



Test report No. : 10012353S-B
Page : 1 of 55
Issued date : June 12, 2013
Revised date : July 26, 2013
FCC ID : 2AAAXMC15000

RADIO TEST REPORT

Test Report No.: 10012353S-B

Applicant : Janome Sewing Machine Co., Ltd.
Type of Equipment : WLAN Module
Model No. : BP3591
FCC ID : 2AAAXMC15000
Test regulation : FCC Part15 Subpart C: 2012
Test result : Complied

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Date of test: June 3 to 6, 2013

Tested by:

Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

Approved by :

Go Ishiwata
Manager of WiSE Japan,
UL Verification Service



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13-EM-F0429

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SECTION 1: Customer information

Company Name : Janome Sewing Machine Co., Ltd.
Address : 1463 Hazama-cho, Hachioji-shi, Tokyo 193-0941 Japan
Telephone Number : +81-42-661-3155
Facsimile Number : +81-42-661-3175
Contact Person : Norio Sumiyoshi

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

2.1 Identification of E.U.T.

Type of Equipment : WLAN Module
Model Number : BP3591
Serial Number : 001
Rating : DC3.3V
Country of Mass-production : China
Condition of EUT : Production model
Receipt Date of Sample : June 3, 2013
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: BP3591 (referred to as the EUT in this report) is a WLAN Module.

Clock frequency(ies) in the system : X'tal: 40MHz / CPU: 60MHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 2412-2462MHz
Bandwidth : 20MHz
Channel spacing : 5MHz
Type of modulation : DSSS, OFDM
Antenna type : Planar dipole
Antenna connector type : MS-156C-LP-068
Antenna gain : 2.5dBi
ITU code : D1D, G1D
Operation temperature range : -20 to +80 deg.C

FCC 15.31 (e) / 212

The stable voltage (DC3.3V) is constantly provided to RF Module from the Host device regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC 15.203 / 212

The EUT has a unique coupling/antenna connector. 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: 2012, final revised on December 27, 2012 and effective January 28, 2013
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	23.4dB Freq.: 0.44615MHz Detector: Quasi-Peak and Average Phase: N Mode: IEEE 802.11g, 2412MHz	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	1.8dB Freq.: 9648MHz Polarization: Vertical Detection: Average Mode: IEEE 802.11b, 2412MHz	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 v03r01 (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 4.6.1	-	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 (±)
Conducted emission (AC Mains) LISN	150kHz-30MHz	3.6 dB	3.6 dB	3.5 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.7 dB	3.7 dB	3.6 dB
	30MHz-300MHz	4.9 dB	5.1 dB	4.9 dB
	300MHz-1GHz	5.0 dB	5.2 dB	4.9 dB
	1GHz-15GHz	4.8 dB	4.8 dB	4.9 dB
Radiated emission (Measurement distance: 1m)	15GHz-18GHz	5.6 dB	5.6 dB	5.6 dB
	18GHz-40GHz	4.6 dB	4.3 dB	4.4 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 test report meets the limits unless the uncertainty is taken into consideration.

Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB

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

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 2.3dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 3.0dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.9dB

Bandwidth measurement uncertainty for this test was: (±) 5.4%

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3.5 Test location

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JAB Accreditation No. : RTL02610

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
☐ No.1 semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.2 semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.3 semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ No.4 semi-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
☐ No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☒ No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
☐ No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
☐ No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☐ No.6 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

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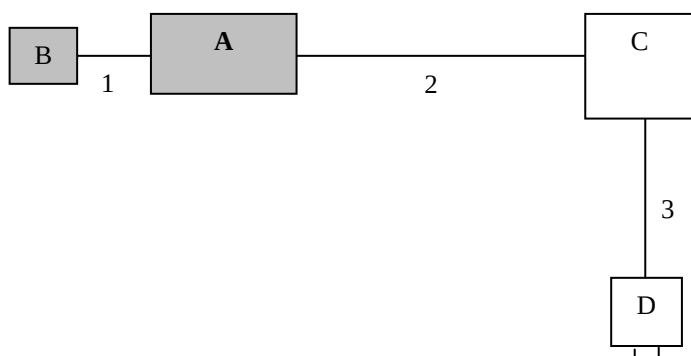
SECTION 4: Operation of E.U.T. during testing

4.1 Operating mode

Test item	Mode	Tested frequency	Power setting *1)	Worst data rate *2)
Conducted emission Radiated emission (below 1GHz) *3)	Transmitting IEEE 802.11g	2412MHz	13dBm	11Mbps, PN9
Other items	Transmitting IEEE 802.11b	2412MHz, 2437MHz, 2462MHz	15dBm	11Mbps, PN9
	Transmitting IEEE 802.11g	2412MHz, 2437MHz, 2462MHz	13dBm	24Mbps, PN9
	Transmitting IEEE 802.11n (HT20)	2412MHz, 2437MHz, 2462MHz	12dBm	MCS6, PN9
*1) Software used for the test: RADITS for 11n Test Mode Ver.1.52. This power setting is average value and maximum except tolerance, and any user cannot set over this value. *2) The worst condition was determined based on the test result of Maximum Peak Conducted Output Power. *3) 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.				

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

4.2 Configuration and peripherals



AC 120V / 60Hz

* Test data was taken under worst case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	WLAN Module	BP3591	001	Janome Sewing Machine	EUT
B	WLAN Antenna	FML2.4W	001	Janome Sewing Machine	EUT
C	Jig	BP3591-T01	-	ROHM	-
D	AC Adaptor	AD-D50P100	-	XIAMEN UME ELECTRONICS	-

List of cables used

No.	Cable	Length (m)	Shield	Remarks
1	Antenna	0.1	Shielded	-
2	Signal	0.3	Unshielded	-
3	DC	1.5	Shielded	-

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SECTION 5: Conducted emission

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). 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

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SECTION 6: Radiated emission

6.1 Operating environment

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

6.2 Test configuration

EUT was placed on a urethane platform of nominal size, 0.5m by 0.5m, raised 0.8m (below 15GHz) / 1m (above 15GHz) above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

6.3 Test conditions

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

6.4 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: RMS	RBW: 100kHz VBW: 300kHz

*1) Average Power Measurement was measured based on 12.2.5 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	Carrier (Band edge)	Spurious			
			Below 1GHz	Above 1GHz		
				1-2.8GHz	2.8-15GHz	15-25GHz
Module	Horizontal	Z	Z	Z	Z	X
	Vertical	Y	Z	Y	Y	X
Antenna	Horizontal	X	X	X	X	X
	Vertical	Z	X	Z	Y	X

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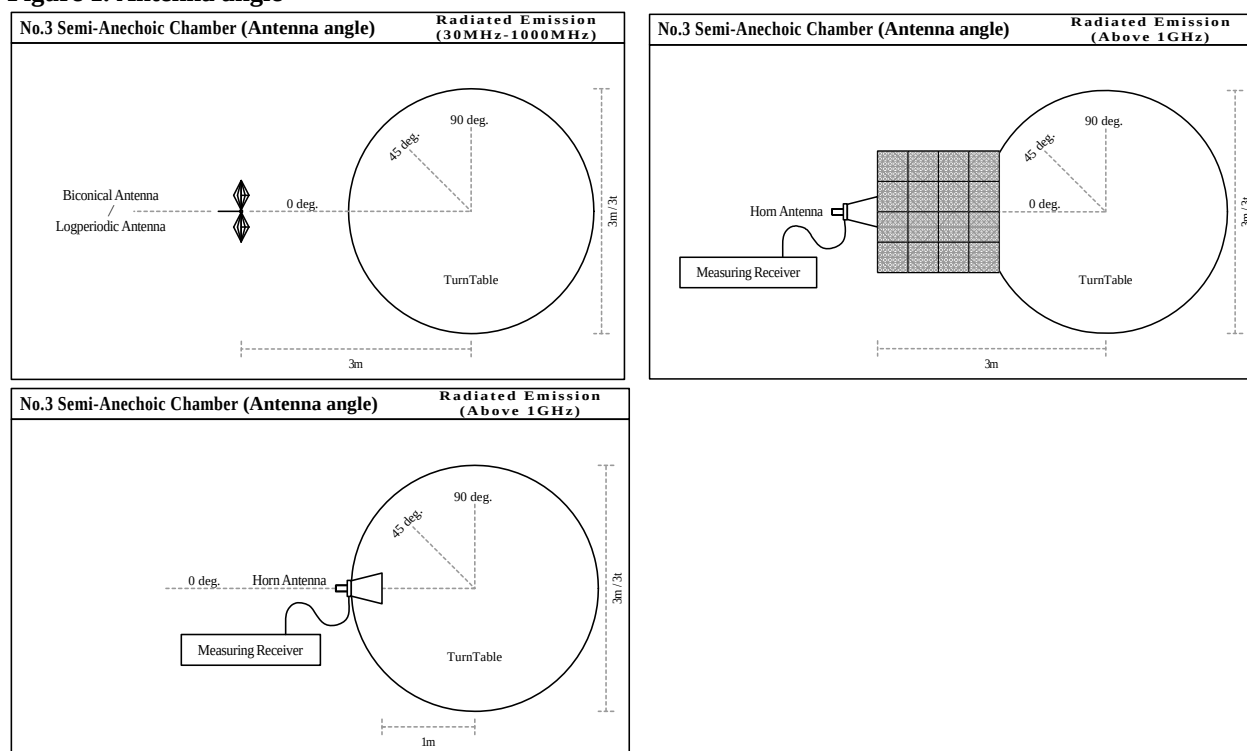
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Figure 1. Antenna angle



6.5 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.

6.6 Results

Summary of the test results : Pass
* No noise was detected above the 5th order harmonics.

Refer to APPENDIX 1

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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. In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, 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: 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 8.1 Option 1 and 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 9: 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 9.1.3 PKPM1 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 10: 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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Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

Conducted emission
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

Conducted emission
Radiated emission
Pre-check of worst position

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DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/06/06

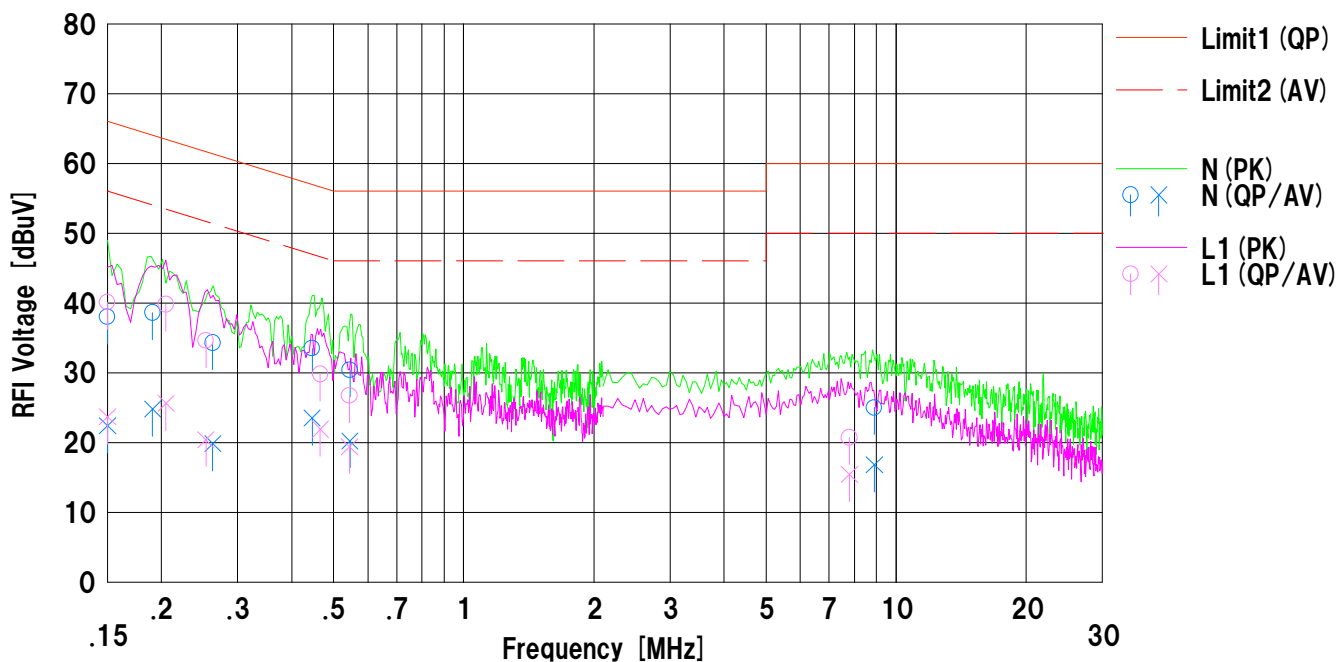
Company : Janome Sewing Machine Co., Ltd.
Kind of EUT : WLAN Module
Model No. : BP3591
Serial No. : 001

Mode : Tx IEEE802.11g 2412MHz
Order No. : 10012353S
Power : AC 120V / 60Hz
Temp./Humi. : 26deg.C / 49%RH

Remarks : -

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

Engineer : Shinichi Takano

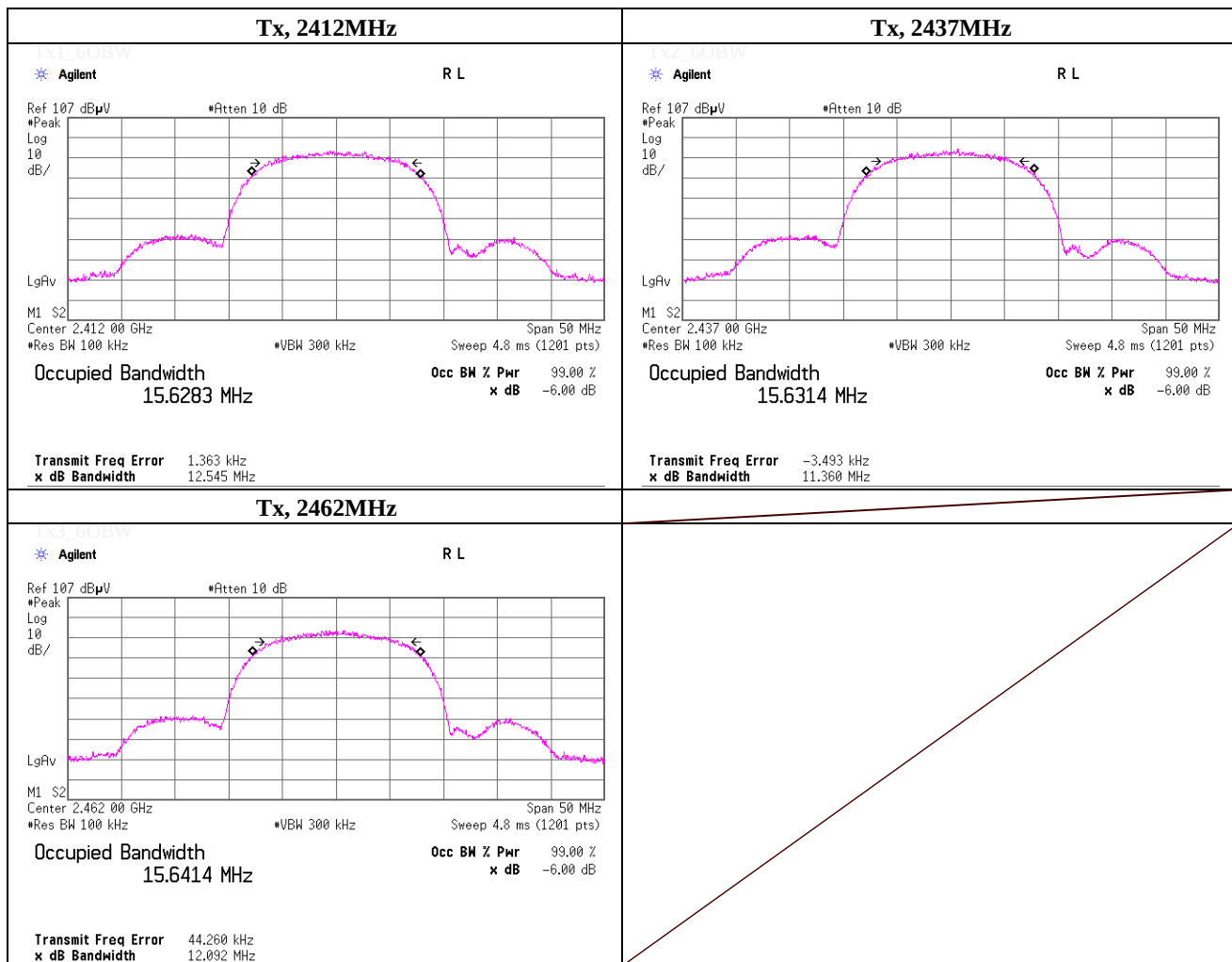


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	25.3	9.7	12.7	38.0	22.4	66.0	56.0	28.0	33.6	N	
2	0.19086	25.9	12.1	12.7	38.6	24.8	63.9	53.9	25.3	29.1	N	
3	0.26281	21.6	7.1	12.7	34.3	19.8	61.3	51.3	27.0	31.5	N	
4	0.44615	20.8	10.8	12.7	33.5	23.5	56.9	46.9	23.4	23.4	N	
5	0.54545	17.7	7.5	12.7	30.4	20.2	56.0	46.0	25.6	25.8	N	
6	8.90581	11.9	3.7	13.1	25.0	16.8	60.0	50.0	35.0	33.2	N	
7	0.15000	27.4	11.0	12.7	40.1	23.7	66.0	56.0	25.9	32.3	L1	
8	0.20486	27.1	12.9	12.7	39.8	25.6	63.4	53.4	23.6	27.8	L1	
9	0.25323	21.9	7.7	12.7	34.6	20.4	61.6	51.6	27.0	31.2	L1	
10	0.46591	17.1	9.2	12.7	29.8	21.9	56.5	46.5	26.7	24.6	L1	
11	0.54425	14.0	6.7	12.7	26.7	19.4	56.0	46.0	29.3	26.6	L1	
12	7.79960	7.7	2.4	13.0	20.7	15.4	60.0	50.0	39.3	34.6	L1	

-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Shielded Room
Date	June 3, 2013	
Temperature / Humidity	25deg.C , 45%RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11b, PN9, worst data mode 11Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	12.545	> 0.500
2437.0000	11.360	> 0.500
2462.0000	12.092	> 0.500



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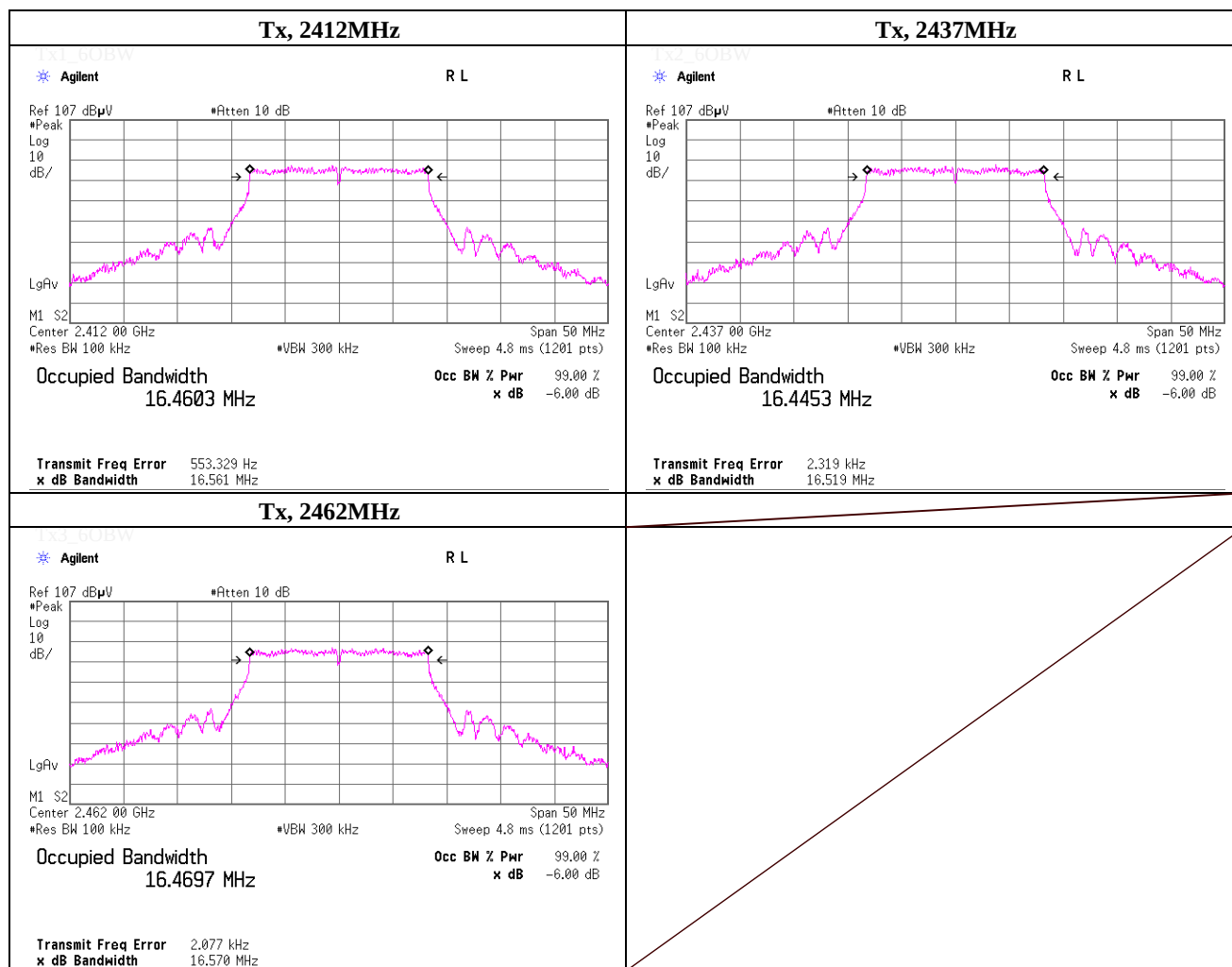
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-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Shielded Room
Date	June 3, 2013	
Temperature / Humidity	25deg.C , 45%RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11g, PN9, worst data mode 24Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	16.561	> 0.500
2437.0000	16.519	> 0.500
2462.0000	16.570	> 0.500



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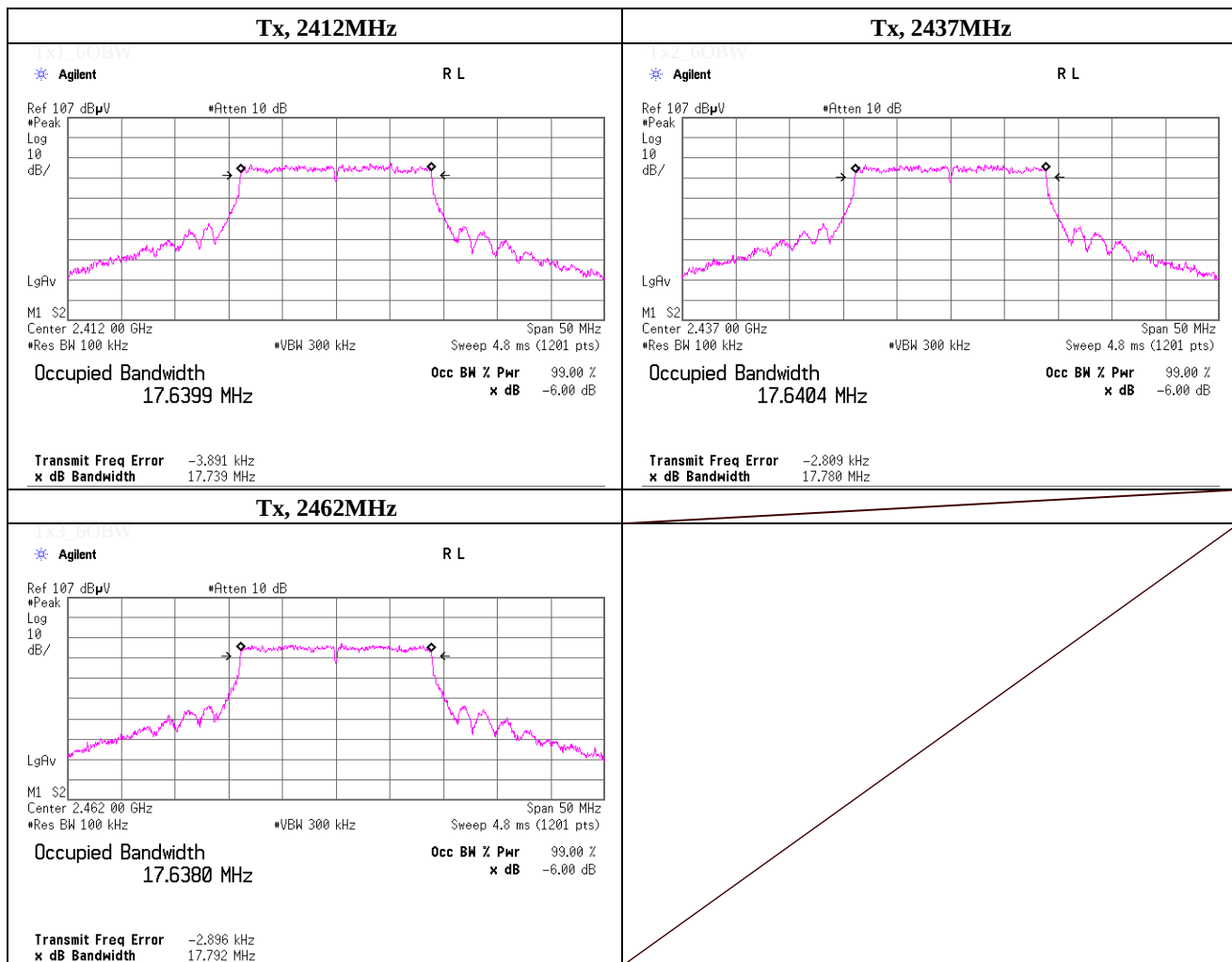
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-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Shielded Room
Date	June 3, 2013	
Temperature / Humidity	25deg.C , 45%RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n, PN9, worst data mode 6(MCS)	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	17.739	> 0.500
2437.0000	17.780	> 0.500
2462.0000	17.792	> 0.500



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Maximum Peak Conducted Output Power (PKPM1)

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date June 3, 2013
Temperature / Humidity 25deg.C , 45%RH
Engineer Tatsuya Arai
Mode Tx, IEEE802.11b, PN9, worst data mode : 11 Mbps

(* 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	-3.47	0.77	20.00	17.30	53.70	30.00	1000	12.70
Mid	2437.0	-3.61	0.77	20.00	17.16	52.00	30.00	1000	12.84
High	2462.0	-3.57	0.77	20.00	17.20	52.48	30.00	1000	12.80

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

[Pre check]

	Data rate [Mbps]	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin
						[dBm]	[mW]	[dBm]	[mW]	[dB]
	1	2437.0	-3.64	0.77	20.00	17.13	51.64	30.00	1000	12.87
	2	2437.0	-3.75	0.77	20.00	17.02	50.35	30.00	1000	12.98
	5.5	2437.0	-3.90	0.77	20.00	16.87	48.64	30.00	1000	13.13
	11	2437.0	-3.61	0.77	20.00	17.16	52.00	30.00	1000	12.84

Worst

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

Average conducted power (Reference data)

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

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result	
					[dBm]	[mW]
Low	2412.0	-5.88	0.77	20.00	14.89	30.83
Mid	2437.0	-6.03	0.77	20.00	14.74	29.79
High	2462.0	-5.98	0.77	20.00	14.79	30.13

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Shonan EMC Lab.

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Maximum Peak Conducted Output Power

(PKPM1)

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
 Date June 3, 2013
 Temperature / Humidity 25deg.C , 45%RH
 Engineer Tatsuya Arai
 Mode Tx, IEEE802.11g, PN9, worst data mode : 24 Mbps

(* 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	-0.24	0.77	20.00	20.53	112.98	30.00	1000	9.47
Mid	2437.0	-0.36	0.77	20.00	20.41	109.90	30.00	1000	9.59
High	2462.0	-0.42	0.77	20.00	20.35	108.39	30.00	1000	9.65

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

[Pre check]

	Data rate [Mbps]	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin
						[dBm]	[mW]	[dBm]	[mW]	[dB]
	6	2437.0	-0.78	0.77	20.00	19.99	99.77	30.00	1000	10.01
	9	2437.0	-0.75	0.77	20.00	20.02	100.46	30.00	1000	9.98
	12	2437.0	-0.48	0.77	20.00	20.29	106.91	30.00	1000	9.71
	18	2437.0	-0.43	0.77	20.00	20.34	108.14	30.00	1000	9.66
	24	2437.0	-0.36	0.77	20.00	20.41	109.90	30.00	1000	9.59
	36	2437.0	-0.37	0.77	20.00	20.40	109.65	30.00	1000	9.60
	48	2437.0	-0.65	0.77	20.00	20.12	102.80	30.00	1000	9.88
	54	2437.0	-0.64	0.77	20.00	20.13	103.04	30.00	1000	9.87

Worst

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

Average conducted power (Reference data)

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

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result	
					[dBm]	[mW]
Low	2412.0	-8.93	0.77	20.00	11.84	15.28
Mid	2437.0	-8.85	0.77	20.00	11.92	15.56
High	2462.0	-8.99	0.77	20.00	11.78	15.07

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Maximum Peak Conducted Output Power

(PKPM1)

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room

Date June 3, 2013

Temperature / Humidity 25deg.C , 45%RH

Engineer Tatsuya Arai

Mode Tx, IEEE802.11n, PN9,

worst data mode : 6 (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	-0.36	0.77	20.00	20.41	109.90	30.00	1000	9.59
Mid	2437.0	-0.38	0.77	20.00	20.39	109.40	30.00	1000	9.61
High	2462.0	-0.56	0.77	20.00	20.21	104.95	30.00	1000	9.79

Sample Calculation:

Result = Reading + Cable Loss + 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	-0.55	0.77	20.00	20.22	105.20	30.00	1000	9.78
1	2437.0	-0.43	0.77	20.00	20.34	108.14	30.00	1000	9.66
2	2437.0	-0.45	0.77	20.00	20.32	107.65	30.00	1000	9.68
3	2437.0	-0.46	0.77	20.00	20.31	107.40	30.00	1000	9.69
4	2437.0	-0.39	0.77	20.00	20.38	109.14	30.00	1000	9.62
5	2437.0	-0.51	0.77	20.00	20.26	106.17	30.00	1000	9.74
6	2437.0	-0.38	0.77	20.00	20.39	109.40	30.00	1000	9.61
7	2437.0	-0.45	0.77	20.00	20.32	107.65	30.00	1000	9.68

Worst

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

Average conducted power (Reference data)

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

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result	
					[dBm]	[mW]
Low	2412.0	-9.47	0.77	20.00	11.30	13.49
Mid	2437.0	-9.46	0.77	20.00	11.31	13.52
High	2462.0	-9.53	0.77	20.00	11.24	13.30

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date June 5, 2013 June 6, 2013
Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
Engineer Shinichi Takano Tatsuya Arai
Mode Tx, 2412 MHz
 Tx, IEEE802.11b, PN9, worst data mode 11Mbps

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	53.3	27.4	14.7	41.4	54.0	73.9	19.9	100	146	
Hori.	4824.000	PK	57.4	31.1	7.5	41.2	54.8	73.9	19.1	100	122	
Hori.	7236.000	PK	47.4	36.6	9.0	41.4	51.6	73.9	22.3	100	0	
Hori.	9648.000	PK	47.5	38.6	10.2	38.9	57.4	73.9	16.5	165	340	
Hori.	12060.000	PK	44.9	39.5	11.5	39.4	56.5	73.9	17.4	100	0	
Hori.	2390.000	AV	44.8	27.4	14.7	41.4	45.5	53.9	8.4	100	146	
Hori.	4824.000	AV	46.4	31.1	7.5	41.2	43.8	53.9	10.1	100	122	
Hori.	7236.000	AV	38.2	36.6	9.0	41.4	42.4	53.9	11.5	100	0	
Hori.	9648.000	AV	41.2	38.6	10.2	38.9	51.1	53.9	2.8	165	340	
Hori.	12060.000	AV	35.6	39.5	11.5	39.4	47.2	53.9	6.7	100	0	
Vert.	2390.000	PK	52.6	27.4	14.7	41.4	53.3	73.9	20.6	100	316	
Vert.	4824.000	PK	56.3	31.1	7.5	41.2	53.7	73.9	20.2	100	287	
Vert.	7236.000	PK	46.9	36.6	9.0	41.4	51.1	73.9	22.8	100	0	
Vert.	9648.000	PK	48.4	38.6	10.2	38.9	58.3	73.9	15.6	174	182	
Vert.	12060.000	PK	44.3	39.5	11.5	39.4	55.9	73.9	18.0	100	0	
Vert.	2390.000	AV	43.1	27.4	14.7	41.4	43.8	53.9	10.1	100	316	
Vert.	4824.000	AV	48.8	31.1	7.5	41.2	46.2	53.9	7.7	100	287	
Vert.	7236.000	AV	37.7	36.6	9.0	41.4	41.9	53.9	12.0	100	0	
Vert.	9648.000	AV	42.2	38.6	10.2	38.9	52.1	53.9	1.8	174	182	
Vert.	12060.000	AV	35.4	39.5	11.5	39.4	47.0	53.9	6.9	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	101.7	27.5	14.7	41.4	102.5	-	-	
Hori.	2397.441	PK	65.8	27.4	14.7	41.4	66.5	82.5	16.0	
Hori.	2400.000	PK	61.5	27.4	14.7	41.4	62.2	82.5	20.3	
Vert.	2412.000	PK	99.8	27.5	14.7	41.4	100.6	-	-	
Vert.	2398.295	PK	63.2	27.4	14.7	41.4	63.9	80.6	16.7	
Vert.	2400.000	PK	59.9	27.4	14.7	41.4	60.6	80.6	20.0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter) - Gain(Amplifier)

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2437 MHz
 Tx, IEEE802.11b, PN9, worst data mode 11Mbps

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	57.4	31.3	7.5	41.1	55.1	73.9	18.8	100	118	
Hori.	7311.000	PK	48.0	36.6	9.0	41.4	52.2	73.9	21.7	100	0	
Hori.	9748.000	PK	47.2	38.7	10.1	38.9	57.1	73.9	16.8	150	319	
Hori.	12185.000	PK	45.0	39.5	11.4	39.3	56.6	73.9	17.3	100	0	
Hori.	4874.000	AV	46.9	31.3	7.5	41.1	44.6	53.9	9.3	100	118	
Hori.	7311.000	AV	37.2	36.6	9.0	41.4	41.4	53.9	12.5	100	0	
Hori.	9748.000	AV	40.1	38.7	10.1	38.9	50.0	53.9	3.9	150	319	
Hori.	12185.000	AV	34.8	39.5	11.4	39.3	46.4	53.9	7.5	100	0	
Vert.	4874.000	PK	57.4	31.3	7.5	41.1	55.1	73.9	18.8	100	326	
Vert.	7311.000	PK	46.7	36.6	9.0	41.4	50.9	73.9	23.0	100	0	
Vert.	9748.000	PK	45.7	38.7	10.1	38.9	55.6	73.9	18.3	132	183	
Vert.	12185.000	PK	44.4	39.5	11.4	39.3	56.0	73.9	17.9	100	0	
Vert.	4874.000	AV	46.0	31.3	7.5	41.1	43.7	53.9	10.2	100	326	
Vert.	7311.000	AV	37.8	36.6	9.0	41.4	42.0	53.9	11.9	100	0	
Vert.	9748.000	AV	38.4	38.7	10.1	38.9	48.3	53.9	5.6	132	183	
Vert.	12185.000	AV	34.5	39.5	11.4	39.3	46.1	53.9	7.8	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2462 MHz
 Tx, IEEE802.11b, PN9, worst data mode 11Mbps

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	51.2	27.5	14.8	41.4	52.1	73.9	21.8	100	159	
Hori.	4924.000	PK	53.2	31.5	7.5	41.0	51.2	73.9	22.7	100	256	
Hori.	7386.000	PK	47.3	36.7	9.0	41.5	51.5	73.9	22.4	100	0	
Hori.	9848.000	PK	47.1	38.9	10.0	38.9	57.1	73.9	16.8	164	340	
Hori.	12310.000	PK	44.8	39.5	11.3	39.3	56.3	73.9	17.6	100	0	
Hori.	2483.500	AV	41.7	27.5	14.8	41.4	42.6	53.9	11.3	100	159	
Hori.	4924.000	AV	43.9	31.5	7.5	41.0	41.9	53.9	12.0	100	256	
Hori.	7386.000	AV	37.4	36.7	9.0	41.5	41.6	53.9	12.3	100	0	
Hori.	9848.000	AV	40.0	38.9	10.0	38.9	50.0	53.9	3.9	164	340	
Hori.	12310.000	AV	34.8	39.5	11.3	39.3	46.3	53.9	7.6	100	0	
Vert.	2483.500	PK	51.6	27.5	14.8	41.4	52.5	73.9	21.4	100	310	
Vert.	4924.000	PK	53.9	31.5	7.5	41.0	51.9	73.9	22.0	100	300	
Vert.	7386.000	PK	47.4	36.7	9.0	41.5	51.6	73.9	22.3	100	0	
Vert.	9848.000	PK	46.9	38.9	10.0	38.9	56.9	73.9	17.0	193	183	
Vert.	12310.000	PK	43.9	39.5	11.3	39.3	55.4	73.9	18.5	100	0	
Vert.	2483.500	AV	42.2	27.5	14.8	41.4	43.1	53.9	10.8	100	310	
Vert.	4924.000	AV	46.6	31.5	7.5	41.0	44.6	53.9	9.3	100	300	
Vert.	7386.000	AV	37.2	36.7	9.0	41.5	41.4	53.9	12.5	100	0	
Vert.	9848.000	AV	39.9	38.9	10.0	38.9	49.9	53.9	4.0	193	183	
Vert.	12310.000	AV	34.6	39.5	11.3	39.3	46.1	53.9	7.8	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2412 MHz
 Tx, IEEE802.11g, PN9, worst data mode 24Mbps

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.	280.022	QP	37.7	18.6	8.4	32.0	32.7	46.0	13.3	126	281	
Hori.	320.018	QP	37.3	14.4	8.6	31.9	28.4	46.0	17.6	100	111	
Hori.	520.014	QP	34.6	17.8	9.5	32.0	29.9	46.0	16.1	182	163	
Hori.	2390.000	PK	61.6	27.4	14.7	41.4	62.3	73.9	11.6	100	145	
Hori.	4824.000	PK	50.9	31.1	7.5	41.2	48.3	73.9	25.6	100	116	
Hori.	7236.000	PK	47.6	36.6	9.0	41.4	51.8	73.9	22.1	100	0	
Hori.	9648.000	PK	44.3	38.6	10.2	38.9	54.2	73.9	19.7	100	350	
Hori.	12060.000	PK	45.2	39.5	11.5	39.4	56.8	73.9	17.1	100	0	
Hori.	2390.000	AV	46.7	27.4	14.7	41.4	47.4	53.9	6.5	100	145	
Hori.	4824.000	AV	42.4	31.1	7.5	41.2	39.8	53.9	14.1	100	116	
Hori.	7236.000	AV	37.8	36.6	9.0	41.4	42.0	53.9	11.9	100	0	
Hori.	9648.000	AV	35.0	38.6	10.2	38.9	44.9	53.9	9.0	100	350	
Hori.	12060.000	AV	35.2	39.5	11.5	39.4	46.8	53.9	7.1	100	0	
Vert.	45.592	QP	38.5	12.2	6.7	32.2	25.2	40.0	14.8	100	166	
Vert.	75.215	QP	51.6	6.5	7.2	32.1	33.2	40.0	6.8	100	171	
Vert.	96.669	QP	43.4	9.5	7.4	32.1	28.2	43.5	15.3	100	171	
Vert.	2390.000	PK	61.2	27.4	14.7	41.4	61.9	73.9	12.0	100	310	
Vert.	4824.000	PK	50.3	31.1	7.5	41.2	47.7	73.9	26.2	100	238	
Vert.	7236.000	PK	47.5	36.6	9.0	41.4	51.7	73.9	22.2	100	0	
Vert.	9648.000	PK	44.8	38.6	10.2	38.9	54.7	73.9	19.2	148	162	
Vert.	12060.000	PK	44.7	39.5	11.5	39.4	56.3	73.9	17.6	100	0	
Vert.	2390.000	AV	46.3	27.4	14.7	41.4	47.0	53.9	6.9	100	310	
Vert.	4824.000	AV	43.4	31.1	7.5	41.2	40.8	53.9	13.1	100	238	
Vert.	7236.000	AV	38.0	36.6	9.0	41.4	42.2	53.9	11.7	100	0	
Vert.	9648.000	AV	35.1	38.6	10.2	38.9	45.0	53.9	8.9	148	162	
Vert.	12060.000	AV	35.4	39.5	11.5	39.4	47.0	53.9	6.9	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	93.6	27.5	14.7	41.4	94.4	-	-	100k/300k
Hori.	2398.207	PK	63.7	27.4	14.7	41.4	64.4	74.4	10.0	100k/300k
Hori.	2400.000	PK	62.7	27.4	14.7	41.4	63.4	74.4	11.0	100k/300k
Vert.	2412.000	PK	94.9	27.5	14.7	41.4	95.7	-	-	100k/300k
Vert.	2398.250	PK	64.5	27.4	14.7	41.4	65.2	75.7	10.5	100k/300k
Vert.	2400.000	PK	63.6	27.4	14.7	41.4	64.3	75.7	11.4	100k/300k

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter) - Gain(Amplifier)

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2437 MHz
 Tx, IEEE802.11g, PN9, worst data mode 24Mbps

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	49.4	31.3	7.5	41.1	47.1	73.9	26.8	100	117	
Hori.	7311.000	PK	47.4	36.6	9.0	41.4	51.6	73.9	22.3	100	0	
Hori.	9748.000	PK	44.9	38.7	10.1	38.9	54.8	73.9	19.1	166	6	
Hori.	12185.000	PK	45.3	39.5	11.4	39.3	56.9	73.9	17.0	100	0	
Hori.	4874.000	AV	42.4	31.3	7.5	41.1	40.1	53.9	13.8	100	117	
Hori.	7311.000	AV	37.6	36.6	9.0	41.4	41.8	53.9	12.1	100	0	
Hori.	9748.000	AV	35.4	38.7	10.1	38.9	45.3	53.9	8.6	166	6	
Hori.	12185.000	AV	35.4	39.5	11.4	39.3	47.0	53.9	6.9	100	0	
Vert.	4874.000	PK	51.0	31.3	7.5	41.1	48.7	73.9	25.2	100	41	
Vert.	7311.000	PK	47.1	36.6	9.0	41.4	51.3	73.9	22.6	100	0	
Vert.	9748.000	PK	45.5	38.7	10.1	38.9	55.4	73.9	18.5	146	166	
Vert.	12185.000	PK	44.8	39.5	11.4	39.3	56.4	73.9	17.5	100	0	
Vert.	4874.000	AV	42.9	31.3	7.5	41.1	40.6	53.9	13.3	100	41	
Vert.	7311.000	AV	37.8	36.6	9.0	41.4	42.0	53.9	11.9	100	0	
Vert.	9748.000	AV	35.0	38.7	10.1	38.9	44.9	53.9	9.0	146	166	
Vert.	12185.000	AV	35.7	39.5	11.4	39.3	47.3	53.9	6.6	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2462 MHz
 Tx, IEEE802.11g, PN9, worst data mode 24Mbps

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	60.2	27.5	14.8	41.4	61.1	73.9	12.8	100	160	
Hori.	4924.000	PK	50.9	31.5	7.5	41.0	48.9	73.9	25.0	100	117	
Hori.	7386.000	PK	47.4	36.7	9.0	41.5	51.6	73.9	22.3	100	0	
Hori.	9848.000	PK	45.0	38.9	10.0	38.9	55.0	73.9	18.9	149	0	
Hori.	12310.000	PK	44.0	39.5	11.3	39.3	55.5	73.9	18.4	100	0	
Hori.	2483.500	AV	44.9	27.5	14.8	41.4	45.8	53.9	8.1	100	160	
Hori.	4924.000	AV	43.4	31.5	7.5	41.0	41.4	53.9	12.5	100	117	
Hori.	7386.000	AV	38.0	36.7	9.0	41.5	42.2	53.9	11.7	100	0	
Hori.	9848.000	AV	35.6	38.9	10.0	38.9	45.6	53.9	8.3	149	0	
Hori.	12310.000	AV	35.1	39.5	11.3	39.3	46.6	53.9	7.3	100	0	
Vert.	2483.500	PK	59.7	27.5	14.8	41.4	60.6	73.9	13.3	100	313	
Vert.	4924.000	PK	50.7	31.5	7.5	41.0	48.7	73.9	25.2	100	219	
Vert.	7386.000	PK	47.2	36.7	9.0	41.5	51.4	73.9	22.5	100	0	
Vert.	9848.000	PK	45.4	38.9	10.0	38.9	55.4	73.9	18.5	163	166	
Vert.	12310.000	PK	45.5	39.5	11.3	39.3	57.0	73.9	16.9	100	0	
Vert.	2483.500	AV	45.4	27.5	14.8	41.4	46.3	53.9	7.6	100	313	
Vert.	4924.000	AV	43.1	31.5	7.5	41.0	41.1	53.9	12.8	100	219	
Vert.	7386.000	AV	37.9	36.7	9.0	41.5	42.1	53.9	11.8	100	0	
Vert.	9848.000	AV	35.2	38.9	10.0	38.9	45.2	53.9	8.7	163	166	
Vert.	12310.000	AV	35.4	39.5	11.3	39.3	46.9	53.9	7.0	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2412 MHz
 Tx, IEEE802.11n, PN9, worst data mode 6(MCS)

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	64.3	27.4	14.7	41.4	65.0	73.9	8.9	100	145	
Hori.	4824.000	PK	49.7	31.1	7.5	41.2	47.1	73.9	26.8	100	114	
Hori.	7236.000	PK	47.1	36.6	9.0	41.4	51.3	73.9	22.6	100	0	
Hori.	9648.000	PK	44.6	38.6	10.2	38.9	54.5	73.9	19.4	154	353	
Hori.	12060.000	PK	44.7	39.5	11.5	39.4	56.3	73.9	17.6	100	0	
Hori.	2390.000	AV	48.4	27.4	14.7	41.4	49.1	53.9	4.8	100	145	
Hori.	4824.000	AV	41.8	31.1	7.5	41.2	39.2	53.9	14.7	100	114	
Hori.	7236.000	AV	37.8	36.6	9.0	41.4	42.0	53.9	11.9	100	0	
Hori.	9648.000	AV	35.3	38.6	10.2	38.9	45.2	53.9	8.7	154	353	
Hori.	12060.000	AV	35.4	39.5	11.5	39.4	47.0	53.9	6.9	100	0	
Vert.	2390.000	PK	63.0	27.4	14.7	41.4	63.7	73.9	10.2	100	314	
Vert.	4824.000	PK	50.8	31.1	7.5	41.2	48.2	73.9	25.7	100	239	
Vert.	7236.000	PK	47.2	36.6	9.0	41.4	51.4	73.9	22.5	100	0	
Vert.	9648.000	PK	45.7	38.6	10.2	38.9	55.6	73.9	18.3	164	165	
Vert.	12060.000	PK	46.0	39.5	11.5	39.4	57.6	73.9	16.3	100	0	
Vert.	2390.000	AV	47.9	27.4	14.7	41.4	48.6	53.9	5.3	100	314	
Vert.	4824.000	AV	43.2	31.1	7.5	41.2	40.6	53.9	13.3	100	239	
Vert.	7236.000	AV	37.6	36.6	9.0	41.4	41.8	53.9	12.1	100	0	
Vert.	9648.000	AV	35.1	38.6	10.2	38.9	45.0	53.9	8.9	164	165	
Vert.	12060.000	AV	35.6	39.5	11.5	39.4	47.2	53.9	6.7	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	93.5	27.5	14.7	41.4	94.3	-	-	100k/300k
Hori.	2398.257	PK	63.2	27.4	14.7	41.4	63.9	74.3	10.4	100k/300k
Hori.	2400.000	PK	62.6	27.4	14.7	41.4	63.3	74.3	11.0	100k/300k
Vert.	2412.000	PK	94.4	27.5	14.7	41.4	95.2	-	-	100k/300k
Vert.	2398.342	PK	62.6	27.4	14.7	41.4	63.3	75.2	11.9	100k/300k
Vert.	2400.000	PK	63.3	27.4	14.7	41.4	64.0	75.2	11.2	100k/300k

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter) - Gain(Amplifier)

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2437 MHz
 Tx, IEEE802.11n, PN9, worst data mode 6(MCS)

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	49.9	31.3	7.5	41.1	47.6	73.9	26.3	100	119	
Hori.	7311.000	PK	47.9	36.6	9.0	41.4	52.1	73.9	21.8	100	0	
Hori.	9748.000	PK	44.6	38.7	10.1	38.9	54.5	73.9	19.4	176	353	
Hori.	12185.000	PK	45.1	39.5	11.4	39.3	56.7	73.9	17.2	100	0	
Hori.	4874.000	AV	42.9	31.3	7.5	41.1	40.6	53.9	13.3	100	119	
Hori.	7311.000	AV	38.1	36.6	9.0	41.4	42.3	53.9	11.6	100	0	
Hori.	9748.000	AV	35.5	38.7	10.1	38.9	45.4	53.9	8.5	176	353	
Hori.	12185.000	AV	35.3	39.5	11.4	39.3	46.9	53.9	7.0	100	0	
Vert.	4874.000	PK	50.2	31.3	7.5	41.1	47.9	73.9	26.0	100	325	
Vert.	7311.000	PK	47.2	36.6	9.0	41.4	51.4	73.9	22.5	100	0	
Vert.	9748.000	PK	44.3	38.7	10.1	38.9	54.2	73.9	19.7	151	163	
Vert.	12185.000	PK	45.1	39.5	11.4	39.3	56.7	73.9	17.2	100	0	
Vert.	4874.000	AV	42.8	31.3	7.5	41.1	40.5	53.9	13.4	100	325	
Vert.	7311.000	AV	37.8	36.6	9.0	41.4	42.0	53.9	11.9	100	0	
Vert.	9748.000	AV	35.1	38.7	10.1	38.9	45.0	53.9	8.9	151	163	
Vert.	12185.000	AV	35.4	39.5	11.4	39.3	47.0	53.9	6.9	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 5, 2013 June 6, 2013
 Temperature / Humidity 23 deg.C, 58%RH 23 deg.C, 58%RH
 Engineer Shinichi Takano Tatsuya Arai
 Mode Tx, 2462 MHz
 Tx, IEEE802.11n, PN9, worst data mode 6(MCS)

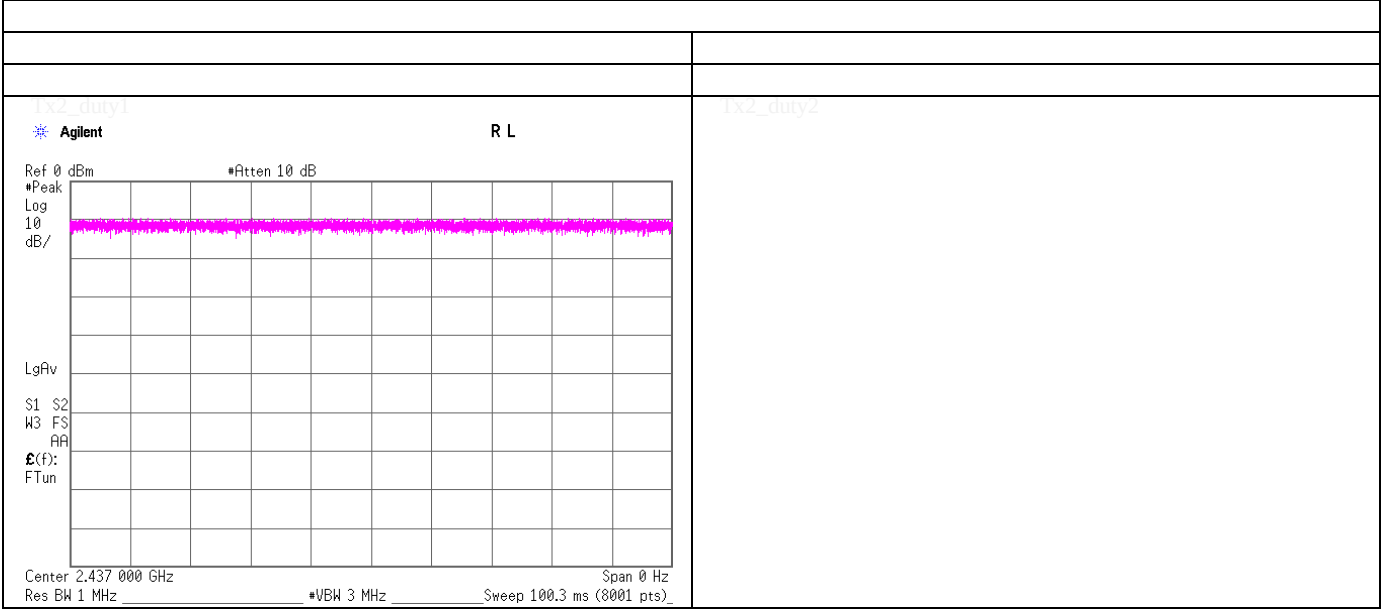
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	60.8	27.5	14.8	41.4	61.7	73.9	12.2	100	160	
Hori.	4924.000	PK	51.0	31.5	7.5	41.0	49.0	73.9	24.9	100	0	
Hori.	7386.000	PK	47.9	36.7	9.0	41.5	52.1	73.9	21.8	100	0	
Hori.	9848.000	PK	45.5	38.9	10.0	38.9	55.5	73.9	18.4	138	358	
Hori.	12310.000	PK	45.1	39.5	11.3	39.3	56.6	73.9	17.3	100	0	
Hori.	2483.500	AV	46.8	27.5	14.8	41.4	47.7	53.9	6.2	100	160	
Hori.	4924.000	AV	44.0	31.5	7.5	41.0	42.0	53.9	11.9	100	0	
Hori.	7386.000	AV	38.0	36.7	9.0	41.5	42.2	53.9	11.7	100	0	
Hori.	9848.000	AV	35.9	38.9	10.0	38.9	45.9	53.9	8.0	138	358	
Hori.	12310.000	AV	35.4	39.5	11.3	39.3	46.9	53.9	7.0	100	0	
Vert.	2483.500	PK	60.3	27.5	14.8	41.4	61.2	73.9	12.7	100	310	
Vert.	4924.000	PK	50.3	31.5	7.5	41.0	48.3	73.9	25.6	100	289	
Vert.	7386.000	PK	47.7	36.7	9.0	41.5	51.9	73.9	22.0	100	0	
Vert.	9848.000	PK	44.6	38.9	10.0	38.9	54.6	73.9	19.3	167	162	
Vert.	12310.000	PK	44.6	39.5	11.3	39.3	56.1	73.9	17.8	100	0	
Vert.	2483.500	AV	47.0	27.5	14.8	41.4	47.9	53.9	6.0	100	310	
Vert.	4924.000	AV	43.6	31.5	7.5	41.0	41.6	53.9	12.3	100	289	
Vert.	7386.000	AV	38.1	36.7	9.0	41.5	42.3	53.9	11.6	100	0	
Vert.	9848.000	AV	35.3	38.9	10.0	38.9	45.3	53.9	8.6	167	162	
Vert.	12310.000	AV	35.3	39.5	11.3	39.3	46.8	53.9	7.1	100	0	

Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

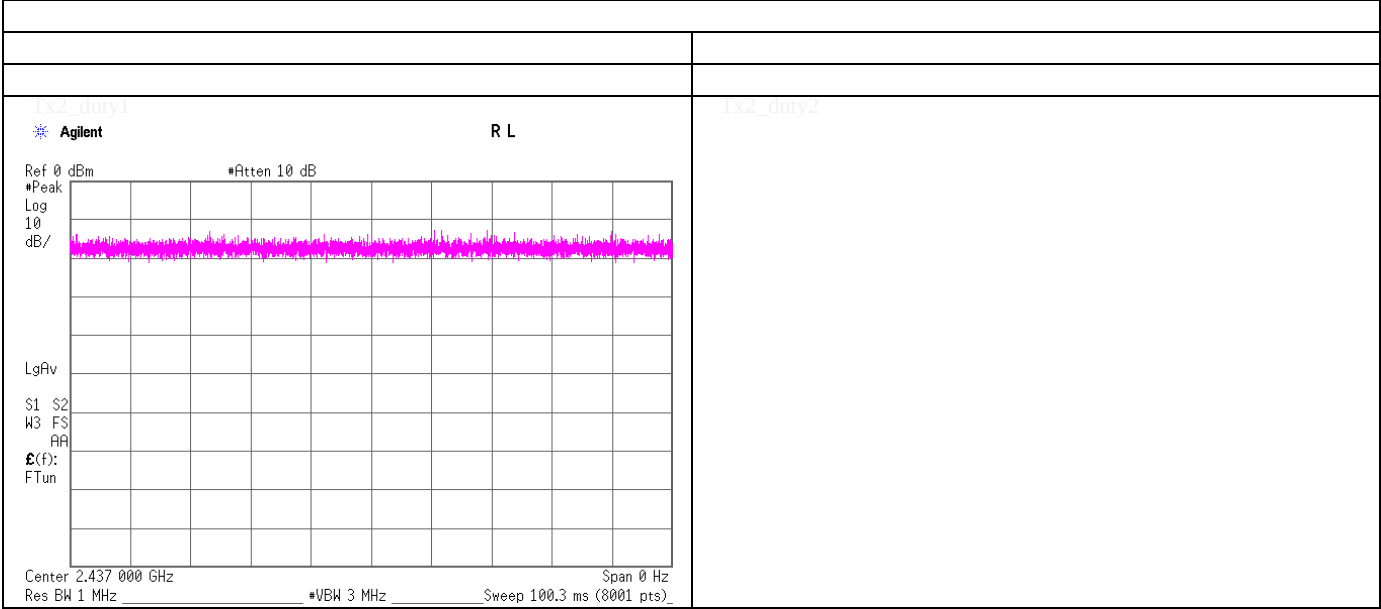
Burst rate confirmation

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



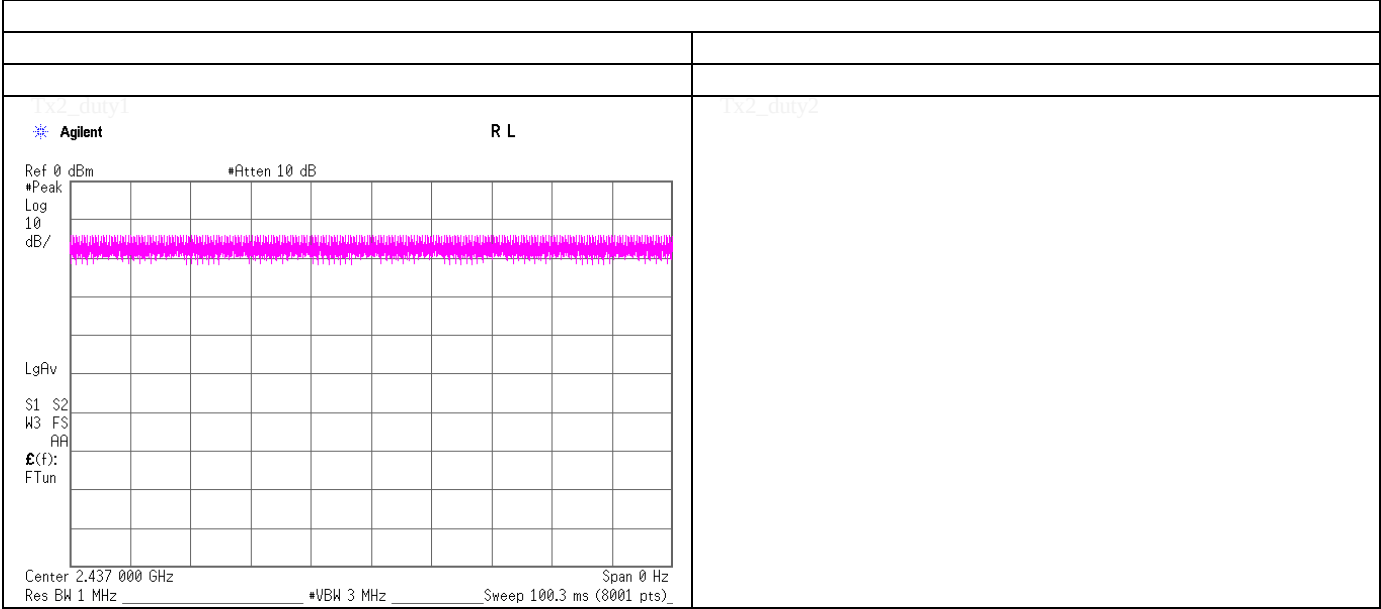
Burst rate confirmation

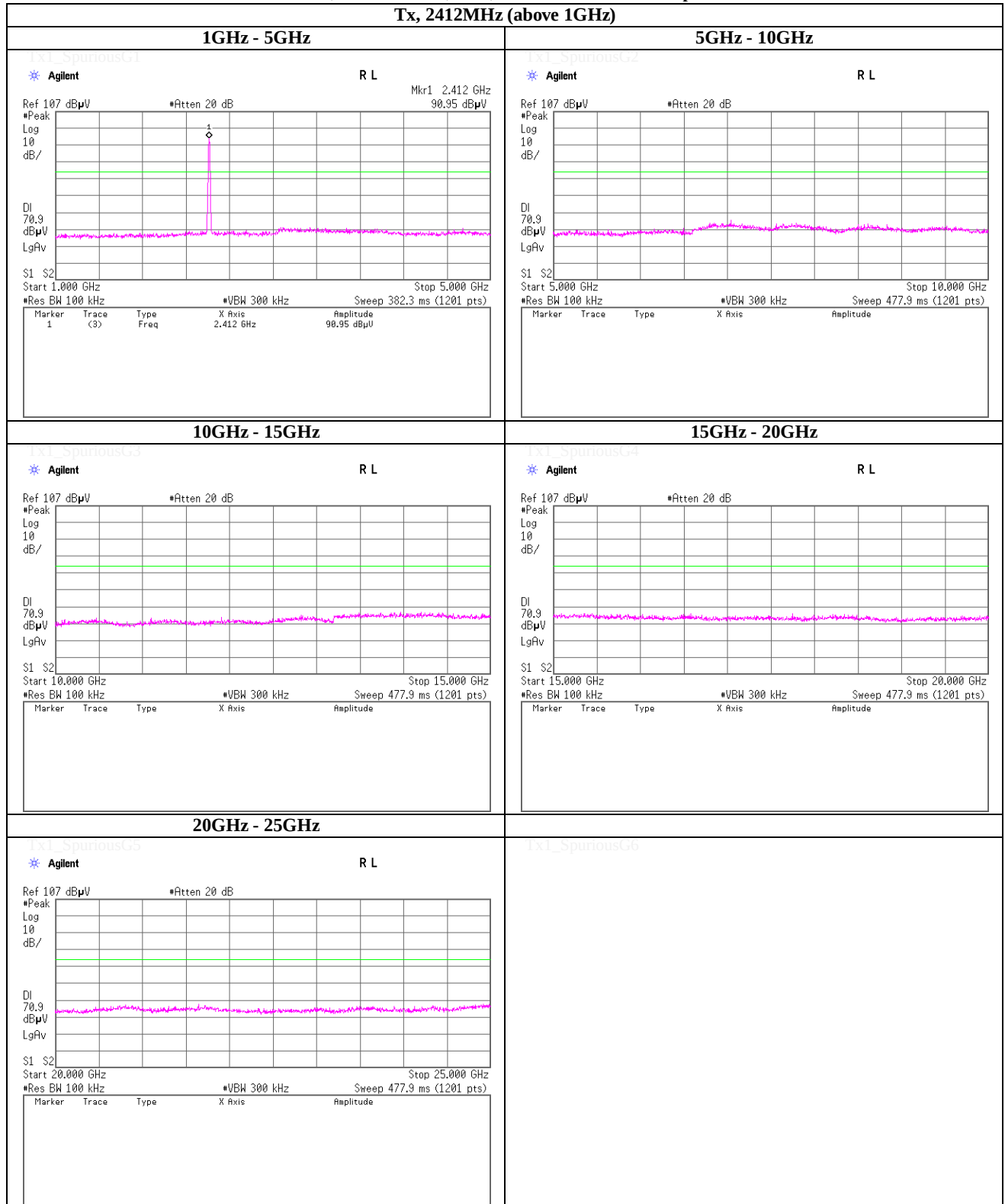
Tx, IEEE802.11g, PN9, worst data mode 24Mbps



Burst rate confirmation

Tx, IEEE802.11n, PN9, worst data mode 6(MCS)

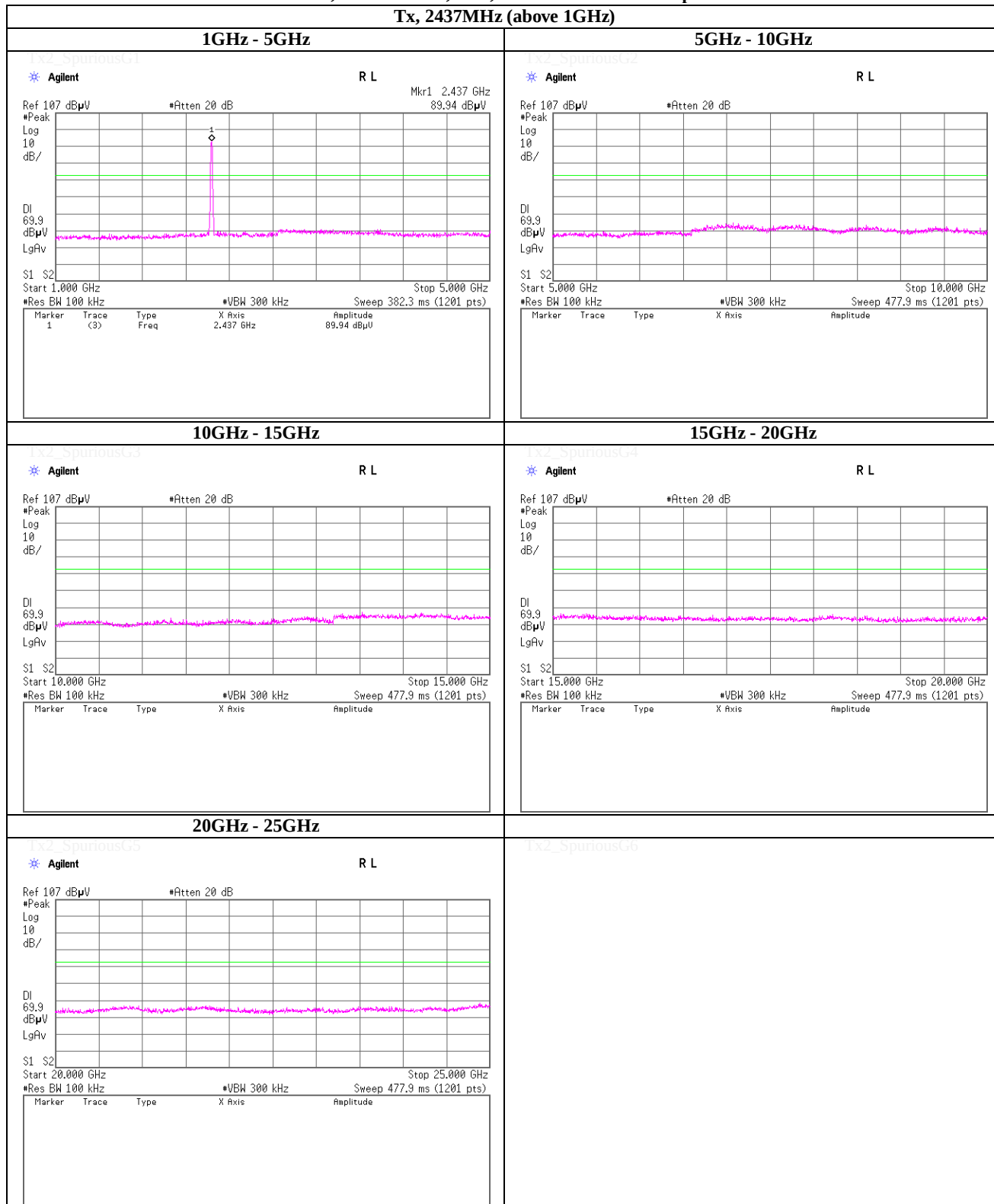


(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11b, PN9, worst data mode 11Mbps****Tx, 2412MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

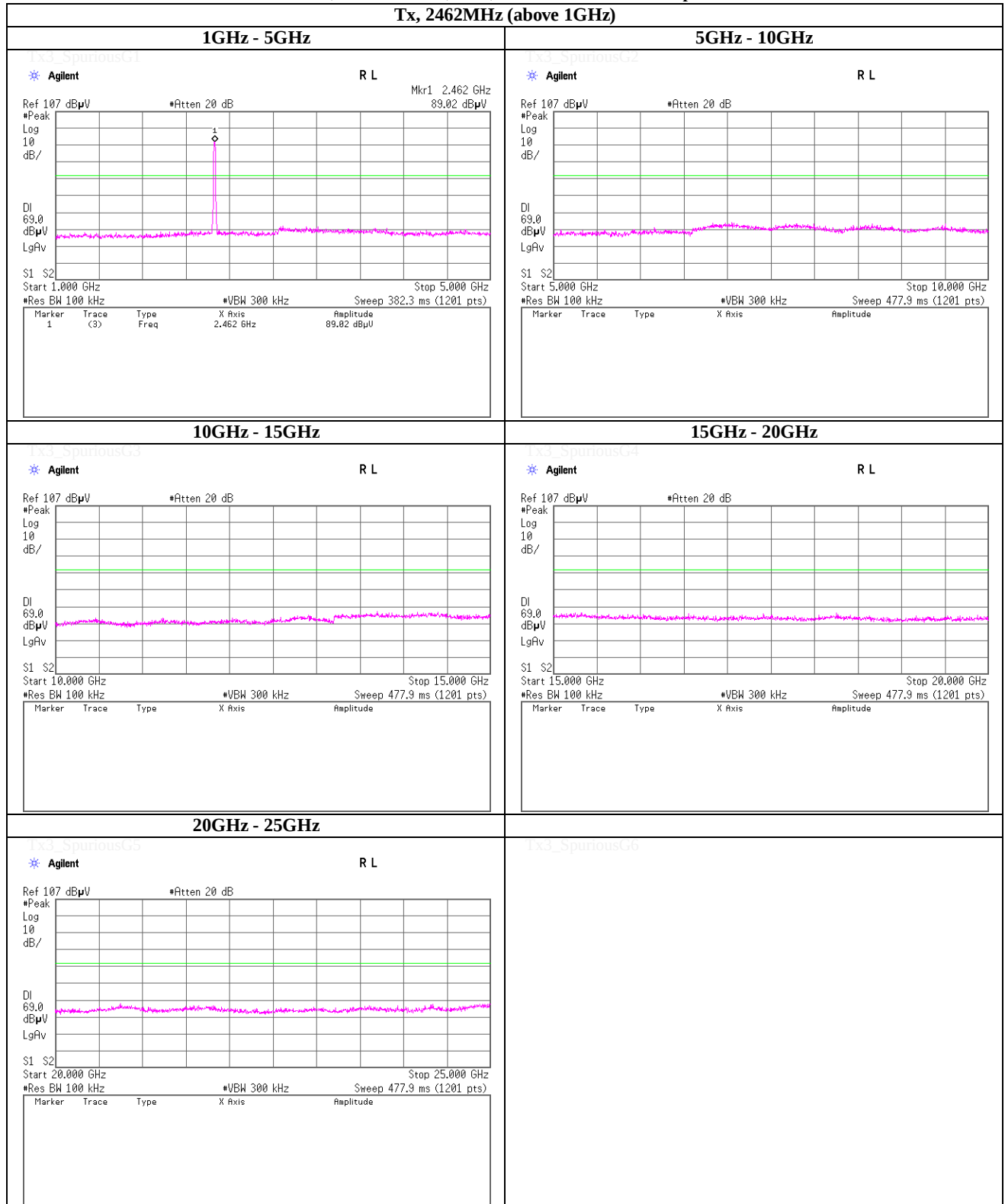
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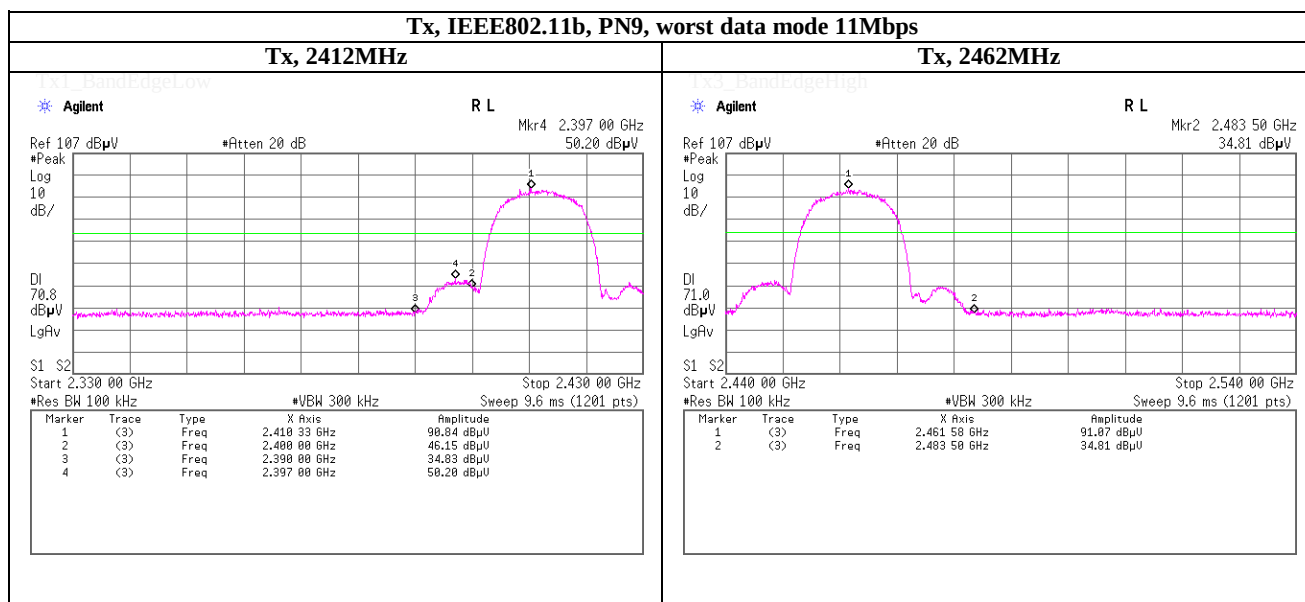
(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11b, PN9, worst data mode 11Mbps****Tx, 2437MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11b, PN9, worst data mode 11Mbps****Tx, 2462MHz (above 1GHz)****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**

(Reference chart) Spurious emission (Conducted)**Band Edge compliance****UL Japan, Inc.****Shonan EMC Lab.**

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

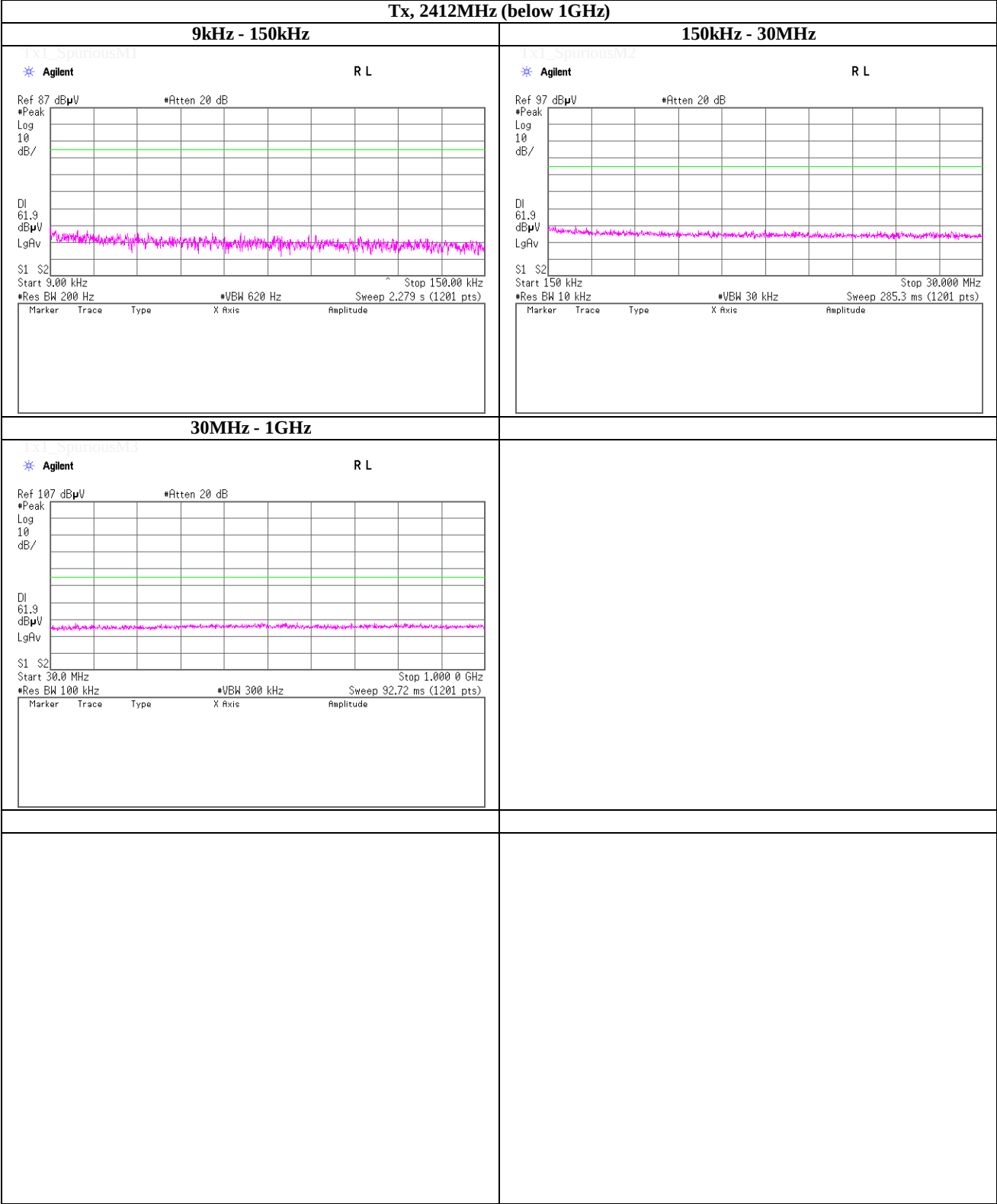
Telephone : +81 463 50 6400

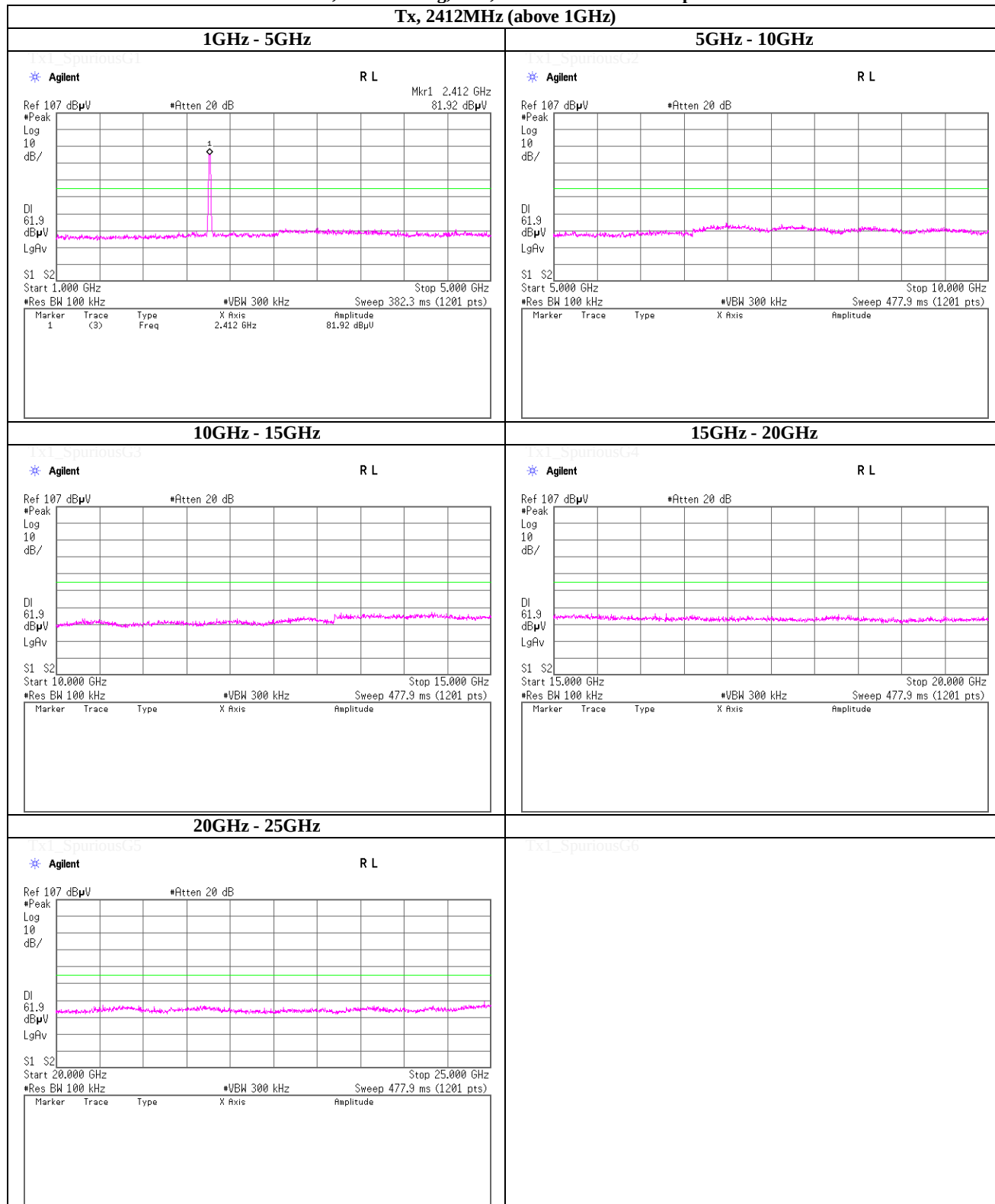
Facsimile : +81 463 50 6401

(Reference chart) Spurious emission (Conducted)

Tx, IEEE802.11g, PN9, worst data mode 24Mbps

Tx, 2412MHz (below 1GHz)

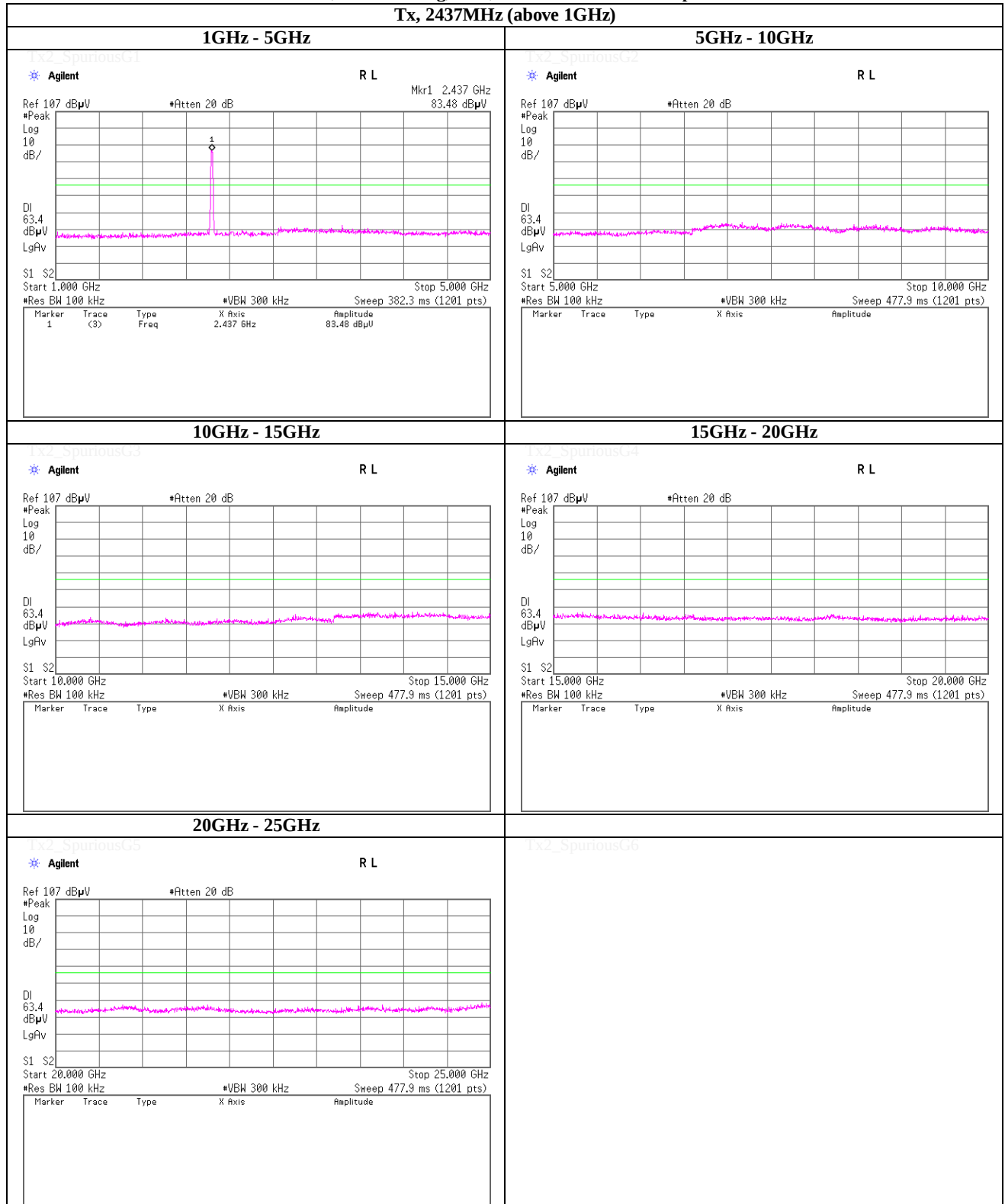


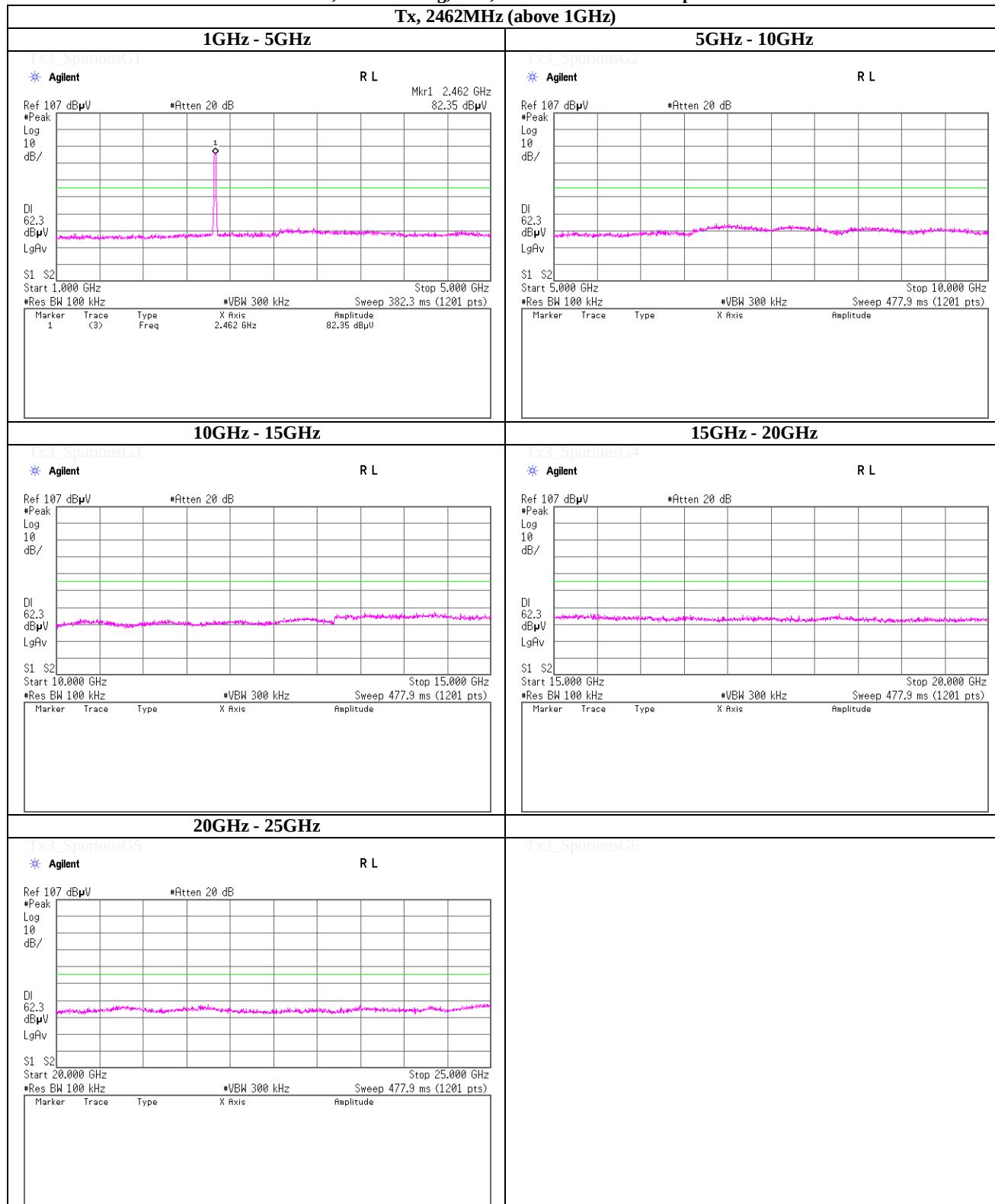
(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11g, PN9, worst data mode 24Mbps****Tx, 2412MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

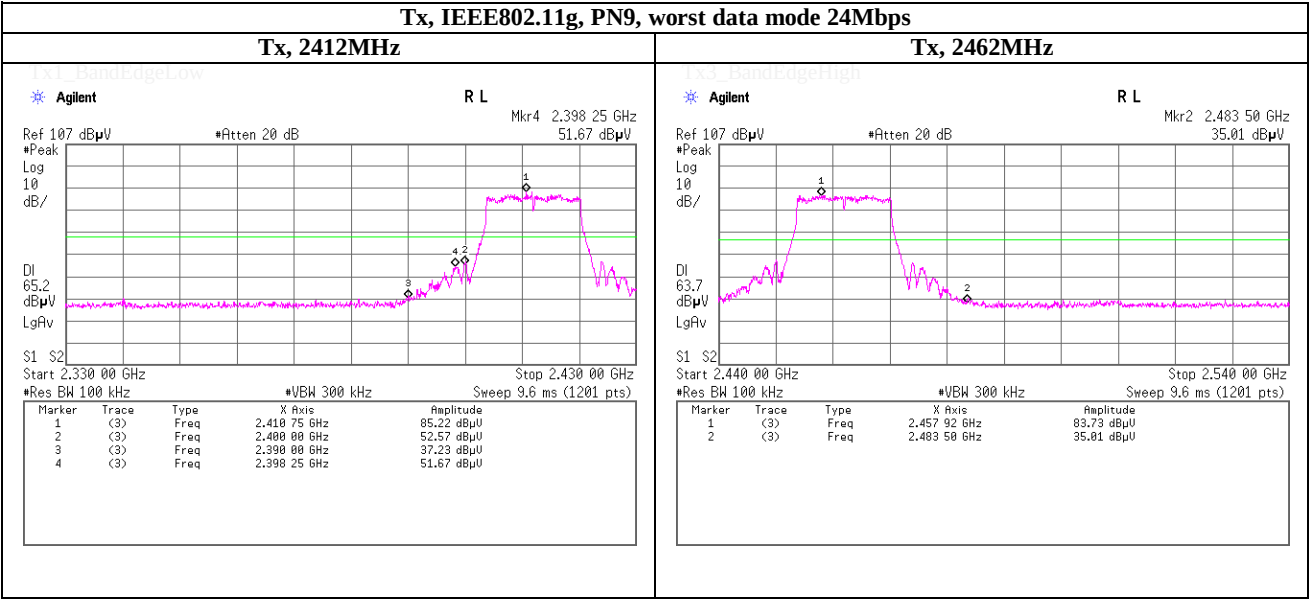
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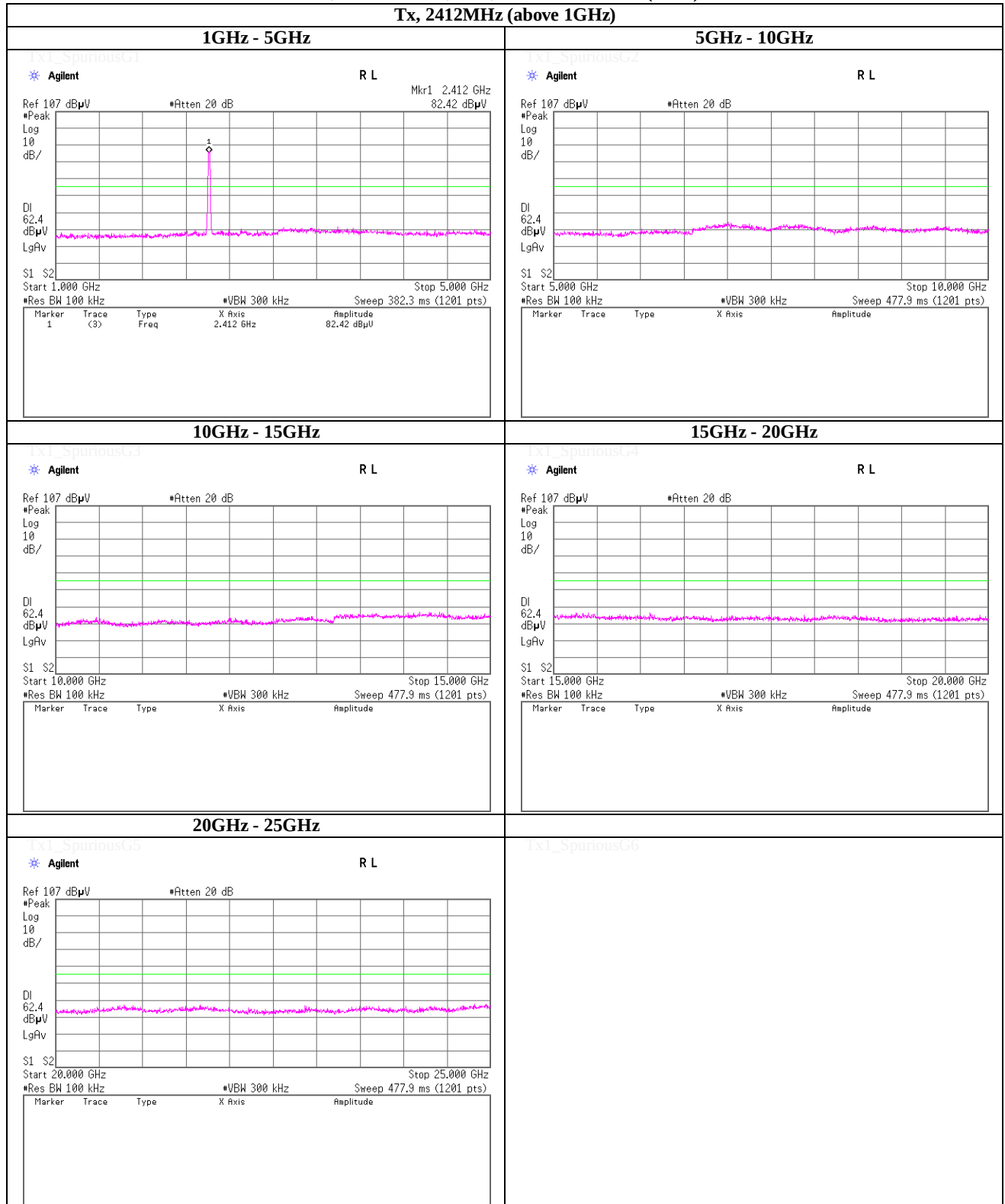
(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11g, PN9, worst data mode 24Mbps****Tx, 2437MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

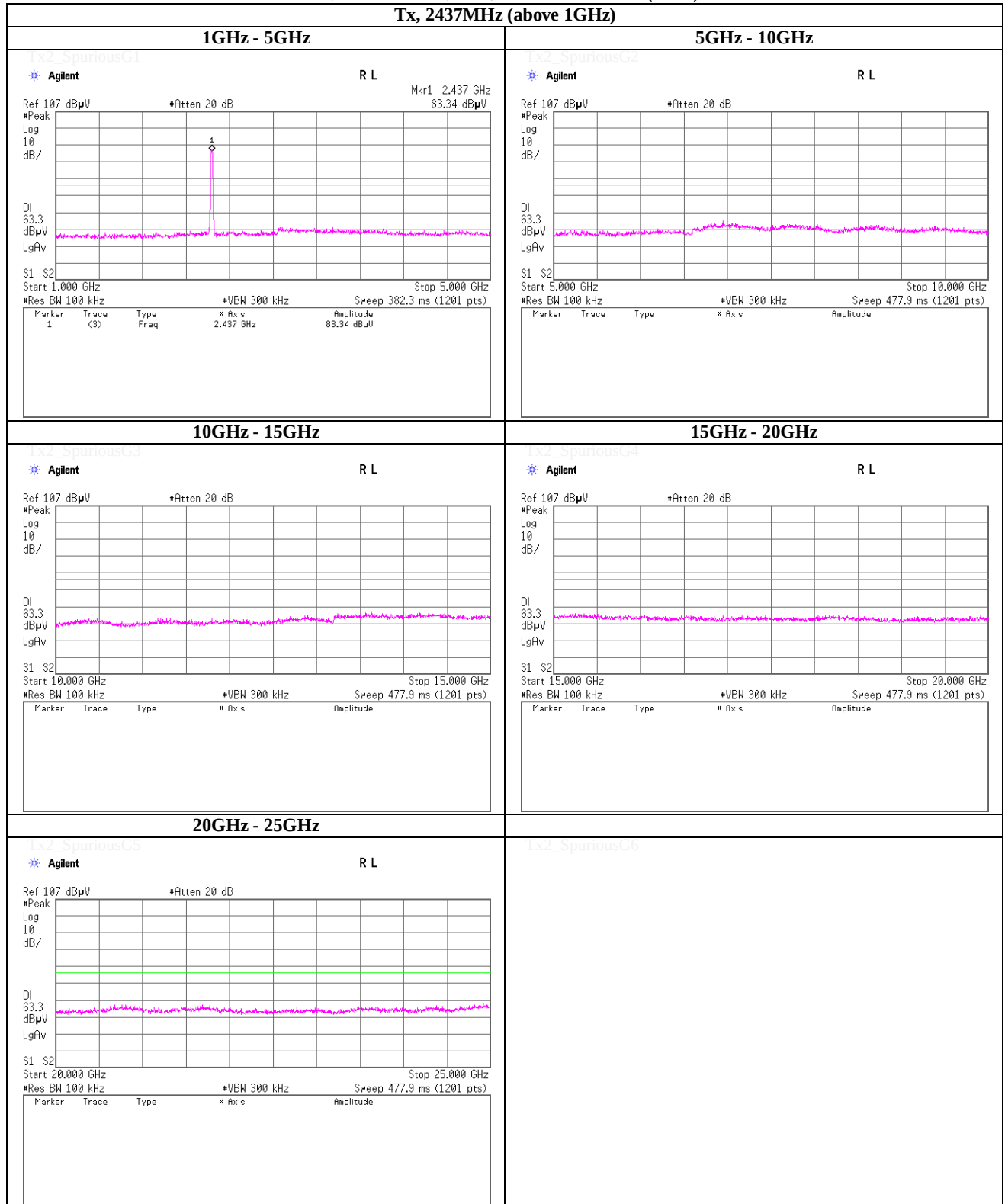
(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11g, PN9, worst data mode 24Mbps****Tx, 2462MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

(Reference chart) Spurious emission (Conducted)

Band Edge compliance



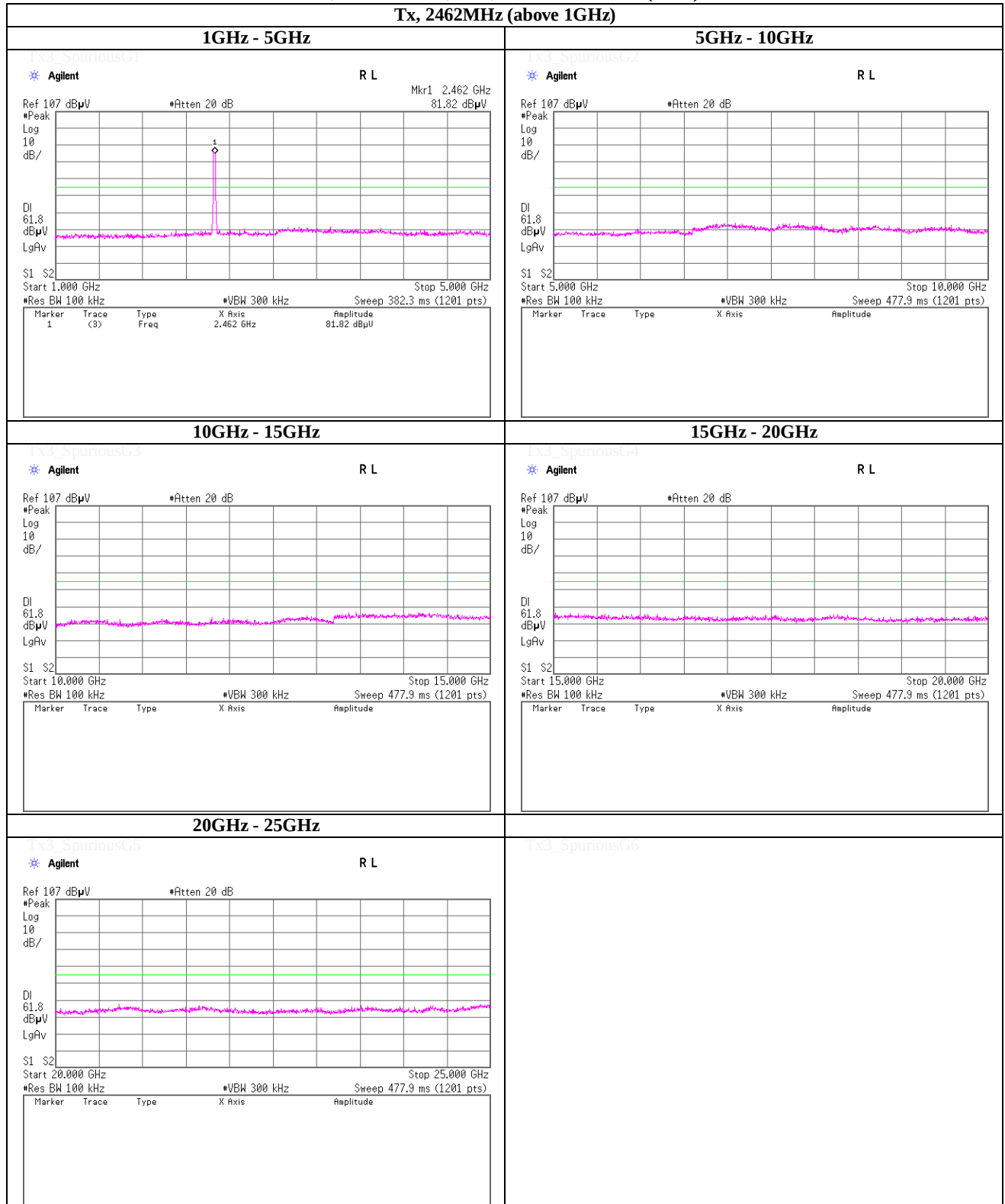
(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11n, PN9, worst data mode 6(MCS)****Tx, 2412MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11n, PN9, worst data mode 6(MCS)****Tx, 2437MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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

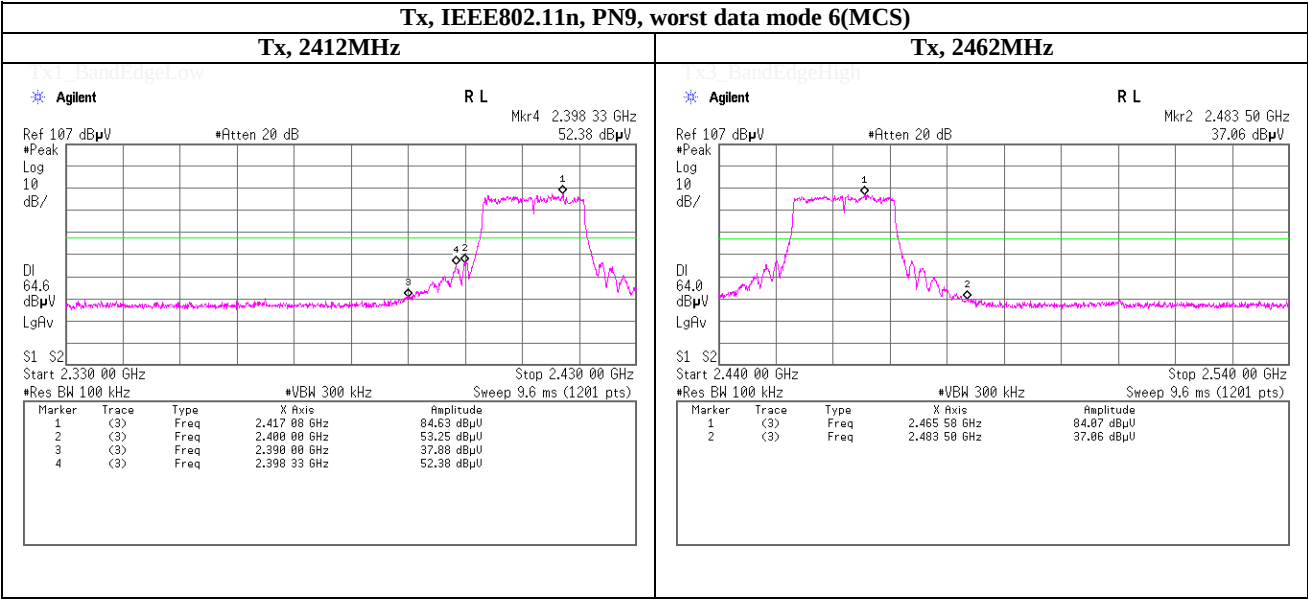
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

(Reference chart) Spurious emission (Conducted)**Tx, IEEE802.11n, PN9, worst data mode 6(MCS)****Tx, 2462MHz (above 1GHz)****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**

(Reference chart) Spurious emission (Conducted)

Band Edge compliance



Maximum Power Spectral Density

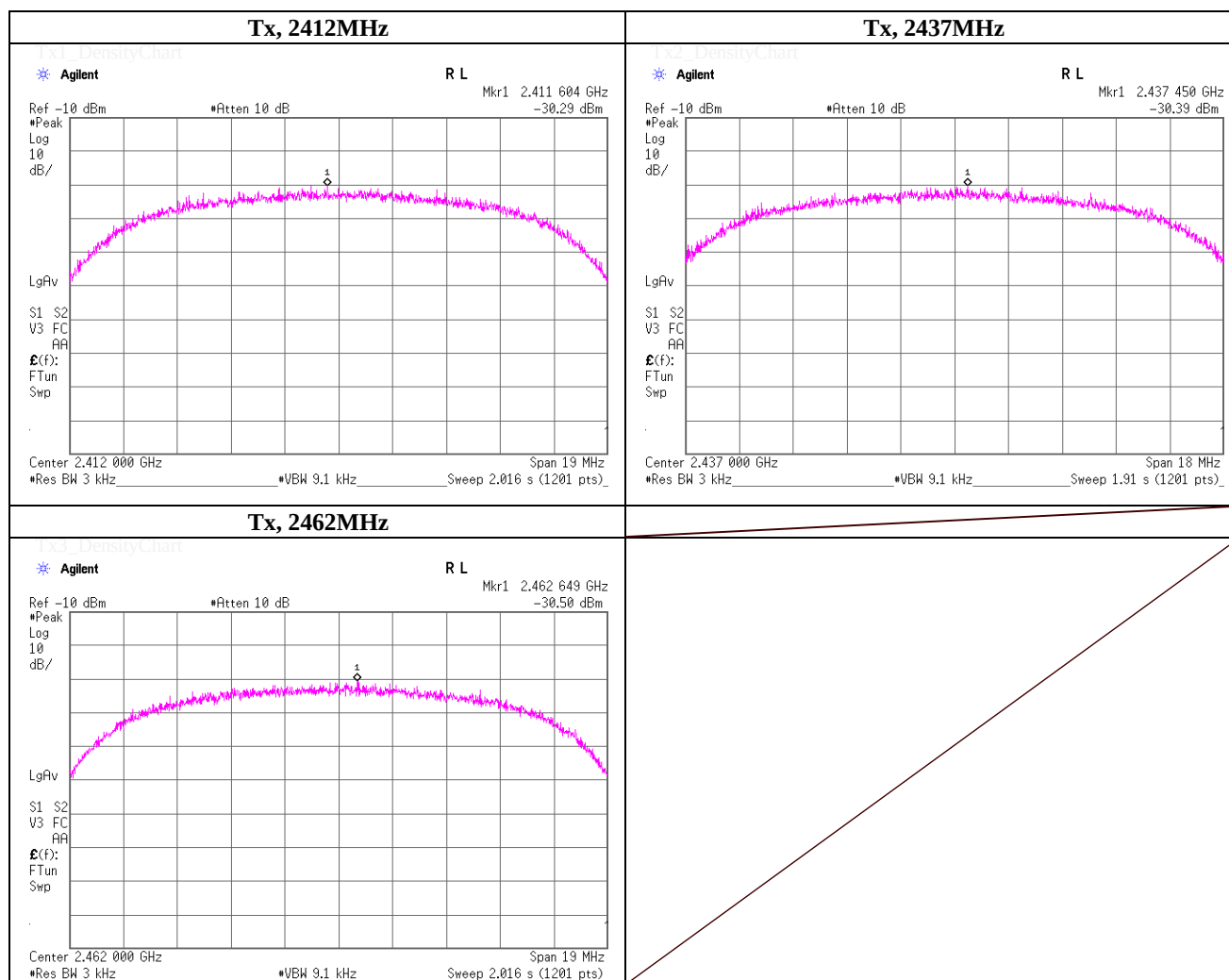
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Shielded Room
Date	June 3, 2013	
Temperature / Humidity	25deg.C , 45%RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11b, PN9, worst data mode 11Mbps	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2411.60	-30.29	0.77	20.00	-9.52	8.00	17.52
2437.0000	2437.45	-30.39	0.77	20.00	-9.62	8.00	17.62
2462.0000	2462.65	-30.50	0.77	20.00	-9.73	8.00	17.73

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Maximum Power Spectral Density

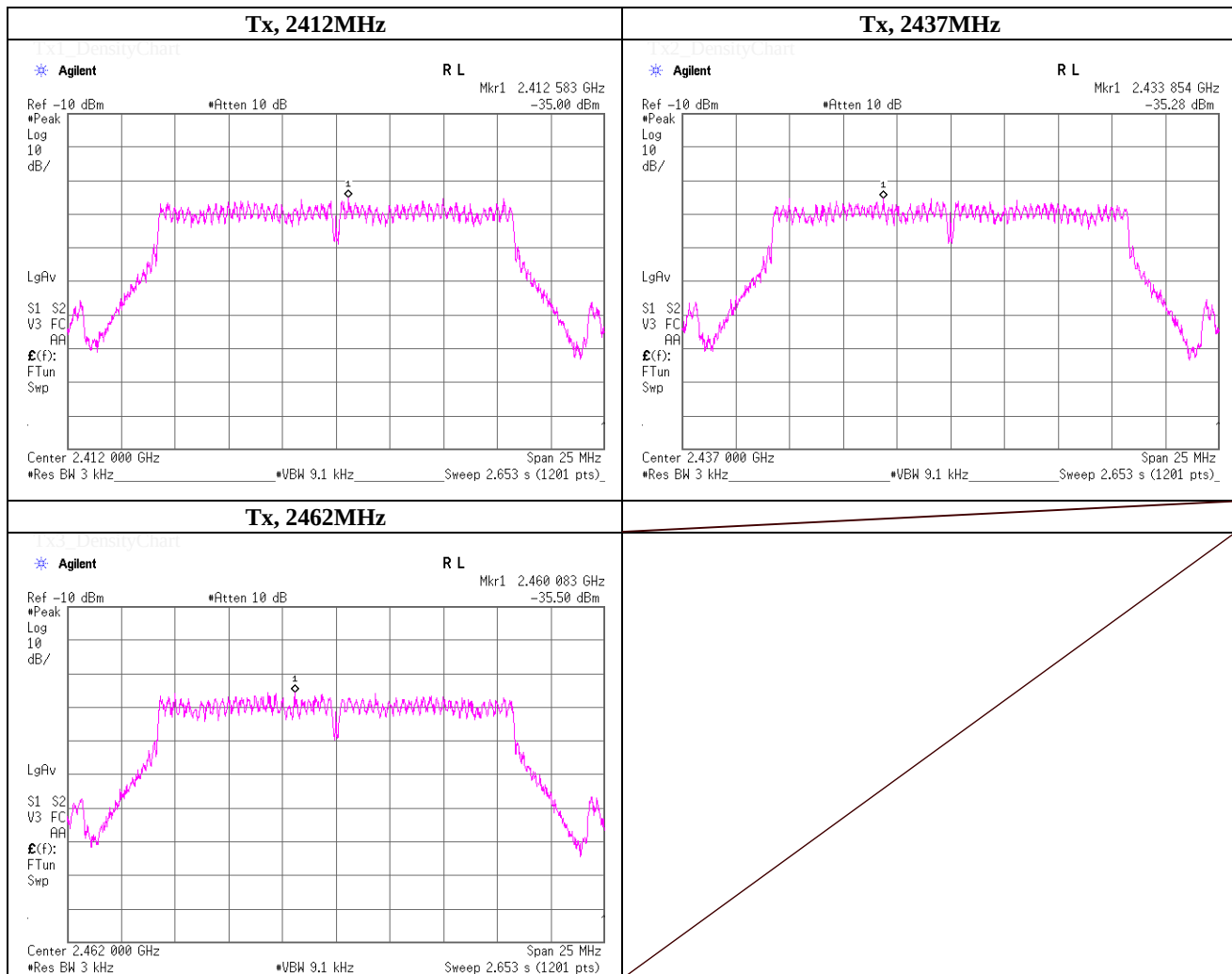
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Shielded Room
Date	June 3, 2013	
Temperature / Humidity	25deg.C , 45%RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11g, PN9, worst data mode 24Mbps	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2412.58	-35.00	0.77	20.00	-14.23	8.00	22.23
2437.0000	2433.85	-35.28	0.77	20.00	-14.51	8.00	22.51
2462.0000	2460.08	-35.50	0.77	20.00	-14.73	8.00	22.73

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Maximum Power Spectral Density

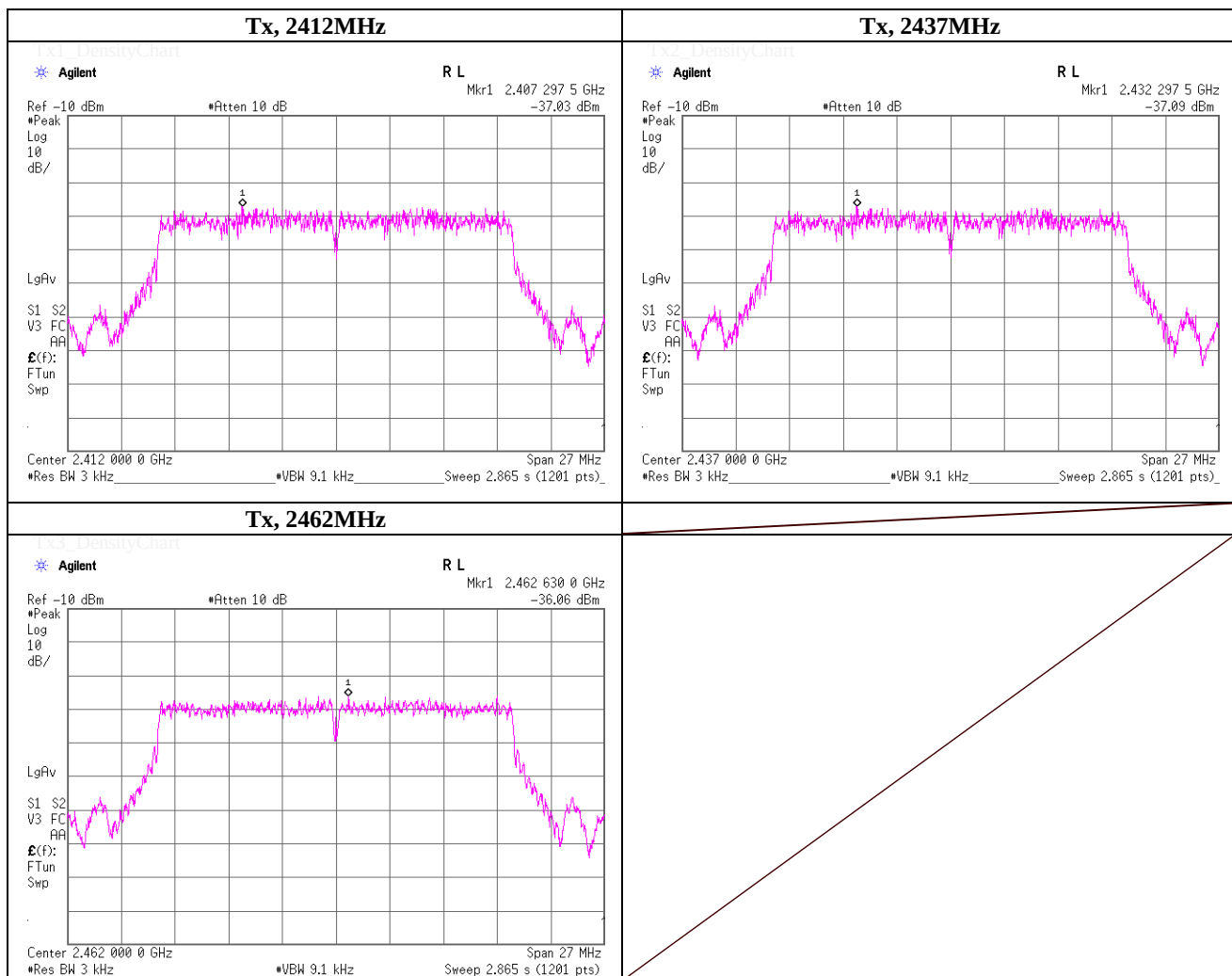
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Shielded Room
Date	June 3, 2013	
Temperature / Humidity	25deg.C , 45%RH	
Engineer	Tatsuya Arai	
Mode	Tx, IEEE802.11n, PN9, worst data mode 6(MCS)	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2407.30	-37.03	0.77	20.00	-16.26	8.00	24.26
2437.0000	2432.30	-37.09	0.77	20.00	-16.32	8.00	24.32
2462.0000	2462.63	-36.06	0.77	20.00	-15.29	8.00	23.29

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

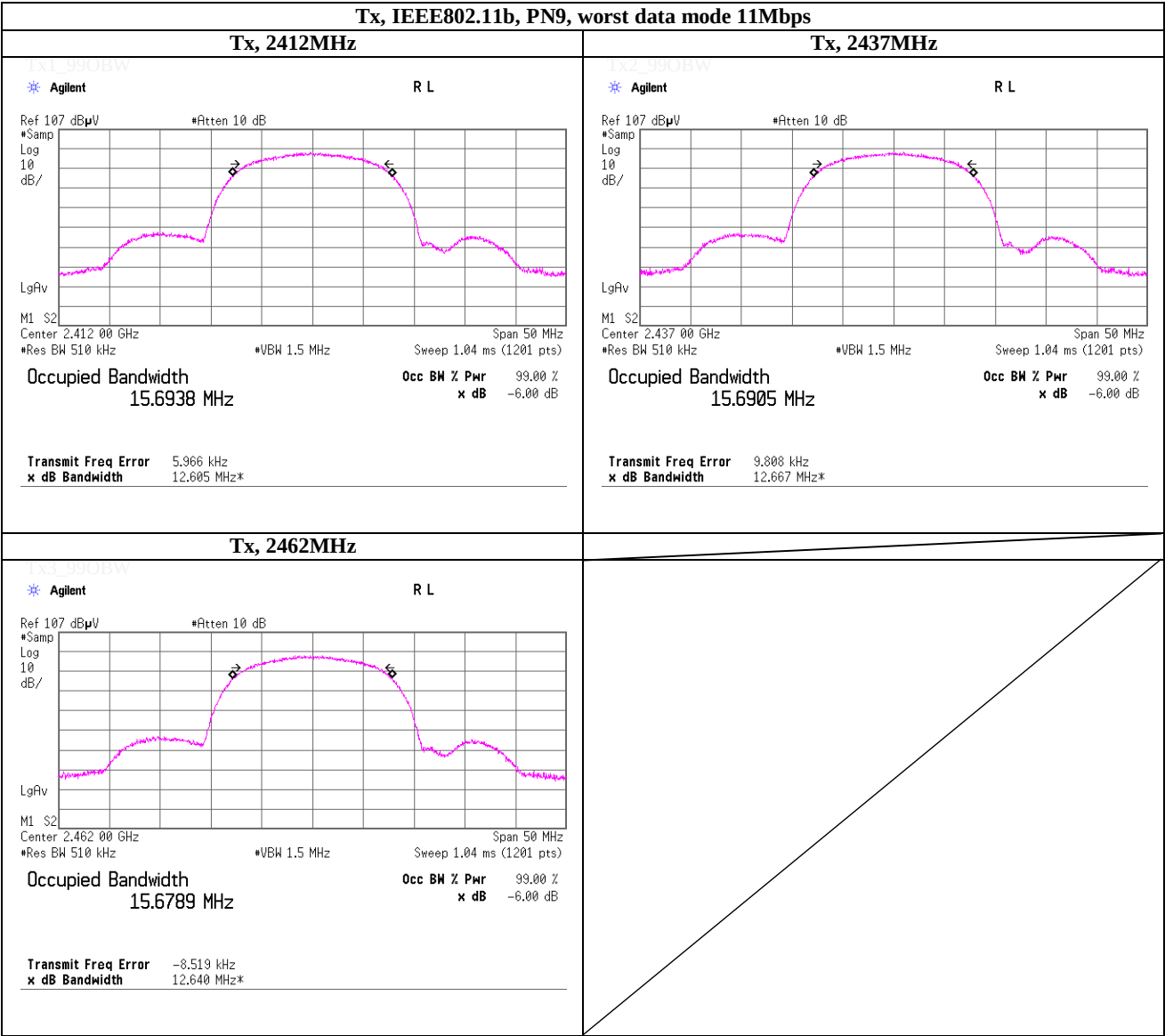
**UL Japan, Inc.****Shonan EMC Lab.**

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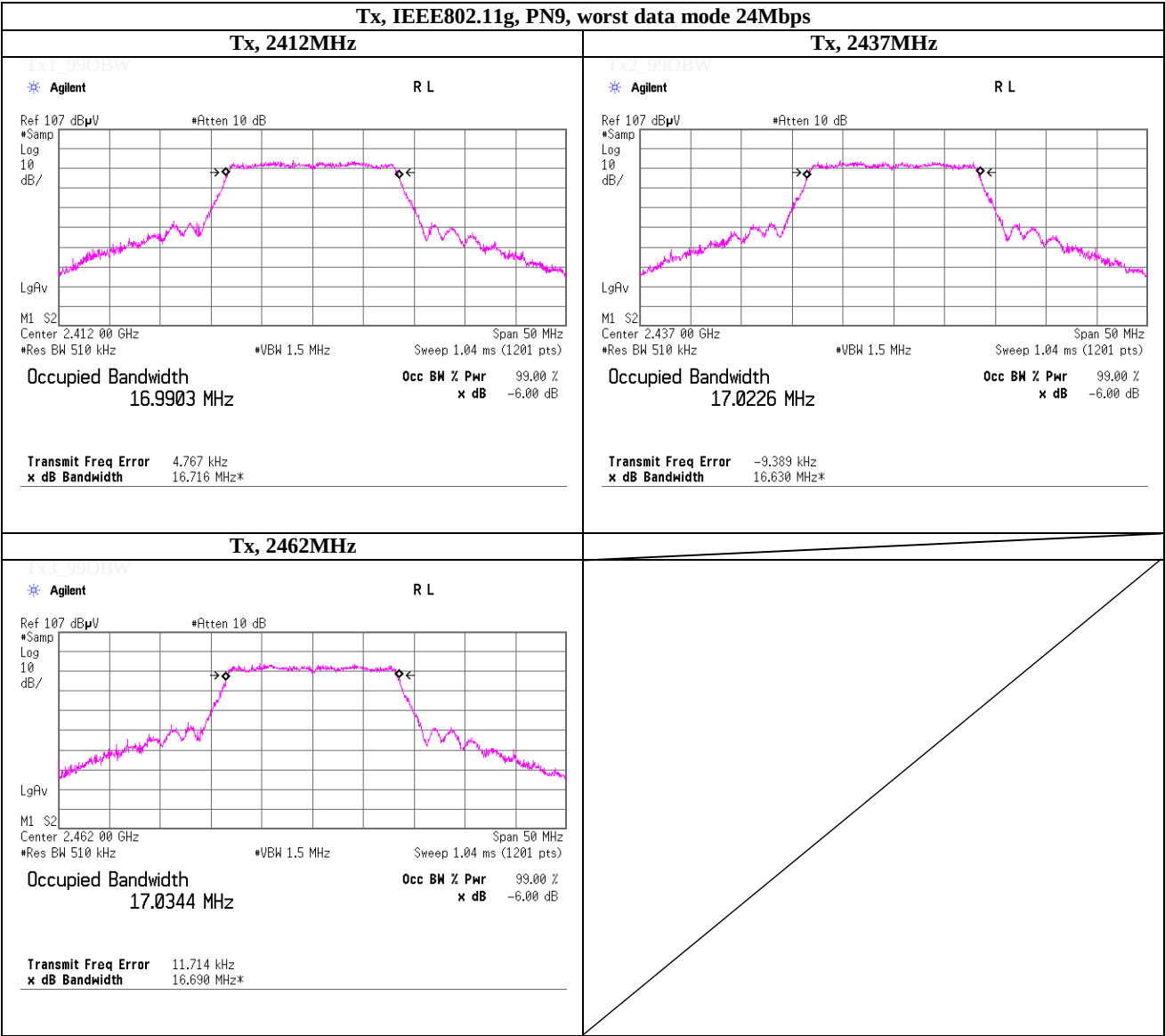
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

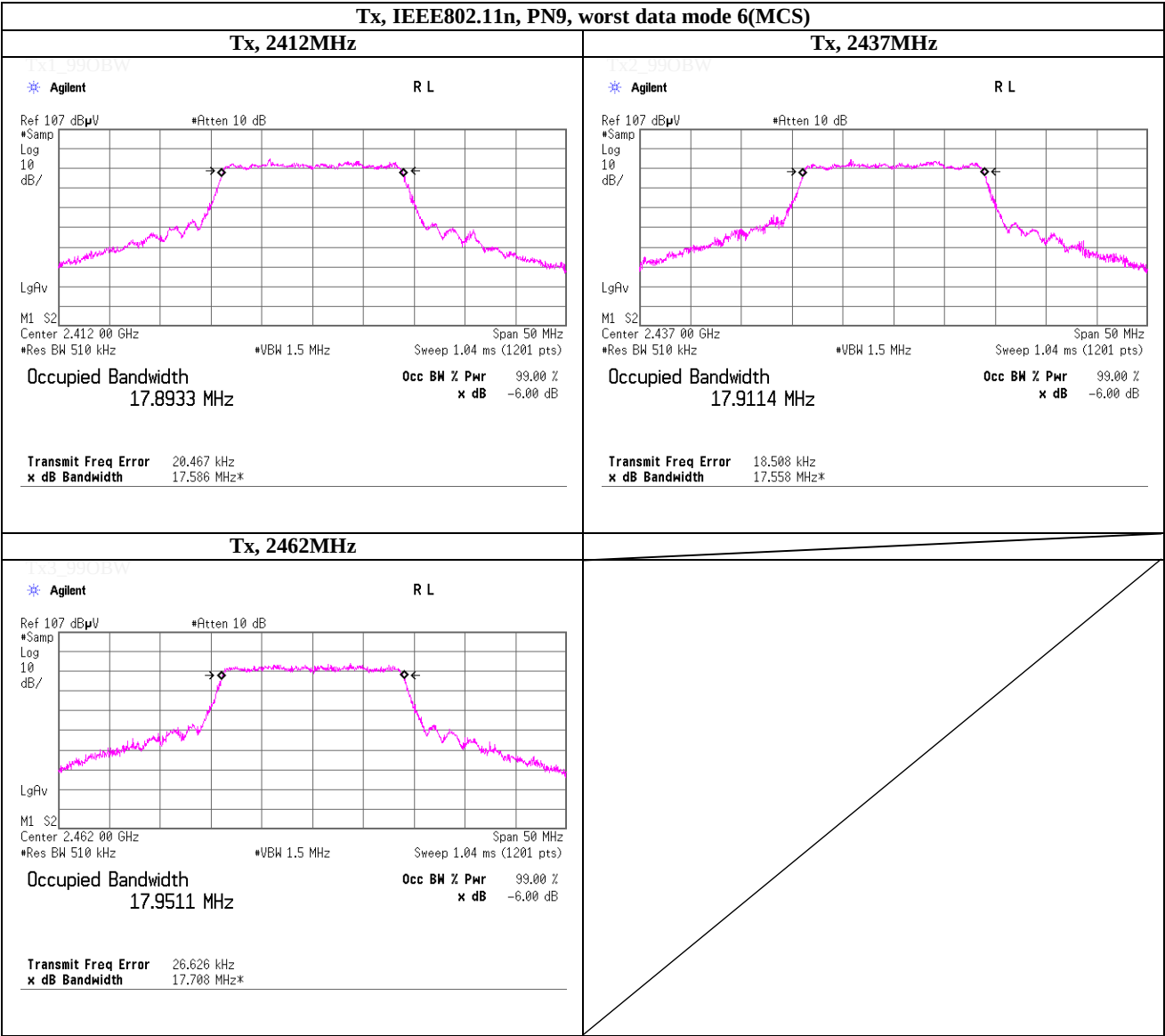
99% Occupied Bandwidth



99% Occupied Bandwidth



99% Occupied Bandwidth



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	2013/03/28 * 12
SAT20-06	Attenuator	Weinschel Corp.	54A-20	31506	AT	2013/04/09 * 12
SCC-G29	Coaxial Cable	Junkosha	MWX241-01000KM SKMS	SEP-20-12-003	AT	2012/09/26 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2013/04/09 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2013/04/09 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	AT/CE	2013/03/07 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2012/07/18 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	2013/04/11 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2013/05/22 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2012/08/17 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2013/02/27 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2013/03/04 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE/CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFL,MF)	-	RE/CE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2012/12/18 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2012/12/18 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2013/03/14 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2013/03/19 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2013/03/16 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2013/02/12 * 12
SAT6-06	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2012/10/08 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2013/04/03 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2012/10/08 * 12
STR-03	Test Receiver	Rohde & Schwarz	ES140	100054/040	RE/CE	2012/06/14 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-271(RF Selector)	CE	2013/04/03 * 12
SLS-05	LISN	Rohde & Schwarz	ENV216	100516	CE	2013/02/25 * 12
SAT3-06	Attenuator	JFW	50HF-003N	-	CE	2013/02/12 * 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: Out of Band Emission (Radiated)

AT: Antenna terminal conducted test