6\,\mathrm{dB}\,i$ 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 0.000 479 / 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)

 $= 0.205 632 \le 1.0$

- End of the Test Report -