



# RADIO TEST REPORT

**Test Report No. : 12258310S-A-R2**

**Applicant** : PIONEER CORPORATION  
**Type of Equipment** : Car Audio with Bluetooth / WLAN  
**Model No.** : PVH-3668  
(\* WLAN part)  
**FCC ID** : AJDK107  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**Test Result** : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
7. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
8. This report is a revised version of 12258310S-A-R1. 12258310S-A-R1 is replaced with this report.

**Date of test:** April 23 to May 5, 2018

**Representative test engineer:**

*T. Suzuki*

Takahiro Suzuki  
Engineer

Consumer Technology Division

**Approved by:**

*H. Shirasawa*

Hikaru Shirasawa  
Engineer  
Consumer Technology Division



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

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## **SECTION 1: Customer information**

Company Name : PIONEER CORPORATION  
Address : 25-1, Yamada, Kawagoe-shi, Saitama, 350-8555, JAPAN  
Telephone Number : +81-49-228-7791  
Facsimile Number : +81-49-228-6493  
Contact Person : Masahiro Sato

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

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

Type of Equipment : Car Audio with Bluetooth / WLAN  
Model No. : PVH-3668  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 13.2 V(car battery)  
Receipt Date of Sample : April 20, 2018  
Country of Mass-production : Thailand  
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: PVH-3668 (referred to as the EUT in this report) is a Car Audio with Bluetooth / WLAN.

### **General Specification**

Clock frequency(ies) in the system : 49.5 MHz (WLAN/BT combo Module Communication)

### **Radio Specification**

#### **Bluetooth Ver4.1+EDR**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz- 2480 MHz  
Modulation : GFSK,  $\pi/4$ DQPSK, 8DPSK  
Power Supply (radio part input) : DC 3.3 V / 1.8 V  
Antenna type : Pattern inverted F type  
Antenna Gain : -12.23 dBi (max)  
Operating Temperature : -20 deg. C- +65 deg. C

#### **WLAN (IEEE802.11b/g/n-20)**

Radio Type : Transceiver  
Frequency of Operation : 2412 MHz- 2462 MHz  
Modulation : DSSS/CCK, OFDM  
Power Supply (inner) : DC 3.3 V / 1.8 V  
Antenna type : Pattern inverted F type  
Antenna Gain : -12.23 dBi (max)  
Operating Temperature : -20 deg. C- +65 deg. C

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## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

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

### **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	N/A	N/A	N/A *1)
6 dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(e) ----- IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: RSS-Gen 6.13	FCC: Section15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	3.5 dB 1056.009 MHz, AV, Vert. Tx 11n20 2437 MHz	Complied#	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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

\*1) The test is not applicable since the EUT does not have AC power ports.

\*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

#### **FCC Part 15.31 (e)**

The equipment provides the wireless transmitter with stable power supply (DC 3.3 V / 1.8 V).

Instead of a new battery, DC power supply (DC 13.2 V) was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

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. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.3 Addition to standard

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

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

### 3.4 Uncertainty

#### EMI

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

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Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.9 dB	4.8 dB	4.9 dB	-	-
	200 MHz-1 GHz	6.1 dB	6.1 dB	6.1 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-13 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

### 3.5 Test Location

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JAB Accreditation No. RTL02610  
FCC Test Firm Registration Number: 839876

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	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
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.

## **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.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n HT20 (11n-20)	MCS 4 (Short GI), PN9
*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 as follows; Power settings: Fixed Software: SYSTEM SOFTWARE 1.001300 *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)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Spurious Emission	Transmitting (Tx), 11b	2412 MHz
	Transmitting (Tx), 11g	2437 MHz
	Transmitting (Tx), 11n-20	2462 MHz
6 dB Bandwidth Maximum Peak Output Power Power Density 99 % Occupied Bandwidth	Transmitting (Tx), 11b	2412 MHz
	Transmitting (Tx), 11g	2437 MHz
	Transmitting (Tx), 11n-20	2462 MHz

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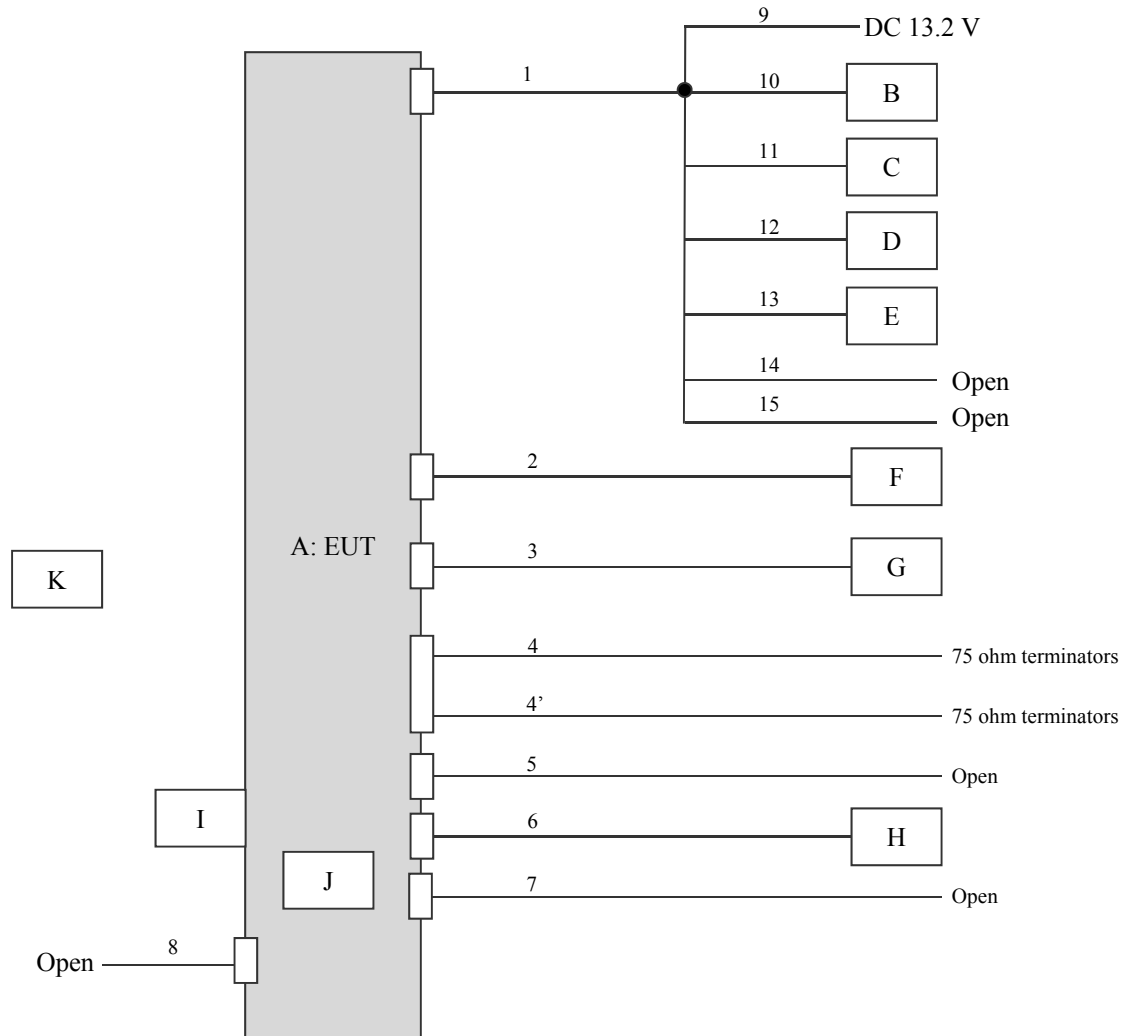
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## 4.2 Configuration and peripherals



\* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

**Description of EUT and Support equipment**

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Audio with Bluetooth	PVH-3668ZT	RDTM900003ME *1) RDTM900004ME *2)	PIONEER	EUT
B	Speaker	LV-002	S11014200775	L&V	-
C	Speaker	LV-002	S11014200775	L&V	-
D	Speaker	LV-002	S11014200773	L&V	-
E	Speaker	LV-002	S11014200773	L&V	-
F	Steering SW	-	-	-	-
G	Rear Camera	-	-	-	-
H	USB Memory	USM4GL-W	-	SONY	-
I	USB Memory	RUF2-KR8GA-WH	N3033	Buffalo	-
J	SD Card	SD-K04G	1146UK9398C	TOSHIBA	-
K	Remote control	CXE5722	-	-	-

\*1) Used for Radiated Emission test

\*2) Used for Antenna Terminal conducted test

**List of cables used**

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Wire Harness Set	0.6	Unshielded	Unshielded	-
2	Wire Harness Set	1.0	Unshielded	Unshielded	-
3	Wire Harness Set	1.0	Unshielded	Unshielded	-
4, 4'	Radio antenna	0.2 + 2.0	Shielded	Shielded	-
5	HDMI for RSE	0.4 + 1.8	Shielded	Shielded	-
6	USB	0.8	Shielded	Shielded	-
7	Steering Sensor	2.8	Unshielded	Unshielded	-
8	HDMI Input	1.0	Shielded	Shielded	-
9	DC	2.5	Unshielded	Unshielded	-
10	Speaker	2.0	Unshielded	Unshielded	-
11	Speaker	2.0	Unshielded	Unshielded	-
12	Speaker	2.0	Unshielded	Unshielded	-
13	Speaker	2.0	Unshielded	Unshielded	-
14	Signal	1.0	Unshielded	Unshielded	-
15	Signal	1.0	Unshielded	Unshielded	-

## **SECTION 5: Radiated Spurious Emission**

### **Test Procedure**

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

### **Test Antennas are used as below;**

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

### **20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3.88 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.88 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)

\*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

\*2) Distance Factor:  $20 \times \log(3.88 \text{ m} / 3.0 \text{ m}) = 2.23 \text{ dB}$

\*3) Distance Factor:  $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

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The carrier level and noise levels were confirmed at angle of 0 deg. to 30 deg. based on the product specification to see the position of maximum noise, and the test was made at the position that has the maximum noise.

**Combinations of the worst case**

Antenna polarization	Frequency	Spurious				
		Below 1 GHz	1 GHz – 2.8 GHz	2.8 GHz – 13 GHz	13 GHz-18 GHz	18 GHz-26.5 GHz
Horizontal		0 deg.	0 deg.	30 deg.	0 deg.	0 deg.
Vertical		0 deg.	0 deg.	30 deg.	0 deg.	0 deg.

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

**Measurement range** : 30 MHz - 26.5 GHz  
**Test data** : APPENDIX  
**Test result** : Pass

## **SECTION 6: Antenna Terminal Conducted Tests**

### **Test Procedure**

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

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
6dB Bandwidth	50 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	Peak	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 v04".

\*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**

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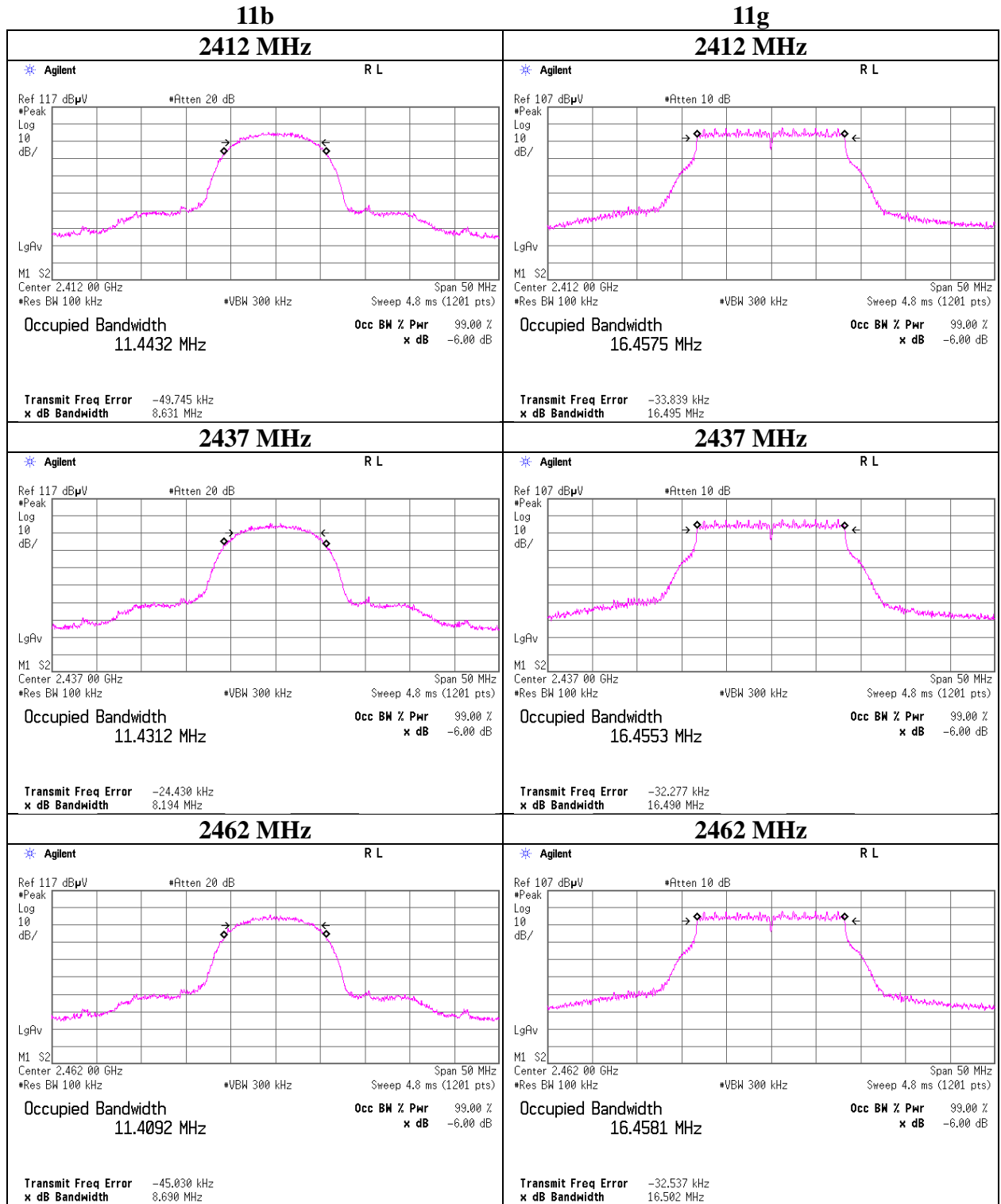
## APPENDIX 1: Test data

### 6 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 23, 2018  
Temperature / Humidity 26 deg. C / 45 % RH  
Engineer Shiro Kobayashi  
Mode Tx

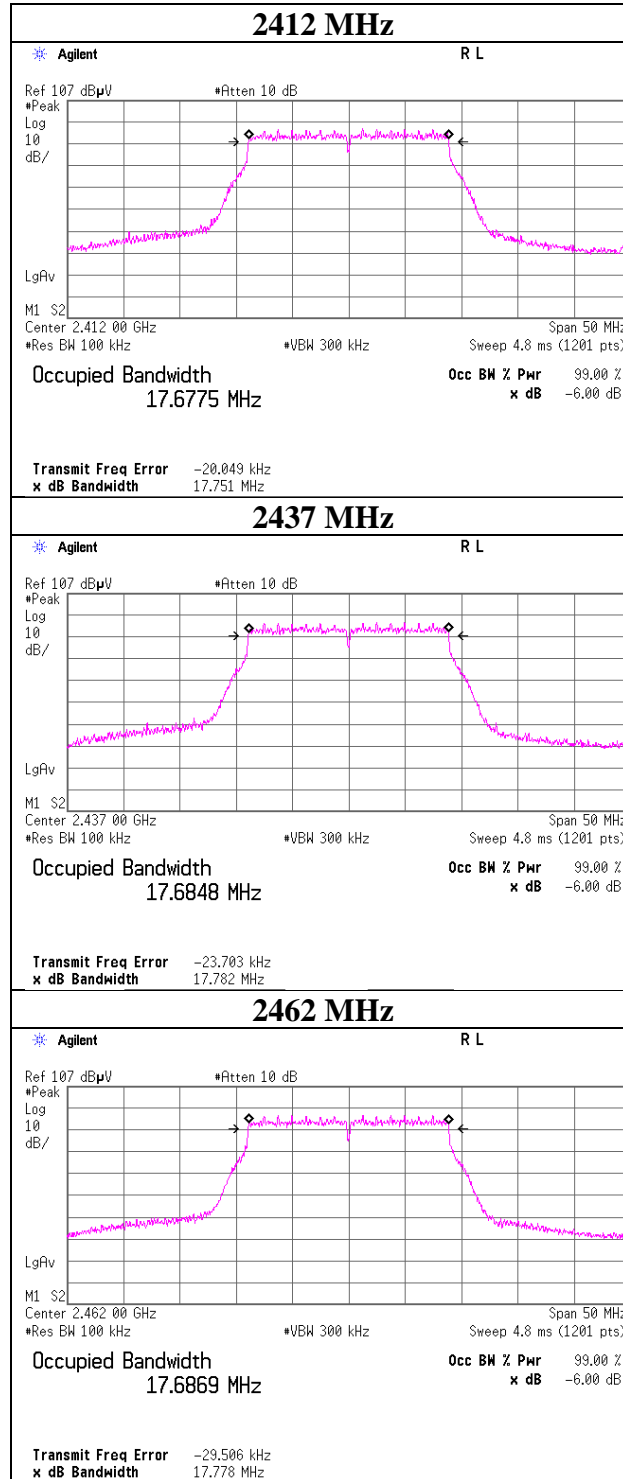
Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	11514.0	8.631	> 0.5000
	2437	11463.4	8.194	> 0.5000
	2462	11474.8	8.690	> 0.5000
11g	2412	16887.8	16.495	> 0.5000
	2437	16943.8	16.490	> 0.5000
	2462	16950.9	16.502	> 0.5000
11n-20	2412	18123.2	17.751	> 0.5000
	2437	18089.1	17.782	> 0.5000
	2462	18122.0	17.778	> 0.5000

## 6dB Bandwidth



## 6dB Bandwidth

**11n-20**



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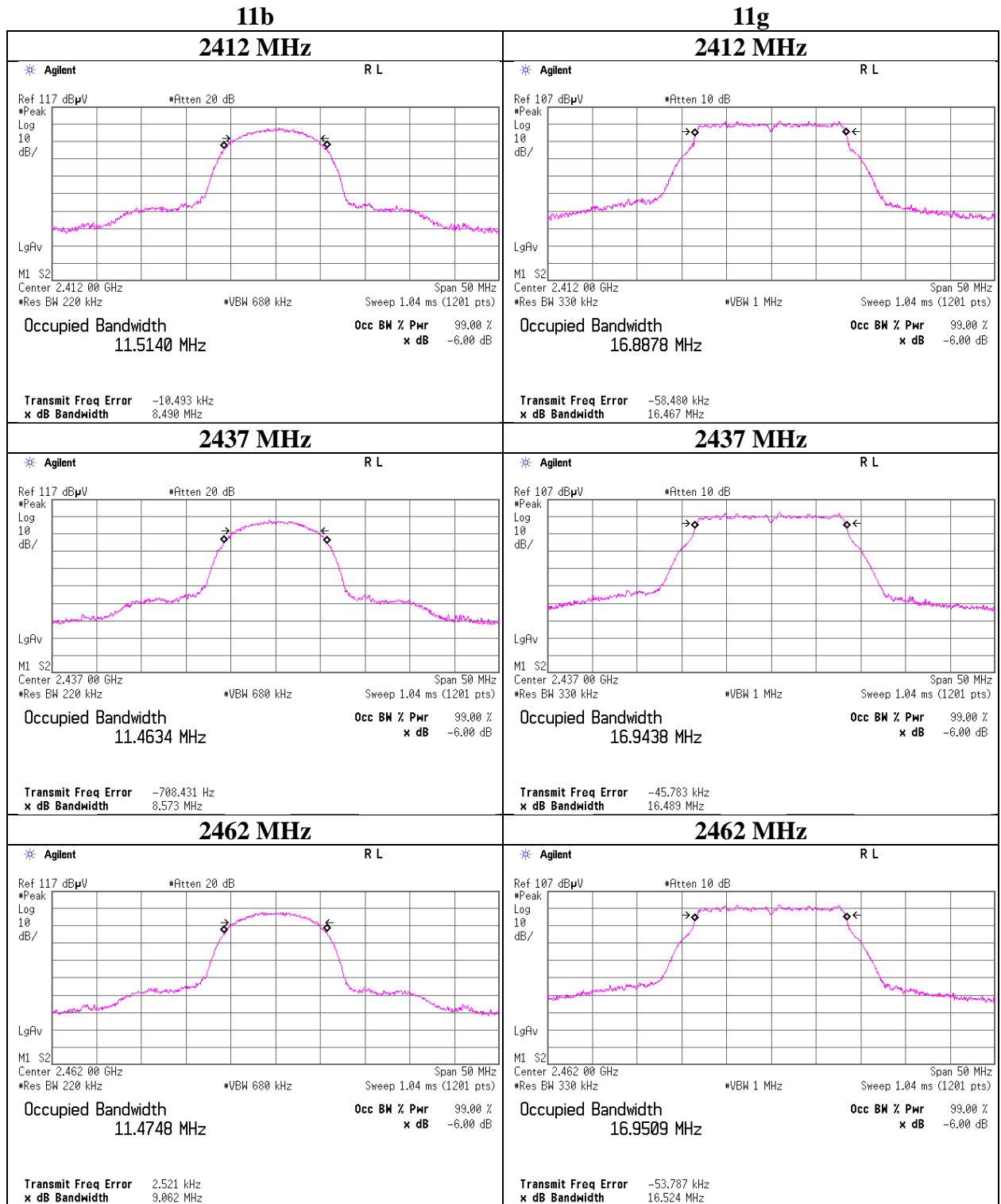
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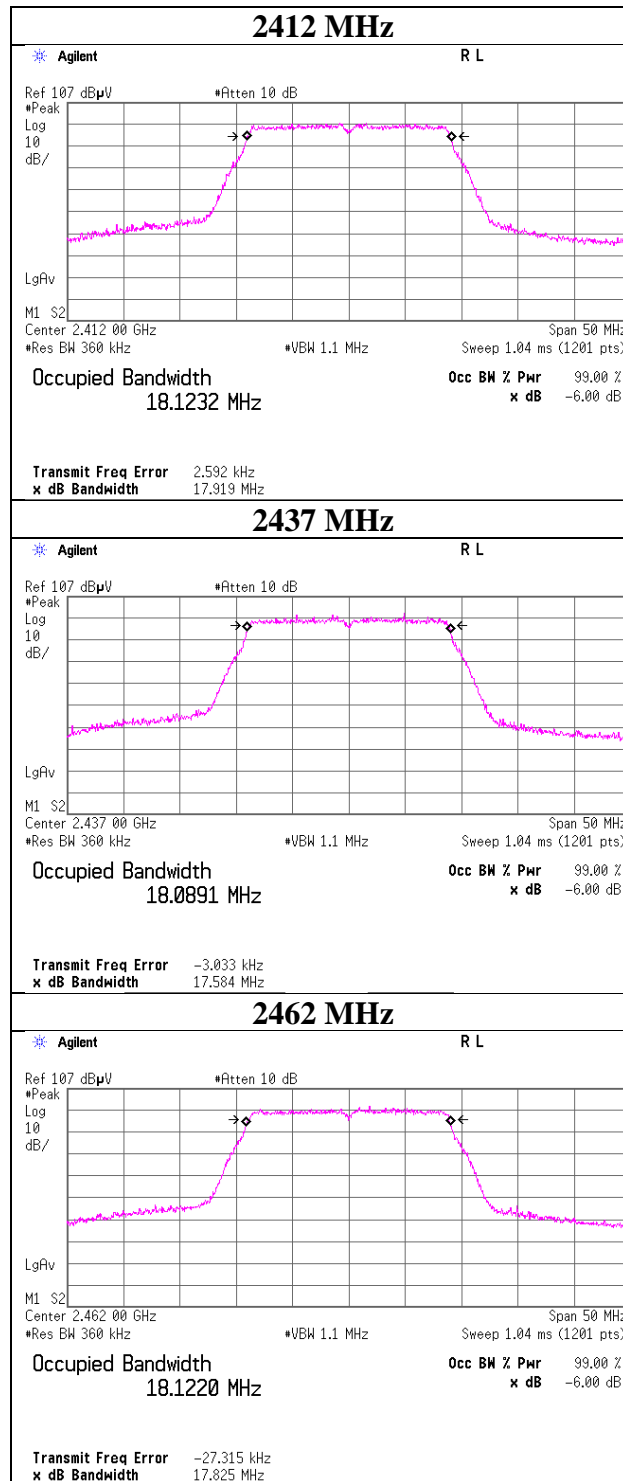


**99% Occupied Bandwidth**



## 99% Occupied Bandwidth

**11n-20**



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**Maximum Peak Output Power**

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 23, 2018  
Temperature / Humidity 26 deg. C / 45 % RH  
Engineer Shiro Kobayashi  
Mode Tx 11b

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	6.75	1.88	9.88	18.51	70.96	30.00	1000	11.49
2437	6.69	1.88	9.88	18.45	69.98	30.00	1000	11.55
2462	6.86	1.89	9.88	18.63	72.95	30.00	1000	11.37

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

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
1	6.31	
2	6.56	
5.5	6.41	
11	6.69	*

\*: Worst Rate

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

### Maximum Peak Output Power

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 23, 2018  
Temperature / Humidity 26 deg. C / 45 % RH  
Engineer Shiro Kobayashi  
Mode Tx 11g

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	8.12	1.88	9.88	19.88	97.27	30.00	1000	10.12
2437	8.01	1.88	9.88	19.77	94.84	30.00	1000	10.23
2462	8.20	1.89	9.88	19.97	99.31	30.00	1000	10.03

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

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	5.80	
9	5.84	
12	5.88	
18	5.62	
24	7.93	
36	7.81	
48	8.01	*
54	7.52	

\*: Worst Rate

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

## Maximum Peak Output Power

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 23, 2018  
Temperature / Humidity 26 deg. C / 45 % RH  
Engineer Shiro Kobayashi  
Mode Tx 11n-20

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	7.98	1.88	9.88	19.74	94.19	30.00	1000	10.26
2437	8.07	1.88	9.88	19.83	96.16	30.00	1000	10.17
2462	7.90	1.89	9.88	19.67	92.68	30.00	1000	10.33

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

2437 MHz, Long GI

MCS Number	Reading [dBm]	Remark
0	5.08	
1	4.57	
2	4.47	
3	7.71	
4	7.62	
5	6.98	
6	7.43	
7	7.22	

2437 MHz, Short GI

MCS Number	Reading [dBm]	Remark
0	5.01	
1	4.57	
2	4.65	
3	7.56	
4	8.07	*
5	7.45	
6	7.21	
7	7.42	

\*: Worst Rate

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

**Average Output Power**  
**(Reference data for RF Exposure)**

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 23, 2018  
Temperature / Humidity 26 deg. C / 45 % RH  
Engineer Shiro Kobayashi  
Mode Tx

**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	2.85	1.88	9.88	14.61	28.91	0.02	14.63	29.04
2437	2.91	1.88	9.88	14.67	29.31	0.02	14.69	29.44
2462	3.01	1.89	9.88	14.78	30.06	0.02	14.80	30.20

**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	-1.56	1.88	9.88	10.20	10.47	0.15	10.35	10.84
2437	-1.43	1.88	9.88	10.33	10.79	0.15	10.48	11.17
2462	-1.46	1.89	9.88	10.31	10.74	0.15	10.46	11.12

**11n-20 MCS 0 (Long GI)**

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	-2.70	1.88	9.88	9.06	8.05	0.16	9.22	8.36
2437	-2.71	1.88	9.88	9.05	8.04	0.16	9.21	8.34
2462	-2.78	1.89	9.88	8.99	7.93	0.16	9.15	8.22

Sample Calculation:

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

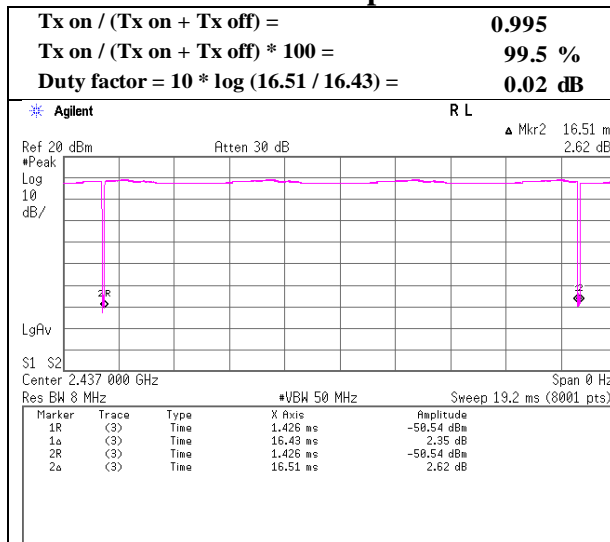
\*The equipment and cables were not used for factor 0 dB of the data sheets.

**The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.**

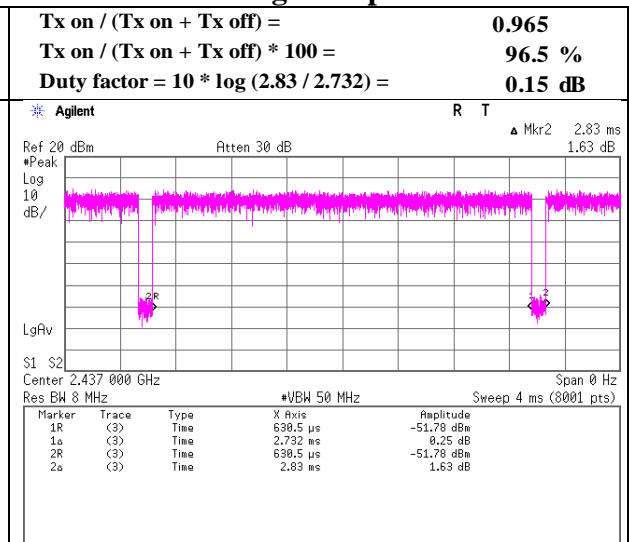
**Burst rate confirmation(for Average Output Power)**

Report No. 12258310S-A-R2  
 Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber  
 Date April 23, 2018  
 Temperature / Humidity 26 deg. C / 45 % RH  
 Engineer Shiro Kobayashi  
 Mode Tx

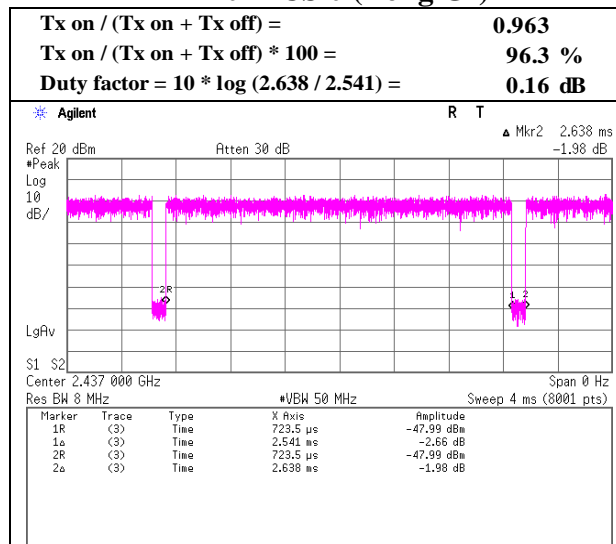
**11b 1 Mbps**



**11g 6 Mbps**



**11n-20 MCS 0 (Long GI)**



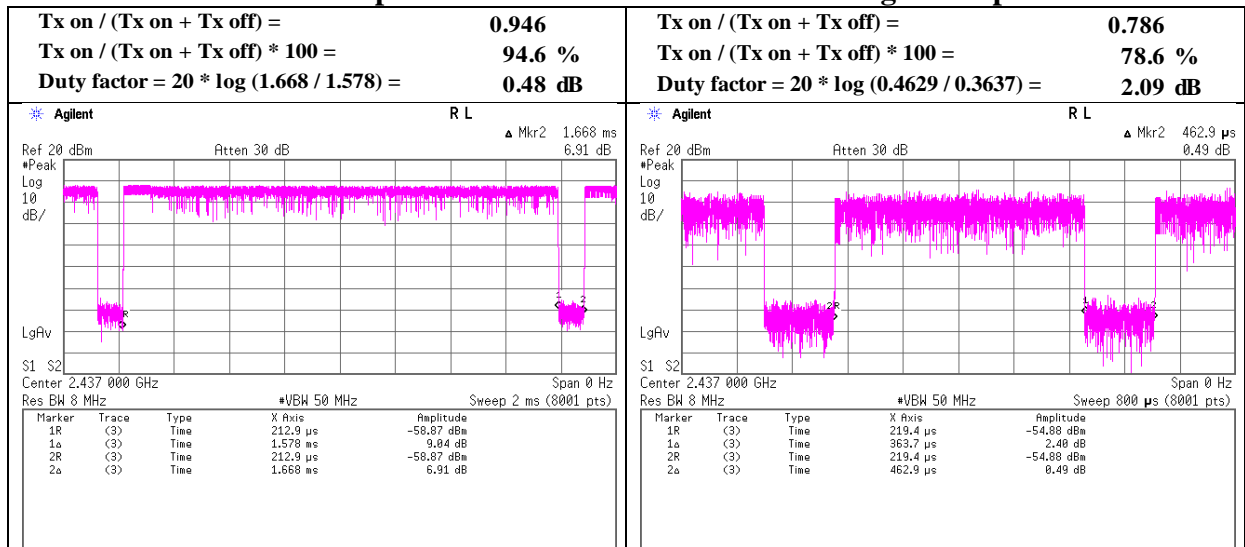
\* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

### Burst rate confirmation(for Radiated Spurious Emission)

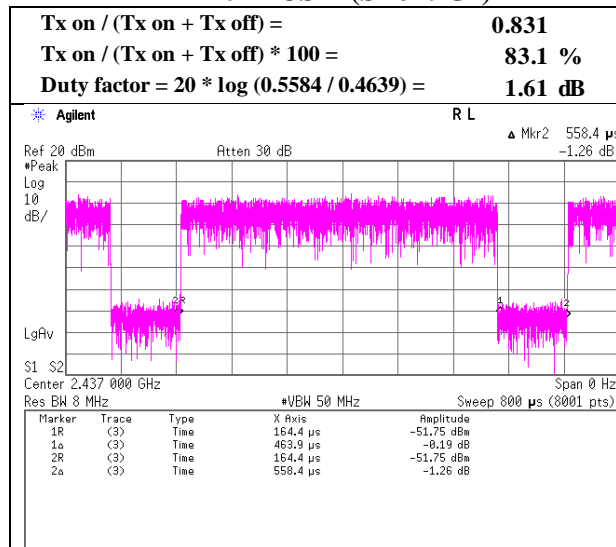
Report No. 12258310S-A-R2  
 Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber  
 Date April 23, 2018  
 Temperature / Humidity 26 deg. C / 45 % RH  
 Engineer Shiro Kobayashi  
 Mode Tx

#### 11b 11 Mbps

#### 11g 48 Mbps



#### 11n-20 MCS 4 (Short GI)



\* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.



## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11b 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1056.004	PK	49.81	24.34	13.06	37.08	2.23	52.36	73.90	21.5	155	70	
Hori.	1584.006	PK	47.94	25.14	13.71	36.99	2.23	52.03	73.90	21.9	194	222	
Hori.	2112.001	PK	47.05	26.24	14.28	36.77	2.23	53.03	73.90	20.9	183	219	
Hori.	2390.000	PK	45.98	27.14	14.56	36.58	2.23	53.33	73.90	20.6	109	310	
Hori.	2822.426	PK	46.81	28.23	7.02	36.57	2.23	47.72	73.90	26.2	135	170	
Hori.	3167.914	PK	49.56	28.66	6.45	36.62	2.23	50.28	73.90	23.6	174	343	
Hori.	3695.846	PK	47.48	29.13	6.80	36.59	2.23	49.05	73.90	24.9	151	332	
Hori.	4824.000	PK	43.24	31.18	7.27	36.88	2.23	47.04	73.90	26.9	150	0	
Hori.	7236.000	PK	44.42	36.39	8.93	37.30	2.23	54.67	73.90	19.2	150	0	
Hori.	1056.004	AV	43.48	24.34	13.06	37.08	2.23	46.03	53.90	7.9	155	70	
Hori.	1584.006	AV	41.78	25.14	13.71	36.99	2.23	45.87	53.90	8.0	194	222	
Hori.	2112.001	AV	39.28	26.24	14.28	36.77	2.23	45.26	53.90	8.6	183	219	
Hori.	2822.426	AV	40.67	28.23	7.02	36.57	2.23	41.58	53.90	12.3	135	170	
Hori.	3167.914	AV	45.08	28.66	6.45	36.62	2.23	45.80	53.90	8.1	174	343	
Hori.	3695.846	AV	42.30	29.13	6.80	36.59	2.23	43.87	53.90	10.0	151	332	
Vert.	1056.012	PK	52.59	24.34	13.06	37.08	2.23	55.14	73.90	18.8	191	329	
Vert.	2390.000	PK	46.81	27.14	14.56	36.58	2.23	54.16	73.90	19.7	212	292	
Vert.	3167.977	PK	48.92	28.66	6.45	36.62	2.23	49.64	73.90	24.3	171	43	
Vert.	4824.000	PK	43.46	31.18	7.27	36.88	2.23	47.26	73.90	26.6	150	0	
Vert.	7236.000	PK	44.28	36.39	8.93	37.30	2.23	54.53	73.90	19.4	150	0	
Vert.	1056.012	AV	47.34	24.34	13.06	37.08	2.23	49.89	53.90	4.0	191	329	
Vert.	3167.977	AV	44.49	28.66	6.45	36.62	2.23	45.21	53.90	8.7	171	43	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	36.94	27.14	14.56	36.58	0.48	2.23	44.77	53.90	9.1	*1)
Hori.	4824.000	AV	34.85	31.18	7.27	36.88	0.48	2.23	39.13	53.90	14.8	
Hori.	7236.000	AV	35.64	36.39	8.93	37.30	0.48	2.23	46.37	53.90	7.5	
Vert.	2390.000	AV	37.25	27.14	14.56	36.58	0.48	2.23	45.08	53.90	8.8	*1)
Vert.	4824.000	AV	34.54	31.18	7.27	36.88	0.48	2.23	38.82	53.90	15.1	
Vert.	7236.000	AV	35.48	36.39	8.93	37.30	0.48	2.23	46.21	53.90	7.7	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	88.75	27.21	14.58	36.57	2.23	96.20	-	-	Carrier
Hori.	2400.000	PK	42.73	27.17	14.57	36.58	2.23	50.12	76.20	26.1	
Vert.	2412.000	PK	89.48	27.21	14.58	36.57	2.23	96.93	-	-	Carrier
Vert.	2400.000	PK	43.27	27.17	14.57	36.58	2.23	50.66	76.93	26.3	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

**UL Japan, Inc.**

**Shonan EMC Lab.**

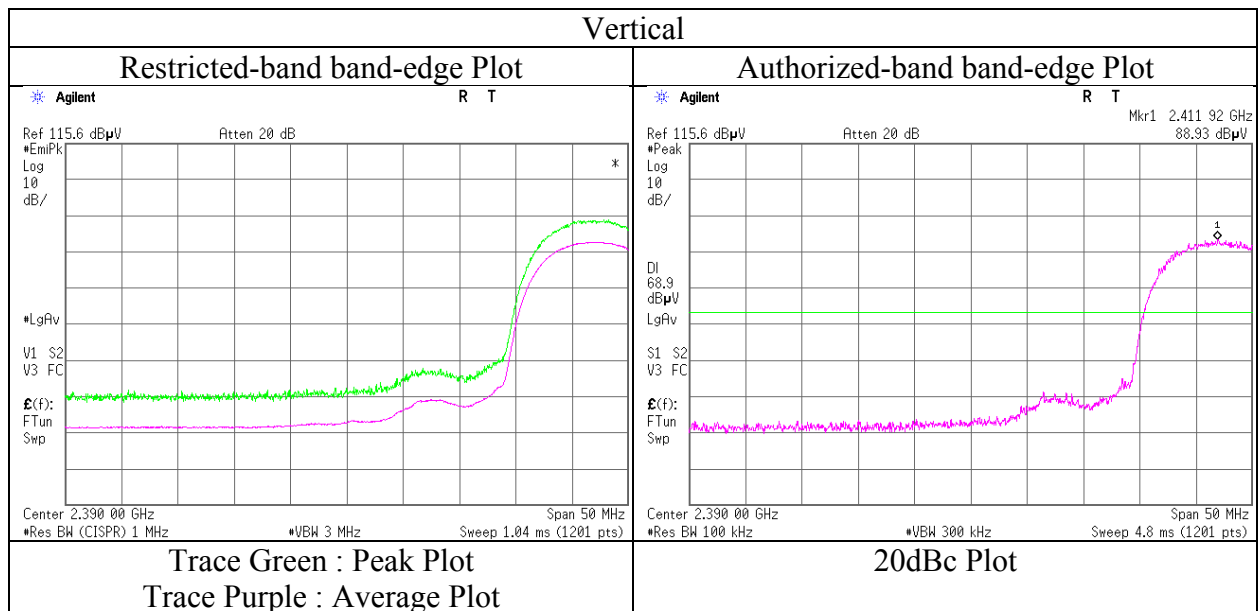
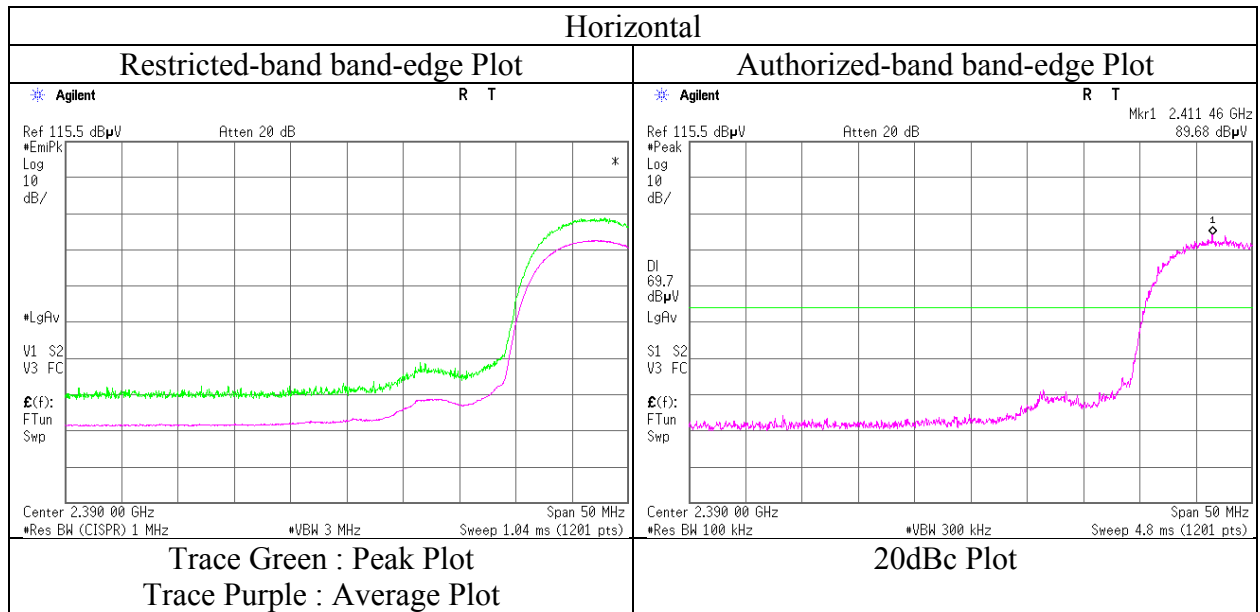
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12258310S-A-R2
Test place	Shonan EMC Lab. No.1 Semi Anechoic Chamber
Date	May 1, 2018
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)
Mode	Tx 11b 2412 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11b 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1056.014	PK	49.93	24.34	13.06	37.08	2.23	52.48	73.90	21.4	137	68	
Hori.	1583.995	PK	48.23	25.14	13.71	36.99	2.23	52.32	73.90	21.6	157	228	
Hori.	2111.993	PK	46.75	26.24	14.28	36.77	2.23	52.73	73.90	21.2	167	218	
Hori.	2822.474	PK	47.44	28.23	7.02	36.57	2.23	48.35	73.90	25.6	125	167	
Hori.	3167.986	PK	49.53	28.66	6.45	36.62	2.23	50.25	73.90	23.7	172	344	
Hori.	3696.006	PK	47.36	29.13	6.80	36.59	2.23	48.93	73.90	25.0	153	332	
Hori.	4874.000	PK	43.32	31.29	7.32	36.90	2.23	47.26	73.90	26.6	150	0	
Hori.	7311.000	PK	44.40	36.50	9.02	37.42	2.23	54.73	73.90	19.2	150	0	
Hori.	1056.014	AV	42.49	24.34	13.06	37.08	2.23	45.04	53.90	8.9	137	68	
Hori.	1583.995	AV	41.71	25.14	13.71	36.99	2.23	45.80	53.90	8.1	157	228	
Hori.	2111.993	AV	39.12	26.24	14.28	36.77	2.23	45.10	53.90	8.8	167	218	
Hori.	2822.474	AV	40.45	28.23	7.02	36.57	2.23	41.36	53.90	12.5	125	167	
Hori.	3167.986	AV	45.17	28.66	6.45	36.62	2.23	45.89	53.90	8.0	172	344	
Hori.	3696.006	AV	41.77	29.13	6.80	36.59	2.23	43.34	53.90	10.6	153	332	
Vert.	1055.989	PK	51.87	24.34	13.06	37.08	2.23	54.42	73.90	19.5	188	334	
Vert.	2822.515	PK	45.45	28.23	7.02	36.57	2.23	46.36	73.90	27.5	151	333	
Vert.	3167.986	PK	49.06	28.66	6.45	36.62	2.23	49.78	73.90	24.1	166	41	
Vert.	4874.000	PK	43.22	31.29	7.32	36.90	2.23	47.16	73.90	26.7	150	0	
Vert.	7311.000	PK	45.05	36.50	9.02	37.42	2.23	55.38	73.90	18.5	150	0	
Vert.	1055.989	AV	47.14	24.34	13.06	37.08	2.23	49.69	53.90	4.2	188	334	
Vert.	2822.515	AV	38.15	28.23	7.02	36.57	2.23	39.06	53.90	14.8	151	333	
Vert.	3167.986	AV	44.51	28.66	6.45	36.62	2.23	45.23	53.90	8.7	166	41	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.23\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	AV	34.37	31.29	7.32	36.90	0.48	2.23	38.79	53.90	15.1	
Hori.	7311.000	AV	35.08	36.50	9.02	37.42	0.48	2.23	45.89	53.90	8.0	
Vert.	4874.000	AV	34.52	31.29	7.32	36.90	0.48	2.23	38.94	53.90	15.0	
Vert.	7311.000	AV	35.15	36.50	9.02	37.42	0.48	2.23	45.96	53.90	7.9	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.23\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11b 2462 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1055.994	PK	49.29	24.34	13.06	37.08	2.23	51.84	73.90	22.1	136	71	
Hori.	1583.978	PK	48.36	25.14	13.71	36.99	2.23	52.45	73.90	21.5	156	231	
Hori.	2111.996	PK	40.56	26.24	14.28	36.77	2.23	46.54	73.90	27.4	173	214	
Hori.	2483.500	PK	46.04	27.45	14.66	36.52	2.23	53.86	73.90	20.0	106	314	
Hori.	2822.437	PK	46.85	28.23	7.02	36.57	2.23	47.76	73.90	26.1	127	169	
Hori.	3167.952	PK	49.70	28.66	6.45	36.62	2.23	50.42	73.90	23.5	171	345	
Hori.	3695.876	PK	47.64	29.13	6.80	36.59	2.23	49.21	73.90	24.7	155	333	
Hori.	4924.000	PK	43.39	31.40	7.40	36.92	2.23	47.50	73.90	26.4	150	0	
Hori.	7386.000	PK	44.34	36.60	9.12	37.54	2.23	54.75	73.90	19.2	150	0	
Hori.	1055.994	AV	43.08	24.34	13.06	37.08	2.23	45.63	53.90	8.3	136	71	
Hori.	1583.978	AV	41.99	25.14	13.71	36.99	2.23	46.08	53.90	7.8	156	231	
Hori.	2111.996	AV	39.38	26.24	14.28	36.77	2.23	45.36	53.90	8.5	173	214	
Hori.	2822.437	AV	40.68	28.23	7.02	36.57	2.23	41.59	53.90	12.3	127	169	
Hori.	3167.952	AV	44.85	28.66	6.45	36.62	2.23	45.57	53.90	8.3	171	345	
Hori.	3695.876	AV	41.77	29.13	6.80	36.59	2.23	43.34	53.90	10.6	155	333	
Vert.	1056.004	PK	52.87	24.34	13.06	37.08	2.23	55.42	73.90	18.5	185	338	
Vert.	2483.500	PK	45.98	27.45	14.66	36.52	2.23	53.80	73.90	20.1	151	303	
Vert.	3167.934	PK	50.12	28.66	6.45	36.62	2.23	50.84	73.90	23.1	156	39	
Vert.	4924.000	PK	43.26	31.40	7.40	36.92	2.23	47.37	73.90	26.5	150	0	
Vert.	7386.000	PK	44.04	36.60	9.12	37.54	2.23	54.45	73.90	19.5	150	0	
Vert.	1056.004	AV	47.31	24.34	13.06	37.08	2.23	49.86	53.90	4.0	185	338	
Vert.	3167.934	AV	44.60	28.66	6.45	36.62	2.23	45.32	53.90	8.6	156	39	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	36.49	27.45	14.66	36.52	0.48	2.23	44.79	53.90	9.1	*1)
Hori.	4924.000	AV	34.44	31.40	7.40	36.92	0.48	2.23	39.03	53.90	14.9	
Hori.	7386.000	AV	35.09	36.60	9.12	37.54	0.48	2.23	45.98	53.90	7.9	
Vert.	2483.500	AV	36.27	27.45	14.66	36.52	0.48	2.23	44.57	53.90	9.3	*1)
Vert.	4924.000	AV	34.41	31.40	7.40	36.92	0.48	2.23	39.00	53.90	14.9	
Vert.	7386.000	AV	35.17	36.60	9.12	37.54	0.48	2.23	46.06	53.90	7.8	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

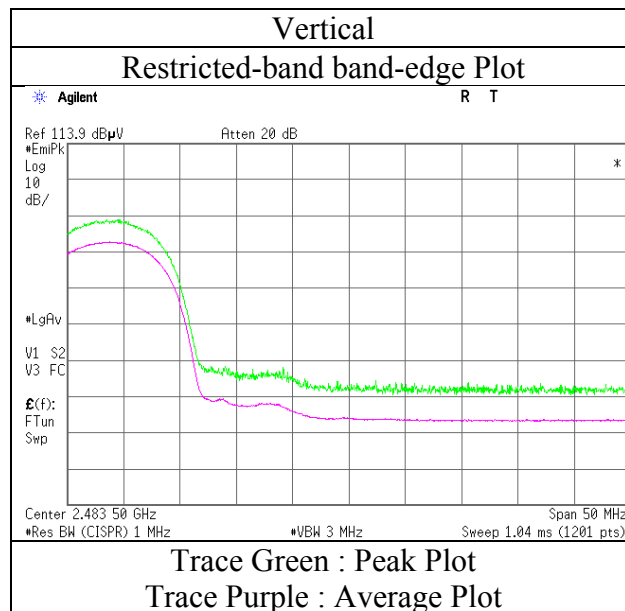
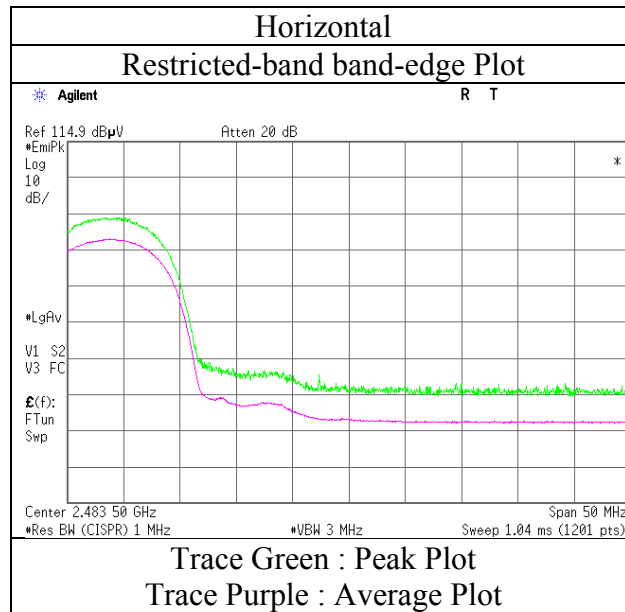
13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018  
Temperature / Humidity 25 deg. C / 48 % RH  
Engineer Kazuya Noda  
(1 GHz – 2.8 GHz)  
Mode Tx 11b 2462 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11g 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1055.996	PK	49.28	24.34	13.06	37.08	2.23	51.83	73.90	22.1	139	70	
Hori.	1583.995	PK	48.83	25.14	13.71	36.99	2.23	52.92	73.90	21.0	200	222	
Hori.	2111.996	PK	47.37	26.24	14.28	36.77	2.23	53.35	73.90	20.6	181	213	
Hori.	2390.000	PK	46.28	27.14	14.56	36.58	2.23	53.63	73.90	20.3	109	308	
Hori.	2822.490	PK	47.45	28.23	7.02	36.57	2.23	48.36	73.90	25.5	124	167	
Hori.	3167.983	PK	49.82	28.66	6.45	36.62	2.23	50.54	73.90	23.4	173	344	
Hori.	3695.928	PK	48.25	29.13	6.80	36.59	2.23	49.82	73.90	24.1	152	331	
Hori.	4824.000	PK	43.56	31.18	7.27	36.88	2.23	47.36	73.90	26.5	150	0	
Hori.	7236.000	PK	44.77	36.39	8.93	37.30	2.23	55.02	73.90	18.9	150	0	
Hori.	1055.996	AV	42.44	24.34	13.06	37.08	2.23	44.99	53.90	8.9	139	70	
Hori.	1583.995	AV	42.75	25.14	13.71	36.99	2.23	46.84	53.90	7.1	200	222	
Hori.	2111.996	AV	39.33	26.24	14.28	36.77	2.23	45.31	53.90	8.6	181	213	
Hori.	2822.490	AV	40.55	28.23	7.02	36.57	2.23	41.46	53.90	12.4	124	167	
Hori.	3167.983	AV	45.19	28.66	6.45	36.62	2.23	45.91	53.90	8.0	173	344	
Hori.	3695.928	AV	43.00	29.13	6.80	36.59	2.23	44.57	53.90	9.3	152	331	
Vert.	1056.020	PK	52.48	24.34	13.06	37.08	2.23	55.03	73.90	18.9	189	334	
Vert.	2390.000	PK	46.99	27.14	14.56	36.58	2.23	54.34	73.90	19.6	211	295	
Vert.	3167.982	PK	48.97	28.66	6.45	36.62	2.23	49.69	73.90	24.2	163	41	
Vert.	4824.000	PK	43.59	31.18	7.27	36.88	2.23	47.39	73.90	26.5	150	0	
Vert.	7236.000	PK	44.44	36.39	8.93	37.30	2.23	54.69	73.90	19.2	150	0	
Vert.	1056.020	AV	47.26	24.34	13.06	37.08	2.23	49.81	53.90	4.1	189	334	
Vert.	3167.982	AV	44.32	28.66	6.45	36.62	2.23	45.04	53.90	8.9	163	41	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	36.04	27.14	14.56	36.58	2.09	2.23	45.48	53.90	8.4	*1)
Hori.	4824.000	AV	34.67	31.18	7.27	36.88	2.09	2.23	40.56	53.90	13.3	
Hori.	7236.000	AV	35.73	36.39	8.93	37.30	2.09	2.23	48.07	53.90	5.8	
Vert.	2390.000	AV	36.49	27.14	14.56	36.58	2.09	2.23	45.93	53.90	8.0	*1)
Vert.	4824.000	AV	34.26	31.18	7.27	36.88	2.09	2.23	40.15	53.90	13.8	
Vert.	7236.000	AV	35.47	36.39	8.93	37.30	2.09	2.23	47.81	53.90	6.1	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	81.34	27.21	14.58	36.57	2.23	88.79	-	-	Carrier
Hori.	2400.000	PK	41.67	27.17	14.57	36.58	2.23	49.06	68.79	19.7	
Vert.	2412.000	PK	82.18	27.21	14.58	36.57	2.23	89.63	-	-	Carrier
Vert.	2400.000	PK	42.15	27.17	14.57	36.58	2.23	49.54	69.63	20.1	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

**UL Japan, Inc.**

**Shonan EMC Lab.**

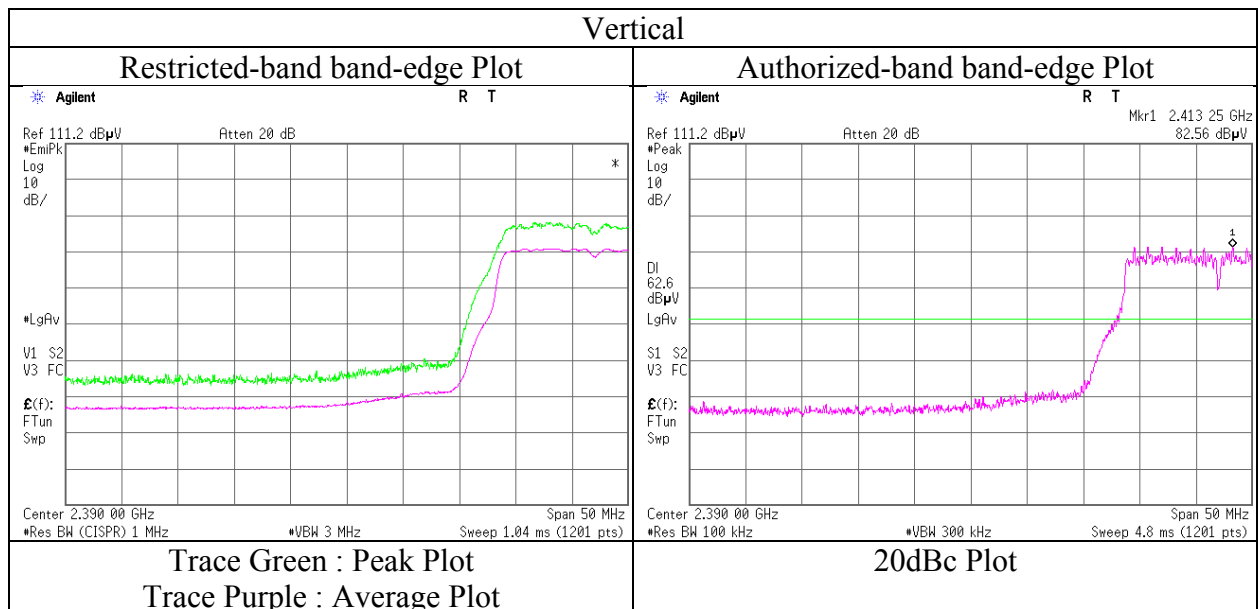
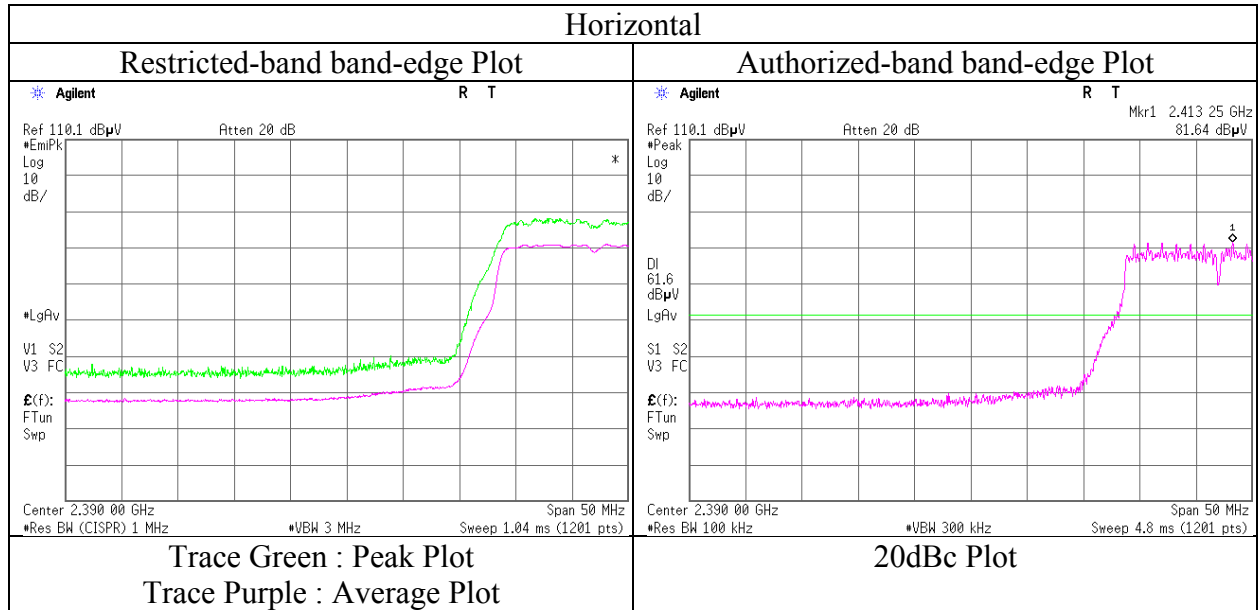
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018  
Temperature / Humidity 25 deg. C / 48 % RH  
Engineer Kazuya Noda  
(1 GHz – 2.8 GHz)  
Mode Tx 11g 2412 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11g 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1055.999	PK	49.77	24.34	13.06	37.08	2.23	52.32	73.90	21.6	133	70	
Hori.	1583.998	PK	48.81	25.14	13.71	36.99	2.23	52.90	73.90	21.0	158	230	
Hori.	2111.997	PK	46.84	26.24	14.28	36.77	2.23	52.82	73.90	21.1	184	225	
Hori.	2822.490	PK	47.45	28.23	7.02	36.57	2.23	48.36	73.90	25.5	124	167	
Hori.	3167.983	PK	49.82	28.66	6.45	36.62	2.23	50.54	73.90	23.4	173	344	
Hori.	3695.928	PK	48.25	29.13	6.80	36.59	2.23	49.82	73.90	24.1	152	331	
Hori.	4824.000	PK	43.56	31.18	7.27	36.88	2.23	47.36	73.90	26.5	150	0	
Hori.	7236.000	PK	44.77	36.39	8.93	37.30	2.23	55.02	73.90	18.9	150	0	
Hori.	1055.999	AV	43.61	24.34	13.06	37.08	2.23	46.16	53.90	7.7	133	70	
Hori.	1583.998	AV	42.71	25.14	13.71	36.99	2.23	46.80	53.90	7.1	158	230	
Hori.	2111.997	AV	39.31	26.24	14.28	36.77	2.23	45.29	53.90	8.6	184	225	
Hori.	2822.490	AV	40.55	28.23	7.02	36.57	2.23	41.46	53.90	12.4	124	167	
Hori.	3167.983	AV	45.19	28.66	6.45	36.62	2.23	45.91	53.90	8.0	173	344	
Hori.	3695.928	AV	43.00	29.13	6.80	36.59	2.23	44.57	53.90	9.3	152	331	
Vert.	1056.000	PK	51.84	24.34	13.06	37.08	2.23	54.39	73.90	19.5	187	335	
Vert.	3167.982	PK	48.97	28.66	6.45	36.62	2.23	49.69	73.90	24.2	163	41	
Vert.	4824.000	PK	43.59	31.18	7.27	36.88	2.23	47.39	73.90	26.5	150	0	
Vert.	7236.000	PK	44.44	36.39	8.93	37.30	2.23	54.69	73.90	19.2	150	0	
Vert.	1056.000	AV	47.47	24.34	13.06	37.08	2.23	50.02	53.90	3.9	187	335	
Vert.	3167.982	AV	44.32	28.66	6.45	36.62	2.23	45.04	53.90	8.9	163	41	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.23\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4824.000	AV	34.67	31.18	7.27	36.88	2.09	2.23	40.56	53.90	13.3	
Hori.	7236.000	AV	35.73	36.39	8.93	37.30	2.09	2.23	48.07	53.90	5.8	
Vert.	4824.000	AV	34.26	31.18	7.27	36.88	2.09	2.23	40.15	53.90	13.8	
Vert.	7236.000	AV	35.47	36.39	8.93	37.30	2.09	2.23	47.81	53.90	6.1	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.23\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.



## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 2, 2018 May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 23 deg. C / 47 % RH 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Takahiro Suzuki Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(30 MHz – 1000 MHz) (1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11g 2462 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	320.707	QP	40.77	13.90	7.05	31.77	0.00	29.95	46.00	16.0	100	179	
Hori.	351.001	QP	39.45	14.54	7.24	31.77	0.00	29.46	46.00	16.5	100	179	
Hori.	364.501	QP	41.72	14.83	7.31	31.79	0.00	32.07	46.00	13.9	100	201	
Hori.	391.500	QP	38.81	15.40	7.44	31.82	0.00	29.83	46.00	16.1	100	217	
Hori.	449.845	QP	31.96	16.62	7.69	31.89	0.00	24.38	46.00	21.6	100	55	
Hori.	514.103	QP	33.68	17.87	7.98	31.94	0.00	27.59	46.00	18.4	100	320	
Hori.	960.277	QP	32.69	22.20	9.87	30.89	0.00	33.87	53.90	20.0	116	276	
Hori.	1055.995	PK	49.28	24.34	13.06	37.08	2.23	51.83	73.90	22.1	133	77	
Hori.	1583.992	PK	48.46	25.14	13.71	36.99	2.23	52.55	73.90	21.4	157	227	
Hori.	2111.993	PK	46.31	26.24	14.28	36.77	2.23	52.29	73.90	21.6	179	218	
Hori.	2483.500	PK	44.58	27.45	14.66	36.52	2.23	52.40	73.90	21.5	107	311	
Hori.	2822.474	PK	47.06	28.23	7.02	36.57	2.23	47.97	73.90	25.9	133	168	
Hori.	3167.985	PK	50.01	28.66	6.45	36.62	2.23	50.73	73.90	23.2	169	343	
Hori.	3695.980	PK	48.84	29.13	6.80	36.59	2.23	50.41	73.90	23.5	144	330	
Hori.	4924.000	PK	43.67	31.40	7.40	36.92	2.23	47.78	73.90	26.1	150	0	
Hori.	7386.000	PK	43.85	36.60	9.12	37.54	2.23	54.26	73.90	19.6	150	0	
Hori.	1055.995	AV	43.17	24.34	13.06	37.08	2.23	45.72	53.90	8.2	133	77	
Hori.	1583.992	AV	42.38	25.14	13.71	36.99	2.23	46.47	53.90	7.4	157	227	
Hori.	2111.993	AV	39.12	26.24	14.28	36.77	2.23	45.10	53.90	8.8	179	218	
Hori.	2822.474	AV	40.71	28.23	7.02	36.57	2.23	41.62	53.90	12.3	133	168	
Hori.	3167.985	AV	45.47	28.66	6.45	36.62	2.23	46.19	53.90	7.7	169	343	
Hori.	3695.980	AV	43.29	29.13	6.80	36.59	2.23	44.86	53.90	9.0	144	330	
Vert.	120.035	QP	35.23	13.21	8.18	31.80	0.00	24.82	43.50	18.6	100	332	
Vert.	144.081	QP	32.76	14.47	8.69	31.78	0.00	24.14	43.50	19.3	100	1	
Vert.	257.051	QP	36.14	11.95	6.45	31.75	0.00	22.79	46.00	23.2	219	110	
Vert.	321.318	QP	38.43	13.91	7.05	31.77	0.00	27.62	46.00	18.3	197	121	
Vert.	580.494	QP	30.06	18.86	8.25	32.02	0.00	25.15	46.00	20.8	100	324	
Vert.	1056.001	PK	51.62	24.34	13.06	37.08	2.23	54.17	73.90	19.7	190	344	
Vert.	2483.500	PK	45.51	27.45	14.66	36.52	2.23	53.33	73.90	20.6	152	308	
Vert.	3167.984	PK	49.57	28.66	6.45	36.62	2.23	50.29	73.90	23.6	156	39	
Vert.	4924.000	PK	43.53	31.40	7.40	36.92	2.23	47.64	73.90	26.3	150	0	
Vert.	7386.000	PK	44.12	36.60	9.12	37.54	2.23	54.53	73.90	19.4	150	0	
Vert.	1056.001	AV	47.74	24.34	13.06	37.08	2.23	50.29	53.90	3.6	190	344	
Vert.	3167.984	AV	44.65	28.66	6.45	36.62	2.23	45.37	53.90	8.5	156	39	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	35.43	27.45	14.66	36.52	2.09	2.23	45.34	53.90	8.6	*1)
Hori.	4924.000	AV	34.77	31.40	7.40	36.92	2.09	2.23	40.97	53.90	12.9	
Hori.	7386.000	AV	35.59	36.60	9.12	37.54	2.09	2.23	48.09	53.90	5.8	
Vert.	2483.500	AV	35.65	27.45	14.66	36.52	2.09	2.23	45.56	53.90	8.3	*1)
Vert.	4924.000	AV	34.69	31.40	7.40	36.92	2.09	2.23	40.89	53.90	13.0	
Vert.	7386.000	AV	35.62	36.60	9.12	37.54	2.09	2.23	48.12	53.90	5.8	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

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**Shonan EMC Lab.**

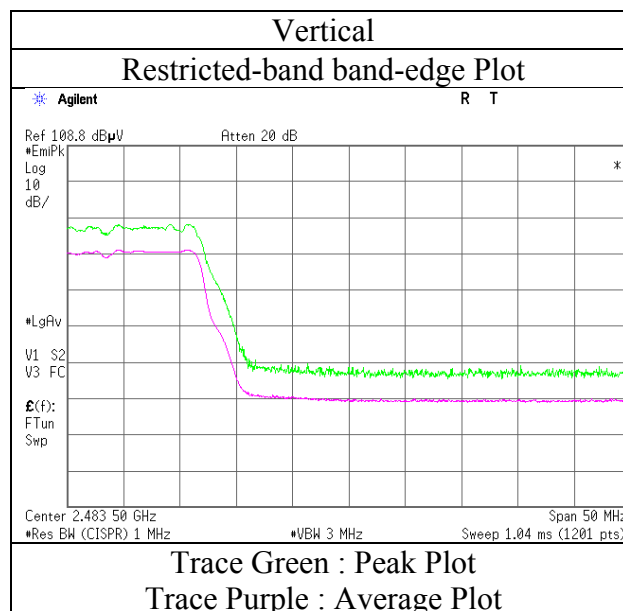
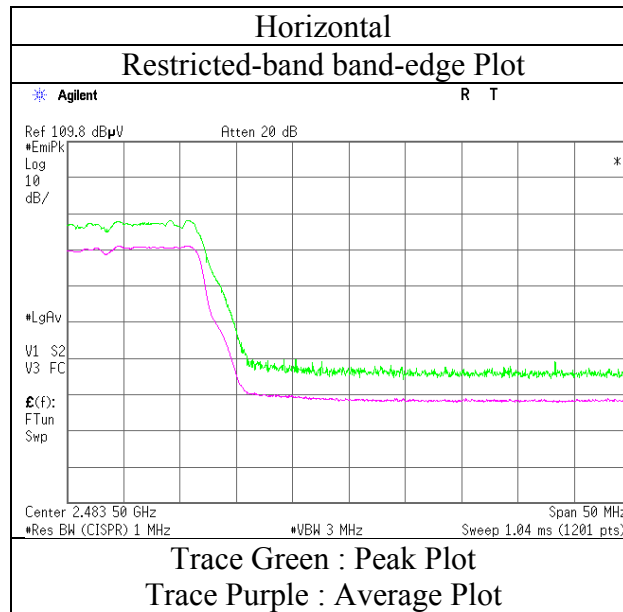
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018  
Temperature / Humidity 25 deg. C / 48 % RH  
Engineer Kazuya Noda  
(1 GHz – 2.8 GHz)  
Mode Tx 11g 2462 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11n-20 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1056.001	PK	49.57	24.34	13.06	37.08	2.23	52.12	73.90	21.8	134	71	
Hori.	1583.996	PK	48.93	25.14	13.71	36.99	2.23	53.02	73.90	20.9	160	229	
Hori.	2111.996	PK	46.86	26.24	14.28	36.77	2.23	52.84	73.90	21.1	177	225	
Hori.	2390.000	PK	46.59	27.14	14.56	36.58	2.23	53.94	73.90	20.0	108	319	
Hori.	2822.474	PK	47.77	28.23	7.02	36.57	2.23	48.68	73.90	25.2	123	166	
Hori.	3167.985	PK	50.32	28.66	6.45	36.62	2.23	51.04	73.90	22.9	173	345	
Hori.	3695.981	PK	49.35	29.13	6.80	36.59	2.23	50.92	73.90	23.0	162	332	
Hori.	4824.000	PK	43.92	31.18	7.27	36.88	2.23	47.72	73.90	26.2	150	0	
Hori.	7236.000	PK	44.83	36.39	8.93	37.30	2.23	55.08	73.90	18.8	150	0	
Hori.	1056.001	AV	43.12	24.34	13.06	37.08	2.23	45.67	53.90	8.2	134	71	
Hori.	1583.996	AV	42.25	25.14	13.71	36.99	2.23	46.34	53.90	7.6	160	229	
Hori.	2111.996	AV	39.64	26.24	14.28	36.77	2.23	45.62	53.90	8.3	177	225	
Hori.	2822.474	AV	40.85	28.23	7.02	36.57	2.23	41.76	53.90	12.1	123	166	
Hori.	3167.985	AV	45.73	28.66	6.45	36.62	2.23	46.45	53.90	7.5	173	345	
Hori.	3695.981	AV	43.39	29.13	6.80	36.59	2.23	44.96	53.90	8.9	162	332	
Vert.	1056.023	PK	51.62	24.34	13.06	37.08	2.23	54.17	73.90	19.7	199	338	
Vert.	2390.000	PK	47.08	27.14	14.56	36.58	2.23	54.43	73.90	19.5	175	296	
Vert.	3167.985	PK	50.11	28.66	6.45	36.62	2.23	50.83	73.90	23.1	158	41	
Vert.	4824.000	PK	43.69	31.18	7.27	36.88	2.23	47.49	73.90	26.4	150	0	
Vert.	7236.000	PK	44.81	36.39	8.93	37.30	2.23	55.06	73.90	18.8	150	0	
Vert.	1056.023	AV	47.31	24.34	13.06	37.08	2.23	49.86	53.90	4.0	199	338	
Vert.	3167.985	AV	45.20	28.66	6.45	36.62	2.23	45.92	53.90	8.0	158	41	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	36.43	27.14	14.56	36.58	1.61	2.23	45.39	53.90	8.5	*1)
Hori.	4824.000	AV	34.83	31.18	7.27	36.88	1.61	2.23	40.24	53.90	13.7	
Hori.	7236.000	AV	35.71	36.39	8.93	37.30	1.61	2.23	47.57	53.90	6.3	
Vert.	2390.000	AV	36.55	27.14	14.56	36.58	1.61	2.23	45.51	53.90	8.4	*1)
Vert.	4824.000	AV	35.05	31.18	7.27	36.88	1.61	2.23	40.46	53.90	13.4	
Vert.	7236.000	AV	35.76	36.39	8.93	37.30	1.61	2.23	47.62	53.90	6.3	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	80.22	27.21	14.58	36.57	2.23	87.67	-	-	Carrier
Hori.	2400.000	PK	41.79	27.17	14.57	36.58	2.23	49.18	67.67	18.5	
Vert.	2412.000	PK	80.07	27.21	14.58	36.57	2.23	87.52	-	-	Carrier
Vert.	2400.000	PK	42.52	27.17	14.57	36.58	2.23	49.91	67.52	17.6	

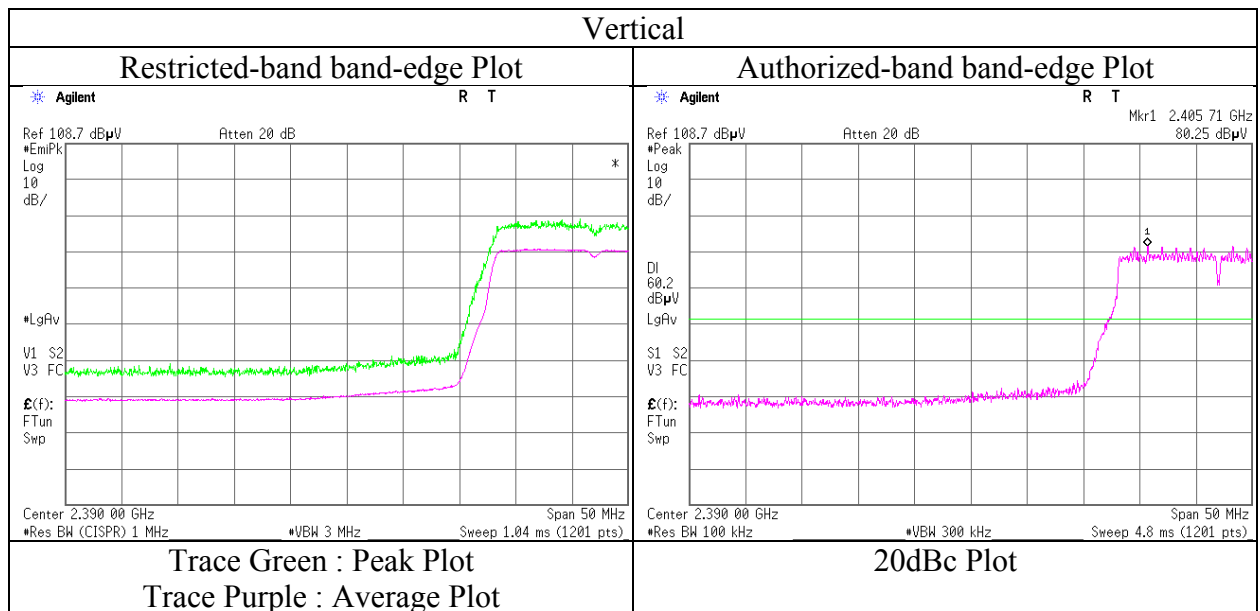
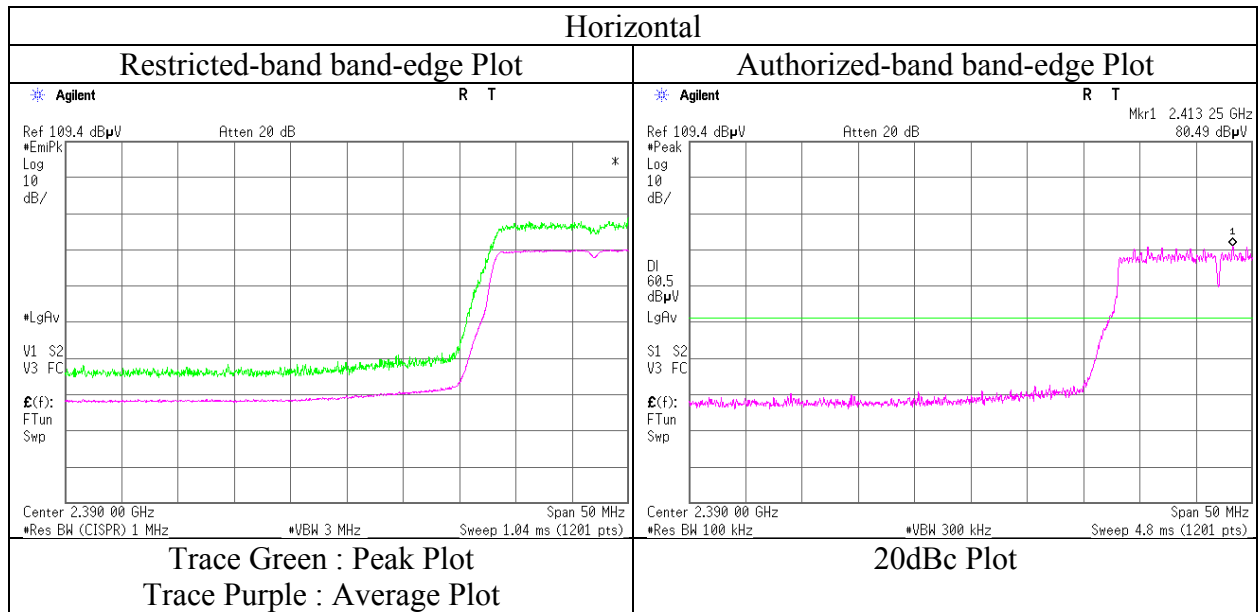
Result = Reading + Ant. Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018  
Temperature / Humidity 25 deg. C / 48 % RH  
Engineer Kazuya Noda  
(1 GHz – 2.8 GHz)  
Mode Tx 11n-20 2412 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11n-20 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1056.009	PK	49.37	24.34	13.06	37.08	2.23	51.92	73.90	22.0	135	73	
Hori.	1583.997	PK	49.84	25.14	13.71	36.99	2.23	53.93	73.90	20.0	172	226	
Hori.	2112.000	PK	46.79	26.24	14.28	36.77	2.23	52.77	73.90	21.1	166	218	
Hori.	2822.474	PK	47.49	28.23	7.02	36.57	2.23	48.40	73.90	25.5	100	0	
Hori.	3167.985	PK	50.24	28.66	6.45	36.62	2.23	50.96	73.90	22.9	171	346	
Hori.	3695.984	PK	49.15	29.13	6.80	36.59	2.23	50.72	73.90	23.2	151	330	
Hori.	4874.000	PK	44.15	31.29	7.32	36.90	2.23	48.09	73.90	25.8	150	0	
Hori.	7311.000	PK	44.25	36.50	9.02	37.42	2.23	54.58	73.90	19.3	150	0	
Hori.	1056.009	AV	43.24	24.34	13.06	37.08	2.23	45.79	53.90	8.1	135	73	
Hori.	1583.997	AV	42.02	25.14	13.71	36.99	2.23	46.11	53.90	7.8	172	226	
Hori.	2112.000	AV	39.43	26.24	14.28	36.77	2.23	45.41	53.90	8.5	166	218	
Hori.	3167.985	AV	45.64	28.66	6.45	36.62	2.23	46.36	53.90	7.5	171	346	
Hori.	3695.984	AV	43.42	29.13	6.80	36.59	2.23	44.99	53.90	8.9	151	330	
Vert.	1056.009	PK	51.84	24.34	13.06	37.08	2.23	54.39	73.90	19.5	193	342	
Vert.	3167.985	PK	49.84	28.66	6.45	36.62	2.23	50.56	73.90	23.3	154	42	
Vert.	4874.000	PK	43.75	31.29	7.32	36.90	2.23	47.69	73.90	26.2	150	0	
Vert.	7311.000	PK	44.03	36.50	9.02	37.42	2.23	54.36	73.90	19.5	150	0	
Vert.	1056.009	AV	47.82	24.34	13.06	37.08	2.23	50.37	53.90	3.5	193	342	
Vert.	3167.985	AV	44.95	28.66	6.45	36.62	2.23	45.67	53.90	8.2	154	42	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	AV	34.50	31.29	7.32	36.90	1.61	2.23	40.05	53.90	13.9	
Hori.	7311.000	AV	35.42	36.50	9.02	37.42	1.61	2.23	47.36	53.90	6.5	
Hori.	4874.000	AV	34.62	31.29	7.32	36.90	1.61	2.23	40.17	53.90	13.7	
Vert.	7311.000	AV	35.62	36.50	9.02	37.42	1.61	2.23	47.56	53.90	6.3	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

## Radiated Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
Date May 1, 2018 May 4, 2018 May 5, 2018  
Temperature / Humidity 25 deg. C / 48 % RH 22 deg. C / 50 % RH 22 deg. C / 31 % RH  
Engineer Kazuya Noda Shiro Kobayashi Shiro Kobayashi  
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)  
Mode Tx 11n-20 2462 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1056.028	PK	49.66	24.34	13.06	37.08	2.23	52.21	73.90	21.7	127	67	
Hori.	1583.991	PK	48.62	25.14	13.71	36.99	2.23	52.71	73.90	21.2	155	234	
Hori.	2111.996	PK	46.67	26.24	14.28	36.77	2.23	52.65	73.90	21.3	176	218	
Hori.	2483.500	PK	45.68	27.45	14.66	36.52	2.23	53.50	73.90	20.4	106	307	
Hori.	2822.479	PK	47.28	28.23	7.02	36.57	2.23	48.19	73.90	25.7	125	166	
Hori.	3167.985	PK	50.53	28.66	6.45	36.62	2.23	51.25	73.90	22.7	169	344	
Hori.	3695.983	PK	49.75	29.13	6.80	36.59	2.23	51.32	73.90	22.6	152	330	
Hori.	4924.000	PK	44.07	31.40	7.40	36.92	2.23	48.18	73.90	25.7	150	0	
Hori.	7386.000	PK	44.95	36.60	9.12	37.54	2.23	55.36	73.90	18.5	150	0	
Hori.	1056.028	AV	42.56	24.34	13.06	37.08	2.23	45.11	53.90	8.8	127	67	
Hori.	1583.991	AV	42.21	25.14	13.71	36.99	2.23	46.30	53.90	7.6	155	234	
Hori.	2111.996	AV	39.35	26.24	14.28	36.77	2.23	45.33	53.90	8.6	176	218	
Hori.	2822.479	AV	40.58	28.23	7.02	36.57	2.23	41.49	53.90	12.4	125	166	
Hori.	3167.985	AV	45.47	28.66	6.45	36.62	2.23	46.19	53.90	7.7	169	344	
Hori.	3695.983	AV	43.42	29.13	6.80	36.59	2.23	44.99	53.90	8.9	152	330	
Vert.	1056.000	PK	51.80	24.34	13.06	37.08	2.23	54.35	73.90	19.6	191	345	
Vert.	2483.500	PK	45.61	27.45	14.66	36.52	2.23	53.43	73.90	20.5	211	113	
Vert.	3168.166	PK	49.75	28.66	6.45	36.62	2.23	50.47	73.90	23.4	152	40	
Vert.	4924.000	PK	43.89	31.40	7.40	36.92	2.23	48.00	73.90	25.9	150	0	
Vert.	7386.000	PK	44.81	36.60	9.12	37.54	2.23	55.22	73.90	18.7	150	0	
Vert.	1056.000	AV	46.92	24.34	13.06	37.08	2.23	49.47	53.90	4.4	191	345	
Vert.	3168.166	AV	44.85	28.66	6.45	36.62	2.23	45.57	53.90	8.3	152	40	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant. Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	35.22	27.45	14.66	36.52	1.61	2.23	44.65	53.90	9.3	*1)
Hori.	4924.000	AV	34.58	31.40	7.40	36.92	1.61	2.23	40.30	53.90	13.6	
Hori.	7386.000	AV	35.35	36.60	9.12	37.54	1.61	2.23	47.37	53.90	6.5	
Vert.	2483.500	AV	35.21	27.45	14.66	36.52	1.61	2.23	44.64	53.90	9.3	*1)
Vert.	4924.000	AV	34.54	31.40	7.40	36.92	1.61	2.23	40.26	53.90	13.6	
Vert.	7386.000	AV	35.25	36.60	9.12	37.54	1.61	2.23	47.27	53.90	6.6	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.23 dB

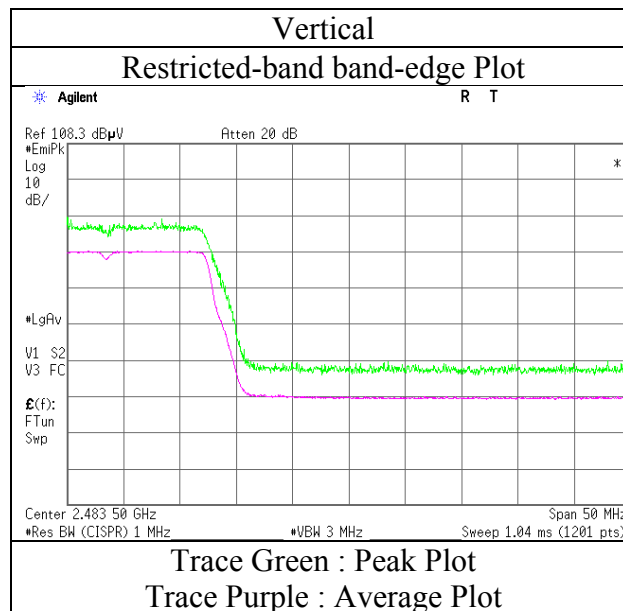
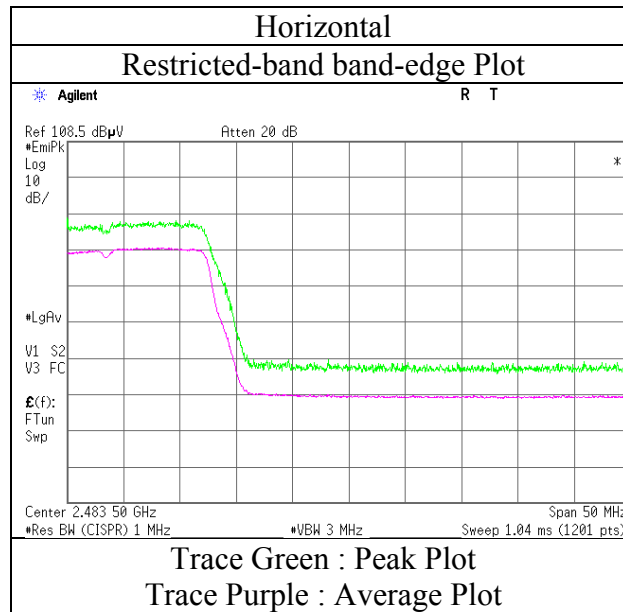
13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

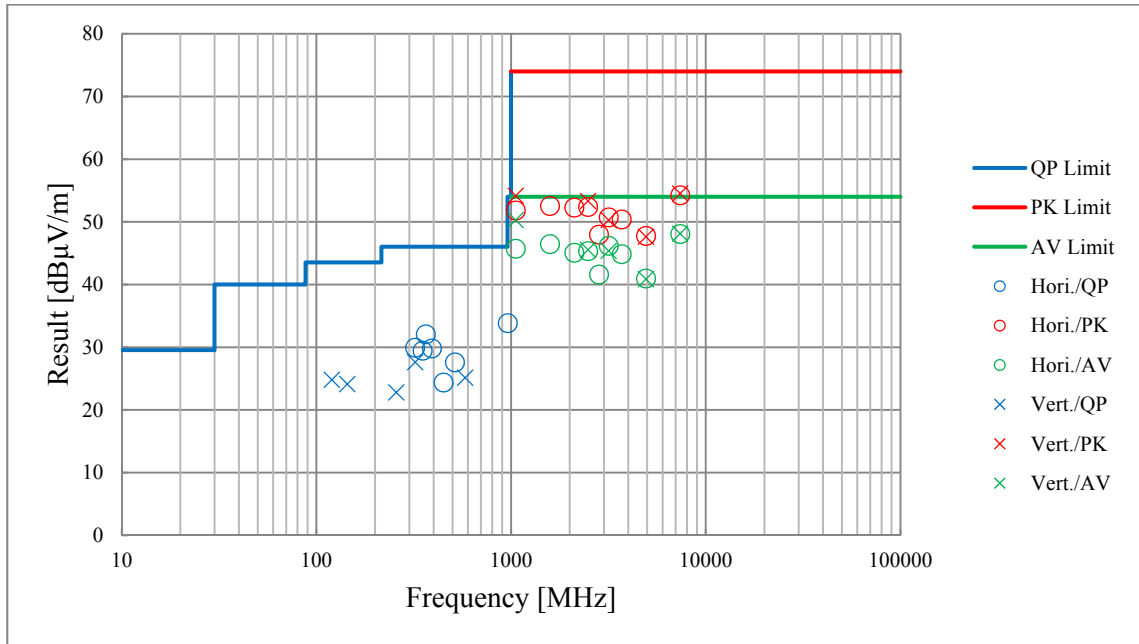
Report No. 12258310S-A-R2  
 Test place Shonan EMC Lab. No.1 Semi Anechoic Chamber  
 Date May 1, 2018  
 Temperature / Humidity 25 deg. C / 48 % RH  
 Engineer Kazuya Noda  
 (1 GHz – 2.8 GHz)  
 Mode Tx 11n-20 2462 MHz



\* Final result of restricted band edge was shown in tabular data.

**Radiated Spurious Emission**  
**(Plot data, Worst case)**

Report No.	12258310S-A-R2			
Test place	Shonan EMC Lab. No.1 Semi Anechoic Chamber			
Date	May 2, 2018	May 1, 2018	May 4, 2018	May 5, 2018
Temperature / Humidity	23 deg. C / 47 % RH	25 deg. C / 48 % RH	22 deg. C / 50 % RH	22 deg. C / 31 % RH
Engineer	Takahiro Suzuki (30 MHz – 1000 MHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Shiro Kobayashi (2.8 GHz – 13 GHz)	Shiro Kobayashi (13 GHz – 26.5 GHz)
Mode	Tx 11g 2462 MHz			

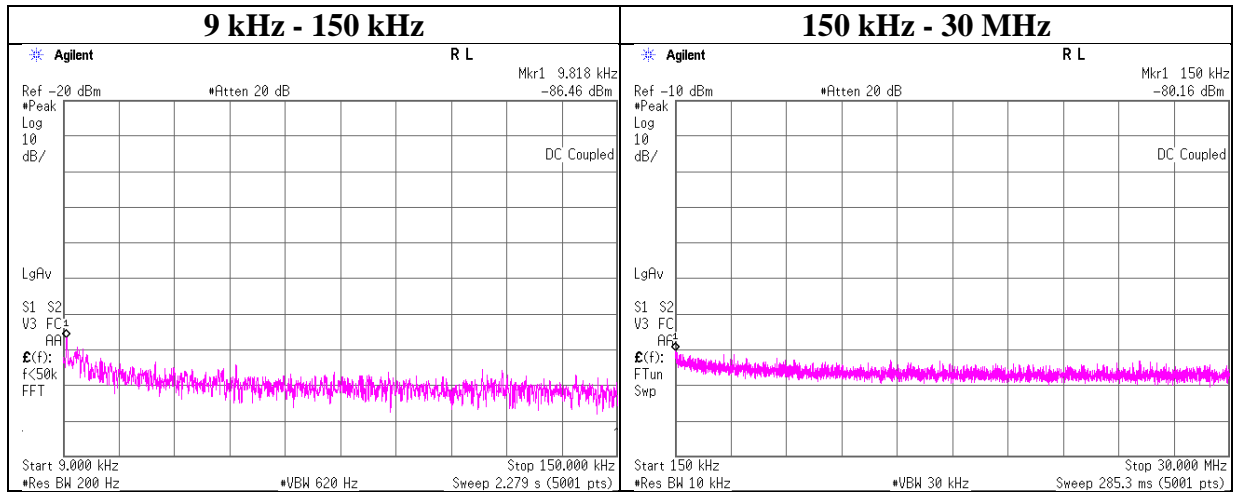


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.



## Conducted Spurious Emission

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 23, 2018  
Temperature / Humidity 26 deg. C / 45 % RH  
Engineer Shiro Kobayashi  
Mode Tx 11g 2462 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
9.82	-86.5	0.01	9.8	2.0	1	-74.6	300	6.0	-13.4	47.7	61.1	
150.00	-80.2	0.01	9.8	2.0	1	-68.3	300	6.0	-7.1	24.0	31.1	

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

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

\*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

### Power Density

Report No. 12258310S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 23, 2018  
Temperature / Humidity 26 deg. C / 45 % RH  
Engineer Shiro Kobayashi  
Mode Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-17.98	1.88	9.88	-6.22	8.00	14.22
2437.00	-19.17	1.88	9.88	-7.41	8.00	15.41
2462.00	-19.12	1.89	9.88	-7.35	8.00	15.35

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-25.86	1.88	9.88	-14.10	8.00	22.10
2437.00	-25.77	1.88	9.88	-14.01	8.00	22.01
2462.00	-25.87	1.89	9.88	-14.10	8.00	22.10

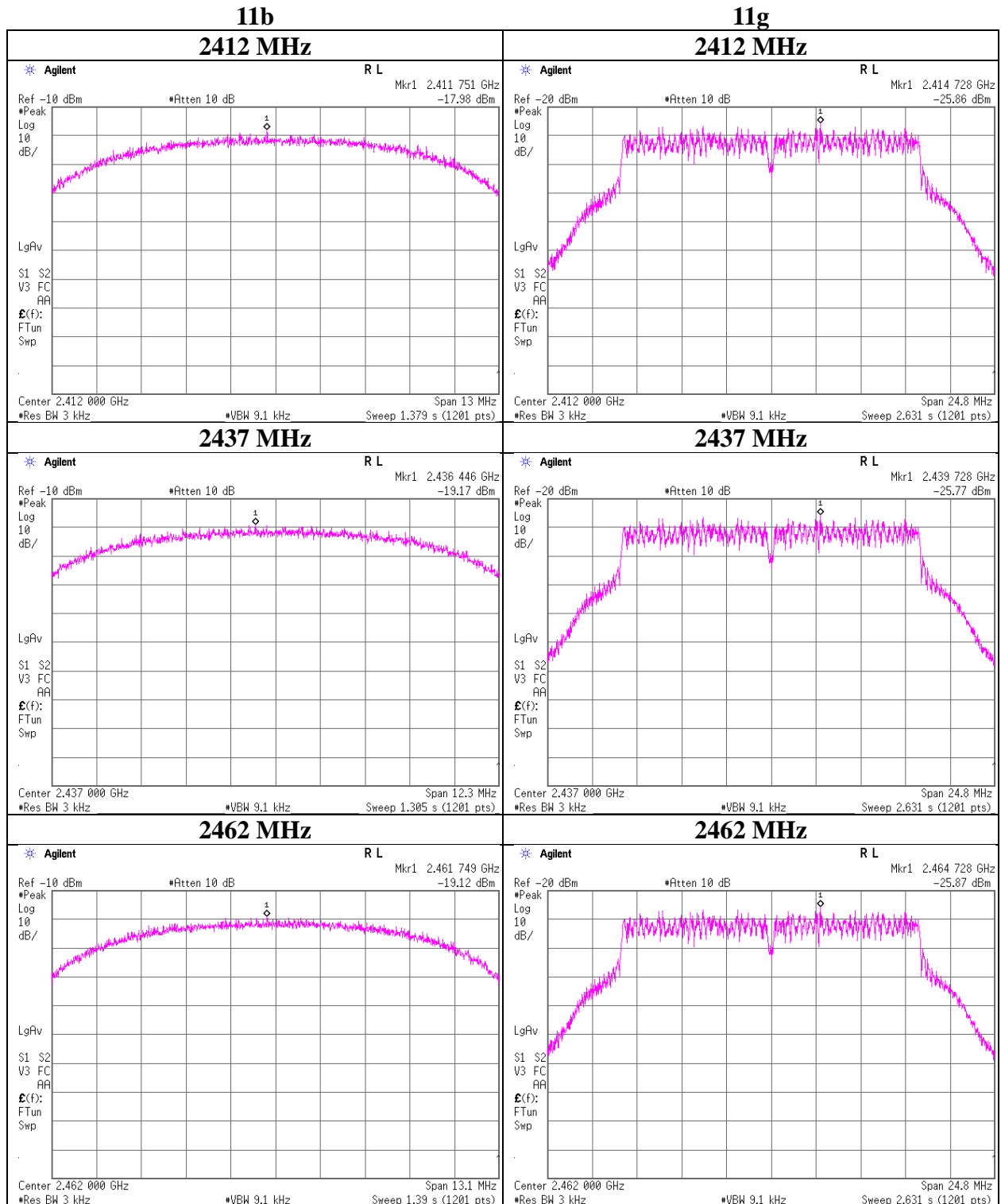
11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-27.84	1.88	9.88	-16.08	8.00	24.08
2437.00	-27.16	1.88	9.88	-15.40	8.00	23.40
2462.00	-27.51	1.89	9.88	-15.74	8.00	23.74

Sample Calculation:

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

**Power Density**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

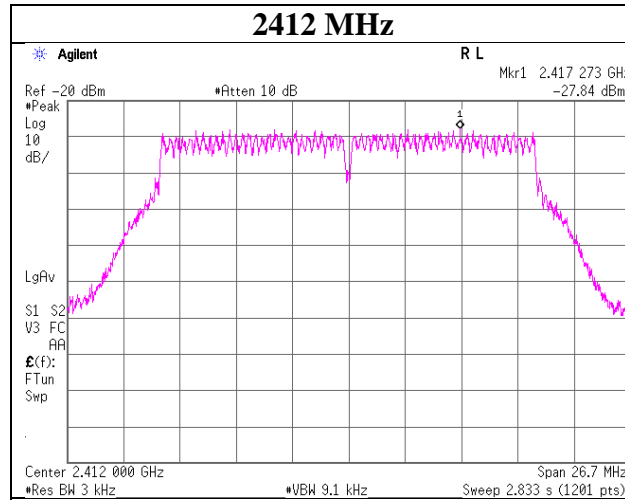
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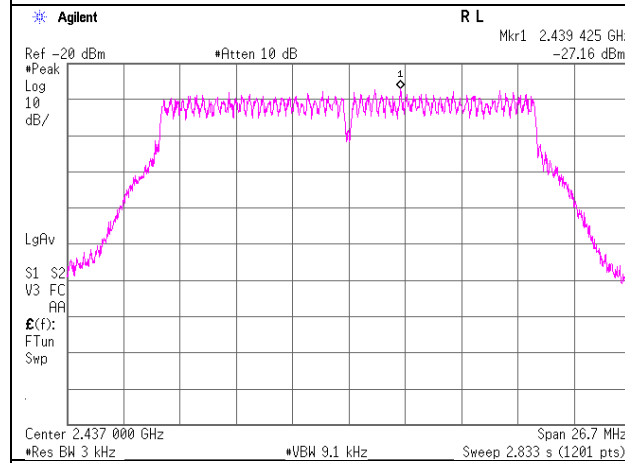
## Power Density

11n-20

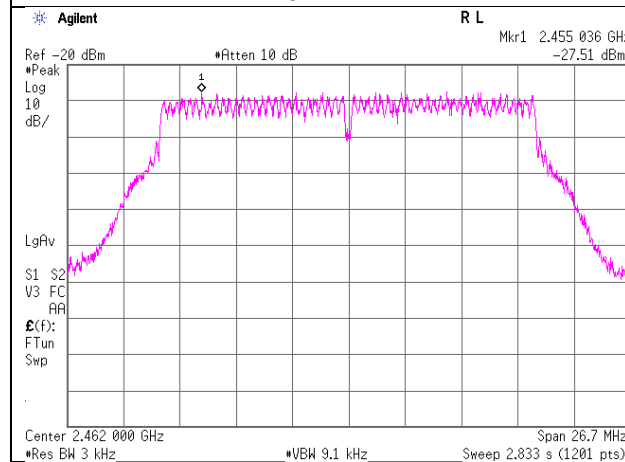
2412 MHz



2437 MHz



2462 MHz



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## APPENDIX 2: Test instruments

### Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2017/12/21 * 12
SJM-17	Measure	ASKUL	-	-	AT	-
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2017/10/16 * 12
SRENT-15	Spectrum Analyzer	Agilent	E4440A	MY46185516	AT	2017/12/26 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2017/04/25 * 12 *1)
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2017/04/25 * 12 *1)
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2018/03/19 * 12
SAT10-13	Attenuator	Weinschel Corp.	54A-10	81626	AT	2018/03/19 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2018/02/15 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	RE	2018/01/29 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2017/05/08 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	RE	2017/08/14 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2017/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2017/10/10 * 12
KJM-09	Measure	KOMELON	KMC-36	-	RE	-
SAEC-01(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-01(SVSW R)	1	RE	2017/07/20 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE, CE,RFI,MF)	-	RE	-
STS-01	Digital Hitester	Hioki	3805-50	080997812	RE	2017/10/16 * 12
SAT10-05	Attenuator(above 1 GHz)	Agilent	8493C-010	74864	RE	2017/11/22 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2018/04/20 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000 NFSNMS/B	1612S006	RE	2018/01/29 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2018/03/20 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2017/09/22 * 12
SCC-G20	Coaxial Cable	Junkosha	J12J102518-00	APR-15-15-003	RE	2018/04/20 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2018/04/20 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2018/02/16 * 12
KAT6-04	Attenuator	INMET	18N-6dB	-	RE	2017/12/14 * 12
SAT3-09	Attenuator	JFW	50HF-003N	-	RE	2017/08/24 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2017/10/21 * 12
SCC-A1/A3/A5/A7/A8/A13/SRS E-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	RE	2018/04/12 * 12
SCC-A2/A4/A6/A7/A8/A13/SRS E-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	RE	2018/04/12 * 12
SLA-05	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	RE	2017/12/10 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2018/04/13 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2017/06/09 * 12

\*1) This test equipment was used for the tests before the expiration date of the calibration.

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: CE: Conducted Emission test  
RE: Radiated Emission test  
AT: Antenna Terminal Conducted test

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