

TEST REPORT

of

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

FCC ID: TQ8-ATB40S8AN

Equipment Under Test : DIGITAL CAR AVN SYSTEM
Model Name : ATB40S8AN
Applicant : Hyundai Mobis Co., Ltd.
Manufacturer : Hyundai Mobis Co., Ltd.
Date of Receipt : 2018.09.03
Date of Test(s) : 2018.09.04 ~ 2018.11.07
Date of Issue : 2018.11.23

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

Tested By:



Murphy Kim

Date:

2018.11.23

Technical
Manager:



Jungmin Yang

Date:

2018.11.23

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SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2017.07.10)(0)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

-Wireless Div. 2FL, 10-2, 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, 06141

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	DIGITAL CAR AVN SYSTEM
Model Name	ATB40S8AN
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), 5 745 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), 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)
Modulation Technique	DSSS, OFDM, GFSK, $\pi/4$ QPSK, 8DPSK
Number of Channels	79 channel (Bluetooth), 11 channel (11b/g/n_HT20), 5 channel (Band 3: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 3: 11n_HT40, 11ac_VHT40), 1 channel (Band 3: 11ac_VHT80), 4 channel (Band 1: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 1: 11n_HT40, 11ac_VHT40), 1 channel (Band 1: 11ac_VHT80), 4 channel (Band 2A: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 2A: 11n_HT40, 11ac_VHT40), 1 channel (Band 2A: 11ac_VHT80), 9 channel (Band 2C: 11a/n_HT20, 11ac_VHT20), 4 channel (Band 2C: 11n_HT40, 11ac_VHT40), 2 channel (Band 2C: 11ac_VHT80)
Antenna Type	PCB pattern antenna
Antenna Gain	Bluetooth
	2 400 MHz ~ 2 4835 MHz: 0.29 dB i
Antenna Gain	WLAN
	2 400 MHz ~ 2 4835 MHz: -0.70 dB i, 5 150 MHz ~ 5 250 MHz: 3.51 dB i, 5 250 MHz ~ 5 350 MHz: 3.12 dB i, 5 470 MHz ~ 5 725 MHz: 2.28 dB i, 5 725 MHz ~ 5 850 MHz: -0.84 dB i

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1.5. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL013161	2018.11.23	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	-1.71	2.80	1.09
CDMA - BC1	1 850 ~ 1 910	-3.30	5.23	1.93
LTE - Band 2	1 850 ~ 1 910	-3.30	5.23	1.93
LTE - Band 4	1 710 ~ 1 755	-3.30	3.96	0.66
LTE - Band 5	824 ~ 849	-1.71	2.80	1.09
LTE - Band 13	777 ~ 787	-1.71	1.38	-0.33

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 Range (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	0.29	0.000 534	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	-0.70	0.001 693	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	3.51	0.004 464	1
5 260 ~ 5 320	10	3.12	0.004 081	1
5 500 ~ 5 720	10	2.28	0.003 363	1
5 745 ~ 5 825	10	-0.84	0.001 640	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	1.09	0.080 859	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	1.93	0.098 114	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	24	1.93	0.077 935	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	24	0.66	0.058 174	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	24	1.09	0.064 229	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	24	-0.33	0.046 316	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 MPE test exclusion for worst case configuration.

Bluetooth: the ratio is 0.000 534 / 1

WLAN: the ratio is 0.004 464 / 1

CDMA: the ratio is 0.080 859 / 0.55

LTE: the ratio is 0.064 229 / 0.55

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

Bluetooth + WLAN + CDMA + LTE: $(0.000\ 534 / 1) + (0.004\ 464 / 1) + (0.080\ 859 / 0.55) + (0.064\ 229 / 0.55)$
 $= 0.268\ 794 \leq 1.0$

So this device meets the KDB447498 D01 v06 section 7.2 requirement of "Simultaneous transmission MPE test exclusion"

- End of the Test Report -

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