




RADIO TEST REPORT


Test Report No. : 11217682S-C-R2

Applicant : PIONEER CORPORATION
Type of Equipment : Main Unit
Model No. : D171G
FCC ID : AJDK097
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)
7. This report is a revised version of 11217682S-C-R1. 11217682S-C-R1 is replaced with this report.

Date of test: May 2 to 12, 2016

Representative test engineer: 
Shinichi Takano
Engineer
Consumer Technology Division

Approved by: 
Akio Hayashi
Leader
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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13-EM-F0429

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SECTION 1: Customer information

Company Name : PIONEER CORPORATION
Address : 25-1, Yamada, Kawagoe-shi, Saitama-ken 350-8555, JAPAN
Telephone Number : +81-49-228-7787
Facsimile Number : +81-49-228-6493
Contact Person : Tomoyuki Tanaka

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

2.1 Identification of E.U.T.

Type of Equipment : Main Unit
Model No. : D171G
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12.0 V
Receipt Date of Sample : April 6, 2016
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model: D171G (referred to as the EUT in this report) is a Main Unit.

General Specification

Clock frequency(ies) in the system : Oscillator (Module) 32.768 kHz,
(System u-Com) 8 MHz
Internal Communication (Module) 195 MHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 2412 MHz - 2462 MHz
Modulation : DSSS
Power Supply (radio part input) : DC 3.3 V / 1.8 V
Antenna type : Pattern inverted F type
Antenna Gain : 2.29 dBi (max)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	N/A	N/A	N/A*1)
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	4.8 dB 2483.500, AV, Horizontal Tx 11b 2462 MHz	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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

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

*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 (DC 3.3 V / 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 EUT has a unique coupling/antenna connector (U.FL). 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 report meets the limits unless the uncertainty is taken into consideration.

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	10m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

Mode	Remarks*
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n MIMO 20 MHz BW (11n-20)	MCS 6 , 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: 11b : 15, 11g : 11, 11n-20 : 10 Software: WLAN A113 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Spurious Emission (above 1 GHz)	11b Tx	2412 MHz
6dB Bandwidth	11g Tx	2437 MHz
Maximum Peak Output Power	11n-20 Tx	2462 MHz
Power Density		
99% Occupied Bandwidth		
Restricted Band Edges	11b Tx	2412 MHz
	11g Tx	2462 MHz
	11n-20 Tx	
Spurious Emission (below 1 GHz)	11g Tx	2462 MHz

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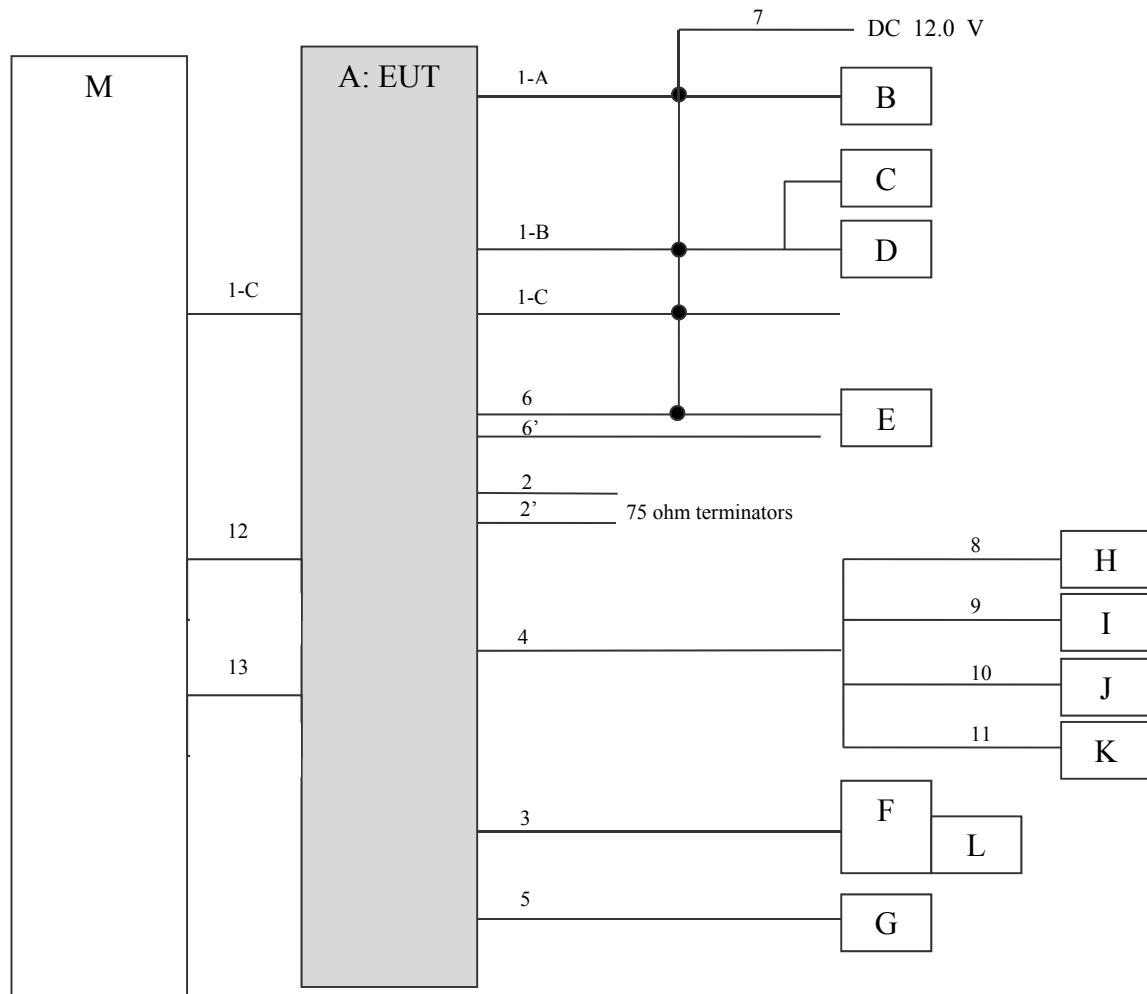
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4.2 Configuration and peripherals



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

* The testing was performed with DC 12.0 V only.

The voltage which the car battery mounted in the car outputs was selected as a test voltage according to the customer's request.

As the stable voltage (DC 3.3 V/ 1.8 V) is provided to RF module via the internal regulator, it does not influence on the test result.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	MAIN UNIT	D171G	PBPKTP0028CS *1) PBPKTP0053CS *2)	PIONEER	EUT
B	Steering SW	75E921LH/RH	-	-	-
C	Mic	-	-	-	-
D	Rear Camera	-	-	-	-
E	Air-con ECU	-	-	DENSO	-
F	USB	-	-	-	-
G	GPS Antenna	86860-71011	-	AISIN	-
H	Speaker	LV-002	S11014200775	L&V	-
I	Speaker	LV-002	S11014200775	L&V	-
J	Speaker	LV-002	S11014200773	L&V	-
K	Speaker	LV-002	S11014200773	L&V	-
L	USB Memory	-	-	-	-
M	Display	-	-	PIONEER	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1-A	Wire Harness Set	1.1	Unshielded	Unshielded	-
1-B	Wire Harness	1.1	Unshielded	Unshielded	-
1-C	Wire Harness	1.1	Unshielded	Unshielded	-
2, 2'	Radio antenna	1.6	Shielded	Shielded	-
3	USB connector	1.1	Shielded	Shielded	-
4	Speaker	1.1	Unshielded	Unshielded	-
5	GPS antenna connector	1.5	Shielded	Shielded	-
6, 6'	Wire Harness (Air-con ECU)	1.9	Unshielded	Unshielded	-
7	DC	3.0	Shielded	Unshielded	-
8	Speaker	1.9	Unshielded	Unshielded	-
9	Speaker	1.9	Unshielded	Unshielded	-
10	Speaker	1.9	Unshielded	Unshielded	-
11	Speaker	1.9	Unshielded	Unshielded	-
12	Flat cable	0.5	Unshielded	Unshielded	-
13	Flat cable	0.5	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 platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity. 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 0.8 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: $20 \times \log(4.3 \text{ m} / 3.0 \text{ m}) = 3.13 \text{ dB}$

*2) Distance Factor: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

*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 deg. to 30 deg. based on the product specification to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst case:

Antenna polarization	Carrier (Band edge)	Spurious		
		Below 1 GHz	Above 1 GHz	
			1 - 18 GHz	18 - 26.5 GHz
Horizontal	0 deg.	0 deg.	0 deg.	30 deg.
Vertical	0 deg.	0 deg.	0 deg.	30 deg.

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

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

SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	20 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	9.1 kHz	27 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 30 MHz, 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.

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

Test data : APPENDIX

Test result : Pass

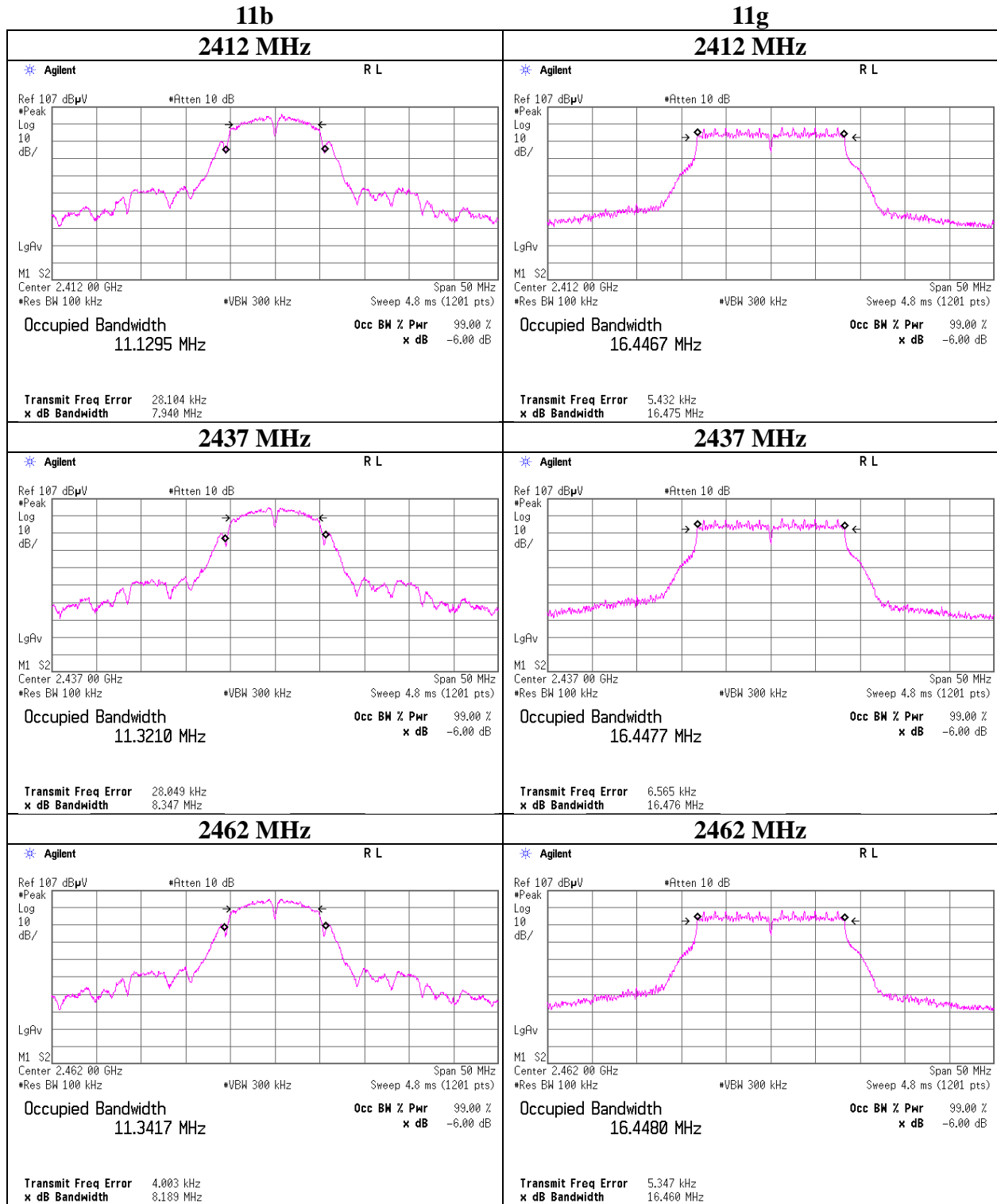
APPENDIX 1: Test data

6dB Bandwidth

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11217682S-C-R2
Date May 12, 2016
Temperature / Humidity 25 deg. C / 44 % RH
Engineer Shinichi Takano
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	7.940	> 500
	2437	8.347	> 500
	2462	8.189	> 500
11g	2412	16.475	> 500
	2437	16.476	> 500
	2462	16.460	> 500
11n-20	2412	17.741	> 500
	2437	17.738	> 500
	2462	17.766	> 500

6dB Bandwidth



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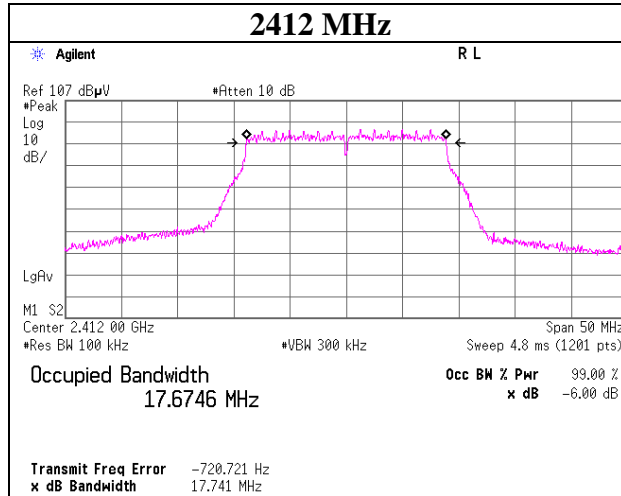
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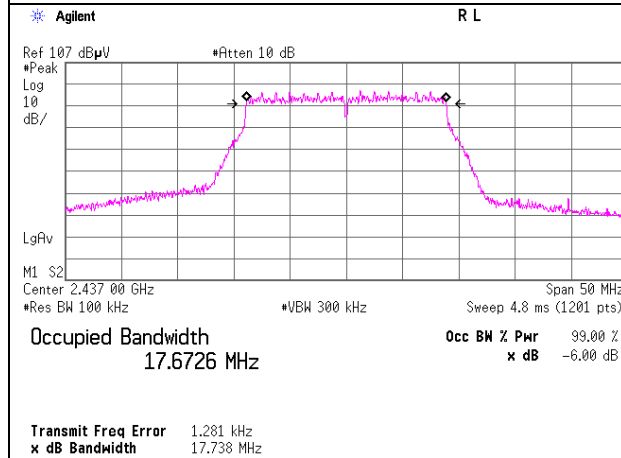
6dB Bandwidth

11n-20

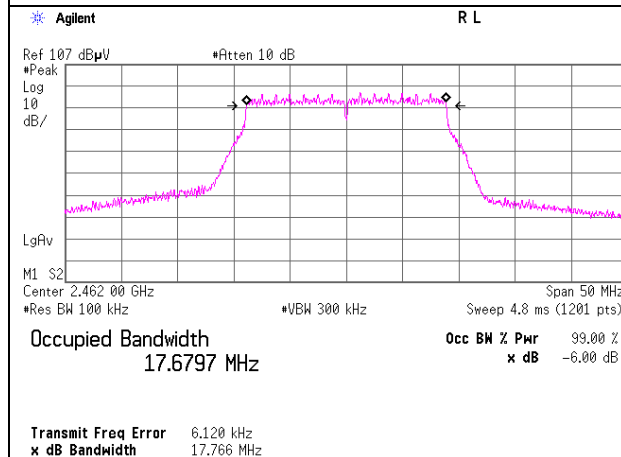
2412 MHz



2437 MHz



2462 MHz



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Maximum Peak Output Power

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 11217682S-C-R2
Date : May 2, 2016
Temperature / Humidity : 24 deg. C / 51 % RH
Engineer : Shinichi Takano
Mode : Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	6.67	1.97	9.92	18.56	71.78	30.00	1000	11.44
2437	6.88	1.97	9.92	18.77	75.34	30.00	1000	11.23
2462	6.92	1.98	9.92	18.82	76.21	30.00	1000	11.18

Sample Calculation:

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	6.78	
2	6.88	*
5.5	6.79	
11	6.86	

*: Worst Rate

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

Maximum Peak Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11217682S-C-R2
Date	May 2, 2016
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Shinichi Takano
Mode	Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	8.78	1.97	9.92	20.67	116.68	30.00	1000	9.33
2437	8.85	1.97	9.92	20.74	118.58	30.00	1000	9.26
2462	8.92	1.98	9.92	20.82	120.78	30.00	1000	9.18

Sample Calculation:

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

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	6.37	
9	6.39	
12	6.34	
18	6.15	
24	8.30	
36	8.26	
48	8.85	*
54	8.05	

*: Worst Rate

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

Maximum Peak Output Power

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11217682S-C-R2
Date	May 2, 2016
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Shinichi Takano
Mode	Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	7.63	1.97	9.92	19.52	89.54	30.00	1000	10.48
2437	7.76	1.97	9.92	19.65	92.26	30.00	1000	10.35
2462	7.78	1.98	9.92	19.68	92.90	30.00	1000	10.32

Sample Calculation:

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

2437 MHz

Rate [MCS]	Reading [dBm]	Remark
0	5.83	
1	6.09	
2	5.67	
3	7.57	
4	7.37	
5	7.54	
6	7.76	*
7	7.63	

*: Worst Rate

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.1 Measurement Room
Report No. : 11217682S-C-R2
Date : May 2, 2016
Temperature / Humidity : 24 deg. C / 51 % RH
Engineer : Shinichi Takano
Mode : Tx

11b 2 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	2.92	1.97	9.92	14.81	30.27	0.09	14.90	30.90
2437	3.14	1.97	9.92	15.03	31.84	0.09	15.12	32.51
2462	3.17	1.98	9.92	15.07	32.14	0.09	15.16	32.81

11g 48 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	-2.86	1.97	9.92	9.03	8.00	1.76	10.79	11.99
2437	-2.71	1.97	9.92	9.18	8.28	1.76	10.94	12.42
2462	-2.69	1.98	9.92	9.21	8.34	1.76	10.97	12.50

11n-20 MCS 6

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-4.22	1.97	9.92	7.67	5.85	1.86	9.53	8.97
2437	-4.12	1.97	9.92	7.77	5.98	1.86	9.63	9.18
2462	-4.07	1.98	9.92	7.83	6.07	1.86	9.69	9.31

Sample Calculation:

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

Result (Burst power) = Frame power + Duty factor

Average Output Power
(Reference data for RF Exposure)

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 11217682S-C-R2
Date : May 2, 2016
Temperature / Humidity : 24 deg. C / 51 % RH
Engineer : Shinichi Takano
Mode : Tx

2437 MHz

Mode	Rate Mbps	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11b	1	3.07	0.04	3.11	
	2	3.14	0.09	3.23	*
	5.5	2.90	0.22	3.12	
	11	2.73	0.43	3.16	
11g	6	-1.41	0.29	-1.12	
	9	-1.52	0.43	-1.09	
	12	-1.69	0.55	-1.14	
	18	-1.91	0.79	-1.12	
	24	-2.05	1.02	-1.03	
	36	-2.45	1.43	-1.02	
	48	-2.71	1.76	-0.95	*
	54	-2.89	1.90	-0.99	
11n-20	0	-2.86	0.31	-2.55	
	1	-3.08	0.58	-2.50	
	2	-3.21	0.81	-2.40	
	3	-3.37	1.04	-2.33	
	4	-3.78	1.41	-2.37	
	5	-4.08	1.72	-2.36	
	6	-4.12	1.86	-2.26	*
7	-4.34	2.01	-2.33		

* Worst rate

Sample Calculation:

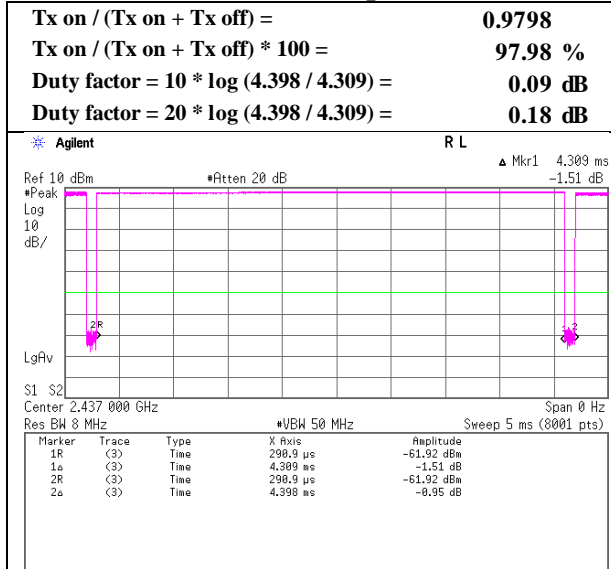
$$\text{Burst power} = \text{Reading (timed average)} + \text{Duty factor}$$

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

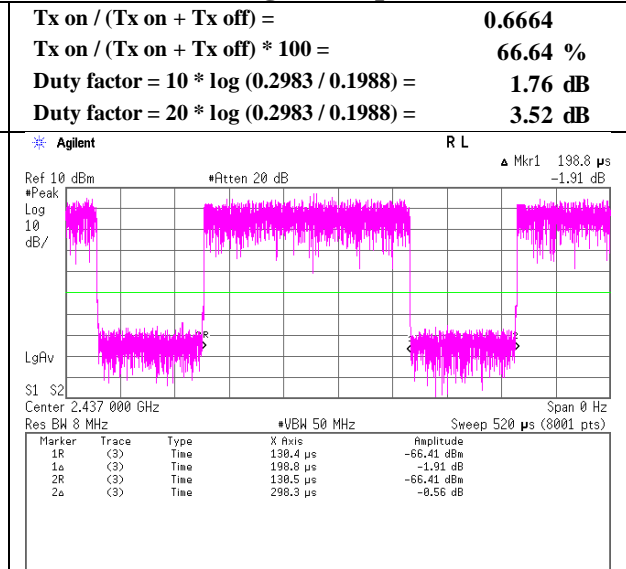
Burst rate confirmation

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	11217682S-C-R2
Date	May 2, 2016
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Shinichi Takano
Mode	Tx

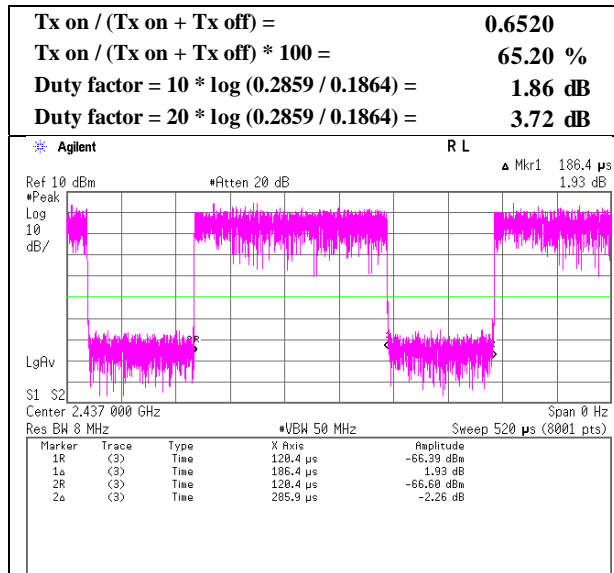
11b 2 Mbps



11g 48 Mbps

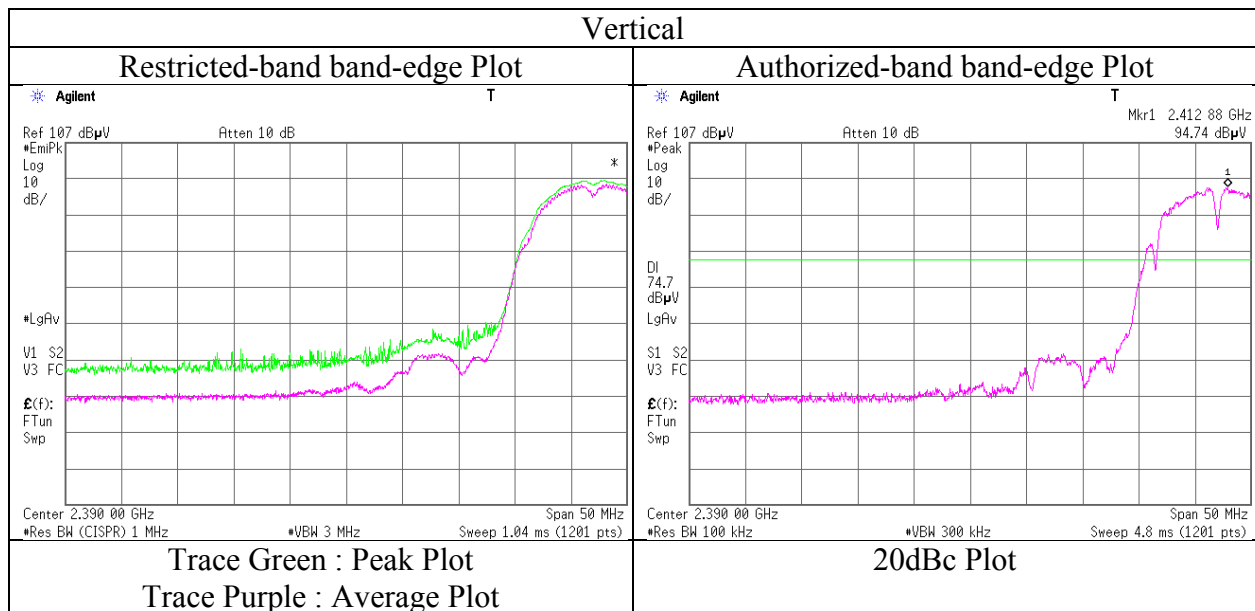
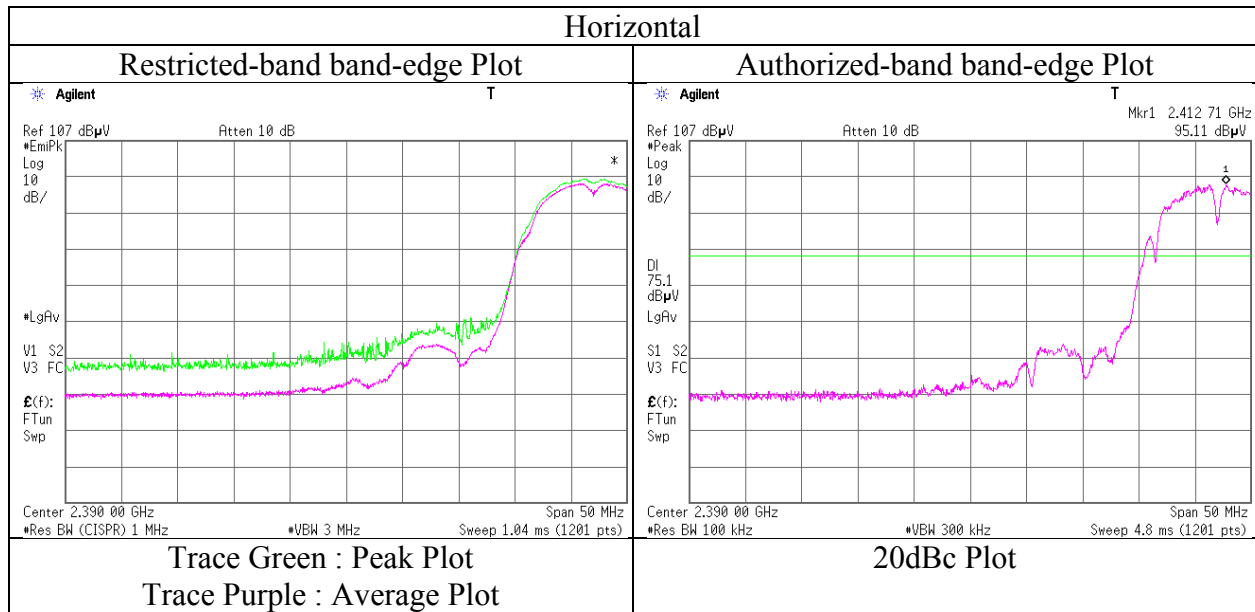


11n-20 MCS 0



Radiated Spurious Emission
(Reference Plot for band-edge)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11217682S-C-R2
Date : May 3, 2016
Temperature / Humidity : 23 deg. C / 49 % RH
Engineer : Shinichi Takano
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.	11217682S-C-R2	
Date	May 3, 2016	May 4, 2016
Temperature / Humidity	23 deg. C / 49 % RH	24 deg. C / 57 % RH
Engineer	Shinichi Takano	Takahiro Suzuki
	(1-13 GHz)	(13-26.5 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	56.3	27.9	13.8	41.0	3.1	60.1	73.9	13.8	329	299	
Hori.	4924.000	PK	46.7	31.9	5.9	39.4	3.1	48.2	73.9	25.7	175	56	
Hori.	7386.000	PK	46.3	36.9	7.4	40.3	3.1	53.4	73.9	20.5	150	0	
Hori.	22401.480	PK	43.0	40.2	14.5	48.1	-9.5	40.1	73.9	33.8	153	219	
Hori.	22401.480	AV	38.7	40.2	14.5	48.1	-9.5	35.8	53.9	18.1	153	219	
Vert.	2483.500	PK	55.1	27.9	13.8	41.0	3.1	58.9	73.9	15.0	145	316	
Vert.	4924.000	PK	46.7	31.9	5.9	39.4	3.1	48.2	73.9	25.7	170	72	
Vert.	7386.000	PK	46.7	36.9	7.4	40.3	3.1	53.8	73.9	20.1	150	0	
Vert.	22401.500	PK	41.0	40.2	14.5	48.1	-9.5	38.1	73.9	35.8	149	228	
Vert.	22401.500	AV	33.8	40.2	14.5	48.1	-9.5	30.9	53.9	23.0	149	228	

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

Distance factor : 1 GHz - 13 GHz : 20log(4.3 m / 3.0 m) = 3.13 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.5 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	45.1	27.9	13.8	41.0	0.2	3.1	49.1	53.9	4.8	*1)
Hori.	4924.000	AV	38.0	31.9	5.9	39.4	0.2	3.1	39.7	53.9	14.2	
Hori.	7386.000	AV	36.8	36.9	7.4	40.3	0.2	3.1	44.1	53.9	9.8	
Vert.	2483.500	AV	43.5	27.9	13.8	41.0	0.2	3.1	47.5	53.9	6.4	*1)
Vert.	4924.000	AV	37.0	31.9	5.9	39.4	0.2	3.1	38.7	53.9	15.2	
Vert.	7386.000	AV	36.6	36.9	7.4	40.3	0.2	3.1	43.9	53.9	10.0	

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

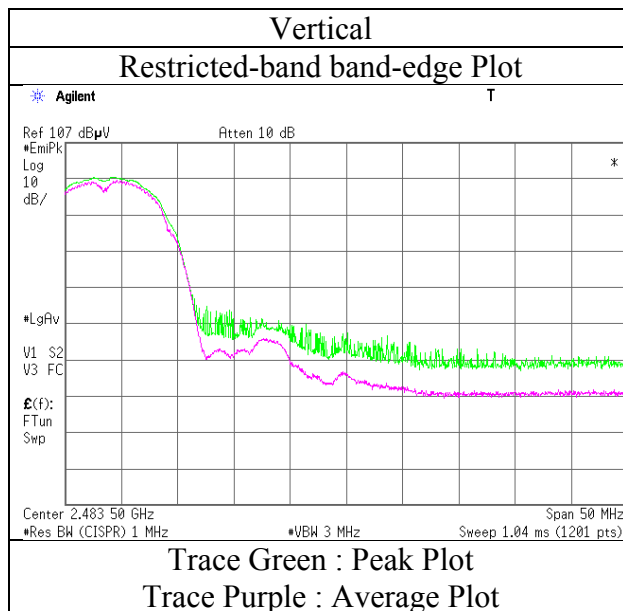
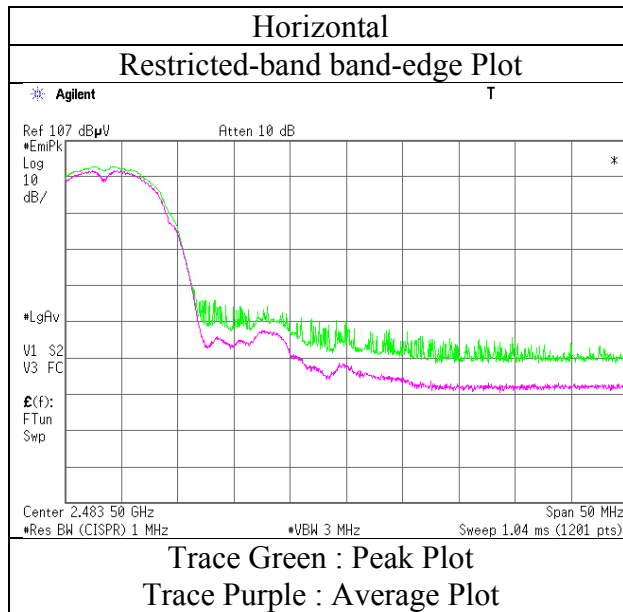
Distance factor : 1 GHz - 13 GHz : 20log(4.3 m / 3.0 m) = 3.13 dB

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)

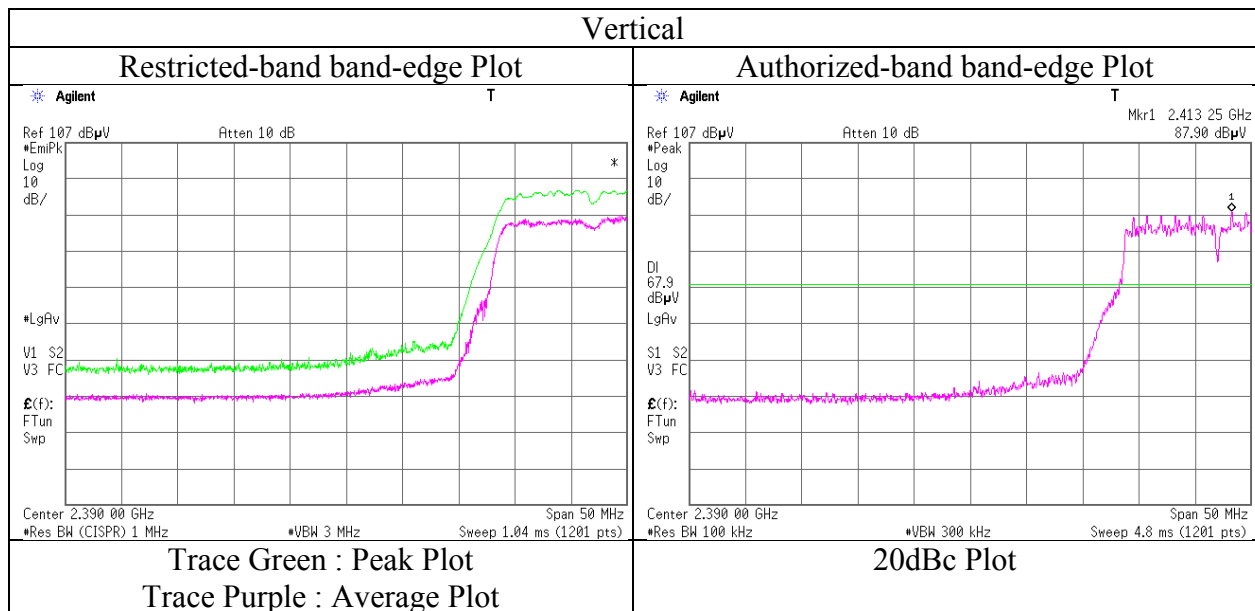
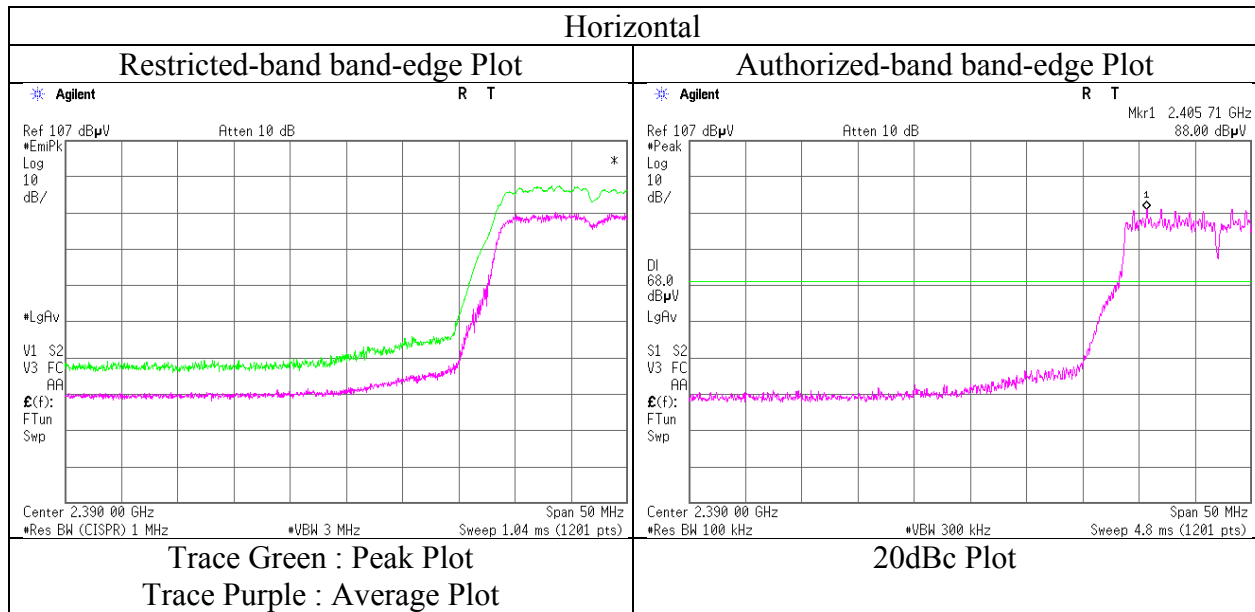
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11217682S-C-R2
Date	May 3, 2016
Temperature / Humidity	23 deg. C / 49 % RH
Engineer	Shinichi Takano
Mode	Tx 11b 2462 MHz



* 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. : 11217682S-C-R2
Date : May 3, 2016
Temperature / Humidity : 23 deg. C / 49 % RH
Engineer : Shinichi Takano
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. : 11217682S-C-R2
Date : May 3, 2016 May 4, 2016 May 5, 2016
Temperature / Humidity : 23 deg. C / 49 % RH 24 deg. C / 57 % RH 23 deg. C / 45 % RH
Engineer : Shinichi Takano Takahiro Suzuki Takahiro Suzuki
 (1-13 GHz) (13-26.5 GHz) (30-1000 MHz)
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.	74.017	QP	43.1	5.9	7.2	32.2	0.0	24.0	40.0	16.0	258	77	
Hori.	111.017	QP	40.1	11.3	7.5	32.1	0.0	26.8	43.5	16.7	295	329	
Hori.	120.269	QP	41.0	12.6	7.6	32.1	0.0	29.1	43.5	14.4	310	231	
Hori.	666.123	QP	27.0	19.8	10.2	31.9	0.0	25.1	46.0	20.9	165	47	
Hori.	2483.500	PK	49.2	27.9	13.8	41.0	3.1	53.0	73.9	20.9	332	296	
Hori.	4924.000	PK	45.2	31.9	5.9	39.4	3.1	46.7	73.9	27.2	150	0	
Hori.	7386.000	PK	46.0	36.9	7.4	40.3	3.1	53.1	73.9	20.8	150	0	
Hori.	22401.520	PK	43.4	40.2	14.5	48.1	-9.5	40.5	73.9	33.4	153	219	
Hori.	22401.520	AV	37.7	40.2	14.5	48.1	-9.5	34.8	53.9	19.1	153	219	
Vert.	37.007	QP	27.4	15.0	6.8	32.2	0.0	17.0	40.0	23.0	100	35	
Vert.	59.998	QP	36.4	7.3	7.1	32.2	0.0	18.6	40.0	21.4	100	36	
Vert.	74.014	QP	47.3	5.9	7.2	32.2	0.0	28.2	40.0	11.8	168	19	
Vert.	101.767	QP	34.4	10.0	7.5	32.1	0.0	19.8	43.5	23.7	126	1	
Vert.	111.018	QP	41.3	11.3	7.5	32.1	0.0	28.0	43.5	15.5	100	359	
Vert.	120.275	QP	42.7	12.6	7.6	32.1	0.0	30.8	43.5	12.7	100	302	
Vert.	141.953	QP	25.1	14.2	7.7	32.1	0.0	14.9	43.5	28.6	100	28	
Vert.	666.123	QP	23.9	19.8	10.2	31.9	0.0	22.0	46.0	24.0	100	9	
Vert.	2483.500	PK	49.1	27.9	13.8	41.0	3.1	52.9	73.9	21.0	190	312	
Vert.	4924.000	PK	44.4	31.9	5.9	39.4	3.1	45.9	73.9	28.0	150	0	
Vert.	7386.000	PK	45.7	36.9	7.4	40.3	3.1	52.8	73.9	21.1	150	0	
Vert.	22401.480	PK	40.5	40.2	14.5	48.1	-9.5	37.6	73.9	36.3	146	230	
Vert.	22401.480	AV	33.2	40.2	14.5	48.1	-9.5	30.3	53.9	23.6	146	230	

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

Distance factor : 1 GHz - 13 GHz : 20log(4.3 m / 3.0 m) = 3.13 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.5 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	39.0	27.9	13.8	41.0	3.5	3.1	46.3	53.9	7.6	*1)
Hori.	4924.000	AV	36.0	31.9	5.9	39.4	3.5	3.1	41.0	53.9	12.9	
Hori.	7386.000	AV	36.4	36.9	7.4	40.3	3.5	3.1	47.0	53.9	6.9	
Vert.	2483.500	AV	38.3	27.9	13.8	41.0	3.5	3.1	45.6	53.9	8.3	*1)
Vert.	4924.000	AV	35.7	31.9	5.9	39.4	3.5	3.1	40.7	53.9	13.2	
Vert.	7386.000	AV	36.7	36.9	7.4	40.3	3.5	3.1	47.3	53.9	6.6	

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

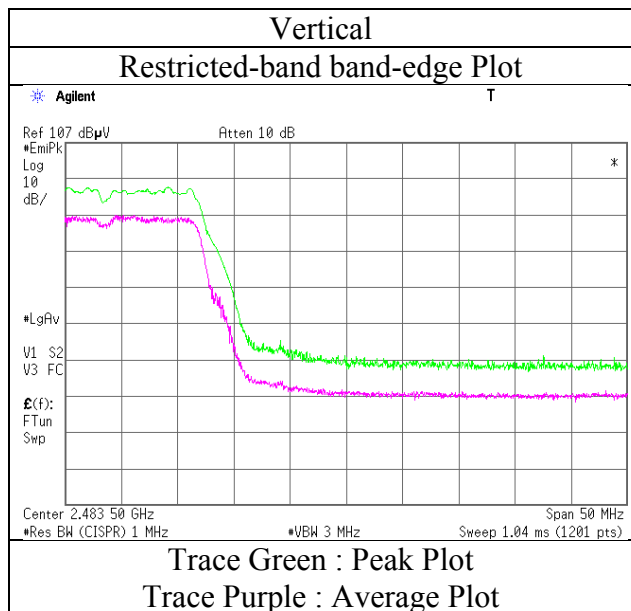
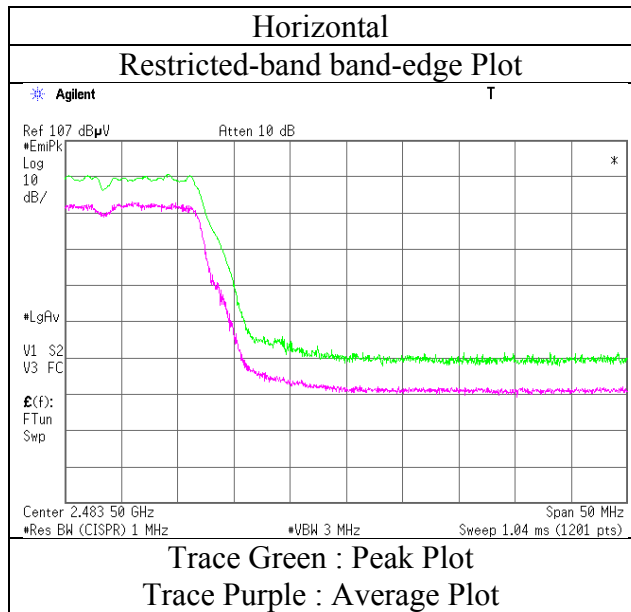
Distance factor : 1 GHz - 13 GHz : 20log(4.3 m / 3.0 m) = 3.13 dB

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)

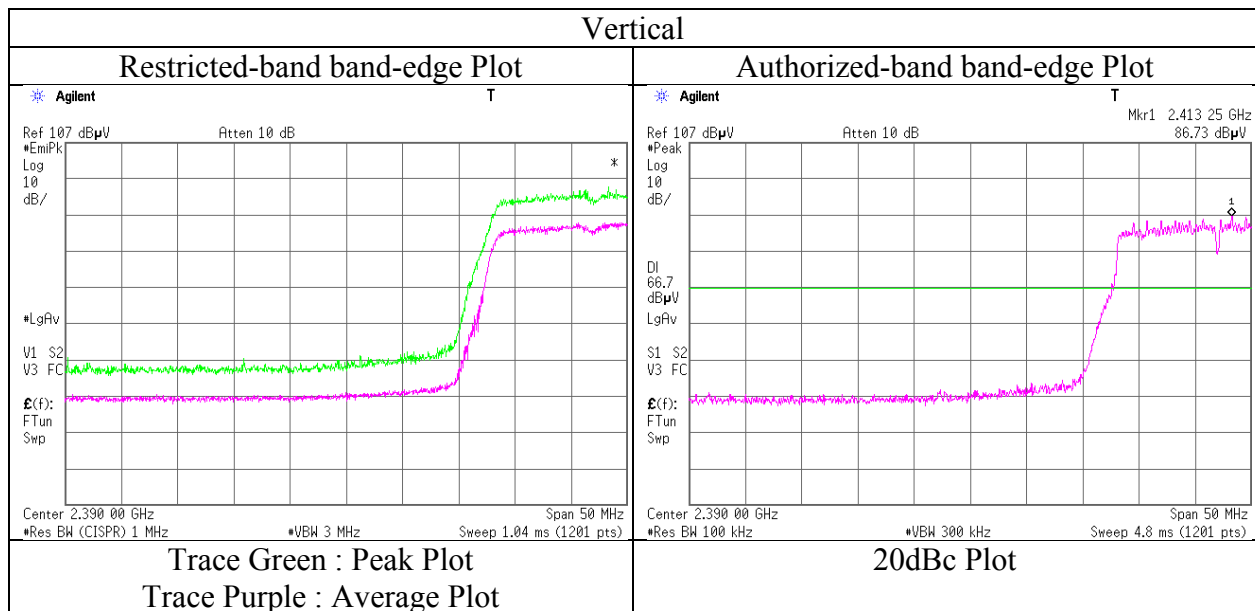
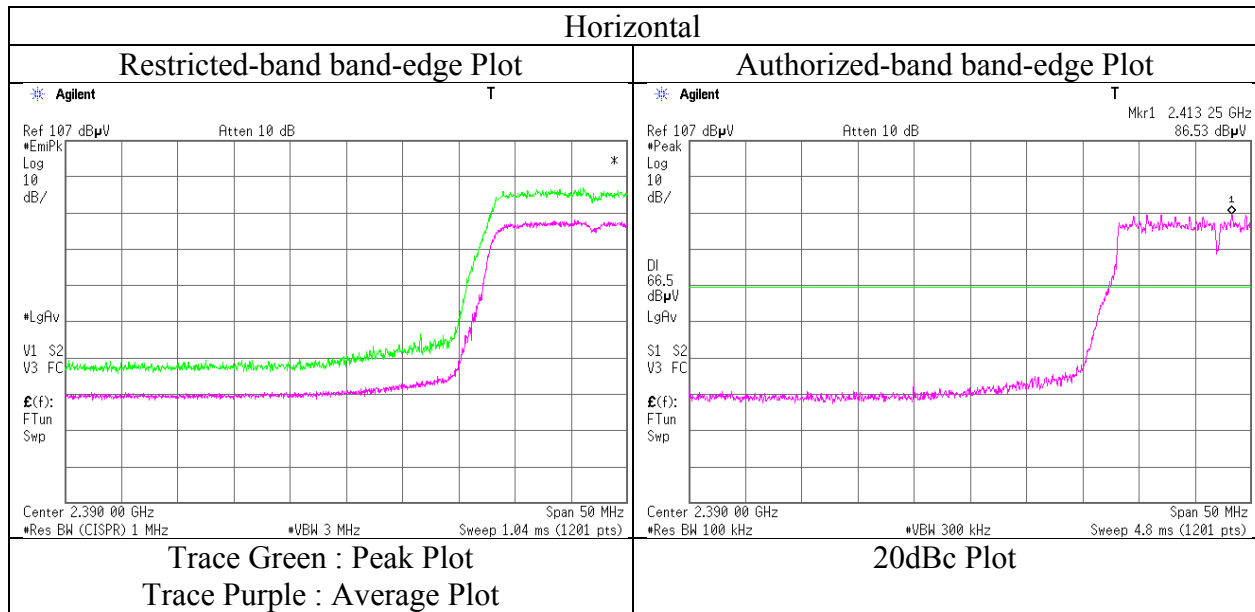
Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11217682S-C-R2
Date : May 3, 2016
Temperature / Humidity : 23 deg. C / 49 % RH
Engineer : Shinichi Takano
Mode : Tx 11g 2462 MHz



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

Radiated Spurious Emission
(Reference Plot for band-edge)

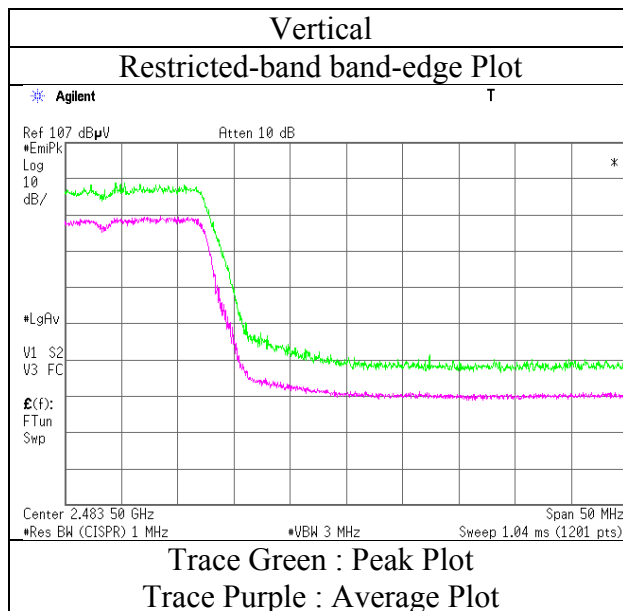
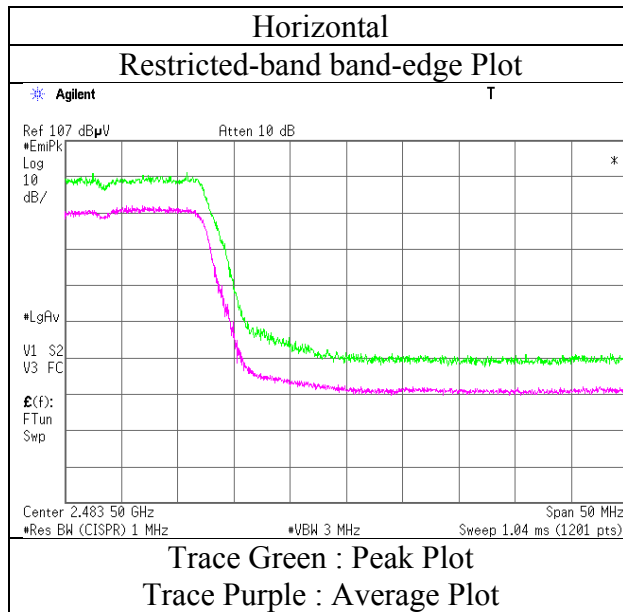
Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11217682S-C-R2
Date : May 3, 2016
Temperature / Humidity : 23 deg. C / 49 % RH
Engineer : Shinichi Takano
Mode : Tx 11n-20 2412 MHz



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

Radiated Spurious Emission
(Reference Plot for band-edge)

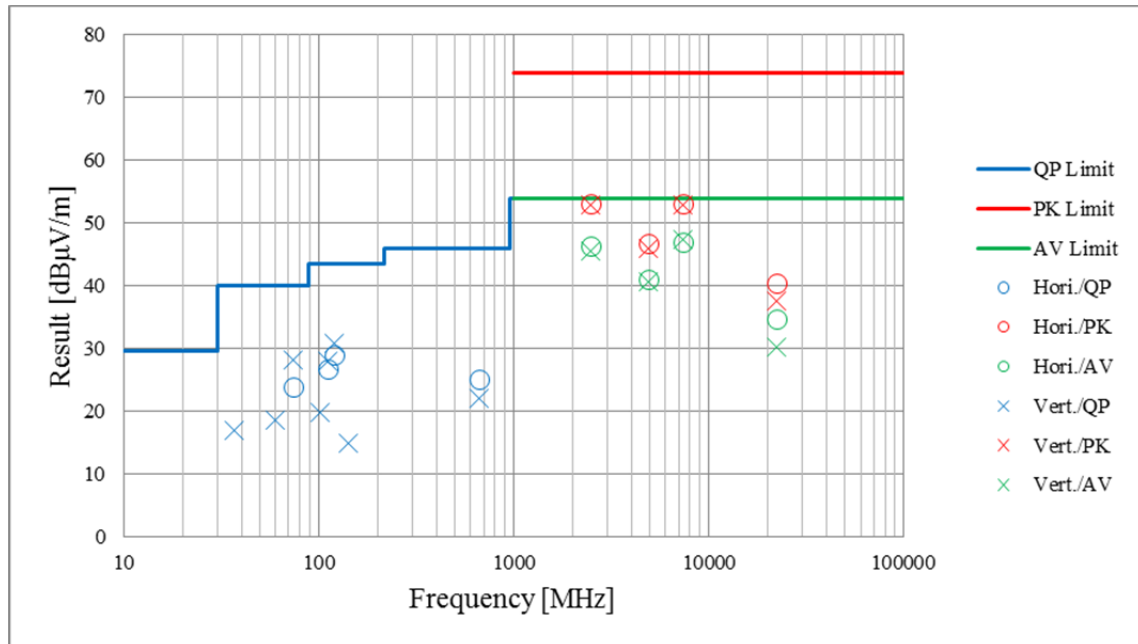
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11217682S-C-R2
Date	May 3, 2016
Temperature / Humidity	23 deg. C / 49 % RH
Engineer	Shinichi Takano
Mode	Tx 11n-20 2462 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

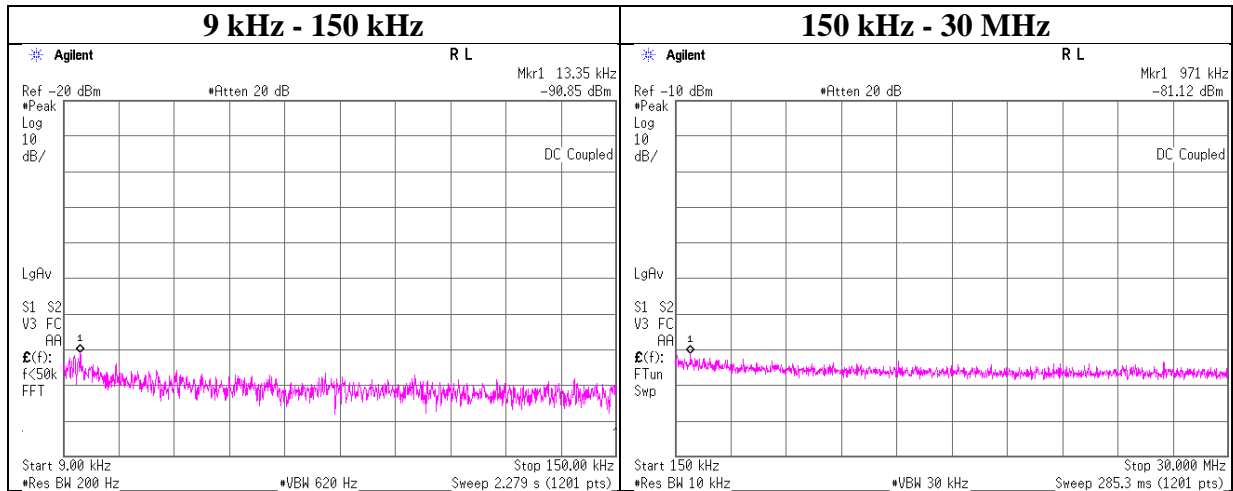
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11217682S-C-R2		
Date	May 3, 2016	May 4, 2016	May 5, 2016
Temperature / Humidity	23 deg. C / 49 % RH	24 deg. C / 57 % RH	23 deg. C / 45 % RH
Engineer	Shinichi Takano (1-13 GHz)	Takahiro Suzuki (13-26.5 GHz)	Takahiro Suzuki (30-1000 MHz)
Mode	Tx 11g 2462 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. : 11217682S-C-R2
 Date : May 12, 2016
 Temperature / Humidity : 25 deg. C / 44 % RH
 Engineer : Shinichi Takano
 Mode : Tx 11g 2462 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.35	-90.9	0.01	9.8	2.3	1	-78.7	300	6.0	-17.5	45.0	62.5	
971.00	-81.1	0.03	9.8	2.3	1	-69.0	30	6.0	12.3	27.8	15.5	

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

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

Power Density

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11217682S-C-R2
Date May 12, 2016
Temperature / Humidity 25 deg. C / 44 % RH
Engineer Shinichi Takano
Mode Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-19.02	1.97	9.92	-7.13	8.00	15.13
2437.00	-18.40	1.97	9.92	-6.51	8.00	14.51
2462.00	-17.50	1.98	9.92	-5.60	8.00	13.60

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-27.38	1.97	9.92	-15.49	8.00	23.49
2437.00	-27.50	1.97	9.92	-15.61	8.00	23.61
2462.00	-27.42	1.98	9.92	-15.52	8.00	23.52

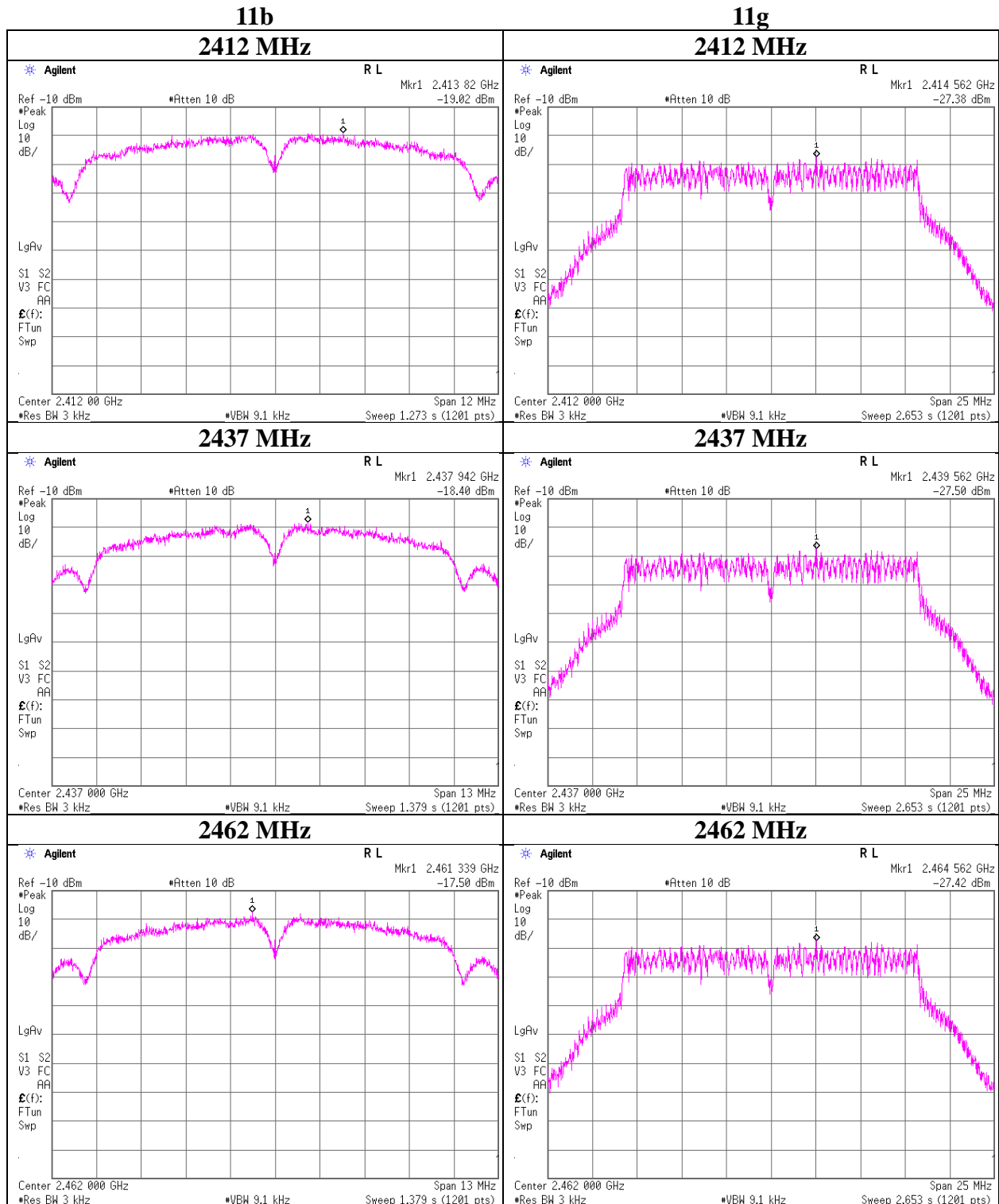
11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-27.71	1.97	9.92	-15.82	8.00	23.82
2437.00	-26.59	1.97	9.92	-14.70	8.00	22.70
2462.00	-26.91	1.98	9.92	-15.01	8.00	23.01

Sample Calculation:

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

Power Density



UL Japan, Inc.

Shonan EMC Lab.

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

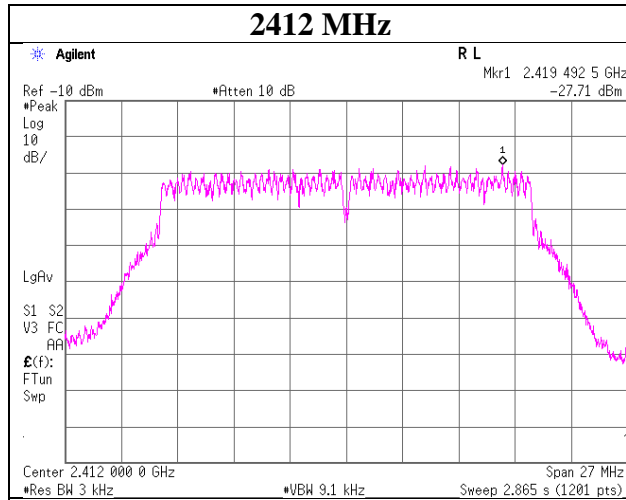
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

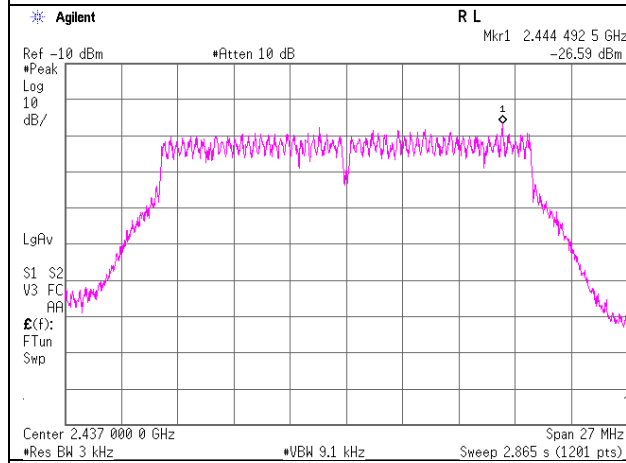
Power Density

11n-20

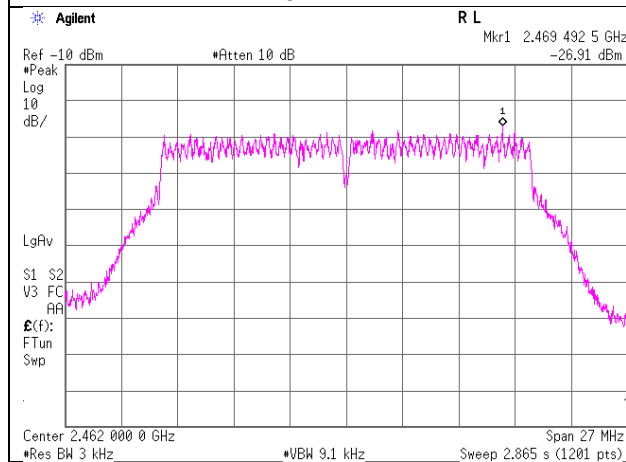
2412 MHz



2437 MHz



2462 MHz



UL Japan, Inc.

Shonan EMC Lab.

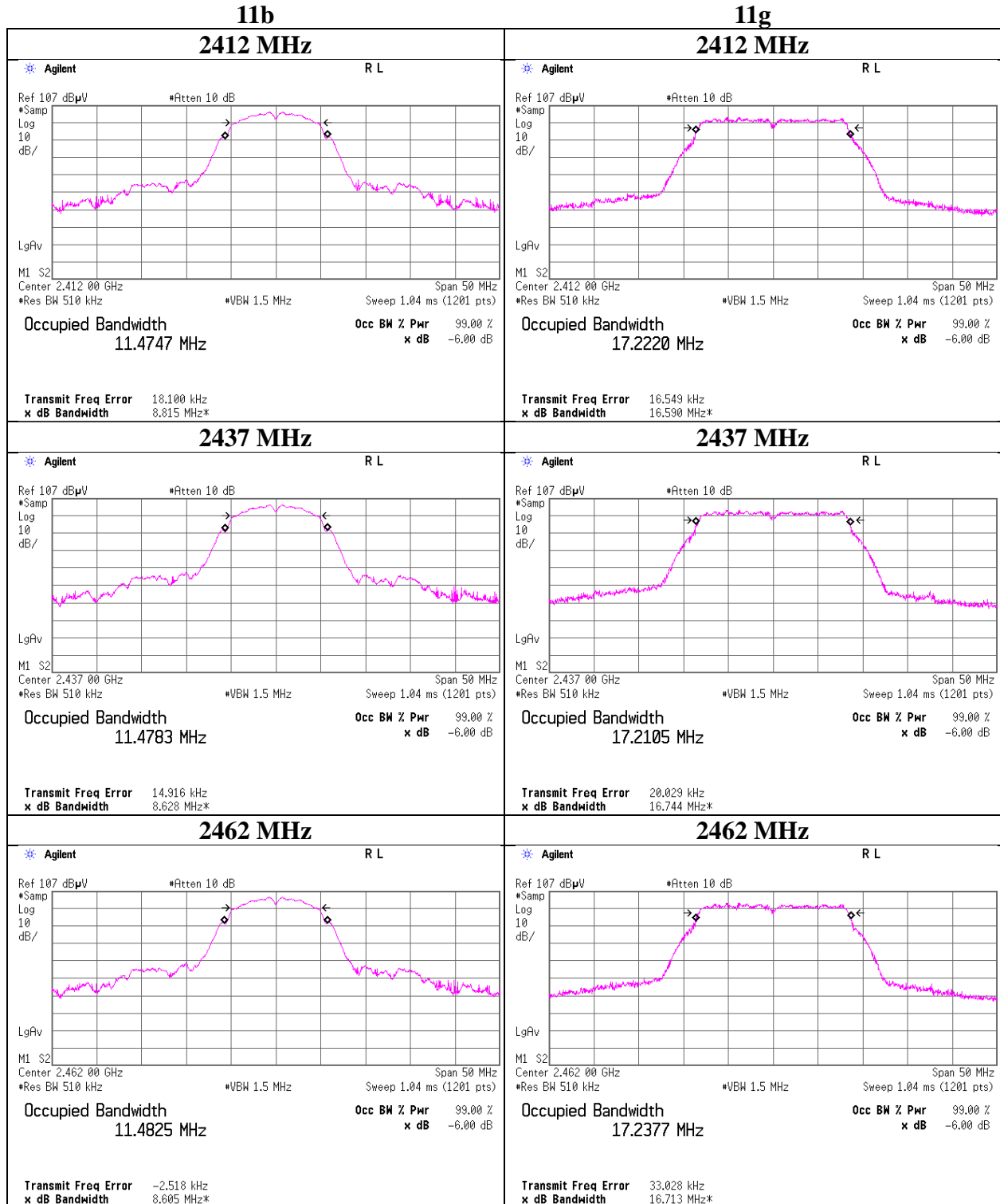
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

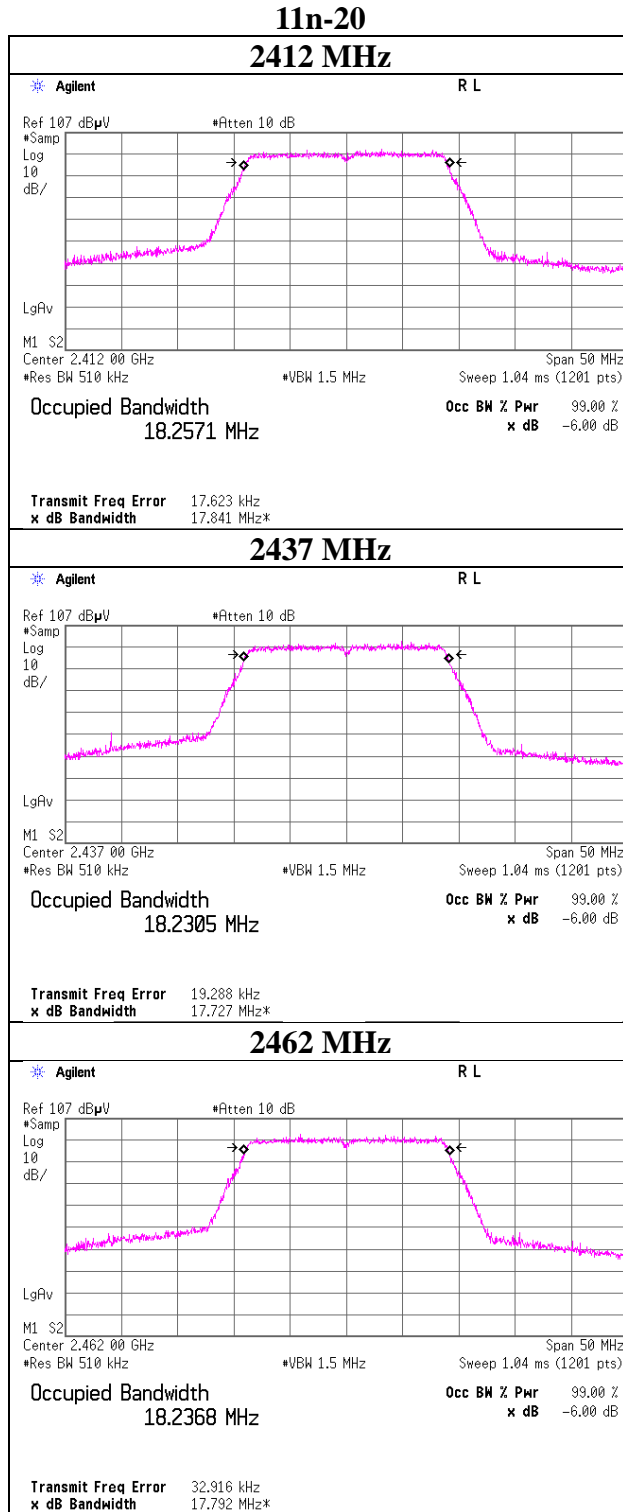
99%Occupied Bandwidth

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11217682S-C-R2
Date : May 12, 2016
Temperature / Humidity : 25 deg. C / 44 % RH
Engineer : Shinichi Takano
Mode : Tx



99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11217682S-C-R2
Date	May 12, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Shinichi Takano
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)
SRENT-05	Spectrum Analyzer	KEYSIGHT	E4440A	MY46187752	AT	2015/10/05 * 12
SCC-G32	Coaxial Cable	Junkosha	MWX241-0200 0KMSKMS	OCT-09-13-0 05	AT	2015/10/08 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2016/04/18 * 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
SOS-13	Humidity Indicator	Custom	CTH-202	Q.C.17	AT	2015/12/07 * 12
KTS-08	Digital Tester	SANWA	PC500	7019224	AT	2016/03/15 * 12
SRENT-04	Spectrum Analyzer	KEYSIGHT	E4440A	MY46186388	AT	2015/10/06 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2015/12/07 * 12
KTS-07	Digital Tester	SANWA	PC500	7019232	AT	2015/11/18 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2015/05/27 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-00	JUN-12-14-0 18	RE	2015/06/08 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2015/05/19 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2015/08/11 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2015/10/22 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2016/03/28 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SAEC-03(SVSW R)	Semi-Anechoic Chamber	TDK	SAEC-03(SVS WR)	3	RE	2015/08/28 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE ,CE,RFI,MF)	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2015/11/18 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2015/11/04 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2015/11/16 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2016/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2015/09/07 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-0100 0KMSKMS	-	RE	2016/04/18 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2016/03/08 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2015/07/16 * 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	2015/08/31 * 12
SCC-C1/C2/C3/C 4/C5/C10/SRSE- 03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner /Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA /141PE/141PE/ 141PE/141PE/ NS4906	-/0901-271(R F 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

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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