



RADIO TEST REPORT

Test Report No. : 12219846H-B

Applicant : Sony Interactive Entertainment Inc.
Type of Equipment : Wireless communication module
Model No. : J20H096
FCC ID : AK8M18DFT1
Test regulation : **FCC Part 15 Subpart C: 2018**
For Permissive Change
***WLAN, Bluetooth Low Energy parts**
(Maximum Peak Output Power and Radiated Spurious Emission tests only)

Test Result : **Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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.

Date of test: January 23 to March 28, 2018

Representative test engineer:

T. Shimada
Takumi Shimada

Engineer

Consumer Technology Division

Approved by:

Takayuki S.
Takayuki Shimada

Leader

Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://japan.ul.com/resources/emc_accredited/

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

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

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12219846H-B

[illegible]

CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	7
SECTION 4: Operation of E.U.T. during testing.....	10
SECTION 5: Radiated Spurious Emission	12
SECTION 6: Antenna Terminal Conducted Tests.....	14
APPENDIX 1: Test data	15
Maximum Peak Output Power	15
Radiated Spurious Emission	20
APPENDIX 2: Test instruments	40
APPENDIX 3: Photographs of test setup	41
Radiated Spurious Emission	41
Worst Case Position	42
Test Configuration and peripherals.....	45

SECTION 1: Customer information

Company Name	Sony Interactive Entertainment Inc.
Brand Name	SONY
Address	1-7-1 Konan, Minato-ku, Tokyo, 108-0075 Japan
Telephone Number	+81-50-3807-5639
Facsimile Number	+81-50-3807-9594
Contact Person	Kiyoto Sasaki

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

2.1 Identification of E.U.T.

Type of Equipment	Wireless communication module
Model No	J20H096
Serial No	Refer to Clause 4.2
Country of Manufacture	China/Japan
Receipt Date of Sample	January 20, 2018
Condition of EUT	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	No modification by the test lab.

2.2 Product Description

J20H096 is the Wireless communication module.

Product Specification

Clock frequency in the system (radio part)	26 MHz
Operating Temperature	-10 deg. C - +85 deg. C
Power Supply	DC 3.3 V, DC 1.8 V
Size	20 x 18 x 3.0 mm, 55pin LGA

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

Radio Specification

WLAN (IEEE802.11b/g/n-20)

Equipment Type	Transceiver
Frequency of Operation	2412 MHz - 2462 MHz
Type of Modulation	DSSS, OFDM
Bandwidth & Channel spacing	Less than 20 MHz & 5 MHz
Method of frequency generation	Synthesizer
Antenna Type	PIFA (Antenna port WA for 2.4GHz / Antenna port WB)
Antenna Gain: G _{ANT}	5.6 dBi (Antenna port WA for 2.4GHz / Antenna port WB)
Directional Gain *1)	8.61 dBi

WLAN (IEEE802.11a/11n-20/11ac-20/11n-40/11ac-40/11ac-80)

Equipment Type	Transceiver
Frequency of Operation	U-NII-1: 5180 MHz - 5240 MHz U-NII-2A: 5260 MHz - 5320 MHz U-NII-2C: 5500 MHz - 5700 MHz U-NII-3: 5745 MHz - 5825 MHz
Type of Modulation	OFDM
Bandwidth & Channel spacing	Less than 20 MHz / 40 MHz / 80 MHz & 20 MHz / 40 MHz / 80 MHz
Method of frequency generation	Synthesizer
Antenna Type	PIFA (Antenna port WA for 5GHz / Antenna port WC for 5GHz)
Antenna Gain: G _{ANT}	5.0 dBi (Antenna port WA for 5 GHz), 5.6 dBi (Antenna port WC for 5 GHz)
Directional Gain *1)	8.32 dBi

Bluetooth (BDR/EDR)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz - 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Bandwidth & Channel spacing	79 MHz & 1 MHz
Method of frequency generation	Synthesizer
Antenna Type	PIFA (Antenna port WC for 2.4 GHz)
Antenna Gain	7.0 dBi (Antenna port WC for 2.4 GHz)

Bluetooth (Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz - 2480 MHz
Type of Modulation	GFSK
Bandwidth & Channel spacing	1 MHz & 2 MHz
Method of frequency generation	Synthesizer
Antenna Type	PIFA (Antenna port WC for 2.4 GHz)
Antenna Gain	7.0 dBi (Antenna port WC for 2.4 GHz)

*1) Directional antenna gain = $10 \log \left(\frac{G_{ANT1}}{10^{20}} + \frac{G_{ANT2}}{10^{20}} \right)^2 / 2$

*This test report applies to WLAN (2.4 GHz band) and Bluetooth Low Energy.

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

<Contents of the change from original model>

Test Report Number of original model is 12079942H-B-R1 (issued by UL Japan, Inc.)

Antenna was only changed from the original model, and other radio specification is identical to it.

In this report, Radiated Spurious Emission test was performed.

For Maximum Peak Output Power test, test result from the original report and new antenna gain were used in the test data.

Information of antenna was updated in Section 2.2.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

* The revision on March 12, 2018, does not affect the test specification applied to the EUT.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(d)	See data.	Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	6.1 dB 2483.500 MHz, Horizontal, AV	Complied	Radiated (above 30 MHz) *1)

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 DTS Meas Guidance v04 12.2.7.

Symbols:

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

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

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

FCC Part 15.31 (e)

The EUT has the power supply regulator. However one of the input voltages to RF part doesn't go through the regulator. The stable voltage will be supplied by the end product, which will be required to have a power supply regulator. Therefore, the EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The EUT has a unique coupling/antenna connector (U.FL). Therefore the equipment complies with the requirement of 15.203/212.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

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

3.4 Uncertainty

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

Antenna Terminal test

Test Item	Uncertainty (+/-)
RF output power	1.3 dB
Antenna terminal conducted emission / Power density /	2.7 dB
Adjacent channel power / Channel power	
Below 3GHz	1.9 dB
3 GHz ot 6 GHz	2.1 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)	4.8 dB
	(Vertical)	5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
	(Vertical)	6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	4.9 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
	(Vertical)	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

3.5 Test Location

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
 NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	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	2973C-1	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	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	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	2973C-4	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.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	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

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)	54 Mbps, PN9
IEEE 802.11n MIMO 20 MHz BW (11n-20)	MCS 4, PN9
Bluetooth Low Energy(BT LE)	Maximum Packet Size, PRBS9
*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: WLAN value = 16 Bluetooth (LE) Same as production model Software: MT_TEST_Tool_Ver6.3 *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.	

*Details of Operating mode for WLAN

Test Item	Operating Mode	Used Antenna port	Tested frequency
Maximum Peak Output Power	11b Tx 11g Tx 11n-20 Tx	WA + WB, WA, WB	2412 MHz 2437 MHz 2462 MHz
Radiated Spurious Emission (Below 1 GHz)	11n-20 Tx *1)	WA + WB	2437 MHz
Radiated Spurious Emission (Above 1 GHz)	11b Tx 11n-20 Tx *2)	WA + WB	2412 MHz 2437 MHz 2462 MHz
*1) The test was performed on the mode as a representative, because it had the highest power at antenna terminal test. *2) The test was performed on 11n-20 Tx mode according to “Section 1 of 6 802.11 a/b/g/n testing- Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009, as the 11n-20 Tx mode had higher power than 11g mode at antenna terminal test.			

*Details of Operating mode for BT LE

Test Item	Operating Mode	Tested frequency
Maximum Peak Output Power Radiated Spurious Emission	BT LE	2402 MHz 2440 MHz 2480 MHz

*Simultaneously transmission

Test Item	Mode *1)
Radiated Spurious Emission	Tx BT LE 2402 MHz + 11ac-40 5550 MHz Tx BT LE 2440 MHz + 11ac-40 5550 MHz Tx BT LE 2480 MHz + 11ac-40 5550 MHz
*1) The test was performed on the mode as a representative, because it had the highest power of 5 GHz band at antenna terminal test.	

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

4.2 Configuration and peripherals

This page has been submitted for a separate exhibit.

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

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

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	4.3 m / 4.5 m *2) (1 GHz - 10 GHz), 1 m *3) (10 GHz - 26.5 GHz)		4.3 m / 4.5 m *2) (1 GHz - 10 GHz), 1 m *3) (10 GHz - 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

*2) Distance Factor: $20 \times \log(4.4 \text{ m} / 3.0 \text{ m}) = 3.33 \text{ dB}$ (for WLAN),
 $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.53 \text{ dB}$ (for BT LE)

*3) Distance Factor: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

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

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

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

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

SECTION 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
Maximum Peak Output Power	-	-	-	Auto	Peak	-	Power Meter (Sensor: 50 MHz BW)

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

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Maximum Peak Output Power

Report No. 12219846H
Test place Ise EMC Lab. No.11 Measurement Room
Date January 23, 2018 January 25, 2018
Temperature / Humidity 23 deg. C / 34 % RH 23 deg. C / 20 % RH
Engineer Takumi Shimada Takumi Shimada
Mode Tx 11b

Antenna port WA + WB

Freq. [MHz]	Antenna port WA Result [mW]	Antenna port WB Result [mW]	Result		Limit		Margin [dB]
			[dBm]	[mW]	[dBm]	[mW]	
2412	10.62	8.39	12.79	19.01	27.39	548.28	14.60
2437	10.91	9.98	13.20	20.89	27.39	548.28	14.19
2462	11.02	9.77	13.18	20.79	27.39	548.28	14.21

Sample Calculation:

Result = Antenna port WA + WB

*This Limit was reduced by the amount in dB (2.61 dB)

that the directional gain of the antenna/antenna array exceeding 6 dBi.

Antenna port WA

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	0.02	0.50	9.74	10.26	10.62
2437	0.14	0.50	9.74	10.38	10.91
2462	0.18	0.50	9.74	10.42	11.02

Antenna port WB

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	-0.97	0.50	9.71	9.24	8.39
2437	-0.22	0.50	9.71	9.99	9.98
2462	-0.31	0.50	9.71	9.90	9.77

Sample Calculation:

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

2437MHz

Rate [Mbps]	Antenna port WA Reading Peak		Antenna port WB Reading Peak		Total Reading Power		Remark [dB]
	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
1	0.14	1.03	-0.22	0.95	2.97	1.98	*
2	0.12	1.03	-0.29	0.94	2.93	1.96	
5.5	0.11	1.03	-0.35	0.92	2.90	1.95	
11	0.10	1.02	-0.30	0.93	2.91	1.96	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12219846H
Test place Ise EMC Lab. No.11 Measurement Room
Date January 23, 2018 January 25, 2018
Temperature / Humidity 23 deg. C / 34 % RH 23 deg. C / 20 % RH
Engineer Takumi Shimada Takumi Shimada
Mode Tx 11g

Antenna port WA + WB

Freq. [MHz]	Antenna port WA Result [mW]	Antenna port WB Result [mW]	Result		Limit		Margin [dB]
			[dBm]	[mW]	[dBm]	[mW]	
2412	76.56	66.07	21.54	142.63	27.39	548.28	5.85
2437	76.03	71.78	21.70	147.81	27.39	548.28	5.69
2462	79.98	67.76	21.70	147.75	27.39	548.28	5.69

Sample Calculation:

Result = Antenna port WA + WB

*This Limit was reduced by the amount in dB (2.61 dB)

that the directional gain of the antenna/antenna array exceeding 6 dBi.

Antenna port WA

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	8.60	0.50	9.74	18.84	76.56
2437	8.57	0.50	9.74	18.81	76.03
2462	8.79	0.50	9.74	19.03	79.98

Antenna port WB

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	7.99	0.50	9.71	18.20	66.07
2437	8.35	0.50	9.71	18.56	71.78
2462	8.10	0.50	9.71	18.31	67.76

Sample Calculation:

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

2437MHz

Rate [Mbps]	Antenna port WA Reading Peak		Antenna port WB Reading Peak		Total Reading Power		Remark [dB]
	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
6	8.32	6.79	7.77	5.98	11.06	12.78	
9	8.57	7.19	7.74	5.94	11.19	13.14	
12	7.95	6.24	7.49	5.61	10.74	11.85	
18	8.06	6.40	7.59	5.74	10.84	12.14	
24	8.31	6.78	7.66	5.83	11.01	12.61	
36	8.51	7.10	8.30	6.76	11.42	13.86	
48	8.53	7.13	8.32	6.79	11.44	13.92	
54	8.57	7.19	8.35	6.84	11.47	14.03	*

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12219846H
Test place Ise EMC Lab. No.11 Measurement Room
Date January 25, 2018
Temperature / Humidity 23 deg. C / 20 % RH
Engineer Takumi Shimada
Mode Tx 11n-20

Antenna port WA + WB

Freq. [MHz]	Antenna port WA Result [mW]	Antenna port WB Result [mW]	Result		Limit		Margin [dB]
			[dBm]	[mW]	[dBm]	[mW]	
2412	83.56	68.39	21.82	151.95	27.39	548.28	5.57
2437	82.60	76.21	22.01	158.81	27.39	548.28	5.38
2462	78.89	66.99	21.64	145.87	27.39	548.28	5.75

Sample Calculation:

Result = Antenna port WA + WB

*This Limit was reduced by the amount in dB (2.61 dB)

that the directional gain of the antenna/antenna array exceeding 6 dBi.

Antenna port WA

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	8.98	0.50	9.74	19.22	83.56
2437	8.93	0.50	9.74	19.17	82.60
2462	8.73	0.50	9.74	18.97	78.89

Antenna port WB

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
				[dBm]	[mW]
2412	8.14	0.50	9.71	18.35	68.39
2437	8.61	0.50	9.71	18.82	76.21
2462	8.05	0.50	9.71	18.26	66.99

Sample Calculation:

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

2437MHz

MCS Number	Antenna port WA Reading Peak		Antenna port WB Reading Peak		Total Reading Power		Remark [dB]
	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
0	8.77	7.53	8.24	6.67	11.52	14.20	
1	8.42	6.95	7.90	6.17	11.18	13.12	
2	8.43	6.97	7.95	6.24	11.21	13.20	
3	8.48	7.05	7.96	6.25	11.24	13.30	
4	8.93	7.82	8.61	7.26	11.78	15.08	*
5	8.90	7.76	8.53	7.13	11.73	14.89	
6	8.93	7.82	8.56	7.18	11.76	14.99	
7	8.91	7.78	8.38	6.89	11.66	14.67	
8	8.80	7.59	8.12	6.49	11.48	14.07	
9	8.43	6.97	7.91	6.18	11.19	13.15	
10	8.37	6.87	7.67	5.85	11.04	12.72	
11	8.22	6.64	7.75	5.96	11.00	12.59	
12	8.64	7.31	8.33	6.81	11.50	14.12	
13	8.63	7.29	8.44	6.98	11.55	14.28	
14	8.48	7.05	8.33	6.81	11.42	13.85	
15	8.72	7.45	8.23	6.65	11.49	14.10	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12219846H
Test place Ise EMC Lab. No.11 Measurement Room
Date January 24, 2018
Temperature / Humidity 23 deg. C / 20 % RH
Engineer Takafumi Noguchi
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-7.38	0.50	9.71	2.83	1.92	29.00	794.33	26.17
2440	-7.83	0.50	9.71	2.38	1.73	29.00	794.33	26.62
2480	-7.66	0.50	9.71	2.55	1.80	29.00	794.33	26.45

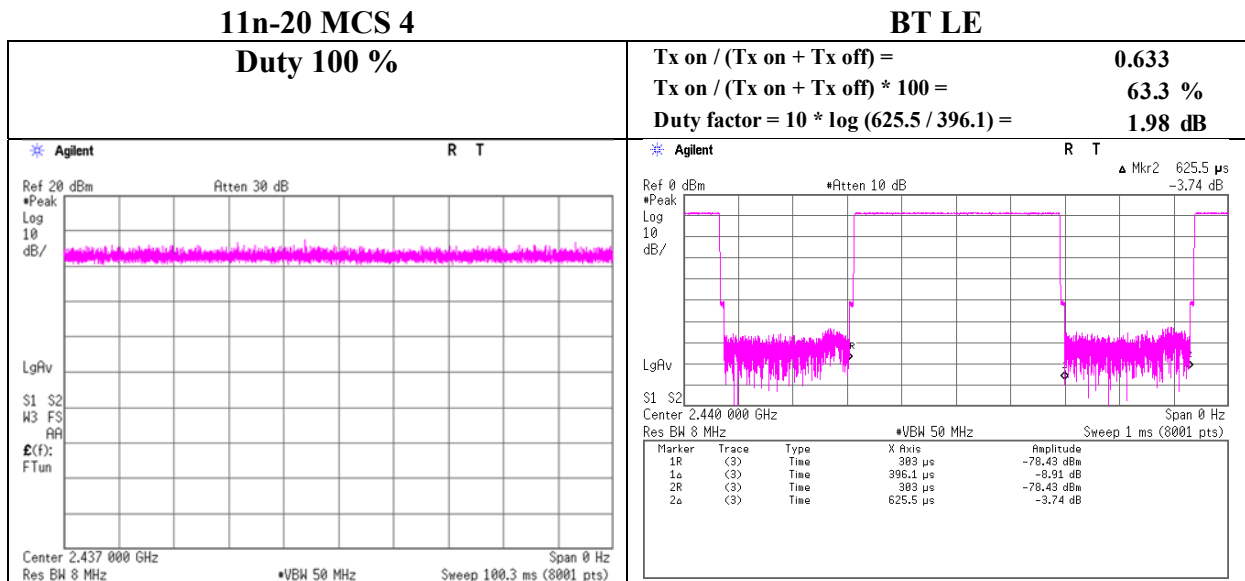
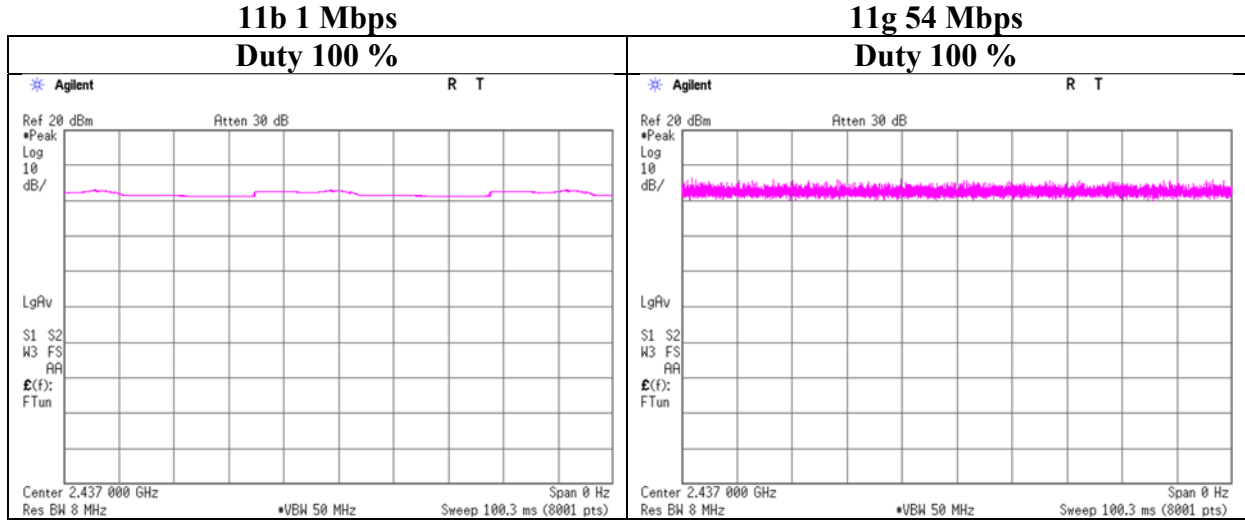
Sample Calculation:

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

*This Limit was reduced by the amount in dB (1.0 dB) that the directional gain of the antenna exceeding 6 dBi.

Burst rate confirmation

Report No.	12219846H
Test place	Ise EMC Lab. No.11 Measurement Room
Date	January 24, 2018 January 26, 2018
Temperature / Humidity	23 deg. C / 20 % RH 23 deg. C / 30 % RH
Engineer	Takafumi Noguchi Takumi Shimada
Mode	Tx



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

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.	12219846H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018
Temperature / Humidity	22 deg. C / 42 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH
Engineer	Takumi Shimada (1 GHz - 10 GHz)	Takumi Shimada (10 GHz - 18 GHz)	Takafumi Noguchi (18 GHz - 26.5 GHz)
Mode	Tx 11b 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	43.1	27.7	6.5	32.7	-	44.6	73.9	29.3	
Hori	2396.975	PK	50.1	27.7	6.6	32.7	-	51.7	73.9	22.2	
Hori	4824.000	PK	40.7	31.7	8.8	31.8	-	49.4	73.9	24.5	
Hori	7236.000	PK	40.8	36.1	10.2	32.6	-	54.5	73.9	19.4	Floor noise
Hori	9648.000	PK	41.0	38.6	10.7	33.3	-	57.0	73.9	16.9	Floor noise
Hori	2390.000	AV	32.6	27.7	6.5	32.7	-	34.1	53.9	19.8	
Hori	4824.000	AV	30.6	31.7	8.8	31.8	-	39.3	53.9	14.6	
Hori	7236.000	AV	30.2	36.1	10.2	32.6	-	43.9	53.9	10.0	Floor noise
Hori	9648.000	AV	31.1	38.6	10.7	33.3	-	47.1	53.9	6.8	Floor noise
Vert	2390.000	PK	43.7	27.7	6.5	32.7	-	45.2	73.9	28.7	
Vert	2396.992	PK	50.3	27.7	6.6	32.7	-	51.9	73.9	22.0	
Vert	4824.000	PK	42.3	31.7	8.8	31.8	-	51.0	73.9	22.9	
Vert	7236.000	PK	40.6	36.1	10.2	32.6	-	54.3	73.9	19.6	Floor noise
Vert	9648.000	PK	40.7	38.6	10.7	33.3	-	56.7	73.9	17.2	Floor noise
Vert	2390.000	AV	35.0	27.7	6.5	32.7	-	36.5	53.9	17.4	
Vert	4824.000	AV	34.0	31.7	8.8	31.8	-	42.7	53.9	11.2	
Vert	7236.000	AV	30.1	36.1	10.2	32.6	-	43.8	53.9	10.1	Floor noise
Vert	9648.000	AV	31.0	38.6	10.7	33.3	-	47.0	53.9	6.9	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 20log (4.4 m / 3.0 m) = 3.33 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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	96.2	27.7	6.6	32.7	97.8	-	-	Carrier
Hori	2400.000	PK	40.1	27.7	6.6	32.7	41.7	77.8	36.1	
Vert	2412.000	PK	97.0	27.7	6.6	32.7	98.6	-	-	Carrier
Vert	2400.000	PK	40.8	27.7	6.6	32.7	42.4	78.6	36.2	

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

UL Japan, Inc.

Ise EMC Lab.

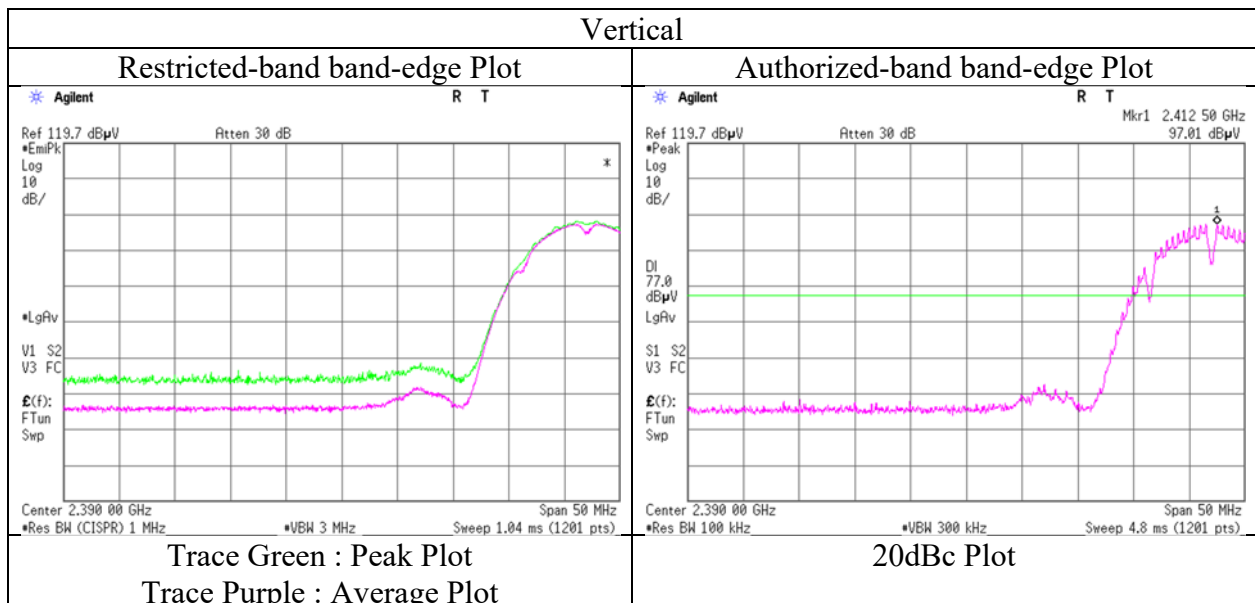
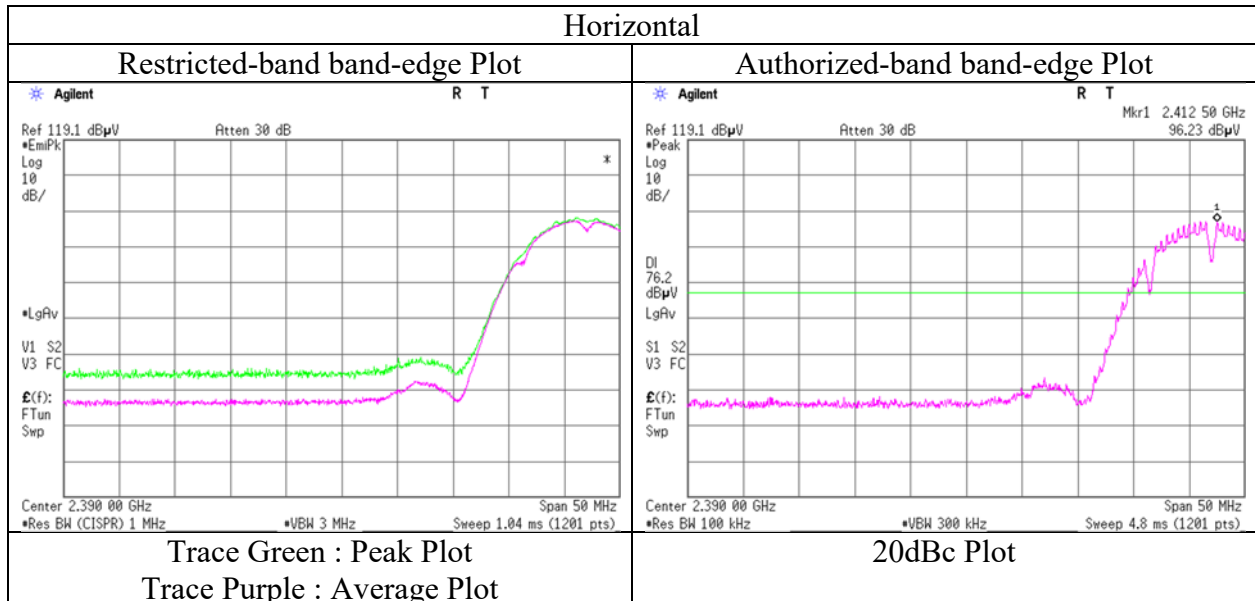
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12219846H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 19, 2018
Temperature / Humidity	22 deg. C / 42 % RH
Engineer	Takumi Shimada
	(1 GHz - 10 GHz)
Mode	Tx 11b 2412 MHz



* 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.	12219846H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018
Temperature / Humidity	22 deg. C / 42 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH
Engineer	Takumi Shimada (1 GHz - 10 GHz)	Takumi Shimada (10 GHz - 18 GHz)	Takafumi Noguchi (18 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	42.7	31.9	8.8	31.7	-	51.7	73.9	22.2	
Hori	7311.000	PK	41.7	36.2	10.2	32.7	-	55.4	73.9	18.5	Floor noise
Hori	9748.000	PK	40.9	38.7	10.8	33.4	-	57.0	73.9	16.9	Floor noise
Hori	4874.000	AV	36.0	31.9	8.8	31.7	-	45.0	53.9	8.9	
Hori	7311.000	AV	32.5	36.2	10.2	32.7	-	46.2	53.9	7.7	Floor noise
Hori	9748.000	AV	31.6	38.7	10.8	33.4	-	47.7	53.9	6.2	Floor noise
Vert	4874.000	PK	42.6	31.9	8.8	31.7	-	51.6	73.9	22.3	
Vert	7311.000	PK	41.6	36.2	10.2	32.7	-	55.3	73.9	18.6	Floor noise
Vert	9748.000	PK	40.7	38.7	10.8	33.4	-	56.8	73.9	17.1	Floor noise
Vert	4874.000	AV	35.9	31.9	8.8	31.7	-	44.9	53.9	9.0	
Vert	7311.000	AV	32.3	36.2	10.2	32.7	-	46.0	53.9	7.9	Floor noise
Vert	9748.000	AV	31.7	38.7	10.8	33.4	-	47.8	53.9	6.1	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 $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.33\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No.	12219846H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018
Temperature / Humidity	22 deg. C / 42 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH
Engineer	Takumi Shimada (1 GHz - 10 GHz)	Takumi Shimada (10 GHz - 18 GHz)	Takafumi Noguchi (18 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	44.5	27.8	6.6	32.7	-	46.2	73.9	27.7	
Hori	4924.000	PK	43.1	32.0	8.9	31.7	-	52.3	73.9	21.6	
Hori	7386.000	PK	41.8	36.3	10.2	32.7	-	55.6	73.9	18.3	Floor noise
Hori	9848.000	PK	41.5	38.8	10.8	33.4	-	57.7	73.9	16.2	Floor noise
Hori	2483.500	AV	34.4	27.8	6.6	32.7	-	36.1	53.9	17.8	
Hori	4924.000	AV	36.7	32.0	8.9	31.7	-	45.9	53.9	8.0	
Hori	7386.000	AV	31.2	36.3	10.2	32.7	-	45.0	53.9	8.9	Floor noise
Hori	9848.000	AV	31.1	38.8	10.8	33.4	-	47.3	53.9	6.6	Floor noise
Vert	2483.500	PK	43.2	27.8	6.6	32.7	-	44.9	73.9	29.0	
Vert	4924.000	PK	42.8	32.0	8.9	31.7	-	52.0	73.9	21.9	
Vert	7236.000	PK	41.7	36.1	10.2	32.6	-	55.4	73.9	18.5	Floor noise
Vert	9848.000	PK	41.7	38.8	10.8	33.4	-	57.9	73.9	16.0	Floor noise
Vert	2483.500	AV	35.3	27.8	6.6	32.7	-	37.0	53.9	16.9	
Vert	4924.000	AV	35.0	32.0	8.9	31.7	-	44.2	53.9	9.7	
Vert	7236.000	AV	31.5	36.1	10.2	32.6	-	45.2	53.9	8.7	Floor noise
Vert	9848.000	AV	31.3	38.8	10.8	33.4	-	47.5	53.9	6.4	Floor noise

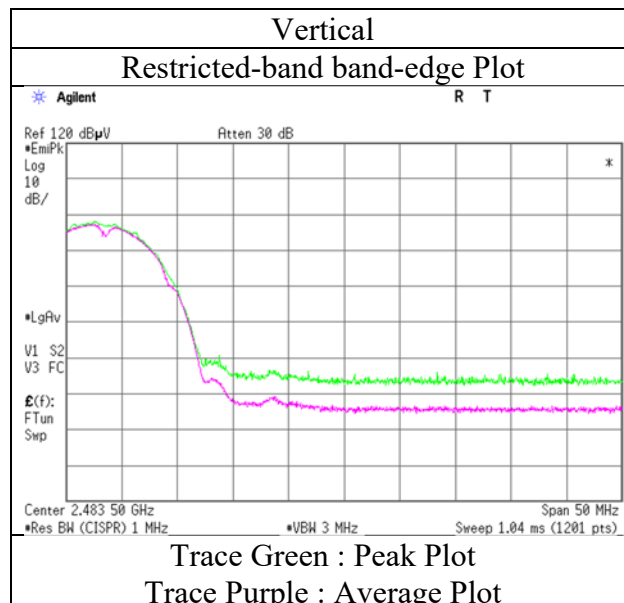
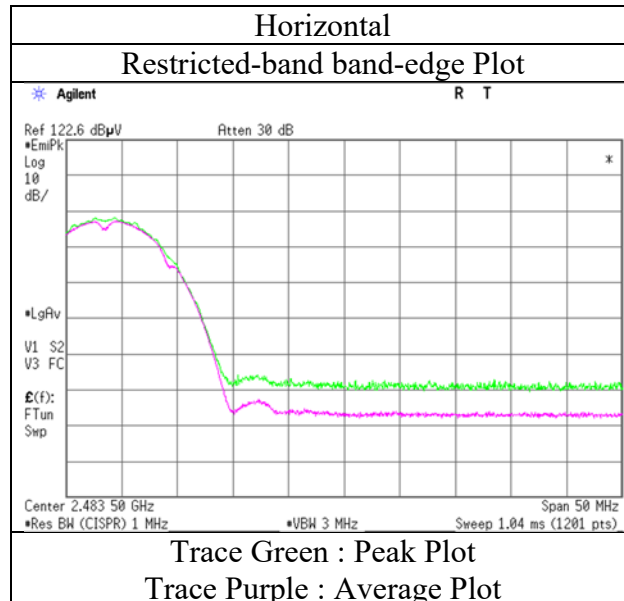
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.33\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12219846H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 19, 2018
Temperature / Humidity	22 deg. C / 42 % RH
Engineer	Takumi Shimada
	(1 GHz - 10 GHz)
Mode	Tx 11b 2462 MHz



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

Radiated Spurious Emission

Report No.	12219846H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018
Temperature / Humidity	22 deg. C / 42 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH
Engineer	Takumi Shimada (1 GHz - 10 GHz)	Takumi Shimada (10 GHz - 18 GHz)	Takafumi Noguchi (18 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	51.4	27.7	6.5	32.7	-	52.9	73.9	21.0	
Hori	4824.000	PK	40.9	31.7	8.8	31.8	-	49.6	73.9	24.3	Floor noise
Hori	7236.000	PK	40.7	36.1	10.2	32.6	-	54.4	73.9	19.5	Floor noise
Hori	9648.000	PK	41.1	38.6	10.7	33.3	-	57.1	73.9	16.8	Floor noise
Hori	2390.000	AV	40.4	27.7	6.5	32.7	-	41.9	53.9	12.0	
Hori	4824.000	AV	30.6	31.7	8.8	31.8	-	39.3	53.9	14.6	Floor noise
Hori	7236.000	AV	30.3	36.1	10.2	32.6	-	44.0	53.9	9.9	Floor noise
Hori	9648.000	AV	31.3	38.6	10.7	33.3	-	47.3	53.9	6.6	Floor noise
Vert	2390.000	PK	48.3	27.7	6.5	32.7	-	49.8	73.9	24.1	
Vert	4824.000	PK	41.0	31.7	8.8	31.8	-	49.7	73.9	24.2	Floor noise
Vert	7236.000	PK	40.6	36.1	10.2	32.6	-	54.3	73.9	19.6	Floor noise
Vert	9648.000	PK	40.8	38.6	10.7	33.3	-	56.8	73.9	17.1	Floor noise
Vert	2390.000	AV	39.8	27.7	6.5	32.7	-	41.3	53.9	12.6	
Vert	4824.000	AV	30.7	31.7	8.8	31.8	-	39.4	53.9	14.5	Floor noise
Vert	7236.000	AV	30.2	36.1	10.2	32.6	-	43.9	53.9	10.0	Floor noise
Vert	9648.000	AV	31.1	38.6	10.7	33.3	-	47.1	53.9	6.8	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 $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.33\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

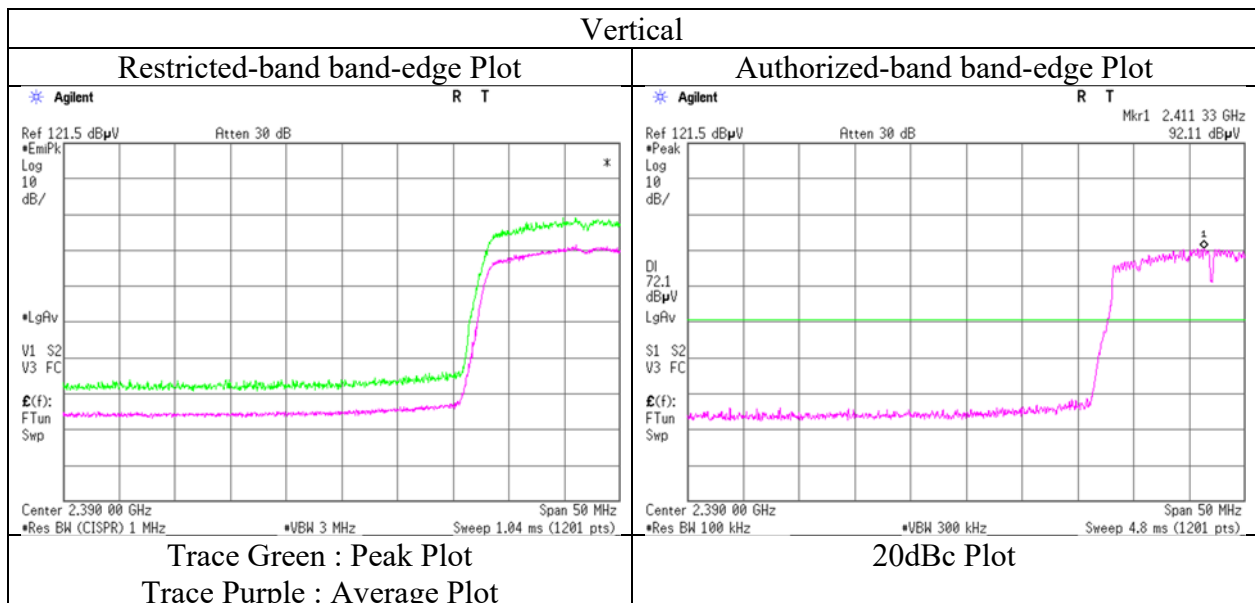
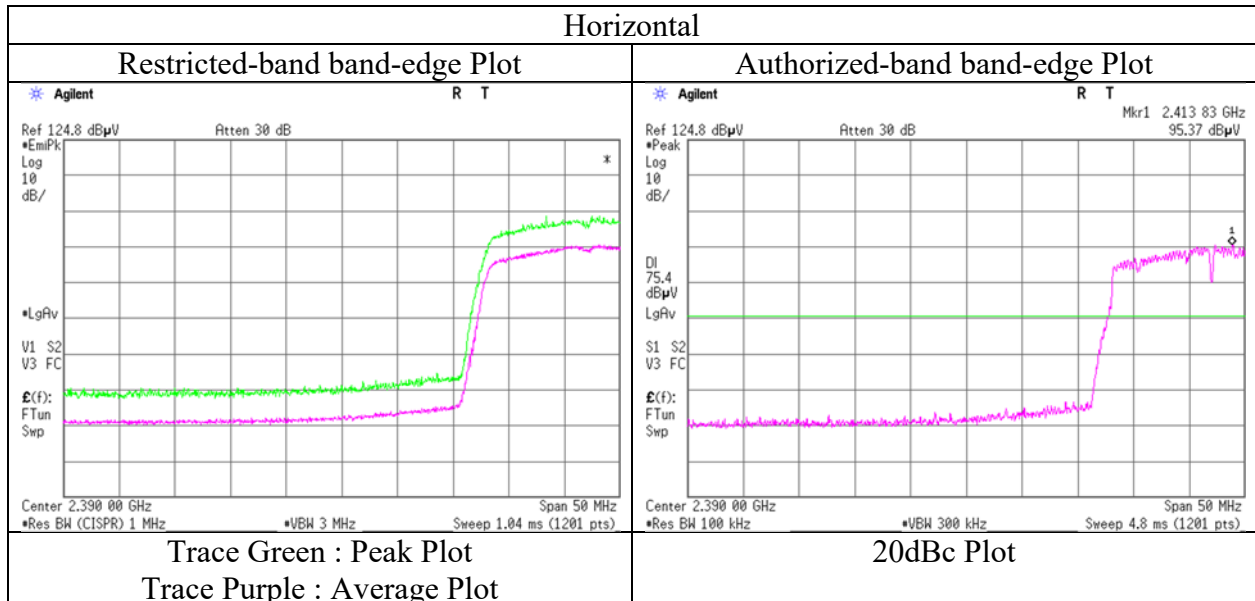
20dBc Data Sheet

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	95.4	27.7	6.6	32.7	97.0	-	-	Carrier
Hori	2400.000	PK	47.8	27.7	6.6	32.7	49.4	77.0	27.6	
Vert	2412.000	PK	92.1	27.7	6.6	32.7	93.7	-	-	Carrier
Vert	2400.000	PK	46.6	27.7	6.6	32.7	48.2	73.7	25.5	

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.	12219846H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 19, 2018
Temperature / Humidity	22 deg. C / 42 % RH
Engineer	Takumi Shimada
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 2412 MHz



* 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.	12219846H			
Test place	Ise EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018	March 28, 2018
Temperature / Humidity	22 deg. C / 42 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH	18 deg. C / 42 % RH
Engineer	Takumi Shimada	Takumi Shimada	Takafumi Noguchi	Takafumi Noguchi
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)	(Below 1 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	50.145	QP	23.9	10.6	7.5	32.2	-	9.8	40.0	30.2	
Hori	107.713	QP	38.9	11.1	8.3	32.2	-	26.1	43.5	17.4	
Hori	128.143	QP	34.2	13.4	8.5	32.2	-	23.9	43.5	19.6	
Hori	193.144	QP	35.5	16.4	9.1	32.1	-	28.9	43.5	14.6	
Hori	247.000	QP	37.2	11.5	9.6	32.0	-	26.3	46.0	19.7	
Hori	271.142	QP	42.5	12.3	9.8	32.0	-	32.6	46.0	13.4	
Hori	4874.000	PK	41.2	31.9	8.8	31.7	-	50.2	73.9	23.7	Floor noise
Hori	7311.000	PK	41.5	36.2	10.2	32.7	-	55.2	73.9	18.7	Floor noise
Hori	9748.000	PK	41.0	38.7	10.8	33.4	-	57.1	73.9	16.8	Floor noise
Hori	4874.000	AV	32.8	31.9	8.8	31.7	-	41.8	53.9	12.1	Floor noise
Hori	7311.000	AV	32.4	36.2	10.2	32.7	-	46.1	53.9	7.8	Floor noise
Hori	9748.000	AV	31.6	38.7	10.8	33.4	-	47.7	53.9	6.2	Floor noise
Vert	50.145	QP	34.1	10.6	7.5	32.2	-	20.0	40.0	20.0	
Vert	107.713	QP	35.4	11.1	8.3	32.2	-	22.6	43.5	20.9	
Vert	128.143	QP	35.0	13.4	8.5	32.2	-	24.7	43.5	18.8	
Vert	193.144	QP	31.6	16.4	9.1	32.1	-	25.0	43.5	18.5	
Vert	247.000	QP	28.5	11.5	9.6	32.0	-	17.6	46.0	28.4	
Vert	271.142	QP	35.3	12.3	9.8	32.0	-	25.4	46.0	20.6	
Vert	4874.000	PK	41.3	31.9	8.8	31.7	-	50.3	73.9	23.6	Floor noise
Vert	7311.000	PK	41.7	36.2	10.2	32.7	-	55.4	73.9	18.5	Floor noise
Vert	9748.000	PK	40.8	38.7	10.8	33.4	-	56.9	73.9	17.0	Floor noise
Vert	4874.000	AV	32.9	31.9	8.8	31.7	-	41.9	53.9	12.0	Floor noise
Vert	7311.000	AV	32.4	36.2	10.2	32.7	-	46.1	53.9	7.8	Floor noise
Vert	9748.000	AV	31.6	38.7	10.8	33.4	-	47.7	53.9	6.2	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 $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.33\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No.	12219846H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018
Temperature / Humidity	22 deg. C / 42 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH
Engineer	Takumi Shimada (1 GHz - 10 GHz)	Takumi Shimada (10 GHz - 18 GHz)	Takafumi Noguchi (18 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	56.5	27.8	6.6	32.7	-	58.2	73.9	15.7	
Hori	4924.000	PK	41.1	32.0	8.9	31.7	-	50.3	73.9	23.6	Floor noise
Hori	7386.000	PK	41.6	36.3	10.2	32.7	-	55.4	73.9	18.5	Floor noise
Hori	9848.000	PK	41.5	38.8	10.8	33.4	-	57.7	73.9	16.2	Floor noise
Hori	2483.500	AV	42.9	27.8	6.6	32.7	-	44.6	53.9	9.3	
Hori	4924.000	AV	30.7	32.0	8.9	31.7	-	39.9	53.9	14.0	Floor noise
Hori	7386.000	AV	31.6	36.3	10.2	32.7	-	45.4	53.9	8.5	Floor noise
Hori	9848.000	AV	31.3	38.8	10.8	33.4	-	47.5	53.9	6.4	Floor noise
Vert	2483.500	PK	53.2	27.8	6.6	32.7	-	54.9	73.9	19.0	
Vert	4924.000	PK	41.3	32.0	8.9	31.7	-	50.5	73.9	23.4	Floor noise
Vert	7236.000	PK	41.5	36.1	10.2	32.6	-	55.2	73.9	18.7	Floor noise
Vert	9848.000	PK	41.7	38.8	10.8	33.4	-	57.9	73.9	16.0	Floor noise
Vert	2483.500	AV	43.3	27.8	6.6	32.7	-	45.0	53.9	8.9	
Vert	4924.000	AV	30.9	32.0	8.9	31.7	-	40.1	53.9	13.8	Floor noise
Vert	7236.000	AV	31.6	36.1	10.2	32.6	-	45.3	53.9	8.6	Floor noise
Vert	9848.000	AV	31.5	38.8	10.8	33.4	-	47.7	53.9	6.2	Floor noise

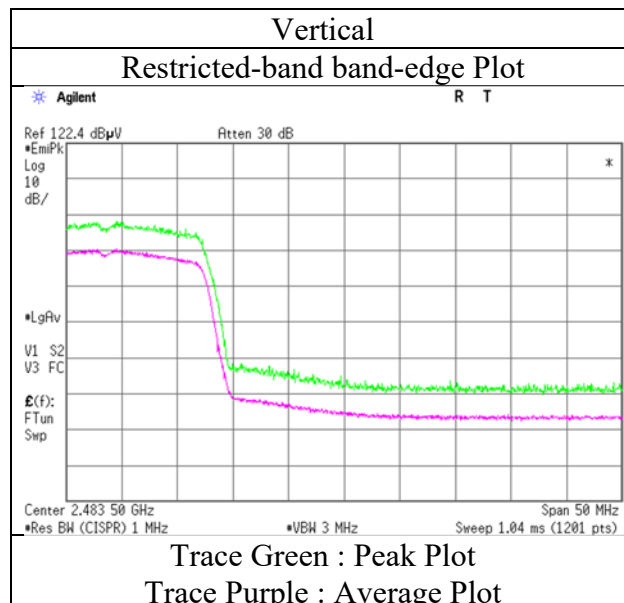
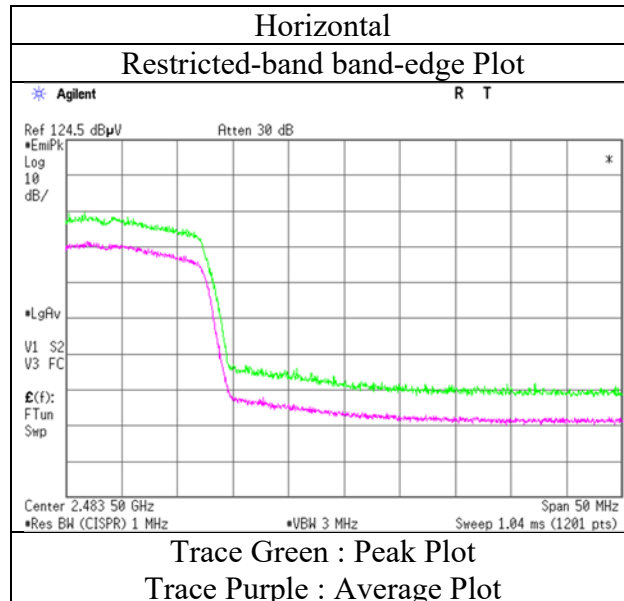
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (4.4 m / 3.0 m) = 3.33 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission (Reference Plot for band-edge)

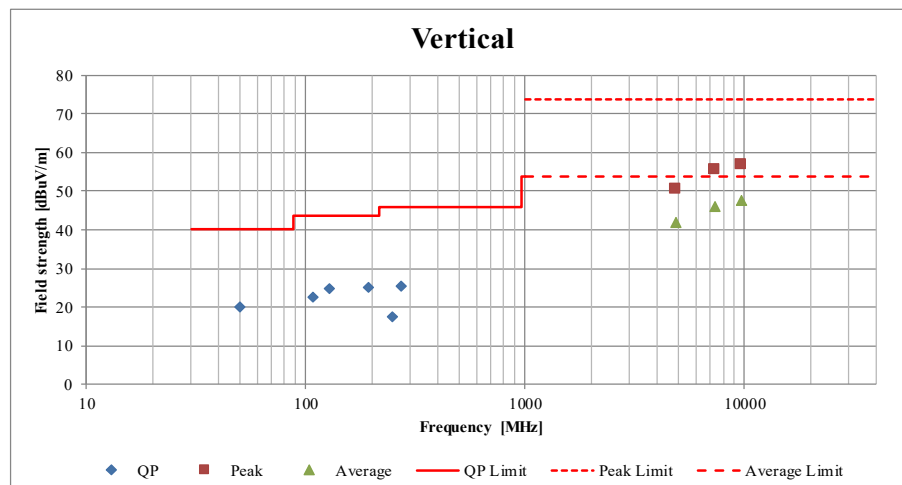
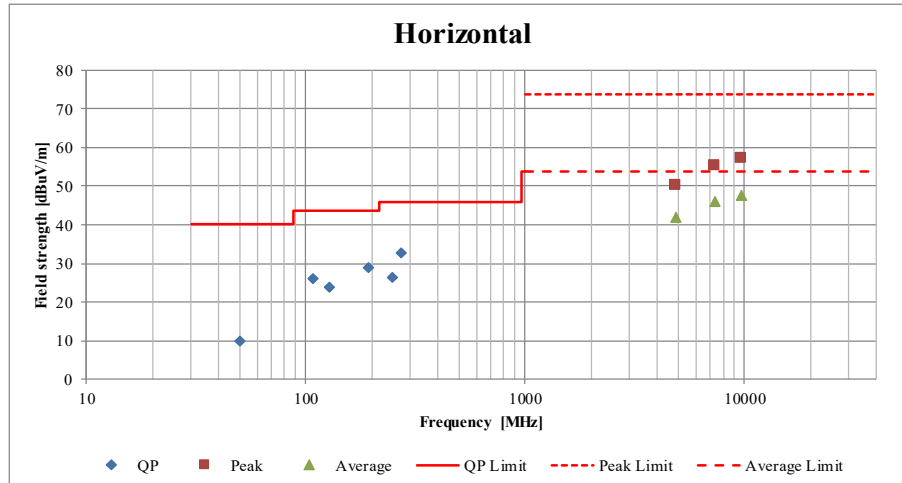
Report No.	12219846H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 19, 2018
Temperature / Humidity	22 deg. C / 42 % RH
Engineer	Takumi Shimada
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 2462 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12219846H	No.3	No.3	No.3
Test place	Ise EMC Lab.	March 22, 2018	March 25, 2018	March 28, 2018
Semi Anechoic Chamber	No.3	20 deg. C / 38 % RH	22 deg. C / 31 % RH	18 deg. C / 42 % RH
Date	March 19, 2018	Takumi Shimada	Takafumi Noguchi	Takafumi Noguchi
Temperature / Humidity	22 deg. C / 42 % RH	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Engineer	Takumi Shimada	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx 11n-20 2437 MHz			



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

Radiated Spurious Emission

Report No.	12219846H			
Test place	Ise EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018	March 28, 2018
Temperature / Humidity	20 deg. C / 41 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH	25 deg. C / 33 % RH
Engineer	Takafumi Noguchi	Takumi Shimada	Takafumi Noguchi	Masafumi Niwa
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2402 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	45.300	QP	22.2	12.2	7.4	32.2	-	9.6	40.0	30.4	
Hori	129.000	QP	23.8	13.5	8.5	32.2	-	13.6	43.5	29.9	
Hori	244.000	QP	21.6	11.5	9.6	32.0	-	10.7	46.0	35.3	
Hori	501.400	QP	21.2	17.5	11.3	32.0	-	18.0	46.0	28.0	
Hori	833.663	QP	21.0	21.1	13.2	31.3	-	24.0	46.0	22.0	
Hori	968.370	QP	20.3	22.2	13.8	30.6	-	25.7	53.9	28.2	
Hori	2390.000	PK	42.2	27.7	6.7	32.7	-	43.9	73.9	30.0	
Hori	3602.960	PK	44.4	29.5	9.0	32.2	-	50.7	73.9	23.2	
Hori	4804.000	PK	40.9	31.6	9.0	31.8	-	49.7	73.9	24.2	Floor noise
Hori	7206.000	PK	42.2	36.0	10.4	32.6	-	56.0	73.9	17.9	Floor noise
Hori	9608.000	PK	43.1	38.5	10.9	33.3	-	59.2	73.9	14.7	Floor noise
Hori	2390.000	AV	33.6	27.7	6.7	32.7	2.0	37.3	53.9	16.6	*1)
Hori	3602.960	AV	34.7	29.5	9.0	32.2	2.0	43.0	53.9	10.9	*2)
Hori	4804.000	AV	30.8	31.6	9.0	31.8	-	39.6	53.9	14.3	Floor noise
Hori	7206.000	AV	32.0	36.0	10.4	32.6	-	45.8	53.9	8.1	Floor noise
Hori	9608.000	AV	31.5	38.5	10.9	33.3	-	47.6	53.9	6.3	Floor noise
Vert	45.300	QP	22.3	12.2	7.4	32.2	-	9.7	40.0	30.3	
Vert	129.000	QP	23.0	13.5	8.5	32.2	-	12.8	43.5	30.7	
Vert	244.000	QP	21.5	11.5	9.6	32.0	-	10.6	46.0	35.4	
Vert	501.400	QP	21.2	17.5	11.3	32.0	-	18.0	46.0	28.0	
Vert	833.663	QP	21.1	21.1	13.2	31.3	-	24.1	46.0	21.9	
Vert	968.370	QP	20.4	22.2	13.8	30.6	-	25.8	53.9	28.1	
Vert	2390.000	PK	41.7	27.7	6.7	32.7	-	43.4	73.9	30.5	
Vert	3602.960	PK	43.8	29.5	9.0	32.2	-	50.1	73.9	23.8	
Vert	4804.000	PK	40.7	31.6	9.0	31.8	-	49.5	73.9	24.4	Floor noise
Vert	7206.000	PK	42.7	36.0	10.4	32.6	-	56.5	73.9	17.4	Floor noise
Vert	9608.000	PK	42.5	38.5	10.9	33.3	-	58.6	73.9	15.3	Floor noise
Vert	2390.000	AV	33.7	27.7	6.7	32.7	2.0	37.4	53.9	16.5	*1)
Vert	3602.960	AV	35.0	29.5	9.0	32.2	2.0	43.3	53.9	10.6	*2)
Vert	4804.000	AV	32.4	31.6	9.0	31.8	-	41.2	53.9	12.7	Floor noise
Vert	7206.000	AV	32.0	36.0	10.4	32.6	-	45.8	53.9	8.1	Floor noise
Vert	9608.000	AV	31.4	38.5	10.9	33.3	-	47.5	53.9	6.4	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 $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
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) Noise synchronized with duty of carrier frequency.

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	2402.000	PK	91.8	27.7	6.8	32.7	93.6	-	-	Carrier
Hori	2400.000	PK	34.6	27.7	6.8	32.7	36.4	73.6	37.2	
Vert	2402.000	PK	91.8	27.7	6.8	32.7	93.6	-	-	Carrier
Vert	2400.000	PK	35.5	27.7	6.8	32.7	37.3	73.6	36.3	

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

UL Japan, Inc.

Ise EMC Lab.

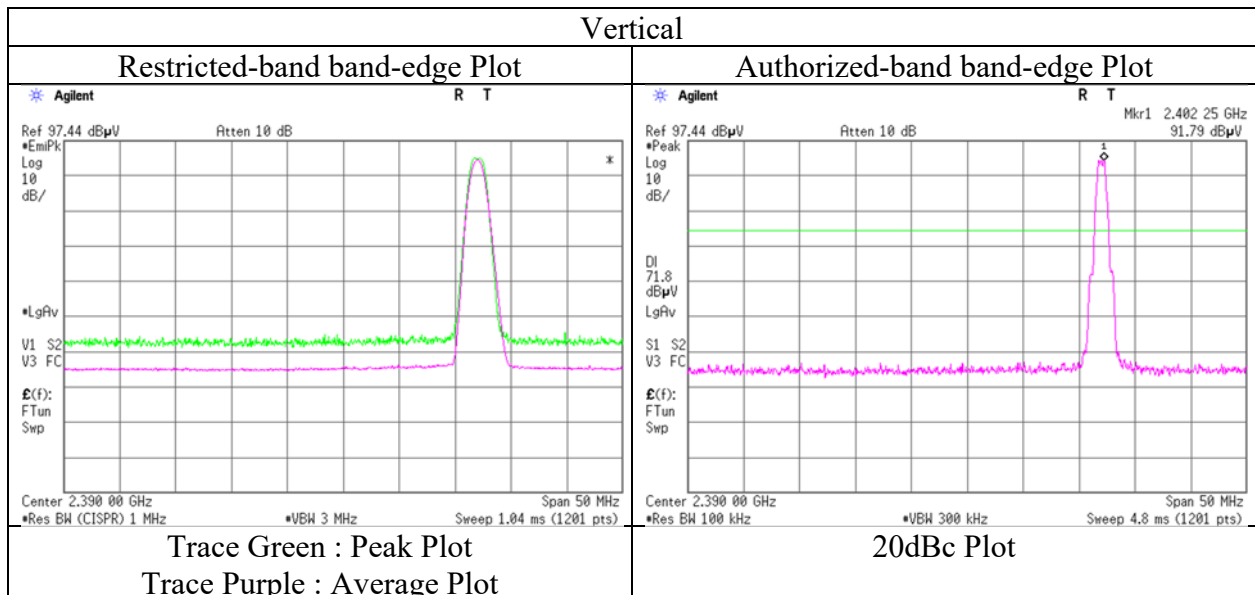
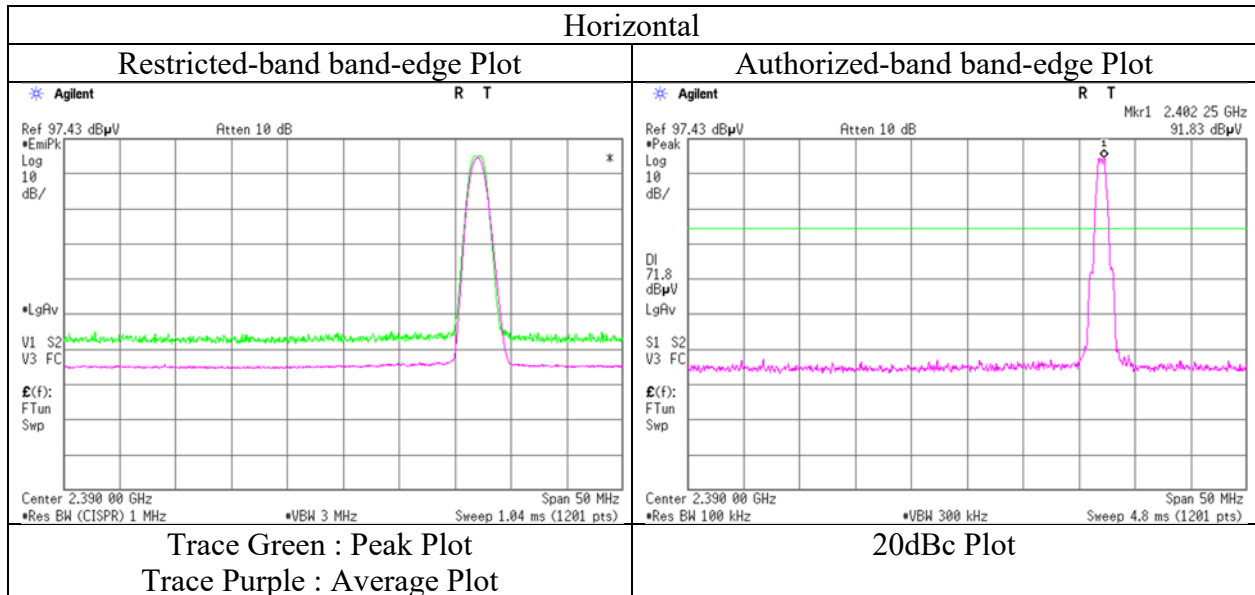
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12219846H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 19, 2018
Temperature / Humidity	20 deg. C / 41 % RH
Engineer	Takafumi Noguchi
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz



* 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.	12219846H			
Test place	Ise EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018	March 28, 2018
Temperature / Humidity	20 deg. C / 41 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH	25 deg. C / 33 % RH
Engineer	Takafumi Noguchi	Takumi Shimada	Takafumi Noguchi	Masafumi Niwa
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2440 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	45.300	QP	22.3	12.2	7.4	32.2	-	9.7	40.0	30.3	
Hori	129.000	QP	23.7	13.5	8.5	32.2	-	13.5	43.5	30.0	
Hori	244.000	QP	21.5	11.5	9.6	32.0	-	10.6	46.0	35.4	
Hori	501.400	QP	21.3	17.5	11.3	32.0	-	18.1	46.0	27.9	
Hori	833.663	QP	21.1	21.1	13.2	31.3	-	24.1	46.0	21.9	
Hori	968.370	QP	20.3	22.2	13.8	30.6	-	25.7	53.9	28.2	
Hori	3660.227	PK	43.0	29.6	8.9	32.2	-	49.3	73.9	24.6	
Hori	4880.000	PK	40.7	31.9	9.0	31.7	-	49.9	73.9	24.0	Floor noise
Hori	7320.000	PK	43.4	36.2	10.4	32.7	-	57.3	73.9	16.6	Floor noise
Hori	9760.000	PK	42.0	38.7	11.0	33.4	-	58.3	73.9	15.6	Floor noise
Hori	3660.227	AV	32.8	29.6	8.9	32.2	2.0	41.1	53.9	12.8	*1)
Hori	4880.000	AV	32.3	31.9	9.0	31.7	-	41.5	53.9	12.4	Floor noise
Hori	7320.000	AV	33.9	36.2	10.4	32.7	-	47.8	53.9	6.1	Floor noise
Hori	9760.000	AV	31.4	38.7	11.0	33.4	-	47.7	53.9	6.2	Floor noise
Vert	45.300	QP	22.3	12.2	7.4	32.2	-	9.7	40.0	30.3	
Vert	129.000	QP	22.9	13.5	8.5	32.2	-	12.7	43.5	30.8	
Vert	244.000	QP	21.4	11.5	9.6	32.0	-	10.5	46.0	35.5	
Vert	501.400	QP	21.2	17.5	11.3	32.0	-	18.0	46.0	28.0	
Vert	833.663	QP	21.1	21.1	13.2	31.3	-	24.1	46.0	21.9	
Vert	968.370	QP	20.2	22.2	13.8	30.6	-	25.6	53.9	28.3	
Vert	3660.227	PK	42.5	29.6	8.9	32.2	-	48.8	73.9	25.1	
Vert	4880.000	PK	40.1	31.9	9.0	31.7	-	49.3	73.9	24.6	Floor noise
Vert	7320.000	PK	42.6	36.2	10.4	32.7	-	56.5	73.9	17.4	Floor noise
Vert	9760.000	PK	42.1	38.7	11.0	33.4	-	58.4	73.9	15.5	Floor noise
Vert	3660.227	AV	33.0	29.6	8.9	32.2	2.0	41.3	53.9	12.6	*1)
Vert	4880.000	AV	32.3	31.9	9.0	31.7	-	41.5	53.9	12.4	Floor noise
Vert	7320.000	AV	33.8	36.2	10.4	32.7	-	47.7	53.9	6.2	Floor noise
Vert	9760.000	AV	31.5	38.7	11.0	33.4	-	47.8	53.9	6.1	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 $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Noise synchronized with duty of carrier frequency.

Radiated Spurious Emission

Report No.	12219846H			
Test place	Ise EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018	March 28, 2018
Temperature / Humidity	20 deg. C / 41 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH	25 deg. C / 33 % RH
Engineer	Takafumi Noguchi	Takumi Shimada	Takafumi Noguchi	Masafumi Niwa
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2480 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	45.300	QP	22.4	12.2	7.4	32.2	-	9.8	40.0	30.2	
Hori	129.000	QP	23.8	13.5	8.5	32.2	-	13.6	43.5	29.9	
Hori	244.000	QP	21.4	11.5	9.6	32.0	-	10.5	46.0	35.5	
Hori	501.400	QP	21.3	17.5	11.3	32.0	-	18.1	46.0	27.9	
Hori	833.663	QP	21.2	21.1	13.2	31.3	-	24.2	46.0	21.8	
Hori	968.370	QP	20.2	22.2	13.8	30.6	-	25.6	53.9	28.3	
Hori	2483.500	PK	34.2	27.8	6.8	32.7	-	36.1	73.9	37.8	
Hori	4960.000	PK	40.5	32.1	9.1	31.7	-	50.0	73.9	23.9	Floor noise
Hori	7440.000	PK	42.2	36.4	10.3	32.7	-	56.2	73.9	17.7	Floor noise
Hori	9920.000	PK	41.8	38.9	11.0	33.4	-	58.3	73.9	15.6	Floor noise
Hori	2483.500	AV	43.9	27.8	6.8	32.7	2.0	47.8	53.9	6.1	*1)
Hori	4960.000	AV	30.3	32.1	9.1	31.7	-	39.8	53.9	14.1	Floor noise
Hori	7440.000	AV	31.6	36.4	10.3	32.7	-	45.6	53.9	8.3	Floor noise
Hori	9920.000	AV	31.3	38.9	11.0	33.4	-	47.8	53.9	6.1	Floor noise
Vert	45.300	QP	22.3	12.2	7.4	32.2	-	9.7	40.0	30.3	
Vert	129.000	QP	23.1	13.5	8.5	32.2	-	12.9	43.5	30.6	
Vert	244.000	QP	21.3	11.5	9.6	32.0	-	10.4	46.0	35.6	
Vert	501.400	QP	21.3	17.5	11.3	32.0	-	18.1	46.0	27.9	
Vert	833.663	QP	21.1	21.1	13.2	31.3	-	24.1	46.0	21.9	
Vert	968.370	QP	20.3	22.2	13.8	30.6	-	25.7	53.9	28.2	
Vert	2483.500	PK	43.2	27.8	6.8	32.7	-	45.1	73.9	28.8	
Vert	4960.000	PK	41.8	32.1	9.1	31.7	-	51.3	73.9	22.6	Floor noise
Vert	7440.000	PK	42.5	36.4	10.3	32.7	-	56.5	73.9	17.4	Floor noise
Vert	9920.000	PK	41.4	38.9	11.0	33.4	-	57.9	73.9	16.0	Floor noise
Vert	2483.500	AV	34.7	27.8	6.8	32.7	2.0	38.6	53.9	15.3	*1)
Vert	4960.000	AV	30.3	32.1	9.1	31.7	-	39.8	53.9	14.1	Floor noise
Vert	7440.000	AV	32.0	36.4	10.3	32.7	-	46.0	53.9	7.9	Floor noise
Vert	9920.000	AV	31.2	38.9	11.0	33.4	-	47.7	53.9	6.2	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).

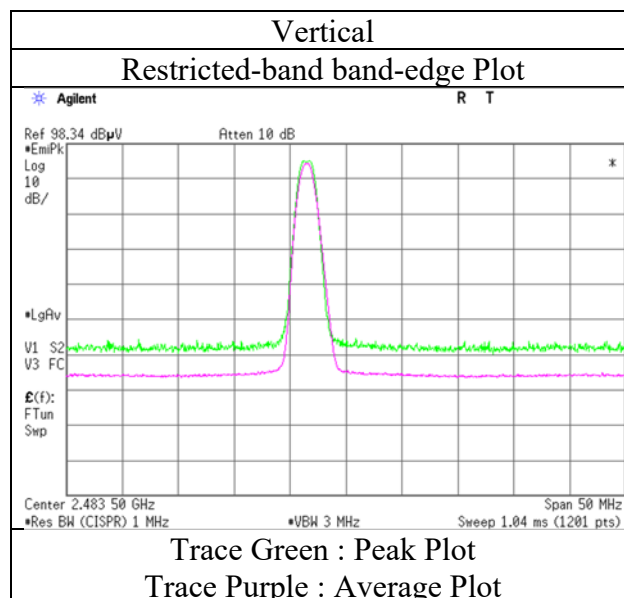
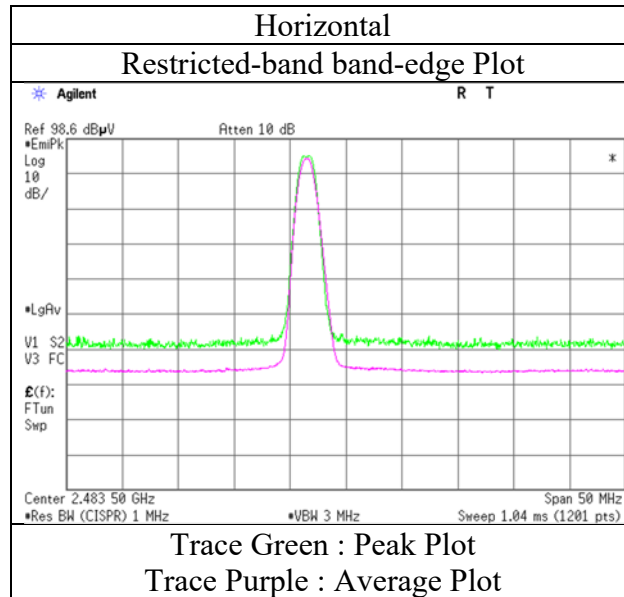
Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$

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.	12219846H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 19, 2018
Temperature / Humidity	20 deg. C / 41 % RH
Engineer	Takafumi Noguchi
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz



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

UL Japan, Inc.

Ise EMC Lab.

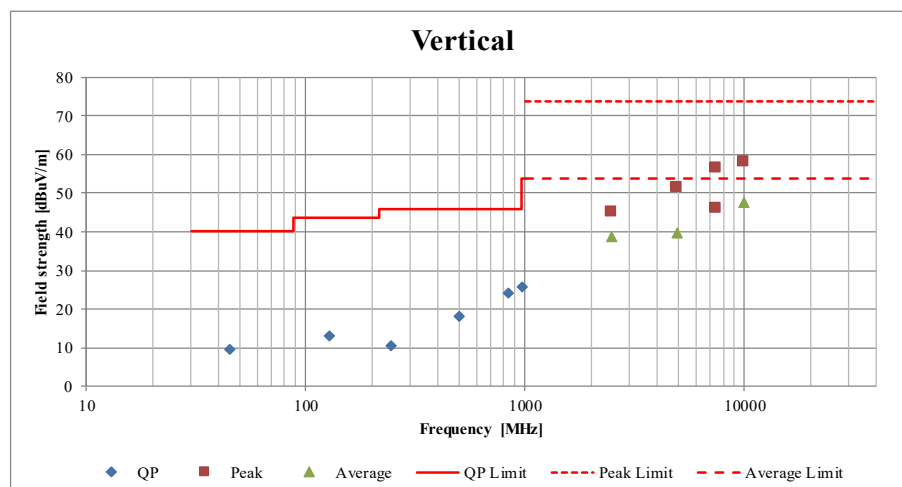
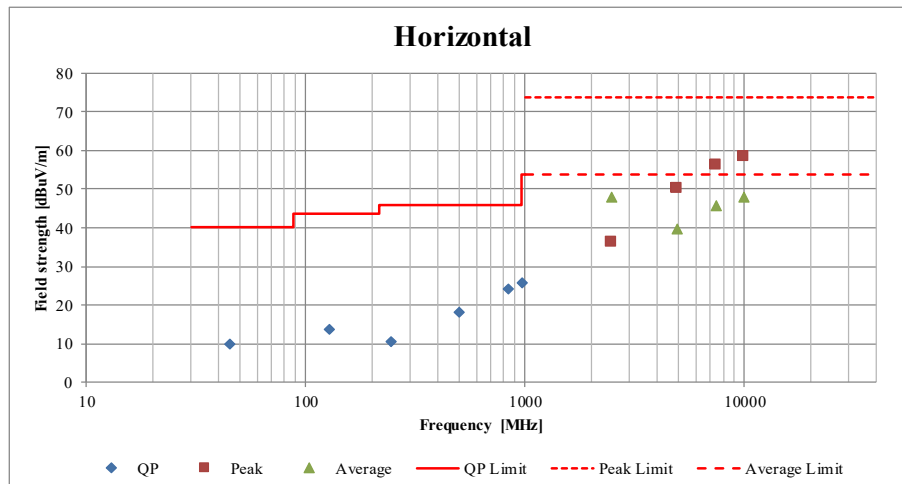
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12219846H	No.3	No.3	No.3
Test place	Ise EMC Lab.	No.3	No.3	No.3
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	March 19, 2018	March 22, 2018	March 25, 2018	March 28, 2018
Temperature / Humidity	20 deg. C / 41 % RH	20 deg. C / 38 % RH	22 deg. C / 31 % RH	25 deg. C / 33 % RH
Engineer	Takafumi Noguchi	Takumi Shimada	Takafumi Noguchi	Masafumi Niwa
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(18 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2480 MHz			



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

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. 12219846H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date March 20, 2018
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Takumi Shimada
(1 GHz -10 GHz)
Mode Tx BT LE 2402 MHz and 11ac-40 5550 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	42.0	27.7	6.7	32.7	-	43.7	73.9	30.2	
Hori	2390.000	AV	31.8	27.7	6.7	32.7	2.0	35.5	53.9	18.4	*1)
Vert	2390.000	PK	42.7	27.7	6.7	32.7	-	44.4	73.9	29.5	
Vert	2390.000	AV	31.5	27.7	6.7	32.7	2.0	35.2	53.9	18.7	*1)

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 (4.5 m / 3.0 m) = 3.53 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	2402.000	PK	92.5	27.7	6.8	32.7	94.3	-	-	Carrier
Hori	2400.000	PK	37.0	27.7	6.8	32.7	38.8	74.3	35.5	
Vert	2402.000	PK	89.0	27.7	6.8	32.7	90.8	-	-	Carrier
Vert	2400.000	PK	33.7	27.7	6.8	32.7	35.5	70.8	35.3	

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

Radiated Spurious Emission

Report No. 12219846H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date March 20, 2018 March 22, 2018 March 25, 2018 March 28, 2018
Temperature / Humidity 23 deg. C / 40 % RH 20 deg. C / 38 % RH 22 deg. C / 31 % RH 25 deg. C / 33 % RH
Engineer Takumi Shimada Takumi Shimada Takafumi Noguchi Masafumi Niwa
(1 GHz -10 GHz) (10 GHz - 18 GHz) (18 GHz - 26.5 GHz) (Below 1 GHz)
Mode Tx BT LE 2440 MHz and 11ac-40 5550 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	50.145	QP	24.5	10.6	7.5	32.2	-	10.4	40.0	29.6	
Hori	107.713	QP	38.2	11.1	8.3	32.2	-	25.4	43.5	18.1	
Hori	130.000	QP	33.9	13.6	8.5	32.2	-	23.8	43.5	19.7	
Hori	193.144	QP	36.8	16.4	9.1	32.1	-	30.2	43.5	13.3	
Hori	247.000	QP	37.8	11.5	9.6	32.0	-	26.9	46.0	19.1	
Hori	271.142	QP	42.3	12.3	9.8	32.0	-	32.4	46.0	13.6	
Hori	4880.000	PK	40.3	31.9	9.0	31.7	-	49.5	73.9	24.4	Floor noise
Hori	7320.000	PK	43.1	36.2	10.4	32.7	-	57.0	73.9	16.9	Floor noise
Hori	9760.000	PK	42.2	38.7	11.0	33.4	-	58.5	73.9	15.4	Floor noise
Hori	4880.000	AV	32.2	31.9	9.0	31.7	-	41.4	53.9	12.5	Floor noise
Hori	7320.000	AV	33.8	36.2	10.4	32.7	-	47.7	53.9	6.2	Floor noise
Hori	9760.000	AV	31.4	38.7	11.0	33.4	-	47.7	53.9	6.2	Floor noise
Vert	50.145	QP	35.9	10.6	7.5	32.2	-	21.8	40.0	18.2	
Vert	107.713	QP	35.1	11.1	8.3	32.2	-	22.3	43.5	21.2	
Vert	130.000	QP	34.7	13.6	8.5	32.2	-	24.6	43.5	18.9	
Vert	193.144	QP	32.8	16.4	9.1	32.1	-	26.2	43.5	17.3	
Vert	247.000	QP	29.0	11.5	9.6	32.0	-	18.1	46.0	27.9	
Vert	271.142	QP	35.1	12.3	9.8	32.0	-	25.2	46.0	20.8	
Vert	4880.000	PK	40.6	31.9	9.0	31.7	-	49.8	73.9	24.1	Floor noise
Vert	7320.000	PK	43.2	36.2	10.4	32.7	-	57.1	73.9	16.8	Floor noise
Vert	9760.000	PK	42.0	38.7	11.0	33.4	-	58.3	73.9	15.6	Floor noise
Vert	4880.000	AV	32.3	31.9	9.0	31.7	-	41.5	53.9	12.4	Floor noise
Vert	7320.000	AV	33.9	36.2	10.4	32.7	-	47.8	53.9	6.1	Floor noise
Vert	9760.000	AV	31.4	38.7	11.0	33.4	-	47.7	53.9	6.2	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 $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 12219846H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date March 20, 2018
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Takumi Shimada
(1 GHz -10 GHz)
Mode Tx BT LE 2480 MHz and 11ac-40 5550 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	42.3	27.8	6.8	32.7	-	44.2	73.9	29.7	
Hori	2483.500	AV	32.1	27.8	6.8	32.7	2.0	36.0	53.9	17.9	*1)
Vert	2483.500	PK	42.4	27.8	6.8	32.7	-	44.3	73.9	29.6	
Vert	2483.500	AV	31.9	27.8	6.8	32.7	2.0	35.8	53.9	18.1	*1)

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 $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$

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

APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2017/10/31 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2018/01/24 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2017/11/07 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2017/05/22 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2017/05/29 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2018/03/13 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2018/01/09 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2017/09/22 * 12
MCC-224						
MPA-03	Microwave System Power Amplifier	Agilent	83050A	MY39500610	RE	2017/10/12 * 12
MHA-29	Horn Antenna 26.5-40GHz	ETS LINDGREN	3160-10	00152399	RE	2017/09/15 * 12
MPA-22	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-33-8P / AMF-4F-2600400-33-8P	1871355 /1871328	RE	2017/09/07 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2017/06/30 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2017/08/22 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2017/10/02 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2018/01/30 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2017/07/12 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2017/12/14 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2017/10/13 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2017/10/13 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2017/06/20 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2017/06/20 * 12
MAT-88	Attenuator	Weinschel Associates	WA56-10	56100304	AT	2017/06/12 * 12
MAT-89	Attenuator	Weinschel Associates	WA56-10	56100305	AT	2017/06/12 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2017/12/21 * 12
MCC-174	Microwave Cable	Junkosha	MWX221	1409S497	AT	2017/03/13 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2017/11/14 * 12
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	AT	2017/11/16 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2017/03/24 * 12

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

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