RADIO TEST REPORT

Test Report No.: 10191284S-C

Applicant	:	**PIONEER CORPORATION**
Type of Equipment	:	**Car Audio**
Model No.	:	**NVF-8538ZH**
FCC ID	:	**AJDK082**
Test regulation	:	**FCC Part15 Subpart C: 2013**
Test result	:	**Complied**

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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: January 30 to February 12, 2014

Representative test engineer:

Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

Approved by :

Toyokazu Imamura
Leader of WiSE Japan,
UL Verification Service

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☒ There is no testing item of "Non-accreditation".

RTL02610

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

REVISION HISTORY

Original Test Report No.: 10191284S-C

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10191284S-C	February 28, 2014	-	-
1	10191284S-C	March 14, 2014	1,33 5	Correction of description Correction of Clock list

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

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SECTION 1: Customer information

Company Name	:	PIONEER CORPORATION
Brand name	:	Pioneer
Address	:	25-1 Aza-Nishi-machi, Yamada, Kawagoe-shi, Saitama, 350-8555, JAPAN
Telephone Number	:	+81-49-228-6415
Facsimile Number	:	+81-49-228-6493
Contact Person	:	Tomoyuki Tanaka

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

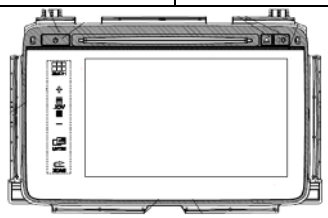
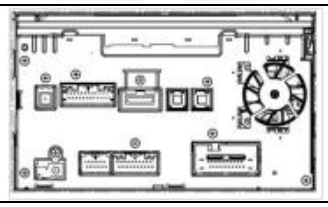
2.1 Identification of E.U.T.

Type of Equipment	:	Car Audio
Model No.	:	NVF-8538ZH
Serial No.	:	Refer to 4.2 of this report.
Rating	:	DC 13.2V
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No modification by the test lab.
Receipt Date of Sample	:	January 28, 2014

2.2 Product description

Model: NVF-8538ZH (referred to as the EUT in this report) is a Car Audio.

The derived model and differences:

Model No.	NVF-8538ZH	NVF-8638ZH	CVH-7738ZH	CVH-7838ZH
Destination	United States	Canada	United States	Canada
Automotive navigation system	Internal	Internal	None	None
G/Gyro Sensor	Internal	Internal	None	None
HD radio Tuner	Internal	Internal	None	None
Front Side Design				
Back Side Design				

Radio specification:
Bluetooth:

Equipment type	:	Transceiver
Frequency of operation	:	2402-2480MHz
Bandwidth & channel spacing	:	79MHz & 1MHz
Type of modulation	:	GFSK, π/4DQPSK, 8DPSK
Antenna type	:	Inverted-F Antenna
Antenna gain with cable loss	:	-0.84dBi (max)
Antenna connector type	:	None
Operation temperature range	:	-20 to +70 deg.C.

Wireless LAN:

Equipment type	:	Transceiver
Frequency of operation	:	2412-2462MHz
Bandwidth & channel spacing	:	5MHz
Type of modulation	:	CCK, OFDM
Antenna type	:	Inverted-F Antenna
Antenna gain with cable loss	:	-1.30dBi (max)
Antenna connector type	:	None
Operation temperature range	:	-20 to +70 deg.C.

Refer to the test report: 10191284S-A for Bluetooth part.

The clock frequencies used in the EUT:
(1) FM/AM TUNER CLOCK: 41.6MHz, 16.384MHz, 8.192MHz, 2.048MHz
(2) MICRO COMPUTER CLOCK: 25MHz, 3.98MHz, 32.768kHz
(3) DDR3 CLOCK: 533MHz
(4) AUDIO CLOCK: 24.576MHz, 11.2896MHz, 4.096MHz, 3.072MHz, 2.8224MHz, 1.024MHz, 133.33kHz, 48kHz, 44.1kHz, 512kHz, 16kHz, 8kHz
(5) VIDEO: 37MHz, 24.576MHz, 27MHz
(6) LED: 100kHz
(7) HDMI: 28.636MHz
(8) USB: 48MHz
(9) WLAN: 50MHz
(10) POWER: 2.1MHz, 615kHz, 404kHz

FCC 15.31 (e)
The equipment provides the wireless transmitter with stable power supply (3.3±0.1V). Therefore, the equipment 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.

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2013,
final revised on September 30, 2013 and effective October 30, 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 *2)	-	-
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	7.2dB Freq.: 228.007MHz Polarization: Horizontal Detection: Quasi-Peak Mode: Tx 2437MHz, IEEE 802.11g	Complied
Power density	ANSI C63.10:2009	FCC 15.247 (e)	Conducted	N/A	* See data	Complied

Note: UL Japan's EMI Work Procedures No.13-EM-W0420 and 13-EM-W0422.
*1) These tests were also referred to KDB 558074 v03 r01 (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.

3.3 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.

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	3.7 dB	3.6 dB
	30MHz-300MHz	4.8 dB	5.0 dB	4.8 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	5.6 dB	5.6 dB
	18GHz-40GHz	5.2 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 the site margin.

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: (±) 1.6dB
Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 1.4dB
Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 2.8dB
Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB
Bandwidth measurement uncertainty for this test was: (±) 5.4%

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone number : +81 463 50 6400
Facsimile number : +81 463 50 6401
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	-
☒ No.1 measurement room	-	-	2.55 x 4.1 x 2.5	-	-

3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

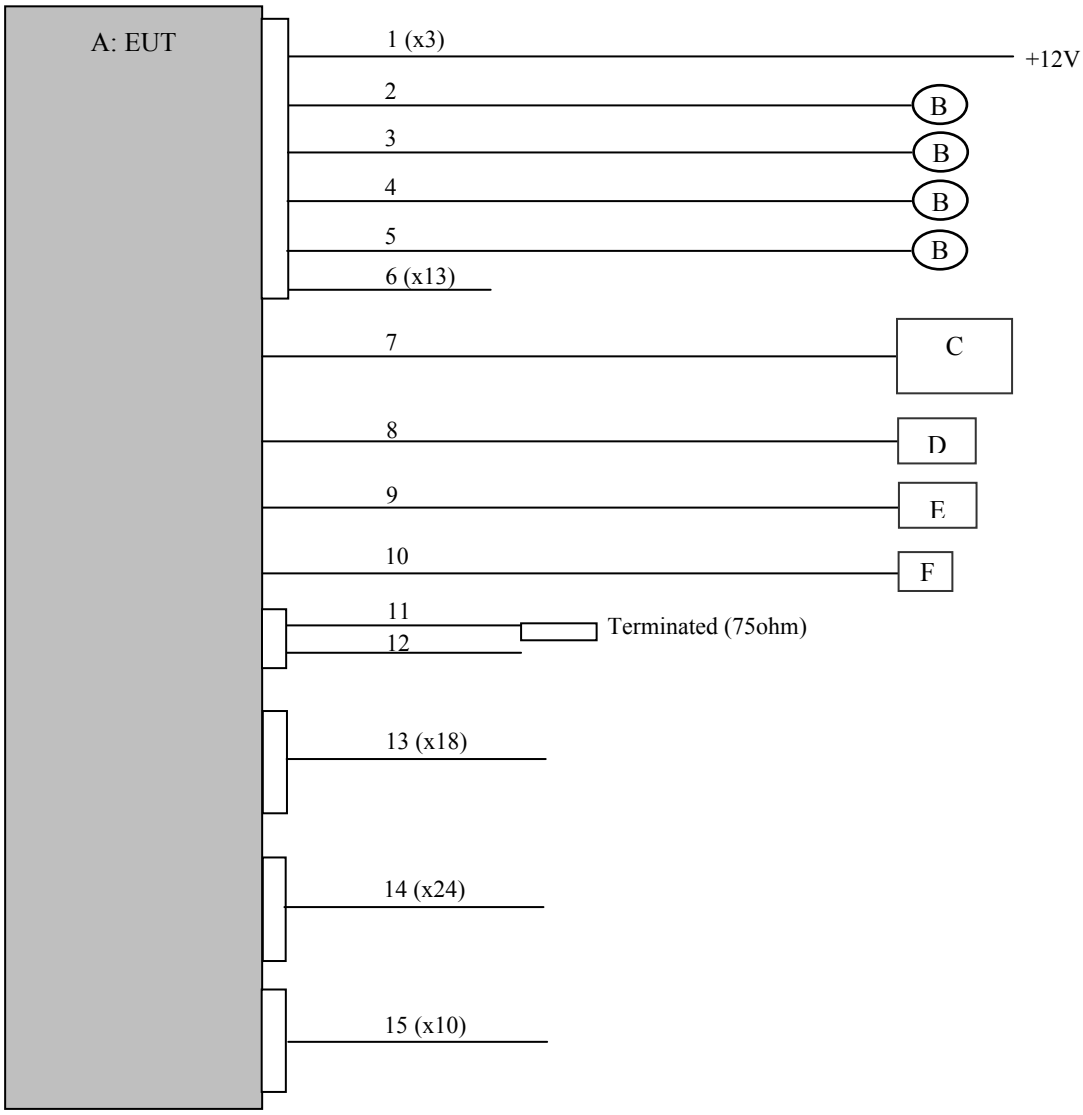
SECTION 4: Operation of E.U.T. during testing

4.1 Operating mode

Test item	Mode	Tested frequency	Power setting *1)	Worst data rate *2)
Spurious emission Radiated (below 1GHz) *3) Conducted (below 30MHz)	Transmitting IEEE 802.11g	2437MHz	Fixed	12Mbps, PN9
Other items	Transmitting IEEE 802.11b	2412MHz, 2437MHz, 2462MHz	Fixed	11Mbps, PN9
	Transmitting IEEE 802.11g	2412MHz, 2437MHz, 2462MHz	Fixed	12Mbps, PN9
	Transmitting IEEE 802.11n (20HT)	2412MHz, 2437MHz, 2462MHz	Fixed	MCS0, 800ns GI, PN9
*1) Software used for the test: System uCom: H41F10 21.29.12, Application: 1.D100.30 *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



Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Audio	NVF-8538ZH	*1)	PIONEER	EUT
B	Speaker	LV-002	S11014200773 (x2) S11014200775 (x2)	L&V	-
C	Tablet Computer	Nexus 7 (2013) ME571-16G	07924744	ASUS	-
D	iPod nano	A1199	YM7034TTVQH	Apple	-
E	iPod nano	A1137	YM619HBMUNA	Apple	-
F	GPS antenna	CXB2773	SCP	PIONEER	-

*1) MLPGTP0001US: Antenna port conducted tests, MLPGTP0003US: Radiated emission

List of cables used

No.	Cable name	Length (m)	Shield (Cable)	Shield (Connector)	Remarks
1	DC	1.2+0.6	Unshielded	Unshielded	ACC, +B, GND
2	Speaker	0.8+3.0	Unshielded	Unshielded	-
3	Speaker	0.8+3.0	Unshielded	Unshielded	-
4	Speaker	0.8+3.0	Unshielded	Unshielded	-
5	Speaker	0.8+3.0	Unshielded	Unshielded	-
6	Signal	0.4	Unshielded	Unshielded	-
7	HDMI	0.2+3.0	Shielded	Shielded	-
8	USB	0.3+1.0	Shielded	Shielded	-
9	USB	0.3+1.0	Shielded	Shielded	-
10	GPS Antenna	5.0	Shielded	Shielded	-
11	Radio	0.2	Shielded	Shielded	-
12	Radio	0.2	Shielded	Shielded	-
13	H-5-1 connector	0.3	Unshielded	Unshielded	-
14	H-3-1 connector	0.3	Unshielded	Unshielded	-
15	H-2 connector	0.4 (x5) 1.0 (x5)	Unshielded	Unshielded	-

*All cables used for the measurement are exclusive use or marketed.

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 8.1 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 6: 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 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.

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

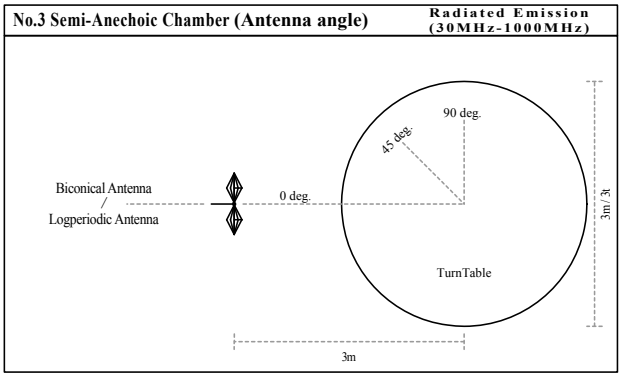
The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 15GHz) / 1m (above 15GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied 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.

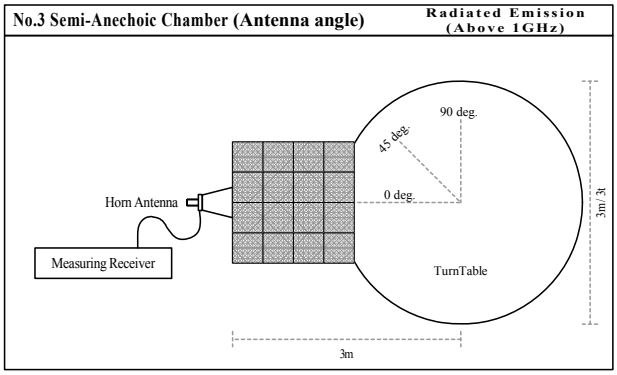
Frequency	30-1000MHz	1-25GHz		20dBc
Detection type	Quasi-Peak	Peak	Average *1)	Peak
IF Bandwidth	120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 3MHz Detector: RMS	RBW: 100kHz VBW: 300kHz

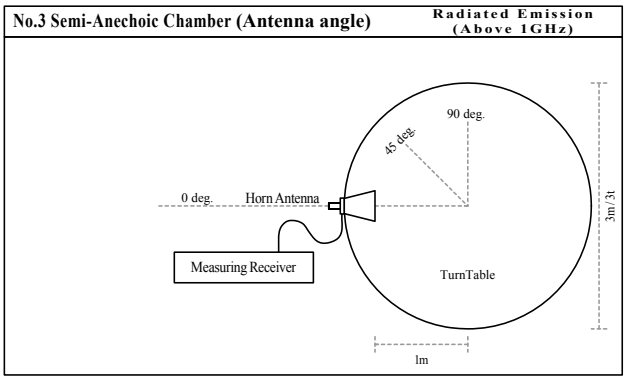
*1) Average Power Measurement was measured based on 12.2.5 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

The axis of EUT was fixed at angle of 34 deg. based on the product specification.

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

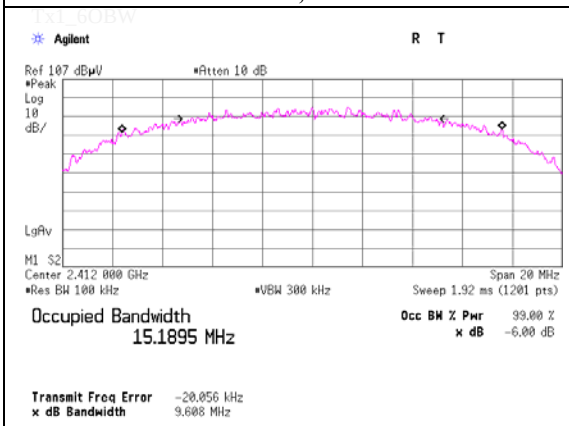
APPENDIX 1: Data of Radio tests

-6dB Bandwidth

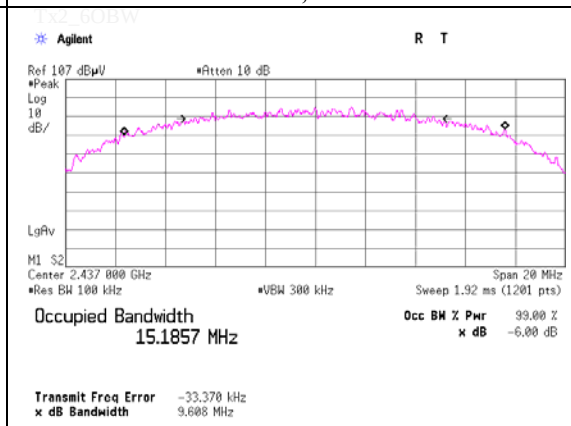
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, IEEE802.11b, PN9, worst data mode 11Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	9.608	> 0.500
2437.0000	9.608	> 0.500
2462.0000	9.664	> 0.500

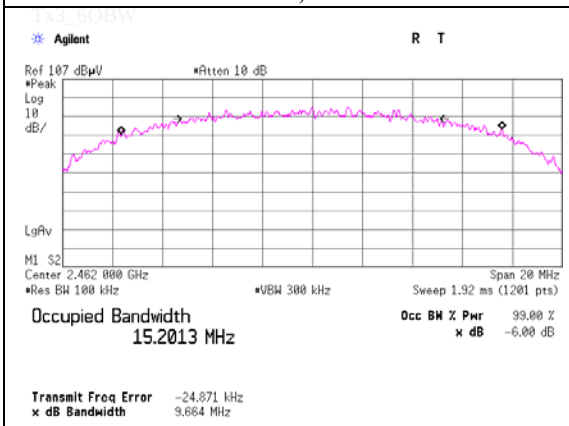
Tx, 2412MHz



Tx, 2437MHz



Tx, 2462MHz



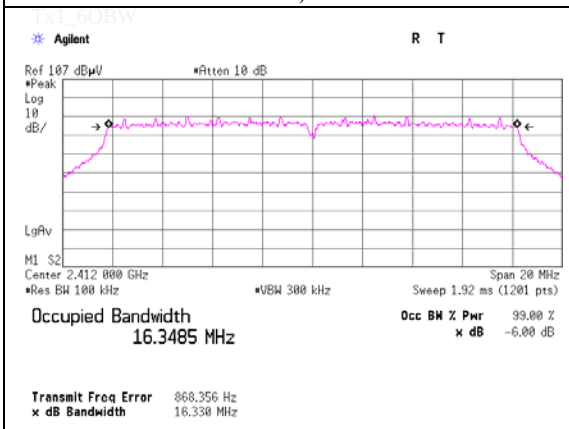
UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN
Telephone : +81 463 50 6400
Facsimile : +81 463 50 6401

-6dB Bandwidth

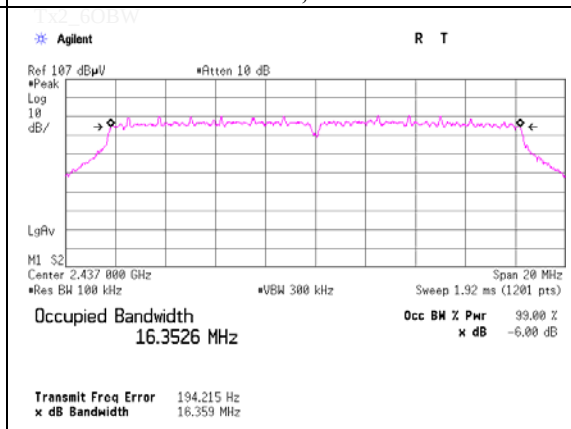
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, IEEE802.11g, PN9, worst data mode 12Mbps	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	16.330	> 0.500
2437.0000	16.359	> 0.500
2462.0000	16.283	> 0.500

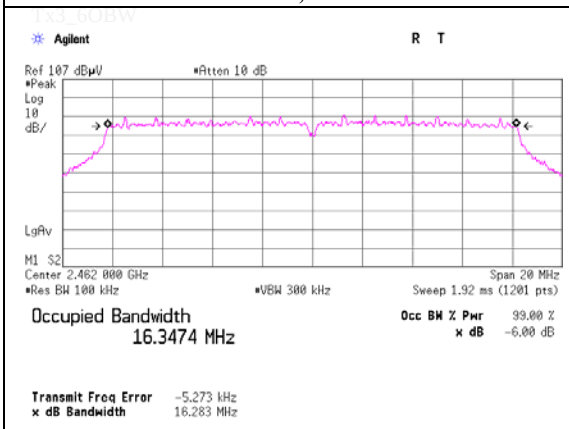
Tx, 2412MHz



Tx, 2437MHz



Tx, 2462MHz



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

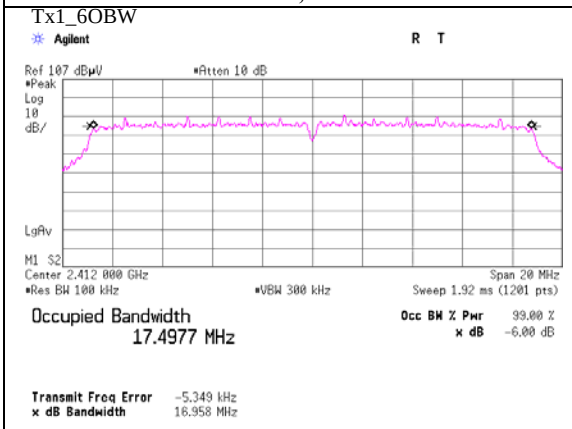
-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, IEEE802.11n-HT20, PN9, worst data mode 0(MCS)[800ns GI]	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2412.0000	16.958	> 0.500
2437.0000	16.940	> 0.500
2462.0000	16.915	> 0.500

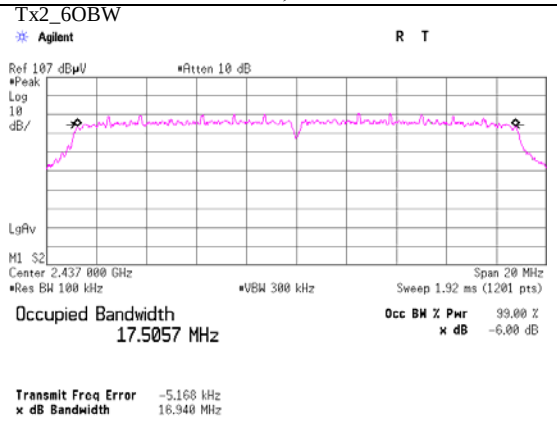
Tx, 2412MHz

Tx1_6OBW



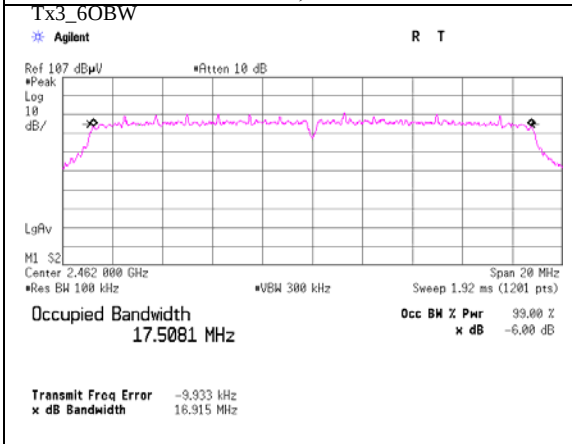
Tx, 2437MHz

Tx2_6OBW



Tx, 2462MHz

Tx3_6OBW



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

Maximum Peak Conducted Output Power

(PKPM1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room	
Date	January 30, 2014		
Temperature / Humidity	25deg.C , 49%RH		
Engineer	Akio Hayashi		
Mode	Tx, IEEE802.11b, PN9,	worst data mode :	11 Mbps

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

Ch	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2412.0	-4.35	1.10	20.00	16.75	47.32	30.00	1000	13.25
Mid	2437.0	-4.25	1.11	20.00	16.86	48.53	30.00	1000	13.14
High	2462.0	-4.27	1.12	20.00	16.85	48.42	30.00	1000	13.15

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

[Pre check]

	Data rate	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	
	[Mbps]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	
	1	2437.0	-4.38	1.11	20.00	16.73	47.10	30.00	1000	13.27	
	2	2437.0	-4.35	1.11	20.00	16.76	47.42	30.00	1000	13.24	
	5.5	2437.0	-4.30	1.11	20.00	16.81	47.97	30.00	1000	13.19	
	11	2437.0	-4.25	1.11	20.00	**16.86**	48.53	30.00	1000	**13.14**	**Worst**

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

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Telephone : +81 463 50 6400
Facsimile : +81 463 50 6401

Maximum Peak Conducted Output Power

(PKPM1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room	
Date	January 30, 2014		
Temperature / Humidity	25deg.C , 49%RH		
Engineer	Akio Hayashi		
Mode	Tx, IEEE802.11g, PN9,	worst data mode :	12 Mbps

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

Ch	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2412.0	-0.06	1.10	20.00	21.04	127.06	30.00	1000	8.96
Mid	2437.0	0.02	1.11	20.00	21.13	129.72	30.00	1000	8.87
High	2462.0	-0.23	1.12	20.00	20.89	122.74	30.00	1000	9.11

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

[Pre check]

Data rate	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	
[Mbps]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	
6	2437.0	0.00	1.11	20.00	21.11	129.12	30.00	1000	8.89	
9	2437.0	-0.60	1.11	20.00	20.51	112.46	30.00	1000	9.49	
12	2437.0	0.02	1.11	20.00	**21.13**	129.72	30.00	1000	**8.87**	**Worst**
18	2437.0	-0.23	1.11	20.00	20.88	122.46	30.00	1000	9.12	
24	2437.0	-0.13	1.11	20.00	20.98	125.31	30.00	1000	9.02	
36	2437.0	-0.15	1.11	20.00	20.96	124.74	30.00	1000	9.04	
48	2437.0	-0.18	1.11	20.00	20.93	123.88	30.00	1000	9.07	
54	2437.0	-0.26	1.11	20.00	20.85	121.62	30.00	1000	9.15	

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

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Facsimile : +81 463 50 6401

Maximum Peak Conducted Output Power

(PKPM1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room	
Date	January 30, 2014		
Temperature / Humidity	25deg.C , 49%RH		
Engineer	Akio Hayashi		
Mode	Tx, IEEE802.11n-HT20, PN9,	worst data mode :	0 (MCS)[800ns GI]

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

Ch	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2412.0	-0.02	1.10	20.00	21.08	128.23	30.00	1000	8.92
Mid	2437.0	-0.06	1.11	20.00	21.05	127.35	30.00	1000	8.95
High	2462.0	-0.19	1.12	20.00	20.93	123.88	30.00	1000	9.07

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

[Pre check]
[400ns GI]

Mode	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
(MCS)	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
0	2437.0	-0.09	1.11	20.00	21.02	126.47	30.00	1000	8.98
1	2437.0	-0.11	1.11	20.00	21.00	125.89	30.00	1000	9.00
2	2437.0	-0.16	1.11	20.00	20.95	124.45	30.00	1000	9.05
3	2437.0	-0.37	1.11	20.00	20.74	118.58	30.00	1000	9.26
4	2437.0	-0.49	1.11	20.00	20.62	115.35	30.00	1000	9.38
5	2437.0	-0.94	1.11	20.00	20.17	103.99	30.00	1000	9.83
6	2437.0	-0.84	1.11	20.00	20.27	106.41	30.00	1000	9.73
7	2437.0	-1.17	1.11	20.00	19.94	98.63	30.00	1000	10.06

[800ns GI]

Mode	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	
(MCS)	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	
0	2437.0	-0.06	1.11	20.00	**21.05**	127.35	30.00	1000	**8.95**	**Worst**
1	2437.0	-0.21	1.11	20.00	20.90	123.03	30.00	1000	9.10	
2	2437.0	-0.16	1.11	20.00	20.95	124.45	30.00	1000	9.05	
3	2437.0	-0.20	1.11	20.00	20.91	123.31	30.00	1000	9.09	
4	2437.0	-0.40	1.11	20.00	20.71	117.76	30.00	1000	9.29	
5	2437.0	-1.23	1.11	20.00	19.88	97.27	30.00	1000	10.12	
6	2437.0	-0.83	1.11	20.00	20.28	106.66	30.00	1000	9.72	
7	2437.0	-1.02	1.11	20.00	20.09	102.09	30.00	1000	9.91	

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2412 MHz	
	Tx, IEEE802.11b	

(* 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	58.9	26.8	14.7	38.2	62.2	73.9	11.7	219	297	
Hori.	2822.400	PK	49.2	27.8	7.2	38.1	46.1	73.9	27.8	100	178	
Hori.	4824.000	PK	50.0	31.1	7.4	37.1	51.4	73.9	22.5	100	202	
Hori.	7236.000	PK	45.2	37.1	8.8	39.4	51.7	73.9	22.2	100	0	
Hori.	9648.000	PK	43.7	38.6	10.0	37.6	54.7	73.9	19.2	100	0	
Hori.	2390.000	AV	37.7	26.8	14.7	38.2	41.0	53.9	12.9	219	297	
Hori.	2822.400	AV	45.6	27.8	7.2	38.1	42.5	53.9	11.4	100	178	
Hori.	4824.000	AV	39.4	31.1	7.4	37.1	40.8	53.9	13.1	100	202	
Hori.	7236.000	AV	36.0	37.1	8.8	39.4	42.5	53.9	11.4	100	0	
Hori.	9648.000	AV	33.8	38.6	10.0	37.6	44.8	53.9	**9.1**	100	0	
Vert.	2390.000	PK	52.2	26.8	14.7	38.2	55.5	73.9	18.4	130	198	
Vert.	2822.400	PK	48.5	27.8	7.2	38.1	45.4	73.9	28.5	100	324	
Vert.	4824.000	PK	48.0	31.1	7.4	37.1	49.4	73.9	24.5	100	290	
Vert.	7236.000	PK	45.7	37.1	8.8	39.4	52.2	73.9	21.7	100	0	
Vert.	9648.000	PK	43.6	38.6	10.0	37.6	54.6	73.9	19.3	100	0	
Vert.	2390.000	AV	35.4	26.8	14.7	38.2	38.7	53.9	15.2	130	198	
Vert.	2822.400	AV	45.0	27.8	7.2	38.1	41.9	53.9	12.0	100	324	
Vert.	4824.000	AV	37.3	31.1	7.4	37.1	38.7	53.9	15.2	100	290	
Vert.	7236.000	AV	36.2	37.1	8.8	39.4	42.7	53.9	11.2	100	0	
Vert.	9648.000	AV	33.7	38.6	10.0	37.6	44.7	53.9	9.2	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
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	93.6	26.8	14.7	38.2	96.9	-	-	100k/300k
Hori.	2400.000	PK	48.5	26.8	14.7	38.2	51.8	76.9	25.1	100k/300k
Vert.	2412.000	PK	85.5	26.8	14.7	38.2	88.8	-	-	100k/300k
Vert.	2400.000	PK	43.2	26.8	14.7	38.2	46.5	68.8	22.3	100k/300k

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2437 MHz	
	Tx, IEEE802.11b	

(* 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.	2822.400	PK	49.7	27.8	7.2	38.1	46.6	73.9	27.3	100	178	
Hori.	4874.000	PK	52.6	31.3	7.4	37.1	54.2	73.9	19.7	120	205	
Hori.	7311.000	PK	45.6	37.2	8.8	39.4	52.2	73.9	21.7	100	0	
Hori.	9748.000	PK	43.7	38.7	10.0	37.6	54.8	73.9	19.1	100	0	
Hori.	2822.400	AV	45.8	27.8	7.2	38.1	42.7	53.9	11.2	100	178	
Hori.	4874.000	AV	42.4	31.3	7.4	37.1	44.0	53.9	9.9	120	205	
Hori.	7311.000	AV	35.8	37.2	8.8	39.4	42.4	53.9	11.5	100	0	
Hori.	9748.000	AV	34.0	38.7	10.0	37.6	45.1	53.9	**8.8**	100	0	
Vert.	2822.400	PK	49.9	27.8	7.2	38.1	46.8	73.9	27.1	100	324	
Vert.	4874.000	PK	51.7	31.3	7.4	37.1	53.3	73.9	20.6	142	53	
Vert.	7311.000	PK	45.3	37.2	8.8	39.4	51.9	73.9	22.0	100	0	
Vert.	9748.000	PK	43.7	38.7	10.0	37.6	54.8	73.9	19.1	100	0	
Vert.	2822.400	AV	45.2	27.8	7.2	38.1	42.1	53.9	11.8	100	324	
Vert.	4874.000	AV	40.9	31.3	7.4	37.1	42.5	53.9	11.4	142	53	
Vert.	7311.000	AV	35.8	37.2	8.8	39.4	42.4	53.9	11.5	100	0	
Vert.	9748.000	AV	33.7	38.7	10.0	37.6	44.8	53.9	9.1	100	0	

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2462 MHz	
	Tx, IEEE802.11b	

(* 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	60.2	26.9	14.8	38.1	63.8	73.9	10.1	100	313	
Hori.	2822.400	PK	48.8	27.8	7.2	38.1	45.7	73.9	28.2	100	178	
Hori.	4924.000	PK	53.6	31.6	7.4	37.0	55.6	73.9	18.3	100	205	
Hori.	7386.000	PK	45.2	37.3	8.9	39.4	52.0	73.9	21.9	100	0	
Hori.	9848.000	PK	44.2	38.9	10.0	37.5	55.6	73.9	18.3	100	0	
Hori.	2483.500	AV	38.5	26.9	14.8	38.1	42.1	53.9	11.8	100	313	
Hori.	2822.400	AV	45.6	27.8	7.2	38.1	42.5	53.9	11.4	100	178	
Hori.	4924.000	AV	43.2	31.6	7.4	37.0	45.2	53.9	8.7	100	205	
Hori.	7386.000	AV	35.9	37.3	8.9	39.4	42.7	53.9	11.2	100	0	
Hori.	9848.000	AV	34.0	38.9	10.0	37.5	45.4	53.9	**8.5**	100	0	
Vert.	2483.500	PK	52.6	26.9	14.8	38.1	56.2	73.9	17.7	100	195	
Vert.	2822.400	PK	49.1	27.8	7.2	38.1	46.0	73.9	27.9	100	325	
Vert.	4924.000	PK	53.2	31.6	7.4	37.0	55.2	73.9	18.7	159	53	
Vert.	7386.000	PK	45.8	37.3	8.9	39.4	52.6	73.9	21.3	100	0	
Vert.	9848.000	PK	44.1	38.9	10.0	37.5	55.5	73.9	18.4	100	0	
Vert.	2483.500	AV	35.4	26.9	14.8	38.1	39.0	53.9	14.9	100	195	
Vert.	2822.400	AV	45.2	27.8	7.2	38.1	42.1	53.9	11.8	100	325	
Vert.	4924.000	AV	42.5	31.6	7.4	37.0	44.5	53.9	9.4	159	53	
Vert.	7386.000	AV	35.8	37.3	8.9	39.4	42.6	53.9	11.3	100	0	
Vert.	9848.000	AV	33.9	38.9	10.0	37.5	45.3	53.9	8.6	100	0	

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2412 MHz	
	Tx, IEEE802.11g	

(* 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	55.0	26.8	14.7	38.2	58.3	73.9	15.6	223	294	
Hori.	2822.400	PK	48.9	27.8	7.2	38.1	45.8	73.9	28.1	100	180	
Hori.	4824.000	PK	45.8	31.1	7.4	37.1	47.2	73.9	26.7	100	203	
Hori.	7236.000	PK	46.5	37.1	8.8	39.4	53.0	73.9	20.9	100	0	
Hori.	9648.000	PK	43.7	38.6	10.0	37.6	54.7	73.9	19.2	100	0	
Hori.	2390.000	AV	42.2	26.8	14.7	38.2	45.5	53.9	**8.4**	223	294	*1
Hori.	2822.400	AV	45.3	27.8	7.2	38.1	42.2	53.9	11.7	100	180	*2
Vert.	2390.000	PK	48.3	26.8	14.7	38.2	51.6	73.9	22.3	100	191	
Vert.	2822.400	PK	48.6	27.8	7.2	38.1	45.5	73.9	28.4	100	325	
Vert.	4824.000	PK	44.3	31.1	7.4	37.1	45.7	73.9	28.2	100	175	
Vert.	7236.000	PK	46.2	37.1	8.8	39.4	52.7	73.9	21.2	100	0	
Vert.	9648.000	PK	43.8	38.6	10.0	37.6	54.8	73.9	19.1	100	0	
Vert.	2390.000	AV	37.5	26.8	14.7	38.2	40.8	53.9	13.1	100	191	*1
Vert.	2822.400	AV	45.3	27.8	7.2	38.1	42.2	53.9	11.7	100	325	*2

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB
*1) Out of Band emission (Leakage Power)
*2) Continuous wave (no pulse emission)

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	36.8	31.1	7.4	37.1	0.2	38.4	53.9	15.5	
Hori.	7236.000	AV	36.0	37.1	8.8	39.4	0.2	42.7	53.9	11.2	
Hori.	9648.000	AV	33.9	38.6	10.0	37.6	0.2	45.1	53.9	8.8	
Vert.	4824.000	AV	34.5	31.1	7.4	37.1	0.2	36.1	53.9	17.8	
Vert.	7236.000	AV	36.3	37.1	8.8	39.4	0.2	43.0	53.9	10.9	
Vert.	9648.000	AV	34.0	38.6	10.0	37.6	0.2	45.2	53.9	**8.7**	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + 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	89.2	26.8	14.7	38.2	92.5	-	-	100k/300k
Hori.	2400.000	PK	51.1	26.8	14.7	38.2	54.4	72.5	18.1	100k/300k
Vert.	2412.000	PK	80.7	26.8	14.7	38.2	84.0	-	-	100k/300k
Vert.	2400.000	PK	45.6	26.8	14.7	38.2	48.9	64.0	15.1	100k/300k

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2437 MHz	
	Tx, IEEE802.11g	

(* 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.	204.003	QP	41.6	16.5	8.0	32.0	34.1	43.5	9.4	159	119	
Hori.	228.007	QP	45.9	16.8	8.1	32.0	38.8	46.0	**7.2**	146	305	
Hori.	312.007	QP	43.3	14.1	8.6	31.9	34.1	46.0	11.9	120	138	
Hori.	324.007	QP	41.6	14.4	8.7	31.9	32.8	46.0	13.2	100	138	
Hori.	408.005	QP	40.6	16.4	9.1	32.0	34.1	46.0	11.9	100	157	
Hori.	2822.400	PK	49.1	27.8	7.2	38.1	46.0	73.9	27.9	100	178	
Hori.	4874.000	PK	47.8	31.3	7.4	37.1	49.4	73.9	24.5	100	206	
Hori.	7311.000	PK	45.8	37.2	8.8	39.4	52.4	73.9	21.5	100	0	
Hori.	9748.000	PK	43.5	38.7	10.0	37.6	54.6	73.9	19.3	100	0	
Hori.	2822.400	AV	45.3	27.8	7.2	38.1	42.2	53.9	11.7	100	178	*1
Vert.	849.998	QP	31.2	21.1	10.7	31.3	31.7	46.0	14.3	151	20	
Vert.	2822.400	PK	49.2	27.8	7.2	38.1	46.1	73.9	27.8	100	325	
Vert.	4874.000	PK	47.0	31.3	7.4	37.1	48.6	73.9	25.3	140	54	
Vert.	7311.000	PK	45.1	37.2	8.8	39.4	51.7	73.9	22.2	100	0	
Vert.	9748.000	PK	43.1	38.7	10.0	37.6	54.2	73.9	19.7	100	0	
Vert.	2822.400	AV	45.3	27.8	7.2	38.1	42.2	53.9	11.7	100	325	*1

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB
*1) Continuous wave (no pulse emission)

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	38.0	31.3	7.4	37.1	0.2	39.8	53.9	14.1	
Hori.	7311.000	AV	35.8	37.2	8.8	39.4	0.2	42.6	53.9	11.3	
Hori.	9748.000	AV	34.1	38.7	10.0	37.6	0.2	45.4	53.9	**8.5**	
Vert.	4874.000	AV	37.5	31.3	7.4	37.1	0.2	39.3	53.9	14.6	
Vert.	7311.000	AV	35.8	37.2	8.8	39.4	0.2	42.6	53.9	11.3	
Vert.	9748.000	AV	34.0	38.7	10.0	37.6	0.2	45.3	53.9	8.6	

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2462 MHz	
	Tx, IEEE802.11g	

(* 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	26.9	14.8	38.1	59.0	73.9	14.9	219	313	
Hori.	2822.400	PK	48.9	27.8	7.2	38.1	45.8	73.9	28.1	100	178	
Hori.	4924.000	PK	49.4	31.6	7.4	37.0	51.4	73.9	22.5	100	205	
Hori.	7386.000	PK	46.2	37.3	8.9	39.4	53.0	73.9	20.9	100	0	
Hori.	9848.000	PK	44.0	38.9	10.0	37.5	55.4	73.9	18.5	100	0	
Hori.	2483.500	AV	41.7	26.9	14.8	38.1	45.3	53.9	**8.6**	219	313	*1
Hori.	2822.400	AV	45.4	27.8	7.2	38.1	42.3	53.9	11.6	100	178	*2
Vert.	2483.500	PK	47.8	26.9	14.8	38.1	51.4	73.9	22.5	112	334	
Vert.	2822.400	PK	48.6	27.8	7.2	38.1	45.5	73.9	28.4	100	325	
Vert.	4924.000	PK	48.2	31.6	7.4	37.0	50.2	73.9	23.7	143	52	
Vert.	7386.000	PK	45.2	37.3	8.9	39.4	52.0	73.9	21.9	100	0	
Vert.	9848.000	PK	42.9	38.9	10.0	37.5	54.3	73.9	19.6	100	0	
Vert.	2483.500	AV	36.5	26.9	14.8	38.1	40.1	53.9	13.8	112	334	*1
Vert.	2822.400	AV	45.2	27.8	7.2	38.1	42.1	53.9	11.8	100	325	*2

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB
*1) Out of Band emission (Leakage Power)
*2) Continuous wave (no pulse emission)

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	40.2	31.6	7.4	37.0	0.2	42.4	53.9	11.5	
Hori.	7386.000	AV	35.8	37.3	8.9	39.4	0.2	42.8	53.9	11.1	
Hori.	9848.000	AV	33.9	38.9	10.0	37.5	0.2	45.5	53.9	**8.4**	
Vert.	4924.000	AV	38.9	31.6	7.4	37.0	0.2	41.1	53.9	12.8	
Vert.	7386.000	AV	35.8	37.3	8.9	39.4	0.2	42.8	53.9	11.1	
Vert.	9848.000	AV	33.6	38.9	10.0	37.5	0.2	45.2	53.9	8.7	

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2412 MHz	
	Tx, IEEE802.11n-HT20	

(* 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	59.5	26.8	14.7	38.2	62.8	73.9	11.1	220	294	
Hori.	2822.400	PK	48.6	27.8	7.2	38.1	45.5	73.9	28.4	100	179	
Hori.	4824.000	PK	45.8	31.1	7.4	37.1	47.2	73.9	26.7	100	205	
Hori.	7236.000	PK	45.6	37.1	8.8	39.4	52.1	73.9	21.8	100	0	
Hori.	9648.000	PK	43.5	38.6	10.0	37.6	54.5	73.9	19.4	100	0	
Hori.	2390.000	AV	41.9	26.8	14.7	38.2	45.2	53.9	8.7	220	294	
Hori.	2822.400	AV	45.3	27.8	7.2	38.1	42.2	53.9	11.7	100	179	
Hori.	4824.000	AV	36.1	31.1	7.4	37.1	37.5	53.9	16.4	100	205	
Hori.	7236.000	AV	36.0	37.1	8.8	39.4	42.5	53.9	11.4	100	0	
Hori.	9648.000	AV	34.0	38.6	10.0	37.6	45.0	53.9	8.9	100	0	
Vert.	2390.000	PK	52.9	26.8	14.7	38.2	56.2	73.9	17.7	100	190	
Vert.	2822.400	PK	48.5	27.8	7.2	38.1	45.4	73.9	28.5	100	324	
Vert.	4824.000	PK	44.8	31.1	7.4	37.1	46.2	73.9	27.7	147	52	
Vert.	7236.000	PK	45.5	37.1	8.8	39.4	52.0	73.9	21.9	100	0	
Vert.	9648.000	PK	44.5	38.6	10.0	37.6	55.5	73.9	18.4	100	0	
Vert.	2390.000	AV	37.7	26.8	14.7	38.2	41.0	53.9	12.9	100	190	
Vert.	2822.400	AV	44.9	27.8	7.2	38.1	41.8	53.9	12.1	100	324	
Vert.	4824.000	AV	35.0	31.1	7.4	37.1	36.4	53.9	17.5	147	52	
Vert.	7236.000	AV	36.3	37.1	8.8	39.4	42.8	53.9	11.1	100	0	
Vert.	9648.000	AV	34.3	38.6	10.0	37.6	45.3	53.9	**8.6**	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
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	89.5	26.8	14.7	38.2	92.8	-	-	100k/300k
Hori.	2400.000	PK	50.5	26.8	14.7	38.2	53.8	72.8	19.0	100k/300k
Vert.	2412.000	PK	80.9	26.8	14.7	38.2	84.2	-	-	100k/300k
Vert.	2400.000	PK	44.8	26.8	14.7	38.2	48.1	64.2	16.1	100k/300k

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2437 MHz	
	Tx, IEEE802.11n-HT20	

(* 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.	2822.400	PK	49.3	27.8	7.2	38.1	46.2	73.9	27.7	100	180	
Hori.	4874.000	PK	48.2	31.3	7.4	37.1	49.8	73.9	24.1	100	206	
Hori.	7311.000	PK	45.3	37.2	8.8	39.4	51.9	73.9	22.0	100	0	
Hori.	9748.000	PK	43.4	38.7	10.0	37.6	54.5	73.9	19.4	100	0	
Hori.	2822.400	AV	45.2	27.8	7.2	38.1	42.1	53.9	11.8	100	180	
Hori.	4874.000	AV	37.4	31.3	7.4	37.1	39.0	53.9	14.9	100	206	
Hori.	7311.000	AV	35.8	37.2	8.8	39.4	42.4	53.9	11.5	100	0	
Hori.	9748.000	AV	34.0	38.7	10.0	37.6	45.1	53.9	**8.8**	100	0	
Vert.	2822.400	PK	48.3	27.8	7.2	38.1	45.2	73.9	28.7	100	324	
Vert.	4874.000	PK	49.0	31.3	7.4	37.1	50.6	73.9	23.3	143	53	
Vert.	7311.000	PK	45.3	37.2	8.8	39.4	51.9	73.9	22.0	100	0	
Vert.	9748.000	PK	43.1	38.7	10.0	37.6	54.2	73.9	19.7	100	0	
Vert.	2822.400	AV	44.7	27.8	7.2	38.1	41.6	53.9	12.3	100	324	
Vert.	4874.000	AV	36.9	31.3	7.4	37.1	38.5	53.9	15.4	143	53	
Vert.	7311.000	AV	35.6	37.2	8.8	39.4	42.2	53.9	11.7	100	0	
Vert.	9748.000	AV	33.9	38.7	10.0	37.6	45.0	53.9	8.9	100	0	

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

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber	
Date	February 11, 2014	February 12, 2014
Temperature / Humidity	23 deg.C, 25 %RH	25 deg.C, 24 %RH
Engineer	Tatsuya Arai	
Mode	Tx, 2462 MHz	
	Tx, IEEE802.11n-HT20	

(* 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	57.1	26.9	14.8	38.1	60.7	73.9	13.2	222	313	
Hori.	2822.400	PK	49.1	27.8	7.2	38.1	46.0	73.9	27.9	100	179	
Hori.	4924.000	PK	49.5	31.6	7.4	37.0	51.5	73.9	22.4	100	204	
Hori.	7386.000	PK	45.6	37.3	8.9	39.4	52.4	73.9	21.5	100	0	
Hori.	9848.000	PK	44.4	38.9	10.0	37.5	55.8	73.9	18.1	100	0	
Hori.	2483.500	AV	41.7	26.9	14.8	38.1	45.3	53.9	**8.6**	222	313	
Hori.	2822.400	AV	45.3	27.8	7.2	38.1	42.2	53.9	11.7	100	179	
Hori.	4924.000	AV	38.5	31.6	7.4	37.0	40.5	53.9	13.4	100	204	
Hori.	7386.000	AV	36.0	37.3	8.9	39.4	42.8	53.9	11.1	100	0	
Hori.	9848.000	AV	33.8	38.9	10.0	37.5	45.2	53.9	8.7	100	0	
Vert.	2483.500	PK	48.3	26.9	14.8	38.1	51.9	73.9	22.0	112	334	
Vert.	2822.400	PK	48.9	27.8	7.2	38.1	45.8	73.9	28.1	100	325	
Vert.	4924.000	PK	49.2	31.6	7.4	37.0	51.2	73.9	22.7	140	54	
Vert.	7386.000	PK	45.7	37.3	8.9	39.4	52.5	73.9	21.4	100	0	
Vert.	9848.000	PK	43.5	38.9	10.0	37.5	54.9	73.9	19.0	100	0	
Vert.	2483.500	AV	36.5	26.9	14.8	38.1	40.1	53.9	13.8	112	334	
Vert.	2822.400	AV	45.1	27.8	7.2	38.1	42.0	53.9	11.9	100	325	
Vert.	4924.000	AV	38.6	31.6	7.4	37.0	40.6	53.9	13.3	140	54	
Vert.	7386.000	AV	35.9	37.3	8.9	39.4	42.7	53.9	11.2	100	0	
Vert.	9848.000	AV	33.9	38.9	10.0	37.5	45.3	53.9	**8.6**	100	0	

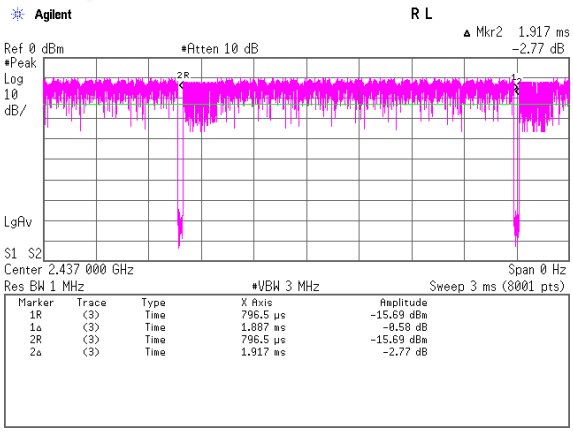
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	

Burst rate confirmation

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

Duty Cycle = 1.887 / 1.917 = 0.9844 (98.4%)	
	

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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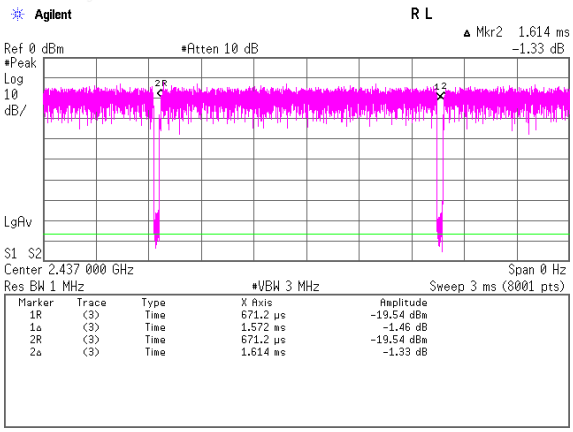
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	

Duty Factor Calculation Chart

Tx, IEEE802.11g, PN9, worst data mode 12Mbps

Duty Factor: 20log(1/Duty Cycle) : 0.2	
Duty Cycle = 1.572 / 1.614 = 0.974 (97.4%)	
Tx2_duty1 	Tx2_duty2

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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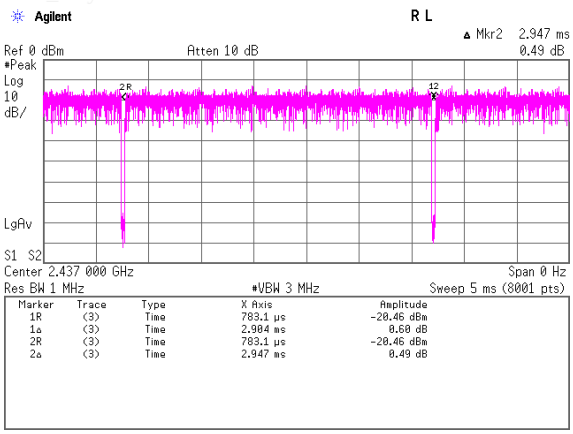
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	

Burst rate confirmation

Tx, IEEE802.11n-HT20, PN9, worst data mode 0(MCS)[800ns GI]

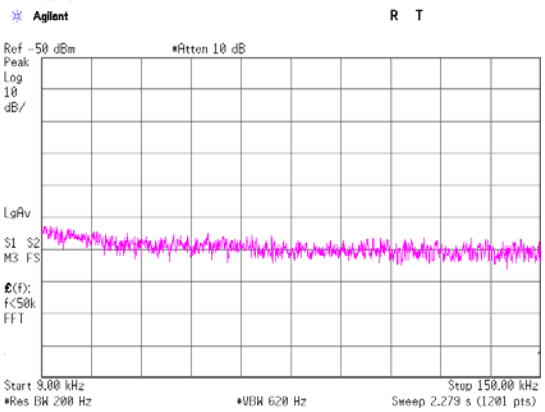
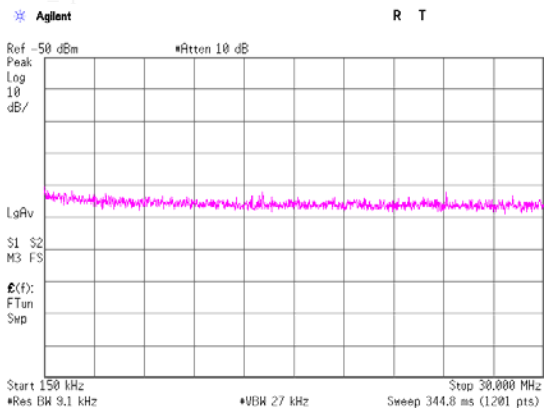
Duty Cycle = 2.904 / 2.947 = 0.9854 (98.5%)	
	

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

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	

(Reference chart) Spurious emission (Conducted)

Tx, IEEE802.11g, PN9, worst data mode 12Mbps

Tx, 2437MHz (below 30MHz)	
9kHz - 150kHz	**150kHz - 30MHz**
	

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Shonan EMC Lab.
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Maximum Power Spectral Density

(PKPSD)

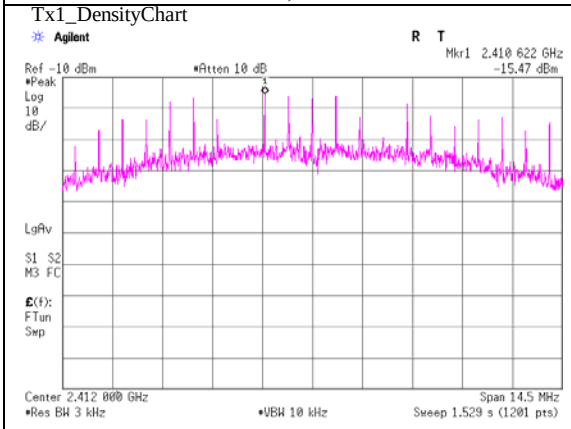
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, IEEE802.11b, PN9, worst data mode 11Mbps	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2410.62	-15.47	1.10	20.00	5.63	8.00	2.37
2437.0000	2435.62	-15.38	1.11	20.00	5.73	8.00	2.27
2462.0000	2460.62	-15.29	1.12	20.00	5.83	8.00	2.17

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

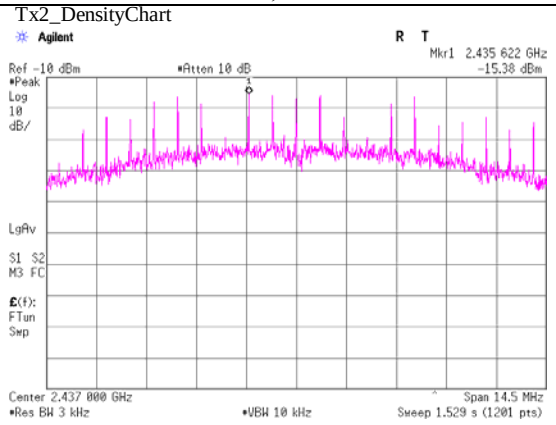
Tx, 2412MHz

Tx1_DensityChart



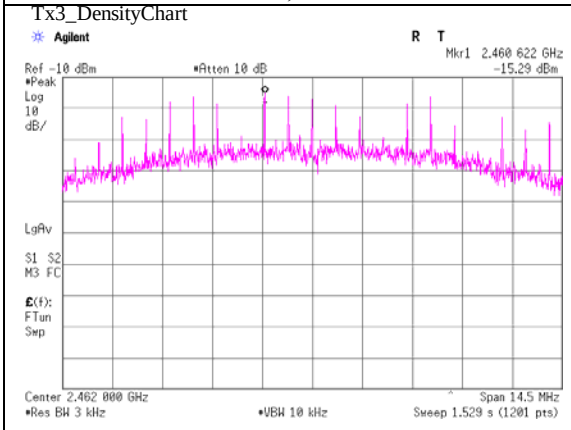
Tx, 2437MHz

Tx2_DensityChart



Tx, 2462MHz

Tx3_DensityChart



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Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN
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Maximum Power Spectral Density

(PKPSD)

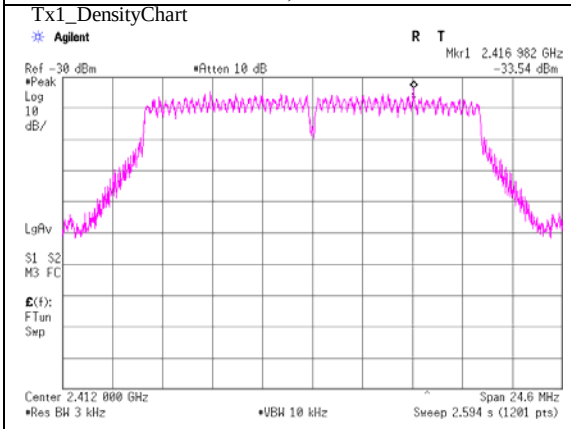
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, IEEE802.11g, PN9, worst data mode 12Mbps	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2416.98	-33.54	1.10	20.00	-12.44	8.00	20.44
2437.0000	2431.38	-34.83	1.11	20.00	-13.72	8.00	21.72
2462.0000	2464.50	-34.70	1.12	20.00	-13.58	8.00	21.58

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

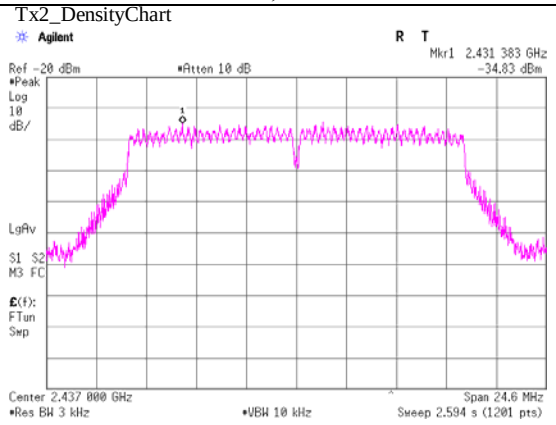
Tx, 2412MHz

Tx1_DensityChart



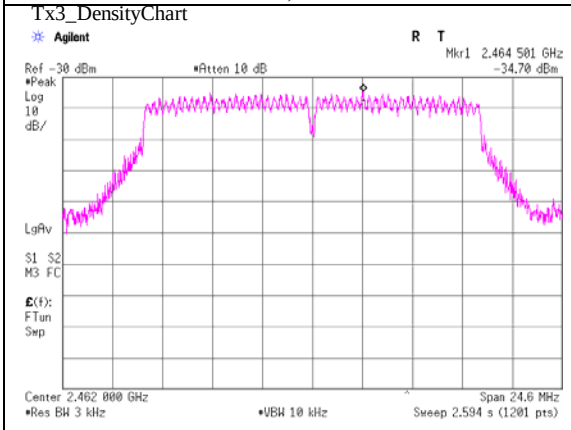
Tx, 2437MHz

Tx2_DensityChart



Tx, 2462MHz

Tx3_DensityChart



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Maximum Power Spectral Density

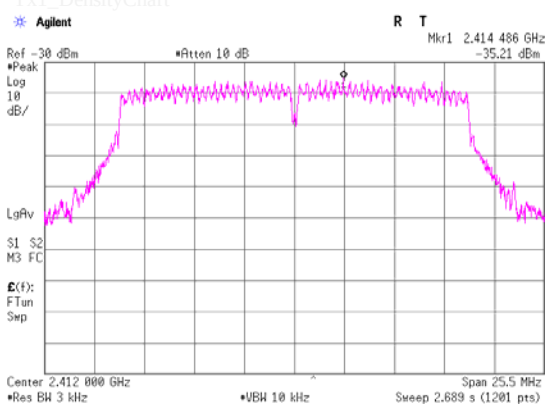
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, IEEE802.11n-HT20, PN9, worst data mode 0(MCS)[800ns GI]	

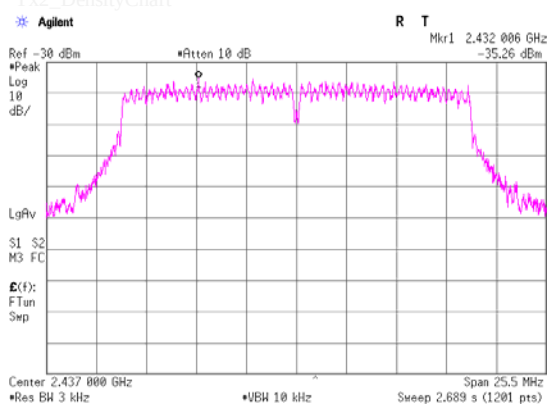
Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.0000	2414.49	-35.21	1.10	20.00	-14.11	8.00	22.11
2437.0000	2432.01	-35.26	1.11	20.00	-14.15	8.00	22.15
2462.0000	2455.73	-34.56	1.12	20.00	-13.44	8.00	21.44

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

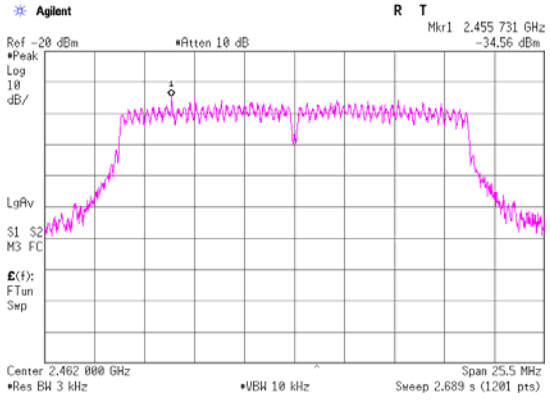
Tx, 2412MHz



Tx, 2437MHz



Tx, 2462MHz



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1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN
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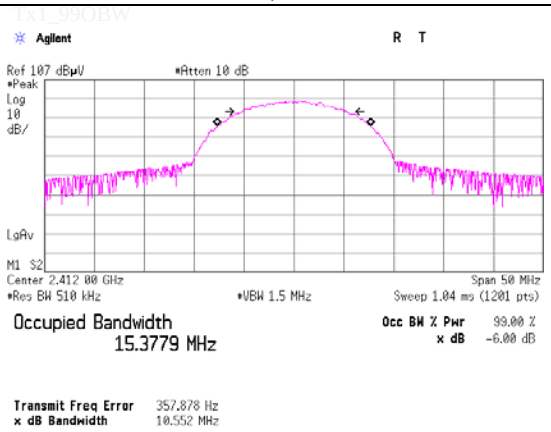
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	

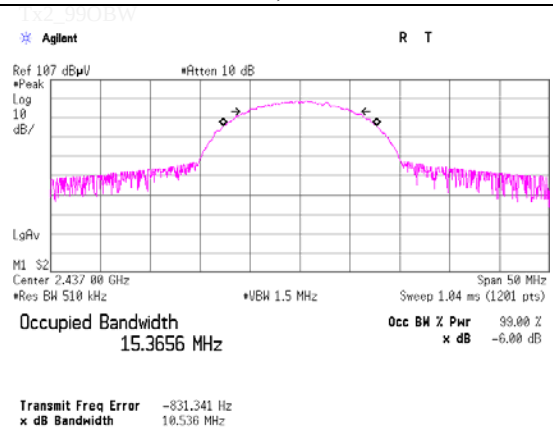
99% Occupied Bandwidth

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

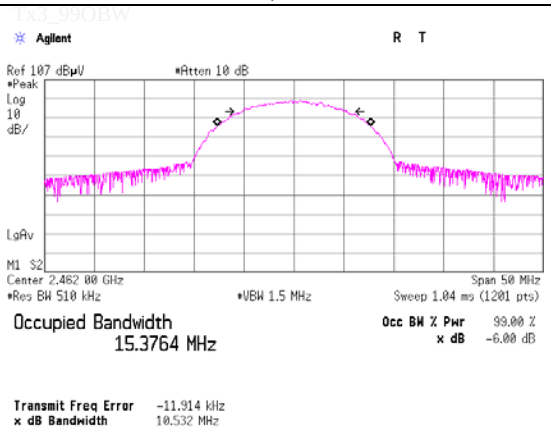
Tx, 2412MHz



Tx, 2437MHz



Tx, 2462MHz



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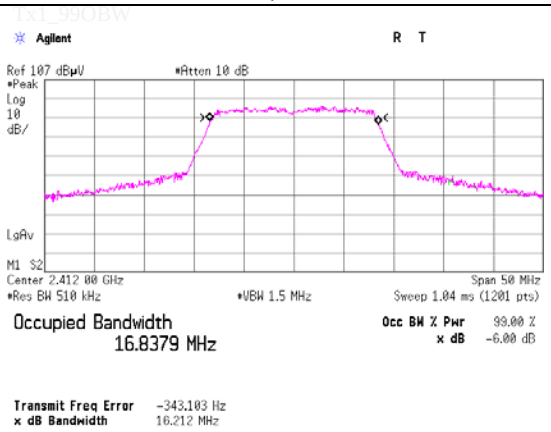
Engineer	Akio Hayashi	

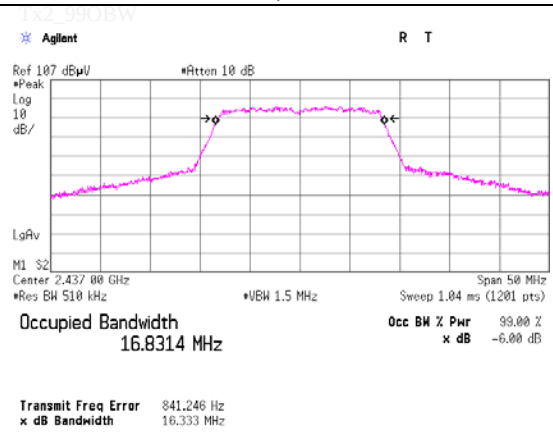
99% Occupied Bandwidth

Tx, IEEE802.11g, PN9, worst data mode 12Mbps

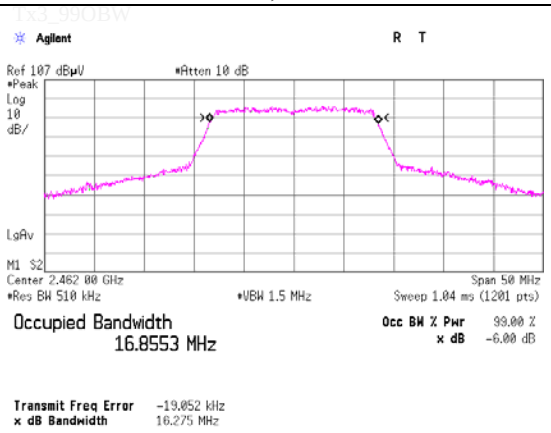
Tx, 2412MHz



Tx, 2437MHz



Tx, 2462MHz



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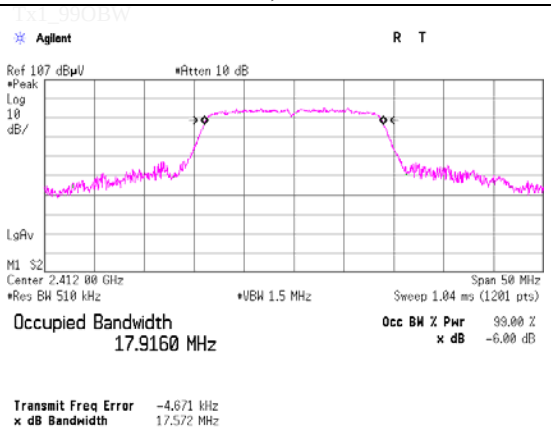
Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Measurement Room
Date	January 30, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	

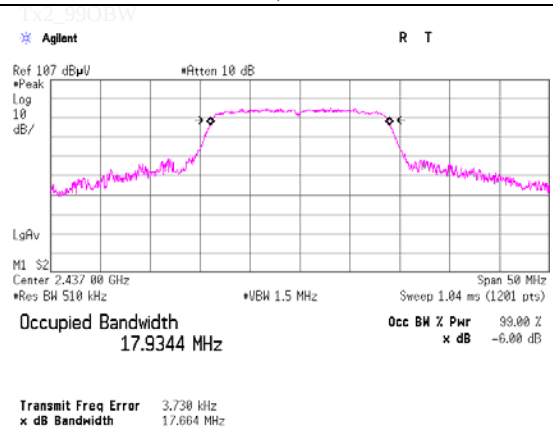
99% Occupied Bandwidth

Tx, IEEE802.11n-HT20, PN9, worst data mode 0(MCS)[800ns GI]

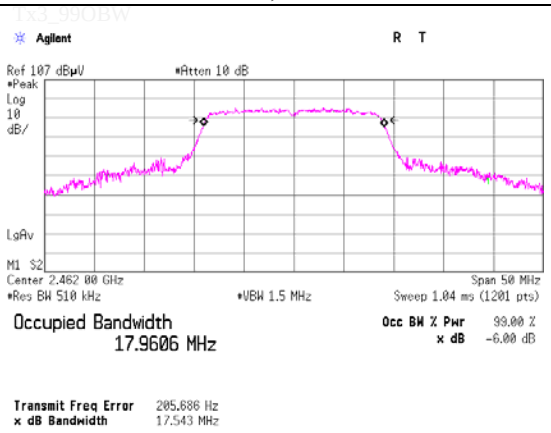
Tx, 2412MHz



Tx, 2437MHz



Tx, 2462MHz



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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)
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2013/07/09 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2013/07/22 * 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	2013/08/19 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2013/02/27 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2013/03/28 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	RE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	AT	2013/11/22 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2013/11/22 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2013/03/14 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2013/03/19 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2		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	2013/10/26 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/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	2013/10/26 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2013/02/27 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2013/03/04 * 12
SAT20-06	Attenuator	Weinschel Corp.	54A-20	31506	AT	2013/04/09 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2013/03/16 * 12
SOS-13	Humidity Indicator	Custom	CTH-202	Q.C.17	AT	2013/04/25 * 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

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: Out of Band Emission (Radiated)
AT: Antenna terminal conducted test