



# **RADIO TEST REPORT**

**Test Report No. : 11984010S-A-R1**

**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: 2017**  
**Test item** : **Radiated Emission**  
**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)
7. This report is a revised version of 11984010S-A. 11984010S-A is replaced with this report.

**Date of test:** November 28 to 29, 2017

**Representative test engineer:**

H. morikawa

Hiroyuki Morikawa  
Engineer  
Consumer Technology Division

**Approved by:**

A. Hayashi

Akio Hayashi  
Leader  
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

## REVISION HISTORY

**Original Test Report No.: 11984010S-A**

[illegible]

<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information.....</b>	<b>4</b>
<b>SECTION 2: Equipment under test (E.U.T.).....</b>	<b>4</b>
<b>SECTION 3: Test specification, procedures &amp; results.....</b>	<b>5</b>
<b>SECTION 4: Operation of E.U.T. during testing.....</b>	<b>7</b>
<b>SECTION 5: Radiated Spurious Emission .....</b>	<b>8</b>
<b>APPENDIX 1: Test data .....</b>	<b>10</b>
Radiated Spurious Emission (Antenna: ANT-2400-SF).....	10
Radiated Spurious Emission (Antenna: ANT-2400-SFW-HG).....	16
<b>APPENDIX 2: Test instruments .....</b>	<b>22</b>
<b>APPENDIX 3: Photographs of test setup .....</b>	<b>23</b>
Radiated Spurious Emission (Antenna : ANT-2400-SF).....	23
Radiated Spurious Emission (Antenna : ANT-2400-SFW-HG).....	24
Worst Case Position .....	25

## **SECTION 1: Customer information**

Company Name : Circuit Design, Inc.  
Address : 7557-1, Hotaka, Azumino, Nagano 399-8303 Japan  
Telephone Number : +81-263-82-1011  
Facsimile Number : +81-263-82-1012  
Contact Person : Maiko Yasunaga

## **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: DC 5 V (Input mode:DC 2.2 V to 5.5 V, Output mode: DC 4.7 V to DC 5.5 V)  
Receipt Date of Sample : November 22, 2017  
Country of Mass-production : Japan  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

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

### **Radio Specification**

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

There are 5 types of Antenna.

Antenna Type	ANT-2G4S2	ANT-2G4S3	Pattern Antenna	ANT-2400-SF *2)	ANT-2400-SFW-HG *2)
External / Internal	External	External	Internal (Pattern)	External	External
RF Cable length	90 mm *1)	3 mm *1)	-	70 mm	70 mm
Antenna Gain with internal cable loss	2.14 dBi	2.14 dBi	-2.0 dBi	1.7 dBi	4.7 dBi

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

\*2) Tested antenna

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on November 2, 2017

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

### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Spurious Emission & Band Edge Compliance	<b>FCC:</b> FCC Public Notice DA 00-705 <b>IC:</b> RSS-Gen 6.13	<b>FCC:</b> Section15.247(d) <b>IC:</b> RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	Antenna : ANT-2400-SFW-HG 2.2 dB 2483.500 MHz, PK, Vert., Tx 2479 MHz	Complied	Radiated (above 30 MHz) *1)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. * For the rest of the test items required, refer to the original test report 10726974S-A. *1) Radiated test was selected over 30 MHz based on section 15.247(d).For below 30 MHz the EUT was confirmed to comply with the requirement by conducted test (original test report: 10726974S-A).					

\* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

#### **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-2400-SF and ANT-2400-SFW-HG have a unique coupling/antenna connector (inverted SMA with MHF-inverted SMA conversion cable).

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**

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	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.5 dB	2.5 dB	2.5 dB	2.6 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.3 dB	4.3 dB	4.3 dB	-	-
	200 MHz-1 GHz	5.9 dB	5.9 dB	5.9 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

#### Radiated emission test

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

### 3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.

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JAB Accreditation No. RTL02610

FCC Test Firm Registration Number: 839876

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	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
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.

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

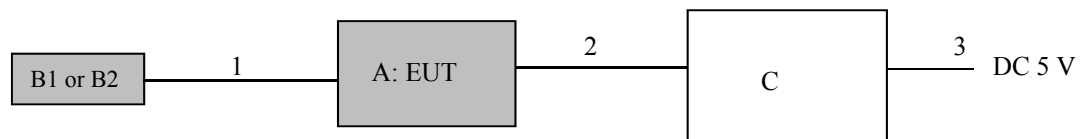
### 4.1 Operating Mode(s)

Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Spurious Emission (Radiated)	Tx -Hopping Off (Input Mode)	2403 MHz 2439 MHz 2479 MHz
<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



\* 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
A	2.4GHz Transceiver module	NK-2.4Y	1	Circuit design	EUT
B1	External antenna	ANT-2400-SF	-	Circuit design	EUT
B2	External antenna	ANT-2400-SFW-HG	-	Circuit design	EUT
C	Jig	-	-	Circuit design	-

#### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	RF	0.07	Shielded	Shielded	-
2	Signal	0.2	Unshielded	Unshielded	-
3	DC	1.8	Unshielded	Unshielded	-

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## **SECTION 5: Radiated Spurious Emission**

### **Test Procedure**

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m 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	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.



20 dBc 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 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3.89 m*2) (1 GHz – 13 GHz), 3.93 m*3) (1 GHz – 13 GHz), 3.95 m*4) (1 GHz – 13 GHz), 1.0 m*5) (13 GHz – 40 GHz)		3.89 m*2) (1 GHz – 13 GHz), 3.93 m*3) (1 GHz – 13 GHz), 3.95 m*4) (1 GHz – 13 GHz), 1.0 m*5) (13 GHz – 40 GHz)

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

\*2) Distance Factor:  $20 \times \log(3.89 \text{ m}/3.0 \text{ m}) = 2.26 \text{ dB}$

\*3) Distance Factor:  $20 \times \log(3.93 \text{ m}/3.0 \text{ m}) = 2.35 \text{ dB}$

\*4) Distance Factor:  $20 \times \log(3.95 \text{ m}/3.0 \text{ m}) = 2.39 \text{ dB}$

\*5) Distance Factor:  $20 \times \log(1.0 \text{ m}/3.0 \text{ m}) = -9.54 \text{ dB}$

- 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.

#### Worst case:

EUT	Antenna polarization	Carrier (Band edge)	Spurious			
			Below 1 GHz	Above 1 GHz		
				1 GHz – 13 GHz	13 GHz - 18 GHz	18 GHz – 26.5 GHz
Module	Horizontal	Z	Y	Z	X	X
	Vertical	Z	Y	Z	X	X
Antenna	Horizontal	X	X	X	Y	X
	Vertical	Y	X	Y	Y	X

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

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

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## APPENDIX 1: Test data

### Radiated Spurious Emission (Antenna: ANT-2400-SF)

Report No. 11984010S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.1 No.2 No.1  
Date November 29, 2017 November 28, 2017 November 29, 2017  
Temperature / Humidity 22 deg. C / 36 % RH 22 deg. C / 36 % RH 22 deg. C / 36 % RH  
Engineer Hiroyuki Morikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(30 MHz -1 GHz) (1 GHz -18 GHz) (18 MHz -26.5 GHz)  
Mode Tx, Hopping Off 2403 MHz

(\* 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.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Hori.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Hori.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Hori.	400.000	QP	20.80	15.77	7.64	31.80	0.00	12.41	46.00	33.5	100	0	
Hori.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Hori.	800.000	QP	20.90	20.78	9.49	31.78	0.00	19.39	46.00	26.6	100	0	
Hori.	2390.000	PK	52.83	27.16	13.71	36.83	2.35	59.22	73.90	14.6	189	339	
Hori.	4806.000	PK	51.17	31.15	5.97	36.99	2.35	53.65	73.90	20.2	100	194	
Hori.	7209.000	PK	44.02	36.49	7.44	37.81	2.35	52.49	73.90	21.4	150	0	
Hori.	9612.000	PK	45.32	38.21	8.19	38.48	2.35	55.59	73.90	18.3	150	0	
Hori.	12015.000	PK	45.53	39.06	9.77	39.18	2.35	57.53	73.90	16.3	150	0	
Hori.	2390.000	AV	31.72	27.16	13.71	36.83	2.35	38.11	53.90	15.7	189	339	
Hori.	4806.000	AV	34.36	31.15	5.97	36.99	2.35	36.84	53.90	17.0	100	194	
Hori.	7209.000	AV	32.20	36.49	7.44	37.81	2.35	40.67	53.90	13.2	150	0	
Hori.	9612.000	AV	33.31	38.21	8.19	38.48	2.35	43.58	53.90	10.3	150	0	
Hori.	12015.000	AV	33.72	39.06	9.77	39.18	2.35	45.72	53.90	8.1	150	0	
Vert.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Vert.	100.000	QP	21.50	9.86	8.18	31.80	0.00	7.74	43.50	35.7	100	0	
Vert.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Vert.	400.000	QP	20.80	15.77	7.64	31.80	0.00	12.41	46.00	33.5	100	0	
Vert.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Vert.	800.000	QP	20.90	20.78	9.49	31.78	0.00	19.39	46.00	26.6	100	0	
Vert.	2390.000	PK	52.79	27.16	13.71	36.83	2.39	59.22	73.90	14.6	143	184	
Vert.	4806.000	PK	51.51	31.15	5.97	36.99	2.39	54.03	73.90	19.8	158	185	
Vert.	7209.000	PK	44.24	36.49	7.44	37.81	2.39	52.75	73.90	21.1	150	0	
Vert.	9612.000	PK	44.43	38.21	8.19	38.48	2.39	54.74	73.90	19.1	150	0	
Vert.	12015.000	PK	44.87	39.06	9.77	39.18	2.39	56.91	73.90	16.9	150	0	
Vert.	2390.000	AV	31.83	27.16	13.71	36.83	2.39	38.26	53.90	15.6	143	184	
Vert.	4806.000	AV	34.69	31.15	5.97	36.99	2.39	37.21	53.90	16.6	158	185	
Vert.	7209.000	AV	32.20	36.49	7.44	37.81	2.39	40.71	53.90	13.1	150	0	
Vert.	9612.000	AV	33.30	38.21	8.19	38.48	2.39	43.61	53.90	10.2	150	0	
Vert.	12015.000	AV	33.71	39.06	9.77	39.18	2.39	45.75	53.90	8.1	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB (Hori.)

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB (Vert.)

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

\* These results have sufficient margin without taking account Dwell time factor.

#### 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	90.39	27.21	13.72	36.82	2.35	96.85	-	-	Carrier
Hori.	2400.000	PK	47.67	27.20	13.71	36.83	2.35	54.10	76.85	22.8	
Vert.	2403.000	PK	90.66	27.21	13.72	36.82	2.39	97.16	-	-	Carrier
Vert.	2400.000	PK	47.44	27.20	13.71	36.83	2.39	53.91	77.16	23.3	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB (Hori.)

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB (Vert.)

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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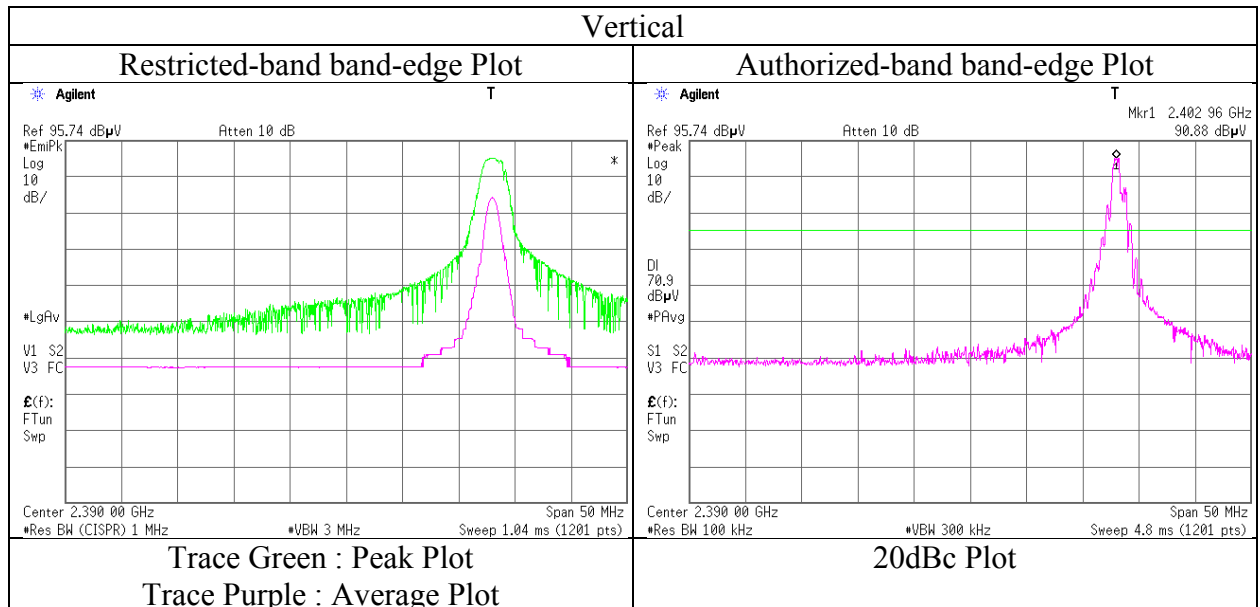
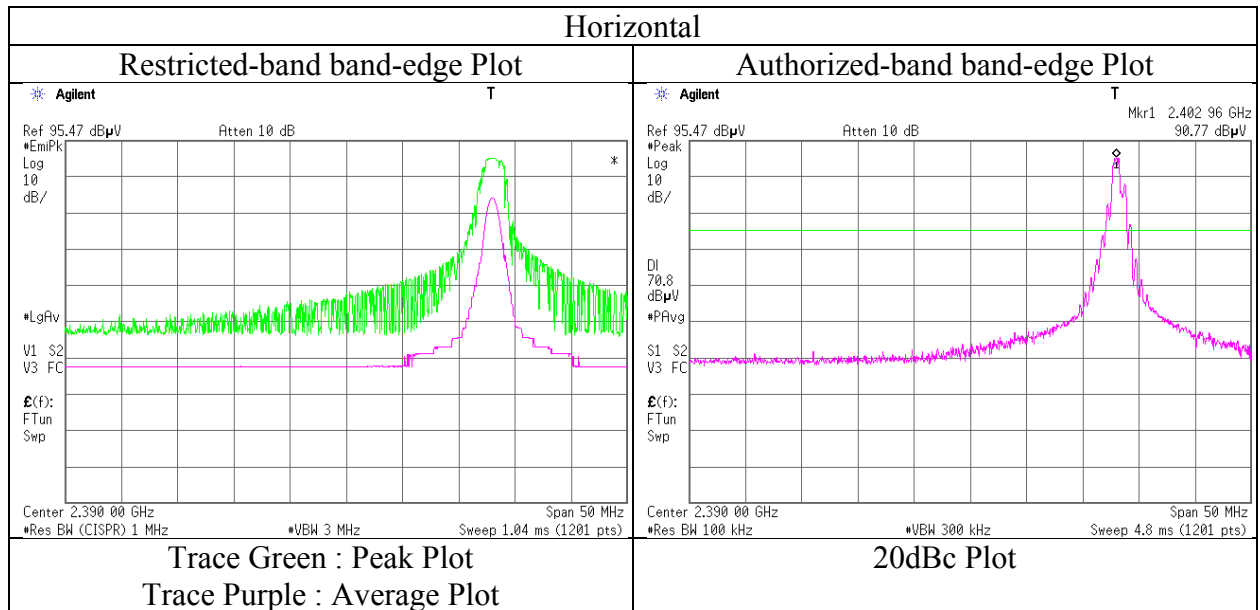
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## Radiated Spurious Emission (Antenna: ANT-2400-SF) (Reference Plot for band-edge)

Report No.	11984010S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 28, 2017
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx, Hopping Off 2403 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission (Antenna: ANT-2400-SF)

Report No.	11984010S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.2	No.1
Date	November 29, 2017	November 28, 2017	November 29, 2017
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 36 % RH	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Hiroyuki Morikawa (1 GHz -18 GHz)	Hiroyuki Morikawa (18 MHz -26.5 GHz)
Mode	Tx, Hopping Off 2439 MHz		

(\* 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.	50.000	QP	21.70	10.94	7.49	31.82	0.00	8.31	40.00	31.6	100	0	
Hori.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Hori.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Hori.	400.000	QP	20.80	15.77	7.64	31.80	0.00	12.41	46.00	33.5	100	0	
Hori.	500.000	QP	21.20	17.70	8.16	31.87	0.00	15.19	46.00	30.8	100	0	
Hori.	800.000	QP	20.90	20.78	9.49	31.78	0.00	19.39	46.00	26.6	100	0	
Hori.	4878.000	PK	49.02	31.30	6.05	37.03	2.35	51.69	73.90	22.2	165	194	
Hori.	7317.000	PK	43.57	36.64	7.53	37.88	2.35	52.21	73.90	21.6	150	0	
Hori.	9756.000	PK	45.30	38.50	8.29	38.66	2.35	55.78	73.90	18.1	150	0	
Hori.	12195.000	PK	44.78	39.08	10.04	39.14	2.35	57.11	73.90	16.7	150	0	
Hori.	4878.000	AV	33.41	31.30	6.05	37.03	2.35	36.08	53.90	17.8	165	194	
Hori.	7317.000	AV	32.28	36.64	7.53	37.88	2.35	40.92	53.90	12.9	150	0	
Hori.	9756.000	AV	33.84	38.50	8.29	38.66	2.35	44.32	53.90	9.5	150	0	
Hori.	12195.000	AV	33.94	39.08	10.04	39.14	2.35	46.27	53.90	7.6	150	0	
Vert.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Vert.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Vert.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Vert.	400.000	QP	20.90	15.77	7.64	31.80	0.00	12.51	46.00	33.4	100	0	
Vert.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Vert.	800.000	QP	20.80	20.78	9.49	31.78	0.00	19.29	46.00	26.7	100	0	
Vert.	4878.000	PK	49.93	31.30	6.05	37.03	2.39	52.64	73.90	21.2	152	187	
Vert.	7317.000	PK	44.76	36.64	7.53	37.88	2.39	53.44	73.90	20.4	150	0	
Vert.	9756.000	PK	44.28	38.50	8.29	38.66	2.39	54.80	73.90	19.1	150	0	
Vert.	12195.000	PK	45.69	39.08	10.04	39.14	2.39	58.06	73.90	15.8	150	0	
Vert.	4878.000	AV	33.88	31.30	6.05	37.03	2.39	36.59	53.90	17.3	152	187	
Vert.	7317.000	AV	32.38	36.64	7.53	37.88	2.39	41.06	53.90	12.8	150	0	
Vert.	9756.000	AV	33.79	38.50	8.29	38.66	2.39	44.31	53.90	9.5	150	0	
Vert.	12195.000	AV	33.96	39.08	10.04	39.14	2.39	46.33	53.90	7.5	150	0	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.93\text{ m} / 3.0\text{ m}) = 2.35\text{ dB}$  (Hori.)

Distance factor : 1 GHz - 13 GHz :  $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$  (Vert.)

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

\* These results have sufficient margin without taking account Dwell time factor.

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## Radiated Spurious Emission (Antenna: ANT-2400-SF)

Report No.	11984010S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.2	No.1
Date	November 29, 2017	November 28, 2017	November 29, 2017
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 36 % RH	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Hiroyuki Morikawa (1 GHz -18 GHz)	Hiroyuki Morikawa (18 MHz -26.5 GHz)
Mode	Tx, Hopping Off 2479 MHz		

(\* 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.	50.000	QP	21.70	10.94	7.49	31.82	0.00	8.31	40.00	31.6	100	0	
Hori.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Hori.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Hori.	400.000	QP	20.80	15.77	7.64	31.80	0.00	12.41	46.00	33.5	100	0	
Hori.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Hori.	800.000	QP	20.90	20.78	9.49	31.78	0.00	19.39	46.00	26.6	100	0	
Hori.	2483.500	PK	62.64	27.48	13.81	36.79	2.35	69.49	73.90	4.4	145	349	
Hori.	4958.000	PK	48.61	31.48	6.12	37.07	2.35	51.49	73.90	22.4	103	193	
Hori.	7437.000	PK	43.68	36.80	7.64	37.95	2.35	52.52	73.90	21.3	150	0	
Hori.	9916.000	PK	45.51	38.81	8.39	38.86	2.35	56.20	73.90	17.7	150	0	
Hori.	12395.000	PK	46.11	39.10	10.33	39.10	2.35	58.79	73.90	15.1	150	0	
Hori.	2483.500	AV	31.88	27.48	13.81	36.79	2.35	38.73	53.90	15.1	145	349	
Hori.	4958.000	AV	33.40	31.48	6.12	37.07	2.35	36.28	53.90	17.6	103	193	
Hori.	7437.000	AV	32.53	36.80	7.64	37.95	2.35	41.37	53.90	12.5	150	0	
Hori.	9916.000	AV	33.69	38.81	8.39	38.86	2.35	44.38	53.90	9.5	150	0	
Hori.	12395.000	AV	33.85	39.10	10.33	39.10	2.35	46.53	53.90	7.3	150	0	
Vert.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Vert.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Vert.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Vert.	400.000	QP	20.90	15.77	7.64	31.80	0.00	12.51	46.00	33.4	100	0	
Vert.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Vert.	800.000	QP	20.90	20.78	9.49	31.78	0.00	19.39	46.00	26.6	100	0	
Vert.	2483.500	PK	62.27	27.48	13.81	36.79	2.39	69.16	73.90	4.7	145	0	
Vert.	4958.000	PK	50.30	31.48	6.12	37.07	2.39	53.22	73.90	20.6	151	184	
Vert.	7437.000	PK	44.47	36.80	7.64	37.95	2.39	53.35	73.90	20.5	150	0	
Vert.	9916.000	PK	45.82	38.81	8.39	38.86	2.39	56.55	73.90	17.3	150	0	
Vert.	12395.000	PK	45.12	39.10	10.33	39.10	2.39	57.84	73.90	16.0	150	0	
Vert.	2483.500	AV	31.89	27.48	13.81	36.79	2.39	38.78	53.90	15.1	145	0	
Vert.	4958.000	AV	34.23	31.48	6.12	37.07	2.39	37.15	53.90	16.7	151	184	
Vert.	7437.000	AV	32.53	36.80	7.64	37.95	2.39	41.41	53.90	12.4	150	0	
Vert.	9916.000	AV	33.77	38.81	8.39	38.86	2.39	44.50	53.90	9.4	150	0	
Vert.	12395.000	AV	34.04	39.10	10.33	39.10	2.39	46.76	53.90	7.1	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB (Hori.)

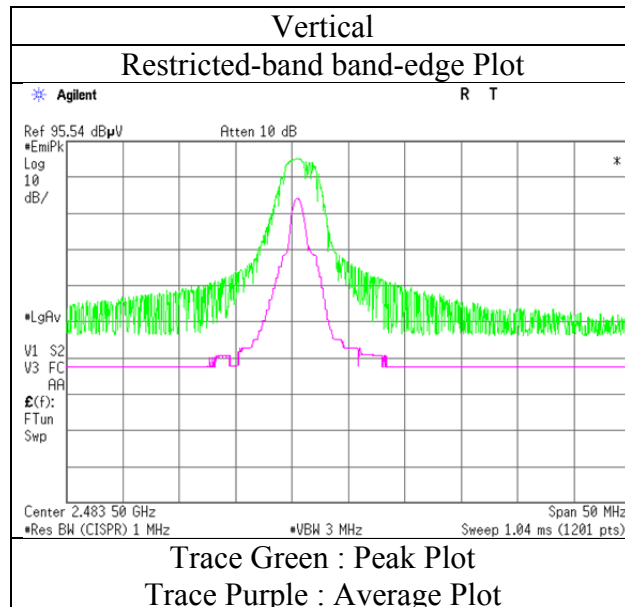
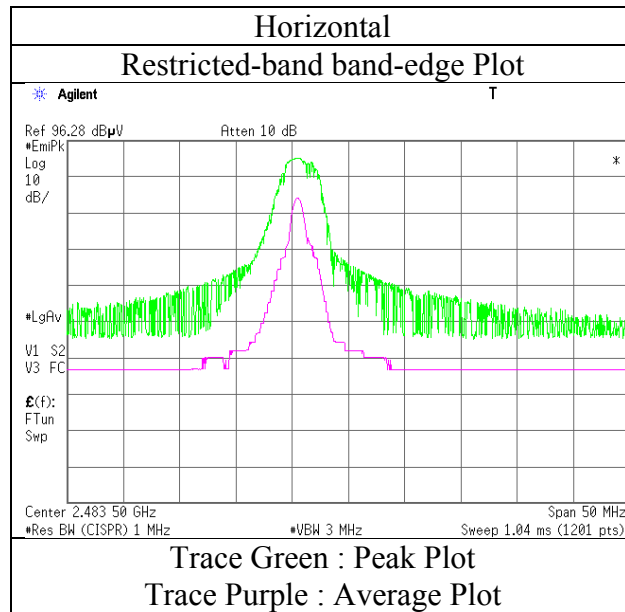
Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB (Vert.)

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

\* These results have sufficient margin without taking account Dwell time factor.

## Radiated Spurious Emission (Antenna: ANT-2400-SF) (Reference Plot for band-edge)

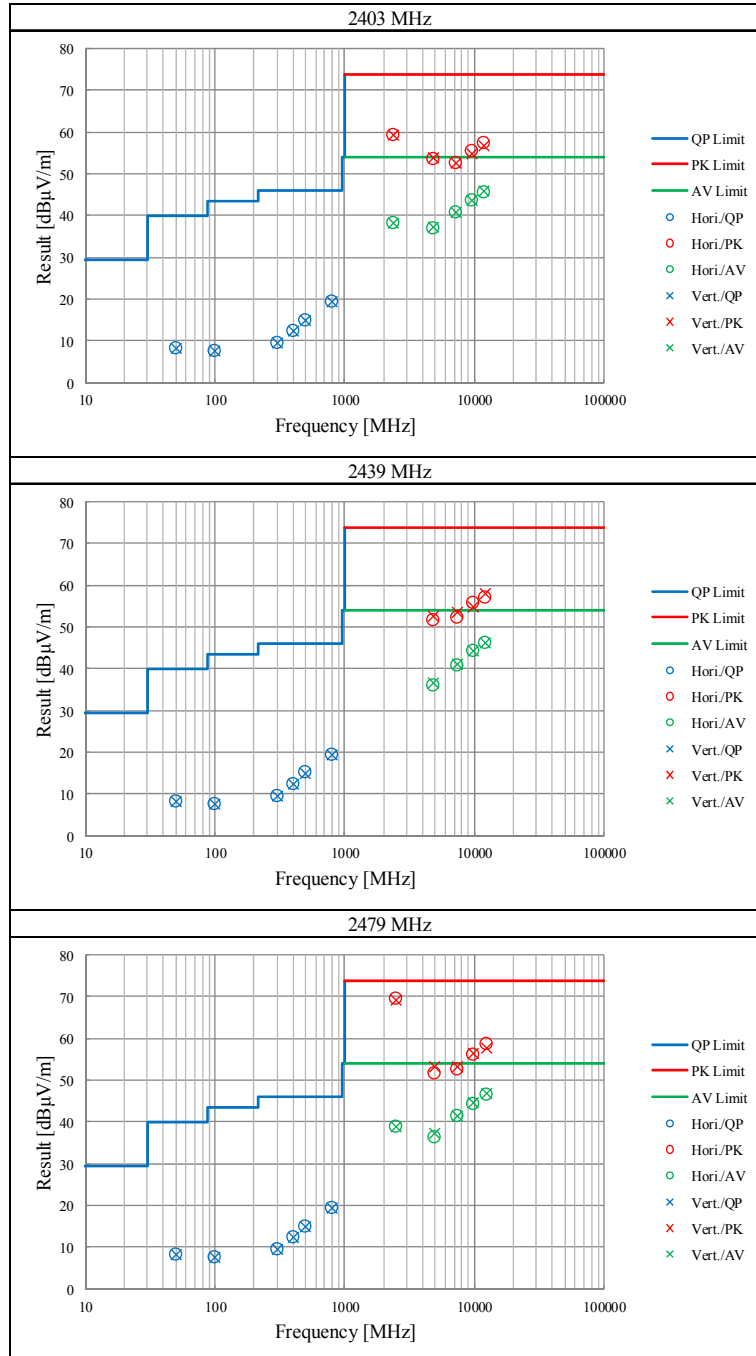
Report No.	11984010S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 28, 2017
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx, Hopping Off 2479 MHz



\* Final result of restricted band edge was shown in tabular data.

## **Radiated Spurious Emission (Antenna: ANT-2400-SF)** (All band chart)

Report No.	11984010S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.2	No.1
Date	November 29, 2017	November 28, 2017	November 29, 2017
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 36 % RH	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Hiroyuki Morikawa (1 GHz -18 GHz)	Hiroyuki Morikawa (18 MHz -26.5 GHz)
Mode	Tx, Hopping Off		



\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

## Radiated Spurious Emission (Antenna: ANT-2400-SFW-HG)

Report No.	11984010S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.2	No.1
Date	November 29, 2017	November 28, 2017	November 29, 2017
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 36 % RH	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa	Hiroyuki Morikawa	Hiroyuki Morikawa
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 MHz -26.5 GHz)
Mode	Tx, Hopping Off 2403 MHz		

(\* 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.	50.000	QP	21.70	10.94	7.49	31.82	0.00	8.31	40.00	31.6	100	0	
Hori.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Hori.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Hori.	400.000	QP	20.90	15.77	7.64	31.80	0.00	12.51	46.00	33.4	100	0	
Hori.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Hori.	800.000	QP	20.90	20.78	9.49	31.78	0.00	19.39	46.00	26.6	100	0	
Hori.	2390.000	PK	57.11	27.16	13.71	36.83	2.26	63.41	73.90	10.4	149	181	
Hori.	4806.000	PK	58.72	31.15	5.97	36.99	2.26	61.11	73.90	12.7	166	120	
Hori.	7209.000	PK	44.25	36.49	7.44	37.81	2.26	52.63	73.90	21.2	150	0	
Hori.	9612.000	PK	44.45	38.21	8.19	38.48	2.26	54.63	73.90	19.2	150	0	
Hori.	12015.000	PK	44.69	39.06	9.77	39.18	2.26	56.60	73.90	17.3	150	0	
Hori.	2390.000	AV	31.69	27.16	13.71	36.83	2.26	37.99	53.90	15.9	149	181	
Hori.	4806.000	AV	39.52	31.15	5.97	36.99	2.26	41.91	53.90	11.9	166	120	
Hori.	7209.000	AV	32.22	36.49	7.44	37.81	2.26	40.60	53.90	13.3	150	0	
Hori.	9612.000	AV	33.11	38.21	8.19	38.48	2.26	43.29	53.90	10.6	150	0	
Hori.	12015.000	AV	33.48	39.06	9.77	39.18	2.26	45.39	53.90	8.5	150	0	
Vert.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Vert.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Vert.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Vert.	400.000	QP	20.80	15.77	7.64	31.80	0.00	12.41	46.00	33.5	100	0	
Vert.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Vert.	800.000	QP	20.80	20.78	9.49	31.78	0.00	19.29	46.00	26.7	100	0	
Vert.	2390.000	PK	55.67	27.16	13.71	36.83	2.39	62.10	73.90	11.8	131	258	
Vert.	4806.000	PK	55.29	31.15	5.97	36.99	2.39	57.81	73.90	16.0	213	187	
Vert.	7209.000	PK	43.72	36.49	7.44	37.81	2.39	52.23	73.90	21.6	150	0	
Vert.	9612.000	PK	44.84	38.21	8.19	38.48	2.39	55.15	73.90	18.7	150	0	
Vert.	12015.000	PK	45.35	39.06	9.77	39.18	2.39	57.39	73.90	16.5	150	0	
Vert.	2390.000	AV	31.74	27.16	13.71	36.83	2.39	38.17	53.90	15.7	131	258	
Vert.	4806.000	AV	37.20	31.15	5.97	36.99	2.39	39.72	53.90	14.1	213	187	
Vert.	7209.000	AV	32.19	36.49	7.44	37.81	2.39	40.70	53.90	13.2	150	0	
Vert.	9612.000	AV	33.21	38.21	8.19	38.48	2.39	43.52	53.90	10.3	150	0	
Vert.	12015.000	AV	33.84	39.06	9.77	39.18	2.39	45.88	53.90	8.0	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB (Hori.)

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB (Vert.)

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

\* These results have sufficient margin without taking account Dwell time factor.

### 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	93.71	27.21	13.72	36.82	2.26	100.08	-	-	Carrier
Hori.	2400.000	PK	50.77	27.20	13.71	36.83	2.26	57.11	80.08	23.0	
Vert.	2403.000	PK	93.83	27.21	13.72	36.82	2.39	100.33	-	-	Carrier
Vert.	2400.000	PK	50.79	27.20	13.71	36.83	2.39	57.26	80.33	23.1	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB (Hori.)

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB (Vert.)

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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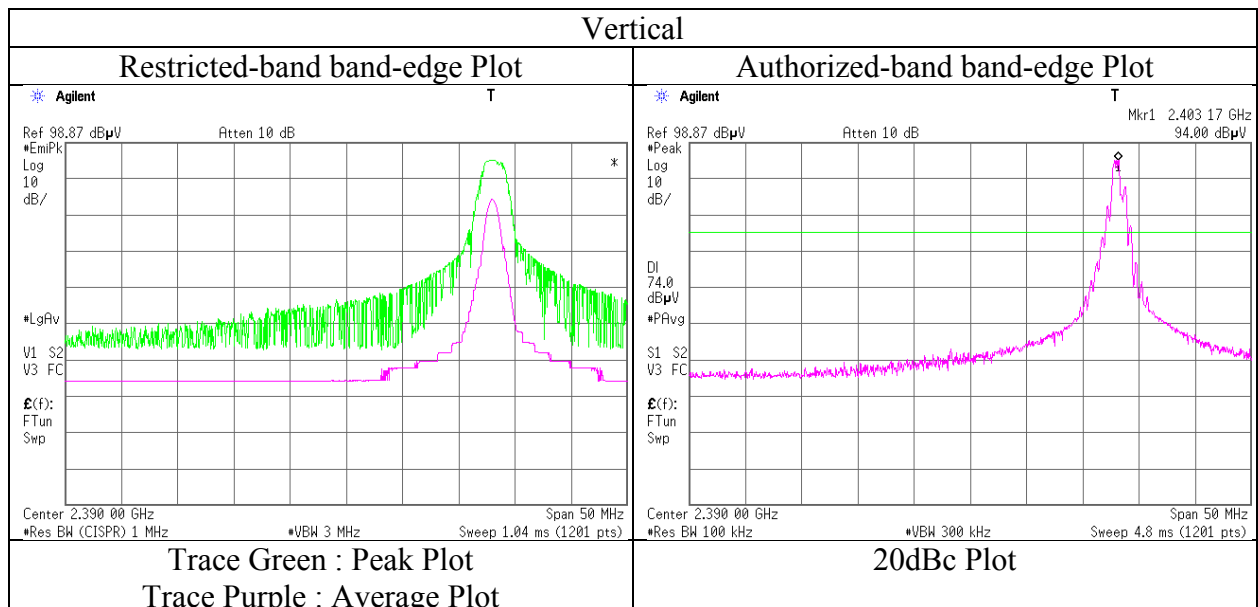
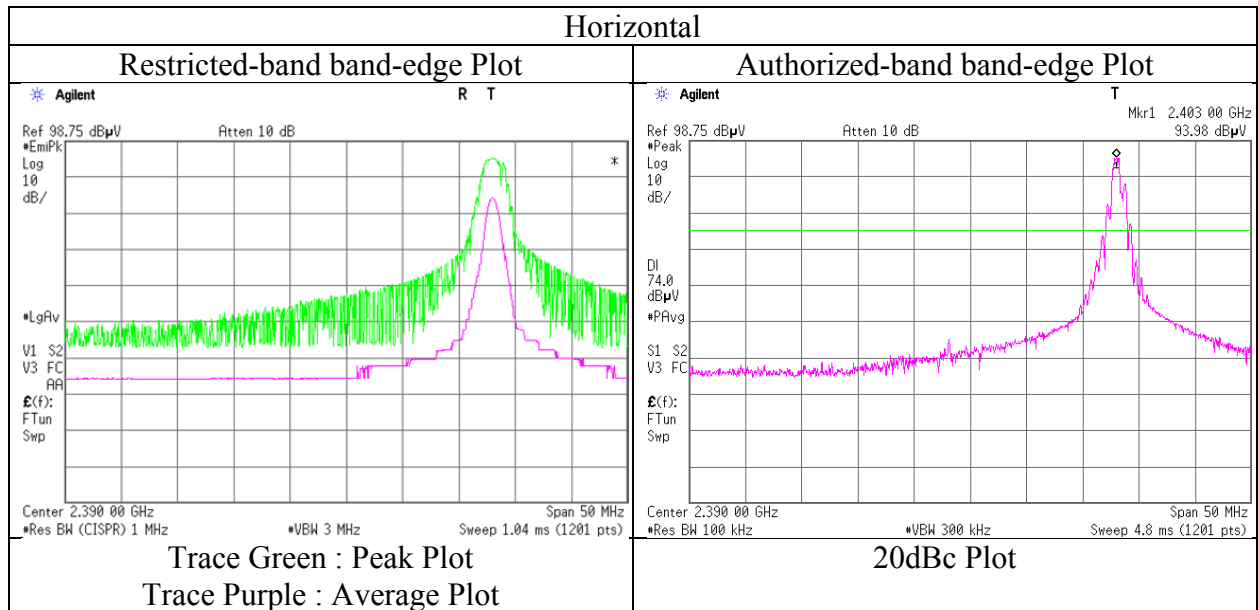
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Facsimile : +81 463 50 6401



## Radiated Spurious Emission (Antenna: ANT-2400-SFW-HG) (Reference Plot for band-edge)

Report No.	11984010S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 28, 2017
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx, Hopping Off 2403 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission (Antenna: ANT-2400-SFW-HG)

Report No.	11984010S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.2	No.1
Date	November 29, 2017	November 28, 2017	November 29, 2017
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 36 % RH	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Hiroyuki Morikawa (1 GHz -18 GHz)	Hiroyuki Morikawa (18 MHz -26.5 GHz)
Mode	Tx, Hopping Off 2439 MHz		

(\* 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.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Hori.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Hori.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Hori.	400.000	QP	20.90	15.77	7.64	31.80	0.00	12.51	46.00	33.4	100	0	
Hori.	500.000	QP	21.20	17.70	8.16	31.87	0.00	15.19	46.00	30.8	100	0	
Hori.	800.000	QP	20.80	20.78	9.49	31.78	0.00	19.29	46.00	26.7	100	0	
Hori.	4878.000	PK	58.64	31.30	6.05	37.03	2.26	61.22	73.90	12.6	165	124	
Hori.	7317.000	PK	44.78	36.64	7.53	37.88	2.26	53.33	73.90	20.5	150	0	
Hori.	9756.000	PK	45.18	38.50	8.29	38.66	2.26	55.57	73.90	18.3	150	0	
Hori.	12195.000	PK	45.02	39.08	10.04	39.14	2.26	57.26	73.90	16.6	150	0	
Hori.	4878.000	AV	39.21	31.30	6.05	37.03	2.26	41.79	53.90	12.1	165	124	
Hori.	7317.000	AV	32.42	36.64	7.53	37.88	2.26	40.97	53.90	12.9	150	0	
Hori.	9756.000	AV	33.56	38.50	8.29	38.66	2.26	43.95	53.90	9.9	150	0	
Hori.	12195.000	AV	34.01	39.08	10.04	39.14	2.26	46.25	53.90	7.6	150	0	
Vert.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Vert.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Vert.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Vert.	400.000	QP	20.80	15.77	7.64	31.80	0.00	12.41	46.00	33.5	100	0	
Vert.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Vert.	800.000	QP	20.80	20.78	9.49	31.78	0.00	19.29	46.00	26.7	100	0	
Vert.	4878.000	PK	54.76	31.30	6.05	37.03	2.39	57.47	73.90	16.4	171	200	
Vert.	7317.000	PK	43.93	36.64	7.53	37.88	2.39	52.61	73.90	21.2	150	0	
Vert.	9756.000	PK	44.66	38.50	8.29	38.66	2.39	55.18	73.90	18.7	150	0	
Vert.	12195.000	PK	44.83	39.08	10.04	39.14	2.39	57.20	73.90	16.7	150	0	
Vert.	4878.000	AV	36.79	31.30	6.05	37.03	2.39	39.50	53.90	14.4	171	200	
Vert.	7317.000	AV	32.05	36.64	7.53	37.88	2.39	40.73	53.90	13.1	150	0	
Vert.	9756.000	AV	33.09	38.50	8.29	38.66	2.39	43.61	53.90	10.2	150	0	
Vert.	12195.000	AV	33.43	39.08	10.04	39.14	2.39	45.80	53.90	8.1	150	0	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$  (Hori.)

Distance factor : 1 GHz - 13 GHz :  $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$  (Vert.)

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

\* These results have sufficient margin without taking account Dwell time factor.

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## Radiated Spurious Emission (Antenna: ANT-2400-SFW-HG)

Report No.	11984010S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.2	No.1
Date	November 29, 2017	November 28, 2017	November 29, 2017
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 36 % RH	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Hiroyuki Morikawa (1 GHz -18 GHz)	Hiroyuki Morikawa (18 MHz -26.5 GHz)
Mode	Tx, Hopping Off 2479 MHz		

(\* 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.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Hori.	100.000	QP	21.40	9.86	8.18	31.80	0.00	7.64	43.50	35.8	100	0	
Hori.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Hori.	400.000	QP	20.90	15.77	7.64	31.80	0.00	12.51	46.00	33.4	100	0	
Hori.	500.000	QP	21.20	17.70	8.16	31.87	0.00	15.19	46.00	30.8	100	0	
Hori.	800.000	QP	20.80	20.78	9.49	31.78	0.00	19.29	46.00	26.7	100	0	
Hori.	2483.500	PK	64.10	27.48	13.81	36.79	2.26	70.86	73.90	3.0	150	0	
Hori.	2835.160	PK	50.06	28.26	6.04	36.75	2.26	49.87	73.90	24.0	105	0	
Hori.	4958.000	PK	56.70	31.48	6.12	37.07	2.26	59.49	73.90	14.4	132	122	
Hori.	7437.000	PK	44.88	36.80	7.64	37.95	2.26	53.63	73.90	20.2	150	0	
Hori.	9916.000	PK	45.15	38.81	8.39	38.86	2.26	55.75	73.90	18.1	150	0	
Hori.	12395.000	PK	44.69	39.10	10.33	39.10	2.26	57.28	73.90	16.6	150	0	
Hori.	2483.500	AV	32.01	27.48	13.81	36.79	2.26	38.77	53.90	15.1	150	0	
Hori.	2835.160	AV	33.89	28.26	6.04	36.75	2.26	33.70	53.90	20.2	105	0	
Hori.	4958.000	AV	37.78	31.48	6.12	37.07	2.26	40.57	53.90	13.3	132	122	
Hori.	7437.000	AV	32.34	36.80	7.64	37.95	2.26	41.09	53.90	12.8	150	0	
Hori.	9916.000	AV	33.51	38.81	8.39	38.86	2.26	44.11	53.90	9.7	150	0	
Hori.	12395.000	AV	33.90	39.10	10.33	39.10	2.26	46.49	53.90	7.4	150	0	
Vert.	50.000	QP	21.60	10.94	7.49	31.82	0.00	8.21	40.00	31.7	100	0	
Vert.	100.000	QP	21.50	9.86	8.18	31.80	0.00	7.74	43.50	35.7	100	0	
Vert.	300.000	QP	21.10	13.51	6.78	31.76	0.00	9.63	46.00	36.3	100	0	
Vert.	400.000	QP	20.90	15.77	7.64	31.80	0.00	12.51	46.00	33.4	100	0	
Vert.	500.000	QP	21.10	17.70	8.16	31.87	0.00	15.09	46.00	30.9	100	0	
Vert.	800.000	QP	20.80	20.78	9.49	31.78	0.00	19.29	46.00	26.7	100	0	
Vert.	2483.500	PK	64.73	27.48	13.81	36.79	2.39	71.62	73.90	2.2	100	0	
Vert.	4958.000	PK	51.78	31.48	6.12	37.07	2.39	54.70	73.90	19.2	150	197	
Vert.	7437.000	PK	44.07	36.80	7.64	37.95	2.39	52.95	73.90	20.9	150	0	
Vert.	9916.000	PK	44.87	38.81	8.39	38.86	2.39	55.60	73.90	18.3	150	0	
Vert.	12395.000	PK	45.90	39.10	10.33	39.10	2.39	58.62	73.90	15.2	150	0	
Vert.	2483.500	AV	32.06	27.48	13.81	36.79	2.39	38.95	53.90	14.9	100	0	
Vert.	4958.000	AV	34.96	31.48	6.12	37.07	2.39	37.88	53.90	16.0	150	197	
Vert.	7437.000	AV	32.32	36.80	7.64	37.95	2.39	41.20	53.90	12.7	150	0	
Vert.	9916.000	AV	33.42	38.81	8.39	38.86	2.39	44.15	53.90	9.7	150	0	
Vert.	12395.000	AV	33.83	39.10	10.33	39.10	2.39	46.55	53.90	7.3	150	0	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$  (Hori.)

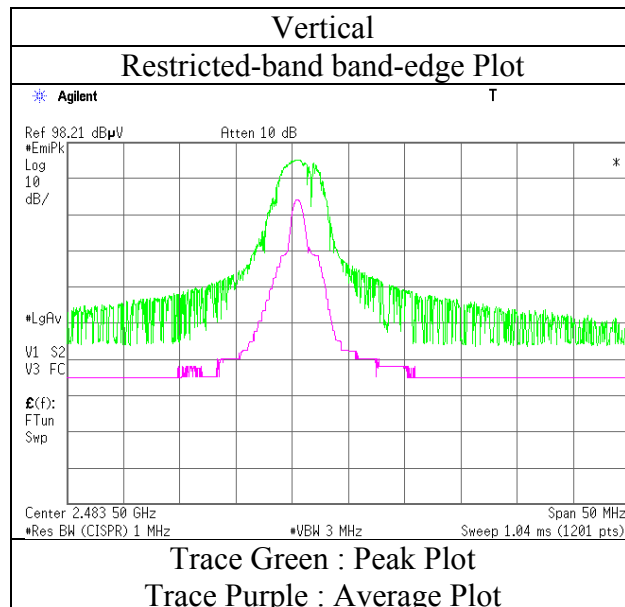
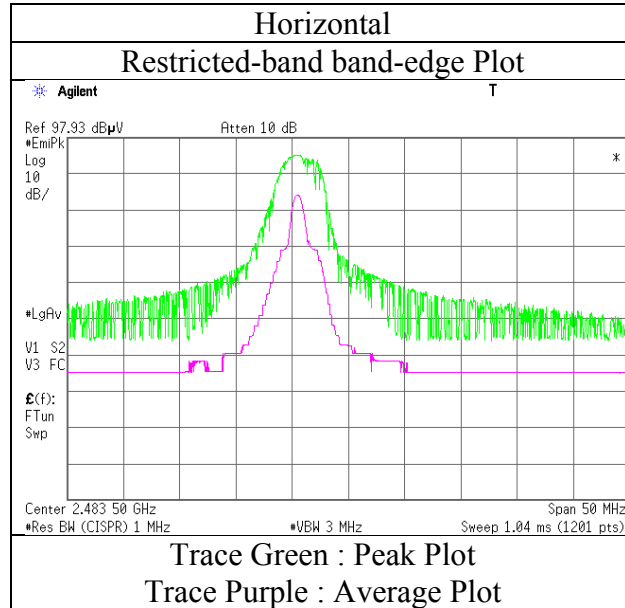
Distance factor : 1 GHz - 13 GHz :  $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$  (Vert.)

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

\* These results have sufficient margin without taking account Dwell time factor.

## Radiated Spurious Emission (Antenna: ANT-2400-SFW-HG) (Reference Plot for band-edge)

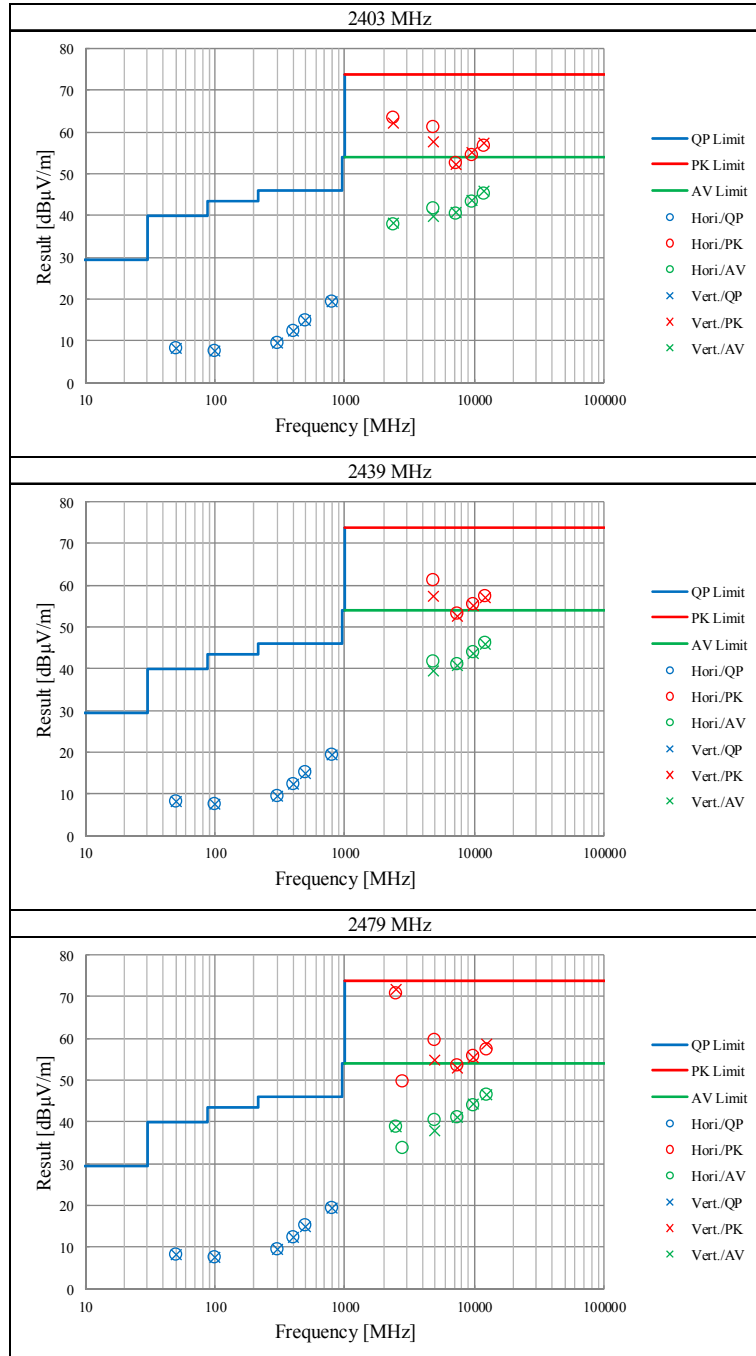
Report No.	11984010S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 28, 2017
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx, Hopping Off 2479 MHz



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission (Antenna: ANT-2400-SFW-HG) (All band chart)

Report No.	11984010S-A-R1	No.1	No.2	No.1
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.1	No.2		
Date	November 29, 2017	November 28, 2017		November 29, 2017
Temperature / Humidity	22 deg. C / 36 % RH	22 deg. C / 36 % RH		22 deg. C / 36 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Hiroyuki Morikawa (1 GHz -18 GHz)		Hiroyuki Morikawa (18 MHz -26.5 GHz)
Mode	Tx, Hopping Off			



\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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## **APPENDIX 2: Test instruments**

### **Test Instruments**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2017/02/17 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	RE	2017/06/13 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2017/05/08 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2017/08/14 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2017/10/30 * 12
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	RE	2017/10/12 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE	-
SAEC-02(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-02(SVSW R)	2	RE	2017/07/18 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,C E,RFLMF)	-	RE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE	2017/03/08 * 12
SAT10-05	Attenuator(above 1 GHz)	Agilent	8493C-010	74864	RE	2017/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2017/11/16 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2017/02/09 * 12
KAT6-04	Attenuator	INMET	18N-6dB	-	RE	2016/12/15 * 12
SAT3-09	Attenuator	JFW	50HF-003N	-	RE	2017/08/24 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2017/10/21 * 12
SCC-A1/A3/A5/A7/A8/A13/SRS E-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	~/0901-269(RF Selector)	RE	2017/04/07 * 12
SCC-A2/A4/A6/A7/A8/A13/SRS E-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	~/0901-269(RF Selector)	RE	2017/04/07 * 12
SLA-05	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	RE	2017/01/05 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2017/10/30 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2017/04/12 * 12
KJM-09	Measure	KOMELON	KMC-36	-	RE	-
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2017/06/09 * 12
STS-01	Digital Hitester	Hioki	3805-50	080997812	RE	2017/10/16 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM9861	RE	2017/07/11 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2017/03/17 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2017/04/20 * 12

\*Hyphens for Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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: RE: Radiated Emission test

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