



# RADIO TEST REPORT

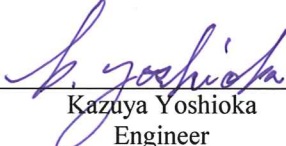
**Test Report No. : 11201778H-A**

**Applicant** : KEYENCE CORPORATION  
**Type of Equipment** : Handheld Mobile Computer  
**Model No.** : BT-W85GA  
**FCC ID** : RF41395B  
**Test regulation** : FCC Part 15 Subpart C: 2016  
\*WLAN Part  
**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:** April 13 to 26, 2016

**Representative test engineer:**

  
Kazuya Yoshioka  
Engineer  
Consumer Technology Division

**Approved by:**

  
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/](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



<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information.....</b>	<b>4</b>
<b>SECTION 2: Equipment under test (E.U.T.).....</b>	<b>4</b>
<b>SECTION 3: Test specification, procedures &amp; results.....</b>	<b>7</b>
<b>SECTION 4: Operation of E.U.T. during testing.....</b>	<b>10</b>
<b>SECTION 5: Conducted Emission.....</b>	<b>12</b>
<b>SECTION 6: Radiated Spurious Emission .....</b>	<b>13</b>
<b>SECTION 7: Antenna Terminal Conducted Tests.....</b>	<b>15</b>
<b>APPENDIX 1: Test data .....</b>	<b>16</b>
Conducted Emission .....	16
6dB Bandwidth .....	17
Maximum Peak Output Power .....	20
Radiated Spurious Emission .....	24
Conducted Spurious Emission .....	39
Power Density .....	40
99% Occupied Bandwidth .....	43
<b>APPENDIX 2: Test instruments .....</b>	<b>45</b>
<b>APPENDIX 3: Photographs of test setup .....</b>	<b>47</b>
Conducted Emission .....	47
Radiated Spurious Emission .....	48
Worst Case Position .....	49

## **SECTION 1: Customer information**

Company Name : KEYENCE CORPORATION  
Address : 1-3-14, Higashinakajima Higashiyodogawa-ku Osaka 533-8555 Japan  
Telephone Number : +81-6-6379-1111  
Facsimile Number : +81-6-6325-6818  
Contact Person : Tsuyoshi Aoyama

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

### **2.1 Identification of E.U.T.**

Type of Equipment : Handheld Mobile Computer  
Model No. : BT-W85GA  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 2.8 V – 4.2 V (Battery)  
                  DC 5.3 V (Cradle)  
Receipt Date of Sample : April 11, 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: BT-W85GA (referred to as the EUT in this report) is a Handheld Mobile Computer.

#### **General Specification**

Clock frequency(ies) in the system : 38.4 MHz (X'tal)  
Operating Temperature : -20 deg. C - +50 deg. C

**Radio Specification**

Radio Type : Transceiver  
Power Supply (inner) : DC 1.8 V / DC 3.3 V

	IEEE802.11b *1)	IEEE802.11g/n (20 M band) *1)	IEEE802.11a/n (20 M band)	IEEE802.11n (40 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5280 MHz - 5320 MHz 5500 MHz - 5580 MHz 5660 MHz - 5700 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5310 MHz 5510 MHz - 5550 MHz 5670 MHz 5755 MHz - 5795 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)	
Channel spacing	5MHz		20MHz	40MHz
Antenna type	Multilayer Monopole Antenna			
Antenna Connector type	Soldering			
Antenna Gain	2.1 dBi (2.4 GHz)		2.4 dBi (5 GHz)	

	Bluetooth Ver.2.1 with EDR function
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	FHSS (GFSK, $\pi/4$ -DQPSK, 8-DPSK)
Channel spacing	1 MHz
Antenna type	Multilayer Monopole Antenna
Antenna Connector type	Soldering
Antenna Gain	2.1 dBi

\*1) This test report applies to WLAN (2.4 GHz band) part.

\*Wireless LAN and Bluetooth do not transmit simultaneously.

**Variant model**

This model has a variant model: BT-W80GA.

BT-W80GA is a Laser-type handy scanner. BT-W85GA is a Camera-type handy scanner.

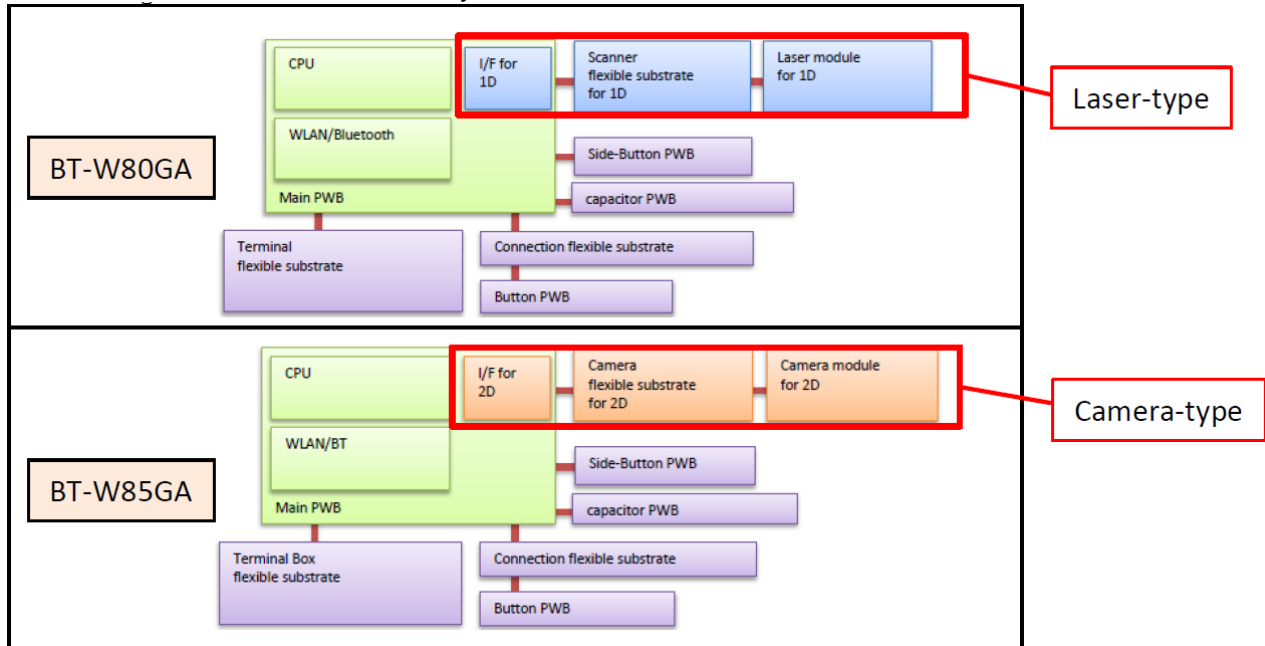
The schematic differences between BT-W80GA and BT-W85GA are the following diagrams.

Circuit design related with WLAN/Bluetooth is same between 2 models.

These difference cause no influence to radio specification.

There was no degradation of EMC characteristic.

Therefore we can consider them electrically identical.



## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC part 15 final revised on April 6, 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

### **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 19.3dB, 0.64659 MHz, L AV 15.1 dB, 0.64659 MHz, L	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	2.0 dB 4924.00 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 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 4.2 V) and the EUT constantly provides the stable voltage 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	1.7 dB	2.8 dB	2.8 dB	2.9 dB	

Frequency range	Conducted emission using AMN(LISN) (+dB)
0.009 - 0.15MHz	3.5 dB
0.15 - 30MHz	2.9 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+dB)		(10 m*)(+dB)	
	30 - 200 MHz	200 - 1000MHz	30 - 200 MHz	200 - 1000MHz
Horizontal	4.9 dB	5.2 dB	4.9 dB	5.0 dB
Vertical	4.6 dB	5.9 dB	5.0 dB	5.0 dB

Radiated emission				
	(3 m*)(+dB)	(1 m*)(+dB)	(0.5 m*)(+dB)	(10 m*)(+dB)
1 - 6GHz	6 - 18GHz	10 - 26.5 GHz	26.5 - 40GHz	1 - 18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 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.



### 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)**

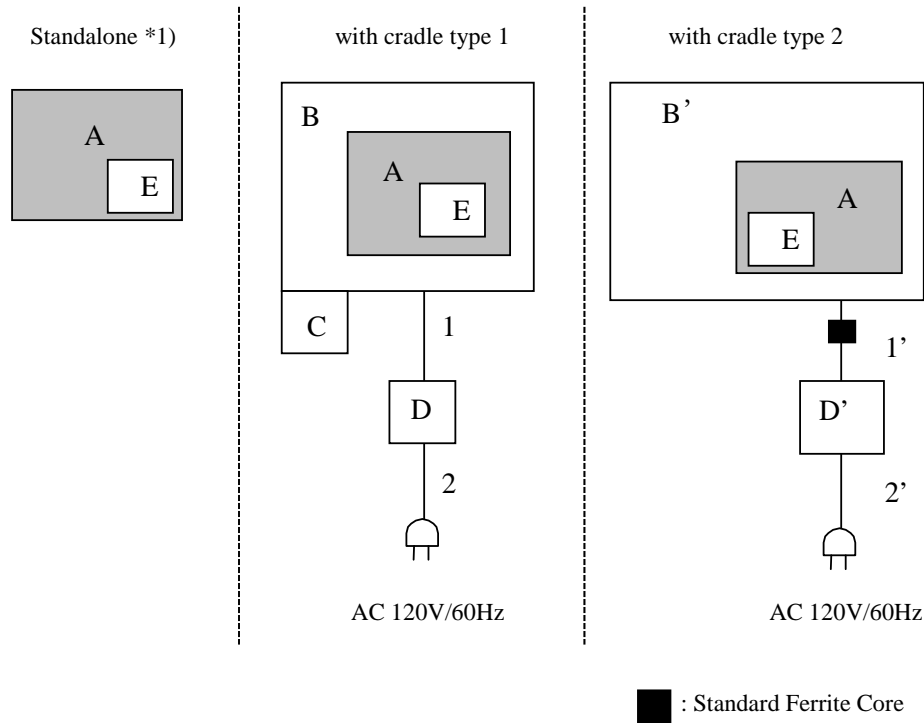
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	24 Mbps, PN9
IEEE 802.11n SISO 20 MHz 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 settings: 13 dBm Software: calibrateG  *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)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Conducted Emission, Radiated Spurious Emission (Below 1 GHz), Conducted Spurious Emission	11g Tx *1)	2412 MHz
Radiated Spurious Emission (Above 1 GHz)	11b Tx	2412 MHz
	11g Tx *2)	2437 MHz 2462 MHz
	11n-20 Tx *3)	2412 MHz 2462 MHz
6dB Bandwidth, Maximum Peak Output Power, Power Density, 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power *3) Only band edge test was tested on this mode, because the 11g Tx mode had the higher power at antenna terminal test.		

## 4.2 Configuration and peripherals



\* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.  
\*1) Antenna terminal conducted tests were performed only with this condition.

### Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Handheld Mobile Computer	BT-W85GA	#2A610012 *1) #2A610011 *2)	KEYENCE CORPORATION	EUT
B	Cradle	BT-WCU8UGA	#2A610633	KEYENCE CORPORATION	*3)
B'	Cradle	BT-WCU84GA	-	KEYENCE CORPORATION	-
C	USB Memory	OP-87502	-	KEYENCE CORPORATION	-
D	AC Adaptor	OP-88020	-	KEYENCE CORPORATION	-
D'	AC Adaptor	SEE60N2-16-0	ES057	Sanken Electric Co., Ltd.	-
E	Micro SD	MMAUR02G3AC A-MP	A299220077	Transcend	-

\*1) Used for antenna terminal conducted tests  
\*2) Used for all tests except for Antenna terminal conducted tests  
\*3) Used for Conducted emission test as a representative

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.8	Unshielded	Unshielded	-
1'	DC Cable	1.3	Unshielded	Unshielded	-
2	AC Cable	2.0	Unshielded	Unshielded	-
2'	AC Cable	2.0	Unshielded	Unshielded	-

**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, 0.5 m by 1.0 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 v03r05".

[For below 1GHz]

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 1GHz]

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: <u>12.2.5.1</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces	RBW: 100 kHz VBW: 300kHz
Test Distance	3m	4.5 m *1) (1 GHz – 10GHz), 1 m *2) (10 GHz – 26.5 GHz)		4.5 m *1) (1 GHz – 10GHz), 1 m *2) (10 GHz – 26.5 GHz)

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

\*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, EUT on the cradle Type1 and Type2 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 M - 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.

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
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 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**

**Conducted Emission**

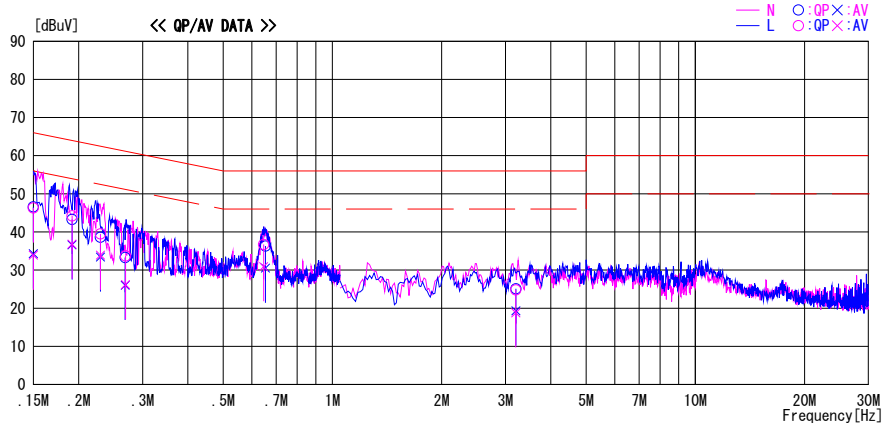
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber  
Date : 04/15/2016

Report No. : 11201778H  
Temp./Humi. : 23deg. C / 43% RH  
Engineer : Hiroyuki Furutaka

Mode / Remarks : WLAN 11g 24Mbps 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	33.4	21.1	13.2	46.6	34.3	66.0	56.0	19.4	21.7	N	
0.19174	30.1	23.4	13.2	43.3	36.6	64.0	54.0	20.7	17.4	N	
0.22957	25.3	20.1	13.3	38.6	33.4	62.5	52.5	23.9	19.1	N	
0.26854	20.0	12.7	13.3	33.3	26.0	61.2	51.2	27.9	25.2	N	
0.65400	22.9	17.1	13.4	36.3	30.5	56.0	46.0	19.7	15.5	N	
3.20300	11.3	5.5	13.8	25.1	19.3	56.0	46.0	30.9	26.7	N	
0.15000	33.1	20.7	13.2	46.3	33.9	66.0	56.0	19.7	22.1	L	
0.19175	31.0	23.6	13.2	44.2	36.8	64.0	54.0	19.8	17.2	L	
0.22956	26.2	20.6	13.3	39.5	33.9	62.5	52.5	23.0	18.6	L	
0.26923	20.4	12.9	13.3	33.7	26.2	61.1	51.1	27.4	24.9	L	
0.64659	23.3	17.5	13.4	36.7	30.9	56.0	46.0	19.3	15.1	L	
3.20100	11.0	5.0	13.8	24.8	18.8	56.0	46.0	31.2	27.2	L	

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

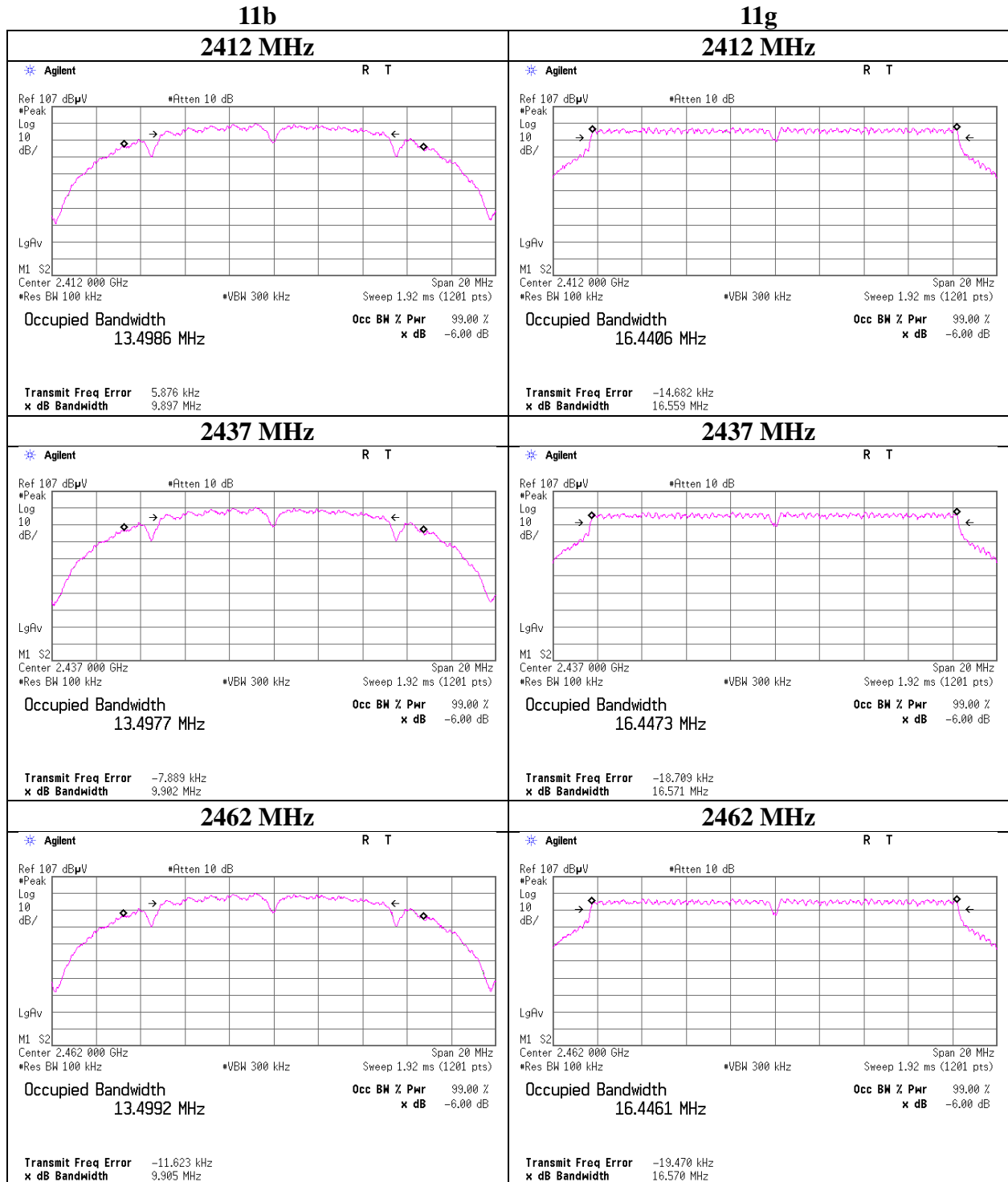


### 6dB Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room  
Report No. 11201778H  
Date April 14, 2016  
Temperature / Humidity 26 deg. C / 51 % RH  
Engineer Takafumi Noguchi  
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	9.897	> 500
	2437	9.902	> 500
	2462	9.905	> 500
11g	2412	16.559	> 500
	2437	16.571	> 500
	2462	16.570	> 500
11n-20	2412	17.816	> 500
	2437	17.807	> 500
	2462	17.832	> 500

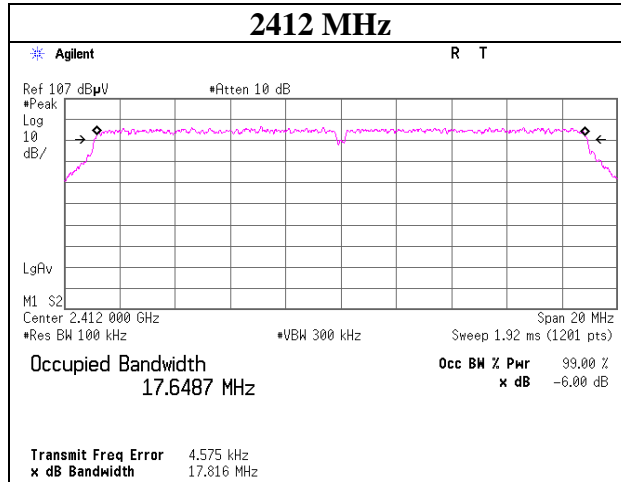
**6dB Bandwidth**



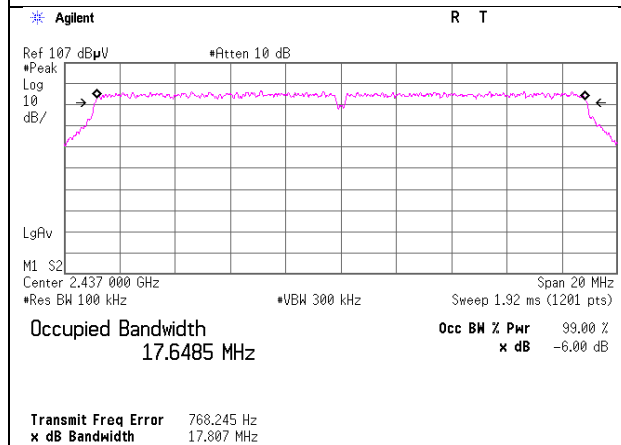
## 6dB Bandwidth

**11n-20**

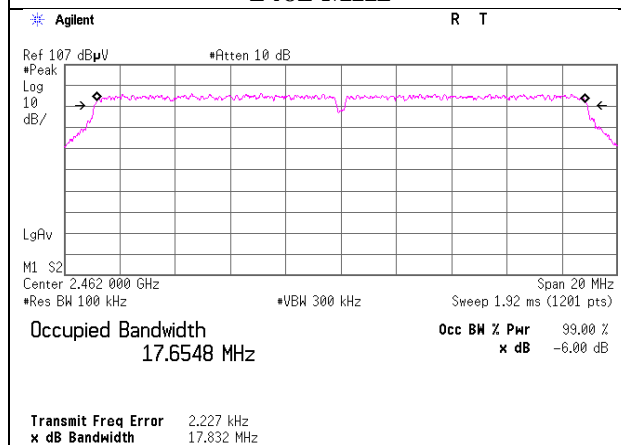
**2412 MHz**



**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.6 Measurement Room
Report No.	11201778H
Date	April 13, 2016
Temperature / Humidity	25 deg. C / 45% RH
Engineer	Masafumi Niwa
Mode	Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	2.82	1.89	10.03	14.74	29.79	30.00	1000	15.26
2437	2.97	1.91	10.03	14.91	30.97	30.00	1000	15.09
2462	2.71	1.91	10.03	14.65	29.17	30.00	1000	15.35

Sample Calculation:

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	2.94	
2	2.95	*
5.5	2.01	
11	2.77	

\*: Worst Rate

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

## Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11201778H
Date	April 13, 2016
Temperature / Humidity	25 deg. C / 45% RH
Engineer	Masafumi Niwa
Mode	Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	9.99	1.89	10.03	21.91	155.24	30.00	1000	8.09
2437	9.63	1.91	10.03	21.57	143.55	30.00	1000	8.43
2462	9.81	1.91	10.03	21.75	149.62	30.00	1000	8.25

Sample Calculation:

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

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	9.05	
9	8.63	
12	8.89	
18	8.75	
24	9.55	*
36	8.76	
48	8.95	
54	9.12	

\*: Worst Rate

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

### Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11201778H
Date	April 13, 2016
Temperature / Humidity	25 deg. C / 45% RH
Engineer	Masafumi Niwa
Mode	Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	8.79	1.89	10.03	20.71	117.76	30.00	1000	9.29
2437	8.53	1.91	10.03	20.47	111.43	30.00	1000	9.53
2462	8.54	1.91	10.03	20.48	111.69	30.00	1000	9.52

Sample Calculation:

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

2437 MHz

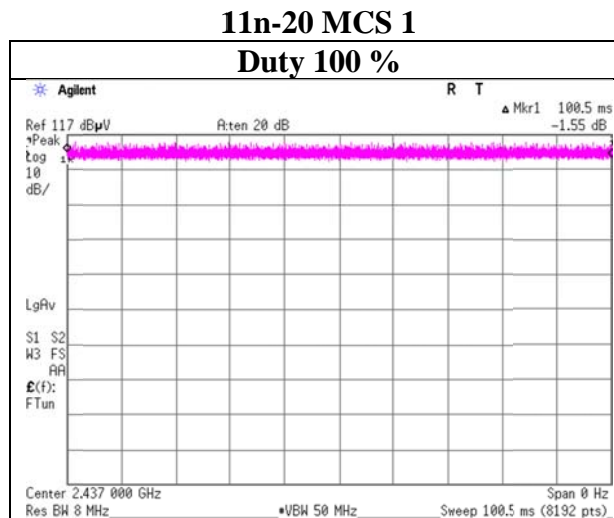
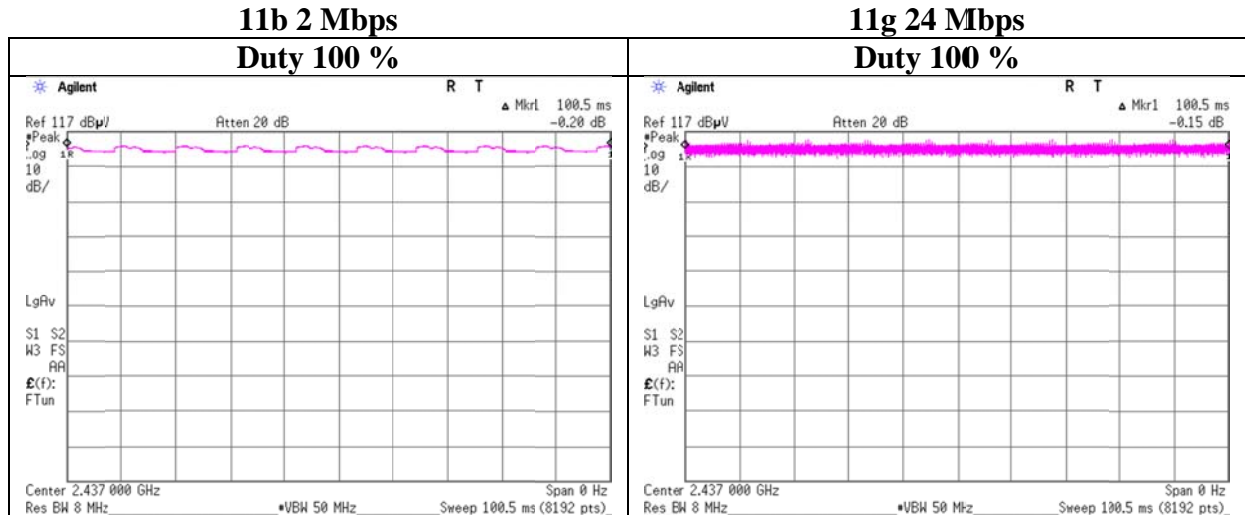
MCS Number	Reading [dBm]	Remark
0	8.55	
1	8.62	*
2	8.38	
3	8.35	
4	8.52	
5	8.42	
6	8.33	
7	8.26	

\* Worst MCS

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

**Burst rate confirmation**

Test place : Ise EMC Lab. No.6 Measurement Room  
 Report No. : 11201778H  
 Date : April 14, 2016  
 Temperature / Humidity : 26 deg. C / 51 % RH  
 Engineer : Takafumi Noguchi  
 Mode : Tx



## Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11201778H  
Date April 13, 2016 April 21, 2016 April 26, 2016  
Temperature / Humidity 23deg. C / 54 % RH 22 deg. C / 55 % RH 24 deg. C / 51 % RH  
Engineer Kazuya Yoshioka Kazuya Yoshioka Takafumi Noguchi  
(1 GHz - 10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz)  
Mode Tx 11b 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	43.1	27.9	6.8	32.1	45.7	73.9	28.2	
Hori	4824.000	PK	43.2	32.9	9.2	31.3	54.0	73.9	19.9	
Hori	7236.000	PK	41.4	36.8	10.4	32.6	56.0	73.9	17.9	Floor noise
Hori	9648.000	PK	41.4	38.1	9.7	32.6	56.6	73.9	17.3	Floor noise
Hori	2390.000	AV	34.8	27.9	6.8	32.1	37.4	53.9	16.5	
Hori	4824.000	AV	37.5	32.9	9.2	31.3	48.3	53.9	5.6	
Hori	7236.000	AV	29.9	36.8	10.4	32.6	44.5	53.9	9.4	Floor noise
Hori	9648.000	AV	31.1	38.1	9.7	32.6	46.3	53.9	7.6	Floor noise
Vert	2390.000	PK	43.1	27.9	6.8	32.1	45.7	73.9	28.2	
Vert	4824.000	PK	43.0	32.9	9.2	31.3	53.8	73.9	20.1	
Vert	7236.000	PK	41.2	36.8	10.4	32.6	55.8	73.9	18.1	Floor noise
Vert	9648.000	PK	41.7	38.1	9.7	32.6	56.9	73.9	17.0	Floor noise
Vert	2390.000	AV	33.6	27.9	6.8	32.1	36.2	53.9	17.7	
Vert	4824.000	AV	37.5	32.9	9.2	31.3	48.3	53.9	5.6	
Vert	7236.000	AV	29.9	36.8	10.4	32.6	44.5	53.9	9.4	Floor noise
Vert	9648.000	AV	31.1	38.1	9.7	32.6	46.3	53.9	7.6	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  $20\log(4.5\text{m} / 3.0\text{m}) = 3.53\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{m} / 3.0\text{m}) = -9.5\text{ dB}$

### 20dBc Data Sheet

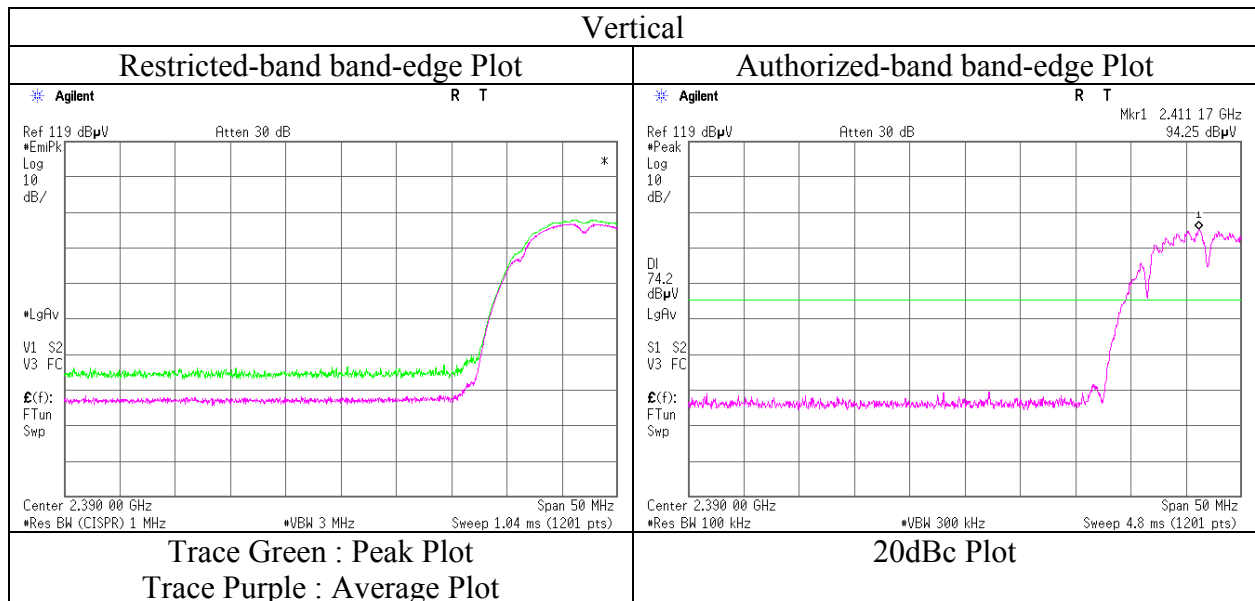
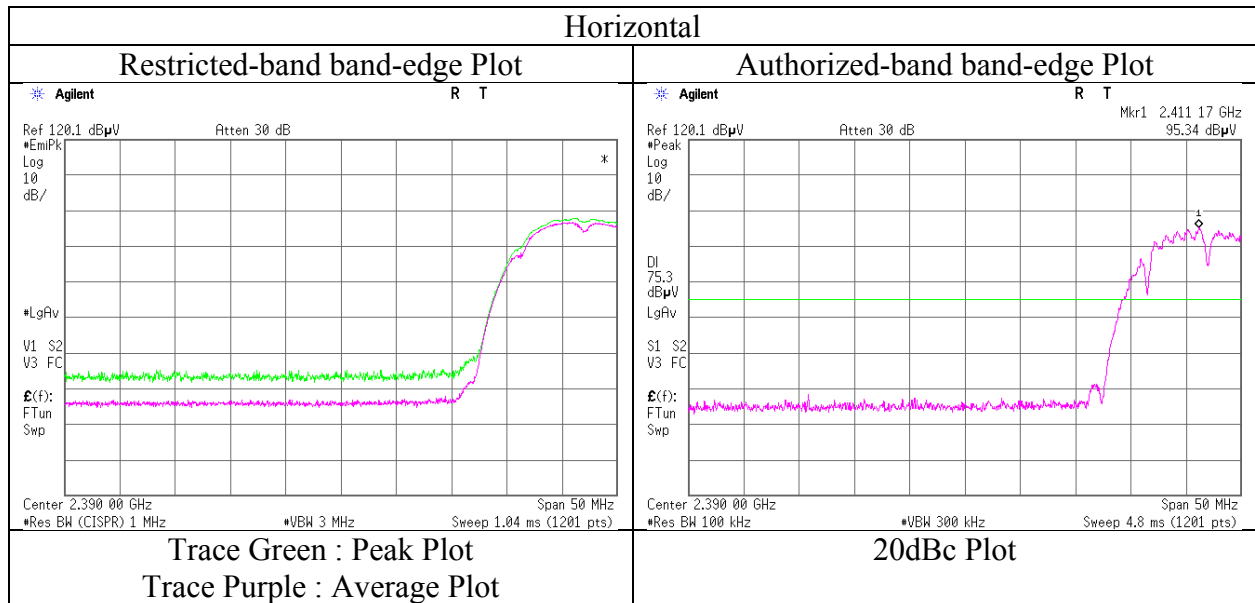
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	95.3	28.0	6.8	32.1	98.0	-	-	Carrier
Hori	2400.000	PK	39.5	28.0	6.8	32.1	42.2	78.0	35.8	
Vert	2412.000	PK	94.3	28.0	6.8	32.1	97.0	-	-	Carrier
Vert	2400.000	PK	37.7	28.0	6.8	32.1	40.4	77.0	36.6	

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.4 Semi Anechoic Chamber
Report No.	11201778H
Date	April 13, 2016
Temperature / Humidity	23deg. C / 54 % RH
Engineer	Kazuya Yoshioka
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.4 Semi Anechoic Chamber		
Report No.	11201778H		
Date	April 14, 2016	April 21, 2016	April 26, 2016
Temperature / Humidity	23 deg. C / 60 % RH	22 deg. C / 55 % RH	24 deg. C / 51 % RH
Engineer	Shinichi Miyazono (1 GHz - 10 GHz)	Kazuya Yoshioka (10 GHz - 18 GHz)	Takafumi Noguchi (18 GHz - 26.5 GHz)
Mode	Tx 11b 2437 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	43.9	33.1	9.2	31.3	54.9	73.9	19.0	
Hori	7311.000	PK	41.2	36.8	9.1	32.6	54.5	73.9	19.4	Floor Noise
Hori	9748.000	PK	41.9	38.2	9.7	32.7	57.1	73.9	16.8	Floor Noise
Hori	4874.000	AV	38.2	33.1	9.2	31.3	49.2	53.9	4.7	
Hori	7311.000	AV	32.0	36.8	9.1	32.6	45.3	53.9	8.6	Floor Noise
Hori	9748.000	AV	32.6	38.2	9.7	32.7	47.8	53.9	6.1	Floor Noise
Vert	4874.000	PK	44.9	33.1	9.2	31.3	55.9	73.9	18.0	
Vert	7311.000	PK	41.1	36.8	9.1	32.6	54.4	73.9	19.5	Floor Noise
Vert	9748.000	PK	41.8	38.2	9.7	32.7	57.0	73.9	16.9	Floor Noise
Vert	4874.000	AV	39.3	33.1	9.2	31.3	50.3	53.9	3.6	
Vert	7311.000	AV	31.9	36.8	9.1	32.6	45.2	53.9	8.7	Floor Noise
Vert	9748.000	AV	32.5	38.2	9.7	32.7	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 (4.5 m / 3.0 m) = 3.53 dB  
                           10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

## Radiated Spurious Emission

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber		
Report No.	11201778H		
Date	April 14, 2016	April 21, 2016	April 26, 2016
Temperature / Humidity	23 deg. C / 60 % RH	22 deg. C / 55 % RH	24 deg. C / 51 % RH
Engineer	Shinichi Miyazono (1 GHz - 10 GHz)	Kazuya Yoshioka (10 GHz - 18 GHz)	Takafumi Noguchi (18 GHz - 26.5 GHz)
Mode	Tx 11b 2462 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	42.5	28.1	6.9	32.1	45.4	73.9	28.5	
Hori	4924.000	PK	44.9	33.3	9.3	31.3	56.2	73.9	17.7	
Hori	7386.000	PK	41.8	36.8	9.1	32.6	55.1	73.9	18.8	Floor Noise
Hori	9848.000	PK	41.7	38.2	9.6	32.7	56.8	73.9	17.1	Floor Noise
Hori	2483.500	AV	34.8	28.1	6.9	32.1	37.7	53.9	16.2	
Hori	4924.000	AV	38.5	33.3	9.3	31.3	49.8	53.9	4.1	
Hori	7386.000	AV	30.3	36.8	9.1	32.6	43.6	53.9	10.3	Floor Noise
Hori	9848.000	AV	31.7	38.2	9.6	32.7	46.8	53.9	7.1	Floor Noise
Vert	2483.500	PK	43.5	28.1	6.9	32.1	46.4	73.9	27.5	
Vert	4924.000	PK	46.3	33.3	9.3	31.3	57.6	73.9	16.3	
Vert	7386.000	PK	41.9	36.8	9.1	32.6	55.2	73.9	18.7	Floor Noise
Vert	9848.000	PK	41.9	38.2	9.6	32.7	57.0	73.9	16.9	Floor Noise
Vert	2483.500	AV	35.1	28.1	6.9	32.1	38.0	53.9	15.9	
Vert	4924.000	AV	40.6	33.3	9.3	31.3	51.9	53.9	2.0	
Vert	7386.000	AV	30.4	36.8	9.1	32.6	43.7	53.9	10.2	Floor Noise
Vert	9848.000	AV	31.8	38.2	9.6	32.7	46.9	53.9	7.0	Floor Noise

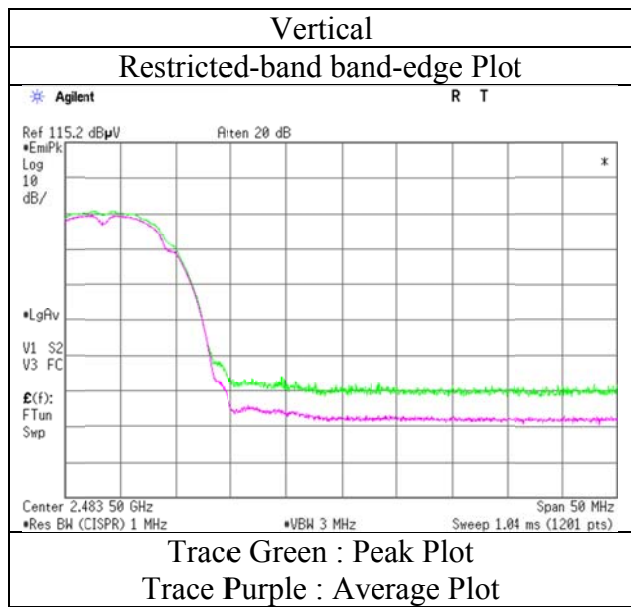
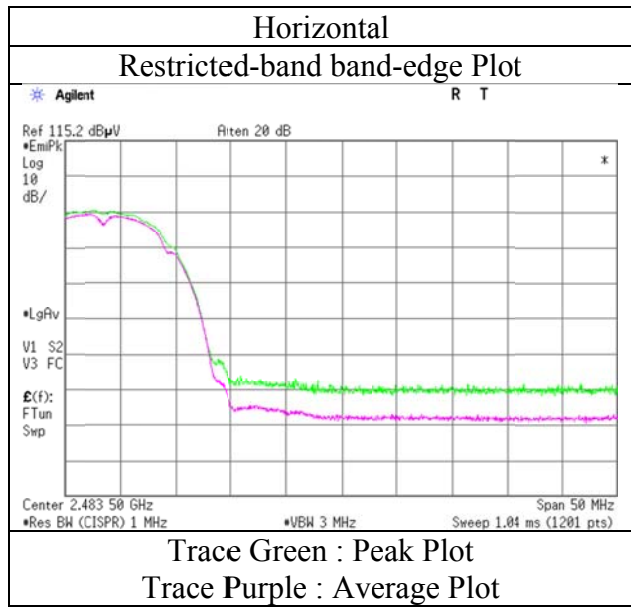
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*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

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11201778H
Date	April 14, 2016
Temperature / Humidity	23 deg. C / 60 % RH
Engineer	Shinichi Miyazono
	(1 GHz - 10 GHz)
Mode	Tx 11b 2462 MHz



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

## Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11201778H  
Date April 14, 2016 April 21, 2016 April 23, 2016 April 26, 2016  
Temperature / Humidity 23 deg. C / 60 % RH 22 deg. C / 55 % RH 22 deg. C / 51 % RH 24 deg. C / 51 % RH  
Engineer Shinichi Miyazono Kazuya Yoshioka Koji Yamamoto Takafumi Noguchi  
(1 GHz - 10 GHz) (10 GHz - 18 GHz) (Below 1 GHz) (18 GHz - 26.5 GHz)  
Mode Tx 11g 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	168.629	QP	43.7	15.6	8.8	32.0	36.1	43.5	7.4	
Hori	173.380	QP	44.7	15.8	8.9	32.0	37.4	43.5	6.1	
Hori	175.751	QP	42.8	15.9	8.9	32.0	35.6	43.5	7.9	
Hori	256.489	QP	41.9	12.5	9.6	31.9	32.1	46.0	13.9	
Hori	299.198	QP	43.5	13.4	9.9	31.8	35.0	46.0	11.0	
Hori	798.000	QP	34.3	20.7	12.8	31.6	36.2	46.0	9.8	
Hori	2390.000	PK	54.8	27.9	6.8	32.1	57.4	73.9	16.5	
Hori	4824.000	PK	41.3	32.9	9.2	31.3	52.1	73.9	21.8	Floor noise
Hori	7236.000	PK	43.0	36.8	9.1	32.6	56.3	73.9	17.6	Floor noise
Hori	9648.000	PK	43.4	38.1	9.7	32.6	58.6	73.9	15.3	Floor noise
Hori	2390.000	AV	45.5	27.9	6.8	32.1	48.1	53.9	5.8	
Hori	4824.000	AV	31.4	32.9	9.2	31.3	42.2	53.9	11.7	Floor noise
Hori	7236.000	AV	30.8	36.8	9.1	32.6	44.1	53.9	9.8	Floor noise
Hori	9648.000	AV	31.8	38.1	9.7	32.6	47.0	53.9	6.9	Floor noise
Vert	74.293	QP	50.5	6.3	7.8	32.1	32.5	40.0	7.5	
Vert	173.302	QP	41.2	15.8	8.9	32.0	33.9	43.5	9.6	
Vert	175.755	QP	39.0	15.9	8.9	32.0	31.8	43.5	11.7	
Vert	242.249	QP	45.0	12.2	9.5	31.9	34.8	46.0	11.2	
Vert	318.251	QP	39.1	13.9	10.0	31.9	31.1	46.0	14.9	
Vert	798.039	QP	35.9	20.7	12.8	31.6	37.8	46.0	8.2	
Vert	2390.000	PK	53.9	27.9	6.8	32.1	56.5	73.9	17.4	
Vert	4824.000	PK	41.2	32.9	9.2	31.3	52.0	73.9	21.9	Floor noise
Vert	7236.000	PK	43.0	36.8	9.1	32.6	56.3	73.9	17.6	Floor noise
Vert	9648.000	PK	43.4	38.1	9.7	32.6	58.6	73.9	15.3	Floor noise
Vert	2390.000	AV	44.9	27.9	6.8	32.1	47.5	53.9	6.4	
Vert	4824.000	AV	31.3	32.9	9.2	31.3	42.1	53.9	11.8	Floor noise
Vert	7236.000	AV	30.7	36.8	9.1	32.6	44.0	53.9	9.9	Floor noise
Vert	9648.000	AV	31.7	38.1	9.7	32.6	46.9	53.9	7.0	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  $20\log(1.0\text{m} / 3.0\text{m}) = -9.5\text{ dB}$

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	93.6	28.0	6.8	32.1	96.3	-	-	Carrier
Hori	2400.000	PK	53.4	28.0	6.8	32.1	56.1	76.3	20.2	
Vert	2412.000	PK	92.8	28.0	6.8	32.1	95.5	-	-	Carrier
Vert	2400.000	PK	53.4	28.0	6.8	32.1	56.1	75.5	19.4	

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

**UL Japan, Inc.**

**Ise EMC Lab.**

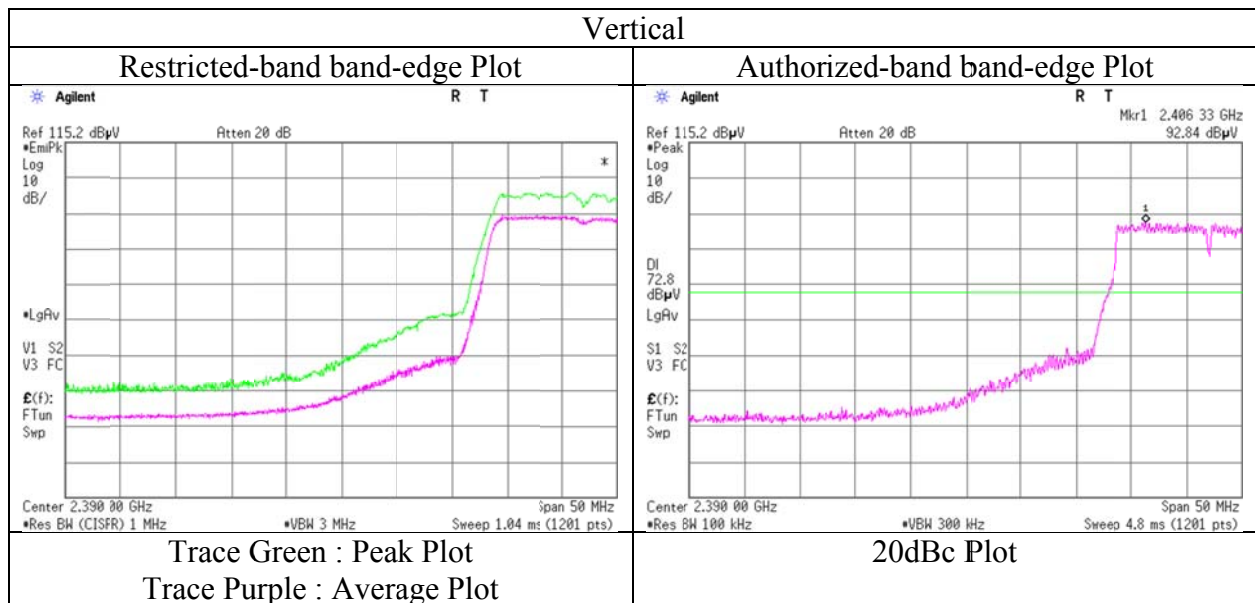
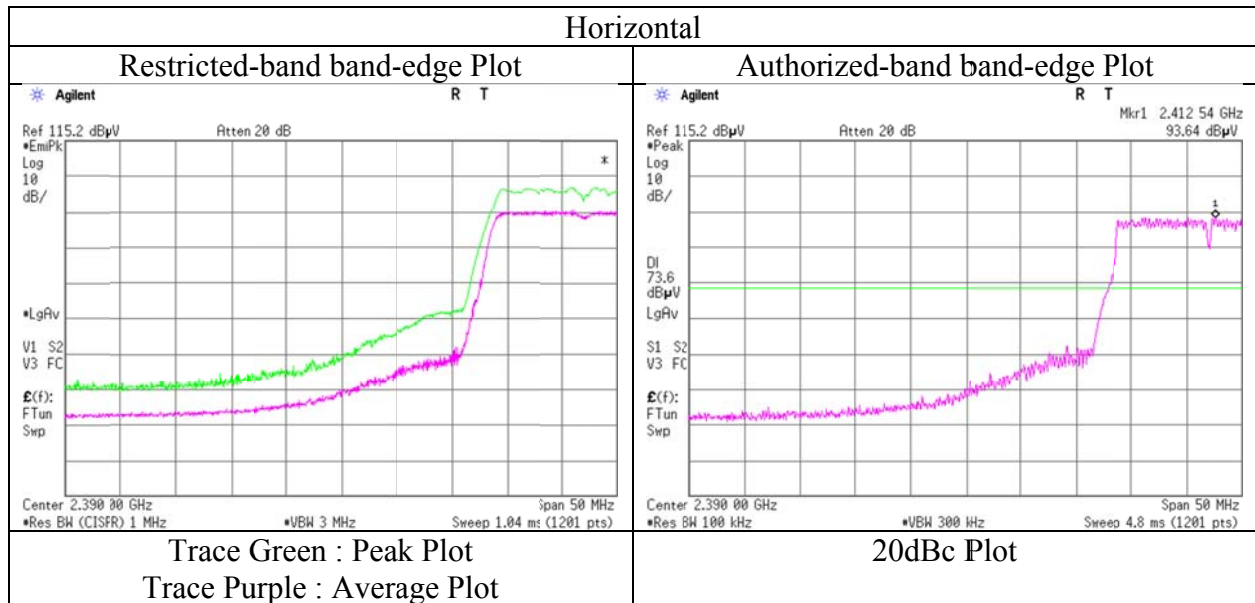
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

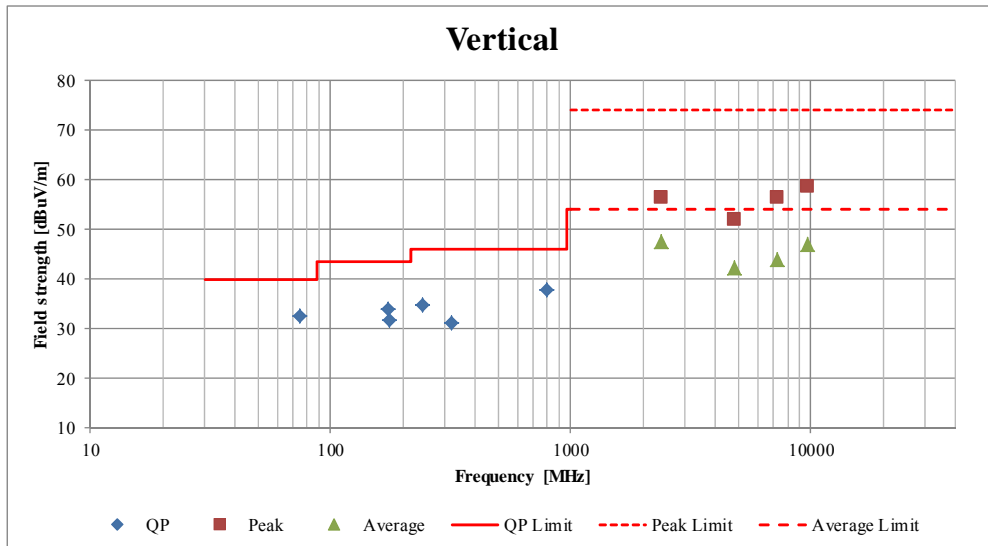
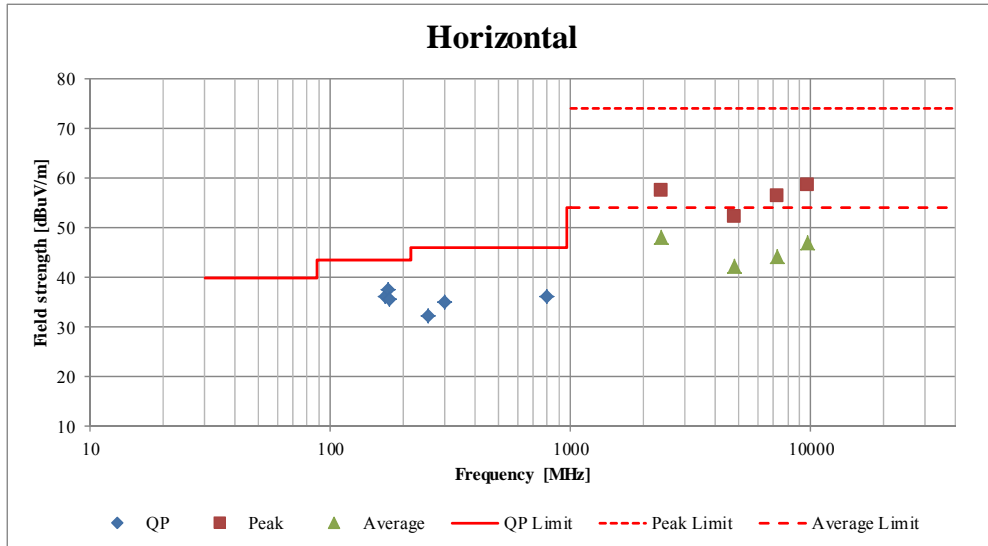
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11201778H
Date	April 14, 2016
Temperature / Humidity	23 deg. C / 60 % RH
Engineer	Shinichi Miyazono (1 GHz – 10 GHz)
Mode	Tx 11g 2412 MHz



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

**Radiated Spurious Emission**  
**(Plot data, Worst case)**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber			
Report No.	11201778H			
Date	April 14, 2016	April 21, 2016	April 23, 2016	April 26, 2016
Temperature / Humidity	23 deg. C / 60 % RH	22 deg. C / 55 % RH	22 deg. C / 51 % RH	24 deg. C / 51 % RH
Engineer	Shinichi Miyazono (1 GHz - 10 GHz)	Kazuya Yoshioka (10 GHz - 18 GHz)	Koji Yamamoto (Below 1 GHz)	Takafumi Noguchi (18 GHz - 26.5 GHz)
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.4 Semi Anechoic Chamber		
Report No.	11201778H		
Date	April 14, 2016	April 21, 2016	April 26, 2016
Temperature / Humidity	23 deg. C / 60 % RH	22 deg. C / 55 % RH	24 deg. C / 51 % RH
Engineer	Shinichi Miyazono (18 GHz - 26.5 GHz)	Kazuya Yoshioka (18 GHz - 26.5 GHz)	Takafumi Noguchi (18 GHz - 26.5 GHz)
Mode	Tx 11g 2437 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	41.9	33.1	8.3	31.3	52.0	73.9	21.9	Floor Noise
Hori	7311.000	PK	41.2	36.8	9.1	32.6	54.5	73.9	19.4	Floor Noise
Hori	9748.000	PK	41.9	38.2	9.7	32.7	57.1	73.9	16.8	Floor Noise
Hori	4874.000	AV	32.9	33.1	8.3	31.3	43.0	53.9	10.9	Floor Noise
Hori	7311.000	AV	32.0	36.8	9.1	32.6	45.3	53.9	8.6	Floor Noise
Hori	9748.000	AV	32.6	38.2	9.7	32.7	47.8	53.9	6.1	Floor Noise
Vert	4874.000	PK	42.0	33.1	9.2	31.3	53.0	73.9	20.9	Floor Noise
Vert	7311.000	PK	41.2	36.8	9.1	32.6	54.5	73.9	19.4	Floor Noise
Vert	9748.000	PK	41.8	38.2	9.7	32.7	57.0	73.9	16.9	Floor Noise
Vert	4874.000	AV	33.0	33.1	9.2	31.3	44.0	53.9	9.9	Floor Noise
Vert	7311.000	AV	31.9	36.8	9.1	32.6	45.2	53.9	8.7	Floor Noise
Vert	9748.000	AV	32.5	38.2	9.7	32.7	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 (4.5 m / 3.0 m) = 3.53 dB  
                                  10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB



## Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11201778H  
Date April 14, 2016 April 21, 2016 April 26, 2016  
Temperature / Humidity 23 deg. C / 60 % RH 22 deg. C / 55 % RH 24 deg. C / 51 % RH  
Engineer Shinichi Miyazono Kazuya Yoshioka Takafumi Noguchi  
(18 GHz - 26.5 GHz) (18 GHz - 26.5 GHz) (18 GHz - 26.5 GHz)  
Mode Tx 11g 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	51.3	28.1	6.9	32.1	54.2	73.9	19.7	
Hori	4924.000	PK	41.7	33.3	9.3	31.3	53.0	73.9	20.9	Floor Noise
Hori	7386.000	PK	41.8	36.8	9.1	32.6	55.1	73.9	18.8	Floor Noise
Hori	9848.000	PK	41.7	38.2	9.6	32.7	56.8	73.9	17.1	Floor Noise
Hori	2483.500	AV	41.3	28.1	6.9	32.1	44.2	53.9	9.7	
Hori	4924.000	AV	31.4	33.3	9.3	31.3	42.7	53.9	11.2	Floor Noise
Hori	7386.000	AV	30.3	36.8	9.1	32.6	43.6	53.9	10.3	Floor Noise
Hori	9848.000	AV	31.7	38.2	9.6	32.7	46.8	53.9	7.1	Floor Noise
Vert	2483.500	PK	52.7	28.1	6.9	32.1	55.6	73.9	18.3	
Vert	4924.000	PK	41.8	33.3	9.3	31.3	53.1	73.9	20.8	Floor Noise
Vert	7386.000	PK	41.9	36.8	9.1	32.6	55.2	73.9	18.7	Floor Noise
Vert	9848.000	PK	41.9	38.2	9.6	32.7	57.0	73.9	16.9	Floor Noise
Vert	2483.500	AV	42.7	28.1	6.9	32.1	45.6	53.9	8.3	
Vert	4924.000	AV	31.5	33.3	9.3	31.3	42.8	53.9	11.1	Floor Noise
Vert	7386.000	AV	30.4	36.8	9.1	32.6	43.7	53.9	10.2	Floor Noise
Vert	9848.000	AV	31.8	38.2	9.6	32.7	46.9	53.9	7.0	Floor Noise

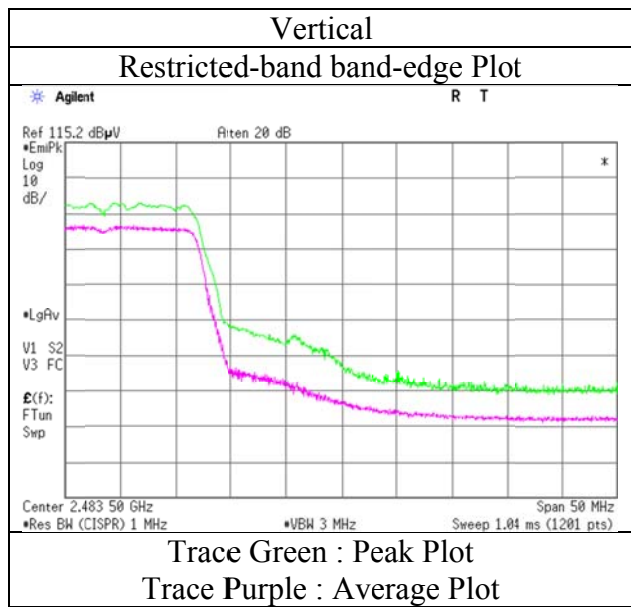
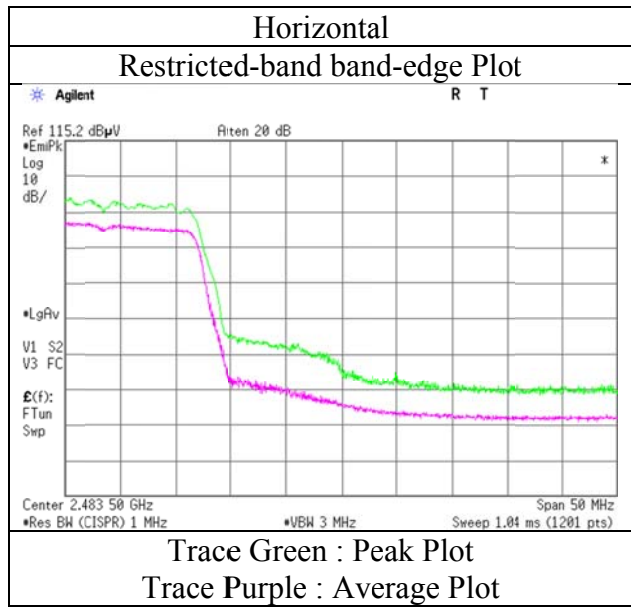
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*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**  
**(Reference Plot for band-edge)**

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11201778H  
Date April 14, 2016  
Temperature / Humidity 23 deg. C / 60 % 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.4 Semi Anechoic Chamber  
Report No. : 11201778H  
Date : April 14, 2016  
Temperature / Humidity : 23 deg. C / 60 % RH  
Engineer : Shinichi Miyazono  
(1 GHz - 10 GHz)  
Mode : Tx 11n-20 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	59.9	27.9	6.8	32.1	62.5	73.9	11.4	
Hori	2390.000	AV	41.3	27.9	6.8	32.1	43.9	53.9	10.0	
Vert	2390.000	PK	60.0	27.9	6.8	32.1	62.6	73.9	11.3	
Vert	2390.000	AV	45.6	27.9	6.8	32.1	48.2	53.9	5.7	

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

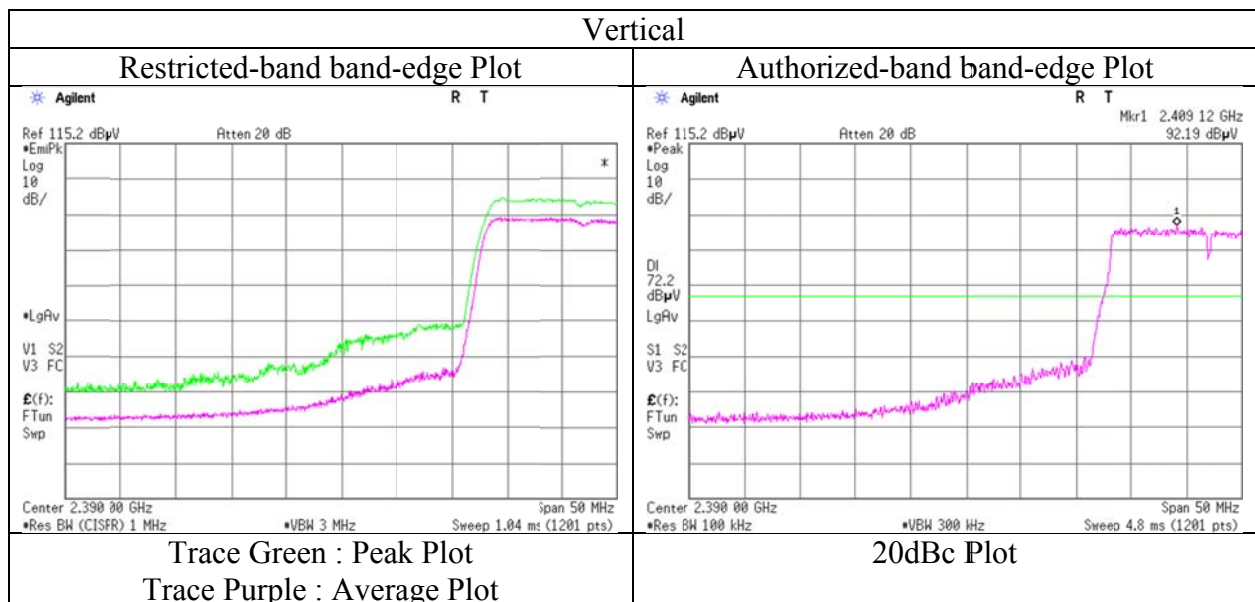
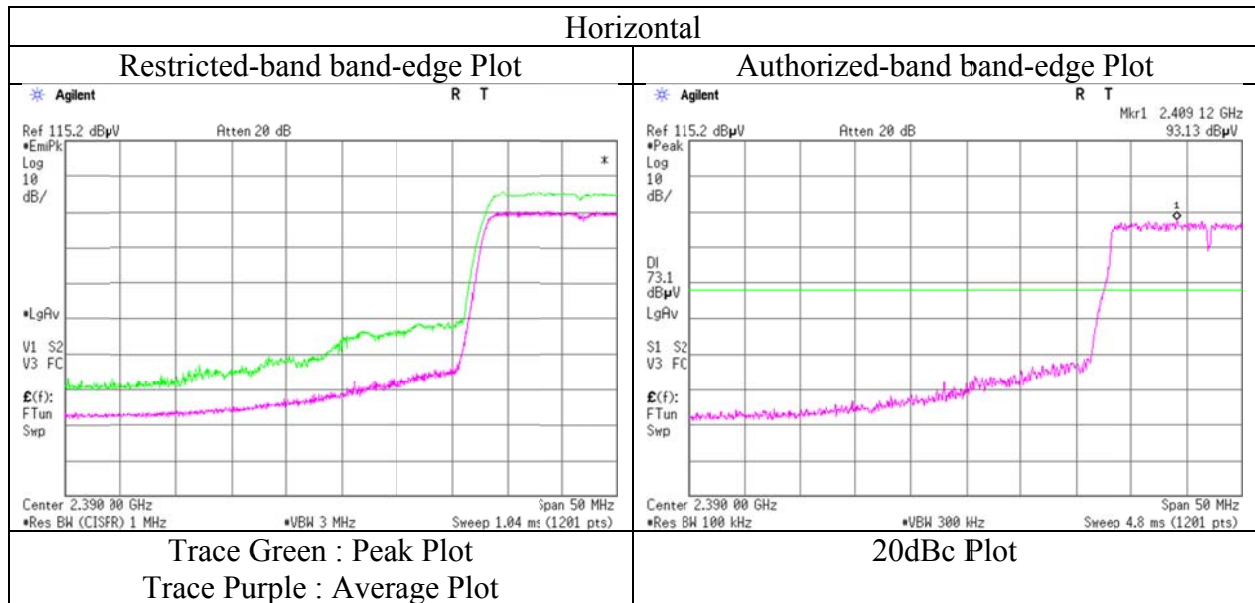
### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	93.1	28.0	6.8	32.1	95.8	-	-	Carrier
Hori	2400.000	PK	52.1	28.0	6.8	32.1	54.8	75.8	21.0	
Vert	2412.000	PK	92.2	28.0	6.8	32.1	94.9	-	-	Carrier
Vert	2400.000	PK	51.7	28.0	6.8	32.1	54.4	74.9	20.5	

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.4 Semi Anechoic Chamber
Report No.	11201778H
Date	April 14, 2016
Temperature / Humidity	23 deg. C / 60 % RH
Engineer	Shinichi Miyazono
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 2412 MHz



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

## Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 11201778H  
Date April 14, 2016  
Temperature / Humidity 23 deg. C / 60 % RH  
Engineer Shinichi Miyazono  
(1 GHz - 10 GHz)  
Mode Tx 11n-20 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	53.1	28.1	6.9	32.1	56.0	73.9	17.9	
Hori	2483.500	AV	41.7	28.1	6.9	32.1	44.6	53.9	9.3	
Vert	2483.500	PK	55.1	28.1	6.9	32.1	58.0	73.9	15.9	
Vert	2483.500	AV	43.1	28.1	6.9	32.1	46.0	53.9	7.9	

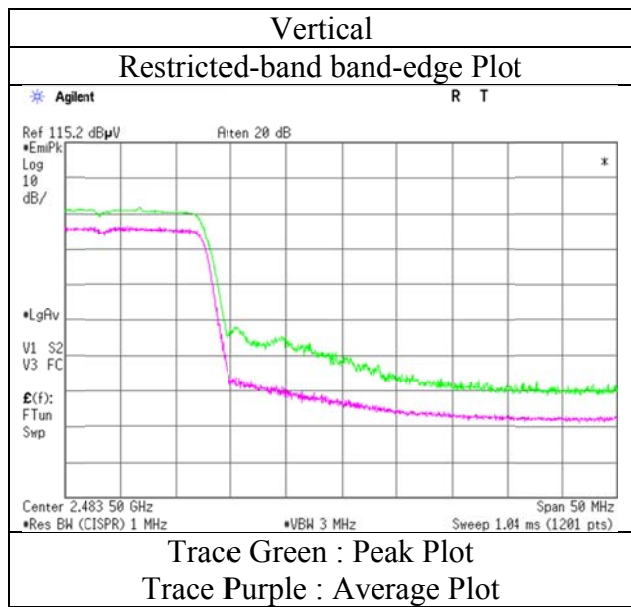
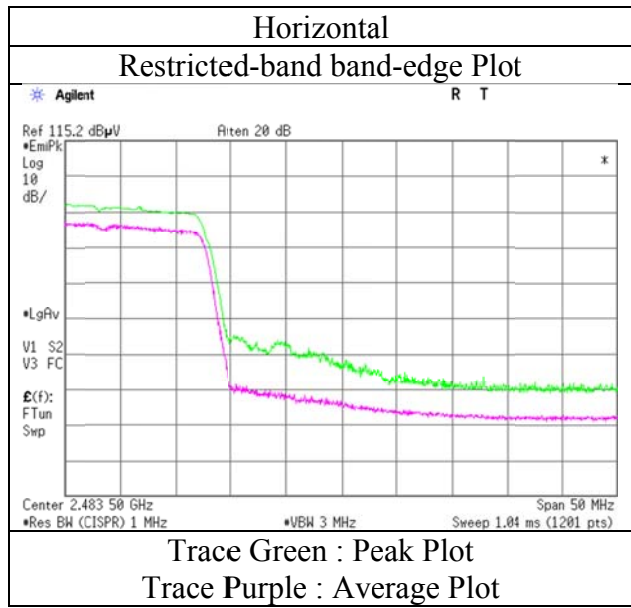
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*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**  
**(Reference Plot for band-edge)**

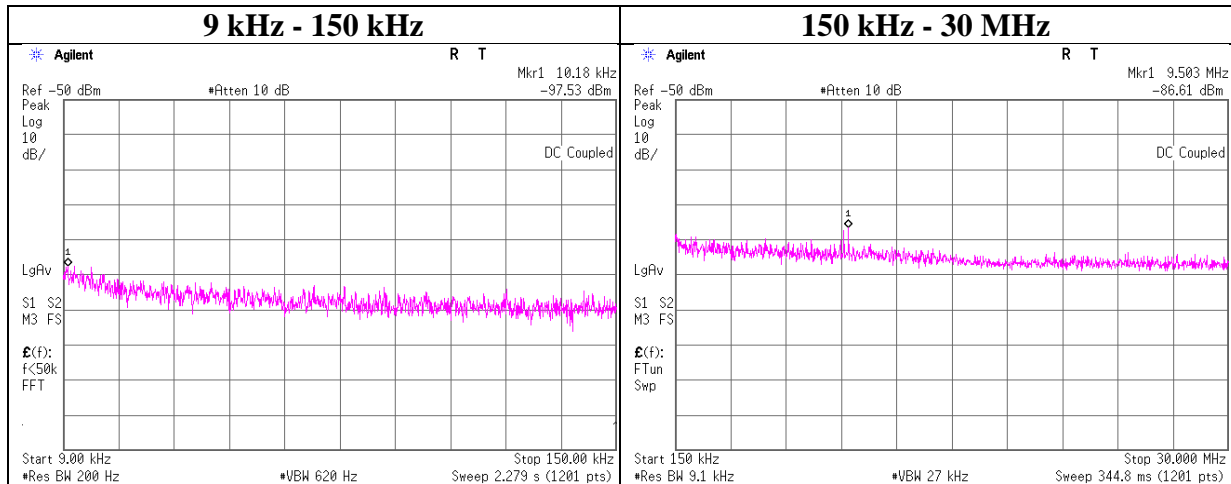
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11201778H
Date	April 14, 2016
Temperature / Humidity	23 deg. C / 60 % RH
Engineer	Shinichi Miyazono
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 2462 MHz



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

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11201778H
Date	April 14, 2016
Temperature / Humidity	26 deg. C / 51 % 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
10.18	-97.5	0.01	9.8	2.1	1	-85.6	300	6.0	-24.3	47.4	71.7	
9503.00	-86.6	0.01	9.9	2.1	1	-74.6	30	6.0	6.7	29.5	22.9	

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

$$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$$

**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

Test place Ise EMC Lab. No.6 Measurement Room  
Report No. 11201778H  
Date April 14, 2016  
Temperature / Humidity 26 deg. C / 51 % RH  
Engineer Takafumi Noguchi  
Mode Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-21.85	0.97	10.09	-10.79	8.00	18.79
2437.00	-21.92	0.98	10.09	-10.85	8.00	18.85
2462.00	-22.43	0.99	10.09	-11.35	8.00	19.35

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-25.17	0.97	10.09	-14.11	8.00	22.11
2437.00	-25.07	0.98	10.09	-14.00	8.00	22.00
2462.00	-26.26	0.99	10.09	-15.18	8.00	23.18

11n-20

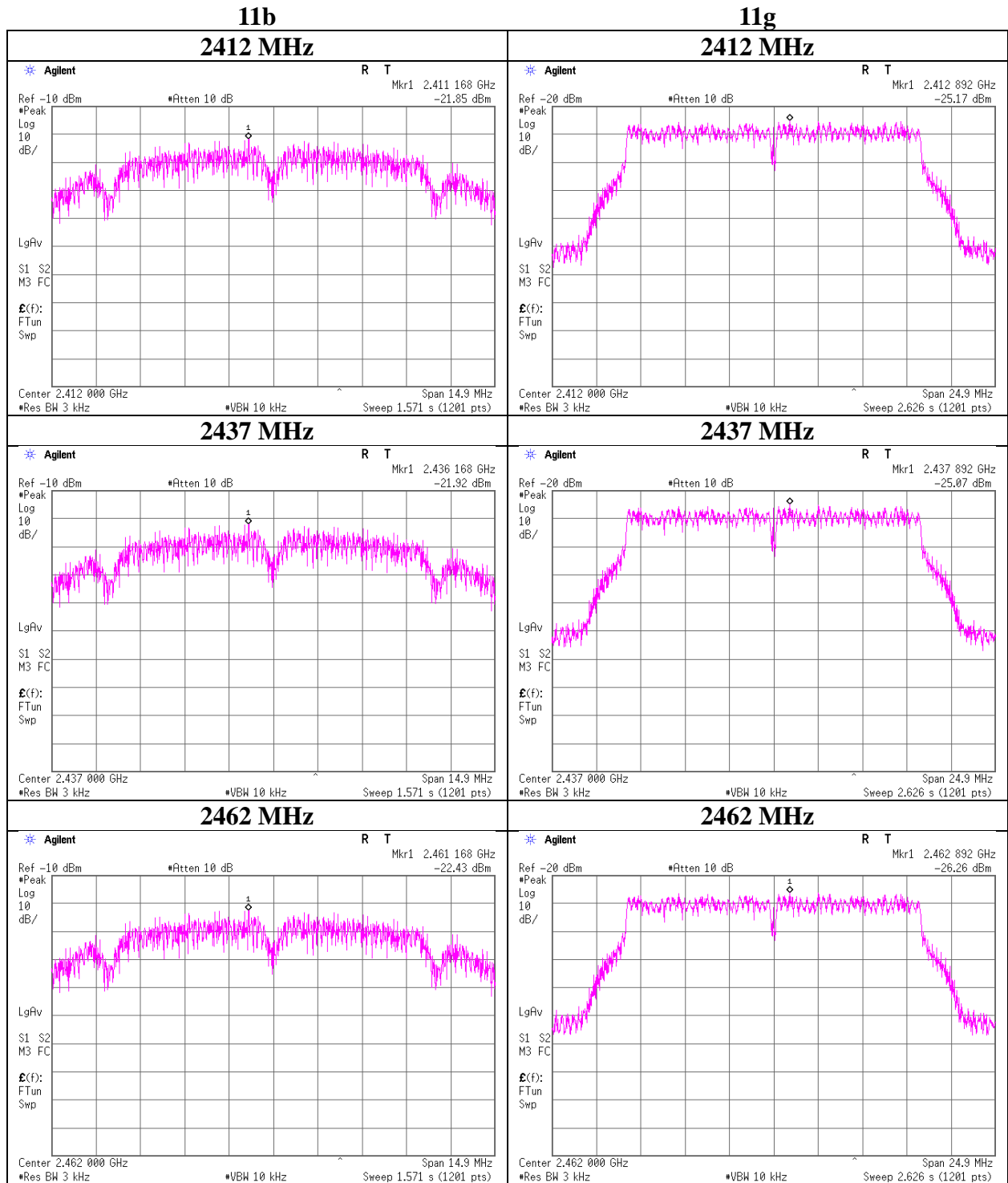
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-26.86	0.97	10.09	-15.80	8.00	23.80
2437.00	-26.68	0.98	10.09	-15.61	8.00	23.61
2462.00	-27.33	0.99	10.09	-16.25	8.00	24.25

Sample Calculation:

Result = Reading + Cable Loss + Attenuator



**Power Density**



**UL Japan, Inc.**

**Ise EMC Lab.**

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

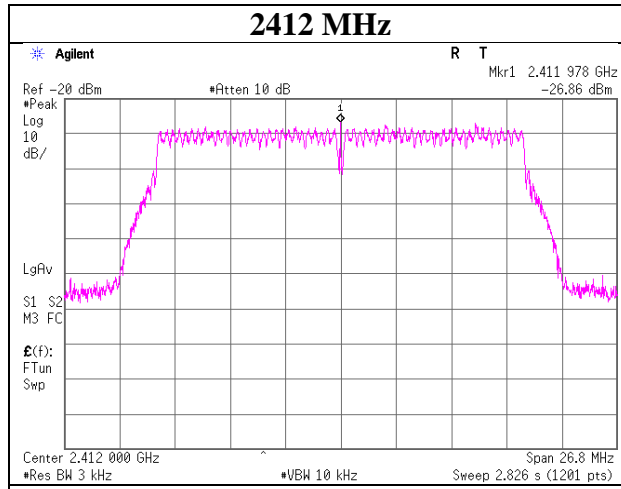
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

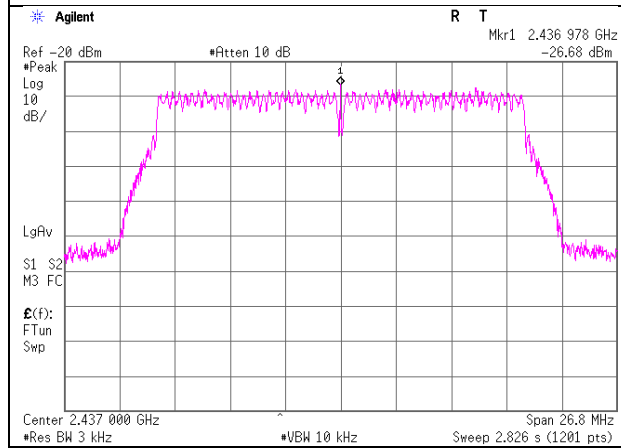
## Power Density

11n-20

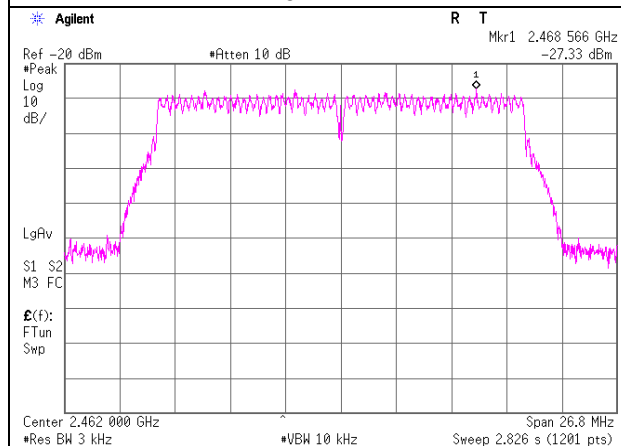
2412 MHz



2437 MHz



2462 MHz



UL Japan, Inc.

Ise EMC Lab.

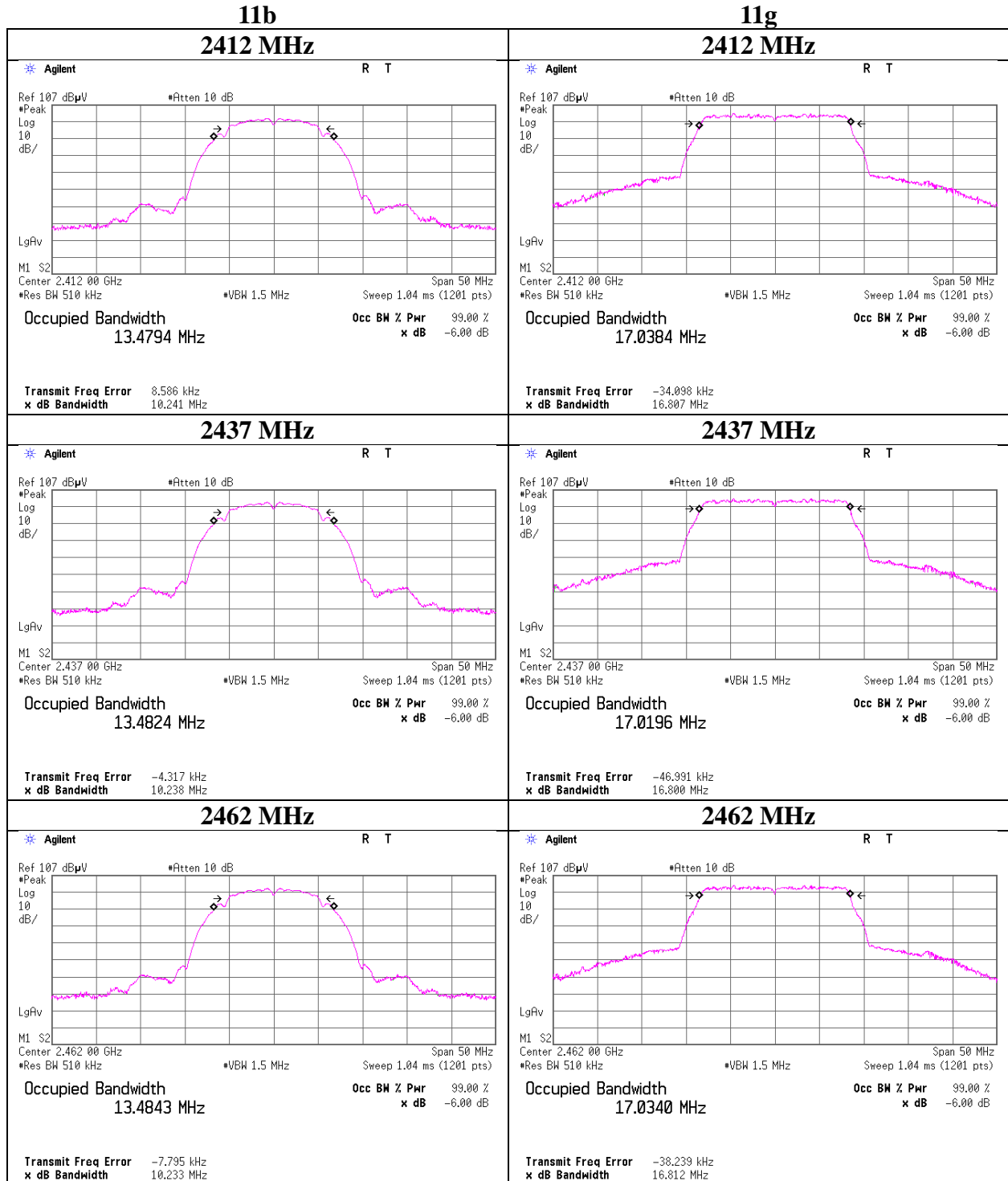
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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 11201778H April 14, 2016 26 deg. C / 51 % RH Takafumi Noguchi Tx
--	--

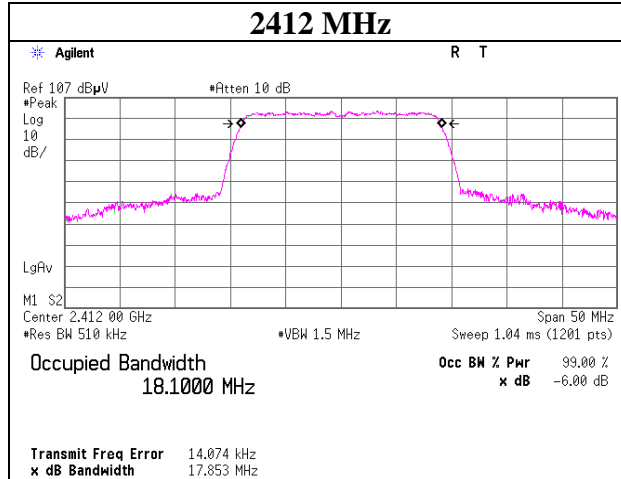


## 99% Occupied Bandwidth

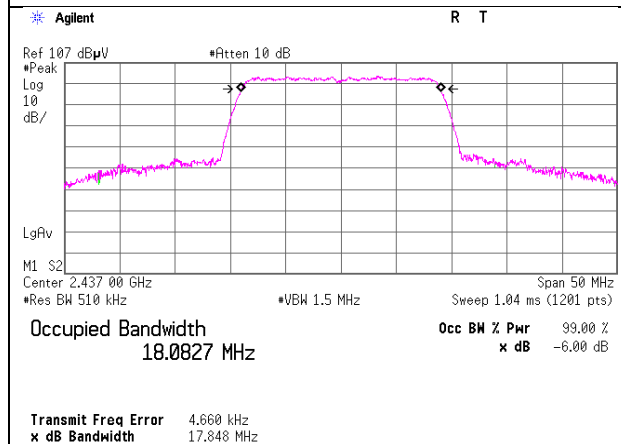
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11201778H
Date	April 14, 2016
Temperature / Humidity	26 deg. C / 51 % RH
Engineer	Takafumi Noguchi
Mode	Tx

### 11n-20

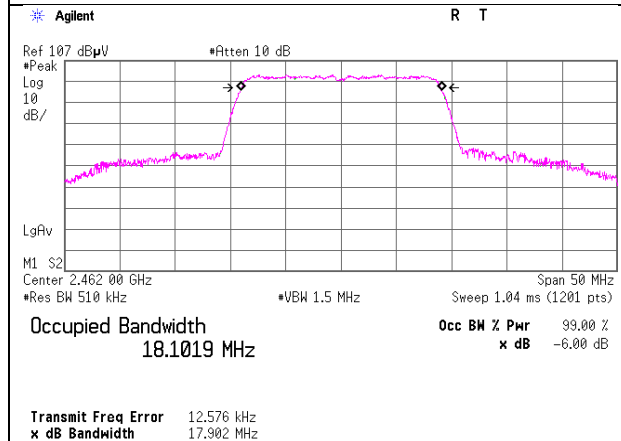
#### 2412 MHz



#### 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

## APPENDIX 2: Test instruments

### Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2016/01/21 * 12
MPM-16	Power Meter	Agilent	8990B	MY51000271	AT	2016/04/07 * 12
MPSE-23	Power sensor	Agilent	N1923A	MY54070004	AT	2016/04/07 * 12
MCC-144	Microwave Cable	Junkosha	MWX221	1207S407	AT	2015/08/06 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2016/03/18 * 12
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2015/10/07 * 12
MMM-12	DIGITAL HiTESTER	Hioki	3805	060500120	AT	2016/02/23 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2016/01/21 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE,CE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2015/11/06 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2015/08/10 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2015/10/01 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2016/01/18 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2015/09/17 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2015/05/15 * 12
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	AT	2015/11/11 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2016/03/18 * 12
MCC-45	Microwave Cable	Murata	MXGS83RK3000	-	AT	2015/07/27 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	CE	2015/09/19 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	CE	2016/01/21 * 12
MJM-25	Measure	KOMELON	KMC-36	-	CE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	CE	2015/06/08 * 12
MLS-25	LISN(AMN)	Schwarzbeck	NSLK8127	8127-731	CE	2015/07/17 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/3D-2 W(7.5m)/RG400u( 1.5m)/RFM-E421( Switcher)	-/01068(Switcher)	CE	2015/09/29 * 12
MAT-64	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	CE	2015/08/19 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2015/05/18 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2015/05/21 * 12
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE	2016/01/29 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MLA-23	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	RE	2016/01/30 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2015/11/12 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2016/03/18 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2015/06/06 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	RE	2015/11/10 * 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**