



RADIO TEST REPORT

Test Report No. : 32KE0010-HO-01-B-R1

Applicant : Alps Electric Co., Ltd.

Type of Equipment : UNIT ASSY IMMOBI & KEYLESS

Model No. : TWD1U827

Test regulation : FCC Part 15 Subpart C: 2012

FCC ID : CWTWD1U827

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 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 32KE0010-HO-01-B. 32KE0010-HO-01-B is replaced with this report.

Date of test: June 23, 2012

Representative test engineer: K. Kawamura
Keisuke Kawamura
Engineer of WiSE Japan,
UL Verification Service

Approved by: T. Hatakeya
Takahiro Hatakeya
Leader 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>

UL Japan, Inc.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

13-EM-F0429

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SECTION 1: Customer information

Company Name : Alps Electric Co., Ltd.
Address : 6-3-36, Nakazato, Furukawa, Osaki-city, Miyagi-pref, 989-6181, Japan
Telephone Number : +81-229-23-5111
Facsimile Number : +81-229-22-3755
Contact Person : Toru Kinoshita

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

2.1 Identification of E.U.T.

Type of Equipment : UNIT ASSY IMMOBI & KEYLESS
Model No. : TWD1U827
Serial No. : Refer to Clause 4.2
Receipt Date of Sample : Refer to Section 4, Clause 4.2
Country of Mass-production : June 20, 2012
Condition of EUT : Japan
Modification of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)

2.2 Product description

Model No: TWD1U827 (referred to as the EUT in this report) is the UNIT ASSY IMMOBI & KEYLESS.

General Specification

Clock frequency(ies) in the system : 8MHz, 16MHz, 29.4014MHz

Radio Specification

(Immobilizer System: LF Transceiving function)

Equipment Type : Transceiver
Frequency of Operation : 125kHz
Type of Modulation : ASK
Mode of Operation : Half duplex
Antenna Type : Loop Antenna
Method of Frequency Generation : Ceramic resonator
Operating voltage (inner) : DC 12.0V
Operating Temperature : -40 deg. C to +85 deg. C

(Keyless Entry System: RF Receiving function) *1)

Equipment type : Receiver
Frequency of operation : 313.85MHz
Type of modulation : FSK
Antenna Type : Metallic Antenna
Method of Frequency Generation : Crystal + PLL IC
Local frequency : 313.65MHz
IF frequency : 220 kHz
Operating voltage (inner) : DC 12.0V
Operating Temperature : -40 deg. C to +85 deg. C

*1) Reference: EUT also has this function. Please refer to No. 32KE0010-HO-01-C.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2012, final revised on May 17, 2012 and effective June 18, 2012

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	19.6dB 0.1250MHz 0 deg. PK *2)	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	18.6dB 30.511MHz, Vertical, QP	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	Complied

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 performed with severer PK detection for average limit.

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3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.6.1	RSS-Gen 4.6.1	Radiated	N/A	N/A	N/A

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	4.2dB	5.0dB	5.1dB	4.7dB	5.7dB	4.4dB	4.3dB
No.2	4.1dB	5.2dB	5.1dB	4.8dB	5.6dB	4.3dB	4.2dB
No.3	4.5dB	5.0dB	5.2dB	4.8dB	5.6dB	4.5dB	4.2dB
No.4	4.7dB	5.2dB	5.2dB	4.8dB	5.6dB	5.1dB	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
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116 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	4.75 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 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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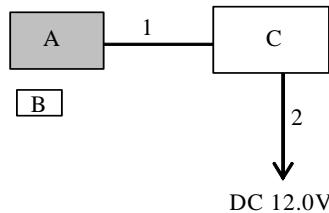
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

Test mode	Remarks
Continuous Transmitting mode	125kHz

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

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	Remarks
A	UNIT ASSY IMMOBI & KEYLESS	TWD1U827	2012061803	Alps Electric Co., Ltd.	EUT
B	TRANSMITTER ASSY KEYLESS (Hand Unit)	TWB1U859	20120618 No3	Alps Electric Co., Ltd.	
C	Checker Bench	-	No.24	-	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal and Power Cable	3.0	Unshielded	Unshielded	-
2	DC Cable	1.0	Unshielded	Unshielded	-

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SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

The Radiated Electric Field Strength intensity has been measured on No 3 and 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) and the spectrum analyzer (above 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 *2)	QP	PK *2)	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz

*1) The Spectrum Analyzer was used in 3dB resolution bandwidth.

*2) Average emission measurements were not performed since the PK measurement value did not exceed the AV limit.

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

The test was made with a transponder key as a representative, since no difference was found between the data with and without a transponder key.

With the position, the noise levels of all the frequencies were measured.

* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)
 [Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])
 [Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

Test data : APPENDIX 1
Test result : Pass

Date: June 23, 2012

Test engineer: Keisuke Kawamura

UL Japan, Inc.

Head Office EMC Lab.

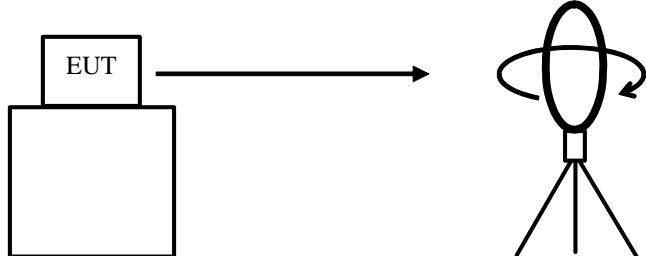
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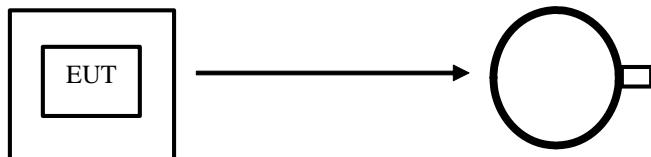
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

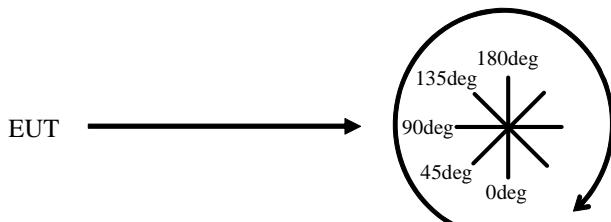


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

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SECTION 6: -26dB 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
-26dB Bandwidth	200kHz	2kHz	6.2kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 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
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 1
Test result : Pass

APPENDIX 1: Data of EMI test

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber
Date : 2012/06/23

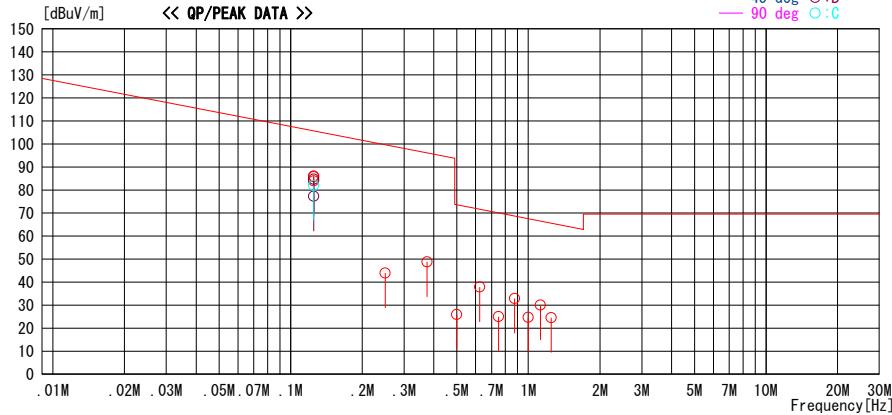
Report No. : 32KE0010-HO-01

Temp. / Humi. : 23 deg. C / 57% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 125kHz Worst-Axis:Y

LIMIT : FCC15.209(a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP
All other spurious emissions were less than 20dB for the limit.

— 0 deg ○:A
— 45 deg ○:B
— 90 deg ○:C



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
			[MHz]	[dBuV]	[dB/m]	[dB]	[dBuV/m]	[dBuV/m]			
0.12500	91.0	PEAK	19.9	6.0	32.2	84.7	105.7	21.0	45	B	328
0.12500	88.3	PEAK	19.9	6.0	32.2	82.0	105.7	23.7	90	C	275
0.12500	90.2	PEAK	19.9	6.0	32.2	83.9	105.7	21.8	135	A	215
0.12500	92.4	PEAK	19.9	6.0	32.2	86.1	105.7	19.6	0	A	359 Worst
0.12500	83.6	PEAK	19.9	6.0	32.2	77.3	105.7	28.4	0	B	188 Loop-Ant:Hor
0.12500	92.1	PEAK	19.9	6.0	32.2	85.8	105.7	19.9	180	A	185
0.25000	50.4	PEAK	19.7	6.1	32.2	44.0	99.7	55.7	0	A	191
0.37500	55.2	PEAK	19.7	6.1	32.2	48.8	96.1	47.3	0	A	179
0.50000	32.5	QP	19.6	6.1	32.3	25.9	73.6	47.7	0	A	359
0.62500	44.4	QP	19.6	6.1	32.2	37.9	71.7	33.8	0	A	189
0.75000	31.5	QP	19.6	6.1	32.2	25.0	70.1	45.1	0	A	359
0.87500	39.5	QP	19.5	6.1	32.2	32.9	68.7	35.8	0	A	181
1.00000	31.2	QP	19.5	6.2	32.2	24.7	67.6	42.9	0	A	359
1.12500	36.5	QP	19.5	6.2	32.2	30.0	66.5	36.5	0	A	180
1.25000	31.0	QP	19.5	6.2	32.2	24.5	65.6	41.1	0	A	359

CHART: WITH FACTOR, ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS (CABLE + ATTEN.) - GAIN(AMP.)

* Average emission measurements were not performed since the PK measurement value did not exceed the AV limit.

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

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Radiated Emission above 30MHz (Spurious Emission)

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber

Date : 2012/06/23

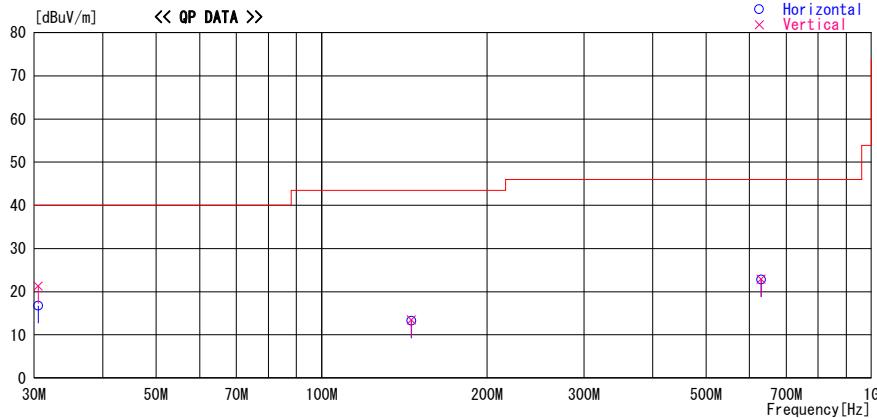
Report No. : 32KE0010-HO-01

Temp./Humi. : 23deg. C / 57% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 125kHz Worst-Axis(Hori:X / Vert:X)

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

— Horizontal
— Vertical
○ Horizontal
X Vertical



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss& Factor [dB/m]	Level [dB]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			QP	18.6	-24.9	21.4	104	100	Vert.	40.0	
30.511	27.7	QP		18.6	-24.9	21.4	104	100	Vert.	40.0	18.6
30.511	23.0	QP		18.6	-24.9	16.7	0	300	Hori.	40.0	23.3
145.650	22.1	QP		14.8	-23.5	13.4	0	100	Vert.	43.5	30.1
145.650	22.0	QP		14.8	-23.5	13.3	0	300	Hori.	43.5	30.2
630.167	22.3	QP		21.0	-20.5	22.8	0	100	Hori.	46.0	23.2
630.167	22.4	QP		21.0	-20.5	22.9	0	100	Vert.	46.0	23.1

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.

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

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-26dB Bandwidth and 99% Occupied Bandwidth

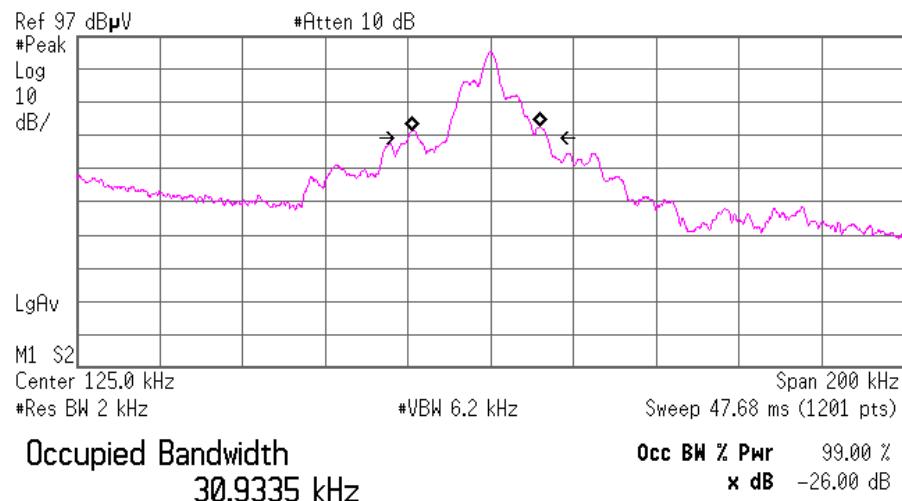
UL Japan, Inc.
Head Office EMC Lab. No.4 Semi Anechoic Chamber

POWER	: DC 12V	REPORT NO	: 32KE0010-HO-01
MODE	: Tx 125kHz	REGULATION	: Reference data
		TEST DISTANCE	: 3m
		DATE	: 06/23/2012
		TEMPERATURE	: 23 deg.C
		HUMIDITY	: 57 % RH
		Engineer	Keisuke Kawamura

FREQ [kHz]	-26dB Bandwidth [kHz]	9% Occupied Bandwidth [kHz]
125.0	33.746	30.934

Agilent

R T



Transmit Freq Error -3.629 kHz
x dB Bandwidth 33.746 kHz

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	2012/02/29 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2012/04/06 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2011/08/11 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2011/11/16 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2011/11/16 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2012/06/01 * 12
AT-38	Attenuator	Amritsu	MP721B	6200961025	RE	2011/12/08 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2012/03/05 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2011/10/19 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(5m)/ 421-010(1m)/ ucoform141-PE(1m)/ RFM-E121(Switcher)	-/04178	RE	2011/07/04 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2011/11/02 * 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, -26dB Bandwidth, 99% Occupied Bandwidth

UL Japan, Inc.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

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