



RADIO TEST REPORT

Test Report No. : 12491766H

Applicant : OMRON HEALTHCARE Co., Ltd.
Type of Equipment : Blood Pressure Monitor
Model No. : HEM-6411T
FCC ID : Q6ZHEM6410T
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.

Date of test: August 29 and September 6, 2018

Representative test engineer:

J. Nagatomi

Junki Nagatomi
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Consumer Technology Division

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Takayuki S.

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Leader

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

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SECTION 1: Customer information

Company Name	:	OMRON HEALTHCARE Co., Ltd.
Address	:	53, Kunotsubo, Terado-cho, Muko, KYOTO, 617-0002 Japan
Telephone Number	:	+81-75-925-2045
Facsimile Number	:	+81-75-925-2046
Contact Person	:	Toshiaki Yuasa

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

2.1 Identification of E.U.T.

Type of Equipment	:	Blood Pressure Monitor
Model No.	:	HEM-6411T
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.8 V
Receipt Date of Sample	:	September 5, 2018
Country of Mass-production	:	Japan
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

Model: HEM-6411T (referred to as the EUT in this report) is a Blood Pressure Monitor.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Antenna type	:	Chip Antenna
Antenna Gain	:	3.77 dBi
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 902-928 MHz,
2400-2483.5 MHz, and 5725-5850 MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	N/A *1)	N/A	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section 15.247(a)(2)	See data.	Complied	Conducted
	IC: -	IC: RSS-247 5.2(a)			
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section 15.247(b)(3)		Complied	Conducted
	IC: RSS-Gen 6.12	IC: RSS-247 5.4(d)			
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section 15.247(e)		Complied	Conducted
	IC: -	IC: RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05	FCC: Section 15.247(d)	12.3 dB 4804.00 MHz, AV, Horizontal	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)
	IC: RSS-Gen 6.13	IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

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

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line and during USB charging EUT can not transmit Radio frequency.

*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05 8.5 and 8.6.

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 test was performed with the full-charged battery and the stable voltage was supplied to the RF part during the tests. Therefore, the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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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 $k=2$.

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

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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.

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

4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth Low Energy (BT LE)	Payload: PRBS9 Uncoded 1M-PHY
*Transmitting duty was 100 % on all tests.	
*Power of the EUT was set by the software as follows; Power settings: 0 dBm Software: OPM-Communication Tool Version 1.0.0.0 *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)

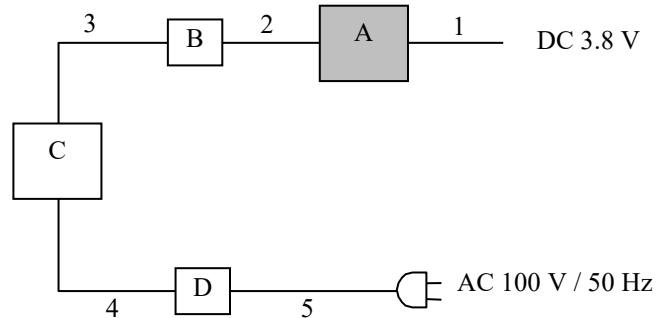
Test Item	Operating Mode	Tested frequency
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth Spurious Emission(Radiated / Conducted)	Tx BT LE	2402 MHz 2440 MHz 2480 MHz

4.2 Configuration and peripherals

[For Radiated Emission test]



[For Antenna Terminal Conducted test]



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Blood Pressure Monitor	HEM-6411T	W5-12 *1) 80 *2)	OMRON HEALTHCARE Co., Ltd.	EUT
B	Jig	-	-	-	-
C	Laptop PC	PC-BL530VH6B	99185918A	NEC	-
D	AC Adapter	ADP-60NH	9903033DD	NEC	-

*1) Used for Radiated Emission test

*2) Used for Antenna Terminal conducted test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.05	Unshielded	Unshielded	-
2	DC Cable	0.10	Unshielded	Unshielded	-
3	USB Cable	1.50	Shielded	Shielded	-
4	DC Cable	2.00	Unshielded	Unshielded	-
5	AC Cable	1.00	Unshielded	Unshielded	-

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SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05".

[For below 1 GHz]

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

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 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	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 ANSI C63.10-2013.

*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 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	3 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected 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

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APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

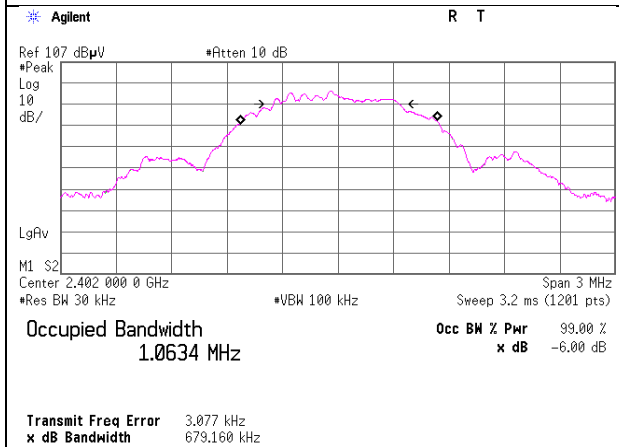
Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
BT LE	2402	1063.4	0.753	> 0.5000
	2440	1064.0	0.752	> 0.5000
	2480	1063.2	0.751	> 0.5000

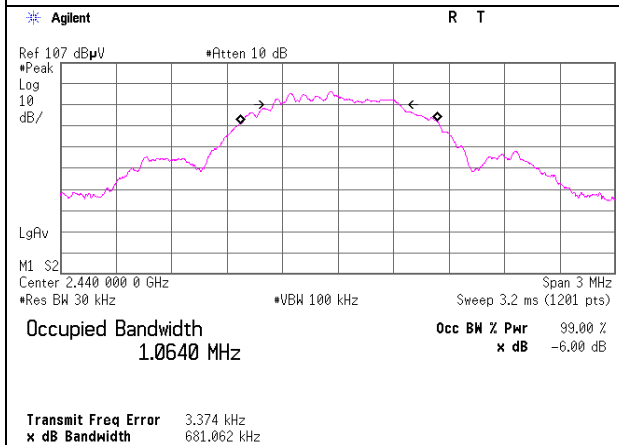
99%Occupied Bandwidth

BT LE

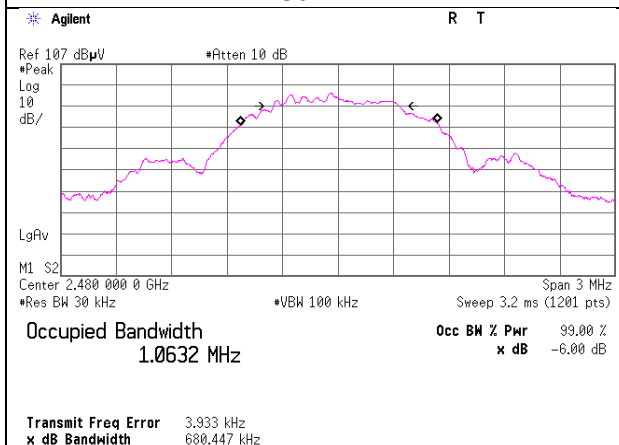
2402 MHz



2440 MHz



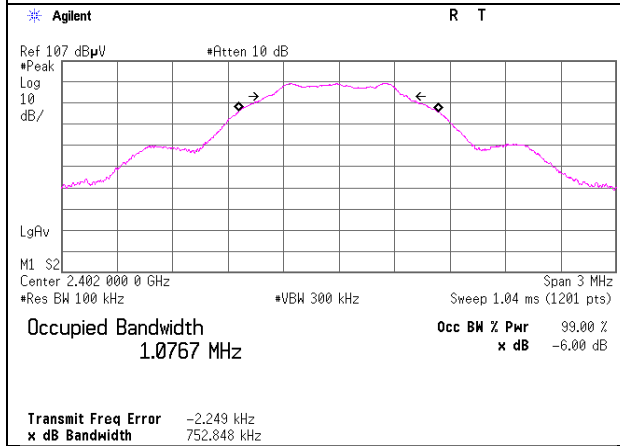
2480 MHz



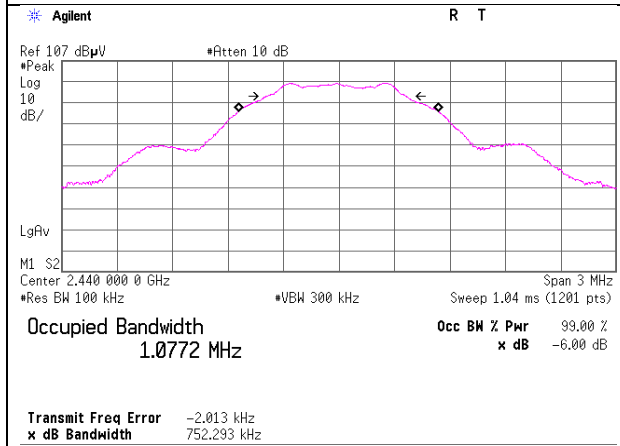
6dB Bandwidth

BT LE

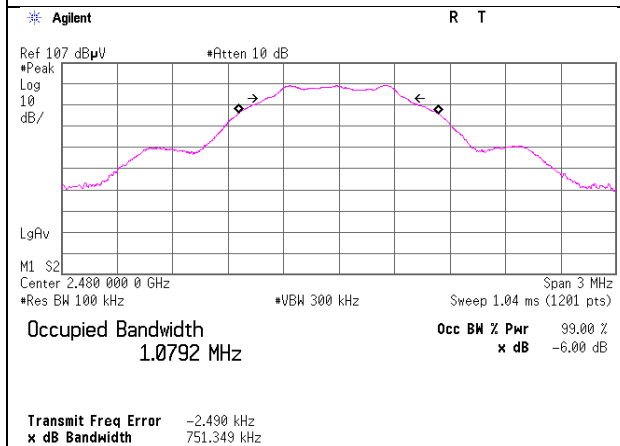
2402 MHz



2440 MHz



2480 MHz



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Maximum Peak Output Power

Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-9.92	0.50	10.04	0.62	1.15	30.00	1000	29.38	3.77	4.39	2.75	36.02	4000	31.63
2440	-9.92	0.50	10.04	0.62	1.15	30.00	1000	29.38	3.77	4.39	2.75	36.02	4000	31.63
2480	-9.91	0.50	10.04	0.63	1.16	30.00	1000	29.37	3.77	4.40	2.75	36.02	4000	31.62

Sample Calculation:

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

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

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

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Average Output Power
(Reference data for RF Exposure / SAR testing)

Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result	
				Burst power average	
				[dBm]	[mW]
2402	-10.12	0.50	10.04	0.42	1.10
2440	-10.12	0.50	10.04	0.42	1.10
2480	-10.12	0.50	10.04	0.42	1.10

Sample Calculation:

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

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

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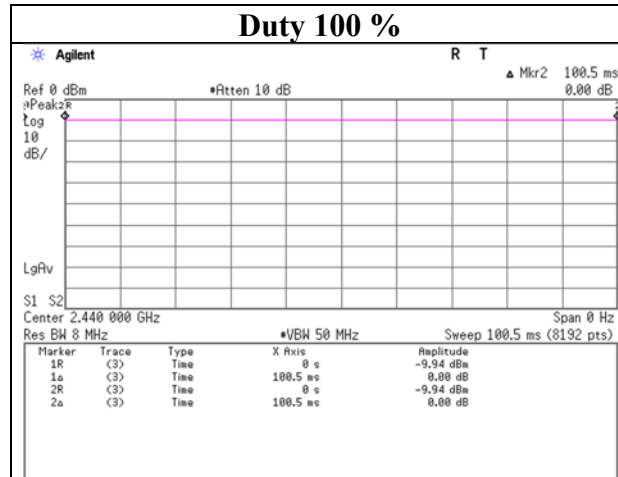
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Burst rate confirmation

Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE



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

Radiated Spurious Emission

Report No. 12491766H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date August 29, 2018 September 6, 2018
Temperature / Humidity 24 deg. C / 67 % RH 23 deg. C / 72 % RH
Engineer Junki Nagatomi Junki Nagatomi
(1 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	39.702	QP	21.3	14.8	7.4	32.1	-	11.4	40.0	28.6	
Hori	166.918	QP	20.8	15.6	8.9	32.0	-	13.3	43.5	30.2	
Hori	322.080	QP	20.4	14.2	10.1	32.0	-	12.7	46.0	33.3	
Hori	527.740	QP	20.6	17.9	11.4	32.1	-	17.8	46.0	28.2	
Hori	723.214	QP	20.9	20.1	12.4	32.1	-	21.3	46.0	24.7	
Hori	863.800	QP	20.3	21.9	13.0	31.4	-	23.8	46.0	22.2	
Hori	2390.000	PK	41.9	27.6	5.9	32.1	-	43.3	73.9	30.6	
Hori	4804.000	PK	41.3	31.4	8.1	31.3	-	49.5	73.9	24.4	
Hori	7206.000	PK	42.2	36.2	9.4	32.4	-	55.4	73.9	18.5	Floor noise
Hori	9608.000	PK	42.0	37.9	8.1	32.6	-	55.4	73.9	18.5	Floor noise
Hori	2390.000	AV	33.5	27.6	5.9	32.1	-	34.9	53.9	19.0	
Hori	4804.000	AV	33.4	31.4	8.1	31.3	-	41.6	53.9	12.3	
Hori	7206.000	AV	33.4	36.2	9.4	32.4	-	46.6	53.9	7.3	Floor noise
Hori	9608.000	AV	33.4	37.9	8.1	32.6	-	46.8	53.9	7.1	Floor noise
Vert	39.702	QP	21.3	14.8	7.4	32.1	-	11.4	40.0	28.6	
Vert	166.918	QP	20.8	15.6	8.9	32.0	-	13.3	43.5	30.2	
Vert	322.080	QP	20.4	14.2	10.1	32.0	-	12.7	46.0	33.3	
Vert	527.740	QP	20.6	17.9	11.4	32.1	-	17.8	46.0	28.2	
Vert	723.214	QP	20.9	20.1	12.4	32.1	-	21.3	46.0	24.7	
Vert	863.800	QP	20.4	21.9	13.0	31.4	-	23.9	46.0	22.1	
Vert	2390.000	PK	41.5	27.6	5.9	32.1	-	42.9	73.9	31.0	
Vert	4804.000	PK	41.3	31.4	8.1	31.3	-	49.5	73.9	24.4	
Vert	7206.000	PK	33.4	36.2	9.4	32.4	-	46.6	73.9	27.3	Floor noise
Vert	9608.000	PK	42.0	37.9	8.1	32.6	-	55.4	73.9	18.5	Floor noise
Vert	2390.000	AV	33.0	27.6	5.9	32.1	-	34.4	53.9	19.5	
Vert	4804.000	AV	33.2	31.4	8.1	31.3	-	41.4	53.9	12.5	
Vert	7206.000	AV	33.4	36.2	9.4	32.4	-	46.6	53.9	7.3	Floor noise
Vert	9608.000	AV	33.4	37.9	8.1	32.6	-	46.8	53.9	7.1	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 20log (4.0 m / 3.0 m) = 2.5 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	2402.000	PK	75.4	27.6	5.9	32.1	76.8	-	-	Carrier
Hori	2400.000	PK	33.5	27.6	5.9	32.1	34.9	56.8	21.9	
Vert	2402.000	PK	74.2	27.6	5.9	32.1	75.6	-	-	Carrier
Vert	2400.000	PK	33.4	27.6	5.9	32.1	34.8	55.6	20.8	

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

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Ise EMC Lab.

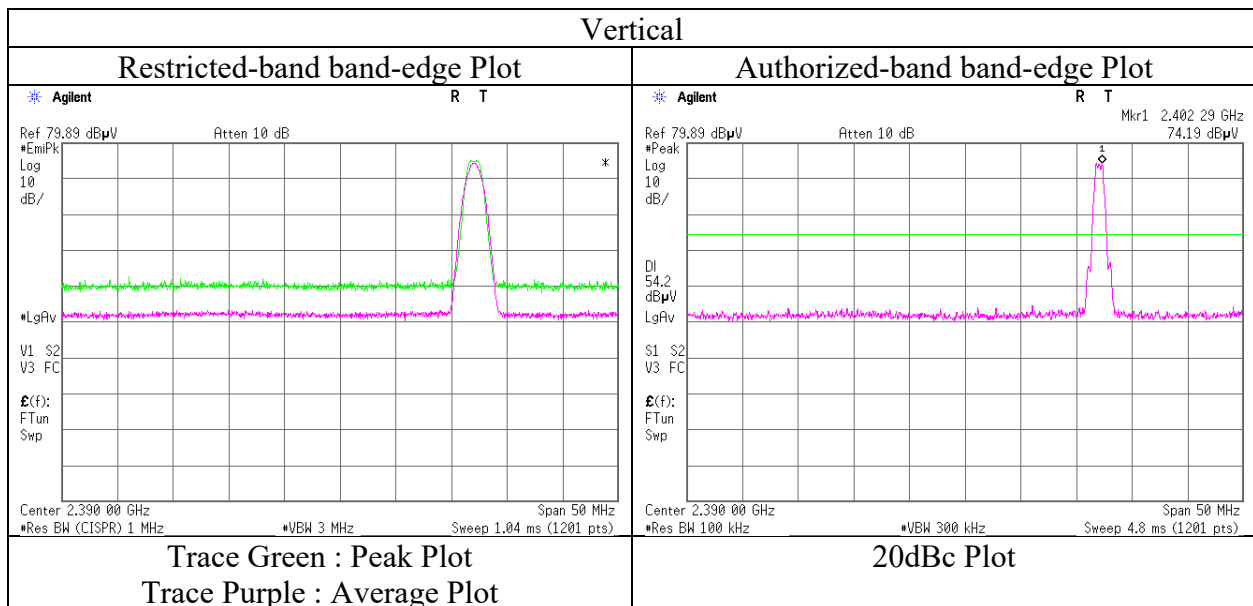
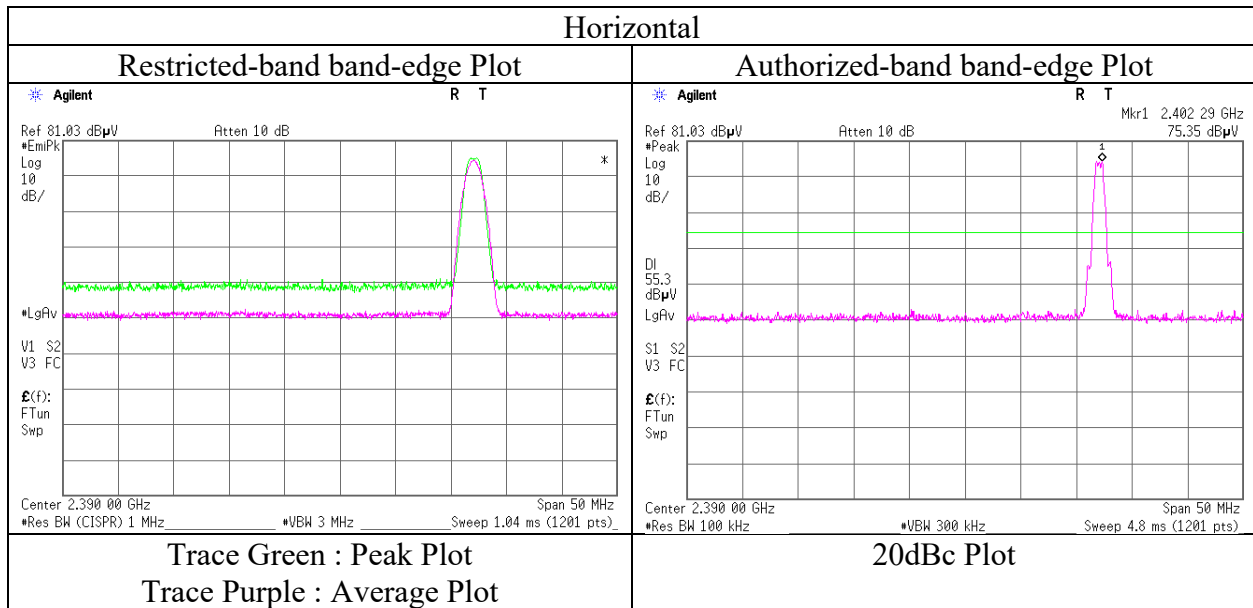
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12491766H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	August 29, 2018
Temperature / Humidity	24 deg. C / 67 % RH
Engineer	Junki Nagatomi
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Report No. 12491766H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date August 29, 2018 September 6, 2018
Temperature / Humidity 24 deg. C / 67 % RH 23 deg. C / 72 % RH
Engineer Junki Nagatomi Junki Nagatomi
(1 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	39.702	QP	21.3	14.8	7.4	32.1	-	11.4	40.0	28.6	
Hori	166.918	QP	20.8	15.6	8.9	32.0	-	13.3	43.5	30.2	
Hori	322.080	QP	20.4	14.2	10.1	32.0	-	12.7	46.0	33.3	
Hori	527.740	QP	20.6	17.9	11.4	32.1	-	17.8	46.0	28.2	
Hori	723.214	QP	20.9	20.1	12.4	32.1	-	21.3	46.0	24.7	
Hori	863.800	QP	20.3	21.9	13.0	31.4	-	23.8	46.0	22.2	
Hori	4880.000	PK	41.1	31.5	8.1	31.2	-	49.5	73.9	24.4	
Hori	7320.000	PK	42.2	36.3	9.4	32.4	-	55.5	73.9	18.4	Floor noise
Hori	9760.000	PK	41.8	38.3	8.1	32.7	-	55.5	73.9	18.4	Floor noise
Hori	4880.000	AV	32.7	31.5	8.1	31.2	-	41.1	53.9	12.8	
Hori	7320.000	AV	33.5	36.3	9.4	32.4	-	46.8	53.9	7.1	Floor noise
Hori	9760.000	AV	33.4	38.3	8.1	32.7	-	47.1	53.9	6.8	Floor noise
Vert	39.702	QP	21.3	14.8	7.4	32.1	-	11.4	40.0	28.6	
Vert	166.918	QP	20.8	15.6	8.9	32.0	-	13.3	43.5	30.2	
Vert	322.080	QP	20.4	14.2	10.1	32.0	-	12.7	46.0	33.3	
Vert	527.740	QP	20.6	17.9	11.4	32.1	-	17.8	46.0	28.2	
Vert	723.214	QP	20.9	20.1	12.4	32.1	-	21.3	46.0	24.7	
Vert	863.800	QP	20.4	21.9	13.0	31.4	-	23.9	46.0	22.1	
Vert	4880.000	PK	41.1	31.5	8.1	31.2	-	49.5	73.9	24.4	
Vert	7320.000	PK	42.2	36.3	9.4	32.4	-	55.5	73.9	18.4	Floor noise
Vert	9760.000	PK	41.8	38.3	8.1	32.7	-	55.5	73.9	18.4	Floor noise
Vert	4880.000	AV	32.8	31.5	8.1	31.2	-	41.2	53.9	12.7	
Vert	7320.000	AV	33.5	36.3	9.4	32.4	-	46.8	53.9	7.1	Floor noise
Vert	9760.000	AV	33.4	38.3	8.1	32.7	-	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 20log (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

UL Japan, Inc.

Ise EMC Lab.

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Radiated Spurious Emission

Report No.	12491766H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 29, 2018	September 6, 2018
Temperature / Humidity	24 deg. C / 67 % RH	23 deg. C / 72 % RH
Engineer	Junki Nagatomi	Junki Nagatomi
	(1 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	39.702	QP	21.3	14.8	7.4	32.1	-	11.4	40.0	28.6	
Hori	166.918	QP	20.8	15.6	8.9	32.0	-	13.3	43.5	30.2	
Hori	322.080	QP	20.4	14.2	10.1	32.0	-	12.7	46.0	33.3	
Hori	527.740	QP	20.6	17.9	11.4	32.1	-	17.8	46.0	28.2	
Hori	723.214	QP	20.9	20.1	12.4	32.1	-	21.3	46.0	24.7	
Hori	863.800	QP	20.3	21.9	13.0	31.4	-	23.8	46.0	22.2	
Hori	2483.500	PK	42.0	27.5	5.9	32.0	-	43.4	73.9	30.5	
Hori	4960.000	PK	40.3	31.7	8.1	31.2	-	48.9	73.9	25.0	
Hori	7440.000	PK	41.8	36.4	9.3	32.5	-	55.0	73.9	18.9	Floor noise
Hori	9920.000	PK	42.0	38.4	8.2	32.8	-	55.8	73.9	18.1	Floor noise
Hori	2483.500	AV	33.1	27.5	5.9	32.0	-	34.5	53.9	19.4	
Hori	4960.000	AV	32.1	31.7	8.1	31.2	-	40.7	53.9	13.2	
Hori	7440.000	AV	33.5	36.4	9.3	32.5	-	46.7	53.9	7.2	Floor noise
Hori	9920.000	AV	33.4	38.4	8.2	32.8	-	47.2	53.9	6.7	Floor noise
Vert	39.702	QP	21.3	14.8	7.4	32.1	-	11.4	40.0	28.6	
Vert	166.918	QP	20.8	15.6	8.9	32.0	-	13.3	43.5	30.2	
Vert	322.080	QP	20.4	14.2	10.1	32.0	-	12.7	46.0	33.3	
Vert	527.740	QP	20.6	17.9	11.4	32.1	-	17.8	46.0	28.2	
Vert	723.214	QP	20.9	20.1	12.4	32.1	-	21.3	46.0	24.7	
Vert	863.800	QP	20.4	21.9	13.0	31.4	-	23.9	46.0	22.1	
Vert	2483.500	PK	41.5	27.5	5.9	32.0	-	42.9	73.9	31.0	
Vert	4960.000	PK	40.1	31.7	8.1	31.2	-	48.7	73.9	25.2	
Vert	7440.000	PK	41.8	36.4	9.3	32.5	-	55.0	73.9	18.9	Floor noise
Vert	9920.000	PK	42.0	38.4	8.2	32.8	-	55.8	73.9	18.1	Floor noise
Vert	2483.500	AV	33.1	27.5	5.9	32.0	-	34.5	53.9	19.4	
Vert	4960.000	AV	32.0	31.7	8.1	31.2	-	40.6	53.9	13.3	
Vert	7440.000	AV	33.5	36.4	9.3	32.5	-	46.7	53.9	7.2	Floor noise
Vert	9920.000	AV	33.4	38.4	8.2	32.8	-	47.2	53.9	6.7	Floor noise

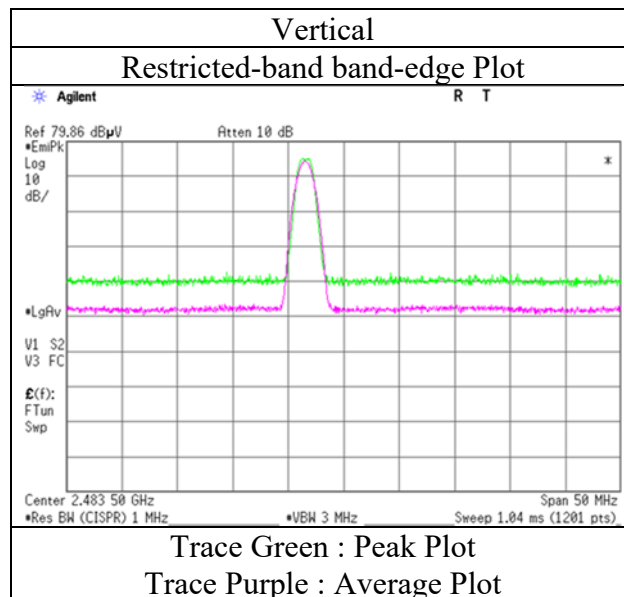
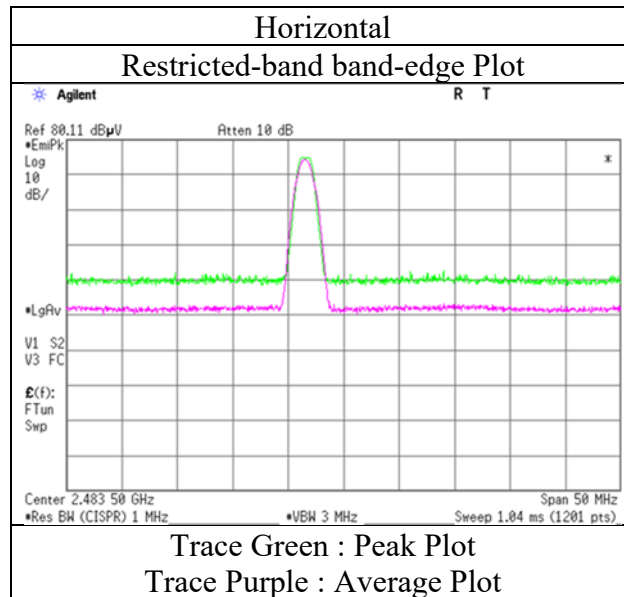
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Radiated Spurious Emission (Reference Plot for band-edge)

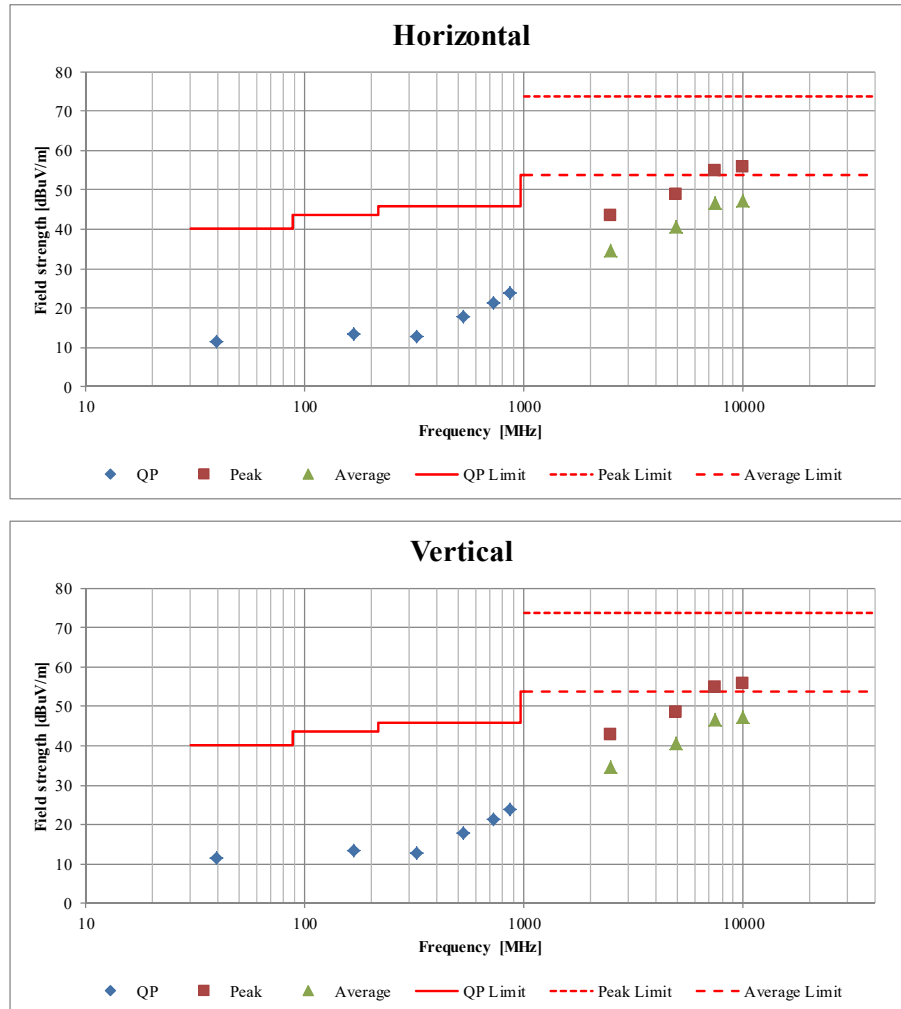
Report No.	12491766H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	August 29, 2018
Temperature / Humidity	24 deg. C / 67 % RH
Engineer	Junki Nagatomi
Mode	Tx BT LE 2480 MHz



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

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

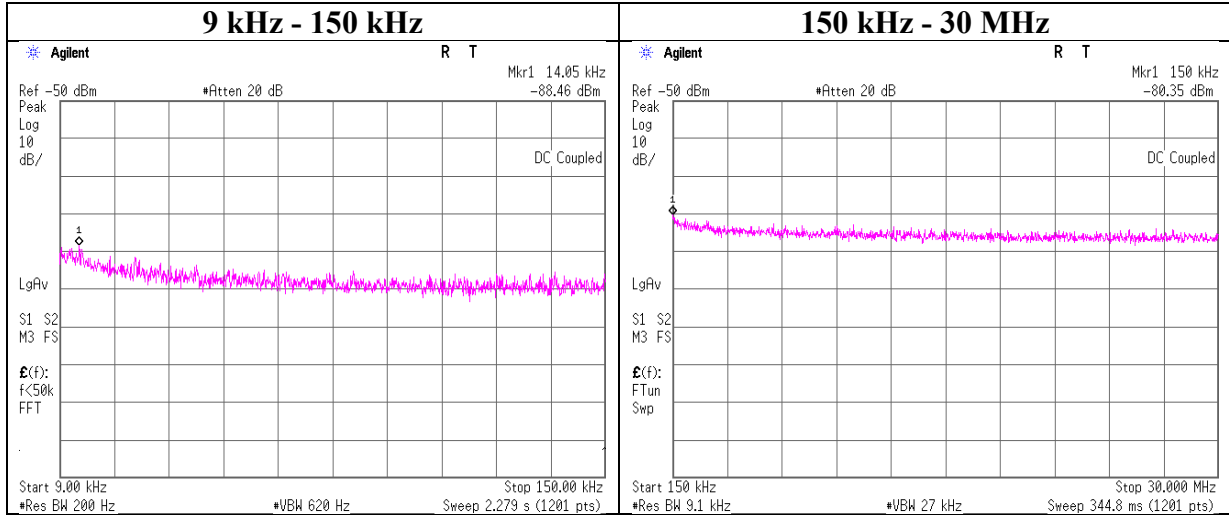
Report No.	12491766H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 29, 2018	September 6, 2018
Temperature / Humidity	24 deg. C / 67 % RH	23 deg. C / 72 % RH
Engineer	Junki Nagatomi	Junki Nagatomi
	(1 GHz - 26.5 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2480 MHz	



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

Conducted Spurious Emission

Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE 2402MHz



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
14.05	-88.5	0.50	0.0	3.8	1	-84.2	300	6.0	-22.9	44.6	67.5	
150.00	-80.4	0.50	0.0	3.8	1	-76.1	300	6.0	-14.8	24.0	38.8	

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

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

N: Number of output

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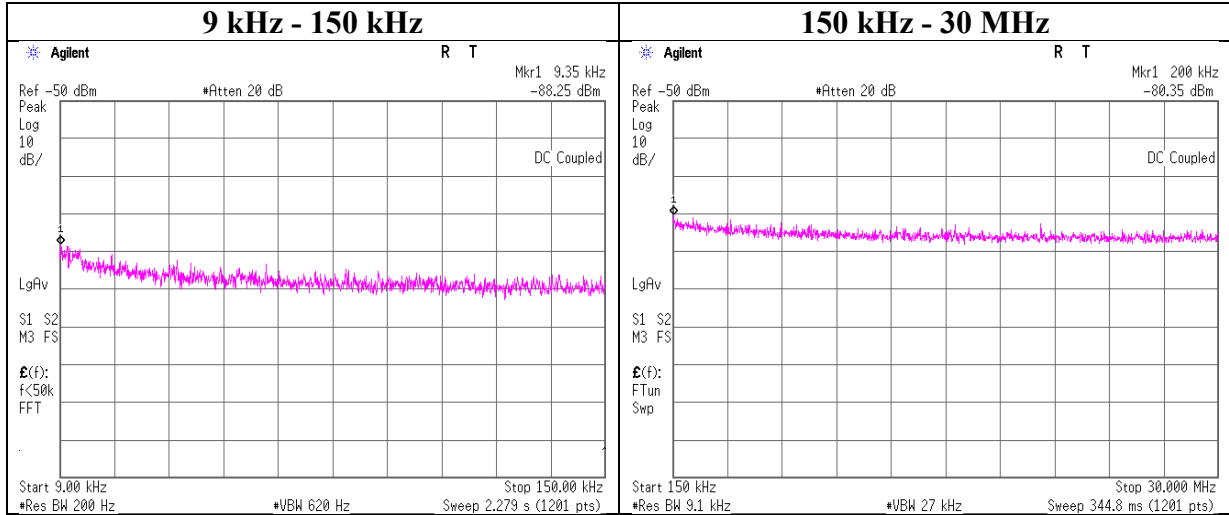
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Conducted Spurious Emission

Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE 2440MHz



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
9.35	-88.3	0.50	0.0	3.8	1	-84.0	300	6.0	-22.7	48.1	70.8	
200.00	-80.4	0.50	0.0	3.8	1	-76.1	300	6.0	-14.8	21.5	36.3	

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

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

N: Number of output

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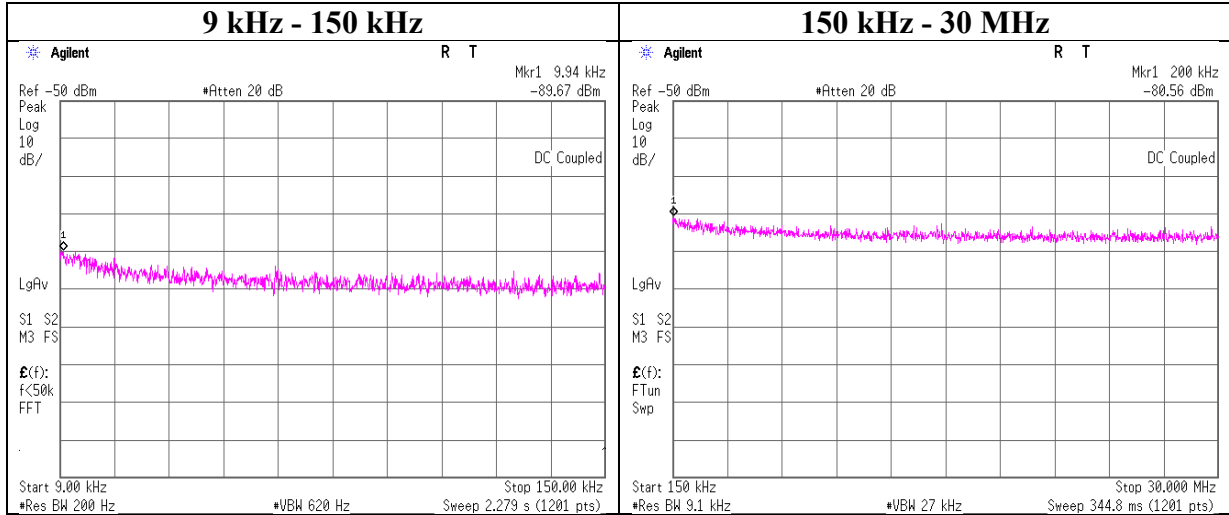
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Conducted Spurious Emission

Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE 2480MHz



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
9.94	-89.7	0.50	0.0	3.8	1	-85.4	300	6.0	-24.1	47.6	71.7	
200.00	-80.6	0.50	0.0	3.8	1	-76.3	300	6.0	-15.0	21.5	36.5	

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

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

N: Number of output

UL Japan, Inc.

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Power Density

Report No. 12491766H
Test place Ise EMC Lab. No.4 Measurement Room
Date September 6, 2018
Temperature / Humidity 23 deg. C / 72 % RH
Engineer Junki Nagatomi
Mode Tx BT LE

BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-23.97	0.50	10.04	-13.43	8.00	21.43
2440.00	-23.90	0.50	10.04	-13.36	8.00	21.36
2480.00	-24.01	0.50	10.04	-13.47	8.00	21.47

Sample Calculation:

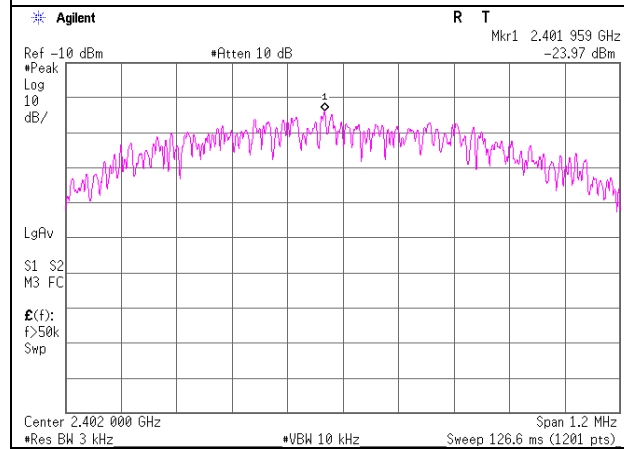
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

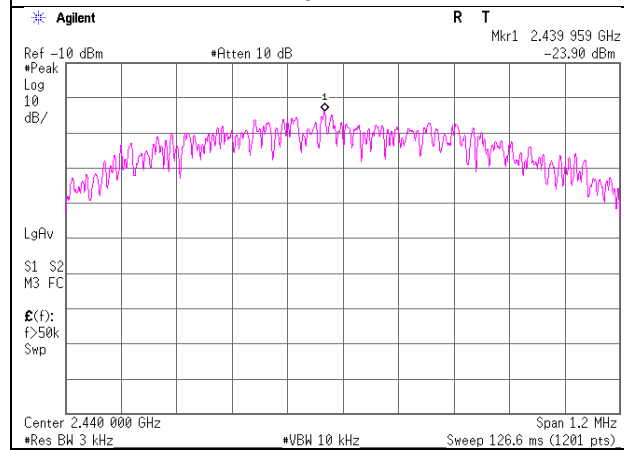
Power Density

BT LE

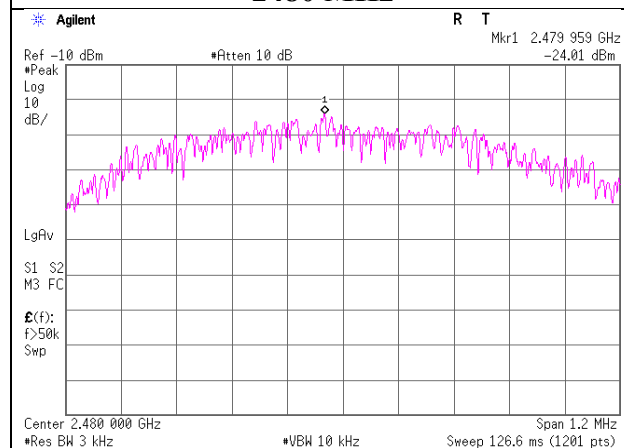
2402 MHz



2440 MHz



2480 MHz



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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
RE	142017	AC4 Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/07/2018	04/30/2019	12
RE	148898	Attenuator	KEYSIGHT	8491A	MY52462282	10/12/2017	10/31/2018	12
RE	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/14/2018	06/30/2019	12
RE	141581	MicroWave System Amplifier	AGILENT	83017A	650	10/06/2017	10/31/2018	12
RE	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/11/2017	09/30/2018	12
RE	141506	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	06/08/2018	06/30/2019	12
RE	142011	AC4 Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/28/2018	06/30/2020	24
RE/AT	141562	Thermo-Hygrometer	CUSTOM	CTH-180	1501	01/24/2018	01/31/2019	12
RE/AT	142227	Measure	KOMELON	KMC-36	-	-	-	-
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	01/30/2018	01/31/2019	12
RE	141425	Biconical Antenna	Schwarzbeck	BBA9106	1302	06/01/2018	06/30/2019	12
RE	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	06/01/2018	06/30/2019	12
RE	141397	Coaxial Cable	UL Japan	-	-	06/13/2018	06/30/2019	12
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	11/5/1900	260833	02/27/2018	02/28/2019	12
RE/AT	141545	DIGITAL HiTESTER	HIOKI	3805	51201148	01/09/2018	01/31/2019	12
AT	141855	Spectrum Analyzer	AGILENT	E4440A	MY46187750	11/17/2017	11/30/2018	12
AT	141269	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	03/12/2018	03/31/2019	12
AT	141809	Power Meter	ANRITSU	ML2495A	825002	05/21/2018	05/31/2019	12
AT	141830	Power sensor	ANRITSU	MA2411B	738285	05/21/2018	05/31/2019	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	06/08/2018	06/30/2019	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:

RE: Radiated Emission test

AT: Antenna Terminal Conducted test

UL Japan, Inc.

Ise EMC Lab.

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