

# TEST REPORT

of

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

FCC ID: TQ8-AVCB0GSAN

Equipment Under Test : DIGITAL CAR AVNT SYSTEM

Model Name : AVCB0GSAN

Applicant : Hyundai MOBIS Co., Ltd.

Manufacturer : Hyundai MOBIS Co., Ltd.

Date of Test(s) : 2014. 07. 07 ~ 2014. 07. 17

Date of Issue : 2014. 08. 05

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

Tested By:



Date:

2014.08.05

Alvin Kim

Approved By:



Date:

2014.08.05

Hyunchae You

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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, 435-837

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, 135-977, Korea

Contact Person : Choi, Seung-Hun

Phone No. : +82 31 260 0098

### 1.3. Description of EUT

Kind of Product	DIGITAL CAR AVNT SYSTEM
Model Name	AVCB0GSAN
Power Supply	DC 14.4 V (Vehicle Battery)
Frequency Range	824.70 MHz ~ 848.31 MHz (CDMA850) 1 851.25 MHz ~ 1 908.75 MHz (CDMA1900) 2 402 MHz ~ 2 480 MHz (BT) 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20)
Antenna Gain	824.70 MHz ~ 848.31 MHz : 2.94 dB i, 1 851.25 MHz ~ 1 908.75 MHz : 3.45 dB i, 2 402 MHz ~ 2 480 MHz : -3.48 dB i, 2 412 MHz ~ 2 462 MHz : 1.94 dB i

### 1.4. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL007835	2014.07.21	Initial
1	F690501/RF-RTL007835-1	2014.08.05	Add result of simultaneous transmission MPE test exclusion

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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

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

#### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500	--	--	F/300	6
1 500 – 100 000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
<b>300 – 1 500</b>	--	--	<b>F/1500</b>	<b>30</b>
<b>1 500 – 100 000</b>	--	--	<b>1</b>	<b>30</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.

## 2.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data

Test Mode : Normal Operation

## 2.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

Mode: CDMA850 1xRTT

Channel	Channel Frequency (MHz)	Measured E.R.P. (dB m)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
Low	824.70	24.30	100	0.105 373	0.549 80
Middle	836.52	23.86	100	0.095 220	0.557 68
High	848.31	24.18	100	0.102 501	0.565 54

Mode	Channel 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> )
Maximum tune up tolerance	Low	25.50	2.94	0.138 909	0.549 80

Mode: CDMA1 900 1xRTT

Channel	Channel Frequency (MHz)	Measured E.I.R.P. (dB m)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
Low	1 851.25	23.85	100	0.106 839	1
Middle	1 880.00	24.09	100	0.112 909	1
High	1 908.75	23.88	100	0.107 580	1

Mode	Channel 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> )
Maximum tune up tolerance	Middle	25.50	3.45	0.156 218	1

Note :

1. The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit .

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**Mode: CDMA850 1xEV-DO**

Channel	Channel Frequency (MHz)	Measured E.R.P. (dB m)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
Low	824.70	24.31	100	0.105 616	0.549 80
Middle	836.52	23.88	100	0.095 660	0.557 68
High	848.31	24.14	100	0.101 562	0.565 54

Mode	Channel 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> )
Maximum tune up tolerance	Low	25.50	2.94	0.138 909	0.549 80

**Mode: CDMA1900 1xEV-DO**

Channel	Channel Frequency (MHz)	Measured E.I.R.P. (dB m)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	LIMITS (mW/cm <sup>2</sup> )
Low	1 851.25	24.25	100	0.117 147	1
Middle	1 880.00	24.38	100	0.120 706	1
High	1 908.75	24.15	100	0.114 480	1

Mode	Channel 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> )
Maximum tune up tolerance	Middle	25.50	3.45	0.156 218	1

Note :

1. The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit .

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## WLAN

### Mode: 11b

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
Low	2 412	16.19	1.94	100	0.012 934	1
Middle	2 437	16.20	1.94	100	0.012 964	1
High	2 462	16.30	1.94	100	0.013 266	1
Maximum tune up tolerance	High	18.00	1.94	100	0.019 621	1

### Mode: 11g

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
Low	2 412	11.95	1.94	98	0.004 972	1
Middle	2 437	11.98	1.94	98	0.005 006	1
High	2 462	12.12	1.94	98	0.005 170	1
Maximum tune up tolerance	High	14.00	1.94	98	0.007 971	1

### Mode: 11n

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
Low	2 412	11.80	1.94	98	0.004 803	1
Middle	2 437	11.86	1.94	98	0.004 870	1
High	2 462	11.92	1.94	98	0.004 937	1
Maximum tune up tolerance	High	14.00	1.94	98	0.007 971	1

#### 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>.

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## BT

### Mode: GFSK

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
Low	2 402	0.52	-3.48	77	0.000 131	1
Middle	2 441	0.24	-3.48	77	0.000 123	1
High	2 480	0.39	-3.48	77	0.000 127	1
Maximum tune up tolerance	Low	4.00	-3.48	77	0.000 291	1

### Mode: $\pi/4$ DQPSK

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
Low	2 402	-0.15	-3.48	77	0.000 112	1
Middle	2 441	-0.38	-3.48	77	0.000 106	1
High	2 480	-0.18	-3.48	77	0.000 111	1
Maximum tune up tolerance	Low	4.00	-3.48	77	0.000 291	1

### Mode: 8DPSK

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm <sup>2</sup> )	Limits (mW/cm <sup>2</sup> )
Low	2 402	-0.13	-3.48	77	0.000 113	1
Middle	2 441	-0.39	-3.48	77	0.000 106	1
High	2 480	-0.19	-3.48	77	0.000 111	1
Maximum tune up tolerance	Low	4.00	-3.48	77	0.000 291	1

#### Note :

1. 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>.



### Simultaneous transmission MPE test exclusion

WWAN CDMA850 1xRTT: the ratio is 0.138 909 / 0.549 80

WLAN 802.11b: the ratio is 0.019 621 / 1

Bluetooth GFSK: the ratio is 0.000 291 / 1

Confirm the sum result of individual MPEs ratio is  $\leq 1.0$ ;

$$(0.138\ 909 / 0.549\ 80) + (0.019\ 621 / 1) + (0.000\ 291 / 1) = 0.272\ 566 \leq 1.0$$

So this device meets the KDB447498 D01 v05r02 section 7.2 requirement of "Simultaneous transmission MPE test exclusion".

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