SGS Korea Co., Ltd.
4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
Tel. +82 31 428 5700 / Fax. +82 31 427 2370
http://www.sgsgroup.kr

TEST REPORT

of

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

FCC ID: TQ8-ADB40GWAN

1. Equipment Under Test	:	DISPLAY CAR SYSTEM
2. Model Name	:	FCC: ADB40GWAN IC: ADB40GWKN
3. Variant Model Name(s)	:	Refer to the page 3
4. Applicant	:	Hyundai Mobis Co., Ltd.
5. Manufacturer	:	Hyundai Mobis Co., Ltd.
6. Date of Receipt	:	2020.03.26
7. Date of Test(s)	:	2020.04.03 ~ 2020.05.26
8. Date of Issue	:	2020.06.09

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

Tested by:  **Jinhyoung Cho**

Technical Manager:  **Jungmin Yang**

SGS Korea Co., Ltd. Gunpo Laboratory

INDEX

Table of Contents Page

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.

Telephone : +82 31 688 0901
FAX : +82 31 688 0921

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	ADB40GWAN
Variant Model Names	ADB10GWGG, ADB10GWDG, ADB11GWGG, ADB10GWGN, ADB10GWEG, ADB10GWEP, ADB11GWEP, DAB50GWRP, ADB10GWUG, ADB10GWAN, DA350GWAN, ADB10GTEG, ADB10GTEP, ADB10GTEL, ADB10JFEP, ADB11JFEP, ADB12JFEP, ADB13JFEP, ADB14JFEP, ADB15JFEP
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 5 G) 5 250 ㎒ ~ 5 350 ㎒: -0.18 ㏈i (WLAN 5 G) 5 470 ㎒ ~ 5 725 ㎒: -0.77 ㏈i (WLAN 5 G) 5 725 ㎒ ~ 5 850 ㎒: -0.18 ㏈i (WLAN 5 G)

1.5. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000753	2020.06.09	Initial

1.6. Information of Variant Models

Model Names		Description							
		Local	BT / WIFI / TELE	UI	RDS	DAB	SXM	HD	FM/AM Code
Basic Model	ADB40GWAN	U.S.A.	BT, WIFI, TELE	GEN	X	X	O	O	A2
Variant Models	ADB10GWGG	General	BT, WIFI	GEN	X	X	X	X	A1
	ADB10GWDG	South Korea	BT, WIFI	GEN	X	X	X	X	A1
	ADB11GWGG	General	BT, WIFI	GEN	O	X	X	X	A1
	ADB10GWGN	General	BT, WIFI	GEN	X	X	X	X	A2
	ADB10GWEG	Europe	BT, WIFI	GEN	X	X	X	X	A1
	ADB10GWEP	Europe	BT, WIFI	GEN	X	X	X	X	A8
	ADB11GWEP	Europe	BT, WIFI	GEN	O	X	X	X	A8
	DAB50GWRP	Russia	BT, WIFI	GEN	O	X	X	X	A8
	ADB10GWUG	Australia	BT, WIFI	GEN	O	X	X	X	A9
	ADB10GWAN	U.S.A.	BT, WIFI	GEN	X	X	X	O	A2
	DA350GWAN	U.S.A.	BT, WIFI	GEN	X	X	X	X	A2
	ADB10GTEG	Columbia	BT, WIFI	GEN	X	X	X	X	A5
	ADB10GTEP	Mexico	BT, WIFI	GEN	O	X	X	O	A2
	ADB10GTEL	Europe	BT, WIFI	GEN	O	O	X	X	A8
	ADB10JFEP	Europe	BT, WIFI	HEV	X	X	X	X	A8
	ADB11JFEP	Europe	BT, WIFI	HEV	O	X	X	X	A8
	ADB12JFEP	Europe	BT, WIFI	HEV	O	O	X	X	A8
	ADB13JFEP	Europe	BT, WIFI	PHEV	X	X	X	X	A8
	ADB14JFEP	Europe	BT, WIFI	PHEV	O	X	X	X	A8
	ADB15JFEP	Europe	BT, WIFI	PHEV	O	O	X	X	A8

CODE	BAND	FREQUENCY RANGE	STEP	LOCAL
A1	FM	87.5-108.0 ㎒	100 ㎑	DOM/GEN
	AM	531-1 602 ㎑	9 ㎑	
A2	FM	87.5-107.9 ㎒	200 ㎑	NA/GEN
	AM	530-1 710 ㎑	10 ㎑	
A5	FM	87.5-107.9 ㎒	100 ㎑	COLOMBIA
	AM	530-1 710 ㎑	10 ㎑	
A8	FM	87.5-108.0 ㎒	100 ㎑	EU
	AM	522-1 620 ㎑	9 ㎑	
A9	FM	87.5-108.0 ㎒	100 ㎑	AU
	AM	522-1 701 ㎑	9 ㎑	

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 (㏈)	Antenna Gain (㏈i)	Final Antenna Gain (㏈i)
CDMA - BC0	824 ~ 849	-1.71	-0.16	-1.87
CDMA - BC1	1 850 ~ 1 910	-3.30	4.80	1.50
LTE - Band 2	1 850 ~ 1 910	-3.30	4.80	1.50
LTE - Band 4	1 710 ~ 1 755	-3.30	2.93	-0.37
LTE - Band 5	824 ~ 849	-1.71	-0.16	1.87
LTE - Band 13	777 ~ 787	-1.71	0.67	-1.04

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 Range (㎒)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
2 400 ~ 2 483.5	3	-0.18	0.000 381	1

WLAN (2.4G)

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
2 400 ~ 2 483.5	11	-0.01	0.002 499	1

WLAN (5G)

- Maximum tune up tolerance

Frequency Range (㎒)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)	Limits (㎽/㎠)
5 150 ~ 5 250	8	-0.61	0.001 091	1
5 250 ~ 5 350	8	-0.18	0.001 204	1
5 470 ~ 5 725	8	-0.77	0.001 051	1
5 725 ~ 5 850	8	-0.18	0.001 204	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	-1.87	0.048 054	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	1.50	0.104 407	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	1.50	0.104 407	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	-0.37	0.067 878	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	1.87	0.113 692	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	-1.04	0.058 174	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.
- According to KDB 447498 D01 RF Exposure Guidance 4.1.

Simultaneous transmission of RF Exposure test exclusion for worst case configuration.

Bluetooth: the ratio is 0.000 381 / 1
WLAN: the ratio is 0.002 499 / 1
WWLAN: the ratio is 0.113 692 / 0.55

Confirm the sum result of individual MPEs ratio is ≤ 1.0;
Bluetooth + WLAN + WWLAN: (0.000 381 / 1) + (0.002 499 / 1) + (0.113 692 / 0.55) = 0.209 593 ≤ 1.0

- End of the Test Report -