



RADIO TEST REPORT

Test Report No. : 11689535H-A

Applicant : FUJIFILM Corporation
Type of Equipment : Communication Module
Model No. : 1FJ-FF
FCC ID : W2Z-03000005
Test regulation : FCC Part 15 Subpart C: 2017
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 test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: June 5 to 16, 2017

Representative test engineer:

T. Noguchi

Takafumi Noguchi
Engineer
Consumer Technology Division

Approved by:

Takayuki Shimada

Takayuki Shimada
Engineer
Consumer Technology Division



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://japan.ul.com/resources/emc_accredited/

UL Japan, Inc.

Ise 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.....	13
APPENDIX 1: Test data	14
Conducted Emission	14
6dB Bandwidth	15
Maximum Peak Output Power	18
Average Output Power	21
Radiated Spurious Emission	24
Conducted Spurious Emission	39
Power Density	40
99%Occupied Bandwidth	43
APPENDIX 2: Test instruments	45
APPENDIX 3: Photographs of test setup	47
Conducted Emission	47
Radiated Spurious Emission	48
Worst Case Position	49

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 14, 2017 and effective July 14, 2017

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 revision on June 14, 2017, does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	QP 35.1 dB, 0.15000 MHz, L AV 35.5 dB, 0.50825 MHz, L	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	0.2 dB 3648.020 MHz, AV, Vert.	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC1.2V / DC3.3V) through the regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The antenna is not removable from the EUT.

Therefore, the equipment complies with the antenna requirement of Section 15.203.

UL Japan, Inc.

Ise 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 6.6	IC: -	N/A	-	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

Ise EMC Lab.

Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density				Conducted emission	Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz - 3 GHz	3 GHz - 13 GHz	13 GHz - 18 GHz	18 GHz - 40 GHz	
0.9 dB	1.0 dB	1.8 dB	2.0 dB	2.9 dB	2.9 dB	3.1 dB	2.6 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz - 0.15 MHz	3.5 dB
0.15 MHz - 30 MHz	3.0 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3 m	3.8 dB
10 m	3.7 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1 GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

*Measurement distance

Conducted Emission test

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

Radiated emission test

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

UL Japan, Inc.

Ise 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. Ise 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

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m 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 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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)	11 Mbps, PN9
IEEE 802.11g (11g)	54 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 7, 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: 34 Software: MFG Tool Version 7.13.52.4 *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 Radiated Spurious Emission (Below 1GHz) Conducted Spurious Emission	11g Tx *1)	2412 MHz
Radiated Spurious Emission (Above 1GHz)	11b Tx 11g Tx *2)	2412 MHz 2437 MHz 2462 MHz
Band edge of Radiated Spurious Emission (Above 1GHz)	11n-20 Tx *3)	2412 MHz 2462 MHz
6dB Bandwidth 99% Occupied Bandwidth Maximum Peak Output Power Power Density	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
Conducted Spurious Emission	11g Tx *1)	2412 MHz
*1) The operating mode and tested frequency were 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 *3) Only band edge test was tested on this mode, because the 11g Tx mode had the higher power at antenna terminal test.		

UL Japan, Inc.

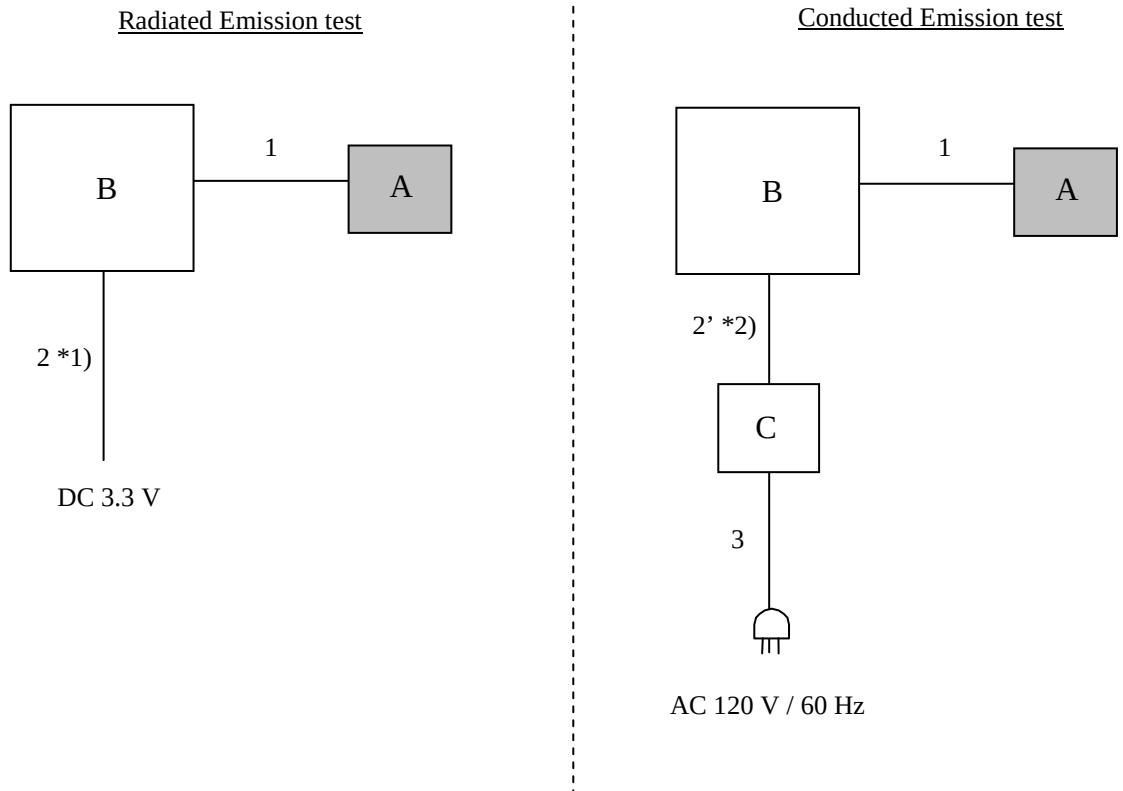
Ise EMC Lab.

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	Communication Module	1FJ-FF	1	Murata Manufacturing Co., Ltd.	EUT
B	Jig	-	-	Murata Manufacturing Co., Ltd.	-
C	Power Supply	DMC35-2A	13090501	KIKUSUI	*2)

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.1	Unshielded	Unshielded	-
2	AC Cable	1.5 *1)	Unshielded	Unshielded	-
2'	AC Cable	1.0 *2)	Unshielded	Unshielded	-
3	DC Cable	2.0	Unshielded	Unshielded	*2)

*1) Used for Radiated Emission test

*2) Used for Conducted Emission test

UL Japan, Inc.

Ise 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, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm 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 80 cm 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 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm 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 MHz – 30 MHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

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

The height of the measuring antenna varied between 1 and 4 m 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	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	4.5 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)		4.5 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r05".

*2) Distance Factor: $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.53 \text{ dB}$

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

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

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

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	20 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				

*1) Peak hold was applied as Worst-case measurement.

*2) Reference data

*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".

*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 low enough as shown in the chart.(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz).

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.

Ise 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: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

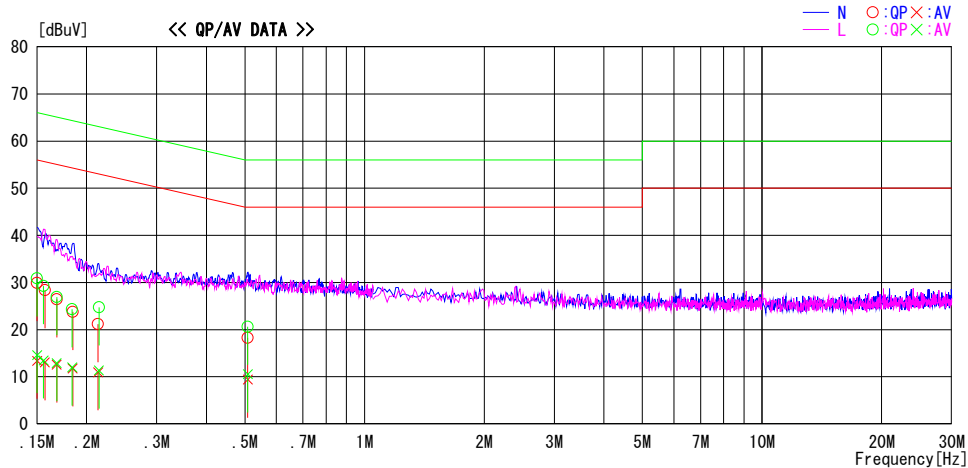
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2017/06/11

Report No. : 11689535H

Temp./Humi. : 24 deg. C / 47 % RH
Engineer : Yuta Moriya

Mode / Remarks : WLAN Tx 11g 2412MHz

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]		
0.15000	16.7	0.2	13.2	29.9	13.4	66.0	56.0	36.1	42.6	N	
0.15700	15.2	-0.1	13.2	28.4	13.1	65.6	55.6	37.2	42.5	N	
0.16808	13.2	-0.6	13.2	26.4	12.6	65.1	55.1	38.7	42.5	N	
0.18442	10.6	-1.4	13.2	23.8	11.8	64.3	54.3	40.5	42.5	N	
0.21358	8.0	-2.2	13.2	21.2	11.0	63.1	53.1	41.9	42.1	N	
0.50825	5.0	-3.9	13.3	18.3	9.4	56.0	46.0	37.7	36.6	N	
0.15000	17.7	1.4	13.2	30.9	14.6	66.0	56.0	35.1	41.4	L	
0.15583	16.1	0.3	13.2	29.3	13.5	65.7	55.7	36.4	42.2	L	
0.16808	13.7	-0.3	13.2	26.9	12.9	65.1	55.1	38.2	42.2	L	
0.18383	11.1	-1.2	13.2	24.3	12.0	64.3	54.3	40.0	42.3	L	
0.21475	11.5	-1.8	13.2	24.7	11.4	63.0	53.0	38.3	41.6	L	
0.50825	7.3	-2.8	13.3	20.6	10.5	56.0	46.0	35.4	35.5	L	

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

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

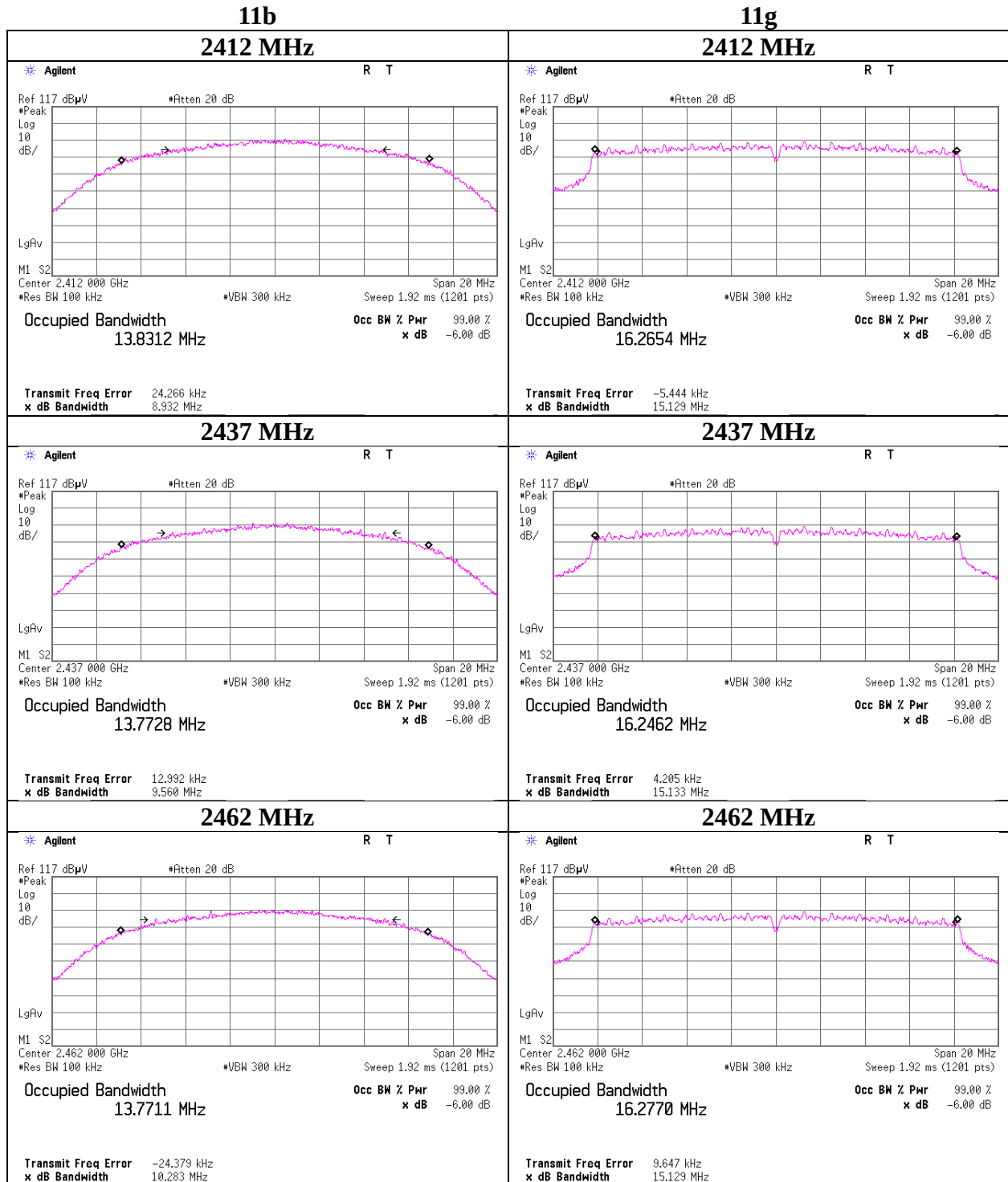
Facsimile : +81 596 24 8124

6dB Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 11689535H
Date June 5, 2017
Temperature / Humidity 25 deg. C / 42 % RH
Engineer Takafumi Noguchi
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	8.932	> 500
	2437	9.560	> 500
	2462	10.283	> 500
11g	2412	15.129	> 500
	2437	15.133	> 500
	2462	15.129	> 500
11n-20	2412	15.126	> 500
	2437	15.391	> 500
	2462	15.130	> 500

6dB Bandwidth



UL Japan, Inc.

Ise EMC Lab.

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

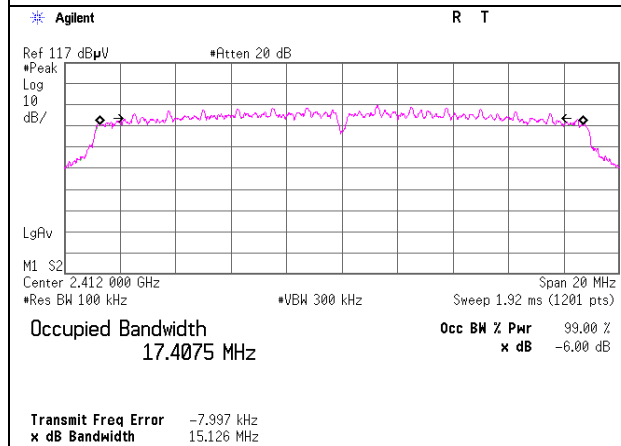
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

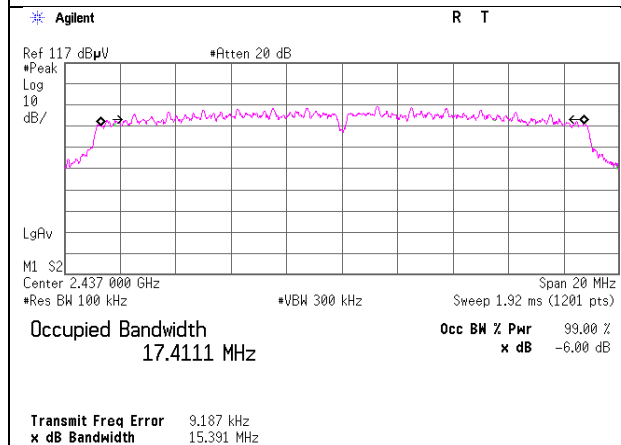
6dB Bandwidth

11n-20

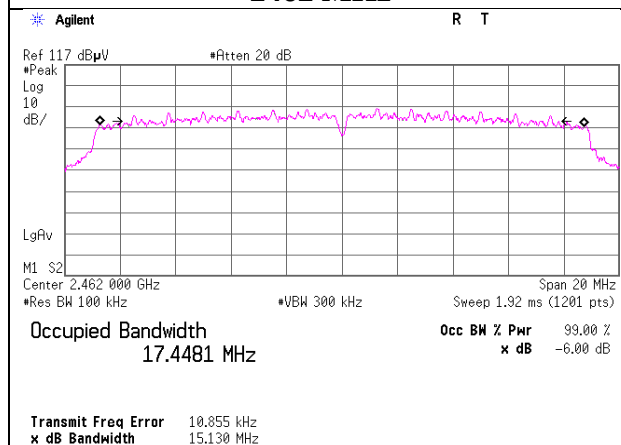
2412 MHz



2437 MHz



2462 MHz



Maximum Peak Output Power

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11689535H
Date : June 16, 2017
Temperature / Humidity : 26 deg. C / 43 % RH
Engineer : Takumi Shimada
Mode : Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	0.01	2.03	10.09	12.13	16.33	30.00	1000	17.87
2437	-0.27	2.03	10.09	11.85	15.31	30.00	1000	18.15
2462	-0.31	2.04	10.09	11.82	15.21	30.00	1000	18.18

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	-0.60	
2	-0.70	
5.5	-0.57	
11	-0.27	*

*: Worst Rate

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

Maximum Peak Output Power

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11689535H
Date : June 16, 2017
Temperature / Humidity : 26 deg. C / 43 % RH
Engineer : Takumi Shimada
Mode : Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	6.54	2.03	10.09	18.66	73.45	30.00	1000	11.34
2437	6.43	2.03	10.09	18.55	71.61	30.00	1000	11.45
2462	6.37	2.04	10.09	18.50	70.79	30.00	1000	11.50

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	6.35	
9	6.32	
12	6.38	
18	6.39	
24	6.36	
36	6.38	
48	6.41	
54	6.43	*

*: Worst Rate

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

Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11689535H
Date	June 16, 2017
Temperature / Humidity	26 deg. C / 43 % RH
Engineer	Takumi Shimada
Mode	Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	6.51	2.03	10.09	18.63	72.95	30.00	1000	11.37
2437	6.34	2.03	10.09	18.46	70.15	30.00	1000	11.54
2462	6.28	2.04	10.09	18.41	69.34	30.00	1000	11.59

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

2437 MHz

MCS Number	Reading [dBm]	Remark
0	6.25	
1	6.29	
2	6.30	
3	6.31	
4	6.30	
5	6.29	
6	6.32	
7	6.34	*

* Worst MCS

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

Average Output Power
(Reference data for RF Exposure / SAR testing)

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11689535H
Date	June 16, 2017
Temperature / Humidity	26 deg. C / 43 % RH
Engineer	Takumi Shimada
Mode	Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-3.14	2.03	10.09	8.98	7.91	0.00	8.98	7.91
2437	-3.28	2.03	10.09	8.84	7.66	0.00	8.84	7.66
2462	-3.42	2.04	10.09	8.71	7.43	0.00	8.71	7.43

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-2.85	2.03	10.09	9.27	8.45	0.06	9.33	8.57
2437	-2.96	2.03	10.09	9.16	8.24	0.06	9.22	8.36
2462	-3.03	2.04	10.09	9.10	8.13	0.06	9.16	8.24

11n-20 MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-3.07	2.03	10.09	9.05	8.04	0.06	9.11	8.15
2437	-3.12	2.03	10.09	9.00	7.94	0.06	9.06	8.05
2462	-3.22	2.04	10.09	8.91	7.78	0.06	8.97	7.89

Sample Calculation:

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

Result (Burst power average) = Time average + Duty factor

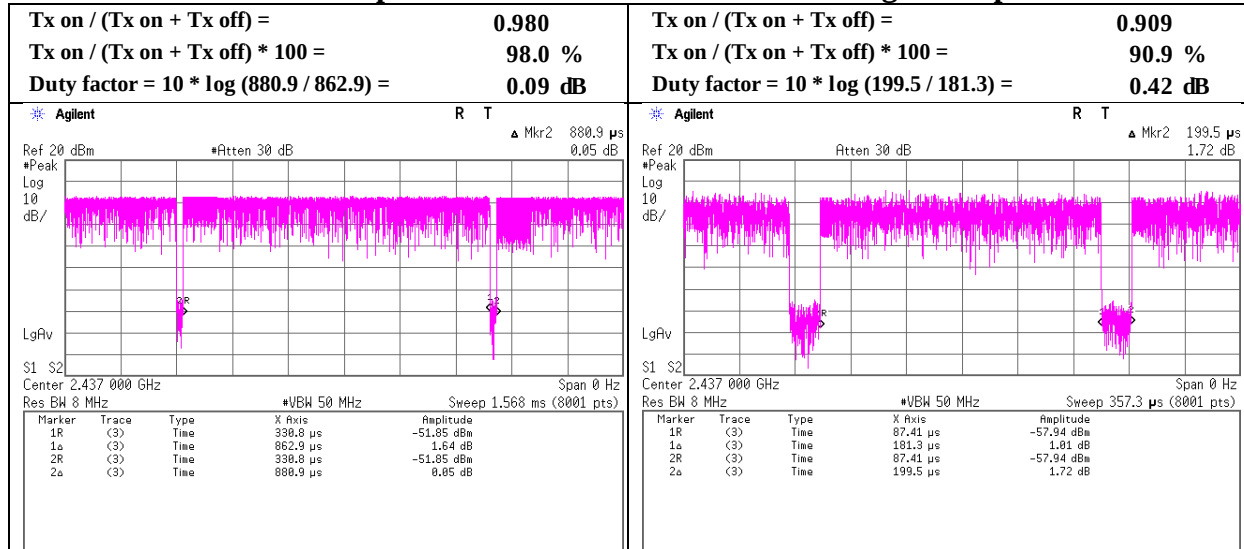
*The equipment and cables were not used for factor 0 dB of the data sheets.

The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.

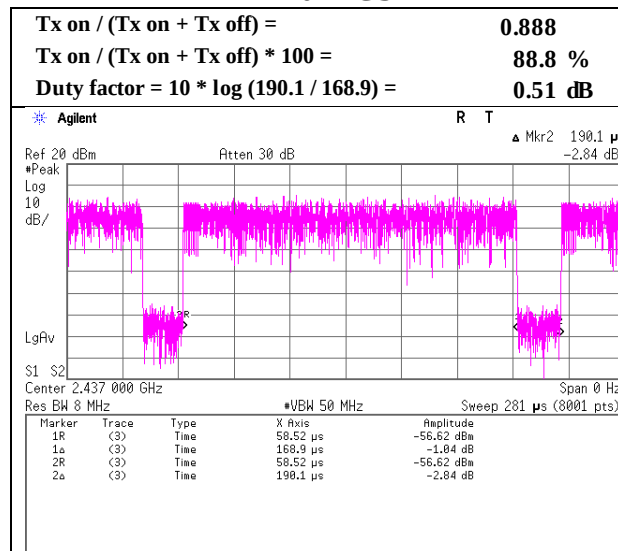
Burst rate confirmation

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 11689535H
Date : June 5, 2017
Temperature / Humidity : 25 deg. C / 42 % RH
Engineer : Takafumi Noguchi
Mode : Tx

11b 11 Mbps



11n-20 MCS 7

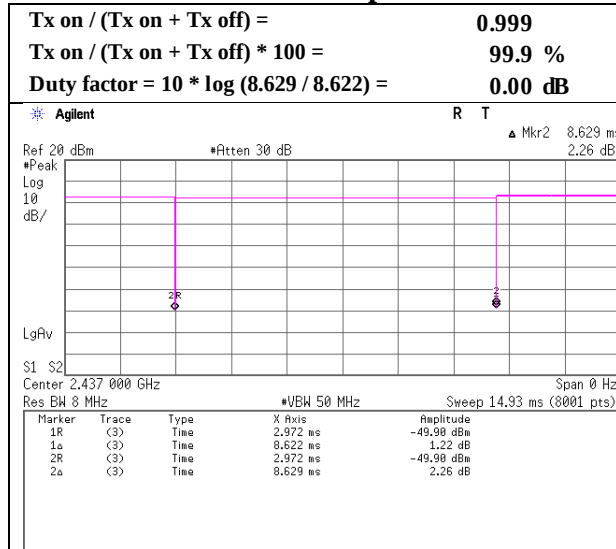


* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

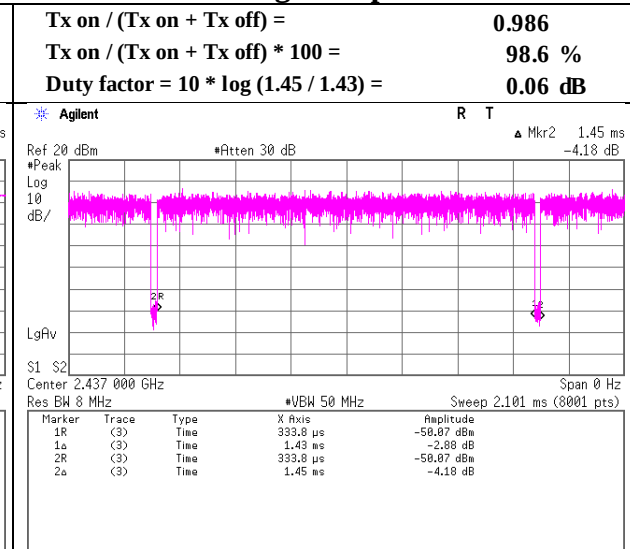
Burst rate confirmation

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 11689535H
Date : June 5, 2017
Temperature / Humidity : 25 deg. C / 42 % RH
Engineer : Takafumi Noguchi
Mode : Tx

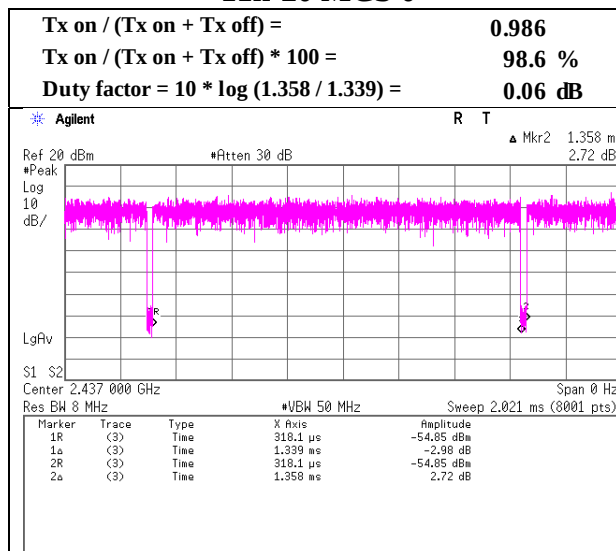
11b 1 Mbps



11g 6 Mbps



11n-20 MCS 0



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Test place : Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11689535H
Date : June 9, 2017 June 11, 2017
Temperature / Humidity : 24 deg. C / 42 % RH 24 deg. C / 47 % RH
Engineer : Shuichi Ohyama Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode : Tx 11b 2412 MHz

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	2390.000	PK	44.5	27.7	6.6	32.1	-	46.7	73.9	27.2	
Hori	4824.000	PK	40.0	31.7	9.3	31.2	-	49.8	73.9	24.1	Floor noise
Hori	7236.000	PK	41.4	36.1	10.1	32.4	-	55.2	73.9	18.7	Floor noise
Hori	9648.000	PK	40.3	38.6	11.2	32.8	-	57.3	73.9	16.6	Floor noise
Hori	2390.000	AV	33.6	27.7	6.6	32.1	-	35.8	53.9	18.1	
Hori	4824.000	AV	29.8	31.7	9.3	31.2	-	39.6	53.9	14.3	Floor noise
Hori	7236.000	AV	31.4	36.1	10.1	32.4	-	45.2	53.9	8.7	Floor noise
Hori	9648.000	AV	30.9	38.6	11.2	32.8	-	47.9	53.9	6.0	Floor noise
Vert	2390.000	PK	43.2	27.7	6.6	32.1	-	45.4	73.9	28.5	
Vert	4824.000	PK	41.9	31.7	9.3	31.2	-	51.7	73.9	22.2	Floor noise
Vert	7236.000	PK	41.1	36.1	10.1	32.4	-	54.9	73.9	19.0	Floor noise
Vert	9648.000	PK	41.3	38.6	11.2	32.8	-	58.3	73.9	15.6	Floor noise
Vert	2390.000	AV	33.2	27.7	6.6	32.1	-	35.4	53.9	18.5	
Vert	4824.000	AV	30.1	31.7	9.3	31.2	-	39.9	53.9	14.0	Floor noise
Vert	7236.000	AV	31.3	36.1	10.1	32.4	-	45.1	53.9	8.8	Floor noise
Vert	9648.000	AV	30.8	38.6	11.2	32.8	-	47.8	53.9	6.1	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

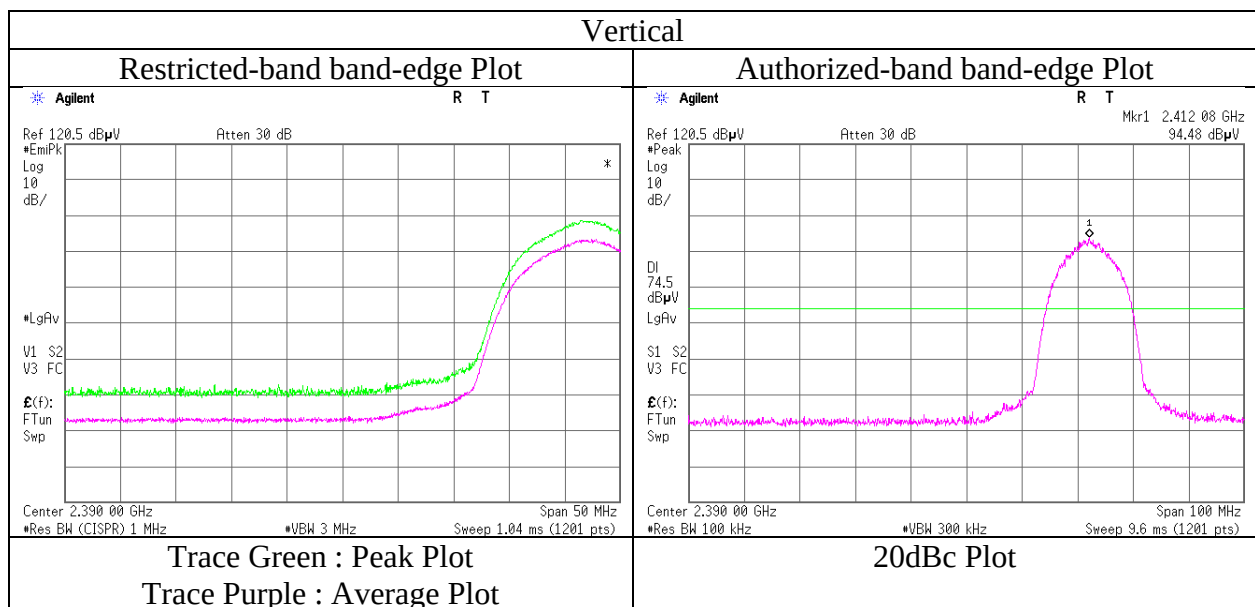
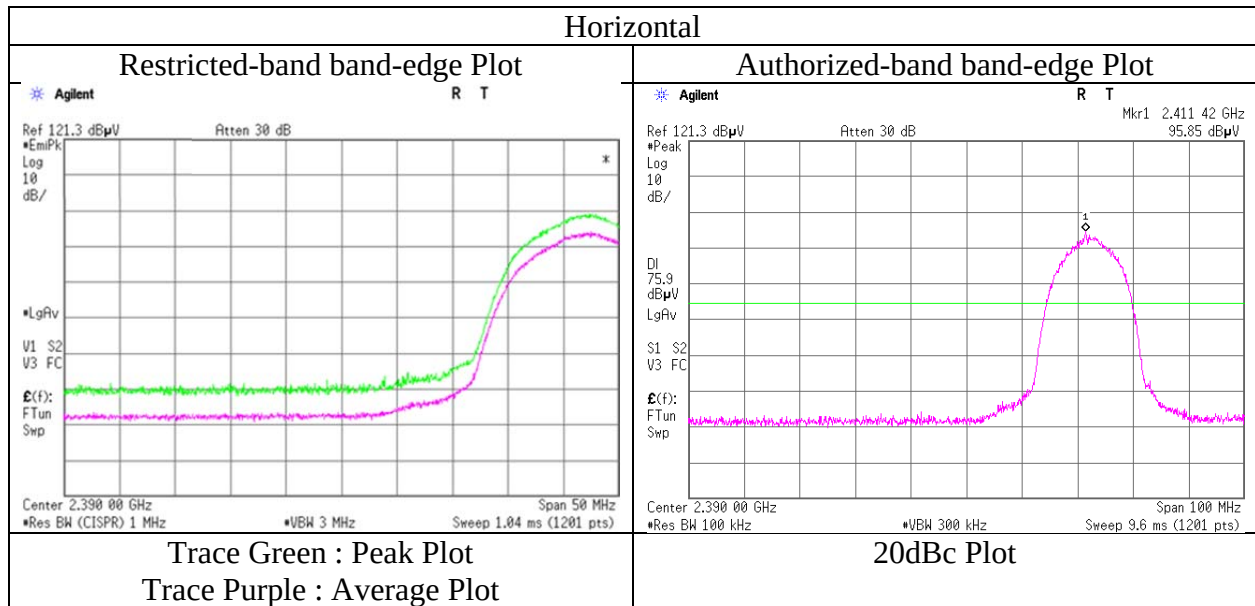
20dBc Data Sheet

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	95.9	27.7	6.7	32.1	98.2	-	-	Carrier
Hori	2400.000	PK	49.2	27.7	6.6	32.1	51.4	78.2	26.8	
Hori	3618.000	PK	49.1	29.5	7.5	31.5	54.6	78.2	23.6	
Vert	2412.000	PK	94.5	27.4	6.5	32.1	96.3	-	-	Carrier
Vert	2400.000	PK	60.9	27.4	6.5	32.1	62.7	76.3	13.6	
Vert	3618.000	PK	49.0	29.5	7.5	31.5	54.5	76.3	21.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Shuichi Ohyama (1 GHz - 10 GHz)
Mode	Tx 11b 2412 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise 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	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017 June 11, 2017
Temperature / Humidity	24 deg. C / 42 % RH 24 deg. C / 47 % RH
Engineer	Shuichi Ohyama Yuta Moriya
	(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode	Tx 11b 2437 MHz

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	3648.020	PK	49.2	29.6	7.5	31.5	-	54.8	73.9	19.1	
Hori	4874.000	PK	39.7	31.9	9.3	31.2	-	49.7	73.9	24.2	Floor noise
Hori	7311.000	PK	41.7	36.2	10.2	32.5	-	55.6	73.9	18.3	Floor noise
Hori	9748.000	PK	41.3	38.7	11.1	32.8	-	58.3	73.9	15.6	Floor noise
Hori	3648.020	AV	46.7	29.6	7.5	31.5	-	52.3	53.9	1.6	*1)
Hori	4874.000	AV	32.0	31.9	9.3	31.2	-	42.0	53.9	11.9	Floor noise
Hori	7311.000	AV	33.6	36.2	10.2	32.5	-	47.5	53.9	6.4	Floor noise
Hori	9748.000	AV	30.8	38.7	11.1	32.8	-	47.8	53.9	6.1	Floor noise
Vert	3648.020	PK	50.7	29.6	7.5	31.5	-	56.3	73.9	17.6	
Vert	4874.000	PK	40.3	31.9	9.3	31.2	-	50.3	73.9	23.6	Floor noise
Vert	7311.000	PK	41.5	36.2	10.2	32.5	-	55.4	73.9	18.5	Floor noise
Vert	9748.000	PK	41.4	38.7	11.1	32.8	-	58.4	73.9	15.5	Floor noise
Vert	3648.020	AV	48.1	29.6	7.5	31.5	-	53.7	53.9	0.2	*1)
Vert	4874.000	AV	32.1	31.9	9.3	31.2	-	42.1	53.9	11.8	Floor noise
Vert	7311.000	AV	33.7	36.2	10.2	32.5	-	47.6	53.9	6.3	Floor noise
Vert	9748.000	AV	30.5	38.7	11.1	32.8	-	47.5	53.9	6.4	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
 10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Duty 100 % Noise

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11689535H	
Date	June 9, 2017	June 11, 2017
Temperature / Humidity	24 deg. C / 42 % RH	24 deg. C / 47 % RH
Engineer	Shuichi Ohyama	Yuta Moriya
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx 11b 2462 MHz	

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	2483.500	PK	43.4	27.8	6.8	32.0	-	46.0	73.9	27.9	
Hori	3693.017	PK	51.0	29.6	7.5	31.5	-	56.6	73.9	17.3	
Hori	4924.000	PK	40.1	32.0	9.3	31.2	-	50.2	73.9	23.7	Floor noise
Hori	7386.000	PK	40.9	36.3	10.2	32.5	-	54.9	73.9	19.0	Floor noise
Hori	9848.000	PK	41.5	38.8	11.2	32.9	-	58.6	73.9	15.3	Floor noise
Hori	2483.500	AV	34.0	27.8	6.8	32.0	-	36.6	53.9	17.3	
Hori	3693.017	AV	47.5	29.6	7.5	31.5	-	53.1	53.9	0.8	*1)
Hori	4924.000	AV	30.0	32.0	9.3	31.2	-	40.1	53.9	13.8	Floor noise
Hori	7386.000	AV	31.0	36.3	10.2	32.5	-	45.0	53.9	8.9	Floor noise
Hori	9848.000	AV	30.8	38.8	11.2	32.9	-	47.9	53.9	6.0	Floor noise
Vert	2483.500	PK	45.1	27.8	6.8	32.0	-	47.7	73.9	26.2	
Vert	3693.017	PK	50.3	29.6	7.5	31.5	-	55.9	73.9	18.0	
Vert	4924.000	PK	40.7	32.0	9.3	31.2	-	50.8	73.9	23.1	Floor noise
Vert	7386.000	PK	40.8	36.3	10.2	32.5	-	54.8	73.9	19.1	Floor noise
Vert	9848.000	PK	41.8	38.8	11.2	32.9	-	58.9	73.9	15.0	Floor noise
Vert	2483.500	AV	34.3	27.8	6.8	32.0	-	36.9	53.9	17.0	
Vert	3693.017	AV	47.7	29.6	7.5	31.5	-	53.3	53.9	0.6	*1)
Vert	4924.000	AV	30.2	32.0	9.3	31.2	-	40.3	53.9	13.6	Floor noise
Vert	7386.000	AV	31.7	36.3	10.2	32.5	-	45.7	53.9	8.2	Floor noise
Vert	9848.000	AV	30.6	38.8	11.2	32.9	-	47.7	53.9	6.2	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

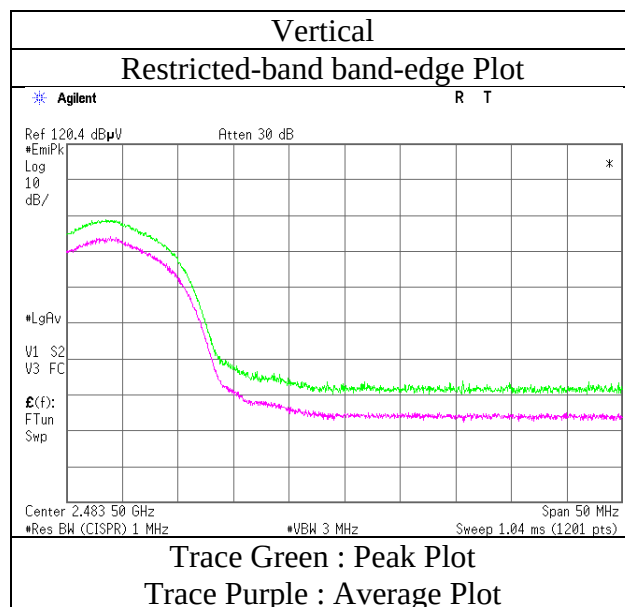
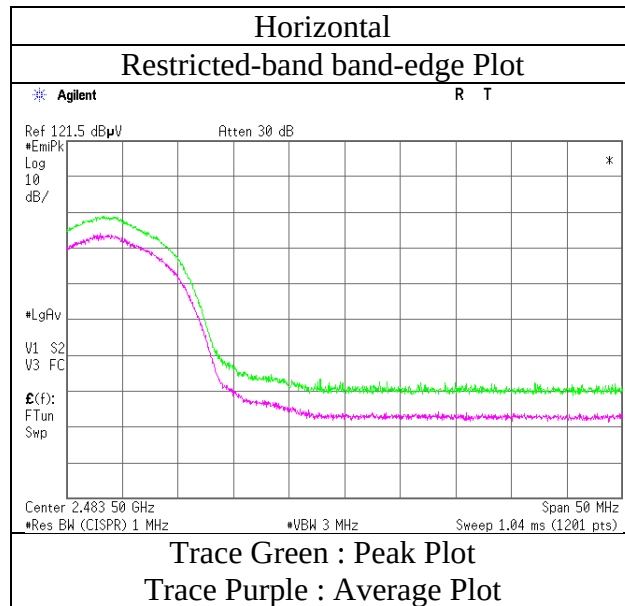
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
 10 GHz - 40 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Duty 100 % Noise

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Shuichi Ohyama
	(1 GHz - 10 GHz)
Mode	Tx 11b 2462 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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	71.148	QP	23.3	6.2	7.8	32.2	-	5.1	40.0	34.9	
Hori	114.433	QP	22.4	12.1	8.3	32.2	-	10.6	43.5	32.9	
Hori	197.168	QP	22.3	16.4	9.2	32.1	-	15.8	43.5	27.7	
Hori	244.800	QP	29.3	11.8	9.6	32.0	-	18.7	46.0	27.3	
Hori	461.335	QP	21.8	16.9	11.1	32.0	-	17.8	46.0	28.2	
Hori	489.335	QP	29.5	17.5	11.3	32.0	-	26.3	46.0	19.7	
Hori	2390.000	PK	63.8	27.7	6.6	32.1	-	66.0	73.9	7.9	
Hori	4824.000	PK	41.5	31.7	9.3	31.2	-	51.3	73.9	22.6	Floor noise
Hori	7236.000	PK	41.7	36.1	10.1	32.4	-	55.5	73.9	18.4	Floor noise
Hori	9648.000	PK	41.8	38.6	11.2	32.8	-	58.8	73.9	15.1	Floor noise
Hori	2390.000	AV	39.8	27.7	6.6	32.1	0.4	42.4	53.9	11.5	*1)
Hori	4824.000	AV	31.2	31.7	9.3	31.2	-	41.0	53.9	12.9	Floor noise
Hori	7236.000	AV	31.4	36.1	10.1	32.4	-	45.2	53.9	8.7	Floor noise
Hori	9648.000	AV	30.7	38.6	11.2	32.8	-	47.7	53.9	6.2	Floor noise
Vert	71.148	QP	31.3	6.2	7.8	32.2	-	13.1	40.0	26.9	
Vert	114.433	QP	22.8	12.1	8.3	32.2	-	11.0	43.5	32.5	
Vert	197.168	QP	22.4	16.4	9.2	32.1	-	15.9	43.5	27.6	
Vert	244.800	QP	32.1	11.8	9.6	32.0	-	21.5	46.0	24.5	
Vert	461.335	QP	21.9	16.9	11.1	32.0	-	17.9	46.0	28.1	
Vert	489.604	QP	30.0	17.5	11.3	32.0	-	26.8	46.0	19.2	
Vert	2390.000	PK	64.7	27.7	6.6	32.1	-	66.9	73.9	7.0	
Vert	4824.000	PK	39.7	31.7	9.3	31.2	-	49.5	73.9	24.4	Floor noise
Vert	7236.000	PK	42.1	36.1	10.1	32.4	-	55.9	73.9	18.0	Floor noise
Vert	9648.000	PK	40.0	38.6	11.2	32.8	-	57.0	73.9	16.9	Floor noise
Vert	2390.000	AV	50.3	27.7	6.6	32.1	0.4	52.9	53.9	1.0	*1)
Vert	4824.000	AV	29.9	31.7	9.3	31.2	-	39.7	53.9	14.2	Floor noise
Vert	7236.000	AV	30.5	36.1	10.1	32.4	-	44.3	53.9	9.6	Floor noise
Vert	9648.000	AV	30.9	38.6	11.2	32.8	-	47.9	53.9	6.0	Floor noise

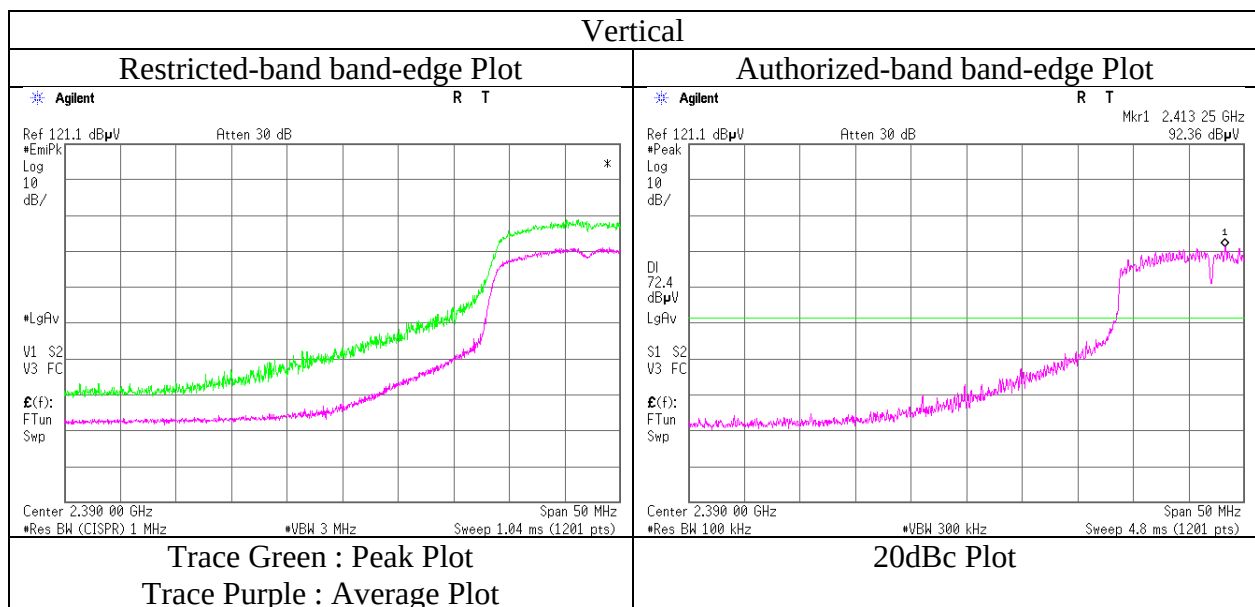
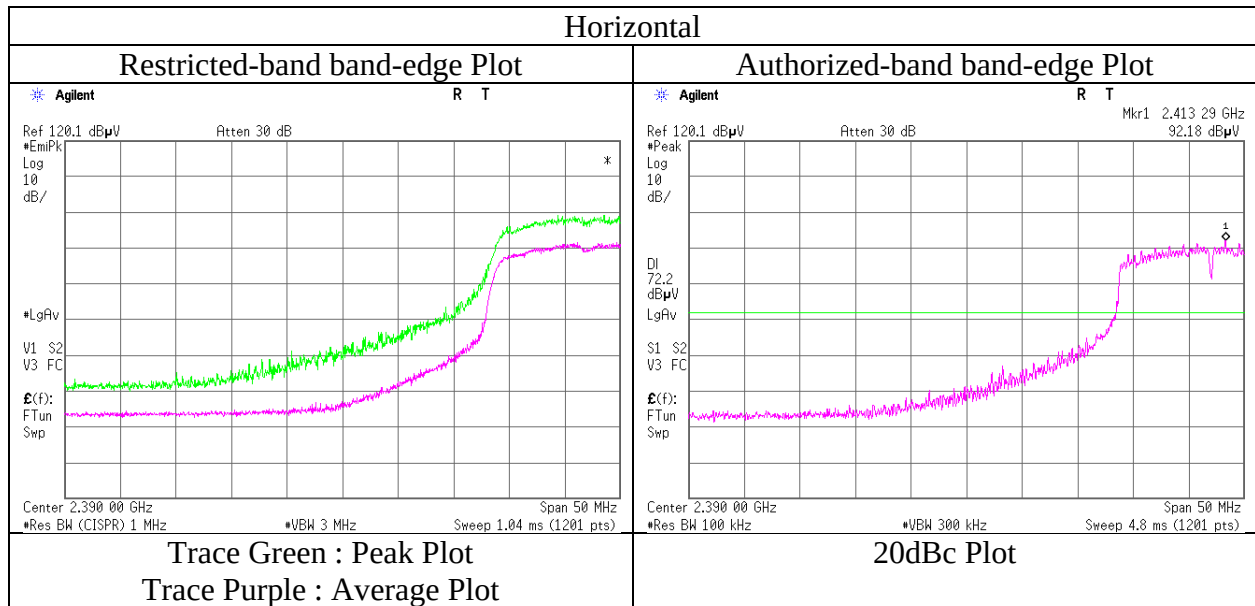
*1) Not Out of Band emission(Leakage Power)

Polarity	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori	2402.000	PK	92.2	27.7	6.7	32.1	94.5	-	-	Carrier
Hori	2400.000	PK	59.3	27.4	6.5	32.1	61.1	74.5	13.4	
Hori	3618.000	PK	49.7	29.5	7.5	31.5	55.2	74.5	19.3	
Vert	2402.000	PK	92.4	27.7	6.7	32.1	94.7	-	-	Carrier
Vert	2400.000	PK	60.9	27.4	6.5	32.1	62.7	74.7	12.0	
Vert	3618.000	PK	47.5	29.5	7.5	31.5	53.0	74.7	21.7	

UL Japan, Inc.
Ise 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 (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Shuichi Ohyama (1 GHz - 10 GHz)
Mode	Tx 11g 2412 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

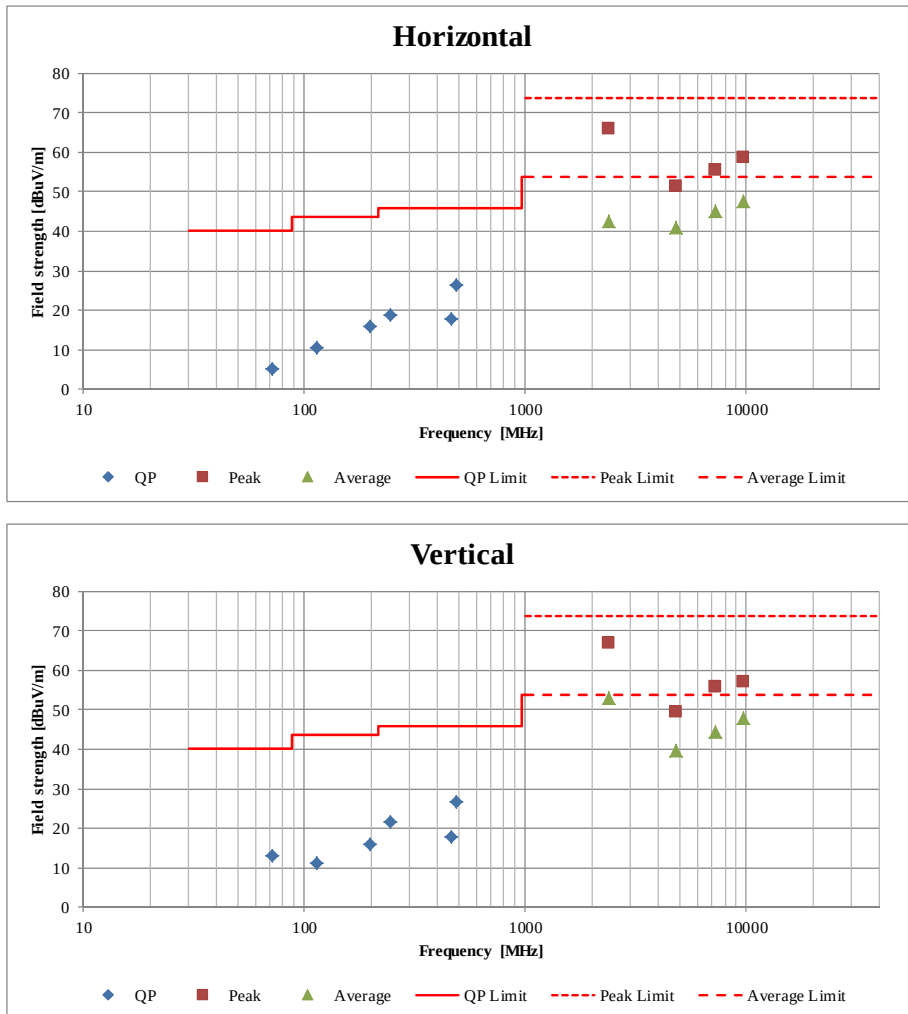
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11689535H		
Date	June 9, 2017	June 11, 2017	June 11, 2017
Temperature / Humidity	24 deg. C / 42 % RH	24 deg. C / 47 % RH	24 deg. C / 47 % RH
Engineer	Shuichi Ohyama (1 GHz - 10 GHz)	Yuta Moriya (10 GHz - 26.5 GHz)	Yuta Moriya (30 MHz - 1000 MHz)
Mode	Tx 11g 2412 MHz		



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11689535H	
Date	June 9, 2017	June 11, 2017
Temperature / Humidity	24 deg. C / 42 % RH	24 deg. C / 47 % RH
Engineer	Shuichi Ohyama	Yuta Moriya
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx 11g 2437 MHz	

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	3648.020	PK	48.6	29.6	7.5	31.5	-	54.2	73.9	19.7	
Hori	4874.000	PK	40.4	31.9	9.3	31.2	-	50.4	73.9	23.5	Floor noise
Hori	7311.000	PK	41.8	36.2	10.2	32.5	-	55.7	73.9	18.2	Floor noise
Hori	9748.000	PK	41.1	38.7	11.1	32.8	-	58.1	73.9	15.8	Floor noise
Hori	3648.020	AV	45.6	29.6	7.5	31.5	-	51.2	53.9	2.7	*1)
Hori	4874.000	AV	31.4	31.9	9.3	31.2	-	41.4	53.9	12.5	Floor noise
Hori	7311.000	AV	31.9	36.2	10.2	32.5	-	45.8	53.9	8.1	Floor noise
Hori	9748.000	AV	30.7	38.7	11.1	32.8	-	47.7	53.9	6.2	Floor noise
Vert	3648.020	PK	48.0	29.6	7.5	31.5	-	53.6	73.9	20.3	
Vert	4874.000	PK	40.3	31.9	9.3	31.2	-	50.3	73.9	23.6	Floor noise
Vert	7311.000	PK	42.2	36.2	10.2	32.5	-	56.1	73.9	17.8	Floor noise
Vert	9748.000	PK	41.1	38.7	11.1	32.8	-	58.1	73.9	15.8	Floor noise
Vert	3648.020	AV	44.5	29.6	7.5	31.5	-	50.1	53.9	3.8	*1)
Vert	4874.000	AV	31.2	31.9	9.3	31.2	-	41.2	53.9	12.7	Floor noise
Vert	7311.000	AV	32.0	36.2	10.2	32.5	-	45.9	53.9	8.0	Floor noise
Vert	9748.000	AV	30.0	38.7	11.1	32.8	-	47.0	53.9	6.9	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Duty 100 % Noise

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11689535H	
Date	June 9, 2017	June 11, 2017
Temperature / Humidity	24 deg. C / 42 % RH	24 deg. C / 47 % RH
Engineer	Shuichi Ohyama	Yuta Moriya
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx 11g 2462 MHz	

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	2483.500	PK	67.4	27.8	6.8	32.0	-	70.0	73.9	3.9	
Hori	3693.017	PK	49.3	29.6	7.5	31.5	-	54.9	73.9	19.0	
Hori	4924.000	PK	40.2	32.0	9.3	31.2	-	50.3	73.9	23.6	Floor noise
Hori	7386.000	PK	41.2	36.3	10.2	32.5	-	55.2	73.9	18.7	Floor noise
Hori	9848.000	PK	41.8	38.8	11.2	32.9	-	58.9	73.9	15.0	Floor noise
Hori	2483.500	AV	44.2	27.8	6.8	32.0	0.4	47.2	53.9	6.7	*1)
Hori	3693.017	AV	46.7	29.6	7.5	31.5	-	52.3	53.9	1.6	*2)
Hori	4924.000	AV	30.0	32.0	9.3	31.2	-	40.1	53.9	13.8	Floor noise
Hori	7386.000	AV	31.5	36.3	10.2	32.5	-	45.5	53.9	8.4	Floor noise
Hori	9848.000	AV	30.7	38.8	11.2	32.9	-	47.8	53.9	6.1	Floor noise
Vert	2483.500	PK	65.2	27.8	6.8	32.0	-	67.8	73.9	6.1	
Vert	3693.017	PK	48.1	29.6	7.5	31.5	-	53.7	73.9	20.2	
Vert	4924.000	PK	40.3	32.0	9.3	31.2	-	50.4	73.9	23.5	Floor noise
Vert	7386.000	PK	42.4	36.3	10.2	32.5	-	56.4	73.9	17.5	Floor noise
Vert	9848.000	PK	41.6	38.8	11.2	32.9	-	58.7	73.9	15.2	Floor noise
Vert	2483.500	AV	40.9	27.8	6.8	32.0	0.4	43.9	53.9	10.0	*1)
Vert	3693.017	AV	44.5	29.6	7.5	31.5	-	50.1	53.9	3.8	*2)
Vert	4924.000	AV	30.0	32.0	9.3	31.2	-	40.1	53.9	13.8	Floor noise
Vert	7386.000	AV	31.5	36.3	10.2	32.5	-	45.5	53.9	8.4	Floor noise
Vert	9848.000	AV	30.6	38.8	11.2	32.9	-	47.7	53.9	6.2	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

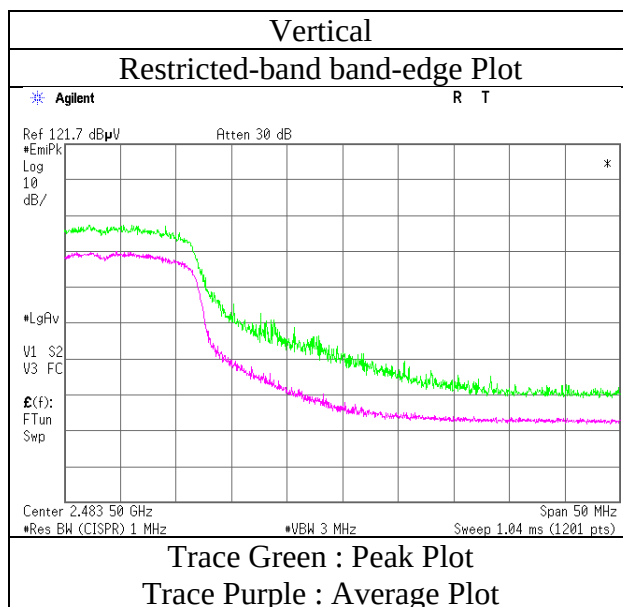
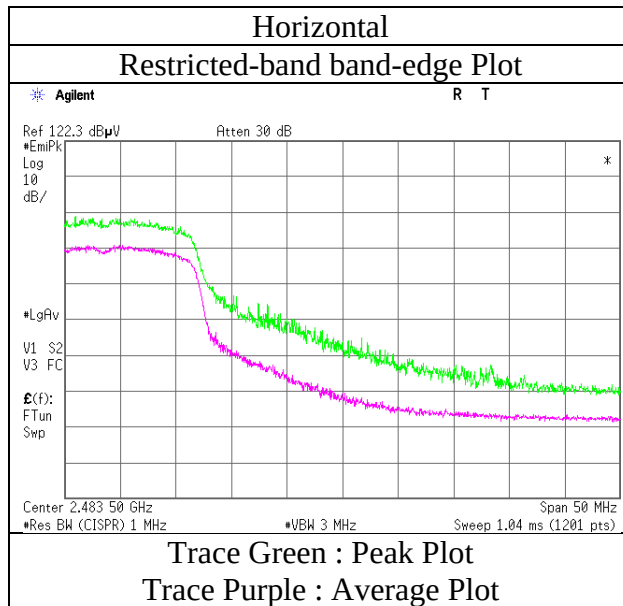
Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

*2) Duty 100 % Noise

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Shuichi Ohyama
	(1 GHz - 10 GHz)
Mode	Tx 11g 2462 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Shuichi Ohyama (1 GHz - 10 GHz)
Mode	Tx 11n-20 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dBm]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	59.3	27.7	6.6	32.1	-	61.5	73.9	12.4	
Hori	2390.000	AV	36.6	27.7	6.6	32.1	0.5	39.3	53.9	14.6	*1)
Vert	2390.000	PK	64.1	27.7	6.6	32.1	-	66.3	73.9	7.6	
Vert	2390.000	AV	40.3	27.7	6.6	32.1	0.5	43.0	53.9	10.9	*1)

$$\text{Result} = \text{Reading} + \text{Ant Factor} + \text{Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))} - \text{Gain(Amplifier)} + \text{Duty factor}$$

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

Distance factor: 1 GHz - 10 GHz $20\log(4.5 \text{ m} / 3.0 \text{ m}) = 3.53 \text{ dB}$

$$10 \text{ GHz} - 26.5 \text{ GHz } 20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$$

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

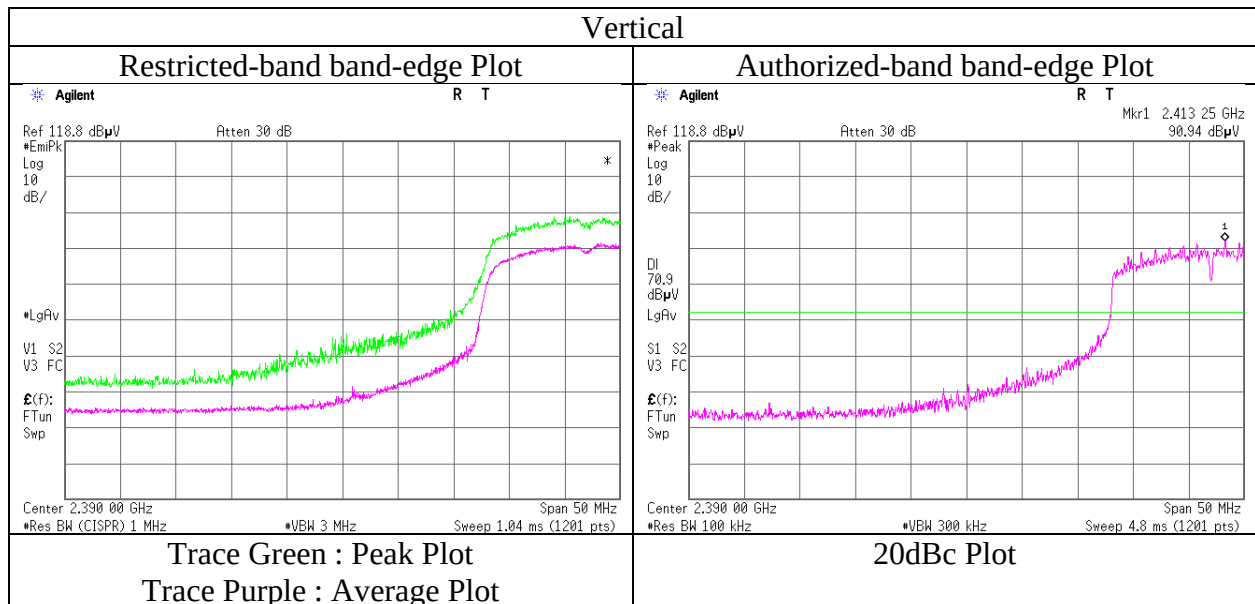
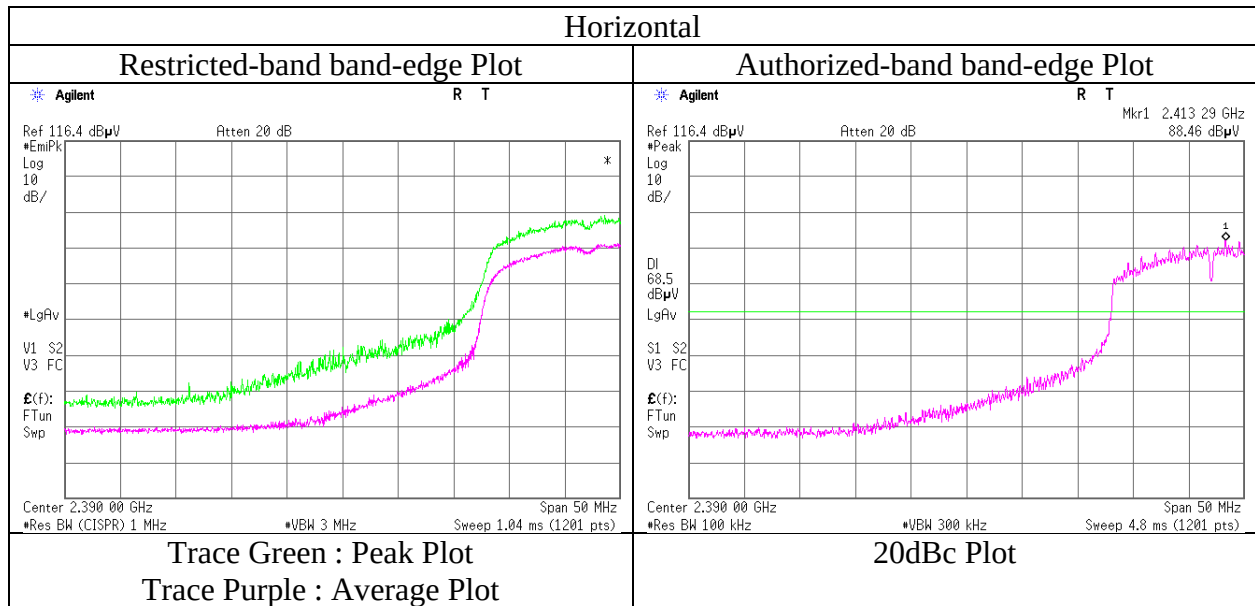
20dBc Data Sheet

Polarity	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori	2412.000	PK	88.5	27.7	6.7	32.1	90.8	-	-	Carrier
Hori	2400.000	PK	54.9	27.7	6.6	32.1	57.1	70.8	13.7	
Vert	2412.000	PK	90.9	27.7	6.7	32.1	93.2	-	-	Carrier
Vert	2400.000	PK	59.0	27.7	6.6	32.1	61.2	73.2	12.0	

$$\text{Result} = \text{Reading} + \text{Ant Factor} + \text{Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))} - \text{Gain(Amplifier)}$$

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Shuichi Ohyama (1 GHz - 10 GHz)
Mode	Tx 11n-20 2412 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise 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 : Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11689535H
Date : June 9, 2017
Temperature / Humidity : 24 deg. C / 42 % RH
Engineer : Shuichi Ohyama
(1 GHz - 10 GHz)
Mode : Tx 11n-20 2462 MHz

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	2483.500	PK	66.4	27.8	6.8	32.0	-	69.0	73.9	4.9	
Hori	2483.500	AV	41.5	27.8	6.8	32.0	0.5	44.6	53.9	9.3	*1)
Vert	2483.500	PK	64.6	27.8	6.8	32.0	-	67.2	73.9	6.7	
Vert	2483.500	AV	39.6	27.8	6.8	32.0	0.5	42.7	53.9	11.2	*1)

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

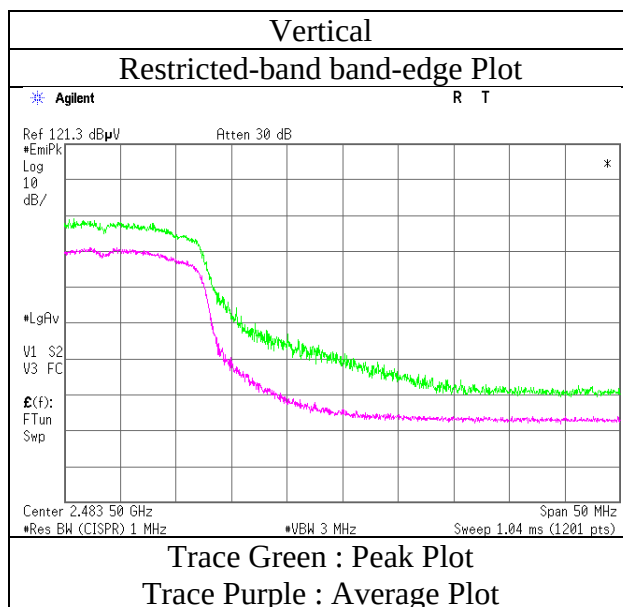
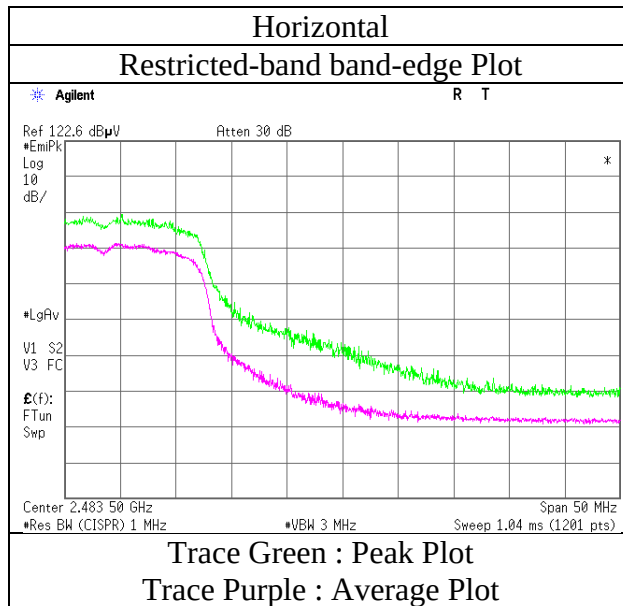
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11689535H
Date	June 9, 2017
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Shuichi Ohyama
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 2462 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

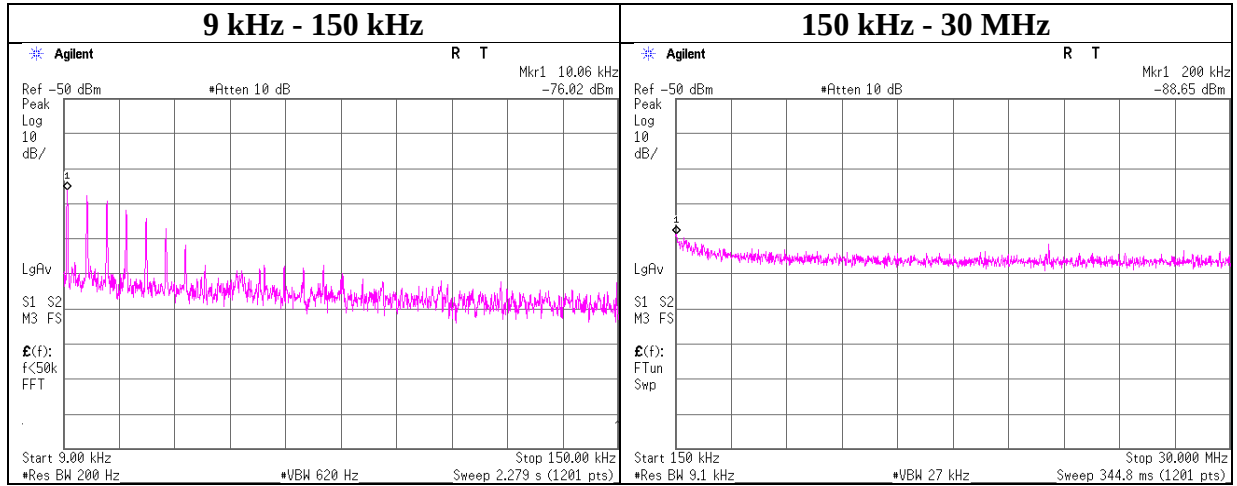
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11689535H
Date	June 5, 2017
Temperature / Humidity	25 deg. C / 42 % RH
Engineer	Takafumi Noguchi
Mode	Tx 11g 2412 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.06	-76.0	0.71	9.8	2.0	1	-63.5	300	6.0	-2.2	47.5	49.7	
200.00	-88.7	0.70	9.8	2.0	1	-76.1	300	6.0	-14.9	21.5	36.4	

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

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Test place	Ise EMC Lab. No. 11 Measurement Room
Report No.	11689535H
Date	June 16, 2017
Temperature / Humidity	26 deg. C / 43 % RH
Engineer	Takumi Shimada
Mode	Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-26.00	2.03	10.09	-13.88	8.00	21.88
2437.00	-25.47	2.03	10.09	-13.35	8.00	21.35
2462.00	-26.32	2.04	10.09	-14.19	8.00	22.19

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-27.53	2.03	10.09	-15.41	8.00	23.41
2437.00	-26.74	2.03	10.09	-14.62	8.00	22.62
2462.00	-27.14	2.04	10.09	-15.01	8.00	23.01

11n-20

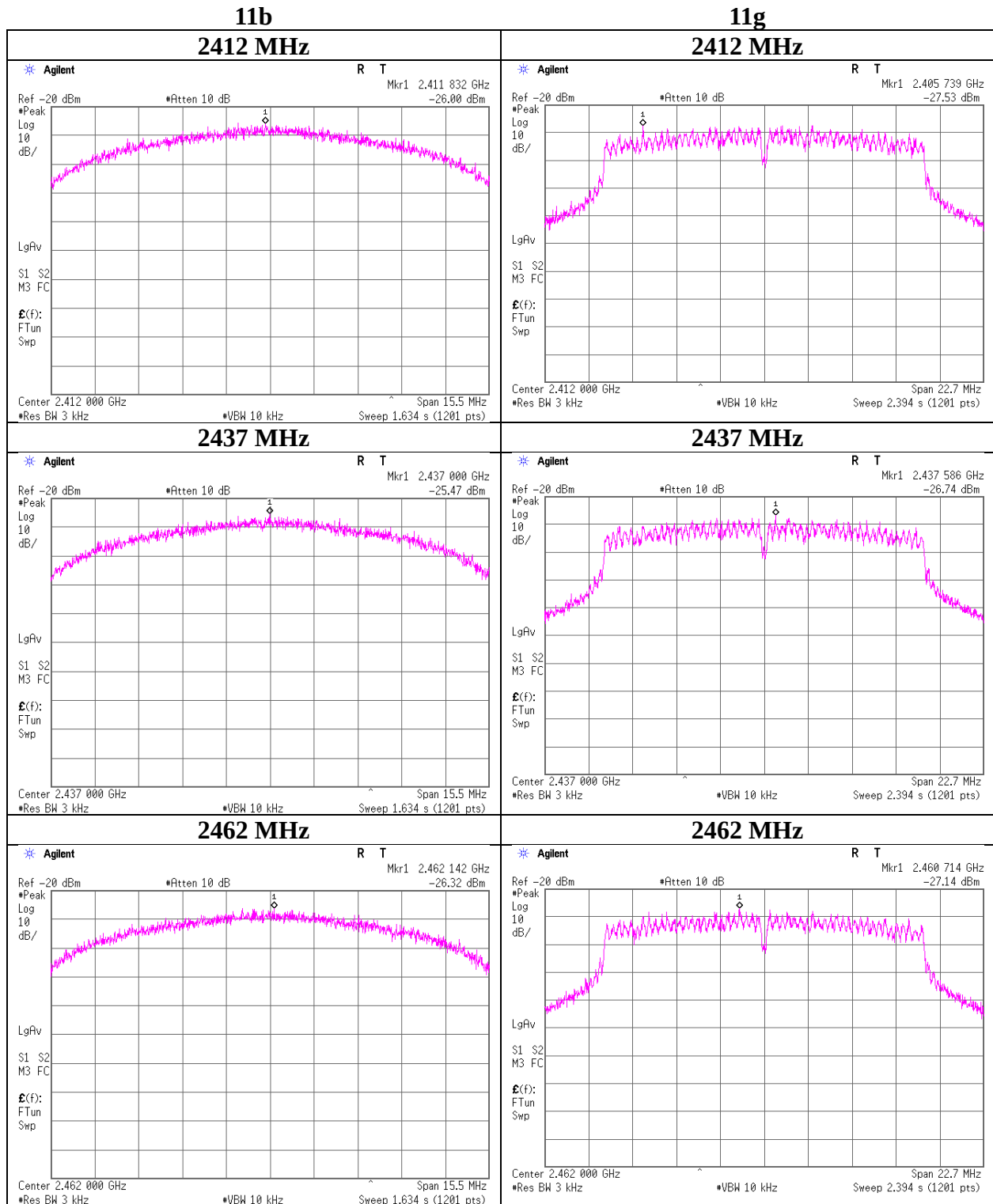
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-26.27	2.03	10.09	-14.15	8.00	22.15
2437.00	-27.10	2.03	10.09	-14.98	8.00	22.98
2462.00	-27.42	2.04	10.09	-15.29	8.00	23.29

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density



UL Japan, Inc.

Ise EMC Lab.

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

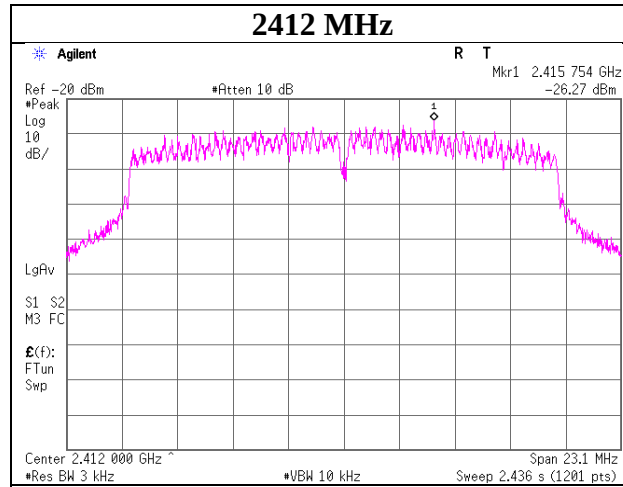
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

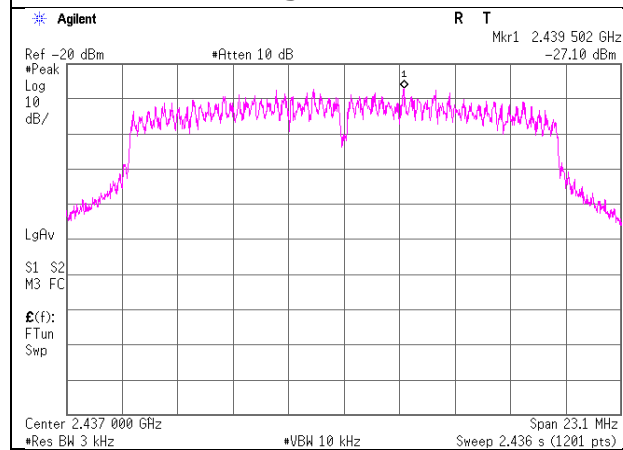
Power Density

11n-20

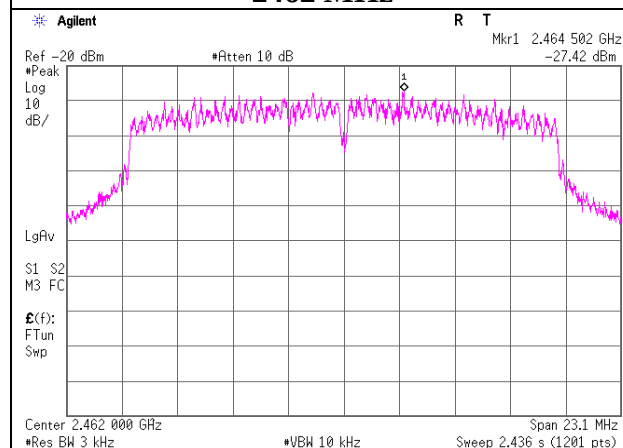
2412 MHz



2437 MHz



2462 MHz



UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

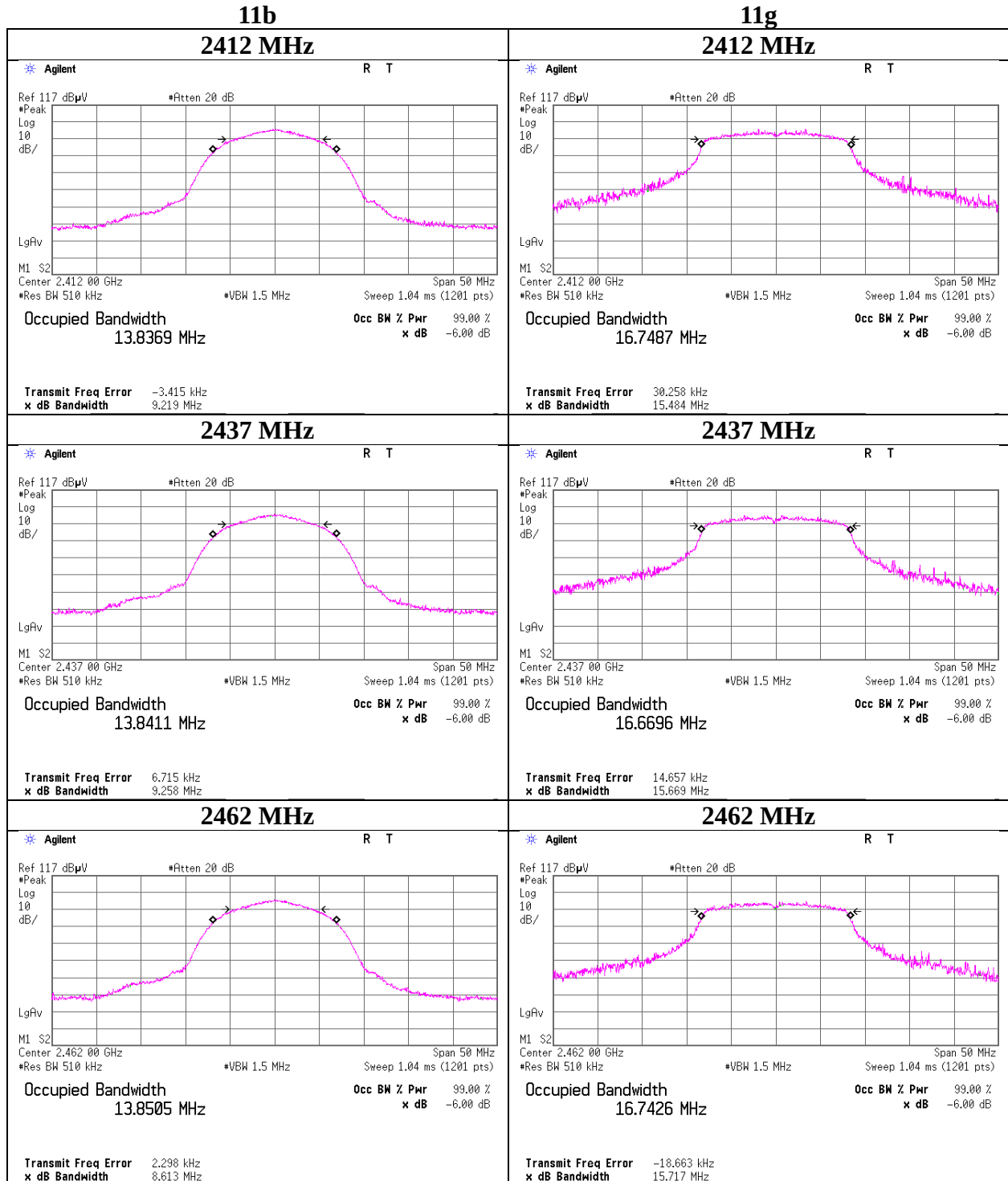
Facsimile : +81 596 24 8124

99%Occupied Bandwidth

Test place
Report No.

Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.6 Measurement Room
11689535H
June 5, 2017
25 deg. C / 42 % RH
Takafumi Noguchi
Tx



UL Japan, Inc.

Ise EMC Lab.

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

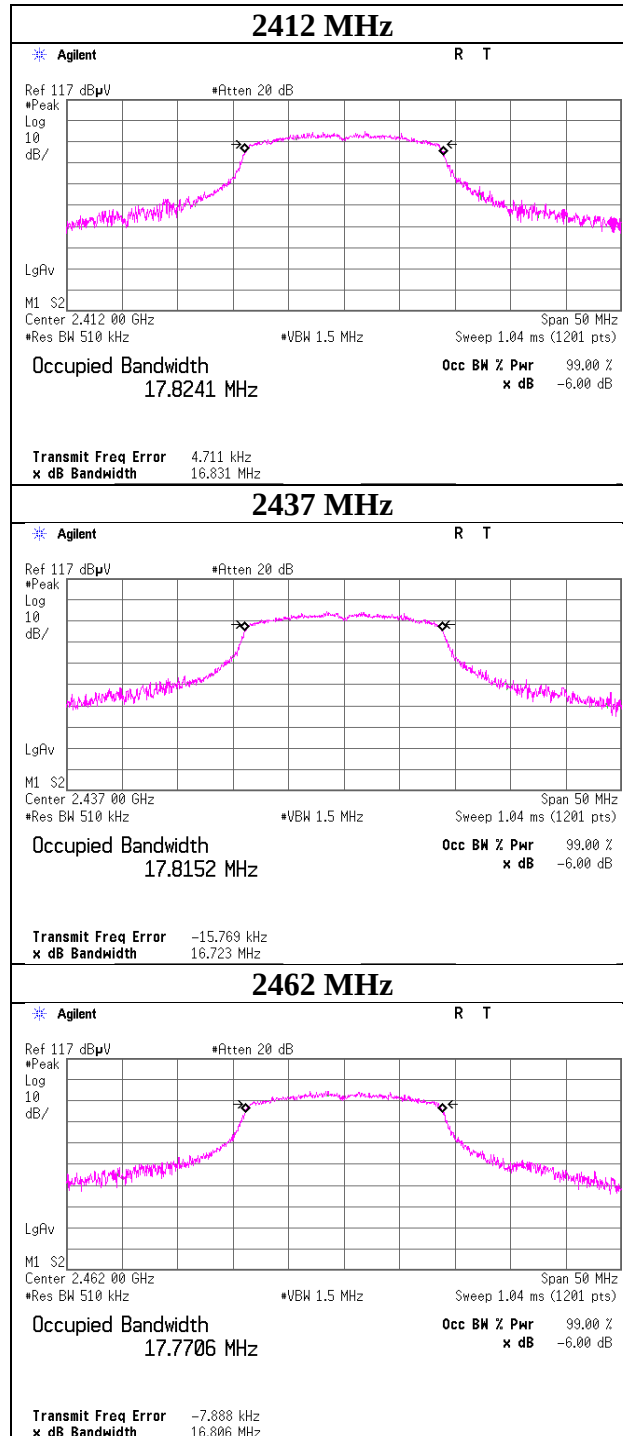
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11689535H
Date	June 5, 2017
Temperature / Humidity	25 deg. C / 42 % RH
Engineer	Takafumi Noguchi
Mode	Tx

11n-20



UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2016/06/06 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2016/06/06 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2017/05/29 * 12
MAT-20	Attenuator(10dB)(above 1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	AT	2016/12/15 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2016/10/14 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2017/01/20 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2017/03/24 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2016/11/28 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2016/10/20 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE/CE	2017/01/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE/CE	2016/10/14 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2017/05/22 * 12
MCC-217	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	RE	2016/08/29 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2016/10/21 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2016/09/19 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2017/01/19 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2017/05/14 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2016/09/15 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2016/10/15 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2017/01/26 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2016/07/26 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2016/12/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2016/07/07 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2016/12/24 * 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	2016/07/26 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/12/24 * 12
MRENT-126	Spectrum Analyzer	KEYSIGHT	E4440A	MY46185516	AT	2016/07/01 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2016/10/17 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2016/10/17 * 12
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2017/04/04 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2017/03/21 * 12
MMM-17	DIGITAL HiTESTER	Hioki	3805	070900530	AT	2017/01/19 * 12

UL Japan, Inc.

Ise 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 test
 RE: Radiated Emission test
 AT: Antenna Terminal Conducted test