



RADIO TEST REPORT

Test Report No. : 10093118H-A-R1

Applicant : Braveridge Co., Ltd.
Type of Equipment : Bluetooth Low Energy Module
Model No. : BVMCN5102
FCC ID : 2ABXRBVMCN5102
Test regulation : FCC Part 15 Subpart C: 2013
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 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 report is a revised version of 10093118H-A. 10093118H-A is replaced with this report.

Date of test: October 22 to December 25, 2013

Representative test engineer:

Satofumi Matsuyama
Engineer of WiSE Japan,
UL Verification Service

Approved by:

Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



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.
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<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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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: Conducted Emission.....	10
SECTION 6: Radiated Spurious Emission	11
SECTION 7: Antenna Terminal Conducted Tests.....	12
APPENDIX 1: Data of EMI test.....	13
Conducted Emission	13
6dB Bandwidth	15
Maximum Peak Output Power	17
Average Output Power	18
Conducted Spurious Emission	23
Power Density	26
99%Occupied Bandwidth	28
APPENDIX 2: Test instruments	29
APPENDIX 3: Photographs of test setup	30
Conducted Emission	30
Radiated Spurious Emission	31
Worst Case Position (Horizontal: X-axis/ Vertical:Y-axis).....	32

SECTION 1: Customer information

Company Name	:	Braveridge Co., Ltd.
Address	:	3-27-2 Shusenji Nishi-ku, Fukuoka-city, Fukuoka, Japan 819-0373
Telephone Number	:	+81-92-834-5789
Facsimile Number	:	+81-92-807-7718
Contact Person	:	Yasunari Kohashi

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Low Energy Module
Model No.	:	BVMCN5102
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC1.8V - 3.6V
Receipt Date of Sample	:	October 15, 2013
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

General Specification

Clock frequency(ies) in the system	:	16MHz
------------------------------------	---	-------

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402-2480MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.6V
Antenna type	:	Helical Monopole Antenna
Antenna Gain	:	0.9dBi (peak)

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2013, final revised on September 30, 2013 and effective October 30, 2013

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 30, 2013 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4:2003 7. AC powerline Conducted Emission measurements ----- IC: RSS-Gen 7.2.4	FCC: Section 15.207 ----- IC: RSS-Gen 7.2.4	QP 10.6dB, 0.45146MHz, N AV 6.8dB, 0.45146MHz, N 0.45243MHz, L	Complied	-
6dB Bandwidth	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.6.2	FCC: Section 15.247(a)(2) ----- IC: RSS-210 A8.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) ----- IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.9	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 7.2.3	14.5dB 48.003MHz, QP, Vert.	Complied	Conducted/ Radiated

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

* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

FCC 15.31 (e)

This EUT provides stable voltage (DC1.6V) constantly to RF part regardless of input voltage. 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 the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 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 4.6.1	IC: RSS-Gen 4.6.1	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.

Test room (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.5dB
No.3	3.6dB
No.4	3.5dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

*3m/1m/0.5m = Measurement distance

Power meter (+dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

Conducted Emission test

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

Radiated emission test(3m)

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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	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	-	6.2 x 4.7 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 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 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

Bluetooth (BT): Transmitting (Tx)

Details of Operating Mode(s)

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

*Power of the EUT was set by the software as follows;

Power settings: -30dBm (Minimum)^{*1)}, +4dBm (Maximum)

Software: nRF Studio Ver.1.14.1.2369

*1) -30dBm (Minimum) setting was used for Maximum Peak output power test only.

Other tests were performed only with +4dBm (Maximum) setting.

*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.

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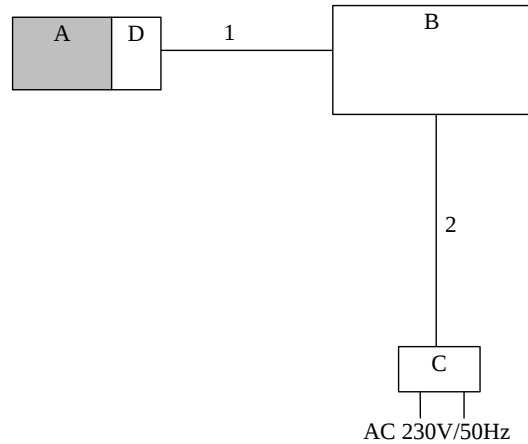
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4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Low Energy Module	BVMCN5102	201309	Braveridge Co., Ltd.	EUT
B	Laptop PC	X202E	X202E-CT3217	ASUS	-
C	AC Adapter	AD890326	12494	ASUS	-
D	Jig	-	-	Braveridge Co., Ltd.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	DC Cable	2.4	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 0.5m, raised 0.8m above the conducting ground plane.

The rear of tabletop was located 40cm 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 80cm 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 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm 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	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.

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

The height of the measuring antenna varied between 1 and 4m 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	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 5 of RSS-Gen 7.2.5(IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	Alternative Method1 RBW: 1MHz VBW: 3MHz Trace: Free Run Detector: Power Averaging (RMS) Duty factor was added to the results.	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m *2) (above 10GHz)		3m (below 10GHz), 1m *2) (above 10GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)"

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

- 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	: 30M-26.5GHz
Test data	: APPENDIX
Test result	: Pass

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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	3MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold*1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	119msec	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				

*1) The measurement was performed with Max Hold since the duty cycle was not 100%.
*2) Reference data
*3) Section 10.2 Method PKPSD (peak PSD) of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 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.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

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: Data of EMI test

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

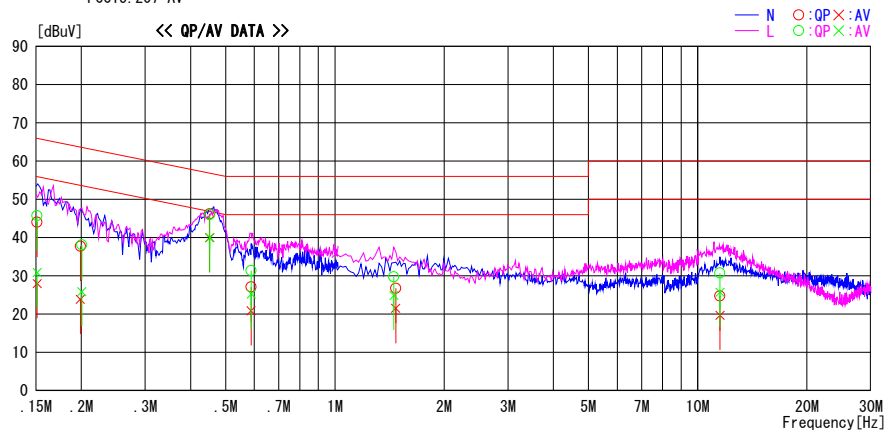
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2013/11/10

Report No. : 10093118H

Temp./Humi. : 22deg. C / 50% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : LE Tx 2402MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15106	30.8	14.8	13.2	44.0	28.0	65.9	55.9	21.9	27.9	N	
0.19882	24.5	10.7	13.2	37.7	23.9	63.7	53.7	26.0	29.8	N	
0.45146	33.0	26.8	13.2	46.2	40.0	56.8	46.8	10.6	6.8	N	
0.58762	13.9	7.7	13.2	27.1	20.9	56.0	46.0	28.9	25.1	N	
1.47076	13.2	8.0	13.5	26.7	21.5	56.0	46.0	29.3	24.5	N	
11.51152	10.1	5.1	14.6	24.7	19.7	60.0	50.0	35.3	30.3	N	
0.15100	32.5	17.7	13.2	45.7	30.9	65.9	55.9	20.2	25.0	L	
0.20056	24.9	12.7	13.2	38.1	25.9	63.6	53.6	25.5	27.7	L	
0.45243	32.8	26.8	13.2	46.0	40.0	56.8	46.8	10.8	6.8	L	
0.58820	18.2	12.0	13.2	31.4	25.2	56.0	46.0	24.6	20.8	L	
1.45258	16.2	11.4	13.5	29.7	24.9	56.0	46.0	26.3	21.1	L	
11.51523	16.1	11.1	14.6	30.7	25.7	60.0	50.0	29.3	24.3	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT=READING+C. F (1SN LOSS + CABLE LOSS)
Except for the above table : adequate margin data below the limits.

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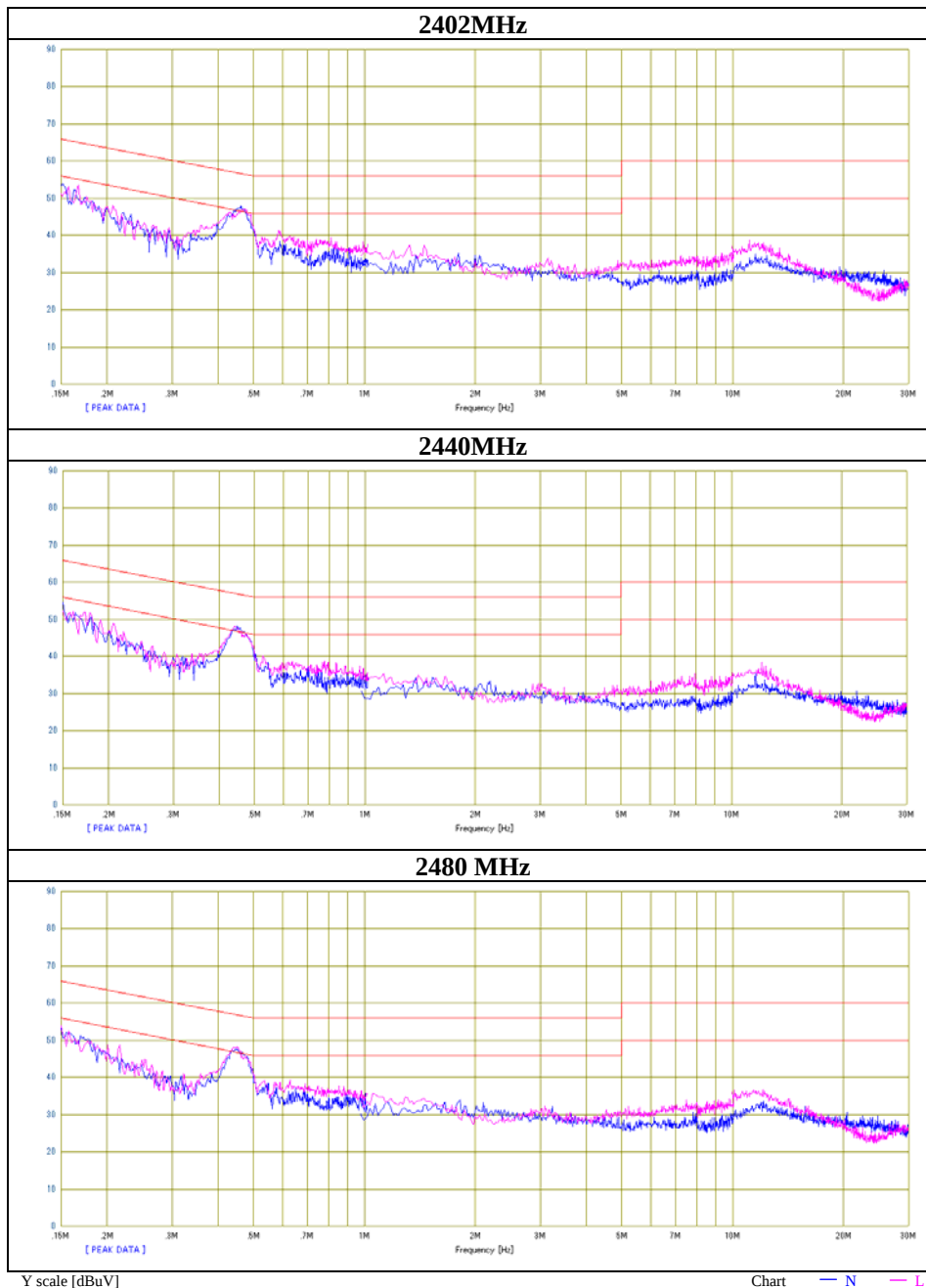
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Conducted Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10093118H
Date	11/10/2013
Temperature/ Humidity	22deg. C / 50% RH
Engineer	Satofumi Matsuyama
Mode	BT LE Tx



6dB Bandwidth

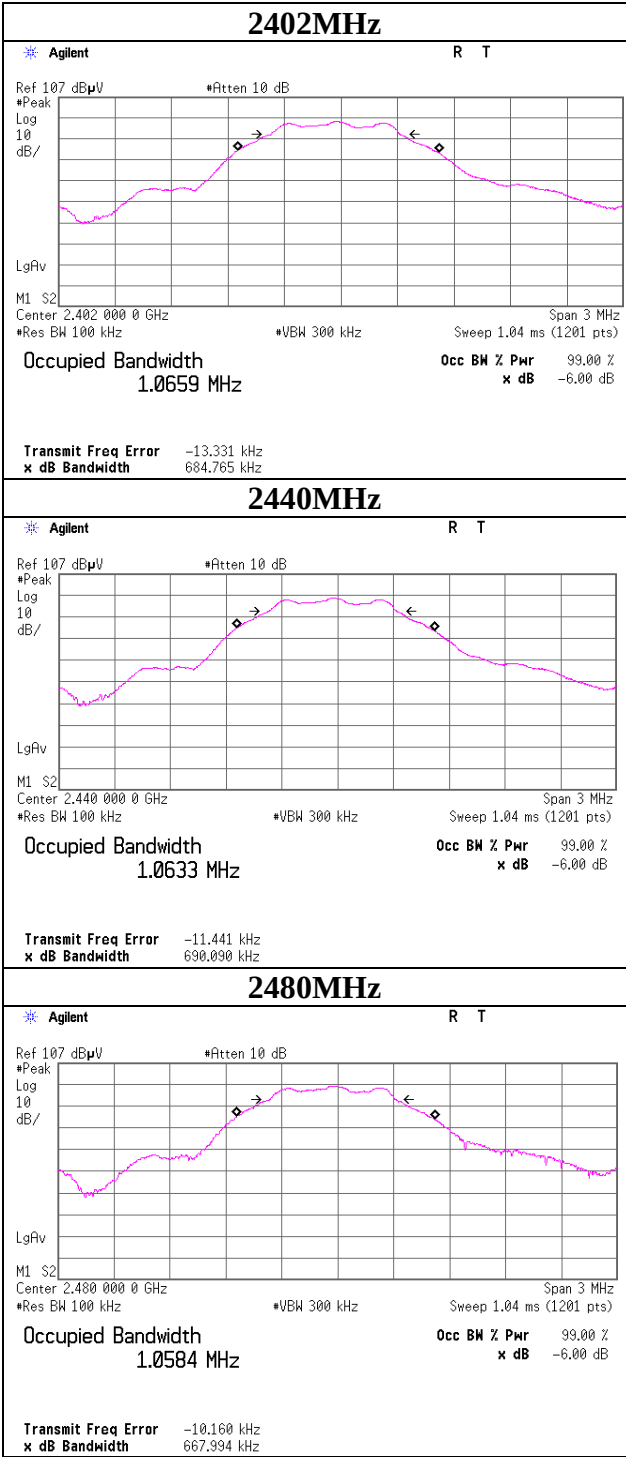
Test place Head Office EMC Lab. No.6 Measurement Room
Report No. 10093118H
Date 10/22/2013
Temperature/ Humidity 22 deg. C / 51% RH
Engineer Keisuke Kawamura
Mode Tx

11b

Frequency [MHz]	6dB Bandwidth [kHz]	Limit [kHz]
2402	684.765	>500
2440	690.090	>500
2480	667.994	>500

6dB Bandwidth

BT LE



Maximum Peak Output Power

Test place Head Office EMC Lab. No.6 Measurement Room
Report No. 10093118H
Date 10/22/2013 12/25/2013
Temperature/ Humidity 22 deg. C / 51% RH 22 deg. C / 38% RH
Engineer Keisuke Kawamura Tomohisa Nakagawa
Mode BT LE Tx

Maximum setting value

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.91	1.69	9.97	-0.25	0.94	30.00	1000	30.25
2440	-10.94	1.70	9.97	0.73	1.18	30.00	1000	29.27
2480	-10.57	1.71	9.97	1.11	1.29	30.00	1000	28.89

Sample Calculation:

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

Minimum setting value

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-48.70	1.69	9.97	-37.04	0.00020	30.00	1000	67.04
2440	-47.50	1.70	9.97	-35.83	0.00026	30.00	1000	65.83
2480	-46.10	1.71	9.97	-34.42	0.00036	30.00	1000	64.42

Sample Calculation:

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

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Average Output Power

Test place Head Office EMC Lab. No.6 Measurement Room
Report No. 10093118H
Date 10/22/2013
Temperature/ Humidity 22 deg. C / 51% RH
Engineer Keisuke Kawamura
Mode BT LE Tx (max power)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-13.78	1.69	9.97	-2.12	0.61	30.00	1000	32.12
2440	-12.67	1.70	9.97	-1.00	0.79	30.00	1000	31.00
2480	-12.32	1.71	9.97	-0.64	0.86	30.00	1000	30.64

Sample Calculation:

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

Radiated Spurious Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber		
Report No.	10093118H		
Date	11/09/2013	11/10/2013	
Temperature/ Humidity	23deg. C / 41% RH	22deg. C / 50% RH	
Engineer	Satofumi Matsuyama	Satofumi Matsuyama	
	(1-10GHz)	(Below 1GHz)	
Mode	BT LE Tx 2402MHz		

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	48.003	QP	23.8	11.6	7.0	28.5		13.9	40.0	26.1	
Hori	72.002	QP	26.6	6.5	7.2	28.6		11.7	40.0	28.3	
Hori	167.990	QP	23.1	15.6	8.0	28.1		18.6	43.5	24.9	
Hori	323.777	QP	25.8	15.0	8.9	27.8		21.9	46.0	24.1	
Hori	453.142	QP	24.7	17.7	9.5	28.6		23.3	46.0	22.7	
Hori	2390.000	PK	49.1	26.8	3.2	35.7		43.4	73.9	30.5	
Hori	4804.000	PK	NS	-	-	-		-	73.9	-	
Hori	7206.000	PK	NS	-	-	-		-	73.9	-	
Hori	9608.000	PK	NS	-	-	-		-	73.9	-	
Hori	2390.000	AV	32.0	26.8	3.2	35.7	1.6	27.9	53.9	26.0	*1
Hori	4804.000	AV	NS	-	-	-		-	53.9	-	
Hori	7206.000	AV	NS	-	-	-		-	53.9	-	
Hori	9608.000	AV	NS	-	-	-		-	53.9	-	
Vert	48.003	QP	35.4	11.6	7.0	28.5		25.5	40.0	14.5	
Vert	72.002	QP	35.8	6.5	7.2	28.6		20.9	40.0	19.1	
Vert	167.990	QP	24.7	15.6	8.0	28.1		20.2	43.5	23.3	
Vert	240.002	QP	27.4	17.0	8.4	27.7		25.1	46.0	20.9	
Vert	323.777	QP	30.5	15.0	8.9	27.8		26.6	46.0	19.4	
Vert	2390.000	PK	49.5	26.8	3.2	35.7		43.8	73.9	30.1	
Vert	4804.000	PK	NS	-	-	-		-	73.9	-	
Vert	7206.000	PK	NS	-	-	-		-	73.9	-	
Vert	9608.000	PK	NS	-	-	-		-	73.9	-	
Vert	2390.000	AV	32.0	26.8	3.2	35.7	1.6	27.9	53.9	26.0	*1
Vert	4804.000	AV	NS	-	-	-		-	53.9	-	
Vert	7206.000	AV	NS	-	-	-		-	53.9	-	
Vert	9608.000	AV	NS	-	-	-		-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty Factor

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

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

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

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	92.5	26.8	3.2	35.7	86.8	-	-	Carrier
Hori	2400.000	PK	46.3	26.8	3.2	35.7	40.6	66.8	26.2	
Vert	2402.000	PK	93.9	26.8	3.2	35.7	88.2	-	-	Carrier
Vert	2400.000	PK	46.2	26.8	3.2	35.7	40.5	68.2	27.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

UL Japan, Inc.

Head Office EMC Lab.

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Test place Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10093118H
Date 11/09/2013 11/10/2013
Temperature/ Humidity 23deg. C / 41% RH 22deg. C / 50% RH
Engineer Satofumi Matsuyama Satofumi Matsuyama
(1-10GHz) (Below 1GHz)
Mode BT LE Tx 2440MHz

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	48.001	QP	23.7	11.6	7.0	28.5		13.8	40.0	26.2	
Hori	72.001	QP	24.6	6.5	7.2	28.6		9.7	40.0	30.3	
Hori	167.991	QP	23.1	15.6	8.0	28.1		18.6	43.5	24.9	
Hori	323.798	QP	27.7	15.0	8.9	27.8		23.8	46.0	22.2	
Hori	453.140	QP	24.8	17.7	9.5	28.6		23.4	46.0	22.6	
Hori	4880.000	PK	NS	-	-	-		-	73.9	-	
Hori	7320.000	PK	NS	-	-	-		-	73.9	-	
Hori	9760.000	PK	NS	-	-	-		-	73.9	-	
Hori	4880.000	AV	NS	-	-	-		-	53.9	-	
Hori	7320.000	AV	NS	-	-	-		-	53.9	-	
Hori	9760.000	AV	NS	-	-	-		-	53.9	-	
Vert	48.002	QP	30.9	11.6	7.0	28.5		21.0	40.0	19.0	
Vert	72.001	QP	34.8	6.5	7.2	28.6		19.9	40.0	20.1	
Vert	167.996	QP	28.1	15.6	8.0	28.1		23.6	43.5	19.9	
Vert	240.001	QP	27.5	17.0	8.4	27.7		25.2	46.0	20.8	
Vert	323.798	QP	28.0	15.0	8.9	27.8		24.1	46.0	21.9	
Vert	4880.000	PK	NS	-	-	-		-	73.9	-	
Vert	7320.000	PK	NS	-	-	-		-	73.9	-	
Vert	9760.000	PK	NS	-	-	-		-	73.9	-	
Vert	4880.000	AV	NS	-	-	-		-	53.9	-	
Vert	7320.000	AV	NS	-	-	-		-	53.9	-	
Vert	9760.000	AV	NS	-	-	-		-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty Factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10093118H
Date 11/09/2013 11/10/2013
Temperature/ Humidity 23deg. C / 41% RH 22deg. C / 50% RH
Engineer Satofumi Matsuyama Satofumi Matsuyama
(1-10GHz) (Below 1GHz)
Mode BT LE Tx 2480MHz

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	48.002	QP	23.6	11.6	7.0	28.5		13.7	40.0	26.3	
Hori	72.003	QP	24.6	6.5	7.2	28.6		9.7	40.0	30.3	
Hori	167.995	QP	23.2	15.6	8.0	28.1		18.7	43.5	24.8	
Hori	323.798	QP	27.8	15.0	8.9	27.8		23.9	46.0	22.1	
Hori	453.145	QP	24.9	17.7	9.5	28.6		23.5	46.0	22.5	
Hori	2483.500	PK	50.3	26.7	3.3	35.7		44.6	73.9	29.3	
Hori	2571.428	PK	56.5	26.9	3.3	35.6		51.1	73.9	22.8	
Hori	4960.000	PK	NS	-	-	-		-	73.9	-	
Hori	7440.000	PK	NS	-	-	-		-	73.9	-	
Hori	9920.000	PK	NS	-	-	-		-	73.9	-	
Hori	2483.500	AV	33.1	26.7	3.3	35.7	1.6	29.0	53.9	24.9	*1
Hori	2571.428	AV	41.6	26.9	3.3	35.6	1.6	37.8	53.9	16.1	*1
Hori	4960.000	AV	NS	-	-	-		-	53.9	-	
Hori	7440.000	AV	NS	-	-	-		-	53.9	-	
Hori	9920.000	AV	NS	-	-	-		-	53.9	-	
Vert	48.004	QP	30.8	11.6	7.0	28.5		20.9	40.0	19.1	
Vert	72.002	QP	34.7	6.5	7.2	28.6		19.8	40.0	20.2	
Vert	167.992	QP	28.0	15.6	8.0	28.1		23.5	43.5	20.0	
Vert	240.002	QP	27.6	17.0	8.4	27.7		25.3	46.0	20.7	
Vert	323.799	QP	28.1	15.0	8.9	27.8		24.2	46.0	21.8	
Vert	2483.500	PK	48.6	26.7	3.3	35.7		42.9	73.9	31.0	
Vert	2571.948	PK	57.0	26.9	3.3	35.6		51.6	73.9	22.3	
Vert	4960.000	PK	NS	-	-	-		-	73.9	-	
Vert	7440.000	PK	NS	-	-	-		-	73.9	-	
Vert	9920.000	PK	NS	-	-	-		-	73.9	-	
Vert	2483.500	AV	32.5	26.7	3.3	35.7	1.6	28.4	53.9	25.5	*1
Vert	2571.948	AV	41.4	26.9	3.3	35.6	1.6	37.6	53.9	16.3	*1
Vert	4960.000	AV	NS	-	-	-		-	53.9	-	
Vert	7440.000	AV	NS	-	-	-		-	53.9	-	
Vert	9920.000	AV	NS	-	-	-		-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty Factor

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

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

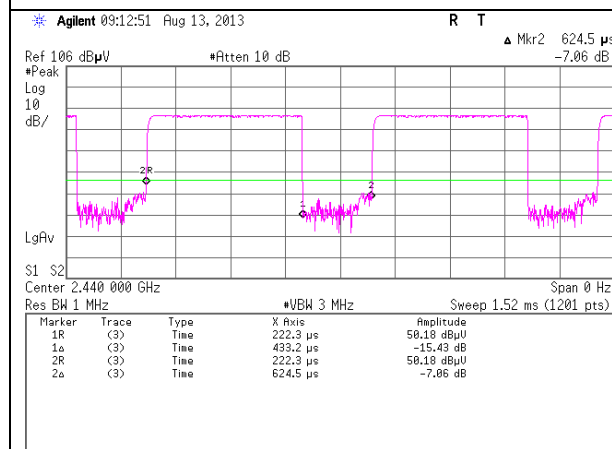
*1) Not Out of band emission(Leakage Power)

Burst rate confirmation

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber		
Report No.	10093118H		
Date	11/09/2013	11/10/2013	
Temperature/ Humidity	23deg. C / 41% RH	22deg. C / 50% RH	
Engineer	Satofumi Matsuyama	Satofumi Matsuyama	
	(1-10GHz)	(Below 1GHz)	
Mode	BT LE Tx 2480MHz		

BT LE

Tx on / (Tx on + Tx off) =	0.694
Tx on / (Tx on + Tx off) * 100 =	69.4 %
Duty factor = 10 * log (624.5 / 433.2) =	1.59 dB



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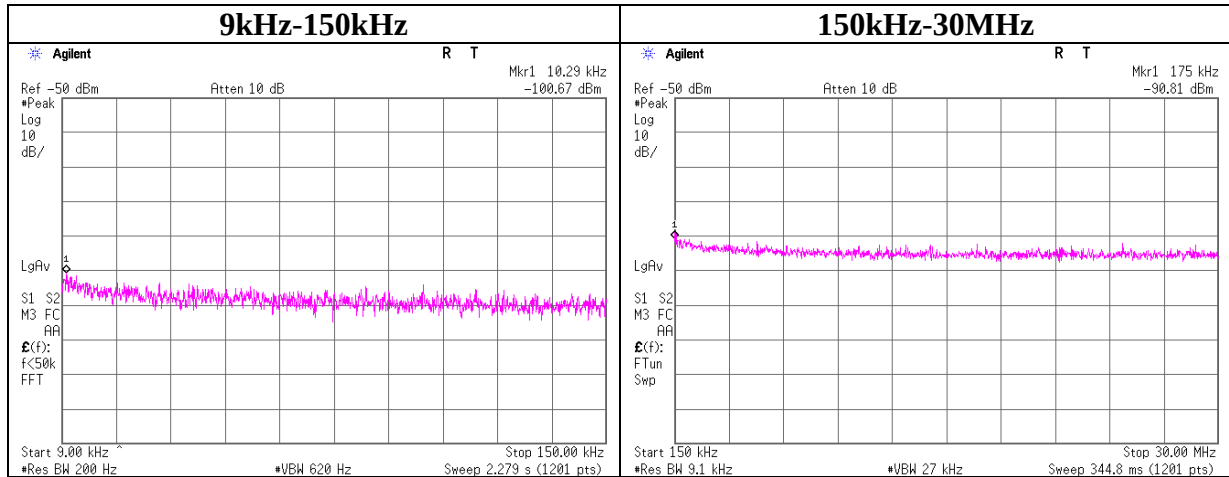
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.6 Measurement Room
Report No.	10093118H
Date	10/22/2013
Temperature/ Humidity	22 deg. C / 51% RH
Engineer	Keisuke Kawamura
Mode	Tx

BT LE 2402MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]
10.29	-100.7	0.01	10.0	2.0	-88.7	300.0	6.0	-27.4	47.4
175	-90.8	0.01	10.0	2.0	-78.8	300.0	6.0	-17.5	22.7

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

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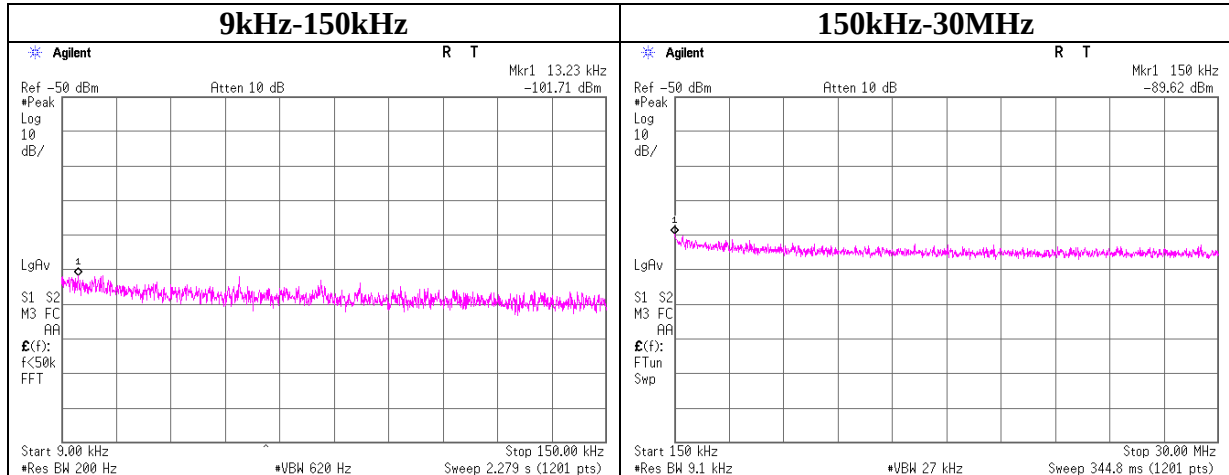
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.6 Measurement Room
Report No.	10093118H
Date	10/22/2013
Temperature/ Humidity	22 deg. C / 51% RH
Engineer	Keisuke Kawamura
Mode	Tx

BT LE 2440MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]
13.23	-101.7	0.01	10.0	2.0	-89.7	300.0	6.0	-28.5	45.2
150	-89.6	0.01	10.0	2.0	-77.6	300.0	6.0	-16.4	24.1

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

EIRP=Reading+Cable Loss+Attenuator+Antenna Gain

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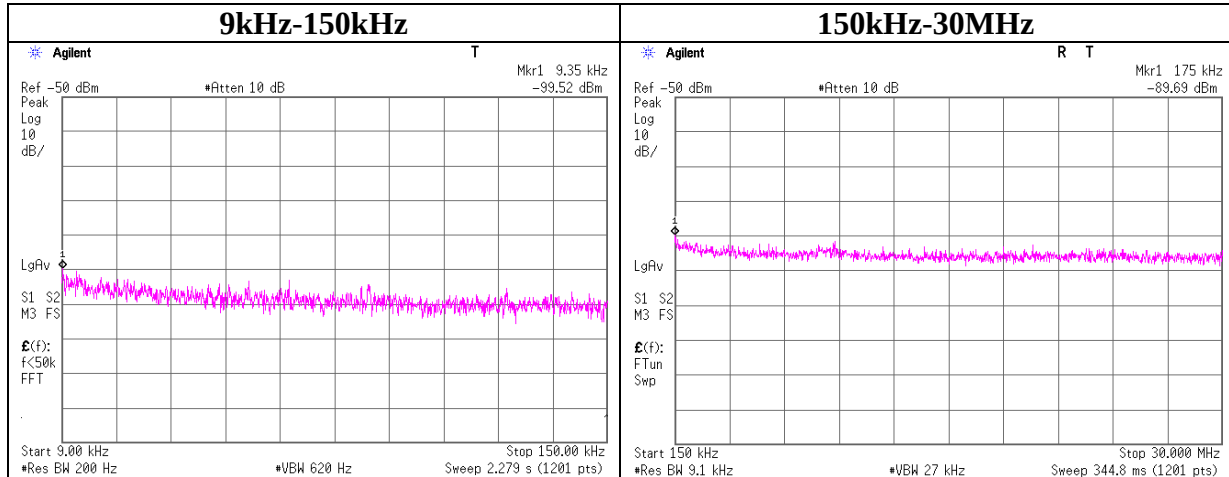
Telephone : +81 596 24 8999

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Conducted Spurious Emission

Test place	Head Office EMC Lab. No.6 Measurement Room
Report No.	10093118H
Date	10/22/2013
Temperature/ Humidity	22 deg. C / 51% RH
Engineer	Keisuke Kawamura
Mode	Tx

BT LE 2480MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]
9.35	-99.5	0.01	10.0	2.0	-87.5	300.0	6.0	-26.3	48.2
175	-89.7	0.01	10.0	2.0	-77.7	300.0	6.0	-16.4	22.7

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

UL Japan, Inc.

Head Office EMC Lab.

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Power Density

Test place	Head Office EMC Lab. No.6 Measurement Room
Report No.	10093118H
Date	10/22/2013
Temperature/ Humidity	22 deg.C./ 51%
Engineer	Keisuke Kawamura
Mode	BT LE Tx

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-25.48	1.69	9.97	-13.82	8.00	21.82
2440.00	-24.02	1.70	9.97	-12.35	8.00	20.35
2480.00	-23.29	1.71	9.97	-11.61	8.00	19.61

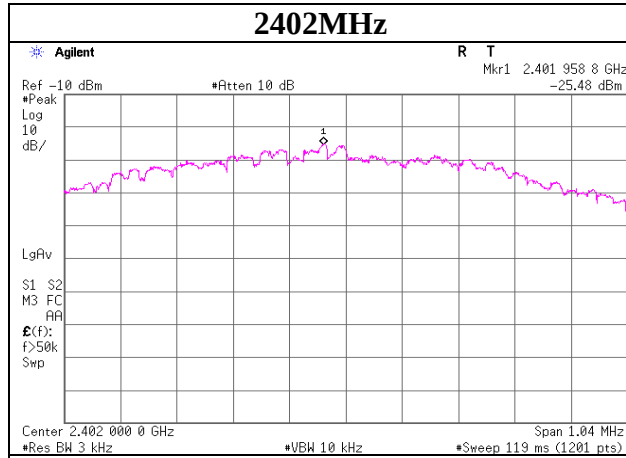
Sample Calculation:

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

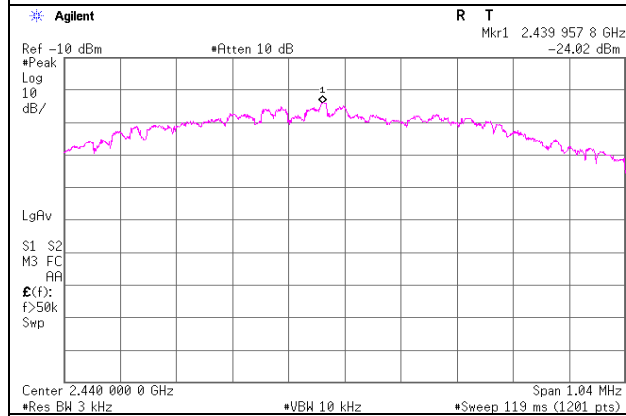
Power Density

BT LE

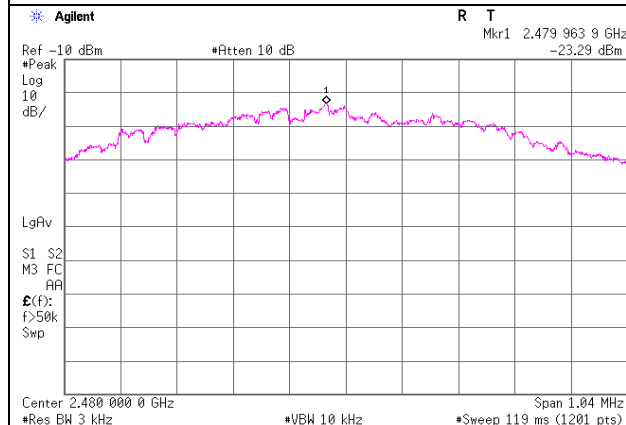
2402MHz



2440MHz



2480MHz



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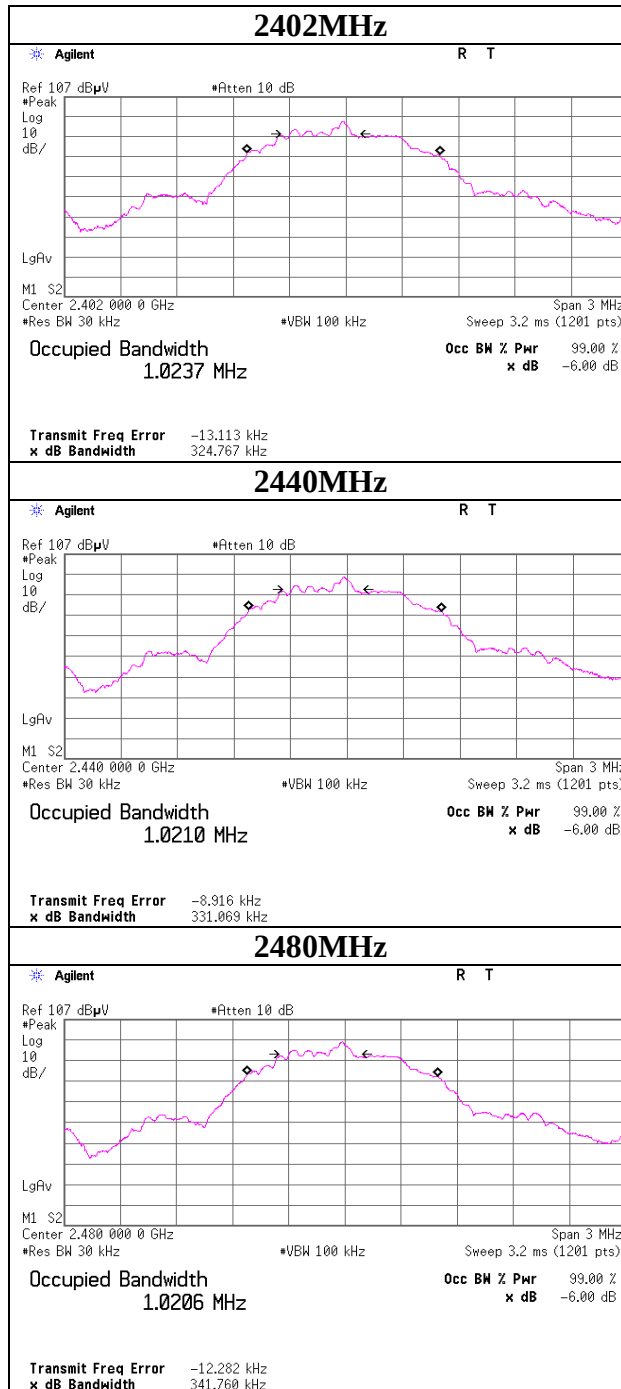
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place Head Office EMC Lab. No.6 Measurement Room
Report No. 10093118H
Date 10/22/2013
Temperature/ Humidity 22 deg. C / 51% RH
Engineer Keisuke Kawamura
Mode Tx

BT LE



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-14	Thermo-Hygrometer	Custom	CTH-201	-	AT	2013/02/26 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2013/02/22 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2013/10/15 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2013/10/15 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2013/04/17 * 12
MAT-24	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71389	AT	2013/06/05 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2013/06/30 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2013/02/26 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE/CE	2012/11/20 * 12 *1)
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2013/02/15 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2013/01/10 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2013/02/15 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1204S062(5m)	RE	2013/05/28 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2013/09/01 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE/CE	2013/06/11 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE	2013/01/07 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2013/02/06 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/09 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2013/10/13 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2013/10/13 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2013/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2012/11/06 * 12 *1)
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2013/09/12 * 12

*1) This test equipment was used for the tests before the expiration date of the calibration.

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

RE: Radiated Emission

AT: Antenna Terminal Conducted test

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