



## RADIO TEST REPORT

Test Report No. : 28IE0193-HO-01-A-R2

Applicant : Mitsubishi Electric Corporation Himeji Works  
Type of Equipment : SMART KEYLESS SYSTEM (TRANSMITTER)  
Model No. : SKE11A-03  
Test regulation : FCC Part 15 Subpart C:2008  
Section 15.231  
FCC ID : WAZX1T768SKE11A03  
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.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. Original test report number of this report is 28IE0193-HO-01-A.

Date of test:

May 9 to 19, 2008

Tested by:

  
Takumi Shimada  
EMC Services

  
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Approved by :

  
Makoto Kosaka  
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NVLAP LAB CODE: 200572-0

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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 (TRANSMITTER)
Model No.	:	SKE11A-03
Serial No.	:	20080424-01, 20080424-02
Rating	:	DC 3.0V (CR2025)
Receipt Date of Sample	:	May 8, 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 (TRANSMITTER).

Clock frequency(ies)	:	5MHz (CPU), 9.84375MHz
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#### [Transmitter part]

Frequency of Operation	:	315MHz
Type of modulation	:	FSK
Antenna Type	:	PCB Pattern Antenna
Operating voltage (Inner)	:	DC 3.0V

#### [Receiver part]

Type of Receiver	:	electromagnetic induction type
Frequency of Operation	:	133.33kHz
Antenna Type	:	Inductive loop
Method of Frequency Generation	:	Crystal
Operating voltage (Inner)	:	DC 3.0V

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

#### **3.1 Test Specification**

Test Specification	: FCC Part 15 Subpart C: 2008, final revised on March 24, 2008
Title	: FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.231 Periodic operation in the band 40.66 - 40.70MHz and above 70MHz

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

This test was performed with the New Battery (DC 3.0V) and the constant voltage was supplied to the EUT during the tests. Therefore, the 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 EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

### 3.2 Procedures and results

No.	Item	Test Procedure	Specification	Deviation	Worst margin	Results
1	Automatically Deactivate	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Section 15.231(a)(1) <IC> RSS-210 A1.1.1	N/A	-	Complied
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8	<FCC> Section 15.231(b) <IC> RSS-210 A1.1.2	N/A	0.4dB 315.00MHz Horizontal, PK	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9	<FCC> Section 15.205 Section 15.209 Section 15.231(b) <IC> RSS-210 A1.1.2, 2.6, 2.7	N/A	2.7dB 1575.00MHz Vertical, PK	Complied
4	Receiver Spurious Emissions	<FCC> ANSI C63.4:2003 12. Measurement of unintentional radiators other than ITE <IC> RSS-Gen 4.10	<FCC> Section 15.109(a) Section 15.209 <IC> RSS-Gen 6(a) RSS-210 2.6	N/A	19.6dB 600.469MHz Vertical, QP	Complied
5	-20dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Section 15.231(c) <IC> Reference data	N/A	-	Complied
6	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

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

\*1) The test is not applicable since the EUT does not have AC Mains.

### 3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Bandwidth	<IC> RSS-Gen 4.6.1	<IC> RSS-210 A1.1.3	Radiated	N/A	N/A	Complied

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### 3.4 Uncertainty

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	18GHz-40GHz
No.1 semi-anechoic chamber (±)	3.7dB	3.1dB	4.7dB	4.4dB	3.2dB	3.7dB	4.4dB	5.9dB	6.1dB
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.3dB	3.9dB	5.9dB	6.1dB
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB

\*10m/3m = Measurement distance

#### Radiated emission test(3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

### 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.

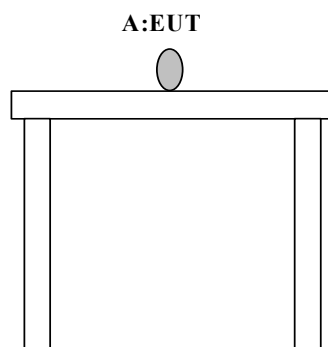
## **SECTION 4: Operation of E.U.T. during testing**

### **4.1 Operating Modes**

- The mode is used :
- 1) Normal use mode (for Automatically deactivate and Duty cycle tests)  
Continuously Transmitting of normal use signal\* which is modulated to FSK.  
\*The normal operation signal when Lock or Unlock button is pushed.
  - 2) Transmitting mode  
(for Radiated emission, 99% Occupied Bandwidth, and -20dB bandwidth tests)  
Sending FSK modulated signal when Lock or Unlock button is pushed.
  - 3) LF Receiving mode (for Receiver Spurious emission test only)  
EUT receives 133.33kHz signal from the Smart ECU via LF Antenna.
- \* The transmission pattern is described in "Theory of Operation (Confidential)" document.
- Justification : The system was configured in typical fashion (as a customer would normally use it) for testing.

### **4.2 Configuration and peripherals**

#### **1) Normal use mode and 2) Transmitting mode**



\* Test data was taken under worse case conditions.

#### **Description of EUT**

No	Item	Model number	Serial number	Manufacturer	Remarks
A	SMART KEYLESS SYSTEM (TRANSMITTER)	SKE11A-03	20080424-01 *1), 20080424-02 *2)	Mitsubishi Electric Corporation Himeji Works	EUT

\*1) Used for Radiated emission, 99% Occupied Bandwidth, and -20dB bandwidth tests

\*2) Used for Automatically deactivate and Duty cycle tests

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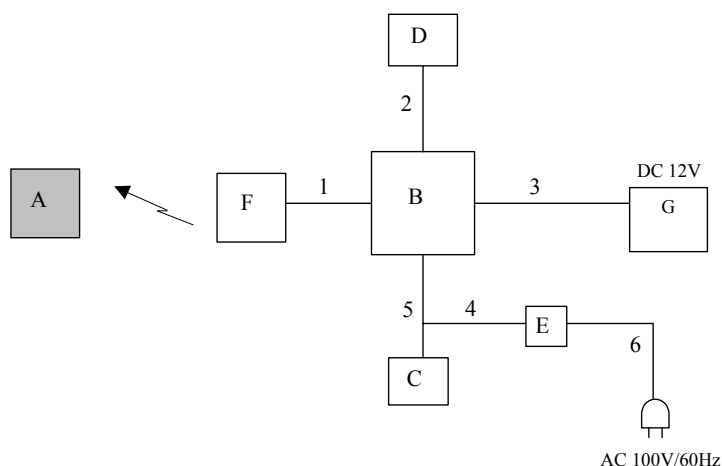
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### 3) LF Receiving mode



#### Description of EUT and Support equipment

No	Item	Model number	Serial number	Manufacturer	Remarks
A	SMART KEYLESS SYSTEM (TRANSMITTER)	SKE11A-03	20080424-02	Mitsubishi Electric Corporation Himeji Works	EUT
B	Smart ECU	SKE11A-03	20080509-02	Mitsubishi Electric Corporation Himeji Works	-
C	SKE CHECKER	-	-	Mitsubishi Electric Corporation Himeji Works	-
D	Receiver	SKE11A-03	20080512-R2	Mitsubishi Electric Corporation Himeji Works	-
E	Request SW timer	H3CR-F8	1869OM	OMRON Corporation	-
F	LF antenna (ANT-A)	-	-	Mitsubishi Electric Corporation Himeji Works	-
G	Car Battery	40B19L	A030402	YUASA	-

#### List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	Signal Cable	1.0	Unshielded	Unshielded
2	Signal Cable	1.0	Unshielded	Unshielded
3	DC Cable	1.2	Unshielded	Unshielded
4	Signal Cable	0.5	Unshielded	Unshielded
5	Signal Cable	1.5	Unshielded	Unshielded
6	AC Cable	0.7	Unshielded	Unshielded

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

### **5.1 Operating environment**

Test date	May 9, 2008	May 19, 2008
Test place	No.3 semi anechoic chamber	No.1 semi anechoic chamber
Temperature	See data	See data
Humidity	See data	See data

### **5.2 Test configuration**

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane.

The EUT was set on the center of the tabletop.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

A drawing of the set up is shown in the photos of APPENDIX 1.

### **5.3 Test conditions**

Test mode	-Transmitting mode -Normal use mode	-LF Receiving mode
Frequency range	30MHz-3200MHz	9kHz-1000MHz
Test distance	3m	3m
EUT position	Top of Polyurethane table	Top of Polyurethane table

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## 5.4 Test procedure

### [Transmitting mode]

The Radiated Electric Field Strength intensity has been measured on a semi anechoic chamber with a ground plane and at a distance of 3m. The measuring antenna height was 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.

The radiated emission measurements were made with the following detector function of the test receiver/spectrum analyzer.

	Below or equal to 1GHz	Above 1GHz (FCC15.205 and 15.231)
Detector Type	Peak	Peak
IF Bandwidth	120kHz	PK: S/A:RBW 1MHz, VBW:1MHz

- 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 was measured.

### [LF Receiving mode]

The Radiated Electric Field Strength intensity has been measured on a 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 1000MHz at distance 3m

The measuring antenna height was 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.

The radiated emission measurements were made with the following detector function of the test receiver/spectrum analyzer.

	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

## 5.5 Results

Summary of the test results: Pass

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