



Underwriters  
Laboratories UL Japan, Inc.

Test report No. : 28IE0193-HO-02-A-R2  
Page : 1 of 52  
Issued date : July 22, 2008  
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FCC ID : WAZX1T805SKE11A03

# RADIO TEST REPORT

Test Report No. : 28IE0193-HO-02-A-R2

Applicant : Mitsubishi Electric Corporation Himeji Works  
Type of Equipment : SMART KEYLESS SYSTEM (Smart ECU)  
Model No. : SKE11A-03  
Test regulation : FCC Part 15 Subpart C : 2008  
Section 15.207 and 15.209  
FCC ID : WAZX1T805SKE11A03  
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
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6. Original test report number of this report is 28IE0193-HO-02-A.

Date of test:  
July 7 and 9, 2008

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## **SECTION 1: Customer information**

Company Name : Mitsubishi Electric Corporation Himeji Works  
Address : 840 Chiyoda-machi Himeji Hyogo 670-8677 Japan  
Telephone Number : +81-792-98-8896  
Facsimile Number : +81-792-98-9262  
Contact Person : Yoshiharu Goto

## **SECTION 2: Equipment under test (E.U.T.)**

### **2.1 Identification of E.U.T.**

Type of Equipment : SMART KEYLESS SYSTEM (Smart ECU)  
Model No. : SKE11A-03  
Sample No. : 20080624-01  
Rating : DC 12.0V  
Receipt Date of Sample : May 15, 2008  
Country of Mass-production : Japan  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model No: SKE11A-03 (referred to as the EUT in this report) is the SMART KEYLESS SYSTEM (Smart ECU).  
Clock frequencies : 10MHz

Frequency of Operation : 133.33kHz  
Type of modulation : PPM  
Antenna Type : Bar Antenna  
Method of Frequency Generation : Crystal  
Operating Voltage (Inner) : DC 5V

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part15 Subpart C: 2008, , final revised on May 19, 2008  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted Emission  
Section 15.209 Radiated emission limits, general requirements

#### **FCC 15.31 (e)**

The EUT is a battery-operated device and test was performed with the full-charged battery.  
The power supply of this EUT is transformed to DC 5.0V and provides stable voltage (DC5.0V) constantly to Radio part.  
Therefore, this EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC> RSS-Gen 7.2.2	<FCC> Section 15.207 <IC> RSS-Gen 7.2.2	-	N/A *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.6, 2.7	Radiated	N/A	18.1dB 0.13333MHz 0 deg. AV (Antenna C(Full))	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.6, 2.7	Radiated	N/A	8.2dB 61.881MHz, Horizontal (Antenna G(Full))	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15.

\*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

\*These tests were performed without any deviations from test procedure except for additions or exclusions.

### 3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.6.1	RSS-Gen 4.6.1	Radiated	N/A	N/A	N/A

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### 3.4 Uncertainty

#### EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test room	Conducted emission	Radiated emission (10m*)			Radiated emission (3m*)			Radiated emission (3m*)	
		150kHz-30MHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	1GHz-18GHz
No.1 semi-anechoic Chamber (±)	3.7dB	3.1dB		4.4dB	4.2dB	3.2dB	3.8dB	3.9dB	5.9dB
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	-	3.2dB	4.4dB	4.0dB	5.9dB
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	-	3.2dB	4.6dB	4.0dB	5.9dB
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	-	3.2dB	3.9dB	3.9dB	5.9dB
									6.1dB

\*10m/3m = Measurement distance

#### Conducted emission test

The data listed in this test report has enough margin, more than the site margin.

#### Radiated emission test(3m)

The data listed in this test report has enough margin, more than the site margin.

#### Other test except Conducted Emission and Spurious Emission (Radiated)

The measurement uncertainty for this test is ±3.0dB.

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### 3.5 Test Location

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	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 3.6 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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## SECTION 4: Operation of E.U.T. during testing

### 4.1 Operating Modes

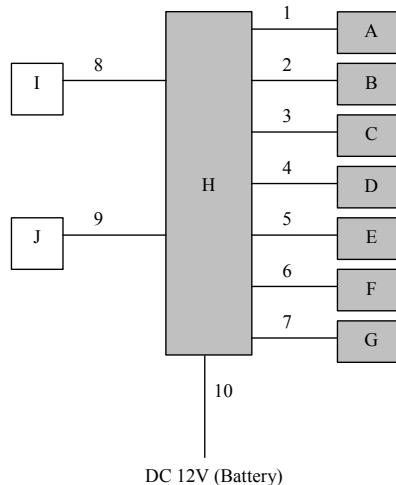
The mode is used :

- 1) Continuous Transmitting 133.33kHz mode (Full)
- 2) Continuous Transmitting 133.33kHz mode (Half)

The output power level can be switched from (Full) to (Half) by Jig.  
 The tests were performed with both output power level.  
 \*Please refer to Appendix 4 for data of pulse line.

Justification : The system was configured in typical fashion (as a customer would normally use it) for testing.

### 4.2 Configuration and peripherals



\* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

#### Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Antenna A	SKE11A-03	20080509-01	Mitsubishi Electric Corporation Himeji Works	EUT
B	Antenna B	SKE11A-03	20080509-01	Mitsubishi Electric Corporation Himeji Works	EUT
C	Antenna C	SKE11A-03	20080509-01	Mitsubishi Electric Corporation Himeji Works	EUT
D	Antenna D	SKE11A-03	20080509-01	Mitsubishi Electric Corporation Himeji Works	EUT
E	Antenna E	SKE11A-03	20080509-01	Mitsubishi Electric Corporation Himeji Works	EUT
F	Antenna F	SKE11A-03	20080509-01	Mitsubishi Electric Corporation Himeji Works	EUT
G	Antenna G	SKE11A-03	20080509-01	Mitsubishi Electric Corporation Himeji Works	EUT
H	SMART KEYLESS SYSTEM (Smart ECU)	SKE11A-03	20080624-01	Mitsubishi Electric Corporation Himeji Works	EUT
I	SMART KEYLESS SYSTEM (Receiver)	SKE11A-03	20080512-R1	Mitsubishi Electric Corporation Himeji Works	-
J	Jig	-	-	Mitsubishi Electric Corporation Himeji Works	-

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**List of cables used**

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna Cable	1.5	Unshielded	Unshielded	-
2	Antenna Cable	1.5	Unshielded	Unshielded	-
3	Antenna Cable	1.4	Unshielded	Unshielded	-
4	Antenna Cable	1.4	Unshielded	Unshielded	*1)
5	Antenna Cable	1.4	Unshielded	Unshielded	*1)
6	Antenna Cable	1.4	Unshielded	Unshielded	*1)
7	Antenna Cable	1.4	Unshielded	Unshielded	*1)
8	Signal & DC cable	1.3	Unshielded	Unshielded	-
9	Signal & DC cable	1.4	Unshielded	Unshielded	-
10	DC Cable	1.2	Unshielded	Unshielded	-

\*1) 1.25m out of 1.4m have been shielded.

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## **SECTION 5: Radiated emission (Fundamental and Spurious Emission)**

### **Test Procedure**

The Radiated Electric Field Strength intensity has been measured on No.3 semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for each antenna angle 0deg. , 45deg. and 90deg.

Frequency : From 30MHz to 1GHz at distance 3m

The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

Measurements were performed with a QP, PK, and AV detector.

The radiated emission measurements were made with the following detector function of the test receiver (below 1GHz) and the spectrum analyzer (above 1GHz).

	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz

- The carrier level (or, noise levels) was (or were) measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.

With the position, the noise levels of all the frequencies were measured.

\* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)

[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

**Test data** : APPENDIX 3  
**Test result** : Pass

Date: July 7 and 9, 2008

Test engineer: Takahiro Hatakeda and Hisayoshi Sato

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## **SECTION 6: -26dB Bandwidth**

### **Test Procedure**

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

**Test data** : APPENDIX 2  
**Test result** : Pass

## **SECTION 7: 99% Occupied Bandwidth**

### **Test Procedure**

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

**Test data** : APPENDIX 2  
**Test result** : Pass