RADIO TEST REPORT

Test Report No. : 10159701H-B-R1

Applicant	:	**Mitsubishi Electric Corporation Himeji works**
Type of Equipment	:	**Keyless System SSU** ***This test report is for Keyless System SSU with Antenna coil**
Model No.	:	**SKE133-02**
Type No.	:	**X1T838**
FCC ID	:	**WAZSKE13302**
Test regulation	:	**FCC Part 15 Subpart C: 2013** **Class II Permissive Change**
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. This report is a revised version of 10159701H-B. 10159701H-B is replaced with this report.

Date of test: January 6, 2014

Representative test engineer:

Hironobu Ohnishi
Engineer of WiSE Japan,
UL Verification Service

Approved by:

Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service

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

REVISION HISTORY

Original Test Report No.: 10159701H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10159701H-B	January 30, 2014	-	-
1	10159701H-B-R1	February 25, 2014	P. 12	Addition of the following sentence; * Gain 0.0dB shows that the pre amplifier was not used to avoid the influence of carrier power.

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

CONTENTS **PAGE**

SECTION 1: Customer information **4**
SECTION 2: Equipment under test (E.U.T.) **4**
SECTION 3: Test specification, procedures & results **5**
SECTION 4: Operation of E.U.T. during testing **8**
SECTION 5: Radiated emission (Fundamental and Spurious Emission) **10**
APPENDIX 1: Data of EMI test **12**
Radiated Emission below 30MHz (Fundamental and Spurious Emission) **12**
Radiated Emission above 30MHz (Spurious Emission) **13**
APPENDIX 2: Test instruments **14**
APPENDIX 3: Photographs of test setup **15**
Radiated Emission **15**
Worst Case Position **16**

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 SSU
Model No.	:	SKE133-02
Type No.	:	X1T838
Serial No.	:	Refer to Clause 4.2
Rating	:	DC 12.0V
Receipt Date of Sample	:	December 25, 2013
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: SKE133-02 [Type No.: X1T838] (referred to as the EUT in this report) is the Keyless System SSU.

Feature of EUT
The Keyless Entry System installed in vehicles.
The lock or unlock of the door push the switch on the door, the transmitter starts communication between LF control unit (LFU) and a 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	:	(CPU) 8MHz

Radio Specification

Radio Type	:	Transmitter
Frequency of Operation	:	125kHz
Modulation	:	ASK
Method of Frequency Genenration	:	Crystal
Antenna type	:	Inductive
Duty Cycle	:	Very Low
Operating temperature range	:	-40 to +85 deg. C

<Contents of the change from original model>
Original test report number of this report is 31BE0219-HO-15-B-R1.
The EUT is changed the specification from original model as below.
- Change of oscillator of microcomputer: from 16MHz to 8MHz
- Change of capacitance of a capacitor in power supply part: from 47μF to 22μF
- Change of circuit board (There is no change of circuit board of LF Antenna and Antenna-coil.)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2013, final revised on September 30, 2013 and effective October 30, 2013
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)
This test was performed with the New Battery (DC 12V) and the constant voltage was supplied to this EUT during the tests. 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.

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 7.2.4	<FCC> Section 15.207 <IC> RSS-Gen 7.2.4	-	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 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	16.8dB 0.12500MHz 0 deg. PK with Duty factor	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 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	7.4dB 32.504MHz, Vertical, QP	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A *2)	N/A	N/A

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*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.
*2) The test was not performed for class 2 permissive change.

3.3 Addition to standard

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	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.

3.5 Test Location

UL Japan, Inc. Head Office 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

	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	-	-	8.0 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

Test mode	Remarks
Transmitting mode (Tx)	125kHz

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

4.2 Configuration and peripherals

This page has been submitted for a separate exhibit.

SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure
The Radiated Electric Field Strength intensity has been measured on No. 4 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 vertical polarization (antenna angle: 0deg., 45deg., 90deg., and 135 deg.) and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

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 and PK detector.
The radiated emission measurements were made with the following detector function of the test receiver (below 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
Distance factor *1)	-80dB	-80dB	-80dB	-40dB	-

*1) -80dB = 40 x log (3m/300m)
-40dB = 40 x log (3m /30m)

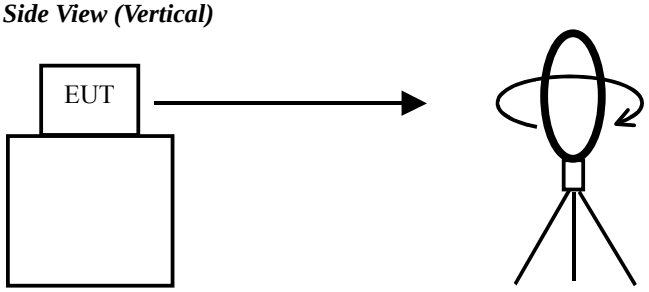
- The carrier level and noise levels were measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.
With the position, the noise levels of all the frequencies were measured.

Test data **: APPENDIX 1**
Test result **: Pass**

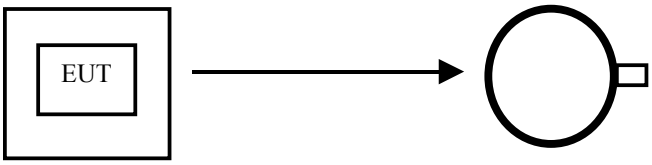
Date: January 6, 2014 Test engineer: Hironobu Ohnishi

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

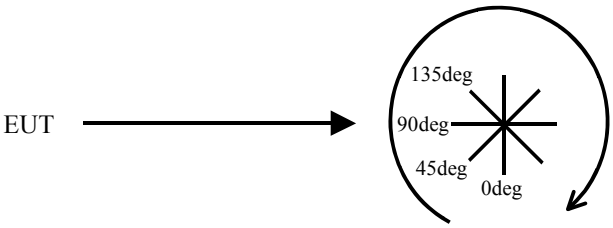


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

APPENDIX 1: Data of EMI test

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Test place	Head Office EMC Lab. No.4 Measurement Room
Order No.	10159701H
Date	01/06/2014
Temperature/ Humidity	20 deg. C / 30% RH
Engineer	Hironobu Ohnishi
Mode	Tx 125kHz

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m	Margin [dB]	Remark
0	0.12500	PK	62.7	20.0	-73.9	0.0	-	8.8	45.6	36.8	Fundamental
0	0.25000	PK	8.6	19.9	-73.9	0.0	-	-45.4	39.6	85.0	
0	0.37500	PK	22.7	19.8	-73.9	0.0	-	-31.4	36.1	67.5	
0	0.50000	QP	2.0	19.8	-33.8	0.0	-	-12.0	33.6	45.6	
0	0.62500	QP	13.2	19.8	-33.8	0.0	-	-0.8	31.7	32.5	
0	0.75000	QP	0.9	19.8	-33.8	0.0	-	-13.1	30.1	43.2	
0	0.87500	QP	8.2	19.8	-33.8	0.0	-	-5.8	28.7	34.5	
0	1.00000	QP	0.5	19.8	-33.8	0.0	-	-13.5	27.6	41.1	
0	1.12500	QP	5.3	19.8	-33.8	0.0	-	-8.7	26.5	35.2	
0	1.25000	QP	0.0	19.8	-33.8	0.0	-	-14.0	25.6	39.6	
0	8.00000	QP	2.0	20.0	-33.4	0.0	-	-11.4	29.5	40.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+D.Factor) - Gain(Amprifier)

AV (PK with Duty factor)

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m	Margin [dB]	Remark
0	0.12500	PK	62.7	20.0	-73.9	0.0	0.0	8.8	25.6	16.8	Fundamental
0	0.25000	PK	8.6	19.9	-73.9	0.0	0.0	-45.4	19.6	65.0	
0	0.37500	PK	22.7	19.8	-73.9	0.0	0.0	-31.4	16.1	47.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+D.Factor) - Gain(Amprifier) + Duty factor *

* Since the peak emission result satisfied the average limit, duty factor was omitted.

Although Duty of this product was 100% or less, the result of AV (PK with Duty factor) was calculated by applying Duty 100% as worst.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.12500	PK	62.7	20.0	6.1	0.0	-	88.8	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

* All spurious emissions lower than this result.

* Gain 0.0dB shows that the pre amplifier was not used to avoid the influence of carrier power.

Radiated Emission above 30MHz (Spurious Emission)

DATA OF RADIATED EMISSION TEST

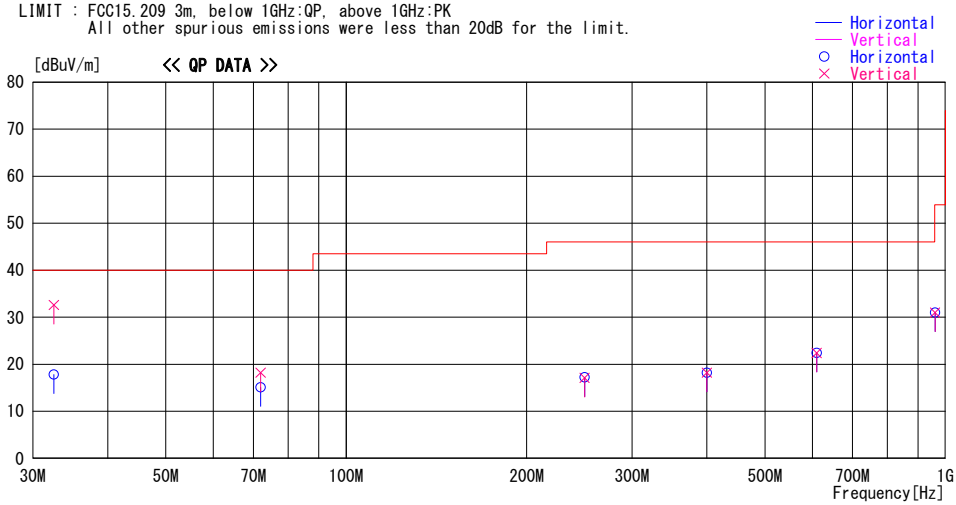
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2014/01/06

Report No. : 10159701H

Temp./Humi. : 20deg. C / 30% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx Antenna coil 125kHz, Worst axis (Antenna: X, SSU: X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
32.504	26.0	QP	16.9	-25.1	17.8	41	261	Hori.	40.0	22.2	
32.504	40.8	QP	16.9	-25.1	32.6	110	100	Vert.	40.0	7.4	
72.010	32.9	QP	6.5	-24.3	15.1	166	400	Hori.	40.0	24.9	
72.010	36.0	QP	6.5	-24.3	18.2	90	100	Vert.	40.0	21.8	
250.000	22.3	QP	17.3	-22.4	17.2	0	300	Hori.	46.0	28.8	No signal
250.000	22.2	QP	17.3	-22.4	17.1	0	100	Vert.	46.0	28.9	No signal
400.000	22.1	QP	17.5	-21.4	18.2	0	100	Hori.	46.0	27.8	No signal
400.000	22.1	QP	17.5	-21.4	18.2	0	100	Vert.	46.0	27.8	No signal
610.000	22.5	QP	20.3	-20.4	22.4	0	100	Hori.	46.0	23.6	No signal
610.000	22.5	QP	20.3	-20.4	22.4	0	100	Vert.	46.0	23.6	No signal
961.000	22.5	QP	25.9	-17.4	31.0	0	100	Hori.	53.9	22.9	No signal
961.000	22.5	QP	25.9	-17.4	31.0	0	100	Vert.	53.9	22.9	No signal

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

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

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2013/02/28 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2013/02/26 * 12
MJM-09	Measure	KDS	E19-55	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2013/11/12 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2013/10/30 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2013/07/23 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2013/07/22 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2013/03/12 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2013/11/26 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2013/11/24 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2013/11/24 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2013/06/18 * 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: Spurious emission