



Test report No. : 10275983-003A-G
Page : 1 of 27
Issued date : June 27, 2014
Revised date : July 7, 2014
FCC ID : BBQW004

RADIO TEST REPORT

Test Report No.: 10275983-003A-G

Applicant : CASIO COMPUTER CO., LTD.
Type of Equipment : Bluetooth Watch
Model No. : GBA-400
FCC ID : BBQW004
Test regulation : FCC Part15 Subpart C: 2014
Test result : Complied

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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test: June 11 to 13, 2014

Tested by: 

Akio Hayashi
Engineer
Consumer Technology Division

Approved by : 

Toyokazu Imamura
Leader
Consumer Technology Division



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13-EM-F0429

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SECTION 1: Customer information

Company Name : CASIO COMPUTER CO., LTD.
Brand Name : CASIO
Address : 3-2-1, Sakae-cho, Hamura-shi, Tokyo, 205-8555, JAPAN
Telephone Number : +81-42-579-7282
Facsimile Number : +81-42-579-7702
Contact Person : Hiroaki Suzuki

SECTION 2: Equipment under test (E.U.T.)**2.1 Identification of E.U.T.**

Type of equipment : Bluetooth Watch
Trade name : CASIO
Model No. : GBA-400
Serial No. : Refer to 4.2 in this report
Rating : DC3.1V
Country of Mass-production : Thailand
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.
Receipt Date of Sample : June 4, 2014

2.2 Product description

Model: GBA-400 (referred to as the EUT in this report) is a Bluetooth Watch.

The clock frequencies used in the EUT: 26MHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth & channel spacing : 2MHz
Type of modulation : GFSK
Antenna type : Chip antenna
Antenna gain : -1.0dBi
Operation temperature range : -10 ~ +60 deg.C.

FCC 15.31 (e)

The EUT provides stable voltage (DC3.1V) constantly to the wireless transmitter regardless of input voltage.

Instead of a new battery, DC power supply was used for the test.

That does not affect the test result, therefore the EUT complies with the requirement.

FCC 15.203

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

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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 May 1, 2014 and effective June 2, 2014
 Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted limits
 Section 15.209 Radiated emission limits, general requirements
 Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,
 and 5725-5850MHz

3.2 Procedures & Results

Item	Test Procedure *1)	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.10:2009	FCC 15.207	-	N/A *2)	N/A	N/A
6dB bandwidth	ANSI C63.10:2009	FCC 15.247 (a)(2)	Conducted	N/A	* See data	Complied
Maximum peak output power	ANSI C63.10:2009	FCC 15.247 (b)(3)	Conducted	N/A		Complied
Out of band emission & Restricted band edges	ANSI C63.10:2009	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	3.4 dB Freq.: 7440.000MHz Polarization: Vertical Detection: Average Mode: Tx 2480MHz	Complied
Power density	ANSI C63.10:2009	FCC 15.247 (e)	Conducted	N/A	* See data	Complied

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

*1) These tests were also referred to KDB 558074 v03r01 (FCC), "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

*2) The test is not applicable since the EUT has no AC mains.

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2009 13. Measurement of intentional radiators, RSS-Gen 4.6.1	-	Conducted	-	-

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

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

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3.4 Uncertainty

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

Item	Frequency range	No.1 SAC ^{*1} /SR ^{*2} (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.7 dB	3.7 dB	3.6 dB
	30MHz-300MHz	4.8 dB	5.0 dB	4.8 dB
	300MHz-1GHz	5.0 dB	5.0 dB	4.8 dB
	1GHz-15GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1m)	15GHz-18GHz	5.7 dB	5.6 dB	5.6 dB
	18GHz-40GHz	5.2 dB	4.3 dB	4.3 dB

*1: SAC=Semi-Anechoic Chamber

*2: SR= Shielded Room is applied besides radiated emission

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

Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.6dB

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 1.4dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 2.8dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB

Bandwidth measurement uncertainty for this test was: (±) 5.4%

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3.5 Test location

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Telephone number : +81 463 50 6400

Facsimile number: +81 463 50 6401

JAB Accreditation No. : RTL02610

	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
<input type="checkbox"/> No.1 semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.2 semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input checked="" type="checkbox"/> No.3 semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
<input type="checkbox"/> No.4 semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
<input type="checkbox"/> No.1 shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.2 shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.3 shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
<input type="checkbox"/> No.4 shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
<input checked="" type="checkbox"/> No.5 shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.6 shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.1 measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

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

4.1 Operating mode

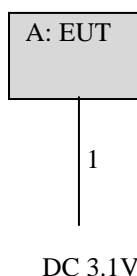
Test item	Mode	Tested frequency
All items	Transmitting Hopping OFF (Low Energy), Payload: PRBS9	2402MHz, 2440MHz, 2480MHz

Power settings: Fixed

Test software: Engineering Sample Software Ver.9

Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

4.2 Configuration and peripherals



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

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Bluetooth Watch	GBA-400	*1)	CASIO	EUT

*1) Radiated emission: 4, Other test: 3

List of cable used

No.	Item	Length (m)	Shield	Remark
1	DC	2.8	Unshielded	-

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SECTION 5: 6dB bandwidth & Occupied bandwidth (99%)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.
The test was measured based on Method 8.1 Option 1 and 8.2 Option 2 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 6: Maximum peak output power

Test procedure

The Maximum Peak Output Power was measured with a power meter connected to the antenna port.
The test was measured based on Method 9.1.3 PKPM1 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 7: Spurious emissions (Antenna port conducted)

Test procedure

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.
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.
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=10kHz)

Summary of the test results: Pass
Refer to APPENDIX 1.

SECTION 8: Peak power density

Test procedure

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer
RBW / VBW : 3kHz / 9kHz

The test was measured based on Method 10.2 PKPSD of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX 1

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SECTION 9: Radiated emission

9.1 Operating environment

Test room : See test data (APPENDIX 1)
Temperature : See test data (APPENDIX 1)
Humidity : See test data (APPENDIX 1)

9.2 Test configuration

EUT was placed on a polystyrene platform of nominal size, 0.5m by 0.5m, raised 0.8m above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

9.3 Test conditions

Frequency range : 30MHz - 25GHz
EUT position : Table top

9.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 15GHz) / 1m (above 15GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detection.

Frequency	30 - 1000MHz	1 - 25GHz		20dBc
Detection Type	: Quasi-Peak	Peak	Average *1)	Peak
IF Bandwidth	: 120kHz	RBW:1MHz VBW:3MHz	RBW: 1MHz VBW: 3MHz	RBW: 100kHz, VBW: 300kHz
			Detector: Linear Voltage Averaging	

*1) Average Power Measurement was measured based on 12.2.5 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

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

Antenna polarization	Carrier	Spurious (Below 1GHz)	Spurious (Above 1GHz)
Horizontal	Z	X	X
Vertical	Y	X	X

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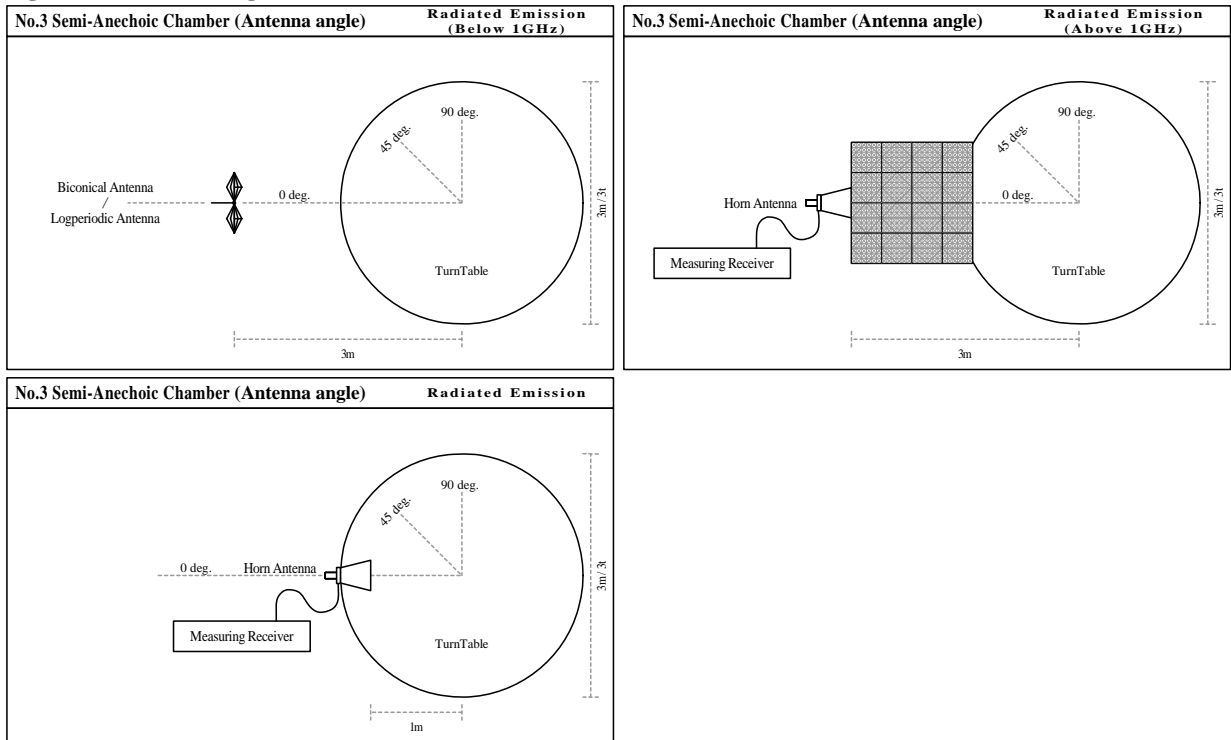
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Figure 1. Antenna angle



9.5 Band edge

Band edge level at 2390MHz, 2483.5MHz and 2400MHz is below the limits of FCC 15.209. Refer to the data.

9.6 Results

Summary of the test results: Pass
 *No noise was detected above the 5th order harmonics.

Refer to APPENDIX 1.

Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

6dB bandwidth
Maximum peak output power
Radiated emission
Spurious emission (Antenna port conducted)
Peak power density
Occupied bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Radiated emission
Pre-check of the worst position

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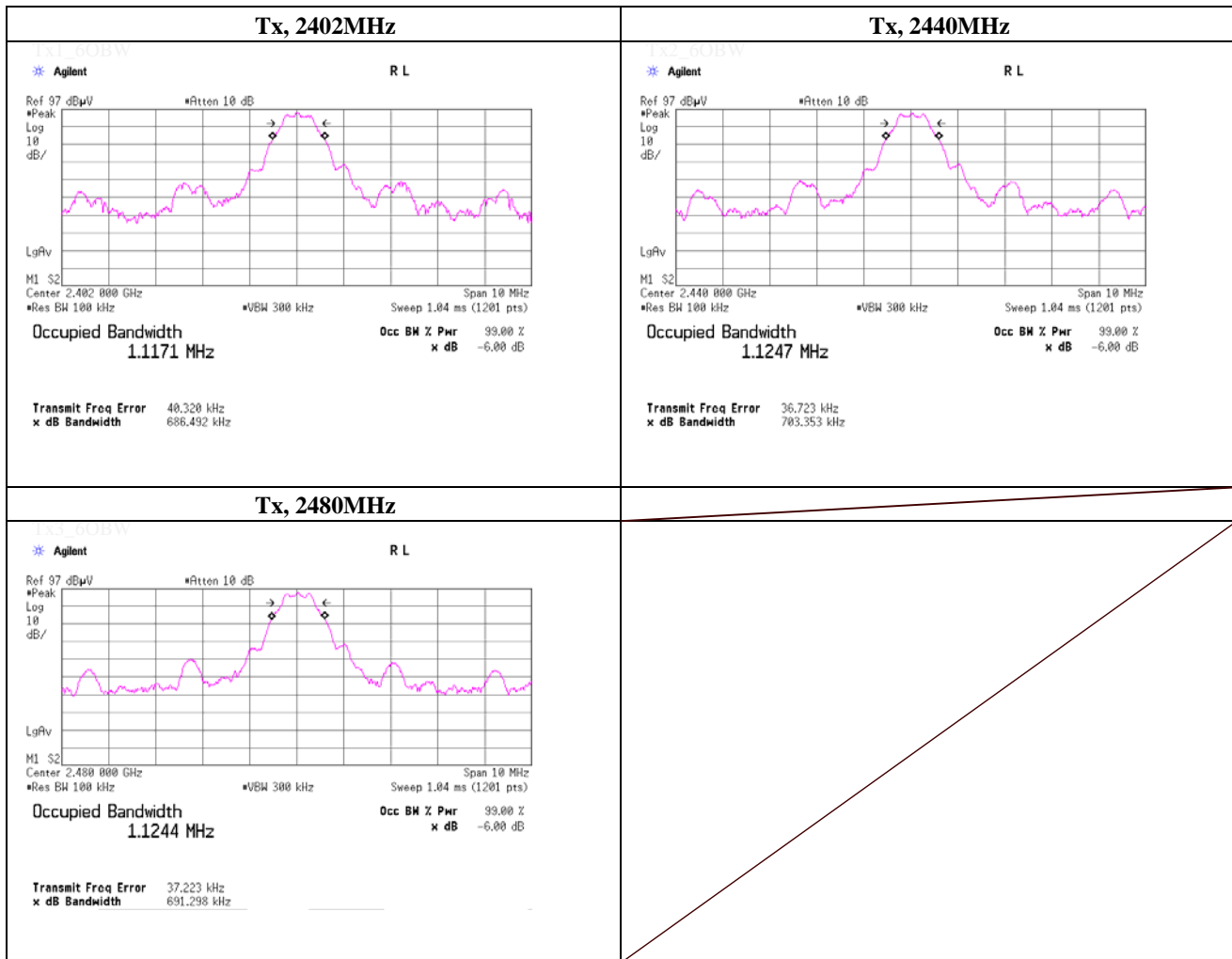
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-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	June 13, 2014	
Temperature / Humidity	26deg.C , 43%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth Low Energy, PN9	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2402.0000	0.686	> 0.500
2440.0000	0.703	> 0.500
2480.0000	0.691	> 0.500



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Maximum Peak Conducted Output Power

(PKPM1)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 13, 2014
 Temperature / Humidity 26deg.C , 43%RH
 Engineer Akio Hayashi
 Mode Tx, Bluetooth Low Energy, PN9,

(* P/M: Power Meter with power sensor)

Ch	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
Low	2402.0	-12.55	0.77	9.90	-1.88	0.65	30.00	1000	31.88
Mid	2440.0	-12.41	0.78	9.89	-1.74	0.67	30.00	1000	31.74
High	2480.0	-12.44	0.79	9.89	-1.76	0.67	30.00	1000	31.76

Sample Calculation:

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

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Maximum Conducted Output Power (Reference Data)

(AVGPM)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 13, 2014
 Temperature / Humidity 26deg.C , 43%RH
 Engineer Akio Hayashi
 Mode Tx, Bluetooth Low Energy, PN9,

(* P/M: Power Meter with power sensor, AV: Average)

Ch	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	Result		Result (E.I.R.P)	
							[dBm]	[mW]	[dBm]	[mW]
Low	2402.0	-14.08	0.77	9.90	1.41	-1.00	-2.00	0.63	-3.00	0.50
Mid	2440.0	-13.96	0.78	9.89	1.41	-1.00	-1.88	0.65	-2.88	0.52
High	2480.0	-13.96	0.79	9.89	1.41	-1.00	-1.87	0.65	-2.87	0.52

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

E.I.R.P = Result + Antenna Gain

Duty Factor Calculation for Conducted Output Power

<p>Duty Factor = $10 \cdot \log(1/x) = 1.41 \text{ dB}$ x: $Ton/(Ton+Toff) = 0.4519 / 0.6249$</p>																										
<table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1R</td> <td>(3)</td> <td>Time</td> <td>628.5 μs</td> <td>-12.52 dBm</td> </tr> <tr> <td>1Δ</td> <td>(3)</td> <td>Time</td> <td>451.9 μs</td> <td>-0.63 dB</td> </tr> <tr> <td>2R</td> <td>(3)</td> <td>Time</td> <td>628.5 μs</td> <td>-12.52 dBm</td> </tr> <tr> <td>2Δ</td> <td>(3)</td> <td>Time</td> <td>624.9 μs</td> <td>-0.02 dB</td> </tr> </tbody> </table>	Marker	Trace	Type	X Axis	Amplitude	1R	(3)	Time	628.5 μs	-12.52 dBm	1Δ	(3)	Time	451.9 μs	-0.63 dB	2R	(3)	Time	628.5 μs	-12.52 dBm	2Δ	(3)	Time	624.9 μs	-0.02 dB	<p>Tx2_duty2</p>
Marker	Trace	Type	X Axis	Amplitude																						
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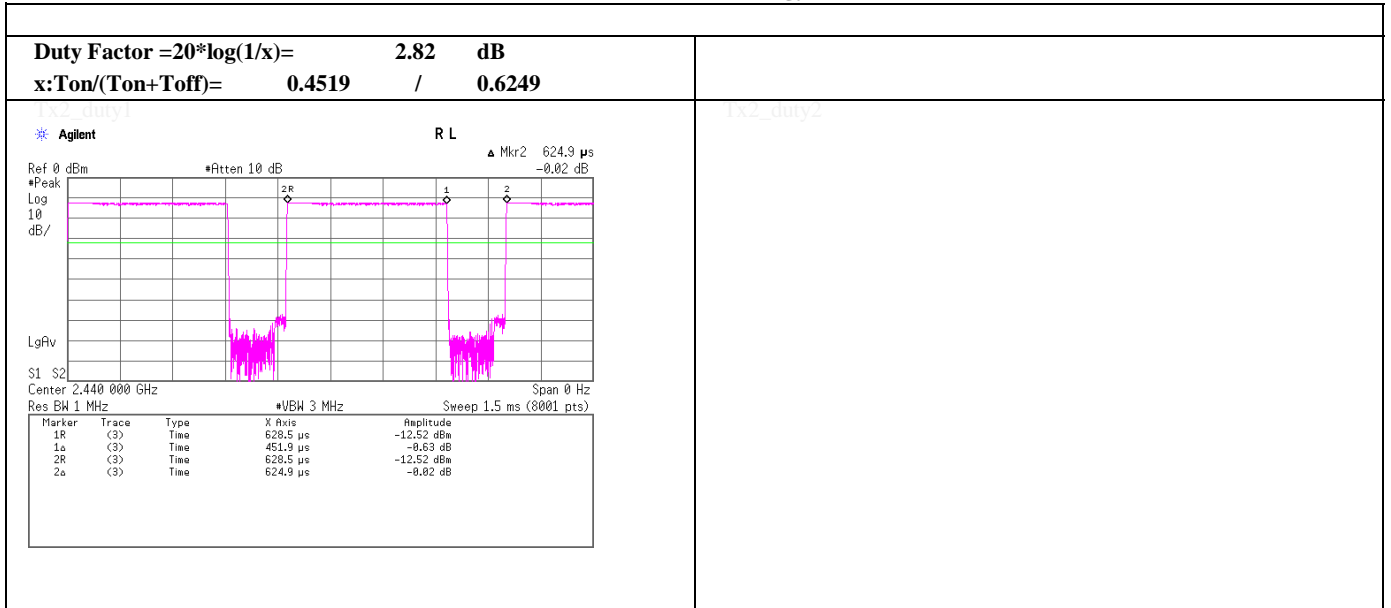
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 13, 2014
 Temperature / Humidity 26deg.C , 43%RH
 Engineer Akio Hayashi

Duty Factor Calculation chart for Radiated Emission Tests

Tx, Bluetooth Low Energy, PN9



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Radiated Emission

Test place No.3 Semi Anechoic Chamber
 Date June 11, 2014
 Temperature / Humidity 25 deg.C, 55 %RH
 Engineer Wataru Kojima
 Mode Tx, 2402 MHz
 Tx, Bluetooth, Low Energy

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	208.000	QP	23.3	16.5	7.9	32.1	15.6	43.5	27.9	300	31	
Hori.	858.000	QP	21.3	21.2	10.5	31.3	21.7	46.0	24.3	150	161	
Hori.	2390.000	PK	47.6	26.8	14.6	41.1	47.9	73.9	26.0	100	37	
Hori.	2397.638	PK	51.9	26.8	14.6	41.1	52.2	73.9	21.7	100	37	
Hori.	2399.839	PK	56.4	26.8	14.6	41.1	56.7	73.9	17.2	100	37	
Hori.	2400.000	PK	56.4	26.8	14.6	41.1	56.7	73.9	17.2	100	37	
Hori.	4804.000	PK	45.8	30.9	7.5	39.8	44.4	73.9	29.5	100	166	
Hori.	12010.000	PK	44.6	39.6	10.7	39.6	55.3	73.9	18.6	156	216	
Hori.	2390.000	AV	34.9	26.8	14.6	41.1	35.2	53.9	18.7	100	37	
Hori.	2397.638	AV	35.2	26.8	14.6	41.1	35.5	53.9	18.4	100	37	
Hori.	2399.839	AV	37.6	26.8	14.6	41.1	37.9	53.9	16.0	100	37	
Hori.	2400.000	AV	42.6	26.8	14.6	41.1	42.9	53.9	11.0	100	37	
Vert.	208.000	QP	23.2	16.5	7.9	32.1	15.5	43.5	28.0	100	279	
Vert.	858.000	QP	21.2	21.2	10.5	31.3	21.6	46.0	24.4	100	342	
Vert.	2390.000	PK	46.9	26.8	14.6	41.1	47.2	73.9	26.7	100	17	
Vert.	2397.638	PK	53.3	26.8	14.6	41.1	53.6	73.9	20.3	100	17	
Vert.	2399.839	PK	57.5	26.8	14.6	41.1	57.8	73.9	16.1	100	17	
Vert.	2400.000	PK	58.8	26.8	14.6	41.1	59.1	73.9	14.8	100	17	
Vert.	4804.000	PK	45.3	30.9	7.5	39.8	43.9	73.9	30.0	100	112	
Vert.	12010.000	PK	46.2	39.6	10.7	39.6	56.9	73.9	17.0	100	114	
Vert.	2390.000	AV	35.3	26.8	14.6	41.1	35.6	53.9	18.3	100	17	
Vert.	2397.638	AV	36.0	26.8	14.6	41.1	36.3	53.9	17.6	100	17	
Vert.	2399.839	AV	40.6	26.8	14.6	41.1	40.9	53.9	13.0	100	17	
Vert.	2400.000	AV	45.8	26.8	14.6	41.1	46.1	53.9	7.8	100	17	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Average measurement value with duty factor

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.	4804.000	AV	35.7	30.9	7.5	39.8	2.8	37.1	53.9	16.8	
Hori.	12010.000	AV	33.7	39.6	10.7	39.6	2.8	47.2	53.9	6.7	
Vert.	4804.000	AV	35.3	30.9	7.5	39.8	2.8	36.7	53.9	17.2	
Vert.	12010.000	AV	35.2	39.6	10.7	39.6	2.8	48.7	53.9	5.2	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	85.6	26.8	14.6	41.1	85.9	-	-	
Hori.	7206.000	PK	41.8	37.1	8.6	40.2	47.3	65.9	18.6	
Hori.	9608.000	PK	40.7	38.6	9.6	40.1	48.8	65.9	17.1	
Vert.	2402.000	PK	87.9	26.8	14.6	41.1	88.2	-	-	
Vert.	7206.000	PK	42.2	37.1	8.6	40.2	47.7	68.2	20.5	
Vert.	9608.000	PK	43.6	38.6	9.6	40.1	51.7	68.2	16.5	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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Radiated Emission

Test place No.3 Semi Anechoic Chamber
 Date June 11, 2014
 Temperature / Humidity 25 deg.C, 55 %RH
 Engineer Wataru Kojima
 Mode Tx, 2440 MHz
 Tx, Bluetooth, Low Energy

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	208.000	QP	23.2	16.5	7.9	32.1	15.5	43.5	28.0	300	279	
Hori.	858.000	QP	21.2	21.2	10.5	31.3	21.6	46.0	24.4	100	1	
Hori.	4880.000	PK	43.8	31.4	7.5	39.7	43.0	73.9	30.9	100	134	
Hori.	7320.000	PK	47.7	37.2	8.6	40.3	53.2	73.9	20.7	136	323	
Hori.	12200.000	PK	45.1	39.6	10.8	39.8	55.7	73.9	18.2	100	0	
Vert.	208.000	QP	23.2	16.5	7.9	32.1	15.5	43.5	28.0	100	14	
Vert.	858.000	QP	21.2	21.2	10.5	31.3	21.6	46.0	24.4	100	357	
Vert.	4880.000	PK	44.9	31.4	7.5	39.7	44.1	73.9	29.8	100	6	
Vert.	7320.000	PK	48.1	37.2	8.6	40.3	53.6	73.9	20.3	100	168	
Vert.	12200.000	PK	45.3	39.6	10.8	39.8	55.9	73.9	18.0	100	345	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Average measurement value with duty factor

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.	4880.000	AV	32.9	31.4	7.5	39.7	2.8	34.9	53.9	19.0	
Hori.	7320.000	AV	36.9	37.2	8.6	40.3	2.8	45.2	53.9	8.7	
Hori.	12200.000	AV	34.4	39.6	10.8	39.8	2.8	47.8	53.9	6.1	
Vert.	4880.000	AV	33.7	31.4	7.5	39.7	2.8	35.7	53.9	18.2	
Vert.	7320.000	AV	38.4	37.2	8.6	40.3	2.8	46.7	53.9	7.2	
Vert.	12200.000	AV	34.9	39.6	10.8	39.8	2.8	48.3	53.9	5.6	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2440.000	PK	88.4	26.8	14.6	41.1	88.7	-	-	
Hori.	9760.000	PK	41.4	38.8	9.6	40.0	49.8	68.7	18.9	
Vert.	2440.000	PK	89.2	26.8	14.6	41.1	89.5	-	-	
Vert.	9760.000	PK	40.8	38.8	9.6	40.0	49.2	69.5	20.3	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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Radiated Emission

Test place No.3 Semi Anechoic Chamber
 Date June 11, 2014
 Temperature / Humidity 25 deg.C, 55 %RH
 Engineer Wataru Kojima
 Mode Tx, 2480 MHz
 Tx, Bluetooth, Low Energy

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	208.000	QP	23.2	16.5	7.9	32.1	15.5	43.5	28.0	150	68	
Hori.	858.000	QP	21.2	21.2	10.5	31.3	21.6	46.0	24.4	150	227	
Hori.	2483.500	PK	53.5	26.9	14.7	41.1	54.0	73.9	19.9	132	150	
Hori.	2484.111	PK	55.3	26.9	14.7	41.1	55.8	73.9	18.1	132	150	
Hori.	4960.000	PK	46.0	31.8	7.5	39.6	45.7	73.9	28.2	100	166	
Hori.	7440.000	PK	47.4	37.4	8.8	40.4	53.2	73.9	20.7	100	121	
Hori.	12400.000	PK	44.3	39.7	10.9	40.0	54.9	73.9	19.0	100	0	
Hori.	2483.500	AV	36.0	26.9	14.7	41.1	36.5	53.9	17.4	132	150	
Hori.	2484.111	AV	36.3	26.9	14.7	41.1	39.6	53.9	14.3	132	150	
Vert.	208.000	QP	23.3	16.5	7.9	32.1	15.6	43.5	27.9	100	202	
Vert.	858.000	QP	21.3	21.2	10.5	31.3	21.7	46.0	24.3	100	308	
Vert.	2483.500	PK	53.4	26.9	14.7	41.1	53.9	73.9	20.0	100	24	
Vert.	2484.111	PK	55.2	26.9	14.7	41.1	55.7	73.9	18.2	100	24	
Vert.	4960.000	PK	48.1	31.8	7.5	39.6	47.8	73.9	26.1	100	70	
Vert.	7440.000	PK	50.4	37.4	8.8	40.4	56.2	73.9	17.7	100	350	
Vert.	12400.000	PK	44.5	39.7	10.9	40.0	55.1	73.9	18.8	100	0	
Vert.	2483.500	AV	35.8	26.9	14.7	41.1	36.3	53.9	17.6	100	24	
Vert.	2484.111	AV	35.8	26.9	14.7	41.1	39.1	53.9	14.8	100	24	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Average measurement value with duty factor

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.	4960.000	AV	36.5	31.8	7.5	39.6	2.8	39.0	53.9	14.9	
Hori.	7440.000	AV	39.4	37.4	8.8	40.4	2.8	48.0	53.9	5.9	
Hori.	12400.000	AV	33.9	39.7	10.9	40.0	2.8	47.3	53.9	6.6	
Vert.	4960.000	AV	36.6	31.8	7.5	39.6	2.8	39.1	53.9	14.8	
Vert.	7440.000	AV	41.9	37.4	8.8	40.4	2.8	50.5	53.9	3.4	
Vert.	12400.000	AV	33.6	39.7	10.9	40.0	2.8	47.0	53.9	6.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2480.000	PK	89.3	26.9	14.7	41.1	89.8	-	-	
Hori.	9920.000	PK	39.7	38.9	9.6	39.9	48.3	69.8	21.5	
Vert.	2480.000	PK	90.3	26.9	14.7	41.1	90.8	-	-	
Vert.	9920.000	PK	40.0	38.9	9.6	39.9	48.6	70.8	22.2	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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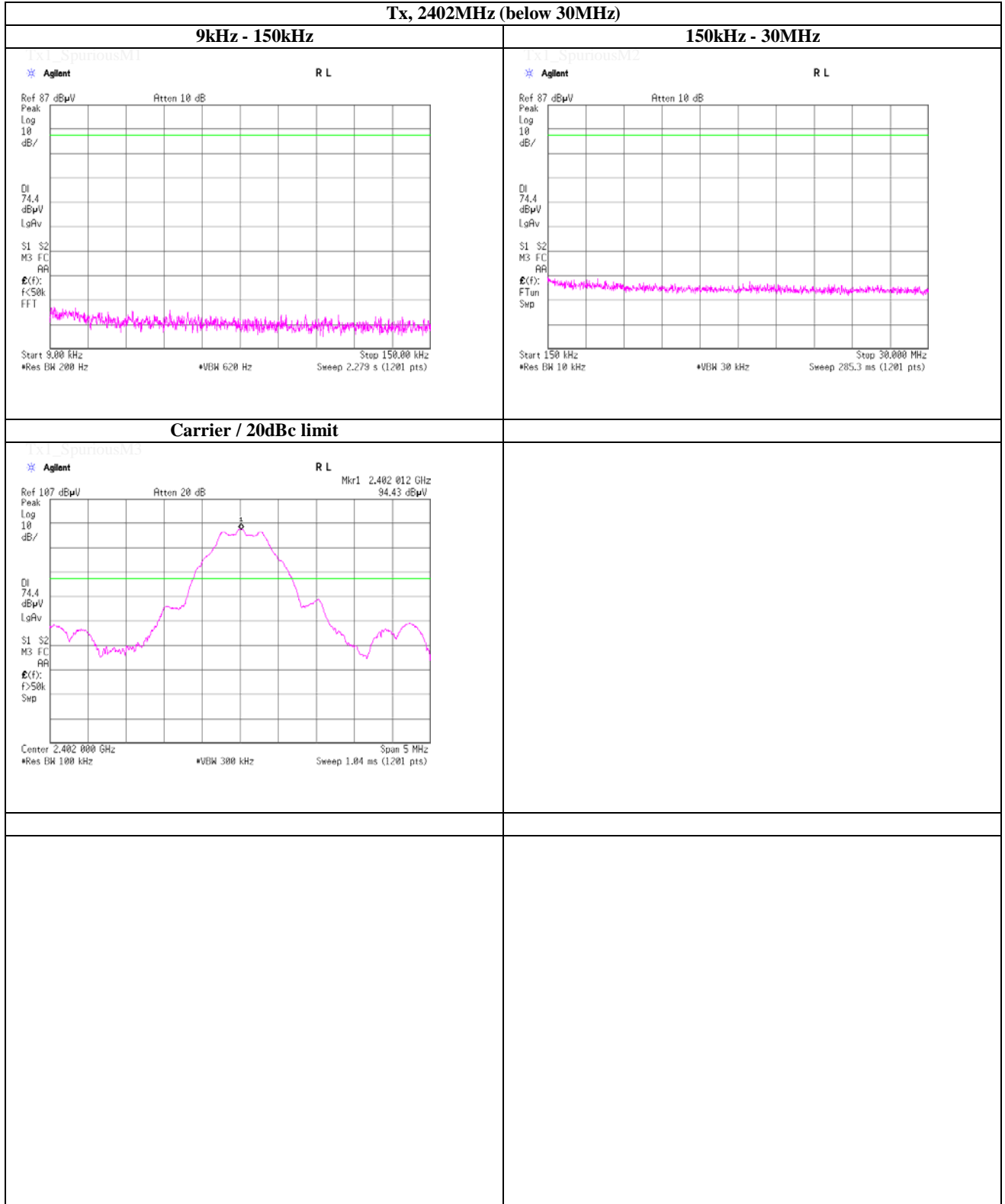
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 13, 2014
 Temperature / Humidity 26deg.C , 43%RH
 Engineer Akio Hayashi

(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

Tx, 2402MHz (below 30MHz)



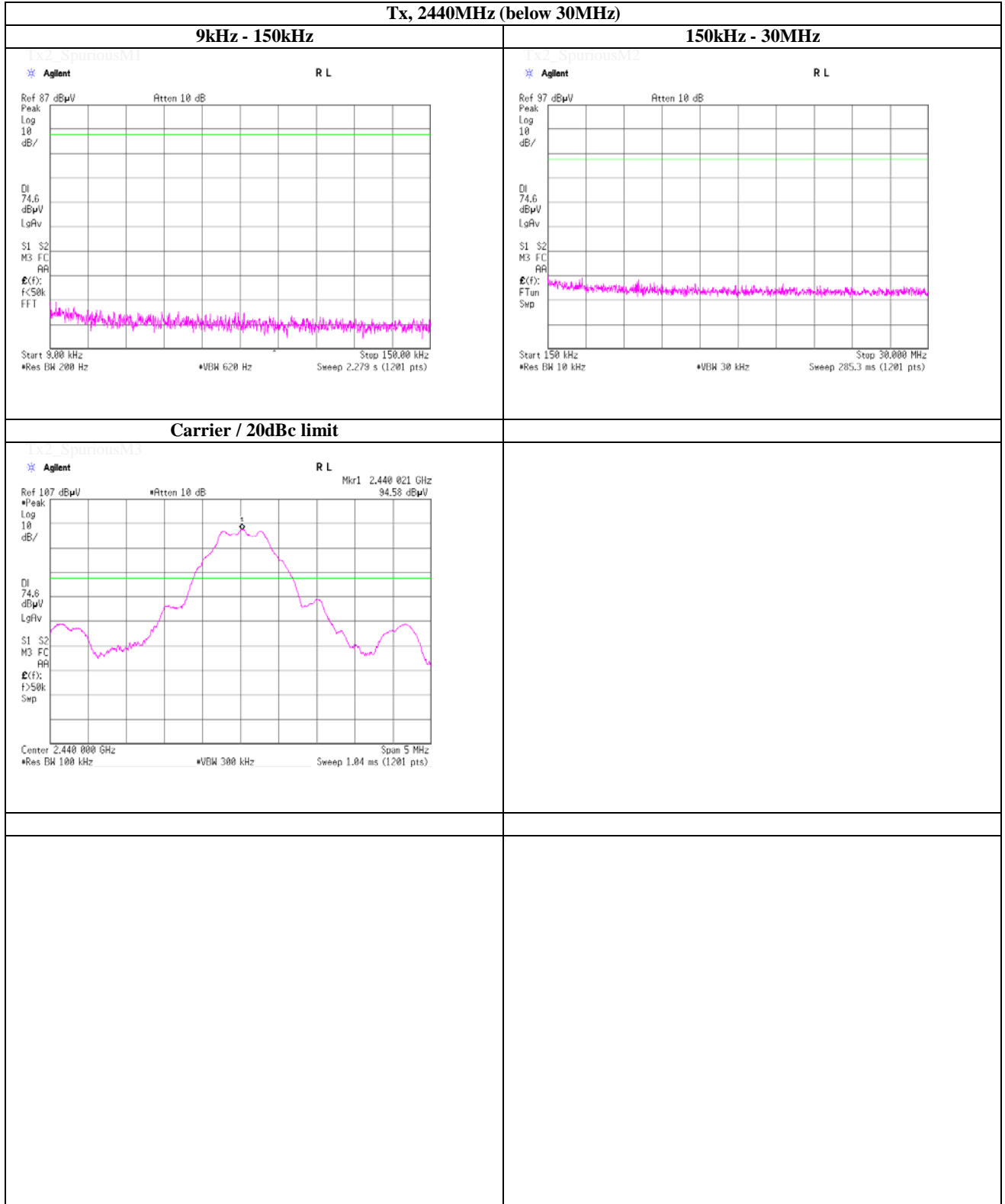
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 Date June 13, 2014
 Temperature / Humidity 26deg.C , 43%RH
 Engineer Akio Hayashi

(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

Tx, 2440MHz (below 30MHz)



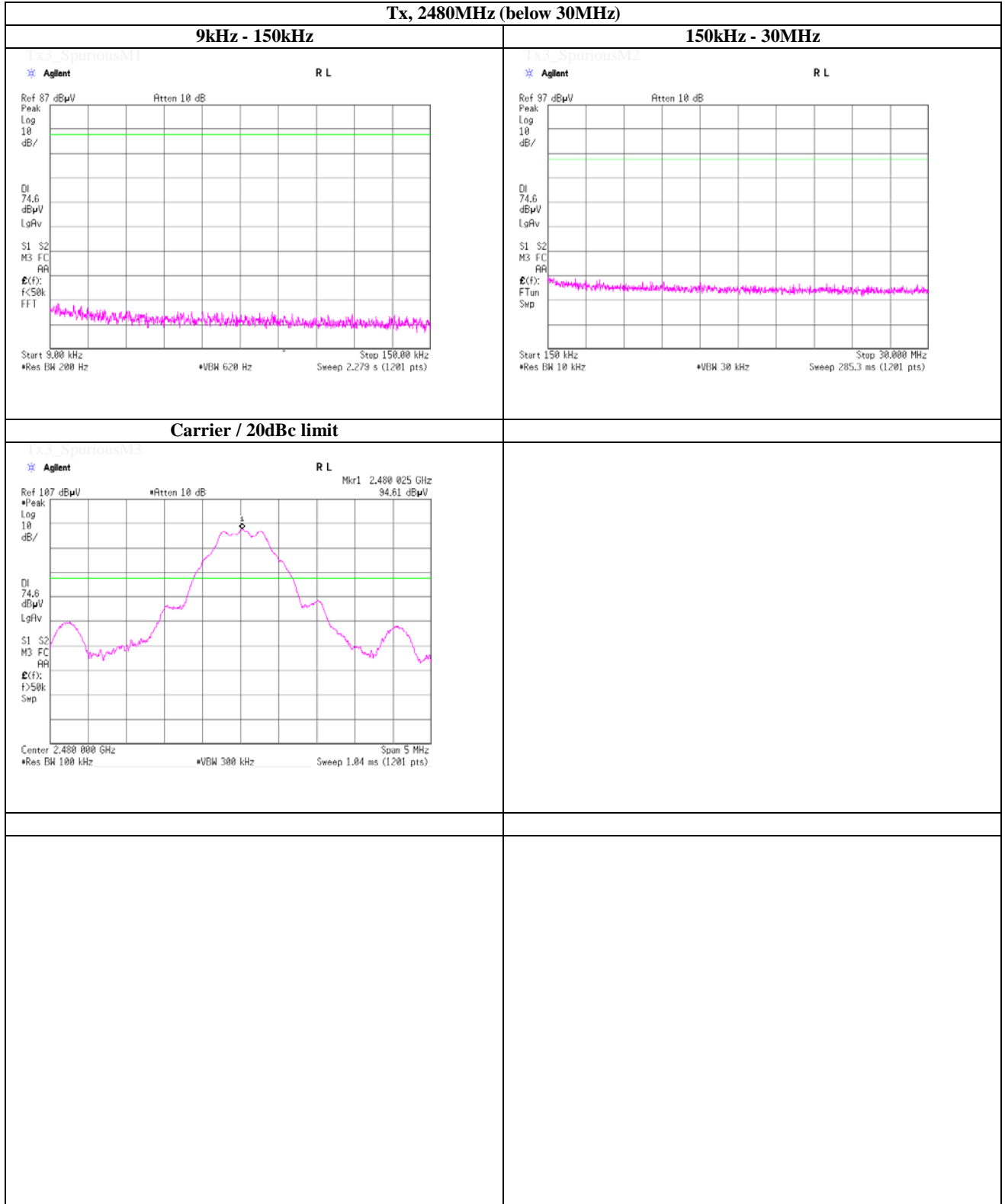
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 13, 2014
 Temperature / Humidity 26deg.C , 43%RH
 Engineer Akio Hayashi

(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

Tx, 2480MHz (below 30MHz)



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Maximum Power Spectral Density

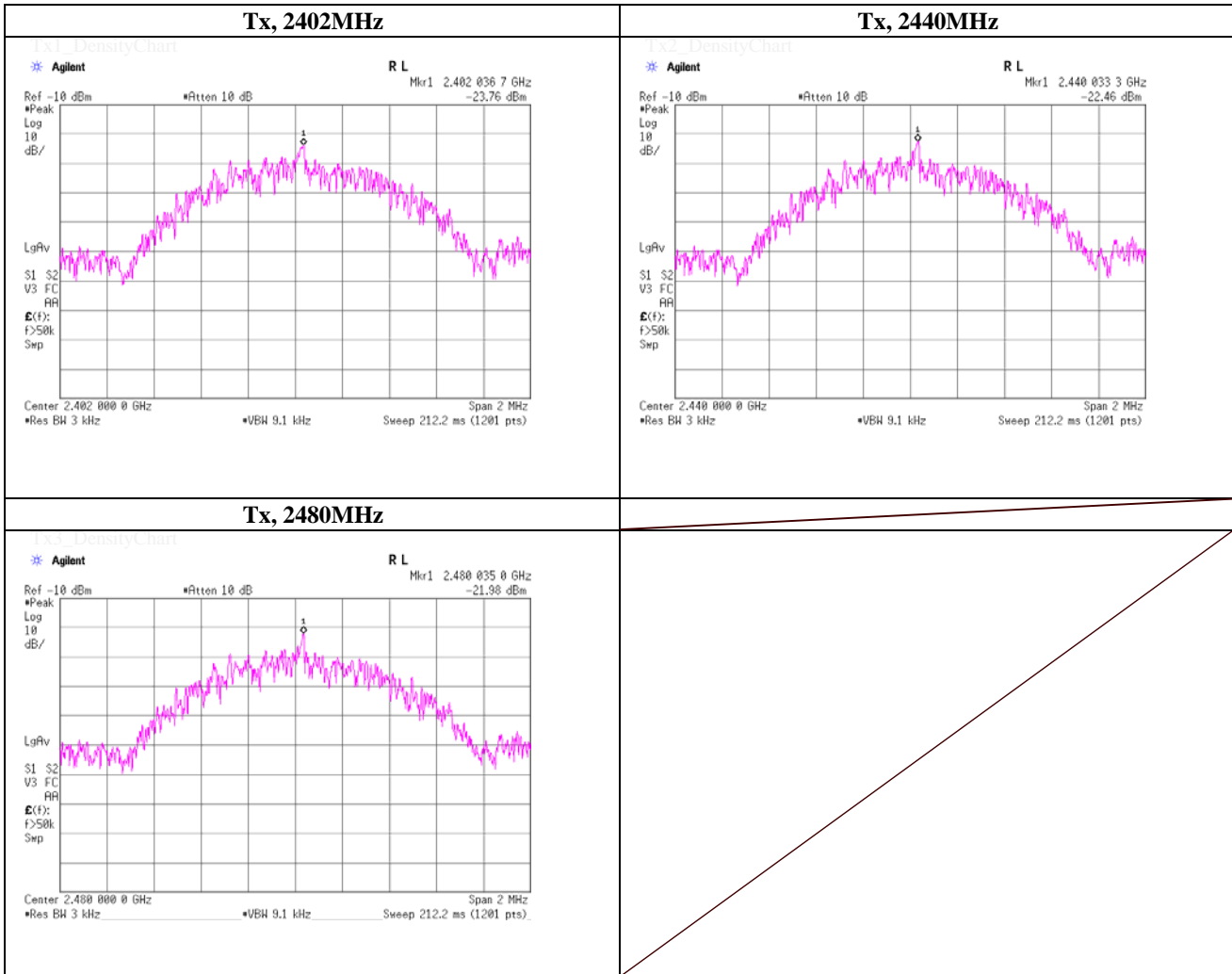
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	June 13, 2014	
Temperature / Humidity	26deg.C , 43%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth Low Energy, PN9	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.0000	2402.04	-23.76	0.77	9.90	-13.09	8.00	21.09
2440.0000	2440.03	-22.46	0.78	9.89	-11.79	8.00	19.79
2480.0000	2480.04	-21.98	0.79	9.89	-11.30	8.00	19.30

Sample Calculation:

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



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APPENDIX 2

Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2014/02/14 * 12
SAT6-06	Attenuator	JFW	50HF-006N	-	RE	2014/02/17 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2013/10/26 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271 (RF Selector)	RE	2014/04/25 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2013/10/26 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/02/21 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2014/03/04 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2013/07/09 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFLMF)	-	RE	-
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2014/05/23 * 12
SCC-G01	Coaxial Cable	Suhner	SUCOFLEX 104A	46497/4A	RE	2014/04/22 * 12
SCC-G21	Coaxial Cable	Suhner	SUCOFLEX 104	296169/4	RE	2014/05/15 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2013/08/19 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2014/03/04 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2014/03/14 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2014/03/15 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2014/03/13 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2013/11/22 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2013/11/22 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/03/07 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2014/04/08 * 12
SPSS-01	Power Sensor	Anritsu	MA2444D	0738366	AT	2014/04/08 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT	2014/03/17 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2014/03/13 * 12
SAT10-11	Attenuator	Weinschel Corp.	54A-10	37588	AT	2014/04/22 * 12

The expiration date of the calibration is the end of the expired month .
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards .

Test Item :

RE: Radiated emission ,
AT: Antenna terminal disturbance voltage