



# RADIO TEST REPORT


Test Report No. : 32DE0142-HO-02-B

**Applicant** : Alps Electric Co., Ltd.  
**Type of Equipment** : UNIT ASSY IMMOBI & KEYLESS  
**Model No.** : TWD1G763  
**Test regulation** : FCC Part 15 Subpart C: 2012  
**FCC ID** : CWTWD1G763  
**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:** February 9, 2012

**Representative test engineer:**

  
Tomotaka Sasagawa  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by:**

  
Takahiro Hatakeda  
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

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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. : TWD1G763  
Serial No. : Refer to Clause 4.2  
Receipt Date of Sample : Refer to Section 4, Clause 4.2  
Country of Mass-production : February 1, 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: TWD1G763 (referred to as the EUT in this report) is the UNIT ASSY IMMOBI & KEYLESS.

#### **General Specification**

Clock frequency(ies) in the system : 24MHz, 8MHz, 1MHz, 16MHz, 40.66027MHz

#### **Radio Specification**

##### **(Immobilizer System: LF Transceiving function)**

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)**

Frequency of operation : 433.92MHz  
Type of modulation : FSK  
Antenna Type : Metallic Antenna  
Method of Frequency Generation : Crystal + PLL IC  
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. 32DE0142-HO-02-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 15.209 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	23.9dB 0.12500MHz 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	17.9dB 884.505MHz, Horizontal	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

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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.

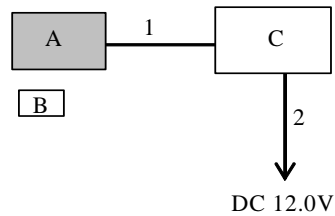
## **SECTION 4: Operation of E.U.T. during testing**

### **4.1 Operating Modes**

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	TWD1G763	No.6	Alps Electric Co., Ltd.	EUT
B	TRANSMITTER ASSY KEYLESS (Hand Unit)	TWB1G721	No.6	Alps Electric Co., Ltd.	-
C	Checker	-	-	Alps Electric Co., Ltd.	-

#### **List of cables used**

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal Cable	2.0	Unshielded	Unshielded	-
2	DC Cable	2.0	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.

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: February 9, 2012

Test engineer: Tomotaka Sasagawa

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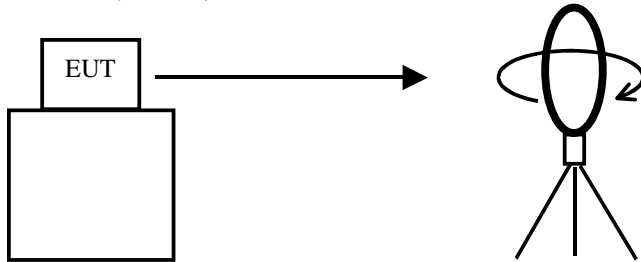
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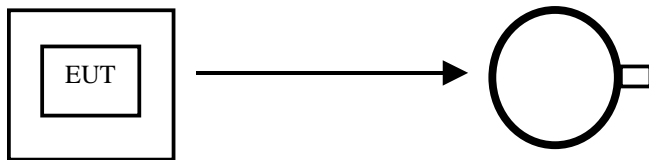


**Figure 1: Direction of the Loop Antenna**

*Side View (Vertical)*

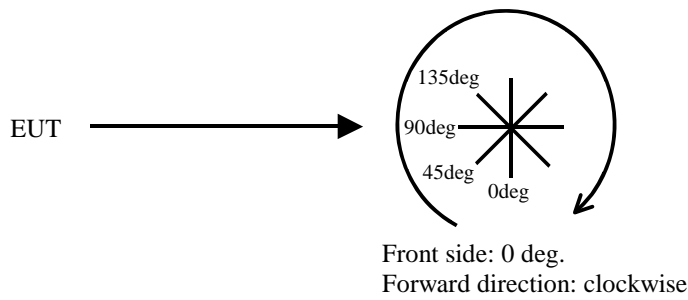


.....  
*Top View (Horizontal)*



Antenna was not rotated.

.....  
*Top View (Vertical)*



## **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

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**APPENDIX 1: Data of EMI test**

**Radiated Emission below 30MHz (Fundamental and Spurious Emission)**

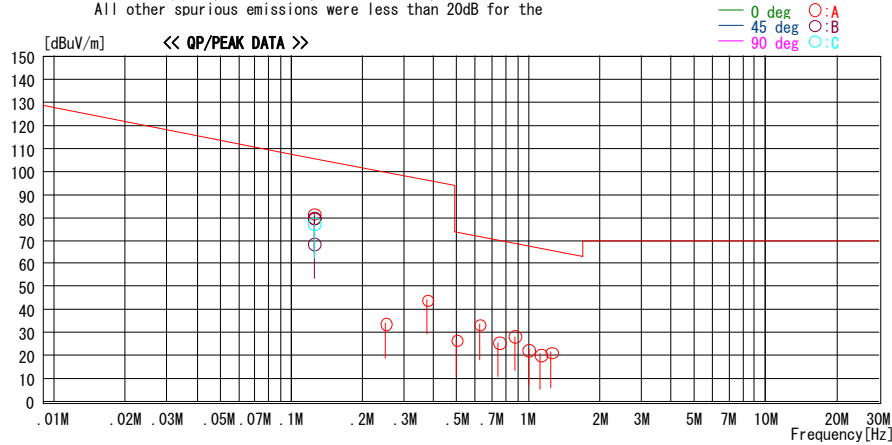
**DATA OF RADIATED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic  
Date : 2012/02/09

Report No. : 32DE0142-HO-02  
Temp. / Humi. : 23deg. C / 36% RH  
Engineer : Tomotaka Sasagawa

Mode / Remarks : Tx 125KHz

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



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	89.6	PEAK	19.9	2.9	32.2	80.2	105.7	25.5	45	B	122
0.12500	88.9	PEAK	19.9	2.9	32.2	79.5	105.7	26.2	135	B	306
0.12500	77.9	PEAK	19.9	2.9	32.2	68.5	105.7	37.2	0	B	223
0.12500	91.2	PEAK	19.9	2.9	32.2	81.8	105.7	23.9	0	A	355
0.12500	86.7	PEAK	19.9	2.9	32.2	77.3	105.7	28.4	90	C	95
0.25000	43.3	PEAK	19.7	2.9	32.2	33.7	99.7	66.0	0	A	233
0.37500	53.8	PEAK	19.7	2.9	32.2	44.2	96.1	51.9	0	A	321
0.50000	36.5	QP	19.6	2.9	32.3	26.7	73.6	46.9	0	A	349
0.62500	43.2	QP	19.6	2.9	32.2	33.5	71.7	38.2	0	A	344
0.75000	35.4	QP	19.6	2.9	32.2	25.7	70.1	44.4	0	A	351
0.87500	38.2	QP	19.5	2.9	32.2	28.4	68.7	40.3	0	A	182
1.00000	32.1	QP	19.5	3.0	32.2	22.4	67.6	45.2	0	A	0
1.12500	30.2	QP	19.5	2.9	32.2	20.4	66.5	46.1	0	A	0
1.25000	31.2	QP	19.5	2.9	32.2	21.4	65.6	44.2	0	A	0

CHART: WITH FACTOR, ANT TYPE: LOOP. Except for the data below: adequate margin data below the  
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.

**Radiated Emission above 30MHz (Spurious Emission)**

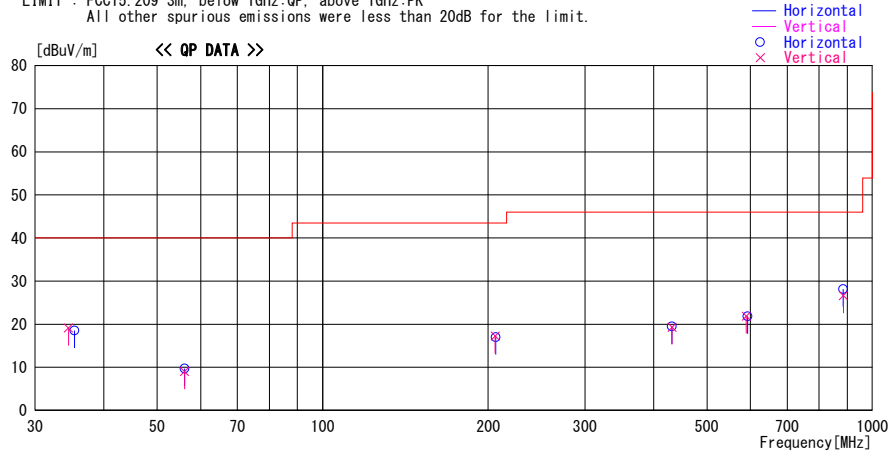
**DATA OF RADIATED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber  
Date : 2012/02/09

Report No. : 32DE0142-H0-02  
Temp./Humi. : 23deg. C / 36% RH  
Engineer : Tomotaka Sasagawa

Mode / Remarks : Tx 125KHz

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Gain							
			[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
34.500	27.1	QP	17.0	-25.0	19.1	0	100	Vert.	40.0	20.9	
35.400	26.8	QP	16.7	-25.0	18.5	199	100	Hori.	40.0	21.5	
56.100	25.2	QP	9.1	-24.6	9.7	179	100	Hori.	40.0	30.3	
56.100	24.5	QP	9.1	-24.6	9.0	268	100	Vert.	40.0	31.0	
205.949	23.1	QP	17.0	-22.8	17.3	0	100	Vert.	43.5	26.2	
206.399	22.8	QP	17.0	-22.8	17.0	0	100	Hori.	43.5	26.5	
431.832	22.7	QP	17.9	-21.1	19.5	359	100	Hori.	46.0	26.5	
431.832	22.5	QP	17.9	-21.1	19.3	1	100	Vert.	46.0	26.7	
589.333	22.8	QP	19.2	-20.1	21.9	12	100	Vert.	46.0	24.1	
592.833	22.6	QP	19.3	-20.1	21.8	16	100	Hori.	46.0	24.2	
884.505	23.4	QP	22.4	-17.7	28.1	352	100	Hori.	46.0	17.9	
885.671	21.9	QP	22.4	-17.7	26.6	0	100	Vert.	46.0	19.4	

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

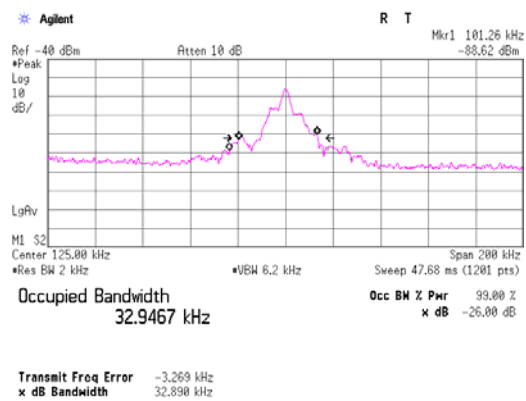
## -26dB Bandwidth

UL Japan, Inc.  
 Head Office EMC Lab. No.7 Semi Anechoic Chamber

POWER : DC 12V  
 MODE : Tx 125kHz

REPORT NO : 32DE0142-HO-02  
 REGULATION : Reference data  
 DATE : 02/09/2012  
 TEMPERATURE : 22 deg.C  
 HUMIDITY : 35 % RH  
 Engineer : Hiroshi Kukita

	FREQ	-26dB Bandwidth
	[kHz]	[kHz]
	125.0	32.890



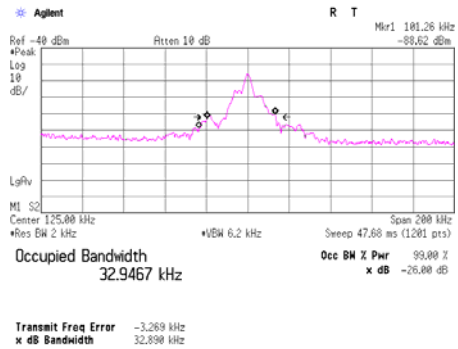
## 99% Occupied Bandwidth

UL Japan, Inc.  
 Head Office EMC Lab. No.7 Semi Anechoic Chamber

REPORT NO : 32DE0142-HO-02  
 REGULATION : Reference data  
 TEST DISTANCE : 3m  
 DATE : 02/09/2012  
 TEMPERATURE : 22 deg.C  
 HUMIDITY : 35 % RH  
 Engineer : Hiroshi Kukita

POWER : DC 12V  
 MODE : Tx 125kHz

	FREQ	99% Occupied Bandwidth
	[kHz]	[kHz]
	125.0	32.947



## APPENDIX 2: Test instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-04	Digital Humidity Indicator	N.T	NT-1800	MOS04	RE	2012/02/06 * 12
MBM-11	Barometer	Sunoh	SBR121	839	RE	2010/12/13 * 36
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2012/02/03 * 12
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	2012/02/06 * 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
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2011/03/01 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2011/10/19 * 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)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2011/07/04 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2011/03/04 * 12
MAT-51	Attenuator(6dB)	Weinschel	2	AS3557	RE	2012/01/11 * 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

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