



RADIO TEST REPORT

Test Report No. : 10085326H-A-R2

Applicant : Seiko Epson Corporation
Type of Equipment : Heart Rate activity monitor
Model No. : PS-100
FCC ID : BKMAP005
Test regulation : FCC Part 15 Subpart C: 2014
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 10085326H-A-R1. 10085326H-A-R1 is replaced with this report.

Date of test: December 19, 2013 to January 11, 2014

Representative test engineer:

T. Nakagawa

Tomohisa Nakagawa
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Consumer Technology Division

Approved by:

Takayuki Shimada

Takayuki Shimada
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10085326H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10085326H-A	January 29, 2014	-	-
1	10085326H-A-R1	April 10, 2014	P.1, 5	Update of FCC15 version
1	10085326H-A-R1	April 10, 2014	P.5	Correction of FCC 15.31 (e) sentence
1	10085326H-A-R1	April 10, 2014	P.18, 20	Addition of explanatory note for test data
1	10085326H-A-R1	April 10, 2014	P.21, 27	Addition of test date, test engineer, test environment, and test mode
2	10085326H-A-R2	April 11, 2014	P.1	Correction of date of test
2	10085326H-A-R2	April 11, 2014	P.22-25, 27	Correction of test date

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SECTION 1: Customer information

Company Name : Seiko Epson Corporation
Address : 3-3-5 Owa, Suwa-shi, Nagano-Ken, 392-8502 Japan
Telephone Number : +81-266-61-0616
Facsimile Number : +81-266-61-2051
Contact Person : Naoshi Furuta

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

2.1 Identification of E.U.T.

Type of Equipment : Heart Rate activity monitor
Model No. : PS-100
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC3.7V (Battery), AC100-240V, 50/60Hz (AC Adaptor)
Receipt Date of Sample : December 18, 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 : 16MHz (for Bluetooth normal operation)
32.768kHz (for Bluetooth slow clock and MCU)

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 2402-2480MHz
Modulation : GFSK
Bandwidth & Channel spacing : 1MHz & 2MHz
Power Supply (radio part input) : DC1.2V
Antenna Type : Printed inverted-F antenna
Antenna Gain : -4dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2014, final revised on March 6, 2014 and effective April 7, 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

- * The revision on March 6, 2014 does not affect the test specification applied to the EUT.
- * The EUT complies with FCC Part 15 Subpart B: 2014, final revised on March 6, 2014 and effective April 7, 2014.

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 32.0dB, 0.35922MHz, N AV 30.7dB, 0.62946MHz, N	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	3.5dB 2400.000MHz, PK, Vert.	Complied	Conducted/ Radiated

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

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

FCC 15.31 (e)

This test was performed with the New Battery and the constant voltage was supplied to the EUT during the tests. Therefore, the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	N/A	-	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

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

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

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

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

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

Conducted Emission test

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

Radiated emission test(3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

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	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

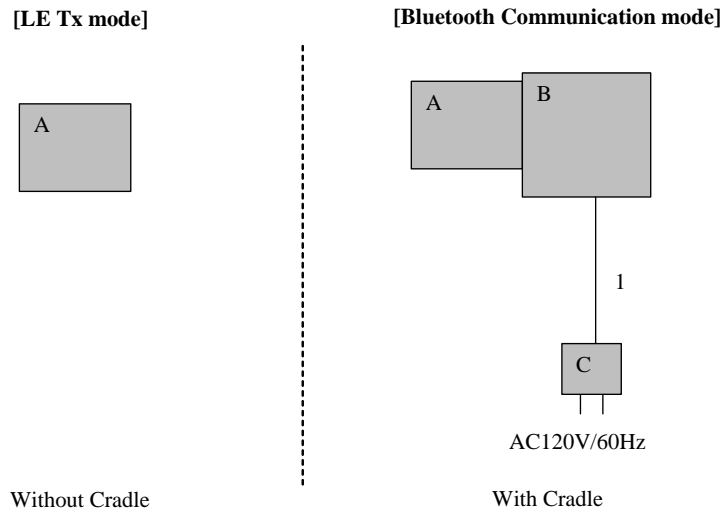
4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth Communication mode	-
Bluetooth(BT) LE Transmitting (Tx) mode	Maximum Packet Size, PN9
<p>*Power of the EUT was set by the software as follows; - Power settings: same as mass-production product - Software: Test firmware for EMC (version 01.01) 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.</p>	

*Details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	Bluetooth Communication mode*	-
6dB Bandwidth	LE Tx	2402MHz
Maximum Peak Output Power		2440MHz
Radiated/Conducted Spurious Emission		2480MHz
Power Density		
99% Occupied Bandwidth		
<p>*Since continuous transmitting as test mode is not possible during battery charging, test was performed on Bluetooth Communication mode as the normal Bluetooth specification.</p>		

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	Heart Rate activity monitor	PS-100	PAAIE0003X for CE* 001 for RE* 002 for AT*	Seiko Epson Corporation	EUT
B	Cradle	PS-100	4BES045	Seiko Epson Corporation	EUT
C	AC Adaptor	3A-058WT05B	001	Seiko Epson Corporation	EUT

*CE: Conducted Emission, RE: Radiated Emission, AT: Antenna Terminal Conducted test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	0.3	Shielded	Shielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with AC Adaptor (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

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: Alternative 1 *1) RBW: 1MHz VBW: 3MHz Trace: Free Run Detector: Power Averaging (RMS) Duty factor was added to the results.	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m *2) (above 10GHz)		3m (below 10GHz), 1m *2) (above 10GHz)

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

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

The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT and with cradle to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

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

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	3MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold*1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	105.4msec	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				

*1) The measurement was performed with Max Hold since the duty cycle was not 100%.
*2) Reference data
*3) Section 10.2 Method PKPSD (peak PSD) of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".
*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Data of EMI test

Conducted Emission

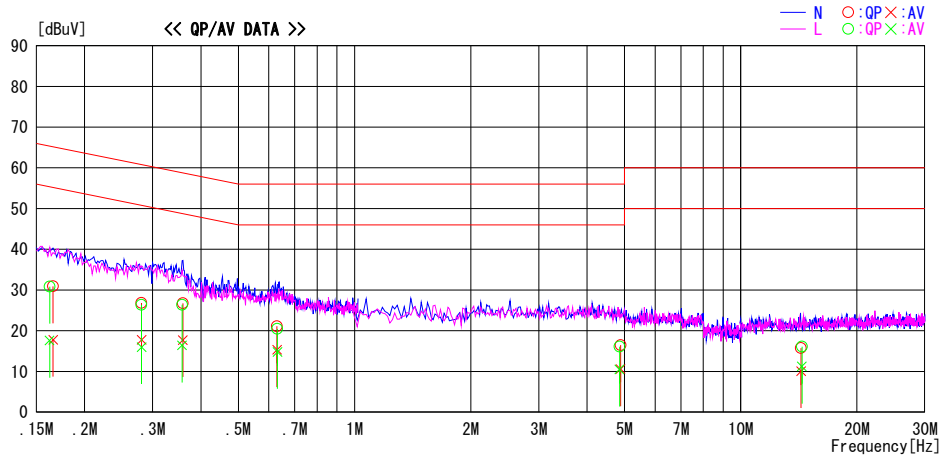
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
 Date : 2014/01/11

Report No. : 10085326H
 Temp./Humi. : 24deg. C / 40% RH
 Engineer : Ken Fujita

Mode / Remarks : BT Communication mode

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.16569	17.7	4.6	13.2	30.9	17.8	65.2	55.2	34.3	37.4	N	
0.29076	13.5	4.5	13.3	26.8	17.8	60.8	50.8	34.0	33.0	N	
0.35922	13.4	4.4	13.3	26.7	17.7	58.7	48.7	32.0	31.0	N	
0.62946	7.7	1.9	13.4	21.1	15.3	56.0	46.0	34.9	30.7	N	
4.88792	2.5	-3.4	14.0	16.5	10.6	56.0	46.0	39.5	35.4	N	
14.32964	0.7	-4.9	15.0	15.7	10.1	60.0	50.0	44.3	39.9	N	
0.16220	17.6	4.4	13.2	30.8	17.6	65.4	55.4	34.6	37.8	L	
0.28076	13.1	2.7	13.3	26.4	16.0	60.8	50.8	34.4	34.8	L	
0.35748	13.1	3.1	13.3	26.4	16.4	58.8	48.8	32.4	32.4	L	
0.63120	7.1	1.4	13.4	20.5	14.8	56.0	46.0	35.5	31.2	L	
4.85157	2.1	-3.5	14.0	16.1	10.5	56.0	46.0	39.9	35.5	L	
14.41000	1.1	-3.8	15.0	16.1	11.2	60.0	50.0	43.9	38.8	L	

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

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6dB Bandwidth

Test place Head Office EMC Lab. No.11 measurement room
Report No. 10085326H
Date 12/19/2013
Temperature/ Humidity 24 deg. C / 50% RH
Engineer Tomohisa Nakagawa
Mode LE Tx

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2402	0.643	>500
2440	0.658	>500
2480	0.638	>500

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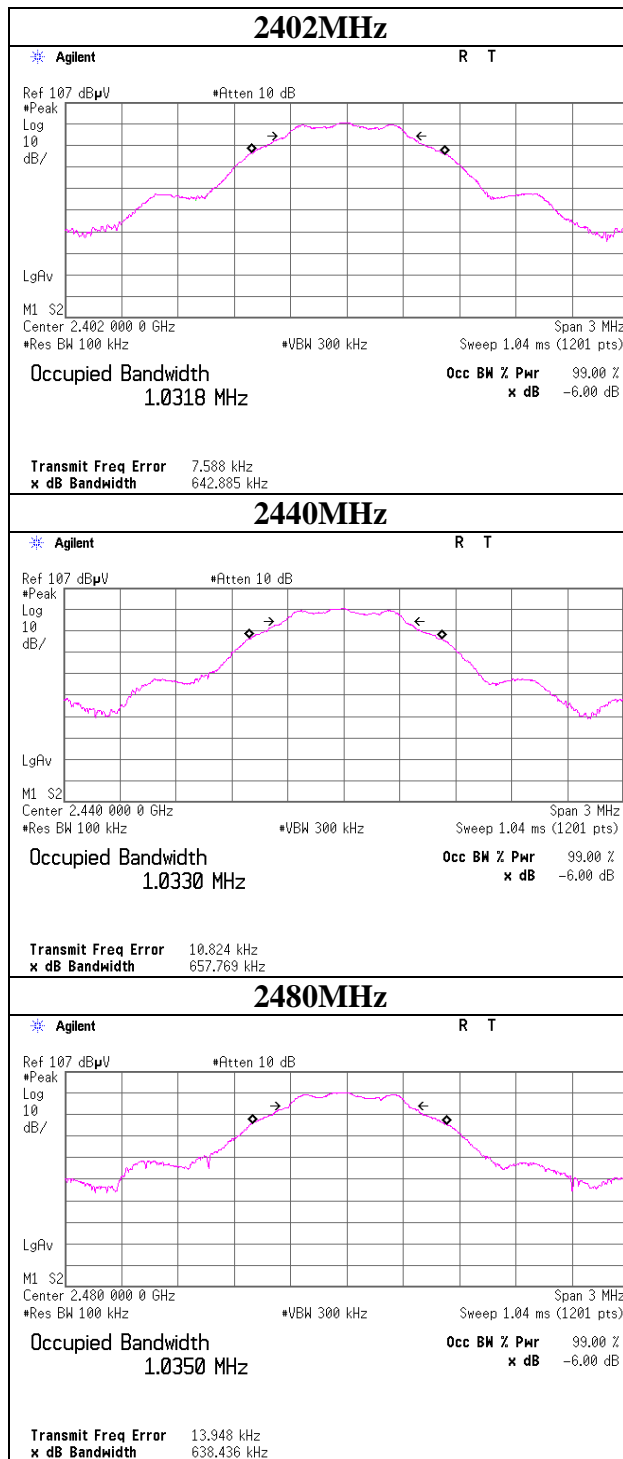
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6dB Bandwidth



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Maximum Peak Output Power

Test place Head Office EMC Lab. No.11 measurement room
Report No. 10085326H
Date 12/19/2013
Temperature/ Humidity 24 deg. C / 50% RH
Engineer Tomohisa Nakagawa
Mode LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-9.49	1.77	10.01	2.29	1.69	30.00	1000	27.71
2440	-9.64	1.78	10.01	2.15	1.64	30.00	1000	27.85
2480	-9.89	1.79	10.01	1.91	1.55	30.00	1000	28.09

Sample Calculation:

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

Maximum Average Output Power (Reference data for RF Exposure)

Test place Head Office EMC Lab. No.11 measurement room
Report No. 10085326H
Date 12/19/2013
Temperature/ Humidity 24 deg. C / 50% RH
Engineer Tomohisa Nakagawa
Mode LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.29	1.77	10.01	0.49	1.12	30.00	1000	29.51
2440	-11.43	1.78	10.01	0.36	1.09	30.00	1000	29.64
2480	-11.71	1.79	10.01	0.09	1.02	30.00	1000	29.91

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. 10085326H
Date 01/08/2014 01/08/2014
Temperature/ Humidity 23 deg.C./ 40% 26 deg.C./ 28%
Engineer Kazuya Yoshioka Tomohisa Nakagawa
(30-1000MHz) (above 1GHz)
Mode LE Tx 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.000	QP	23.0	17.6	7.0	32.2	-	15.4	40.0	24.6	
Hori	64.000	QP	22.8	7.3	7.6	32.2	-	5.5	40.0	34.5	
Hori	96.000	QP	22.6	9.3	8.0	32.1	-	7.8	43.5	35.7	
Hori	128.000	QP	22.6	13.6	8.4	32.1	-	12.5	43.5	31.0	
Hori	256.000	QP	22.1	17.6	9.5	32.1	-	17.1	46.0	28.9	
Hori	512.000	QP	22.0	18.3	11.2	32.0	-	19.5	46.0	26.5	
Hori	2390.000	PK	42.6	28.2	3.1	32.4	-	41.5	73.9	32.4	
Hori	4804.000	PK	43.7	30.5	5.3	31.4	-	48.1	73.9	25.8	
Hori	7206.000	PK	42.4	35.8	6.7	32.3	-	52.6	73.9	21.3	
Hori	9608.000	PK	42.6	39.0	7.3	33.0	-	55.9	73.9	18.0	
Hori	2390.000	AV	33.7	28.2	3.1	32.4	1.1	33.7	53.9	20.2	*1)
Hori	4804.000	AV	36.1	30.5	5.3	31.4	1.1	41.6	53.9	12.3	
Hori	7206.000	AV	33.7	35.8	6.7	32.3	1.1	45.0	53.9	8.9	
Hori	9608.000	AV	33.8	39.0	7.3	33.0	1.1	48.2	53.9	5.7	
Vert	32.000	QP	23.0	17.6	7.0	32.2	-	15.4	40.0	24.6	
Vert	64.000	QP	22.8	7.3	7.6	32.2	-	5.5	40.0	34.5	
Vert	96.000	QP	22.6	9.3	8.0	32.1	-	7.8	43.5	35.7	
Vert	128.000	QP	22.6	13.6	8.4	32.1	-	12.5	43.5	31.0	
Vert	256.000	QP	22.1	17.6	9.5	32.1	-	17.1	46.0	28.9	
Vert	512.000	QP	22.0	18.3	11.2	32.0	-	19.5	46.0	26.5	
Vert	2390.000	PK	44.1	28.2	3.1	32.4	-	43.0	73.9	30.9	
Vert	4804.000	PK	43.3	30.5	5.3	31.4	-	47.7	73.9	26.2	
Vert	7206.000	PK	42.0	35.8	6.7	32.3	-	52.2	73.9	21.7	
Vert	9608.000	PK	42.1	39.0	7.3	33.0	-	55.4	73.9	18.5	
Vert	2390.000	AV	33.9	28.2	3.1	32.4	1.1	33.9	53.9	20.0	*1)
Vert	4804.000	AV	34.8	30.5	5.3	31.4	1.1	40.3	53.9	13.6	
Vert	7206.000	AV	33.8	35.8	6.7	32.3	1.1	45.1	53.9	8.8	
Vert	9608.000	AV	33.9	39.0	7.3	33.0	1.1	48.3	53.9	5.6	

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).

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

*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	93.3	28.2	3.1	32.4	92.2	-	-	Carrier
Hori	2400.000	PK	68.6	28.2	3.1	32.4	67.5	72.2	4.7	
Vert	2402.000	PK	93.6	28.2	3.1	32.4	92.5	-	-	Carrier
Vert	2400.000	PK	70.1	28.2	3.1	32.4	69.0	72.5	3.5	

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.	10085326H	
Date	01/08/2014	01/08/2014
Temperature/ Humidity	23 deg.C./ 40%	26 deg.C./ 28%
Engineer	Kazuya Yoshioka (30-1000MHz)	Tomohisa Nakagawa (above 1GHz)
Mode	LE Tx 2440MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.000	QP	23.0	17.6	7.0	32.2	-	15.4	40.0	24.6	
Hori	64.000	QP	22.8	7.3	7.6	32.2	-	5.5	40.0	34.5	
Hori	96.000	QP	22.6	9.3	8.0	32.1	-	7.8	43.5	35.7	
Hori	128.000	QP	22.6	13.6	8.4	32.1	-	12.5	43.5	31.0	
Hori	256.000	QP	22.1	17.6	9.5	32.1	-	17.1	46.0	28.9	
Hori	512.000	QP	22.0	18.3	11.2	32.0	-	19.5	46.0	26.5	
Hori	4880.000	PK	44.1	30.6	5.3	31.4	-	48.6	73.9	25.3	
Hori	7320.000	PK	43.4	36.0	6.8	32.4	-	53.8	73.9	20.1	
Hori	9760.000	PK	43.1	39.4	7.3	33.0	-	56.8	73.9	17.1	
Hori	4880.000	AV	34.8	30.6	5.3	31.4	1.1	40.4	53.9	13.5	
Hori	7320.000	AV	33.4	36.0	6.8	32.4	1.1	44.9	53.9	9.0	
Hori	9760.000	AV	33.3	39.4	7.3	33.0	1.1	48.1	53.9	5.8	
Vert	32.000	QP	23.0	17.6	7.0	32.2	-	15.4	40.0	24.6	
Vert	64.000	QP	22.8	7.3	7.6	32.2	-	5.5	40.0	34.5	
Vert	96.000	QP	22.6	9.3	8.0	32.1	-	7.8	43.5	35.7	
Vert	128.000	QP	22.6	13.6	8.4	32.1	-	12.5	43.5	31.0	
Vert	256.000	QP	22.1	17.6	9.5	32.1	-	17.1	46.0	28.9	
Vert	512.000	QP	22.0	18.3	11.2	32.0	-	19.5	46.0	26.5	
Vert	4880.000	PK	44.7	30.6	5.3	31.4	-	49.2	73.9	24.7	
Vert	7320.000	PK	43.3	36.0	6.8	32.4	-	53.7	73.9	20.2	
Vert	9760.000	PK	42.7	39.4	7.3	33.0	-	56.4	73.9	17.5	
Vert	4880.000	AV	37.4	30.6	5.3	31.4	1.1	43.0	53.9	10.9	
Vert	7320.000	AV	34.2	36.0	6.8	32.4	1.1	45.7	53.9	8.2	
Vert	9760.000	AV	34.4	39.4	7.3	33.0	1.1	49.2	53.9	4.7	

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
 26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

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Radiated Spurious Emission

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	10085326H	
Date	01/08/2014	01/08/2014
Temperature/ Humidity	23 deg.C./ 40%	26 deg.C./ 28%
Engineer	Kazuya Yoshioka	Tomohisa Nakagawa
	(30-1000MHz)	(above 1GHz)
Mode	LE Tx 2480MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.000	QP	23.0	17.6	7.0	32.2	-	15.4	40.0	24.6	
Hori	64.000	QP	22.8	7.3	7.6	32.2	-	5.5	40.0	34.5	
Hori	96.000	QP	22.6	9.3	8.0	32.1	-	7.8	43.5	35.7	
Hori	128.000	QP	22.6	13.6	8.4	32.1	-	12.5	43.5	31.0	
Hori	256.000	QP	22.1	17.6	9.5	32.1	-	17.1	46.0	28.9	
Hori	512.000	QP	22.0	18.3	11.2	32.0	-	19.5	46.0	26.5	
Hori	2483.500	PK	54.2	28.4	3.1	32.3	-	53.4	73.9	20.5	
Hori	4960.000	PK	45.1	30.7	5.4	31.4	-	49.8	73.9	24.1	
Hori	7440.000	PK	43.2	36.2	6.7	32.4	-	53.7	73.9	20.2	
Hori	9920.000	PK	43.0	39.8	7.4	33.1	-	57.1	73.9	16.8	
Hori	2483.500	AV	41.3	28.4	3.1	32.3	1.1	41.6	53.9	12.3	*1)
Hori	4960.000	AV	36.5	30.7	5.4	31.4	1.1	42.3	53.9	11.6	
Hori	7440.000	AV	34.4	36.2	6.7	32.4	1.1	46.0	53.9	7.9	
Hori	9920.000	AV	34.2	39.8	7.4	33.1	1.1	49.4	53.9	4.5	
Vert	32.000	QP	23.0	17.6	7.0	32.2	-	15.4	40.0	24.6	
Vert	64.000	QP	22.8	7.3	7.6	32.2	-	5.5	40.0	34.5	
Vert	96.000	QP	22.6	9.3	8.0	32.1	-	7.8	43.5	35.7	
Vert	128.000	QP	22.6	13.6	8.4	32.1	-	12.5	43.5	31.0	
Vert	256.000	QP	22.1	17.6	9.5	32.1	-	17.1	46.0	28.9	
Vert	512.000	QP	22.0	18.3	11.2	32.0	-	19.5	46.0	26.5	
Vert	2483.500	PK	52.6	28.4	3.1	32.3	-	51.8	73.9	22.1	
Vert	4960.000	PK	44.9	30.7	5.4	31.4	-	49.6	73.9	24.3	
Vert	7440.000	PK	44.4	36.2	6.7	32.4	-	54.9	73.9	19.0	
Vert	9920.000	PK	43.5	39.8	7.4	33.1	-	57.6	73.9	16.3	
Vert	2483.500	AV	35.6	28.4	3.1	32.3	1.1	35.9	53.9	18.0	*1)
Vert	4960.000	AV	36.2	30.7	5.4	31.4	1.1	42.0	53.9	11.9	
Vert	7440.000	AV	33.9	36.2	6.7	32.4	1.1	45.5	53.9	8.4	
Vert	9920.000	AV	33.6	39.8	7.4	33.1	1.1	48.8	53.9	5.1	

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
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

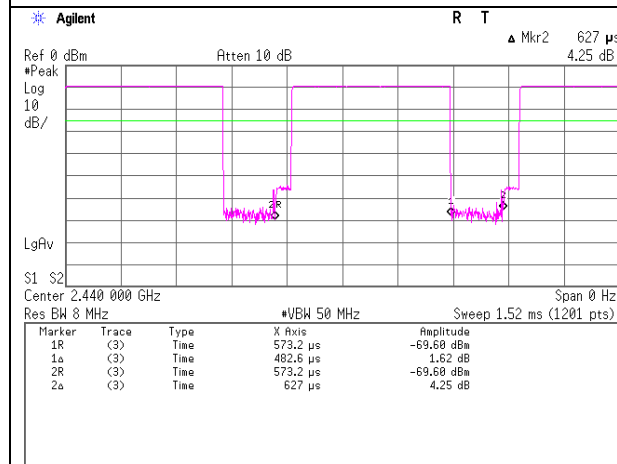
*1) Not Out of Band emission (Leakage Power)

Burst rate confirmation

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10085326H
Date	01/08/2014
Temperature/ Humidity	26 deg. C / 28% RH
Engineer	Tomohisa Nakagawa
Mode	LE Tx

LE

Tx on / (Tx on + Tx off) =	0.770
Tx on / (Tx on + Tx off) * 100 =	77.0 %
Duty factor = 10 * log (627 / 482.6) =	1.14 dB



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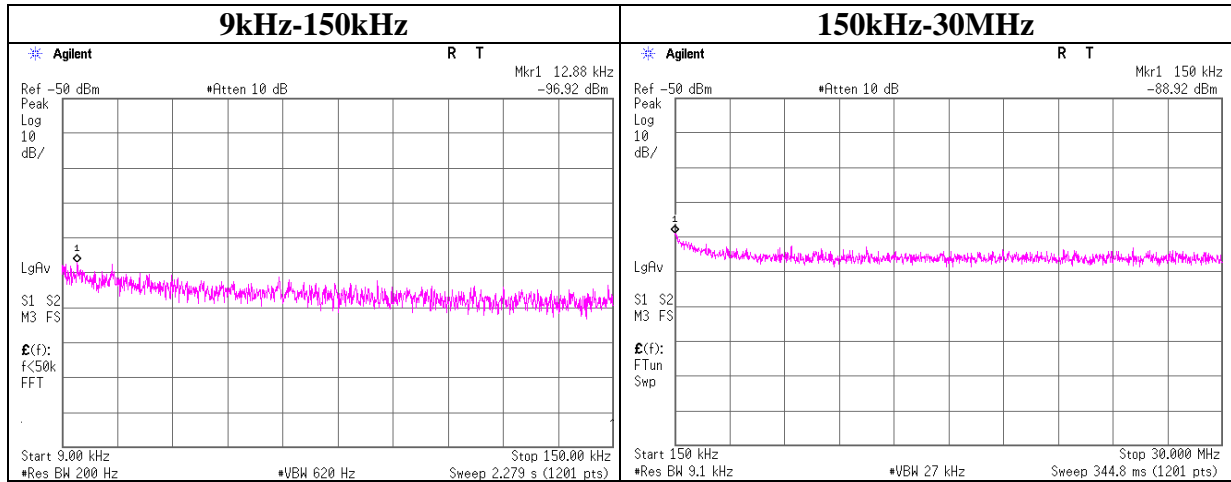
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Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 measurement room
Report No.	10085326H
Date	12/19/2013
Temperature/ Humidity	24 deg. C / 50% RH
Engineer	Tomohisa Nakagawa
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]
12.88	-96.9	0.57	9.8	2.0	-84.5	300.0	6.0	-23.2	45.4
150	-88.9	0.76	9.9	2.0	-76.3	300.0	6.0	-15.0	24.1

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

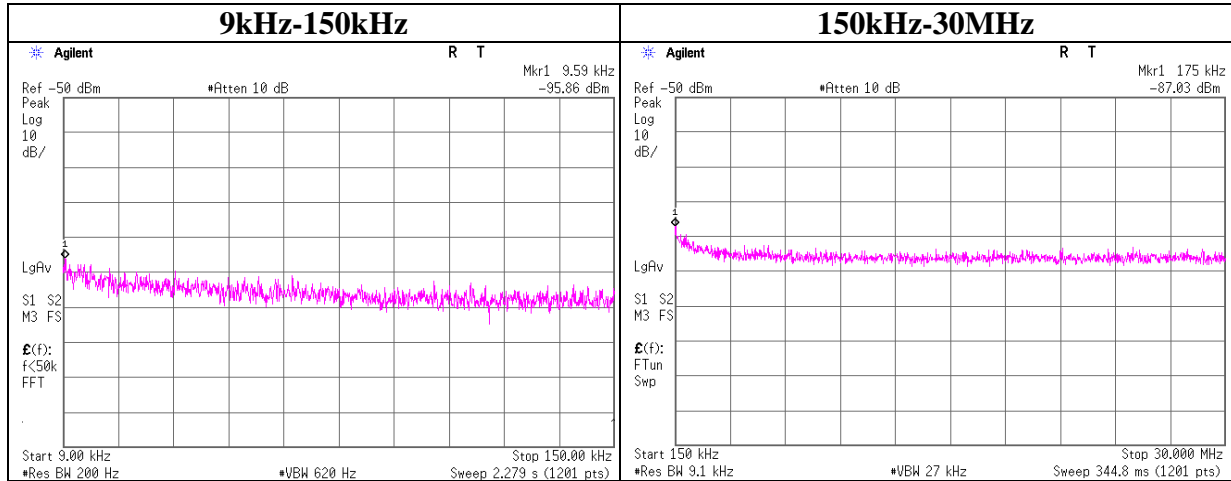
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Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 measurement room
Report No.	10085326H
Date	12/19/2013
Temperature/ Humidity	24 deg. C / 50% RH
Engineer	Tomohisa Nakagawa
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]
9.59	-95.9	0.57	9.8	2.0	-83.5	300.0	6.0	-22.2	48.0
175	-87.0	0.79	9.9	2.0	-74.3	300.0	6.0	-13.1	22.7

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

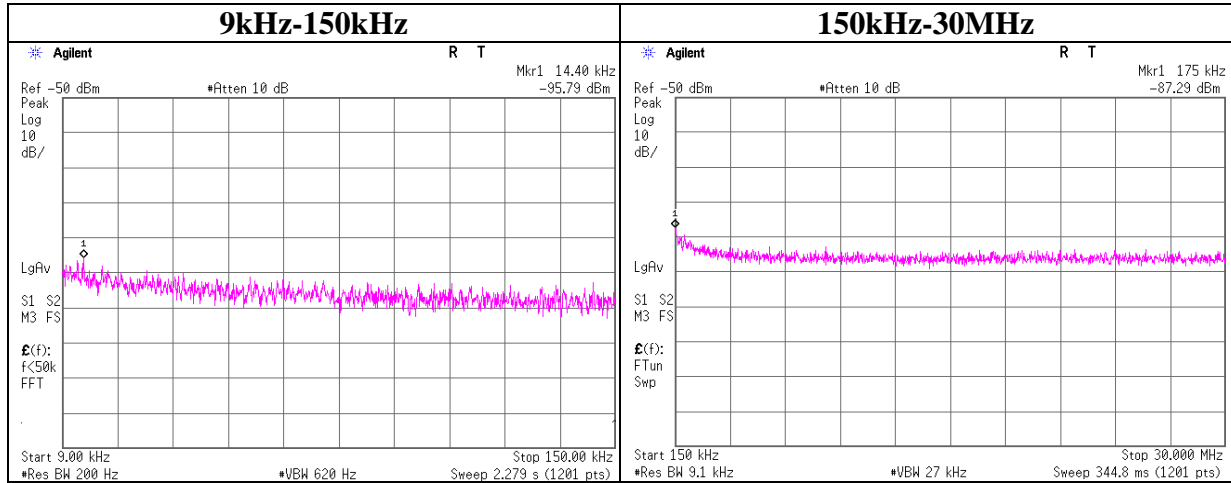
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Conducted Spurious Emission

Test place	Head Office EMC Lab. No.11 measurement room
Report No.	10085326H
Date	12/19/2013
Temperature/ Humidity	24 deg. C / 50% RH
Engineer	Tomohisa Nakagawa
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]
14.40	-95.8	0.57	9.9	2.0	-83.4	300.0	6.0	-22.1	44.4
175	-87.3	0.79	9.9	2.0	-74.6	300.0	6.0	-13.3	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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Power Density

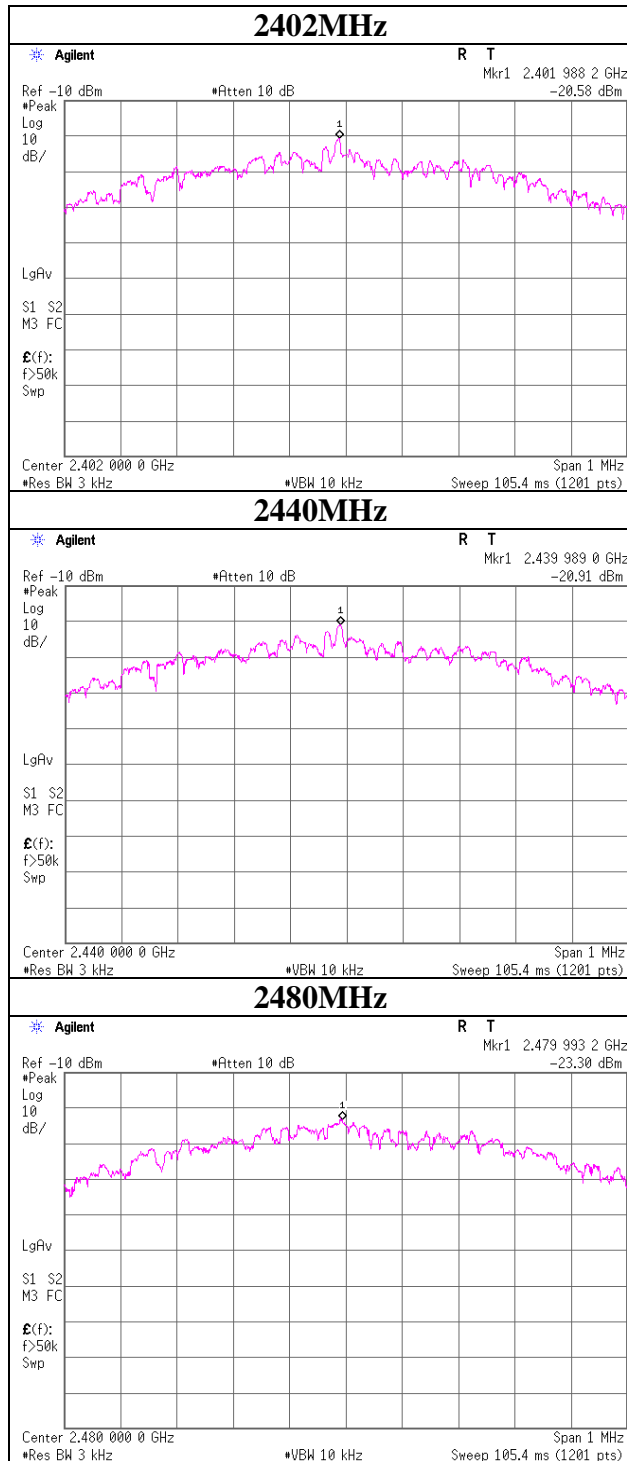
Test place Head Office EMC Lab. No.11 measurement room
Report No. 10085326H
Date 12/19/2013
Temperature/ Humidity 24 deg. C / 50% RH
Engineer Tomohisa Nakagawa
Mode LE Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2401.99	-20.58	1.77	10.01	-8.80	8.00	16.80
2439.99	-20.91	1.78	10.01	-9.12	8.00	17.12
2479.99	-23.30	1.79	10.01	-11.50	8.00	19.50

Sample Calculation:

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

Power Density



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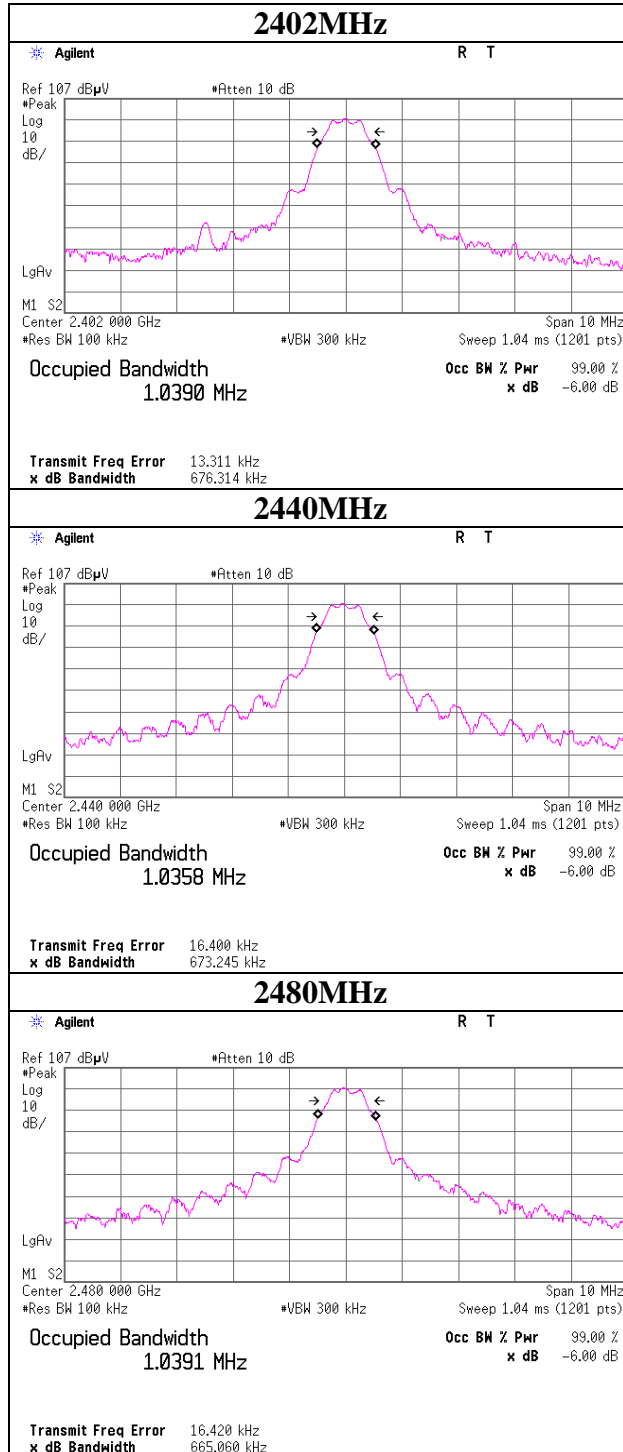
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99%Occupied Bandwidth

Test place	Head Office EMC Lab. No.11 measurement room
Report No.	10085326H
Date	12/19/2013
Temperature/ Humidity	24 deg. C / 50% RH
Engineer	Tomohisa Nakagawa
Mode	LE Tx



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APPENDIX 2: Test instruments

EMI test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2013/11/15 * 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
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2013/04/16 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2013/03/21 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2013/12/17 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2013/03/22 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2013/11/26 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2013/02/28 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2013/02/26 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-06	Spectrum Analyzer	Agilent	E4407B	MY45107638	RE	2013/04/05 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	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
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2013/02/22 * 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
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2013/03/12 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA917030 6	RE	2013/05/17 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2013/09/01 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	CE	2013/08/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	CE	2013/02/26 * 12
MJM-21	Measure	KOMELON	KMC-36	-	CE	-

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EMI test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	CE	2013/06/07 * 12
MLS-02	LISN(AMN)	Schwarzbeck	NSLK8127	8127383	CE(EUT)	2013/07/11 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/3D-2W(7.5m)/RG400u(1.5m)/RFM-E421(Switcher)	- /01068(Switcher)	CE	2013/09/12 * 12
MAT-64	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/09 * 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**

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