

# TEST REPORT

of

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

FCC ID: TQ8-ATB40F6AN

Equipment Under Test : DIGITAL CAR AVN SYSTEM  
Model Name : ATB40F6AN  
Applicant : Hyundai Mobis Co., Ltd.  
Manufacturer : Hyundai Mobis Co., Ltd.  
Date of Receipt : 2019.03.20  
Date of Test(s) : 2019.03.20 ~ 2019.05.29  
Date of Issue : 2019.06.19

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

Tested By:



Nancy Park

Date:

2019.06.19

Technical  
Manager:



Jungmin Yang

Date:

2019.06.19

*The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.*

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

# INDEX

| <u>Table of Contents</u>        | Page |
|---------------------------------|------|
| 1. General Information -----    | 3    |
| 2. RF Exposure Evaluation ----- | 5    |

*The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.*

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

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

## 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

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Kind of Product</b>      | DIGITAL CAR AVN SYSTEM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Model Name</b>           | ATB40F6AN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Power Supply</b>         | DC 14.4 V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Frequency Range</b>      | 2 402 MHz ~ 2 480 MHz (Bluetooth), 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20),<br>5 180 MHz ~ 5 240 MHz (Band 1: 11a/n_HT20, 11ac_VHT20),<br>5 190 MHz ~ 5 230 MHz (Band 1: 11n_HT40, 11ac_VHT40),<br>5 210 MHz (Band 1: 11ac_VHT80),<br>5 260 MHz ~ 5 320 MHz (Band 2A: 11a/n_HT20, 11ac_VHT20),<br>5 270 MHz ~ 5 310 MHz (Band 2A: 11n_HT40, 11ac_VHT40),<br>5 290 MHz (Band 2A: 11ac_VHT80),<br>5 500 MHz ~ 5 720 MHz (Band 2C: 11a/n_HT20, 11ac_VHT20),<br>5 510 MHz ~ 5 710 MHz (Band 2C: 11n_HT40, 11ac_VHT40),<br>5 530 MHz ~ 5 690 MHz (Band 2C: 11ac_VHT80),<br>5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20, 11ac_VHT20),<br>5 755 MHz ~ 5 795 MHz (Band 3: 11n_HT40, 11ac_VHT40),<br>5 775 MHz (Band 3: 11ac_VHT80) |
| <b>Modulation Technique</b> | DSSS, OFDM, GFSK, $\pi/4$ DQPSK, 8DPSK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Number of Channels</b>   | 79 channel (Bluetooth), 11 channel (11b/g/n_HT20),<br>4 channel (Band 1: 11a/n_HT20, 11ac_VHT20),<br>2 channel (Band 1: 11n_HT40, 11ac_VHT40), 1 channel (Band 1: 11ac_VHT80),<br>4 channel (Band 2A: 11a/n_HT20, 11ac_VHT20),<br>2 channel (Band 2A: 11n_HT40, 11ac_VHT40), 1 channel (Band 2A: 11ac_VHT80),<br>9 channel (Band 2C: 11a/n_HT20, 11ac_VHT20),<br>4 channel (Band 2C: 11n_HT40, 11ac_VHT40), 2 channel (Band 2C: 11ac_VHT80),<br>5 channel (Band 3: 11a/n_HT20, 11ac_VHT20),<br>2 channel (Band 3: 11n_HT40, 11ac_VHT40), 1 channel (Band 3: 11ac_VHT80)                                                                                                                                               |

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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

|              |                                                                                                                                                                                                                                                                                                   |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Antenna Type | PCB pattern antenna                                                                                                                                                                                                                                                                               |
| Antenna Gain | 2 400 MHz ~ 2 483.5 MHz: -1.79 dB i (Bluetooth),<br>2 400 MHz ~ 2 483.5 MHz: 1.84 dB i (WLAN 2.4 G),<br>5 150 MHz ~ 5 250 MHz: 2.75 dB i (WLAN 5G),<br>5 250 MHz ~ 5 350 MHz: 2.75 dB i (WLAN 5G),<br>5 470 MHz ~ 5 725 MHz: -0.80 dB i (WLAN 5G),<br>5 725 MHz ~ 5 850 MHz: -1.24 dB i (WLAN 5G) |

### 1.5. Test Report Revision

| Revision | Report Number          | Date of Issue | Description                                 |
|----------|------------------------|---------------|---------------------------------------------|
| 0        | F690501/RF-RTL013844   | 2019.05.29    | Initial                                     |
| 1        | F690501/RF-RTL013844-1 | 2019.06.19    | Corrected Maximum tune up tolerance of WWAN |

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

## 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<br>(MHz)                                | Electric Field<br>Strength<br>(V/m) | Magnetic Field<br>Strength<br>(A/m) | Power Density<br>(mW/cm <sup>2</sup> ) | 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 <sup>2</sup>                    | 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 <sup>2</sup>                    | 30               |
| 30-300                                                  | 27.5                                | 0.073                               | 0.2                                    | 30               |
| <b><u>300-1 500</u></b>                                 | -                                   | -                                   | <b><u>f/1500</u></b>                   | <b><u>30</u></b> |
| <b><u>1 500-100 000</u></b>                             | -                                   | -                                   | <b><u>1.0</u></b>                      | <b><u>30</u></b> |

#### 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/cm<sup>2</sup>

$P_{out}$  = 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

$P_d$  the limit of MPE, 1 mW/cm<sup>2</sup>. 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.

*The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.*

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

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

### 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<br>(MHz) | Cable Loss<br>(dB) | Antenna Gain<br>(dB i) | Final Antenna Gain<br>(dB i) |
|---------------|--------------------|--------------------|------------------------|------------------------------|
| CDMA - BC0    | 824 ~ 849          | -1.71              | 4.20                   | 2.49                         |
| CDMA - BC1    | 1 850 ~ 1 910      | -3.30              | 5.09                   | 1.79                         |
| LTE - Band 2  | 1 850 ~ 1 910      | -3.30              | 5.09                   | 1.79                         |
| LTE - Band 4  | 1 710 ~ 1 755      | -3.30              | 4.12                   | 0.82                         |
| LTE - Band 5  | 824 ~ 849          | -1.71              | 4.20                   | 2.49                         |
| LTE - Band 13 | 777 ~ 787          | -1.71              | 3.74                   | 2.03                         |

**Note;**

- Final Antenna Gain (dB i) = Cable Loss (dB) + Antenna Gain (dB i)

*The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.*

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

## 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 <sup>2</sup> ) | Limits (mW/cm <sup>2</sup> ) |
|-----------------|----------------------------------------|---------------------|----------------------------------------------|------------------------------|
| 2 402 ~ 2 480   | 4                                      | -1.79               | 0.000 331                                    | 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 <sup>2</sup> ) | Limits (mW/cm <sup>2</sup> ) |
|-----------------|----------------------------------------|---------------------|----------------------------------------------|------------------------------|
| 2 412 ~ 2 462   | 10                                     | 1.84                | 0.003 039                                    | 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 <sup>2</sup> ) | Limits (mW/cm <sup>2</sup> ) |
|-----------------|----------------------------------------|---------------------|----------------------------------------------|------------------------------|
| 5 180 ~ 5 240   | 10                                     | 2.75                | 0.003 747                                    | 1                            |
| 5 260 ~ 5 320   | 10                                     | 2.75                | 0.003 747                                    | 1                            |
| 5 500 ~ 5 720   | 10                                     | -0.80               | 0.001 655                                    | 1                            |
| 5 745 ~ 5 825   | 10                                     | -1.24               | 0.001 495                                    | 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 <sup>2</sup> ) | Limits (mW/cm <sup>2</sup> ) |
|-----------------------|----------------------------------------|---------------------------|----------------------------------------------|------------------------------|
| 824 ~ 849             | 25.7                                   | 2.49                      | 0.131 138                                    | 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 <sup>2</sup> ) | Limits (mW/cm <sup>2</sup> ) |
|-----------------------|----------------------------------------|---------------------------|----------------------------------------------|------------------------------|
| 1 850 ~ 1 910         | 25.7                                   | 1.79                      | 0.111 617                                    | 1                            |

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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

#### LTE - Band 2

##### - Maximum tune up tolerance

| Frequency Range<br>(MHz) | Output Average<br>Power to Antenna<br>(dB m) | Final Antenna<br>Gain<br>(dB i) | Power Density<br>at 20 cm<br>(mW/cm <sup>2</sup> ) | Limits<br>(mW/cm <sup>2</sup> ) |
|--------------------------|----------------------------------------------|---------------------------------|----------------------------------------------------|---------------------------------|
| 1 850 ~ 1 910            | 25.7                                         | 1.79                            | 0.111 617                                          | 1                               |

#### LTE - Band 4

##### - Maximum tune up tolerance

| Frequency Range<br>(MHz) | Output Average<br>Power to Antenna<br>(dB m) | Final Antenna<br>Gain<br>(dB i) | Power Density<br>at 20 cm<br>(mW/cm <sup>2</sup> ) | Limits<br>(mW/cm <sup>2</sup> ) |
|--------------------------|----------------------------------------------|---------------------------------|----------------------------------------------------|---------------------------------|
| 1 710 ~ 1 755            | 25.7                                         | 0.82                            | 0.089 275                                          | 1                               |

#### LTE - Band 5

##### - Maximum tune up tolerance

| Frequency Range<br>(MHz) | Output Average<br>Power to Antenna<br>(dB m) | Final Antenna<br>Gain<br>(dB i) | Power Density<br>at 20 cm<br>(mW/cm <sup>2</sup> ) | Limits<br>(mW/cm <sup>2</sup> ) |
|--------------------------|----------------------------------------------|---------------------------------|----------------------------------------------------|---------------------------------|
| 824 ~ 849                | 25.7                                         | 2.49                            | 0.131 138                                          | 0.55                            |

#### LTE - Band 13

##### - Maximum tune up tolerance

| Frequency Range<br>(MHz) | Output Average<br>Power to Antenna<br>(dB m) | Final Antenna<br>Gain<br>(dB i) | Power Density<br>at 20 cm<br>(mW/cm <sup>2</sup> ) | Limits<br>(mW/cm <sup>2</sup> ) |
|--------------------------|----------------------------------------------|---------------------------------|----------------------------------------------------|---------------------------------|
| 777 ~ 787                | 25.7                                         | 2.03                            | 0.117 959                                          | 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/cm<sup>2</sup>.
- 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.

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

---

**Simultaneous transmission of MPE test exclusion for worst case configuration.**

Bluetooth: the ratio is 0.000 331 / 1  
WLAN: the ratio is 0.003 747 / 1  
WWAN: the ratio is 0.131 138 / 0.55

Confirm the sum result of individual MPEs ratio is  $\leq 1.0$ ;  
Bluetooth + WLAN + WWAN:  $(0.000\ 331 / 1) + (0.003\ 747 / 1) + (0.131\ 138 / 0.55)$   
 $= 0.352\ 511 \leq 1.0$

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

**- End of the Test Report -**

---

*The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.*

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

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)