



RADIO TEST REPORT

Test Report No. : 12751991H-A-R1

Applicant : Roland Corporation
Type of Equipment : Musical Keyboard
Model No. : GO-61P-A
FCC ID : SOP421401A
Test regulation : FCC Part 15 Subpart C: 2019
*WLAN part
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 above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12751991H-A. 12751991H-A is replaced with this report.

Date of test: March 11 to June 19, 2019

Representative test engineer:

Takumi Shimada

Engineer

Consumer Technology Division

Approved by:

Takayuki Shimada

Leader

Consumer Technology Division



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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

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SECTION 1: Customer information

Company Name	:	Roland Corporation
Address	:	2036-1 Nakagawa, Hosoe-cho, Kita-ku, Hamamatsu, Shizuoka, 431-1304 JAPAN
Telephone Number	:	+81-53-523-0329
Facsimile Number	:	+81-53-523-0240
Contact Person	:	Shohei Okumura

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	:	Musical Keyboard
Model No.	:	GO-61P-A
Serial No.	:	Refer to SECTION 4.2
Rating	:	AC 100 V to 240 V, 50 Hz / 60 Hz
Receipt Date of Sample (Information from test lab.)	:	March 7, 2019
Country of Mass-production	:	China
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: GO-61P-A (referred to as the EUT in this report) is a Musical Keyboard.

Radio Specification

[Specification of WLAN (IEEE802.11b/g/n-20/n-40)]

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS, OFDM
Antenna type	:	Copper Tube Antenna
Antenna Gain	:	3.6 dBi

[Specification of Bluetooth (BR/EDR)]

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz to 2480 MHz
Channel spacing	:	1 MHz
Modulation	:	FHSS
Antenna type	:	Pattern Antenna
Antenna Gain	:	1.927 dBi

[Specification of Bluetooth (Low Energy: LE)]

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz to 2480 MHz
Channel spacing	:	2 MHz
Modulation	:	GFSK
Antenna type	:	Pattern Antenna
Antenna Gain	:	1.927 dBi

*This test report applies to WLAN.

*For Bluetooth part, the EUT has module approval (FCC ID: A8TBM62S2). Therefore the tests for only WLAN part were performed on host device.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 4, 2019 and effective July 5, 2019
except 15.258

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

* The revision on June 4, 2019, does not affect the test specification applied to the EUT.

** The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	18.95 dB, 0.32780 MHz, L, AV	Complied a)	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(a)(2)	See data.	Complied b)	Conducted
	IC: -	IC: RSS-247 5.2(a)			
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(b)(3)		Complied c)	Conducted
	IC: RSS-Gen 6.12	IC: RSS-247 5.4(d)			
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(e)		Complied d)	Conducted
	IC: -	IC: RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section15.247(d)	1.0 dB 2483.500 MHz, AV, Hori.	Complied# e), f)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) 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 Conducted Emission) b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth) c) Refer to APPENDIX 1 (data of Maximum Peak Output Power) d) Refer to APPENDIX 1 (data of Power Density) e) Refer to APPENDIX 1 (data of Conducted Spurious Emission) f) 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)

This EUT provides stable voltage constantly to RF Module 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 of Section 15.203.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	RSS-Gen 6.7	IC: -	N/A	- a)	Conducted
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.					
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					
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.				
Other than above, no addition, exclusion nor deviation has been made from the standard.					

3.4 Uncertainty

EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the following 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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Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.3 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.7 dB

Conducted emission

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.8 dB
	0.15 MHz to 30 MHz	3.4 dB

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.9 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		5.0 dB
3 m	1 GHz to 6 GHz	5.0 dB
	6 GHz to 18 GHz	5.3 dB
1 m	10 GHz to 26.5 GHz	5.8 dB
	26.5 GHz to 40 GHz	5.8 dB
10 m	1 GHz to 18 GHz	5.2 dB

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.5 Test Location

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*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

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

Mode	Remarks*
IEEE 802.11b (11b)	1 Mbps, PN9
IEEE 802.11g (11g)	36 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 3 , PN9
IEEE 802.11n 40 MHz BW (11n-40)	MCS 5 , PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b: 21 11g: 21 11n: 21 Software: 4.3.6604.1 dsp:6.180.4.35, Release Date 20190104 *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
Conducted Emission Radiated Spurious Emission below 1 GHz Conducted Spurious Emission	11n-40 Tx *1)	2422 MHz
Spurious Emission	11b Tx 11n-20 Tx *2)	2412 MHz 2437 MHz 2462 MHz
	11n-40 Tx	2422 MHz 2437 MHz 2452 MHz
6dB Bandwidth 99% Occupied Bandwidth Maximum Peak Output Power Power Density	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
	11n-40 Tx	2422 MHz 2437 MHz 2452 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power		

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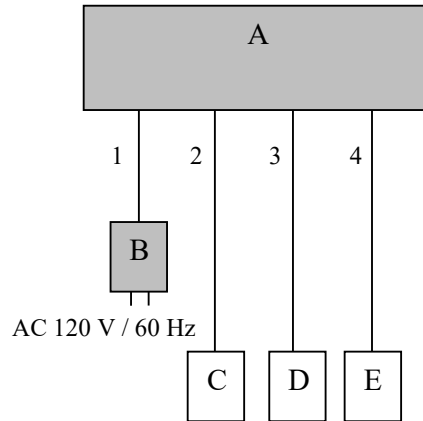
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4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Musical Keyboard	GO-61P-A	D0000 GC003 103009 *1) D0000 GC003 103011 *2)	Roland	EUT
B	AC / DC Adapter	UN312-5920	H06-0105986	UNIFIVE	EUT
C	Piano Dumper	DP-2	-	Roland	-
D	Rhythm Machine	DB-30	H0B3105	BOSS	-
E	Headphone	RH300V	-	Roland	-

*1) Used for Conducted Emission test and Radiated Emission test

*2) Used for Antenna Terminal conducted test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.0	Unshielded	Unshielded	-
2	Audio Cable	2.5	Shielded	Shielded	-
3	Audio Cable	1.0	Shielded	Shielded	-
4	Audio Cable	2.5	Shielded	Shielded	-

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

1) For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

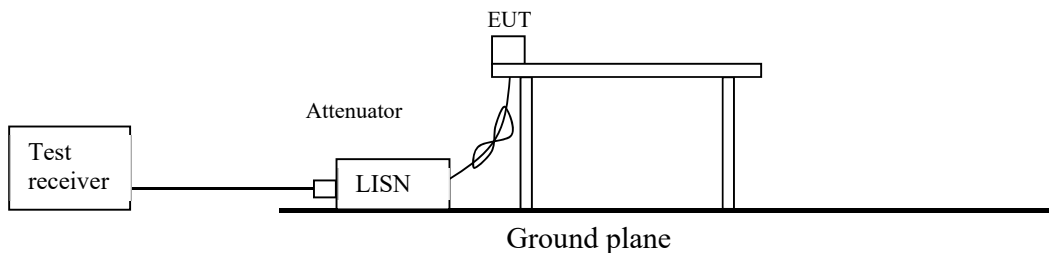
The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX
Test result	: Pass

Figure 1: Test Setup



SECTION 6: 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 urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

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.

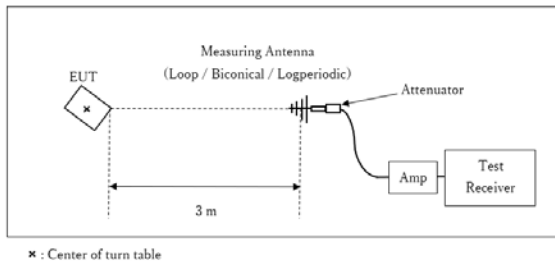
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	<u>11.12.2.5.1</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces <u>11.12.2.5.2</u> The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results. Integration Method: <u>11.13.3.4</u> RBW: 100 kHz VBW: 300 kHz Span: 2 MHz Band Power: 1 MHz Detector: Power Averaging (RMS) 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.

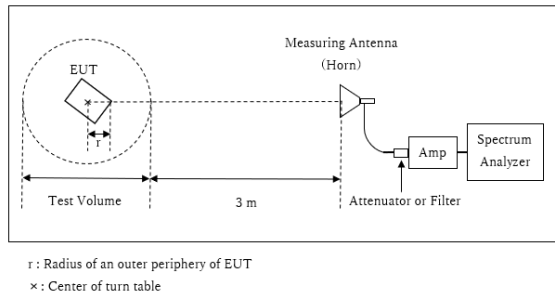
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

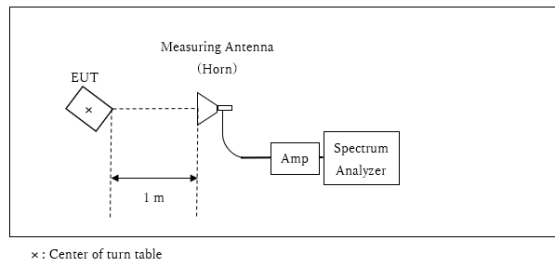
1 GHz - 10 GHz



Distance Factor: $20 \times \log (3.6 \text{ m} / 3.0 \text{ m}) = 1.59 \text{ dB}$
* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.6 \text{ m}$

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.4 m

10 GHz - 26.5 GHz



Distance Factor: $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$
*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 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	20 MHz / 40 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart. (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz).							

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.

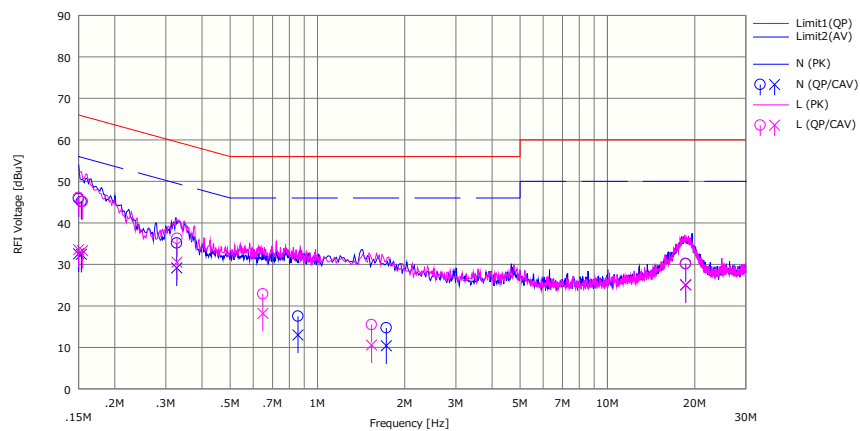
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Report No. 12751991H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date March 18, 2019
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Akihiko Maeda
Mode Tx 11n-40 2422MHz

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]			(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
		[dBuV]	[dBuV]			[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	32.50	19.20	0.17	13.15	45.82	32.52	66.00	56.00	20.18	23.48	N	
2	0.15350	31.80	19.10	0.17	13.15	45.12	32.42	65.80	55.80	20.68	23.38	N	
3	0.32713	21.80	15.80	0.18	13.17	35.15	29.15	59.50	49.50	24.35	20.35	N	
4	0.85700	4.10	-0.40	0.19	13.22	17.51	13.01	56.00	46.00	38.49	32.99	N	
5	1.72804	1.20	-3.10	0.23	13.27	14.70	10.40	56.00	46.00	41.30	35.60	N	
6	18.60564	14.50	9.40	1.91	13.80	30.21	25.11	60.00	50.00	29.79	24.89	N	
7	0.15000	32.80	20.20	0.17	13.15	46.12	33.52	66.00	56.00	19.88	22.48	L	
8	0.15490	31.80	20.00	0.17	13.15	45.12	33.32	65.70	55.70	20.58	22.38	L	
9	0.32780	22.90	17.20	0.18	13.17	36.25	30.55	59.50	49.50	23.25	18.95	L	
10	0.64803	9.50	4.80	0.19	13.19	22.88	18.18	56.00	46.00	33.12	27.82	L	
11	1.53607	2.00	-2.90	0.22	13.26	15.48	10.58	56.00	46.00	40.52	35.42	L	
12	18.60600	14.40	9.30	1.91	13.80	30.11	25.01	60.00	50.00	29.89	24.99	L	

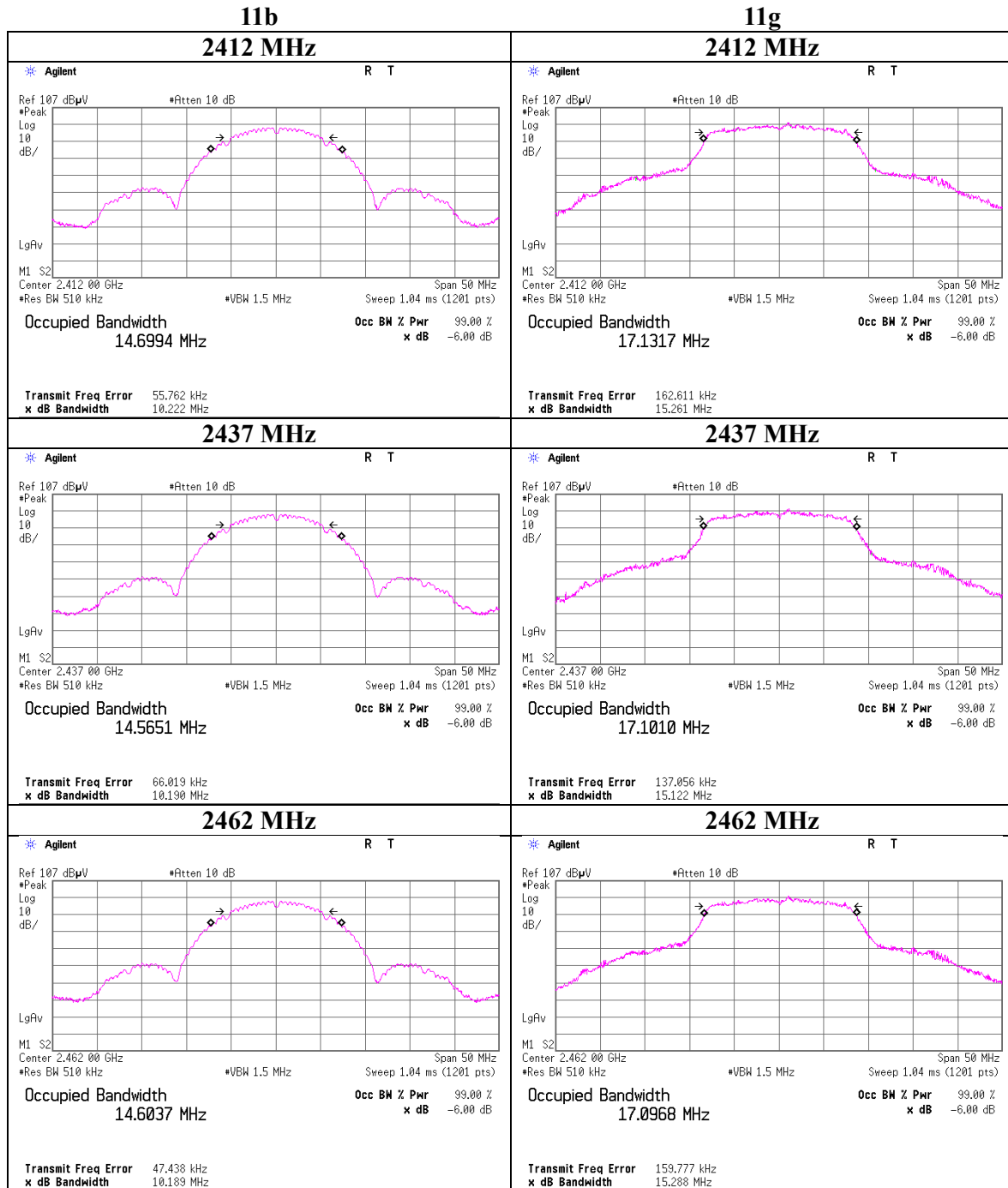
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

6 dB Bandwidth and 99 % Occupied Bandwidth

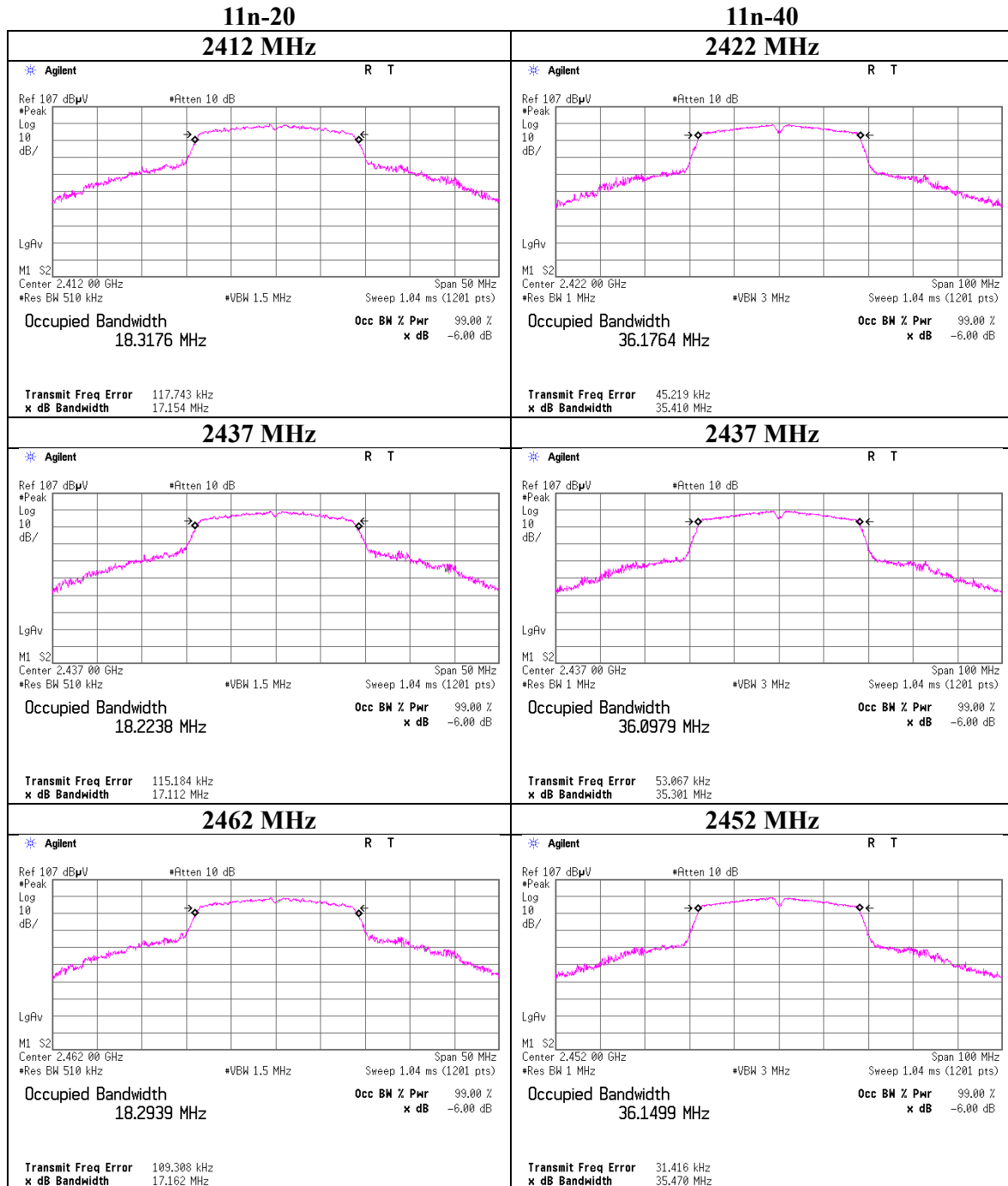
Report No. 12751991H
Test place Ise EMC Lab. No.6 Measurement Room
Date March 11, 2019
Temperature / Humidity 25 deg. C / 32 % RH
Engineer Takumi Shimada
Mode Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	14699.4	10.069	> 0.5000
	2437	14565.1	9.106	> 0.5000
	2462	14603.7	9.102	> 0.5000
11g	2412	17131.7	15.127	> 0.5000
	2437	17101.0	15.120	> 0.5000
	2462	17096.8	15.125	> 0.5000
11n-20	2412	18317.6	15.104	> 0.5000
	2437	18223.8	15.124	> 0.5000
	2462	18293.9	13.908	> 0.5000
11n-40	2422	36176.4	35.113	> 0.5000
	2437	36097.9	35.104	> 0.5000
	2452	36149.9	35.075	> 0.5000

99%Occupied Bandwidth



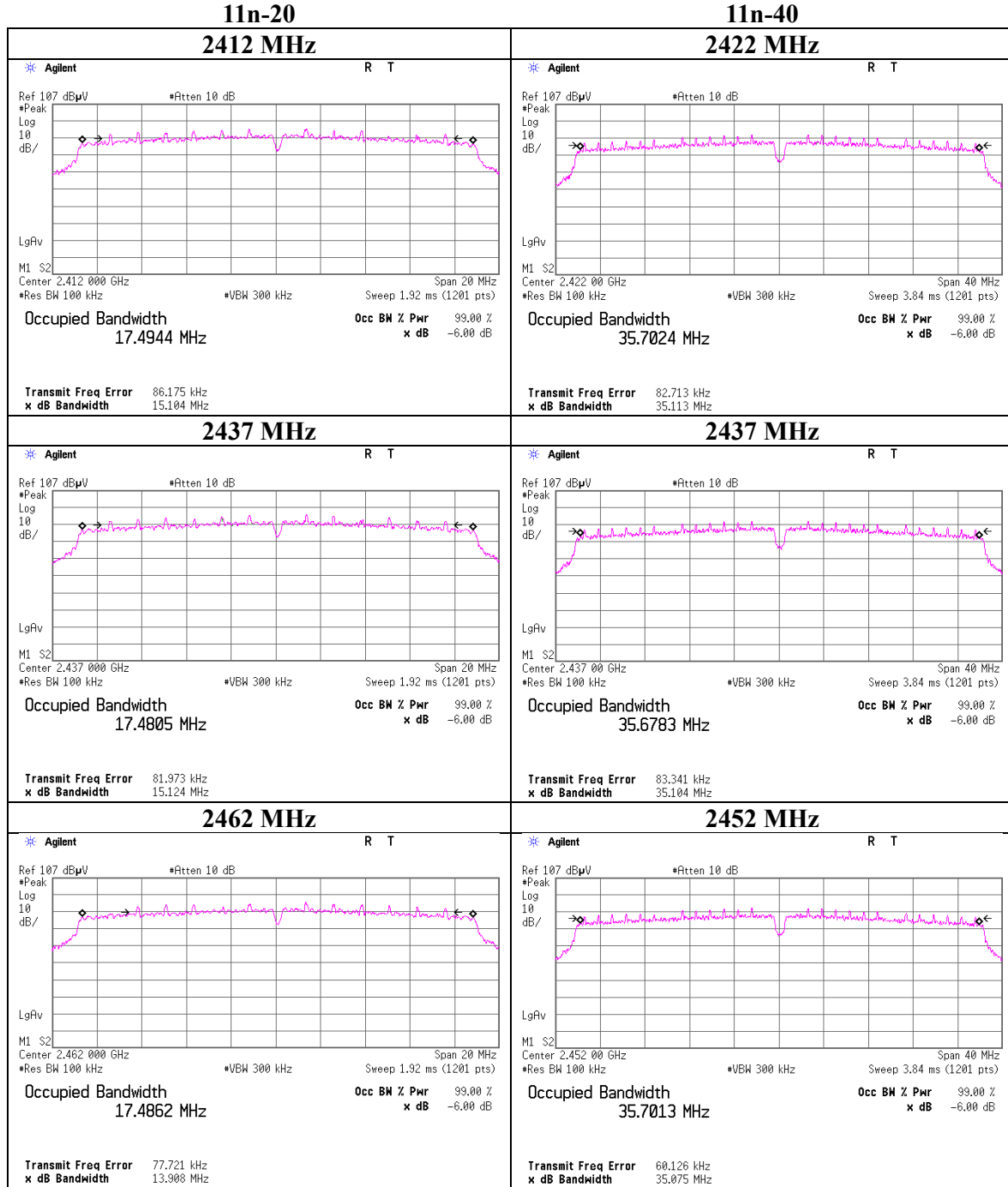
99% Occupied Bandwidth



6dB Bandwidth



6dB Bandwidth



Maximum Peak Output Power

Report No. 12751991H
Test place Ise EMC Lab. No.7 Measurement Room
Date June 19, 2019
Temperature / Humidity 24 deg. C / 46 % RH
Engineer Yuta Moriya
Mode Tx 11b

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dB]	[dBi]	[dBm]	[mW]	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	3.76	1.56	9.77	15.09	32.28	30.00	1000	14.91	3.60	18.69	73.96	36.02	4000	17.33
2437	3.71	1.57	9.77	15.05	31.99	30.00	1000	14.95	3.60	18.65	73.28	36.02	4000	17.37
2462	3.50	1.57	9.77	14.84	30.48	30.00	1000	15.16	3.60	18.44	69.82	36.02	4000	17.58

Sample Calculation:

Result = Reading + Cable Loss + 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.

Antenna 1, 2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	8.04	*
2	8.01	
5.5	8.00	
11	8.01	

*: Worst Rate

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

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Maximum Peak Output Power

Report No. 12751991H
Test place Ise EMC Lab. No.7 Measurement Room
Date June 19, 2019
Temperature / Humidity 24 deg. C / 46 % RH
Engineer Yuta Moriya
Mode Tx 11g

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dB]	[dB]	[dBm]	[mW]	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	11.28	1.56	9.77	22.61	182.39	30.00	1000	7.39	3.60	26.21	417.83	36.02	4000	9.81
2437	11.17	1.57	9.77	22.51	178.24	30.00	1000	7.49	3.60	26.11	408.32	36.02	4000	9.91
2462	11.19	1.57	9.77	22.53	179.06	30.00	1000	7.47	3.60	26.13	410.20	36.02	4000	9.89

Sample Calculation:

Result = Reading + Cable Loss + 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]	
6	12.01	
9	11.83	
12	11.75	
18	11.69	
24	12.76	
36	12.83	*
48	12.55	
54	12.53	

*: Worst Rate

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

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Ise EMC Lab.

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Maximum Peak Output Power

Report No. 12751991H
Test place Ise EMC Lab. No.7 Measurement Room
Date June 19, 2019
Temperature / Humidity 24 deg. C / 46 % RH
Engineer Yuta Moriya
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	10.33	1.56	9.77	21.66	146.55	30.00	1000	8.34	3.60	25.26	335.74	36.02	4000	10.76
2437	10.47	1.57	9.77	21.81	151.71	30.00	1000	8.19	3.60	25.41	347.54	36.02	4000	10.61
2462	10.38	1.57	9.77	21.72	148.59	30.00	1000	8.28	3.60	25.32	340.41	36.02	4000	10.70

Sample Calculation:

Result = Reading + Cable Loss + 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

MCS Number	Reading Short GI [dBm]	Reading Long GI [dBm]	Remark
0	12.01		
1	11.84		
2	11.92		
3	12.84	12.82	*
4	12.77		
5	12.78		
6	12.61		
7	12.54		

*: Worst Rate

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

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Maximum Peak Output Power

Report No. 12751991H
Test place Ise EMC Lab. No.7 Measurement Room
Date June 19, 2019
Temperature / Humidity 24 deg. C / 46 % RH
Engineer Yuta Moriya
Mode Tx 11n-40

				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]
2422	11.63	1.57	9.77	22.97	198.15	30.00	1000	7.03	3.60	26.57	453.94	36.02	4000	9.45
2437	11.47	1.57	9.77	22.81	190.99	30.00	1000	7.19	3.60	26.41	437.52	36.02	4000	9.61
2452	11.48	1.57	9.77	22.82	191.43	30.00	1000	7.18	3.60	26.42	438.53	36.02	4000	9.60

Sample Calculation:

Result = Reading + Cable Loss + 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

MCS Number	Reading Short GI [dBm]	Reading Long GI [dBm]	Remark
0	11.44		
1	11.33		
2	11.37		
3	12.49		
4	12.45		
5	12.63	12.59	*
6	12.06		
7	12.10		

*: Worst Rate

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

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Average Output Power
(Reference data for RF Exposure)

Report No. 12751991H
Test place Ise EMC Lab. No.7 Measurement Room
Date June 19, 2019
Temperature / Humidity 24 deg. C / 46 % RH
Engineer Yuta Moriya
Mode Tx

11b 1 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	1.86	1.56	9.77	13.19	20.84	0.10	13.29	21.33
2437	1.75	1.57	9.77	13.09	20.37	0.10	13.19	20.84
2462	1.56	1.57	9.77	12.90	19.50	0.10	13.00	19.95

11g 6 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	0.61	1.56	9.77	11.94	15.63	0.46	12.40	17.38
2437	0.54	1.57	9.77	11.88	15.42	0.46	12.34	17.14
2462	0.31	1.57	9.77	11.65	14.62	0.46	12.11	16.26

11n-20 MCS 0

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	0.44	1.56	9.77	11.77	15.03	0.46	12.23	16.71
2437	0.34	1.57	9.77	11.68	14.72	0.46	12.14	16.37
2462	0.24	1.57	9.77	11.58	14.39	0.46	12.04	16.00

11n-40 MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2422	-0.85	1.57	9.77	10.49	11.19	0.91	11.40	13.80
2437	-0.95	1.57	9.77	10.39	10.94	0.91	11.30	13.49
2452	-1.03	1.57	9.77	10.31	10.74	0.91	11.22	13.24

Sample Calculation:

Result (Time average) = Reading + Cable Loss + Attenuator Loss

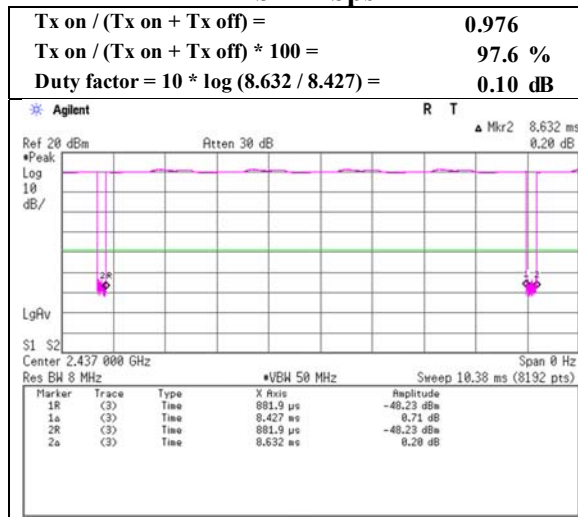
Result (Burst power average) = Time average + Duty factor

The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.

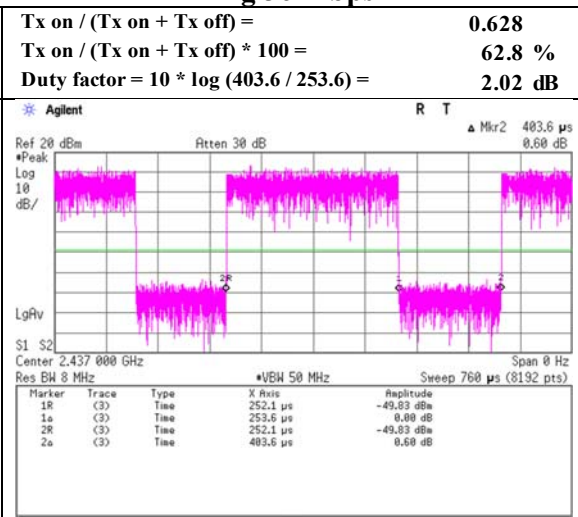
Burst rate confirmation

Report No. 12751991H
Test place Ise EMC Lab. No.6 Measurement Room
Date March 11, 2019
Temperature / Humidity 25 deg. C / 32 % RH
Engineer Takumi Shimada
Mode Tx

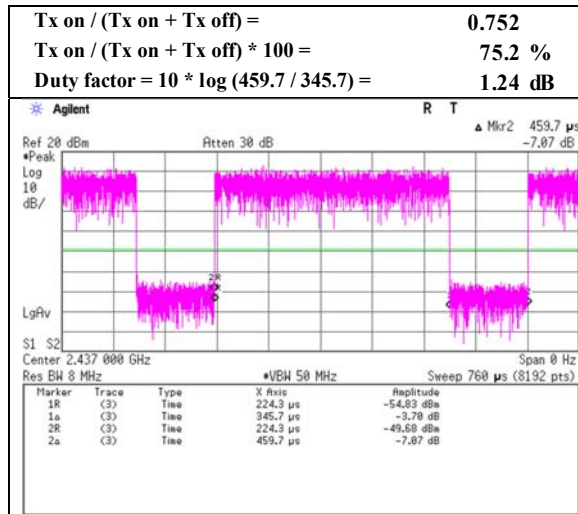
11b 1 Mbps



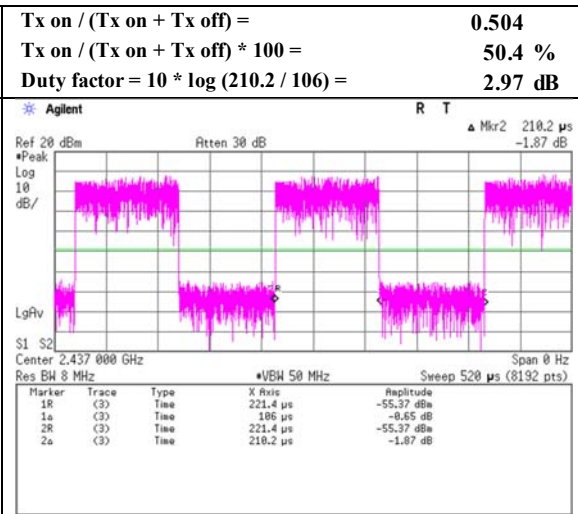
11g 36 Mbps



11n-20 MCS 3



11n-40 MCS 5



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

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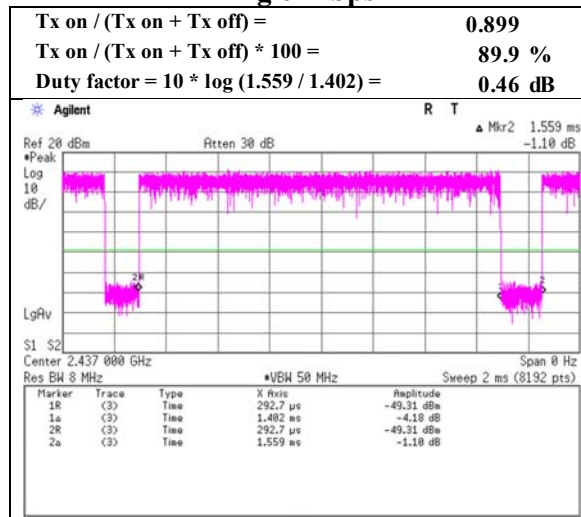
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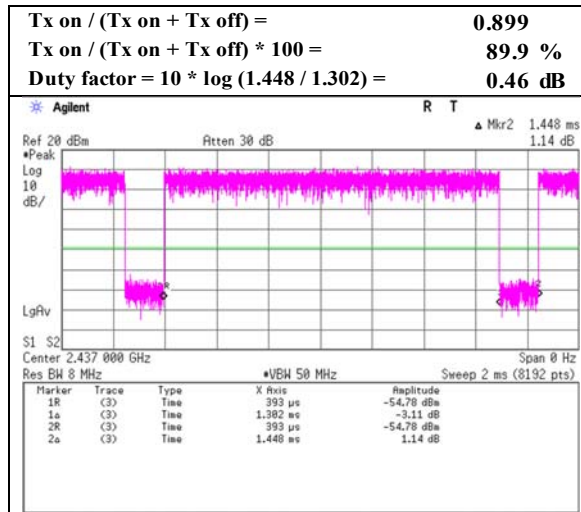
Burst rate confirmation

Report No.	12751991H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	March 11, 2019
Temperature / Humidity	25 deg. C / 32 % RH
Engineer	Takumi Shimada
Mode	Tx

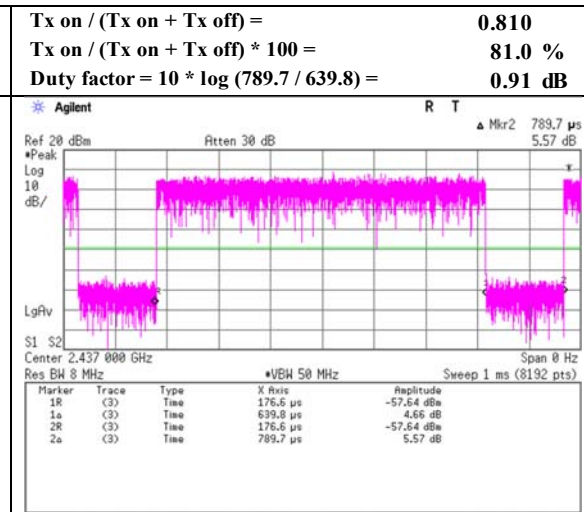
11g 6 Mbps



11n-20 MCS 0



11n-40 MCS 0



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

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 12751991H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date March 17, 2019
Temperature / Humidity 20 deg. C / 35 % RH
Engineer Takafumi Noguchi
(1 GHz - 10 GHz)
Mode Tx 11b 2412 MHz

No.3
March 17, 2019
23 deg. C / 34 % RH
Akihiko Maeda
(10 GHz - 26.5 GHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	PK	48.9	27.8	4.6	32.8	-	48.6	73.9	25.3	Floor noise
Hori.	4824.000	PK	47.6	31.7	6.8	31.8	-	54.3	73.9	19.6	
Hori.	7236.000	PK	42.2	35.9	8.0	32.7	-	53.4	73.9	20.5	
Hori.	9648.000	PK	45.2	38.7	8.5	33.3	-	59.2	73.9	14.7	
Hori.	2390.000	AV	38.8	27.8	4.6	32.8	0.1	38.6	53.9	15.3	*1) Floor noise
Hori.	4824.000	AV	43.2	31.7	6.8	31.8	0.1	49.9	53.9	4.0	
Hori.	7236.000	AV	34.0	35.9	8.0	32.7	-	45.1	53.9	8.8	
Hori.	9648.000	AV	37.7	38.7	8.5	33.3	0.1	51.8	53.9	2.1	
Vert.	2390.000	PK	47.8	27.8	4.6	32.8	-	47.5	73.9	26.4	Floor noise
Vert.	4824.000	PK	50.0	31.7	6.8	31.8	-	56.7	73.9	17.2	
Vert.	7236.000	PK	42.6	35.9	8.0	32.7	-	53.8	73.9	20.1	
Vert.	9648.000	PK	44.8	38.7	8.5	33.3	-	58.7	73.9	15.2	
Vert.	2390.000	AV	39.2	27.8	4.6	32.8	0.1	38.9	53.9	15.0	*1) Floor noise
Vert.	4824.000	AV	45.0	31.7	6.8	31.8	0.1	51.8	53.9	2.1	
Vert.	7236.000	AV	33.2	35.9	8.0	32.7	-	44.4	53.9	9.5	
Vert.	9648.000	AV	36.9	38.7	8.5	33.3	0.1	51.0	53.9	2.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

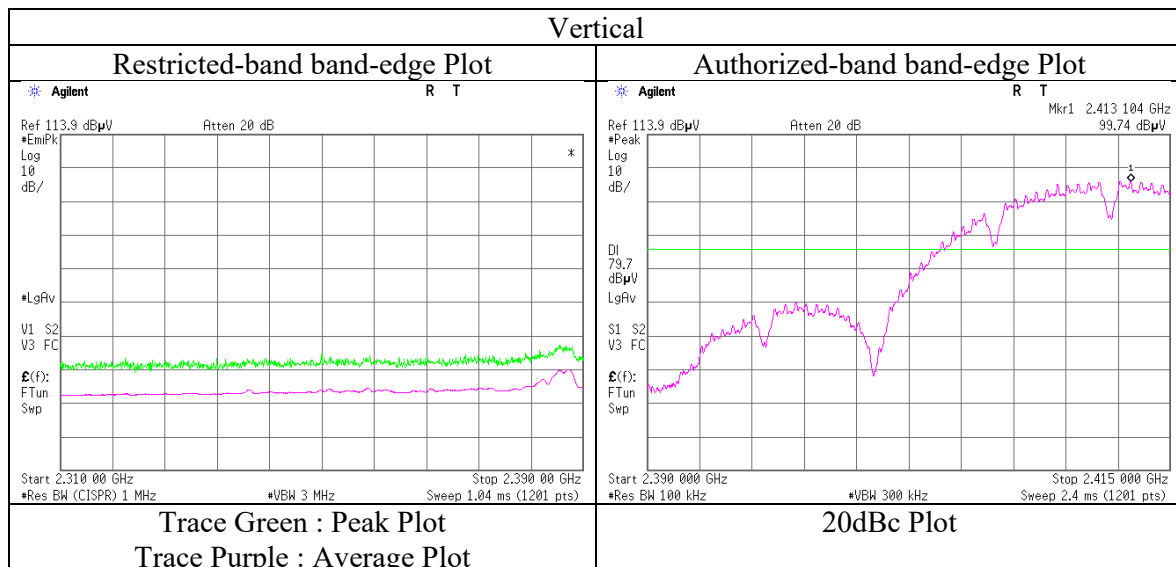
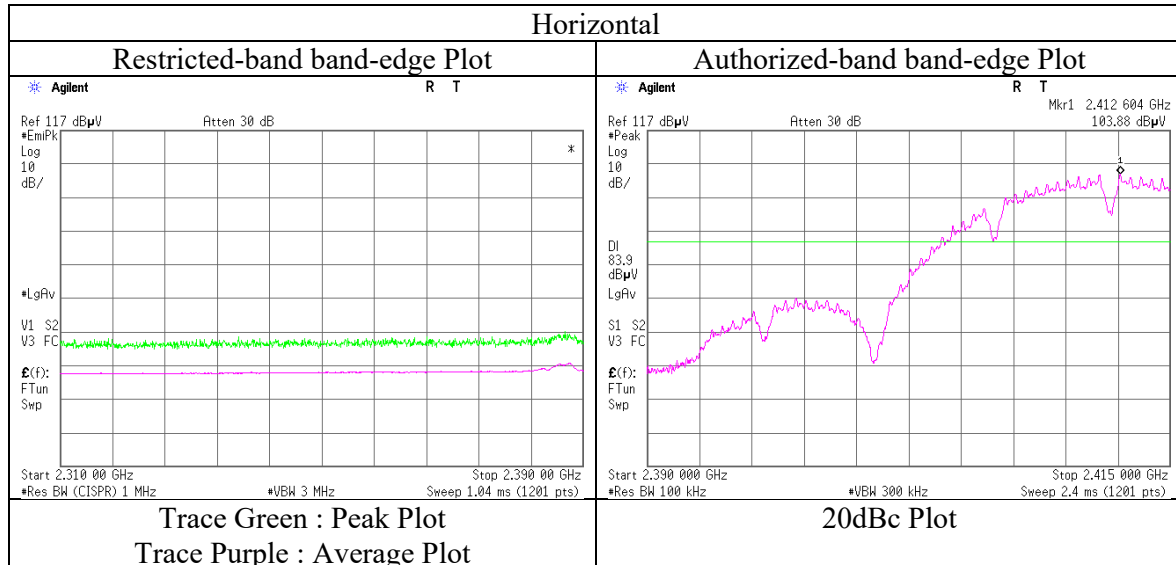
20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	103.9	27.7	4.6	32.7	103.5	-	-	Carrier
Hori.	2400.000	PK	59.8	27.8	4.6	32.7	59.4	83.5	24.1	
Vert.	2412.000	PK	99.7	27.7	4.6	32.7	99.3	-	-	Carrier
Vert.	2400.000	PK	57.5	27.8	4.6	32.7	57.2	79.3	22.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12751991H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 17, 2019
Temperature / Humidity	20 deg. C / 35 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 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.	12751991H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	March 17, 2019	March 17, 2019
Temperature / Humidity	20 deg. C / 35 % RH	23 deg. C / 34 % RH
Engineer	Takafumi Noguchi	Akihiko Maeda
	(1 GHz – 10 GHz)	(10 GHz – 26.5 GHz)
Mode	Tx 11b 2437 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	PK	47.3	31.7	6.8	31.8	-	54.0	73.9	19.9	Floor noise
Hori.	7311.000	PK	42.0	36.3	8.0	32.7	-	53.6	73.9	20.3	
Hori.	9748.000	PK	44.6	39.0	8.5	33.4	-	58.8	73.9	15.1	
Hori.	4874.000	AV	42.4	31.7	6.8	31.8	0.1	49.2	53.9	4.7	Floor noise
Hori.	7311.000	AV	32.8	36.3	8.0	32.7	-	44.4	53.9	9.5	
Hori.	9748.000	AV	36.3	39.0	8.5	33.4	0.1	50.6	53.9	3.3	
Vert.	4874.000	PK	48.3	31.7	6.8	31.8	-	55.1	73.9	18.9	Floor noise
Vert.	7311.000	PK	42.9	36.3	8.0	32.7	-	54.5	73.9	19.5	
Vert.	9748.000	PK	44.2	39.0	8.5	33.4	-	58.4	73.9	15.5	
Vert.	4874.000	AV	45.3	31.7	6.8	31.8	0.1	52.1	53.9	1.8	Floor noise
Vert.	7311.000	AV	34.0	36.3	8.0	32.7	-	45.6	53.9	8.3	
Vert.	9748.000	AV	35.4	39.0	8.5	33.4	0.1	49.7	53.9	4.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No.	12751991H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	March 17, 2019	March 17, 2019
Temperature / Humidity	20 deg. C / 35 % RH	23 deg. C / 34 % RH
Engineer	Takafumi Noguchi	Akihiko Maeda
	(1 GHz – 10 GHz)	(10 GHz – 26.5 GHz)
Mode	Tx 11b 2462 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	PK	52.5	27.5	4.7	32.7	-	52.0	73.9	21.9	Floor noise
Hori.	4924.000	PK	44.9	31.8	6.8	31.8	-	51.7	73.9	22.2	
Hori.	7386.000	PK	41.9	36.7	8.0	32.7	-	53.9	73.9	20.0	
Hori.	9848.000	PK	44.3	39.1	8.5	33.4	-	58.6	73.9	15.3	
Hori.	2483.500	AV	42.7	27.5	4.7	32.7	0.1	42.3	53.9	11.6	*1) Floor noise
Hori.	4924.000	AV	40.8	31.8	6.8	31.8	0.1	47.7	53.9	6.2	
Hori.	7386.000	AV	33.7	36.7	8.0	32.7	-	45.7	53.9	8.2	
Hori.	9848.000	AV	34.2	39.1	8.5	33.4	0.1	48.6	53.9	5.3	
Vert.	2483.500	PK	49.1	27.5	4.7	32.7	-	48.6	73.9	25.3	Floor noise
Vert.	4924.000	PK	47.8	31.8	6.8	31.8	-	54.6	73.9	19.3	
Vert.	7386.000	PK	41.9	36.7	8.0	32.7	-	53.9	73.9	20.0	
Vert.	9848.000	PK	42.6	39.1	8.5	33.4	-	56.9	73.9	17.1	
Vert.	2483.500	AV	40.2	27.5	4.7	32.7	0.1	39.8	53.9	14.1	*1) Floor noise
Vert.	4924.000	AV	43.6	31.8	6.8	31.8	0.1	50.5	53.9	3.4	
Vert.	7386.000	AV	33.9	36.7	8.0	32.7	-	45.8	53.9	8.1	
Vert.	9848.000	AV	35.5	39.1	8.5	33.4	0.1	49.9	53.9	4.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

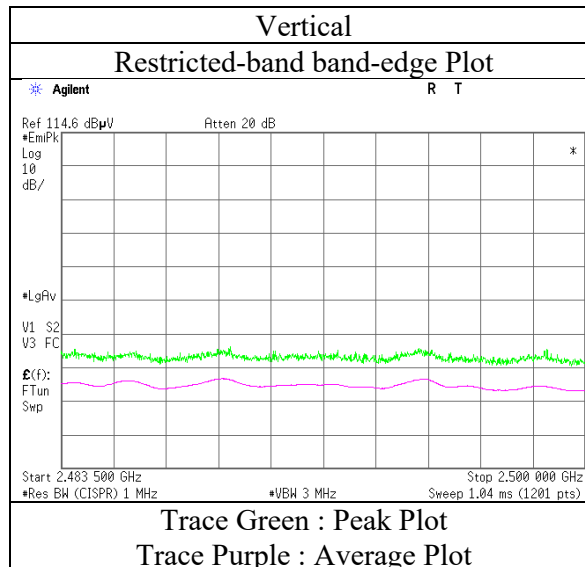
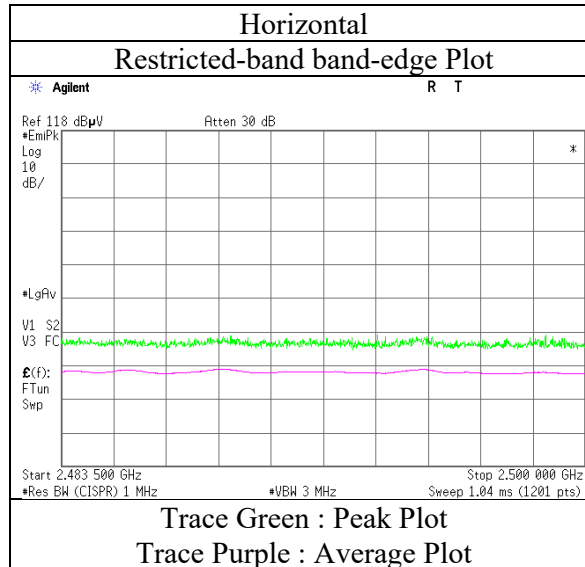
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12751991H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 17, 2019
Temperature / Humidity	20 deg. C / 35 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 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. 12751991H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date March 17, 2019
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Akihiko Maeda
(1 GHz – 26.5 GHz)
Mode Tx 11n-20 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	PK	67.0	27.8	4.6	32.8	-	66.7	73.9	7.3	Floor noise
Hori.	4824.000	PK	41.3	31.7	6.8	31.8	-	47.9	73.9	26.0	
Hori.	7236.000	PK	42.2	35.9	8.0	32.7	-	53.4	73.9	20.5	
Hori.	9648.000	PK	42.1	38.7	8.5	33.3	-	56.1	73.9	17.8	
Hori.	2390.000	AV	51.5	27.8	4.6	32.8	1.2	52.4	53.9	1.5	*1)
Hori.	4824.000	AV	32.9	31.7	6.8	31.8	-	39.5	53.9	14.4	
Hori.	7236.000	AV	34.0	35.9	8.0	32.7	-	45.2	53.9	8.7	
Hori.	9648.000	AV	31.0	38.7	8.5	33.3	-	45.0	53.9	8.9	
Vert.	2390.000	PK	65.4	27.8	4.6	32.8	-	65.1	73.9	8.8	Floor noise
Vert.	4824.000	PK	41.3	31.7	6.8	31.8	-	47.9	73.9	26.0	
Vert.	7236.000	PK	41.8	35.9	8.0	32.7	-	53.0	73.9	20.9	
Vert.	9648.000	PK	42.1	38.7	8.5	33.3	-	56.1	73.9	17.9	
Vert.	2390.000	AV	50.6	27.8	4.6	32.8	1.2	51.5	53.9	2.4	*1)
Vert.	4824.000	AV	33.5	31.7	6.8	31.8	-	40.1	53.9	13.8	
Vert.	7236.000	AV	33.8	35.9	8.0	32.7	-	45.0	53.9	8.9	
Vert.	9648.000	AV	31.0	38.7	8.5	33.3	-	45.0	53.9	8.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.6 m / 3.0 m) = 1.59 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	98.4	27.7	4.6	32.7	98.0	-	-	Carrier
Hori.	2400.000	PK	63.2	27.8	4.6	32.7	62.8	78.0	15.2	
Vert.	2412.000	PK	96.5	27.7	4.6	32.7	96.1	-	-	Carrier
Vert.	2400.000	PK	59.6	27.8	4.6	32.7	59.3	76.1	16.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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Ise EMC Lab.

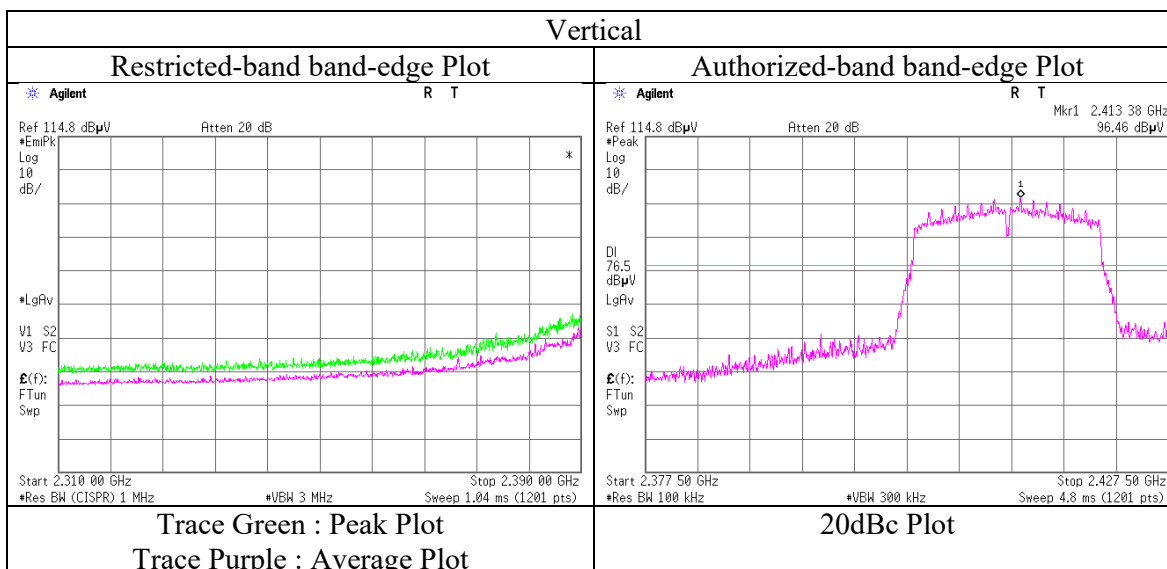
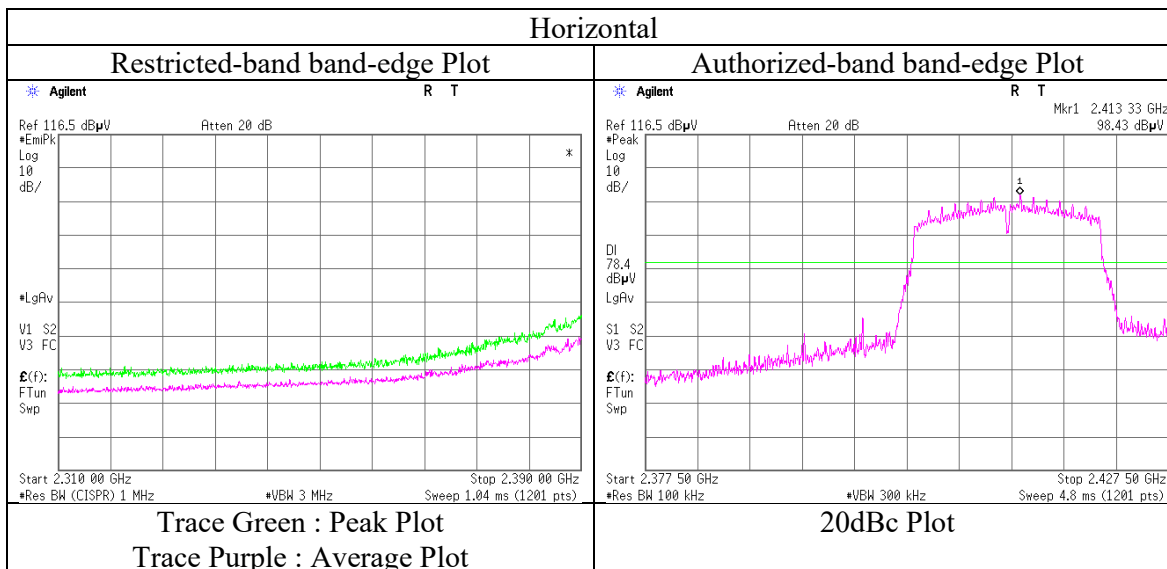
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12751991H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 17, 2019
Temperature / Humidity	23 deg. C / 34 % RH
Engineer	Akihiko Maeda
	(1 GHz – 26.5 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. 12751991H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date March 17, 2019
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Akihiko Maeda
(1 GHz – 26.5 GHz)
Mode Tx 11n-20 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	PK	42.8	31.7	6.0	31.8	-	48.8	73.9	25.2	Floor noise
Hori.	7311.000	PK	43.1	36.3	7.3	32.7	-	53.9	73.9	20.0	Floor noise
Hori.	9748.000	PK	41.6	39.0	8.2	33.4	-	55.4	73.9	18.5	Floor noise
Hori.	4874.000	AV	32.3	31.7	6.0	31.8	-	38.3	53.9	15.7	Floor noise
Hori.	7311.000	AV	32.6	36.3	7.3	32.7	-	43.4	53.9	10.5	Floor noise
Hori.	9748.000	AV	30.5	39.0	8.2	33.4	-	44.3	53.9	9.6	Floor noise
Vert.	4874.000	PK	42.6	31.7	6.0	31.8	-	48.6	73.9	25.4	Floor noise
Vert.	7311.000	PK	42.8	36.3	7.3	32.7	-	53.6	73.9	20.3	Floor noise
Vert.	9748.000	PK	41.5	39.0	8.2	33.4	-	55.3	73.9	18.6	Floor noise
Vert.	4874.000	AV	32.4	31.7	6.0	31.8	-	38.4	53.9	15.6	Floor noise
Vert.	7311.000	AV	32.5	36.3	7.3	32.7	-	43.3	53.9	10.6	Floor noise
Vert.	9748.000	AV	30.2	39.0	8.2	33.4	-	44.0	53.9	9.9	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 12751991H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date March 17, 2019
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Akihiko Maeda
(1 GHz – 26.5 GHz)
Mode Tx 11n-20 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	PK	65.3	27.5	4.7	32.7	-	64.8	73.9	9.1	
Hori.	4924.000	PK	41.8	31.8	6.1	31.8	-	47.8	73.9	26.1	Floor noise
Hori.	7386.000	PK	41.6	36.7	7.3	32.7	-	52.9	73.9	21.0	Floor noise
Hori.	9848.000	PK	42.2	39.1	8.2	33.4	-	56.1	73.9	17.8	Floor noise
Hori.	2483.500	AV	52.2	27.5	4.7	32.7	1.2	52.9	53.9	1.0	*1)
Hori.	4924.000	AV	32.0	31.8	6.1	31.8	-	38.0	53.9	15.9	Floor noise
Hori.	7386.000	AV	31.4	36.7	7.3	32.7	-	42.7	53.9	11.2	Floor noise
Hori.	9848.000	AV	30.6	39.1	8.2	33.4	-	44.5	53.9	9.4	Floor noise
Vert.	2483.500	PK	64.7	27.5	4.7	32.7	-	64.2	73.9	9.7	
Vert.	4924.000	PK	41.8	31.8	6.1	31.8	-	47.8	73.9	26.1	Floor noise
Vert.	7386.000	PK	42.2	36.7	7.3	32.7	-	53.5	73.9	20.4	Floor noise
Vert.	9848.000	PK	42.6	39.1	8.2	33.4	-	56.5	73.9	17.4	Floor noise
Vert.	2483.500	AV	51.6	27.5	4.7	32.7	1.2	52.3	53.9	1.6	*1)
Vert.	4924.000	AV	32.0	31.8	6.1	31.8	-	38.0	53.9	15.9	Floor noise
Vert.	7386.000	AV	32.8	36.7	7.3	32.7	-	44.1	53.9	9.8	Floor noise
Vert.	9848.000	AV	30.9	39.1	8.2	33.4	-	44.8	53.9	9.1	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

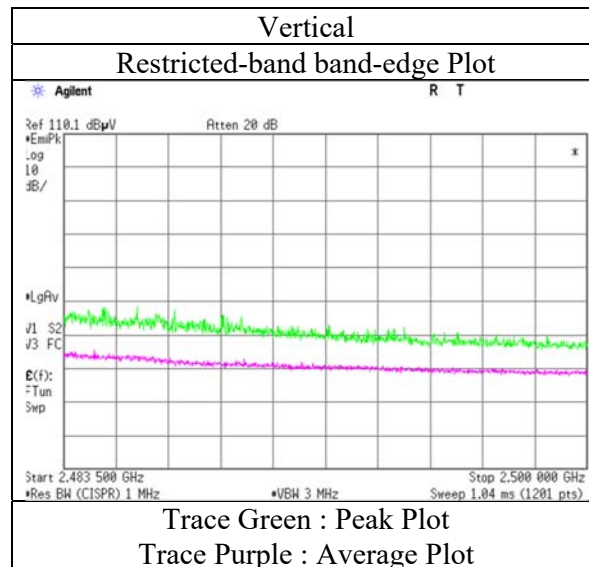
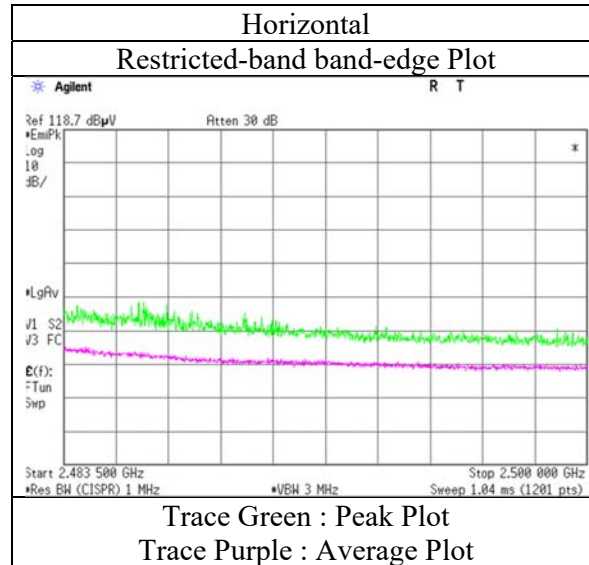
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12751991H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 17, 2019
Temperature / Humidity	23 deg. C / 34 % RH
Engineer	Akihiko Maeda
	(1 GHz – 26.5 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.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 12751991H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3 No.3
Date March 17, 2019 March 18, 2019
Temperature / Humidity 22 deg. C / 34 % RH 23 deg. C / 34 % RH
Engineer Akihiko Maeda Akihiko Maeda
(1 GHz – 26.5 GHz) (below 1 GHz)
Mode Tx 11n-40 2422 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	158.369	QP	35.1	15.6	8.9	32.1	-	27.5	43.5	16.0	
Hori.	175.950	QP	38.0	16.4	9.0	32.1	-	31.4	43.5	12.1	
Hori.	193.536	QP	43.3	16.6	9.2	32.1	-	37.0	43.5	6.5	
Hori.	199.999	QP	46.9	16.8	9.3	32.0	-	40.9	43.5	2.6	
Hori.	211.137	QP	46.8	11.2	9.3	32.0	-	35.3	43.5	8.2	
Hori.	386.680	QP	40.6	15.4	10.7	31.9	-	34.8	46.0	11.2	
Hori.	580.024	QP	38.7	18.7	12.0	32.0	-	37.4	46.0	8.6	
Hori.	2390.000	PK	54.0	27.8	4.6	32.8	-	53.7	73.9	20.2	
Hori.	4844.000	PK	52.2	31.7	6.0	31.8	-	58.1	73.9	15.8	Floor noise
Hori.	7266.000	PK	41.7	36.0	7.3	32.7	-	52.3	73.9	21.6	Floor noise
Hori.	9688.000	PK	42.2	38.9	8.1	33.3	-	55.9	73.9	18.0	Floor noise
Hori.	2390.000	AV	41.8	27.8	4.6	32.8	3.0	44.5	53.9	9.4	*1)
Hori.	4844.000	AV	37.8	31.7	6.0	31.8	-	43.7	53.9	10.2	Floor noise
Hori.	7266.000	AV	33.4	36.0	7.3	32.7	-	44.0	53.9	9.9	Floor noise
Hori.	9688.000	AV	31.8	38.9	8.1	33.3	-	45.5	53.9	8.4	Floor noise
Vert.	158.392	QP	34.3	15.6	8.9	32.1	-	26.7	43.5	16.8	
Vert.	175.960	QP	31.2	16.4	9.0	32.1	-	24.6	43.5	18.9	
Vert.	193.532	QP	32.8	16.6	9.2	32.1	-	26.5	43.5	17.0	
Vert.	199.999	QP	38.9	16.8	9.3	32.0	-	32.9	43.5	10.6	
Vert.	225.970	QP	35.3	11.4	9.5	32.0	-	24.2	46.0	21.8	
Vert.	386.690	QP	34.6	15.4	10.7	31.9	-	28.8	46.0	17.2	
Vert.	580.024	QP	32.1	18.7	12.0	32.0	-	30.8	46.0	15.2	
Vert.	2390.000	PK	54.6	27.8	4.6	32.8	-	54.3	73.9	19.6	
Vert.	4844.000	PK	46.6	31.7	6.0	31.8	-	52.5	73.9	21.4	Floor noise
Vert.	7266.000	PK	43.5	36.0	7.3	32.7	-	54.1	73.9	19.8	Floor noise
Vert.	9688.000	PK	43.0	38.9	8.1	33.3	-	56.7	73.9	17.2	Floor noise
Vert.	2390.000	AV	40.9	27.8	4.6	32.8	3.0	43.6	53.9	10.3	*1)
Vert.	4844.000	AV	34.9	31.7	6.0	31.8	-	40.8	53.9	13.1	Floor noise
Vert.	7266.000	AV	33.0	36.0	7.3	32.7	-	43.6	53.9	10.3	Floor noise
Vert.	9688.000	AV	31.8	38.9	8.1	33.3	-	45.5	53.9	8.4	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.6 m / 3.0 m) = 1.59 dB

10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

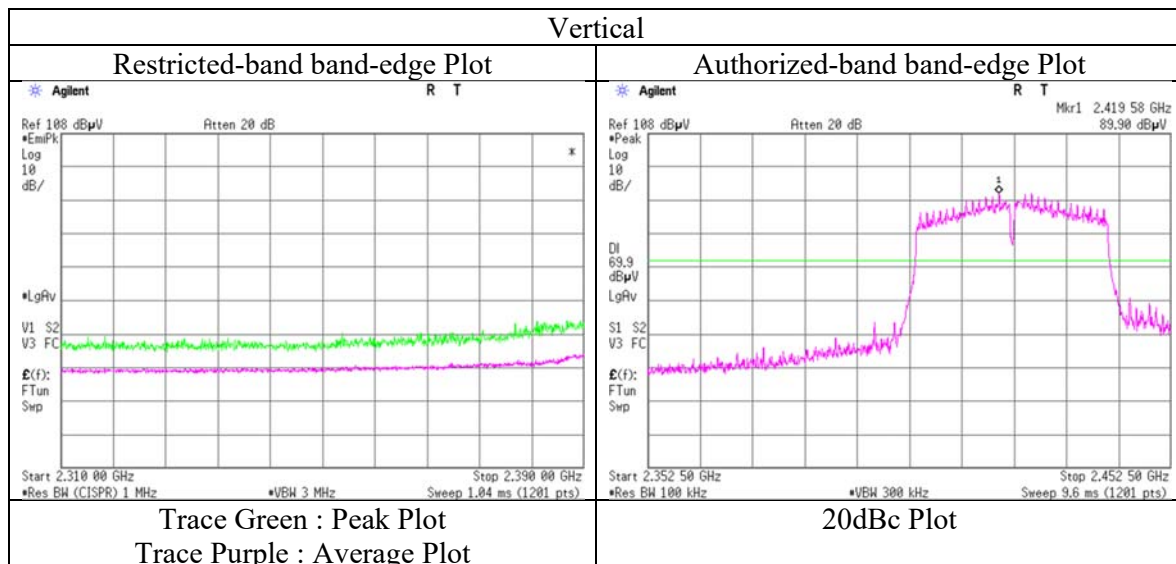
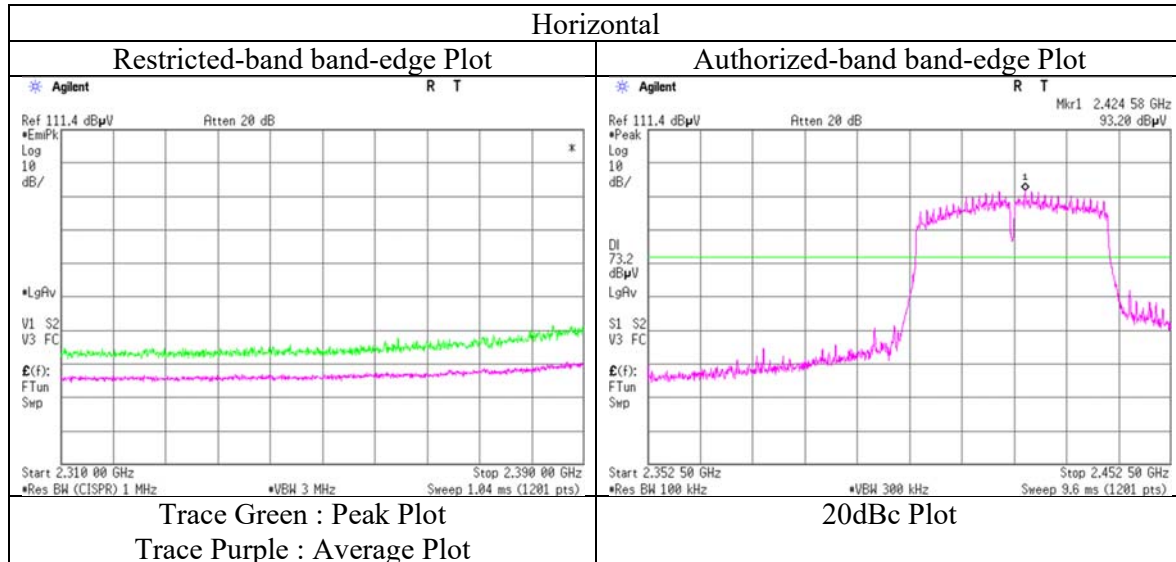
20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2422.000	PK	93.2	27.6	4.7	32.7	92.7	-	-	Carrier
Hori.	2400.000	PK	57.5	27.8	4.6	32.7	57.2	72.7	15.5	
Vert.	2422.000	PK	89.9	27.6	4.7	32.7	89.4	-	-	Carrier
Vert.	2400.000	PK	56.0	27.8	4.6	32.7	55.7	69.4	13.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12751991H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 17, 2019
Temperature / Humidity	23 deg. C / 34 % RH
Engineer	Akihiko Maeda
	(1 GHz – 26.5 GHz)
Mode	Tx 11n-40 2422 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. 12751991H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date March 17, 2019
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Akihiko Maeda
(1 GHz – 26.5 GHz)
Mode Tx 11n-40 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	PK	42.0	31.7	6.0	31.8	-	48.0	73.9	26.0	Floor noise
Hori.	7311.000	PK	42.5	36.3	7.3	32.7	-	53.3	73.9	20.6	Floor noise
Hori.	9748.000	PK	41.4	39.0	8.2	33.4	-	55.2	73.9	18.7	Floor noise
Hori.	4874.000	AV	32.7	31.7	6.0	31.8	-	38.7	53.9	15.3	Floor noise
Hori.	7311.000	AV	33.0	36.3	7.3	32.7	-	43.8	53.9	10.1	Floor noise
Hori.	9748.000	AV	31.6	39.0	8.2	33.4	-	45.4	53.9	8.5	Floor noise
Vert.	4874.000	PK	41.7	31.7	6.0	31.8	-	47.7	73.9	26.3	Floor noise
Vert.	7311.000	PK	41.8	36.3	7.3	32.7	-	52.6	73.9	21.3	Floor noise
Vert.	9748.000	PK	41.4	39.0	8.2	33.4	-	55.2	73.9	18.7	Floor noise
Vert.	4874.000	AV	32.0	31.7	6.0	31.8	-	38.0	53.9	16.0	Floor noise
Vert.	7311.000	AV	32.4	36.3	7.3	32.7	-	43.2	53.9	10.7	Floor noise
Vert.	9748.000	AV	31.5	39.0	8.2	33.4	-	45.3	53.9	8.6	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 12751991H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date March 17, 2019
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Akihiko Maeda
(1 GHz – 26.5 GHz)
Mode Tx 11n-40 2452 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	PK	61.7	27.5	4.7	32.7	-	61.2	73.9	12.7	
Hori.	4904.000	PK	40.7	31.8	6.0	31.8	-	46.7	73.9	27.2	Floor noise
Hori.	7356.000	PK	42.7	36.5	7.3	32.7	-	53.8	73.9	20.1	Floor noise
Hori.	9808.000	PK	42.0	39.2	8.2	33.4	-	56.0	73.9	17.9	Floor noise
Hori.	2483.500	AV	49.1	27.5	4.7	32.7	3.0	51.6	53.9	2.4	*1),*2)
Hori.	4904.000	AV	32.3	31.8	6.0	31.8	-	38.3	53.9	15.6	Floor noise
Hori.	7356.000	AV	33.5	36.5	7.3	32.7	-	44.6	53.9	9.3	Floor noise
Hori.	9808.000	AV	31.4	39.2	8.2	33.4	-	45.4	53.9	8.5	Floor noise
Vert.	2483.500	PK	60.4	27.5	4.7	32.7	-	59.9	73.9	14.0	
Vert.	4904.000	PK	41.1	31.8	6.0	31.8	-	47.1	73.9	26.8	Floor noise
Vert.	7356.000	PK	42.3	36.5	7.3	32.7	-	53.4	73.9	20.5	Floor noise
Vert.	9808.000	PK	42.8	39.2	8.2	33.4	-	56.8	73.9	17.1	Floor noise
Vert.	2483.500	AV	47.3	27.5	4.7	32.7	3.0	49.8	53.9	4.2	*1),*2)
Vert.	4904.000	AV	32.6	31.8	6.0	31.8	-	38.6	53.9	15.3	Floor noise
Vert.	7356.000	AV	33.1	36.5	7.3	32.7	-	44.2	53.9	9.7	Floor noise
Vert.	9808.000	AV	31.5	39.2	8.2	33.4	-	45.5	53.9	8.4	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

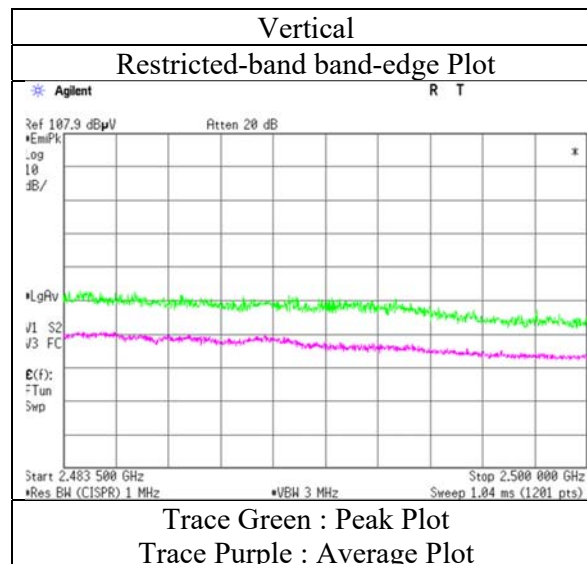
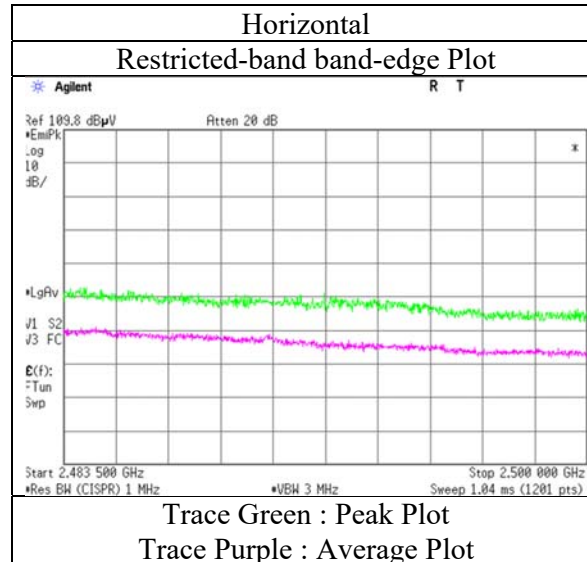
Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

*2) Integration method

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12751991H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 17, 2019
Temperature / Humidity	23 deg. C / 34 % RH
Engineer	Akihiko Maeda
	(1 GHz – 26.5 GHz)
Mode	Tx 11n-40 2452 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.

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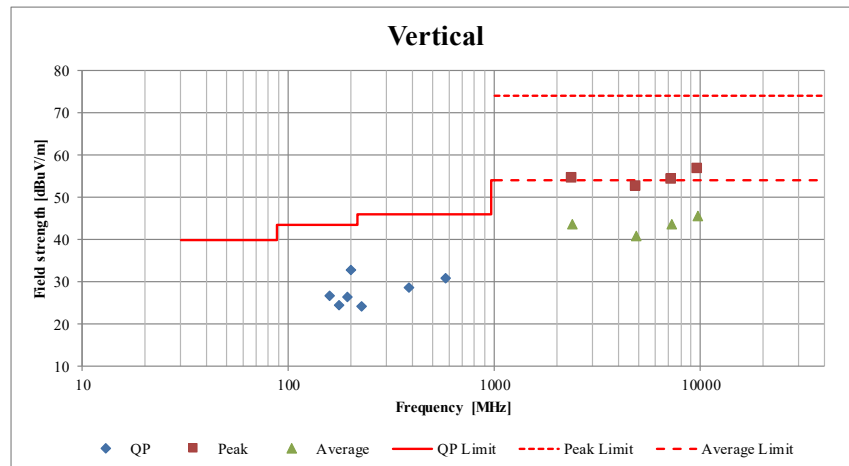
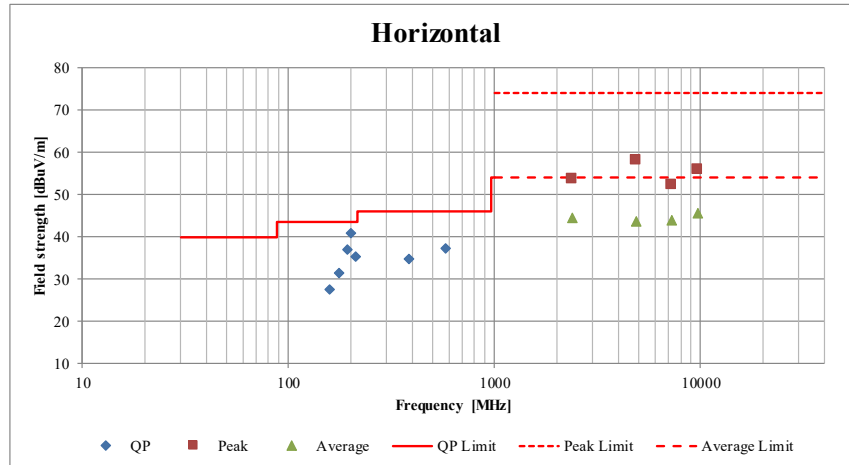
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

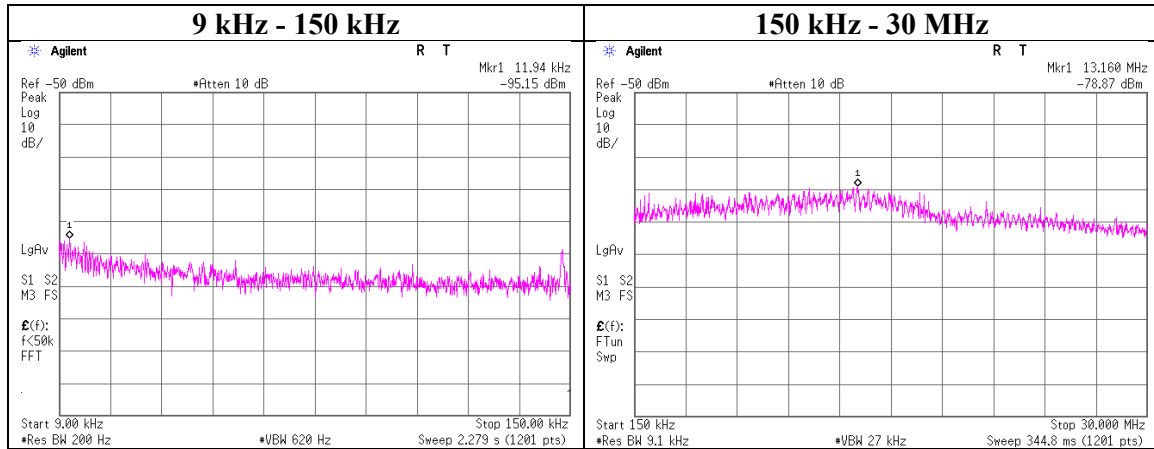
Report No.	12751991H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	March 17, 2019	March 18, 2019
Temperature / Humidity	23 deg. C / 34 % RH	23 deg. C / 34 % RH
Engineer	Akihiko Maeda	Akihiko Maeda
	(1 GHz – 26.5 GHz)	(below 1 GHz)
Mode	Tx 11n-40 2422 MHz	



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

Conducted Spurious Emission

Report No. 12751991H
Test place Ise EMC Lab. No.6 Measurement Room
Date March 11, 2019
Temperature / Humidity 25 deg. C / 32 % RH
Engineer Takumi Shimada
Mode Tx 11n-40 2422 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
11.94	-95.2	0.01	9.8	3.6	1	-81.7	300	6.0	-20.4	46.0	66.4	
13.16	-78.9	0.06	9.8	3.6	1	-65.4	300	6.0	-4.1	45.2	49.3	

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

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

N: Number of output

Power Density

Report No. 12751991H
Test place Ise EMC Lab. No.7 Measurement Room
Date June 19, 2019
Temperature / Humidity 24 deg. C / 46 % RH
Engineer Yuta Moriya
Mode Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-8.93	1.56	9.77	2.40	8.00	5.60
2437.00	-9.05	1.57	9.77	2.29	8.00	5.71
2462.00	-9.06	1.57	9.77	2.28	8.00	5.72

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-23.72	1.56	9.77	-12.39	8.00	20.39
2437.00	-24.36	1.57	9.77	-13.02	8.00	21.02
2462.00	-24.19	1.57	9.77	-12.85	8.00	20.85

11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-25.08	1.56	9.77	-13.75	8.00	21.75
2437.00	-24.45	1.57	9.77	-13.11	8.00	21.11
2462.00	-25.24	1.57	9.77	-13.90	8.00	21.90

11n-40

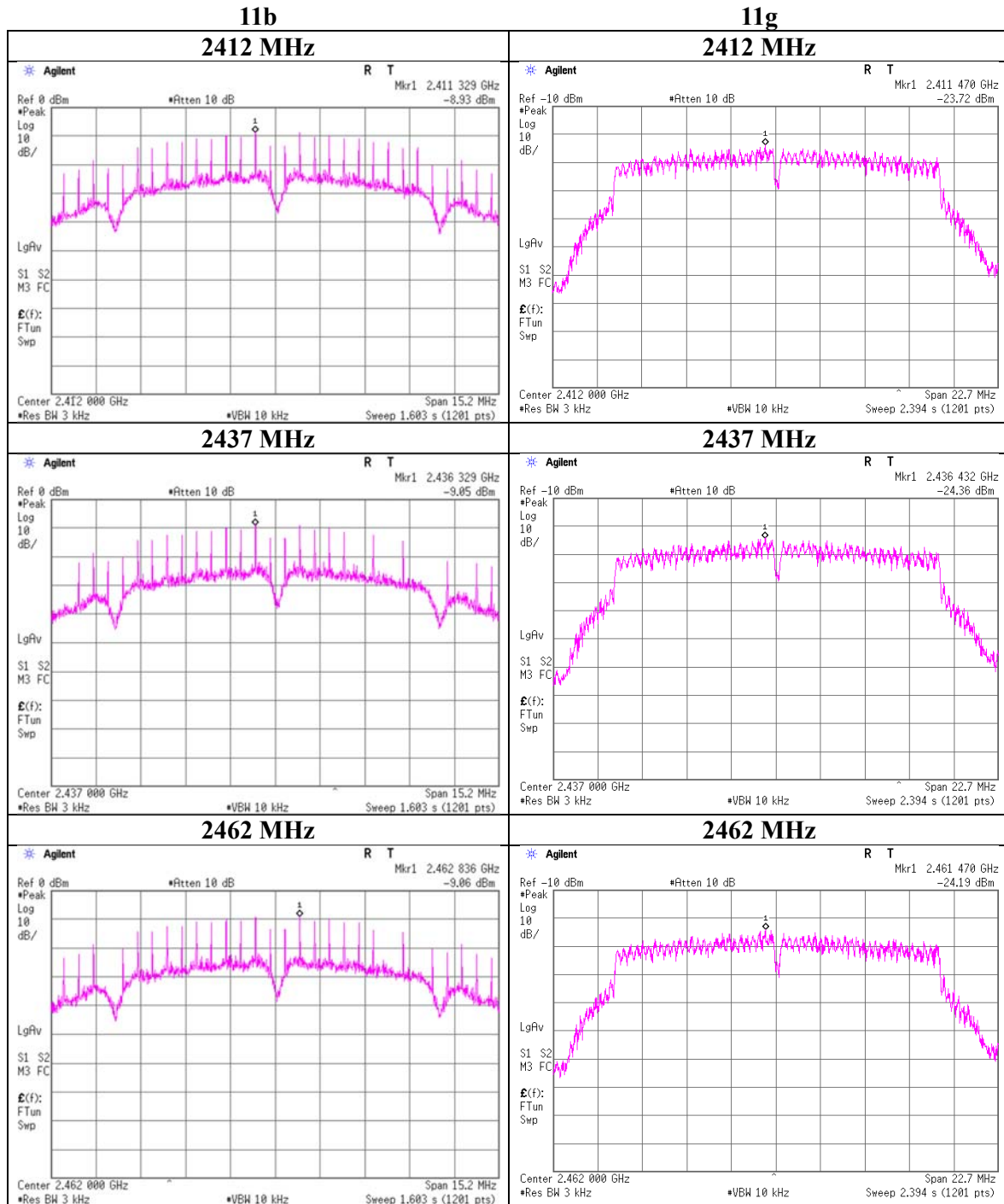
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2422.00	-30.23	1.57	9.77	-18.89	8.00	26.89
2437.00	-30.00	1.57	9.77	-18.66	8.00	26.66
2452.00	-30.06	1.57	9.77	-18.72	8.00	26.72

Sample Calculation:

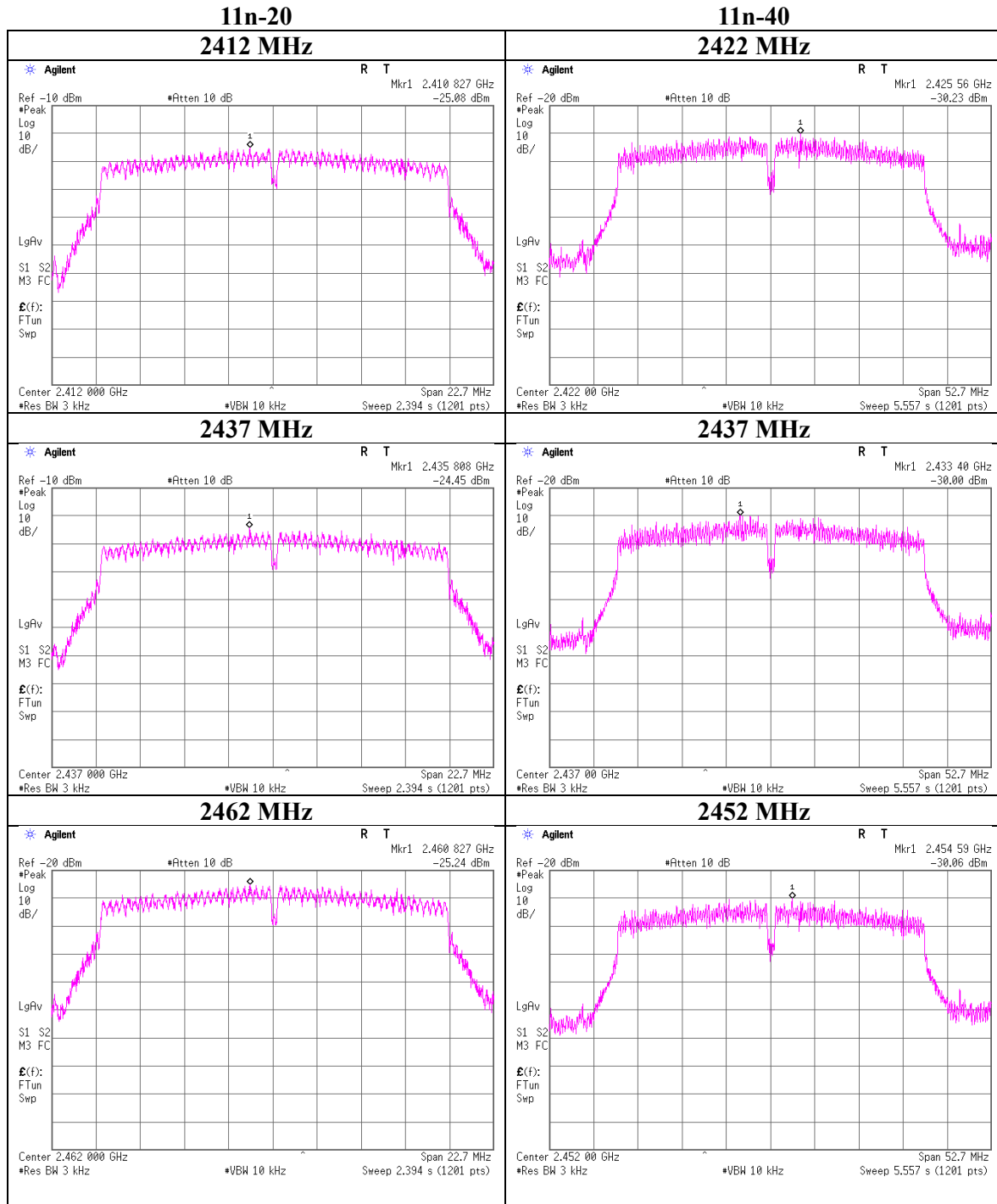
Result = Reading + Cable Loss (including the cable(s)) + Attenuator Loss

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

Power Density



Power Density



APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/06/2018	04/30/2019 *1)	12
RE	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/05/2019	03/31/2020	12
RE,CE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	141885	Spectrum Analyzer	AGILENT	E4448A	US44300523	11/07/2018	11/30/2019	12
RE,CE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24
RE,CE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	141513	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	06/07/2018	06/30/2019	12
RE	141580	MicroWave System Amplifier	AGILENT	83017A	MY39500779	03/05/2019	03/31/2020	12
RE	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/19/2018	09/30/2019	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	06/07/2018	06/30/2019	12
RE,CE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/29/2019	01/31/2020	12
CE	141357	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	07/24/2018	07/31/2019	12
CE	141247	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	12/06/2018	12/31/2019	12
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/20/2018	12/31/2019	12
RE	141323	Coaxial cable	UL Japan	-	-	07/03/2018	07/31/2019	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	06/04/2018	06/30/2019	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	06/04/2018	06/30/2019	12
CE	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/sucoform141-PE/421-010	-/00640	07/03/2018	07/31/2019	12
AT	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	01/11/2019	01/31/2020	12
AT	141832	Power sensor	ANRITSU	MA2411B	738174	10/09/2018	10/31/2019	12
AT	141361	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	03/04/2019	03/31/2020	12
AT	141322	Microwave Cable	RS Pro	R-132G7210200CD	-	04/11/2018	04/30/2019 *1)	12
AT	141410	Microwave cable	Huber+Suhner	SUCOFLEX 102	37953/2	09/19/2018	09/30/2019	12
AT	141366	Attenuator	Weinschel Associates	WA56-20	56200213	05/29/2018	05/31/2019 *1)	12
AT	141810	Power Meter	ANRITSU	ML2495A	824014	10/09/2018	10/31/2019	12
AT	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/02/2018	11/30/2019	12
AT	141899	Spectrum Analyzer	AGILENT	E4448A	MY46180655	08/10/2018	08/31/2019	12
AT	141395	Coaxial Cable	UL Japan	-	-	11/13/2018	11/30/2019	12
RE	141556	Thermo-Hygrometer	CUSTOM	CTH-201	0003	12/05/2018	12/31/2019	12
RE	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/21/2018	08/31/2019	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	142228	Measure	KOMELON	KMC-36	-	-	-	-
RE	141512	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	06/06/2018	06/30/2019	12
RE	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	08/08/2018	08/31/2019	12
RE	141579	Pre Amplifier	AGILENT	8449B	3008A02142	01/21/2019	01/31/2020	12
AT	141840	Power sensor	ANRITSU	MA2411B	11737	10/16/2018	10/31/2019	12
AT	141805	Power Meter	ANRITSU	ML2495A	6K00003338	10/16/2018	10/31/2019	12
AT	141173	Attenuator(10dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	12/17/2018	12/31/2019	12
AT	141572	Thermo-Hygrometer	CUSTOM	CTH-201	3401	01/11/2019	01/31/2020	12
AT	141224	Microwave Cable	Junkosha	MWX221	1409S496	03/05/2019	03/31/2020	12
AT	141421	Attenuator	Weinschel Associates	WA56-10	56100308	05/17/2019	05/31/2020	12
AT	141884	Spectrum Analyzer	AGILENT	E4448A	MY44020357	03/13/2019	03/31/2020	12
AT	141391	Microwave Cable	RS Pro	R-132G7210200CD	-	04/17/2019	04/30/2020	12

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

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

***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: CE: Conducted Emission test
 RE: Radiated Emission test
 AT: Antenna Terminal Conducted test**