

# TEST REPORT

OF

FCC Part 15 Subpart C §15.209

FCC ID : CQOED00480

Equipment Under Test : Smart Key ECU  
Model Name : ED00480  
Applicant : DENSO KOREA ELECTRONICS CORPORATION  
Manufacturer : DENSO KOREA ELECTRONICS CORPORATION  
Date of Test(s) : 2015.08.11 ~ 2015.09.14  
Date of Issue : 2015.09.24

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

Tested By:



Jaeha Chung

Date:

2015.09.24

Approved By:



Hyunchoe You

Date:

2015.09.24

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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 : DENSO KOREA ELECTRONICS CORPORATION

Address : 3, Cheomdansaneop-ro, Masanhappo-gu, Chang-won-si, Gyeongsangnam-do, Korea

Contact Person : Kang, Sung-Won

Phone No. : + 82 55 600 9346

### 1.3. Description of EUT

<b>Kind of Product</b>	Smart Key ECU
<b>Model Name</b>	ED00480
<b>Power Supply</b>	DC 12 V (Used by Vehicle battery)
<b>Frequency Range</b>	Tx: 134.20 kHz (LF Antenna) Rx: 433.92 MHz (RF Antenna)
<b>Modulation Technique</b>	ASK
<b>Number of Channels</b>	1
<b>Operating Conditions</b>	-30 °C ~ 80 °C
<b>Antenna Type</b>	Internal Type (Coil Antenna)

### 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.
Spectrum Analyzer	R&S	FSV30	103100	Jun. 22,2015	Annual	Jun. 22,2016
Signal Generator	R&S	SMBV100A	255834	Jun. 22,2015	Annual	Jun. 22,2016
Loop Antenna	SCHWARZBECK	FMZB 1519	1519-039	Aug. 19, 2015	Biennial	Aug. 19, 2017
DC power Supply	Agilent	U8002A	MY50060028	Mar. 28, 2015	Annual	Mar. 28, 2016
Test Receiver	R&S	ESU26	100109	Mar. 03, 2015	Annual	Mar. 03, 2016
Turn Device	DE-3600-RH	INN-CO	N/A	N.C.R.	N.C.R.	N.C.R.
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 6.4 m x 6.6 m)	N/A	N.C.R.	N/A	N.C.R.

### 1.6. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL009141	2015.09.17	Initial
1	F690501/RF-RTL009141-1	2015.09.24	Added information of specific frequency range of radiated emission.

### 1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

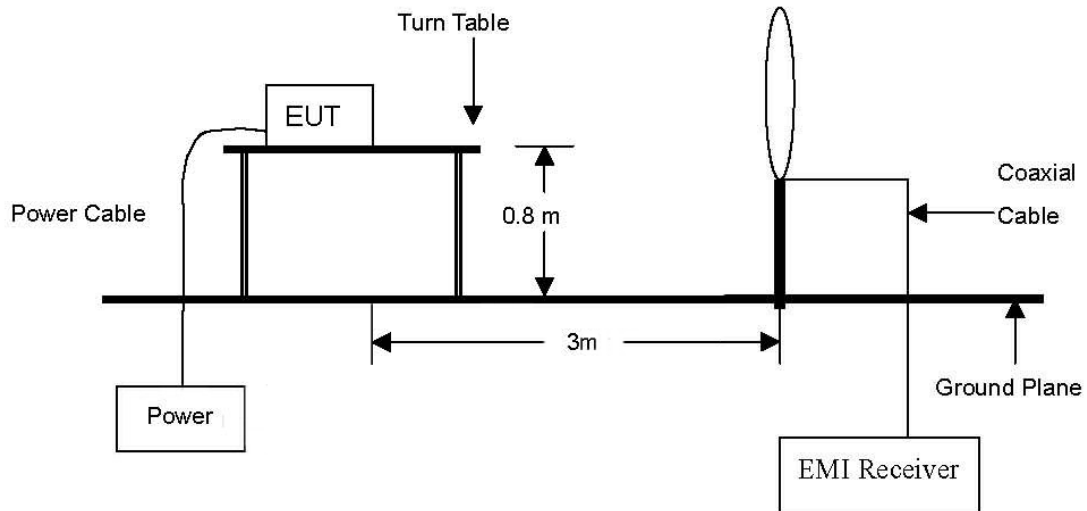
APPLIED STANDARD: FCC Part 15 Subpart C §15.209		
Section in FCC 15 Subpart C	Test Item	Result
15.209 15.209(a)	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied

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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 C63.4:2009

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

- 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.
- 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.
- 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.
- 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.

### - 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)
0.134	65.70	Average	H	19.42	0.10	85.22	5.22	25.06	19.84

### - 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)
0.134	64.90	Average	H	19.42	0.10	84.42	4.42	25.06	20.64

### - 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)
0.134	64.80	Average	H	19.42	0.10	84.32	4.32	25.06	20.74

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**- INT 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)
0.134	69.00	Average	H	19.42	0.10	88.52	8.52	25.06	16.54

**- TNK 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)
0.134	67.20	Average	H	19.42	0.10	86.72	6.72	25.06	18.34

**- SSB 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)
0.134	58.30	Average	H	19.42	0.10	77.82	-2.18	25.06	27.24

**Note:**

1. According to §15.31 (f)(2) 300 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(300/3) (dB $\mu$ V/m)
2. According to §15.209 (d), the measurements were tested by using Quasi peak detector except for the frequency bands 9 – 90 kHz, 110 – 490 kHz and above 1 GHz in these three bands on measurements employing an average detector.
3. The limit above was calculated based on table of §15.209 (a).

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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 C63.4:2009

##### 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. The frequency spectrum from 9 kHz to 30 MHz was investigated.

#### - 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	Limit (dB $\mu$ V/m)	Margin (dB)
Above 0.009	Not detected	-	-	-	-	-	-	-	-

#### - 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	Limit (dB $\mu$ V/m)	Margin (dB)
Above 0.009	Not detected	-	-	-	-	-	-	-	-

#### - 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 <sup>1</sup> (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
Above 0.009	Not detected	-	-	-	-	-	-	-	-

#### - INT 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	Limit (dB $\mu$ V/m)	Margin (dB)
Above 0.009	Not detected	-	-	-	-	-	-	-	-

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**- TNK 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	Limit (dB $\mu$ V/m)	Margin (dB)
Above 0.009	Not detected	-	-	-	-	-	-	-	-

**- SSB 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	Limit (dB $\mu$ V/m)	Margin (dB)
Above 0.009	Not detected	-	-	-	-	-	-	-	-

**Note:**

- According to §15.31 (f)(2),
  - 300 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(300/3) (dB $\mu$ V/m)
  - 30 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(30/3) (dB $\mu$ V/m)
- According to field strength table of general requirement in §15.209 (a), field strength limits below 1.705 MHz were calculated as below.
  - 9 kHz to 490 kHz : 20log(2 400 / F (kHz)) at 300 m (dB $\mu$ V/m)
  - 490 kHz to 1 705 kHz : 20log(24 000 / F (kHz)) at 30 m (dB $\mu$ V/m)
- According to §15.209 (d), the measurements were tested by using Quasi peak detector except for the frequency bands 9 – 90 kHz, 110 – 490 kHz and above 1 GHz in these three bands on measurements employing an average detector.
- According to § 15.31(o), Emission levels are not reported much lower than the limits by over 20 dB.

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