




RADIO TEST REPORT

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

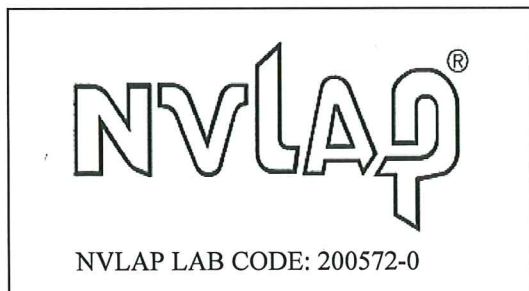
Applicant : Alps Electric Co., Ltd.
Type of Equipment : TRANSMITTER ASSY KEYLESS (Hand Unit)
Model No. : TWB1G721
Test regulation : FCC Part 15 Subpart C: 2012
FCC ID : CWTWB1G721
Test Result : Complied

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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.

Date of test: February 8 and 9, 2012

Representative test engineer: 
Shinya Watanabe
Engineer of WiSE Japan,
UL Verification Service

Approved by: 
Takahiro Hatakeda
Leader of WiSE Japan,
UL Verification Service



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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 10
SECTION 7: -20dB and 99% Occupied Bandwidth 10
APPENDIX 1: Data of EMI test 11
 Automatically deactivate.....11
 Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission).....12
 -20dB and 99% Occupied Bandwidth.....13
 Duty Cycle14
APPENDIX 2: Test Instruments 15
APPENDIX 3: Photographs of test setup..... 16
 Radiated emission16
 Worst case position17

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 : TRANSMITTER ASSY KEYLESS (Hand Unit)
Model No. : TWB1G721
Serial No. : Refer to Section 4, Clause 4.2
Receipt Date of Sample : February 1, 2012
Country of Mass-production : Japan
Condition of EUT : Engineering 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: TWB1G721 (referred to as the EUT in this report) is the TRANSMITTER ASSY KEYLESS (Hand Unit).

General Specification

Clock frequencies in the system : 13.56MHz

Radio Specification

[Transmitter part]

Frequency of operation : 433.92MHz
Type of modulation : FSK
Antenna Type : PWB Pattern antenna
Method of Frequency Generation : Crystal + PLL IC
Operating voltage (inner) : DC 3.0V
Operating Temperature : -20 deg. C to +60 deg. C

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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

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

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	1.9dB 433.92MHz 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	4.1dB 4339.200MHz Horizontal 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

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

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	N/A	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)

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

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

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.

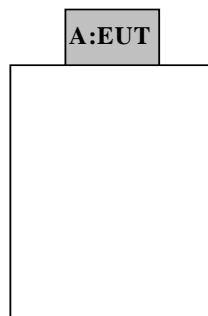
Refer to APPENDIX.

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

4.1 Operating Modes

Test Item*	Mode
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)
* The system was configured in typical fashion (as a customer would normally use it) for testing.	

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	TRANSMITTER ASSY KEYLESS (Hand Unit)	TWB1G721	20120131 No.6 *1) 20120203 No.1 *2)	Alps Electric Co., Ltd.	EUT

*1) Used for Normal use mode

*2) Used for Transmitting mode

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

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
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.

- 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 folded in or out. The worst case was confirmed that mechanical key is folded in and out, as a result, the test which mechanical key was folded out was the worst case. Therefore the test was performed under the worst condition.

*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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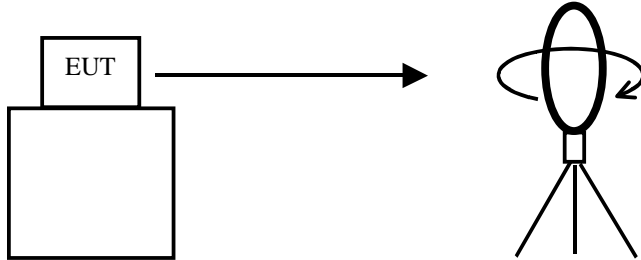
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Telephone : +81 596 24 8116

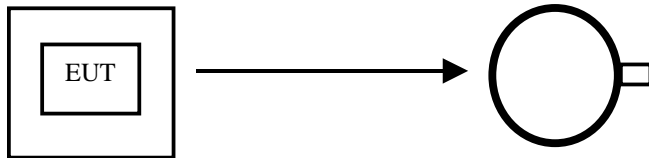
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

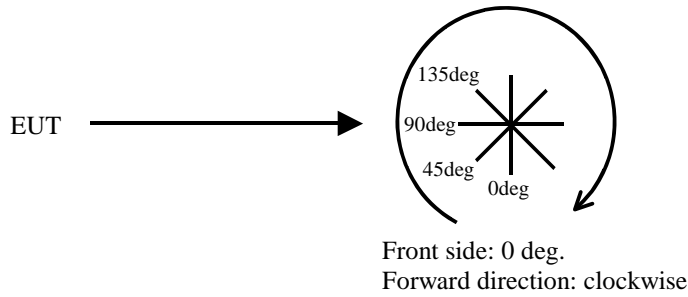


.....
Top View (Horizontal)



Antenna was not rotated.

.....
Top View (Vertical)



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	500kHz	15kHz	43kHz	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%.

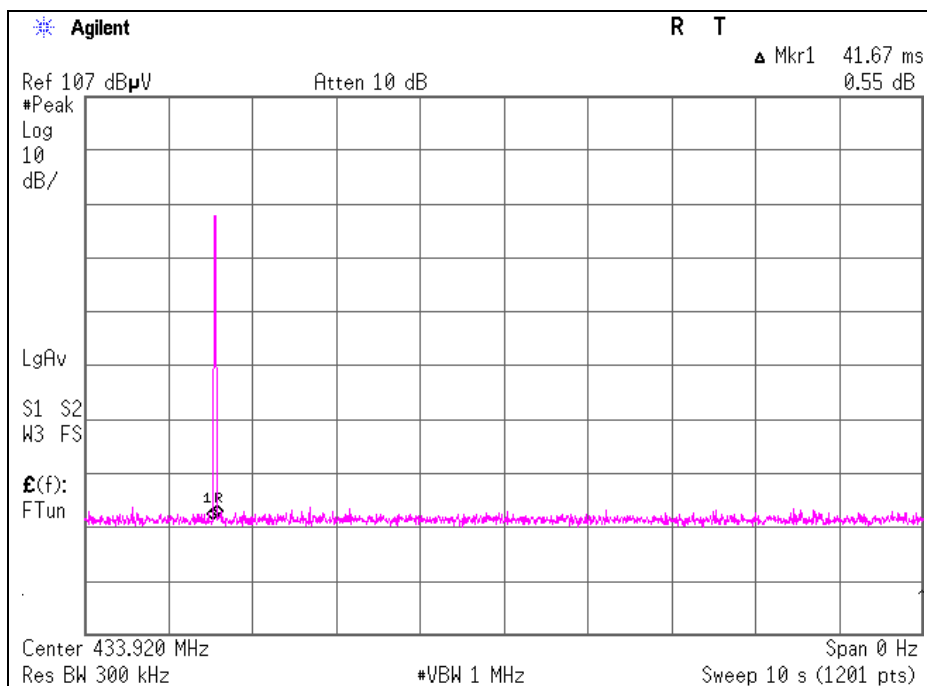
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Data of EMI test

Automatically deactivate

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
 Report No. 32DE0142-HO-02
 Date 02/08/2012
 Temperature/ Humidity 22 deg. C / 31% RH
 Engineer Shinya Watanabe
 Mode Normal use mode

Time of Transmitting [sec]	Limit [sec]	Result
0.04	5.00	Pass



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

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber	
Report No.	32DE0142-HO-02	
Date	02/08/2012	02/08/2012
Temperature/ Humidity	22 deg. C / 31% RH	22 deg. C / 31% RH
Engineer	Shinya Watanabe	Tomotaka Sasagawa
	(Below 1GHz)	(Above 1GHz)
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	
433.920	PK	88.9	88.7	18.1	10.7	32.1	-	85.6	85.4	100.8	15.2	15.4	Carrier
867.840	PK	43.0	40.9	24.0	13.1	31.4	-	48.7	46.6	80.8	32.1	34.2	Outside
1301.760	PK	52.2	55.7	24.8	1.9	33.9	-	45.0	48.5	73.9	28.9	25.4	Inside
1735.680	PK	48.8	52.6	25.8	2.1	32.9	-	43.8	47.6	80.8	37.0	33.2	Outside
2169.600	PK	50.2	50.9	27.1	2.4	32.3	-	47.4	48.1	80.8	33.4	32.7	Outside
2603.520	PK	58.3	55.0	28.6	2.6	32.1	-	57.4	54.1	80.8	23.4	26.7	Outside
3037.440	PK	52.4	53.9	28.7	2.8	31.9	-	52.0	53.5	80.8	28.8	27.3	Outside
3471.360	PK	49.2	48.5	28.9	3.1	31.8	-	49.4	48.7	80.8	31.4	32.1	Outside
3905.280	PK	44.8	45.4	29.8	3.3	31.6	-	46.3	46.9	73.9	27.6	27.0	Inside
4339.200	PK	54.3	50.5	30.2	3.5	31.5	-	56.5	52.7	73.9	17.4	21.2	Inside

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	
433.920	PK	88.9	88.7	18.1	10.7	32.1	-6.7	78.9	78.7	80.8	1.9	2.1	Carrier
867.840	PK	43.0	40.9	24.0	13.1	31.4	-6.7	42.0	39.9	60.8	18.8	20.9	Outside
1301.760	PK	52.2	55.7	24.8	1.9	33.9	-6.7	38.3	41.8	53.9	15.6	12.1	Inside
1735.680	PK	48.8	52.6	25.8	2.1	32.9	-6.7	37.1	40.9	60.8	23.7	19.9	Outside
2169.600	PK	50.2	50.9	27.1	2.4	32.3	-6.7	40.7	41.4	60.8	20.1	19.4	Outside
2603.520	PK	58.3	55.0	28.6	2.6	32.1	-6.7	50.7	47.4	60.8	10.1	13.4	Outside
3037.440	PK	52.4	53.9	28.7	2.8	31.9	-6.7	45.3	46.8	60.8	15.5	14.0	Outside
3471.360	PK	49.2	48.5	28.9	3.1	31.8	-6.7	42.7	42.0	60.8	18.1	18.8	Outside
3905.280	PK	44.8	45.4	29.8	3.3	31.6	-6.7	39.6	40.2	53.9	14.3	13.7	Inside
4339.200	PK	54.3	50.5	30.2	3.5	31.5	-6.7	49.8	46.0	53.9	4.1	7.9	Inside

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 above 1GHz 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.
- * The noise measured with PK detect was pulse emission.

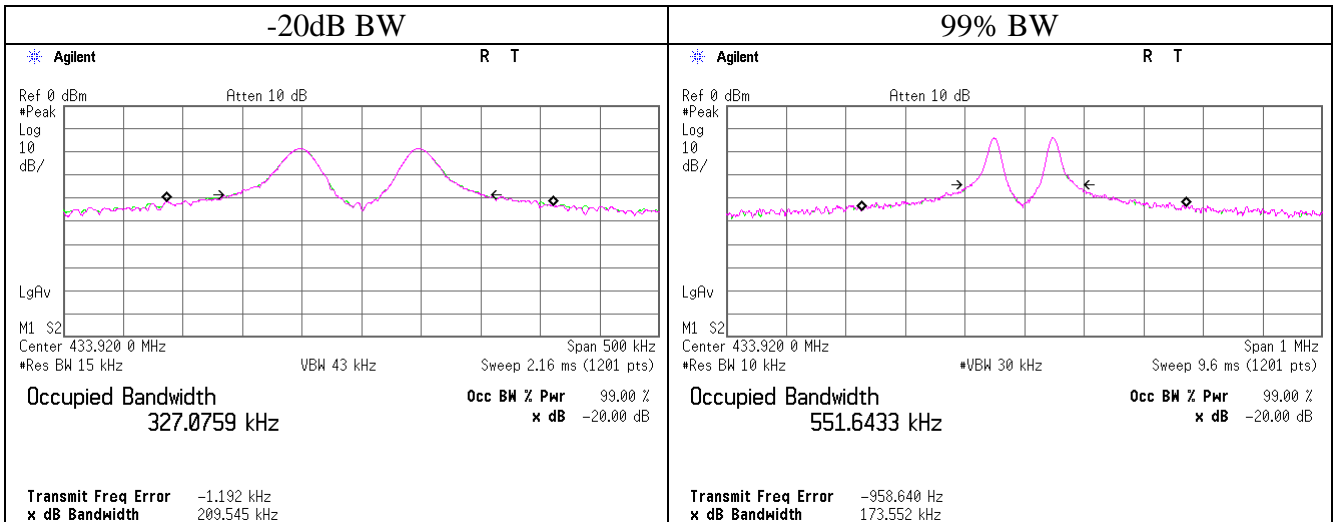
-20dB and 99% Occupied Bandwidth

Test place Head Office EMC Lab. No.7 Semi Anechoic Chamber
Report No. 32DE0142-HO-02
Date 02/09/2012
Temperature/ Humidity 22 deg. C / 35% RH
Engineer Hiroshi Kukita
Mode Transmitting mode

Bandwidth Limit : Fundamental Frequency $433.92 \text{ MHz} \times 0.25\% = 1084.80 \text{ kHz}$

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
209.55	1084.80	Pass

99% Occupied Bandwidth [kHz]
551.64



Duty Cycle

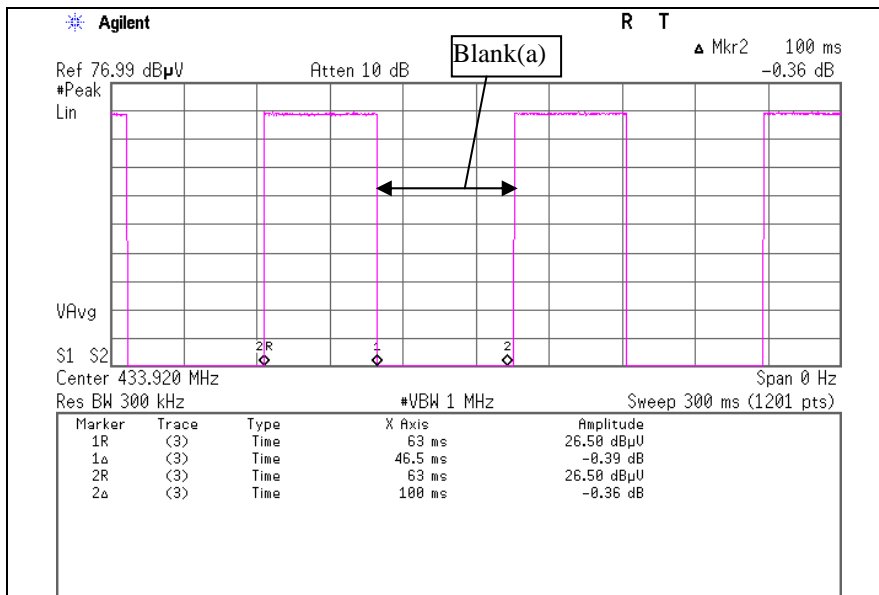
Test place Head Office EMC Lab. No.4Semi Anechoic Chamber
Report No. 32DE0142-HO-02
Date 02/08/2012
Temperature/ Humidity 22 deg. C / 31% RH
Engineer Shinya Watanabe
Mode Normal use mode

(Total)

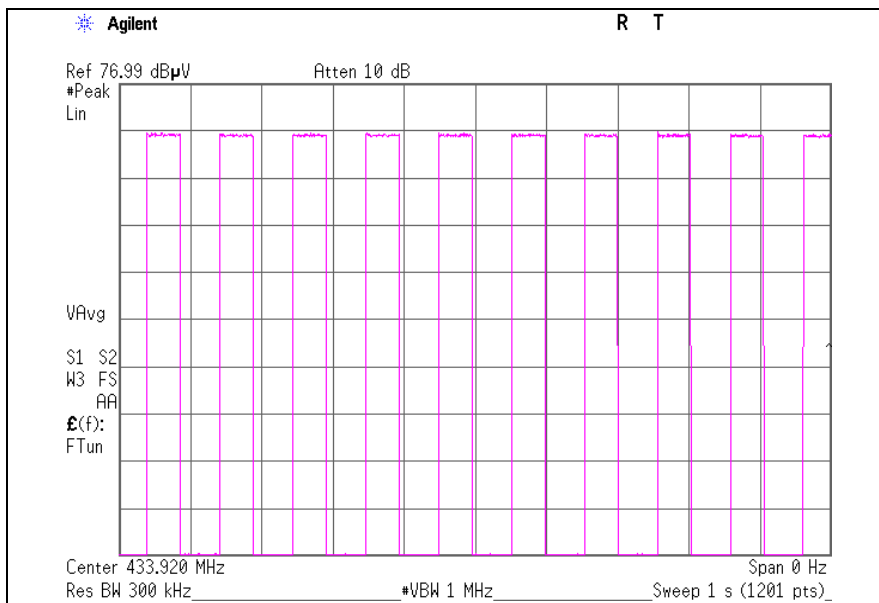
ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
46.50	100.00	0.47	-6.7

Duty = 20log10(ON time/Cycle)

*Blank(a) is intentional OFF time.



Above Duty is appropriate judging from the specification.



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	2011/03/01 * 12
MOS-15	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-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2012/02/03 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2011/10/19 * 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	2011/03/25 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2011/11/02 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2011/03/04 * 12
MOS-04	Digital Humidity Indicator	N.T	NT-1800	MOS04	RE	2012/02/06 * 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)/suciform 141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2011/07/04 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2011/11/02 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2011/08/11 * 12
MCC-57	Microwave Cable	Suhner	SUCOFLEX104	267195/4(0.6m) / 292411(5m)	RE	2011/11/09 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2011/03/10 * 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

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