



# RADIO TEST REPORT

Test Report No. : 11483195S-A

**Applicant** : Panasonic Corporation  
**Type of Equipment** : Car Audio System  
**Model No.** : AT1607  
**FCC ID** : ACJ932AT1607  
**Test regulation** : FCC Part 15 Subpart C: 2016  
**Test Result** : Complied

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

**Date of test:** November 9, 2015  
October 12 to 14, 2016

**Representative test engineer:**

  
Hiroyuki Morikawa  
Engineer  
Consumer Technology Division

**Approved by:**

  
Makoto Hosaka  
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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**Shonan EMC Lab.**

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## **SECTION 1: Customer information**

Company Name : Panasonic Corporation  
Address : 4261 Ikonobe-cho, Tsuzuki-ku, Yokohama-city, 224-8520, Japan  
Telephone Number : +81-50-3380-3285  
Contact Person : Kohei Tanaka

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

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

Type of Equipment : Car Audio System  
Model No. : AT1607  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 13.2 V  
Receipt Date of Sample : October 27, 2015 (AT1603)  
October 12, 2016 (AT1607)  
Country of Mass-production : Japan, Czech, Mexico, 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: AT1607 (referred to as the EUT in this report) is a Car Audio System.

### **General Specification**

Clock frequency(ies) in the system : 37 MHz, 48 MHz, 54.9 MHz, 194 MHz, 795 MHz, 1.56 GHz

### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 2412 MHz - 2462 MHz  
Modulation : DSSS  
Power Supply (radio part input) : DC 3.3 V, DC 1.8 V  
Antenna type : Dipole Antenna  
Antenna gain with cable loss : 3.55 dBi

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

#### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

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

\* The revision on November 14, 2016, does not affect the test specification applied to the EUT.

\* All the revisions made after testing date (November 9, 2015) do 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 ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8		N/A *1)	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 ----- IC: -	FCC: Section 15.247(e) ----- IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 ----- IC: RSS-Gen 6.13	FCC: Section 15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	6.3 dB 12110.000 MHz, AV, Hori./ Vert., Tx 11n-40 2422 MHz ----- 12260.000 MHz, AV, Hori., Tx 11n-40 2452 MHz	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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

\*1) The test is not applicable since the EUT has no AC mains.

\*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r05 12.2.7.

\* 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 (RF: DC 3.3 V, I/O: DC 1.8 V).

Instead of a new battery, DC power supply 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	-	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
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.1 dB	2.1 dB	2.6 dB	2.2 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	2.7 dB	2.7 dB	3.1 dB	-
	30 MHz-300 MHz	4.4 dB	4.4 dB	4.6 dB	-
	300 MHz-1 GHz	5.6 dB	5.5 dB	5.3 dB	-
	1 GHz-13 GHz	5.2 dB	5.2 dB	5.2 dB	-
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	4.9 dB	4.9 dB	4.9 dB	-
	18 GHz-40 GHz	4.9 dB	4.9 dB	4.9 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	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	1.5 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.4 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.5 dB
Bandwidth Measurement	0.66 %
Duty cycle and Time Measurement	0.012 %

#### Radiated emission test

The data listed in this test report has enough margin, more than the site margin.

### 3.5 Test Location

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JAB Accreditation No. RTL02610

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	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)**

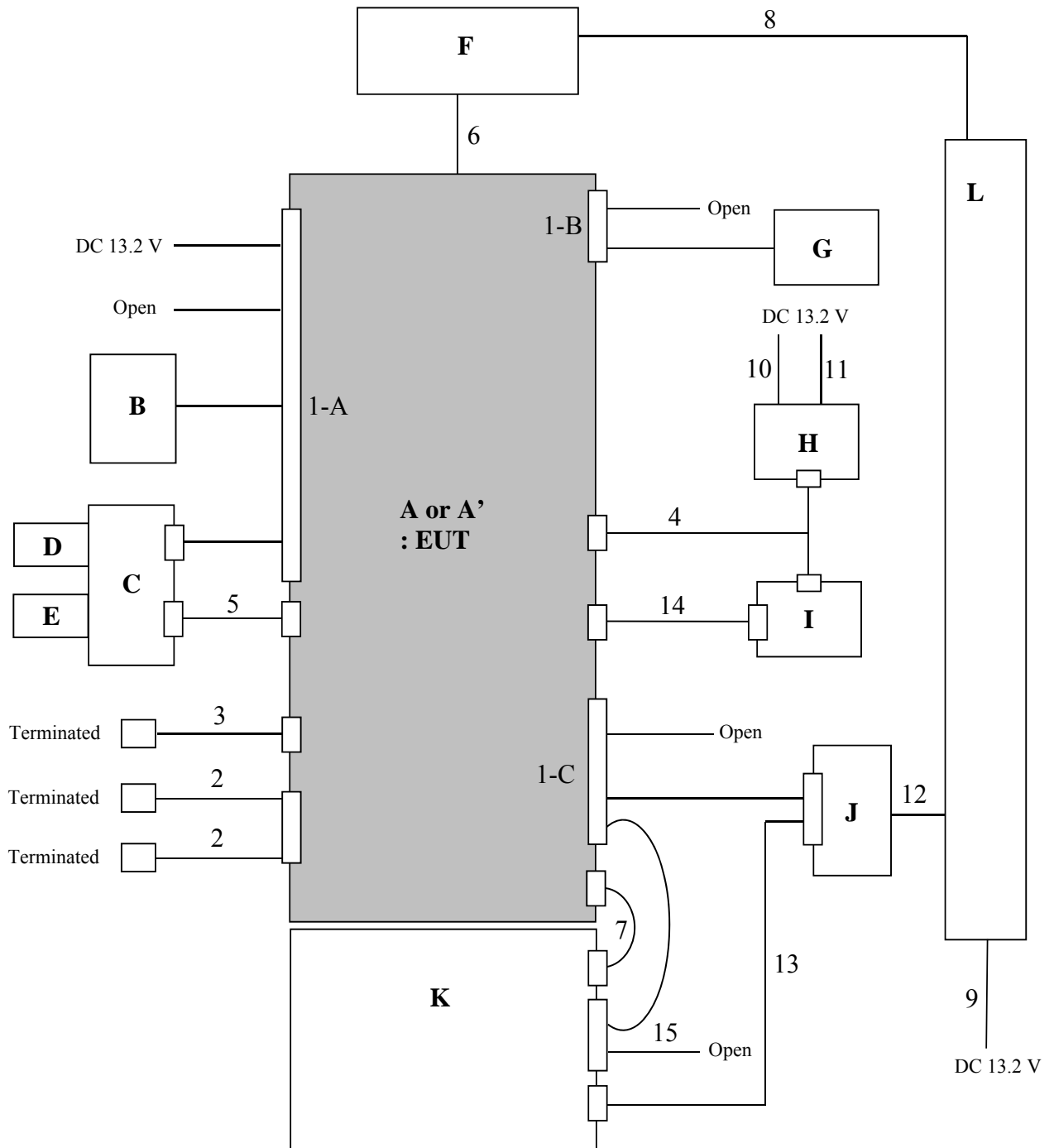
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11b (11b)	11Mbps, PN9
IEEE 802.11g (11g)	36 Mbps, PN9
IEEE 802.11n HT20 (11n-20)	MCS 4 (800 ns GI), PN9
IEEE 802.11n HT40 (11n-40)	MCS 7 (800 ns 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 (Firmware): D17517010700001V0, Ver. 1.0 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 (below 1 GHz)	11g Tx	2437 MHz
Spurious Emission (above 1 GHz) 6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx	2412 MHz
	11g Tx	2437 MHz
	11n-20 Tx	2462 MHz
	11n-40 Tx	2422 MHz
Bandedge Compliance	11b Tx	2412 MHz
		2462 MHz
	11g Tx	2412 MHz
	11n-20 Tx	2462 MHz
	11n-40 Tx	2422 MHz
		2452 MHz

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	Remark
A	Car Audio System	AT1607	CV-DL57N0AJ No.500331	Panasonic Corporation	EUT
A'	Car Audio System	AT1603 (Display Separated Type (L2))	CV-DL56N0AJ No.13	Panasonic Corporation	EUT *1)
B	Steering SW	-	0009	-	-
C	IF-Box	CA-UL56X0AJ	3	Panasonic	-
D	USB Memory	SDK-USM4GL(B)	-	SONY	-
E	USB Memory	SDK-USM4GL(B)	-	SONY	-
F	Display	83290-48130	-	DENSO	-
G	Microphone	86730-20050	-	-	-
H	AMP	86280-76050	521343	Panasonic	-
I	RSE-ECU	CV-UL45H0AJ	-	Panasonic	-
J	DCM	86741-53054	-	DENSO	-
K	MEU	CN-SL56N0AJ	004	Panasonic	-
L	Jig Board	-	-	-	-

\*1) For Antenna terminal conducted test, the result of AT1603 (Display Separate Type (L2)) is used since there is no difference in the radio block of AT1607 and AT1603 (Display Separate Type (L2)).

**List of cables used**

No.	Name	Length (m)	Cable Shield	Connector Shield	Remark
1-A	General-purpose	2.0	Unshielded	Unshielded	-
1-B	General-purpose	2.0	Unshielded	Unshielded	-
1-C	General-purpose	2.0	Unshielded	Unshielded	-
2	Radio/D-Radio antenna	2.0	Shielded	Shielded	-
3	XM antenna	2.0	Shielded	Shielded	-
4	AVC-LAN Step3	1.0	Unshielded	Unshielded	-
5	USB (IF-BOX)	1.0	Shielded	Shielded	-
6	GVIF	1.0	Shielded	Shielded	-
7	GVIF, USB from MEU	0.15	Unshielded	Unshielded	-
8	DC Power / Signal	1.0	Unshielded	Unshielded	-
9	DC Power	0.5	Unshielded	Unshielded	-
10	DC Power	1.0	Unshielded	Unshielded	-
11	Signal	1.0	Unshielded	Unshielded	-
12	DC Power / Signal	0.9	Unshielded	Unshielded	-
13	Signal	2.4	Unshielded	Unshielded	-
14	GVIF	1.0	Unshielded	Unshielded	-
15	Signal	2.0	Unshielded	Unshielded	-

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

### **Test Procedure**

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r05".

[For below 1 GHz]

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 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 300 MHz	300 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 *3)	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 m *1) (1 GHz – 13 GHz), 1 m *2) (13 GHz – 26.5 GHz)		3 m *1) (1 GHz – 13 GHz), 1 m *2) (13 GHz – 26.5 GHz)

\*1) Distance Factor:  $20 \times \log(3.875 \text{ m} / 3.0 \text{ m}) = 2.23 \text{ dB}$

\*2) Distance Factor:  $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

\*3) Average Power Measurement was performed based on 6. 0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r05"

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

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 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Sample / 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 *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				

\*1) Peak hold was applied as Worst-case measurement.  
\*2) Reference data  
\*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r05".  
\*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.

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

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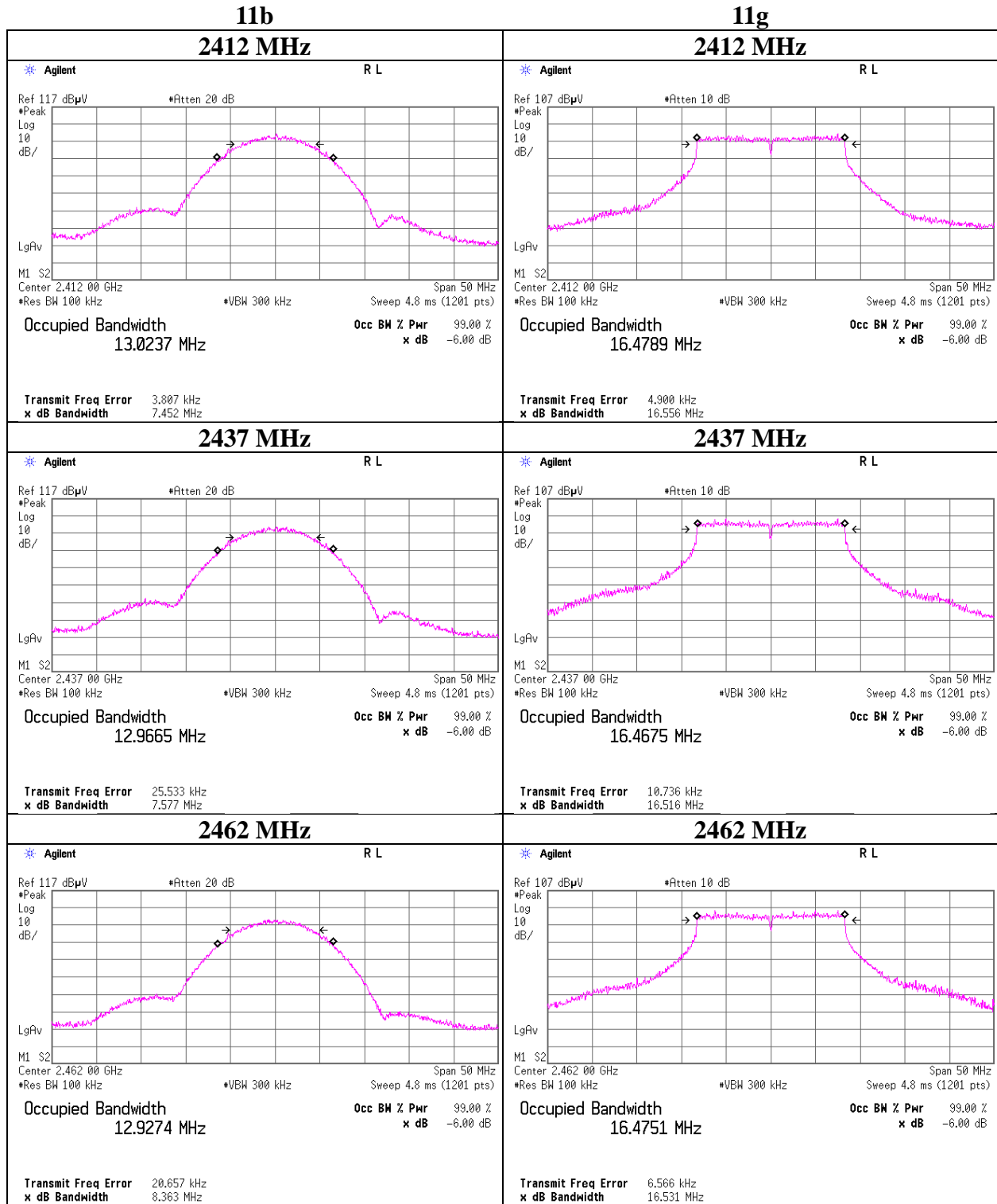
**APPENDIX 1: Test data**

**6dB Bandwidth**

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11483195S-A
Date	November 9, 2015
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Yosuke Ishikawa
Mode	Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	7.452	> 500
	2437	7.577	> 500
	2462	8.363	> 500
11g	2412	16.556	> 500
	2437	16.516	> 500
	2462	16.531	> 500
11n-20	2412	17.739	> 500
	2437	17.767	> 500
	2462	17.751	> 500
11n-40	2422	36.472	> 500
	2437	36.541	> 500
	2452	36.481	> 500

### 6dB Bandwidth



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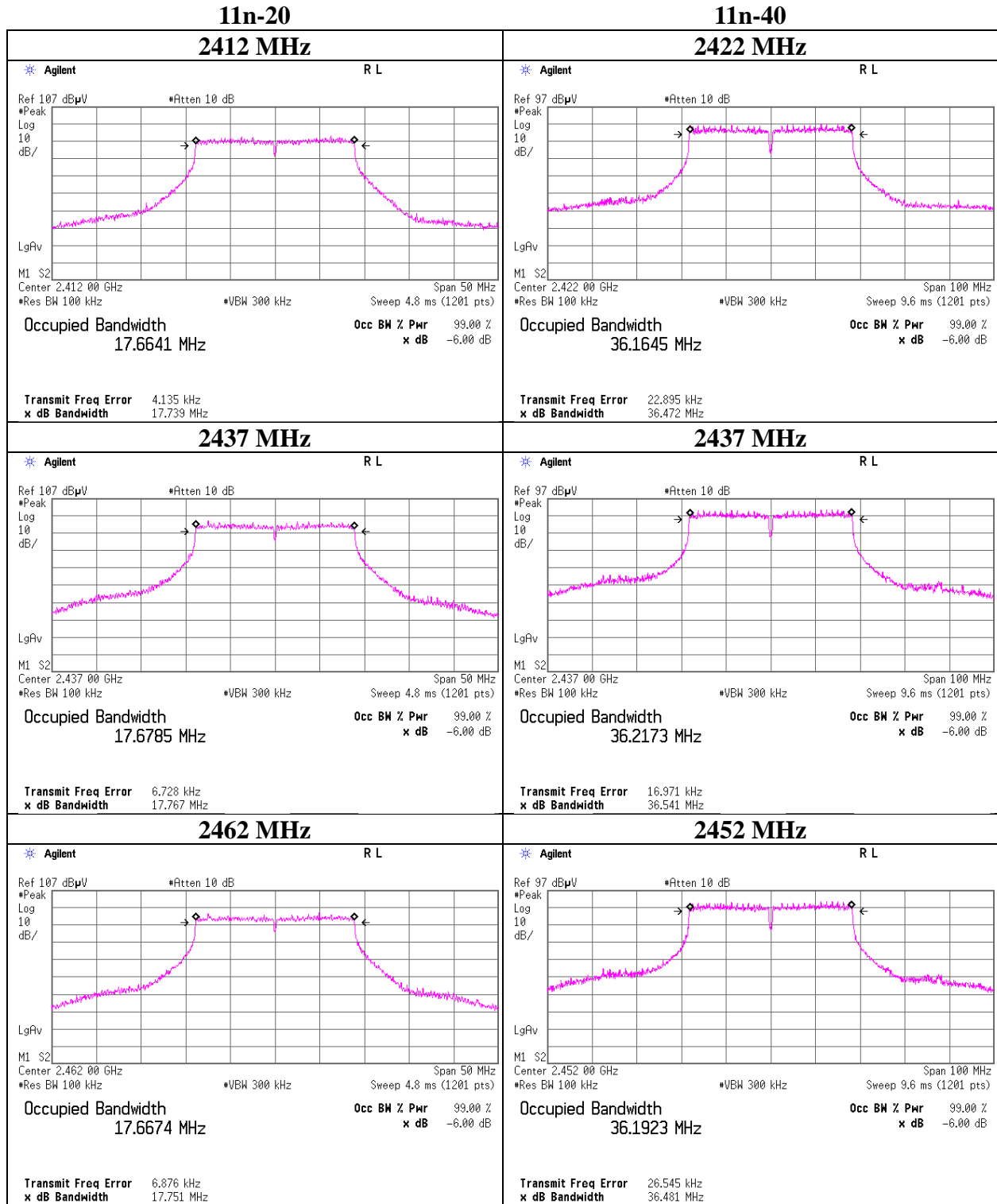
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### 6dB Bandwidth



### Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 11483195S-A  
Date : November 9, 2015  
Temperature / Humidity : 24 deg. C / 41 % RH  
Engineer : Yosuke Ishikawa  
Mode : Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	4.49	2.03	10.01	16.53	44.98	30.00	1000	13.47
2437	4.44	2.04	10.01	16.49	44.57	30.00	1000	13.51
2462	4.21	2.05	10.01	16.27	42.36	30.00	1000	13.73

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	4.13	
2	4.41	
5.5	4.39	
11	4.44	*

\*: Worst Rate

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

## Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 11483195S-A  
Date : November 9, 2015  
Temperature / Humidity : 24 deg. C / 41 % RH  
Engineer : Yosuke Ishikawa  
Mode : Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	7.01	2.03	10.01	19.05	80.35	30.00	1000	10.95
2437	9.58	2.04	10.01	21.63	145.55	30.00	1000	8.37
2462	9.28	2.05	10.01	21.34	136.14	30.00	1000	8.66

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	5.74	
9	5.68	
12	5.71	
18	5.94	
24	9.43	
36	9.58	*
48	8.83	
54	9.42	

\*: Worst Rate

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

## Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 11483195S-A  
Date : November 9, 2015  
Temperature / Humidity : 24 deg. C / 41 % RH  
Engineer : Yosuke Ishikawa  
Mode : Tx 11n-20

### 800 ns GI

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	6.41	2.03	10.01	18.45	69.98	30.00	1000	11.55
2437	9.20	2.04	10.01	21.25	133.35	30.00	1000	8.75
2462	8.86	2.05	10.01	20.92	123.59	30.00	1000	9.08

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.

### 800 ns GI, 2437 MHz

Mode [MCS]	Reading [dBm]	Remark
0	4.87	
1	4.75	
2	4.86	
3	9.02	
4	9.20	*
5	8.58	
6	9.18	
7	9.10	

### 400 ns GI, 2437 MHz

Mode [MCS]	Reading [dBm]	Remark
0	4.97	
1	4.53	
2	4.64	
3	8.96	
4	8.90	
5	8.51	
6	9.12	
7	8.62	

\*: Worst Mode

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

### Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 11483195S-A  
Date : November 9, 2015  
Temperature / Humidity : 24 deg. C / 41 % RH  
Engineer : Yosuke Ishikawa  
Mode : Tx 11n-40

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2422	5.68	2.03	10.01	17.72	59.16	30.00	1000	12.28
2437	8.77	2.04	10.01	20.82	120.78	30.00	1000	9.18
2452	8.95	2.04	10.01	21.00	125.89	30.00	1000	9.00

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.

800 ns GI, 2437 MHz

Mode [MCS]	Reading [dBm]	Remark
0	4.70	
1	4.53	
2	4.46	
3	8.24	
4	8.62	
5	8.67	
6	8.18	
7	8.77	*

400 ns GI, 2437 MHz

Mode [MCS]	Reading [dBm]	Remark
0	4.56	
1	4.54	
2	4.58	
3	8.30	
4	8.40	
5	8.63	
6	8.37	
7	8.74	

\*: Worst Mode

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

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

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 11483195S-A  
Date : November 9, 2015  
Temperature / Humidity : 24 deg. C / 41 % RH  
Engineer : Yosuke Ishikawa  
Mode : Tx

**11b 11 Mbps**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	1.94	2.03	10.01	13.98	25.00	0.03	14.01	25.18
2437	1.89	2.04	10.01	13.94	24.77	0.03	13.97	24.95
2462	1.51	2.05	10.01	13.57	22.75	0.03	13.60	22.91

**11g 36 Mbps**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-4.28	2.03	10.01	7.76	5.97	0.11	7.87	6.12
2437	-0.55	2.04	10.01	11.50	14.13	0.11	11.61	14.49
2462	-0.73	2.05	10.01	11.33	13.58	0.11	11.44	13.93

**11n-20 MCS 4 (800 ns GI)**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-5.12	2.03	10.01	6.92	4.92	0.11	7.03	5.05
2437	-1.60	2.04	10.01	10.45	11.09	0.11	10.56	11.38
2462	-1.80	2.05	10.01	10.26	10.62	0.11	10.37	10.89

**11n-40 MCS 7 (800 ns GI)**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2422	-6.05	2.03	10.01	5.99	3.97	0.67	6.66	4.63
2437	-3.01	2.04	10.01	9.04	8.02	0.67	9.71	9.35
2452	-3.14	2.04	10.01	8.91	7.78	0.67	9.58	9.08

Sample Calculation:

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

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

**Average Output Power**  
**(Reference data)**

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 11483195S-A  
Date November 9, 2015  
Temperature / Humidity 24 deg. C / 41 % RH  
Engineer Yosuke Ishikawa  
Mode Tx

2437 MHz

Mode	Rate Mbps	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11b	1	1.52	0.00	1.52	
	2	1.78	0.00	1.78	
	5.5	1.87	0.01	1.88	
	11	1.89	0.03	1.92	*
11g	6	-0.90	0.02	-0.88	
	9	-0.94	0.03	-0.91	
	12	-0.93	0.04	-0.89	
	18	-0.97	0.05	-0.92	
	24	-0.55	0.07	-0.48	
	36	-0.55	0.11	-0.44	*
	48	-0.63	0.13	-0.50	
	54	-0.64	0.16	-0.48	

\* Worst rate

Sample Calculation:

$$\text{Burst power} = \text{Reading (timed average)} + \text{Duty factor}$$

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

11n-20, 2437 MHz

GI	Mode MCS	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
800 ns	0	-2.08	0.02	-2.06	
	1	-2.08	0.04	-2.04	
	2	-2.14	0.06	-2.08	
	3	-1.58	0.08	-1.50	
	4	-1.60	0.11	-1.49	*
	5	-1.64	0.14	-1.50	
	6	-1.67	0.17	-1.50	
	7	-1.68	0.18	-1.50	
400 ns	0	-2.02	0.02	-2.00	
	1	-2.13	0.04	-2.09	
	2	-2.15	0.06	-2.09	
	3	-1.59	0.08	-1.51	
	4	-1.62	0.11	-1.51	
	5	-1.64	0.14	-1.50	
	6	-1.67	0.17	-1.50	
	7	-1.68	0.18	-1.50	

\* Worst Mode

Sample Calculation:

$$\text{Burst power} = \text{Reading (timed average)} + \text{Duty factor}$$

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

**Average Output Power**  
**(Reference data)**

Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                      11483195S-A  
Date                              November 9, 2015  
Temperature / Humidity      24 deg. C / 41 % RH  
Engineer                        Yosuke Ishikawa  
Mode                              Tx

11n-40, 2437 MHz

GI	Mode	Reading	Duty factor	Burst power	Remarks
	MCS	[dBm]	[dB]	[dBm]	
800 ns	0	-2.61	0.07	-2.54	
	1	-2.68	0.16	-2.52	
	2	-2.76	0.22	-2.54	
	3	-2.69	0.30	-2.39	
	4	-2.78	0.41	-2.37	
	5	-2.94	0.54	-2.40	
	6	-2.99	0.63	-2.36	
	7	-3.01	0.67	-2.34	*
400 ns	0	-2.62	0.07	-2.55	
	1	-2.70	0.16	-2.54	
	2	-2.78	0.22	-2.56	
	3	-2.67	0.30	-2.37	
	4	-2.79	0.41	-2.38	
	5	-2.91	0.54	-2.37	
	6	-3.04	0.63	-2.41	
	7	-3.08	0.67	-2.41	

\* Worst Mode

Sample Calculation:

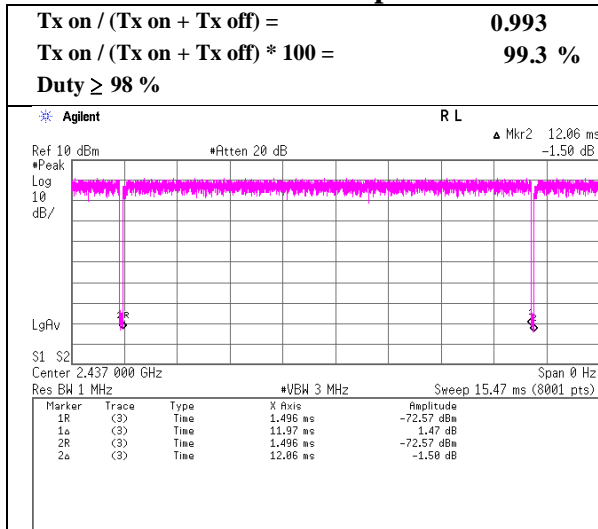
$$\text{Burst power} = \text{Reading (timed average)} + \text{Duty factor}$$

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

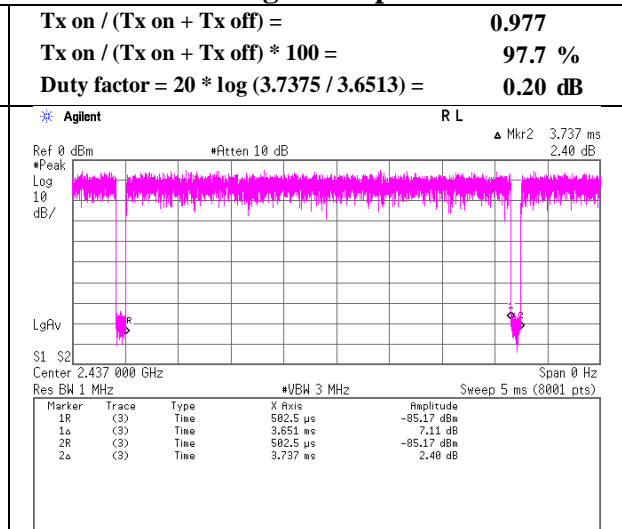
### Burst rate confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11483195S-A
Date	November 9, 2015
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Yosuke Ishikawa
Mode	Tx

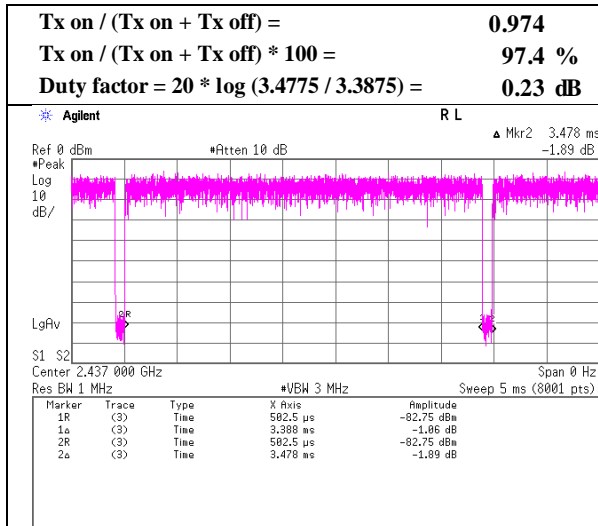
#### 11b 11 Mbps



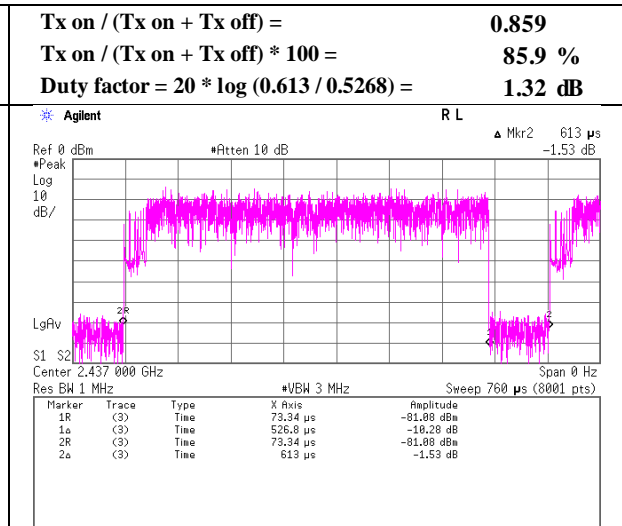
#### 11g 36 Mbps



#### 11n-20 MCS 4



#### 11n-40 MCS 7



## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016      October 13, 2016      October 14, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH      25 deg. C / 44 % RH      24 deg. C / 44 % RH  
Engineer : Hiroyuki Morikawa      Yasumasa Owaki      Hiroyuki Morikawa  
            (1 GHz -13 GHz)      (13 GHz -18 GHz)      (18 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	48.16	27.41	13.82	36.87	2.23	54.75	73.90	19.1	288	357	
Hori.	3531.535	PK	48.36	28.81	5.68	36.76	2.23	48.32	73.90	25.5	147	110	
Hori.	4824.000	PK	43.59	31.17	5.95	37.13	2.23	45.81	73.90	28.0	155	333	
Hori.	7236.000	PK	42.83	36.52	7.38	37.86	2.23	51.10	73.90	22.8	100	0	
Hori.	9648.000	PK	45.23	38.66	8.33	39.15	2.23	55.30	73.90	18.6	192	7	
Hori.	12060.000	PK	43.39	39.29	9.57	39.38	2.23	55.10	73.90	18.8	100	0	
Hori.	2390.000	AV	38.76	27.41	13.82	36.87	2.23	45.35	53.90	8.5	288	357	
Hori.	3531.535	AV	44.30	28.81	5.68	36.76	2.23	44.26	53.90	9.6	147	110	
Hori.	4824.000	AV	34.00	31.17	5.95	37.13	2.23	36.22	53.90	17.6	155	333	
Hori.	7236.000	AV	33.84	36.52	7.38	37.86	2.23	42.11	53.90	11.7	100	0	
Hori.	9648.000	AV	36.71	38.66	8.33	39.15	2.23	46.78	53.90	7.1	192	7	
Hori.	12060.000	AV	34.69	39.29	9.57	39.38	2.23	46.40	53.90	7.5	100	0	
Vert.	2390.000	PK	47.17	27.41	13.82	36.87	2.23	53.76	73.90	20.1	279	53	
Vert.	3531.547	PK	48.58	28.81	5.68	36.76	2.23	48.54	73.90	25.3	167	194	
Vert.	4824.000	PK	44.38	31.17	5.95	37.13	2.23	46.60	73.90	27.3	144	43	
Vert.	7236.000	PK	42.78	36.52	7.38	37.86	2.23	51.05	73.90	22.8	100	0	
Vert.	9648.000	PK	44.35	38.66	8.33	39.15	2.23	54.42	73.90	19.4	120	344	
Vert.	12060.000	PK	43.89	39.29	9.57	39.38	2.23	55.60	73.90	18.3	100	0	
Vert.	2390.000	AV	38.05	27.41	13.82	36.87	2.23	44.64	53.90	9.2	279	53	
Vert.	3531.547	AV	45.24	28.81	5.68	36.76	2.23	45.20	53.90	8.7	167	194	
Vert.	4824.000	AV	34.59	31.17	5.95	37.13	2.23	36.81	53.90	17.0	144	43	
Vert.	7236.000	AV	33.86	36.52	7.38	37.86	2.23	42.13	53.90	11.7	100	0	
Vert.	9648.000	AV	36.15	38.66	8.33	39.15	2.23	46.22	53.90	7.6	120	344	
Vert.	12060.000	AV	34.53	39.29	9.57	39.38	2.23	46.24	53.90	7.6	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor  
Distance factor : 1 GHz - 13 GHz : 20log(3.875 m / 3.0 m) = 2.23 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	95.66	27.50	13.84	36.87	2.23	102.36	-	-	Carrier
Hori.	2397.988	PK	52.27	27.44	13.83	36.87	2.23	58.90	82.36	23.5	
Hori.	2400.000	PK	49.95	27.45	13.83	36.87	2.23	56.59	82.36	25.8	
Vert.	2412.000	PK	92.85	27.50	13.84	36.87	2.23	99.55	-	-	Carrier
Vert.	2397.885	PK	50.81	27.44	13.83	36.87	2.23	57.44	79.55	22.1	
Vert.	2400.000	PK	48.08	27.45	13.83	36.87	2.23	54.72	79.55	24.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor  
Distance factor : 1 GHz - 13 GHz : 20log(3.875 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.**

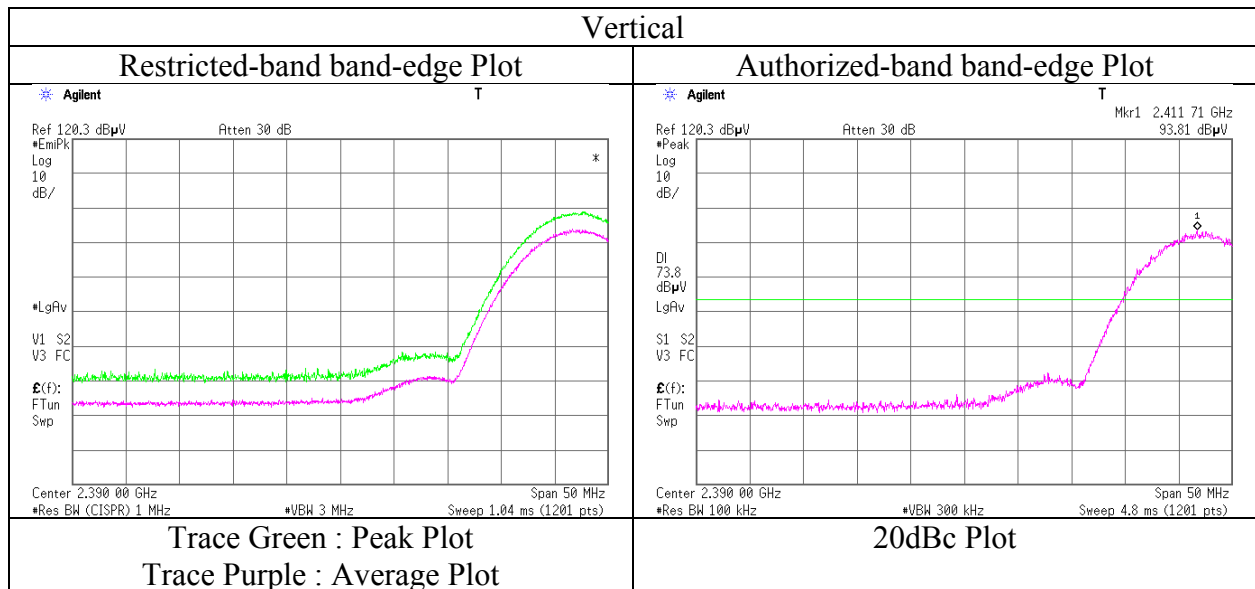
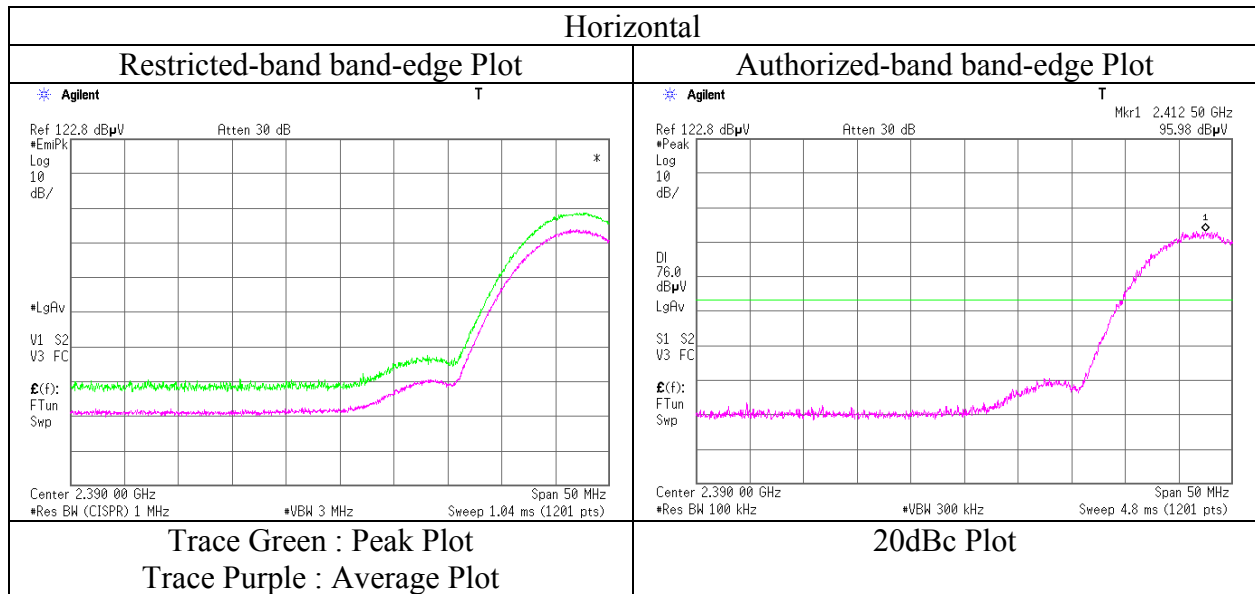
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH  
Engineer : Hiroyuki Morikawa  
(1 GHz -13 GHz)  
Mode : Tx 11b 2412 MHz



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

## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016      October 13, 2016      October 14, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH      25 deg. C / 44 % RH      24 deg. C / 44 % RH  
Engineer : Hiroyuki Morikawa      Yasumasa Owaki      Hiroyuki Morikawa  
            (1 GHz -13 GHz)      (13 GHz -18 GHz)      (18 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.	3531.538	PK	49.00	28.81	5.68	36.76	2.23	48.96	73.90	24.9	167	19	
Hori.	4874.000	PK	46.52	31.28	5.96	37.15	2.23	48.84	73.90	25.0	140	22	
Hori.	7311.000	PK	42.99	36.74	7.36	37.91	2.23	51.41	73.90	22.4	100	0	
Hori.	9748.000	PK	44.95	38.74	8.35	39.19	2.23	55.08	73.90	18.8	195	37	
Hori.	12185.000	PK	44.23	39.30	9.57	39.39	2.23	55.94	73.90	17.9	100	0	
Hori.	3531.538	AV	45.26	28.81	5.68	36.76	2.23	45.22	53.90	8.6	167	19	
Hori.	4874.000	AV	36.27	31.28	5.96	37.15	2.23	38.59	53.90	15.3	140	22	
Hori.	7311.000	AV	33.59	36.74	7.36	37.91	2.23	42.01	53.90	11.8	100	0	
Hori.	9748.000	AV	35.69	38.74	8.35	39.19	2.23	45.82	53.90	8.0	195	37	
Hori.	12185.000	AV	34.98	39.30	9.57	39.39	2.23	46.69	53.90	7.2	100	0	
Vert.	3531.559	PK	47.90	28.81	5.68	36.76	2.23	47.86	73.90	26.0	155	27	
Vert.	4874.000	PK	45.39	31.28	5.96	37.15	2.23	47.71	73.90	26.1	201	24	
Vert.	7311.000	PK	42.68	36.74	7.36	37.91	2.23	51.10	73.90	22.8	100	0	
Vert.	9748.000	PK	44.94	38.74	8.35	39.19	2.23	55.07	73.90	18.8	139	62	
Vert.	12185.000	PK	44.46	39.30	9.57	39.39	2.23	56.17	73.90	17.7	100	0	
Vert.	3531.559	AV	44.28	28.81	5.68	36.76	2.23	44.24	53.90	9.6	155	27	
Vert.	4874.000	AV	34.77	31.28	5.96	37.15	2.23	37.09	53.90	16.8	201	24	
Vert.	7311.000	AV	33.57	36.74	7.36	37.91	2.23	41.99	53.90	11.9	100	0	
Vert.	9748.000	AV	35.77	38.74	8.35	39.19	2.23	45.90	53.90	8.0	139	62	
Vert.	12185.000	AV	34.58	39.30	9.57	39.39	2.23	46.29	53.90	7.6	100	0	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.875 m / 3.0 m) = 2.23 dB

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

## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016      October 13, 2016      October 14, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH      25 deg. C / 44 % RH      24 deg. C / 44 % RH  
Engineer : Hiroyuki Morikawa      Yasumasa Owaki      Hiroyuki Morikawa  
            (1 GHz -13 GHz)      (13 GHz -18 GHz)      (18 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	46.88	27.79	13.91	36.85	2.23	53.96	73.90	19.9	279	354	
Hori.	3531.541	PK	48.43	28.81	5.68	36.76	2.23	48.39	73.90	25.5	146	110	
Hori.	4924.000	PK	47.77	31.38	5.97	37.18	2.23	50.17	73.90	23.7	100	359	
Hori.	7386.000	PK	43.19	36.95	7.34	37.96	2.23	51.75	73.90	22.1	100	0	
Hori.	9848.000	PK	44.45	38.81	8.37	39.23	2.23	54.63	73.90	19.2	152	40	
Hori.	12310.000	PK	44.51	39.31	9.57	39.39	2.23	56.23	73.90	17.6	100	0	
Hori.	2483.500	AV	37.16	27.79	13.91	36.85	2.23	44.24	53.90	9.6	279	354	
Hori.	3531.541	AV	44.41	28.81	5.68	36.76	2.23	44.37	53.90	9.5	146	110	
Hori.	4924.000	AV	36.82	31.38	5.97	37.18	2.23	39.22	53.90	14.6	100	359	
Hori.	7386.000	AV	33.81	36.95	7.34	37.96	2.23	42.37	53.90	11.5	100	0	
Hori.	9848.000	AV	35.50	38.81	8.37	39.23	2.23	45.68	53.90	8.2	152	40	
Hori.	12310.000	AV	34.60	39.31	9.57	39.39	2.23	46.32	53.90	7.5	100	0	
Vert.	2483.500	PK	46.40	27.79	13.91	36.85	2.23	53.48	73.90	20.4	269	45	
Vert.	3531.538	PK	48.69	28.81	5.68	36.76	2.23	48.65	73.90	25.2	160	194	
Vert.	4924.000	PK	45.21	31.38	5.97	37.18	2.23	47.61	73.90	26.2	156	28	
Vert.	7386.000	PK	42.88	36.95	7.34	37.96	2.23	51.44	73.90	22.4	100	0	
Vert.	9848.000	PK	44.38	38.81	8.37	39.23	2.23	54.56	73.90	19.3	166	348	
Vert.	12310.000	PK	43.73	39.31	9.57	39.39	2.23	55.45	73.90	18.4	100	0	
Vert.	2483.500	AV	37.03	27.79	13.91	36.85	2.23	44.11	53.90	9.7	269	45	
Vert.	3531.538	AV	45.44	28.81	5.68	36.76	2.23	45.40	53.90	8.5	160	194	
Vert.	4924.000	AV	35.48	31.38	5.97	37.18	2.23	37.88	53.90	16.0	156	28	
Vert.	7386.000	AV	33.92	36.95	7.34	37.96	2.23	42.48	53.90	11.4	100	0	
Vert.	9848.000	AV	35.44	38.81	8.37	39.23	2.23	45.62	53.90	8.2	166	348	
Vert.	12310.000	AV	34.86	39.31	9.57	39.39	2.23	46.58	53.90	7.3	100	0	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.875 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.**

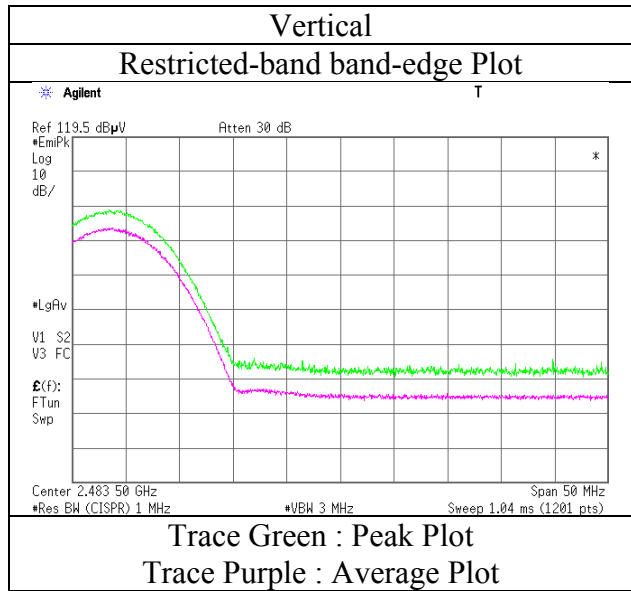
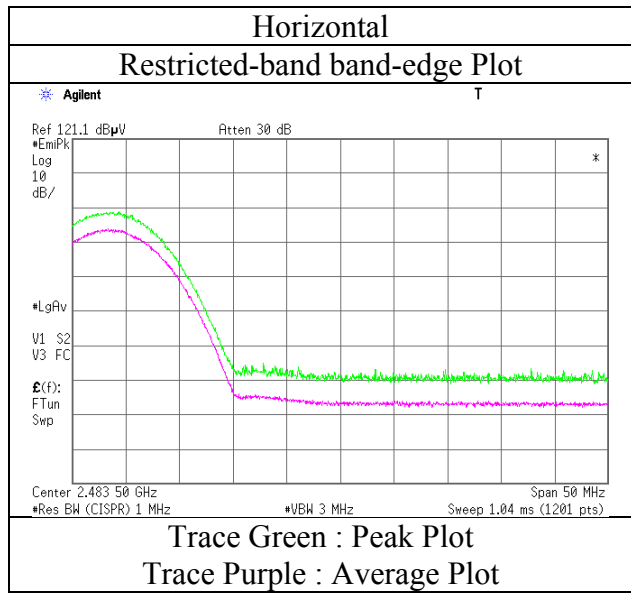
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11483195S-A
Date	October 12, 2016
Temperature / Humidity	24 deg. C / 45 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx 11b 2462 MHz

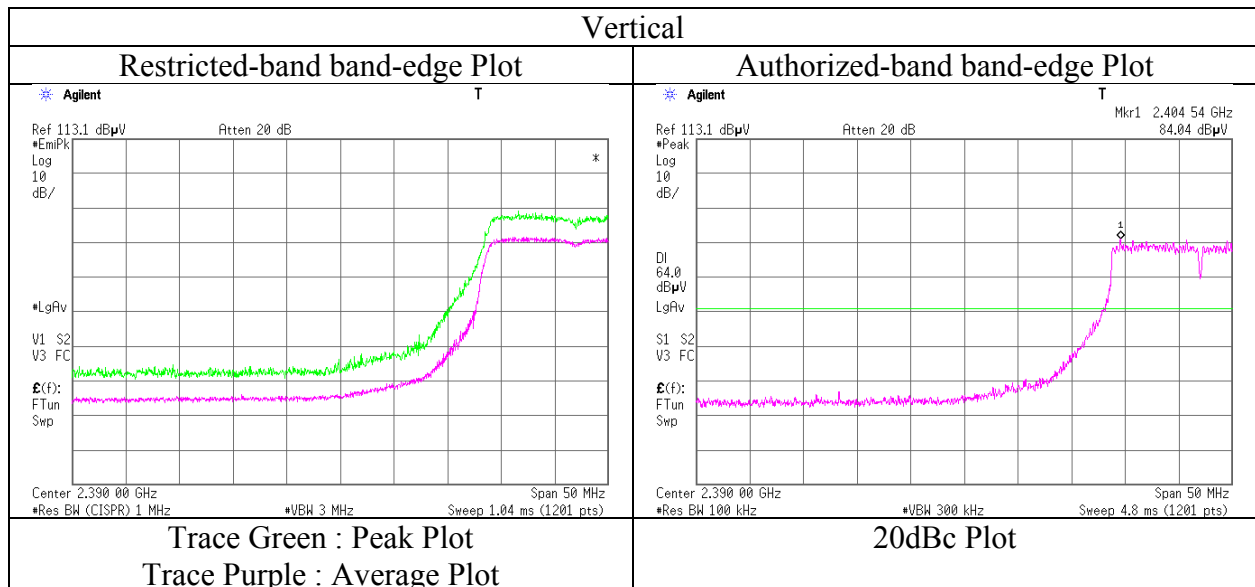
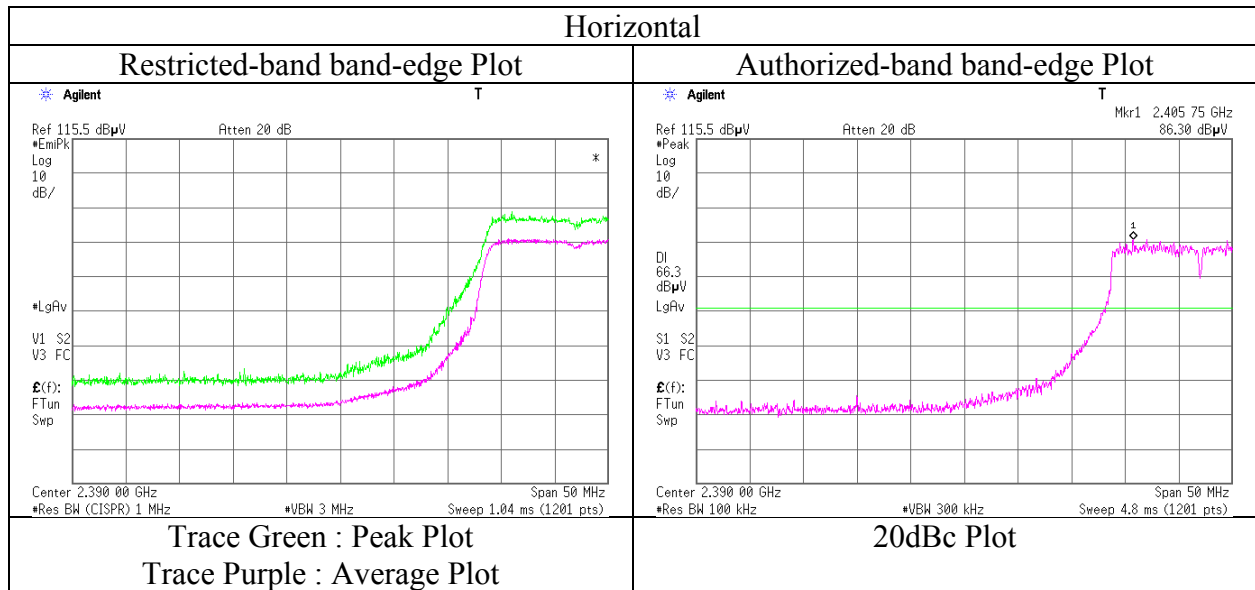


\* Final result of restricted band edge was shown in tabular data.



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

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11483195S-A
Date	October 12, 2016
Temperature / Humidity	24 deg. C / 45 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz -13 GHz)
Mode	Tx 11g 2412 MHz



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

## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016      October 13, 2016      October 14, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH      25 deg. C / 44 % RH      24 deg. C / 44 % RH  
Engineer : Hiroyuki Morikawa      Hikaru Shirasawa      Hiroyuki Morikawa  
(1 GHz -13 GHz)      (30 MHz - 1 GHz)      (18 GHz -26.5 GHz)  
(13 GHz -18 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.	163.475	QP	35.37	15.23	8.00	32.08	0.00	26.52	43.50	16.9	189	101	
Hori.	318.913	QP	40.25	14.30	8.79	31.96	0.00	31.38	46.00	14.6	104	336	
Hori.	491.512	QP	36.41	17.27	9.56	31.92	0.00	31.32	46.00	14.6	100	204	
Hori.	658.577	QP	41.05	19.71	10.21	31.93	0.00	39.04	46.00	6.9	163	181	
Hori.	960.262	QP	40.28	22.69	11.22	30.51	0.00	43.68	53.90	10.2	111	266	
Hori.	987.863	QP	41.46	22.86	11.30	30.31	0.00	45.31	53.90	8.5	100	205	
Hori.	3531.535	PK	48.68	28.81	5.68	36.76	2.23	48.64	73.90	25.2	137	108	
Hori.	4874.000	PK	42.58	31.28	5.96	37.15	2.23	44.90	73.90	29.0	136	33	
Hori.	7311.000	PK	41.98	36.74	7.36	37.91	2.23	50.40	73.90	23.5	100	0	
Hori.	9748.000	PK	44.71	38.74	8.35	39.19	2.23	54.84	73.90	19.0	157	37	
Hori.	12185.000	PK	43.51	39.30	9.57	39.39	2.23	55.22	73.90	18.6	100	0	
Hori.	3531.535	AV	44.54	28.81	5.68	36.76	2.23	44.50	53.90	9.4	137	108	
Vert.	163.443	QP	34.66	15.22	8.00	32.08	0.00	25.80	43.50	17.7	100	140	
Vert.	581.750	QP	36.37	18.67	9.91	31.94	0.00	33.01	46.00	12.9	100	194	
Vert.	637.821	QP	36.42	19.44	10.13	31.94	0.00	34.05	46.00	11.9	100	308	
Vert.	658.577	QP	39.41	19.71	10.21	31.93	0.00	37.40	46.00	8.6	100	207	
Vert.	960.262	QP	40.06	22.69	11.22	30.51	0.00	43.46	53.90	10.4	154	331	
Vert.	987.863	QP	40.67	22.86	11.30	30.31	0.00	44.52	53.90	9.3	119	201	
Vert.	3531.547	PK	49.42	28.81	5.68	36.76	2.23	49.38	73.90	24.5	166	194	
Vert.	4874.000	PK	42.23	31.28	5.96	37.15	2.23	44.55	73.90	29.3	100	0	
Vert.	7311.000	PK	44.40	36.74	7.36	37.91	2.23	52.82	73.90	21.0	100	0	
Vert.	9748.000	PK	43.49	38.74	8.35	39.19	2.23	53.62	73.90	20.2	156	347	
Vert.	12185.000	PK	44.26	39.30	9.57	39.39	2.23	55.97	73.90	17.9	100	0	
Vert.	3531.547	AV	45.54	28.81	5.68	36.76	2.23	45.50	53.90	8.4	166	194	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.875 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	34.06	31.28	5.96	37.15	0.20	2.23	36.58	53.90	17.3	
Hori.	7311.000	AV	33.61	36.74	7.36	37.91	0.20	2.23	42.23	53.90	11.7	
Hori.	9748.000	AV	35.48	38.74	8.35	39.19	0.20	2.23	45.81	53.90	8.1	
Hori.	12185.000	AV	34.50	39.30	9.57	39.39	0.20	2.23	46.41	53.90	7.5	
Vert.	4874.000	AV	33.51	31.28	5.96	37.15	0.20	2.23	36.03	53.90	17.9	
Vert.	7311.000	AV	33.64	36.74	7.36	37.91	0.20	2.23	42.26	53.90	11.6	
Vert.	9748.000	AV	35.03	38.74	8.35	39.19	0.20	2.23	45.36	53.90	8.5	
Vert.	12185.000	AV	34.68	39.30	9.57	39.39	0.20	2.23	46.59	53.90	7.3	

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(3.875 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

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016      October 13, 2016      October 14, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH      25 deg. C / 44 % RH      24 deg. C / 44 % RH  
Engineer : Hiroyuki Morikawa      Yasumasa Owaki      Hiroyuki Morikawa  
            (1 GHz -13 GHz)      (13 GHz -18 GHz)      (18 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	47.90	27.79	13.91	36.85	2.23	54.98	73.90	18.9	279	350	
Hori.	3531.521	PK	48.20	28.81	5.68	36.76	2.23	48.16	73.90	25.7	147	112	
Hori.	4924.000	PK	42.49	31.38	5.97	37.18	2.23	44.89	73.90	29.0	146	42	
Hori.	7386.000	PK	42.45	36.95	7.34	37.96	2.23	51.01	73.90	22.8	100	0	
Hori.	9848.000	PK	43.96	38.81	8.37	39.23	2.23	54.14	73.90	19.7	177	38	
Hori.	12310.000	PK	44.27	39.31	9.57	39.39	2.23	55.99	73.90	17.9	100	0	
Hori.	3531.521	AV	44.21	28.81	5.68	36.76	2.23	44.17	53.90	9.7	147	112	
Vert.	2483.500	PK	47.39	27.79	13.91	36.85	2.23	54.47	73.90	19.4	268	44	
Vert.	3531.536	PK	48.91	28.81	5.68	36.76	2.23	48.87	73.90	25.0	166	195	
Vert.	4924.000	PK	42.60	31.38	5.97	37.18	2.23	45.00	73.90	28.9	100	0	
Vert.	7386.000	PK	42.83	36.95	7.34	37.96	2.23	51.39	73.90	22.5	100	0	
Vert.	9848.000	PK	44.10	38.81	8.37	39.23	2.23	54.28	73.90	19.6	198	45	
Vert.	12310.000	PK	44.18	39.31	9.57	39.39	2.23	55.90	73.90	18.0	100	0	
Vert.	3531.536	AV	45.34	28.81	5.68	36.76	2.23	45.30	53.90	8.6	166	195	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.875 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	37.82	27.79	13.91	36.85	0.20	2.23	45.10	53.90	8.8	*1)
Hori.	4924.000	AV	33.79	31.38	5.97	37.18	0.20	2.23	36.39	53.90	17.5	
Hori.	7386.000	AV	33.90	36.95	7.34	37.96	0.20	2.23	42.66	53.90	11.2	
Hori.	9848.000	AV	35.49	38.81	8.37	39.23	0.20	2.23	45.87	53.90	8.0	
Hori.	12310.000	AV	34.85	39.31	9.57	39.39	0.20	2.23	46.77	53.90	7.1	
Vert.	2483.500	AV	37.61	27.79	13.91	36.85	0.20	2.23	44.89	53.90	9.0	*1)
Vert.	4924.000	AV	33.22	31.38	5.97	37.18	0.20	2.23	35.82	53.90	18.1	
Vert.	7386.000	AV	33.58	36.95	7.34	37.96	0.20	2.23	42.34	53.90	11.6	
Vert.	9848.000	AV	35.38	38.81	8.37	39.23	0.20	2.23	45.76	53.90	8.1	
Vert.	12310.000	AV	34.59	39.31	9.57	39.39	0.20	2.23	46.51	53.90	7.4	

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(3.875 m / 3.0 m) = 2.23 dB

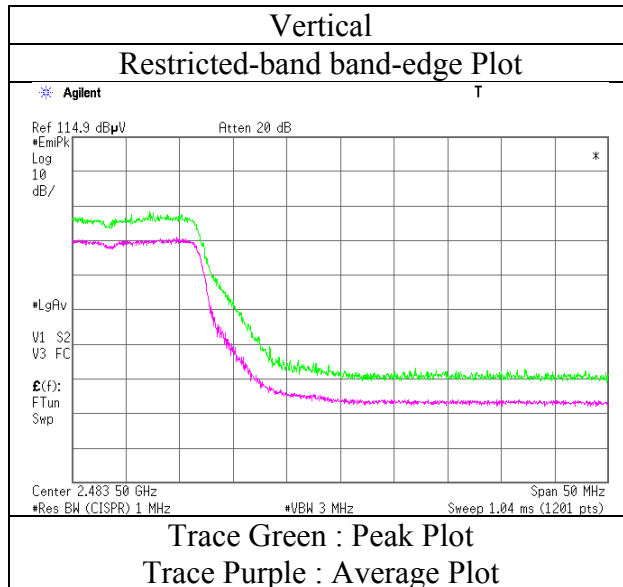
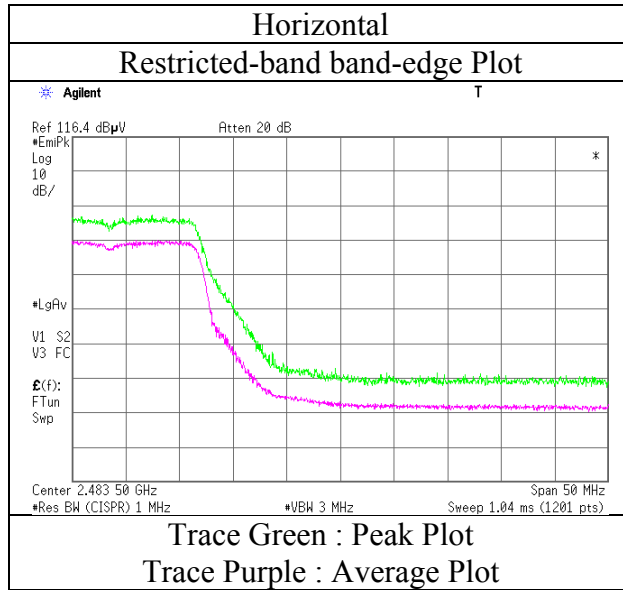
13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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)**

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH  
Engineer : Hiroyuki Morikawa  
(1 GHz -13 GHz)  
Mode : Tx 11g 2462 MHz

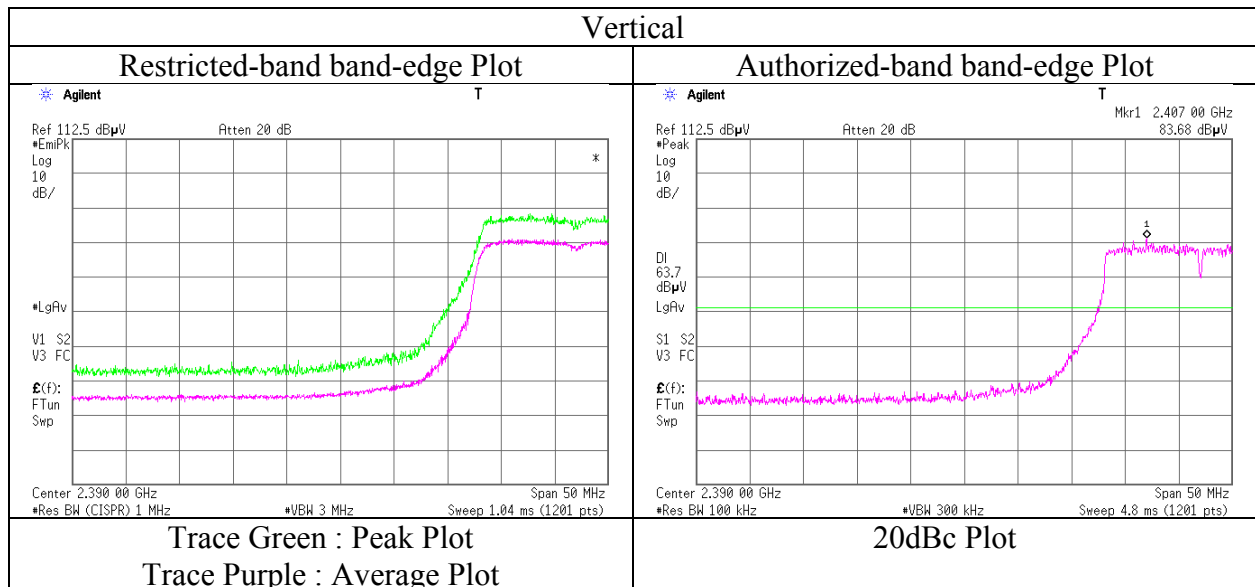
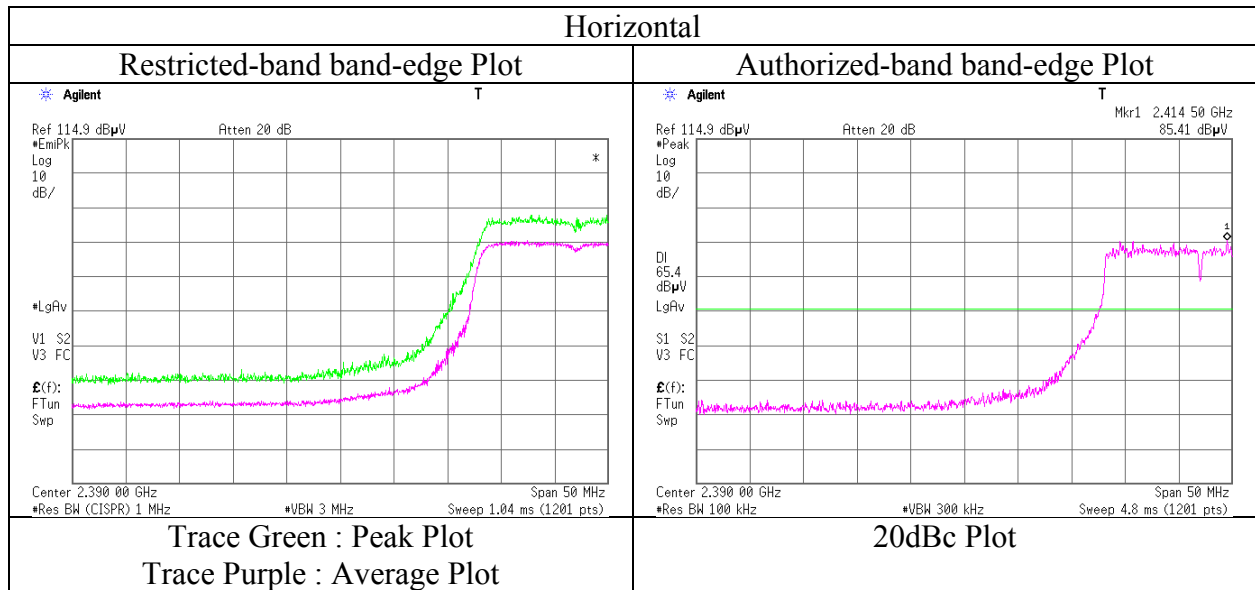


\* Final result of restricted band edge was shown in tabular data.



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

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH  
Engineer : Hiroyuki Morikawa  
(1 GHz -13 GHz)  
Mode : Tx 11n-20 2412 MHz



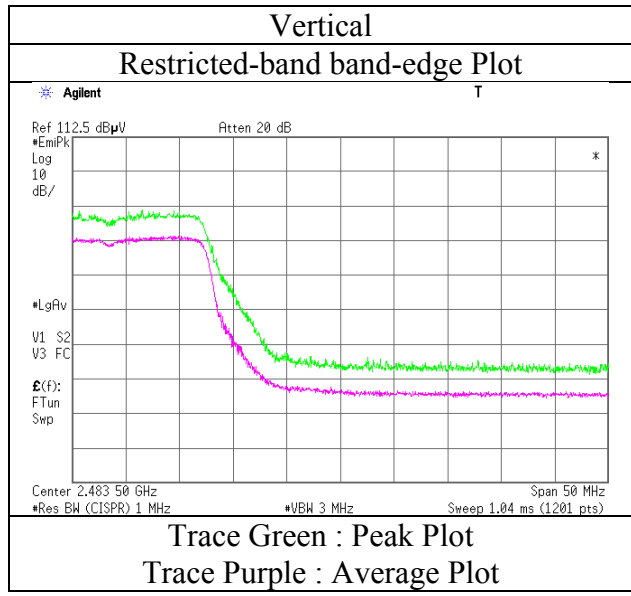
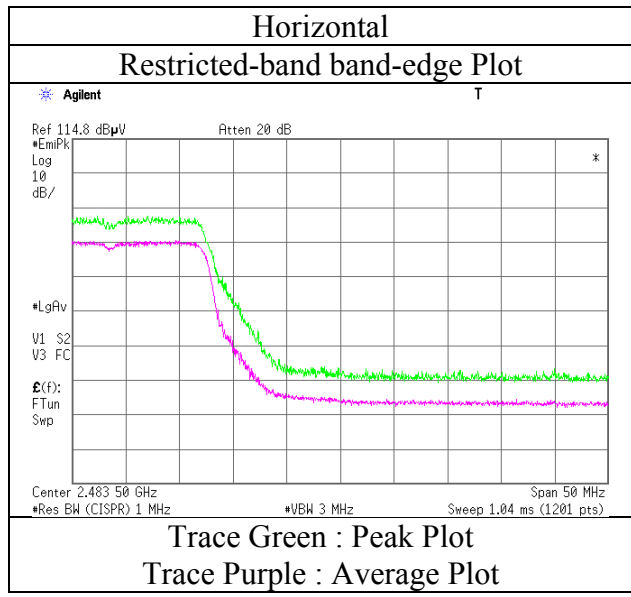
\* Final result of restricted band edge was shown in tabular data.





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

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11483195S-A
Date	October 12, 2016
Temperature / Humidity	24 deg. C / 45 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz -13 GHz)
Mode	Tx 11n-20 2462 MHz

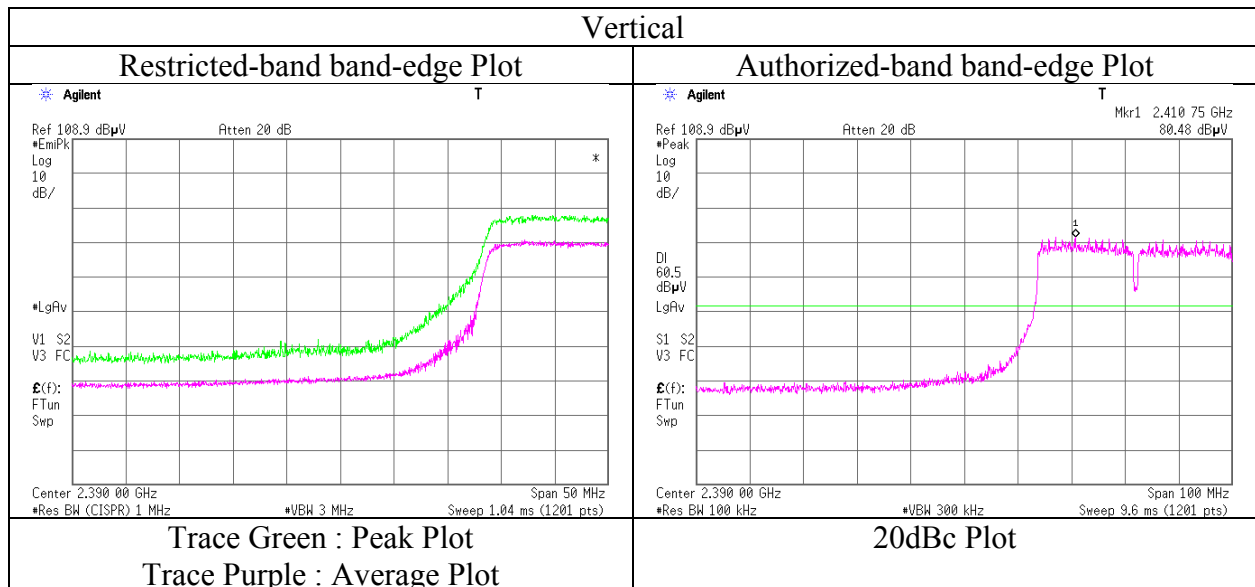
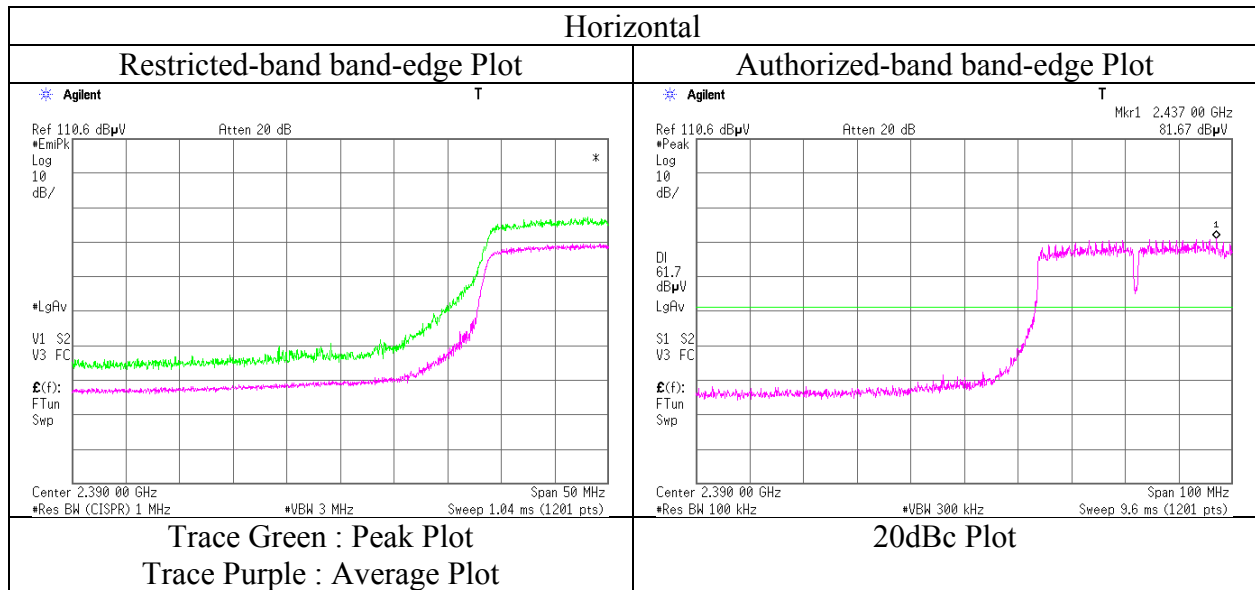


\* Final result of restricted band edge was shown in tabular data.



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

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11483195S-A
Date	October 12, 2016
Temperature / Humidity	24 deg. C / 45 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz -13 GHz)
Mode	Tx 11n-40 2422 MHz



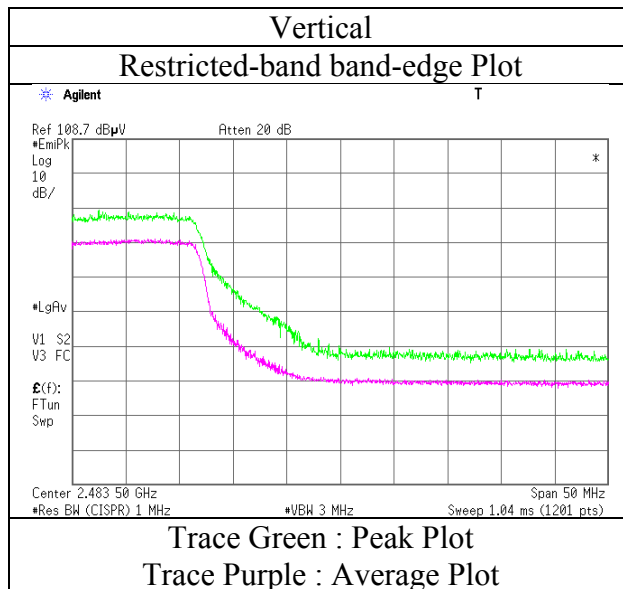
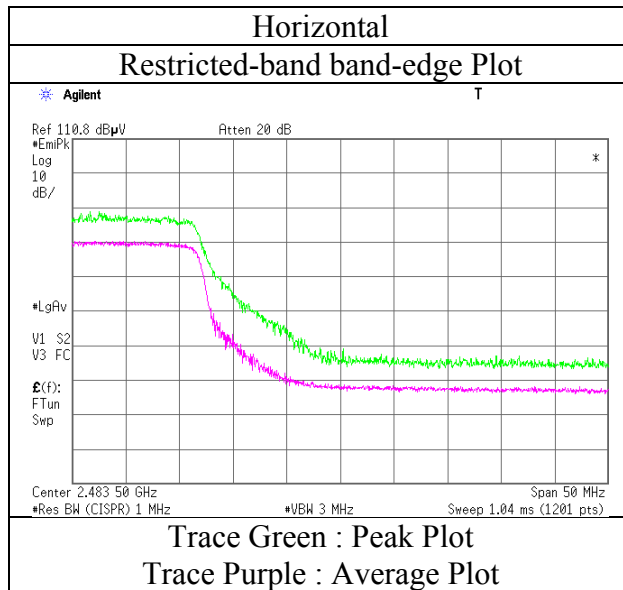
\* Final result of restricted band edge was shown in tabular data.





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

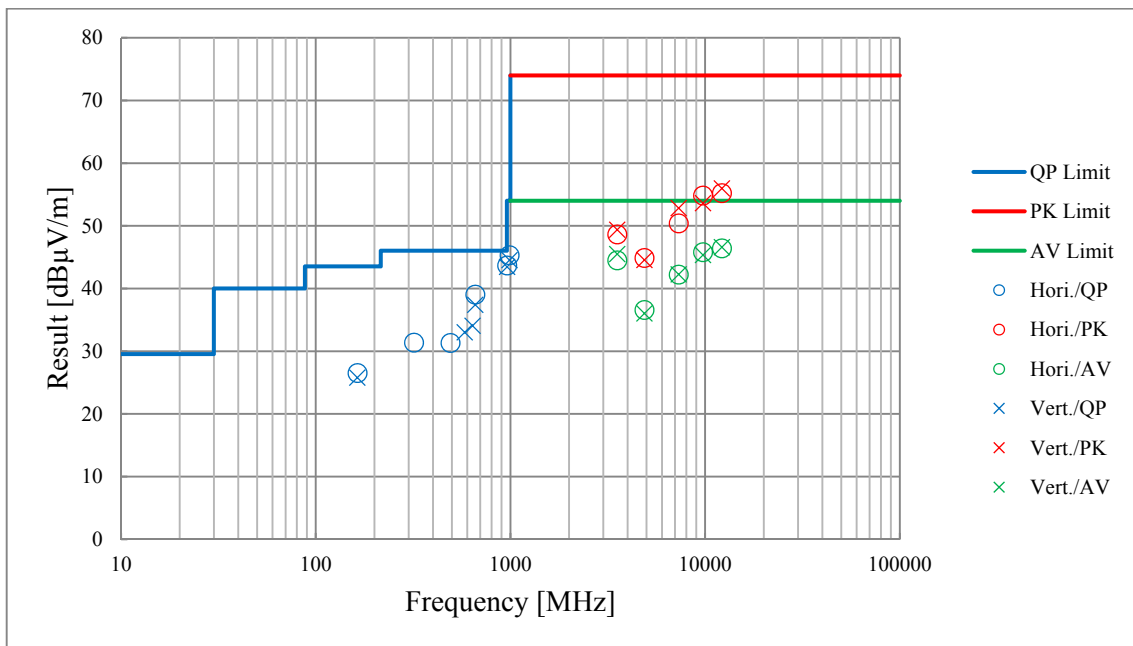
Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 11483195S-A  
Date : October 12, 2016  
Temperature / Humidity : 24 deg. C / 45 % RH  
Engineer : Hiroyuki Morikawa  
(1 GHz -13 GHz)  
Mode : Tx 11n-40 2452 MHz



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

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

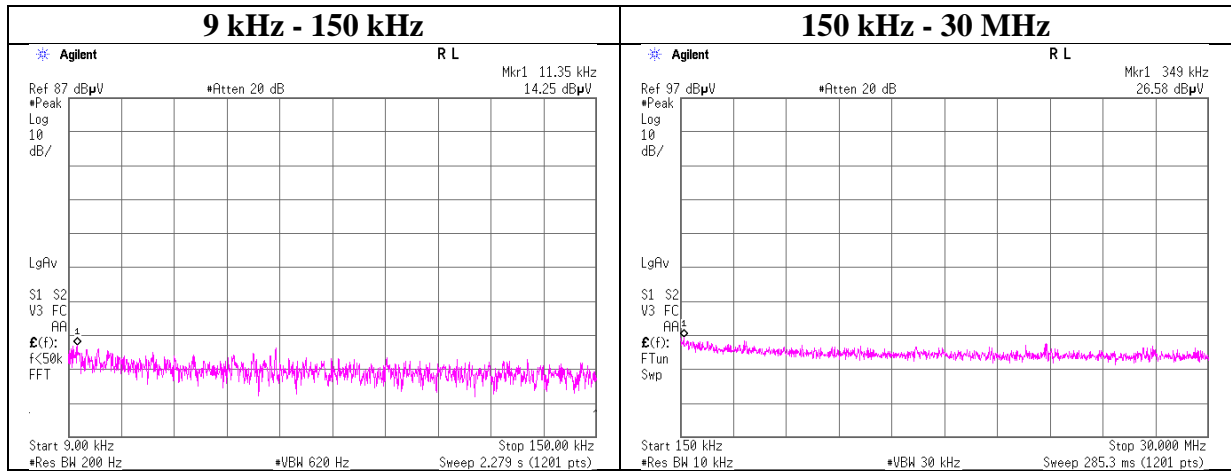
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11483195S-A		
Date	October 12, 2016	October 13, 2016	October 14, 2016
Temperature / Humidity	24 deg. C / 45 % RH	25 deg. C / 44 % RH	24 deg. C / 44 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)	Hikaru Shirasawa (30 MHz – 1 GHz) (13 GHz -18 GHz)	Hiroyuki Morikawa (18 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

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11483195S-A
Date	November 9, 2015
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Yosuke Ishikawa
Mode	Tx 11g 2437 MHz



## Power Density

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 11483195S-A  
Date : November 9, 2015  
Temperature / Humidity : 24 deg. C / 41 % 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	-13.92	2.03	10.01	-1.88	8.00	9.88
2437.00	-10.36	2.04	10.01	1.69	8.00	6.31
2462.00	-10.63	2.05	10.01	1.43	8.00	6.57

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-29.05	2.03	10.01	-17.01	8.00	25.01
2437.00	-25.14	2.04	10.01	-13.09	8.00	21.09
2462.00	-25.33	2.05	10.01	-13.27	8.00	21.27

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-29.25	2.03	10.01	-17.21	8.00	25.21
2437.00	-26.26	2.04	10.01	-14.21	8.00	22.21
2462.00	-25.85	2.05	10.01	-13.79	8.00	21.79

11n-40

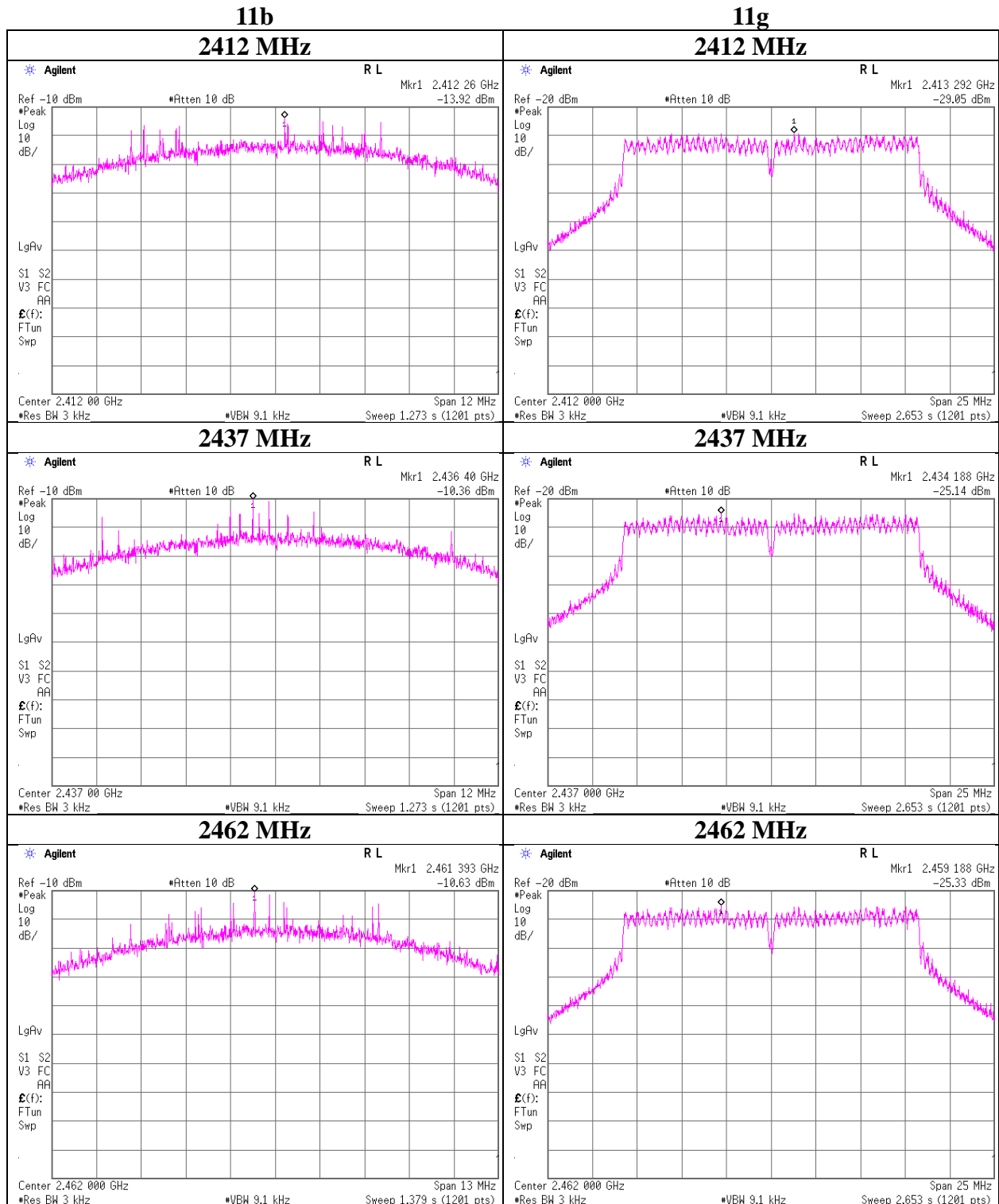
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2422.00	-35.10	2.03	10.01	-23.06	8.00	31.06
2437.00	-30.42	2.04	10.01	-18.37	8.00	26.37
2452.00	-31.42	2.04	10.01	-19.37	8.00	27.37

Sample Calculation:

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

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

**Power Density**



**UL Japan, Inc.**

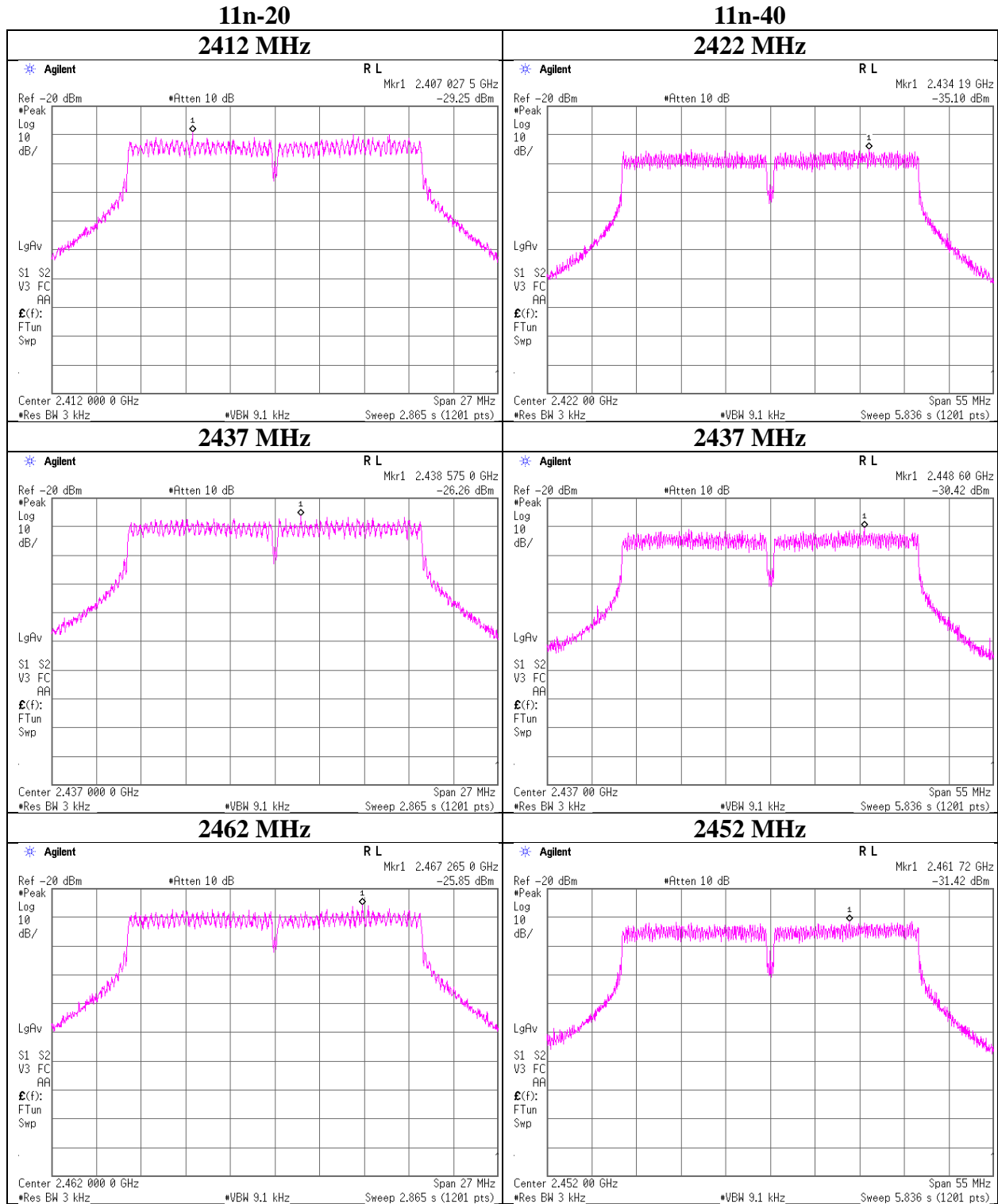
**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

**Power Density**



**UL Japan, Inc.**

**Shonan EMC Lab.**

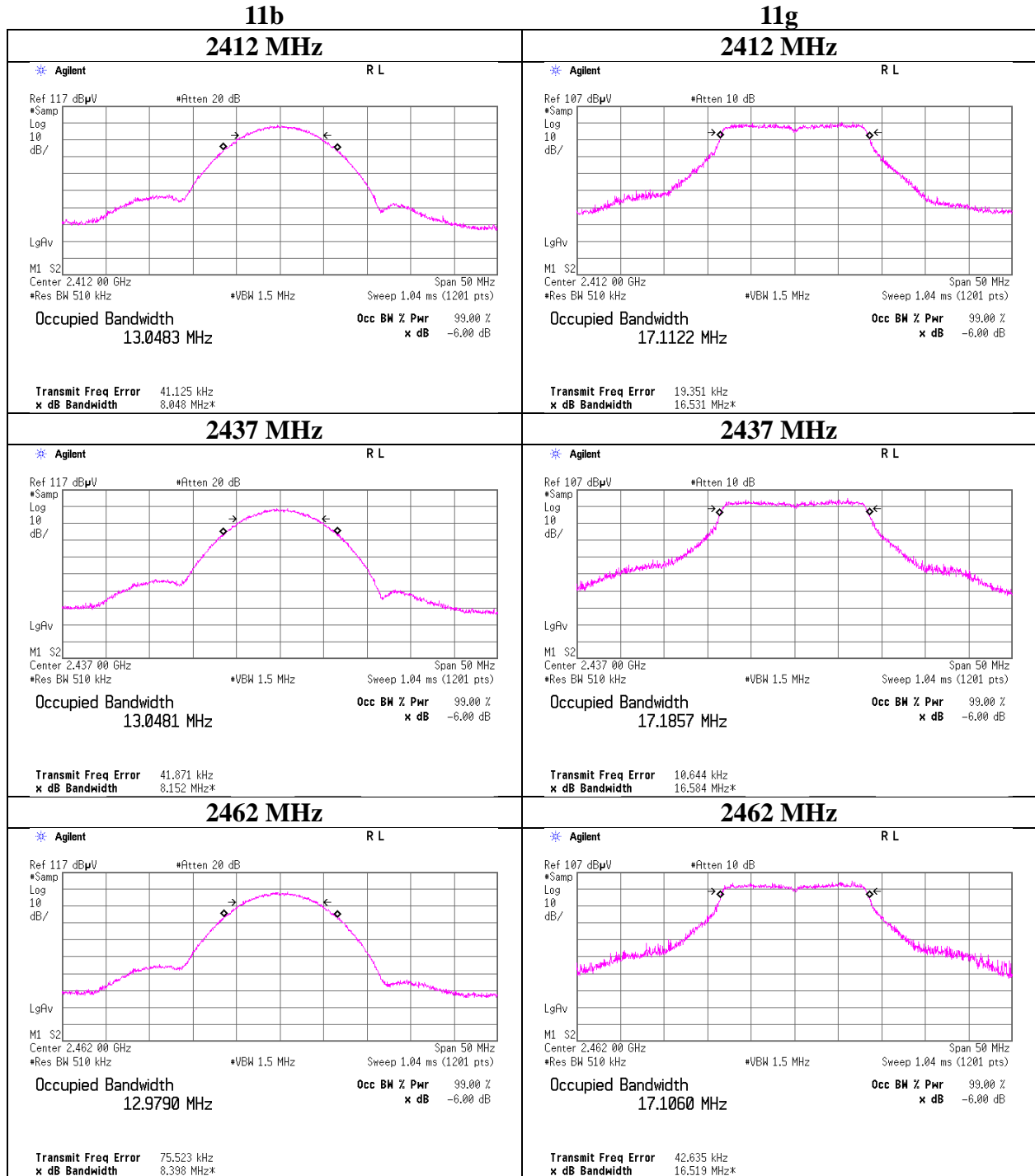
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

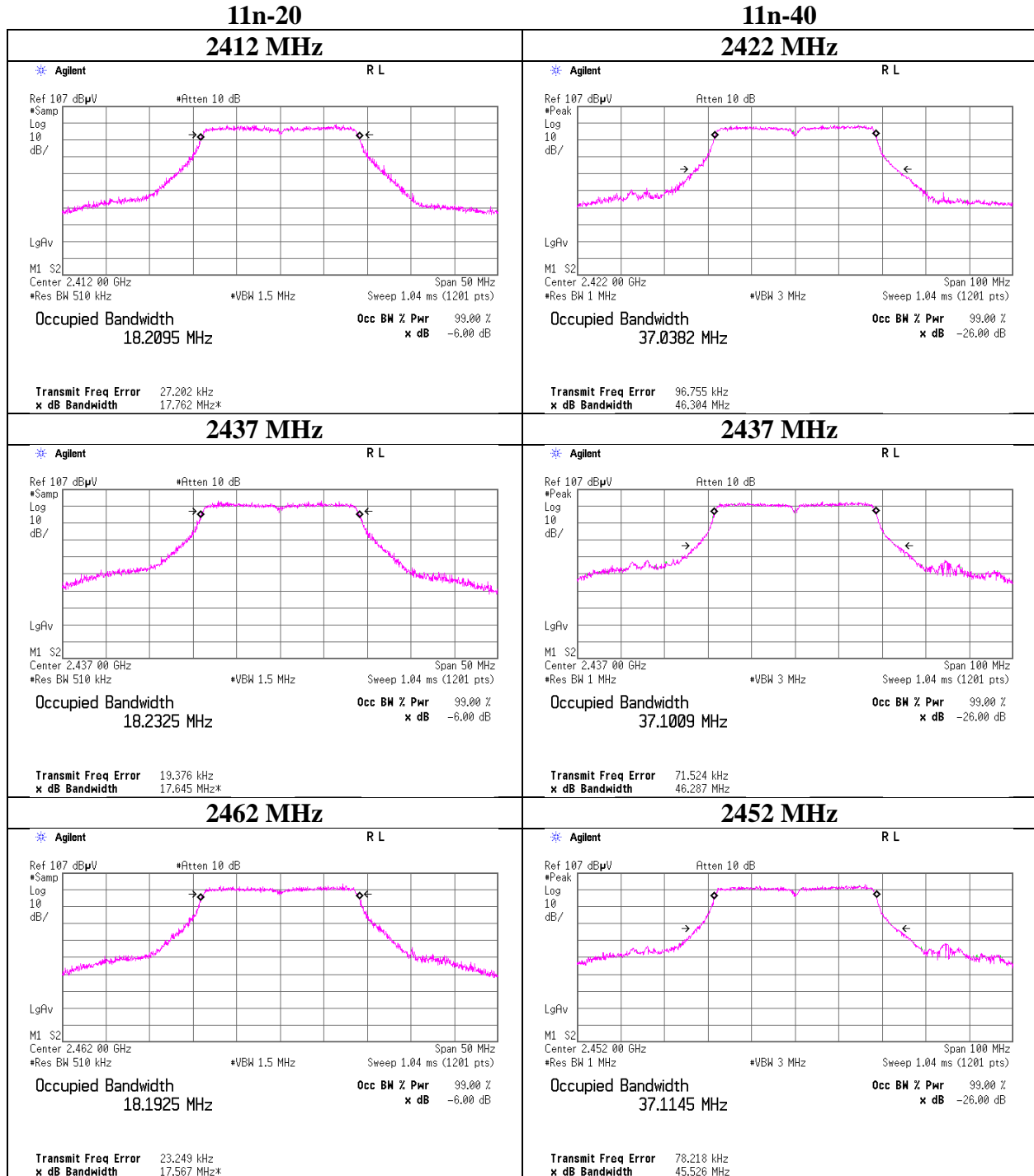
## 99% Occupied Bandwidth

Test place Report No. Date Temperature / Humidity Engineer Mode	Shonan EMC Lab. No.5 Shielded Room 11483195S-A November 9, 2015 24 deg. C / 41 % RH Yosuke Ishikawa Tx
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## 99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11483195S-A
Date	November 9, 2015
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Yosuke Ishikawa
Mode	Tx



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## **APPENDIX 2: Test instruments**

### **Test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
KAF-02	Pre Amplifier	Hewlett Packard	8449B	3008A01268	RE	2016/04/22 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-00	JUN-12-14-018	RE	2016/06/23 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2016/05/11 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2016/08/22 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	RE	2015/12/07 * 12
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	RE	2016/02/08 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2016/07/25 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE, CE, RFL, MF)	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2015/11/18 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2015/11/04 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2016/04/18 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2016/02/10 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2016/07/15 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2015/10/11 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2015/10/11 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2016/08/04 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2016/04/22 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2016/02/25 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2016/03/28 * 12
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-36	1440489	RE	2016/03/22 * 12
SSA-01	Spectrum Analyzer	Agilent	N9010A-526	MY48031482	RE	2016/04/28 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2016/03/08 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2016/04/18 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2016/03/15 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2016/03/23 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2016/09/26 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2016/04/04 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2016/04/04 * 12
SCC-G14	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	AT	2016/03/23 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2016/11/07 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2015/12/07 * 12
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2016/10/17 * 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: RE: Radiated Emission test, AT: Antenna Terminal Conducted test**

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