



RADIO TEST REPORT

Test Report No. : 10543857H-A

Applicant : Omron Healthcare Co., Ltd.
Type of Equipment : Omron BLE Module
Model No. : HHX-MD03C
FCC ID : Q6ZHHXMD03C
Test regulation : FCC Part 15 Subpart C: 2014
Test Result : Complied

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4. The test results in this report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: October 30 to November 8, 2014

Representative test engineer:

T. Shimada

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Approved by:

Takayuki Shimada

Takayuki Shimada
Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

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SECTION 1: Customer information

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

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

2.1 Identification of E.U.T.

Type of Equipment : Omron BLE Module
Model No. : HHX-MD03C
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 6V
Receipt Date of Sample : October 27, 2014
Country of Mass-production : Japan, China, Vietnam
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 : 32.768kHz, 26MHz

Radio Specification

Bluetooth (Low Energy)

Radio Type : Transceiver
Frequency of Operation : 2402-2480MHz
Modulation : GFSK
Bandwidth & Channel Spacing : 1MHz & 2MHz
Power Supply (radio part input) : DC 3.3V
Antenna type : Chip Antenna
Antenna Gain : 2.72dBi

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2014, final revised on August 15, 2014 and effective October 14, 2014

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 C63.4:2003 7. AC powerline Conducted Emission measurements ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	QP 30.9dB, 0.15000MHz, L AV 35.1dB, 0.40000MHz, N	Complied	-
6dB Bandwidth	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" ----- IC: -	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 June 5, 2014)" ----- IC: RSS-Gen 6.12	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 June 5, 2014)" ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" ----- IC: RSS-Gen 6.13	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 8.9 RSS-Gen 8.10	7.4dB 9760.00MHz, AV, Hori	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 Part 15.31 (e)

The stable voltage (DC3.3V) is constantly to the RF Module through the regulator. 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.

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

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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	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	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	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	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	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	4.8 x 4.6m	-

* 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.

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

4.1 Operating Mode(s)

Bluetooth Low Energy (BT LE): Transmitting (Tx), Payload: PRBS9

Test Item	Operating Mode	Tested frequency
Conducted emission 6dB Bandwidth Maximum Peak Output Power Power Density Spurious Emission 99% Occupied Bandwidth	BT LE	2402MHz 2440MHz 2480MHz
*Transmitting duty was 100% on all tests *Power of the EUT was set by the software as follows; Power settings: 0dBm Software: OPM_Communication_TOOL *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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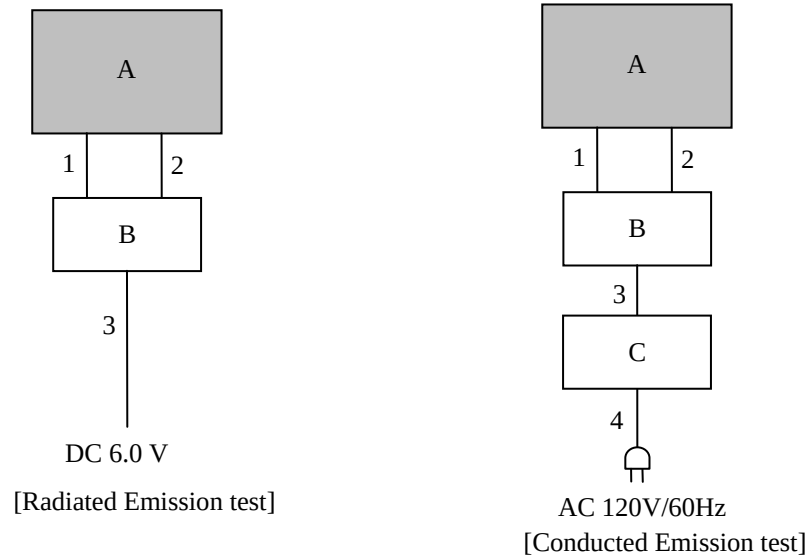
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4.2 Configuration and peripherals



* 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	Omron BLE Module	HHX-MD03C	22	Omron Healthcare Co., Ltd.	EUT
B	Jig	-	-	-	-
C	DC Power Supply	PMC35-2A	1309D501	KIKUSUI	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.1	Unshielded	Unshielded	-
2	Signal Cable	0.1	Unshielded	Unshielded	-
3	DC Cable	2.5	Unshielded	Unshielded	-
4	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, 0.5m by 1.0m, 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.

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 "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)".

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	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	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	RBW: 1MHz VBW: 3MHz	Average Power Method: 12.2.5.1 RBW: 1MHz VBW: 3MHz Trace: Free Run Detector: Power Averaging (RMS)	RBW: 100kHz VBW: 300kHz
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 "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014) (Issued on June 5, 2014)"

*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	2MHz	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	Sample	Clear write	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *1)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)
Conducted Spurious Emission *3)	9kHz to 150kHz 150kHz to 30MHz	200Hz 9.1kHz	620Hz 27kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) Reference data.
*2) Section 10.2 Method PKPSD (peak PSD) of "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)".
*3) 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

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APPENDIX 1: Data of EMI test

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

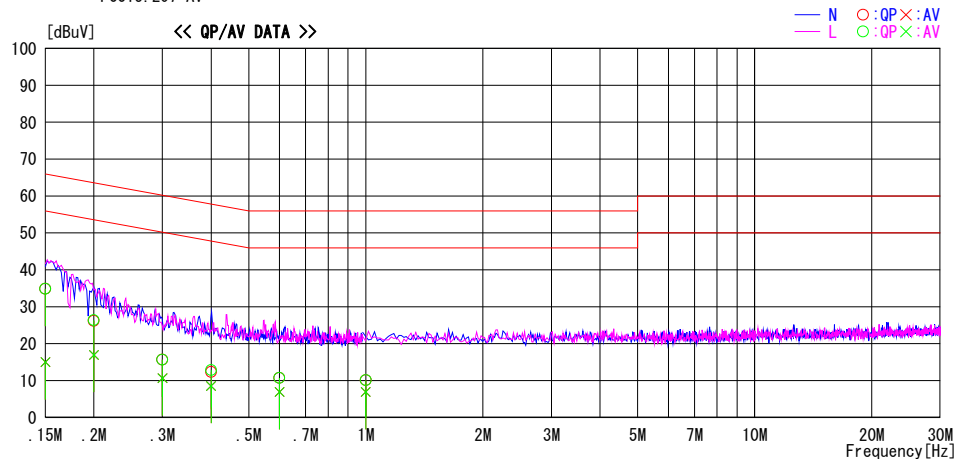
UL Japan, Inc. Ise EMC Lab. No. 4 Semi Anechoic Chamber
Date : 2014/11/08

Report No. : 10543857H

Temp./Humi. : 22deg. C / 52% RH
Engineer : Takumi Shimada

Mode / Remarks : BTLE 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]		
0.15000	21.6	1.7	13.3	34.9	15.0	66.0	56.0	31.1	41.0	L	
0.15000	21.6	1.7	13.3	34.9	15.0	66.0	56.0	31.1	41.0	N	
0.20000	12.9	3.7	13.3	26.2	17.0	63.6	53.6	37.4	36.6	N	
0.20000	13.1	3.7	13.3	26.4	17.0	63.6	53.6	37.2	36.6	L	
0.30000	2.4	-2.6	13.3	15.7	10.7	60.2	50.2	44.5	39.5	L	
0.30000	2.4	-2.6	13.3	15.7	10.7	60.2	50.2	44.5	39.5	N	
0.40000	-1.0	-4.7	13.3	12.3	8.6	57.9	47.9	45.6	39.3	N	
0.40000	-0.5	-4.7	13.3	12.8	8.6	57.9	47.9	45.1	39.3	L	
0.60000	-2.6	-6.5	13.4	10.8	6.9	56.0	46.0	45.2	39.1	L	
0.60000	-2.6	-6.5	13.4	10.8	6.9	56.0	46.0	45.2	39.1	N	
1.00000	-3.3	-6.5	13.4	10.1	6.9	56.0	46.0	45.9	39.1	N	
1.00000	-3.3	-6.5	13.4	10.1	6.9	56.0	46.0	45.9	39.1	L	

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

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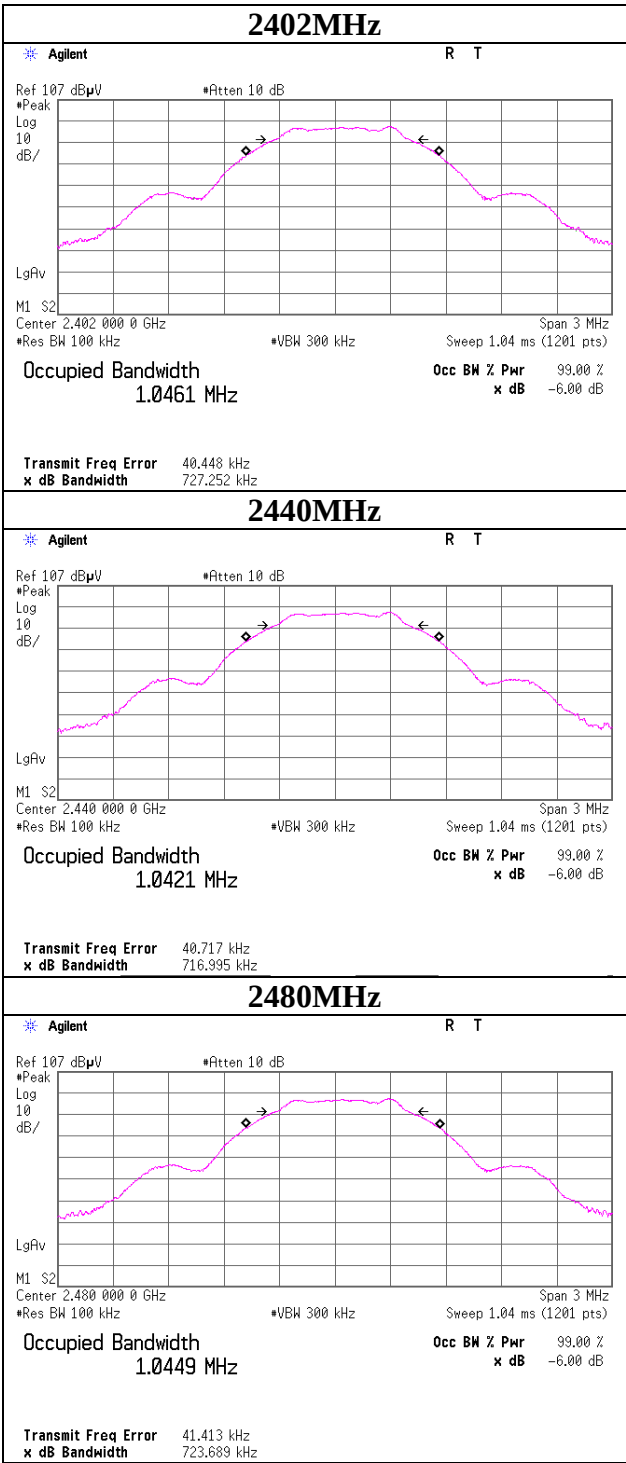
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6dB Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10543857H
Date 10/30/2014
Temperature/ Humidity 23 deg.C / 51% RH
Engineer Takumi Shimada
Mode BT LE Tx

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2402	0.727	>500
2440	0.717	>500
2480	0.724	>500

6dB Bandwidth



Maximum Peak Output Power

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10543857H
Date 10/30/2014
Temperature/ Humidity 23 deg.C / 51% RH
Engineer Takumi Shimada
Mode BT LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.13	1.41	10.08	0.36	1.09	30.00	1000	29.64
2440	-11.12	1.42	10.08	0.38	1.09	30.00	1000	29.62
2480	-11.26	1.43	10.08	0.25	1.06	30.00	1000	29.75

Sample Calculation:

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

Maximum Average Output Power (Reference data for RF EXposure)

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10543857H
Date 10/30/2014
Temperature/ Humidity 23 deg.C / 51% RH
Engineer Takumi Shimada
Mode BT LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.47	1.41	10.08	0.02	1.00	30.00	1000	29.98
2440	-11.47	1.42	10.08	0.03	1.01	30.00	1000	29.97
2480	-11.62	1.43	10.08	-0.11	0.97	30.00	1000	30.11

Sample Calculation:

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

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Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10543857H
Date : 11/07/2014
Temperature/ Humidity : 23 deg.C/ 55% RH
Engineer : Tsubasa Takayama
Mode : BT LE Tx 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.009	QP	22.9	16.7	6.7	28.5	17.8	40.0	22.2	
Hori	66.000	QP	22.7	6.9	7.1	28.4	8.3	40.0	31.7	
Hori	92.219	QP	22.3	8.6	7.4	28.3	10.0	43.5	33.5	
Hori	125.638	QP	22.1	13.3	7.6	28.1	14.9	43.5	28.6	
Hori	287.995	QP	27.5	19.1	8.6	27.4	27.8	46.0	18.2	
Hori	897.271	QP	21.4	22.5	11.1	27.2	27.8	46.0	18.2	
Hori	2390.000	PK	44.2	27.0	2.8	34.7	39.3	73.9	34.6	
Hori	4804.000	PK	45.0	31.8	4.8	33.9	47.7	73.9	26.2	
Hori	7206.000	PK	43.7	35.7	5.1	33.8	50.7	73.9	23.2	
Hori	9608.000	PK	44.4	38.0	6.8	34.4	54.8	73.9	19.1	
Hori	2390.000	AV	35.2	27.0	2.8	34.7	30.3	53.9	23.6	
Hori	4804.000	AV	34.0	31.8	4.8	33.9	36.7	53.9	17.2	
Hori	7206.000	AV	34.5	35.7	5.1	33.8	41.5	53.9	12.4	
Hori	9608.000	AV	35.2	38.0	6.8	34.4	45.6	53.9	8.3	
Vert	32.009	QP	22.7	16.7	6.7	28.5	17.6	40.0	22.4	
Vert	66.000	QP	22.7	6.9	7.1	28.4	8.3	40.0	31.7	
Vert	92.219	QP	22.6	8.6	7.4	28.3	10.3	43.5	33.2	
Vert	125.638	QP	22.2	13.3	7.6	28.1	15.0	43.5	28.5	
Vert	287.995	QP	27.2	19.1	8.6	27.4	27.5	46.0	18.5	
Vert	897.271	QP	21.5	22.5	11.1	27.2	27.9	46.0	18.1	
Vert	2390.000	PK	48.1	27.0	2.8	34.7	43.2	73.9	30.7	
Vert	4804.000	PK	44.8	31.8	4.8	33.9	47.5	73.9	26.4	
Vert	7206.000	PK	44.3	35.7	5.7	33.8	51.9	73.9	22.0	
Vert	9608.000	PK	45.4	38.0	6.8	34.4	55.8	73.9	18.1	
Vert	2390.000	AV	35.0	27.0	2.8	34.7	30.1	53.9	23.8	
Vert	4804.000	AV	34.2	31.8	4.8	33.9	36.9	53.9	17.0	
Vert	7206.000	AV	35.5	35.7	5.7	33.8	43.1	53.9	10.8	
Vert	9608.000	AV	35.7	38.0	6.8	34.4	46.1	53.9	7.8	

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

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

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

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	97.4	27.0	2.8	34.7	92.5	-	-	Carrier
Hori	2400.000	PK	37.3	27.0	2.8	34.7	32.4	72.5	40.1	
Vert	2402.000	PK	94.8	27.0	2.8	34.7	89.9	-	-	Carrier
Vert	2400.000	PK	41.0	27.0	2.8	34.7	36.1	69.9	33.8	

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

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Ise EMC Lab.

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Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10543857H
Date : 11/07/2014
Temperature/ Humidity : 23 deg.C/ 55% RH
Engineer : Tsubasa Takayama
Mode : BT LE Tx 2440MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.009	QP	22.8	16.7	6.7	28.5	17.7	40.0	22.3	
Hori	66.000	QP	22.6	6.9	7.1	28.4	8.2	40.0	31.8	
Hori	92.219	QP	22.5	8.6	7.4	28.3	10.2	43.5	33.3	
Hori	125.638	QP	22.1	13.3	7.6	28.1	14.9	43.5	28.6	
Hori	287.995	QP	23.8	19.1	8.6	27.4	24.1	46.0	21.9	
Hori	897.271	QP	21.4	22.5	11.1	27.2	27.8	46.0	18.2	
Hori	4880.000	PK	42.4	32.0	4.8	33.9	45.3	73.9	28.6	
Hori	7320.000	PK	43.4	35.8	5.7	33.8	51.1	73.9	22.8	
Hori	9760.000	PK	44.2	38.3	6.9	34.5	54.9	73.9	19.0	
Hori	4880.000	AV	33.8	32.0	4.8	33.9	36.7	53.9	17.2	
Hori	7320.000	AV	34.6	35.8	5.7	33.8	42.3	53.9	11.6	
Hori	9760.000	AV	35.8	38.3	6.9	34.5	46.5	53.9	7.4	
Vert	32.009	QP	22.9	16.7	6.7	28.5	17.8	40.0	22.2	
Vert	66.000	QP	22.6	6.9	7.1	28.4	8.2	40.0	31.8	
Vert	92.219	QP	22.7	8.6	7.4	28.3	10.4	43.5	33.1	
Vert	125.638	QP	22.2	13.3	7.6	28.1	15.0	43.5	28.5	
Vert	287.995	QP	23.9	19.1	8.6	27.4	24.2	46.0	21.8	
Vert	897.271	QP	21.4	22.5	11.1	27.2	27.8	46.0	18.2	
Vert	4880.000	PK	44.5	32.0	4.8	33.9	47.4	73.9	26.5	
Vert	7320.000	PK	44.4	35.8	5.7	33.8	52.1	73.9	21.8	
Vert	9760.000	PK	45.9	38.3	6.9	34.5	56.6	73.9	17.3	
Vert	4880.000	AV	34.2	32.0	4.8	33.9	37.1	53.9	16.8	
Vert	7320.000	AV	36.2	35.8	5.7	33.8	43.9	53.9	10.0	
Vert	9760.000	AV	35.6	38.3	6.9	34.5	46.3	53.9	7.6	

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

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

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
 26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

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Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10543857H
Date : 11/07/2014
Temperature/ Humidity : 23 deg.C/ 55% RH
Engineer : Tsubasa Takayama
Mode : BT LE Tx 2480MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.009	QP	22.7	16.7	6.7	28.5	17.6	40.0	22.4	
Hori	66.000	QP	22.6	6.9	7.1	28.4	8.2	40.0	31.8	
Hori	92.219	QP	22.7	8.6	7.4	28.3	10.4	43.5	33.1	
Hori	125.638	QP	21.9	13.3	7.6	28.1	14.7	43.5	28.8	
Hori	287.995	QP	22.9	19.1	8.6	27.4	23.2	46.0	22.8	
Hori	897.271	QP	21.4	22.5	11.1	27.2	27.8	46.0	18.2	
Hori	2483.500	PK	47.4	26.9	2.8	34.7	42.4	73.9	31.5	
Hori	4960.000	PK	44.0	32.2	4.8	34.0	47.0	73.9	26.9	
Hori	7440.000	PK	44.0	35.8	5.7	33.9	51.6	73.9	22.3	
Hori	9920.000	PK	44.2	38.7	7.0	34.5	55.4	73.9	18.5	
Hori	2483.500	AV	36.3	26.9	2.8	34.7	31.3	53.9	22.6	
Hori	4960.000	AV	34.2	32.2	4.8	34.0	37.2	53.9	16.7	
Hori	7440.000	AV	34.3	35.8	5.7	33.9	41.9	53.9	12.0	
Hori	9920.000	AV	34.7	38.7	7.0	34.5	45.9	53.9	8.0	
Vert	32.009	QP	22.9	16.7	6.7	28.5	17.8	40.0	22.2	
Vert	66.000	QP	22.5	6.9	7.1	28.4	8.1	40.0	31.9	
Vert	92.219	QP	22.9	8.6	7.4	28.3	10.6	43.5	32.9	
Vert	125.638	QP	22.0	13.3	7.6	28.1	14.8	43.5	28.7	
Vert	287.995	QP	23.9	19.1	8.6	27.4	24.2	46.0	21.8	
Vert	897.271	QP	21.5	22.5	11.1	27.2	27.9	46.0	18.1	
Vert	2483.500	PK	45.4	26.9	2.8	34.7	40.4	73.9	33.5	
Vert	4960.000	PK	44.6	32.2	4.8	34.0	47.6	73.9	26.3	
Vert	7440.000	PK	44.5	35.8	5.7	33.9	52.1	73.9	21.8	
Vert	9920.000	PK	45.5	38.7	7.0	34.5	56.7	73.9	17.2	
Vert	2483.500	AV	34.2	26.9	2.8	34.7	29.2	53.9	24.7	
Vert	4960.000	AV	34.2	32.2	4.8	34.0	37.2	53.9	16.7	
Vert	7440.000	AV	35.5	35.8	5.7	33.9	43.1	53.9	10.8	
Vert	9920.000	AV	34.7	38.7	7.0	34.5	45.9	53.9	8.0	

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

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

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Burst rate confirmation

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.2 Semi Anechoic Chamber

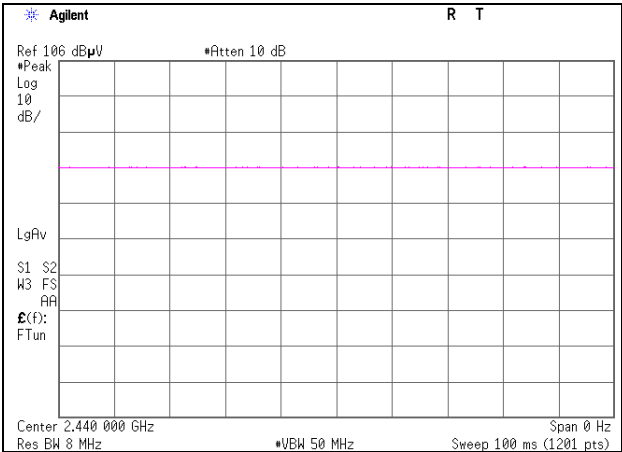
10543857H

11/07/2014

23 deg.C / 55% RH

Tsubasa Takayama

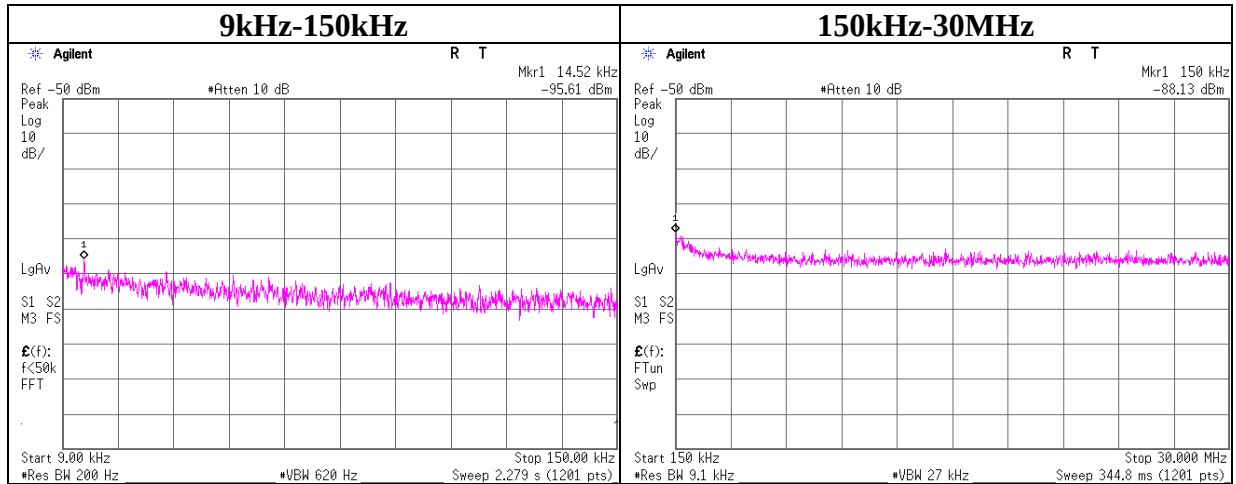
BT LE Tx 2440MHz



Conducted Spurious Emission

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10543857H
Date : 10/30/2014
Temperature/ Humidity : 23 deg.C / 51% RH
Engineer : Takumi Shimada
Mode : BT LE Tx

BT LE Tx 2402MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
14.52	-95.6	0.10	10.1	2.7	-82.7	300.0	6.0	-21.5	44.3
150	-88.1	0.10	10.1	2.7	-75.3	300.0	6.0	-14.0	24.0

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

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

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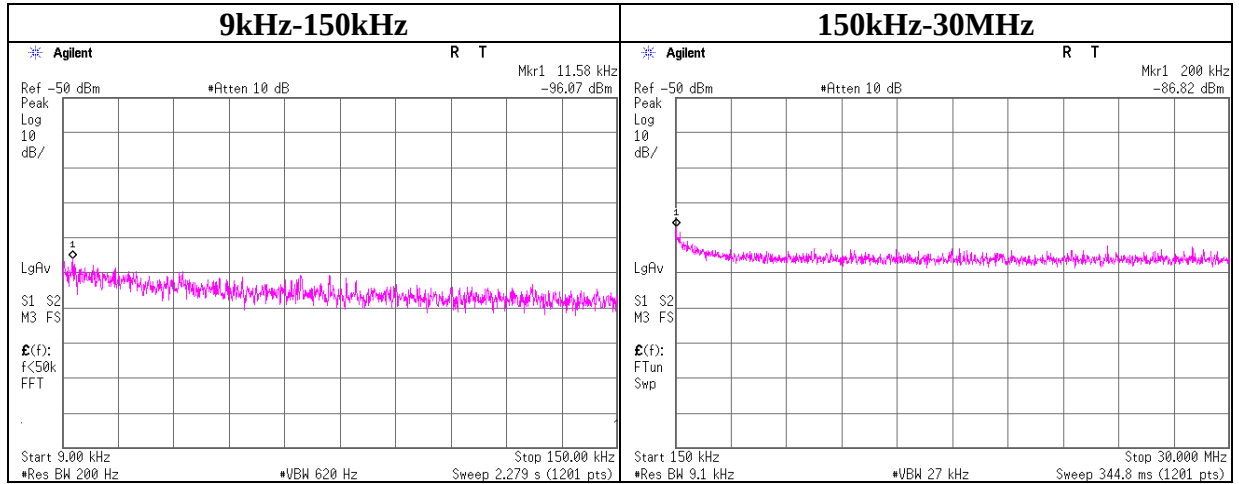
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10543857H
Date 10/30/2014
Temperature/ Humidity 23 deg.C / 51% RH
Engineer Takumi Shimada
Mode BT LE Tx

BT LE Tx 2440MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
11.58	-96.1	0.10	10.1	2.7	-83.2	300.0	6.0	-21.9	46.3
200	-86.8	0.10	10.1	2.7	-73.9	300.0	6.0	-12.7	21.5

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

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

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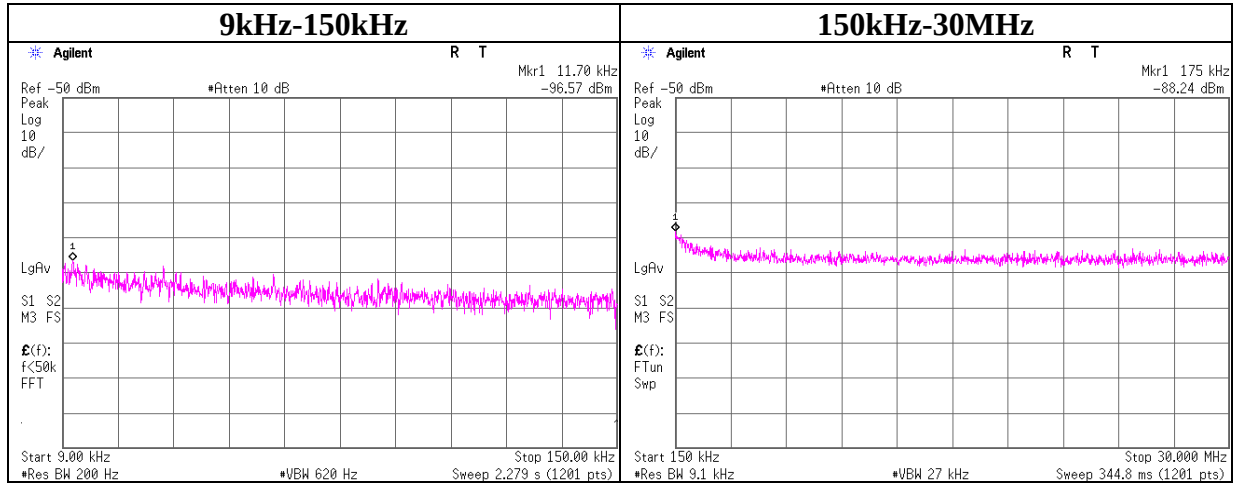
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10543857H
Date 10/30/2014
Temperature/ Humidity 23 deg.C / 51% RH
Engineer Takumi Shimada
Mode BT LE Tx

BT LE Tx 2480MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
11.70	-96.6	0.10	10.1	2.7	-83.7	300.0	6.0	-22.4	46.2
175	-88.2	0.10	10.1	2.7	-75.3	300.0	6.0	-14.1	22.7

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

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

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Power Density

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10543857H
Date 10/30/2014
Temperature/ Humidity 23 deg.C / 51% RH
Engineer Takumi Shimada
Mode BT LE Tx

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-27.59	1.41	10.08	-16.10	8.00	24.10
2440.00	-27.44	1.42	10.08	-15.94	8.00	23.94
2480.00	-27.93	1.43	10.08	-16.42	8.00	24.42

Sample Calculation:

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

UL Japan, Inc.

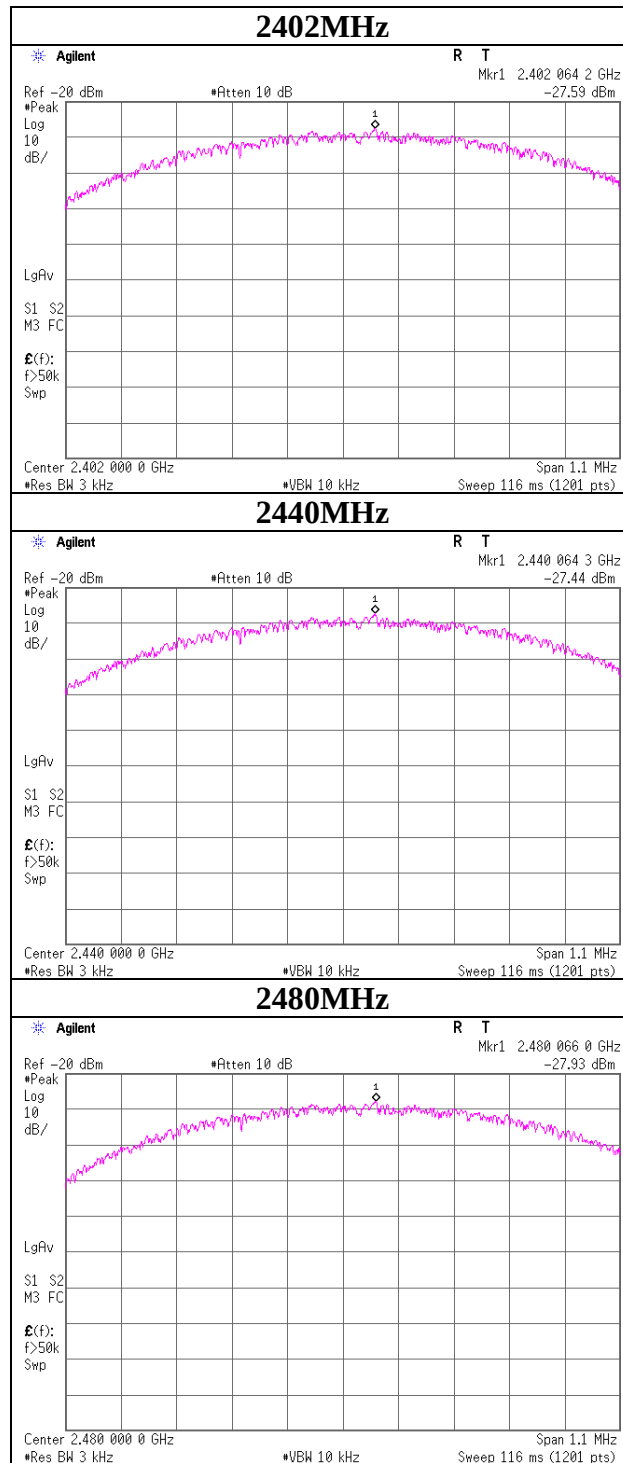
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Power Density



UL Japan, Inc.

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99%Occupied Bandwidth

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.6 Measurement Room

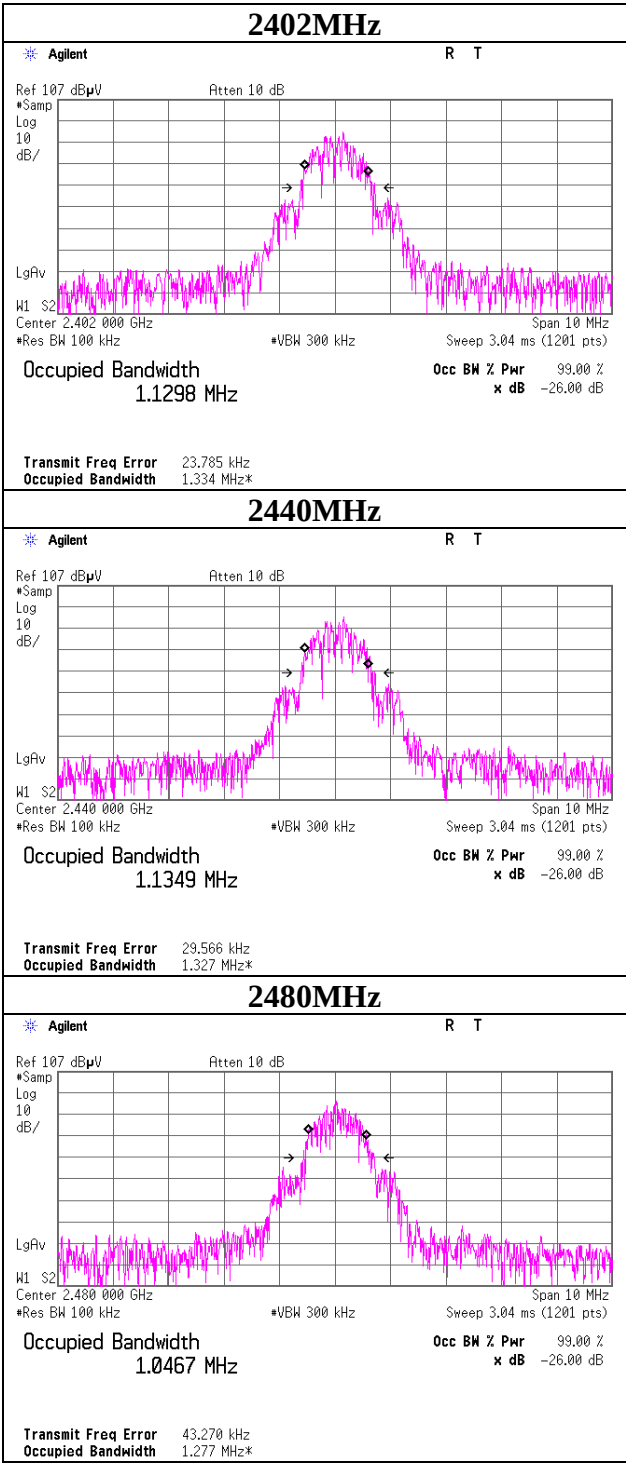
10543857H

10/30/2014

23 deg.C / 51% RH

Takumi Shimada

BT LE Tx



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2013/11/25 * 12
MAT-20	Attenuator(10dB)(above 1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	AT	2014/01/29 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2014/04/09 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2013/11/15 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2013/11/15 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2014/02/20 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2014/02/20 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE, CE	-
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2014/06/03 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2014/10/18 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2014/10/18 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2014/02/20 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 12
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2014/06/06 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2014/02/21 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2014/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2014/01/21 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2014/02/21 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2014/05/21 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE	2014/02/28 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	CE	2014/02/20 * 12
MJM-22	Measure	ASKUL	-	-	CE	-
MTR-01	Test Receiver	Rohde & Schwarz	ES140	100084	CE	2013/11/12 * 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	2014/01/29 * 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

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

UL Japan, Inc.

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