



# **RADIO TEST REPORT**

**Test Report No. : 11826181S**

**Applicant** : Kyowa Electronic Instruments Co., Ltd.  
**Type of Equipment** : Radio frequency module for Small-sized Digital Telemetry Systems  
**Model No.** : MR-2400MA  
**FCC ID** : 2AJE9MR-2400MA  
**Test regulation** : FCC Part 15 Subpart C: 2017  
**Test item** : Radiated Spurious Emission  
Conducted Spurious Emission  
**Test Result** : Complied

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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:** June 27 to July 4, 2017

**Representative test engineer:**

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**JAB**  
Testing  
RTL02610

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

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## **SECTION 1: Customer information**

Company Name : Kyowa Electronic Instruments Co., Ltd.  
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Contact Person : Kiyoshi Egawa

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

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

Type of Equipment : Radio frequency module for Small-sized Digital Telemetry Systems  
Model No. : MR-2400MA  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : Typical: DC 3.0 V  
Receipt Date of Sample : June 27, 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: MR-2400MA (referred to as the EUT in this report) is a Radio frequency module for Small-sized Digital Telemetry Systems.

### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 2405 MHz - 2480 MHz  
Modulation : GFSK  
Power Supply (radio part input) : DC 1.2 V, DC 1.7 V  
Clock frequency : 32 MHz, 32.768 kHz

Cable and connector:

No.	Cable and connector	Loss [dB]
1	Internal layer pattern (Board 1)	0.48
2	Internal layer pattern (Board 2)	0.33
3	Internal layer pattern (Board 3)	0.12
4	6303090203-150	0.63
5	SMA-RP(P)-SMA-RP(J)-174/U-2000	3.30
6	D-C22-054-A-G (SMA-PR-A-PP)	-
7	D-C22-052-A-G (SMA-PR-LA-PJ)	-
8	D-C16-086-A-G	0.20
9	SMA454A1	0.04
10	SMA40A1/1	0.07
11	6303020003-60	0.36
12	D-E01-276-A-G	9.97

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Antenna name, type, gain, connector type			
W1030 *2)	Lambda/2 dipole antenna,	+2.00 dBi,	Reverse SMA (P)
	with antenna cable 1 & 4 (loss 1.11 dB) total antenna gain: 0.89 dBi		
	with antenna cable 2 & 4 (loss 0.96 dB) total antenna gain: 1.04 dBi		
	with antenna cable 3 & 4 (loss 0.75 dB) total antenna gain: 1.25 dBi *1)		
	with antenna cable 1 & 4 & 5 (loss 4.41 dB) total antenna gain: -2.41 dBi		
	with antenna cable 2 & 4 & 5 (loss 4.26 dB) total antenna gain: -2.26 dBi		
	with antenna cable 3 & 4 & 5 (loss 4.05 dB) total antenna gain: -2.05 dBi		
	with antenna cable 1 & 4 & 12 (loss 11.08 dB) total antenna gain: -9.08 dBi		
	with antenna cable 2 & 4 & 12 (loss 10.93 dB) total antenna gain: -8.93 dBi		
	with antenna cable 3 & 4 & 12 (loss 10.72 dB) total antenna gain: -8.72 dBi		
EXT-ANT2 *2)	bow-tie antenna,	+1.70 dBi,	Reverse SMA (J)
	with antenna cable 1 & 4 & 6 (loss 1.11 dB) total antenna gain: 0.59 dBi		
	with antenna cable 2 & 4 & 6 (loss 0.96 dB) total antenna gain: 0.74 dBi		
	with antenna cable 3 & 4 & 6 (loss 0.75 dB) total antenna gain: 0.95 dBi *1)		
	with antenna cable 1 & 4 & 5 & 6 (loss 4.41 dB) total antenna gain: -2.71 dBi		
	with antenna cable 2 & 4 & 5 & 6 (loss 4.26 dB) total antenna gain: -2.56 dBi		
	with antenna cable 3 & 4 & 5 & 6 (loss 4.05 dB) total antenna gain: -2.35 dBi		
	with antenna cable 1 & 4 & 5 & 6 & 7 (loss 4.41 dB) total antenna gain: -2.71 dBi		
	with antenna cable 2 & 4 & 5 & 6 & 7 (loss 4.26 dB) total antenna gain: -2.56 dBi		
	with antenna cable 3 & 4 & 5 & 6 & 7 (loss 4.05 dB) total antenna gain: -2.35 dBi		
	with antenna cable 1 & 4 & 5 & 9 (loss 4.41 dB) total antenna gain: -2.71 dBi		
	with antenna cable 2 & 4 & 5 & 9 (loss 4.30 dB) total antenna gain: -2.60 dBi		
	with antenna cable 3 & 4 & 5 & 9 (loss 4.09dB) total antenna gain: -2.39 dBi		
	with antenna cable 1 & 4 & 5 & 10 (loss 4.48 dB) total antenna gain: -2.78 dBi		
	with antenna cable 2 & 4 & 5 & 10 (loss 4.33 dB) total antenna gain: -2.63 dBi		
	with antenna cable 3 & 4 & 5 & 10 (loss 4.12 dB) total antenna gain: -2.42 dBi		
	with antenna cable 1 & 4 & 9 (loss 1.15 dB) total antenna gain: 0.55 dBi		
	with antenna cable 2 & 4 & 9 (loss 1.00 dB) total antenna gain: 0.70 dBi		
	with antenna cable 3 & 4 & 9 (loss 0.79 dB) total antenna gain: 0.91 dBi		
	with antenna cable 1 & 4 & 10 (loss 1.18 dB) total antenna gain: 0.52 dBi		
	with antenna cable 2 & 4 & 10 (loss 1.03 dB) total antenna gain: 0.67 dBi		
	with antenna cable 3 & 4 & 10 (loss 0.82 dB) total antenna gain: 0.88 dBi		
	with antenna cable 1 & 4 & 10 & 12 (loss 11.15 dB) total antenna gain: -9.45 dBi		
	with antenna cable 2 & 4 & 10 & 12 (loss 11.00 dB) total antenna gain: -9.30 dBi		
	with antenna cable 3 & 4 & 10 & 12 (loss 10.79 dB) total antenna gain: -9.09 dBi		
A 21 M245001 AH 212 *2)	monopole antenna (chip antenna),	+0.90 dBi,	Connector none
MR-ANT1 *2)	monopole antenna,	-6.00 dBi,	Connector none
AA-562-2050	Patch antenna	+1.95 dBi	Reverse SMA (P)
	with antenna cable 1 & 4 (loss 1.11 dB) total antenna gain: 0.84 dBi		
	with antenna cable 2 & 4 (loss 0.96 dB) total antenna gain: 0.99 dBi		
	with antenna cable 3 & 4 (loss 0.75 dB) total antenna gain: 1.20 dBi *1)		
	with antenna cable 1 & 4 & 5 (loss 4.41 dB) total antenna gain: -2.46 dBi		
	with antenna cable 2 & 4 & 5 (loss 4.26 dB) total antenna gain: -2.31 dBi		
	with antenna cable 3 & 4 & 5 (loss 4.05 dB) total antenna gain: -2.10 dBi		
	with antenna cable 1 & 4 & 12 (loss 11.08 dB) total antenna gain: -9.13 dBi		
	with antenna cable 2 & 4 & 12 (loss 10.93 dB) total antenna gain: -8.98 dBi		
	with antenna cable 3 & 4 & 12 (loss 10.72 dB) total antenna gain: -8.77 dBi		
2.4GHZ WIRE ANTENNA	monopole antenna	1.62 dBi	Connector none
	with antenna cable 2 (loss 0.33 dB) total antenna gain: 1.29 dBi		
	with antenna cable 3 (loss 0.12 dB) total antenna gain: 1.50 dBi *1)		
EXT-ANT3	Bowtie antenna	2.70 dBi	Connector none
	with antenna cable 2 & 11 (loss 0.69 dB) total antenna gain: 2.01 dBi		
	with antenna cable 3 & 11 (loss 0.48 dB) total antenna gain: 2.22 dBi *1)		

\*1) The combination which has the highest antenna gain has been chosen for the test.

\*2) Refer to the original test report: 11392143S-B-R4

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on June 14, 2017 and effective July 14, 2017

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

\* The revision on June 14, 2017, does not affect the test specification applied to the EUT.

### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04	FCC: Section15.247(d)	1.0 dB	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	4960.00 MHz, AV, Horizontal, Tx 2480 MHz Antenna: EXT-ANT3		
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.					
*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.					

\* 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 1.2 V / 1.7 V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

#### **FCC Part 15.203 / 212 Antenna requirement**

W1030 (Lambda/2 dipole antenna), EXT-ANT2 (bow-tie antenna), AA-562-2050(Patch antenna),  
2.4GHZ WIRE ANTENNA(Monopole antenna), EXT-ANT3(bow-tie antenna):

There is a unique coupling/antenna connector. Therefore the equipment complies with the requirement.

A 21 M245001 AH 212 (monopole antenna (chip antenna)):

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement.

MR-ANT1 (monopole antenna):

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

### **3.3 Addition to standard**

No addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

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

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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	2.6 dB	2.5 dB	2.6 dB	2.5 dB	2.5 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.1 dB	3.1 dB	3.1 dB	-	-
	30 MHz-200 MHz	4.6 dB	4.4 dB	4.6 dB	-	-
	200 MHz-1 GHz	5.8 dB	5.7 dB	5.8 dB	-	-
	1 GHz-13 GHz	4.9 dB	4.9 dB	4.9 dB	-	-
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	4.6 dB	4.6 dB	4.6 dB	-	-
	18 GHz-40 GHz	4.9 dB	4.9 dB	4.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.72 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.85 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.91 dB
Spurious emission (Conducted) below 1GHz	1.6 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.3 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.2 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.3 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

#### Radiated emission test

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

### 3.5 Test Location

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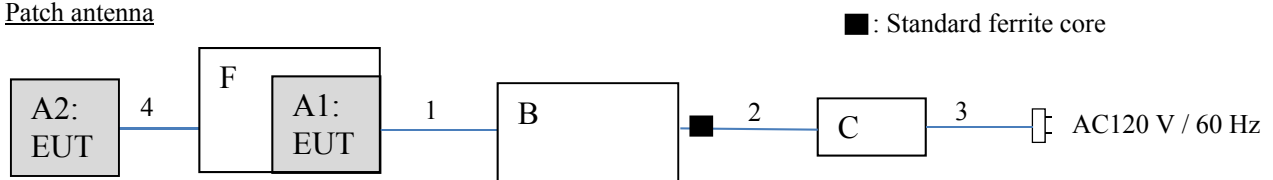
## SECTION 4: Operation of E.U.T. during testing

### 4.1 Operating Mode(s)

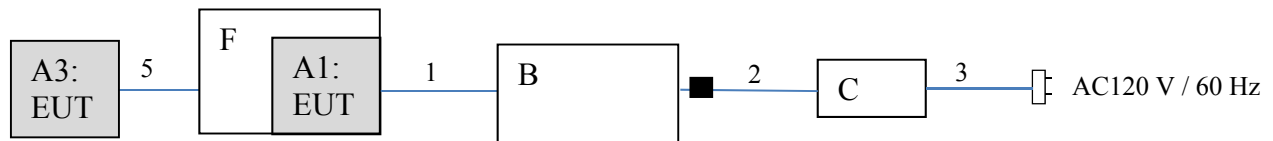
Mode	Frequency	Remarks*
Transmitting (Tx)	2405 MHz, 2440 MHz, 2480 MHz	PN9
*Power of the EUT was set by the software as follows; Power settings: Fixed Software Version: MRT-50A_v0.16.exe, ver.0.16  *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.		

### 4.2 Configuration and peripherals

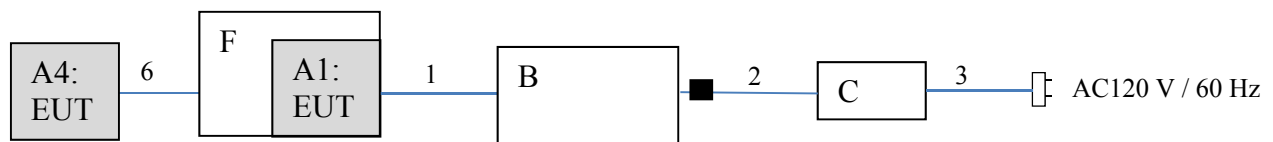
#### Patch antenna



#### Monopole antenna



#### Bow-tie antenna



\* 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	Radio frequency module for Small-sized Digital Telemetry Systems	MR-2400MA	9	TAIYOYUDEN	EUT
A2	Patch Antenna	AA-562-2050	-	-	EUT
A3	Monopole Antenna	2.4GHZ WIRE ANTENNA	-	-	EUT
A4	Bow-tie antenna	EXT-ANT3	-	-	EUT
B	Telemetry Receiver	-	-	Kyowa	-
C	AC Adapter	SA-10A	S09-0202243	Kyowa	-
F	Jig	-	-	-	-

#### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Relay harness	0.2	Unshielded	Unshielded	-
2	DC	1.8	Unshielded	Unshielded	-
3	AC	1.5	Unshielded	Unshielded	-
4	Antenna	1.0 + 0.15	Shielded	Shielded	-
5	Antenna	0.2	Shielded	Shielded	-
6	Antenna	0.1	Shielded	Shielded	-

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

### **Test Procedure**

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.25 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 0.25 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 *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	3.91 / 3.90 / 3.95 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		

\*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

\*2) Distance Factor: Patch Antenna:  $20 \times \log(3.91 \text{ m} / 3.0 \text{ m}) = 2.31 \text{ dB}$   
Monopole Antenna:  $20 \times \log(3.90 \text{ m} / 3.0 \text{ m}) = 2.27 \text{ dB}$   
Bow-tie Antenna:  $20 \times \log(3.95 \text{ m} / 3.0 \text{ m}) = 2.38 \text{ dB}$

\*3) Distance Factor:  $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

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

#### Patch antenna (AA-562-2050)

	Measurement antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Module	Horizontal	X	X	Z	X
	Vertical	Z	X	Z	X
Antenna	Horizontal	Y (V side)	X (H side)	Z (V side)	X (H side)
	Vertical	Y (H side)	X (H side)	X (V side)	X (H side)

#### Monopole antenna (2.4GHz WIRE ANTENNA)

	Measurement antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Module	Horizontal	X	X	Z	X
	Vertical	Z	X	Z	X
Antenna	Horizontal	X	Y	X	X
	Vertical	Y	Y	X	X

#### Bow-tie antenna (EXT-ANT3)

	Measurement antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Module	Horizontal	X	X	Z	X
	Vertical	Z	X	Z	X
Antenna	Horizontal	Z	X	X	X
	Vertical	Y	X	Z	X

Measurement range : 30 MHz - 26.5 GHz  
 Test data : APPENDIX  
 Test result : Pass

## SECTION 6: 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
Conducted Spurious Emission *1)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				
*1) 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. (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)							

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

Test data : APPENDIX  
 Test result : Pass

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## APPENDIX 1: Test data

### Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2405 MHz, Patch Antenna

(\* 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.	159.997	QP	31.22	15.30	8.65	31.79	0.00	23.38	43.50	20.1	214	56	
Hori.	177.115	QP	31.11	16.02	8.83	31.78	0.00	24.18	43.50	19.3	220	52	
Hori.	332.074	QP	46.40	14.17	6.86	31.63	0.00	35.80	46.00	10.2	100	161	
Hori.	393.599	QP	38.82	15.66	7.28	31.62	0.00	30.14	46.00	15.8	100	189	
Hori.	781.670	QP	34.50	20.68	9.29	31.35	0.00	33.12	46.00	12.8	134	242	
Hori.	875.569	QP	30.59	21.96	9.73	30.97	0.00	31.31	46.00	14.6	115	222	
Hori.	2338.806	PK	53.97	27.04	14.10	40.87	2.31	56.55	73.90	17.4	161	9	
Hori.	2390.000	PK	50.18	27.21	14.16	40.85	2.31	53.01	73.90	20.9	161	9	
Hori.	4810.000	PK	58.05	31.14	6.69	41.86	2.31	56.33	73.90	17.6	208	31	
Hori.	7215.000	PK	48.56	36.26	8.35	41.19	2.31	54.29	73.90	19.6	183	158	
Vert.	40.108	QP	30.72	14.35	7.11	31.89	0.00	20.29	40.00	19.7	100	356	
Vert.	67.284	QP	35.43	6.69	7.53	31.88	0.00	17.77	40.00	22.2	100	252	
Vert.	781.747	QP	27.01	20.68	9.29	31.35	0.00	25.63	46.00	20.3	100	357	
Vert.	2338.664	PK	54.92	27.04	14.10	40.87	2.31	57.50	73.90	16.4	139	359	
Vert.	2390.000	PK	50.20	27.21	14.16	40.85	2.31	53.03	73.90	20.9	139	359	
Vert.	4810.000	PK	57.32	31.14	6.69	41.86	2.31	55.60	73.90	18.3	234	102	
Vert.	7215.000	PK	48.54	36.26	8.35	41.19	2.31	54.27	73.90	19.6	217	145	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91\text{ m} / 3.0\text{ m}) = 2.31\text{ dB}$

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

#### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2338.806	AV	40.71	27.04	14.10	40.87	2.93	2.31	46.22	53.90	7.7	
Hori.	2390.000	AV	38.57	27.21	14.16	40.85	2.93	2.31	44.33	53.90	9.6	*1)
Hori.	4810.000	AV	45.83	31.14	6.69	41.86	2.93	2.31	47.04	53.90	6.9	
Hori.	7215.000	AV	40.48	36.26	8.35	41.19	2.93	2.31	49.14	53.90	4.8	
Vert.	2338.664	AV	40.31	27.04	14.10	40.87	2.93	2.31	45.82	53.90	8.1	
Vert.	2390.000	AV	38.66	27.21	14.16	40.85	2.93	2.31	44.42	53.90	9.5	*1)
Vert.	4810.000	AV	44.55	31.14	6.69	41.86	2.93	2.31	45.76	53.90	8.1	
Vert.	7215.000	AV	40.09	36.26	8.35	41.19	2.93	2.31	48.75	53.90	5.2	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91\text{ m} / 3.0\text{ m}) = 2.31\text{ dB}$

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

#### 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.	2405.000	PK	96.54	27.26	14.17	40.84	2.31	99.44	-	-	Carrier
Hori.	2394.599	PK	51.15	27.23	14.16	40.85	2.31	54.00	79.44	25.4	
Hori.	2400.000	PK	44.08	27.25	14.16	40.84	2.31	46.96	79.44	32.5	
Vert.	2405.000	PK	96.70	27.26	14.17	40.84	2.31	99.60	-	-	Carrier
Vert.	2394.493	PK	51.79	27.23	14.16	40.85	2.31	54.64	79.60	25.0	
Vert.	2400.000	PK	44.64	27.25	14.16	40.84	2.31	47.52	79.60	32.1	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91\text{ m} / 3.0\text{ m}) = 2.31\text{ dB}$

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

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Shonan EMC Lab.

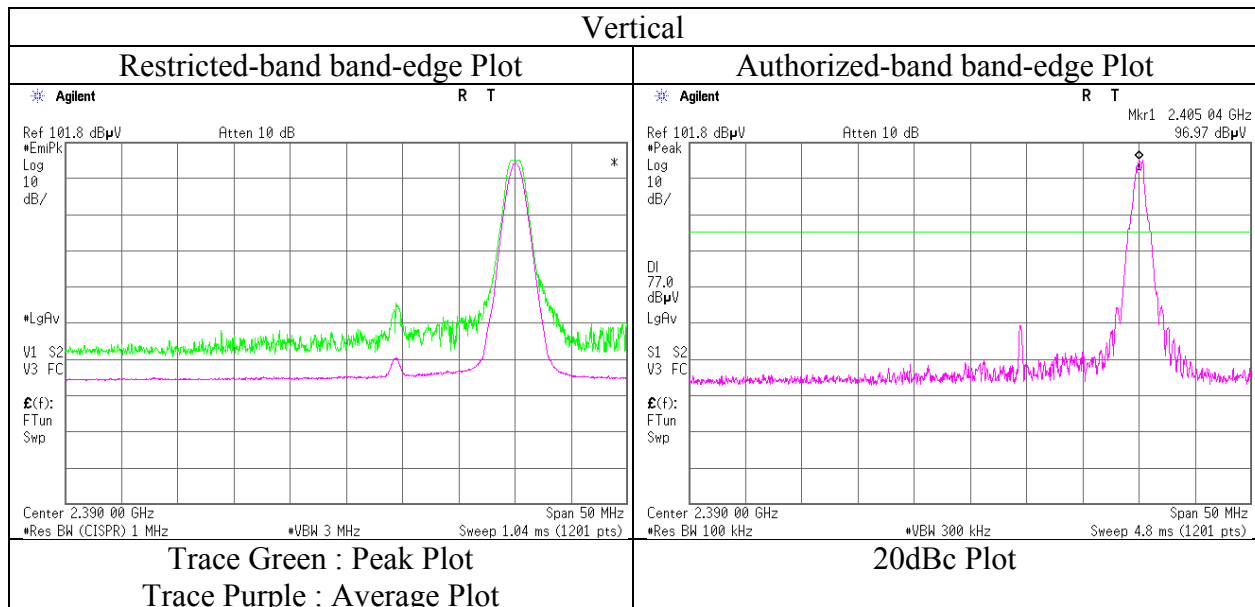
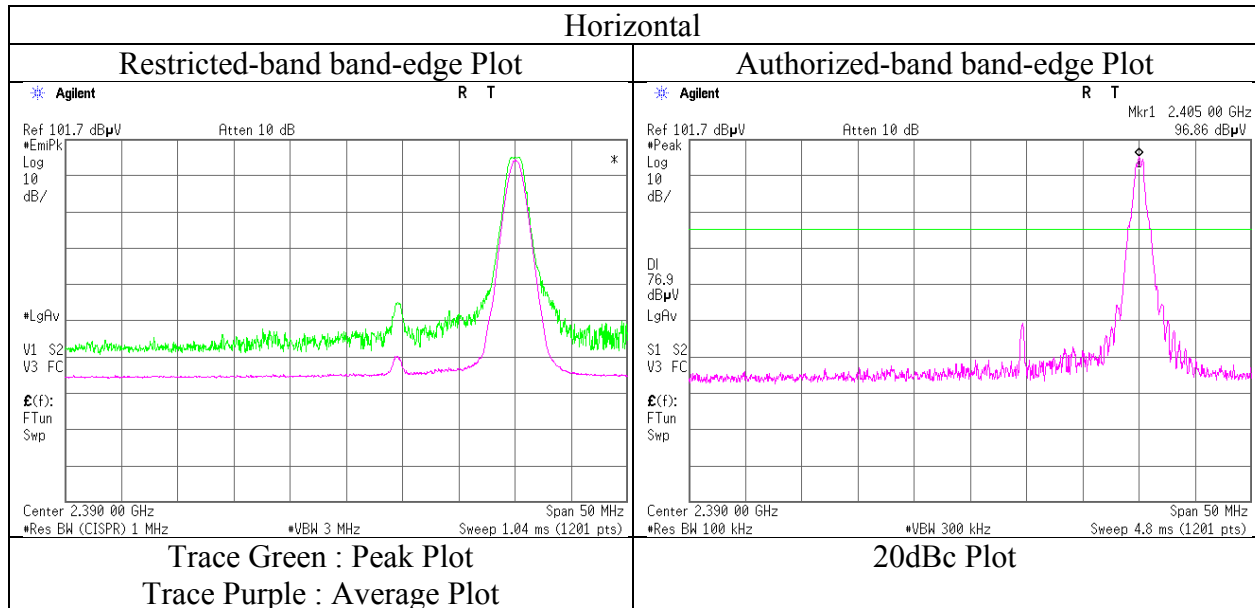
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## Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11826181S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber No.	1
Date	July 4, 2017
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz – 13 GHz)
Mode	Tx 2405 MHz, Patch Antenna



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

## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2440 MHz, Patch Antenna

(\* 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.	119.998	QP	31.19	12.95	8.21	31.83	0.00	20.52	43.50	22.9	146	180	
Hori.	177.073	QP	32.08	16.02	8.83	31.78	0.00	25.15	43.50	18.3	216	57	
Hori.	331.934	QP	46.89	14.17	6.86	31.63	0.00	36.29	46.00	<b>9.7</b>	101	153	
Hori.	388.140	QP	41.01	15.53	7.24	31.62	0.00	32.16	46.00	13.8	100	185	
Hori.	788.072	QP	34.36	20.74	9.32	31.32	0.00	33.10	46.00	12.9	138	234	
Hori.	877.105	QP	30.48	21.98	9.74	30.96	0.00	31.24	46.00	14.7	114	225	
Hori.	2338.812	PK	54.36	27.04	14.10	40.87	2.31	56.94	73.90	17.0	160	9	
Hori.	4880.000	PK	56.33	31.29	6.77	41.76	2.31	54.94	73.90	19.0	201	314	
Hori.	7320.000	PK	48.17	36.40	8.51	41.27	2.31	54.12	73.90	19.8	211	169	
Vert.	40.557	QP	31.53	14.20	7.12	31.89	0.00	20.96	40.00	19.0	100	348	
Vert.	63.891	QP	34.85	7.20	7.48	31.88	0.00	17.65	40.00	22.3	100	231	
Vert.	785.991	QP	31.13	20.72	9.31	31.33	0.00	29.83	46.00	16.1	100	329	
Vert.	2338.666	PK	54.25	27.04	14.10	40.87	2.31	56.83	73.90	17.1	137	354	
Vert.	4880.000	PK	54.79	31.29	6.77	41.76	2.31	53.40	73.90	20.5	224	95	
Vert.	7320.000	PK	50.39	36.40	8.51	41.27	2.31	56.34	73.90	17.6	228	137	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91\text{ m} / 3.0\text{ m}) = 2.31\text{ dB}$

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2338.812	AV	39.54	27.04	14.10	40.87	2.93	2.31	45.05	53.90	8.9	
Hori.	4880.000	AV	44.55	31.29	6.77	41.76	2.93	2.31	46.09	53.90	7.8	
Hori.	7320.000	AV	40.86	36.40	8.51	41.27	2.93	2.31	49.74	53.90	4.2	
Vert.	2338.666	AV	40.65	27.04	14.10	40.87	2.93	2.31	46.16	53.90	7.7	
Vert.	4880.000	AV	42.57	31.29	6.77	41.76	2.93	2.31	44.11	53.90	9.8	
Vert.	7320.000	AV	42.19	36.40	8.51	41.27	2.93	2.31	51.07	53.90	<b>2.8</b>	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91\text{ m} / 3.0\text{ m}) = 2.31\text{ dB}$

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

### 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.	2440.000	PK	97.11	27.38	14.22	40.83	2.31	100.19	-	-	Carrier
Hori.	2394.646	PK	50.82	27.23	14.16	40.85	2.31	53.67	80.19	26.5	
Vert.	2440.000	PK	97.35	27.38	14.22	40.83	2.31	100.43	-	-	Carrier
Vert.	2394.475	PK	51.49	27.23	14.16	40.85	2.31	54.34	80.43	26.1	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91\text{ m} / 3.0\text{ m}) = 2.31\text{ dB}$

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

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## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2480 MHz, Patch Antenna

(\* 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.	119.998	QP	33.73	12.95	8.21	31.83	0.00	23.06	43.50	20.4	215	185	
Hori.	177.038	QP	31.56	16.02	8.82	31.78	0.00	24.62	43.50	18.8	223	45	
Hori.	332.780	QP	44.84	14.19	6.87	31.63	0.00	34.27	46.00	11.7	100	160	
Hori.	405.340	QP	38.49	15.92	7.36	31.62	0.00	30.15	46.00	15.8	100	183	
Hori.	784.850	QP	33.77	20.71	9.30	31.33	0.00	32.45	46.00	13.5	131	233	
Hori.	875.358	QP	30.76	21.95	9.73	30.97	0.00	31.47	46.00	14.5	126	314	
Hori.	2483.500	PK	53.22	27.52	14.27	40.81	2.31	56.51	73.90	17.4	184	6	
Hori.	2514.325	PK	59.12	27.61	14.29	40.82	2.31	62.51	73.90	11.4	184	6	
Hori.	2582.639	PK	55.67	27.73	14.36	40.90	2.31	59.17	73.90	14.7	184	6	
Hori.	4960.000	PK	56.12	31.45	6.85	41.65	2.31	55.08	73.90	18.8	202	320	
Hori.	7440.000	PK	47.99	36.57	8.66	41.36	2.31	54.17	73.90	19.7	208	169	
Vert.	40.101	QP	30.80	14.35	7.11	31.89	0.00	20.37	40.00	19.6	100	355	
Vert.	63.991	QP	34.98	7.19	7.48	31.88	0.00	17.77	40.00	22.2	100	246	
Vert.	787.019	QP	26.69	20.73	9.31	31.33	0.00	25.40	46.00	20.6	100	333	
Vert.	2483.500	PK	54.21	27.52	14.27	40.81	2.31	57.50	73.90	16.4	128	355	
Vert.	2514.159	PK	59.51	27.61	14.29	40.82	2.31	62.90	73.90	11.0	128	355	
Vert.	2582.417	PK	57.19	27.73	14.36	40.90	2.31	60.69	73.90	13.2	128	355	
Vert.	4960.000	PK	56.36	31.45	6.85	41.65	2.31	55.32	73.90	18.6	151	82	
Vert.	7440.000	PK	49.22	36.57	8.66	41.36	2.31	55.40	73.90	18.5	146	153	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91 \text{ m} / 3.0 \text{ m}) = 2.31 \text{ dB}$

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	41.13	27.52	14.27	40.81	2.93	2.31	47.35	53.90	6.6	*1)
Hori.	2514.325	AV	43.54	27.61	14.29	40.82	2.93	2.31	49.86	53.90	4.0	
Hori.	2582.639	AV	41.32	27.73	14.36	40.90	2.93	2.31	47.75	53.90	6.2	
Hori.	4960.000	AV	46.68	31.45	6.85	41.65	2.93	2.31	48.57	53.90	5.3	
Hori.	7440.000	AV	40.04	36.57	8.66	41.36	2.93	2.31	49.15	53.90	4.8	
Vert.	2483.500	AV	41.72	27.52	14.27	40.81	2.93	2.31	47.94	53.90	6.0	*1)
Vert.	2514.159	AV	44.48	27.61	14.29	40.82	2.93	2.31	50.80	53.90	3.1	
Vert.	2582.417	AV	42.37	27.73	14.36	40.90	2.93	2.31	48.80	53.90	5.1	
Vert.	4960.000	AV	46.73	31.45	6.85	41.65	2.93	2.31	48.62	53.90	5.3	
Vert.	7440.000	AV	41.24	36.57	8.66	41.36	2.93	2.31	50.35	53.90	3.6	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.91 \text{ m} / 3.0 \text{ m}) = 2.31 \text{ dB}$

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

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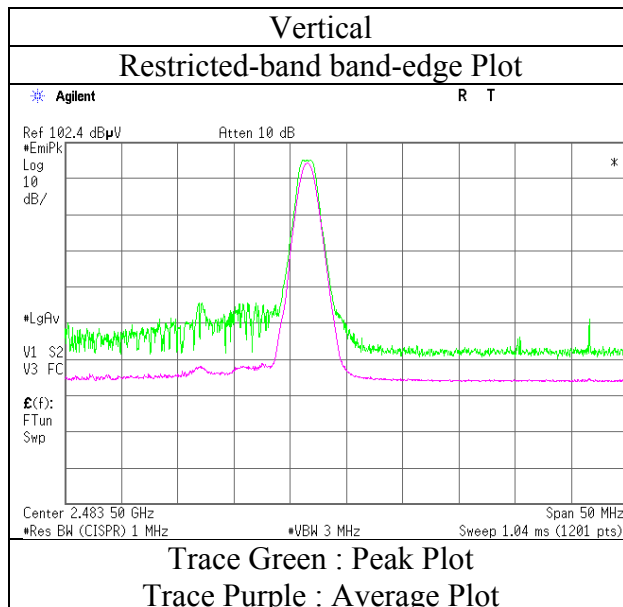
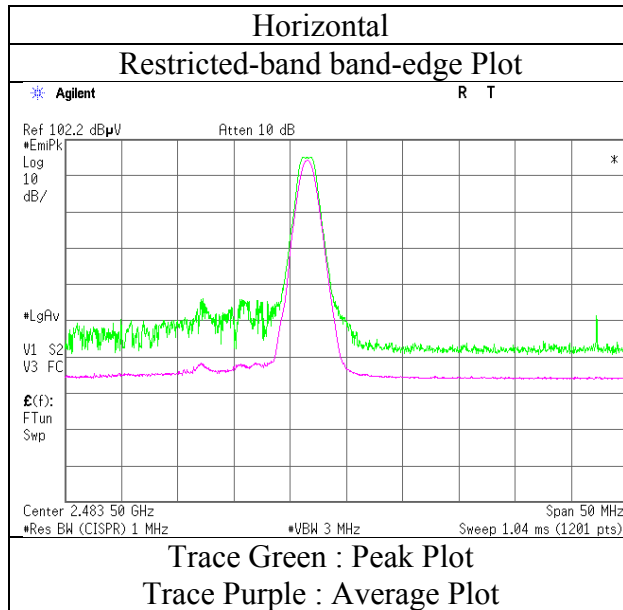
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## Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11826181S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber No.	1
Date	July 4, 2017
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz – 13 GHz)
Mode	Tx 2480 MHz, Patch Antenna



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



## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2405 MHz, Monopole Antenna

(\* 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.	221.270	QP	38.58	11.52	6.01	31.74	0.00	24.37	46.00	21.6	148	114	
Hori.	322.451	QP	39.07	13.94	6.79	31.65	0.00	28.15	46.00	17.8	100	124	
Hori.	388.806	QP	34.58	15.55	7.25	31.62	0.00	25.76	46.00	20.2	100	7	
Hori.	787.499	QP	31.36	20.74	9.31	31.33	0.00	30.08	46.00	15.9	127	235	
Hori.	875.383	QP	30.20	21.95	9.73	30.97	0.00	30.91	46.00	15.0	127	321	
Hori.	2338.708	PK	55.89	27.04	14.10	40.87	2.27	58.43	73.90	15.5	189	244	
Hori.	2390.000	PK	50.83	27.21	14.16	40.85	2.27	53.62	73.90	20.3	189	244	
Hori.	4810.000	PK	54.69	31.14	6.69	41.86	2.27	52.93	73.90	21.0	214	146	
Hori.	7215.000	PK	48.62	36.26	8.35	41.19	2.27	54.31	73.90	19.6	196	239	
Vert.	41.020	QP	35.05	14.03	7.13	31.89	0.00	24.32	40.00	15.6	100	358	
Vert.	63.420	QP	35.95	7.28	7.48	31.88	0.00	18.83	40.00	21.1	100	73	
Vert.	784.080	QP	26.64	20.70	9.30	31.34	0.00	25.30	46.00	20.7	100	355	
Vert.	2338.671	PK	52.54	27.04	14.10	40.87	2.27	55.08	73.90	18.8	146	76	
Vert.	2390.000	PK	47.00	27.21	14.16	40.85	2.27	49.79	73.90	24.1	146	76	
Vert.	4810.000	PK	54.74	31.14	6.69	41.86	2.27	52.98	73.90	20.9	120	198	
Vert.	7215.000	PK	48.98	36.26	8.35	41.19	2.27	54.67	73.90	19.2	122	62	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2338.708	AV	41.10	27.04	14.10	40.87	2.93	2.27	46.57	53.90	7.3	
Hori.	2390.000	AV	38.30	27.21	14.16	40.85	2.93	2.27	44.02	53.90	9.9	*1)
Hori.	4810.000	AV	47.37	31.14	6.69	41.86	2.93	2.27	48.54	53.90	5.4	
Hori.	7215.000	AV	40.49	36.26	8.35	41.19	2.93	2.27	49.11	53.90	4.8	
Vert.	2338.671	AV	39.60	27.04	14.10	40.87	2.93	2.27	45.07	53.90	8.8	
Vert.	2390.000	AV	38.06	27.21	14.16	40.85	2.93	2.27	43.78	53.90	10.1	*1)
Vert.	4810.000	AV	48.81	31.14	6.69	41.86	2.93	2.27	49.98	53.90	3.9	
Vert.	7215.000	AV	40.55	36.26	8.35	41.19	2.93	2.27	49.17	53.90	4.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

### 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.	2405.000	PK	96.06	27.26	14.17	40.84	2.27	98.92	-	-	Carrier
Hori.	2394.452	PK	51.01	27.23	14.16	40.85	2.27	53.82	78.92	25.1	
Hori.	2400.000	PK	44.33	27.25	14.16	40.84	2.27	47.17	78.92	31.8	
Vert.	2405.000	PK	91.53	27.26	14.17	40.84	2.27	94.39	-	-	Carrier
Vert.	2394.455	PK	47.27	27.23	14.16	40.85	2.27	50.08	74.39	24.3	
Vert.	2400.000	PK	40.39	27.25	14.16	40.84	2.27	43.23	74.39	31.2	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

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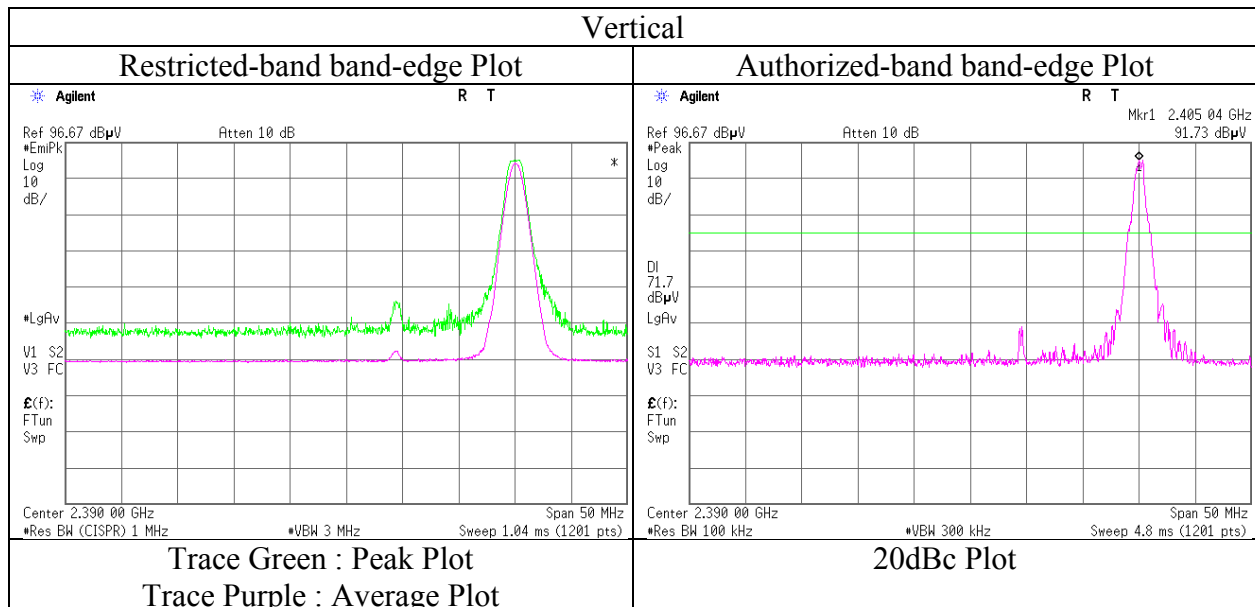
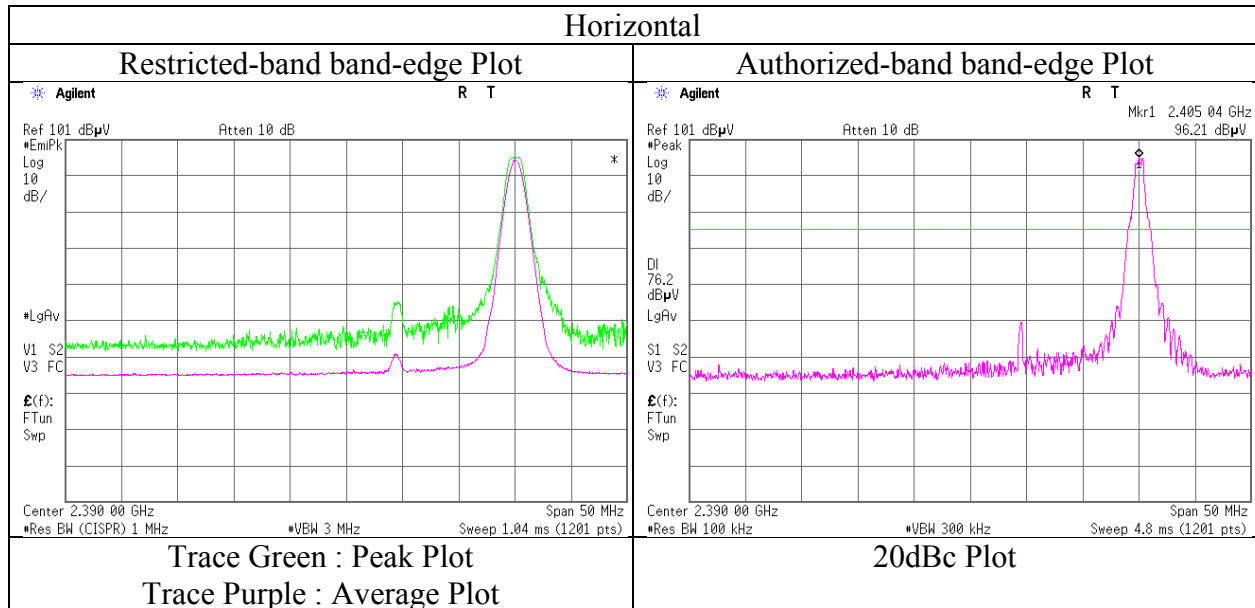
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## Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11826181S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber No.	1
Date	July 4, 2017
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz – 13 GHz)
Mode	Tx 2405 MHz, Monopole Antenna



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

## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2440 MHz, Monopole Antenna

(\* 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.	221.257	QP	38.76	11.52	6.01	31.74	0.00	24.55	46.00	21.4	147	104	
Hori.	322.339	QP	39.77	13.93	6.79	31.65	0.00	28.84	46.00	17.1	100	132	
Hori.	388.887	QP	33.42	15.55	7.25	31.62	0.00	24.60	46.00	21.4	100	14	
Hori.	786.617	QP	31.86	20.73	9.31	31.33	0.00	30.57	46.00	15.4	126	124	
Hori.	872.550	QP	30.88	21.91	9.71	30.99	0.00	31.51	46.00	14.4	128	324	
Hori.	2338.720	PK	51.29	27.04	14.10	40.87	2.27	53.83	73.90	20.1	205	242	
Hori.	4880.000	PK	54.41	31.29	6.77	41.76	2.27	52.98	73.90	20.9	114	170	
Hori.	7320.000	PK	48.05	36.40	8.51	41.27	2.27	53.96	73.90	19.9	162	131	
Vert.	41.230	QP	34.73	13.96	7.13	31.89	0.00	23.93	40.00	16.0	100	359	
Vert.	63.468	QP	35.98	7.27	7.48	31.88	0.00	18.85	40.00	21.1	100	84	
Vert.	781.300	QP	26.47	20.68	9.29	31.35	0.00	25.09	46.00	20.9	100	357	
Vert.	2338.685	PK	53.22	27.04	14.10	40.87	2.27	55.76	73.90	18.1	132	0	
Vert.	4880.000	PK	53.58	31.29	6.77	41.76	2.27	52.15	73.90	21.8	131	195	
Vert.	7320.000	PK	48.40	36.40	8.51	41.27	2.27	54.31	73.90	19.6	132	94	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2338.720	AV	40.48	27.04	14.10	40.87	2.93	2.27	45.95	53.90	8.0	
Hori.	4880.000	AV	46.85	31.29	6.77	41.76	2.93	2.27	48.35	53.90	5.6	
Hori.	7320.000	AV	40.04	36.40	8.51	41.27	2.93	2.27	48.88	53.90	5.0	
Vert.	2338.685	AV	39.95	27.04	14.10	40.87	2.93	2.27	45.42	53.90	8.5	
Vert.	4880.000	AV	46.04	31.29	6.77	41.76	2.93	2.27	47.54	53.90	6.4	
Vert.	7320.000	AV	39.57	36.40	8.51	41.27	2.93	2.27	48.41	53.90	5.5	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

### 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.	2440.000	PK	96.78	27.38	14.22	40.83	2.27	99.82	-	-	Carrier
Hori.	2394.467	PK	56.05	27.23	14.16	40.85	2.27	58.86	79.82	21.0	
Vert.	2440.000	PK	91.98	27.38	14.22	40.83	2.27	95.02	-	-	Carrier
Vert.	2394.478	PK	46.42	27.23	14.16	40.85	2.27	49.23	75.02	25.8	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz – 26.5 GHz) (1 GHz – 13 GHz)  
Mode Tx 2480 MHz, Monopole Antenna

(\* 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.	221.272	QP	38.59	11.52	6.01	31.74	0.00	24.38	46.00	21.6	159	107	
Hori.	326.396	QP	40.29	14.03	6.82	31.64	0.00	29.50	46.00	16.5	100	137	
Hori.	389.475	QP	34.86	15.56	7.25	31.62	0.00	26.05	46.00	19.9	100	13	
Hori.	784.191	QP	31.47	20.71	9.30	31.34	0.00	30.14	46.00	15.8	128	220	
Hori.	877.139	QP	30.68	21.98	9.74	30.96	0.00	31.44	46.00	14.5	121	329	
Hori.	2483.500	PK	55.13	27.52	14.27	40.81	2.27	58.38	73.90	15.5	189	244	
Hori.	2514.087	PK	58.35	27.61	14.29	40.82	2.27	61.70	73.90	12.2	189	244	
Hori.	2582.426	PK	55.60	27.73	14.36	40.90	2.27	59.06	73.90	14.8	189	244	
Hori.	4960.000	PK	52.93	31.45	6.85	41.65	2.27	51.85	73.90	22.1	195	147	
Hori.	7440.000	PK	47.28	36.57	8.66	41.36	2.27	53.42	73.90	20.5	220	250	
Vert.	41.221	QP	34.99	13.96	7.13	31.89	0.00	24.19	40.00	15.8	100	357	
Vert.	63.310	QP	35.88	7.29	7.47	31.88	0.00	18.76	40.00	21.2	100	76	
Vert.	781.291	QP	26.72	20.68	9.29	31.35	0.00	25.34	46.00	20.6	100	359	
Vert.	2483.500	PK	51.09	27.52	14.27	40.81	2.27	54.34	73.90	19.6	154	280	
Vert.	2514.109	PK	54.21	27.61	14.29	40.82	2.27	57.56	73.90	16.3	154	280	
Vert.	2582.364	PK	51.55	27.73	14.36	40.90	2.27	55.01	73.90	18.9	154	280	
Vert.	4960.000	PK	53.37	31.45	6.85	41.65	2.27	52.29	73.90	21.6	124	199	
Vert.	7440.000	PK	48.59	36.57	8.66	41.36	2.27	54.73	73.90	19.2	115	179	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	42.47	27.52	14.27	40.81	2.93	2.27	48.65	53.90	5.3	*1)
Hori.	2514.087	AV	43.16	27.61	14.29	40.82	2.93	2.27	49.44	53.90	4.5	
Hori.	2582.426	AV	40.79	27.73	14.36	40.90	2.93	2.27	47.18	53.90	6.7	
Hori.	4960.000	AV	43.85	31.45	6.85	41.65	2.93	2.27	45.70	53.90	8.2	
Hori.	7440.000	AV	38.99	36.57	8.66	41.36	2.93	2.27	48.06	53.90	5.8	
Vert.	2483.500	AV	39.43	27.52	14.27	40.81	2.93	2.27	45.61	53.90	8.3	*1)
Vert.	2514.109	AV	39.56	27.61	14.29	40.82	2.93	2.27	45.84	53.90	8.1	
Vert.	2582.364	AV	38.64	27.73	14.36	40.90	2.93	2.27	45.03	53.90	8.9	
Vert.	4960.000	AV	45.27	31.45	6.85	41.65	2.93	2.27	47.12	53.90	6.8	
Vert.	7440.000	AV	39.76	36.57	8.66	41.36	2.93	2.27	48.83	53.90	5.1	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.90 m / 3.0 m) = 2.27 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

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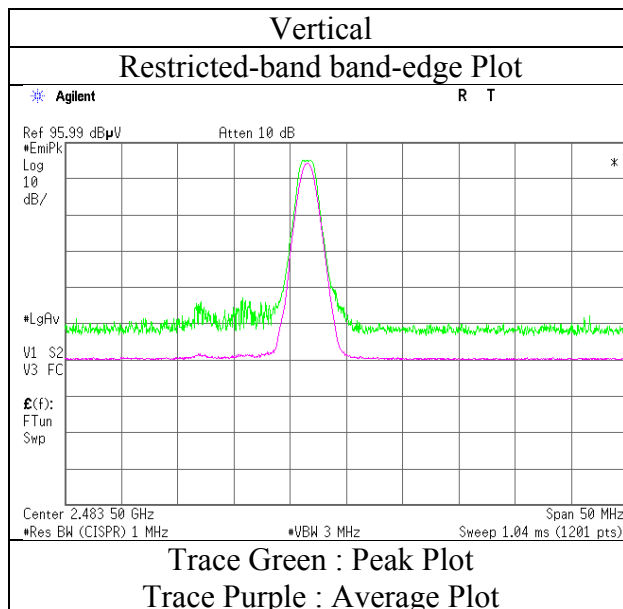
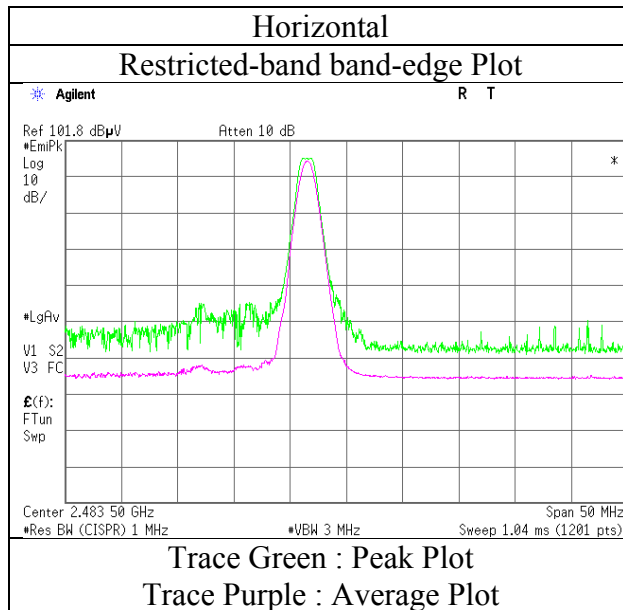
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## Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11826181S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber No.	1
Date	July 4, 2017
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz – 13 GHz)
Mode	Tx 2480 MHz, Monopole Antenna



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

## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2405 MHz, Bow-tie Antenna

(\* 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.	159.997	QP	29.39	15.30	8.65	31.79	0.00	21.55	43.50	21.9	205	30	
Hori.	329.177	QP	40.98	14.10	6.84	31.64	0.00	30.28	46.00	15.7	100	293	
Hori.	627.742	QP	33.66	19.32	8.56	31.59	0.00	29.95	46.00	16.0	150	41	
Hori.	783.496	QP	32.55	20.70	9.30	31.34	0.00	31.21	46.00	14.7	129	235	
Hori.	872.892	QP	30.72	21.92	9.71	30.98	0.00	31.37	46.00	14.6	127	314	
Hori.	2338.896	PK	55.09	27.04	14.10	40.87	2.38	57.74	73.90	16.2	188	152	
Hori.	2390.000	PK	51.10	27.21	14.16	40.85	2.38	54.00	73.90	19.9	188	152	
Hori.	4810.000	PK	57.33	31.14	6.69	41.86	2.38	55.68	73.90	18.2	132	128	
Hori.	7215.000	PK	49.15	36.26	8.35	41.19	2.38	54.95	73.90	19.0	231	173	
Vert.	40.393	QP	33.98	14.25	7.12	31.89	0.00	23.46	40.00	16.5	100	357	
Vert.	63.543	QP	36.07	7.26	7.48	31.88	0.00	18.93	40.00	21.0	100	77	
Vert.	625.167	QP	30.44	19.30	8.55	31.59	0.00	26.70	46.00	19.3	99	46	
Vert.	2338.695	PK	56.13	27.04	14.10	40.87	2.38	58.78	73.90	15.1	134	47	
Vert.	2390.000	PK	51.59	27.21	14.16	40.85	2.38	54.49	73.90	19.4	134	47	
Vert.	4810.000	PK	55.33	31.14	6.69	41.86	2.38	53.68	73.90	20.2	160	113	
Vert.	7215.000	PK	49.85	36.26	8.35	41.19	2.38	55.65	73.90	18.3	127	155	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.38 dB

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2338.896	AV	40.14	27.04	14.10	40.87	2.93	2.38	45.72	53.90	8.2	
Hori.	2390.000	AV	39.12	27.21	14.16	40.85	2.93	2.38	44.95	53.90	9.0	*1)
Hori.	4810.000	AV	47.16	31.14	6.69	41.86	2.93	2.38	48.44	53.90	5.5	
Hori.	7215.000	AV	42.31	36.26	8.35	41.19	2.93	2.38	51.04	53.90	2.9	
Vert.	2338.695	AV	40.90	27.04	14.10	40.87	2.93	2.38	46.48	53.90	7.4	
Vert.	2390.000	AV	39.86	27.21	14.16	40.85	2.93	2.38	45.69	53.90	8.2	*1)
Vert.	4810.000	AV	45.58	31.14	6.69	41.86	2.93	2.38	46.86	53.90	7.0	
Vert.	7215.000	AV	42.44	36.26	8.35	41.19	2.93	2.38	51.17	53.90	2.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.38 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

### 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.	2405.000	PK	97.69	27.26	14.17	40.84	2.38	100.66	-	-	Carrier
Hori.	2394.775	PK	52.55	27.23	14.16	40.85	2.38	55.47	80.66	25.2	
Hori.	2400.000	PK	45.50	27.25	14.16	40.84	2.38	48.45	80.66	32.2	
Vert.	2405.000	PK	97.41	27.26	14.17	40.84	2.38	100.38	-	-	Carrier
Vert.	2394.509	PK	52.52	27.23	14.16	40.85	2.38	55.44	80.38	24.9	
Vert.	2400.000	PK	45.65	27.25	14.16	40.84	2.38	48.60	80.38	31.8	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.38 dB

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

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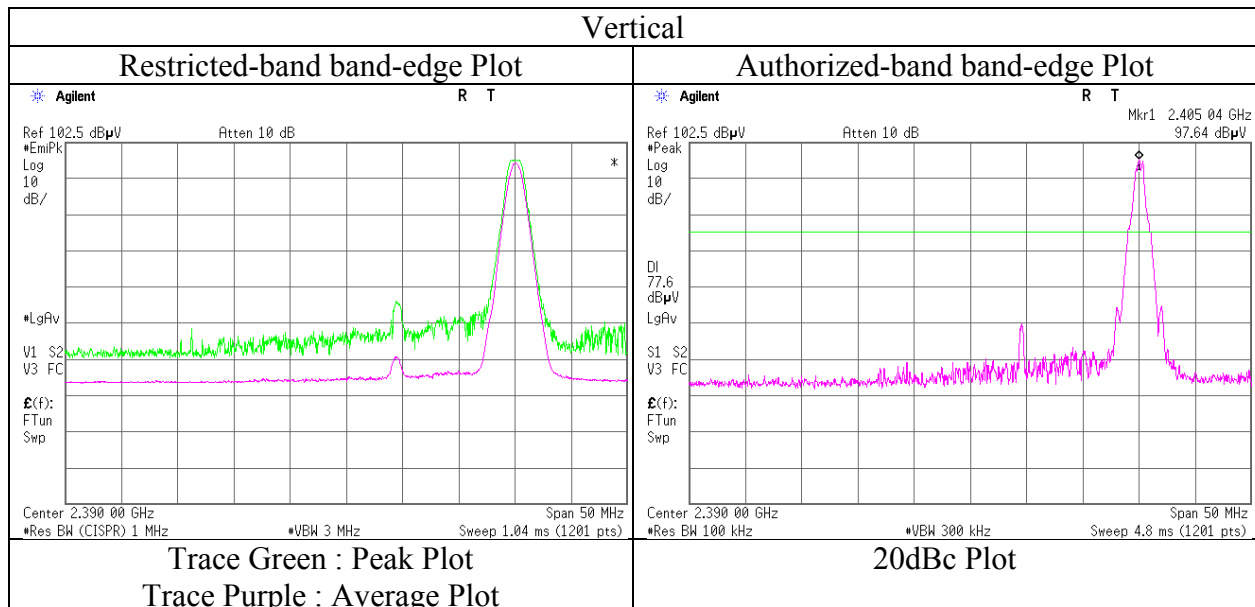
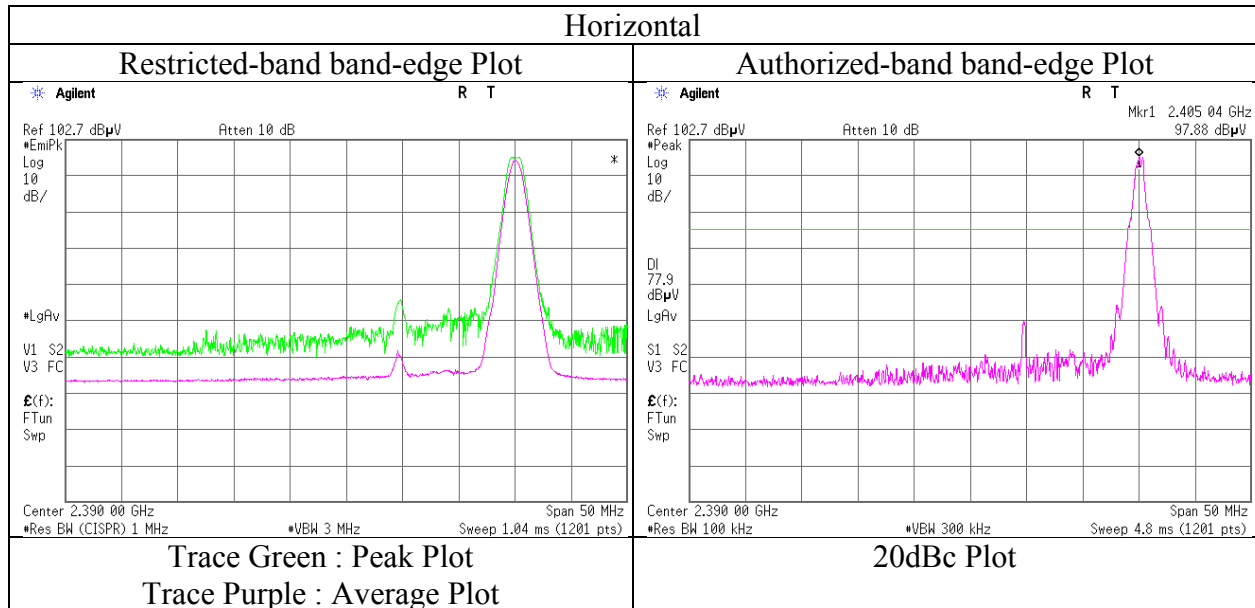
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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11826181S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber No.	1
Date	July 4, 2017
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Hiroyuki Morikawa
	(1 GHz – 13 GHz)
Mode	Tx 2405 MHz, Bow-tie Antenna



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

## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2440 MHz, Bow-tie Antenna

(\* 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.	159.997	QP	28.77	15.30	8.65	31.79	0.00	20.93	43.50	22.5	195	202	
Hori.	328.477	QP	41.57	14.08	6.84	31.64	0.00	30.85	46.00	15.1	100	273	
Hori.	629.840	QP	33.40	19.33	8.57	31.59	0.00	29.71	46.00	16.2	146	39	
Hori.	783.080	QP	32.92	20.69	9.30	31.34	0.00	31.57	46.00	14.4	129	238	
Hori.	873.444	QP	31.20	21.92	9.71	30.98	0.00	31.85	46.00	14.1	125	333	
Hori.	2338.981	PK	54.17	27.04	14.10	40.87	2.38	56.82	73.90	17.1	212	149	
Hori.	4880.000	PK	58.78	31.29	6.77	41.76	2.38	57.46	73.90	16.4	139	134	
Hori.	7320.000	PK	48.54	36.40	8.51	41.27	2.38	54.56	73.90	19.3	234	157	
Vert.	41.182	QP	34.92	13.98	7.13	31.89	0.00	24.14	40.00	15.8	100	359	
Vert.	63.639	QP	35.96	7.24	7.48	31.88	0.00	18.80	40.00	21.2	100	66	
Vert.	625.149	QP	30.20	19.30	8.55	31.59	0.00	26.46	46.00	19.5	100	38	
Vert.	2338.698	PK	55.99	27.04	14.10	40.87	2.38	58.64	73.90	15.3	110	47	
Vert.	4880.000	PK	57.06	31.29	6.77	41.76	2.38	55.74	73.90	18.2	142	109	
Vert.	7320.000	PK	48.20	36.40	8.51	41.27	2.38	54.22	73.90	19.7	163	141	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.95 \text{ m} / 3.0 \text{ m}) = 2.38 \text{ dB}$

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2338.981	AV	40.32	27.04	14.10	40.87	2.93	2.38	45.90	53.90	8.0	
Hori.	4880.000	AV	50.00	31.29	6.77	41.76	2.93	2.38	51.61	53.90	2.3	
Hori.	7320.000	AV	40.55	36.40	8.51	41.27	2.93	2.38	49.50	53.90	4.4	
Vert.	2338.698	AV	41.31	27.04	14.10	40.87	2.93	2.38	46.89	53.90	7.0	
Vert.	4880.000	AV	48.18	31.29	6.77	41.76	2.93	2.38	49.79	53.90	4.1	
Vert.	7320.000	AV	40.07	36.40	8.51	41.27	2.93	2.38	49.02	53.90	4.9	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.95 \text{ m} / 3.0 \text{ m}) = 2.38 \text{ dB}$

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

### 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.	2440.000	PK	97.17	27.38	14.22	40.83	2.38	100.32	-	-	Carrier
Hori.	2394.761	PK	52.43	27.23	14.16	40.85	2.38	55.35	80.32	25.0	
Vert.	2440.000	PK	97.01	27.38	14.22	40.83	2.38	100.16	-	-	Carrier
Vert.	2394.487	PK	52.70	27.23	14.16	40.85	2.38	55.62	80.16	24.5	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.95 \text{ m} / 3.0 \text{ m}) = 2.38 \text{ dB}$

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



## Radiated Spurious Emission

Report No. 11826181S  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No. 2 2 1  
Date June 27, 2017 July 3, 2017 July 4, 2017  
Temperature / Humidity 24 deg. C / 72 % RH 22 deg. C / 60 % RH 21 deg. C / 62 % RH  
Engineer Yosuke Ishikawa Hiroyuki Morikawa Hiroyuki Morikawa  
(13 GHz -18 GHz) (30 MHz -1000 MHz, 18 GHz - 26.5 GHz) (1 GHz - 13 GHz)  
Mode Tx 2480 MHz, Bow-tie Antenna

(\* 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.	159.997	QP	28.02	15.30	8.65	31.79	0.00	20.18	43.50	23.3	197	195	
Hori.	329.822	QP	40.80	14.11	6.84	31.64	0.00	30.11	46.00	15.8	100	285	
Hori.	625.828	QP	33.58	19.30	8.55	31.59	0.00	29.84	46.00	16.1	149	59	
Hori.	783.103	QP	32.45	20.69	9.30	31.34	0.00	31.10	46.00	14.9	127	231	
Hori.	873.606	QP	30.87	21.93	9.71	30.98	0.00	31.53	46.00	14.4	128	334	
Hori.	2483.500	PK	54.17	27.52	14.27	40.81	2.38	57.53	73.90	16.4	206	145	
Hori.	2514.294	PK	59.36	27.61	14.29	40.82	2.38	62.82	73.90	11.1	206	145	
Hori.	2582.737	PK	59.60	27.73	14.36	40.90	2.38	63.17	73.90	10.7	206	145	
Hori.	4960.000	PK	60.71	31.45	6.85	41.65	2.38	59.74	73.90	14.2	141	124	
Hori.	7440.000	PK	47.20	36.57	8.66	41.36	2.38	53.45	73.90	20.5	242	180	
Vert.	40.130	QP	33.98	14.34	7.11	31.89	0.00	23.54	40.00	16.4	100	359	
Vert.	63.544	QP	36.12	7.26	7.48	31.88	0.00	18.98	40.00	21.0	100	82	
Vert.	627.317	QP	30.18	19.31	8.56	31.59	0.00	26.46	46.00	19.5	100	40	
Vert.	2483.500	PK	53.46	27.52	14.27	40.81	2.38	56.82	73.90	17.1	162	115	
Vert.	2514.212	PK	58.04	27.61	14.29	40.82	2.38	61.50	73.90	12.4	162	115	
Vert.	2582.513	PK	57.48	27.73	14.36	40.90	2.38	61.05	73.90	12.9	162	115	
Vert.	4960.000	PK	58.62	31.45	6.85	41.65	2.38	57.65	73.90	16.3	167	114	
Vert.	7440.000	PK	47.38	36.57	8.66	41.36	2.38	53.63	73.90	20.3	173	147	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.95 m / 3.0 m) = 2.38 dB

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

### Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	41.49	27.52	14.27	40.81	2.93	2.38	47.78	53.90	6.1	*1)
Hori.	2514.294	AV	44.49	27.61	14.29	40.82	2.93	2.38	50.88	53.90	3.0	
Hori.	2582.737	AV	43.35	27.73	14.36	40.90	2.93	2.38	49.85	53.90	4.1	
Hori.	4960.000	AV	50.98	31.45	6.85	41.65	2.93	2.38	52.94	53.90	1.0	
Hori.	7440.000	AV	39.60	36.57	8.66	41.36	2.93	2.38	48.78	53.90	5.1	
Vert.	2483.500	AV	40.79	27.52	14.27	40.81	2.93	2.38	47.08	53.90	6.8	*1)
Vert.	2514.212	AV	42.37	27.61	14.29	40.82	2.93	2.38	48.76	53.90	5.1	
Vert.	2582.513	AV	41.95	27.73	14.36	40.90	2.93	2.38	48.45	53.90	5.4	
Vert.	4960.000	AV	48.80	31.45	6.85	41.65	2.93	2.38	50.76	53.90	3.1	
Vert.	7440.000	AV	40.18	36.57	8.66	41.36	2.93	2.38	49.36	53.90	4.5	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.95 m / 3.0 m) = 2.38 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

**UL Japan, Inc.**

**Shonan EMC Lab.**

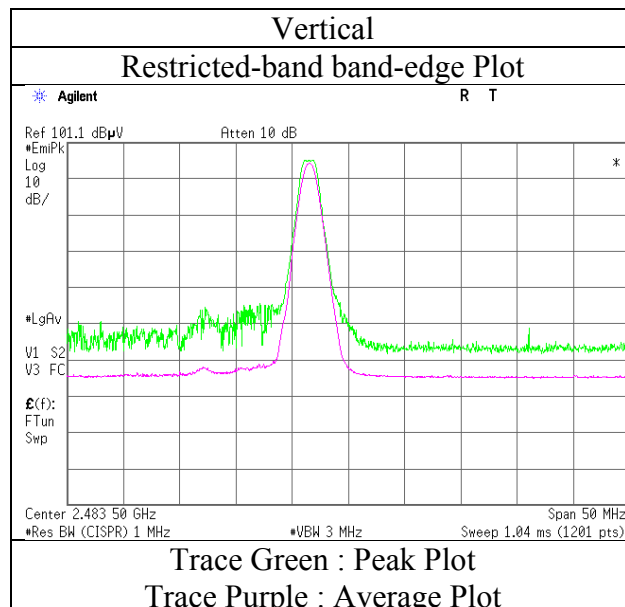
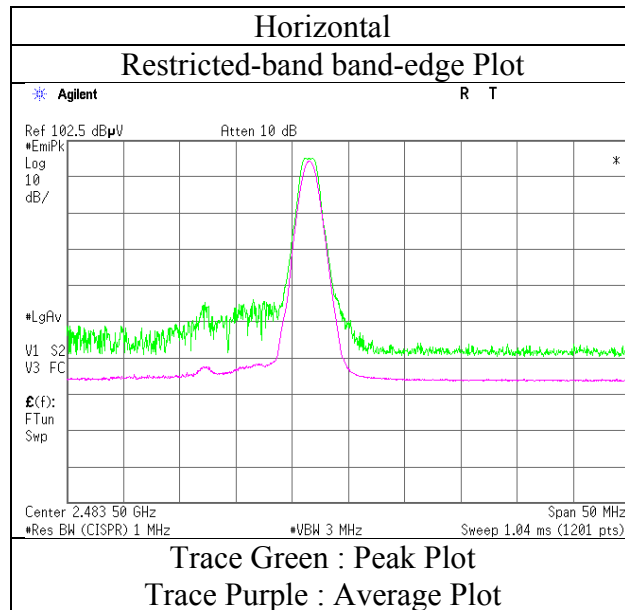
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Radiated Spurious Emission (Reference Plot for band-edge)

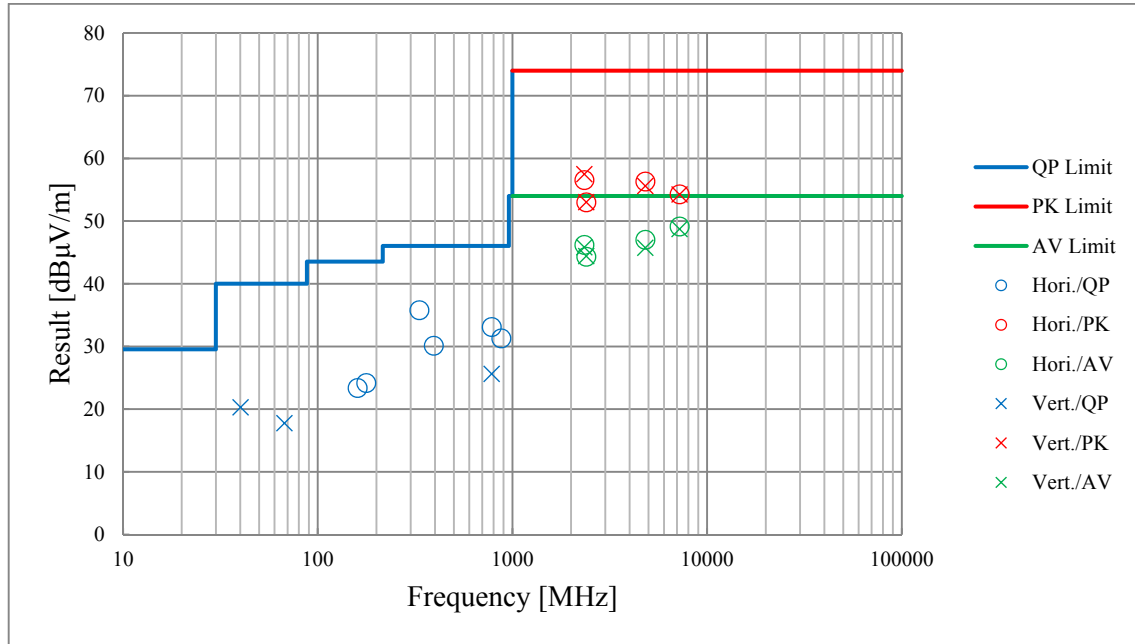
Report No.	11826181S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber No.	1
Date	July 4, 2017
Temperature / Humidity	21 deg. C / 62 % RH
Engineer	Hiroyuki Morikawa (1 GHz – 13 GHz)
Mode	Tx 2480 MHz, Bow-tie Antenna



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

## Radiated Spurious Emission (Plot data, Worst case)

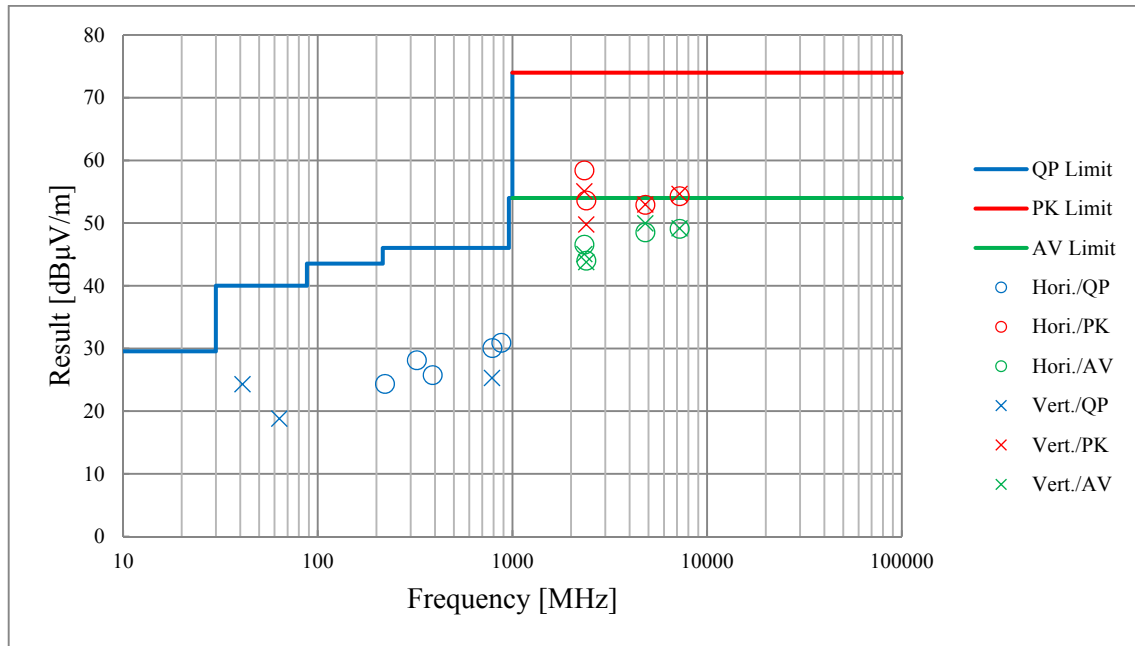
Report No.	11826181S		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber No.	2	2	1
Date	June 27, 2017	July 3, 2017	July 4, 2017
Temperature / Humidity	24 deg. C / 72 % RH	22 deg. C / 60 % RH	21 deg. C / 62 % RH
Engineer	Yosuke Ishikawa (13 GHz -18 GHz)	HiroYuki Morikawa (30 MHz -1000 MHz, 18 GHz – 26.5 GHz)	HiroYuki Morikawa (1 GHz – 13 GHz)
Mode	Tx 2405 MHz, Patch Antenna		



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

### **Radiated Spurious Emission** **(Plot data, Worst case)**

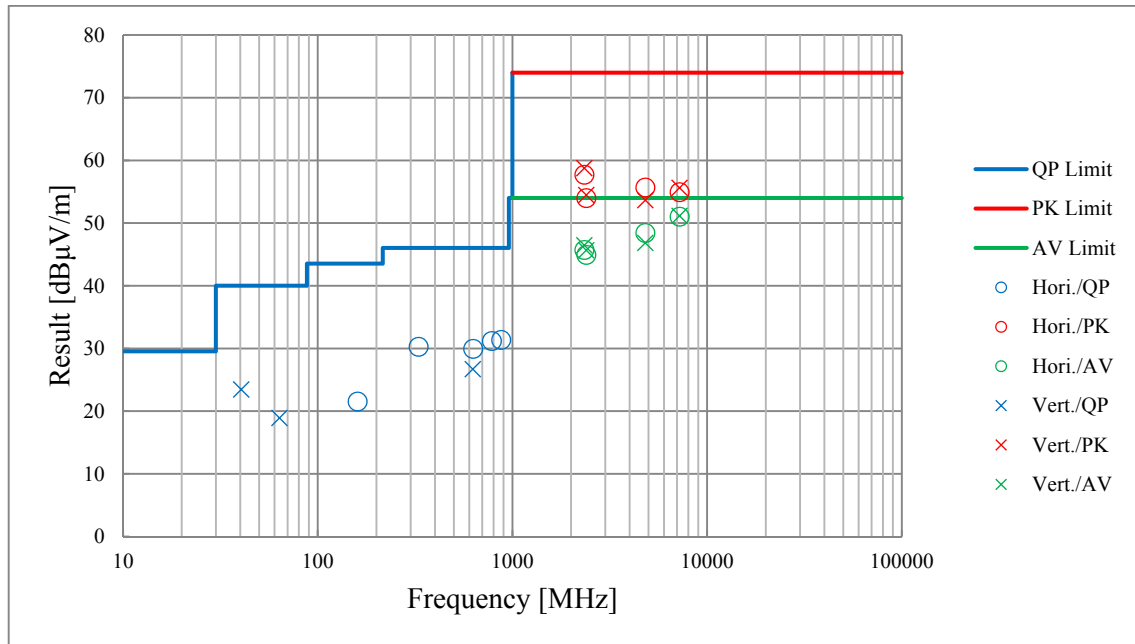
Report No.	11826181S		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber No.	2	2	1
Date	June 27, 2017	July 3, 2017	July 4, 2017
Temperature / Humidity	24 deg. C / 72 % RH	22 deg. C / 60 % RH	21 deg. C / 62 % RH
Engineer	Yosuke Ishikawa (13 GHz -18 GHz)	Hiroiyuki Morikawa (30 MHz -1000 MHz, 18 GHz – 26.5 GHz)	Hiroiyuki Morikawa (1 GHz – 13 GHz)
Mode	Tx 2405 MHz, Monopole Antenna		



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

### Radiated Spurious Emission (Plot data, Worst case)

Report No.	11826181S		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber No.	2	2	1
Date	June 27, 2017	July 3, 2017	July 4, 2017
Temperature / Humidity	24 deg. C / 72 % RH	22 deg. C / 60 % RH	21 deg. C / 62 % RH
Engineer	Yosuke Ishikawa (13 GHz -18 GHz)	HiroYuki Morikawa (30 MHz -1000 MHz, 18 GHz – 26.5 GHz)	HiroYuki Morikawa (1 GHz – 13 GHz)
Mode	Tx 2405 MHz, Bow-tie Antenna		



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

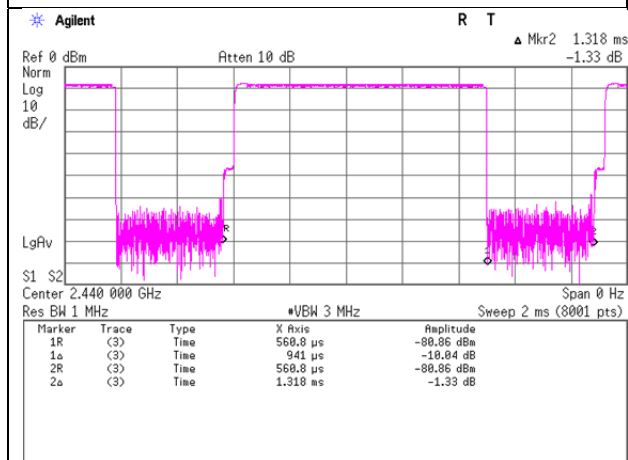
### Burst rate confirmation

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 11826181S  
Date July 4, 2017  
Temperature / Humidity 24 deg. C / 47 % RH  
Engineer Hiroyuki Morikawa  
Mode Tx

#### **Tx**

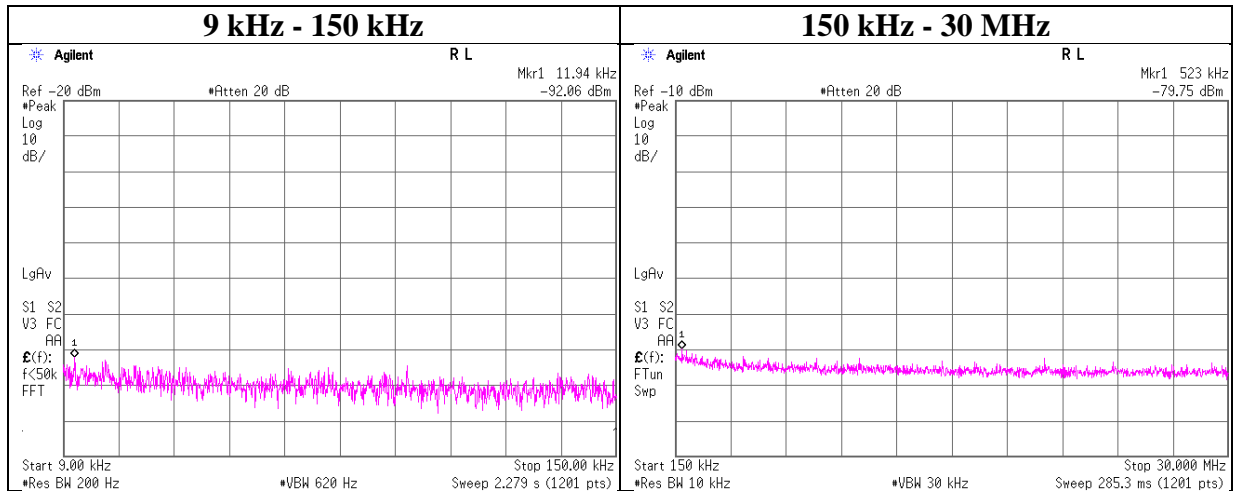
##### **For Spurious**

$Tx\ on / (Tx\ on + Tx\ off) = 0.714$   
 $Tx\ on / (Tx\ on + Tx\ off) * 100 = 71.4\ \%$   
 $Duty\ factor = 20 * \log(1318 / 941) = 2.93\ dB$



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11826181S
Date	July 4, 2017
Temperature / Humidity	24 deg. C / 47 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx 2405 MHz



Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain	N (Number of Output)	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]		[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
11.94	-92.1	0.02	9.7	2.7	1	-79.6	300	6.0	-18.3	46.0	64.3	
523.00	-79.8	0.02	9.7	2.7	1	-67.3	30	6.0	14.0	33.2	19.2	

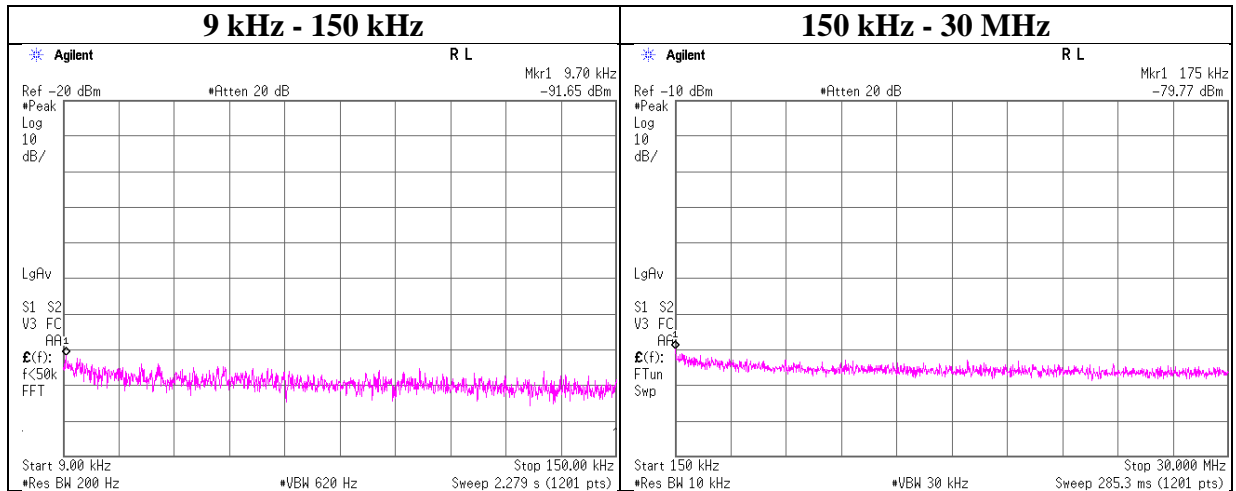
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11826181S
Date	July 4, 2017
Temperature / Humidity	24 deg. C / 47 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.70	-91.7	0.02	9.7	2.7	1	-79.2	300	6.0	-17.9	47.8	65.7	
175.00	-79.8	0.02	9.7	2.7	1	-67.3	300	6.0	-6.1	22.7	28.8	

$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

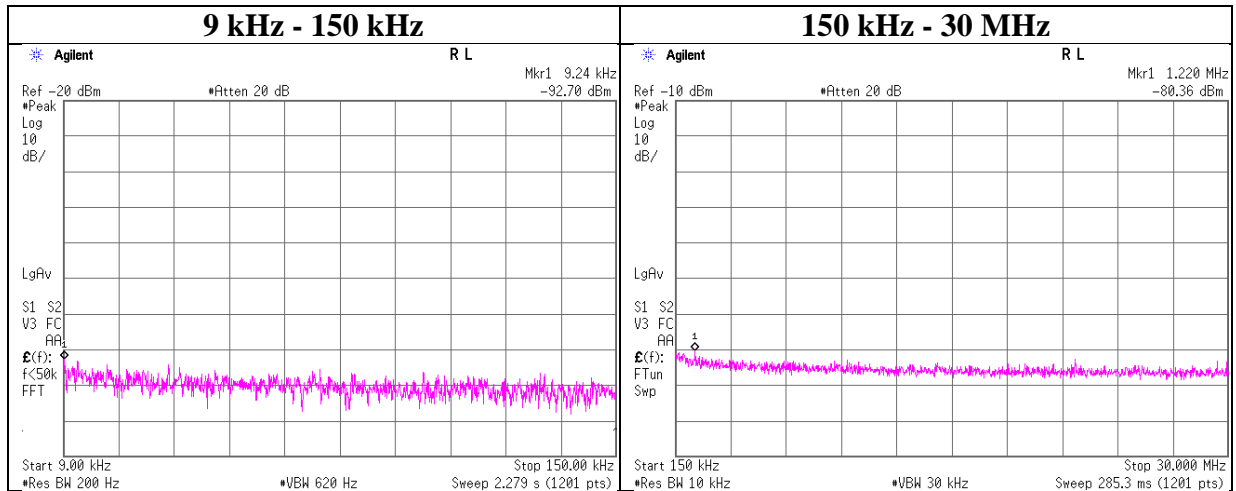
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11826181S
Date	July 4, 2017
Temperature / Humidity	24 deg. C / 47 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.24	-92.7	0.02	9.7	2.7	1	-80.2	300	6.0	-19.0	48.2	67.2	
1220.00	-80.4	0.03	9.7	2.7	1	-67.9	30	6.0	13.4	25.8	12.4	

$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

## APPENDIX 2: Test instruments

### Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAEC-02(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	RE	2016/07/22 * 12
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-36	1440489	RE	2017/03/17 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000NFSN MS/B	1612S006	RE	2017/01/08 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2017/05/08 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2016/08/09 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2016/10/12 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2016/10/11 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI, MF)	-	RE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE	2017/03/08 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2016/11/07 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	RE	2017/06/13 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2016/11/29 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2017/02/09 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2017/02/09 * 12
KAT3-10	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2016/07/26 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2016/11/23 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SLA-06	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	RE	2017/01/05 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2016/10/12 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2016/09/28 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE	-
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2017/06/08 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2016/09/27 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2017/03/15 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KMSK MS	-	RE	2017/04/20 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT, RE	2017/03/07 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2017/03/23 * 12
SAT10-14	Attenuator	Weinschel Corp.	54A-10	81595	AT	2017/04/20 * 12
SCC-H15	Microwave cable	RS Pro	R-132G7210 100CO	-	AT	2017/04/07 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 12
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2016/10/17 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000NFSN MS/B	1612S005	RE	2017/01/08 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	RE	2016/08/09 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2016/10/12 * 12
KJM-09	Measure	KOMELON	KMC-36	-	RE	-
SAEC-01(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	RE	2016/07/24 * 12
STS-01	Digital Hitester	Hioki	3805-50	080997812	RE	2016/10/17 * 12

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, AT: Antenna Terminal Conducted test

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