



# RADIO TEST REPORT

**Test Report No. : 11155190H-A-R1**

**Applicant** : Sony Interactive Entertainment Inc.  
**Type of Equipment** : Wireless Controller  
**Model No.** : CUH-ZCT2U  
**FCC ID** : AK8CUHZCT2  
**Test regulation** : FCC Part 15 Subpart C: 2015  
**Test Result** : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
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 11155190H-A. 11155190H-A is replaced with this report.

**Date of test:** February 8 and 9, 2016

**Representative test engineer:**

*T. Shimada*

Takumi Shimada  
Engineer  
Consumer Technology Division

**Approved by:**

*Takayuki S.*

Takayuki Shimada  
Engineer  
Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation. \*As for the range of Accreditation in NVLAP, you may refer to the WEB address, [http://japan.ul.com/resources/emc\\_accredited/](http://japan.ul.com/resources/emc_accredited/)

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

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
Telephone : +81 596 24 8999  
Facsimile : +81 596 24 8124

13-EM-F0429



<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>8</b>
<b>SECTION 5: Conducted Emission.....</b>	<b>10</b>
<b>SECTION 6: Radiated Spurious Emission .....</b>	<b>11</b>
<b>SECTION 7: Antenna Terminal Conducted Tests.....</b>	<b>12</b>
<b>APPENDIX 1: Data of EMI test.....</b>	<b>13</b>
Conducted Emission .....	13
20 dB Bandwidth and Carrier Frequency Separation.....	17
Number of Hopping Frequency .....	20
Dwell time.....	22
Maximum Peak Output Power .....	25
Radiated Spurious Emission .....	27
Conducted Spurious Emission .....	39
Conducted Emission Band Edge compliance .....	45
99%Occupied Bandwidth .....	47
<b>APPENDIX 2: Test instruments .....</b>	<b>49</b>
<b>APPENDIX 3: Photographs of test setup .....</b>	<b>50</b>
Conducted Emission .....	50
Radiated Spurious Emission .....	51
Worst Case Position (Horizontal: X-axis/ Vertical: Y-axis).....	52
Test Configuration and peripherals.....	53

## **SECTION 1: Customer information**

Company Name	Sony Interactive Entertainment Inc.
Brand Name	SONY
Address	1-7-1 Konan, Minato-ku, Tokyo, 108-0075 Japan
Telephone Number	+81-3-6748-6333
Facsimile Number	+81-3-6748-6383
Contact Person	Kiyoto Sasaki

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

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

Type of Equipment	Wireless Controller
Model No	CUH-ZCT2U
Serial No	See Clause 4.2
Country of Manufacture	China
Receipt Date of Sample	February 8, 2016
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 No: CUH-ZCT2U is the Wireless Controller for game machine.

#### **Product Specification**

Maximum clock frequency in the system (except radio part)	96MHz
Clock frequency in the system (radio part)	26MHz
Operating Temperature	5-35 deg. C
Power Supply	DC 5V (USB Bus Power)
Battery Supply	DC 3.65V
Size	161.2 x 100.3 x 64.5 mm
Weight	210 g

#### **Radio Specification: Bluetooth (Ver. 2.1+EDR)**

Equipment Type	Transceiver
Frequency of Operation	2402-2480MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Bandwidth & Channel spacing	79MHz & 1MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 3.2V
Antenna Type	IFA
Antenna Gain	3.00dBi max

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015  
\*Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision does not affect the test specification applied to the EUT.

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 EUT complies with FCC Part 15 Subpart B: 2015, final revised on November 23, 2015

### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	QP 17.5 dB, 0.18487 MHz, N AV 18.8 dB, 0.18487 MHz, N	Complied	-
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1(2)	See data.	Complied	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1(1)		Complied	Conducted
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1(4)		Complied	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1(4)		Complied	Conducted
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.12	FCC: Section15.247(a)(b)(1) IC: RSS-247 5.4(2)		Complied	Conducted
Spurious Emission & Band Edge Compliance	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10		12.2 dB 167.713 MHz, QP, Horizontal	Complied

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).

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

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

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

This EUT provides stable voltage (DC 3.2V) constantly to RF Part regardless of input voltage. Therefore, this EUT complies with the requirement.

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

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

#### EMI

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

Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz - 3 GHz	3 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	

Frequency range	Conducted emission using AMN(LISN) (+dB)
0.009 - 0.15MHz	3.5 dB
0.15 - 30MHz	2.9 dB

Test distance	Radiated emission (+dB) 9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+dB)		(10 m*)(+dB)	
	30 - 300 MHz	300 - 1000MHz	30 - 300 MHz	300 - 1000MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	4.5 dB	5.9 dB	4.8 dB	5.1 dB

Radiated emission				
(3 m*)(+dB)		(1 m*)(+dB)	(0.5 m*)(+dB)	(10 m*)(+dB)
1 - 6GHz	6 - 18GHz	10 - 26.5 GHz	26.5 - 40GHz	1 - 18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 dB

\*Measurement distance

#### Conducted Emission test

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

#### Radiated emission test (3m)

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

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### 3.5 Test Location

UL Japan, Inc. Ise EMC Lab. \*NVLAP Lab. code: 200572-0  
 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
 Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 3.6 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

## UL Japan, Inc. Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
 Telephone : +81 596 24 8999  
 Facsimile : +81 596 24 8124

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

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

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

<b>Test Item</b>	<b>Mode</b>	<b>Tested frequency</b>
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping off) DH5, 3DH5	2402MHz 2441MHz 2480MHz
Carrier Frequency Separation	Tx (Hopping on) DH5, 3DH5	2402MHz 2441MHz 2480MHz
20dB Bandwidth	Tx (Hopping off) DH5, 3DH5	2402MHz 2441MHz 2480MHz
Number of Hopping Frequency	Tx (Hopping on) DH5, 3DH5	-
Dwell time	Tx (Hopping on), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping off) DH5, 2DH5, 3DH5	2402MHz 2441MHz 2480MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping on -Hopping off	2402MHz 2480MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping on -Hopping off	2402MHz 2441MHz 2480MHz
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)  *2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.  *It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.</p> <p>*The power value of the EUT was set for testing as follows (setting value might be different from product specification value);  Power settings: 4dBm  Software: BtUART V2.1.6  *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.</p>		

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## 4.2 Configuration and peripherals

**This page has been submitted for a separate exhibit.**

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

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

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber .

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

**Detector** : QP and CISPR AV  
**Measurement range** : 0.15-30MHz  
**Test data** : APPENDIX  
**Test result** : Pass

---

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

### **Test Procedure**

[For below 1GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 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 1GHz]

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	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

### **20dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz *1)	RBW: 100kHz VBW: 300kHz
Test Distance	3m	4.4m *2)(1GHz - 10GHz), 1m *3) (above 10GHz)		4.4m *2) (1GHz - 10GHz), 1m *3) (above 10GHz)

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

\*2) Distance Factor:  $20 \times \log(4.4\text{m}/3.0\text{m}) = 3.3\text{dB}$

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

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

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

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

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **SECTION 7: Antenna Terminal Conducted Tests**

### **Test Procedure**

The tests were made with below setting connected to the antenna port.

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *3)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	300 kHz	1 MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *2)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

\*1) Peak hold was applied as Worst-case measurement.  
\*2) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)  
\*3) Reference data

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

**Test data** : **APPENDIX**  
**Test result** : **Pass**

**APPENDIX 1: Data of EMI test**

**Conducted Emission**

**DATA OF CONDUCTED EMISSION TEST**

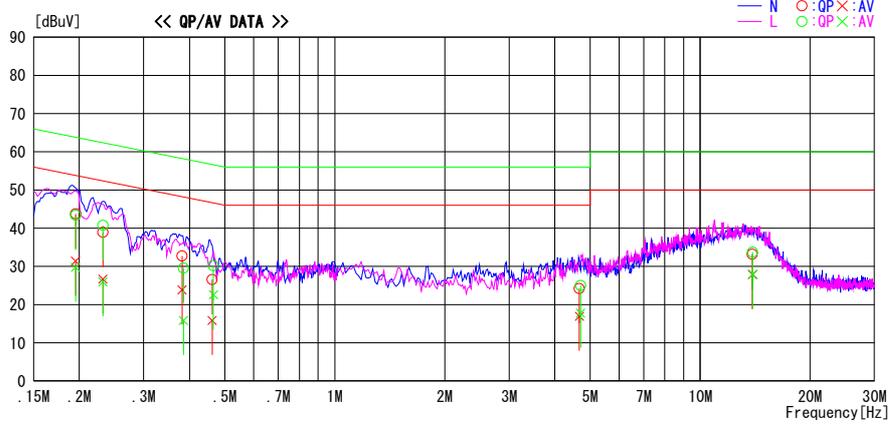
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber  
Date : 2016/02/09

Report No. : 11155190H

Temp./Humi. : 23deg. C / 30% RH  
Engineer : Ken Fujita

Mode / Remarks : Tx DH5 2402MHz

LIMIT : FCC15.207 QP  
FCC15.207 AV

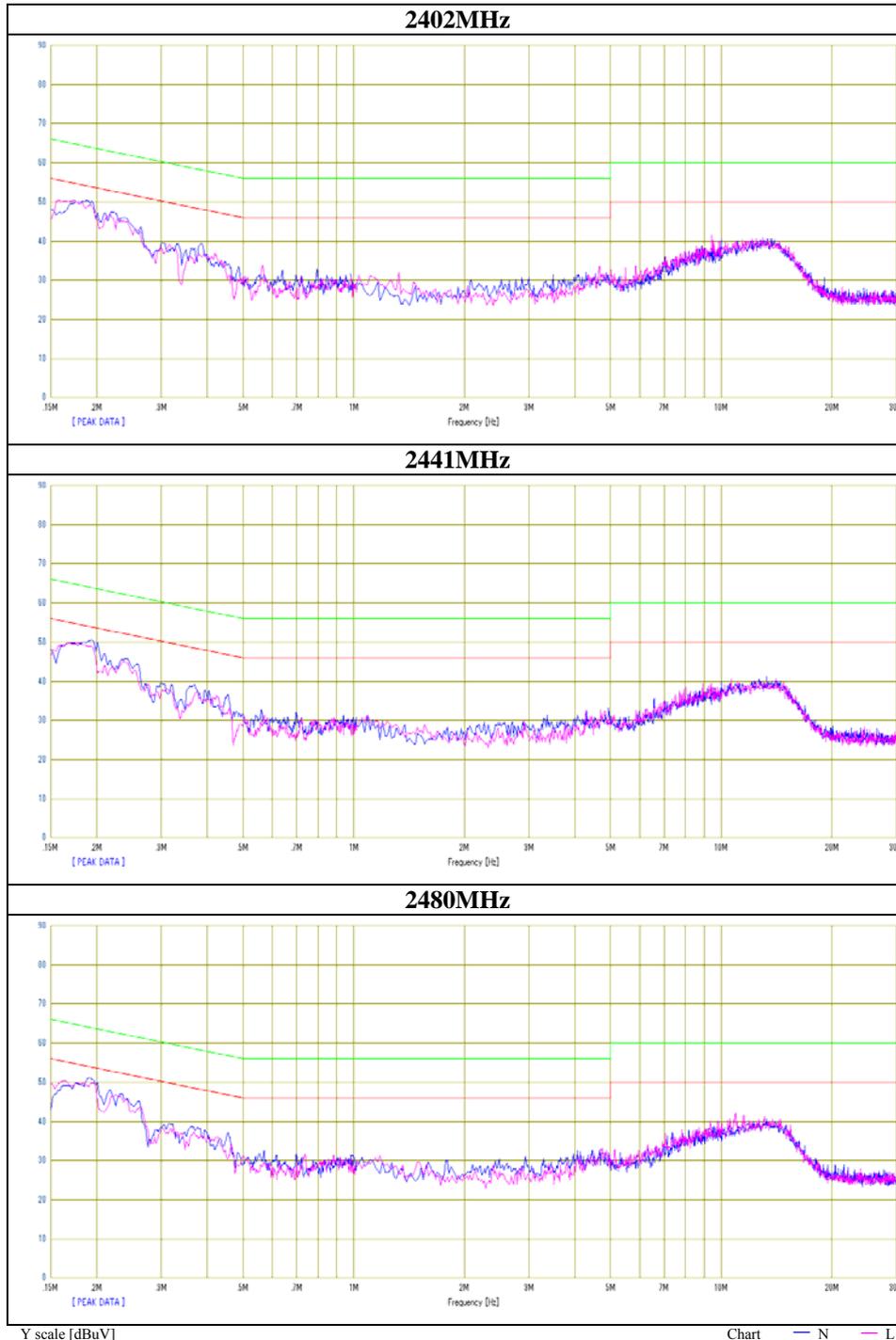


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.19533	30.5	18.2	13.2	43.7	31.4	63.8	53.8	20.1	22.4	N	
0.23194	25.7	13.5	13.2	38.9	26.7	62.4	52.4	23.5	25.7	N	
0.38188	19.5	10.7	13.2	32.7	23.9	58.2	48.2	25.5	24.3	N	
0.46209	13.4	2.7	13.2	26.6	15.9	56.7	46.7	30.1	30.8	N	
4.66980	10.4	3.2	13.8	24.2	17.0	56.0	46.0	31.8	29.0	N	
13.88766	18.7	13.4	14.5	33.2	27.9	60.0	50.0	26.8	22.1	N	
0.19533	30.2	16.6	13.2	43.4	29.8	63.8	53.8	20.4	24.0	L	
0.23194	27.5	12.8	13.2	40.7	26.0	62.4	52.4	21.7	26.4	L	
0.38537	16.4	2.7	13.2	29.6	15.9	58.2	48.2	28.6	32.3	L	
0.46557	17.0	9.4	13.2	30.2	22.6	56.6	46.6	26.4	24.0	L	
4.70615	11.2	4.0	13.8	25.0	17.8	56.0	46.0	31.0	28.2	L	
13.92784	19.2	13.5	14.5	33.7	28.0	60.0	50.0	26.3	22.0	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN. + CABLE)  
Except for the above table : adequate margin data below the limits.

## Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	23deg. C / 30% RH
Engineer	Ken Fujita
Mode	Tx DH5



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

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
 Telephone : +81 596 24 8999  
 Facsimile : +81 596 24 8124

## Conducted Emission

### DATA OF CONDUCTED EMISSION TEST

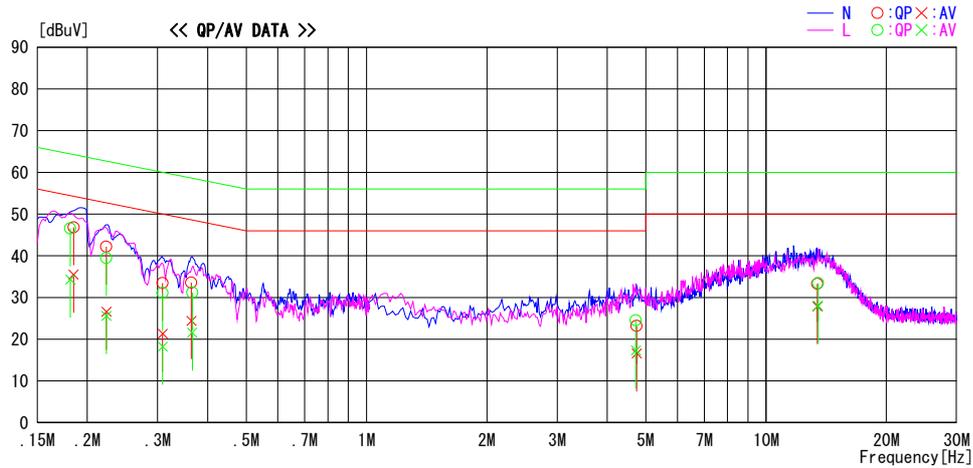
UL Japan, Inc. Ise EMC Lab. No. 2 Semi Anechoic Chamber  
 Date : 2016/02/09

Report No. : 11155190H

Temp./Humi. : 23deg. C / 30% RH  
 Engineer : Ken Fujita

Mode / Remarks : Tx 3DH5 2402MHz

LIMIT : FCC15.207 QP  
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.18487	33.6	22.3	13.2	46.8	35.5	64.3	54.3	17.5	18.8	N	
0.22323	29.0	13.4	13.2	42.2	26.6	62.7	52.7	20.5	26.1	N	
0.30866	20.3	8.1	13.2	33.5	21.3	60.0	50.0	26.5	28.7	N	
0.36445	20.4	11.2	13.2	33.6	24.4	58.6	48.6	25.0	24.2	N	
4.74251	9.4	2.8	13.8	23.2	16.6	56.0	46.0	32.8	29.4	N	
13.44568	18.9	13.5	14.4	33.3	27.9	60.0	50.0	26.7	22.1	N	
0.18138	33.4	21.1	13.2	46.6	34.3	64.4	54.4	17.8	20.1	L	
0.22323	26.3	12.4	13.2	39.5	25.6	62.7	52.7	23.2	27.1	L	
0.30866	17.9	5.0	13.2	31.1	18.2	60.0	50.0	28.9	31.8	L	
0.36619	18.0	8.4	13.2	31.2	21.6	58.6	48.6	27.4	27.0	L	
4.72433	10.8	3.5	13.8	24.6	17.3	56.0	46.0	31.4	28.7	L	
13.48586	19.0	13.6	14.5	33.5	28.1	60.0	50.0	26.5	21.9	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN. + CABLE)  
 Except for the above table : adequate margin data below the limits.

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

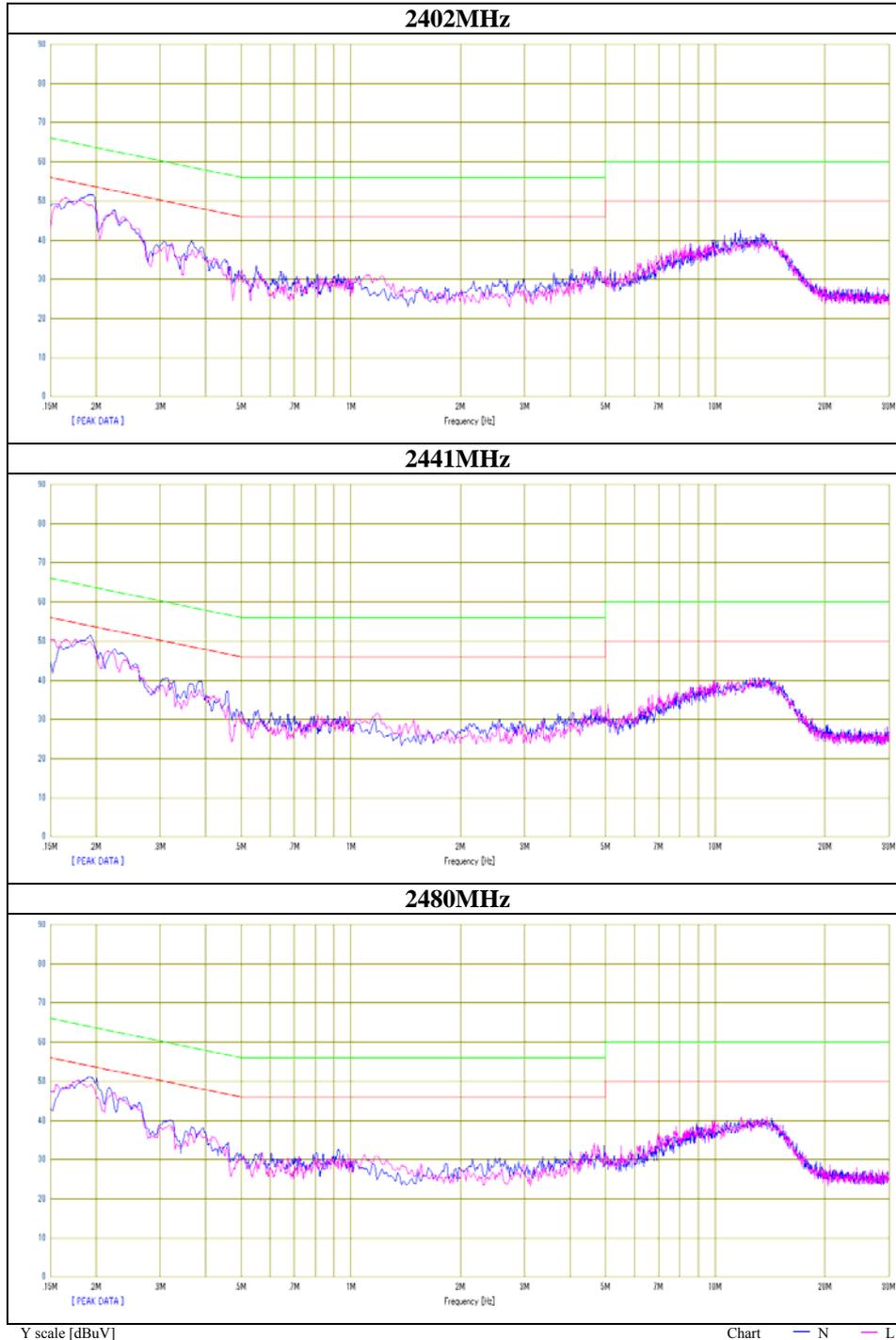
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	23deg. C / 30% RH
Engineer	Ken Fujita
Mode	Tx 3DH5



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

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
 Telephone : +81 596 24 8999  
 Facsimile : +81 596 24 8124

## 20 dB Bandwidth and Carrier Frequency Separation

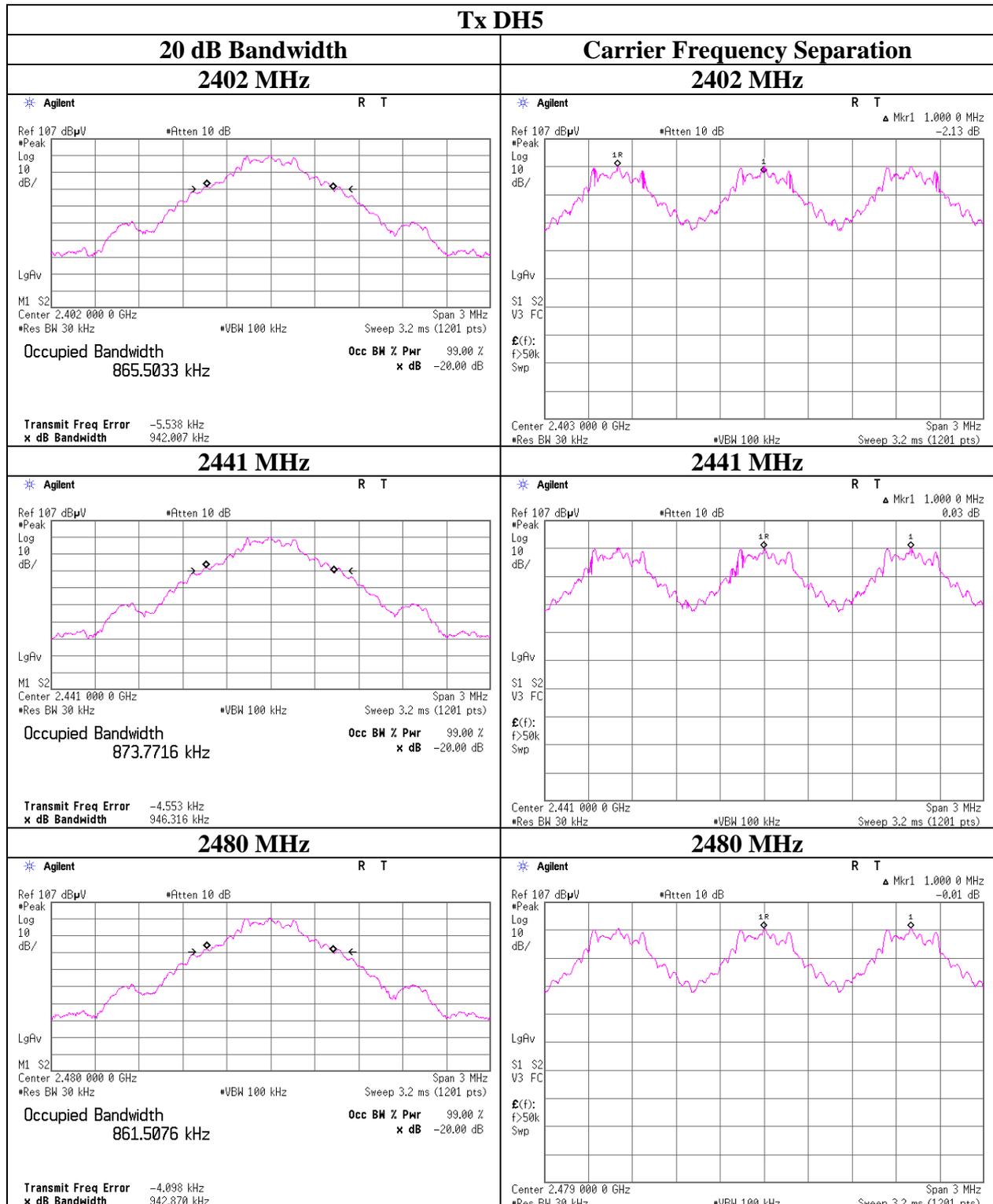
Test place : Ise EMC Lab. No.11 Measurement Room  
Report No. : 11155190H  
Date : February 9, 2016  
Temperature/ Humidity : 24 deg. C / 32% RH  
Engineer : Takumi Shimada  
Mode : Tx (Hopping on) DH5/3DH5

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.942	1.000	$\geq 0.628$
DH5	2441.0	0.946	1.000	$\geq 0.631$
DH5	2480.0	0.943	1.000	$\geq 0.629$
3DH5	2402.0	1.298	1.000	$\geq 0.865$
3DH5	2441.0	1.298	1.000	$\geq 0.865$
3DH5	2480.0	1.298	1.000	$\geq 0.865$

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

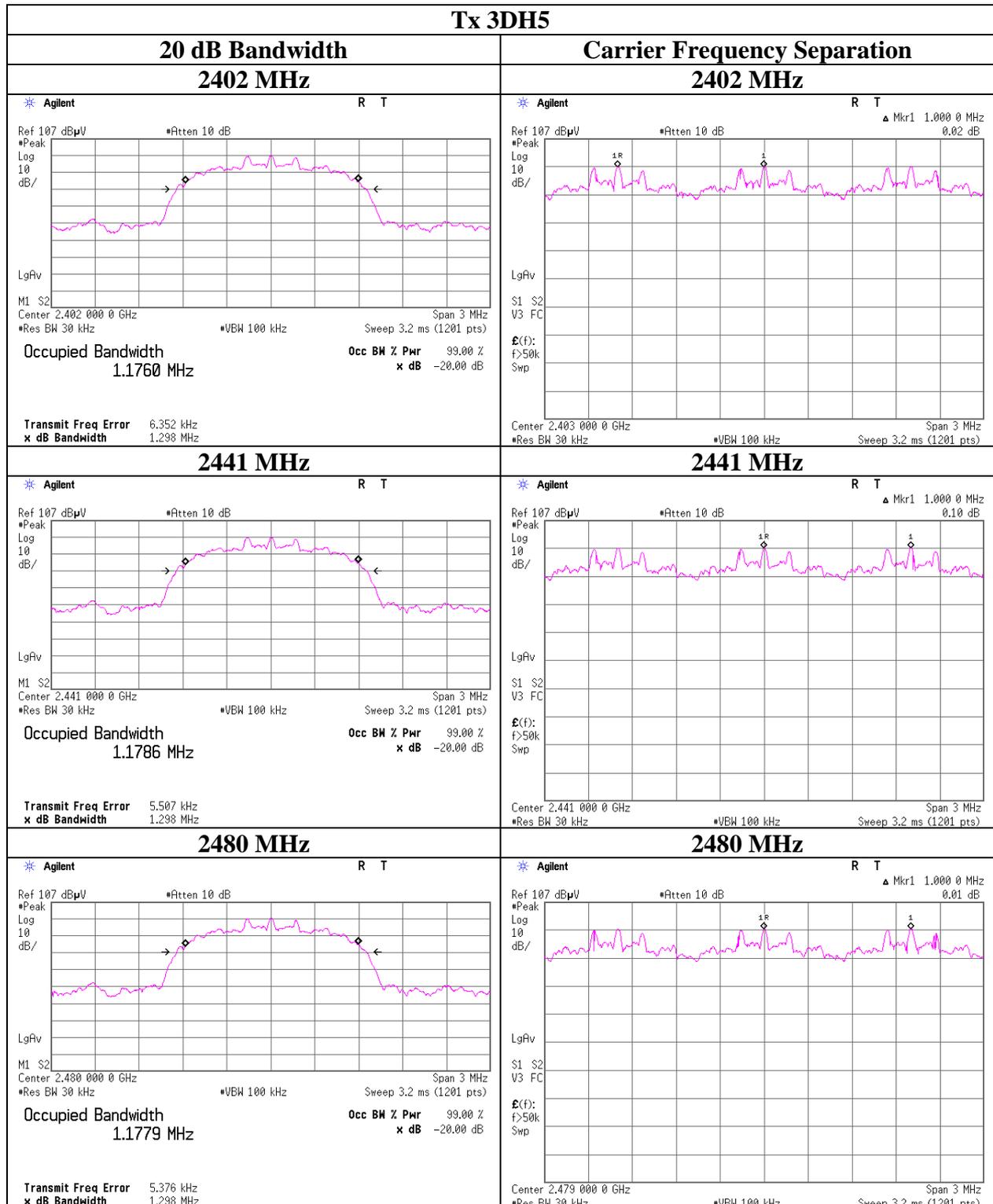
## 20 dB Bandwidth and Carrier Frequency Separation



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

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
 Telephone : +81 596 24 8999  
 Facsimile : +81 596 24 8124

## 20 dB Bandwidth and Carrier Frequency Separation



**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

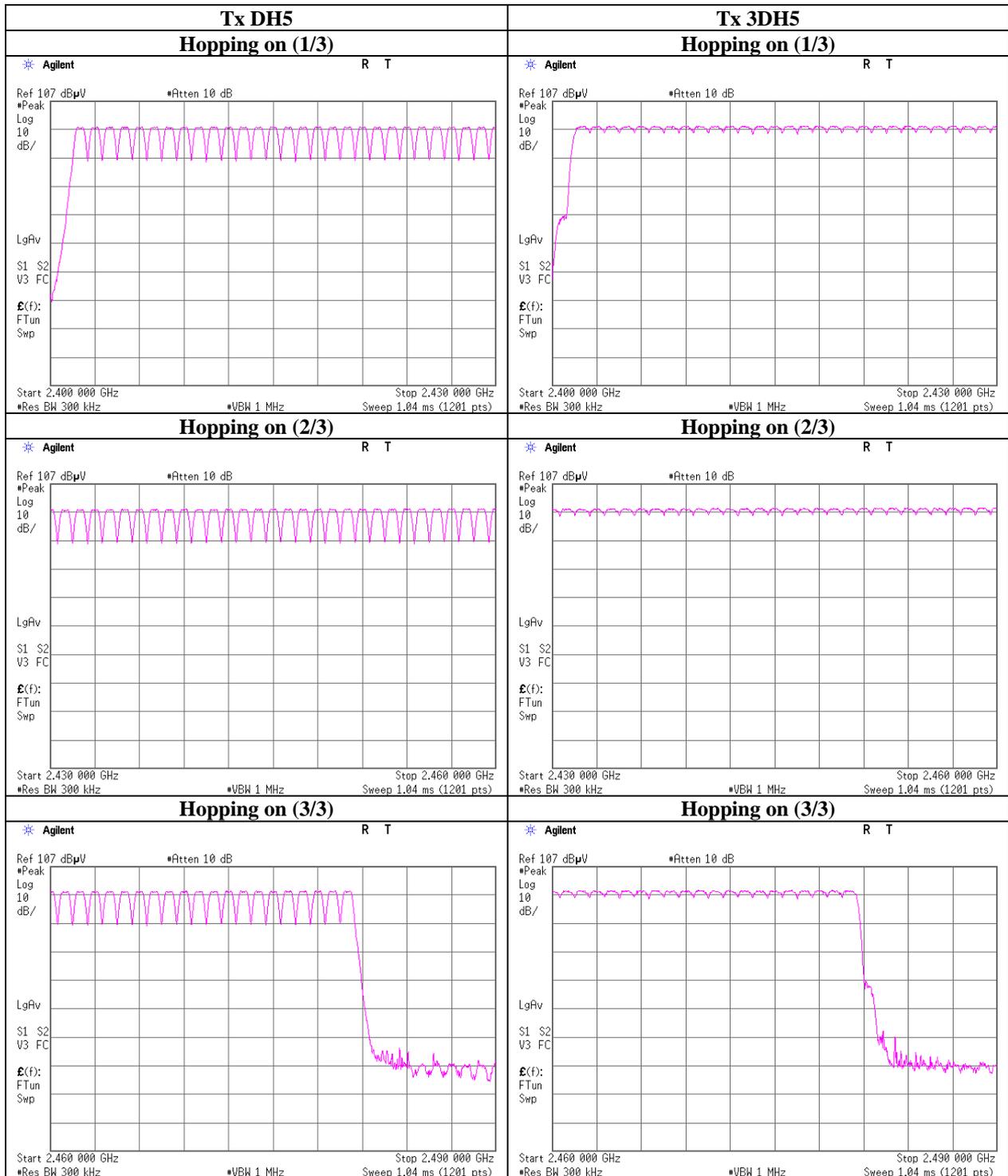
### Number of Hopping Frequency

Test place Ise EMC Lab. No.11 Measurement Room  
Report No. 11155190H  
Date February 9, 2016  
Temperature/ Humidity 24 deg. C / 32% RH  
Engineer Takumi Shimada  
Mode Tx (Hopping on) DH5/3DH5

Mode	Number of channel [times]	Limit [times]
DH5	79	>= 15
3DH5	79	>= 15

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.

### Number of Hopping Frequency



### Dwell time

Test place : Ise EMC Lab. No.11 Measurement Room  
Report No. : 11155190H  
Date : February 9, 2016  
Temperature/ Humidity : 24 deg. C / 32% RH  
Engineer : Takumi Shimada  
Mode : Tx (Hopping on) DH5/3DH5

Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8(32 Hopping x 0.4)second period		Length of transmission time [msec]	Result [msec]	Limit [msec]
DH1	50.6 times / 5 sec.	x 31.6 sec. = 320 times	0.4015	128	400
DH3	28.2 times / 5 sec.	x 31.6 sec. = 179 times	1.660	297	400
DH5	16.4 times / 5 sec.	x 31.6 sec. = 104 times	2.909	303	400
3DH1	50.6 times / 5 sec.	x 31.6 sec. = 320 times	0.4105	131	400
3DH3	26.8 times / 5 sec.	x 31.6 sec. = 170 times	1.665	283	400
3DH5	16.8 times / 5 sec.	x 31.6 sec. = 107 times	2.917	312	400

Sample Calculation

Result = Number of transmission x Length of transmission time

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

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	51	50	51	51	50.6
DH3	28	26	29	30	28	28.2
DH5	20	15	16	12	19	16.4
3DH1	51	51	49	52	50	50.6
3DH3	30	30	24	25	25	26.8
3DH5	17	19	11	19	18	16.8

Sample Calculation

Average= Summation(Sampling 1 to 5) / 5

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in  $N \times 0.4s$ , where  $N$  is the number of channels being used in the hopping sequence ( $20 \leq N \leq 79$ ), is always less than  $0.4s$  regardless of packet size. This is confirmed in the test report for  $N=79$ .

**UL Japan, Inc.**

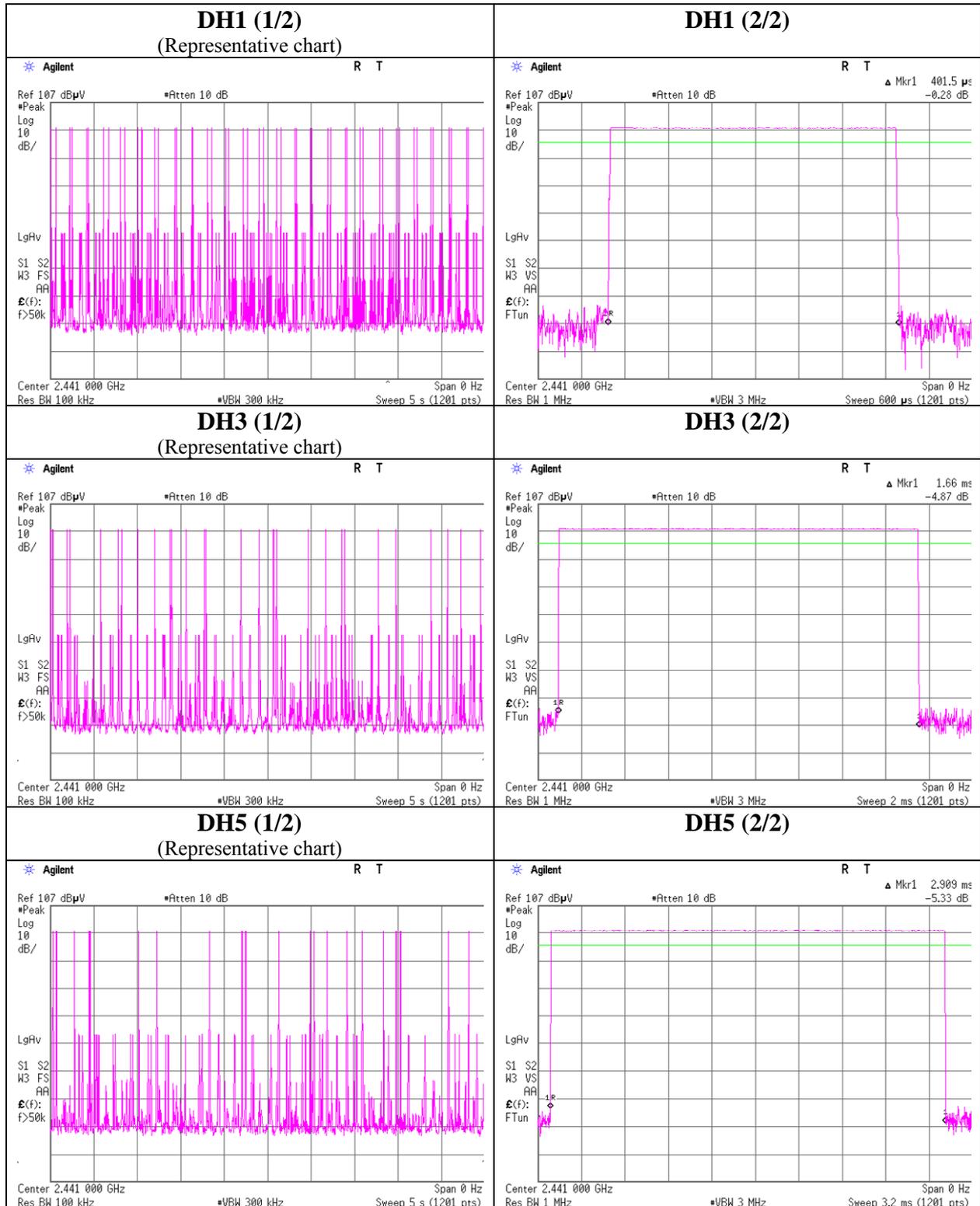
**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Dwell time**



**UL Japan, Inc.**

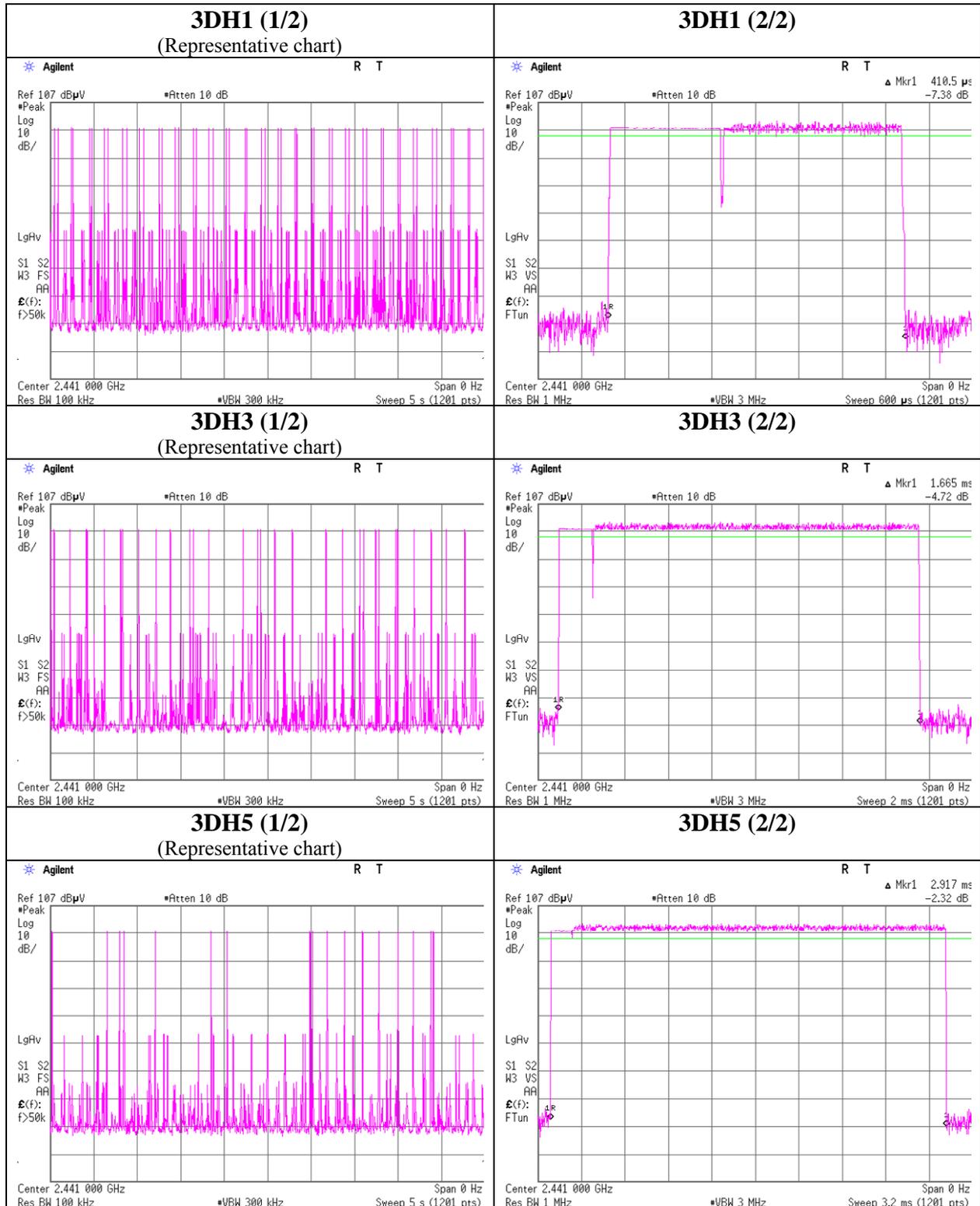
**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Dwell time**



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

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
 Telephone : +81 596 24 8999  
 Facsimile : +81 596 24 8124

### Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) DH5/2DH5/3DH5

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-8.89	0.80	9.74	1.65	1.46	20.97	125	19.32
DH5	2441.0	-8.70	0.80	9.74	1.84	1.53	20.97	125	19.13
DH5	2480.0	-8.40	0.80	9.74	2.14	1.64	20.97	125	18.83
2DH5	2402.0	-6.60	0.80	9.74	3.94	2.48	20.97	125	17.03
2DH5	2441.0	-6.38	0.80	9.74	4.16	2.61	20.97	125	16.81
2DH5	2480.0	-6.06	0.80	9.74	4.48	2.81	20.97	125	16.49
3DH5	2402.0	-6.13	0.80	9.74	4.41	2.76	20.97	125	16.56
3DH5	2441.0	-5.90	0.80	9.74	4.64	2.91	20.97	125	16.33
3DH5	2480.0	-5.62	0.80	9.74	4.92	3.10	20.97	125	16.05

Sample Calculation:

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Average Output Power**  
**(Reference data for SAR testing)**

Test place : Ise EMC Lab. No.11 Measurement Room  
Report No. : 11155190H  
Date : February 9, 2016  
Temperature/ Humidity : 24 deg. C / 32% RH  
Engineer : Takumi Shimada  
Mode : Tx (Hopping off) DH5/2DH5/3DH5

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
DH5	2402.0	-10.27	0.80	9.74	0.27	1.06
DH5	2441.0	-10.10	0.80	9.74	0.44	1.11
DH5	2480.0	-9.82	0.80	9.74	0.72	1.18
2DH5	2402.0	-10.16	0.80	9.74	0.38	1.09
2DH5	2441.0	-9.93	0.80	9.74	0.61	1.15
2DH5	2480.0	-9.63	0.80	9.74	0.91	1.23
3DH5	2402.0	-10.13	0.80	9.74	0.41	1.10
3DH5	2441.0	-9.91	0.80	9.74	0.63	1.16
3DH5	2480.0	-9.62	0.80	9.74	0.92	1.24

Sample Calculation:

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

## Radiated Spurious Emission

Test place Ise EMC Lab. No.3 Ise EMC Lab. No.2  
(Semi Anechoic Chamber)  
Report No. 11155190H  
Date February 8, 2016 February 9, 2016  
Temperature / Humidity 25 deg. C / 30 % RH 22 deg. C / 33 % RH  
Engineer Yuta Moriya Ken Fujita  
Above 1GHz Below 1GHz  
Mode Tx, Hopping Off, DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	45.312	QP	25.6	12.0	6.9	28.5	16.0	40.0	24.0	
Hori	91.200	QP	31.1	8.0	7.4	28.2	18.3	43.5	25.2	
Hori	119.915	QP	34.2	12.5	7.6	28.1	26.2	43.5	17.3	
Hori	167.713	QP	35.5	15.7	8.0	27.9	31.3	43.5	12.2	
Hori	487.832	QP	23.8	17.8	9.7	28.5	22.8	46.0	23.2	
Hori	630.167	QP	25.0	19.6	10.3	28.3	26.6	46.0	19.4	
Hori	2390.000	PK	43.9	26.9	6.6	32.0	45.4	73.9	28.5	
Hori	4804.000	PK	40.5	31.8	8.8	31.3	49.8	73.9	24.1	
Hori	7206.000	PK	42.2	36.0	10.0	32.0	56.2	73.9	17.7	Floor Noise
Hori	9608.000	PK	42.1	38.2	10.8	32.4	58.7	73.9	15.2	Floor Noise
Hori	2390.000	AV	30.5	26.9	6.6	32.0	32.0	53.9	22.0	
Hori	4804.000	AV	28.4	31.8	8.8	31.3	37.7	53.9	16.2	
Hori	7206.000	AV	28.8	36.0	10.0	32.0	42.8	53.9	11.1	Floor Noise
Hori	9608.000	AV	28.8	38.2	10.8	32.4	45.4	53.9	8.5	Floor Noise
Vert	44.389	QP	36.0	12.3	6.9	28.5	26.7	40.0	13.3	
Vert	90.899	QP	35.6	7.9	7.4	28.2	22.7	43.5	20.8	
Vert	119.892	QP	30.4	12.5	7.6	28.1	22.4	43.5	21.1	
Vert	139.800	QP	30.2	14.1	7.8	28.0	24.1	43.5	19.4	
Vert	490.163	QP	23.9	17.8	9.7	28.5	22.9	46.0	23.1	
Vert	627.821	QP	30.8	19.6	10.2	28.3	32.3	46.0	13.7	
Vert	2390.000	PK	41.8	26.9	6.6	32.0	43.3	73.9	30.6	
Vert	4804.000	PK	42.1	31.8	8.8	31.3	51.4	73.9	22.5	
Vert	7206.000	PK	42.8	36.0	10.0	32.0	56.8	73.9	17.2	Floor Noise
Vert	9608.000	PK	42.7	38.2	10.8	32.4	59.3	73.9	14.6	Floor Noise
Vert	2390.000	AV	28.6	26.9	6.6	32.0	30.1	53.9	23.8	
Vert	4804.000	AV	28.8	31.8	8.8	31.3	38.1	53.9	15.8	
Vert	7206.000	AV	28.7	36.0	10.0	32.0	42.7	53.9	11.2	Floor Noise
Vert	9608.000	AV	28.8	38.2	10.8	32.4	45.4	53.9	8.5	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 1 GHz - 10 GHz 20log(4.4 m / 3.0 m) = 3.3 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	94.6	26.9	6.6	32.0	96.1	-	-	Carrier
Hori	2400.000	PK	39.8	26.9	6.6	32.0	41.3	76.1	34.8	
Vert	2402.000	PK	94.9	26.9	6.6	32.0	96.4	-	-	Carrier
Vert	2400.000	PK	38.2	26.9	6.6	32.0	39.7	76.4	36.7	

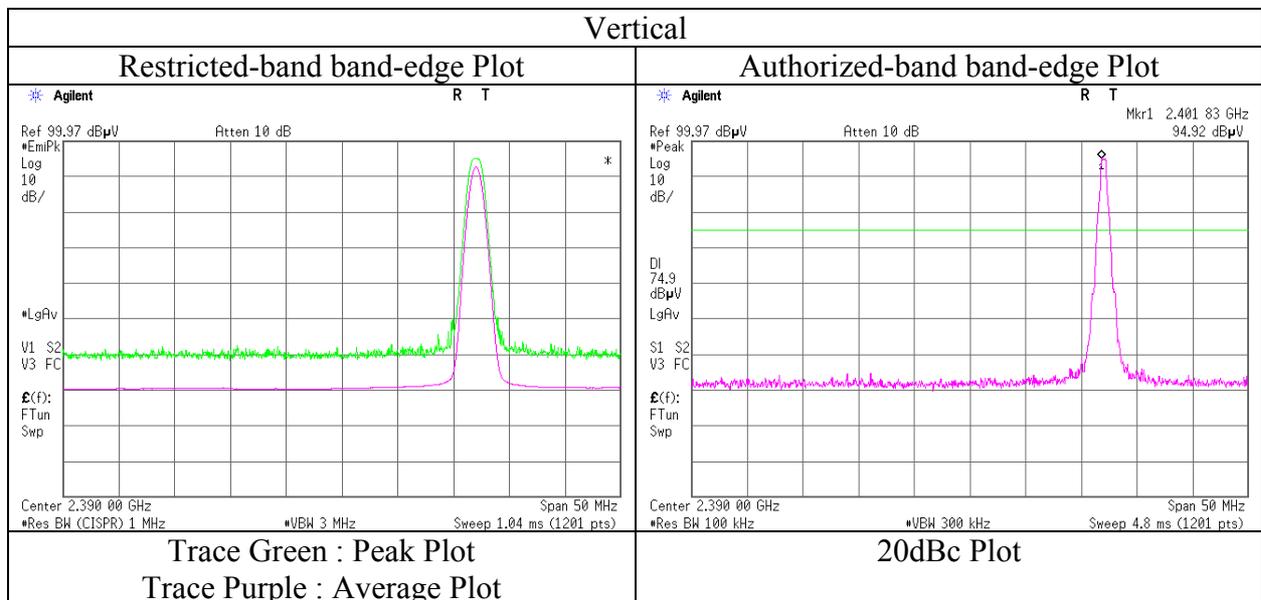
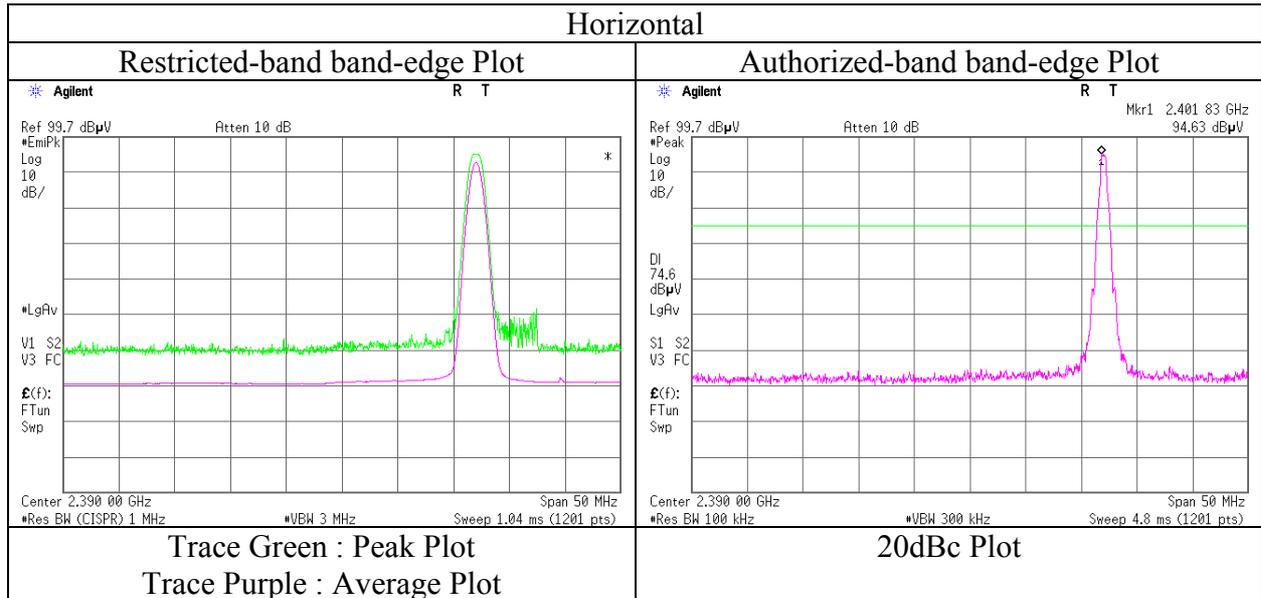
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1GHz)) - Gain(Amplifier)

Distance factor: 1 GHz - 10 GHz 20log(4.4 m / 3.0 m) = 3.3 dB

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

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

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11155190H
Date	February 8, 2016
Temperature / Humidity	25 deg. C / 30 % RH
Engineer	Yuta Moriya (1-10GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz



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

## Radiated Spurious Emission

Test place Ise EMC Lab. No.3 Ise EMC Lab. No.2  
(Semi Anechoic Chamber)  
Report No. 11155190H  
Date February 8, 2016 February 9, 2016  
Temperature / Humidity 25 deg. C / 30 % RH 22 deg. C / 33 % RH  
Engineer Yuta Moriya Ken Fujita  
Mode Above 1GHz Below 1GHz  
Tx, Hopping Off, DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	45.218	QP	25.5	12.0	6.9	28.5	15.9	40.0	24.1	
Hori	91.232	QP	31.2	8.0	7.4	28.2	18.4	43.5	25.1	
Hori	119.991	QP	34.3	12.5	7.6	28.1	26.3	43.5	17.2	
Hori	139.342	QP	32.5	14.1	7.8	28.0	26.4	43.5	17.1	
Hori	487.821	QP	24.4	17.8	9.7	28.5	23.4	46.0	22.6	
Hori	630.189	QP	25.2	19.6	10.3	28.3	26.8	46.0	19.2	
Hori	4882.000	PK	40.0	31.9	8.8	31.3	49.4	73.9	24.5	
Hori	7323.000	PK	42.0	36.0	10.1	32.0	56.1	73.9	17.8	Floor Noise
Hori	9764.000	PK	40.6	38.2	10.8	32.5	57.1	73.9	16.8	Floor Noise
Hori	4882.000	AV	27.7	31.9	8.8	31.3	37.1	53.9	16.8	
Hori	7323.000	AV	28.3	36.0	10.1	32.0	42.4	53.9	11.5	Floor Noise
Hori	9764.000	AV	28.0	38.2	10.8	32.5	44.5	53.9	9.4	Floor Noise
Vert	44.421	QP	34.8	12.3	6.9	28.5	25.5	40.0	14.5	
Vert	91.221	QP	34.1	8.0	7.4	28.2	21.3	43.5	22.2	
Vert	119.879	QP	31.8	12.5	7.6	28.1	23.8	43.5	19.7	
Vert	139.742	QP	32.6	14.1	7.8	28.0	26.5	43.5	17.0	
Vert	490.165	QP	24.7	17.8	9.7	28.5	23.7	46.0	22.3	
Vert	627.834	QP	30.7	19.6	10.2	28.3	32.2	46.0	13.8	
Vert	4882.000	PK	40.2	31.9	8.8	31.3	49.6	73.9	24.3	
Vert	7323.000	PK	42.2	36.0	10.1	32.0	56.3	73.9	17.6	Floor Noise
Vert	9764.000	PK	41.7	38.2	10.8	32.5	58.2	73.9	15.7	Floor Noise
Vert	4882.000	AV	28.5	31.9	8.8	31.3	37.9	53.9	16.0	
Vert	7323.000	AV	28.4	36.0	10.1	32.0	42.5	53.9	11.4	Floor Noise
Vert	9764.000	AV	28.0	38.2	10.8	32.5	44.5	53.9	9.4	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 1 GHz - 10 GHz  $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.3      Ise EMC Lab. No.2  
(Semi Anechoic Chamber)  
Report No. : 11155190H  
Date : February 8, 2016      February 9, 2016  
Temperature / Humidity : 25 deg. C / 30 % RH      22 deg. C / 33 % RH  
Engineer : Yuta Moriya      Ken Fujita  
Mode : Above 1GHz      Below 1GHz  
Tx, Hopping Off, DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	45.311	QP	26.5	12.0	6.9	28.5	16.9	40.0	23.1	
Hori	91.198	QP	30.2	8.0	7.4	28.2	17.4	43.5	26.1	
Hori	120.304	QP	34.6	12.5	7.6	28.1	26.6	43.5	16.9	
Hori	139.311	QP	30.1	14.1	7.8	28.0	24.0	43.5	19.5	
Hori	487.837	QP	23.3	17.8	9.7	28.5	22.3	46.0	23.7	
Hori	630.187	QP	24.7	19.6	10.3	28.3	26.3	46.0	19.7	
Hori	2483.500	PK	46.0	26.9	6.6	32.0	47.5	73.9	26.4	
Hori	4960.000	PK	40.7	32.1	8.7	31.2	50.3	73.9	23.6	
Hori	7440.000	PK	41.3	36.0	10.0	32.1	55.2	73.9	18.7	Floor Noise
Hori	9920.000	PK	42.1	38.2	10.9	32.5	58.7	73.9	15.2	Floor Noise
Hori	2483.500	AV	31.2	26.9	6.6	32.0	32.7	53.9	21.2	
Hori	4960.000	AV	27.6	32.1	8.7	31.2	37.2	53.9	16.7	
Hori	7440.000	AV	28.8	36.0	10.0	32.1	42.7	53.9	11.2	Floor Noise
Hori	9920.000	AV	28.7	38.2	10.9	32.5	45.3	53.9	8.6	Floor Noise
Vert	44.332	QP	36.1	12.3	6.9	28.5	26.8	40.0	13.2	
Vert	91.218	QP	35.6	8.0	7.4	28.2	22.8	43.5	20.7	
Vert	119.489	QP	32.2	12.4	7.6	28.1	24.1	43.5	19.4	
Vert	139.800	QP	32.1	14.1	7.8	28.0	26.0	43.5	17.5	
Vert	490.165	QP	23.7	17.8	9.7	28.5	22.7	46.0	23.3	
Vert	627.834	QP	30.7	19.6	10.2	28.3	32.2	46.0	13.8	
Vert	2483.500	PK	44.3	26.9	6.6	32.0	45.8	73.9	28.1	
Vert	4960.000	PK	40.0	32.1	8.7	31.2	49.6	73.9	24.3	
Vert	7440.000	PK	41.1	36.0	10.0	32.1	55.0	73.9	18.9	Floor Noise
Vert	9920.000	PK	41.0	38.2	10.9	32.5	57.6	73.9	16.3	Floor Noise
Vert	2483.500	AV	30.5	26.9	6.6	32.0	32.0	53.9	21.9	
Vert	4960.000	AV	27.7	32.1	8.7	31.2	37.3	53.9	16.6	
Vert	7440.000	AV	28.5	36.0	10.0	32.1	42.4	53.9	11.5	Floor Noise
Vert	9920.000	AV	28.8	38.2	10.4	32.5	44.9	53.9	9.0	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

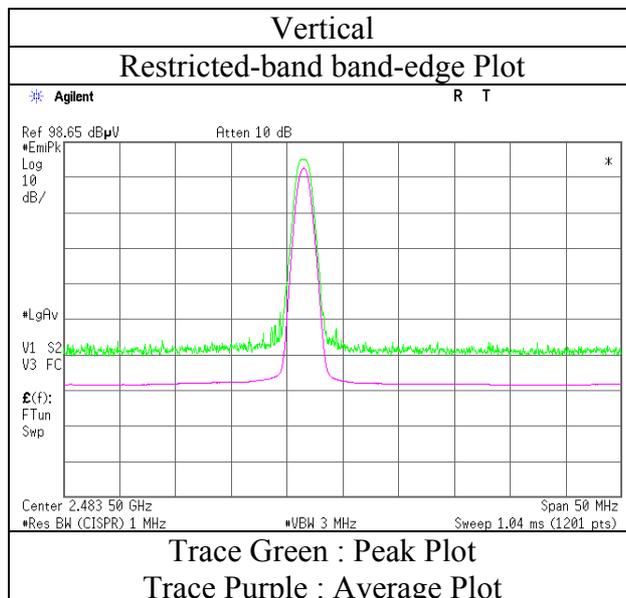
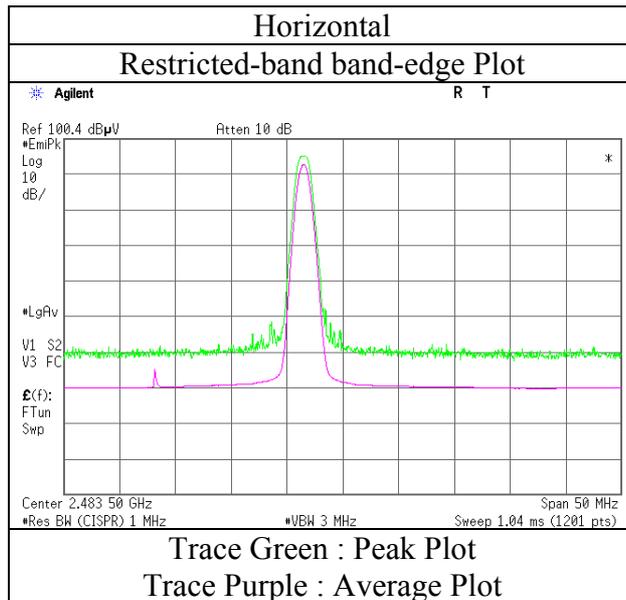
\*The 10th harmonic was not seen so the result was its base noise level.

Distance factor:      1 GHz - 10 GHz      20log(4.4 m / 3.0 m) = 3.3 dB  
                                 10 GHz - 26.5 GHz      20log(1.0 m / 3.0 m) = -9.5 dB

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

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

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11155190H
Date	February 8, 2016
Temperature / Humidity	25 deg. C / 30 % RH
Engineer	Yuta Moriya (1-10GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz



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

## Radiated Spurious Emission

Test place Ise EMC Lab. No.3 Ise EMC Lab. No.2  
(Semi Anechoic Chamber)  
Report No. 11155190H  
Date February 8, 2016 February 9, 2016  
Temperature / Humidity 25 deg. C / 30 % RH 22 deg. C / 33 % RH  
Engineer Yuta Moriya Ken Fujita  
Above 1GHz Below 1GHz  
Mode Tx, Hopping Off, 3DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	45.300	QP	26.5	12.0	6.9	28.5	16.9	40.0	23.1	
Hori	91.200	QP	30.2	8.0	7.4	28.2	17.4	43.5	26.1	
Hori	119.786	QP	34.5	12.5	7.6	28.1	26.5	43.5	17.0	
Hori	139.350	QP	25.9	14.1	7.8	28.0	19.8	43.5	23.7	
Hori	487.776	QP	26.7	17.8	9.7	28.5	25.7	46.0	20.3	
Hori	630.189	QP	25.1	19.6	10.3	28.3	26.7	46.0	19.3	
Hori	2390.000	PK	41.2	26.9	6.6	32.0	42.7	73.9	31.2	
Hori	4804.000	PK	40.7	31.8	8.8	31.3	50.0	73.9	23.9	
Hori	7206.000	PK	40.2	36.0	10.0	32.0	54.2	73.9	19.7	Floor Noise
Hori	9608.000	PK	40.8	38.2	10.8	32.4	57.4	73.9	16.5	Floor Noise
Hori	2390.000	AV	29.3	26.9	6.6	32.0	30.8	53.9	23.1	
Hori	4804.000	AV	28.6	31.8	8.8	31.3	37.9	53.9	16.1	
Hori	7206.000	AV	28.7	36.0	10.0	32.0	42.7	53.9	11.2	Floor Noise
Hori	9608.000	AV	28.6	38.2	10.8	32.4	45.2	53.9	8.7	Floor Noise
Vert	44.400	QP	35.3	12.3	6.9	28.5	26.0	40.0	14.0	
Vert	91.376	QP	28.7	8.0	7.4	28.2	15.9	43.5	27.6	
Vert	119.897	QP	32.4	12.5	7.6	28.1	24.4	43.5	19.1	
Vert	139.800	QP	34.4	14.1	7.8	28.0	28.3	43.5	15.2	
Vert	490.134	QP	23.9	17.8	9.7	28.5	22.9	46.0	23.1	
Vert	627.821	QP	30.4	19.6	10.2	28.3	31.9	46.0	14.1	
Vert	2390.000	PK	43.3	26.9	6.6	32.0	44.8	73.9	29.2	
Vert	4804.000	PK	40.2	31.8	8.8	31.3	49.5	73.9	24.4	
Vert	7206.000	PK	40.9	36.0	10.0	32.0	54.9	73.9	19.0	Floor Noise
Vert	9608.000	PK	42.0	38.2	10.8	32.4	58.6	73.9	15.3	Floor Noise
Vert	2390.000	AV	29.6	26.9	6.6	32.0	31.1	53.9	22.8	
Vert	4804.000	AV	28.9	31.8	8.8	31.3	38.2	53.9	15.7	
Vert	7206.000	AV	28.4	36.0	10.0	32.0	42.4	53.9	11.5	Floor Noise
Vert	9608.000	AV	28.7	38.2	10.8	32.4	45.3	53.9	8.7	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 1 GHz - 10 GHz 20log(4.4 m / 3.0 m) = 3.3 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	94.7	26.9	6.6	32.0	96.2	-	-	Carrier
Hori	2400.000	PK	39.2	26.9	6.6	32.0	40.7	76.2	35.5	
Vert	2402.000	PK	94.8	26.9	6.6	32.0	96.3	-	-	Carrier
Vert	2400.000	PK	39.0	26.9	6.6	32.0	40.5	76.3	35.8	

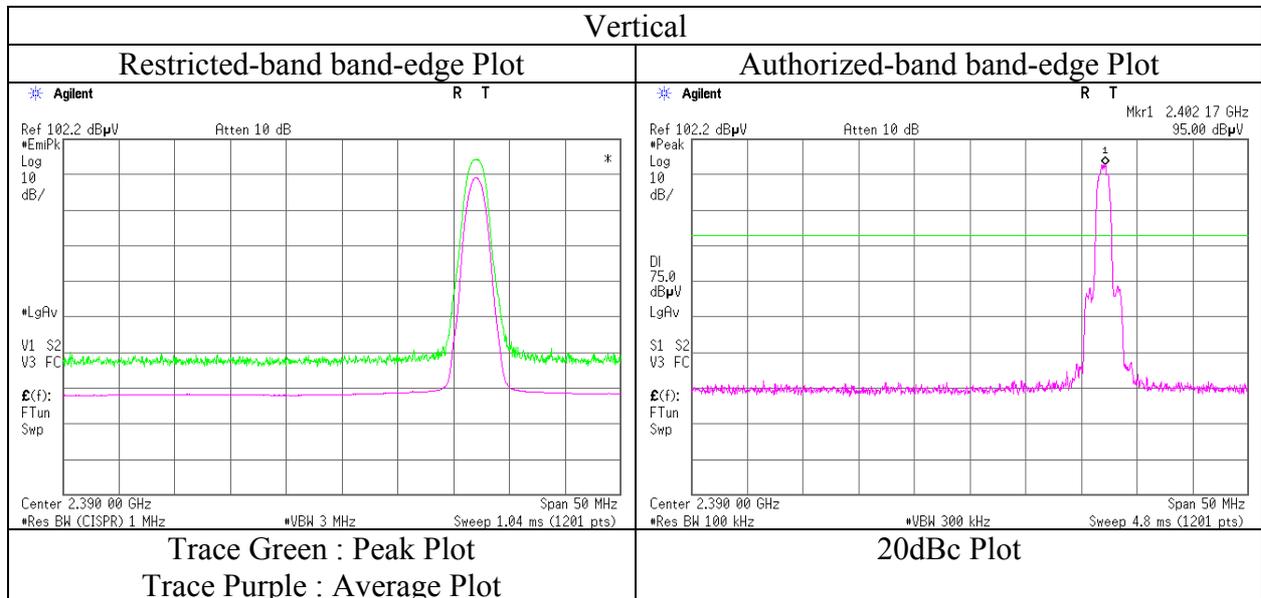
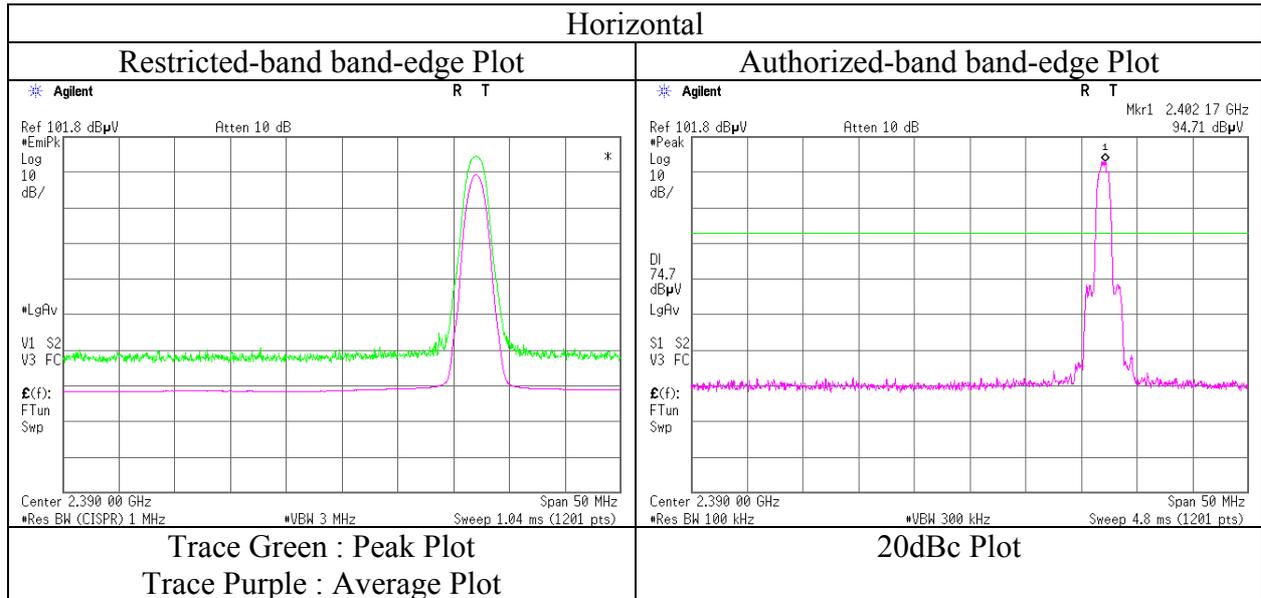
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1GHz)) - Gain(Amplifier)

Distance factor: 1 GHz - 10 GHz 20log(4.4 m / 3.0 m) = 3.3 dB

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

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

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11155190H
Date	February 8, 2016
Temperature / Humidity	25 deg. C / 30 % RH
Engineer	Yuta Moriya (1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz



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

### Radiated Spurious Emission

Test place Ise EMC Lab. No.3 Ise EMC Lab. No.2  
(Semi Anechoic Chamber)  
Report No. 11155190H  
Date February 8, 2016 February 9, 2016  
Temperature / Humidity 25 deg. C / 30 % RH 22 deg. C / 33 % RH  
Engineer Yuta Moriya Ken Fujita  
Mode Above 1GHz Below 1GHz  
Tx, Hopping Off, 3DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	45.300	QP	26.5	12.0	6.9	28.5	16.9	40.0	23.1	
Hori	91.200	QP	30.7	8.0	7.4	28.2	17.9	43.5	25.6	
Hori	119.896	QP	32.6	12.5	7.6	28.1	24.6	43.5	18.9	
Hori	139.350	QP	27.7	14.1	7.8	28.0	21.6	43.5	21.9	
Hori	487.832	QP	24.0	17.8	9.7	28.5	23.0	46.0	23.0	
Hori	630.167	QP	25.2	19.6	10.3	28.3	26.8	46.0	19.2	
Hori	4882.000	PK	40.0	31.9	8.8	31.3	49.4	73.9	24.5	
Hori	7323.000	PK	40.8	36.0	10.1	32.0	54.9	73.9	19.0	Floor Noise
Hori	9764.000	PK	40.4	38.2	10.8	32.5	56.9	73.9	17.1	Floor Noise
Hori	4882.000	AV	27.9	31.9	8.8	31.3	37.3	53.9	16.6	
Hori	7323.000	AV	28.4	36.0	10.1	32.0	42.5	53.9	11.4	Floor Noise
Hori	9764.000	AV	28.2	38.2	10.8	32.5	44.7	53.9	9.2	Floor Noise
Vert	44.612	QP	33.8	12.2	6.9	28.5	24.4	40.0	15.6	
Vert	91.344	QP	28.0	8.0	7.4	28.2	15.2	43.5	28.3	
Vert	119.423	QP	29.6	12.4	7.6	28.1	21.5	43.5	22.0	
Vert	139.612	QP	27.3	14.1	7.8	28.0	21.2	43.5	22.3	
Vert	490.165	QP	24.3	17.8	9.7	28.5	23.3	46.0	22.7	
Vert	627.834	QP	30.5	19.6	10.2	28.3	32.0	46.0	14.0	
Vert	4882.000	PK	40.5	31.9	8.8	31.3	49.9	73.9	24.0	
Vert	7323.000	PK	41.0	36.0	10.1	32.0	55.1	73.9	18.8	Floor Noise
Vert	9764.000	PK	40.0	38.2	10.8	32.5	56.5	73.9	17.4	Floor Noise
Vert	4882.000	AV	28.3	31.9	8.8	31.3	37.7	53.9	16.2	
Vert	7323.000	AV	28.4	36.0	10.1	32.0	42.5	53.9	11.4	Floor Noise
Vert	9764.000	AV	28.1	38.2	10.8	32.5	44.6	53.9	9.3	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 1 GHz - 10 GHz  $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.3\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

## Radiated Spurious Emission

Test place (Semi Anechoic Chamber)	Ise EMC Lab. No.3	Ise EMC Lab. No.2
Report No.	11155190H	
Date	February 8, 2016	February 9, 2016
Temperature / Humidity	25 deg. C / 30 % RH	22 deg. C / 33 % RH
Engineer	Yuta Moriya	Ken Fujita
	Above 1GHz	Below 1GHz
Mode	Tx, Hopping Off, 3DH5 2480 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	45.300	QP	24.1	12.0	6.9	28.5	14.5	40.0	25.5	
Hori	91.200	QP	24.5	8.0	7.4	28.2	11.7	43.5	31.8	
Hori	119.879	QP	30.7	12.5	7.6	28.1	22.7	43.5	20.8	
Hori	139.350	QP	24.8	14.1	7.8	28.0	18.7	43.5	24.8	
Hori	487.841	QP	24.2	17.8	9.7	28.5	23.2	46.0	22.8	
Hori	630.116	QP	24.8	19.6	10.3	28.3	26.4	46.0	19.6	
Hori	2483.500	PK	46.3	26.9	6.6	32.0	47.8	73.9	26.1	
Hori	4960.000	PK	40.6	32.1	8.7	31.2	50.2	73.9	23.7	
Hori	7440.000	PK	40.9	36.0	10.0	32.1	54.8	73.9	19.1	Floor Noise
Hori	9920.000	PK	41.8	38.2	10.9	32.5	58.4	73.9	15.5	Floor Noise
Hori	2483.500	AV	30.1	26.9	6.6	32.0	31.6	53.9	22.3	
Hori	4960.000	AV	27.6	32.1	8.7	31.2	37.2	53.9	16.7	
Hori	7440.000	AV	28.7	36.0	10.0	32.1	42.6	53.9	11.3	Floor Noise
Hori	9920.000	AV	28.6	38.2	10.9	32.5	45.2	53.9	8.7	Floor Noise
Vert	44.400	QP	34.5	12.3	6.9	28.5	25.2	40.0	14.8	
Vert	91.127	QP	29.2	8.0	7.4	28.2	16.4	43.5	27.1	
Vert	119.651	QP	30.5	12.4	7.6	28.1	22.4	43.5	21.1	
Vert	139.800	QP	27.9	14.1	7.8	28.0	21.8	43.5	21.7	
Vert	490.114	QP	24.0	17.8	9.7	28.5	23.0	46.0	23.0	
Vert	627.832	QP	30.5	19.6	10.2	28.3	32.0	46.0	14.0	
Vert	2483.500	PK	44.9	26.9	6.6	32.0	46.4	73.9	27.5	
Vert	4960.000	PK	40.2	32.1	8.7	31.2	49.8	73.9	24.1	
Vert	7440.000	PK	41.7	36.0	10.0	32.1	55.6	73.9	18.3	Floor Noise
Vert	9920.000	PK	41.6	38.2	10.9	32.5	58.2	73.9	15.7	Floor Noise
Vert	2483.500	AV	30.7	26.9	6.6	32.0	32.2	53.9	21.7	
Vert	4960.000	AV	27.7	32.1	8.7	31.2	37.3	53.9	16.6	
Vert	7440.000	AV	28.6	36.0	10.0	32.1	42.5	53.9	11.4	Floor Noise
Vert	9920.000	AV	28.8	38.2	10.4	32.5	44.9	53.9	9.0	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

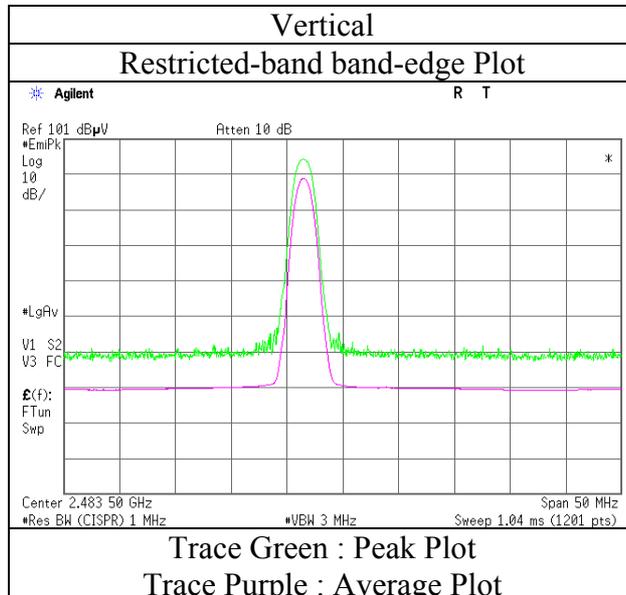
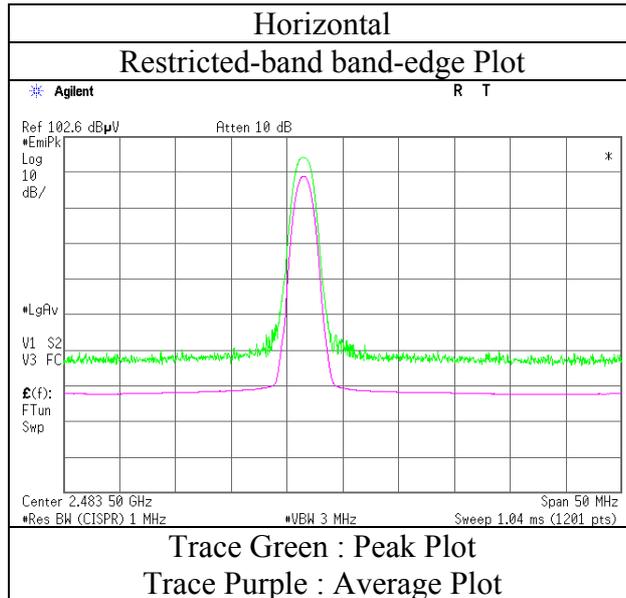
\*The 10th harmonic was not seen so the result was its base noise level.

Distance factor:    1 GHz - 10 GHz    20log(4.4 m / 3.0 m) = 3.3 dB  
                          10 GHz - 26.5 GHz    20log(1.0 m / 3.0 m) = -9.5 dB

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

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

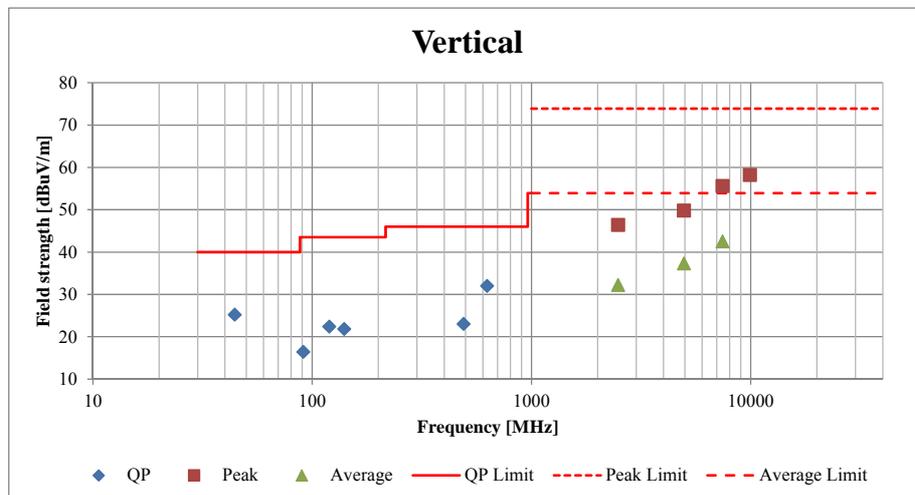
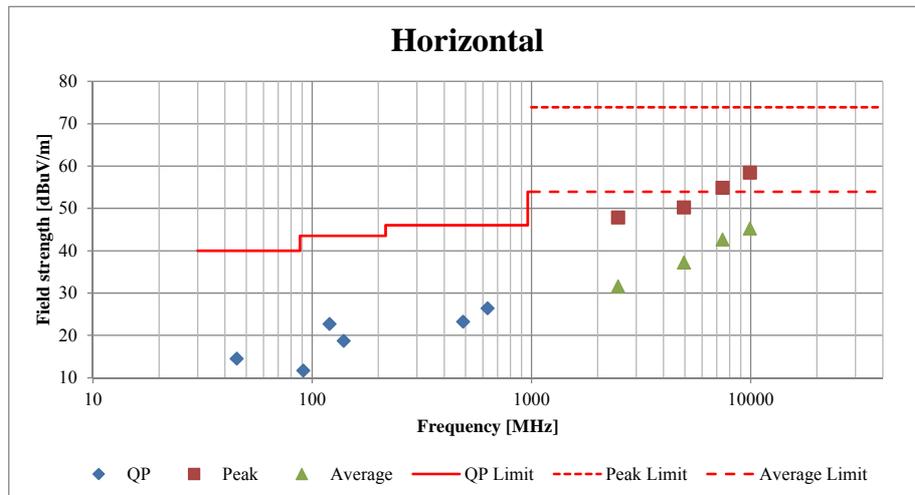
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11155190H
Date	February 8, 2016
Temperature / Humidity	25 deg. C / 30 % RH
Engineer	Yuta Moriya (1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz



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

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

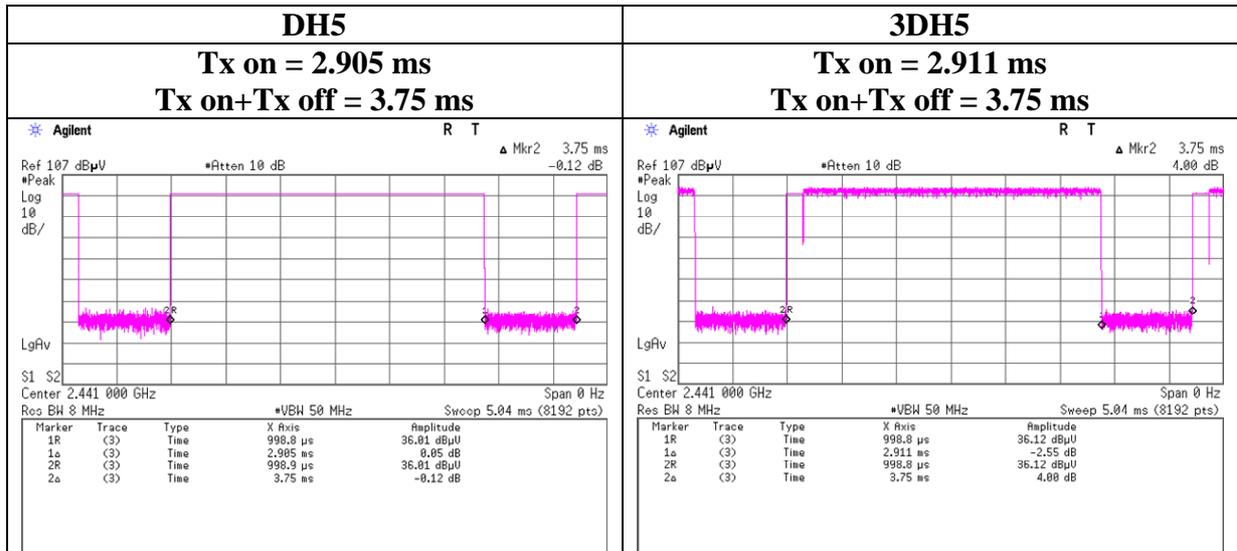
Test place (Semi Anechoic Chamber)	Ise EMC Lab. No.3	Ise EMC Lab. No.2
Report No.	11155190H	
Date	February 8, 2016	February 9, 2016
Temperature / Humidity	25 deg. C / 30 % RH	22 deg. C / 33 % RH
Engineer	Yuta Moriya	Ken Fujita
Mode	Above 1GHz	Below 1GHz
	Tx, Hopping Off, 3DH5 2480 MHz	



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

### Burst Rate Confirmation

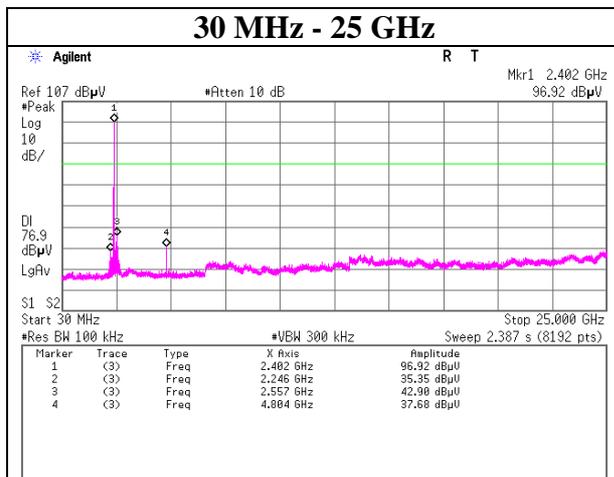
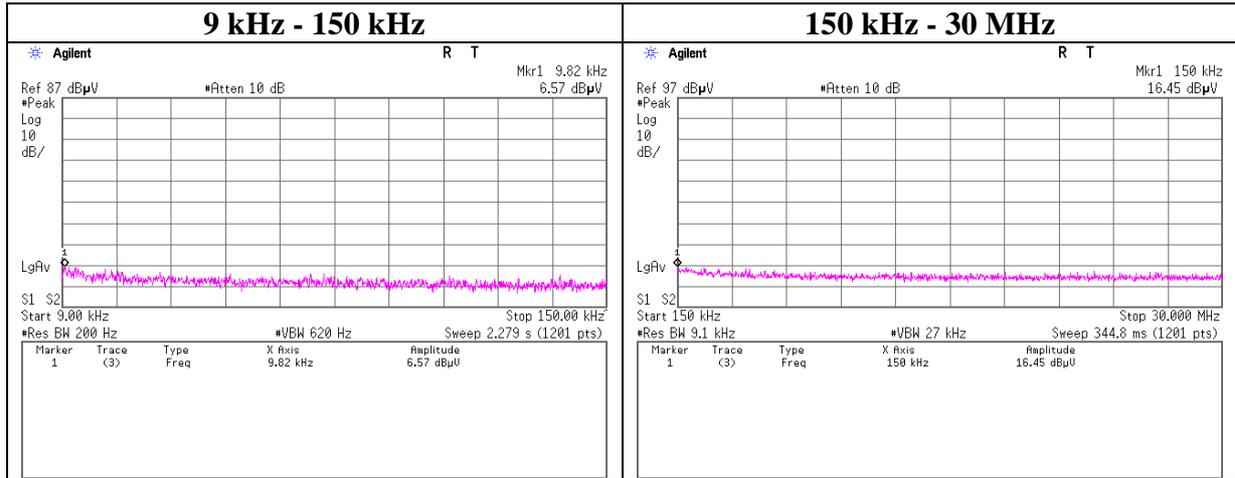
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	02/09/2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) DH5/3DH5



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) DH5

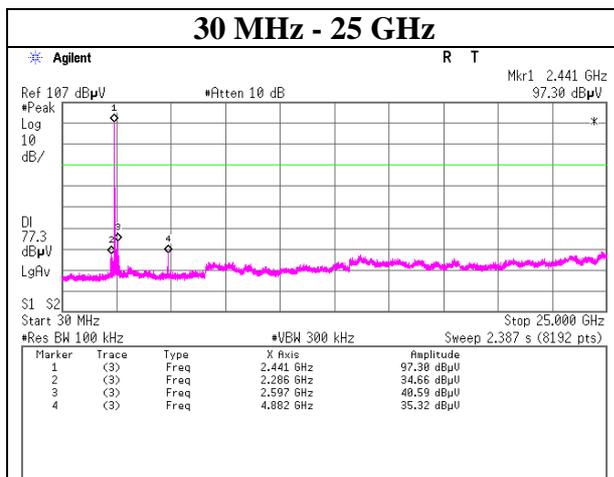
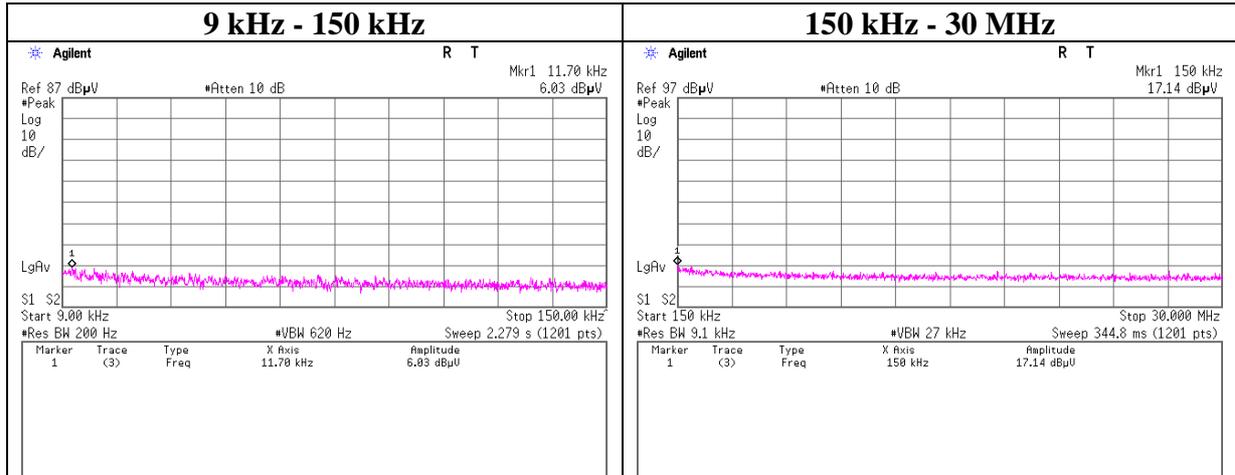
### 2402 MHz



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) DH5

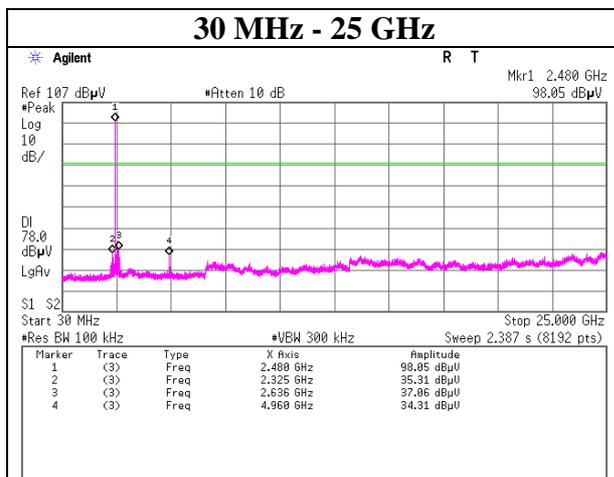
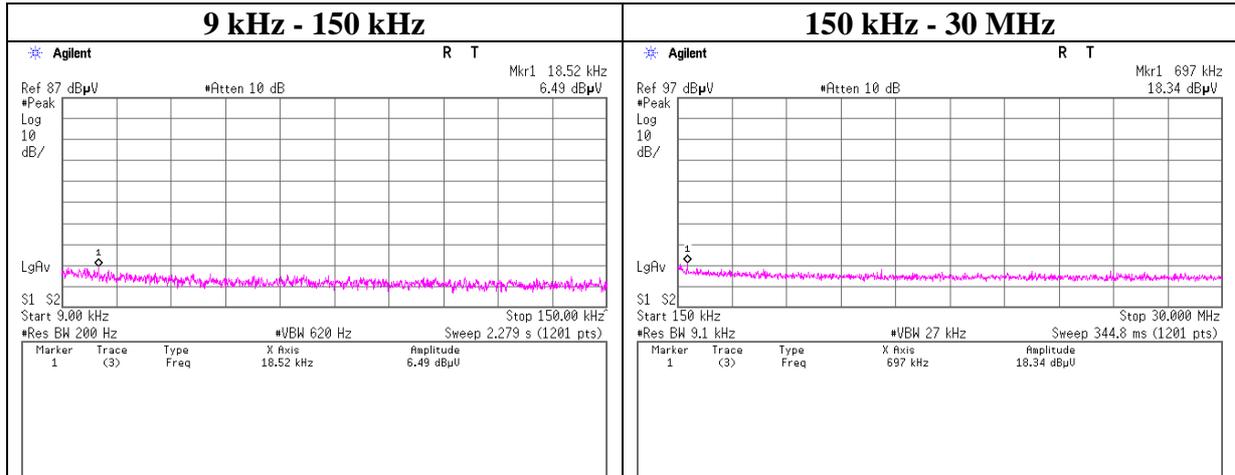
### 2441 MHz



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) DH5

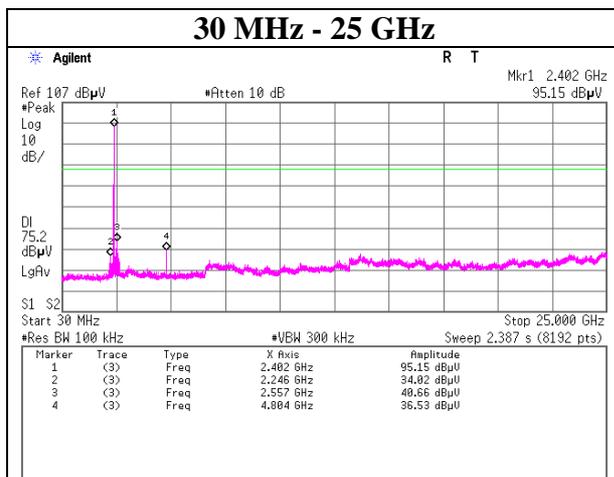
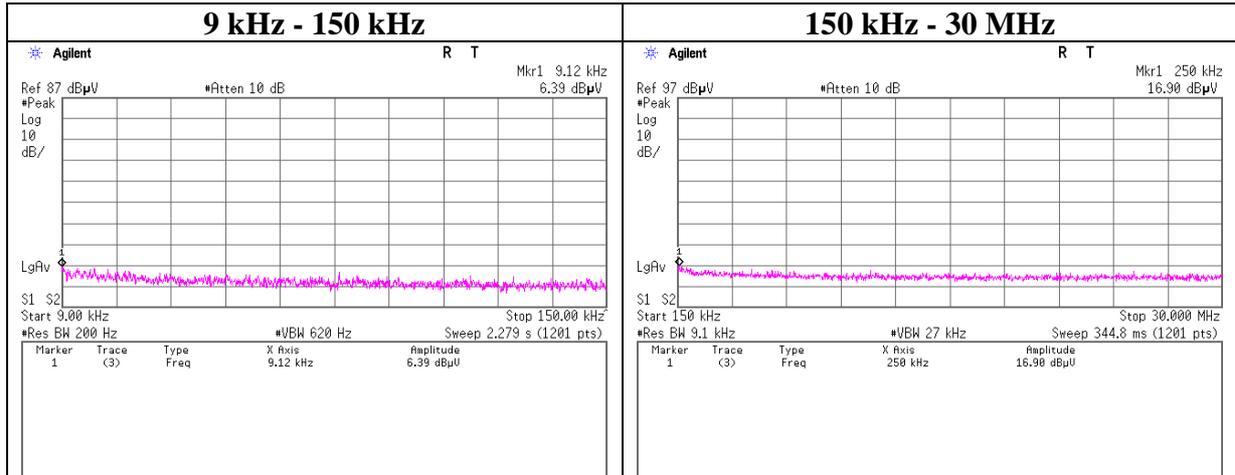
### 2480 MHz



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) 3DH5

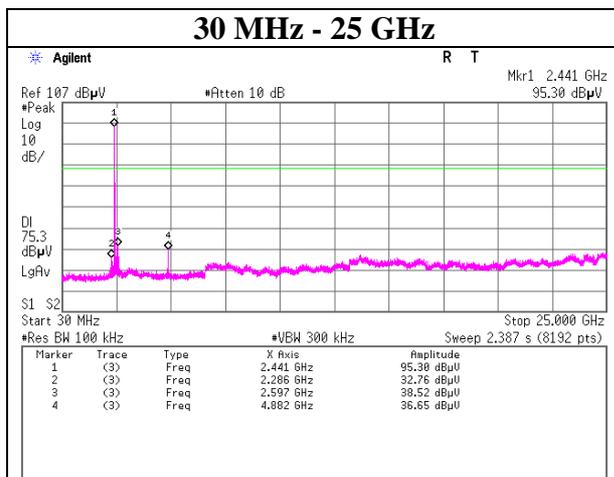
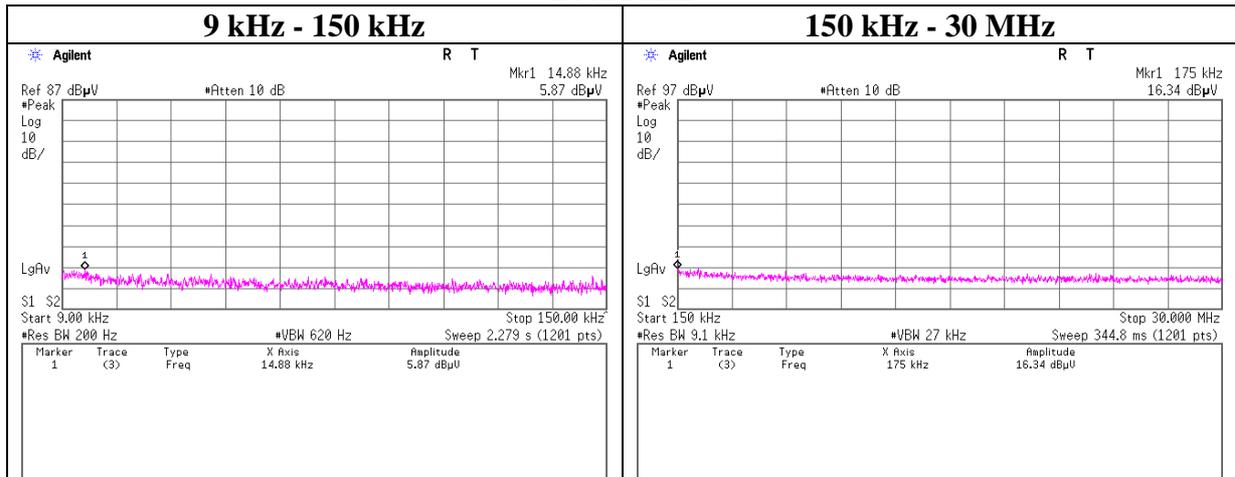
### 2402 MHz



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) 3DH5

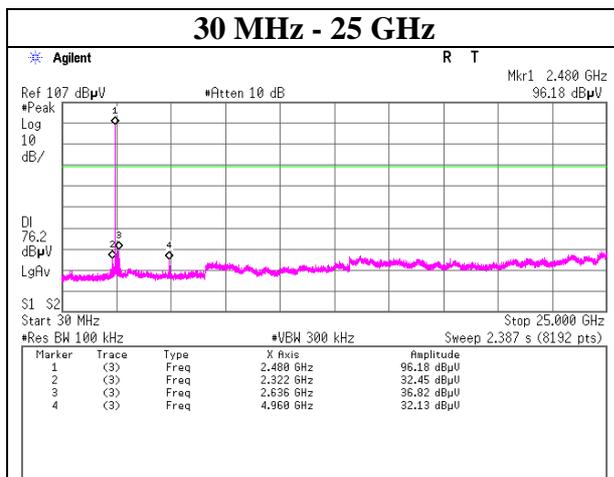
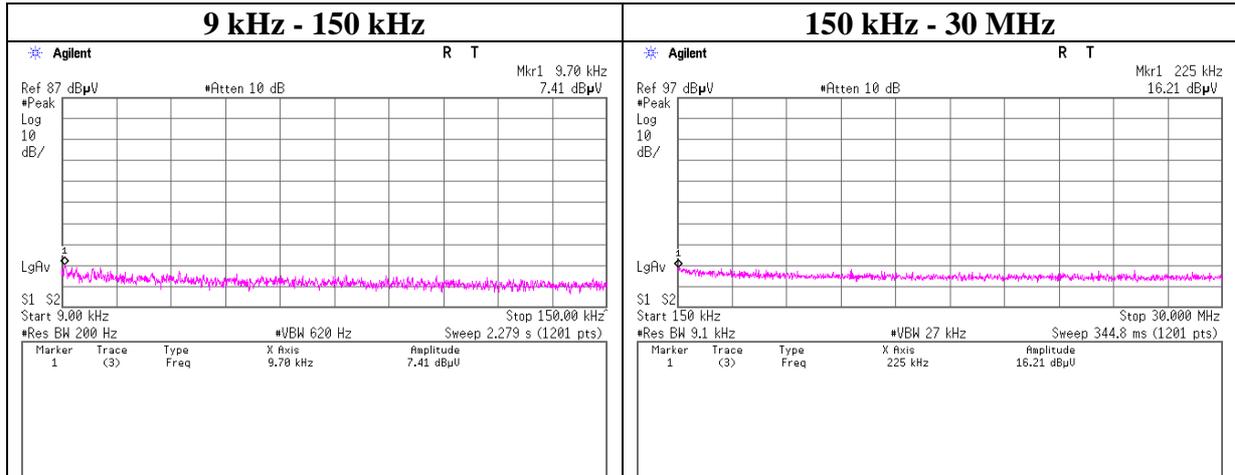
### 2441 MHz



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) 3DH5

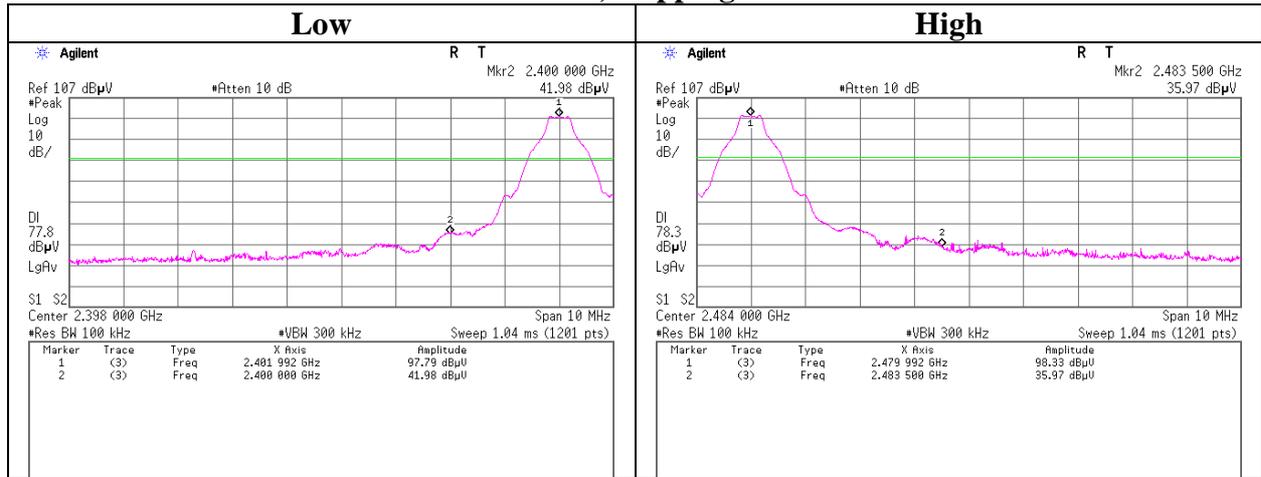
### 2480 MHz



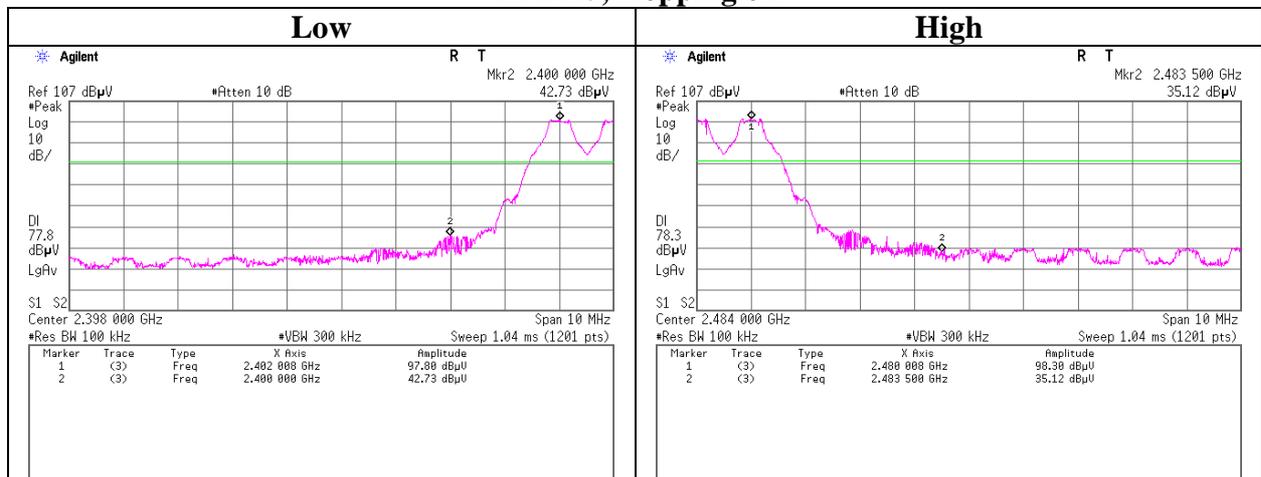
### Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping on/off) DH5

#### Tx DH5, Hopping off



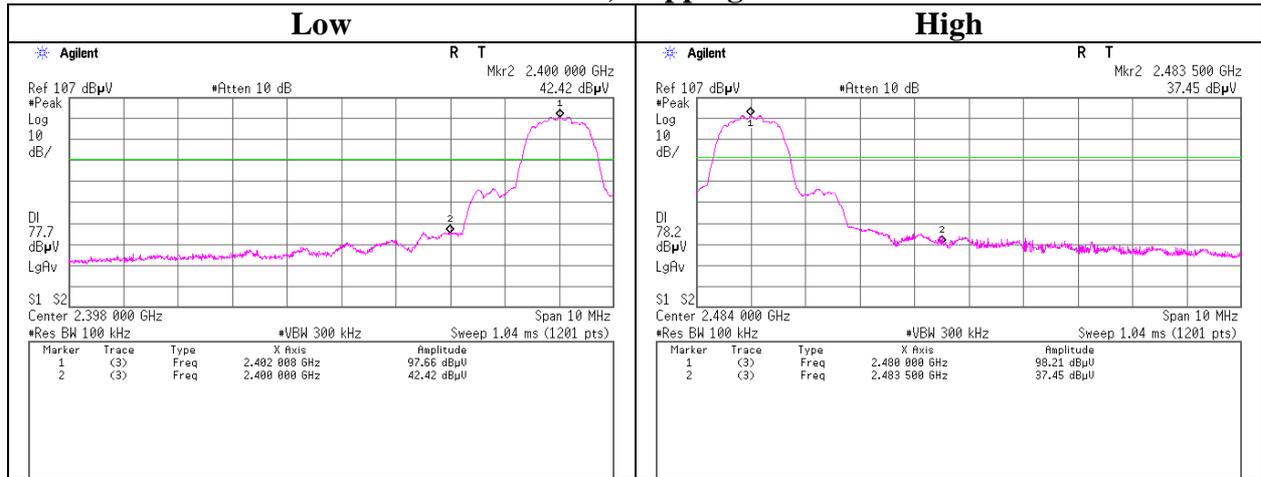
#### Tx DH5, Hopping on



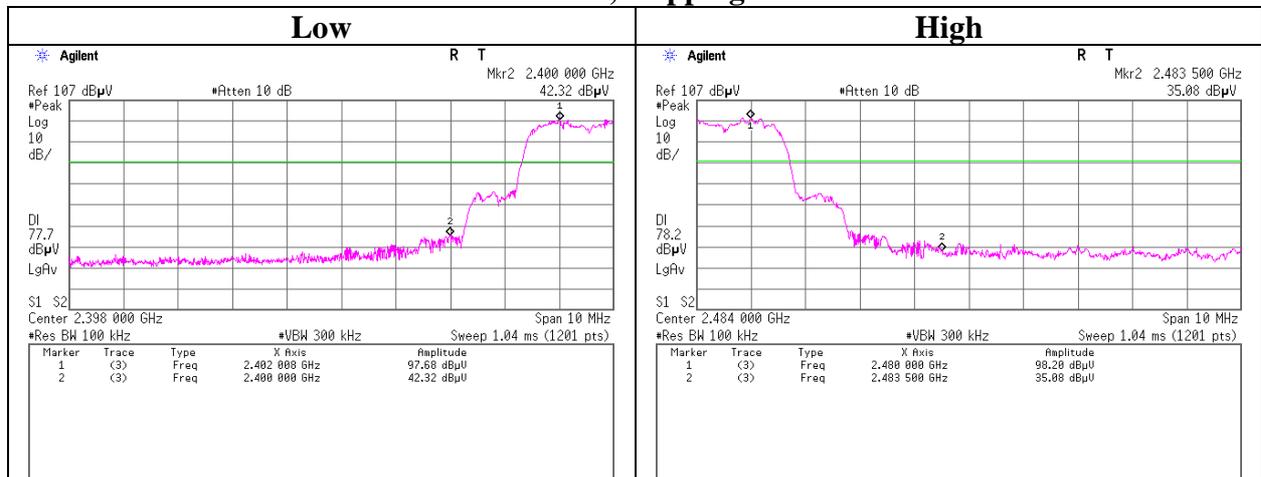
### Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping on/off) 3DH5

#### Tx 3DH5, Hopping off



#### Tx 3DH5, Hopping on



**UL Japan, Inc.**

**Ise EMC Lab.**

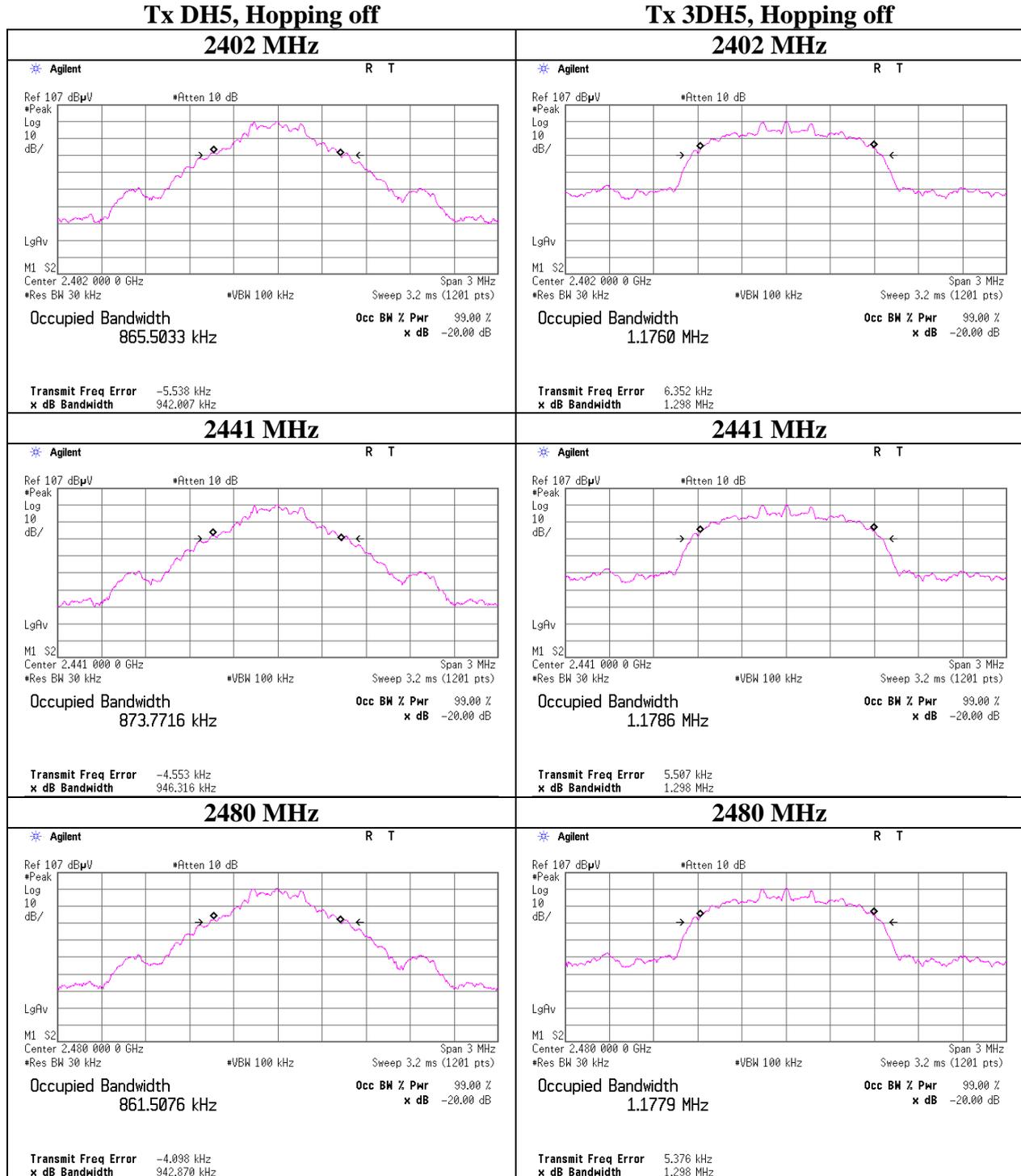
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

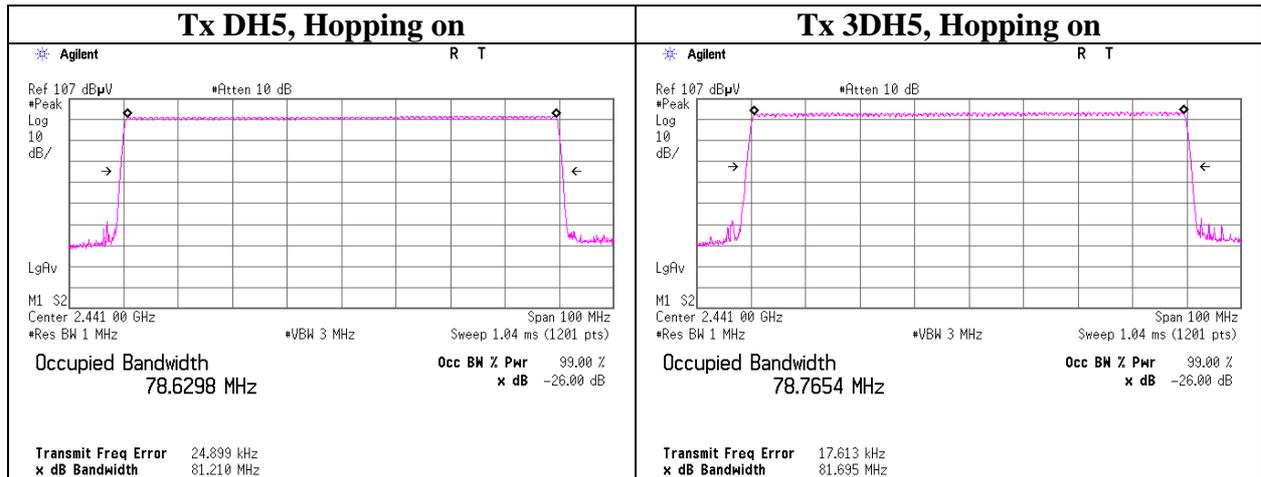
### 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping off) DH5/3DH5



## 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11155190H
Date	February 9, 2016
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Takumi Shimada
Mode	Tx (Hopping on) DH5/3DH5



## APPENDIX 2: Test instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2015/05/18 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2015/05/18 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2015/05/21 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2015/03/19 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2015/05/19 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2016/01/13 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2015/07/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE/CE	2015/06/02 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE/CE	2015/10/11 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2015/10/11 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2015/10/11 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2015/09/04 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2015/08/19 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE	2015/11/06 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(EUT)	2015/07/10 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2016/02/08 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MOTS-MATM	Antenna Terminal Measurement Software	UL Japan	-	-	AT	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2015/02/26 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2015/06/09 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2015/06/09 * 12
MAT-88	Attenuator	Weinschel Associates	WA56-10	56100304	AT	2015/06/01 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MMM-17	DIGITAL HiTESTER	Hioki	3805	070900530	AT	2016/01/13 * 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: CE: Conducted Emission test

RE: Radiated Emission test

AT: Antenna Terminal Conducted test

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124