



# **RADIO TEST REPORT**

**Test Report No.: 10670940S-A**

**Applicant** : OLYMPUS IMAGING CORP.  
**Type of Equipment** : Wireless LAN Module  
**Model No.** : S059WIFI-PCA  
**FCC ID** : YSKW59  
**Test regulation** : FCC Part 15 Subpart C: 2015  
**Test result** : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test 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 any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

**Date of test:** February 9 to 12, 2015

**Tested by:**

*M. Hosaka*

Makoto Hosaka  
Engineer  
Consumer Technology Division

**Approved by :**

*T. Imamura*

Toyokazu Imamura  
Leader  
Consumer Technology Division



- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
☒ There is no testing item of "Non-accreditation".

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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name : OLYMPUS IMAGING CORP.  
Address : 2951, Ishikawa-machi, Hachioji-shi, Tokyo, 192-8507, Japan  
Telephone Number : +81-42-642-2283  
Facsimile Number : +81-42-642-2398  
Contact Person : Kenichi Aoki

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

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

Type of Equipment : Wireless LAN Module  
Model No. : S059WIFI-PCA  
Serial No. : Refer to 4.2  
Rating : DC3.15V, DC1.8V  
Receipt Date of Sample : February 6, 2015  
Country of Mass-production : Vietnam  
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: S059WIFI-PCA (referred to as the EUT in this report) is a Wireless LAN Module.

Clock frequency(ies) in the system : 26MHz

Radio specification:

Equipment type : Transceiver  
Frequency of operation : 2412-2462MHz  
Bandwidth : 20MHz  
Channel spacing : 5MHz  
Type of modulation : DSSS (IEEE 802.11b), OFDM (IEEE 802.11g/n)  
Antenna type :  $\lambda/4$  Monopole  
- LDA312G9213M-321(Tested model)  
- LDA312G6613M-320  
- LDA313G2613M-322  
Antenna connector type : None  
Antenna gain : -2.8dBi(Test model: LDA312G9213M-321),  
-2.9dBi(LDA312G6613M-320)  
-5.8dBi(LDA313G2613M-322)  
ITU code : D1D, G1D  
Operation temperature range : -10 to +40 deg.C

FCC 15.31 (e) / 212

This host device provides stable voltage (DC3.15 and 1.8V) constantly to the module regardless of input voltage.  
Therefore, the equipment complies with the requirement.

FCC 15.203 / 212

It is impossible for end users to replace the antenna, because it is soldered on the circuit board.  
Therefore, the equipment complies with the requirement.

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## SECTION 3: Test specification, procedures & results

### 3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2015, final revised on January 21, 2015  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits, general requirements  
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,  
and 5725-5850MHz

### 3.2 Procedures & Results

Item	Test Procedure *1)	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.10:2009	FCC 15.207	-	N/A	16.5 dB Freq.: 7.0030 0 MHz Detector: Quasi-Peak Phase: N Mode: Tx 2412MHz, IEEE 802.11g	Complied
6dB bandwidth	ANSI C63.10:2009	FCC 15.247 (a)(2)	Conducted	N/A	* See data	Complied
Maximum peak conducted output power	ANSI C63.10:2009	FCC 15.247 (b)(3)	Conducted	N/A		Complied
Out of band emission & Restricted band edges	ANSI C63.10:2009	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	4.3 dB Freq.: 48.003 MHz Polarization: Vertical Detection: Quasi-Peak Mode: Tx 2412MHz, IEEE 802.11g	Complied
Power density	ANSI C63.10:2009	FCC 15.247 (e)	Conducted	N/A	* See data	Complied
Note: UL Japan's EMI Work Procedures No.13-EM-W0420 and 13-EM-W0422. *1) These tests were also referred to KDB 558074 v03 r02 (FCC), "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".						

### 3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied bandwidth (99%)	ANSI C63.4:2009 RSS-Gen 6.6	-	Conducted	-	-
Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422					

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

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### 3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Item	Frequency range	No.1 SAC <sup>*1</sup> /SR <sup>*2</sup> (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) LISN	150kHz-30MHz	3.6 dB	3.4 dB	3.4 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.7 dB	3.5 dB	3.5 dB
	30MHz-300MHz	4.9 dB	4.9 dB	4.7 dB
	300MHz-1GHz	5.0 dB	5.0 dB	4.8 dB
	1GHz-15GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1m)	15GHz-18GHz	5.7 dB	5.7 dB	5.7 dB
	18GHz-40GHz	4.5 dB	4.3 dB	4.3 dB

\*1: SAC=Semi-Anechoic Chamber

\*2: SR= Shielded Room is applied besides radiated emission

#### 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.

#### Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 0.68dB

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.5dB

Conducted emissions, Power Density Measurement (1G-3GHz) uncertainty for this test was: (±) 1.7dB

Bandwidth Measurement uncertainty for this test was: (±) 0.66%

Time Measurement uncertainty for this test was: (±) 0.012%

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### 3.5 Test location

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JAB Accreditation No. : RTL02610

	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
<input type="checkbox"/> No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input checked="" type="checkbox"/> No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
<input type="checkbox"/> No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
<input type="checkbox"/> No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
<input type="checkbox"/> No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
<input checked="" type="checkbox"/> No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input checked="" type="checkbox"/> No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.7 Shielded room	-	2.76 x 3.76 x 2.4	2.76 x 3.76	-
<input type="checkbox"/> No.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
<input type="checkbox"/> No.1 Measurement room	-	2.55 x 4.1 x 2.5	2.55 x 4.1	-

### 3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

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

### **4.1 Operating mode**

Test item	Mode	Tested frequency	Worst data mode *1)
Conducted emission, Radiated emission (below 1GHz) *2)	Transmitting IEEE 802.11g	2412MHz	PN9, 11Mbps
Other items	Transmitting IEEE 802.11b	2412MHz, 2437MHz, 2462MHz	PN9, 11Mbps
	Transmitting IEEE 802.11g	2412MHz, 2437MHz, 2462MHz	PN9, 6Mbps
	Transmitting IEEE 802.11n HT20	2412MHz, 2437MHz, 2462MHz	PN9, MCS1
*1) The worst condition was determined based on the test result of Maximum Peak Output Power. *2) 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.			

The test was performed at Channel (2412-2462MHz) which is controlled by the firmware of digital camera.

EUT has the power settings by the software as follows;

Radiated emission and Conducted emission tests

Power settings	36
Software	Wireless Test v1.0.1.2

Antenna terminal conducted tests

Power settings	36
Software	Wireless Test Ver. 1.00

**Justification:** The system was configured in typical fashion (as customer would normally use it) for testing.

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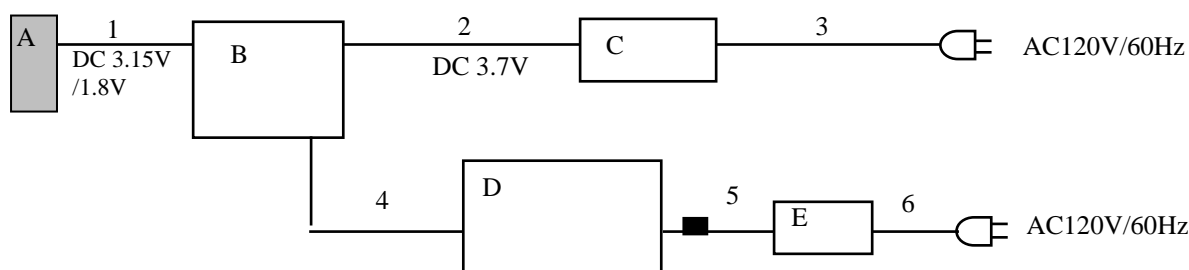
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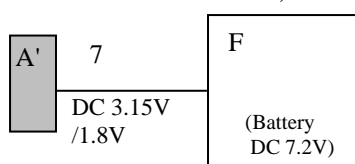
## 4.2 Configuration and peripherals

■ : Standard ferrite core

(for Radiated emission and Conducted emission tests)



(for antenna terminal conducted tests)



\* Test data was taken under worse case conditions.

### Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID (Remarks)
A	Wireless LAN Module	S059WIFI-PCA	PP2-2	OLYMPUS IMAGING CORP.	EUT (for radiated tests)
A'	Wireless LAN Module	S059WIFI-PCA	PP2-1	OLYMPUS IMAGING CORP.	EUT (for antenna terminal tests)
B	Jig	-	-	OLYMPUS IMAGING CORP.	-
C	DC Power supply	PAN35-10A	DE001677	Kikusui	-
D	Laptop Computer	7666-77J	LV-B8PVT 08/05	Lenovo	-
E	AC Adaptor	42T4422	11S42T4422Z1ZF3D 9BV4XN	Lenovo	-
F	Digital Camera	E-M10	ES2-1-122	OLYMPUS IMAGING CORP.	-

### List of cables used

No.	Cable Name	Length (m)	Shield		Remark
			Cable	Connector	
1	FPC	0.05	Unshielded	Unshielded	-
2	DC cable	1.0	Unshielded	Unshielded	-
3	AC cable	1.8	Unshielded	Unshielded	-
4	USB cable	3.5	Shielded	Shielded	-
5	DC cable	1.8	Unshielded	Unshielded	-
6	AC cable	1.0	Unshielded	Unshielded	-
7	FPC	0.05	Unshielded	Unshielded	-

## SECTION 5: Conducted emission

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## 5.1 Operating environment

Test place : See test data (APPENDIX 1)  
Temperature : See test data (APPENDIX 1)  
Humidity : See test data (APPENDIX 1)

## 5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 0.8m above the conducting ground plane.

The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals was aligned and was flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the input power source.

Photographs of the set up are shown in APPENDIX 3.

## 5.3 Test conditions

Frequency range : 0.15 - 30MHz  
EUT position : Table top

## 5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT within a Shielded room.

The EUT was connected to a Line Impedance Stabilization Network (LISN) via DC power supply. An overview sweep with peak detection has been performed.

The measurements had been performed with a quasi-peak detector and if required, a CISPR average detector.

The conducted emission measurements were made with the following detection of the test receiver.

Detection Type : Quasi-Peak/ CISPR Average  
IF Bandwidth : 9kHz

## 5.5 Results

Summary of the test results : Pass  
Refer to APPENDIX 1.

## **SECTION 6: 6dB bandwidth & Occupied bandwidth (99%)**

### **Test procedure**

The bandwidth was measured with a spectrum analyzer connected to the antenna port.  
The test was measured based on Method 8.2 Option 2 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass  
Refer to APPENDIX 1.

## **SECTION 7: Maximum peak conducted output power**

### **Test procedure**

The Maximum Peak Output Power was measured with a power meter connected to the antenna port.  
The test was measured based on Method 9.1.2 PKPM1 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Detection type: Peak / Average \*1)

Summary of the test results: Pass  
Refer to APPENDIX 1

\*1) Average detector was used only for Reference data.

## **SECTION 8: Peak power density**

### **Test procedure**

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer  
RBW / VBW : 3kHz / 9.1kHz

The test was measured based on Method 10.2 PKPSD of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass  
Refer to APPENDIX 1.

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## **SECTION 9: Radiated emission**

### **9.1 Operating environment**

Test place : See test data (APPENDIX 1)  
Temperature : See test data (APPENDIX 1)  
Humidity : See test data (APPENDIX 1)

### **9.2 Test configuration**

EUT was placed on a urethane platform of nominal size, 0.5m by 0.5m, raised 0.8m above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

### **9.3 Test conditions**

Frequency range : 30MHz - 25GHz  
EUT position : Table top

### **9.4 Test procedure**

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 15GHz) / 1m (above 15GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detection.

Frequency	30-1000MHz	1-25GHz		20dBc
Detection type	Quasi-Peak	Peak	Average *1)	Peak
IF Bandwidth	120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 3MHz Detector: Linear Voltage Averaging	RBW: 100kHz VBW: 300kHz

\*1) Average Power Measurement was measured based on 13.3.2 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

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.

Worst case:

Antenna polarization	Below 1GHz	Above 1GHz
Horizontal	X	X
Vertical	X	Y

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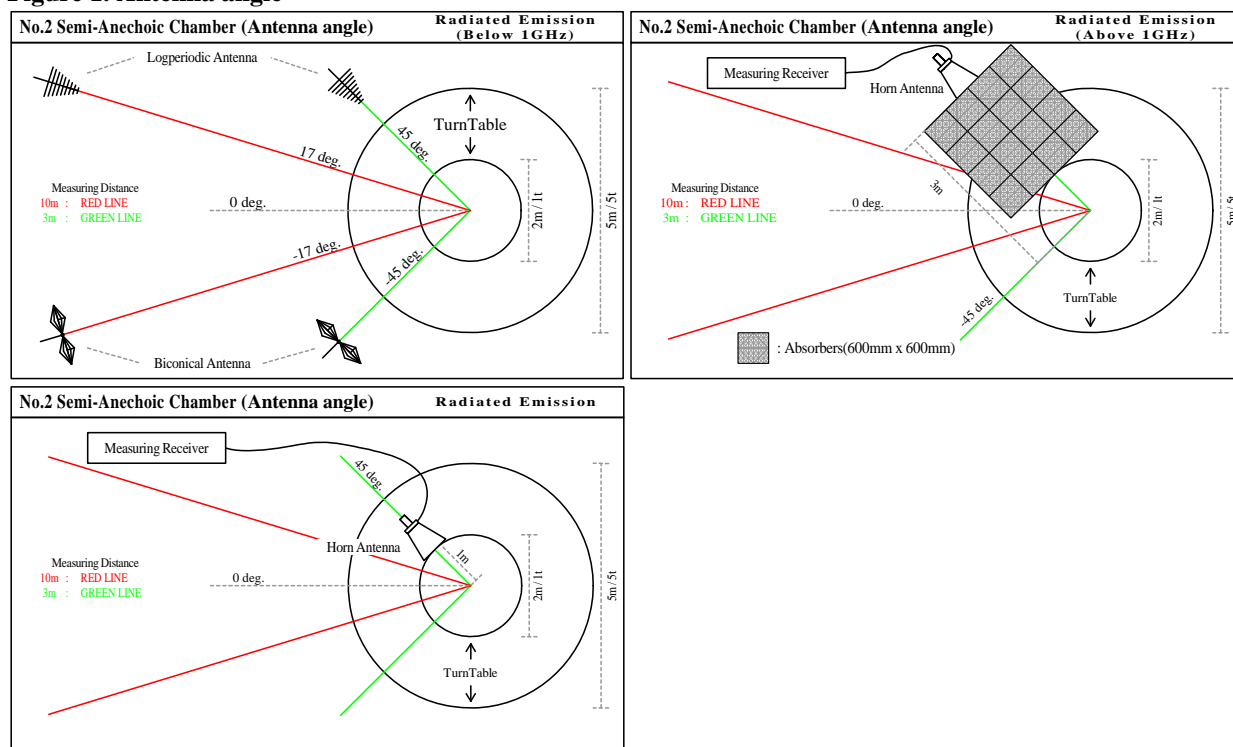
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**Figure 1. Antenna angle**



## 9.5 Band edge

Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209 and band edge level at 2400MHz is below the 20dBc. Refer to the data.

## 9.6 Results

Summary of the test results : Pass  
\* No noise was detected above the 4<sup>th</sup> order harmonics.

Refer to APPENDIX 1.

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## **Contents of APPENDIXES**

### **APPENDIX 1: Data of Radio tests**

Conducted emission  
6dB bandwidth  
Maximum peak output power  
Radiated emission (Spurious emissions)  
Peak power density  
Occupied bandwidth

### **APPENDIX 2: Test instruments**

Test instruments

### **APPENDIX 3: Photographs of test setup**

Conducted emission  
Radiated emission  
Pre-check of the worst position

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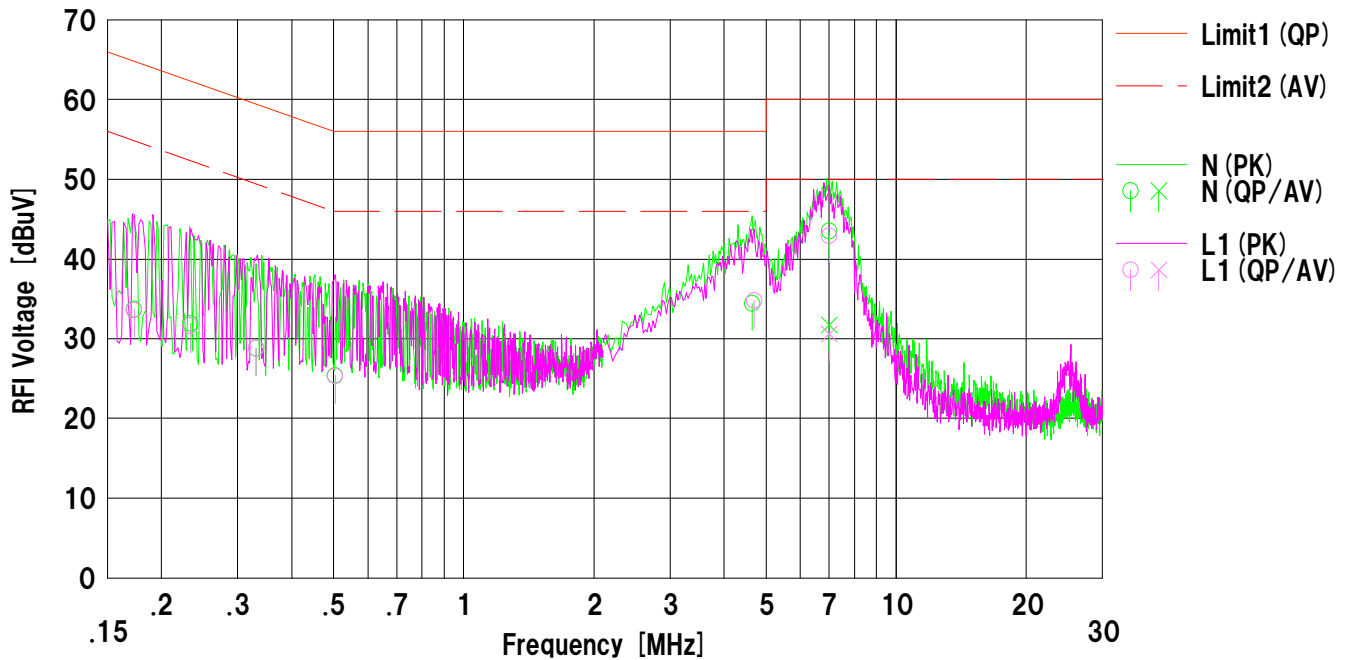
**APPENDIX 1: Data of Radio tests****DATA OF CONDUCTED EMISSION TEST**UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room  
Date : 2015/02/12

Company : OLYMPUS IMAGING CORP.  
 Kind of EUT : Wireless LAN Module  
 Model No. : SO59WIFI-PCA  
 Serial No. : PP2-2  
 Remarks : -

Mode : IEEE802.11g, Tx, 2412MHz  
 Order No. : 10670940S  
 Power : AC 120V / 60Hz (EUT: DC 3.15V / 1.8V)  
 Temp./Humi. : 24deg.C / 31%RH

Limit1 : FCC 15C (15.207) QP  
 Limit2 : FCC 15C (15.207) AV

Engineer : Tatsuya Arai



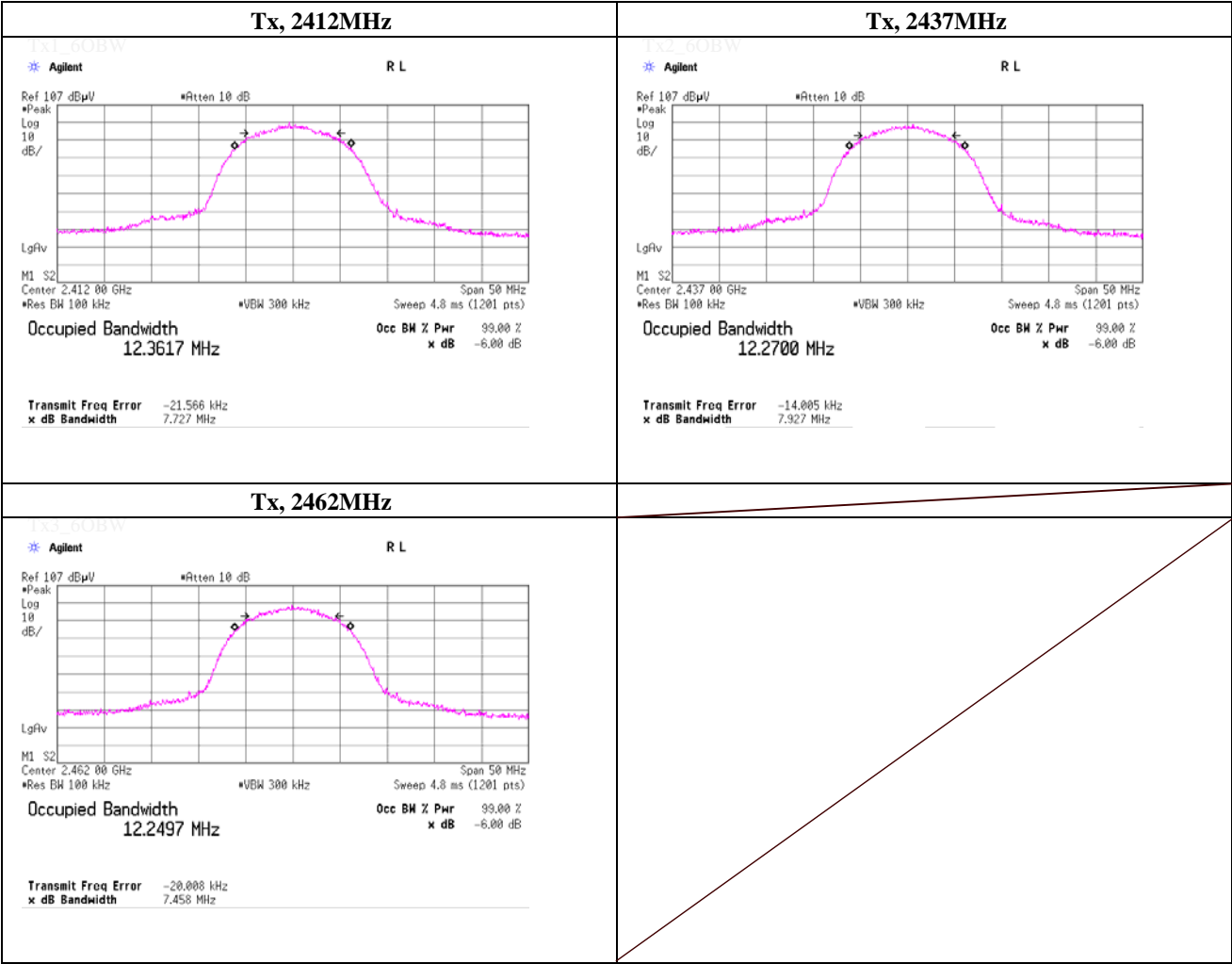
No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.17299	21.1	---	12.6	33.7	---	64.8	54.8	31.1	---	N	
2	0.23367	19.3	---	12.6	31.9	---	62.3	52.3	30.4	---	N	
3	0.33129	16.1	---	12.7	28.8	---	59.4	49.4	30.6	---	N	
4	0.50460	12.8	---	12.6	25.4	---	56.0	46.0	30.6	---	N	
5	4.64858	21.5	---	12.9	34.4	---	56.0	46.0	21.6	---	N	
6	7.00300	30.4	18.6	13.1	43.5	31.7	60.0	50.0	16.5	18.3	N	
7	0.17299	21.0	---	12.6	33.6	---	64.8	54.8	31.2	---	L1	
8	0.23367	19.0	---	12.6	31.6	---	62.3	52.3	30.7	---	L1	
9	0.33129	16.1	---	12.7	28.8	---	59.4	49.4	30.6	---	L1	
10	0.50460	12.7	---	12.6	25.3	---	56.0	46.0	30.7	---	L1	
11	4.69900	21.9	---	12.9	34.8	---	56.0	46.0	21.2	---	L1	
12	7.00500	29.8	17.5	13.1	42.9	30.6	60.0	50.0	17.1	19.4	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
 LISN:SLS-03

-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	February 10, 2015	
Temperature / Humidity	23deg.C , 41% RH	
Engineer	Makoto Hosaka	
Mode	Tx, IEEE802.11b , PN9, worst data mode 11Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	7.727	> 0.500
2437.0000	7.927	> 0.500
2462.0000	7.458	> 0.500



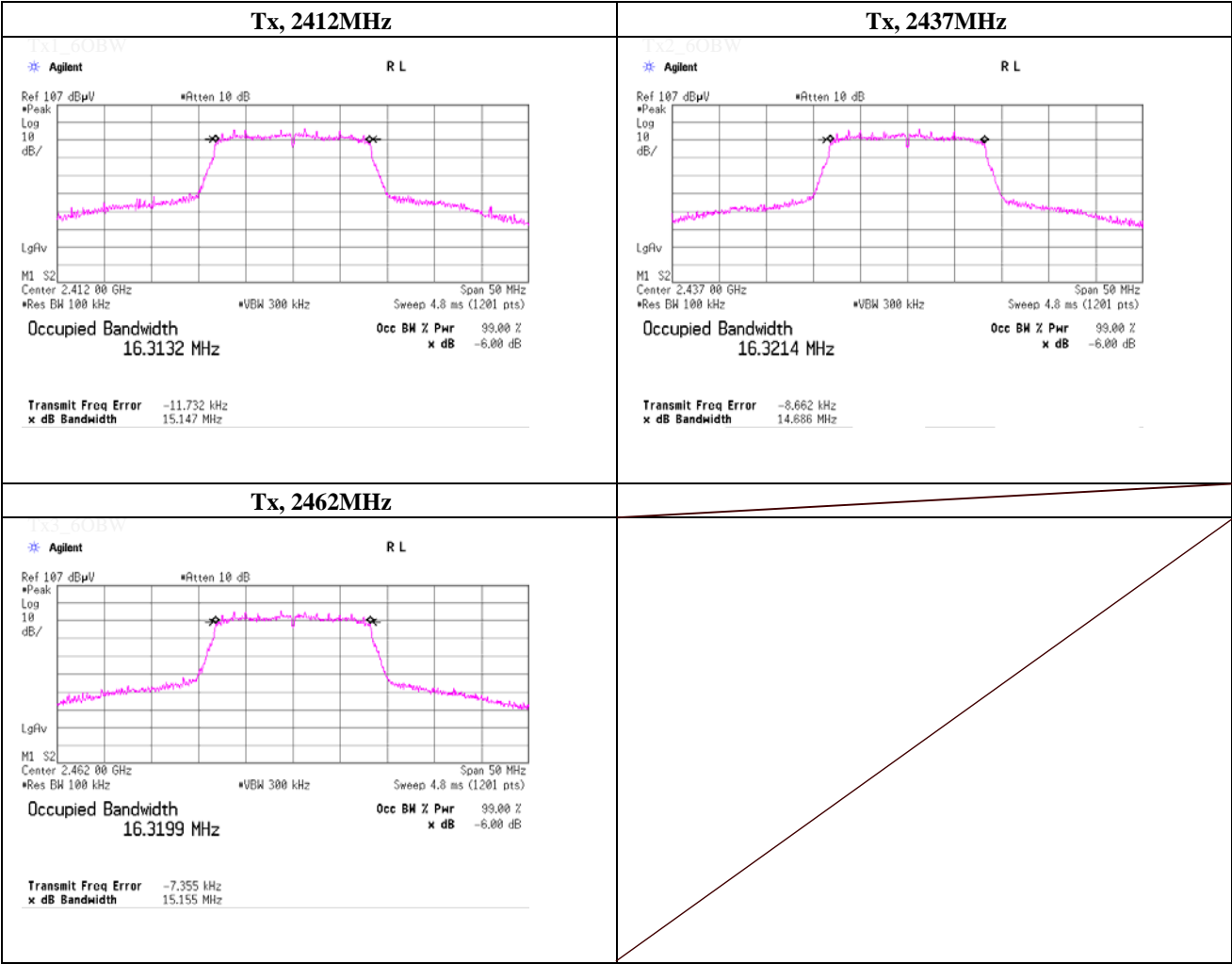
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-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	February 10, 2015	
Temperature / Humidity	23deg.C , 41% RH	
Engineer	Makoto Hosaka	
Mode	Tx, IEEE802.11g , PN9, worst data mode 6Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	15.147	> 0.500
2437.0000	14.686	> 0.500
2462.0000	15.155	> 0.500

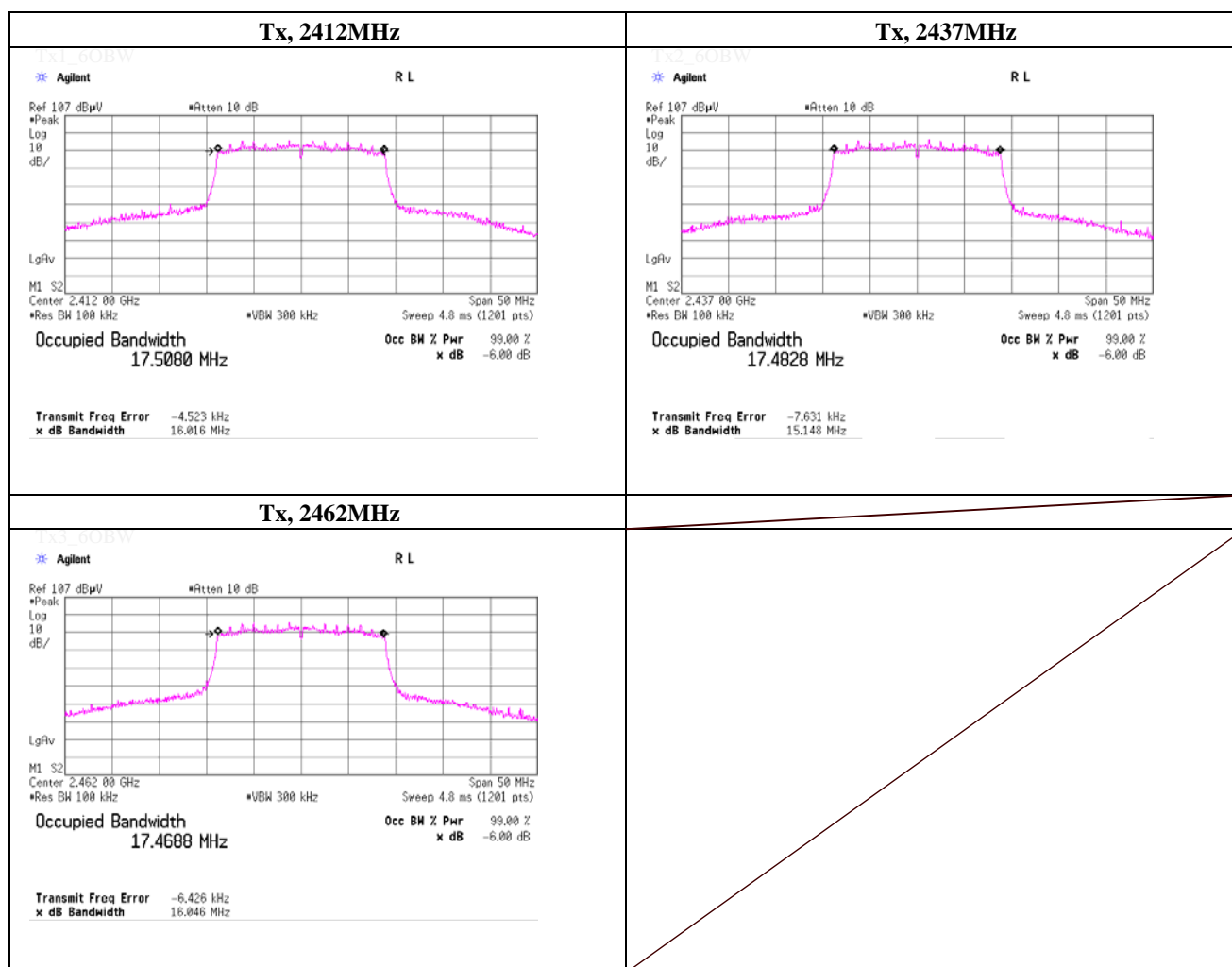


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### -6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	February 10, 2015	
Temperature / Humidity	23deg.C , 41%RH	
Engineer	Makoto Hosaka	
Mode	Tx, IEEE802.11n HT20 , PN9, worst data mode 1(MCS)	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	16.016	> 0.500
2437.0000	15.148	> 0.500
2462.0000	16.046	> 0.500



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(PKPM1)

(\* P/M: Power Meter with power sensor)

**Sample Calculation:**

**[Pre check]**

## Worst

**Sample Calculation:**

---

**1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN**

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Test place UL Japan, Inc. Shonan EMC Lab. No.6 Shielded Room  
 Date February 9, 2015  
 Temperature / Humidity 23deg.C , 45%RH  
 Engineer Makoto Hosaka

## Duty Factor Calculation chart for Maximum Conducted Output Power



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### Maximum Peak Conducted Output Power

(PKPM1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.6 Shielded Room
------------	--------------------------------	--------------------

Date February 9, 2015

Temperature / Humidity 23deg.C , 45%RH

Engineer Makoto Hosaka

Mode Tx, IEEE802.11g, PN9,

worst data mode : 6 Mbps

(\* P/M: Power Meter with power sensor)

Ch	Freq.	P/M (Peak Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2412.0	8.38	1.95	9.90	20.23	105.44	30.00	1000	9.77
Mid	2437.0	8.06	1.96	9.90	19.92	98.17	30.00	1000	10.08
High	2462.0	7.54	1.97	9.90	19.41	87.30	30.00	1000	10.59

**Sample Calculation:**

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

**[Pre check]**

	Data rate	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[Mbps]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
	6	2437.0	8.06	1.96	9.90	<b>19.92</b>	98.17	30.00	1000	<b>10.08</b>
	9	2437.0	7.85	1.96	9.90	19.71	93.54	30.00	1000	10.29
	12	2437.0	7.07	1.96	9.90	18.93	78.16	30.00	1000	11.07
	18	2437.0	7.07	1.96	9.90	18.93	78.16	30.00	1000	11.07
	24	2437.0	7.20	1.96	9.90	19.06	80.54	30.00	1000	10.94
	36	2437.0	7.79	1.96	9.90	19.65	92.26	30.00	1000	10.35
	48	2437.0	7.52	1.96	9.90	19.38	86.70	30.00	1000	10.62
	54	2437.0	6.93	1.96	9.90	18.79	75.68	30.00	1000	11.21

**Worst**

**Sample Calculation:**

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

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Maximum Conducted Output Power  
(AVGPM)

Test place                      UL Japan, Inc. Shonan EMC Lab.                      No.6 Shielded Room  
Date                              February 9, 2015  
Temperature / Humidity        23deg.C                      , 45%RH  
Engineer                        Makoto Hosaka  
Mode                              Tx, IEEE802.11g , PN9,                      worst data mode :                      54 Mbps

(\* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Result		Limit		Margin [dB]
						[dBm]	[mW]	[dBm]	[mW]	
Low	2412.0	-3.61	1.95	9.90	0.44	8.68	7.38	30.00	1000	21.32
Mid	2437.0	-3.69	1.96	9.90	0.44	8.61	7.26	30.00	1000	21.39
High	2462.0	-4.12	1.97	9.90	0.44	8.19	6.59	30.00	1000	21.81

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor  
E.I.R.P = Result + Antenna Gain

[Pre check]

	Data rate [Mbps]	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Result		Limit		Margin [dB]
							[dBm]	[mW]	[dBm]	[mW]	
	6	2437.0	-3.70	1.96	9.90	0.06	8.22	6.64	30.00	1000	21.78
	9	2437.0	-3.49	1.96	9.90	0.09	8.46	7.01	30.00	1000	21.54
	12	2437.0	-3.81	1.96	9.90	0.12	8.17	6.56	30.00	1000	21.83
	18	2437.0	-3.56	1.96	9.90	0.18	8.48	7.05	30.00	1000	21.52
	24	2437.0	-3.60	1.96	9.90	0.23	8.49	7.06	30.00	1000	21.51
	36	2437.0	-3.61	1.96	9.90	0.32	8.57	7.19	30.00	1000	21.43
	48	2437.0	-3.71	1.96	9.90	0.41	8.56	7.18	30.00	1000	21.44
	54	2437.0	-3.69	1.96	9.90	0.44	8.61	7.26	30.00	1000	21.39

Worst

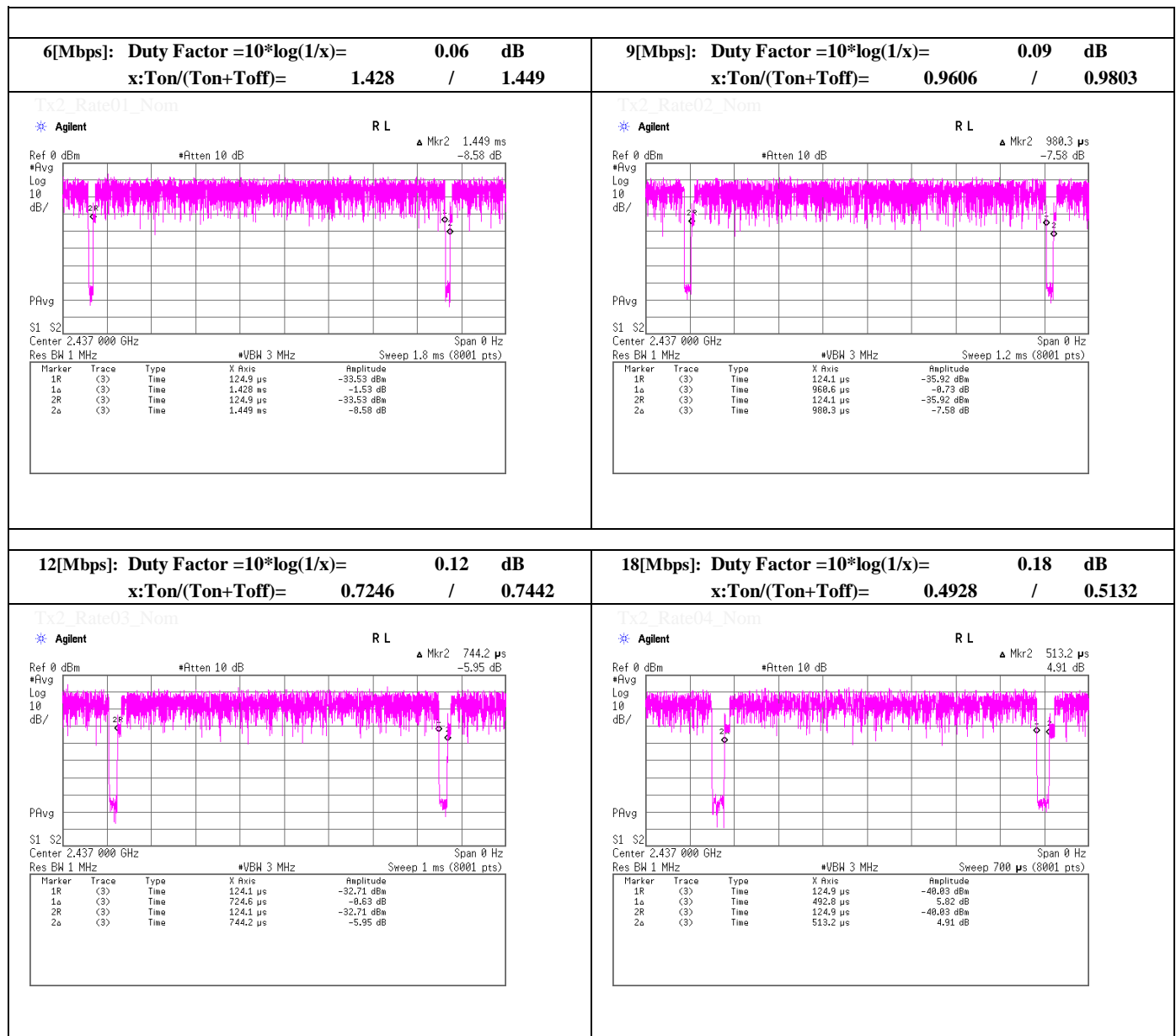
Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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Test place UL Japan, Inc. Shonan EMC Lab. No.6 Shielded Room  
 Date February 9, 2015  
 Temperature / Humidity 23deg.C , 45%RH  
 Engineer Makoto Hosaka

## Duty Factor Calculation chart for Maximum Conducted Output Power



**UL Japan, Inc.**  
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Test place UL Japan, Inc. Shonan EMC Lab. No.6 Shielded Room  
 Date February 9, 2015  
 Temperature / Humidity 23deg.C , 45%RH  
 Engineer Makoto Hosaka

## Duty Factor Calculation chart for Maximum Conducted Output Power



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## Maximum Peak Conducted Output Power

(PKPM1)

Test place                      UL Japan, Inc. Shonan EMC Lab.                      No.6 Shielded Room  
 Date                              February 9, 2015  
 Temperature / Humidity      23deg.C                      , 45%RH  
 Engineer                        Makoto Hosaka  
 Mode                              Tx, IEEE802.11n HT20 , PN9,                      worst data mode :                      1 (MCS)

(\* P/M: Power Meter with power sensor)

Ch	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin
					[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2412.0	8.12	1.95	9.90	19.97	99.31	30.00	1000	10.03
Mid	2437.0	7.74	1.96	9.90	19.60	91.20	30.00	1000	10.40
High	2462.0	7.32	1.97	9.90	19.19	82.99	30.00	1000	10.81

Sample Calculation:

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

### [Pre check]

	Mode (MCS)	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin
						[dBm]	[mW]	[dBm]	[mW]	[dB]
	0	2437.0	7.30	1.96	9.90	19.16	82.41	30.00	1000	10.84
	1	2437.0	7.74	1.96	9.90	<b>19.60</b>	91.20	30.00	1000	<b>10.40</b>
	2	2437.0	7.14	1.96	9.90	19.00	79.43	30.00	1000	11.00
	3	2437.0	7.23	1.96	9.90	19.09	81.10	30.00	1000	10.91
	4	2437.0	7.19	1.96	9.90	19.05	80.35	30.00	1000	10.95
	5	2437.0	6.95	1.96	9.90	18.81	76.03	30.00	1000	11.19
	6	2437.0	7.27	1.96	9.90	19.13	81.85	30.00	1000	10.87
	7	2437.0	7.17	1.96	9.90	19.03	79.98	30.00	1000	10.97

**Worst**

Sample Calculation:

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

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## Maximum Conducted Output Power

(AVGPM)

Test place                      UL Japan, Inc. Shonan EMC Lab.                      No.6 Shielded Room  
 Date                              February 9, 2015  
 Temperature / Humidity      23deg.C                      , 45%RH  
 Engineer                        Makoto Hosaka  
 Mode                              Tx, IEEE802.11n HT20 , PN9,                      worst data mode :                      7 (MCS)

(\* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Result		Limit		Margin
						[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2412.0	-3.65	1.95	9.90	0.49	8.69	7.40	30.00	1000	21.31
Mid	2437.0	-3.81	1.96	9.90	0.49	8.54	7.14	30.00	1000	21.46
High	2462.0	-4.21	1.97	9.90	0.49	8.15	6.53	30.00	1000	21.85

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

E.I.R.P = Result + Antenna Gain

### [Pre check]

	Mode (MCS)	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Result		Limit		Margin
							[dBm]	[mW]	[dBm]	[mW]	[dB]
	0	2437.0	-3.64	1.96	9.90	0.06	8.28	6.73	30.00	1000	21.72
	1	2437.0	-3.71	1.96	9.90	0.13	8.28	6.73	30.00	1000	21.72
	2	2437.0	-3.54	1.96	9.90	0.18	8.50	7.08	30.00	1000	21.50
	3	2437.0	-3.77	1.96	9.90	0.23	8.32	6.79	30.00	1000	21.68
	4	2437.0	-3.81	1.96	9.90	0.32	8.37	6.87	30.00	1000	21.63
	5	2437.0	-3.84	1.96	9.90	0.41	8.43	6.97	30.00	1000	21.57
	6	2437.0	-3.80	1.96	9.90	0.45	8.51	7.10	30.00	1000	21.49
	7	2437.0	-3.81	1.96	9.90	0.49	<b>8.54</b>	7.14	30.00	1000	<b>21.46</b>

**Worst**

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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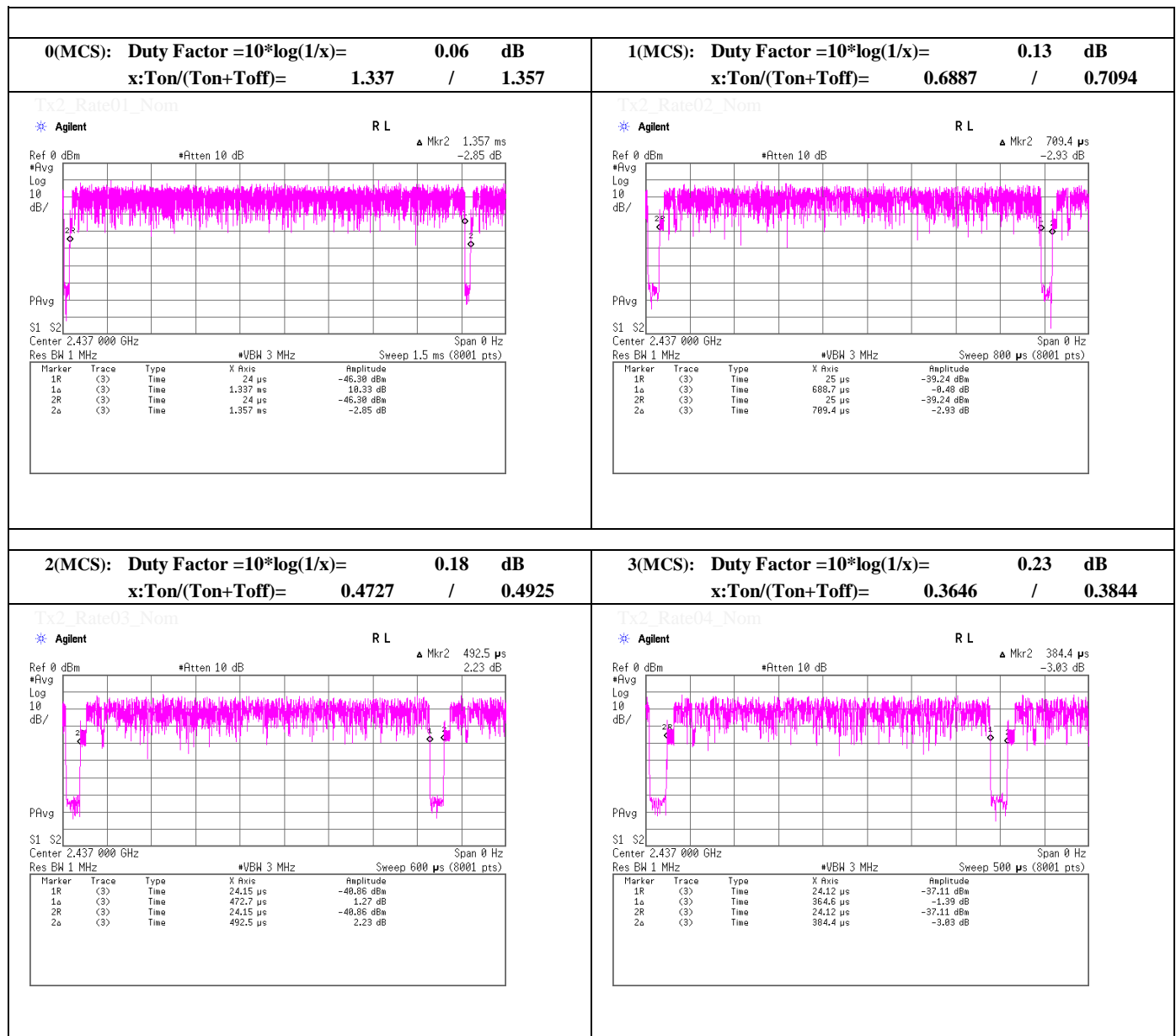
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Test place UL Japan, Inc. Shonan EMC Lab. No.6 Shielded Room  
 Date February 9, 2015  
 Temperature / Humidity 23deg.C , 45%RH  
 Engineer Makoto Hosaka

## Duty Factor Calculation chart for Maximum Conducted Output Power



**UL Japan, Inc.**  
**Shonan EMC Lab.**

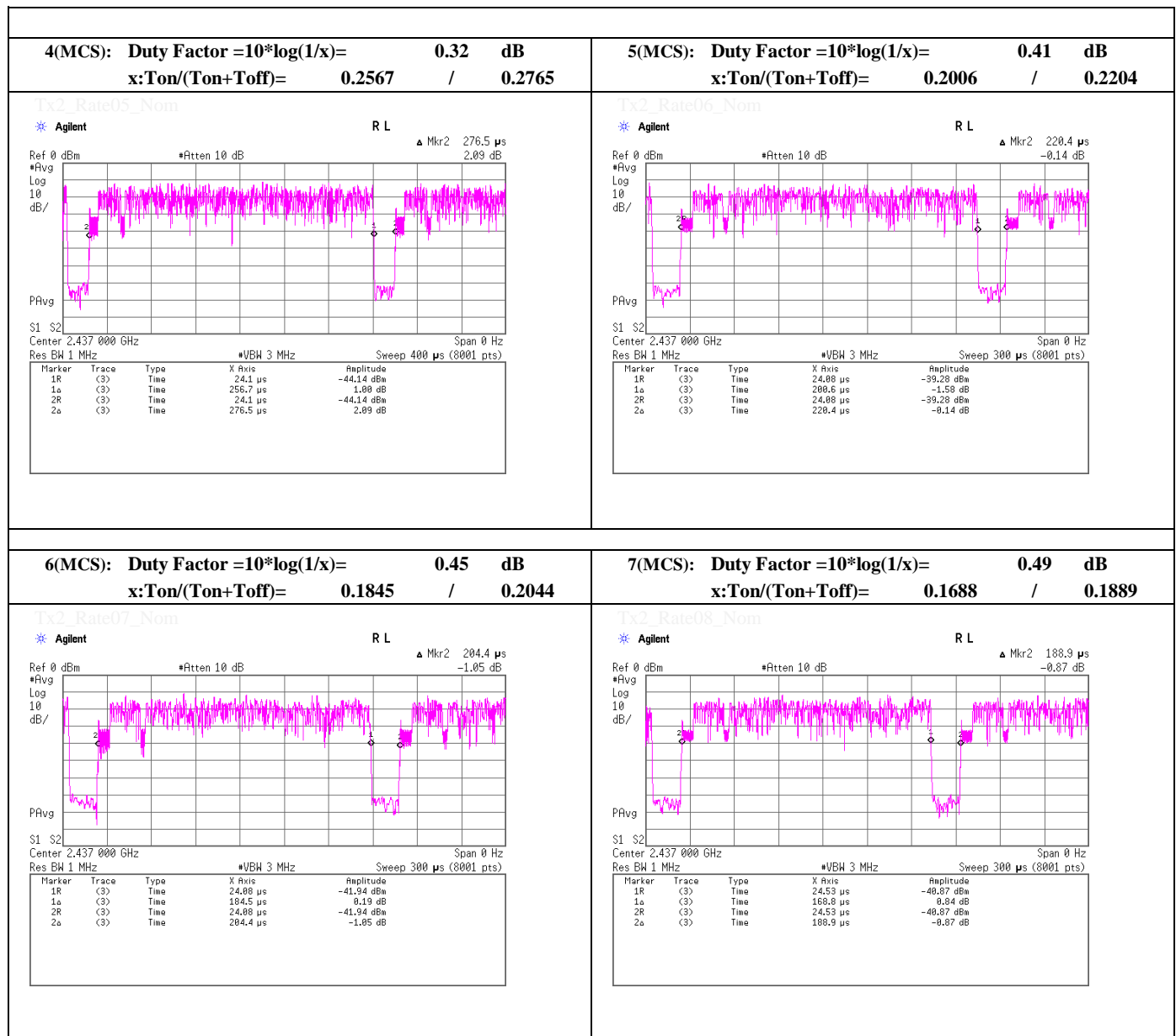
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Test place UL Japan, Inc. Shonan EMC Lab. No.6 Shielded Room  
 Date February 9, 2015  
 Temperature / Humidity 23deg.C , 45%RH  
 Engineer Makoto Hosaka

## Duty Factor Calculation chart for Maximum Conducted Output Power



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Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber  
Date February 11, 2015 February 12, 2015  
Temperature / Humidity 23 deg.C, 31 %RH 24 deg.C, 31 %RH  
Engineer Tatsuya Arai Tatsuya Arai  
Mode Tx, 2412 MHz  
Tx, IEEE802.11b, PN9, 11Mbps

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	44.0	25.9	14.5	38.1	46.3	73.9	27.6	100	280	
Hori.	4824.000	PK	42.7	30.5	7.5	36.8	43.9	73.9	30.0	100	0	
Hori.	7236.000	PK	44.0	36.3	8.8	39.1	50.0	73.9	23.9	100	0	
Hori.	9648.000	PK	41.8	38.3	9.6	36.9	52.8	73.9	21.1	100	0	
Hori.	2390.000	AV	34.5	25.9	14.5	38.1	36.8	53.9	17.1	100	280	
Hori.	4824.000	AV	33.0	30.5	7.5	36.8	34.2	53.9	19.7	100	0	
Hori.	7236.000	AV	34.9	36.3	8.8	39.1	40.9	53.9	13.0	100	0	
Hori.	9648.000	AV	32.4	38.3	9.6	36.9	43.4	53.9	10.5	100	0	
Vert.	2390.000	PK	43.3	25.9	14.5	38.1	45.6	73.9	28.3	100	133	
Vert.	4824.000	PK	43.0	30.5	7.5	36.8	44.2	73.9	29.7	100	0	
Vert.	7236.000	PK	44.1	36.3	8.8	39.1	50.1	73.9	23.8	100	0	
Vert.	9648.000	PK	42.3	38.3	9.6	36.9	53.3	73.9	20.6	100	0	
Vert.	2390.000	AV	34.1	25.9	14.5	38.1	36.4	53.9	17.5	100	133	
Vert.	4824.000	AV	33.0	30.5	7.5	36.8	34.2	53.9	19.7	100	0	
Vert.	7236.000	AV	34.9	36.3	8.8	39.1	40.9	53.9	13.0	100	0	
Vert.	9648.000	AV	32.4	38.3	9.6	36.9	43.4	53.9	10.5	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriplier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

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	83.5	25.9	14.6	38.1	85.9	-	-	
Hori.	2400.000	PK	37.0	25.9	14.5	38.1	39.3	65.9	26.6	
Vert.	2412.000	PK	80.6	25.9	14.6	38.1	83.0	-	-	
Vert.	2400.000	PK	36.3	25.9	14.5	38.1	38.6	63.0	24.4	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriplier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place                      No.2 Semi Anechoic Chamber      No.2 Semi Anechoic Chamber  
Date                              February 11, 2015                      February 12, 2015  
Temperature / Humidity      23 deg.C, 31 %RH                      24 deg.C, 31 %RH  
Engineer                      Tatsuya Arai                      Tatsuya Arai  
Mode                              Tx,                      2437 MHz  
   Tx, IEEE802.11b, PN9, 11Mbps

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	42.2	30.7	7.5	36.8	43.6	73.9	30.3	100	0	
Hori.	7311.000	PK	45.0	36.4	8.7	39.1	51.0	73.9	22.9	100	0	
Hori.	9748.000	PK	42.6	38.3	9.8	37.0	53.7	73.9	20.2	100	0	
Hori.	4874.000	AV	33.1	30.7	7.5	36.8	34.5	53.9	19.4	100	0	
Hori.	7311.000	AV	35.6	36.4	8.7	39.1	41.6	53.9	12.3	100	0	
Hori.	9748.000	AV	32.6	38.3	9.8	37.0	43.7	53.9	10.2	100	0	
Vert.	4874.000	PK	42.9	30.7	7.5	36.8	44.3	73.9	29.6	100	0	
Vert.	7311.000	PK	45.1	36.4	8.7	39.1	51.1	73.9	22.8	100	0	
Vert.	9748.000	PK	41.3	38.3	9.8	37.0	52.4	73.9	21.5	100	0	
Vert.	4874.000	AV	32.9	30.7	7.5	36.8	34.3	53.9	19.6	100	0	
Vert.	7311.000	AV	35.1	36.4	8.7	39.1	41.1	53.9	12.8	100	0	
Vert.	9748.000	AV	32.4	38.3	9.8	37.0	43.5	53.9	10.4	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place	No.2 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber
Date	February 11, 2015	February 12, 2015
Temperature / Humidity	23 deg.C, 31 %RH	24 deg.C, 31 %RH
Engineer	Tatsuya Arai	Tatsuya Arai
Mode	Tx, 2462 MHz	
	Tx, IEEE802.11b, PN9, 11Mbps	

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	43.4	25.9	14.6	38.0	45.9	73.9	28.0	100	273	
Hori.	4924.000	PK	43.3	30.9	7.6	36.7	45.1	73.9	28.8	100	0	
Hori.	7386.000	PK	45.1	36.5	8.7	39.2	51.1	73.9	22.8	100	0	
Hori.	9848.000	PK	42.0	38.3	9.8	37.0	53.1	73.9	20.8	100	0	
Hori.	2483.500	AV	34.3	25.9	14.6	38.0	36.8	53.9	17.1	100	273	
Hori.	4924.000	AV	33.2	30.9	7.6	36.7	35.0	53.9	18.9	100	0	
Hori.	7386.000	AV	35.4	36.5	8.7	39.2	41.4	53.9	12.5	100	0	
Hori.	9848.000	AV	32.7	38.3	9.8	37.0	43.8	53.9	<b>10.1</b>	100	0	
Vert.	2483.500	PK	43.5	25.9	14.6	38.0	46.0	73.9	27.9	100	324	
Vert.	4924.000	PK	43.6	30.9	7.6	36.7	45.4	73.9	28.5	100	0	
Vert.	7386.000	PK	44.6	36.5	8.7	39.2	50.6	73.9	23.3	100	0	
Vert.	9848.000	PK	41.6	38.3	9.8	37.0	52.7	73.9	21.2	100	0	
Vert.	2483.500	AV	34.1	25.9	14.6	38.0	36.6	53.9	17.3	100	324	
Vert.	4924.000	AV	33.0	30.9	7.6	36.7	34.8	53.9	19.1	100	0	
Vert.	7386.000	AV	35.5	36.5	8.7	39.2	41.5	53.9	12.4	100	0	
Vert.	9848.000	AV	32.5	38.3	9.8	37.0	43.6	53.9	10.3	100	0	

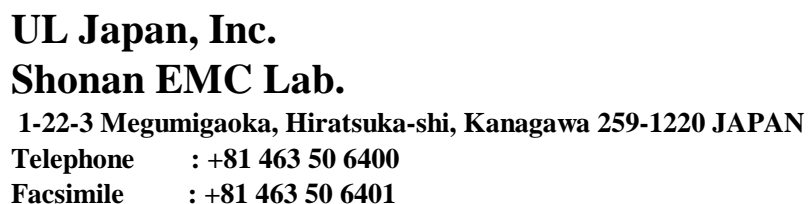
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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**Tx, IEEE802.11b , PN9, worst data mode 11Mbps**



# Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place	No.2 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber
Date	February 11, 2015	February 12, 2015
Temperature / Humidity	23 deg.C, 31 %RH	24 deg.C, 31 %RH
Engineer	Tatsuya Arai	Tatsuya Arai
Mode	Tx, 2412 MHz	
	Tx, IEEE802.11g, PN9, 6Mbps	

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	144.004	QP	44.1	14.5	8.4	31.8	35.2	43.5	8.3	224	95	
Hori.	335.998	QP	44.5	14.8	6.7	31.7	34.3	46.0	11.7	100	210	
Hori.	2390.000	PK	49.5	25.9	14.5	38.1	51.8	73.9	22.1	100	280	
Hori.	4824.000	PK	42.3	30.5	7.5	36.8	43.5	73.9	30.4	100	0	
Hori.	7236.000	PK	44.3	36.3	8.8	39.1	50.3	73.9	23.6	100	0	
Hori.	9648.000	PK	41.6	38.3	9.6	36.9	52.6	73.9	21.3	100	0	
Hori.	2390.000	AV	36.3	25.9	14.5	38.1	38.6	53.9	15.3	100	280	
Hori.	4824.000	AV	32.9	30.5	7.5	36.8	34.1	53.9	19.8	100	0	
Hori.	7236.000	AV	34.9	36.3	8.8	39.1	40.9	53.9	13.0	100	0	
Hori.	9648.000	AV	32.4	38.3	9.6	36.9	43.4	53.9	10.5	100	0	
Vert.	48.003	QP	49.0	11.4	7.2	31.9	35.7	40.0	4.3	100	115	
Vert.	144.004	QP	40.7	14.5	8.4	31.8	31.8	43.5	11.7	100	68	
Vert.	240.001	QP	43.6	16.8	9.2	31.7	37.9	46.0	8.1	100	270	
Vert.	2390.000	PK	46.8	25.9	14.5	38.1	49.1	73.9	24.8	100	324	
Vert.	4824.000	PK	42.6	30.5	7.5	36.8	43.8	73.9	30.1	100	0	
Vert.	7236.000	PK	44.2	36.3	8.8	39.1	50.2	73.9	23.7	100	0	
Vert.	9648.000	PK	41.9	38.3	9.6	36.9	52.9	73.9	21.0	100	0	
Vert.	2390.000	AV	36.0	25.9	14.5	38.1	38.3	53.9	15.6	100	324	
Vert.	4824.000	AV	32.9	30.5	7.5	36.8	34.1	53.9	19.8	100	0	
Vert.	7236.000	AV	35.0	36.3	8.8	39.1	41.0	53.9	12.9	100	0	
Vert.	9648.000	AV	32.3	38.3	9.6	36.9	43.3	53.9	10.6	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

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	80.3	25.9	14.6	38.1	82.7	-	-	
Hori.	2400.000	PK	41.8	25.9	14.5	38.1	44.1	62.7	18.6	
Vert.	2412.000	PK	78.7	25.9	14.6	38.1	81.1	-	-	
Vert.	2400.000	PK	39.1	25.9	14.5	38.1	41.4	61.1	19.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber  
Date February 11, 2015 February 12, 2015  
Temperature / Humidity 23 deg.C, 31 %RH 24 deg.C, 31 %RH  
Engineer Tatsuya Arai Tatsuya Arai  
Mode Tx, 2437 MHz  
Tx, IEEE802.11g, PN9, 6Mbps

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	42.4	30.7	7.5	36.8	43.8	73.9	30.1	100	0	
Hori.	7311.000	PK	45.3	36.4	8.7	39.1	51.3	73.9	22.6	100	0	
Hori.	9748.000	PK	42.1	38.3	9.8	37.0	53.2	73.9	20.7	100	0	
Hori.	4874.000	AV	33.1	30.7	7.5	36.8	34.5	53.9	19.4	100	0	
Hori.	7311.000	AV	35.4	36.4	8.7	39.1	41.4	53.9	12.5	100	0	
Hori.	9748.000	AV	32.5	38.3	9.8	37.0	43.6	53.9	10.3	100	0	
Vert.	4874.000	PK	43.1	30.7	7.5	36.8	44.5	73.9	29.4	100	0	
Vert.	7311.000	PK	45.5	36.4	8.7	39.1	51.5	73.9	22.4	100	0	
Vert.	9748.000	PK	42.4	38.3	9.8	37.0	53.5	73.9	20.4	100	0	
Vert.	4874.000	AV	33.2	30.7	7.5	36.8	34.6	53.9	19.3	100	0	
Vert.	7311.000	AV	35.4	36.4	8.7	39.1	41.4	53.9	12.5	100	0	
Vert.	9748.000	AV	32.5	38.3	9.8	37.0	43.6	53.9	10.3	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place	No.2 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber
Date	February 11, 2015	February 12, 2015
Temperature / Humidity	23 deg.C, 31 %RH	24 deg.C, 31 %RH
Engineer	Tatsuya Arai	Tatsuya Arai
Mode	Tx, 2462 MHz	
	Tx, IEEE802.11g, PN9, 6Mbps	

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	46.1	25.9	14.6	38.0	48.6	73.9	25.3	100	274	
Hori.	4924.000	PK	43.1	30.9	7.6	36.7	44.9	73.9	29.0	100	0	
Hori.	7386.000	PK	44.1	36.5	8.7	39.2	50.1	73.9	23.8	100	0	
Hori.	9848.000	PK	41.9	38.3	9.8	37.0	53.0	73.9	20.9	100	0	
Hori.	2483.500	AV	35.7	25.9	14.6	38.0	38.2	53.9	15.7	100	274	
Hori.	4924.000	AV	33.3	30.9	7.6	36.7	35.1	53.9	18.8	100	0	
Hori.	7386.000	AV	35.2	36.5	8.7	39.2	41.2	53.9	12.7	100	0	
Hori.	9848.000	AV	32.6	38.3	9.8	37.0	43.7	53.9	<b>10.2</b>	100	0	
Vert.	2483.500	PK	44.6	25.9	14.6	38.0	47.1	73.9	26.8	100	326	
Vert.	4924.000	PK	43.2	30.9	7.6	36.7	45.0	73.9	28.9	100	0	
Vert.	7386.000	PK	44.8	36.5	8.7	39.2	50.8	73.9	23.1	100	0	
Vert.	9848.000	PK	41.8	38.3	9.8	37.0	52.9	73.9	21.0	100	0	
Vert.	2483.500	AV	35.1	25.9	14.6	38.0	37.6	53.9	16.3	100	326	
Vert.	4924.000	AV	33.3	30.9	7.6	36.7	35.1	53.9	18.8	100	0	
Vert.	7386.000	AV	35.1	36.5	8.7	39.2	41.1	53.9	12.8	100	0	
Vert.	9848.000	AV	32.5	38.3	9.8	37.0	43.6	53.9	10.3	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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**Tx, IEEE802.11g , PN9, worst data mode 6Mbps**

Agilent

Ref 0 dBm

Atten 10 dB

R L

Mkr2 1.449 ms -8.58 dB

PAvg

S1 S2

Center 2.437 000 GHz

Res BW 1 MHz

Span 0 Hz

VEW 3 MHz

Sweep 1.8 ms (8001 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(3)	Time	124.9 $\mu$ s	-33.53 dBm
1a	(3)	Time	1.428 ms	-1.53 dB
2R	(3)	Time	124.9 $\mu$ s	-33.53 dBm
2a	(3)	Time	1.449 ms	-8.58 dB

Tx2\_duty2

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# Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber  
 Date February 11, 2015 February 12, 2015  
 Temperature / Humidity 23 deg.C, 31 %RH 24 deg.C, 31 %RH  
 Engineer Tatsuya Arai Tatsuya Arai  
 Mode Tx, 2412 MHz  
 Tx, IEEE802.11n(HT20), PN9, MCS1

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	47.4	25.9	14.5	38.1	49.7	73.9	24.2	100	278	
Hori.	4824.000	PK	42.6	30.5	7.5	36.8	43.8	73.9	30.1	100	0	
Hori.	7236.000	PK	44.1	36.3	8.8	39.1	50.1	73.9	23.8	100	0	
Hori.	9648.000	PK	42.1	38.3	9.6	36.9	53.1	73.9	20.8	100	0	
Vert.	2390.000	PK	47.5	25.9	14.5	38.1	49.8	73.9	24.1	100	322	
Vert.	4824.000	PK	42.3	30.5	7.5	36.8	43.5	73.9	30.4	100	0	
Vert.	7236.000	PK	44.3	36.3	8.8	39.1	50.3	73.9	23.6	100	0	
Vert.	9648.000	PK	43.1	38.3	9.6	36.9	54.1	73.9	<b>19.8</b>	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Average measurement value with duty factor

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	AV	36.7	25.9	14.5	38.1	0.3	39.3	53.9	14.6	*1
Hori.	4824.000	AV	32.8	30.5	7.5	36.8	0.3	34.3	53.9	19.6	
Hori.	7236.000	AV	35.0	36.3	8.8	39.1	0.3	41.3	53.9	12.6	
Hori.	9648.000	AV	32.5	38.3	9.6	36.9	0.3	43.8	53.9	<b>10.1</b>	
Vert.	2390.000	AV	36.7	25.9	14.5	38.1	0.3	39.3	53.9	14.6	*1
Vert.	4824.000	AV	33.3	30.5	7.5	36.8	0.3	34.8	53.9	19.1	
Vert.	7236.000	AV	35.0	36.3	8.8	39.1	0.3	41.3	53.9	12.6	
Vert.	9648.000	AV	32.5	38.3	9.6	36.9	0.3	43.8	53.9	<b>10.1</b>	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

\* Duty factor refer to "Duty Factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage power).

## 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

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	80.3	25.9	14.6	38.1	82.7	-	-	
Hori.	2400.000	PK	41.2	25.9	14.5	38.1	43.5	62.7	19.2	
Vert.	2412.000	PK	78.6	25.9	14.6	38.1	81.0	-	-	
Vert.	2400.000	PK	40.0	25.9	14.5	38.1	42.3	61.0	18.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place	No.2 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber
Date	February 11, 2015	February 12, 2015
Temperature / Humidity	23 deg.C, 31 %RH	24 deg.C, 31 %RH
Engineer	Tatsuya Arai	Tatsuya Arai
Mode	Tx, 2437 MHz	
	Tx, IEEE802.11n(HT20), PN9, MCS1	

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	42.2	30.7	7.5	36.8	43.6	73.9	30.3	100	0	
Hori.	7311.000	PK	44.6	36.4	8.7	39.1	50.6	73.9	23.3	100	0	
Hori.	9748.000	PK	42.5	38.3	9.8	37.0	53.6	73.9	<b>20.3</b>	100	0	
Vert.	4874.000	PK	42.0	30.7	7.5	36.8	43.4	73.9	30.5	100	0	
Vert.	7311.000	PK	45.5	36.4	8.7	39.1	51.5	73.9	22.4	100	0	
Vert.	9748.000	PK	41.6	38.3	9.8	37.0	52.7	73.9	21.2	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Average measurement value with duty factor**

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	AV	32.9	30.7	7.5	36.8	0.3	34.6	53.9	19.3	
Hori.	7311.000	AV	35.3	36.4	8.7	39.1	0.3	41.6	53.9	12.3	
Hori.	9748.000	AV	32.3	38.3	9.8	37.0	0.3	43.7	53.9	10.2	
Vert.	4874.000	AV	32.9	30.7	7.5	36.8	0.3	34.6	53.9	19.3	
Vert.	7311.000	AV	35.0	36.4	8.7	39.1	0.3	41.3	53.9	12.6	
Vert.	9748.000	AV	32.4	38.3	9.8	37.0	0.3	43.8	53.9	<b>10.1</b>	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

\* Duty factor refer to "Duty Factor Calculation chart" sheet.

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## Radiated Emission

UL Japan, Inc. Shonan EMC Lab.

Test place	No.2 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber
Date	February 11, 2015	February 12, 2015
Temperature / Humidity	23 deg.C, 31 %RH	24 deg.C, 31 %RH
Engineer	Tatsuya Arai	Tatsuya Arai
Mode	Tx, 2462 MHz	
	Tx, IEEE802.11n(HT20), PN9, MCS1	

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	45.5	25.9	14.6	38.0	48.0	73.9	25.9	100	275	
Hori.	4924.000	PK	42.1	30.9	7.6	36.7	43.9	73.9	30.0	100	0	
Hori.	7386.000	PK	45.1	36.5	8.7	39.2	51.1	73.9	22.8	100	0	
Hori.	9848.000	PK	42.2	38.3	9.8	37.0	53.3	73.9	<b>20.6</b>	100	0	
Vert.	2483.500	PK	47.2	25.9	14.6	38.0	49.7	73.9	24.2	100	322	
Vert.	4924.000	PK	44.1	30.9	7.6	36.7	45.9	73.9	28.0	100	0	
Vert.	7386.000	PK	44.6	36.5	8.7	39.2	50.6	73.9	23.3	100	0	
Vert.	9848.000	PK	42.0	38.3	9.8	37.0	53.1	73.9	20.8	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ **Average measurement value with duty factor**

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	AV	36.1	25.9	14.6	38.0	0.3	38.9	53.9	15.0	*1
Hori.	4924.000	AV	33.0	30.9	7.6	36.7	0.3	35.1	53.9	18.8	
Hori.	7386.000	AV	35.1	36.5	8.7	39.2	0.3	41.4	53.9	12.5	
Hori.	9848.000	AV	32.7	38.3	9.8	37.0	0.3	44.1	53.9	<b>9.8</b>	
Vert.	2483.500	AV	35.1	25.9	14.6	38.0	0.3	37.9	53.9	16.0	*1
Vert.	4924.000	AV	33.1	30.9	7.6	36.7	0.3	35.2	53.9	18.7	
Vert.	7386.000	AV	35.9	36.5	8.7	39.2	0.3	42.2	53.9	11.7	
Vert.	9848.000	AV	32.4	38.3	9.8	37.0	0.3	43.8	53.9	10.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ 

\* Duty factor refer to "Duty Factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage power).

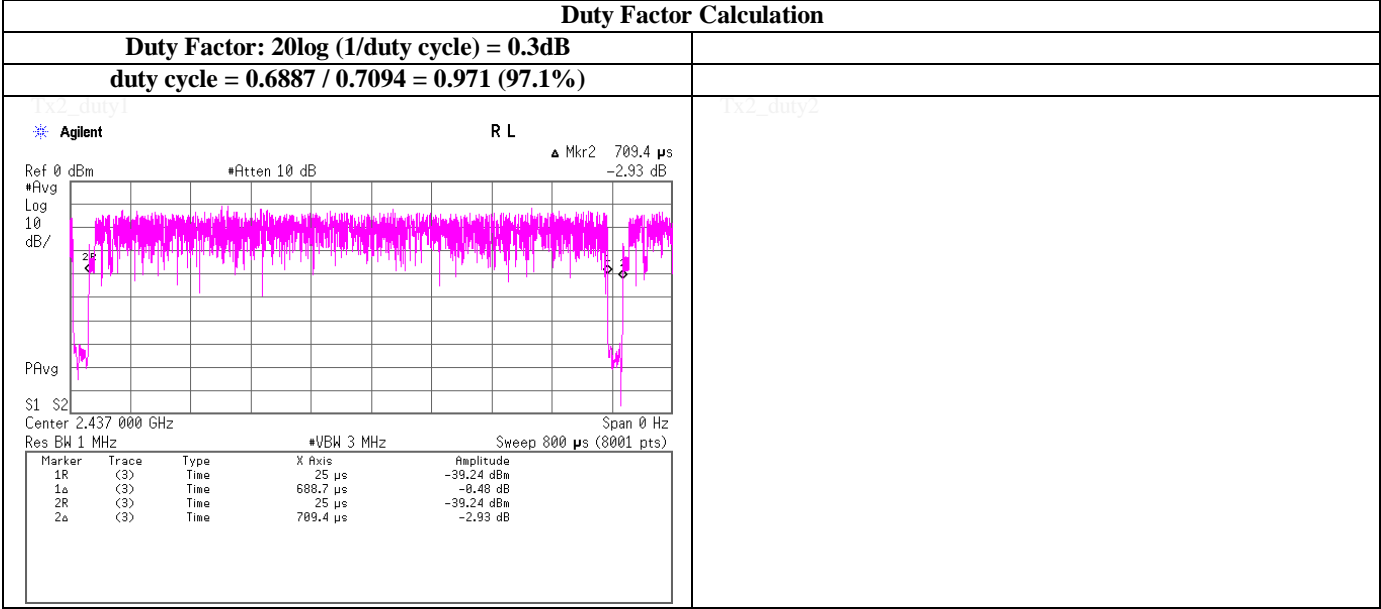
**UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**



Test place                   UL Japan, Inc. Shonan EMC Lab.       No.6 Shielded Room  
Date                        February 9, 2015  
Temperature / Humidity   23deg.C       , 45%RH  
Engineer                  Makoto Hosaka

**Duty Factor Calculation chart**

**Tx, IEEE802.11n HT20 , PN9, worst data mode 1(MCS)**



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**Facsimile       : +81 463 50 6401**

Test place

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room

Date

February 10, 2015

Temperature / Humidity

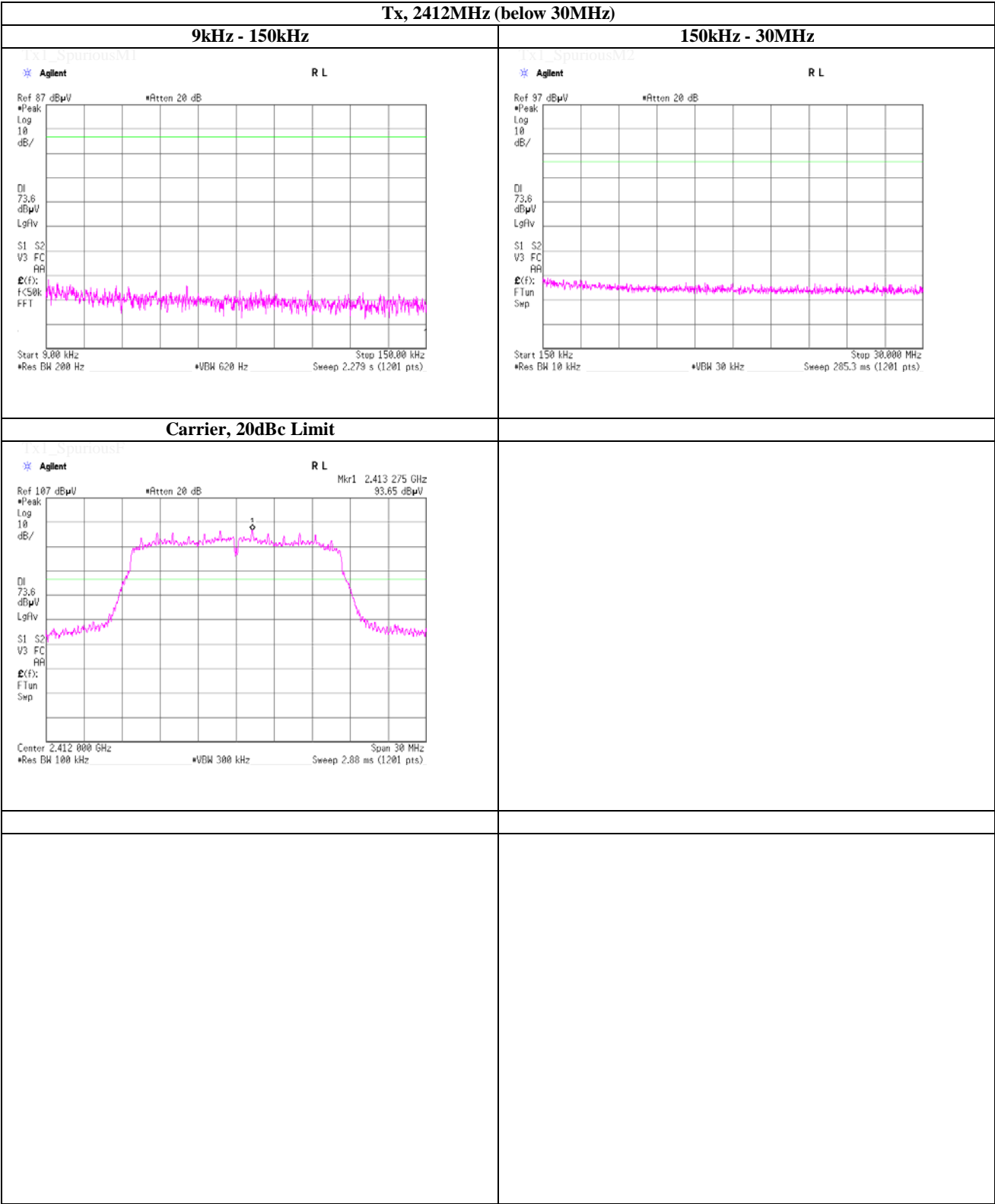
23deg.C , 41%RH

Engineer

Makoto Hosaka

Spurious emission (Conducted)

Tx, IEEE802.11g , PN9, worst data mode 6Mbps



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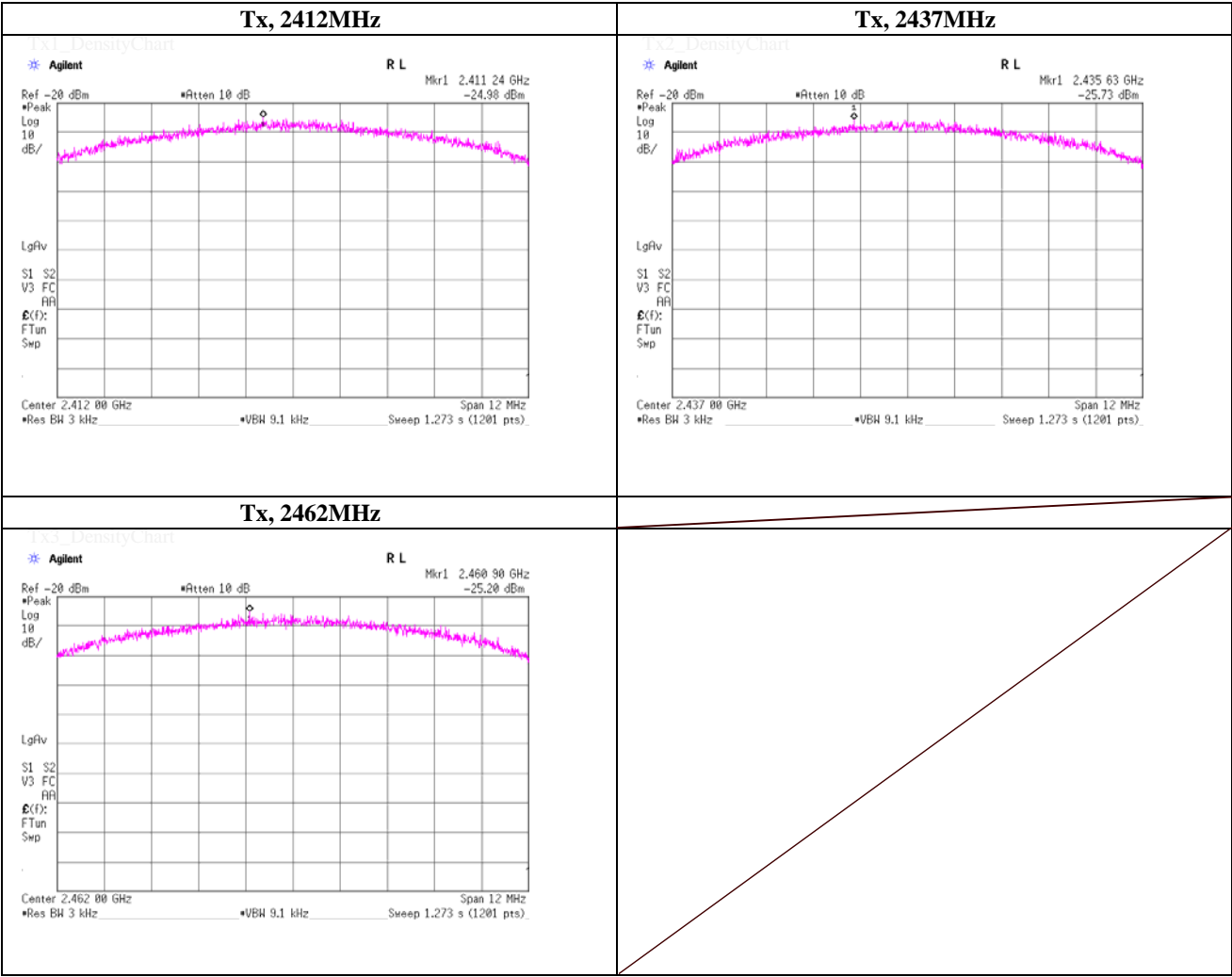
Facsimile : +81 463 50 6401

**Maximum Power Spectral Density**  
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	February 10, 2015	
Temperature / Humidity	23deg.C , 41%RH	
Engineer	Makoto Hosaka	
Mode	Tx, IEEE802.11b , PN9, worst data mode 11Mbps	

Ch. Freq.	Freq. Reading	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.0000	2411.24	-24.98	1.95	9.90	-13.13	8.00	21.13
2437.0000	2435.63	-25.73	1.96	9.90	-13.87	8.00	21.87
2462.0000	2460.90	-25.20	1.97	9.90	-13.33	8.00	21.33

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss



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**Maximum Power Spectral Density**  
(PKPSD)

Test place

UL Japan, Inc. Shonan EMC Lab.

No.5 Shielded Room

Date

February 10, 2015

Temperature / Humidity

23deg.C , 41%RH

Engineer

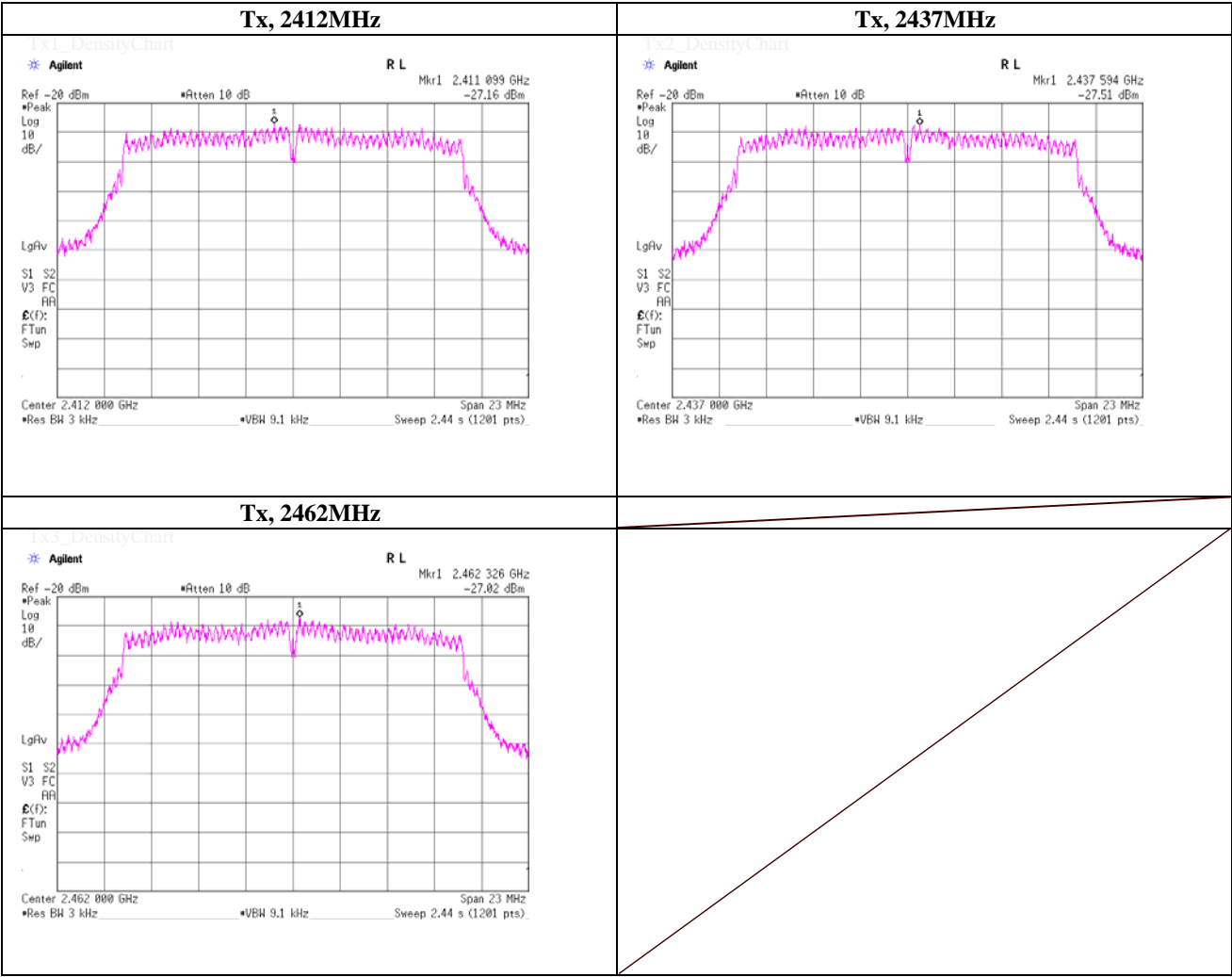
Makoto Hosaka

Mode

Tx, IEEE802.11g, PN9, worst data mode 6Mbps

Ch. Freq.	Freq. Reading	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.0000	2411.10	-27.16	1.95	9.90	-15.31	8.00	23.31
2437.0000	2437.59	-27.51	1.96	9.90	-15.65	8.00	23.65
2462.0000	2462.33	-27.02	1.97	9.90	-15.15	8.00	23.15

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss



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**Maximum Power Spectral Density**  
(PKPSD)

Test place

UL Japan, Inc. Shonan EMC Lab.

No.5 Shielded Room

Date

February 10, 2015

Temperature / Humidity

23deg.C , 41%RH

Engineer

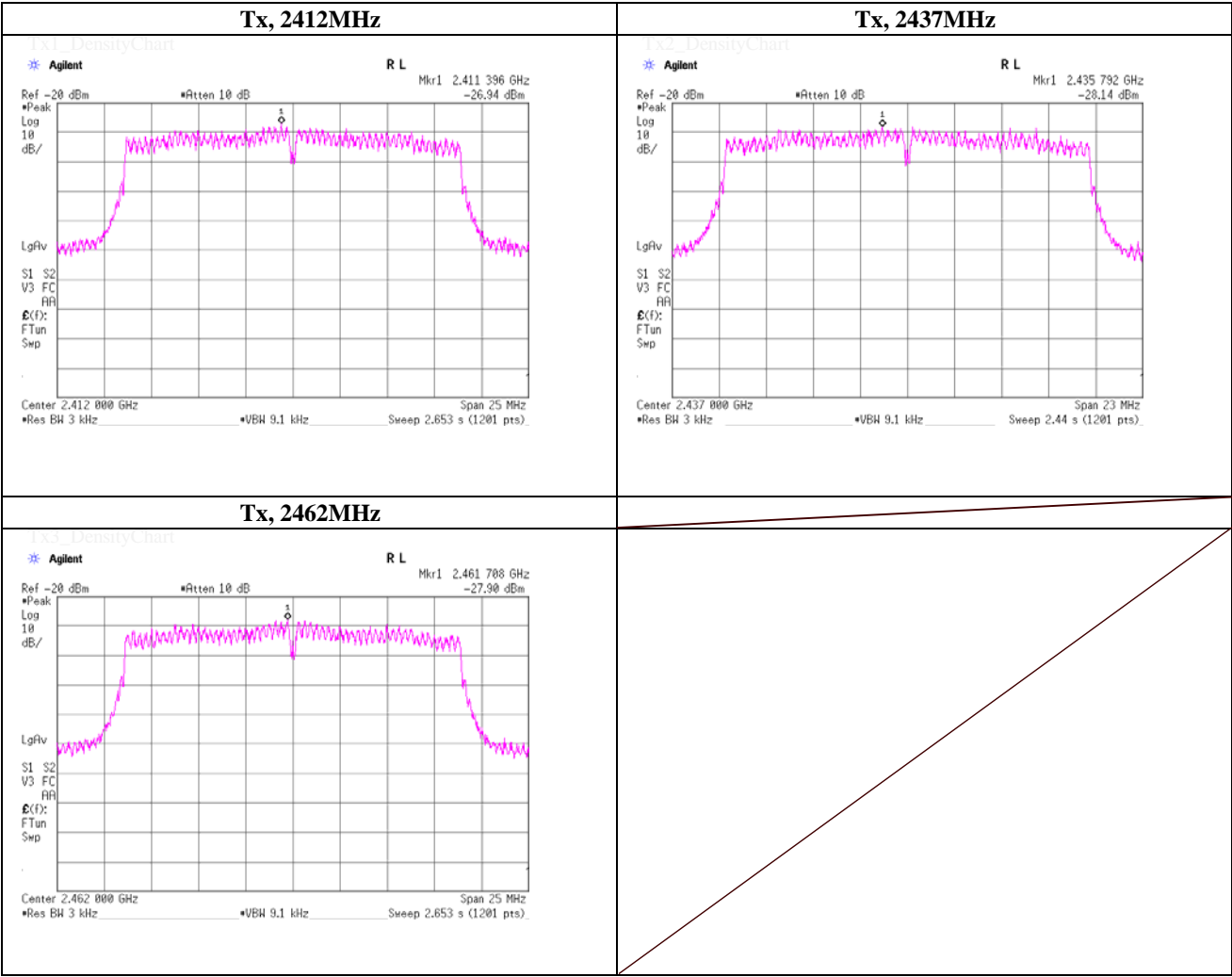
Makoto Hosaka

Mode

Tx, IEEE802.11n HT20 , PN9, worst data mode 1(MCS)

Ch. Freq.	Freq. Reading	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.0000	2411.40	-26.95	1.95	9.90	-15.10	8.00	23.10
2437.0000	2435.79	-28.14	1.96	9.90	-16.28	8.00	24.28
2462.0000	2461.71	-27.90	1.97	9.90	-16.03	8.00	24.03

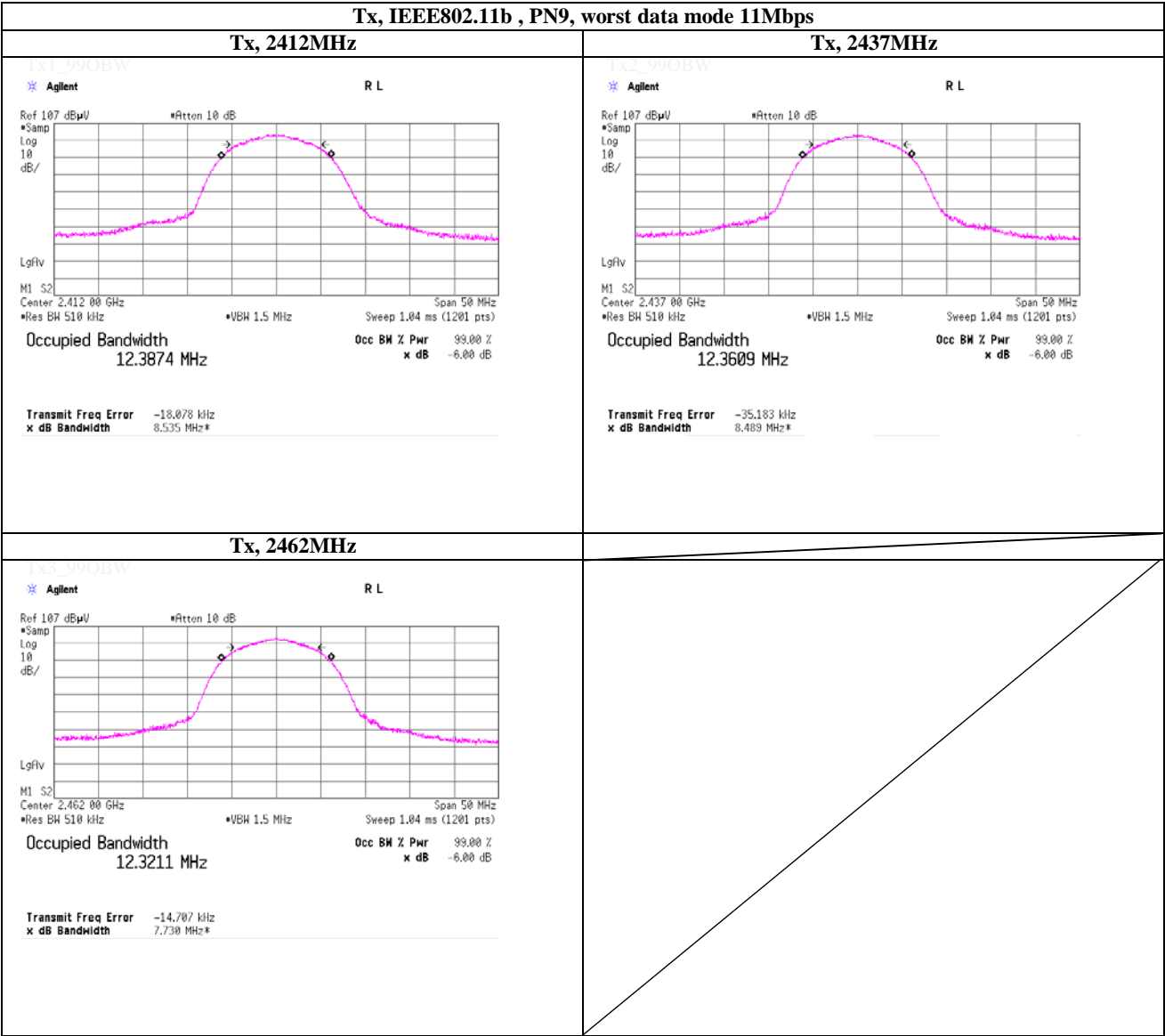
Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss



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Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
Date                        February 10, 2015  
Temperature / Humidity   23deg.C           , 41%RH  
Engineer                  Makoto Hosaka

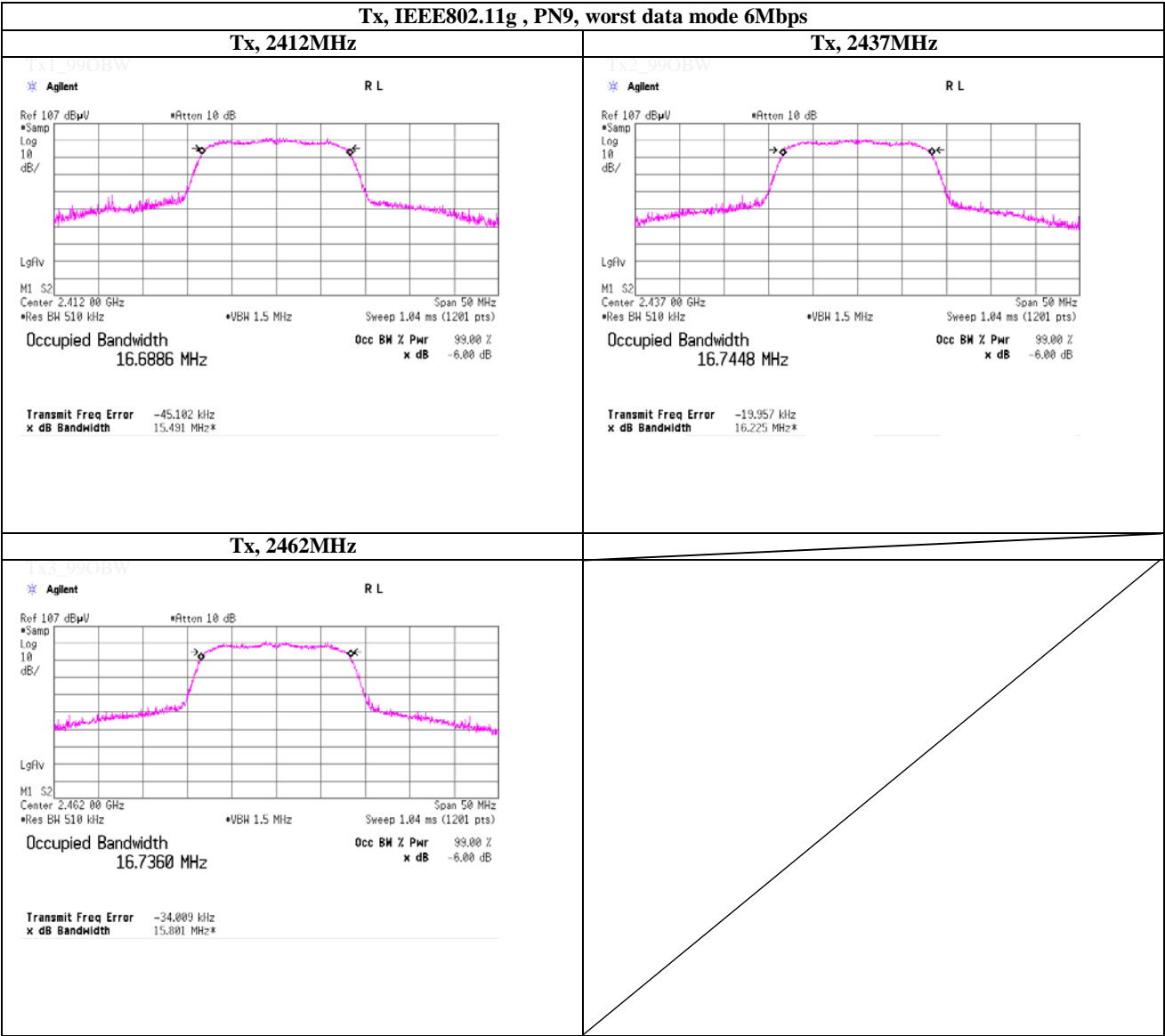
**99% Occupied Bandwidth**



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Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
Date                        February 10, 2015  
Temperature / Humidity   23deg.C           , 41%RH  
Engineer                 Makoto Hosaka

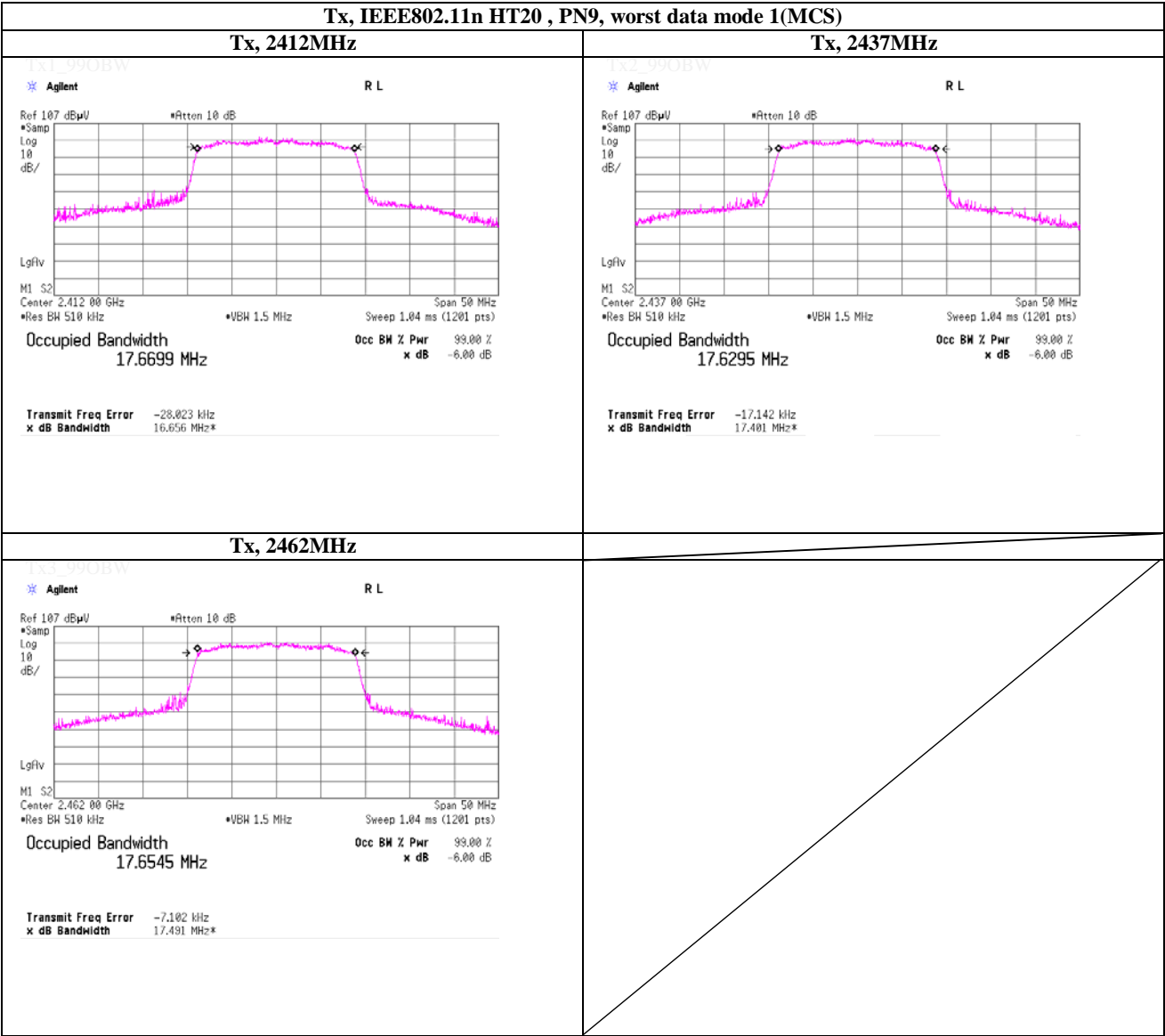
**99% Occupied Bandwidth**



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Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
Date                        February 10, 2015  
Temperature / Humidity   23deg.C           , 41%RH  
Engineer                  Makoto Hosaka

**99% Occupied Bandwidth**



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## APPENDIX 2

### Test Instruments

#### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2014/04/08 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2014/04/08 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT	2014/03/17 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2014/04/22 * 12
SCC-G32	Coaxial Cable	Junkosha	MWX241-02000KM SKMS	OCT-09-13-00 5	AT	2014/10/23 * 12
SOS-10	Humidity Indicator	A&D	AD-5681	4064561	AT	2014/10/30 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/12/24 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2014/07/08 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2014/11/21 * 12
SCC-G02	Coaxial Cable	Suhner	SUCOFLEX 104A	46498/4A	RE	2014/04/22 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2014/05/15 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2014/08/12 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2014/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2014/03/04 * 12
SJM-14	Measure	ASKUL	-	-	RE/CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFLMF)	-	RE/CE	-
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2014/11/21 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2014/04/22 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2014/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2014/05/15 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2014/03/14 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2014/02/17 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2014/02/17 * 12
KAT3-11	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2014/08/27 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2014/11/22 * 12
SCC-B1/B3/B5 /B7/B8/B13/S RSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhne r/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/14 1PE/141PE/141PE /141PE/NS4906	-/0901-270(RF Selector)	RE	2014/04/25 * 12
SCC-B2/B4/B6 /B7/B8/B13/S RSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhne r/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/14 1PE/141PE/141PE /141PE/NS4906	-/0901-270(RF Selector)	RE	2014/04/25 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0893	RE	2014/11/22 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE/CE	2014/09/03 * 12
SCC-B12/B13/ SRSE-02	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/N S4906	-/0901-270(RF Selector)	CE	2014/04/25 * 12
SLS-03	LISN	Rohde & Schwarz	ENV216	100513	CE(EUT)	2014/02/14 * 12
SLS-04	LISN	Rohde & Schwarz	ENV216	100514	CE(AE)	2014/02/26 * 12
SAT3-05	Attenuator	JFW	50HF-003N	-	CE	2014/02/17 * 12
SOS-04	Humidity Indicator	A&D	AD-5681	4061512	CE	2014/12/24 * 12
STM-02	Terminator	TME	CT-01 BP	-	CE	2014/12/19 * 12

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

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

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

Test Item :

CE: Conducted emission ,

RE: Radiated emission ,

AT: Antenna terminal conducted test