



# RADIO TEST REPORT

Test Report No. : 10416942H-A-R1

**Applicant** : Sony Corporation  
**Type of Equipment** : Smart Tennis Sensor  
**Model No.** : SSE-TN1W  
**FCC ID** : AK8SSETN1  
**Test regulation** : FCC Part 15 Subpart C: 2014  
**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. 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 report is a revised version of 10416942H-A. 10416942H-A is replaced with this report.

**Date of test:** August 5, 2014

**Representative test engineer:**

*S. Matsuyama*

Satofumi Matsuyama  
Engineer  
Consumer Technology Division

**Approved by:**

*T. Hatakeda*

Takahiro Hatakeda  
Leader  
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://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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

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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name : Sony Corporation  
Address : 1-7-1 Konan, Minato-ku, Tokyo, 108-0075 Japan  
Telephone Number : +81-3-6748-2569  
Facsimile Number : +81-3-6748-2574  
Contact Person : Hideo Nomura

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

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

Type of Equipment : Smart Tennis Sensor  
Model No. : SSE-TN1W  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 5.0V  
Receipt Date of Sample : Augsut 5, 2014  
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**

SSE-TN1W is a Motion and Shock sensor for Tennis racket.  
It have two modes, offline (standalone) and online (it is connected to a smart phone through Bluetooth).

### **General Specification**

Clock frequency(ies) in the system : Crystal: 26MHz

### **Radio Specification**

#### **[Bluetooth (Ver. 3.0 with EDR function)]**

Radio Type : Transmitter  
Frequency of Operation : 2402-2480MHz  
Modulation : FHSS  
Power Supply (radio part input) : DC 3.0V  
Antenna type : Dipole antenna formed on the film  
Antenna Gain : 1.15dBi

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C: 2014, final revised on May 1, 2014 and effective June 2, 2014

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

### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst Margin	Results	Remarks	
Conducted Emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements IC: RSS-Gen 7.2.4	FCC: Section 15.207 ----- IC: RSS-Gen 7.2.4	QP 28.2dB, 0.20141MHz, L AV 30.9dB, 0.62022MHz, L	Complied	-	
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-210 A8.1 (b)	See data.	Complied	Conducted	
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-210 A8.1 (a)		Complied	Conducted	
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-210 A8.1 (d)		Complied	Conducted	
Dwell time	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-210 A8.1 (d)		Complied	Conducted	
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 4.8	FCC: Section15.247(a)(b)(1) ----- IC: RSS-210 A8.4 (2)		Complied	Conducted	
Spurious Emission & Band Edge Compliance	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 4.9	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 6 and 7.2.3		4.3dB 4960.000MHz, AV, Horizontal	Complied	Conducted/ Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

\* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

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**FCC Part 15.31 (e)**

This EUT provides stable voltage (DC 3.0V) 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.

**3.3 Addition to standard**

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	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.

Test room (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.5dB
No.3	3.6dB
No.4	3.5dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

\*3m/1m/0.5m = Measurement distance

Power meter (+dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

**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 report meets the limits unless the uncertainty is taken into consideration.

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### 3.5 Test Location

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	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.

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

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

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9  
\*EUT does not have inquiry mode.

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, 20dB Bandwidth	Tx (Hopping on) 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, Average Output Power (Reference)	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 off	2402MHz 2441MHz 2480MHz
	Tx DH5, 3DH5 -Hopping on	2441MH
Burst Rate Confirmation	Tx (Hopping off) DH5, 3DH5	-
<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</p> <p>*EUT has the power settings by the software as follows;  Power settings: BDR: Ext.=7, Int.=37  EDR: Ext.=72, Int.=43  Software: CSR BlueTest3 V2.2.0.0</p> <p>*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>		

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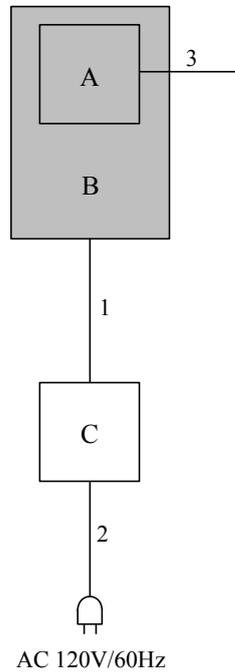
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## 4.2 Configuration and peripherals



\* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

### Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Smart Tennis Sensor	SSE-TN1	2000136 for CE and RE* 9992003 for AT*	Sony Corporation	EUT *1)
B	Cradle	CRDL-1	-	Sony Corporation	EUT *1)
C	AC Adapter	AC-UD10	14026000830	Sony Corporation	-

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	0.6	Shielded	Shielded	-
2	AC Cable	0.9	Unshielded	Unshielded	-
3	Signal Cable	0.03	Unshielded	Unshielded	*2)

\*1) This product is composed of these items, and its system number is SSE-TN1W.

\*2) The cable was used as test jig and will not be included in the package of production model.  
There was no influence on Spurious emission test.

CE: Conducted emission test, RE: Radiated emission test, AT: Antenna terminal conducted test

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## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

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

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

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

### **Test Procedure**

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.

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

The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

### **Test Antennas are used as below;**

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

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

### **20dBc was applied to the frequency over the limit of FCC 15.209 / Table 5 of RSS-Gen 7.2.5 (IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).**

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

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

\*2) Distance Factor:  $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT and EUT with cradle 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

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

### **Test Procedure**

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3MHz	30kHz	100kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3MHz	30kHz	100kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30MHz	300kHz	1MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100kHz, 1MHz	300kHz, 3MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				
	30MHz to 25GHz (Less or equal to 5GHz)	100kHz	300kHz				
Conducted Spurious Emission Band Edge compliance	10MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) The measurement was performed with Max Hold since the duty cycle was not 100%. *2) Reference data *3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)							

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**

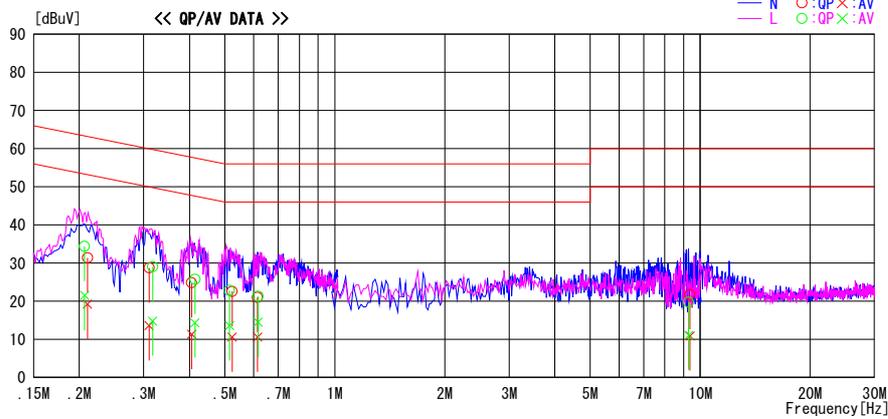
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Ise EMC Lab. No. 2 Semi Anechoic Chamber  
Date : 2014/08/05

Report No. : 10416942H  
 Temp./Humi. : 23deg. C / 59% RH  
 Engineer : Satofumi Matsuyama

Mode / Remarks : Tx DH5 2402MHz

LIMIT : FCC15.207 QP  
 FCC15.207 AV

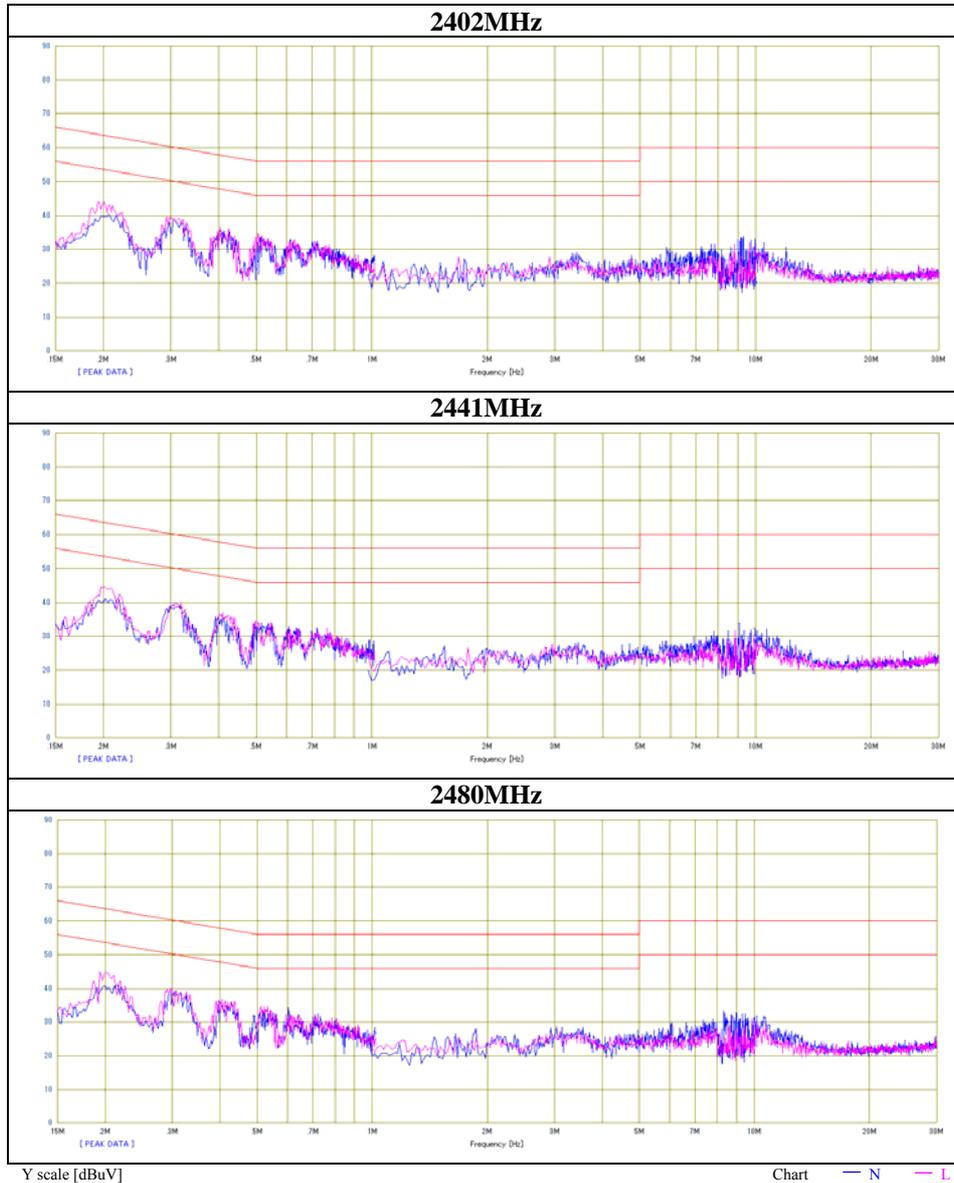


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.21061	18.2	6.0	13.2	31.4	19.2	63.2	53.2	31.8	34.0	N	
0.31040	15.5	0.4	13.2	28.7	13.6	60.0	50.0	31.3	36.4	N	
0.40585	11.6	-1.9	13.2	24.8	11.3	57.7	47.7	32.9	36.4	N	
0.52382	9.4	-2.6	13.2	22.6	10.6	56.0	46.0	33.4	35.4	N	
0.61484	7.7	-2.7	13.3	21.0	10.6	56.0	46.0	35.0	35.4	N	
9.38243	7.5	-3.3	14.2	21.7	10.9	60.0	50.0	38.3	39.1	N	
0.20662	21.2	8.3	13.2	34.4	21.5	63.3	53.3	28.9	31.8	L	
0.31744	15.8	1.6	13.2	29.0	14.8	59.8	49.8	30.8	35.0	L	
0.41446	12.5	1.1	13.2	25.7	14.3	57.6	47.6	31.9	33.3	L	
0.51528	9.6	0.4	13.2	22.8	13.6	56.0	46.0	33.2	32.4	L	
0.61686	8.0	1.2	13.3	21.3	14.5	56.0	46.0	34.7	31.5	L	
9.29880	5.5	-3.1	14.2	19.7	11.1	60.0	50.0	40.3	38.9	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT[dBuV]=READING[dBuV]+C. F [dB] (LISN+CABLE+ATTEN.)  
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. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 23 deg. C / 59% RH  
Engineer : Satofumi Matsuyama  
Mode : Tx DH5



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## Conducted Emission

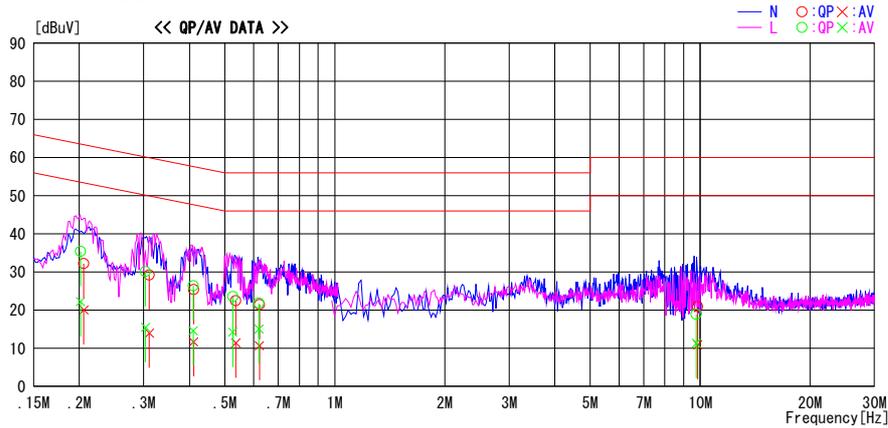
### DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber  
Date : 2014/08/05

Report No. : 10416942H  
 Temp./Humi. : 23deg. C / 59% RH  
 Engineer : Satofumi Matsuyama

Mode / Remarks : Tx 3DH5 2402MHz

LIMIT : FCC15.207 QP  
FCC15.207 AV

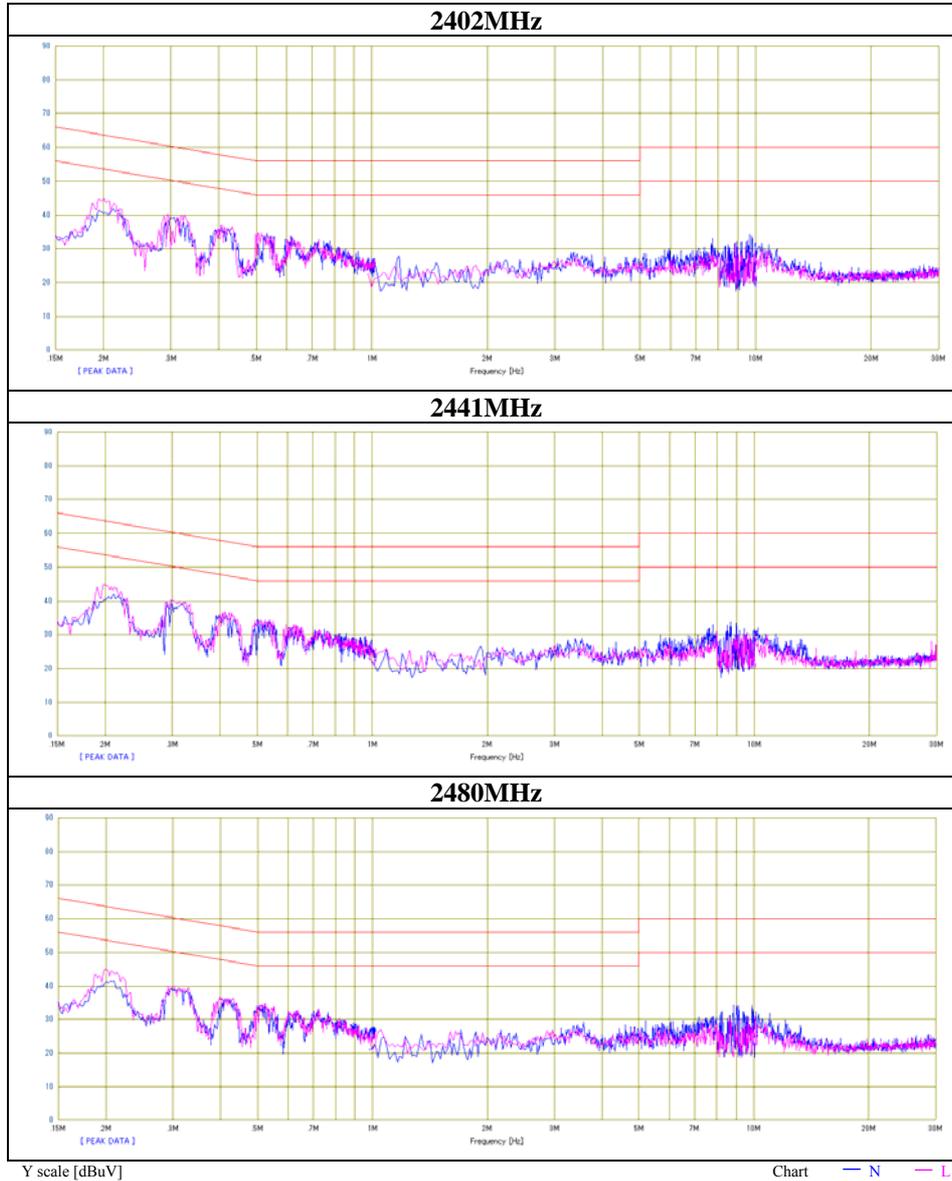


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.20572	19.0	6.9	13.2	32.2	20.1	63.4	53.4	31.2	33.3	N	
0.31084	16.0	0.8	13.2	29.2	14.0	59.9	49.9	30.7	35.9	N	
0.41106	12.2	-1.5	13.2	25.4	11.7	57.6	47.6	32.2	35.9	N	
0.53624	9.3	-1.8	13.2	22.5	11.4	56.0	46.0	33.5	34.6	N	
0.62182	8.2	-2.6	13.3	21.5	10.7	56.0	46.0	34.5	35.3	N	
9.84197	6.7	-3.2	14.2	20.9	11.0	60.0	50.0	39.1	39.0	N	
0.20141	22.2	9.0	13.2	35.4	22.2	63.6	53.6	28.2	31.4	L	
0.30321	16.9	2.3	13.2	30.1	15.5	60.2	50.2	30.1	34.7	L	
0.40986	13.2	1.4	13.2	26.4	14.6	57.7	47.7	31.3	33.1	L	
0.52583	10.4	1.0	13.2	23.6	14.2	56.0	46.0	32.4	31.8	L	
0.62022	8.5	1.8	13.3	21.8	15.1	56.0	46.0	34.2	30.9	L	
9.75897	4.7	-2.9	14.2	18.9	11.3	60.0	50.0	41.1	38.7	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT[dBuV]=READING[dBuV]+C. F [dB] (LISN+CABLE+ATTEN.)  
 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. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 23 deg. C / 59% RH  
Engineer : Satofumi Matsuyama  
Mode : Tx 3DH5



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

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## 20dB Bandwidth and Carrier Frequency Separation

Test place Ise EMC Lab. No.2 Measurement Room  
Report No. 10416942H  
Date 08/05/2014  
Temperature/ Humidity 23 deg. C / 59% RH  
Engineer Satofumi Matsuyama  
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	0.943	1.000	$\geq 0.629$
DH5	2441.0	0.937	1.000	$\geq 0.625$
DH5	2480.0	0.936	1.000	$\geq 0.624$
3DH5	2402.0	1.284	1.000	$\geq 0.856$
3DH5	2441.0	1.253	1.000	$\geq 0.835$
3DH5	2480.0	1.301	1.000	$\geq 0.867$

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

No limit applies to 20dB Bandwidth.

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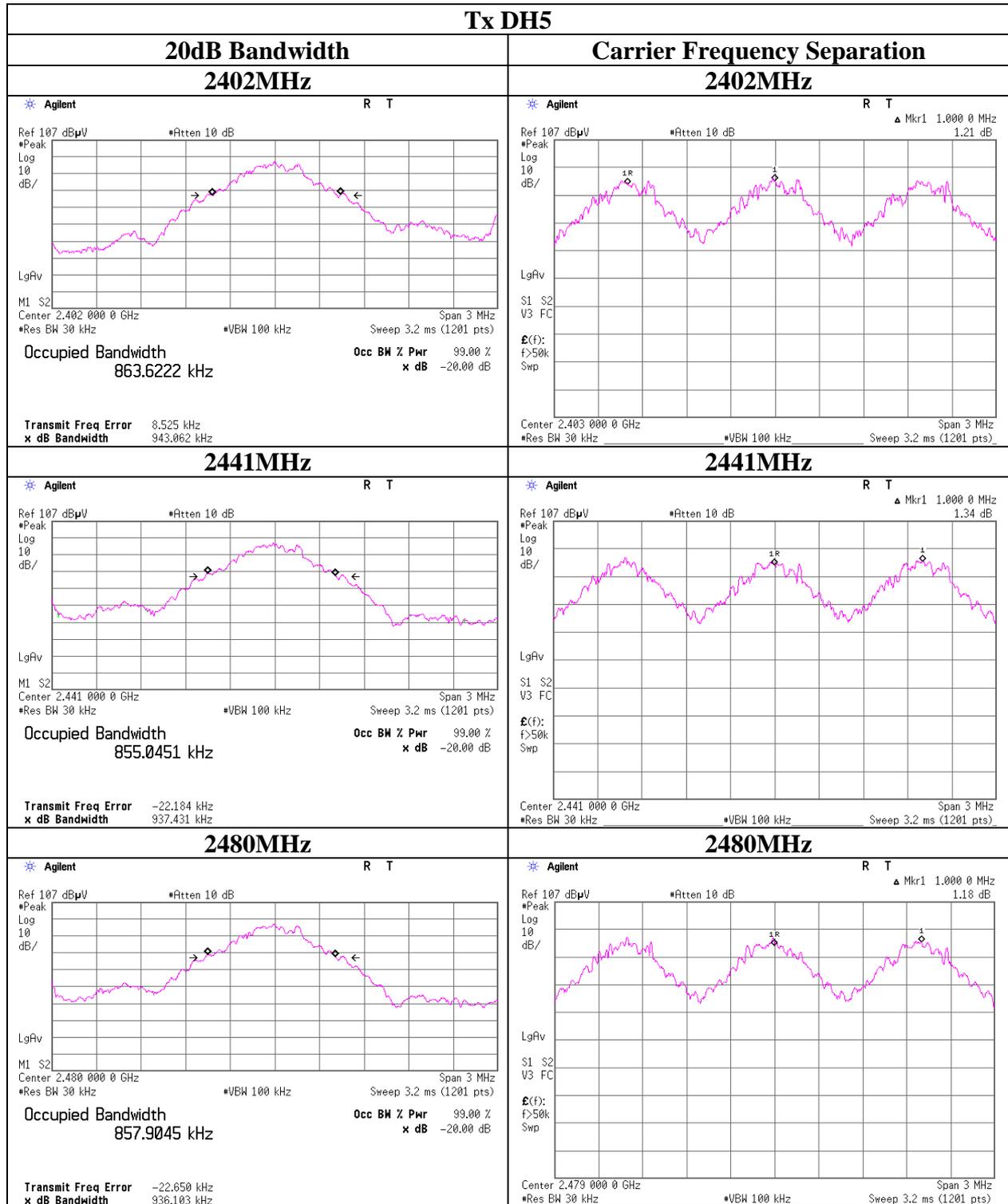
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## 20dB Bandwidth and Carrier Frequency Separation



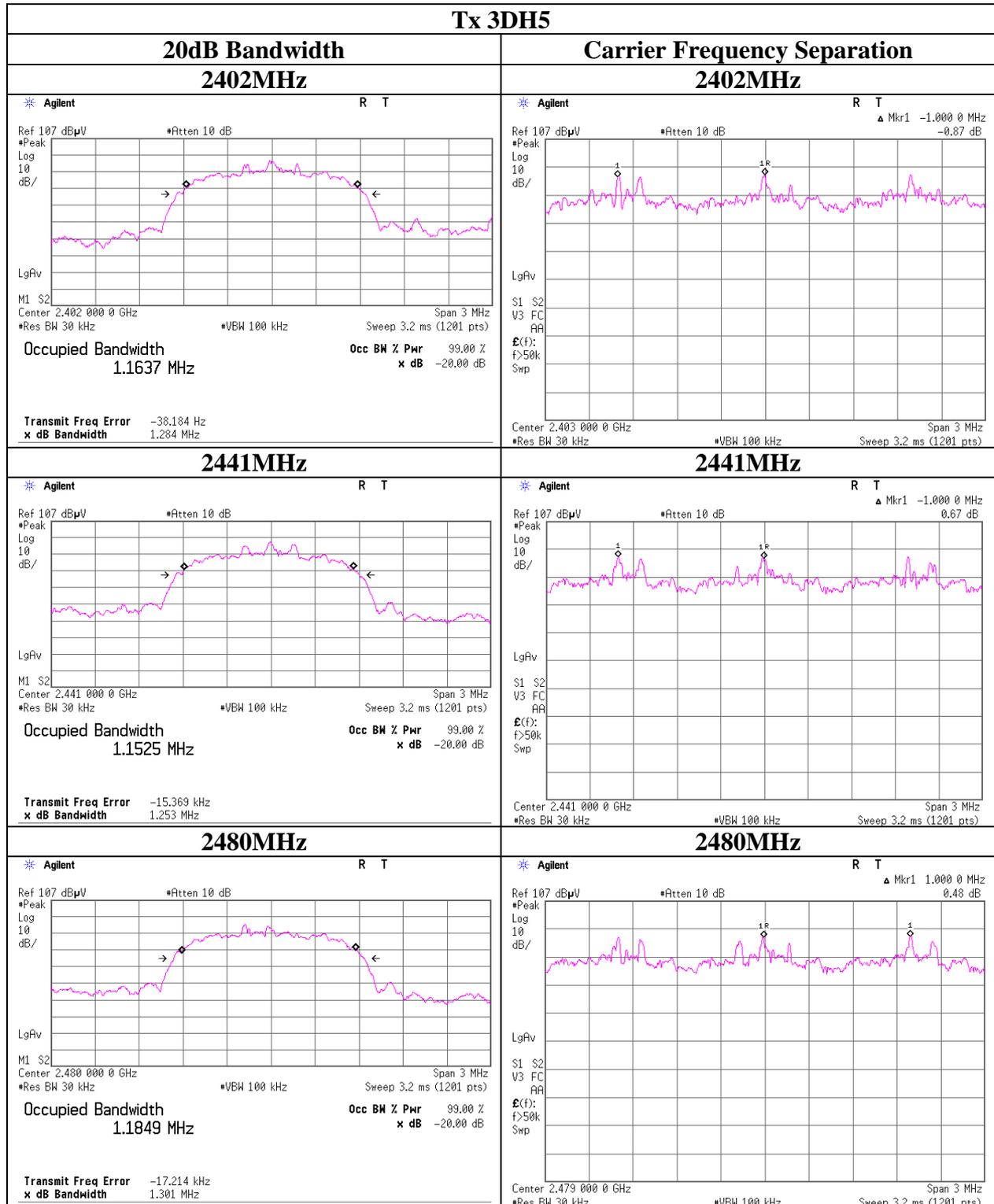
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## 20dB Bandwidth and Carrier Frequency Separation



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### Number of Hopping Frequency

Test place Ise EMC Lab. No.2 Measurement Room  
Report No. 10416942H  
Date 08/05/2014  
Temperature/ Humidity 23 deg. C / 59% RH  
Engineer Satofumi Matsuyama  
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.

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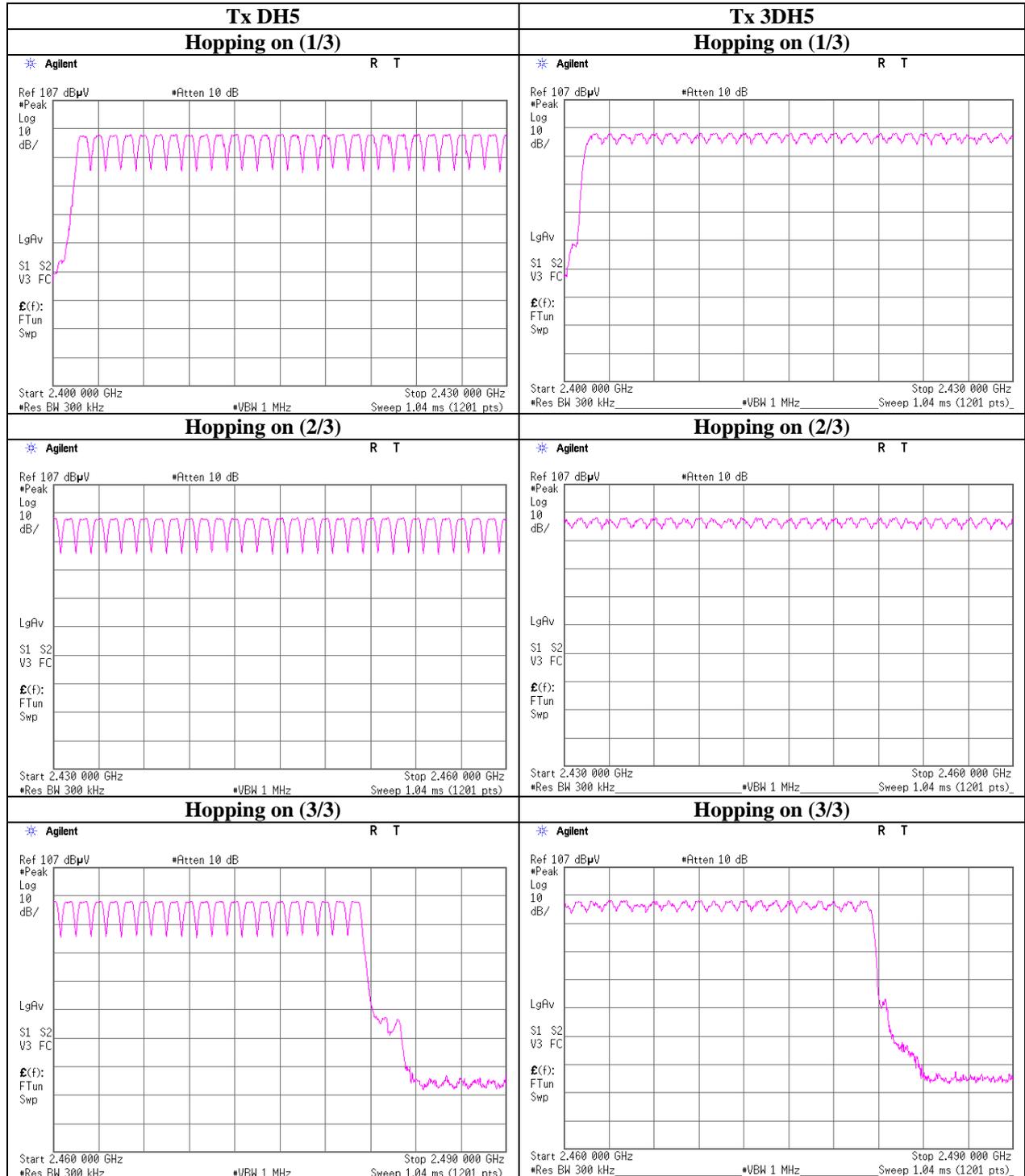
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## Number of Hopping Frequency



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### Dwell time

Test place : Ise EMC Lab. No.2 Measurement Room  
Report No. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 23 deg. C / 59% RH  
Engineer : Satofumi Matsuyama  
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	51.0 times / 5 sec. x	31.6 sec. =	323 times	0.416	134	400
DH3	26.0 times / 5 sec. x	31.6 sec. =	165 times	1.670	276	400
DH5	17.0 times / 5 sec. x	31.6 sec. =	108 times	2.923	316	400
3DH1	51.0 times / 5 sec. x	31.6 sec. =	323 times	0.434	140	400
3DH3	26.0 times / 5 sec. x	31.6 sec. =	165 times	1.687	278	400
3DH5	17.0 times / 5 sec. x	31.6 sec. =	108 times	2.936	317	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	51	51	51	51	51	51
DH3	26	26	26	26	26	26
DH5	17	17	17	17	17	17
3DH1	51	51	51	51	51	51
3DH3	26	26	26	26	26	26
3DH5	17	17	17	17	17	17

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  $N=79$ .

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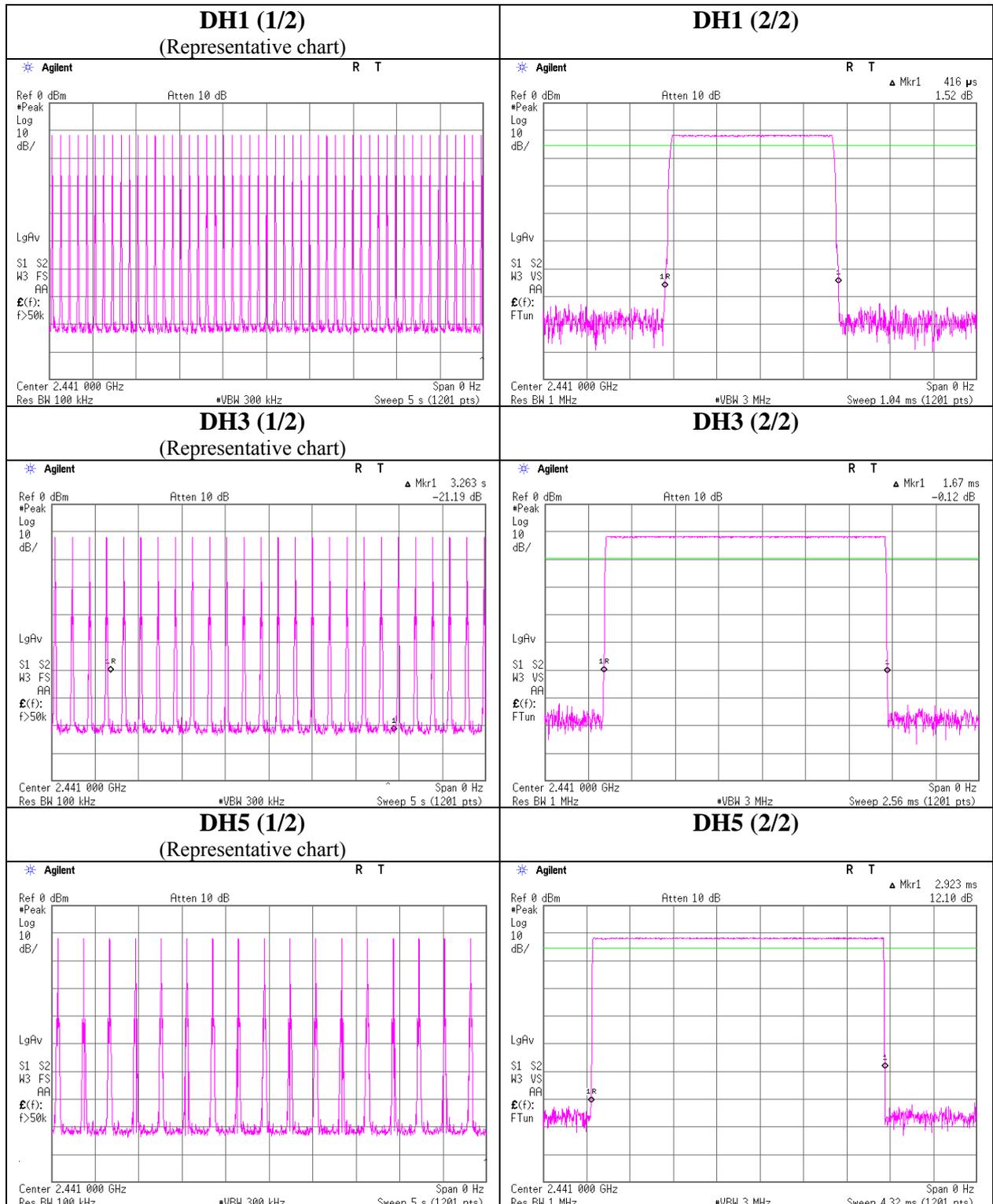
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**Dwell time**



**UL Japan, Inc.**

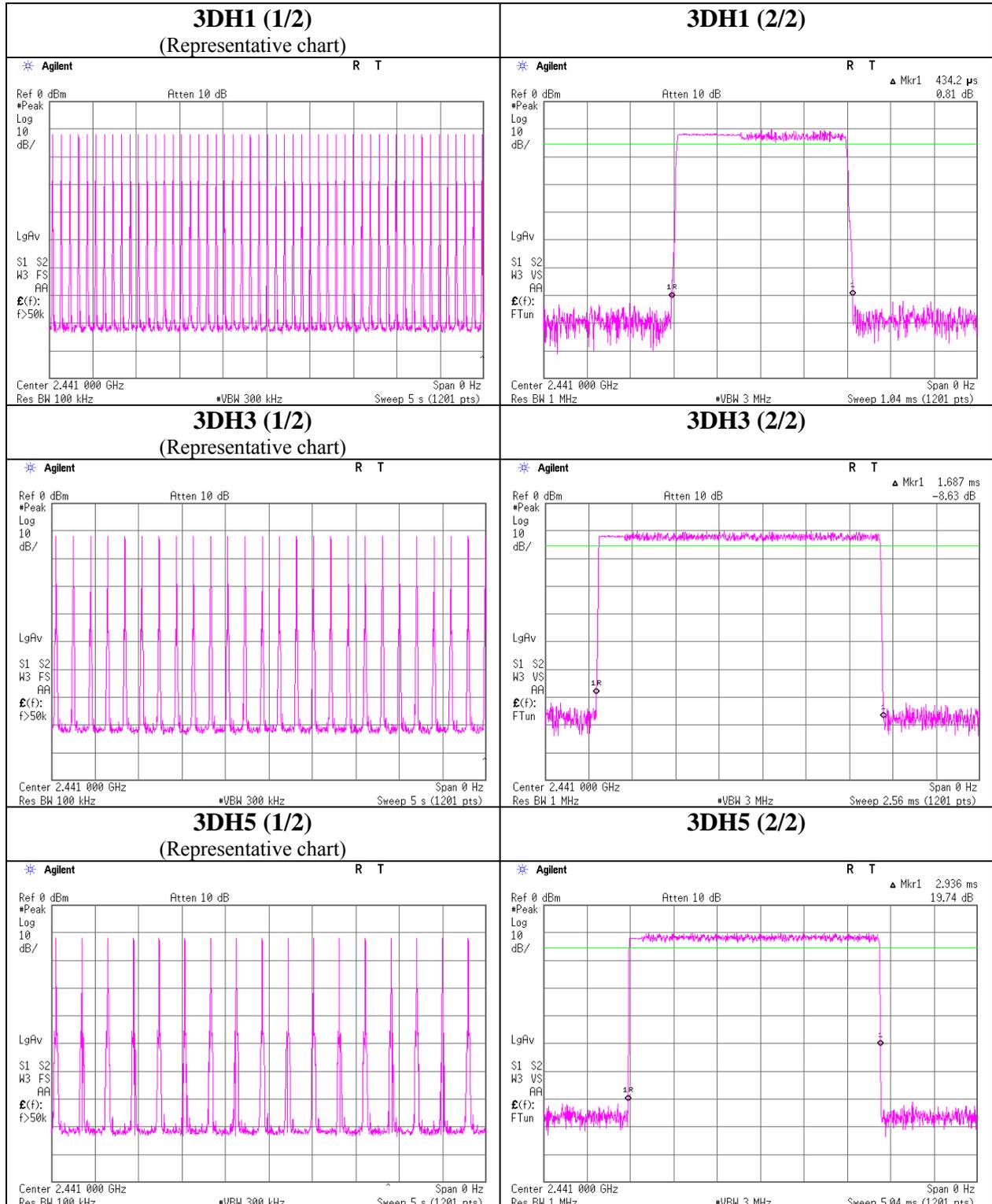
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**Dwell time**



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**Ise EMC Lab.**

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### Maximum Peak Output Power

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
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	-11.22	1.65	10.00	0.43	1.10	20.96	125	20.53
DH5	2441.0	-11.19	1.66	10.00	0.47	1.11	20.96	125	20.49
DH5	2480.0	-10.96	1.68	10.00	0.72	1.18	20.96	125	20.24
2DH5	2402.0	-10.08	1.65	10.00	1.57	1.44	20.96	125	19.39
2DH5	2441.0	-10.01	1.66	10.00	1.65	1.46	20.96	125	19.31
2DH5	2480.0	-9.95	1.68	10.00	1.73	1.49	20.96	125	19.23
3DH5	2402.0	-9.64	1.65	10.00	2.01	1.59	20.96	125	18.95
3DH5	2441.0	-9.56	1.66	10.00	2.10	1.62	20.96	125	18.86
3DH5	2480.0	-9.58	1.68	10.00	2.10	1.62	20.96	125	18.86

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.**

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

Test place Ise EMC Lab. No.2 Measurement Room  
Report No. 10416942H  
Date 08/05/2014  
Temperature/ Humidity 23 deg. C / 59% RH  
Engineer Satofumi Matsuyama  
Mode Tx (Hopping off) DH5/2DH5/3DH5

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
DH5	2402.0	-13.11	1.65	10.00	-1.46	0.71
DH5	2441.0	-12.85	1.66	10.00	-1.19	0.76
DH5	2480.0	-12.85	1.68	10.00	-1.17	0.76
2DH5	2402.0	-14.40	1.65	10.00	-2.75	0.53
2DH5	2441.0	-14.38	1.66	10.00	-2.72	0.53
2DH5	2480.0	-14.34	1.68	10.00	-2.66	0.54
3DH5	2402.0	-14.34	1.65	10.00	-2.69	0.54
3DH5	2441.0	-14.35	1.66	10.00	-2.69	0.54
3DH5	2480.0	-14.29	1.68	10.00	-2.61	0.55

Sample Calculation:  
Result = Reading + Cable Loss + Attenuator

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 20 deg. C / 61% RH  
Engineer : Takumi Shimada

Mode : Tx, DH5 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	52.000	QP	23.0	10.2	7.0	28.5	11.7	40.0	28.3	
Hori	78.000	QP	23.1	6.4	7.2	28.6	8.1	40.0	31.9	
Hori	130.000	QP	22.5	13.7	7.7	28.3	15.6	43.5	27.9	
Hori	260.000	QP	21.6	17.6	8.5	27.7	20.0	46.0	26.0	
Hori	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Hori	520.000	QP	22.8	18.4	9.6	28.8	22.0	46.0	24.0	
Hori	2390.000	PK	44.4	27.0	3.0	34.7	39.7	73.9	34.2	
Hori	4804.000	PK	51.2	31.8	5.3	33.9	54.4	73.9	19.5	
Hori	7206.000	PK	43.0	35.7	6.6	33.8	51.5	73.9	22.4	
Hori	9608.000	PK	43.7	38.0	7.0	34.4	54.3	73.9	19.6	
Hori	2390.000	AV	31.9	27.0	3.0	34.7	27.2	53.9	26.7	
Hori	4804.000	AV	45.3	31.8	5.3	33.9	48.5	53.9	5.4	
Hori	7206.000	AV	31.5	35.7	6.6	33.8	40.0	53.9	13.9	
Hori	9608.000	AV	31.1	38.0	7.0	34.4	41.7	53.9	12.2	
Vert	52.000	QP	25.3	10.2	7.0	28.5	14.0	40.0	26.0	
Vert	78.000	QP	30.5	6.4	7.2	28.6	15.5	40.0	24.5	
Vert	130.000	QP	22.5	13.7	7.7	28.3	15.6	43.5	27.9	
Vert	260.000	QP	21.6	17.6	8.5	27.7	20.0	46.0	26.0	
Vert	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Vert	520.000	QP	22.9	18.4	9.6	28.8	22.1	46.0	23.9	
Vert	2390.000	PK	44.8	27.0	3.0	34.7	40.1	73.9	33.8	
Vert	4804.000	PK	50.0	31.8	5.3	33.9	53.2	73.9	20.7	
Vert	7206.000	PK	43.4	35.7	6.6	33.8	51.9	73.9	22.0	
Vert	9608.000	PK	43.5	38.0	7.0	34.4	54.1	73.9	19.8	
Vert	2390.000	AV	32.1	27.0	3.0	34.7	27.4	53.9	26.5	
Vert	4804.000	AV	43.5	31.8	5.3	33.9	46.7	53.9	7.3	
Vert	7206.000	AV	31.4	35.7	6.6	33.8	39.9	53.9	14.0	
Vert	9608.000	AV	31.5	38.0	7.0	34.4	42.1	53.9	11.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

### 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	90.8	27.0	3.0	34.7	86.1	-	-	Carrier
Hori	2400.000	PK	39.2	27.0	3.0	34.7	34.5	66.1	31.6	
Vert	2402.000	PK	96.0	27.0	3.0	34.7	91.3	-	-	Carrier
Vert	2400.000	PK	46.2	27.0	3.0	34.7	41.5	71.3	29.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 20 deg. C / 61% RH  
Engineer : Takumi Shimada  
Mode : Tx, DH5 2441MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	52.000	QP	23.0	10.2	7.0	28.5	11.7	40.0	28.3	
Hori	78.000	QP	23.2	6.4	7.2	28.6	8.2	40.0	31.8	
Hori	130.000	QP	22.5	13.7	7.7	28.3	15.6	43.5	27.9	
Hori	260.000	QP	21.7	17.6	8.5	27.7	20.1	46.0	25.9	
Hori	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Hori	520.000	QP	22.8	18.4	9.6	28.8	22.0	46.0	24.0	
Hori	4882.000	PK	51.7	32.0	5.3	33.9	55.1	73.9	18.8	
Hori	7323.000	PK	43.5	35.8	6.7	33.8	52.2	73.9	21.7	
Hori	9764.000	PK	43.5	38.3	7.1	34.5	54.4	73.9	19.5	
Hori	4882.000	AV	45.8	32.0	5.3	33.9	49.2	53.9	4.7	
Hori	7323.000	AV	31.5	35.8	6.7	33.8	40.2	53.9	13.7	
Hori	9764.000	AV	30.9	38.3	7.1	34.5	41.8	53.9	12.1	
Vert	52.000	QP	25.2	10.2	7.0	28.5	13.9	40.0	26.1	
Vert	78.000	QP	31.3	6.4	7.2	28.6	16.3	40.0	23.7	
Vert	130.000	QP	22.6	13.7	7.7	28.3	15.7	43.5	27.8	
Vert	260.000	QP	21.6	17.6	8.5	27.7	20.0	46.0	26.0	
Vert	338.000	QP	21.6	15.4	8.9	27.9	18.0	46.0	28.0	
Vert	520.000	QP	22.8	18.4	9.6	28.8	22.0	46.0	24.0	
Vert	4882.000	PK	50.3	32.0	5.3	33.9	53.7	73.9	20.2	
Vert	7323.000	PK	43.3	35.8	6.7	33.8	52.0	73.9	21.9	
Vert	9764.000	PK	42.8	38.3	7.1	34.5	53.7	73.9	20.2	
Vert	4882.000	AV	43.4	32.0	5.3	33.9	46.8	53.9	7.1	
Vert	7323.000	AV	31.2	35.8	6.7	33.8	39.9	53.9	14.0	
Vert	9764.000	AV	30.6	38.3	7.1	34.5	41.5	53.9	12.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

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## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 20 deg. C / 61% RH  
Engineer : Takumi Shimada  
  
Mode : Tx, DH5 2480MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	52.000	QP	23.0	10.2	7.0	28.5	11.7	40.0	28.3	
Hori	78.000	QP	23.1	6.4	7.2	28.6	8.1	40.0	31.9	
Hori	130.000	QP	22.6	13.7	7.7	28.3	15.7	43.5	27.8	
Hori	260.000	QP	21.7	17.6	8.5	27.7	20.1	46.0	25.9	
Hori	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Hori	520.000	QP	22.7	18.4	9.6	28.8	21.9	46.0	24.1	
Hori	2483.500	PK	46.6	26.9	3.1	34.7	41.9	73.9	32.0	
Hori	4960.000	PK	51.9	32.2	5.3	34.0	55.4	73.9	18.6	
Hori	7440.000	PK	44.3	35.8	6.6	33.9	52.8	73.9	21.1	
Hori	9920.000	PK	43.4	38.7	7.1	34.5	54.7	73.9	19.3	
Hori	2483.500	AV	32.9	26.9	3.1	34.7	28.2	53.9	25.7	
Hori	4960.000	AV	46.1	32.2	5.3	34.0	49.6	53.9	4.3	
Hori	7440.000	AV	31.6	35.8	6.6	33.9	40.1	53.9	13.8	
Hori	9920.000	AV	31.1	38.7	7.1	34.5	42.4	53.9	11.5	
Vert	52.000	QP	25.0	10.2	7.0	28.5	13.7	40.0	26.3	
Vert	78.000	QP	31.1	6.4	7.2	28.6	16.1	40.0	23.9	
Vert	130.000	QP	22.6	13.7	7.7	28.3	15.7	43.5	27.8	
Vert	260.000	QP	21.7	17.6	8.5	27.7	20.1	46.0	25.9	
Vert	338.000	QP	21.6	15.4	8.9	27.9	18.0	46.0	28.0	
Vert	520.000	QP	22.8	18.4	9.6	28.8	22.0	46.0	24.0	
Vert	2483.500	PK	46.8	26.9	3.1	34.7	42.1	73.9	31.9	
Vert	4960.000	PK	51.0	32.2	5.3	34.0	54.5	73.9	19.4	
Vert	7440.000	PK	43.5	35.8	6.6	33.9	52.0	73.9	21.9	
Vert	9920.000	PK	43.1	38.7	7.1	34.5	54.4	73.9	19.5	
Vert	2483.500	AV	34.3	26.9	3.1	34.7	29.6	53.9	24.3	
Vert	4960.000	AV	45.2	32.2	5.3	34.0	48.7	53.9	5.2	
Vert	7440.000	AV	31.5	35.8	6.6	33.9	40.0	53.9	13.9	
Vert	9920.000	AV	31.1	38.7	7.1	34.5	42.4	53.9	11.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

**UL Japan, Inc.**

**Ise EMC Lab.**

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 20 deg. C / 61% RH  
Engineer : Takumi Shimada

Mode : Tx, 3DH5 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	52.000	QP	23.1	10.2	7.0	28.5	11.8	40.0	28.2	
Hori	78.000	QP	23.1	6.4	7.2	28.6	8.1	40.0	31.9	
Hori	130.000	QP	22.6	13.7	7.7	28.3	15.7	43.5	27.8	
Hori	260.000	QP	21.7	17.6	8.5	27.7	20.1	46.0	25.9	
Hori	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Hori	520.000	QP	22.7	18.4	9.6	28.8	21.9	46.0	24.1	
Hori	2390.000	PK	44.0	27.0	3.0	34.7	39.3	73.9	34.6	
Hori	4804.000	PK	50.0	31.8	5.3	33.9	53.2	73.9	20.7	
Hori	7206.000	PK	43.1	35.7	6.6	33.8	51.6	73.9	22.3	
Hori	9608.000	PK	43.3	38.0	7.0	34.4	53.9	73.9	20.0	
Hori	2390.000	AV	31.8	27.0	3.0	34.7	27.1	53.9	26.8	
Hori	4804.000	AV	40.8	31.8	5.3	33.9	44.0	53.9	9.9	
Hori	7206.000	AV	31.3	35.7	6.6	33.8	39.8	53.9	14.1	
Hori	9608.000	AV	31.0	38.0	7.0	34.4	41.6	53.9	12.3	
Vert	52.000	QP	25.0	10.2	7.0	28.5	13.7	40.0	26.3	
Vert	78.000	QP	31.1	6.4	7.2	28.6	16.1	40.0	23.9	
Vert	130.000	QP	22.6	13.7	7.7	28.3	15.7	43.5	27.8	
Vert	260.000	QP	21.6	17.6	8.5	27.7	20.0	46.0	26.0	
Vert	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Vert	520.000	QP	22.8	18.4	9.6	28.8	22.0	46.0	24.0	
Vert	2390.000	PK	44.2	27.0	3.0	34.7	39.5	73.9	34.4	
Vert	4804.000	PK	48.4	31.8	5.3	33.9	51.6	73.9	22.3	
Vert	7206.000	PK	43.8	35.7	6.6	33.8	52.3	73.9	21.6	
Vert	9608.000	PK	43.5	38.0	7.0	34.4	54.1	73.9	19.8	
Vert	2390.000	AV	31.9	27.0	3.0	34.7	27.2	53.9	26.7	
Vert	4804.000	AV	39.1	31.8	5.3	33.9	42.3	53.9	11.6	
Vert	7206.000	AV	31.3	35.7	6.6	33.8	39.8	53.9	14.1	
Vert	9608.000	AV	31.0	38.0	7.0	34.4	41.6	53.9	12.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

### 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	91.0	27.0	3.0	34.7	86.3	-	-	Carrier
Hori	2400.000	PK	43.2	27.0	3.0	34.7	38.5	66.3	27.8	
Vert	2402.000	PK	95.5	27.0	3.0	34.7	90.8	-	-	Carrier
Vert	2400.000	PK	47.3	27.0	3.0	34.7	42.6	70.8	28.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 20 deg. C / 61% RH  
Engineer : Takumi Shimada  
  
Mode : Tx, 3DH5 2441MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	52.000	QP	23.2	10.2	7.0	28.5	11.9	40.0	28.1	
Hori	78.000	QP	23.1	6.4	7.2	28.6	8.1	40.0	31.9	
Hori	130.000	QP	22.6	13.7	7.7	28.3	15.7	43.5	27.8	
Hori	260.000	QP	21.7	17.6	8.5	27.7	20.1	46.0	25.9	
Hori	338.000	QP	21.6	15.4	8.9	27.9	18.0	46.0	28.0	
Hori	520.000	QP	22.8	18.4	9.6	28.8	22.0	46.0	24.0	
Hori	4882.000	PK	50.7	32.0	5.3	33.9	54.1	73.9	19.8	
Hori	7323.000	PK	43.0	35.8	6.7	33.8	51.7	73.9	22.2	
Hori	9764.000	PK	43.2	38.3	7.1	34.5	54.1	73.9	19.8	
Hori	4882.000	AV	41.7	32.0	5.3	33.9	45.1	53.9	8.8	
Hori	7323.000	AV	31.4	35.8	6.7	33.8	40.1	53.9	13.8	
Hori	9764.000	AV	30.9	38.3	7.1	34.5	41.8	53.9	12.1	
Vert	52.000	QP	25.1	10.2	7.0	28.5	13.8	40.0	26.2	
Vert	78.000	QP	31.1	6.4	7.2	28.6	16.1	40.0	23.9	
Vert	130.000	QP	22.6	13.7	7.7	28.3	15.7	43.5	27.8	
Vert	260.000	QP	21.6	17.6	8.5	27.7	20.0	46.0	26.0	
Vert	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Vert	520.000	QP	22.9	18.4	9.6	28.8	22.1	46.0	23.9	
Vert	4882.000	PK	50.4	32.0	5.3	33.9	53.8	73.9	20.1	
Vert	7323.000	PK	43.5	35.8	6.7	33.8	52.2	73.9	21.7	
Vert	9764.000	PK	43.5	38.3	7.1	34.5	54.4	73.9	19.5	
Vert	4882.000	AV	40.7	32.0	5.3	33.9	44.1	53.9	9.9	
Vert	7323.000	AV	31.2	35.8	6.7	33.8	39.9	53.9	14.0	
Vert	9764.000	AV	30.8	38.3	7.1	34.5	41.7	53.9	12.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

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**Ise EMC Lab.**

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Facsimile : +81 596 24 8124

## Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10416942H  
Date : 08/05/2014  
Temperature/ Humidity : 20 deg. C / 61% RH  
Engineer : Takumi Shimada  
  
Mode : Tx, 3DH5 2480MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	52.000	QP	23.0	10.2	7.0	28.5	11.7	40.0	28.3	
Hori	78.000	QP	23.0	6.4	7.2	28.6	8.0	40.0	32.0	
Hori	130.000	QP	22.5	13.7	7.7	28.3	15.6	43.5	27.9	
Hori	260.000	QP	21.6	17.6	8.5	27.7	20.0	46.0	26.0	
Hori	338.000	QP	21.6	15.4	8.9	27.9	18.0	46.0	28.0	
Hori	520.000	QP	22.8	18.4	9.6	28.8	22.0	46.0	24.0	
Hori	2483.500	PK	45.0	26.9	3.1	34.7	40.3	73.9	33.6	
Hori	4960.000	PK	51.6	32.2	5.3	34.0	55.1	73.9	18.8	
Hori	7440.000	PK	44.1	35.8	6.6	33.9	52.6	73.9	21.3	
Hori	9920.000	PK	43.2	38.7	7.1	34.5	54.5	73.9	19.4	
Hori	2483.500	AV	32.8	26.9	3.1	34.7	28.1	53.9	25.8	
Hori	4960.000	AV	42.3	32.2	5.3	34.0	45.8	53.9	8.1	
Hori	7440.000	AV	31.8	35.8	6.6	33.9	40.3	53.9	13.6	
Hori	9920.000	AV	31.1	38.7	7.1	34.5	42.4	53.9	11.5	
Vert	52.000	QP	25.1	10.2	7.0	28.5	13.8	40.0	26.2	
Vert	78.000	QP	30.8	6.4	7.2	28.6	15.8	40.0	24.2	
Vert	130.000	QP	22.5	13.7	7.7	28.3	15.6	43.5	27.9	
Vert	260.000	QP	21.6	17.6	8.5	27.7	20.0	46.0	26.0	
Vert	338.000	QP	21.7	15.4	8.9	27.9	18.1	46.0	27.9	
Vert	520.000	QP	22.9	18.4	9.6	28.8	22.1	46.0	23.9	
Vert	2483.500	PK	47.7	26.9	3.1	34.7	43.0	73.9	30.9	
Vert	4960.000	PK	49.9	32.2	5.3	34.0	53.4	73.9	20.5	
Vert	7440.000	PK	43.9	35.8	6.6	33.9	52.4	73.9	21.5	
Vert	9920.000	PK	40.2	38.7	7.1	34.5	51.5	73.9	22.4	
Vert	2483.500	AV	34.2	26.9	3.1	34.7	29.5	53.9	24.4	
Vert	4960.000	AV	42.9	32.2	5.3	34.0	46.4	53.9	7.5	
Vert	7440.000	AV	31.6	35.8	6.6	33.9	40.1	53.9	13.8	
Vert	9920.000	AV	31.1	38.7	7.1	34.5	42.4	53.9	11.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

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**Ise EMC Lab.**

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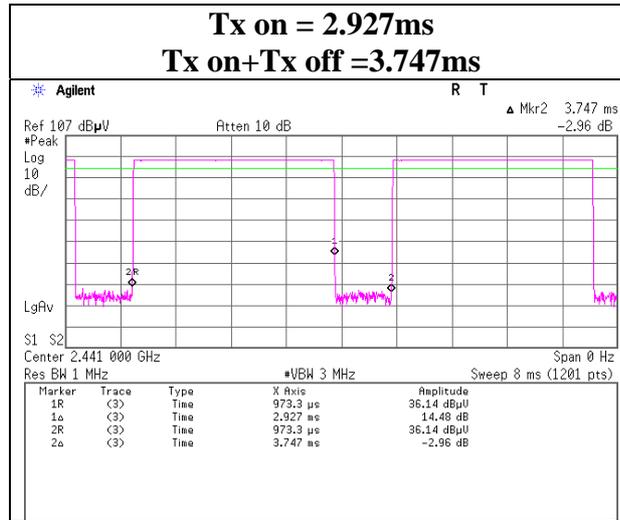
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

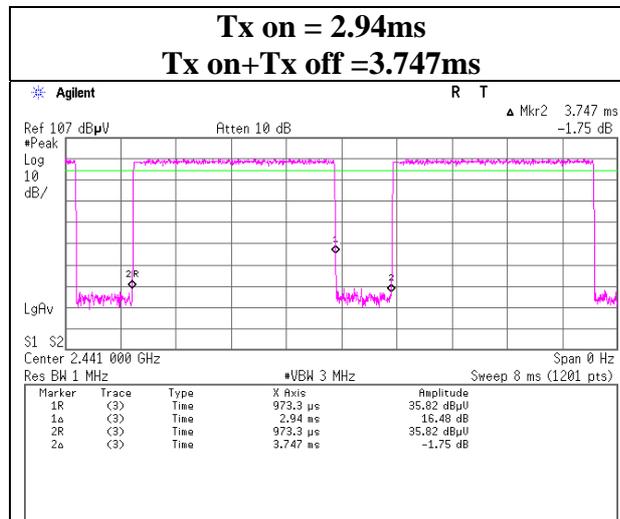
### Burst Rate Confirmation

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5/3DH5

#### DH5



#### 3DH5



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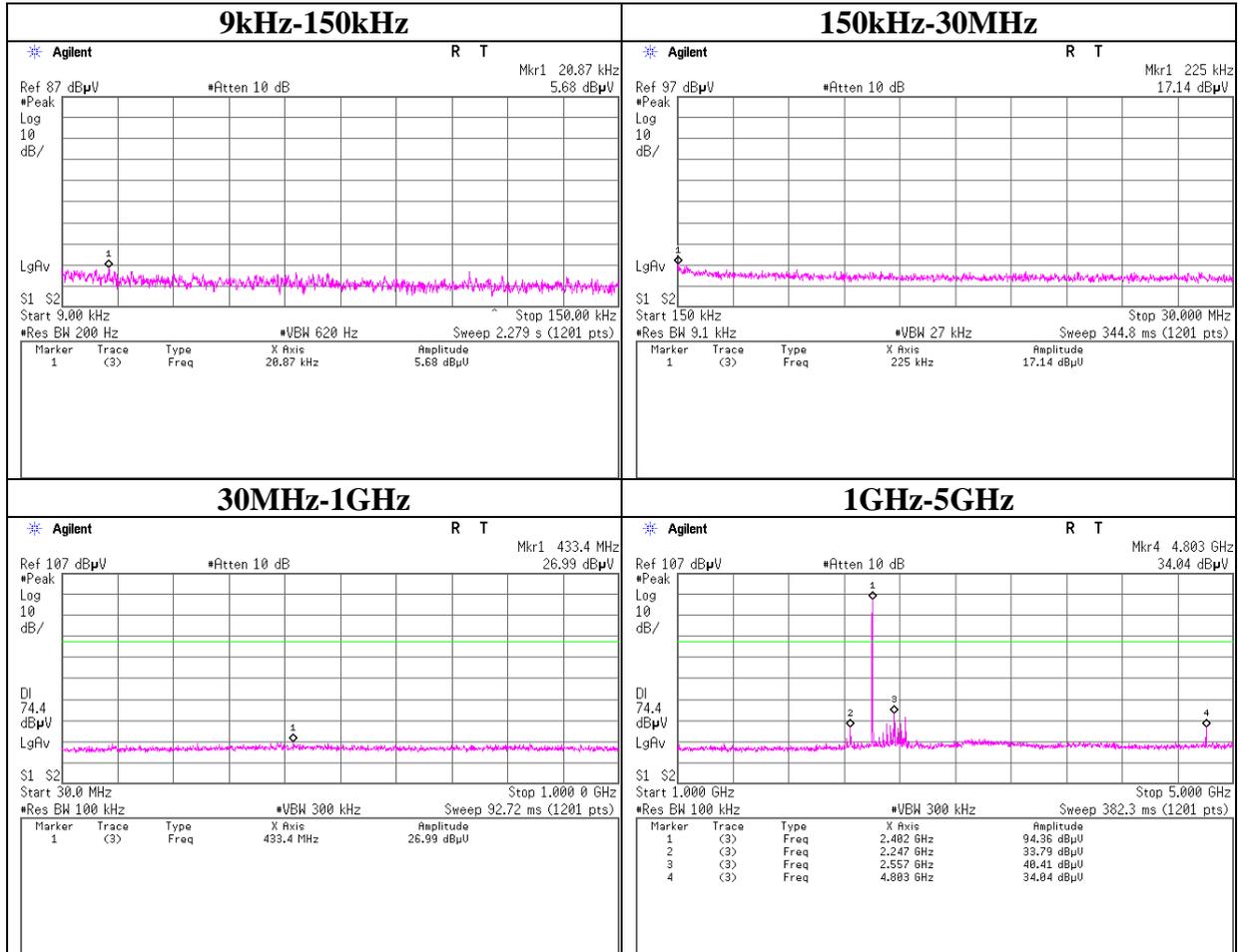
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5

### Tx DH5 2402MHz



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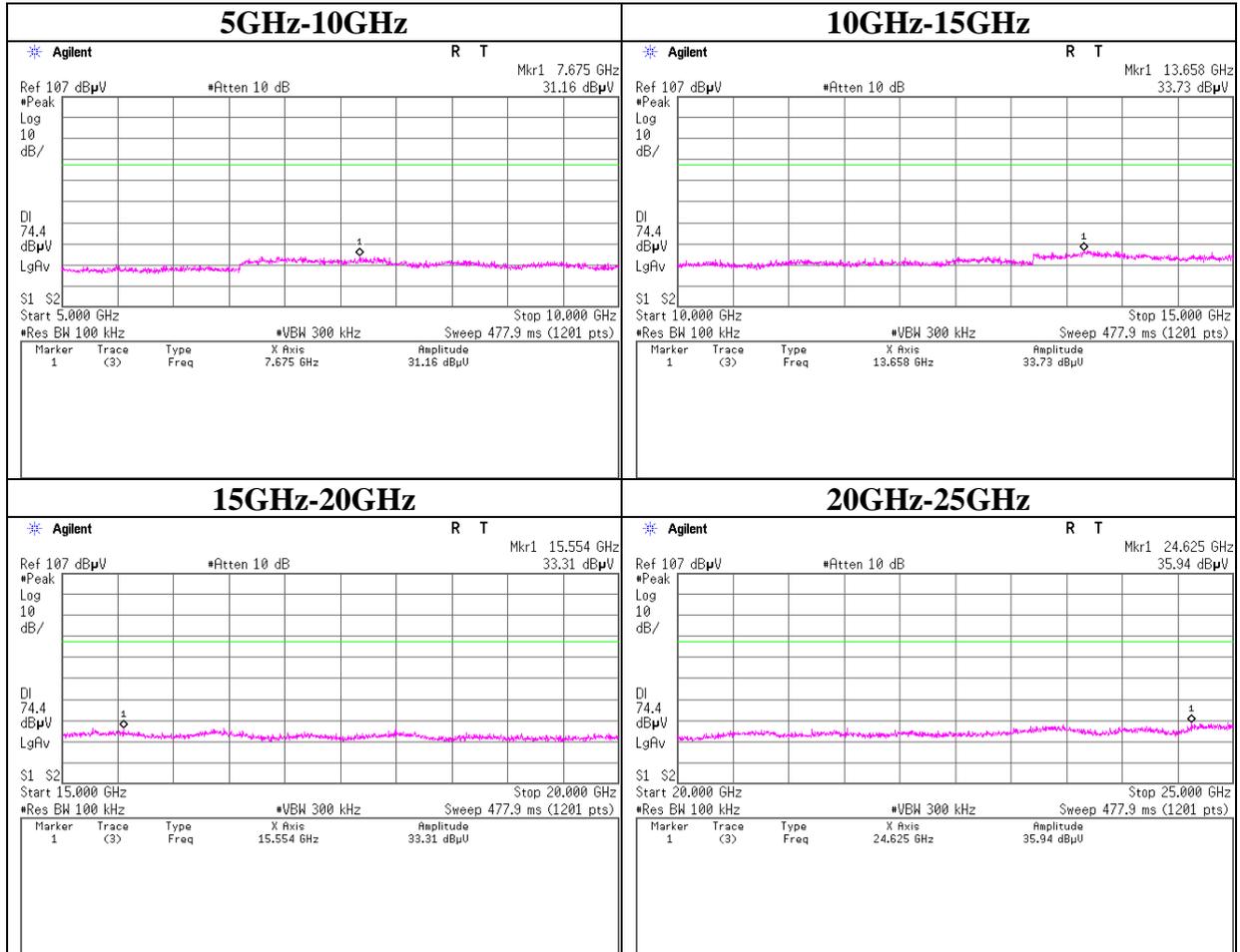
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5

### Tx DH5 2402MHz



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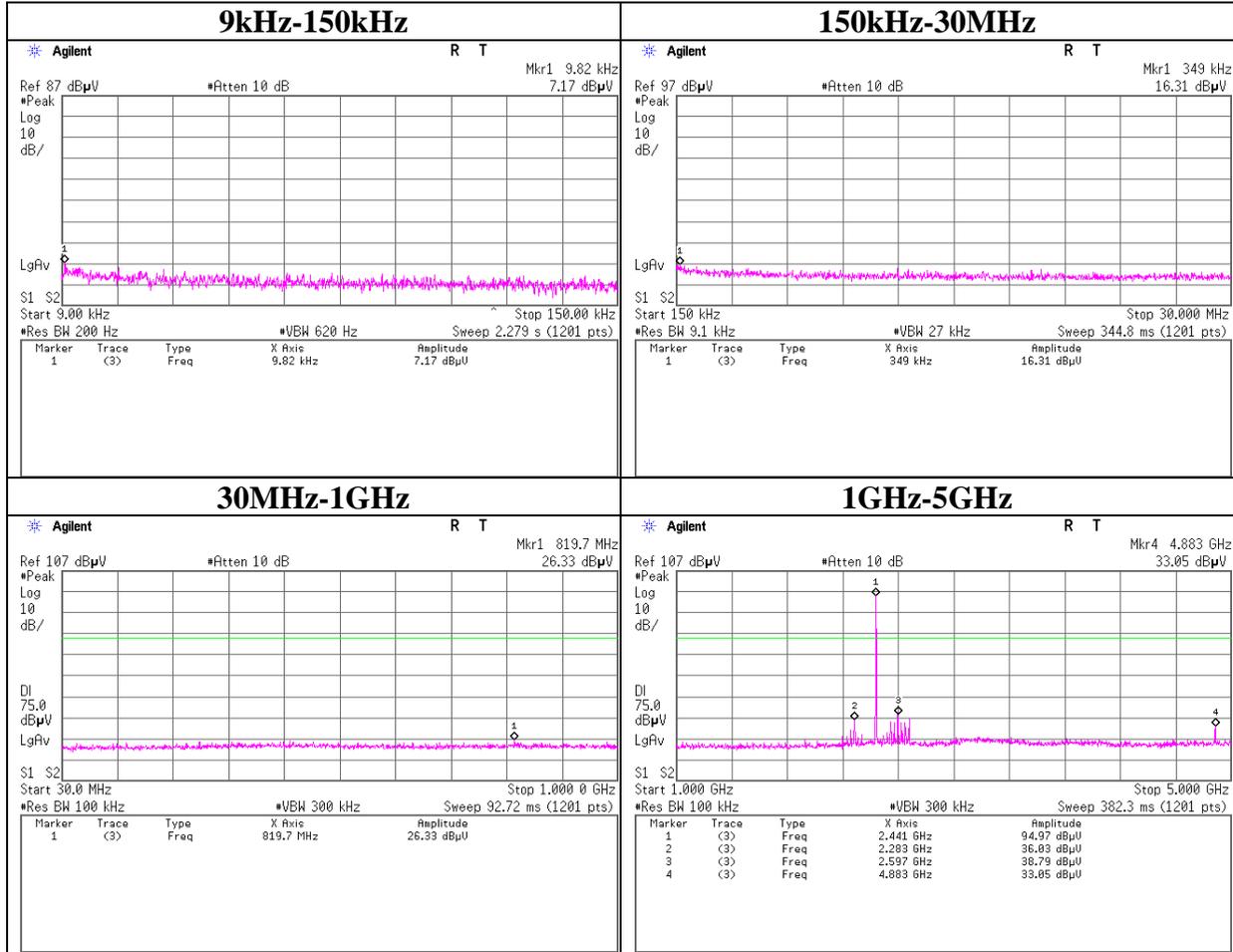
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5

#### Tx DH5 2441MHz



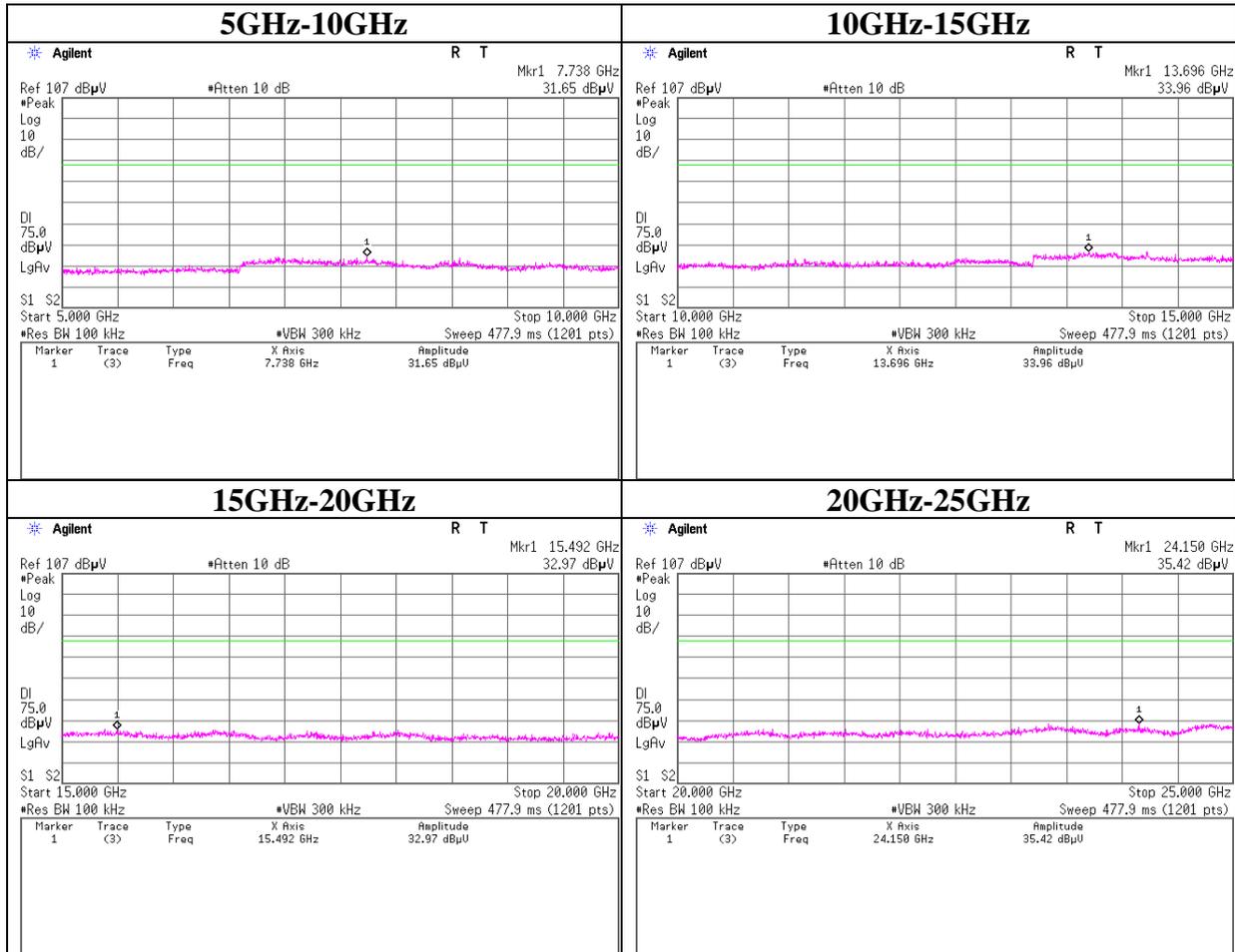
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**Ise EMC Lab.**

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 Telephone : +81 596 24 8999  
 Facsimile : +81 596 24 8124

### Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5

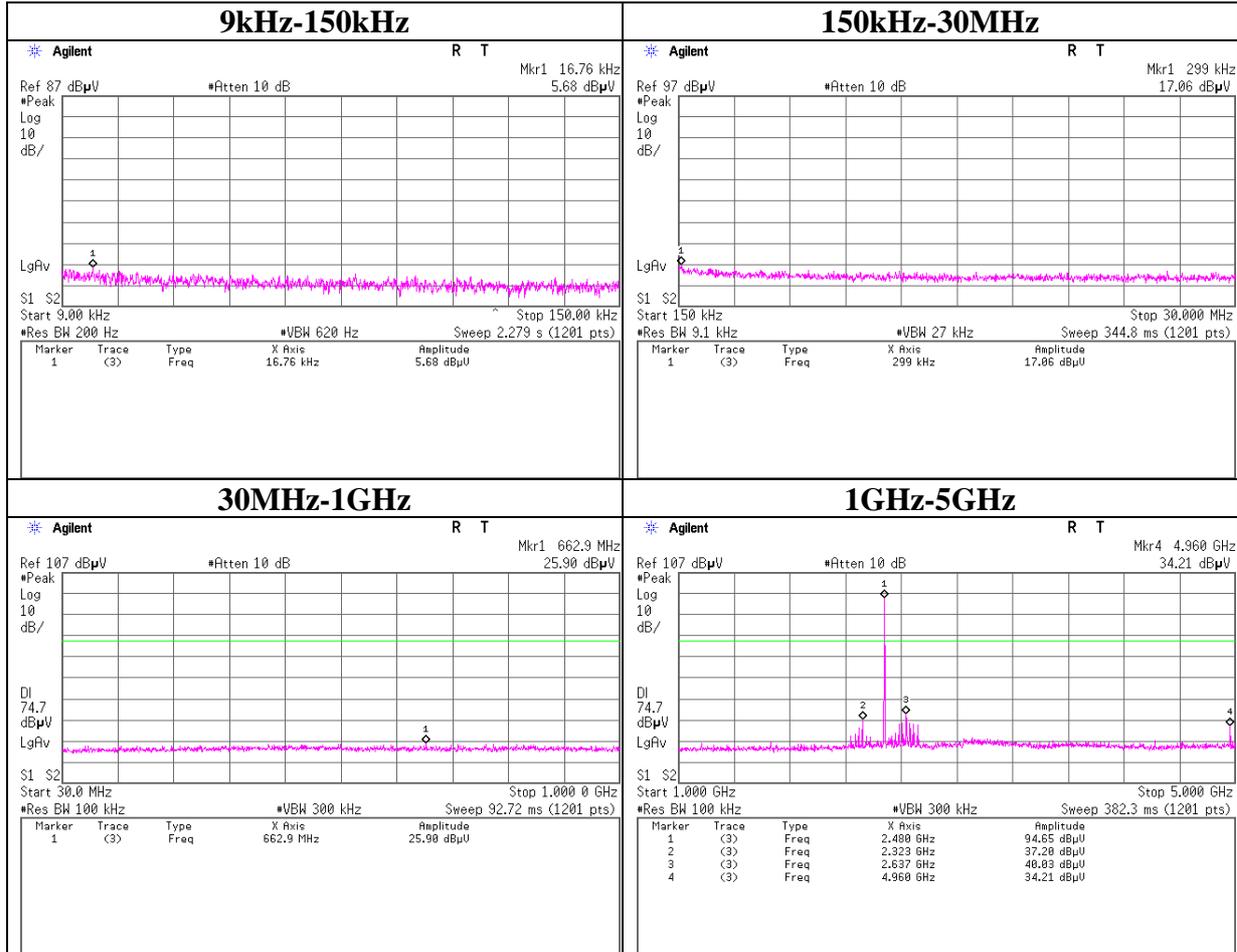
#### Tx DH5 2441MHz



## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5

### Tx DH5 2480MHz



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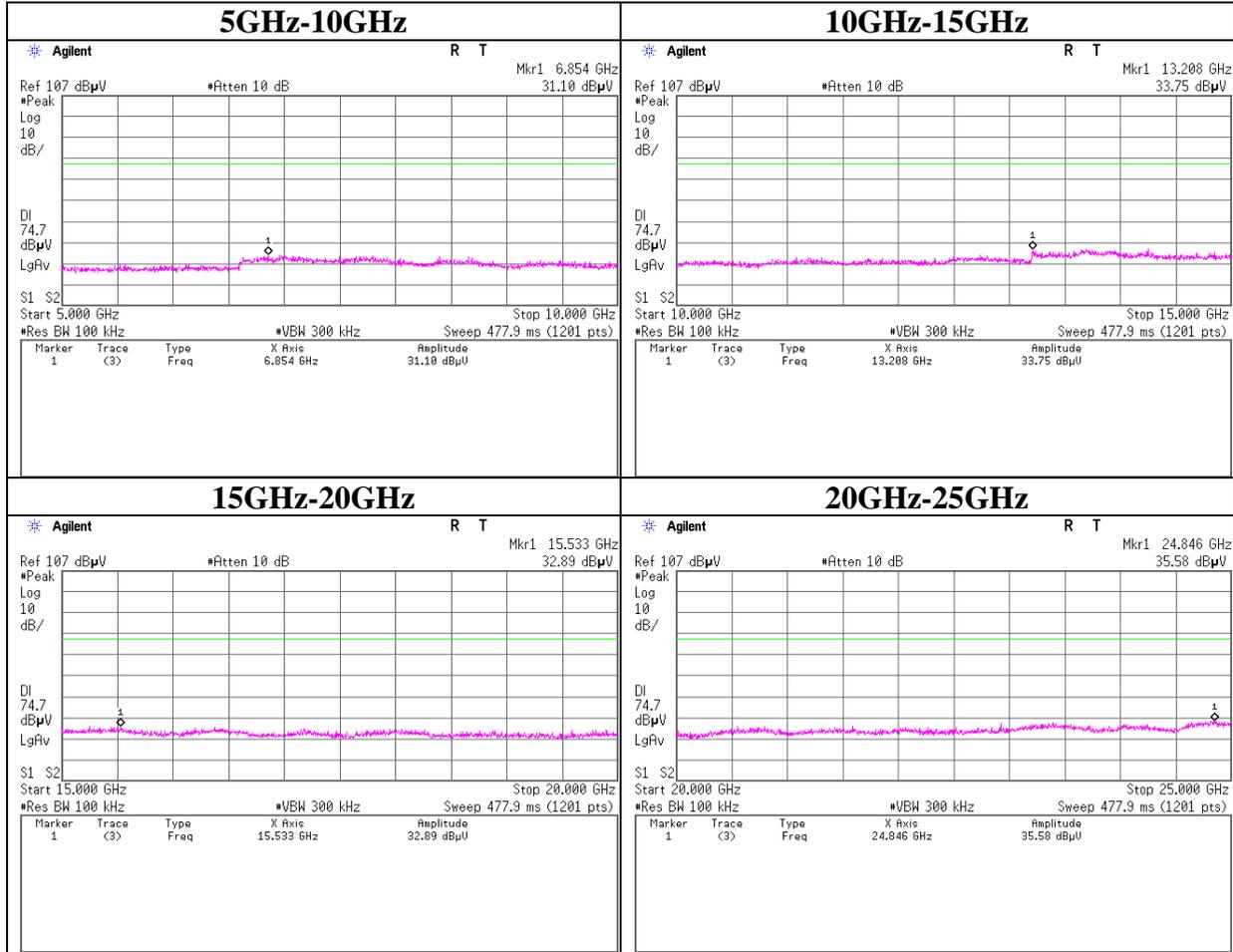
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5

### Tx DH5 2480MHz



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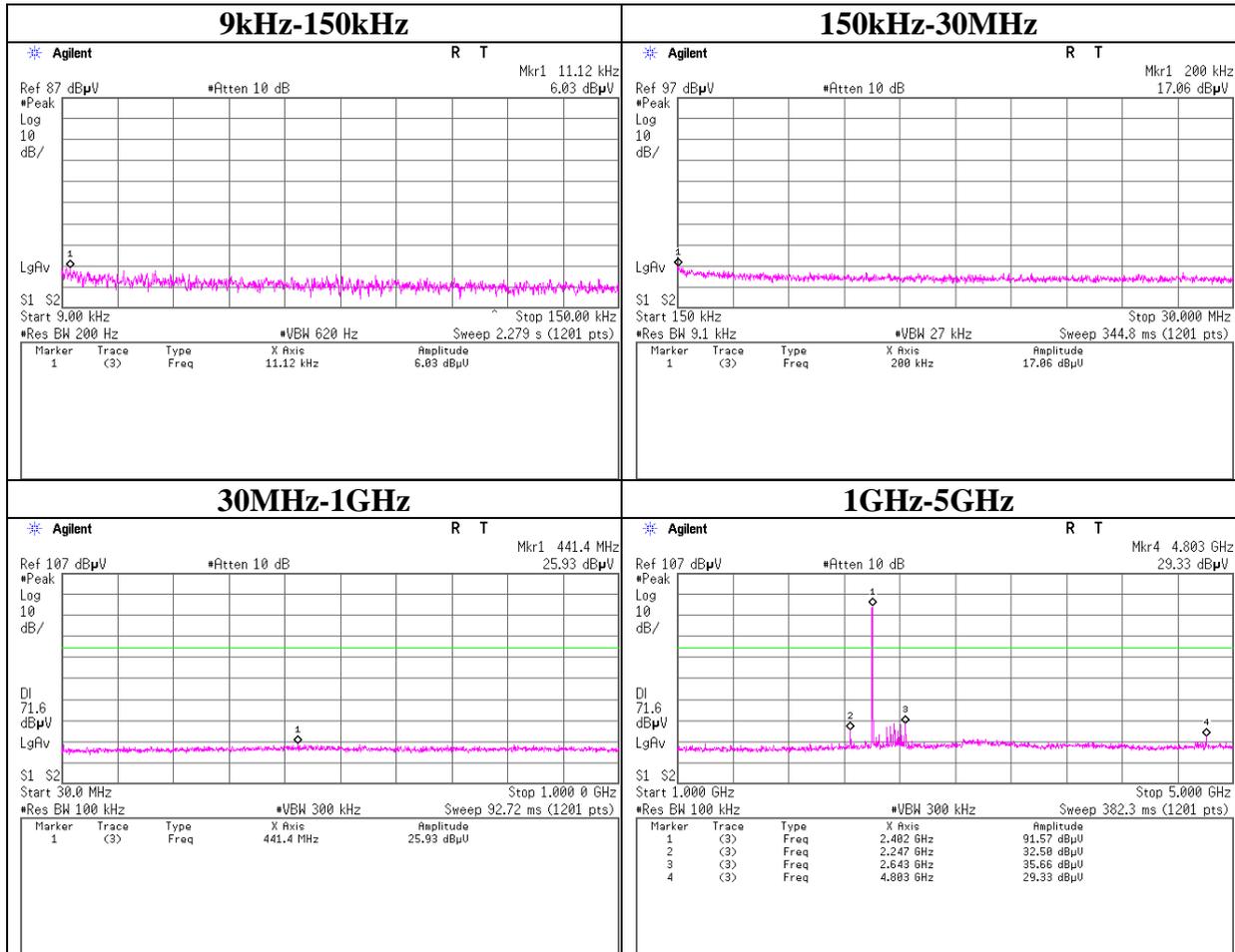
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) 3DH5

### Tx 3DH5 2402MHz



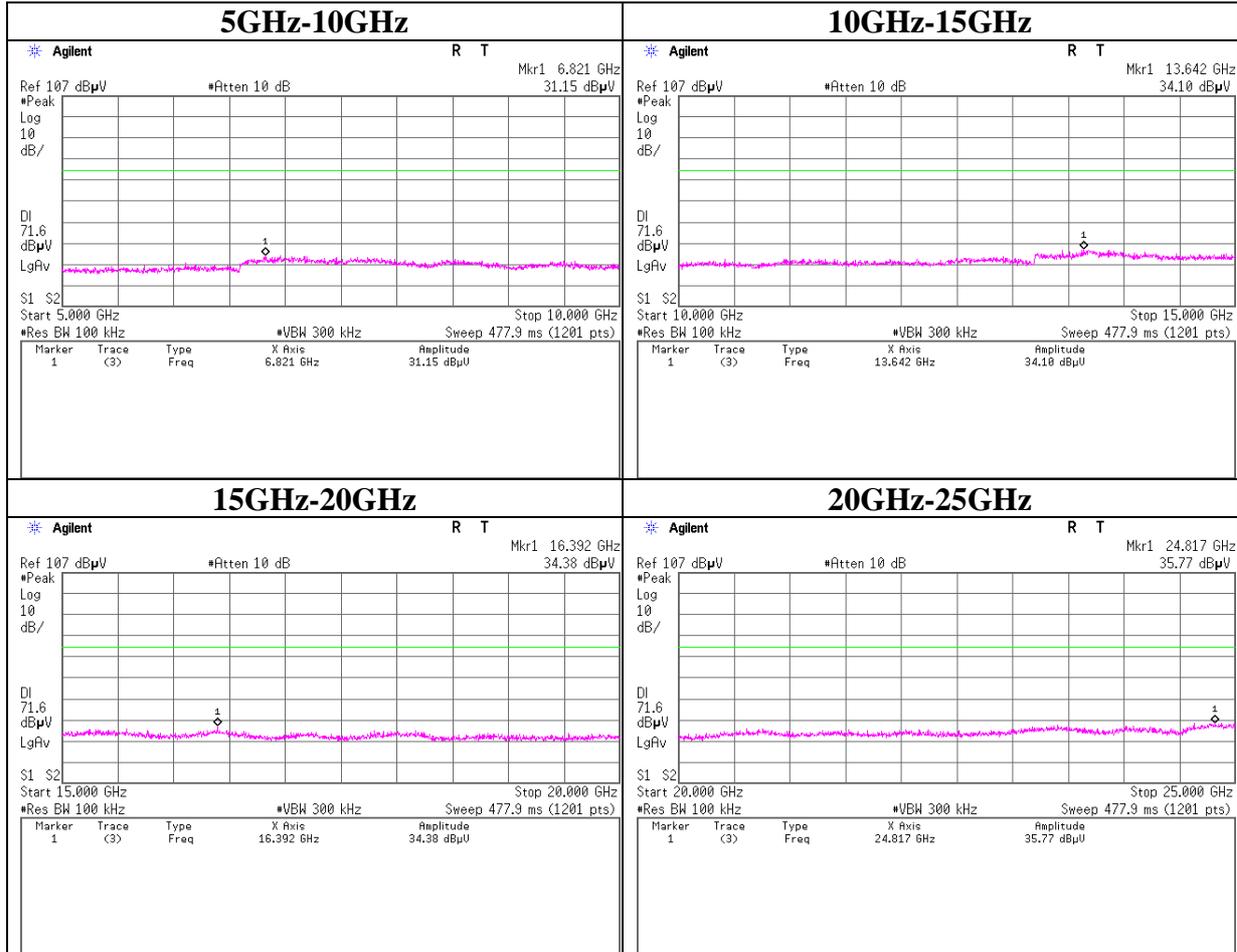
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**Ise EMC Lab.**

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 Telephone : +81 596 24 8999  
 Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) 3DH5

### Tx 3DH5 2402MHz



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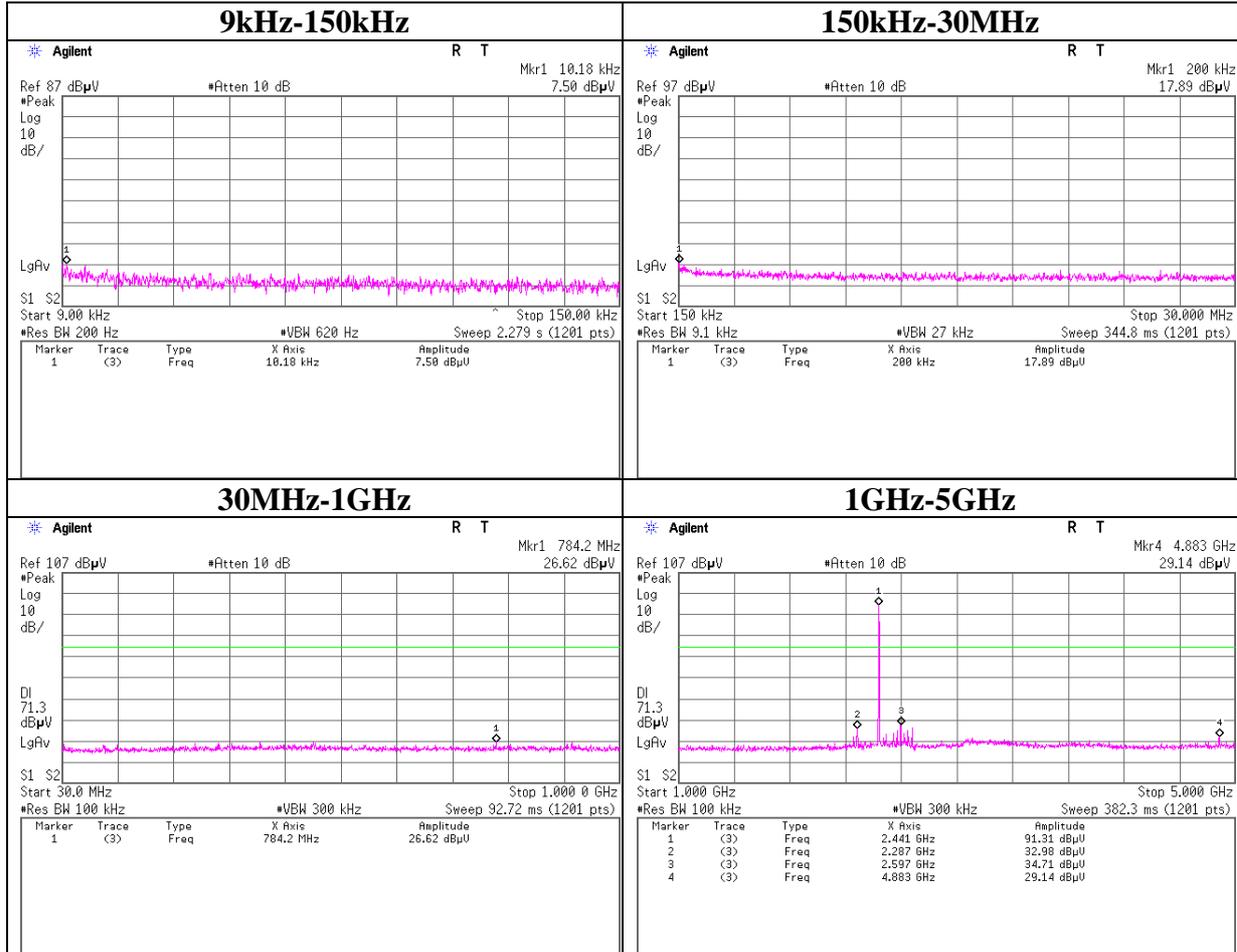
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) 3DH5

### Tx 3DH5 2441MHz



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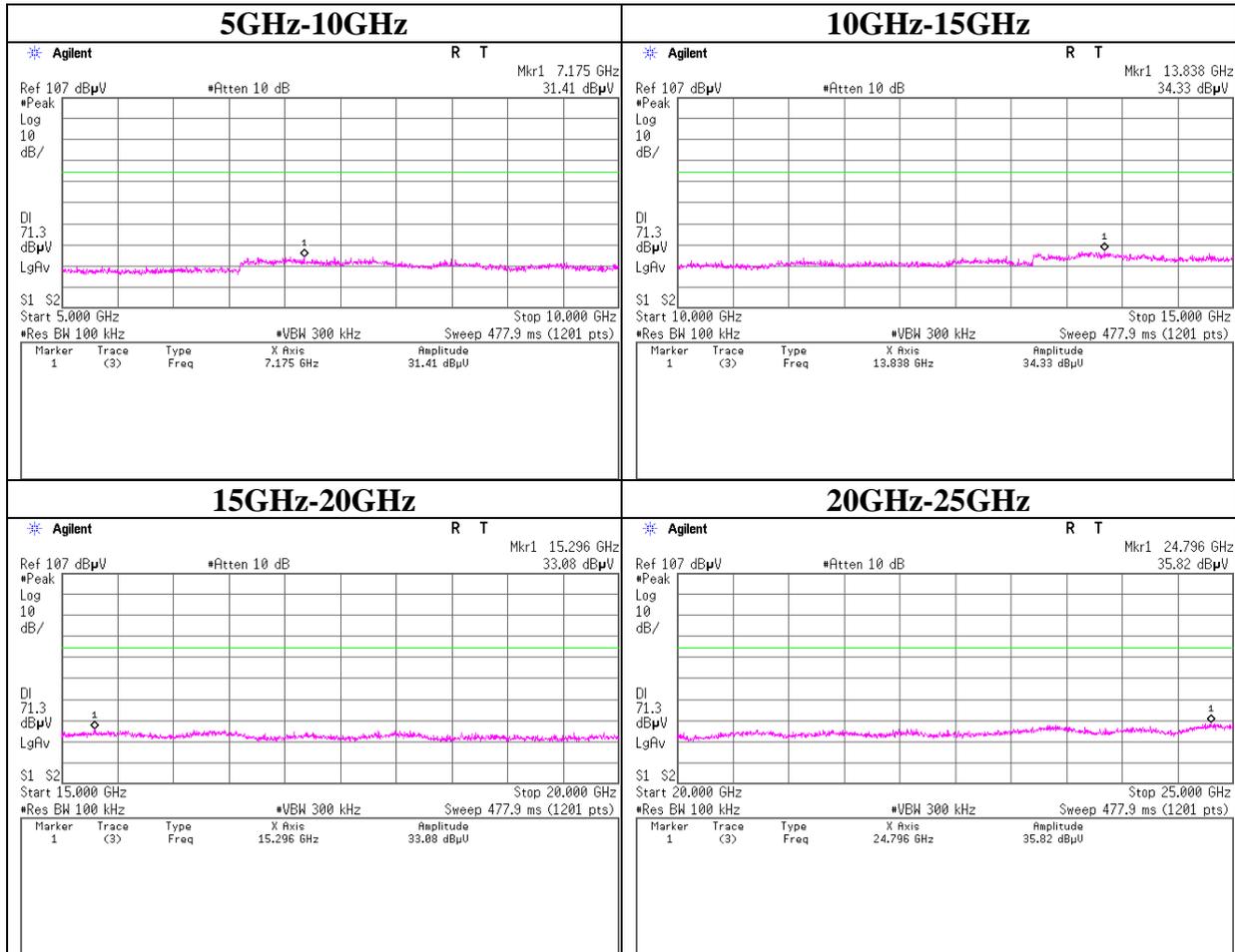
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) 3DH5

### Tx 3DH5 2441MHz



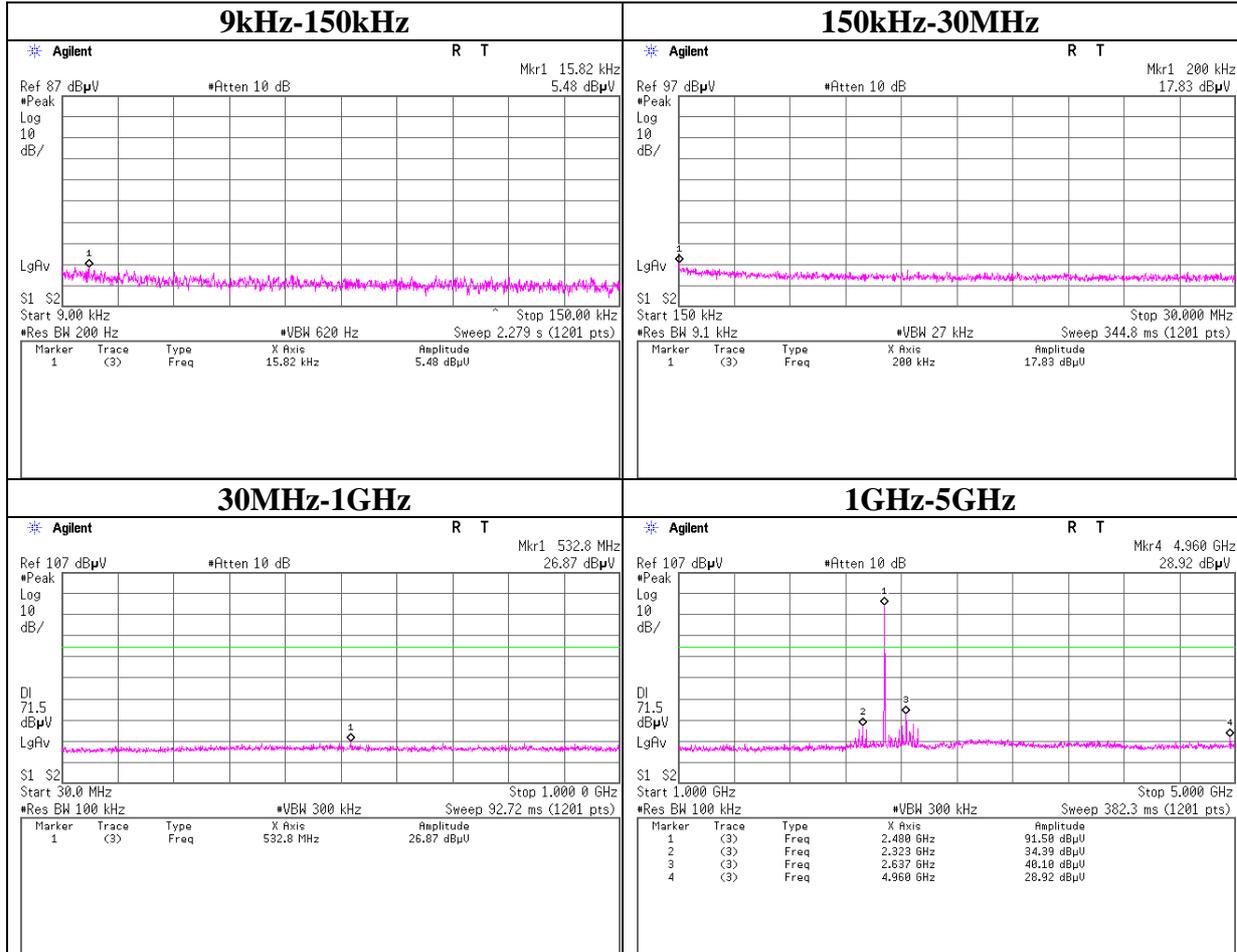
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**Ise EMC Lab.**

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 Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) 3DH5

### Tx 3DH5 2480MHz



**UL Japan, Inc.**

**Ise EMC Lab.**

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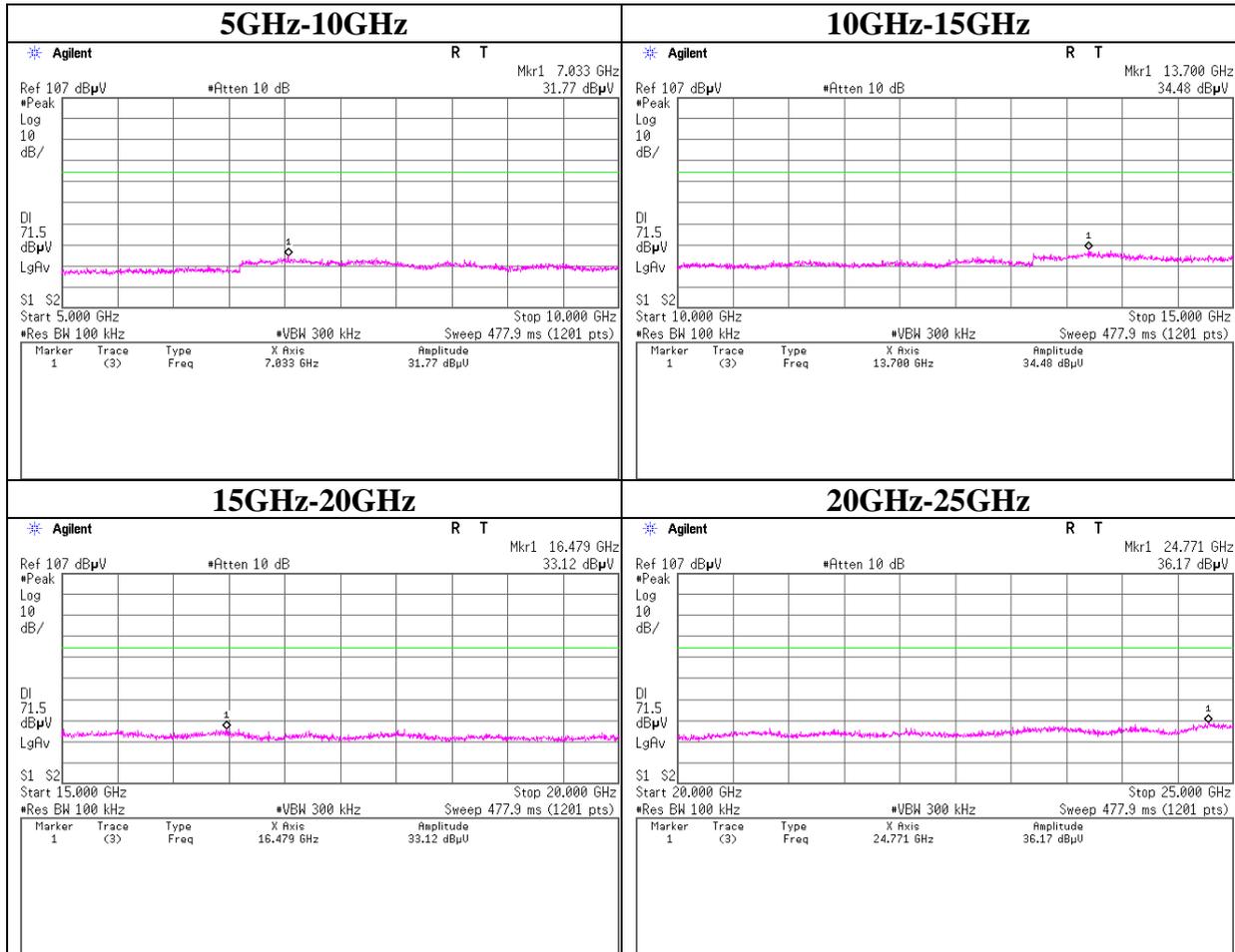
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) 3DH5

### Tx 3DH5 2480MHz



**UL Japan, Inc.**

**Ise EMC Lab.**

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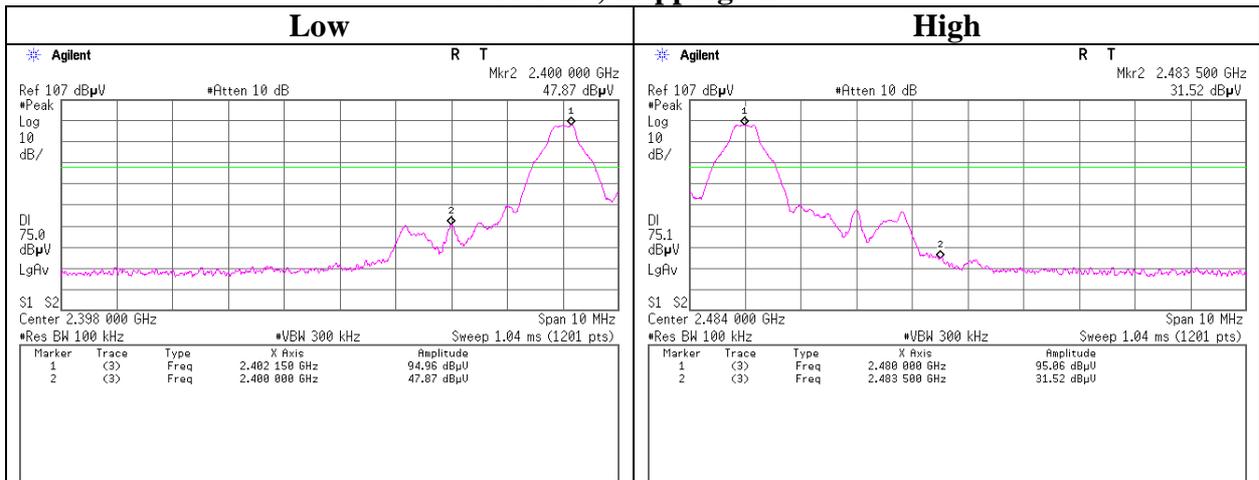
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Facsimile : +81 596 24 8124

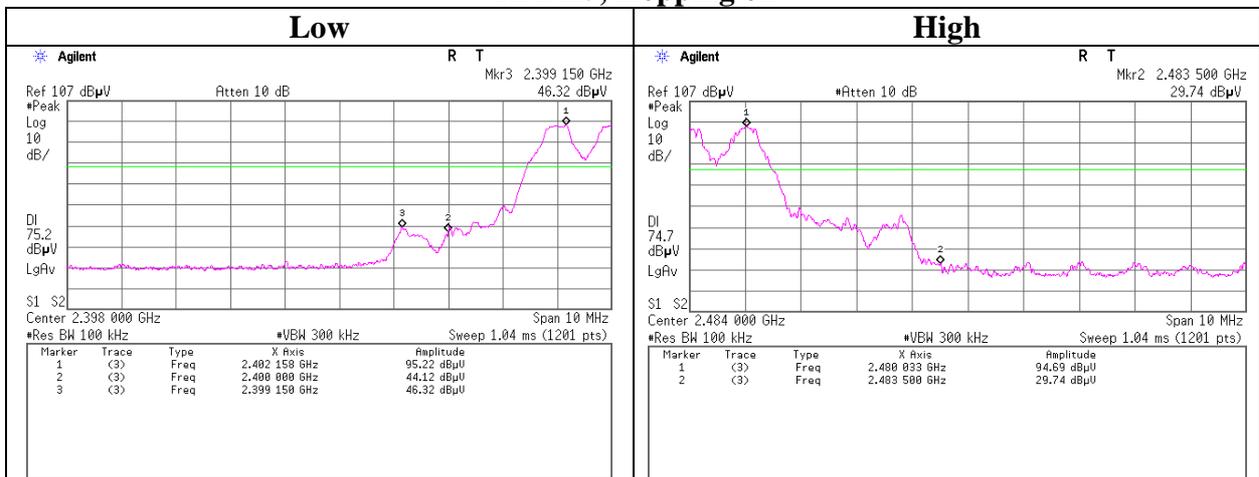
## Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping on/off) DH5

### Tx DH5, Hopping off



### Tx DH5, Hopping on



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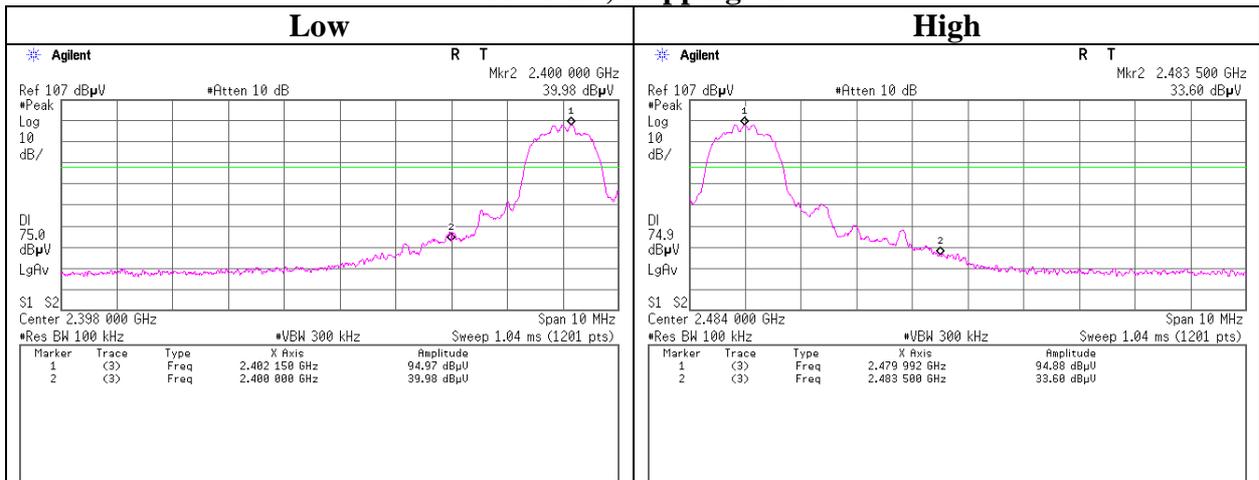
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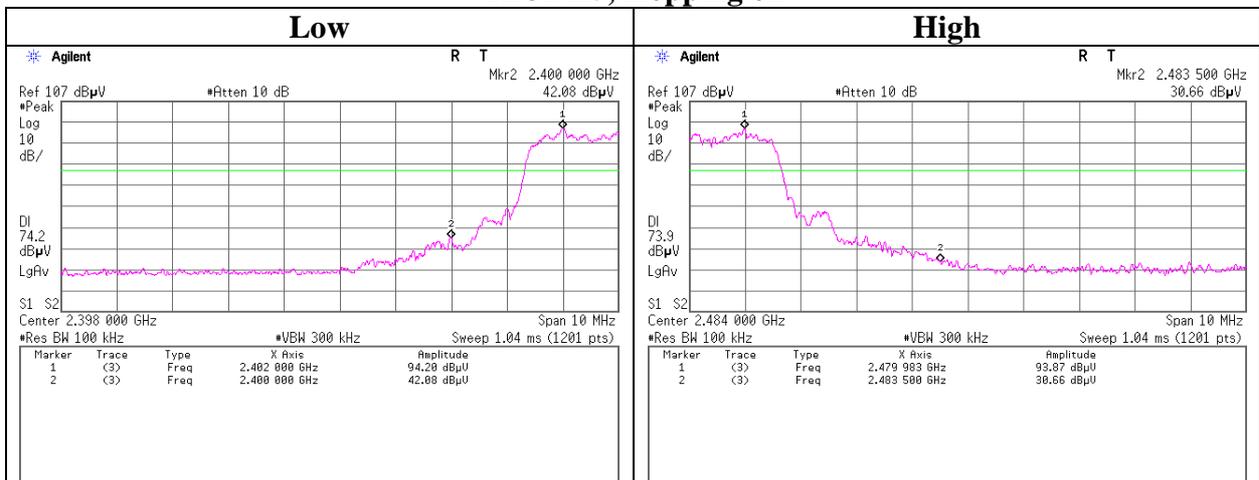
## Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping on/off) 3DH5

### Tx 3DH5, Hopping off



### Tx 3DH5, Hopping on



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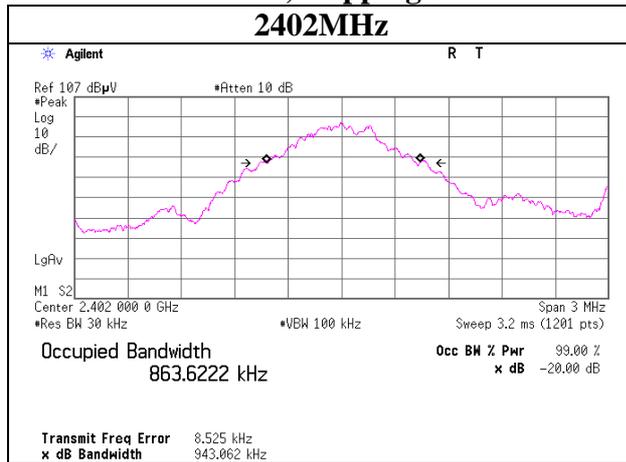
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

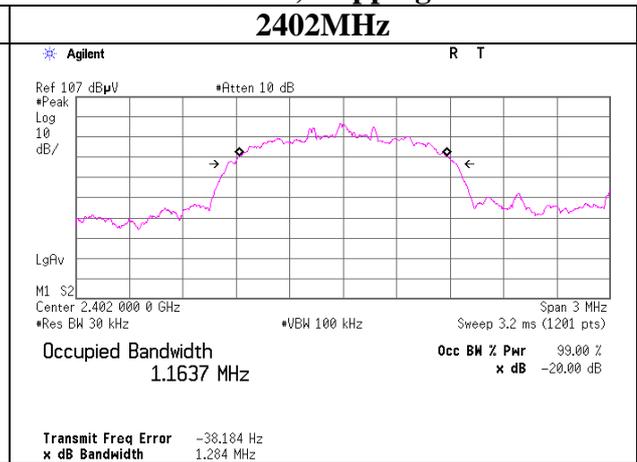
## 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping off) DH5/3DH5

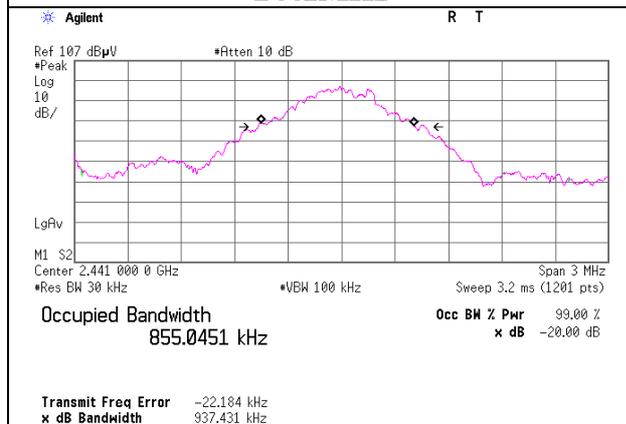
### Tx DH5, Hopping off



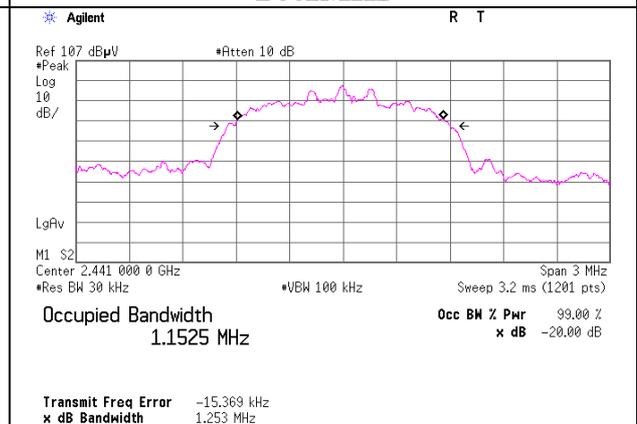
### Tx 3DH5, Hopping off



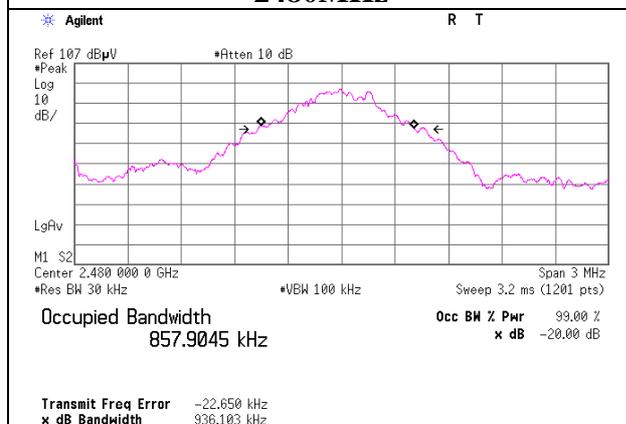
### 2441MHz



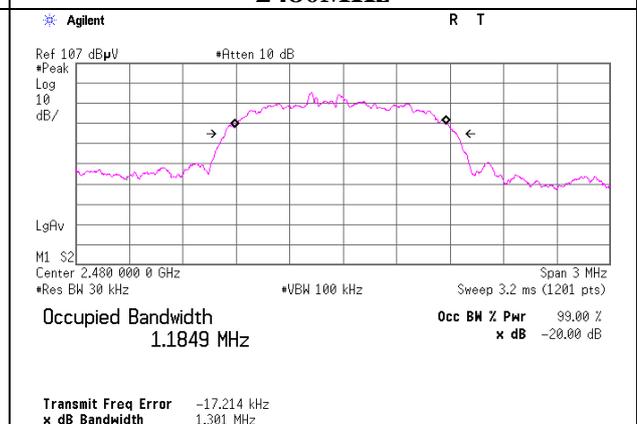
### 2441MHz



### 2480MHz



### 2480MHz



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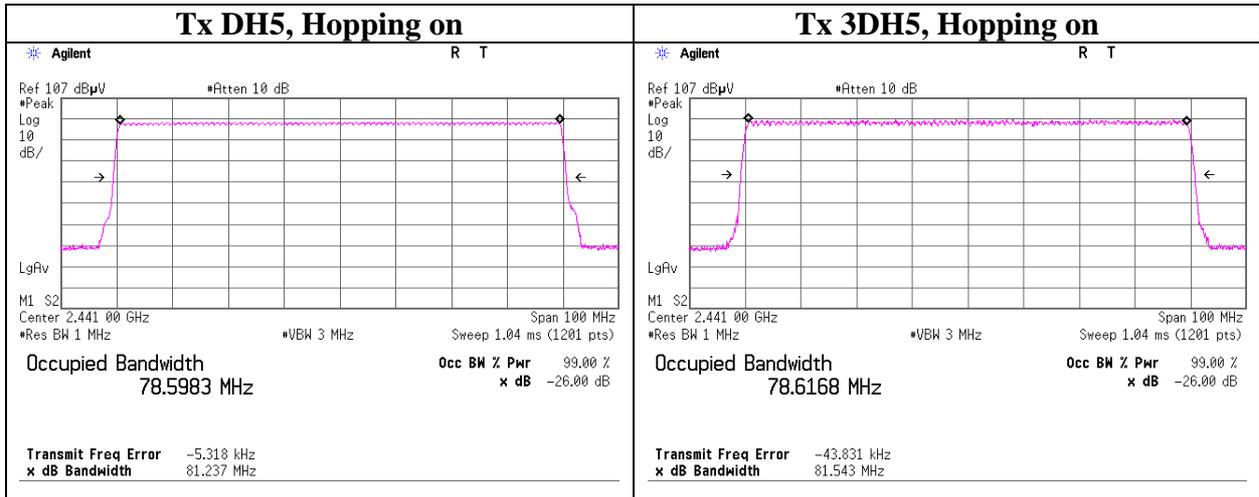
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## 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10416942H
Date	08/05/2014
Temperature/ Humidity	23 deg. C / 59% RH
Engineer	Satofumi Matsuyama
Mode	Tx (Hopping on) DH5/3DH5



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## **APPENDIX 2: Test instruments**

### **EMI test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE/AT	2014/02/20 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE/AT	2014/02/20 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE/CE	2014/06/03 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2013/10/13 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2013/10/13 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2014/02/20 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2013/09/12 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2014/02/21 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2013/11/27 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2014/01/21 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2014/02/21 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2013/09/01 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE	2014/07/10 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2014/02/20 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2014/01/29 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2014/06/16 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2014/06/16 * 12
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2014/04/14 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2014/03/13 * 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**

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