RADIO TEST REPORT

Test Report No. : 31BE0219-HO-08-B-R1

Applicant	:	**Mitsubishi Electric Corporation Himeji works**
Type of Equipment	:	**Keyless System Hand Unit**
Model No.	:	**SKE13D-01**
Test regulation	:	**FCC Part 15 Subpart C: 2010**
FCC ID	:	**WAZSKE13D01**
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.
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6. This report is a revised version of 31BE0219-HO-08-B. 31BE0219-HO-08-B is replaced with this report.

Date of test: February 9, 2011

Representative test engineer:

Tomotaka Sasagawa
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UL Verification Service

Approved by:

Shinya Watanabe
Leader of WiSE Japan,
UL Verification Service

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http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

CONTENTS **PAGE**

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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	:	+81-79-298-8994
Facsimile Number	:	+81-79-298-9929
Contact Person	:	Toshio Koga

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

2.1 Identification of E.U.T.

Type of Equipment	:	Keyless System Hand Unit
Model No.	:	SKE13D-01
Serial No.	:	Refer to Clause 4.2
Rating	:	DC 3.0V
Receipt Date of Sample	:	February 9, 2011
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: SKE13D-01 (referred to as the EUT in this report) is the Keyless System Hand Unit.

Feature of EUT

The Keyless Entry System installed in vehicles.
When Lock and Unlock of the door push the switch in the door, the transmitter starts the LF control unit(LFU) and communication between the receiver and opens and closes the key of the door, and the engine start is possible.
It can also lock or unlock the doors by operating the button on the transmitter.

General Specification

Clock frequency in the system : (RF IC) 9.84375MHz, (CPU) 615.2kHz

Radio Specification

Radio Type	:	Transmitter
Frequency of Operation	:	315MHz
Modulation	:	FSK
Method of Frequency Genenration	:	Crystal
Antenna type	:	PCB Pattern
Duty Cycle	:	Very Low
Operating temperature range	:	-20 to +60 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2010, final revised on December 6, 2010 and effective January 5, 2011
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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
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	N/A*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	Radiated
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	0.7dB 315.000MHz, Horizontal (PK with Duty factor)	Complied	Radiated
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	3.8dB 2835.00MHz, Horizontal (PK with Duty factor)	Complied	Radiated
-20dB Bandwidth	**FCC:** ANSI C63.4:2003 13. Measurement of intentional radiators **IC:** -	**FCC:** Section 15.231(c) **IC:** Reference data	N/A	Complied	Radiated
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.					

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.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	**IC:** RSS-Gen 4.6.1	**IC:** RSS-Gen 4.6.1	N/A	Complied	Radiated

Other than above, no addition, exclusion nor deviation has been made from the standard.

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 (semi-anechoic chamber)	**Radiated emission**						
	(3m*)(±dB)				**(1m*)(±dB)**		**(0.5m*)(±dB)**
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	3.5dB	5.1dB	5.2dB	4.8dB	5.1dB	4.4dB	4.3dB
No.2	4.0dB	5.1dB	5.2dB	4.8dB	5.0dB	4.3dB	4.2dB
No.3	4.2dB	4.7dB	5.2dB	4.8dB	5.0dB	4.5dB	4.2dB
No.4	4.0dB	5.0dB	5.1dB	4.8dB	5.0dB	5.1dB	4.2dB

*3m/1m/0.5m = 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, Data of EMI, Test instruments.

Refer to APPENDIX.

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

4.1 Operating Modes

Test Item*	Mode
Automatically Deactivate Duty Cycle	Normal use mode
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth	Transmitting mode (Tx) *1)
* The system was configured in typical fashion (as a customer would normally use it) for testing. *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit when transmitter button is being pressed (For Normal use mode, EUT stops when transmitter button is being pressed.) End users cannot change the settings of the output power of the product.	

4.2 Configuration and peripherals

A

* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Keyless System Hand Unit	SKE13D-01	20110208-T3	Mitsubishi Electric Corporation Himeji works	EUT

SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m 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.
Photographs of the set up are shown in Appendix 1.

[Transmitting mode]

The Radiated Electric Field Strength has been measured on 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 strength.
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.

Test Antennas are used as below;

Frequency	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

	Below or equal to 1GHz	Above 1GHz
Detector Type	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	120kHz	PK: S/A:RBW 1MHz, VBW:3MHz

- 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.
This EUT has two modes which mechanical key is inserted or not. The worst case was confirmed with and without mechanical key, as a result, the test without mechanical key was the worst case. Therefore the test without mechanical key was performed only.

*The result is rounded off to the second decimal place, so some differences might be observed.

Measurement range : 30MHz-3.2GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Automatically deactivate

Test Procedure

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data : APPENDIX
Test result : Pass

SECTION 7: -20dB and 99% Occupied Bandwidth

Test Procedure

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

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20dB Bandwidth	1MHz	10kHz	30kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 % of Span	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.							

Test data : APPENDIX
Test result : Pass