



RADIO TEST REPORT

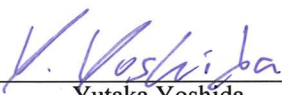
Test Report No. : 11130215H-A-R1

Applicant : **silex technology, Inc.**
Type of Equipment : **Bluetooth Low Energy Module**
Model No. : **RE-HURTL01**
FCC ID : **N6C-REHURTL01**
Test regulation : **FCC Part 15 Subpart C: 2015**
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)
7. This report is a revised version of 11130215H-A. 11130215H-A is replaced with this report.

Date of test: January 14 to 24, 2016

Representative test engineer:


Yutaka Yoshida
Engineer
Consumer Technology Division

Approved by:


Takahiro Hatakeda
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	:	silex technology, Inc.
Address	:	2-3-1 Hikaridai, Seika-cho, Kyoto 619-0237, Japan
Telephone Number	:	+81-774-98-3878
Facsimile Number	:	+81-774-98-3758
Contact Person	:	Toshiro Kometani

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Low Energy Module
Model No.	:	RE-HURTL01
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.3 V
Receipt Date of Sample	:	January 14, 2016
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: RE-HURTL01 (referred to as the EUT in this report) is a Bluetooth Low Energy Module.

General Specification

Clock frequency(ies) in the system	:	XTAL 32.768 kHz, 32 MHz
------------------------------------	---	-------------------------

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS
Power Supply (radio part input)	:	DC 1.6 V
Antenna type	:	WiFi Dual Band Chip Antenna
Antenna Gain	:	1.4 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015
 *Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision does not affect the test specification applied to the EUT.

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 11.8 dB, 0.21785 MHz, N AV 11.7 dB, 0.87063 MHz, N	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	7.5 dB 9760.000 MHz, AV, Vert.	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 v03r04 12.2.7.

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

FCC 15.31 (e)

The stable voltage (DC 1.6 V) was provided to the EUT during the tests.
 Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 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	-	Conducted

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 $k = 2$.
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Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz - 3 GHz	3 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	

Frequency range	Conducted emission using AMN(LISN) (+dB)
0.009 – 0.15MHz	3.5 dB
0.15 – 30MHz	2.9 dB

Test distance	Radiated emission (+dB) 9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+dB)		(10 m*)(+dB)	
	30 – 300 MHz	300 – 1000MHz	30 – 300 MHz	300 – 1000MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	4.5 dB	5.9 dB	4.8 dB	5.1 dB

Radiated emission				
(3 m*)(+dB)		(1 m*)(+dB)	(0.5 m*)(+dB)	(10 m*)(+dB)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 dB

*Measurement distance

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test

The data listed in this test report has enough margin, more than the site margin.

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3.5 Test Location

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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(BT) Low Energy (LE)	Maximum Packet Size, PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Low Channel)	
*The power value of the EUT was set for testing as follows (setting value might be different from product specification value); Power settings: 0 dBm, -15dBm Software: Bluetooth Low Energy Protocol Stack Software *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 except for above output power of the product.	

*The details of Operating mode(s)

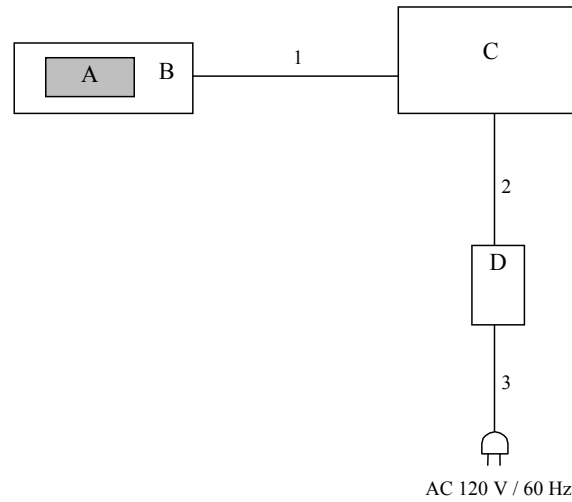
Test Item	Operating Mode	Tested frequency
Conducted Emission, 6dB Bandwidth, Maximum Peak Output Power, Power Density, 99% Occupied Bandwidth, Spurious Emission (Radiated) Spurious Emission (Conducted)	BT LE Tx	2402MHz 2440MHz 2480MHz

* Maximum Peak Output Power was performed with power setting: 0dBm and -15dBm.

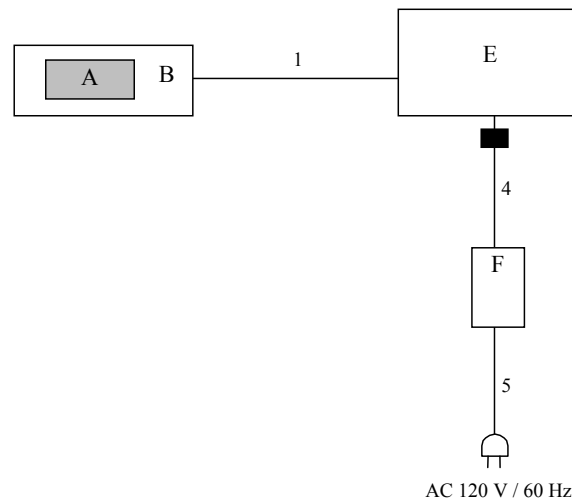
All tests except for Maximum Peak Output Power were performed with worst case power setting: 0dBm.

4.2 Configuration and peripherals

[Conducted emission test]



[Radiated emission test]



■ : Standard Ferrite Core

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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Low Energy Module	RE-HURTBL01	13 *1) 6 *2)	silex technology, Inc.	EUT
B	Jig board	-	-	silex technology, Inc.	-
C	Laptop PC	CF-W5	7HKSA86870	Panasonic	-
D	AC Adapter	CF-AA6282A M1	6282AM107619146A	Panasonic	-
E	Laptop PC	FMVNC4BC3	R7305017	FUJITSU	-
F	AC Adapter	CA01007-0930	04X20745E	FUJITSU	-

*1) Used for Antenna Terminal conducted tests

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

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	DC Cable	1.5	Unshielded	Unshielded	-
3	AC Cable	0.9	Unshielded	Unshielded	-
4	DC Cable	1.8	Unshielded	Unshielded	-
5	AC Cable	2.0	Unshielded	Unshielded	-

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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 "558074 D01 DTS Meas Guidance v03r04".

[For below 1GHz]

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 1GHz]

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 300 MHz	300 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	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: 12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces
Test Distance	3m	4.5 m *2) (below 10 GHz), 1 m *3) (above 10 GHz)	4.5 m *2) (below 10 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r04"

*2) Distance Factor: $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.5 \text{ dB}$

*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 M - 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	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	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 v03r04".							

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

DATA OF CONDUCTED EMISSION TEST

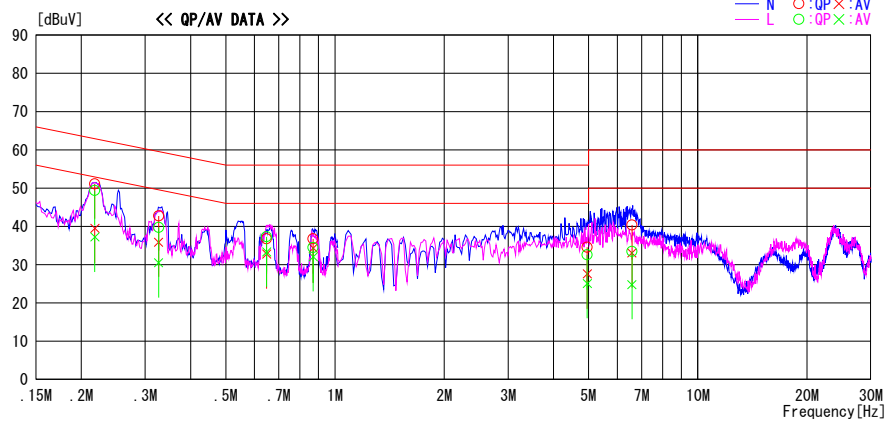
UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
Date : 2016/01/24

Report No. : 11130215H

Temp./Humi. : 17deg.C. / 33% RH
Engineer : Takafumi Noguchi

Mode / Remarks : Tx BT LE (2402 MHz)

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
0.21785	37.8	26.2	13.3	51.1	39.5	62.9	52.9	11.8	13.4	N
0.32649	29.4	22.6	13.3	42.7	35.9	59.5	49.5	16.8	13.6	N
0.64783	23.3	19.4	13.4	36.7	32.8	56.0	46.0	19.3	13.2	N
0.87063	23.3	20.9	13.4	36.7	34.3	56.0	46.0	19.3	11.7	N
4.95805	20.7	13.7	13.9	34.6	27.6	56.0	46.0	21.4	18.4	N
6.58390	26.3	19.0	14.1	40.4	33.1	60.0	50.0	19.6	16.9	N
0.21785	36.1	23.9	13.3	49.4	37.2	62.9	52.9	13.5	15.7	L
0.32649	26.4	17.2	13.3	39.7	30.5	59.5	49.5	19.8	19.0	L
0.64783	23.9	19.9	13.4	37.3	33.3	56.0	46.0	18.7	12.7	L
0.87063	21.1	18.7	13.4	34.5	32.1	56.0	46.0	21.5	13.9	L
4.95805	18.7	11.2	13.9	32.6	25.1	56.0	46.0	23.4	20.9	L
6.58390	19.4	10.7	14.1	33.5	24.8	60.0	50.0	26.5	25.2	L

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

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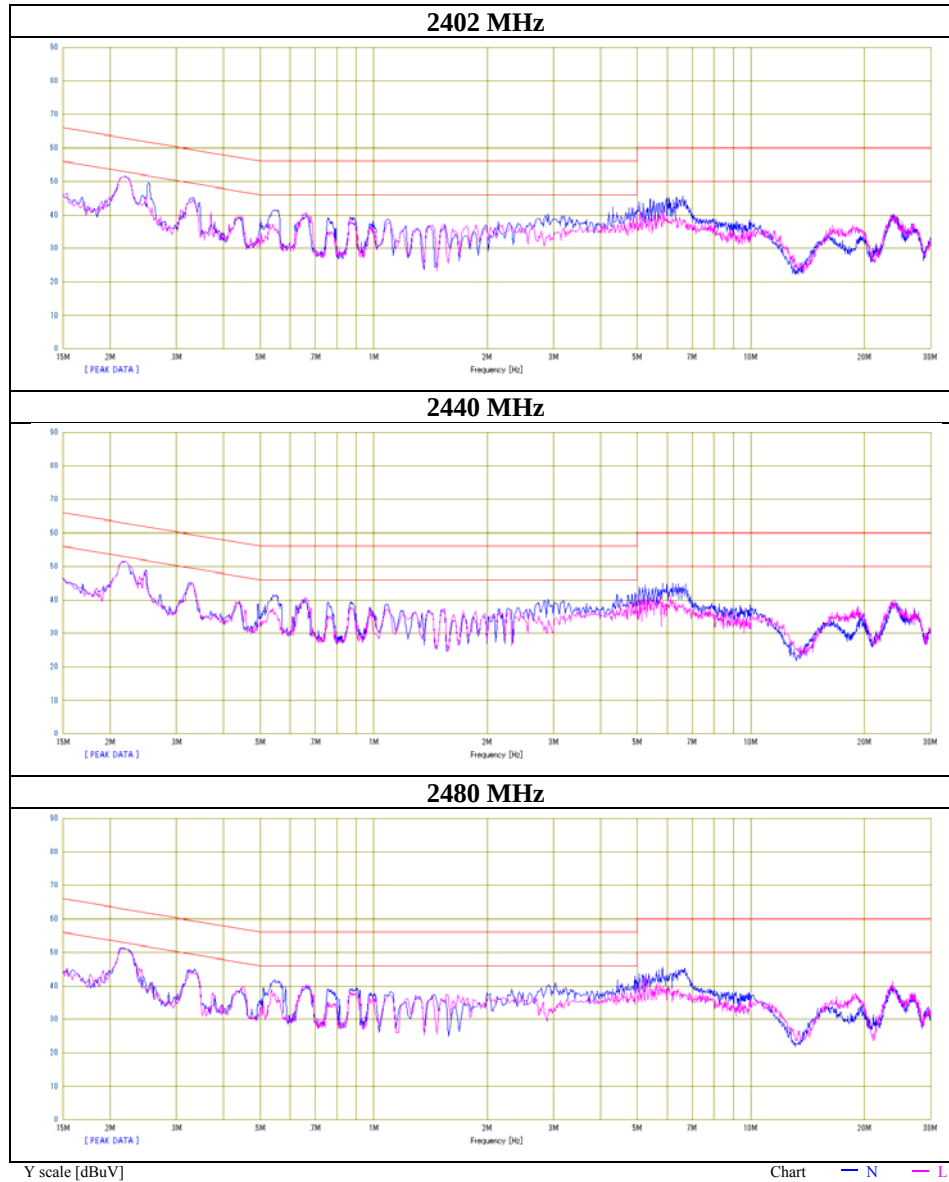
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Conducted Emission

Test place	Ise EMC Lab. No.1 Semi Anechoic Chamber
Report No.	11130215H
Date	January 24, 2016
Temperature / Humidity	17 deg. C / 33 % RH
Engineer	Takafumi Noguchi
Mode	Tx BT LE



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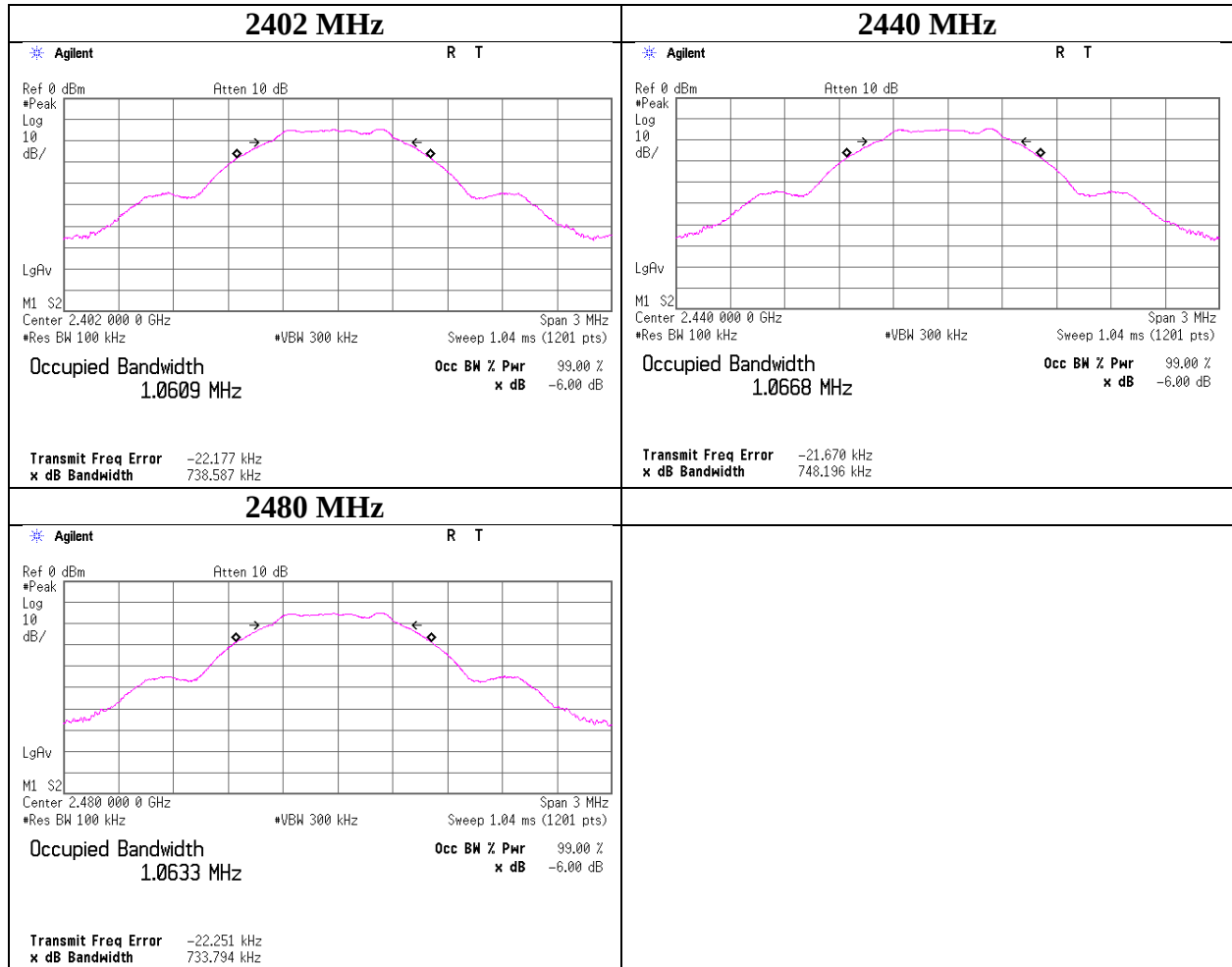
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6dB Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 11130215H
Date January 14, 2016
Temperature / Humidity 25 deg. C / 26 % RH
Engineer Yutaka Yoshida
Mode Tx BT LE

Frequency [MHz]	6dB Bandwidth [kHz]	Limit [kHz]
2402	738.587	> 500
2440	748.196	> 500
2480	733.794	> 500

6dB Bandwidth



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Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11130215H
Date	January 14, 2016
Temperature / Humidity	25 deg. C / 26 % RH
Engineer	Yutaka Yoshida
Mode	Tx BT LE

Power setting 0dBm

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-13.55	1.53	10.03	-1.99	0.63	30.00	1000	31.99
2440	-13.67	1.54	10.03	-2.10	0.62	30.00	1000	32.10
2480	-13.93	1.55	10.03	-2.35	0.58	30.00	1000	32.35

Sample Calculation:

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

Power setting -15dBm

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-17.25	1.53	0.00	-15.72	0.03	30.00	1000	45.72
2440	-16.81	1.54	0.00	-15.27	0.03	30.00	1000	45.27
2480	-16.65	1.55	0.00	-15.10	0.03	30.00	1000	45.10

Sample Calculation:

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

Average Output Power

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11130215H
Date	January 14, 2016
Temperature / Humidity	25 deg. C / 26 % RH
Engineer	Yutaka Yoshida
Mode	Tx BT LE

Powre setting 0dBm

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-14.00	1.53	10.03	-2.44	0.57	30.00	1000	32.44
2440	-14.11	1.54	10.03	-2.54	0.56	30.00	1000	32.54
2480	-14.42	1.55	10.03	-2.84	0.52	30.00	1000	32.84

Sample Calculation:

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

Powre setting -15dBm

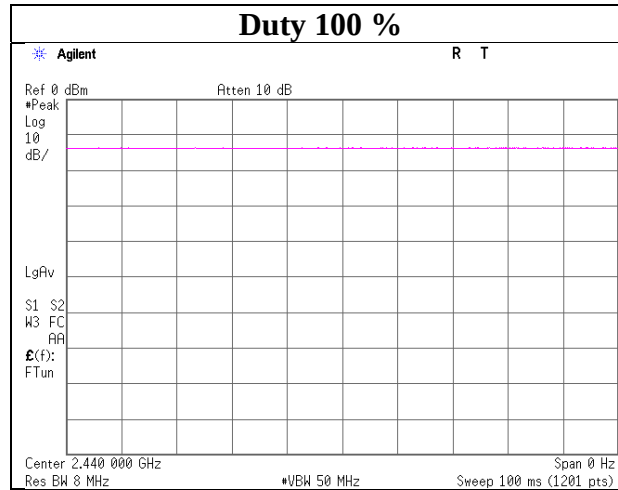
Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-18.67	1.53	0.00	-17.14	0.02	30.00	1000	47.14
2440	-18.13	1.54	0.00	-16.59	0.02	30.00	1000	46.59
2480	-17.63	1.55	0.00	-16.08	0.02	30.00	1000	46.08

Sample Calculation:

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

Burst rate confirmation

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 11130215H
Date January 14, 2016
Temperature / Humidity 25 deg. C / 26 % RH
Engineer Yutaka Yoshida
Mode Tx BT LE



Radiated Spurious Emission

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11130215H
Date	January 23, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Keisuke Kawamura
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	37.653	QP	22.8	15.0	7.2	32.1	-	12.9	40.0	27.1	
Hori	166.353	QP	29.4	15.5	8.8	31.9	-	21.8	43.5	21.7	
Hori	243.435	QP	23.3	17.8	9.5	31.8	-	18.8	46.0	27.2	
Hori	293.506	QP	24.4	19.5	9.8	31.8	-	21.9	46.0	24.1	
Hori	366.548	QP	40.1	18.1	10.4	31.9	-	36.7	46.0	9.3	
Hori	503.947	QP	29.4	19.5	11.2	32.0	-	28.1	46.0	17.9	
Hori	2390.000	PK	41.5	27.9	6.2	32.1	-	43.5	73.9	30.4	
Hori	4804.000	PK	41.4	32.8	8.2	31.3	-	51.1	73.9	22.8	
Hori	7206.000	PK	37.7	36.8	9.1	32.6	-	51.0	73.9	22.9	
Hori	9608.000	PK	39.7	38.1	9.6	32.6	-	54.8	73.9	19.1	
Hori	2390.000	AV	32.7	27.9	6.2	32.1	0.0	34.7	53.9	19.2	
Hori	4804.000	AV	32.6	32.8	8.2	31.3	0.0	42.3	53.9	11.6	
Hori	7206.000	AV	31.7	36.8	9.1	32.6	0.0	45.0	53.9	8.9	
Hori	9608.000	AV	30.9	38.1	9.6	32.6	0.0	46.0	53.9	7.9	
Vert	37.653	QP	25.1	15.0	7.2	32.1	-	15.2	40.0	24.8	
Vert	166.353	QP	28.0	15.5	8.8	31.9	-	20.4	43.5	23.1	
Vert	243.435	QP	22.9	17.8	9.5	31.8	-	18.4	46.0	27.6	
Vert	295.129	QP	22.9	19.6	9.9	31.8	-	20.6	46.0	25.4	
Vert	497.795	QP	30.0	19.4	11.2	32.0	-	28.6	46.0	17.4	
Vert	879.365	QP	26.6	23.9	13.2	31.2	-	32.5	46.0	13.5	
Vert	2390.000	PK	41.5	27.9	6.2	32.1	-	43.5	73.9	30.4	
Vert	4804.000	PK	39.7	32.8	8.2	31.3	-	49.4	73.9	24.5	
Vert	7206.000	PK	39.7	36.8	9.1	32.6	-	53.0	73.9	20.9	
Vert	9608.000	PK	39.3	38.1	9.6	32.6	-	54.4	73.9	19.5	
Vert	2390.000	AV	32.8	27.9	6.2	32.1	0.0	34.8	53.9	19.1	
Vert	4804.000	AV	31.9	32.8	8.2	31.3	0.0	41.6	53.9	12.3	
Vert	7206.000	AV	31.7	36.8	9.1	32.6	0.0	45.0	53.9	8.9	
Vert	9608.000	AV	31.2	38.1	9.6	32.6	0.0	46.3	53.9	7.6	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor) - 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 (4.5 m / 3.0 m) = 3.5 dB
10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = -9.5 dB

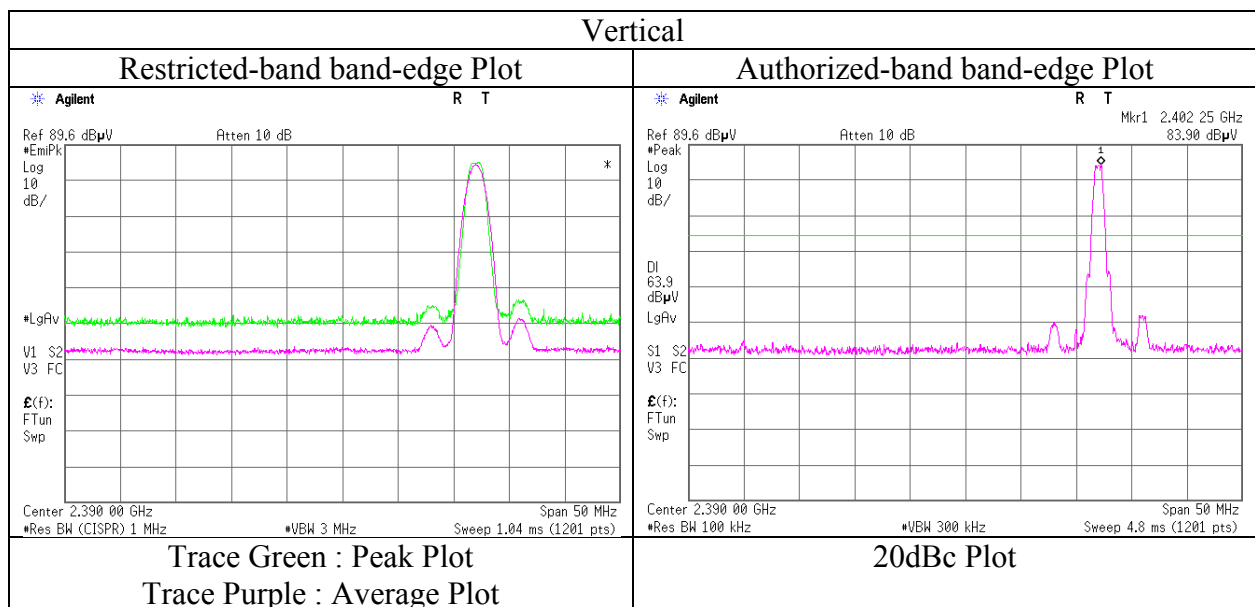
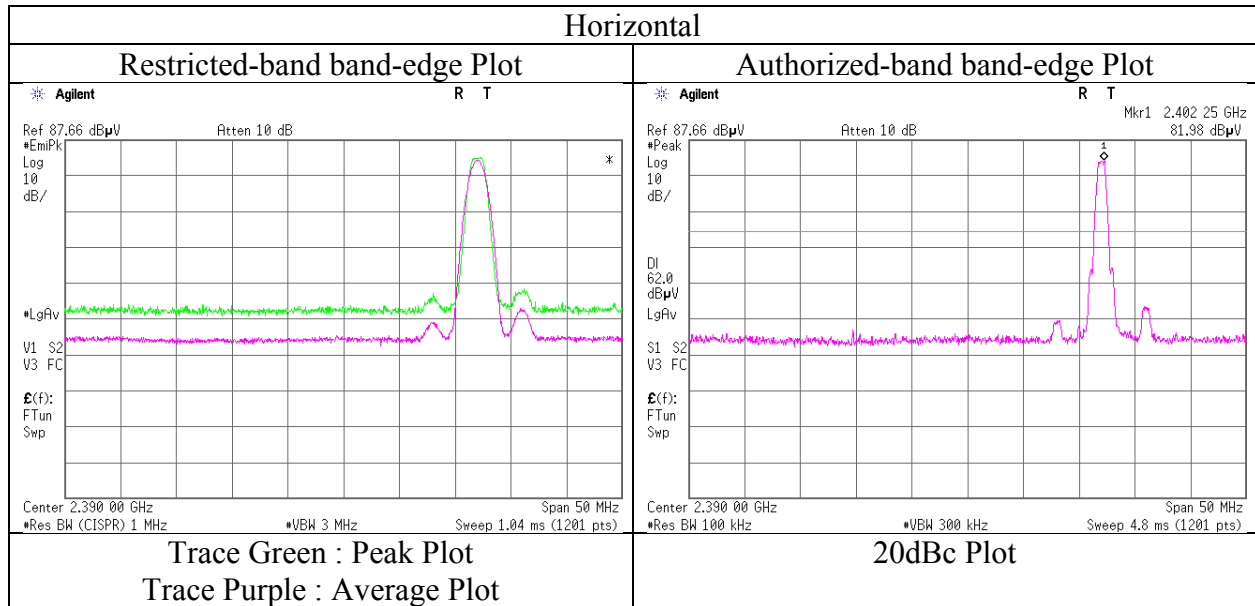
20dBc Data Sheet

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	82.0	28.0	6.2	32.1	84.1	-	-	Carrier
Hori	2400.000	PK	35.5	28.0	6.2	32.1	37.6	64.1	26.5	
Vert	2402.000	PK	83.9	28.0	6.2	32.1	86.0	-	-	Carrier
Vert	2400.000	PK	37.1	28.0	6.2	32.1	39.2	66.0	26.8	

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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11130215H
Date	January 23, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Keisuke Kawamura
Mode	Tx BT LE 2402 MHz



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

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Ise EMC Lab.

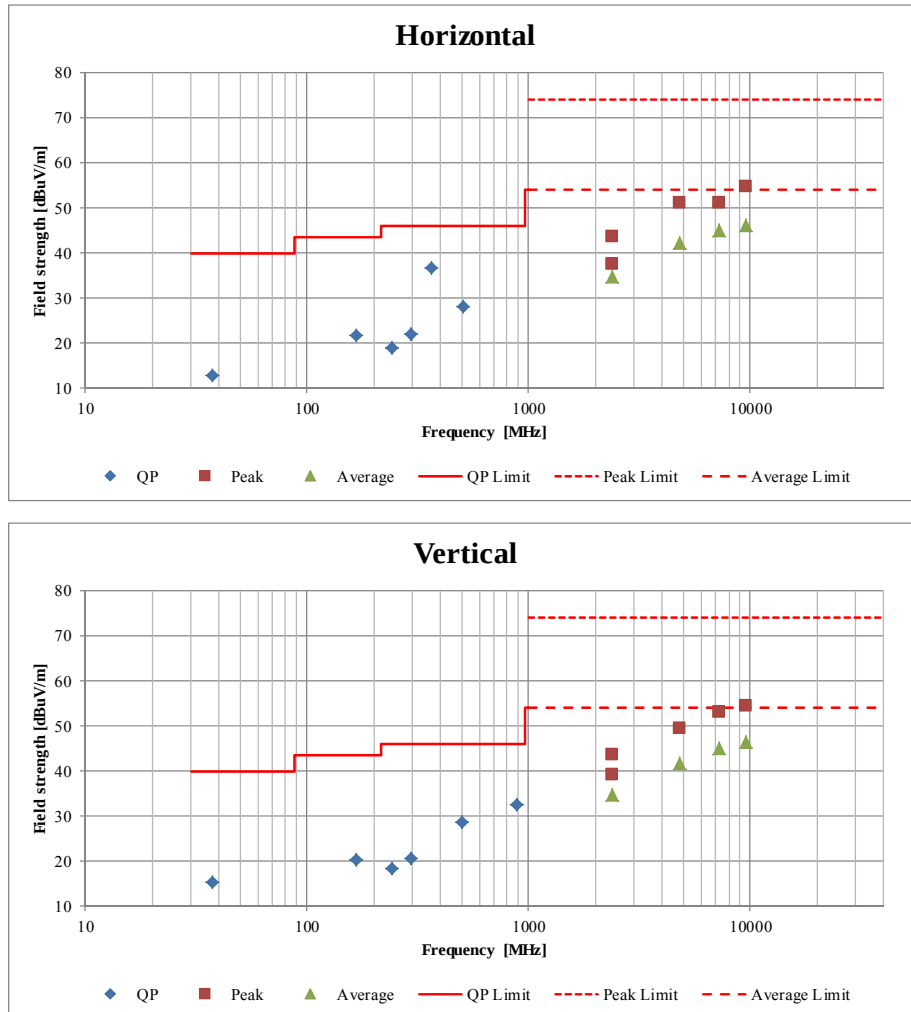
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 11130215H
Date : January 23, 2016
Temperature / Humidity : 20 deg. C / 38 % RH
Engineer : Keisuke Kawamura
Mode : Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11130215H
Date	January 23, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Keisuke Kawamura
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	37.653	QP	22.8	15.0	7.2	32.1	-	12.9	40.0	27.1	
Hori	166.353	QP	29.7	15.5	8.8	31.9	-	22.1	43.5	21.4	
Hori	243.435	QP	23.5	17.8	9.5	31.8	-	19.0	46.0	27.0	
Hori	293.506	QP	24.3	19.5	9.8	31.8	-	21.8	46.0	24.2	
Hori	366.548	QP	40.4	18.1	10.4	31.9	-	37.0	46.0	9.0	
Hori	503.947	QP	29.4	19.5	11.2	32.0	-	28.1	46.0	17.9	
Hori	4880.000	PK	40.5	33.1	8.3	31.3	-	50.6	73.9	23.3	
Hori	7320.000	PK	37.7	36.8	9.1	32.6	-	51.0	73.9	22.9	
Hori	9760.000	PK	39.7	38.2	9.7	32.7	-	54.9	73.9	19.0	
Hori	4880.000	AV	32.5	33.1	8.3	31.3	0.0	42.6	53.9	11.3	
Hori	7320.000	AV	31.7	36.8	9.1	32.6	0.0	45.0	53.9	8.9	
Hori	9760.000	AV	30.9	38.2	9.7	32.7	0.0	46.1	53.9	7.8	
Vert	37.653	QP	25.2	15.0	7.2	32.1	-	15.3	40.0	24.7	
Vert	166.353	QP	28.0	15.5	8.8	31.9	-	20.4	43.5	23.1	
Vert	243.435	QP	22.9	17.8	9.5	31.8	-	18.4	46.0	27.6	
Vert	295.129	QP	22.9	19.6	9.9	31.8	-	20.6	46.0	25.4	
Vert	497.795	QP	29.5	19.4	11.2	32.0	-	28.1	46.0	17.9	
Vert	879.365	QP	26.6	23.9	13.2	31.2	-	32.5	46.0	13.5	
Vert	4880.000	PK	40.8	33.1	8.3	31.3	-	50.9	73.9	23.0	
Vert	7320.000	PK	39.7	36.8	9.1	32.6	-	53.0	73.9	20.9	
Vert	9760.000	PK	39.3	38.2	9.7	32.7	-	54.5	73.9	19.4	
Vert	4880.000	AV	33.0	33.1	8.3	31.3	0.0	43.1	53.9	10.8	
Vert	7320.000	AV	31.7	36.8	9.1	32.6	0.0	45.0	53.9	8.9	
Vert	9760.000	AV	31.2	38.2	9.7	32.7	0.0	46.4	53.9	7.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor) - 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 (4.5 m / 3.0 m) = 3.5 dB
 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = -9.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11130215H
Date	January 23, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Keisuke Kawamura
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	37.653	QP	22.8	15.0	7.2	32.1	-	12.9	40.0	27.1	
Hori	166.353	QP	29.3	15.5	8.8	31.9	-	21.7	43.5	21.8	
Hori	243.435	QP	23.5	17.8	9.5	31.8	-	19.0	46.0	27.0	
Hori	293.506	QP	24.1	19.5	9.8	31.8	-	21.6	46.0	24.4	
Hori	366.548	QP	40.4	18.1	10.4	31.9	-	37.0	46.0	9.0	
Hori	503.947	QP	29.4	19.5	11.2	32.0	-	28.1	46.0	17.9	
Hori	2483.500	PK	43.8	28.1	6.3	32.1	-	46.1	73.9	27.8	
Hori	2484.000	PK	44.9	28.1	6.3	32.1	-	47.2	73.9	26.7	
Hori	4960.000	PK	40.1	33.4	8.2	31.2	-	50.5	73.9	23.4	
Hori	7440.000	PK	37.7	36.8	9.1	32.7	-	50.9	73.9	23.0	
Hori	9920.000	PK	39.7	38.3	9.6	32.8	-	54.8	73.9	19.1	
Hori	2483.500	AV	36.4	28.1	6.3	32.1	0.0	38.7	53.9	15.2	
Hori	2484.000	AV	37.7	28.1	6.3	32.1	0.0	40.0	53.9	13.9	
Hori	4960.000	AV	32.6	33.4	8.2	31.2	0.0	43.0	53.9	10.9	
Hori	7440.000	AV	31.7	36.8	9.1	32.7	0.0	44.9	53.9	9.0	
Hori	9920.000	AV	30.9	38.3	9.6	32.8	0.0	46.0	53.9	7.9	
Vert	37.653	QP	25.2	15.0	7.2	32.1	-	15.3	40.0	24.7	
Vert	166.353	QP	28.0	15.5	8.8	31.9	-	20.4	43.5	23.1	
Vert	243.435	QP	22.9	17.8	9.5	31.8	-	18.4	46.0	27.6	
Vert	295.129	QP	22.9	19.6	9.9	31.8	-	20.6	46.0	25.4	
Vert	497.795	QP	29.2	19.4	11.2	32.0	-	27.8	46.0	18.2	
Vert	879.365	QP	26.1	23.9	13.2	31.2	-	32.0	46.0	14.0	
Vert	2483.500	PK	43.9	28.1	6.3	32.1	-	46.2	73.9	27.7	
Vert	2484.000	PK	43.7	28.1	6.3	32.1	-	46.0	73.9	27.9	
Vert	4960.000	PK	41.0	33.4	8.2	31.2	-	51.4	73.9	22.5	
Vert	7440.000	PK	39.7	36.8	9.1	32.7	-	52.9	73.9	21.0	
Vert	9920.000	PK	39.3	38.3	9.6	32.8	-	54.4	73.9	19.5	
Vert	2483.500	AV	35.8	28.1	6.3	32.1	0.0	38.1	53.9	15.8	
Vert	2484.000	AV	37.0	28.1	6.3	32.1	0.0	39.3	53.9	14.6	
Vert	4960.000	AV	33.4	33.4	8.2	31.2	0.0	43.8	53.9	10.1	
Vert	7440.000	AV	31.7	36.8	9.1	32.7	0.0	44.9	53.9	9.0	
Vert	9920.000	AV	31.2	38.3	9.6	32.8	0.0	46.3	53.9	7.6	

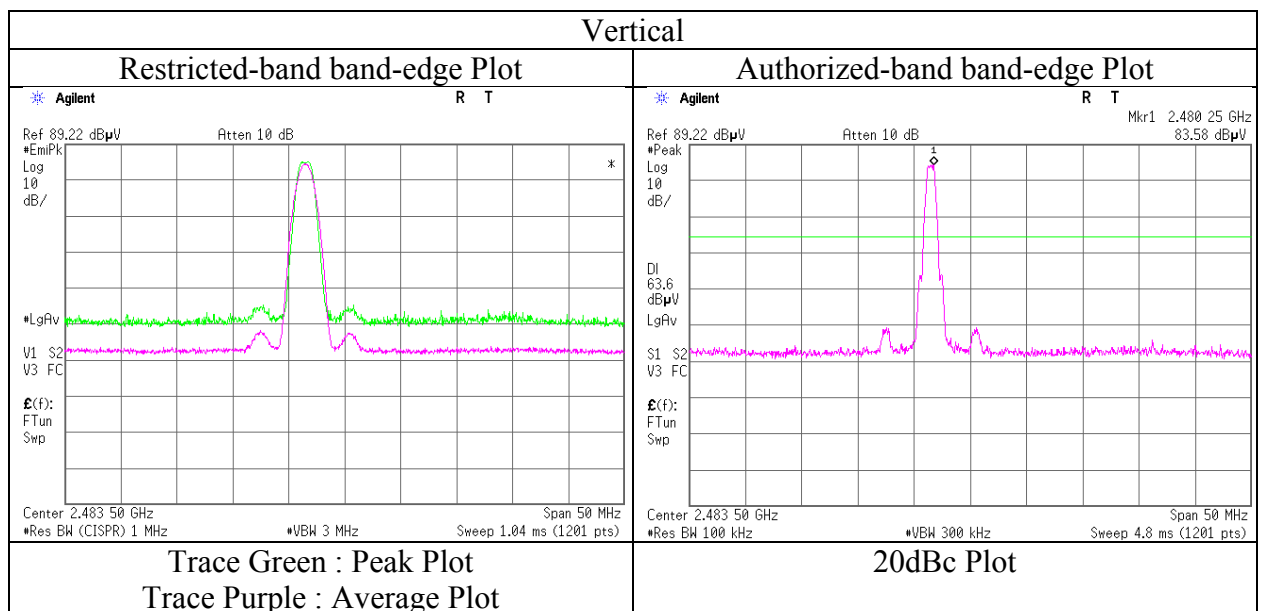
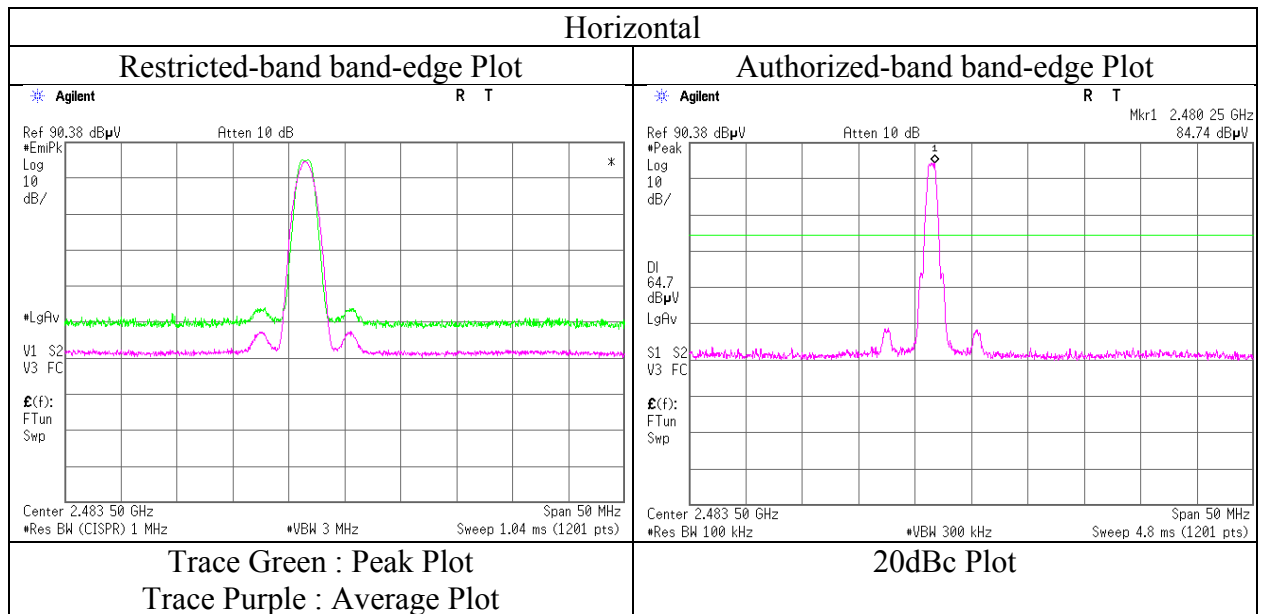
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor) - Gain(Amplifier)

*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 (4.5 m / 3.0 m) = 3.5 dB
10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = -9.5 dB

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11130215H
Date	January 23, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Keisuke Kawamura
Mode	Tx BT LE 2480 MHz



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

UL Japan, Inc.

Ise EMC Lab.

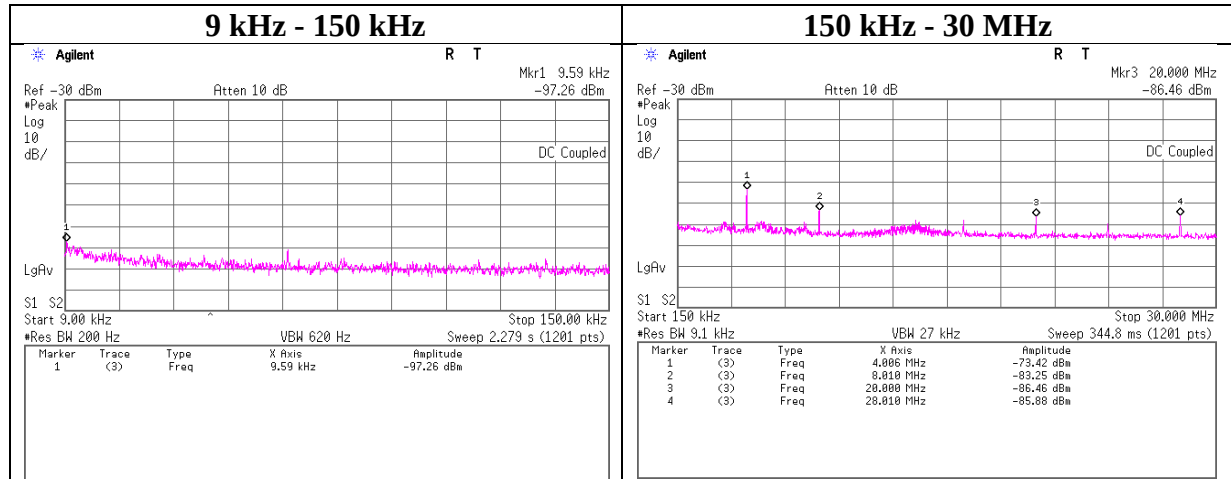
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11130215H
Date	January 14, 2016
Temperature / Humidity	25 deg. C / 26 % RH
Engineer	Yutaka Yoshida
Mode	Tx BT LE 2402 MHz

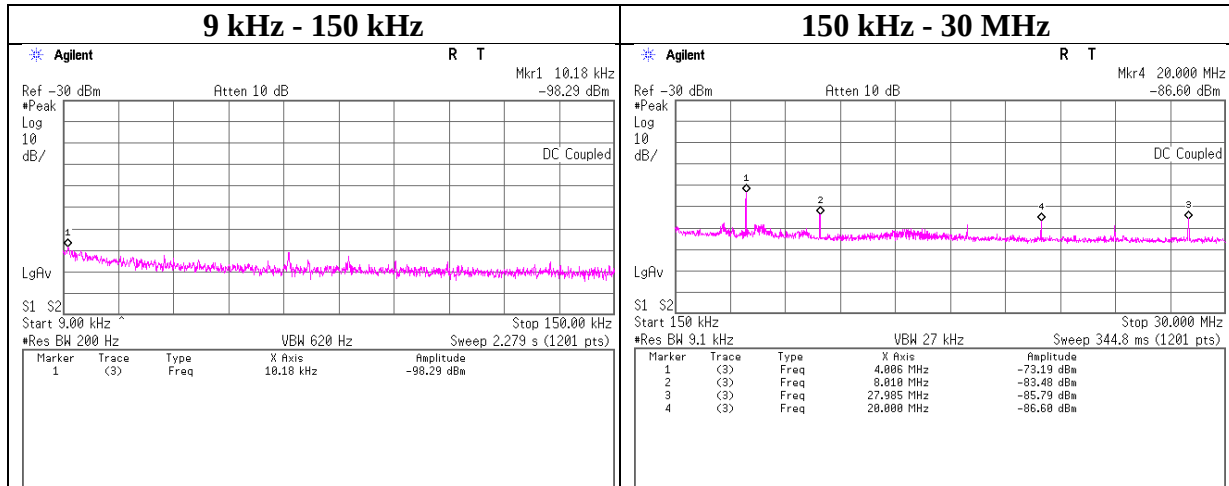


Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0.010	-97.3	1.05	10.0	2.0	1	-84.2	300	6.0	-22.9	48.0	70.9	
4.006	-73.4	1.05	10.0	2.0	1	-60.4	30	6.0	20.9	29.5	8.6	
8.010	-83.3	1.05	10.0	2.0	1	-70.2	30	6.0	11.1	29.5	18.5	
20.000	-86.5	1.05	10.0	2.0	1	-73.4	30	6.0	7.9	29.5	21.7	
28.010	-85.9	1.05	10.0	2.0	1	-72.8	30	6.0	8.4	29.5	21.1	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11130215H
Date	January 14, 2016
Temperature / Humidity	25 deg. C / 26 % RH
Engineer	Yutaka Yoshida
Mode	Tx BT LE 2440 MHz

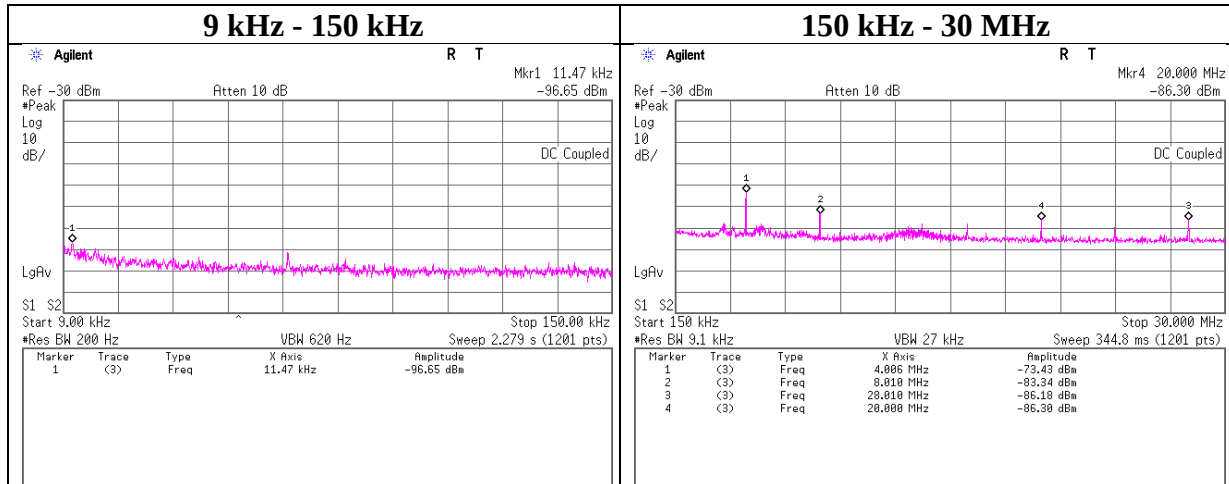


Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0.010	-98.3	1.05	10.0	2.0	1	-85.2	300	6.0	-24.0	47.4	71.4	
4.006	-86.6	1.05	10.0	2.0	1	-73.5	30	6.0	7.7	29.5	21.8	
8.010	-83.5	1.05	10.0	2.0	1	-70.4	30	6.0	10.8	29.5	18.7	
27.985	-85.8	1.05	10.0	2.0	1	-72.7	30	6.0	8.5	29.5	21.0	
20.000	-86.6	1.05	10.0	2.0	1	-73.5	30	6.0	7.7	29.5	21.8	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11130215H
Date	January 14, 2016
Temperature / Humidity	25 deg. C / 26 % RH
Engineer	Yutaka Yoshida
Mode	Tx BT LE 2480 MHz



Frequency [MHz]	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
0.011	-96.7	1.05	10.0	2.0	1	-83.6	300	6.0	-22.3	46.4	68.7	
4.006	-73.4	1.05	10.0	2.0	1	-60.4	30	6.0	20.9	29.5	8.7	
8.010	-83.3	1.05	10.0	2.0	1	-70.3	30	6.0	11.0	29.5	18.6	
28.010	-86.2	1.05	10.0	2.0	1	-73.1	30	6.0	8.1	29.5	21.4	
20.000	-86.3	1.05	10.0	2.0	1	-73.2	30	6.0	8.0	29.5	21.5	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

Power Density

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 11130215H
Date January 14, 2016
Temperature / Humidity 25 deg. C / 26 % RH
Engineer Yutaka Yoshida
Mode Tx BT LE

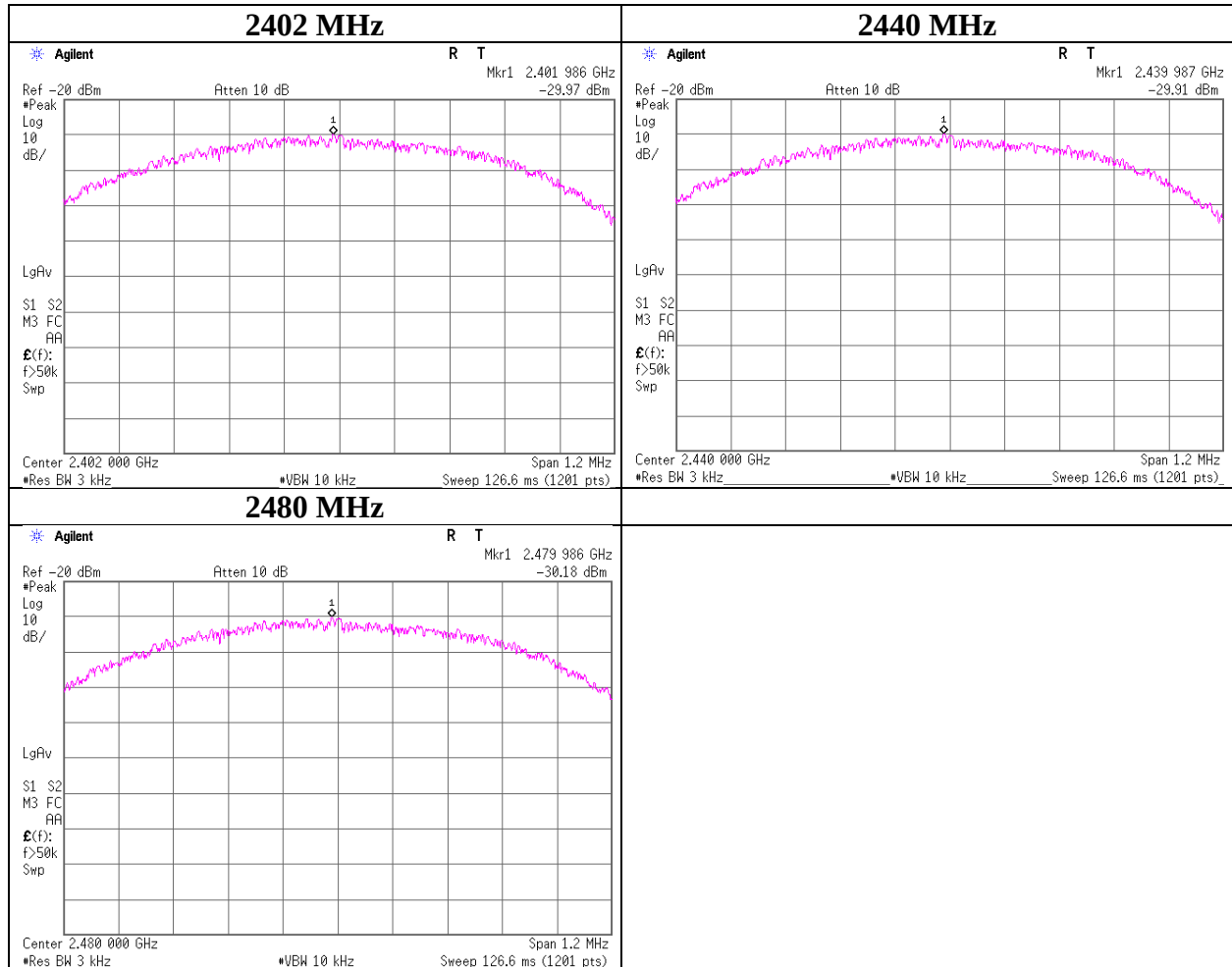
Bluetooth LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-29.97	1.53	10.03	-18.41	8.00	26.41
2440.00	-29.91	1.54	10.03	-18.34	8.00	26.34
2480.00	-30.18	1.55	10.03	-18.60	8.00	26.60

Sample Calculation:

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

Power Density



UL Japan, Inc.

Ise EMC Lab.

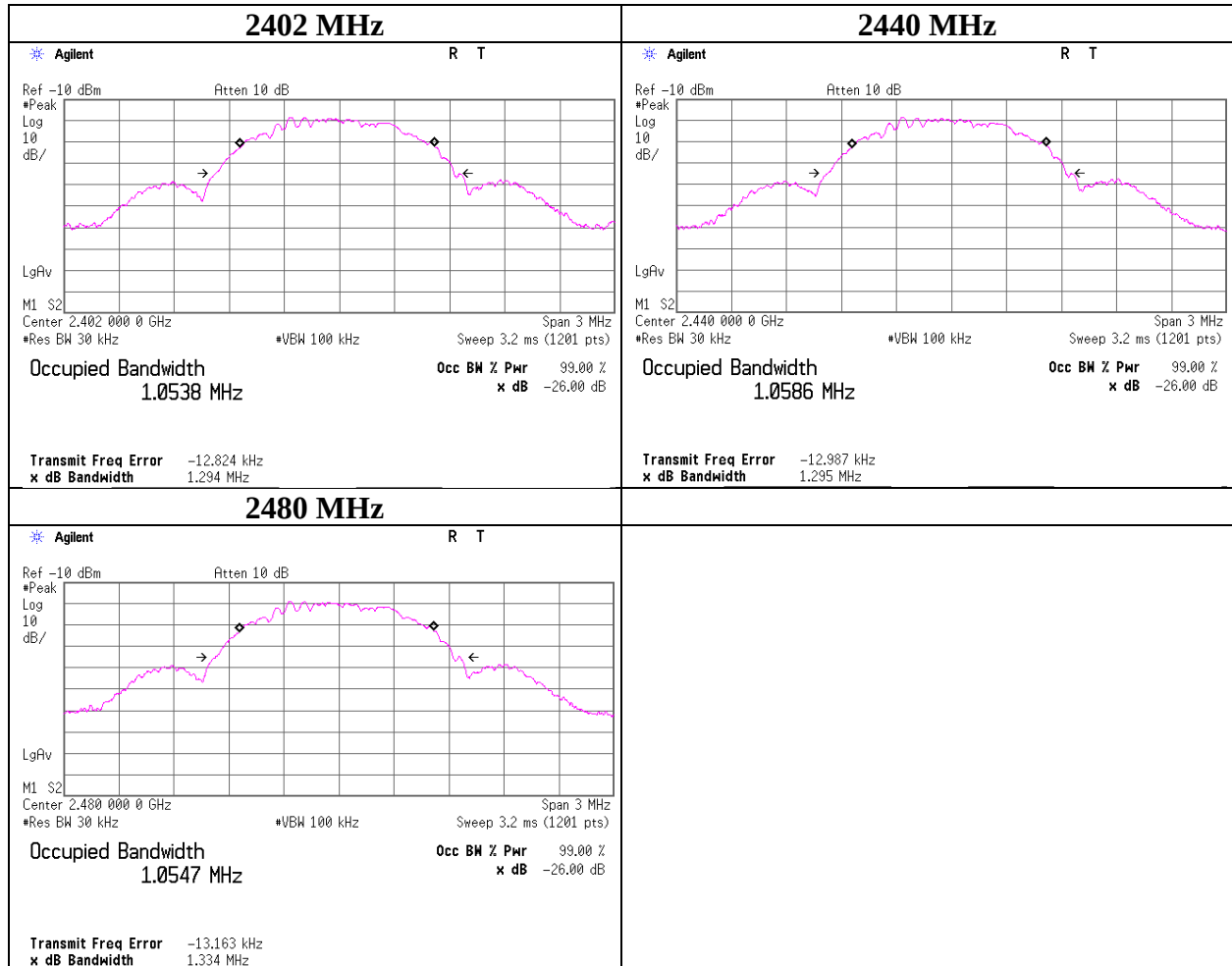
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

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99%Occupied Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11130215H
Date	January 14, 2016
Temperature / Humidity	25 deg. C / 26 % RH
Engineer	Yutaka Yoshida
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)
MRENT-126	Spectrum Analyzer	KEYSIGHT	E4440A	MY46185516	AT	2015/07/31 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2015/10/08 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2015/10/08 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2015/04/02 * 12
MAT-25	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71642	AT	2015/06/18 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2016/01/21 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2016/01/21 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MTR-01	Test Receiver	Rohde & Schwarz	ES140	100084	RE	2015/11/28 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2015/11/03 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2015/11/12 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2016/01/18 * 12
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE	2015/10/07 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2015/08/10 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2015/10/01 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2015/06/06 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2015/05/15 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	CE	2015/09/19 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	CE	2016/01/21 * 12
MJM-25	Measure	KOMELON	KMC-36	-	CE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	CE	2015/06/08 * 12
MLS-25	LISN(AMN)	Schwarzbeck	NSLK8127	8127-731	CE	2015/07/17 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/3D-2 W(7.5m)/RG400u(1. 5m)/RFM-E421(Swi tcher)	-/01068(Switcher)	CE	2015/09/29 * 12
MAT-64	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	CE	2015/08/19 * 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: CE: Conducted Emission test
RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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