

# TEST REPORT

OF

FCC Part 15 Subpart C §15.209  
FCC ID: TQ8-SMK-4E09

Equipment Under Test : SMART KEY ECU  
Model Name : SMK-4E09  
Applicant : Hyundai Mobis Co., Ltd.  
Manufacturer : Hyundai MOBIS Co., Ltd.  
Date of Test(s) : 2014.07.18 ~ 2014.07.21  
Date of Issue : 2014.07.23

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

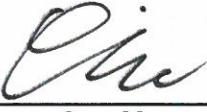
Tested By:

  
\_\_\_\_\_  
Jungmin Yang

Date:

2014.07.23

Approved By:

  
\_\_\_\_\_  
Hyunchae You

Date:

2014.07.23

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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>.

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, 135-977 Republic of Korea

Contact Person : Choi, Seung-Hoon

Phone No. : +82 31 260 0098

### 1.3. Description of EUT

Kind of Product	SMART KEY ECU
Model Name	SMK-4E09
Power Supply	DC 12 V (Used by Vehicle battery)
Frequency Range	Tx: 125.00 kHz (LF Antenna) Rx: 433.92 MHz (RF Antenna)
Modulation Technique	ASK
Number of Channels	1
Operating Conditions	-30 °C ~ +75 °C
Antenna Type	Internal Type

### 1.4. Declarations by the manufacturer

- RF antenna is only Receiver antenna
- The EUT of antennas cannot operate at the same time.

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### 1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due.
Loop Antenna	SCHWARZBECK	FMZB 1519	1519-039	Jul. 12, 2013	Biennial	Jul. 09, 2015
DC power Supply	Agilent	U8002A	MY49030063	Dec. 12, 2013	Annual	Dec. 12, 2014
Test Receiver	R&S	ESU26	100194	Sep. 13, 2013	Annual	Sep. 13, 2014
Antenna Master	MM4000	INN-CO	N/A	N.C.R.	N.C.R.	N.C.R.
Turn Table	DT-3000S-3T	INN-CO	N/A	N.C.R.	N.C.R.	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (21.5 m × 13.0 m × 9.0 m)	N/A	N.C.R.	N.C.R.	N.C.R.

### 1.6. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL007841	2014.07.23	Initial

### 1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

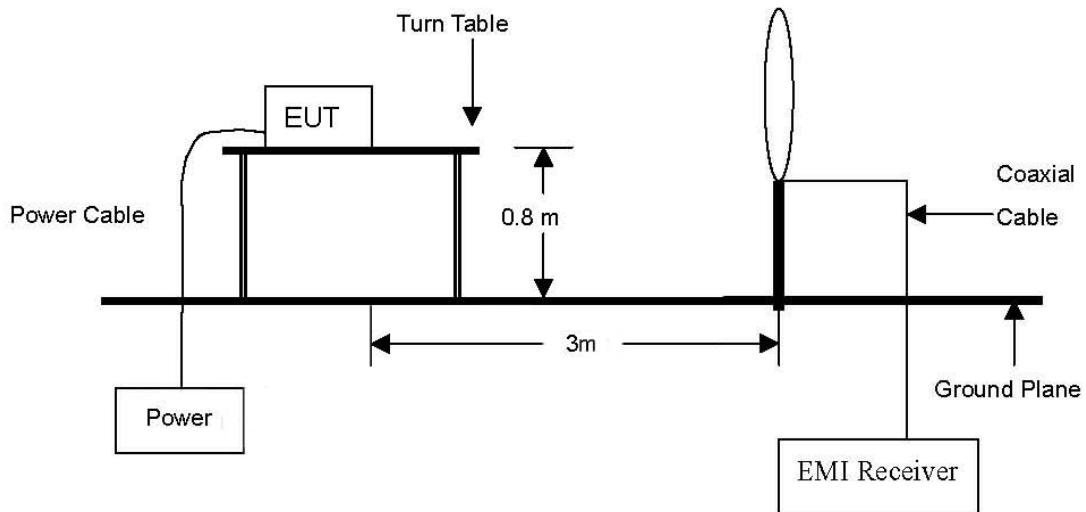
APPLIED STANDARD: FCC Part 15 Subpart C 15.209		
Section in FCC 15 Subpart C §15.209	Test Item	Result
15.209(a)	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied

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## 2. Field Strength of Fundamental

### 2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



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## 2.2. Limit

### 2.2.1. Radiated emission limits, general requirements

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 -88	100**	3
88 -216	150**	3
216 - 960	200**	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241

## 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

### 2.3.1. Test Procedures for emission from 9 kHz to 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to average Detect Function and Specified Bandwidth with Maximum Hold Mode.

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## 2.4. Test Result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. The field strength of spurious emission was measured in three orthogonal EUT position (x-axis, y-axis and z-axis). Worst case is x-axis.

### - INT1 ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	63.00	Average	H	20.03	0.47	83.50	3.50	25.67	22.17

### - INT2 ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	68.20	Average	H	20.03	0.47	88.70	8.70	25.67	16.97

### - DRV ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	67.10	Average	H	20.03	0.47	87.60	7.60	25.67	18.07

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**- AST ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	68.10	Average	H	20.03	0.47	88.60	8.60	25.67	17.07

**- BUM ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	66.90	Average	H	20.03	0.47	87.40	7.40	25.67	18.27

**Note:**

1. 300 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(300/3) (dB $\mu$ V/m)

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### 3. Spurious Emission

#### 3.1. Test Setup

Same as section 2.1 of this report

#### 3.2. Limit

Same as section 2.2 of this report

#### 3.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

##### 3.3.1. Test Procedures for emission from 9 kHz to 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to quasi-peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

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### 3.4. Test Result

Ambient temperature : (24 ± 1) °C

Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

#### 3.4.1. Spurious emission from 9 kHz to 30 MHz

##### - INT1 ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ N)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ N/m) at 3 m	Actual <sup>1</sup> (dB $\mu$ N/m) at 300 m or 30 m	Limit (dB $\mu$ N/m)	Margin (dB)
0.010	19.70	Average	H	20.52	0.19	40.41	-39.59	47.60	87.19

##### - INT2 ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ N)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ N/m) at 3 m	Actual <sup>1</sup> (dB $\mu$ N/m) at 300 m or 30 m	Limit (dB $\mu$ N/m)	Margin (dB)
0.010	21.00	Average	H	20.52	0.19	41.71	-38.29	47.60	85.89

##### - DRV ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ N)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ N/m) at 3 m	Actual <sup>1</sup> (dB $\mu$ N/m) at 300 m or 30 m	Limit (dB $\mu$ N/m)	Margin (dB)
0.010	21.30	Average	H	20.52	0.19	42.01	-37.99	47.60	85.59

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**- AST ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual <sup>1</sup> (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.010	20.90	Average	H	20.52	0.19	41.61	-38.39	47.60	85.99

**-BUM ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual <sup>1</sup> (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.010	21.50	Average	H	20.52	0.19	42.21	-37.79	47.60	85.39

**Note:**

1. 300 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(300/3) (dB $\mu$ V/m)  
or 30 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(30/3) (dB $\mu$ V/m)

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