




RADIO TEST REPORT


Test Report No. : 12559092S-A-R1

Applicant : **Panasonic Corporation**
Type of Equipment : **Car Display with Blu-ray Player**
Model No. : **AT1805**
FCC ID : **ACJ932AT1805**
Test regulation : **FCC Part 15 Subpart C: 2018**
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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 12559092S-A. 12559092S-A is replaced with this report.

Date of test: November 12 to 22, 2018

Representative test engineer: 
Yosuke Ishikawa
Engineer
Consumer Technology Division

Approved by: 
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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13-EM-F0429

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SECTION 1: Customer information

Company Name : Panasonic Corporation
Address : 4261, Ikonobe-cho, Tsuzuki-ku, Yokohama-shi, Kanagawa-ken,
224-8520, Japan
Telephone Number : +81-50-3689-6795
Facsimile Number : +81-45-931-0806
Contact Person : Hayato Fujita

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

2.1 Identification of E.U.T.

Type of Equipment : Car Display with Blu-ray Player
Model No. : AT1805
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 10.5 V ~ 16.0 V (Typ: 13.2 V)
Receipt Date of Sample : November 10, 2018
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: AT1805 (referred to as the EUT in this report) is a Car Display with Blu-ray Player.

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 2412 MHz - 2462 MHz
Modulation : DSSS, OFDM
Antenna type : Dipole
Antenna Gain : 0.45 dBi
Clock frequency (Maximum) : 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	*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)	3.4 dB 2387.058 MHz, AV, Horizontal Tx 11b 2412 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

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	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

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	2.9 dB	2.8 dB	2.9 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.1 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.7 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.1 dB	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-
Radiated emission (Measurement distance: 1 m)	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-
	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.48 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 %

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3.5 Test Location

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

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

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

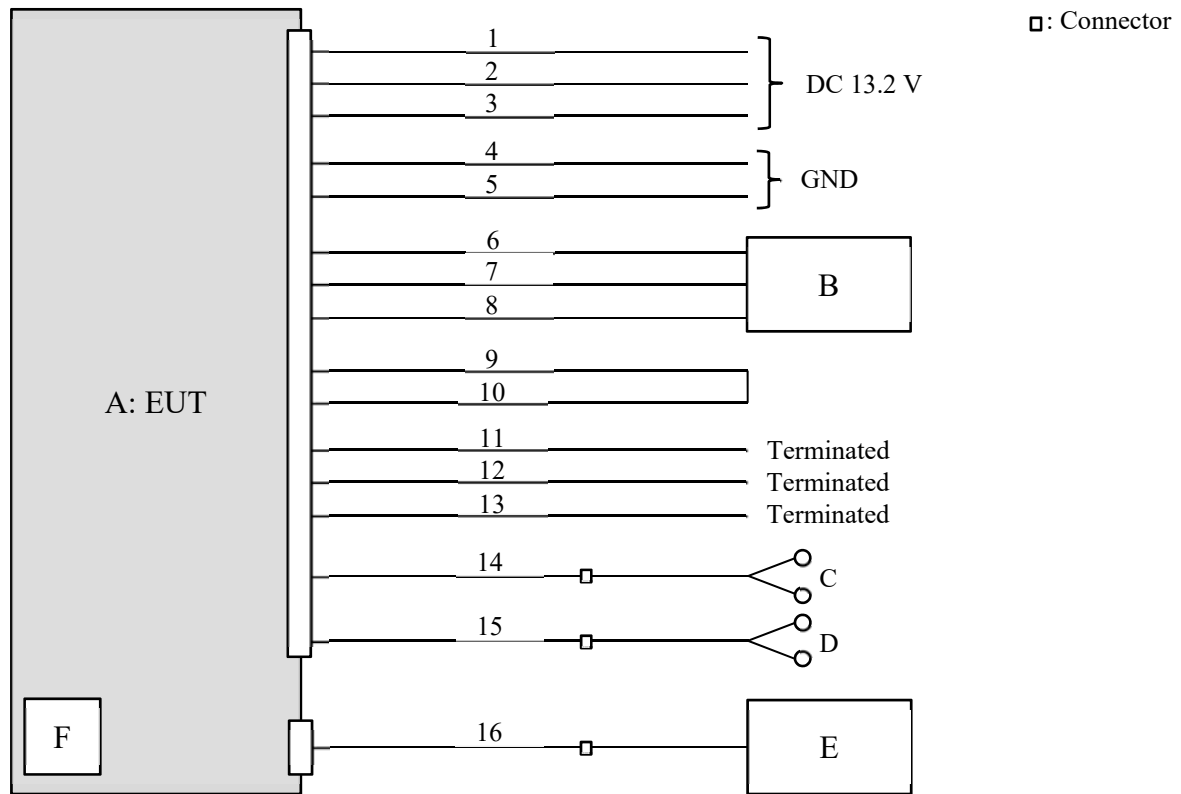
Mode	Remarks*
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	36 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 4, PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b: 15 dBm 11g: 11 dBm (1 and 11 channel), 13 dBm (other channels) 11n-20: 11 dBm (1 and 11 channel), 12 dBm (other channels) Software: WIFI Diag ver.4.25 *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 (below 1 GHz)	11g Tx	2437 MHz
6dB Bandwidth	11b Tx	2412 MHz
Maximum Peak Output Power	11g Tx	2437 MHz
Power Density	11n-20 Tx	2462 MHz
99% Occupied Bandwidth		
Spurious Emission (above 1 GHz)	11b Tx	2412 MHz
	11g Tx	2417 MHz *)
	11n-20 Tx	2437 MHz
		2457 MHz *)
		2462 MHz

*) Bandedge measurement of 11g and 11n-20 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	Remarks
A	Car Display with Blu-ray Player	AT1805	Lo_B_3S-016 *1) Lo B 3S-021 *2)	Panasonic	EUT
B	DCU	AT1603	101050	Panasonic	-
C	Earphone	-	-	-	-
D	Earphone	-	-	-	-
E	Tablet Computer	ME571-16G	07924744	ASUS	-
F	SDHC memory Card	MF-FSDH08GC6	-	ELECOM	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

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List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	ACC	2.0	Unshielded	Unshielded	-
2	+B	2.0	Unshielded	Unshielded	-
3	ILL+	2.0	Unshielded	Unshielded	-
4	GND	2.0	Unshielded	Unshielded	-
5	ILL-	2.0	Unshielded	Unshielded	-
6	Signal	2.0	Unshielded	Unshielded	-
7	Signal	2.0	Unshielded	Unshielded	-
8	Signal	2.0	Unshielded	Unshielded	-
9	ADPG	2.0	Unshielded	Unshielded	-
10	ADPGG	2.0	Unshielded	Unshielded	-
11	VIDEO IN	2.0	Shielded	Shielded	-
12	VTR_R IN	2.0	Shielded	Shielded	-
13	VTR_L IN	2.0	Shielded	Shielded	-
14	HP1	2.0 + 1.0	Unshielded	Unshielded	-
15	HP2	2.0 + 1.0	Unshielded	Unshielded	-
16	HDMI	2.0 + 1.0	Shielded	Shielded	-

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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 platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. 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 polystyrene 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	11,12,2.5,2 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.

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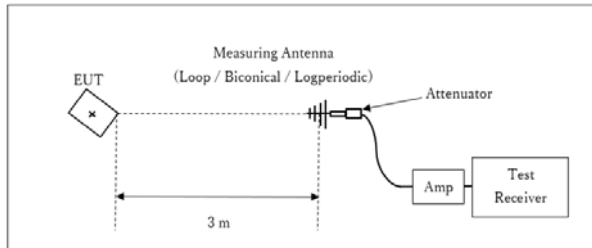
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Figure 2: Test Setup

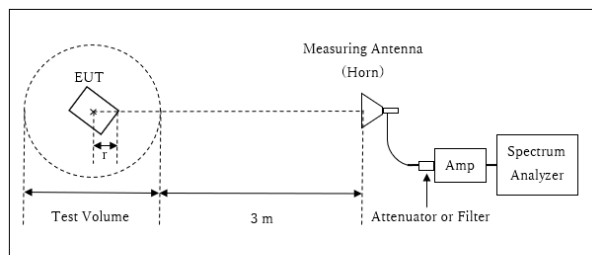
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

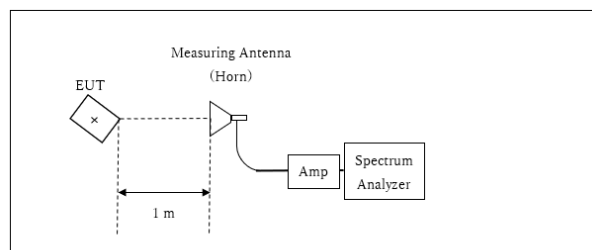


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: $20 \times \log(3.82 \text{ m} / 3.0 \text{ m}) = 2.1 \text{ dB}$
* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.82 \text{ m}$

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.18 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 Display angle of 0 deg., 90 deg. and 130 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.

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz – 2.8 GHz)	Spurious (2.8 GHz – 13 GHz)	Spurious (13 GHz – 26.5 GHz)
Horizontal	130 deg.	0 deg.	130 deg.	0 deg.	0 deg.
Vertical	130 deg.	130 deg.	130 deg.	0 deg.	0 deg.

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

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

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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	50 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)							

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

Test data : APPENDIX
Test result : Pass

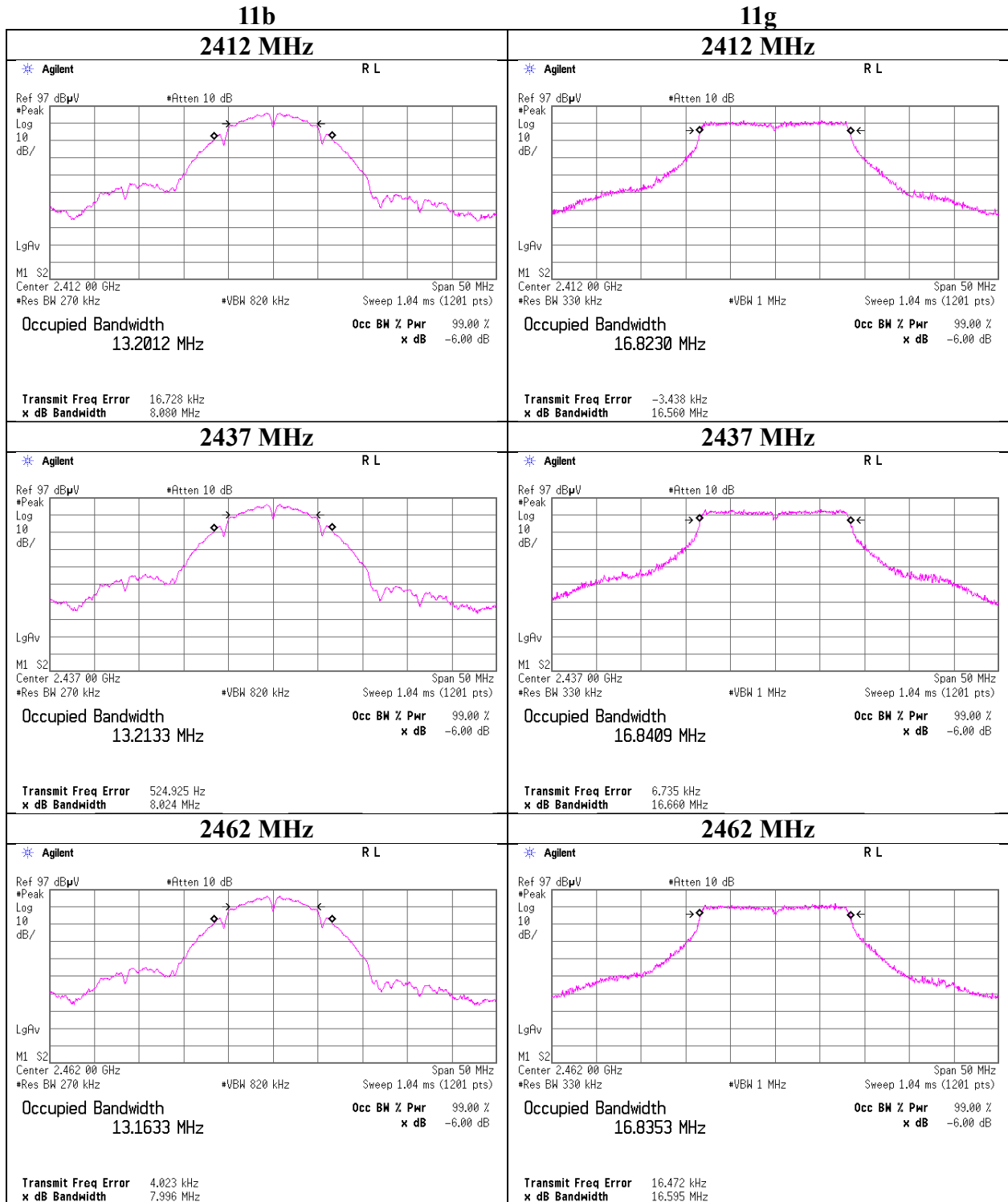
APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 14, 2018
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Yosuke Ishikawa
Mode Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	13201.2	7.882	> 0.5000
	2437	13213.3	7.726	> 0.5000
	2462	13163.3	7.910	> 0.5000
11g	2412	16823.0	16.522	> 0.5000
	2437	16840.9	16.530	> 0.5000
	2462	16835.3	16.536	> 0.5000
11n-20	2412	18028.3	17.726	> 0.5000
	2437	18006.2	17.721	> 0.5000
	2462	18015.9	17.763	> 0.5000

99%Occupied Bandwidth



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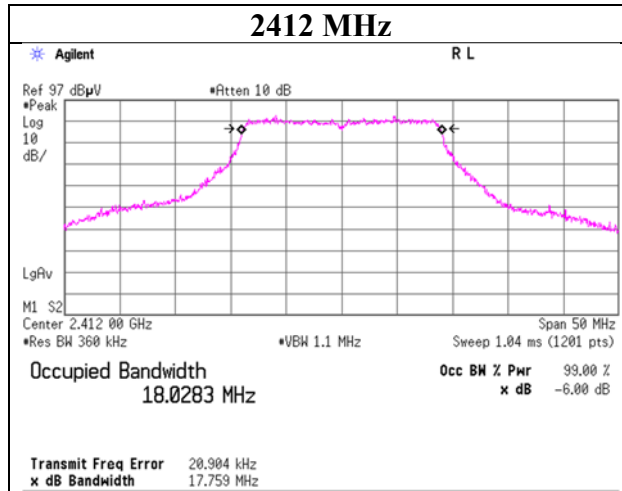
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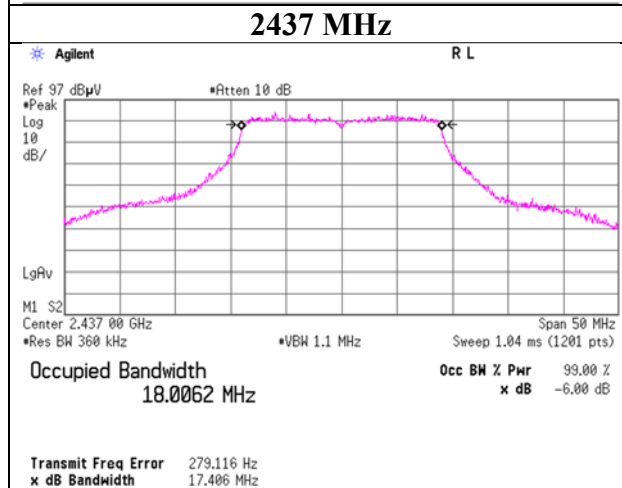
99% Occupied Bandwidth

11n-20

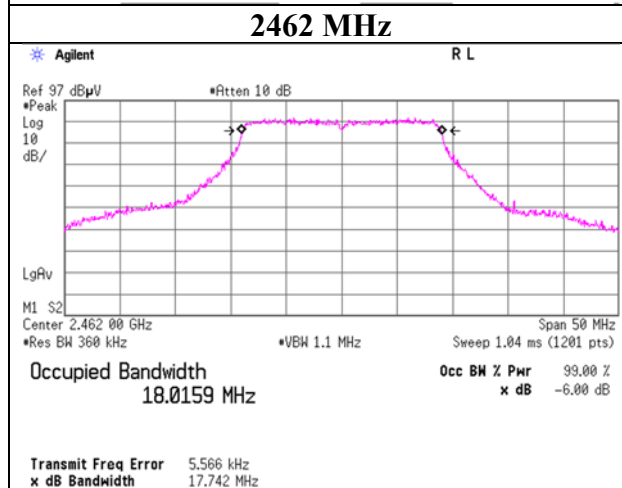
2412 MHz



2437 MHz



2462 MHz



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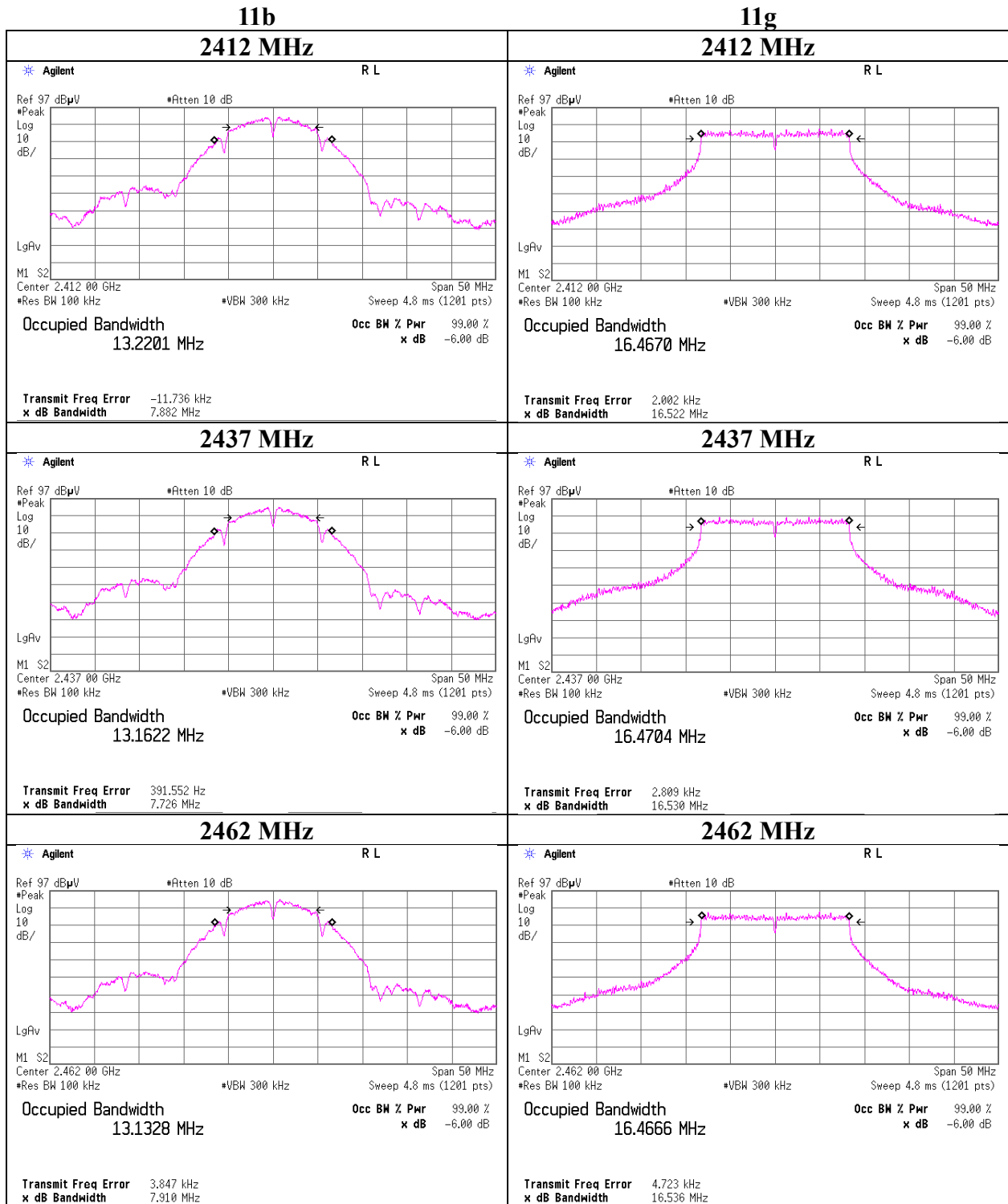
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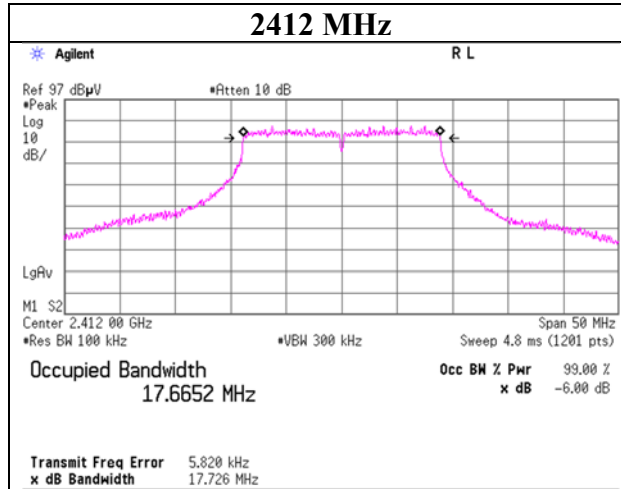
6dB Bandwidth



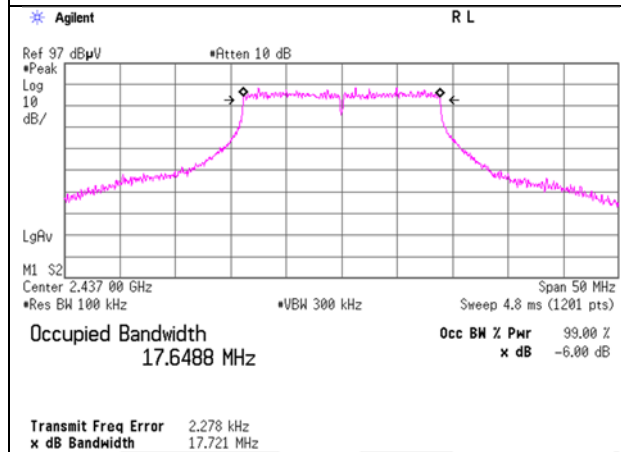
6dB Bandwidth

11n-20

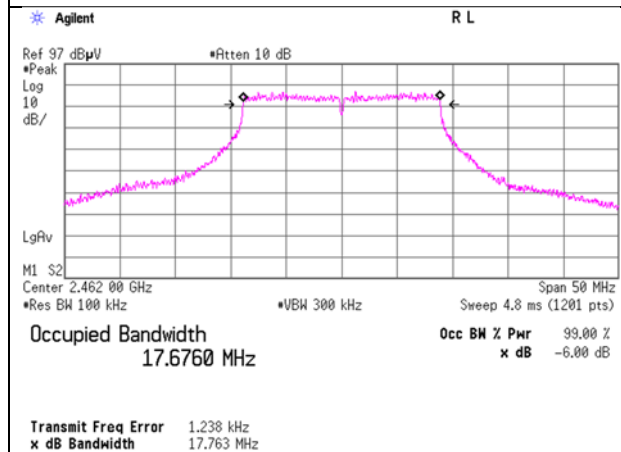
2412 MHz



2437 MHz



2462 MHz



Maximum Peak Output Power

Report No. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 12, 2018
Temperature / Humidity 26 deg. C / 40 % RH
Engineer Kazuya Noda
Mode Tx 11b

11b				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	-4.77	1.74	20.12	17.09	51.17	30.00	1000	12.91	0.45	17.54	56.75	36.02	4000	18.48
2437	-4.68	1.75	20.12	17.19	52.36	30.00	1000	12.81	0.45	17.64	58.08	36.02	4000	18.38
2462	-4.62	1.76	20.12	17.26	53.21	30.00	1000	12.74	0.45	17.71	59.02	36.02	4000	18.31

Sample Calculation:

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

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

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

Rate	Reading	Remark
[Mbps]	[dBm]	
1	-4.89	
2	-4.68	*
5.5	-4.73	
11	-4.69	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 12, 2018
Temperature / Humidity 26 deg. C / 40 % RH
Engineer Kazuya Noda
Mode Tx 11g

11g				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	-1.04	1.74	20.12	20.82	120.78	30.00	1000	9.18	0.45	21.27	133.97	36.02	4000	14.75
2437	0.13	1.75	20.12	22.00	158.49	30.00	1000	8.00	0.45	22.45	175.79	36.02	4000	13.57
2462	-0.86	1.76	20.12	21.02	126.47	30.00	1000	8.98	0.45	21.47	140.28	36.02	4000	14.55

Sample Calculation:

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

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

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

Rate	Reading	Remark
[Mbps]	[dBm]	
6	-3.34	
9	-3.31	
12	-3.33	
18	-3.13	
24	0.11	
36	0.13	*
48	-0.52	
54	-0.32	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 12, 2018
Temperature / Humidity 26 deg. C / 40 % RH
Engineer Kazuya Noda
Mode Tx 11n-20

11n-20				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	-1.02	1.74	20.12	20.84	121.34	30.00	1000	9.16	0.45	21.29	134.59	36.02	4000	14.73
2437	-0.21	1.75	20.12	21.66	146.55	30.00	1000	8.34	0.45	22.11	162.55	36.02	4000	13.91
2462	-0.81	1.76	20.12	21.07	127.94	30.00	1000	8.93	0.45	21.52	141.91	36.02	4000	14.50

Sample Calculation:

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

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

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

MCS Number	Reading [dBm]	Remark
0	-4.25	
1	-4.31	
2	-4.27	
3	-0.38	
4	-0.21	*
5	-0.75	
6	-0.41	
7	-0.33	

*: Worst Rate

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

Average Output Power
(Reference data for RF Exposure)

Report No. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 12, 2018
Temperature / Humidity 26 deg. C / 40 % RH
Engineer Kazuya Noda
Mode Tx

11b 5.5Mbps

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	-6.98	1.74	20.12	14.88	30.76	0.01	14.89	30.83
2437	-7.02	1.75	20.12	14.85	30.55	0.01	14.86	30.62
2462	-6.99	1.76	20.12	14.89	30.83	0.01	14.90	30.90

11g 36 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	-11.41	1.74	20.12	10.45	11.09	0.11	10.56	11.38
2437	-9.38	1.75	20.12	12.49	17.74	0.11	12.60	18.20
2462	-11.40	1.76	20.12	10.48	11.17	0.11	10.59	11.46

11n-20 MCS 6

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	-11.48	1.74	20.12	10.38	10.91	0.16	10.54	11.32
2437	-10.48	1.75	20.12	11.39	13.77	0.16	11.55	14.29
2462	-11.47	1.76	20.12	10.41	10.99	0.16	10.57	11.40

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. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 12, 2018
Temperature / Humidity 26 deg. C / 40 % RH
Engineer Kazuya Noda
Mode Tx

2437 MHz

Mode	Rate Mbps	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11b	1	-7.46	0.00	-7.46	
	2	-7.23	0.01	-7.22	
	5.5	-7.02	0.01	-7.01	*
	11	-7.12	0.03	-7.09	
11g	6	-9.81	0.02	-9.79	
	9	-9.82	0.02	-9.80	
	12	-9.84	0.04	-9.80	
	18	-9.85	0.03	-9.82	
	24	-9.39	0.07	-9.32	
	36	-9.38	0.11	-9.27	*
	48	-9.51	0.14	-9.37	
11n-20	0	-11.07	0.02	-11.05	
	1	-10.96	0.04	-10.92	
	2	-11.04	0.06	-10.98	
	3	-10.45	0.07	-10.38	
	4	-10.46	0.11	-10.35	
	5	-10.48	0.15	-10.33	
	6	-10.48	0.16	-10.32	*
	7	-10.57	0.19	-10.38	

* Worst rate

Sample Calculation:

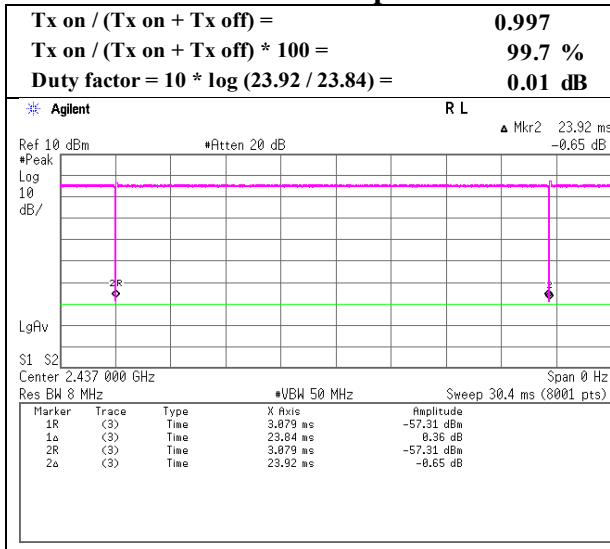
$$\text{Burst power} = \text{Reading (timed average)} + \text{Duty factor}$$

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

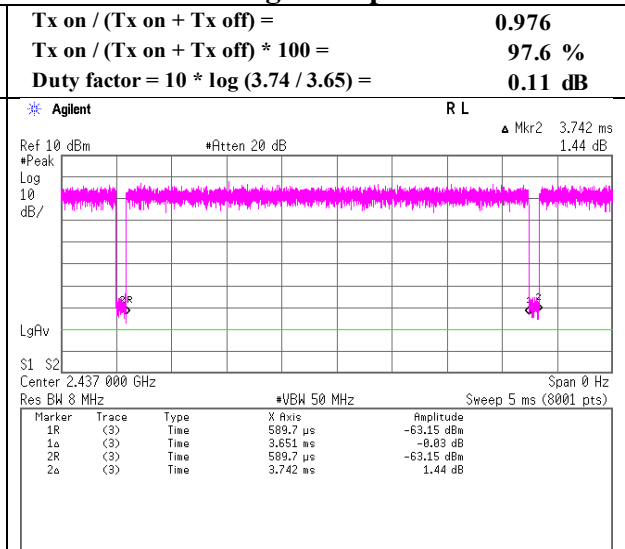
Burst rate confirmation (for Average output power)

Report No. 12559092S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date November 12, 2018
 Temperature / Humidity 26 deg. C / 40 % RH
 Engineer Kazuya Noda
 Mode Tx

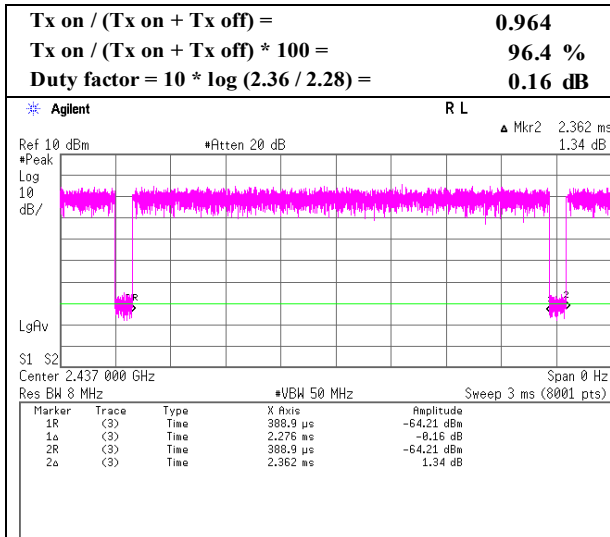
11b 5.5Mbps



11g 36Mbps



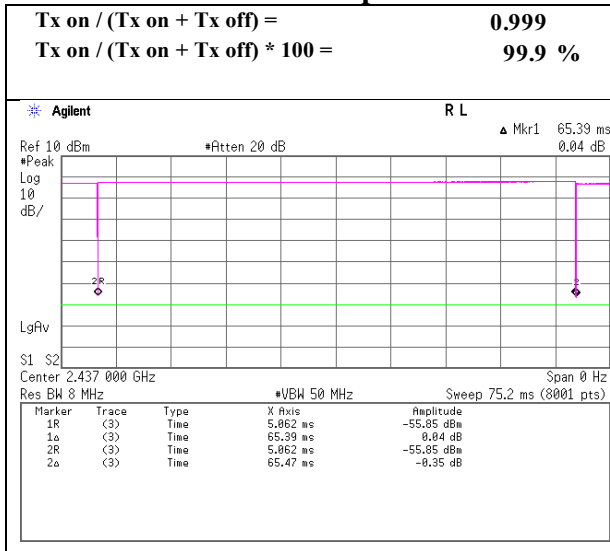
11n-20 MCS 6



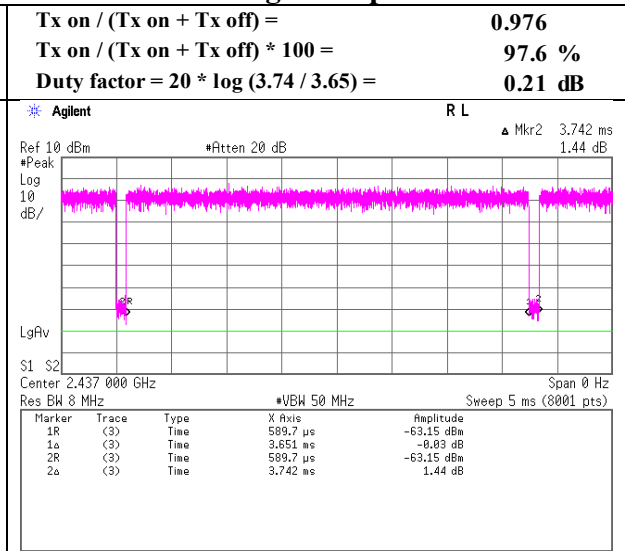
Burst rate confirmation (for Radiated spurious emission)

Report No. 12559092S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date November 12, 2018
 Temperature / Humidity 26 deg. C / 40 % RH
 Engineer Kazuya Noda
 Mode Tx

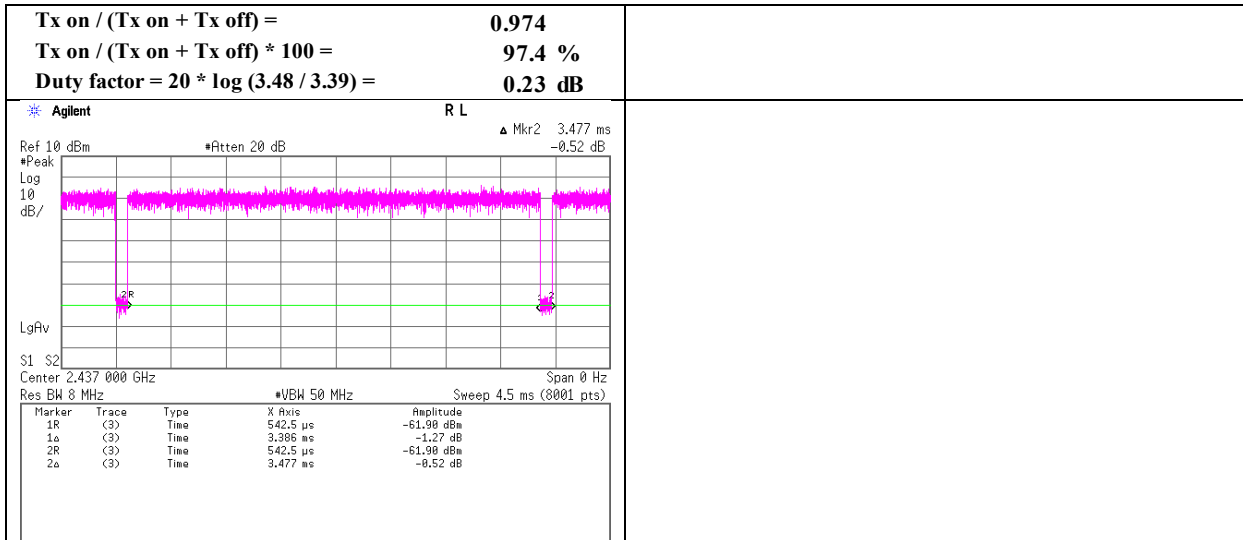
11b 2Mbps



11g 36Mbps



11n-20 MCS 4



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

Radiated Spurious Emission

Report No.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa (1 GHz – 2.8 GHz)	Yosuke Ishikawa (2.8 GHz – 13 GHz)	Shiro Kobayashi (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.	2387.058	PK	51.17	27.85	14.13	39.46	2.10	55.79	73.90	18.1	110	30	
Hori.	2390.000	PK	48.19	27.86	14.13	39.46	2.10	52.82	73.90	21.0	110	30	
Hori.	3330.030	PK	47.08	28.13	5.82	39.33	2.10	43.80	73.90	30.1	100	0	
Hori.	4824.000	PK	46.87	31.46	6.52	39.50	2.10	47.45	73.90	26.4	150	354	
Hori.	7236.000	PK	44.93	36.85	8.34	39.31	2.10	52.91	73.90	20.9	150	0	
Hori.	9648.000	PK	45.97	38.64	9.21	39.49	2.10	56.43	73.90	17.4	150	0	
Hori.	2387.058	AV	45.81	27.85	14.13	39.46	2.10	50.43	53.90	3.4	110	30	
Hori.	2390.000	AV	40.34	27.86	14.13	39.46	2.10	44.97	53.90	8.9	110	30	
Hori.	3330.030	AV	41.18	28.13	5.82	39.33	2.10	37.90	53.90	16.0	100	0	
Hori.	4824.000	AV	39.86	31.46	6.52	39.50	2.10	40.44	53.90	13.4	150	354	
Hori.	7236.000	AV	36.31	36.85	8.34	39.31	2.10	44.29	53.90	9.6	150	0	
Hori.	9648.000	AV	37.96	38.64	9.21	39.49	2.10	48.42	53.90	5.4	150	0	
Vert.	2387.025	PK	47.30	27.85	14.13	39.46	2.10	51.92	73.90	21.9	348	291	
Vert.	2390.000	PK	46.42	27.86	14.13	39.46	2.10	51.05	73.90	22.8	348	291	
Vert.	3330.030	PK	49.62	28.13	5.82	39.33	2.10	46.34	73.90	27.5	150	320	
Vert.	4824.000	PK	46.70	31.46	6.52	39.50	2.10	47.28	73.90	26.6	150	310	
Vert.	7236.000	PK	45.16	36.85	8.34	39.31	2.10	53.14	73.90	20.7	150	0	
Vert.	9648.000	PK	45.57	38.64	9.21	39.49	2.10	56.03	73.90	17.8	150	0	
Vert.	2387.025	AV	37.99	27.85	14.13	39.46	2.10	42.61	53.90	11.2	348	291	
Vert.	2390.000	AV	36.23	27.86	14.13	39.46	2.10	40.86	53.90	13.0	348	291	
Vert.	3330.030	AV	44.11	28.13	5.82	39.33	2.10	40.83	53.90	13.0	150	320	
Vert.	4824.000	AV	38.74	31.46	6.52	39.50	2.10	39.32	53.90	14.5	150	310	
Vert.	7236.000	AV	36.51	36.85	8.34	39.31	2.10	44.49	53.90	9.4	150	0	
Vert.	9648.000	AV	38.16	38.64	9.21	39.49	2.10	48.62	53.90	5.2	150	0	

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

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

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

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	97.09	27.85	14.15	39.46	2.10	101.73	-	-	Carrier
Hori.	2398.158	PK	60.15	27.86	14.14	39.46	2.10	64.79	81.73	16.9	
Hori.	2400.000	PK	53.58	27.86	14.14	39.46	2.10	58.22	81.73	23.5	
Vert.	2412.000	PK	86.36	27.85	14.15	39.46	2.10	91.00	-	-	Carrier
Vert.	2398.058	PK	45.18	27.86	14.14	39.46	2.10	49.82	71.00	21.1	
Vert.	2400.000	PK	42.50	27.86	14.14	39.46	2.10	47.14	71.00	23.8	

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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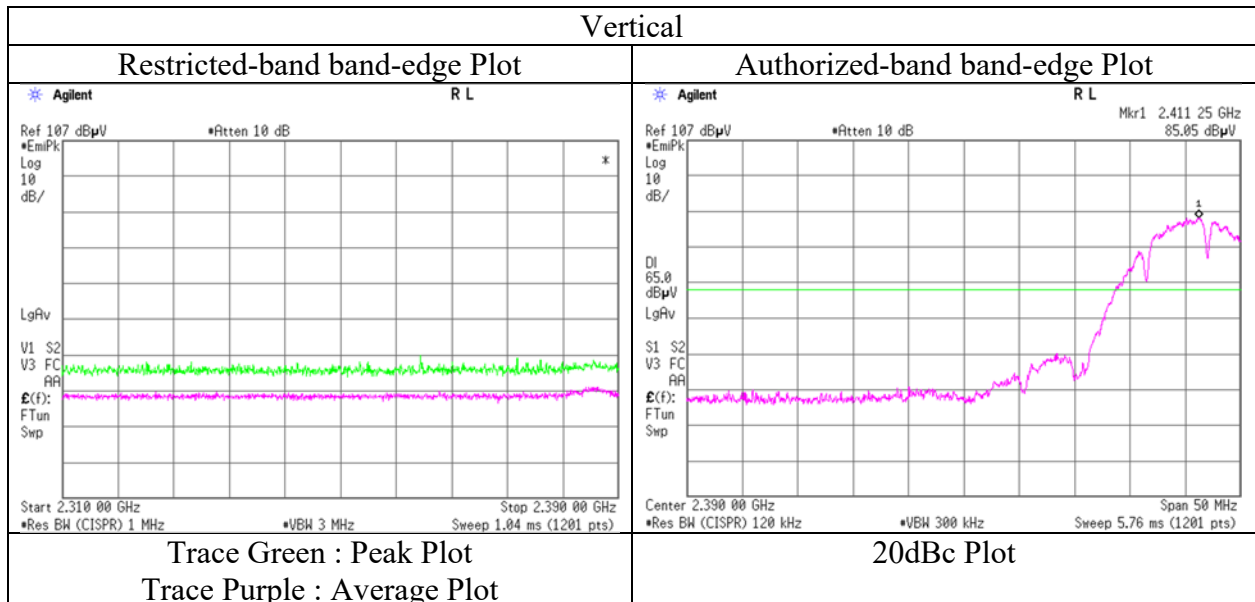
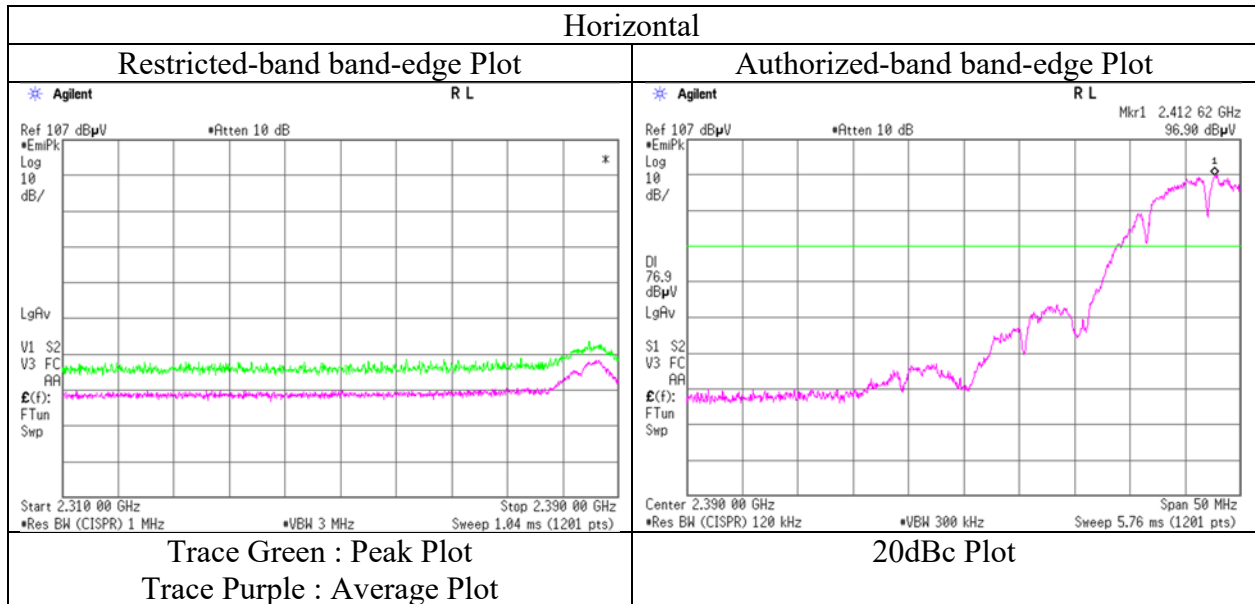
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(1 GHz – 2.8 GHz)
Mode Tx 11b 2412 MHz



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

Radiated Spurious Emission

Report No.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	Shiro Kobayashi
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11b 2437 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	3330.004	PK	47.47	28.13	5.82	39.33	2.10	44.19	73.90	29.7	141	283	
Hori.	4874.000	PK	46.24	31.40	6.52	39.50	2.10	46.76	73.90	27.1	129	0	
Hori.	7311.000	PK	43.93	36.99	8.40	39.35	2.10	52.07	73.90	21.8	100	0	
Hori.	9748.000	PK	44.96	38.92	9.22	39.42	2.10	55.78	73.90	18.1	100	0	
Hori.	3330.004	AV	41.47	28.13	5.82	39.33	2.10	38.19	53.90	15.7	141	283	
Hori.	4874.000	AV	40.05	31.40	6.52	39.50	2.10	40.57	53.90	13.3	129	0	
Hori.	7311.000	AV	35.88	36.99	8.40	39.35	2.10	44.02	53.90	9.8	100	0	
Hori.	9748.000	AV	37.10	38.92	9.22	39.42	2.10	47.92	53.90	5.9	100	0	
Vert.	3330.004	PK	49.05	28.13	5.82	39.33	2.10	45.77	73.90	28.1	114	314	
Vert.	4874.000	PK	45.84	31.40	6.52	39.50	2.10	46.36	73.90	27.5	120	306	
Vert.	7311.000	PK	43.27	36.99	8.40	39.35	2.10	51.41	73.90	22.4	150	0	
Vert.	9748.000	PK	44.88	38.92	9.22	39.42	2.10	55.70	73.90	18.2	150	0	
Vert.	3330.004	AV	44.06	28.13	5.82	39.33	2.10	40.78	53.90	13.1	114	314	
Vert.	4874.000	AV	38.99	31.40	6.52	39.50	2.10	39.51	53.90	14.3	120	306	
Vert.	7311.000	AV	35.72	36.99	8.40	39.35	2.10	43.86	53.90	10.0	150	0	
Vert.	9748.000	AV	37.02	38.92	9.22	39.42	2.10	47.84	53.90	6.0	150	0	

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

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

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

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Radiated Spurious Emission

Report No.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	Shiro Kobayashi
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11b 2462 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	48.16	27.65	14.22	39.46	0.00	50.57	73.90	23.3	103	35	
Hori.	3330.000	PK	47.81	28.13	5.82	39.33	2.10	44.53	73.90	29.3	138	262	
Hori.	4924.000	PK	47.36	31.37	6.54	39.50	2.10	47.87	73.90	26.0	152	337	
Hori.	7386.000	PK	44.19	37.01	8.46	39.39	2.10	52.37	73.90	21.5	150	0	
Hori.	9848.000	PK	44.68	39.12	9.23	39.35	2.10	55.78	73.90	18.1	150	0	
Hori.	2483.500	AV	39.68	27.65	14.22	39.46	0.00	42.09	53.90	11.8	103	35	
Hori.	3330.000	AV	40.80	28.13	5.82	39.33	2.10	37.52	53.90	16.3	138	262	
Hori.	4924.000	AV	41.57	31.37	6.54	39.50	2.10	42.08	53.90	11.8	152	337	
Hori.	7386.000	AV	36.33	37.01	8.46	39.39	2.10	44.51	53.90	9.3	150	0	
Hori.	9848.000	AV	36.62	39.12	9.23	39.35	2.10	47.72	53.90	6.1	150	0	
Vert.	2483.500	PK	45.45	27.65	14.22	39.46	0.00	47.86	73.90	26.0	103	140	
Vert.	3330.000	PK	50.09	28.13	5.82	39.33	2.10	46.81	73.90	27.0	138	316	
Vert.	4924.000	PK	46.44	31.37	6.54	39.50	2.10	46.95	73.90	26.9	152	36	
Vert.	7386.000	PK	43.99	37.01	8.46	39.39	2.10	52.17	73.90	21.7	150	0	
Vert.	9848.000	PK	44.24	39.12	9.23	39.35	2.10	55.34	73.90	18.5	150	0	
Vert.	2483.500	AV	36.73	27.65	14.22	39.46	0.00	39.14	53.90	14.7	103	140	
Vert.	3330.000	AV	44.67	28.13	5.82	39.33	2.10	41.39	53.90	12.5	138	316	
Vert.	4924.000	AV	39.64	31.37	6.54	39.50	2.10	40.15	53.90	13.7	152	36	
Vert.	7386.000	AV	36.27	37.01	8.46	39.39	2.10	44.45	53.90	9.4	150	0	
Vert.	9848.000	AV	36.79	39.12	9.23	39.35	2.10	47.89	53.90	6.0	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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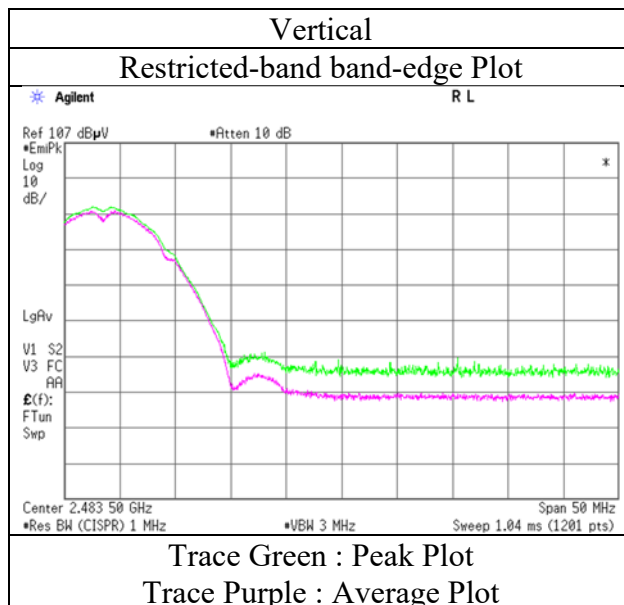
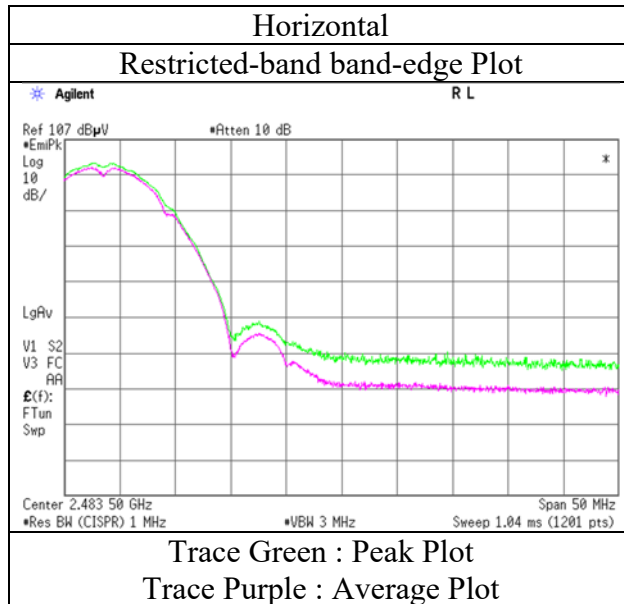
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(1 GHz – 2.8 GHz)
Mode Tx 11b 2462 MHz



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

Radiated Spurious Emission

Report No.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	Shiro Kobayashi
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11g 2412 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	55.28	27.86	14.13	39.46	2.10	59.91	73.90	13.9	111	32	
Hori.	3330.007	PK	48.01	28.13	5.82	39.33	2.10	44.73	73.90	29.1	138	258	
Hori.	4824.000	PK	44.95	31.46	6.52	39.50	2.10	45.53	73.90	28.3	150	0	
Hori.	7236.000	PK	44.45	36.85	8.34	39.31	2.10	52.43	73.90	21.4	150	0	
Hori.	9648.000	PK	45.79	38.64	9.21	39.49	2.10	56.25	73.90	17.6	150	0	
Hori.	3330.007	AV	40.72	28.13	5.82	39.33	2.10	37.44	53.90	16.4	138	258	
Vert.	2390.000	PK	46.26	27.86	14.13	39.46	2.10	50.89	73.90	23.0	324	346	
Vert.	3330.007	PK	49.60	28.13	5.82	39.33	2.10	46.32	73.90	27.5	136	316	
Vert.	4824.000	PK	44.17	31.46	6.52	39.50	2.10	44.75	73.90	29.1	150	0	
Vert.	7236.000	PK	44.75	36.85	8.34	39.31	2.10	52.73	73.90	21.1	150	0	
Vert.	9648.000	PK	45.47	38.64	9.21	39.49	2.10	55.93	73.90	17.9	150	0	
Vert.	3330.007	AV	43.91	28.13	5.82	39.33	2.10	40.63	53.90	13.2	136	316	

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	42.60	27.86	14.13	39.46	0.21	2.10	47.44	53.90	6.4	*1)
Hori.	4824.000	AV	36.82	31.46	6.52	39.50	0.21	2.10	37.61	53.90	16.2	
Hori.	7236.000	AV	37.08	36.85	8.34	39.31	0.21	2.10	45.27	53.90	8.6	
Hori.	9648.000	AV	37.98	38.64	9.21	39.49	0.21	2.10	48.65	53.90	5.2	
Vert.	2390.000	AV	36.96	27.86	14.13	39.46	0.21	2.10	41.80	53.90	12.1	*1)
Vert.	4824.000	AV	37.01	31.46	6.52	39.50	0.21	2.10	37.80	53.90	16.1	
Vert.	7236.000	AV	37.06	36.85	8.34	39.31	0.21	2.10	45.25	53.90	8.6	
Vert.	9648.000	AV	38.09	38.64	9.21	39.49	0.21	2.10	48.76	53.90	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 : 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	90.16	27.85	14.15	39.46	2.10	94.80	-	-	Carrier
Hori.	2400.000	PK	57.17	27.86	14.14	39.46	2.10	61.81	74.80	12.9	
Vert.	2412.000	PK	78.47	27.85	14.15	39.46	2.10	83.11	-	-	Carrier
Vert.	2400.000	PK	43.03	27.86	14.14	39.46	2.10	47.67	63.11	15.4	

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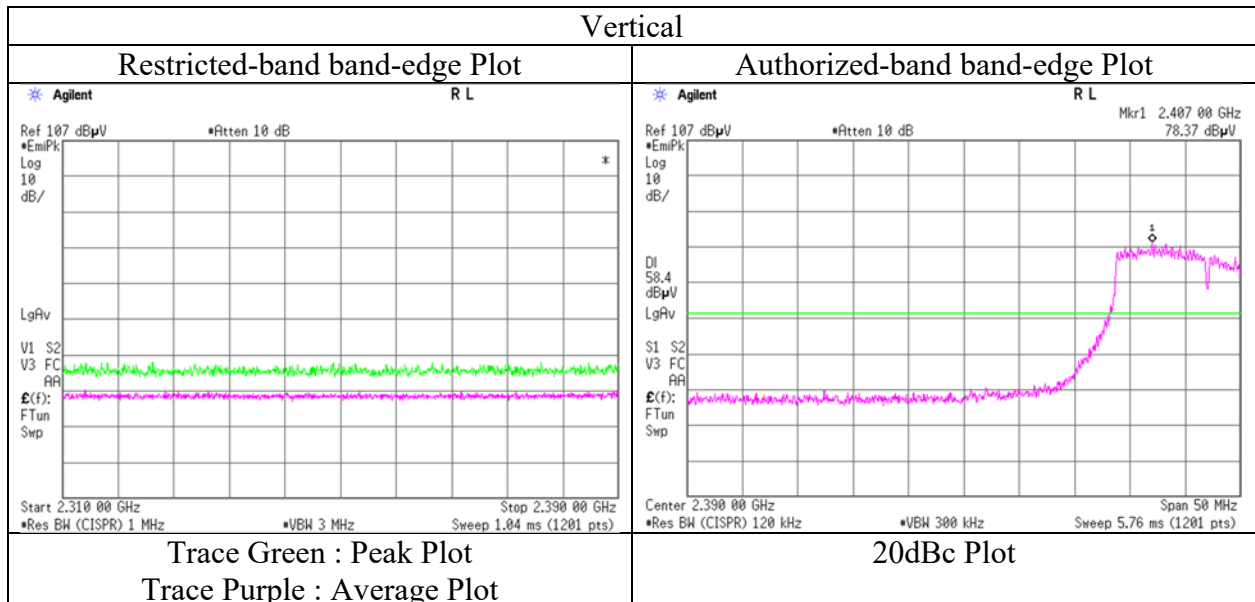
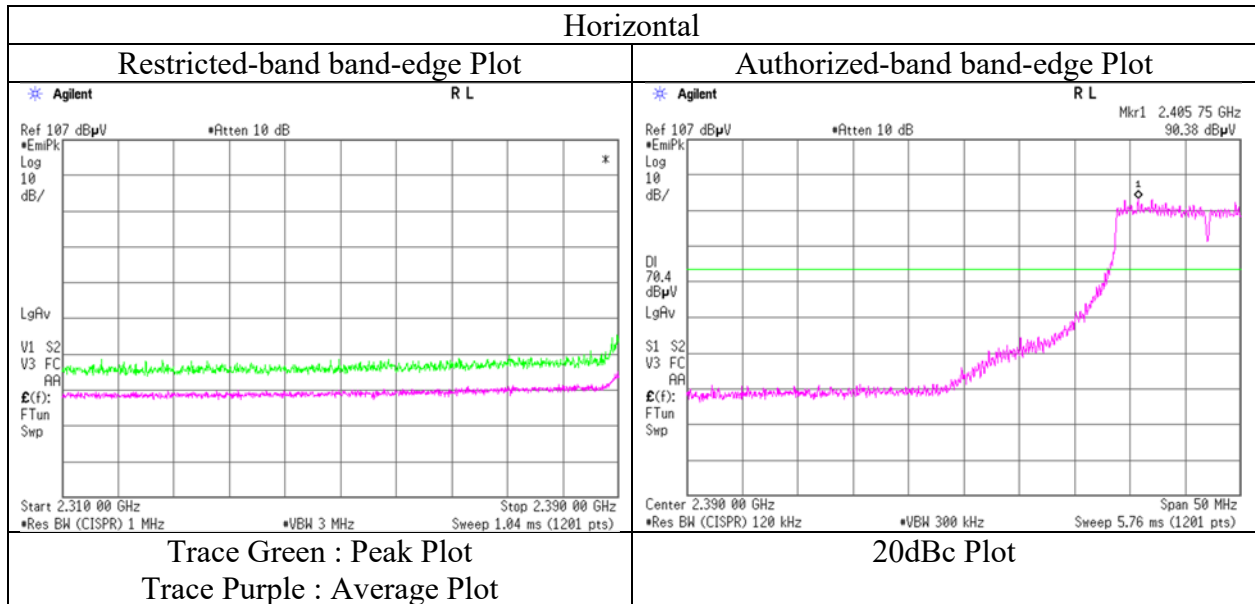
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(1 GHz – 2.8 GHz)
Mode Tx 11g 2412 MHz



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

Radiated Spurious Emission

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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	53.76	27.86	14.13	39.46	2.10	58.39	73.90	15.5	131	29	
Vert.	2390.000	PK	46.02	27.86	14.13	39.46	2.10	50.65	73.90	23.2	355	352	

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	39.30	27.86	14.13	39.46	0.21	2.10	44.14	53.90	9.7	*1)
Vert.	2390.000	AV	36.52	27.86	14.13	39.46	0.21	2.10	41.36	53.90	12.5	*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 : 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	91.45	27.84	14.15	39.46	2.10	96.08	-	-	
Hori.	2400.000	PK	53.96	27.86	14.14	39.46	2.10	58.60	76.08	17.4	
Vert.	2417.000	PK	80.98	27.84	14.15	39.46	2.10	85.61	-	-	
Vert.	2400.000	PK	39.60	27.86	14.14	39.46	2.10	44.24	65.61	21.3	

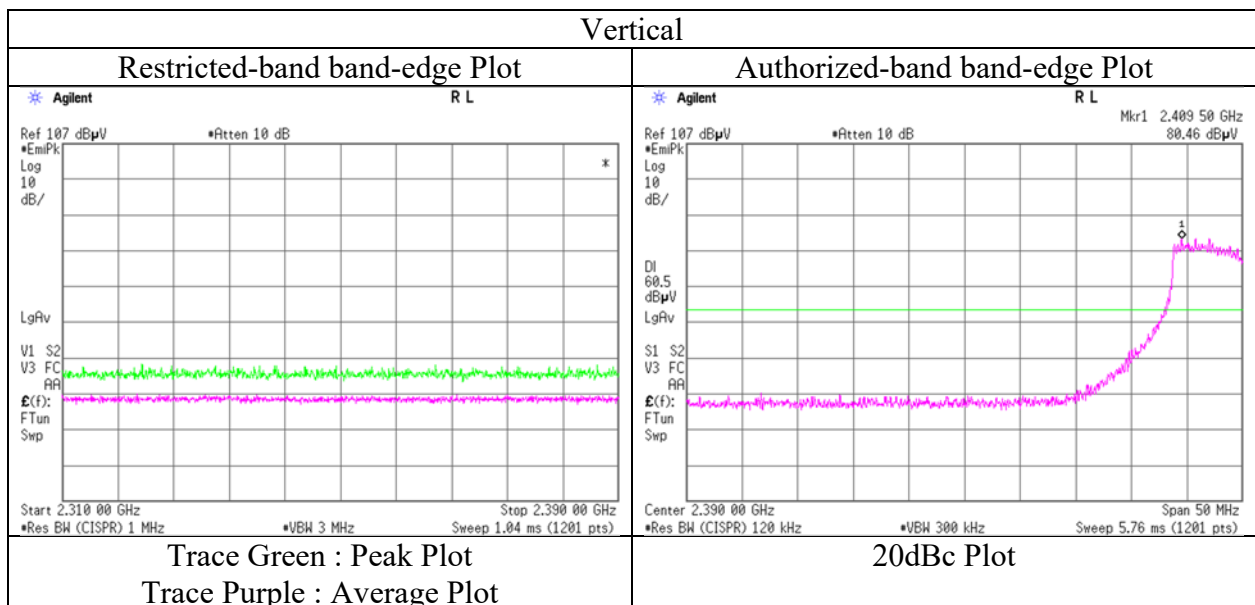
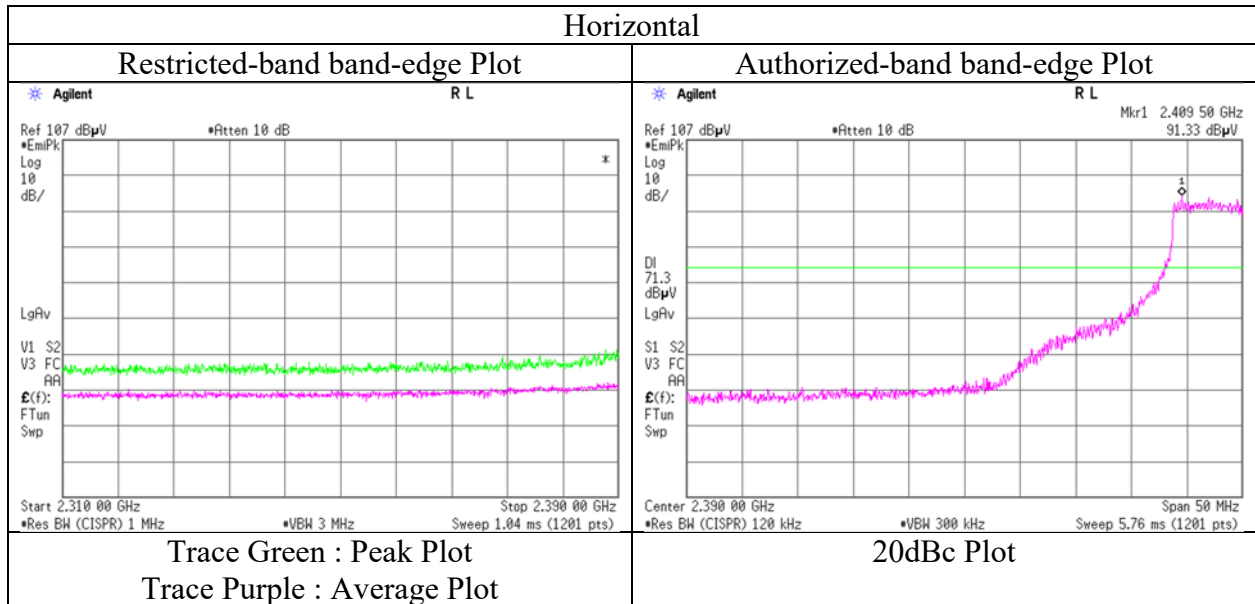
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log(3.82 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. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3 3 3
Date November 22,2018 November 20, 2018 November 21, 2018 November 22, 2018
Temperature / Humidity 23 deg. C / 34 %RH 24 deg. C / 33 %RH 23 deg. C / 35 %RH 23 deg. C / 34 %RH
Engineer Yosuke Ishikawa Yosuke Ishikawa Yosuke Ishikawa Shiro Kobayashi
(30 MHz – 1000 MHz) (1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11g 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	51.592	QP	23.02	10.66	6.77	32.19	0.00	8.26	40.00	31.7	100	1	
Hori.	332.995	QP	29.54	14.73	8.92	31.97	0.00	21.22	46.00	24.7	100	134	
Hori.	432.034	QP	25.55	16.37	9.38	31.97	0.00	19.33	46.00	26.6	100	132	
Hori.	666.006	QP	36.02	19.43	10.25	31.94	0.00	33.76	46.00	12.2	147	216	
Hori.	3330.000	PK	47.64	28.13	5.82	39.33	2.10	44.36	73.90	29.5	153	283	
Hori.	4874.000	PK	44.18	31.40	6.52	39.50	2.10	44.70	73.90	29.2	150	0	
Hori.	7311.000	PK	44.87	36.99	8.40	39.35	2.10	53.01	73.90	20.8	150	0	
Hori.	9748.000	PK	45.19	38.92	9.22	39.42	2.10	56.01	73.90	17.8	150	0	
Hori.	3330.000	AV	41.46	28.13	5.82	39.33	2.10	38.18	53.90	15.7	153	283	
Vert.	35.561	QP	22.84	16.55	6.56	32.20	0.00	13.75	40.00	26.2	100	358	
Vert.	284.361	QP	30.40	13.42	8.61	32.01	0.00	20.42	46.00	25.5	223	199	
Vert.	494.973	QP	22.67	17.72	9.60	31.96	0.00	18.03	46.00	27.9	100	359	
Vert.	666.001	QP	39.25	19.43	10.25	31.94	0.00	36.99	46.00	9.0	100	1	
Vert.	3330.000	PK	49.17	28.13	5.82	39.33	2.10	45.89	73.90	28.0	100	314	
Vert.	4874.000	PK	45.30	31.40	6.52	39.50	2.10	45.82	73.90	28.0	150	0	
Vert.	7311.000	PK	43.99	36.99	8.40	39.35	2.10	52.13	73.90	21.7	150	0	
Vert.	9748.000	PK	45.33	38.92	9.22	39.42	2.10	56.15	73.90	17.7	150	0	
Vert.	3330.000	AV	44.35	28.13	5.82	39.33	2.10	41.07	53.90	12.8	100	314	

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	36.85	31.40	6.52	39.50	0.21	2.10	37.58	53.90	16.3	
Hori.	7311.000	AV	36.66	36.99	8.40	39.35	0.21	2.10	45.01	53.90	8.8	
Hori.	9748.000	AV	37.43	38.92	9.22	39.42	0.21	2.10	48.46	53.90	5.4	
Vert.	4874.000	AV	37.01	31.40	6.52	39.50	0.21	2.10	37.74	53.90	16.1	
Vert.	7311.000	AV	36.31	36.99	8.40	39.35	0.21	2.10	44.66	53.90	9.2	
Vert.	9748.000	AV	37.58	38.92	9.22	39.42	0.21	2.10	48.61	53.90	5.2	

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.

Radiated Spurious Emission

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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	48.36	27.65	14.22	39.46	2.10	52.87	73.90	21.0	103	359	
Vert.	2483.500	PK	46.30	27.65	14.22	39.46	2.10	50.81	73.90	23.0	104	140	

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	39.80	27.65	14.22	39.46	0.21	2.10	44.52	53.90	9.3	*1)
Vert.	2483.500	AV	36.93	27.65	14.22	39.46	0.21	2.10	41.65	53.90	12.2	*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.

UL Japan, Inc.

Shonan EMC Lab.

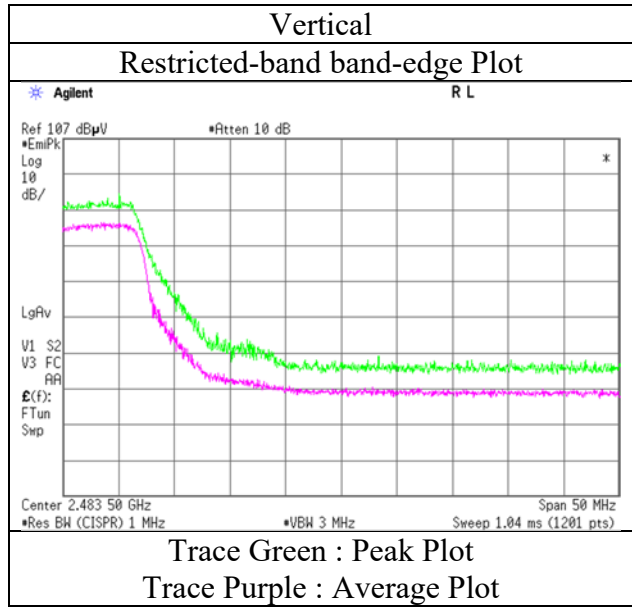
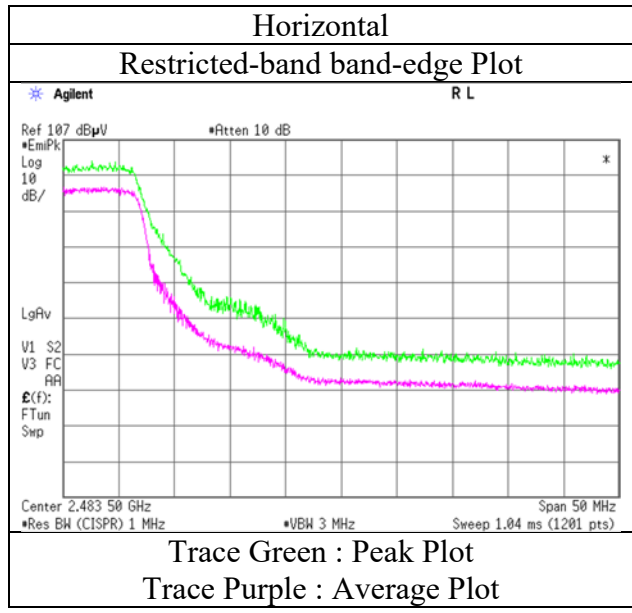
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	Shiro Kobayashi
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11g 2462 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	52.34	27.65	14.22	39.46	2.10	56.85	73.90	17.0	105	34	
Hori.	3330.000	PK	47.81	28.13	5.82	39.33	2.10	44.53	73.90	29.3	146	283	
Hori.	4924.000	PK	45.08	31.37	6.54	39.50	2.10	45.59	73.90	28.3	150	0	
Hori.	7386.000	PK	44.82	37.01	8.46	39.39	2.10	53.00	73.90	20.9	150	0	
Hori.	9848.000	PK	43.68	39.12	9.23	39.35	2.10	54.78	73.90	19.1	150	0	
Hori.	3330.000	AV	41.46	28.13	5.82	39.33	2.10	38.18	53.90	15.7	146	283	
Vert.	2483.500	PK	46.15	27.65	14.22	39.46	2.10	50.66	73.90	23.2	100	140	
Vert.	3330.000	PK	49.11	28.13	5.82	39.33	2.10	45.83	73.90	28.0	100	314	
Vert.	4924.000	PK	46.22	31.37	6.54	39.50	2.10	46.73	73.90	27.1	150	0	
Vert.	7386.000	PK	44.31	37.01	8.46	39.39	2.10	52.49	73.90	21.4	150	0	
Vert.	9848.000	PK	44.52	39.12	9.23	39.35	2.10	55.62	73.90	18.2	150	0	
Vert.	3330.000	AV	43.92	28.13	5.82	39.33	2.10	40.64	53.90	13.2	100	314	

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	41.71	27.65	14.22	39.46	0.21	2.10	46.43	53.90	7.4	*1)
Hori.	4924.000	AV	37.17	31.37	6.54	39.50	0.21	2.10	37.89	53.90	16.0	
Hori.	7386.000	AV	36.15	37.01	8.46	39.39	0.21	2.10	44.54	53.90	9.3	
Hori.	9848.000	AV	36.48	39.12	9.23	39.35	0.21	2.10	47.79	53.90	6.1	
Vert.	2483.500	AV	37.23	27.65	14.22	39.46	0.21	2.10	41.95	53.90	11.9	*1)
Vert.	4924.000	AV	37.02	31.37	6.54	39.50	0.21	2.10	37.74	53.90	16.1	
Vert.	7386.000	AV	36.17	37.01	8.46	39.39	0.21	2.10	44.56	53.90	9.3	
Vert.	9848.000	AV	36.51	39.12	9.23	39.35	0.21	2.10	47.82	53.90	6.0	

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(3.82 m / 3.0 m) = 2.10 dB

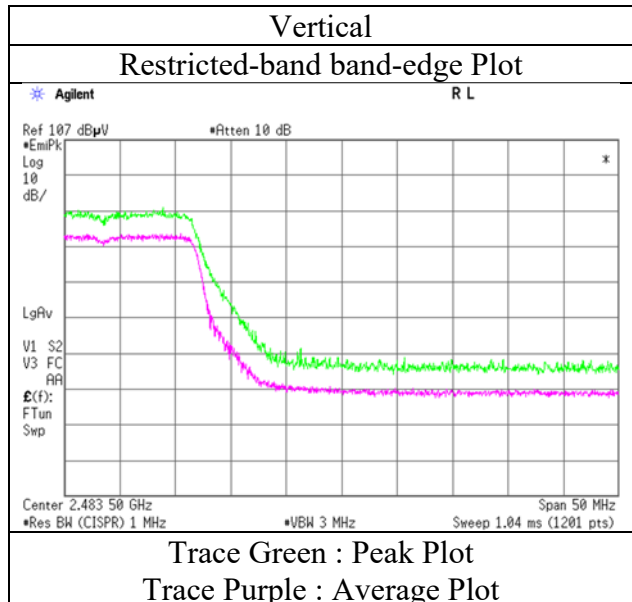
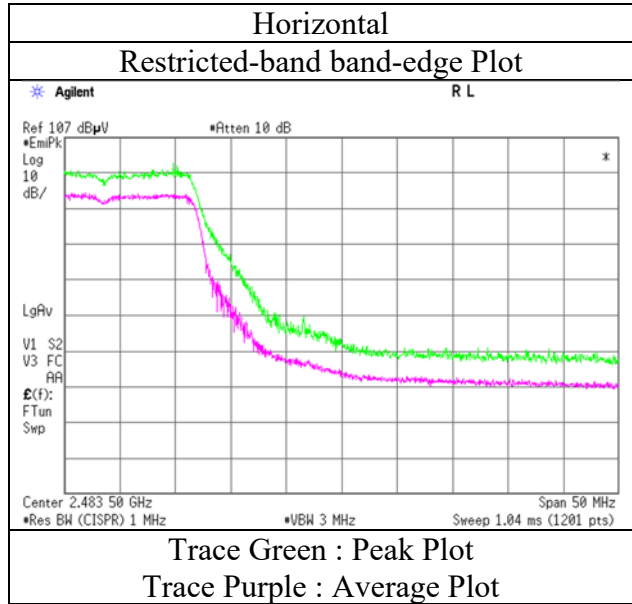
13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(1 GHz – 2.8 GHz)
Mode Tx 11g 2462 MHz



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

Radiated Spurious Emission

Report No.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	Shiro Kobayashi
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11n-20 2412 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	57.83	27.86	14.13	39.46	2.10	62.46	73.90	11.4	112	33	
Hori.	3330.002	PK	47.68	28.13	5.82	39.33	2.10	44.40	73.90	29.5	149	285	
Hori.	4824.000	PK	45.05	31.46	6.52	39.50	2.10	45.63	73.90	28.2	150	0	
Hori.	7236.000	PK	44.07	36.85	8.34	39.31	2.10	52.05	73.90	21.8	150	0	
Hori.	9648.000	PK	45.81	38.64	9.21	39.49	2.10	56.27	73.90	17.6	150	0	
Hori.	3330.002	AV	41.67	28.13	5.82	39.33	2.10	38.39	53.90	15.5	149	285	
Vert.	2390.000	PK	50.04	27.86	14.13	39.46	2.10	54.67	73.90	19.2	365	243	
Vert.	3330.002	PK	48.50	28.13	5.82	39.33	2.10	45.22	73.90	28.6	100	315	
Vert.	4824.000	PK	45.28	31.46	6.52	39.50	2.10	45.86	73.90	28.0	150	0	
Vert.	7236.000	PK	44.25	36.85	8.34	39.31	2.10	52.23	73.90	21.6	150	0	
Vert.	9648.000	PK	46.01	38.64	9.21	39.49	2.10	56.47	73.90	17.4	150	0	
Vert.	3330.002	AV	43.61	28.13	5.82	39.33	2.10	40.33	53.90	13.5	100	315	

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	42.80	27.86	14.13	39.46	0.23	2.10	47.66	53.90	6.2	*1)
Hori.	4824.000	AV	36.91	31.46	6.52	39.50	0.23	2.10	37.72	53.90	16.1	
Hori.	7236.000	AV	37.00	36.85	8.34	39.31	0.23	2.10	45.21	53.90	8.6	
Hori.	9648.000	AV	38.02	38.64	9.21	39.49	0.23	2.10	48.71	53.90	5.1	
Vert.	2390.000	AV	38.83	27.86	14.13	39.46	0.23	2.10	43.69	53.90	10.2	*1)
Vert.	4824.000	AV	36.93	31.46	6.52	39.50	0.23	2.10	37.74	53.90	16.1	
Vert.	7236.000	AV	37.14	36.85	8.34	39.31	0.23	2.10	45.35	53.90	8.5	
Vert.	9648.000	AV	38.22	38.64	9.21	39.49	0.23	2.10	48.91	53.90	4.9	

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.	2412.000	PK	90.03	27.85	14.15	39.46	2.10	94.67	-	-	Carrier
Hori.	2400.000	PK	56.96	27.86	14.14	39.46	2.10	61.60	74.67	13.0	
Vert.	2412.000	PK	80.65	27.85	14.15	39.46	2.10	85.29	-	-	Carrier
Vert.	2400.000	PK	47.14	27.86	14.14	39.46	2.10	51.78	65.29	13.5	

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

UL Japan, Inc.

Shonan EMC Lab.

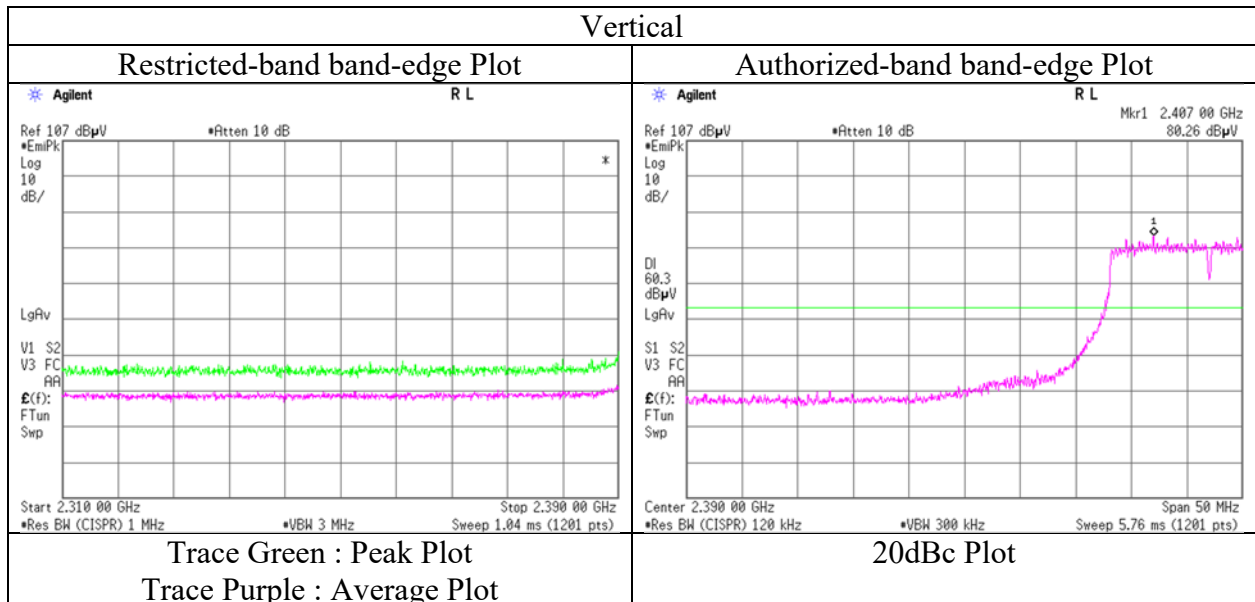
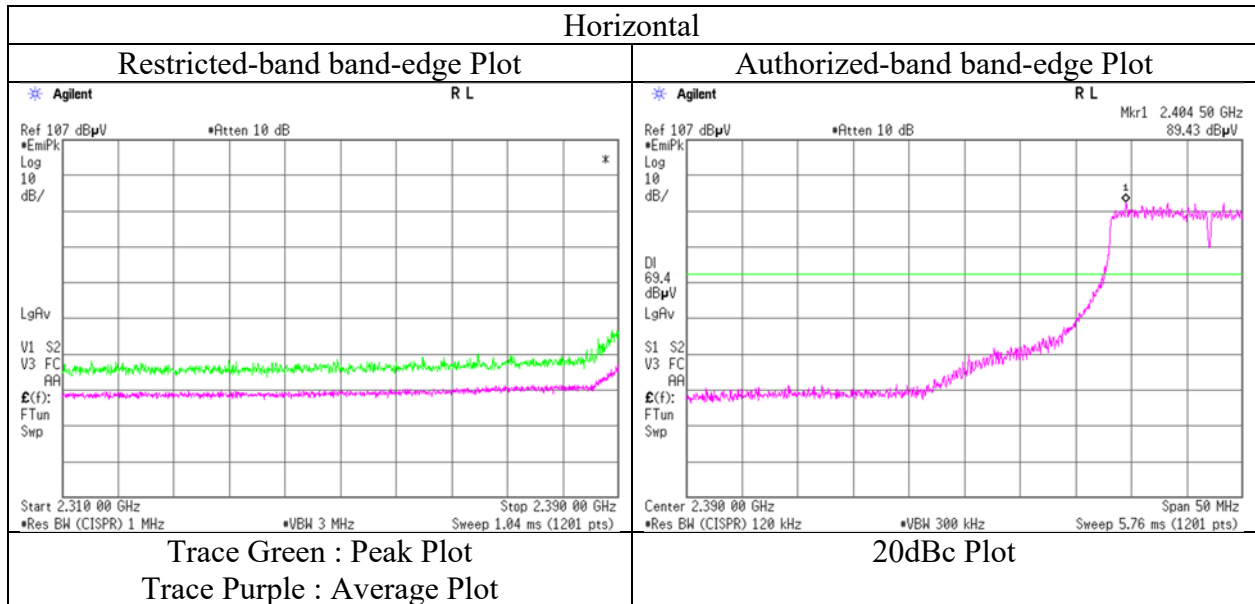
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2412 MHz



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

Radiated Spurious Emission

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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	51.16	27.86	14.13	39.46	2.10	55.79	73.90	18.1	109	31	
Vert.	2390.000	PK	45.83	27.86	14.13	39.46	2.10	50.46	73.90	23.4	364	238	

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	38.98	27.86	14.13	39.46	0.23	2.10	43.84	53.90	10.0	*1)
Vert.	2390.000	AV	36.76	27.86	14.13	39.46	0.23	2.10	41.62	53.90	12.2	*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	91.40	27.84	14.15	39.46	2.10	96.03	-	-	
Hori.	2400.000	PK	51.24	27.86	14.14	39.46	2.10	55.88	76.03	20.1	
Vert.	2417.000	PK	79.53	27.84	14.15	39.46	2.10	84.16	-	-	
Vert.	2400.000	PK	41.32	27.86	14.14	39.46	2.10	45.96	64.16	18.2	

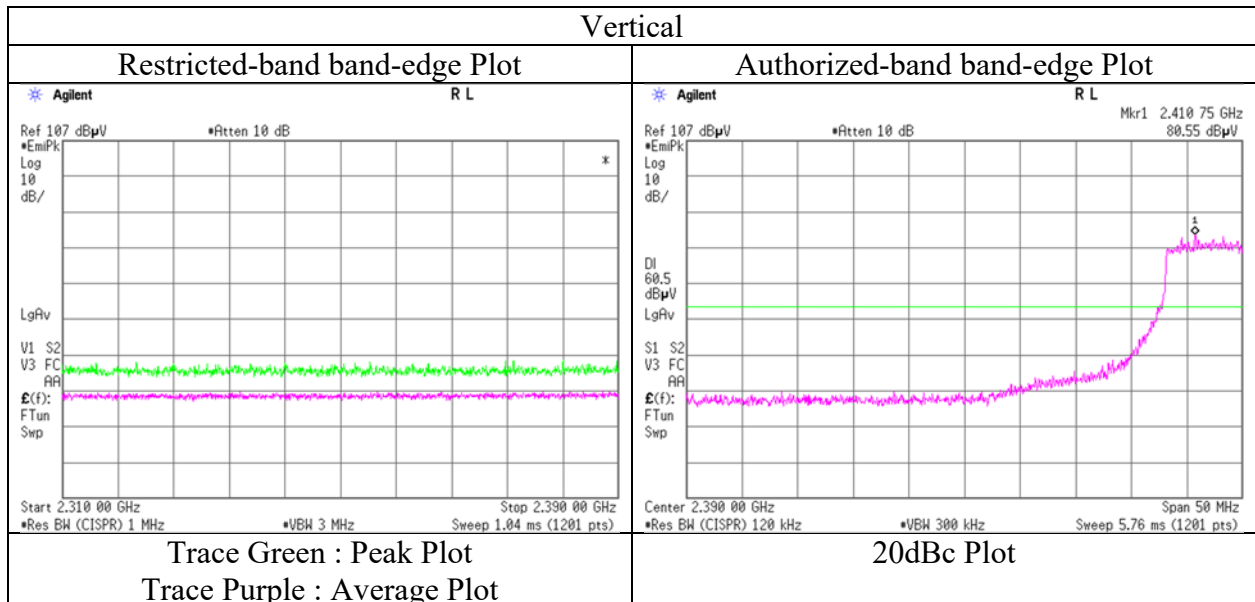
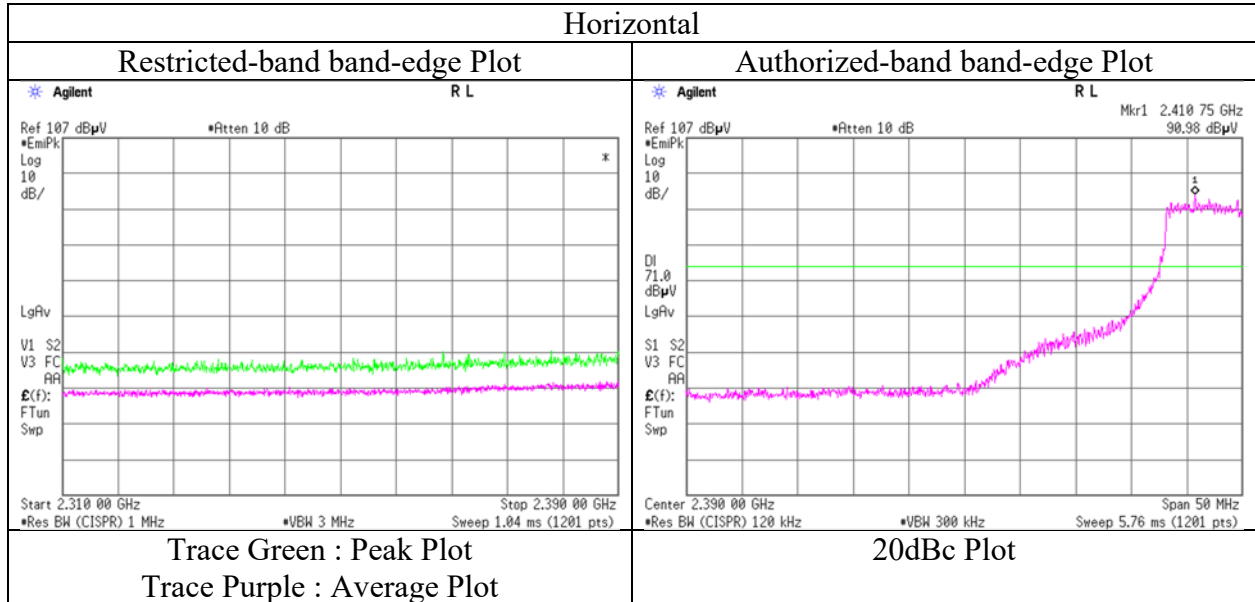
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

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. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	Shiro Kobayashi
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11n-20 2437 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	3330.002	PK	47.26	28.13	5.82	39.33	2.10	43.98	73.90	29.9	145	283	
Hori.	4874.000	PK	44.63	31.40	6.52	39.50	2.10	45.15	73.90	28.7	150	0	
Hori.	7311.000	PK	43.98	36.99	8.40	39.35	2.10	52.12	73.90	21.7	150	0	
Hori.	9748.000	PK	45.32	38.92	9.22	39.42	2.10	56.14	73.90	17.7	150	0	
Hori.	3330.002	AV	40.97	28.13	5.82	39.33	2.10	37.69	53.90	16.2	145	283	
Vert.	3330.002	PK	48.57	28.13	5.82	39.33	2.10	45.29	73.90	28.6	127	312	
Vert.	4874.000	PK	44.99	31.40	6.52	39.50	2.10	45.51	73.90	28.3	150	0	
Vert.	7311.000	PK	44.69	36.99	8.40	39.35	2.10	52.83	73.90	21.0	150	0	
Vert.	9748.000	PK	45.53	38.92	9.22	39.42	2.10	56.35	73.90	17.5	150	0	
Vert.	3330.002	AV	43.48	28.13	5.82	39.33	2.10	40.20	53.90	13.7	127	312	

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	36.79	31.40	6.52	39.50	0.23	2.10	37.54	53.90	16.3	
Hori.	7311.000	AV	36.38	36.99	8.40	39.35	0.23	2.10	44.75	53.90	9.1	
Hori.	9748.000	AV	37.28	38.92	9.22	39.42	0.23	2.10	48.33	53.90	5.5	
Vert.	4874.000	AV	37.29	31.40	6.52	39.50	0.23	2.10	38.04	53.90	15.8	
Vert.	7311.000	AV	36.65	36.99	8.40	39.35	0.23	2.10	45.02	53.90	8.8	
Vert.	9748.000	AV	37.47	38.92	9.22	39.42	0.23	2.10	48.52	53.90	5.3	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.82 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.

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Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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	49.41	27.65	14.22	39.46	2.10	53.92	73.90	19.9	102	39	
Vert.	2483.500	PK	46.11	27.65	14.22	39.46	2.10	50.62	73.90	23.2	100	140	

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	40.22	27.65	14.22	39.46	0.23	2.10	44.96	53.90	8.9	*1)
Vert.	2483.500	AV	37.00	27.65	14.22	39.46	0.23	2.10	41.74	53.90	12.1	*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 : $20\log(3.82\text{ m} / 3.0\text{ m}) = 2.10\text{ dB}$

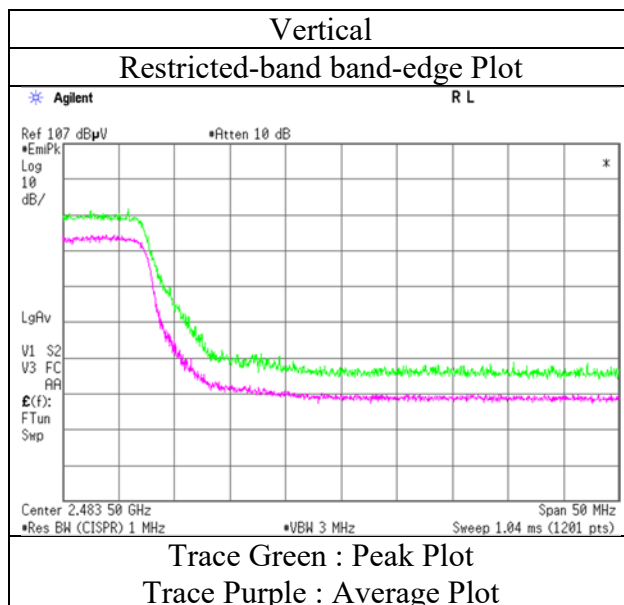
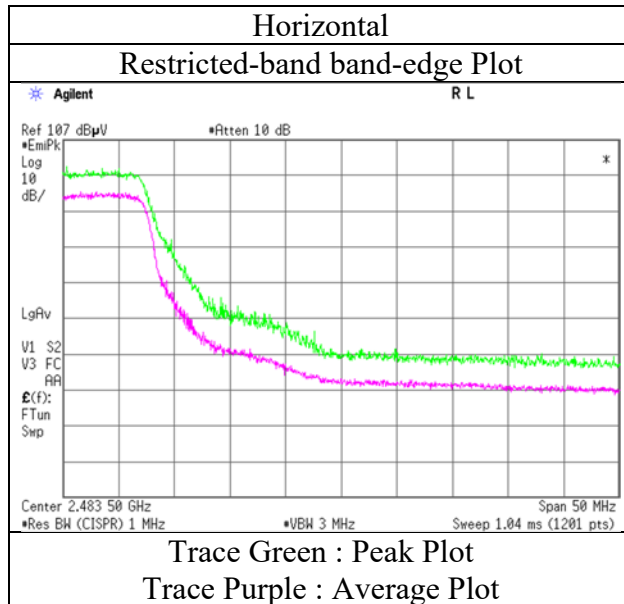
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(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.	12559092S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	3	3
Date	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	Shiro Kobayashi
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11n-20 2462 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	53.59	27.65	14.22	39.46	2.10	58.10	73.90	15.8	102	5	
Hori.	3330.006	PK	47.61	28.13	5.82	39.33	2.10	44.33	73.90	29.5	151	281	
Hori.	4924.000	PK	45.07	31.37	6.54	39.50	2.10	45.58	73.90	28.3	150	0	
Hori.	7386.000	PK	44.14	37.01	8.46	39.39	2.10	52.32	73.90	21.5	150	0	
Hori.	9848.000	PK	43.98	39.12	9.23	39.35	2.10	55.08	73.90	18.8	150	0	
Hori.	3330.006	AV	40.63	28.13	5.82	39.33	2.10	37.35	53.90	16.5	151	281	
Vert.	2483.500	PK	47.15	27.65	14.22	39.46	2.10	51.66	73.90	22.2	100	139	
Vert.	3330.006	PK	48.46	28.13	5.82	39.33	2.10	45.18	73.90	28.7	114	312	
Vert.	4924.000	PK	44.66	31.37	6.54	39.50	2.10	45.17	73.90	28.7	150	0	
Vert.	7386.000	PK	45.04	37.01	8.46	39.39	2.10	53.22	73.90	20.6	150	0	
Vert.	9848.000	PK	44.32	39.12	9.23	39.35	2.10	55.42	73.90	18.4	150	0	
Vert.	3330.006	AV	43.20	28.13	5.82	39.33	2.10	39.92	53.90	13.9	114	312	

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	42.21	27.65	14.22	39.46	0.23	2.10	46.95	53.90	6.9	*1)
Hori.	4924.000	AV	37.05	31.37	6.54	39.50	0.23	2.10	37.79	53.90	16.1	
Hori.	7386.000	AV	36.15	37.01	8.46	39.39	0.23	2.10	44.56	53.90	9.3	
Hori.	9848.000	AV	36.52	39.12	9.23	39.35	0.23	2.10	47.85	53.90	6.0	
Vert.	2483.500	AV	37.53	27.65	14.22	39.46	0.23	2.10	42.27	53.90	11.6	*1)
Vert.	4924.000	AV	37.03	31.37	6.54	39.50	0.23	2.10	37.77	53.90	16.1	
Vert.	7386.000	AV	36.17	37.01	8.46	39.39	0.23	2.10	44.58	53.90	9.3	
Vert.	9848.000	AV	36.49	39.12	9.23	39.35	0.23	2.10	47.82	53.90	6.0	

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(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)

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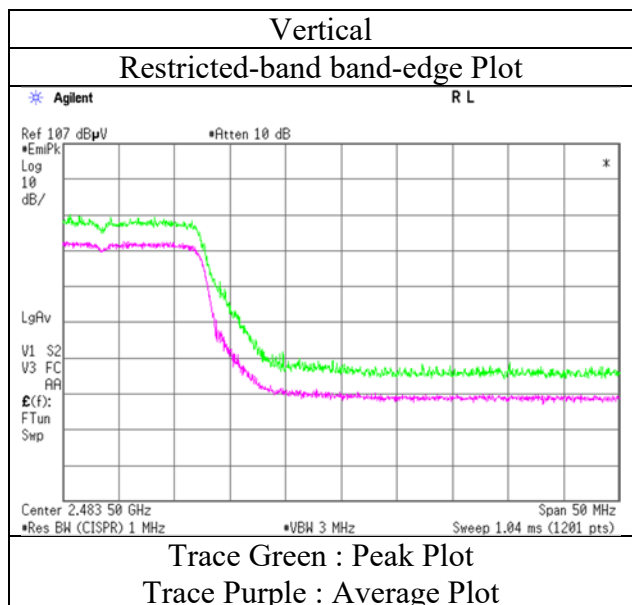
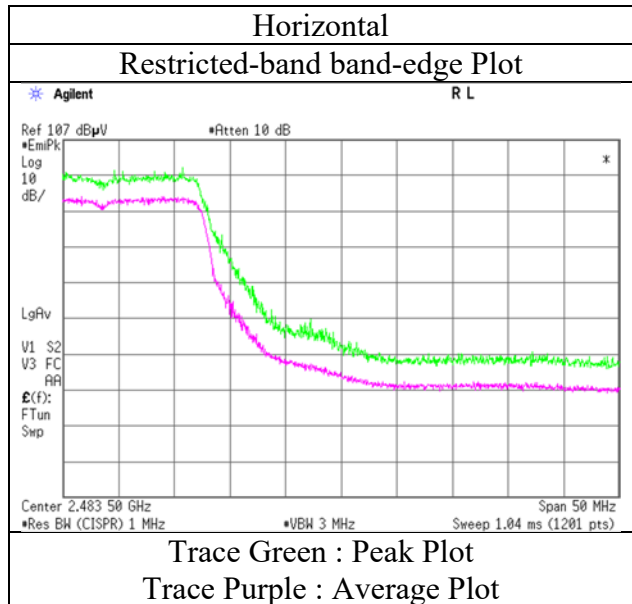
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Radiated Spurious Emission
(Reference Plot for band-edge)

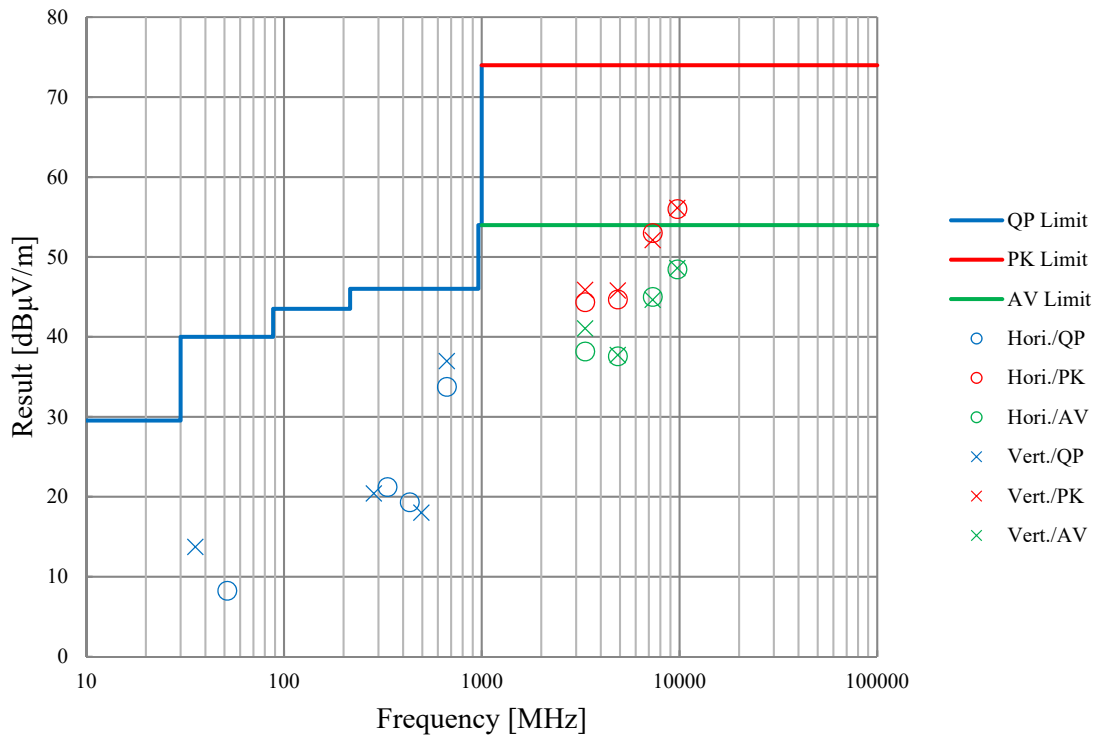
Report No. 12559092S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 20, 2018
Temperature / Humidity 24 deg. C / 33 %RH
Engineer Yosuke Ishikawa
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2462 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

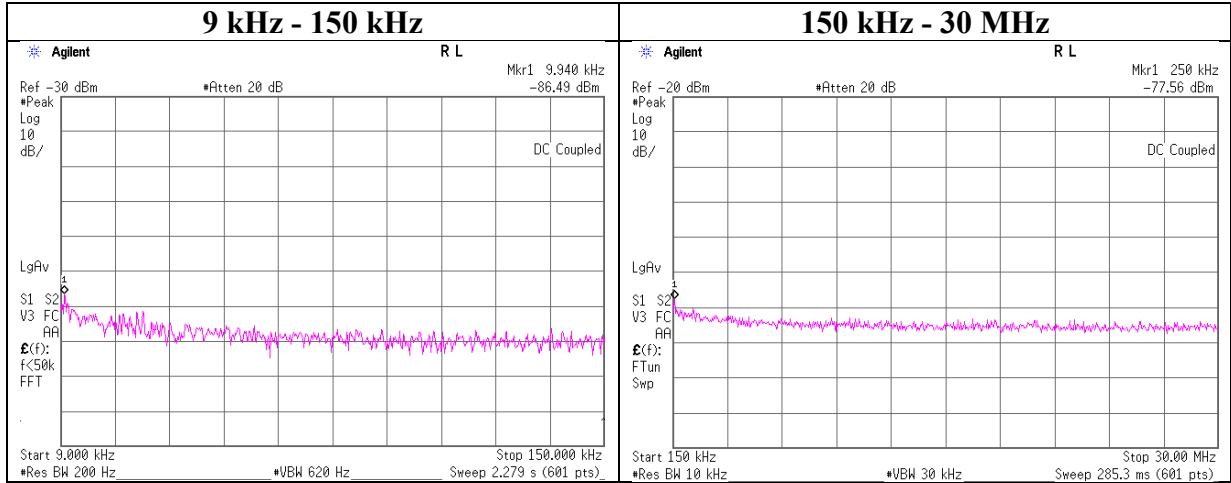
Report No.	12559092S-A-R1			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	November 22,2018	November 20, 2018	November 21, 2018	November 22, 2018
Temperature / Humidity	23 deg. C / 34 %RH	24 deg. C / 33 %RH	23 deg. C / 35 %RH	23 deg. C / 34 %RH
Engineer	Yosuke Ishikawa (30 MHz – 1000 MHz)	Yosuke Ishikawa (1 GHz – 2.8 GHz)	Yosuke Ishikawa (2.8 GHz – 13 GHz)	Shiro Kobayashi (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. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 14, 2018
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Yosuke Ishikawa
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
9.940	-86.49	0.01	20.1	2.0	1	-64.4	300	6.0	-3.1	47.6	50.7	
250.000	-77.56	0.02	20.1	2.0	1	-55.4	300	6.0	5.8	19.6	13.8	

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

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

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. 12559092S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date November 14, 2018
Temperature / Humidity 22 deg. C / 40 % 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	-26.68	1.74	20.12	-4.82	8.00	12.82
2437.00	-25.16	1.75	20.12	-3.29	8.00	11.29
2462.00	-26.43	1.76	20.12	-4.55	8.00	12.55

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-36.03	1.74	20.12	-14.17	8.00	22.17
2437.00	-32.76	1.75	20.12	-10.89	8.00	18.89
2462.00	-36.01	1.76	20.12	-14.13	8.00	22.13

11n-20

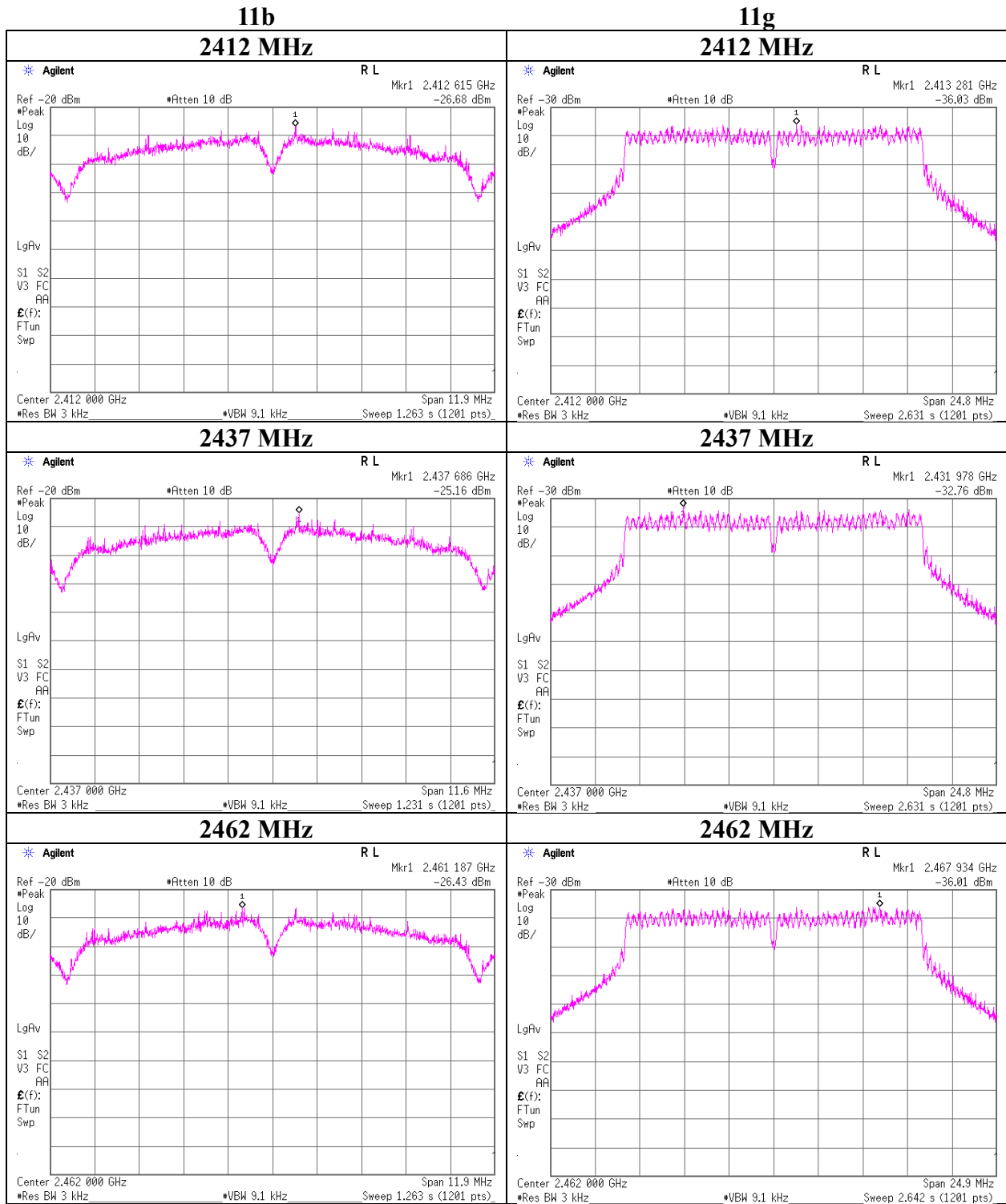
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-36.21	1.74	20.12	-14.35	8.00	22.35
2437.00	-35.23	1.75	20.12	-13.36	8.00	21.36
2462.00	-36.36	1.76	20.12	-14.48	8.00	22.48

Sample Calculation:

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

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

Power Density



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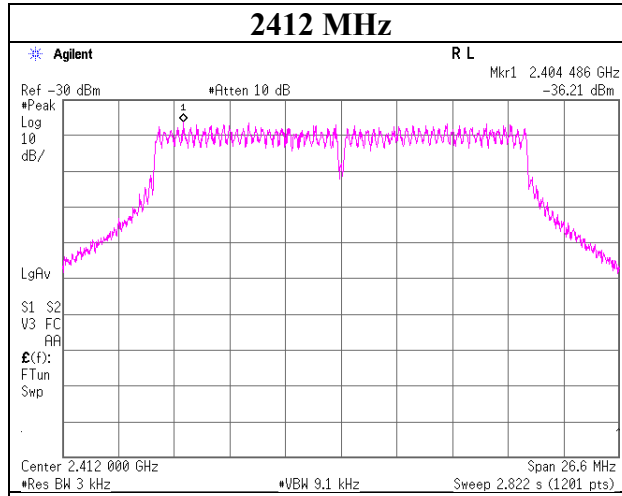
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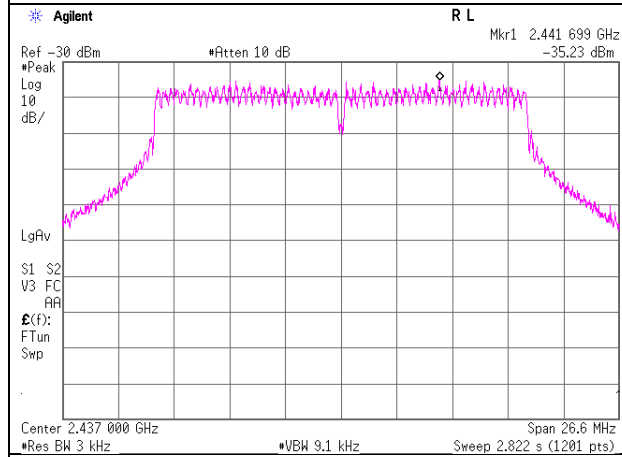
Power Density

11n-20

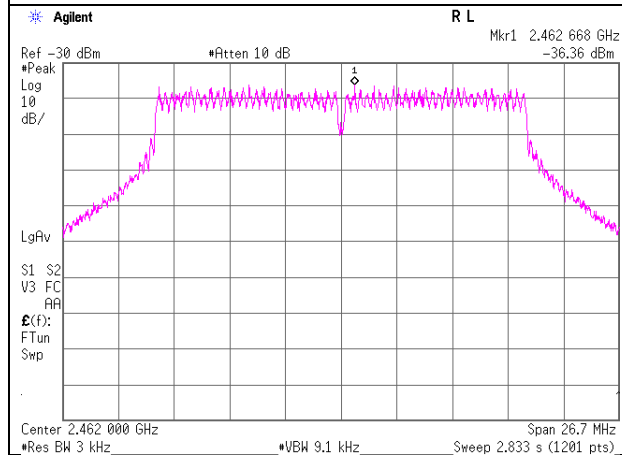
2412 MHz



2437 MHz



2462 MHz



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APPENDIX 2: Test instruments

Test Instruments (1/2)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KTS-07	AT	145111	Digital Tester	SANWA	PC500	7019232	2018/10/17	2019/10/31	12
SAT20-13	AT	160496	Attenuator	Weinschel Corp.	54A-20	87636	2017/12/8	2018/12/31	12
SCC-G32	AT	145183	Coaxial Cable	Junkosha	MWX241-02000KMSK MS	OCT-09-13-005	2017/11/22	2018/11/30	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-15	AT	160899	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46185516	2017/12/26	2018/12/31	12
SSA-03	AT	145801	Spectrum Analyzer	AGILENT	E4448A	MY48250152	2018/8/30	2019/8/31	12
COTS-SEMI-1	RE	144865	EMI Software	TSJ	TEPTO-DV(RE,CE,R FL,MF)	-	-	-	-
KJM-02	RE	146432	Measure	TAJIMA	GL19-55	-	-	-	-
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-04	RE	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2018/6/26	2019/6/30	12
SAF-06	RE	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2018/9/14	2019/9/30	12
SAF-09	RE	145008	Pre Amplifier	Toyo Corporation	HAP18-26W	18	2018/9/21	2019/9/30	12
SAT10-05	RE	145136	Attenuator(above1GHz)	AGILENT	8493C-010	74864	2017/11/22	2018/11/30	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/12DSF A/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-G19	RE	145178	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	2018/3/19	2019/3/31	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	MWX241-01000KMSK MS	-	2018/4/20	2019/4/30	12
SCC-G41	RE	151617	Coaxial Cable	Junkosha	MWX221-01000NFSN MS/B	1612S006	2018/1/29	2019/1/31	12
SFL-02	RE	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2017/11/16	2018/11/30	12
SHA-03	RE	145501	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	2018/7/23	2019/7/31	12
SHA-05	RE	145513	Horn Antenna	ETS LINDGREN	Sep-60	LM4210	2018/7/23	2019/7/31	12
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	2018/10/25	2019/10/31	12

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Test Instruments (2/2)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SSA-02	RE	145800	Spectrum Analyzer	AGILENT	E4448A	MY48250106	2018/3/5	2019/3/31	12
STR-07	RE	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2018/9/26	2019/9/30	12
STS-03	RE	146210	Digital Hitester	HIOKI	3805-50	80997823	2018/10/16	2019/10/31	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: AT: Antenna Terminal Conducted test
 RE: Radiated Emission test**