RADIO TEST REPORT

Test Report No. : 10836717H-B-R1

Applicant	:	**Braveridge Co., Ltd.**
Type of Equipment	:	**Bluetooth Low Energy Module**
Model No.	:	**BVMCN5112**
FCC ID	:	**2ABXR5112**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
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 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 10836717H-B. 10836717H-B is replaced with this report.

Date of test: June 17 to July 22, 2015

Representative test engineer:
T. Nakagawa
Tomohisa Nakagawa
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.
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REVISION HISTORY

Original Test Report No.: 10836717H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10836717H-B	July 8, 2015	-	-
1	10836717H-B-R1	July 22, 2015	P.5	Update to FCC version
1	10836717H-B-R1	July 22, 2015	P.8	Correction of power settings in Clause 4.1
1	10836717H-B-R1	July 22, 2015	P.8	Addition of following sentence in Clause 4.2; Since Antenna was not covered by jig, there was no influence on the tests.
1	10836717H-B-R1	July 22, 2015	P.15, 16	Addition of “Setting value -30dBm” data

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SECTION 1: Customer information

Company Name	:	Braveridge Co., Ltd.
Address	:	3-27-2, Susenji, Nishi-ku, Fukuoka-shi, Fukuoka, 819-0373 Japan
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.	:	BVMCN5112
Serial No.	:	Refer to Clause 4.2
Rating	:	DC 1.8 V to 3.6 V (Typ. DC 2.5 V)
Receipt Date of Sample	:	June 15, 2015
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: BVMCN5112 (referred to as the EUT in this report) is a Bluetooth Low Energy Module.

General Specification

Clock frequency(ies) in the system	:	32 MHz

Radio Specification

Bluetooth Low Energy

Equipment Type	:	Transceiver
Frequency of Operation	:	2402 - 2480MHz
Type of Modulation	:	GFSK
Power Supply (inner)	:	DC 1.6 V
Antenna Type	:	Chip antenna
Antenna Gain	:	0.9 dBi
Operating Temperature	:	0 deg. C - +60 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on June 12, 2015 and effective July 13, 2015
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 June 12, 2015 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 C63.4-2009 7. AC powerline Conducted Emission measurements **IC:** RSS-Gen 8.8	**FCC:** Section 15.207 **IC:** RSS-Gen 8.8	**QP** 34.0 dB, 0.15174 MHz, L **AV** 33.9 dB, 0.43419 MHz, L	Complied	-
6dB Bandwidth	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r03 **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 v03r03 **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 v03r03 **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 v03r03 **IC:** RSS-Gen 6.13	**FCC:** Section15.247(d) **IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	16.4 dB 2511.830 MHz, AV, Vertical	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r03 12.2.7.

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

FCC 15.31 (e)

This EUT provides stable voltage (DC 1.6 V) constantly to RF module 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 it is soldered on the circuit board.
Therefore the equipment complies with the requirement of 15.203/212.

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 $k = 2$.

Ise EMC Lab.

Test site (semi anechoic chamber)	Conducted emission Uncertainty (+/-)			
	No. 1	No. 2	No. 3	No. 4
150 kHz - 30 MHz	3.5 dB	3.5 dB	3.4 dB	3.5 dB

Test site (semi anechoic chamber)	Radiated emission Uncertainty (+/-)						
	Measurement distance: 3 m				1 m		0.5 m
	9 kHz - 30 MHz	30 MHz - 300 MHz	300 MHz - 1 GHz	1 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz
No. 1	4.3 dB	5.5 dB	6.3 dB	5.5 dB	5.8 dB	5.8 dB	4.3 dB
No. 2	4.2 dB	5.4 dB	6.3 dB	5.4 dB	5.7 dB	5.9 dB	5.6 dB
No. 3	4.4 dB	5.4 dB	6.4 dB	5.2 dB	5.5 dB	5.8 dB	5.5 dB
No. 4	4.7 dB	5.6 dB	6.4 dB	5.3 dB	5.7 dB	5.9 dB	5.5 dB

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	
0.7 dB	1.5 dB	1.5 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

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.

3.5 Test Location

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

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)

Bluetooth Low Energy (BT LE): Transmitting (Tx)

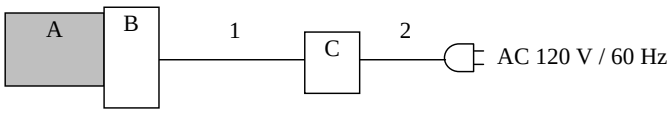
Details of Operating Mode(s)

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

Power of the EUT was set by the software as follows;
Power settings *1): +4dBm (all tests), -30dBm (Maximum Peak Output Power test only)
Software: nRF Studio Ver.1.17.0.3211
*1) All tests were performed with +4dBm power setting as a representative which was the worst condition after having compared with other power settings.

This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* Since Antenna was not covered by jig, there was no influence on the tests.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Low Energy Module	BVMCN5112	001 *1) 002 *2)	Braveridge Co., Ltd.	EUT
B	Jig	-	-	Braveridge Co., Ltd.	-
C	DC Power Supply	PMC35-2A	13090501	KIKUSUI	-

*1) Used for Antenna Terminal conducted test
*2) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.0	Unshielded	Unshielded	-
2	AC Cable	2.0	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

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 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 v03r03".

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.
The height of the measuring antenna varied between 1 m 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	AV *2)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: 12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3m	3 m (below 10 GHz), 1 m *1) (above 10 GHz)		3 m (below 10 GHz), 1 m *1) (above 10 GHz)

*1) Distance Factor: 20 x log (3.0 m / 1.0 m) = 9.5 dB
*2) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r03"

- 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	1 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				
Band Edge confirmation	32.5 MHz, 22.5 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)

*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 v03r03".
*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.

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

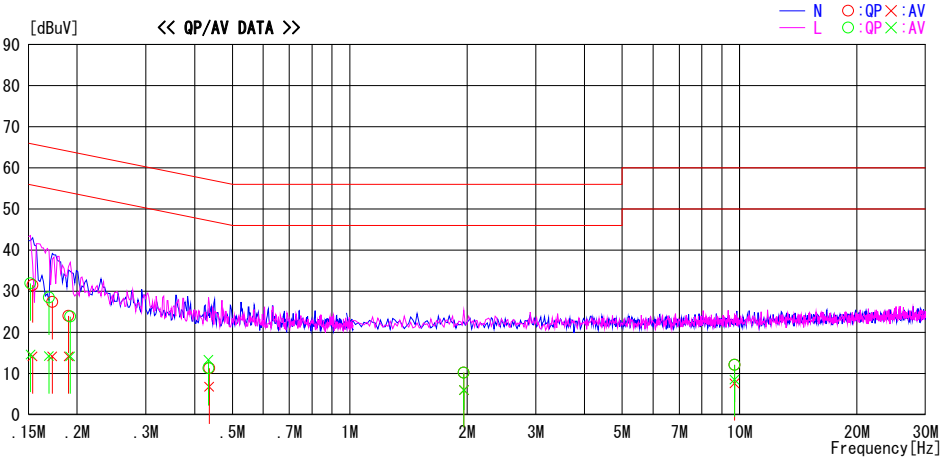
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/06/18

Report No. : 10836717H

Temp./Humi. : 24deg. C / 61% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx BT LE 2402 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



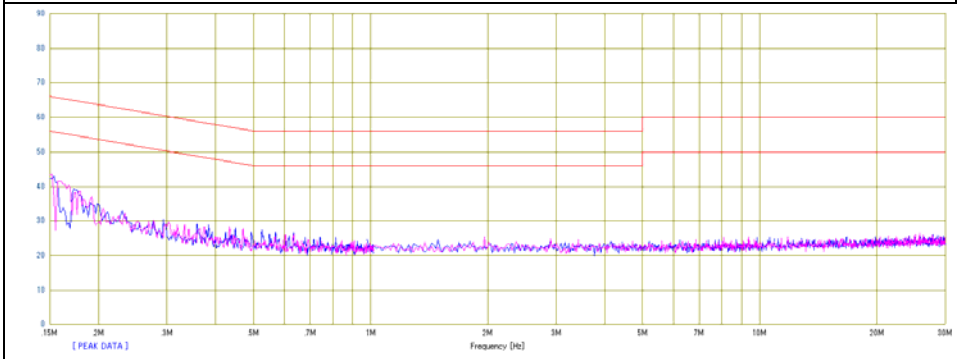
Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15349	18.2	0.9	13.3	31.5	14.2	65.8	55.8	34.3	41.6	N	
0.17267	14.1	0.9	13.3	27.4	14.2	64.8	54.8	37.4	40.6	N	
0.19010	10.7	0.9	13.3	24.0	14.2	64.0	54.0	40.0	39.8	N	
0.43593	-2.0	-6.5	13.3	11.3	6.8	57.1	47.1	45.8	40.3	N	
1.96152	-3.3	-7.5	13.5	10.2	6.0	56.0	46.0	45.8	40.0	N	
9.70466	-2.0	-6.5	14.1	12.1	7.6	60.0	50.0	47.9	42.4	N	
0.15174	18.6	1.3	13.3	31.9	14.6	65.9	55.9	34.0	41.3	L	
0.16918	15.2	0.9	13.3	28.5	14.2	65.0	55.0	36.5	40.8	L	
0.19184	10.6	0.9	13.3	23.9	14.2	64.0	54.0	40.1	39.8	L	
0.43419	-2.0	0.0	13.3	11.3	13.3	57.2	47.2	45.9	33.9	L	
1.96152	-3.3	-7.5	13.5	10.2	6.0	56.0	46.0	45.8	40.0	L	
9.70466	-2.0	-5.6	14.1	12.1	8.5	60.0	50.0	47.9	41.5	L	

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

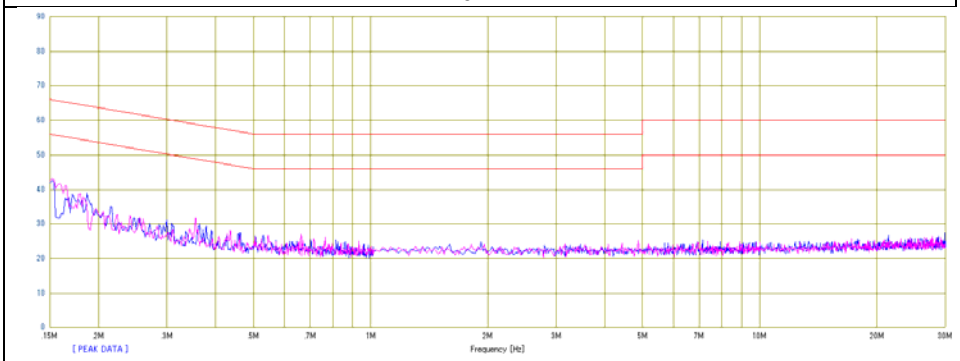
Conducted Emission

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	10836717H
Date	June 17, 2015
Temperature / Humidity	24 deg. C / 61 % RH
Engineer	Takumi Shimada
Mode	Tx BT LE

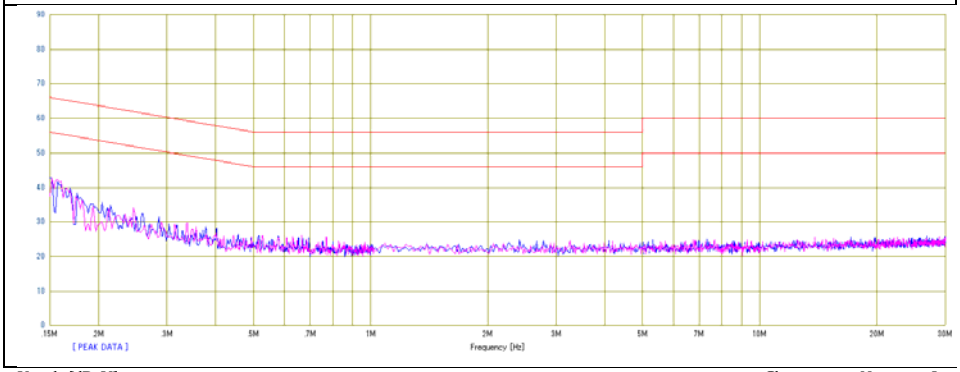
2402 MHz



2440 MHz



2480 MHz



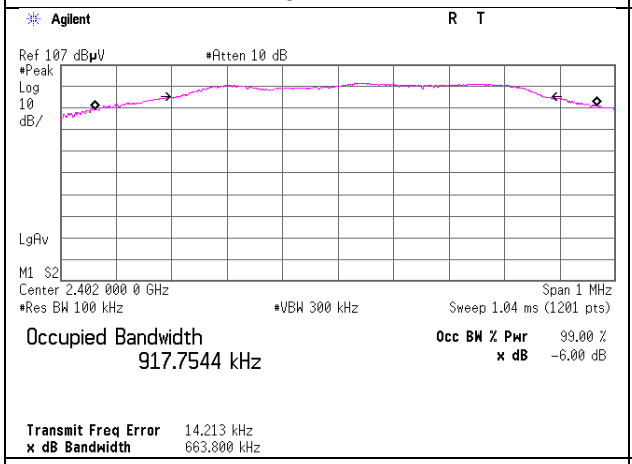
Y scale [dBuV] Chart — N — L

6dB Bandwidth

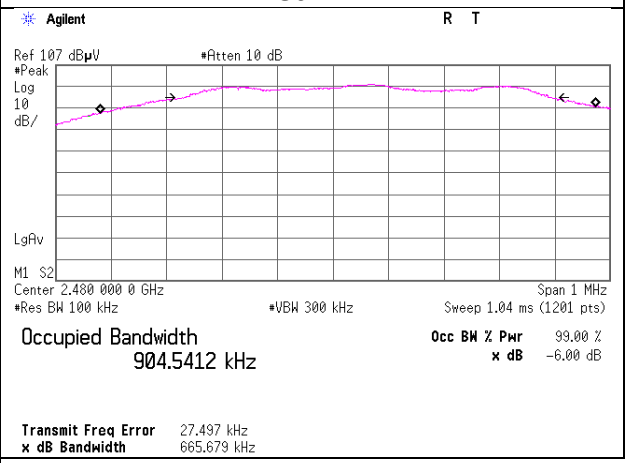
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10836717H
Date	June 19, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2402	0.664	>500
2440	0.681	>500
2480	0.666	>500

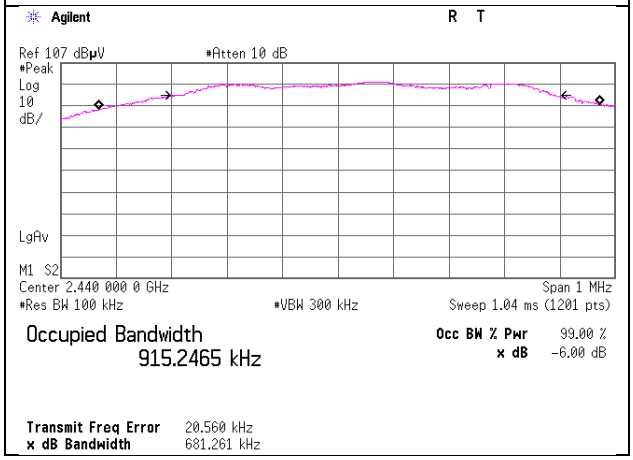
2402MHz



2480MHz



2440MHz



Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room	
Report No.	10836717H	
Date	June 19, 2015	July 22, 2015
Temperature / Humidity	23 deg. C / 58 % RH	24 deg. C / 57 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
Mode	Tx BT LE	

Setting value 4dBm

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-8.58	4.27	9.77	5.46	3.52	30.00	1000	24.54
2440	-8.78	4.29	9.77	5.28	3.37	30.00	1000	24.72
2480	-8.83	4.29	9.77	5.23	3.33	30.00	1000	24.77

Setting value -30dBm

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-30.43	4.27	0.00	-26.16	0.0024	30.00	1000	56.16
2440	-30.43	4.29	0.00	-26.14	0.0024	30.00	1000	56.14
2480	-30.56	4.29	0.00	-26.27	0.0024	30.00	1000	56.27

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

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.11 Measurement Room	
Report No.	10836717H	
Date	June 19, 2015	July 22, 2015
Temperature / Humidity	23 deg. C / 58 % RH	24 deg. C / 57 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
Mode	Tx BT LE	

Setting value 4dBm

Freq.	Reading	Cable Loss	Atten. Loss	Duty Factor	Result	
[MHz]	[dBm]	[dB]	[dB]	[dB]	[dBm]	[mW]
2402	-10.27	4.27	9.77	1.00	4.77	3.00
2440	-10.47	4.29	9.77	1.00	4.59	2.88
2480	-10.95	4.29	9.77	1.00	4.11	2.58

Setting value -30dBm

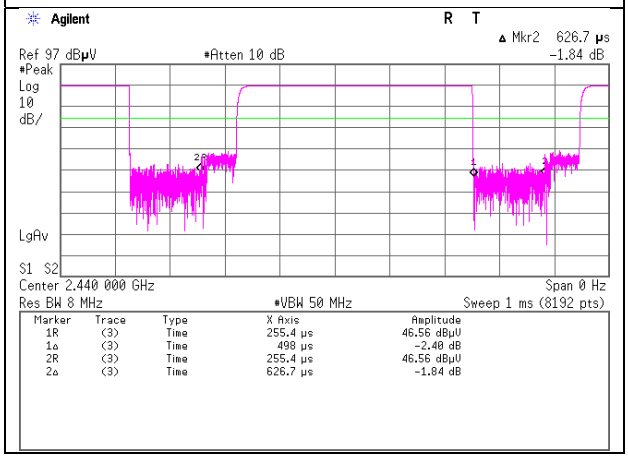
Freq.	Reading	Cable Loss	Atten. Loss	Duty Factor	Result	
[MHz]	[dBm]	[dB]	[dB]	[dB]	[dBm]	[mW]
2402	-35.44	4.27	0.00	1.00	-30.17	0.0010
2440	-35.57	4.29	0.00	1.00	-30.28	0.0009
2480	-35.7	4.29	0.00	1.00	-30.41	0.0009

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss + Duty factor

Burst rate confirmation

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	10836717H
Date	June 17, 2015
Temperature/ Humidity	24 deg. C / 61% RH
Engineer	Takumi Shimada
Mode	Tx BT LE

Tx on / (Tx on + Tx off) = 0.795
Tx on / (Tx on + Tx off) * 100 = 79.5 %
Duty factor = 10 * log (0.6267 / 0.498) = 1.00 dB



Radiated Spurious Emission

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.1
Report No.	10836717H	
Date	June 17, 2015	June 22, 2015
Temperature / Humidity	24 deg. C / 61% RH	20 deg. C / 48 % RH
Engineer	Takumi Shimada (Above 1GHz)	Tomoki Matsui (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	48.938	QP	34.6	11.1	7.7	38.8	-	14.6	40.0	25.4	
Hori	94.930	QP	32.2	9.0	8.4	38.8	-	10.8	43.5	32.7	
Hori	208.557	QP	28.9	16.6	9.6	38.9	-	16.2	43.5	27.3	
Hori	336.473	QP	28.8	15.6	10.7	38.7	-	16.4	46.0	29.6	
Hori	523.046	QP	29.3	18.4	12.1	38.1	-	21.7	46.0	24.3	
Hori	862.531	QP	29.5	22.0	13.9	38.1	-	27.3	46.0	18.7	
Hori	2385.620	PK	53.3	27.4	3.2	32.3	-	51.6	73.9	22.3	
Hori	2390.000	PK	46.3	27.4	3.2	32.3	-	44.6	73.9	29.3	
Hori	4804.000	PK	40.7	31.5	5.4	31.6	-	46.0	73.9	27.9	Floor Noise
Hori	7206.000	PK	42.2	36.8	6.6	32.8	-	52.8	73.9	21.1	Floor Noise
Hori	9608.000	PK	42.4	38.8	7.3	33.2	-	55.3	73.9	18.6	Floor Noise
Hori	2385.620	AV	37.5	27.4	3.2	32.3	1.0	36.8	53.9	17.1	*1)
Hori	2390.000	AV	33.9	27.4	3.2	32.3	1.0	33.2	53.9	20.7	*1)
Hori	4804.000	AV	32.2	31.5	5.4	31.6	-	37.5	53.9	16.4	Floor Noise
Hori	7206.000	AV	33.8	36.8	6.6	32.8	-	44.4	53.9	9.5	Floor Noise
Hori	9608.000	AV	33.9	38.8	7.3	33.2	-	46.8	53.9	7.1	Floor Noise
Vert	48.938	QP	38.9	11.1	7.7	38.8	-	18.9	40.0	21.1	
Vert	94.930	QP	35.3	9.0	8.4	38.8	-	13.9	43.5	29.6	
Vert	208.015	QP	30.4	16.6	9.6	38.9	-	17.7	43.5	25.8	
Vert	336.473	QP	30.1	15.6	10.7	38.7	-	17.7	46.0	28.3	
Vert	523.046	QP	29.3	18.4	12.1	38.1	-	21.7	46.0	24.3	
Vert	865.337	QP	29.3	22.0	14.0	38.1	-	27.2	46.0	18.8	
Vert	2385.620	PK	51.2	27.4	3.2	32.3	-	49.5	73.9	24.4	
Vert	2390.000	PK	42.2	27.4	3.2	32.3	-	40.5	73.9	33.4	
Vert	4804.000	PK	40.9	31.5	5.4	31.6	-	46.2	73.9	27.7	Floor Noise
Vert	7206.000	PK	41.9	36.8	6.6	32.8	-	52.5	73.9	21.4	Floor Noise
Vert	9608.000	PK	42.8	38.8	7.3	33.2	-	55.7	73.9	18.2	Floor Noise
Vert	2385.620	AV	36.4	27.4	3.2	32.3	1.0	35.7	53.9	18.2	*1)
Vert	2390.000	AV	33.0	27.4	3.2	32.3	1.0	32.3	53.9	21.6	*1)
Vert	4804.000	AV	32.4	31.5	5.4	31.6	-	37.7	53.9	16.2	Floor Noise
Vert	7206.000	AV	33.2	36.8	6.6	32.8	-	43.8	53.9	10.1	Floor Noise
Vert	9608.000	AV	33.5	38.8	7.3	33.2	-	46.4	53.9	7.5	Floor Noise

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

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

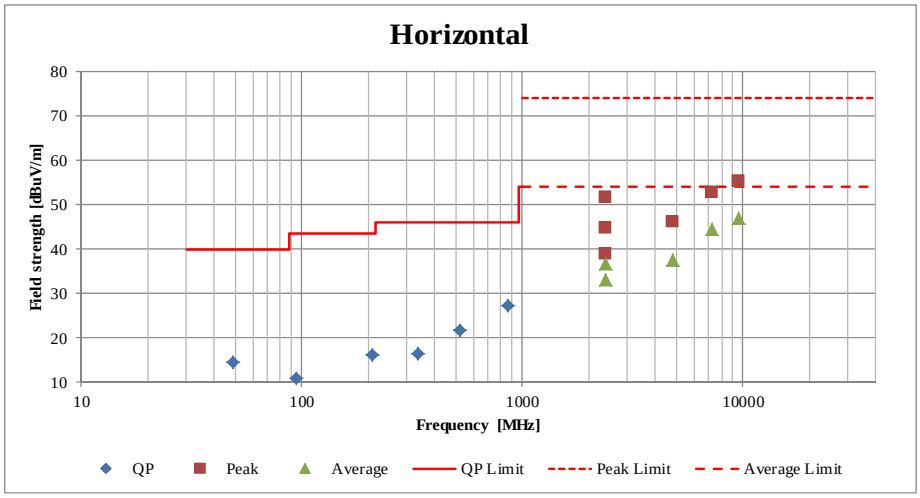
20dBc Data Sheet

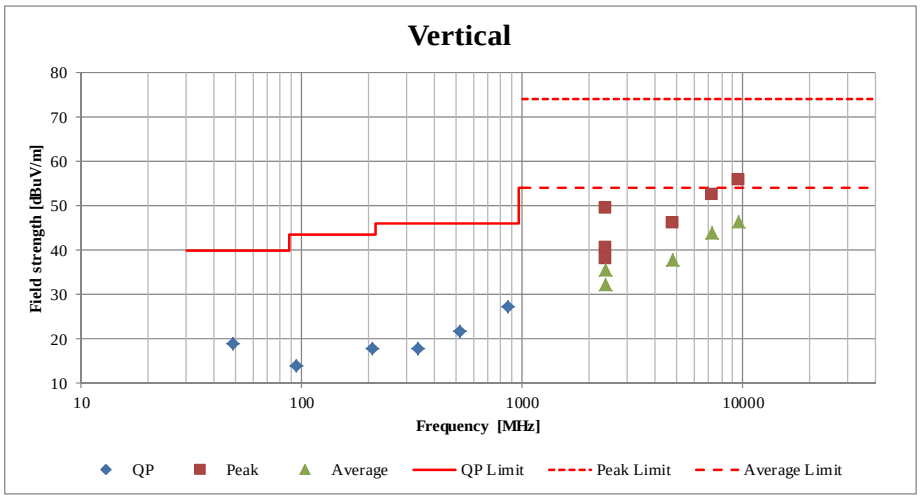
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	88.8	27.4	3.2	32.3	87.1	-	-	Carrier
Hori	2400.000	PK	40.5	27.4	3.2	32.3	38.8	67.1	28.3	
Vert	2402.000	PK	87.4	27.4	3.2	32.3	85.7	-	-	Carrier
Vert	2400.000	PK	39.9	27.4	3.2	32.3	38.2	65.7	27.5	

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

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.1
Report No.	10836717H	
Date	June 17, 2015	June 22, 2015
Temperature / Humidity	24 deg. C / 61% RH	20 deg. C / 48 % RH
Engineer	Takumi Shimada (Above 1GHz)	Tomoki Matsui (Below 1GHz)
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.	
Semi Anechoic Chamber	No.4	No.1
Report No.	10836717H	
Date	June 17, 2015	June 22, 2015
Temperature / Humidity	24 deg. C / 61% RH	20 deg. C / 48 % RH
Engineer	Takumi Shimada (Above 1GHz)	Tomoki Matsui (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	48.938	QP	34.2	11.1	7.7	38.8	-	14.2	40.0	25.8	
Hori	94.930	QP	32.3	9.0	8.4	38.8	-	10.9	43.5	32.6	
Hori	208.557	QP	28.6	16.6	9.6	38.9	-	15.9	43.5	27.6	
Hori	336.473	QP	28.6	15.6	10.7	38.7	-	16.2	46.0	29.8	
Hori	523.046	QP	29.7	18.4	12.1	38.1	-	22.1	46.0	23.9	
Hori	862.531	QP	29.7	22.0	13.9	38.1	-	27.5	46.0	18.5	
Hori	4880.000	PK	40.8	31.8	5.5	31.6	-	46.5	73.9	27.4	Floor Noise
Hori	7320.000	PK	42.2	37.0	6.5	32.8	-	52.9	73.9	21.0	Floor Noise
Hori	9760.000	PK	41.9	38.9	7.4	33.3	-	54.9	73.9	19.0	Floor Noise
Hori	4880.000	AV	31.8	31.8	5.5	31.6	-	37.5	53.9	16.4	Floor Noise
Hori	7320.000	AV	33.4	37.0	6.5	32.8	-	44.1	53.9	9.8	Floor Noise
Hori	9760.000	AV	34.3	38.9	7.4	33.3	-	47.3	53.9	6.6	Floor Noise
Vert	48.938	QP	38.5	11.1	7.7	38.8	-	18.5	40.0	21.5	
Vert	94.930	QP	35.6	9.0	8.4	38.8	-	14.2	43.5	29.3	
Vert	208.015	QP	30.2	16.6	9.6	38.9	-	17.5	43.5	26.0	
Vert	336.473	QP	30.2	15.6	10.7	38.7	-	17.8	46.0	28.2	
Vert	523.046	QP	29.1	18.4	12.1	38.1	-	21.5	46.0	24.5	
Vert	865.337	QP	29.3	22.0	14.0	38.1	-	27.2	46.0	18.8	
Vert	4880.000	PK	40.3	31.8	5.5	31.6	-	46.0	73.9	27.9	Floor Noise
Vert	7320.000	PK	42.7	37.0	6.5	32.8	-	53.4	73.9	20.5	Floor Noise
Vert	9760.000	PK	43.0	38.9	7.4	33.3	-	56.0	73.9	17.9	Floor Noise
Vert	4880.000	AV	31.8	31.8	5.5	31.6	-	37.5	53.9	16.4	Floor Noise
Vert	7320.000	AV	33.4	37.0	6.5	32.8	-	44.1	53.9	9.8	Floor Noise
Vert	9760.000	AV	33.8	38.9	7.4	33.3	-	46.8	53.9	7.1	Floor Noise

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

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

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

Radiated Spurious Emission

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.1
Report No.	10836717H	
Date	June 17, 2015	June 22, 2015
Temperature / Humidity	24 deg. C / 61% RH	20 deg. C / 48 % RH
Engineer	Takumi Shimada (Above 1GHz)	Tomoki Matsui (Below 1GHz)
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	48.938	QP	34.4	11.1	7.7	38.8	-	14.4	40.0	25.6	
Hori	94.930	QP	32.5	9.0	8.4	38.8	-	11.1	43.5	32.4	
Hori	208.557	QP	28.5	16.6	9.6	38.9	-	15.8	43.5	27.7	
Hori	336.473	QP	28.2	15.6	10.7	38.7	-	15.8	46.0	30.2	
Hori	523.046	QP	29.8	18.4	12.1	38.1	-	22.2	46.0	23.8	
Hori	862.531	QP	29.8	22.0	13.9	38.1	-	27.6	46.0	18.4	
Hori	2483.500	PK	46.7	27.6	3.3	32.3	-	45.3	73.9	28.6	
Hori	2511.830	PK	50.9	27.6	3.3	32.3	-	49.5	73.9	24.0	
Hori	4960.000	PK	40.1	32.0	5.5	31.6	-	46.0	73.9	27.9	Floor Noise
Hori	7440.000	PK	41.7	37.2	6.5	32.9	-	52.5	73.9	21.4	Floor Noise
Hori	9920.000	PK	42.4	39.0	7.4	33.3	-	55.5	73.9	18.4	Floor Noise
Hori	2483.500	AV	34.0	27.6	3.3	32.3	1.0	32.6	53.9	21.3	*1)
Hori	2511.830	AV	36.4	27.6	3.3	32.3	1.0	35.0	53.9	18.5	*1)
Hori	4960.000	AV	31.7	32.0	5.5	31.6	-	37.6	53.9	16.3	Floor Noise
Hori	7440.000	AV	34.3	37.2	6.5	32.9	-	45.1	53.9	8.8	Floor Noise
Hori	9920.000	AV	33.4	39.0	7.4	33.3	-	46.5	53.9	7.4	Floor Noise
Vert	48.938	QP	38.4	11.1	7.7	38.8	-	18.4	40.0	21.6	
Vert	94.930	QP	35.9	9.0	8.4	38.8	-	14.5	43.5	29.0	
Vert	208.015	QP	30.3	16.6	9.6	38.9	-	17.6	43.5	25.9	
Vert	336.473	QP	30.6	15.6	10.7	38.7	-	18.2	46.0	27.8	
Vert	523.046	QP	29.8	18.4	12.1	38.1	-	22.2	46.0	23.8	
Vert	865.337	QP	29.5	22.0	14.0	38.1	-	27.4	46.0	18.6	
Vert	2483.500	PK	42.2	27.6	3.3	32.3	-	40.8	73.9	33.1	
Vert	2511.830	PK	51.8	27.6	3.3	32.3	-	50.4	73.9	23.1	
Vert	4960.000	PK	40.4	32.0	5.5	31.6	-	46.3	73.9	27.6	Floor Noise
Vert	7440.000	PK	42.8	37.2	6.5	32.9	-	53.6	73.9	20.3	Floor Noise
Vert	9920.000	PK	41.7	39.0	7.4	33.3	-	54.8	73.9	19.1	Floor Noise
Vert	2483.500	AV	33.5	27.6	3.3	32.3	1.0	32.1	53.9	21.8	*1)
Vert	2511.830	AV	38.5	27.6	3.3	32.3	1.0	37.1	53.9	16.4	*1)
Vert	4960.000	AV	31.5	32.0	5.5	31.6	-	37.4	53.9	16.5	Floor Noise
Vert	7440.000	AV	34.1	37.2	6.5	32.9	-	44.9	53.9	9.0	Floor Noise
Vert	9920.000	AV	34.0	39.0	7.4	33.3	-	47.1	53.9	6.8	Floor Noise

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

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

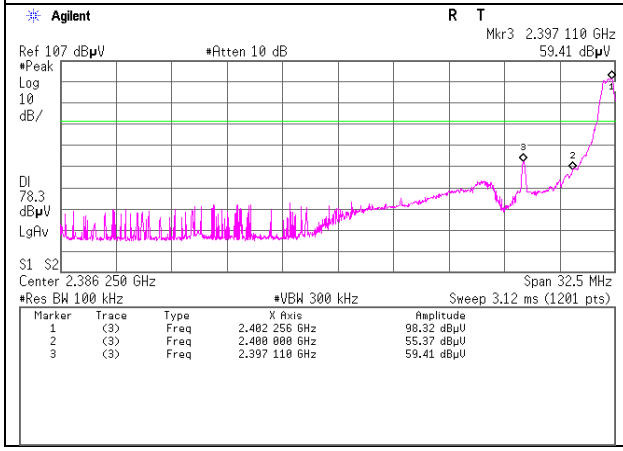
Distance factor: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB

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

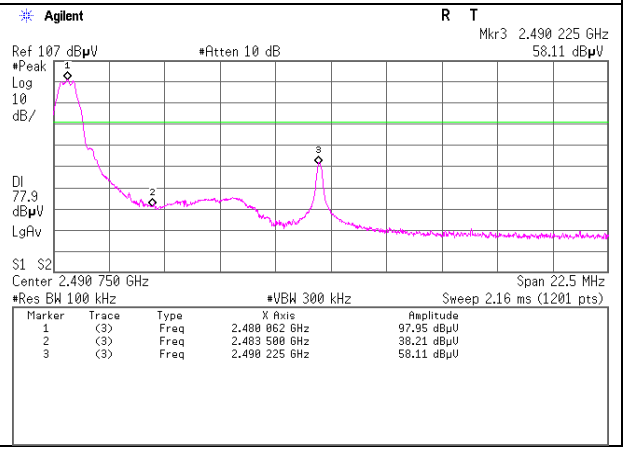
Band Edge confirmation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10836717H
Date	June 19, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

2402 MHz



2480 MHz

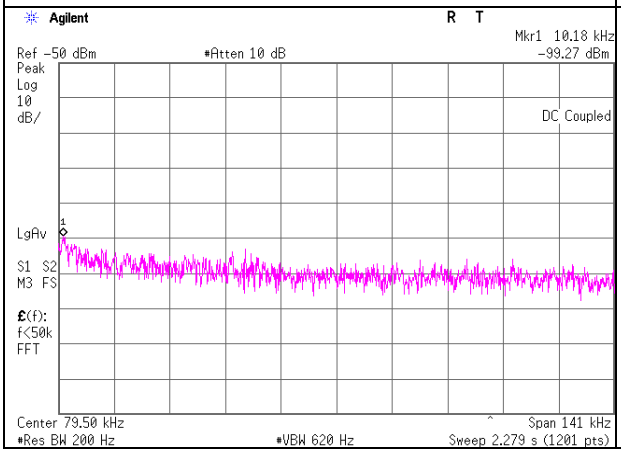


* Final result of band edge was measured as radiated spurious emission. Refer to Radiated Spurious Emission's pages.

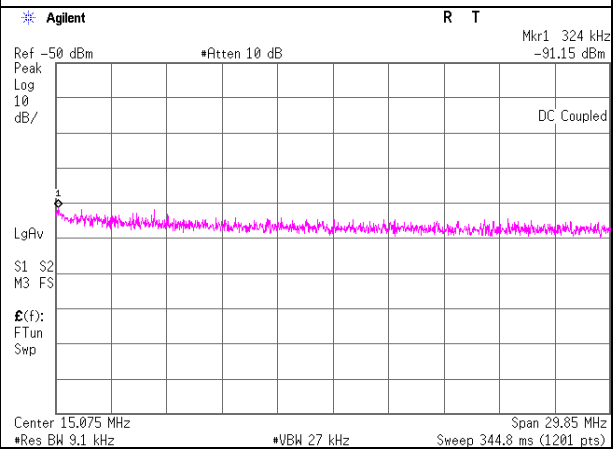
Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10836717H
Date	June 19, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BTLE 2402 MHz

9kHz-150kHz



150kHz-30MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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
10.18	-99.3	4.29	9.8	2.0	1	-83.2	300	6.0	-22.0	47.4	69.4	
324.00	-91.2	4.29	9.8	2.0	1	-75.1	300	6.0	-13.8	17.3	31.1	

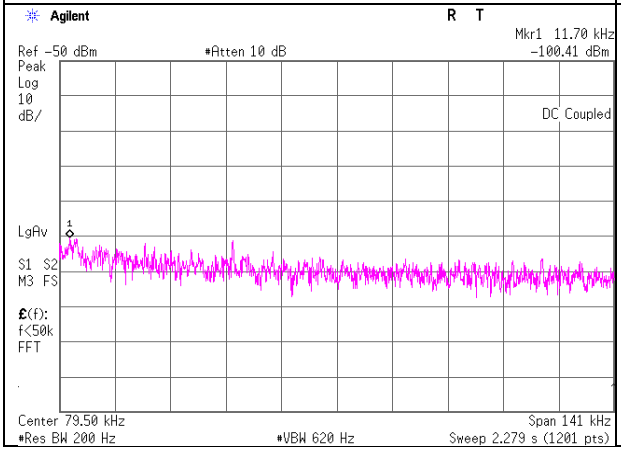
E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

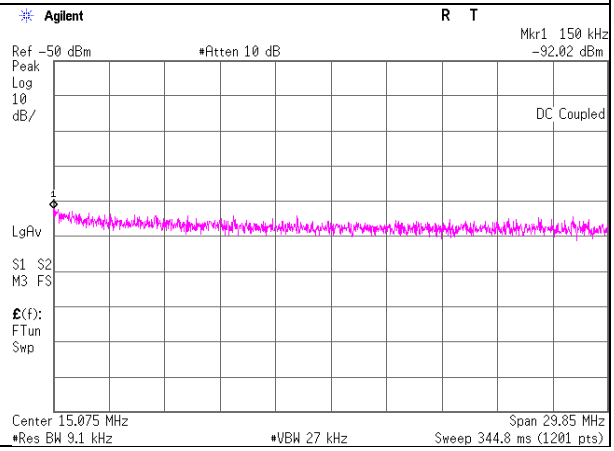
Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10836717H
Date	June 19, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BTLE 2440 MHz

9kHz-150kHz



150kHz-30MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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
11.70	-100.4	4.29	9.8	2.0	1	-84.4	300	6.0	-23.1	46.2	69.3	
150.00	-92.0	4.29	9.8	2.0	1	-76.0	300	6.0	-14.7	24.0	38.7	

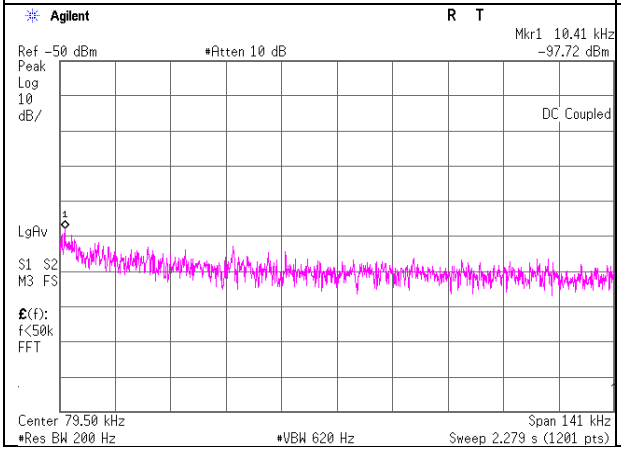
E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

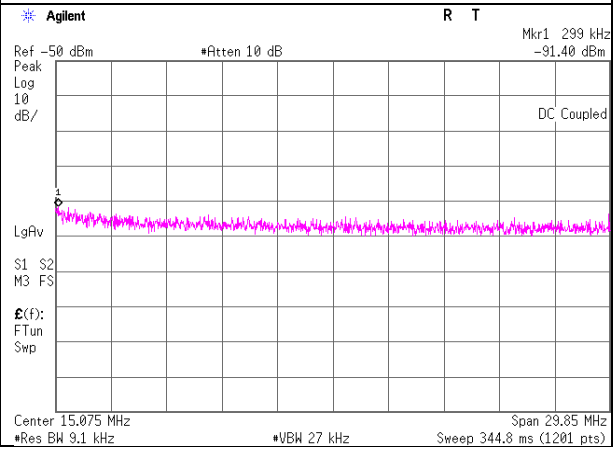
Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10836717H
Date	June 19, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BTLE 2480 MHz

9kHz-150kHz



150kHz-30MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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
10.41	-97.7	4.29	9.8	2.0	1	-81.7	300	6.0	-20.4	47.2	67.6	
299.00	-91.4	4.29	9.8	2.0	1	-75.3	300	6.0	-14.1	18.0	32.1	

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

EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

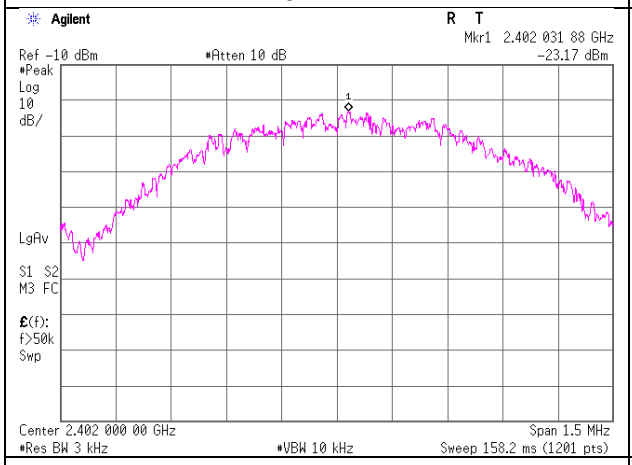
Power Density

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10836717H
Date	June 19, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

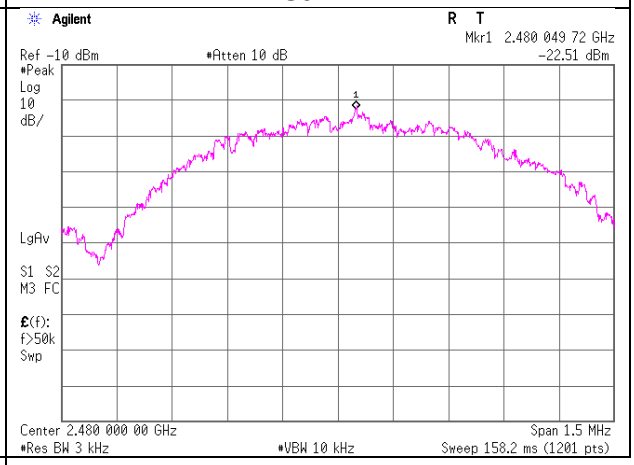
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-23.17	4.27	9.77	-9.13	8.00	17.13
2440.00	-23.51	4.29	9.77	-9.45	8.00	17.45
2480.00	-22.51	4.29	9.77	-8.45	8.00	16.45

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

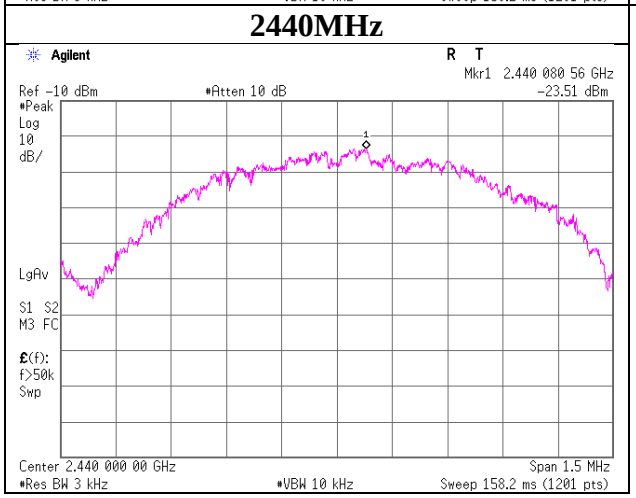
2402MHz



2480MHz



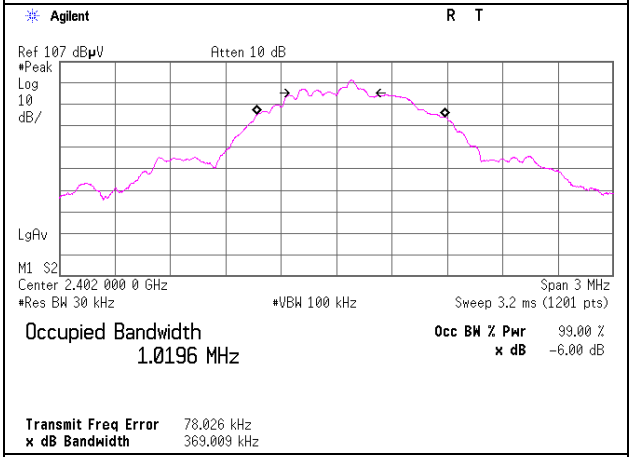
2440MHz



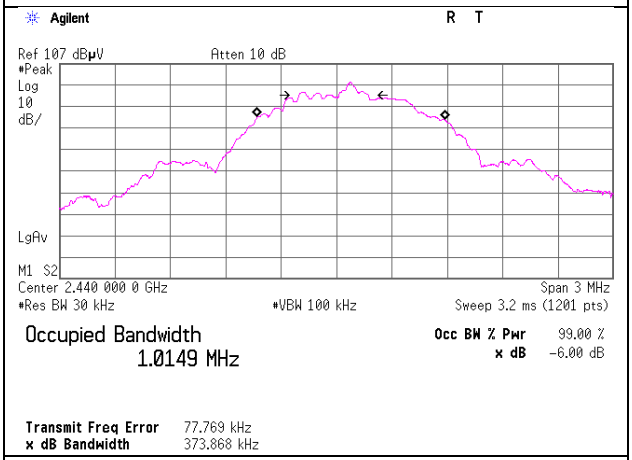
99%Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10836717H
Date	June 19, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

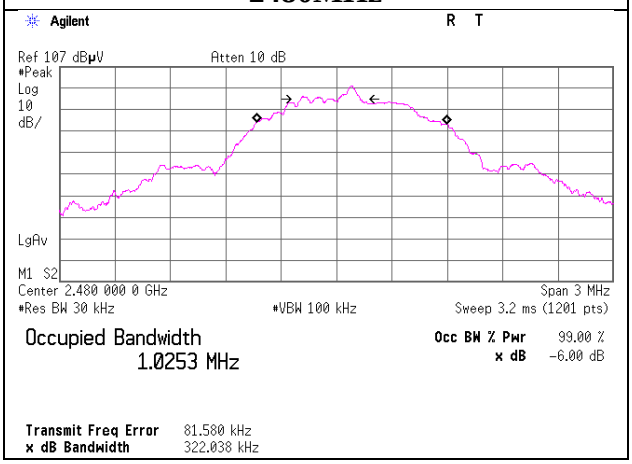
2402MHz



2440MHz



2480MHz



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2015/02/26 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE/CE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2015/06/02 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2014/08/12 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2015/03/12 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2014/06/11 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	CE	2014/11/10 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2014/09/24 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2014/07/10 * 12
MAT-67	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(5m)/ 421-010(1m)/ sucoform141-PE(1m)/ RFM-E121(Switcher)	-/04178	CE	2014/07/15 * 12
MAT-89	Attenuator	Weinschel Associates	WA56-10	56100305	AT	2015/06/01 * 12
MRENT-122	Spectrum Analyzer	KEYSIGHT	E4440A	MY46187096	AT	2015/06/01 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2014/10/02 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2015/06/09 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2015/06/09 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2014/12/22 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2014/09/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2015/01/13 * 12
MJM-21	Measure	KOMELON	KMC-36	-	RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2014/06/06 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2014/11/22 * 12
KLA-04	Logperiodic Antenna	Schwarzbeck	USLP9143	361	RE	2014/11/22 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2014/11/20 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent /TSJ	-	-	RE	2014/09/12 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2015/02/03 * 12
MPM-01	Power Meter	Agilent	E4417A	GB41290639	AT	2015/04/22 * 12
MPSE-03	Power sensor	Agilent	E9327A	US40440576	AT	2015/04/24 * 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