



# **RADIO TEST REPORT**

**Test Report No. : 10726974S-A**

**Applicant** : Circuit Design, Inc  
**Type of Equipment** : 2.4G Transceiver module  
**Model No.** : NK-2.4Y  
**FCC ID** : V9X-NK24Y  
**Test regulation** : FCC Part 15 Subpart C: 2015  
**Test Result** : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

**Date of test:** May 11 to 17, 2015

**Representative test engineer:**

*S. Takano*

Shinichi Takano  
Engineer  
Consumer Technology Division

**Approved by:**

*T. Arai*

Tatsuya Arai  
Engineer  
Consumer Technology Division



- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
☒ There is no testing item of "Non-accreditation".

**UL Japan, Inc.**

**Shonan EMC Lab.**

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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name : Circuit Design, Inc  
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Telephone Number : +81-263-82-1011  
Facsimile Number : +81-263-82-1012  
Contact Person : Yukinaga Koike

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

### **2.1 Identification of E.U.T.**

Type of Equipment : 2.4G Transceiver module  
Model No. : NK-2.4Y  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : Typical: DC5 V (Input mode:DC2.2 V to 5.5 V, Output mode: DC4.7 V to DC 5.5 V)  
Receipt Date of Sample : April 30, 2015  
Country of Mass-production : Japan  
Condition of EUT : Production prototype (Not for Sale: This sample is not mass-produced items.)  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

Model: NK-2.4Y (referred to as the EUT in this report) is a 2.4G Transceiver module.

### **General Specification**

Clock frequency(ies) in the system : 16MHz

### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 2403-2479MHz  
Modulation : FHSS  
Power Supply (radio part input) : DC 2.1 V

There are 3 types of Antenna.

Antenna Type	ANT-2G4S2	ANT-2G4S3	Pattern Antenna
External / Internal	External	External	Internal (Pattern)
RF Cable length	90 mm *1)	3 mm *1)	-
Antenna Gain with internal cable loss	2.14dBi	2.14dBi	-2.0dBi

\*1) ANT-2G4S2 and ANT-2G4S3 have several different length of cables. The shortest RF Cable on the specification was chosen for this test.( The highest antenna gain)

## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on January 21, 2015

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928MHz,  
2400-2483.5MHz, and 5725-5850MHz

### 3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4-2009 7. AC powerline conducted emission measurements IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	Antenna : Pattern antenna, QP 21.5dB, 0.43878MHz, L1, Tx 2439MHz	Complied	-
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (2)	See data.	Complied	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (1)		Complied	Conducted
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (4)		Complied	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (4)		Complied	Conducted
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.12	FCC: Section15.24(b)(1) IC: RSS-247 5.4 (2)		Complied	Conducted
Spurious Emission & Band Edge Compliance	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	Antenna : ANT-2G4S2 5.1dB 2483.500MHz, PK, Hori., Tx 2479MHz	Complied	Conducted/ Radiated
<p>* In case any questions arise about test procedure, ANSI C63.4-2009 is also referred.</p> <p>*Radiated test was selected over 30 MHz based on section 15.247(d).</p> <p>Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.</p>					

#### **FCC Part 15.31 (e)**

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC 2.1 V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement of 15.212.

#### **FCC Part 15.203 Antenna requirement**

ANT-2G4S2 and ANT-2G4S3 have a unique coupling/antenna connector (MHF).

Pattern Antenna is not removable from the EUT.

Therefore, the equipment complies with the antenna requirement of Section 15.203.

### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	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  $k = 2$ .  
Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)		
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR
Conducted emission (AC Mains) LISN	150kHz - 30MHz	3.6 dB	3.4 dB	3.4 dB
Radiated emission (Measurement distance: 3m)	9kHz - 30MHz	3.7 dB	3.5 dB	3.5 dB
	30MHz - 300MHz	4.9 dB	4.9 dB	4.7 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	5.7 dB	5.7 dB
	18GHz - 40GHz	4.5 dB	4.3 dB	4.3 dB

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1GHz	0.68dB
Spurious emission (Conducted) below 1GHz	1.5dB
Spurious emission (Conducted) 1GHz - 3GHz	1.7dB
Spurious emission (Conducted) 3GHz - 18GHz	2.4dB
Spurious emission (Conducted) 18GHz - 26.5GHz	2.5dB
Bandwidth Measurement	0.66%

#### Conducted Emission test

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

#### Radiated emission test

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

### 3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.  
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Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401  
JAB Accreditation No. RTL02610

Test site	IC Registration Number	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.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

### 3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

### **4.1 Operating Mode(s)**

Transmitting (Tx), Payload: PRBS9

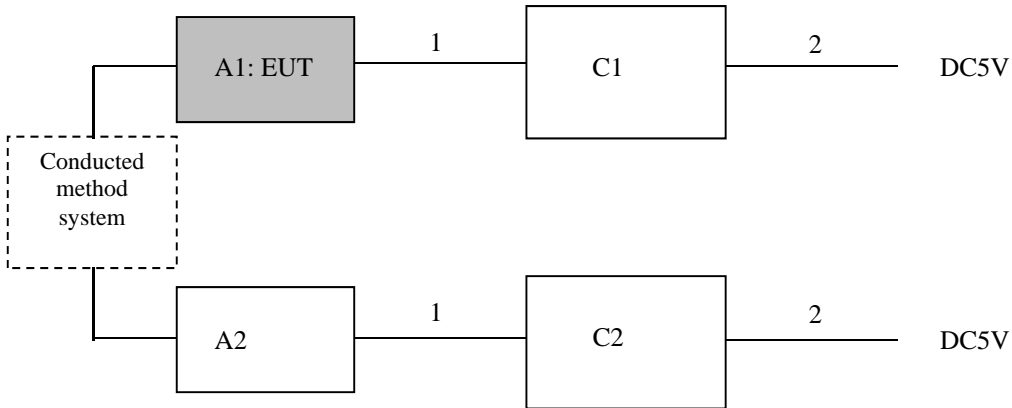
Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx -Hopping Off (Input Mode)	2403MHz 2439MHz 2479MHz
Carrier Frequency Separation	Tx -Hopping On (Input Mode / Output Mode)	-
20dB Bandwidth	Tx -Hopping Off (Input Mode)	2403MHz 2439MHz 2479MHz
Number of Hopping Frequency	Tx -Hopping On (Input Mode / Output Mode)	-
Dwell time	Tx -Hopping On (Input Mode / Output Mode)	-
Maximum Peak Output Power	Tx -Hopping Off (Input Mode)	2403MHz 2439MHz 2479MHz
Band Edge Compliance (Conducted)	Tx -Hopping On (Input Mode / Output Mode) -Hopping Off (Input Mode)	2403MHz 2479MHz
99% Occupied Bandwidth	Tx -Hopping On (Input Mode / Output Mode) -Hopping Off (Input Mode)	2403MHz 2439MHz 2479MHz
<p>*EUT has the power settings by the software as follows;  Power settings: Fixed  Firmware: U072A02_V1  Software: U072A02_V1  *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.  *EUT is operated with Input Mode and Output Mode by switching of setting.  The difference of these 2 modes is Hopping operation.  (Under Input Mode, it transmits with Hopping by itself. Under Output Mode, it transmits with Hopping by receiving signal from device of Input mode.)  Under the test with Hopping Off, Input Mode was chosen as representative since these 2 modes are equal.  Under the test with Hopping On, both two modes were carried out.</p>		

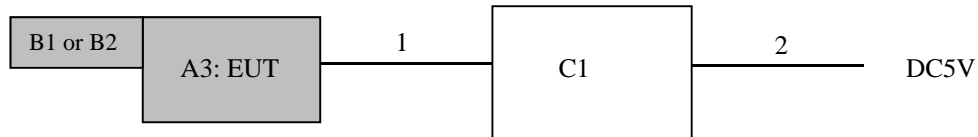


## 4.2 Configuration and peripherals

< Antenna port conducted tests (Hopping ON, Output Mode) >



< Other tests >



\* Cabling and setup(s) 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	Remarks
A1	2.4GHz Transceiver module	NK-2.4Y	3	Circuit design	EUT
A2	2.4GHz Transceiver module	NK-2.4Y	1	Circuit design	-
A3	2.4GHz Transceiver module	NK-2.4Y	*1)	Circuit design	EUT
B1	External antenna	ANT-2G4S2	-	Circuit design	EUT
B2	External antenna	ANT-2G4S3	-	Circuit design	EUT
C1	Jig	-	-	Circuit design	-
C2	Jig	-	-	Circuit design	-

\*1) Antenna port conducted tests: 1, Radiated emission tests: 1 (Using External antenna), 2 (Using Pattern antenna)

### List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	Signal	0.2	Unshielded	Unshielded	-
2	DC	1.8	Unshielded	Unshielded	-

## **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.

#### **1) For the tests on EUT with other peripherals (as a whole system)**

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded room. 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.

<b>Detector</b>	<b>: QP and CISPR AV</b>
<b>Measurement range</b>	<b>: 0.15-30MHz</b>
<b>Test data</b>	<b>: APPENDIX</b>
<b>Test result</b>	<b>: Pass</b>

## **SECTION 6: Radiated Spurious Emission**

### **Test Procedure**

EUT was placed on a urethane platform of nominal size, 0.5m by 0.5m, 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 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz *1)	RBW: 100kHz VBW: 300kHz
Test Distance	3m	3m*2) (below 15GHz), 1m*3) (above 15GHz)		3m*2) (below 15GHz), 1m*3) (above 15GHz)

\*1) Although DA 00-705 accepts VBW=10Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.

\*2) Distance Factor:  $20 \times \log(4.43\text{m}/3.0\text{m}) = 3.4\text{dB}$

\*3) Distance Factor:  $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

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

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

<b>Measurement range</b>	<b>: 30M-26.5GHz</b>
<b>Test data</b>	<b>: APPENDIX</b>
<b>Test result</b>	<b>: Pass</b>

## **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
20dB Bandwidth	3MHz	30kHz	100kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5% of OBW	Three times of RBW	Auto	Sample	Max Hold *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *3)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	10MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30MHz	300kHz	1MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100kHz, 1MHz	300kHz, 3MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *2)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10kHz	30kHz				
	30MHz to 25GHz	100kHz	300kHz				
Conducted Spurious Emission Band Edge compliance	20MHz	200kHz	620kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) Peak hold was applied as Worst-case measurement. *2) 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) *3) Reference data							

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: Test data

### Conducted Emission(Antenna : ANT-2G4S2)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 17, 2015  
Temperature / Humidity : 24deg. C / 58% RH  
Engineer : Shinichi Takano  
Mode : Tx

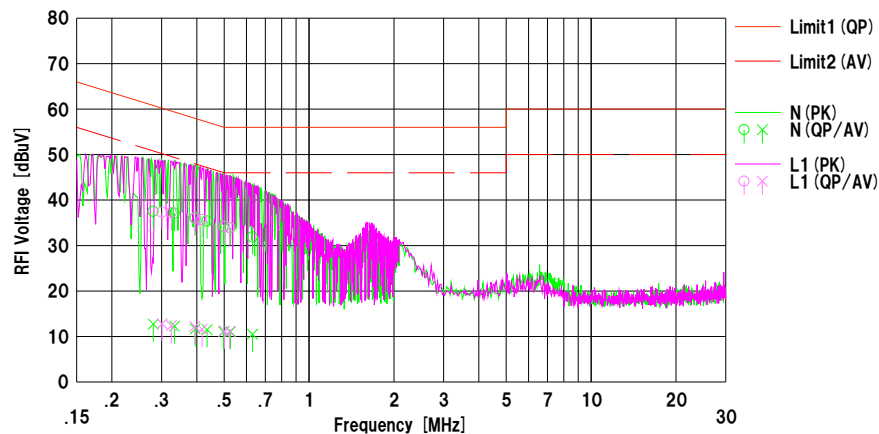
## DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/05/17

Mode : Tx 2439MHz  
Power : AC120V/60Hz (DC Power Supply)  
Temp./Humi. : 24deg.C / 58%RH

Limit1 : FCC 15C (15.207) QP  
Limit2 : FCC 15C (15.207) AV

Engineer : Shinichi Takano



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.28054	25.1	0.3	12.4	37.5	12.7	60.7	50.7	23.2	38.0	N	
2	0.33361	24.7	-0.1	12.4	37.1	12.3	59.3	49.3	22.2	37.0	N	
3	0.39523	23.7	-0.7	12.4	36.1	11.7	57.9	47.9	21.8	36.2	N	
4	0.43501	23.0	-0.9	12.4	35.4	11.5	57.1	47.1	21.7	35.6	N	
5	0.49720	21.8	-1.3	12.4	34.2	11.1	56.0	46.0	21.8	34.9	N	
6	0.52633	21.4	-1.4	12.5	33.9	11.1	56.0	46.0	22.1	34.9	N	
7	0.63054	19.5	-1.9	12.4	31.9	10.5	56.0	46.0	24.1	35.5	N	
8	0.30127	24.9	0.4	12.4	37.3	12.8	60.2	50.2	22.9	37.4	L1	
9	0.32536	24.8	0.0	12.4	37.2	12.4	59.5	49.5	22.3	37.1	L1	
10	0.39357	23.6	-0.2	12.4	36.0	12.2	57.9	47.9	21.9	35.7	L1	
11	0.41767	23.3	-0.8	12.4	35.7	11.8	57.4	47.4	21.7	35.8	L1	
12	0.50181	21.7	-1.3	12.5	34.2	11.2	56.0	46.0	21.8	34.8	L1	
13	0.52294	21.4	-1.4	12.5	33.9	11.1	56.0	46.0	22.1	34.9	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN: SLS-05

UL Japan, Inc.

Shonan EMC Lab.

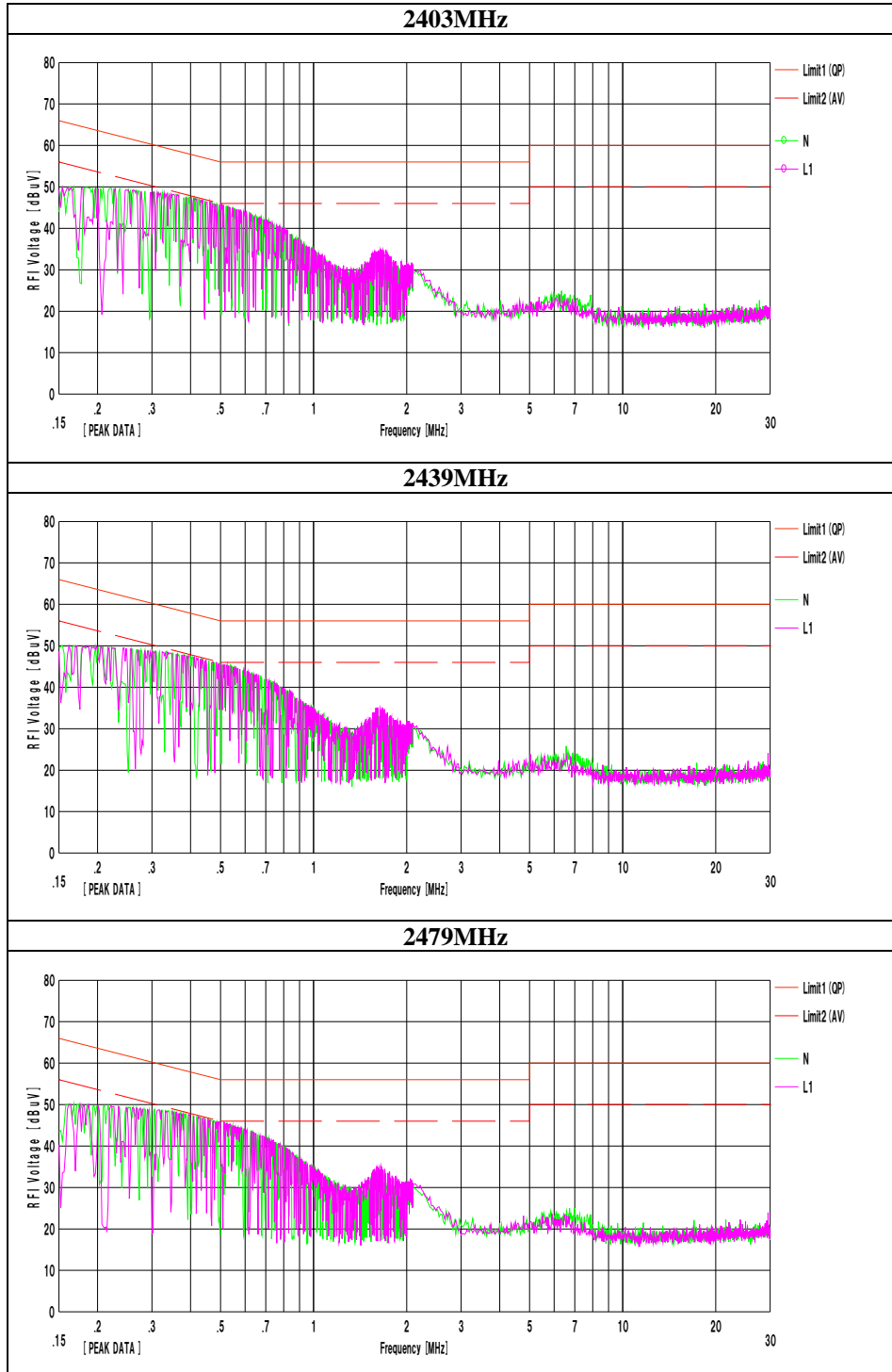
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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### Conducted Emission(Antenna : ANT-2G4S2)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10726974S-A
Date	May 17, 2015
Temperature / Humidity	24deg. C / 58% RH
Engineer	Shinichi Takano
Mode	Tx



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## Conducted Emission(Antenna : ANT-2G4S3)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 17, 2015  
Temperature / Humidity : 24deg. C / 58% RH  
Engineer : Shinichi Takano  
Mode : Tx

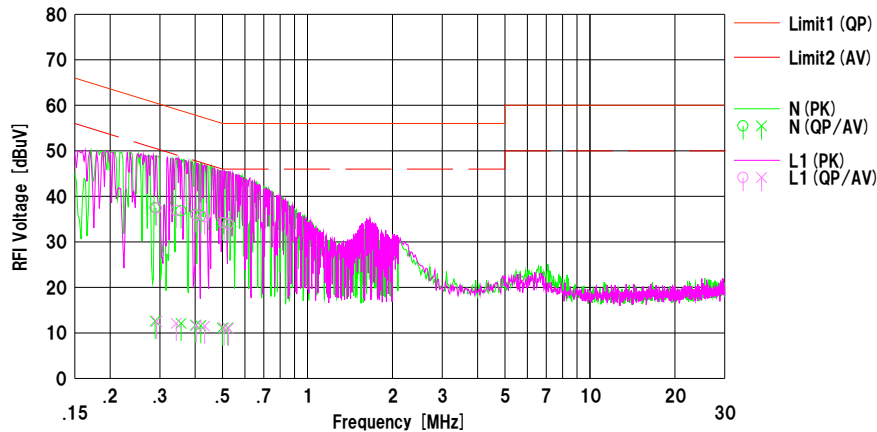
## DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/05/17

Mode : Tx 2439MHz  
Power : AC120V/60Hz (DC Power Supply)  
Temp./Humi. : 24deg.C / 58%RH

Limit1 : FCC 15C (15.207) QP  
Limit2 : FCC 15C (15.207) AV

Engineer : Shinichi Takano

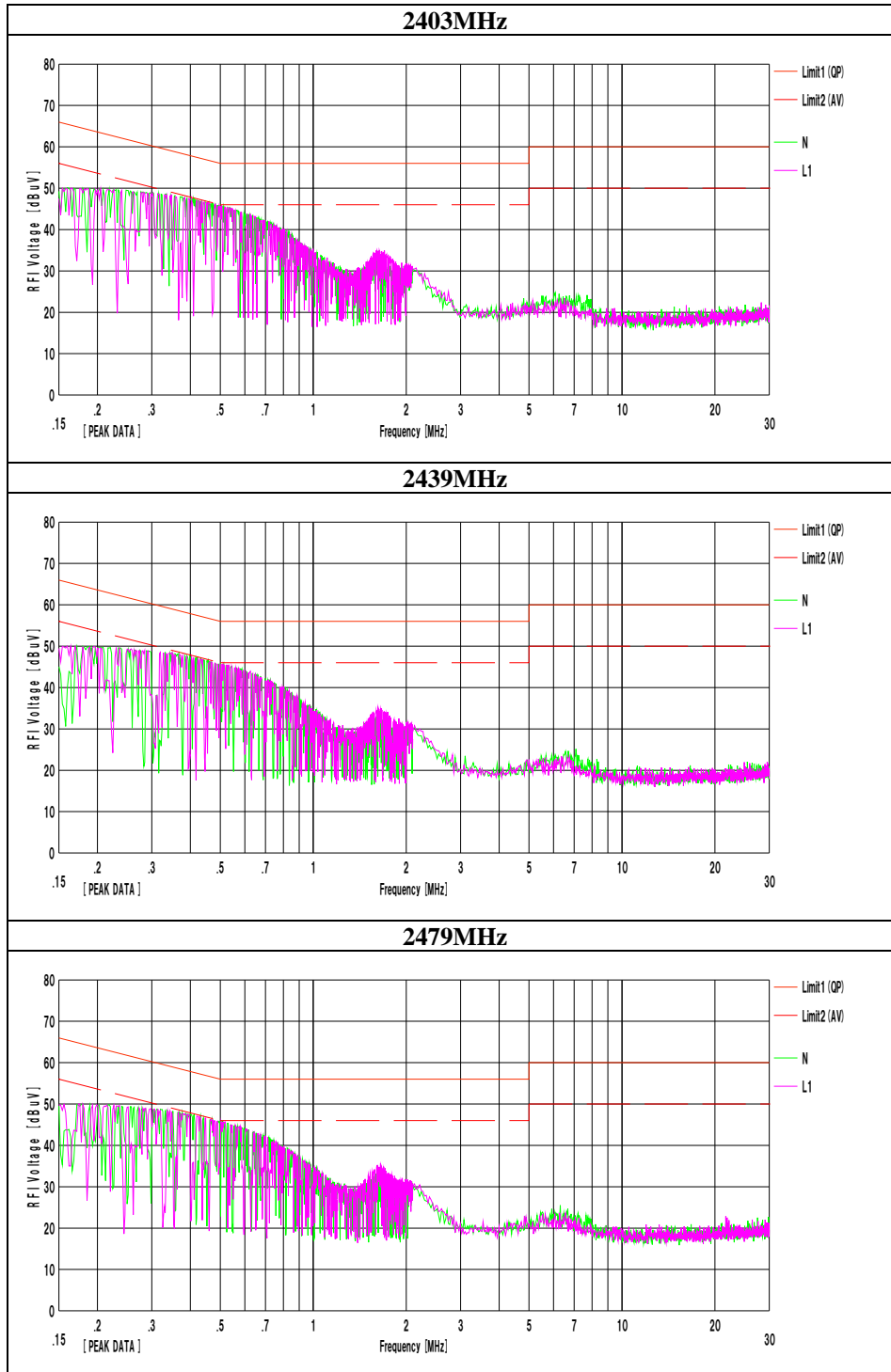


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.28866	25.1	0.2	12.4	37.5	12.6	60.5	50.5	23.0	37.9	N	
2	0.35670	24.4	-0.3	12.4	36.8	12.1	58.8	48.8	22.0	36.7	N	
3	0.40127	23.6	-0.7	12.4	36.0	11.7	57.8	47.8	21.8	36.1	N	
4	0.41903	23.3	-0.8	12.4	35.7	11.6	57.4	47.4	21.7	35.8	N	
5	0.49947	21.8	-1.3	12.4	34.2	11.1	56.0	46.0	21.8	34.9	N	
6	0.52192	21.5	-1.4	12.5	34.0	11.1	56.0	46.0	22.0	34.9	N	
7	0.29201	25.0	0.1	12.4	37.4	12.5	60.4	50.4	23.0	37.9	L1	
8	0.34297	24.5	-0.3	12.4	36.9	12.1	59.1	49.1	22.2	37.0	L1	
9	0.40361	23.5	-0.7	12.4	35.9	11.7	57.7	47.7	21.8	36.0	L1	
10	0.43196	23.1	-0.9	12.4	35.5	11.5	57.2	47.2	21.7	35.7	L1	
11	0.50696	21.7	-1.4	12.5	34.2	11.1	56.0	46.0	21.8	34.9	L1	
12	0.52454	21.4	-1.5	12.5	33.9	11.0	56.0	46.0	22.1	35.0	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN: SLS-05

### Conducted Emission(Antenna : ANT-2G4S3)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10726974S-A
Date	May 17, 2015
Temperature / Humidity	24deg. C / 58% RH
Engineer	Shinichi Takano
Mode	Tx



**UL Japan, Inc.**

**Shonan EMC Lab.**

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## Conducted Emission(Antenna : Pattern antenna)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 17, 2015  
Temperature / Humidity : 24deg. C / 58% RH  
Engineer : Shinichi Takano  
Mode : Tx

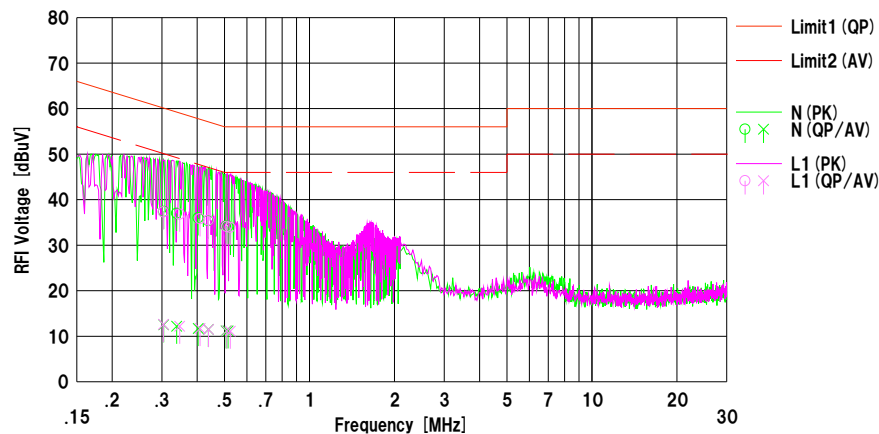
## DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/05/17

Mode : Tx 2439MHz  
Power : AC120V/60Hz (DC Power Supply)  
Temp./Humi. : 24deg.C / 58%RH

Limit1 : FCC 15C (15.207) QP  
Limit2 : FCC 15C (15.207) AV

Engineer : Shinichi Takano



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.30444	25.0	0.1	12.4	37.4	12.5	60.1	50.1	22.7	37.6	N	
2	0.33846	24.6	-0.2	12.4	37.0	12.2	59.2	49.2	22.2	37.0	N	
3	0.40344	23.6	-0.7	12.4	36.0	11.7	57.7	47.7	21.7	36.0	N	
4	0.43848	23.0	-0.9	12.4	35.4	11.5	57.0	47.0	21.6	35.5	N	
5	0.50687	21.7	-1.3	12.5	34.2	11.2	56.0	46.0	21.8	34.8	N	
6	0.51469	21.6	-1.3	12.5	34.1	11.2	56.0	46.0	21.9	34.8	N	
7	0.30403	24.9	0.2	12.4	37.3	12.6	60.1	50.1	22.8	37.5	L1	
8	0.34685	24.4	-0.2	12.4	36.8	12.2	59.0	49.0	22.2	36.8	L1	
9	0.40950	23.4	-0.7	12.4	35.8	11.7	57.6	47.6	21.8	35.9	L1	
10	0.43878	23.1	-0.9	12.4	35.5	11.5	57.0	47.0	21.5	35.5	L1	
11	0.50899	21.6	-1.3	12.5	34.1	11.2	56.0	46.0	21.9	34.8	L1	
12	0.52410	21.4	-1.4	12.5	33.9	11.1	56.0	46.0	22.1	34.9	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN: SLS-05

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Shonan EMC Lab.

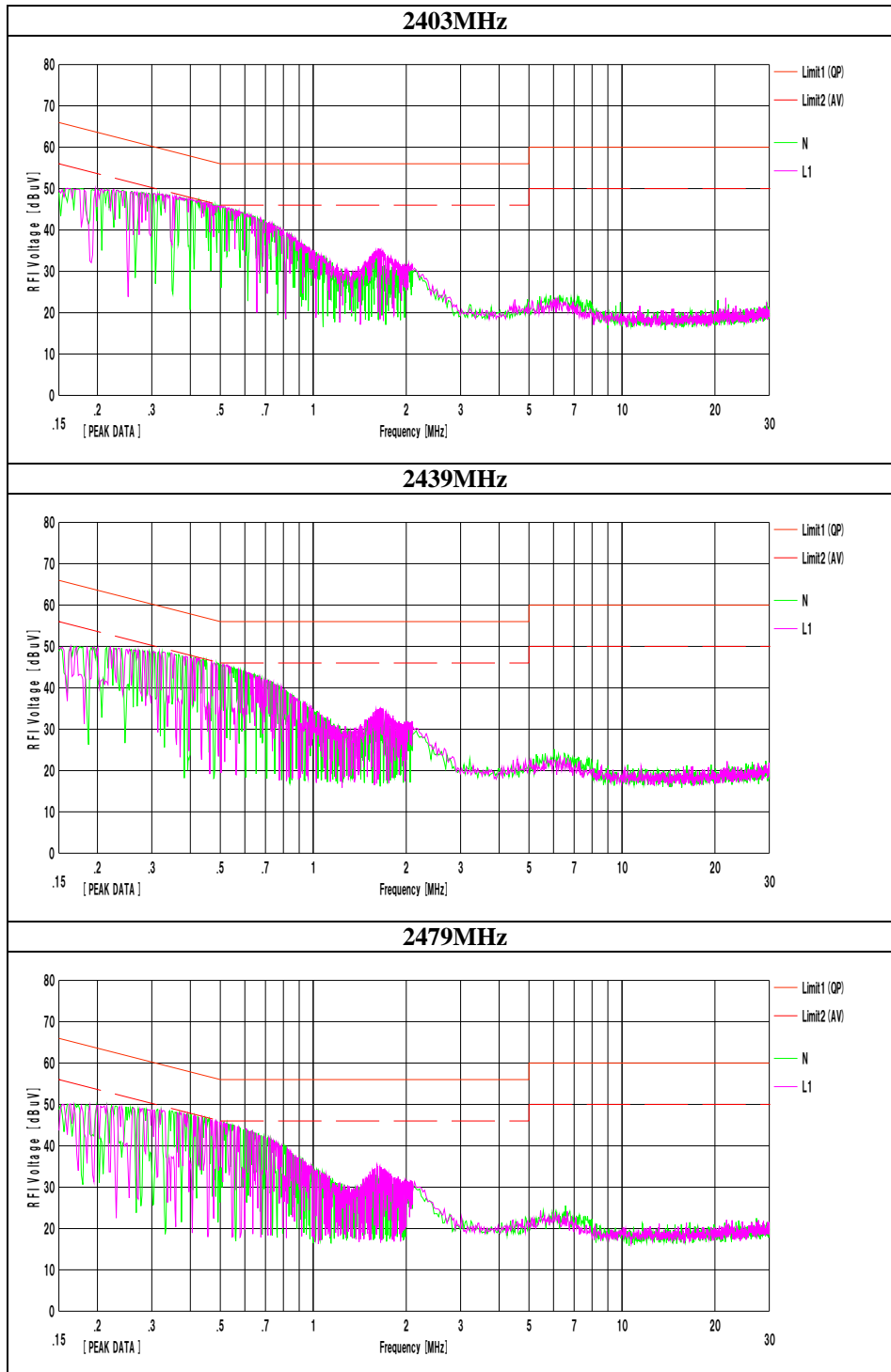
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### Conducted Emission(Antenna : Pattern antenna)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10726974S-A
Date	May 17, 2015
Temperature / Humidity	24deg. C / 58% RH
Engineer	Shinichi Takano
Mode	Tx



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## **20dB Bandwidth and Carrier Frequency Separation**

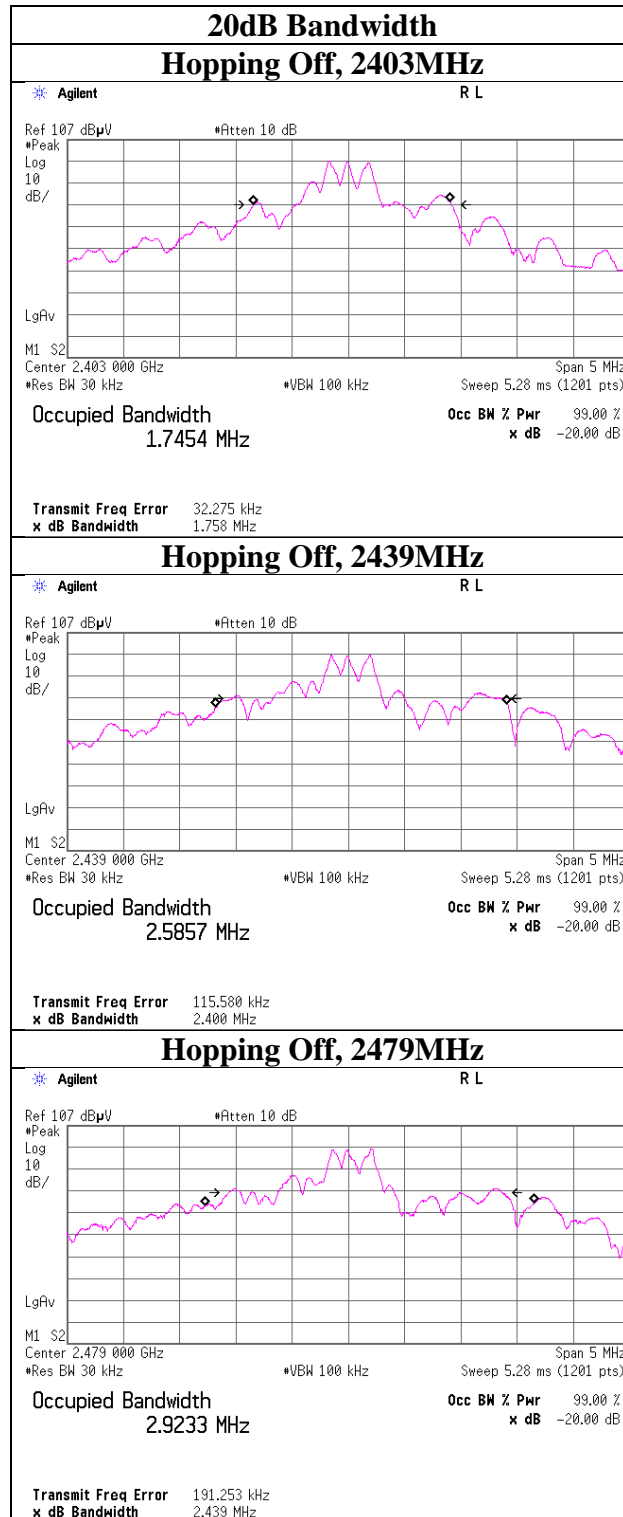
Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                     10726974S-A  
Date                             May 11, 2015  
Temperature / Humidity      26deg. C / 31% RH  
Engineer                       Shinichi Takano  
Mode                             Tx

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
Input Mode	2403.0	1.758	4.000	>= 1.758
Input Mode	2439.0	2.400	4.000	>= 2.400
Input Mode	2479.0	2.439	4.000	>= 2.439
Output Mode	2403.0	1.758	4.000	>= 1.758
Output Mode	2439.0	2.400	4.000	>= 2.400
Output Mode	2479.0	2.439	4.000	>= 2.439

Limit: 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

## 20dB Bandwidth and Carrier Frequency Separation



UL Japan, Inc.

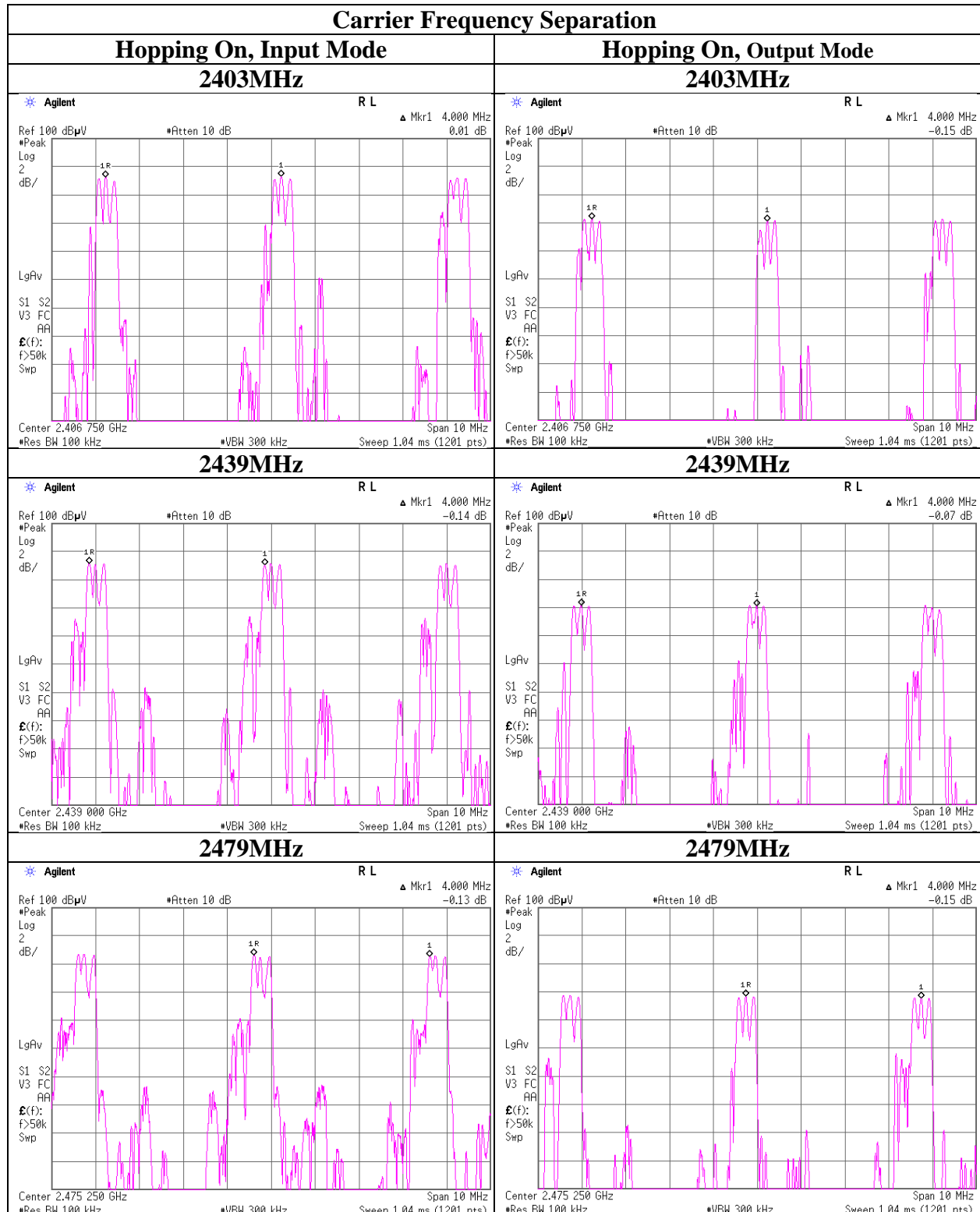
Shonan EMC Lab.

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## 20dB Bandwidth and Carrier Frequency Separation



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Telephone : +81 463 50 6400

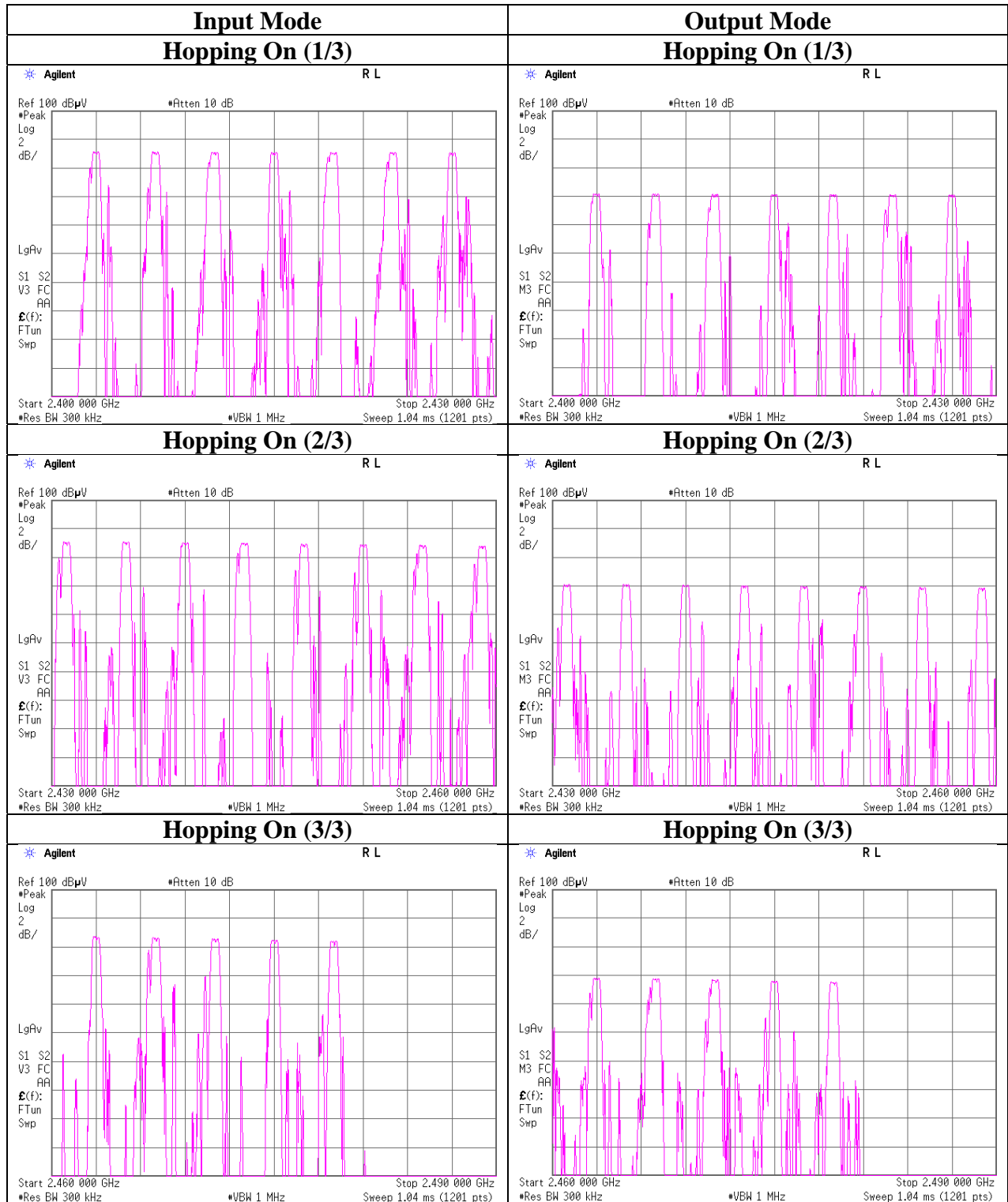
Facsimile : +81 463 50 6401

### **Number of Hopping Frequency**

Test place Shonan EMC Lab. No. No.5 Shielded Room  
Report No. 10726974S-A  
Date May 11, 2015  
Temperature / Humidity 26deg. C / 31% RH  
Engineer Shinichi Takano  
Mode Tx Hopping On

Mode	Number of channel [channels]	Limit [channels]
Input Mode	20	$\geq 15$
Output Mode	20	$\geq 15$

## Number of Hopping Frequency



**UL Japan, Inc.**

**Shonan EMC Lab.**

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## Dwell time

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10726974S-A
Date	May 11, 2015
Temperature / Humidity	26deg. C / 31% RH
Engineer	Shinichi Takano
Mode	Tx Hopping On

Mode	Number of transmission in a 8.0(20 Hopping x 0.4)	Length of transmission [msec]	Result [msec]	Limit [msec]
Input Mode	24.2 times / 5 sec. x 8.0 sec. = 39 times	0.722	28	400
Output Mode	24.6 times / 5 sec. x 8.0 sec. = 40 times	0.721	29	400

Sample Calculation

Result = Number of transmission x Length of transmission

\*Average data of 5 tests.(except Inquiry)

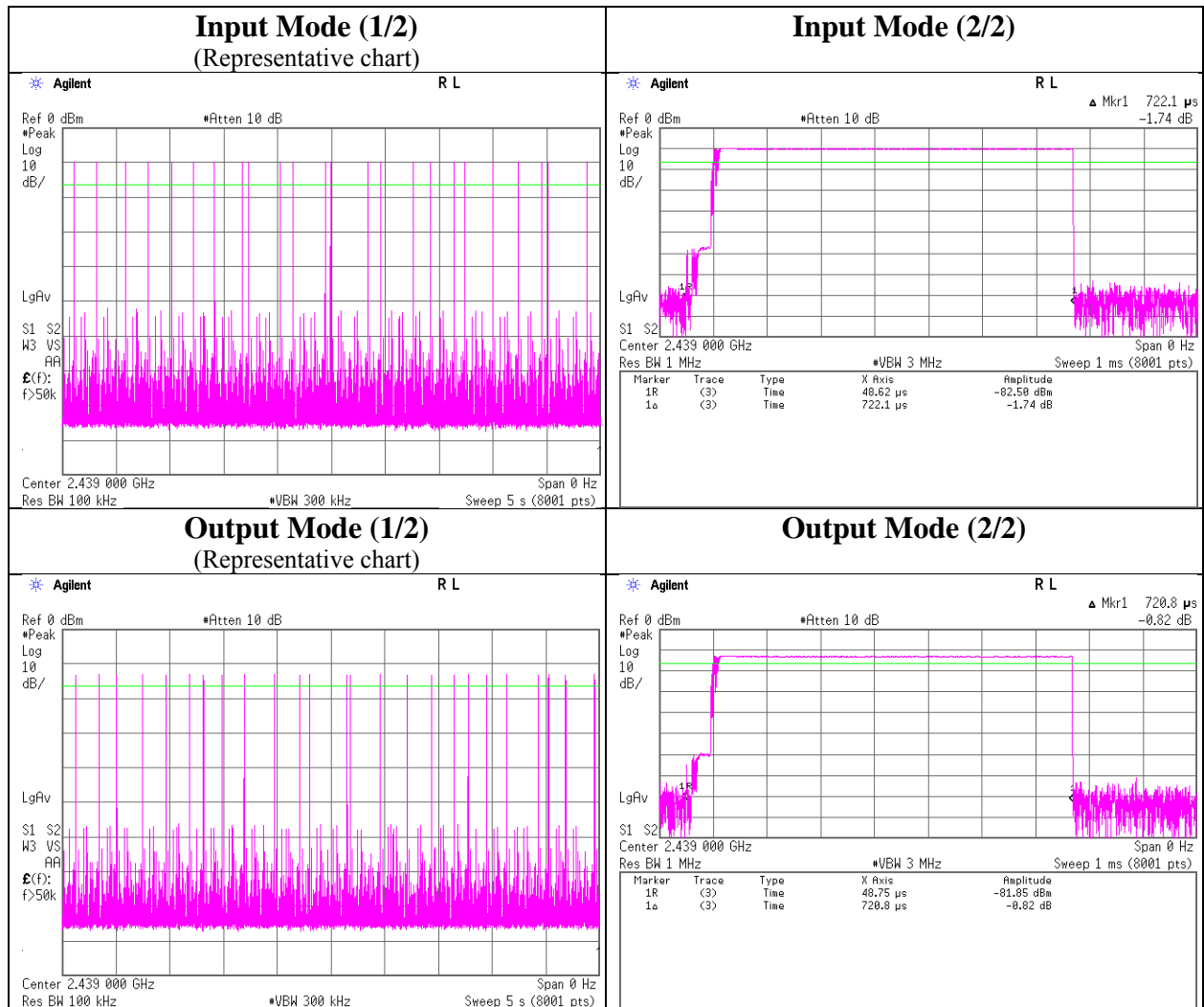
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
Input Mode	24	24	24	25	24	24.2
Output Mode	25	24	25	25	24	24.6

Sample Calculation

Average = Summation (Sampling 1 to 5) / 5



## Dwell time



**UL Japan, Inc.**

**Shonan EMC Lab.**

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### **Maximum Peak Output Power**

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 10726974S-A  
Date May 11, 2015  
Temperature / Humidity 26deg. C / 31% RH  
Engineer Shinichi Takano  
Mode Tx Hopping Off

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2403.0	-9.79	1.43	9.63	1.27	1.34	20.96	125	19.69
2439.0	-9.88	1.42	9.63	1.17	1.31	20.96	125	19.79
2479.0	-10.43	1.43	9.63	0.63	1.16	20.96	125	20.33

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

\*The equipment and cables were not used for factor 0dB of the data sheets.

**Average Output Power**  
**(Reference data)**

Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                    10726974S-A  
Date                            May 11, 2015  
Temperature / Humidity      26deg. C / 31% RH  
Engineer                      Shinichi Takano  
Mode                            Tx Hopping Off

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result	
					[dBm]	[mW]
2403.0	-9.97	1.43	9.63	0.00	1.09	1.29
2439.0	-10.06	1.42	9.63	0.00	0.99	1.26
2479.0	-10.66	1.43	9.63	0.00	0.40	1.10

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

\*The equipment and cables were not used for factor 0dB of the data sheets.

\* Power was measured with using the gate function of power meter.

It was means that the intervals during which the transmitter is off or is transmitting at reduced power level is not included in the average.

Therefore, there is no need to add duty cycle correction to the result.

## Radiated Spurious Emission(Antenna : ANT-2G4S2)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015  
Temperature / Humidity : 23deg. C / 59% RH  
Engineer : Akira Sato  
Mode : Tx 2403MHz

May 14, 2015  
24deg. C / 47% RH  
Kenichi Adachi  
(1 GHz – 18 GHz)

May 17, 2015  
24deg. C / 58% RH  
Shinichi Takano  
(18 GHz – 25 GHz)

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	191.327	QP	21.4	16.2	7.9	32.0	0.0	13.5	43.5	30.0	150	1	
Hori.	618.469	QP	21.2	19.5	10.0	31.9	0.0	18.8	46.0	27.2	100	359	
Hori.	929.936	QP	20.3	22.8	11.1	30.7	0.0	23.5	46.0	22.5	100	0	
Hori.	1195.000	PK	45.1	24.1	12.5	40.9	3.4	44.2	73.9	29.7	100	0	
Hori.	2390.000	PK	57.0	26.4	13.6	41.1	3.4	59.3	73.9	14.6	100	306	
Hori.	4806.000	PK	51.6	30.6	5.6	39.8	3.4	51.4	73.9	22.5	100	99	
Hori.	7209.000	PK	45.2	36.6	7.1	40.2	3.4	52.1	73.9	21.8	100	0	
Hori.	9612.000	PK	44.0	38.5	8.1	40.1	3.4	53.9	73.9	20.0	100	0	
Hori.	12015.000	PK	44.7	39.5	9.2	39.6	3.4	57.2	73.9	16.7	100	0	
Hori.	1195.000	AV	33.5	24.1	12.5	40.9	3.4	32.6	53.9	21.3	100	0	
Hori.	2390.000	AV	33.5	26.4	13.6	41.1	3.4	35.8	53.9	18.1	100	306	
Hori.	4806.000	AV	35.1	30.6	5.6	39.8	3.4	34.9	53.9	19.0	100	99	
Hori.	7209.000	AV	32.5	36.6	7.1	40.2	3.4	39.4	53.9	14.5	100	0	
Hori.	9612.000	AV	31.9	38.5	8.1	40.1	3.4	41.8	53.9	12.1	100	0	
Hori.	12015.000	AV	31.4	39.5	9.2	39.6	3.4	43.9	53.9	10.0	100	0	
Vert.	30.661	QP	22.4	17.2	6.7	32.1	0.0	14.2	40.0	25.8	100	359	
Vert.	36.628	QP	22.3	15.4	6.7	32.1	0.0	12.3	40.0	27.7	100	0	
Vert.	165.727	QP	21.7	15.4	8.0	32.0	0.0	13.1	43.5	30.4	100	359	
Vert.	1195.000	PK	45.9	24.1	12.5	40.9	3.4	45.0	73.9	28.9	100	0	
Vert.	2390.000	PK	55.6	26.4	13.6	41.1	3.4	57.9	73.9	16.0	100	147	
Vert.	4806.000	PK	51.6	30.6	5.6	39.8	3.4	51.4	73.9	22.5	100	75	
Vert.	7209.000	PK	44.7	36.6	7.1	40.2	3.4	51.6	73.9	22.3	100	0	
Vert.	9612.000	PK	44.0	38.5	8.1	40.1	3.4	53.9	73.9	20.0	100	0	
Vert.	12015.000	PK	45.6	39.5	9.2	39.6	3.4	58.1	73.9	15.8	100	0	
Vert.	1195.000	AV	34.0	24.1	12.5	40.9	3.4	33.1	53.9	20.8	100	0	
Vert.	2390.000	AV	33.7	26.4	13.6	41.1	3.4	36.0	53.9	17.9	100	147	
Vert.	4806.000	AV	35.4	30.6	5.6	39.8	3.4	35.2	53.9	18.7	100	75	
Vert.	7209.000	AV	33.0	36.6	7.1	40.2	3.4	39.9	53.9	14.0	100	0	
Vert.	9612.000	AV	32.7	38.5	8.1	40.1	3.4	42.6	53.9	11.3	100	0	
Vert.	12015.000	AV	33.0	39.5	9.2	39.6	3.4	45.5	53.9	8.4	100.0	0.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.43\text{ m} / 3.0\text{ m}) = 3.4\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2403.000	PK	94.5	26.4	13.6	41.1	3.4	96.8	-	-	Carrier
Hori.	2400.000	PK	56.8	26.4	13.6	41.1	3.4	59.1	76.8	17.7	
Vert.	2403.000	PK	93.9	26.4	13.6	41.1	3.4	96.2	-	-	Carrier
Vert.	2400.000	PK	56.2	26.4	13.6	41.1	3.4	58.5	76.2	17.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.43\text{ m} / 3.0\text{ m}) = 3.4\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

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## Radiated Spurious Emission(Antenna : ANT-2G4S2)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015      May 14, 2015      May 17, 2015  
Temperature / Humidity : 23deg. C / 59% RH      24deg. C / 47% RH      24deg. C / 58% RH  
Engineer : Akira Sato      Kenichi Adachi      Shinichi Takano  
(30 MHz-1000 MHz)      (1 GHz – 18 GHz)      (18 GHz – 25 GHz)  
Mode : Tx 2439MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	31.991	QP	22.5	16.8	6.7	32.1	0.0	13.9	40.0	26.1	300	0	
Hori.	209.306	QP	21.9	16.4	8.2	32.0	0.0	14.5	43.5	29.0	150	359	
Hori.	690.865	QP	21.3	20.4	10.2	31.8	0.0	20.1	46.0	25.9	100	359	
Hori.	1216.000	PK	44.9	24.2	12.5	40.9	3.4	44.1	73.9	29.8	100	0	
Hori.	4878.000	PK	51.4	30.9	5.6	39.7	3.4	51.6	73.9	22.3	154	230	
Hori.	7317.000	PK	44.8	36.8	7.0	40.3	3.4	51.7	73.9	22.2	100	0	
Hori.	9756.000	PK	45.1	38.6	8.1	40.0	3.4	55.2	73.9	18.7	100	0	
Hori.	12195.000	PK	44.3	39.4	9.3	39.8	3.4	56.6	73.9	17.3	100	0	
Hori.	1216.000	AV	33.4	24.2	12.5	40.9	3.4	32.6	53.9	21.3	100	0	
Hori.	4878.000	AV	34.7	30.9	5.6	39.7	3.4	34.9	53.9	19.0	154	230	
Hori.	7317.000	AV	33.8	36.8	7.0	40.3	3.4	40.7	53.9	13.2	100	0	
Hori.	9756.000	AV	32.9	38.6	8.1	40.0	3.4	43.0	53.9	10.9	100	0	
Hori.	12195.000	AV	32.2	39.4	9.3	39.8	3.4	44.5	53.9	9.4	100	0	
Vert.	35.587	QP	21.9	15.7	6.7	32.1	0.0	12.2	40.0	27.8	100	0	
Vert.	187.136	QP	22.4	16.1	7.9	32.0	0.0	14.4	43.5	29.1	100	359	
Vert.	649.909	QP	21.3	19.9	10.1	31.9	0.0	19.4	46.0	26.6	100	0	
Vert.	1216.000	PK	45.4	24.2	12.5	40.9	3.4	44.6	73.9	29.3	100	0	
Vert.	4878.000	PK	51.3	30.9	5.6	39.7	3.4	51.5	73.9	22.4	100	253	
Vert.	7317.000	PK	44.8	36.8	7.0	40.3	3.4	51.7	73.9	22.2	100	0	
Vert.	9756.000	PK	43.9	38.6	8.1	40.0	3.4	54.0	73.9	19.9	100	0	
Vert.	12195.000	PK	44.6	39.4	9.3	39.8	3.4	56.9	73.9	17.0	100	0	
Vert.	1216.000	AV	33.9	24.2	12.5	40.9	3.4	33.1	53.9	20.8	100	0	
Vert.	4878.000	AV	35.0	30.9	5.6	39.7	3.4	35.2	53.9	18.7	100	253	
Vert.	7317.000	AV	33.5	36.8	7.0	40.3	3.4	40.4	53.9	13.5	100	0	
Vert.	9756.000	AV	32.8	38.6	8.1	40.0	3.4	42.9	53.9	11.0	100	0	
Vert.	12195.000	AV	32.9	39.4	9.3	39.8	3.4	45.2	53.9	8.7	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.43\text{ m} / 3.0\text{ m}) = 3.4\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

**UL Japan, Inc.**

**Shonan EMC Lab.**

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## Radiated Spurious Emission(Antenna : ANT-2G4S2)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015      May 14, 2015      May 17, 2015  
Temperature / Humidity : 23deg. C / 59% RH      24deg. C / 47% RH      24deg. C / 58% RH  
Engineer : Akira Sato      Kenichi Adachi      Shinichi Takano  
(30 MHz-1000 MHz)      (1 GHz – 18 GHz)      (18 GHz – 25 GHz)  
Mode : Tx 2479MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	30.499	QP	22.9	17.2	6.7	32.1	0.0	14.7	40.0	25.3	300	351	
Hori.	161.162	QP	22.5	15.2	8.0	32.0	0.0	13.7	43.5	29.8	150	359	
Hori.	840.526	QP	20.7	21.6	10.8	31.3	0.0	21.8	46.0	24.2	150	1	
Hori.	1237.000	PK	45.7	24.2	12.5	40.9	3.4	44.9	73.9	29.0	100	0	
Hori.	2483.500	PK	66.3	26.6	13.6	41.1	3.4	68.8	73.9	5.1	100	303	
Hori.	2485.000	PK	64.7	26.6	13.6	41.1	3.4	67.2	73.9	6.7	100	300	
Hori.	4958.000	PK	57.3	31.2	5.7	39.6	3.4	58.0	73.9	15.9	100	229	
Hori.	7437.000	PK	46.7	37.0	7.0	40.4	3.4	53.7	73.9	20.2	100	0	
Hori.	9916.000	PK	44.8	38.6	8.0	39.9	3.4	54.9	73.9	19.0	100	0	
Hori.	12395.000	PK	44.8	39.3	9.4	40.0	3.4	56.9	73.9	17.0	100	0	
Hori.	1237.000	AV	33.9	24.2	12.5	40.9	3.4	33.1	53.9	20.8	100	0	
Hori.	2483.500	AV	33.7	26.6	13.6	41.1	3.4	36.2	53.9	17.7	100	303	
Hori.	2485.000	AV	33.7	26.6	13.6	41.1	3.4	36.2	53.9	17.7	100	300	
Hori.	4958.000	AV	38.5	31.2	5.7	39.6	3.4	39.2	53.9	14.7	100	229	
Hori.	7437.000	AV	34.0	37.0	7.0	40.4	3.4	41.0	53.9	12.9	100	0	
Hori.	9916.000	AV	33.4	38.6	8.0	39.9	3.4	43.5	53.9	10.4	100	0	
Hori.	12395.000	AV	33.5	39.3	9.4	40.0	3.4	45.6	53.9	8.3	100	0	
Vert.	32.205	QP	22.4	16.7	6.7	32.1	0.0	13.7	40.0	26.3	100	359	
Vert.	189.697	QP	22.3	16.2	7.9	32.0	0.0	14.4	43.5	29.1	100	0	
Vert.	796.777	QP	21.1	21.0	10.7	31.5	0.0	21.3	46.0	24.7	100	0	
Vert.	1237.000	PK	45.1	24.2	12.5	40.9	3.4	44.3	73.9	29.6	100	0	
Vert.	2483.500	PK	65.0	26.6	13.6	41.1	3.4	67.5	73.9	6.4	100	45	
Vert.	2485.000	PK	63.3	26.6	13.6	41.1	3.4	65.8	73.9	8.1	100	45	
Vert.	4958.000	PK	56.7	31.2	5.7	39.6	3.4	57.4	73.9	16.5	100	36	
Vert.	7437.000	PK	45.5	37.0	7.0	40.4	3.4	52.5	73.9	21.4	100	0	
Vert.	9916.000	PK	44.9	38.6	8.0	39.9	3.4	55.0	73.9	18.9	100	0	
Vert.	12395.000	PK	44.7	39.3	9.4	40.0	3.4	56.8	73.9	17.1	100	0	
Vert.	1237.000	AV	34.0	24.2	12.5	40.9	3.4	33.2	53.9	20.7	100	0	
Vert.	2483.500	AV	33.8	26.6	13.6	41.1	3.4	36.3	53.9	17.6	100	45	
Vert.	2485.000	AV	34.3	26.6	13.6	41.1	3.4	36.8	53.9	17.1	100	45	
Vert.	4958.000	AV	38.2	31.2	5.7	39.6	3.4	38.9	53.9	15.0	100	36	
Vert.	7437.000	AV	33.9	37.0	7.0	40.4	3.4	40.9	53.9	13.0	100	0	
Vert.	9916.000	AV	33.6	38.6	8.0	39.9	3.4	43.7	53.9	10.2	100	0	
Vert.	12395.000	AV	33.6	39.3	9.4	40.0	3.4	45.7	53.9	8.2	100	0	

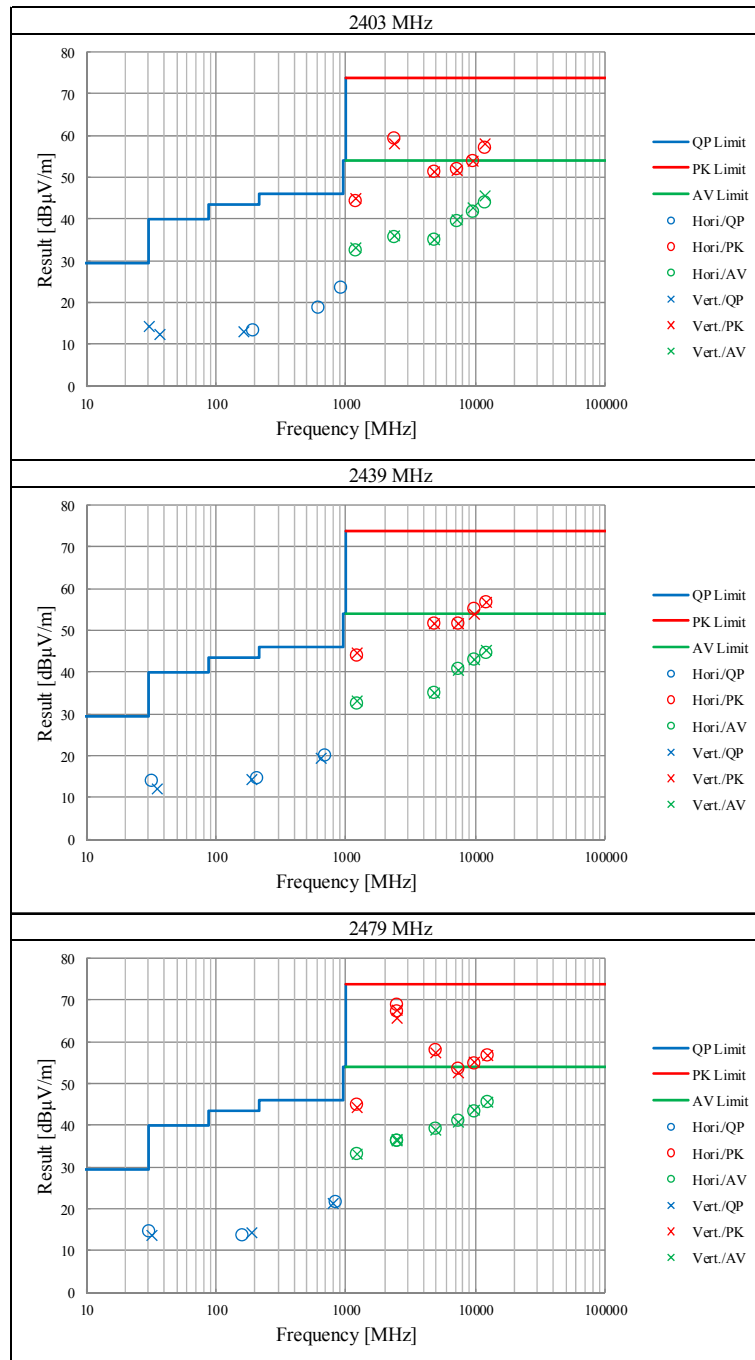
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.43\text{ m} / 3.0\text{ m}) = 3.4\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

## Radiated Spurious Emission(Antenna : ANT-2G4S2) (All band chart)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	10726974S-A		
Date	May 13, 2015	May 14, 2015	May 17, 2015
Temperature / Humidity	23deg. C / 59% RH	24deg. C / 47% RH	24deg. C / 58% RH
Engineer	Akira Sato (30 MHz-1000 MHz)	Kenichi Adachi (1 GHz – 18 GHz)	Shinichi Takano (18 GHz – 25 GHz)
Mode	Tx 2403MHz, 2439MHz, 2479 MHz		



## Radiated Spurious Emission(Antenna : ANT-2G4S3)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015      May 14, 2015      May 17, 2015  
Temperature / Humidity : 23deg. C / 59% RH      24deg. C / 47% RH      24deg. C / 58% RH  
Engineer : Akira Sato      Kenichi Adachi      Shinichi Takano  
(30 MHz-1000 MHz)      (1 GHz – 18 GHz)      (18 GHz – 25 GHz)  
Mode : Tx 2403MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	37.289	QP	22.4	15.2	6.7	32.1	0.0	12.2	40.0	27.8	300	359	
Hori.	270.991	QP	21.6	18.0	8.5	32.0	0.0	16.1	46.0	29.9	100	0	
Hori.	652.121	QP	21.4	19.9	10.1	31.9	0.0	19.5	46.0	26.5	150	359	
Hori.	1195.000	PK	45.6	24.1	12.5	40.9	3.5	44.8	73.9	29.1	100	0	
Hori.	2390.000	PK	57.2	26.4	13.6	41.1	3.5	59.6	73.9	14.3	100	2	
Hori.	4806.000	PK	47.3	30.6	5.6	39.8	3.5	47.2	73.9	26.7	100	199	
Hori.	7209.000	PK	44.9	36.6	7.1	40.2	3.5	51.9	73.9	22.0	100	0	
Hori.	9612.000	PK	44.3	38.5	8.1	40.1	3.5	54.3	73.9	19.6	100	0	
Hori.	12015.000	PK	44.1	39.5	9.2	39.6	3.5	56.7	73.9	17.2	100	0	
Hori.	1195.000	AV	34.2	24.1	12.5	40.9	3.5	33.4	53.9	20.5	100	0	
Hori.	2390.000	AV	33.7	26.4	13.6	41.1	3.5	36.1	53.9	17.8	100	2	
Hori.	4806.000	AV	33.8	30.6	5.6	39.8	3.5	33.7	53.9	20.2	100	199	
Hori.	7209.000	AV	33.1	36.6	7.1	40.2	3.5	40.1	53.9	13.8	100	0	
Hori.	9612.000	AV	32.8	38.5	8.1	40.1	3.5	42.8	53.9	11.1	100	0	
Hori.	12015.000	AV	33.3	39.5	9.2	39.6	3.5	45.9	53.9	8.0	100	0	
Vert.	30.243	QP	22.3	17.3	6.7	32.1	0.0	14.2	40.0	25.8	100	359	
Vert.	33.997	QP	21.6	16.2	6.7	32.1	0.0	12.4	40.0	27.6	100	0	
Vert.	180.391	QP	21.8	16.0	7.9	32.0	0.0	13.7	43.5	29.8	100	359	
Vert.	1195.000	PK	45.5	24.1	12.5	40.9	3.5	44.7	73.9	29.2	100	0	
Vert.	2390.000	PK	58.5	26.4	13.6	41.1	3.5	60.9	73.9	13.0	100	165	
Vert.	4806.000	PK	46.1	30.6	5.6	39.8	3.5	46.0	73.9	27.9	100	182	
Vert.	7209.000	PK	44.6	36.6	7.1	40.2	3.5	51.6	73.9	22.3	100	0	
Vert.	9612.000	PK	44.9	38.5	8.1	40.1	3.5	54.9	73.9	19.0	100	0	
Vert.	12015.000	PK	45.7	39.5	9.2	39.6	3.5	58.3	73.9	15.6	100	0	
Vert.	1195.000	AV	34.2	24.1	12.5	40.9	3.5	33.4	53.9	20.5	100	0	
Vert.	2390.000	AV	33.8	26.4	13.6	41.1	3.5	36.2	53.9	17.7	100	165	
Vert.	4806.000	AV	33.3	30.6	5.6	39.8	3.5	33.2	53.9	20.7	100	182	
Vert.	7209.000	AV	33.2	36.6	7.1	40.2	3.5	40.2	53.9	13.7	100	0	
Vert.	9612.000	AV	32.8	38.5	8.1	40.1	3.5	42.8	53.9	11.1	100	0	
Vert.	12015.000	AV	33.3	39.5	9.2	39.6	3.5	45.9	53.9	8.0	100.0	0.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2403.000	PK	94.6	26.4	13.6	41.1	3.5	97.0	-	-	Carrier
Hori.	2399.945	PK	59.5	26.4	13.6	41.1	3.5	61.9	77.0	15.1	
Hori.	2400.000	PK	59.0	26.4	13.6	41.1	3.5	61.4	77.0	15.6	
Vert.	2403.000	PK	96.7	26.4	13.6	41.1	3.5	99.1	-	-	Carrier
Vert.	2400.000	PK	60.8	26.4	13.6	41.1	3.5	63.2	79.1	15.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

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## Radiated Spurious Emission(Antenna : ANT-2G4S3)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015      May 14, 2015      May 17, 2015  
Temperature / Humidity : 23deg. C / 59% RH      24deg. C / 47% RH      24deg. C / 58% RH  
Engineer : Akira Sato      Kenichi Adachi      Shinichi Takano  
(30 MHz-1000 MHz)      (1 GHz – 18 GHz)      (18 GHz – 25 GHz)  
Mode : Tx 2439MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	30.261	QP	22.4	17.3	6.7	32.1	0.0	14.3	40.0	25.7	300	0	
Hori.	189.556	QP	21.7	16.2	7.9	32.0	0.0	13.8	43.5	29.7	200	359	
Hori.	740.306	QP	21.2	20.7	10.4	31.7	0.0	20.6	46.0	25.4	150	359	
Hori.	1216.000	PK	45.4	24.2	12.5	40.9	3.5	44.7	73.9	29.2	100	0	
Hori.	4878.000	PK	48.4	30.9	5.6	39.7	3.5	48.7	73.9	25.2	100	187	
Hori.	7317.000	PK	45.1	36.8	7.0	40.3	3.5	52.1	73.9	21.8	100	0	
Hori.	9756.000	PK	44.7	38.6	8.1	40.0	3.5	54.9	73.9	19.0	100	0	
Hori.	12195.000	PK	44.4	39.4	9.3	39.8	3.5	56.8	73.9	17.1	100	0	
Hori.	1216.000	AV	34.2	24.2	12.5	40.9	3.5	33.5	53.9	20.4	100	0	
Hori.	4878.000	AV	33.5	30.9	5.6	39.7	3.5	33.8	53.9	20.1	100	187	
Hori.	7317.000	AV	33.8	36.8	7.0	40.3	3.5	40.8	53.9	13.1	100	0	
Hori.	9756.000	AV	33.0	38.6	8.1	40.0	3.5	43.2	53.9	10.7	100	0	
Hori.	12195.000	AV	33.2	39.4	9.3	39.8	3.5	45.6	53.9	8.3	100	0	
Vert.	35.312	QP	21.8	15.8	6.7	32.1	0.0	12.2	40.0	27.8	100	0	
Vert.	44.023	QP	22.3	12.9	6.9	32.1	0.0	10.0	40.0	30.0	100	360	
Vert.	162.905	QP	21.8	15.3	8.0	32.0	0.0	13.1	43.5	30.4	100	359	
Vert.	1216.000	PK	45.8	24.2	12.5	40.9	3.5	45.1	73.9	28.8	100	0	
Vert.	4878.000	PK	48.0	30.9	5.6	39.7	3.5	48.3	73.9	25.6	106	258	
Vert.	7317.000	PK	44.6	36.8	7.0	40.3	3.5	51.6	73.9	22.3	100	0	
Vert.	9756.000	PK	44.4	38.6	8.1	40.0	3.5	54.6	73.9	19.3	100	0	
Vert.	12195.000	PK	44.8	39.4	9.3	39.8	3.5	57.2	73.9	16.7	100	0	
Vert.	1216.000	AV	34.0	24.2	12.5	40.9	3.5	33.3	53.9	20.6	100	0	
Vert.	4878.000	AV	33.3	30.9	5.6	39.7	3.5	33.6	53.9	20.3	106	258	
Vert.	7317.000	AV	33.6	36.8	7.0	40.3	3.5	40.6	53.9	13.3	100	0	
Vert.	9756.000	AV	32.8	38.6	8.1	40.0	3.5	43.0	53.9	10.9	100	0	
Vert.	12195.000	AV	32.9	39.4	9.3	39.8	3.5	45.3	53.9	8.6	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

## Radiated Spurious Emission(Antenna : ANT-2G4S3)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015      May 14, 2015      May 17, 2015  
Temperature / Humidity : 23deg. C / 59% RH      24deg. C / 47% RH      24deg. C / 58% RH  
Engineer : Akira Sato      Kenichi Adachi      Shinichi Takano  
(30 MHz-1000 MHz)      (1 GHz – 18 GHz)      (18 GHz – 25 GHz)  
Mode : Tx 2479MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	30.415	QP	22.8	17.2	6.7	32.1	0.0	14.6	40.0	25.4	300	0	
Hori.	126.225	QP	21.9	13.3	7.4	32.1	0.0	10.5	43.5	33.0	250	359	
Hori.	649.202	QP	21.3	19.8	10.1	31.9	0.0	19.3	46.0	26.7	150	359	
Hori.	1237.000	PK	45.4	24.2	12.5	40.9	3.5	44.7	73.9	29.2	100	0	
Hori.	2483.500	PK	64.8	26.6	13.6	41.1	3.5	67.4	73.9	6.5	103	1	
Hori.	2485.000	PK	63.3	26.6	13.6	41.1	3.5	65.9	73.9	8.0	100	0	
Hori.	4958.000	PK	47.6	31.2	5.7	39.6	3.5	48.4	73.9	25.5	100	202	
Hori.	7437.000	PK	45.8	37.0	7.0	40.4	3.5	52.9	73.9	21.0	100	0	
Hori.	9916.000	PK	44.9	38.6	8.0	39.9	3.5	55.1	73.9	18.8	100	0	
Hori.	12395.000	PK	45.0	39.3	9.4	40.0	3.5	57.2	73.9	16.7	100	0	
Hori.	1237.000	AV	33.6	24.2	12.5	40.9	3.5	32.9	53.9	21.0	100	0	
Hori.	2483.500	AV	33.8	26.6	13.6	41.1	3.5	36.4	53.9	17.5	103	1	
Hori.	2485.000	AV	33.8	26.6	13.6	41.1	3.5	36.4	53.9	17.5	100	0	
Hori.	4958.000	AV	33.8	31.2	5.7	39.6	3.5	34.6	53.9	19.3	100	202	
Hori.	7437.000	AV	33.9	37.0	7.0	40.4	3.5	41.0	53.9	12.9	100	0	
Hori.	9916.000	AV	33.3	38.6	8.0	39.9	3.5	43.5	53.9	10.4	100	0	
Hori.	12395.000	AV	32.5	39.3	9.4	40.0	3.5	44.7	53.9	9.2	100	0	
Vert.	31.457	QP	22.2	16.9	6.7	32.1	0.0	13.7	40.0	26.3	100	0	
Vert.	176.660	QP	21.6	15.9	8.0	32.0	0.0	13.5	43.5	30.0	100	359	
Vert.	194.058	QP	22.1	16.2	8.0	32.0	0.0	14.3	43.5	29.2	100	0	
Vert.	1237.000	PK	45.1	24.2	12.5	40.9	3.5	44.4	73.9	29.5	100	0	
Vert.	2483.500	PK	66.0	26.6	13.6	41.1	3.5	68.6	73.9	5.3	100	177	
Vert.	2485.000	PK	62.4	26.6	13.6	41.1	3.5	65.0	73.9	8.9	100	0	
Vert.	4958.000	PK	47.1	31.2	5.7	39.6	3.5	47.9	73.9	26.0	112	293	
Vert.	7437.000	PK	45.8	37.0	7.0	40.4	3.5	52.9	73.9	21.0	100	0	
Vert.	9916.000	PK	45.4	38.6	8.0	39.9	3.5	55.6	73.9	18.3	100	0	
Vert.	12395.000	PK	44.1	39.3	9.4	40.0	3.5	56.3	73.9	17.6	100	0	
Vert.	1237.000	AV	33.6	24.2	12.5	40.9	3.5	32.9	53.9	21.0	100	0	
Vert.	2483.500	AV	34.0	26.6	13.6	41.1	3.5	36.6	53.9	17.3	100	177	
Vert.	2485.000	AV	33.9	26.6	13.6	41.1	3.5	36.5	53.9	17.4	100	0	
Vert.	4958.000	AV	33.8	31.2	5.7	39.6	3.5	34.6	53.9	19.3	112	293	
Vert.	7437.000	AV	33.9	37.0	7.0	40.4	3.5	41.0	53.9	12.9	100	0	
Vert.	9916.000	AV	33.9	38.6	8.0	39.9	3.5	44.1	53.9	9.8	100	0	
Vert.	12395.000	AV	32.5	39.3	9.4	40.0	3.5	44.7	53.9	9.2	100	0	

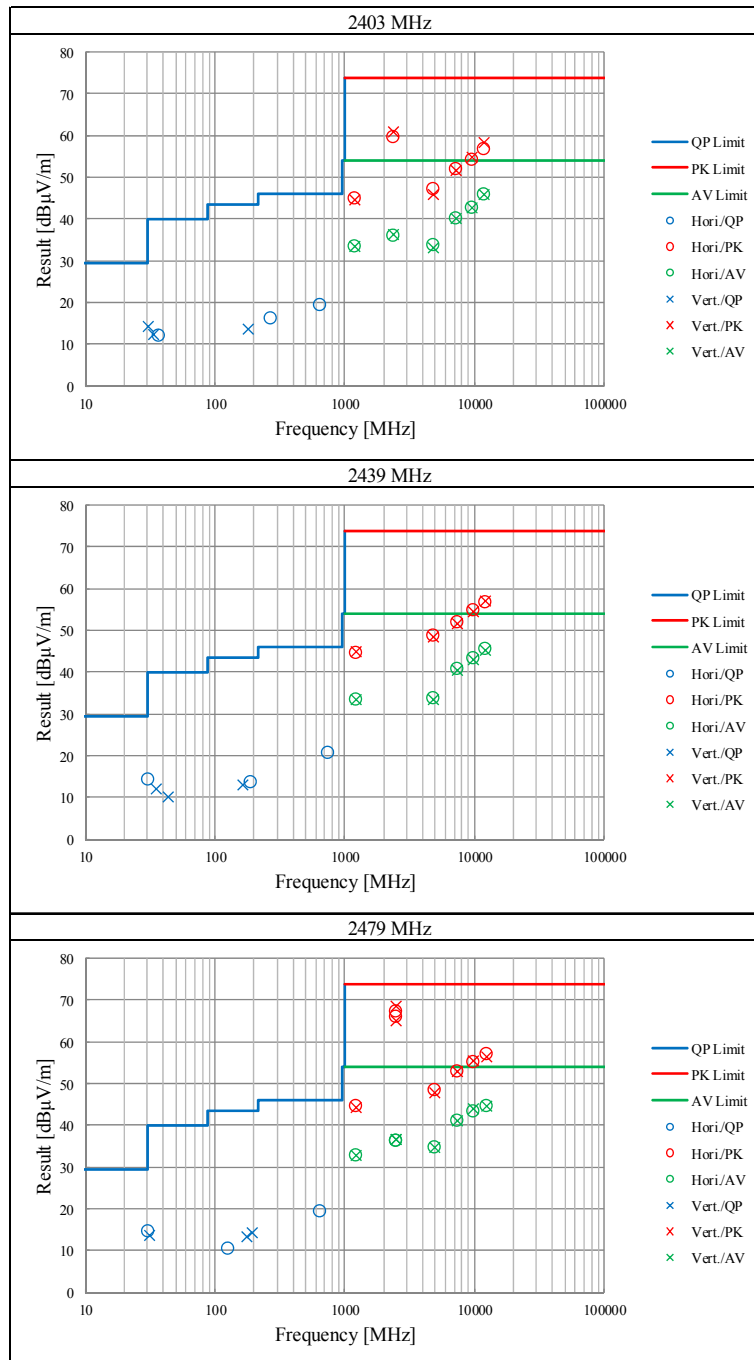
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

**Radiated Spurious Emission(Antenna : ANT-2G4S3)**  
**(All band chart)**

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	10726974S-A		
Date	May 13, 2015	May 14, 2015	May 17, 2015
Temperature / Humidity	23deg. C / 59% RH	24deg. C / 47% RH	24deg. C / 58% RH
Engineer	Akira Sato (30 MHz-1000 MHz)	Kenichi Adachi (1 GHz – 18 GHz)	Shinichi Takano (18 GHz – 25 GHz)
Mode	Tx 2403MHz, 2439MHz, 2479 MHz		



## Radiated Spurious Emission(Antenna : Pattern antenna)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015  
Temperature / Humidity : 23deg. C / 59% RH  
Engineer : Akira Sato  
Mode : Tx 2403MHz

May 13, 2015  
23deg. C / 59% RH  
Kenichi Adachi  
(1 GHz – 18 GHz)

May 17, 2015  
24deg. C / 58% RH  
Shinichi Takano  
(18 GHz – 25 GHz)

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	31.114	QP	22.3	17.0	6.7	32.1	0.0	13.9	40.0	26.1	200	306	
Hori.	35.000	QP	22.2	15.9	6.7	32.1	0.0	12.7	40.0	27.3	300	359	
Hori.	159.782	QP	21.9	15.2	7.9	32.1	0.0	12.9	43.5	30.6	256	0	
Hori.	489.000	QP	21.3	17.6	9.5	31.9	0.0	16.5	46.0	29.5	150	143	
Hori.	1195.000	PK	45.2	24.1	12.5	40.9	3.5	44.4	73.9	29.5	100	0	
Hori.	2390.000	PK	54.3	26.4	13.6	41.1	3.5	56.7	73.9	17.2	275	202	
Hori.	4806.000	PK	53.1	30.6	5.6	39.8	3.5	53.0	73.9	20.9	100	83	
Hori.	7209.000	PK	43.5	36.6	7.1	40.2	3.5	50.5	73.9	23.4	100	0	
Hori.	9612.000	PK	44.1	38.5	8.1	40.1	3.5	54.1	73.9	19.8	100	0	
Hori.	12015.000	PK	44.6	39.5	9.2	39.6	3.5	57.2	73.9	16.7	100	0	
Hori.	1195.000	AV	34.0	24.1	12.5	40.9	3.5	33.2	53.9	20.7	100	0	
Hori.	2390.000	AV	33.8	26.4	13.6	41.1	3.5	36.2	53.9	17.7	275	202	
Hori.	4806.000	AV	35.9	30.6	5.6	39.8	3.5	35.8	53.9	18.1	100	83	
Hori.	7209.000	AV	32.1	36.6	7.1	40.2	3.5	39.1	53.9	14.8	100	0	
Hori.	9612.000	AV	32.5	38.5	8.1	40.1	3.5	42.5	53.9	11.4	100	0	
Hori.	12015.000	AV	33.2	39.5	9.2	39.6	3.5	45.8	53.9	8.1	100	0	
Vert.	117.998	QP	24.6	12.6	7.4	32.1	0.0	12.5	43.5	31.0	100	1	
Vert.	213.872	QP	21.6	16.5	8.2	32.0	0.0	14.3	43.5	29.2	100	359	
Vert.	1195.000	PK	46.4	24.1	12.5	40.9	3.5	45.6	73.9	28.3	100	0	
Vert.	2390.000	PK	55.3	26.4	13.6	41.1	3.5	57.7	73.9	16.2	100	289	
Vert.	4806.000	PK	51.7	30.6	5.6	39.8	3.5	51.6	73.9	22.3	100	61	
Vert.	7209.000	PK	43.8	36.6	7.1	40.2	3.5	50.8	73.9	23.1	100	0	
Vert.	9612.000	PK	44.1	38.5	8.1	40.1	3.5	54.1	73.9	19.8	100	0	
Vert.	12015.000	PK	44.4	39.5	9.2	39.6	3.5	57.0	73.9	16.9	100	0	
Vert.	1195.000	AV	33.6	24.1	12.5	40.9	3.5	32.8	53.9	21.1	100	0	
Vert.	2390.000	AV	33.7	26.4	13.6	41.1	3.5	36.1	53.9	17.8	100	289	
Vert.	4806.000	AV	35.3	30.6	5.6	39.8	3.5	35.2	53.9	18.7	100	61	
Vert.	7209.000	AV	32.1	36.6	7.1	40.2	3.5	39.1	53.9	14.8	100	0	
Vert.	9612.000	AV	32.7	38.5	8.1	40.1	3.5	42.7	53.9	11.2	100	0	
Vert.	12015.000	AV	33.2	39.5	9.2	39.6	3.5	45.8	53.9	8.1	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48 \text{ m} / 3.0 \text{ m}) = 3.5 \text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0 \text{ m} / 1.0 \text{ m}) = 9.5 \text{ dB}$

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2403.000	PK	90.6	26.4	13.6	41.1	3.5	93.0	-	-	Carrier
Hori.	2400.000	PK	48.5	26.4	13.6	41.1	3.5	50.9	73.0	22.1	
Vert.	2403.000	PK	92.4	26.4	13.6	41.1	3.5	94.8	-	-	Carrier
Vert.	2400.000	PK	50.3	26.4	13.6	41.1	3.5	52.7	74.8	22.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48 \text{ m} / 3.0 \text{ m}) = 3.5 \text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0 \text{ m} / 1.0 \text{ m}) = 9.5 \text{ dB}$

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## Radiated Spurious Emission(Antenna : Pattern antenna)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015      May 13, 2015      May 17, 2015  
Temperature / Humidity : 23deg. C / 59% RH      23deg. C / 59% RH      24deg. C / 58% RH  
Engineer : Akira Sato      Kenichi Adachi      Shinichi Takano  
              (30 MHz-1000 MHz)      (1 GHz – 18 GHz)      (18 GHz – 25 GHz)  
Mode : Tx 2439MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	31.077	QP	22.3	17.0	6.7	32.1	0.0	13.9	40.0	26.1	300	359	
Hori.	168.337	QP	21.8	15.5	8.0	32.0	0.0	13.3	43.5	30.2	199	1	
Hori.	486.887	QP	21.3	17.6	9.5	31.9	0.0	16.5	46.0	29.5	100	359	
Hori.	1216.000	PK	45.5	24.2	12.5	40.9	3.5	44.8	73.9	29.1	100	0	
Hori.	4878.000	PK	56.2	30.9	5.6	39.7	3.5	56.5	73.9	17.4	100	78	
Hori.	7317.000	PK	44.3	36.8	7.0	40.3	3.5	51.3	73.9	22.6	100	0	
Hori.	9756.000	PK	43.8	38.6	8.1	40.0	3.5	54.0	73.9	19.9	100	0	
Hori.	12195.000	PK	45.0	39.4	9.3	39.8	3.5	57.4	73.9	16.5	100	0	
Hori.	1216.000	AV	34.1	24.2	12.5	40.9	3.5	33.4	53.9	20.5	100	0	
Hori.	4878.000	AV	37.6	30.9	5.6	39.7	3.5	37.9	53.9	16.0	100	78	
Hori.	7317.000	AV	32.7	36.8	7.0	40.3	3.5	39.7	53.9	14.2	100	0	
Hori.	9756.000	AV	32.6	38.6	8.1	40.0	3.5	42.8	53.9	11.1	100	0	
Hori.	12195.000	AV	33.0	39.4	9.3	39.8	3.5	45.4	53.9	8.5	100	0	
Vert.	33.246	QP	21.5	16.4	6.7	32.1	0.0	12.5	40.0	27.5	100	0	
Vert.	127.596	QP	22.1	13.4	7.5	32.1	0.0	10.9	43.5	32.6	100	359	
Vert.	140.207	QP	21.9	14.4	7.7	32.1	0.0	11.9	43.5	31.6	100	288	
Vert.	1216.000	PK	45.5	24.2	12.5	40.9	3.5	44.8	73.9	29.1	100	0	
Vert.	4878.200	PK	55.2	30.9	5.6	39.7	3.5	55.5	73.9	18.4	100	64	
Vert.	7317.000	PK	44.1	36.8	7.0	40.3	3.5	51.1	73.9	22.8	100	0	
Vert.	9756.000	PK	43.8	38.6	8.1	40.0	3.5	54.0	73.9	19.9	100	0	
Vert.	12195.000	PK	44.3	39.4	9.3	39.8	3.5	56.7	73.9	17.2	100	0	
Vert.	1216.000	AV	34.2	24.2	12.5	40.9	3.5	33.5	53.9	20.4	100	0	
Vert.	4878.200	AV	36.6	30.9	5.6	39.7	3.5	36.9	53.9	17.0	100	64	
Vert.	7317.000	AV	32.7	36.8	7.0	40.3	3.5	39.7	53.9	14.2	100	0	
Vert.	9756.000	AV	32.6	38.6	8.1	40.0	3.5	42.8	53.9	11.1	100	0	
Vert.	12195.000	AV	33.1	39.4	9.3	39.8	3.5	45.5	53.9	8.4	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

## Radiated Spurious Emission(Antenna : Pattern antenna)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. : 10726974S-A  
Date : May 13, 2015      May 13, 2015      May 17, 2015  
Temperature / Humidity : 23deg. C / 59% RH      23deg. C / 59% RH      24deg. C / 58% RH  
Engineer : Akira Sato      Kenichi Adachi      Shinichi Takano  
              (30 MHz-1000 MHz)      (1 GHz – 18 GHz)      (18 GHz – 25 GHz)  
Mode : Tx 2479MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	30.295	QP	22.3	17.3	6.7	32.1	0.0	14.2	40.0	25.8	300	359	
Hori.	160.788	QP	21.9	15.2	7.9	32.0	0.0	13.0	43.5	30.5	200	0	
Hori.	229.186	QP	21.8	16.7	8.3	32.0	0.0	14.8	46.0	31.2	150	359	
Hori.	1237.000	PK	45.1	24.2	12.5	40.9	3.5	44.4	73.9	29.5	100	0	
Hori.	2483.500	PK	61.8	26.6	13.6	41.1	3.5	64.4	73.9	9.5	259	168	
Hori.	2485.000	PK	55.0	26.6	13.6	41.1	3.5	57.6	73.9	16.3	100	0	
Hori.	4958.000	PK	58.3	31.2	5.7	39.6	3.5	59.1	73.9	14.8	100	81	
Hori.	7437.000	PK	44.6	37.0	7.0	40.4	3.5	51.7	73.9	22.2	100	0	
Hori.	9916.000	PK	43.9	38.6	8.0	39.9	3.5	54.1	73.9	19.8	100	0	
Hori.	12395.000	PK	45.7	39.3	9.4	40.0	3.5	57.9	73.9	16.0	100	0	
Hori.	1237.000	AV	34.1	24.2	12.5	40.9	3.5	33.4	53.9	20.5	100	0	
Hori.	2483.500	AV	33.8	26.6	13.6	41.1	3.5	36.4	53.9	17.5	259	168	
Hori.	2485.000	AV	34.2	26.6	13.6	41.1	3.5	36.8	53.9	17.1	100	0	
Hori.	4958.000	AV	39.1	31.2	5.7	39.6	3.5	39.9	53.9	14.0	100	81	
Hori.	7437.000	AV	33.4	37.0	7.0	40.4	3.5	40.5	53.9	13.4	100	0	
Hori.	9916.000	AV	32.7	38.6	8.0	39.9	3.5	42.9	53.9	11.0	100	0	
Hori.	12395.000	AV	33.5	39.3	9.4	40.0	3.5	45.7	53.9	8.2	100	0	
Vert.	36.836	QP	22.3	15.3	6.7	32.1	0.0	12.2	40.0	27.8	100	359	
Vert.	153.921	QP	21.9	14.9	7.9	32.1	0.0	12.6	43.5	30.9	100	0	
Vert.	905.572	QP	20.5	22.6	11.0	30.9	0.0	23.2	46.0	22.8	100	359	
Vert.	1237.000	PK	45.4	24.2	12.5	40.9	3.5	44.7	73.9	29.2	100	0	
Vert.	2483.500	PK	62.6	26.6	13.6	41.1	3.5	65.2	73.9	8.7	100	281	
Vert.	2485.000	PK	56.3	26.6	13.6	41.1	3.5	58.9	73.9	15.0	100	0	
Vert.	4958.000	PK	57.3	31.2	5.7	39.6	3.5	58.1	73.9	15.8	118	46	
Vert.	7437.000	PK	44.9	37.0	7.0	40.4	3.5	52.0	73.9	21.9	100	0	
Vert.	9916.000	PK	44.7	38.6	8.0	39.9	3.5	54.9	73.9	19.0	100	0	
Vert.	12395.000	PK	44.8	39.3	9.4	40.0	3.5	57.0	73.9	16.9	100	0	
Vert.	1237.000	AV	34.1	24.2	12.5	40.9	3.5	33.4	53.9	20.5	100	0	
Vert.	2483.500	AV	33.7	26.6	13.6	41.1	3.5	36.3	53.9	17.6	100	281	
Vert.	2485.000	AV	33.6	26.6	13.6	41.1	3.5	36.2	53.9	17.7	100	0	
Vert.	4958.000	AV	38.5	31.2	5.7	39.6	3.5	39.3	53.9	14.6	118	46	
Vert.	7437.000	AV	33.2	37.0	7.0	40.4	3.5	40.3	53.9	13.6	100	0	
Vert.	9916.000	AV	32.7	38.6	8.0	39.9	3.5	42.9	53.9	11.0	100	0	
Vert.	12395.000	AV	33.5	39.3	9.4	40.0	3.5	45.7	53.9	8.2	100	0	

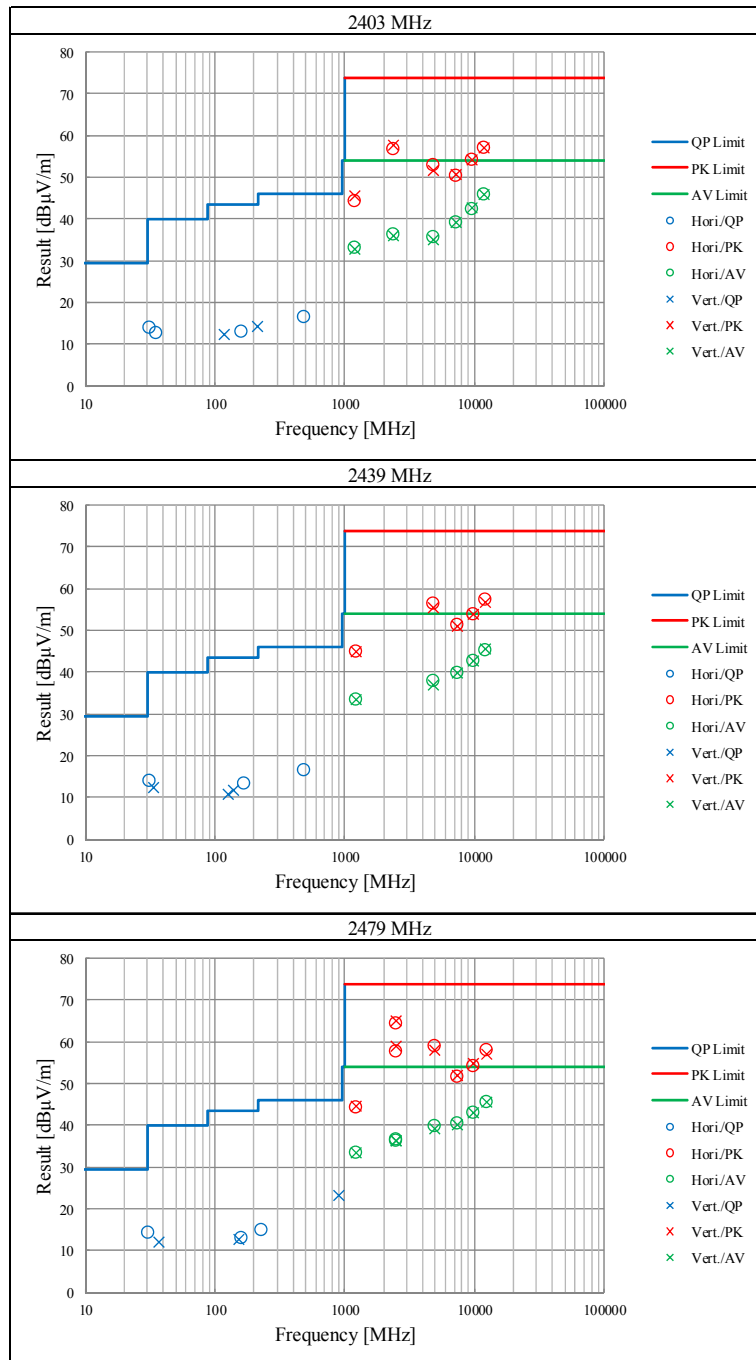
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 15 GHz :  $20\log(4.48\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

15 GHz - 40 GHz :  $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

**Radiated Spurious Emission(Antenna : Pattern antenna)**  
**(All band chart)**

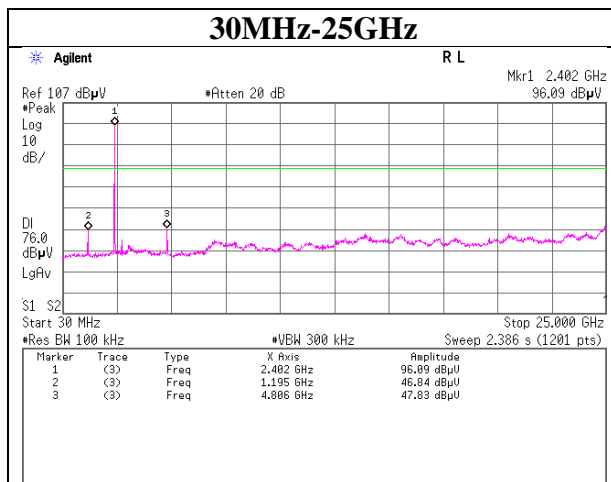
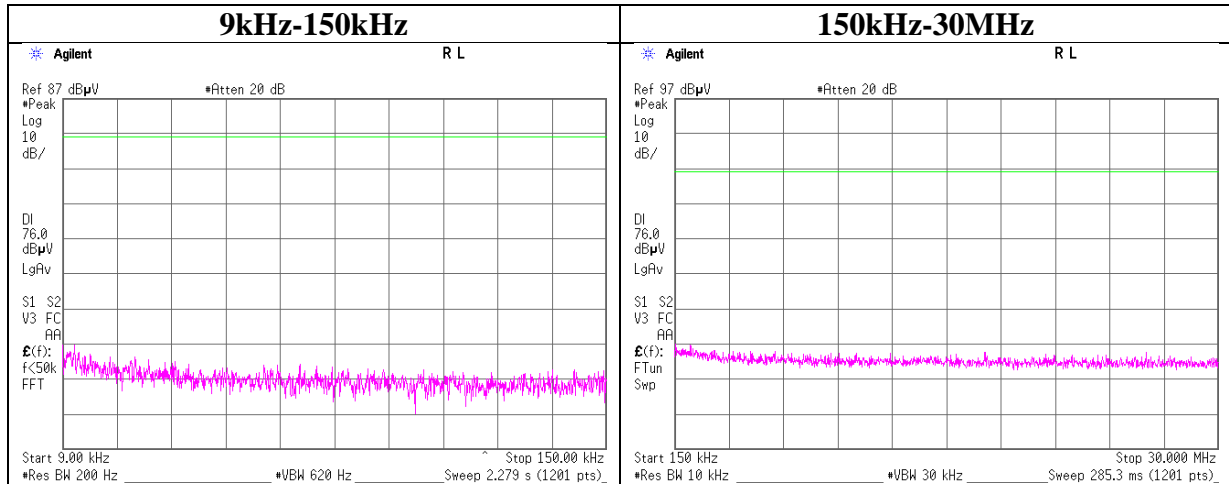
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	10726974S-A		
Date	May 13, 2015	May 13, 2015	May 17, 2015
Temperature / Humidity	23deg. C / 59% RH	23deg. C / 59% RH	24deg. C / 58% RH
Engineer	Akira Sato (30 MHz-1000 MHz)	Kenichi Adachi (1 GHz – 18 GHz)	Shinichi Takano (18 GHz – 25 GHz)
Mode	Tx 2403MHz, 2439MHz, 2479 MHz		



## Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 10726974S-A  
Date : May 11, 2015  
Temperature / Humidity : 26deg. C / 31% RH  
Engineer : Shinichi Takano  
Mode : Tx Hopping Off

### 2403MHz



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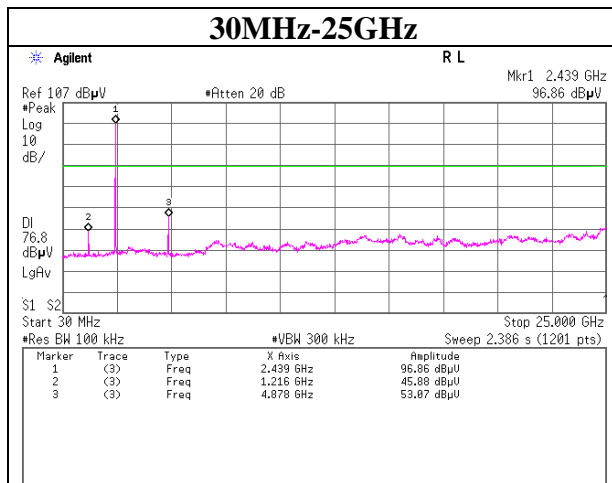
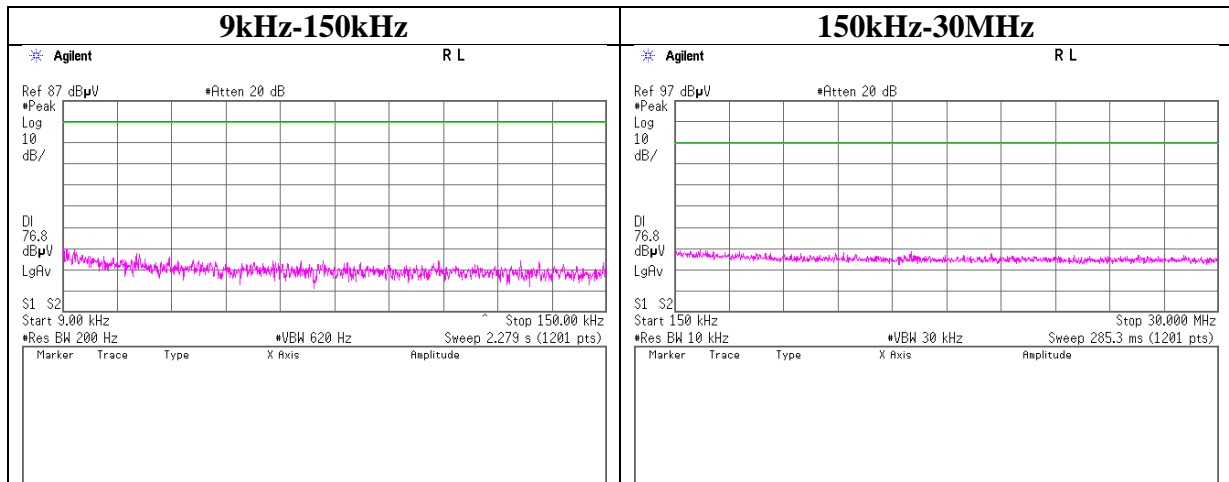
Facsimile : +81 463 50 6401



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10726974S-A
Date	May 11, 2015
Temperature / Humidity	26deg. C / 31% RH
Engineer	Shinichi Takano
Mode	Tx Hopping Off

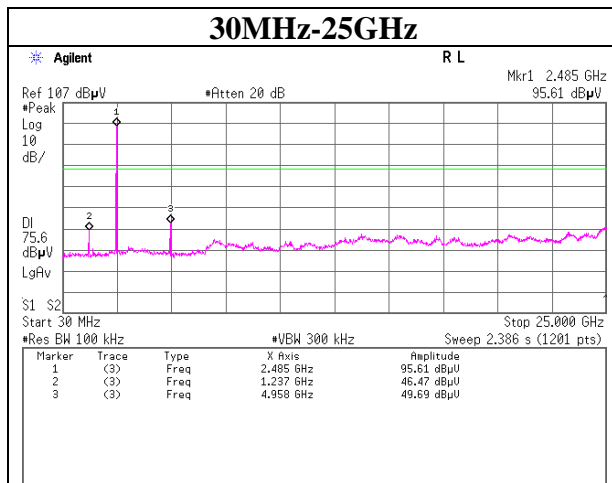
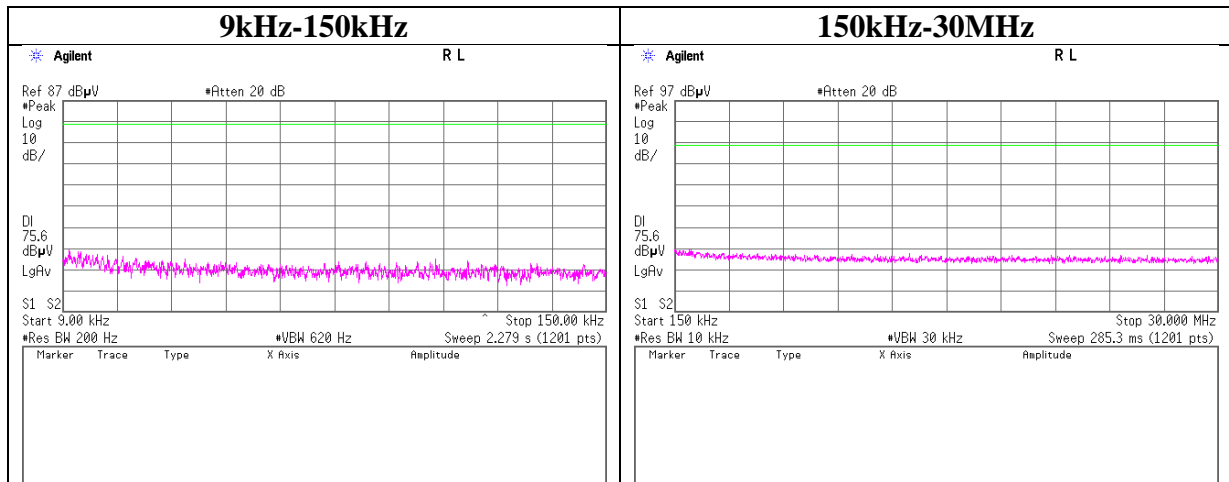
### 2439MHz



## Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 10726974S-A  
Date : May 11, 2015  
Temperature / Humidity : 26deg. C / 31% RH  
Engineer : Shinichi Takano  
Mode : Tx Hopping Off

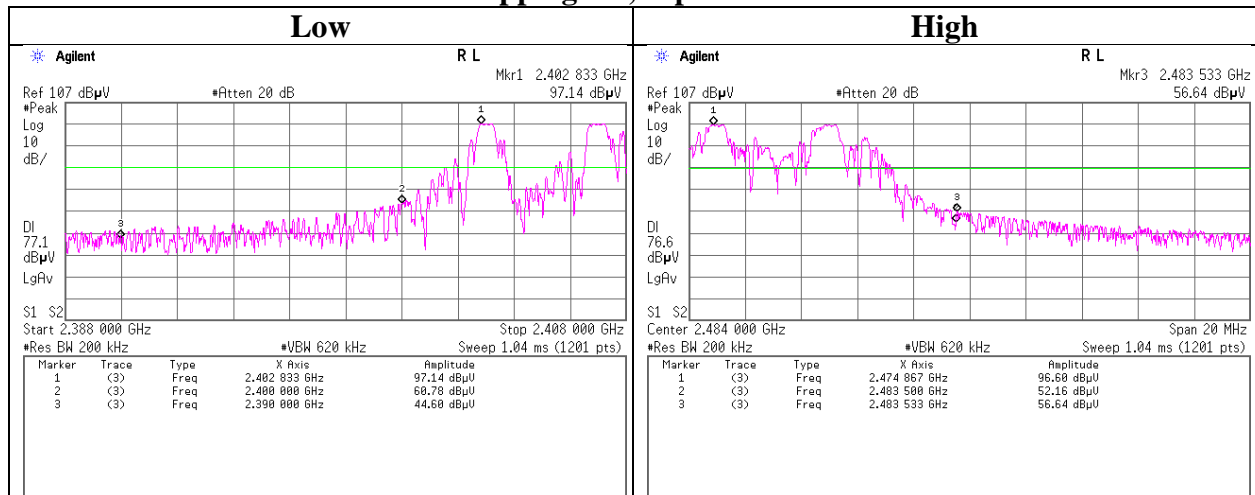
### 2479MHz



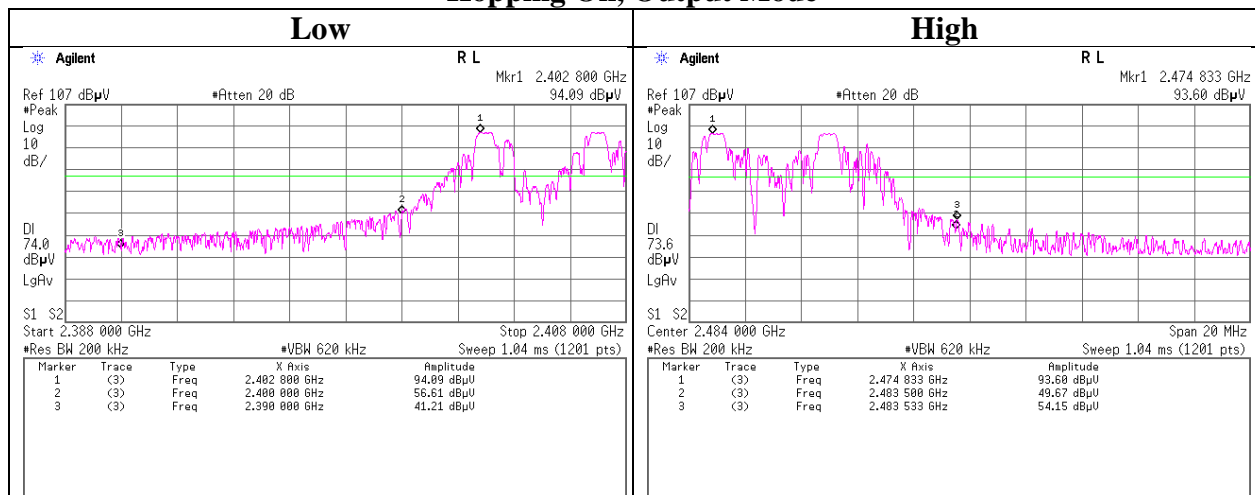
## Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10726974S-A
Date	May 11, 2015
Temperature / Humidity	26deg. C / 31% RH
Engineer	Shinichi Takano
Mode	Tx

### Hopping On, Input Mode



### Hopping On, Output Mode



**UL Japan, Inc.**

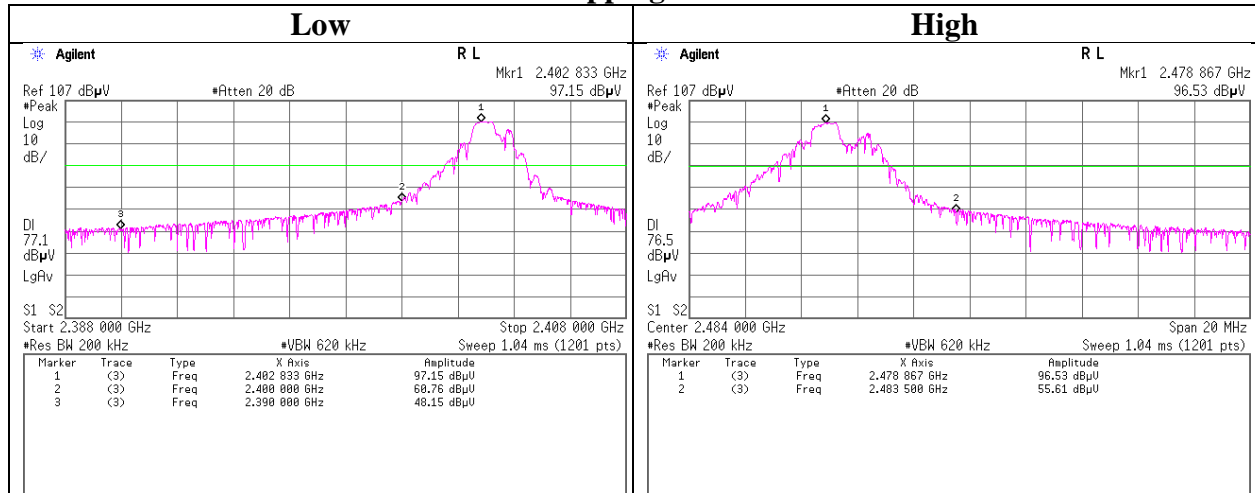
**Shonan EMC Lab.**

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## Hopping Off



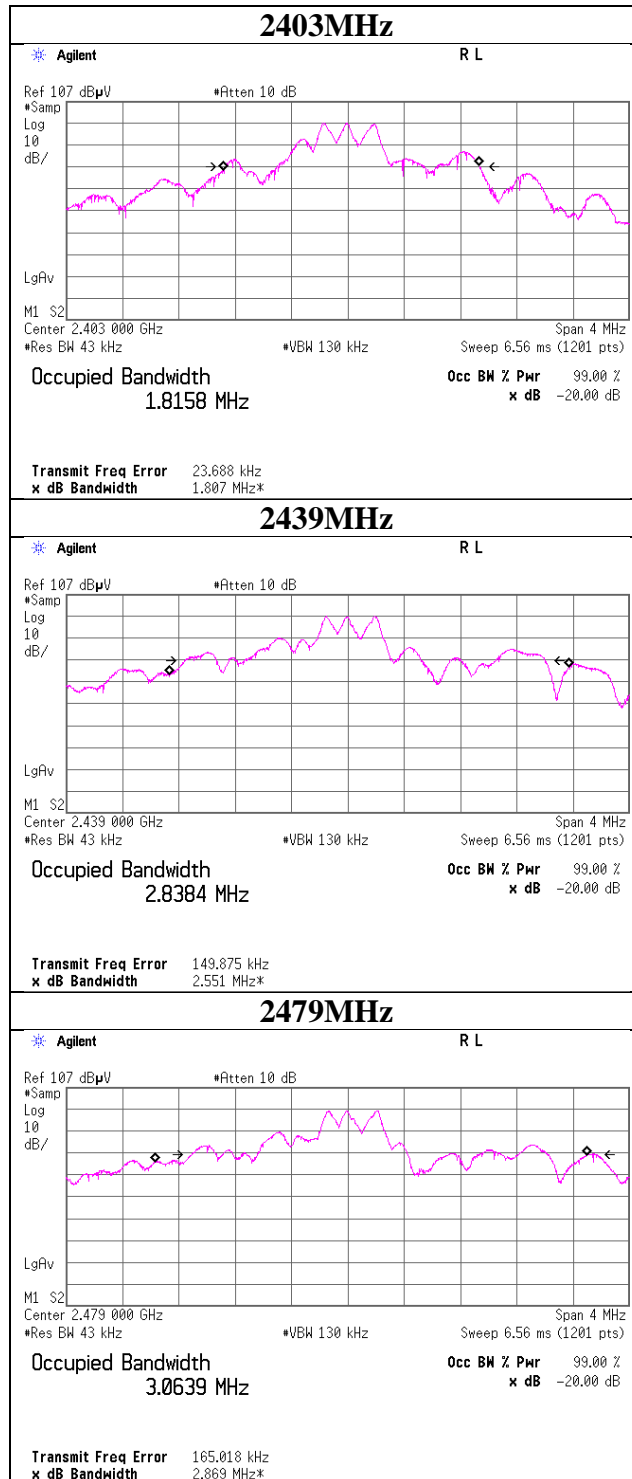
\*For radiated emission, RBW was set to 1 MHz for 2390 MHz.

In addition, RBW of 2400 MHz were set to 100 kHz for confirmation of 20 dBc.

Considering the difference in both settings, the data has a correlation.

## 99%Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10726974S-A
Date	May 11, 2015
Temperature / Humidity	26deg. C / 31% RH
Engineer	Shinichi Takano
Mode	Tx Hopping Off



**UL Japan, Inc.**

**Shonan EMC Lab.**

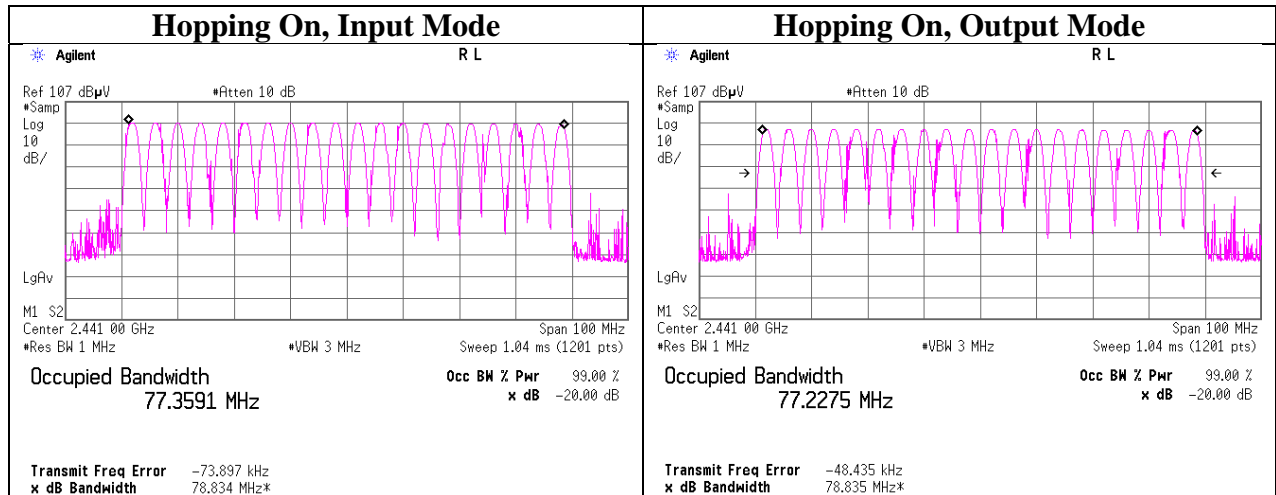
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## 99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10726974S-A
Date	May 11, 2015
Temperature / Humidity	26deg. C / 31% RH
Engineer	Shinichi Takano
Mode	Tx Hopping On



## APPENDIX 2: Test instruments

### Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY461805 25	AT, RE	2015/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01 000KMSKM S	-	AT	2015/04/09 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2014/11/21 * 12
SAT20-05	Attenuator	Weinschel Corp.	54A-20	Y5649	AT	2014/11/21 * 12
SAT20-06	Attenuator	Weinschel Corp.	54A-20	31506	AT	2015/04/09 * 12
SAT20-07	Attenuator	Weinschel Corp.	54A-20	31484	AT	2015/04/09 * 12
SPSC-02	Power Splitters/Combiners	Mini-Circuits	ZFSC-2-10G +	-	AT	2015/04/09 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/12/24 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2015/04/07 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2015/04/07 * 12
SAEC-03(NSA )	Semi-Anechoic Chamber	TDK	SAEC-03(NS A)	3	RE	2014/07/14 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2014/10/18 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108 A	UHALP 9108-A 0901	RE	2014/10/18 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2014/08/27 * 12
SCC-C1/C2/C3 /C4/C5/C10/SR SE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suh ner/Suhner/Suhner/Su hner/TOYO	8D2W/12DSF A/141PE/141 PE/141PE/14 1PE/NS4906	-/0901-271( RF Selector)	RE	2015/04/17 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2015/02/18 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE,CE	2015/03/24 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV( RE,CE,RFI,M F)	-	RE,CE	-
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/10/30 * 12
SJM-15	Measure	ASKUL	-	-	RE,CE	-
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2014/05/23 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-0 0	JUN-12-14- 018	RE	2014/06/24 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2014/05/15 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2014/08/12 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY482501 52	RE	2015/02/24 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2014/11/21 * 12
SAT10-05	Attenuator(above1GH z)	Agilent	8493C-010	74864	RE	2014/11/21 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2015/03/17 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2015/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SCC-C9/C10/S RSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141 PE/NS4906	-/0901-271( RF Selector)	CE	2015/04/17 * 12
SLS-05	LISN	Rohde & Schwarz	ENV216	100516	CE	2015/02/24 * 12
SAT3-07	Attenuator	JFW	50HF-003N	-	CE	2014/09/02 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2014/12/24 * 12

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