



RADIO TEST REPORT

Test Report No. : 13480623S-A-R2

Applicant : Panasonic Corporation
Type of EUT : RSE-ECU
Model Number of EUT : AT2106
FCC ID : ACJ932AT2106
Test regulation : FCC Part 15 Subpart C: 2020
Test Result : Complied (Refer to SECTION 3.2)

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 13480623S-A-R1. 13480623S-A-R1 is replaced with this report.

Date of test: September 12 to 28, 2020

Representative test engineer:

T. Kawakami

Takahiro Kawakami
Engineer
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Approved by:

S. Takano

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Engineer
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CERTIFICATE 1266.03

- The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
 There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 13480623S-A

Revision	Test report No.	Date	Page revised	Contents																																																						
- (Original)	13480623S-A	December 7, 2020	-	-																																																						
1	13480623S-A-R1	December 9, 2020	9	Correction of Power setting: “11b: 11 dBm 11g: 10 dBm (1 channel), 9 dBm (11 channel), 11 dBm (other channels) 11n-20: 9 dBm (1 channel), 9 dBm (11 channel), 11 dBm (other channels)” to “Fixed”																																																						
			30	Addition: Duty Factor Horizontal and vertical points of 4824.000 MHz Average detection																																																						
			58-59	Addition: Cable# “25” to AC cable of DC power supply, Row “25” to List of cables used																																																						
2	13480623S-A-R2	December 14, 2020	20	Correction of typo in the table: 2437 MHz 400 ns GI <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>MCS Number [MCS]</th> <th>Reading [dBm]</th> <th>Remark</th> </tr> </thead> <tbody> <tr><td>10</td><td>9.15</td><td></td></tr> <tr><td>10</td><td>9.17</td><td></td></tr> <tr><td>10</td><td>9.20</td><td></td></tr> <tr><td>10</td><td>9.20</td><td></td></tr> <tr><td>10</td><td>9.21</td><td></td></tr> <tr><td>10</td><td>9.22</td><td></td></tr> <tr><td>9</td><td>9.25</td><td></td></tr> <tr><td>10</td><td>9.26</td><td></td></tr> </tbody> </table> to 2437 MHz 400 ns GI <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>MCS Number [MCS]</th> <th>Reading [dBm]</th> <th>Remark</th> </tr> </thead> <tbody> <tr><td>0</td><td>9.68</td><td></td></tr> <tr><td>1</td><td>9.78</td><td></td></tr> <tr><td>2</td><td>10.01</td><td></td></tr> <tr><td>3</td><td>9.64</td><td></td></tr> <tr><td>4</td><td>9.67</td><td></td></tr> <tr><td>5</td><td>9.70</td><td></td></tr> <tr><td>6</td><td>9.49</td><td></td></tr> <tr><td>7</td><td>9.62</td><td></td></tr> </tbody> </table>	MCS Number [MCS]	Reading [dBm]	Remark	10	9.15		10	9.17		10	9.20		10	9.20		10	9.21		10	9.22		9	9.25		10	9.26		MCS Number [MCS]	Reading [dBm]	Remark	0	9.68		1	9.78		2	10.01		3	9.64		4	9.67		5	9.70		6	9.49		7	9.62	
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Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	MCS	Modulation and Coding Scheme
AC	Alternating Current	MRA	Mutual Recognition Arrangement
AFH	Adaptive Frequency Hopping	N/A	Not Applicable
AM	Amplitude Modulation	NIST	National Institute of Standards and Technology
Amp, AMP	Amplifier	NS	No signal detect.
ANSI	American National Standards Institute	NSA	Normalized Site Attenuation
Ant, ANT	Antenna	NVLAP	National Voluntary Laboratory Accreditation Program
AP	Access Point	OBW	Occupied Band Width
ASK	Amplitude Shift Keying	OFDM	Orthogonal Frequency Division Multiplexing
Atten., ATT	Attenuator	P/M	Power meter
AV	Average	PCB	Printed Circuit Board
BPSK	Binary Phase-Shift Keying	PER	Packet Error Rate
BR	Bluetooth Basic Rate	PHY	Physical Layer
BT	Bluetooth	PK	Peak
BT LE	Bluetooth Low Energy	PN	Pseudo random Noise
BW	BandWidth	PRBS	Pseudo-Random Bit Sequence
Cal Int	Calibration Interval	PSD	Power Spectral Density
CCK	Complementary Code Keying	QAM	Quadrature Amplitude Modulation
Ch., CH	Channel	QP	Quasi-Peak
CISPR	Comite International Special des Perturbations Radioelectriques	QPSK	Quadri-Phase Shift Keying
CW	Continuous Wave	RBW	Resolution Band Width
DBPSK	Differential BPSK	RDS	Radio Data System
DC	Direct Current	RE	Radio Equipment
D-factor	Distance factor	RF	Radio Frequency
DFS	Dynamic Frequency Selection	RMS	Root Mean Square
DQPSK	Differential QPSK	RSS	Radio Standards Specifications
DSSS	Direct Sequence Spread Spectrum	Rx	Receiving
EDR	Enhanced Data Rate	SA, S/A	Spectrum Analyzer
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	SG	Signal Generator
EMC	ElectroMagnetic Compatibility	SVSWR	Site-Voltage Standing Wave Ratio
EMI	ElectroMagnetic Interference	TR	Test Receiver
EN	European Norm	Tx	Transmitting
ERP, e.r.p.	Effective Radiated Power	VBW	Video BandWidth
EU	European Union	Vert.	Vertical
EUT	Equipment Under Test	WLAN	Wireless LAN
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
FSK	Frequency Shift Keying		
GFSK	Gaussian Frequency-Shift Keying		
GNSS	Global Navigation Satellite System		
GPS	Global Positioning System		
Hori.	Horizontal		
ICES	Interference-Causing Equipment Standard		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		
ILAC	International Laboratory Accreditation Conference		
ISED	Innovation, Science and Economic Development Canada		
ISO	International Organization for Standardization		
JAB	Japan Accreditation Board		
LAN	Local Area Network		
LIMS	Laboratory Information Management System		

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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 : +81-50-3689-7000
Facsimile Number : +81-45-931-0806
Contact Person : Shinji Isawa

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type : RSE-ECU
Model Number : AT2106
Serial Number : Refer to SECTION 4.2
Rating : DC 13.2 V
Receipt Date : September 9, 2020
Country of Mass-production : Japan
Condition : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification : No Modification by the test lab.

2.2 Product Description

Model: AT2106 (referred to as the EUT in this report) is an RSE-ECU.

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 2412 MHz - 2462 MHz
Modulation : DSSS, OFDM
Antenna type : Dipole
Antenna Gain : 3.4 dBi
Clock frequency (Maximum) : 40 MHz

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 26, 2020 and effective July 27, 2020

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
and 5725-5850 MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	-	N/A	*1)
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(2) ISED: RSS-247 5.2(a)	See data.	Complied a)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ISED: RSS-247 5.4(d)		Complied b)	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(e) ISED: RSS-247 5.2(b)		Complied c)	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	0.2 dB 2390.00 MHz, AV, Vertical Mode: Tx 11n-20 2412 MHz	Complied# d), e)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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

*1) The test is not applicable since the EUT 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 v05r02 8.5 and 8.6.

a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)

b) Refer to APPENDIX 1 (data of Maximum Peak Output Power)

c) Refer to APPENDIX 1 (data of Power Density)

d) Refer to APPENDIX 1 (data of Conducted Spurious Emission)

e) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

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

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

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

FCC Part 15.31 (e)

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	ISED: RSS-Gen 6.7	ISED: -	N/A	- a)	Conducted
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

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

3.4 Uncertainty

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

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

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Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4,5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.6 dB	2.5 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.0 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.0 dB	-
	1 GHz-6 GHz	4.9 dB	4.9 dB	4.9 dB	-
	6 GHz-18 GHz	5.5 dB	5.5 dB	5.5 dB	-
	18 GHz-40 GHz	5.4 dB	5.4 dB	5.4 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.8 dB	5.8 dB	5.8 dB	-
	18 GHz-40 GHz	5.7 dB	5.7 dB	5.7 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	0.98 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.75 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.12 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.06 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.24 dB
Spurious emission (Conducted) below 1GHz	0.9 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.9 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.9 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.0 dB
Bandwidth Measurement	0.07 %
Duty cycle and Time Measurement	0.262 %
Temperature	0.95 deg.C.
Voltage	0.83 %

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3.5 Test Location

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A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

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.

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SECTION 4: Operation of EUT 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)	12 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 2 (GI:800 ns), 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: WIFI Diag ver.9.89 (Date: 2020.09.12, Storage location: EUT memory)	
*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)	11n-20 Tx	2437 MHz
Spurious Emission (Above 1 GHz)	11b Tx	2412 MHz
		2437 MHz
		2462 MHz
	11g Tx 11n-20 Tx	2412 MHz
		2417 MHz *)
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx	2412 MHz
		11g Tx
	11n-20 Tx	2437 MHz
		2457 MHz *)
		2462 MHz

*) Bandedge measurement only.

4.2 Configuration and peripherals

The pages have been submitted for separate exhibit (refer to APPENDIX 4).

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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 v05r02".

[For below 1 GHz]

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of 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 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 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

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

The 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(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	<u>11.12.2.5.2</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.

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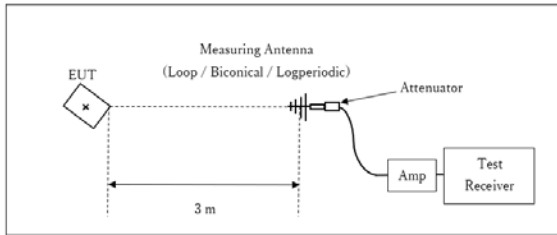
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Figure 1: Test Setup

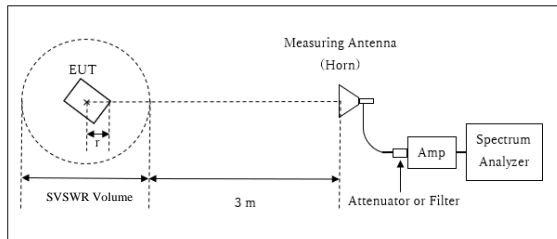
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



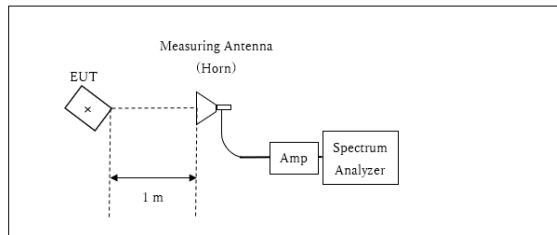
r : Radius of an outer periphery of EUT

× : Center of turn table

Distance Factor: $20 \times \log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$
 * Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.88 \text{ m}$

SVSWR Volume : 2.0 m
 (SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.12 \text{ m}$

10 GHz – 26.5 GHz



× : Center of turn table

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

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

Antenna polarization	Below 1GHz	1 GHz -2.8 GHz	2.8 GHz -10 GHz	10 GHz -18 GHz	18 GHz -26.5 GHz
Horizontal	Z	Z	X	X	X
Vertical	Z	Y	X	X	X

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

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

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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: 160 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 *5) *6)	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". *5) 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) *6) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 – 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.							

The test results and limit are rounded off to two decimals place, so some differences might be observed.
The equipment and cables were not used for factor 0 dB of the data sheets.

Test data : APPENDIX
Test result : Pass

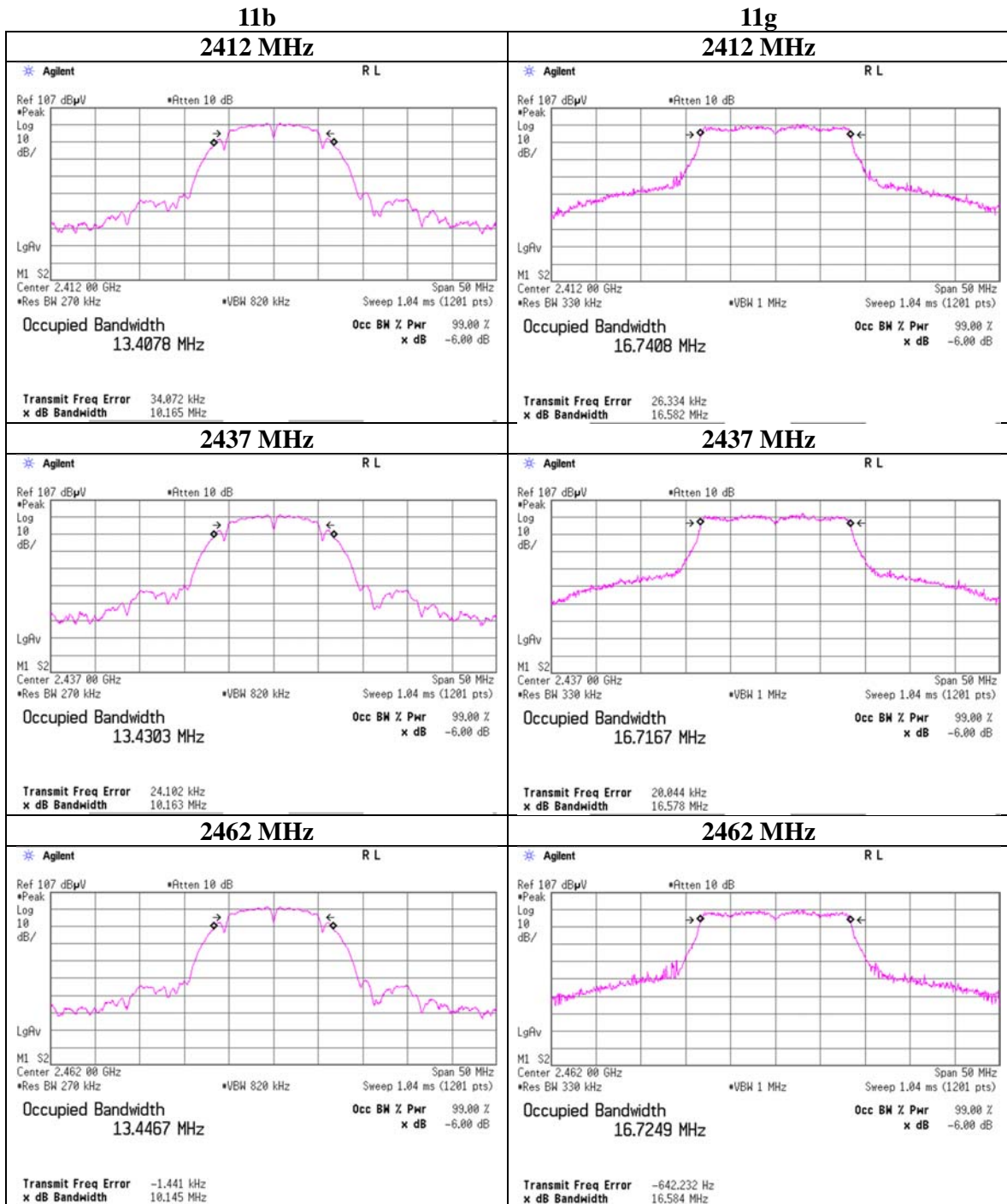
APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 12, 2020 September 24, 2020
Temperature / Humidity 25 deg. C / 60 % RH 24 deg. C / 47 % RH
Engineer Takahiro Kawakami Makoto Hosaka
Mode Tx

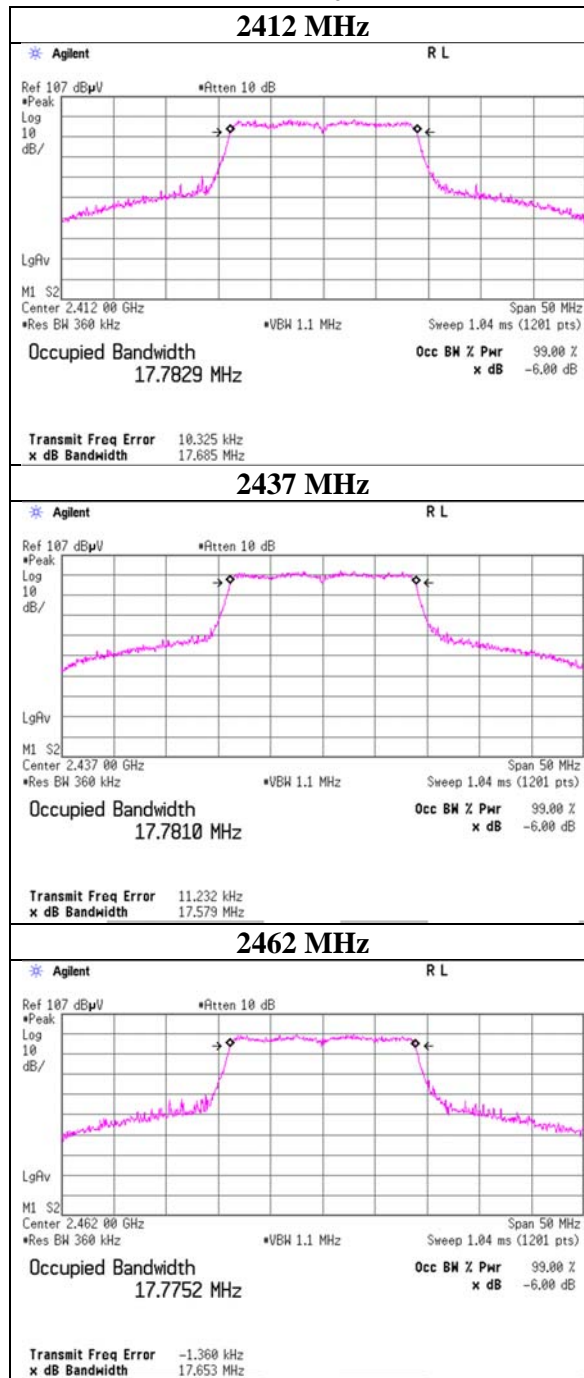
Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	13407.8	10.000	> 0.5000
	2437	13430.3	9.948	> 0.5000
	2462	13446.7	10.136	> 0.5000
11g	2412	16740.8	16.466	> 0.5000
	2437	16716.7	16.458	> 0.5000
	2462	16724.9	16.448	> 0.5000
11n-20	2412	17782.9	17.375	> 0.5000
	2437	17781.0	17.574	> 0.5000
	2462	17775.2	17.576	> 0.5000

99%Occupied Bandwidth

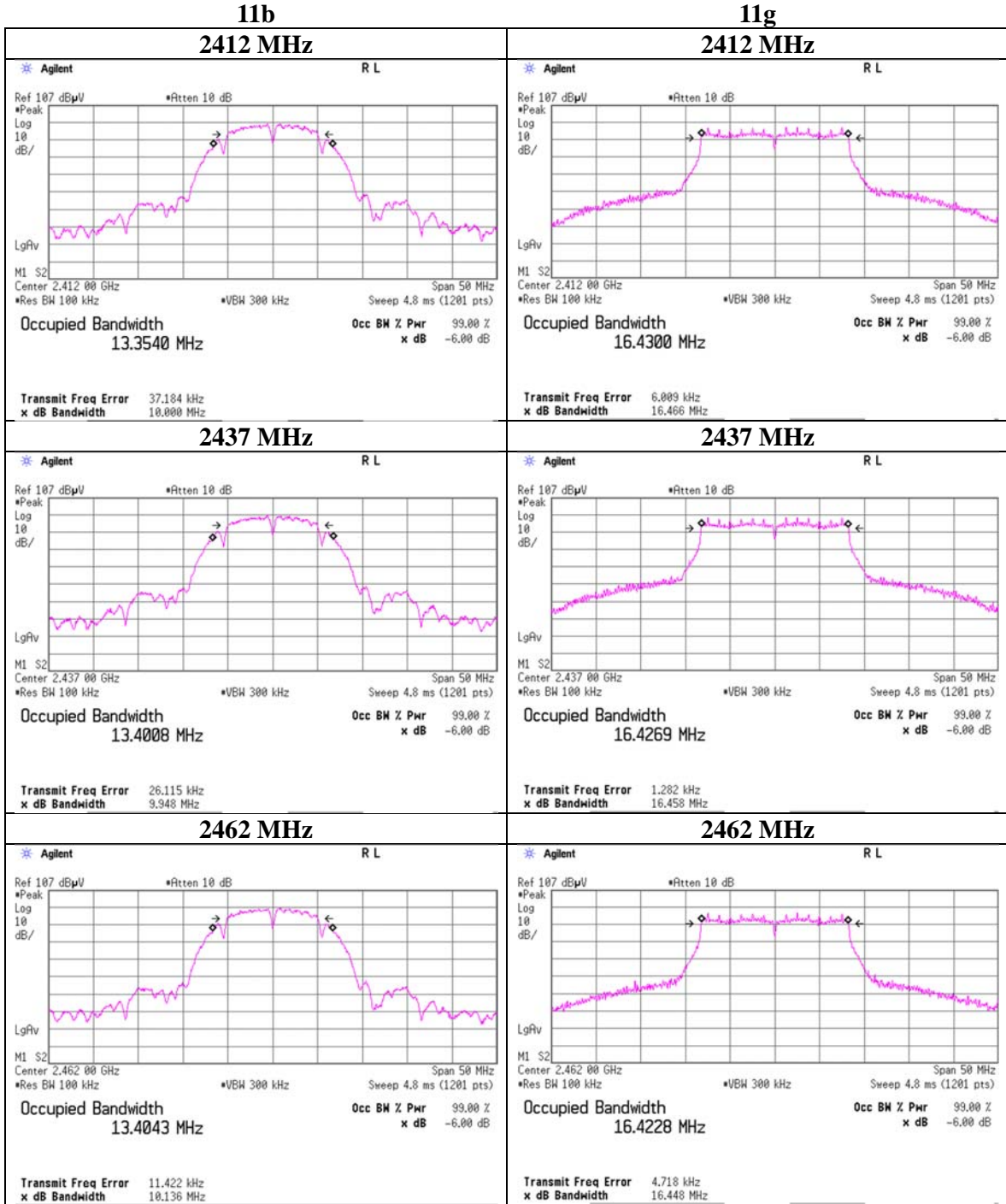


99% Occupied Bandwidth

11n-20

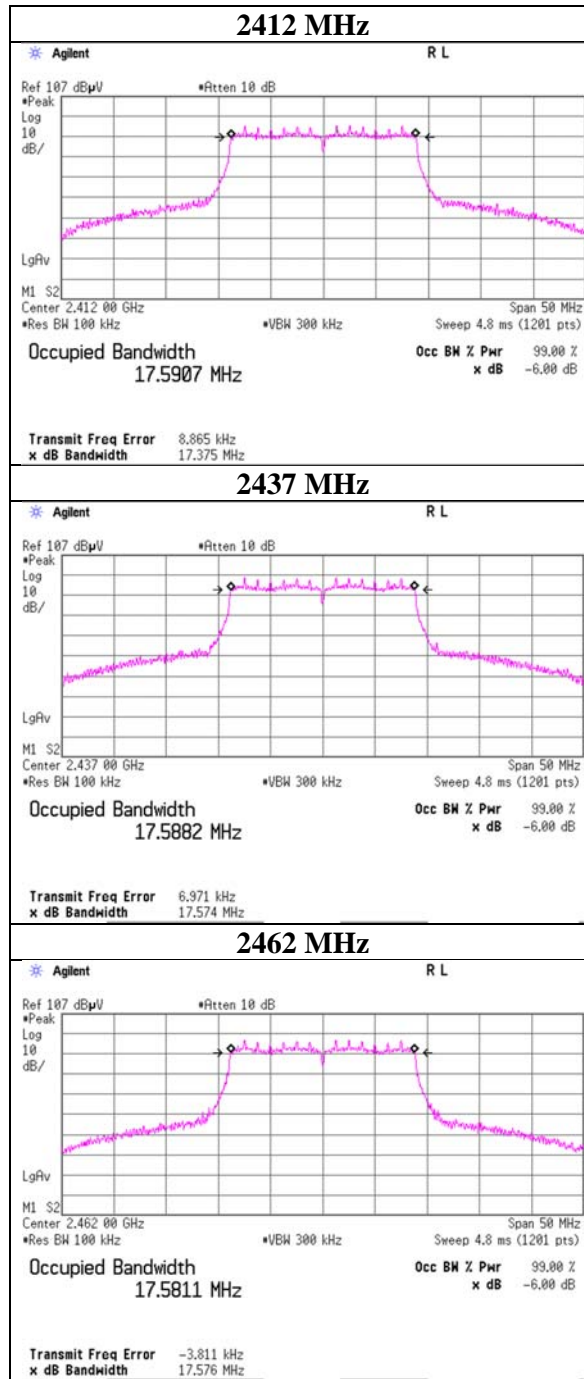


6dB Bandwidth



6dB Bandwidth

11n-20



Maximum Peak Output Power

Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 12, 2020
Temperature / Humidity 25 deg. C / 60 % RH
Engineer Takahiro Kawakami
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	2.11	1.04	9.63	12.78	18.97	30.00	1000	17.22	3.40	16.18	41.50	36.02	4000	19.84
2437	2.55	1.04	9.63	13.22	20.99	30.00	1000	16.78	3.40	16.62	45.92	36.02	4000	19.40
2462	2.16	1.04	9.63	12.83	19.19	30.00	1000	17.17	3.40	16.23	41.98	36.02	4000	19.79

Sample Calculation:

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

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

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	2.50	
2	2.55	*
5.5	2.54	
11	2.49	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 12, 2020
Temperature / Humidity 25 deg. C / 60 % RH
Engineer Takahiro Kawakami
Mode Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power				Margin [dB]	Antenna Gain [dBi]	e.i.r.p. for RSS-247				
				Result		Limit				Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	9.04	1.04	9.63	19.71	93.54	30.00	1000	10.29	3.40	23.11	204.64	36.02	4000	12.91
2437	9.61	1.04	9.63	20.28	106.66	30.00	1000	9.72	3.40	23.68	233.35	36.02	4000	12.34
2462	8.53	1.04	9.63	19.20	83.18	30.00	1000	10.80	3.40	22.60	181.97	36.02	4000	13.42

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.

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	9.60	
9	9.57	
12	9.61	*
18	9.41	
24	9.47	
36	9.23	
48	9.52	
54	9.39	

*: Worst Rate

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

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Maximum Peak Output Power

Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 12, 2020 September 24, 2020
Temperature / Humidity 25 deg. C / 60 % RH 24 deg. C / 47 % RH
Engineer Takahiro Kawakami Makoto Hosaka
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	7.42	1.76	9.81	18.99	79.25	30.00	1000	11.01	3.40	22.39	173.38	36.02	4000	13.63
2437	10.04	1.04	9.63	20.71	117.76	30.00	1000	9.29	3.40	24.11	257.63	36.02	4000	11.91
2462	8.76	1.04	9.63	19.43	87.70	30.00	1000	10.57	3.40	22.83	191.87	36.02	4000	13.19

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.

2437 MHz 800 ns GI

MCS Number [MCS]	Reading [dBm]	Remark
0	9.66	
1	9.77	
2	10.04	*
3	9.80	
4	9.70	
5	9.71	
6	9.63	
7	9.65	

2437 MHz 400 ns GI

MCS Number [MCS]	Reading [dBm]	Remark
0	9.68	
1	9.78	
2	10.01	
3	9.64	
4	9.67	
5	9.70	
6	9.49	
7	9.62	

*: Worst Rate

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

Average Output Power
(Reference data for RF Exposure)

Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 24, 2020
Temperature / Humidity 24 deg. C / 47 % RH
Engineer Makoto Hosaka
Mode Tx

11b 5.5 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	-2.07	1.76	9.81	9.50	8.91	0.26	9.76	9.46
2437	-1.66	1.77	9.82	9.93	9.84	0.26	10.19	10.45
2462	-1.62	1.77	9.82	9.97	9.93	0.26	10.23	10.54

11g 12 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	-3.48	1.76	9.81	8.09	6.44	0.56	8.65	7.33
2437	-2.07	1.77	9.82	9.52	8.95	0.56	10.08	10.19
2462	-4.14	1.77	9.82	7.45	5.56	0.56	8.01	6.32

11n-20 MCS 5, 800 ns 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	-5.70	1.76	9.81	5.87	3.86	1.73	7.60	5.75
2437	-3.28	1.77	9.82	8.31	6.78	1.73	10.04	10.09
2462	-5.30	1.77	9.82	6.29	4.26	1.73	8.02	6.34

Sample Calculation:

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

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

Average Output Power
(Reference data for RF Exposure)

Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 24, 2020
Temperature / Humidity 24 deg. C / 47 % RH
Engineer Makoto Hosaka
Mode Tx

2437 MHz

Mode	Rate Mbps / MCS	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11b	1	-1.47	0.05	-1.42	-
	2	-1.52	0.10	-1.42	-
	5.5	-1.66	0.26	-1.40	*
	11	-1.92	0.48	-1.44	-
11g	6	-1.81	0.29	-1.52	-
	9	-1.97	0.43	-1.54	-
	12	-2.07	0.56	-1.51	*
	18	-2.34	0.80	-1.54	-
	24	-2.58	1.03	-1.55	-
	36	-2.97	1.41	-1.56	-
	48	-3.37	1.79	-1.58	-
	54	-3.50	1.91	-1.59	-
11n-20 800 ns GI	0	-1.90	0.31	-1.59	-
	1	-2.18	0.58	-1.60	-
	2	-2.43	0.84	-1.59	-
	3	-2.64	1.07	-1.57	-
	4	-3.04	1.44	-1.60	-
	5	-3.28	1.73	-1.55	*
	6	-3.47	1.86	-1.61	-
	7	-3.61	2.01	-1.60	-
11n-20 400 ns GI	0	-1.89	0.31	-1.58	-
	1	-2.16	0.58	-1.58	-
	2	-2.43	0.84	-1.59	-
	3	-2.65	1.07	-1.58	-
	4	-3.04	1.44	-1.60	-
	5	-3.31	1.73	-1.58	-
	6	-3.44	1.86	-1.58	-
	7	-3.58	2.01	-1.57	-

* Worst rate

Sample Calculation:

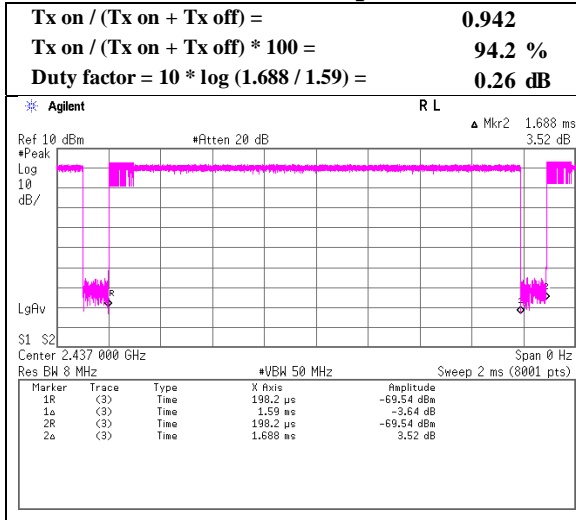
$$\text{Burst power} = \text{Reading (timed average)} + \text{Duty factor}$$

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

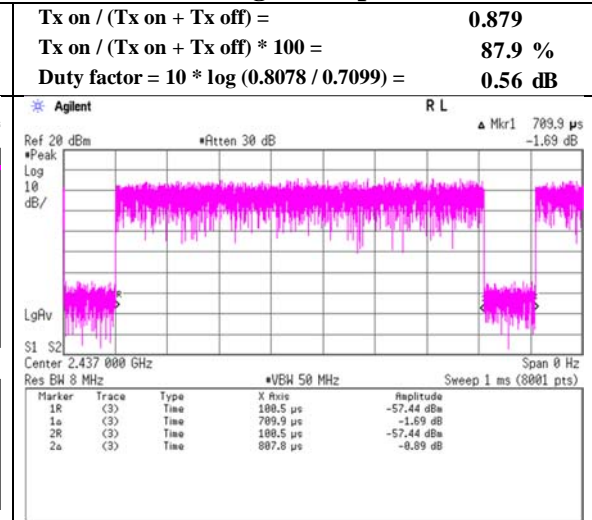
Burst rate confirmation(for Average Output Power)

Report No. 13480623S-A-R2
 Test place Shonan EMC Lab. No.5 Shielded Room
 Date September 12, 2020
 Temperature / Humidity 25 deg. C / 60 % RH
 Engineer Takahiro Kawakami
 Mode Tx

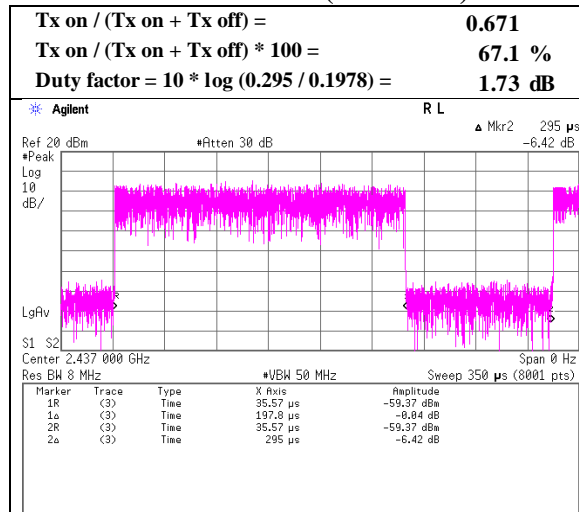
11b 5.5 Mbps



11g 12 Mbps



11n-20 MCS 5 (GI:800 ns)



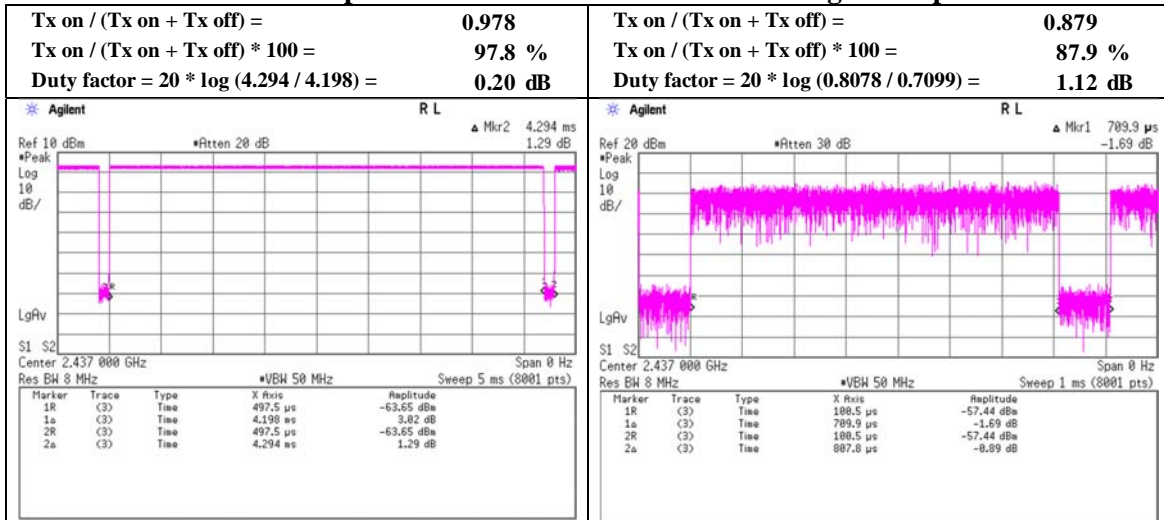
* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Burst rate confirmation(for Radiated Spurious Emission)

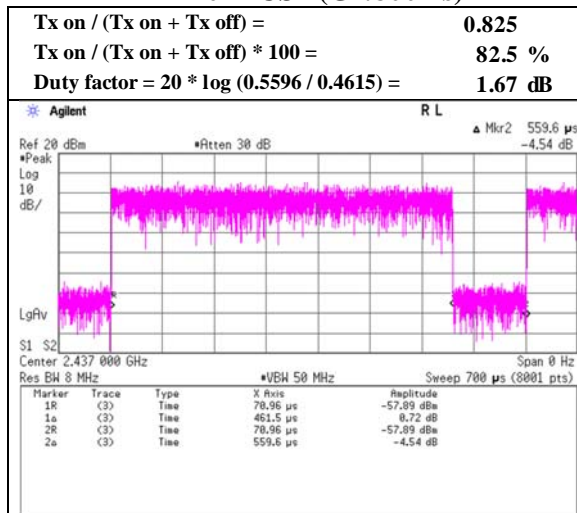
Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 12, 2020
Temperature / Humidity 25 deg. C / 60 % RH
Engineer Takahiro Kawakami
Mode Tx

11b 2 Mbps

11g 12 Mbps



11n-20 MCS 2(GI:800 ns)



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

Radiated Spurious Emission

Report No. 13480623S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date September 14, 2020 No.3 September 15, 2020 No.3 September 28, 2020 No.2 September 25, 2020
Temperature / Humidity 23 deg. C / 48 % RH 24 deg. C / 52 % RH 25 deg. C / 43 % RH 24 deg. C / 52 % RH
Engineer Kazuya Noda Yohsuke Matsuzawa Yohsuke Matsuzawa Hiromasa Sato
(1 GHz - 2.8 GHz) (1 GHz - 2.8 GHz) (2.8 GHz - 10 GHz) (10 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.	2386.817	PK	50.25	28.42	14.21	41.66	2.24	53.46	73.9	20.4	141	18	-
Hori.	2390.000	PK	48.42	28.41	14.22	41.66	2.24	51.63	73.9	22.2	141	18	-
Hori.	4824.000	PK	48.40	31.61	6.83	42.93	2.24	46.15	73.9	27.7	162	298	-
Hori.	6374.366	PK	53.15	34.40	7.87	43.57	2.24	54.09	73.9	19.8	106	188	-
Hori.	7236.000	PK	48.11	37.62	8.39	43.41	2.24	52.95	73.9	20.9	150	0	-
Hori.	9648.000	PK	48.94	39.01	9.57	43.10	2.24	56.66	73.9	17.2	150	0	-
Hori.	19296.000	PK	44.52	40.33	13.77	48.20	-9.54	40.88	73.9	33.0	156	62	-
Hori.	6374.366	AV	46.85	34.40	7.87	43.57	2.24	47.79	53.9	6.1	106	188	-
Hori.	7236.000	AV	39.29	37.62	8.39	43.41	2.24	44.13	53.9	9.7	150	0	Floor noise
Hori.	9648.000	AV	39.68	39.01	9.57	43.10	2.24	47.40	53.9	6.5	150	0	Floor noise
Vert.	2386.817	PK	50.05	28.42	14.21	41.66	2.24	53.26	73.9	20.6	161	73	-
Vert.	2390.000	PK	49.06	28.41	14.22	41.66	2.24	52.27	73.9	21.6	161	73	-
Vert.	3515.500	PK	54.69	29.21	6.14	42.19	2.24	50.09	73.9	23.8	186	133	-
Vert.	4824.000	PK	48.94	31.61	6.83	42.93	2.24	46.69	73.9	27.2	179	206	-
Vert.	6051.830	PK	57.33	33.49	7.69	43.41	2.24	57.34	73.9	16.5	120	229	-
Vert.	6374.366	PK	54.00	34.40	7.87	43.57	2.24	54.94	73.9	18.9	197	179	-
Vert.	7236.000	PK	49.44	37.62	8.39	43.41	2.24	54.28	73.9	19.6	150	0	-
Vert.	9648.000	PK	48.74	39.01	9.57	43.10	2.24	56.46	73.9	17.4	150	0	-
Vert.	19296.000	PK	46.10	40.33	13.77	48.20	-9.54	42.46	73.9	31.4	161	347	-
Vert.	3515.500	AV	51.44	29.21	6.14	42.19	2.24	46.84	53.9	7.0	186	133	-
Vert.	6051.830	AV	50.19	33.49	7.69	43.41	2.24	50.20	53.9	3.7	120	229	-
Vert.	6374.366	AV	48.15	34.40	7.87	43.57	2.24	49.09	53.9	4.8	197	179	-
Vert.	7236.000	AV	39.62	37.62	8.39	43.41	2.24	44.46	53.9	9.4	150	0	Floor noise
Vert.	9648.000	AV	39.92	39.01	9.57	43.10	2.24	47.64	53.9	6.2	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

10 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.	2386.817	AV	40.58	28.42	14.21	41.66	0.20	2.24	43.99	53.9	9.9	-
Hori.	2390.000	AV	38.80	28.41	14.22	41.66	0.20	2.24	42.21	53.9	11.6	*1)
Hori.	4824.000	AV	39.32	31.61	6.83	42.93	0.20	2.24	37.3	53.9	16.6	-
Hori.	19296.000	AV	35.70	40.33	13.77	48.20	0.20	-9.54	32.3	53.9	21.6	-
Vert.	2386.817	AV	41.07	28.42	14.21	41.66	0.20	2.24	44.5	53.9	9.4	-
Vert.	2390.000	AV	39.71	28.41	14.22	41.66	0.20	2.24	43.1	53.9	10.7	*1)
Vert.	4824.000	AV	39.52	31.61	6.83	42.93	0.20	2.24	37.5	53.9	16.4	-
Vert.	19296.000	AV	39.13	40.33	13.77	48.20	0.20	-9.54	35.7	53.9	18.2	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

Duty factor refer to "Burst rate confirmation" 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	95.83	28.37	14.23	41.67	2.24	99.00	-	-	Carrier
Hori.	2397.442	PK	55.32	28.39	14.22	41.67	2.24	58.50	79.0	20.5	-
Hori.	2400.000	PK	49.57	28.38	14.22	41.67	2.24	52.74	79.0	26.2	-
Vert.	2412.000	PK	96.07	28.37	14.23	41.67	2.24	99.24	-	-	Carrier
Vert.	2399.492	PK	52.87	28.38	14.22	41.67	2.24	56.04	79.2	23.2	-
Vert.	2400.000	PK	47.32	28.38	14.22	41.67	2.24	50.49	79.2	28.7	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

UL Japan, Inc.

Shonan EMC Lab.

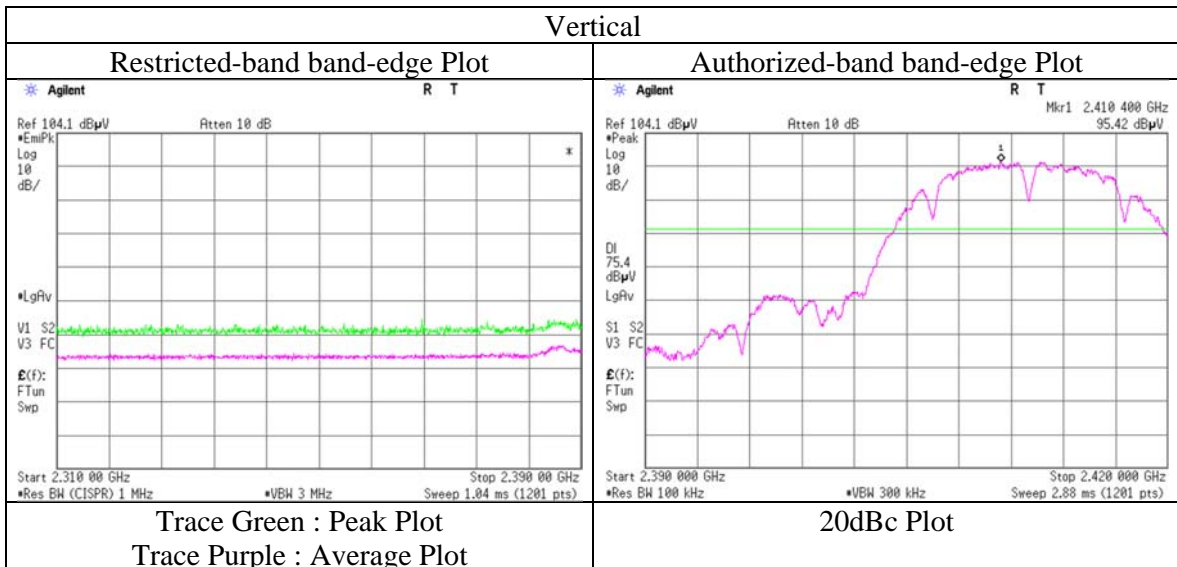
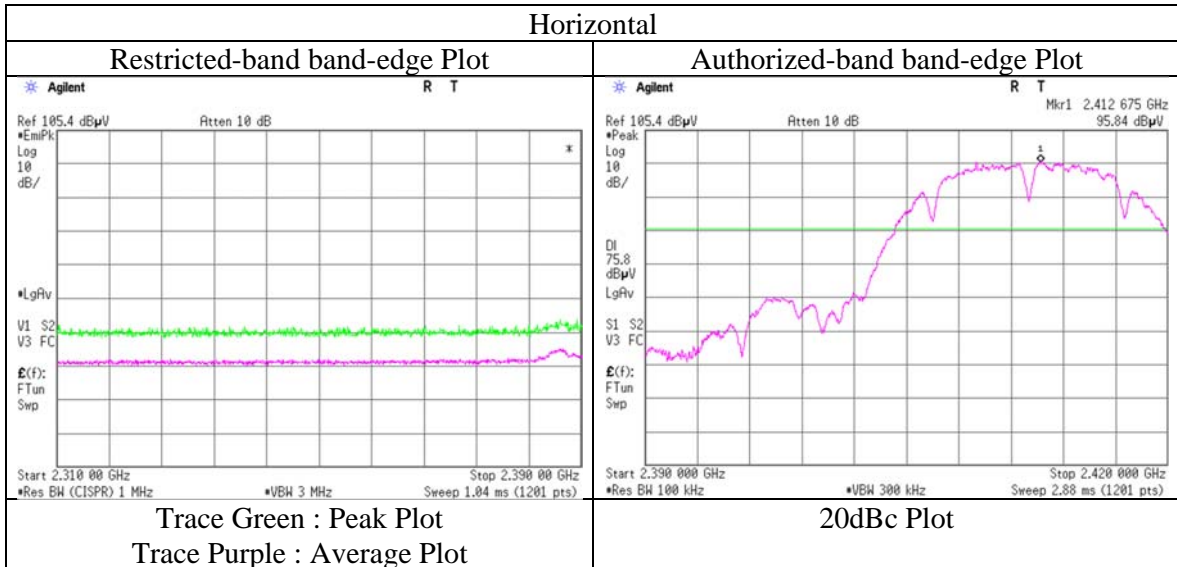
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (1 GHz – 2.8 GHz)
Mode	Tx 11b 2412 MHz	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.2
Date	September 14, 2020	September 15, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz – 10 GHz)	Hiromasa Sato (10 GHz – 26.5 GHz)
Mode	Tx 11b 2437 MHz			

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	48.22	31.63	6.87	42.93	2.24	46.03	73.9	27.8	158	302	-
Hori.	6374.413	PK	53.95	34.40	7.87	43.57	2.24	54.89	73.9	19.0	104	189	-
Hori.	7311.000	PK	48.63	37.69	8.43	43.48	2.24	53.51	73.9	20.3	150	0	-
Hori.	9748.000	PK	48.15	39.17	9.62	42.98	2.24	56.20	73.9	17.7	150	0	-
Hori.	19496.000	PK	43.65	40.36	13.84	48.04	-9.54	40.27	73.9	33.6	153	62	-
Hori.	6374.413	AV	46.78	34.40	7.87	43.57	2.24	47.72	53.9	6.1	104	189	-
Hori.	7311.000	AV	38.59	37.69	8.43	43.48	2.24	43.47	53.9	10.4	150	0	Floor noise
Hori.	9748.000	AV	38.52	39.17	9.62	42.98	2.24	46.57	53.9	7.3	150	0	Floor noise
Vert.	3515.500	PK	55.37	29.21	6.14	42.19	2.24	50.77	73.9	23.1	187	133	-
Vert.	4874.000	PK	48.38	31.63	6.87	42.93	2.24	46.19	73.9	27.7	174	204	-
Vert.	6053.503	PK	57.18	33.49	7.69	43.41	2.24	57.19	73.9	16.7	117	226	-
Vert.	6374.413	PK	54.36	34.40	7.87	43.57	2.24	55.30	73.9	18.6	183	180	-
Vert.	7311.000	PK	47.94	37.69	8.43	43.48	2.24	52.82	73.9	21.0	150	0	-
Vert.	9748.000	PK	48.24	39.17	9.62	42.98	2.24	56.29	73.9	17.6	150	0	-
Vert.	19496.000	PK	44.69	40.36	13.84	48.04	-9.54	41.31	73.9	32.5	142	197	-
Vert.	3515.500	AV	51.16	29.21	6.14	42.19	2.24	46.56	53.9	7.3	187	133	-
Vert.	6053.503	AV	50.63	33.49	7.69	43.41	2.24	50.64	53.9	3.2	117	226	-
Vert.	6374.413	AV	48.21	34.40	7.87	43.57	2.24	49.15	53.9	4.7	183	180	-
Vert.	7311.000	AV	38.73	37.69	8.43	43.48	2.24	43.61	53.9	10.2	150	0	Floor noise
Vert.	9748.000	AV	38.75	39.17	9.62	42.98	2.24	46.80	53.9	7.1	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

10 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	38.63	31.63	6.87	42.93	0.20	2.24	36.6	53.9	17.2	-
Hori.	19496.000	AV	34.80	40.36	13.84	48.04	0.20	-9.54	31.6	53.9	22.2	-
Vert.	4874.000	AV	38.78	31.63	6.87	42.93	0.20	2.24	36.8	53.9	17.1	-
Vert.	19496.000	AV	35.16	40.36	13.84	48.04	0.20	-9.54	32.0	53.9	21.9	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

Duty factor refer to "Burst rate confirmation" sheet.

Radiated Spurious Emission

Report No.	13480623S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.2
Date	September 14, 2020	September 15, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz – 10 GHz)	Hiromasa Sato (10 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	50.44	28.28	14.31	41.69	2.24	53.58	73.9	20.3	135	20	-
Hori.	2487.529	PK	50.03	28.27	14.31	41.70	2.24	53.15	73.9	20.7	135	20	-
Hori.	4924.000	PK	47.92	31.68	6.91	42.94	2.24	45.81	73.9	28.0	155	289	-
Hori.	6374.400	PK	53.50	34.40	7.87	43.57	2.24	54.44	73.9	19.4	104	189	-
Hori.	7386.000	PK	47.49	37.81	8.48	43.55	2.24	52.47	73.9	21.4	150	0	-
Hori.	9848.000	PK	47.13	39.16	9.68	42.87	2.24	55.34	73.9	18.5	150	0	-
Hori.	19696.000	PK	44.78	40.36	13.92	47.77	-9.54	41.75	73.9	32.1	153	78	-
Hori.	6374.400	AV	46.97	34.40	7.87	43.57	2.24	47.91	53.9	5.9	104	189	-
Hori.	7386.000	AV	38.33	37.81	8.48	43.55	2.24	43.31	53.9	10.5	150	0	Floor noise
Hori.	9848.000	AV	38.28	39.16	9.68	42.87	2.24	46.49	53.9	7.4	150	0	Floor noise
Vert.	2483.500	PK	49.26	28.28	14.31	41.69	2.24	52.40	73.9	21.5	173	59	-
Vert.	2487.529	PK	48.79	28.27	14.31	41.70	2.24	51.91	73.9	21.9	173	59	-
Vert.	3515.500	PK	55.00	29.21	6.14	42.19	2.24	50.40	73.9	23.5	184	133	-
Vert.	4924.000	PK	48.04	31.68	6.91	42.94	2.24	45.93	73.9	27.9	166	198	-
Vert.	6054.953	PK	57.35	33.49	7.69	43.41	2.24	57.36	73.9	16.5	120	223	-
Vert.	6374.400	PK	54.37	34.40	7.87	43.57	2.24	55.31	73.9	18.5	179	179	-
Vert.	7386.000	PK	48.28	37.81	8.48	43.55	2.24	53.26	73.9	20.6	150	0	-
Vert.	9848.000	PK	47.09	39.16	9.68	42.87	2.24	55.30	73.9	18.6	150	0	-
Vert.	19696.000	PK	45.39	40.36	13.92	47.77	-9.54	42.36	73.9	31.5	162	11	-
Vert.	3515.500	AV	51.11	29.21	6.14	42.19	2.24	46.51	53.9	7.3	184	133	-
Vert.	6054.953	AV	50.78	33.49	7.69	43.41	2.24	50.79	53.9	3.1	120	223	-
Vert.	6374.400	AV	48.20	34.40	7.87	43.57	2.24	49.14	53.9	4.7	179	179	-
Vert.	7386.000	AV	38.20	37.81	8.48	43.55	2.24	43.18	53.9	10.7	150	0	Floor noise
Vert.	9848.000	AV	38.00	39.16	9.68	42.87	2.24	46.21	53.9	7.6	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

10 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	41.28	28.28	14.31	41.69	0.20	2.24	44.62	53.9	9.2	*1)
Hori.	2487.529	AV	40.98	28.27	14.31	41.70	0.20	2.24	44.30	53.9	9.5	-
Hori.	4924.000	AV	38.75	31.68	6.91	42.94	0.20	2.24	36.8	53.9	17.0	-
Hori.	19696.000	AV	34.96	40.36	13.92	47.77	0.20	-9.54	32.1	53.9	21.7	-
Vert.	2483.500	AV	40.67	28.28	14.31	41.69	0.20	2.24	44.0	53.9	9.8	*1)
Vert.	2487.529	AV	39.70	28.27	14.31	41.70	0.20	2.24	43.0	53.9	10.8	-
Vert.	4924.000	AV	38.99	31.68	6.91	42.94	0.20	2.24	37.1	53.9	16.8	-
Vert.	19696.000	AV	37.71	40.36	13.92	47.77	0.20	-9.54	34.9	53.9	19.0	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

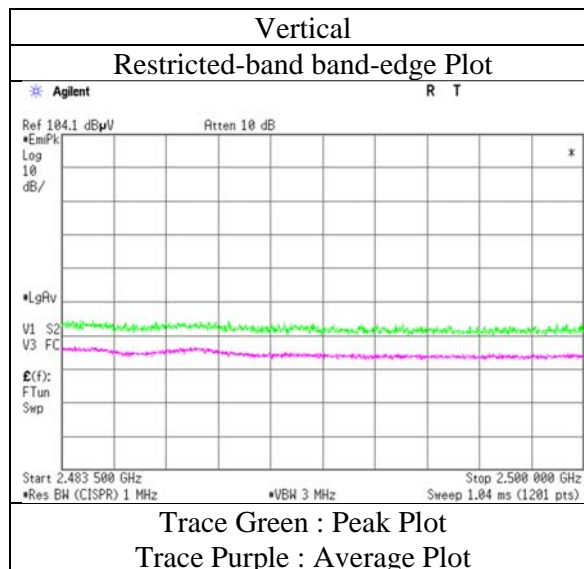
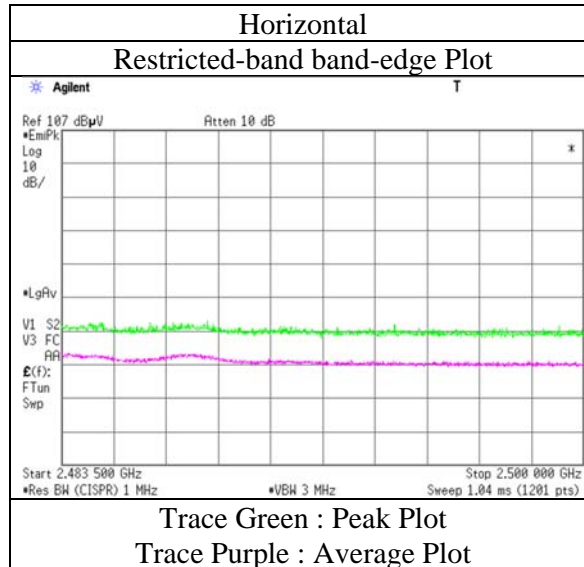
10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Burst rate confirmation" sheet.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(1 GHz – 2.8 GHz)
Mode	Tx 11b 2462 MHz	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.2
Date	September 14, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	23 deg. C / 48 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz – 10 GHz)	Hiromasa Sato (10 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	61.98	28.41	14.22	41.66	2.24	65.19	73.9	8.7	141	18	-
Hori.	4824.000	PK	48.41	31.61	6.83	42.93	2.24	46.16	73.9	27.7	164	301	-
Hori.	6374.419	PK	53.47	34.40	7.87	43.57	2.24	54.41	73.9	19.4	106	189	-
Hori.	7236.000	PK	48.20	37.62	8.39	43.41	2.24	53.04	73.9	20.8	150	0	-
Hori.	9648.000	PK	49.43	39.01	9.57	43.10	2.24	57.15	73.9	16.7	150	0	-
Hori.	19296.000	PK	43.77	40.33	13.77	48.20	-9.54	40.13	73.9	33.7	162	37	-
Hori.	6374.419	AV	47.13	34.40	7.87	43.57	2.24	48.07	53.9	5.8	106	189	-
Hori.	7236.000	AV	39.56	37.62	8.39	43.41	2.24	44.40	53.9	9.5	150	0	Floor noise
Hori.	9648.000	AV	39.83	39.01	9.57	43.10	2.24	47.55	53.9	6.3	150	0	Floor noise
Vert.	2390.000	PK	62.61	28.41	14.22	41.66	2.24	65.82	73.9	8.0	156	34	-
Vert.	3515.500	PK	54.60	29.21	6.14	42.19	2.24	50.00	73.9	23.9	184	133	-
Vert.	4824.000	PK	49.01	31.61	6.83	42.93	2.24	46.76	73.9	27.1	170	200	-
Vert.	6057.180	PK	57.76	33.50	7.69	43.41	2.24	57.78	73.9	16.1	115	226	-
Vert.	6374.419	PK	54.12	34.40	7.87	43.57	2.24	55.06	73.9	18.8	181	180	-
Vert.	7236.000	PK	48.53	37.62	8.39	43.41	2.24	53.37	73.9	20.5	150	0	-
Vert.	9648.000	PK	48.36	39.01	9.57	43.10	2.24	56.08	73.9	17.8	150	0	-
Vert.	19296.000	PK	45.90	40.33	13.77	48.20	-9.54	42.26	73.9	31.6	163	346	-
Vert.	3515.500	AV	51.39	29.21	6.14	42.19	2.24	46.79	53.9	7.1	184	133	-
Vert.	6057.180	AV	50.30	33.50	7.69	43.41	2.24	50.32	53.9	3.5	115	226	-
Vert.	6374.419	AV	48.44	34.40	7.87	43.57	2.24	49.38	53.9	4.5	181	180	-
Vert.	7236.000	AV	39.40	37.62	8.39	43.41	2.24	44.24	53.9	9.6	150	0	Floor noise
Vert.	9648.000	AV	39.72	39.01	9.57	43.10	2.24	47.44	53.9	6.4	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

10 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	48.51	28.41	14.22	41.66	1.12	2.24	52.84	53.9	1.0	*1)
Hori.	4824.000	AV	39.14	31.61	6.83	42.93	1.12	2.24	38.01	53.9	15.8	-
Hori.	19296.000	AV	35.31	40.33	13.77	48.20	1.12	-9.54	32.8	53.9	21.1	-
Vert.	2390.000	AV	48.62	28.41	14.22	41.66	1.12	2.24	53.0	53.9	0.9	*1)
Vert.	4824.000	AV	39.28	31.61	6.83	42.93	1.12	2.24	38.2	53.9	15.7	-
Vert.	19296.000	AV	38.81	40.33	13.77	48.20	1.12	-9.54	36.3	53.9	17.6	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

Duty factor refer to "Burst rate confirmation" 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	93.68	28.37	14.23	41.67	2.24	96.85	-	-	Carrier
Hori.	2400.000	PK	58.77	28.38	14.22	41.67	2.24	61.94	76.9	14.9	-
Vert.	2412.000	PK	93.94	28.37	14.23	41.67	2.24	97.11	-	-	Carrier
Vert.	2400.000	PK	59.35	28.38	14.22	41.67	2.24	62.52	77.1	14.5	-

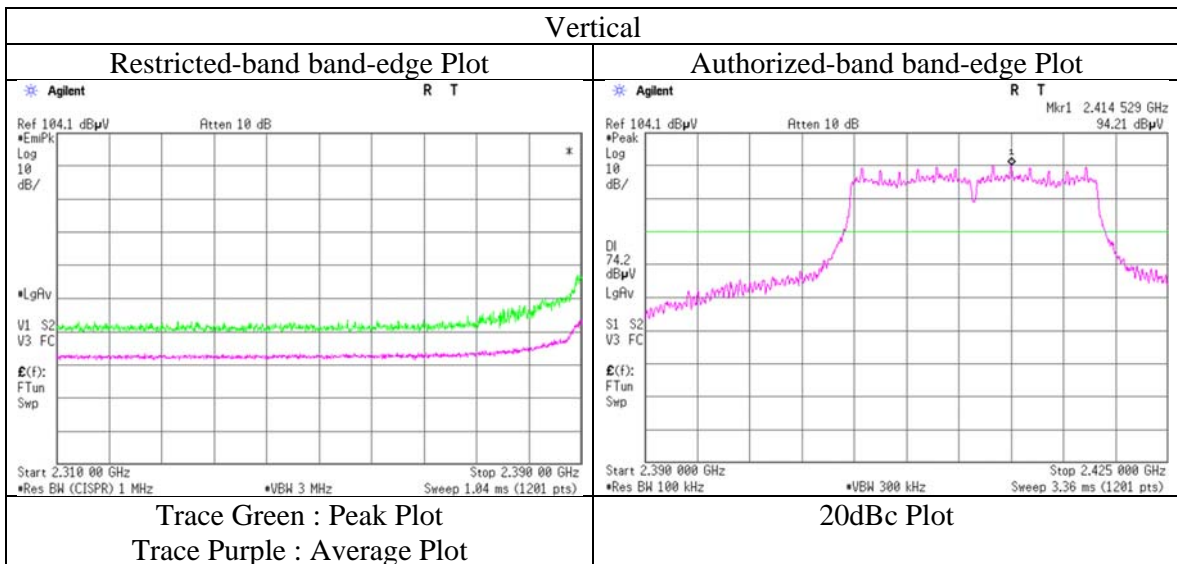
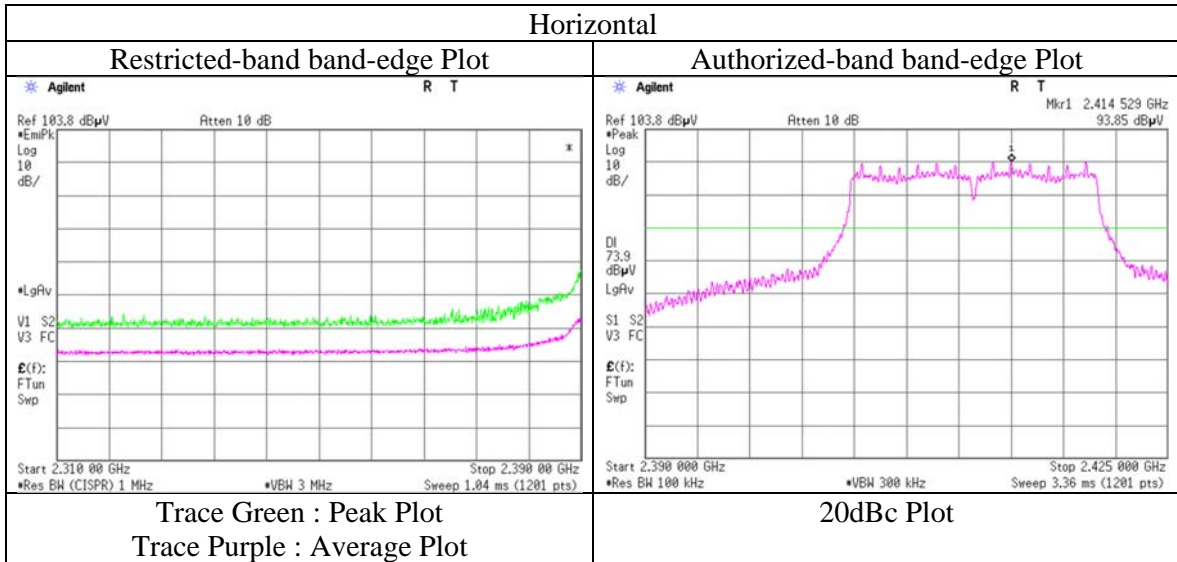
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 13480623S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date September 14, 2020
Temperature / Humidity 23 deg. C / 48 % RH
Engineer Kazuya Noda
(1 GHz – 2.8 GHz)
Mode Tx 11g 2412 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(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	56.37	28.41	14.22	41.66	2.24	59.58	73.9	14.3	143	17	-
Vert.	2390.000	PK	56.01	28.41	14.22	41.66	2.24	59.22	73.9	14.6	170	57	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

10 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.	2390.000	AV	43.88	28.41	14.22	41.66	1.12	2.24	48.21	53.9	5.6	*1)
Vert.	2390.000	AV	41.92	28.41	14.22	41.66	1.12	2.24	46.25	53.9	7.6	*1)

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

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

Duty factor refer to "Burst rate confirmation" 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	94.79	28.36	14.25	41.67	2.24	97.97	-	-	Carrier
Hori.	2400.000	PK	56.83	28.38	14.22	41.67	2.24	60.00	78.0	17.9	-
Vert.	2417.000	PK	94.74	28.36	14.25	41.67	2.24	97.92	-	-	Carrier
Vert.	2400.000	PK	55.69	28.38	14.22	41.67	2.24	58.86	77.9	19.0	-

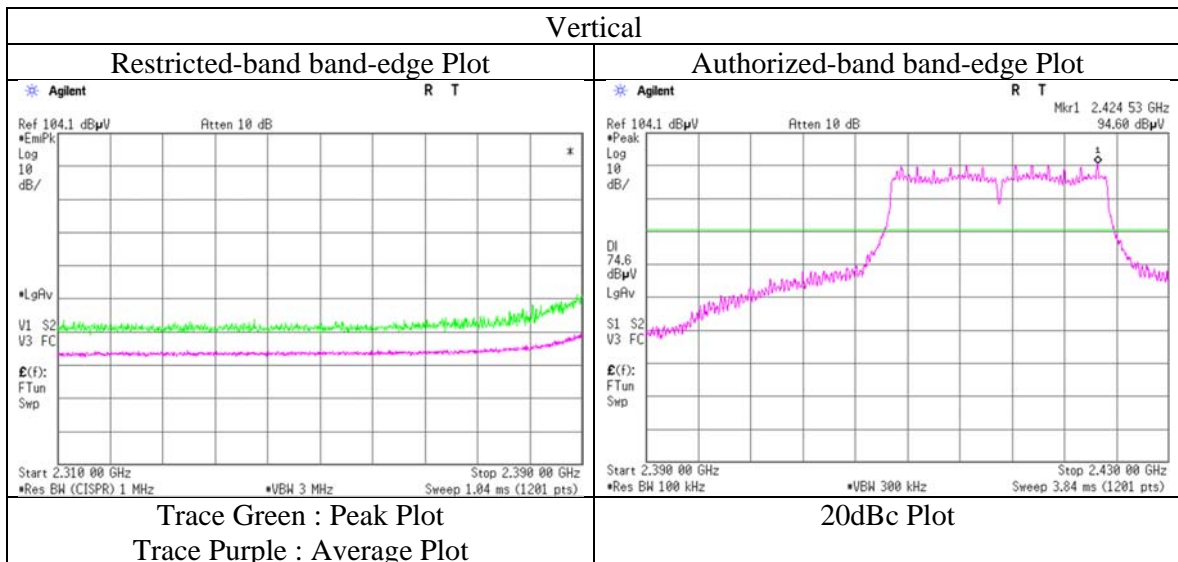
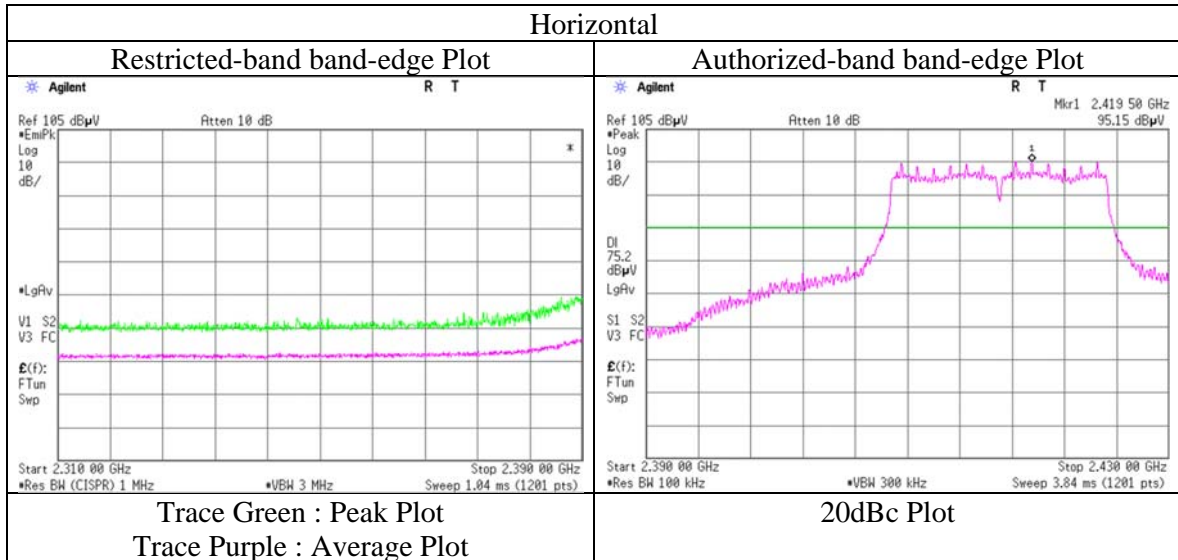
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2417 MHz	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.2
Date	September 14, 2020	September 15, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz – 10 GHz)	Hiromasa Sato (10 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.	4874.000	PK	48.48	31.63	6.87	42.93	2.24	46.29	73.9	27.6	160	293	-
Hori.	6374.430	PK	53.79	34.40	7.87	43.57	2.24	54.73	73.9	19.1	105	188	-
Hori.	7311.000	PK	49.04	37.69	8.43	43.48	2.24	53.92	73.9	19.9	150	0	-
Hori.	9748.000	PK	48.25	39.17	9.62	42.98	2.24	56.30	73.9	17.6	150	0	-
Hori.	19496.000	PK	44.74	40.36	13.84	48.04	-9.54	41.36	73.9	32.5	152	70	-
Hori.	6374.430	AV	46.57	34.40	7.87	43.57	2.24	47.51	53.9	6.3	105	188	-
Hori.	7311.000	AV	38.72	37.69	8.43	43.48	2.24	43.60	53.9	10.3	150	0	Floor noise
Hori.	9748.000	AV	38.90	39.17	9.62	42.98	2.24	46.95	53.9	6.9	150	0	Floor noise
Vert.	3515.500	PK	55.11	29.21	6.14	42.19	2.24	50.51	73.9	23.3	186	133	-
Vert.	4874.000	PK	48.22	31.63	6.87	42.93	2.24	46.03	73.9	27.8	168	211	-
Vert.	6054.926	PK	57.79	33.49	7.69	43.41	2.24	57.80	73.9	16.1	117	227	-
Vert.	6374.430	PK	54.01	34.40	7.87	43.57	2.24	54.95	73.9	18.9	183	180	-
Vert.	7311.000	PK	47.48	37.69	8.43	43.48	2.24	52.36	73.9	21.5	150	0	-
Vert.	9748.000	PK	48.20	39.17	9.62	42.98	2.24	56.25	73.9	17.6	150	0	-
Vert.	19496.000	PK	44.75	40.36	13.84	48.04	-9.54	41.37	73.9	32.5	143	155	-
Vert.	3515.500	AV	51.32	29.21	6.14	42.19	2.24	46.72	53.9	7.1	186	133	-
Vert.	6054.926	AV	50.37	33.49	7.69	43.41	2.24	50.38	53.9	3.5	117	227	-
Vert.	6374.430	AV	48.27	34.40	7.87	43.57	2.24	49.21	53.9	4.6	183	180	-
Vert.	7311.000	AV	38.64	37.69	8.43	43.48	2.24	43.52	53.9	10.3	150	0	Floor noise
Vert.	9748.000	AV	38.57	39.17	9.62	42.98	2.24	46.62	53.9	7.2	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

10 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	38.92	31.63	6.87	42.93	1.12	2.24	37.9	53.9	16.0	-
Hori.	19496.000	AV	34.96	40.36	13.84	48.04	1.12	-9.54	32.7	53.9	21.2	-
Vert.	4874.000	AV	38.88	31.63	6.87	42.93	1.12	2.24	37.8	53.9	16.0	-
Vert.	19496.000	AV	35.17	40.36	13.84	48.04	1.12	-9.54	32.9	53.9	20.9	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

Duty factor refer to "Burst rate confirmation" sheet.

Radiated Spurious Emission

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(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	59.81	28.28	14.31	41.69	2.24	62.95	73.9	10.9	136	15	-
Vert.	2483.500	PK	57.85	28.28	14.31	41.69	2.24	60.99	73.9	12.9	165	44	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

10 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	41.91	28.28	14.31	41.69	1.12	2.24	46.17	53.9	7.7	*1)
Vert.	2483.500	AV	41.95	28.28	14.31	41.69	1.12	2.24	46.21	53.9	7.6	*1)

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

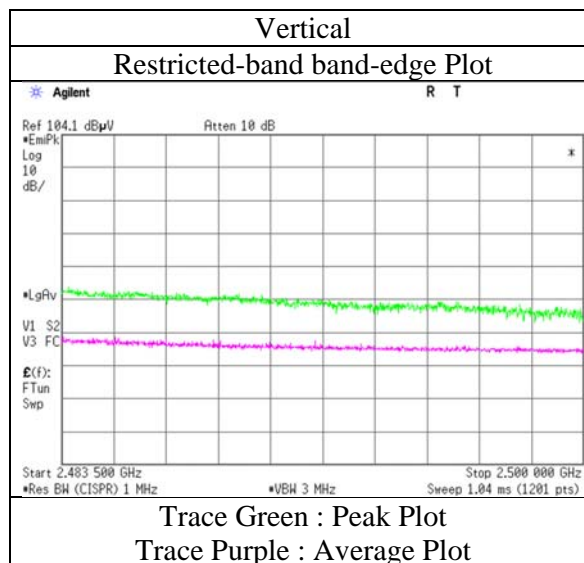
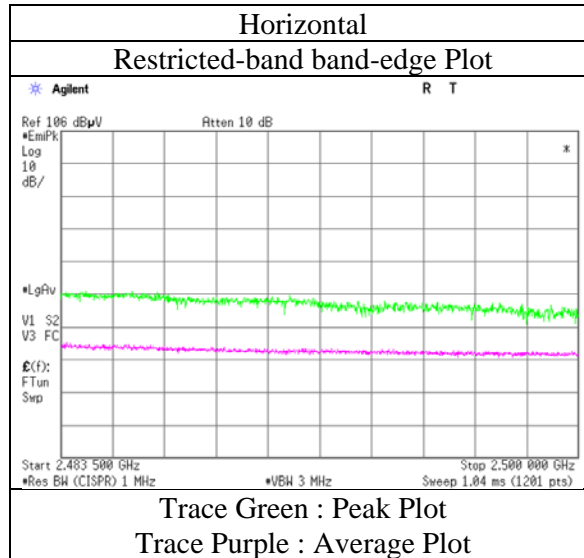
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Burst rate confirmation" sheet.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2457 MHz	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.2
Date	September 14, 2020	September 15, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz – 10 GHz)	Hiromasa Sato (10 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	62.14	28.28	14.31	41.69	2.24	65.28	73.9	8.6	136	17	-
Hori.	4924.000	PK	48.38	31.68	6.91	42.94	2.24	46.27	73.9	27.6	159	306	-
Hori.	6374.418	PK	53.01	34.40	7.87	43.57	2.24	53.95	73.9	19.9	105	189	-
Hori.	7386.000	PK	47.93	37.81	8.48	43.55	2.24	52.91	73.9	20.9	150	0	-
Hori.	9848.000	PK	47.50	39.16	9.68	42.87	2.24	55.71	73.9	18.1	150	0	-
Hori.	19696.000	PK	44.14	40.36	13.92	47.77	-9.54	41.11	73.9	32.7	153	54	-
Hori.	6374.418	AV	46.68	34.40	7.87	43.57	2.24	47.62	53.9	6.2	105	189	-
Hori.	7386.000	AV	38.39	37.81	8.48	43.55	2.24	43.37	53.9	10.5	150	0	Floor noise
Hori.	9848.000	AV	38.37	39.16	9.68	42.87	2.24	46.58	53.9	7.3	150	0	Floor noise
Vert.	2483.500	PK	59.94	28.28	14.31	41.69	2.24	63.08	73.9	10.8	177	50	-
Vert.	3515.500	PK	54.98	29.21	6.14	42.19	2.24	50.38	73.9	23.5	185	133	-
Vert.	4924.000	PK	47.93	31.68	6.91	42.94	2.24	45.82	73.9	28.0	174	195	-
Vert.	6056.657	PK	57.51	33.50	7.69	43.41	2.24	57.53	73.9	16.3	117	226	-
Vert.	6374.418	PK	54.24	34.40	7.87	43.57	2.24	55.18	73.9	18.7	178	179	-
Vert.	7386.000	PK	48.05	37.81	8.48	43.55	2.24	53.03	73.9	20.8	150	0	-
Vert.	9848.000	PK	47.29	39.16	9.68	42.87	2.24	55.50	73.9	18.4	150	0	-
Vert.	19696.000	PK	45.40	40.36	13.92	47.77	-9.54	42.37	73.9	31.5	163	10	-
Vert.	3515.500	AV	51.28	29.21	6.14	42.19	2.24	46.68	53.9	7.2	185	133	-
Vert.	6056.657	AV	50.86	33.50	7.69	43.41	2.24	50.88	53.9	3.0	117	226	-
Vert.	6374.418	AV	48.13	34.40	7.87	43.57	2.24	49.07	53.9	4.8	178	179	-
Vert.	7386.000	AV	38.51	37.81	8.48	43.55	2.24	43.49	53.9	10.4	150	0	Floor noise
Vert.	9848.000	AV	38.32	39.16	9.68	42.87	2.24	46.53	53.9	7.3	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

10 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	45.02	28.28	14.31	41.69	1.12	2.24	49.28	53.9	4.6	*1)
Hori.	4924.000	AV	38.95	31.68	6.91	42.94	1.12	2.24	37.96	53.9	15.9	-
Hori.	19696.000	AV	35.32	40.36	13.92	47.77	1.12	-9.54	33.4	53.9	20.4	-
Vert.	2483.500	AV	43.92	28.28	14.31	41.69	1.12	2.24	48.2	53.9	5.7	*1)
Vert.	4924.000	AV	39.09	31.68	6.91	42.94	1.12	2.24	38.1	53.9	15.8	-
Vert.	19696.000	AV	37.50	40.36	13.92	47.77	1.12	-9.54	35.6	53.9	18.3	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

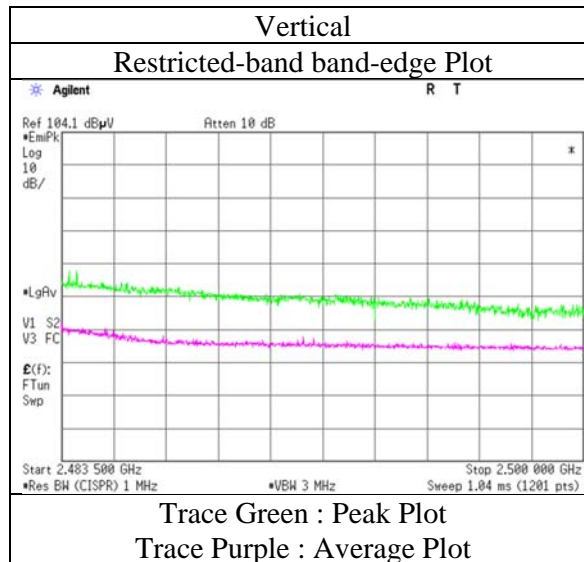
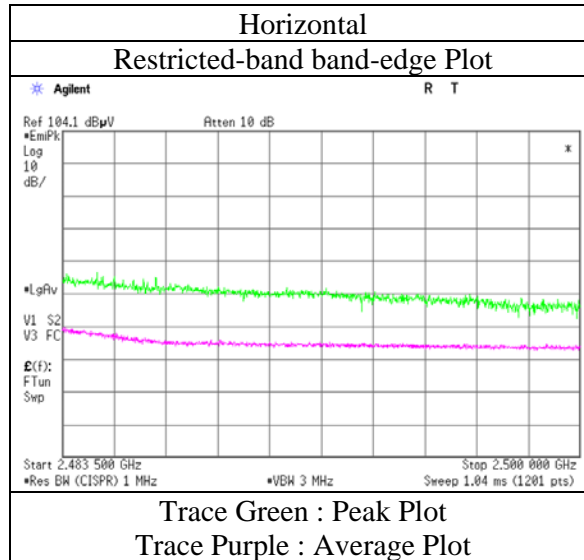
10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Burst rate confirmation" sheet.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2462 MHz	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.2
Date	September 23, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	21 deg. C / 59 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Yosuke Murakami (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz – 10 GHz)	Hiromasa Sato (10 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	61.93	28.41	14.22	41.66	2.24	65.14	73.9	8.7	139	17	-
Hori.	4824.000	PK	48.19	31.61	6.83	42.93	2.24	45.94	73.9	27.9	158	291	-
Hori.	6374.391	PK	53.40	34.40	7.87	43.57	2.24	54.34	73.9	19.5	105	187	-
Hori.	7236.000	PK	48.38	37.62	8.39	43.41	2.24	53.22	73.9	20.6	150	0	-
Hori.	9648.000	PK	48.39	39.01	9.57	43.10	2.24	56.11	73.9	17.7	150	0	-
Hori.	19296.000	PK	45.10	40.33	13.77	48.20	-9.54	41.46	73.9	32.4	163	53	-
Hori.	6374.391	AV	46.44	34.40	7.87	43.57	2.24	47.38	53.9	6.5	105	187	-
Hori.	7236.000	AV	39.65	37.62	8.39	43.41	2.24	44.49	53.9	9.4	150	0	Floor noise
Hori.	9648.000	AV	39.50	39.01	9.57	43.10	2.24	47.22	53.9	6.6	150	0	Floor noise
Vert.	2390.000	PK	62.65	28.41	14.22	41.66	2.24	65.86	73.9	8.0	164	63	-
Vert.	3515.500	PK	54.52	29.21	6.14	42.19	2.24	49.92	73.9	23.9	185	133	-
Vert.	4824.000	PK	47.97	31.61	6.83	42.93	2.24	45.72	73.9	28.1	171	191	-
Vert.	6051.721	PK	57.40	33.49	7.69	43.41	2.24	57.41	73.9	16.4	122	227	-
Vert.	6374.391	PK	54.31	34.40	7.87	43.57	2.24	55.25	73.9	18.6	182	179	-
Vert.	7236.000	PK	48.45	37.62	8.39	43.41	2.24	53.29	73.9	20.6	150	0	-
Vert.	9648.000	PK	48.94	39.01	9.57	43.10	2.24	56.66	73.9	17.2	150	0	-
Vert.	19296.000	PK	45.75	40.33	13.77	48.20	-9.54	42.11	73.9	31.7	166	345	-
Vert.	3515.500	AV	51.01	29.21	6.14	42.19	2.24	46.41	53.9	7.4	185	133	-
Vert.	6051.721	AV	50.16	33.49	7.69	43.41	2.24	50.17	53.9	3.7	122	227	-
Vert.	6374.391	AV	48.08	34.40	7.87	43.57	2.24	49.02	53.9	4.8	182	179	-
Vert.	7236.000	AV	39.38	37.62	8.39	43.41	2.24	44.22	53.9	9.6	150	0	Floor noise
Vert.	9648.000	AV	39.78	39.01	9.57	43.10	2.24	47.50	53.9	6.4	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB
10 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	47.02	28.41	14.22	41.66	1.67	2.24	51.90	53.9	1.9	*1)
Hori.	4824.000	AV	39.00	31.61	6.83	42.93	1.67	2.24	38.42	53.9	15.4	-
Hori.	19296.000	AV	35.34	40.33	13.77	48.20	1.67	-9.54	33.4	53.9	20.5	-
Vert.	2390.000	AV	48.75	28.41	14.22	41.66	1.67	2.24	53.6	53.9	0.2	*1)
Vert.	4824.000	AV	38.68	31.61	6.83	42.93	1.67	2.24	38.1	53.9	15.8	-
Vert.	19296.000	AV	37.48	40.33	13.77	48.20	1.67	-9.54	35.5	53.9	18.3	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB
10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Burst rate confirmation" 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	92.75	28.37	14.23	41.67	2.24	95.92	-	-	Carrier
Hori.	2400.000	PK	57.89	28.38	14.22	41.67	2.24	61.06	75.9	14.8	-
Vert.	2412.000	PK	93.01	28.37	14.23	41.67	2.24	96.18	-	-	Carrier
Vert.	2400.000	PK	58.27	28.38	14.22	41.67	2.24	61.44	76.2	14.7	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB
10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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Shonan EMC Lab.

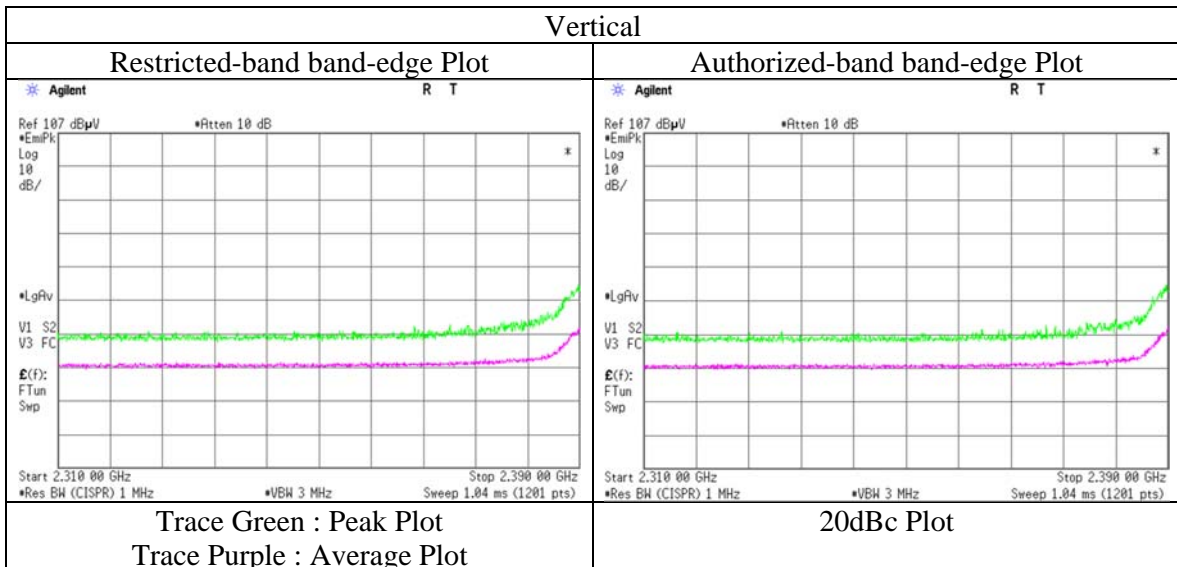
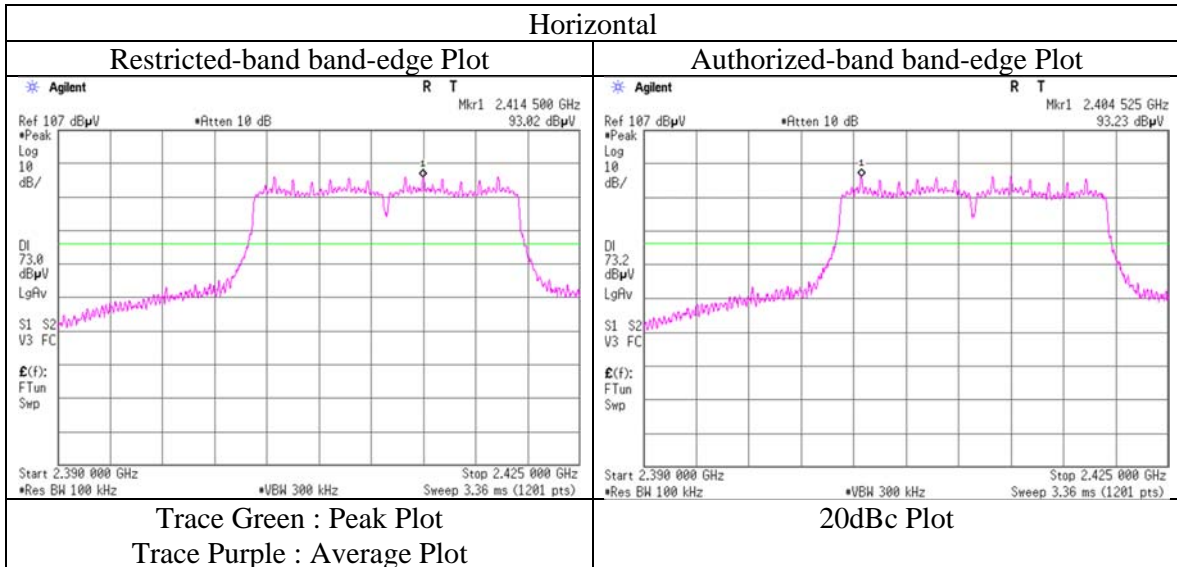
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 13480623S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date September 23, 2020
Temperature / Humidity 21 deg. C / 59 % RH
Engineer Yosuke Murakami
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2412 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz - 2.8 GHz)	(1 GHz - 2.8 GHz)
Mode	Tx 1In-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	58.36	28.41	14.22	41.66	2.24	61.57	73.9	12.3	141	16	-
Vert.	2390.000	PK	57.71	28.41	14.22	41.66	2.24	60.92	73.9	12.9	154	35	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

10 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.	2390.000	AV	44.29	28.41	14.22	41.66	1.67	2.24	49.17	53.9	4.7	*1)
Vert.	2390.000	AV	43.93	28.41	14.22	41.66	1.67	2.24	48.81	53.9	5.0	*1)

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

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

Duty factor refer to "Burst rate confirmation" 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	95.45	28.36	14.25	41.67	2.24	98.63	-	-	Carrier
Hori.	2400.000	PK	57.98	28.38	14.22	41.67	2.24	61.15	78.6	17.4	-
Vert.	2417.000	PK	95.18	28.36	14.25	41.67	2.24	98.36	-	-	Carrier
Vert.	2400.000	PK	57.72	28.38	14.22	41.67	2.24	60.89	78.4	17.4	-

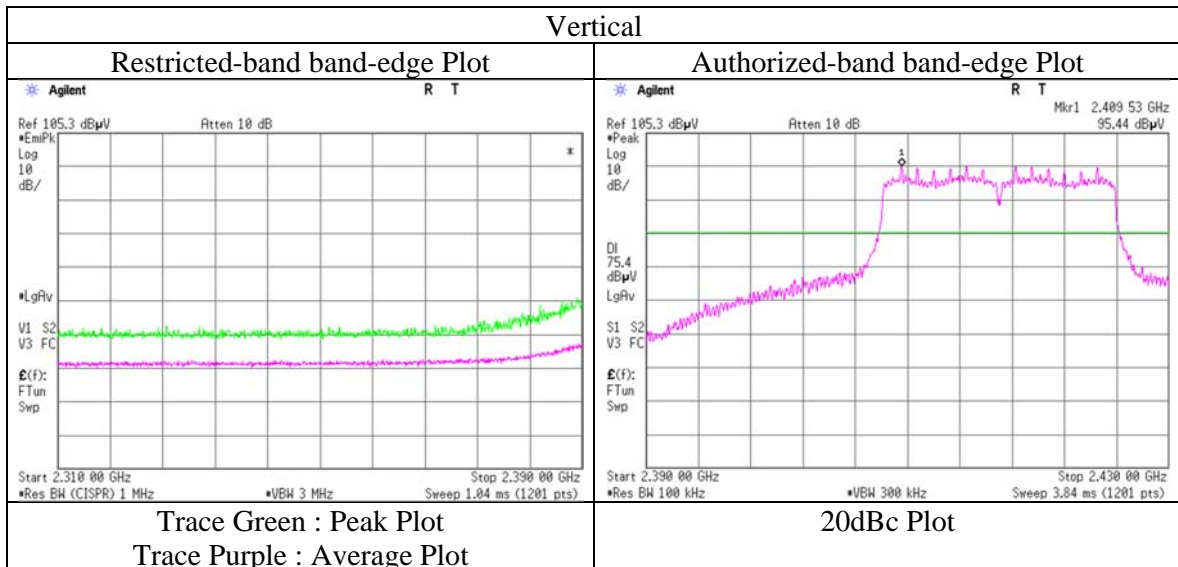
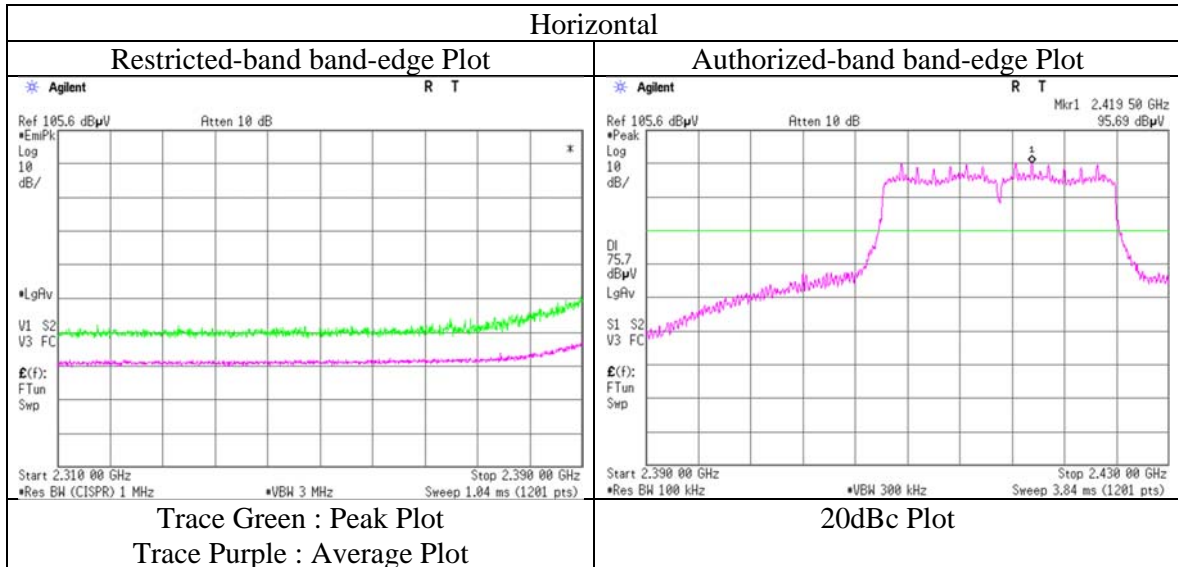
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2417 MHz	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No. 13480623S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2 No.3 No.3 No.3 No.2
Date September 25, 2020 September 14, 2020 September 15, 2020 September 28, 2020 September 25, 2020
Temperature / Humidity 25 deg. C / 67 % RH 23 deg. C / 48 % RH 24 deg. C / 52 % RH 25 deg. C / 43 % RH 24 deg. C / 52 % RH
Engineer Yosuke Murakami Kazuya Noda Yohsuke Matsuzawa Yohsuke Matsuzawa Hiromasa Sato
(30 MHz - 1 GHz) (1 GHz - 2.8 GHz) (1 GHz - 2.8 GHz) (2.8 GHz - 10 GHz) (10 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.	74.245	QP	42.80	6.30	7.68	31.88	0.00	24.90	40.0	15.1	246	69	-
Hori.	393.212	QP	34.70	15.49	6.97	31.63	0.00	25.53	46.0	20.4	100	204	-
Hori.	491.510	QP	34.50	17.58	7.54	31.60	0.00	28.02	46.0	17.9	100	222	-
Hori.	626.976	QP	32.70	19.41	8.23	31.61	0.00	28.73	46.0	17.2	100	341	-
Hori.	749.995	QP	32.40	20.11	8.82	31.43	0.00	29.90	46.0	16.1	151	5	-
Hori.	861.129	QP	35.40	21.81	9.29	31.03	0.00	35.47	46.0	10.5	109	299	-
Hori.	874.995	QP	34.60	22.08	9.36	30.97	0.00	35.07	46.0	10.9	110	270	-
Hori.	933.873	QP	34.70	21.90	9.61	30.62	0.00	35.59	46.0	10.4	106	183	-
Hori.	958.450	QP	32.70	22.08	9.72	30.43	0.00	34.07	46.0	11.9	150	194	-
Hori.	4874.000	PK	47.70	31.63	6.87	42.93	2.24	45.51	73.9	28.3	155	290	-
Hori.	6374.412	PK	53.31	34.40	7.87	43.57	2.24	54.25	73.9	19.6	105	189	-
Hori.	7311.000	PK	48.06	37.69	8.43	43.48	2.24	52.94	73.9	20.9	150	0	-
Hori.	9748.000	PK	47.79	39.17	9.62	42.98	2.24	55.84	73.9	18.0	150	0	-
Hori.	19496.000	PK	44.22	40.36	13.84	48.04	-9.54	40.84	73.9	33.0	151	62	-
Hori.	6374.412	AV	46.51	34.40	7.87	43.57	2.24	47.45	53.9	6.4	105	189	-
Hori.	7311.000	AV	38.72	37.69	8.43	43.48	2.24	43.60	53.9	10.3	150	0	Floor noise
Hori.	9748.000	AV	38.89	39.17	9.62	42.98	2.24	46.94	53.9	6.9	150	0	Floor noise
Vert.	74.240	QP	40.80	6.30	7.68	31.88	0.00	22.90	40.0	17.1	100	192	-
Vert.	111.358	QP	31.70	12.12	7.92	31.85	0.00	19.89	43.5	23.6	100	33	-
Vert.	712.696	QP	30.70	19.98	8.63	31.53	0.00	27.78	46.0	18.2	100	36	-
Vert.	874.994	QP	32.80	22.08	9.36	30.97	0.00	33.27	46.0	12.7	110	267	-
Vert.	933.870	QP	33.10	21.90	9.61	30.62	0.00	33.99	46.0	12.0	100	64	-
Vert.	3515.500	PK	55.02	29.21	6.14	42.19	2.24	50.42	73.9	23.4	185	133	-
Vert.	4874.000	PK	47.24	31.63	6.87	42.93	2.24	45.05	73.9	28.8	168	199	-
Vert.	6052.256	PK	57.14	33.49	7.69	43.41	2.24	57.15	73.9	16.7	119	226	-
Vert.	6374.412	PK	54.11	34.40	7.87	43.57	2.24	55.05	73.9	18.8	182	179	-
Vert.	7311.000	PK	47.33	37.69	8.43	43.48	2.24	52.21	73.9	21.6	150	0	-
Vert.	9748.000	PK	48.46	39.17	9.62	42.98	2.24	56.51	73.9	17.3	150	0	-
Vert.	19496.000	PK	44.93	40.36	13.84	48.04	-9.54	41.55	73.9	32.3	152	198	-
Vert.	3515.500	AV	51.29	29.21	6.14	42.19	2.24	46.69	53.9	7.2	185	133	-
Vert.	6052.256	AV	50.46	33.49	7.69	43.41	2.24	50.47	53.9	3.4	119	226	-
Vert.	6374.412	AV	47.98	34.40	7.87	43.57	2.24	48.92	53.9	4.9	182	179	-
Vert.	7311.000	AV	38.49	37.69	8.43	43.48	2.24	43.37	53.9	10.5	150	0	Floor noise
Vert.	9748.000	AV	38.54	39.17	9.62	42.98	2.24	46.59	53.9	7.3	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB
10 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	38.67	31.63	6.87	42.93	1.67	2.24	38.2	53.9	15.7	-
Hori.	19496.000	AV	34.47	40.36	13.84	48.04	1.67	-9.54	32.8	53.9	21.1	-
Vert.	4874.000	AV	38.53	31.63	6.87	42.93	1.67	2.24	38.0	53.9	15.8	-
Vert.	19496.000	AV	35.15	40.36	13.84	48.04	1.67	-9.54	33.4	53.9	20.4	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB
10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Burst rate confirmation" sheet.

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Shonan EMC Lab.

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Radiated Spurious Emission

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(1 GHz – 2.8 GHz)
Mode	Tx 1In-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	58.51	28.28	14.31	41.69	2.24	61.65	73.9	12.2	134	20	-
Vert.	2483.500	PK	58.04	28.28	14.31	41.69	2.24	61.18	73.9	12.7	166	59	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

10 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	43.13	28.28	14.31	41.69	1.67	2.24	47.94	53.9	5.9	*1)
Vert.	2483.500	AV	42.67	28.28	14.31	41.69	1.67	2.24	47.48	53.9	6.4	*1)

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

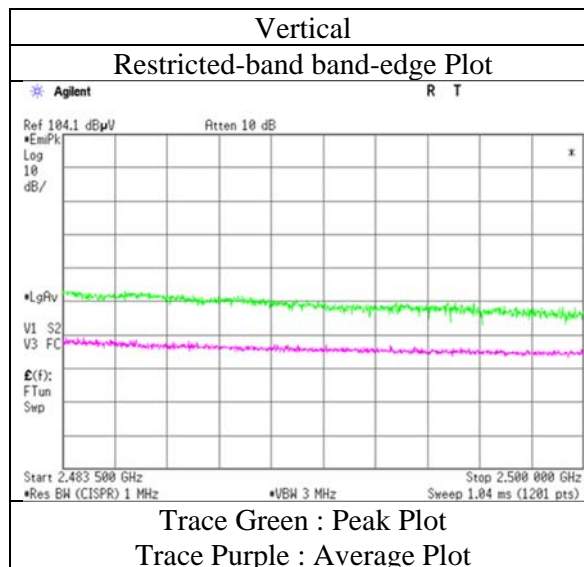
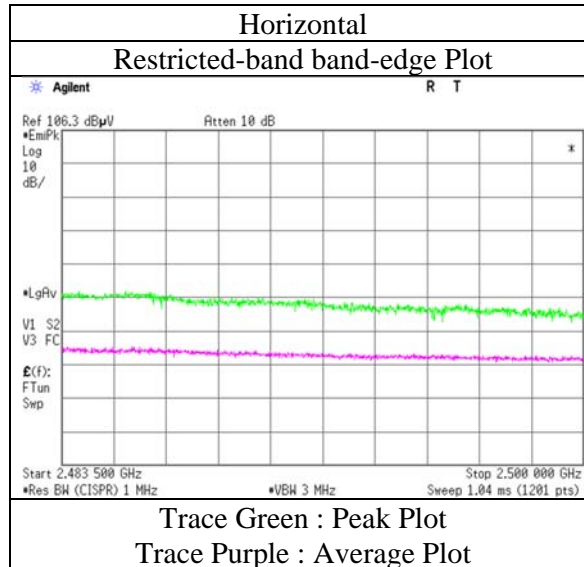
10 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

Duty factor refer to "Burst rate confirmation" sheet.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2457 MHz	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	13480623S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.2
Date	September 14, 2020	September 15, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda (1 GHz - 2.8 GHz)	Yohsuke Matsuzawa (1 GHz - 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz - 10 GHz)	Hiromasa Sato (10 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	62.43	28.28	14.31	41.69	2.24	65.57	73.9	8.3	133	18	-
Hori.	4924.000	PK	48.09	31.68	6.91	42.94	2.24	45.98	73.9	27.9	158	288	-
Hori.	6374.401	PK	53.70	34.40	7.87	43.57	2.24	54.64	73.9	19.2	109	188	-
Hori.	7386.000	PK	47.82	37.81	8.48	43.55	2.24	52.80	73.9	21.1	150	0	-
Hori.	9848.000	PK	47.47	39.16	9.68	42.87	2.24	55.68	73.9	18.2	150	0	-
Hori.	19696.000	PK	44.21	40.36	13.92	47.77	-9.54	41.18	73.9	32.7	150	77	-
Hori.	6374.401	AV	46.26	34.40	7.87	43.57	2.24	47.20	53.9	6.7	109	188	-
Hori.	7386.000	AV	38.58	37.81	8.48	43.55	2.24	43.56	53.9	10.3	150	0	Floor noise
Hori.	9848.000	AV	37.90	39.16	9.68	42.87	2.24	46.11	53.9	7.7	150	0	Floor noise
Vert.	2483.500	PK	61.94	28.28	14.31	41.69	2.24	65.08	73.9	8.8	176	65	-
Vert.	3515.500	PK	54.88	29.21	6.14	42.19	2.24	50.28	73.9	23.6	186	133	-
Vert.	4924.000	PK	47.93	31.68	6.91	42.94	2.24	45.82	73.9	28.0	171	198	-
Vert.	6051.371	PK	57.22	33.48	7.69	43.41	2.24	57.22	73.9	16.6	115	228	-
Vert.	6374.401	PK	54.64	34.40	7.87	43.57	2.24	55.58	73.9	18.3	181	179	-
Vert.	7386.000	PK	47.74	37.81	8.48	43.55	2.24	52.72	73.9	21.1	150	0	-
Vert.	9848.000	PK	47.20	39.16	9.68	42.87	2.24	55.41	73.9	18.4	150	0	-
Vert.	19696.000	PK	44.48	40.36	13.92	47.77	-9.54	41.45	73.9	32.4	146	163	-
Vert.	3515.500	AV	51.09	29.21	6.14	42.19	2.24	46.49	53.9	7.4	186	133	-
Vert.	6051.371	AV	50.12	33.48	7.69	43.41	2.24	50.12	53.9	3.7	115	228	-
Vert.	6374.401	AV	47.95	34.40	7.87	43.57	2.24	48.89	53.9	5.0	181	179	-
Vert.	7386.000	AV	38.34	37.81	8.48	43.55	2.24	43.32	53.9	10.5	150	0	Floor noise
Vert.	9848.000	AV	37.93	39.16	9.68	42.87	2.24	46.14	53.9	7.7	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

10 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	45.87	28.28	14.31	41.69	1.67	2.24	50.68	53.9	3.2	*1)
Hori.	4924.000	AV	38.84	31.68	6.91	42.94	1.67	2.24	38.40	53.9	15.5	-
Hori.	19696.000	AV	34.45	40.36	13.92	47.77	1.67	-9.54	33.1	53.9	20.8	-
Vert.	2483.500	AV	45.28	28.28	14.31	41.69	1.67	2.24	50.1	53.9	3.8	*1)
Vert.	4924.000	AV	38.87	31.68	6.91	42.94	1.67	2.24	38.4	53.9	15.4	-
Vert.	19696.000	AV	35.08	40.36	13.92	47.77	1.67	-9.54	33.7	53.9	20.1	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

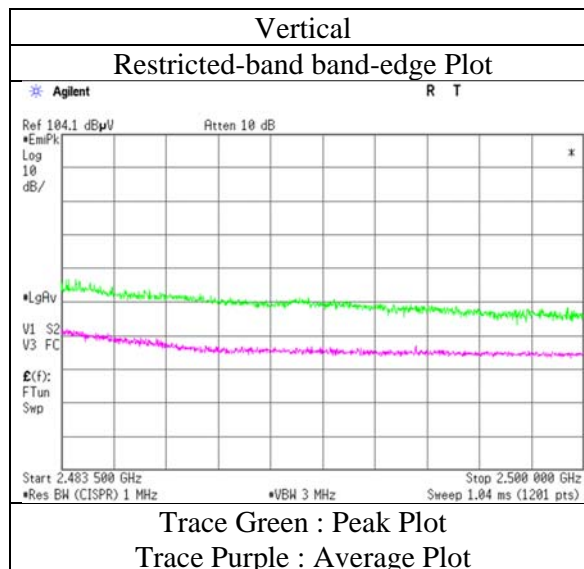
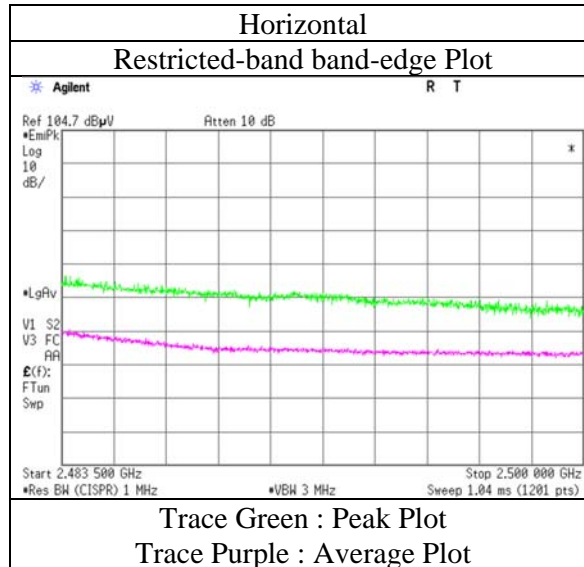
10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Burst rate confirmation" sheet.

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13480623S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	September 14, 2020	September 15, 2020
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 52 % RH
Engineer	Kazuya Noda	Yohsuke Matsuzawa
	(1 GHz – 2.8 GHz)	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2462 MHz	

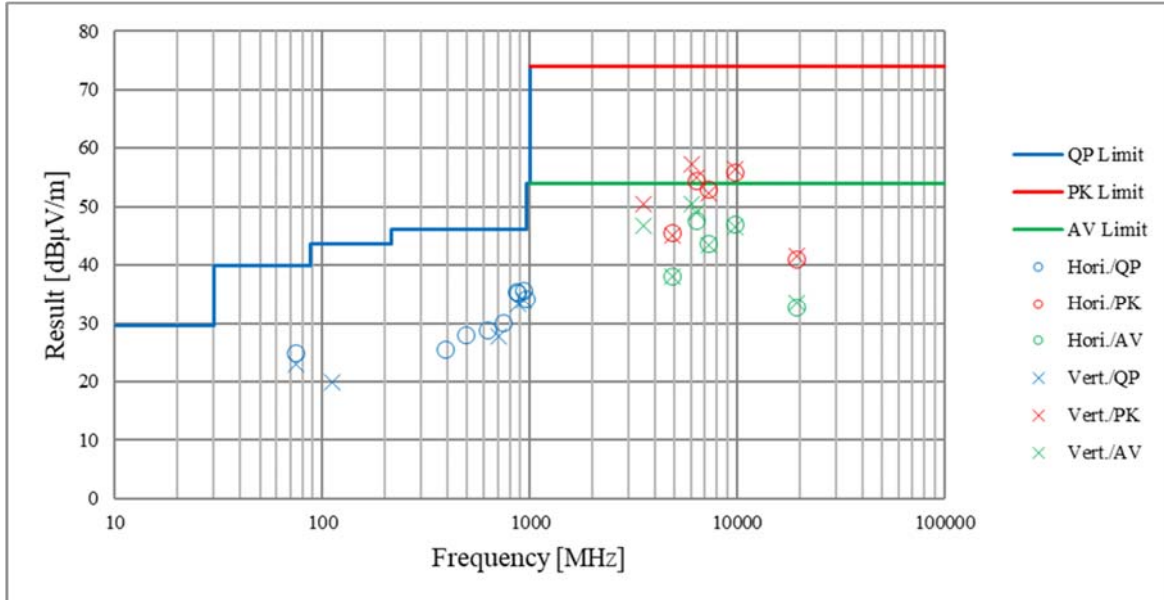


* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission
(Plot data, Worst case)

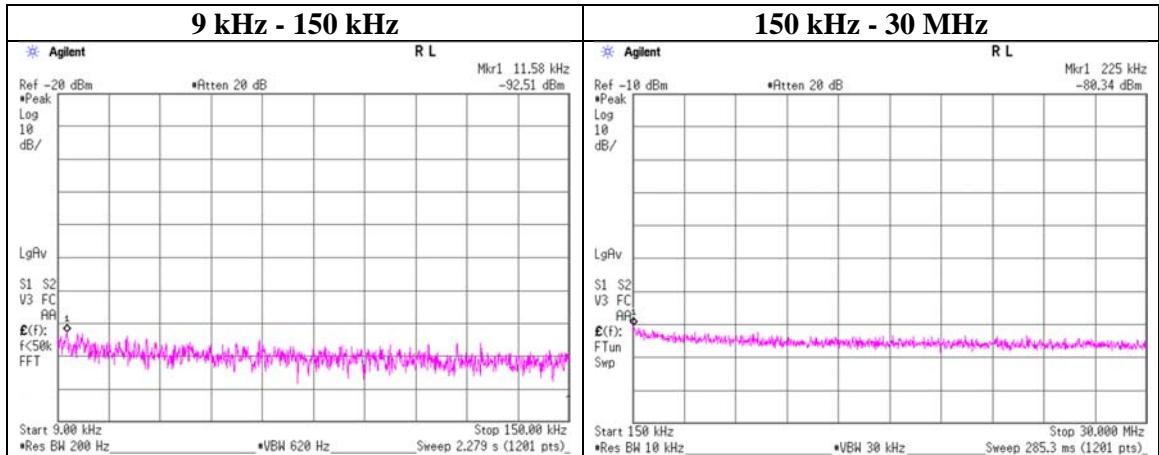
Report No.	13480623S-A-R2				
Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	No.2	No.3	No.3	No.3	No.2
Date	September 25, 2020	September 14, 2020	September 15, 2020	September 28, 2020	September 25, 2020
Temperature / Humidity	25 deg. C / 67 % RH	23 deg. C / 48 % RH	24 deg. C / 52 % RH	25 deg. C / 43 % RH	24 deg. C / 52 % RH
Engineer	Yosuke Murakami (30 MHz – 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (1 GHz – 2.8 GHz)	Yohsuke Matsuzawa (2.8 GHz – 10 GHz)	Hiromasa Sato (10 GHz – 26.5 GHz)
Mode	Tx 11n-20 2437 MHz				



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

Conducted Spurious Emission

Report No. 13480623S-A-R2
 Test place Shonan EMC Lab. No.5 Shielded Room
 Date September 12, 2020
 Temperature / Humidity 25 deg. C / 60 % RH
 Engineer Takahiro Kawakami
 Mode Tx 11n-20 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
11.58	-92.5	0.00	9.5	3.4	1	-79.6	300	6.0	-18.3	46.3	64.6	
225.00	-80.3	0.01	9.5	3.4	1	-67.4	300	6.0	-6.1	20.5	26.6	

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

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

N: Number of output

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Power Density

Report No. 13480623S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date September 12, 2020 September 24, 2020
Temperature / Humidity 25 deg. C / 60 % RH 24 deg. C / 47 % RH
Engineer Takahiro Kawakami Makoto Hosaka
Mode Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-19.21	1.04	9.63	-8.54	8.00	16.54
2437	-20.50	1.04	9.63	-9.83	8.00	17.83
2462	-18.44	1.04	9.63	-7.77	8.00	15.77

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-27.52	1.04	9.63	-16.85	8.00	24.85
2437	-26.98	1.04	9.63	-16.31	8.00	24.31
2462	-28.69	1.04	9.63	-18.02	8.00	26.02

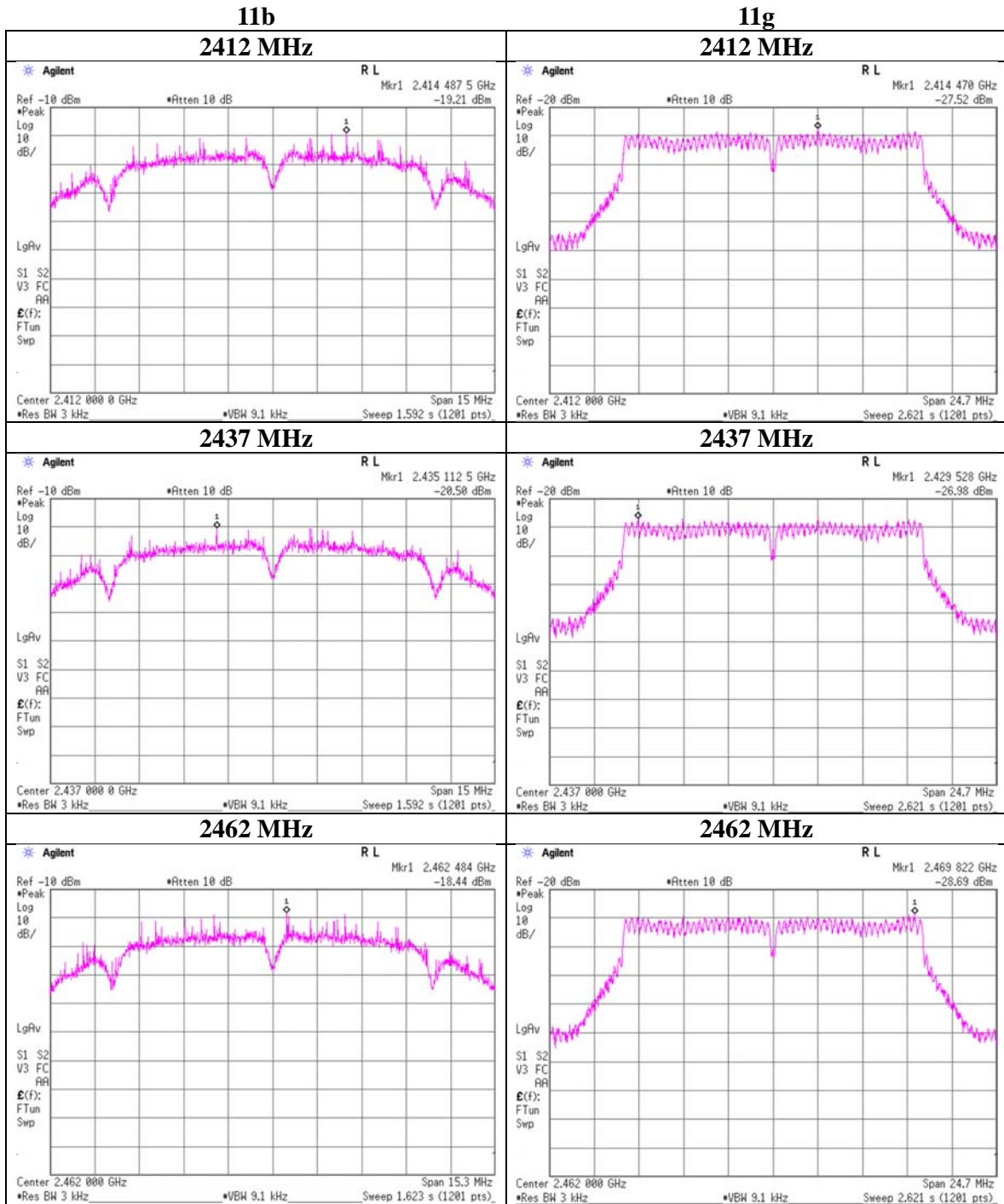
11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-29.51	1.76	9.81	-17.94	8.00	25.94
2437	-26.11	1.04	9.63	-15.44	8.00	23.44
2462	-27.87	1.04	9.63	-17.20	8.00	25.20

Sample Calculation:

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

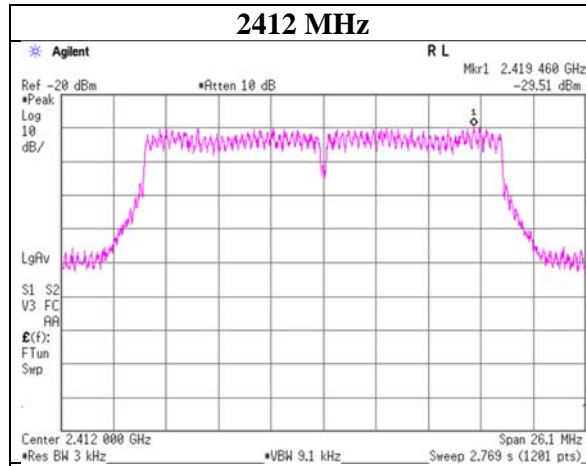
Power Density



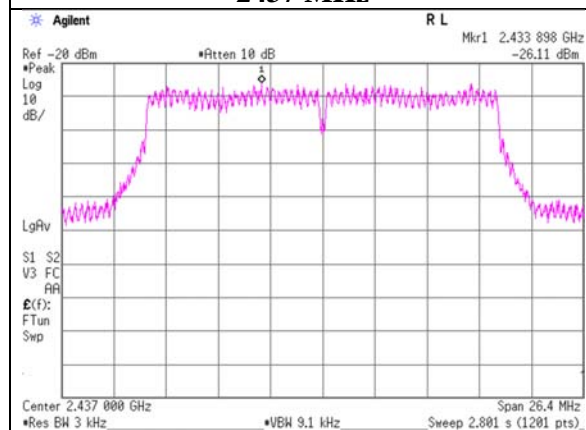
Power Density

11n-20

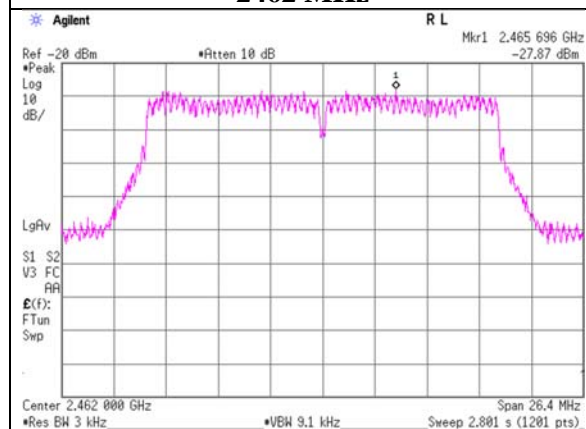
2412 MHz



2437 MHz



2462 MHz



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APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2019/10/01	12
AT	SAT10-09	145132	Attenuator	Weinschel Corp.	54A-10	W5692	2019/11/05	12
AT	SAT10-14	154591	Attenuator	Weinschel Corp.	54A-10	81595	2020/04/01	12
AT	SCC-G14	145175	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	2019/12/12	12
AT	SCC-G63	196946	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102	803411/2	2020/03/10	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2019/12/12	12
AT	SPM-07	146247	Power Meter	Keysight Technologies Inc	8990B	MY5100272	2020/05/27	12
AT	SPM-13	169910	Power Meter	Keysight Technologies Inc	8990B	MY51000448	2020/01/28	12
AT	SPSS-04	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2020/05/27	12
AT	SPSS-06	169911	Power sensor	Keysight Technologies Inc	N1923A	MY57270004	2020/01/28	12
AT,RE	KSA-08	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2019/11/05	12
AT,RE	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2020/04/16	12
RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
RE	SAEC-02(NSA)	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2020/03/20	12
RE	SAEC-03(SVSWR)	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2020/05/11	12
RE	SAF-05	145128	Pre Amplifier	Toyo Corporation	TPA0118-36	1440490	2020/06/03	12
RE	SAF-06	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2020/02/20	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2020/03/03	12
RE	SAT10-05	145136	Attenuator(above 1GHz)	Keysight Technologies Inc	8493C-010	74864	2019/11/06	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2020/03/04	12
RE	SCC-G40	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2020/01/08	12
RE	SCC-G43	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104_E	SN MY 13406/4E	2020/06/04	12
RE	SCC-G50	178573	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104_E	MY13407/4E	2020/03/09	12
RE	SCC-G51	178572	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800288 /4A	2020/03/09	12
RE	SCC-G57	179540	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102	802815/2	2020/05/12	12
RE	SCC-G58	183047	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800287/4A	2020/06/04	12
RE	SCC-G69	200009	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	575617/4	2020/07/07	12
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2019/11/06	12
RE	SFL-18	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2020/04/03	12
RE	SHA-03	145501	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA9120D	9120D-739	2020/06/15	12
RE	SHA-04	145512	Horn Antenna	ETS LINDGREN	3160-09	00094868	2020/06/15	12
RE	SHA-09	194684	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA 9120 C	695	2020/02/17	12
RE	SJM-09	145336	Measure	PROMART	SEN1935	-	-	-
RE	SOS-21	191838	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2019/12/12	12
RE	SOS-23	191840	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2019/12/12	12
RE	STS-02	145793	Digital Hitester	Hioki	3805-50	80997819	2020/04/09	12
RE	STS-03	146210	Digital Hitester	Hioki	3805-50	80997823	2019/10/01	12

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***Hyphens for Last Calibration 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.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

**Test item: RE: Radiated Emission test
AT: Antenna Terminal Conducted test**