




# RADIO TEST REPORT


**Test Report No. : 12802488S-C**

**Applicant** : Canon Inc.  
**Type of Equipment** : WIRELESS LAN MODULE  
**Model No.** : WM321  
**FCC ID** : AZD321  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**Test Result** : Complied (Refer to SECTION 3.2)

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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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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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. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.

**Date of test:** April 29 to May 21, 2019

**Representative test engineer:**   
Yosuke Ishikawa  
Engineer  
Consumer Technology Division

**Approved by:**   
Toyokazu Imamura  
Leader  
Consumer Technology Division



CERTIFICATE 1266.03

- 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.**  
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## **SECTION 1: Customer information**

Company Name : Canon Inc.  
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Facsimile Number : +81-3-3757-8431  
Contact Person : Hironobu Saida

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
  - SECTION 1: Customer information
  - SECTION 2: Equipment under test (E.U.T.)
  - SECTION 4: Operation of E.U.T. during testing
- \* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

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

Type of Equipment : WIRELESS LAN MODULE  
Model No. : WM321  
Serial No. : Refer to SECTION 4.2  
Rating : DC 7.4 V  
Receipt Date of Sample : April 26, 2019  
(Information from test lab.)  
Country of Mass-production : China  
Condition of EUT : Engineering prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model: WM321 (referred to as the EUT in this report) is a WIRELESS LAN MODULE.

### **Radio Specification**

#### **WLAN**

WLAN Module : WM321  
Radio Type : Transceiver  
Frequency of Operation : 2412 MHz - 2462 MHz  
Modulation : DSSS: CCK, QPSK, BPSK  
OFDM: 64QAM, 16QAM, QPSK, BPSK  
Antenna type : Inverted-F Antenna  
Antenna Gain : -2.1 dBi  
Operating Temperature : 0 deg. C to +55 deg. C  
Operating voltage (radio part) : DC 3.3 V  
Clock frequency (Maximum) : 40 MHz (X'tal)

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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 June 4, 2019 and effective July 5, 2019 except 15.258

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 revision on June 4, 2019, does not affect the test specification applied to the EUT.

### 3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	17.0 dB 8.64749 MHz, L1, AV, Tx 11g 2437 MHz	Complied a)	
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
6 dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(a)(2)	See data.	Complied b)	Conducted
	IC: -	IC: RSS-247 5.2(a)			
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(b)(3)		Complied c)	Conducted
	IC: RSS-Gen 6.12	IC: RSS-247 5.4(d)			
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(e)	Complied d)	Conducted	
	IC: -	IC: RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(d)	5.9 dB 2483.500 MHz, AV, Vert. Tx 11g 2462 MHz	Complied e)/f)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

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

\*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6.

- a) Refer to APPENDIX 1 (data of Conducted Emission)
- b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)
- c) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
- d) Refer to APPENDIX 1 (data of Power Density)
- e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
- f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

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)**

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

#### **FCC Part 15.203/212 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 antenna requirement of Section 15.203/212.

### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	RSS-Gen 6.7	IC: -	N/A	- b)	Conducted
b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

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

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### 3.4 Uncertainty

#### EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.9 dB	2.8 dB	2.9 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.1 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.7 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.1 dB	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 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	0.81 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.53 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.95 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.21 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 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	2.3 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.4 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 dB
Bandwidth Measurement	0.61 %
Duty cycle and Time Measurement	0.012 %

### 3.5 Test Location

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A2LA Certificate Number: 1266.03  
FCC Test Firm Registration Number: 626366

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)**

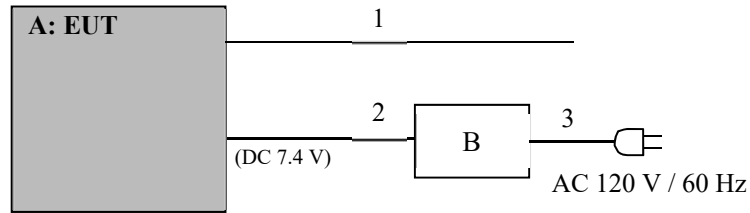
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	6 Mbps, PN9
*Transmitting duty was 100 % on all tests.	
*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: 12 dBm Software: MFG-Tool v01.04 *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>
Conducted Emission	Tx (Transmitting), 11g	2437 MHz
6 dB Bandwidth	Tx, 11b	2412 MHz
Maximum Peak Output Power	Tx, 11g	2437 MHz
Power Density		2462 MHz
99 % Occupied Bandwidth		
Spurious Emission		

## 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	WIRELESS LAN MODULE	WM321	66 *1) 27 *2)	Canon	EUT
B	Power Supply (DC)	PAN35-10A	DE001677	Kikusui	-

\*1) Used for Antenna Terminal conducted test

\*2) Used for Conducted Emission test and Radiated Emission test

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	2.0	Shielded	Shielded	-
2	DC	0.4+1.5	Unshielded	Unshielded	-
3	AC	2.5	Unshielded	Unshielded	-

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

#### For the tests on EUT itself (as a standalone equipment)

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via DC power supply in a shielded room.

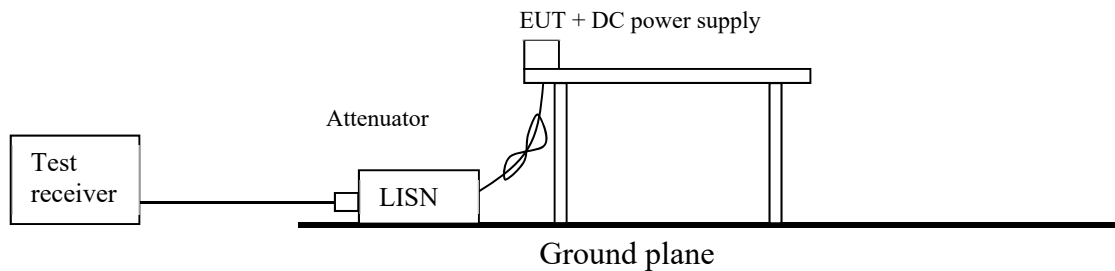
The EUT via DC power supply was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

<b>Detector</b>	<b>: QP and CISPR AV</b>
<b>Measurement range</b>	<b>: 0.15 MHz - 30 MHz</b>
<b>Test data</b>	<b>: APPENDIX</b>
<b>Test result</b>	<b>: Pass</b>

**Figure 1: Test Setup**



## **SECTION 6: Radiated Spurious Emission**

### **Test Procedure**

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r02".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 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.

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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	<u>11,12,2,5,1</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces	RBW: 100 kHz VBW: 300 kHz

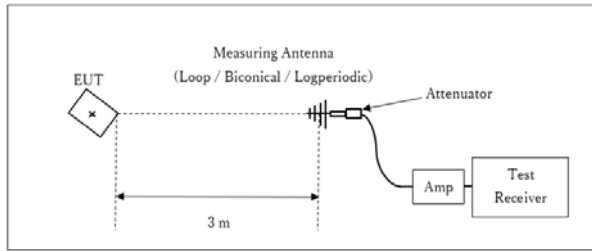
\*1) Average Power Measurement was performed based on ANSI C63.10-2013.

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**Figure 2: Test Setup**

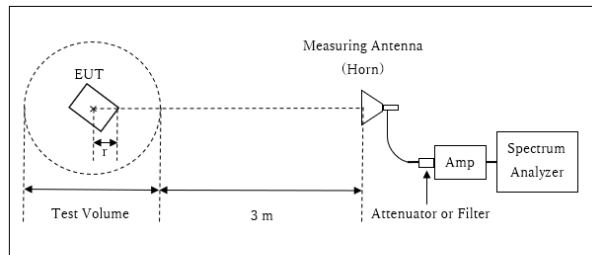
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

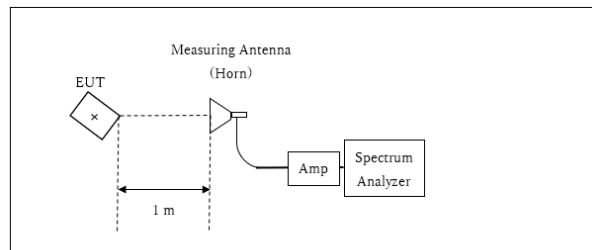


r : Radius of an outer periphery of EUT  
× : Center of turn table

Distance Factor:  $20 \times \log(3.965 \text{ m} / 3.0 \text{ m}) = 2.43 \text{ dB}$   
\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.965 \text{ m}$

Test Volume : 2.0 m  
(Test Volume has been calibrated based on CISPR 16-1-4.)  
r = 0.035 m

13 GHz - 26.5 GHz



× : Center of turn table

Distance Factor:  $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$   
\*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz – 2.8 GHz)	Spurious (2.8 GHz – 13 GHz)	Spurious (13 GHz – 18 GHz)	Spurious (18 GHz – 26.5 GHz)
Horizontal	X	X	X	X	X	X
Vertical	Y	X	Y	Y	X	X

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 7: 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
6 dB 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: 160 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013". *4) 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.  
The equipment and cables were not used for factor 0 dB of the data sheets.

**Test data** : APPENDIX  
**Test result** : Pass

**APPENDIX 1: Test data**

**Conducted Emission**

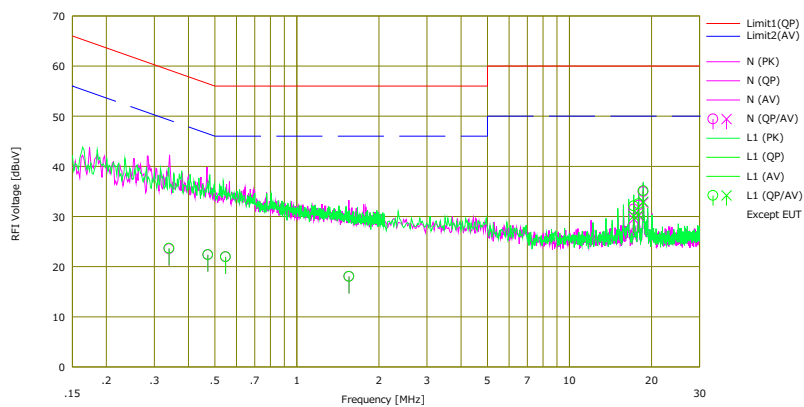
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room  
 Date : 2019/05/01

Mode : Tx IEEE802.11g 2437 MHz  
 Power : AC 120 V / 60 Hz (DC7.4 V)  
 Temp./Humi. : 20 deg.C / 60 %RH  
 Remarks : Measurement line: AC line for DC power supply

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Makoto Hosaka



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]		(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.33941	11.00	---	12.55	23.55	---	59.22	49.22	35.6	---	N	
2	0.47119	9.80	---	12.55	22.35	---	56.49	46.49	34.1	---	N	
3	0.54763	9.40	---	12.55	21.95	---	56.00	46.00	34.0	---	N	
4	1.55270	5.40	---	12.64	18.04	---	56.00	46.00	37.9	---	N	
5	17.21328	18.00	16.00	13.48	31.48	29.48	60.00	50.00	28.5	20.5	N	
6	17.92879	18.70	16.60	13.52	32.22	30.12	60.00	50.00	27.7	19.8	N	
7	18.64749	21.40	19.20	13.54	34.94	32.74	60.00	50.00	25.0	17.2	N	
8	0.33941	11.10	---	12.55	23.65	---	59.22	49.22	35.5	---	L1	
9	0.47119	9.80	---	12.55	22.35	---	56.49	46.49	34.1	---	L1	
10	0.54763	9.40	---	12.55	21.95	---	56.00	46.00	34.0	---	L1	
11	1.55270	5.40	---	12.64	18.04	---	56.00	46.00	37.9	---	L1	
12	17.21328	18.60	16.60	13.48	32.08	30.08	60.00	50.00	27.9	19.9	L1	
13	17.92879	19.00	16.80	13.52	32.52	30.32	60.00	50.00	27.4	19.6	L1	
14	18.64749	21.60	19.40	13.54	35.14	32.94	60.00	50.00	24.8	17.0	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN))+Cable+ATT[dB]  
 LISN(AMN): SLS-02

**6 dB Bandwidth and 99 % Occupied Bandwidth**

Report No. 12802488S-C  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 16, 2019  
Temperature / Humidity 23 deg. C / 37 % RH  
Engineer Yosuke Ishikawa  
Mode Tx

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
11b	2412	13575.1	9.818	> 0.5000
	2437	13582.5	9.832	> 0.5000
	2462	13581.0	9.838	> 0.5000
11g	2412	16850.0	16.609	> 0.5000
	2437	16856.2	16.590	> 0.5000
	2462	16856.3	16.599	> 0.5000

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**UL Japan, Inc.**

**Shonan EMC Lab.**

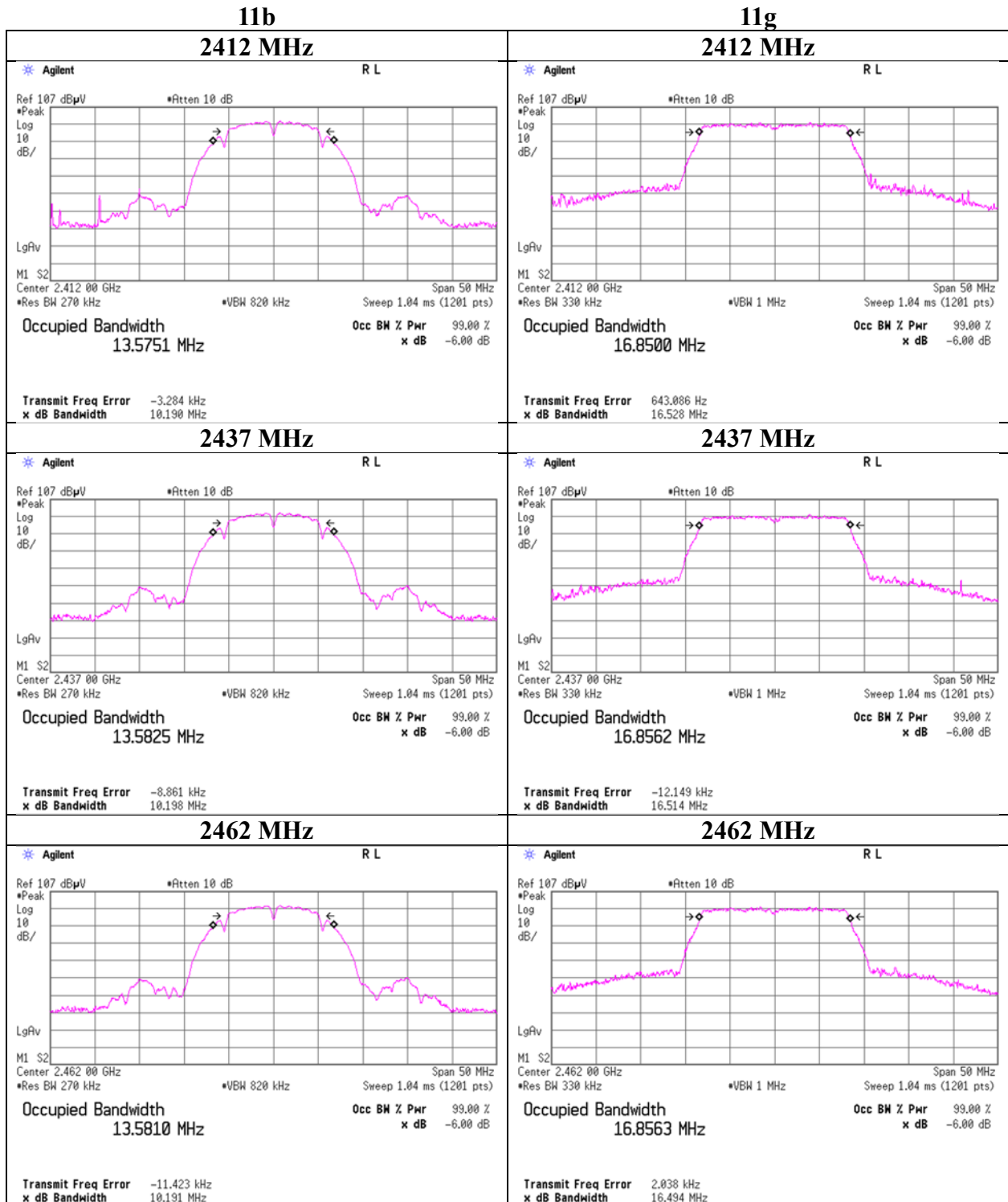
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

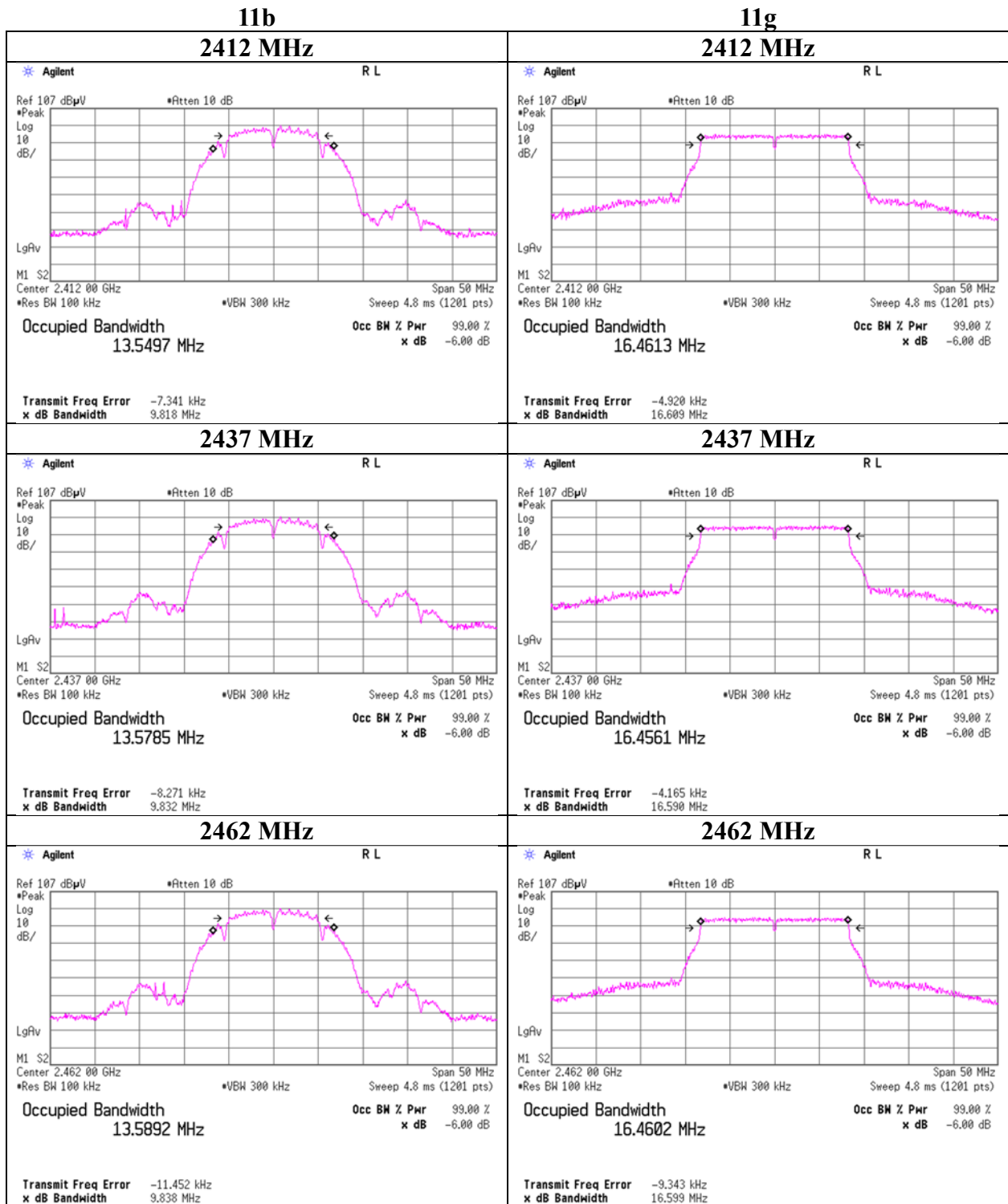
Facsimile : +81 463 50 6401



**99 % Occupied Bandwidth**



**6 dB Bandwidth**



## Maximum Peak Output Power

Report No. 12802488S-C  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date April 29, 2019 May 16, 2019  
Temperature / Humidity 22 deg. C / 41 % RH 23 deg. C / 37 % RH  
Engineer Kazuya Noda Yosuke Ishikawa  
Mode Tx

11b				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	3.03	2.13	9.82	14.98	31.48	30.00	1000	15.02	-2.10	12.88	19.41	36.02	4000	23.14
2437	3.40	2.14	9.82	15.36	34.36	30.00	1000	14.64	-2.10	13.26	21.18	36.02	4000	22.76
2462	3.19	2.15	9.82	15.16	32.81	30.00	1000	14.84	-2.10	13.06	20.23	36.02	4000	22.96

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	3.32	
2	3.40	*
5.5	3.21	
11	3.39	

\*: Worst Rate

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

11g				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	10.57	2.13	9.82	22.52	178.65	30.00	1000	7.48	-2.10	20.42	110.15	36.02	4000	15.60
2437	10.68	2.14	9.82	22.64	183.65	30.00	1000	7.36	-2.10	20.54	113.24	36.02	4000	15.48
2462	10.40	2.15	9.82	22.37	172.58	30.00	1000	7.63	-2.10	20.27	106.41	36.02	4000	15.75

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	10.68	*
9	10.14	
12	9.73	
18	9.44	
24	10.45	
36	9.50	
48	10.05	
54	9.87	

\*: Worst Rate

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

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

Report No. 12802488S-C  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 16, 2019  
Temperature / Humidity 23 deg. C / 37 % RH  
Engineer Yosuke Ishikawa  
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	0.28	2.13	9.82	12.23	16.71	0.00	12.23	16.71
2437	0.69	2.14	9.82	12.65	18.41	0.00	12.65	18.41
2462	0.51	2.15	9.82	12.48	17.70	0.00	12.48	17.70

**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	-0.17	2.13	9.82	11.78	15.07	0.00	11.78	15.07
2437	0.13	2.14	9.82	12.09	16.18	0.00	12.09	16.18
2462	-0.19	2.15	9.82	11.78	15.07	0.00	11.78	15.07

Sample Calculation:

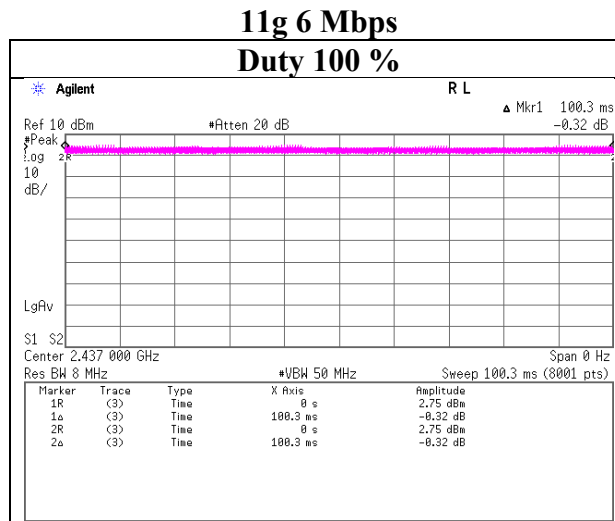
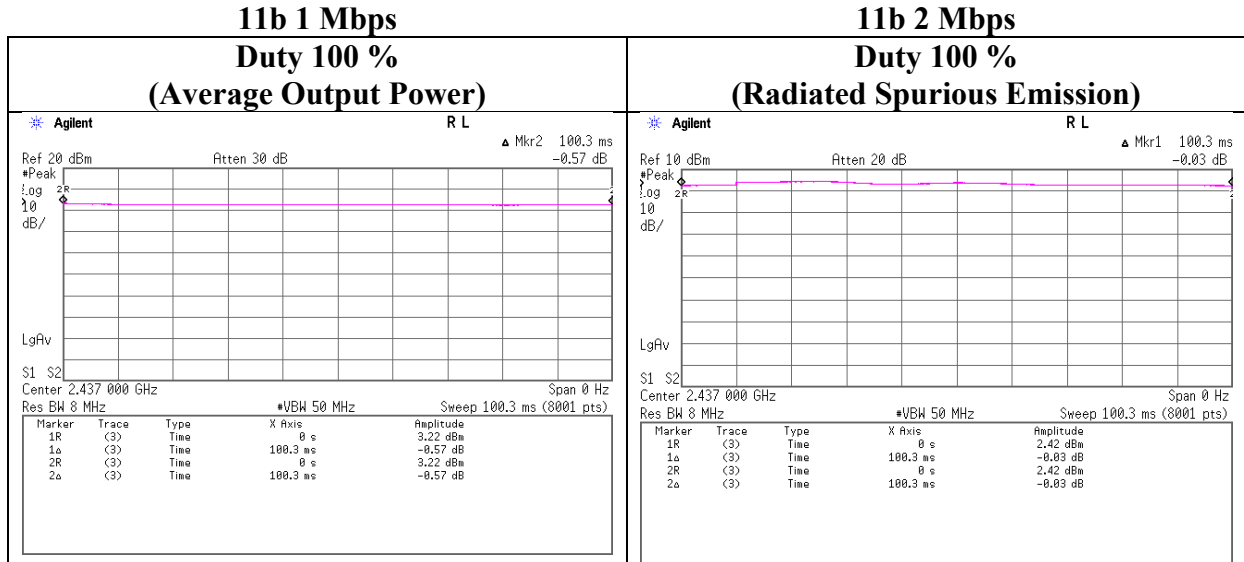
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

**The 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**

Report No. 12802488S-C  
 Test place Shonan EMC Lab. No.5 Shielded Room  
 Date April 29, 2019  
 Temperature / Humidity 22 deg. C / 41 % RH  
 Engineer Kazuya Noda  
 Mode Tx



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

## Radiated Spurious Emission

Report No.	12802488S-C	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	1
Date	May 1, 2019	May 2, 2019
Temperature / Humidity	20deg. C / 56 % RH	20deg. C / 59 % RH
Engineer	Makoto Hosaka	Kazuya Noda
	(1 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.	2390.000	PK	47.96	27.89	14.14	39.46	2.43	52.96	73.90	20.9	385	297	
Hori.	4824.000	PK	44.93	31.34	6.46	39.50	2.43	45.66	73.90	28.2	306	204	
Hori.	7236.000	PK	44.15	36.81	8.13	39.31	2.43	52.21	73.90	21.6	150	0	
Hori.	9648.000	PK	44.92	38.26	9.30	39.49	2.43	55.42	73.90	18.4	150	0	
Hori.	2390.000	AV	37.72	27.89	14.14	39.46	2.43	42.72	53.90	11.1	385	297	
Hori.	4824.000	AV	36.49	31.34	6.46	39.50	2.43	37.22	53.90	16.6	306	204	
Hori.	7236.000	AV	35.49	36.81	8.13	39.31	2.43	43.55	53.90	10.3	150	0	
Hori.	9648.000	AV	36.42	38.26	9.30	39.49	2.43	46.92	53.90	6.9	150	0	
Vert.	2390.000	PK	47.36	27.89	14.14	39.46	2.43	52.36	73.90	21.5	167	159	
Vert.	4824.000	PK	44.98	31.34	6.46	39.50	2.43	45.71	73.90	28.1	320	157	
Vert.	7236.000	PK	44.46	36.81	8.13	39.31	2.43	52.52	73.90	21.3	150	0	
Vert.	9648.000	PK	44.92	38.26	9.30	39.49	2.43	55.42	73.90	18.4	150	0	
Vert.	2390.000	AV	37.37	27.89	14.14	39.46	2.43	42.37	53.90	11.5	167	159	
Vert.	4824.000	AV	36.90	31.34	6.46	39.50	2.43	37.63	53.90	16.2	320	157	
Vert.	7236.000	AV	35.45	36.81	8.13	39.31	2.43	43.51	53.90	10.3	150	0	
Vert.	9648.000	AV	35.82	38.26	9.30	39.49	2.43	46.32	53.90	7.5	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 dB

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

### 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	92.09	27.86	14.15	39.46	2.43	97.07	-	-	Carrier
Hori.	2397.127	PK	44.52	27.89	14.14	39.46	2.43	49.52	77.07	27.5	
Hori.	2400.000	PK	41.30	27.89	14.15	39.46	2.43	46.31	77.07	30.7	
Vert.	2412.000	PK	90.79	27.86	14.15	39.46	2.43	95.77	-	-	Carrier
Vert.	2397.127	PK	43.42	27.89	14.14	39.46	2.43	48.42	75.77	27.3	
Vert.	2400.000	PK	39.98	27.89	14.15	39.46	2.43	44.99	75.77	30.7	

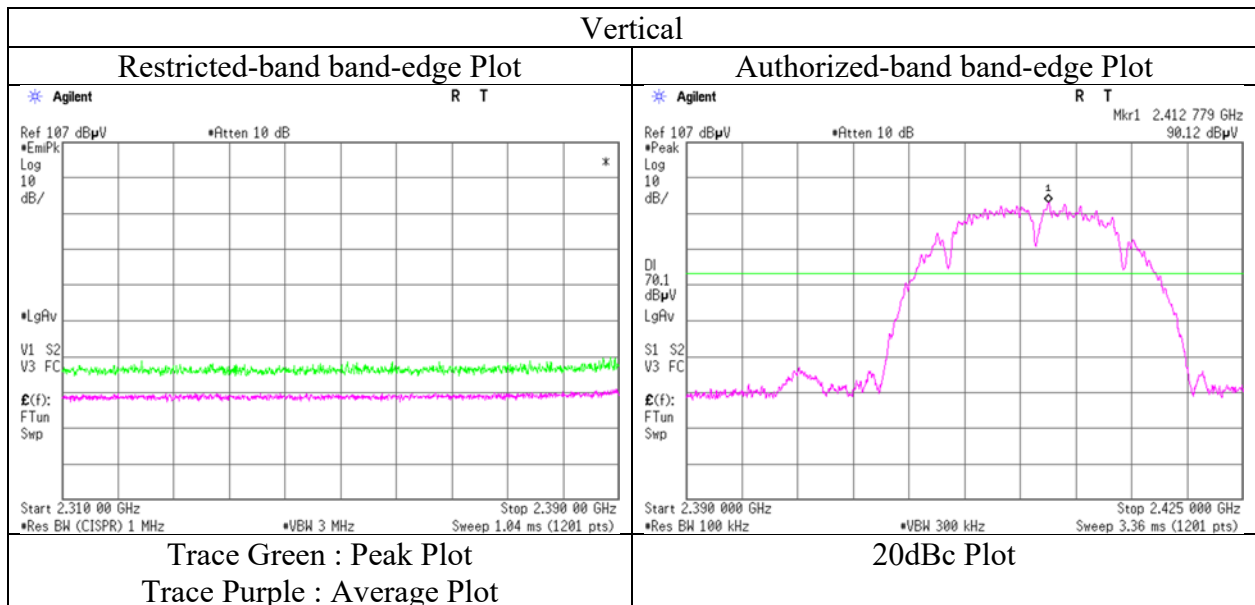
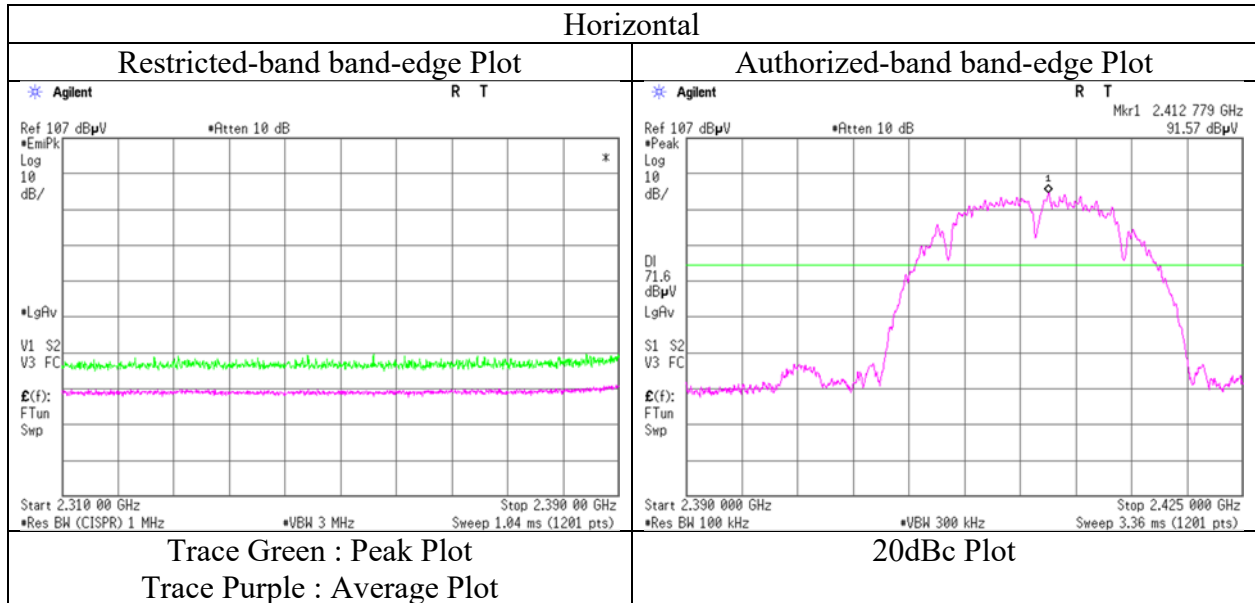
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amp rifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 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. 12802488S-C  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 1  
Date May 1, 2019  
Temperature / Humidity 20deg. C / 56 % RH  
Engineer Makoto Hosaka  
(1 GHz - 13 GHz)  
Mode Tx 11b 2412 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No.	12802488S-C	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	1
Date	May 1, 2019	May 2, 2019
Temperature / Humidity	20deg. C / 56 % RH	20deg. C / 59 % RH
Engineer	Makoto Hosaka	Kazuya Noda
	(1 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.	4874.000	PK	45.68	31.22	6.48	39.50	2.43	46.31	73.90	27.5	400	185	
Hori.	7311.000	PK	44.81	36.70	8.13	39.35	2.43	52.72	73.90	21.1	150	0	
Hori.	9748.000	PK	44.77	38.56	9.29	39.42	2.43	55.63	73.90	18.2	150	0	
Hori.	4874.000	AV	36.29	31.22	6.48	39.50	2.43	36.92	53.90	16.9	400	185	
Hori.	7311.000	AV	35.35	36.70	8.13	39.35	2.43	43.26	53.90	10.6	150	0	
Hori.	9748.000	AV	35.76	38.56	9.29	39.42	2.43	46.62	53.90	7.2	150	0	
Vert.	4874.000	PK	45.57	31.22	6.48	39.50	2.43	46.20	73.90	27.7	178	156	
Vert.	7311.000	PK	43.73	36.70	8.13	39.35	2.43	51.64	73.90	22.2	150	0	
Vert.	9748.000	PK	45.08	38.56	9.29	39.42	2.43	55.94	73.90	17.9	150	0	
Vert.	4874.000	AV	36.58	31.22	6.48	39.50	2.43	37.21	53.90	16.6	178	156	
Vert.	7311.000	AV	35.52	36.70	8.13	39.35	2.43	43.43	53.90	10.4	150	0	
Vert.	9748.000	AV	36.10	38.56	9.29	39.42	2.43	46.96	53.90	6.9	150	0	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.965\text{ m} / 3.0\text{ m}) = 2.43\text{ dB}$

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



## Radiated Spurious Emission

Report No.	12802488S-C	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	1
Date	May 1, 2019	May 2, 2019
Temperature / Humidity	20deg. C / 56 % RH	20deg. C / 59 % RH
Engineer	Makoto Hosaka	Kazuya Noda
	(1 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.	2483.500	PK	46.95	27.64	14.21	39.46	2.43	51.77	73.90	22.1	134	292	
Hori.	4924.000	PK	44.36	31.22	6.50	39.50	2.43	45.01	73.90	28.8	392	292	
Hori.	7386.000	PK	44.36	36.75	8.14	39.39	2.43	52.29	73.90	21.6	150	0	
Hori.	9848.000	PK	45.25	38.76	9.28	39.35	2.43	56.37	73.90	17.5	150	0	
Hori.	2483.500	AV	36.81	27.64	14.21	39.46	2.43	41.63	53.90	12.2	134	292	
Hori.	4924.000	AV	35.73	31.22	6.50	39.50	2.43	36.38	53.90	17.5	392	292	
Hori.	7386.000	AV	35.08	36.75	8.14	39.39	2.43	43.01	53.90	10.8	150	0	
Hori.	9848.000	AV	35.93	38.76	9.28	39.35	2.43	47.05	53.90	<b>6.8</b>	150	0	
Vert.	2483.500	PK	46.41	27.64	14.21	39.46	2.43	51.23	73.90	22.6	153	296	
Vert.	4924.000	PK	45.30	31.22	6.50	39.50	2.43	45.95	73.90	27.9	225	163	
Vert.	7386.000	PK	43.99	36.75	8.14	39.39	2.43	51.92	73.90	21.9	150	0	
Vert.	9848.000	PK	44.74	38.76	9.28	39.35	2.43	55.86	73.90	18.0	150	0	
Vert.	2483.500	AV	36.62	27.64	14.21	39.46	2.43	41.44	53.90	12.4	153	296	
Vert.	4924.000	AV	36.16	31.22	6.50	39.50	2.43	36.81	53.90	17.0	225	163	
Vert.	7386.000	AV	35.68	36.75	8.14	39.39	2.43	43.61	53.90	10.2	150	0	
Vert.	9848.000	AV	35.63	38.76	9.28	39.35	2.43	46.75	53.90	7.1	150	0	

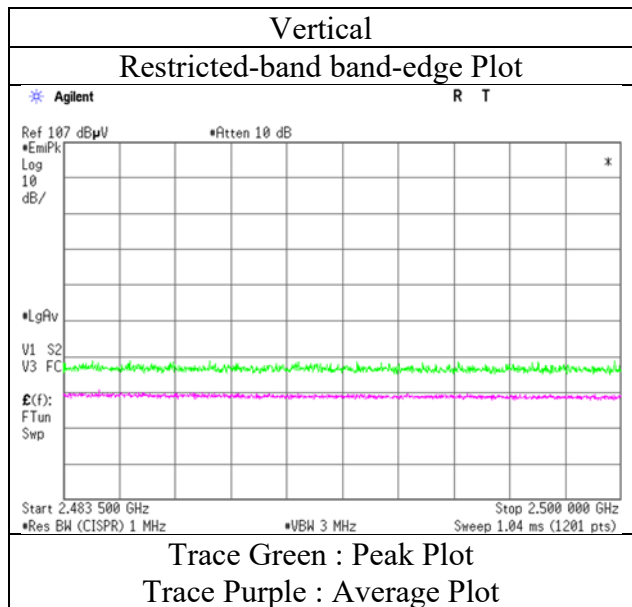
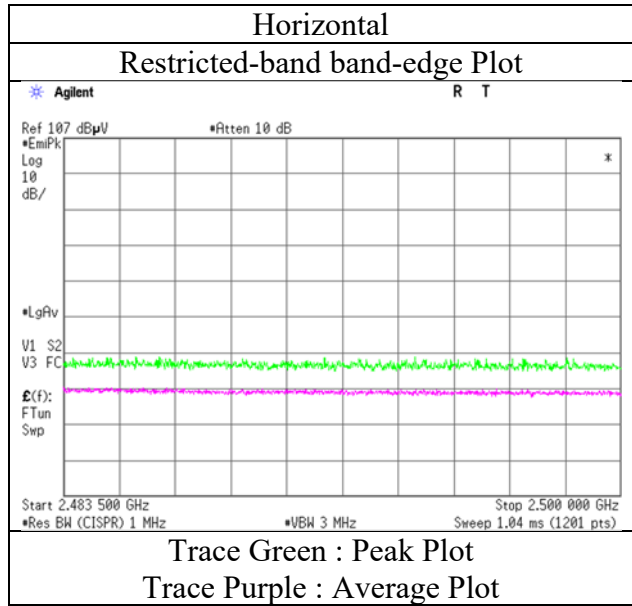
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log(3.965 m / 3.0 m) = 2.43 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. 12802488S-C  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 1  
Date May 1, 2019  
Temperature / Humidity 20deg. C / 56 % RH  
Engineer Makoto Hosaka  
(1 GHz - 13 GHz)  
Mode Tx 11b 2462 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No.	12802488S-C	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	1
Date	May 1, 2019	May 2, 2019
Temperature / Humidity	20deg. C / 56 % RH	20deg. C / 59 % RH
Engineer	Makoto Hosaka	Kazuya Noda
	(1 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.	2339.130	PK	47.12	27.94	14.07	39.46	2.43	52.10	73.90	21.8	150	352	
Hori.	2390.000	PK	53.25	27.89	14.14	39.46	2.43	58.25	73.90	15.6	150	352	
Hori.	4824.000	PK	44.80	31.34	6.46	39.50	2.43	45.53	73.90	28.3	102	208	
Hori.	7236.000	PK	45.52	36.81	8.13	39.31	2.43	53.58	73.90	20.3	150	0	
Hori.	9648.000	PK	45.47	38.26	9.30	39.49	2.43	55.97	73.90	17.9	150	0	
Hori.	2339.130	AV	37.46	27.94	14.07	39.46	2.43	42.44	53.90	11.4	150	352	
Hori.	2390.000	AV	42.28	27.89	14.14	39.46	2.43	47.28	53.90	6.6	150	352	
Hori.	4824.000	AV	36.17	31.34	6.46	39.50	2.43	36.90	53.90	17.0	102	208	
Hori.	7236.000	AV	35.30	36.81	8.13	39.31	2.43	43.36	53.90	10.5	150	0	
Hori.	9648.000	AV	36.17	38.26	9.30	39.49	2.43	46.67	53.90	7.2	150	0	
Vert.	2339.130	PK	47.92	27.94	14.07	39.46	2.43	52.90	73.90	21.0	139	198	
Vert.	2390.000	PK	53.49	27.89	14.14	39.46	2.43	58.49	73.90	15.4	139	198	
Vert.	4824.000	PK	44.53	31.34	6.46	39.50	2.43	45.26	73.90	28.6	168	147	
Vert.	7236.000	PK	44.47	36.81	8.13	39.31	2.43	52.53	73.90	21.3	150	0	
Vert.	9648.000	PK	44.99	38.26	9.30	39.49	2.43	55.49	73.90	18.4	150	0	
Vert.	2339.130	AV	38.46	27.94	14.07	39.46	2.43	43.44	53.90	10.4	139	198	
Vert.	2390.000	AV	42.29	27.89	14.14	39.46	2.43	47.29	53.90	6.6	139	198	
Vert.	4824.000	AV	35.95	31.34	6.46	39.50	2.43	36.68	53.90	17.2	168	147	
Vert.	7236.000	AV	35.52	36.81	8.13	39.31	2.43	43.58	53.90	10.3	150	0	
Vert.	9648.000	AV	35.71	38.26	9.30	39.49	2.43	46.21	53.90	7.6	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor  
Distance factor : 1 GHz - 13 GHz :  $20\log(3.965\text{ m} / 3.0\text{ m}) = 2.43\text{ dB}$   
13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

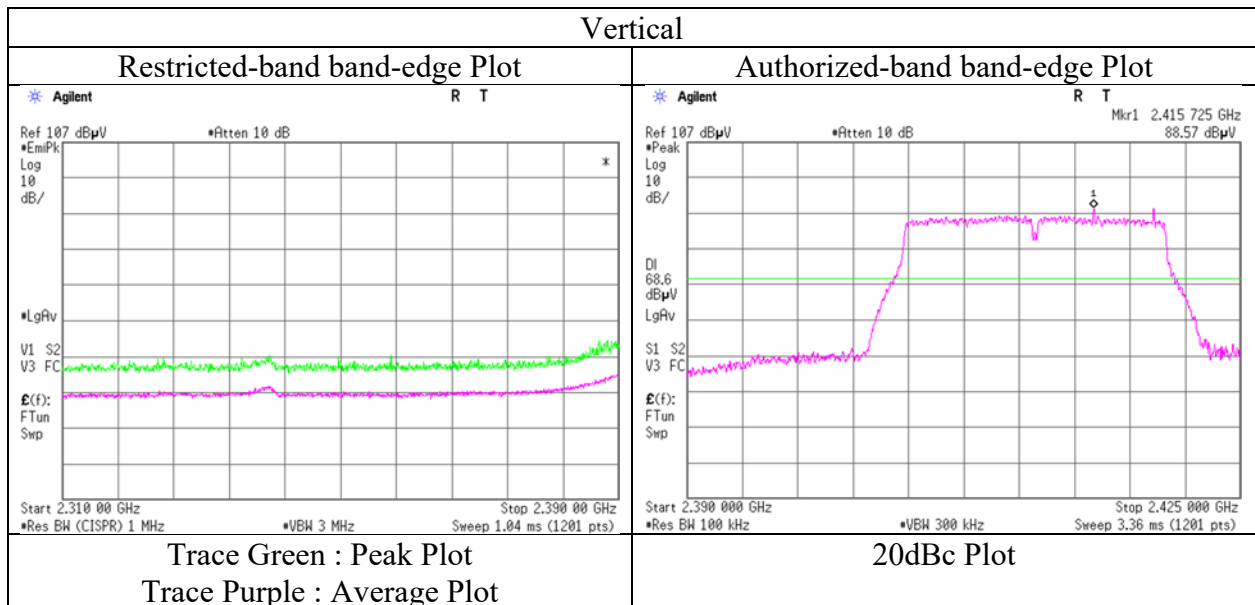
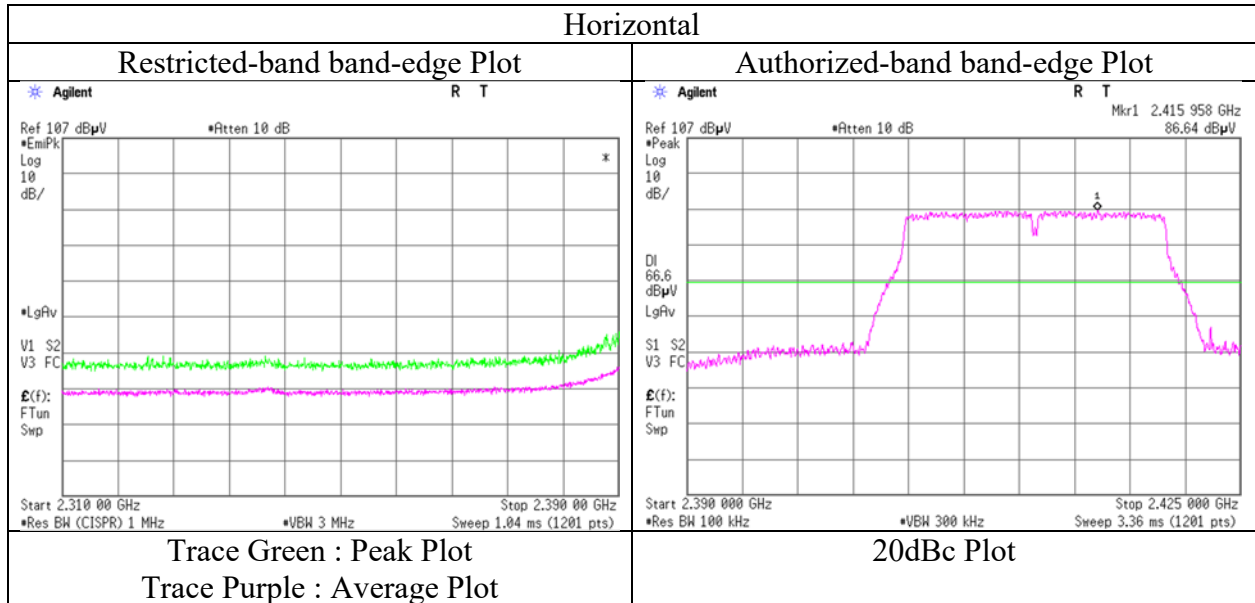
### 20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

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	88.11	27.86	14.15	39.46	2.43	93.09	-	-	Carrier
Hori.	2400.000	PK	46.77	27.89	14.15	39.46	2.43	51.78	73.09	21.3	
Vert.	2412.000	PK	89.31	27.86	14.15	39.46	2.43	94.29	-	-	Carrier
Vert.	2400.000	PK	46.53	27.89	14.15	39.46	2.43	51.54	74.29	22.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor  
Distance factor : 1 GHz - 13 GHz :  $20\log(3.965\text{ m} / 3.0\text{ m}) = 2.43\text{ dB}$   
13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

Report No. 12802488S-C  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 1  
Date May 1, 2019  
Temperature / Humidity 20deg. C / 56 % RH  
Engineer Makoto Hosaka  
(1 GHz - 13 GHz)  
Mode Tx 11g 2412 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No.	12802488S-C	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	1
Date	May 1, 2019	May 2, 2019
Temperature / Humidity	20deg. C / 56 % RH	20deg. C / 59 % RH
Engineer	Makoto Hosaka (1 GHz - 13 GHz)	Kazuya Noda (30 MHz – 1 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.	189.402	QP	22.91	16.50	9.16	31.78	0.00	16.79	43.50	26.7	302	8	
Hori.	286.101	QP	37.89	13.53	7.06	31.77	0.00	26.71	46.00	19.2	152	291	
Hori.	4874.000	PK	44.38	31.22	6.48	39.50	2.43	45.01	73.90	28.8	192	191	
Hori.	7311.000	PK	44.20	36.70	8.13	39.35	2.43	52.11	73.90	21.7	150	0	
Hori.	9748.000	PK	44.83	38.56	9.29	39.42	2.43	55.69	73.90	18.2	150	0	
Hori.	4874.000	AV	36.07	31.22	6.48	39.50	2.43	36.70	53.90	17.2	192	191	
Hori.	7311.000	AV	35.51	36.70	8.13	39.35	2.43	43.42	53.90	10.4	150	0	
Hori.	9748.000	AV	35.65	38.56	9.29	39.42	2.43	46.51	53.90	7.3	150	0	
Vert.	43.651	QP	29.19	13.47	7.36	31.84	0.00	18.18	40.00	21.8	100	253	
Vert.	73.997	QP	40.01	6.31	7.92	31.83	0.00	22.41	40.00	17.5	115	262	
Vert.	86.832	QP	36.04	7.54	8.44	31.83	0.00	20.19	40.00	19.8	100	256	
Vert.	105.224	QP	40.35	11.14	8.24	31.82	0.00	27.91	43.50	15.5	100	202	
Vert.	345.555	QP	23.94	15.02	7.62	31.75	0.00	14.83	46.00	31.1	100	118	
Vert.	4874.000	PK	45.34	31.22	6.48	39.50	2.43	45.97	73.90	27.9	121	151	
Vert.	7311.000	PK	44.70	36.70	8.13	39.35	2.43	52.61	73.90	21.2	150	0	
Vert.	9748.000	PK	45.53	38.56	9.29	39.42	2.43	56.39	73.90	17.5	150	0	
Vert.	4874.000	AV	35.84	31.22	6.48	39.50	2.43	36.47	53.90	17.4	121	151	
Vert.	7311.000	AV	35.60	36.70	8.13	39.35	2.43	43.51	53.90	10.3	150	0	
Vert.	9748.000	AV	35.64	38.56	9.29	39.42	2.43	46.50	53.90	7.4	150	0	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.965\text{ m} / 3.0\text{ m}) = 2.43\text{ dB}$

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

## Radiated Spurious Emission

Report No.	12802488S-C	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	1
Date	May 1, 2019	May 2, 2019
Temperature / Humidity	20deg. C / 56 % RH	20deg. C / 59 % RH
Engineer	Makoto Hosaka	Kazuya Noda
	(1 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.	2483.500	PK	53.55	27.64	14.21	39.46	2.43	58.37	73.90	15.5	290	137	
Hori.	4924.000	PK	44.83	31.22	6.50	39.50	2.43	45.48	73.90	28.4	389	304	
Hori.	7386.000	PK	44.12	36.75	8.14	39.39	2.43	52.05	73.90	21.8	150	0	
Hori.	9848.000	PK	44.99	38.76	9.28	39.35	2.43	56.11	73.90	17.7	150	0	
Hori.	2483.500	AV	42.58	27.64	14.21	39.46	2.43	47.40	53.90	6.5	290	137	
Hori.	4924.000	AV	35.61	31.22	6.50	39.50	2.43	36.26	53.90	17.6	389	304	
Hori.	7386.000	AV	35.23	36.75	8.14	39.39	2.43	43.16	53.90	10.7	150	0	
Hori.	9848.000	AV	35.65	38.76	9.28	39.35	2.43	46.77	53.90	7.1	150	0	
Vert.	2483.500	PK	53.67	27.64	14.21	39.46	2.43	58.49	73.90	15.4	399	148	
Vert.	4924.000	PK	44.79	31.22	6.50	39.50	2.43	45.44	73.90	28.4	194	194	
Vert.	7386.000	PK	44.73	36.75	8.14	39.39	2.43	52.66	73.90	21.2	150	0	
Vert.	9848.000	PK	44.45	38.76	9.28	39.35	2.43	55.57	73.90	18.3	150	0	
Vert.	2483.500	AV	43.09	27.64	14.21	39.46	2.43	47.91	53.90	5.9	399	148	
Vert.	4924.000	AV	35.81	31.22	6.50	39.50	2.43	36.46	53.90	17.4	194	194	
Vert.	7386.000	AV	35.66	36.75	8.14	39.39	2.43	43.59	53.90	10.3	150	0	
Vert.	9848.000	AV	35.57	38.76	9.28	39.35	2.43	46.69	53.90	7.2	150	0	

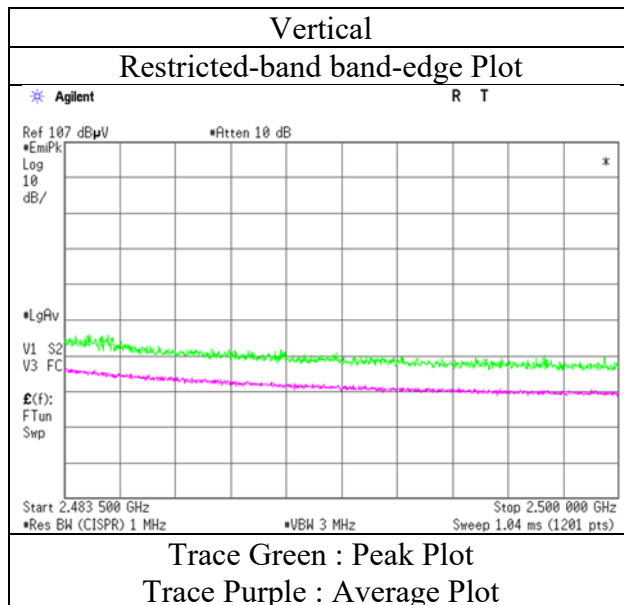
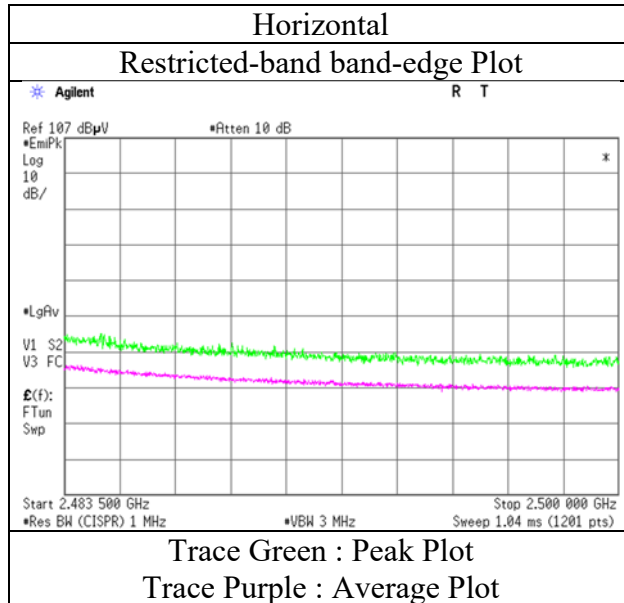
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log(3.965 m / 3.0 m) = 2.43 dB

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

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

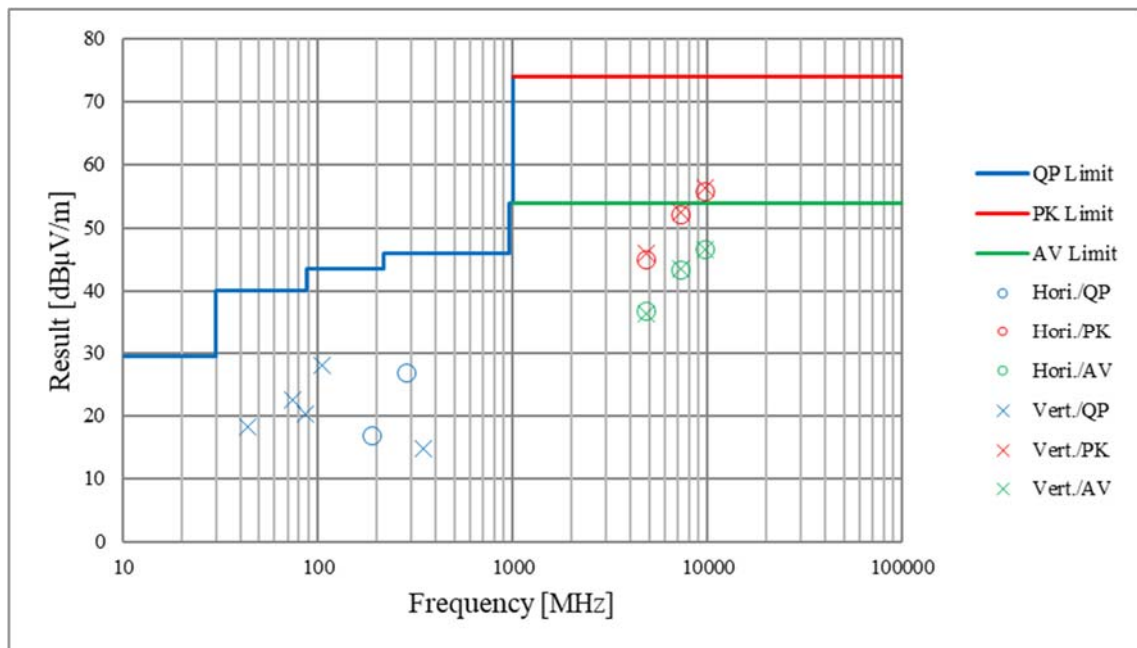
Report No. 12802488S-C  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 1  
Date May 1, 2019  
Temperature / Humidity 20deg. C / 56 % RH  
Engineer Makoto Hosaka  
(1 GHz - 13 GHz)  
Mode Tx 11g 2462 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

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

Report No.	12802488S-C	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	1	1
Date	May 1, 2019	May 2, 2019
Temperature / Humidity	20deg. C / 56 % RH	20deg. C / 59 % RH
Engineer	Makoto Hosaka (1 GHz - 13 GHz)	Kazuya Noda (30 MHz - 1 GHz) (13 GHz - 26.5 GHz)
Mode	Tx 11g 2437 MHz	

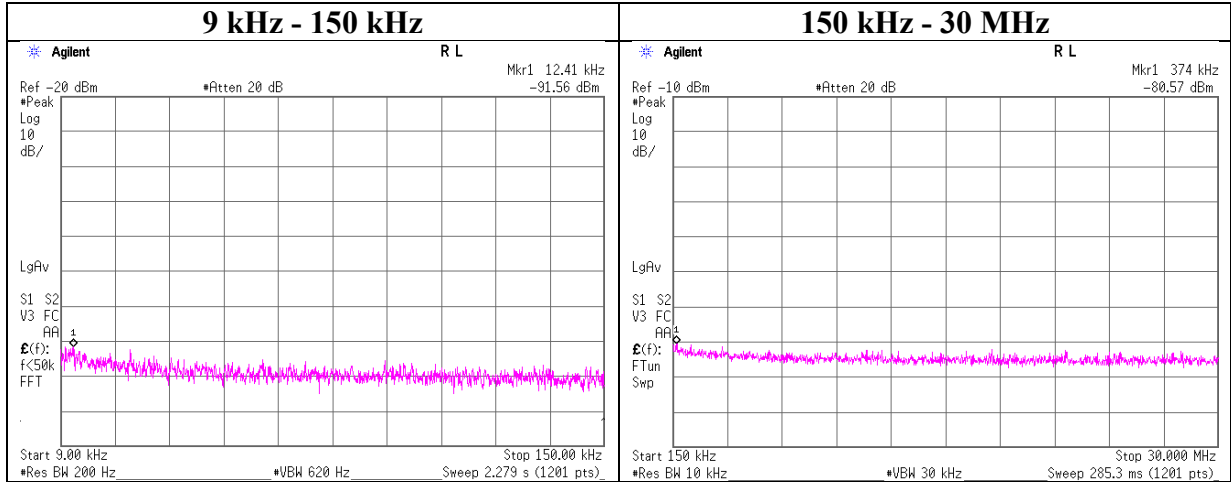


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.



## Conducted Spurious Emission

Report No. 12802488S-C  
 Test place Shonan EMC Lab. No.5 Shielded Room  
 Date April 29, 2019  
 Temperature / Humidity 22 deg. C / 41 % RH  
 Engineer Kazuya Noda  
 Mode Tx 11g 2437 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
12.41	-91.6	0.02	9.7	2.0	1	-79.8	300	6.0	-18.5	45.7	64.2	
374.00	-80.6	0.02	9.7	2.0	1	-68.8	300	6.0	-7.6	16.1	23.7	

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

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

N: Number of output

\*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

### Power Density

Report No. 12802488S-C  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 16, 2019  
Temperature / Humidity 23 deg. C / 37 % RH  
Engineer Yosuke Ishikawa  
Mode Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-22.35	2.13	9.82	-10.40	8.00	18.40
2437.00	-21.90	2.14	9.82	-9.94	8.00	17.94
2462.00	-22.10	2.15	9.82	-10.13	8.00	18.13

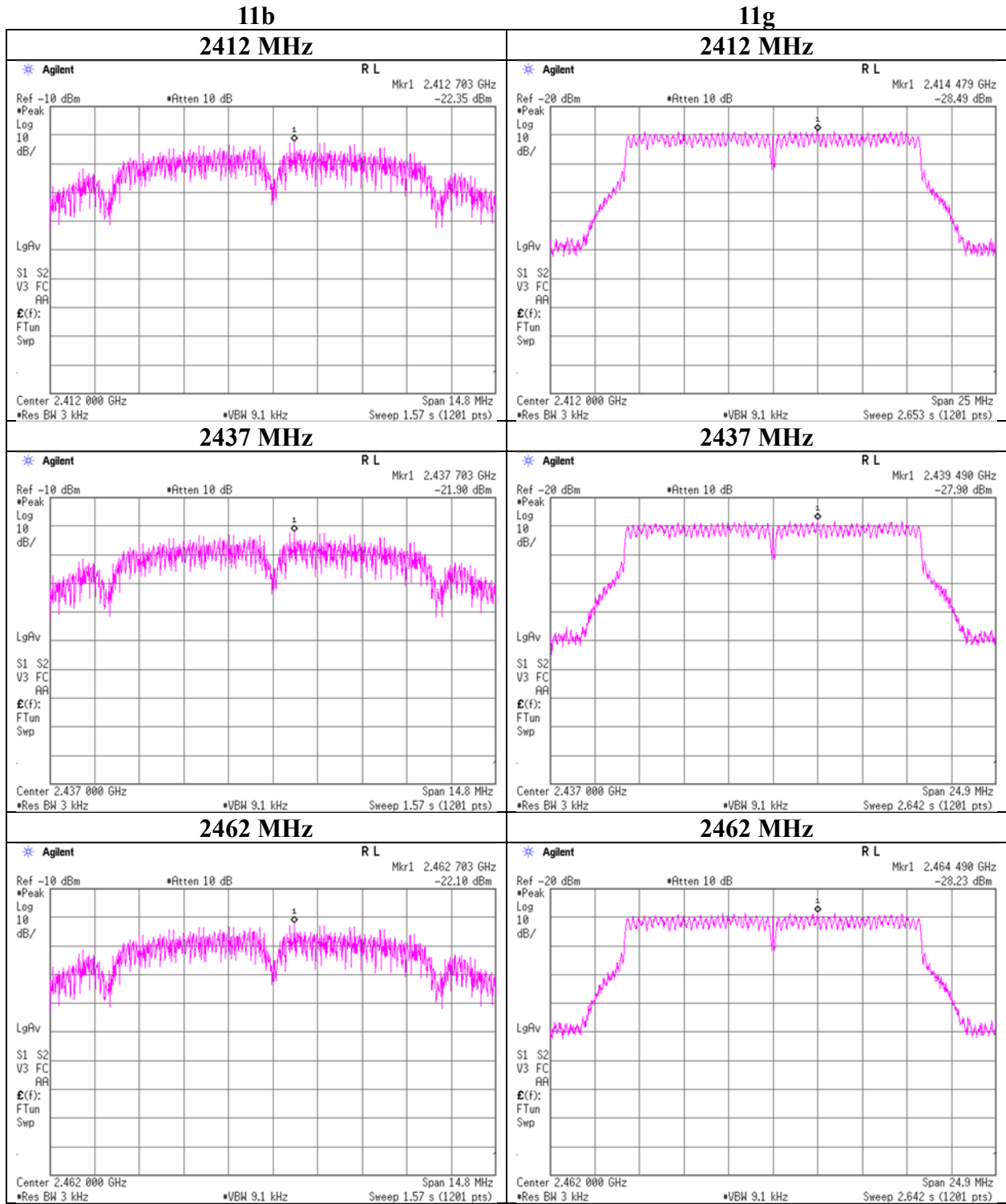
11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-28.49	2.13	9.82	-16.54	8.00	24.54
2437.00	-27.90	2.14	9.82	-15.94	8.00	23.94
2462.00	-28.23	2.15	9.82	-16.26	8.00	24.26

Sample Calculation:

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

**Power Density**



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

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## **APPENDIX 2: Test instruments**

### **Test Instruments**

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KSA-08	AT	145089	Spectrum Analyzer	AGILENT	E4446A	MY46180525	2018/10/7	2019/10/31	12
KTS-07	AT	145111	Digital Tester	SANWA	PC500	7019232	2018/10/17	2019/10/31	12
SAT10-14	AT	154591	Attenuator	Weinschel Corp.	54A-10	81595	2019/4/16	2020/4/30	12
SCC-G32	AT	145183	Coaxial Cable	Junkosha	MWX241-02000KMSKMS	OCT-09-13-005	2018/11/25	2019/11/30	12
SOS-19	AT	175823	Humidity Indicator	CUSTOM	CTH-201	-	2018/12/5	2019/12/31	12
SPM-07	AT	146247	Power Meter	AGILENT	8990B	MY5100272	2018/7/13	2019/7/31	12
SPSS-04	AT	146310	Power sensor	AGILENT	N1923A	MY5326009	2018/7/13	2019/7/31	12
SAT3-13	CE	150923	Attenuator	JFW	50HF-003N	-	2019/1/25	2020/1/31	12
SCC-A12/A13/SRSE-01	CE	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269(RF Selector)	2019/4/19	2020/4/30	12
SLS-02	CE	145539	LISN	Rohde & Schwarz	ENV216	100512	2019/2/20	2020/2/29	12
SOS-16	CE	167990	Humidity Indicator	CUSTOM	CTH-202	708Q08R	2019/1/11	2020/1/31	12
COTS-SEMI-5	CE,RE	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME,PE)	-	-	-	-
KJM-09	CE,RE	145929	Measure	KOMELON	KMC-36	-	-	-	-
STR-01	CE,RE	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2019/4/14	2020/4/30	12
STS-01	CE,RE	145792	Digital Hitester	HIOKI	3805-50	80997812	2018/10/16	2019/10/31	12
KAT6-04	RE	144899	Attenuator	Inmet	18N-6dB	-	2018/12/25	2019/12/31	12
SAEC-01(NSA)	RE	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2019/4/2	2020/4/30	12
SAEC-01(SVSWR)	RE	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2018/7/19	2019/7/31	12
SAF-01	RE	145003	Pre Amplifier	SONOMA	310N	290211	2019/2/5	2020/2/29	12
SAF-04	RE	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2018/6/26	2019/6/30	12
SAF-08	RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2019/3/5	2020/3/31	12

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SAT10-06	RE	145137	Attenuator	AGILENT	8493C-010	74865	2018/11/25	2019/11/30	12
SAT3-09	RE	144959	Attenuator	JFW	50HF-003N	-	2018/8/23	2019/8/31	12
SBA-01	RE	145161	Biconical Antenna	Schwarzbeck	BBA9106	91032664	2019/4/1	2020/4/30	12
SCC-A1/A3/A5/A7/A8/A13/SRSE-01	RE	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-269(RF Selector)	2019/4/19	2020/4/30	12
SCC-A2/A4/A6/A7/A8/A13/SRSE-01	RE	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-269(RF Selector)	2019/4/19	2020/4/30	12
SCC-G15	RE	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2019/3/27	2020/3/31	12
SCC-G40	RE	166491	Coaxial Cable	Junkosha	MWX221-01000NFSN MS/B	1612S005	2019/1/25	2020/1/31	12
SCC-G43	RE	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104 E	SN MY 13406/4E	2018/7/10	2019/7/31	12
SCC-G44	RE	168300	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800070/4A	2019/3/26	2020/3/31	12
SFL-02	RE	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2018/11/16	2019/11/30	12
SHA-01	RE	145383	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	2018/7/23	2019/7/31	12
SHA-04	RE	145512	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	2018/7/23	2019/7/31	12
SLA-05	RE	145527	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	2019/4/1	2020/4/30	12
SOS-01	RE	146316	Humidity Indicator	A&D	AD-5681	4062555	2018/10/25	2019/10/31	12
SSA-03	RE	145801	Spectrum Analyzer	AGILENT	E4448A	MY48250152	2018/8/30	2019/8/31	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: CE: Conducted Emission test  
RE: Radiated Emission test  
AT: Antenna Terminal Conducted test