




RADIO TEST REPORT


Test Report No. : 10140775H-A-R1

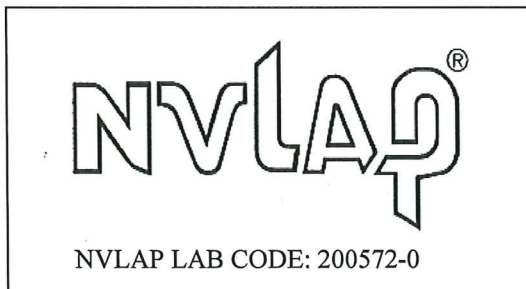
Applicant : Omron Healthcare Co., Ltd.
Type of Equipment : Bluetooth (BLE) Module
Model No. : HHX-MD01T
FCC ID : Q6ZHHXMD01T
Test regulation : FCC Part 15 Subpart C: 2013
Test Result : Complied

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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 10140775H-A. 10140775H-A is replaced with this report.

Date of test: December 4 and 5, 2013

Representative test engineer: 
Takumi Shimada
Engineer of WiSE Japan,
UL Verification Service

Approved by: 
Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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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 : +81-75-925-2499
Facsimile Number : +81-75-925-2032
Contact Person : Hirokazu Furukawa

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

2.1 Identification of E.U.T.

Type of Equipment : Bluetooth (BLE) Module
Model No. : HHX-MD01T
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 6V
Receipt Date of Sample : November 22, 2013
Country of Mass-production : China
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, 32MHz

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 : 0.2dBi

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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

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 30.5dB, 0.15000MHz, L AV 36.9dB, 2.00000MHz, 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		6.1dB 9920.000MHz, AV, Vert.	Complied

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.

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FCC 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.

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.

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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 Restricted Band Edges 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: SmartRF Studio 7 1.14.0 *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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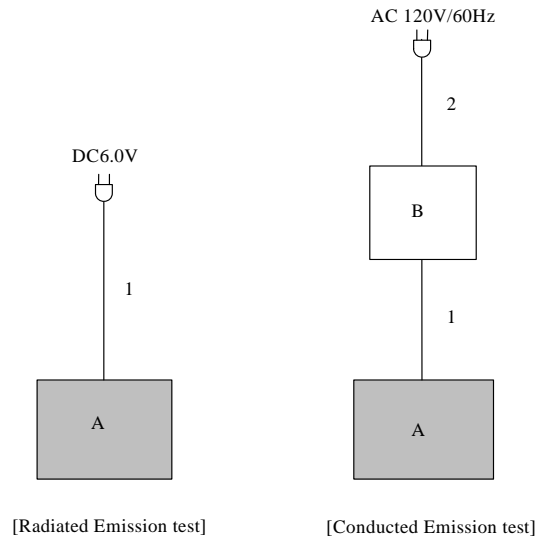
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4.2 Configuration and peripherals



* 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 (BLE) Module	HHX-MD01T	001 *1) 002 *2)	Omron Healthcare Co., Ltd.	EUT
B	DC Power Supply	PMC35-2A	1309D501	KIKUSUI	-

*1) Used for Conducted Emission/Radiated Emission tests

*2) Used for Antenna Terminal conducted test

List of cables used

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

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	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(T/R)	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 (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	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	116msec	Peak	Max Hold	Spectrum Analyzer *2)
Conducted Spurious Emission *3)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				
*1) Reference data *2) 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)". *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

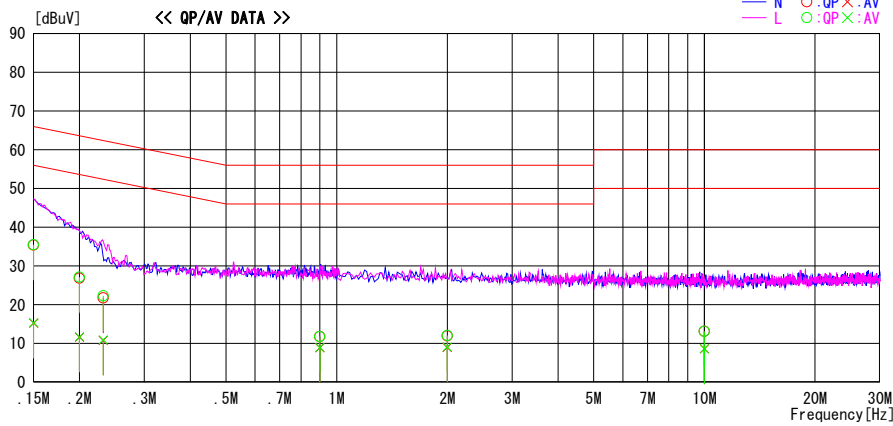
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
 Date : 2013/12/05

Report No. : 10140775H
 Temp./Humi. : 24deg. C / 34% RH
 Engineer : Takumi Shimada

Mode / Remarks : Tx 2480MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV

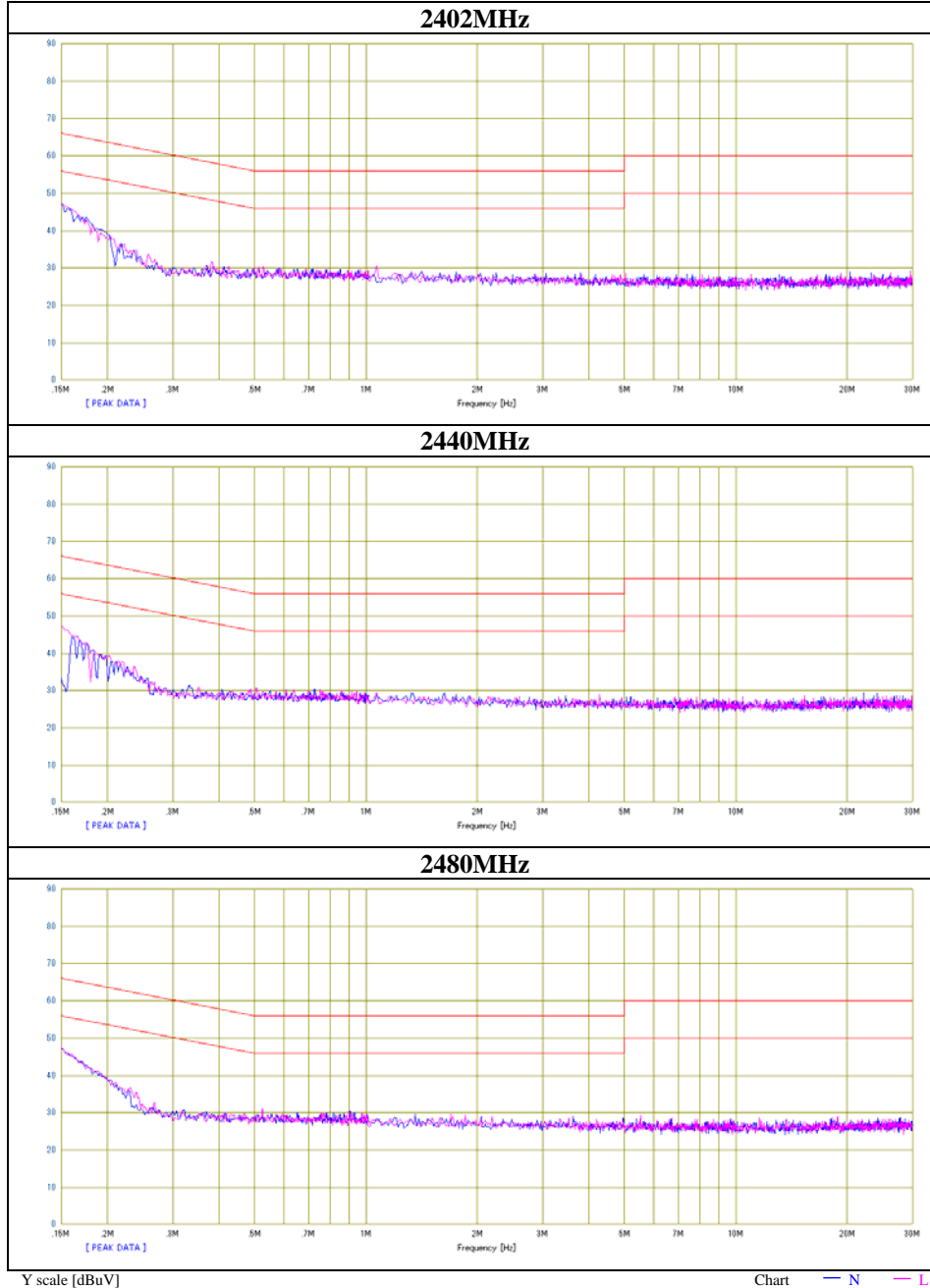


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	22.2	2.0	13.2	35.4	15.2	66.0	56.0	30.6	40.8	N	
0.20000	13.5	-1.7	13.3	26.8	11.6	63.6	53.6	36.8	42.0	N	
0.23202	8.4	-2.5	13.3	21.7	10.8	62.4	52.4	40.7	41.6	N	
0.90000	-1.7	-4.5	13.4	11.7	8.9	56.0	46.0	44.3	37.1	N	
2.00000	-1.6	-4.5	13.5	11.9	9.0	56.0	46.0	44.1	37.0	N	
10.00000	-1.1	-5.6	14.2	13.1	8.6	60.0	50.0	46.9	41.4	N	
0.15000	22.3	2.1	13.2	35.5	15.3	66.0	56.0	30.5	40.7	L	
0.20000	13.8	-1.6	13.3	27.1	11.7	63.6	53.6	36.5	41.9	L	
0.23202	9.0	-2.4	13.3	22.3	10.9	62.4	52.4	40.1	41.5	L	
0.90000	-1.7	-4.4	13.4	11.7	9.0	56.0	46.0	44.3	37.0	L	
2.00000	-1.5	-4.4	13.5	12.0	9.1	56.0	46.0	44.0	36.9	L	
10.00000	-1.1	-5.6	14.2	13.1	8.6	60.0	50.0	46.9	41.4	L	

CHART: WITH FACTOR. Peak hold data
 CALCULATION: RESULT[dBuV] = READING[dBuV] + C.F[dB] (LISN LOSS + CABLE LOSS + ATT LOSS)

Conducted Emission

Test place : Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 10140775H
Date : 12/04/2013
Temperature/ Humidity : 24deg. C / 34% RH
Engineer : Takumi Shimada
Mode : LE Tx



6dB Bandwidth

Test place Head Office EMC Lab. No.3 Measurement Room
Report No. 10140775H
Date 12/05/2013
Temperature/ Humidity 24 deg. C / 48% RH
Engineer Keisuke Kawamura
Mode LE Tx

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2402	0.683	>500
2440	0.671	>500
2480	0.684	>500

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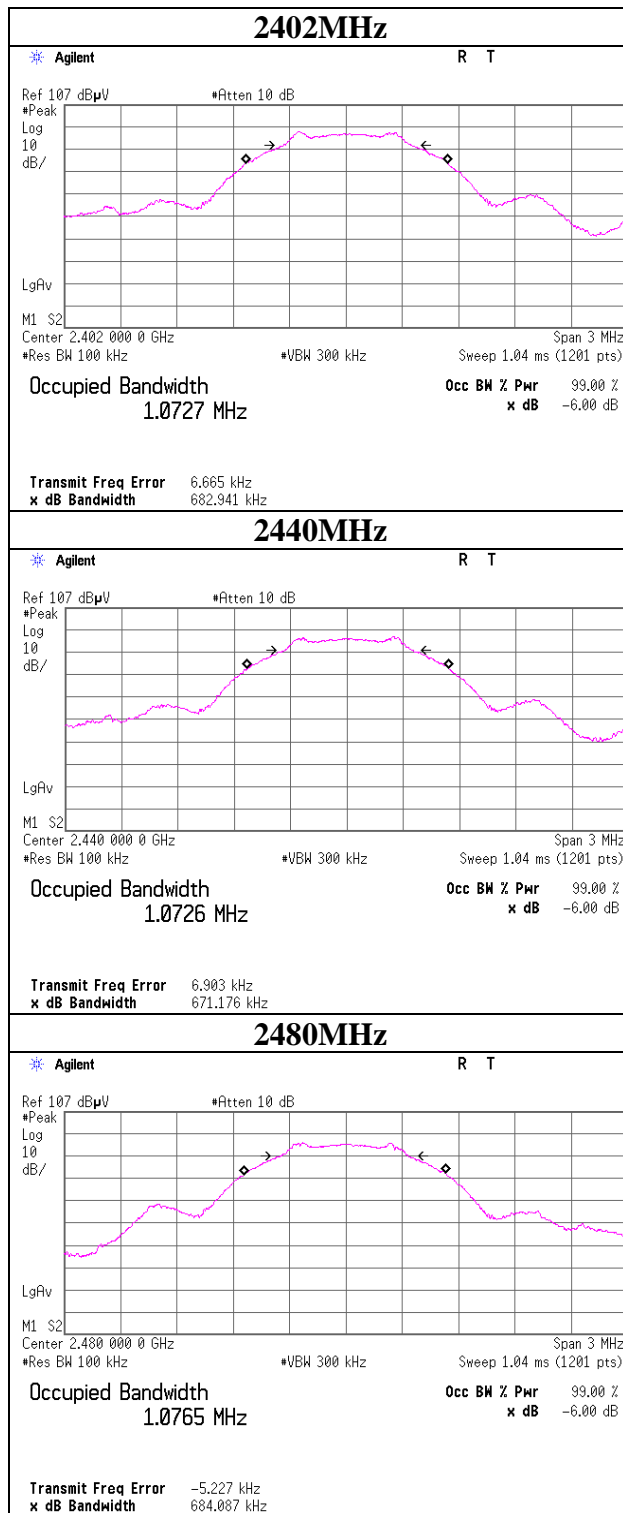
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6dB Bandwidth



Maximum Peak Output Power

Test place Head Office EMC Lab. No.3 Measurement Room
Report No. 10140775H
Date 12/05/2013
Temperature/ Humidity 24 deg. C / 48% RH
Engineer Keisuke Kawamura
Mode LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.25	1.40	10.07	0.22	1.05	30.00	1000	29.78
2440	-11.94	1.40	10.07	-0.47	0.90	30.00	1000	30.47
2480	-12.47	1.42	10.08	-0.97	0.80	30.00	1000	30.97

Sample Calculation:

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

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Maximum Average Output Power (Reference data for RF Exposure)

Test place Head Office EMC Lab. No.3 Measurement Room
Report No. 10140775H
Date 12/05/2013
Temperature/ Humidity 24 deg.C / 48% RH
Engineer Keisuke Kawamura
Mode LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.97	1.40	10.07	-0.50	0.89	30.00	1000	30.50
2440	-12.77	1.40	10.07	-1.30	0.74	30.00	1000	31.30
2480	-13.60	1.42	10.08	-2.10	0.62	30.00	1000	32.10

Sample Calculation:

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

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Radiated Spurious Emission

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10140775H
Date	12/04/2013
Temperature/ Humidity	24deg. C / 34% RH
Engineer	Takumi Shimada
Mode	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	120.000	QP	22.4	13.0	8.3	32.1	11.6	43.5	31.9	
Hori	200.000	QP	22.0	16.6	9.1	32.1	15.6	43.5	27.9	
Hori	250.000	QP	22.0	17.3	9.5	32.1	16.7	46.0	29.3	
Hori	400.000	QP	21.8	17.5	10.6	32.0	17.9	46.0	28.1	
Hori	500.000	QP	21.9	18.1	11.2	32.0	19.2	46.0	26.8	
Hori	600.000	QP	22.0	19.5	11.8	32.1	21.2	46.0	24.8	
Hori	2337.843	PK	52.7	28.0	3.1	32.4	51.4	73.9	22.5	
Hori	2390.000	PK	50.6	28.2	3.1	32.4	49.5	73.9	24.4	
Hori	4804.000	PK	46.6	30.5	5.3	31.4	51.0	73.9	22.9	
Hori	7206.000	PK	43.0	35.8	6.7	32.3	53.2	73.9	20.7	
Hori	9608.000	PK	42.7	39.0	7.3	33.0	56.0	73.9	17.9	
Hori	2337.843	AV	48.5	28.0	3.1	32.4	47.2	53.9	6.7	
Hori	2390.000	AV	43.5	28.2	3.1	32.4	42.4	53.9	11.5	
Hori	4804.000	AV	40.1	30.5	5.3	31.4	44.5	53.9	9.4	
Hori	7206.000	AV	33.5	35.8	6.7	32.3	43.7	53.9	10.2	
Hori	9608.000	AV	33.3	39.0	7.3	33.0	46.6	53.9	7.3	
Vert	120.000	QP	22.4	13.0	8.3	32.1	11.6	43.5	31.9	
Vert	200.000	QP	22.0	16.6	9.1	32.1	15.6	43.5	27.9	
Vert	250.000	QP	22.1	17.3	9.5	32.1	16.8	46.0	29.2	
Vert	400.000	QP	21.9	17.5	10.6	32.0	18.0	46.0	28.0	
Vert	500.000	QP	22.0	18.1	11.2	32.0	19.3	46.0	26.7	
Vert	600.000	QP	22.1	19.5	11.8	32.1	21.3	46.0	24.7	
Vert	2337.900	PK	49.5	28.0	3.1	32.4	48.2	73.9	25.7	
Vert	2390.000	PK	46.2	28.2	3.1	32.4	45.1	73.9	28.8	
Vert	4804.000	PK	43.7	30.5	5.3	31.4	48.1	73.9	25.8	
Vert	7206.000	PK	42.9	35.8	6.7	32.3	53.1	73.9	20.8	
Vert	9608.000	PK	42.5	39.0	7.3	33.0	55.8	73.9	18.1	
Vert	2337.900	AV	44.9	28.0	3.1	32.4	43.6	53.9	10.3	
Vert	2390.000	AV	38.7	28.2	3.1	32.4	37.6	53.9	16.3	
Vert	4804.000	AV	34.9	30.5	5.3	31.4	39.3	53.9	14.6	
Vert	7206.000	AV	33.8	35.8	6.7	32.3	44.0	53.9	9.9	
Vert	9608.000	AV	33.2	39.0	7.3	33.0	46.5	53.9	7.4	

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).

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

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	95.9	28.2	3.1	32.4	94.8	-	-	Carrier
Hori	2399.252	PK	59.3	28.2	3.1	32.4	58.2	74.8	16.6	
Hori	2400.000	PK	56.8	28.2	3.1	32.4	55.7	74.8	19.1	
Vert	2402.000	PK	90.3	28.2	3.1	32.4	89.2	-	-	Carrier
Vert	2399.266	PK	52.6	28.2	3.1	32.4	51.5	69.2	17.7	
Vert	2400.000	PK	51.8	28.2	3.1	32.4	50.7	69.2	18.5	

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

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Radiated Spurious Emission

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10140775H
Date	12/04/2013
Temperature/ Humidity	24deg. C / 34% RH
Engineer	Takumi Shimada
Mode	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	120.000	QP	22.4	13.0	8.3	32.1	11.6	43.5	31.9	
Hori	200.000	QP	22.0	16.6	9.1	32.1	15.6	43.5	27.9	
Hori	250.000	QP	22.0	17.3	9.5	32.1	16.7	46.0	29.3	
Hori	400.000	QP	21.9	17.5	10.6	32.0	18.0	46.0	28.0	
Hori	500.000	QP	22.1	18.1	11.2	32.0	19.4	46.0	26.6	
Hori	600.000	QP	22.1	19.5	11.8	32.1	21.3	46.0	24.7	
Hori	2376.058	PK	50.2	28.1	3.1	32.4	49.0	73.9	24.9	
Hori	2504.113	PK	49.3	28.5	3.2	32.3	48.7	73.9	25.2	
Hori	4880.000	PK	45.2	30.6	5.3	31.4	49.7	73.9	24.2	
Hori	7320.000	PK	43.1	36.0	6.8	32.4	53.5	73.9	20.4	
Hori	9760.000	PK	42.0	39.4	7.3	33.0	55.7	73.9	18.2	
Hori	2376.058	AV	45.7	28.1	3.1	32.4	44.5	53.9	9.4	
Hori	2504.113	AV	46.0	28.5	3.2	32.3	45.4	53.9	8.5	
Hori	4880.000	AV	38.3	30.6	5.3	31.4	42.8	53.9	11.1	
Hori	7320.000	AV	34.2	36.0	6.8	32.4	44.6	53.9	9.3	
Hori	9760.000	AV	33.5	39.4	7.3	33.0	47.2	53.9	6.7	
Vert	120.000	QP	22.3	13.0	8.3	32.1	11.5	43.5	32.0	
Vert	200.000	QP	22.1	16.6	9.1	32.1	15.7	43.5	27.8	
Vert	250.000	QP	22.0	17.3	9.5	32.1	16.7	46.0	29.3	
Vert	400.000	QP	21.9	17.5	10.6	32.0	18.0	46.0	28.0	
Vert	500.000	QP	22.0	18.1	11.2	32.0	19.3	46.0	26.7	
Vert	600.000	QP	22.1	19.5	11.8	32.1	21.3	46.0	24.7	
Vert	2375.972	PK	47.9	28.1	3.1	32.4	46.7	73.9	27.3	
Vert	2504.217	PK	44.5	28.5	3.2	32.3	43.9	73.9	30.0	
Vert	4880.000	PK	42.5	30.6	5.3	31.4	47.0	73.9	26.9	
Vert	7320.000	PK	42.5	36.0	6.8	32.4	52.9	73.9	21.0	
Vert	9760.000	PK	41.9	39.4	7.3	33.0	55.6	73.9	18.3	
Vert	2375.972	AV	43.8	28.1	3.1	32.4	42.6	53.9	11.3	
Vert	2504.217	AV	35.7	28.5	3.2	32.3	35.1	53.9	18.8	
Vert	4880.000	AV	34.7	30.6	5.3	31.4	39.2	53.9	14.7	
Vert	7320.000	AV	33.6	36.0	6.8	32.4	44.0	53.9	9.9	
Vert	9760.000	AV	33.2	39.4	7.3	33.0	46.9	53.9	7.0	

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).

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 10140775H
Date 12/04/2013
Temperature/ Humidity 24deg. C / 34% RH
Engineer Takumi Shimada
Mode 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	200.000	QP	22.1	16.6	9.1	32.1	15.7	43.5	27.8	
Hori	250.000	QP	22.0	17.3	9.5	32.1	16.7	46.0	29.3	
Hori	400.000	QP	21.9	17.5	10.6	32.0	18.0	46.0	28.0	
Hori	500.000	QP	22.0	18.1	11.2	32.0	19.3	46.0	26.7	
Hori	600.000	QP	22.1	19.5	11.8	32.1	21.3	46.0	24.7	
Hori	2483.500	PK	51.7	28.4	3.1	32.3	50.9	73.9	23.0	
Hori	2544.213	PK	47.5	28.5	3.2	32.3	46.9	73.9	27.0	
Hori	4960.000	PK	44.5	30.7	5.4	31.4	49.2	73.9	24.7	
Hori	7440.000	PK	43.1	36.2	6.7	32.4	53.6	73.9	20.3	
Hori	9920.000	PK	42.4	39.8	7.4	33.1	56.5	73.9	17.4	
Hori	2483.500	AV	45.8	28.4	3.1	32.3	45.0	53.9	8.9	
Hori	2544.213	AV	42.2	28.5	3.2	32.3	41.6	53.9	12.3	
Hori	4960.000	AV	36.8	30.7	5.4	31.4	41.5	53.9	12.4	
Hori	7440.000	AV	34.5	36.2	6.7	32.4	45.0	53.9	8.9	
Hori	9920.000	AV	33.5	39.8	7.4	33.1	47.6	53.9	6.3	
Vert	120.000	QP	22.4	13.0	8.3	32.1	11.6	43.5	31.9	
Vert	200.000	QP	22.1	16.6	9.1	32.1	15.7	43.5	27.8	
Vert	250.000	QP	22.1	17.3	9.5	32.1	16.8	46.0	29.2	
Vert	400.000	QP	21.9	17.5	10.6	32.0	18.0	46.0	28.0	
Vert	500.000	QP	22.0	18.1	11.2	32.0	19.3	46.0	26.7	
Vert	600.000	QP	22.1	19.5	11.8	32.1	21.3	46.0	24.7	
Vert	2483.500	PK	49.0	28.4	3.1	32.3	48.2	73.9	25.7	
Vert	2544.023	PK	46.0	28.5	3.2	32.3	45.4	73.9	28.5	
Vert	4960.000	PK	42.0	30.7	5.4	31.4	46.7	73.9	27.2	
Vert	7440.000	PK	42.9	36.2	6.7	32.4	53.4	73.9	20.5	
Vert	9920.000	PK	42.9	39.8	7.4	33.1	57.0	73.9	16.9	
Vert	2483.500	AV	43.5	28.4	3.1	32.3	42.7	53.9	11.2	
Vert	2544.023	AV	39.5	28.5	3.2	32.3	38.9	53.9	15.0	
Vert	4960.000	AV	33.1	30.7	5.4	31.4	37.8	53.9	16.1	
Vert	7440.000	AV	34.0	36.2	6.7	32.4	44.5	53.9	9.4	
Vert	9920.000	AV	33.7	39.8	7.4	33.1	47.8	53.9	6.1	

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

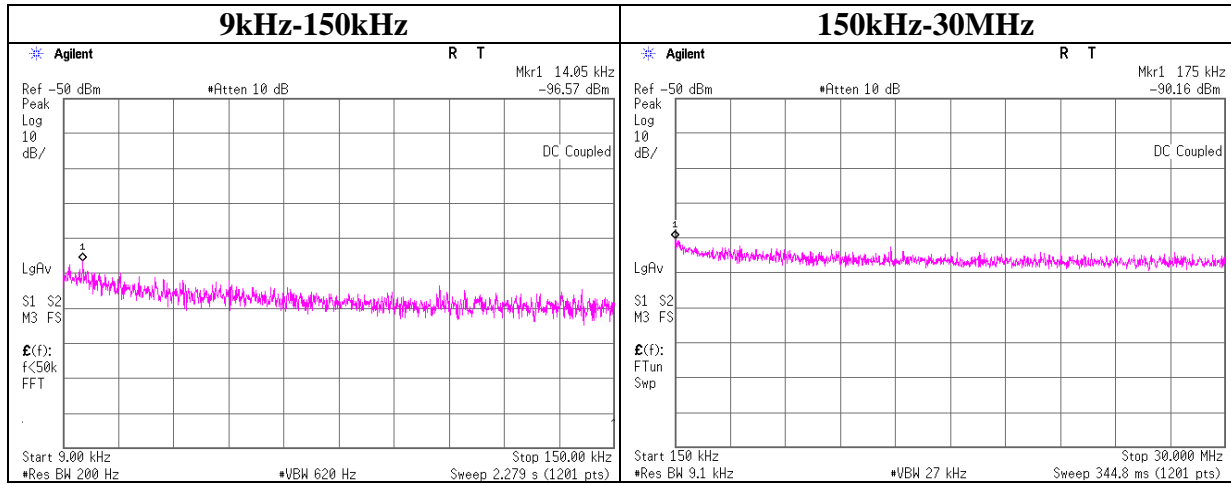
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

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

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.3 Measurement Room
Report No.	10140775H
Date	12/05/2013
Temperature/ Humidity	24 deg.C / 48% RH
Engineer	Keisuke Kawamura
Mode	LE Tx

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]
14.05	-96.6	0.01	10.0	0.2	-86.4	300.0	6.0	-25.1	44.7
175	-90.2	0.01	10.0	0.2	-80.0	300.0	6.0	-18.7	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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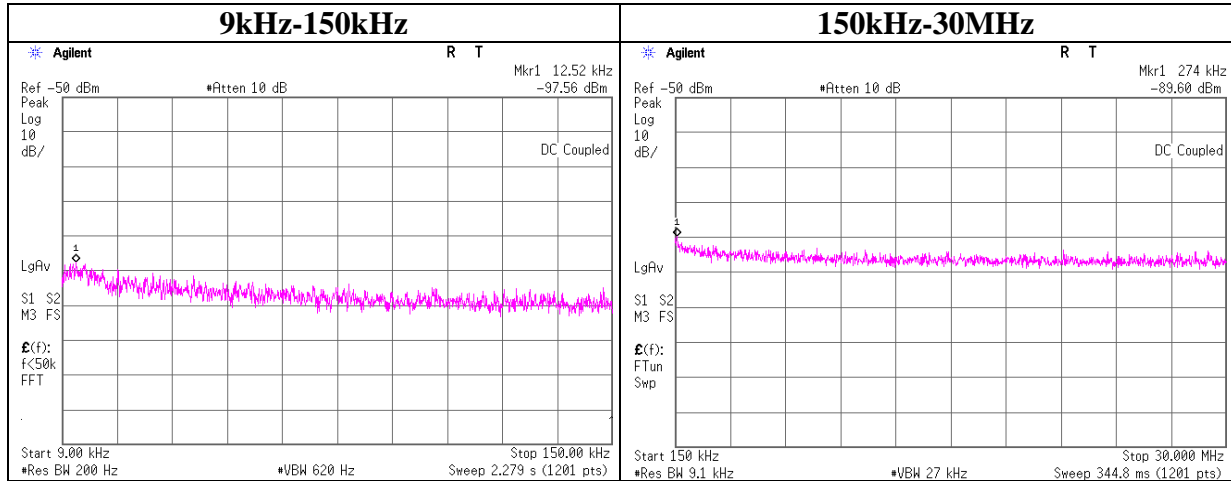
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Conducted Spurious Emission

Test place	Head Office EMC Lab. No.3 Measurement Room
Report No.	10140775H
Date	12/05/2013
Temperature/ Humidity	24 deg.C / 48% RH
Engineer	Keisuke Kawamura
Mode	LE Tx

LE Tx 2440MHz



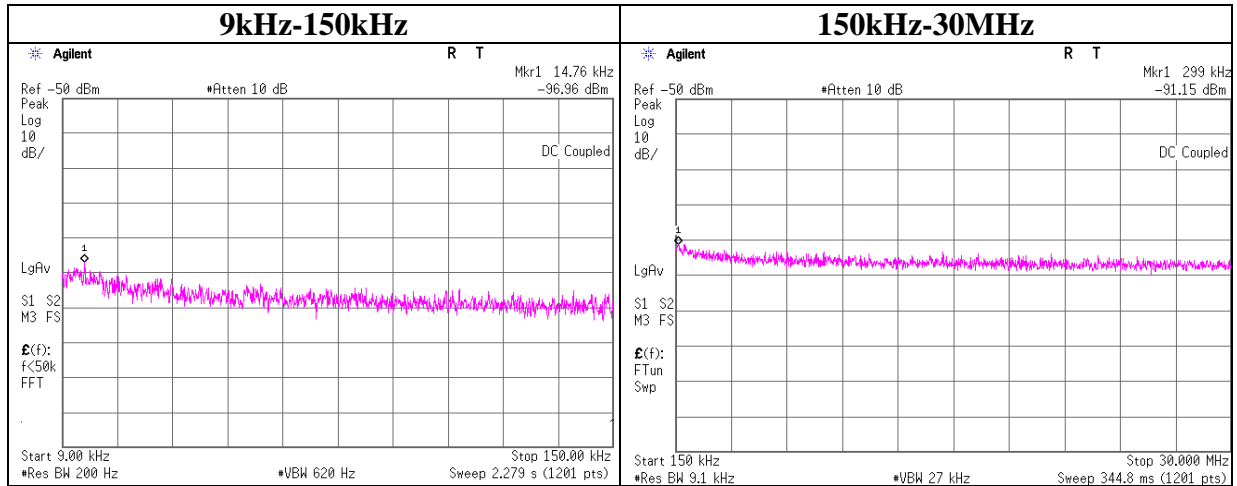
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
12.52	-97.6	0.01	10.0	0.2	-87.4	300.0	6.0	-26.1	45.7
274	-89.6	0.01	10.0	0.2	-79.4	300.0	6.0	-18.1	18.8

$E = \text{EIRP} - 20\log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$
 $\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

Conducted Spurious Emission

Test place	Head Office EMC Lab. No.3 Measurement Room
Report No.	10140775H
Date	12/05/2013
Temperature/ Humidity	24 deg.C / 48% RH
Engineer	Keisuke Kawamura
Mode	LE Tx

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]
14.76	-97.0	0.01	10.0	0.2	-86.8	300.0	6.0	-25.5	44.2
299	-91.2	0.01	10.0	0.2	-80.9	300.0	6.0	-19.7	18.1

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

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

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Power Density

Test place Head Office EMC Lab. No.3 Measurement Room
Report No. 10140775H
Date 12/05/2013
Temperature/ Humidity 24 deg.C / 48% RH
Engineer Keisuke Kawamura
Mode LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-24.62	1.40	10.07	-13.15	8.00	21.15
2440.00	-24.41	1.40	10.07	-12.94	8.00	20.94
2480.00	-25.81	1.42	10.07	-14.32	8.00	22.32

Sample Calculation:

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

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Head Office EMC Lab.

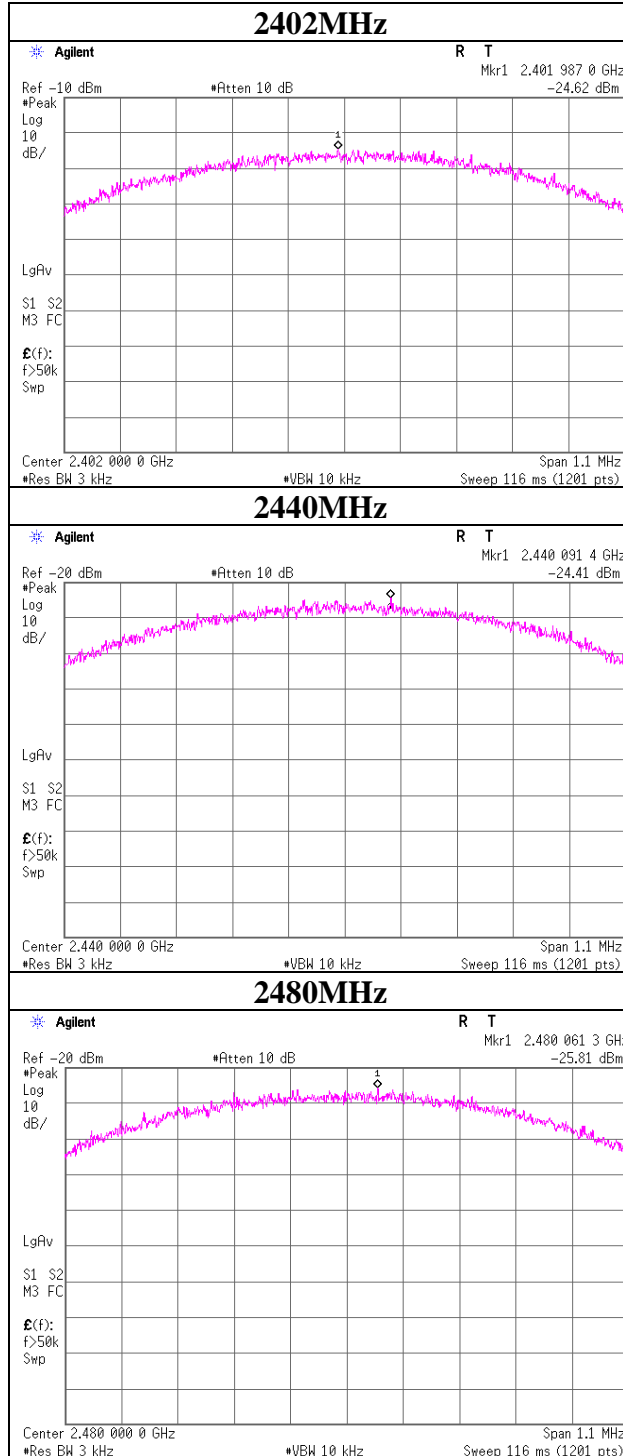
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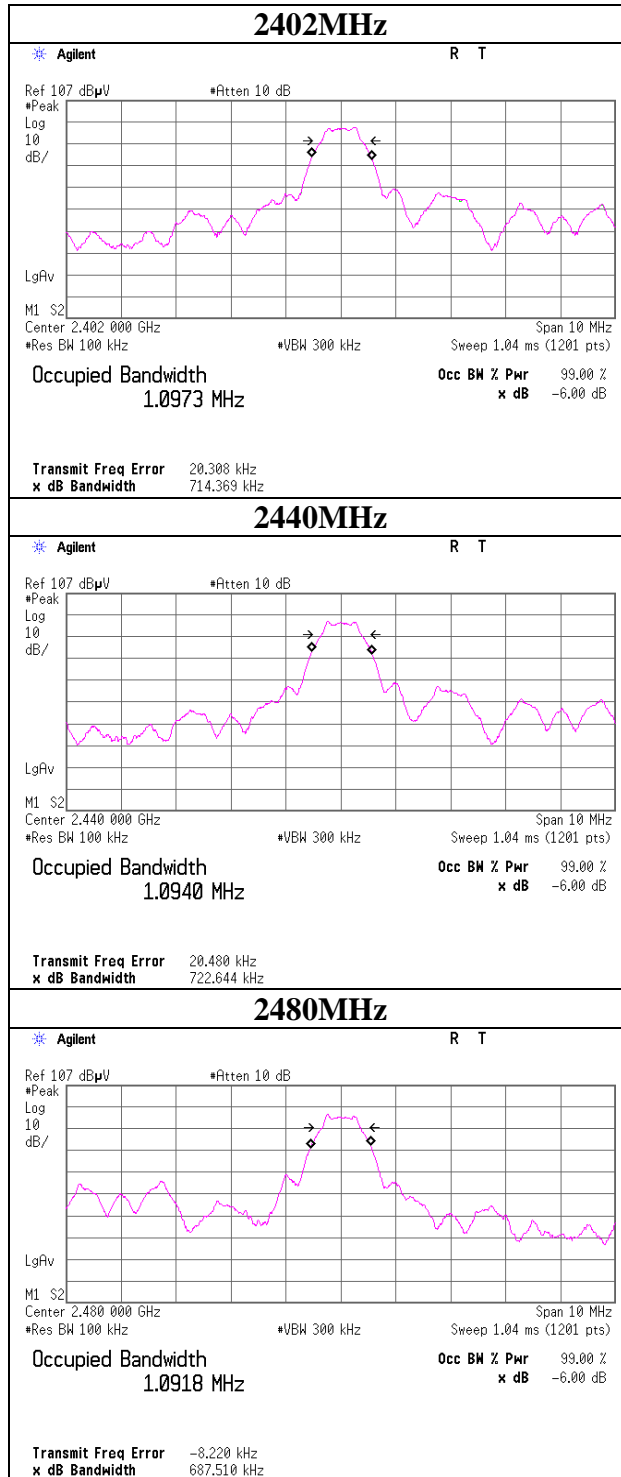
Power Density

Test place	Head Office EMC Lab. No.3 Measurement Room
Report No.	10140775H
Date	12/05/2013
Temperature/ Humidity	24 deg.C / 48% RH
Engineer	Keisuke Kawamura
Mode	LE Tx



99% Occupied Bandwidth

Test place	Head Office EMC Lab. No.3 Measurement Room
Report No.	10140775H
Date	12/05/2013
Temperature/ Humidity	24 deg.C / 48% RH
Engineer	Keisuke Kawamura
Mode	LE Tx



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2013/02/28 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2013/02/26 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE/CE	2013/02/22 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2013/08/20 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2013/10/13 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2013/10/13 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2013/07/23 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2013/04/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2013/03/12 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2013/05/17 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2013/09/27 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2013/09/01 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2013/03/12 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2013/05/17 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(EUT)	2013/01/07 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/ sucoform141-PE(1m)/ 421-010(1.5m)/ RFM-E321(Switcher)	-/00640	CE	2013/07/23 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/22 * 12
MOS-12	Thermo-Hygrometer	Custom	CTH-180	-	AT	2013/01/17 * 12
MAT-20	Attenuator(10dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	AT	2013/01/09 * 12
MRENT-114	Spectrum Analyzer	Agilent	E4440A	MY46187105	AT	2013/11/11 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2013/04/17 * 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

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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