



Test report No. : 10443993H-C-R1
Page : 1 of 13
Issued date : October 17, 2014
Revised date : October 28, 2014
FCC ID : WAZSKE45A01

EMI TEST REPORT

Test Report No. : 10443993H-C-R1

Applicant : Mitsubishi Electric Corporation Himeji works
Type of Equipment : Smart Keyless System (Smart Unit)
Model No. : SKE45A-01
FCC ID : WAZSKE45A01
Test regulation : FCC Part 15 Subpart B: 2014
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test 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. This report is a revised version of 10443993H-C. 10443993H-C is replaced with this report.

Date of test: September 29, 2014

Representative test engineer:

T. Shimada

Takumi Shimada
Engineer
Consumer Technology Division

Approved by:

M. Nishiyama

Masanori Nishiyama
Manager
Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation. *As for the range of Accreditation in NVLAP, you may refer to the WEB address, <http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

13-EM-F0429

CONTENTS **PAGE**

SECTION 1: Customer information 4
SECTION 2: Equipment under test (E.U.T.) 4
SECTION 3: Test specification, procedures & results 4
SECTION 4: Operation of E.U.T. during testing 7
SECTION 5: Radiated Emission 8
APPENDIX 1: Data of EMI test 9
 Radiated Emission 9
APPENDIX 2: Test instruments 11
APPENDIX 3: Photographs of test setup..... 12
 Radiated Emission 12
 Worst Case Position (Horizontal: X-axis/ Vertical:X-axis) 13

SECTION 1: Customer information

Company Name : Mitsubishi Electric Corporation Himeji works
Address : 840 Chiyoda-machi Himeji Hyogo, 670-8677, Japan
Telephone Number : +81-79-298-7363
Facsimile Number : +81-79-298-9929
Contact Person : Shinichi Furuta

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

2.1 Identification of E.U.T.

Type of Equipment : Smart Keyless System (Smart Unit)
Model No. : SKE45A-01
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12.0V
Receipt Date of Sample : September 24, 2014
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: SKE45A-01 (referred to as the EUT in this report) is the Smart Keyless System (Smart Unit).
The clock frequency of EUT is 10 MHz (CPU) and 29.509394MHz (RF receiving IC).

Radio Specification

LF Part *

Equipment Type : Transmitter
Type of modulation : ASK
Frequency of operation : 125kHz
Other clock frequency : 10MHz
Antenna Type : Inductive
Method of Frequency Generation : Crystal
Operating voltage (inner) : DC +5.0V

RF Part

Type of Receiver : Receiver
Frequency of operation : 315MHz
Other clock frequency : 29.509394MHz
Intermediate frequency : 220kHz
Antenna Type : Bar Antenna
Method of Frequency Generation : Crystal
Operating voltage (inner) : DC +5.0V

* EUT also has this function. Please refer to No. 10443993H-A-R1 (FCC15C).

FCC15.111(b)

The receiving antenna (of this EUT) is installed inside the EUT and cannot be removed (permanently attached).
Therefore, Radiated emission test was performed.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart B: 2014, final revised on August 15, 2014 and effective October 14, 2014

Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

* The revision on August 15, 2014 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	FCC: ANSI C63.4: 2003 7. AC powerline conducted emission measurements	FCC:Part 15 Subpart B 15.107(a)	N/A	N/A	N/A *1)
	IC: RSS-Gen 7.2.4	IC: RSS-Gen 7.2.4			
Radiated emission	FCC: ANSI C63.4: 2003 8. Radiated emission measurements	FCC: Part 15 Subpart B 15.109(a)	N/A	22.7dB 630.440MHz Vertical, QP	Complied
	IC: RSS-Gen 4.10	IC: RSS-Gen 6.1			

*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420.

*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.

3.3 Addition to standard

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	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

*3m/1m/0.5m = Measurement distance

Radiated emission test(3m)

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

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
 Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

	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	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	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	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	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	4.0 x 4.5 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 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* 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 Data of EMI, Test instruments, and Test set up

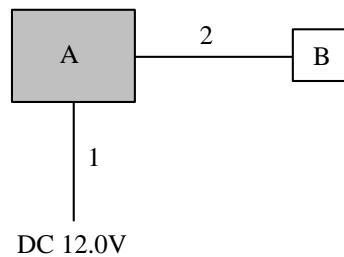
Refer to APPENDIX.

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

4.1 Operating modes

The mode is used : Receiving mode (315MHz)

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	Smart Keyless System (Smart Unit)	SKE45A-01	20140922-F2(No.7)	Mitsubishi Electric Corporation Himeji works	EUT
B	Switch Box 1	-	No.17	Mitsubishi Electric Corporation Himeji works	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.5	Unshielded	Unshielded	-
2	Signal Cable	1.5	Unshielded	Unshielded	-

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.2 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

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 edge 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 3.

5.3 Test conditions

Frequency range : 30MHz-300MHz (Biconical antenna) / 300MHz-1000MHz (Logperiodic antenna)
1000MHz - 2000MHz (Horn antenna)
Test distance : 3m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The height of the measuring antenna 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 with the Test Receiver, or the Spectrum Analyzer.
The radiated emission measurements were made with the following detector function of the Test Receiver and the Spectrum Analyzer.

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	QP: BW 120kHz	PK: RBW:1MHz/VBW: 3MHz AV *1): RBW:1MHz/VBW:10Hz

*1) When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

5.5 Test result

Summary of the test results: Pass

Date: September 29, 2014

Test engineer: Takumi Shimada

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 1: Data of EMI test

Radiated Emission

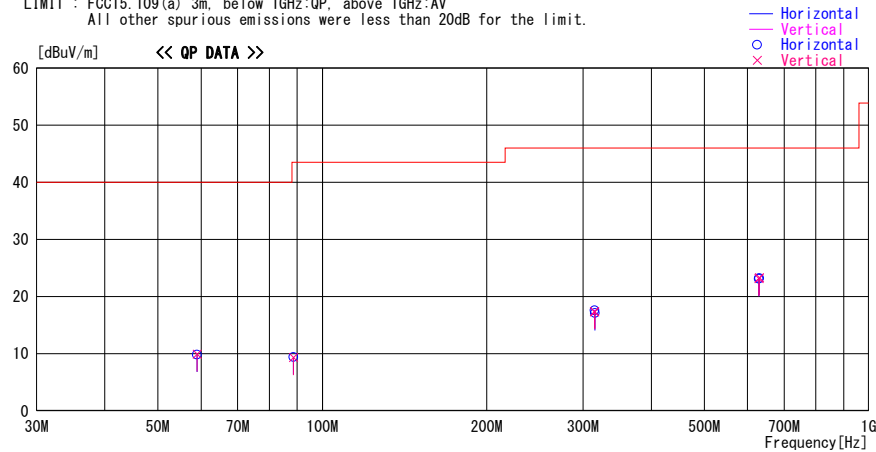
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2014/09/29

Report No. : 10443993H
Temp./Humi. : 25deg. C / 57% RH
Engineer : Yuta Moriya

Mode / Remarks : Rx 315MHz (Wost-axis Hori:X Vert:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level (dBuV/m)	Angle [Deg]	Height [cm]	Polar.	Limit (dBuV/m)	Margin (dB)	Comment
			Factor (dB/m)	Gain [dB]							
59.019	23.1	QP	8.1	-21.3	9.9	319	100	Vert.	40.0	30.1	
59.019	23.0	QP	8.1	-21.3	9.8	0	300	Hori.	40.0	30.2	
88.528	22.5	QP	7.8	-21.0	9.3	320	100	Vert.	43.5	34.2	
88.528	22.6	QP	7.8	-21.0	9.4	0	300	Hori.	43.5	34.1	
314.780	21.4	QP	14.7	-18.7	17.4	359	200	Vert.	46.0	28.6	
314.780	21.6	QP	14.7	-18.7	17.6	0	200	Hori.	46.0	28.4	
315.220	21.1	QP	14.7	-18.7	17.1	359	200	Hori.	46.0	28.9	
315.220	21.3	QP	14.7	-18.7	17.3	359	200	Vert.	46.0	28.7	
629.560	21.6	QP	19.7	-18.2	23.1	359	200	Hori.	46.0	22.9	
629.560	21.6	QP	19.7	-18.2	23.1	359	200	Vert.	46.0	22.9	
630.440	21.7	QP	19.8	-18.2	23.3	359	200	Vert.	46.0	22.7	
630.440	21.6	QP	19.8	-18.2	23.2	359	200	Hori.	46.0	22.8	

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-300MHz: BICONICAL, 300MHz-1000MHz: LOGPERIODIC, 1000MHz--: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATTEN. - GAIN (AMP))

*The limit is rounded down to one decimal place.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission

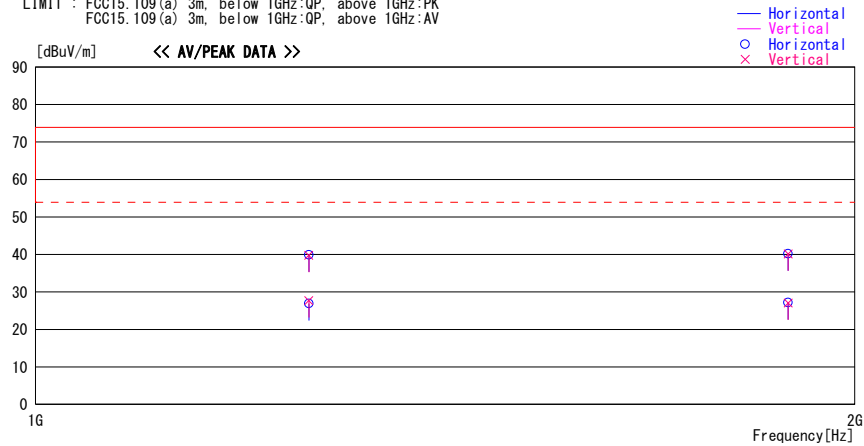
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
 Date : 2014/09/29

Report No. : 10443993H
 Temp./Humi. : 22deg. C / 59% RH
 Engineer : Takumi Shimada

Mode / Remarks : Rx 315MHz (Worst axis Hori:X Vert:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
 FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit	Margin	Comment
			Factor [dB/m]	Gain [dB]					[dBuV/m]	[dB]	
1260.000	47.6	PK	25.7	-33.4	39.9	0	100	Hori.	73.9	34.0	
1260.000	47.5	PK	25.7	-33.4	39.8	0	100	Vert.	73.9	34.1	
1260.000	34.7	AV	25.7	-33.4	27.0	0	100	Hori.	53.9	27.0	
1260.000	35.4	AV	25.7	-33.4	27.7	0	100	Vert.	53.9	26.2	
1890.000	45.3	PK	27.3	-32.4	40.2	0	100	Hori.	73.9	33.7	
1890.000	45.3	PK	27.3	-32.4	40.2	0	100	Vert.	73.9	33.8	
1890.000	32.3	AV	27.3	-32.4	27.2	0	100	Hori.	53.9	26.7	
1890.000	32.2	AV	27.3	-32.4	27.1	0	100	Vert.	53.9	26.8	

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-300MHz: BICONICAL, 300MHz-1000MHz: LOGPERIODIC, 1000MHz-: HORN
 CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATTEN. - GAIN (AMP))

*The limit is rounded down to one decimal place.
 *The test result is rounded off to one or two decimal places, so some differences might be observed.

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2014/02/20 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2013/11/25 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2014/06/03 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2013/10/13 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2013/10/13 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2014/02/20 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2014/02/21 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2014/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2014/01/21 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item:

RE: Radiated emission

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124