

TEST REPORT

of

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

FCC ID: TQ8-ADB20HYAN

Equipment Under Test : DISPLAY CAR SYSTEM
Model Name : ADB20HYAN
Variant Model Names : ADB11GZGG, ADB10GZMG, ADB30HYAN,
ADB30HCAN, ADB20HYFN, ADB10HYFL,
ADB20HCAN, ADB10GZGG, ADB11GZGG,
ADB10GZMG, ADB10GZGP, ADB10GZGN,
ADB10GZBB
Applicant : Hyundai Mobis Co., Ltd.
Manufacturer : Hyundai Mobis Co., Ltd.
Date of Receipt : 2019.09.23
Date of Test(s) : 2019.10.09 ~ 2019.10.30
Date of Issue : 2019.11.22

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

Tested By:



Jinhyoung Cho

Date:

2019.11.22

Technical
Manager:



Jungmin Yang

Date:

2019.11.22

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A4(210 mm x 297 mm)

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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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Telephone : +82 31 688 0901

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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	DISPLAY CAR SYSTEM
Model Name	ADB20HYAN
Variant Model Name	ADB11GZGG, ADB10GZMG, ADB30HYAN, ADB30HCAN, ADB20HYFN, ADB10HYFL, ADB20HCAN, ADB10GZGG, ADB11GZGG, ADB10GZMG, ADB10GZGP, ADB10GZGN, ADB10GZBB
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: -0.18 dBi (Bluetooth) 2 400 MHz ~ 2 483.5 MHz: -0.01 dBi (WLAN 2.4 G) 5 150 MHz ~ 5 250 MHz: -0.61 dBi (WLAN 5G) 5 250 MHz ~ 5 350 MHz: -0.18 dBi (WLAN 5G) 5 470 MHz ~ 5 725 MHz: -0.77 dBi (WLAN 5G) 5 725 MHz ~ 5 850 MHz: -0.18 dBi (WLAN 5G)

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1.5. Information of Variant Models

Model Names			Description								
			LOCAL	BT/WiFi	UI	RDS	DAB	SXM	HD	HANDLE	FM/AM Code
Basic Model	FCC	ADB20HYAN	U.S.A	BT, WiFi	GEN	X	X	X	O	LHD	A2
Variant Models	FCC	ADB11GZGG	GEN	BT	GEN	O	X	X	X	RHD	A1
		ADB10GZMG	Mid East	BT	GEN	O	X	X	X	LHD	A1
		ADB20HYFN	MEXICO	BT, WiFi	GEN	O	X	X	O	LHD	A2
		ADB10HYFL	Colombia	BT, WiFi	GEN	X	X	X	X	LHD	A5
		ADB20HCAN	U.S.A	BT, WiFi	HEV	X	X	X	O	LHD	A2
		ADB10GZGG	GEN	BT, WiFi	GEN	X	X	X	X	LHD	A1
		ADB11GZGG	GEN	BT, WiFi	GEN	O	X	X	X	RHD	A1
		ADB10GZMG	Mid East	BT, WiFi	GEN	O	X	X	X	LHD	A1
		ADB10GZGP	GEN	BT, WiFi	GEN	X	X	X	X	LHD	A8
		ADB10GZGN	GEN	BT, WiFi	GEN	X	X	X	X	LHD	A2
		ADB10GZBB	Brazil	BT, WiFi	GEN	X	X	X	X	LHD	A7
		ADB30HYAN	U.S.A	BT, WiFi, Tele	GEN	X	X	O	O	LHD	A2
		ADB30HCAN	U.S.A	BT, WiFi, Tele	HEV	X	X	O	O	LHD	A2

BAND	CODE	FREQUENCY RANGE	STEP	LOCAL	CODE	FREQUENCY RANGE	STEP	LOCAL
FM	A1	87.5-108.0 MHz	100 kHz	DOM/GEN	A5	87.5-107.9 MHz	100 kHz	COLOMBIA
AM		531-1602 kHz	9 kHz			530-1710 kHz	10 kHz	
FM	A2	87.5-107.9 MHz	200 kHz	NA/GEN	A6	87.5-107.9 MHz	200 kHz	GUAM
AM		530-1710 kHz	10 kHz			531-1701 kHz	9 kHz	
FM	A3	87.5-108.0 MHz	50 kHz	EU	A7	76.1-107.9 MHz	100 kHz	BRAZIL
AM		522-1620 kHz	9 kHz			530-1710 kHz	10 kHz	
FM	A4	76.0~90.0 MHz	100 kHz	JAPAN	A8	87.5-108.0 MHz	100 kHz	EU
AM		522~1629 KHz	9 kHz			522-1620 kHz	9 kHz	

1.6. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501/RF-RTL014546	2019.11.22	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: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

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	0.89	-0.90
CDMA - BC1	1 850 ~ 1 910	-2.62	2.92	0.30
LTE - Band 2	1 850 ~ 1 910	-2.62	2.92	0.30
LTE - Band 4	1 710 ~ 1 755	-2.62	1.81	-0.81
LTE - Band 5	824 ~ 849	-1.79	0.89	-0.90
LTE - Band 13	777 ~ 787	-1.79	0.42	-1.37

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	-0.18	0.000 479	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	12	-0.01	0.003 146	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	9	-0.61	0.001 373	1
5 260 ~ 5 320	9	-0.18	0.001 516	1
5 500 ~ 5 720	9	-0.77	0.001 324	1
5 745 ~ 5 825	9	-0.18	0.001 516	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	-0.90	0.060 080	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	0.30	0.079 201	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	0.30	0.079 201	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	-0.81	0.061 338	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	-0.90	0.060 080	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	-1.37	0.053 918	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 0.000 479 / 1

WLAN: the ratio is 0.003 146 / 1

WWLAN: the ratio is 0.060 080 / 0.55

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

Bluetooth + WLAN + WWLAN: $(0.000\ 479 / 1) + (0.003\ 146 / 1) + (0.060\ 080 / 0.55)$

$= 0.112\ 861 \leq 1.0$

- End of the Test Report -

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