



# RADIO TEST REPORT

**Test Report No. : 10990291S-A**

**Applicant** : Sony Corporation  
**Type of Equipment** : IC Recorder  
**Model No.** : ICD-SX2000  
**FCC ID** : AK8ICDSX2000  
**Test regulation** : FCC Part 15 Subpart C: 2015  
**Test Result** : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

**Date of test:** October 8 to 27, 2015

**Representative test engineer:**

Yosuke Ishikawa  
Engineer  
Consumer Technology Division

**Approved by:**

Toyokazu Imamura  
Leader  
Consumer Technology Division



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

**UL Japan, Inc.**

**Shonan EMC Lab.**

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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name : Sony Corporation  
Address : 2-10-1 Osaki, Shinagawa-ku, Tokyo, 141-8610, Japan  
Telephone Number : +81-50 3750 7634

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

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

Type of Equipment : IC Recorder  
Model No. : ICD-SX2000  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 3.7 V, DC 5 V  
Receipt Date of Sample : October 8, 2015  
Country of Mass-production : China  
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: ICD-SX2000 (referred to as the EUT in this report) is an IC Recorder.

### **General Specification**

Clock frequency(ies) in the system : 32.768 kHz (RTC), 24 MHz (CPU), 11.2896 MHz (Audio),  
12.288 MHz (Audio), 49.152 MHz (Audio), 26 MHz (Bluetooth)

### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : FHSS  
Power Supply (radio part input) : DC 1.8 V  
Antenna type : Pattern  
Antenna Gain : +0.5 dBi

## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on September 8, 2015  
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928 MHz,  
2400-2483.5 MHz, and 5725-5850 MHz

\* The EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report 10990291S-C.

### 3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4-2009 7. AC powerline conducted emission measurements IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	18.0 dB, 0.20210 MHz, L1 QP, Tx 2441 MHz, DH5	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
20 dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-247 5.1 (1)		-	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		4.5 dB 2399.167 MHz, AV, Vertical Tx 2402 MHz, DH5	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) and KDB 558074 D01 12.2.7.

\* In case any questions arise about test procedure, ANSI C 63.10:2013 is also referred.

However, there is one deviation from ANSI C 63.10:2013. (ANSI C63.10:2013 is Non-accreditation)

Measurement height is not 1.5 m, but 0.8 m.

### FCC Part 15.31 (e)

This EUT provides stable voltage (DC 1.8 V) constantly to RF part regardless of input voltage. Therefore, this EUT complies with the requirement.

### FCC Part 15.203

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

### 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.

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### 3.4 Uncertainty

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

Item	Frequency range	Uncertainty (+/-)		
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	3.6 dB	3.4 dB	3.4 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.7 dB	3.5 dB	3.5 dB
	30 MHz-300 MHz	4.9 dB	4.9 dB	4.7 dB
	300 MHz-1 GHz	5.0 dB	5.0 dB	4.8 dB
	1 GHz-13 GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB
	18 GHz-40 GHz	4.5 dB	4.3 dB	4.3 dB

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	1.5 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.4 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.5 dB
Bandwidth Measurement	0.66 %
Duty cycle and Time Measurement	0.012 %

#### Conducted Emission test

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

#### Radiated emission test

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

### 3.5 Test Location

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JAB Accreditation No. RTL02610

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

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

Refer to APPENDIX.

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

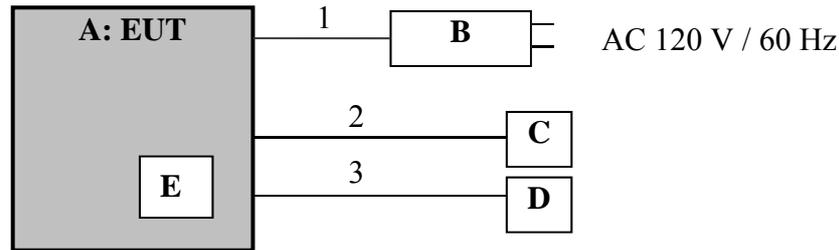
### **4.1 Operating Mode(s)**

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, 3-DH5	2402 MHz, 2441 MHz, 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3-DH5	2402 MHz, 2441 MHz, 2480 MHz
20 dB Bandwidth	Tx (Hopping Off) DH5, 3-DH5	2402 MHz, 2441 MHz, 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3-DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 - 3-DH1, 3-DH3, 3-DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz, 2441 MHz, 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3-DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
Band Edge Compliance (Radiated)	Tx DH5, 3-DH5 -Hopping Off	2402 MHz 2480 MHz
99 % Occupied Bandwidth	Tx DH5, 3-DH5 -Hopping On -Hopping Off	2402 MHz, 2441 MHz, 2480 MHz
<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)  *2-DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3-DH mode (3 Mb/s EDR: 8DPSK) as a representative.  * It is considered that the non-tested packet type (e.g. page scan) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.  * This EUT does not have inquiry mode.</p> <p>Power settings: Fixed  Software: nmobile1.0_icx0453/Ver.0.62</p>		

## 4.2 Configuration and peripherals



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

### Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	IC Recorder	ICD-SX2000	0310161 *1) 0310160 *2) 0310162 *3)	Sony Corporation	EUT
B	AC Adaptor	AC-UD20	13026000078	Sony Corporation	-
C	Headphones	MDR-E804	-	Sony Corporation	-
D	MIC	ECM-CS3	-	Sony Corporation	-
E	micro SDHC card	RP-SMEB08GJK	UJ3AA005833	Panasonic	-

\*1) Used for antenna terminal conducted tests except maximum peak output power test.

\*2) Used for maximum peak output power test.

\*3) Used for Conducted Emission test and Radiated Emission test

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	0.1 + 1.0	Shielded	Shielded	-
2	Headphone	1.1	Unshielded	Unshielded	-
3	MIC	1.05	Unshielded	Unshielded	-

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The rear of tabletop was located 40 cm 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 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via AC adaptor in a shielded room. The EUT via AC adaptor 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 MHz - 30 MHz  
**Test data** : APPENDIX  
**Test result** : Pass

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

### **Test Procedure**

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m (below 1 GHz) or 1.0 m by 1.5 m (above 1 GHz), raised 0.8 m above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

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 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

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

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

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

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

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

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3 m (below 13 GHz), 1 m*2) (above 13 GHz)		3 m (below 13 GHz), 1 m*2) (above 13 GHz)

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

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

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

Antenna polarization	Frequency			
	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 18 GHz	18 GHz - 25 GHz
Horizontal	X	X	Y	X
Vertical	X	Y	Y	X

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

**Measurement range : 30 M - 25 GHz**

**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.

<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>
20 dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Sample	Max Hold *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *3)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3 MHz	100 kHz	300 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	10 kHz	30 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) The measurement was performed with Max Hold since the duty cycle was not 100 %. *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 = 10 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

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**APPENDIX 1: Test data**

**Conducted Emission**

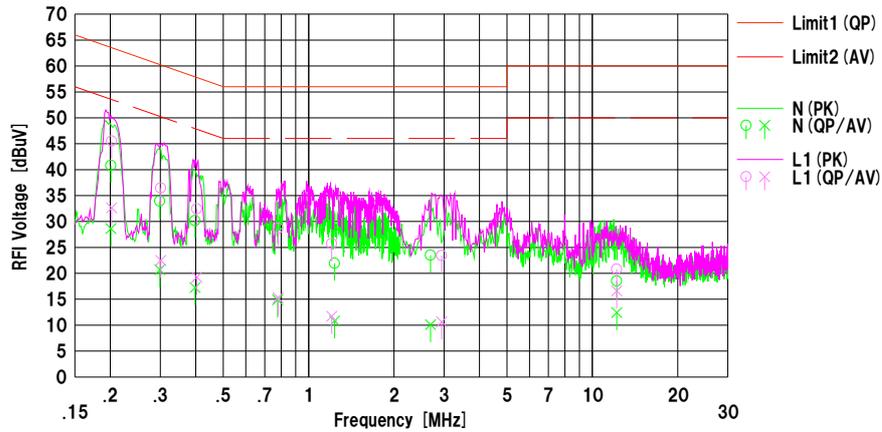
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room  
Date : 2015/10/21

Mode : Bluetooth.Tx.DH5.2441 MHz  
Order No. : 10990291S  
Temp./Humi. : 25 deg.C / 39 %RH

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

Engineer : Yosuke Ishikawa

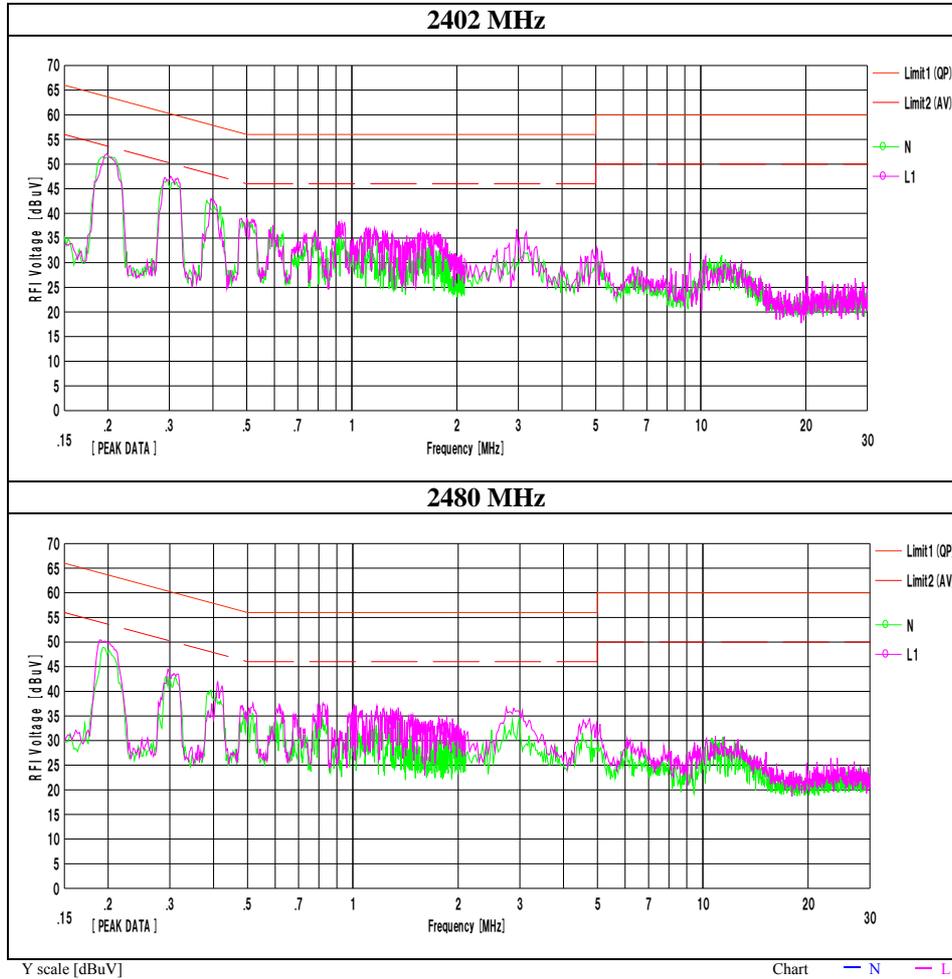


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.20100	28.40	16.20	12.41	40.81	28.61	63.57	53.57	22.7	24.9	N	
2	0.29900	21.50	8.30	12.41	33.91	20.71	60.27	50.27	26.3	29.5	N	
3	0.39800	17.70	4.80	12.45	30.15	17.25	57.90	47.90	27.7	30.6	N	
4	0.77760	16.70	2.40	12.47	29.17	14.87	56.00	46.00	26.8	31.1	N	
5	1.23550	9.40	-1.70	12.53	21.93	10.83	56.00	46.00	34.0	35.1	N	
6	2.68800	10.90	-2.50	12.60	23.50	10.10	56.00	46.00	32.5	35.9	N	
7	12.19200	5.40	-0.70	13.12	18.52	12.42	60.00	50.00	41.4	37.5	N	
8	0.20210	33.10	20.20	12.41	45.51	32.61	63.52	53.52	18.0	20.9	L1	
9	0.30135	24.05	10.09	12.41	36.46	22.50	60.21	50.21	23.7	27.7	L1	
10	0.40372	20.00	6.80	12.45	32.45	19.25	57.78	47.78	25.3	28.5	L1	
11	0.78040	16.20	2.80	12.47	28.67	15.27	56.00	46.00	27.3	30.7	L1	
12	1.20600	13.20	-0.80	12.53	25.73	11.73	56.00	46.00	30.2	34.2	L1	
13	2.94400	10.80	-2.00	12.63	23.43	10.63	56.00	46.00	32.5	35.3	L1	
14	12.19200	7.70	3.50	13.12	20.82	16.62	60.00	50.00	39.1	33.3	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN:SLS-02

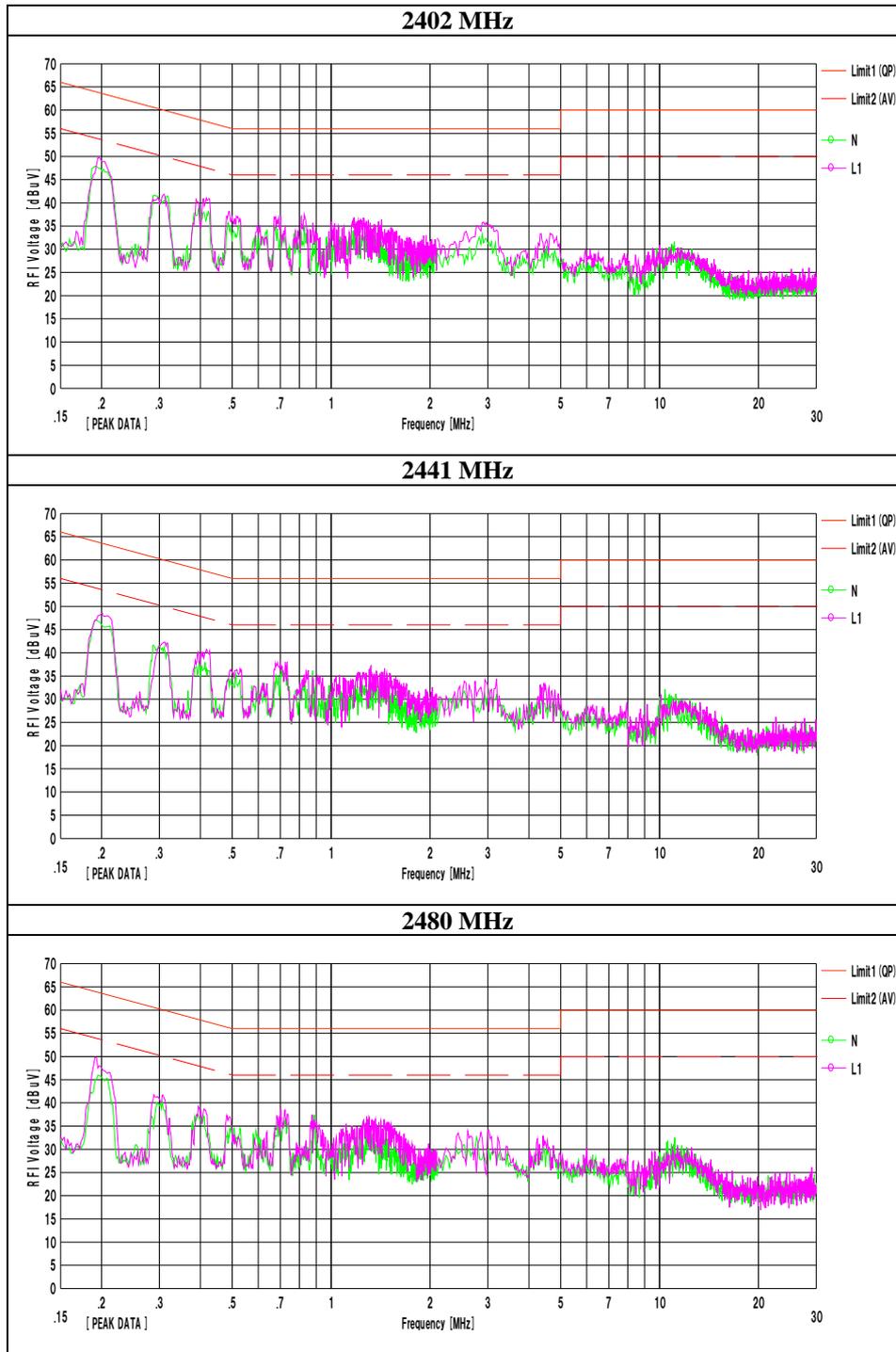
## Conducted Emission

Test place : Shonan EMC Lab. No.2 Shielded room  
Report No. : 10990291S-A  
Date : October 21, 2015  
Temperature / Humidity : 25 deg. C / 39 % RH  
Engineer : Yosuke Ishikawa  
Mode : Tx, Hopping Off, DH5



## Conducted Emission

Test place	Shonan EMC Lab. No.2 Shielded room
Report No.	10990291S-A
Date	October 21, 2015
Temperature / Humidity	25 deg. C / 39 % RH
Engineer	Yosuke Ishikawa
Mode	Tx, Hopping Off, 3-DH5



Y scale [dBuV]

Chart — N — L

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## 20 dB Bandwidth and Carrier Frequency Separation

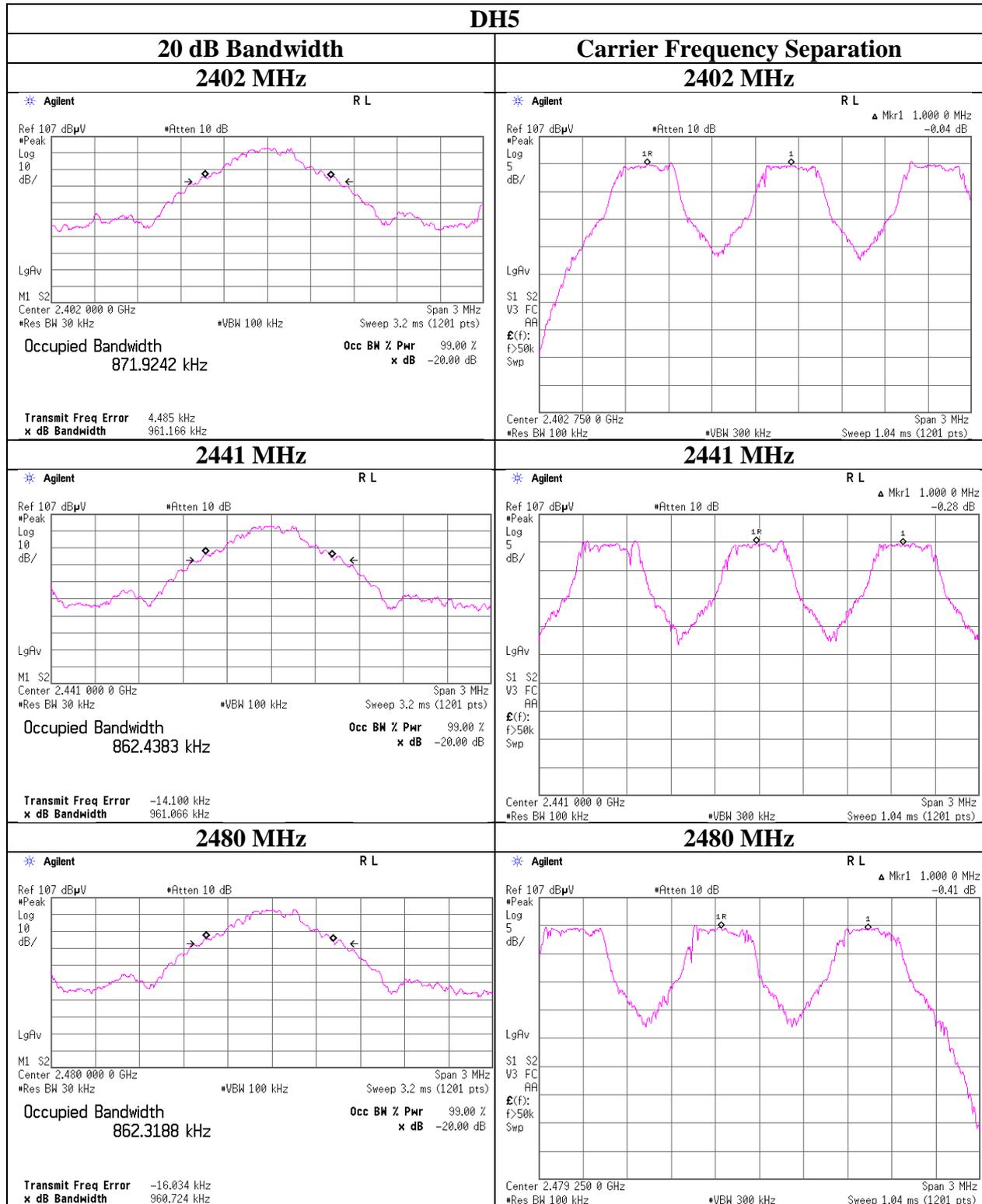
Test place                   Shonan EMC Lab. No.5 Shielded Room  
Report No.                 10990291S-A  
Date                        October 8, 2015  
Temperature / Humidity   26 deg. C / 34 % RH  
Engineer                  Kenichi Adachi  
Mode                        Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20 dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.961	1.000	$\geq 0.641$
DH5	2441.0	0.961	1.000	$\geq 0.641$
DH5	2480.0	0.961	1.000	$\geq 0.640$
3-DH5	2402.0	1.281	1.000	$\geq 0.854$
3-DH5	2441.0	1.277	1.000	$\geq 0.852$
3-DH5	2480.0	1.276	1.000	$\geq 0.851$

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

No limit applies to 20 dB Bandwidth.

## 20 dB Bandwidth and Carrier Frequency Separation



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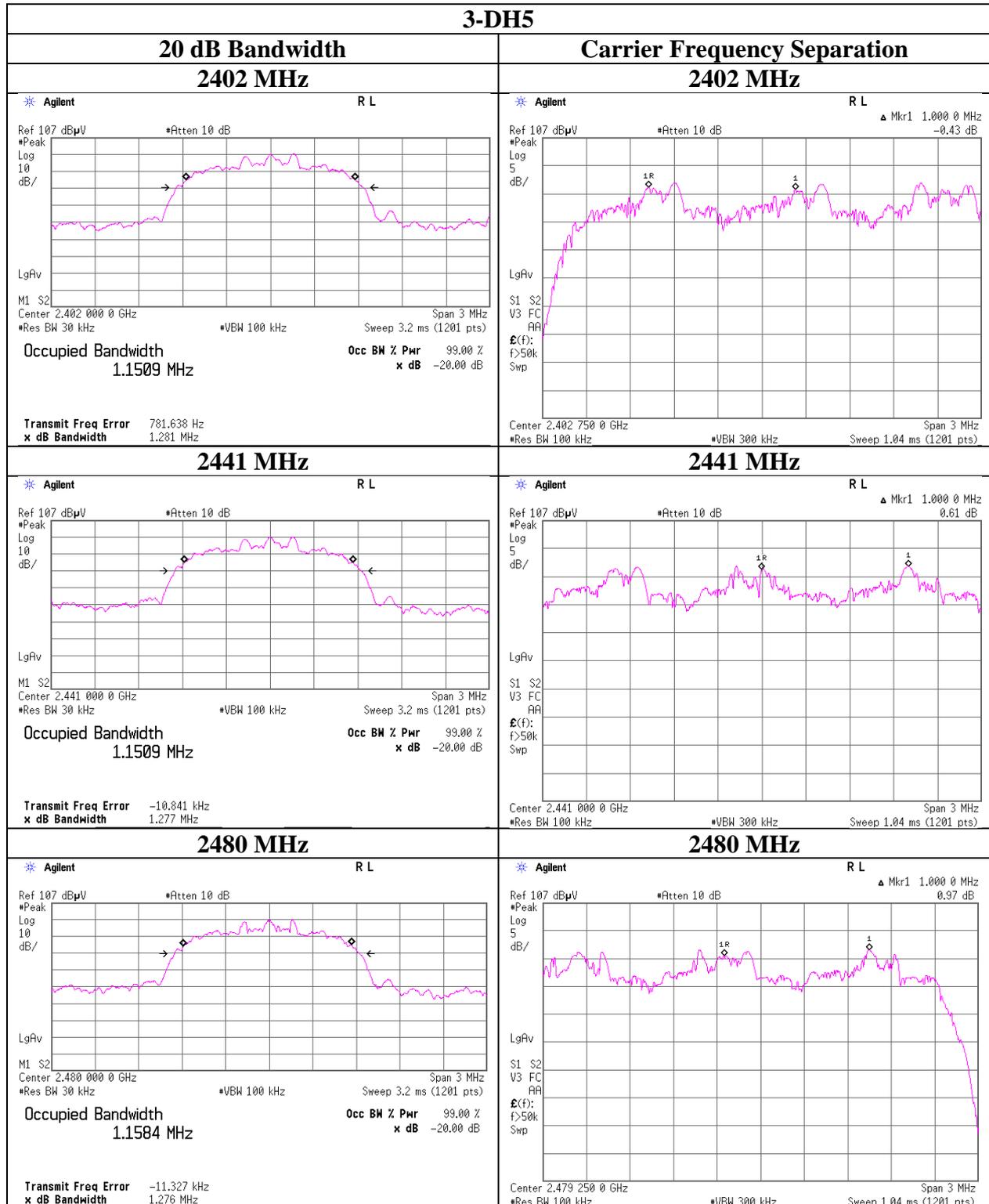
**Shonan EMC Lab.**

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Facsimile : +81 463 50 6401

## 20 dB Bandwidth and Carrier Frequency Separation



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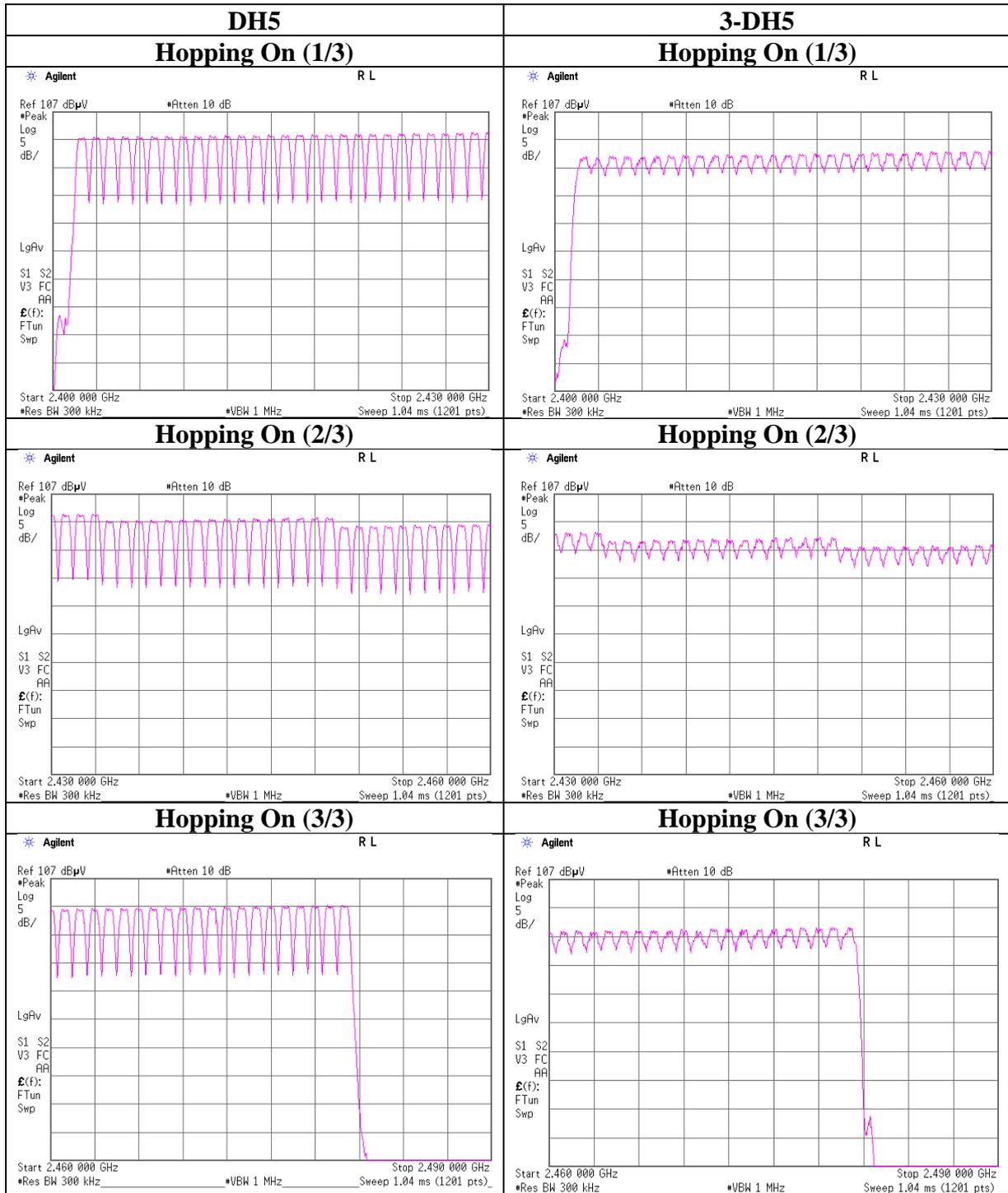
### Number of Hopping Frequency

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 10990291S-A  
Date October 8, 2015  
Temperature / Humidity 26 deg. C / 34 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	$\geq 15$
3-DH5	79	$\geq 15$
-	-	-

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	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 8, 2015
Temperature / Humidity	26 deg. C / 34 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping On

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 [ms]	Result [ms]	Limit [ms]
DH1	51.0 times / 5 s x 31.6 s = 323 times	0.413	133	400
DH3	26.0 times / 5 s x 31.6 s = 165 times	1.674	276	400
DH5	17.0 times / 5 s x 31.6 s = 108 times	2.919	315	400
3-DH1	51.0 times / 5 s x 31.6 s = 323 times	0.427	138	400
3-DH3	26.0 times / 5 s x 31.6 s = 165 times	1.678	277	400
3-DH5	17.0 times / 5 s x 31.6 s = 108 times	2.928	316	400

Sample Calculation

Result = Number of transmission x Length of transmission

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

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	51	51	51	51
DH3	26	26	26	26	26	26
DH5	17	17	17	17	17	17
3-DH1	51	51	51	51	51	51
3-DH3	26	26	26	26	26	26
3-DH5	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  $N \times 0.4$  s, where  $N$  is the number of channels being used in the hopping sequence ( $20 \leq N \leq 79$ ), is always less than 0.4 s regardless of packet size. This is confirmed in the test report for  $N = 79$ .

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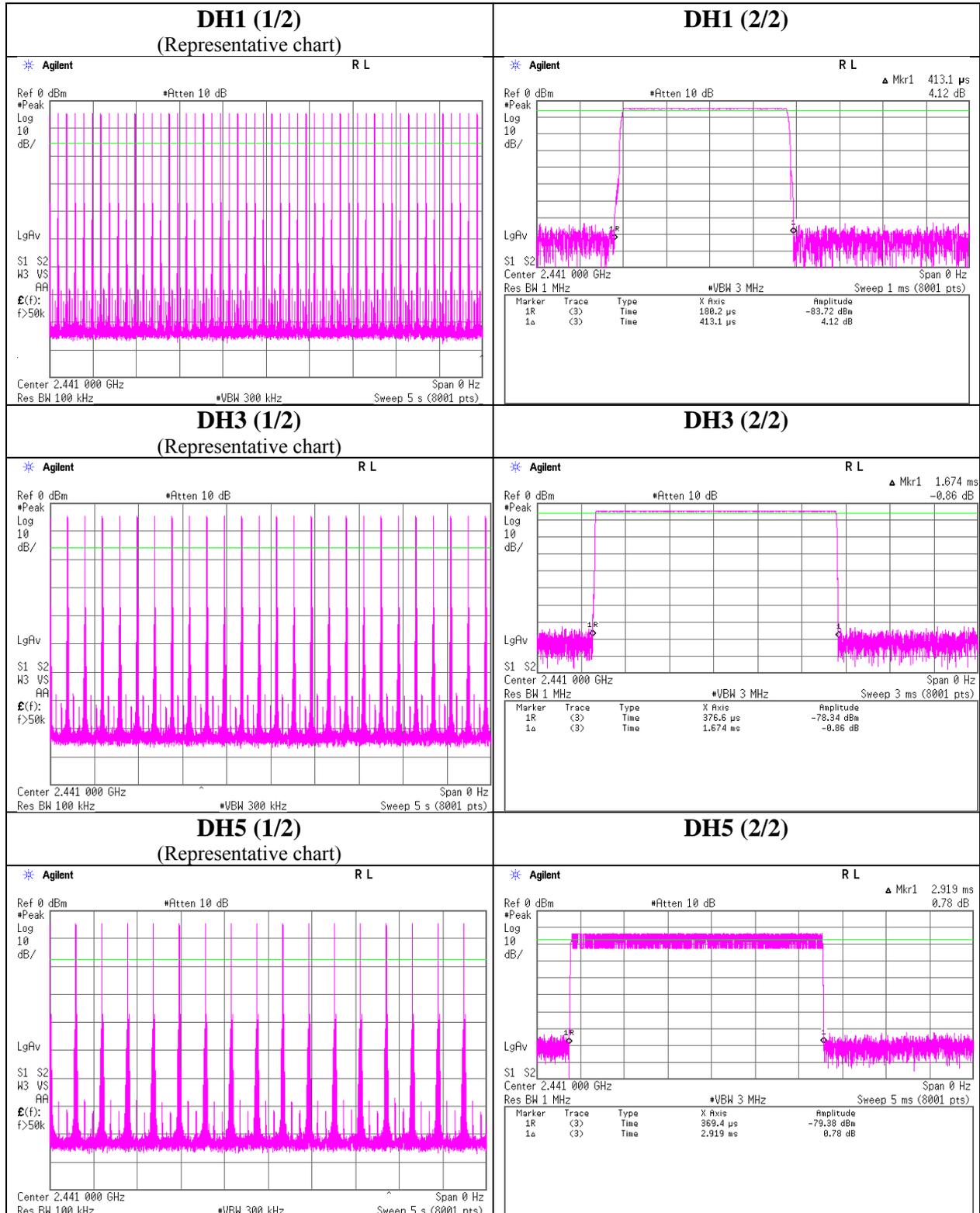
**Shonan EMC Lab.**

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**Dwell time**



**UL Japan, Inc.**

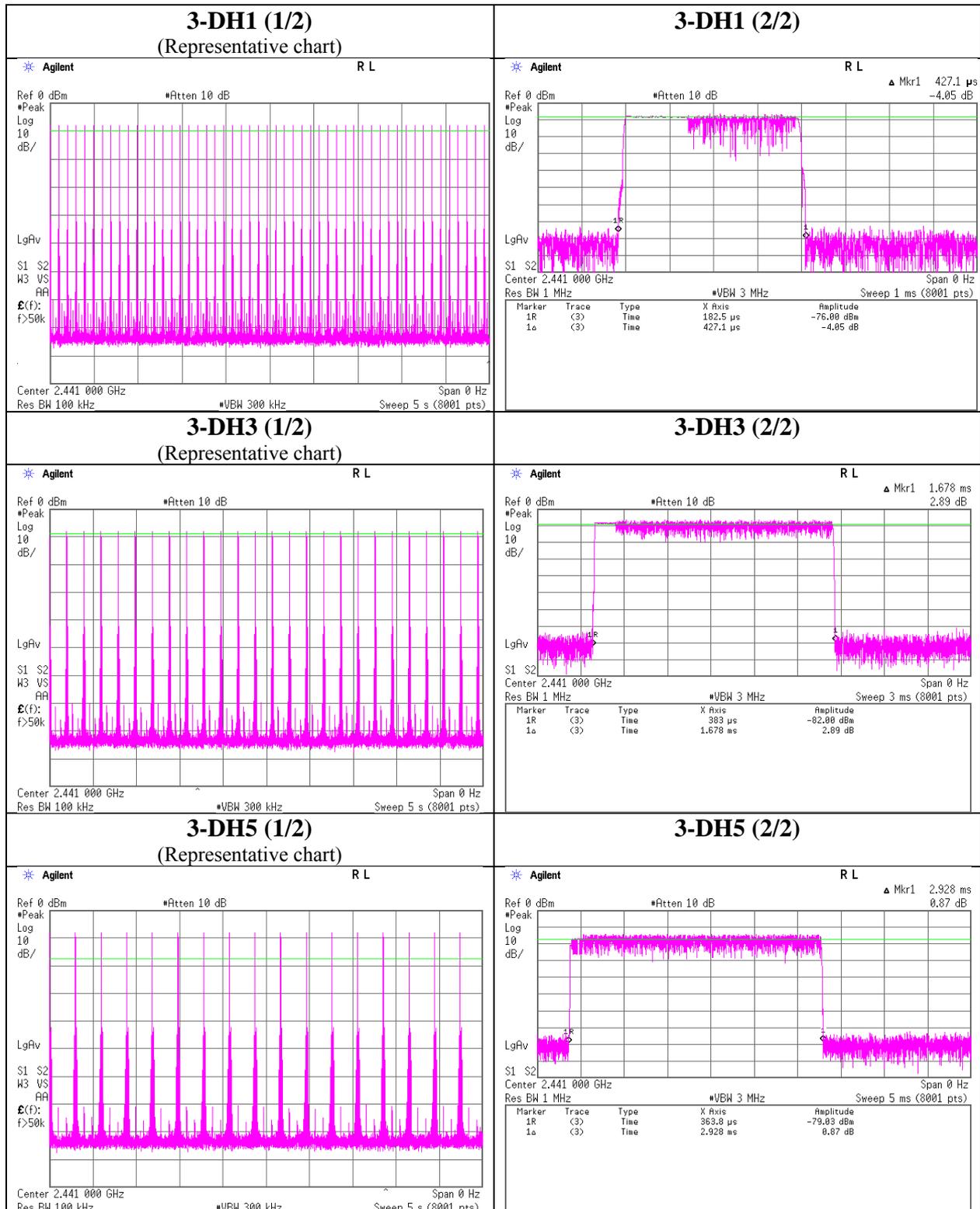
**Shonan EMC Lab.**

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Facsimile : +81 463 50 6401

### Dwell time



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

### Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 10990291S-A  
Date : October 8, 2015  
Temperature / Humidity : 26 deg. C / 34 % RH  
Engineer : Kenichi Adachi  
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-2.53	1.67	9.93	9.07	8.07	20.96	125	11.89
DH5	2441.0	-2.50	1.68	9.93	<b>9.11</b>	<b>8.15</b>	20.96	125	11.85
DH5	2480.0	-2.55	1.69	9.93	9.07	8.07	20.96	125	11.89
2-DH5	2402.0	-3.77	1.67	9.93	7.83	6.07	20.96	125	13.13
2-DH5	2441.0	-3.66	1.68	9.93	7.95	6.24	20.96	125	13.01
2-DH5	2480.0	-3.75	1.69	9.93	7.87	6.12	20.96	125	13.09
3-DH5	2402.0	-3.41	1.67	9.93	8.19	6.59	20.96	125	12.77
3-DH5	2441.0	-3.30	1.68	9.93	8.31	6.78	20.96	125	12.65
3-DH5	2480.0	-3.42	1.69	9.93	8.20	6.61	20.96	125	12.76

Sample Calculation:

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

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20 ch) 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 20 dB BW without 2/3 relaxation, 125 mW power limit was applied to it.

**Average Output Power**  
**(Reference data for RF Exposure / SAR testing)**

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 10990291S-A  
Date : October 8, 2015  
Temperature / Humidity : 26 deg. C / 34 % RH  
Engineer : Kenichi Adachi  
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
					[dBm]	[mW]		[dBm]	[mW]
DH5	2402.0	-3.83	1.67	9.93	7.77	5.98	1.08	8.85	7.67
DH5	2441.0	-3.77	1.68	9.93	<b>7.84</b>	<b>6.08</b>	1.08	<b>8.92</b>	<b>7.80</b>
DH5	2480.0	-3.83	1.69	9.93	7.79	6.01	1.08	8.87	7.71
2-DH5	2402.0	-7.02	1.67	9.93	4.58	2.87	1.07	5.65	3.67
2-DH5	2441.0	-6.91	1.68	9.93	4.70	2.95	1.07	5.77	3.78
2-DH5	2480.0	-7.01	1.69	9.93	4.61	2.89	1.07	5.68	3.70
3-DH5	2402.0	-7.04	1.67	9.93	4.56	2.86	1.07	5.63	3.66
3-DH5	2441.0	-6.91	1.68	9.93	4.70	2.95	1.07	5.77	3.78
3-DH5	2480.0	-7.01	1.69	9.93	4.61	2.89	1.07	5.68	3.70

Sample Calculation:

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

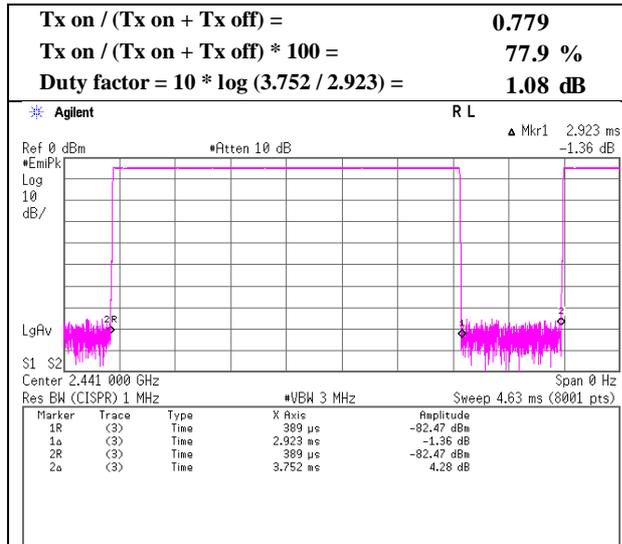
Result (Burst power) = Frame power + Duty factor

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

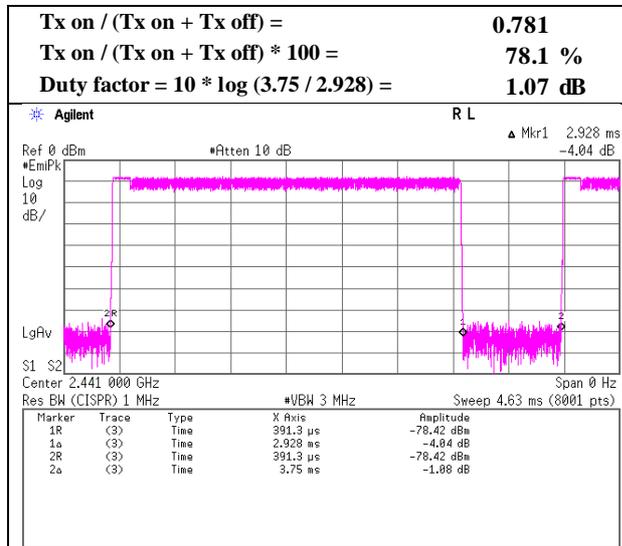
**Burst Rate Confirmation (for average output power)**

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 10990291S-A  
Date : October 8, 2015  
Temperature / Humidity : 26 deg. C / 34 % RH  
Engineer : Kenichi Adachi  
Mode : Tx, Hopping Off

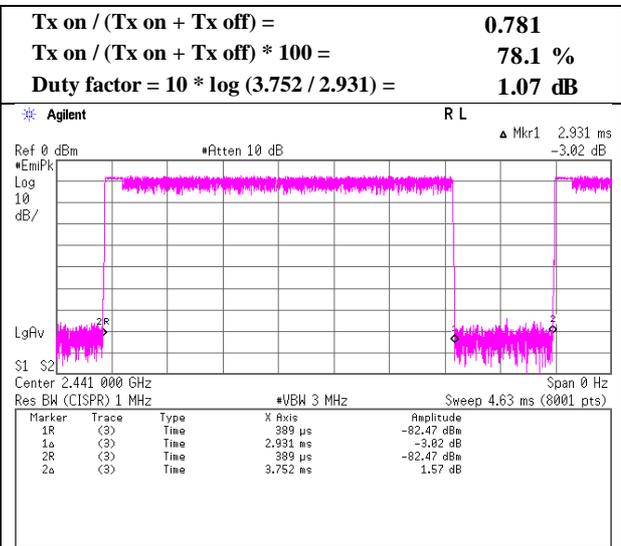
**DH5**



**2-DH5**



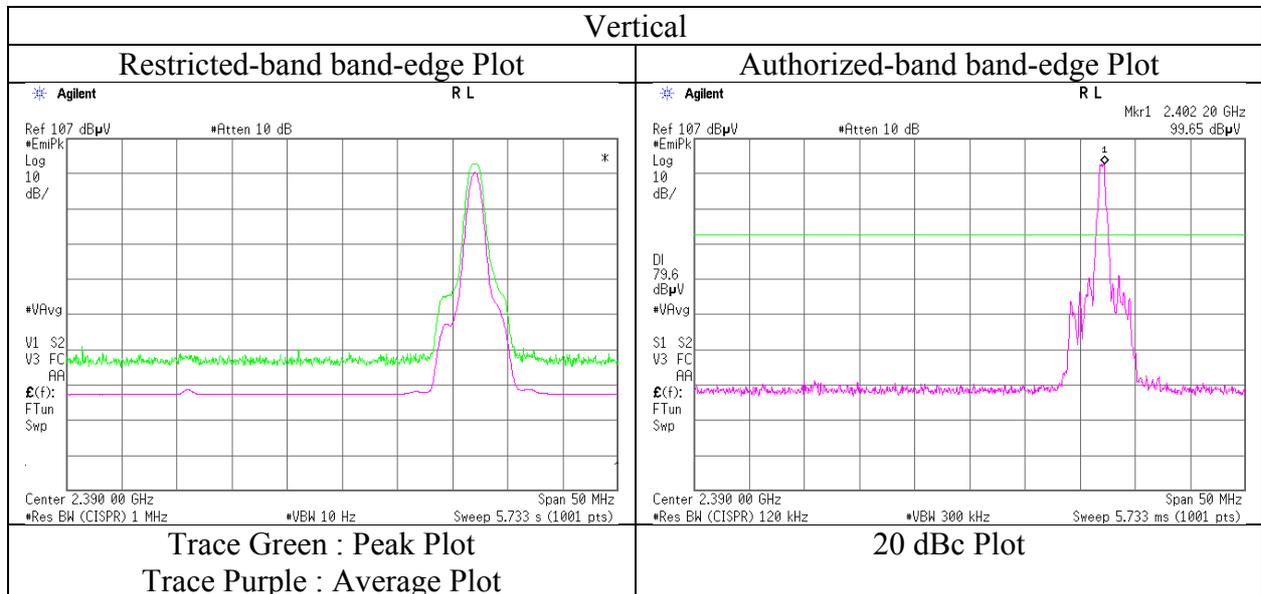
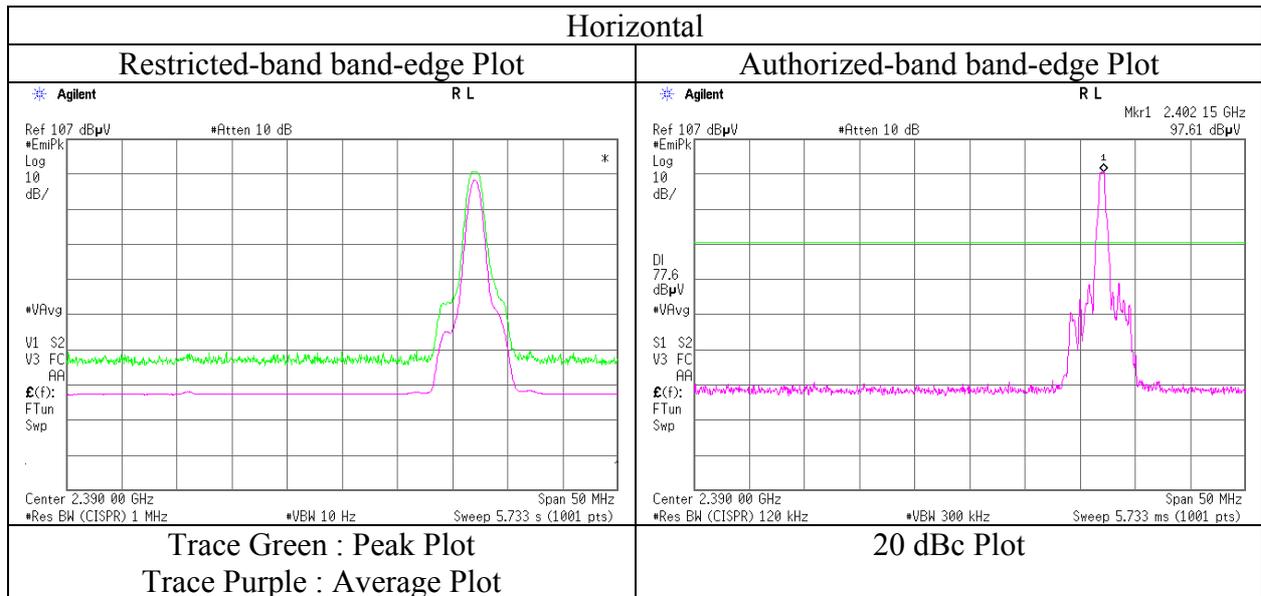
**3-DH5**





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

Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber
Report No.	10990291S-A
Date	October 15, 2015
Temperature / Humidity	23 deg. C / 48 % RH
Engineer	Yosuke Ishikawa
Mode	Tx, Hopping Off, DH5, 2402 MHz



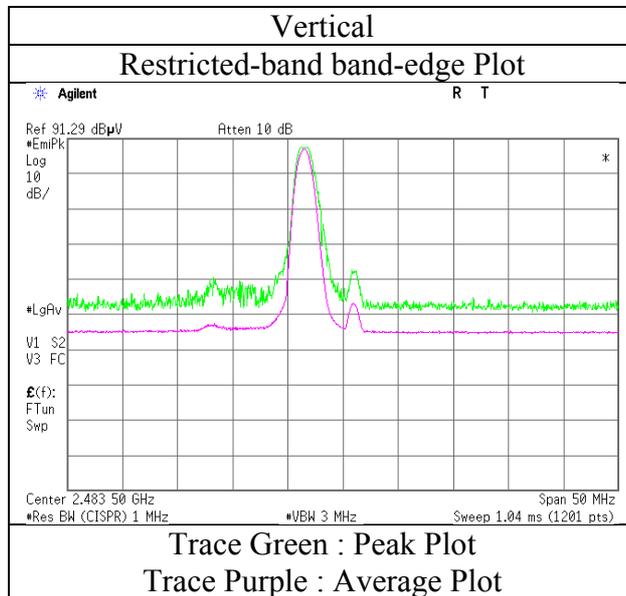
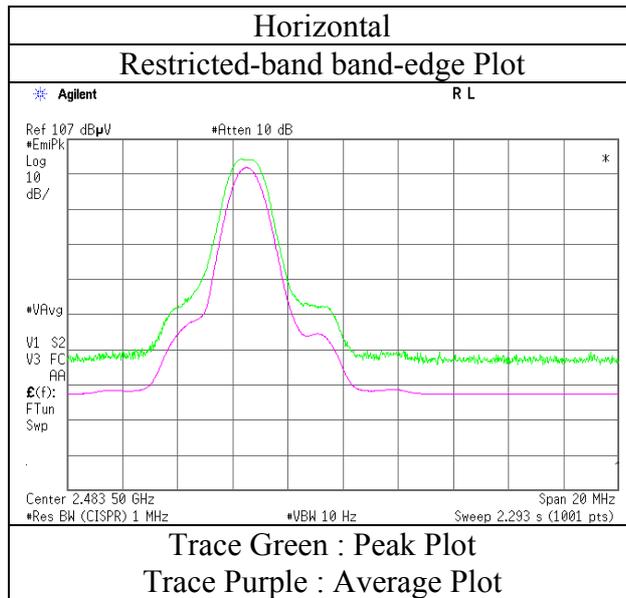
\* Final result of restricted band edge was shown in tabular data.





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

Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber
Report No.	10990291S-A
Date	October 15, 2015
Temperature / Humidity	23 deg. C / 48 % RH
Engineer	Yosuke Ishikawa
Mode	Tx, Hopping Off, DH5, 2480 MHz

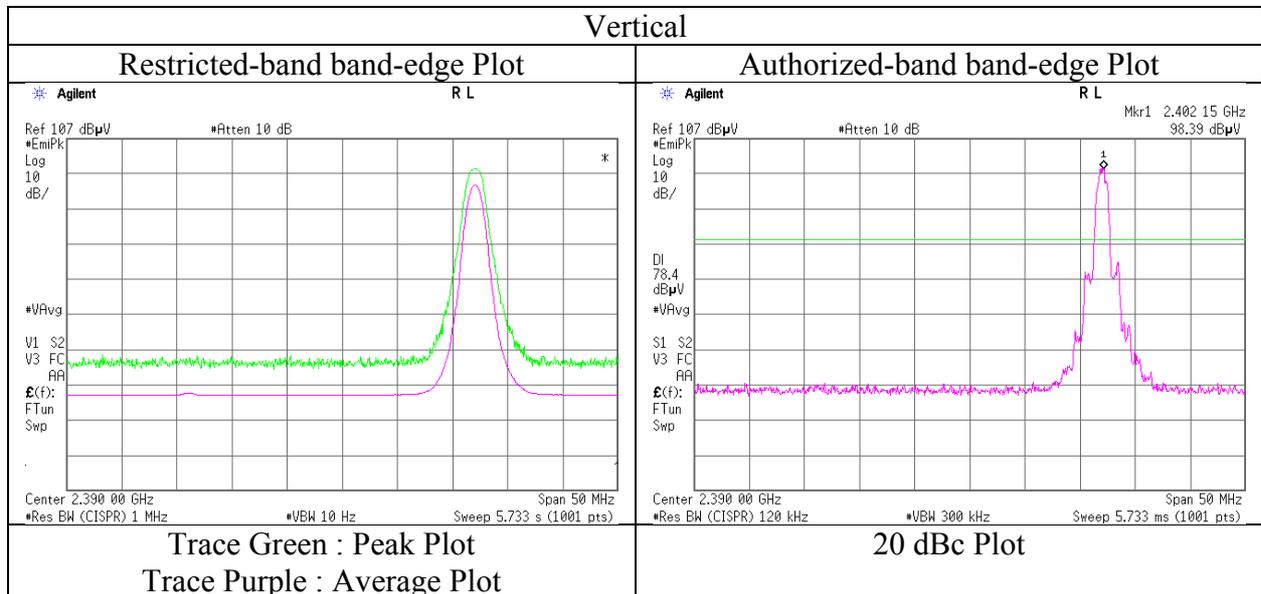
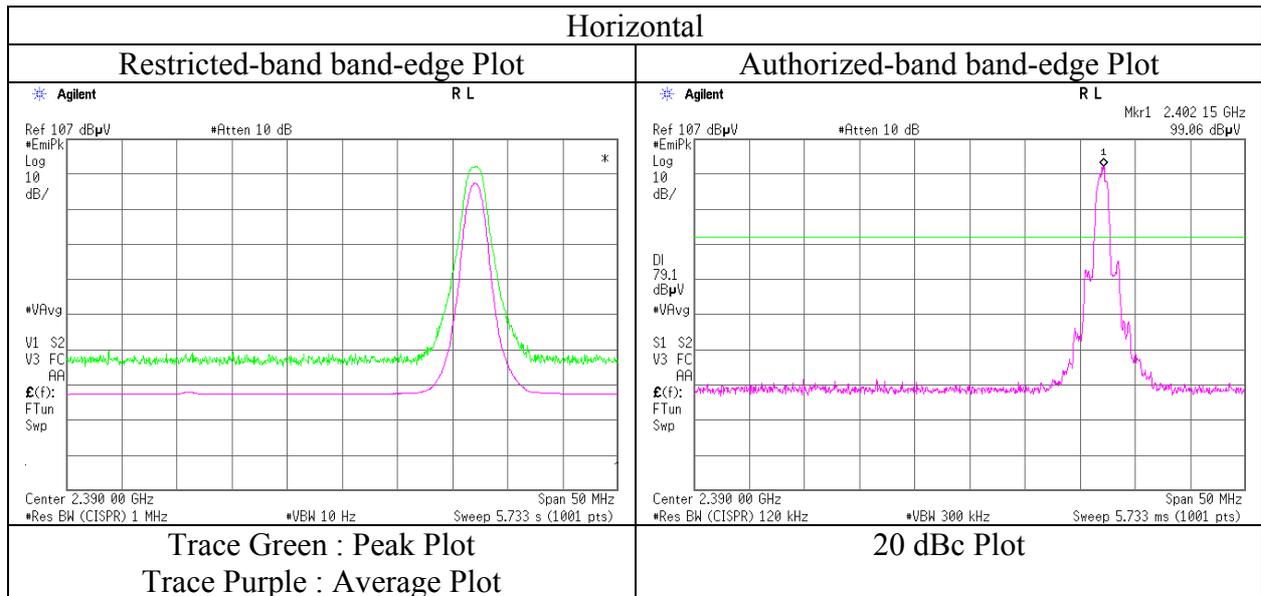


\* Final result of restricted band edge was shown in tabular data.



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

Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber
Report No.	10990291S-A
Date	October 15, 2015
Temperature / Humidity	23 deg. C / 48 % RH
Engineer	Yosuke Ishikawa
Mode	Tx, Hopping Off, 3-DH5, 2402 MHz



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

## Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber  
Report No. : 10990291S-A  
Date : October 15, 2015      October 21, 2015  
Temperature / Humidity : 23 deg. C / 48 % RH      24 deg. C / 44 % RH  
Engineer : Yosuke Ishikawa      Yosuke Ishikawa  
(1 - 18 GHz)      (30 - 1000 MHz,  
18-26.5 GHz)  
Mode : Tx, Hopping Off, 3-DH5, 2441 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	41.338	QP	22.4	13.9	7.1	31.9	0.0	11.5	40.0	28.5	200	179	
Hori.	140.054	QP	22.2	14.3	8.4	31.8	0.0	13.1	43.5	30.4	200	299	
Hori.	612.761	QP	21.7	19.2	8.4	31.6	0.0	17.7	46.0	28.3	100	348	
Hori.	2596.980	PK	50.1	28.0	13.8	40.9	1.2	52.2	73.9	21.7	100	88	
Hori.	4882.000	PK	47.7	31.7	5.8	39.5	1.2	46.9	73.9	27.0	100	189	
Hori.	7323.000	PK	46.4	36.9	7.2	40.2	1.2	51.5	73.9	22.4	100	0	
Hori.	9764.000	PK	46.3	38.5	8.2	39.5	1.2	54.7	73.9	19.2	100	0	
Hori.	2596.980	AV	41.5	28.0	13.8	40.9	1.2	43.6	53.9	10.3	100	88	
Hori.	4882.000	AV	36.7	31.7	5.8	39.5	1.2	35.9	53.9	18.0	100	189	
Hori.	7323.000	AV	33.7	36.9	7.2	40.2	1.2	38.8	53.9	15.1	100	0	
Hori.	9764.000	AV	34.1	38.5	8.2	39.5	1.2	42.5	53.9	11.4	100	0	
Vert.	41.338	QP	22.5	13.9	7.1	31.9	0.0	11.6	40.0	28.4	100	223	
Vert.	140.050	QP	22.2	14.3	8.4	31.8	0.0	13.1	43.5	30.4	100	305	
Vert.	612.761	QP	21.7	19.2	8.4	31.6	0.0	17.7	46.0	28.3	100	32	
Vert.	2596.980	PK	51.3	28.0	13.8	40.9	1.2	53.4	73.9	20.5	100	260	
Vert.	4882.000	PK	47.6	31.7	5.8	39.5	1.2	46.8	73.9	27.1	100	185	
Vert.	7323.000	PK	45.8	36.9	7.2	40.2	1.2	50.9	73.9	23.0	100	0	
Vert.	9764.000	PK	46.5	38.5	8.2	39.5	1.2	54.9	73.9	19.0	100	0	
Vert.	2596.980	AV	43.3	28.0	13.8	40.9	1.2	45.4	53.9	8.5	100	260	
Vert.	4882.000	AV	37.0	31.7	5.8	39.5	1.2	36.2	53.9	17.7	100	185	
Vert.	7323.000	AV	33.7	36.9	7.2	40.2	1.2	38.8	53.9	15.1	100	0	
Vert.	9764.000	AV	34.1	38.5	8.2	39.5	1.2	42.5	53.9	11.4	100	0	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.45 m / 3.0 m) = 1.2 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

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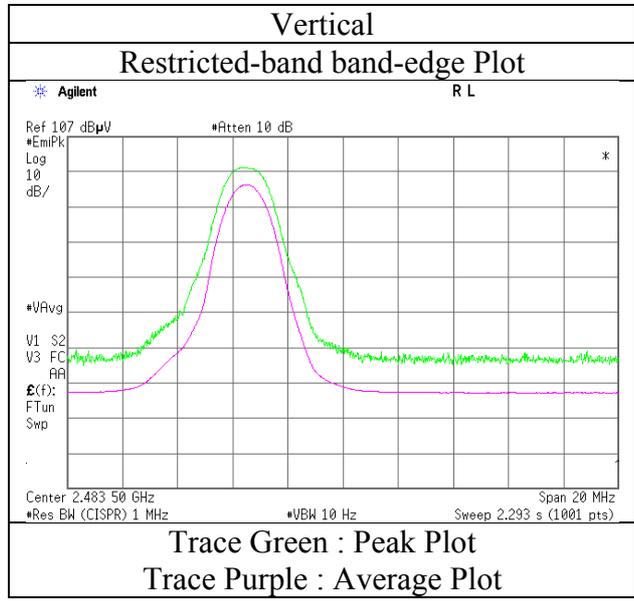
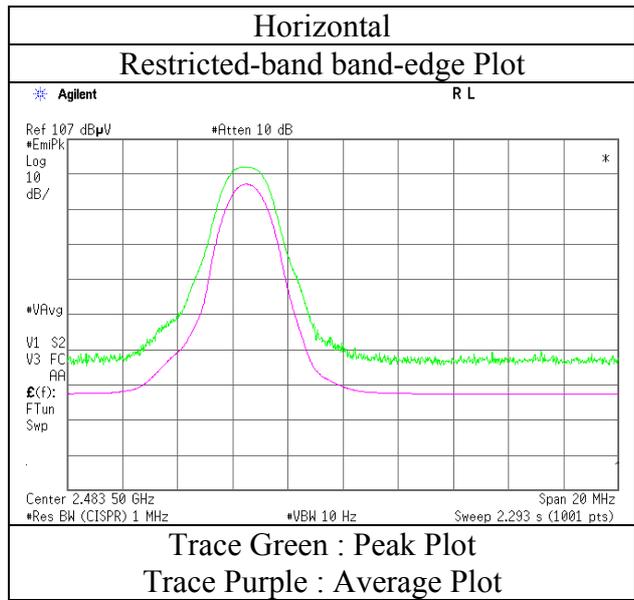
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

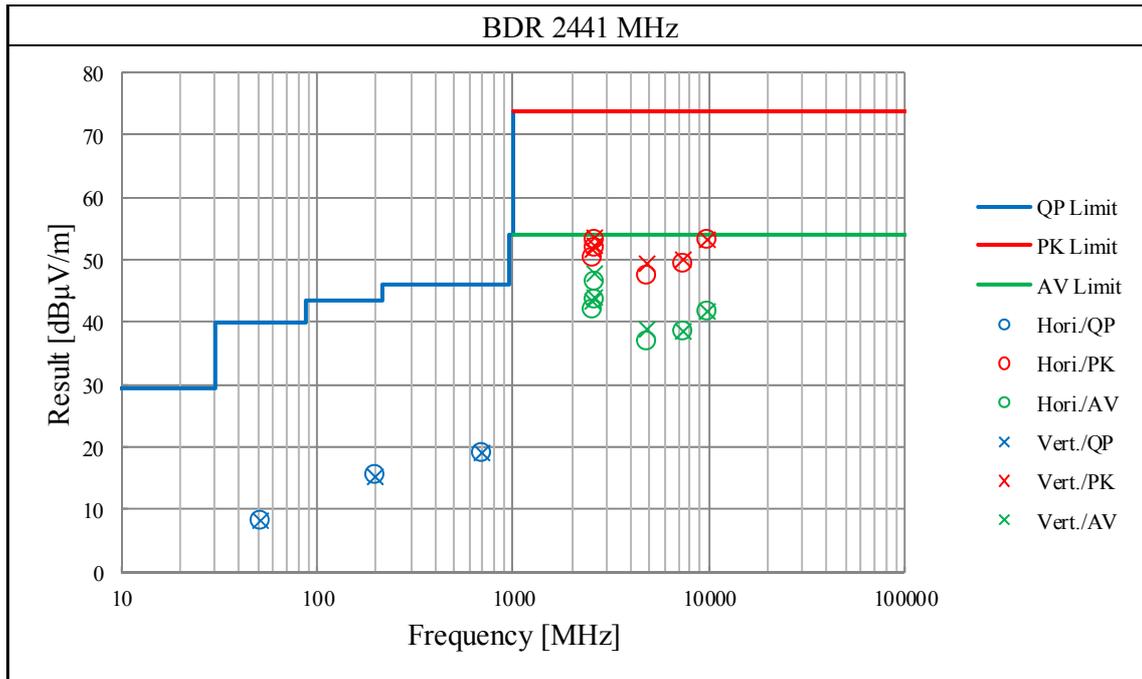
Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber
Report No.	10990291S-A
Date	October 15, 2015
Temperature / Humidity	23 deg. C / 48 % RH
Engineer	Yosuke Ishikawa
Mode	Tx, Hopping Off, 3-DH5, 2480 MHz



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

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

Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber	
Report No.	10990291S-A	
Date	October 15, 2015	October 21, 2015
Temperature / Humidity	23 deg. C / 48 % RH	24 deg. C / 44 % RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa
	(1 - 18 GHz)	(30 - 1000 MHz, 18-26.5 GHz)
Mode	Tx, Hopping Off, DH5, 2441 MHz	

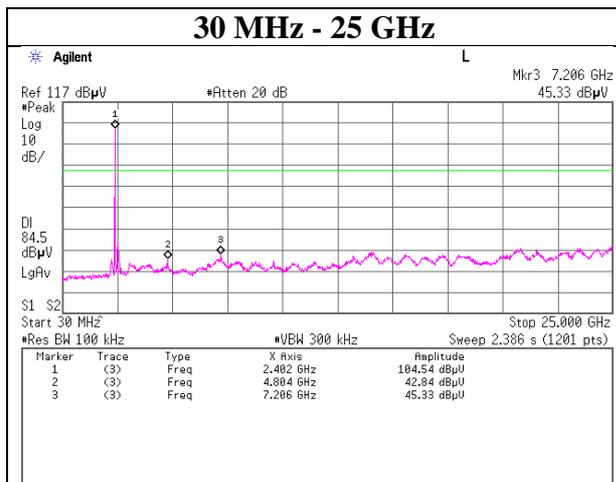
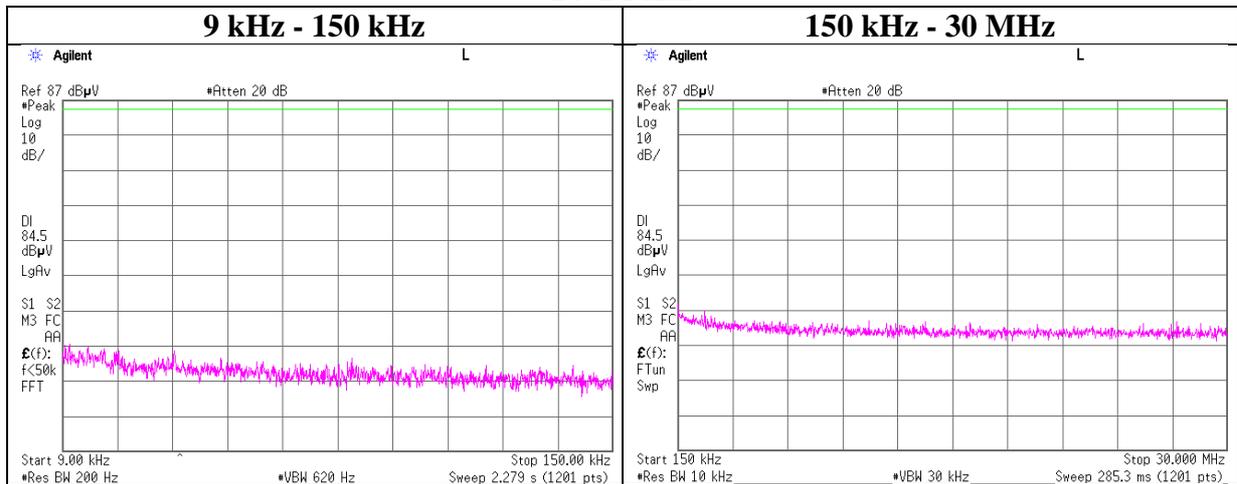


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping Off, DH5

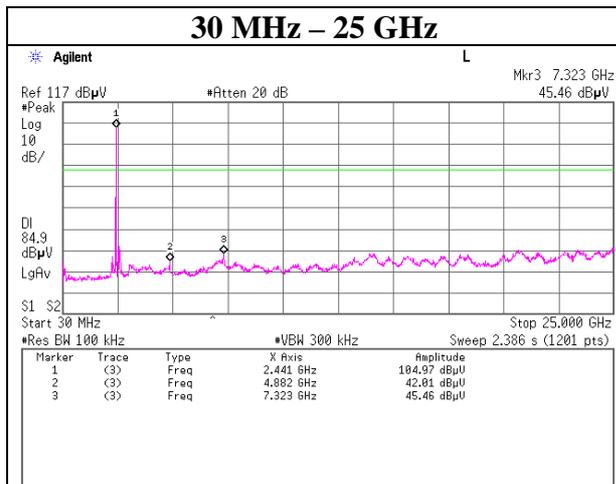
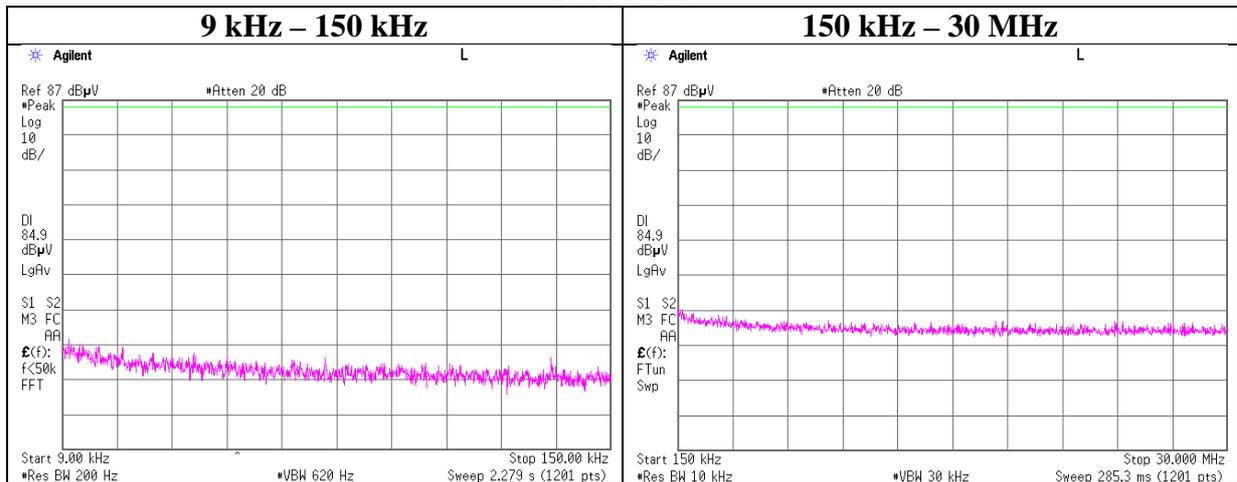
### 2402 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping Off, DH5

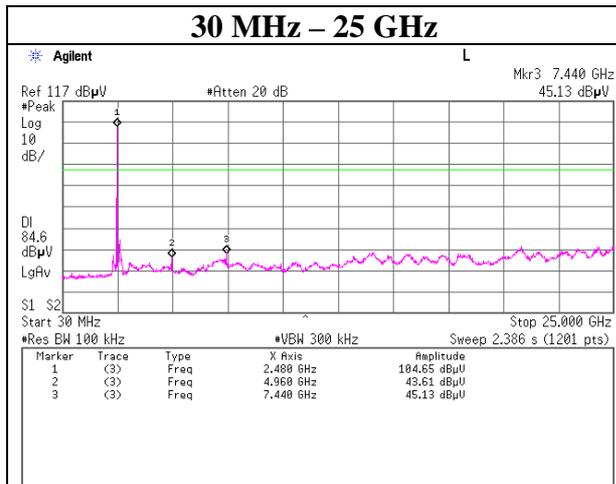
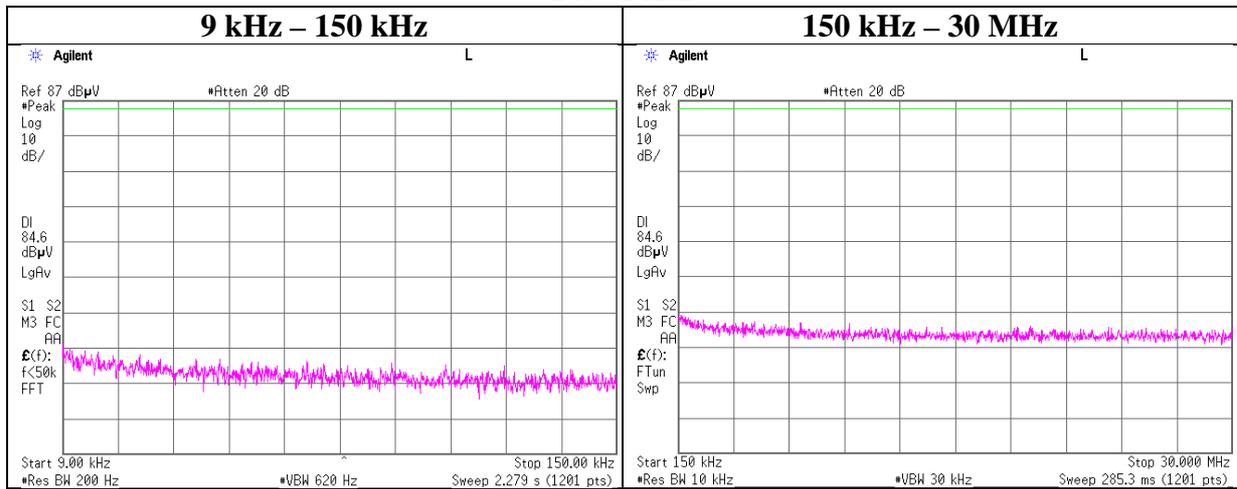
### 2441 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping Off, DH5

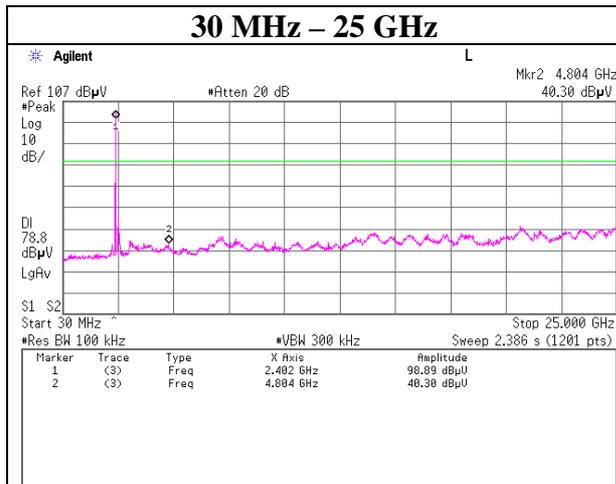
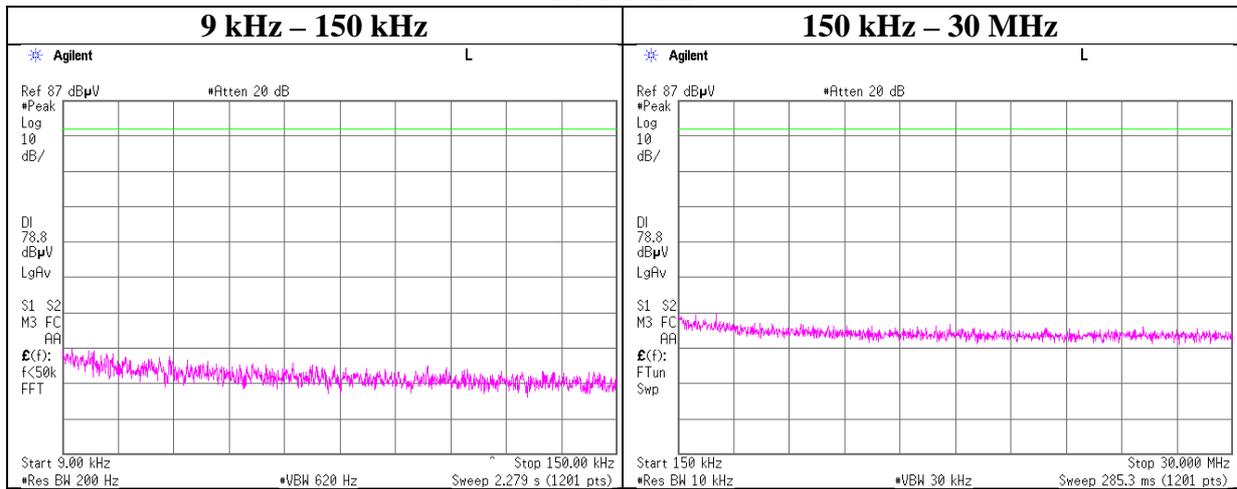
### 2480 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping Off, 3-DH5

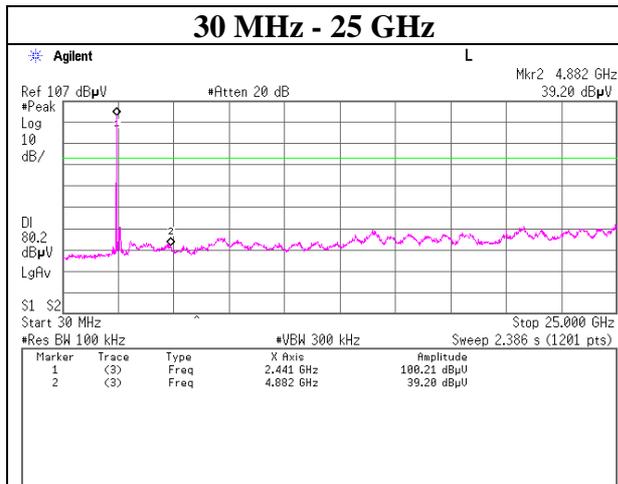
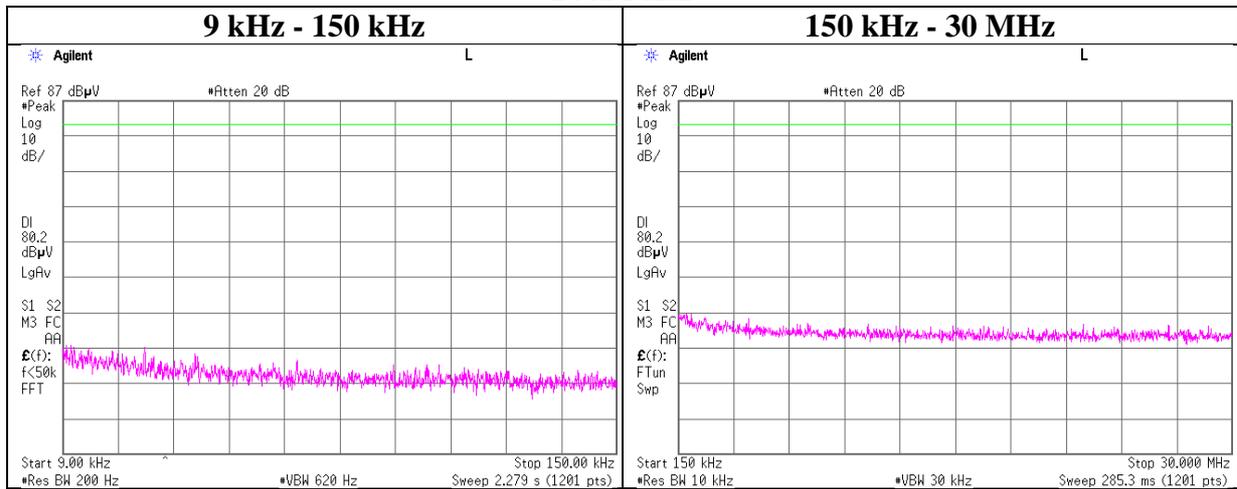
### 2402 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping Off, 3-DH5

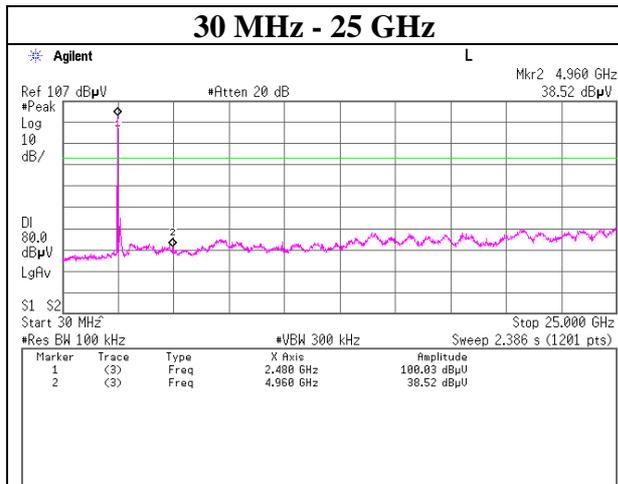
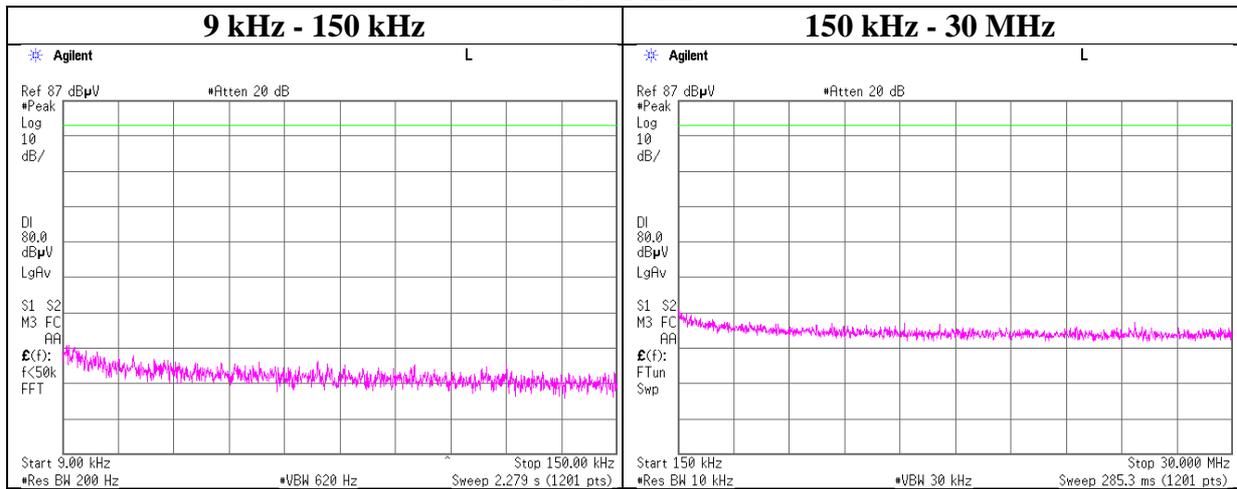
### 2441 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping Off, 3-DH5

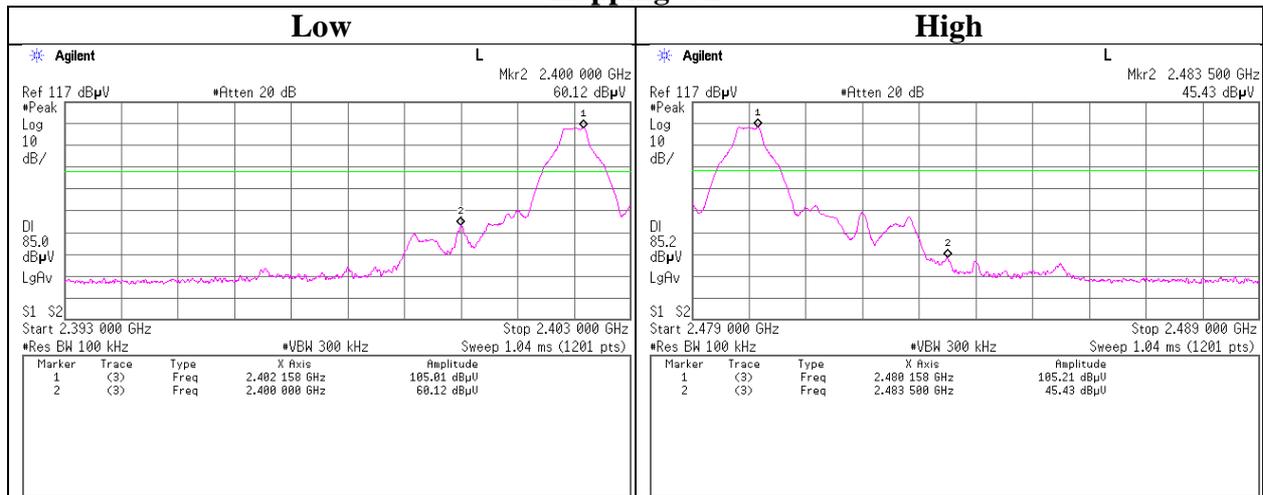
### 2480 MHz



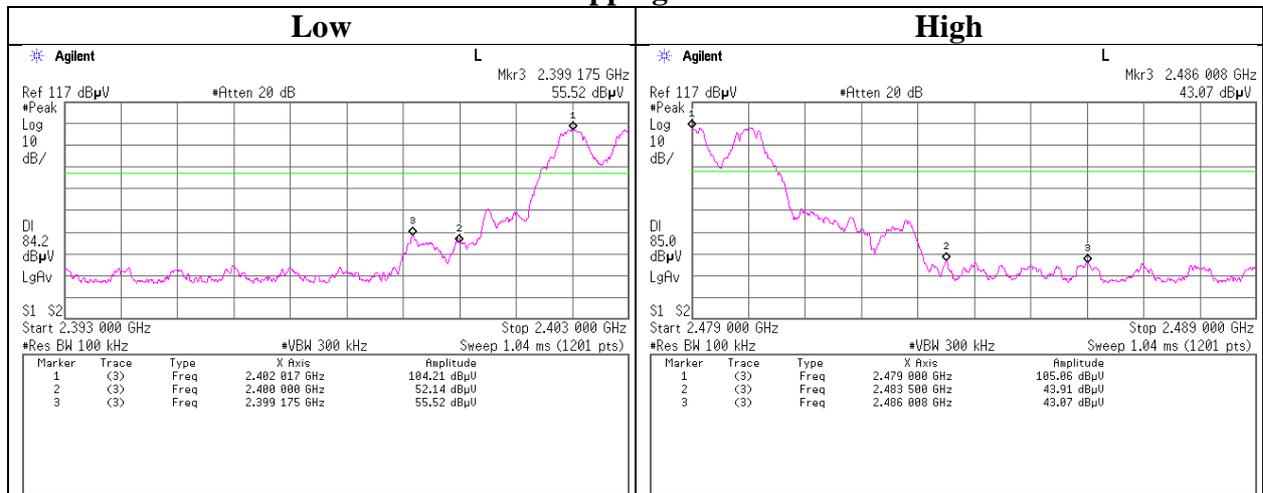
## Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, DH5

### Hopping On



### Hopping Off



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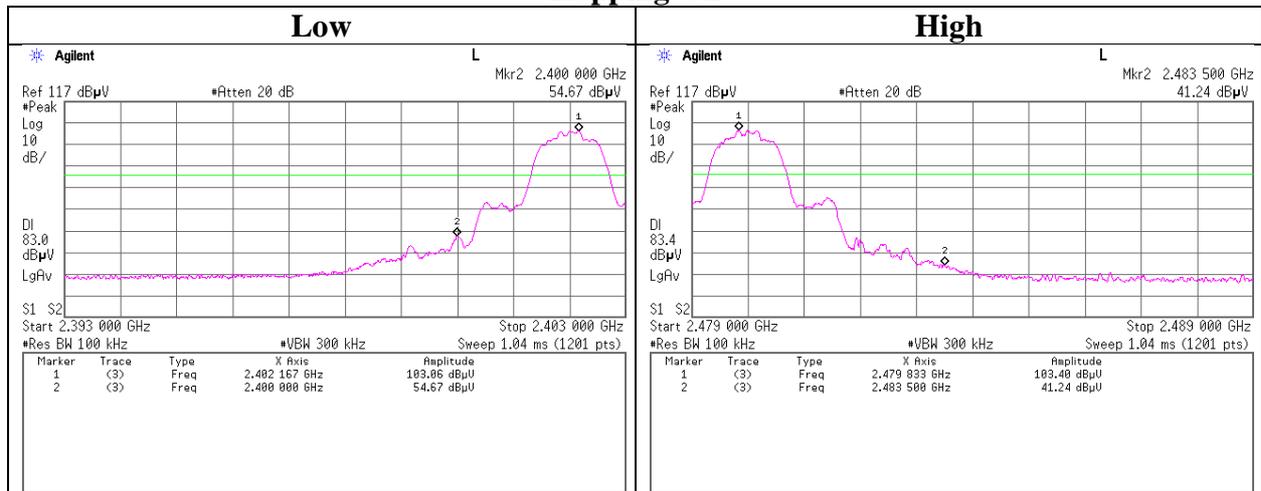
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

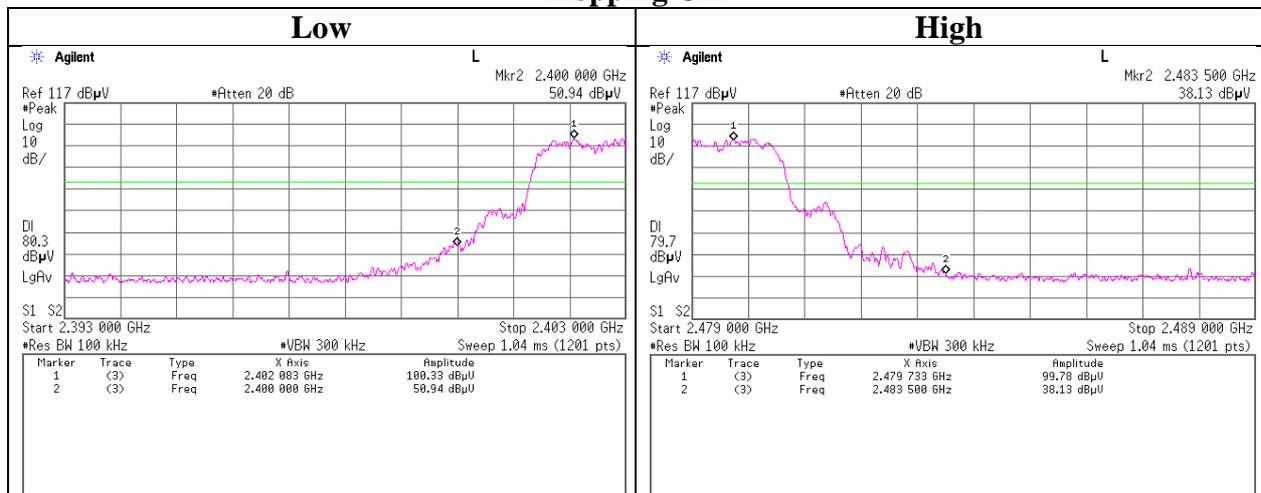
## Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 27, 2015
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Kenichi Adachi
Mode	Tx, 3-DH5

### Hopping On



### Hopping Off



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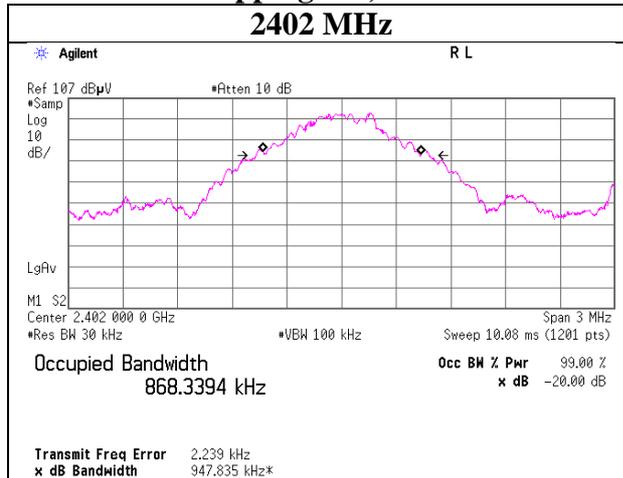
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

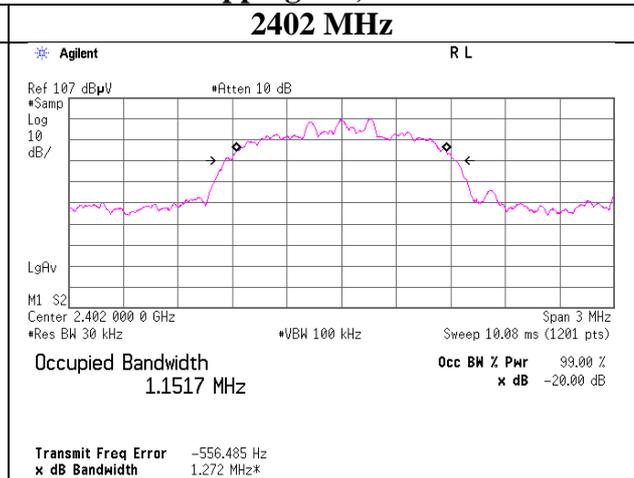
## 99 %Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 8, 2015
Temperature / Humidity	26 deg. C / 34 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping Off

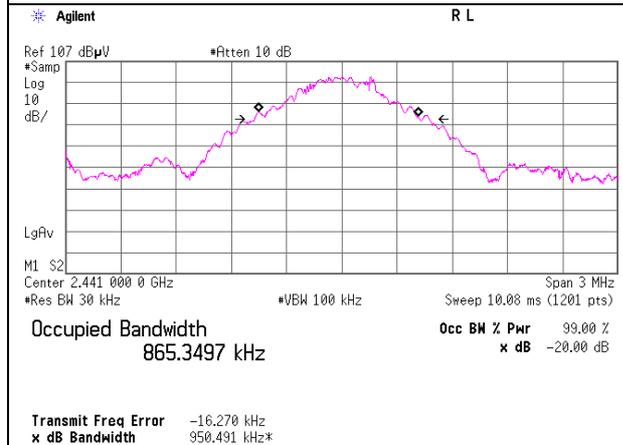
### Hopping Off, DH5



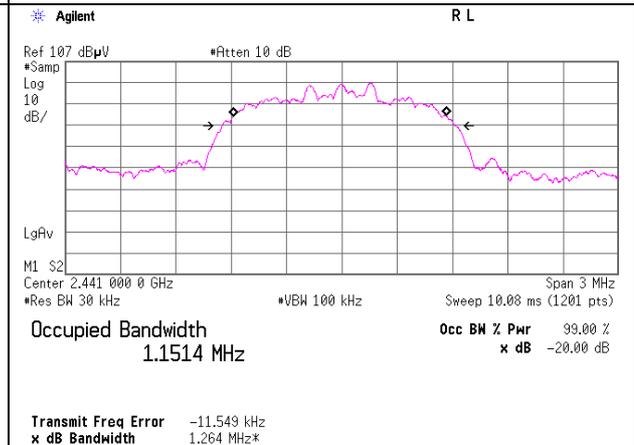
### Hopping Off, 3-DH5



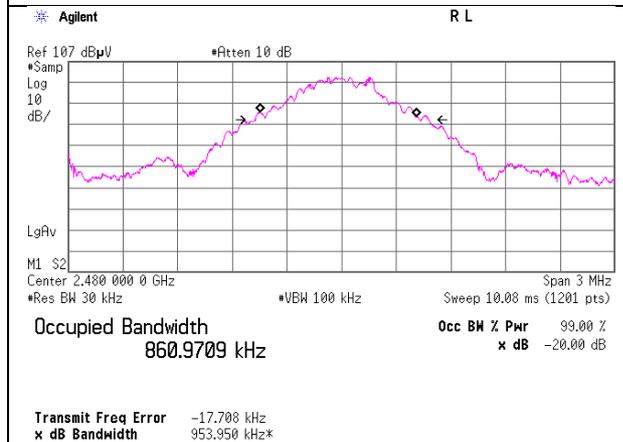
### 2441 MHz



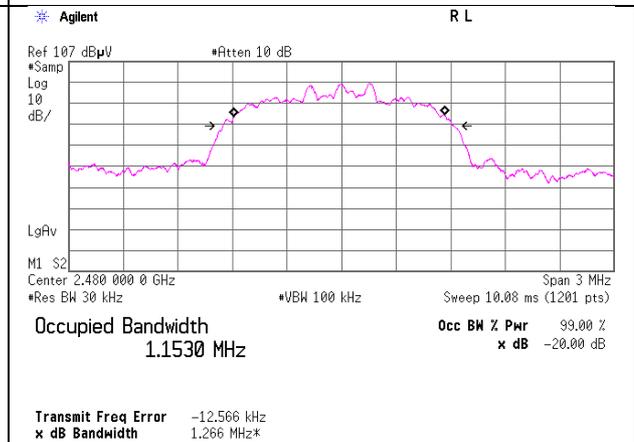
### 2441 MHz



### 2480 MHz



### 2480 MHz



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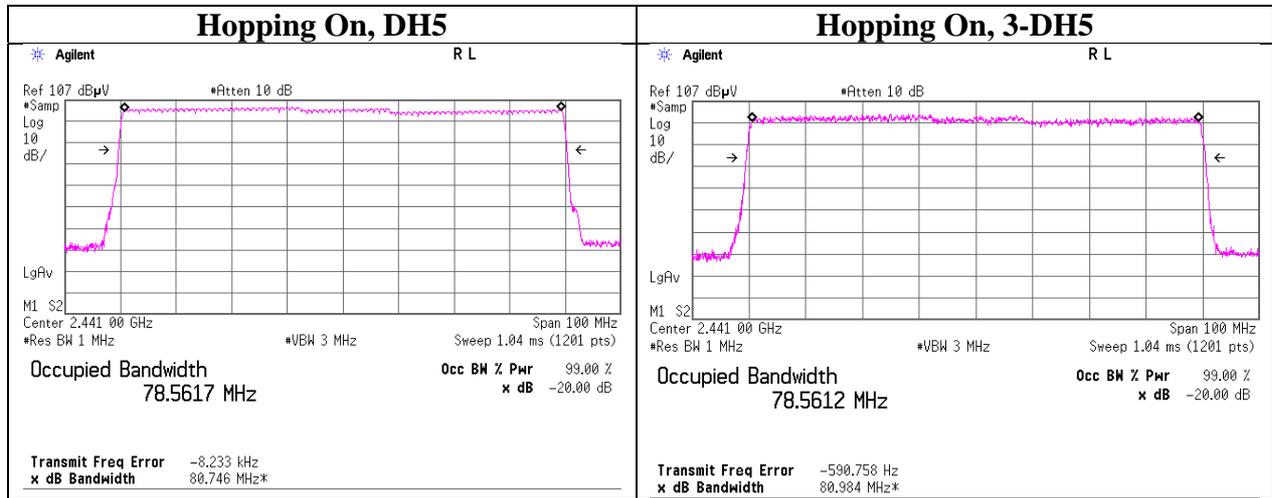
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## 99 % Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10990291S-A
Date	October 8, 2015
Temperature / Humidity	26 deg. C / 34 % RH
Engineer	Kenichi Adachi
Mode	Tx, Hopping On



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## APPENDIX 2: Test instruments

### Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2015/04/02 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2015/04/02 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT,RE	2015/03/26 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2015/04/09 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2015/03/11 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/12/24 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2015/05/27 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-0 0	JUN-12-14-01 8	RE	2015/06/08 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2015/05/19 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2015/08/11 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/10/30 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	RE	2015/09/16 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SAEC-03(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-03(SV SWR)	3	RE	2015/08/28 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV( RE,CE,RFI, MF)	-	RE,CE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2014/11/21 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2015/04/09 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2015/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2015/02/18 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2015/02/18 * 12
KAT3-11	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2015/08/31 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2014/11/22 * 12
SCC-B1/B3/B5/ B7/B8/B13/SRS E-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DS FA/141PE/14 1PE/141PE/1 41PE/NS490 6	-/0901-270(RF Selector)	RE	2015/04/17 * 12
SCC-B2/B4/B6/ B7/B8/B13/SRS E-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DS FA/141PE/14 1PE/141PE/1 41PE/NS490 6	-/0901-270(RF Selector)	RE	2015/04/17 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108 A	UHALP 9108-A 0893	RE	2014/11/22 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2014/10/30 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE,CE	2015/09/04 * 12
SJM-14	Measure	ASKUL	-	-	RE,CE	-
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NS A)	2	RE	2015/07/15 * 12
SCC-B12/B13/S RSE-02	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141 PE/NS4906	-/0901-270(RF Selector)	CE	2015/04/17 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2015/02/24 * 12
SAT3-10	Attenuator	JFW	50HF-003N	-	CE	2015/08/31 * 12
SOS-04	Humidity Indicator	A&D	AD-5681	4061512	CE	2014/12/24 * 12
STS-02	Digital Hitester	Hioki	3805-50	080997819	CE	2015/03/10 * 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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