



RADIO TEST REPORT cover sheet

Applicant : **Clarion Co., Ltd.**

Model No. : **QY-5120, PH-3782**

FCC ID : **AX2QY5120**

The difference between 3 models (QY-5092, QY-5120 and PH-3782) doesn't affect the radio characteristics.

The electrical characteristics among those models are identical to each other.

Therefore, we use test report No. 10399701S-F-R1 and 10399701S-H-R1.

Date

July 9, 2015

A handwritten signature in blue ink that reads 'T. Imamura'.

Toyokazu Imamura

Leader

Consumer Technology Division

UL Japan, Inc.

Shonan EMC Lab.

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RADIO TEST REPORT

Test Report No.: 10399701S-H-R1

Applicant : Clarion Co., Ltd.
Type of Equipment : Navigation Unit
Model No. : QY-5092
FCC ID : AX2QY5092
Test regulation : FCC Part15 Subpart C: 2014
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 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: December 18, 2014 to January 9, 2015

Representative test engineer:

S. Takano

Shinichi Takano
Engineer
Consumer Technology Division

Approved by :

T. Arai

Tatsuya Arai
Engineer
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 : Clarion Co., Ltd.
Address : 7-2 Shintoshin, Chuo-ku, Saitama-shi, Saitama, 330-0081 Japan
Telephone Number : +81-48-601-3602
Facsimile Number : +81-48-601-3802
Contact Person : Matsuhiko Hirano

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

2.1 Identification of E.U.T.

Type of Equipment : Navigation Unit
Model Number : QY-5092
Serial Number : Refer to Section 4.2
Rating : DC10-16V
Country of Mass-production : China
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : September 8, 2014
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: QY-5092 (referred to as the EUT in this report) is a Navigation Unit.

Clock frequency(ies) in the system : 5.6448MHz, 6.144MHz, 8.192MHz, 12.2896MHz, 12.8MHz,
24.576MHz, 26MHz, 27MHz, 28.224MHz, 33.231MHz, 41.6MHz,
48MHz

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<Bluetooth part>

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth & channel spacing : 79MHz & 1MHz
Type of modulation : GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna type : Metal Sheet
Antenna gain : -1.11dBi
Antenna connector type : U.FL
Operation temperature range : -30 to +70 deg.C.
ITU code : F1D, G1D

<Wireless LAN part>

Equipment type : Transceiver
Frequency of operation : 2412-2462MHz
Bandwidth & channel spacing : 20MHz & 5MHz
Type of modulation : CCK, OFDM
Antenna type : Metal Sheet
Antenna gain : -1.11dBi
Antenna connector type : U.FL
Operation temperature range : -30 to +70 deg.C.
ITU code : G1D, D1D

* For Bluetooth part, refer to the test report: 10399701S-F-R1.

FCC 15.31 (e)

The EUT provides stable voltage (DC3.3V) constantly to the wireless transmitter regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

FCC 15.203

The equipment and its antenna comply with the requirement since the antenna is built in the equipment and it cannot be replaced by end users.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2014, final revised on December 23, 2014
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

* The revision on December 23, 2014 does not affect the test specification applied to the EUT.

The EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report 10399701S-J.

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 *2)	-	-
6dB bandwidth	ANSI C63.10:2009	FCC 15.247 (a)(2)	Conducted	N/A	* See data	Complied
Maximum peak 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 *3)	5.1dB Freq.: 4924.000MHz Polarization: Horizontal Detection: Average Mode: Tx 2462MHz, IEEE 802.11b	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".

*2) The test is not applicable since the EUT has no AC mains.

*3) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 12.2.7.

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.10:2009, 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 ^{*1} /SR ^{*2} (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
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

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

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

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 1.7dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 2.4dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB

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

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 type="checkbox"/> No.6 shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.1 measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test setup, Test data & 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)
Radiated emission (below 1GHz) *2)	Transmitting IEEE 802.11n HT20	2412MHz	PN9, MCS2
Other items	Transmitting IEEE 802.11b	2412MHz, 2437MHz, 2462MHz	PN9, 2Mbps
	Transmitting IEEE 802.11g	2412MHz, 2437MHz, 2462MHz	PN9, 48Mbps
	Transmitting IEEE 802.11n HT20	2412MHz, 2437MHz, 2462MHz	PN9, MCS2
*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.			

EUT has the power settings by the software as follows;

Power settings	Fixed
Software	Tera Term Ver. 4.83

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

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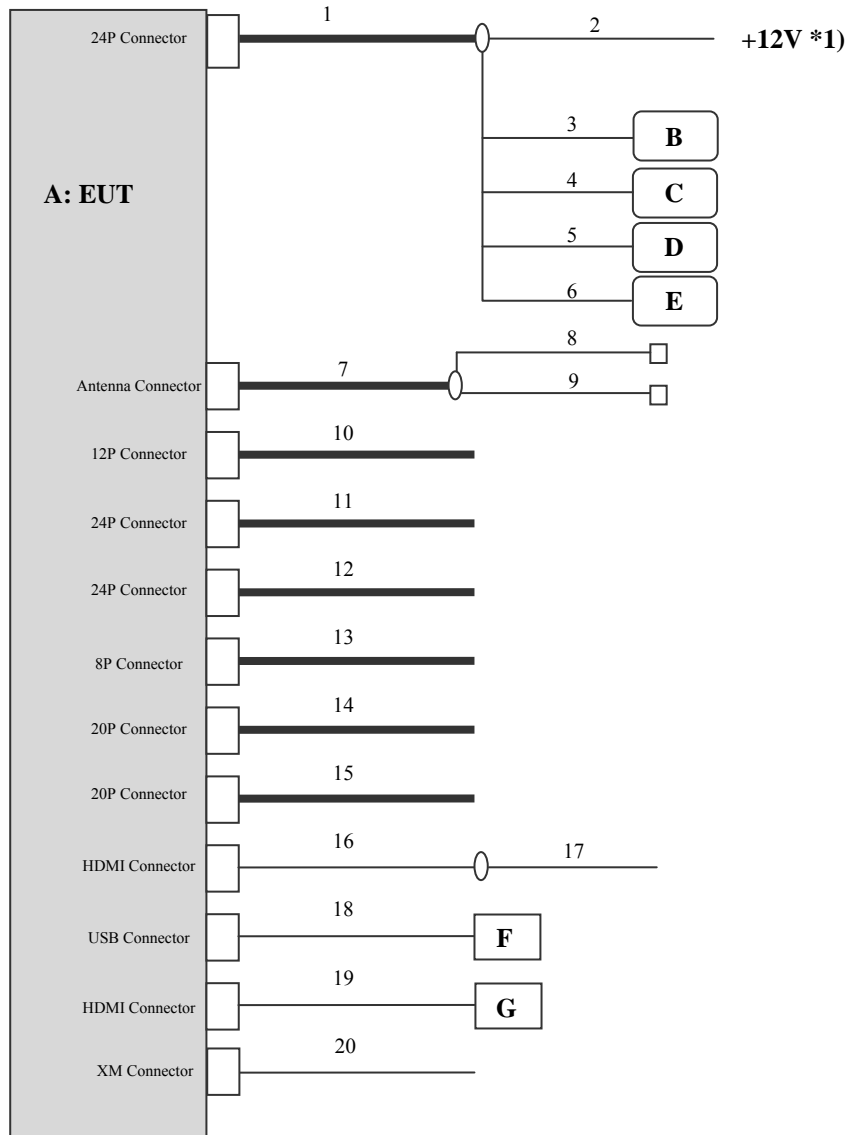
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4.2 Configuration and peripherals

□ : Terminated



* Test data was taken under worse case conditions.

*1) DC power supply (Model No.: PAN35-10A) was used for DC 12V input.

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Description of EUT and Auxiliary equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Navigation Unit	QY-5092	#56	Clarion	EUT
B	Speaker	KFC-RS160	-	KENWOOD	-
C	Speaker	KFC-RS160	-	KENWOOD	-
D	Speaker	KFC-RS160	-	KENWOOD	-
E	Speaker	KFC-RS160	-	KENWOOD	-
F	USB Memory	MF-RSU204GBK	BR00007341	ELECOM	-
G	GPS Antenna	-	0960138000763	-	-

List of cables used

No.	Item	Length(m)	Shield (Cable)	Shield (Connector)	Remarks
1	24P Connector (Gray)	2.0	Unshielded	Unshielded	-
2	+B, ACC, GND	1.2	Unshielded	Unshielded	-
3	Speaker Front Left	1.8	Unshielded	Unshielded	-
4	Speaker Front Right	1.8	Unshielded	Unshielded	-
5	Speaker Rear Left	1.8	Unshielded	Unshielded	-
6	Speaker Rear Right	1.8	Unshielded	Unshielded	-
7	Antenna Connector	0.2	Shielded	Shielded	-
8	Main antenna	2.0	Shielded	Shielded	-
9	Sub antenna	1.2	Shielded	Shielded	-
10	12P Connector (Gray)	2.2	Unshielded	Unshielded	-
11	24P Connector (Blue)	2.2	Unshielded	Unshielded	-
12	24P Connector (Gray)	2.2	Unshielded	Unshielded	-
13	8P Connector (Gray)	2.5	Unshielded	Unshielded	-
14	20P Connector (Gray)	2.2	Unshielded	Unshielded	-
15	28P Connector (Gray)	2.2	Unshielded	Unshielded	-
16	HDMI Connector	1.0	Shielded	Shielded	-
17	HDMI	1.8	Shielded	Shielded	-
18	USB connector	2.5	Shielded	Shielded	-
19	GPS connector	2.5	Shielded	Shielded	-
20	XM connector	2.0	Shielded	Shielded	-

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SECTION 5: 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 6: Maximum peak output power

Test procedure

The Maximum 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 7: Out of band emissions (Antenna port conducted)

Test procedure

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.
The radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement. In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

Summary of the test results: Pass
Refer to APPENDIX 1

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 platform of nominal size, 1.0m 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 EUT, including its peripherals was aligned and flushed with rear of tabletop. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. Photographs of the set up are shown in APPENDIX 3.

9.3 Test conditions

Frequency range : 30MHz to 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 angle of 35.5 or 39 deg. based on the product specification to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Antenna polarization \ Test item	Carrier *1)	Spurious emission (Below 1GHz)	Spurious emission (Above 1GHz)
Horizontal	35.5 deg.	35.5 deg.	35.5 deg.
Vertical	35.5 deg.	35.5 deg.	35.5 deg.

*1) with spurious emissions near carrier frequency

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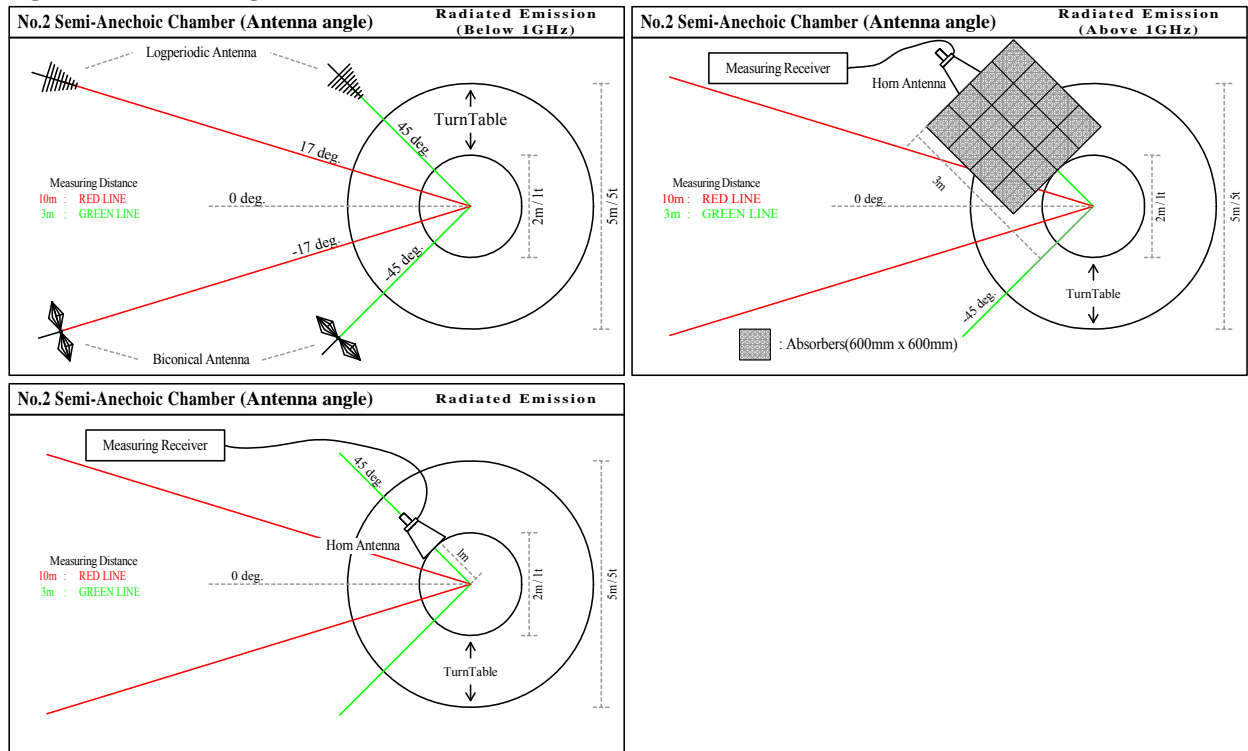
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Figure 1. Antenna angle



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 4th order harmonics.

Refer to APPENDIX 1

Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

6dB bandwidth
Maximum peak output power
Radiated emission
Spurious emission (Antenna port conducted)
Peak power density
Occupied bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Radiated emission

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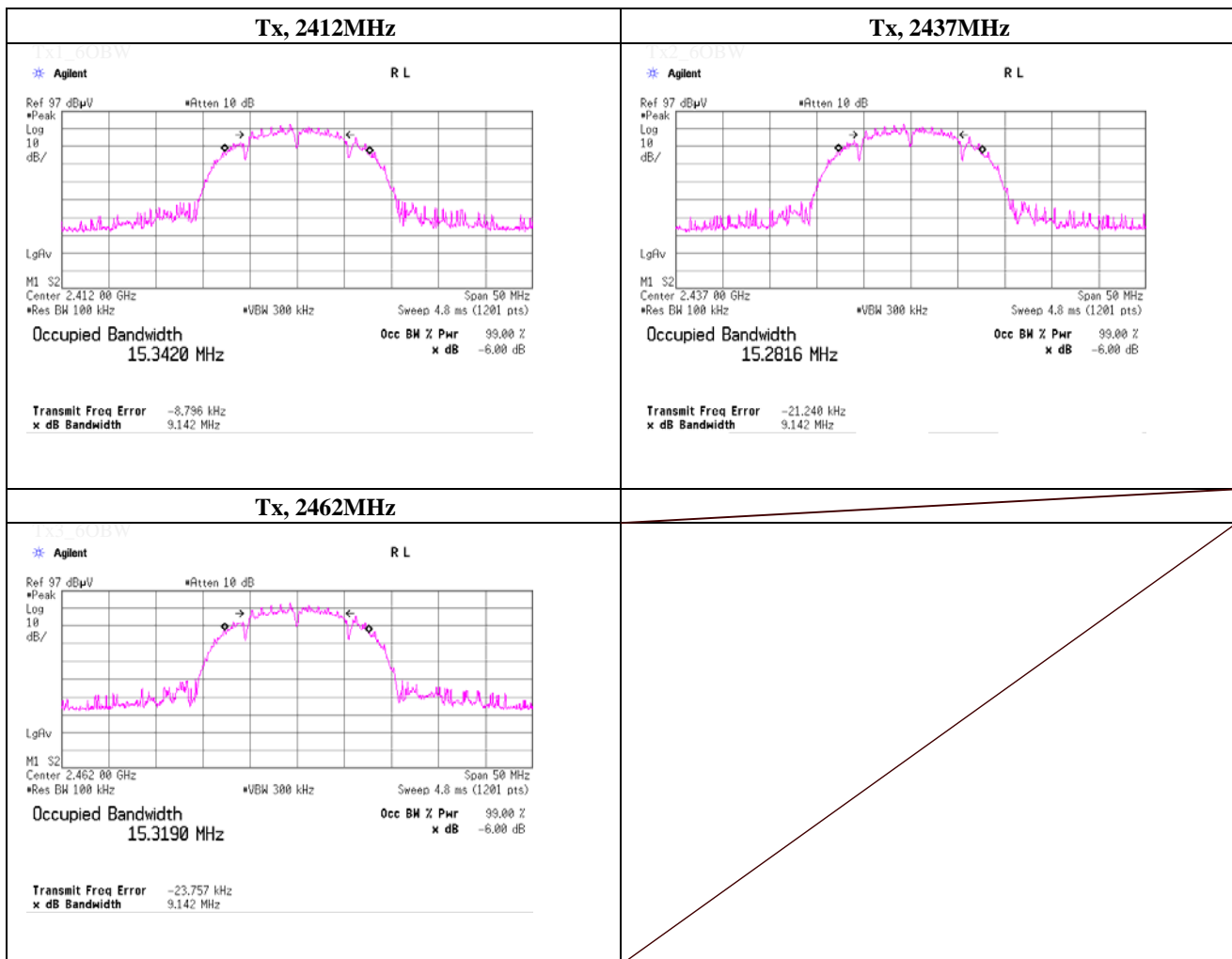
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APPENDIX 1: Data of Radio tests

-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	December 18, 2014	
Temperature / Humidity	26deg.C , 28%RH	
Engineer	Shinichi Takano	
Mode	Tx, IEEE802.11b, PN9, worst data mode 2Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	9.142	> 0.500
2437.0000	9.142	> 0.500
2462.0000	9.142	> 0.500



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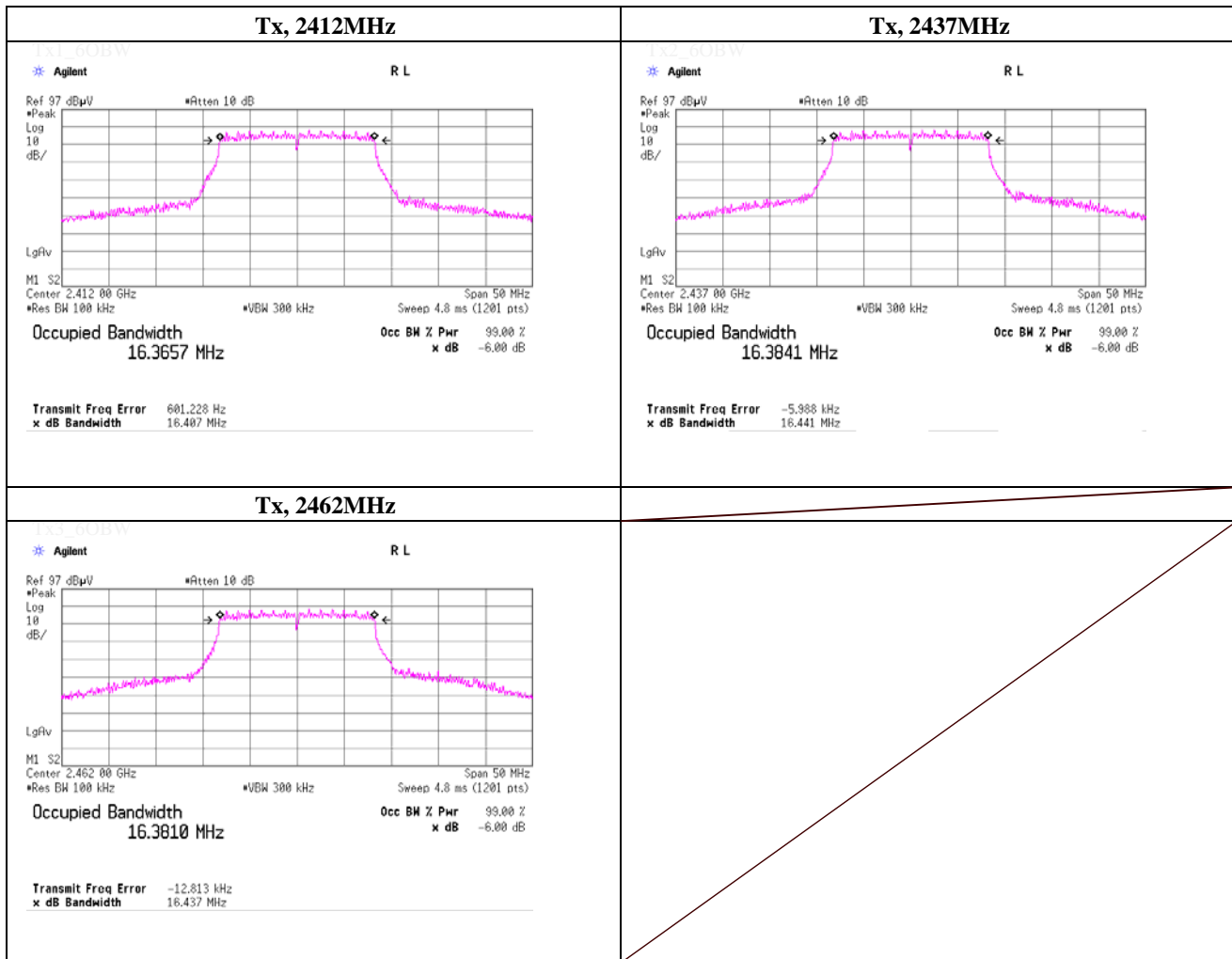
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-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	December 18, 2014	
Temperature / Humidity	26deg.C , 28%RH	
Engineer	Shinichi Takano	
Mode	Tx, IEEE802.11g, PN9, worst data mode 48Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	16.407	> 0.500
2437.0000	16.441	> 0.500
2462.0000	16.437	> 0.500

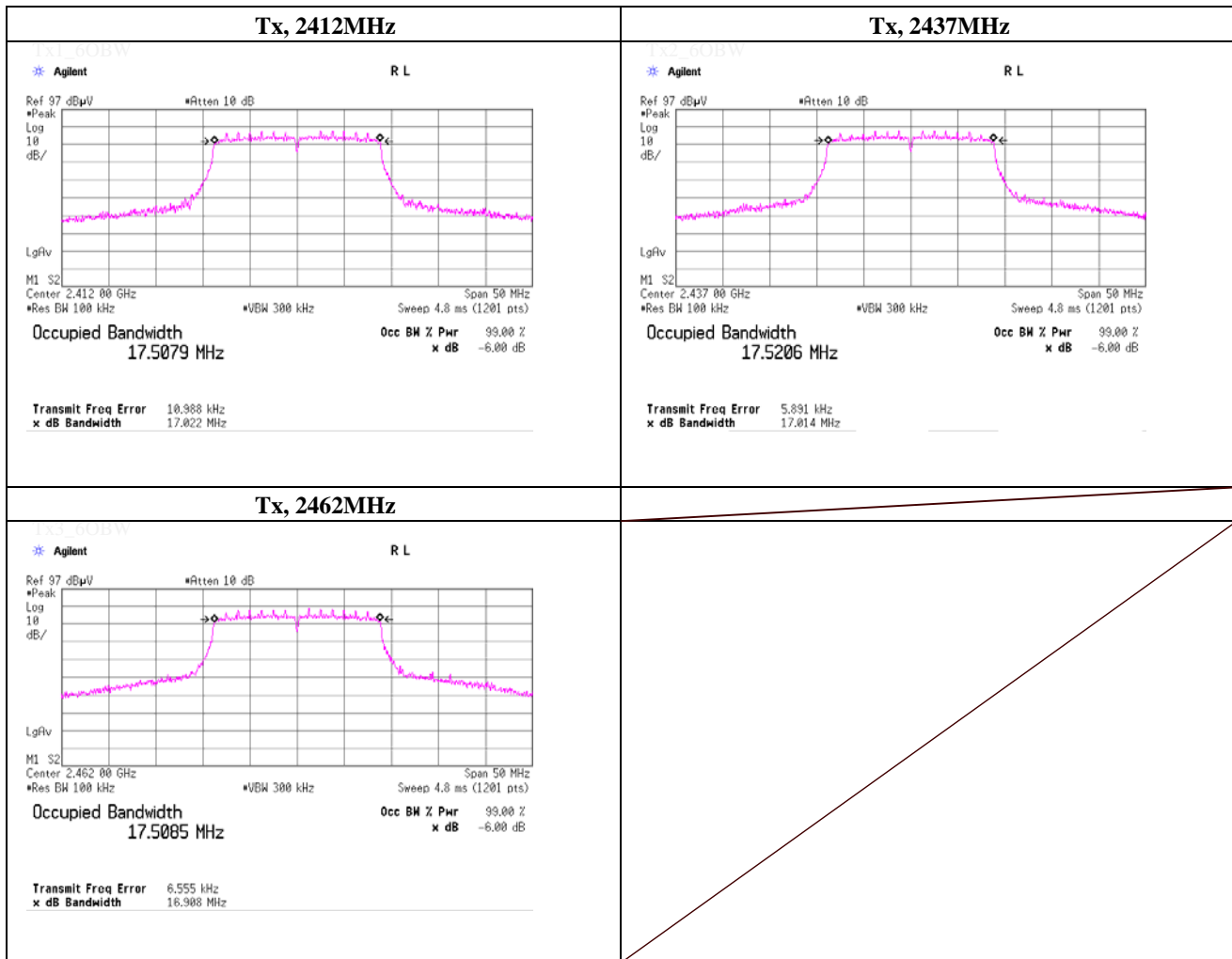


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-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	December 18, 2014	
Temperature / Humidity	26deg.C , 28%RH	
Engineer	Shinichi Takano	
Mode	Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	17.022	> 0.500
2437.0000	17.014	> 0.500
2462.0000	16.908	> 0.500



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Maximum Peak Conducted Output Power

(PKPM1)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano
 Mode Tx, IEEE802.11n HT20, PN9, Guard interval : long worst data mode : 2 (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 [dB]
					[dBm]	[mW]	[dBm]	[mW]	
Low	2412.0	-1.80	2.15	20.24	20.59	114.55	30.00	1000	9.41
Mid	2437.0	-2.16	2.13	20.24	20.21	104.95	30.00	1000	9.79
High	2462.0	-2.23	2.13	20.24	20.14	103.28	30.00	1000	9.86

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

[Pre check]**Guard interval long**

	Mode (MCS)	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
						[dBm]	[mW]	[dBm]	[mW]	
long	0	2412.0	-1.83	2.15	20.24	20.56	113.76	30.00	1000	9.44
long	1	2412.0	-2.09	2.15	20.24	20.30	107.15	30.00	1000	9.70
long	2	2412.0	-1.80	2.15	20.24	20.59	114.55	30.00	1000	9.41
long	3	2412.0	-1.97	2.15	20.24	20.42	110.15	30.00	1000	9.58
long	4	2412.0	-2.23	2.15	20.24	20.16	103.75	30.00	1000	9.84
long	5	2412.0	-2.57	2.15	20.24	19.82	95.94	30.00	1000	10.18
long	6	2412.0	-2.37	2.15	20.24	20.02	100.46	30.00	1000	9.98
long	7	2412.0	-2.58	2.15	20.24	19.81	95.72	30.00	1000	10.19

Worst**Guard interval short**

	Mode (MCS)	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
						[dBm]	[mW]	[dBm]	[mW]	
short	0	2412.0	-1.84	2.15	20.24	20.55	113.50	30.00	1000	9.45
short	1	2412.0	-1.97	2.15	20.24	20.42	110.15	30.00	1000	9.58
short	2	2412.0	-1.89	2.15	20.24	20.50	112.20	30.00	1000	9.50
short	3	2412.0	-2.02	2.15	20.24	20.37	108.89	30.00	1000	9.63
short	4	2412.0	-2.11	2.15	20.24	20.28	106.66	30.00	1000	9.72
short	5	2412.0	-2.55	2.15	20.24	19.84	96.38	30.00	1000	10.16
short	6	2412.0	-2.40	2.15	20.24	19.99	99.77	30.00	1000	10.01
short	7	2412.0	-2.62	2.15	20.24	19.77	94.84	30.00	1000	10.23

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Maximum Conducted Output Power (Reference Data)

(AVGPM)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date December 18, 2014
Temperature / Humidity 26deg.C , 28%RH
Engineer Shinichi Takano
Mode Tx, IEEE802.11n HT20, PN9, Guard interval : short worst data mode : 0 (MCS)

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

Ch	Freq. [MHz]	P/M (AV) Reading(*1) [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Result	
						[dBm]	[mW]
Low	2412.0	-10.92	2.15	20.24	0.00	11.47	14.03
Mid	2437.0	-10.72	2.13	20.24	0.00	11.65	14.62
High	2462.0	-10.65	2.13	20.24	0.00	11.72	14.86

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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

[Pre check]**Guard interval long**

	Mode (MCS)	Freq. [MHz]	P/M (AV) Reading(*1) [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Result	
							[dBm]	[mW]
long	0	2412.0	-11.18	2.15	20.24	0.00	11.21	13.21
long	1	2412.0	-11.13	2.15	20.24	0.00	11.26	13.37
long	2	2412.0	-11.03	2.15	20.24	0.00	11.36	13.68
long	3	2412.0	-11.04	2.15	20.24	0.00	11.35	13.65
long	4	2412.0	-11.11	2.15	20.24	0.00	11.28	13.43
long	5	2412.0	-12.94	2.15	20.24	0.00	9.45	8.81
long	6	2412.0	-12.93	2.15	20.24	0.00	9.46	8.83
long	7	2412.0	-12.85	2.15	20.24	0.00	9.54	8.99

Guard interval short

	Mode (MCS)	Freq. [MHz]	P/M (AV) Reading(*1) [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Result	
							[dBm]	[mW]
short	0	2412.0	-10.92	2.15	20.24	0.00	11.47	14.03
short	1	2412.0	-10.98	2.15	20.24	0.00	11.41	13.84
short	2	2412.0	-11.10	2.15	20.24	0.00	11.29	13.46
short	3	2412.0	-11.31	2.15	20.24	0.00	11.08	12.82
short	4	2412.0	-11.17	2.15	20.24	0.00	11.22	13.24
short	5	2412.0	-12.86	2.15	20.24	0.00	9.53	8.97
short	6	2412.0	-12.89	2.15	20.24	0.00	9.50	8.91
short	7	2412.0	-12.79	2.15	20.24	0.00	9.60	9.12

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

(*1) Power was measured with using the gate function of power meter.

It was means that the intervals during which the transmitter is off or is transmitting at reduced power level is not included in the average.
Therefore, there is no need to add duty cycle correction to the result.

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Radiated Emission

Test place No.2 Semi Anechoic Chamber
Date January 8, 2015 January 9, 2015
Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
Engineer Wataru Kojima Wataru Kojima
Mode Tx, 2412 MHz
 Tx, IEEE802.11b, PN9, worst data mode 2Mbps

(* 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	51.4	25.9	14.5	38.1	53.7	73.9	20.2	145	114	
Hori.	2822.321	PK	50.0	26.6	7.0	38.1	45.5	73.9	28.4	104	208	
Hori.	4824.000	PK	47.1	30.5	7.6	36.8	48.4	73.9	25.5	102	355	
Hori.	7236.000	PK	43.9	36.3	9.0	39.1	50.1	73.9	23.8	100	0	
Hori.	2390.000	AV	39.7	25.9	14.5	38.1	42.0	53.9	11.9	145	114	
Hori.	2822.321	AV	47.0	26.6	7.0	38.1	42.5	53.9	11.4	104	208	
Hori.	4824.000	AV	43.0	30.5	7.6	36.8	44.3	53.9	9.6	102	355	
Hori.	7236.000	AV	36.7	36.3	9.0	39.1	42.9	53.9	11.0	100	0	
Vert.	2390.000	PK	55.4	25.9	14.5	38.1	57.7	73.9	16.2	100	204	
Vert.	2822.305	PK	50.7	26.6	7.0	38.1	46.2	73.9	27.7	148	211	
Vert.	4824.000	PK	47.8	30.5	7.6	36.8	49.1	73.9	24.8	100	110	
Vert.	7236.000	PK	44.6	36.3	9.0	39.1	50.8	73.9	23.1	100	0	
Vert.	2390.000	AV	39.5	25.9	14.5	38.1	41.8	53.9	12.1	100	204	
Vert.	2822.305	AV	47.2	26.6	7.0	38.1	42.7	53.9	11.2	148	211	
Vert.	4824.000	AV	44.5	30.5	7.6	36.8	45.8	53.9	8.1	100	110	
Vert.	7236.000	AV	37.4	36.3	9.0	39.1	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

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	87.8	25.9	14.6	38.1	90.2	-	-	Carrier
Hori.	2400.000	PK	41.0	25.9	14.5	38.1	43.3	70.2	26.9	
Hori.	9648.000	PK	38.8	38.3	9.8	36.9	50.0	70.2	20.2	
Vert.	2412.000	PK	90.4	25.9	14.6	38.1	92.8	-	-	Carrier
Vert.	2400.000	PK	44.7	25.9	14.5	38.1	47.0	72.8	25.8	
Vert.	9648.000	PK	37.2	38.3	9.8	36.9	48.4	72.8	24.4	

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

Test place No.2 Semi Anechoic Chamber
 Date January 8, 2015 January 9, 2015
 Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
 Engineer Wataru Kojima Wataru Kojima
 Mode Tx, 2437 MHz
 Tx, IEEE802.11b, PN9, worst data mode 2Mbps

(* 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.	2822.277	PK	50.2	26.6	7.0	38.1	45.7	73.9	28.2	106	208	
Hori.	4874.000	PK	49.7	30.7	7.6	36.8	51.2	73.9	22.7	104	2	
Hori.	7311.000	PK	44.5	36.4	8.9	39.1	50.7	73.9	23.2	100	0	
Hori.	2822.277	AV	48.0	26.6	7.0	38.1	43.5	53.9	10.4	106	208	
Hori.	4874.000	AV	46.5	30.7	7.6	36.8	48.0	53.9	5.9	104	2	
Hori.	7311.000	AV	37.1	36.4	8.9	39.1	43.3	53.9	10.6	100	0	
Vert.	2822.292	PK	50.9	26.6	7.0	38.1	46.4	73.9	27.5	100	215	
Vert.	4874.000	PK	50.7	30.7	7.6	36.8	52.2	73.9	21.7	116	329	
Vert.	7311.000	PK	43.6	36.4	8.9	39.1	49.8	73.9	24.1	100	0	
Vert.	2822.292	AV	48.1	26.6	7.0	38.1	43.6	53.9	10.3	100	215	
Vert.	4874.000	AV	47.2	30.7	7.6	36.8	48.7	53.9	5.2	116	329	
Vert.	7311.000	AV	36.7	36.4	8.9	39.1	42.9	53.9	11.0	100	0	

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

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$ **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.	2437.000	PK	90.2	25.9	14.6	38.0	92.7	-	-	Carrier
Hori.	9748.000	PK	40.7	38.3	9.9	37.0	51.9	72.7	20.8	
Vert.	2437.000	PK	91.7	25.9	14.6	38.0	94.2	-	-	Carrier
Vert.	9748.000	PK	39.1	38.3	9.9	37.0	50.3	74.2	23.9	

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

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$ **UL Japan, Inc.****Shonan EMC Lab.**

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Radiated Emission

Test place No.2 Semi Anechoic Chamber
Date January 8, 2015 January 9, 2015
Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
Engineer Wataru Kojima Wataru Kojima
Mode Tx, 2462 MHz
 Tx, IEEE802.11b, PN9, worst data mode 2Mbps

(* 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	54.8	25.9	14.6	38.0	57.3	73.9	16.6	184	108	
Hori.	2822.233	PK	51.1	26.6	7.0	38.1	46.6	73.9	27.3	104	209	
Hori.	4924.000	PK	49.7	30.9	7.7	36.7	51.6	73.9	22.3	149	58	
Hori.	7386.000	PK	45.0	36.5	8.9	39.2	51.2	73.9	22.7	100	0	
Hori.	2483.500	AV	40.0	25.9	14.6	38.0	42.5	53.9	11.4	184	108	
Hori.	2822.233	AV	49.2	26.6	7.0	38.1	44.7	53.9	9.2	104	209	
Hori.	4924.000	AV	46.9	30.9	7.7	36.7	48.8	53.9	5.1	149	58	
Hori.	7386.000	AV	37.8	36.5	8.9	39.2	44.0	53.9	9.9	100	0	
Vert.	2483.500	PK	56.7	25.9	14.6	38.0	59.2	73.9	14.7	100	232	
Vert.	2822.234	PK	50.8	26.6	7.0	38.1	46.3	73.9	27.6	100	213	
Vert.	4924.000	PK	49.0	30.9	7.7	36.7	50.9	73.9	23.0	100	228	
Vert.	7386.000	PK	44.8	36.5	8.9	39.2	51.0	73.9	22.9	100	0	
Vert.	2483.500	AV	39.9	25.9	14.6	38.0	42.4	53.9	11.5	100	232	
Vert.	2822.234	AV	48.9	26.6	7.0	38.1	44.4	53.9	9.5	100	213	
Vert.	4924.000	AV	45.8	30.9	7.7	36.7	47.7	53.9	6.2	100	228	
Vert.	7386.000	AV	37.6	36.5	8.9	39.2	43.8	53.9	10.1	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.	2462.000	PK	88.9	25.9	14.6	38.0	91.4	-	-	Carrier
Hori.	9848.000	PK	37.6	38.3	9.8	37.0	48.7	71.4	22.7	
Vert.	2462.000	PK	90.4	25.9	14.6	38.0	92.9	-	-	Carrier
Vert.	9848.000	PK	37.8	38.3	9.8	37.0	48.9	72.9	24.0	

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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Radiated Emission

Test place No.2 Semi Anechoic Chamber
 Date January 8, 2015 January 9, 2015
 Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
 Engineer Wataru Kojima Wataru Kojima
 Mode Tx, 2412 MHz
 Tx, IEEE802.11g, PN9, worst data mode 48Mbps

(* 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	48.6	25.9	14.5	38.1	50.9	73.9	23.0	157	114	*1)
Hori.	2822.340	PK	49.8	26.6	7.0	38.1	45.3	73.9	28.6	107	209	
Hori.	4824.000	PK	46.5	30.5	7.6	36.8	47.8	73.9	26.1	105	356	
Hori.	7236.000	PK	45.7	36.3	9.0	39.1	51.9	73.9	22.0	100	0	
Hori.	2390.000	AV	40.4	25.9	14.5	38.1	42.7	53.9	11.2	157	114	
Hori.	2822.340	AV	47.6	26.6	7.0	38.1	43.1	53.9	10.8	107	209	
Vert.	2390.000	PK	52.1	25.9	14.5	38.1	54.4	73.9	19.5	100	229	
Vert.	2822.338	PK	50.4	26.6	7.0	38.1	45.9	73.9	28.0	100	210	
Vert.	4824.000	PK	46.8	30.5	7.6	36.8	48.1	73.9	25.8	132	338	
Vert.	7236.000	PK	45.2	36.3	9.0	39.1	51.4	73.9	22.5	100	0	
Vert.	2390.000	AV	41.0	25.9	14.5	38.1	43.3	53.9	10.6	100	229	*1)
Vert.	2822.338	AV	47.8	26.6	7.0	38.1	43.3	53.9	10.6	100	210	

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

*1) Out of Band emission (Leakage Power)

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.	4824.000	AV	40.5	30.5	7.6	36.8	2.1	43.9	53.9	10.0	
Hori.	7236.000	AV	36.7	36.3	9.0	39.1	2.1	45.0	53.9	8.9	
Vert.	4824.000	AV	39.5	30.5	7.6	36.8	2.1	42.9	53.9	11.0	
Vert.	7236.000	AV	37.4	36.3	9.0	39.1	2.1	45.7	53.9	8.2	

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

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	83.7	25.9	14.6	38.1	86.1	-	-	Carrier
Hori.	2400.000	PK	43.3	25.9	14.5	38.1	45.6	66.1	20.5	
Hori.	9648.000	PK	37.6	38.3	9.8	36.9	48.8	66.1	17.3	
Vert.	2412.000	PK	87.0	25.9	14.6	38.1	89.4	-	-	Carrier
Vert.	2400.000	PK	46.9	25.9	14.5	38.1	49.2	69.4	20.2	
Vert.	9648.000	PK	35.6	38.3	9.8	36.9	46.8	69.4	22.6	

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

Test place No.2 Semi Anechoic Chamber
Date January 8, 2015 January 9, 2015
Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
Engineer Wataru Kojima Wataru Kojima
Mode Tx, 2437 MHz
 Tx, IEEE802.11g, PN9, worst data mode 48Mbps

(* 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.	2822.312	PK	50.4	26.6	7.0	38.1	45.9	73.9	28.0	105	208	
Hori.	4874.000	PK	45.3	30.7	7.6	36.8	46.8	73.9	27.1	100	5	
Hori.	7311.000	PK	43.4	36.4	8.9	39.1	49.6	73.9	24.3	100	0	
Hori.	2822.312	AV	48.0	26.6	7.0	38.1	43.5	53.9	10.4	105	208	
Vert.	2822.323	PK	50.2	26.6	7.0	38.1	45.7	73.9	28.2	100	211	
Vert.	4874.000	PK	45.7	30.7	7.6	36.8	47.2	73.9	26.7	100	259	
Vert.	7311.000	PK	44.7	36.4	8.9	39.1	50.9	73.9	23.0	100	0	
Vert.	2822.323	AV	47.6	26.6	7.0	38.1	43.1	53.9	10.8	100	211	

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	37.6	30.7	7.6	36.8	2.1	41.2	53.9	12.7	
Hori.	7311.000	AV	37.2	36.4	8.9	39.1	2.1	45.5	53.9	8.4	
Vert.	4874.000	AV	39.4	30.7	7.6	36.8	2.1	43.0	53.9	10.9	
Vert.	7311.000	AV	36.5	36.4	8.9	39.1	2.1	44.8	53.9	9.1	

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

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.	2437.000	PK	83.2	25.9	14.6	38.0	85.7	-	-	Carrier
Hori.	9748.000	PK	35.8	38.3	9.9	37.0	47.0	65.7	18.7	
Vert.	2437.000	PK	85.3	25.9	14.6	38.0	87.8	-	-	Carrier
Vert.	9748.000	PK	35.4	38.3	9.9	37.0	46.6	67.8	21.2	

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

Test place No.2 Semi Anechoic Chamber
 Date January 8, 2015 January 9, 2015
 Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
 Engineer Wataru Kojima Wataru Kojima
 Mode Tx, 2462 MHz
 Tx, IEEE802.11g, PN9, worst data mode 48Mbps

(* 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	55.4	25.9	14.6	38.0	57.9	73.9	16.0	149	115	
Hori.	2822.000	PK	49.6	26.6	7.0	38.1	45.1	73.9	28.8	100	239	
Hori.	4924.000	PK	45.6	30.9	7.7	36.7	47.5	73.9	26.4	100	8	
Hori.	7386.000	PK	45.5	36.5	8.9	39.2	51.7	73.9	22.2	100	0	
Hori.	2483.500	AV	43.6	25.9	14.6	38.0	46.1	53.9	7.8	149	115	*1)
Hori.	2822.000	AV	47.7	26.6	7.0	38.1	43.2	53.9	10.7	100	239	
Vert.	2483.500	PK	56.3	25.9	14.6	38.0	58.8	73.9	15.1	100	287	
Vert.	2822.311	PK	50.2	26.6	7.0	38.1	45.7	73.9	28.2	100	209	
Vert.	4924.000	PK	45.5	30.9	7.7	36.7	47.4	73.9	26.5	100	228	
Vert.	7386.000	PK	45.2	36.5	8.9	39.2	51.4	73.9	22.5	100	0	
Vert.	2483.500	AV	43.4	25.9	14.6	38.0	45.9	53.9	8.0	100	287	*1)
Vert.	2822.311	AV	48.1	26.6	7.0	38.1	43.6	53.9	10.3	100	209	

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

*1) Out of Band emission (Leakage Power)

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.	4924.000	AV	38.0	30.9	7.7	36.7	2.1	42.0	53.9	11.9	
Hori.	7386.000	AV	38.6	36.5	8.9	39.2	2.1	46.9	53.9	7.0	
Vert.	4924.000	AV	38.6	30.9	7.7	36.7	2.1	42.6	53.9	11.3	
Vert.	7386.000	AV	37.0	36.5	8.9	39.2	2.1	45.3	53.9	8.6	

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

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.	2462.000	PK	84.9	25.9	14.6	38.0	87.4	-	-	Carrier
Hori.	9848.000	PK	35.7	38.3	9.8	37.0	46.8	67.4	20.6	
Vert.	2462.000	PK	85.5	25.9	14.6	38.0	88.0	-	-	Carrier
Vert.	9848.000	PK	35.0	38.3	9.8	37.0	46.1	68.0	21.9	

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

Test place No.2 Semi Anechoic Chamber
Date January 8, 2015 January 9, 2015
Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
Engineer Wataru Kojima Wataru Kojima
Mode Tx, 2412 MHz
 Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)

(* 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.	249.595	QP	39.0	16.9	9.3	31.7	33.5	46.0	12.5	138	99	
Hori.	499.689	QP	37.5	17.5	7.6	31.7	30.9	46.0	15.1	100	20	
Hori.	767.818	QP	32.1	20.6	8.9	31.5	30.1	46.0	15.9	100	200	
Hori.	2390.000	PK	50.1	25.9	14.5	38.1	52.4	73.9	21.5	157	117	
Hori.	2822.290	PK	49.9	26.6	7.0	38.1	45.4	73.9	28.5	109	209	
Hori.	4824.000	PK	44.4	30.5	7.6	36.8	45.7	73.9	28.2	104	7	
Hori.	7236.000	PK	44.2	36.3	9.0	39.1	50.4	73.9	23.5	100	0	
Hori.	2390.000	AV	41.0	25.9	14.5	38.1	43.3	53.9	10.6	157	117	*1)
Hori.	2822.290	AV	47.5	26.6	7.0	38.1	43.0	53.9	10.9	109	209	
Vert.	135.204	QP	46.7	14.0	8.3	31.8	37.2	43.5	6.3	100	238	
Vert.	475.320	QP	40.9	17.2	7.5	31.7	33.9	46.0	12.1	100	253	
Vert.	499.693	QP	41.8	17.5	7.6	31.7	35.2	46.0	10.8	100	247	
Vert.	792.194	QP	33.8	20.6	9.0	31.4	32.0	46.0	14.0	100	215	
Vert.	2390.000	PK	53.1	25.9	14.5	38.1	55.4	73.9	18.5	100	229	
Vert.	2822.296	PK	50.2	26.6	7.0	38.1	45.7	73.9	28.2	100	211	
Vert.	4824.000	PK	45.5	30.5	7.6	36.8	46.8	73.9	27.1	100	324	
Vert.	7236.000	PK	44.4	36.3	9.0	39.1	50.6	73.9	23.3	100	0	
Vert.	2390.000	AV	42.6	25.9	14.5	38.1	44.9	53.9	9.0	100	229	*1)
Vert.	2822.296	AV	47.8	26.6	7.0	38.1	43.3	53.9	10.6	100	211	

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

*1) Out of Band emission (Leakage Power)

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.	4824.000	AV	38.1	30.5	7.6	36.8	0.3	39.7	53.9	14.2	
Hori.	7236.000	AV	37.0	36.3	9.0	39.1	0.3	43.5	53.9	10.4	
Vert.	4824.000	AV	39.2	30.5	7.6	36.8	0.3	40.8	53.9	13.1	
Vert.	7236.000	AV	37.7	36.3	9.0	39.1	0.3	44.2	53.9	9.7	

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

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	83.1	25.9	14.6	38.1	85.5	-	-	Carrier
Hori.	2400.000	PK	44.1	25.9	14.5	38.1	46.4	65.5	19.1	
Hori.	9648.000	PK	36.5	38.3	9.8	36.9	47.7	65.5	17.8	
Vert.	2412.000	PK	86.0	25.9	14.6	38.1	88.4	-	-	Carrier
Vert.	2400.000	PK	47.8	25.9	14.5	38.1	50.1	68.4	18.3	
Vert.	9648.000	PK	35.8	38.3	9.8	36.9	47.0	68.4	21.4	

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

Test place No.2 Semi Anechoic Chamber
Date January 8, 2015 January 9, 2015
Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
Engineer Wataru Kojima Wataru Kojima
Mode Tx, 2437 MHz
 Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)

(* 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.	2822.293	PK	49.5	26.6	7.0	38.1	45.0	73.9	28.9	106	210	
Hori.	4874.000	PK	45.2	30.7	7.6	36.8	46.7	73.9	27.2	103	356	
Hori.	7311.000	PK	44.0	36.4	8.9	39.1	50.2	73.9	23.7	100	0	
Hori.	2822.293	AV	47.1	26.6	7.0	38.1	42.6	53.9	11.3	106	210	
Vert.	2822.303	PK	49.8	26.6	7.0	38.1	45.3	73.9	28.6	100	209	
Vert.	4874.000	PK	46.0	30.7	7.6	36.8	47.5	73.9	26.4	113	328	
Vert.	7311.000	PK	44.6	36.4	8.9	39.1	50.8	73.9	23.1	100	0	
Vert.	2822.303	AV	47.5	26.6	7.0	38.1	43.0	53.9	10.9	100	209	

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	39.0	30.7	7.6	36.8	0.3	40.8	53.9	13.1	
Hori.	7311.000	AV	37.9	36.4	8.9	39.1	0.3	44.4	53.9	9.5	
Vert.	4874.000	AV	39.1	30.7	7.6	36.8	0.3	40.9	53.9	13.0	
Vert.	7311.000	AV	37.7	36.4	8.9	39.1	0.3	44.2	53.9	9.7	

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

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.	2437.000	PK	84.2	25.9	14.6	38.0	86.7	-	-	Carrier
Hori.	9748.000	PK	35.5	38.3	9.9	37.0	46.7	66.7	20.0	
Vert.	2437.000	PK	85.6	25.9	14.6	38.0	88.1	-	-	Carrier
Vert.	9748.000	PK	35.7	38.3	9.9	37.0	46.9	68.1	21.2	

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

Test place No.2 Semi Anechoic Chamber
 Date January 8, 2015 January 9, 2015
 Temperature / Humidity 23 deg.C, 30 %RH 24 deg.C, 33 %RH
 Engineer Wataru Kojima Wataru Kojima
 Mode Tx, 2462 MHz
 Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)

(* 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	54.0	25.9	14.6	38.0	56.5	73.9	17.4	193	111	
Hori.	2822.291	PK	48.9	26.6	7.0	38.1	44.4	73.9	29.5	106	210	
Hori.	4924.000	PK	43.8	30.9	7.7	36.7	45.7	73.9	28.2	103	4	
Hori.	7386.000	PK	45.1	36.5	8.9	39.2	51.3	73.9	22.6	100	0	
Hori.	2483.500	AV	43.0	25.9	14.6	38.0	45.5	53.9	8.4	193	111	*1)
Hori.	2822.291	AV	46.1	26.6	7.0	38.1	41.6	53.9	12.3	106	210	
Vert.	2483.500	PK	55.3	25.9	14.6	38.0	57.8	73.9	16.1	100	217	
Vert.	2822.305	PK	49.1	26.6	7.0	38.1	44.6	73.9	29.3	100	211	
Vert.	4924.000	PK	44.4	30.9	7.7	36.7	46.3	73.9	27.6	136	249	
Vert.	7386.000	PK	44.5	36.5	8.9	39.2	50.7	73.9	23.2	100	0	
Vert.	2483.500	AV	45.2	25.9	14.6	38.0	47.7	53.9	6.2	100	217	*1)
Vert.	2822.305	AV	45.2	26.6	7.0	38.1	40.7	53.9	13.2	100	211	

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

*1) Out of Band emission (Leakage Power)

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.	4924.000	AV	38.5	30.9	7.7	36.7	0.3	40.7	53.9	13.2	
Hori.	7386.000	AV	38.7	36.5	8.9	39.2	0.3	45.2	53.9	8.7	
Vert.	4924.000	AV	38.2	30.9	7.7	36.7	0.3	40.4	53.9	13.5	
Vert.	7386.000	AV	38.7	36.5	8.9	39.2	0.3	45.2	53.9	8.7	

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

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.	2462.000	PK	83.6	25.9	14.6	38.0	86.1	-	-	Carrier
Hori.	9848.000	PK	35.7	38.3	9.8	37.0	46.8	66.1	19.3	
Vert.	2462.000	PK	84.1	25.9	14.6	38.0	86.6	-	-	Carrier
Vert.	9848.000	PK	35.7	38.3	9.8	37.0	46.8	66.6	19.8	

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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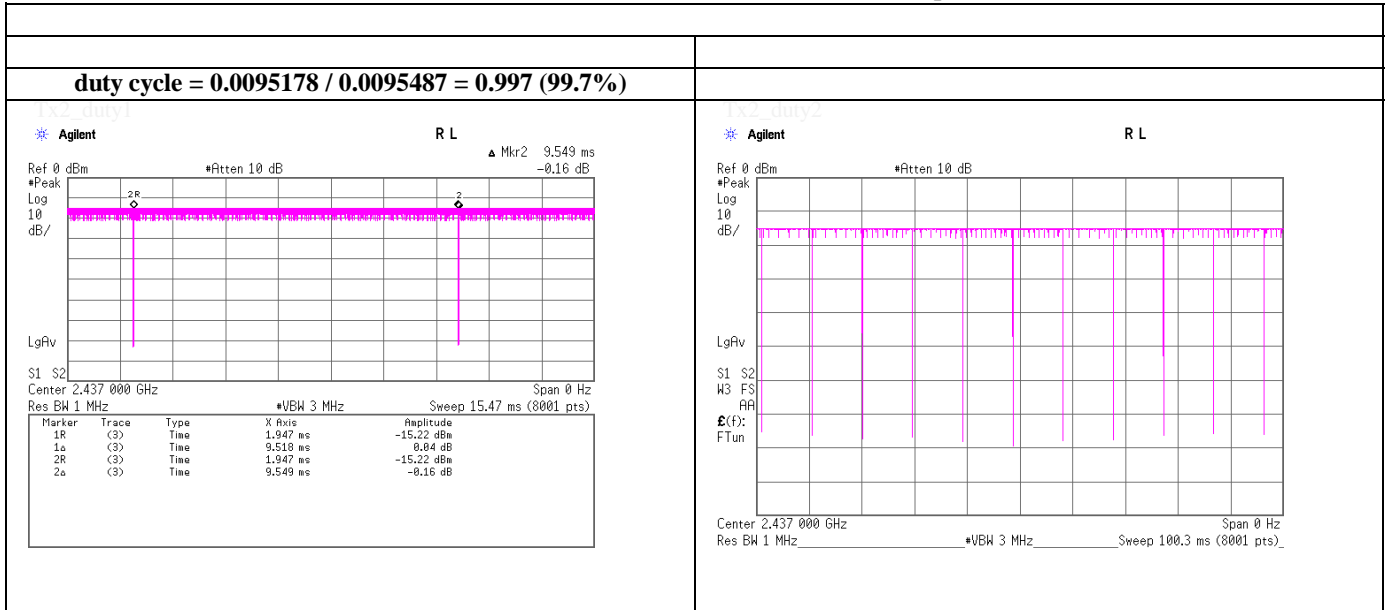
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Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano

Burst rate confirmation

Tx, IEEE802.11b, PN9, worst data mode 2Mbps



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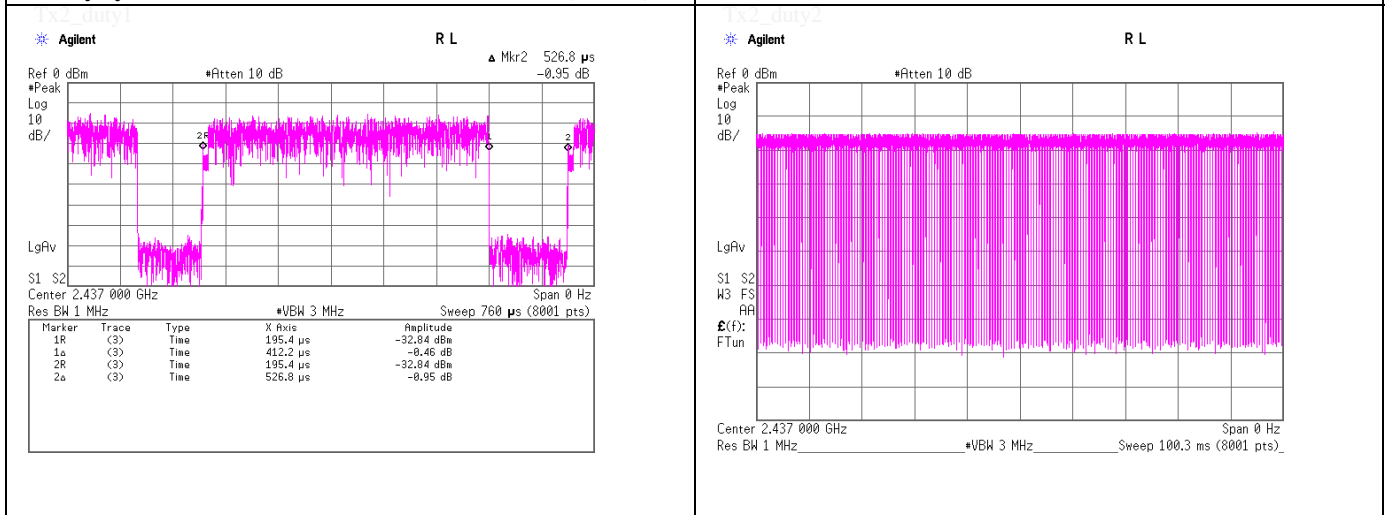
Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano

Duty Factor Calculation chart

Tx, IEEE802.11g, PN9, worst data mode 48Mbps

Duty Factor Calculation

Duty Factor: $20\log(1/\text{duty cycle}) = 2.1\text{dB}$
duty cycle = $0.000412205 / 0.000526775 = 0.783$ (78.3%)

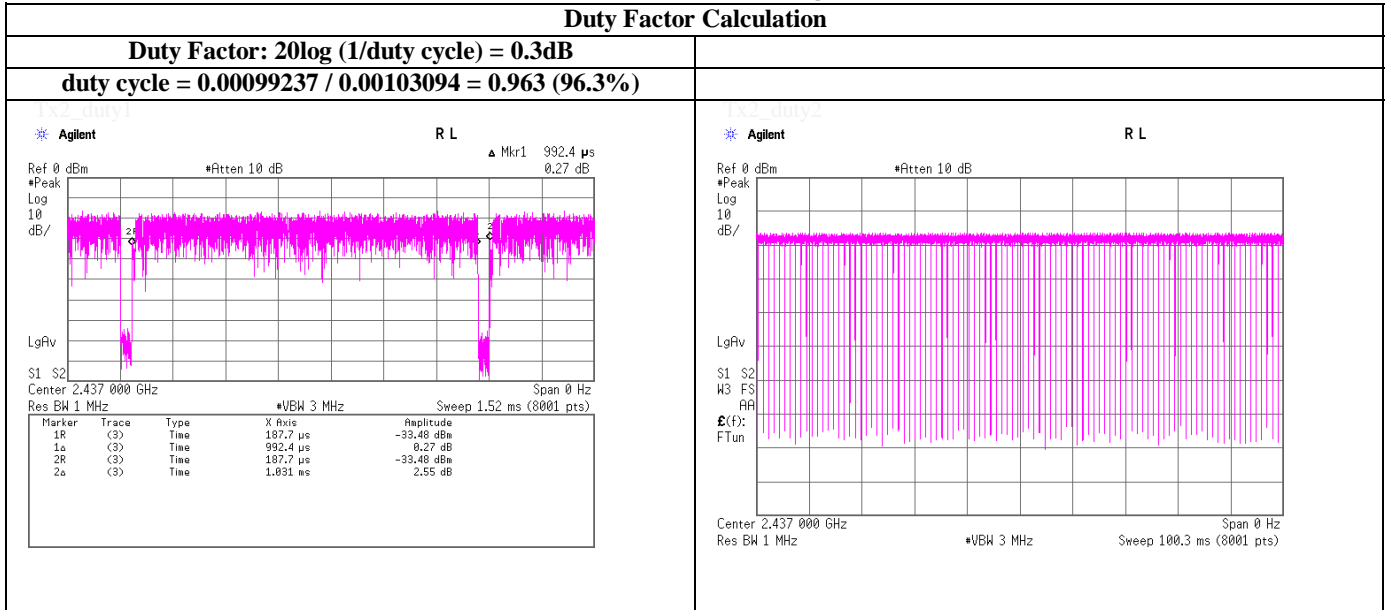


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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano

Duty Factor Calculation chart

Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)

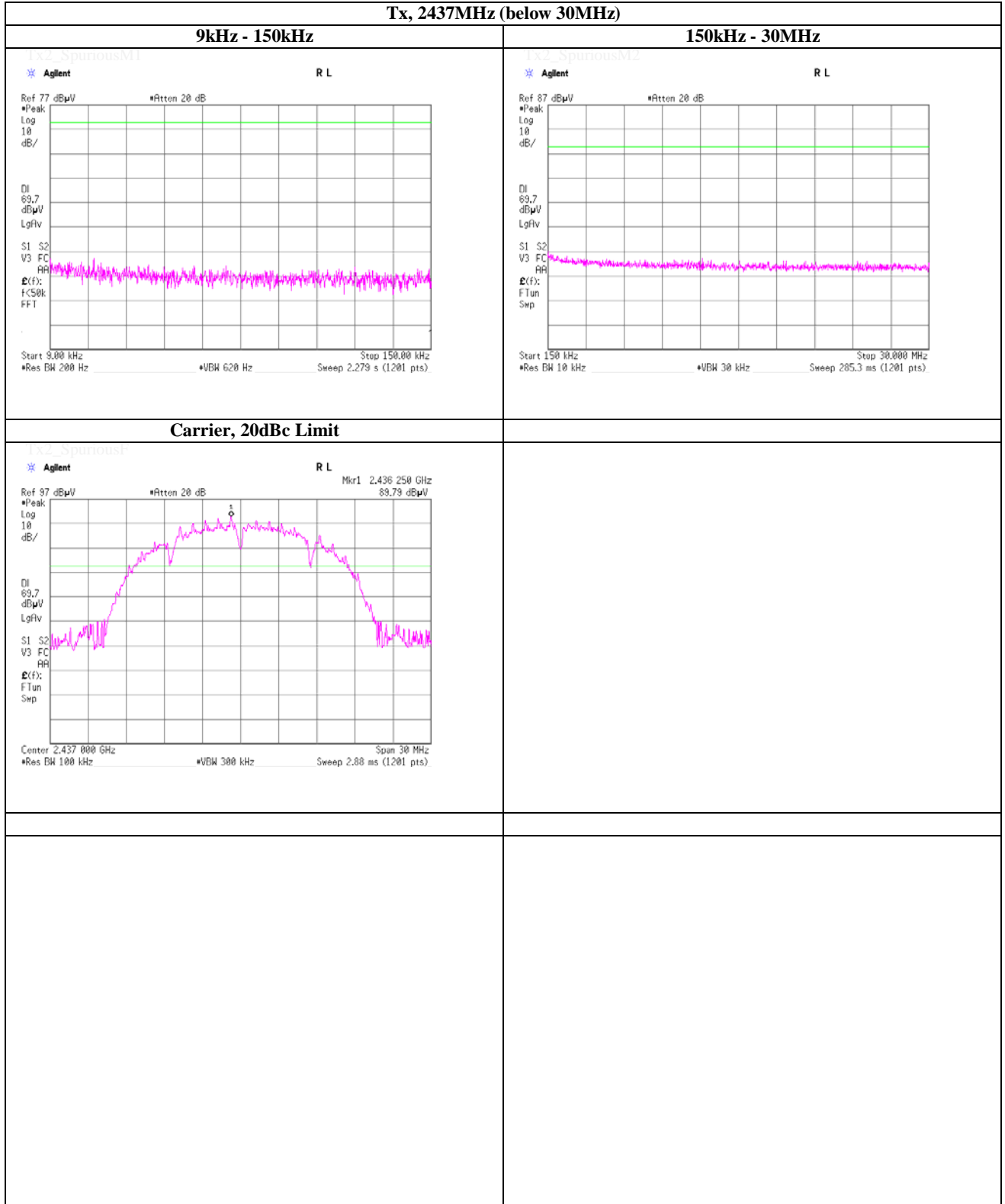


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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano

Spurious emission (Conducted)
Tx, IEEE802.11b, PN9, worst data mode 2Mbps

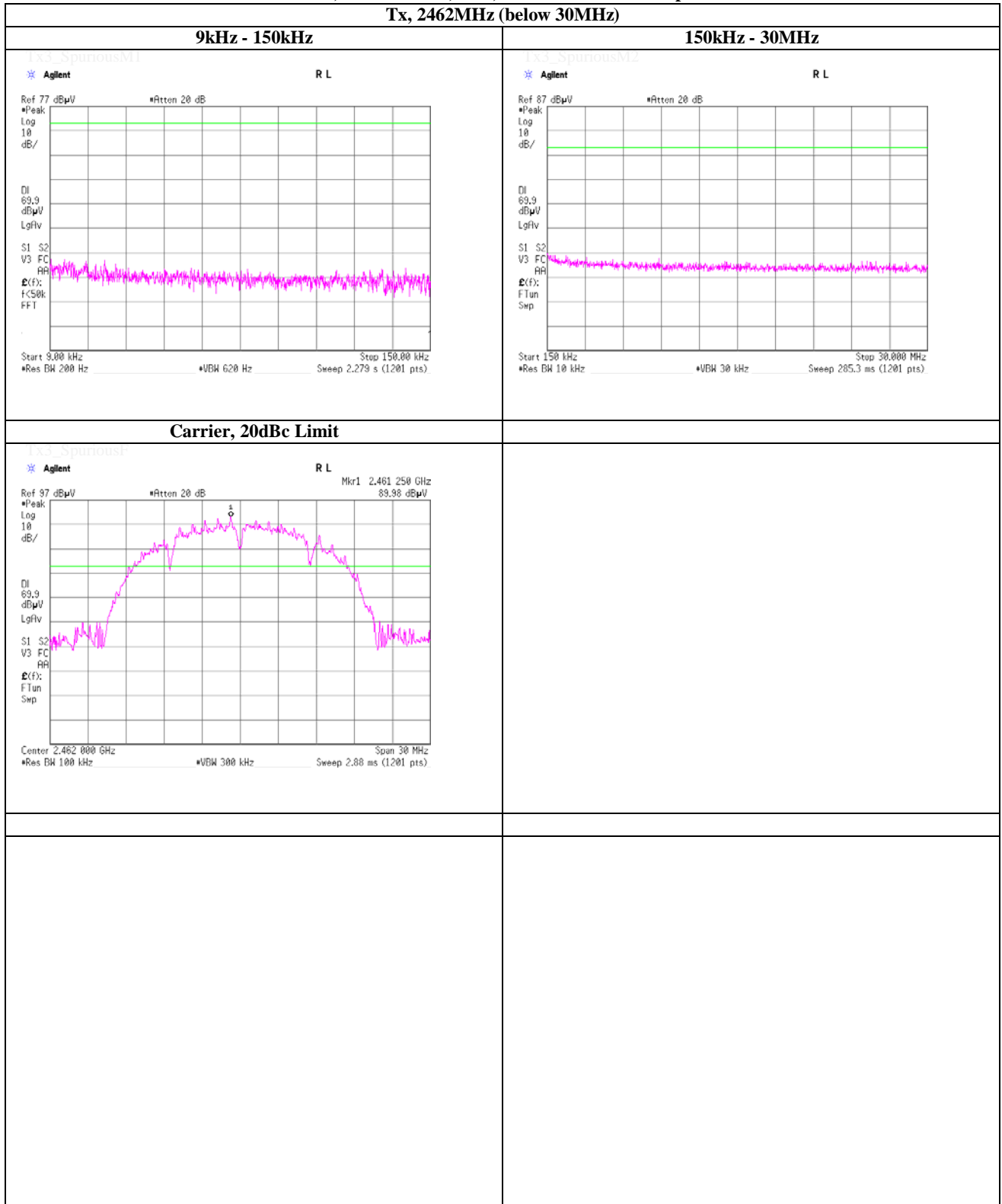
Tx, 2437MHz (below 30MHz)



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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano

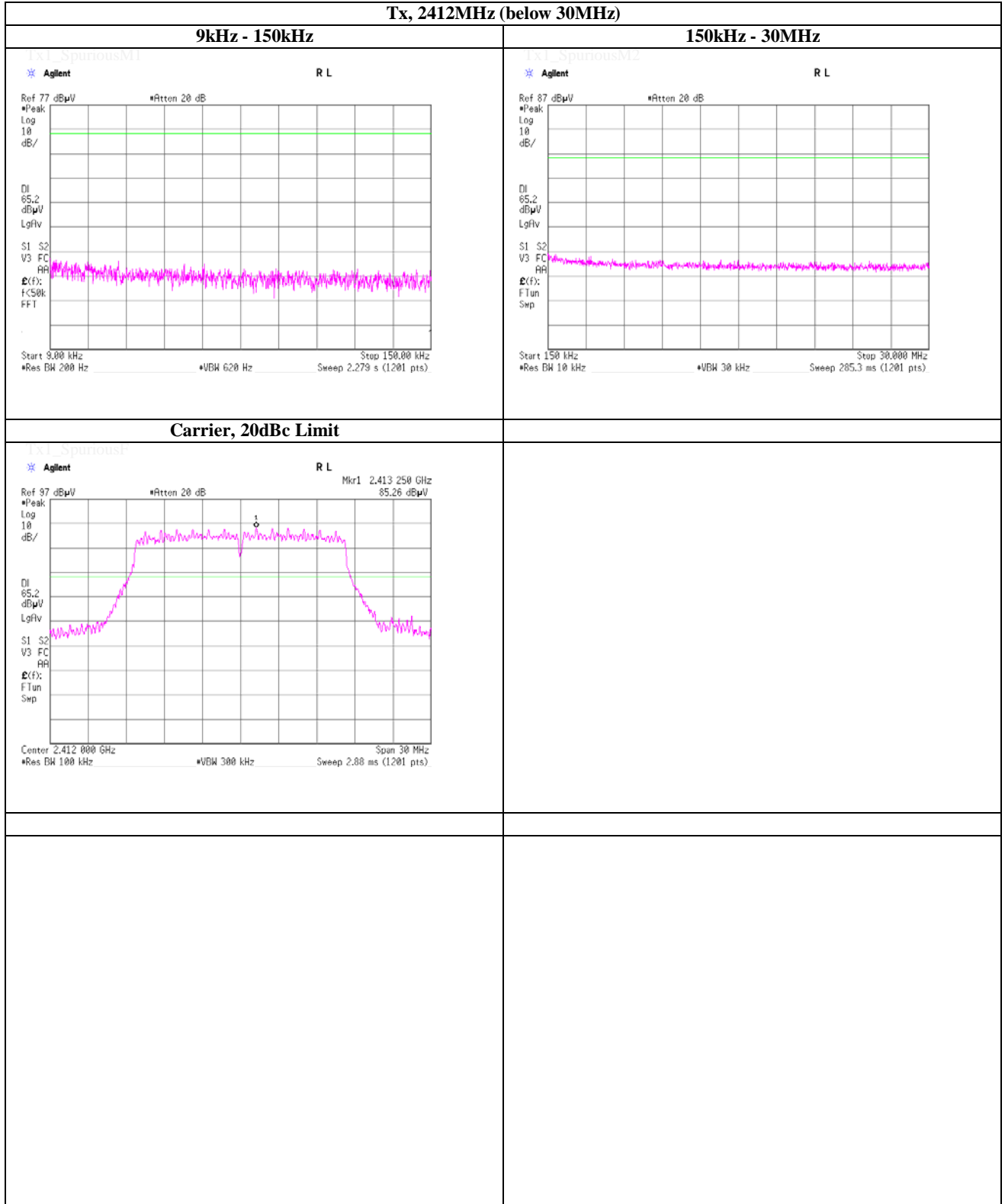
Spurious emission (Conducted)
Tx, IEEE802.11b, PN9, worst data mode 2Mbps



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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano

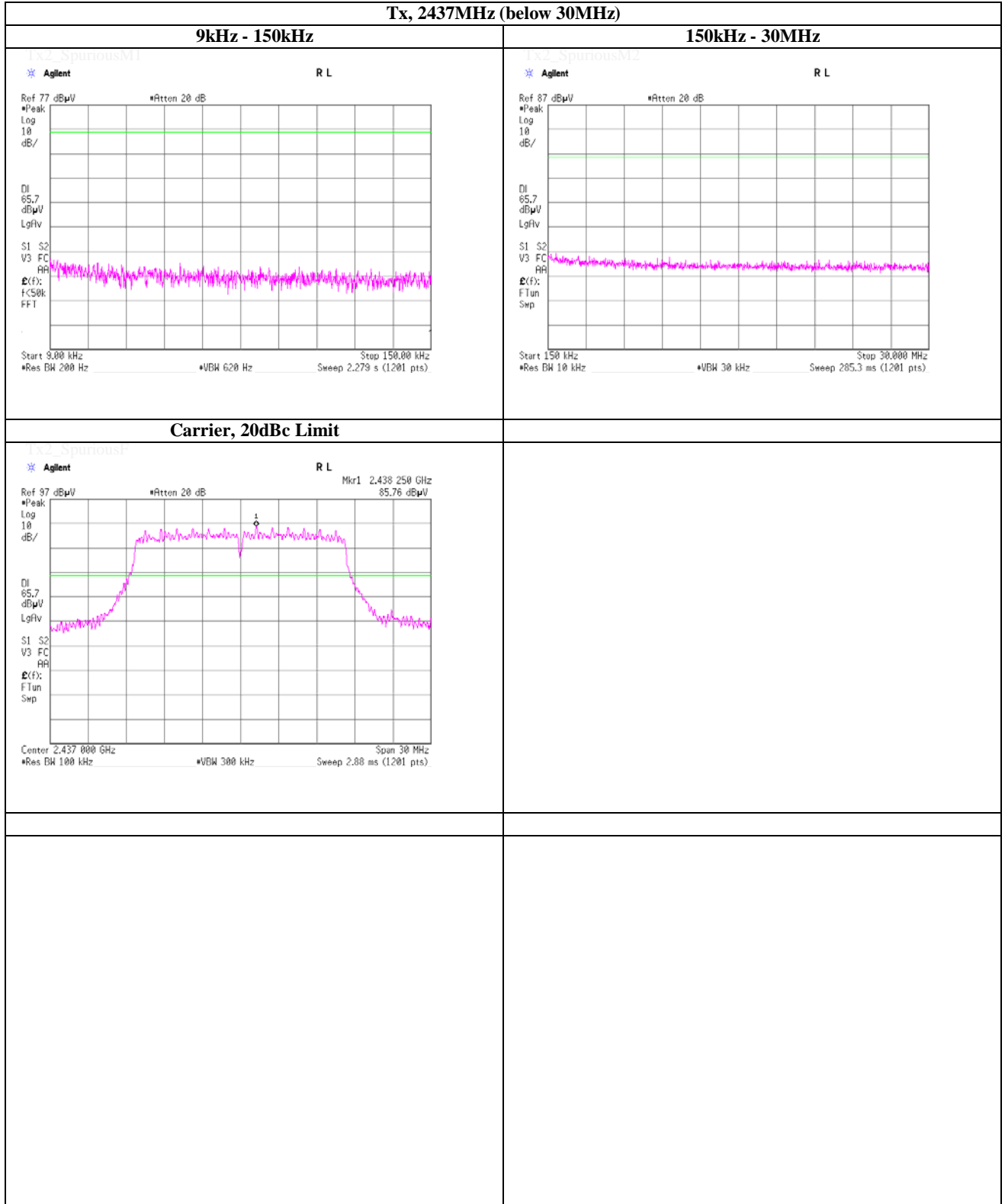
Spurious emission (Conducted)
Tx, IEEE802.11g, PN9, worst data mode 48Mbps



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 Engineer Shinichi Takano

Spurious emission (Conducted)
Tx, IEEE802.11g, PN9, worst data mode 48Mbps
Tx, 2437MHz (below 30MHz)

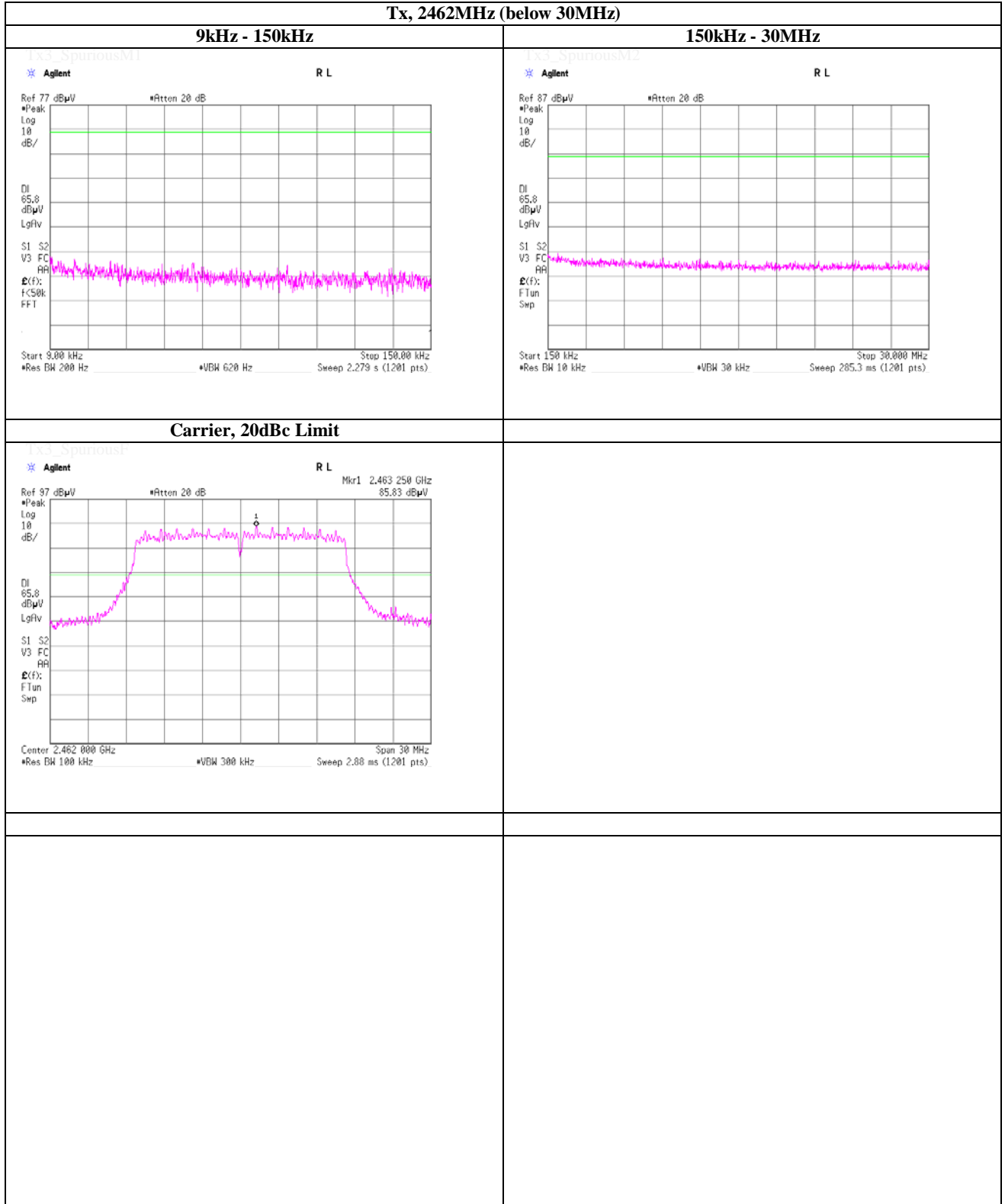


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 Engineer Shinichi Takano

Spurious emission (Conducted)
Tx, IEEE802.11g, PN9, worst data mode 48Mbps

Tx, 2462MHz (below 30MHz)



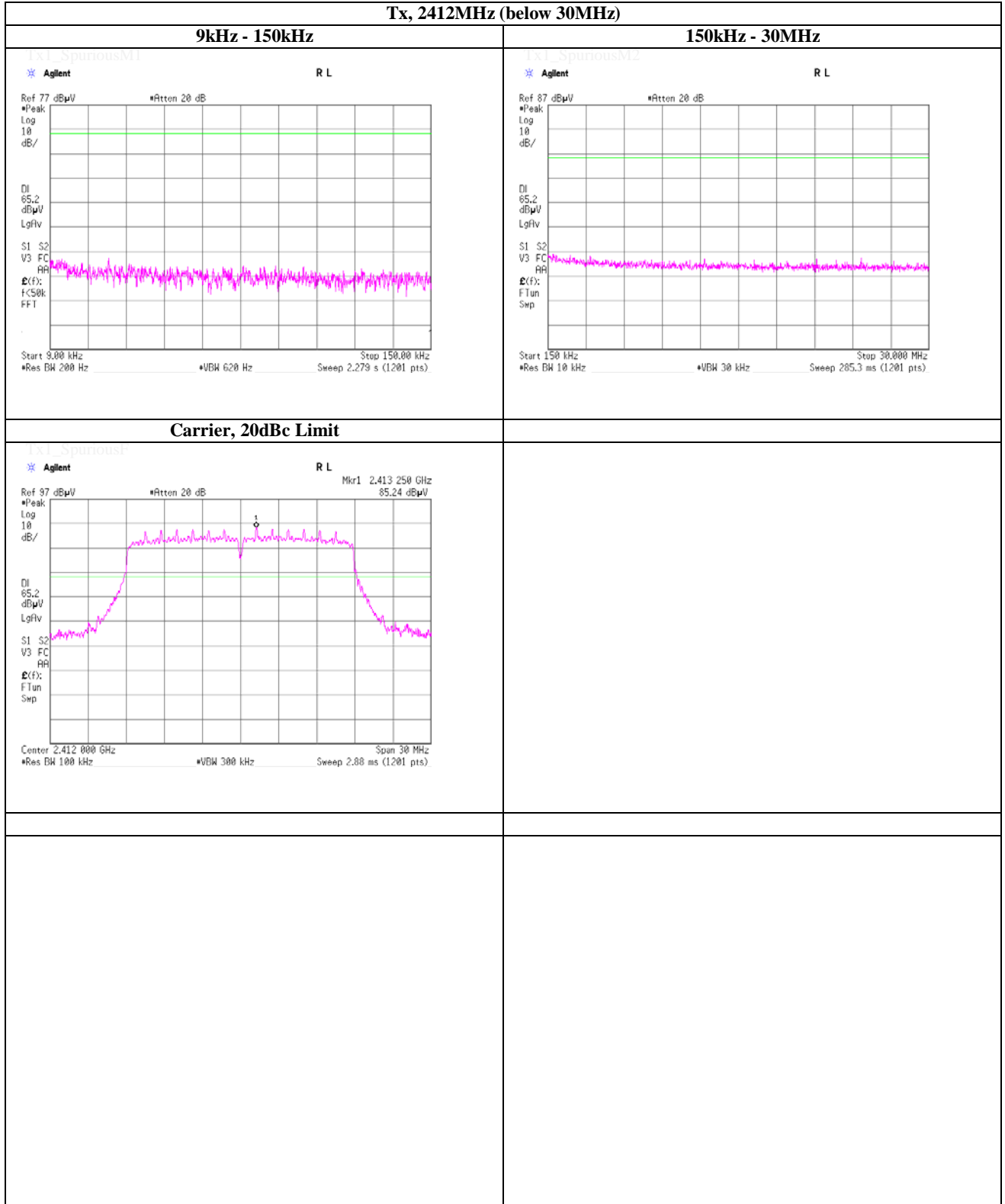
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Spurious emission (Conducted)

Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)

Tx, 2412MHz (below 30MHz)



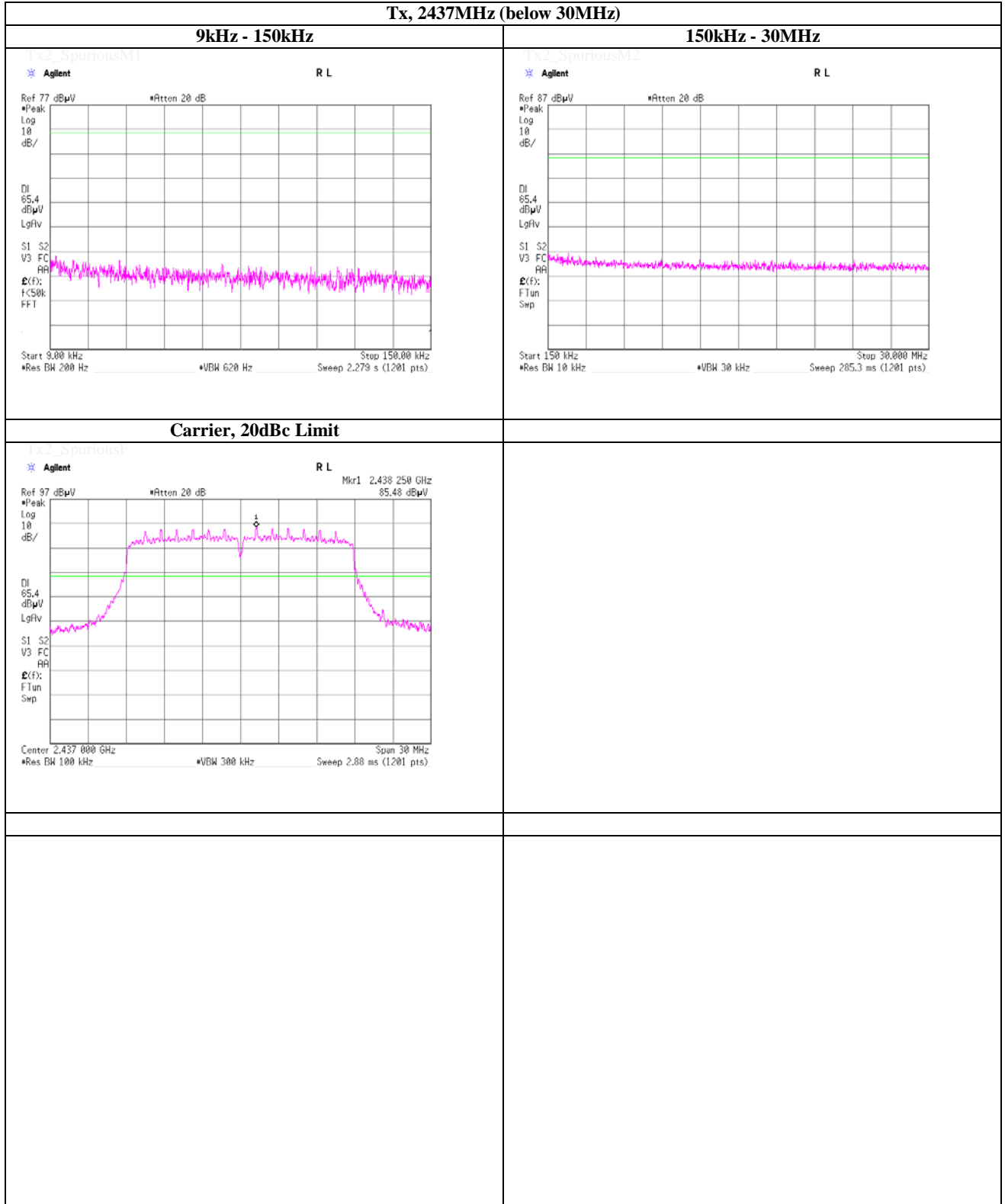
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
 Engineer Shinichi Takano

Spurious emission (Conducted)

Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)

Tx, 2437MHz (below 30MHz)



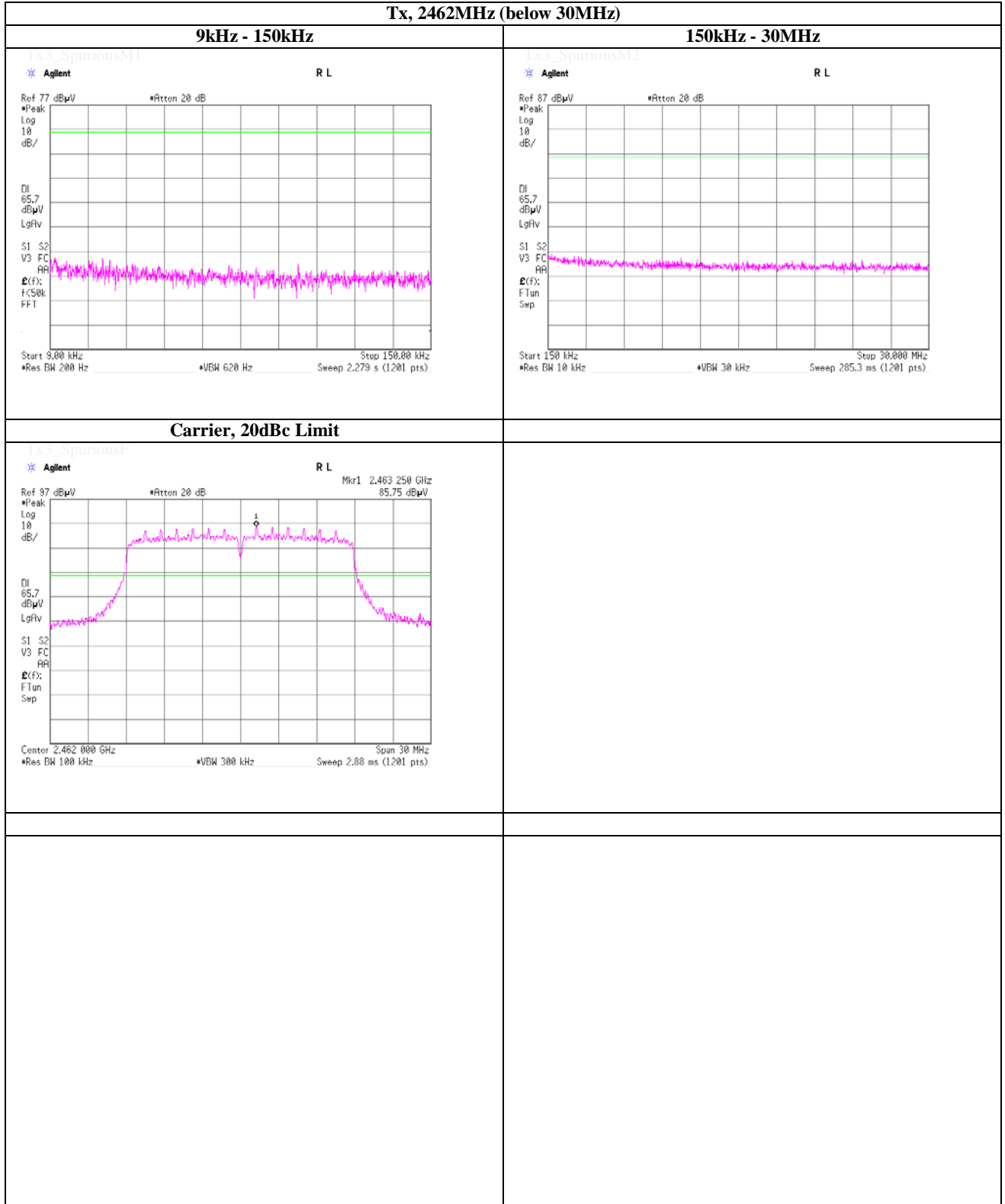
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date December 18, 2014
 Temperature / Humidity 26deg.C , 28%RH
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Spurious emission (Conducted)

Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)

Tx, 2462MHz (below 30MHz)



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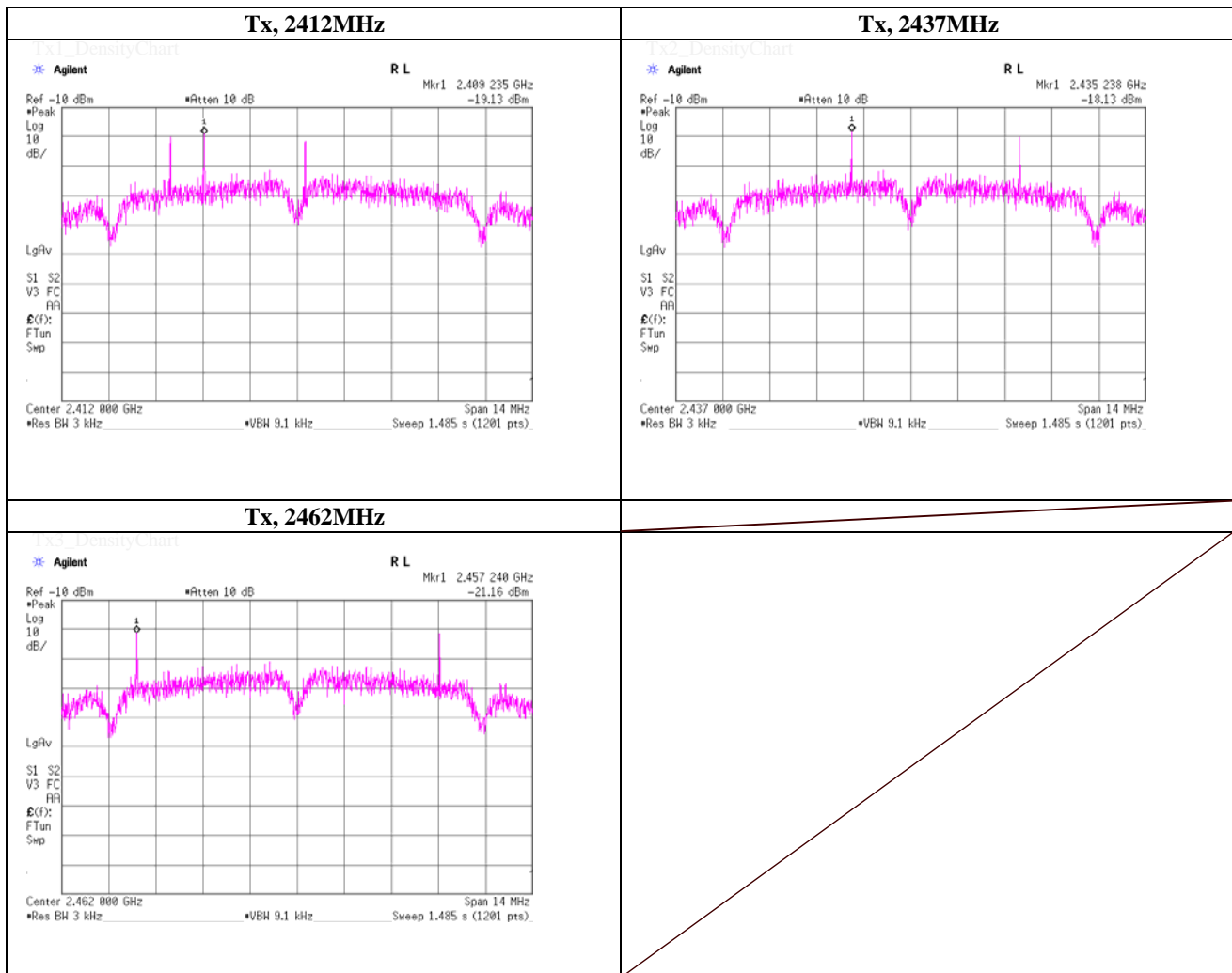
Maximum Power Spectral Density

(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	December 18, 2014	
Temperature / Humidity	26deg.C , 28%RH	
Engineer	Shinichi Takano	
Mode	Tx, IEEE802.11b, PN9, worst data mode 2Mbps	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2409.24	-19.13	2.15	20.24	3.26	8.00	4.74
2437.0000	2435.24	-18.13	2.13	20.24	4.24	8.00	3.76
2462.0000	2457.24	-21.16	2.13	20.24	1.21	8.00	6.79

Sample Calculation:
 Result = Reading + Cable Loss + Atten. Loss



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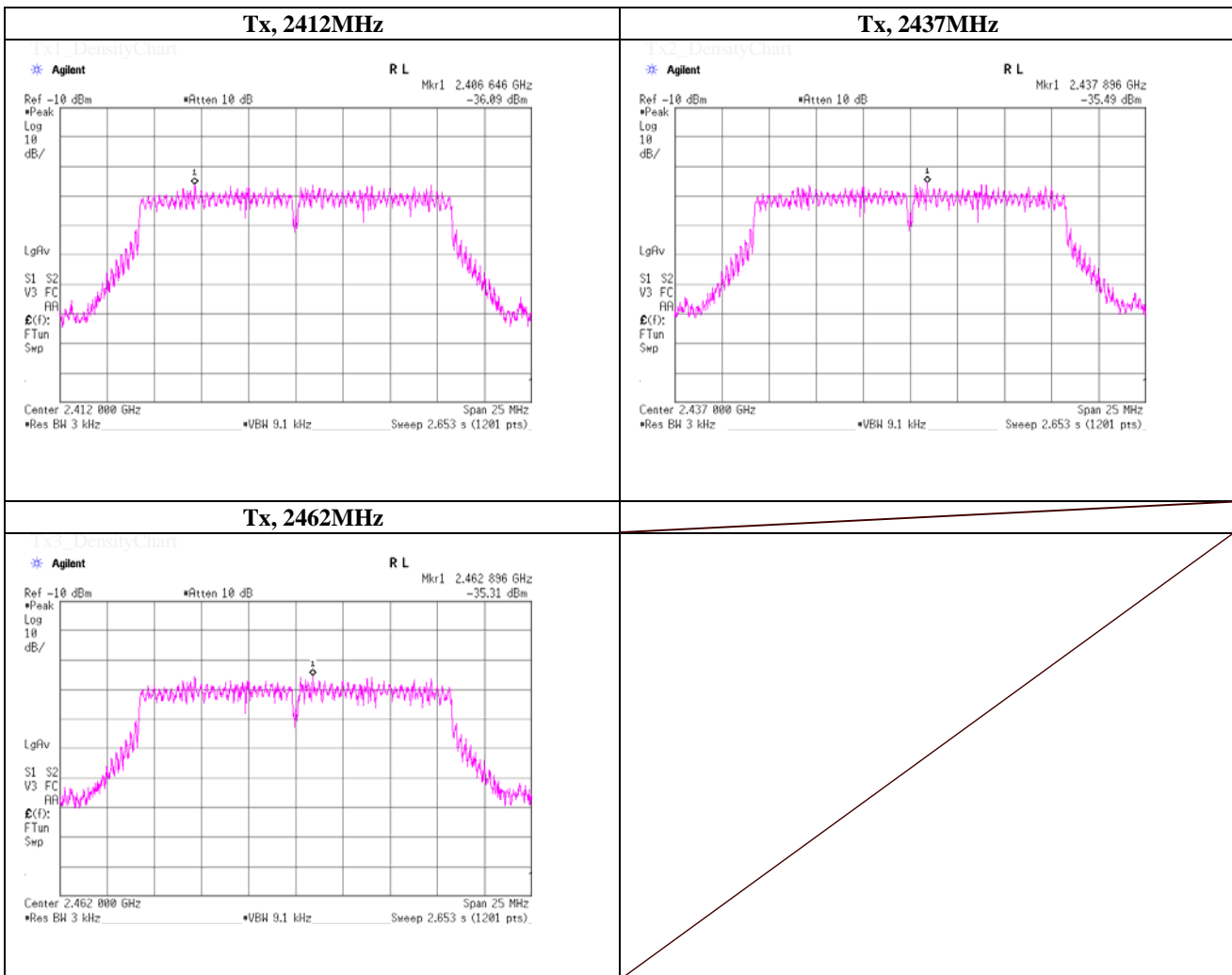
Maximum Power Spectral Density

(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	December 18, 2014	
Temperature / Humidity	26deg.C , 28%RH	
Engineer	Shinichi Takano	
Mode	Tx, IEEE802.11g, PN9, worst data mode 48Mbps	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2406.65	-36.09	2.15	20.24	-13.70	8.00	21.70
2437.0000	2437.90	-35.49	2.13	20.24	-13.12	8.00	21.12
2462.0000	2462.90	-35.32	2.13	20.24	-12.95	8.00	20.95

Sample Calculation:
 Result = Reading + Cable Loss + Atten. Loss



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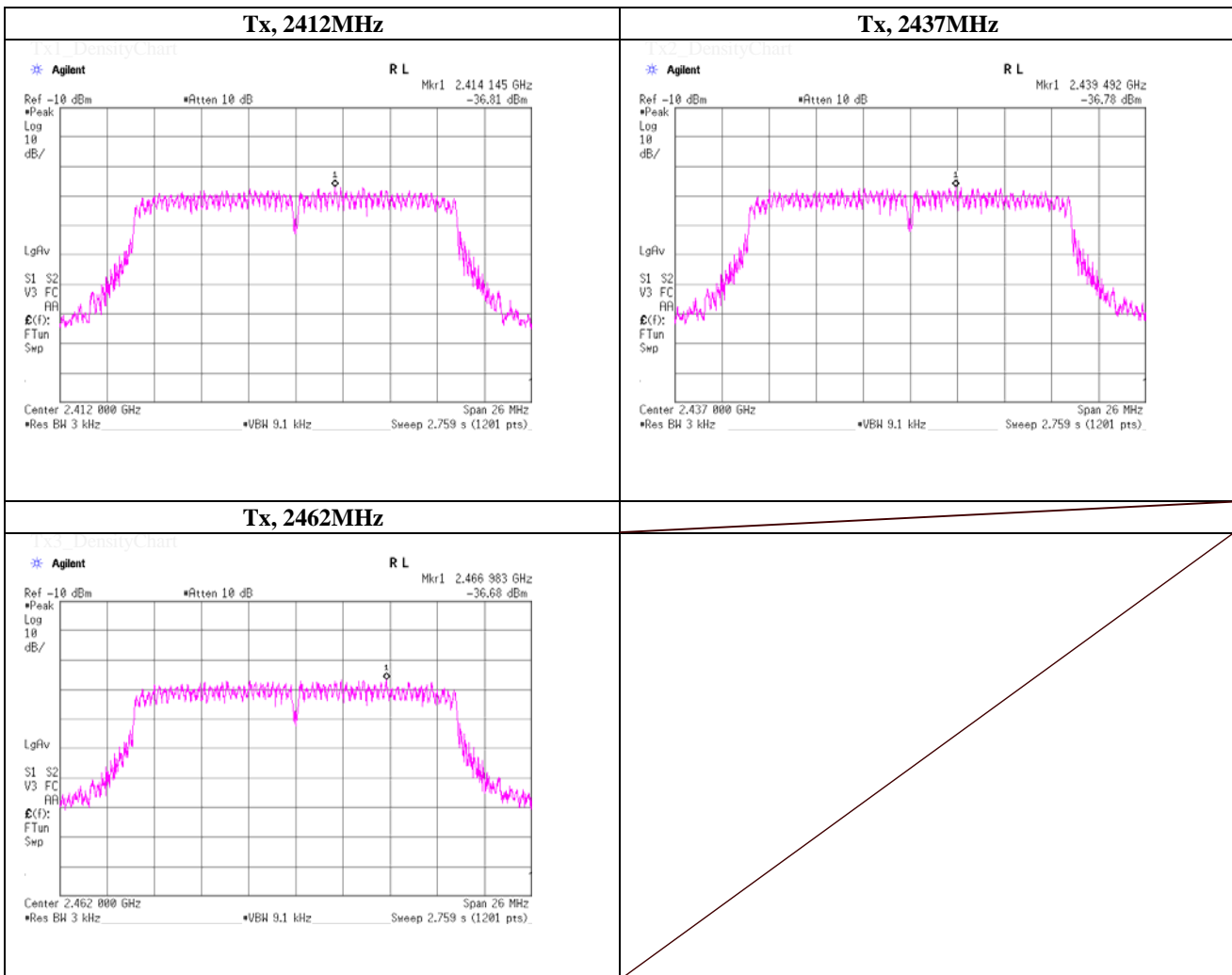
Maximum Power Spectral Density

(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	December 18, 2014	
Temperature / Humidity	26deg.C , 28%RH	
Engineer	Shinichi Takano	
Mode	Tx, IEEE802.11n HT20, PN9, Guard interval long, worst data mode 2(MCS)	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2414.15	-36.81	2.15	20.24	-14.42	8.00	22.42
2437.0000	2439.49	-36.78	2.13	20.24	-14.41	8.00	22.41
2462.0000	2466.98	-36.68	2.13	20.24	-14.31	8.00	22.31

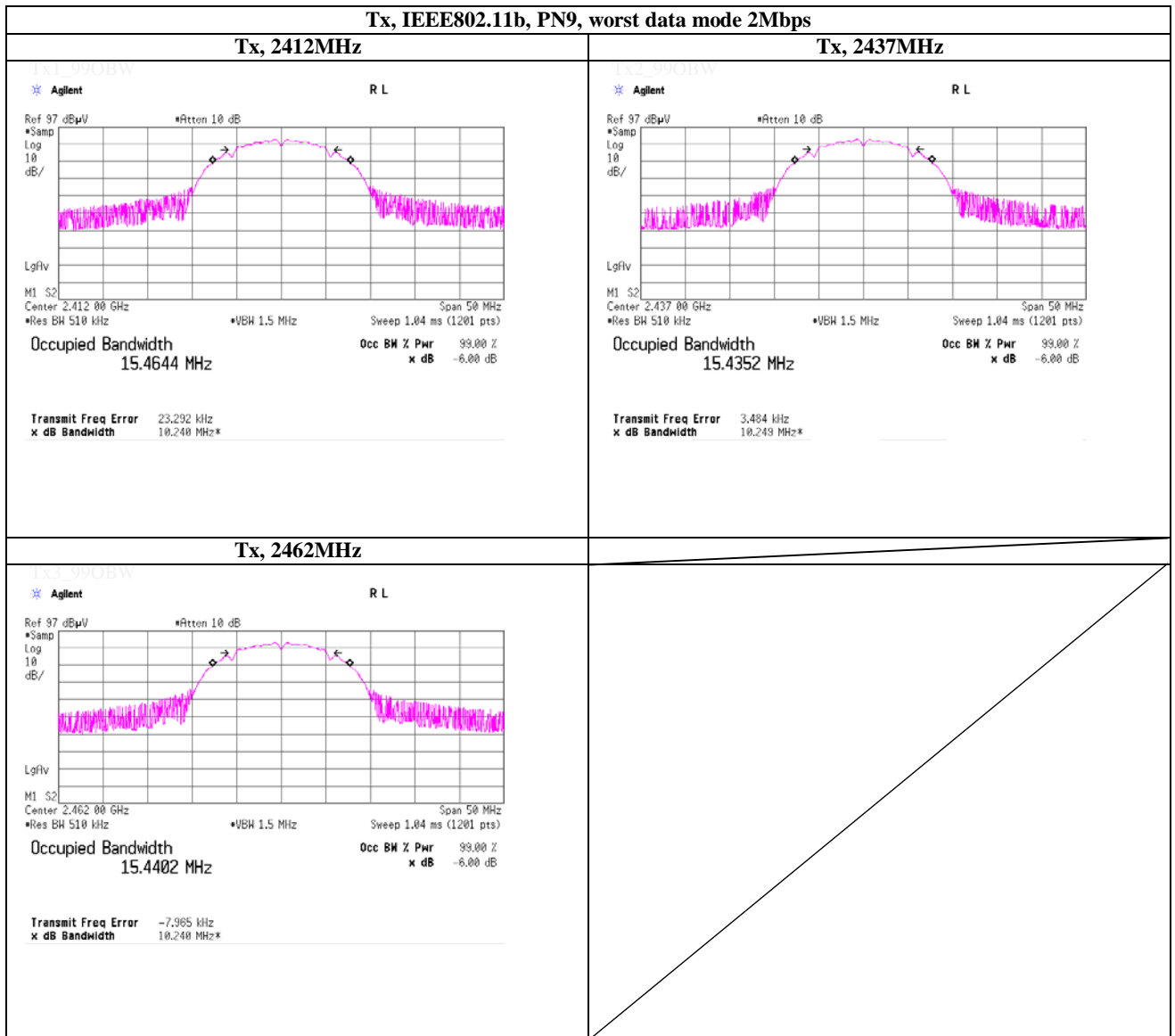
Sample Calculation:
 Result = Reading + Cable Loss + Atten. Loss



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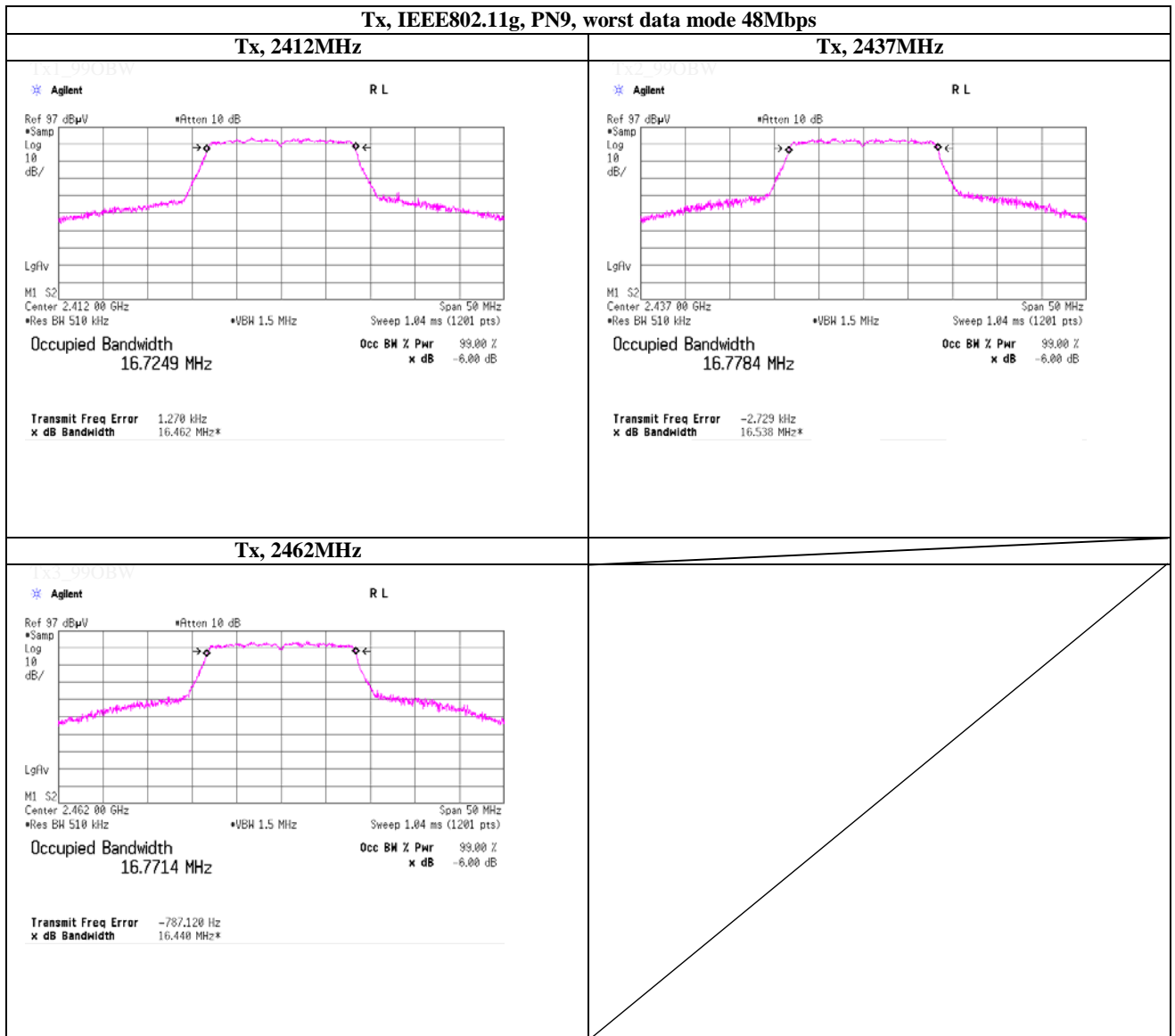
99% Occupied Bandwidth



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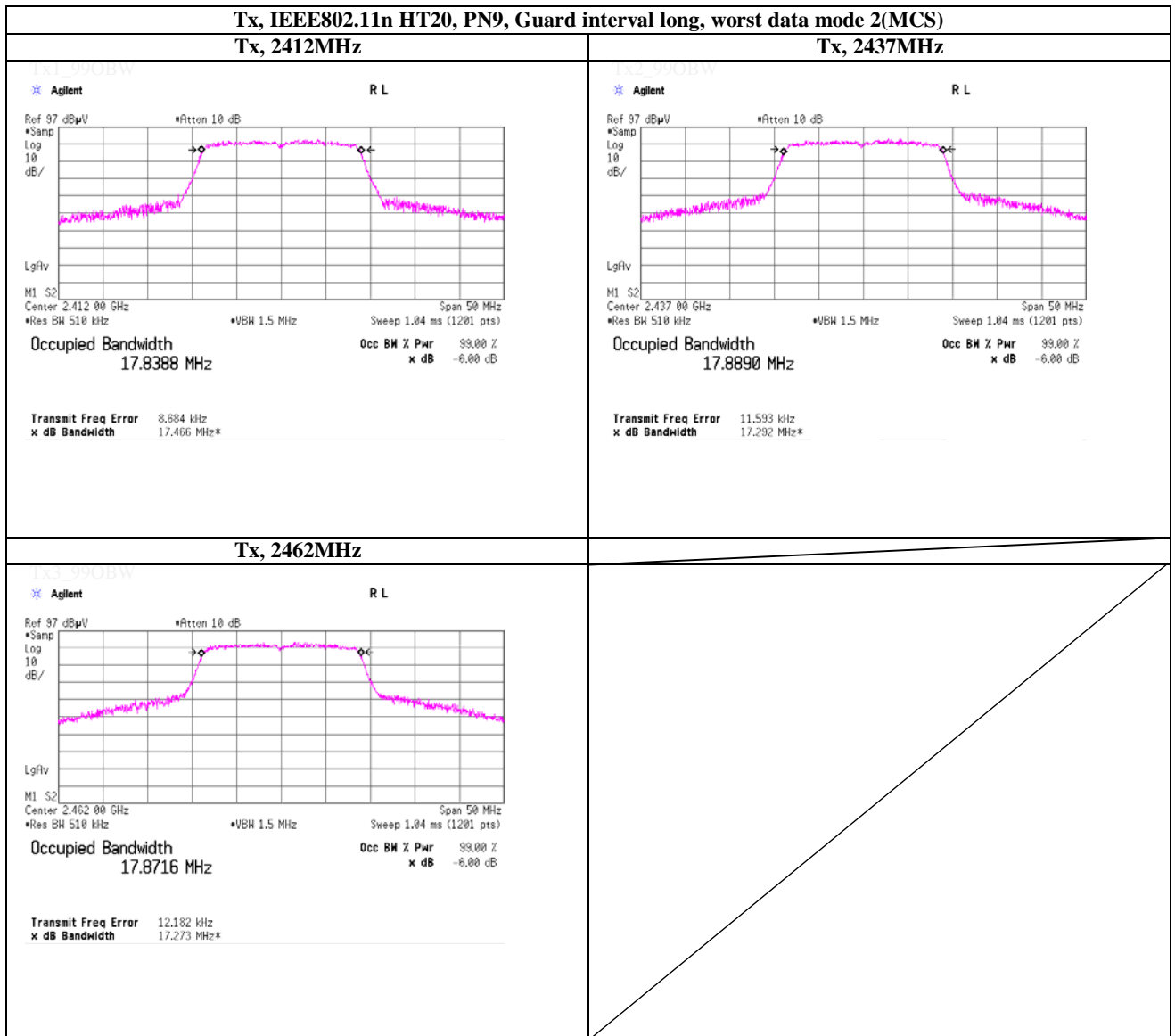
99% Occupied Bandwidth



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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)
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT	2014/03/17 * 12
SAT20-07	Attenuator	Weinschel Corp.	54A-20	31484	AT	2014/04/22 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2014/03/14 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2014/04/04 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2014/04/04 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/12/24 * 12
SCC-H1	Microwave cable	Hirose Electric	U.FL-2LP-066J1-A-(200)	-	AT	Pre Check
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/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2014/04/25 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2014/04/25 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A0893	RE	2014/11/22 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2014/10/30 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2014/09/03 * 12
SJM-14	Measure	ASKUL	-	-	RE	-
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2014/07/08 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
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
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
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2014/11/21 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2014/11/21 * 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 :

RE: Radiated emission ,

AT: Antenna terminal conducted test