



RADIO TEST REPORT

Test Report No. : 11306371S-B-R1

Applicant : Sony Corporation
Type of Equipment : Digital Paper
Model No. : DPT-RP1
FCC ID : AK8DPTRP1
Test regulation : FCC Part 15 Subpart C: 2016
Test item : Antenna terminal conducted tests
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11306371S-B. 11306371S-B is replaced with this report.

Date of test:

June 4 to July 2, 2016

Representative test engineer:

h. Morikawa

Hiroyuki Morikawa
Engineer

Consumer Technology Division

Approved by:

T. Imamura

Toyokazu Imamura

Leader

Consumer Technology Division



JAB
Testing
RTL02610

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

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

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11306371S-B

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SECTION 1: Customer information

Company Name : Sony Corporation
 Brand Name : SONY
 Address : 1-7-1 Konan, Minato-ku, Tokyo 108-0075, Japan

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

2.1 Identification of E.U.T.

Type of Equipment : Digital Paper
 Model No. : DPT-RP1
 Serial No. : Refer to Section 4, Clause 4.2
 Rating : DC 3.7 V
 Receipt Date of Sample : May 30, 2016
 Country of Mass-production : Japan
 Condition of EUT : Production prototype
 (Not for Sale: This sample is equivalent to mass-produced items.)
 Modification of EUT : No Modification by the test lab.

2.2 Product Description

Model: DPT-RP1 (referred to as the EUT in this report) is a Digital Paper.

Clock frequency : 156 MHz (CPLD), 667 MHz (LPDDR3), 200 MHz (eMMC), 40 MHz (WLAN/BT)
 208 MHz (WLAN/BT), 32.768 kHz (clock), 26 MHz (CPU), 27 MHz (NFC)

Radio Specification

Equipment name	IEEE 802.11 2x2 MIMO a/b/g/n/ac Wireless LAN + Bluetooth + NFC		
Frequency of operation	Bluetooth	2.4GHz band: 2402-2480 MHz (BDR (Basic Data Rate), EDR (Enhanced Data Rate), LE (Low Energy mode))	
	WLAN	2.4GHz band: 2412-2462 MHz (b,g,n(HT20)); W52 (U-NII-1): 5180-5240 MHz (a,n(HT20),ac(VHT20)) / 5190-5230 MHz (n(HT40),ac(VHT40)) / 5210 MHz (ac(VHT80)); W53 (U-NII-2A): 5260-5320 MHz (a,n(HT20),ac(VHT20)) / 5270-5310 MHz (n(HT40),ac(VHT40)) / 5290 MHz (ac(VHT80)); W56 (U-NII-2C): 5500-5720 MHz (a,n(HT20),ac(VHT20)) / 5510-5710 MHz (n(HT40),ac(VHT40)) / 5530-5690 MHz (ac(VHT80)); W58 (U-NII-3): 5745-5825 MHz (a,n(HT20),ac(VHT20)) / 5755-5795 MHz (n(HT40),ac(VHT40)) / 5775 MHz (ac(VHT80))	
	NFC	13.56 MHz	
Operation mode	Wi-Fi		Bluetooth
Channel spacing	5 MHz (2.4 GHz band), 20 MHz (W52, W53, W56, W58)		1 MHz (BDR, EDR), 2 MHz (LE)
Bandwidth	20 MHz (b,g,a,n(HT20),ac(VHT20)), 40 MHz (n(HT40),ac(VHT40)), 80 MHz (ac(VHT80))		79 MHz
Type of modulation	DSSS: DBPSK, DQPSK, CCK OFDM: BPSK, QPSK, 16QAM, 64QAM, 256QAM(*1) (*1. 256QAM is only supported by 11ac mode.)		FHSS: GFSK (*. EDR: GFSK + $\pi/4$ -DQPSK, GFSK + 8DPSK)
Antenna	antenna #A (Wi-Fi)		antenna #B (Wi-Fi+Bluetooth)
Antenna type	Loop		
Antenna gain (Peak)	3.75 dBi (2.4 GHz), 2.81 dBi (5 GHz) (*.including cable loss)		1.38 dBi (2.4 GHz), 4.29 dBi (5 GHz) (*.including cable loss)
Antenna	NFC antenna		
Antenna type	Loop		
Card type	type A, type F		

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

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC part 15 final revised on April 6, 2016.

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

The EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report 11306371S-F.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	-	-	*1)
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	-	Complied (below 30 MHz)	Conducted *2)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

*1) Refer to the test report: 11306372M-B.

*2) Refer to the test report: 11306372M-B for Radiated emission (above 30 MHz).

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

This EUT provides stable voltage (DC 3.3 V and 1.8 V) constantly to RF transmitter regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the requirement.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

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

3.4 Uncertainty

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

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	1.5 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.4 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.5 dB
Bandwidth Measurement	0.66 %
Duty cycle and Time Measurement	0.012 %

3.5 Test Location

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
JAB Accreditation No. RTL02610

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
No.3 Semi-anechoic chamber	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.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

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

4.1 Operating Mode(s)

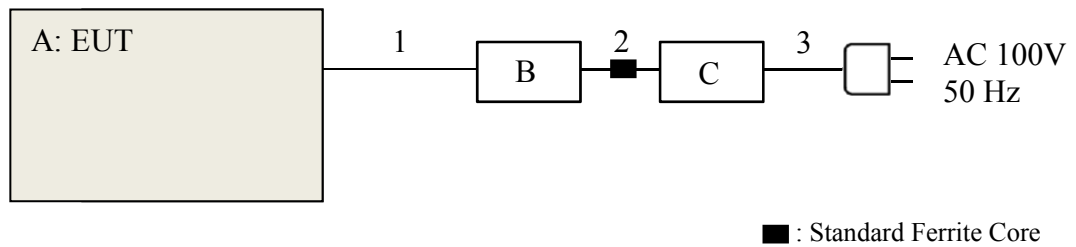
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*	Power setting
IEEE 802.11b (11b)	1 Mbps, PN9	13
IEEE 802.11g (11g)	6 Mbps, PN9	13
IEEE 802.11n SISO 20 MHz BW (11n-20)	MCS 0, PN9	13
IEEE 802.11n MIMO 20 MHz BW (11n-20)	MCS 8, PN9	13
Bluetooth Low Energy (BT LE)	PRBS9	7
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel) *Power of the EUT was set by the software: DutApiMimoBtFmBridgeEth.exe Version 2.0.0.75 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.		

*The details of Operating mode(s)

Test Item	Operating Mode	Tested Antenna	Tested frequency
Spurious Emission Maximum Peak Output Power Power Density	11b Tx	B	2412 MHz
	11g Tx		2437 MHz
			2462 MHz
	11n-20 Tx	A, B A&B (Simultaneously)	2412 MHz
			2437 MHz
			2462 MHz
	BT LE	B	2402 MHz, 2440 MHz, 2480 MHz
6 dB Bandwidth 99 % Occupied Bandwidth	11b Tx	B	2412 MHz
	11g Tx		2437 MHz
	11n-20 Tx		2462 MHz
	BT LE	B	2402 MHz, 2440 MHz, 2480 MHz

4.2 Configuration and peripherals



Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Paper	DPT-RP1	9002565	Sony Corporation	EUT
B	Laptop PC	7666-77J	LV-B8PZ8 08/05	Lenovo	-
C	AC Adaptor	92P1213	11S92P1213Z1ZDDZ92C2B0	Lenovo	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	1.0	Shielded	Shielded	-
2	DC	1.8	Unshielded	Unshielded	-
3	AC	1.0	Unshielded	Unshielded	-

SECTION 5: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Sample	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *5)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				

*1) Peak hold was applied as Worst-case measurement.
 *2) Reference data
 *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r05".
 *5) 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.
 (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

6dB Bandwidth

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 14, 2016
Temperature / Humidity	23 deg. C / 45 % RH
Engineer	Yosuke Ishikawa
Mode	Tx

SISO

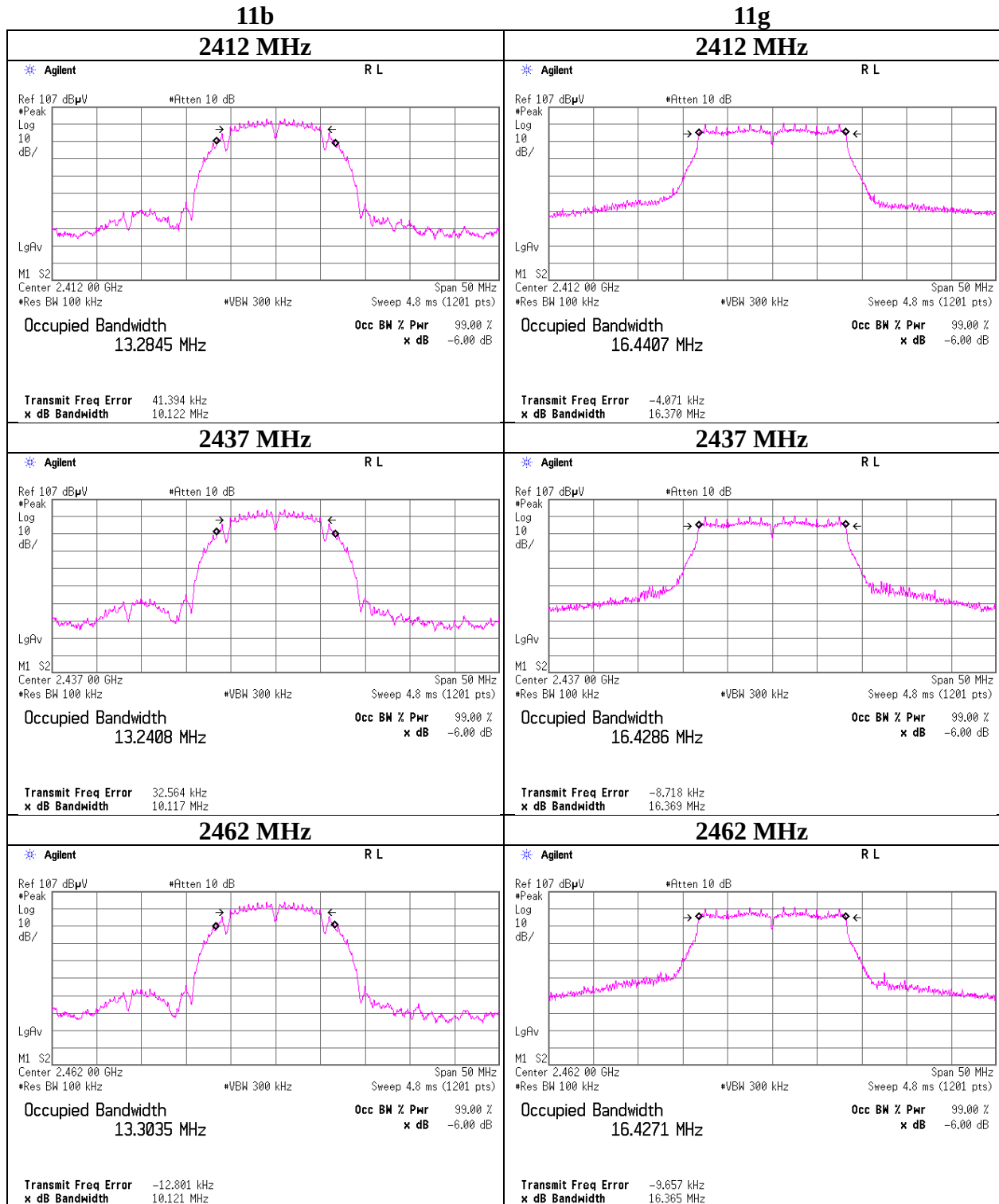
Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	10.122	> 500
	2437	10.117	> 500
	2462	10.121	> 500
11g	2412	16.370	> 500
	2437	16.369	> 500
	2462	16.365	> 500
11n-20	2412	17.275	> 500
	2437	17.490	> 500
	2462	17.482	> 500

MIMO

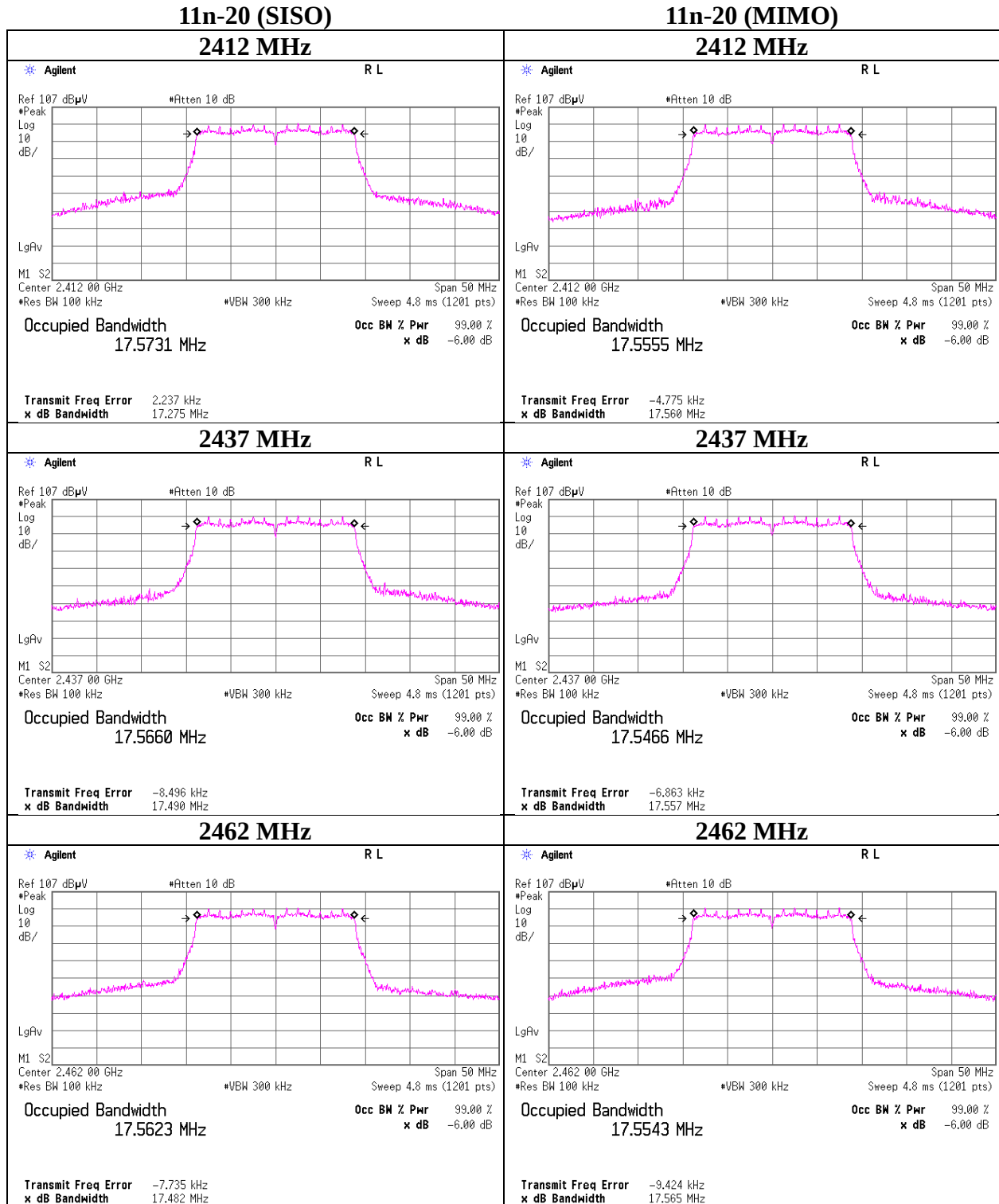
Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11n-20	2412	17.560	> 500
	2437	17.557	> 500
	2462	17.565	> 500

* The test was carried out by worst antenna port.

6dB Bandwidth



6dB Bandwidth



6dB Bandwidth

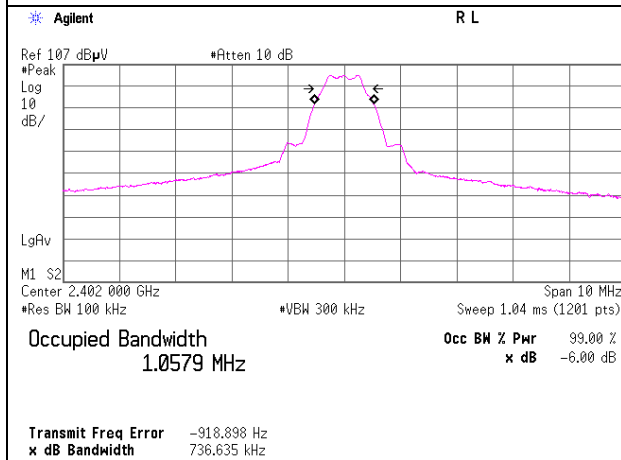
Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11306371S-B-R1
Date July 2, 2016
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
Tx	2402	0.737	> 500
	2440	0.733	> 500
	2480	0.739	> 500

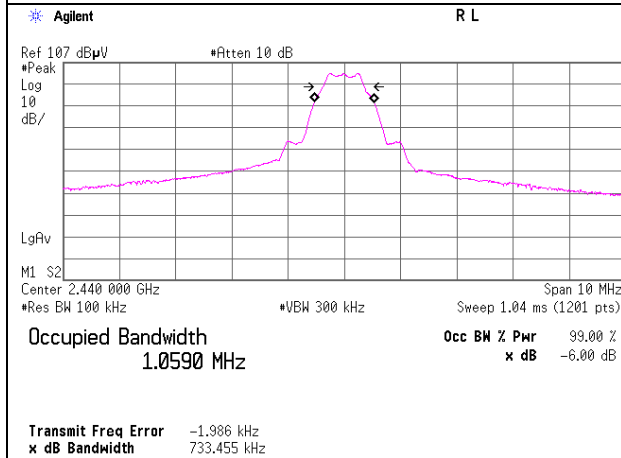
6dB Bandwidth

BT LE

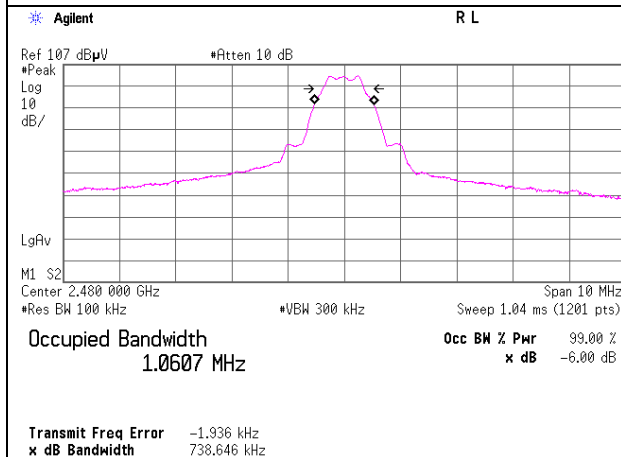
2402 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 4, 2016
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hikaru Shirasawa
Mode	Tx 11b

Antenna B

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	5.36	2.01	9.92	17.29	53.58	30.00	1000	12.71
2437	5.65	2.05	9.92	17.62	57.81	30.00	1000	12.38
2462	5.70	2.04	9.92	17.66	58.34	30.00	1000	12.34

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Antenna A, 2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	4.61	
2	4.60	
5.5	3.56	
11	4.13	

Antenna B, 2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	5.65	*
2	5.59	
5.5	4.65	
11	5.17	

*: Worst Rate

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

Maximum Peak Output Power

Test place : Shonan EMC Lab. No.6 Shielded Room
Report No. : 11306371S-B-R1
Date : June 4, 2016
Temperature / Humidity : 23 deg. C / 40 % RH
Engineer : Hikaru Shirasawa
Mode : Tx 11g

Antenna B

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	12.65	2.01	9.92	24.58	287.08	30.00	1000	5.42
2437	12.48	2.05	9.92	24.45	278.61	30.00	1000	5.55
2462	12.35	2.04	9.92	24.31	269.77	30.00	1000	5.69

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Antenna A, 2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	11.63	
9	10.88	
12	11.95	
18	10.57	
24	11.13	
36	11.17	
48	10.68	
54	10.19	

Antenna B, 2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	12.48	*
9	11.89	
12	12.13	
18	11.12	
24	11.39	
36	10.82	
48	10.64	
54	10.37	

*: Worst Rate

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

Maximum Peak Output Power

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 4, 2016
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hikaru Shirasawa
Mode	Tx 11n-20 (SISO)

Antenna B

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	11.69	2.01	9.92	23.62	230.14	30.00	1000	6.38
2437	11.74	2.05	9.92	23.71	234.96	30.00	1000	6.29
2462	11.55	2.04	9.92	23.51	224.39	30.00	1000	6.49

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Antenna A, 2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	11.52	
9	11.51	
12	11.49	
18	11.17	
24	11.19	
36	10.78	
48	10.84	
54	10.48	

Antenna B, 2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	11.74	*
9	11.15	
12	11.06	
18	11.26	
24	11.15	
36	10.55	
48	10.42	
54	10.72	

*: Worst Rate

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

Maximum Peak Output Power

Test place : Shonan EMC Lab. No.6 Shielded Room
Report No. : 11306371S-B-R1
Date : June 6, 2016
Temperature / Humidity : 23 deg. C / 45 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx 11n-20 (MIMO)

Antenna A+B

Freq. [MHz]	Antenna 1 Result [mW]	Antenna 2 Result [mW]	Result		Limit		Margin [dB]
			[dBm]	[mW]	[dBm]	[mW]	
2412	210.86	224.39	26.39	435.25	30.00	1000	3.61
2437	215.77	227.51	26.47	443.28	30.00	1000	3.53
2462	361.41	389.94	28.76	751.35	30.00	1000	1.24

Sample Calculation:

Result = Antenna A+B

Antenna A

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	11.31	2.01	9.92	23.24	210.86	30.00	1000	6.76
2437	11.37	2.05	9.92	23.34	215.77	30.00	1000	6.66
2462	13.62	2.04	9.92	25.58	361.41	30.00	1000	4.42

Antenna B

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	11.58	2.01	9.92	23.51	224.39	30.00	1000	6.49
2437	11.60	2.05	9.92	23.57	227.51	30.00	1000	6.43
2462	13.95	2.04	9.92	25.91	389.94	30.00	1000	4.09

Sample Calculation:

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

*The equipment and cables were not used for factor 0.0 dB of the data sheets.

2437 MHz

MCS Number	Reading Antenna A		Reading Antenna B		Reading Antenna A+B		Remark
	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
8	11.37	13.71	11.60	14.45	14.50	28.16	*
9	10.76	11.91	11.60	14.45	14.21	26.36	
10	11.31	13.52	11.33	13.58	14.33	27.10	
11	11.09	12.85	11.60	14.45	14.36	27.30	
12	10.58	11.43	11.18	13.12	13.90	24.55	
13	10.46	11.12	11.49	14.09	14.02	25.21	
14	10.88	12.25	11.87	15.38	14.41	27.63	
15	10.48	11.17	11.32	13.55	13.93	24.72	

* Worst MCS

Maximum Peak Output Power

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11306371S-B-R1
Date July 2, 2016
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-4.38	2.00	9.92	7.54	5.68	30.00	1000	22.46
2440	-4.56	2.05	9.92	7.41	5.51	30.00	1000	22.59
2480	-4.72	2.04	9.92	7.24	5.30	30.00	1000	22.76

Sample Calculation:

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

Average Output Power (Reference data for SAR testing)

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 4, 2016
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hikaru Shirasawa
Mode	Tx (SISO)

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	2.38	2.01	9.92	14.31	26.98	0.01	14.32	27.04
2437	2.72	2.05	9.92	14.69	29.44	0.01	14.70	29.51
2462	2.76	2.04	9.92	14.72	29.65	0.01	14.73	29.72

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	1.01	2.01	9.92	12.94	19.68	0.22	13.16	20.70
2437	0.88	2.05	9.92	12.85	19.28	0.22	13.07	20.28
2462	0.95	2.04	9.92	12.91	19.54	0.22	13.13	20.56

11n-20 MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	0.84	2.01	9.92	12.77	18.92	0.25	13.02	20.04
2437	0.84	2.05	9.92	12.81	19.10	0.25	13.06	20.23
2462	0.96	2.04	9.92	12.92	19.59	0.25	13.17	20.75

Sample Calculation:

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

Result (Burst power average) = Frame power + Duty factor

Average Output Power
(Reference data for SAR testing)

Test place : Shonan EMC Lab. No.6 Shielded Room
Report No. : 11306371S-B-R1
Date : June 6, 2016
Temperature / Humidity : 23 deg. C / 45 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx (MIMO)

11n-20 MCS0

Freq. [MHz]	Reading Antenna A [dBm]	Reading Antenna B [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
					[dBm]	[mW]
2412	1.07	1.21	2.01	9.92	16.08	40.56
2437	0.60	1.64	2.05	9.92	16.13	41.03
2462	1.01	2.10	2.04	9.92	16.56	45.28

Sample Calculation:

Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuat

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power (Reference data for SAR testing)

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 4, 2016
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hikaru Shirasawa
Mode	Tx

11b, 2437 MHz

Mode	Rate Mbps	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
Antenna A	1	1.51	0.01	1.52	
	2	1.49	0.03	1.52	
	5.5	0.34	0.19	0.53	
	11	0.77	0.30	1.07	
Antenna B	1	2.72	0.01	2.73	*
	2	2.63	0.03	2.66	
	5.5	1.54	0.19	1.73	
	11	1.95	0.30	2.25	

* Worst rate

11g, 2437 MHz

Mode	Rate Mbps	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
Antenna A	6	0.37	0.22	0.59	
	9	0.31	0.34	0.65	
	12	0.27	0.42	0.69	
	18	0.16	0.55	0.71	
	24	0.01	0.68	0.69	
	36	-0.24	0.94	0.70	
	48	-0.46	1.09	0.63	
	54	-1.09	1.18	0.09	
Antenna B	6	0.88	0.22	1.10	*
	9	0.75	0.34	1.09	
	12	0.67	0.42	1.09	
	18	0.50	0.55	1.05	
	24	0.37	0.68	1.05	
	36	0.14	0.94	1.08	
	48	-0.36	1.09	0.73	
	54	-0.60	1.18	0.58	

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

Average Output Power (Reference data for SAR testing)

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 4, 2016
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hikaru Shirasawa
Mode	Tx (SISO)

11n-20, 2437 MHz

Mode	Rate MCS	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
Antenna A	0	0.46	0.25	0.71	
	1	0.27	0.45	0.72	
	2	0.18	0.53	0.71	
	3	-0.07	0.70	0.63	
	4	-0.27	0.79	0.52	
	5	-0.39	1.00	0.61	
	6	-0.55	1.05	0.50	
	7	-0.54	1.12	0.58	
Antenna B	0	0.84	0.25	1.09	*
	1	0.63	0.45	1.08	
	2	0.48	0.53	1.01	
	3	0.28	0.70	0.98	
	4	-0.03	0.79	0.76	
	5	-0.32	1.00	0.68	
	6	-0.32	1.05	0.73	
	7	-0.38	1.12	0.74	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

Average Output Power
(Reference data for SAR testing)

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 6, 2016
Temperature / Humidity	23 deg. C / 45 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx (MIMO)

11n-20, 2437 MHz

MCS Number	Reading Antenna A		Reading Antenna B		Reading Antenna A+B		Remark
	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
8	0.60	1.15	1.64	1.46	4.17	2.61	*
9	0.50	1.12	1.09	1.29	3.82	2.41	
10	0.55	1.14	1.18	1.31	3.89	2.45	
11	0.70	1.17	1.33	1.36	4.03	2.53	
12	0.87	1.22	1.27	1.34	4.08	2.56	
13	0.74	1.19	1.27	1.34	4.03	2.53	
14	0.92	1.24	1.27	1.34	4.12	2.58	
15	0.86	1.22	1.21	1.32	4.05	2.54	

* Worst MCS

Average Output Power
(Reference data for SAR testing)

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11306371S-B-R1
Date July 2, 2016
Temperature / Humidity 25 deg. C / 1 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-6.74	2.00	9.92	5.18	3.30	2.00	7.18	5.22
2440	-6.90	2.05	9.92	5.07	3.21	2.00	7.07	5.09
2480	-7.08	2.04	9.92	4.88	3.08	2.00	6.88	4.88

Sample Calculation:

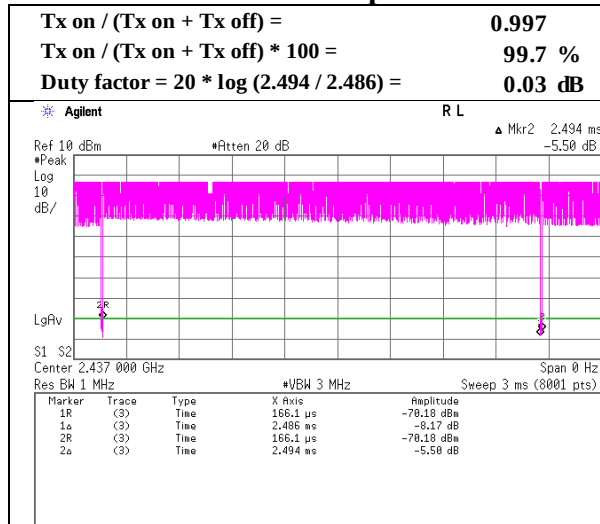
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

Result (Burst power average) = Frame power + Duty factor

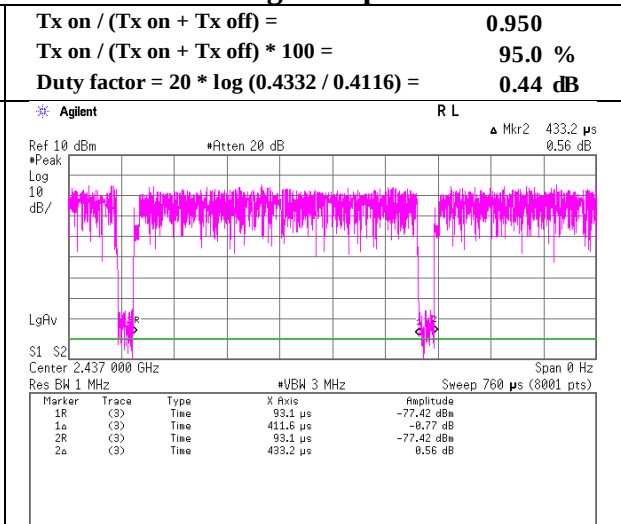
Burst rate confirmation

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 4, 2016
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hikaru Shirasawa
Mode	Tx

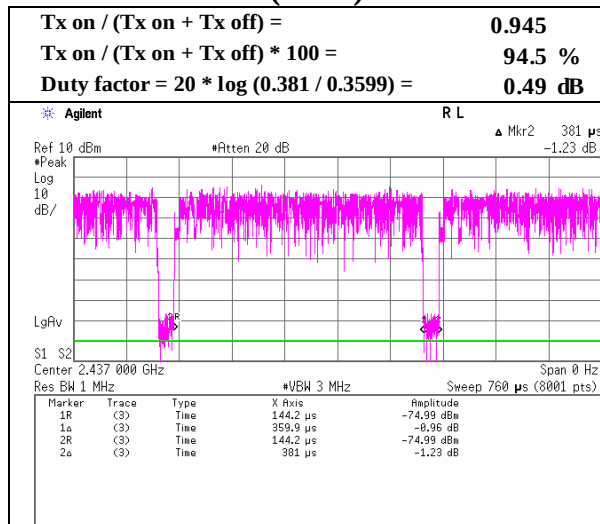
11b 1 Mbps



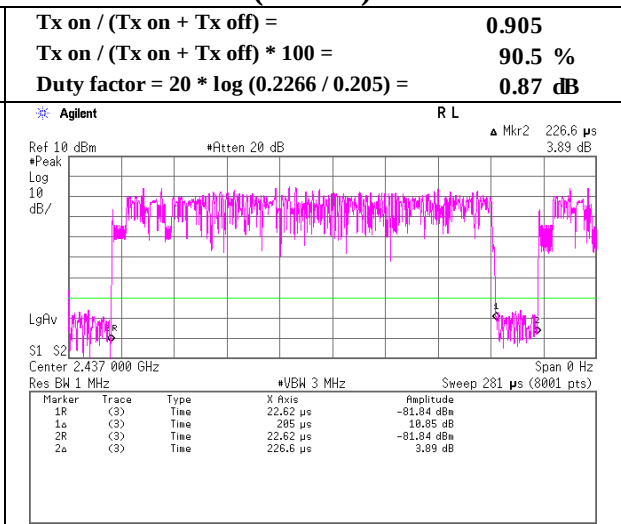
11g 6 Mbps



11n-20 (SISO) MCS 0



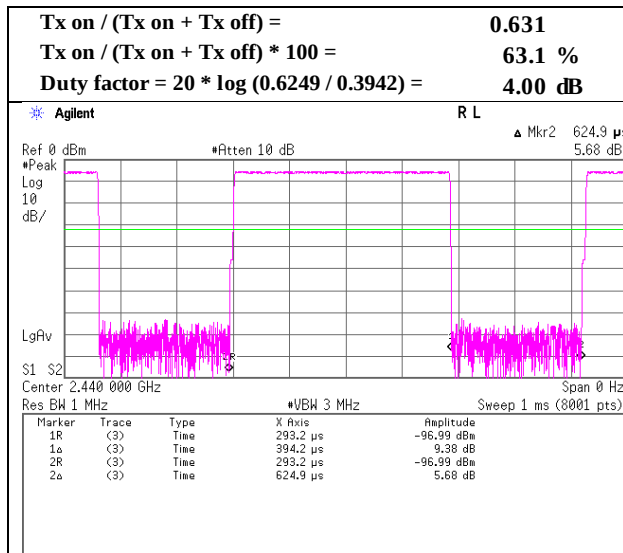
11n-20 (MIMO) MCS 8



Burst rate confirmation

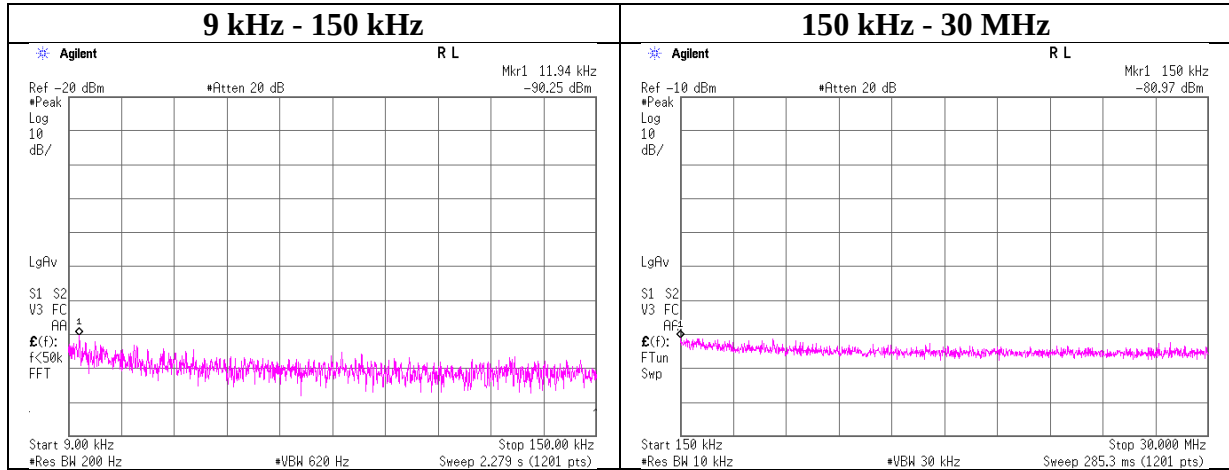
Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11306371S-B-R1
Date July 2, 2016
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

BT LE



Conducted Spurious Emission

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 14, 2016
Temperature / Humidity	23 deg. C / 45 % RH
Engineer	Yosuke Ishikawa
Mode	Tx 11n-20 (MIMO) 2472 MHz



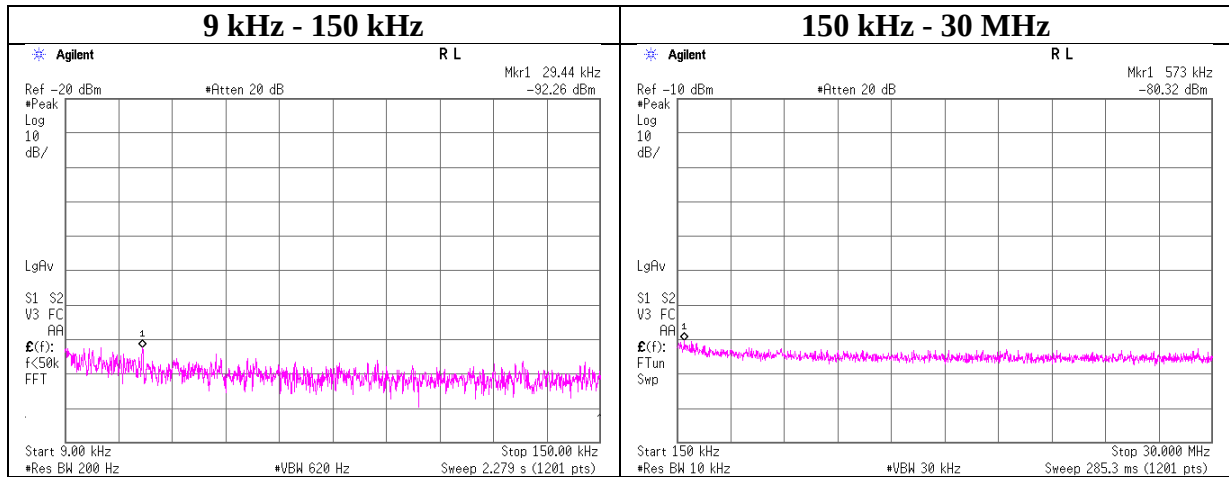
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.94	-90.25	0.01	9.84	3.8	2	-73.6	300	6.0	-12.4	46.0	58.4	
150.00	-80.97	0.01	9.44	3.8	2	-64.8	300	6.0	-3.5	24.0	27.5	

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

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

Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11306371S-B-R1
Date	July 2, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx BT LE 2402 MHz



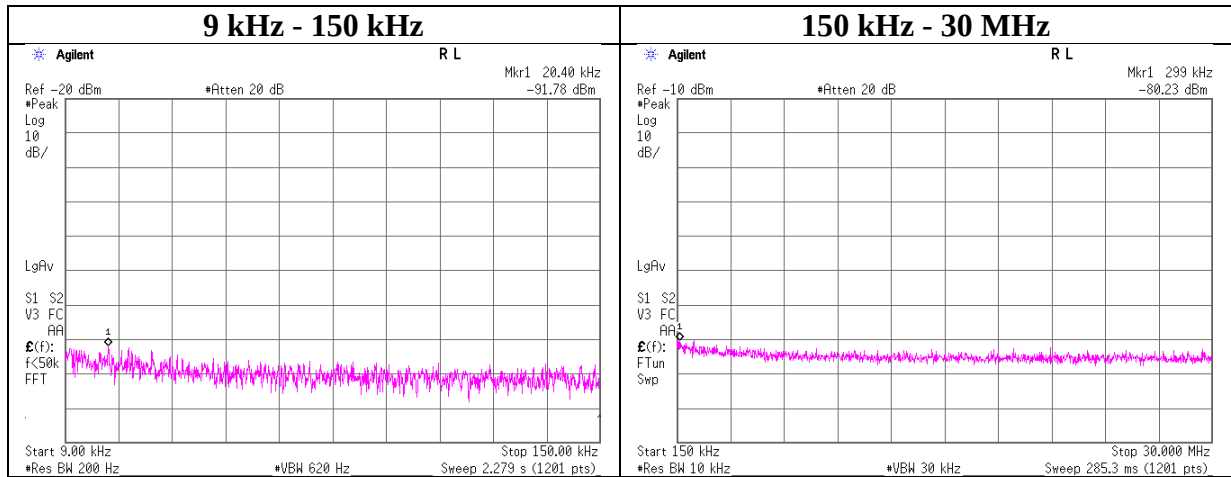
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
29.44	-92.26	0.01	9.84	2.5	2	-76.9	300	6.0	-15.6	38.2	53.8	
573.00	-80.32	0.02	9.84	2.5	2	-65.0	30	6.0	16.3	32.4	16.1	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenuator Loss + Antenna Gain + 10 * log (N)

Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11306371S-B-R1
Date	July 2, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx BT LE 2440 MHz



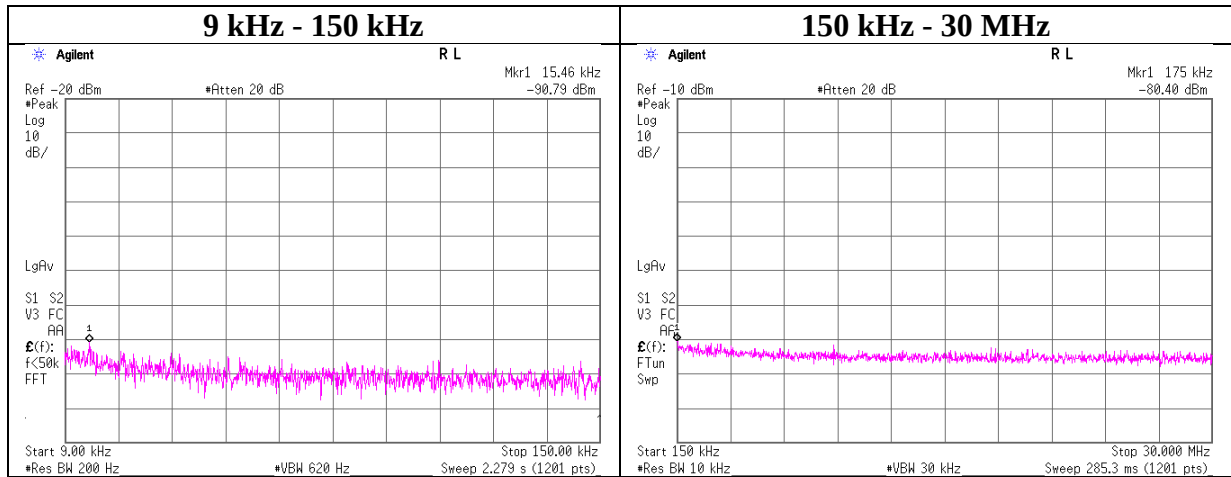
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
20.40	-91.78	0.01	9.84	2.5	2	-76.4	300	6.0	-15.2	41.4	56.6	
299.00	-80.23	0.01	9.84	2.5	2	-64.9	300	6.0	-3.6	18.0	21.6	

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

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

Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11306371S-B-R1
Date	July 2, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx BT LE 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
15.46	-90.79	0.01	9.84	2.5	2	-75.4	300	6.0	-14.2	43.8	58.0	
175.00	-80.40	0.01	9.84	2.5	2	-65.0	300	6.0	-3.8	22.7	26.5	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenuator Loss + Antenna Gain + 10 * log (N)

Power Density

Test place Shonan EMC Lab. No.6 Shielded Room
Report No. 11306371S-B-R1
Date June 14, 2016
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Yosuke Ishikawa
Mode Tx

11b Antenna B

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-21.45	2.01	9.92	-9.52	8.00	17.52
2437	-20.62	2.05	9.92	-8.65	8.00	16.65
2462	-20.50	2.04	9.92	-8.54	8.00	16.54

11g Antenna B

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-24.51	2.01	9.92	-12.58	8.00	20.58
2437	-24.42	2.05	9.92	-12.45	8.00	20.45
2462	-24.09	2.04	9.92	-12.13	8.00	20.13

11n-20 Antenna B

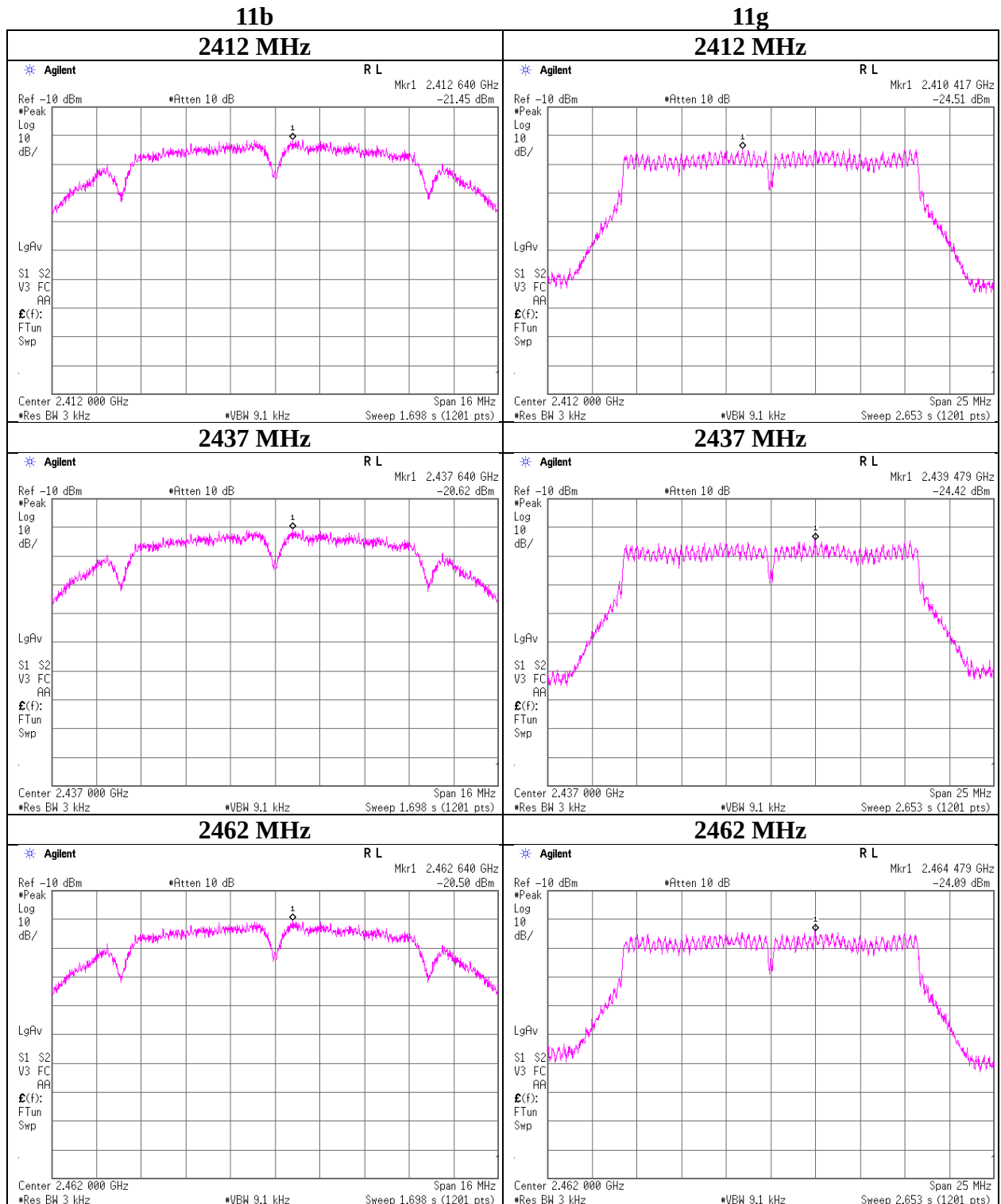
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-24.23	2.01	9.92	-12.30	8.00	20.30
2437	-24.20	2.05	9.92	-12.23	8.00	20.23
2462	-23.82	2.04	9.92	-11.86	8.00	19.86

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density



UL Japan, Inc.

Shonan EMC Lab.

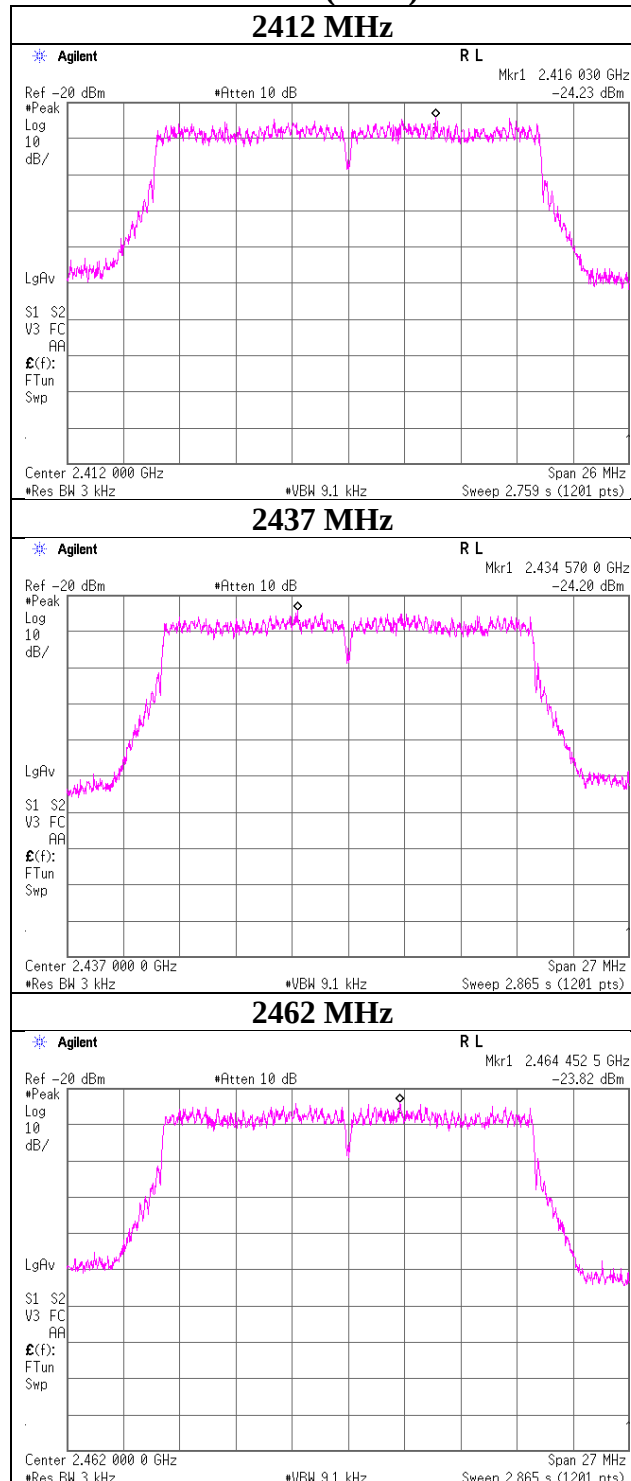
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Power Density

11n-20 (SISO)



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

Power Density

Test place	Shonan EMC Lab. No.6 Shielded Room
Report No.	11306371S-B-R1
Date	June 14, 2016
Temperature / Humidity	23 deg. C / 45 % RH
Engineer	Yosuke Ishikawa
Mode	Tx 11n-20 (MIMO)

Antenna A+B

Freq. [MHz]	Antenna A Result [mW]	Antenna B Result [mW]	Result		Limit	Margin
			[dBm]	[mW]	[dBm]	[dB]
2412	0.05	0.05	-9.84	0.10	8.00	17.84
2437	0.05	0.07	-9.34	0.12	8.00	17.34
2462	0.05	0.06	-9.75	0.11	8.00	17.75

Sample Calculation:

Result = Antenna A+B

Antenna A

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit	Margin
				[dBm]	[mW]	[dBm]	[dB]
2412	-24.77	2.01	9.92	-12.84	0.05	8.00	20.84
2437	-25.13	2.05	9.92	-13.16	0.05	8.00	21.16
2462	-25.04	2.04	9.92	-13.08	0.05	8.00	21.08

Antenna B

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit	Margin
				[dBm]	[mW]	[dBm]	[dB]
2412	-24.79	2.01	9.92	-12.86	0.05	8.00	20.86
2437	-23.63	2.05	9.92	-11.66	0.07	8.00	19.66
2462	-24.42	2.04	9.92	-12.46	0.06	8.00	20.46

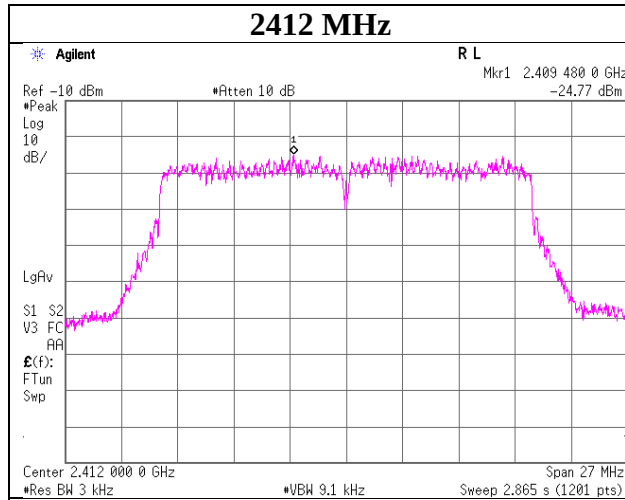
Sample Calculation:

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

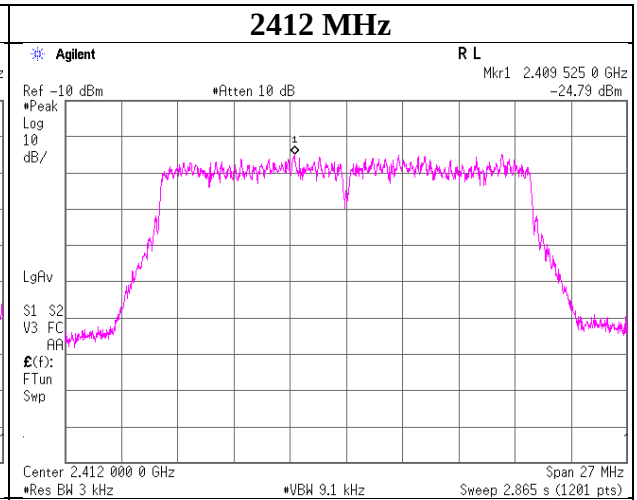
*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density

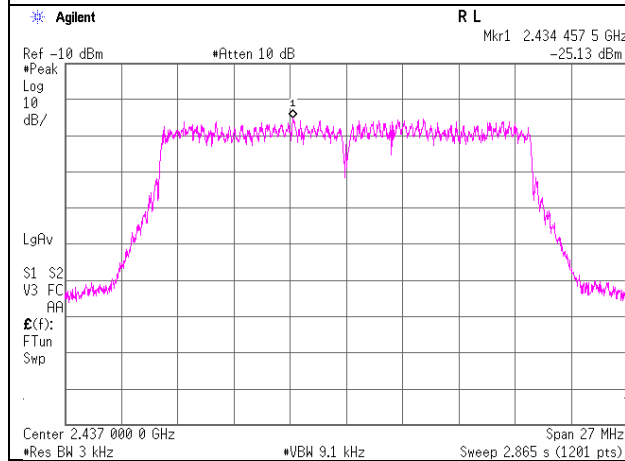
11n-20 Antenna A



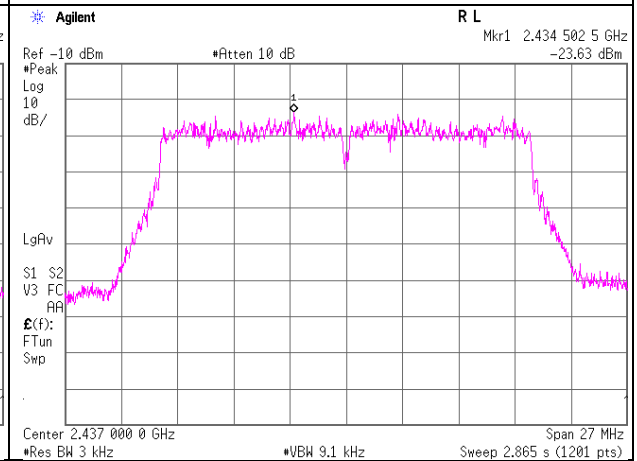
11n-20 Antenna B



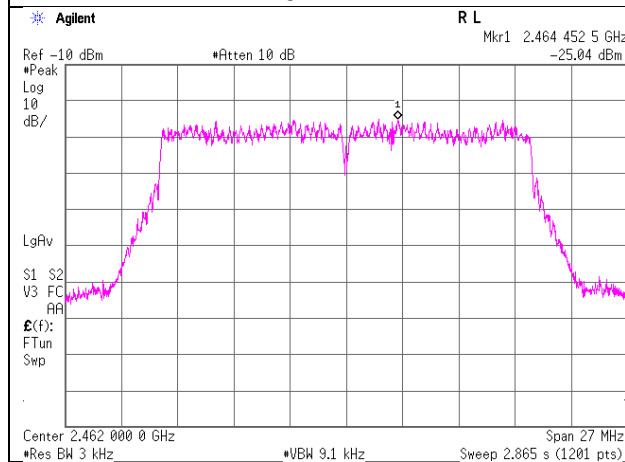
2437 MHz



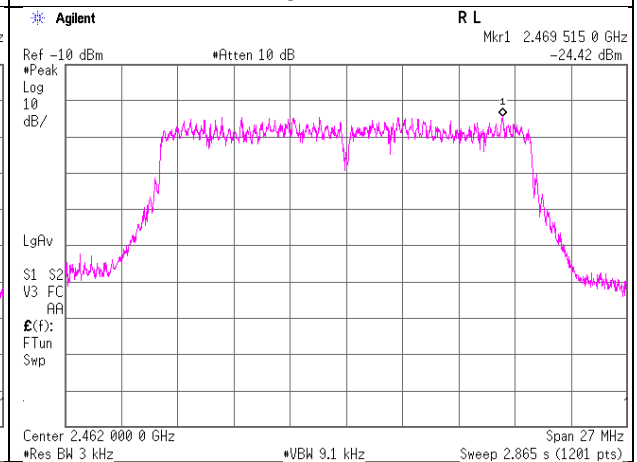
2437 MHz



2462 MHz



2462 MHz



Power Density

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11306371S-B-R1
Date July 2, 2016
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Hiroyuki Morikawa
Mode Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402	-20.00	2.00	9.92	-8.08	8.00	16.08
2440	-20.14	2.05	9.92	-8.17	8.00	16.17
2480	-20.41	2.04	9.92	-8.45	8.00	16.45

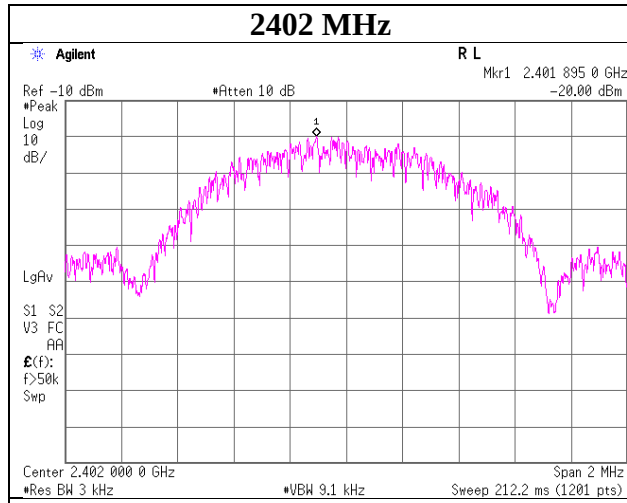
Sample Calculation:

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

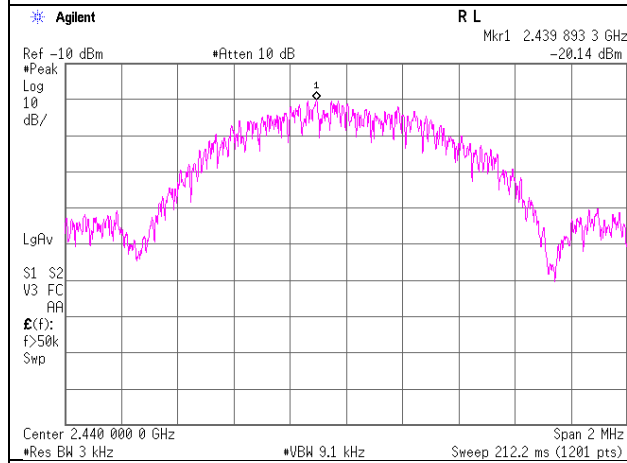
Power Density

BT LE

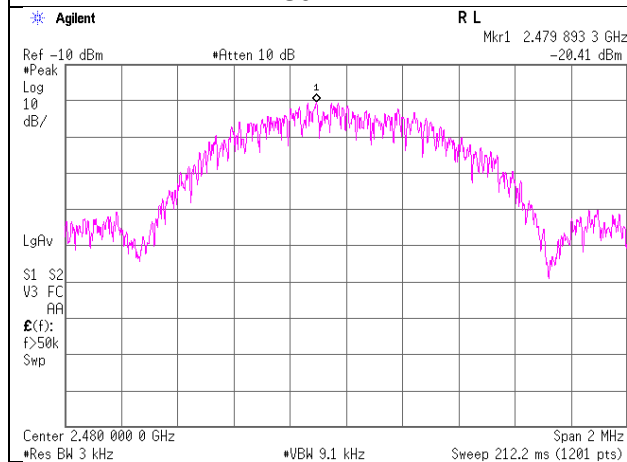
2402 MHz



2440 MHz

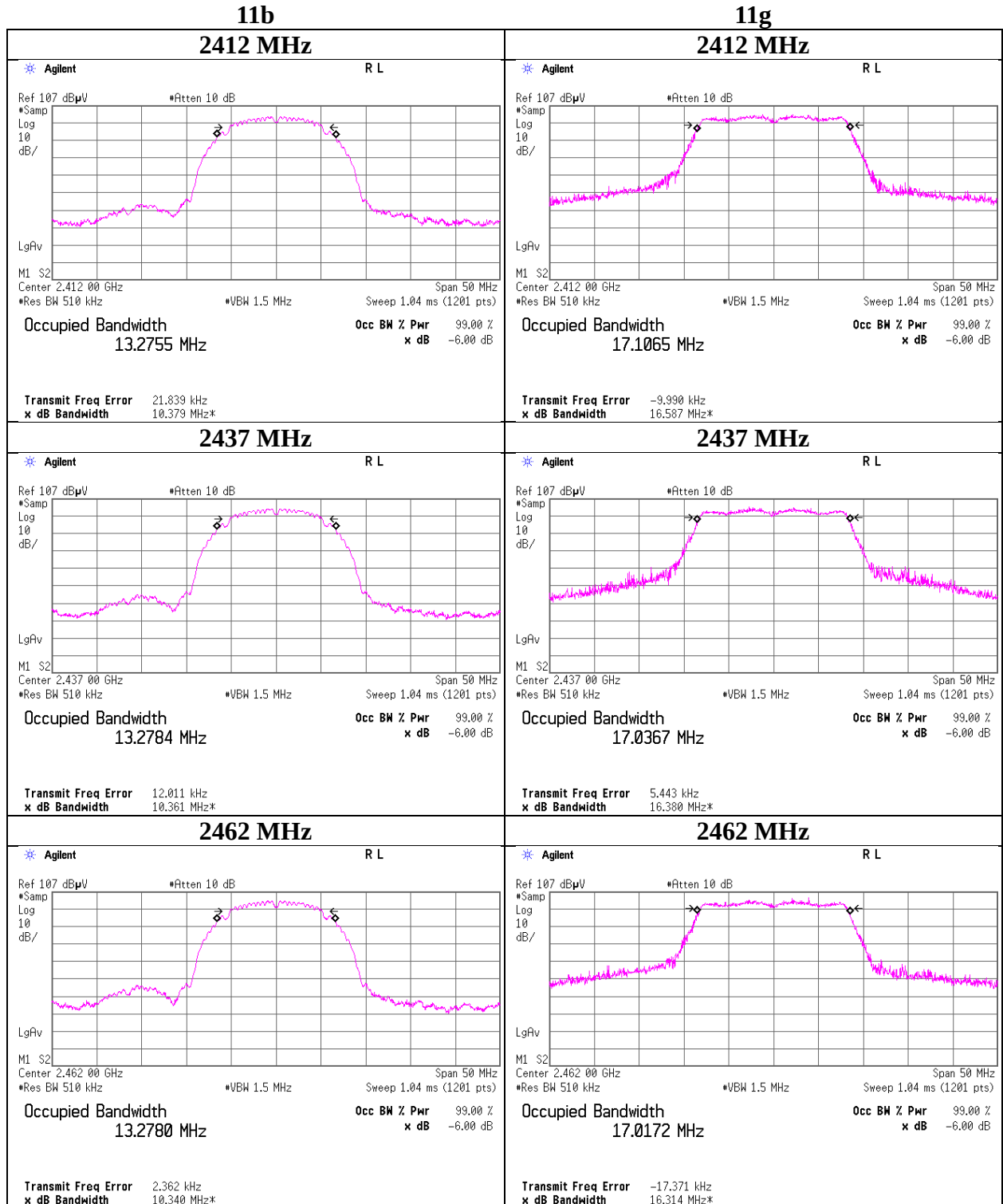


2480 MHz



99%Occupied Bandwidth

Test place Shonan EMC Lab. No.6 Shielded Room
Report No. 11306371S-B-R1
Date June 14, 2016
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Yosuke Ishikawa
Mode Tx

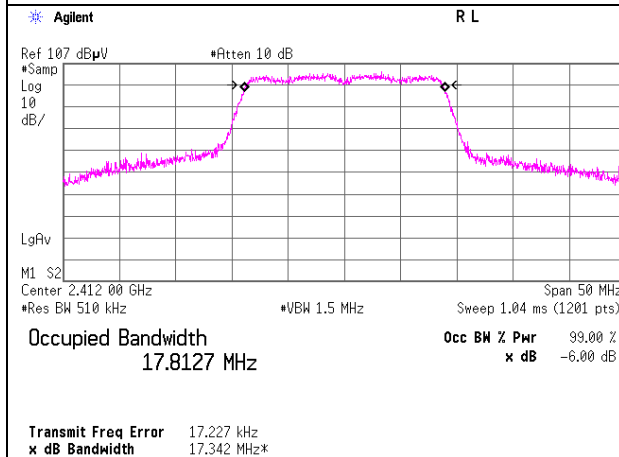


99% Occupied Bandwidth

Test place : Shonan EMC Lab. No.6 Shielded Room
Report No. : 11306371S-B-R1
Date : June 14, 2016
Temperature / Humidity : 23 deg. C / 45 % RH
Engineer : Yosuke Ishikawa
Mode : Tx

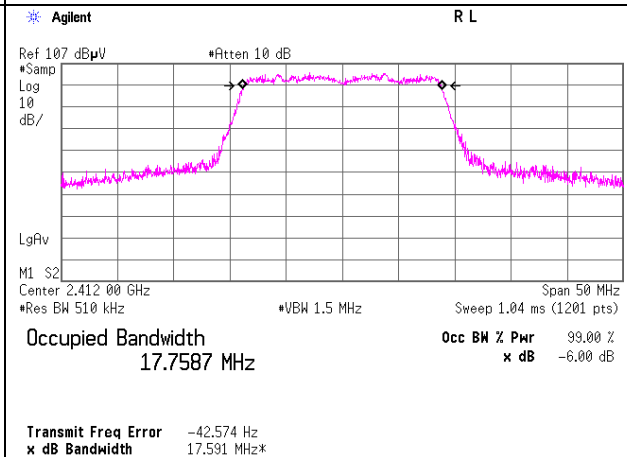
11n-20 (SISO)

2412 MHz

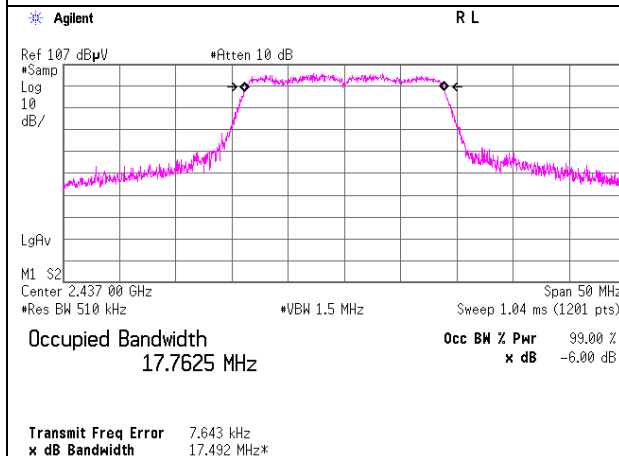


11n-20 (MIMO)

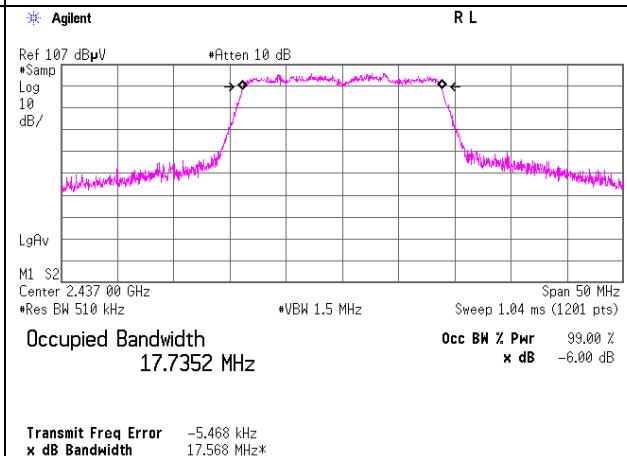
2412 MHz



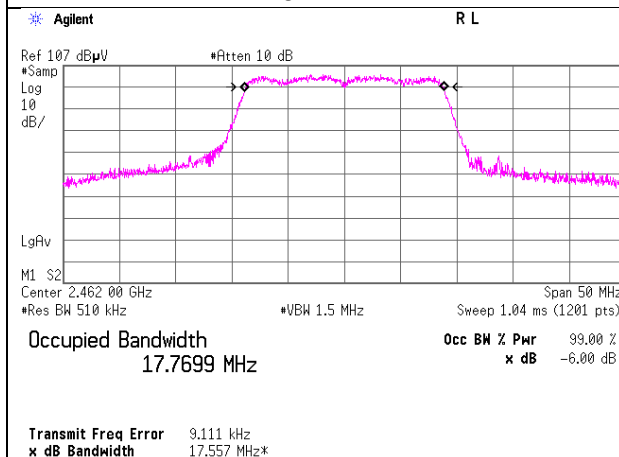
2437 MHz



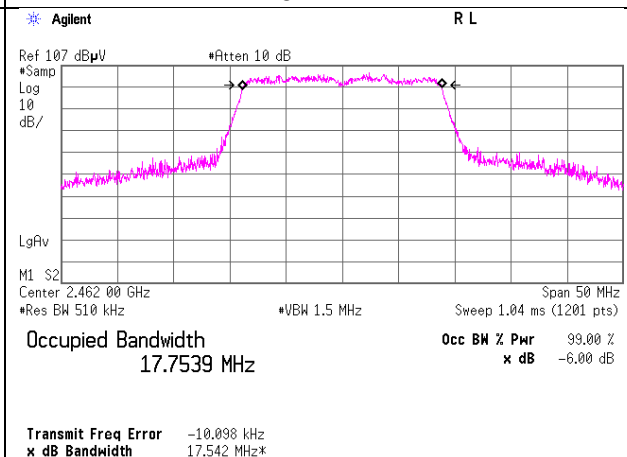
2437 MHz



2462 MHz



2462 MHz

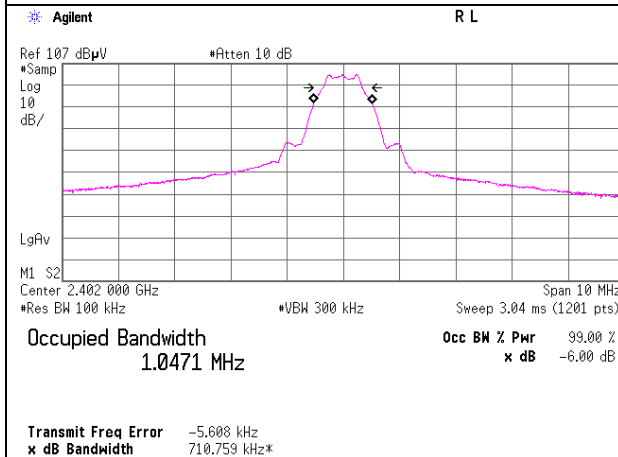


99% Occupied Bandwidth

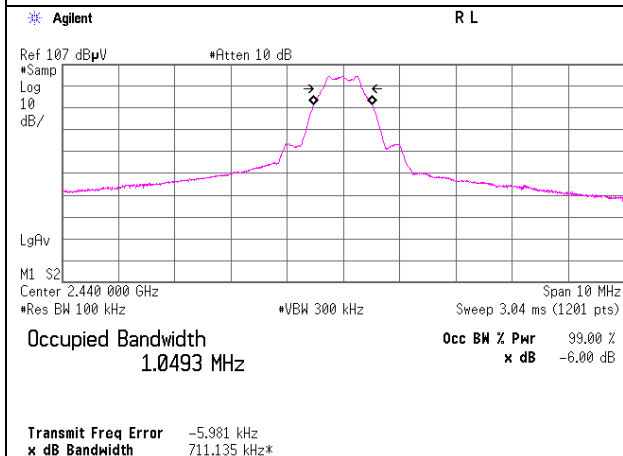
Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11306371S-B-R1
Date : July 2, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx BT LE

BT LE

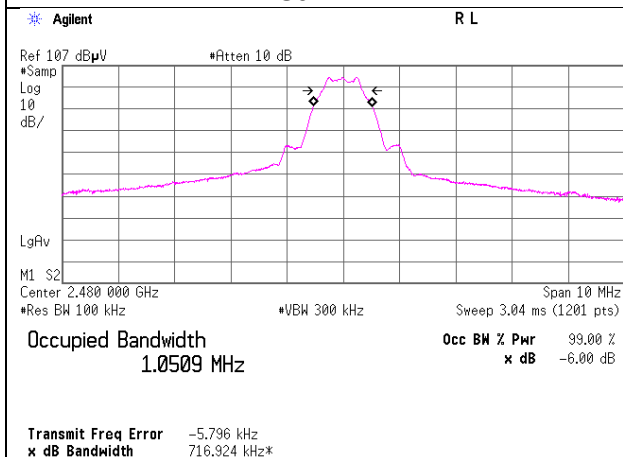
2402 MHz



2440 MHz



2480 MHz



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

APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2016/04/01 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2016/04/01 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY4618052 5	AT	2016/03/28 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2016/04/18 * 12
SCC-G31	Coaxial Cable	Junkosha	MWX241-0100 0KMSKMS	OCT-08-13- 046	AT	2016/04/18 * 12
SOS-10	Humidity Indicator	A&D	AD-5681	4064561	AT	2015/10/22 * 12
STS-06	Digital Hitester	Hioki	3805-50	080997830	AT	2016/03/22 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2016/04/04 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2016/04/04 * 12
STM-G4	Terminator	Weinschel	M1459A	U6592	AT	2015/07/14 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2015/12/07 * 12

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

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

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

Test Item: AT: Antenna Terminal Conducted test