




RADIO TEST REPORT


Test Report No. : 10007808H-A-R1

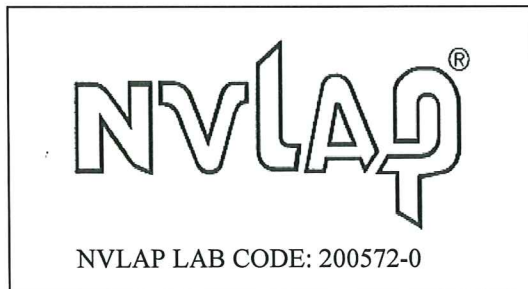
Applicant : TandD Corporation
Type of Equipment : Wireless LAN Thermo Recorder
Model No. : TR-71wf / TR-72wf
FCC ID : SRD50060
Test regulation : FCC Part 15 Subpart C: 2013
Test Result : Complied

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 the 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 10007808H-A. 10007808H-A is replaced with this report.

Date of test: August 21 and 22, 2013

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

Approved by: 
Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



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>

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: Conducted Emission.....	10
SECTION 6: Radiated Spurious Emission	11
SECTION 7: Antenna Terminal Conducted Tests.....	12
APPENDIX 1: Data of EMI test.....	13
Conducted Emission	13
6dB Bandwidth	16
Maximum Peak Output Power	18
Radiated Spurious Emission	19
Conducted Spurious Emission	23
Power Density	26
99% Occupied Bandwidth	28
APPENDIX 2: Test instruments	29
APPENDIX 3: Photographs of test setup	30
Conducted Emission	30
Radiated Spurious Emission	31
Worst Case Position (Horizontal: X-axis/ Vertical:Y-axis).....	32

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2013, final revised on June 11, 2013 and effective July 11, 2013

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

* The EUT complies with FCC Part 15 Subpart B: 2013, final revised on June 11, 2013 and effective July 11, 2013.

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	QP 14.0dB, 0.18741MHz, L 0.18923MHz, L AV 15.4dB, 0.18741MHz, L	Complied	-
6dB Bandwidth	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.6.2	FCC: Section 15.247(a)(2) ----- IC: RSS-210 A8.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) ----- IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.9	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 7.2.3	3.0dB 4824.000MHz, AV, Hori.	Complied	Conducted/ Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

FCC 15.31 (e)

This EUT provides stable voltage(DC1.8V) constantly to RF Part regardless of input voltage. 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 EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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

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	-	Conducted

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)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.6dB
No.3	3.6dB
No.4	3.6dB

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	4.3dB	5.0dB	5.1dB	4.9dB	5.8dB	4.4dB	4.3dB
No.2	4.3dB	5.2dB	5.1dB	5.0dB	5.7dB	4.3dB	4.2dB
No.3	4.6dB	5.0dB	5.1dB	5.0dB	5.7dB	4.5dB	4.2dB
No.4	4.8dB	5.2dB	5.0dB	5.0dB	5.7dB	5.2dB	4.2dB

*3m/1m/0.5m = Measurement distance

Power meter (+dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

Conducted Emission test

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

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 8999

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 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	4.75 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	-	-	8.8 x 4.6 x 2.8m	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.

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

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

4.1 Operating Mode(s)

Mode	Remarks*
IEEE 802.11b (11b)	11Mbps, PN9
*Transmitting duty was 100% on all tests. *The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 0 (Max) Software: Form-Approval ver.1.0.0.0 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	11b Tx	2412MHz
Spurious Emission		2437MHz
6dB Bandwidth		2462MHz
Maximum Peak Output Power		
Power Density		
99% Occupied Bandwidth		

UL Japan, Inc.

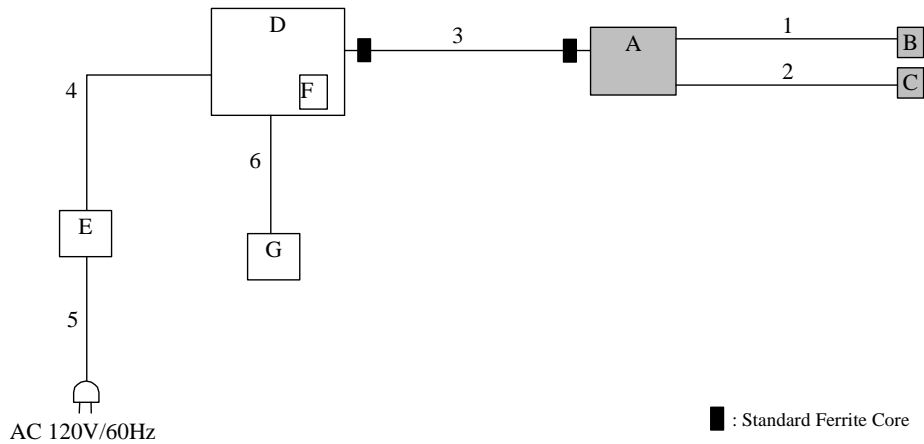
Head Office EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless LAN Thermo Recorder	TR-71wf	5F120706 *1) 5F120705 *2)	TandD Corporation	EUT
B	Sensor	203AT	-	TandD Corporation	EUT
C	Sensor	203AT	-	TandD Corporation	EUT
D	Laptop PC	SVS151E1XN	54523735 0000406	SONY	-
E	AC Adaptor	VGP-AC19V37	0269851	SONY	-
F	SD Card	RP-SD256B	BJ8CA308932	Panasonic	-
G	Mouse	M-LY2UL	0X000841	ELECOM	-

*1) Used for Radiated Emission test

*2) Used for Antenna Terminal conducted test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Sensor Cable	0.6	Unshielded	Unshielded	-
2	Sensor Cable	0.6	Unshielded	Unshielded	-
3	USB Cable	1.5	Shielded	Shielded	-
4	DC Cable	1.7	Unshielded	Unshielded	-
5	AC Cable	0.8	Unshielded	Unshielded	-
6	Mouse Cable	1.5	Shielded	Shielded	-

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

SECTION 5: Conducted 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 rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Detector	: QP and CISPR AV
Measurement range	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

The height of the measuring antenna 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 with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

In any 100kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 5 of RSS-Gen 7.2.5(IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	Average Power Method: <u>WLAN: 12.2.5.1</u> RBW: 1MHz VBW: 3MHz Detector: Power Averaging (RMS) Trace: Free Run	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m *2) (above 10GHz)		3m (below 10GHz), 1m *2) (above 10GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5.1 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)"

*2) Distance Factor: $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 30M-26.5GHz
Test data : APPENDIX
Test result : Pass

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	20MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	2.615sec	Peak	Max Hold	Spectrum Analyzer *1)
Conducted Spurious Emission *2)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				

*1) Section 10.2 Method PKPSD (peak PSD) of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".
*2) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz).

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

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 1: Data of EMI test

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

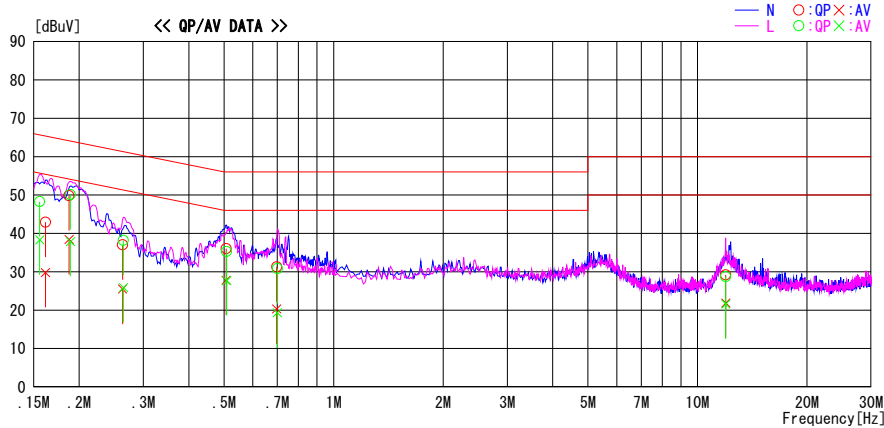
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
 Date : 2013/08/22

Report No. : 10007808H

Temp./Humi. : 21deg. C / 51% RH
 Engineer : Keisuke Kawamura

Mode / Remarks : Tx 11b 11Mbps 2412MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.16161	29.7	16.6	13.2	42.9	29.8	65.4	55.4	22.5	25.6	N	
0.18745	36.6	25.2	13.2	49.8	38.4	64.1	54.1	14.3	15.7	N	
0.26305	23.7	12.2	13.3	37.0	25.5	61.3	51.3	24.3	25.8	N	
0.50671	22.7	14.5	13.3	36.0	27.8	56.0	46.0	20.0	18.2	N	
0.69811	18.0	7.0	13.3	31.3	20.3	56.0	46.0	24.7	25.7	N	
11.95511	14.9	7.6	14.3	29.2	21.9	60.0	50.0	30.8	28.1	N	
0.15580	35.1	25.1	13.2	48.3	38.3	65.7	55.7	17.4	17.4	L	
0.18923	36.9	24.7	13.2	50.1	37.9	64.1	54.1	14.0	16.2	L	
0.26463	24.9	12.6	13.3	38.2	25.9	61.3	51.3	23.1	25.4	L	
0.50841	22.0	14.4	13.3	35.3	27.7	56.0	46.0	20.7	18.3	L	
0.70111	17.5	6.0	13.3	30.8	19.3	56.0	46.0	25.2	26.7	L	
11.95523	14.4	7.3	14.3	28.7	21.6	60.0	50.0	31.3	28.4	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV]=READING [dBuV]+C. F [dB] (L ISN+CABLE+ATTEN.)
 Except for the above table : adequate margin data below the limits.

Conducted Emission

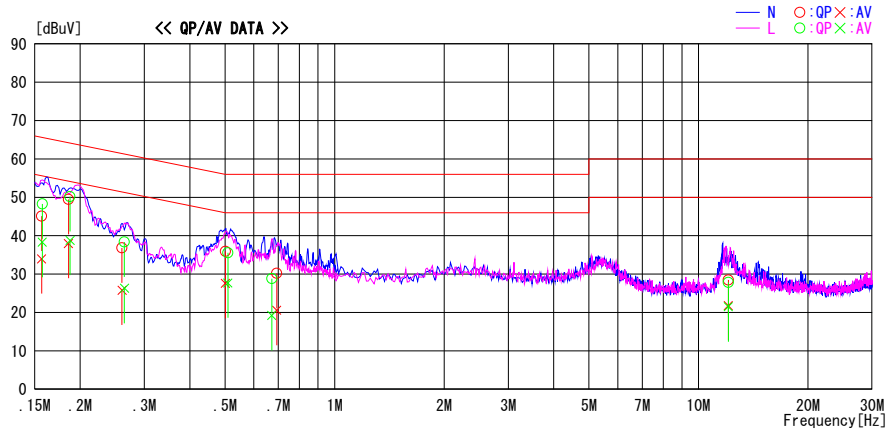
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2013/08/22

Report No. : 10007808H
 Temp./Humi. : 21deg. C / 51% RH
 Engineer : Keisuke Kawamura

Mode / Remarks : Tx 11b 11Mbps 2437MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15662	31.9	20.8	13.2	45.1	34.0	65.6	55.6	20.5	21.6	N	
0.18571	36.3	24.8	13.2	49.5	38.0	64.2	54.2	14.7	16.2	N	
0.26051	23.5	12.5	13.3	36.8	25.8	61.4	51.4	24.6	25.6	N	
0.50091	22.6	14.3	13.3	35.9	27.6	56.0	46.0	20.1	18.4	N	
0.69315	16.9	7.3	13.3	30.2	20.6	56.0	46.0	25.8	25.4	N	
12.07217	14.2	7.5	14.3	28.5	21.8	60.0	50.0	31.5	28.2	N	
0.15725	35.1	25.1	13.2	48.3	38.3	65.6	55.6	17.3	17.3	L	
0.18741	37.0	25.6	13.2	50.2	38.8	64.2	54.2	14.0	15.4	L	
0.26455	25.1	13.0	13.3	38.4	26.3	61.3	51.3	22.9	25.0	L	
0.50875	22.3	14.4	13.3	35.6	27.7	56.0	46.0	20.4	18.3	L	
0.67212	15.5	5.9	13.3	28.8	19.2	56.0	46.0	27.2	26.8	L	
12.07217	13.5	7.2	14.3	27.8	21.5	60.0	50.0	32.2	28.5	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV]=READING [dBuV]+C. F [dB] (LISN+CABLE+ATTEN.)
 Except for the above table : adequate margin data below the limits.

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

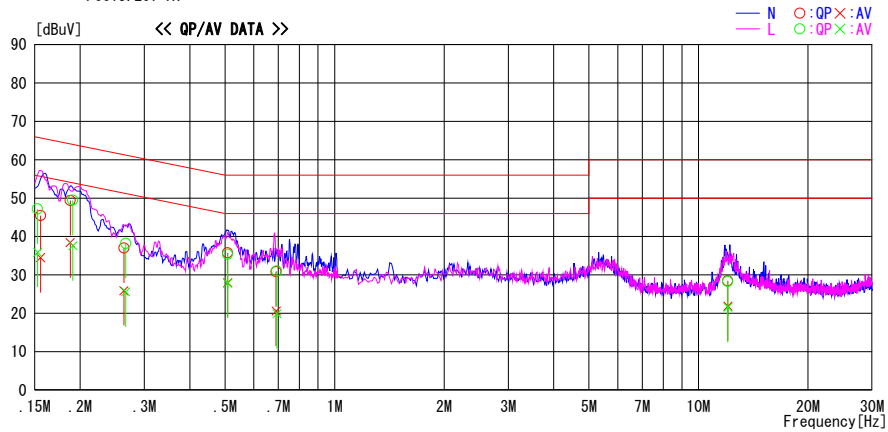
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
 Date : 2013/08/22

Report No. : 10007808H

Temp./Humi. : 21deg. C / 51% RH
 Engineer : Keisuke Kawamura

Mode / Remarks : Tx 11b 11Mbps 2462MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15562	32.3	21.3	13.2	45.5	34.5	65.7	55.7	20.2	21.2	N	
0.18771	36.2	25.2	13.2	49.4	38.4	64.1	54.1	14.7	15.7	N	
0.26365	23.7	12.6	13.3	37.0	25.9	61.3	51.3	24.3	25.4	N	
0.50815	22.4	14.7	13.3	35.7	28.0	56.0	46.0	20.3	18.0	N	
0.69085	17.5	7.3	13.3	30.8	20.6	56.0	46.0	25.2	25.4	N	
12.03551	14.2	7.6	14.3	28.5	21.9	60.0	50.0	31.5	28.1	N	
0.15272	34.0	22.7	13.2	47.2	35.9	65.9	55.9	18.7	20.0	L	
0.19091	36.3	24.4	13.2	49.5	37.6	64.0	54.0	14.5	16.4	L	
0.26661	24.9	12.3	13.3	38.2	25.6	61.2	51.2	23.0	25.6	L	
0.50815	22.1	14.6	13.3	35.4	27.9	56.0	46.0	20.6	18.1	L	
0.69361	17.7	6.6	13.3	31.0	19.9	56.0	46.0	25.0	26.1	L	
12.03551	14.0	7.3	14.3	28.3	21.6	60.0	50.0	31.7	28.4	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT[dBuV]=READING[dBuV]+C.F[dB] (LISN+CABLE+ATTEN.)
 Except for the above table : adequate margin data below the limits.

6dB Bandwidth

Test place Head Office EMC Lab. No.11 Measurement Room
Report No. 10007808H
Date 08/21/2013
Temperature/ Humidity 24 deg. C / 46% RH
Engineer Keisuke Kawamura
Mode Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	8.899	>500
2437	8.904	>500
2462	8.896	>500

UL Japan, Inc.

Head Office EMC Lab.

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

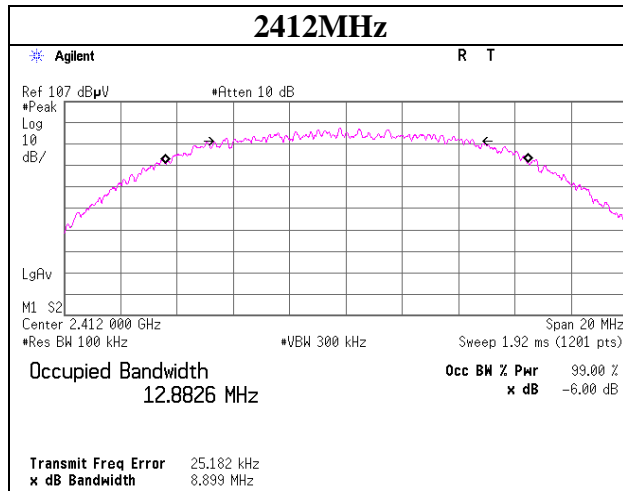
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

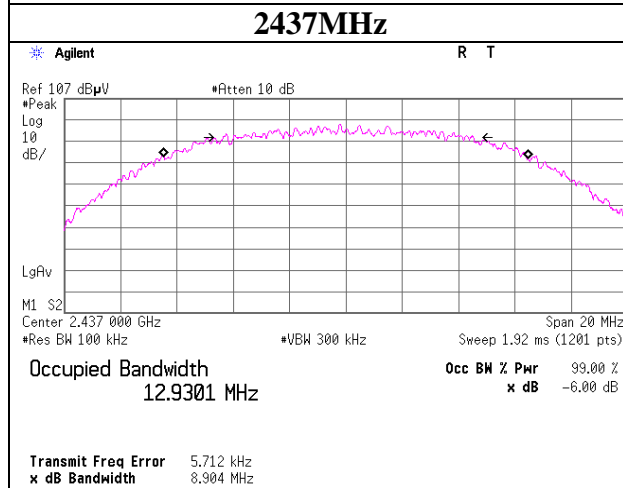
6dB Bandwidth

11b

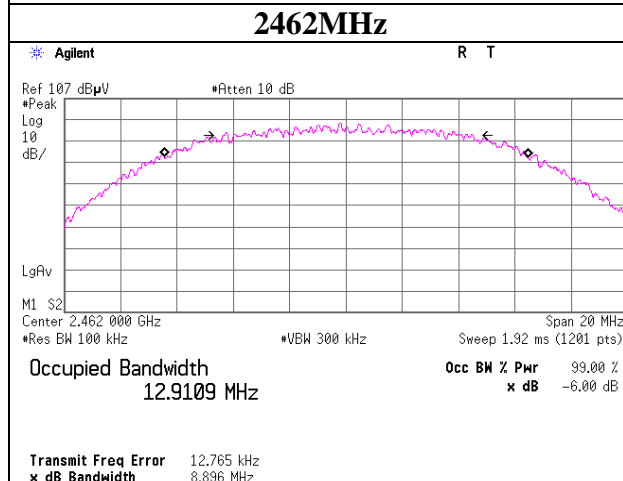
2412MHz



2437MHz



2462MHz



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

Maximum Peak Output Power

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10007808H
Date	08/21/2013
Temperature/ Humidity	24 deg. C / 46% RH
Engineer	Keisuke Kawamura
Mode	11b Tx

11Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-1.21	2.19	10.01	10.99	12.56	30.00	1000	19.01
2437	-0.85	2.20	10.01	11.36	13.68	30.00	1000	18.64
2462	-0.32	2.20	10.01	11.89	15.45	30.00	1000	18.11

Sample Calculation:

Result = Reading + Cable Loss (including the cable customer supplied) + Attenuator

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
1	-1.21	
2	-0.88	
5.5	-1.39	
11	-0.85	Long *
11	-0.91	Short

*: Worst Rate

All comparizon were carried out on same frequency and measurement factors.

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

Radiated Spurious Emission

Test place : Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 10007808H
Date : 08/22/2013
Temperature/ Humidity : 23 deg. C / 65% RH
Engineer : Masatoshi Nishiguchi
(1-10GHz)
Mode : 11b Tx 2412MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	36.040	QP	27.3	15.7	7.1	32.2	-	17.9	40.0	22.1	
Hori	42.150	QP	27.6	13.5	7.2	32.2	-	16.1	40.0	23.9	
Hori	79.950	QP	52.9	6.4	7.8	32.2	-	34.9	40.0	5.1	
Hori	84.096	QP	51.3	7.2	7.8	32.2	-	34.1	40.0	5.9	
Hori	209.289	QP	41.9	16.8	9.1	32.1	-	35.7	43.5	7.8	
Hori	330.673	QP	35.1	15.5	10.1	32.0	-	28.7	46.0	17.3	
Hori	2390.000	PK	45.5	28.2	2.3	32.4	-	43.6	73.9	30.3	
Hori	4824.000	PK	50.0	30.5	4.0	31.4	-	53.1	73.9	20.8	
Hori	7236.000	PK	42.6	35.8	4.8	32.3	-	50.9	73.9	23.0	
Hori	9648.000	PK	43.6	39.1	5.5	33.0	-	55.2	73.9	18.7	
Hori	2390.000	AV	40.1	28.2	2.3	32.4	0.0	38.2	53.9	15.7	
Hori	4824.000	AV	47.8	30.5	4.0	31.4	0.0	50.9	53.9	3.0	
Hori	7236.000	AV	33.2	35.8	4.8	32.3	0.0	41.5	53.9	12.4	
Hori	9648.000	AV	35.1	39.1	5.5	33.0	0.0	46.7	53.9	7.2	
Vert	36.050	QP	37.8	15.7	7.1	32.2	-	28.4	40.0	11.6	
Vert	42.042	QP	38.9	13.6	7.2	32.2	-	27.5	40.0	12.5	
Vert	79.861	QP	42.4	6.4	7.8	32.2	-	24.4	40.0	15.6	
Vert	84.101	QP	42.2	7.2	7.8	32.2	-	25.0	40.0	15.0	
Vert	210.749	QP	30.9	16.8	9.2	32.1	-	24.8	43.5	18.7	
Vert	359.273	QP	25.3	16.3	10.3	32.0	-	19.9	46.0	26.1	
Vert	2390.000	PK	43.0	28.2	2.3	32.4	-	41.1	73.9	32.8	
Vert	4824.000	PK	46.9	30.5	4.0	31.4	-	50.0	73.9	23.9	
Vert	7236.000	PK	41.1	35.8	4.8	32.3	-	49.4	73.9	24.5	
Vert	9648.000	PK	41.6	39.1	5.5	33.0	-	53.2	73.9	20.7	
Vert	2390.000	AV	34.9	28.2	2.3	32.4	0.0	33.0	53.9	20.9	
Vert	4824.000	AV	44.0	30.5	4.0	31.4	0.0	47.1	53.9	6.8	
Vert	7236.000	AV	33.3	35.8	4.8	32.3	0.0	41.6	53.9	12.3	
Vert	9648.000	AV	35.1	39.1	5.5	33.0	0.0	46.7	53.9	7.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remrk
Hori	2412.000	PK	99.1	28.2	2.3	32.4	97.2	-	-	- Carrier
Hori	2400.000	PK	40.3	28.2	2.3	32.4	38.4	77.2	38.8	
Vert	2412.000	PK	98.1	28.2	2.3	32.4	96.2	-	-	- Carrier
Vert	2400.000	PK	40.1	28.2	2.3	32.4	38.2	76.2	38.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

UL Japan, Inc.

Head Office EMC Lab.

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

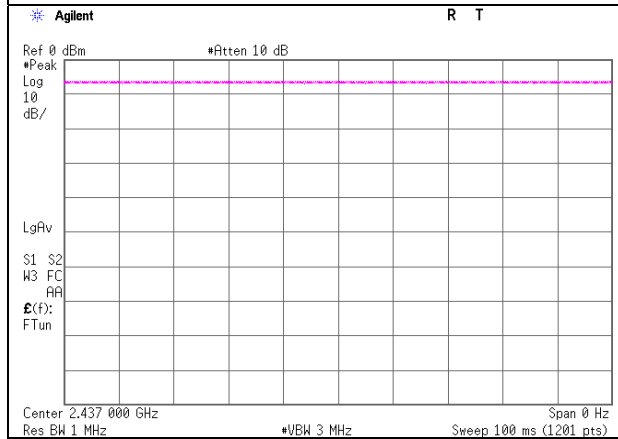
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Burst rate confirmation

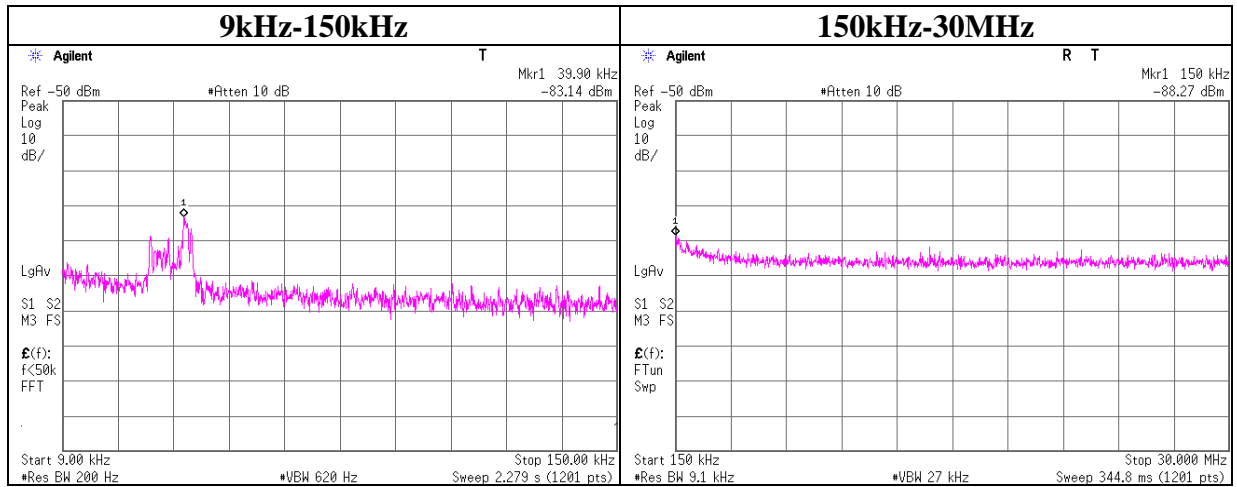
11b 11Mbps

Tx on / (Tx on + Tx off) = 1.000
Tx on / (Tx on + Tx off) * 100 = 100.0 %
Duty factor = 10 * log (1 / 1) = 0.00 dB



Conducted Spurious Emission

11b Tx 2412MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
39.90	-83.1	2.19	10.0	2.1	-68.8	300.0	6.0	-7.5	35.6
150	-88.3	2.19	10.0	2.1	-73.9	300.0	6.0	-12.7	24.1

$E = \text{EIRP} - 20\log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

UL Japan, Inc.

Head Office EMC Lab.

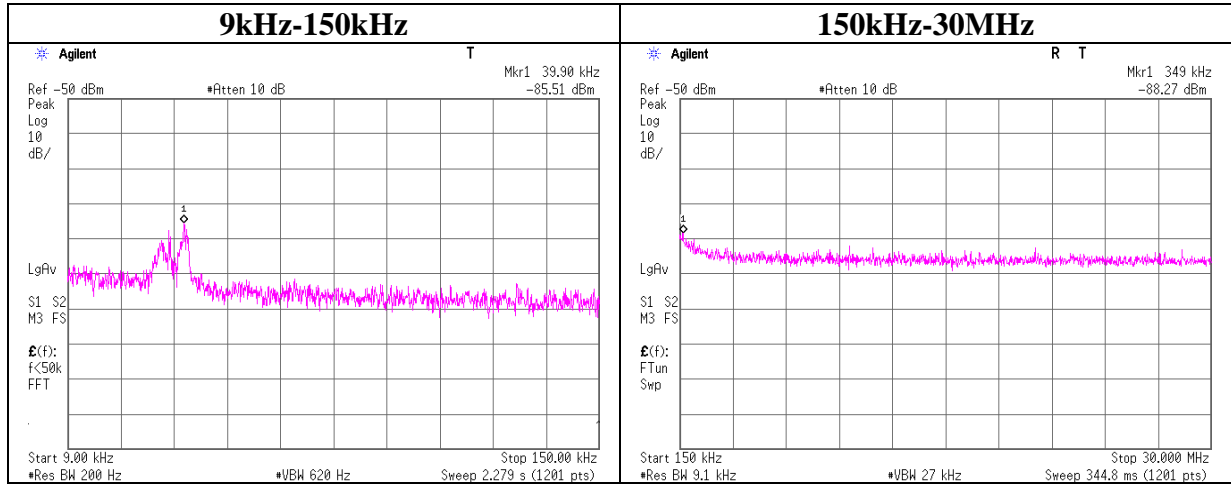
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

11b Tx 2437MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
39.90	-85.5	2.19	10.0	2.1	-71.2	300.0	6.0	-9.9	35.6
349	-88.3	2.19	10.0	2.1	-73.9	300.0	6.0	-12.7	16.7

$E = \text{EIRP} - 20\log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

UL Japan, Inc.

Head Office EMC Lab.

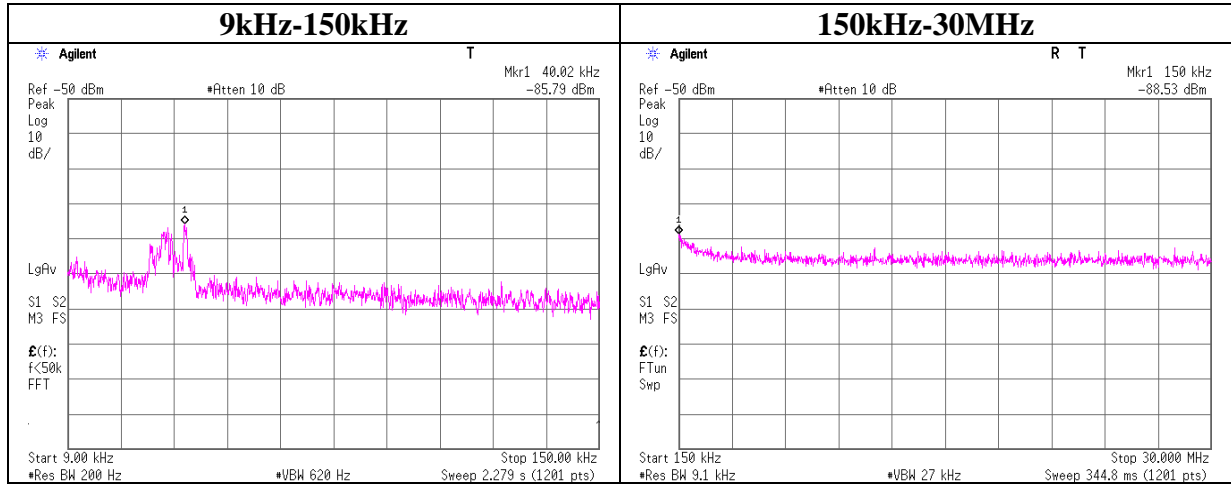
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

11b Tx 2462MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
40.02	-85.8	2.19	10.0	2.1	-71.5	300.0	6.0	-10.2	35.6
150	-88.5	2.19	10.0	2.1	-74.2	300.0	6.0	-12.9	24.1

$E = \text{EIRP} - 20\log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

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

Power Density

Test place Head Office EMC Lab. No.11 Measurement Room
Report No. 10007808H
Date 08/21/2013
Temperature/ Humidity 24 deg. C / 46% RH
Engineer Keisuke Kawamura
Mode 11b Tx,

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-27.28	2.19	10.01	-15.08	8.00	23.08
2437.00	-26.92	2.20	10.01	-14.71	8.00	22.71
2462.00	-26.18	2.20	10.01	-13.97	8.00	21.97

Sample Calculation:

Result = Reading + Cable Loss (including the cable customer supplied) + Attenuator

UL Japan, Inc.

Head Office EMC Lab.

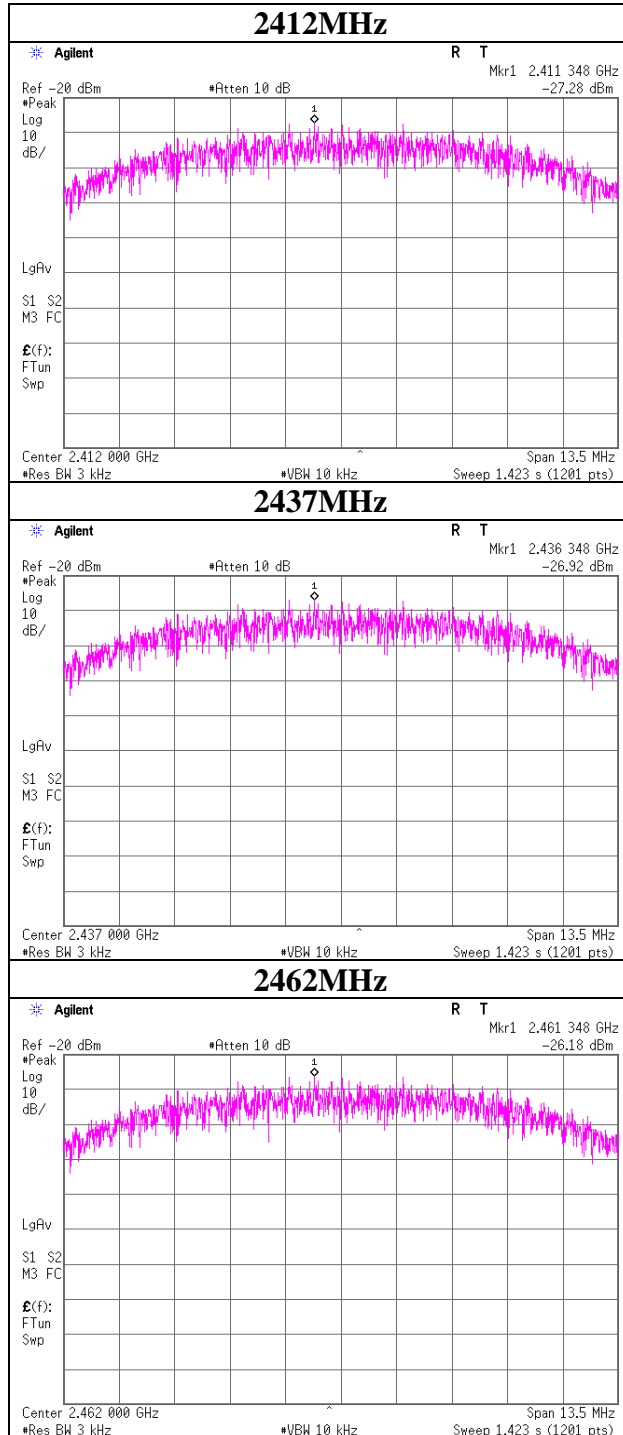
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Power Density

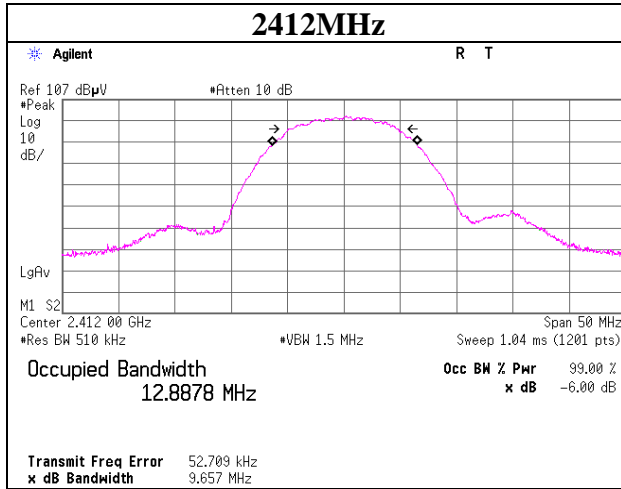
11b



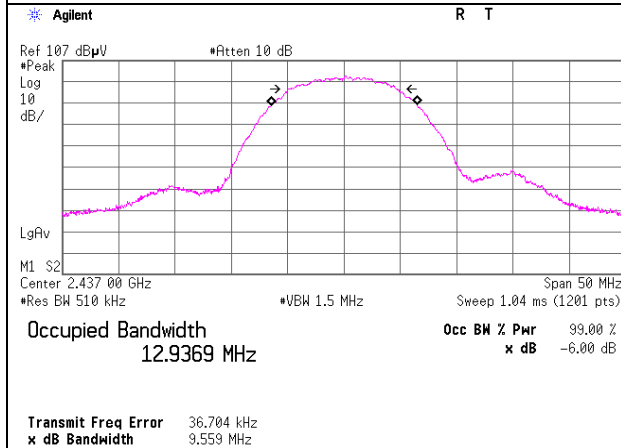
99%Occupied Bandwidth

11b

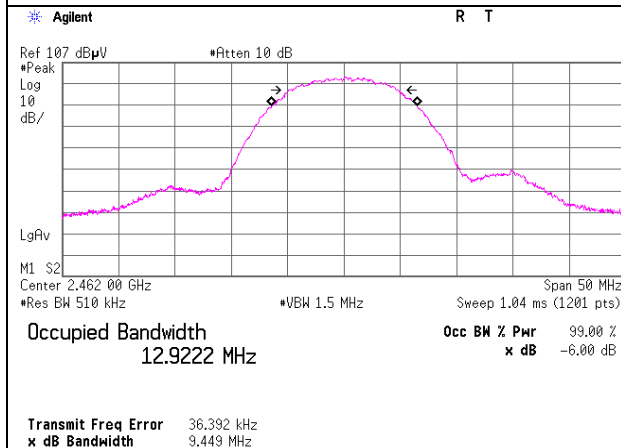
2412MHz



2437MHz



2462MHz



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/CE	2013/02/28 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2013/02/26 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE/CE	2013/02/22 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2013/05/17 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2012/09/05 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2013/03/12 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2013/05/30 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2012/10/08 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2012/10/08 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2013/03/21 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2013/05/17 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2012/08/23 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2012/10/08 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2012/10/08 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2013/07/23 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2013/04/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2013/03/12 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(EUT)	2013/01/07 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	CE	2013/07/23 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/22 * 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: CE: Conducted Emission
RE: Radiated Emission
AT: Antenna Terminal Conducted test**

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