



RADIO TEST REPORT

Test Report No.: 10353836S-B

Applicant : SEIKO EPSON CORPORATION
Type of Equipment : GPS Sports Monitor
Model No. : SF-810
FCC ID : BKMAP006
Test regulation : FCC Part15 Subpart C: 2014
Test result : Complied

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3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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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 24 to 27, 2014

**Representative
test engineer:**

T. Arai

Tatsuya Arai
Engineer
Consumer Technology Division

Approved by :

T. Imamura

Toyokazu Imamura
Leader
Consumer Technology Division



- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10353836S-B

[illegible]

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Contents

	<u>Page</u>
SECTION 1: Customer information	4
SECTION 2: Equipment under test (E.U.T.)	4
SECTION 3: Test specification, procedures & results	5
SECTION 4: Operation of E.U.T. during testing.....	7
SECTION 5: Radiated emission	8
SECTION 6: Out of band emissions (Antenna port conducted)	10
SECTION 7: 6dB bandwidth & Occupied bandwidth (99%).....	10
SECTION 8: Maximum peak conducted output power	10
SECTION 9: Maximum power spectral density	10
Contents of APPENDIXES.....	11
APPENDIX 1: Data of Radio tests.....	12
APPENDIX 2: Test instruments	24
APPENDIX 3: Photographs of test setup.....	25

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SECTION 1: Customer information

Company Name : SEIKO EPSON CORPORATION
Address : 281 Fujimi, Fujimi-machi, Suwa-gun, Nagano-ken 399-0293 Japan
Telephone Number : +81-266-61-0618
Facsimile Number : +81-266-61-2045
Contact Person : Junichi Kiryu

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

2.1 Identification of E.U.T.

Type of Equipment : GPS Sports Monitor
Model Number : SF-810
Serial Number : Refer to Section 4.2
Rating : DC3.7V
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : June 20, 2014
Modification of EUT : The test lab did not make the modification to the EUT supplied from the customer to have it pass the tests.

2.2 Product description

Model: SF-810 (referred to as the EUT in this report) is a GPS Sports Monitor.

Clock frequency(ies) in the system : 26MHz, 32MHz, 32.768kHz, 48MHz, 32kHz, 16MHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth / Channel spacing : 1MHz / 2MHz
Type of modulation : GFSK
Antenna type / Antenna connector type : Chip Antenna / None
Antenna gain : 1.5dBi
ITU code : F1D
Operation temperature range : -5 to +50 deg.C

FCC 15.31 (e)

The EUT is a battery-operated device and test was performed with the full-charged battery. 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 equipment complies with the antenna 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

* The EUT has been tested for compliance with FCC Part 15 Subpart B by the customer.

3.2 Procedures & Results

Item	Test Procedure	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 Conducted 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	8.6dB (9760.000MHz, AV, Vertical, Tx 2440MHz,)	Complied
Maximum Power Spectral 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 v03r02 (FCC), "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

*2) The EUT operates with a battery. AC Line can be connected to the EUT via PC; however, the EUT stops transmission during recharging. Therefore, the test is not applicable to the EUT.

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	RSS-Gen 4.6.1	Conducted	-	-

Note: UL Japan's EMI 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)	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

Radiated emission test

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

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%

3.5 Test location

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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
☐ No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
☐ No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
☐ No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
☒ No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☐ No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☐ No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test setup, Data of EMI & 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 (Tx), Hopping OFF Bluetooth Low Energy (LE), Payload: PN9	2402MHz, 2440MHz, 2480MHz

Power settings: Fixed

Test software: RF test program ver.2.00

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

4.2 Configuration and peripherals

A

* Test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	GPS Sports Monitor	SF-810	*1)	SEIKO EPSON	EUT

*1) Radiated emission: No.01, Other tests: No.02

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SECTION 5: Radiated emission

5.1 Operating environment

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

5.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 0.5m, raised 80cm above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

5.3 Test conditions

Frequency range : 30MHz to 25GHz *)
Test distance : 3m(below 15GHz) / 1m(above15GHz)
EUT position : Table top
EUT operation mode : Refer to SECTION 4.1

*) It was not measured the radiated emissions from 9kHz to 30MHz, because it had been not detected the noise from 9kHz to 30MHz with the antenna terminal.

5.4 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 of the test receiver.

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

*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".

* When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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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.

Combinations of the worst case

Frequency Antenna polarization	Carrier *2)	Spurious			
		Below 1GHz	1-15GHz	15-18GHz	15-25GHz
Horizontal	Y	X	X	X	X
Vertical	Z	X	Y	X	X

*2) with spurious emissions near carrier frequency.

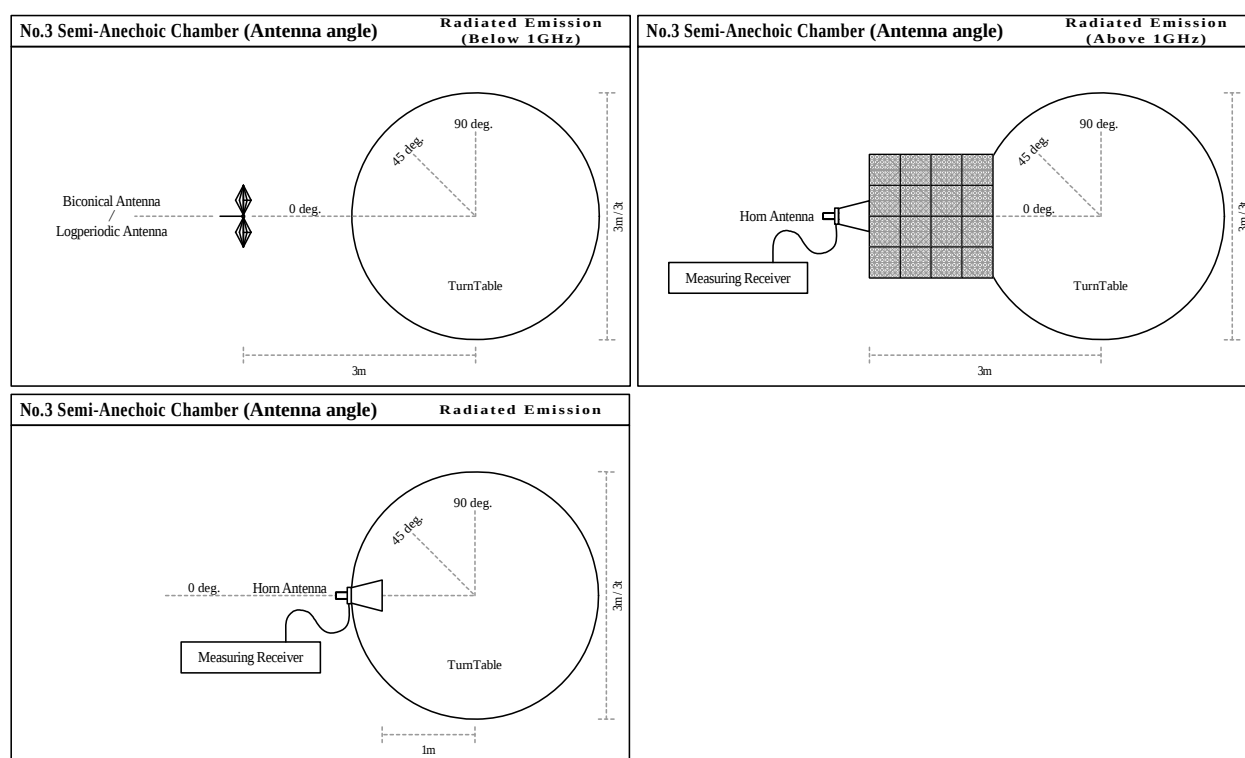


Figure 1. Antenna angle

5.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier.
Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209.
Refer to the data of Radiated emission.

5.6 Results

Summary of the test results : Pass *No noise was detected above the 3th order harmonics.
Refer to APPENDIX 1

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SECTION 6: Out of band emissions (Antenna port conducted)

Test procedure

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

In any 100kHz bandwidth outside the frequency 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.

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 7: 6dB bandwidth & Occupied bandwidth (99%)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

Refer to APPENDIX 1

SECTION 8: Maximum peak conducted output power

Test procedure

The maximum peak conducted output power was measured with a power meter connected to the antenna port.

The test was measured based on Method 9.1.3, method PKPM1 of KDB 558074 ("Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247").

Detection type: Peak / Average *1)

Summary of the test results: Pass

Refer to APPENDIX 1

SECTION 9: Maximum power spectral density

Test procedure

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

Instrument used : Spectrum Analyzer *1)

RBW / VBW : 3kHz / 9.1kHz

The test was measured based on Method 10.2, method 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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Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

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

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Radiated emission
Pre-check of worst position

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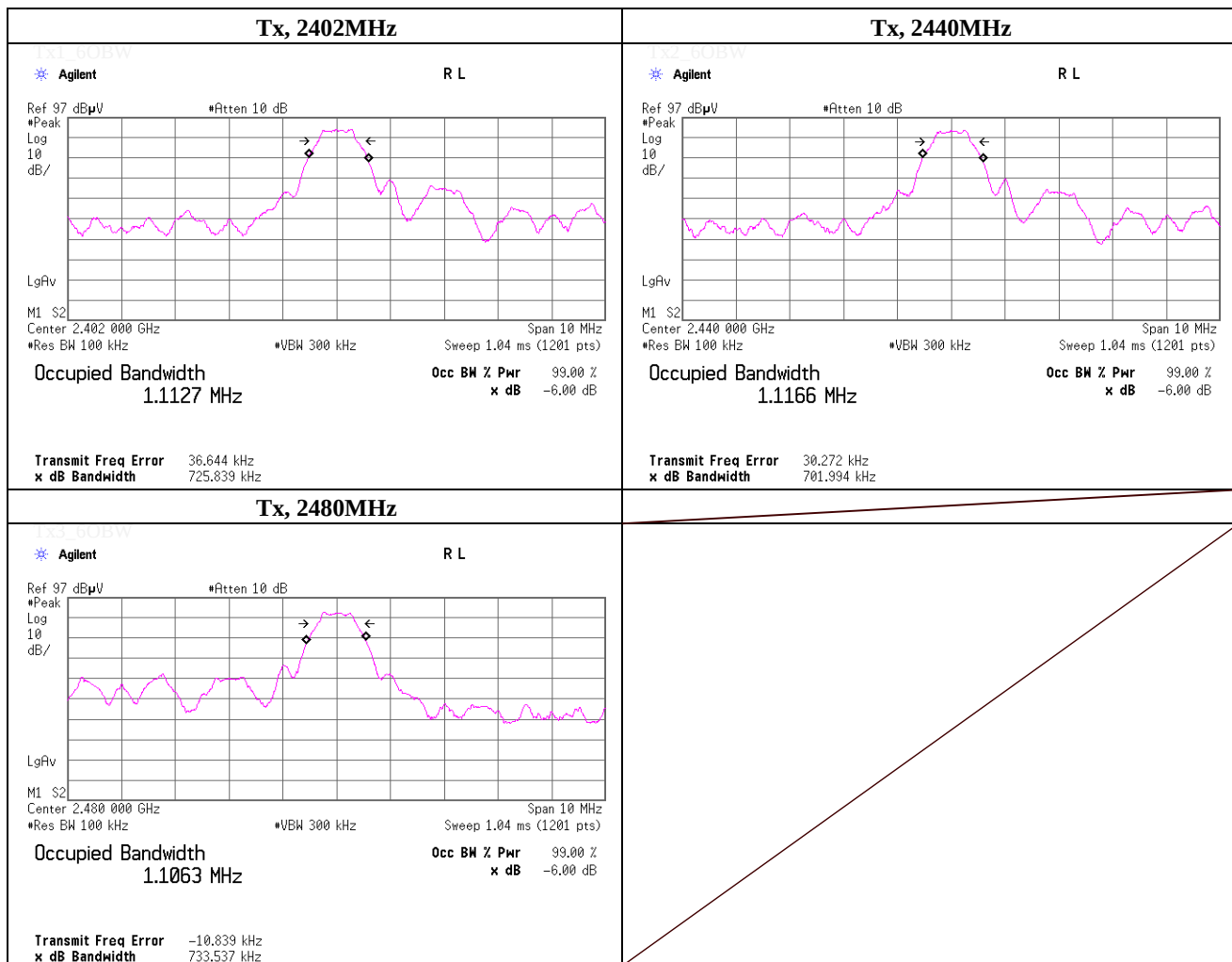
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-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	June 24, 2014	
Temperature / Humidity	25deg.C , 51%RH	
Engineer	Tatsuya Arai	
Mode	Tx, Bluetooth LE, PN9	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2402.0000	0.726	> 0.500
2440.0000	0.702	> 0.500
2480.0000	0.734	> 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 24, 2014
Temperature / Humidity 25deg.C , 51%RH
Engineer Tatsuya Arai
Mode Tx, Bluetooth LE, PN9

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

Ch	Freq.	P/M (Peak Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2402.0	-13.65	1.27	9.90	-2.48	0.56	30.00	1000	32.48
Mid	2440.0	-14.31	1.28	9.90	-3.13	0.49	30.00	1000	33.13
High	2480.0	-15.02	1.29	9.90	-3.83	0.41	30.00	1000	33.83

Sample Calculation:

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

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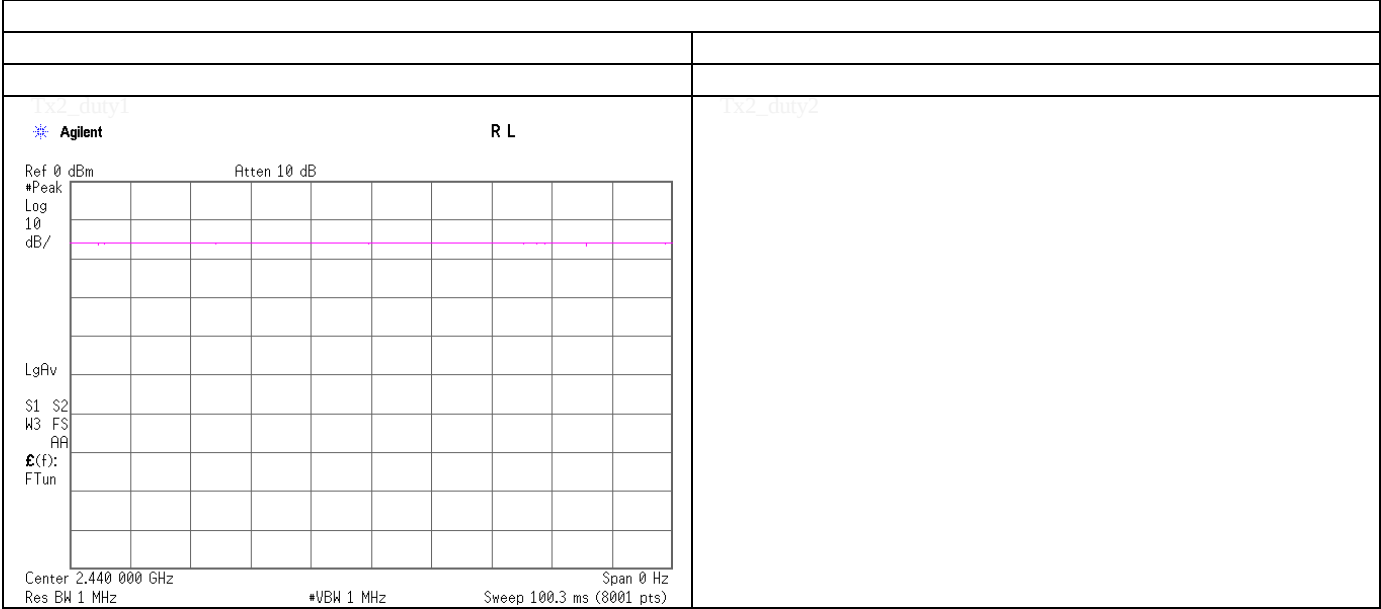
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date June 24, 2014
Temperature / Humidity 25deg.C , 51%RH
Engineer Tatsuya Arai

Burst rate confirmation

Tx, Bluetooth LE, PN9



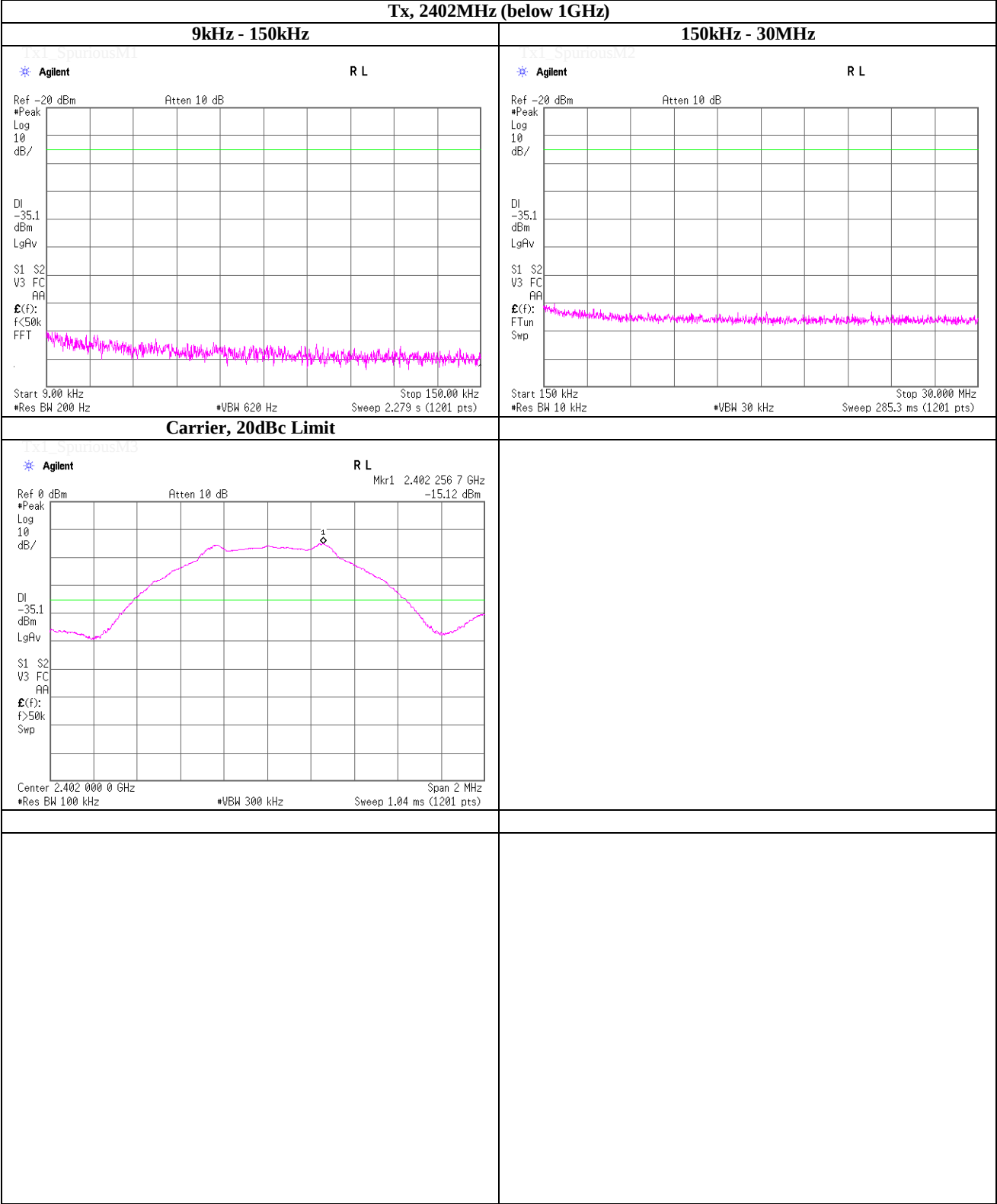
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date June 24, 2014
Temperature / Humidity 25deg.C , 51%RH
Engineer Tatsuya Arai

(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth LE, PN9

Tx, 2402MHz (below 1GHz)



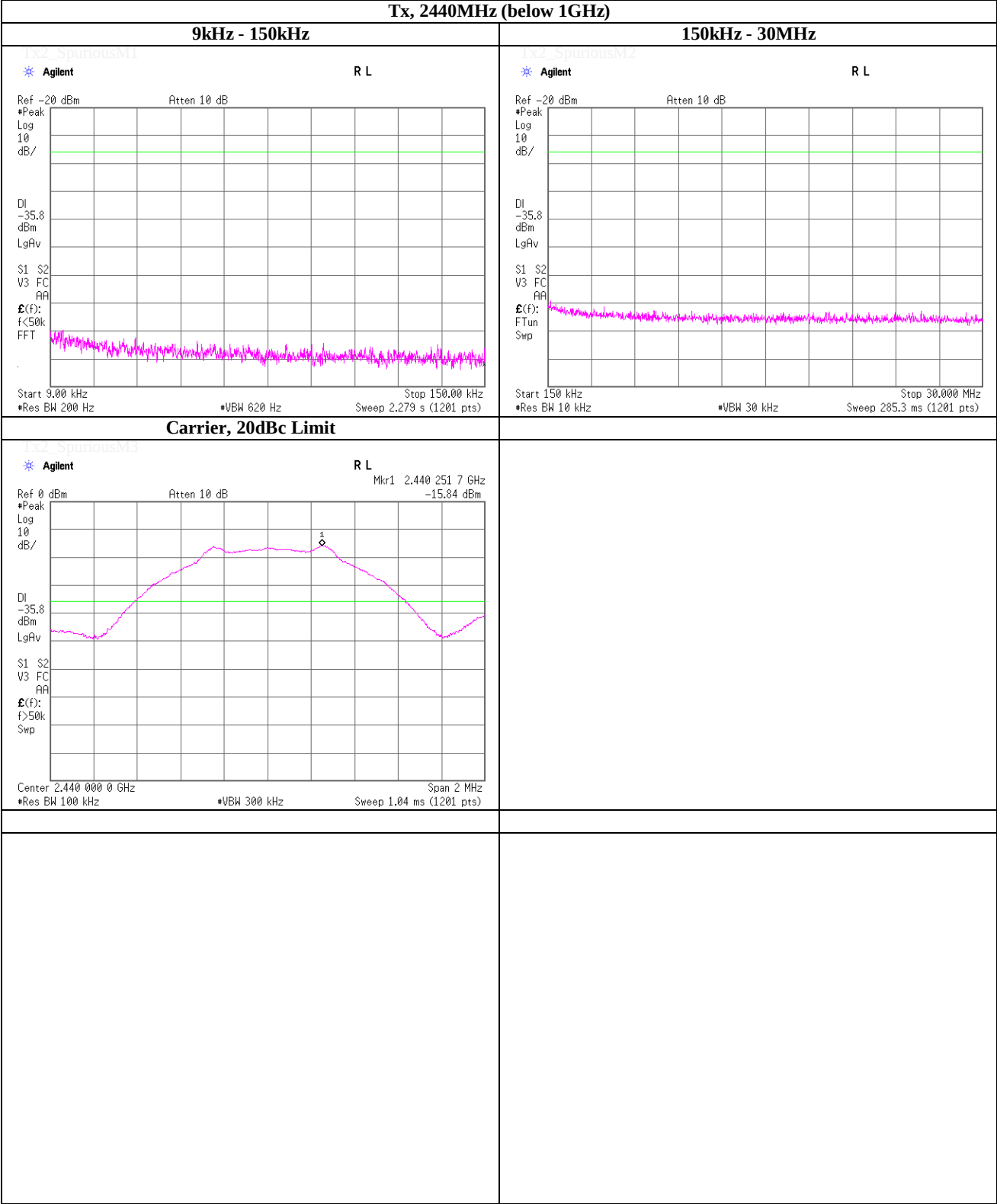
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Date June 24, 2014
Temperature / Humidity 25deg.C , 51%RH
Engineer Tatsuya Arai

(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth LE, PN9

Tx, 2440MHz (below 1GHz)



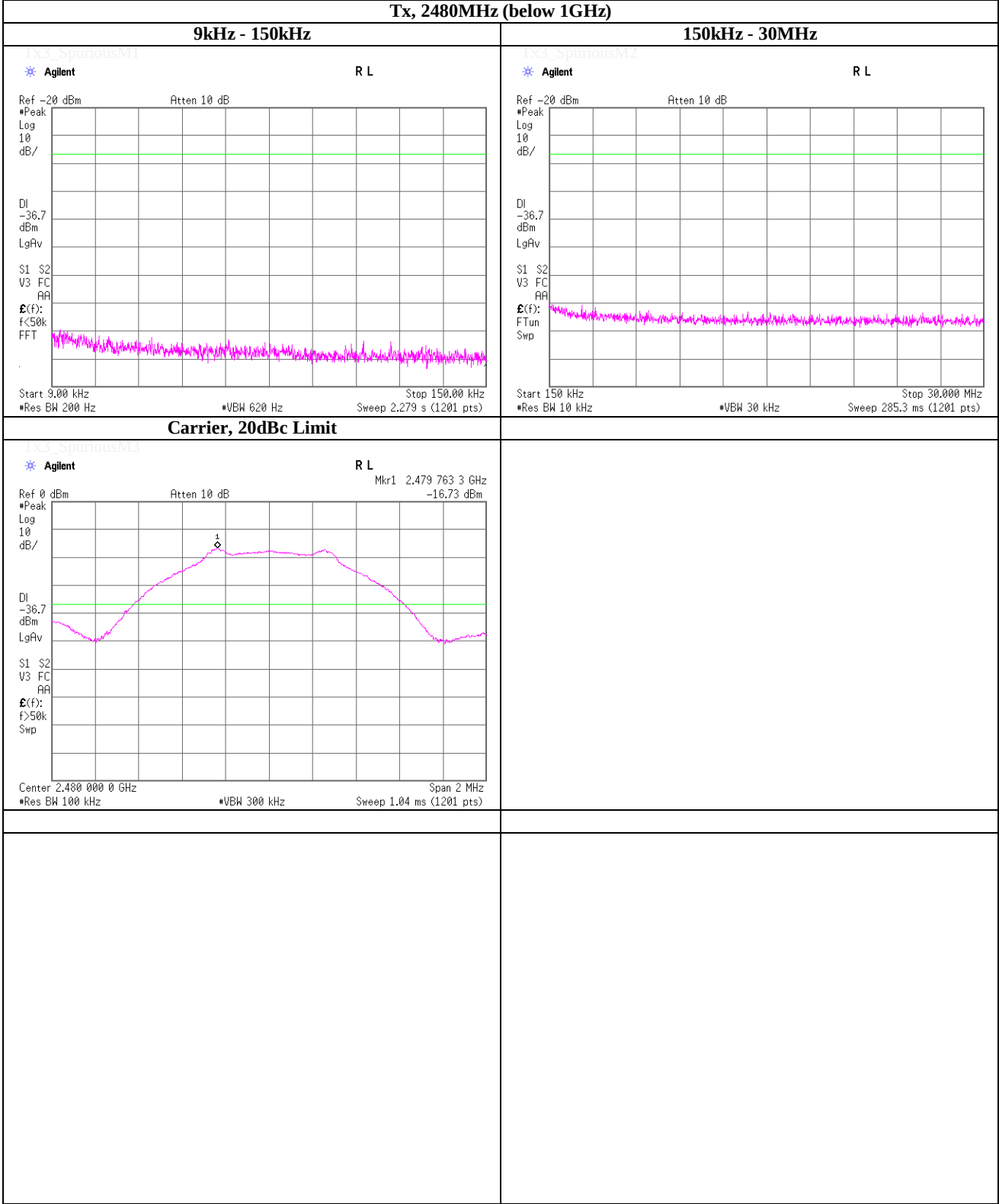
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date June 24, 2014
Temperature / Humidity 25deg.C , 51%RH
Engineer Tatsuya Arai

(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth LE, PN9

Tx, 2480MHz (below 1GHz)



Radiated Emission

Test place No.3 Semi Anechoic Chamber
 Date June 26, 2014 June 27, 2014
 Temperature / Humidity 23 deg.C, 57 %RH 24 deg.C, 53 %RH
 Engineer Kenichi Adachi Kenichi Adachi
 Mode Tx, 2402 MHz EUT worst axis: (below 1GHz): H: X, V: X, (carrier): H: Y, V: Z,
 Tx, Bluetooth, Low energy, PRBS9 (spurious 1G-15GHz): H: X, V: Y, (above 15GHz): H: X, V: X

(* 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.	48.000	QP	21.7	11.5	6.7	32.2	7.7	40.0	32.3	100	0	noise floor level
Hori.	480.604	QP	21.3	17.1	9.2	32.1	15.5	46.0	30.5	100	0	noise floor level
Hori.	961.208	QP	20.5	22.1	10.8	30.6	22.8	53.9	31.1	100	0	noise floor level
Hori.	2369.837	PK	45.7	26.8	13.5	41.1	44.9	73.9	29.0	100	176	
Hori.	2390.000	PK	45.6	26.8	13.6	41.1	44.9	73.9	29.0	100	176	
Hori.	4804.000	PK	49.1	30.9	6.0	39.8	46.2	73.9	27.7	100	51	
Hori.	4806.042	PK	46.0	31.0	6.0	39.8	43.2	73.9	30.7	100	288	
Hori.	7206.000	PK	45.7	37.1	7.1	40.2	49.7	73.9	24.2	100	0	noise floor level
Hori.	9608.000	PK	46.6	38.6	8.2	40.1	53.3	73.9	20.6	100	0	noise floor level
Hori.	2369.837	AV	37.8	26.8	13.5	41.1	37.0	53.9	16.9	100	176	
Hori.	2390.000	AV	37.6	26.8	13.6	41.1	36.9	53.9	17.0	100	176	
Hori.	4804.000	AV	43.1	30.9	6.0	39.8	40.2	53.9	13.7	100	51	
Hori.	4806.042	AV	38.3	31.0	6.0	39.8	35.5	53.9	18.4	100	288	
Hori.	7206.000	AV	37.6	37.1	7.1	40.2	41.6	53.9	12.3	100	0	noise floor level
Hori.	9608.000	AV	38.1	38.6	8.2	40.1	44.8	53.9	9.1	100	0	noise floor level
Vert.	48.000	QP	21.7	11.5	6.7	32.2	7.7	40.0	32.3	100	0	noise floor level
Vert.	480.604	QP	21.3	17.1	9.2	32.1	15.5	46.0	30.5	100	0	noise floor level
Vert.	961.208	QP	20.5	22.1	10.8	30.6	22.8	53.9	31.1	100	0	noise floor level
Vert.	2369.837	PK	45.9	26.8	13.5	41.1	45.1	73.9	28.8	127	147	
Vert.	2390.000	PK	45.8	26.8	13.6	41.1	45.1	73.9	28.8	127	147	
Vert.	4804.000	PK	49.0	30.9	6.0	39.8	46.1	73.9	27.8	109	171	
Vert.	4806.042	PK	47.5	31.0	6.0	39.8	44.7	73.9	29.2	104	158	
Vert.	7206.000	PK	45.8	37.1	7.1	40.2	49.8	73.9	24.1	100	0	noise floor level
Vert.	9608.000	PK	46.7	38.6	8.2	40.1	53.4	73.9	20.5	100	0	noise floor level
Vert.	2369.837	AV	37.7	26.8	13.5	41.1	36.9	53.9	17.0	127	147	
Vert.	2390.000	AV	37.5	26.8	13.6	41.1	36.8	53.9	17.1	127	147	
Vert.	4804.000	AV	42.2	30.9	6.0	39.8	39.3	53.9	14.6	109	171	
Vert.	4806.042	AV	38.7	31.0	6.0	39.8	35.9	53.9	18.0	104	158	
Vert.	7206.000	AV	37.7	37.1	7.1	40.2	41.7	53.9	12.2	100	0	noise floor level
Vert.	9608.000	AV	38.2	38.6	8.2	40.1	44.9	53.9	9.0	100	0	noise floor level

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

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	86.5	26.8	13.6	41.1	85.8	-	-	carrier
Hori.	2399.275	PK	45.6	26.8	13.6	41.1	44.9	65.8	20.9	
Hori.	2400.000	PK	41.2	26.8	13.6	41.1	40.5	65.8	25.3	
Vert.	2402.000	PK	87.4	26.8	13.6	41.1	86.7	-	-	carrier
Vert.	2399.275	PK	46.4	26.8	13.6	41.1	45.7	66.7	21.0	
Vert.	2400.000	PK	40.8	26.8	13.6	41.1	40.1	66.7	26.6	

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 26, 2014 June 27, 2014
 Temperature / Humidity 23 deg.C, 57 %RH 24 deg.C, 53 %RH
 Engineer Kenichi Adachi Kenichi Adachi
 Mode Tx, 2440 MHz EUT worst axis: (below 1GHz): H: X, V: X, (carrier): H: Y, V: Z,
 Tx, Bluetooth, Low energy, PRBS9 (spurious 1G-15GHz): H: X, V: Y, (above 15GHz): H: X, V: X

(* 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.	48.000	QP	21.7	11.5	6.7	32.2	7.7	40.0	32.3	100	0	noise floor level
Hori.	488.204	QP	21.4	17.2	9.2	32.1	15.7	46.0	30.3	100	0	noise floor level
Hori.	976.408	QP	20.5	22.3	10.9	30.4	23.3	53.9	30.6	100	0	noise floor level
Hori.	4880.000	PK	49.4	31.4	6.0	39.7	47.1	73.9	26.8	100	49	
Hori.	4882.040	PK	46.3	31.4	6.0	39.7	44.0	73.9	29.9	100	283	
Hori.	7320.000	PK	46.3	37.2	7.1	40.3	50.3	73.9	23.6	100	0	noise floor level
Hori.	9760.000	PK	46.5	38.8	8.1	40.0	53.4	73.9	20.5	100	0	noise floor level
Hori.	4880.000	AV	42.8	31.4	6.0	39.7	40.5	53.9	13.4	100	49	
Hori.	4882.040	AV	38.5	31.4	6.0	39.7	36.2	53.9	17.7	100	283	
Hori.	7320.000	AV	37.9	37.2	7.1	40.3	41.9	53.9	12.0	100	0	noise floor level
Hori.	9760.000	AV	38.3	38.8	8.1	40.0	45.2	53.9	8.7	100	0	noise floor level
Vert.	48.000	QP	21.7	11.5	6.7	32.2	7.7	40.0	32.3	100	0	noise floor level
Vert.	488.204	QP	21.4	17.2	9.2	32.1	15.7	46.0	30.3	100	0	noise floor level
Vert.	976.408	QP	20.5	22.3	10.9	30.4	23.3	53.9	30.6	100	0	noise floor level
Vert.	4880.000	PK	49.6	31.4	6.0	39.7	47.3	73.9	26.6	103	175	
Vert.	4882.040	PK	48.5	31.4	6.0	39.7	46.2	73.9	27.7	102	155	
Vert.	7320.000	PK	46.2	37.2	7.1	40.3	50.2	73.9	23.7	100	0	noise floor level
Vert.	9760.000	PK	46.6	38.8	8.1	40.0	53.5	73.9	20.4	100	0	noise floor level
Vert.	4880.000	AV	42.4	31.4	6.0	39.7	40.1	53.9	13.8	103	175	
Vert.	4882.040	AV	39.1	31.4	6.0	39.7	36.8	53.9	17.1	102	155	
Vert.	7320.000	AV	37.8	37.2	7.1	40.3	41.8	53.9	12.1	100	0	noise floor level
Vert.	9760.000	AV	38.4	38.8	8.1	40.0	45.3	53.9	8.6	100	0	noise floor level

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 26, 2014 June 27, 2014
 Temperature / Humidity 23 deg.C, 57 %RH 24 deg.C, 53 %RH
 Engineer Kenichi Adachi Kenichi Adachi
 Mode Tx, 2480 MHz EUT worst axis: (below 1GHz): H: X, V: X, (carrier): H: Y, V: Z,
 Tx, Bluetooth, Low energy, PRBS9 (spurious 1G-15GHz): H: X, V: Y, (above 15GHz): H: X, V: X

(* 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.	48.000	QP	21.7	11.5	6.7	32.2	7.7	40.0	32.3	100	0	noise floor level
Hori.	495.804	QP	21.4	17.2	9.2	32.1	15.7	46.0	30.3	100	0	noise floor level
Hori.	991.607	QP	20.4	22.4	10.9	30.3	23.4	53.9	30.5	100	0	noise floor level
Hori.	2483.500	PK	45.5	26.9	13.6	41.1	44.9	73.9	29.0	100	178	
Hori.	2485.175	PK	47.6	26.9	13.6	41.1	47.0	73.9	26.9	100	178	
Hori.	4958.036	PK	48.2	31.8	6.0	39.6	46.4	73.9	27.5	100	291	
Hori.	4960.000	PK	45.9	31.8	6.0	39.6	44.1	73.9	29.8	100	64	
Hori.	7440.000	PK	45.5	37.4	7.2	40.4	49.7	73.9	24.2	100	0	noise floor level
Hori.	9920.000	PK	44.0	38.9	8.1	39.9	51.1	73.9	22.8	100	0	noise floor level
Hori.	2483.500	AV	38.9	26.9	13.6	41.1	38.3	53.9	15.6	100	178	
Hori.	2485.175	AV	39.5	26.9	13.6	41.1	38.9	53.9	15.0	100	178	
Hori.	4958.036	AV	41.2	31.8	6.0	39.6	39.4	53.9	14.5	100	291	
Hori.	4960.000	AV	38.6	31.8	6.0	39.6	36.8	53.9	17.1	100	64	
Hori.	7440.000	AV	37.8	37.4	7.2	40.4	42.0	53.9	11.9	100	0	noise floor level
Hori.	9920.000	AV	38.0	38.9	8.1	39.9	45.1	53.9	8.8	100	0	noise floor level
Vert.	48.000	QP	21.7	11.5	6.7	32.2	7.7	40.0	32.3	100	0	noise floor level
Vert.	495.804	QP	21.4	17.2	9.2	32.1	15.7	46.0	30.3	100	0	noise floor level
Vert.	991.607	QP	20.4	22.4	10.9	30.3	23.4	53.9	30.5	100	0	noise floor level
Vert.	2483.500	PK	45.7	26.9	13.6	41.1	45.1	73.9	28.8	122	152	
Vert.	2485.175	PK	47.9	26.9	13.6	41.1	47.3	73.9	26.6	122	152	
Vert.	4958.036	PK	47.8	31.8	6.0	39.6	46.0	73.9	27.9	102	143	
Vert.	4960.000	PK	46.4	31.8	6.0	39.6	44.6	73.9	29.3	103	139	
Vert.	7440.000	PK	45.4	37.4	7.2	40.4	49.6	73.9	24.3	100	0	noise floor level
Vert.	9920.000	PK	43.9	38.9	8.1	39.9	51.0	73.9	22.9	100	0	noise floor level
Vert.	2483.500	AV	39.0	26.9	13.6	41.1	38.4	53.9	15.5	122	152	
Vert.	2485.175	AV	39.8	26.9	13.6	41.1	39.2	53.9	14.7	122	152	
Vert.	4958.036	AV	41.0	31.8	6.0	39.6	39.2	53.9	14.7	102	143	
Vert.	4960.000	AV	39.0	31.8	6.0	39.6	37.2	53.9	16.7	103	139	
Vert.	7440.000	AV	37.7	37.4	7.2	40.4	41.9	53.9	12.0	100	0	noise floor level
Vert.	9920.000	AV	37.9	38.9	8.1	39.9	45.0	53.9	8.9	100	0	noise floor level

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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Maximum Power Spectral Density

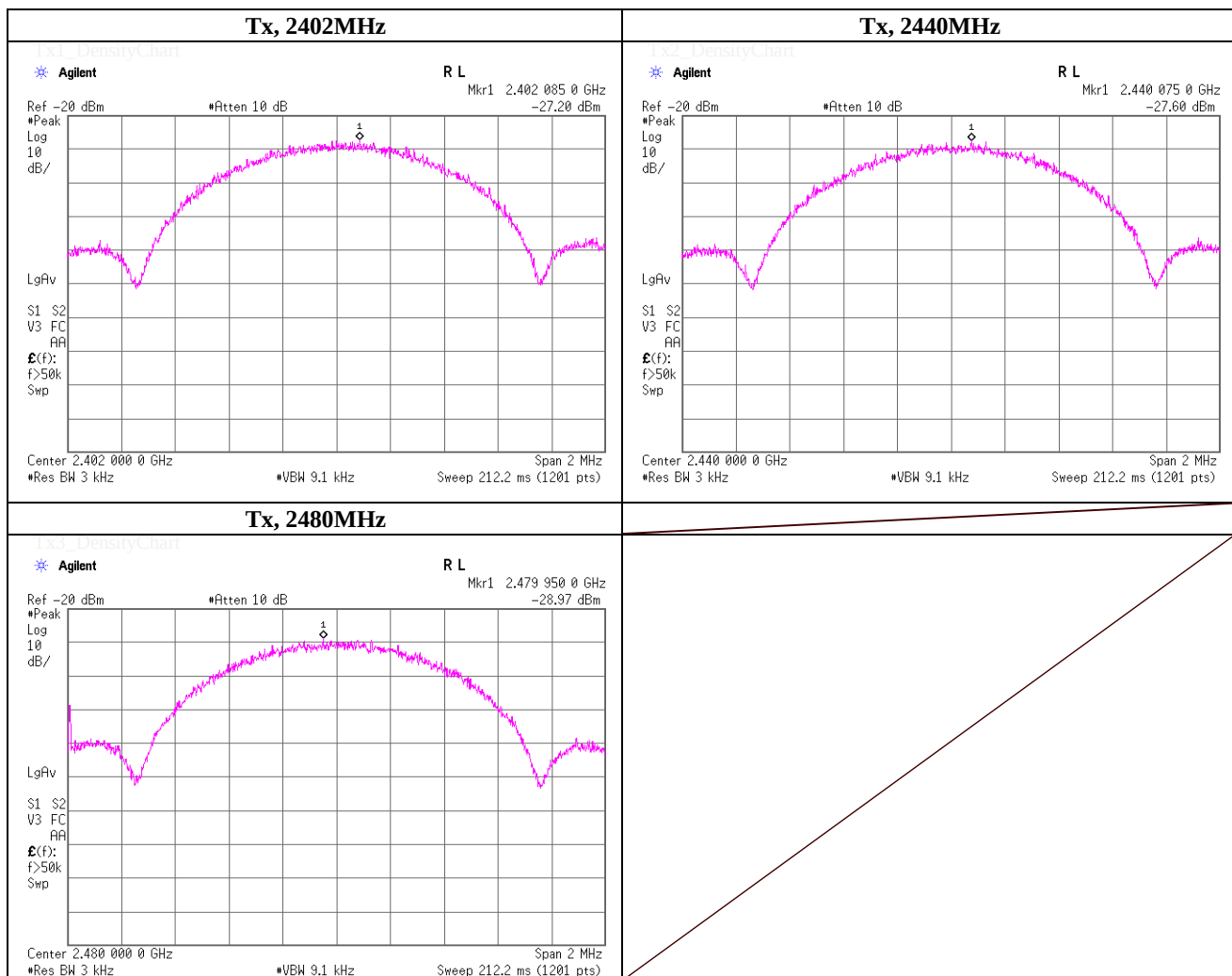
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	June 24, 2014	
Temperature / Humidity	25deg.C , 51%RH	
Engineer	Tatsuya Arai	
Mode	Tx, Bluetooth LE, PN9	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.0000	2402.09	-27.20	1.27	9.90	-16.03	8.00	24.03
2440.0000	2440.08	-27.60	1.28	9.90	-16.42	8.00	24.42
2480.0000	2479.95	-28.97	1.29	9.90	-17.78	8.00	25.78

Sample Calculation:

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

**UL Japan, Inc.****Shonan EMC Lab.**

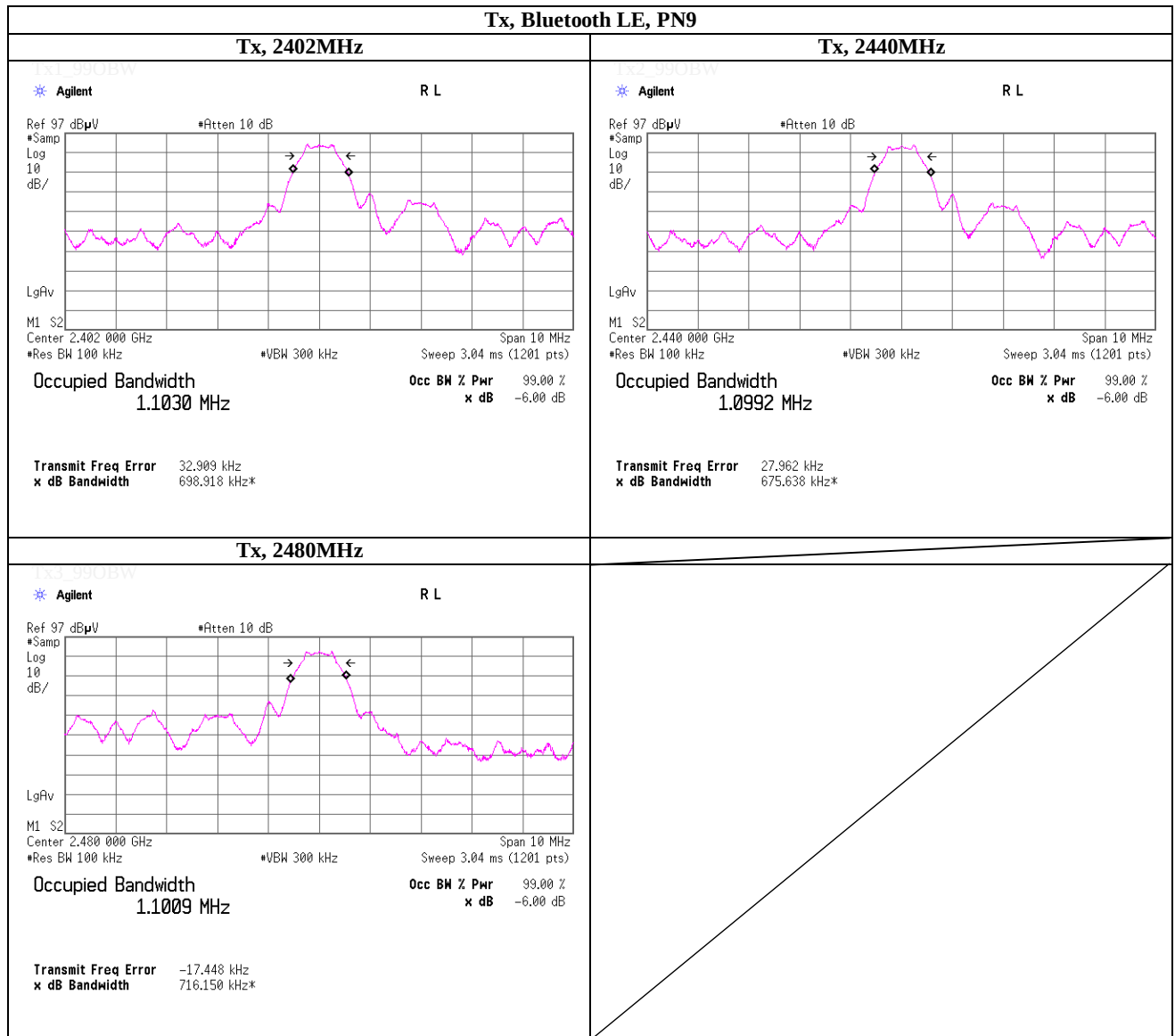
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date June 24, 2014
Temperature / Humidity 25deg.C , 51%RH
Engineer Tatsuya Arai

99% Occupied Bandwidth



UL Japan, Inc.

Shonan EMC Lab.

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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)
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2014/02/03 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2014/04/08 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2014/04/08 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2014/03/13 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2014/04/22 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/03/07 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2013/07/09 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2013/08/19 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-00	JUN-12-14-018	RE	2014/06/24 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2013/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2013/11/22 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2014/05/23 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2014/05/15 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2014/03/17 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RF,IMF)	-	RE	-
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/02/21 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2014/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2014/05/15 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2014/03/14 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2013/10/26 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A0901	RE	2013/10/26 * 12
SAT6-06	Attenuator	JFW	50HF-006N	-	RE	2014/02/17 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2014/02/14 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2014/04/25 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2014/03/04 * 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 emissions (Out of band emissions)

AT: Antenna terminal conducted tests