



RADIO TEST REPORT

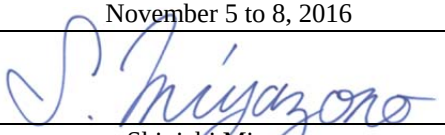
Test Report No. : 11445682H-A-R1

Applicant : Yamaha Motor Co., Ltd.
Type of Equipment : COMMUN.CONT.UNIT ASSY.
Model No. : T722-A00
FCC ID : 2ADBK-T722A00
Test regulation : FCC Part 15 Subpart C: 2016
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)
7. This report is a revised version of 11445682H-A. 11445682H-A is replaced with this report.

Date of test: November 5 to 8, 2016

Representative test engineer:


Shinichi Miyazono
Engineer
Consumer Technology Division

Approved by:


Motoya Imura
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

REVISION HISTORY

Original Test Report No.: 11445682H-A

[illegible]

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: Radiated Spurious Emission	10
SECTION 6: Antenna Terminal Conducted Tests.....	12
APPENDIX 1: Test data	13
6dB Bandwidth	13
Maximum Peak Output Power	16
Average Output Power	17
Radiated Spurious Emission	19
Conducted Spurious Emission	34
Power Density	35
99%Occupied Bandwidth	38
APPENDIX 2: Test instruments	40
APPENDIX 3: Photographs of test setup	41
Radiated Spurious Emission	41
Worst Case Position	42

SECTION 1: Customer information

Company Name	:	Yamaha Motor Co., Ltd.
Address	:	2500 Shingai, Iwata-shi, Shizuoka-ken, 438-8501 Japan
Telephone Number	:	+81-538-32-6582
Facsimile Number	:	+81-538-32-1019
Contact Person	:	Hidenori Akatsuka

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

2.1 Identification of E.U.T.

Type of Equipment	:	COMMUN.CONT.UNIT ASSY.
Model No.	:	T722-A00
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample	:	October 27, 2016
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: T722-A00 (referred to as the EUT in this report) is a COMMUN.CONT.UNIT ASSY..

General Specification

Clock frequency(ies) in the system	:	25 MHz
Operating temperature (Equipment)	:	-10 deg. C to +60 deg. C
Operating temperature (Radio Module)	:	-40 deg. C to +85 deg. C

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS, OFDM
Power Supply (radio part input)	:	DC 3.3 V
Antenna type	:	Chip Antenna
Antenna Gain	:	1.9 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

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 November 14, 2016, 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	N/A *1)	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	3.3 dB 2390.000 MHz, AV, Vertical	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
 *1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.
 *2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r05 12.2.7.

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

FCC Part 15.31 (e)

The test was performed with the New Battery (DC 12.0 V) and the EUT constantly provides the stable voltage (DC 3.3 V) to RF part through the regulator regardless of input voltage from New Battery. 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.

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

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.
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 - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.5 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

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

Polarity	Radiated emission (Below 1GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 - 200 MHz	200 - 1000MHz	30 - 200 MHz	200 - 1000MHz
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 1GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 - 6GHz	6 - 18GHz	10 - 26.5 GHz	26.5 - 40GHz	1 -18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

*Measurement distance

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	-	-

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)	2Mbps, PN9
IEEE 802.11g (11g)	9Mbps, PN9
IEEE 802.11n SISO 20MHz BW (11n-20)	MCS 1, PN9
*Transmitting duty was 100 % on all tests. *The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power Setting: Please see following table. Software: RADITS_11n Version 1.5.0.2 *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.	

Power settings

Test item	Mode	Channel		
		Low	Mid	High
Radiated emission	11b	2C	2C	2D
	11g	31	31	32
	11n-20	2E	2F	2F
Antenna Terminal Conducted	11b	29	2A	2B
	11g	2F	30	30
	11n-20	2C	2D	2E

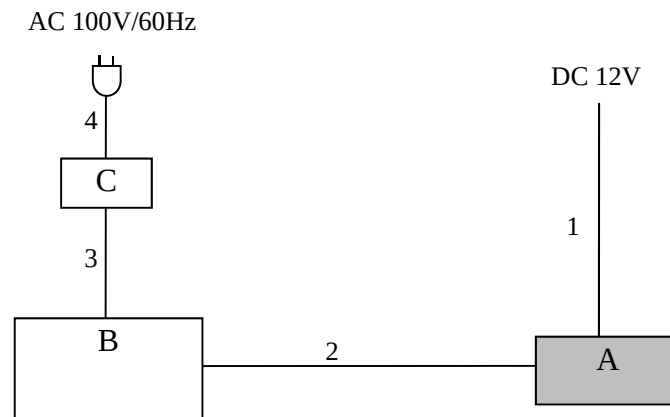
*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Spurious Emission (Radiated)	11b Tx	2412MHz
	11g Tx	2437MHz
	11n-20 Tx *1)	2462MHz
Spurious Emission (Conducted)	11g Tx *2)	2437MHz
6dB Bandwidth, Maximum Peak Output Power, Power Density, 99% Occupied Bandwidth	11b Tx	2412MHz
	11g Tx	2437MHz
	11n-20 Tx	2462MHz

*1) Since 11g had the higher peak output power than 11n-20, band edge test was performed on 11n-20 only.

*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 higher peak output power.

4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remark
A	COMMUN.CONT.UNIT ASSY.	T722-A00	10	Yamaha Motor Co., Ltd.	EUT
B	Laptop PC	FMVNS8BC	R8Z03059	FUJITSU	-
C	AC Adapter	ADP-80NBA	08Z15123A	FUJITSU	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-
2	Signal Cable	0.2	Shielded	Shielded	-
3	DC Cable	1.8	Unshielded	Unshielded	-
4	AC Cable	1.8	Unshielded	Unshielded	-

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r05".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 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 *3)	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 *1) (1 GHz – 10 GHz), 1.0 m *2) (10 GHz – 26.5 GHz)		4.5 m *1) (1 GHz – 10 GHz), 1.0 m *2) (10 GHz – 26.5 GHz)

*1) Distance Factor: $20 \times \log (4.5 \text{ m} / 3.0 \text{ m}) = 3.53 \text{ dB}$ (for 11b)

Distance Factor: $20 \times \log (3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$ (for 11g and 11n-20)

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

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

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

SECTION 6: 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	Single	Clear Write	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 v03r05". *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

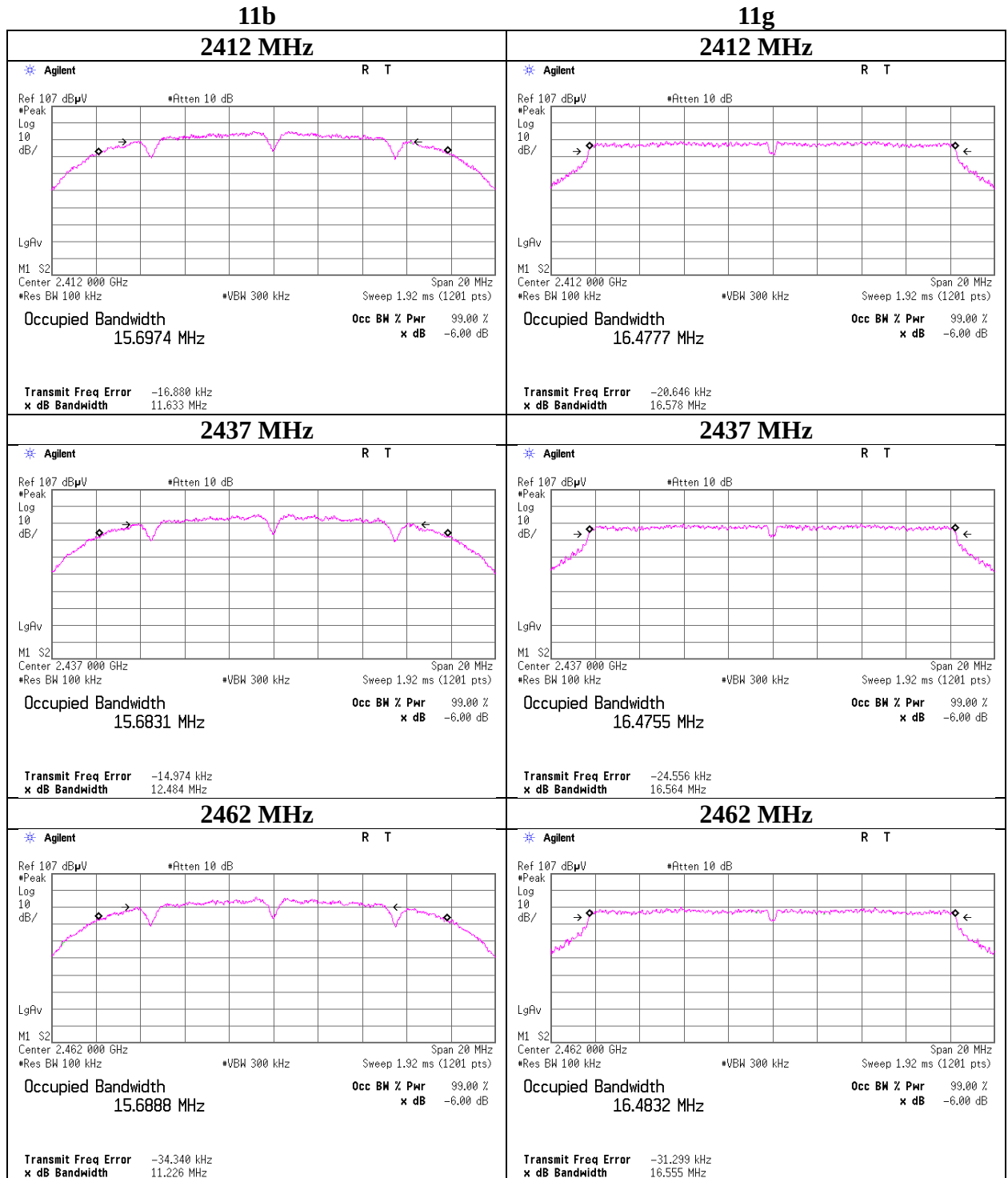
APPENDIX 1: Test data

6dB Bandwidth

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11445682H
Date	November 7, 2016
Temperature / Humidity	20 deg. C / 41 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	11.633	> 500
	2437	12.484	> 500
	2462	11.226	> 500
11g	2412	16.578	> 500
	2437	16.564	> 500
	2462	16.555	> 500
11n-20	2412	17.756	> 500
	2437	17.746	> 500
	2462	17.749	> 500

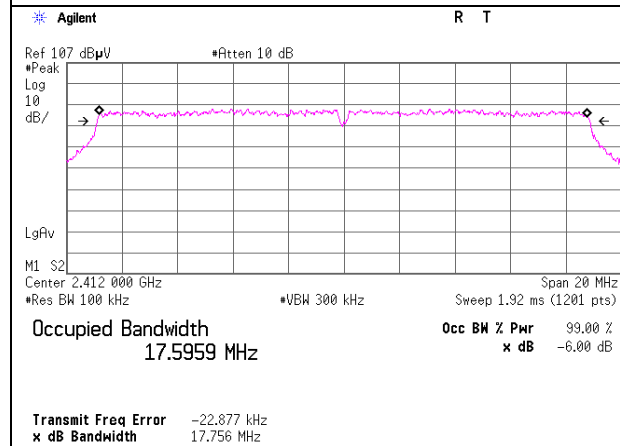
6dB Bandwidth



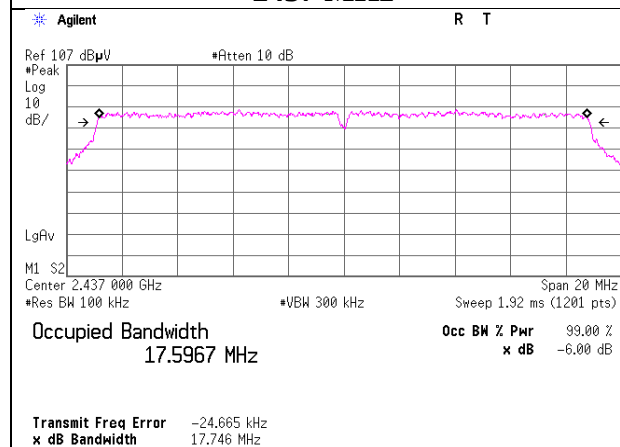
6dB Bandwidth

11n-20

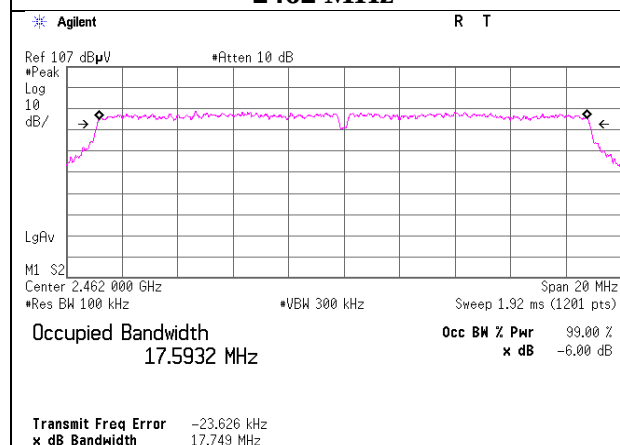
2412 MHz



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

Maximum Peak Output Power

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11445682H
Date : November 5, 2016
Temperature / Humidity : 23 deg. C / 55 % RH
Engineer : Tomohisa Nakagawa
Mode : Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-2.00	0.34	9.78	8.12	6.48	30.00	1000	21.88
2437	-1.78	0.36	9.78	8.36	6.85	30.00	1000	21.64
2462	-1.69	0.34	9.78	8.43	6.96	30.00	1000	21.57

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	2.26	0.34	9.78	12.38	17.29	30.00	1000	17.62
2437	2.62	0.36	9.78	12.76	18.86	30.00	1000	17.24
2462	2.63	0.34	9.78	12.75	18.82	30.00	1000	17.25

11n

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	1.59	0.34	9.78	11.71	14.82	30.00	1000	18.29
2437	1.99	0.36	9.78	12.13	16.31	30.00	1000	17.87
2462	2.02	0.34	9.78	12.14	16.36	30.00	1000	17.86

Sample Calculation:

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

2437MHz

Rate [Mbps]	Reading [dBm]	Remark	Rate [Mbps]	Reading [dBm]	Remark	Rate [MCS]	Reading [dBm]	Remark
1	-1.92		6	2.58		0	1.92	
2	-1.78	*	9	2.62	*	1	1.99	*
5.5	-2.01		12	2.52		2	1.91	
11	-2.11		18	2.60		3	1.95	
			24	2.59		4	1.88	
			36	2.52		5	1.93	
			48	2.60		6	1.95	
			54	2.60		7	1.93	

*: Worst Rate

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

Average Output Power (Reference data for RF Exposure)

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11445682H
Date	November 5, 2016
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
				[dBm]	[mW]
2412	-4.55	0.34	9.78	5.57	3.60
2437	-4.33	0.36	9.78	5.81	3.81
2462	-4.24	0.34	9.78	5.88	3.87

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
				[dBm]	[mW]
2412	-6.53	0.34	9.78	3.59	2.28
2437	-6.23	0.36	9.78	3.91	2.46
2462	-6.47	0.34	9.78	3.65	2.32

11n

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
				[dBm]	[mW]
2412	-7.71	0.34	9.78	2.41	1.74
2437	-7.37	0.36	9.78	2.77	1.89
2462	-7.28	0.34	9.78	2.84	1.92

Sample Calculation:

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

2437MHz

Rate	Reading	Remark	Rate	Reading	Remark	Rate	Reading	Remark
[Mbps]	[dBm]		[Mbps]	[dBm]		[MCS]	[dBm]	
1	-4.34		6	-6.24		0	-7.39	
2	-4.33	*	9	-6.23	*	1	-7.37	*
5.5	-4.35		12	-6.25		2	-7.38	
11	-4.42		18	-6.24		3	-7.38	
			24	-6.24		4	-7.38	
			36	-6.24		5	-7.40	
			48	-6.26		6	-7.41	
			54	-6.24		7	-7.41	

*: Worst Rate

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

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 v02r02.

UL Japan, Inc.

Ise EMC Lab.

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

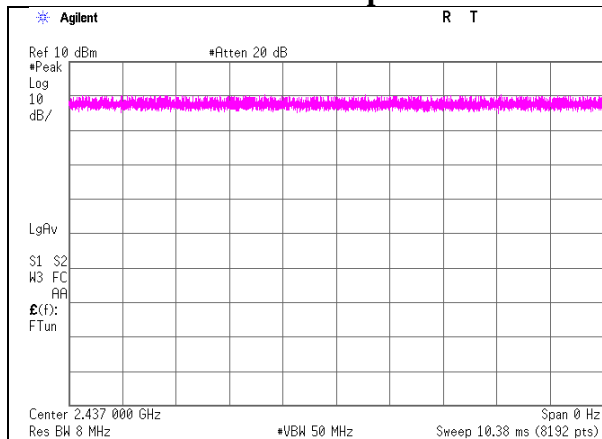
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

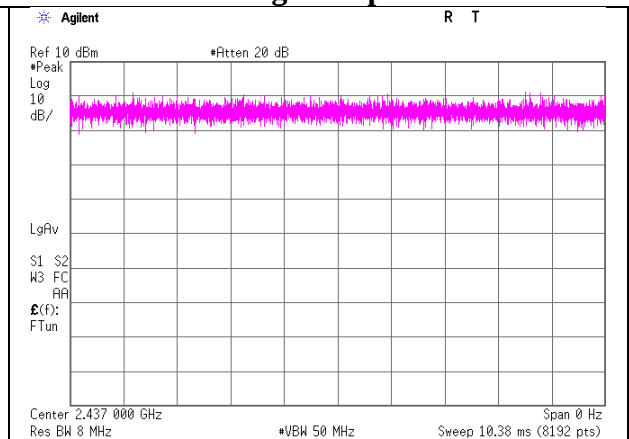
Burst rate confirmation

Test place Ise EMC Lab. No.7 Shielded Room
Report No. 11445682H
Date November 5, 2016
Temperature / Humidity 23 deg. C / 55 % RH
Engineer Tomohisa Nakagawa
Mode Tx

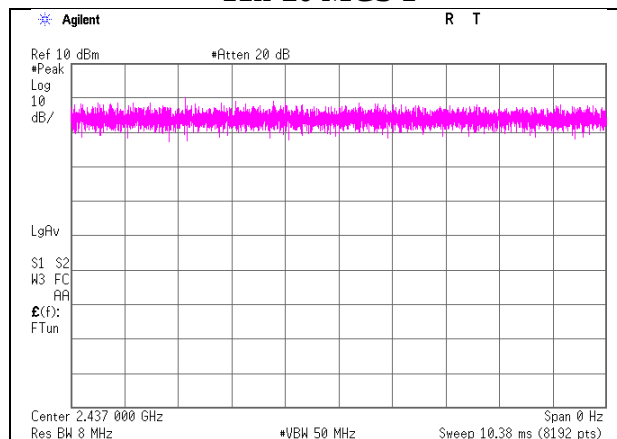
11b 2 Mbps



11g 9 Mbps



11n-20 MCS 1



*Duty is 100 %

Radiated Spurious Emission

Test place : Ise EMC Lab.
Report No. : 11445682H
Semi Anechoic Chamber : No.3
Date : November 5, 2016
Temperature / Humidity : 22 deg. C / 45 % RH
Engineer : Tomohisa Nakagawa
Mode : Tx 11b 2412 MHz

No.2
November 8, 2016
22 deg. C / 54 % RH
Shinichi Miyazono
(Above 10 GHz)

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	45.8	26.7	6.9	32.7	-	46.7	73.9	27.2	
Hori	4824.000	PK	43.9	31.1	9.1	31.8	-	52.3	73.9	21.6	
Hori	7236.000	PK	41.6	35.7	10.4	32.6	-	55.1	73.9	18.8	Floor Noise
Hori	9648.000	PK	41.7	37.2	11.0	33.3	-	56.6	73.9	17.3	Floor Noise
Hori	2390.000	AV	36.0	26.7	6.9	32.7	-	36.9	53.9	17.0	
Hori	4824.000	AV	38.8	31.1	9.1	31.8	-	47.2	53.9	6.7	
Hori	7236.000	AV	34.6	35.7	10.4	32.6	-	48.1	53.9	5.8	Floor Noise
Hori	9648.000	AV	35.5	37.2	11.0	33.3	-	50.4	53.9	3.5	Floor Noise
Vert	2390.000	PK	46.0	26.7	6.9	32.7	-	46.9	73.9	27.0	
Vert	4824.000	PK	44.3	31.1	9.1	31.8	-	52.7	73.9	21.2	
Vert	7236.000	PK	42.1	35.7	10.4	32.6	-	55.6	73.9	18.3	Floor Noise
Vert	9648.000	PK	42.1	37.2	11.0	33.3	-	57.0	73.9	16.9	Floor Noise
Vert	2390.000	AV	36.6	26.7	6.9	32.7	-	37.5	53.9	16.4	
Vert	4824.000	AV	38.8	31.1	9.1	31.8	-	47.2	53.9	6.7	
Vert	7236.000	AV	34.6	35.7	10.4	32.6	-	48.1	53.9	5.8	Floor Noise
Vert	9648.000	AV	34.7	37.2	11.0	33.3	-	49.6	53.9	4.3	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	98.5	26.7	6.9	32.7	99.4	-	-	Carrier
Hori	2396.983	PK	53.0	26.7	6.9	32.7	53.9	79.4	25.5	
Hori	2400.000	PK	46.3	26.7	6.9	32.7	47.2	79.4	32.2	
Vert	2412.000	PK	98.4	26.7	6.9	32.7	99.3	-	-	Carrier
Vert	2396.983	PK	53.7	26.7	6.9	32.7	54.6	79.3	24.7	
Vert	2400.000	PK	45.7	26.7	6.9	32.7	46.6	79.3	32.7	

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

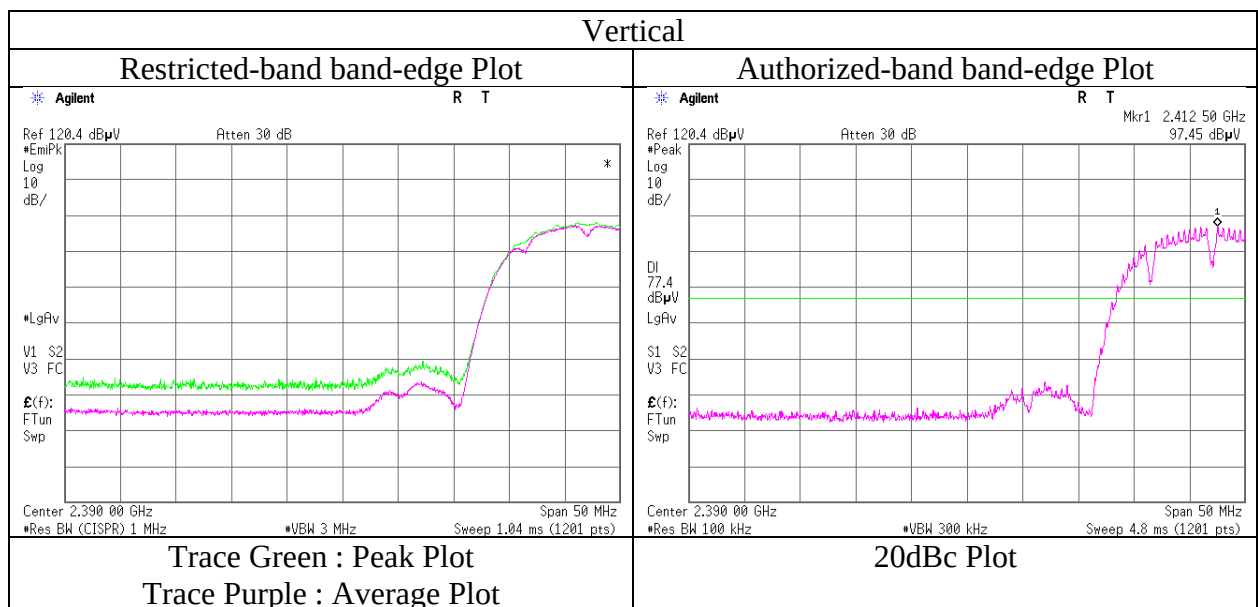
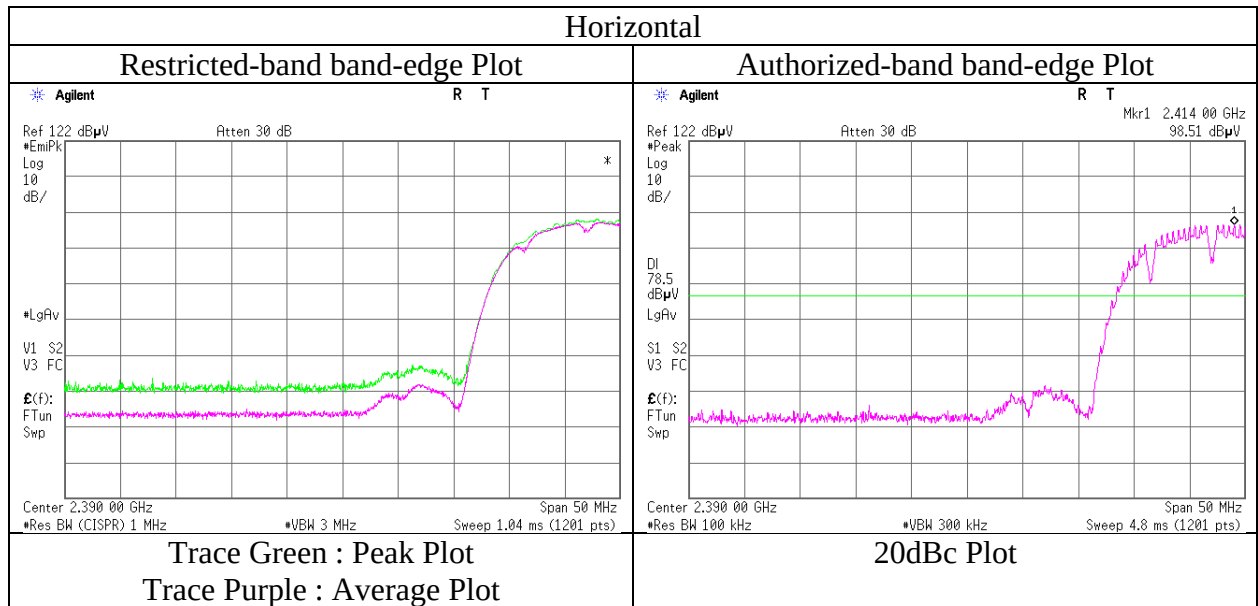
- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

*Above noise was synchronized with carrier frequency.

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) = -9.5dB

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11445682H
Date	November 5, 2016
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Tomohisa Nakagawa (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.	
Report No.	11445682H	
Semi Anechoic Chamber	No.3	No.2
Date	November 5, 2016	November 8, 2016
Temperature / Humidity	22 deg. C / 45 % RH	22 deg. C / 54 % RH
Engineer	Tomohisa Nakagawa	Shinichi Miyazono
	(1 GHz - 10 GHz)	(Above 10 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	4874.000	PK	42.2	31.2	9.1	31.7	-	50.8	73.9	23.1	
Hori	7311.000	PK	43.1	35.6	10.4	32.6	-	56.5	73.9	17.4	Floor Noise
Hori	9748.000	PK	42.2	37.2	11.0	33.3	-	57.1	73.9	16.8	Floor Noise
Hori	4874.000	AV	37.2	31.2	9.1	31.7	-	45.8	53.9	8.1	
Hori	7311.000	AV	34.9	35.6	10.4	32.6	-	48.3	53.9	5.6	Floor Noise
Hori	9748.000	AV	34.6	37.2	11.0	33.3	-	49.5	53.9	4.4	Floor Noise
Vert	4874.000	PK	43.3	31.2	9.1	31.7	-	51.9	73.9	22.0	
Vert	7311.000	PK	42.3	35.6	10.4	32.6	-	55.7	73.9	18.2	Floor Noise
Vert	9748.000	PK	42.5	37.2	11.0	33.3	-	57.4	73.9	16.5	Floor Noise
Vert	4874.000	AV	35.8	31.2	9.1	31.7	-	44.4	53.9	9.5	
Vert	7311.000	AV	34.8	35.6	10.4	32.6	-	48.2	53.9	5.7	Floor Noise
Vert	9748.000	AV	34.2	37.2	11.0	33.3	-	49.1	53.9	4.8	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 $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Test place	Ise EMC Lab.	
Report No.	11445682H	
Semi Anechoic Chamber	No.3	No.2
Date	November 5, 2016	November 8, 2016
Temperature / Humidity	22 deg. C / 45 % RH	22 deg. C / 54 % RH
Engineer	Tomohisa Nakagawa (1 GHz - 10 GHz)	Shinichi Miyazono (Above 10 GHz)
Mode	Tx 11b 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	2483.500	PK	43.7	26.8	7.0	32.6	-	44.9	73.9	29.0	
Hori	4924.000	PK	42.1	31.4	9.1	31.7	-	50.9	73.9	23.0	
Hori	7386.000	PK	42.9	35.5	10.3	32.7	-	56.0	73.9	17.9	Floor noise
Hori	9848.000	PK	41.8	37.2	11.1	33.3	-	56.8	73.9	17.1	Floor noise
Hori	2483.500	AV	33.1	26.8	7.0	32.6	-	34.3	53.9	19.6	
Hori	4924.000	AV	36.4	31.4	9.1	31.7	-	45.2	53.9	8.7	
Hori	7386.000	AV	35.1	35.5	10.3	32.7	-	48.2	53.9	5.7	Floor noise
Hori	9848.000	AV	33.6	37.2	11.1	33.3	-	48.6	53.9	5.3	Floor noise
Vert	2483.500	PK	44.4	26.8	7.0	32.6	-	45.6	73.9	28.3	
Vert	4924.000	PK	42.8	31.4	9.1	31.7	-	51.6	73.9	22.3	
Vert	7386.000	PK	42.3	35.5	10.3	32.7	-	55.4	73.9	18.5	Floor noise
Vert	9848.000	PK	41.2	37.2	11.1	33.3	-	56.2	73.9	17.7	Floor noise
Vert	2483.500	AV	35.9	26.8	7.0	32.6	-	37.1	53.9	16.8	
Vert	4924.000	AV	33.4	31.4	9.1	31.7	-	42.2	53.9	11.7	
Vert	7386.000	AV	32.6	35.5	10.3	32.7	-	45.7	53.9	8.2	Floor noise
Vert	9848.000	AV	32.5	37.2	11.1	33.3	-	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 $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Ise EMC Lab.

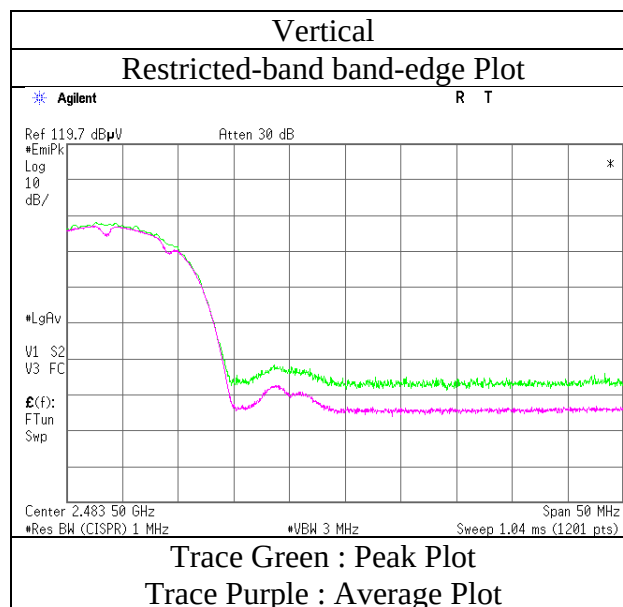
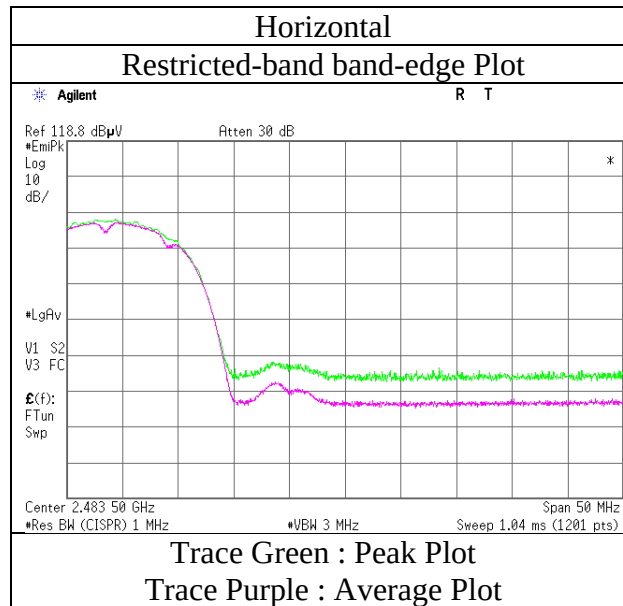
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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.	11445682H
Date	November 5, 2016
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Tomohisa Nakagawa
	(1 GHz - 10 GHz)
Mode	Tx 11b 2462MHz



* 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.2 Semi Anechoic Chamber
Report No. : 11445682H
Date : November 7, 2016 November 8, 2016
Temperature / Humidity : 20 deg. C / 42 % RH 22 deg. C / 54 % RH
Engineer : Shinichi Miyazono Shinichi Miyazono
(1 GHz - 10 GHz) (Above 10 GHz)
Mode : Tx 11g 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	66.2	27.6	5.0	34.8	-	64.0	73.9	9.9	
Hori	4824.000	PK	44.4	31.6	7.2	34.1	-	49.1	73.9	24.8	
Hori	7236.000	PK	43.1	36.2	8.5	34.1	-	53.7	73.9	20.2	Floor noise
Hori	9648.000	PK	44.1	38.5	9.0	34.8	-	56.8	73.9	17.1	Floor noise
Hori	2390.000	AV	50.8	27.6	5.0	34.8	-	48.6	53.9	5.3	
Hori	4824.000	AV	36.5	31.6	7.2	34.1	-	41.2	53.9	12.7	
Hori	7236.000	AV	34.9	36.2	8.5	34.1	-	45.5	53.9	8.4	Floor noise
Hori	9648.000	AV	35.0	38.5	9.0	34.8	-	47.7	53.9	6.2	Floor noise
Vert	2390.000	PK	67.6	27.6	5.0	34.8	-	65.4	73.9	8.5	
Vert	4824.000	PK	44.6	31.6	7.2	34.1	-	49.3	73.9	24.6	
Vert	7236.000	PK	43.1	36.2	8.5	34.1	-	53.7	73.9	20.2	Floor noise
Vert	9648.000	PK	44.1	38.5	9.0	34.8	-	56.8	73.9	17.1	Floor noise
Vert	2390.000	AV	52.8	27.6	5.0	34.8	-	50.6	53.9	3.3	
Vert	4824.000	AV	35.5	31.6	7.2	34.1	-	40.2	53.9	13.7	
Vert	7236.000	AV	34.9	36.2	8.5	34.1	-	45.5	53.9	8.4	Floor noise
Vert	9648.000	AV	35.0	38.5	9.0	34.8	-	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 20log (3.75 m / 3.0 m) = 1.94 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	27.6	5.1	34.7	93.9	-	-	Carrier
Hori	2400.000	PK	67.9	27.6	5.1	34.8	65.8	73.9	8.1	
Vert	2412.000	PK	97.3	27.6	5.1	34.7	95.3	-	-	Carrier
Vert	2400.000	PK	69.1	27.6	5.1	34.8	67.0	75.3	8.3	

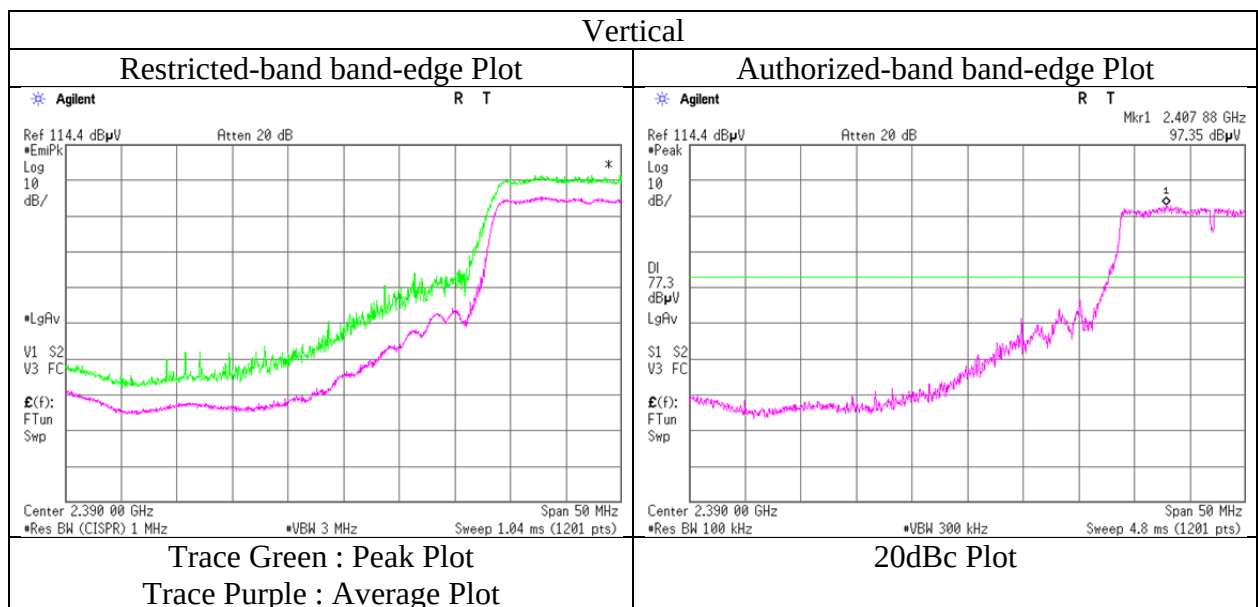
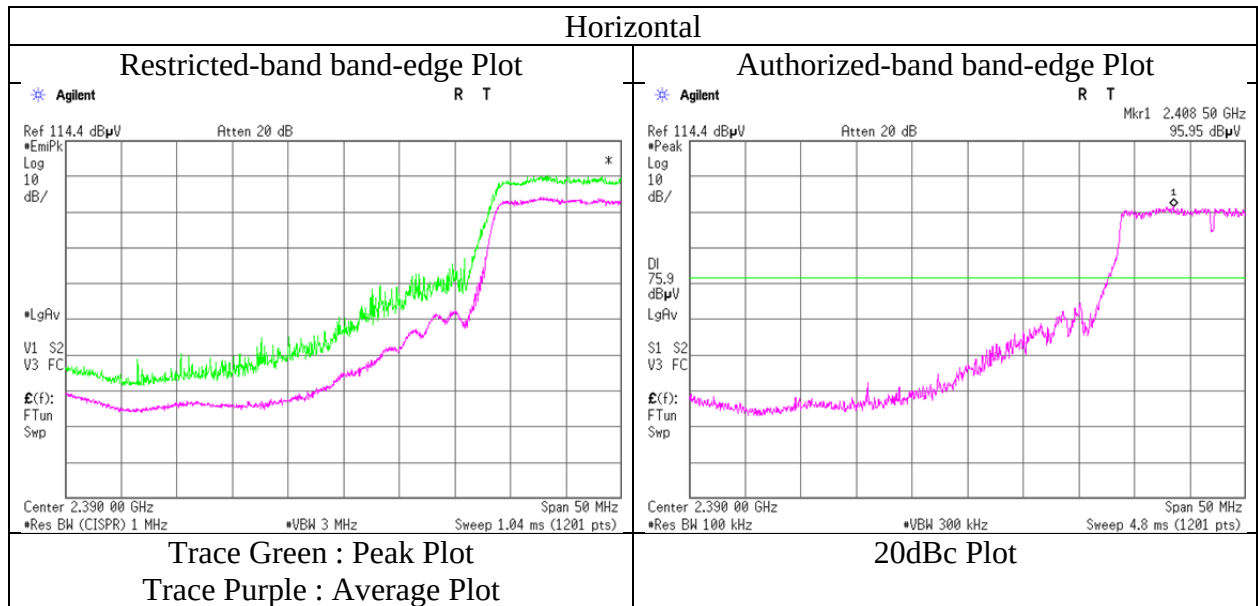
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94dB

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11445682H
Date	November 7, 2016
Temperature / Humidity	20 deg. C / 42 % RH
Engineer	Shinichi Miyazono (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

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	11445682H	
Date	November 7, 2016	November 8, 2016
Temperature / Humidity	20 deg. C / 42 % RH	22 deg. C / 54 % RH
Engineer	Shinichi Miyazono	Shinichi Miyazono
	(1 GHz - 10 GHz)	(Above 10 GHz, Below 1GHz)
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	33.117	QP	23.2	16.5	6.8	28.2	-	18.3	40.0	21.7	
Hori	67.450	QP	23.0	6.5	7.1	28.1	-	8.5	40.0	31.5	
Hori	189.818	QP	25.3	16.3	8.1	27.5	-	22.2	43.5	21.3	
Hori	240.000	QP	21.9	12.4	8.4	27.2	-	15.5	46.0	30.5	
Hori	410.000	QP	22.1	15.8	9.5	27.8	-	19.6	46.0	26.4	
Hori	614.000	QP	22.1	19.0	10.1	27.9	-	23.3	46.0	22.7	
Hori	4874.000	PK	44.4	31.7	7.2	34.1	-	49.2	73.9	24.7	
Hori	7311.000	PK	43.2	36.3	8.6	34.1	-	54.0	73.9	19.9	Floor noise
Hori	9748.000	PK	42.8	38.5	9.0	34.8	-	55.5	73.9	18.4	Floor noise
Hori	4874.000	AV	36.5	31.7	7.2	34.1	-	41.3	53.9	12.6	
Hori	7311.000	AV	34.9	36.3	8.6	34.1	-	45.7	53.9	8.2	Floor noise
Hori	9748.000	AV	34.6	38.5	9.0	34.8	-	47.3	53.9	6.6	Floor noise
Vert	33.117	QP	23.6	16.5	6.8	28.2	-	18.7	40.0	21.3	
Vert	67.450	QP	28.0	6.5	7.1	28.1	-	13.5	40.0	26.5	
Vert	189.818	QP	27.1	16.3	8.1	27.5	-	24.0	43.5	19.5	
Vert	240.000	QP	21.9	12.4	8.4	27.2	-	15.5	46.0	30.5	
Vert	410.000	QP	22.1	15.8	9.5	27.8	-	19.6	46.0	26.4	
Vert	614.000	QP	22.1	19.0	10.1	27.9	-	23.3	46.0	22.7	
Vert	4874.000	PK	44.4	31.7	7.2	34.1	-	49.2	73.9	24.7	
Vert	7311.000	PK	43.2	36.3	8.6	34.1	-	54.0	73.9	19.9	Floor noise
Vert	9748.000	PK	42.8	38.5	9.0	34.8	-	55.5	73.9	18.4	Floor noise
Vert	4874.000	AV	35.7	31.7	7.2	34.1	-	40.5	53.9	13.4	
Vert	7311.000	AV	34.9	36.3	8.6	34.1	-	45.7	53.9	8.2	Floor noise
Vert	9748.000	AV	34.6	38.5	9.0	34.8	-	47.3	53.9	6.6	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 $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	11445682H	
Date	November 7, 2016	November 8, 2016
Temperature / Humidity	20 deg. C / 42 % RH	22 deg. C / 54 % RH
Engineer	Shinichi Miyazono	Shinichi Miyazono
	(1 GHz - 10 GHz)	(Above 10 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	63.4	27.7	5.1	34.7	-	61.5	73.9	12.4	
Hori	4924.000	PK	43.8	31.9	7.2	34.1	-	48.8	73.9	25.1	
Hori	7386.000	PK	42.6	36.4	8.5	34.1	-	53.4	73.9	20.5	Floor noise
Hori	9848.000	PK	43.4	38.5	9.0	34.9	-	56.0	73.9	17.9	Floor noise
Hori	2483.500	AV	48.1	27.7	5.1	34.7	-	46.2	53.9	7.7	
Hori	4924.000	AV	36.0	31.9	7.2	34.1	-	41.0	53.9	12.9	
Hori	7386.000	AV	34.8	36.4	8.5	34.1	-	45.6	53.9	8.3	Floor noise
Hori	9848.000	AV	35.0	38.5	9.0	34.9	-	47.6	53.9	6.3	Floor noise
Vert	2483.500	PK	65.1	27.7	5.1	34.7	-	63.2	73.9	10.7	
Vert	4924.000	PK	44.2	31.9	7.2	34.1	-	49.2	73.9	24.7	
Vert	7386.000	PK	42.6	36.4	8.5	34.1	-	53.4	73.9	20.5	Floor noise
Vert	9848.000	PK	43.4	38.5	9.0	34.9	-	56.0	73.9	17.9	Floor noise
Vert	2483.500	AV	49.8	27.7	5.1	34.7	-	47.9	53.9	6.0	
Vert	4924.000	AV	35.4	31.9	7.2	34.1	-	40.4	53.9	13.5	
Vert	7386.000	AV	34.8	36.4	8.5	34.1	-	45.6	53.9	8.3	Floor noise
Vert	9848.000	AV	35.0	38.5	9.0	34.9	-	47.6	53.9	6.3	Floor noise

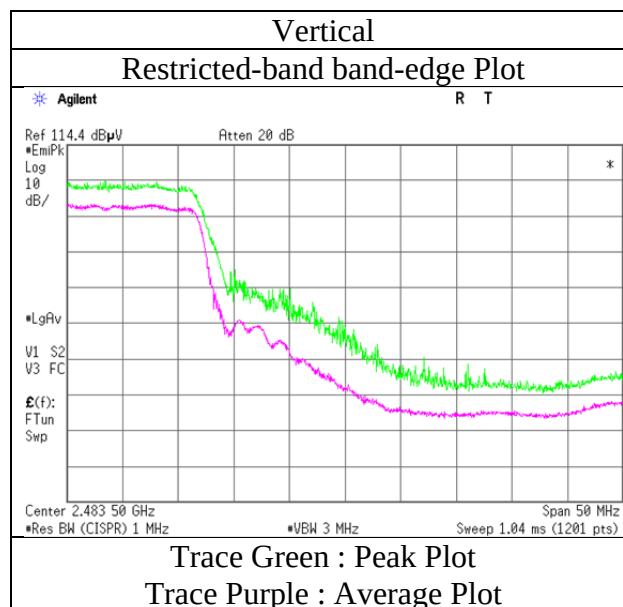
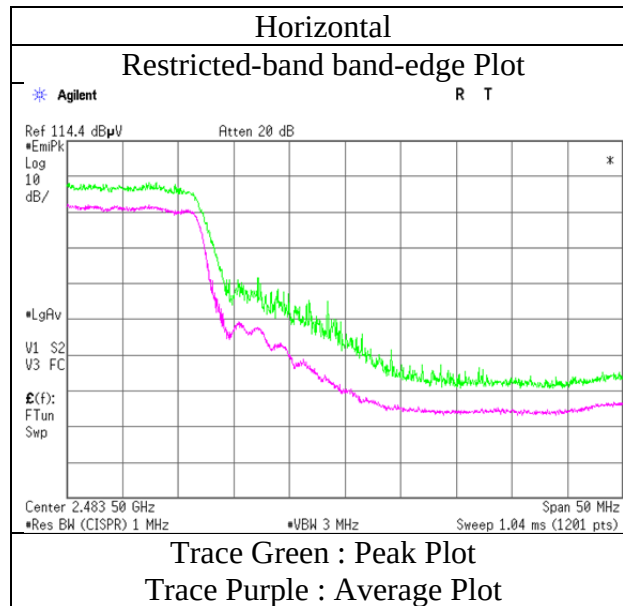
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*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 (3.75 m / 3.0 m) = 1.94 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11445682H
Date	November 7, 2016
Temperature / Humidity	20 deg. C / 42 % RH
Engineer	Shinichi Miyazono (1 GHz - 10 GHz)
Mode	Tx 11g 2462 MHz



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

Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11445682H
Date	November 7, 2016
Temperature / Humidity	20 deg. C / 42 % RH
Engineer	Shinichi Miyazono (Bandedge)
Mode	Tx 11n-20 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	63.8	27.6	5.0	34.8	-	61.6	73.9	12.3	
Hori	2390.000	AV	49.1	27.6	5.0	34.8	-	46.9	53.9	7.0	
Vert	2390.000	PK	64.7	27.6	5.0	34.8	-	62.5	73.9	11.4	
Vert	2390.000	AV	52.0	27.6	5.0	34.8	-	49.8	53.9	4.1	

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 (3.75 m / 3.0 m) = 1.94 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	94.8	27.6	5.1	34.7	92.8	-	-	Carrier
Hori	2400.000	PK	65.5	27.6	5.1	34.8	63.4	72.8	9.4	
Vert	2412.000	PK	95.9	27.6	5.1	34.7	93.9	-	-	Carrier
Vert	2400.000	PK	66.5	27.6	5.1	34.8	64.4	73.9	9.5	

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

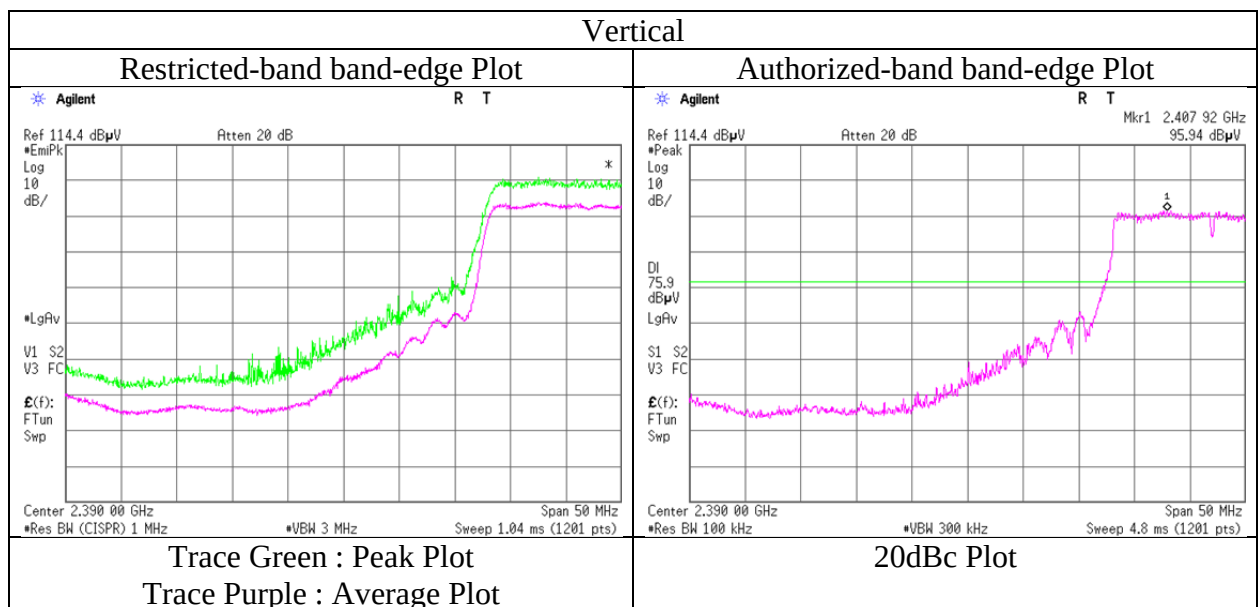
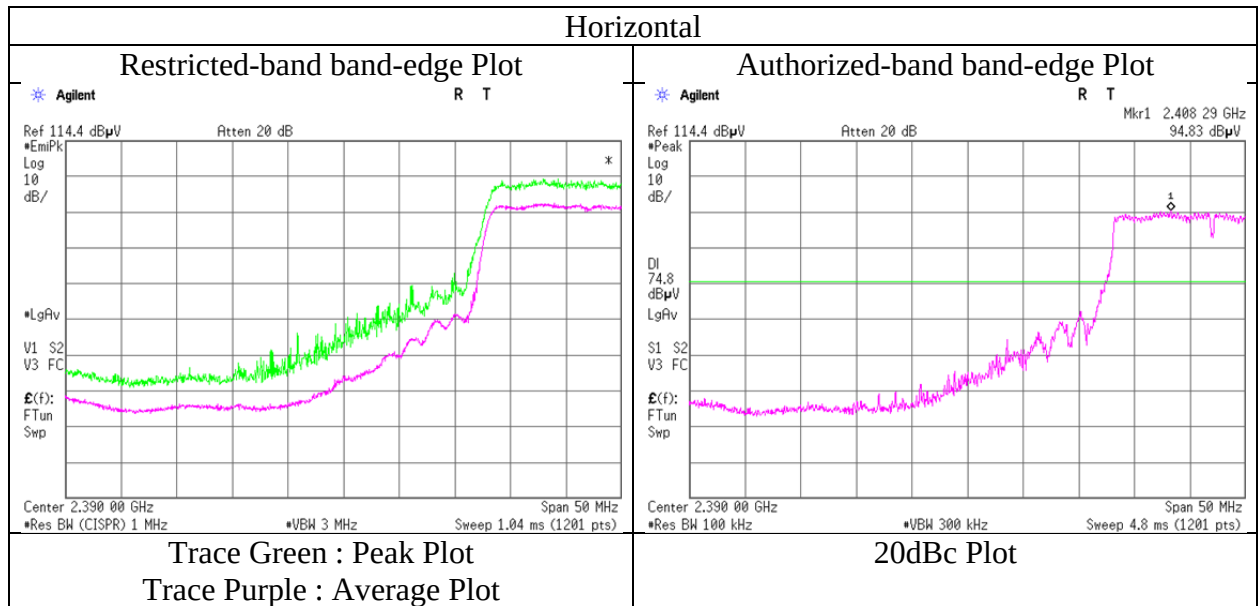
- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94dB

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11445682H
Date	November 7, 2016
Temperature / Humidity	20 deg. C / 42 % RH
Engineer	Shinichi Miyazono (Bandedge)
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.2 Semi Anechoic Chamber
Report No. 11445682H
Date November 7, 2016
Temperature / Humidity 20 deg. C / 42 % RH
Engineer Shinichi Miyazono
 (Bandedge)
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	60.7	27.7	5.1	34.7	-	58.8	73.9	15.1	
Hori	2483.500	AV	45.0	27.7	5.1	34.7	-	43.1	53.9	10.8	
Vert	2483.500	PK	62.6	27.7	5.1	34.7	-	60.7	73.9	13.2	
Vert	2483.500	AV	48.1	27.7	5.1	34.7	-	46.2	53.9	7.7	

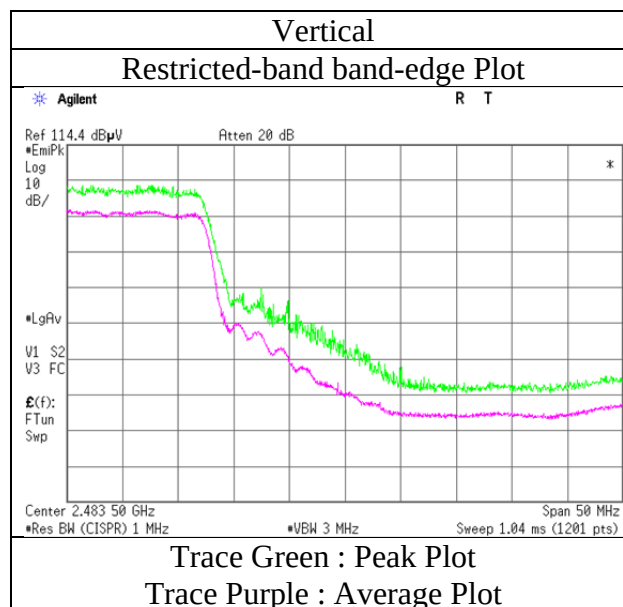
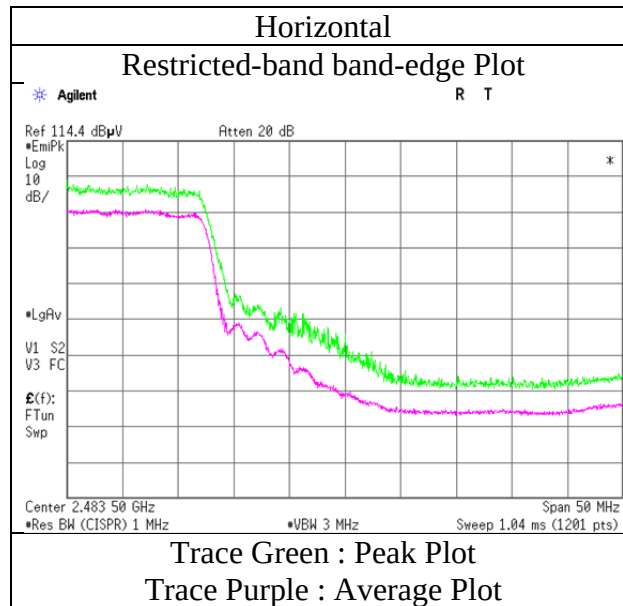
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11445682H
Date	November 7, 2016
Temperature / Humidity	20 deg. C / 42 % RH
Engineer	Shinichi Miyazono (Bandedge)
Mode	Tx 11n-20 2462 MHz



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

UL Japan, Inc.

Ise EMC Lab.

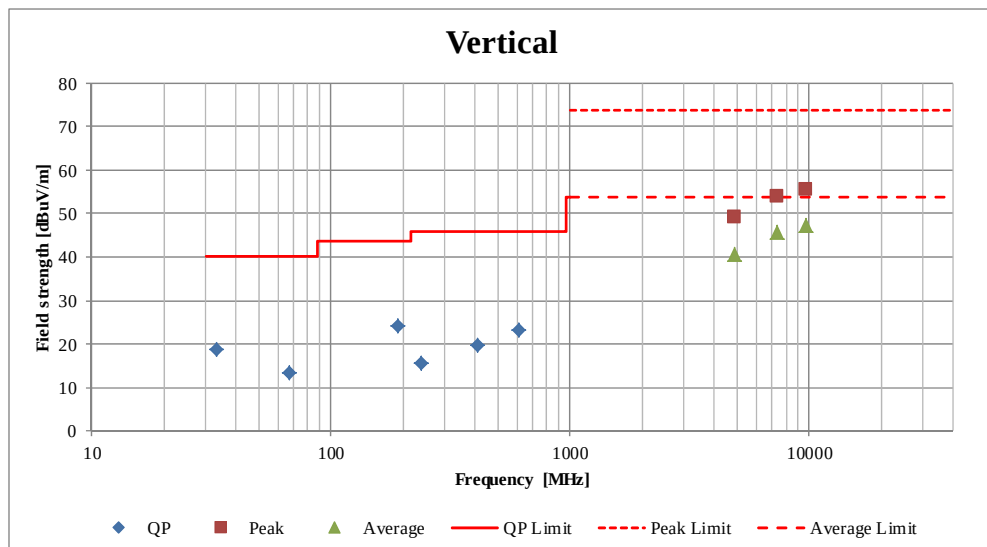
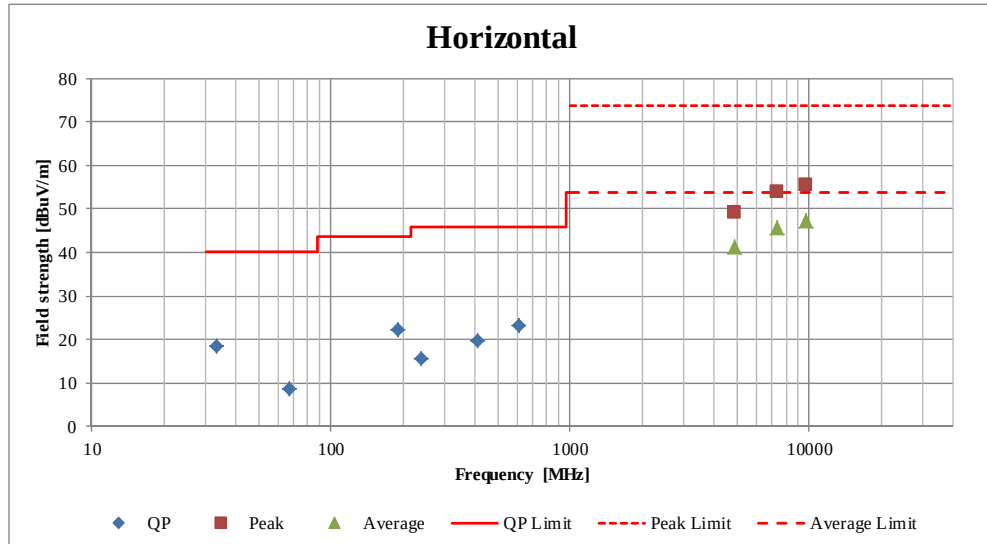
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

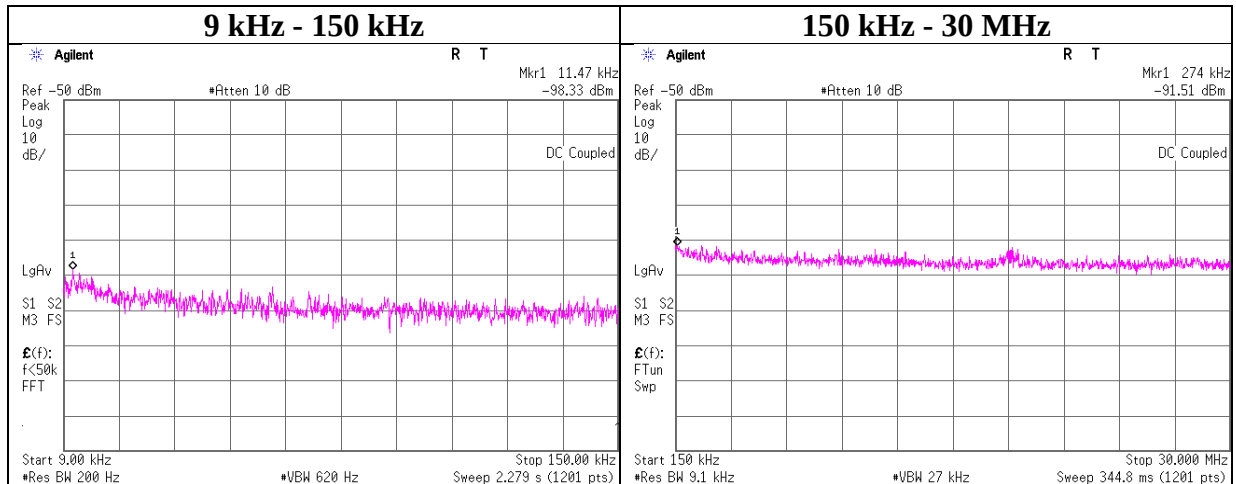
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	11445682H	
Date	November 7, 2016	November 8, 2016
Temperature / Humidity	20 deg. C / 42 % RH	22 deg. C / 54 % RH
Engineer	Shinichi Miyazono	Shinichi Miyazono
	(1 GHz - 10 GHz)	(Above 10 GHz, Below 1GHz)
Mode	Tx 11g 2437 MHz	



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

Conducted Spurious Emission

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11445682H
Date : November 7, 2016
Temperature / Humidity : 20 deg. C / 41 % RH
Engineer : Tomohisa Nakagawa
Mode : Tx 11g 2437 MHz



Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
11.47	-98.3	0.34	9.78	2.0	-86.2	300	6.0	-25.0	46.4	71.4	
274.00	-91.5	0.36	9.78	2.0	-79.4	300	6.0	-18.1	18.8	36.9	

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

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

N: Number of output

*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074.

Power Density

Test place Ise EMC Lab. No.7 Shielded Room
Report No. 11445682H
Date November 7, 2016
Temperature / Humidity 20 deg. C / 41 % RH
Engineer Tomohisa Nakagawa
Mode Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-27.58	0.34	9.78	-17.46	8.00	25.46
2437.00	-27.54	0.36	9.78	-17.40	8.00	25.40
2462.00	-27.91	0.34	9.78	-17.79	8.00	25.79

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-31.53	0.34	9.78	-21.41	8.00	29.41
2437.00	-31.24	0.36	9.78	-21.10	8.00	29.10
2462.00	-30.52	0.34	9.78	-20.40	8.00	28.40

11n-20

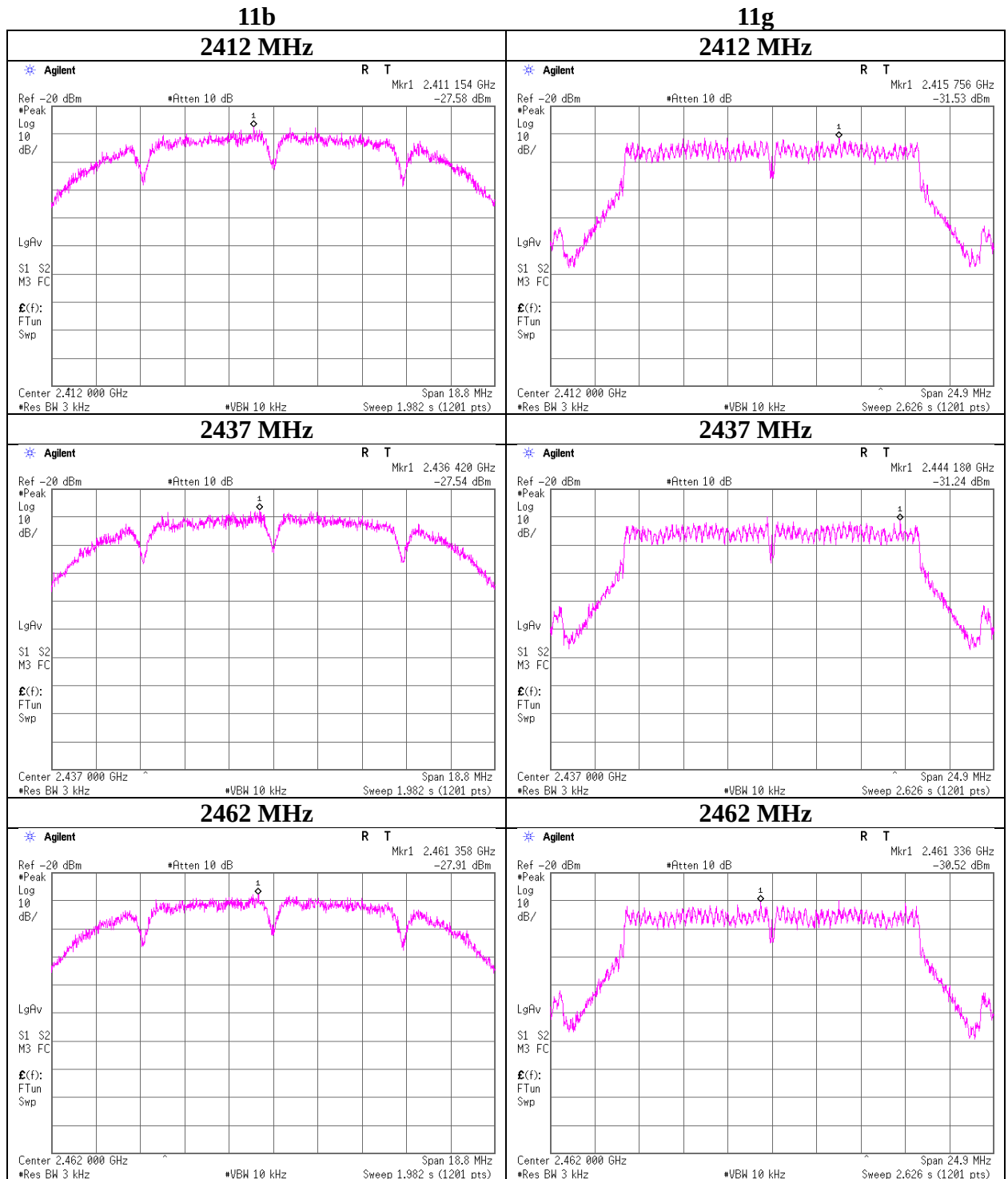
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-33.02	0.34	9.78	-22.90	8.00	30.90
2437.00	-32.26	0.36	9.78	-22.12	8.00	30.12
2462.00	-31.53	0.34	9.78	-21.41	8.00	29.41

Sample Calculation:

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

*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

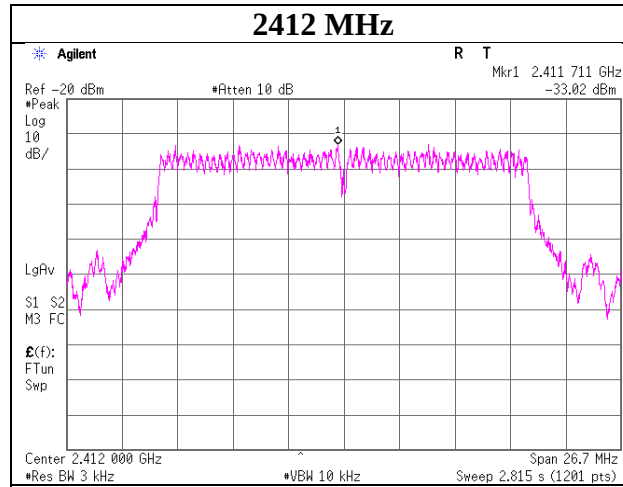
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

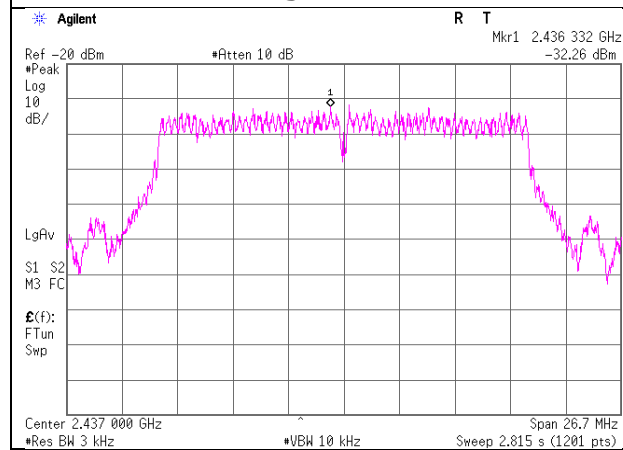
Power Density

11n-20

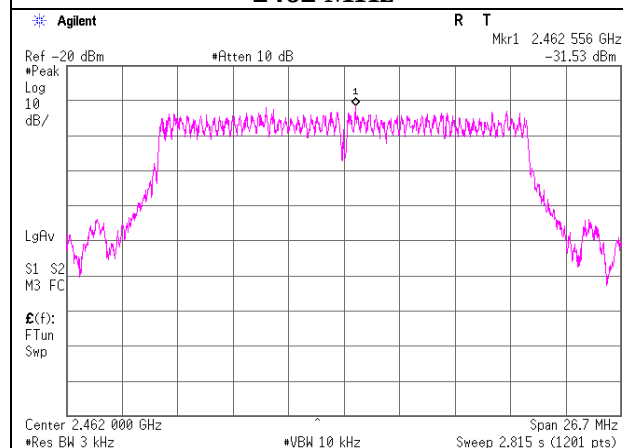
2412 MHz



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

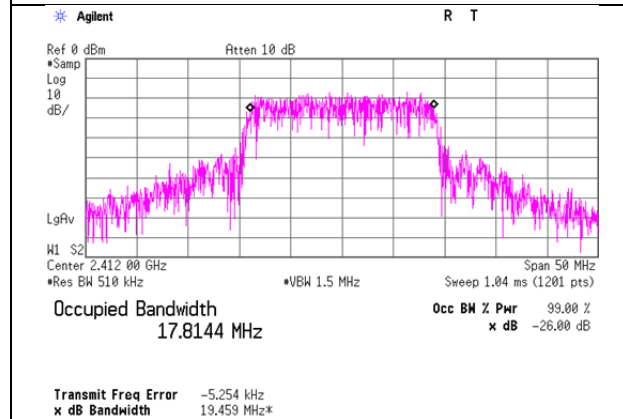
Facsimile : +81 596 24 8124

99% Occupied Bandwidth

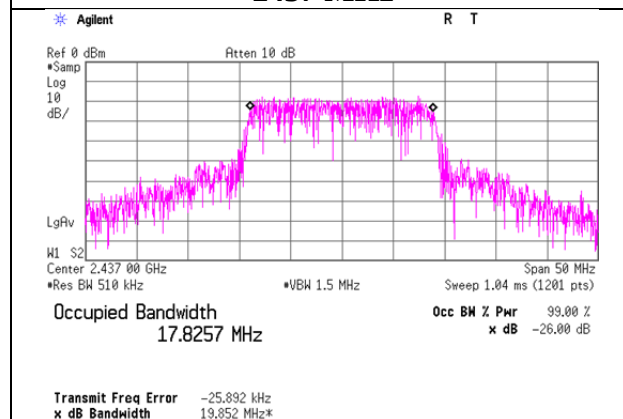
Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11445682H
Date : November 7, 2016
Temperature / Humidity : 20 deg. C / 41 % RH
Engineer : Tomohisa Nakagawa
Mode : Tx

11n-20

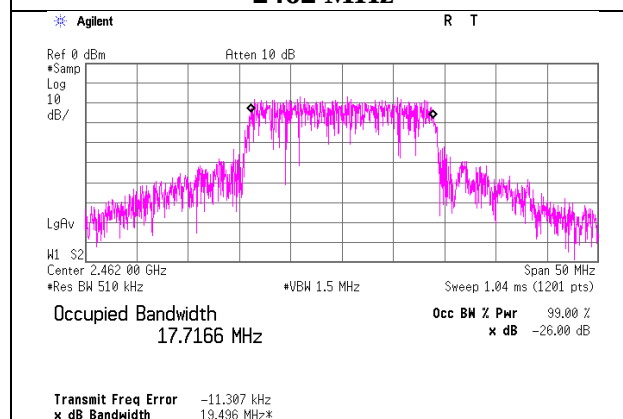
2412 MHz



2437 MHz



2462 MHz



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/20 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE/AT	2016/08/17 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2016/05/29 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2016/05/20 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2016/03/24 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2016/01/13 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2016/05/19 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2016/02/29 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2016/08/29 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2016/01/19 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2016/02/29 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2016/08/23 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2016/09/21 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2016/09/19 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2016/10/21 * 12
MBA-08	Biconical Antenna	Schwarzbeck	VHA9103B	08031	RE	2016/09/29 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2016/01/30 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2016/09/13 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2016/11/02 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2016/11/02 * 12
MAT-92	Attenuator	Weinschel Associates	WA56-10	56100308	AT	2016/06/09 * 12
MMM-16	DIGITAL HiTESTER	Hioki	3805	070900532	AT	2016/01/13 * 12
MOS-34	Thermo-Hygrometer	Custom	CTH-201	3401	AT	2016/01/21 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: RE: Radiated Emission test
AT: Antenna Terminal Conducted 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