



RADIO TEST REPORT

Test Report No. : 13046711S-A

Applicant : Nintendo Co., Ltd.
Type of EUT : Wireless Control Device
Model Number of EUT : HAC-037
FCC ID : BKEHAC037
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.
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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.

Date of test: October 3 to December 13, 2019

Representative test engineer: K. Noda
Kazuya Noda
Engineer
Consumer Technology Division

Approved by: A. Hayashi
Akio Hayashi
Leader
Consumer Technology Division



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.: 13046711S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13046711S-A	July 27, 2020	-	-

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	:	Nintendo Co., Ltd.
Brand Name	:	Nintendo
Address	:	11-1 Hokotate-cho, Kamitoba, Minami-ku, Kyoto 601-8501, Japan
Telephone Number	:	+81 75 662 9600
Facsimile Number	:	+81 75 662 9624
Contact Person	:	Kazuya Kuramoto

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., 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 (E.U.T.)
 - SECTION 4: Operation of E.U.T. 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 (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless Control Device
Model No.	:	HAC-037
Serial No.	:	Refer to Section 4.2
Rating	:	USB input: DC 5 V Internal battery: DC 3.7 V
Receipt Date of Sample (Information from test lab.)	:	September 30, 2019
Country of Mass-production	:	China
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Size	:	111 x 200 x 96 (Width x Length x Height (mm))
Modification of EUT	:	No Modification by the test lab.

2.2 Product Description

Model: HAC-037 (referred to as the EUT in this report) is a Wireless Control Device.

The clock frequency used in EUT: 27 MHz

Radio Specification

Radio type	:	Transceiver
Frequency of Operation	:	2412 MHz -2462 MHz
Modulation	:	DSSS, CCK, OFDM
Antenna type	:	Monopole
Antenna connector	:	None
Antenna gain	:	2.18 dBi max (ANT0), 3.25 dBi max (ANT1)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
 FCC Part 15 final revised on May 26, 2020 and effective July 27, 2020 except 15.258
 * The revision does not affect the test result conducted before its effective date.

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

* Also the EUT complies with FCC Part 15 Subpart B.

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	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	5.2 dB 9748.00 MHz, AV, Vertical Mode: Tx 11b 2437 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 stops transmission during recharging.

*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.

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FCC Part 15.31 (e)

This EUT provides the stable voltage constantly to RF part regardless of input voltage. Therefore, this 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.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	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	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	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 E.U.T. during testing

4.1 Operating Mode(s)

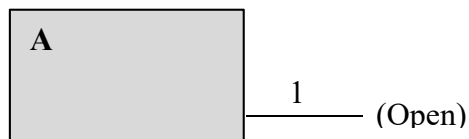
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	24 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 6 (Short GI), PN9
*Transmitting duty was 100 % on all tests.	
*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: Tera Term ver.4.104 (Date: October 3, 2019, Storage location: Driven by connected PC)	
*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 Antenna	Tested frequency
Spurious Emission	11b Tx 11g Tx 11n-20 Tx	1	2412 MHz 2437 MHz 2462 MHz
Spurious Emission (Below 1 GHz)	11g Tx	1	2412 MHz
6dB Bandwidth Power Density 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	1	2412 MHz 2437 MHz 2462 MHz
Maximum Peak Output Power	11b Tx 11g Tx 11n-20 Tx	0 and 1	2412 MHz 2437 MHz 2462 MHz

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless Control Device	HAC-037	XQL01000008300 *2) XQL01000008362 *1)	Nintendo Co., Ltd.	EUT

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.15	Unshielded	Unshielded	*3)

*3) Cable for test operation

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 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a 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	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	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.

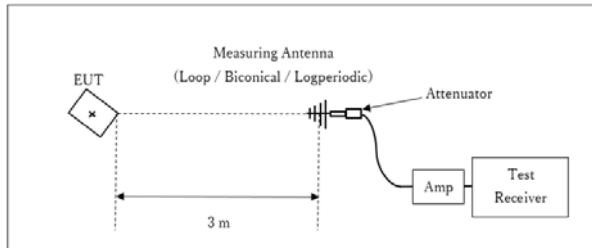
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	11.12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces	RBW: 100 kHz VBW: 300 kHz

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

Figure 1: Test Setup

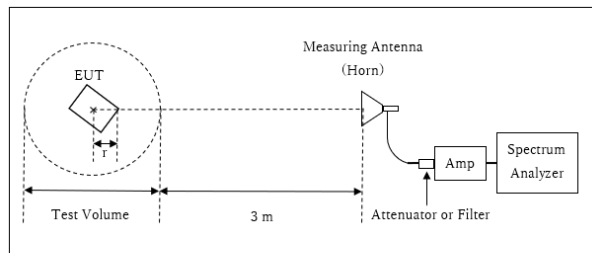
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log (3.90 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

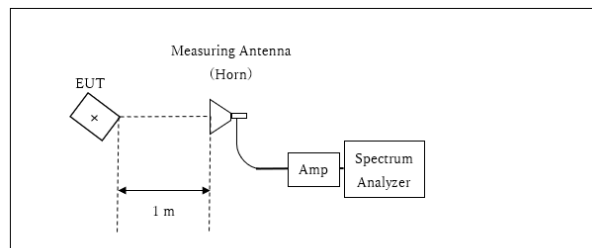
* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.90 \text{ m}$

Test Volume : 2.0 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.10 \text{ m}$

13 GHz - 26.5 GHz



x : 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 test was made on EUT at the normal use position.

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

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	20 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately and the noise was detected as shown in the chart, and therefore, Radiated Emission below 30MHz was performed.							

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

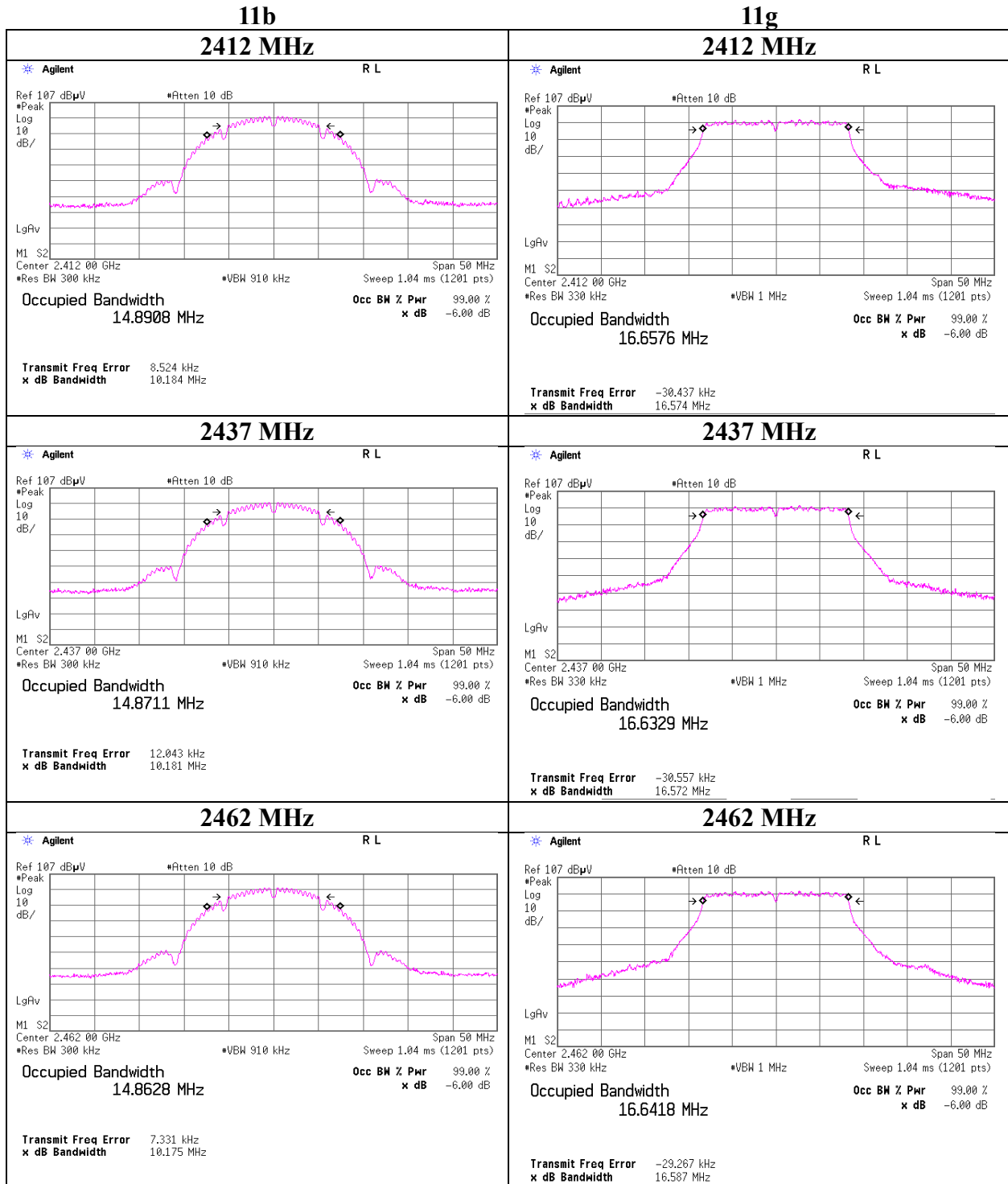
6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	13046711S-A	
Test place	Shonan EMC Lab. No.1 Measurement Room and No.5 Shielded Room	
Date	October 7, 2019	November 22, 2019
Temperature / Humidity	24 deg. C / 53 % RH	24 deg.C / 49 %RH
Engineer	Kenichi Adachi	Kazuya Noda
Mode	Tx	

(Worst antenna port : Ant1)

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
11b	2412	14890.8	10.098	> 0.5000
	2437	14871.1	10.096	> 0.5000
	2462	14862.8	10.095	> 0.5000
11g	2412	16657.6	16.557	> 0.5000
	2437	16632.9	16.560	> 0.5000
	2462	16641.8	16.561	> 0.5000
11n-20	2412	17948.6	17.743	> 0.5000
	2437	17931.8	17.734	> 0.5000
	2462	17881.0	17.734	> 0.5000

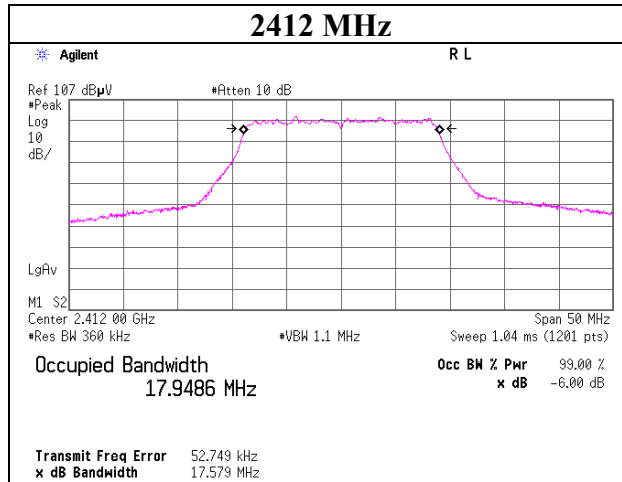
99 % Occupied Bandwidth



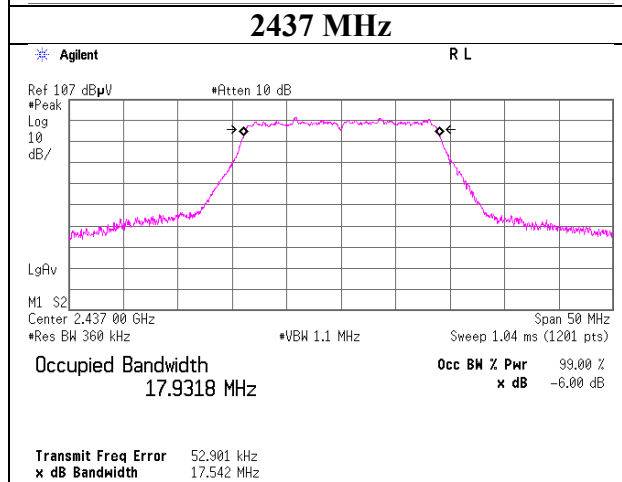
99 % Occupied Bandwidth

11n-20

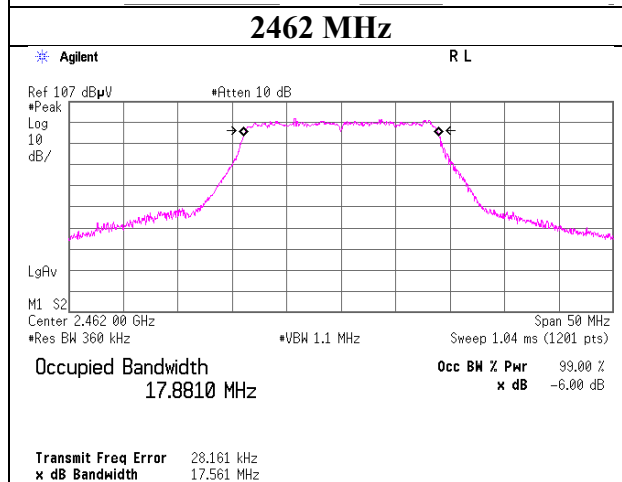
2412 MHz



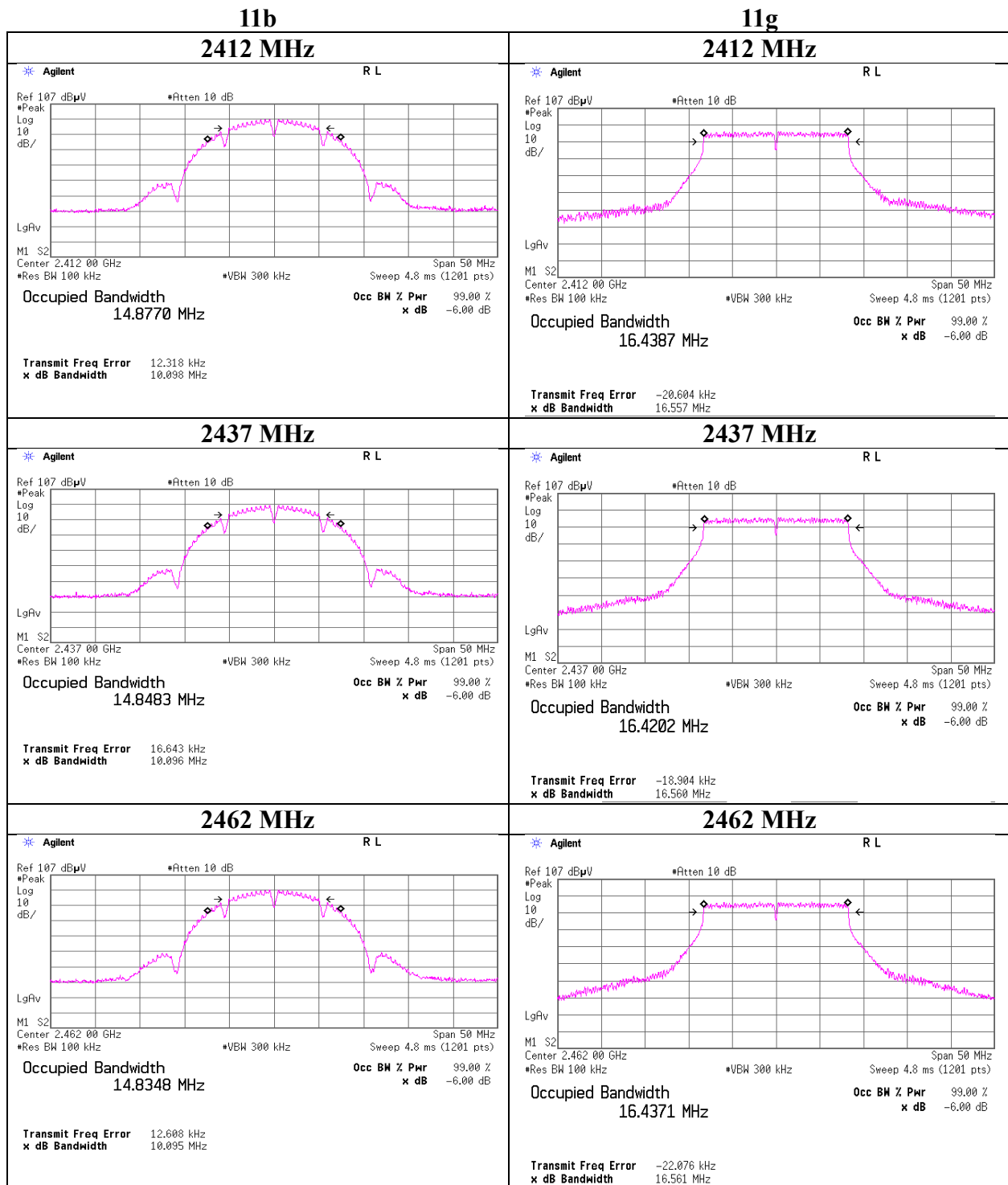
2437 MHz



2462 MHz



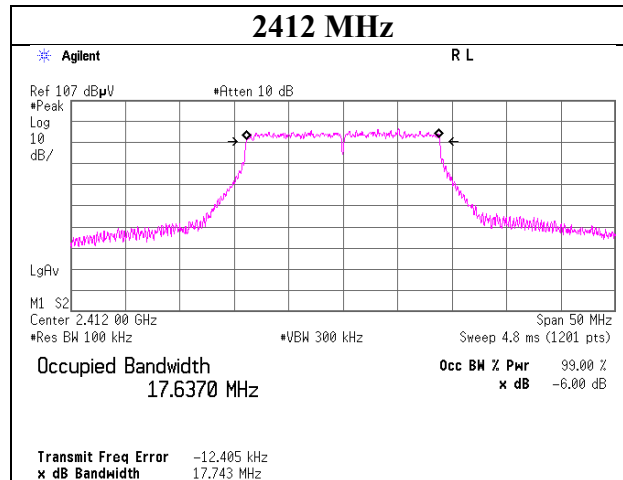
6 dB Bandwidth



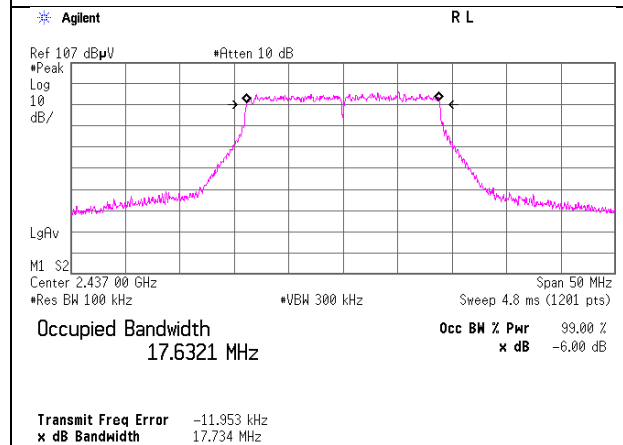
6 dB Bandwidth

11n-20

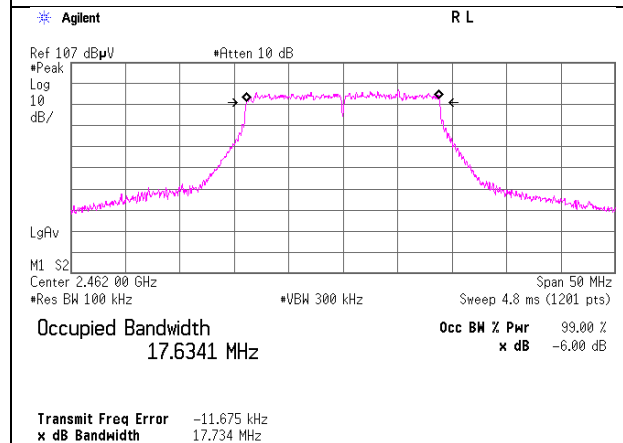
2412 MHz



2437 MHz



2462 MHz



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

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Maximum Peak Output Power

Report No. 13046711S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date November 21, 2019
Temperature / Humidity 20 deg.C / 49 %RH
Engineer Kazuya Noda
Mode Tx 11b

Antenna: Ant1 2 Mbps (worst)				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	3.25	3.93	9.89	17.07	50.93	30.00	1000	12.93	3.25	20.32	107.65	36.02	4000	15.70
2437	2.73	3.94	9.89	16.56	45.29	30.00	1000	13.44	3.25	19.81	95.72	36.02	4000	16.21
2462	3.19	3.95	9.89	17.03	50.47	30.00	1000	12.97	3.25	20.28	106.66	36.02	4000	15.74

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)						(2437 MHz)					
Rate	Ant0					Ant1					
[Mbps]	Reading	Cable loss	Atten.loss	Result	Remarks	Reading	Cable loss	Atten.loss	Result	Remarks	
	[dBm]	[dB]	[dB]	[dBm]		[dBm]	[dB]	[dB]	[dBm]		
1	-0.02	3.94	9.89	13.81		2.66	3.94	9.89	16.49		
2	-0.06	3.94	9.89	13.77		2.73	3.94	9.89	16.56	*	
5.5	0.03	3.94	9.89	13.86		2.59	3.94	9.89	16.42		
11	0.00	3.94	9.89	13.83		2.61	3.94	9.89	16.44		

*: Worst Rate

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

Sample Calculation:

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

Maximum Peak Output Power

Report No. 13046711S-A
Test place Shonan EMC Lab. No.1 Measurement Room and No.5 Shielded Room
Date October 3, 2019 October 7, 2019
Temperature / Humidity 24 deg. C / 56 % RH 24 deg. C / 53 % RH
Engineer Kazuya Noda Kenichi Adachi
Mode Tx 11g

Antenna: Ant1 24 Mbps (worst)				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	10.97	3.93	9.69	24.59	287.74	30.00	1000	5.41	3.25	27.84	608.14	36.02	4000	8.18
2437	10.06	3.94	9.92	23.92	246.60	30.00	1000	6.08	3.25	27.17	521.19	36.02	4000	8.85
2462	10.15	3.95	9.70	23.80	239.88	30.00	1000	6.20	3.25	27.05	506.99	36.02	4000	8.97

Used instruments (cables, attenuators) between the data of channel 2437 MHz and other channels are different.

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)						(2437 MHz)					
Rate	Ant0					Rate	Ant1				
	Reading	Cable loss	Atten.loss	Result	Remarks		Reading	Cable loss	Atten.loss	Result	Remarks
[Mbps]	[dBm]	[dB]	[dB]	[dBm]		[Mbps]	[dBm]	[dB]	[dB]	[dBm]	
6	8.22	3.94	9.92	22.08		6	9.46	3.94	9.92	23.32	
9	7.46	3.94	9.92	21.32		9	9.10	3.94	9.92	22.96	
12	8.20	3.94	9.92	22.06		12	9.86	3.94	9.92	23.72	
18	6.53	3.94	9.92	20.39		18	8.40	3.94	9.92	22.26	
24	8.45	3.94	9.92	22.31		24	10.06	3.94	9.92	23.92	*
36	8.33	3.94	9.92	22.19		36	10.04	3.94	9.92	23.90	
48	7.34	3.94	9.92	21.20		48	9.10	3.94	9.92	22.96	
54	7.95	3.94	9.92	21.81		54	9.56	3.94	9.92	23.42	

*: Worst Rate

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

Sample Calculation:

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

Maximum Peak Output Power

Report No. 13046711S-A
Test place Shonan EMC Lab. No.1 Measurement Room
Date October 3, 2019 October 7, 2019
Temperature / Humidity 24 deg. C / 56 % RH 24 deg. C / 53 % RH
Engineer Kazuya Noda Kenichi Adachi
Mode Tx 11n-20

Antenna: Antl MCS6 short (worst)				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	10.17	3.93	9.69	23.79	239.33	30.00	1000	6.21	3.25	27.04	505.82	36.02	4000	8.98
2437	9.52	3.94	9.92	23.38	217.77	30.00	1000	6.62	3.25	26.63	460.26	36.02	4000	9.39
2462	9.15	3.95	9.70	22.80	190.55	30.00	1000	7.20	3.25	26.05	402.72	36.02	4000	9.97

Used instruments (cables, attenuators) between the data of channel 2437 MHz and other channels are different.

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)							(2437 MHz)				
G.I.	MCS	Ant0 Reading	Cable loss	Atten. loss	Result	Remarks	Ant1 Reading	Cable loss	Atten. loss	Result	Remarks
		[dBm]	[dB]	[dB]	[dBm]		[dBm]	[dB]	[dB]	[dBm]	
Long	0	5.96	3.94	9.92	19.82		7.68	3.94	9.92	21.54	
	1	5.93	3.94	9.92	19.79		7.81	3.94	9.92	21.67	
	2	6.98	3.94	9.92	20.84		8.96	3.94	9.92	22.82	
	3	5.53	3.94	9.92	19.39		7.53	3.94	9.92	21.39	
	4	5.87	3.94	9.92	19.73		7.92	3.94	9.92	21.78	
	5	5.76	3.94	9.92	19.62		7.90	3.94	9.92	21.76	
	6	7.65	3.94	9.92	21.51		9.50	3.94	9.92	23.36	
Short	7	5.92	3.94	9.92	19.78		7.94	3.94	9.92	21.80	
	0	5.59	3.94	9.92	19.45		7.83	3.94	9.92	21.69	
	1	5.88	3.94	9.92	19.74		7.89	3.94	9.92	21.75	
	2	6.93	3.94	9.92	20.79		9.06	3.94	9.92	22.92	
	3	5.33	3.94	9.92	19.19		7.51	3.94	9.92	21.37	
	4	5.77	3.94	9.92	19.63		8.02	3.94	9.92	21.88	
	5	5.85	3.94	9.92	19.71		7.93	3.94	9.92	21.79	
	6	7.55	3.94	9.92	21.41		9.52	3.94	9.92	23.38	*
	7	5.74	3.94	9.92	19.60		7.95	3.94	9.92	21.81	

*: Worst Rate

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

Sample Calculation:

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

Average Output Power (Reference data for RF Exposure)

Report No.	13046711S-A	
Test place	Shonan EMC Lab. No.1 Measurement Room and No.5 Shielded Room	
Date	October 7, 2019	November 21, 2019
Temperature / Humidity	24 deg. C / 53 % RH	20 deg.C / 49 %RH
Engineer	Kenichi Adachi	Kazuya Noda
Mode	Tx	

11b 2 Mbps (worst antenna port: Ant1)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
				[dBm]	[mW]
2412	0.62	3.93	9.89	14.44	27.80
2437	0.22	3.94	9.89	14.05	25.41
2462	0.58	3.95	9.89	14.42	27.67

11g 18 Mbps (worst antenna port: Ant1)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
				[dBm]	[mW]
2412	-0.22	3.93	9.69	13.40	21.88
2437	-0.92	3.94	9.92	12.94	19.68
2462	-0.12	3.95	9.70	13.53	22.54

11n-20 MCS 0 short G.I. (worst antenna port: Ant1)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
				[dBm]	[mW]
2412	-1.02	3.93	9.69	12.60	18.20
2437	-1.82	3.94	9.92	12.04	16.00
2462	-1.15	3.95	9.70	12.50	17.78

Sample Calculation:

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

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

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

Used instruments (cables, attenuators) between the data of channel 2437 MHz and other channels are different.(11g, 11n-20)

Average Output Power (Reference data for RF Exposure)

Report No. 13046711S-A
Test place Shonan EMC Lab. No.1 Measurement Room and No.5 Shielded Room
Date October 3, 2019 November 21, 2019
Temperature / Humidity 24 deg. C / 56 % RH 20 deg.C / 49 %RH
Engineer Kazuya Noda Kazuya Noda
Mode Tx

11b (2437 MHz)

	Rate [Mbps]	Reading (Average) [dBm]	Factor (cable, ATT) [dB]	Antenna Gain [dBi]	Result [dBm]	Remark
Ant0	1	-2.40	13.83	2.18	13.61	
	2	-2.55	13.83	2.18	13.46	
	5.5	-2.52	13.83	2.18	13.49	
	11	-2.42	13.83	2.18	13.59	

*: Worst Rate

11b (2437 MHz)

	Rate [Mbps]	Reading (Average) [dBm]	Factor (cable, ATT) [dB]	Antenna Gain [dBi]	Result [dBm]	Remark
Ant1	1	0.18	13.83	3.25	17.26	
	2	0.22	13.83	3.25	17.30	*
	5.5	0.18	13.83	3.25	17.26	
	11	0.14	13.83	3.25	17.22	

*: Worst Rate

11g (2437 MHz)

	Rate [Mbps]	Reading (Average) [dBm]	Factor (cable, ATT) [dB]	Antenna Gain [dBi]	Result [dBm]	Remark
Ant0	6	-2.74	13.86	2.18	13.30	
	9	-2.89	13.86	2.18	13.15	
	12	-2.96	13.86	2.18	13.08	
	18	-2.91	13.86	2.18	13.13	
	24	-3.02	13.86	2.18	13.02	
	36	-3.09	13.86	2.18	12.95	
	48	-3.05	13.86	2.18	12.99	
	54	-3.09	13.86	2.18	12.95	

*: Worst Rate

11g (2437 MHz)

	Rate [Mbps]	Reading (Average) [dBm]	Factor (cable, ATT) [dB]	Antenna Gain [dBi]	Result [dBm]	Remark
Ant1	6	-0.95	13.86	3.25	16.16	
	9	-0.96	13.86	3.25	16.15	
	12	-0.95	13.86	3.25	16.16	
	18	-0.92	13.86	3.25	16.19	*
	24	-0.97	13.86	3.25	16.14	
	36	-1.01	13.86	3.25	16.10	
	48	-0.96	13.86	3.25	16.15	
	54	-1.03	13.86	3.25	16.08	

*: Worst Rate

11n-20 (2437 MHz)

MCS	MCS	Reading (Average) [dBm]	Factor (cable, ATT) [dB]	Antenna Gain [dBi]	Result [dBm]	Remark
Ant0	0 (long G.I.)	-3.94	13.86	2.18	12.10	
	1 (long G.I.)	-4.10	13.86	2.18	11.94	
	2 (long G.I.)	-4.10	13.86	2.18	11.94	
	3 (long G.I.)	-4.08	13.86	2.18	11.96	
	4 (long G.I.)	-4.16	13.86	2.18	11.88	
	5 (long G.I.)	-4.21	13.86	2.18	11.83	
	6 (long G.I.)	-4.27	13.86	2.18	11.77	
	7 (long G.I.)	-4.23	13.86	2.18	11.81	
	0 (short G.I.)	-4.11	13.86	2.18	11.93	
	1 (short G.I.)	-4.06	13.86	2.18	11.98	
	2 (short G.I.)	-4.16	13.86	2.18	11.88	
	3 (short G.I.)	-4.20	13.86	2.18	11.84	
	4 (short G.I.)	-4.23	13.86	2.18	11.81	
	5 (short G.I.)	-4.24	13.86	2.18	11.80	
	6 (short G.I.)	-4.30	13.86	2.18	11.74	
	7 (short G.I.)	-4.32	13.86	2.18	11.72	

*: Worst Rate

11n-20 (2437 MHz)

MCS	MCS	Reading (Average) [dBm]	Factor (cable, ATT) [dB]	Antenna Gain [dBi]	Result [dBm]	Remark
Ant1	0 (long G.I.)	-2.00	13.86	3.25	15.11	
	1 (long G.I.)	-2.06	13.86	3.25	15.05	
	2 (long G.I.)	-1.96	13.86	3.25	15.15	
	3 (long G.I.)	-1.99	13.86	3.25	15.12	
	4 (long G.I.)	-2.00	13.86	3.25	15.11	
	5 (long G.I.)	-2.02	13.86	3.25	15.09	
	6 (long G.I.)	-1.99	13.86	3.25	15.12	
	7 (long G.I.)	-2.03	13.86	3.25	15.08	
	0 (short G.I.)	-1.82	13.86	3.25	15.29	*
	1 (short G.I.)	-1.90	13.86	3.25	15.21	
	2 (short G.I.)	-1.95	13.86	3.25	15.16	
	3 (short G.I.)	-2.01	13.86	3.25	15.10	
	4 (short G.I.)	-1.98	13.86	3.25	15.13	
	5 (short G.I.)	-2.04	13.86	3.25	15.07	
	6 (short G.I.)	-1.99	13.86	3.25	15.12	
	7 (short G.I.)	-2.04	13.86	3.25	15.07	

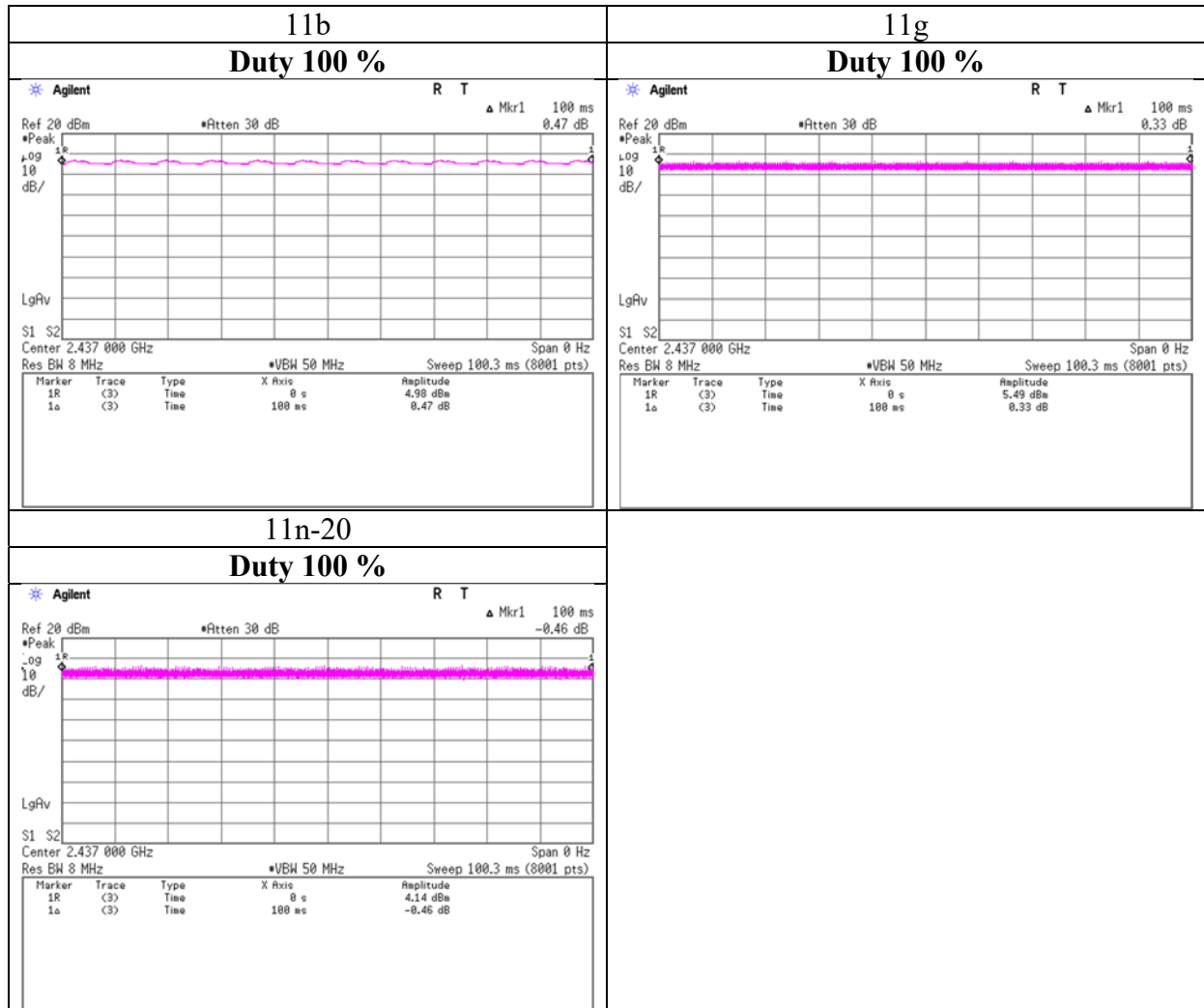
*: Worst Rate

Sample Calculation:

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

Burst rate confirmation

Report No.	13046711S-A
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	October 3, 2019
Temperature / Humidity	24 deg. C / 56 % RH
Engineer	Kazuya Noda
Mode	Tx



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

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Radiated Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date December 13, 2019
Temperature / Humidity 22 deg. C / 35 % RH
Engineer Kazuya Noda
(1 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.	2332.000	PK	47.67	28.44	14.50	39.57	2.28	53.32	73.90	20.6	145	47	*1)
Hori.	2390.000	PK	47.02	28.31	14.56	39.59	2.28	52.58	73.90	21.3	145	47	
Hori.	3332.631	PK	53.17	28.65	6.42	39.59	2.28	50.93	73.90	23.0	287	245	
Hori.	4824.000	PK	45.47	31.61	7.23	39.75	2.28	46.84	73.90	27.1	122	85	
Hori.	7236.000	PK	45.97	37.17	8.98	39.55	2.28	54.85	73.90	19.1	150	0	*1)
Hori.	9648.000	PK	46.07	38.68	10.48	39.62	2.28	57.89	73.90	16.0	150	0	
Hori.	2332.000	AV	39.22	28.44	14.50	39.57	2.28	44.87	53.90	9.0	145	47	
Hori.	2390.000	AV	38.01	28.31	14.56	39.59	2.28	43.57	53.90	10.3	145	47	
Hori.	3332.631	AV	39.53	28.65	6.42	39.59	2.28	37.29	53.90	16.6	287	245	*1)
Hori.	4824.000	AV	36.35	31.61	7.23	39.75	2.28	37.72	53.90	16.2	122	85	
Hori.	7236.000	AV	35.82	37.17	8.98	39.55	2.28	44.70	53.90	9.2	150	0	
Hori.	9648.000	AV	36.27	38.68	10.48	39.62	2.28	48.09	53.90	5.8	150	0	
Vert.	2332.000	PK	47.69	28.44	14.50	39.57	2.28	53.34	73.90	20.6	393	231	*1)
Vert.	2390.000	PK	47.20	28.31	14.56	39.59	2.28	52.76	73.90	21.1	393	231	
Vert.	3332.476	PK	52.57	28.66	6.42	39.59	2.28	50.34	73.90	23.6	164	58	
Vert.	4824.000	PK	45.83	31.61	7.23	39.75	2.28	47.20	73.90	26.7	159	221	
Vert.	7236.000	PK	45.19	37.17	8.98	39.55	2.28	54.07	73.90	19.8	150	0	*1)
Vert.	9648.000	PK	46.26	38.68	10.48	39.62	2.28	58.08	73.90	15.8	150	0	
Vert.	2332.000	AV	37.81	28.44	14.50	39.57	2.28	43.46	53.90	10.4	393	231	
Vert.	2390.000	AV	37.41	28.31	14.56	39.59	2.28	42.97	53.90	10.9	393	231	
Vert.	3332.476	AV	39.31	28.66	6.42	39.59	2.28	37.08	53.90	16.8	164	58	*1)
Vert.	4824.000	AV	35.16	31.61	7.23	39.75	2.28	36.53	53.90	17.4	159	221	
Vert.	7236.000	AV	35.71	37.17	8.98	39.55	2.28	44.59	53.90	9.3	150	0	
Vert.	9648.000	AV	36.40	38.68	10.48	39.62	2.28	48.22	53.90	5.7	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

*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	91.02	28.26	14.58	39.60	2.28	96.54	-	-	Carrier
Hori.	2400.000	PK	52.18	28.29	14.57	39.59	2.28	57.73	76.54	18.8	Carrier
Vert.	2412.000	PK	90.32	28.26	14.58	39.60	2.28	95.84	-	-	
Vert.	2400.000	PK	51.43	28.29	14.57	39.59	2.28	56.98	75.84	18.8	

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

Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

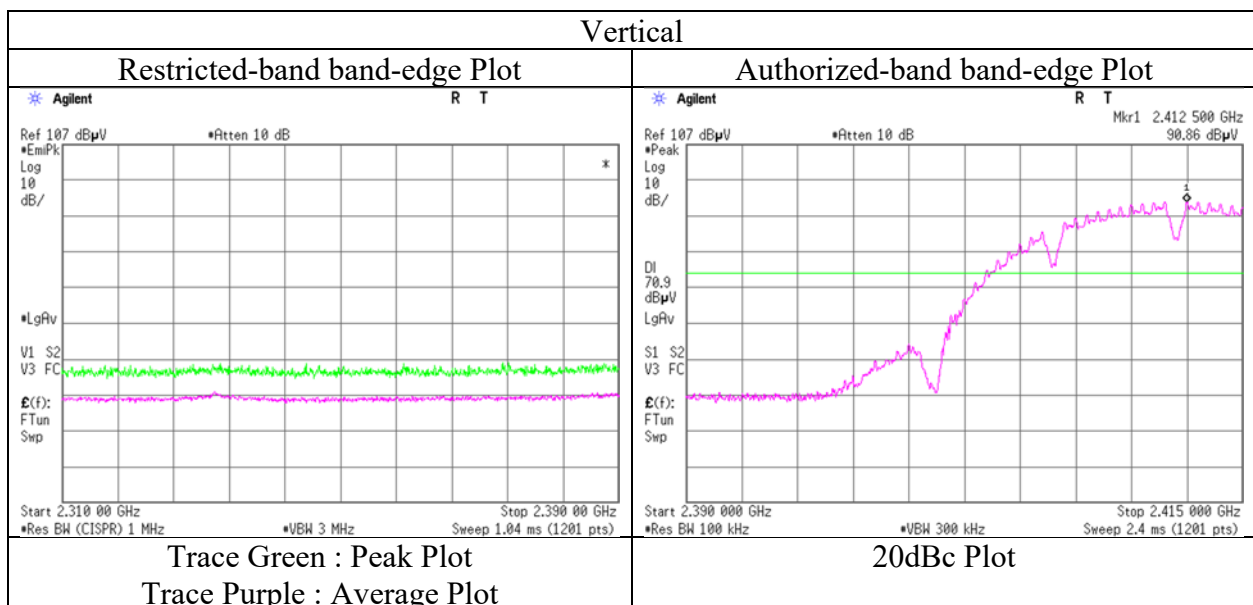
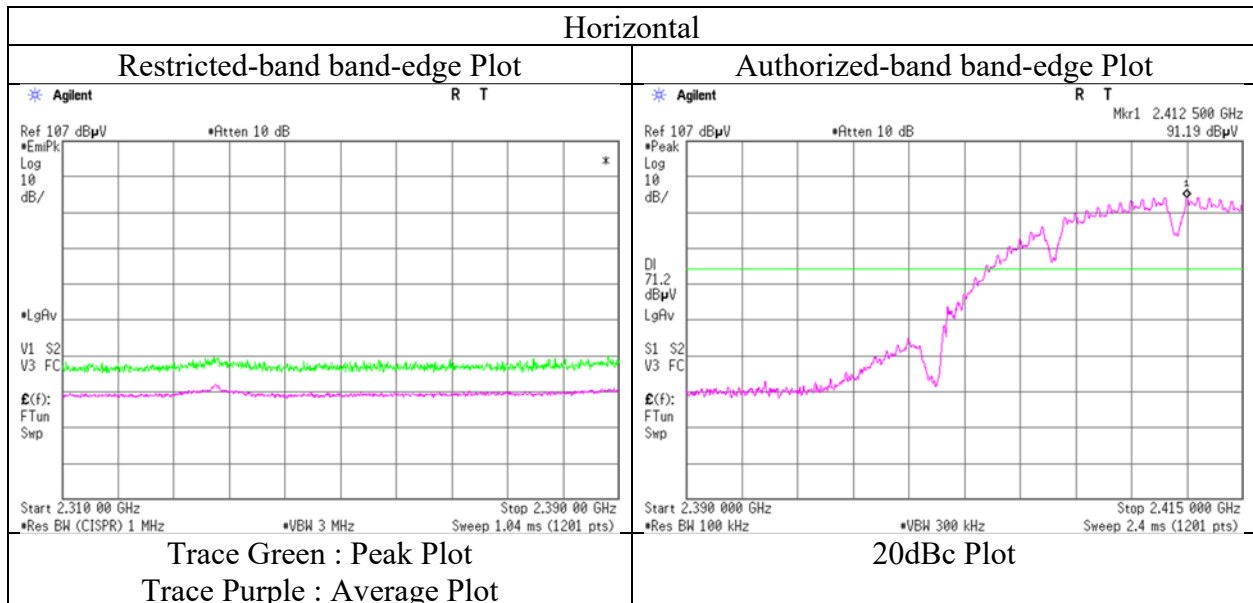
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13046711S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	December 13, 2019
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Kazuya Noda
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.

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

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Radiated Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date December 13, 2019
Temperature / Humidity 22 deg. C / 35 % RH
Engineer Kazuya Noda
(1 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.	3332.573	PK	50.02	28.65	6.42	39.59	2.28	47.78	73.90	26.1	226	216	
Hori.	4874.000	PK	47.06	31.65	7.27	39.74	2.28	48.52	73.90	25.4	121	87	
Hori.	7311.000	PK	45.43	37.23	9.05	39.60	2.28	54.39	73.90	19.5	150	0	
Hori.	9748.000	PK	45.47	39.08	10.46	39.50	2.28	57.79	73.90	16.1	150	0	
Hori.	3332.573	AV	37.75	28.65	6.42	39.59	2.28	35.51	53.90	18.4	226	216	
Hori.	4874.000	AV	37.92	31.65	7.27	39.74	2.28	39.38	53.90	14.5	121	87	
Hori.	7311.000	AV	35.85	37.23	9.05	39.60	2.28	44.81	53.90	9.1	150	0	
Hori.	9748.000	AV	36.09	39.08	10.46	39.50	2.28	48.41	53.90	5.5	150	0	
Vert.	3332.532	PK	50.63	28.65	6.42	39.59	2.28	48.39	73.90	25.5	166	59	
Vert.	4874.000	PK	47.30	31.65	7.27	39.74	2.28	48.76	73.90	25.1	396	166	
Vert.	7311.000	PK	45.47	37.23	9.05	39.60	2.28	54.43	73.90	19.5	150	0	
Vert.	9748.000	PK	45.48	39.08	10.46	39.50	2.28	57.80	73.90	16.1	150	0	
Vert.	3332.532	AV	38.85	28.65	6.42	39.59	2.28	36.61	53.90	17.3	166	59	
Vert.	4874.000	AV	38.27	31.65	7.27	39.74	2.28	39.73	53.90	14.2	396	166	
Vert.	7311.000	AV	35.82	37.23	9.05	39.60	2.28	44.78	53.90	9.1	150	0	
Vert.	9748.000	AV	36.36	39.08	10.46	39.50	2.28	48.68	53.90	5.2	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20 \log (3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

Radiated Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date December 13, 2019
Temperature / Humidity 22 deg. C / 35 % RH
Engineer Kazuya Noda
(1 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	47.14	28.16	14.65	39.62	2.28	52.61	73.90	21.3	116	52	*1)
Hori.	2488.166	PK	47.37	28.15	14.65	39.62	2.28	52.83	73.90	21.1	116	52	
Hori.	3332.612	PK	50.73	28.65	6.42	39.59	2.28	48.49	73.90	25.4	341	239	
Hori.	4924.000	PK	47.03	31.73	7.31	39.73	2.28	48.62	73.90	25.3	162	88	
Hori.	7386.000	PK	44.76	37.32	9.11	39.64	2.28	53.83	73.90	20.1	150	0	
Hori.	9848.000	PK	45.53	39.22	10.45	39.37	2.28	58.11	73.90	15.8	150	0	
Hori.	2483.500	AV	37.36	28.16	14.65	39.62	2.28	42.83	53.90	11.1	116	52	*1)
Hori.	2488.166	AV	38.51	28.15	14.65	39.62	2.28	43.97	53.90	9.9	116	52	
Hori.	3332.612	AV	38.02	28.65	6.42	39.59	2.28	35.78	53.90	18.1	341	239	
Hori.	4924.000	AV	38.18	31.73	7.31	39.73	2.28	39.77	53.90	14.1	162	88	
Hori.	7386.000	AV	35.84	37.32	9.11	39.64	2.28	44.91	53.90	9.0	150	0	
Hori.	9848.000	AV	35.72	39.22	10.45	39.37	2.28	48.30	53.90	5.6	150	0	
Vert.	2483.500	PK	46.82	28.16	14.65	39.62	2.28	52.29	73.90	21.6	381	230	*1)
Vert.	2488.201	PK	47.08	28.15	14.65	39.62	2.28	52.54	73.90	21.4	381	230	
Vert.	3332.586	PK	50.72	28.65	6.42	39.59	2.28	48.48	73.90	25.4	361	156	
Vert.	4924.000	PK	47.21	31.73	7.31	39.73	2.28	48.80	73.90	25.1	269	158	
Vert.	7386.000	PK	45.42	37.32	9.11	39.64	2.28	54.49	73.90	19.4	150	0	
Vert.	9848.000	PK	45.38	39.22	10.45	39.37	2.28	57.96	73.90	15.9	150	0	
Vert.	2483.500	AV	37.24	28.16	14.65	39.62	2.28	42.71	53.90	11.2	381	230	*1)
Vert.	2488.201	AV	38.07	28.15	14.65	39.62	2.28	43.53	53.90	10.4	381	230	
Vert.	3332.586	AV	38.04	28.65	6.42	39.59	2.28	35.80	53.90	18.1	361	156	
Vert.	4924.000	AV	38.68	31.73	7.31	39.73	2.28	40.27	53.90	13.6	269	158	
Vert.	7386.000	AV	35.62	37.32	9.11	39.64	2.28	44.69	53.90	9.2	150	0	
Vert.	9848.000	AV	35.84	39.22	10.45	39.37	2.28	48.42	53.90	5.5	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

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

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Shonan EMC Lab.

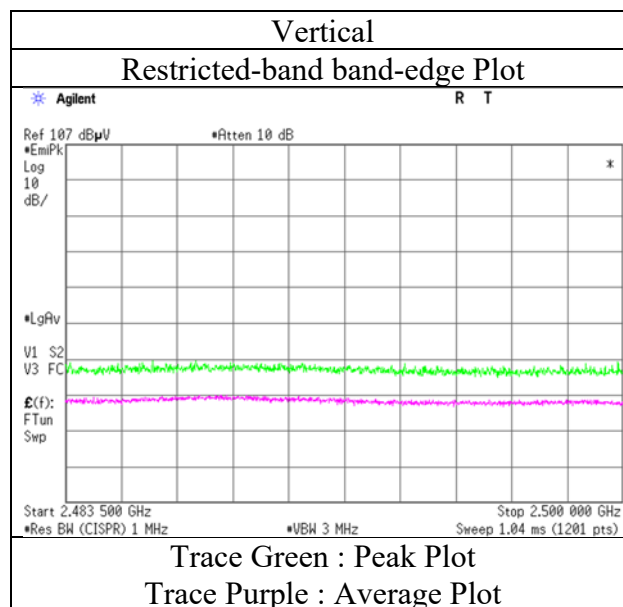
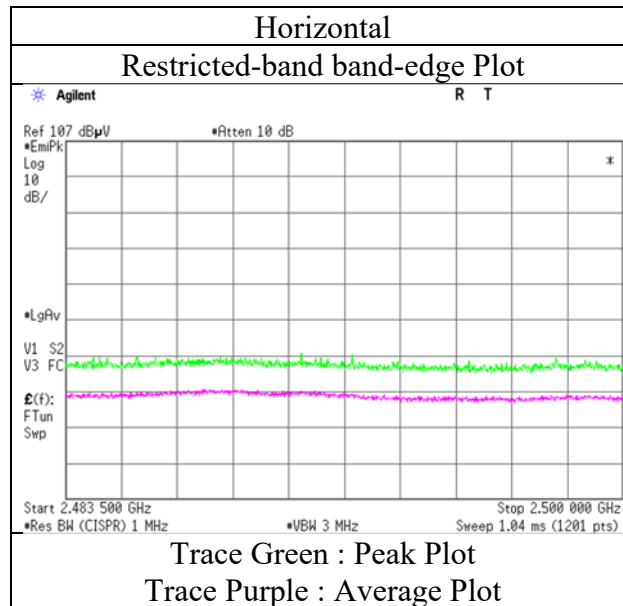
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13046711S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	December 13, 2019
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Kazuya Noda
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. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date October 6, 2019 October 7, 2019 October 7, 2019 October 9, 2019
Temperature / Humidity 25 deg. C / 53 % RH 23 deg. C / 46 % RH 23 deg. C / 46 % RH 26 deg. C / 40 % RH
Engineer Kenichi Adachi Yasumasa Owaki Yasumasa Owaki Yasumasa Owaki
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz) (30 MHz - 1000 MHz) (9 kHz - 30 MHz)
Mode Tx 11g 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dBm]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	405.000	QP	40.60	15.56	9.28	31.97	0.00	33.47	46.00	12.5	100	293	
Hori.	459.000	QP	44.50	16.43	9.50	31.96	0.00	38.47	46.00	7.5	219	95	
Hori.	513.000	QP	37.60	17.47	9.67	31.95	0.00	32.79	46.00	13.2	183	71	
Hori.	621.000	QP	36.30	19.24	10.07	31.94	0.00	33.67	46.00	12.3	140	263	
Hori.	648.000	QP	32.90	18.99	10.17	31.96	0.00	30.10	46.00	15.9	135	68	
Hori.	675.000	QP	35.40	19.29	10.28	31.91	0.00	33.06	46.00	12.9	129	70	
Hori.	2332.000	PK	49.29	28.45	14.09	41.57	2.28	52.54	73.90	21.4	197	59	
Hori.	2390.000	PK	48.86	28.33	14.16	41.59	2.28	52.04	73.90	21.9	197	59	*1)
Hori.	2491.978	PK	48.31	28.23	14.24	41.63	2.28	51.43	73.90	22.5	197	59	
Hori.	3284.081	PK	57.98	28.85	5.88	41.99	2.28	53.00	73.90	20.9	244	258	
Hori.	4824.000	PK	48.01	31.64	6.50	42.88	2.28	45.55	73.90	28.4	159	84	
Hori.	7236.000	PK	48.23	37.25	8.14	42.98	2.28	52.92	73.90	21.0	150	0	
Hori.	9648.000	PK	46.72	38.97	9.32	43.13	2.28	54.16	73.90	19.7	150	0	
Hori.	2332.000	AV	42.54	28.45	14.09	41.57	2.28	45.79	53.90	8.1	197	59	
Hori.	2390.000	AV	39.79	28.33	14.16	41.59	2.28	42.97	53.90	10.9	197	59	*1)
Hori.	2491.978	AV	40.04	28.23	14.24	41.63	2.28	43.16	53.90	10.7	197	59	
Hori.	3284.081	AV	42.97	28.85	5.88	41.99	2.28	37.99	53.90	15.9	244	258	
Hori.	4824.000	AV	37.56	31.64	6.50	42.88	2.28	35.10	53.90	18.8	159	84	
Hori.	7236.000	AV	39.31	37.25	8.14	42.98	2.28	44.00	53.90	9.9	150	0	
Hori.	9648.000	AV	38.26	38.97	9.32	43.13	2.28	45.70	53.90	8.2	150	0	
Vert.	459.000	QP	43.50	16.43	9.50	31.96	0.00	37.47	46.00	8.5	102	149	
Vert.	486.000	QP	35.60	17.16	9.58	31.95	0.00	30.39	46.00	15.6	100	139	
Vert.	513.000	QP	43.40	17.47	9.67	31.95	0.00	38.59	46.00	7.4	100	161	
Vert.	567.000	QP	39.40	17.93	9.88	31.97	0.00	35.24	46.00	10.8	100	177	
Vert.	621.000	QP	37.20	19.24	10.07	31.94	0.00	34.57	46.00	11.4	100	183	
Vert.	675.000	QP	32.10	19.29	10.28	31.91	0.00	29.76	46.00	16.2	100	210	
Vert.	2332.000	PK	48.42	28.45	14.09	41.57	2.28	51.67	73.90	22.2	266	269	
Vert.	2390.000	PK	48.21	28.33	14.16	41.59	2.28	51.39	73.90	22.5	266	269	*1)
Vert.	2491.978	PK	48.22	28.23	14.24	41.63	2.28	51.34	73.90	22.6	266	269	
Vert.	3284.081	PK	54.81	28.85	5.88	41.99	2.28	49.83	73.90	24.1	127	231	
Vert.	4824.000	PK	48.21	31.64	6.50	42.88	2.28	45.75	73.90	28.2	234	235	
Vert.	7236.000	PK	48.14	37.25	8.14	42.98	2.28	52.83	73.90	21.1	150	0	
Vert.	9648.000	PK	46.58	38.97	9.32	43.13	2.28	54.02	73.90	19.9	150	0	
Vert.	2332.000	AV	40.79	28.45	14.09	41.57	2.28	44.04	53.90	9.9	266	269	
Vert.	2390.000	AV	37.74	28.33	14.16	41.59	2.28	40.92	53.90	13.0	266	269	*1)
Vert.	2491.978	AV	38.18	28.23	14.24	41.63	2.28	41.30	53.90	12.6	266	269	
Vert.	3284.081	AV	41.72	28.85	5.88	41.99	2.28	36.74	53.90	17.2	127	231	
Vert.	4824.000	AV	37.46	31.64	6.50	42.88	2.28	35.00	53.90	18.9	234	235	
Vert.	7236.000	AV	39.23	37.25	8.14	42.98	2.28	43.92	53.90	10.0	150	0	
Vert.	9648.000	AV	38.12	38.97	9.32	43.13	2.28	45.56	53.90	8.3	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20 log (3.9 m / 3.0 m) = 2.28 dB

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

*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. [dBm]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	91.08	28.29	14.17	41.60	2.28	94.22	-	-	Carrier
Hori.	2400.000	PK	50.49	28.31	14.16	41.60	2.28	53.64	74.22	20.6	
Vert.	2412.000	PK	88.29	28.29	14.17	41.60	2.28	91.43	-	-	Carrier
Vert.	2400.000	PK	47.77	28.31	14.16	41.60	2.28	50.92	71.43	20.5	

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

Distance factor : 1 GHz - 13 GHz : 20 log (3.9 m / 3.0 m) = 2.28 dB

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

UL Japan, Inc.

Shonan EMC Lab.

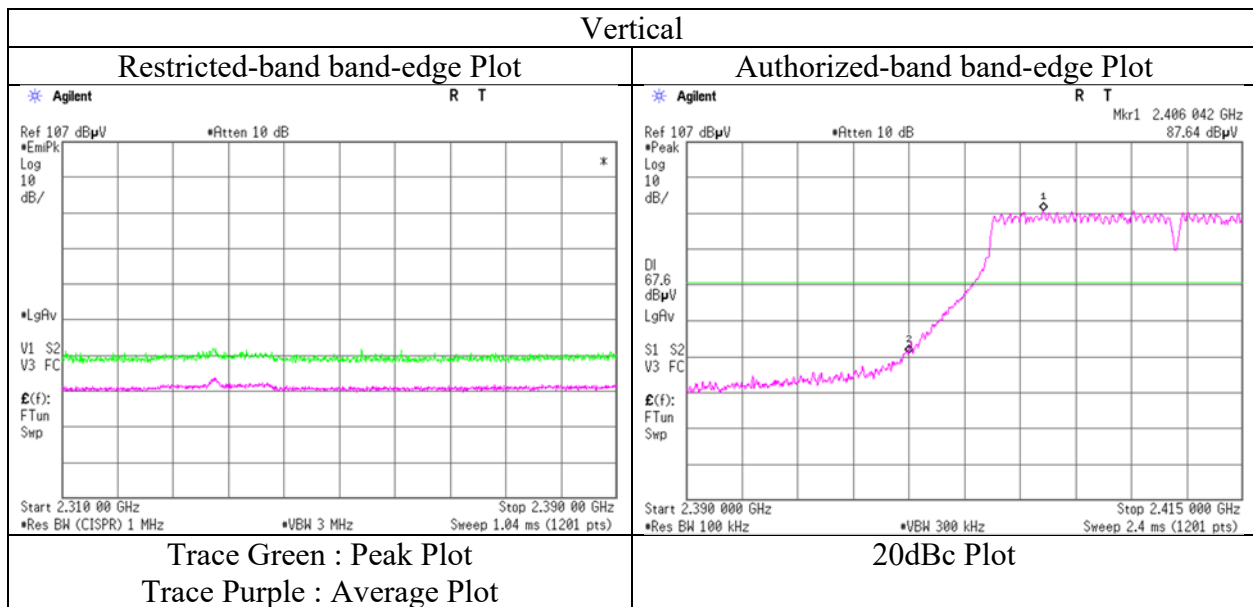
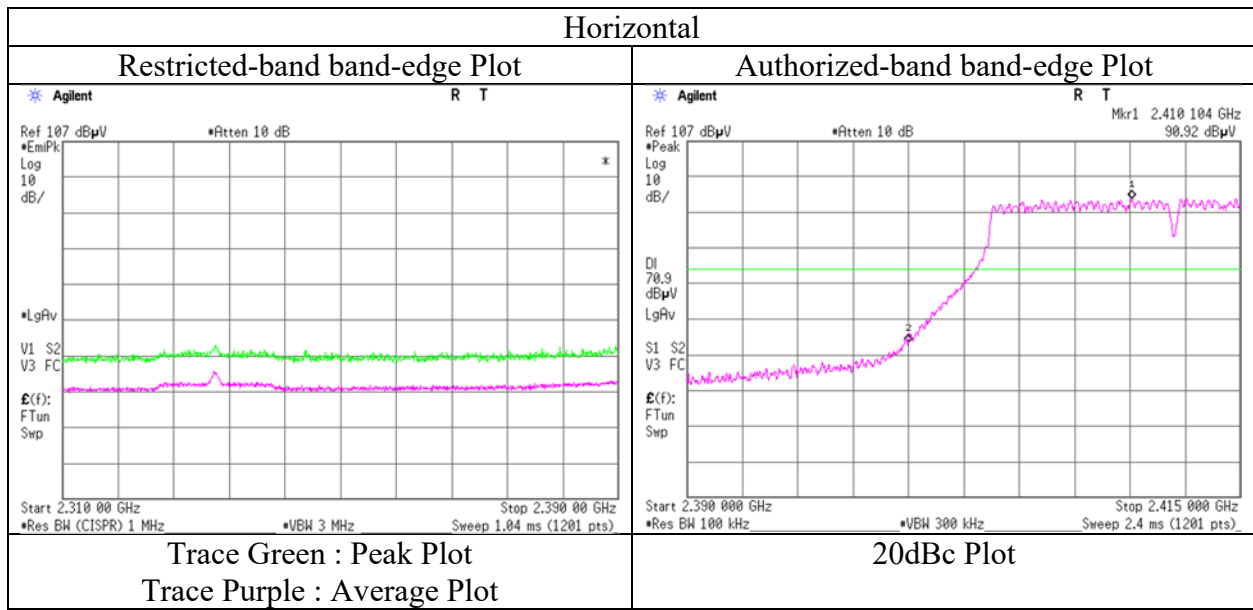
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Radiated Spurious Emission

Report No.	13046711S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	October 6, 2019
Temperature / Humidity	25 deg. C / 53 % RH
Engineer	Kenichi Adachi
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. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date October 6, 2019 October 7, 2019
Temperature / Humidity 25 deg. C / 53 % RH 23 deg. C / 46 % RH
Engineer Kenichi Adachi Yasumasa Owaki
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11g 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2356.980	PK	48.72	28.41	14.11	41.58	2.28	51.94	73.90	22.0	197	58	
Hori.	2516.977	PK	48.56	28.21	14.26	41.64	2.28	51.67	73.90	22.2	197	58	
Hori.	3284.077	PK	57.84	28.85	5.88	41.99	2.28	52.86	73.90	21.0	245	261	
Hori.	4874.000	PK	48.08	31.70	6.52	42.89	2.28	45.69	73.90	28.2	162	79	
Hori.	7311.000	PK	47.56	37.36	8.16	43.13	2.28	52.23	73.90	21.7	150	0	
Hori.	9748.000	PK	47.52	39.31	9.31	43.02	2.28	55.40	73.90	18.5	150	0	
Hori.	2356.980	AV	41.02	28.41	14.11	41.58	2.28	44.24	53.90	9.7	197	58	
Hori.	2516.977	AV	38.99	28.21	14.26	41.64	2.28	42.10	53.90	11.8	197	58	
Hori.	3284.077	AV	42.94	28.85	5.88	41.99	2.28	37.96	53.90	15.9	245	261	
Hori.	4874.000	AV	37.31	31.70	6.52	42.89	2.28	34.92	53.90	19.0	162	79	
Hori.	7311.000	AV	38.59	37.36	8.16	43.13	2.28	43.26	53.90	10.6	150	0	
Hori.	9748.000	AV	36.95	39.31	9.31	43.02	2.28	44.83	53.90	9.1	150	0	
Vert.	2356.980	PK	48.11	28.41	14.11	41.58	2.28	51.33	73.90	22.6	302	271	
Vert.	2516.977	PK	48.28	28.21	14.26	41.64	2.28	51.39	73.90	22.5	302	271	
Vert.	3284.077	PK	54.52	28.85	5.88	41.99	2.28	49.54	73.90	24.4	124	234	
Vert.	4874.000	PK	48.11	31.70	6.52	42.89	2.28	45.72	73.90	28.2	149	229	
Vert.	7311.000	PK	47.47	37.36	8.16	43.13	2.28	52.14	73.90	21.8	150	0	
Vert.	9748.000	PK	47.40	39.31	9.31	43.02	2.28	55.28	73.90	18.6	150	0	
Vert.	2356.980	AV	39.78	28.41	14.11	41.58	2.28	43.00	53.90	10.9	302	271	
Vert.	2516.977	AV	38.94	28.21	14.26	41.64	2.28	42.05	53.90	11.9	302	271	
Vert.	3284.077	AV	41.53	28.85	5.88	41.99	2.28	36.55	53.90	17.4	124	234	
Vert.	4874.000	AV	37.44	31.70	6.52	42.89	2.28	35.05	53.90	18.9	149	229	
Vert.	7311.000	AV	38.54	37.36	8.16	43.13	2.28	43.21	53.90	10.7	150	0	
Vert.	9748.000	AV	36.91	39.31	9.31	43.02	2.28	44.79	53.90	9.1	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

Radiated Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date October 6, 2019 October 7, 2019
Temperature / Humidity 25 deg. C / 53 % RH 23 deg. C / 46 % RH
Engineer Kenichi Adachi Yasumasa Owaki
(1 GHz - 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11g 2462 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2381.978	PK	49.85	28.35	14.15	41.59	2.28	53.04	73.90	20.9	191	57	
Hori.	2483.500	PK	48.44	28.24	14.24	41.62	2.28	51.58	73.90	22.3	191	57	*1)
Hori.	2541.977	PK	48.34	28.21	14.28	41.65	2.28	51.46	73.90	22.4	191	57	
Hori.	3284.086	PK	58.01	28.85	5.88	41.99	2.28	53.03	73.90	20.9	241	263	
Hori.	4924.000	PK	48.28	31.82	6.54	42.90	2.28	46.02	73.90	27.9	164	83	
Hori.	7386.000	PK	47.35	37.49	8.17	43.28	2.28	52.01	73.90	21.9	150	0	
Hori.	9848.000	PK	46.65	39.33	9.30	42.92	2.28	54.64	73.90	19.3	150	0	
Hori.	2381.978	AV	42.29	28.35	14.15	41.59	2.28	45.48	53.90	8.4	191	57	
Hori.	2483.500	AV	39.79	28.24	14.24	41.62	2.28	42.93	53.90	11.0	191	57	*1)
Hori.	2541.977	AV	38.69	28.21	14.28	41.65	2.28	41.81	53.90	12.1	191	57	
Hori.	3284.086	AV	42.96	28.85	5.88	41.99	2.28	37.98	53.90	15.9	241	263	
Hori.	4924.000	AV	37.69	31.82	6.54	42.90	2.28	35.43	53.90	18.5	164	83	
Hori.	7386.000	AV	38.73	37.49	8.17	43.28	2.28	43.39	53.90	10.5	150	0	
Hori.	9848.000	AV	38.28	39.33	9.30	42.92	2.28	46.27	53.90	7.6	150	0	
Vert.	2381.978	PK	48.19	28.35	14.15	41.59	2.28	51.38	73.90	22.5	293	271	
Vert.	2483.500	PK	48.55	28.24	14.24	41.62	2.28	51.69	73.90	22.2	293	271	*1)
Vert.	2541.977	PK	47.59	28.21	14.28	41.65	2.28	50.71	73.90	23.2	293	271	
Vert.	3284.086	PK	54.49	28.85	5.88	41.99	2.28	49.51	73.90	24.4	127	233	
Vert.	4924.000	PK	48.32	31.82	6.54	42.90	2.28	46.06	73.90	27.8	239	227	
Vert.	7386.000	PK	47.26	37.49	8.17	43.28	2.28	51.92	73.90	22.0	150	0	
Vert.	9848.000	PK	46.51	39.33	9.30	42.92	2.28	54.50	73.90	19.4	150	0	
Vert.	2381.978	AV	39.04	28.35	14.15	41.59	2.28	42.23	53.90	11.7	293	271	
Vert.	2483.500	AV	38.64	28.24	14.24	41.62	2.28	41.78	53.90	12.1	293	271	*1)
Vert.	2541.977	AV	37.83	28.21	14.28	41.65	2.28	40.95	53.90	13.0	293	271	
Vert.	3284.086	AV	41.52	28.85	5.88	41.99	2.28	36.54	53.90	17.4	127	233	
Vert.	4924.000	AV	38.48	31.82	6.54	42.90	2.28	36.22	53.90	17.7	239	227	
Vert.	7386.000	AV	38.65	37.49	8.17	43.28	2.28	43.31	53.90	10.6	150	0	
Vert.	9848.000	AV	38.22	39.33	9.30	42.92	2.28	46.21	53.90	7.7	150	0	

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

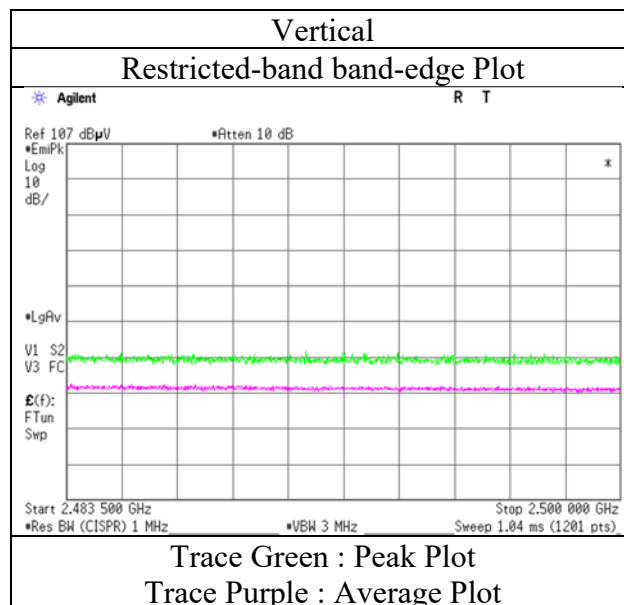
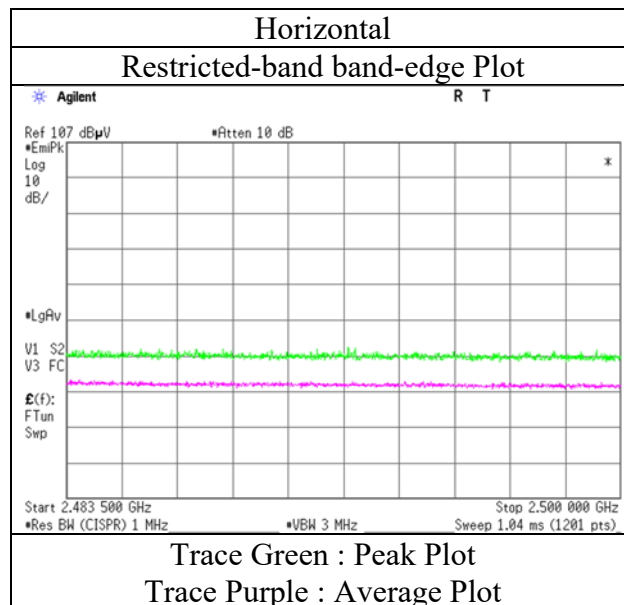
Distance factor : 1 GHz - 13 GHz : $20 \log (3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

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

Radiated Spurious Emission

Report No.	13046711S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	October 6, 2019
Temperature / Humidity	25 deg. C / 53 % RH
Engineer	Kenichi Adachi
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. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date October 6, 2019 October 7, 2019
Temperature / Humidity 25 deg. C / 53 % RH 23 deg. C / 46 % RH
Engineer Kenichi Adachi Yasumasa Owaki
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11n-20 2412 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2331.999	PK	48.04	28.45	14.09	41.57	2.28	51.29	73.90	22.6	196	60	
Hori.	2390.000	PK	48.56	28.33	14.16	41.59	2.28	51.74	73.90	22.2	196	60	*1)
Hori.	2491.978	PK	48.12	28.23	14.24	41.63	2.28	51.24	73.90	22.7	196	60	
Hori.	3284.089	PK	58.04	28.85	5.88	41.99	2.28	53.06	73.90	20.8	242	254	
Hori.	4824.000	PK	48.17	31.64	6.50	42.88	2.28	45.71	73.90	28.2	165	82	
Hori.	7236.000	PK	48.25	37.25	8.14	42.98	2.28	52.94	73.90	21.0	150	0	
Hori.	9648.000	PK	46.59	38.97	9.32	43.13	2.28	54.03	73.90	19.9	150	0	
Hori.	2331.999	AV	39.69	28.45	14.09	41.57	2.28	42.94	53.90	11.0	196	60	
Hori.	2390.000	AV	39.06	28.33	14.16	41.59	2.28	42.24	53.90	11.7	196	60	*1)
Hori.	2491.978	AV	37.45	28.23	14.24	41.63	2.28	40.57	53.90	13.3	196	60	
Hori.	3284.089	AV	43.00	28.85	5.88	41.99	2.28	38.02	53.90	15.9	242	254	
Hori.	4824.000	AV	39.74	31.64	6.50	42.88	2.28	37.28	53.90	16.6	165	82	
Hori.	7236.000	AV	39.25	37.25	8.14	42.98	2.28	43.94	53.90	10.0	150	0	
Hori.	9648.000	AV	38.14	38.97	9.32	43.13	2.28	45.58	53.90	8.3	150	0	
Vert.	2331.999	PK	48.00	28.45	14.09	41.57	2.28	51.25	73.90	22.7	269	270	
Vert.	2390.000	PK	47.98	28.33	14.16	41.59	2.28	51.16	73.90	22.7	269	270	*1)
Vert.	2491.978	PK	48.02	28.23	14.24	41.63	2.28	51.14	73.90	22.8	269	270	
Vert.	3284.089	PK	54.84	28.85	5.88	41.99	2.28	49.86	73.90	24.0	123	229	
Vert.	4824.000	PK	48.28	31.64	6.50	42.88	2.28	45.82	73.90	28.1	206	201	
Vert.	7236.000	PK	48.12	37.25	8.14	42.98	2.28	52.81	73.90	21.1	150	0	
Vert.	9648.000	PK	46.48	38.97	9.32	43.13	2.28	53.92	73.90	20.0	150	0	
Vert.	2331.999	AV	37.94	28.45	14.09	41.57	2.28	41.19	53.90	12.7	269	270	
Vert.	2390.000	AV	38.48	28.33	14.16	41.59	2.28	41.66	53.90	12.2	269	270	*1)
Vert.	2491.978	AV	37.42	28.23	14.24	41.63	2.28	40.54	53.90	13.4	269	270	
Vert.	3284.089	AV	41.75	28.85	5.88	41.99	2.28	36.77	53.90	17.1	123	229	
Vert.	4824.000	AV	40.03	31.64	6.50	42.88	2.28	37.57	53.90	16.3	206	201	
Vert.	7236.000	AV	39.18	37.25	8.14	42.98	2.28	43.87	53.90	10.0	150	0	
Vert.	9648.000	AV	38.07	38.97	9.32	43.13	2.28	45.51	53.90	8.4	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	90.64	28.29	14.17	41.60	2.28	93.78	-	-	Carrier
Hori.	2400.000	PK	52.21	28.31	14.16	41.60	2.28	55.36	73.78	18.4	
Vert.	2412.000	PK	86.68	28.29	14.17	41.60	2.28	89.82	-	-	Carrier
Vert.	2400.000	PK	47.39	28.31	14.16	41.60	2.28	50.54	69.82	19.3	

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

Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

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

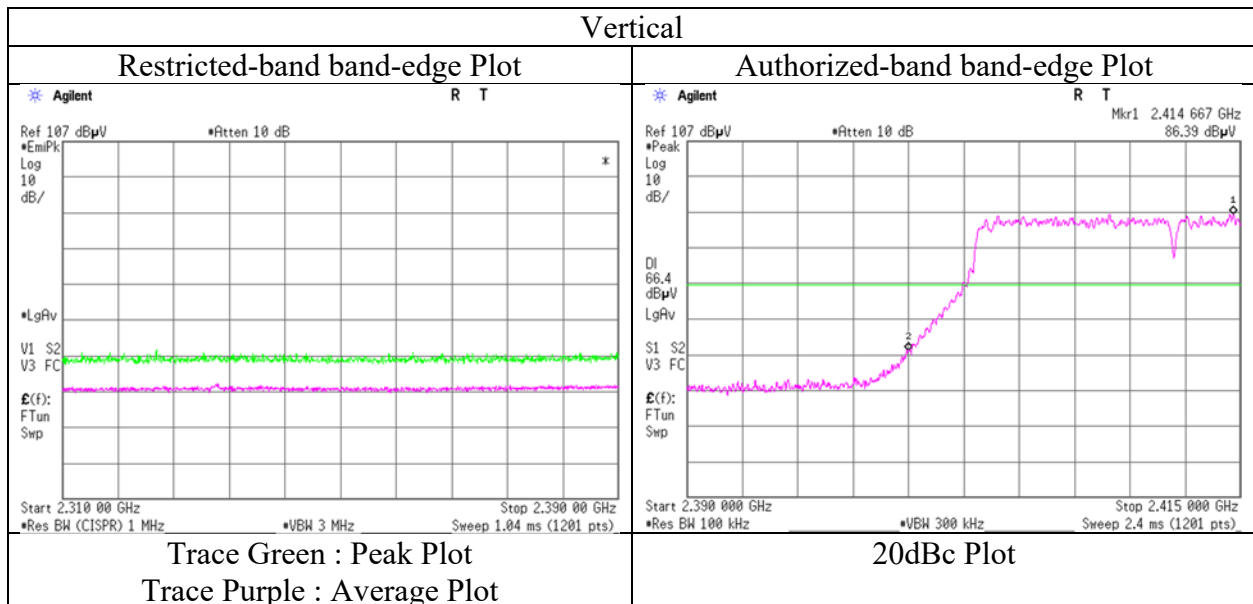
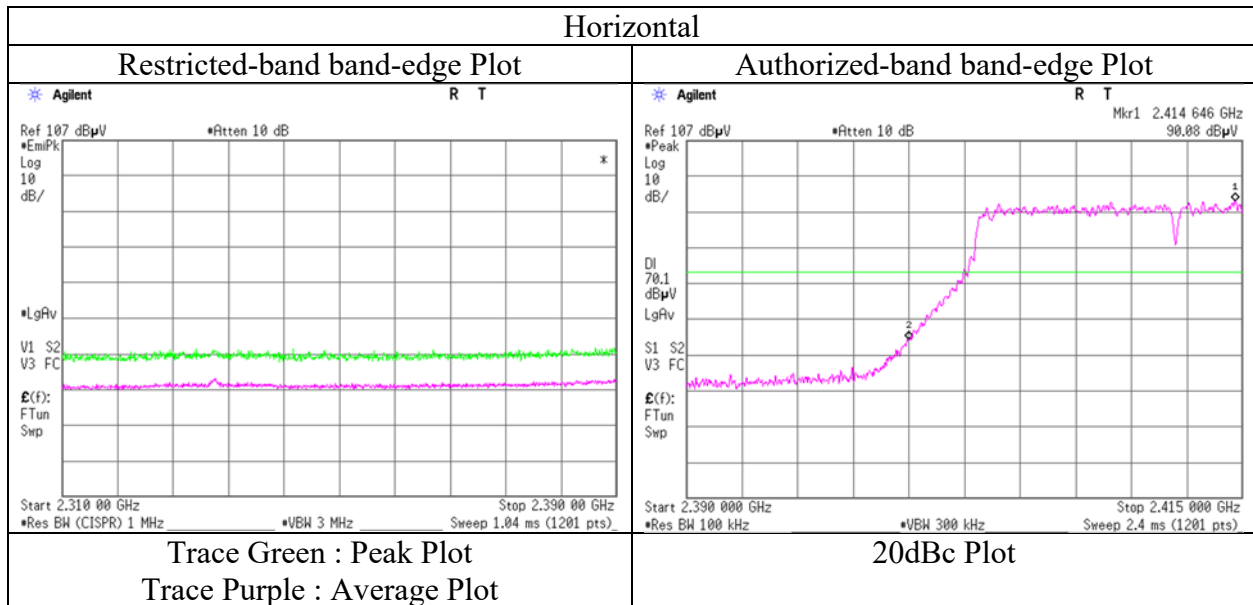
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date October 6, 2019
Temperature / Humidity 25 deg. C / 53 % RH
Engineer Kenichi Adachi

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.

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date October 6, 2019 October 7, 2019
Temperature / Humidity 25 deg. C / 53 % RH 23 deg. C / 46 % RH
Engineer Kenichi Adachi Yasumasa Owaki
(1 GHz - 13 GHz) (13 GHz - 26.5 GHz)
Mode Tx 11n-20 2437 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2356.978	PK	48.24	28.41	14.11	41.58	2.28	51.46	73.90	22.4	191	59	
Hori.	2516.980	PK	48.15	28.21	14.26	41.64	2.28	51.26	73.90	22.6	191	59	
Hori.	3284.081	PK	58.12	28.85	5.88	41.99	2.28	53.14	73.90	20.8	239	264	
Hori.	4874.000	PK	48.11	31.70	6.52	42.89	2.28	45.72	73.90	28.2	166	86	
Hori.	7311.000	PK	47.65	37.36	8.16	43.13	2.28	52.32	73.90	21.6	150	0	
Hori.	9748.000	PK	47.58	39.31	9.31	43.02	2.28	55.46	73.90	18.4	150	0	
Hori.	2356.978	AV	40.87	28.41	14.11	41.58	2.28	44.09	53.90	9.8	191	59	
Hori.	2516.980	AV	38.68	28.21	14.26	41.64	2.28	41.79	53.90	12.1	191	59	
Hori.	3284.081	AV	42.78	28.85	5.88	41.99	2.28	37.80	53.90	16.1	239	264	
Hori.	4874.000	AV	37.86	31.70	6.52	42.89	2.28	35.47	53.90	18.4	166	86	
Hori.	7311.000	AV	37.71	37.36	8.16	43.13	2.28	42.38	53.90	11.5	150	0	
Hori.	9748.000	AV	37.46	39.31	9.31	43.02	2.28	45.34	53.90	8.6	150	0	
Vert.	2356.978	PK	48.08	28.41	14.11	41.58	2.28	51.30	73.90	22.6	298	271	
Vert.	2516.980	PK	48.17	28.21	14.26	41.64	2.28	51.28	73.90	22.6	298	271	
Vert.	3284.081	PK	54.69	28.85	5.88	41.99	2.28	49.71	73.90	24.2	121	231	
Vert.	4874.000	PK	48.23	31.70	6.52	42.89	2.28	45.84	73.90	28.1	172	226	
Vert.	7311.000	PK	47.55	37.36	8.16	43.13	2.28	52.22	73.90	21.7	150	0	
Vert.	9748.000	PK	47.44	39.31	9.31	43.02	2.28	55.32	73.90	18.6	150	0	
Vert.	2356.978	AV	39.42	28.41	14.11	41.58	2.28	42.64	53.90	11.3	298	271	
Vert.	2516.980	AV	38.84	28.21	14.26	41.64	2.28	41.95	53.90	12.0	298	271	
Vert.	3284.081	AV	41.57	28.85	5.88	41.99	2.28	36.59	53.90	17.3	121	231	
Vert.	4874.000	AV	38.02	31.70	6.52	42.89	2.28	35.63	53.90	18.3	172	226	
Vert.	7311.000	AV	37.68	37.36	8.16	43.13	2.28	42.35	53.90	11.6	150	0	
Vert.	9748.000	AV	37.22	39.31	9.31	43.02	2.28	45.10	53.90	8.8	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

Radiated Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date October 6, 2019 October 7, 2019
Temperature / Humidity 25 deg. C / 53 % RH 23 deg. C / 46 % RH
Engineer Kenichi Adachi Yasumasa Owaki
(1 GHz - 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11n-20 2462 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2381.981	PK	49.44	28.35	14.15	41.59	2.28	52.63	73.90	21.3	193	59	
Hori.	2483.500	PK	48.30	28.24	14.24	41.62	2.28	51.44	73.90	22.5	193	59	*1)
Hori.	2541.976	PK	48.21	28.21	14.28	41.65	2.28	51.33	73.90	22.6	193	59	
Hori.	3284.082	PK	57.96	28.85	5.88	41.99	2.28	52.98	73.90	20.9	252	257	
Hori.	4924.000	PK	48.31	31.82	6.54	42.90	2.28	46.05	73.90	27.9	161	84	
Hori.	7386.000	PK	47.37	37.49	8.17	43.28	2.28	52.03	73.90	21.9	150	0	
Hori.	9848.000	PK	46.54	39.33	9.30	42.92	2.28	54.53	73.90	19.4	150	0	
Hori.	2381.981	AV	42.16	28.35	14.15	41.59	2.28	45.35	53.90	8.6	193	59	
Hori.	2483.500	AV	39.56	28.24	14.24	41.62	2.28	42.70	53.90	11.2	193	59	*1)
Hori.	2541.976	AV	38.45	28.21	14.28	41.65	2.28	41.57	53.90	12.3	193	59	
Hori.	3284.082	AV	42.89	28.85	5.88	41.99	2.28	37.91	53.90	16.0	252	257	
Hori.	4924.000	AV	37.72	31.82	6.54	42.90	2.28	35.46	53.90	18.4	161	84	
Hori.	7386.000	AV	38.78	37.49	8.17	43.28	2.28	43.44	53.90	10.5	150	0	
Hori.	9848.000	AV	38.25	39.33	9.30	42.92	2.28	46.24	53.90	7.7	150	0	
Vert.	2381.981	PK	48.22	28.35	14.15	41.59	2.28	51.41	73.90	22.5	294	269	
Vert.	2483.500	PK	48.66	28.24	14.24	41.62	2.28	51.80	73.90	22.1	294	269	*1)
Vert.	2541.976	PK	47.62	28.21	14.28	41.65	2.28	50.74	73.90	23.2	294	269	
Vert.	3284.082	PK	54.62	28.85	5.88	41.99	2.28	49.64	73.90	24.3	126	226	
Vert.	4924.000	PK	48.25	31.82	6.54	42.90	2.28	45.99	73.90	27.9	227	222	
Vert.	7386.000	PK	47.32	37.49	8.17	43.28	2.28	51.98	73.90	21.9	150	0	
Vert.	9848.000	PK	46.46	39.33	9.30	42.92	2.28	54.45	73.90	19.5	150	0	
Vert.	2381.981	AV	38.89	28.35	14.15	41.59	2.28	42.08	53.90	11.8	294	269	
Vert.	2483.500	AV	38.69	28.24	14.24	41.62	2.28	41.83	53.90	12.1	294	269	*1)
Vert.	2541.976	AV	37.81	28.21	14.28	41.65	2.28	40.93	53.90	13.0	294	269	
Vert.	3284.082	AV	41.57	28.85	5.88	41.99	2.28	36.59	53.90	17.3	126	226	
Vert.	4924.000	AV	38.41	31.82	6.54	42.90	2.28	36.15	53.90	17.8	227	222	
Vert.	7386.000	AV	38.71	37.49	8.17	43.28	2.28	43.37	53.90	10.5	150	0	
Vert.	9848.000	AV	38.16	39.33	9.30	42.92	2.28	46.15	53.90	7.8	150	0	

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

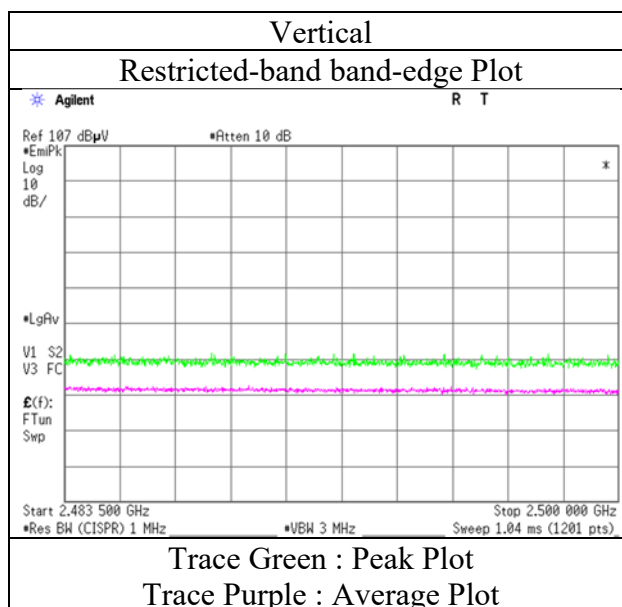
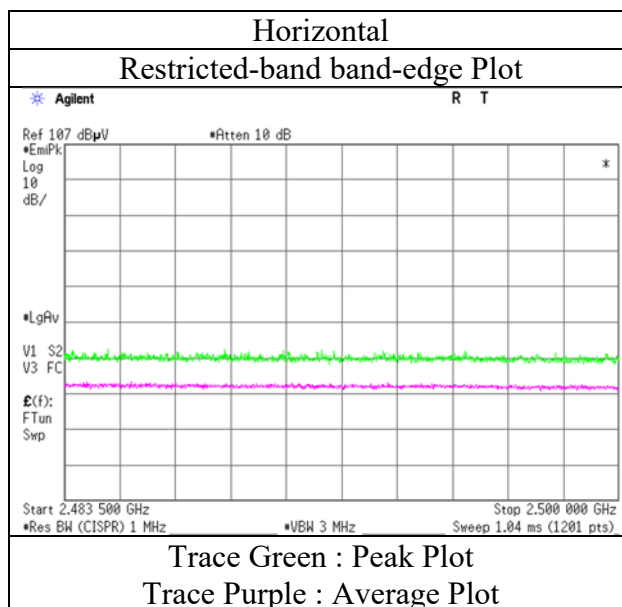
Distance factor : 1 GHz - 13 GHz : $20 \log(3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

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

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

Radiated Spurious Emission

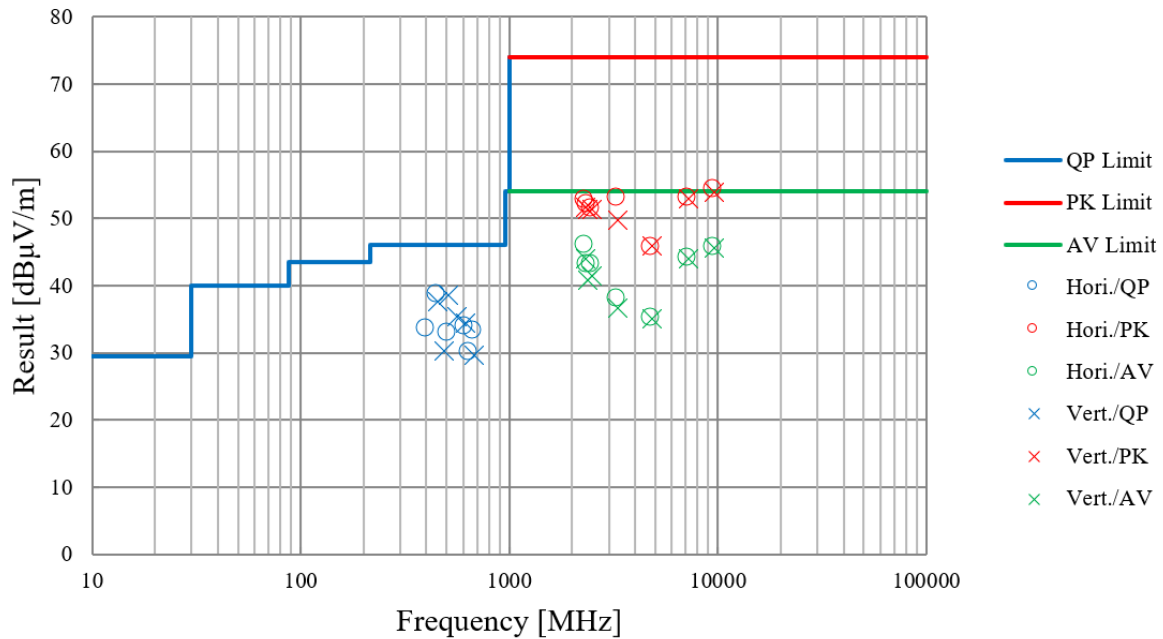
Report No.	13046711S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	October 6, 2019
Temperature / Humidity	25 deg. C / 53 % RH
Engineer	Kenichi Adachi
Mode	Tx 11n-20 2462 MHz



* 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)

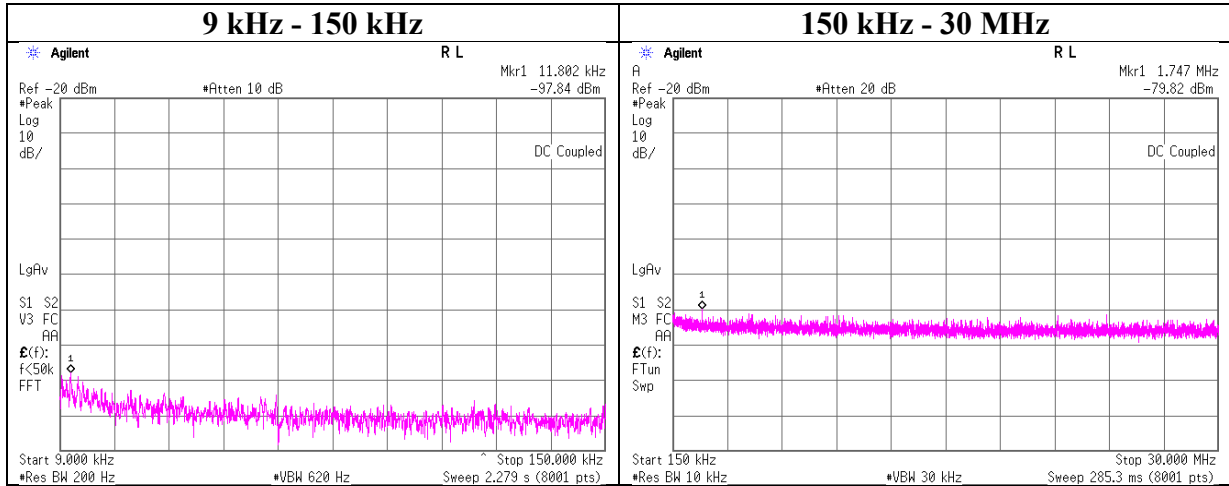
Report No.	13046711S-A		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	October 6, 2019	October 7, 2019	October 7, 2019
Temperature / Humidity	25 deg. C / 53 % RH	23 deg. C / 46 % RH	23 deg. C / 46 % RH
Engineer	Kenichi Adachi	Yasumasa Owaki	Yasumasa Owaki
	(1 GHz - 13 GHz)	(13 GHz - 26.5 GHz)	(30 MHz - 1000 MHz)
Mode	Tx 11g 2412 MHz		



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

Conducted Spurious Emission

Report No. 13046711S-A
Test place Shonan EMC Lab. No.1 Measurement Room
Date October 7, 2019
Temperature / Humidity 24 deg. C / 53 % RH
Engineer Kenichi Adachi
Mode Tx 11g, 2412 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
11.80	-97.84	2.52	9.55	3.25	1	-82.5	300	6.0	-21.3	46.1	67.4	
1747.00	-79.82	2.53	9.55	3.25	1	-64.5	30	6.0	16.8	29.5	12.8	

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

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

N: Number of output

Power Density

Report No. 13046711S-A
Test place Shonan EMC Lab. No.1 Measurement Room and No.5 Shielded Room
Date October 7, 2019 November 22, 2019
Temperature / Humidity 24 deg. C / 53 % RH 24 deg.C / 49 %RH
Engineer Kenichi Adachi Kazuya Noda
Mode Tx

11b, 2 Mbps Antenna: Ant1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-30.04	3.93	9.89	-16.22	8.00	24.22
2437	-30.57	3.94	9.89	-16.74	8.00	24.74
2462	-29.93	3.95	9.89	-16.09	8.00	24.09

11g, 24 Mbps Antenna: Ant1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-26.53	3.93	9.69	-12.91	8.00	20.91
2437	-26.99	3.94	9.69	-13.36	8.00	21.36
2462	-26.35	3.95	9.70	-12.70	8.00	20.70

11n-20, MCS 6 short G.I. Antenna: Ant1

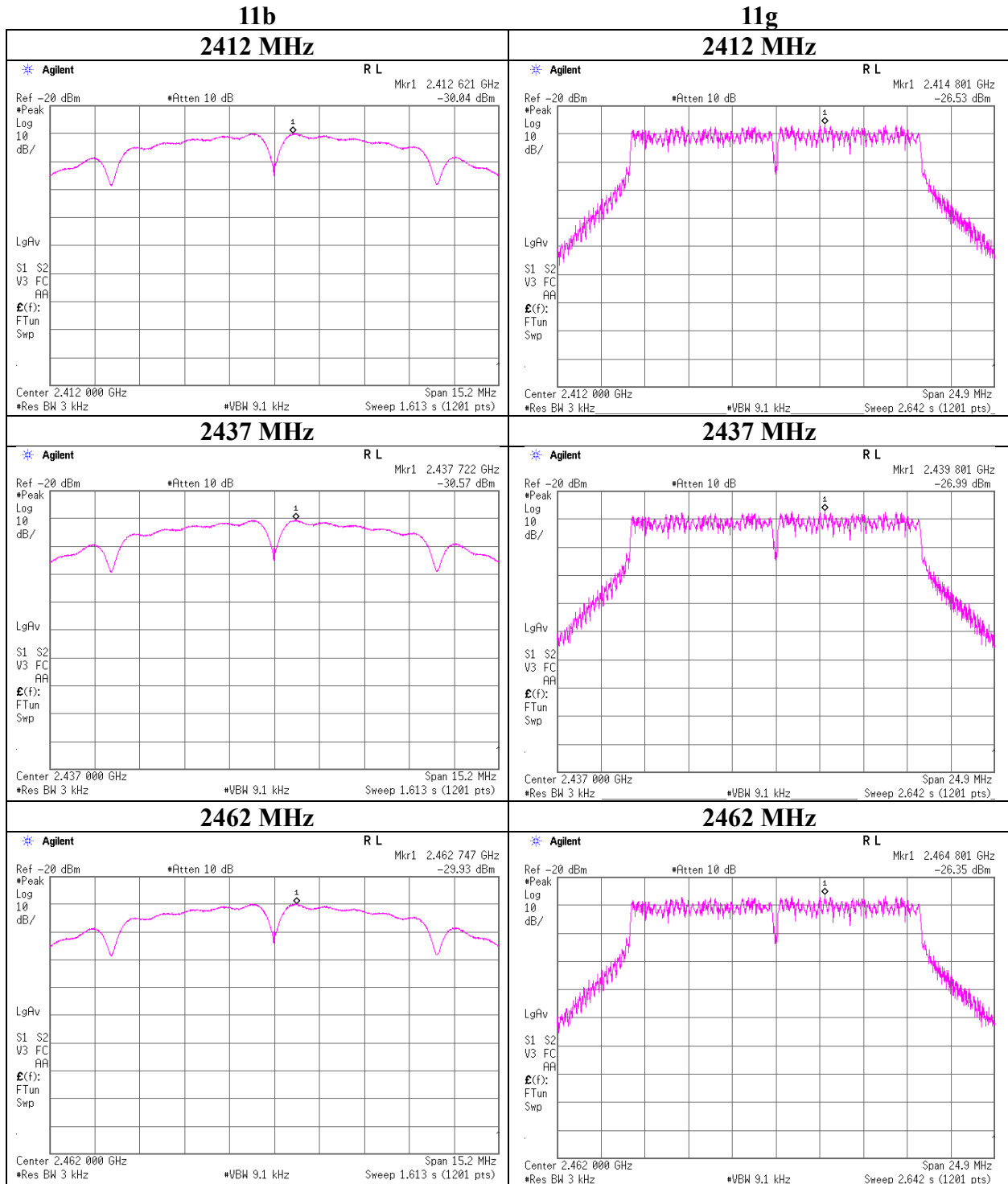
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-28.32	3.93	9.69	-14.70	8.00	22.70
2437	-28.67	3.94	9.69	-15.04	8.00	23.04
2462	-28.04	3.95	9.70	-14.39	8.00	22.39

Sample Calculation:

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

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

Power Density



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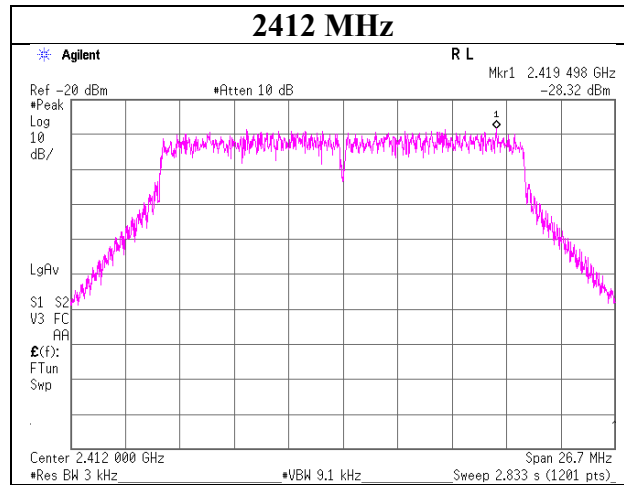
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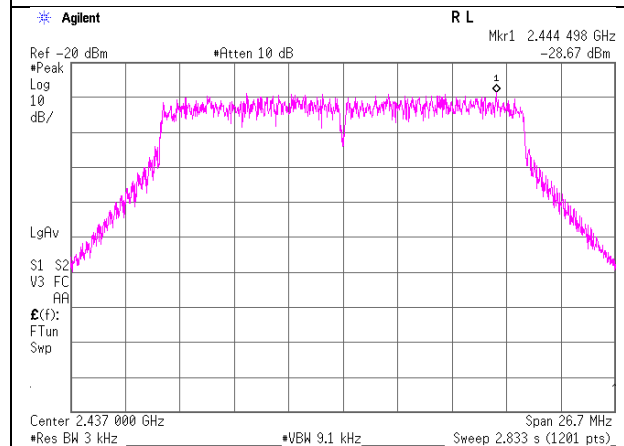
Power Density

11n-20

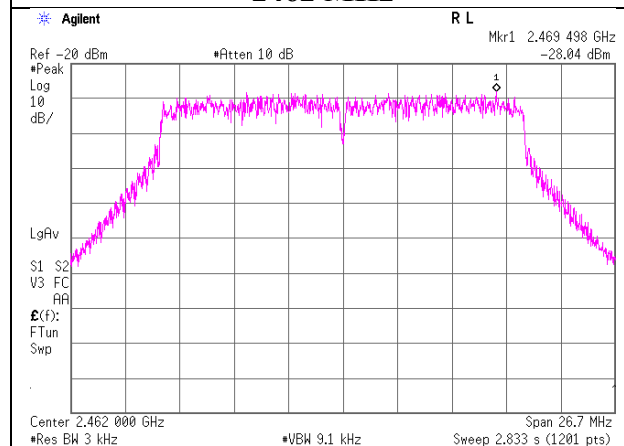
2412 MHz



2437 MHz



2462 MHz



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APPENDIX 2: Test instruments

Test Instruments (1/2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2019/10/1	12
AT	KTS-08	145095	Digital Tester	SANWA	PC500	7019224	2019/4/2	12
AT	SAT10-09	145132	Attenuator	Weinschel Corp.	54A-10	W5692	2019/11/5	12
AT	SAT10-12	151609	Attenuator	Weinschel Corp.	54A-10	81601	2019/3/27	12
AT	SAT10-16	160494	Attenuator	Weinschel Corp.	54A-10	83406	2018/12/6	12
AT	SCC-G32	145183	Coaxial Cable	Junkosha	MWX241-02000KMSKM S	OCT-09-13-005	2018/11/25	12 *1)
AT	SOS-13	146321	Humidity Indicator	CUSTOM	CTH-202	Q.C.17	2018/12/5	12
AT	SOS-19	175823	Humidity Indicator	CUSTOM	CTH-201	-	2018/12/5	12
AT	SPM-06	146267	Power Meter	ANRITSU	ML2495A	850009	2019/5/22	12
AT	SPM-07	146247	Power Meter	AGILENT	8990B	MY5100272	2019/7/16	12
AT	SPM-13	169910	Power Meter	EMC Instruments Corporation	8990B	MY51000448	2019/3/6	12
AT	SPSS-03	146309	Power sensor	ANRITSU	MA2411B	917063	2019/5/22	12
AT	SPSS-04	146310	Power sensor	AGILENT	N1923A	MY5326009	2019/7/16	12
AT	SPSS-06	169911	Power sensor	EMC Instruments Corporation	N1923A	MY57270004	2019/3/6	12
AT	SRENT-09	150461	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46186392	2019/1/3	12
AT	SRENT-15	160899	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46185516	2019/1/21	12
AT	STM-23	146200	Terminator	TME	CT-01 BP	-	2019/1/29	12
RE	COTS-SEMI-5	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,M E,PE)	-	-	-
RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
RE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
RE	KSA-08	145089	Spectrum Analyzer	AGILENT	E4446A	MY46180525	2019/11/5	12
RE	SAEC-01(SVSWR)	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2019/5/6	12
RE	SAEC-03(NSA)	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2019/4/8	12
RE	SAEC-03(SVSWR)	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2019/5/3	12
RE	SAF-03	145126	Pre Amplifier	SONOMA	310N	290213	2019/2/5	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2019/6/4	12
RE	SAF-06	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2019/2/8	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2019/3/5	12
RE	SAJ-03	146105	Antenna Tilt Jig	Intelligent System Engineering Co., Ltd	Antenna Tilt Jig	T-S003	-	-
RE	SAT10-05	145136	Attenuator(above 1GHz)	AGILENT	8493C-010	74864	2019/11/6	12
RE	SAT6-12	145158	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	2019/8/6	12

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Test Instruments (2/2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	SAT6-13	167094	Attenuator	JFW	50HF-006N	-	2019/2/5	12
RE	SBA-03	145023	Biconical Antenna	Schwarzbeck	BBA9106	91032666	2019/5/7	12
RE	SCC-C1/C2/C3/C4/C5/C10/SRS E-03	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-271(RF Selector)	2019/4/19	12
RE	SCC-G05	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2019/1/25	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2019/3/27	12
RE	SCC-G40	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2019/1/25	12
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2019/1/25	12
RE	SCC-G43	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104 E	SN MY 13406/4E	2019/7/3	12
RE	SCC-G56	179539	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	803289/4	2019/5/16	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2019/5/16	12
RE	SCC-G58	183047	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800287/4A	2019/7/23	12
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2019/11/6	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	2019/5/9	12
RE	SHA-03	145501	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	2019/6/26	12
RE	SHA-04	145512	Horn Antenna	ETS LINDGREN	3160-09	94868	2019/6/26	12
RE	SLA-07	145529	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	2019/5/7	12
RE	SLP-02	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2019/10/3	12
RE	SOS-06	146294	Humidity Indicator	A&D	AD-5681	4062118	2018/12/5	12
RE	SOS-17	175821	Humidity Indicator	CUSTOM	CTH-201	-	2018/12/5	12
RE	SSA-02	145800	Spectrum Analyzer	AGILENT	E4448A	MY48250106	2019/4/4	12
RE	STR-08	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2019/11/22	12
RE	STS-01	145792	Digital Hitester	HIOKI	3805-50	80997812	2019/10/1	12

*1) This test equipment was used for the tests before the expiration date of the calibration.

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

The expiration date of the calibration is the end of the expired month.

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

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

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

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