



RADIO TEST REPORT


Test Report No. : 11926812H-B

Applicant : NTT DOCOMO, INC.
Type of Equipment : hitoe Transmitter
Model No. : 01-G
FCC ID : 2ANWDHITOEg
Test regulation : FCC Part 15 Subpart C: 2017
Test Result : Complied

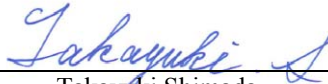
1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: October 6 to 14, 2017

Representative test engineer:


Takafumi Noguchi
Engineer
Consumer Technology Division

Approved by:


Takayuki Shimada
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

13-EM-F0429

CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Radiated Spurious Emission	10
SECTION 6: Antenna Terminal Conducted Tests.....	12
APPENDIX 1: Test data	13
6dB Bandwidth	13
Maximum Peak Output Power	15
Average Output Power	16
Radiated Spurious Emission	18
Conducted Spurious Emission	24
Power Density	27
APPENDIX 2: Test instruments	30
APPENDIX 3: Photographs of test setup	31
Radiated Spurious Emission	31
Worst Case Position (Horizontal: X-axis/ Vertical:Y-axis).....	32

SECTION 1: Customer information

Company Name : NTT DOCOMO, INC.
Address : Sanno Park Tower, 17F, 2-11-1 Nagata-Cho chiyoda-ku, Tokyo
1006150 JAPAN
Telephone Number : +81- 3-5156-2732
Facsimile Number : +81- 3-5509-6255
Contact Person : Toki Takeda

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

2.1 Identification of E.U.T.

Type of Equipment : hitoe Transmitter
Model No. : 01-G
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3.7 V (DC 3.0 V to DC 4.2 V)
Receipt Date of Sample : October 10, 2017
Country of Mass-production : Japan
Condition of EUT : Production model
Modification of EUT : No Modification by the test lab

2.2 Product Description

General Specification

Clock frequency(ies) in the system : 32.768 kHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 2402 to 2480 MHz
Bandwidth & Channel spacing : 1 MHz & 2 MHz/CH
Modulation : GFSK
Power Supply (radio part input) : DC 2.85 V
Antenna type : $\lambda/4$ monopole antenna
Antenna Gain : 1.7 dBi
Method of Frequency Generation : Crystal

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on September 20, 2017 and effective October 20, 2017

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

* The revision on September 20, 2017, does not affect the test specification applied to the EUT.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
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	N/A	N/A *1)	N/A
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.	Complied	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)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	3.0 dB 2483.500 MHz, AV, Vert.	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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

*1) The test is not applicable since the EUT does not have AC mains port, and EUT can't transmit Radio Frequency during USB charging.

*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

* 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 New Battery and the stable voltage (DC 2.85 V) 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.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.3 Addition to standard

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 $k=2$.
Ise EMC Lab.

Antenna terminal test	Uncertainty (+/-)
RF output power	1.2 dB
Antenna terminal conducted emission / Power density / Burst power	3.1 dB
Adjacent channel power / Channel power	
Below 3 GHz	1.8 dB
3 GHz to 6 GHz	2.7 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz - 0.15 MHz	3.1 dB
0.15 MHz - 30 MHz	2.5 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3 m	3.8 dB
10 m	3.6 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	5.2 dB	6.3 dB	5.0 dB	5.0 dB

Radiated emission (Above 1 GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
5.2 dB	5.5 dB	5.5 dB	5.4 dB	5.5 dB

*Measurement distance

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0m 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)

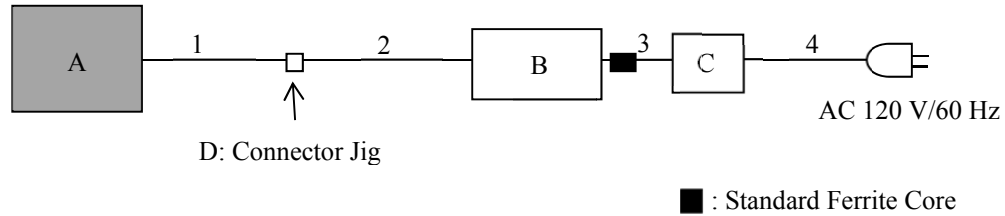
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
Bluetooth Low Energy (BT LE)	Maximum Packet Size, PRBS9
*Power of the EUT was set by the software as follows; Power settings: -1.0 dBm Software: Tera Term version 4.93 *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) for BT LE

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



* 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	hitoe Transmitter	01-G	XJA00034	NTT DOCOMO, INC.	EUT
B	Laptop PC	CF-N8HWCDPS	OBKSA08729	Panasonic	-
C	AC Adapter	CF-AA6372B	-	Panasonic	-
D	Connector Jig	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	0.15	Shielded	Shielded	-
2	USB Cable	0.30 *1) 2.30 *2)	Shielded	Shielded	-
3	DC Cable	1.00	Unshielded	Unshielded	-
4	AC Cable	0.80	Unshielded	Unshielded	-

*1) Used for all tests except for Radiated Emission test

*2) Used for Radiated Emission test only

SECTION 5: Radiated Spurious Emission

Test Procedure

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

[For below 1 GHz]

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

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	3.75 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)		3.75 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: $20 \times \log(3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$

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

- 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

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

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 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.

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

Test data : APPENDIX
Test result : Pass

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

APPENDIX 1: Test data

6dB Bandwidth

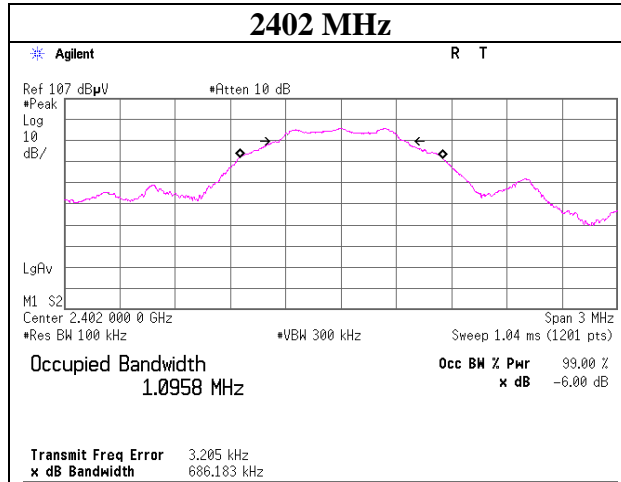
Test place Ise EMC Lab. No.6 Measurement Room
Report No. 11926812H
Date October 6, 2017
Temperature / Humidity 23.5 deg. C / 51 % RH
Engineer Takafumi Noguchi
Mode Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.686	> 500
	2440	0.684	> 500
	2480	0.699	> 500

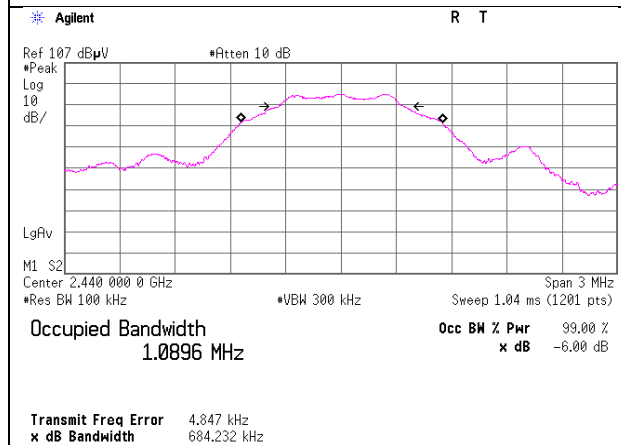
6dB Bandwidth

BT LE

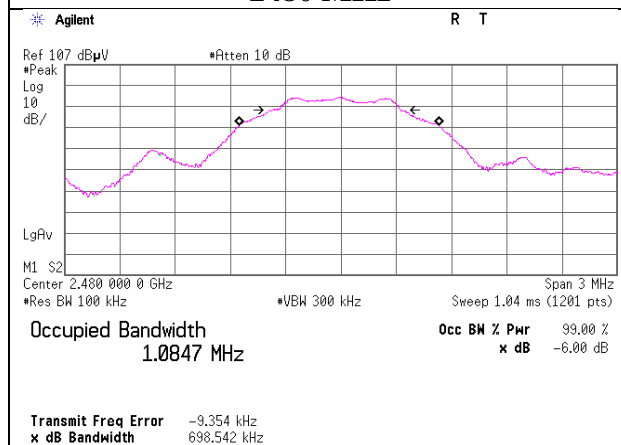
2402 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 11926812H
Date : October 6, 2017
Temperature / Humidity : 23.5 deg. C / 51 % RH
Engineer : Takafumi Noguchi
Mode : Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-12.50	0.61	10.05	-1.84	0.66	30.00	1000	31.84
2440	-13.22	0.63	10.05	-2.54	0.56	30.00	1000	32.54
2480	-13.63	0.66	10.05	-2.92	0.51	30.00	1000	32.92

Sample Calculation:

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

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

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 11926812H
Date : October 6, 2017
Temperature / Humidity : 23.5 deg. C / 51 % RH
Engineer : Takafumi Noguchi
Mode : Tx BT LE

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	-15.95	0.61	10.05	-5.29	0.30	1.86	-3.43	0.45
2440	-16.64	0.63	10.05	-5.96	0.25	1.86	-4.10	0.39
2480	-17.28	0.66	10.05	-6.57	0.22	1.86	-4.71	0.34

Sample Calculation:

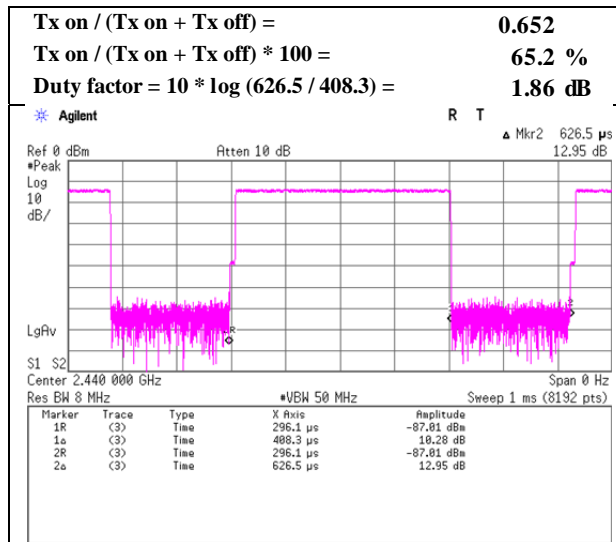
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator I

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

Burst rate confirmation

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11926812H
Date	October 6, 2017
Temperature / Humidity	23.5 deg. C / 51 % RH
Engineer	Takafumi Noguchi
Mode	Tx BT LE

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.	11926812H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	October 7, 2017	October 8, 2017	October 14, 2017
Temperature / Humidity	23 deg. C / 46 % RH	23 deg. C / 46 % RH	22 deg. C / 58 % RH
Engineer	Yuta Moriya	Yuta Moriya	Takafumi Noguchi
	(1 GHz - 10 GHz)	(10 GHz -26.5 GHz)	(Below 1GHz)
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	79.017	QP	24.6	6.2	7.3	30.4	-	7.7	40.0	32.3	
Hori	95.450	QP	25.3	9.3	7.4	30.3	-	11.7	43.5	31.8	
Hori	116.700	QP	24.2	12.5	7.6	30.1	-	14.2	43.5	29.3	
Hori	176.484	QP	26.8	16.0	8.0	29.8	-	21.0	43.5	22.5	
Hori	281.333	QP	23.2	12.8	8.7	29.2	-	15.5	46.0	30.5	
Hori	361.334	QP	23.1	14.9	9.3	29.5	-	17.8	46.0	28.2	
Hori	2390.000	PK	51.2	27.0	5.1	34.6	-	48.7	73.9	25.2	
Hori	3076.025	PK	47.4	28.0	5.6	34.5	-	46.5	73.9	27.4	
Hori	4804.000	PK	44.2	31.3	7.3	33.8	-	49.0	73.9	24.9	
Hori	7206.000	PK	45.2	35.6	8.6	33.9	-	55.5	73.9	18.4	Floor noise
Hori	9608.000	PK	46.5	38.2	8.3	34.5	-	58.5	73.9	15.4	Floor noise
Hori	2390.000	AV	41.7	27.0	5.1	34.6	1.9	41.1	53.9	12.8	*1)
Hori	3076.025	AV	37.5	28.0	5.6	34.5	1.9	38.5	53.9	15.4	
Hori	4804.000	AV	34.2	31.3	7.3	33.8	1.9	40.9	53.9	13.0	
Hori	7206.000	AV	35.2	35.6	8.6	33.9	-	45.5	53.9	8.4	Floor noise
Hori	9608.000	AV	35.8	38.2	8.3	34.5	-	47.8	53.9	6.1	Floor noise
Vert	78.643	QP	34.4	6.2	7.3	30.4	-	17.5	40.0	22.5	
Vert	95.026	QP	30.1	9.2	7.4	30.3	-	16.4	43.5	27.1	
Vert	117.833	QP	26.3	12.6	7.6	30.1	-	16.4	43.5	27.1	
Vert	175.918	QP	38.8	16.0	8.0	29.8	-	33.0	43.5	10.5	
Vert	281.333	QP	23.4	12.8	8.7	29.2	-	15.7	46.0	30.3	
Vert	362.667	QP	23.6	14.9	9.3	29.5	-	18.3	46.0	27.7	
Vert	2390.000	PK	50.7	27.0	5.1	34.6	-	48.2	73.9	25.7	
Vert	3078.000	PK	47.4	28.0	5.6	34.5	-	46.5	73.9	27.4	
Vert	4804.000	PK	41.8	31.3	6.5	33.8	-	45.8	73.9	28.1	Floor noise
Vert	7206.000	PK	43.7	35.6	7.7	33.9	-	53.1	73.9	20.8	Floor noise
Vert	9608.000	PK	45.7	38.2	8.3	34.5	-	57.7	73.9	16.2	Floor noise
Vert	2390.000	AV	42.2	27.0	5.1	34.6	1.9	41.6	53.9	12.3	*1)
Vert	3078.000	AV	40.6	28.0	5.6	34.5	1.9	41.6	73.9	32.3	
Vert	4804.000	AV	34.4	31.3	6.5	33.8	-	38.4	53.9	15.5	Floor noise
Vert	7206.000	AV	35.6	35.6	7.7	33.9	-	45.0	53.9	8.9	Floor noise
Vert	9608.000	AV	35.7	38.2	8.3	34.5	-	47.7	53.9	6.2	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$

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

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

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	95.3	27.0	5.1	34.6	92.8	-	-	Carrier
Hori	2400.000	PK	60.4	27.0	5.1	34.6	57.9	72.8	14.9	
Vert	2402.000	PK	94.2	27.0	5.1	34.6	91.7	-	-	Carrier
Vert	2400.000	PK	60.9	27.0	5.1	34.6	58.4	71.7	13.3	

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

Distance factor: 1 GHz - 10 GHz $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$

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

UL Japan, Inc.

Ise EMC Lab.

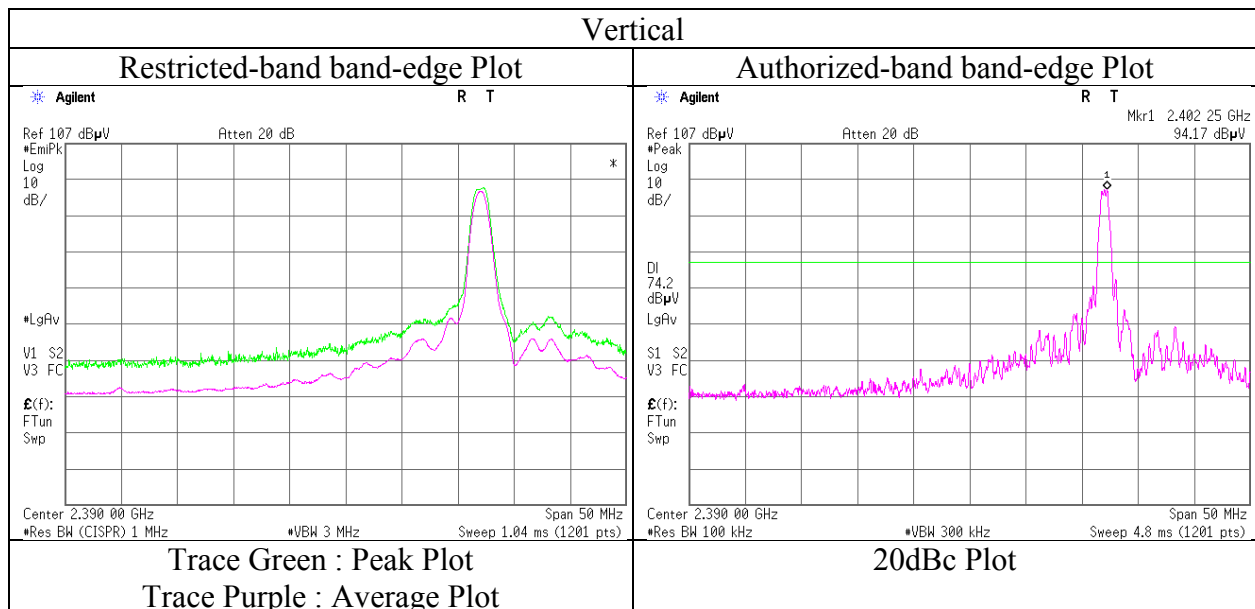
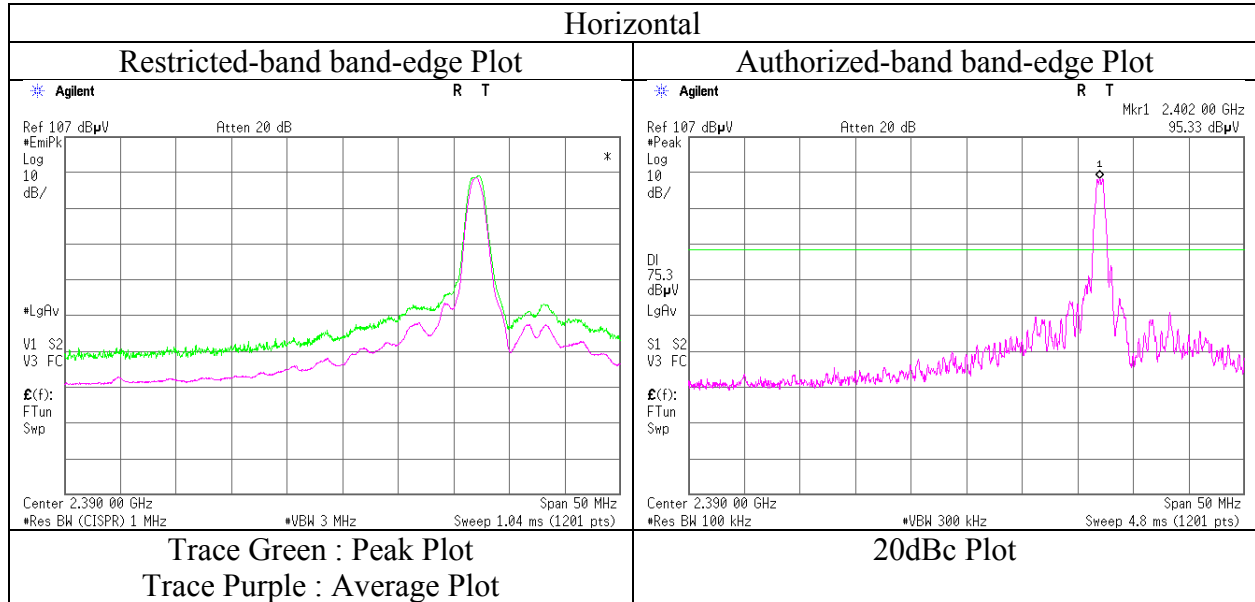
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11926812H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	October 7, 2017
Temperature / Humidity	23 deg. C / 46 % RH
Engineer	Yuta Moriya
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz



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

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	11926812H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	October 7, 2017	October 8, 2017	October 14, 2017
Temperature / Humidity	23 deg. C / 46 % RH	23 deg. C / 46 % RH	22 deg. C / 58 % RH
Engineer	Yuta Moriya (1 GHz - 10 GHz)	Yuta Moriya (10 GHz - 26.5 GHz)	Takafumi Noguchi (Below 1GHz)
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	56.314	QP	24.7	8.9	7.0	30.4	-	10.2	40.0	29.8	
Hori	73.321	QP	25.0	6.3	7.2	30.4	-	8.1	40.0	31.9	
Hori	116.412	QP	24.2	12.5	7.6	30.1	-	14.2	43.5	29.3	
Hori	167.546	QP	24.6	15.6	7.9	29.8	-	18.3	43.5	25.2	
Hori	281.333	QP	23.3	12.8	8.7	29.2	-	15.6	46.0	30.4	
Hori	361.334	QP	23.1	14.9	9.3	29.5	-	17.8	46.0	28.2	
Hori	4880.000	PK	44.5	31.4	7.3	33.8	-	49.4	73.9	24.5	
Hori	7320.000	PK	43.0	35.8	8.6	33.9	-	53.5	73.9	20.4	Floor noise
Hori	9760.000	PK	45.5	38.2	8.3	34.5	-	57.5	73.9	16.4	Floor noise
Hori	4880.000	AV	35.2	31.4	7.3	33.8	1.9	42.0	53.9	11.9	
Hori	7320.000	AV	34.8	35.8	8.6	33.9	-	45.3	53.9	8.6	Floor noise
Hori	9760.000	AV	35.8	38.2	8.3	34.5	-	47.8	53.9	6.1	Floor noise
Vert	56.278	QP	26.0	8.9	7.0	30.4	-	11.5	40.0	28.5	
Vert	73.412	QP	26.3	6.3	7.2	30.4	-	9.4	40.0	30.6	
Vert	116.542	QP	24.2	12.5	7.6	30.1	-	14.2	43.5	29.3	
Vert	167.418	QP	38.3	15.6	7.9	29.9	-	31.9	43.5	11.6	
Vert	281.333	QP	23.4	12.8	8.7	29.2	-	15.7	46.0	30.3	
Vert	362.667	QP	23.6	14.9	9.3	29.5	-	18.3	46.0	27.7	
Vert	4880.000	PK	43.6	31.4	7.3	33.8	-	48.5	73.9	25.4	Floor noise
Vert	7320.000	PK	43.0	35.8	8.6	33.9	-	53.5	73.9	20.4	Floor noise
Vert	9760.000	PK	44.9	38.2	8.3	34.5	-	56.9	73.9	17.0	Floor noise
Vert	4880.000	AV	35.6	31.4	7.3	33.8	-	40.5	53.9	13.4	Floor noise
Vert	7320.000	AV	34.5	35.8	8.6	33.9	-	45.0	53.9	8.9	Floor noise
Vert	9760.000	AV	35.8	38.2	8.3	34.5	-	47.8	53.9	6.1	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log(3.75 m / 3.0 m) = 1.94 dB
 10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	11926812H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	October 7, 2017	October 8, 2017	October 14, 2017
Temperature / Humidity	23 deg. C / 46 % RH	23 deg. C / 46 % RH	22 deg. C / 58 % RH
Engineer	Yuta Moriya	Yuta Moriya	Takafumi Noguchi
	(1 GHz - 10 GHz)	(10 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	54.724	QP	24.8	9.4	7.0	30.4	-	10.8	40.0	29.2	
Hori	78.211	QP	25.7	6.3	7.3	30.4	-	8.9	40.0	31.1	
Hori	99.124	QP	25.0	10.0	7.4	30.2	-	12.2	43.5	31.3	
Hori	176.336	QP	24.3	16.0	8.0	29.8	-	18.5	43.5	25.0	
Hori	281.233	QP	23.4	12.8	8.7	29.2	-	15.7	46.0	30.3	
Hori	361.696	QP	23.1	14.9	9.3	29.5	-	17.8	46.0	28.2	
Hori	2483.500	PK	57.4	27.0	5.2	34.6	-	55.0	73.9	18.9	
Hori	4960.000	PK	44.5	31.6	7.4	33.8	-	49.7	73.9	24.2	
Hori	7440.000	PK	42.5	35.9	8.6	34.0	-	53.0	73.9	20.9	Floor noise
Hori	9920.000	PK	43.6	38.2	8.9	34.6	-	56.1	73.9	17.8	Floor noise
Hori	2483.500	AV	51.1	27.0	5.2	34.6	1.9	50.6	53.9	3.3	*1)
Hori	4960.000	AV	36.0	31.6	7.4	33.8	1.9	43.1	53.9	10.8	
Hori	7440.000	AV	34.7	35.9	8.6	34.0	-	45.2	53.9	8.7	Floor noise
Hori	9920.000	AV	35.3	38.2	8.9	34.6	-	47.8	53.9	6.1	Floor noise
Vert	54.187	QP	25.6	9.6	7.0	30.4	-	11.8	40.0	28.2	
Vert	78.532	QP	28.2	6.2	7.3	30.4	-	11.3	40.0	28.7	
Vert	99.342	QP	25.0	10.0	7.4	30.2	-	12.2	43.5	31.3	
Vert	176.215	QP	32.2	16.0	8.0	29.8	-	26.4	43.5	17.1	
Vert	281.235	QP	23.5	12.8	8.7	29.2	-	15.8	46.0	30.2	
Vert	362.664	QP	23.5	14.9	9.3	29.5	-	18.2	46.0	27.8	
Vert	2483.500	PK	57.2	27.0	5.2	34.6	-	54.8	73.9	19.1	
Vert	4960.000	PK	42.5	31.6	7.4	33.8	-	47.7	73.9	26.2	Floor noise
Vert	7440.000	PK	43.6	35.9	8.6	34.0	-	54.1	73.9	19.8	Floor noise
Vert	9920.000	PK	44.9	38.2	9.4	34.6	-	57.9	73.9	16.0	Floor noise
Vert	2483.500	AV	51.4	27.0	5.2	34.6	1.9	50.9	53.9	3.0	*1)
Vert	4960.000	AV	33.7	31.6	7.4	33.8	-	38.9	53.9	15.0	Floor noise
Vert	7440.000	AV	32.4	35.9	8.6	34.0	-	42.9	53.9	11.0	Floor noise
Vert	9920.000	AV	34.4	38.2	9.4	34.6	-	47.4	53.9	6.5	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$

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

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

UL Japan, Inc.

Ise EMC Lab.

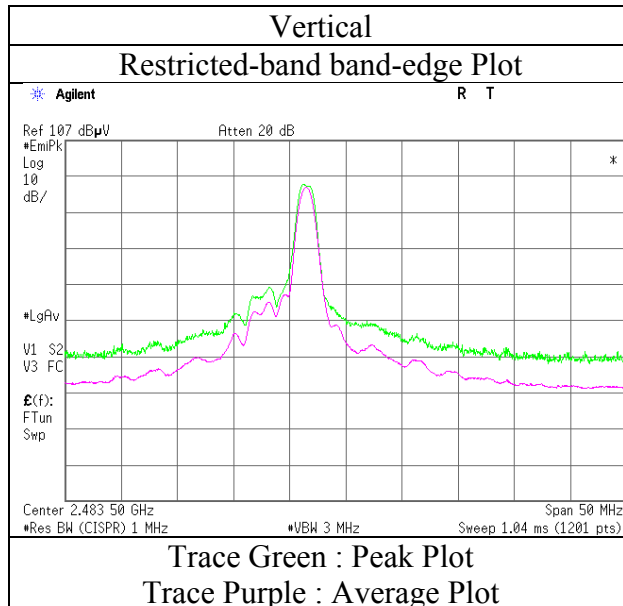
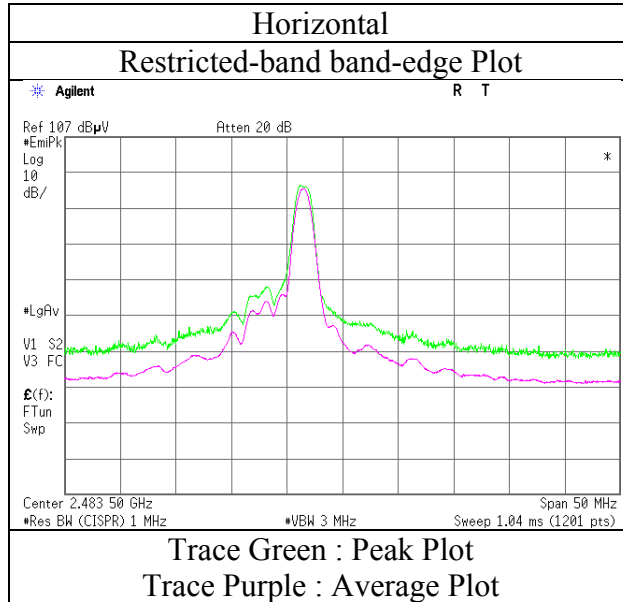
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission
(Reference Plot for band-edge)

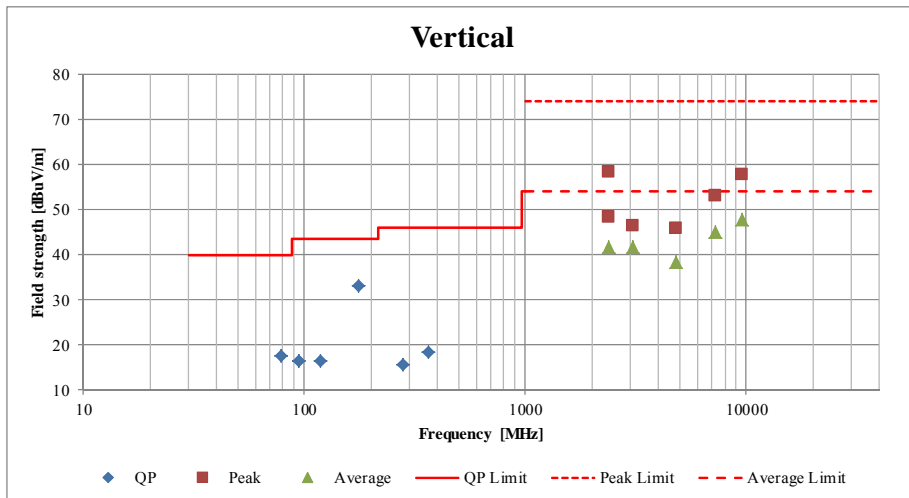
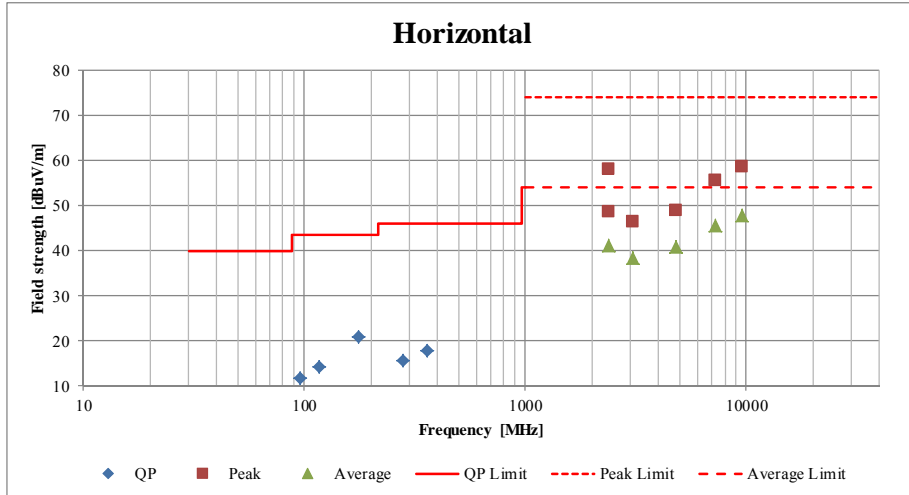
Report No. 11926812H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date October 7, 2017
Temperature / Humidity 23 deg. C / 46 % RH
Engineer Yuta Moriya
(1 GHz - 10 GHz)
Mode Tx BT LE 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

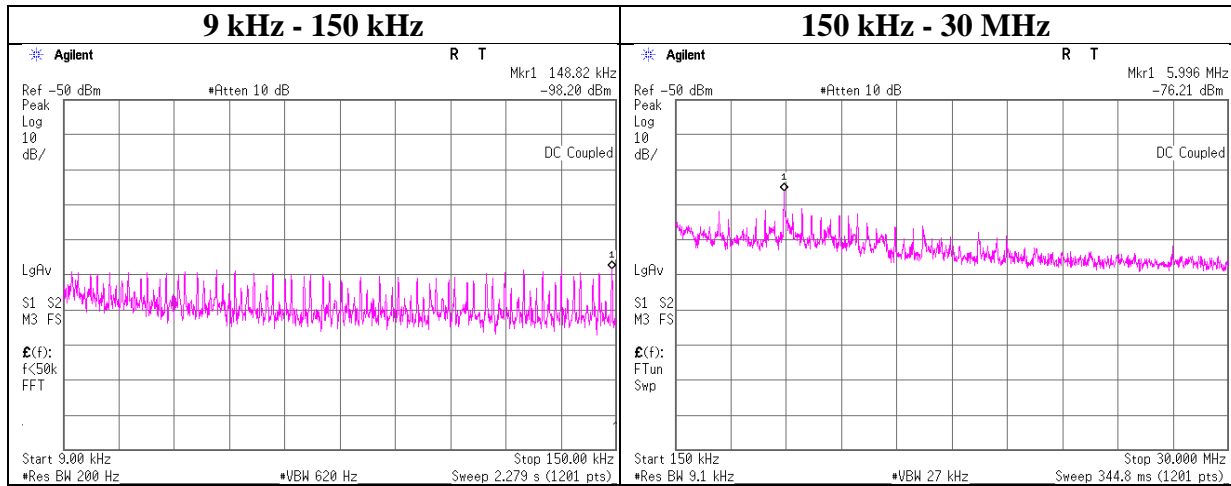
Report No.	11926812H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	October 7, 2017	October 8, 2017	October 14, 2017
Temperature / Humidity	23 deg. C / 46 % RH	23 deg. C / 46 % RH	22 deg. C / 58 % RH
Engineer	Yuta Moriya	Yuta Moriya	Takafumi Noguchi
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(Below 1GHz)
Mode	Tx BT LE 2402 MHz		



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

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11926812H
Date	October 6, 2017
Temperature / Humidity	23.5 deg. C / 51 % RH
Engineer	Takafumi Noguchi
Mode	Tx BT LE 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
148.82	-98.2	0.67	9.8	2.0	1	-85.7	300	6.0	-24.4	24.1	48.5	
5996.00	-76.2	0.67	9.9	2.0	1	-63.7	30	6.0	17.6	29.5	12.0	

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

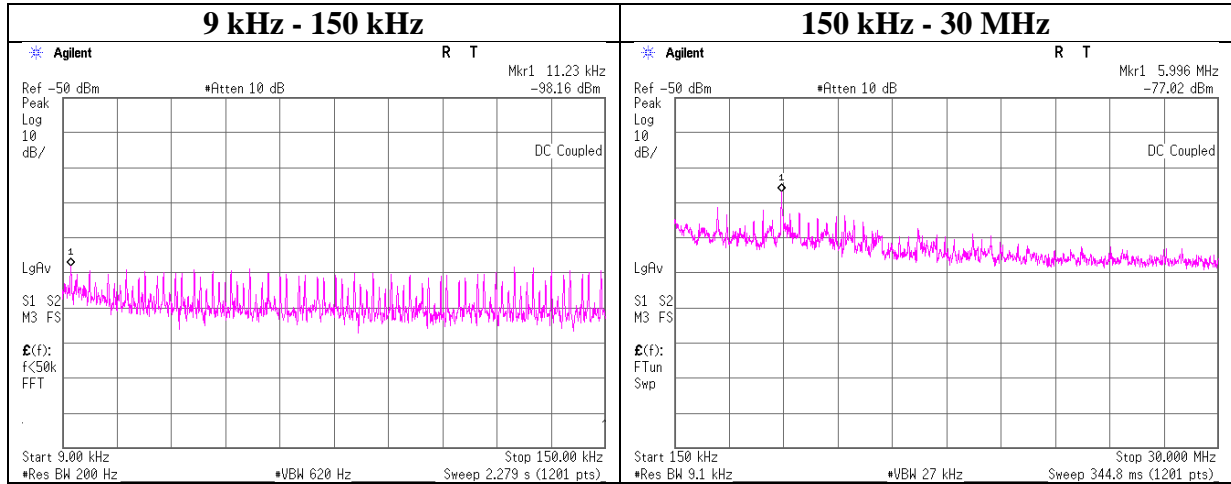
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$$

N: Number of output

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

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11926812H
Date	October 6, 2017
Temperature / Humidity	23.5 deg. C / 51 % RH
Engineer	Takafumi Noguchi
Mode	Tx BT LE 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.23	-98.2	0.67	9.8	2.0	1	-85.7	300	6.0	-24.4	46.5	70.9	
5996.00	-77.0	0.67	9.9	2.0	1	-64.5	30	6.0	16.8	29.5	12.8	

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

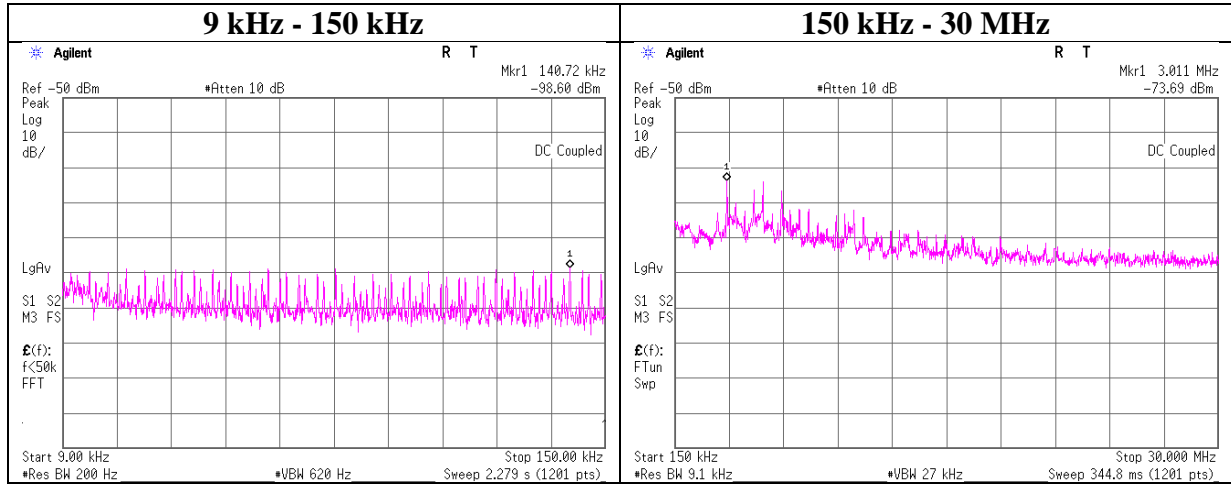
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

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

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11926812H
Date	October 6, 2017
Temperature / Humidity	23.5 deg. C / 51 % RH
Engineer	Takafumi Noguchi
Mode	Tx BT LE 2480 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
140.72	-98.6	0.67	9.8	2.0	1	-86.1	300	6.0	-24.8	24.6	49.4	
3011.00	-73.7	0.67	9.8	2.0	1	-61.2	30	6.0	20.1	29.5	9.5	

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

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

N: Number of output

*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.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Power Density

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 11926812H
Date October 6, 2017
Temperature / Humidity 23.5 deg. C / 51 % RH
Engineer Takafumi Noguchi
Mode Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.0	-28.18	0.61	10.05	-17.52	8.00	25.52
2440.0	-28.79	0.63	10.05	-18.11	8.00	26.11
2480.0	-29.35	0.66	10.05	-18.64	8.00	26.64

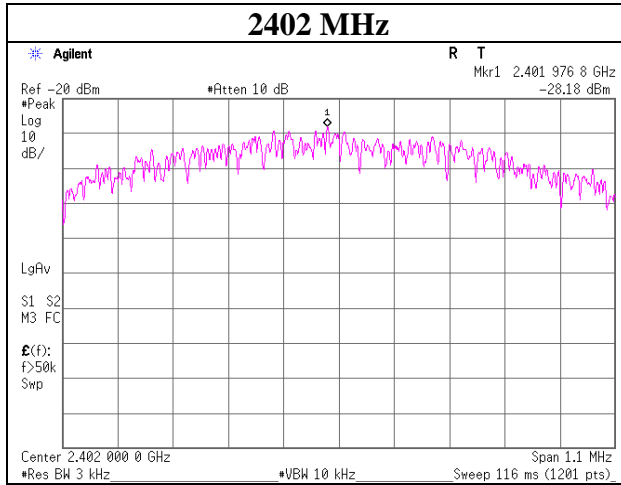
Sample Calculation:

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

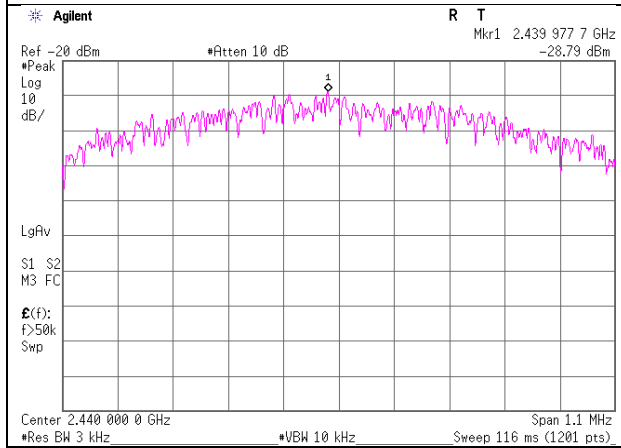
Power Density

BT LE

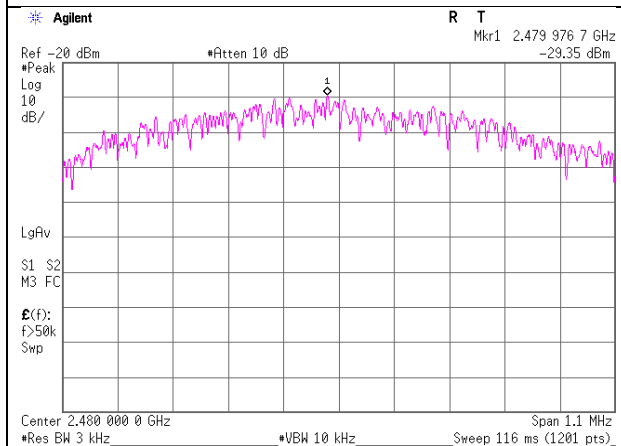
2402 MHz



2440MHz

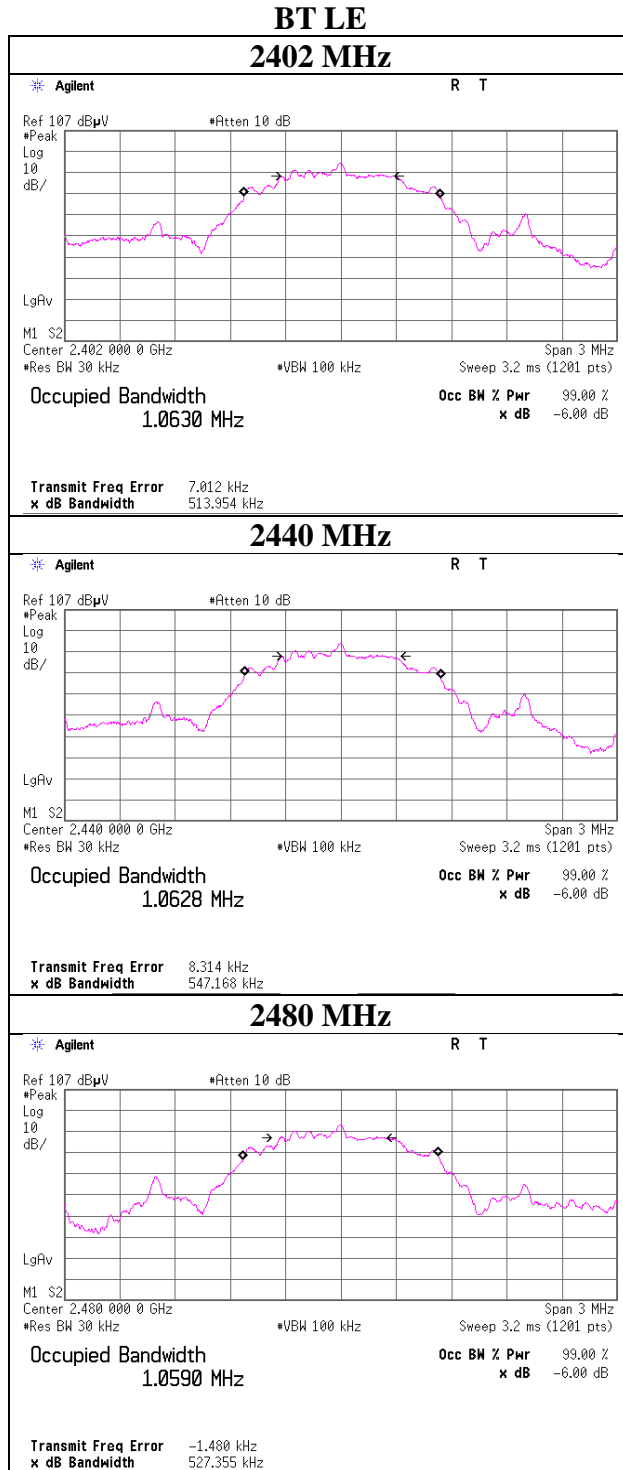


2480 MHz



99% Occupied Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11926812H
Date	October 6, 2017
Temperature / Humidity	23.5 deg. C / 51 % RH
Engineer	Takafumi Noguchi
Mode	Tx BT LE



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

APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2016/11/02 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2016/11/02 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/12/15 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2016/11/28 * 12
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2016/10/14 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2017/01/20 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2017/08/31 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/12/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2016/11/10 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2017/02/24 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2017/08/04 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2017/01/16 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2017/02/24 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2017/08/07 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2017/09/22 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2017/08/21 * 12
MBA-08	Biconical Antenna	Schwarzbeck	VHA9103B	08031	RE	2017/09/13 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2017/01/05 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2017/02/24 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2016/11/28 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2017/09/27 * 12

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

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

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

**Test Item: RE: Radiated Emission test
AT: Antenna Terminal Conducted test**

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124