



Test report No. : 10154203H-A-R2
Page : 1 of 45
Issued date : January 20, 2014
Revised date : January 28, 2014
FCC ID : B3Q8VA652

RADIO TEST REPORT

Test Report No. : 10154203H-A-R2

Applicant : BROTHER INDUSTRIES, LTD.
Type of Equipment : Label Printer
Model No. : PT-P750W
FCC ID : B3Q8VA652
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 10154203H-A-R1. 10154203H-A-R1 is replaced with this report.

Date of test: November 27, 2013 to January 6, 2014

Representative test engineer:

T. Shimada

Takumi Shimada
Engineer of WiSE Japan,
UL Verification Service

Approved by:

T. Hatahara

Takahiro Hatahara
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>

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

13-EM-F0429

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	14
Maximum Peak Output Power	17
Radiated Spurious Emission	20
Conducted Spurious Emission	31
Power Density	37
99% Occupied Bandwidth	39
APPENDIX 2: Test instruments	41
APPENDIX 3: Photographs of test setup	43
Conducted Emission	43
Radiated Spurious Emission	44
Worst Case Position	45

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 1: Customer information

Company Name : BROTHER INDUSTRIES, LTD.
Address : 15-1, Naeshiro-cho, Mizuho-ku, Nagoya, Aihchi-ken, 467-8561 Japan
Telephone Number : +81-52-824-2345
Facsimile Number : +81-52-821-1068
Contact Person : Shintaro Uno

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

2.1 Identification of E.U.T.

Type of Equipment : Label Printer
Model No. : PT-P750W
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12V, 2A, 24W
AC 100-240V, 50/60Hz (AC Adaptor)
* Test was performed with the EUT connected to AC Adaptor.
Receipt Date of Sample : November 27, 2013 and December 13, 2013
Country of Mass-production : China
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

General Specification

Clock frequency(ies) in the system : CPU:96MHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 2412-2462MHz
Modulation : DSSS
Power Supply (radio part input) : DC 3.3V
Antenna type : Internal Antenna
Antenna Gain : 2.03dBi

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 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2013, final revised on September 30, 2013 and effective October 30, 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 September 30, 2013 and effective October 30, 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 13.0dB, 0.18498MHz, L AV 15.3dB, 0.18498MHz, L / 0.18338MHz, N	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)		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)	See data. *1)	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	2.1dB 2390.000MHz, AV, Hori.	Complied	Conducted/ Radiated

*1) The test result of FCC ID: B3Q8VA633 (UL Japan Report No. 10129391H-A) was used for this report, because the EUT has the same radio module as the equipment tested.

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 (DC3.3V) 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 *1)	-	Conducted

*1) The test result of FCC ID: B3Q8VA633 (UL Japan Report No. 10129391H-A) was used for this report, because the EUT has the same radio module as the equipment tested.
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	3.5dB
No.3	3.6dB
No.4	3.5dB

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	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	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	4.0 x 4.5 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 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	-	6.2 x 4.7 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)

Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	1Mbps, PN9
IEEE 802.11g (11g)	6Mbps, PN9
IEEE 802.11n SISO 20MHz BW (11n-20)	MCS 0, PN9
*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: 11b : 17.0dBm, 11g : 13.0dBm, 11n-20 :12.0dBm - Software: Printer Setting Tool Version 1.2.001 Write PTUSB Version 2.1.0 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.	

*Details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	11g Tx *1)	2437MHz *1)
Radiated Spurious Emission	11b Tx 11g Tx	2412MHz 2437MHz 2462MHz
	11n-20 Tx	2412MHz 2462MHz
Conducted Spurious Emission Power Density	11b Tx 11g Tx *2)	2412MHz 2437MHz 2462MHz
6dB Bandwidth Maximum Peak Output Power 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412MHz 2437MHz 2462MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power		

UL Japan, Inc.

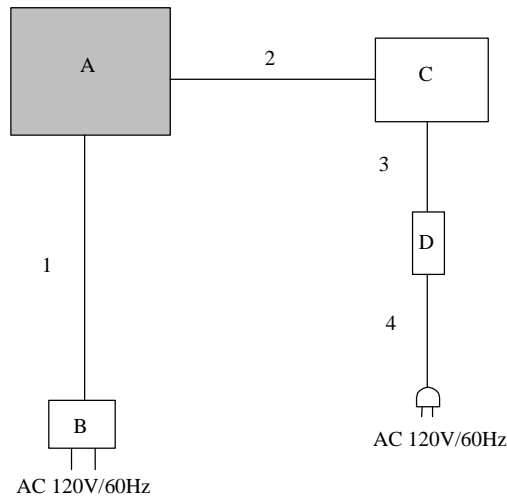
Head Office EMC Lab.

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	Label Printer	PT-P750W	8VA652-9002	BROTHER INDUSTRIES, LTD.	EUT
B	AC Adaptor	AD-E001 US	D10-0020695	BROTHER INDUSTRIES, LTD.	-
C	Personal Computer	Satellite J50	36034323H	TOSHIBA	-
D	AC Adaptor	PA3282U-2ACA	G71C0002SC10	TOSHIBA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.5	Unshielded	Unshielded	-
2	USB Cable	1.0	Shielded	Shielded	-
3	DC Cable	1.8	Unshielded	Unshielded	-
4	AC Cable	2.0	Unshielded	Unshielded	-

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, 1.0m by 0.5m, 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	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	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 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*1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				

*1) The measurement was performed with Max Hold since the duty cycle was not 100%.
*2) Reference data
*3) 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)".
*4) 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 not detected 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

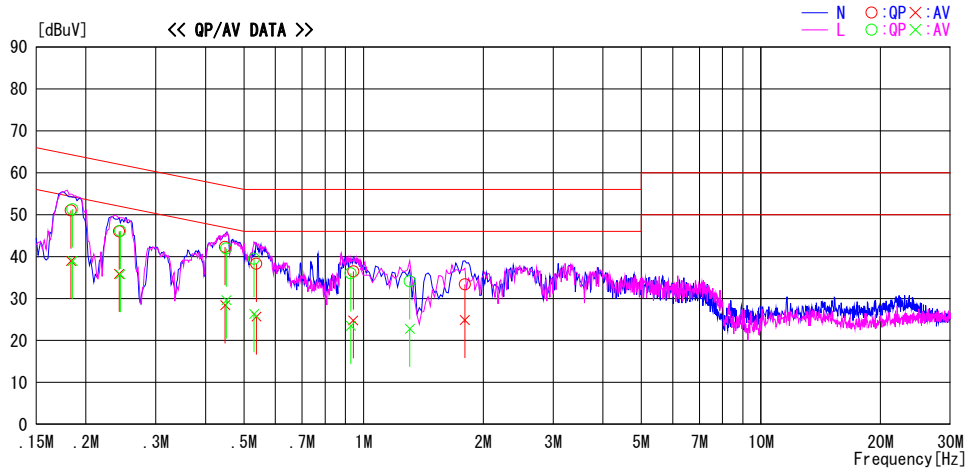
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2014/01/07

Report No. : 10154203H
Temp./Humi. : 21deg.C / 32% RH
Engineer : Masatoshi Nishiguchi

Mode / Remarks : WLAN 11g 2437MHz 6Mbps

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]		
0.18498	38.0	25.7	13.3	51.3	39.0	64.3	54.3	13.0	15.3	L	
0.24414	32.7	22.4	13.4	46.1	35.8	62.0	52.0	15.9	16.2	L	
0.45144	28.5	16.2	13.4	41.9	29.6	56.8	46.8	14.9	17.2	L	
0.53008	26.1	12.9	13.4	39.5	26.3	56.0	46.0	16.5	19.7	L	
0.92875	22.5	10.0	13.5	36.0	23.5	56.0	46.0	20.0	22.5	L	
1.30717	20.5	9.2	13.6	34.1	22.8	56.0	46.0	21.9	23.2	L	
0.18338	37.7	25.7	13.3	51.0	39.0	64.3	54.3	13.3	15.3	N	
0.24241	32.6	22.5	13.4	46.0	35.9	62.0	52.0	16.0	16.1	N	
0.44844	28.9	15.0	13.4	42.3	28.4	56.9	46.9	14.6	18.5	N	
0.53706	24.9	12.3	13.4	38.3	25.7	56.0	46.0	17.7	20.3	N	
0.94155	23.0	11.3	13.5	36.5	24.8	56.0	46.0	19.5	21.2	N	
1.79793	19.7	11.2	13.7	33.4	24.9	56.0	46.0	22.6	21.1	N	

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

*The limit is rounded down to one decimal place.

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

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

Test place Head Office EMC Lab. No.11 Measurement Room
Report No. 10154203H
Date 12/05/2013
Temperature/ Humidity 24deg. C / 48% RH
Engineer Takumi Shimada
Mode Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	7.575	>500
2437	7.095	>500
2462	7.533	>500

11g

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	15.051	>500
2437	14.168	>500
2462	15.063	>500

11n-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	15.023	>500
2437	15.067	>500
2462	15.102	>500

UL Japan, Inc.

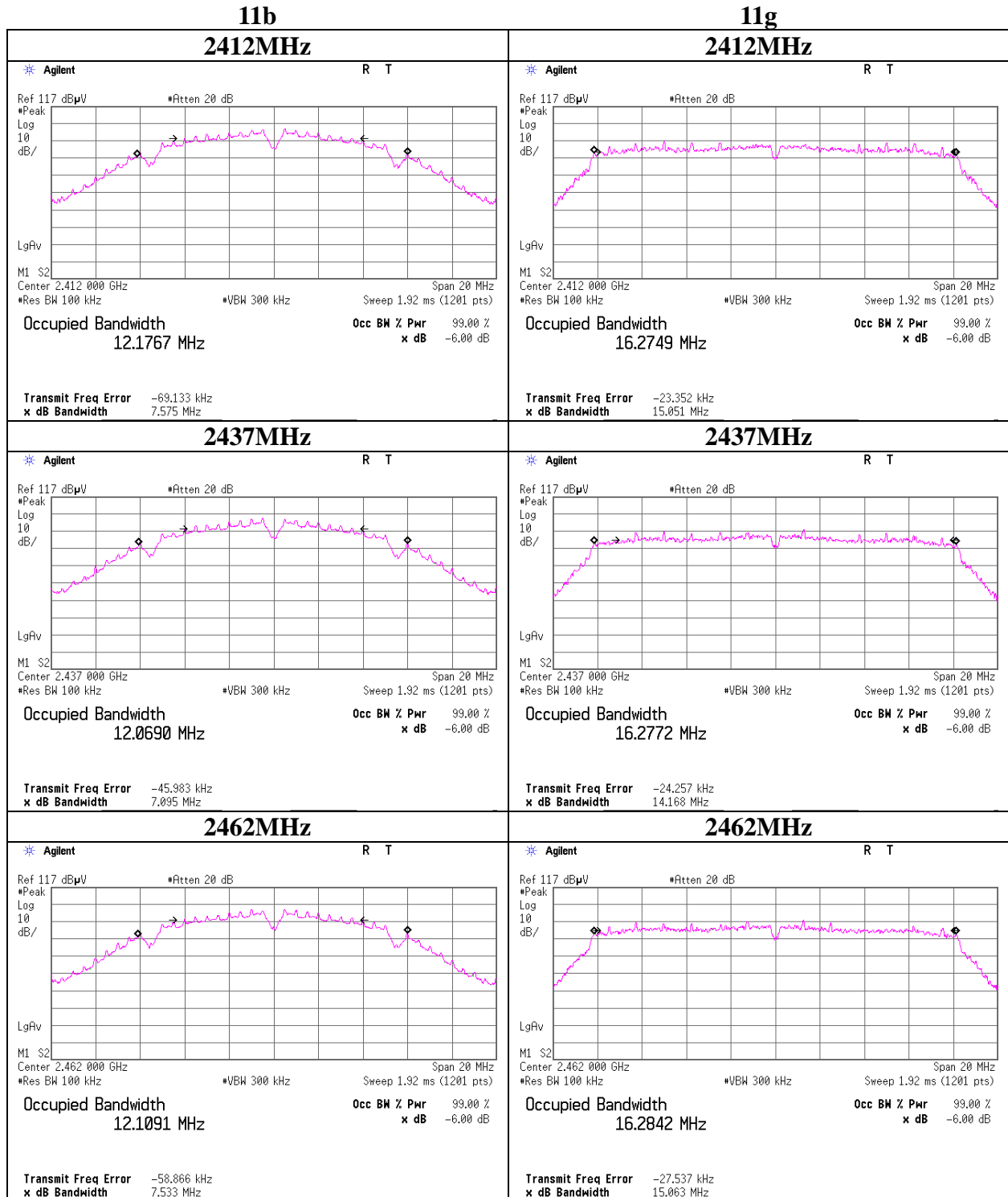
Head Office EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

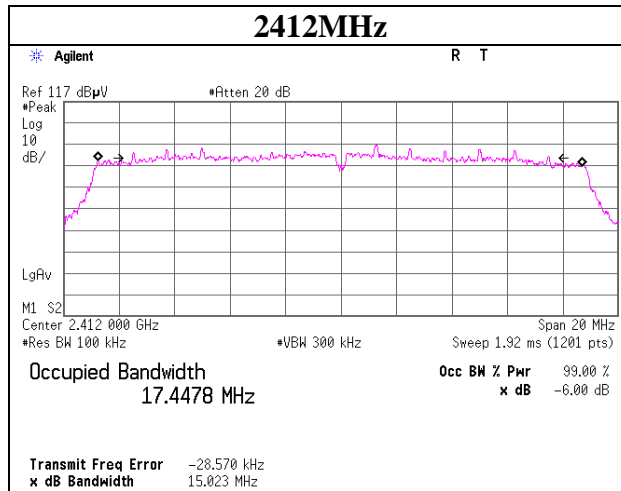
6dB Bandwidth



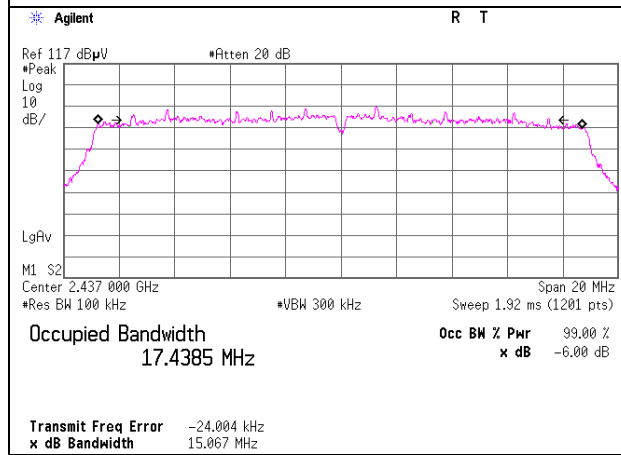
6dB Bandwidth

11n-20

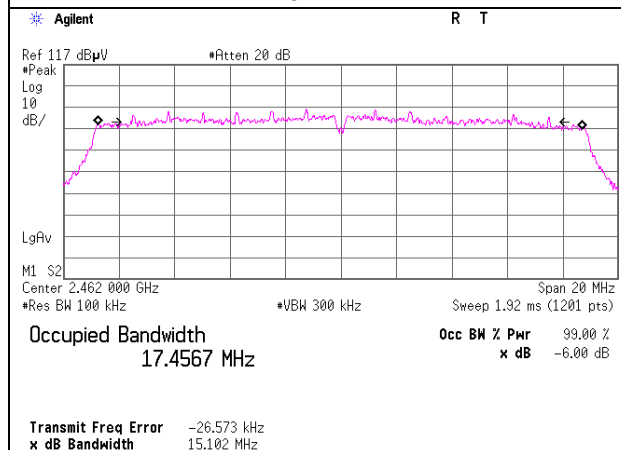
2412MHz



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.3 Measurement Room
Report No.	10154203H
Date	11/27/2013
Temperature/ Humidity	24deg.C./ 31% RH
Engineer	Yutaka Yoshida
Mode	11b Tx

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	8.32	0.93	10.01	19.26	84.33	30.00	1000	10.74
2437	8.79	0.94	10.01	19.74	94.19	30.00	1000	10.26
2462	8.23	0.95	10.01	19.19	82.99	30.00	1000	10.81

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

2437MHz

Rate [Mbps]	Reading PK [dBm]	Remark
1	8.79	*
2	8.64	
5.5	8.67	
11	8.77	

*: Worst Rate

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

[For reporting purpose only]

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	4.98	0.93	10.01	15.92	39.08
2437	5.27	0.94	10.01	16.22	41.88
2462	4.90	0.95	10.01	15.86	38.55

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

2437MHz

Rate [Mbps]	Reading AV [dBm]	Remark
1	5.27	*
2	4.83	
5.5	3.92	
11	2.73	

*: 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

Maximum Peak Output Power

Test place : Head Office EMC Lab. No.3 Measurement Room
Report No. : 10154203H
Date : 11/27/2013
Temperature/ Humidity : 24deg.C./ 31% RH
Engineer : Yutaka Yoshida
Mode : 11g Tx

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	12.05	0.93	10.01	22.99	199.07	30.00	1000	7.01
2437	12.51	0.94	10.01	23.46	221.82	30.00	1000	6.54
2462	12.43	0.95	10.01	23.39	218.27	30.00	1000	6.61

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

2437MHz

Rate [Mbps]	Reading PK [dBm]	Remark
6	12.51	*
9	11.96	
12	11.93	
18	11.71	
24	11.76	
36	11.72	
48	11.82	
54	11.76	

*: Worst Rate

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

[For reporting purpose only]

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	-0.92	0.93	10.01	10.02	10.05
2437	-0.49	0.94	10.01	10.46	11.12
2462	-0.37	0.95	10.01	10.59	11.46

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

2437MHz

Rate [Mbps]	Reading AV [dBm]	Remark
6	-0.49	*
9	-1.97	
12	-1.92	
18	-3.02	
24	-3.84	
36	-5.00	
48	-5.98	
54	-6.29	

*: 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

Maximum Peak Output Power

Test place : Head Office EMC Lab. No.3 Measurement Room
Report No. : 10154203H
Date : 11/27/2013
Temperature/ Humidity : 24deg.C./ 31% RH
Engineer : Yutaka Yoshida
Mode : 11n-20 Tx

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	10.40	0.93	10.01	21.34	136.14	30.00	1000	8.66
2437	11.10	0.94	10.01	22.05	160.32	30.00	1000	7.95
2462	10.92	0.95	10.01	21.88	154.17	30.00	1000	8.12

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

2437MHz

MCS Index	Reading PK [dBm]	Remark
0	11.10	*
1	10.72	
2	10.52	
3	10.46	
4	10.62	
5	10.24	
6	10.25	
7	10.36	

*: Worst Rate

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

[For reporting purpose only]

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	-2.30	0.93	10.01	8.64	7.31
2437	-1.82	0.94	10.01	9.13	8.18
2462	-1.81	0.95	10.01	9.15	8.22

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

2437MHz

MCS Index	Reading AV [dBm]	Remark
0	-1.82	*
1	-3.41	
2	-4.36	
3	-5.15	
4	-6.23	
5	-7.21	
6	-7.59	
7	-7.87	

*: 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.1 Semi Anechoic Chamber	
Report No.	10154203H	
Date	01/06/2014	01/06/2014
Temperature/ Humidity	21 deg. C / 32% RH	21 deg. C / 32% RH
Engineer	Takumi Shimada	Masatoshi Nishiguchi
	(1-10GHz)	(Above 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	2319.947	PK	55.0	26.1	2.5	36.9	-	46.7	73.9	27.2	
Hori	2390.000	PK	60.2	26.3	2.5	36.9	-	52.1	73.9	21.8	
Hori	3617.937	PK	48.9	27.2	3.2	36.5	-	42.8	73.9	31.1	
Hori	4824.000	PK	47.5	29.9	4.9	36.3	-	46.0	73.9	27.9	
Hori	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2319.947	AV	48.2	26.1	2.5	36.9	0.4	40.3	53.9	13.6	
Hori	2390.000	AV	50.8	26.3	2.5	36.9	0.4	43.1	53.9	10.8	*1
Hori	3617.937	AV	42.7	27.2	3.2	36.5	-	36.6	53.9	17.3	
Hori	4824.000	AV	39.5	29.9	4.9	36.3	0.4	38.4	53.9	15.5	
Hori	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9648.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	2319.983	PK	53.1	26.1	2.5	36.9	-	44.8	73.9	29.1	
Vert	2390.000	PK	60.2	26.3	2.5	36.9	-	52.1	73.9	21.8	
Vert	3617.997	PK	46.4	27.2	3.2	36.5	-	40.3	73.9	33.6	
Vert	4824.000	PK	48.2	29.9	3.7	36.3	-	45.5	73.9	28.4	
Vert	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2319.983	AV	46.0	26.1	2.5	36.9	0.4	38.1	53.9	15.8	
Vert	2390.000	AV	50.5	26.3	2.5	36.9	0.4	42.8	53.9	11.1	*1
Vert	3617.997	AV	38.1	27.2	3.2	36.5	-	32.0	53.9	21.9	
Vert	4824.000	AV	42.4	29.9	4.9	36.3	0.4	41.3	53.9	12.6	
Vert	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9648.000	AV	NS	-	-	-	-	-	53.9	-	

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

*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

*1) Not Out of band emission(Leakage Power)

NS: No signal detected

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.1 Semi Anechoic Chamber
Report No. 10154203H
Date 01/06/2014
Temperature/ Humidity 21 deg. C / 32% RH
Engineer Takumi Shimada
(1-10GHz)
Mode 11b Tx 2412MHz

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]	Remark
Hori	2412.000	PK	107.7	26.3	2.5	36.9	99.6	-	-	Carrier
Hori	2399.467	PK	64.2	26.3	2.5	36.9	56.1	79.6	23.5	
Vert	2412.000	PK	108.7	26.3	2.5	36.9	100.6	-	-	Carrier
Vert	2399.000	PK	63.5	26.3	2.5	36.9	55.4	80.6	25.2	

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.1 Semi Anechoic Chamber
Report No. 10154203H
Date 01/06/2014 01/06/2014
Temperature/ Humidity 21 deg. C / 32% RH 21 deg. C / 32% RH
Engineer Takumi Shimada Masatoshi Nishiguchi
(1-10GHz) (Above 10GHz)
Mode 11b Tx 2462MHz

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	2320.005	PK	58.0	26.1	2.5	36.9	-	49.7	73.9	24.2	
Hori	2483.500	PK	51.2	26.5	2.6	37.0	-	43.3	73.9	30.6	
Hori	3693.090	PK	49.0	27.5	4.7	36.4	-	44.8	73.9	29.1	
Hori	4924.000	PK	48.9	30.2	5.0	36.3	-	47.8	73.9	26.1	
Hori	7386.000	PK	48.0	35.1	5.8	36.4	-	52.5	73.9	21.4	
Hori	9848.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2320.005	AV	52.2	26.1	2.5	36.9	0.4	44.3	53.9	9.6	
Hori	2483.500	AV	43.2	26.5	2.6	37.0	0.4	35.7	53.9	18.2	*1
Hori	3693.090	AV	43.1	27.5	4.7	36.4	-	38.9	53.9	15.0	
Hori	4924.000	AV	40.3	30.2	5.0	36.3	0.4	39.6	53.9	14.3	
Hori	7386.000	AV	41.2	35.1	5.8	36.4	0.4	46.1	53.9	7.8	
Hori	9848.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	2320.005	PK	54.4	26.1	2.5	36.9	-	46.1	73.9	27.8	
Vert	2483.500	PK	55.9	26.5	2.6	37.0	-	48.0	73.9	25.9	
Vert	3693.090	PK	49.7	27.5	4.7	36.4	-	45.5	73.9	28.4	
Vert	4924.000	PK	52.4	30.2	5.0	36.3	-	51.3	73.9	22.6	
Vert	7386.000	PK	46.7	35.1	5.8	36.4	-	51.2	73.9	22.7	
Vert	9848.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2320.005	AV	47.6	26.1	2.5	36.9	0.4	39.7	53.9	14.2	
Vert	2483.500	AV	46.8	26.5	2.6	37.0	0.4	39.3	53.9	14.6	*1
Vert	3693.090	AV	41.9	27.5	4.7	36.4	-	37.7	53.9	16.2	
Vert	4924.000	AV	48.5	30.2	5.0	36.3	0.4	47.8	53.9	6.1	
Vert	7386.000	AV	39.8	35.1	5.8	36.4	0.4	44.7	53.9	9.2	
Vert	9848.000	AV	NS	-	-	-	-	-	53.9	-	

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

*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

*1) Not Out of band emission(Leakage Power)

NS: No signal detected

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.1 Semi Anechoic Chamber
Report No. 10154203H
Date 01/06/2014 01/06/2014
Temperature/ Humidity 21 deg. C / 32% RH 21 deg. C / 32% RH
Engineer Takumi Shimada Masatoshi Nishiguchi
(1-10GHz) (Above 10GHz)
Mode 11g 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	2319.939	PK	53.3	26.1	2.5	36.9	-	45.0	73.9	28.9	
Hori	2390.000	PK	71.3	26.3	2.5	36.9	-	63.2	73.9	10.7	
Hori	3617.980	PK	48.8	27.2	3.2	36.5	-	42.7	73.9	31.2	
Hori	4824.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2319.939	AV	45.2	26.1	2.5	36.9	2.3	39.2	53.9	14.7	
Hori	2390.000	AV	57.6	26.3	2.5	36.9	2.3	51.8	53.9	2.1	*1
Hori	3617.980	AV	42.6	27.2	3.2	36.5	-	36.5	53.9	17.4	
Hori	4824.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9648.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	2320.000	PK	50.4	26.1	2.5	36.9	-	42.1	73.9	31.8	
Vert	2390.000	PK	70.6	26.3	2.5	36.9	-	62.5	73.9	11.4	
Vert	3617.973	PK	48.0	27.2	3.2	36.5	-	41.9	73.9	32.0	
Vert	4824.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2320.000	AV	41.5	26.1	2.5	36.9	2.3	35.5	53.9	18.4	
Vert	2390.000	AV	56.2	26.3	2.5	36.9	2.3	50.4	53.9	3.5	*1
Vert	3617.973	AV	41.1	27.2	3.2	36.5	-	35.0	53.9	18.9	
Vert	4824.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9648.000	AV	NS	-	-	-	-	-	53.9	-	

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

*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

*1) Not Out of band emission(Leakage Power)

NS: No signal detected

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.1 Semi Anechoic Chamber
Report No.	10154203H
Date	01/06/2014
Temperature/ Humidity	21 deg. C / 32% RH
Engineer	Takumi Shimada
	(1-10GHz)
Mode	11g Tx 2412MHz

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]	Remark
Hori	2412.000	PK	100.1	26.3	2.5	36.9	92.0	-	-	Carrier
Hori	2400.000	PK	65.1	26.3	2.5	36.9	57.0	72.0	15.0	
Vert	2412.000	PK	102.3	26.3	2.5	36.9	94.2	-	-	Carrier
Vert	2400.000	PK	63.4	26.3	2.5	36.9	55.3	74.2	18.9	

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.1 Semi Anechoic Chamber
Report No. 10154203H
Date 01/06/2014 01/06/2014
Temperature/ Humidity 21 deg. C / 32% RH 21 deg. C / 32% RH
Engineer Takumi Shimada Masatoshi Nishiguchi
(Below 1GHz , (Above 10GHz)
1-10GHz)
Mode 11g Tx 2437MHz

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	36.106	QP	32.5	15.8	7.4	38.7	-	17.0	40.0	23.0	
Hori	119.003	QP	42.6	12.8	8.7	38.9	-	25.2	43.5	18.3	
Hori	170.332	QP	48.5	15.8	9.3	39.0	-	34.6	43.5	8.9	
Hori	383.994	QP	47.3	16.8	11.1	38.6	-	36.6	46.0	9.4	
Hori	673.149	QP	43.5	20.0	12.9	38.2	-	38.2	46.0	7.8	
Hori	959.950	QP	34.3	22.9	14.5	37.6	-	34.1	46.0	11.9	
Hori	2319.993	PK	53.9	26.1	2.5	36.9	-	45.6	73.9	28.3	
Hori	3655.455	PK	47.2	27.3	3.2	36.4	-	41.3	73.9	32.6	
Hori	4874.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	7311.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9748.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2319.993	AV	46.0	26.1	2.5	36.9	2.3	40.0	53.9	13.9	
Hori	3655.455	AV	39.5	27.3	3.2	36.4	-	33.6	53.9	20.3	
Hori	4874.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	7311.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9748.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	36.806	QP	32.1	15.5	7.4	38.7	-	16.3	40.0	23.7	
Vert	115.176	QP	41.1	12.3	8.6	38.8	-	23.2	43.5	20.3	
Vert	170.681	QP	47.4	15.8	9.3	39.0	-	33.5	43.5	10.0	
Vert	384.168	QP	46.0	16.8	11.1	38.6	-	35.3	46.0	10.7	
Vert	671.985	QP	41.5	20.0	12.9	38.2	-	36.2	46.0	9.8	
Vert	959.972	QP	34.9	22.9	14.5	37.6	-	34.7	46.0	11.3	
Vert	2320.105	PK	53.5	26.1	2.5	36.9	-	45.2	73.9	28.7	
Vert	3655.495	PK	47.9	27.3	3.2	36.4	-	42.0	73.9	31.9	
Vert	4874.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	7311.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9748.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2320.105	AV	43.8	26.1	2.5	36.9	2.3	37.8	53.9	16.1	
Vert	3655.495	AV	41.4	27.3	3.2	36.4	-	35.5	53.9	18.4	
Vert	4874.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	7311.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9748.000	AV	NS	-	-	-	-	-	53.9	-	

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

*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

NS: No signal detected

UL Japan, Inc.

Head Office EMC Lab.

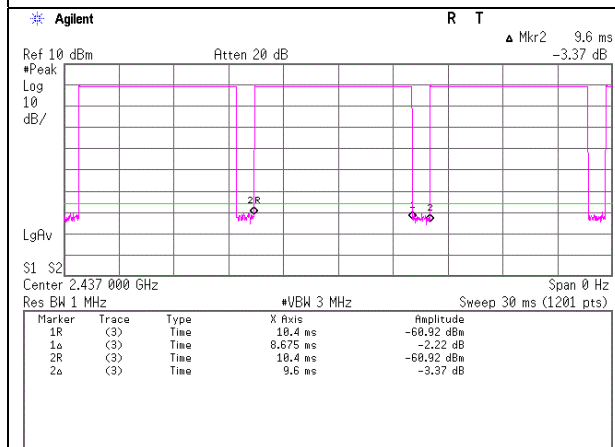
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

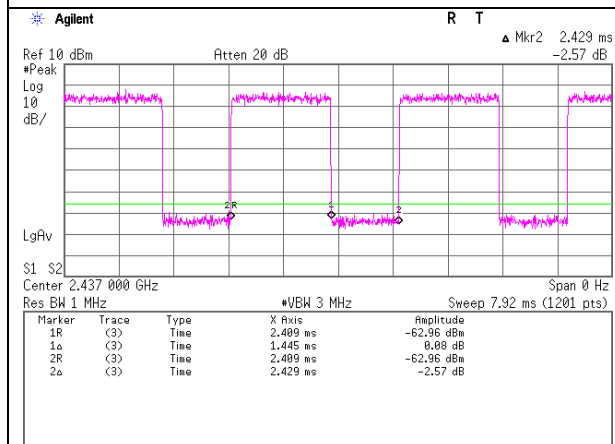
11b 1Mbps

Tx on / (Tx on + Tx off) = 0.904
Tx on / (Tx on + Tx off) * 100 = 90.4 %
Duty factor = 10 * log (9.6 / 8.675) = 0.44 dB



11g 6Mbps

Tx on / (Tx on + Tx off) = 0.595
Tx on / (Tx on + Tx off) * 100 = 59.5 %
Duty factor = 10 * log (2.429 / 1.445) = 2.26 dB



UL Japan, Inc.

Head Office EMC Lab.

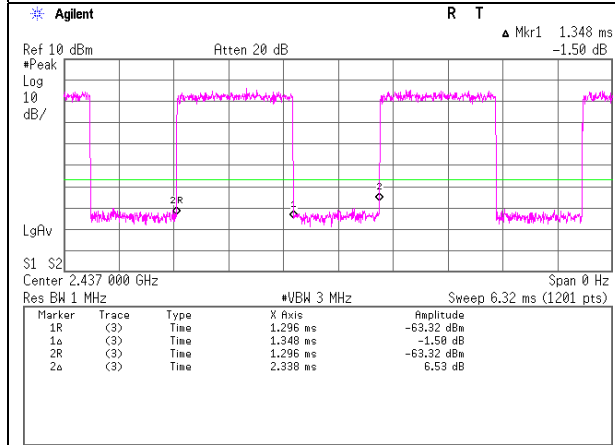
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

11n20 MCS0

Tx on / (Tx on + Tx off) = 0.577
Tx on / (Tx on + Tx off) * 100 = 57.7 %
Duty factor = 10 * log (2.338 / 1.348) = 2.39 dB



UL Japan, Inc.

Head Office EMC Lab.

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

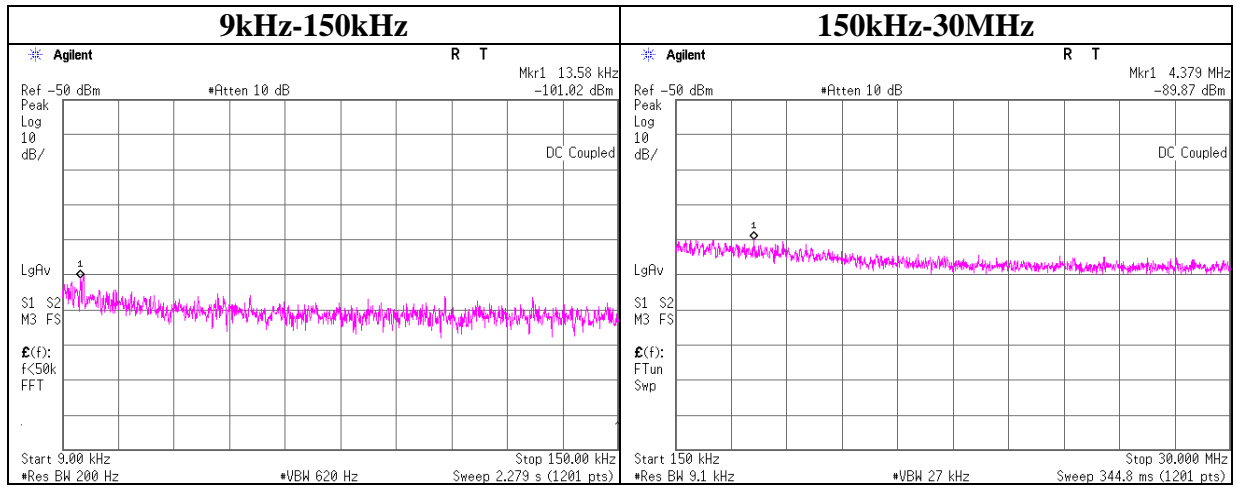
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b Tx

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]
13.58	-101.0	0.01	10.0	2.03	-89.0	300.0	6.0	-27.7	44.9
4379	-89.9	0.01	10.0	2.03	-77.8	300.0	6.0	-16.6	-5.2

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

EIRP=Reading+Cable Loss+Attenuator+Antenna Gain

UL Japan, Inc.

Head Office EMC Lab.

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

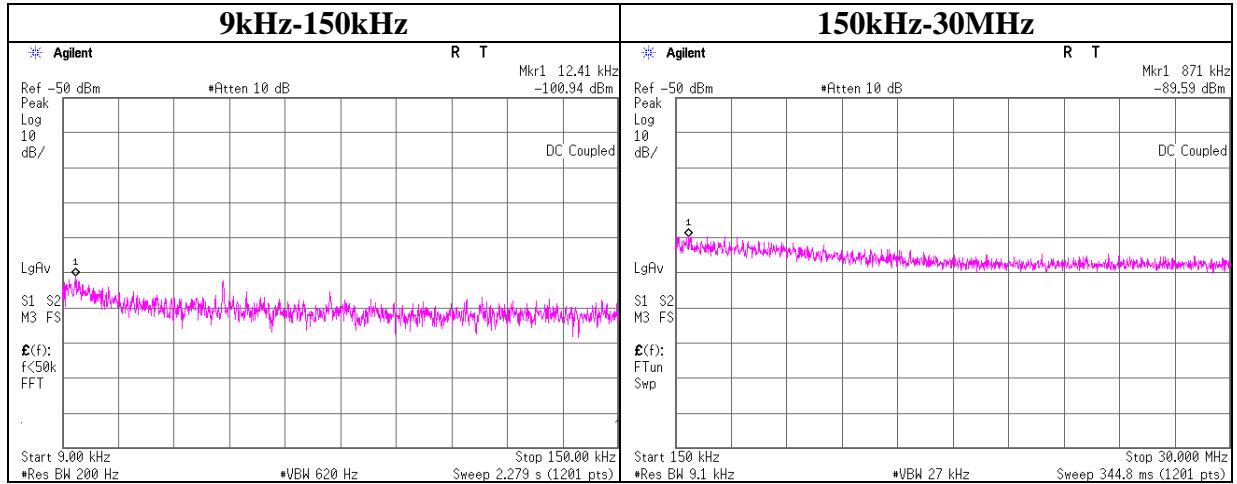
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b Tx

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]
12.41	-100.9	0.01	10.0	2.03	-88.9	300.0	6.0	-27.6	45.7
871	-89.6	0.01	10.0	2.03	-77.6	300.0	6.0	-16.3	8.8

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$
 $\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

UL Japan, Inc.

Head Office EMC Lab.

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

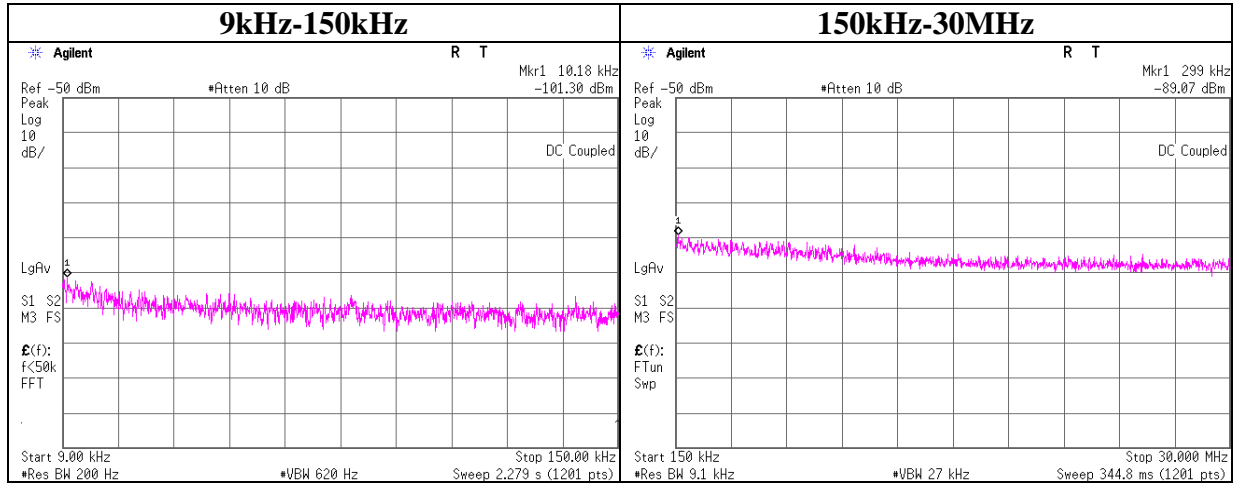
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b Tx

11b Tx 2462MHz



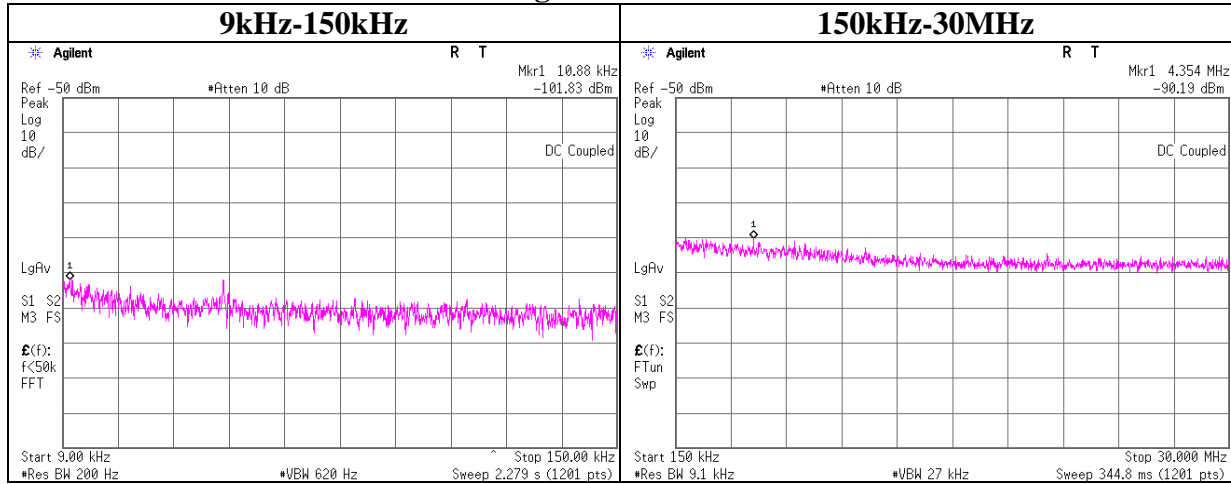
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
10.18	-101.3	0.01	10.0	2.03	-89.3	300.0	6.0	-28.0	47.4
299	-89.1	0.01	10.0	2.03	-77.0	300.0	6.0	-15.8	18.1

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$
 $\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11g Tx

11g 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]
10.88	-101.8	0.01	10.0	2.03	-89.8	300.0	6.0	-28.5	46.9
4354	-90.2	0.01	10.0	2.03	-78.2	300.0	6.0	-16.9	-5.2

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$
 $\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

UL Japan, Inc.

Head Office EMC Lab.

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

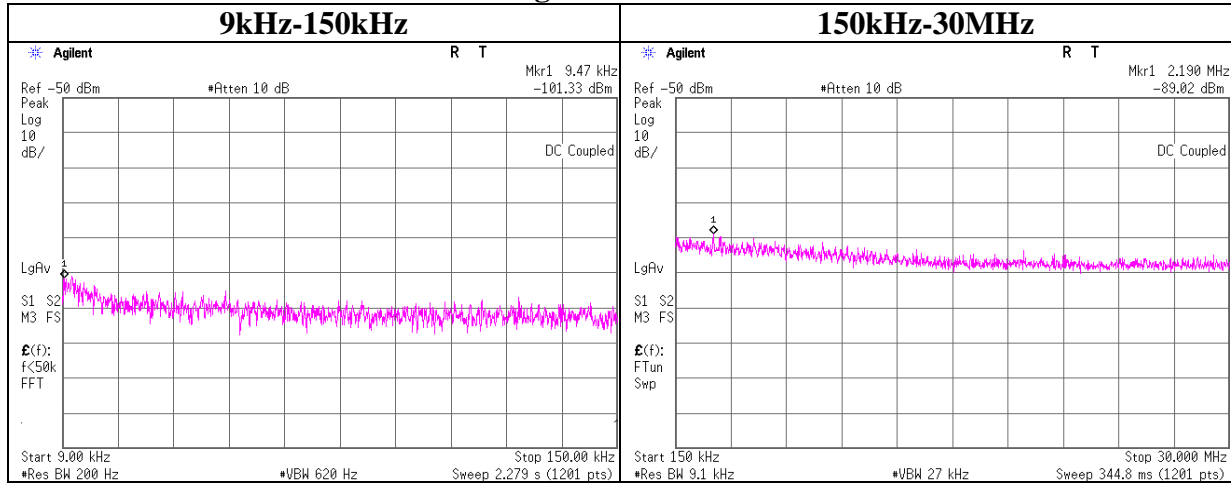
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11g Tx

11g 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]
9.47	-101.3	0.01	10.0	2.03	-89.3	300.0	6.0	-28.0	48.1
2190	-89.0	0.01	10.0	2.03	-77.0	300.0	6.0	-15.7	0.8

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

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

UL Japan, Inc.

Head Office EMC Lab.

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

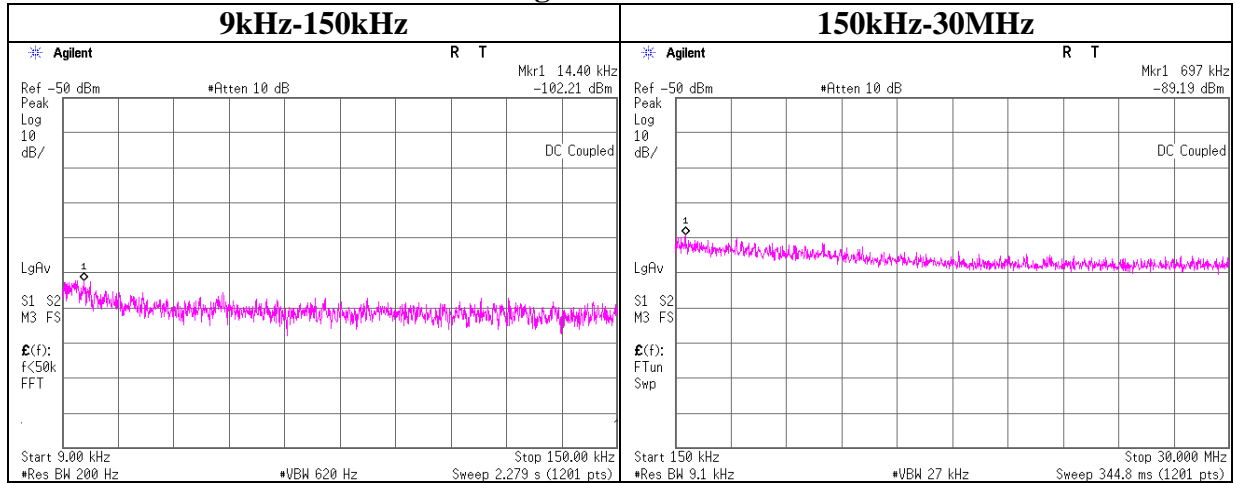
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11g Tx

11g 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]
14.40	-102.2	0.01	10.0	2.03	-90.2	300.0	6.0	-28.9	44.4
697	-89.2	0.01	10.0	2.03	-77.2	300.0	6.0	-15.9	10.7

$E = \text{EIRP} - 20\log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$
 $\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

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

Power Density

Test place Head Office EMC Lab. No.11 Measurement Room
Report No. 10154203H
Date 12/05/2013
Temperature/ Humidity 24deg. C / 48% RH
Engineer Takumi Shimada
Mode 11b Tx, 11g Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-17.25	2.21	9.97	-5.07	8.00	13.07
2437.00	-16.81	2.22	9.97	-4.62	8.00	12.62
2462.00	-15.89	2.24	9.97	-3.68	8.00	11.68

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.45	2.21	9.97	-12.27	8.00	20.27
2437.00	-24.46	2.22	9.97	-12.27	8.00	20.27
2462.00	-24.69	2.24	9.97	-12.48	8.00	20.48

Sample Calculation:

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

UL Japan, Inc.

Head Office EMC Lab.

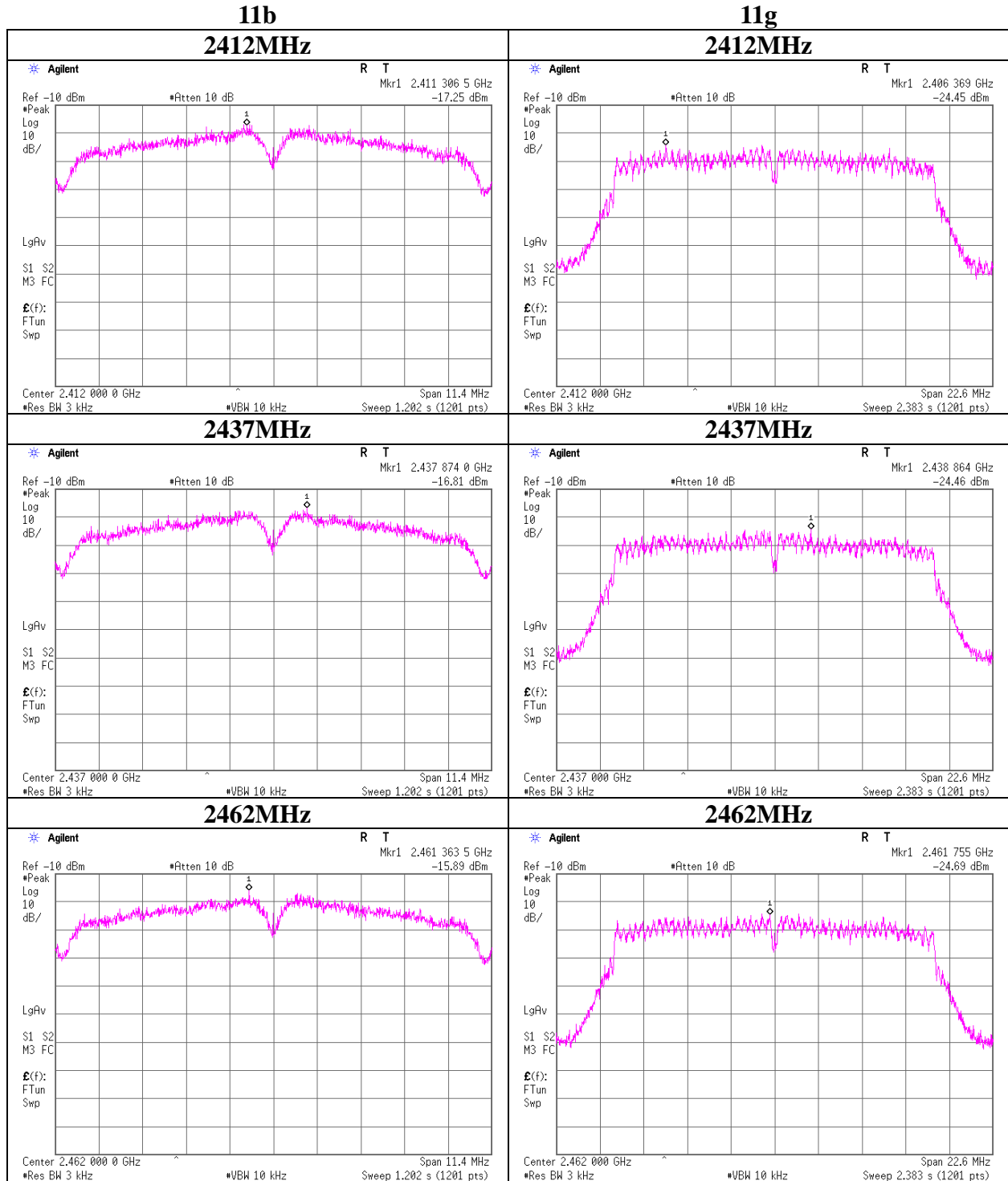
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

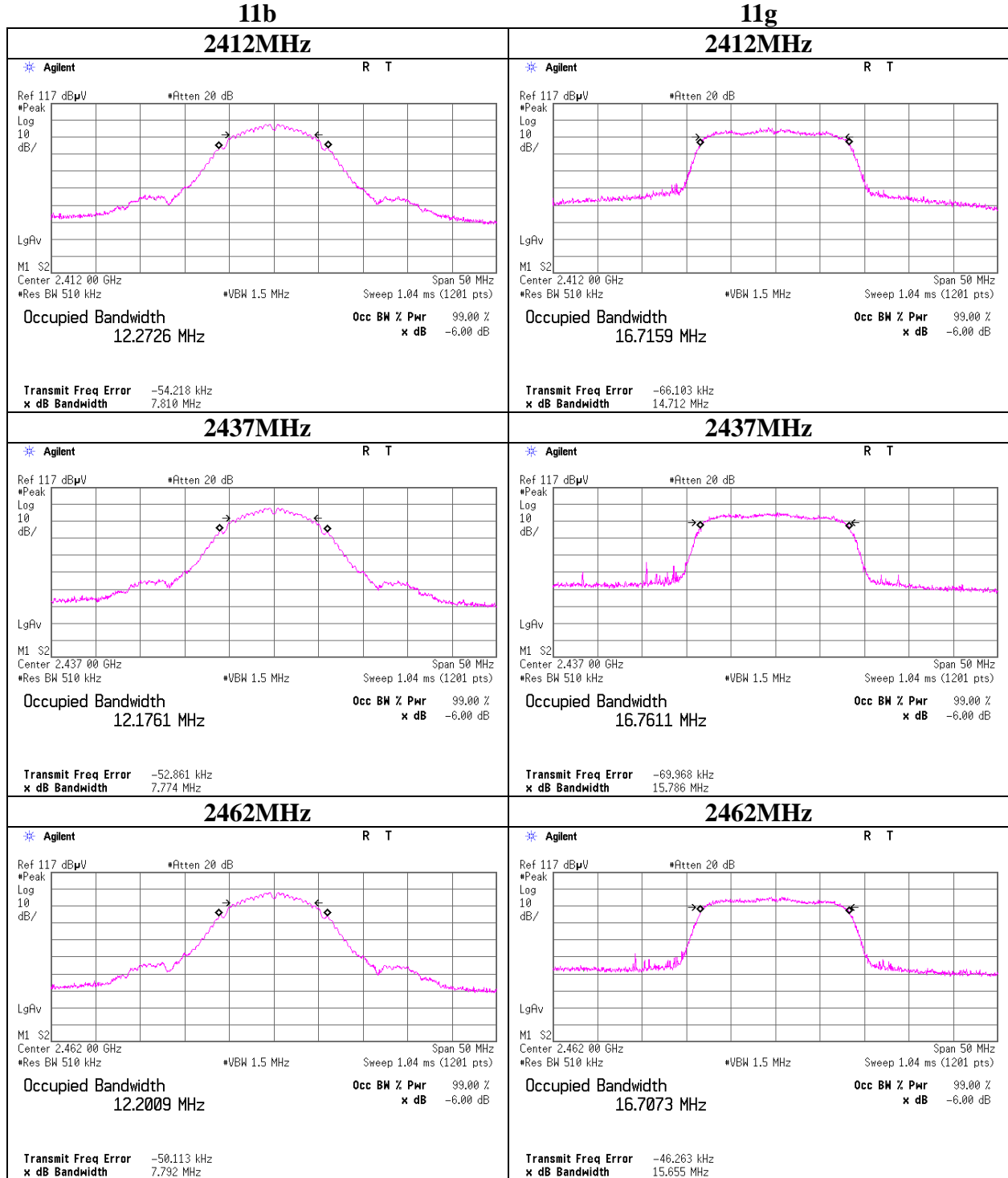
Power Density

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b Tx, 11g Tx



99% Occupied Bandwidth

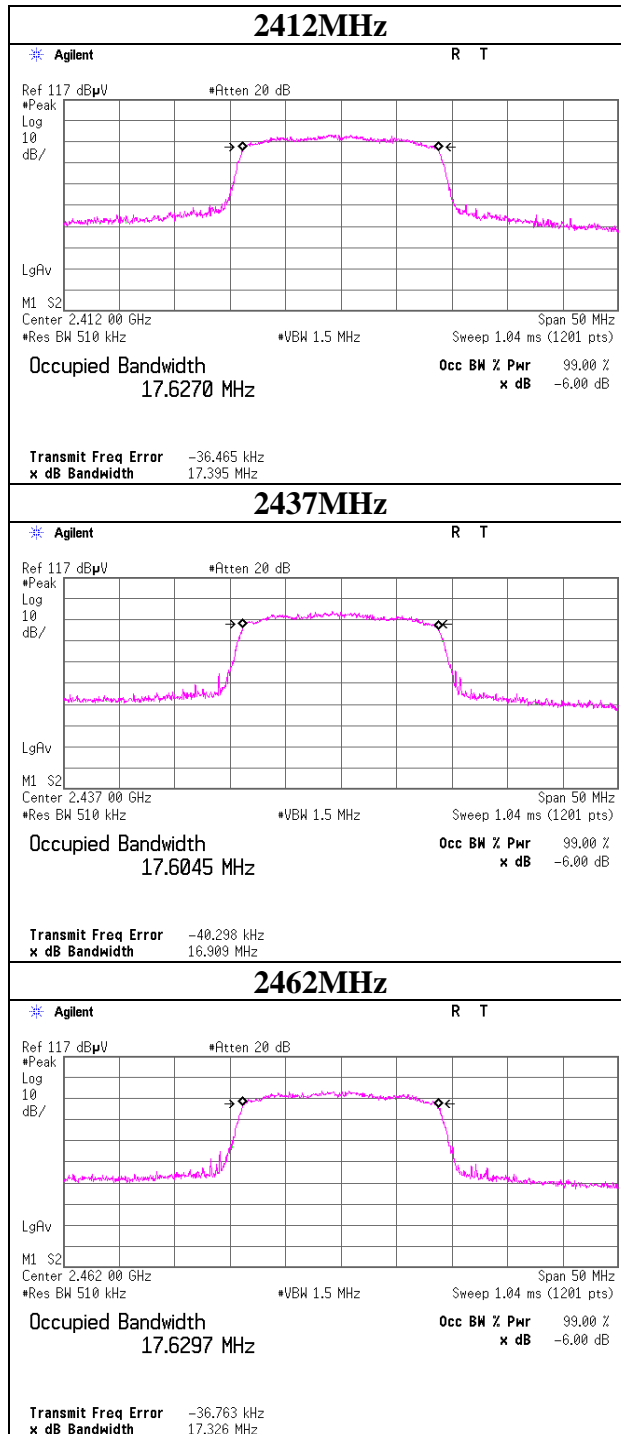
Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b Tx, 11g Tx



99% Occupied Bandwidth

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10154203H
Date	12/05/2013
Temperature/ Humidity	24deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b Tx, 11g Tx

11n-20



APPENDIX 2: Test instruments

EMI test equipment

Tested on November 27 to December 5, 2013

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2013/02/22 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2013/10/15 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2013/10/15 * 12
MAT-25	Attenuator(10dB) (above1GHz)	Agilent	8493C	71642	AT	2013/06/20 * 12
MCC-163	Microwave Cable	Murata	MXGS83RK3000	-	AT	2013/11/08 * 12
MRENT-112	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2013/10/04 * 12
MAT-24	Attenuator(10dB) (above1GHz)	Agilent	8493C	71389	AT	2013/06/05 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2013/10/18 * 12

Tested on January 6, 2014

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE/CE	2013/08/01 * 12
MOS-27	Thermo-Hyrometer	CUSTOM	CTH-201	A08Q26	RE/CE	2013/02/26 * 12
MJM-21	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE/CE	2013/06/07 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2013/11/24 * 12
KLA-04	Logperiodic Antenna	Schwarzbeck	USLP9143	361	RE	2013/11/24 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2013/11/26 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent/TSJ	-	-	RE	2013/09/12 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2013/02/07 * 12
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2013/05/13 * 12
MHA-01	Horn Antenna 18-26.5GHz	EMCO	3160-09	1266	RE	2013/06/30 * 12
MPA-01	Pre Amplifier	Agilent	8449B	3008A01671	RE	2013/02/22 * 12
MCC-165	Microwave Cable	Junkosha	MWX221	1203S213(1m) / 1311S166(5m)	RE	2013/11/27 * 12
MHF-17	High Pass Filter 3.5-18.0GHz	TOKIMEC	TF323DCA	7001	RE	2013/09/18 * 12
MCC-76	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX104	278967/4	RE	2013/12/24 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE(EUT)	2013/01/07 * 12
MLS-03	LISN(AMN)	Schwarzbeck	NSLK8127	8127384	CE(AE)	2013/03/18 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2013/01/21 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/ 3D-2W(7.5m)/ RG400u(1.5m) /RFM-E421 (Switcher)	- /01068(Switcher)	CE	2013/09/12 * 12
MAT-64	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/09 * 12
MRENT-95	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2013/06/14 * 12

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

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