



# RADIO TEST REPORT


Test Report No. : 31GE0216-HO-01-A

**Applicant** : Alps Electric Co., Ltd.  
**Type of Equipment** : Passive Entry System (Hand Unit)  
**Model No.** : TWB1U840  
**Test regulation** : FCC Part 15 Subpart C: 2012  
**FCC ID** : CWTWB1U840  
**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.

**Date of test:** January 17 to 19, 2012

**Representative test engineer:**

  
Tomotaka Sasagawa  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by:**

  
Masanori Nishiyama  
Leader 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>

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13-EM-F0429

**CONTENTS** **PAGE**

---

**SECTION 1: Customer information** ..... 3  
**SECTION 2: Equipment under test (E.U.T.)**..... 3  
**SECTION 3: Test specification, procedures & results**..... 4  
**SECTION 4: Operation of E.U.T. during testing**..... 7  
**SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)** 8  
**SECTION 6: Automatically deactivate** ..... 11  
**SECTION 7: -20dB and 99% Occupied Bandwidth** ..... 11  
**APPENDIX 1: Data of EMI test** ..... 12  
    Automatically deactivate.....12  
    Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission).....13  
    -20dB and 99% Occupied Bandwidth.....14  
    Duty Cycle .....15  
    Receiver Spurious Emission .....17  
**APPENDIX 2: Test Instruments** ..... 19  
**APPENDIX 3: Photographs of test setup**..... 20  
    Radiated emission .....20  
    Worst case position .....21

## **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 : Passive Entry System (Hand Unit)  
Model No. : TWB1U840  
Serial No. : Refer to Clause 4.2  
Rating : DC 3.0V  
Receipt Date of Sample : January 17, 2012  
Country of Mass-production : Janan  
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: TWB1U840 (referred to as the EUT in this report) is the Passive Entry System (Hand Unit).

Feature of EUT : The Hand Unit receives LF signal from I-KEY unit installed in vehicle, transmits RF signal and performs locking and unlocking of a door.  
Or, it transmits RF signal by being pushed button, and performs locking and unlocking of a door.

### **General Specification**

Clock frequency(ies) in the system : CPU: 2MHz

### **Radio Specification**

(Transmitter part)  
Frequency of operation : 314.975MHz  
Type of modulation : FSK  
Antenna Type : PCB Pattern Antenna  
Method of Frequency Generation : SAW Resonator  
Operating voltage (inner) : DC 2.5V - 3.3V (3.0V Battery)  
Operating Temperature : -10 deg. C to +60 deg. C

(Receiver part)  
Frequency of operation : 125kHz  
Antenna Type : Loop coil and Bar Antenna  
Operating voltage (inner) : DC 2.5V - 3.3V (3.0V Battery)  
Operating Temperature : -10 deg. C to +60 deg. 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 February 1, 2012

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

\*The revision on February 1, 2012 does not affect the test specification applied to the EUT.

### **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 7.2.4	FCC: Section 15.207 ----- IC: RSS-Gen 7.2.4	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	3.1dB 314.975MHz 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, 2.5.1 RSS-Gen 7.2.5	8.4dB 1259.900MHz Vertical (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
Receiver Spurious Emissions	FCC: ANSI C63.4:2003 12. Measurement of unintentional radiators other than ITE IC: RSS-Gen 4.10	FCC: Section 15.109(a) Section 15.209 ----- IC: RSS-Gen 6 RSS-210 2.3	12.7dB 944.925MHz Horizontal QP	Complied	Radiated

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 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.

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### 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	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)

[Electric Field Strength of Fundamental Emission]

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

[Electric Field Strength of Spurious Emission]

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

[Receiver Spurious Emissions]

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

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### 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 Data of EMI, Test instruments, and Test set up.

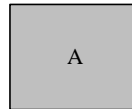
Refer to APPENDIX.

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

### **4.1 Operating Modes**

<b>Test Item*</b>	<b>Mode</b>
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)
Receiver Spurious Emission	Receiving 125kHz mode (Rx)
* The system was configured in typical fashion (as a customer would normally use it) for testing.	

### **4.2 Configuration and peripherals**



\*Setup was taken into consideration and test data was taken under worse case conditions.

#### **Description of EUT and Support equipment**

<b>No.</b>	<b>Item</b>	<b>Model number</b>	<b>Serial number</b>	<b>Manufacturer</b>	<b>Remark</b>
A	Passive Entry System (Hand Unit)	TWB1U840	12011602 *1) 12011601 *2)	ALPS ELECTRIC CO., LTD.	EUT

\*1) Used for Normal use mode

\*2) Used for Transmitting mode

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**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 3.

**[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 (frequency 9kHz – 30MHz: loop antenna was fixed height at 1.0m) 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.

\*Refer to Figure 1 about Direction of the Loop Antenna.

**Test Antennas are used as below;**

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

	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	Above 1GHz *1)
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz	PK: S/A:RBW 1MHz, VBW:3MHz

\*For the test below 30MHz, the noise was not detected when it was confirmed with PK detect.

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

- 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.

Noise levels of all the frequencies were measured at the position.

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** : 9kHz-3.2GHz  
**Test data** : APPENDIX  
**Test result** : Pass

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**[Receiving mode]**

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

The measurements were performed for vertical polarization (antenna angle: 0deg., 45deg., 90deg., and 135deg.) and horizontal polarization.

\*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30MHz to 1000MHz at distance 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.

	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

The worst case in receiving mode was confirmed with and without mechanical key, as a result, no difference was seen. Therefore the test without mechanical key was performed only.

\* 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])

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

**Measurement range : 9kHz-1000MHz**  
**Test data : APPENDIX**  
**Test result : Pass**

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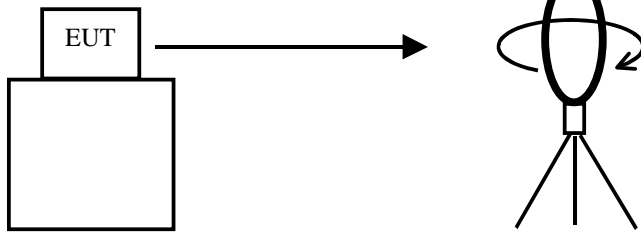
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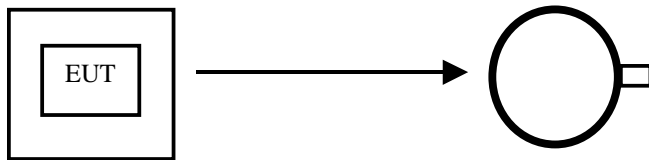
**Figure 1: Direction of the Loop Antenna**

*Side View (Vertical)*



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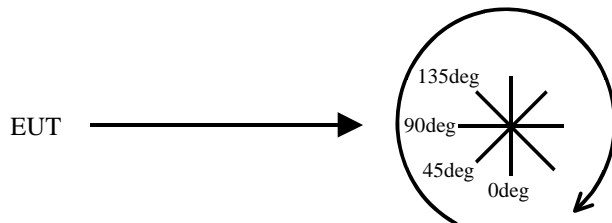
*Top View (Horizontal)*



Antenna was not rotated.

.....

*Top View (Vertical)*



Front side: 0 deg.  
Forward direction: clockwise

## **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	450kHz	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%.

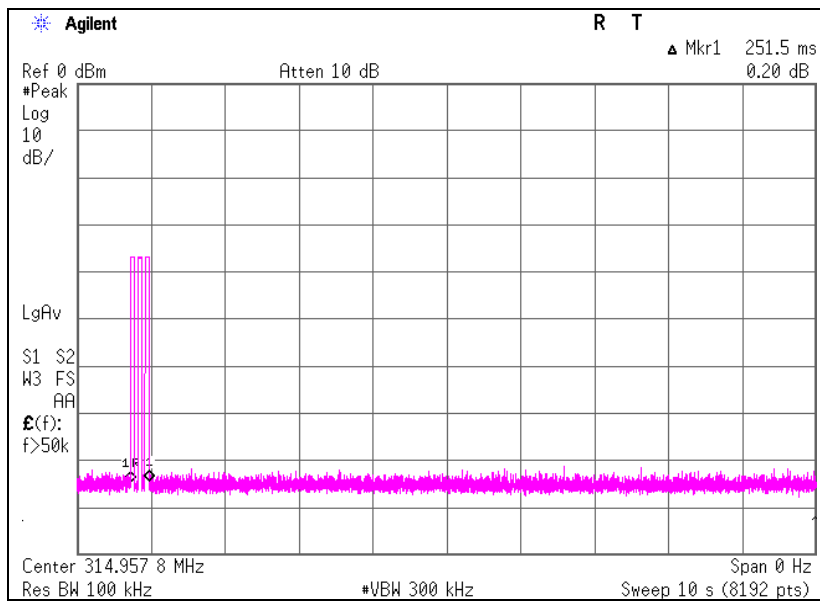
Test data : APPENDIX  
Test result : Pass

**APPENDIX 1: Data of EMI test**

**Automatically deactivate**

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber  
Report No. 31GE0216-HO-01  
Date 01/18/2012  
Temperature/ Humidity 22 deg. C / 34% RH  
Engineer Hisayoshi Sato  
Mode Normal use mode

Time of Transmitting [sec]	Limit [sec]	Result
0.2515	5.00	Pass



## Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	31GE0216-HO-01
Date	01/18/2012
Temperature/ Humidity	22 deg. C / 34% RH
Engineer	Hisayoshi Sato
Mode	Transmitting mode

**PK**

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 Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
314.975	PK	85.4	81.3	14.9	10.1	32.0	0.0	78.4	74.3	95.6	17.2	21.3	Carrier
629.950	PK	28.0	33.8	19.7	12.0	31.9	0.0	27.8	33.6	75.6	47.8	42.0	Outside
944.925	PK	32.2	29.4	22.9	13.7	30.9	0.0	37.9	35.1	75.6	37.7	40.5	Outside
1259.900	PK	53.0	61.4	24.7	1.6	34.6	0.0	44.7	53.1	75.6	30.9	22.5	Outside
1574.875	PK	45.3	48.4	25.6	1.8	33.8	0.0	38.9	42.0	73.9	35.0	31.9	Inside
1889.850	PK	53.7	57.9	25.8	1.9	33.1	0.0	48.3	52.5	75.6	27.3	23.1	Outside
2204.825	PK	47.6	47.6	26.1	2.1	32.8	0.0	43.0	43.0	73.9	30.9	30.9	Inside
2519.800	PK	45.0	41.3	26.6	2.2	32.5	0.0	41.3	37.6	75.6	34.3	38.0	Outside
2834.775	PK	48.7	45.7	27.4	2.4	32.4	0.0	46.1	43.1	73.9	27.8	30.8	Inside
3149.750	PK	44.4	44.4	28.0	2.5	32.2	0.0	42.7	42.7	75.6	32.9	32.9	Outside

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

**PK with Duty factor**

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
		Hor	Ver					Hor	Ver		Hor	Ver	
314.975	PK	85.4	81.3	14.9	10.1	32.0	-5.9	72.5	68.4	75.6	3.1	7.2	Carrier
629.950	PK	28.0	33.8	19.7	12.0	31.9	-5.9	21.9	27.7	55.6	33.7	27.9	Outside
944.925	PK	32.2	29.4	22.9	13.7	30.9	-5.9	32.0	29.2	55.6	23.6	26.4	Outside
1259.900	PK	53.0	61.4	24.7	1.6	34.6	-5.9	38.8	47.2	55.6	16.8	8.4	Outside
1574.875	PK	45.3	48.4	25.6	1.8	33.8	-5.9	33.0	36.1	53.9	20.9	17.8	Inside
1889.850	PK	53.7	57.9	25.8	1.9	33.1	-5.9	42.4	46.6	55.6	13.2	9.0	Outside
2204.825	PK	47.6	47.6	26.1	2.1	32.8	-5.9	37.1	37.1	53.9	16.8	16.8	Inside
2519.800	PK	45.0	41.3	26.6	2.2	32.5	-5.9	35.4	31.7	55.6	20.2	23.9	Outside
2834.775	PK	48.7	45.7	27.4	2.4	32.4	-5.9	40.2	37.2	53.9	13.7	16.7	Inside
3149.750	PK	44.4	44.4	28.0	2.5	32.2	-5.9	36.8	36.8	55.6	18.8	18.8	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

\* The test was performed with PK detect. Average emission measurements were calculated with PK detect and Duty cycle factor.

\* Duty Factor was calculated with the assumption of the worst condition in 100msec.

\* All the measured noise was pulse emission.

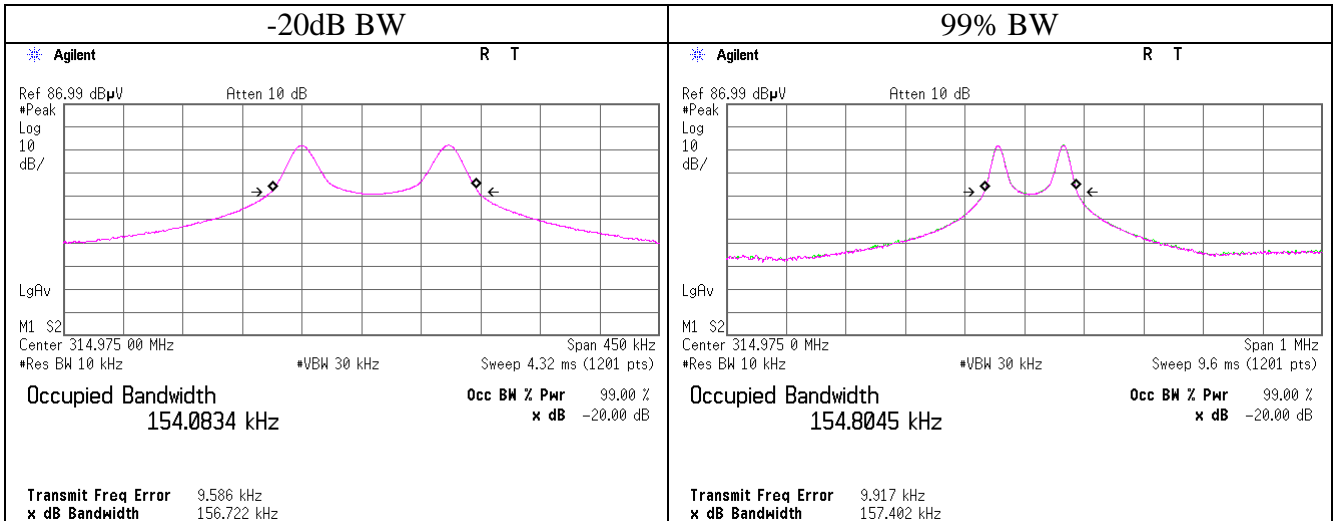
**-20dB and 99% Occupied Bandwidth**

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber  
Report No. 31GE0216-HO-01  
Date 01/18/2012  
Temperature/ Humidity 22 deg. C / 34% RH  
Engineer Hisayoshi Sato  
Mode Transmitting mode

Bandwidth Limit : Fundamental Frequency  $314.975 \text{ MHz} \times 0.25\% = 787.44 \text{ kHz}$

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
156.72	787.44	Pass

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
154.80	787.44	Pass



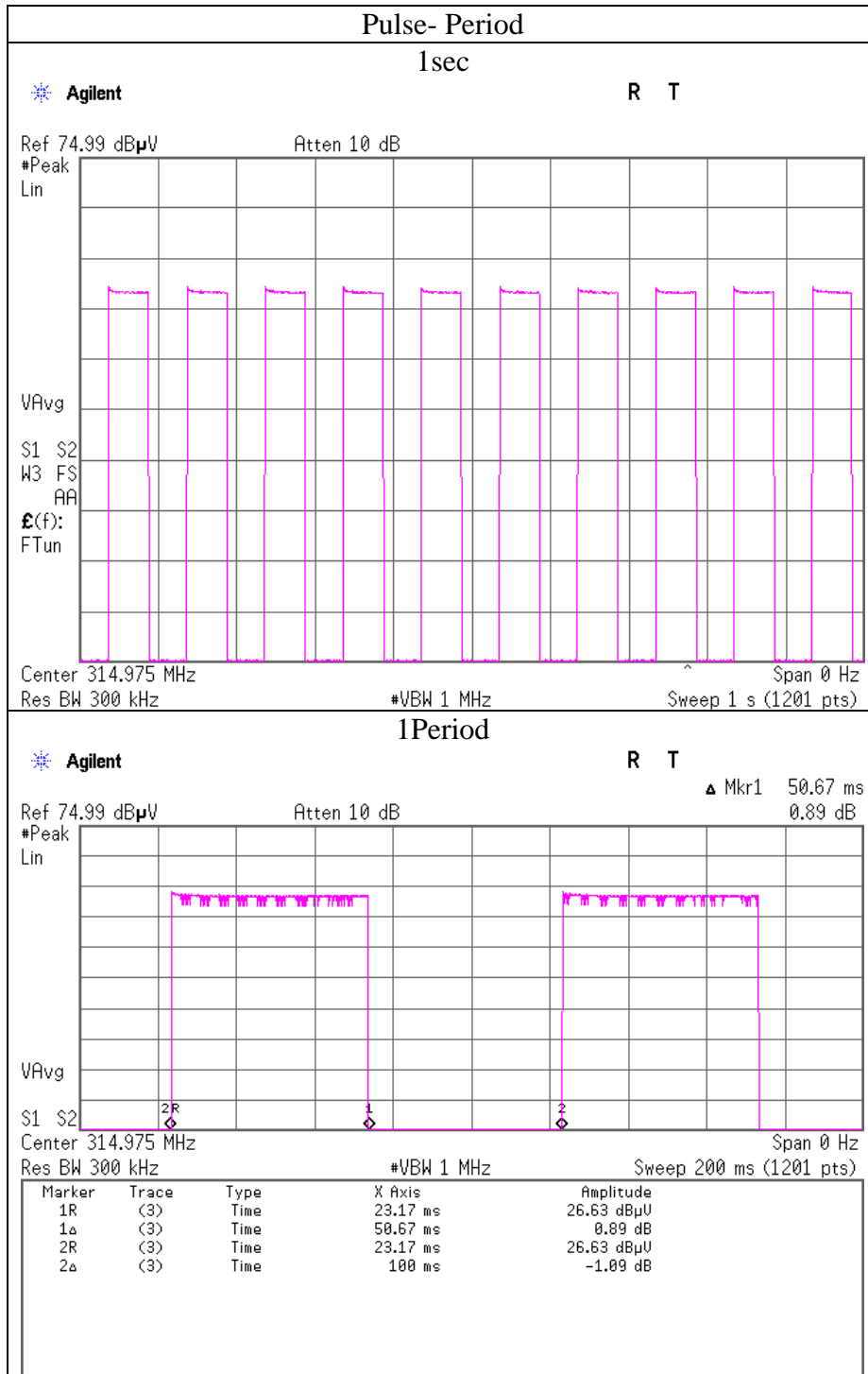
### Duty Cycle

Test place                      Head Office EMC Lab. No.3 Semi Anechoic Chamber  
Report No.                      31GE0216-HO-01  
Date                              01/18/2012  
Temperature/ Humidity        22 deg. C / 34% RH  
Engineer                        Hisayoshi Sato  
Mode                              Normal use mode

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
50.67	100.00	0.51	-5.9

Duty[dB] = 20log<sub>10</sub>(ON time/Cycle)

### Duty Cycle





## Receiver Spurious Emission

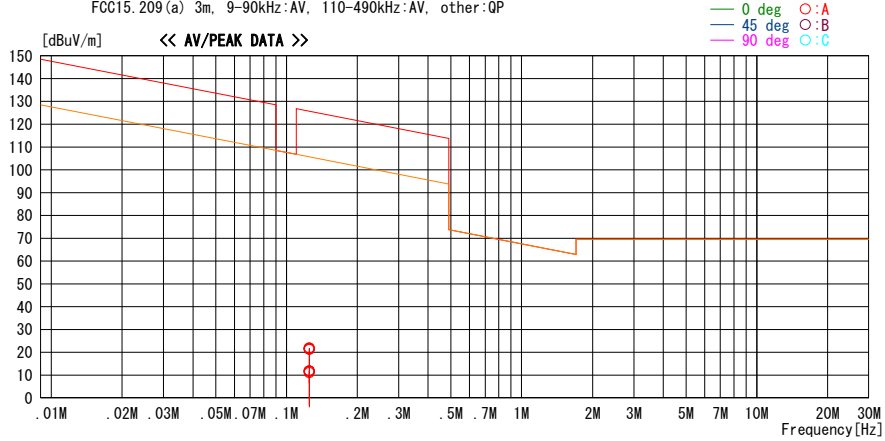
### DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber  
Date : 2012/01/17

Report No. : 31GE0216-HO-01  
Temp. / Humi. : 25 deg. C / 34% RH  
Engineer : Tomotaka Sasagawa

Mode / Remarks : LF Receiving mode 125kHz

LIMIT : FCC15, 209 (a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP  
FCC15, 209 (a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
0.12500	28.1	PEAK	19.9	6.0	32.2	21.8	125.7	103.9	0	A	0
0.12500	18.2	AV	19.9	6.0	32.2	11.9	105.7	93.8	0	A	0
0.12500	27.9	PEAK	19.9	6.0	32.2	21.6	125.7	104.1	45	A	0
0.12500	17.8	AV	19.9	6.0	32.2	11.5	105.7	94.2	45	A	0
0.12500	28.2	PEAK	19.9	6.0	32.2	21.9	125.7	103.8	90	A	0
0.12500	18.2	AV	19.9	6.0	32.2	11.9	105.7	93.8	90	A	0
0.12500	27.5	PEAK	19.9	6.0	32.2	21.2	125.7	104.5	135	A	0
0.12500	17.4	AV	19.9	6.0	32.2	11.1	105.7	94.6	135	A	0
0.12500	27.8	PEAK	19.9	6.0	32.2	21.5	125.7	104.2	135	A	0 LOOP-ANT: HOR
0.12500	18.1	AV	19.9	6.0	32.2	11.8	105.7	93.9	135	A	0 LOOP-ANT: HOR

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.)

## Receiver Spurious Emission

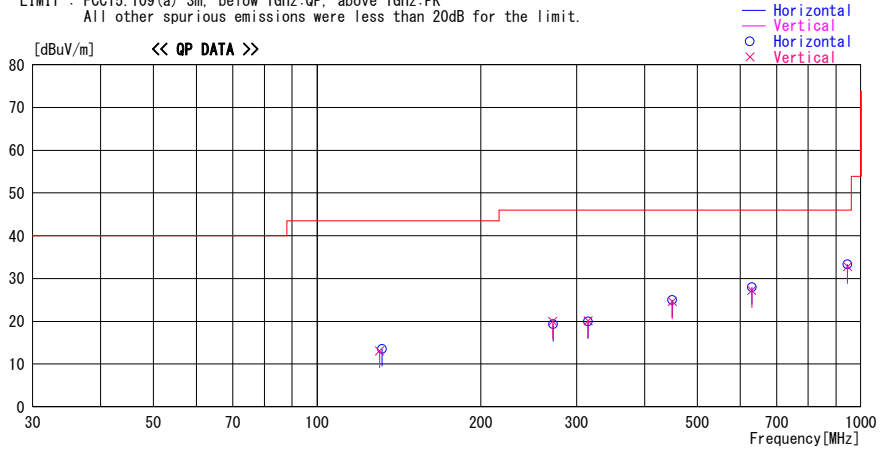
### DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber  
 Date : 2012/01/19

Report No. : 31GE0216-HO-01  
 Temp./Humi. : 22deg. C / 34% RH  
 Engineer : Hisayoshi Sato

Mode / Remarks : LF Receiving mode 125kHz    Ior:X, Ver:Y

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]
			Factor [dB/m]	Loss& Gain [dB]						
130.350	23.0	QP	13.7	-23.6	13.1	132	100	Vert.	43.5	30.4
131.700	23.3	QP	13.8	-23.6	13.5	152	300	Hori.	43.5	30.0
271.199	23.7	QP	18.5	-22.2	20.0	130	100	Vert.	46.0	26.0
271.649	23.0	QP	18.5	-22.2	19.3	124	300	Hori.	46.0	26.7
314.975	27.1	QP	14.9	-21.9	20.1	281	100	Vert.	46.0	25.9
314.975	27.0	QP	14.9	-21.9	20.0	357	100	Hori.	46.0	26.0
450.000	28.0	QP	18.0	-21.0	25.0	357	100	Hori.	46.0	21.0
450.000	27.6	QP	18.0	-21.0	24.6	281	100	Vert.	46.0	21.4
629.950	28.2	QP	19.7	-19.9	28.0	357	100	Hori.	46.0	18.0
629.950	27.4	QP	19.7	-19.9	27.2	281	100	Vert.	46.0	18.8
944.925	27.6	QP	22.9	-17.2	33.3	357	100	Hori.	46.0	12.7
944.925	27.1	QP	22.9	-17.2	32.8	281	100	Vert.	46.0	13.2

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)

## APPENDIX 2: Test Instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2011/02/22 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2011/02/23 * 12
MJM-06	Measure	PROMART	SEN1955	-	RE	
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2011/11/23 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2011/08/11 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2011/10/15 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2011/10/15 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2011/07/15 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2011/11/02 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2011/03/04 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2011/05/23 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2011/09/07 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2011/03/10 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2011/10/19 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/suciform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	RE	2011/07/15 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2011/02/15 * 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, 99% Occupied Bandwidth, -20dB bandwidth , Automatically deactivate and Duty cycle tests

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