



Test report No. : 10131705H-C-R2
Page : 1 of 15
Issued date : February 14, 2014
Revised date : February 28, 2014
FCC ID : WAZSKEA7A01

EMI TEST REPORT


Test Report No. : 10131705H-C-R2

Applicant : Mitsubishi Electric Corporation Himeji Works
Type of Equipment : Smart Keyless System (Smart Unit)
Model No. : SKEA7A-01
FCC ID : WAZSKEA7A01
Test regulation : FCC Part 15 Subpart B: 2013
Test Result : Complied

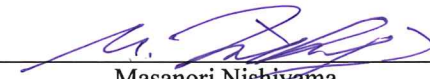
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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This 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 10131705H-C-R1. 10131705H-C-R1 is replaced with this report.

Date of test: January 27, 2014

Representative test engineer:


Masatoshi Nishiguchi
Engineer of WiSE Japan,
UL Verification Service

Approved by:


Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



NVLAP LAB CODE: 200572-0

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*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>

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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	:	+81-79-298-7363
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.	:	SKEA7A-01
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC12.0V
Receipt Date of Sample	:	January 21, 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: SKEA7A-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
Bandwidth	:	2.5kHz
Frequency of operation	:	125kHz
Other clock frequency	:	29.509394MHz
Antenna Type	:	Inductive
Method of Frequency Generation	:	Crystal
Operating voltage (inner)	:	DC +12.0V

RF Part

Type of Receiver	:	Receiver
Frequency of operation	:	315MHz
Other clock frequency	:	10MHz
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. 10131705H-A-R2 (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.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart B: 2013, final revised on September 30, 2013 and effective October 30, 2013

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

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 IC: ICES-003 Issue 5: 2012	Class B	N/A	N/A	N/A *1)
Radiated emission	FCC: ANSI C63.4: 2003 8. Radiated emission measurements IC: ICES-003 Issue 5: 2012	Class B	N/A	19.0dB 867.379MHz Vertical, QP	Complied
*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.

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3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
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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	4.0 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	-	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	-	6.2 x 4.7 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 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)

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4.2 Configuration and peripherals

This page has been submitted for a separate exhibit.

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: January 27, 2014

Test engineer: Tsubasa Takayama

UL Japan, Inc.

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APPENDIX 1: Data of EMI test

Radiated Emission

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2014/01/27

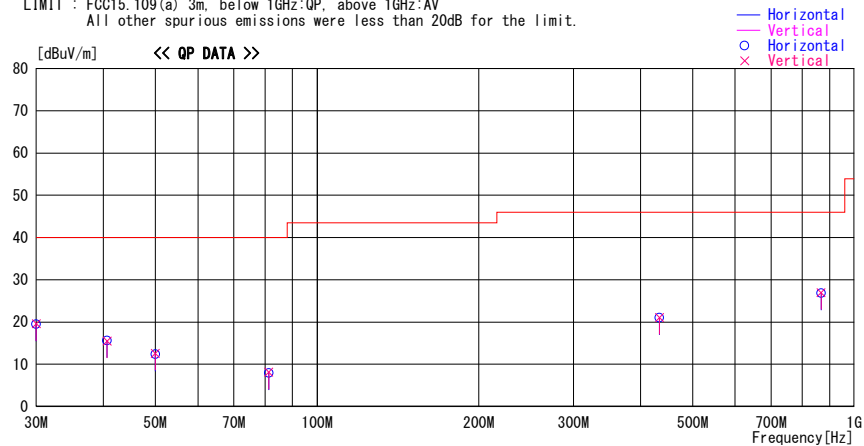
Report No. : 10131705H

Temp./Humi. : 21deg. C / 32% RH
Engineer : Tsubasa Takayama

Mode / Remarks : Receiving mode (315MHz) X-axis

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

All other spurious emissions were less than 20dB for the limit.



Frequency	Reading	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin
[MHz]	[dBuV]		Factor	Gain	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]
30.000	23.1	QP	18.4	-22.0	19.5	152	300	Hori.	40.0	20.5
30.000	23.2	QP	18.4	-22.0	19.6	152	100	Vert.	40.0	20.4
40.658	23.0	QP	14.3	-21.7	15.6	213	300	Hori.	40.0	24.4
40.658	22.9	QP	14.3	-21.7	15.5	242	100	Vert.	40.0	24.5
50.000	23.3	QP	10.8	-21.5	12.6	182	100	Vert.	40.0	27.4
50.000	23.1	QP	10.8	-21.5	12.4	182	300	Hori.	40.0	27.6
81.317	22.6	QP	6.6	-21.3	7.9	167	293	Hori.	40.0	32.1
81.317	22.8	QP	6.6	-21.3	8.1	178	100	Vert.	40.0	31.9
433.690	22.6	QP	17.6	-19.1	21.1	212	100	Vert.	46.0	24.9
433.690	22.5	QP	17.6	-19.1	21.0	117	100	Hori.	46.0	25.0
867.379	21.7	QP	22.0	-16.9	26.8	21	100	Hori.	46.0	19.2
867.379	21.9	QP	22.0	-16.9	27.0	212	100	Vert.	46.0	19.0

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

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Radiated Emission

DATA OF RADIATED EMISSION TEST

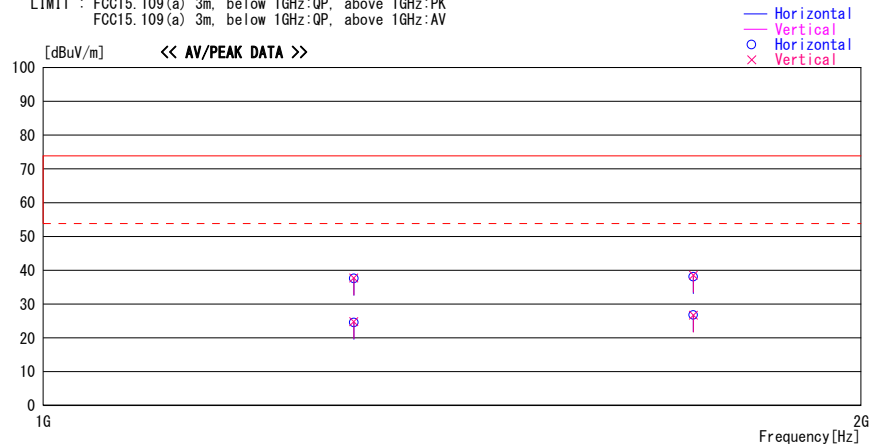
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2014/01/27

Report No. : 10131705H

Temp./Humi. : 21deg. C / 32% RH
Engineer : Tsubasa Takayama

Mode / Remarks : Receiving mode (315MHz) X-axis

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



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]
1301.069	46.4	PK	24.8	-33.6	37.6	123	100	Hori.	73.9	36.3
1301.069	33.6	AV	24.8	-33.6	24.8	123	100	Vert.	53.9	29.1
1301.069	33.4	AV	24.8	-33.6	24.6	123	100	Hori.	53.9	29.3
1301.069	46.5	PK	24.8	-33.6	37.7	123	100	Vert.	73.9	36.2
1734.758	33.6	AV	26.0	-32.9	26.7	182	100	Vert.	53.9	27.2
1734.758	45.0	PK	26.0	-32.9	38.1	291	100	Hori.	73.9	35.8
1734.758	33.7	AV	26.0	-32.9	26.8	291	100	Hori.	53.9	27.1
1734.758	45.4	PK	26.0	-32.9	38.5	182	100	Vert.	73.9	35.4

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

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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	2013/06/30 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2013/02/26 * 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	2013/06/11 * 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	2013/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2013/09/12 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2013/02/15 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2013/11/27 * 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

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