



RADIO TEST REPORT

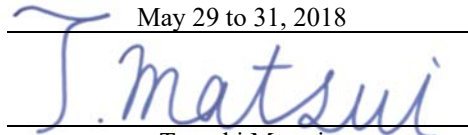
Test Report No. : 12299614H-R2

Applicant : OMRON Amusement Co.,Ltd.
Type of Equipment : 2.4GHz band wireless communication module
Model No. : WPTRF-NR02A
FCC ID : 2AP2AWPTRF-NR02A
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the 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. This report is a revised version of 12299614H-R1. 12299614H-R1 is replaced with this report.

Date of test: May 29 to 31, 2018

Representative test engineer:


Tomoki Matsui
Engineer
Consumer Technology Division

Approved by:


Tsubasa Takayama
Leader
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
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- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

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13-EM-F0429

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SECTION 1: Customer information

Company Name	:	OMRON Amusement Co.,Ltd.
Address	:	46, AZA-NOGOSHI,OKUCHO, ICHINOMIYA-CITY AICHI, 491-0201 JAPAN
Telephone Number	:	+81-586-62-7296
Facsimile Number	:	+81-586-62-7268
Contact Person	:	HIDEAKI KOJIMA

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

2.1 Identification of E.U.T.

Type of Equipment	:	2.4GHz band wireless communication module
Model No.	:	WPTRF-NR02A
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.3 V
Receipt Date of Sample	:	May 28, 2018
Country of Mass-production	:	Japan
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: WPTRF-NR02A (referred to as the EUT in this report) is a 2.4GHz band wireless communication module.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2482 MHz
Modulation	:	GFSK
Antenna type	:	Helical Monopole Antenna
Antenna Gain	:	1.8 dBi (peak)
Clock frequency (Maximum)	:	32 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	QP 33.1 dB, 0.15000 MHz, L 0.15000 MHz, N AV 34.4 dB, 24.81604 MHz, N	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-247 5.2(a)	See data.	N/A	Conducted
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)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(e) ----- IC: RSS-247 5.2(b)		N/A	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	0.8 dB 4964.00 MHz, AV, Vertical	Complied#	Conducted (below 30 MHz)/ 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 RF Module has its own regulator.

The RF Module is constantly provided voltage through the regulator 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 it is soldered on the circuit board. Therefore the equipment complies with the requirement of 15.203/212.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	Complied	Conducted
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

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

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	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

Antenna Terminal test

Test Item	Uncertainty (+/-)
RF output power	1.3 dB
Antenna terminal conducted emission / Power density / Burst power	2.7 dB
Adjacent channel power / Channel power	
Below 3 GHz	1.9 dB
3 GHz to 6 GHz	2.1 dB

3.5 Test Location

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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 2.0m 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.

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

4.1 Operating Mode(s)

Mode	Remarks*
Tx	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: 0.000088W Software: WPTRF-NR02A FCC ver 1.6.1 *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	Tx (1 Mbps / 2 Mbps)	2402 MHz 2441 MHz 2482 MHz
Spurious Emission (Radiated)	Tx (1 Mbps / 2 Mbps)	2402 MHz 2441 MHz 2482 MHz
Spurious Emission (Conducted)	Tx (1 Mbps / 2 Mbps)	2402 MHz 2441 MHz 2482 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	Tx (1 Mbps / 2 Mbps)	2402 MHz 2441 MHz 2482 MHz

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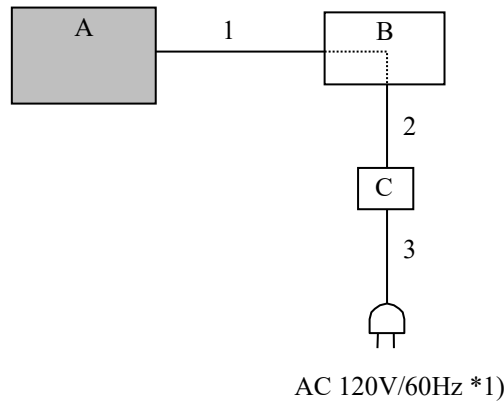
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4.2 Configuration and peripherals



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

* It is confirmed that power supply voltage is input part of EUT (DC 3.3 V).

*1) Conducted emission test was performed on this port.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	2.4GHz band wireless communication module	WPTRF-NR02A	NR-217 *1) NR-218 *2)	OMRON Amusement Co.,Ltd.	EUT
B	Jig board	-	-	-	-
C	DC Power supply	PMC35-2A	13090501	KIKUSUI ELECTRONICS COP.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.5	Unshielded	Unshielded	-
2	DC Cable	1.0 *1) 3.0 *2)	Unshielded	Unshielded	-
3	AC Cable	1.8	Unshielded	Unshielded	-

*1) Used for Antenna Terminal conducted test

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

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.

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

SECTION 6: 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 m *2) (1 GHz - 10 GHz), 1 m *3) (10 GHz - 26.5 GHz)		4 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: $20 \times \log(4.0 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

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

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

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	2 MHz (1 Mbps) 4 MHz (2 Mbps)	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)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				

*1) Peak hold was applied as Worst-case measurement.

*2) Reference data

*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".

*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.

Test data : APPENDIX

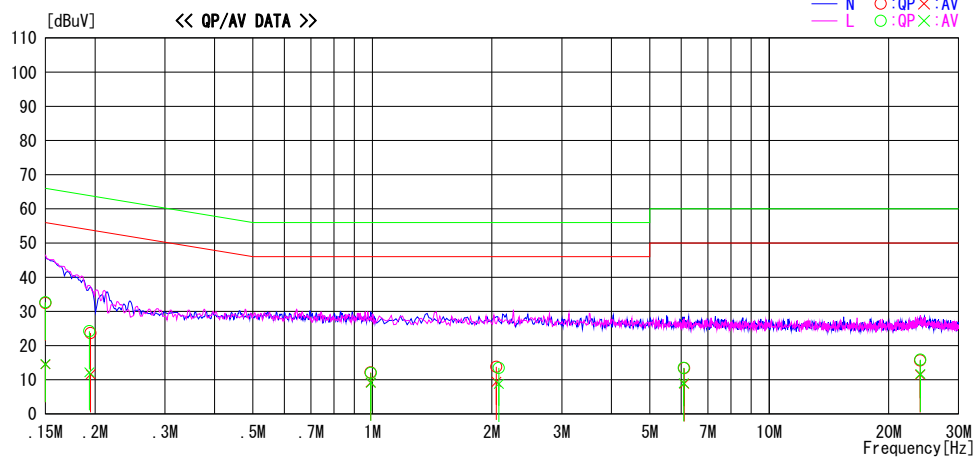
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Report No. 12299614H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date May 31, 2018
Temperature / Humidity 22 deg. C / 67 % RH
Engineer Takumi Shimada
Mode Tx 1 Mbps 2402 MHz

LIMIT : FCC15. 207 QP
FCC15. 207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	19.3	1.3	13.2	32.5	14.5	66.0	56.0	33.5	41.5	N	
0.19495	10.5	-1.6	13.2	23.7	11.6	63.8	53.8	40.1	42.2	N	
0.98955	-1.2	-4.1	13.3	12.1	9.2	56.0	46.0	43.9	36.8	N	
2.05329	0.3	-4.1	13.5	13.8	9.4	56.0	46.0	42.2	36.6	N	
6.10456	-0.4	-4.9	13.8	13.4	8.9	60.0	50.0	46.6	41.1	N	
23.98503	1.2	-3.0	14.5	15.7	11.5	60.0	50.0	44.3	38.5	N	
0.15000	19.5	1.4	13.2	32.7	14.6	66.0	56.0	33.3	41.4	L	
0.19350	11.0	-1.0	13.2	24.2	12.2	63.9	53.9	39.7	41.7	L	
0.99100	-1.3	-4.2	13.3	12.0	9.1	56.0	46.0	44.0	36.9	L	
2.08352	0.0	-4.7	13.5	13.5	8.8	56.0	46.0	42.5	37.2	L	
6.08944	-0.3	-4.8	13.8	13.5	9.0	60.0	50.0	46.5	41.0	L	
24.01845	1.4	-2.8	14.5	15.9	11.7	60.0	50.0	44.1	38.3	L	

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

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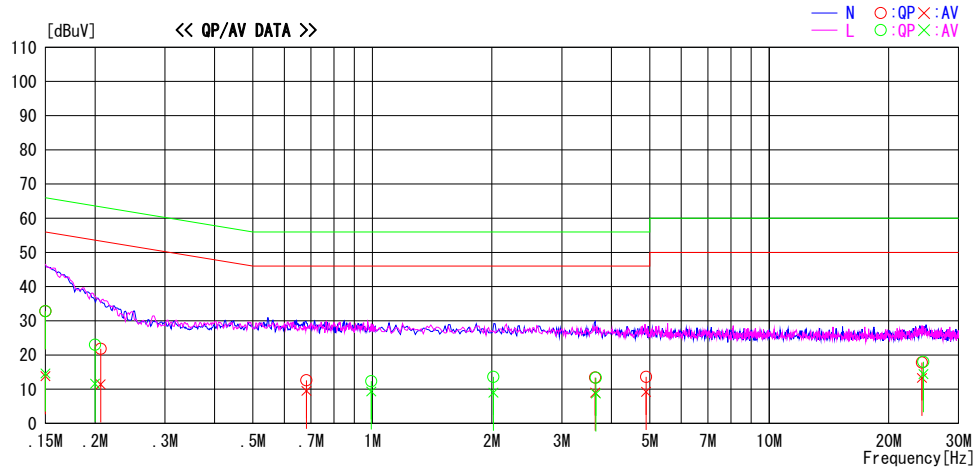
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Date May 31, 2018
Temperature / Humidity 22 deg. C / 67 % RH
Engineer Takumi Shimada
Mode Tx 1 Mbps 2441 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	19.6	0.6	13.2	32.8	13.8	66.0	56.0	33.2	42.2	N	
0.20663	8.6	-1.8	13.2	21.8	11.4	63.3	53.3	41.5	41.9	N	
0.68225	-0.7	-3.8	13.3	12.6	9.5	56.0	46.0	43.4	36.5	N	
3.64054	-0.2	-4.6	13.6	13.4	9.0	56.0	46.0	42.6	37.0	N	
4.89163	-0.1	-4.5	13.7	13.6	9.2	56.0	46.0	42.4	36.8	N	
24.26329	3.3	-1.2	14.5	17.8	13.3	60.0	50.0	42.2	36.7	N	
0.15000	19.6	1.4	13.2	32.8	14.6	66.0	56.0	33.2	41.4	L	
0.19996	9.8	-1.6	13.2	23.0	11.6	63.6	53.6	40.6	42.0	L	
0.99390	-1.0	-4.0	13.3	12.3	9.3	56.0	46.0	43.7	36.7	L	
2.01775	0.1	-4.5	13.5	13.6	9.0	56.0	46.0	42.4	37.0	L	
3.65565	-0.3	-4.9	13.6	13.3	8.7	56.0	46.0	42.7	37.3	L	
24.45287	3.5	-0.1	14.5	18.0	14.4	60.0	50.0	42.0	35.6	L	

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

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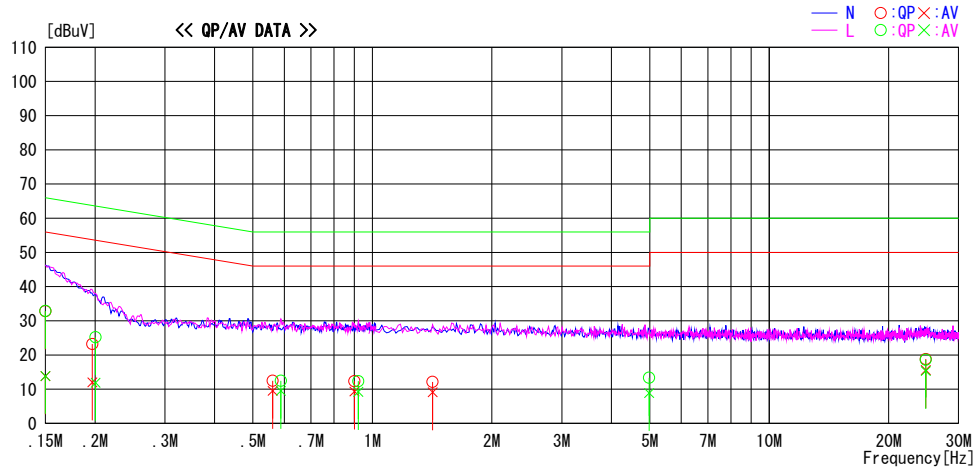
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Date May 31, 2018
Temperature / Humidity 22 deg. C / 67 % RH
Engineer Takumi Shimada
Mode Tx 1 Mbps 2482 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



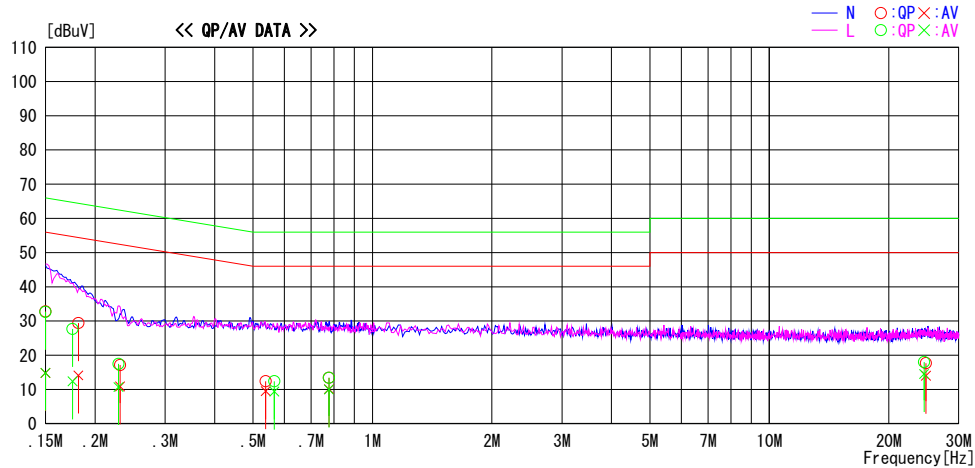
Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	19.6	0.6	13.2	32.8	13.8	66.0	56.0	33.2	42.2	N	
0.19685	10.0	-1.2	13.2	23.2	12.0	63.7	53.7	40.5	41.7	N	
0.56082	-0.8	-3.8	13.3	12.5	9.5	56.0	46.0	43.5	36.5	N	
0.90127	-1.0	-4.0	13.3	12.3	9.3	56.0	46.0	43.7	36.7	N	
1.41838	-1.2	-4.2	13.3	12.1	9.1	56.0	46.0	43.9	36.9	N	
24.81604	4.3	1.1	14.5	18.8	15.6	60.0	50.0	41.2	34.4	N	
0.15000	19.7	0.7	13.2	32.9	13.9	66.0	56.0	33.1	42.1	L	
0.20075	12.0	-1.3	13.2	25.2	11.9	63.6	53.6	38.4	41.7	L	
0.58790	-0.8	-3.8	13.3	12.5	9.5	56.0	46.0	43.5	36.5	L	
0.92140	-1.0	-4.1	13.3	12.3	9.2	56.0	46.0	43.7	36.8	L	
4.97856	-0.4	-4.8	13.7	13.3	8.9	56.0	46.0	42.7	37.1	L	
24.81604	4.1	0.8	14.5	18.6	15.3	60.0	50.0	41.4	34.7	L	

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

Conducted Emission

Report No. 12299614H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date May 31, 2018
Temperature / Humidity 22 deg. C / 67 % RH
Engineer Takumi Shimada
Mode Tx 2 Mbps 2402 MHz

LIMIT : FCC15. 207 QP
FCC15. 207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	19.6	1.6	13.2	32.8	14.8	66.0	56.0	33.2	41.2	N	
0.18162	16.2	0.9	13.2	29.4	14.1	64.4	54.4	35.0	40.3	N	
0.23120	3.9	-2.3	13.2	17.1	10.9	62.4	52.4	45.3	41.5	N	
0.53789	-0.9	-3.8	13.3	12.4	9.5	56.0	46.0	43.6	36.5	N	
0.77710	0.1	-3.2	13.3	13.4	10.1	56.0	46.0	42.6	35.9	N	
24.81416	3.2	-0.5	14.5	17.7	14.0	60.0	50.0	42.3	36.0	N	
0.15000	19.5	1.7	13.2	32.7	14.9	66.0	56.0	33.3	41.1	L	
0.17552	14.5	-0.8	13.2	27.7	12.4	64.7	54.7	37.0	42.3	L	
0.22916	4.3	-2.5	13.2	17.5	10.7	62.5	52.5	45.0	41.8	L	
0.56590	-0.9	-3.9	13.3	12.4	9.4	56.0	46.0	43.6	36.6	L	
0.77652	0.1	-3.3	13.3	13.4	10.0	56.0	46.0	42.6	36.0	L	
24.51862	3.5	0.0	14.5	18.0	14.5	60.0	50.0	42.0	35.5	L	

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

UL Japan, Inc.

Ise EMC Lab.

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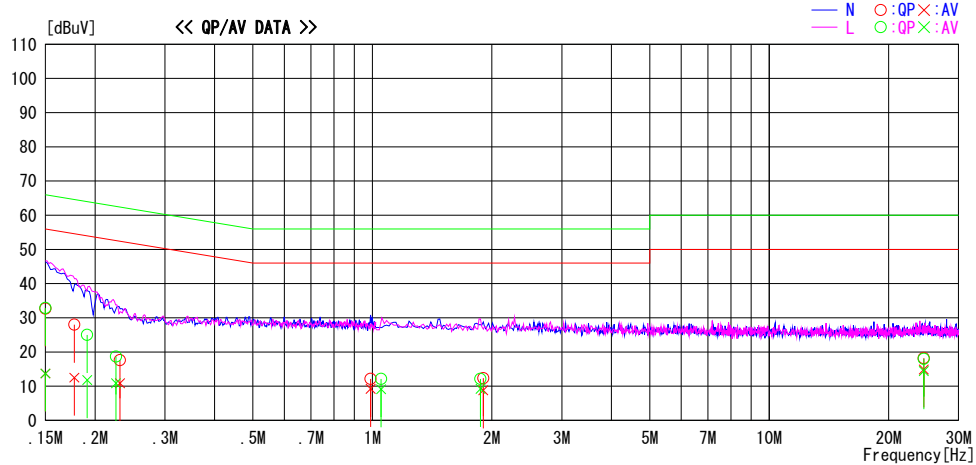
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 12299614H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date May 31, 2018
Temperature / Humidity 22 deg. C / 67 % RH
Engineer Takumi Shimada
Mode Tx 2 Mbps 2441 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	19.5	0.5	13.2	32.7	13.7	66.0	56.0	33.3	42.3	N	
0.17729	14.8	-0.7	13.2	28.0	12.5	64.6	54.6	36.6	42.1	N	
0.23105	4.4	-2.3	13.2	17.6	10.9	62.4	52.4	44.8	41.5	N	
0.98955	-1.2	-4.1	13.3	12.1	9.2	56.0	46.0	43.9	36.8	N	
1.90212	-1.1	-4.6	13.4	12.3	8.8	56.0	46.0	43.7	37.2	N	
24.51648	3.7	0.4	14.5	18.2	14.9	60.0	50.0	41.8	35.1	N	
0.15000	19.7	0.5	13.2	32.9	13.7	66.0	56.0	33.1	42.3	L	
0.19109	11.8	-1.4	13.2	25.0	11.8	64.0	54.0	39.0	42.2	L	
0.22584	5.5	-2.3	13.2	18.7	10.9	62.6	52.6	43.9	41.7	L	
1.05221	-1.2	-4.2	13.3	12.1	9.1	56.0	46.0	43.9	36.9	L	
1.87189	-1.3	-4.2	13.4	12.1	9.2	56.0	46.0	43.9	36.8	L	
24.51662	3.5	-0.1	14.5	18.0	14.4	60.0	50.0	42.0	35.6	L	

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

UL Japan, Inc.

Ise EMC Lab.

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

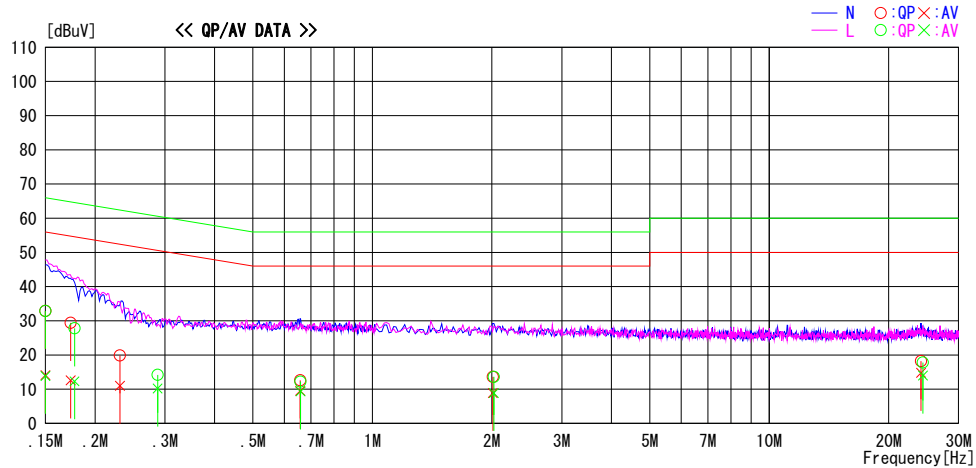
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 12299614H
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Date May 31, 2018
Temperature / Humidity 22 deg. C / 67 % RH
Engineer Takumi Shimada
Mode Tx 2 Mbps 2482 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	19.7	0.9	13.2	32.9	14.1	66.0	56.0	33.1	41.9	N	
0.17362	16.2	-0.6	13.2	29.4	12.6	64.8	54.8	35.4	42.2	N	
0.23114	6.7	-2.2	13.2	19.9	11.0	62.4	52.4	42.5	41.4	N	
0.65788	-0.7	-3.8	13.3	12.6	9.5	56.0	46.0	43.4	36.5	N	
2.01060	0.1	-4.6	13.5	13.6	8.9	56.0	46.0	42.4	37.1	N	
24.11861	3.7	0.3	14.5	18.2	14.8	60.0	50.0	41.8	35.2	N	
0.15000	19.7	0.7	13.2	32.9	13.9	66.0	56.0	33.1	42.1	L	
0.17750	14.6	-0.9	13.2	27.8	12.3	64.6	54.6	36.8	42.3	L	
0.28753	1.0	-3.0	13.2	14.2	10.2	60.6	50.6	46.4	40.4	L	
0.65895	-1.1	-4.0	13.3	12.2	9.3	56.0	46.0	43.8	36.7	L	
2.02210	0.1	-4.6	13.5	13.6	8.9	56.0	46.0	42.4	37.1	L	
24.39656	3.3	-0.5	14.5	17.8	14.0	60.0	50.0	42.2	36.0	L	

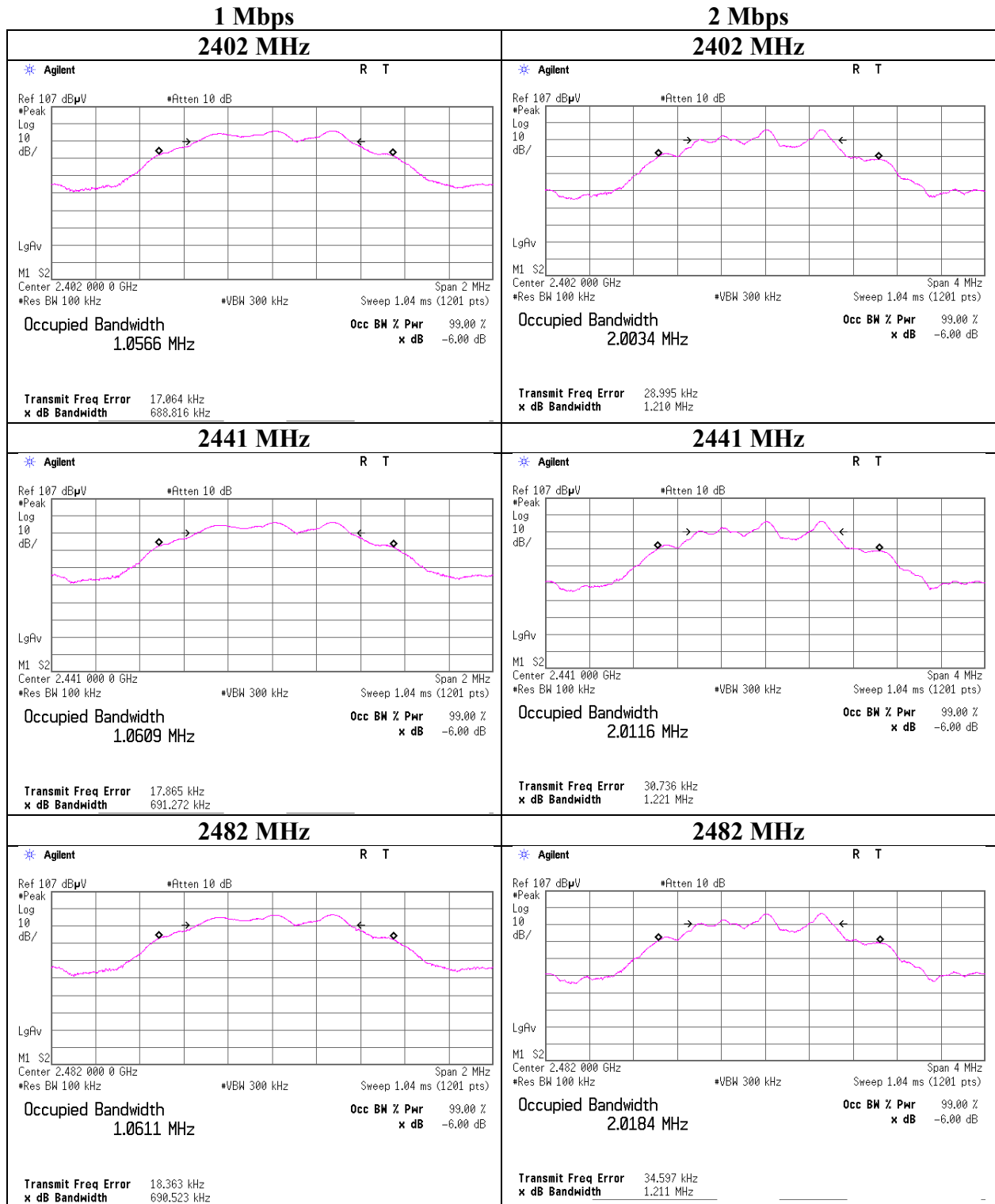
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 12299614H
Test place Ise EMC Lab. No.7 Shielded Room
Date May 29, 2018
Temperature / Humidity 23 deg. C / 50 % RH
Engineer Tomoki Matsui
Mode Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
1 Mbps	2402	1.008	0.689	> 0.5000
	2441	1.011	0.691	> 0.5000
	2482	1.012	0.691	> 0.5000
2 Mbps	2402	2.017	1.210	> 0.5000
	2441	2.022	1.221	> 0.5000
	2482	2.030	1.211	> 0.5000

6dB Bandwidth



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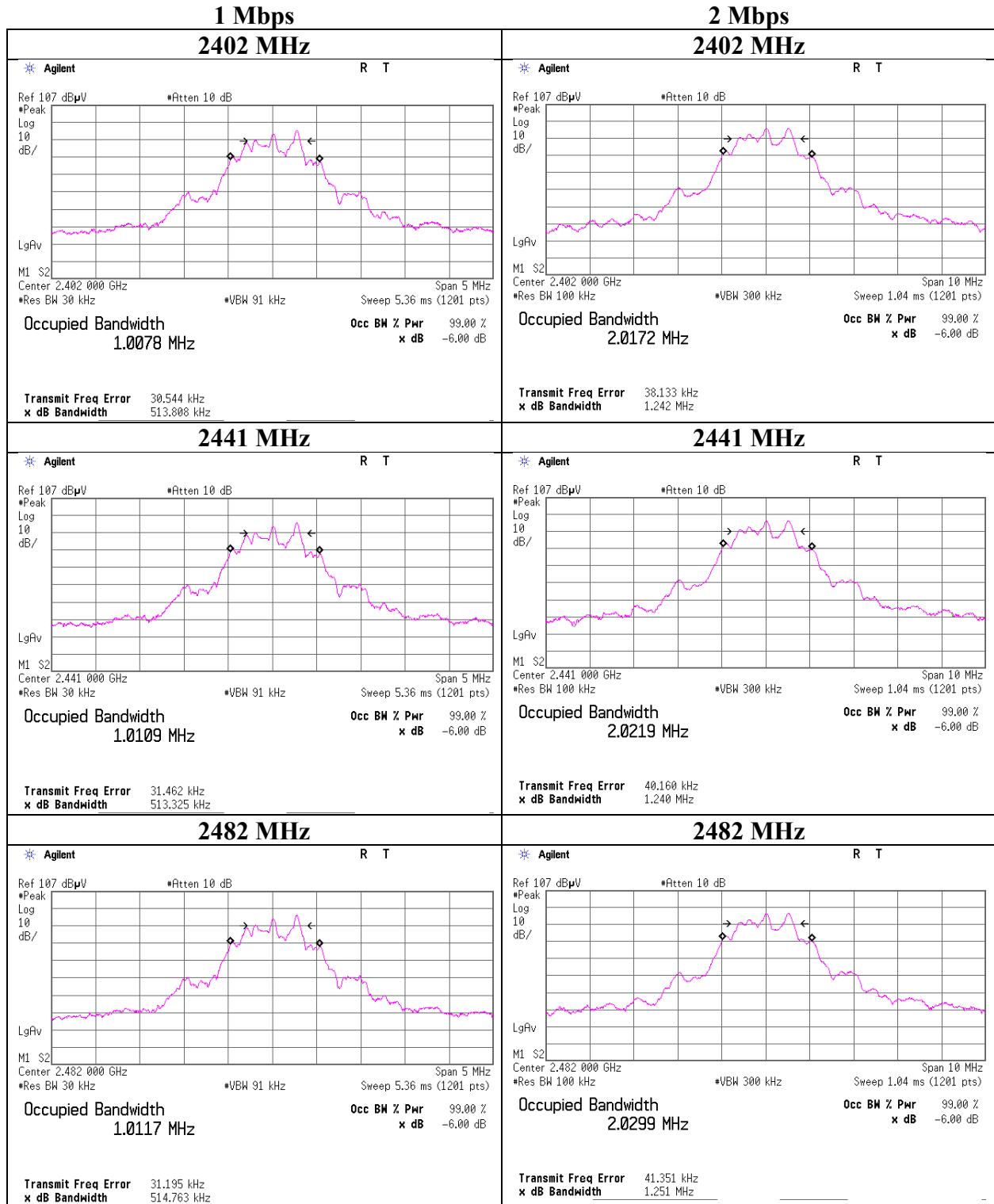
Ise EMC Lab.

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99%Occupied Bandwidth



UL Japan, Inc.

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Maximum Peak Output Power

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 1 Mbps

3.3 V				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-13.59	1.60	0.00	-11.99	0.06	30.00	1000	41.99	1.80	-10.19	0.10	36.02	4000	46.21
2441	-13.11	1.63	0.00	-11.48	0.07	30.00	1000	41.48	1.80	-9.68	0.11	36.02	4000	45.70
2482	-12.93	1.66	0.00	-11.27	0.07	30.00	1000	41.27	1.80	-9.47	0.11	36.02	4000	45.49

Sample Calculation:

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

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.

UL Japan, Inc.

Ise EMC Lab.

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Maximum Peak Output Power

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 2 Mbps

3.3 V				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-13.55	1.60	0.00	-11.95	0.06	30.00	1000	41.95	1.80	-10.15	0.10	36.02	4000	46.17
2441	-13.11	1.63	0.00	-11.48	0.07	30.00	1000	41.48	1.80	-9.68	0.11	36.02	4000	45.70
2482	-12.94	1.66	0.00	-11.28	0.07	30.00	1000	41.28	1.80	-9.48	0.11	36.02	4000	45.50

Sample Calculation:

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

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.

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Telephone : +81 596 24 8999

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Average Output Power
(Reference data for RF Exposure)

Report No. 12299614H
Test place Ise EMC Lab. No.7 Shielded Room
Date May 29, 2018
Temperature / Humidity 23 deg. C / 50 % RH
Engineer Tomoki Matsui
Mode Tx 1 Mbps

3.3 V

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-16.74	1.60	0.00	-15.14	0.03	2.61	-12.53	0.06
2441	-16.28	1.63	0.00	-14.65	0.03	2.61	-12.04	0.06
2482	-16.07	1.66	0.00	-14.41	0.04	2.61	-11.80	0.07

Sample Calculation:

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

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

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

Average Output Power
(Reference data for RF Exposure)

Report No. 12299614H
Test place Ise EMC Lab. No.7 Shielded Room
Date May 29, 2018
Temperature / Humidity 23 deg. C / 50 % RH
Engineer Tomoki Matsui
Mode Tx 2 Mbps

3.3 V

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-17.98	1.60	0.00	-16.38	0.02	3.82	-12.56	0.06
2441	-17.52	1.63	0.00	-15.89	0.03	3.82	-12.07	0.06
2482	-17.31	1.66	0.00	-15.65	0.03	3.82	-11.83	0.07

Sample Calculation:

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

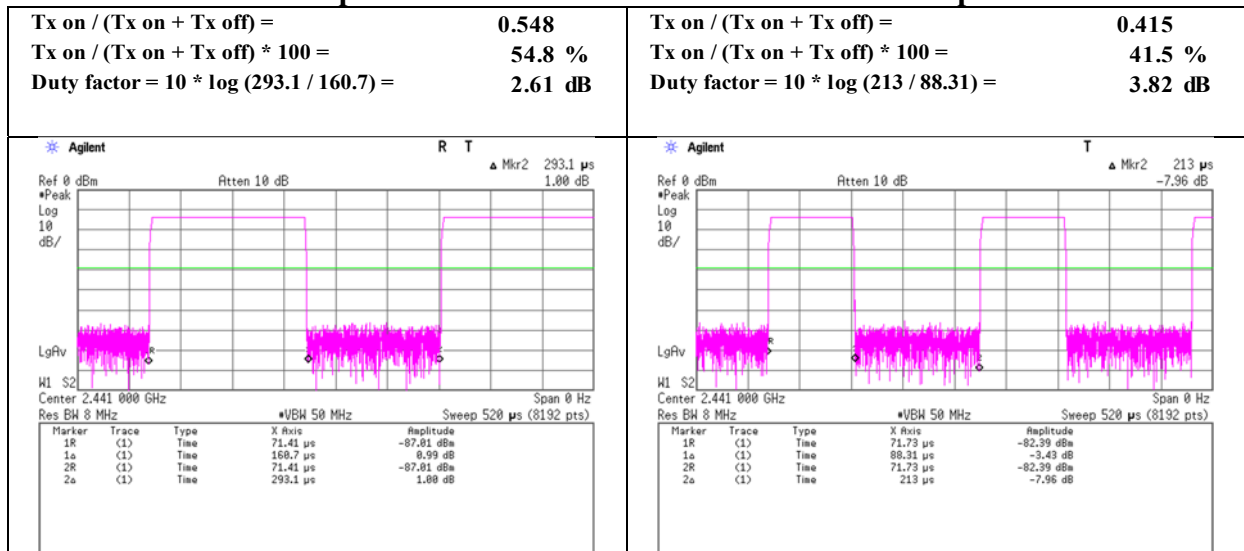
Result (Burst power average) = Time average + Duty factor

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

Burst rate confirmation

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx

1 Mbps



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

Radiated Spurious Emission

Report No. 12299614H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date May 30, 2018 No.3
Temperature / Humidity 21 deg. C / 68 % RH May 31, 2018
Engineer Tomoki Matsui Takumi Shimada
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz and Below 1 GHz)
Mode Tx 1 Mbps 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	50.000	QP	22.7	10.7	7.5	32.2	-	8.7	40.0	31.3	
Hori	60.608	QP	22.9	7.3	7.6	32.2	-	5.6	40.0	34.4	
Hori	176.401	QP	23.1	16.2	9.0	32.1	-	16.2	43.5	27.3	
Hori	400.000	QP	21.6	15.5	10.7	32.1	-	15.7	46.0	30.3	Floor noise
Hori	500.000	QP	21.8	17.5	11.3	32.1	-	18.5	46.0	27.5	Floor noise
Hori	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	Floor noise
Hori	2390.000	PK	41.2	27.7	5.7	32.7	-	41.9	73.9	32.0	
Hori	4804.000	PK	45.1	31.6	8.1	31.8	-	53.0	73.9	20.9	
Hori	7206.000	PK	43.7	36.0	9.3	32.6	-	56.4	73.9	17.5	
Hori	9608.000	PK	41.3	38.5	9.7	33.3	-	56.2	73.9	17.7	Floor noise
Hori	12010.000	PK	45.3	39.7	-1.3	33.4	-	50.3	73.9	23.6	
Hori	2390.000	AV	32.5	27.7	5.7	32.7	2.6	35.8	53.9	18.1	*1)
Hori	4804.000	AV	39.2	31.6	8.1	31.8	2.6	49.7	53.9	4.2	
Hori	7206.000	AV	34.8	36.0	9.3	32.6	2.6	50.1	53.9	3.8	
Hori	9608.000	AV	32.8	38.5	9.7	33.3	-	47.7	53.9	6.2	Floor noise
Hori	12010.000	AV	35.0	39.7	-1.3	33.4	2.6	42.6	53.9	11.3	
Vert	50.000	QP	28.5	10.7	7.5	32.2	-	14.5	40.0	25.5	
Vert	60.100	QP	27.2	7.3	7.6	32.2	-	9.9	40.0	30.1	
Vert	178.451	QP	23.3	16.3	9.0	32.1	-	16.5	43.5	27.0	
Vert	400.000	QP	21.7	15.5	10.7	32.1	-	15.8	46.0	30.2	Floor noise
Vert	500.000	QP	21.8	17.5	11.3	32.1	-	18.5	46.0	27.5	Floor noise
Vert	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	Floor noise
Vert	2390.000	PK	41.2	27.7	5.7	32.7	-	41.9	73.9	32.0	
Vert	4804.000	PK	47.2	31.6	8.1	31.8	-	55.1	73.9	18.8	
Vert	7206.000	PK	41.4	36.0	9.3	32.6	-	54.1	73.9	19.8	Floor noise
Vert	9608.000	PK	41.3	38.5	9.7	33.3	-	56.2	73.9	17.7	Floor noise
Vert	12010.000	PK	44.8	39.7	-1.3	33.4	-	49.8	73.9	24.1	
Vert	2390.000	AV	32.6	27.7	5.7	32.7	2.6	35.9	53.9	18.0	*1)
Vert	4804.000	AV	39.9	31.6	8.1	31.8	2.6	50.4	53.9	3.5	
Vert	7206.000	AV	32.5	36.0	9.3	32.6	-	45.2	53.9	8.7	Floor noise
Vert	9608.000	AV	32.8	38.5	9.7	33.3	-	47.7	53.9	6.2	Floor noise
Vert	12010.000	AV	34.8	39.7	-1.3	33.4	2.6	42.4	53.9	11.5	

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 m / 3.0 m) = 2.5 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	2402.000	PK	84.2	27.7	5.7	32.7	84.9	-	-	Carrier
Hori	2400.000	PK	39.4	27.7	5.7	32.7	40.1	64.9	24.8	
Vert	2402.000	PK	79.4	27.7	5.7	32.7	80.1	-	-	Carrier
Vert	2400.000	PK	37.0	27.7	5.7	32.7	37.7	60.1	22.4	

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

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Ise EMC Lab.

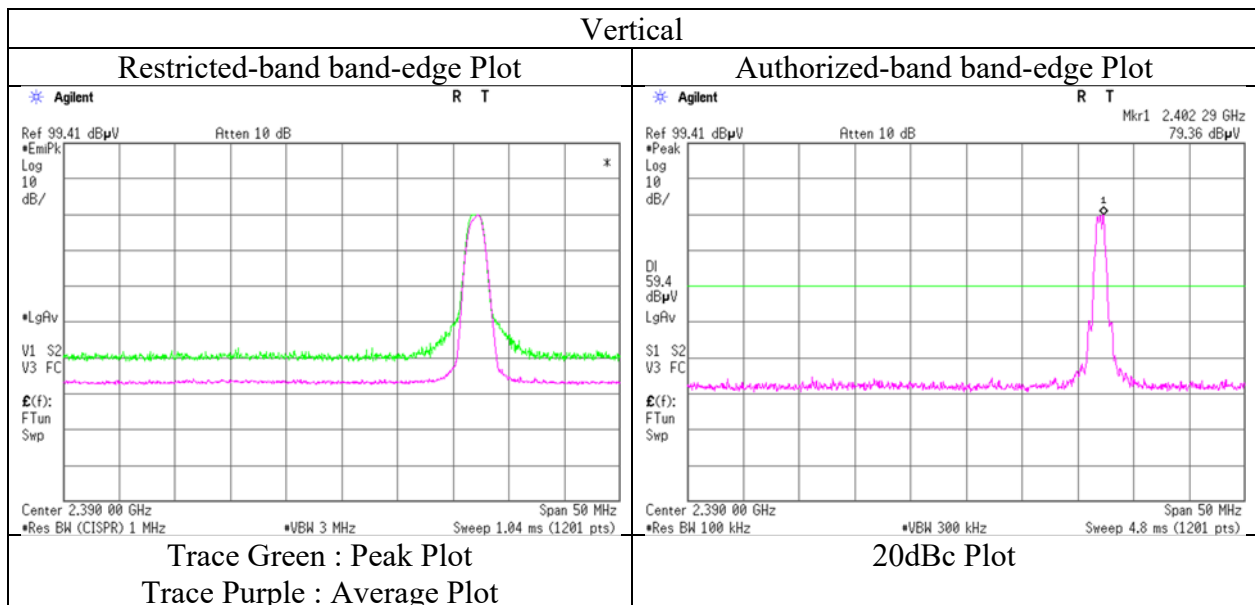
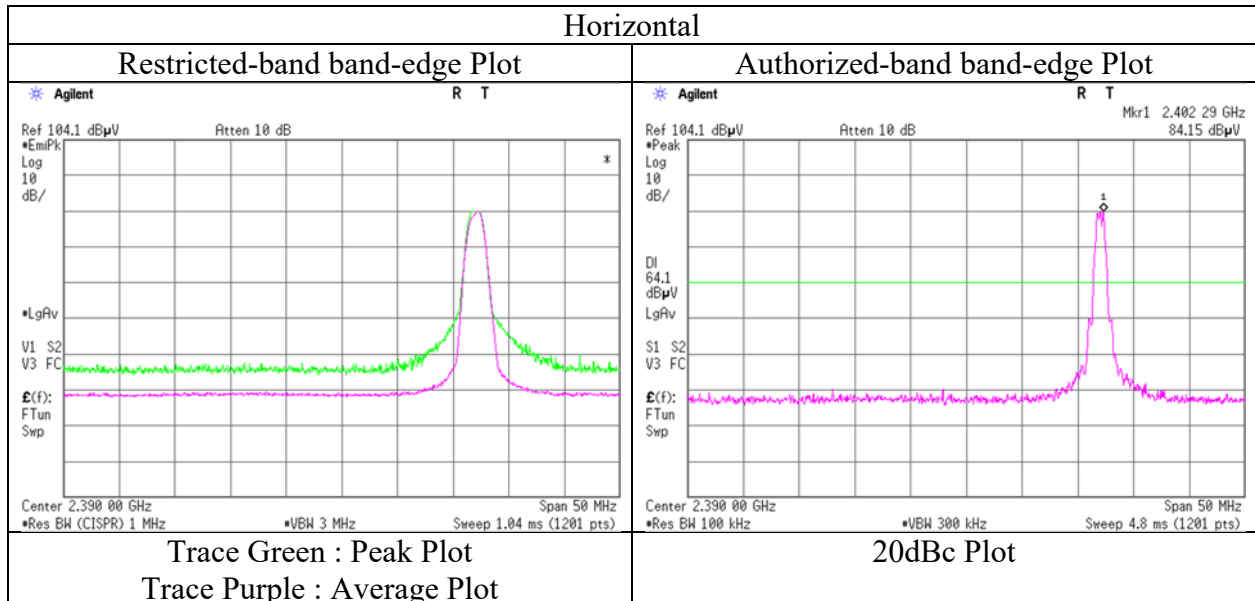
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12299614H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 30, 2018
Temperature / Humidity	21 deg. C / 68 % RH
Engineer	Tomoki Matsui
	(1 GHz - 10 GHz)
Mode	Tx 1 Mbps 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.	12299614H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 30, 2018	May 31, 2018
Temperature / Humidity	21 deg. C / 68 % RH	22 deg. C / 67 % RH
Engineer	Tomoki Matsui	Takumi Shimada
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz and Below 1 GHz)
Mode	Tx 1 Mbps 2441 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	50.000	QP	22.5	10.7	7.5	32.2	-	8.5	40.0	31.5	
Hori	59.858	QP	22.8	7.4	7.6	32.2	-	5.6	40.0	34.4	
Hori	168.467	QP	25.1	15.9	8.9	32.1	-	17.8	43.5	25.7	
Hori	400.000	QP	21.5	15.5	10.7	32.1	-	15.6	46.0	30.4	
Hori	500.000	QP	21.8	17.5	11.3	32.1	-	18.5	46.0	27.5	
Hori	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Hori	4882.000	PK	44.7	31.9	8.1	31.7	-	53.0	73.9	20.9	
Hori	7323.000	PK	44.7	36.2	9.4	32.7	-	57.6	73.9	16.3	
Hori	9764.000	PK	41.3	38.7	9.7	33.4	-	56.3	73.9	17.6	Floor noise
Hori	12205.000	PK	45.7	39.7	-1.3	33.3	-	50.8	73.9	23.1	
Hori	4882.000	AV	38.3	31.9	8.1	31.7	2.6	49.2	53.9	4.7	
Hori	7323.000	AV	35.5	36.2	9.4	32.7	2.6	51.0	53.9	2.9	
Hori	9764.000	AV	32.8	38.7	9.7	33.4	-	47.8	53.9	6.1	Floor noise
Hori	12205.000	AV	35.6	39.7	-1.3	33.3	2.6	43.3	53.9	10.6	
Vert	49.630	QP	27.4	10.8	7.5	32.2	-	13.5	40.0	26.5	
Vert	58.905	QP	28.4	7.7	7.6	32.2	-	11.5	40.0	28.5	
Vert	166.950	QP	26.3	15.8	8.9	32.2	-	18.8	43.5	24.7	
Vert	400.000	QP	21.5	15.5	10.7	32.1	-	15.6	46.0	30.4	
Vert	500.000	QP	21.8	17.5	11.3	32.1	-	18.5	46.0	27.5	
Vert	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Vert	4882.000	PK	46.4	31.9	8.1	31.7	-	54.7	73.9	19.2	
Vert	7323.000	PK	41.4	36.2	9.4	32.7	-	54.3	73.9	19.6	Floor noise
Vert	9764.000	PK	41.3	38.7	9.7	33.4	-	56.3	73.9	17.6	Floor noise
Vert	12205.000	PK	44.8	39.7	-1.3	33.3	-	49.9	73.9	24.0	
Vert	4882.000	AV	40.6	31.9	8.1	31.7	2.6	51.5	53.9	2.4	
Vert	7323.000	AV	32.5	36.2	9.4	32.7	-	45.4	53.9	8.5	Floor noise
Vert	9764.000	AV	32.8	38.7	9.7	33.4	-	47.8	53.9	6.1	Floor noise
Vert	12205.000	AV	34.9	39.7	-1.3	33.3	2.6	42.6	53.9	11.3	

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 $20\log(4\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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Radiated Spurious Emission

Report No.	12299614H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 30, 2018	May 31, 2018
Temperature / Humidity	21 deg. C / 68 % RH	22 deg. C / 67 % RH
Engineer	Tomoki Matsui	Takumi Shimada
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz and Below 1 GHz)
Mode	Tx 1 Mbps 2482 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	50.000	QP	22.5	10.7	7.5	32.2	-	8.5	40.0	31.5	
Hori	59.408	QP	22.6	7.5	7.6	32.2	-	5.5	40.0	34.5	
Hori	179.275	QP	25.1	16.3	9.0	32.1	-	18.3	43.5	25.2	
Hori	400.000	QP	21.6	15.5	10.7	32.1	-	15.7	46.0	30.3	
Hori	500.000	QP	21.8	17.5	11.3	32.1	-	18.5	46.0	27.5	
Hori	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Hori	2483.500	PK	38.4	27.8	5.8	32.7	-	39.3	73.9	34.6	*2)
Hori	4964.000	PK	45.0	32.2	8.1	31.7	-	53.6	73.9	20.3	
Hori	7446.000	PK	42.4	36.4	9.3	32.7	-	55.4	73.9	18.5	
Hori	9928.000	PK	40.8	38.9	9.7	33.4	-	56.0	73.9	17.9	Floor noise
Hori	12410.000	PK	44.9	39.7	-1.2	33.3	-	50.1	73.9	23.8	
Hori	2483.500	AV	35.4	27.8	5.8	32.7	2.6	38.9	53.9	15.0	*1)*2)
Hori	4964.000	AV	38.5	32.2	8.1	31.7	2.6	49.7	53.9	4.2	
Hori	7446.000	AV	33.3	36.4	9.3	32.7	-	46.3	53.9	7.6	Floor noise
Hori	9928.000	AV	32.4	38.9	9.7	33.4	-	47.6	53.9	6.3	Floor noise
Hori	12410.000	AV	34.7	39.7	-1.2	33.3	2.6	42.5	53.9	11.4	
Vert	50.038	QP	27.6	10.7	7.5	32.2	-	13.6	40.0	26.4	
Vert	59.338	QP	27.6	7.6	7.6	32.2	-	10.6	40.0	29.4	
Vert	163.184	QP	25.9	15.7	8.9	32.2	-	18.3	43.5	25.2	
Vert	400.000	QP	21.6	15.5	10.7	32.1	-	15.7	46.0	30.3	
Vert	500.000	QP	21.7	17.5	11.3	32.1	-	18.4	46.0	27.6	
Vert	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Vert	2483.500	PK	34.5	27.8	5.8	32.7	-	35.4	73.9	38.5	*2)
Vert	4964.000	PK	47.4	32.2	8.1	31.7	-	56.0	73.9	17.9	
Vert	7446.000	PK	42.4	36.4	9.3	32.7	-	55.4	73.9	18.5	Floor noise
Vert	9928.000	PK	40.8	38.9	9.7	33.4	-	56.0	73.9	17.9	Floor noise
Vert	12410.000	PK	44.2	39.7	-1.2	33.3	-	49.4	73.9	24.5	
Vert	2483.500	AV	31.4	27.8	5.8	32.7	2.6	34.9	53.9	19.0	*1)*2)
Vert	4964.000	AV	41.2	32.2	8.1	31.7	2.6	52.4	53.9	1.5	
Vert	7446.000	AV	33.3	36.4	9.3	32.7	-	46.3	53.9	7.6	Floor noise
Vert	9928.000	AV	32.4	38.9	9.7	33.4	-	47.6	53.9	6.3	Floor noise
Vert	12410.000	AV	34.7	39.7	-1.2	33.3	2.6	42.5	53.9	11.4	

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).

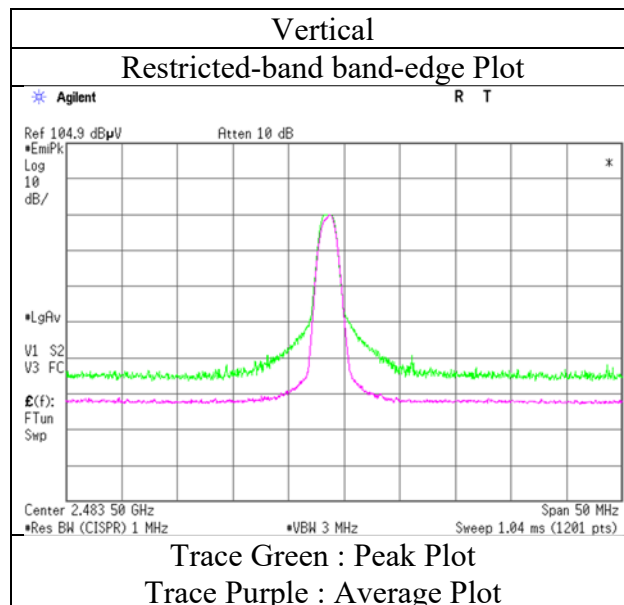
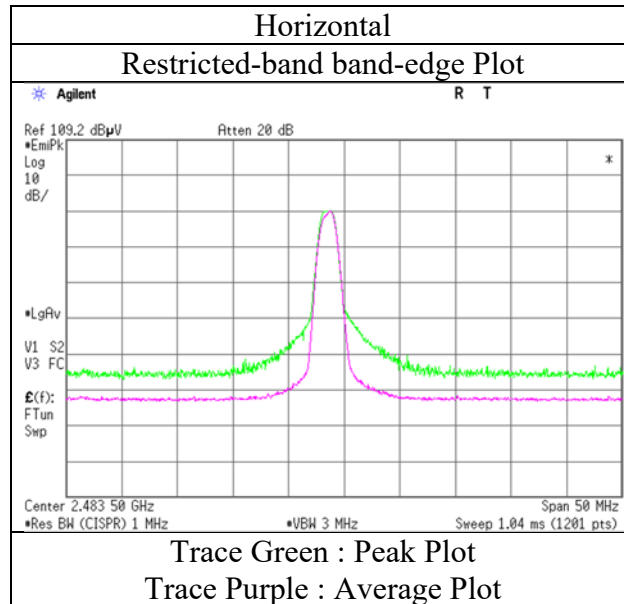
Distance factor: 1 GHz - 10 GHz 20log (4 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

*2) Marker-delta method

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12299614H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 30, 2018
Temperature / Humidity	21 deg. C / 68 % RH
Engineer	Tomoki Matsui
	(1 GHz - 10 GHz)
Mode	Tx 1 Mbps 2482 MHz



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

Radiated Spurious Emission

Report No. 12299614H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date May 30, 2018 May 31, 2018
Temperature / Humidity 21 deg. C / 68 % RH 22 deg. C / 67 % RH
Engineer Tomoki Matsui Takumi Shimada
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz and Below 1 GHz)
Mode Tx 2 Mbps 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	50.000	QP	22.5	10.7	7.5	32.2	-	8.5	40.0	31.5	
Hori	59.384	QP	22.7	7.5	7.6	32.2	-	5.6	40.0	34.4	
Hori	175.673	QP	25.2	16.2	9.0	32.1	-	18.3	43.5	25.2	
Hori	400.000	QP	21.5	15.5	10.7	32.1	-	15.6	46.0	30.4	
Hori	500.000	QP	21.7	17.5	11.3	32.1	-	18.4	46.0	27.6	
Hori	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Hori	2390.000	PK	41.1	27.7	5.7	32.7	-	41.8	73.9	32.1	
Hori	4804.000	PK	45.8	31.6	8.1	31.8	-	53.7	73.9	20.2	
Hori	7206.000	PK	44.6	36.0	9.3	32.6	-	57.3	73.9	16.6	
Hori	9608.000	PK	41.3	38.5	9.7	33.3	-	56.2	73.9	17.7	Floor noise
Hori	12010.000	PK	45.2	39.7	-1.3	33.4	-	50.2	73.9	23.7	
Hori	2390.000	AV	32.4	27.7	5.7	32.7	3.8	36.9	53.9	17.0	*1)
Hori	4804.000	AV	38.4	31.6	8.1	31.8	3.8	50.1	53.9	3.8	
Hori	7206.000	AV	34.5	36.0	9.3	32.6	3.8	51.0	53.9	2.9	
Hori	9608.000	AV	32.8	38.5	9.7	33.3	-	47.7	53.9	6.2	Floor noise
Hori	12010.000	AV	35.7	39.7	-1.3	33.4	3.8	44.5	53.9	9.4	
Vert	50.027	QP	27.8	10.7	7.5	32.2	-	13.8	40.0	26.2	
Vert	59.132	QP	27.5	7.6	7.6	32.2	-	10.5	40.0	29.5	
Vert	175.717	QP	25.6	16.2	9.0	32.1	-	18.7	43.5	24.8	
Vert	400.000	QP	21.6	15.5	10.7	32.1	-	15.7	46.0	30.3	
Vert	500.000	QP	21.7	17.5	11.3	32.1	-	18.4	46.0	27.6	
Vert	700.000	QP	21.8	19.6	12.5	32.2	-	21.7	46.0	24.3	
Vert	2390.000	PK	41.5	27.7	5.7	32.7	-	42.2	73.9	31.7	
Vert	4804.000	PK	46.2	31.6	8.1	31.8	-	54.1	73.9	19.8	
Vert	7206.000	PK	41.4	36.0	9.3	32.6	-	54.1	73.9	19.8	Floor noise
Vert	9608.000	PK	41.3	38.5	9.7	33.3	-	56.2	73.9	17.7	Floor noise
Vert	12010.000	PK	45.4	39.7	-1.3	33.4	-	50.4	73.9	23.5	
Vert	2390.000	AV	32.4	27.7	5.7	32.7	3.8	36.9	53.9	17.0	*1)
Vert	4804.000	AV	40.6	31.6	8.1	31.8	3.8	52.3	53.9	1.6	
Vert	7206.000	AV	32.5	36.0	9.3	32.6	-	45.2	53.9	8.7	Floor noise
Vert	9608.000	AV	32.8	38.5	9.7	33.3	-	47.7	53.9	6.2	Floor noise
Vert	12010.000	AV	35.3	39.7	-1.3	33.4	3.8	44.1	53.9	9.8	

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 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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	82.7	27.7	5.7	32.7	83.4	-	-	Carrier
Hori	2400.000	PK	48.2	27.7	5.7	32.7	48.9	63.4	14.5	
Vert	2402.000	PK	79.8	27.7	5.7	32.7	80.5	-	-	Carrier
Vert	2400.000	PK	46.2	27.7	5.7	32.7	46.9	60.5	13.6	

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

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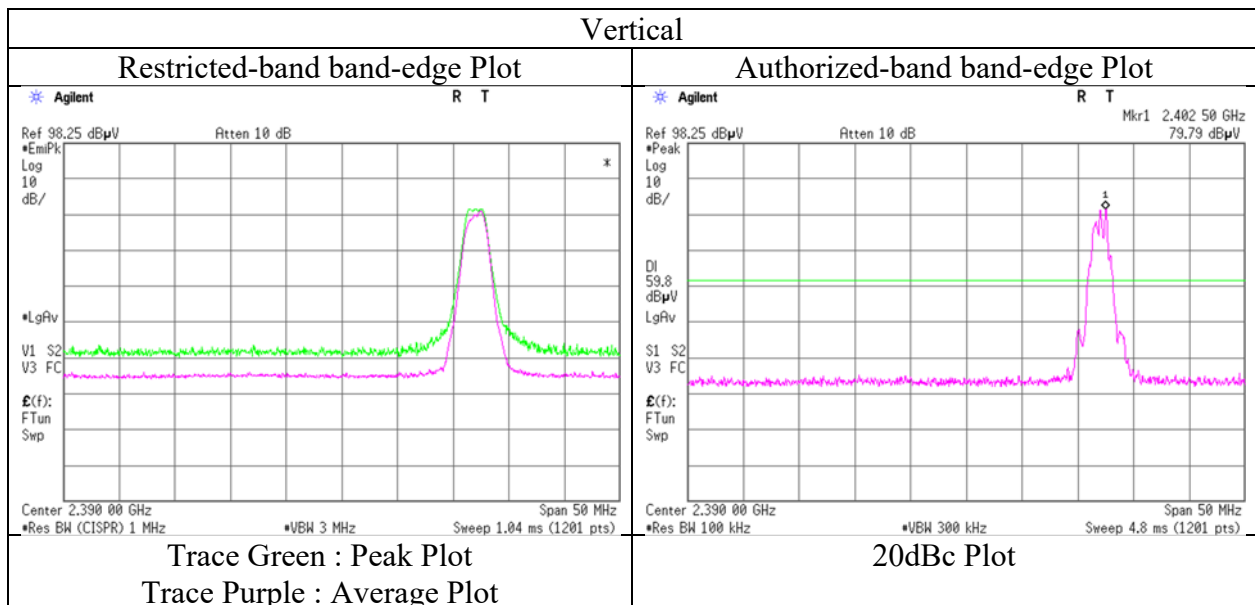
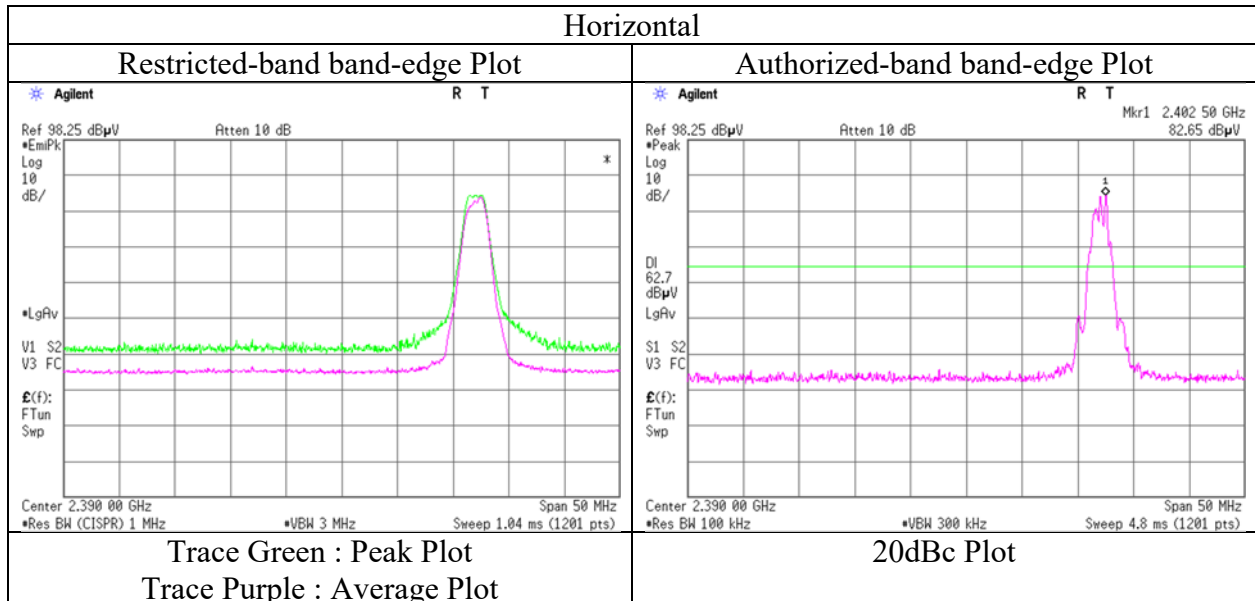
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12299614H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 30, 2018
Temperature / Humidity	21 deg. C / 68 % RH
Engineer	Tomoki Matsui
	(1 GHz - 10 GHz)
Mode	Tx 2 Mbps 2402 MHz



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

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Radiated Spurious Emission

Report No.	12299614H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 30, 2018	May 31, 2018
Temperature / Humidity	21 deg. C / 68 % RH	22 deg. C / 67 % RH
Engineer	Tomoki Matsui	Takumi Shimada
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz and Below 1 GHz)
Mode	Tx 2 Mbps 2441 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	50.000	QP	22.5	10.7	7.5	32.2	-	8.5	40.0	31.5	
Hori	59.508	QP	22.7	7.5	7.6	32.2	-	5.6	40.0	34.4	
Hori	173.523	QP	23.5	16.1	9.0	32.1	-	16.5	43.5	27.0	
Hori	400.000	QP	21.6	15.5	10.7	32.1	-	15.7	46.0	30.3	
Hori	500.000	QP	21.7	17.5	11.3	32.1	-	18.4	46.0	27.6	
Hori	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Hori	4882.000	PK	44.6	31.9	8.1	31.7	-	52.9	73.9	21.0	
Hori	7323.000	PK	42.1	36.2	9.4	32.7	-	55.0	73.9	18.9	Floor noise
Hori	9764.000	PK	41.6	38.7	9.7	33.4	-	56.6	73.9	17.3	Floor noise
Hori	12205.000	PK	45.4	39.7	-1.3	33.3	-	50.5	73.9	23.4	
Hori	4882.000	AV	37.9	31.9	8.1	31.7	3.8	50.0	53.9	3.9	
Hori	7323.000	AV	32.7	36.2	9.4	32.7	-	45.6	53.9	8.3	Floor noise
Hori	9764.000	AV	32.9	38.7	9.7	33.4	-	47.9	53.9	6.0	Floor noise
Hori	12205.000	AV	35.4	39.7	-1.3	33.3	3.8	44.3	53.9	9.6	
Vert	49.817	QP	28.0	10.7	7.5	32.2	-	14.0	40.0	26.0	
Vert	59.633	QP	28.1	7.5	7.6	32.2	-	11.0	40.0	29.0	
Vert	173.350	QP	24.0	16.1	9.0	32.1	-	17.0	43.5	26.5	
Vert	400.000	QP	21.6	15.5	10.7	32.1	-	15.7	46.0	30.3	
Vert	500.000	QP	21.6	17.5	11.3	32.1	-	18.3	46.0	27.7	
Vert	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Vert	4882.000	PK	46.9	31.9	8.1	31.7	-	55.2	73.9	18.7	
Vert	7323.000	PK	42.1	36.2	9.4	32.7	-	55.0	73.9	18.9	Floor noise
Vert	9764.000	PK	41.6	38.7	9.7	33.4	-	56.6	73.9	17.3	Floor noise
Vert	12205.000	PK	44.8	39.7	-1.3	33.3	-	49.9	73.9	24.0	
Vert	4882.000	AV	40.3	31.9	8.1	31.7	3.8	52.4	53.9	1.5	
Vert	7323.000	AV	32.7	36.2	9.4	32.7	-	45.6	53.9	8.3	Floor noise
Vert	9764.000	AV	32.9	38.7	9.7	33.4	-	47.9	53.9	6.0	Floor noise
Vert	12205.000	AV	34.6	39.7	-1.3	33.3	3.8	43.5	53.9	10.4	

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 m / 3.0 m) = 2.5 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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Radiated Spurious Emission

Report No.	12299614H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 30, 2018	May 31, 2018
Temperature / Humidity	21 deg. C / 68 % RH	22 deg. C / 67 % RH
Engineer	Tomoki Matsui	Takumi Shimada
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz and Below 1 GHz)
Mode	Tx 2 Mbps 2482 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	50.000	QP	22.6	10.7	7.5	32.2	-	8.6	40.0	31.4	
Hori	59.769	QP	22.7	7.4	7.6	32.2	-	5.5	40.0	34.5	
Hori	178.825	QP	26.0	16.3	9.0	32.1	-	19.2	43.5	24.3	
Hori	400.000	QP	21.6	15.5	10.7	32.1	-	15.7	46.0	30.3	
Hori	500.000	QP	21.8	17.5	11.3	32.1	-	18.5	46.0	27.5	
Hori	700.000	QP	21.7	19.6	12.5	32.2	-	21.6	46.0	24.4	
Hori	2483.500	PK	48.6	27.8	5.8	32.7	-	49.5	73.9	24.4	*2)
Hori	4964.000	PK	45.5	32.2	8.1	31.7	-	54.1	73.9	19.8	
Hori	7446.000	PK	42.4	36.4	9.3	32.7	-	55.4	73.9	18.5	
Hori	9928.000	PK	40.8	38.9	9.7	33.4	-	56.0	73.9	17.9	Floor noise
Hori	12410.000	PK	43.9	39.7	-1.2	33.3	-	49.1	73.9	24.8	
Hori	2483.500	AV	44.2	27.8	5.8	32.7	3.8	48.9	53.9	5.0	*1) *2)
Hori	4964.000	AV	39.2	32.2	8.1	31.7	3.8	51.6	53.9	2.3	
Hori	7446.000	AV	33.3	36.4	9.3	32.7	-	46.3	53.9	7.6	Floor noise
Hori	9928.000	AV	32.4	38.9	9.7	33.4	-	47.6	53.9	6.3	Floor noise
Hori	12410.000	AV	34.1	39.7	-1.2	33.3	3.8	43.1	53.9	10.8	
Vert	50.117	QP	28.7	10.6	7.5	32.2	-	14.6	40.0	25.4	
Vert	59.650	QP	28.4	7.5	7.6	32.2	-	11.3	40.0	28.7	
Vert	179.417	QP	25.5	16.3	9.0	32.1	-	18.7	43.5	24.8	
Vert	400.000	QP	21.7	15.5	10.7	32.1	-	15.8	46.0	30.2	
Vert	500.000	QP	21.6	17.5	11.3	32.1	-	18.3	46.0	27.7	
Vert	700.000	QP	21.8	19.6	12.5	32.2	-	21.7	46.0	24.3	
Vert	2483.500	PK	45.6	27.8	5.8	32.7	-	46.5	73.9	27.4	*2)
Vert	4964.000	PK	47.3	32.2	8.1	31.7	-	55.9	73.9	18.0	
Vert	7446.000	PK	42.4	36.4	9.3	32.7	-	55.4	73.9	18.5	Floor noise
Vert	9928.000	PK	40.8	38.9	9.7	33.4	-	56.0	73.9	17.9	Floor noise
Vert	12410.000	PK	43.3	39.7	-1.2	33.3	-	48.5	73.9	25.4	
Vert	2483.500	AV	40.7	27.8	5.8	32.7	3.8	45.4	53.9	8.5	*1) *2)
Vert	4964.000	AV	40.7	32.2	8.1	31.7	3.8	53.1	53.9	0.8	
Vert	7446.000	AV	33.3	36.4	9.3	32.7	-	46.3	53.9	7.6	Floor noise
Vert	9928.000	AV	32.4	38.9	9.7	33.4	-	47.6	53.9	6.3	Floor noise
Vert	12410.000	AV	34.5	39.7	-1.2	33.3	3.8	43.5	53.9	10.4	

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 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

*2) Marker-delta method

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Ise EMC Lab.

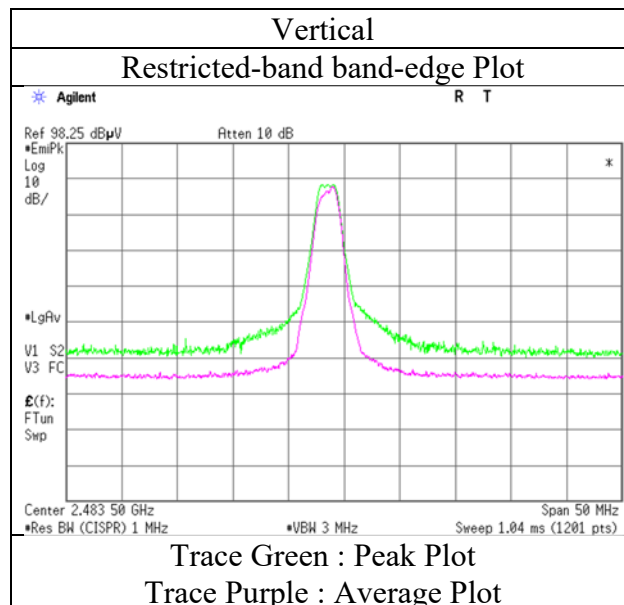
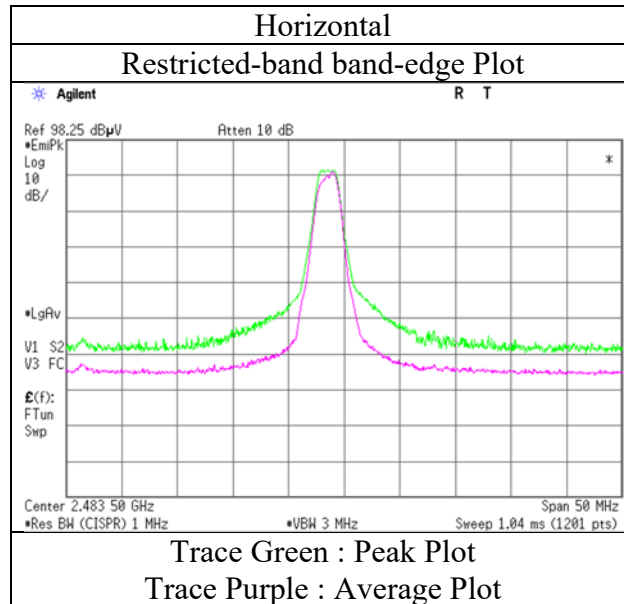
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12299614H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 30, 2018
Temperature / Humidity	21 deg. C / 68 % RH
Engineer	Tomoki Matsui
	(1 GHz - 10 GHz)
Mode	Tx 2 Mbps 2482 MHz



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

UL Japan, Inc.

Ise EMC Lab.

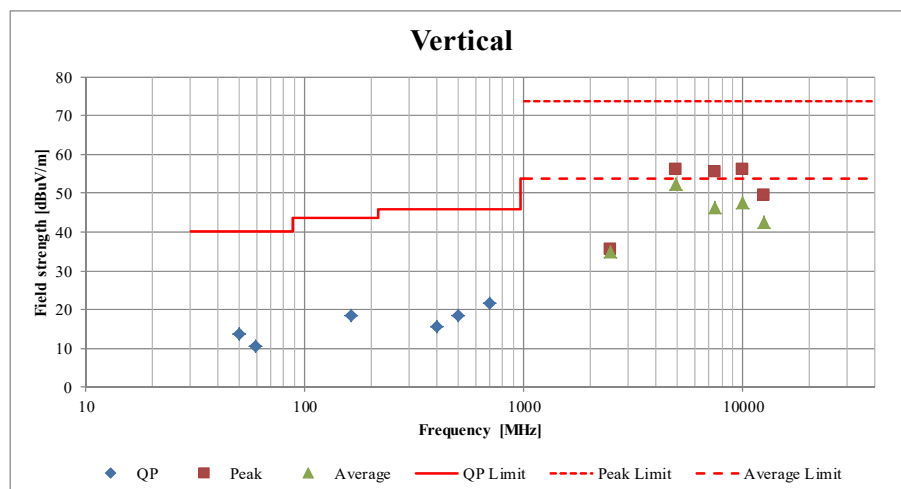
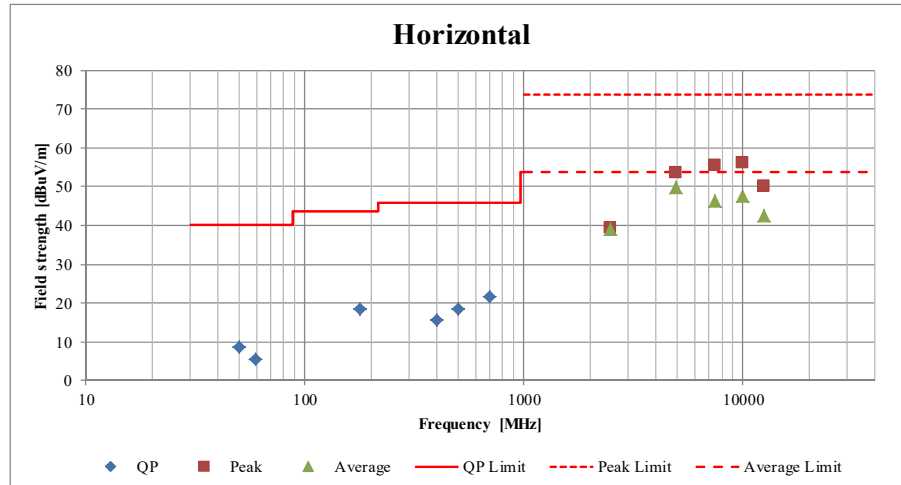
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Radiated Spurious Emission **(Plot data, Worst case)**

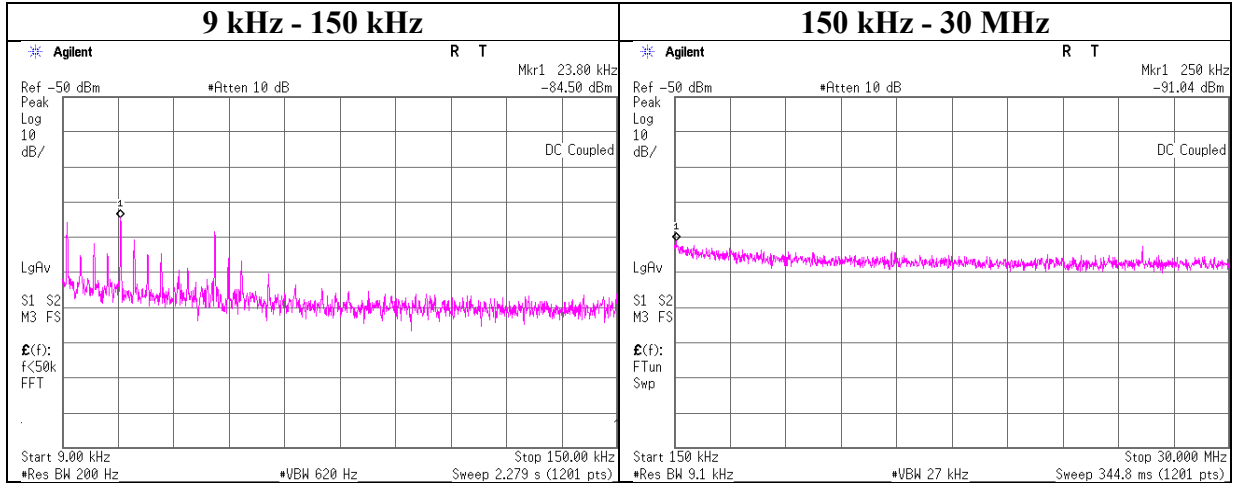
Report No.	12299614H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 30, 2018	May 31, 2018
Temperature / Humidity	21 deg. C / 68 % RH	22 deg. C / 67 % RH
Engineer	Tomoki Matsui	Takumi Shimada
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz and Below 1 GHz)
Mode	Tx 1 Mbps 2482 MHz	



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

Conducted Spurious Emission

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 1 Mbps 2402 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
23.80	-84.5	0.01	0.0	2.0	1	-82.5	300	6.0	-21.2	40.0	61.2	
250.00	-91.0	0.01	0.0	2.0	1	-89.0	300	6.0	-27.8	19.6	47.4	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

UL Japan, Inc.

Ise EMC Lab.

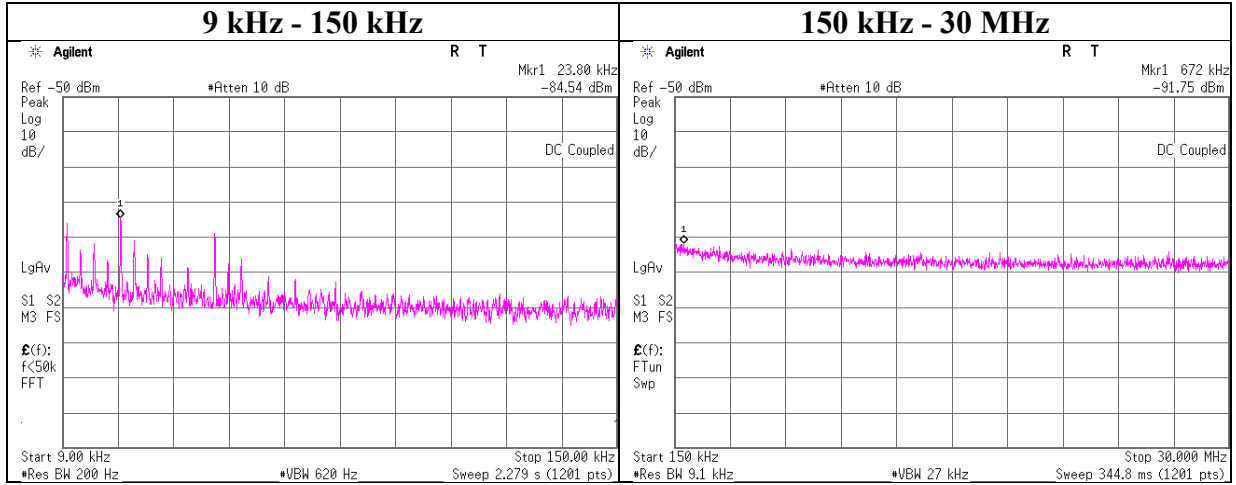
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Conducted Spurious Emission

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 1 Mbps 2441 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
23.80	-84.5	0.01	0.0	2.0	1	-82.5	300	6.0	-21.2	40.0	61.2	
672.00	-91.8	0.01	0.0	2.0	1	-89.7	30	6.0	-8.5	31.0	39.5	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Ise EMC Lab.

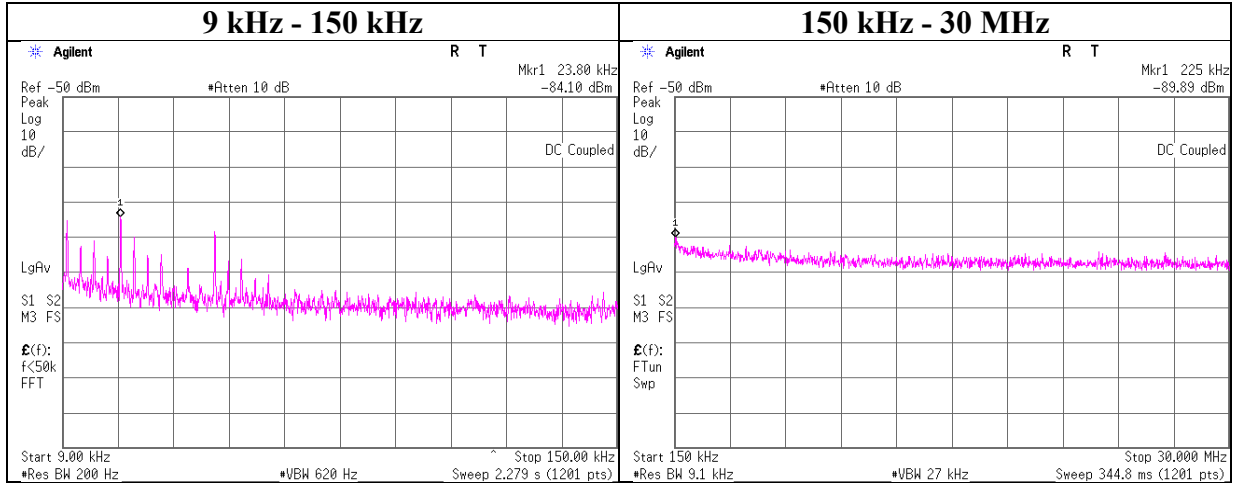
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 1 Mbps 2482 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
23.80	-84.1	0.01	0.0	2.0	1	-82.1	300	6.0	-20.8	40.0	60.8	
225.00	-89.9	0.01	0.0	2.0	1	-87.9	300	6.0	-26.6	20.5	47.1	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

UL Japan, Inc.

Ise EMC Lab.

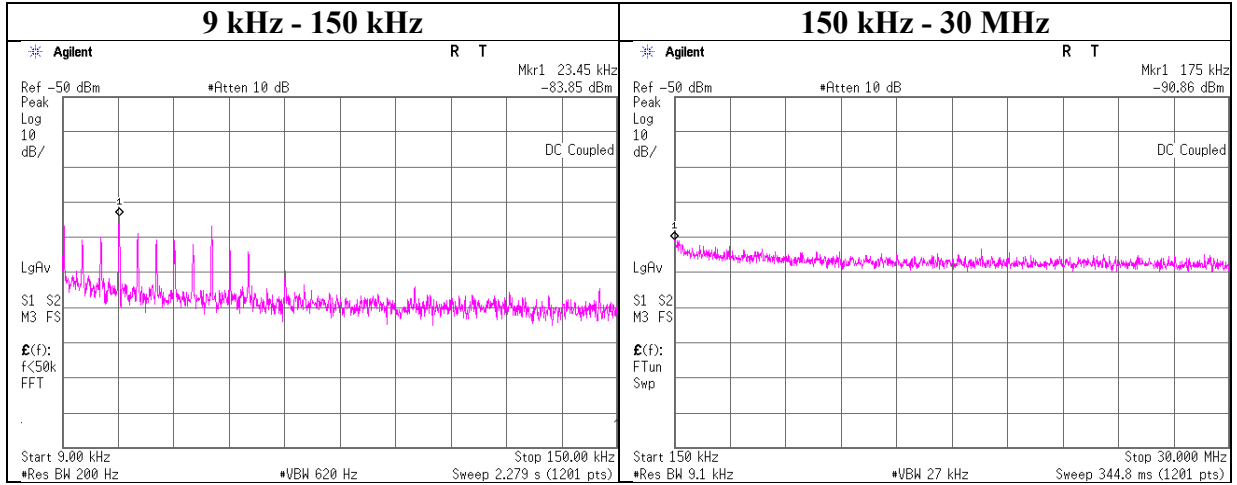
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Conducted Spurious Emission

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 2 Mbps 2402 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
23.45	-83.9	0.01	0.0	2.0	1	-81.8	300	6.0	-20.6	40.2	60.8	
175.00	-90.9	0.01	0.0	2.0	1	-88.9	300	6.0	-27.6	22.7	50.3	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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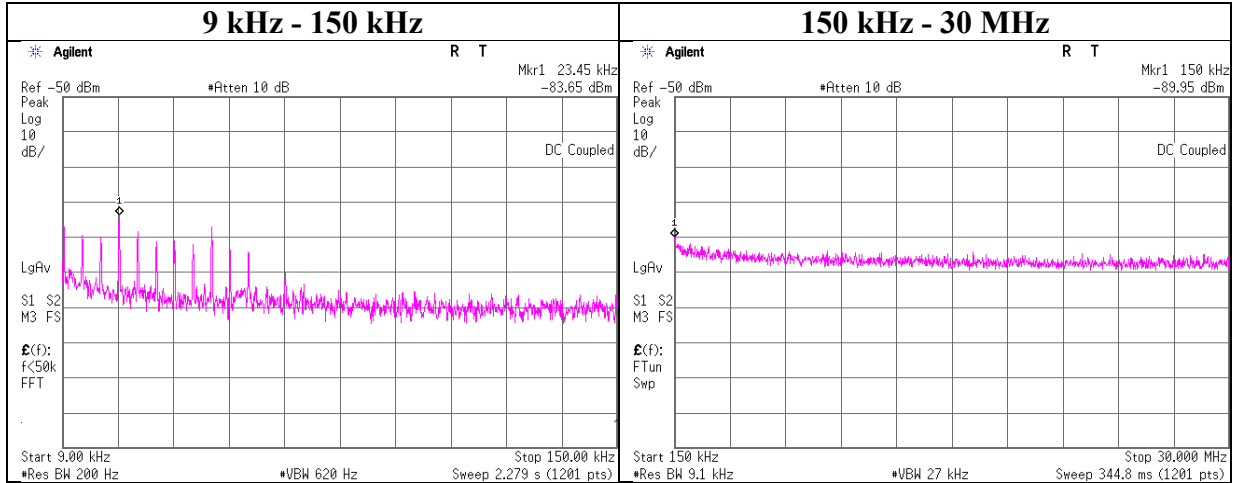
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Conducted Spurious Emission

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 2 Mbps 2441 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
23.45	-83.6	0.01	0.0	2.0	1	-81.6	300	6.0	-20.3	40.2	60.5	
150.00	-89.9	0.01	0.0	2.0	1	-87.9	300	6.0	-26.6	24.0	50.6	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Ise EMC Lab.

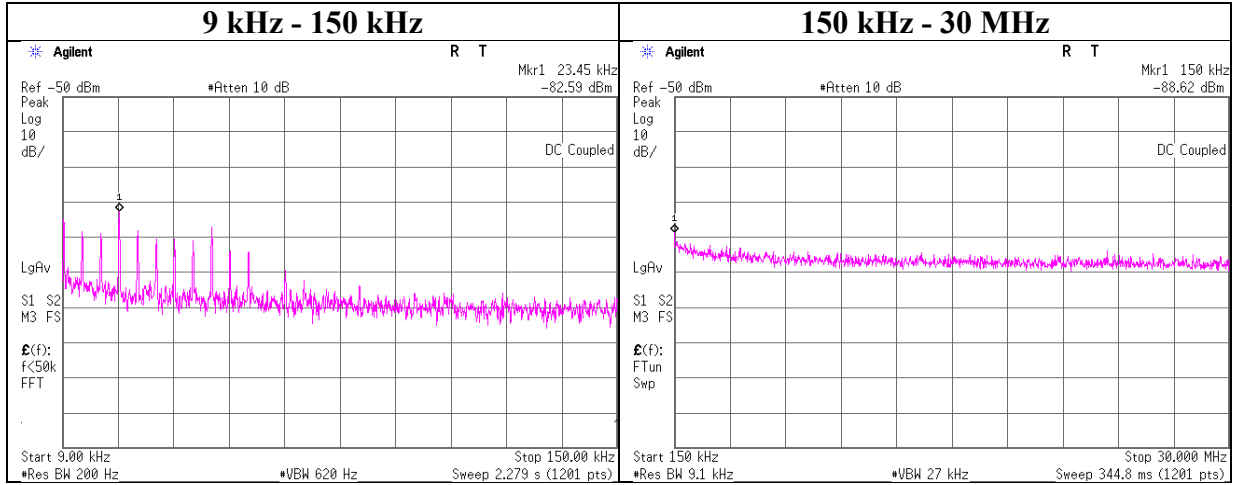
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Conducted Spurious Emission

Report No.	12299614H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 29, 2018
Temperature / Humidity	23 deg. C / 50 % RH
Engineer	Tomoki Matsui
Mode	Tx 2 Mbps 2482 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
23.45	-82.5	0.01	0.0	2.0	1	-80.5	300	6.0	-19.2	40.2	59.4	
150.00	-88.6	0.01	0.0	2.0	1	-86.6	300	6.0	-25.3	24.0	49.3	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Power Density

Report No. 12299614H
Test place Ise EMC Lab. No.7 Shielded Room
Date May 29, 2018
Temperature / Humidity 23 deg. C / 50 % RH
Engineer Tomoki Matsui
Mode Tx

1 Mbps

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-27.65	1.60	0.00	-26.05	8.00	34.05
2441.00	-27.34	1.63	0.00	-25.71	8.00	33.71
2482.00	-27.02	1.66	0.00	-25.36	8.00	33.36

2 Mbps

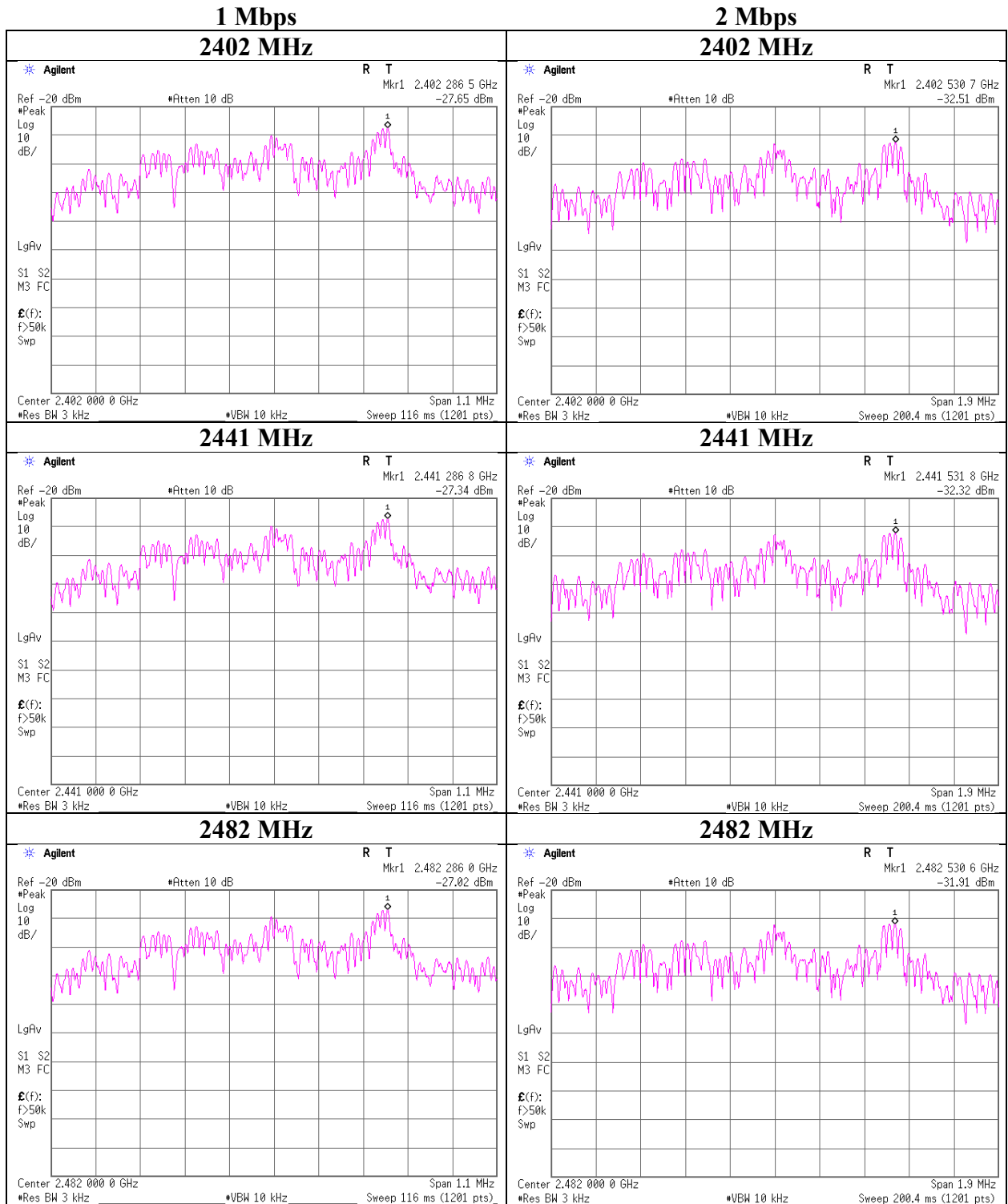
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-32.51	1.60	0.00	-30.91	8.00	38.91
2441.00	-32.32	1.63	0.00	-30.69	8.00	38.69
2482.00	-31.91	1.66	0.00	-30.25	8.00	38.25

Sample Calculation:

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

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

Power Density



UL Japan, Inc.

Ise EMC Lab.

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APPENDIX 2: Test instruments

Test Instruments

Test item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
CE	141216	Coaxial cable	Fujikura/Suhner /TSJ	5D-2W/SFM14/sucoform141-PE/421-010	-/00640	7/12/2017	7/31/2018	12
CE	141357	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	7/24/2017	7/31/2018	12
RE	141417	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	5/7/2018	5/31/2019	12
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	1/24/2018	1/31/2019	12
RE	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	9/22/2017	9/30/2018	12
RE	141580	MicroWave System Amplifier	AGILENT	83017A	MY39500779	3/13/2018	3/31/2019	12
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	141513	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	5/13/2017	5/30/2018	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	5/21/2017	5/30/2018	12
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	1/9/2018	1/31/2019	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	142008	AC3 Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	10/31/2017	10/31/2018	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	11/5/1900	260834	2/27/2018	2/28/2019	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	8/22/2017	8/31/2018	12
RE	141266	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	1/30/2018	1/31/2019	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	10/2/2017	10/31/2018	12
RE	141323	Coaxial cable	UL Japan	-	-	7/12/2017	7/31/2018	12
AT	141809	Power Meter	ANRITSU	ML2495A	825002	5/21/2018	5/31/2019	12
AT	141903	Spectrum Analyzer	AGILENT	E4440A	MY46186390	9/20/2017	9/30/2018	12
AT	141830	Power sensor	ANRITSU	MA2411B	738285	5/21/2018	5/31/2019	12
AT	141328	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	4/24/2018	4/30/2019	12
AT	141572	Thermo-Hygrometer	CUSTOM	CTH-201	3401	1/24/2018	1/31/2019	12

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

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

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

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

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

UL Japan, Inc.

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