RADIO TEST REPORT

Test Report No.: 10329797S-B

Applicant	:	**Sony Corporation**
Type of Equipment	:	**Digital Music Player**
Model No.	:	**NWZ-WS613**
FCC ID	:	**AK8NWZWS610**
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: May 14 to 18, 2014

Tested by:

Akio Hayashi
Engineer
Consumer Technology Division

Approved by :

Toyokazu Imamura
Leader
Consumer Technology Division

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☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 10329797S-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10329797S-B	May 30, 2014	-	-
1	10329797S-B	June 17, 2014	5	Addition the note to 3.1.

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SECTION 1: Customer information

Company Name	:	Sony Corporation
Brand Name	:	SONY
Address	:	2-10-1 Osaki, Shinagawa-ku, Tokyo, 141-8610, Japan
Telephone Number	:	+81 50 3750 7634
Contact Person	:	Shinichi Maru

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

2.1 Identification of E.U.T.

Type of Equipment	:	Digital Music Player
Model Number	:	NWZ-WS613
Serial Number	:	Refer to Clause 4.2
Rating	:	DC3.7V
Country of Mass-production	:	Malaysia
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	:	May 9, 2014
Modification of EUT	:	No modification by the test lab.

2.2 Product description

Model: NWZ-WS613 (referred to as the EUT in this report) is a Digital Music Player.

Variant model: NWZ-WS615
Difference is the memory capacity: NWZ-WS613 (4GB), NWZ-WS615 (16GB)

Clock frequency(ies) in the system	:	24MHz (CPU), 26MHz (BT), 240MHz (USB), ~151.58MHz (mSDRAM), 16MHz (eMMC_Data), ~454MHz (CPU core)

Bluetooth specification:

Equipment type	:	Transceiver
Frequency of operation	:	2402-2480MHz
Bandwidth / Channel spacing	:	1MHz / 2MHz & 1MHz
Type of modulation	:	FHSS (GFSK, π/4-DQPSK, 8DPSK), DSSS (GFSK)
Antenna type	:	Pattern
Antenna connector type	:	None
Antenna gain	:	-1dBi
ITU code	:	F1D, G1D
Operation temperature range	:	+5 to +35 deg.C

* For Bluetooth (BDR, EDR) part, refer to the test report: 10329797S-A.

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 EUT complies with the requirement.

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 15.209 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 *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	3.1 dB Freq.: 4880.000MHz Polarization: Vertical Detection: Average Mode: Tx 2440MHz	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 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	-	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.

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%

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
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
☐ 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 test & Test instruments

Refer to APPENDIX 1 to 3.

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

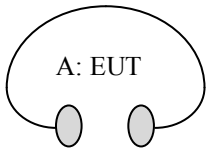
4.1 Operating mode

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

Software : BlueTest3.exe ver.2.5.0.93
Power Settings : Fixed

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

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Music Player	NWZ-WS613	*1)	SONY	EUT

*1) Antenna port conducted tests: 3000060, Radiated emission tests: 3000043

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

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.

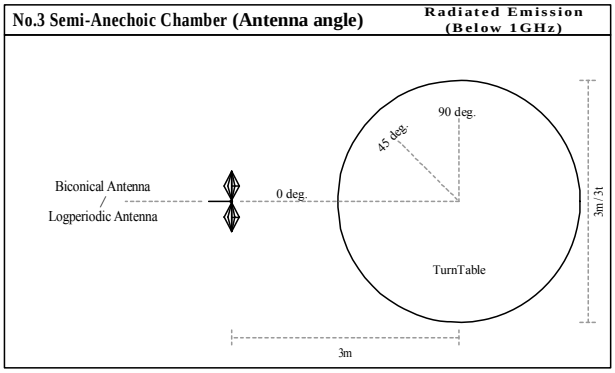
Frequency		30 - 1000MHz	1 - 25GHz		20dBc
Detection Type	:	Quasi-Peak	Peak	Average *1)	Peak
IF Bandwidth	:	120kHz	RBW:1MHz VBW:3MHz	RBW: 1MHz VBW: 3MHz Detector: RMS	RBW: 100kHz, VBW: 300kHz

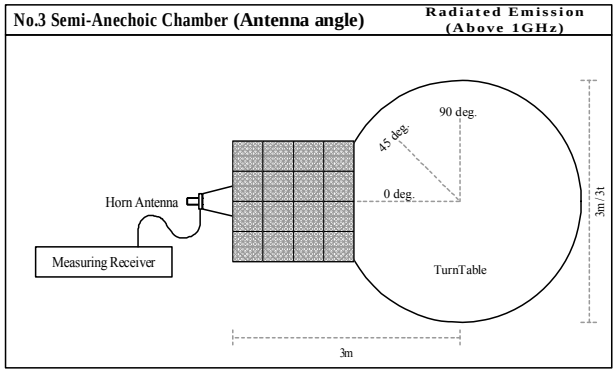
*1) Average Power Measurement was measured based on 12.2.5 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

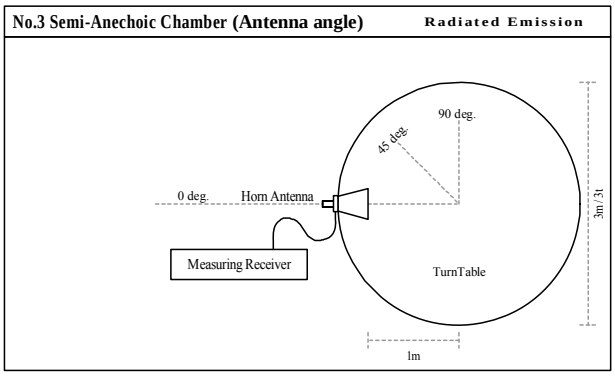
The carrier levels and noise levels were confirmed at each position of X, Y and Z axes to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Antenna polarization	Carrier	Spurious (Below 1GHz)	Spurious (1-15GHz)	Spurious (15-18GHz)	Spurious (18-25GHz)
Horizontal	X	X	X	X	Y
Vertical	Y	X	Y	Y	Y

Figure 1. Antenna angle







9.5 Band edge

Band edge level 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 8th order harmonics.

Refer to APPENDIX 1.

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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

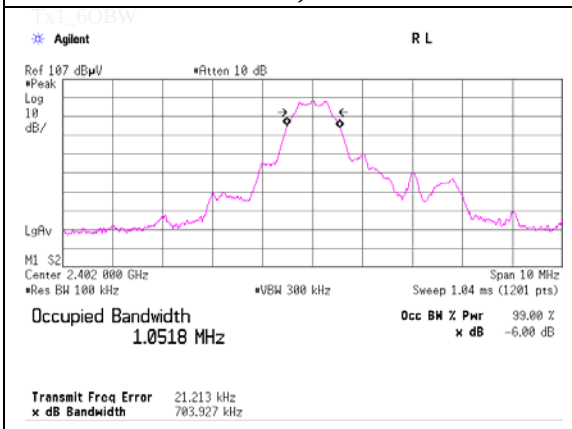
APPENDIX 1: Data of radio tests

-6dB Bandwidth

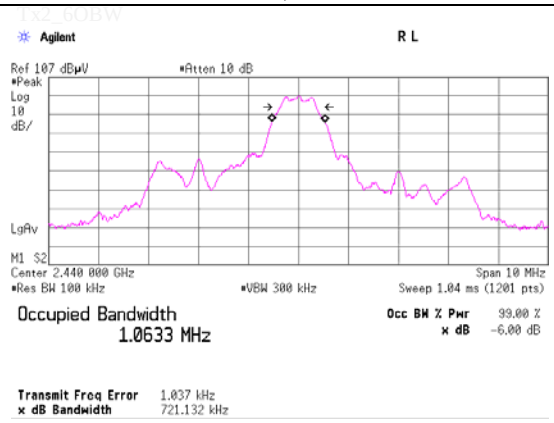
Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	May 14, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth Low Energy, PN9	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2402.0000	0.704	> 0.500
2440.0000	0.721	> 0.500
2480.0000	0.730	> 0.500

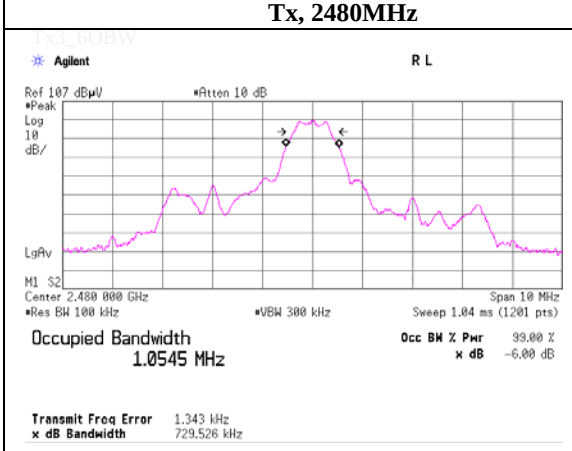
Tx, 2402MHz



Tx, 2440MHz



Tx, 2480MHz



Maximum Peak Conducted Output Power

(PKPM1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	May 14, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth Low Energy, PN9,	

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

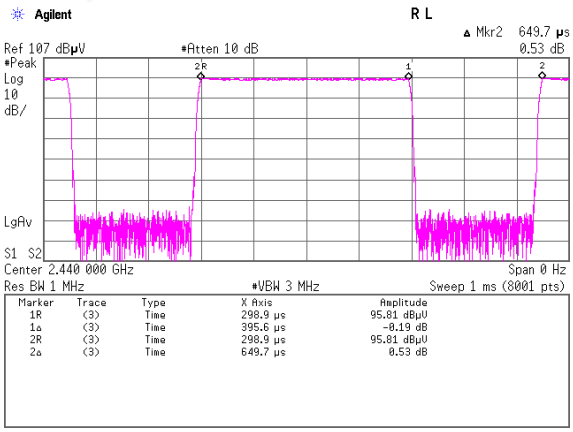
Ch	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2402.0	-11.25	1.63	9.65	0.03	1.01	30.00	1000	29.97
Mid	2440.0	-9.82	1.64	9.66	1.48	1.41	30.00	1000	28.52
High	2480.0	-9.89	1.65	9.66	1.42	1.39	30.00	1000	28.58

Sample Calculation:

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

Duty Factor Calculation Chart

Tx, Bluetooth Low Energy, PN9

Duty Factor = 20log(1/Duty Cycle) = 4.3dB	
Duty Cycle = 395.6 / 649.7 = 0.6089 (60.89%)	
Tx2_duty1 	Tx2_duty2

Radiated Emission

Test place	No.3 Semi Anechoic Chamber		
Date	May 16, 2014	May 17, 2014	May 18, 2014
Temperature / Humidity	26 deg.C, 36 %RH	21 deg.C, 41 %RH	22 deg.C, 34 %RH
Engineer	Kenichi Adachi	Wataru Kojima	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.	31.818	QP	23.0	17.6	6.5	32.2	14.9	40.0	25.1	150	358	
Hori.	141.299	QP	25.4	14.4	7.5	32.1	15.2	43.5	28.3	211	48	
Hori.	240.076	QP	44.2	16.9	8.1	32.0	37.2	46.0	**8.8**	148	211	
Hori.	2390.000	PK	44.9	26.8	14.6	38.2	48.1	73.9	25.8	100	91	
Hori.	2400.000	PK	44.0	26.8	14.6	38.2	47.2	73.9	26.7	100	91	
Hori.	4804.000	PK	52.1	30.9	7.5	37.1	53.4	73.9	20.5	100	293	
Hori.	7206.000	PK	45.2	37.1	8.6	39.4	51.5	73.9	22.4	100	0	
Hori.	9608.000	PK	43.5	38.6	9.6	37.6	54.1	73.9	19.8	100	0	
Hori.	19216.000	PK	51.9	40.8	1.9	48.4	46.2	73.9	27.7	105	230	
Hori.	2390.000	AV	34.2	26.8	14.6	38.2	37.4	53.9	16.5	100	91	
Hori.	2400.000	AV	38.0	26.8	14.6	38.2	41.2	53.9	12.7	100	91	
Vert.	290.789	QP	22.3	18.5	8.3	32.0	17.1	46.0	28.9	100	33	
Vert.	727.512	QP	23.4	19.9	10.0	31.8	21.5	46.0	24.5	100	274	
Vert.	952.337	QP	22.8	22.1	10.8	30.6	25.1	46.0	20.9	100	256	
Vert.	2390.000	PK	42.6	26.8	14.6	38.2	45.8	73.9	28.1	100	72	
Vert.	2400.000	PK	45.6	26.8	14.6	38.2	48.8	73.9	25.1	100	72	
Vert.	4804.000	PK	51.7	30.9	7.5	37.1	53.0	73.9	20.9	100	257	
Vert.	7206.000	PK	45.5	37.1	8.6	39.4	51.8	73.9	22.1	100	0	
Vert.	9608.000	PK	43.8	38.6	9.6	37.6	54.4	73.9	19.5	100	0	
Vert.	19216.000	PK	52.6	40.8	1.9	48.4	46.9	73.9	27.0	100	328	
Vert.	2390.000	AV	35.1	26.8	14.6	38.2	38.3	53.9	15.6	100	72	
Vert.	2400.000	AV	36.6	26.8	14.6	38.2	39.8	53.9	14.1	100	72	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
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	44.3	30.9	7.5	37.1	4.3	49.9	53.9	4.0	
Hori.	7206.000	AV	37.6	37.1	8.6	39.4	4.3	48.2	53.9	5.7	
Hori.	9608.000	AV	34.4	38.6	9.6	37.6	4.3	49.3	53.9	4.6	
Hori.	19216.000	AV	46.4	40.8	1.9	48.4	4.3	45.0	53.9	8.9	
Vert.	4804.000	AV	44.5	30.9	7.5	37.1	4.3	50.1	53.9	**3.8**	
Vert.	7206.000	AV	37.7	37.1	8.6	39.4	4.3	48.3	53.9	5.6	
Vert.	9608.000	AV	34.3	38.6	9.6	37.6	4.3	49.2	53.9	4.7	
Vert.	19216.000	AV	47.3	40.8	1.9	48.4	4.3	45.9	53.9	8.0	

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

Radiated Emission

Test place	No.3 Semi Anechoic Chamber		
Date	May 16, 2014	May 17, 2014	May 18, 2014
Temperature / Humidity	26 deg.C, 36 %RH	21 deg.C, 41 %RH	22 deg.C, 34 %RH
Engineer	Kenichi Adachi	Wataru Kojima	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.	36.977	QP	21.1	15.7	6.5	32.2	11.1	40.0	28.9	100	21	
Hori.	120.462	QP	24.5	13.1	7.2	32.1	12.7	43.5	30.8	111	358	
Hori.	138.915	QP	23.2	14.3	7.5	32.1	12.9	43.5	30.6	198	88	
Hori.	240.060	QP	43.2	16.9	8.1	32.0	36.2	46.0	**9.8**	141	314	
Hori.	556.355	QP	22.2	18.0	9.5	32.1	17.6	46.0	28.4	100	220	
Hori.	4880.000	PK	52.6	31.4	7.5	37.0	54.5	73.9	19.4	100	45	
Hori.	7320.000	PK	45.1	37.2	8.6	39.4	51.5	73.9	22.4	100	0	
Hori.	9760.000	PK	41.1	38.8	9.6	37.5	52.0	73.9	21.9	100	0	
Hori.	19520.000	PK	51.5	40.8	2.0	48.1	46.2	73.9	27.7	102	237	
Vert.	153.455	QP	24.0	14.7	7.7	32.1	14.3	43.5	29.2	100	70	
Vert.	240.105	QP	29.2	16.9	8.1	32.0	22.2	46.0	23.8	100	265	
Vert.	4880.000	PK	52.2	31.4	7.5	37.0	54.1	73.9	19.8	100	304	
Vert.	7320.000	PK	45.0	37.2	8.6	39.4	51.4	73.9	22.5	100	0	
Vert.	9760.000	PK	41.0	38.8	9.6	37.5	51.9	73.9	22.0	100	0	
Vert.	19520.000	PK	50.3	40.8	2.0	48.1	45.0	73.9	28.9	100	330	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
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	44.5	31.4	7.5	37.0	4.3	50.7	53.9	3.2	
Hori.	7320.000	AV	34.6	37.2	8.6	39.4	4.3	45.3	53.9	8.6	
Hori.	9760.000	AV	31.6	38.8	9.6	37.5	4.3	46.8	53.9	7.1	
Hori.	19520.000	AV	45.4	40.8	2.0	48.1	4.3	44.4	53.9	9.5	
Vert.	4880.000	AV	44.6	31.4	7.5	37.0	4.3	50.8	53.9	**3.1**	
Vert.	7320.000	AV	34.5	37.2	8.6	39.4	4.3	45.2	53.9	8.7	
Vert.	9760.000	AV	31.6	38.8	9.6	37.5	4.3	46.8	53.9	7.1	
Vert.	19520.000	AV	44.2	40.8	2.0	48.1	4.3	43.2	53.9	10.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Duty factor
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	May 16, 2014	May 17, 2014	May 18, 2014
Temperature / Humidity	26 deg.C, 36 %RH	21 deg.C, 41 %RH	22 deg.C, 34 %RH
Engineer	Kenichi Adachi	Wataru Kojima	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.	240.011	QP	42.9	16.9	8.1	32.0	35.9	46.0	**10.1**	127	129	
Hori.	245.270	QP	34.0	16.9	8.1	32.0	27.0	46.0	19.0	102	165	
Hori.	578.777	QP	22.3	18.3	9.5	32.1	18.0	46.0	28.0	100	352	
Hori.	2483.500	PK	45.4	26.9	14.7	38.1	48.9	73.9	25.0	100	61	
Hori.	4960.000	PK	50.6	31.8	7.5	37.0	52.9	73.9	21.0	100	36	
Hori.	7440.000	PK	44.3	37.4	8.8	39.4	51.1	73.9	22.8	100	0	
Hori.	9920.000	PK	41.1	38.9	9.6	37.5	52.1	73.9	21.8	100	0	
Hori.	19840.000	PK	50.2	40.7	2.1	47.9	45.1	73.9	28.8	101	232	
Hori.	2483.500	AV	33.7	26.9	14.7	38.1	37.2	53.9	16.7	100	61	
Vert.	35.863	QP	23.1	16.2	6.5	32.2	13.6	40.0	26.4	100	161	
Vert.	91.751	QP	22.1	8.4	7.4	32.1	5.8	43.5	37.7	100	332	
Vert.	945.901	QP	25.2	22.0	10.8	30.7	27.3	46.0	18.7	100	349	
Vert.	2483.500	PK	45.6	26.9	14.7	38.1	49.1	73.9	24.8	126	81	
Vert.	4960.000	PK	50.4	31.8	7.5	37.0	52.7	73.9	21.2	100	32	
Vert.	7440.000	PK	45.0	37.4	8.8	39.4	51.8	73.9	22.1	100	0	
Vert.	9920.000	PK	41.3	38.9	9.6	37.5	52.3	73.9	21.6	100	0	
Vert.	19840.000	PK	49.5	40.7	2.1	47.9	44.4	73.9	29.5	122	331	
Vert.	2483.500	AV	36.4	26.9	14.7	38.1	39.9	53.9	14.0	126	81	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
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	44.1	31.8	7.5	37.0	4.3	50.7	53.9	**3.2**	
Hori.	7440.000	AV	33.5	37.4	8.8	39.4	4.3	44.6	53.9	9.3	
Hori.	9920.000	AV	30.7	38.9	9.6	37.5	4.3	46.0	53.9	7.9	
Hori.	19840.000	AV	43.9	40.7	2.1	47.9	4.3	43.1	53.9	10.8	
Vert.	4960.000	AV	43.9	31.8	7.5	37.0	4.3	50.5	53.9	3.4	
Vert.	7440.000	AV	33.4	37.4	8.8	39.4	4.3	44.5	53.9	9.4	
Vert.	9920.000	AV	30.8	38.9	9.6	37.5	4.3	46.1	53.9	7.8	
Vert.	19840.000	AV	41.3	40.7	2.1	47.9	4.3	40.5	53.9	13.4	

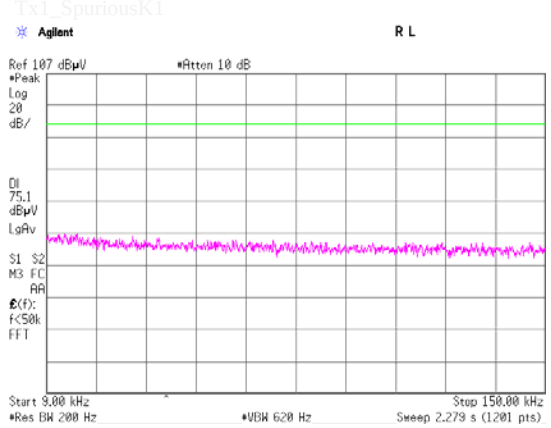
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Duty factor
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

(Reference chart) Spurious emission (Conducted)

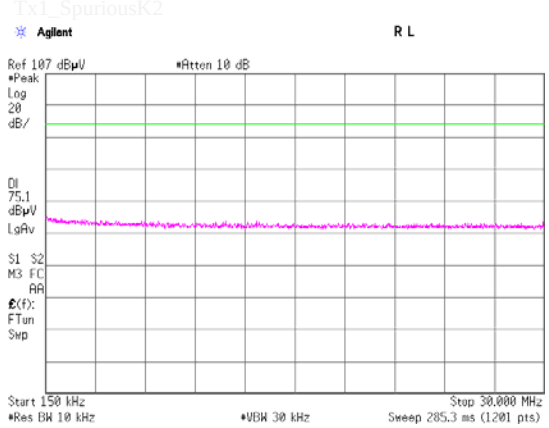
Tx, Bluetooth Low Energy, PN9

Tx, 2402MHz (below 30MHz)

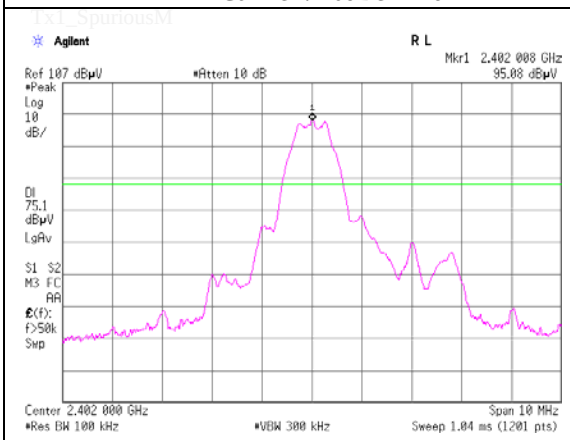
9kHz - 150kHz



150kHz - 30MHz



Carrier / 20dBc limit

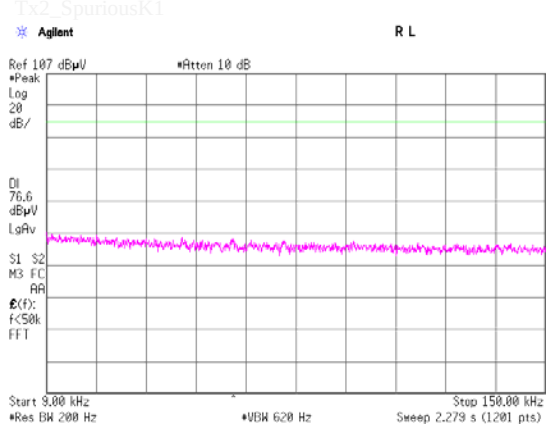


(Reference chart) Spurious emission (Conducted)

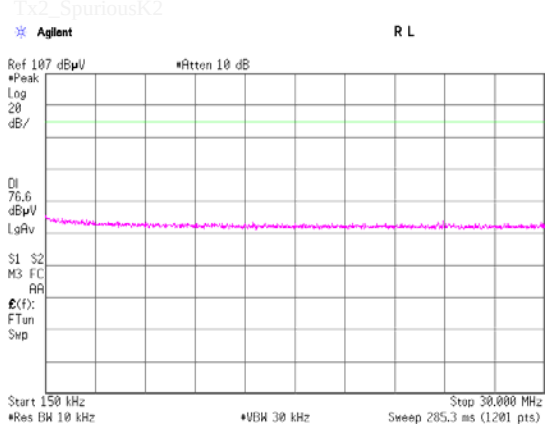
Tx, Bluetooth Low Energy, PN9

Tx, 2440MHz (below 30MHz)

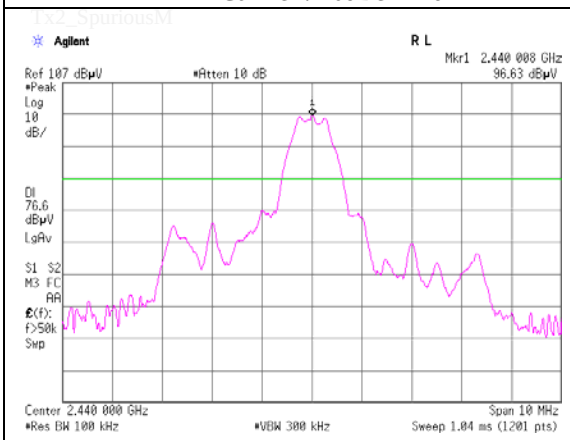
9kHz - 150kHz



150kHz - 30MHz



Carrier / 20dBc limit

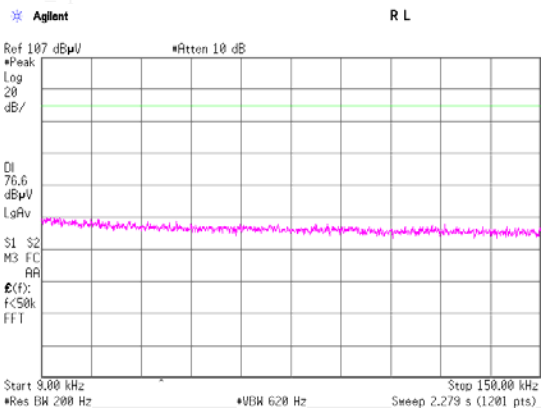


(Reference chart) Spurious emission (Conducted)

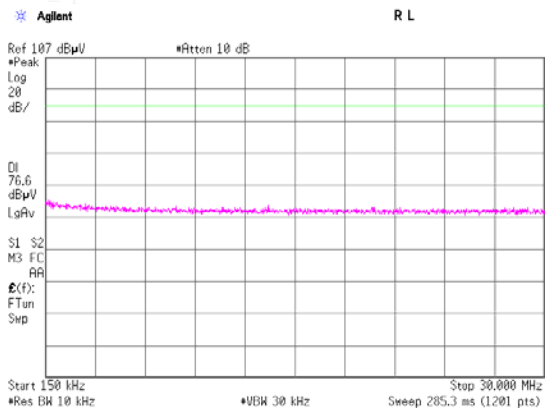
Tx, Bluetooth Low Energy, PN9

Tx, 2480MHz (below 30MHz)

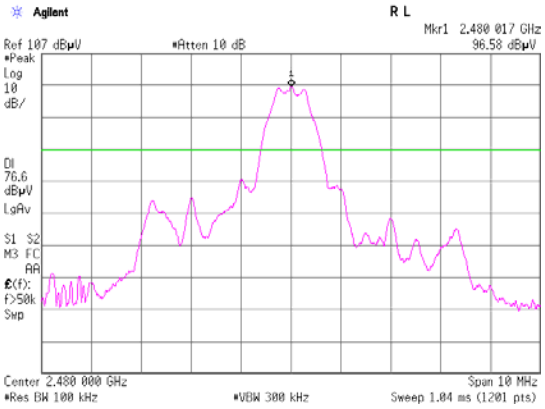
9kHz - 150kHz



150kHz - 30MHz



Carrier / 20dBc limit



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Maximum Power Spectral Density

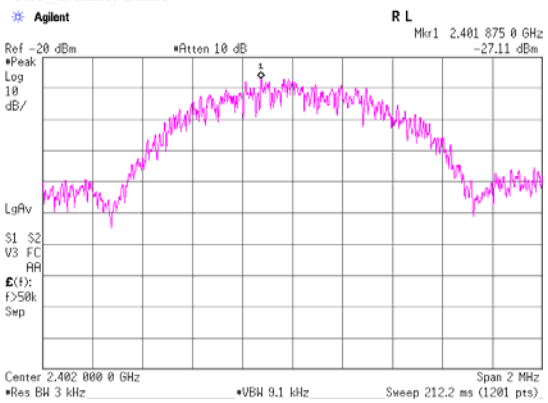
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	May 14, 2014	
Temperature / Humidity	25deg.C , 49%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth Low Energy, PN9	

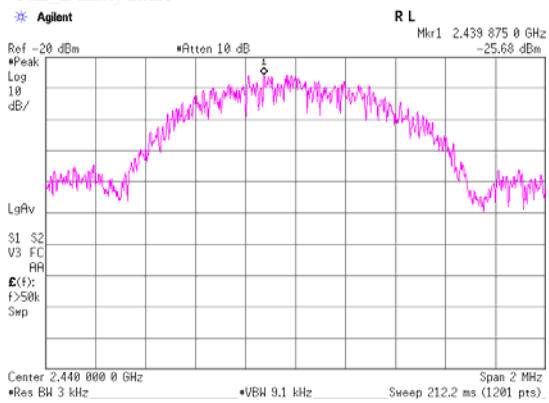
Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.0000	2401.88	-27.11	1.63	9.65	-15.83	8.00	23.83
2440.0000	2439.88	-25.68	1.64	9.66	-14.38	8.00	22.38
2480.0000	2479.88	-25.86	1.65	9.66	-14.55	8.00	22.55

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

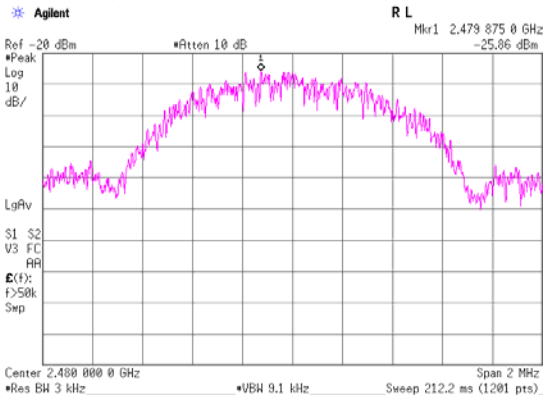
Tx, 2402MHz



Tx, 2440MHz



Tx, 2480MHz



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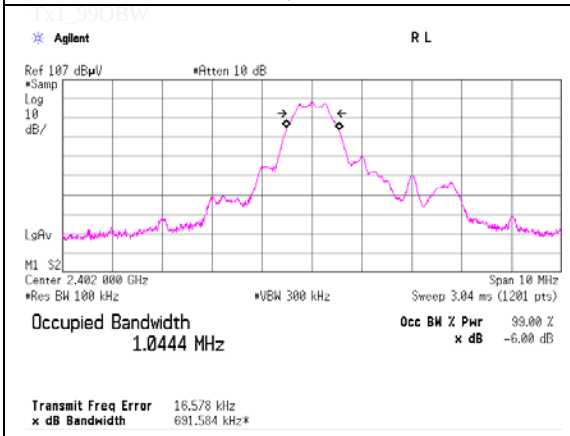
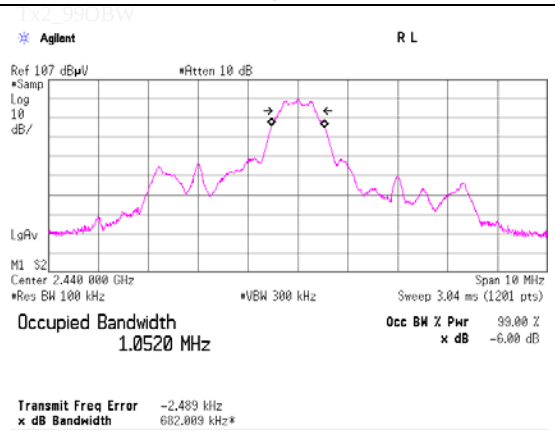
99% Occupied Bandwidth

Tx, Bluetooth Low Energy, PN9

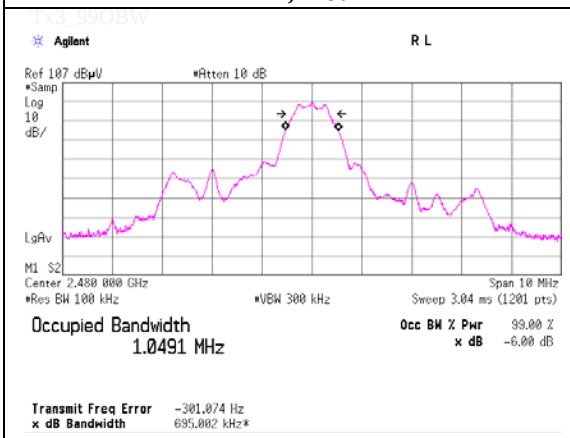
Tx, 2402MHz



Tx, 2440MHz



Tx, 2480MHz



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
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2013/11/27 ＊ 12
SCC-G14	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	AT	2014/03/13 ＊ 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
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-G01	Coaxial Cable	Suhner	SUCOFLEX 104A	46497/4A	RE	2014/04/22 ＊ 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2013/11/22 ＊ 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2013/11/22 ＊ 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2013/11/22 ＊ 12
SCC-G21	Coaxial Cable	Suhner	SUCOFLEX 104	296169/4	RE	2014/05/15 ＊ 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2014/03/17 ＊ 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/02/21 ＊ 12
SJM-15	Measure	ASKUL	-	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	RE	-
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
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2014/03/14 ＊ 12
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
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 emission
AT: Antenna terminal conducted tests