

TEST REPORT

of

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

FCC ID: TQ8-AVC42G5AN

Equipment Under Test : DIGITAL CAR AVN SYSTEM
Model Name : AVC42G5AN
Variant Model Name : AVC43G5AN
Applicant : Hyundai Mobis Co., Ltd.
Manufacturer : Hyundai Mobis Co., Ltd.
Date of Receipt : 2018.11.19
Date of Test(s) : 2018.12.06 ~ 2019.01.15
Date of Issue : 2019.01.15

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

Tested By:


Jinhyoung Cho

Date: 2019.01.15

Technical
Manager:


Harim Lee

Date: 2019.01.15

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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>.

Phone No. : +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, 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 | AVC42G5AN |
| Variant Model Name | AVC43G5AN |
| 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: -0.59 dB i |
| | WLAN 2 400 MHz ~ 2 4835 MHz: -0.70 dB i, 5 150 MHz ~ 5 250 MHz: 1.93 dB i, 5 250 MHz ~ 5 350 MHz: 1.92 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. Information of Variant Models

| Model Name | | Description |
|---------------|-----------|--|
| Basic model | AVC42G5AN | - Basic Model |
| Variant model | AVC43G5AN | - Same to basic model, It's different only software. |

1.6. Test report revision

| Revision | Report number | Date of Issue | Description |
|----------|----------------------|---------------|-------------|
| 0 | F690501/RF-RTL013419 | 2019.01.15 | 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 | -0.59 | 0.000 436 | 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 | 9 | 1.93 | 0.002 465 | 1 |
| 5 260 ~ 5 320 | 9 | 1.92 | 0.002 459 | 1 |
| 5 500 ~ 5 720 | 9 | 2.28 | 0.002 671 | 1 |
| 5 745 ~ 5 825 | 9 | -0.84 | 0.001 302 | 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 0.000 436 / 1

WLAN: the ratio is 0.002 671 / 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: $(0.000\ 436 / 1) + (0.002\ 671 / 1) + (0.080\ 859 / 0.55) + (0.064\ 229 / 0.55)$
 $= 0.266\ 903 \leq 1.0$

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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