



## **RADIO TEST REPORT cover sheet**

**Applicant** : **Clarion Co., Ltd.**

**Type of Equipment** : **Car Audio**

**Model No.** : **PH-3709, QY-5099, QY-5089**

**FCC ID** : **AX2QY5099**

The difference between 4 models (PH-3709, QY-5099, QY-5089 and QY-5092) doesn't affect the radio characteristics.

The electrical characteristics among those models are identical to each other.

Therefore, we use test report No. 10399701S-F-R1 and 10399701S-H-R1.

**Date**

**May 28, 2015**

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*T. Imamura*

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Toyokazu Imamura

Leader

Consumer Technology Division

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**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



Test report No. : 10399701S-F-R1  
Page : 1 of 49  
Issued date : May 28, 2015  
FCC ID : AX2QY5092

# RADIO TEST REPORT

**Test Report No.: 10399701S-F-R1**

**Applicant** : Clarion Co., Ltd.  
**Type of Equipment** : Navigation Unit  
**Model No.** : QY-5092  
**FCC ID** : AX2QY5092  
**Test regulation** : FCC Part15 Subpart C: 2014  
**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 limits of the above regulation.
4. The test results in this test 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 any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This report is a revised version of "10399701S-F ". "10399701S-F " is replaced with this report.

**Date of test:** September 19 to 21, 2014

**Tested by:**

Shinichi Takano  
Engineer  
Consumer Technology Division

**Approved by :**

Tatsuya Arai  
Engineer  
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".

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13-EM-F0429



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Facsimile: +81 463 50 6401

## **SECTION 1: Customer information**

Company Name : Clarion Co., Ltd.  
Address : 7-2 Shintoshin, Chuo-ku, Saitama-shi, Saitama, 330-0081 Japan  
Telephone Number : +81-48-601-3602  
Facsimile Number : +81-48-601-3802  
Contact Person : Matsuhiro Hirano

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

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

Type of Equipment : Navigation Unit  
Model Number : QY-5092  
Serial Number : Refer to Section 4.2  
Rating : DC10-16V  
Country of Mass-production : China  
Condition of EUT : Engineering prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Receipt Date of Sample : September 8, 2014  
Modification of EUT : No modification by the test lab.

### **2.2 Product description**

Model: QY-5092 (referred to as the EUT in this report) is a Navigation Unit.

Clock frequency(ies) in the system : 5.6448MHz, 6.144MHz, 8.192MHz, 12.2896MHz, 12.8MHz,  
24.576MHz, 26MHz, 27MHz, 28.224MHz, 33.231MHz, 41.6MHz,  
48MHz

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<Bluetooth part>

Equipment type : Transceiver  
Frequency of operation : 2402-2480MHz  
Bandwidth & channel spacing : 79MHz & 1MHz  
Type of modulation : GFSK,  $\pi/4$ DQPSK, 8DPSK  
Antenna type : Metal Sheet  
Antenna gain : -1.11dBi  
Antenna connector type : U.FL  
Operation temperature range : -30 to +70 deg.C.  
ITU code : F1D, G1D

<Wireless LAN part>

Equipment type : Transceiver  
Frequency of operation : 2412-2462MHz  
Bandwidth & channel spacing : 20MHz & 5MHz  
Type of modulation : CCK, OFDM  
Antenna type : Metal Sheet  
Antenna gain : -1.11dBi  
Antenna connector type : U.FL  
Operation temperature range : -30 to +70 deg.C.  
ITU code : G1D, D1D

\* For Wireless LAN part, refer to the test report: 10399701S-H-R1.

FCC 15.31 (e)

The EUT provides stable voltage (DC3.3V) constantly to the wireless transmitter regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

FCC 15.203

The equipment and its antenna comply with the requirement since the antenna is built in the equipment and it cannot be replaced by end users.

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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 August 15, 2014 and effective October 14, 2014

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits, general requirements  
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,  
and 5725-5850MHz

\* The revision on August 15, 2014 does not affect the test specification applied to the EUT.

The EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report 10399701S-J.

**3.2 Procedures & Results**

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results	
Conducted emission	ANSI C63.4:2009 7. AC powerline conducted emission measurements	FCC 15.207	-	N/A *1)	-	-	
Carrier frequency separation	FCC Public Notice DA 00-705 & ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.247 (a)(1)	Conducted	N/A	*See data.	Complied	
20dB bandwidth	FCC Public Notice DA 00-705 & ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.247 (a)(1)	Conducted	N/A		-	
Number of hopping frequency	FCC Public Notice DA 00-705 & ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.247 (a)(1)(iii)	Conducted	N/A		Complied	
Dwell time	FCC Public Notice DA 00-705 & ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.247 (a)(1)(iii)	Conducted	N/A		Complied	
Maximum peak output power	FCC Public Notice DA 00-705 & ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.247 (b)(1)	Conducted	N/A		Complied	
Band edge compliance & Spurious emission	FCC Public Notice DA 00-705 & ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.247 (d) 15.209	Conducted/ Radiated	N/A *2)		6.5 dB Freq.: 135.200 MHz Detection: Quasi-Peak Polarization: Vertical Mode: Tx 2480MHz, 3-DH5	Complied
Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422							
*1) The test is not applicable since the EUT has no AC mains.							
*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 12.2.7.							

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2009 13. Measurement of intentional radiators, RSS-Gen 6.6	-	Conducted	-	-

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

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

### 3.4 Uncertainty

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

Item	Frequency range	No.1 SAC <sup>*1</sup> /SR <sup>*2</sup> (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
<b>Radiated emission</b> (Measurement distance: 3m)	9kHz-30MHz	3.7 dB	3.7 dB	3.6 dB
	30MHz-300MHz	4.8 dB	5.0 dB	4.8 dB
	300MHz-1GHz	5.0 dB	5.0 dB	4.8 dB
	1GHz-15GHz	4.9 dB	4.9 dB	4.9 dB
<b>Radiated emission</b> (Measurement distance: 1m)	15GHz-18GHz	5.7 dB	5.6 dB	5.6 dB
	18GHz-40GHz	5.2 dB	4.3 dB	4.3 dB

\*1: SAC=Semi-Anechoic Chamber

\*2: SR= Shielded Room is applied besides radiated emission

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

#### Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.6dB

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 1.4dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 2.8dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB

Bandwidth measurement uncertainty for this test was: (±) 5.4%

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Telephone: +81 463 50 6400

Facsimile: +81 463 50 6401



### 3.5 Test location

UL Japan, Inc. Shonan EMC Lab.

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

Telephone number : +81 463 50 6400

Facsimile number: +81 463 50 6401

JAB Accreditation No. : RTL02610

	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
<input checked="" type="checkbox"/> No.1 semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input checked="" type="checkbox"/> No.2 semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.3 semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
<input type="checkbox"/> No.4 semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
<input type="checkbox"/> No.1 shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.2 shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.3 shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
<input type="checkbox"/> No.4 shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
<input checked="" type="checkbox"/> No.5 shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.6 shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

### 3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

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

**4.1 Operating mode**

Test item	Operating mode	Tested frequency
Carrier frequency separation	Transmitting Hopping ON (DH5 / 3-DH5) / Inquiry, Payload: PRBS9	-
20dB bandwidth	Transmitting Hopping OFF (DH5 / 3-DH5) / Inquiry, Payload: PRBS9	2402MHz, 2441MHz, 2480MHz
Number of hopping frequency	Transmitting Hopping ON (DH5 / 3-DH5) / Inquiry, Payload: PRBS9	-
Dwell time	Transmitting (Hopping ON), Payload: PRBS9 - DH1, - DH3, - DH5 - 3-DH1, - 3-DH3, - 3-DH5 -Inquiry	-
Maximum peak output power	Transmitting Hopping OFF, Payload: PRBS9 - DH5, - 2-DH5, - 3-DH5	2402MHz, 2441MHz, 2480MHz
Spurious emission (Conducted)	Transmitting (DH5 / 3-DH5), Payload: PRBS9 -Hopping OFF	Band edge compliance: 2402MHz, 2480MHz Spurious emission: 2402MHz, 2441MHz, 2480MHz
Band edge compliance & Spurious emission (Radiated)	Transmitting (DH5 / 3-DH5), Payload: PRBS9 -Hopping OFF	
99% occupied bandwidth	Transmitting (DH5 / 3-DH5), Payload: PRBS9 / Inquiry -Hopping ON -Hopping OFF	2402MHz, 2441MHz, 2480MHz

\*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload (except Dwell time test).

\*Remarks: Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not affect the output power and bandwidth of the EUT.  
The carrier separation may be less than 20 dB bandwidth, therefore 125mW power limit was applied to it.

We removed 2-DH mode (2 Mb/s EDR: pi/4DQPSK) except power measurement by using 3-DH mode (3 Mb/s EDR: 8DPSK) as a representative.

EUT has the power settings by the software as follows;

Power settings	Fixed
Software	Tera Term ver. 4.66

**Justification:** The system was configured in typical fashion (as customer would normally use it) for testing.

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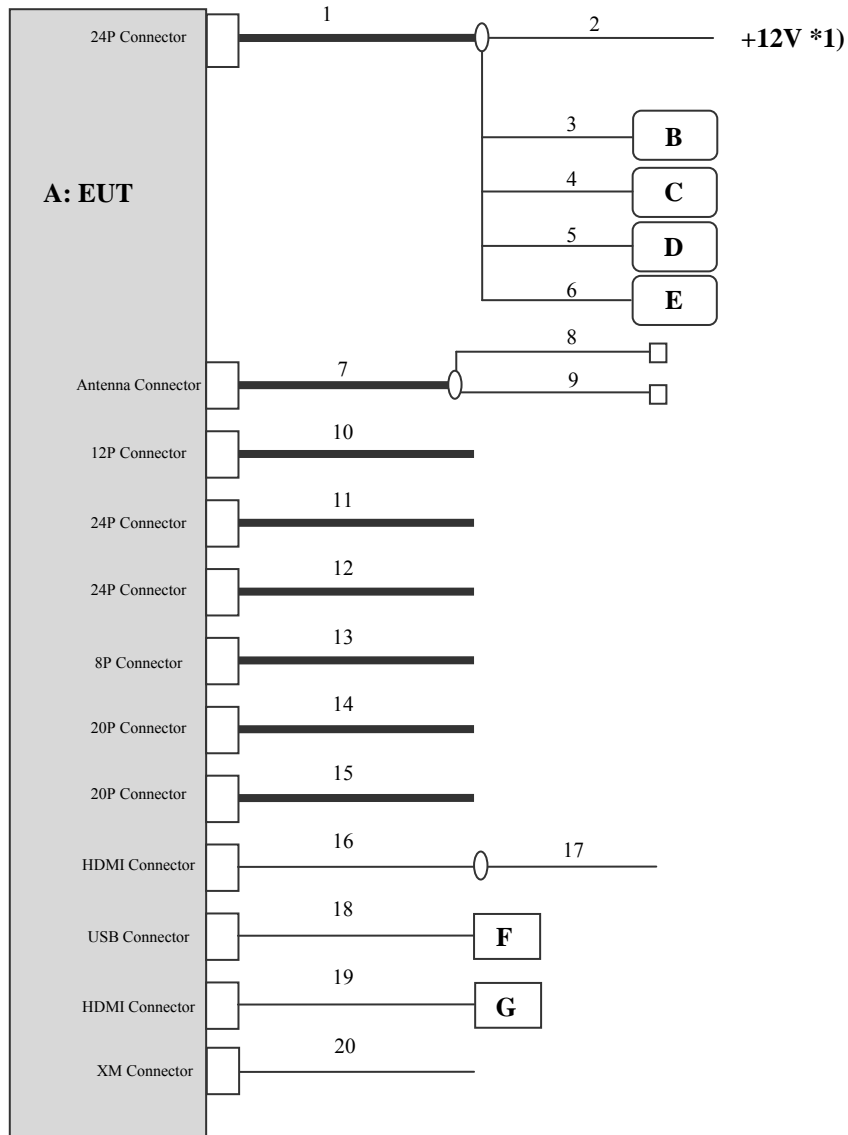
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## 4.2 Configuration and peripherals

□ : Terminated



\* Test data was taken under worse case conditions.

\*1) DC power supply (Model No.: PAN35-10A) was used for DC 12V input.

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**Description of EUT and Auxiliary equipment**

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Navigation Unit	QY-5092	*2)	Clarion	EUT
B	Speaker	KFC-RS160	-	KENWOOD	-
C	Speaker	KFC-RS160	-	KENWOOD	-
D	Speaker	KFC-RS160	-	KENWOOD	-
E	Speaker	KFC-RS160	-	KENWOOD	-
F	USB Memory	MF-RSU204GBK	BR00007341	ELECOM	-
G	GPS Antenna	-	0960138000763	-	-

\*2) #57: Inquiry mode, #56: Other

**List of cables used**

No.	Item	Length(m)	Shield (Cable)	Shield (Connector)	Remarks
1	24P Connector (Gray)	2.0	Unshielded	Unshielded	-
2	+B, ACC, GND	1.2	Unshielded	Unshielded	-
3	Speaker Front Left	1.8	Unshielded	Unshielded	-
4	Speaker Front Right	1.8	Unshielded	Unshielded	-
5	Speaker Rear Left	1.8	Unshielded	Unshielded	-
6	Speaker Rear Right	1.8	Unshielded	Unshielded	-
7	Antenna Connector	0.2	Shielded	Shielded	-
8	Main antenna	2.0	Shielded	Shielded	-
9	Sub antenna	1.2	Shielded	Shielded	-
10	12P Connector (Gray)	2.2	Unshielded	Unshielded	-
11	24P Connector (Blue)	2.2	Unshielded	Unshielded	-
12	24P Connector (Gray)	2.2	Unshielded	Unshielded	-
13	8P Connector (Gray)	2.5	Unshielded	Unshielded	-
14	20P Connector (Gray)	2.2	Unshielded	Unshielded	-
15	28P Connector (Gray)	2.2	Unshielded	Unshielded	-
16	HDMI Connector	1.0	Shielded	Shielded	-
17	HDMI	1.8	Shielded	Shielded	-
18	USB connector	2.5	Shielded	Shielded	-
19	GPS connector	2.5	Shielded	Shielded	-
20	XM connector	2.0	Shielded	Shielded	-

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## **SECTION 5: Carrier frequency separation**

### **Test procedure**

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 1.

## **SECTION 6: 20dB bandwidth & Occupied bandwidth (99%)**

### **Test procedure**

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 1.

## **SECTION 7: Number of hopping frequency**

### **Test procedure**

The Number of Hopping Frequency was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 1.

## **SECTION 8: Dwell time**

### **Test procedure**

The Dwell time was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 1.

## **SECTION 9: Maximum peak output power**

### **Test procedure**

The Maximum Peak Output Power was measured with a power meter connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 1.

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## **SECTION 10: Radiated emission**

### **10.1 Operating environment**

Test room : See test data (APPENDIX 1)  
Temperature : See test data (APPENDIX 1)  
Humidity : See test data (APPENDIX 1)

### **10.2 Test configuration**

EUT was placed on a platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity. The rear of EUT, including its peripherals was aligned and flushed with rear of tabletop. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. Photographs of the set up are shown in APPENDIX 3.

### **10.3 Test conditions**

Frequency range : 30MHz - 25GHz  
EUT position : Table top

### **10.4 Test procedure**

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 15GHz) / 1m (above 15GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detection.

Frequency	30 - 1000MHz	1 - 25GHz		20dBc
Detection Type	: Quasi-Peak	Peak	* Average	Peak
IF Bandwidth	: 120kHz	RBW:1MHz VBW:3MHz	RBW:1MHz VBW:10Hz	RBW: 100kHz VBW: 300kHz

\* When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold. Although 00-705 accepts VBW=10Hz for AV measurements, confirmed that superfluous smoothing was not performed.

The carrier level and noise levels were confirmed at angle of 35.5 or 39 deg. based on the product specification to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Antenna polarization \ Test item	Carrier *1)	Spurious emission (Below 1GHz)	Spurious emission (Above 1GHz)
Horizontal	35.5 deg.	35.5 deg.	35.5 deg.
Vertical	35.5 deg.	35.5 deg.	35.5 deg.

\*1) with spurious emissions near carrier frequency

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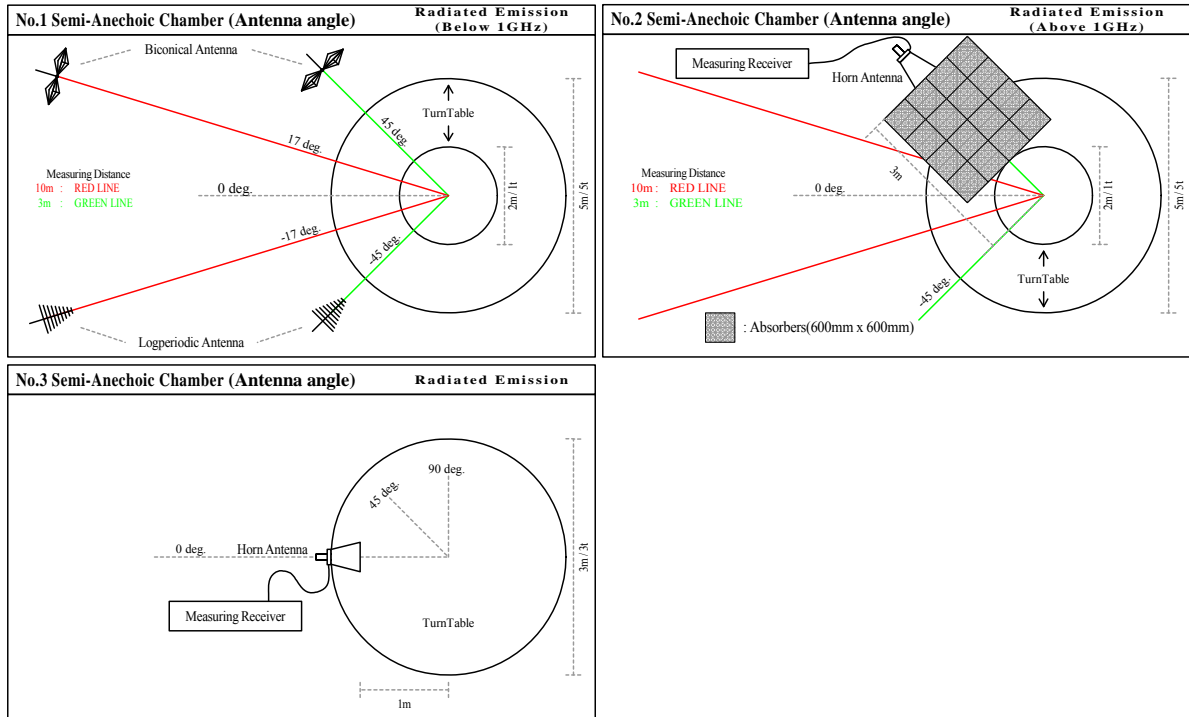
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Facsimile: +81 463 50 6401

**Figure 1. Antenna angle**



### 10.5 Band edge

Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209 and band edge level at 2400MHz is below the 20dBc. Refer to the data.

### 10.6 Results

Summary of the test results: Pass \*No noise was detected above the 5<sup>th</sup> order harmonics.

Refer to APPENDIX 1.

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Facsimile: +81 463 50 6401

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## **SECTION 11: Spurious emissions (Antenna port conducted)**

### **Test procedure**

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.

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.

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=10kHz)

Summary of the test results: Pass

Refer to APPENDIX 1

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Facsimile: +81 463 50 6401



## Contents of APPENDIXES

### **APPENDIX 1: Data of Radio tests**

20dB bandwidth and Carrier frequency separation  
Number of hopping frequency  
Dwell time  
Maximum peak output power  
Radiated emission  
Spurious emission (Antenna port conducted)  
Occupied bandwidth

### **APPENDIX 2: Test instruments**

Test instruments

### **APPENDIX 3: Photographs of test setup**

Radiated emission

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**Shonan EMC Lab.**

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## APPENDIX 1: Data of Radio tests

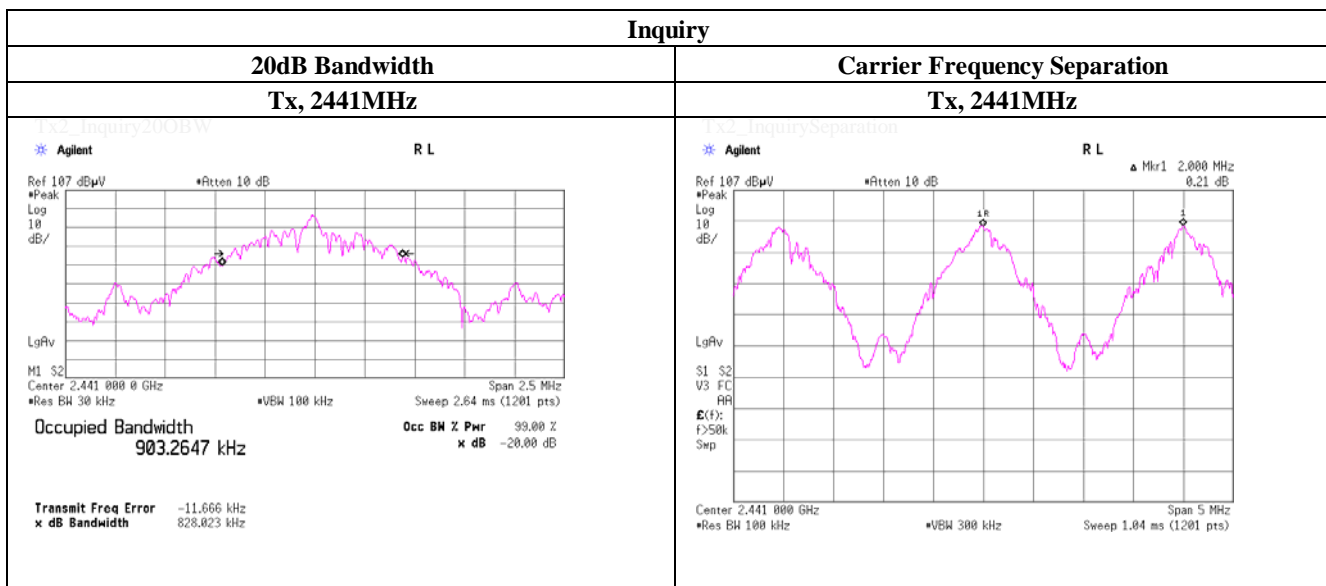
### 20dB Bandwidth and Carrier Frequency Separation

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	September 19, 2014	
Temperature / Humidity	26deg.C , 48%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth, BDR, PRBS9	

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency Separation [MHz]
DH5	2402.0	0.960	1.000	>= 0.640
DH5	2441.0	1.019	1.000	>= 0.679
DH5	2480.0	1.021	1.000	>= 0.681
Inquiry	2441.0	0.828	2.000	>= 0.552

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

No limit applies to 20dB Bandwidth.



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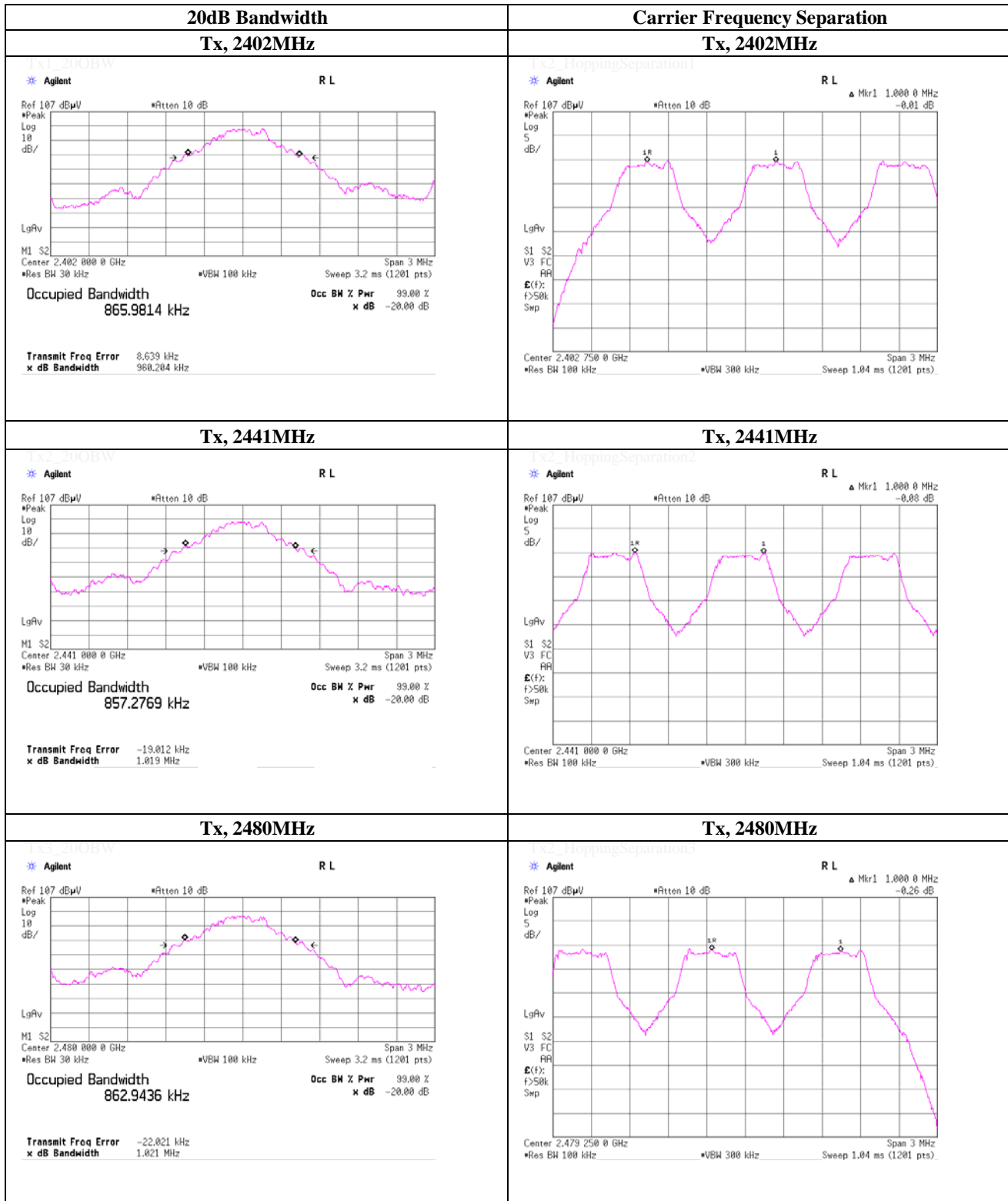
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## 20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, BDR, PRBS9



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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## 20dB Bandwidth and Carrier Frequency Separation

Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
 Date                         September 19, 2014  
 Temperature / Humidity   26deg.C     , 48%RH  
 Engineer                  Akio Hayashi  
 Mode                        Tx, Bluetooth, EDR, PRBS9

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency Separation [MHz]
3-DH5	2402.0	1.290	1.000	>= 0.860
3-DH5	2441.0	1.277	1.000	>= 0.852
3-DH5	2480.0	1.280	1.000	>= 0.854

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

No limit applies to 20dB Bandwidth.

Tx2\_Inquiry20OBW

Tx2\_InquirySeparation

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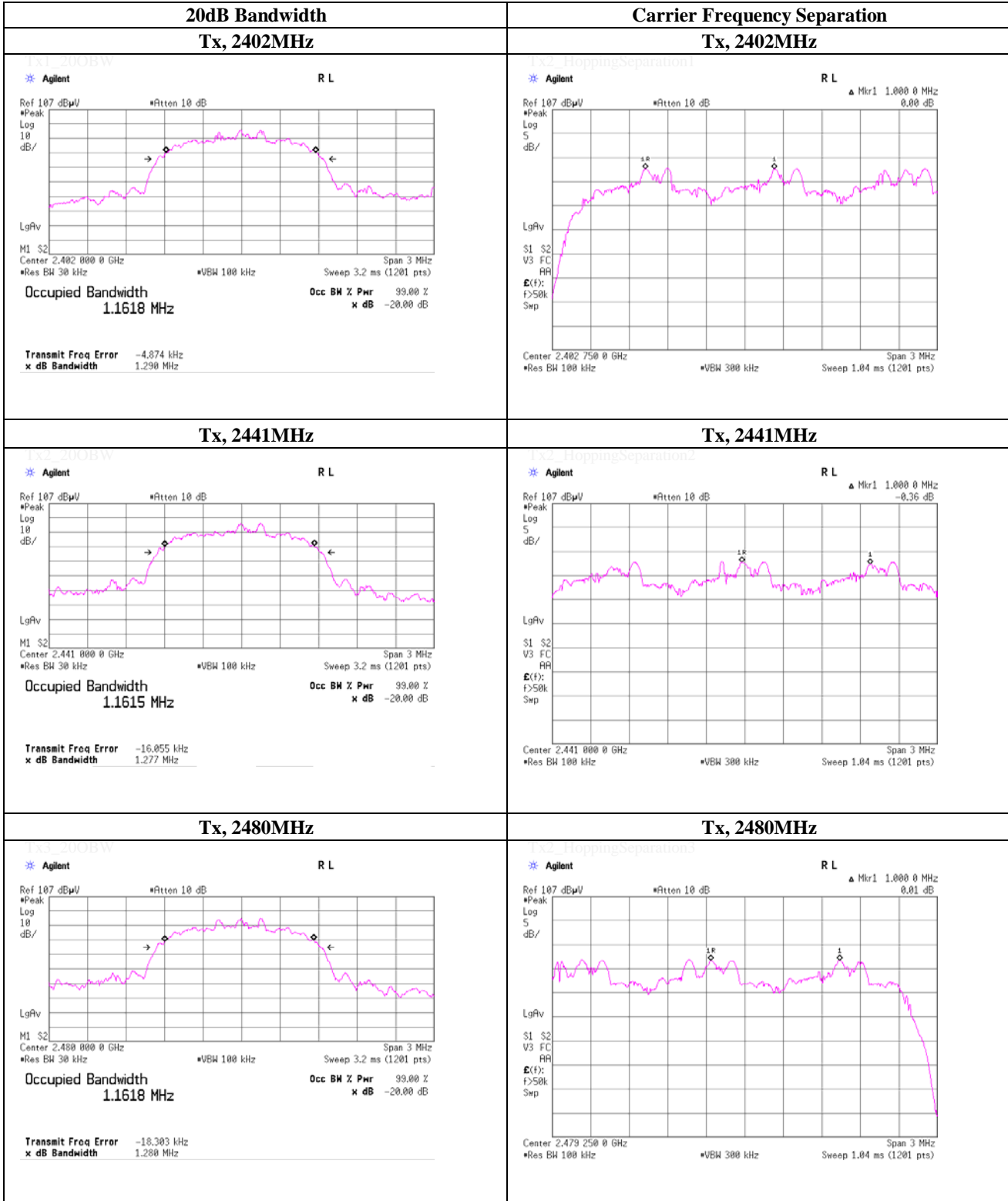
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Facsimile : +81 463 50 6401

## 20dB Bandwidth and Carrier Frequency Separation

### Tx, Bluetooth, EDR, PRBS9



**UL Japan, Inc.**

**Shonan EMC Lab.**

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Telephone : +81 463 50 6400

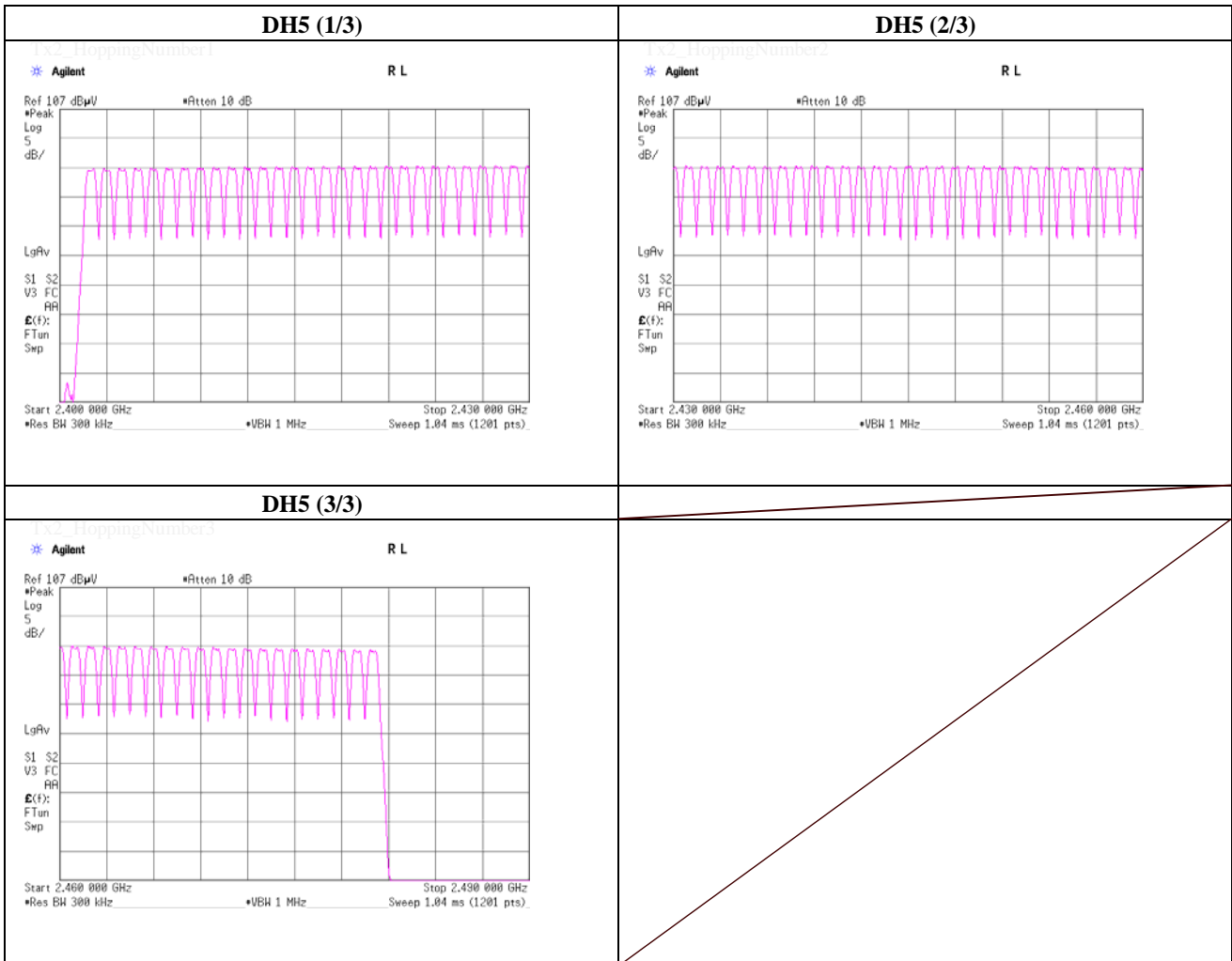
Facsimile : +81 463 50 6401

## Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	September 19, 2014	
Temperature / Humidity	26deg.C , 48%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth, BDR, PRBS9	

Mode	Number of Channel [times]	Limit [times]
DH5	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.

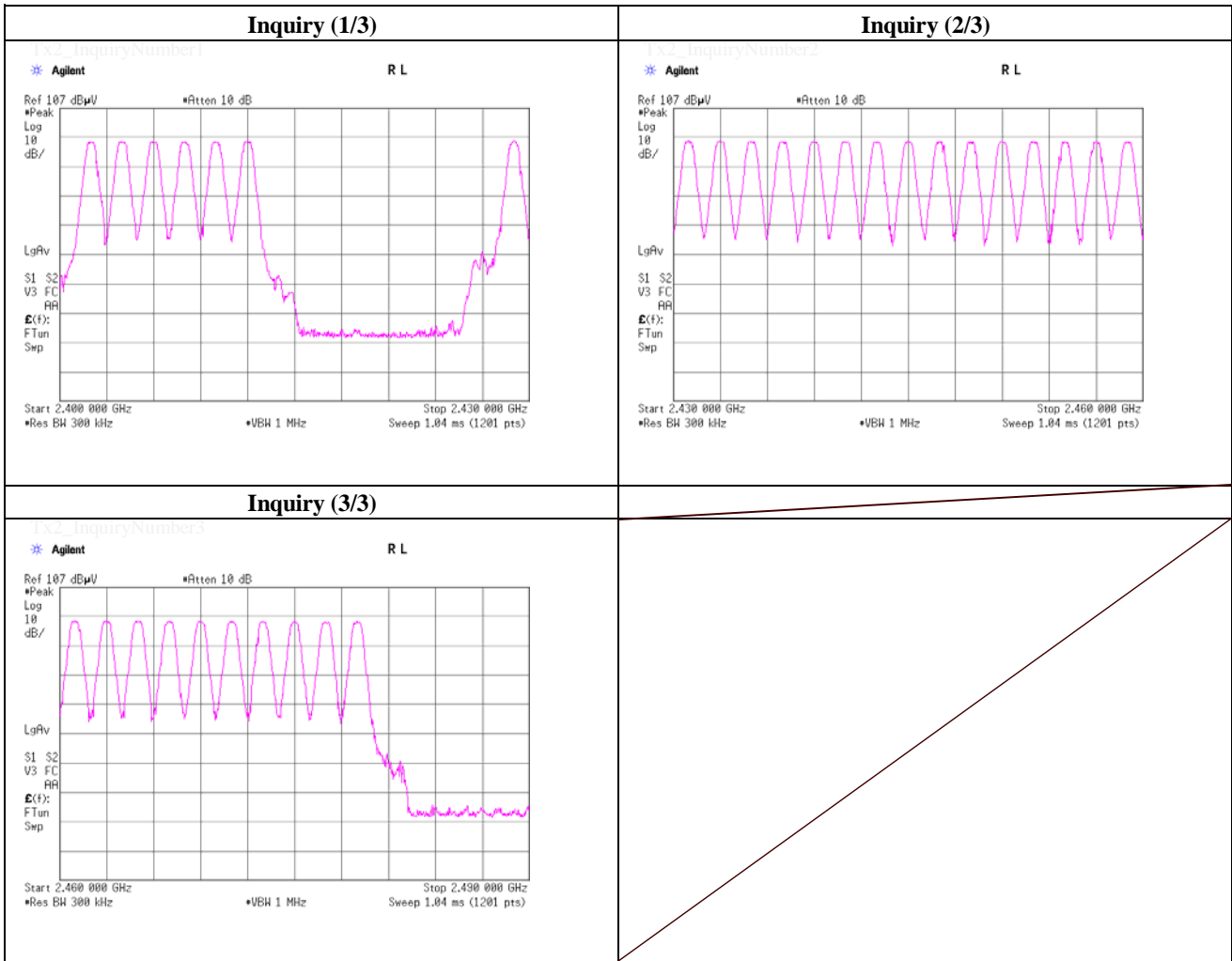


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 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN  
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## Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	September 19, 2014	
Temperature / Humidity	26deg.C , 48%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth, Inquiry	

Mode	Number of Channel [times]	Limit [times]
Inquiry	32	>= 15



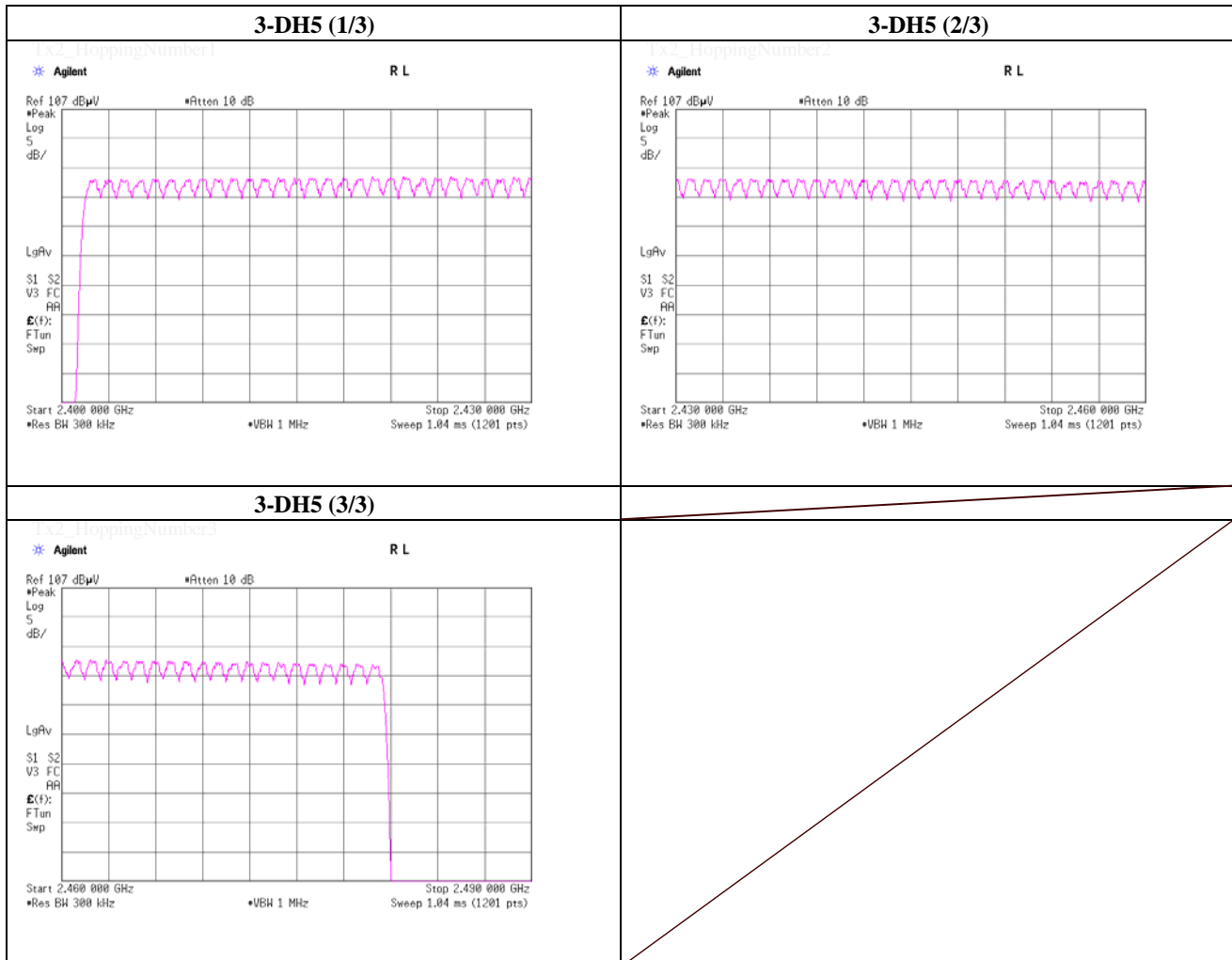
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**Shonan EMC Lab.**  
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### Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	September 19, 2014	
Temperature / Humidity	26deg.C , 48%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth, EDR, PRBS9	

Mode	Number of Channel [times]	Limit [times]
3-DH5	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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## Dwell Time

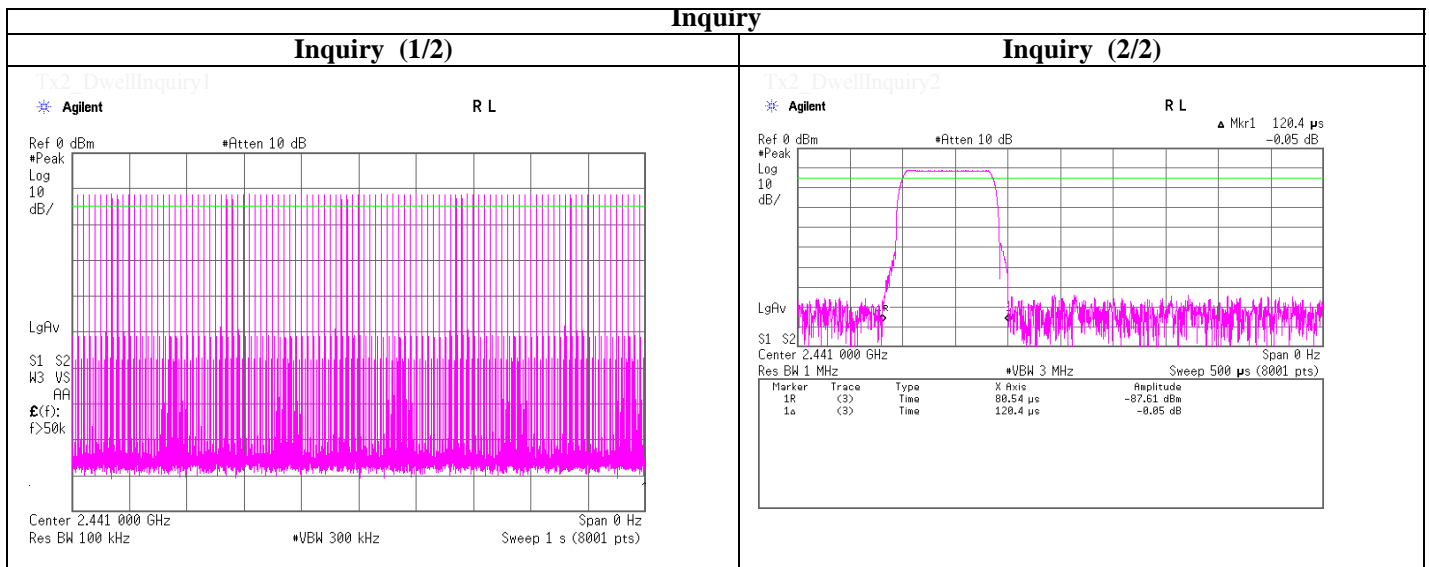
Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	September 19, 2014	
Temperature / Humidity	26deg.C , 48%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth, BDR, PRBS9	

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 / 5.0 sec. x 31.6 sec. = 323 times	0.414	134	400
DH3	26.0 / 5.0 sec. x 31.6 sec. = 165 times	1.671	276	400
DH5	17.0 / 5.0 sec. x 31.6 sec. = 108 times	2.920	315	400
Inquiry	101.0 / 1.0 sec. x 12.8 sec. = 1293 times	0.120	156	400

Sample Calculation

Result = Number of transmission x Length of transmission time

\* 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 (DH1, DH3 or DH5). This is confirmed in the test report for  $N=79$ .



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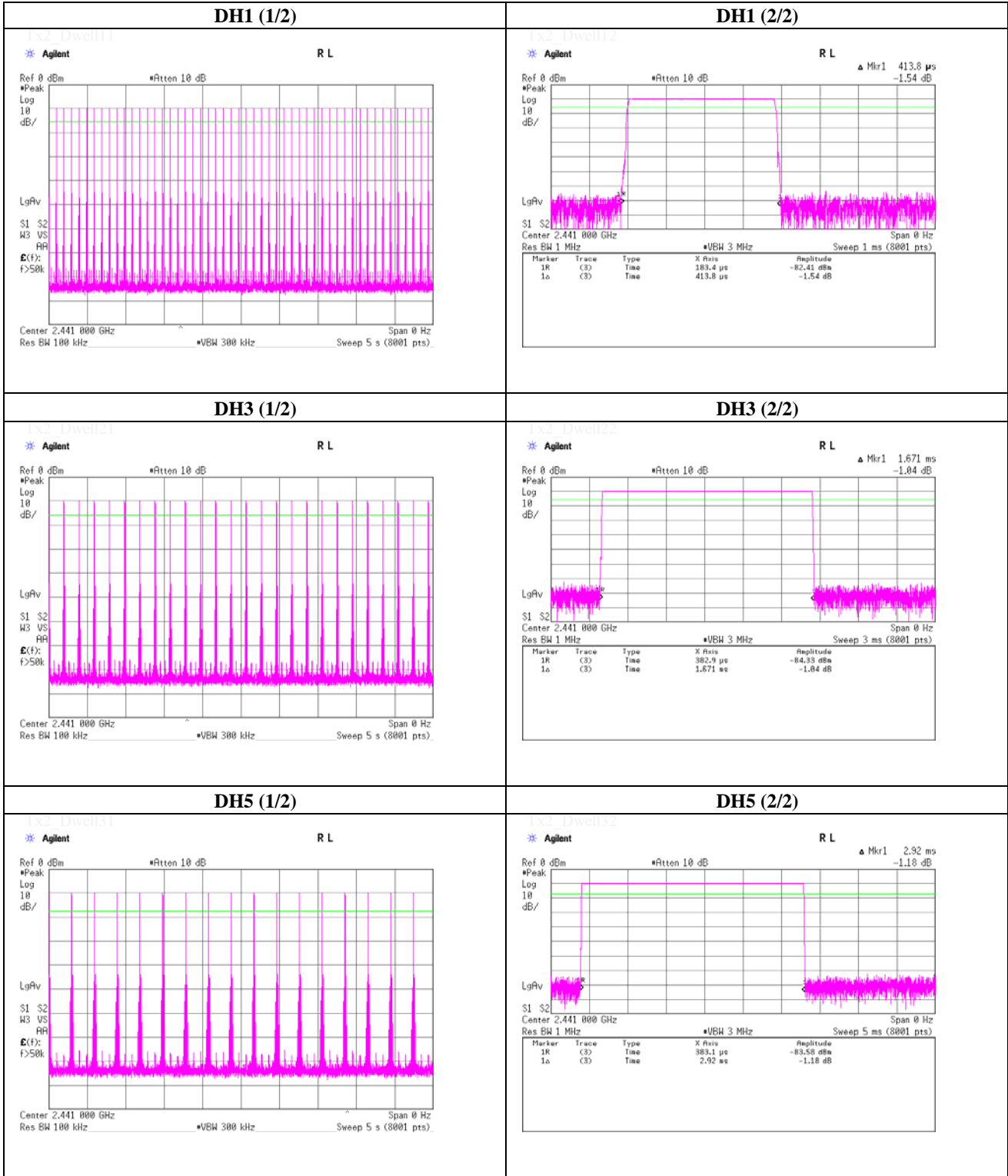
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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## Dwell time

Tx, Bluetooth, BDR, PRBS9



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Dwell Time

Test place           UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
 Date                 September 19, 2014  
 Temperature / Humidity 26deg.C     , 48%RH  
 Engineer            Akio Hayashi  
 Mode                Tx, Bluetooth, EDR, PRBS9

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4) second	Length of transmission time [msec]	Result [msec]	Limit [msec]
3-DH1	51.0 / 5.0 sec. x 31.6 sec. = 323 times	0.429	139	400
3-DH3	26.0 / 5.0 sec. x 31.6 sec. = 165 times	1.680	277	400
3-DH5	17.0 / 5.0 sec. x 31.6 sec. = 108 times	2.933	317	400

Sample Calculation

Result = Number of transmission x Length of transmission time

\* 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 (3-DH1, 3-DH3 or 3-DH5). This is confirmed in the test report for  $N=79$ .

Tx2\_DwellInquiry1

Tx2\_DwellInquiry2

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**Shonan EMC Lab.**

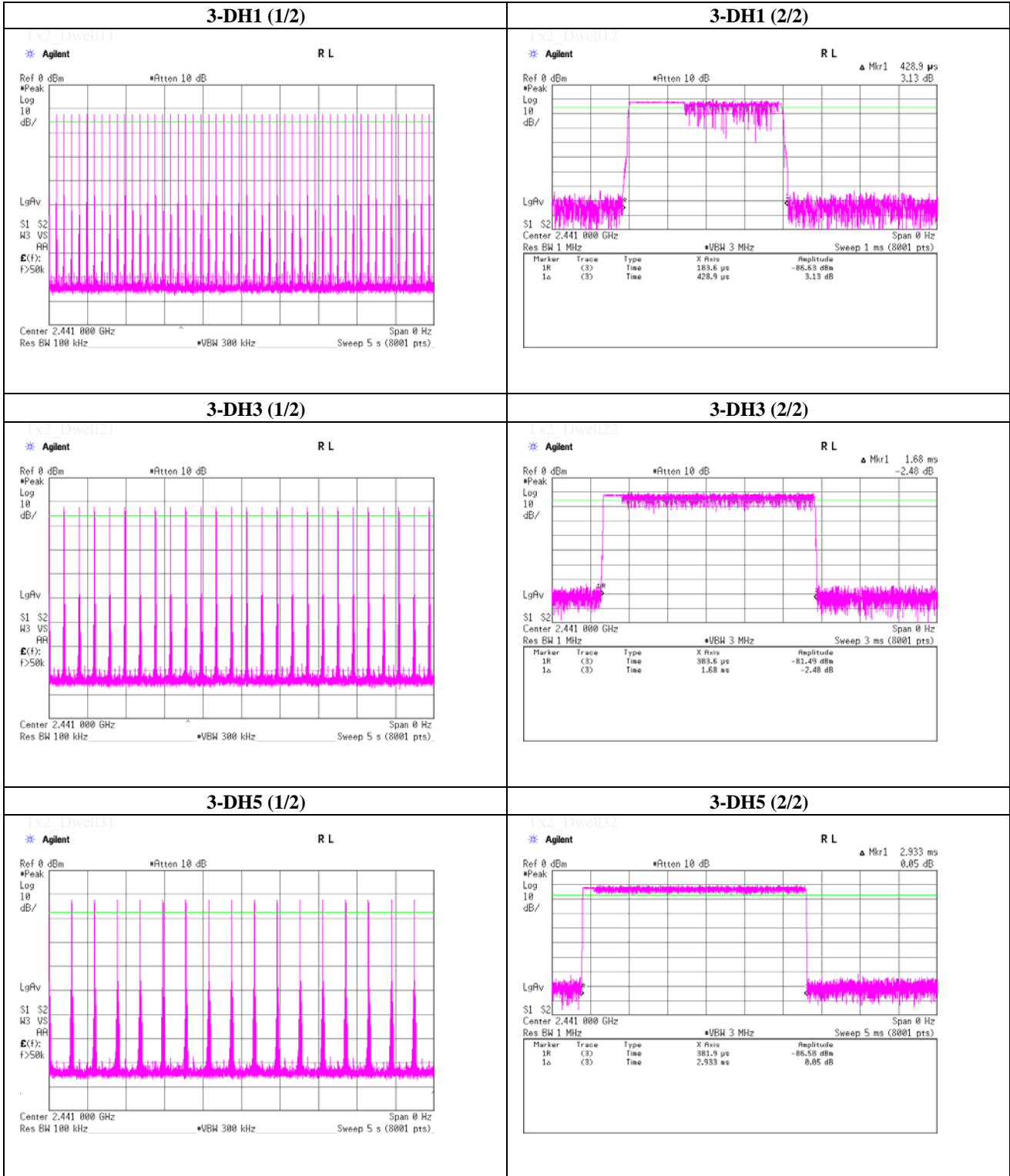
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Telephone : +81 463 50 6400

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## Dwell time

### Tx, Bluetooth, EDR, PRBS9



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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Maximum Peak Conducted Output Power

Test place                   UL Japan, Inc. Shonan EMC Lab.      No.5 Shielded Room  
 Date                         September 19, 2014  
 Temperature / Humidity    26deg.C       , 48%RH  
 Engineer                  Akio Hayashi  
 Mode                        Tx, Bluetooth

(\* P/M: Power Meter with power sensor)

	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	0.19	1.33	0.00	1.52	1.42	20.97	125	19.45
DH5	2441.0	0.86	1.34	0.00	2.20	1.66	20.97	125	18.77
DH5	2480.0	-0.28	1.35	0.00	1.07	1.28	20.97	125	19.90
2-DH5	2402.0	-0.48	1.33	0.00	0.85	1.22	20.97	125	20.12
2-DH5	2441.0	-0.12	1.34	0.00	1.22	1.32	20.97	125	19.75
2-DH5	2480.0	-1.37	1.35	0.00	-0.02	1.00	20.97	125	20.99
3-DH5	2402.0	-0.14	1.33	0.00	1.19	1.32	20.97	125	19.78
3-DH5	2441.0	0.36	1.34	0.00	1.70	1.48	20.97	125	19.27
3-DH5	2480.0	-0.85	1.35	0.00	0.50	1.12	20.97	125	20.47

Sample Calculation:

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

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## Maximum Average Conducted Output Power (Reference)

Test place                   UL Japan, Inc. Shonan EMC Lab.       No.5 Shielded Room  
 Date                         September 19, 2014  
 Temperature / Humidity   26deg.C       , 48%RH  
 Engineer                  Akio Hayashi  
 Mode                        Tx, Bluetooth

(\* P/M: Power Meter with power sensor, AV: Average)

	Freq.	P/M (AV) Reading	Cable Loss	Atten. Loss	Result	
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
DH5	2402.0	-0.26	1.33	0.00	1.07	1.28
DH5	2441.0	0.24	1.34	0.00	1.58	1.44
DH5	2480.0	-0.79	1.35	0.00	0.56	1.14
2-DH5	2402.0	-3.29	1.33	0.00	-1.96	0.64
2-DH5	2441.0	-3.03	1.34	0.00	-1.69	0.68
2-DH5	2480.0	-4.31	1.35	0.00	-2.96	0.51
3-DH5	2402.0	-3.36	1.33	0.00	-2.03	0.63
3-DH5	2441.0	-3.10	1.34	0.00	-1.76	0.67
3-DH5	2480.0	-4.38	1.35	0.00	-3.03	0.50

Sample Calculation:

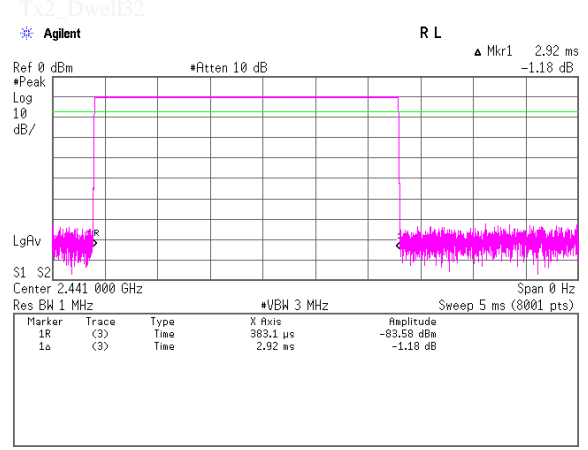
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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 Telephone : +81 463 50 6400  
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## Dwell time factor Calculation chart

### Dwell time factor Calculation Tx, Bluetooth, BDR, PRBS9

<p><b>Worst 100ms</b>  <b>Dwell time factor =<math>20\log((2.92 \times 2)/100) = -24.67\text{dB}</math></b></p> <p>ON time of some channel during 100ms: Twice                  This is the worst case in hopping sequence of Bluetooth.</p>	<p><b>1cycle On time : 2.92ms</b></p>  <p>Agilent R L                  Ref 0 dBm     *Atten 10 dB     Mkr1 2.92 ms                  *Peak     -1.18 dB                  Log 10 dB/                  LgRv                  S1 S2                  Center 2.441 000 GHz     Span 0 Hz                  Res BW 1 MHz     #VBW 3 MHz     Sweep 5 ms (8001 pts)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1R</td> <td>(3)</td> <td>Time</td> <td>383.1 μs</td> <td>-83.58 dBm</td> </tr> <tr> <td>1a</td> <td>(3)</td> <td>Time</td> <td>2.92 ms</td> <td>-1.18 dB</td> </tr> </tbody> </table>	Marker	Trace	Type	X Axis	Amplitude	1R	(3)	Time	383.1 μs	-83.58 dBm	1a	(3)	Time	2.92 ms	-1.18 dB
Marker	Trace	Type	X Axis	Amplitude												
1R	(3)	Time	383.1 μs	-83.58 dBm												
1a	(3)	Time	2.92 ms	-1.18 dB												

### VBW (Average) setting

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

Test place           UL Japan, Inc. Shonan EMC Lab.    No.5 Shielded Room  
 Date                 September 19, 2014  
 Temperature / Humidity   26deg.C     , 48%RH  
 Engineer            Akio Hayashi

## Dwell time factor Calculation chart

### Dwell time factor Calculation

**Tx, Bluetooth, EDR, PRBS9**

Worst 100ms Dwell time factor = $20\log((2.933 \times 2)/100) = -24.63\text{dB}$	1cycle On time : <b>2.933ms</b>															
<p>ON time of some channel during 100ms: Twice                      This is the worst case in hopping sequence of Bluetooth.</p>	<table border="1" style="width: 100%; font-size: small;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1R</td> <td>(3)</td> <td>Time</td> <td>381.9 μs</td> <td>-86.58 dBm</td> </tr> <tr> <td>1a</td> <td>(3)</td> <td>Time</td> <td>2.933 ms</td> <td>0.05 dB</td> </tr> </tbody> </table>	Marker	Trace	Type	X Axis	Amplitude	1R	(3)	Time	381.9 μs	-86.58 dBm	1a	(3)	Time	2.933 ms	0.05 dB
Marker	Trace	Type	X Axis	Amplitude												
1R	(3)	Time	381.9 μs	-86.58 dBm												
1a	(3)	Time	2.933 ms	0.05 dB												

### VBW (Average) setting

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

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 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN  
 Telephone     : +81 463 50 6400  
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## Radiated Emission

Test place	No.1 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber	No.3 Semi Anechoic Chamber
Date	September 19, 2014	September 21, 2014	September 23, 2014
Temperature / Humidity	24 deg.C, 50 %RH	24 deg.C, 51 %RH	24 deg.C, 54 %RH
Engineer	Tatsuya Arai	Wataru Kojima	Shinichi Takano
Mode	Tx, 2402 MHz Tx, Bluetooth, BDR		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	135.200	QP	42.3	14.2	8.5	31.8	33.2	43.5	10.3	223	308	
Hori.	576.000	QP	37.2	18.2	7.9	32.0	31.3	46.0	14.7	100	136	
Hori.	702.008	QP	33.2	19.6	8.5	32.0	29.3	46.0	16.7	150	11	
Hori.	2390.000	PK	42.4	25.9	14.5	38.2	44.6	73.9	29.3	100	41	
Hori.	2822.243	PK	47.8	26.6	6.9	38.1	43.2	73.9	30.7	100	14	
Hori.	4804.000	PK	42.9	30.4	7.4	37.1	43.6	73.9	30.3	100	0	
Hori.	7206.000	PK	43.6	36.3	8.8	39.4	49.3	73.9	24.6	100	0	
Hori.	9608.000	PK	41.9	38.3	9.6	37.6	52.2	73.9	21.7	100	0	
Hori.	12010.000	PK	43.4	39.3	10.9	38.5	55.1	73.9	18.8	100	0	
Hori.	2390.000	AV	30.2	25.9	14.5	38.2	32.4	53.9	21.5	100	41	
Hori.	2822.243	AV	42.3	26.6	6.9	38.1	37.7	53.9	16.2	100	14	
Hori.	4804.000	AV	29.6	30.4	7.4	37.1	30.3	53.9	23.6	100	0	
Hori.	7206.000	AV	31.1	36.3	8.8	39.4	36.8	53.9	17.1	100	0	
Hori.	9608.000	AV	29.4	38.3	9.6	37.6	39.7	53.9	14.2	100	0	
Hori.	12010.000	AV	31.5	39.3	10.9	38.5	43.2	53.9	10.7	100	0	
Vert.	135.200	QP	45.4	14.2	8.5	31.8	36.3	43.5	7.2	100	297	
Vert.	191.958	QP	31.2	16.3	9.0	31.8	24.7	43.5	18.8	100	353	
Vert.	270.400	QP	32.1	18.1	9.6	31.8	28.0	46.0	18.0	100	91	
Vert.	702.006	QP	33.5	19.6	8.5	32.0	29.6	46.0	16.4	100	339	
Vert.	829.190	QP	29.2	20.8	9.1	31.8	27.3	46.0	18.7	100	358	
Vert.	2390.000	PK	43.4	25.9	14.5	38.2	45.6	73.9	28.3	100	163	
Vert.	2822.243	PK	50.6	26.6	6.9	38.1	46.0	73.9	27.9	100	239	
Vert.	4804.000	PK	44.0	30.4	7.4	37.1	44.7	73.9	29.2	100	222	
Vert.	7206.000	PK	43.8	36.3	8.8	39.4	49.5	73.9	24.4	100	0	
Vert.	9608.000	PK	42.8	38.3	9.6	37.6	53.1	73.9	20.8	100	0	
Vert.	12010.000	PK	43.6	39.3	10.9	38.5	55.3	73.9	18.6	100	0	
Vert.	2390.000	AV	31.6	25.9	14.5	38.2	33.8	53.9	20.1	100	163	
Vert.	2822.243	AV	47.6	26.6	6.9	38.1	43.0	53.9	10.9	100	239	
Vert.	4804.000	AV	31.9	30.4	7.4	37.1	32.6	53.9	21.3	100	222	
Vert.	7206.000	AV	31.1	36.3	8.8	39.4	36.8	53.9	17.1	100	0	
Vert.	9608.000	AV	29.3	38.3	9.6	37.6	39.6	53.9	14.3	100	0	
Vert.	12010.000	AV	31.4	39.3	10.9	38.5	43.1	53.9	10.8	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

### 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	83.8	25.9	14.5	38.2	86.0	-	-	Carrier
Hori.	2400.000	PK	36.2	25.9	14.5	38.2	38.4	66.0	27.6	
Hori.	2557.967	PK	36.4	26.0	14.7	38.1	39.0	66.0	27.0	
Vert.	2402.000	PK	88.7	25.9	14.5	38.2	90.9	-	-	Carrier
Vert.	2400.000	PK	40.5	25.9	14.5	38.2	42.7	70.9	28.2	
Vert.	2557.967	PK	38.0	26.0	14.7	38.1	40.6	70.9	30.3	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Radiated Emission

Test place	No.1 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber	No.3 Semi Anechoic Chamber
Date	September 19, 2014	September 21, 2014	September 23, 2014
Temperature / Humidity	24 deg.C, 50 %RH	24 deg.C, 51 %RH	24 deg.C, 54 %RH
Engineer	Tatsuya Arai	Wataru Kojima	Shinichi Takano
Mode	Tx, 2441 MHz Tx, Bluetooth, BDR		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	135.200	QP	42.5	14.2	8.5	31.8	33.4	43.5	10.1	227	311	
Hori.	249.601	QP	33.5	17.1	9.5	31.8	28.3	46.0	17.7	195	178	
Hori.	576.000	QP	31.7	18.2	7.9	32.0	25.8	46.0	20.2	154	238	
Hori.	702.006	QP	32.8	19.6	8.5	32.0	28.9	46.0	17.1	146	15	
Hori.	2822.371	PK	48.5	26.6	6.9	38.1	43.9	73.9	30.0	100	216	
Hori.	4882.000	PK	42.1	30.7	7.5	37.0	43.3	73.9	30.6	100	198	
Hori.	7323.000	PK	43.3	36.4	8.7	39.4	49.0	73.9	24.9	100	0	
Hori.	9764.000	PK	40.6	38.3	9.8	37.5	51.2	73.9	22.7	100	0	
Hori.	12205.000	PK	43.5	39.2	10.9	38.3	55.3	73.9	18.6	100	0	
Hori.	2822.371	AV	44.4	26.6	6.9	38.1	39.8	53.9	14.1	100	216	
Hori.	4882.000	AV	30.6	30.7	7.5	37.0	31.8	53.9	22.1	100	198	
Hori.	7323.000	AV	31.1	36.4	8.7	39.4	36.8	53.9	17.1	100	0	
Hori.	9764.000	AV	28.3	38.3	9.8	37.5	38.9	53.9	15.0	100	0	
Hori.	12205.000	AV	30.6	39.2	10.9	38.3	42.4	53.9	11.5	100	0	
Vert.	135.200	QP	45.6	14.2	8.5	31.8	36.5	43.5	7.0	100	295	
Vert.	191.956	QP	31.2	16.3	9.0	31.8	24.7	43.5	18.8	100	254	
Vert.	270.400	QP	33.2	18.1	9.6	31.8	29.1	46.0	16.9	100	97	
Vert.	702.006	QP	33.1	19.6	8.5	32.0	29.2	46.0	16.8	100	335	
Vert.	828.751	QP	30.7	20.8	9.1	31.8	28.8	46.0	17.2	100	355	
Vert.	2822.371	PK	51.6	26.6	6.9	38.1	47.0	73.9	26.9	100	241	
Vert.	4882.000	PK	43.8	30.7	7.5	37.0	45.0	73.9	28.9	100	246	
Vert.	7323.000	PK	43.7	36.4	8.7	39.4	49.4	73.9	24.5	100	0	
Vert.	9764.000	PK	41.5	38.3	9.8	37.5	52.1	73.9	21.8	100	0	
Vert.	12205.000	PK	43.7	39.2	10.9	38.3	55.5	73.9	18.4	100	0	
Vert.	2822.371	AV	48.8	26.6	6.9	38.1	44.2	53.9	9.7	100	241	
Vert.	4882.000	AV	32.5	30.7	7.5	37.0	33.7	53.9	20.2	100	246	
Vert.	7323.000	AV	31.2	36.4	8.7	39.4	36.9	53.9	17.0	100	0	
Vert.	9764.000	AV	28.4	38.3	9.8	37.5	39.0	53.9	14.9	100	0	
Vert.	12205.000	AV	30.5	39.2	10.9	38.3	42.3	53.9	11.6	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

### 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2441.000	PK	86.5	25.9	14.6	38.2	88.8	-	-	Carrier
Hori.	2570.963	PK	35.5	26.1	14.7	38.1	38.2	68.8	30.6	
Vert.	2441.000	PK	88.8	25.9	14.6	38.2	91.1	-	-	Carrier
Vert.	2570.963	PK	35.4	26.1	14.7	38.1	38.1	71.1	33.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place	No.1 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber	No.3 Semi Anechoic Chamber
Date	September 19, 2014	September 21, 2014	September 23, 2014
Temperature / Humidity	24 deg.C, 50 %RH	24 deg.C, 51 %RH	24 deg.C, 54 %RH
Engineer	Tatsuya Arai	Wataru Kojima	Shinichi Takano
Mode	Tx, 2480 MHz Tx, Bluetooth, BDR		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	135.200	QP	42.4	14.2	8.5	31.8	33.3	43.5	10.2	236	314	
Hori.	249.601	QP	33.7	17.1	9.5	31.8	28.5	46.0	17.5	188	175	
Hori.	270.400	QP	31.8	18.1	9.6	31.8	27.7	46.0	18.3	120	111	
Hori.	576.000	QP	37.1	18.2	7.9	32.0	31.2	46.0	14.8	100	140	
Hori.	2483.500	PK	43.1	25.9	14.6	38.1	45.5	73.9	28.4	164	42	
Hori.	2822.347	PK	48.5	26.6	6.9	38.1	43.9	73.9	30.0	100	201	
Hori.	3989.785	PK	48.2	28.8	6.8	37.7	46.1	73.9	27.8	100	157	
Hori.	4960.000	PK	42.5	31.0	7.6	37.0	44.1	73.9	29.8	130	261	
Hori.	7440.000	PK	41.6	36.5	8.8	39.4	47.5	73.9	26.4	100	0	
Hori.	9920.000	PK	39.1	38.4	9.9	37.5	49.9	73.9	24.0	100	0	
Hori.	12400.000	PK	40.3	39.1	11.0	38.2	52.2	73.9	21.7	100	0	
Hori.	2483.500	AV	31.7	25.9	14.6	38.1	34.1	53.9	19.8	164	42	
Hori.	2822.347	AV	44.0	26.6	6.9	38.1	39.4	53.9	14.5	100	201	
Hori.	3989.785	AV	32.0	28.8	6.8	37.7	29.9	53.9	24.0	100	157	
Hori.	4960.000	AV	30.4	31.0	7.6	37.0	32.0	53.9	21.9	130	261	
Hori.	7440.000	AV	29.9	36.5	8.8	39.4	35.8	53.9	18.1	100	0	
Hori.	9920.000	AV	27.6	38.4	9.9	37.5	38.4	53.9	15.5	100	0	
Hori.	12400.000	AV	28.1	39.1	11.0	38.2	40.0	53.9	13.9	100	0	
Vert.	135.200	QP	46.0	14.2	8.5	31.8	36.9	43.5	<b>6.6</b>	100	290	
Vert.	191.962	QP	31.1	16.3	9.0	31.8	24.6	43.5	18.9	100	258	
Vert.	702.007	QP	32.8	19.6	8.5	32.0	28.9	46.0	17.1	100	342	
Vert.	2483.500	PK	42.8	25.9	14.6	38.1	45.2	73.9	28.7	100	219	
Vert.	2822.347	PK	52.1	26.6	6.9	38.1	47.5	73.9	26.4	100	237	
Vert.	3989.785	PK	45.8	28.8	6.8	37.7	43.7	73.9	30.2	100	190	
Vert.	4960.000	PK	43.6	31.0	7.6	37.0	45.2	73.9	28.7	100	252	
Vert.	7440.000	PK	42.8	36.5	8.8	39.4	48.7	73.9	25.2	100	0	
Vert.	9920.000	PK	40.4	38.4	9.9	37.5	51.2	73.9	22.7	100	0	
Vert.	12400.000	PK	40.5	39.1	11.0	38.2	52.4	73.9	21.5	100	0	
Vert.	2483.500	AV	31.6	25.9	14.6	38.1	34.0	53.9	19.9	100	219	
Vert.	2822.347	AV	49.4	26.6	6.9	38.1	44.8	53.9	9.1	100	237	
Vert.	3989.785	AV	30.5	28.8	6.8	37.7	28.4	53.9	25.5	100	190	
Vert.	4960.000	AV	31.5	31.0	7.6	37.0	33.1	53.9	20.8	100	252	
Vert.	7440.000	AV	29.2	36.5	8.8	39.4	35.1	53.9	18.8	100	0	
Vert.	9920.000	AV	26.6	38.4	9.9	37.5	37.4	53.9	16.5	100	0	
Vert.	12400.000	AV	27.4	39.1	11.0	38.2	39.3	53.9	14.6	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place	No.1 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber	No.3 Semi Anechoic Chamber
Date	September 19, 2014	September 21, 2014	September 23, 2014
Temperature / Humidity	24 deg.C, 50 %RH	24 deg.C, 51 %RH	24 deg.C, 54 %RH
Engineer	Tatsuya Arai	Wataru Kojima	Shinichi Takano
Mode	Tx, 2402 MHz Tx, Bluetooth, EDR		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	135.200	QP	42.2	14.2	8.5	31.8	33.1	43.5	10.4	231	305	
Hori.	249.603	QP	33.8	17.1	9.5	31.8	28.6	46.0	17.4	192	177	
Hori.	448.000	QP	38.7	16.7	7.2	31.9	30.7	46.0	15.3	100	157	
Hori.	576.001	QP	37.6	18.2	7.9	32.0	31.7	46.0	14.3	100	130	
Hori.	702.006	QP	32.9	19.6	8.5	32.0	29.0	46.0	17.0	146	15	
Hori.	2390.000	PK	42.9	25.9	14.5	38.2	45.1	73.9	28.8	233	41	
Hori.	2822.335	PK	48.3	26.6	6.9	38.1	43.7	73.9	30.2	100	202	
Hori.	3990.055	PK	49.6	28.8	6.8	37.7	47.5	73.9	26.4	100	162	
Hori.	4804.000	PK	41.5	30.4	7.4	37.1	42.2	73.9	31.7	100	0	
Hori.	7206.000	PK	44.4	36.3	8.8	39.4	50.1	73.9	23.8	100	0	
Hori.	9608.000	PK	41.4	38.3	9.6	37.6	51.7	73.9	22.2	100	0	
Hori.	12010.000	PK	44.0	39.3	10.9	38.5	55.7	73.9	18.2	100	0	
Hori.	2390.000	AV	31.4	25.9	14.5	38.2	33.6	53.9	20.3	233	41	
Hori.	2822.335	AV	44.6	26.6	6.9	38.1	40.0	53.9	13.9	100	202	
Hori.	3990.055	AV	35.1	28.8	6.8	37.7	33.0	53.9	20.9	100	162	
Hori.	4804.000	AV	30.9	30.4	7.4	37.1	31.6	53.9	22.3	100	0	
Hori.	7206.000	AV	32.3	36.3	8.8	39.4	38.0	53.9	15.9	100	0	
Hori.	9608.000	AV	30.4	38.3	9.6	37.6	40.7	53.9	13.2	100	0	
Hori.	12010.000	AV	32.5	39.3	10.9	38.5	44.2	53.9	9.7	100	0	
Vert.	135.200	QP	45.9	14.2	8.5	31.8	36.8	43.5	6.7	100	302	
Vert.	270.400	QP	33.3	18.1	9.6	31.8	29.2	46.0	16.8	100	100	
Vert.	702.007	QP	33.1	19.6	8.5	32.0	29.2	46.0	16.8	100	354	
Vert.	2390.000	PK	43.1	25.9	14.5	38.2	45.3	73.9	28.6	100	169	
Vert.	2822.335	PK	51.5	26.6	6.9	38.1	46.9	73.9	27.0	100	240	
Vert.	3990.055	PK	47.1	28.8	6.8	37.7	45.0	73.9	28.9	100	190	
Vert.	4804.000	PK	41.9	30.4	7.4	37.1	42.6	73.9	31.3	100	223	
Vert.	7206.000	PK	43.1	36.3	8.8	39.4	48.8	73.9	25.1	100	0	
Vert.	9608.000	PK	41.4	38.3	9.6	37.6	51.7	73.9	22.2	100	0	
Vert.	12010.000	PK	43.7	39.3	10.9	38.5	55.4	73.9	18.5	100	0	
Vert.	2390.000	AV	31.4	25.9	14.5	38.2	33.6	53.9	20.3	100	169	
Vert.	2822.335	AV	48.7	26.6	6.9	38.1	44.1	53.9	9.8	100	240	
Vert.	3990.055	AV	33.2	28.8	6.8	37.7	31.1	53.9	22.8	100	190	
Vert.	4804.000	AV	31.0	30.4	7.4	37.1	31.7	53.9	22.2	100	223	
Vert.	7206.000	AV	32.3	36.3	8.8	39.4	38.0	53.9	15.9	100	0	
Vert.	9608.000	AV	30.3	38.3	9.6	37.6	40.6	53.9	13.3	100	0	
Vert.	12010.000	AV	32.6	39.3	10.9	38.5	44.3	53.9	9.6	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriplier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

### 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	86.0	25.9	14.5	38.2	88.2	-	-	Carrier
Hori.	2400.000	PK	38.3	25.9	14.5	38.2	40.5	68.2	27.7	
Vert.	2402.000	PK	86.6	25.9	14.5	38.2	88.8	-	-	Carrier
Vert.	2400.000	PK	37.8	25.9	14.5	38.2	40.0	68.8	28.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriplier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Radiated Emission

Test place	No.1 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber	No.3 Semi Anechoic Chamber
Date	September 19, 2014	September 21, 2014	September 23, 2014
Temperature / Humidity	24 deg.C, 50 %RH	24 deg.C, 51 %RH	24 deg.C, 54 %RH
Engineer	Tatsuya Arai	Wataru Kojima	Shinichi Takano
Mode	Tx, 2441 MHz Tx, Bluetooth, EDR		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	135.200	QP	42.3	14.2	8.5	31.8	33.2	43.5	10.3	229	304	
Hori.	448.000	QP	38.4	16.7	7.2	31.9	30.4	46.0	15.6	100	155	
Hori.	576.000	QP	37.7	18.2	7.9	32.0	31.8	46.0	14.2	100	142	
Hori.	702.006	QP	34.3	19.6	8.5	32.0	30.4	46.0	15.6	142	12	
Hori.	2822.345	PK	48.3	26.6	6.9	38.1	43.7	73.9	30.2	100	200	
Hori.	4882.000	PK	41.8	30.7	7.5	37.0	43.0	73.9	30.9	100	0	
Hori.	7323.000	PK	43.9	36.4	8.7	39.4	49.6	73.9	24.3	100	0	
Hori.	9764.000	PK	41.0	38.3	9.8	37.5	51.6	73.9	22.3	100	0	
Hori.	12205.000	PK	43.1	39.2	10.9	38.3	54.9	73.9	19.0	100	0	
Hori.	2822.345	AV	43.7	26.6	6.9	38.1	39.1	53.9	14.8	100	200	
Hori.	4882.000	AV	30.9	30.7	7.5	37.0	32.1	53.9	21.8	100	0	
Hori.	7323.000	AV	31.9	36.4	8.7	39.4	37.6	53.9	16.3	100	0	
Hori.	9764.000	AV	28.8	38.3	9.8	37.5	39.4	53.9	14.5	100	0	
Hori.	12205.000	AV	31.1	39.2	10.9	38.3	42.9	53.9	11.0	100	0	
Vert.	135.200	QP	46.0	14.2	8.5	31.8	36.9	43.5	<b>6.6</b>	100	312	
Vert.	191.966	QP	30.5	16.3	9.0	31.8	24.0	43.5	19.5	100	256	
Vert.	270.400	QP	33.3	18.1	9.6	31.8	29.2	46.0	16.8	100	99	
Vert.	702.005	QP	35.4	19.6	8.5	32.0	31.5	46.0	14.5	100	350	
Vert.	2822.345	PK	51.3	26.6	6.9	38.1	46.7	73.9	27.2	100	239	
Vert.	4882.000	PK	42.1	30.7	7.5	37.0	43.3	73.9	30.6	100	245	
Vert.	7323.000	PK	43.8	36.4	8.7	39.4	49.5	73.9	24.4	100	0	
Vert.	9764.000	PK	41.3	38.3	9.8	37.5	51.9	73.9	22.0	100	0	
Vert.	12205.000	PK	44.6	39.2	10.9	38.3	56.4	73.9	17.5	100	0	
Vert.	2822.345	AV	48.3	26.6	6.9	38.1	43.7	53.9	10.2	100	239	
Vert.	4882.000	AV	31.4	30.7	7.5	37.0	32.6	53.9	21.3	100	245	
Vert.	7323.000	AV	32.8	36.4	8.7	39.4	38.5	53.9	15.4	100	0	
Vert.	9764.000	AV	30.0	38.3	9.8	37.5	40.6	53.9	13.3	100	0	
Vert.	12205.000	AV	31.1	39.2	10.9	38.3	42.9	53.9	11.0	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place	No.1 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber	No.3 Semi Anechoic Chamber
Date	September 19, 2014	September 21, 2014	September 23, 2014
Temperature / Humidity	24 deg.C, 50 %RH	24 deg.C, 51 %RH	24 deg.C, 54 %RH
Engineer	Tatsuya Arai	Wataru Kojima	Shinichi Takano
Mode	Tx, 2480 MHz Tx, Bluetooth, EDR		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	135.200	QP	42.9	14.2	8.5	31.8	33.8	43.5	9.7	230	309	
Hori.	249.599	QP	34.9	17.1	9.5	31.8	29.7	46.0	16.3	193	178	
Hori.	576.000	QP	38.1	18.2	7.9	32.0	32.2	46.0	13.8	100	136	
Hori.	702.006	QP	34.3	19.6	8.5	32.0	30.4	46.0	15.6	152	12	
Hori.	2483.500	PK	43.0	25.9	14.6	38.1	45.4	73.9	28.5	192	45	
Hori.	2822.338	PK	48.1	26.6	6.9	38.1	43.5	73.9	30.4	100	202	
Hori.	4960.000	PK	41.0	31.0	7.6	37.0	42.6	73.9	31.3	100	0	
Hori.	7440.000	PK	44.1	36.5	8.8	39.4	50.0	73.9	23.9	100	0	
Hori.	9920.000	PK	40.0	38.4	9.9	37.5	50.8	73.9	23.1	100	0	
Hori.	12400.000	PK	41.0	39.1	11.0	38.2	52.9	73.9	21.0	100	0	
Hori.	2483.500	AV	31.8	25.9	14.6	38.1	34.2	53.9	19.7	192	45	
Hori.	2822.338	AV	43.3	26.6	6.9	38.1	38.7	53.9	15.2	100	202	
Hori.	4960.000	AV	30.8	31.0	7.6	37.0	32.4	53.9	21.5	100	0	
Hori.	7440.000	AV	31.4	36.5	8.8	39.4	37.3	53.9	16.6	100	0	
Hori.	9920.000	AV	28.5	38.4	9.9	37.5	39.3	53.9	14.6	100	0	
Hori.	12400.000	AV	29.0	39.1	11.0	38.2	40.9	53.9	13.0	100	0	
Vert.	135.200	QP	46.1	14.2	8.5	31.8	37.0	43.5	6.5	100	298	
Vert.	270.400	QP	34.6	18.1	9.6	31.8	30.5	46.0	15.5	100	101	
Vert.	609.727	QP	32.7	18.7	8.1	32.1	27.4	46.0	18.6	100	168	
Vert.	702.004	QP	35.2	19.6	8.5	32.0	31.3	46.0	14.7	100	350	
Vert.	2483.500	PK	42.2	25.9	14.6	38.1	44.6	73.9	29.3	100	171	
Vert.	2822.338	PK	50.5	26.6	6.9	38.1	45.9	73.9	28.0	100	0	
Vert.	4960.000	PK	42.3	31.0	7.6	37.0	43.9	73.9	30.0	100	250	
Vert.	7440.000	PK	42.5	36.5	8.8	39.4	48.4	73.9	25.5	100	0	
Vert.	9920.000	PK	39.7	38.4	9.9	37.5	50.5	73.9	23.4	100	0	
Vert.	12400.000	PK	40.1	39.1	11.0	38.2	52.0	73.9	21.9	100	0	
Vert.	2483.500	AV	31.3	25.9	14.6	38.1	33.7	53.9	20.2	100	171	
Vert.	2822.338	AV	47.6	26.6	6.9	38.1	43.0	53.9	10.9	100	0	
Vert.	4960.000	AV	30.9	31.0	7.6	37.0	32.5	53.9	21.4	100	250	
Vert.	7440.000	AV	31.5	36.5	8.8	39.4	37.4	53.9	16.5	100	0	
Vert.	9920.000	AV	28.6	38.4	9.9	37.5	39.4	53.9	14.5	100	0	
Vert.	12400.000	AV	29.0	39.1	11.0	38.2	40.9	53.9	13.0	100	0	

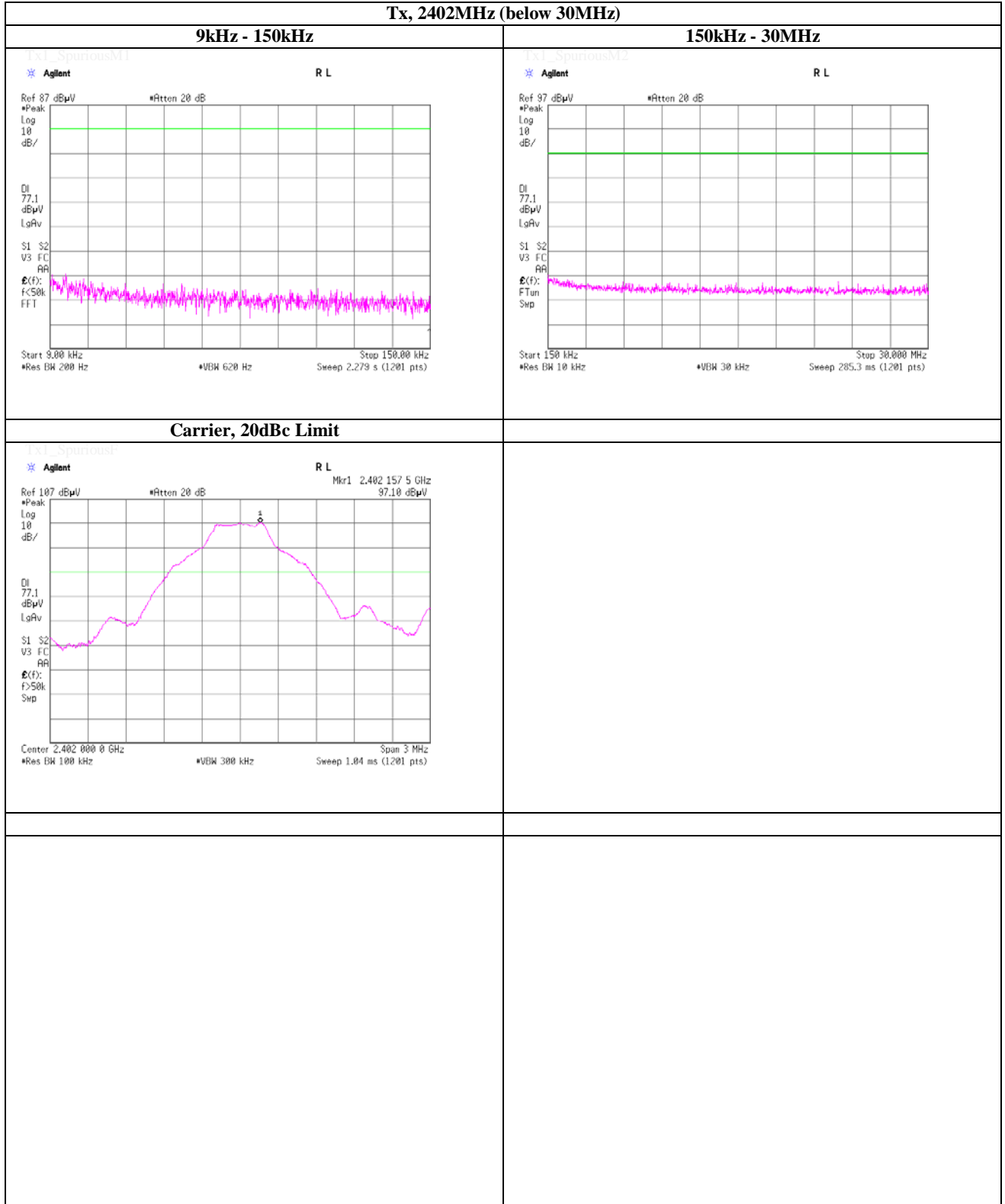
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
 Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

### Spurious emission (Conducted)

**Tx, Bluetooth, BDR, PRBS9**

**Tx, 2402MHz (below 30MHz)**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

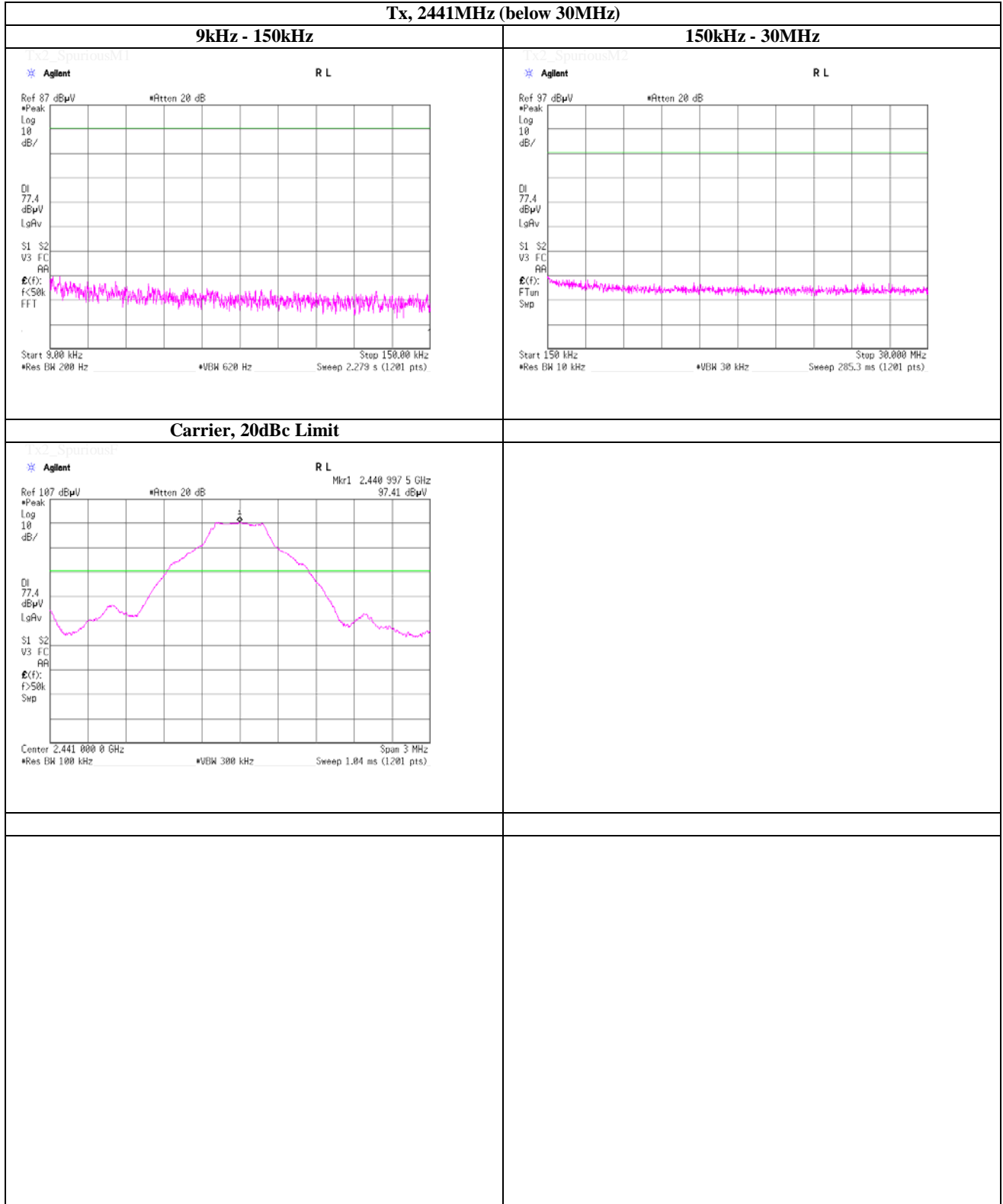
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

### Spurious emission (Conducted)

**Tx, Bluetooth, BDR, PRBS9**

**Tx, 2441MHz (below 30MHz)**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

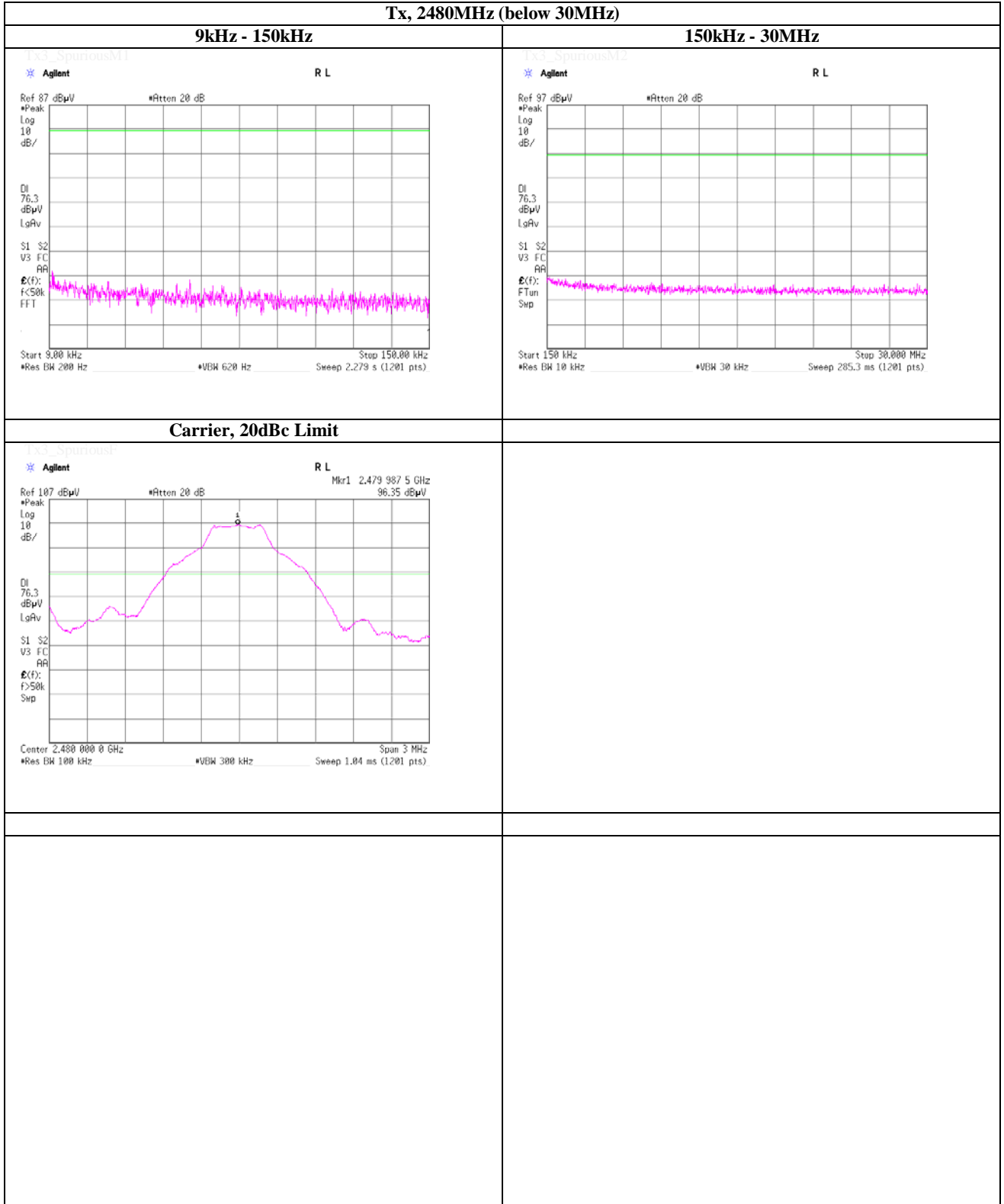


Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

### Spurious emission (Conducted)

**Tx, Bluetooth, BDR, PRBS9**

**Tx, 2480MHz (below 30MHz)**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

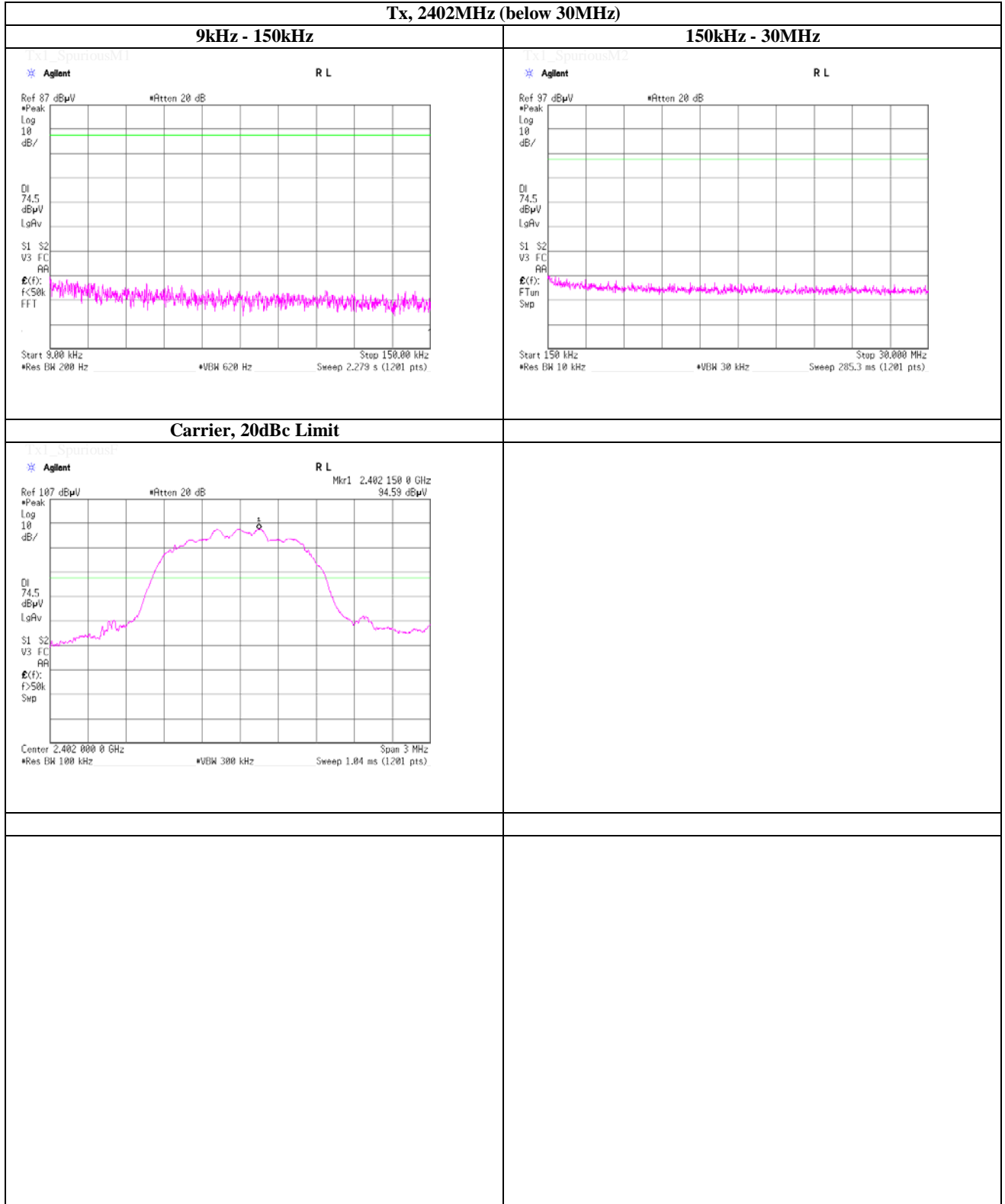
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

### Spurious emission (Conducted)

**Tx, Bluetooth, EDR, PRBS9**

**Tx, 2402MHz (below 30MHz)**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

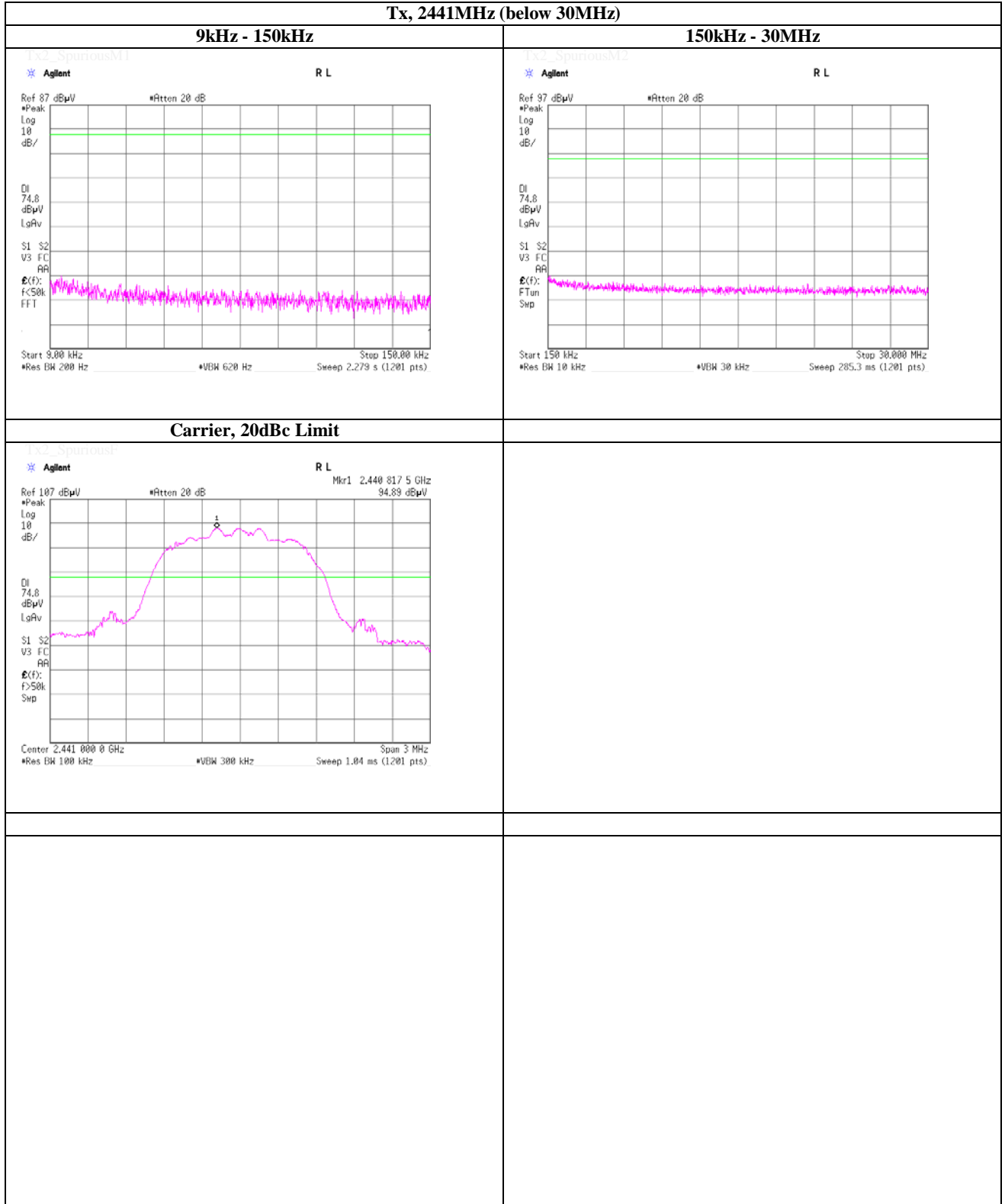
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

**Spurious emission (Conducted)**

**Tx, Bluetooth, EDR, PRBS9**

**Tx, 2441MHz (below 30MHz)**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

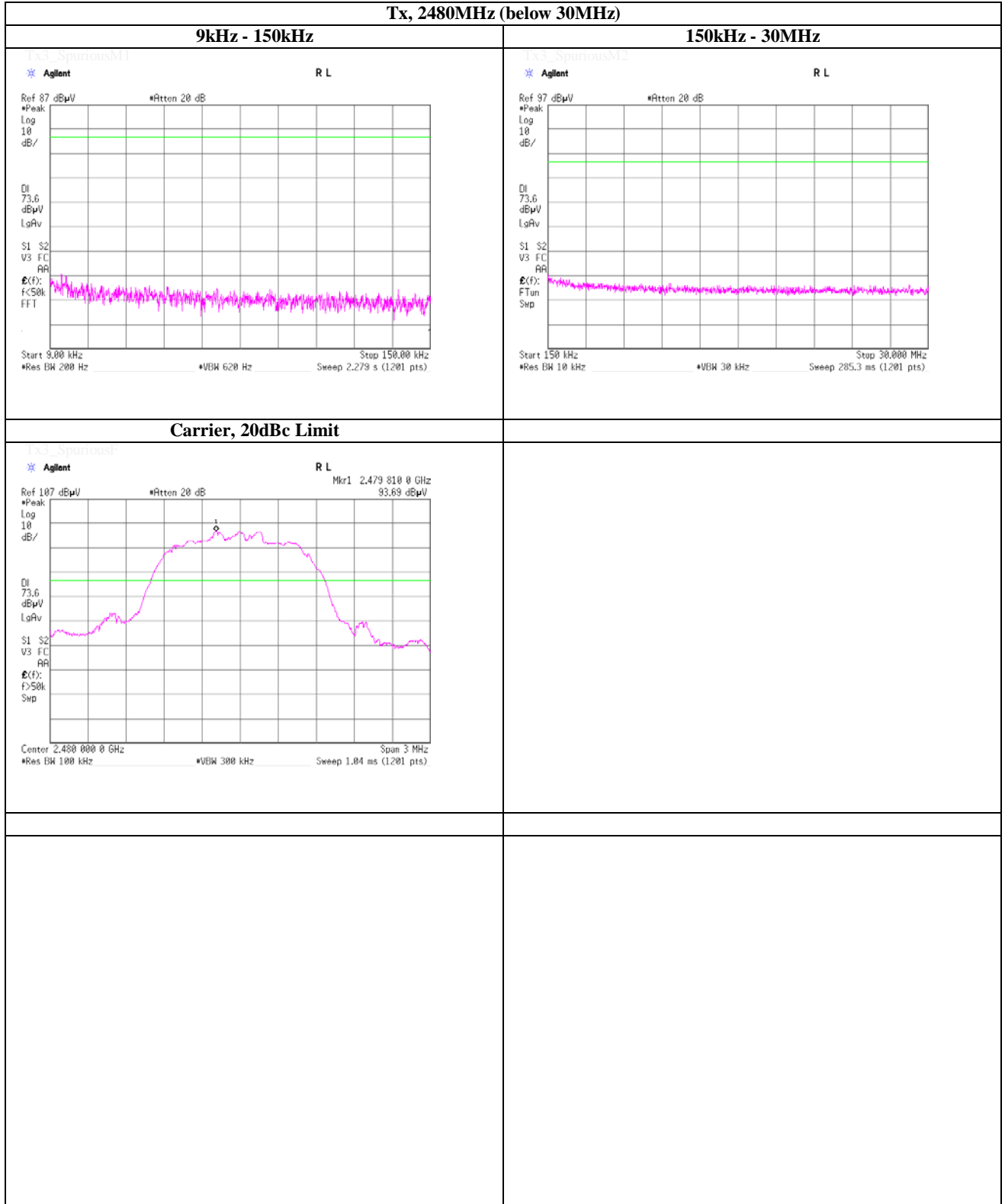
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

### Spurious emission (Conducted)

**Tx, Bluetooth, EDR, PRBS9**

**Tx, 2480MHz (below 30MHz)**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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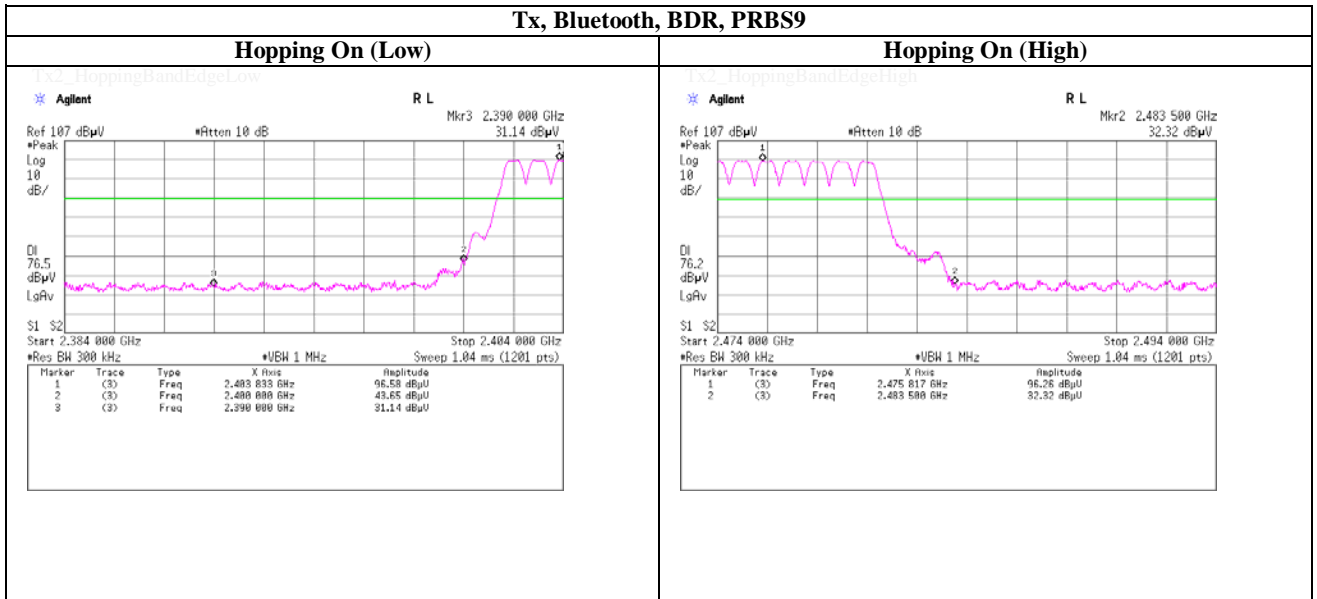
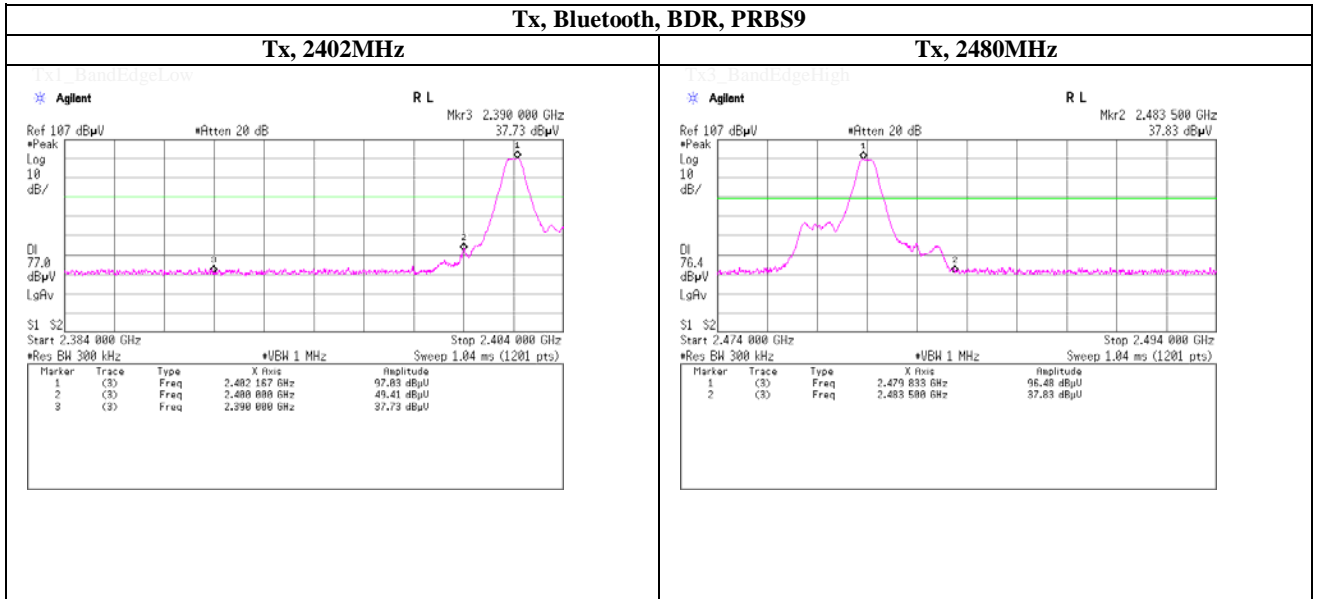
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Test place           UL Japan, Inc. Shonan EMC Lab.    No.5 Shielded Room  
 Date                 September 19, 2014  
 Temperature / Humidity 26deg.C     , 48%RH  
 Engineer            Kenichi Adachi

## Spurious emission (Conducted)

### Band Edge compliance

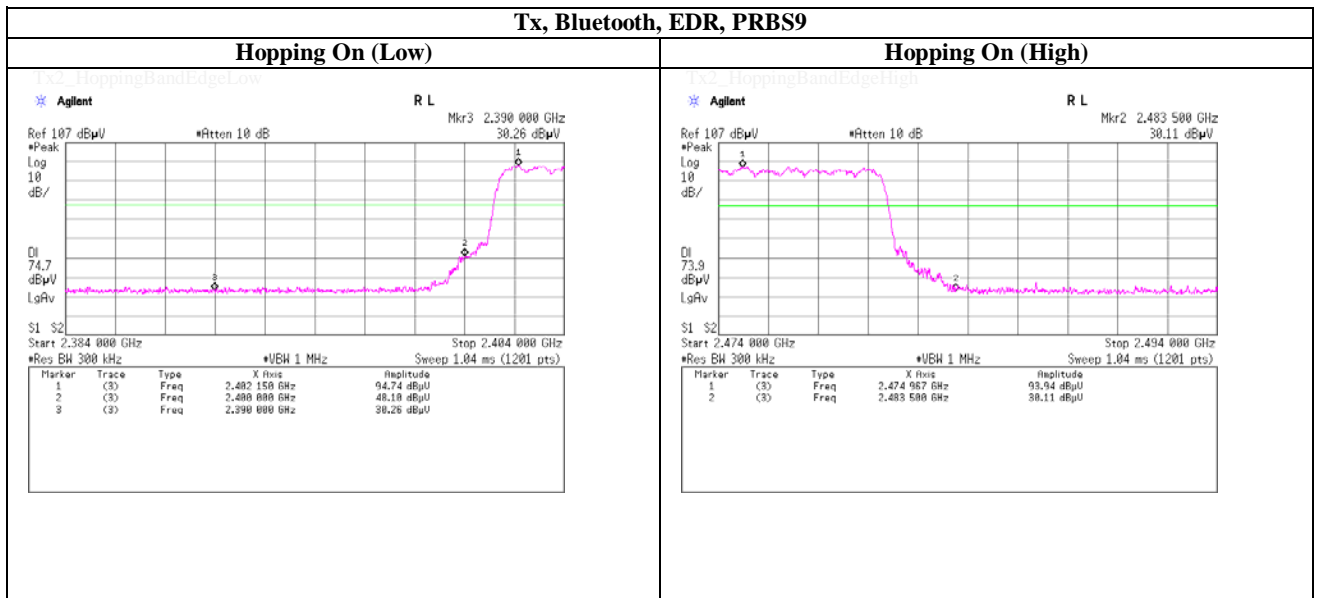
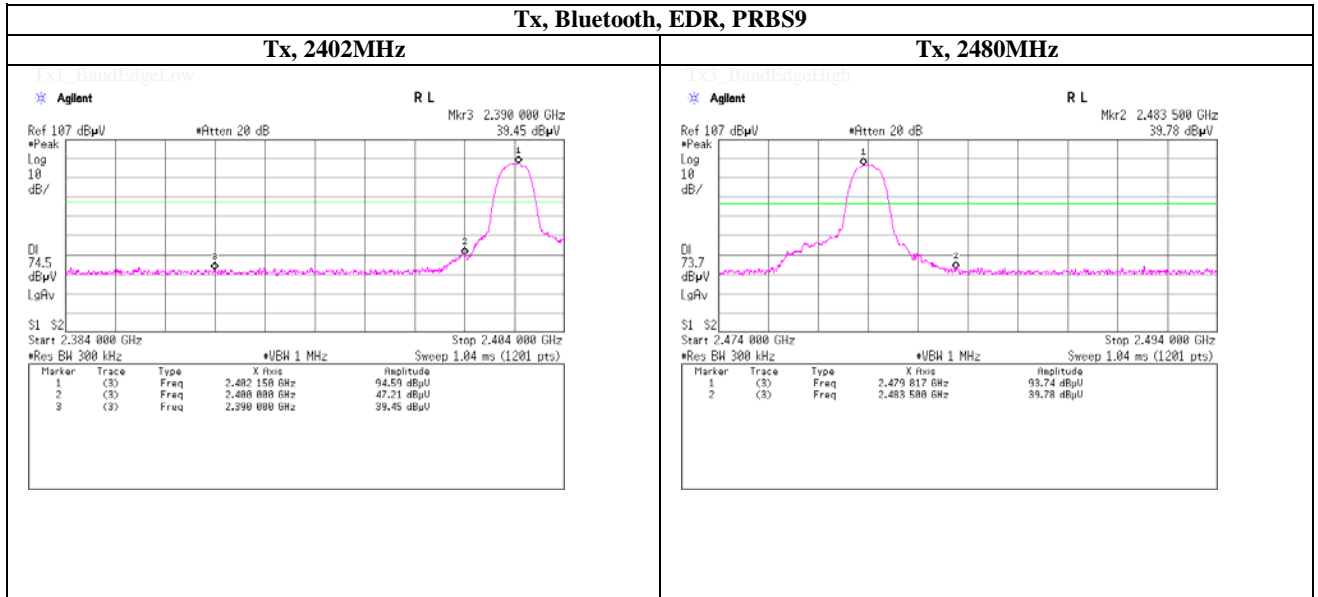


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**Shonan EMC Lab.**  
 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN  
 Telephone     : +81 463 50 6400  
 Facsimile    : +81 463 50 6401

Test place           UL Japan, Inc. Shonan EMC Lab.    No.5 Shielded Room  
 Date                 September 19, 2014  
 Temperature / Humidity   26deg.C     , 48%RH  
 Engineer             Akio Hayashi

## Spurious emission (Conducted)

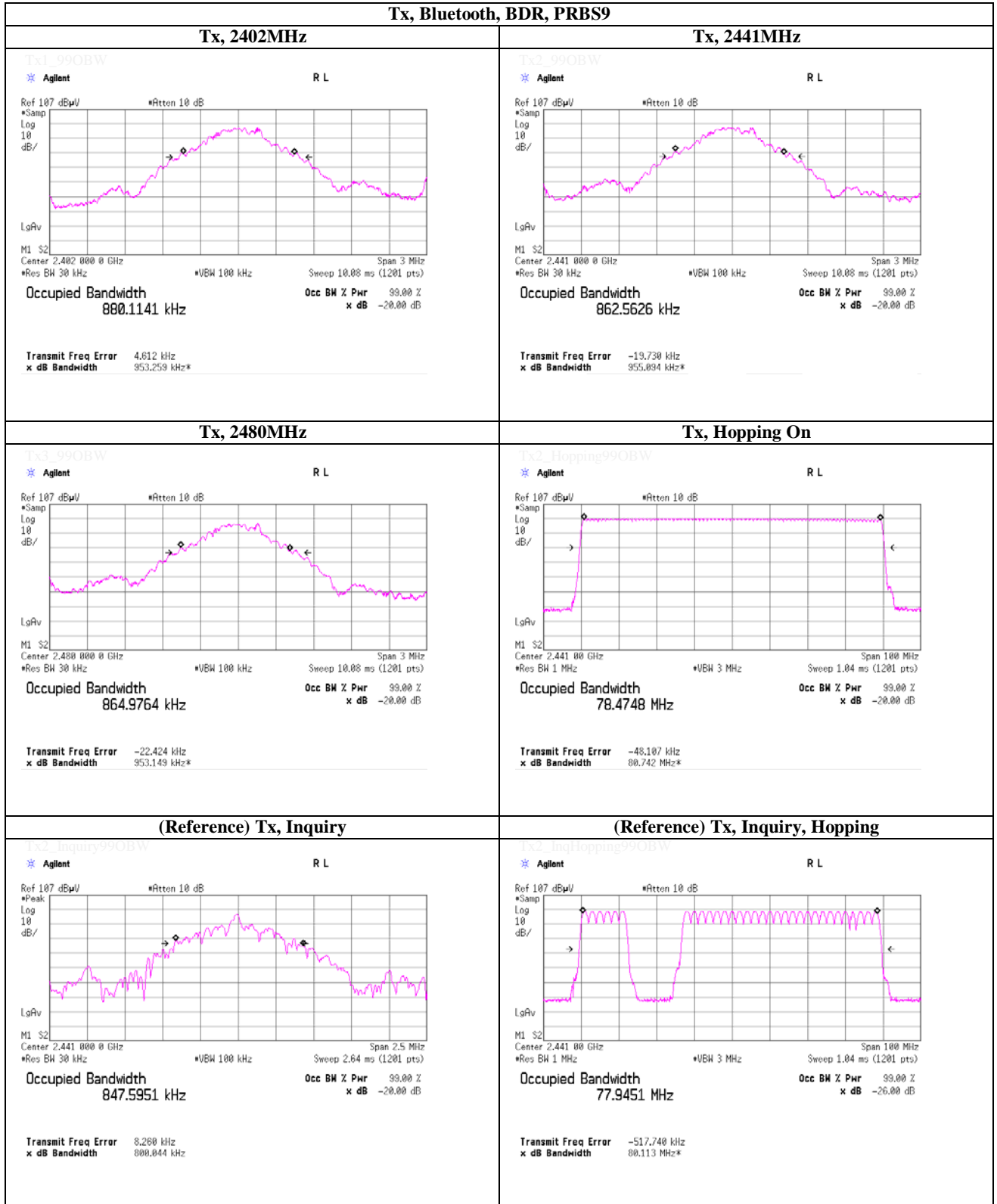
### Band Edge compliance



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**Shonan EMC Lab.**  
 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN  
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

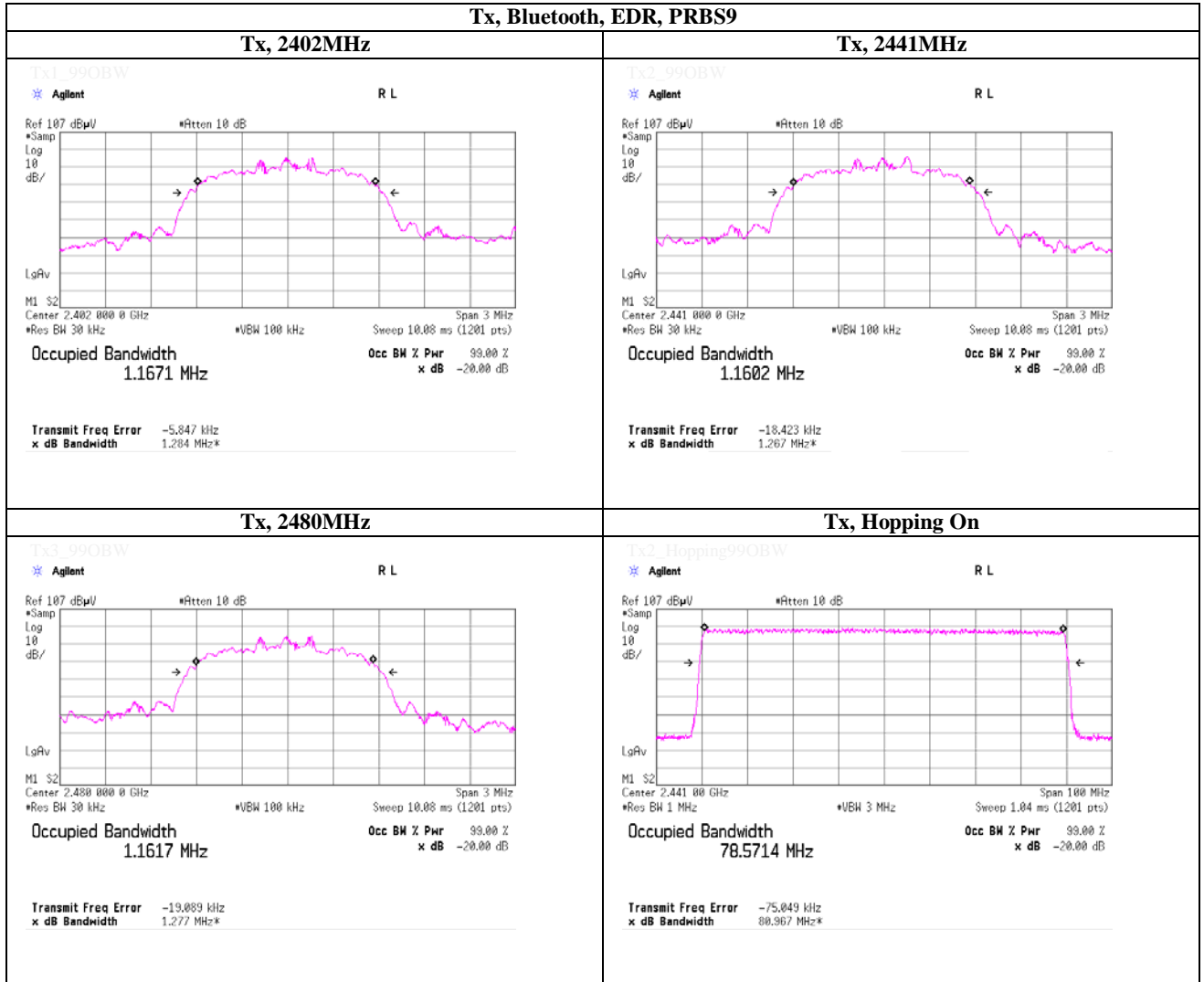
### 99% Occupied Bandwidth



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**Shonan EMC Lab.**  
 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN  
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date September 19, 2014  
 Temperature / Humidity 26deg.C , 48%RH  
 Engineer Akio Hayashi

### 99% Occupied Bandwidth



Tx2\_Inquiry99OBW

Tx2\_InqHopping99OBW

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**Shonan EMC Lab.**  
 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN  
 Telephone : +81 463 50 6400  
 Facsimile : +81 463 50 6401



## APPENDIX 2 Test Instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2014/03/04 * 12
SAT10-11	Attenuator	Weinschel Corp.	54A-10	37588	AT	2014/04/22 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2014/03/14 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2014/04/04 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2014/04/04 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/03/07 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	RE	2014/02/03 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2014/02/17 * 12
KAT6-04	Attenuator	INMET	18N-6dB	-	RE	2013/12/26 * 12
KAT3-09	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2014/08/27 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2014/10/18 * 12
SCC-A1/A3/A5/A7/A8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269 (RF Selector)	RE	2014/04/25 * 12
SCC-A2/A4/A6/A7/A8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269 (RF Selector)	RE	2014/04/25 * 12
SLA-01	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A0888	RE	2014/10/18 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2014/02/21 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2013/11/20 * 12
SJM-13	Measure	ASKUL	-	-	RE	-
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2014/07/09 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
SSG-02	Signal Generator	Agilent	E8257D-540	MY48051404	RE	2014/03/20 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2014/07/08 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2013/11/22 * 12
SCC-G02	Coaxial Cable	Suhner	SUCOFLEX 104A	46498/4A	RE	2014/04/22 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2014/05/15 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2014/08/12 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2014/02/21 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2014/09/03 * 12
SJM-14	Measure	ASKUL	-	-	RE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2013/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2013/11/22 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2014/07/14 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2014/05/23 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-00	JUN-12-14-018	RE	2014/06/24 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2014/05/15 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2014/08/12 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/02/21 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2014/03/17 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2014/03/15 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2014/03/14 * 12

The expiration date of the calibration is the end of the expired month .  
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards .

Test Item :

RE: Radiated emission ,  
AT: Antenna terminal conducted test