



RADIO TEST REPORT

Test Report No. : 12443391S-A-R1

Applicant : Panasonic Corporation
Type of Equipment : Car Audio System
Model No. : AT1804
FCC ID : ACJ932AT1804
Test regulation : FCC Part 15 Subpart C: 2018
* Wireless LAN part
Test Result : Complied

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8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 12443391S-A. 12443391S-A is replaced with this report.

Date of test: September 7 to 19, 2018

Representative test engineer: M. Hosaka
Makoto Hosaka
Engineer
Consumer Technology Division

Approved by: S. Takano
Shinichi Takano
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 : +81-50-3689-6982
Contact Person : Tomohiko Nakajo

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

2.1 Identification of E.U.T.

Type of Equipment : Car Audio System
Model No. : AT1804
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 13.2 V
Receipt Date of Sample : September 5, 2018
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: AT1804 (referred to as the EUT in this report) is a Car Audio System.

Radio Specification

[WLAN]

Radio Type : Transceiver
Frequency of Operation : 2412 MHz - 2462 MHz
Modulation : DSSS
Antenna type : Dipole antenna
Antenna gain with cable loss : 1.1 dBi
Clock frequency (Maxmum) : 48 MHz

[Bluetooth]

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : FHSS
Antenna type : Dipole antenna
Antenna gain with cable loss : 1.1 dBi
Clock frequency (Maxmum) : 48 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	N/A	N/A	*1)
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section 15.247(a)(2)	See data.	Complied	Conducted
	IC: -	IC: RSS-247 5.2(a)			
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section 15.247(b)(3)		Complied	Conducted
	IC: RSS-Gen 6.12	IC: RSS-247 5.4(d)			
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section 15.247(e)		Complied	Conducted
	IC: -	IC: RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section15.247(d)	7.7 dB 4924.000 MHz, AV, Vert. Tx 11b 2462 MHz	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)
	IC: RSS-Gen 6.13	IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

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

*1) 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 15.247 Meas Guidance v05 8.5 and 8.6.

Symbols:

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

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

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

FCC Part 15.31 (e)

The equipment provides the wireless transmitter with stable power supply.

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 antenna connector (HFCIII connector). Therefore the equipment complies with the requirement of 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 6.7	IC: -	N/A	Complied	Conducted

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

3.4 Uncertainty

EMI

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

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

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

3.5 Test Location

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Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
JAB Accreditation No. RTL02610
FCC Test Firm Registration Number: 839876

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

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

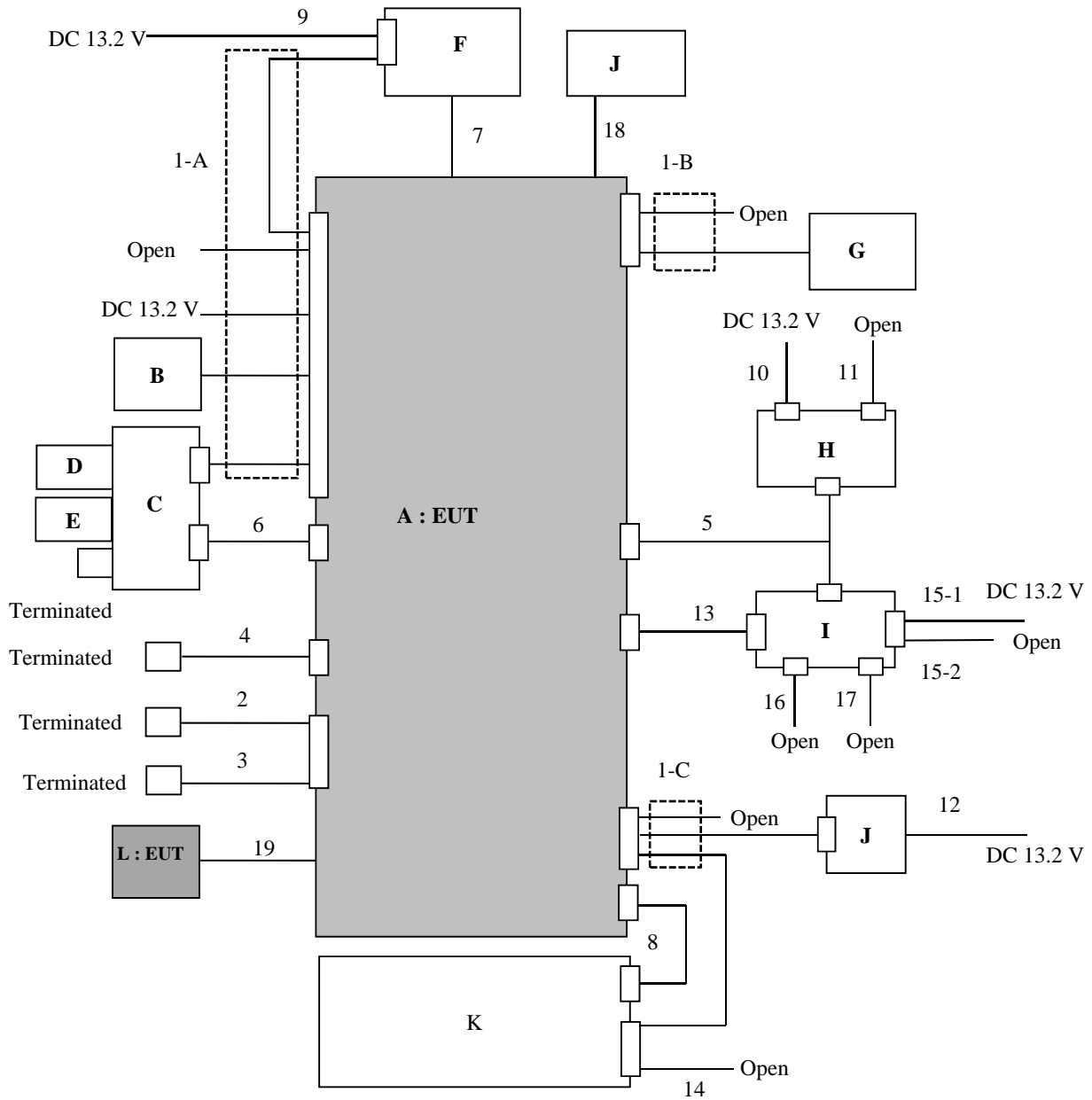
Mode	Remarks*
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 4 (Short GI), PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: Fixed Software: D17517010700001V0 Ver.1.0 *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(Radiated above1 GHz)	11b Tx	2412 MHz 2437 MHz 2462 MHz
	11g Tx 11n-20 Tx	2412 MHz 2417 MHz *1) 2437 MHz 2457 MHz *1) 2462 MHz
Spurious Emission (Radiated below 1 GHz) Spurious Emission (Conducted below 30 MHz)	11g Tx	2437 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz

*1) Band-edge only

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	AT1804	500043	Panasonic Corporation	EUT
B	Steering SW	-	0022	-	-
C	IF-Box	CA-UL56X0AJ	3	Panasonic	-
D	USB Memory	SDK-USM4GL(B)	-	SONY	-
E	USB Memory	SDK-USM4GL(B)	-	SONY	-
F	Display	17EMVD	54	DENSO	-
G	Microphone	86730-20050	-	-	-
H	AMP	86280-76050	521343	Panasonic	-
I	RSE-ECU	CV-UL45H0AJ	-	Panasonic	-
J	DCM	86741-53054	8KYLK327398	DENSO	-
K	MEU	CN-SLM8N0AJ	500003	Panasonic	-
L	Antenna	CA-AT29X04J	500063	Panasonic	EUT

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
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 antenna	0.15 + 2.0	Shielded	Shielded	-
3	Radio/D-Radio antenna	0.15 + 1.1	Shielded	Shielded	-
4	XM antenna	1.0	Shielded	Shielded	-
5	AVC-LAN Step3	2.0	Unshielded	Unshielded	-
6	USB (IF-BOX)	1.0	Shielded	Shielded	-
7	GVIF	1.0	Shielded	Shielded	-
8	GVIF, USB from MEU	2.0	Shielded	Shielded	-
9	DC Power / Signal	1.0	Unshielded	Unshielded	-
10	DC Power	1.0 + 1.5	Unshielded	Unshielded	-
11	Signal	1.0	Unshielded	Unshielded	-
12	DC Power / Signal	1.0	Unshielded	Unshielded	-
13	GVIF	2.0	Unshielded	Unshielded	-
14	Signal	2.0	Unshielded	Unshielded	-
15-1	DC Power	2.0	Unshielded	Unshielded	-
15-2	Signal	2.0	Unshielded	Unshielded	-
16	Signal	2.0	Unshielded	Unshielded	-
17	Signal	2.0	Unshielded	Unshielded	-
18	Signal	2.0	Unshielded	Unshielded	-
19	Antenna	0.2	Shielded	Shielded	-

* Test data was taken under worse case conditions.

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SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05".

[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 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

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

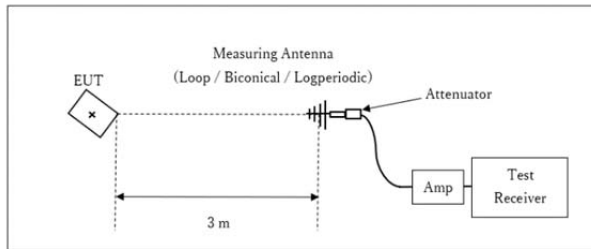
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

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

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

Radiated emission

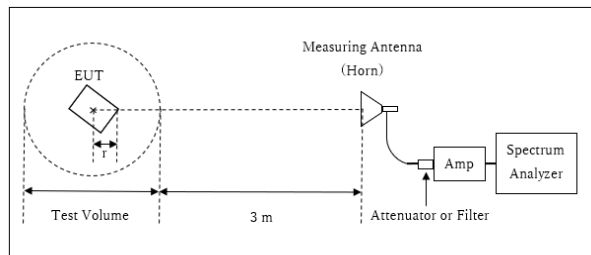
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

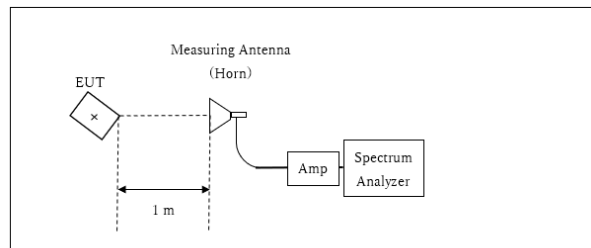


r : Radius of an outer periphery of EUT
 × : Center of turn table

Distance Factor: $20 \times \log(3.82 \text{ m}^*/3.0 \text{ m}) = 2.10 \text{ dB}$
 * Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.82 \text{ m}$

Test Volume: 2 m
 (Test Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.18 \text{ m}$

13 GHz - 26.5 GHz



× : Center of turn table

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

-The carrier level and noise levels were confirmed at each position of X, Y and Z axes of Antenna to see the position of maximum noise, and the test was made at the position 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 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	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: 50 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				

*1) Peak hold was applied as Worst-case measurement.

*2) Reference data

*3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".

*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

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

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

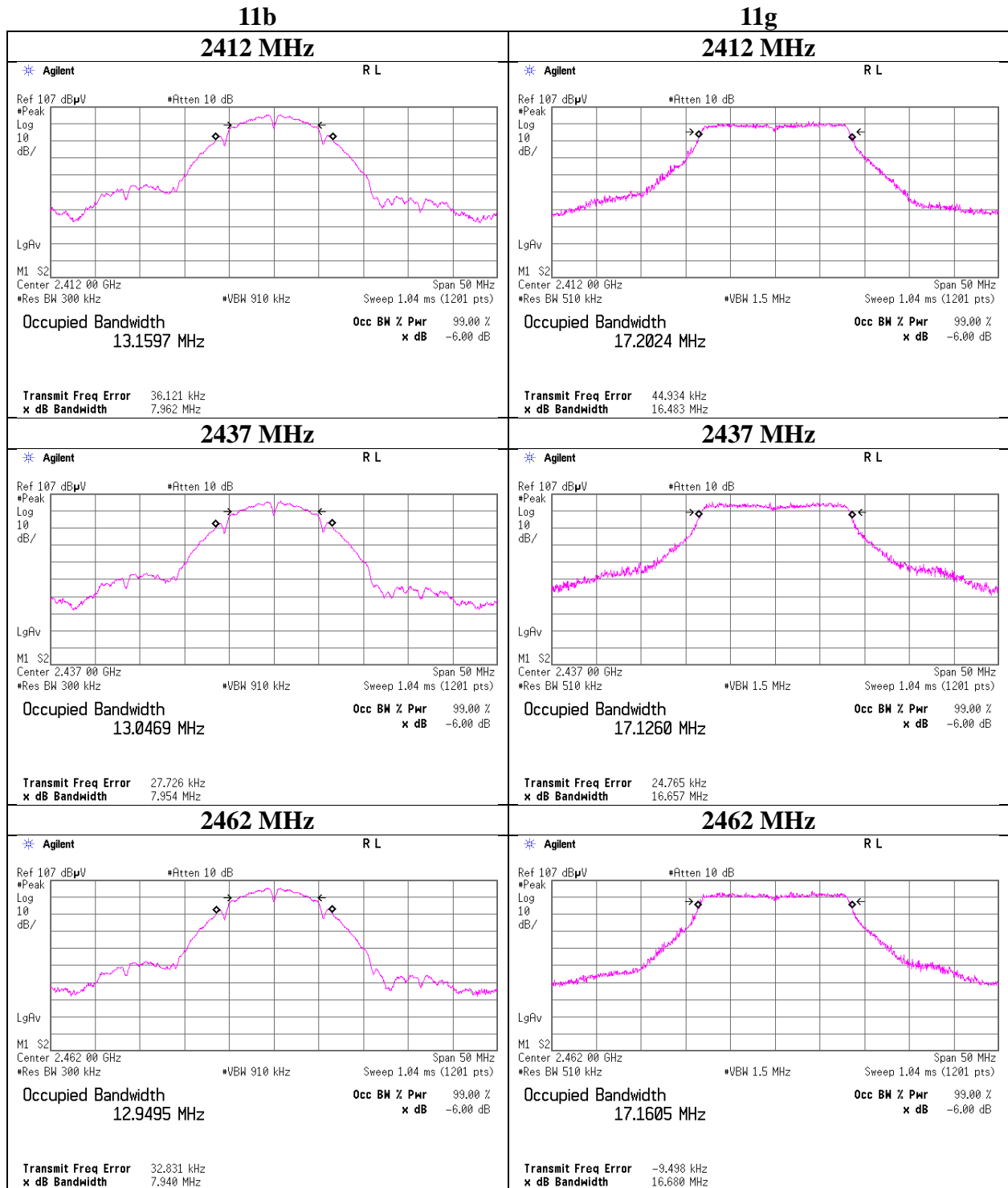
APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 19, 2018
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yosuke Ishikawa
Mode Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	13159.7	7.740	> 0.5000
	2437	13046.9	7.507	> 0.5000
	2462	12949.5	7.826	> 0.5000
11g	2412	17202.4	16.551	> 0.5000
	2437	17126.0	16.523	> 0.5000
	2462	17160.5	16.545	> 0.5000
11n-20	2412	18209.3	17.728	> 0.5000
	2437	18232.9	17.750	> 0.5000
	2462	18226.2	17.729	> 0.5000

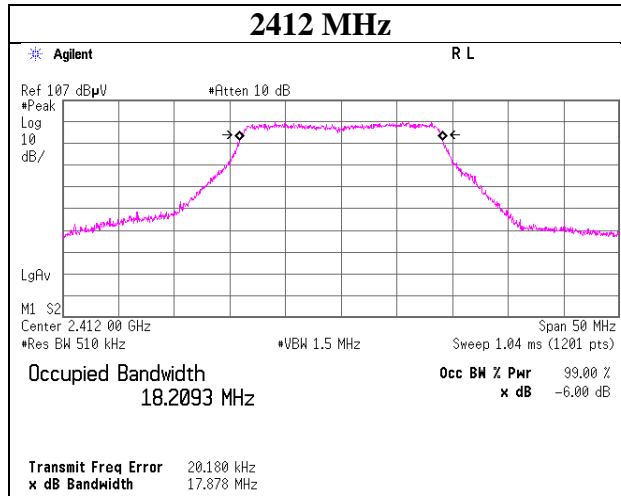
99% Occupied Bandwidth



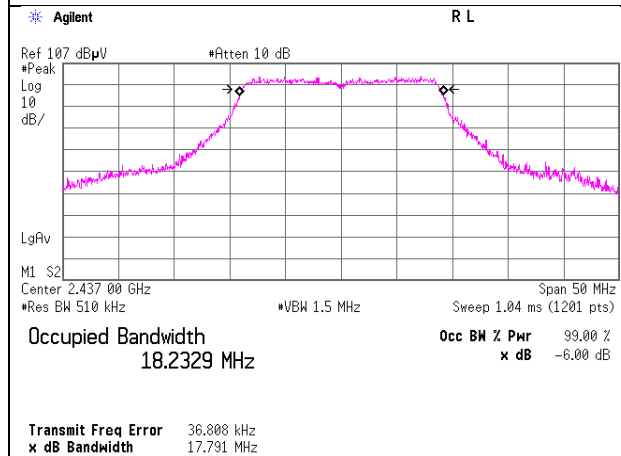
99% Occupied Bandwidth

11n-20

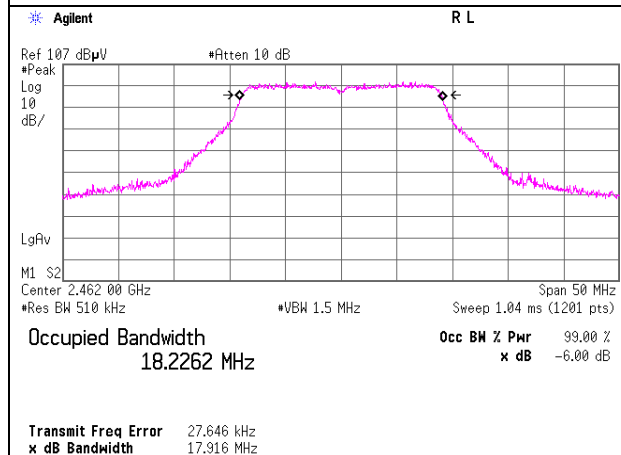
2412 MHz



2437 MHz



2462 MHz



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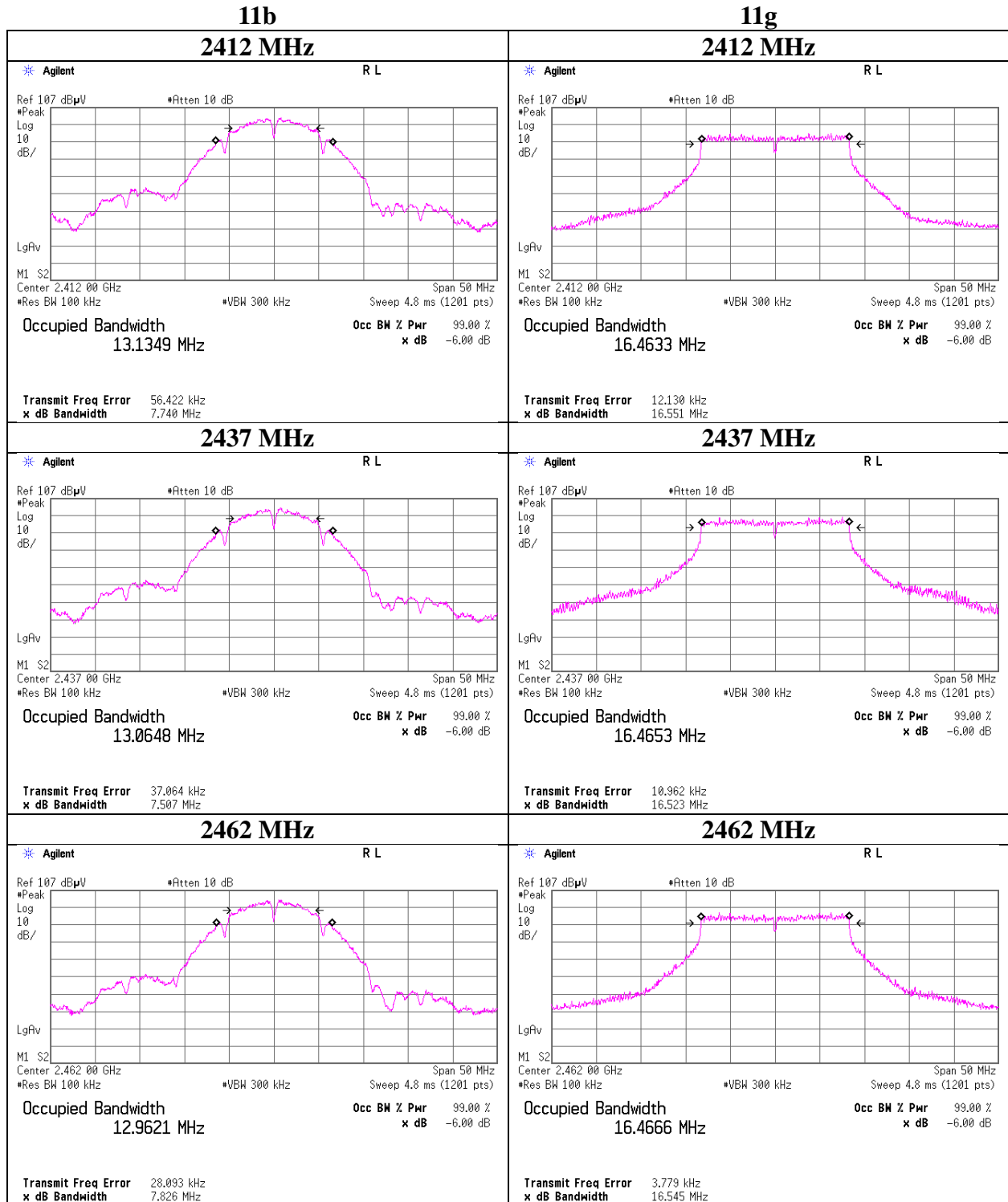
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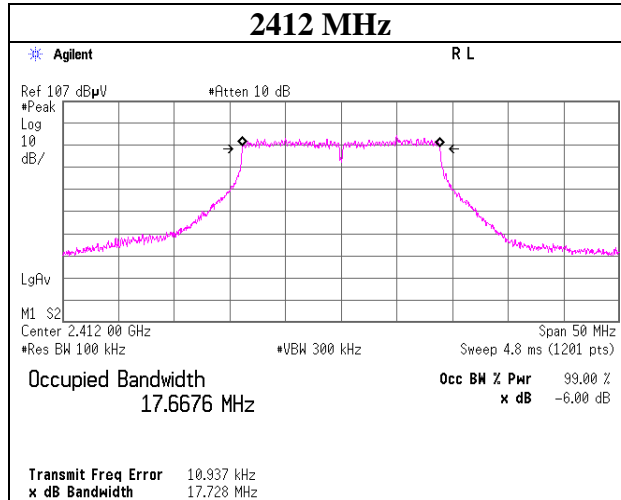
6dB Bandwidth



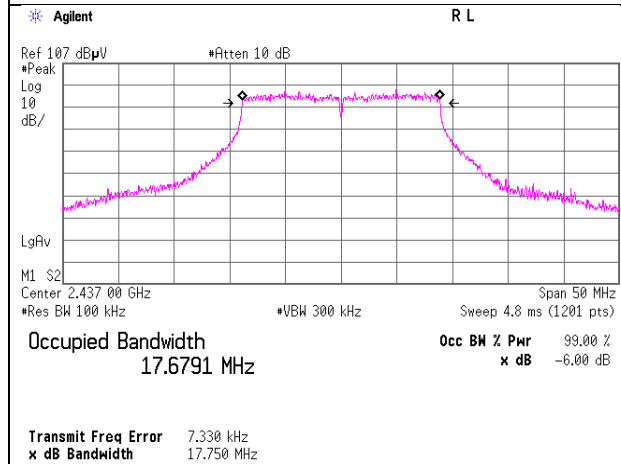
6dB Bandwidth

11n-20

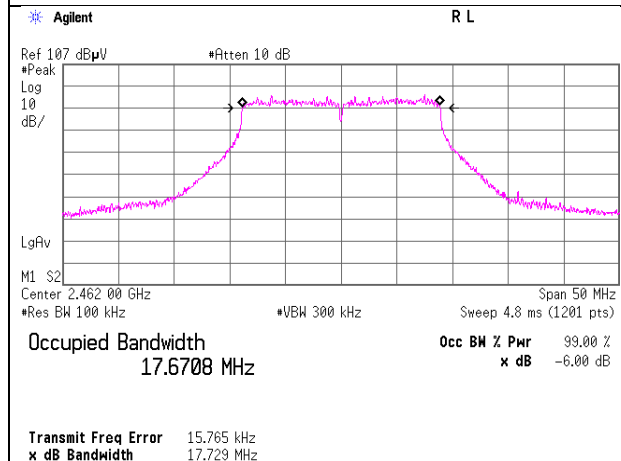
2412 MHz



2437 MHz



2462 MHz



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Maximum Peak Output Power

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 19, 2018
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yosuke Ishikawa
Mode Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	4.63	1.96	10.18	16.77	47.53	30.00	1000	13.23	1.10	17.87	61.24	36.02	4000	18.15
2437	4.87	1.96	10.18	17.01	50.23	30.00	1000	12.99	1.10	18.11	64.71	36.02	4000	17.91
2462	4.81	1.97	10.18	16.96	49.66	30.00	1000	13.04	1.10	18.06	63.97	36.02	4000	17.96

Sample Calculation:

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

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	4.55	
2	4.87	*
5.5	4.80	
11	4.85	

*: Worst Rate

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

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Maximum Peak Output Power

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 19, 2018
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yosuke Ishikawa
Mode Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	7.35	1.96	10.18	19.49	88.92	30.00	1000	10.51	1.10	20.59	114.55	36.02	4000	15.43
2437	10.14	1.96	10.18	22.28	169.04	30.00	1000	7.72	1.10	23.38	217.77	36.02	4000	12.64
2462	8.93	1.97	10.18	21.08	128.23	30.00	1000	8.92	1.10	22.18	165.20	36.02	4000	13.84

Sample Calculation:

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

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

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	6.26	
9	6.32	
12	6.46	
18	6.38	
24	10.02	
36	9.81	
48	10.14	*
54	9.84	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 19, 2018
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yosuke Ishikawa
Mode Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	7.01	1.96	10.18	19.15	82.22	30.00	1000	10.85	1.10	20.25	105.93	36.02	4000	15.77
2437	9.71	1.96	10.18	21.85	153.11	30.00	1000	8.15	1.10	22.95	197.24	36.02	4000	13.07
2462	8.33	1.97	10.18	20.48	111.69	30.00	1000	9.52	1.10	21.58	143.88	36.02	4000	14.44

Sample Calculation:

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

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

2437 MHz, Short GI

MCS Number	Reading [dBm]	Remark
0	5.13	
1	5.40	
2	5.28	
3	9.26	
4	9.71	*
5	9.08	
6	9.37	
7	9.26	

2437 MHz, Long GI

MCS Number	Reading [dBm]	Remark
0	5.31	
1	5.37	
2	5.49	
3	9.04	
4	9.68	*
5	9.12	
6	9.08	
7	9.30	

* Worst MCS

MCS Number	Reading [dBm]	GI	Remark
4	9.71	Short	*
4	9.68	Long	

* Worst Condition

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

Average Output Power
(Reference data for RF Exposure)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 19, 2018
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yosuke Ishikawa
Mode Tx

11b 11 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	2.30	1.96	10.18	14.44	27.80	0.01	14.45	27.86
2437	2.39	1.96	10.18	14.53	28.38	0.01	14.54	28.44
2462	2.15	1.97	10.18	14.30	26.92	0.01	14.31	26.98

11g 24 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-4.09	1.96	10.18	8.05	6.38	0.07	8.12	6.49
2437	-0.03	1.96	10.18	12.11	16.26	0.07	12.18	16.52
2462	-2.09	1.97	10.18	10.06	10.14	0.07	10.13	10.30

11n-20 MCS 4, Short GI

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-4.29	1.96	10.18	7.85	6.10	0.11	7.96	6.25
2437	-1.15	1.96	10.18	10.99	12.56	0.11	11.10	12.88
2462	-3.20	1.97	10.18	8.95	7.85	0.11	9.06	8.05

Sample Calculation:

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

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

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

Average Output Power
(Reference data for RF Exposure)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 19, 2018
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yosuke Ishikawa
Mode Tx

2437 MHz

Mode	Rate Mbps	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11b	1	1.92	0.00	1.92	
	2	2.25	0.00	2.25	
	5.5	2.39	0.01	2.40	*
	11	2.29	0.03	2.32	
11g	6	-0.42	0.02	-0.40	
	9	-0.45	0.03	-0.42	
	12	-0.45	0.04	-0.41	
	18	-0.47	0.05	-0.42	
	24	-0.03	0.07	0.04	*
	36	-0.11	0.09	-0.02	
	48	-0.14	0.14	0.00	
	54	-0.16	0.16	0.00	

* 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.

2437 MHz

Mode	Rate MCS	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11n-20 Long_GI	0	-1.66	0.02	-1.64	
	1	-1.66	0.04	-1.62	
	2	-1.68	0.05	-1.63	
	3	-1.17	0.07	-1.10	
	4	-1.21	0.11	-1.10	
	5	-1.22	0.15	-1.07	
	6	-1.26	0.17	-1.09	
11n-20 Short_GI	0	-1.68	0.02	-1.66	
	1	-1.65	0.04	-1.61	
	2	-1.67	0.05	-1.62	
	3	-1.15	0.07	-1.08	
	4	-1.15	0.11	-1.04	*
	5	-1.23	0.15	-1.08	
	6	-1.24	0.17	-1.07	
7	-1.25	0.18	-1.07		

* 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.

UL Japan, Inc.

Shonan EMC Lab.

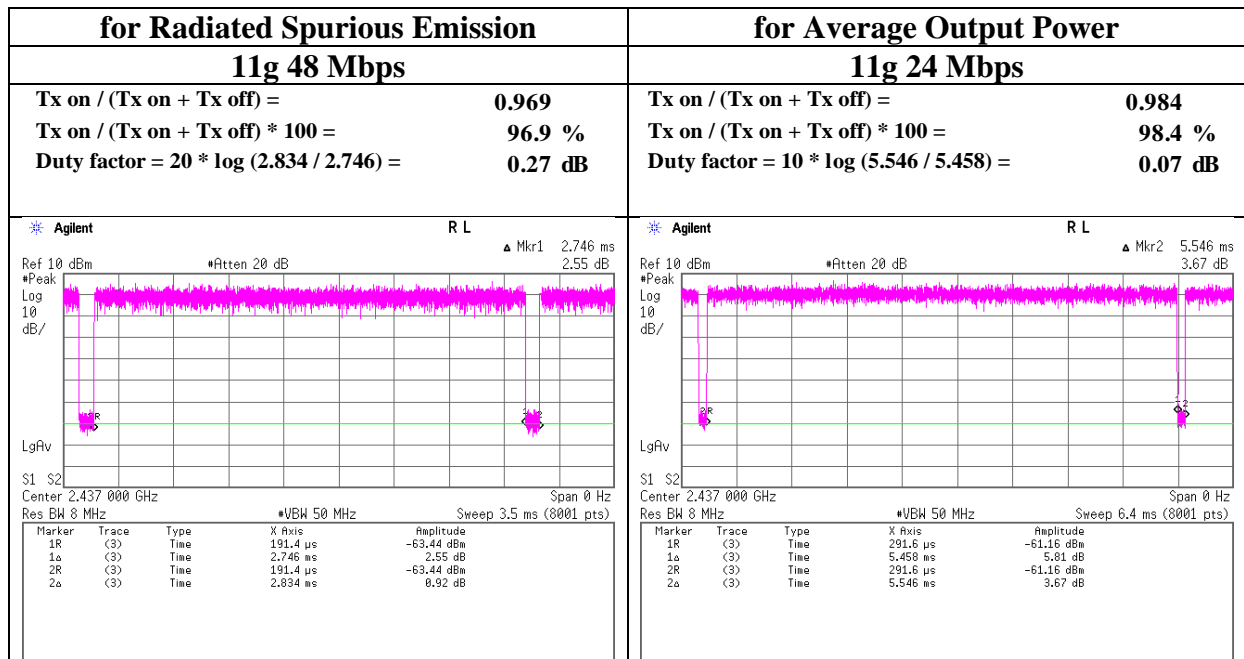
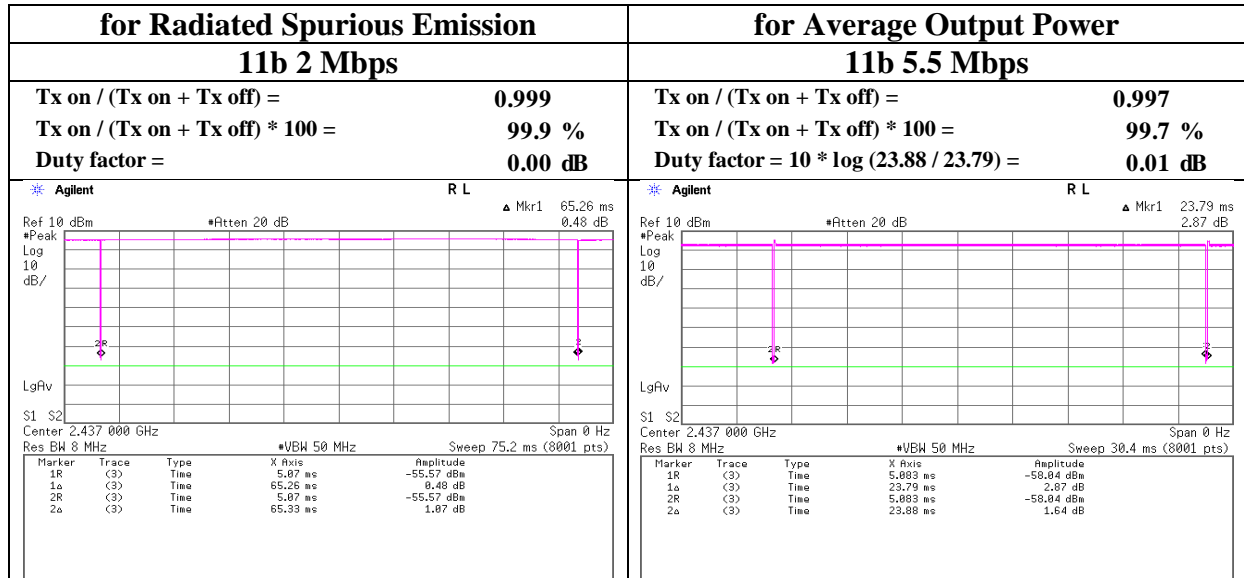
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

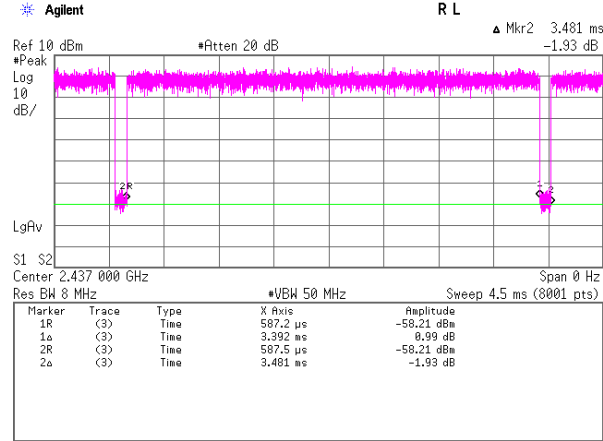
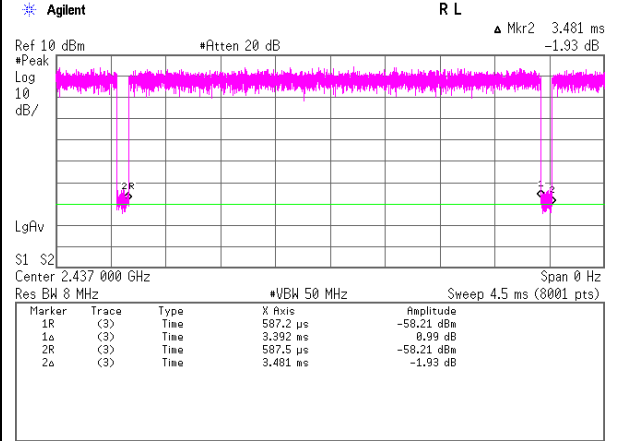
Facsimile : +81 463 50 6401

Duty factor Calculation chart

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 7, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Kazutaka Takeyama
Mode Tx



Duty factor Calculation chart

for Radiated Spurious Emission 11n-20 MCS 4, Short GI	for Average Output Power 11n-20 MCS 4, Short GI																																																		
$Tx\ on / (Tx\ on + Tx\ off) = 0.974$ $Tx\ on / (Tx\ on + Tx\ off) * 100 = 97.4\ \%$ $Duty\ factor = 20 * \log(3.481 / 3.392) = 0.22\ dB$	$Tx\ on / (Tx\ on + Tx\ off) = 0.974$ $Tx\ on / (Tx\ on + Tx\ off) * 100 = 97.4\ \%$ $Duty\ factor = 10 * \log(3.481 / 3.392) = 0.11\ dB$																																																		
 <table border="1"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1R</td> <td>(3)</td> <td>Time</td> <td>587.2 μs</td> <td>-58.21 dBm</td> </tr> <tr> <td>1Δ</td> <td>(3)</td> <td>Time</td> <td>3.392 ms</td> <td>0.99 dB</td> </tr> <tr> <td>2R</td> <td>(3)</td> <td>Time</td> <td>587.5 μs</td> <td>-58.21 dBm</td> </tr> <tr> <td>2Δ</td> <td>(3)</td> <td>Time</td> <td>3.481 ms</td> <td>-1.93 dB</td> </tr> </tbody> </table>	Marker	Trace	Type	X Axis	Amplitude	1R	(3)	Time	587.2 μs	-58.21 dBm	1Δ	(3)	Time	3.392 ms	0.99 dB	2R	(3)	Time	587.5 μs	-58.21 dBm	2Δ	(3)	Time	3.481 ms	-1.93 dB	 <table border="1"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1R</td> <td>(3)</td> <td>Time</td> <td>587.2 μs</td> <td>-58.21 dBm</td> </tr> <tr> <td>1Δ</td> <td>(3)</td> <td>Time</td> <td>3.392 ms</td> <td>0.99 dB</td> </tr> <tr> <td>2R</td> <td>(3)</td> <td>Time</td> <td>587.5 μs</td> <td>-58.21 dBm</td> </tr> <tr> <td>2Δ</td> <td>(3)</td> <td>Time</td> <td>3.481 ms</td> <td>-1.93 dB</td> </tr> </tbody> </table>	Marker	Trace	Type	X Axis	Amplitude	1R	(3)	Time	587.2 μs	-58.21 dBm	1Δ	(3)	Time	3.392 ms	0.99 dB	2R	(3)	Time	587.5 μs	-58.21 dBm	2Δ	(3)	Time	3.481 ms	-1.93 dB
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* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018 September 11, 2018
Temperature / Humidity 22 deg. C / 69 % RH 25 deg. C / 52 % RH
Engineer Kazuya Noda Kazuya Noda
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11b 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.230	PK	50.53	24.99	13.49	43.91	2.10	47.20	73.90	26.7	161	80	
Hori.	2387.175	PK	53.89	27.85	14.13	44.13	2.10	53.84	73.90	20.0	144	98	
Hori.	2390.000	PK	51.92	27.86	14.13	44.13	2.10	51.88	73.90	22.0	144	98	
Hori.	3330.575	PK	54.93	28.13	5.93	44.44	2.10	46.65	73.90	27.2	351	171	
Hori.	3531.585	PK	54.62	28.92	6.03	44.58	2.10	47.09	73.90	26.8	152	256	
Hori.	4440.788	PK	53.61	30.38	6.32	44.32	2.10	48.09	73.90	25.8	148	188	
Hori.	4824.000	PK	54.63	31.46	6.53	44.46	2.10	50.26	73.90	23.6	191	121	
Hori.	7236.000	PK	47.95	36.85	8.26	44.00	2.10	51.16	73.90	22.7	100	0	
Hori.	1745.230	AV	42.09	24.99	13.49	43.91	2.10	38.76	53.90	15.1	161	80	
Hori.	2387.175	AV	45.79	27.85	14.13	44.13	2.10	45.74	53.90	8.1	144	98	
Hori.	2390.000	AV	42.47	27.86	14.13	44.13	2.10	42.43	53.90	11.4	144	98	
Hori.	3330.575	AV	49.56	28.13	5.93	44.44	2.10	41.28	53.90	12.6	351	171	
Hori.	3531.585	AV	49.92	28.92	6.03	44.58	2.10	42.39	53.90	11.5	152	256	
Hori.	4440.788	AV	46.33	30.38	6.32	44.32	2.10	40.81	53.90	13.0	148	188	
Hori.	4824.000	AV	48.23	31.46	6.53	44.46	2.10	43.86	53.90	10.0	191	121	
Hori.	7236.000	AV	37.97	36.85	8.26	44.00	2.10	41.18	53.90	12.7	100	0	
Vert.	2096.672	PK	50.78	26.93	13.87	44.06	2.10	49.62	73.90	24.2	206	314	
Vert.	2387.178	PK	52.11	27.85	14.13	44.13	2.10	52.06	73.90	21.8	148	49	
Vert.	2390.000	PK	51.04	27.86	14.13	44.13	2.10	51.00	73.90	22.9	148	49	
Vert.	3330.511	PK	55.51	28.13	5.93	44.44	2.10	47.23	73.90	26.6	351	147	
Vert.	3531.585	PK	54.87	28.92	6.03	44.58	2.10	47.34	73.90	26.5	100	19	
Vert.	4440.741	PK	53.93	30.38	6.32	44.32	2.10	48.41	73.90	25.4	141	213	
Vert.	4824.000	PK	54.20	31.46	6.53	44.46	2.10	49.83	73.90	24.0	195	356	
Vert.	7236.000	PK	48.47	36.85	8.26	44.00	2.10	51.68	73.90	22.2	100	0	
Vert.	2096.672	AV	42.54	26.93	13.87	44.06	2.10	41.38	53.90	12.5	206	314	
Vert.	2387.178	AV	44.92	27.85	14.13	44.13	2.10	44.87	53.90	9.0	148	49	
Vert.	2390.000	AV	42.34	27.86	14.13	44.13	2.10	42.30	53.90	11.6	148	49	
Vert.	3330.511	AV	49.11	28.13	5.93	44.44	2.10	40.83	53.90	13.0	351	147	
Vert.	3531.585	AV	50.58	28.92	6.03	44.58	2.10	43.05	53.90	10.8	100	19	
Vert.	4440.741	AV	47.39	30.38	6.32	44.32	2.10	41.87	53.90	12.0	141	213	
Vert.	4824.000	AV	48.32	31.46	6.53	44.46	2.10	43.95	53.90	9.9	195	356	
Vert.	7236.000	AV	38.68	36.85	8.26	44.00	2.10	41.89	53.90	12.0	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 (3.82 m / 3.0 m) = 2.10 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	102.75	27.85	14.15	44.14	2.10	102.71	-	-	Carrier
Hori.	2397.618	PK	60.40	27.86	14.14	44.14	2.10	60.36	82.71	22.4	
Hori.	2400.000	PK	56.26	27.86	14.14	44.14	2.10	56.22	82.71	26.5	
Hori.	9648.000	PK	40.53	38.64	9.21	43.83	2.10	46.65	82.71	36.1	
Vert.	2412.000	PK	102.51	27.85	14.15	44.14	2.10	102.47	-	-	Carrier
Vert.	2397.577	PK	59.89	27.86	14.14	44.14	2.10	59.85	82.47	22.6	
Vert.	2400.000	PK	57.01	27.86	14.14	44.14	2.10	56.97	82.47	25.5	
Vert.	9648.000	PK	43.61	38.64	9.21	43.83	2.10	49.73	82.47	32.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

UL Japan, Inc.

Shonan EMC Lab.

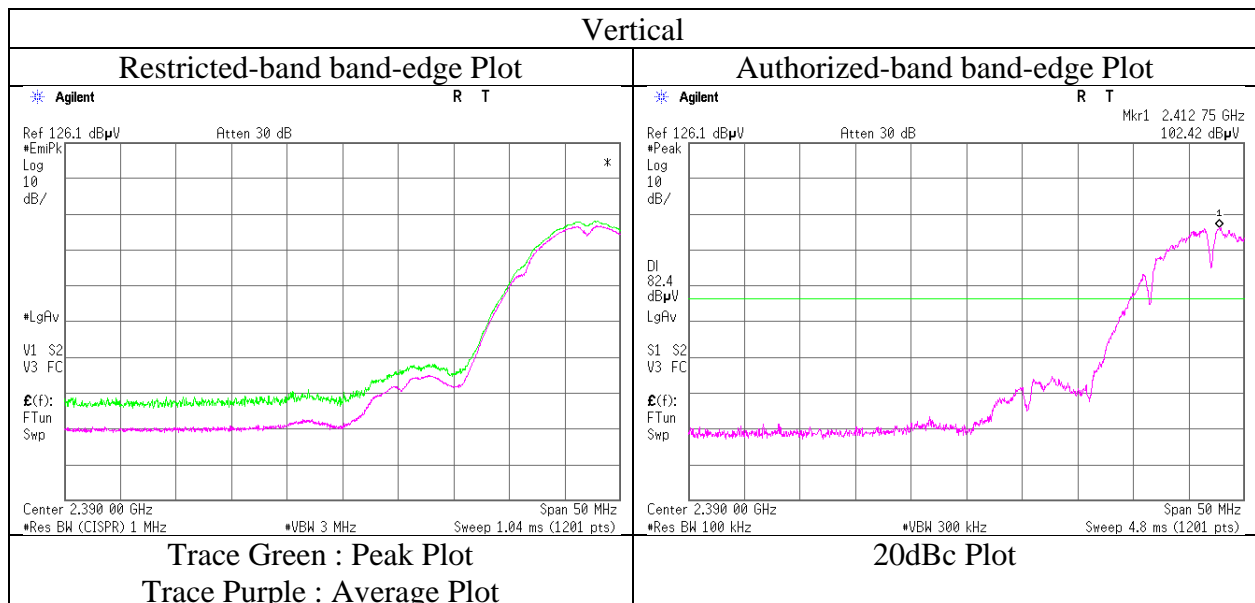
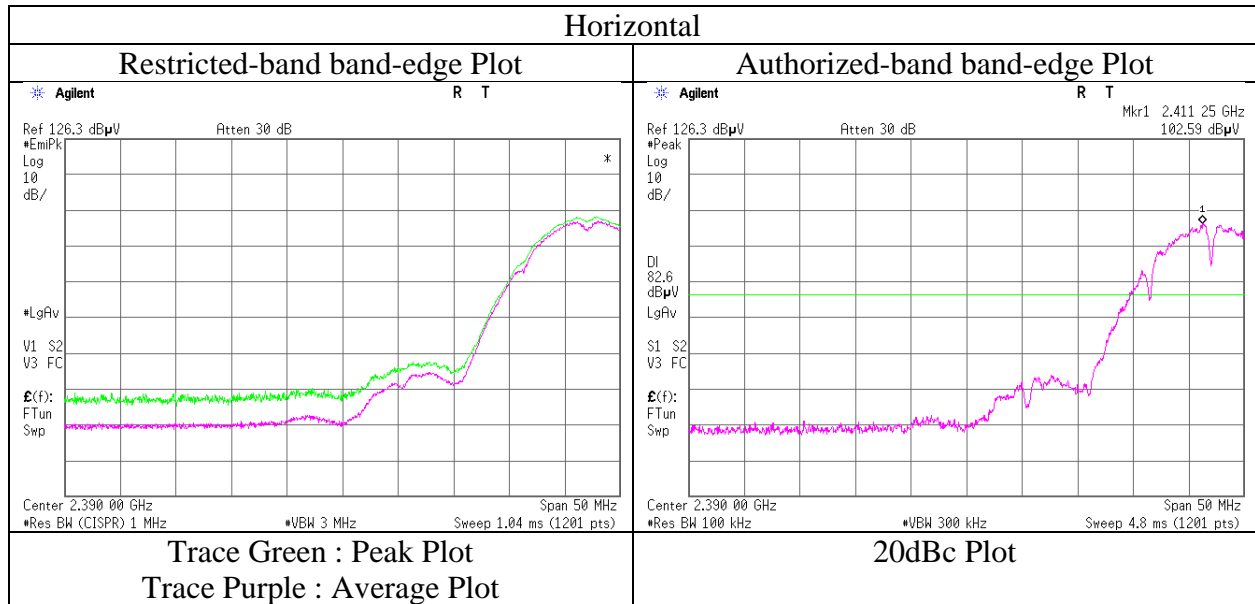
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018
Temperature / Humidity 22 deg. C / 69 % RH
Engineer Kazuya Noda
(1 GHz - 13 GHz)
Mode Tx 11b 2412 MHz



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

Radiated Spurious Emission

Report No.	12443391S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3	3
Date	September 10, 2018	September 11, 2018
Temperature / Humidity	22 deg. C / 69 % RH	25 deg. C / 52 % RH
Engineer	Kazuya Noda	Kazuya Noda
	(1 GHz - 13 GHz)	(13 GHz - 26.5 GHz)
Mode	Tx 11b 2437 MHz	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.231	PK	50.16	24.99	13.49	43.91	2.10	46.83	73.90	27.0	161	82	
Hori.	3330.627	PK	54.91	28.13	5.93	44.44	2.10	46.63	73.90	27.2	351	170	
Hori.	3531.389	PK	54.72	28.92	6.03	44.58	2.10	47.19	73.90	26.7	152	253	
Hori.	4440.747	PK	53.71	30.38	6.32	44.32	2.10	48.19	73.90	25.7	148	189	
Hori.	4874.000	PK	53.58	31.40	6.55	44.47	2.10	49.16	73.90	24.7	188	118	
Hori.	7311.000	PK	46.96	36.99	8.31	44.03	2.10	50.33	73.90	23.5	100	0	
Hori.	1745.231	AV	42.02	24.99	13.49	43.91	2.10	38.69	53.90	15.2	161	82	
Hori.	3330.627	AV	49.55	28.13	5.93	44.44	2.10	41.27	53.90	12.6	351	170	
Hori.	3531.389	AV	50.02	28.92	6.03	44.58	2.10	42.49	53.90	11.4	152	253	
Hori.	4440.747	AV	46.13	30.38	6.32	44.32	2.10	40.61	53.90	13.2	148	189	
Hori.	4874.000	AV	47.34	31.40	6.55	44.47	2.10	42.92	53.90	10.9	188	118	
Hori.	7311.000	AV	37.99	36.99	8.31	44.03	2.10	41.36	53.90	12.5	100	0	
Vert.	2096.678	PK	50.64	26.93	13.87	44.06	2.10	49.48	73.90	24.4	205	315	
Vert.	3330.621	PK	55.49	28.13	5.93	44.44	2.10	47.21	73.90	26.6	355	150	
Vert.	3531.597	PK	54.88	28.92	6.03	44.58	2.10	47.35	73.90	26.5	100	23	
Vert.	4440.846	PK	53.78	30.38	6.32	44.32	2.10	48.26	73.90	25.6	141	215	
Vert.	4874.000	PK	54.44	31.40	6.55	44.47	2.10	50.02	73.90	23.8	214	357	
Vert.	7311.000	PK	47.15	36.99	8.31	44.03	2.10	50.52	73.90	23.3	100	0	
Vert.	2096.678	AV	42.51	26.93	13.87	44.06	2.10	41.35	53.90	12.5	205	315	
Vert.	3330.621	AV	49.02	28.13	5.93	44.44	2.10	40.74	53.90	13.1	355	150	
Vert.	3531.597	AV	50.34	28.92	6.03	44.58	2.10	42.81	53.90	11.0	100	23	
Vert.	4440.846	AV	47.33	30.38	6.32	44.32	2.10	41.81	53.90	12.0	141	215	
Vert.	4874.000	AV	49.33	31.40	6.55	44.47	2.10	44.91	53.90	8.9	214	357	
Vert.	7311.000	AV	36.79	36.99	8.31	44.03	2.10	40.16	53.90	13.7	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 (3.82 m / 3.0 m) = 2.10 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.	2437.000	PK	101.00	27.82	14.16	44.14	2.10	100.94	-	-	Carrier
Hori.	9748.000	PK	41.63	38.92	9.21	43.84	2.10	48.02	80.94	32.9	
Vert.	2437.000	PK	101.61	27.82	14.16	44.14	2.10	101.55	-	-	Carrier
Vert.	9748.000	PK	42.46	38.92	9.21	43.84	2.10	48.85	81.55	32.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

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Radiated Spurious Emission

Report No.	12443391S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3	3
Date	September 10, 2018	September 11, 2018
Temperature / Humidity	22 deg. C / 69 % RH	25 deg. C / 52 % RH
Engineer	Kazuya Noda	Kazuya Noda
	(1 GHz - 13 GHz)	(13 GHz - 26.5 GHz)
Mode	Tx 11b 2462 MHz	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.231	PK	50.12	24.99	13.49	43.91	2.10	46.79	73.90	27.1	161	80	
Hori.	2483.500	PK	51.81	27.65	14.22	44.16	2.10	51.62	73.90	22.2	147	107	
Hori.	3330.635	PK	54.98	28.13	5.93	44.44	2.10	46.70	73.90	27.2	351	170	
Hori.	3531.707	PK	55.05	28.92	6.03	44.58	2.10	47.52	73.90	26.3	151	248	
Hori.	4440.722	PK	53.68	30.38	6.32	44.32	2.10	48.16	73.90	25.7	148	185	
Hori.	4924.000	PK	54.57	31.37	6.59	44.49	2.10	50.14	73.90	23.7	141	113	
Hori.	7386.000	PK	46.94	37.01	8.36	44.06	2.10	50.35	73.90	23.5	100	0	
Hori.	1745.231	AV	41.98	24.99	13.49	43.91	2.10	38.65	53.90	15.2	161	80	
Hori.	2483.500	AV	42.70	27.65	14.22	44.16	2.10	42.51	53.90	11.4	147	107	
Hori.	3330.635	AV	49.51	28.13	5.93	44.44	2.10	41.23	53.90	12.6	351	170	
Hori.	3531.707	AV	50.07	28.92	6.03	44.58	2.10	42.54	53.90	11.3	151	248	
Hori.	4440.722	AV	46.25	30.38	6.32	44.32	2.10	40.73	53.90	13.1	148	185	
Hori.	4924.000	AV	49.32	31.37	6.59	44.49	2.10	44.89	53.90	9.0	141	113	
Hori.	7386.000	AV	38.03	37.01	8.36	44.06	2.10	41.44	53.90	12.4	100	0	
Vert.	2096.698	PK	50.71	26.93	13.87	44.06	2.10	49.55	73.90	24.3	206	310	
Vert.	2483.500	PK	52.80	27.65	14.22	44.16	2.10	52.61	73.90	21.2	136	54	
Vert.	3330.585	PK	55.35	28.13	5.93	44.44	2.10	47.07	73.90	26.8	355	151	
Vert.	3531.541	PK	54.75	28.92	6.03	44.58	2.10	47.22	73.90	26.6	100	15	
Vert.	4440.755	PK	53.85	30.38	6.32	44.32	2.10	48.33	73.90	25.5	141	221	
Vert.	4924.000	PK	56.02	31.37	6.59	44.49	2.10	51.59	73.90	22.3	233	355	
Vert.	7386.000	PK	47.84	37.01	8.36	44.06	2.10	51.25	73.90	22.6	100	0	
Vert.	2096.698	AV	42.55	26.93	13.87	44.06	2.10	41.39	53.90	12.5	206	310	
Vert.	2483.500	AV	43.81	27.65	14.22	44.16	2.10	43.62	53.90	10.2	136	54	
Vert.	3330.585	AV	48.95	28.13	5.93	44.44	2.10	40.67	53.90	13.2	355	151	
Vert.	3531.541	AV	50.42	28.92	6.03	44.58	2.10	42.89	53.90	11.0	100	15	
Vert.	4440.755	AV	47.18	30.38	6.32	44.32	2.10	41.66	53.90	12.2	141	221	
Vert.	4924.000	AV	50.60	31.37	6.59	44.49	2.10	46.17	53.90	7.7	233	355	
Vert.	7386.000	AV	37.14	37.01	8.36	44.06	2.10	40.55	53.90	13.3	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(3.82 m / 3.0 m) = 2.10 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.	2462.000	PK	101.38	27.75	14.20	44.15	2.10	101.28	-	-	Carrier
Hori.	9848.000	PK	37.04	39.12	9.21	43.86	2.10	43.61	81.28	37.7	
Vert.	2462.000	PK	101.57	27.75	14.20	44.15	2.10	101.47	-	-	Carrier
Vert.	9848.000	PK	40.77	39.12	9.21	43.86	2.10	47.34	81.47	34.1	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

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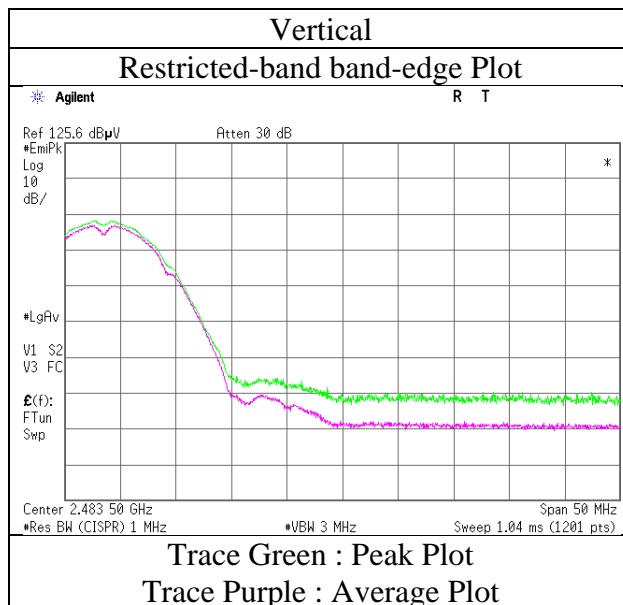
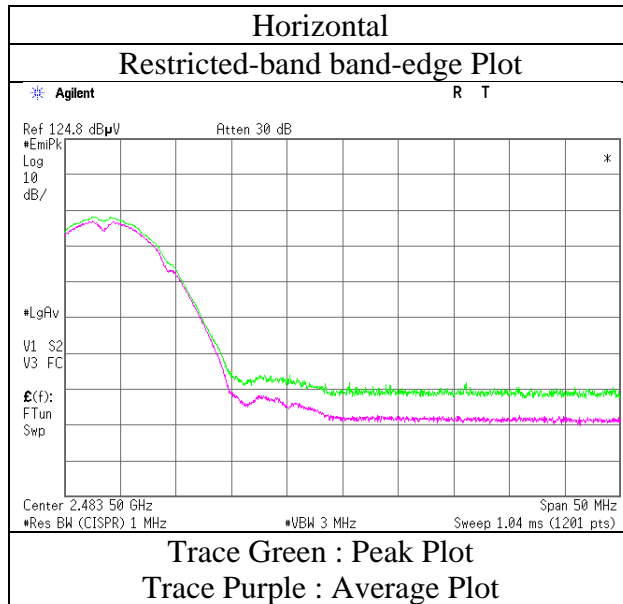
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12443391S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	September 10, 2018
Temperature / Humidity	22 deg. C / 69 % RH
Engineer	Kazuya Noda
	(1 GHz - 13 GHz)
Mode	Tx 11b 2462 MHz



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

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date September 10, 2018 September 11, 2018
Temperature / Humidity 22 deg. C / 69 % RH 25 deg. C / 52 % RH
Engineer Kazuya Noda Kazuya Noda
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11g 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.219	PK	50.05	24.99	13.49	43.91	2.10	46.72	73.90	27.1	161	86	
Hori.	2390.000	PK	55.03	27.86	14.13	44.13	2.10	54.99	73.90	18.9	144	97	
Hori.	3330.612	PK	55.02	28.13	5.93	44.44	2.10	46.74	73.90	27.1	358	172	
Hori.	3531.701	PK	55.19	28.92	6.03	44.58	2.10	47.66	73.90	26.2	151	261	
Hori.	4440.702	PK	53.77	30.38	6.32	44.32	2.10	48.25	73.90	25.6	142	179	
Hori.	4824.000	PK	49.16	31.46	6.53	44.46	2.10	44.79	73.90	29.1	195	124	
Hori.	7236.000	PK	48.51	36.85	8.26	44.00	2.10	51.72	73.90	22.1	100	0	
Hori.	1745.219	AV	42.14	24.99	13.49	43.91	2.10	38.81	53.90	15.0	161	86	
Hori.	3330.612	AV	49.57	28.13	5.93	44.44	2.10	41.29	53.90	12.6	358	172	
Hori.	3531.701	AV	50.11	28.92	6.03	44.58	2.10	42.58	53.90	11.3	151	261	
Hori.	4440.702	AV	46.41	30.38	6.32	44.32	2.10	40.89	53.90	13.0	142	179	
Vert.	2096.767	PK	50.89	26.94	13.87	44.06	2.10	49.74	73.90	24.1	209	312	
Vert.	2390.000	PK	55.04	27.86	14.13	44.13	2.10	55.00	73.90	18.9	151	48	
Vert.	3330.584	PK	55.51	28.13	5.93	44.44	2.10	47.23	73.90	26.6	355	151	
Vert.	3531.531	PK	54.56	28.92	6.03	44.58	2.10	47.03	73.90	26.8	102	21	
Vert.	4440.801	PK	53.59	30.38	6.32	44.32	2.10	48.07	73.90	25.8	141	213	
Vert.	4824.000	PK	49.11	31.46	6.53	44.46	2.10	44.74	73.90	29.1	191	353	
Vert.	7236.000	PK	48.25	36.85	8.26	44.00	2.10	51.46	73.90	22.4	100	0	
Vert.	2096.767	AV	42.58	26.94	13.87	44.06	2.10	41.43	53.90	12.4	209	312	
Vert.	3330.584	AV	49.05	28.13	5.93	44.44	2.10	40.77	53.90	13.1	355	151	
Vert.	3531.531	AV	50.28	28.92	6.03	44.58	2.10	42.75	53.90	11.1	102	21	
Vert.	4440.801	AV	47.16	30.38	6.32	44.32	2.10	41.64	53.90	12.2	141	213	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	43.49	27.86	14.13	44.13	0.27	2.10	43.72	53.90	10.2	*1)
Hori.	4824.000	AV	39.84	31.46	6.53	44.46	0.27	2.10	35.74	53.90	18.2	
Hori.	7236.000	AV	38.92	36.85	8.26	44.00	0.27	2.10	42.40	53.90	11.5	
Vert.	2390.000	AV	43.99	27.86	14.13	44.13	0.27	2.10	44.22	53.90	9.7	*1)
Vert.	4824.000	AV	39.94	31.46	6.53	44.46	0.27	2.10	35.84	53.90	18.1	
Vert.	7236.000	AV	39.19	36.85	8.26	44.00	0.27	2.10	42.67	53.90	11.2	

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(3.82 m / 3.0 m) = 2.10 dB

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	93.11	27.85	14.15	44.14	2.10	93.07	-	-	Carrier
Hori.	2400.000	PK	58.42	27.86	14.14	44.14	2.10	58.38	73.07	14.7	
Hori.	9648.000	PK	39.50	38.64	9.21	43.83	2.10	45.62	73.07	27.5	
Vert.	2412.000	PK	93.33	27.85	14.15	44.14	2.10	93.29	-	-	Carrier
Vert.	2400.000	PK	57.78	27.86	14.14	44.14	2.10	57.74	73.29	15.6	
Vert.	9648.000	PK	40.26	38.64	9.21	43.83	2.10	46.38	73.29	26.9	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

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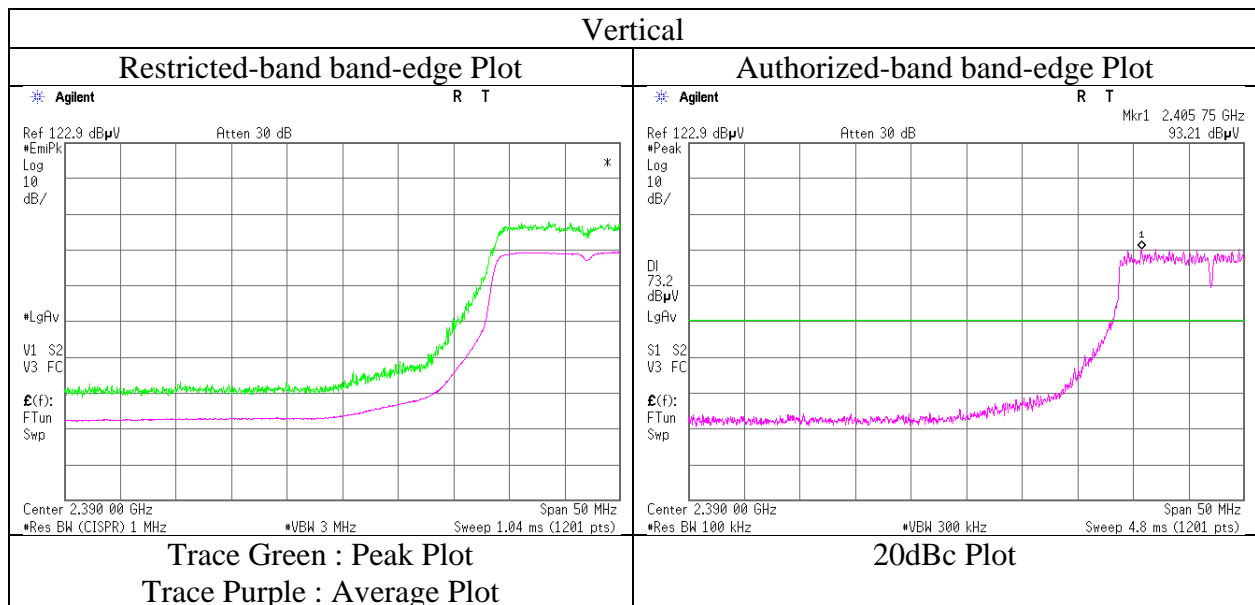
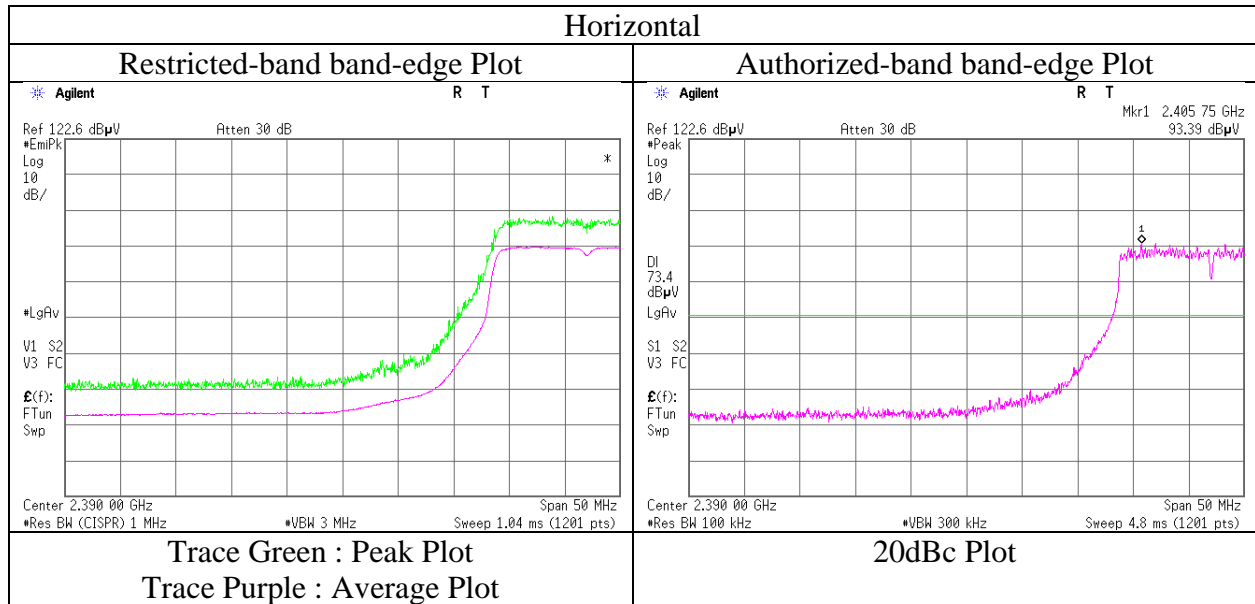
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018
Temperature / Humidity 22 deg. C / 69 % RH
Engineer Kazuya Noda
(1 GHz - 13 GHz)
Mode Tx 11g 2412 MHz



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

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018
Temperature / Humidity 22 deg. C / 69 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11g 2417 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	59.24	27.86	14.13	44.13	2.10	59.20	73.90	14.7	144	98	
Vert.	2390.000	PK	58.93	27.86	14.13	44.13	2.10	58.89	73.90	15.0	151	48	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	44.16	27.86	14.13	44.13	0.27	2.10	44.39	53.90	9.5	*1)
Vert.	2390.000	AV	43.91	27.86	14.13	44.13	0.27	2.10	44.14	53.90	9.8	*1)

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2417.000	PK	97.19	27.84	14.15	44.14	2.10	97.14	-	-	Carrier
Hori.	2400.000	PK	54.71	27.86	14.14	44.14	2.10	54.67	77.14	22.5	
Vert.	2417.000	PK	97.04	27.84	14.15	44.14	2.10	96.99	-	-	Carrier
Vert.	2400.000	PK	54.47	27.86	14.14	44.14	2.10	54.43	76.99	22.6	

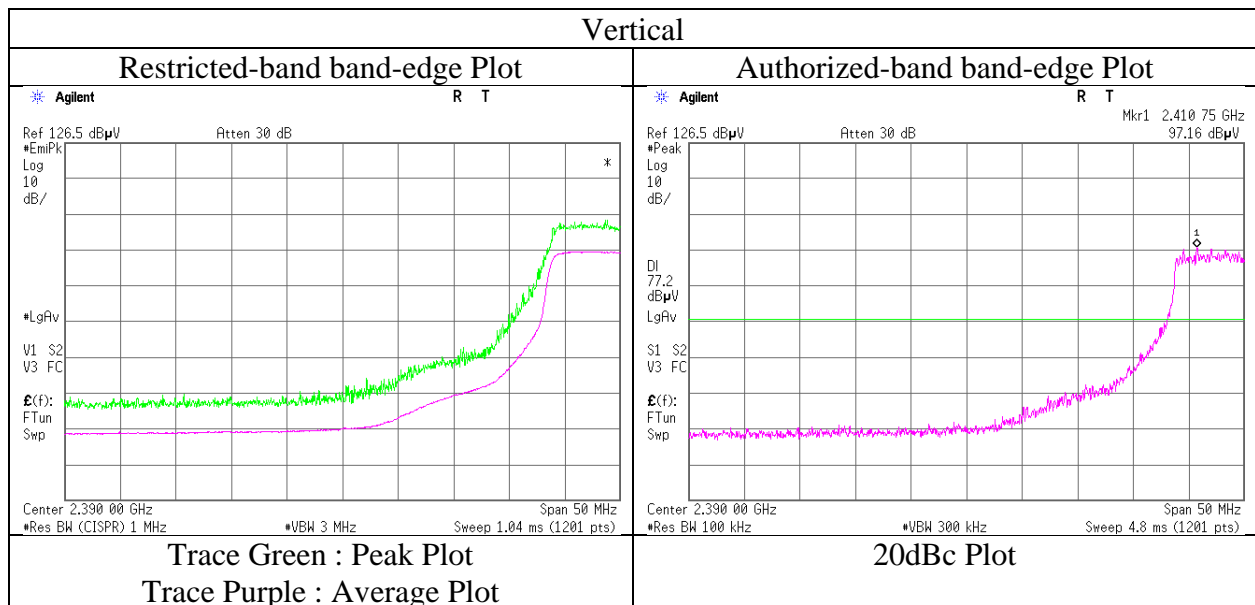
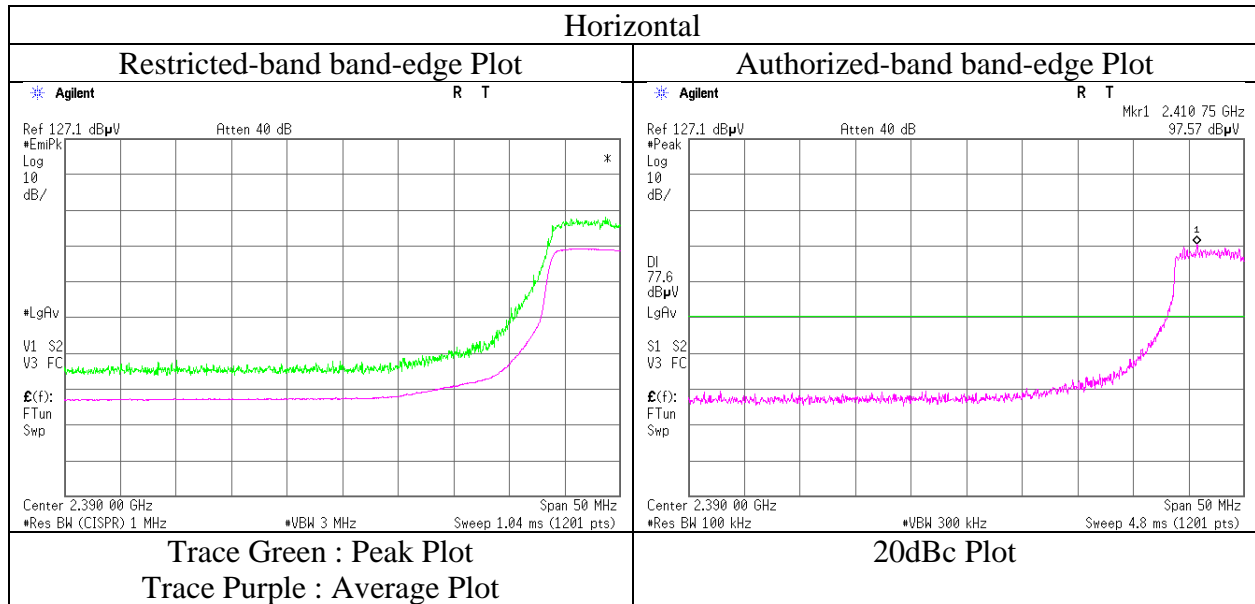
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018
Temperature / Humidity 22 deg. C / 69 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11g 2417 MHz



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

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3 3
Date September 13, 2018 September 10, 2018 September 11, 2018
Temperature / Humidity 25 deg. C / 49 % RH 22 deg. C / 69 % RH 25 deg. C / 52 % RH
Engineer Kazuya Noda Kazuya Noda Kazuya Noda
(30 GHz - 1 GHz) (1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11g 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	444.084	QP	39.77	16.66	9.43	31.97	0.00	33.89	46.00	12.1	100	23	
Hori.	542.550	QP	36.61	17.71	9.79	32.00	0.00	32.11	46.00	13.8	100	228	
Hori.	555.133	QP	35.88	17.94	9.84	32.00	0.00	31.66	46.00	14.3	100	205	
Hori.	666.114	QP	33.41	19.43	10.25	31.94	0.00	31.15	46.00	14.8	100	124	
Hori.	1745.233	PK	50.12	24.99	13.49	43.91	2.10	46.79	73.90	27.1	1611	81	
Hori.	3330.636	PK	54.89	28.13	5.93	44.44	2.10	46.61	73.90	27.2	351	172	
Hori.	3531.764	PK	54.92	28.92	6.03	44.58	2.10	47.39	73.90	26.5	155	256	
Hori.	4440.773	PK	53.88	30.38	6.32	44.32	2.10	48.36	73.90	25.5	153	189	
Hori.	4874.000	PK	50.00	31.40	6.55	44.47	2.10	45.58	73.90	28.3	187	121	
Hori.	7311.000	PK	47.51	36.99	8.31	44.03	2.10	50.88	73.90	23.0	100	0	
Hori.	1745.233	AV	41.99	24.99	13.49	43.91	2.10	38.66	53.90	15.2	1611	81	
Hori.	3330.636	AV	49.45	28.13	5.93	44.44	2.10	41.17	53.90	12.7	351	172	
Hori.	3531.764	AV	50.04	28.92	6.03	44.58	2.10	42.51	53.90	11.3	155	256	
Hori.	4440.773	AV	46.42	30.38	6.32	44.32	2.10	40.90	53.90	13.0	153	189	
Vert.	175.105	QP	31.02	15.82	7.86	32.10	0.00	22.60	43.50	20.9	100	133	
Vert.	706.312	QP	33.57	19.92	10.41	31.86	0.00	32.04	46.00	13.9	122	344	
Vert.	795.551	QP	31.21	20.88	10.73	31.62	0.00	31.20	46.00	14.8	131	197	
Vert.	851.151	QP	29.51	21.63	10.94	31.38	0.00	30.70	46.00	15.3	110	358	
Vert.	2096.669	PK	50.59	26.93	13.87	44.06	2.10	49.43	73.90	24.4	205	319	
Vert.	3330.595	PK	55.61	28.13	5.93	44.44	2.10	47.33	73.90	26.5	355	151	
Vert.	3531.581	PK	54.91	28.92	6.03	44.58	2.10	47.38	73.90	26.5	100	16	
Vert.	4440.754	PK	53.76	30.38	6.32	44.32	2.10	48.24	73.90	25.6	142	213	
Vert.	4874.000	PK	48.69	31.40	6.55	44.47	2.10	44.27	73.90	29.6	193	355	
Vert.	7311.000	PK	47.51	36.99	8.31	44.03	2.10	50.88	73.90	23.0	100	0	
Vert.	2096.669	AV	42.49	26.93	13.87	44.06	2.10	41.33	53.90	12.5	205	319	
Vert.	3330.595	AV	49.46	28.13	5.93	44.44	2.10	41.18	53.90	12.7	355	151	
Vert.	3531.581	AV	50.64	28.92	6.03	44.58	2.10	43.11	53.90	10.7	100	16	
Vert.	4440.754	AV	47.19	30.38	6.32	44.32	2.10	41.67	53.90	12.2	142	213	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 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	40.31	31.40	6.55	44.47	0.27	2.10	36.16	53.90	17.7	
Hori.	7311.000	AV	38.59	36.99	8.31	44.03	0.27	2.10	42.23	53.90	11.7	
Vert.	4874.000	AV	39.70	31.40	6.55	44.47	0.27	2.10	35.55	53.90	18.4	
Vert.	7311.000	AV	38.51	36.99	8.31	44.03	0.27	2.10	42.15	53.90	11.8	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

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

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.	2437.000	PK	96.34	27.82	14.16	44.14	2.10	96.28	-	-	Carrier
Hori.	9748.000	PK	39.11	38.92	9.21	43.84	2.10	45.50	76.28	30.8	
Vert.	2437.000	PK	96.61	27.82	14.16	44.14	2.10	96.55	-	-	Carrier
Vert.	9748.000	PK	39.65	38.92	9.21	43.84	2.10	46.04	76.55	30.5	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

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Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018
Temperature / Humidity 22 deg. C / 69 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11g 2457 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	58.15	27.65	14.22	44.16	2.10	57.96	73.90	15.9	144	105	
Vert.	2483.500	PK	57.96	27.65	14.22	44.16	2.10	57.77	73.90	16.1	146	51	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	44.59	27.65	14.22	44.16	0.27	2.10	44.67	53.90	9.2	*1)
Vert.	2483.500	AV	44.78	27.65	14.22	44.16	0.27	2.10	44.86	53.90	9.0	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

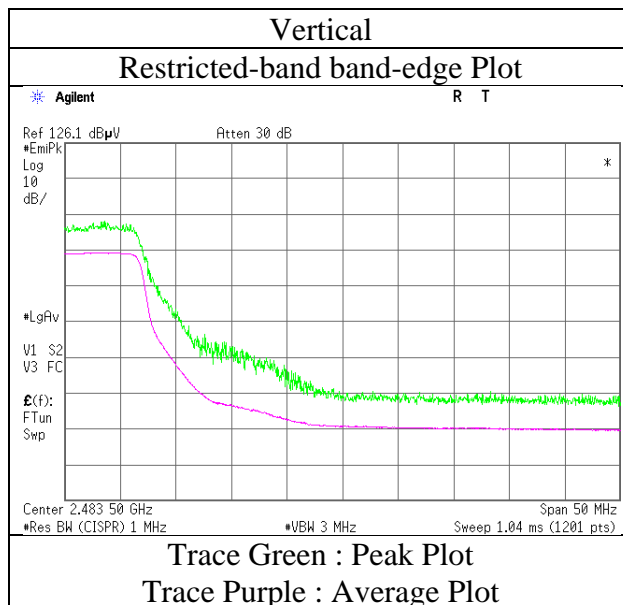
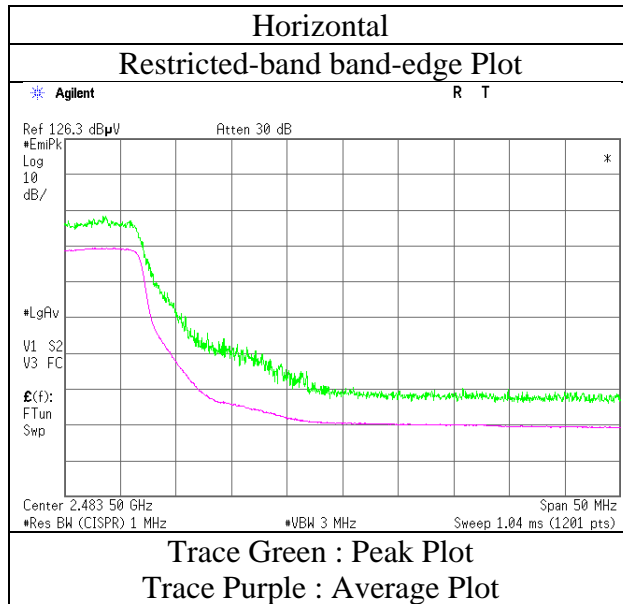
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12443391S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	September 10, 2018
Temperature / Humidity	22 deg. C / 69 % RH
Engineer	Kazuya Noda
	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2457 MHz



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

Radiated Spurious Emission

Report No.	12443391S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3	3
Date	September 10, 2018	September 11, 2018
Temperature / Humidity	22 deg. C / 69 % RH	25 deg. C / 52 % RH
Engineer	Kazuya Noda	Kazuya Noda
	(1 GHz - 13 GHz)	(13 GHz - 26.5 GHz)
Mode	Tx 11g 2462 MHz	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.230	PK	50.11	24.99	13.49	43.91	2.10	46.78	73.90	27.1	161		
Hori.	2483.500	PK	56.44	27.65	14.22	44.16	2.10	56.25	73.90	17.6	148		
Hori.	3330.621	PK	54.78	28.13	5.93	44.44	2.10	46.50	73.90	27.4	354		
Hori.	3531.721	PK	54.81	28.92	6.03	44.58	2.10	47.28	73.90	26.6	152		
Hori.	4440.712	PK	53.81	30.38	6.32	44.32	2.10	48.29	73.90	25.6	148		
Hori.	4924.000	PK	49.81	31.37	6.59	44.49	2.10	45.38	73.90	28.5	144		
Hori.	7386.000	PK	48.25	37.01	8.36	44.06	2.10	51.66	73.90	22.2	100		
Hori.	1745.230	AV	41.95	24.99	13.49	43.91	2.10	38.62	53.90	15.2	161		
Hori.	3330.621	AV	49.52	28.13	5.93	44.44	2.10	41.24	53.90	12.6	354		
Hori.	3531.721	AV	50.06	28.92	6.03	44.58	2.10	42.53	53.90	11.3	152		
Hori.	4440.712	AV	46.11	30.38	6.32	44.32	2.10	40.59	53.90	13.3	148		
Vert.	2096.687	PK	50.61	26.93	13.87	44.06	2.10	49.45	73.90	24.4	206		
Vert.	2483.500	PK	57.46	27.65	14.22	44.16	2.10	57.27	73.90	16.6	142		
Vert.	3330.501	PK	55.47	28.13	5.93	44.44	2.10	47.19	73.90	26.7	355		
Vert.	3531.535	PK	54.65	28.92	6.03	44.58	2.10	47.12	73.90	26.7	100		
Vert.	4440.781	PK	53.51	30.38	6.32	44.32	2.10	47.99	73.90	25.9	141		
Vert.	4924.000	PK	49.05	31.37	6.59	44.49	2.10	44.62	73.90	29.2	192		
Vert.	7386.000	PK	47.87	37.01	8.36	44.06	2.10	51.28	73.90	22.6	100		
Vert.	2096.687	AV	42.27	26.93	13.87	44.06	2.10	41.11	53.90	12.7	206		
Vert.	3330.501	AV	49.09	28.13	5.93	44.44	2.10	40.81	53.90	13.0	355		
Vert.	3531.535	AV	50.24	28.92	6.03	44.58	2.10	42.71	53.90	11.1	100		
Vert.	4440.781	AV	47.29	30.38	6.32	44.32	2.10	41.77	53.90	12.1	141		

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 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	44.78	27.65	14.22	44.16	0.27	2.10	44.86	53.90	9.0	*1)
Hori.	4924.000	AV	40.02	31.37	6.59	44.49	0.27	2.10	35.86	53.90	18.0	
Hori.	7386.000	AV	38.30	37.01	8.36	44.06	0.27	2.10	41.98	53.90	11.9	
Vert.	2483.500	AV	45.58	27.65	14.22	44.16	0.27	2.10	45.66	53.90	8.2	*1)
Vert.	4924.000	AV	40.00	31.37	6.59	44.49	0.27	2.10	35.84	53.90	18.1	
Vert.	7386.000	AV	37.78	37.01	8.36	44.06	0.27	2.10	41.46	53.90	12.4	

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(3.82 m / 3.0 m) = 2.10 dB

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2462.000	PK	93.58	27.75	14.20	44.15	2.10	93.48	-	-	Carrier
Hori.	9848.000	PK	37.15	39.12	9.21	43.86	2.10	43.72	73.48	29.8	
Vert.	2462.000	PK	94.13	27.75	14.20	44.15	2.10	94.03	-	-	Carrier
Vert.	9848.000	PK	38.83	39.12	9.21	43.86	2.10	45.40	74.03	28.6	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

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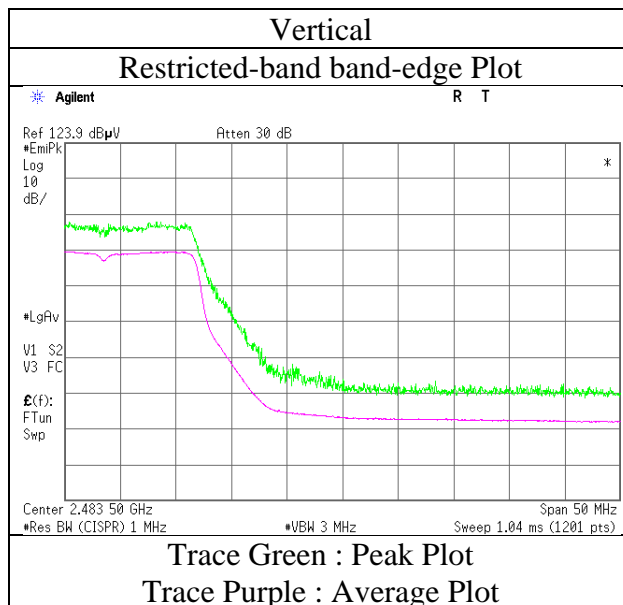
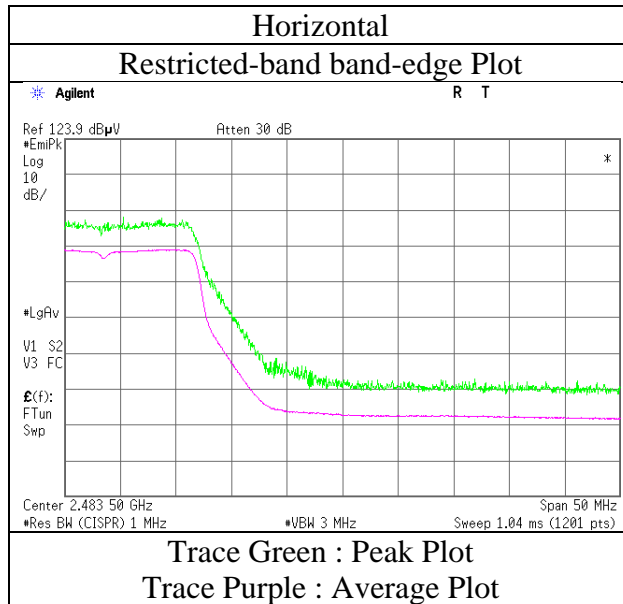
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018
Temperature / Humidity 22 deg. C / 69 % RH
Engineer Kazuya Noda
(1 GHz - 13 GHz)
Mode Tx 11g 2462 MHz



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

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date September 11, 2018 September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH 25 deg. C / 52 % RH
Engineer Kazuya Noda Kazuya Noda
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11n-20 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.229	PK	50.05	24.99	13.49	43.91	2.10	46.72	73.90	27.1	160	79	
Hori.	2390.000	PK	57.12	27.86	14.13	44.13	2.10	57.08	73.90	16.8	239	92	
Hori.	3330.602	PK	54.89	28.13	5.93	44.44	2.10	46.61	73.90	27.2	351	163	
Hori.	3531.576	PK	54.61	28.92	6.03	44.58	2.10	47.08	73.90	26.8	152	255	
Hori.	4440.813	PK	53.77	30.38	6.32	44.32	2.10	48.25	73.90	25.6	148	189	
Hori.	4824.000	PK	48.92	31.46	6.53	44.46	2.10	44.55	73.90	29.3	188	121	
Hori.	7236.000	PK	47.60	36.85	8.26	44.00	2.10	50.81	73.90	23.0	100	0	
Hori.	1745.229	AV	41.91	24.99	13.49	43.91	2.10	38.58	53.90	15.3	160	79	
Hori.	3330.602	AV	49.61	28.13	5.93	44.44	2.10	41.33	53.90	12.5	351	163	
Hori.	3531.576	AV	50.10	28.92	6.03	44.58	2.10	42.57	53.90	11.3	152	255	
Hori.	4440.813	AV	46.24	30.38	6.32	44.32	2.10	40.72	53.90	13.1	148	189	
Vert.	2096.679	PK	50.66	26.93	13.87	44.06	2.10	49.50	73.90	24.4	204	314	
Vert.	2390.000	PK	55.09	27.86	14.13	44.13	2.10	55.05	73.90	18.8	150	48	
Vert.	3330.608	PK	55.41	28.13	5.93	44.44	2.10	47.13	73.90	26.7	355	147	
Vert.	3531.615	PK	54.36	28.92	6.03	44.58	2.10	46.83	73.90	27.0	100	21	
Vert.	4440.814	PK	54.13	30.38	6.32	44.32	2.10	48.61	73.90	25.2	141	213	
Vert.	4824.000	PK	49.25	31.46	6.53	44.46	2.10	44.88	73.90	29.0	222	347	
Vert.	7236.000	PK	47.83	36.85	8.26	44.00	2.10	51.04	73.90	22.8	100	0	
Vert.	2096.679	AV	42.81	26.93	13.87	44.06	2.10	41.65	53.90	12.2	204	314	
Vert.	3330.608	AV	49.05	28.13	5.93	44.44	2.10	40.77	53.90	13.1	355	147	
Vert.	3531.615	AV	49.98	28.92	6.03	44.58	2.10	42.45	53.90	11.4	100	21	
Vert.	4440.814	AV	47.51	30.38	6.32	44.32	2.10	41.99	53.90	11.9	141	213	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	44.21	27.86	14.13	44.13	0.22	2.10	44.39	53.90	9.5	*1)
Hori.	4824.000	AV	39.97	31.46	6.53	44.46	0.22	2.10	35.82	53.90	18.1	
Hori.	7236.000	AV	38.36	36.85	8.26	44.00	0.22	2.10	41.79	53.90	12.1	
Vert.	4824.000	AV	39.84	31.46	6.53	44.46	0.22	2.10	35.69	53.90	18.2	
Vert.	7236.000	AV	38.37	36.85	8.26	44.00	0.22	2.10	41.80	53.90	12.1	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	92.13	27.85	14.15	44.14	2.10	92.09	-	-	Carrier
Hori.	2400.000	PK	58.88	27.86	14.14	44.14	2.10	58.84	72.09	13.3	
Hori.	9648.000	PK	37.70	38.64	9.21	43.83	2.10	43.82	72.09	28.3	
Vert.	2412.000	PK	91.81	27.85	14.15	44.14	2.10	91.77	-	-	Carrier
Vert.	2400.000	PK	57.90	27.86	14.14	44.14	2.10	57.86	71.77	13.9	
Vert.	9648.000	PK	38.81	38.64	9.21	43.83	2.10	44.93	71.77	26.8	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

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Shonan EMC Lab.

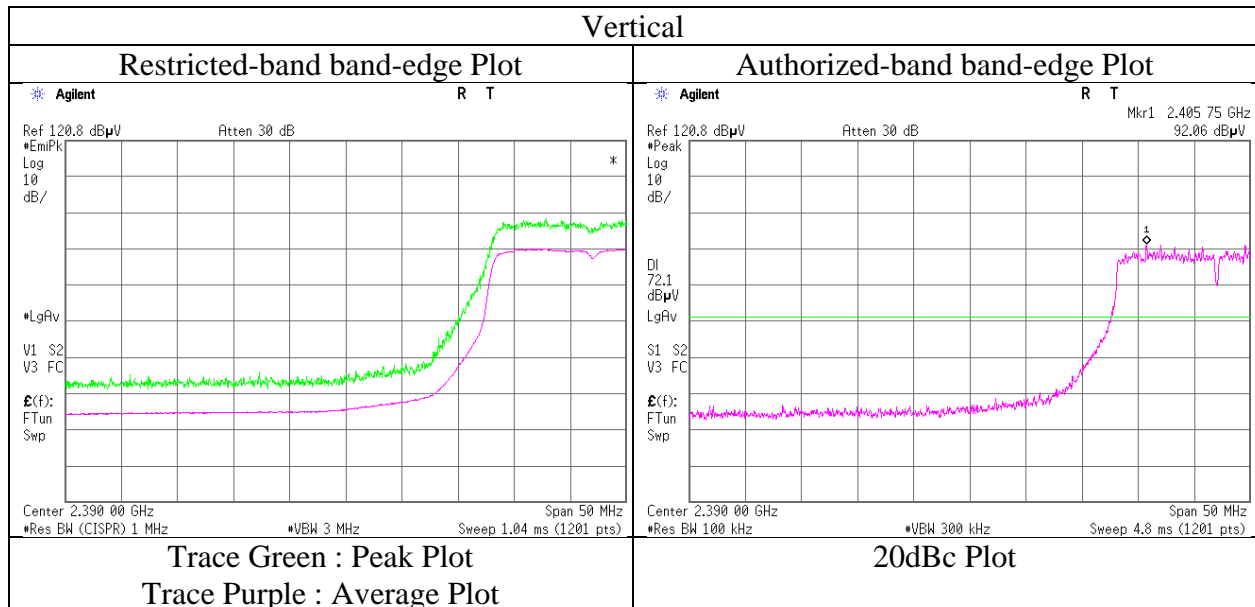
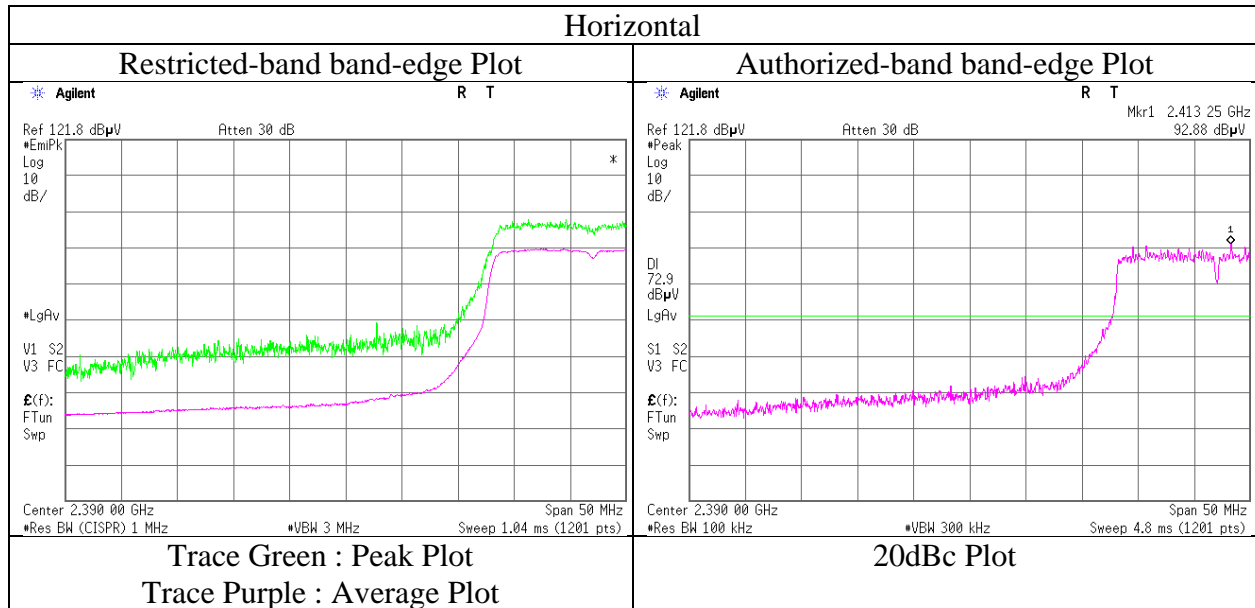
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Kazuya Noda
(1 GHz - 13 GHz)
Mode Tx 11n-20 2412 MHz



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

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2417 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	58.62	27.86	14.13	44.13	2.10	58.58	73.90	15.3	211	88	
Vert.	2390.000	PK	57.11	27.86	14.13	44.13	2.10	57.07	73.90	16.8	151	57	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	43.27	27.86	14.13	44.13	0.22	2.10	43.45	53.90	10.5	*1)
Vert.	2390.000	AV	42.92	27.86	14.13	44.13	0.22	2.10	43.10	53.90	10.8	*1)

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

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2417.000	PK	95.77	27.84	14.15	44.14	2.10	95.72	-	-	Carrier
Hori.	2400.000	PK	54.49	27.86	14.14	44.14	2.10	54.45	75.72	21.3	
Vert.	2417.000	PK	95.45	27.84	14.15	44.14	2.10	95.40	-	-	Carrier
Vert.	2400.000	PK	54.33	27.86	14.14	44.14	2.10	54.29	75.40	21.1	

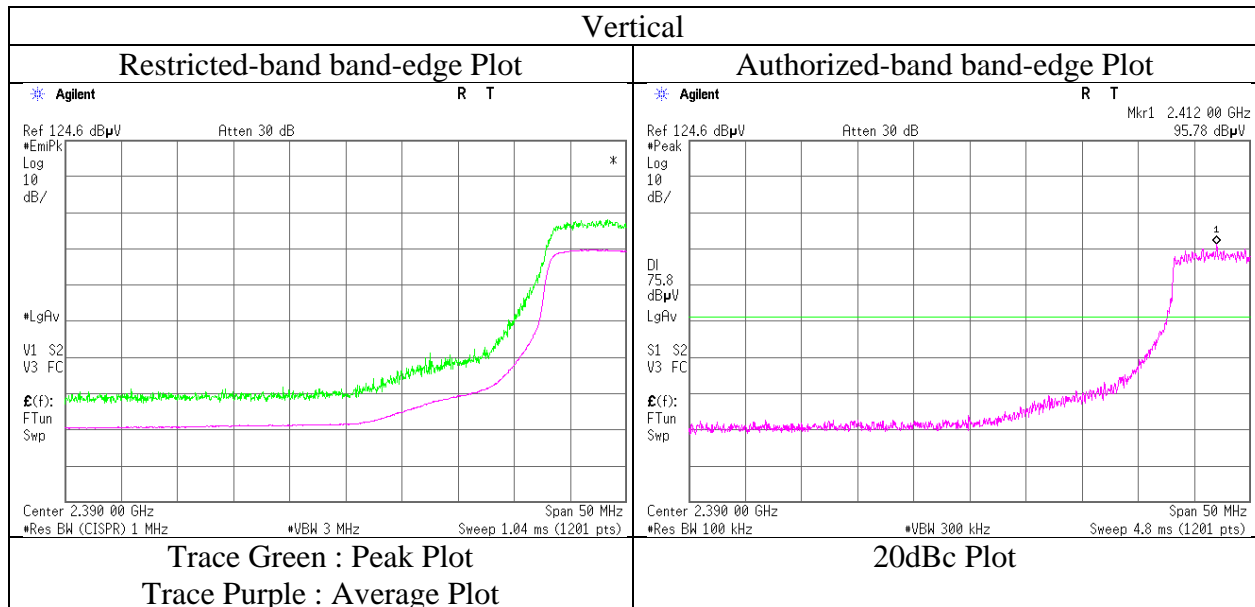
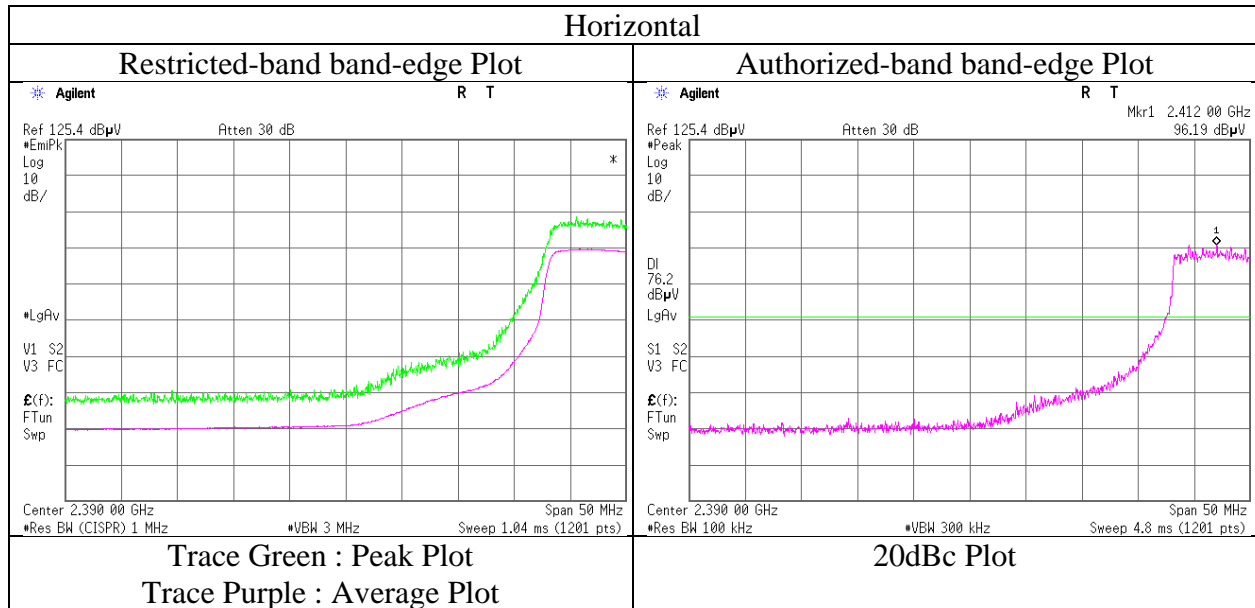
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.82 m / 3.0 m) = 2.10 dB

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 10, 2018
Temperature / Humidity 22 deg. C / 69 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2417 MHz



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

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date September 11, 2018 September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH 25 deg. C / 52 % RH
Engineer Kazuya Noda Kazuya Noda
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11n-20 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.231	PK	50.16	24.99	13.49	43.91	2.10	46.83	73.90	27.0	161	83	
Hori.	3330.583	PK	54.99	28.13	5.93	44.44	2.10	46.71	73.90	27.1	354	166	
Hori.	3531.598	PK	54.69	28.92	6.03	44.58	2.10	47.16	73.90	26.7	152	256	
Hori.	4440.818	PK	54.37	30.38	6.32	44.32	2.10	48.85	73.90	25.0	149	189	
Hori.	4874.000	PK	49.87	31.40	6.55	44.47	2.10	45.45	73.90	28.4	199	109	
Hori.	7311.000	PK	47.69	36.99	8.31	44.03	2.10	51.06	73.90	22.8	100	0	
Hori.	1745.231	AV	42.01	24.99	13.49	43.91	2.10	38.68	53.90	15.2	161	83	
Hori.	3330.583	AV	49.51	28.13	5.93	44.44	2.10	41.23	53.90	12.6	354	166	
Hori.	3531.598	AV	50.09	28.92	6.03	44.58	2.10	42.56	53.90	11.3	152	256	
Hori.	4440.818	AV	46.72	30.38	6.32	44.32	2.10	41.20	53.90	12.7	149	189	
Vert.	2096.671	PK	50.56	26.93	13.87	44.06	2.10	49.40	73.90	24.5	205	309	
Vert.	3330.604	PK	55.51	28.13	5.93	44.44	2.10	47.23	73.90	26.6	355	151	
Vert.	3531.613	PK	54.56	28.92	6.03	44.58	2.10	47.03	73.90	26.8	100	22	
Vert.	4440.698	PK	54.76	30.38	6.32	44.32	2.10	49.24	73.90	24.6	141	217	
Vert.	2096.671	AV	42.48	26.93	13.87	44.06	2.10	41.32	53.90	12.5	205	309	
Vert.	3330.604	AV	49.21	28.13	5.93	44.44	2.10	40.93	53.90	12.9	355	151	
Vert.	3531.613	AV	50.11	28.92	6.03	44.58	2.10	42.58	53.90	11.3	100	22	
Vert.	4440.698	AV	47.68	30.38	6.32	44.32	2.10	42.16	53.90	11.7	141	217	
Vert.	4874.000	AV	39.95	31.40	6.55	44.47	2.10	35.53	53.90	18.3	244	346	
Vert.	7311.000	AV	37.92	36.99	8.31	44.03	2.10	41.29	53.90	12.6	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	AV	40.11	31.40	6.55	44.47	0.22	2.10	35.91	53.90	18.0	
Hori.	7311.000	AV	38.23	36.99	8.31	44.03	0.22	2.10	41.82	53.90	12.1	
Vert.	4874.000	PK	49.64	31.40	6.55	44.47	0.22	2.10	45.44	73.90	28.5	
Vert.	7311.000	PK	47.98	36.99	8.31	44.03	0.22	2.10	51.57	73.90	22.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

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

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

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.	2437.000	PK	94.88	27.82	14.16	44.14	2.10	94.82	-	-	Carrier
Hori.	9748.000	PK	38.41	38.92	9.21	43.84	2.10	44.80	74.82	30.0	
Vert.	2437.000	PK	95.52	27.82	14.16	44.14	2.10	95.46	-	-	Carrier
Vert.	9748.000	PK	40.48	38.92	9.21	43.84	2.10	46.87	75.46	28.6	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

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

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Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2457 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	56.08	27.65	14.22	44.16	2.10	55.89	73.90	18.0	232	93	
Vert.	2483.500	PK	55.96	27.65	14.22	44.16	2.10	55.77	73.90	18.1	142	53	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	44.79	27.65	14.22	44.16	0.22	2.10	44.82	53.90	9.1	*1)
Vert.	2483.500	AV	44.34	27.65	14.22	44.16	0.22	2.10	44.37	53.90	9.5	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

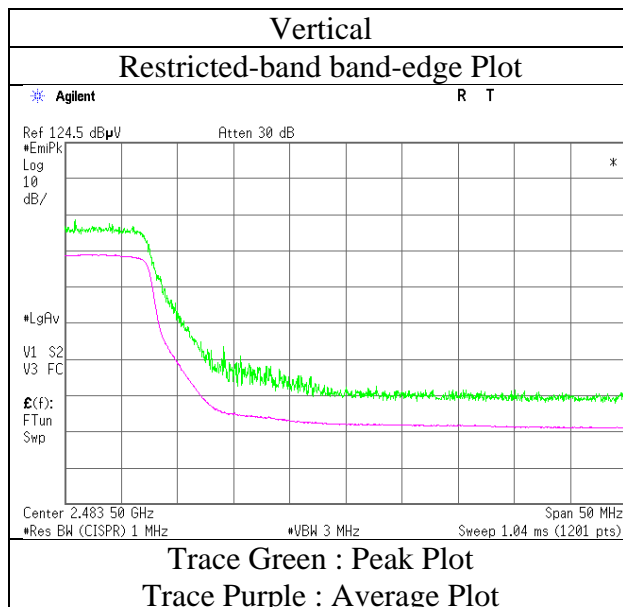
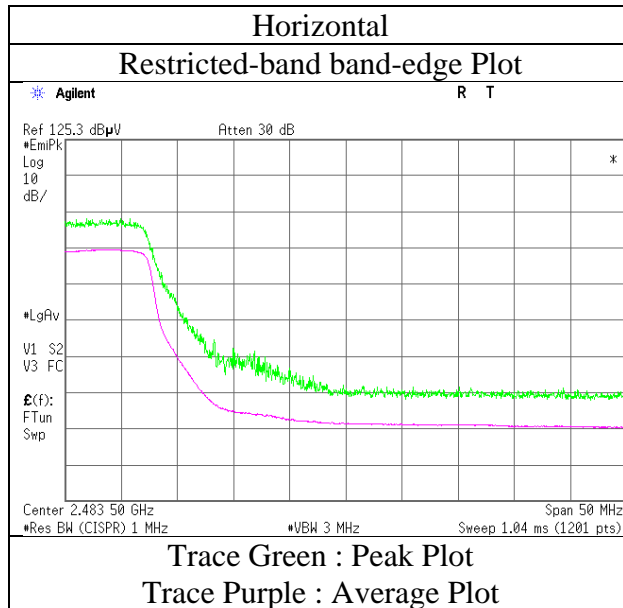
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2457 MHz



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

Radiated Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date September 11, 2018 September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH 25 deg. C / 52 % RH
Engineer Kazuya Noda Kazuya Noda
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11n-20 2462 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1745.241	PK	50.25	24.99	13.49	43.91	2.10	46.92	73.90	26.9	161	79	
Hori.	2483.500	PK	55.58	27.65	14.22	44.16	2.10	55.39	73.90	18.5	154	93	
Hori.	3330.618	PK	54.99	28.13	5.93	44.44	2.10	46.71	73.90	27.1	353	163	
Hori.	3531.546	PK	54.89	28.92	6.03	44.58	2.10	47.36	73.90	26.5	152	255	
Hori.	4440.851	PK	53.87	30.38	6.32	44.32	2.10	48.35	73.90	25.5	141	189	
Hori.	4924.000	PK	48.46	31.37	6.59	44.49	2.10	44.03	73.90	29.8	186	105	
Hori.	7386.000	PK	46.85	37.01	8.36	44.06	2.10	50.26	73.90	23.6	100	0	
Hori.	1745.241	AV	42.14	24.99	13.49	43.91	2.10	38.81	53.90	15.0	161	79	
Hori.	3330.618	AV	49.71	28.13	5.93	44.44	2.10	41.43	53.90	12.4	353	163	
Hori.	3531.546	AV	50.11	28.92	6.03	44.58	2.10	42.58	53.90	11.3	152	255	
Hori.	4440.851	AV	46.77	30.38	6.32	44.32	2.10	41.25	53.90	12.6	141	189	
Vert.	2096.676	PK	50.66	26.93	13.87	44.06	2.10	49.50	73.90	24.4	204	315	
Vert.	2483.500	PK	55.55	27.65	14.22	44.16	2.10	55.36	73.90	18.5	138	58	
Vert.	3330.653	PK	55.56	28.13	5.93	44.44	2.10	47.28	73.90	26.6	355	147	
Vert.	3531.589	PK	54.56	28.92	6.03	44.58	2.10	47.03	73.90	26.8	100	19	
Vert.	4440.825	PK	54.34	30.38	6.32	44.32	2.10	48.82	73.90	25.0	141	215	
Vert.	4924.000	PK	49.21	31.37	6.59	44.49	2.10	44.78	73.90	29.1	232	344	
Vert.	7386.000	PK	47.26	37.01	8.36	44.06	2.10	50.67	73.90	23.2	100	0	
Vert.	2096.676	AV	42.51	26.93	13.87	44.06	2.10	41.35	53.90	12.5	204	315	
Vert.	3330.653	AV	49.13	28.13	5.93	44.44	2.10	40.85	53.90	13.0	355	147	
Vert.	3531.589	AV	50.25	28.92	6.03	44.58	2.10	42.72	53.90	11.1	100	19	
Vert.	4440.825	AV	47.76	30.38	6.32	44.32	2.10	42.24	53.90	11.6	141	215	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 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	44.68	27.65	14.22	44.16	0.22	2.10	44.71	53.90	9.2	*1)
Hori.	4924.000	AV	39.82	31.37	6.59	44.49	0.22	2.10	35.61	53.90	18.3	
Hori.	7386.000	AV	38.02	37.01	8.36	44.06	0.22	2.10	41.65	53.90	12.3	
Vert.	2483.500	AV	44.38	27.65	14.22	44.16	0.22	2.10	44.41	53.90	9.5	*1)
Vert.	4924.000	AV	40.83	31.37	6.59	44.49	0.22	2.10	36.62	53.90	17.3	
Vert.	7386.000	AV	38.41	37.01	8.36	44.06	0.22	2.10	42.04	53.90	11.9	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2462.000	PK	93.39	27.75	14.20	44.15	2.10	93.29	-	-	Carrier
Hori.	9848.000	PK	36.94	39.12	9.21	43.86	2.10	43.51	73.29	29.8	
Vert.	2462.000	PK	92.65	27.75	14.20	44.15	2.10	92.55	-	-	Carrier
Vert.	9848.000	PK	40.12	39.12	9.21	43.86	2.10	46.69	72.55	25.9	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 m / 3.0 m) = 2.10 dB

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

UL Japan, Inc.

Shonan EMC Lab.

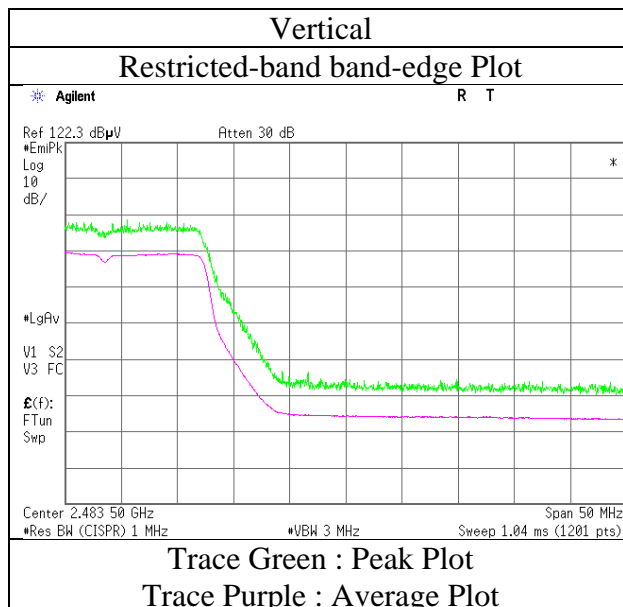
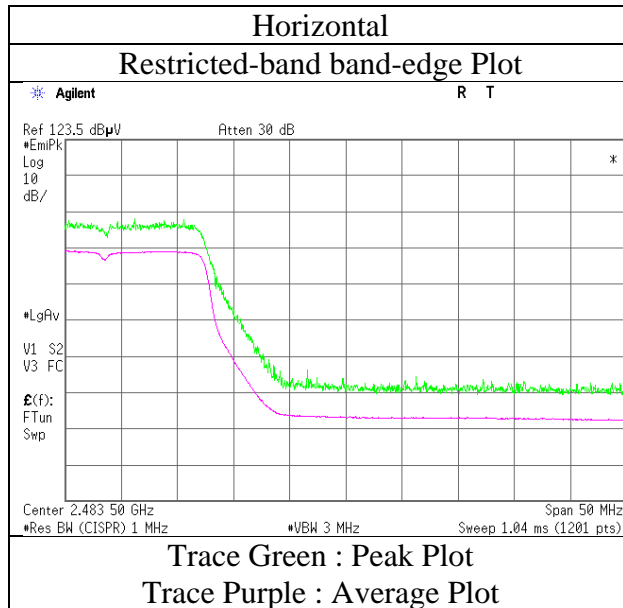
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Radiated Spurious Emission
(Reference Plot for band-edge)

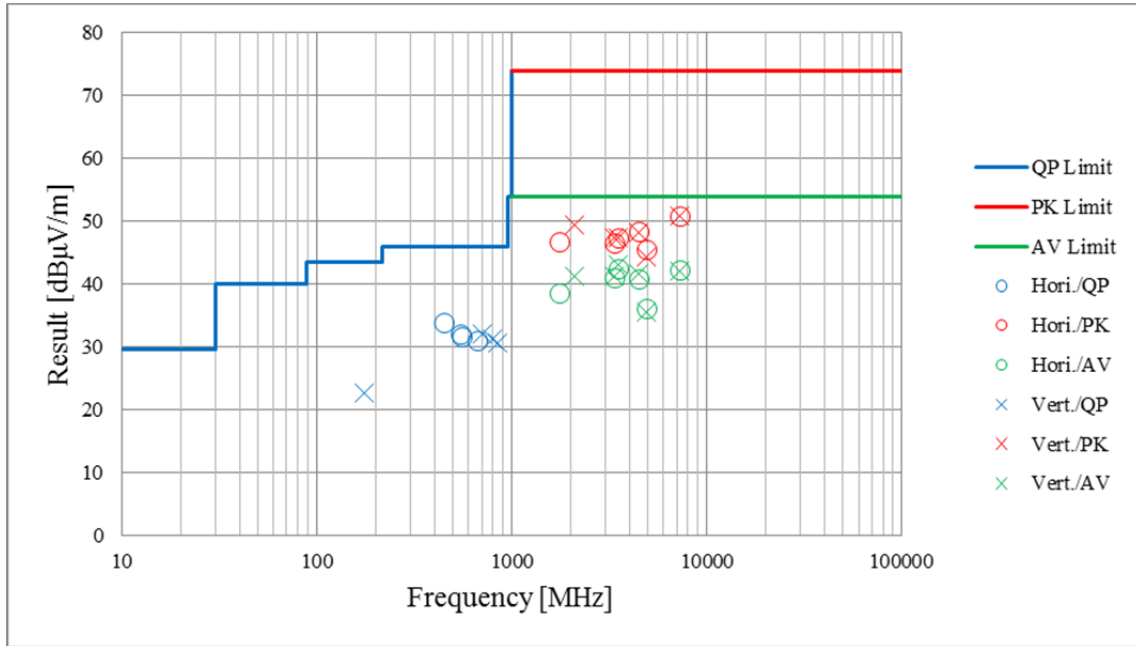
Report No. 12443391S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date September 11, 2018
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Kazuya Noda
(1 GHz - 13 GHz)
Mode Tx 11n-20 2462 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

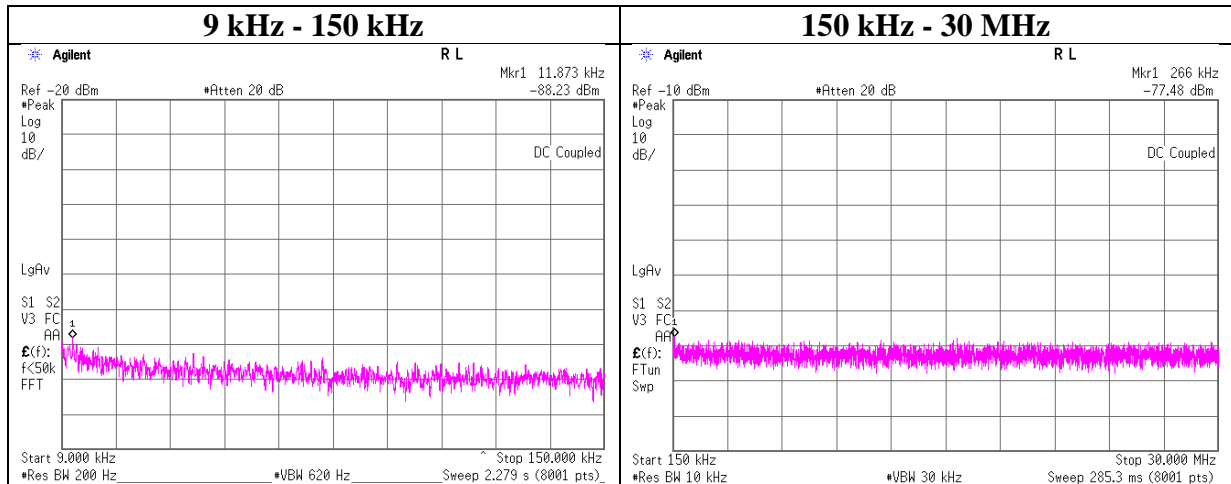
Report No.	12443391S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	September 13, 2018	September 10, 2018	September 11, 2018
Temperature / Humidity	25 deg. C / 49 % RH	22 deg. C / 69 % RH	25 deg. C / 52 % RH
Engineer	Kazuya Noda	Kazuya Noda	Kazuya Noda
	(30 GHz - 1 GHz)	(1 GHz - 13 GHz)	(13 GHz - 26.5 GHz)
Mode	Tx 11g 2437 MHz		



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

Conducted Spurious Emission

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 11, 2018
Temperature / Humidity 25 deg. C / 53 % RH
Engineer Makoto Hosaka
Mode Tx 11g 2437 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.87	-88.2	0.01	10.1	2.0	1	-76.1	300	6.0	-14.9	46.1	61.0	
266.00	-77.5	0.01	10.1	2.0	1	-65.4	300	6.0	-4.1	19.1	23.2	

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

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

N: Number of output

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

Power Density

Report No. 12443391S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 19, 2018
Temperature / Humidity 24 deg. C / 52 % 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	-19.11	1.96	10.18	-6.97	8.00	14.97
2437.00	-18.80	1.96	10.18	-6.66	8.00	14.66
2462.00	-18.98	1.97	10.18	-6.83	8.00	14.83

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-28.75	1.96	10.18	-16.61	8.00	24.61
2437.00	-24.72	1.96	10.18	-12.58	8.00	20.58
2462.00	-26.17	1.97	10.18	-14.02	8.00	22.02

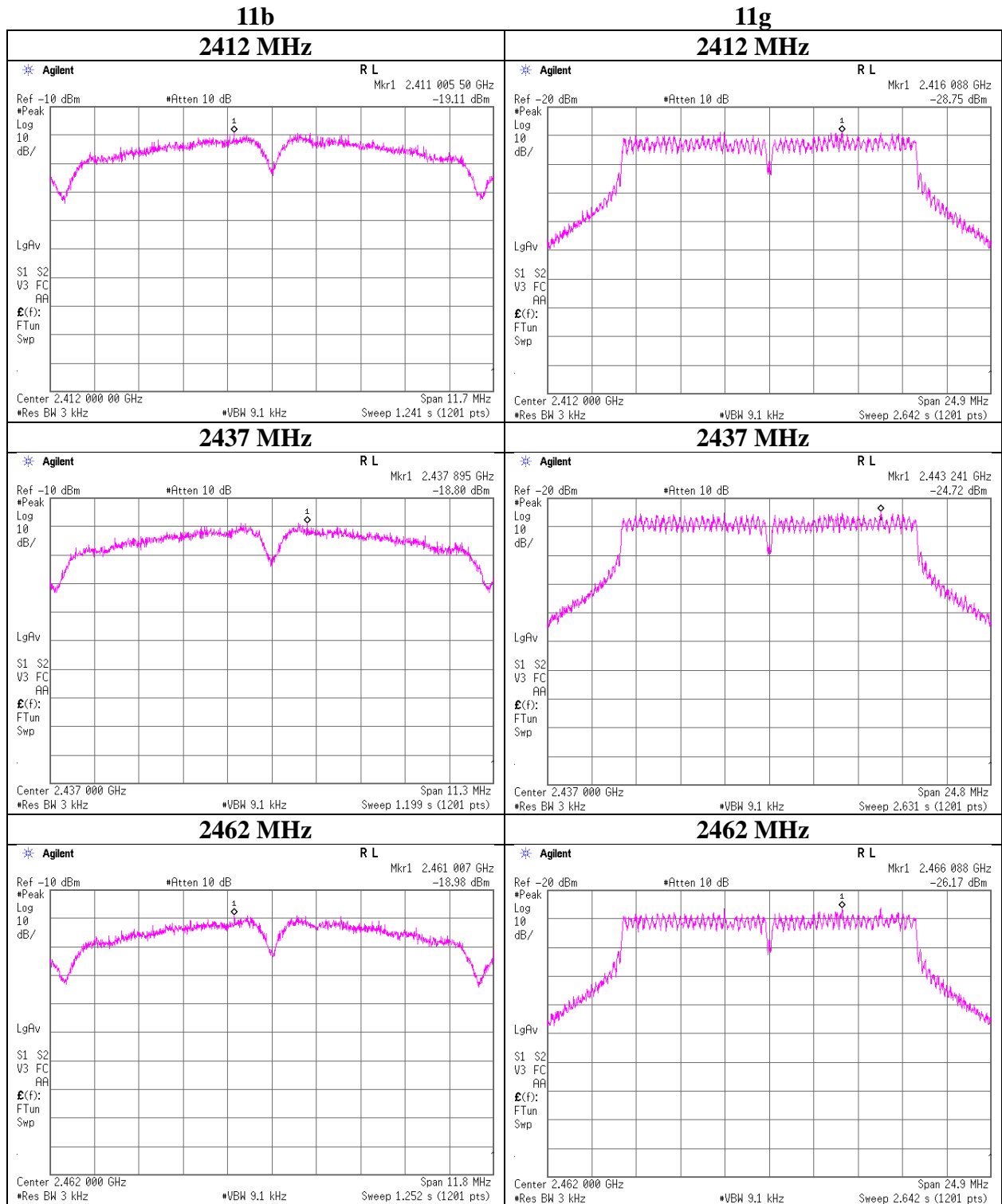
11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-29.69	1.96	10.18	-17.55	8.00	25.55
2437.00	-25.87	1.96	10.18	-13.73	8.00	21.73
2462.00	-27.73	1.97	10.18	-15.58	8.00	23.58

Sample Calculation:

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

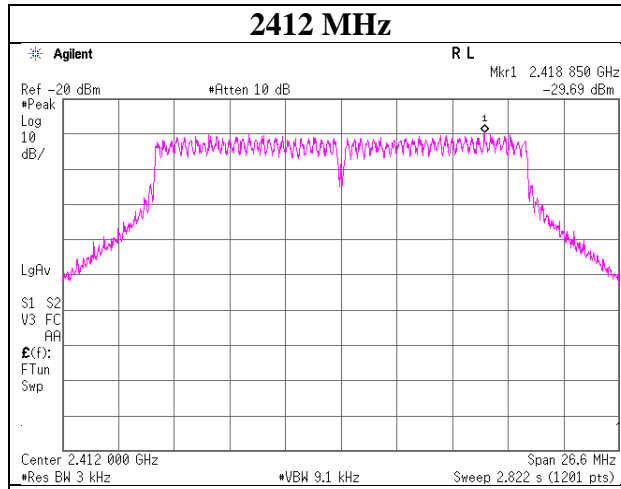
Power Density



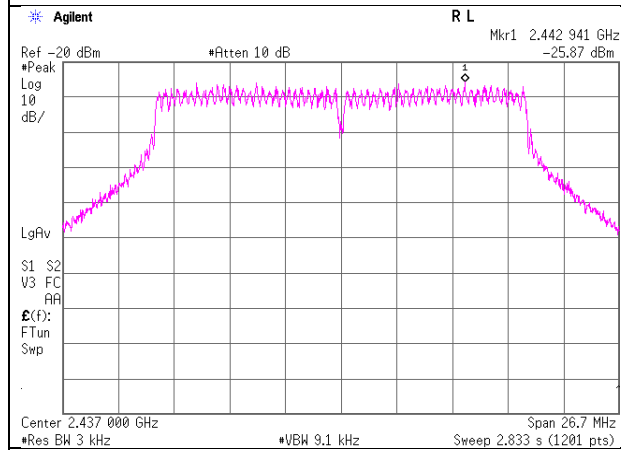
Power Density

11n-20

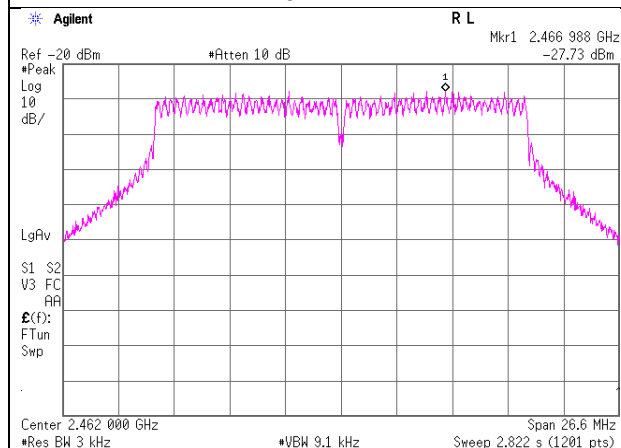
2412 MHz



2437 MHz



2462 MHz



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APPENDIX 2: Test instruments

Test Instruments

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
COTS-SEMI-1	RE	144865	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	-	-	-
SAEC-03(NSA)	RE	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2018/6/2	2019/6/30	12
SAEC-03(SVSWR)	RE	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2018/7/17	2019/7/31	12
SAF-03	RE	145126	Pre Amplifier	SONOMA	310N	290213	2018/2/16	2019/2/28	12
SAF-06	RE	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2018/9/14	2019/9/30	12
SAF-08	RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2018/3/27	2019/3/31	12
SAT6-13	RE	167094	Attenuator	JFW	50HF-006N	-	2018/2/9	2019/2/28	12
SBA-03	RE	145023	Biconical Antenna	Schwarzbeck	BBA9106	91032666	2018/6/17	2019/6/30	12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	RE	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-271(RF Selector)	2018/4/9	2019/4/30	12
SCC-G06	RE	145173	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	2018/6/1	2019/6/30	12
SCC-G23	RE	145168	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	2018/5/11	2019/5/31	12
SCC-G33	RE	145184	Coaxial Cable	Junkosha	MWX241-0100 0KMSKMS	-	2018/4/20	2019/4/30	12
SCC-G41	RE	151617	Coaxial Cable	Junkosha	MWX221-0100 0NFSNMS/B	1612S006	2018/1/29	2019/1/31	12
SCC-G45	RE	168301	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102 E	800137/2EA	2018/3/28	2019/3/31	12
SHA-03	RE	145501	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	2018/7/23	2019/7/31	12
SHA-04	RE	145512	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	2018/7/23	2019/7/31	12
SJM-02	RE	147479	Measure	KOMELON	KMC-36	-	-	-	-
SLA-07	RE	145529	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	2018/6/17	2019/6/30	12
SOS-05	RE	146293	Humidity Indicator	A&D	AD-5681	4062518	2017/10/30	2018/10/31	12
SSA-02	RE	145800	Spectrum Analyzer	AGILENT	E4448A	MY48250106	2018/3/5	2019/3/31	12
STR-06	RE	146208	Test Receiver	Rohde & Schwarz	ESCI	101259	2018/3/22	2019/3/31	12
STS-03	RE	146210	Digital Hitester	HIOKI	3805-50	80997823	2017/10/16	2018/10/31	12
KSA-08	AT	145089	Spectrum Analyzer	AGILENT	E4446A	MY46180525	2017/10/10	2018/10/31	12
KTS-07	AT	145111	Digital Tester	SANWA	PC500	7019232	2017/10/11	2018/10/31	12
SAT10-15	AT	160493	Attenuator	Weinschel Corp.	54A-10	83406	2017/12/8	2018/12/31	12
SCC-G13	AT	145166	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	2018/3/19	2019/3/31	12
SOS-09	AT	146318	Humidity Indicator	A&D	AD-5681	4061484	2017/12/21	2018/12/31	12
SPM-07	AT	146247	Power Meter	AGILENT	8990B	MY5100272	2018/7/13	2019/7/31	12
SPSS-04	AT	146310	Power sensor	AGILENT	N1923A	MY5326009	2018/7/13	2019/7/31	12
SRENT-09	AT	150461	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46186392	2017/11/8	2018/11/30	12

*Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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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