



Test report No. : 10003129S-A

Page : 1 of 51

Issued date : May 24, 2013

FCC ID : AX2NX603

RADIO TEST REPORT

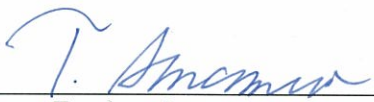
Test Report No.: 10003129S-A

Applicant : Clarion Co., Ltd.
Type of Equipment : Car Navigation
Model No. : NX603
FCC ID : AX2NX603
Test regulation : FCC Part15 Subpart C: 2012
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.

Date of test: April 27 to May 9, 2013

Tested by: 
Shinichi Takano
Engineer of WiSE Japan,
UL Verification Service

Approved by : 
Toyokazu Imamura
Leader of WiSE Japan,
UL Verification Service



- ☐ 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.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

13-EM-F0429

Original Test Report No.: 10003129S-A

[illegible]

Facsimile : +81 463 50 6401

Contents

	<u>Page</u>
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Carrier frequency separation.....	11
SECTION 6: 20dB bandwidth & Occupied bandwidth (99%)	11
SECTION 7: Number of hopping frequency	11
SECTION 8: Dwell time.....	11
SECTION 9: Maximum peak output power	11
SECTION 10: Spurious emissions (Antenna port conducted).....	11
SECTION 11: Radiated emission.....	12
Contents of APPENDIXES.....	14
APPENDIX 1: Data of Radio tests.....	15
APPENDIX 2: Test instruments	50
APPENDIX 3: Photographs of test setup	51

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

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 : Matsuhiko Hirano

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

2.1 Identification of E.U.T.

Type of Equipment : Car Navigation
Model Number : NX603
Serial Number : Refer to 4.2 in this report.
Rating : DC12V
Country of Mass-production : Japan
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : April 16, 2013
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: NX603 (referred to as the EUT in this report) is a Car Navigation.

Clock frequency(ies) in the system : 41.6MHz (Xtal), 333MHz (DDR3)

Radio specification:

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth & Channel spacing : 79MHz & 1MHz
Type of modulation : GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna type : Pattern
Antenna gain : -6.6dBi
Antenna connector type : None
ITU code : F1D
Operation temperature range : -20 to +60 deg.C

FCC 15.31 (e)

The EUT provides stable voltage (DC3.3V) constantly to the wireless transmitter regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC 15.203

The antenna is not removable from the EUT. Therefore the equipment complies with the requirement.

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

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : Test specification: FCC Part 15 Subpart C: 2012, final revised on December 27, 2012 and effective January 28, 2013
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 EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report: 10003129S-C.

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)	N/A	N/A
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	6.2dB Freq.: 832.492MHz Polarization: Vertical Detection: Quasi-Peak Mode: Tx 2480MHz, 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.						

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

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 4.6.1	-	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 ^{*1} /SR ^{*2} (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.7 dB	3.7 dB	3.6 dB
	30MHz-300MHz	4.9 dB	5.1 dB	4.9 dB
	300MHz-1GHz	5.0 dB	5.2 dB	4.9 dB
	1GHz-15GHz	4.8 dB	4.8 dB	4.9 dB
Radiated emission (Measurement distance: 1m)	15GHz-18GHz	5.6 dB	5.6 dB	5.6 dB
	18GHz-40GHz	4.6 dB	4.3 dB	4.4 dB

*1: SAC=Semi-Anechoic Chamber

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

Radiated emission test

The data listed in this test report has enough margin, more than 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: (±) 1.7dB

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 2.3dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 3.0dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.9dB

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

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

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

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
☐ No.1 semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.2 semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.3 semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ 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.7 shielded room	-	-	2.76 x 3.76 x 2.4	2.76 x 3.76	-

3.6 Test setup, Test data & Test instruments

Refer to APPENDIX 1 to 3.

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

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

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

The EUT has no inquiry mode.

Software: Tera Term ver. 4.66
Power setting: Fixed

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

UL Japan, Inc.

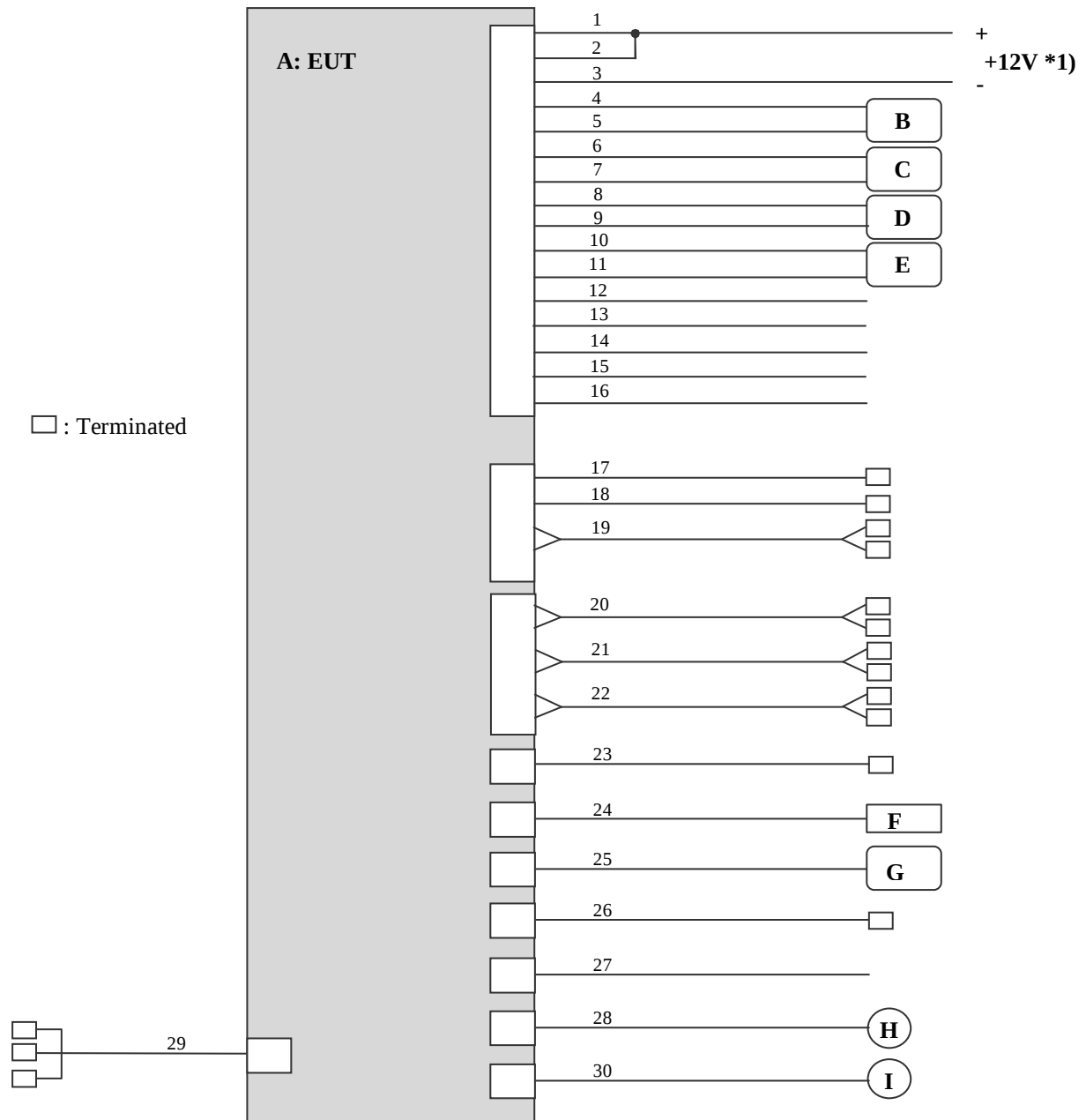
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

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

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Navigation	NX603	*2)	Clarion	EUT
B	Speaker dummy load (4ohm)	-	-	-	-
C	Speaker dummy load (4ohm)	-	-	-	-
D	Speaker dummy load (4ohm)	-	-	-	-
E	Speaker dummy load (4ohm)	-	-	-	-
F	USB Memory	USB DATA STICK 32MB	-	ADTEC	-
G	Steering Wheel Interface	SWI-RC	-	-	-
H	Microphone	-	-	-	-
I	GPS Antenna	-	096016900 AA112500414030	-	-

*1) DC power supply (Model No.: PAN35-10A) was used for DC 12.0V input.

*2) Antenna terminal conducted tests: 9000021, Radiated emission tests: 9000020

List of cables used

No.	Cable Name	Length (m)	Shield		Remark
			Cable	Connector	
1	+12V main power	1.7	Unshielded	Unshielded	-
2	+12V accessory	1.7	Unshielded	Unshielded	-
3	Ground	1.7	Unshielded	Unshielded	-
4	Rear right +	1.3	Unshielded	Unshielded	-
5	Rear right -	1.3	Unshielded	Unshielded	-
6	Front right +	1.3	Unshielded	Unshielded	-
7	Front right -	1.3	Unshielded	Unshielded	-
8	Rear left +	1.3	Unshielded	Unshielded	-
9	Rear left -	1.3	Unshielded	Unshielded	-
10	Front left +	1.3	Unshielded	Unshielded	-
11	Front left -	1.3	Unshielded	Unshielded	-
12	Illumination	0.15	Unshielded	Unshielded	-
13	Parking brake cord	3.0	Unshielded	Unshielded	-
14	Reverse gear cord	5.0	Unshielded	Unshielded	-
15	Auto Antenna	1.3	Unshielded	Unshielded	-
16	Amplifier turn on	1.3	Unshielded	Unshielded	-
17	Video output	0.2+1.5	Unshielded	Unshielded	-
18	Video input	0.2+1.5	Unshielded	Unshielded	-
19	Audio input	0.2+1.5	Unshielded	Unshielded	-
20	Front audio output	0.2+1.5	Unshielded	Unshielded	-
21	Rear audio output	0.2+1.5	Unshielded	Unshielded	-
22	Subwoofer audio output	0.2+1.5	Unshielded	Unshielded	-
23	Radio antenna	3.0	Shielded	Shielded	-
24	USB	1.5	Shielded	Shielded	-
25	Steering Wheel Interface	0.9	Unshielded	Unshielded	-
26	Rear View Camera	0.3+1.4	Shielded	Shielded	-
27	HDMI	1.7	Shielded	Shielded	-
28	Microphone	2.9	Shielded	Shielded	-
29	AUX	0.3+2.0	Shielded	Shielded	-
30	GPS antenna	2.5	Shielded	Shielded	-

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

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

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

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

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

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

SECTION 10: Spurious emissions (Antenna port conducted)

Test procedure

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

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

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

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

SECTION 11: Radiated emission

11.1 Operating environment

Test room : Refer to APPENDIX
 Temperature : Refer to APPENDIX
 Humidity : Refer to APPENDIX

11.2 Test configuration

EUT was placed on a platform of nominal size, 1m 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.

11.3 Test conditions

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

11.4 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	
Detection Type	: Quasi-Peak	Peak	* Average
IF Bandwidth	: 120kHz	RBW:1MHz	RBW:1MHz
		VBW:3MHz	VBW:10Hz

* 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 0 to 30 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	Spurious emission (Below 1GHz)	Spurious emission (Above 1GHz)
Horizontal	30 deg.	15 deg.	30 deg.
Vertical	15 deg.	15 deg.	0 deg.

UL Japan, Inc.

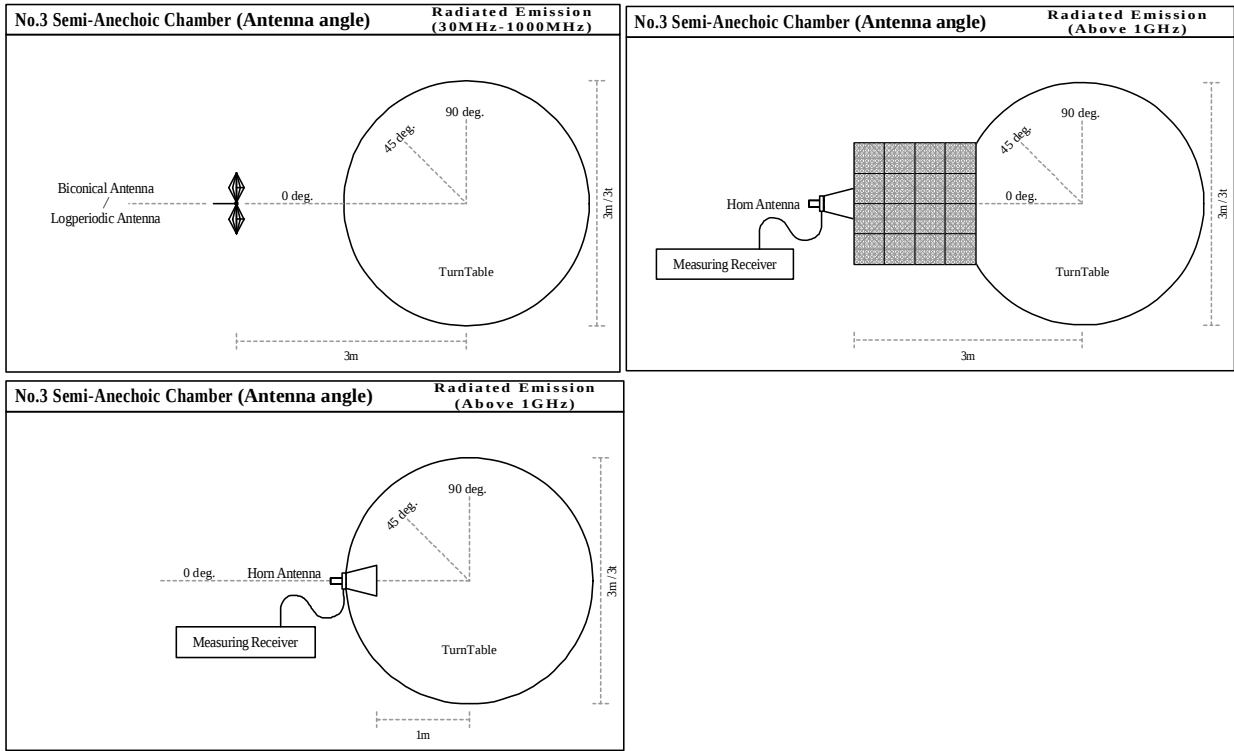
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Figure 1. Antenna angle



11.5 Band edge

Band edge level is below the limits of FCC 15.209. Refer to the data.

11.6 Results

Summary of the test results: Pass *No noise was detected above the 5th order harmonics.

Refer to APPENDIX

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

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

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 May 9, 2013
Temperature / Humidity 25 deg.C , 37 %RH
Engineer Shinichi Takano
Mode Tx, Bluetooth, BDR, PRBS9

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency Separation [MHz]
DH5	2402.0	0.947	1.000	>= 0.631
DH5	2441.0	0.919	1.000	>= 0.613
DH5	2480.0	0.962	1.000	>= 0.641

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

No limit applies to 20dB Bandwidth.

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

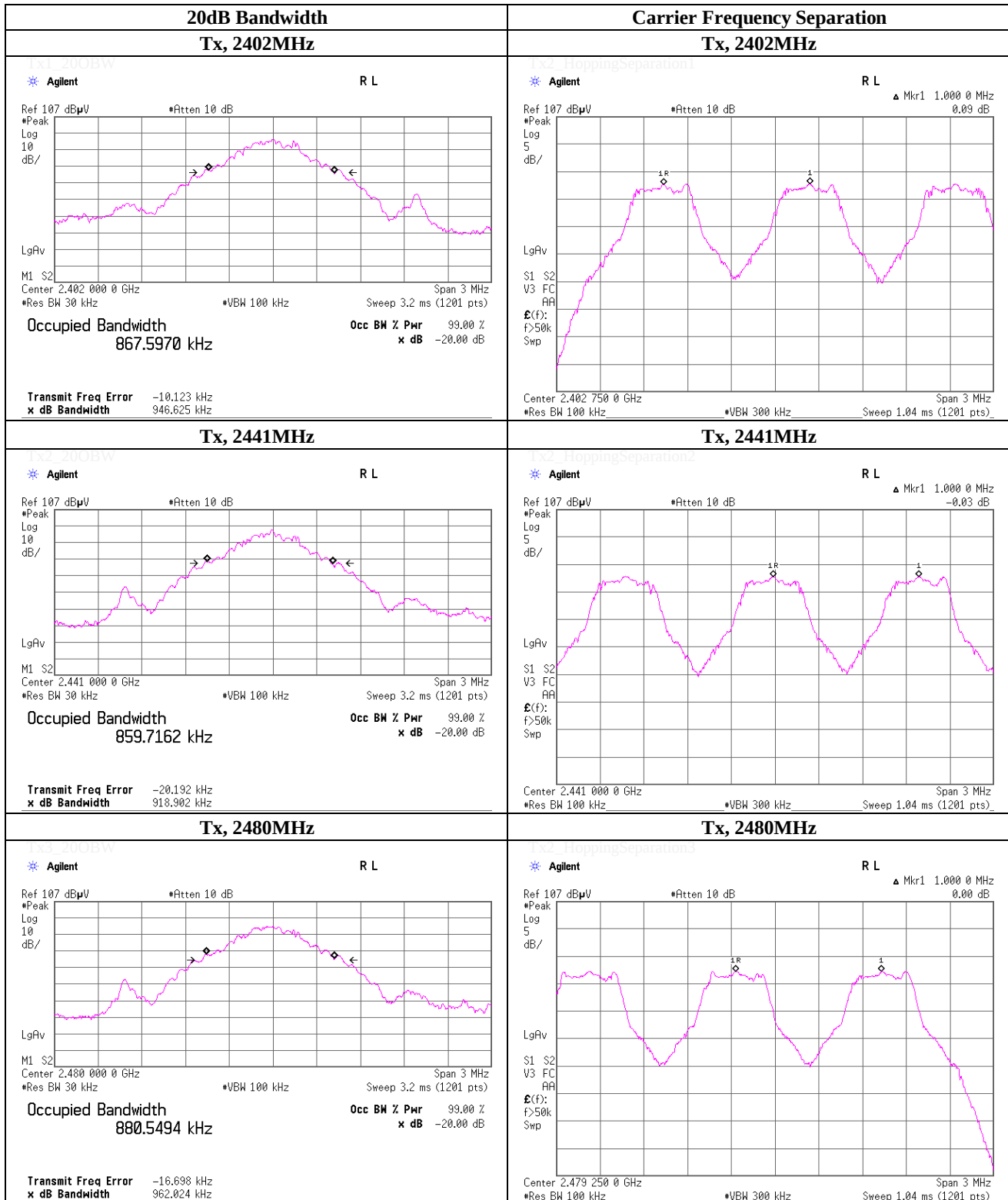
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

20dB Bandwidth and Carrier Frequency Separation

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

20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date May 9, 2013
Temperature / Humidity 25 deg.C , 37 %RH
Engineer Shinichi Takano
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	1.256	1.000	>= 0.837
3-DH5	2441.0	1.255	1.000	>= 0.836
3-DH5	2480.0	1.250	1.000	>= 0.833

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

No limit applies to 20dB Bandwidth.

UL Japan, Inc.

Shonan EMC Lab.

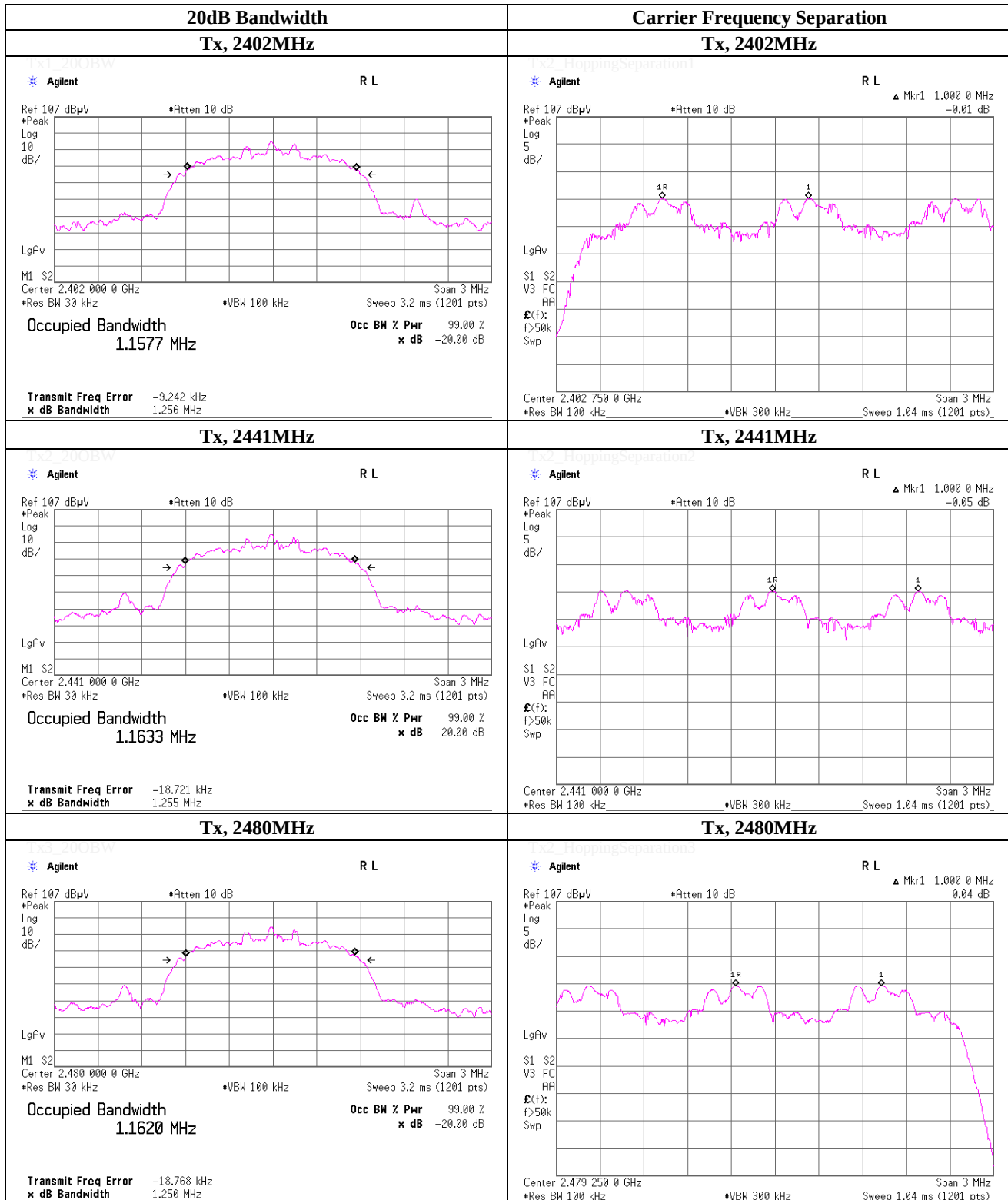
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, EDR, PRBS9



UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

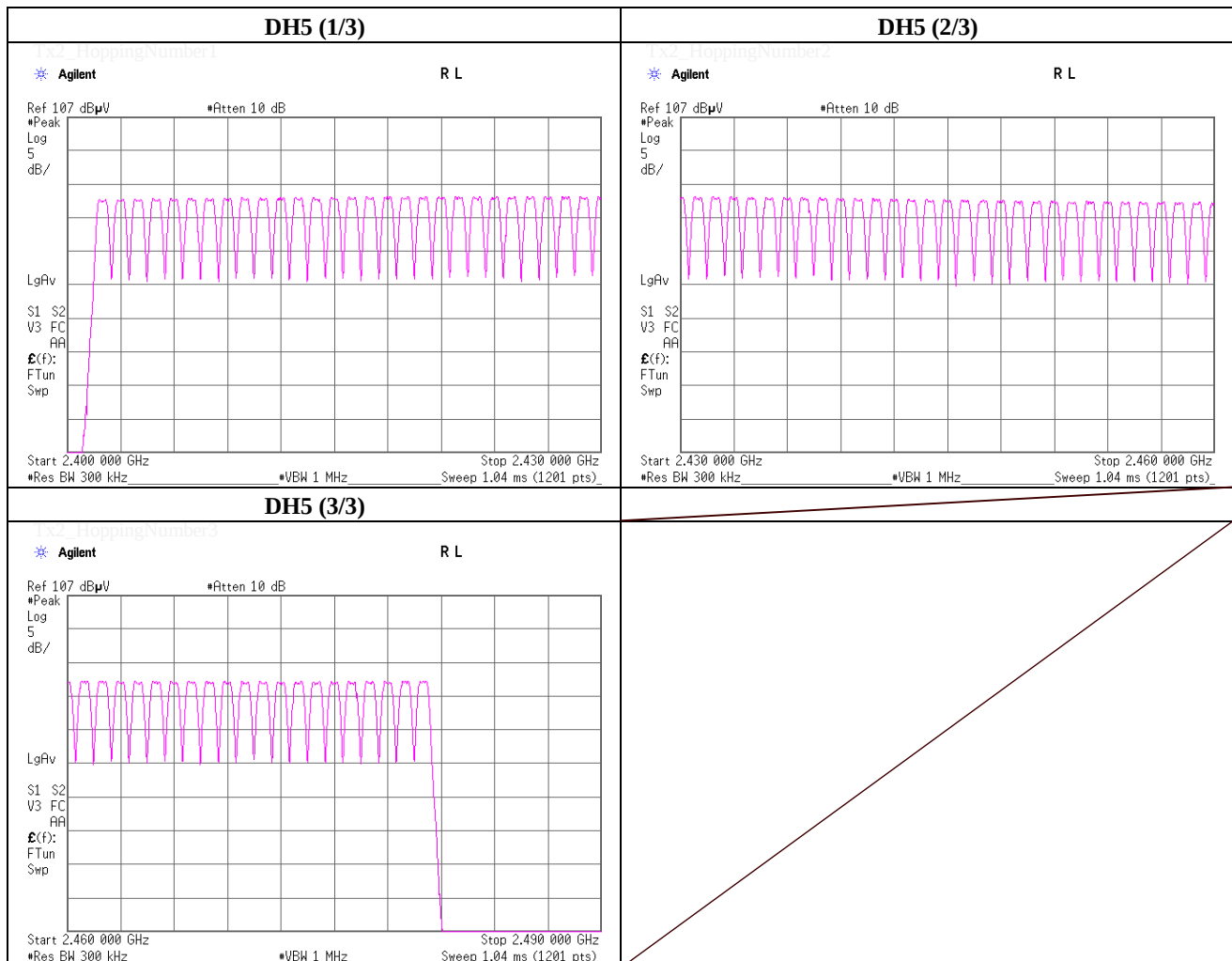
Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	May 9, 2013	
Temperature / Humidity	25 deg.C , 37 %RH	
Engineer	Shinichi Takano	
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.



UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

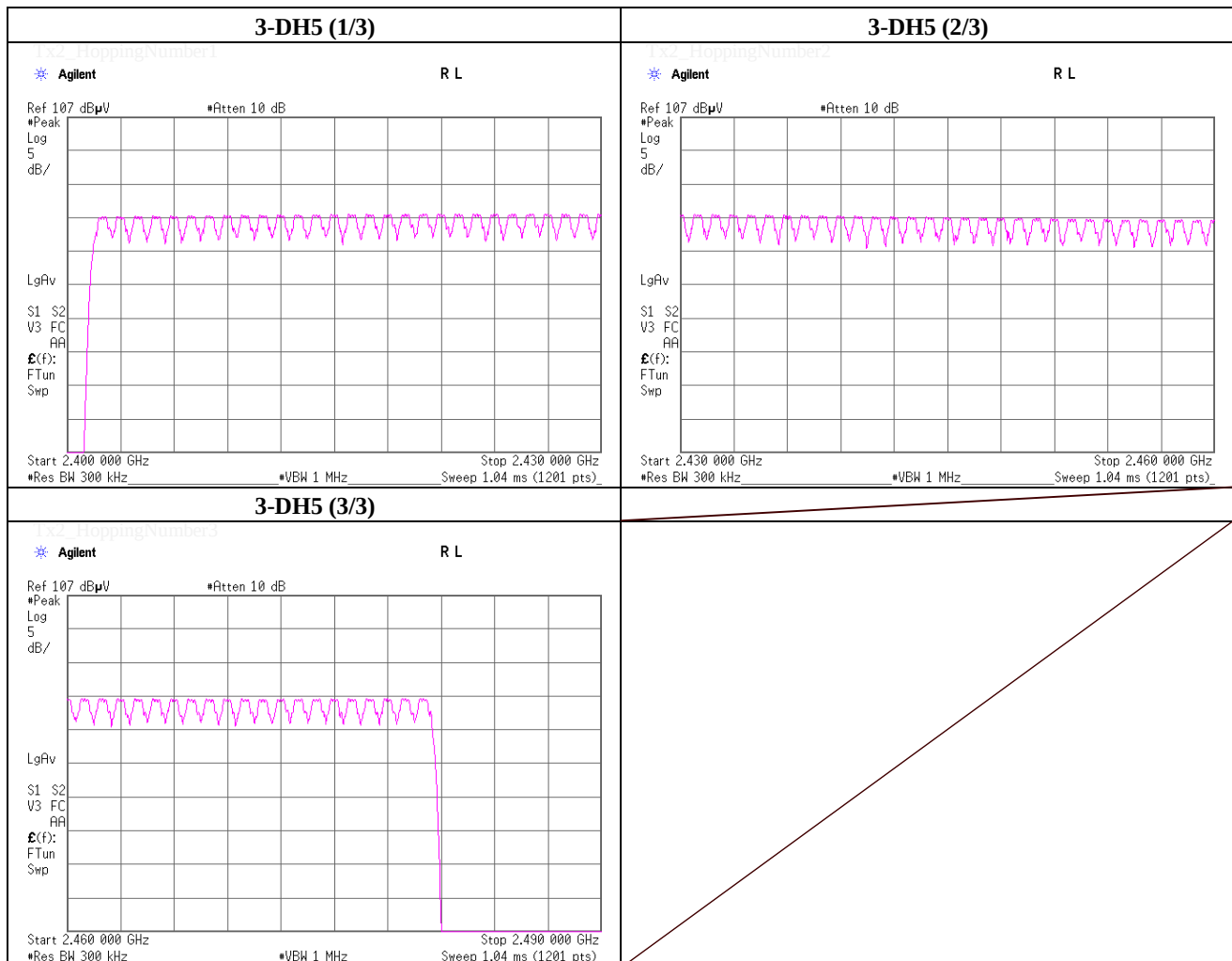
Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	May 9, 2013	
Temperature / Humidity	25 deg.C , 37 %RH	
Engineer	Shinichi Takano	
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.



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 May 9, 2013
 Temperature / Humidity 25 deg.C , 37 %RH
 Engineer Shinichi Takano
 Mode Tx, Bluetooth, BDR, PRBS9

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4) second	Length of transmission time [msec]	Result [msec]	Limit [msec]
DH1	51.0 / 5.0 sec. x 31.6 sec. = 323 times	0.404	131	400
DH3	26.0 / 5.0 sec. x 31.6 sec. = 165 times	1.659	274	400
DH5	17.0 / 5.0 sec. x 31.6 sec. = 108 times	2.909	314	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 $N=79$.

UL Japan, Inc.

Shonan EMC Lab.

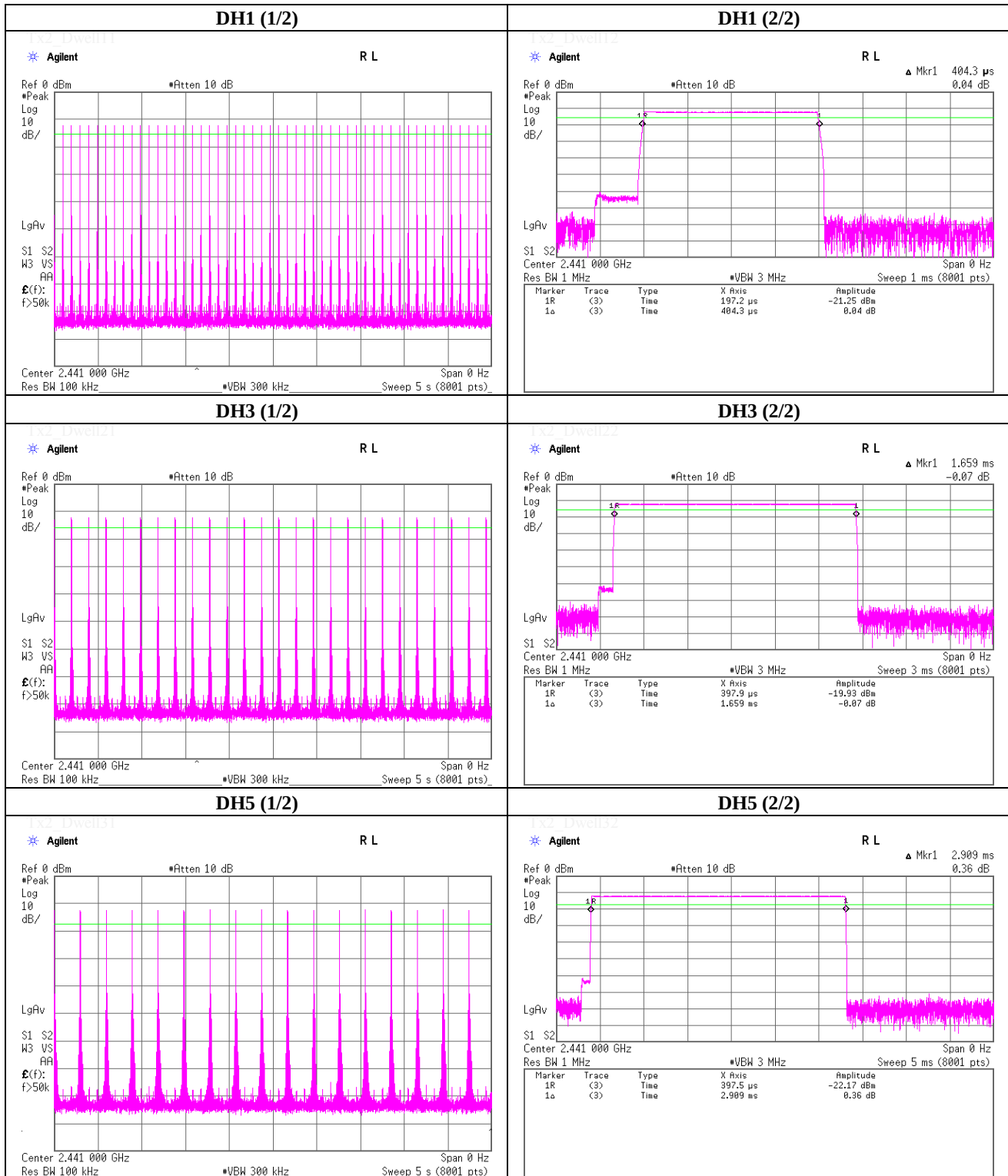
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time

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 May 9, 2013
 Temperature / Humidity 25 deg.C , 37 %RH
 Engineer Shinichi Takano
 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	0.421	136	400
3-DH3	26.0 / 5.0 sec. x 31.6 sec. = 165 times	1.670	276	400
3-DH5	17.0 / 5.0 sec. x 31.6 sec. = 108 times	2.922	316	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 $N=79$.

UL Japan, Inc.

Shonan EMC Lab.

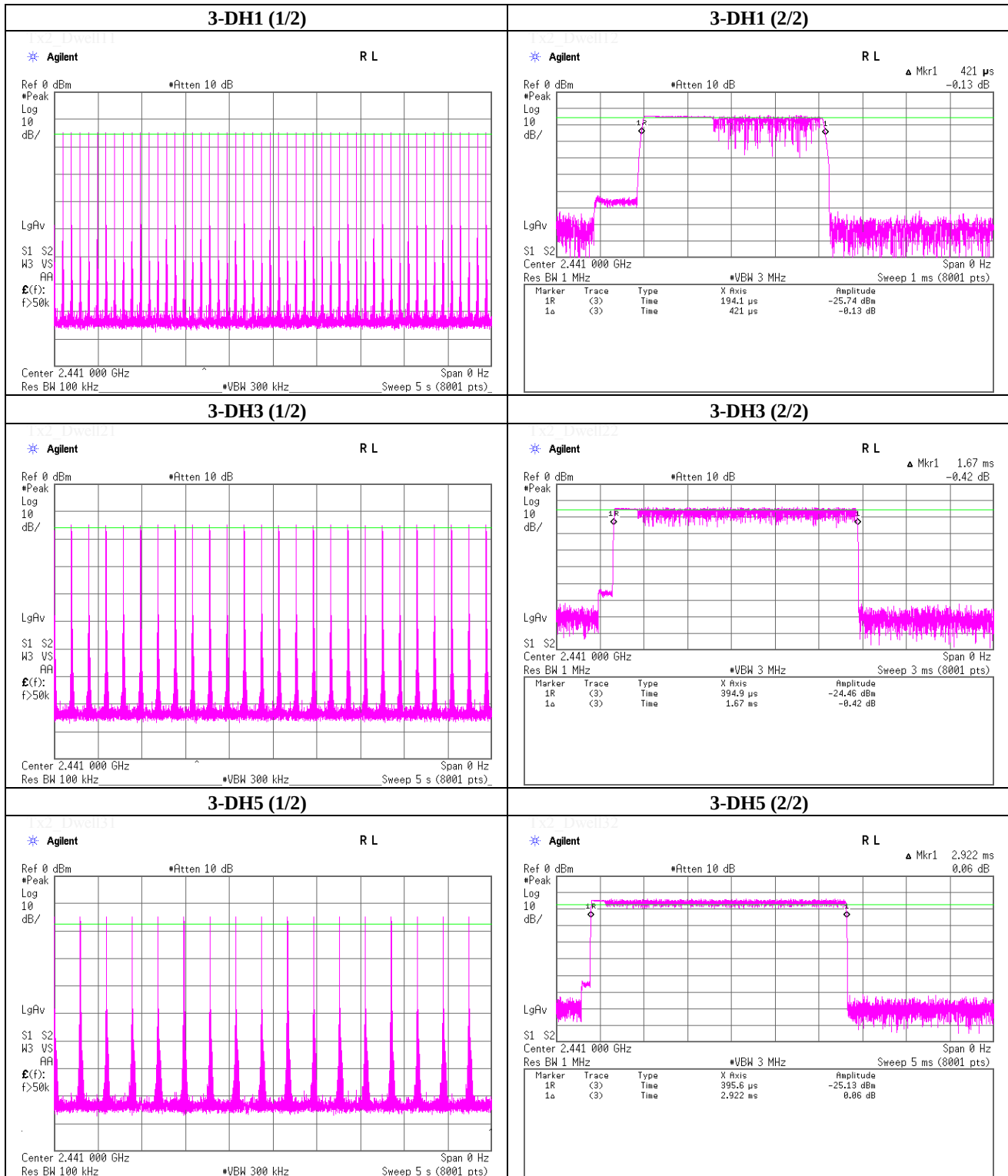
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time

Tx, Bluetooth, EDR, 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

Maximum Peak Conducted Output Power (Conducted)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date May 9, 2013
 Temperature / Humidity 25 deg.C , 37 %RH
 Engineer Shinichi Takano
 Mode Tx, Bluetooth

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

	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
DH5	2402.0	-11.19	1.13	9.97	-0.09	0.98	20.97	125	21.06
DH5	2441.0	-11.08	1.14	9.97	0.03	1.01	20.97	125	20.94
DH5	2480.0	-11.46	1.15	9.97	-0.34	0.92	20.97	125	21.31
2-DH5	2402.0	-12.77	1.13	9.97	-1.67	0.68	20.97	125	22.64
2-DH5	2441.0	-12.75	1.14	9.97	-1.64	0.69	20.97	125	22.61
2-DH5	2480.0	-13.22	1.15	9.97	-2.10	0.62	20.97	125	23.07
3-DH5	2402.0	-12.60	1.13	9.97	-1.50	0.71	20.97	125	22.47
3-DH5	2441.0	-12.51	1.14	9.97	-1.40	0.72	20.97	125	22.37
3-DH5	2480.0	-13.02	1.15	9.97	-1.90	0.65	20.97	125	22.87

Sample Calculation:

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

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	UL Japan, Inc. Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	April 28, 2013	April 29, 2013	May 1, 2013
Temperature / Humidity	22 deg.C , 33 %RH	25 deg.C , 30 %RH	22 deg.C , 44 %RH
Engineer	Tatsuya Arai	Tatsuya Arai	Akio Hayashi
	(1-18GHz)	(above18GHz)	(30M-1GHz)
Mode	Tx, 2402 MHz		
	Tx, Bluetooth, BDR, PRBS9		

(* 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.	71.016	QP	37.7	6.5	6.8	32.1		18.9	40.0	21.1	255	249	
Hori.	144.000	QP	35.5	14.6	7.7	32.1		25.7	43.5	17.8	249	109	
Hori.	200.150	QP	39.7	16.3	8.0	32.0		32.0	43.5	11.5	190	278	
Hori.	215.999	QP	42.1	16.6	8.0	32.0		34.7	43.5	8.8	154	233	
Hori.	240.000	QP	31.1	16.9	8.2	32.0		24.2	46.0	21.8	248	217	
Hori.	332.305	QP	40.4	14.7	8.7	31.9		31.9	46.0	14.1	100	120	
Hori.	365.539	QP	39.6	15.4	8.9	31.9		32.0	46.0	14.0	124	18	
Hori.	431.999	QP	39.3	16.6	9.2	31.9		33.2	46.0	12.8	100	242	
Hori.	2390.000	PK	46.8	27.4	14.8	41.4		47.6	73.9	26.3	125	244	
Hori.	2400.000	PK	51.2	27.4	14.8	41.4		52.0	73.9	21.9	125	244	
Hori.	3383.910	PK	51.8	29.1	6.6	41.8		45.7	73.9	28.2	132	184	
Hori.	4804.000	PK	53.3	31.1	7.6	41.2		50.8	73.9	23.1	166	292	
Hori.	7206.000	PK	48.9	36.6	9.1	41.4		53.2	73.9	20.7	126	169	
Hori.	9608.000	PK	43.3	38.5	10.3	38.9		53.2	73.9	20.7	100	0	
Hori.	12010.000	PK	44.7	39.4	11.5	39.4		56.2	73.9	17.7	100	0	
Hori.	3383.910	AV	47.2	29.1	6.6	41.8		41.1	53.9	12.8	132	184	
Vert.	832.471	QP	38.3	21.3	10.6	31.4		38.8	46.0	7.2	100	359	
Vert.	920.140	QP	30.4	22.4	10.9	30.9		32.8	46.0	13.2	100	8	
Vert.	2390.000	PK	46.6	27.4	14.8	41.4		47.4	73.9	26.5	100	180	
Vert.	2400.000	PK	52.4	27.4	14.8	41.4		53.2	73.9	20.7	100	180	
Vert.	3383.910	PK	52.8	29.1	6.6	41.8		46.7	73.9	27.2	100	192	
Vert.	4804.000	PK	54.5	31.1	7.6	41.2		52.0	73.9	21.9	100	166	
Vert.	7206.000	PK	48.3	36.6	9.1	41.4		52.6	73.9	21.3	100	169	
Vert.	9608.000	PK	44.1	38.5	10.3	38.9		54.0	73.9	19.9	100	0	
Vert.	12010.000	PK	44.5	39.4	11.5	39.4		56.0	73.9	17.9	100	0	
Vert.	3383.910	AV	48.8	29.1	6.6	41.8		42.7	53.9	11.2	100	192	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2390.000	AV	34.1	27.4	14.8	41.4	-24.7	10.2	53.9	43.7	125	244	
Hori.	2400.000	AV	37.8	27.4	14.8	41.4	-24.7	13.9	53.9	40.0	125	244	
Hori.	4804.000	AV	43.8	31.1	7.6	41.2	-24.7	16.6	53.9	37.3	166	292	
Hori.	7206.000	AV	39.3	36.6	9.1	41.4	-24.7	18.9	53.9	35.0	126	169	
Hori.	9608.000	AV	32.1	38.5	10.3	38.9	-24.7	17.3	53.9	36.6	100	0	
Hori.	12010.000	AV	33.2	39.4	11.5	39.4	-24.7	20.0	53.9	33.9	100	0	
Vert.	2390.000	AV	34.1	27.4	14.8	41.4	-24.7	10.2	53.9	43.7	100	180	
Vert.	2400.000	AV	39.1	27.4	14.8	41.4	-24.7	15.2	53.9	38.7	100	180	
Vert.	4804.000	AV	44.7	31.1	7.6	41.2	-24.7	17.5	53.9	36.4	100	166	
Vert.	7206.000	AV	38.1	36.6	9.1	41.4	-24.7	17.7	53.9	36.2	100	169	
Vert.	9608.000	AV	32.1	38.5	10.3	38.9	-24.7	17.3	53.9	36.6	100	0	
Vert.	12010.000	AV	33.1	39.4	11.5	39.4	-24.7	19.9	53.9	34.0	100	0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

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

Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	April 28, 2013	April 29, 2013	May 1, 2013
Temperature / Humidity	22 deg.C , 33 %RH	25 deg.C , 30 %RH	22 deg.C , 44 %RH
Engineer	Tatsuya Arai	Tatsuya Arai	Akio Hayashi
	(1-18GHz)	(above18GHz)	(30M-1GHz)
Mode	Tx, 2441 MHz		
	Tx, Bluetooth, BDR, PRBS9		

(* 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.	71.021	QP	39.2	6.5	6.8	32.1		20.4	40.0	19.6	256	244	
Hori.	215.999	QP	41.3	16.6	8.0	32.0		33.9	43.5	9.6	140	238	
Hori.	332.310	QP	41.6	14.7	8.7	31.9		33.1	46.0	12.9	100	227	
Hori.	365.539	QP	38.9	15.4	8.9	31.9		31.3	46.0	14.7	100	8	
Hori.	432.002	QP	39.0	16.6	9.2	31.9		32.9	46.0	13.1	100	224	
Hori.	3383.947	PK	52.6	29.1	6.6	41.8		46.5	73.9	27.4	131	183	
Hori.	4882.000	PK	56.9	31.3	7.7	41.1		54.8	73.9	19.1	100	211	
Hori.	7323.000	PK	48.2	36.6	9.2	41.4		52.6	73.9	21.3	100	206	
Hori.	9764.000	PK	43.1	38.7	10.2	38.9		53.1	73.9	20.8	100	0	
Hori.	12205.000	PK	44.7	39.5	11.4	39.3		56.3	73.9	17.6	100	0	
Hori.	3383.947	AV	48.3	29.1	6.6	41.8		42.2	53.9	11.7	131	183	
Vert.	832.494	QP	39.0	21.3	10.6	31.4		39.5	46.0	6.5	100	359	
Vert.	919.860	QP	30.1	22.4	10.9	30.9		32.5	46.0	13.5	100	11	
Vert.	3383.947	PK	52.8	29.1	6.6	41.8		46.7	73.9	27.2	100	192	
Vert.	4882.000	PK	59.7	31.3	7.7	41.1		57.6	73.9	16.3	100	163	
Vert.	7323.000	PK	47.9	36.6	9.2	41.4		52.3	73.9	21.6	100	127	
Vert.	9764.000	PK	43.6	38.7	10.2	38.9		53.6	73.9	20.3	100	0	
Vert.	12205.000	PK	43.9	39.5	11.4	39.3		55.5	73.9	18.4	100	0	
Vert.	3383.947	AV	49.2	29.1	6.6	41.8		43.1	53.9	10.8	100	192	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	4882.000	AV	46.4	31.3	7.7	41.1	-24.7	19.6	53.9	34.3	100	211	
Hori.	7323.000	AV	36.8	36.6	9.2	41.4	-24.7	16.5	53.9	37.4	100	206	
Hori.	9764.000	AV	31.9	38.7	10.2	38.9	-24.7	17.2	53.9	36.7	100	0	
Hori.	12205.000	AV	32.9	39.5	11.4	39.3	-24.7	19.8	53.9	34.1	100	0	
Vert.	4882.000	AV	49.7	31.3	7.7	41.1	-24.7	22.9	53.9	31.0	100	163	
Vert.	7323.000	AV	36.6	36.6	9.2	41.4	-24.7	16.3	53.9	37.6	100	127	
Vert.	9764.000	AV	31.7	38.7	10.2	38.9	-24.7	17.0	53.9	36.9	100	0	
Vert.	12205.000	AV	32.7	39.5	11.4	39.3	-24.7	19.6	53.9	34.3	100	0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

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

Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	April 28, 2013	April 29, 2013	May 1, 2013
Temperature / Humidity	22 deg.C , 33 %RH	25 deg.C , 30 %RH	22 deg.C , 44 %RH
Engineer	Tatsuya Arai	Tatsuya Arai	Akio Hayashi
	(1-18GHz)	(above18GHz)	(30M-1GHz)
Mode	Tx, 2480 MHz		
	Tx, Bluetooth, BDR, PRBS9		

(* 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.	75.324	QP	36.8	6.5	7.2	32.1		18.4	40.0	21.6	265	263	
Hori.	200.125	QP	41.6	16.3	8.0	32.0		33.9	43.5	9.6	170	286	
Hori.	215.999	QP	43.4	16.6	8.0	32.0		36.0	43.5	7.5	162	251	
Hori.	335.999	QP	41.6	14.8	8.7	31.9		33.2	46.0	12.8	102	218	
Hori.	383.998	QP	39.9	15.8	9.0	31.9		32.8	46.0	13.2	100	264	
Hori.	455.998	QP	37.0	16.9	9.3	31.9		31.3	46.0	14.7	276	235	
Hori.	654.882	QP	35.8	19.7	10.0	32.0		33.5	46.0	12.5	161	43	
Hori.	2483.500	PK	47.3	27.5	14.9	41.4		48.3	73.9	25.6	100	22	
Hori.	3383.953	PK	52.1	29.1	6.6	41.8		46.0	73.9	27.9	135	183	
Hori.	4960.000	PK	60.8	31.6	7.7	41.0		59.1	73.9	14.8	117	155	
Hori.	7440.000	PK	48.5	36.7	9.2	41.5		52.9	73.9	21.0	100	132	
Hori.	9920.000	PK	44.1	39.0	10.3	38.9		54.5	73.9	19.4	100	0	
Hori.	12400.000	PK	45.0	39.5	11.3	39.3		56.5	73.9	17.4	100	0	
Hori.	3383.953	AV	48.1	29.1	6.6	41.8		42.0	53.9	11.9	135	183	
Vert.	832.492	QP	39.3	21.3	10.6	31.4		39.8	46.0	6.2	100	0	
Vert.	2483.500	PK	47.8	27.5	14.9	41.4		48.8	73.9	25.1	108	202	
Vert.	3383.953	PK	52.6	29.1	6.6	41.8		46.5	73.9	27.4	100	192	
Vert.	4960.000	PK	64.4	31.6	7.7	41.0		62.7	73.9	11.2	100	165	
Vert.	7440.000	PK	48.6	36.7	9.2	41.5		53.0	73.9	20.9	182	179	
Vert.	9920.000	PK	43.2	39.0	10.3	38.9		53.6	73.9	20.3	100	0	
Vert.	12400.000	PK	44.8	39.5	11.3	39.3		56.3	73.9	17.6	100	0	
Vert.	3383.953	AV	48.9	29.1	6.6	41.8		42.8	53.9	11.1	100	192	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2483.500	AV	34.3	27.5	14.9	41.4	-24.7	10.6	53.9	43.3	100	22	
Hori.	4960.000	AV	50.4	31.6	7.7	41.0	-24.7	24.0	53.9	29.9	117	155	
Hori.	7440.000	AV	37.5	36.7	9.2	41.5	-24.7	17.2	53.9	36.7	100	132	
Hori.	9920.000	AV	32.0	39.0	10.3	38.9	-24.7	17.7	53.9	36.2	100	0	
Hori.	12400.000	AV	33.1	39.5	11.3	39.3	-24.7	19.9	53.9	34.0	100	0	
Vert.	2483.500	AV	34.4	27.5	14.9	41.4	-24.7	10.7	53.9	43.2	108	202	
Vert.	4960.000	AV	54.3	31.6	7.7	41.0	-24.7	27.9	53.9	26.0	100	165	
Vert.	7440.000	AV	37.6	36.7	9.2	41.5	-24.7	17.3	53.9	36.6	182	179	
Vert.	9920.000	AV	31.9	39.0	10.3	38.9	-24.7	17.6	53.9	36.3	100	0	
Vert.	12400.000	AV	33.1	39.5	11.3	39.3	-24.7	19.9	53.9	34.0	100	0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

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

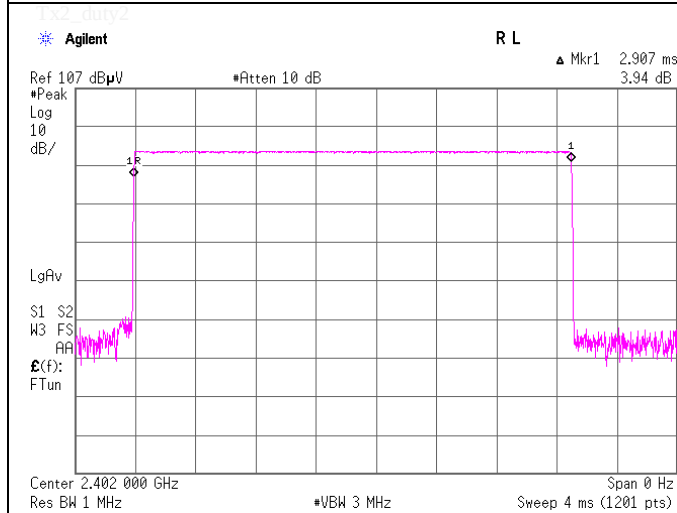
Dwell time factor Calculation chart

Dwell time factor Calculation

Tx, Bluetooth, BDR, PRBS9

Worst 100ms

Dwell time factor $= 20\log((2.907 \times 2)/100) = -24.71\text{dB}$



ON time of some channel during 100ms: Twice

This is the worst case in hopping sequence of Bluetooth.

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	UL Japan, Inc. Shonan EMC Lab.	No.3 Semi Anechoic Chamber	No.3
Semi Anechoic Chamber	No.3	No.3	No.3
Date	April 27, 2013	April 29, 2013	May 1, 2013
Temperature / Humidity	23 deg.C , 36 %RH	25 deg.C , 30 %RH	22 deg.C , 44 %RH
Engineer	Tatsuya Arai	Tatsuya Arai	Akio Hayashi
	(1-18GHz)	(above18GHz)	(30M-1GHz)
Mode	Tx, 2402 MHz		
	Tx, Bluetooth, EDR, PRBS9		

(* 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.	75.333	QP	37.0	6.5	7.2	32.1		18.6	40.0	21.4	254	240	
Hori.	200.151	QP	41.6	16.3	8.0	32.0		33.9	43.5	9.6	177	277	
Hori.	215.999	QP	40.4	16.6	8.0	32.0		33.0	43.5	10.5	160	248	
Hori.	240.007	QP	30.1	16.9	8.2	32.0		23.2	46.0	22.8	137	226	
Hori.	332.309	QP	40.4	14.7	8.7	31.9		31.9	46.0	14.1	100	226	
Hori.	365.542	QP	40.0	15.4	8.9	31.9		32.4	46.0	13.6	100	25	
Hori.	432.002	QP	36.8	16.6	9.2	31.9		30.7	46.0	15.3	101	297	
Hori.	2390.000	PK	46.6	27.4	14.8	41.4		47.4	73.9	26.5	227	70	
Hori.	2400.000	PK	52.2	27.4	14.8	41.4		53.0	73.9	20.9	227	70	
Hori.	3383.946	PK	52.3	29.1	6.6	41.8		46.2	73.9	27.7	131	182	
Hori.	4804.000	PK	46.7	31.1	7.6	41.2		44.2	73.9	29.7	100	150	
Hori.	7206.000	PK	45.8	36.6	9.1	41.4		50.1	73.9	23.8	100	0	
Hori.	9608.000	PK	43.9	38.5	10.3	38.9		53.8	73.9	20.1	100	0	
Hori.	12010.000	PK	44.4	39.4	11.5	39.4		55.9	73.9	18.0	100	0	
Hori.	3383.946	AV	48.5	29.1	6.6	41.8		42.4	53.9	11.5	131	182	
Vert.	832.492	QP	39.2	21.3	10.6	31.4		39.7	46.0	6.3	100	358	
Vert.	2390.000	PK	46.6	27.4	14.8	41.4		47.4	73.9	26.5	105	177	
Vert.	2400.000	PK	52.1	27.4	14.8	41.4		52.9	73.9	21.0	105	177	
Vert.	3383.946	PK	52.8	29.1	6.6	41.8		46.7	73.9	27.2	100	190	
Vert.	4804.000	PK	49.6	31.1	7.6	41.2		47.1	73.9	26.8	100	167	
Vert.	7206.000	PK	45.8	36.6	9.1	41.4		50.1	73.9	23.8	100	0	
Vert.	9608.000	PK	44.0	38.5	10.3	38.9		53.9	73.9	20.0	100	0	
Vert.	12010.000	PK	44.4	39.4	11.5	39.4		55.9	73.9	18.0	100	0	
Vert.	3383.946	AV	48.8	29.1	6.6	41.8		42.7	53.9	11.2	100	190	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2390.000	AV	34.1	27.4	14.8	41.4	-24.7	10.2	53.9	43.7	227	70	
Hori.	2400.000	AV	37.3	27.4	14.8	41.4	-24.7	13.4	53.9	40.5	227	70	
Hori.	4804.000	AV	34.0	31.1	7.6	41.2	-24.7	6.8	53.9	47.1	100	150	
Hori.	7206.000	AV	34.1	36.6	9.1	41.4	-24.7	13.7	53.9	40.2	100	0	
Hori.	9608.000	AV	32.2	38.5	10.3	38.9	-24.7	17.4	53.9	36.5	100	0	
Hori.	12010.000	AV	33.3	39.4	11.5	39.4	-24.7	20.1	53.9	33.8	100	0	
Vert.	2390.000	AV	34.2	27.4	14.8	41.4	-24.7	10.3	53.9	43.6	105	177	
Vert.	2400.000	AV	37.6	27.4	14.8	41.4	-24.7	13.7	53.9	40.2	105	177	
Vert.	4804.000	AV	34.7	31.1	7.6	41.2	-24.7	7.5	53.9	46.4	100	167	
Vert.	7206.000	AV	33.9	36.6	9.1	41.4	-24.7	13.5	53.9	40.4	100	0	
Vert.	9608.000	AV	32.1	38.5	10.3	38.9	-24.7	17.3	53.9	36.6	100	0	
Vert.	12010.000	AV	33.3	39.4	11.5	39.4	-24.7	20.1	53.9	33.8	100	0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

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

Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Semi Anechoic Chamber	
Semi Anechoic Chamber	No.3	No.3	No.3
Date	April 27, 2013	April 29, 2013	May 1, 2013
Temperature / Humidity	23 deg.C , 36 %RH	25 deg.C , 30 %RH	22 deg.C , 44 %RH
Engineer	Tatsuya Arai	Tatsuya Arai	Akio Hayashi
	(1-18GHz)	(above18GHz)	(30M-1GHz)
Mode	Tx, 2441 MHz		
	Tx, Bluetooth, EDR, PRBS9		

(* 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.	71.002	QP	39.7	6.5	6.8	32.1		20.9	40.0	19.1	248	252	
Hori.	204.444	QP	40.5	16.4	8.0	32.0		32.9	43.5	10.6	167	284	
Hori.	215.999	QP	40.2	16.6	8.0	32.0		32.8	43.5	10.7	152	233	
Hori.	365.545	QP	40.2	15.4	8.9	31.9		32.6	46.0	13.4	125	17	
Hori.	654.890	QP	35.5	19.7	10.0	32.0		33.2	46.0	12.8	131	39	
Hori.	3383.933	PK	52.6	29.1	6.6	41.8		46.5	73.9	27.4	131	182	
Hori.	4882.000	PK	53.0	31.3	7.7	41.1		50.9	73.9	23.0	100	211	
Hori.	7323.000	PK	45.6	36.6	9.2	41.4		50.0	73.9	23.9	100	0	
Hori.	9764.000	PK	42.9	38.7	10.2	38.9		52.9	73.9	21.0	100	0	
Hori.	12205.000	PK	44.2	39.5	11.4	39.3		55.8	73.9	18.1	100	0	
Hori.	3383.933	AV	48.4	29.1	6.6	41.8		42.3	53.9	11.6	131	182	
Vert.	832.493	QP	38.3	21.3	10.6	31.4		38.8	46.0	7.2	100	0	
Vert.	3383.933	PK	52.8	29.1	6.6	41.8		46.7	73.9	27.2	100	193	
Vert.	4882.000	PK	55.2	31.3	7.7	41.1		53.1	73.9	20.8	100	163	
Vert.	7323.000	PK	45.9	36.6	9.2	41.4		50.3	73.9	23.6	100	0	
Vert.	9764.000	PK	43.7	38.7	10.2	38.9		53.7	73.9	20.2	100	0	
Vert.	12205.000	PK	44.5	39.5	11.4	39.3		56.1	73.9	17.8	100	0	
Vert.	3383.933	AV	49.0	29.1	6.6	41.8		42.9	53.9	11.0	100	193	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	4882.000	AV	35.8	31.3	7.7	41.1	-24.7	9.0	53.9	44.9	100	211	
Hori.	7323.000	AV	34.4	36.6	9.2	41.4	-24.7	14.1	53.9	39.8	100	0	
Hori.	9764.000	AV	31.9	38.7	10.2	38.9	-24.7	17.2	53.9	36.7	100	0	
Hori.	12205.000	AV	32.9	39.5	11.4	39.3	-24.7	19.8	53.9	34.1	100	0	
Vert.	4882.000	AV	37.4	31.3	7.7	41.1	-24.7	10.6	53.9	43.3	100	163	
Vert.	7323.000	AV	34.4	36.6	9.2	41.4	-24.7	14.1	53.9	39.8	100	0	
Vert.	9764.000	AV	32.0	38.7	10.2	38.9	-24.7	17.3	53.9	36.6	100	0	
Vert.	12205.000	AV	32.9	39.5	11.4	39.3	-24.7	19.8	53.9	34.1	100	0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

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

Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Semi Anechoic Chamber	No.3
Semi Anechoic Chamber	No.3	No.3	No.3
Date	April 27, 2013	April 29, 2013	May 1, 2013
Temperature / Humidity	23 deg.C , 36 %RH	25 deg.C , 30 %RH	22 deg.C , 44 %RH
Engineer	Tatsuya Arai	Tatsuya Arai	Akio Hayashi
	(1-18GHz)	(above18GHz)	(30M-1GHz)
Mode	Tx, 2480 MHz		
	Tx, Bluetooth, EDR, PRBS9		

(* 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.	71.005	QP	37.7	6.5	6.8	32.1		18.9	40.0	21.1	273	259	
Hori.	200.127	QP	41.4	16.3	8.0	32.0		33.7	43.5	9.8	168	285	
Hori.	215.999	QP	39.4	16.6	8.0	32.0		32.0	43.5	11.5	162	233	
Hori.	361.315	QP	38.6	15.3	8.9	31.9		30.9	46.0	15.1	100	286	
Hori.	432.001	QP	37.1	16.6	9.2	31.9		31.0	46.0	15.0	100	146	
Hori.	2483.500	PK	47.4	27.5	14.9	41.4		48.4	73.9	25.5	215	80	
Hori.	3383.930	PK	52.3	29.1	6.6	41.8		46.2	73.9	27.7	133	182	
Hori.	4960.000	PK	54.7	31.6	7.7	41.0		53.0	73.9	20.9	100	155	
Hori.	7440.000	PK	45.6	36.7	9.2	41.5		50.0	73.9	23.9	100	0	
Hori.	9920.000	PK	43.1	39.0	10.3	38.9		53.5	73.9	20.4	100	0	
Hori.	12400.000	PK	44.0	39.5	11.3	39.3		55.5	73.9	18.4	100	0	
Hori.	3383.930	AV	48.2	29.1	6.6	41.8		42.1	53.9	11.8	133	182	
Vert.	797.546	QP	34.3	20.8	10.6	31.6		34.1	46.0	11.9	100	26	
Vert.	832.498	QP	38.9	21.3	10.6	31.4		39.4	46.0	6.6	100	1	
Vert.	2483.500	PK	47.1	27.5	14.9	41.4		48.1	73.9	25.8	100	200	
Vert.	3383.930	PK	53.0	29.1	6.6	41.8		46.9	73.9	27.0	100	193	
Vert.	4960.000	PK	58.6	31.6	7.7	41.0		56.9	73.9	17.0	100	164	
Vert.	7440.000	PK	46.3	36.7	9.2	41.5		50.7	73.9	23.2	100	0	
Vert.	9920.000	PK	43.7	39.0	10.3	38.9		54.1	73.9	19.8	100	0	
Vert.	12400.000	PK	45.1	39.5	11.3	39.3		56.6	73.9	17.3	100	0	
Vert.	3383.930	AV	48.8	29.1	6.6	41.8		42.7	53.9	11.2	100	193	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2483.500	AV	34.5	27.5	14.9	41.4	-24.7	10.8	53.9	43.1	215	80	
Hori.	4960.000	AV	36.9	31.6	7.7	41.0	-24.7	10.5	53.9	43.4	100	155	
Hori.	7440.000	AV	34.8	36.7	9.2	41.5	-24.7	14.5	53.9	39.4	100	0	
Hori.	9920.000	AV	32.0	39.0	10.3	38.9	-24.7	17.7	53.9	36.2	100	0	
Hori.	12400.000	AV	33.2	39.5	11.3	39.3	-24.7	20.0	53.9	33.9	100	0	
Vert.	2483.500	AV	34.4	27.5	14.9	41.4	-24.7	10.7	53.9	43.2	100	200	
Vert.	4960.000	AV	38.4	31.6	7.7	41.0	-24.7	12.0	53.9	41.9	100	164	
Vert.	7440.000	AV	34.7	36.7	9.2	41.5	-24.7	14.4	53.9	39.5	100	0	
Vert.	9920.000	AV	31.9	39.0	10.3	38.9	-24.7	17.6	53.9	36.3	100	0	
Vert.	12400.000	AV	33.1	39.5	11.3	39.3	-24.7	19.9	53.9	34.0	100	0	

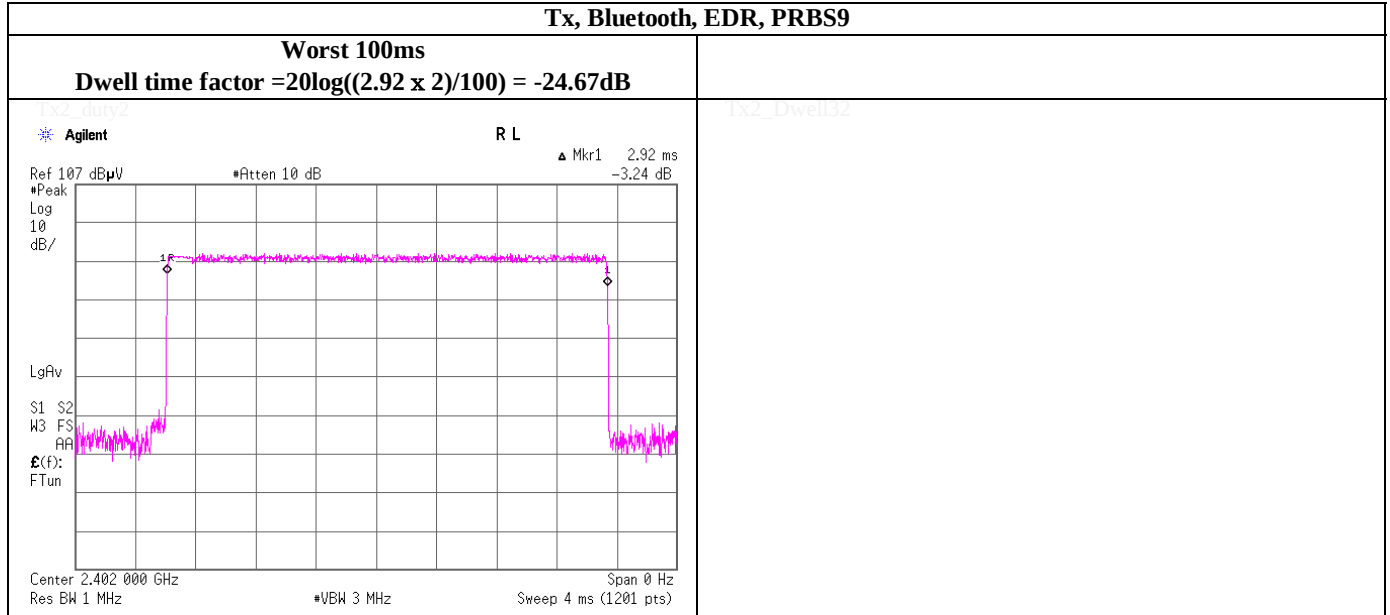
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

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

Dwell time factor Calculation chart

Dwell time factor Calculation

Tx, Bluetooth, EDR, PRBS9



ON time of some channel during 100ms: Twice

This is the worst case in hopping sequence of Bluetooth.

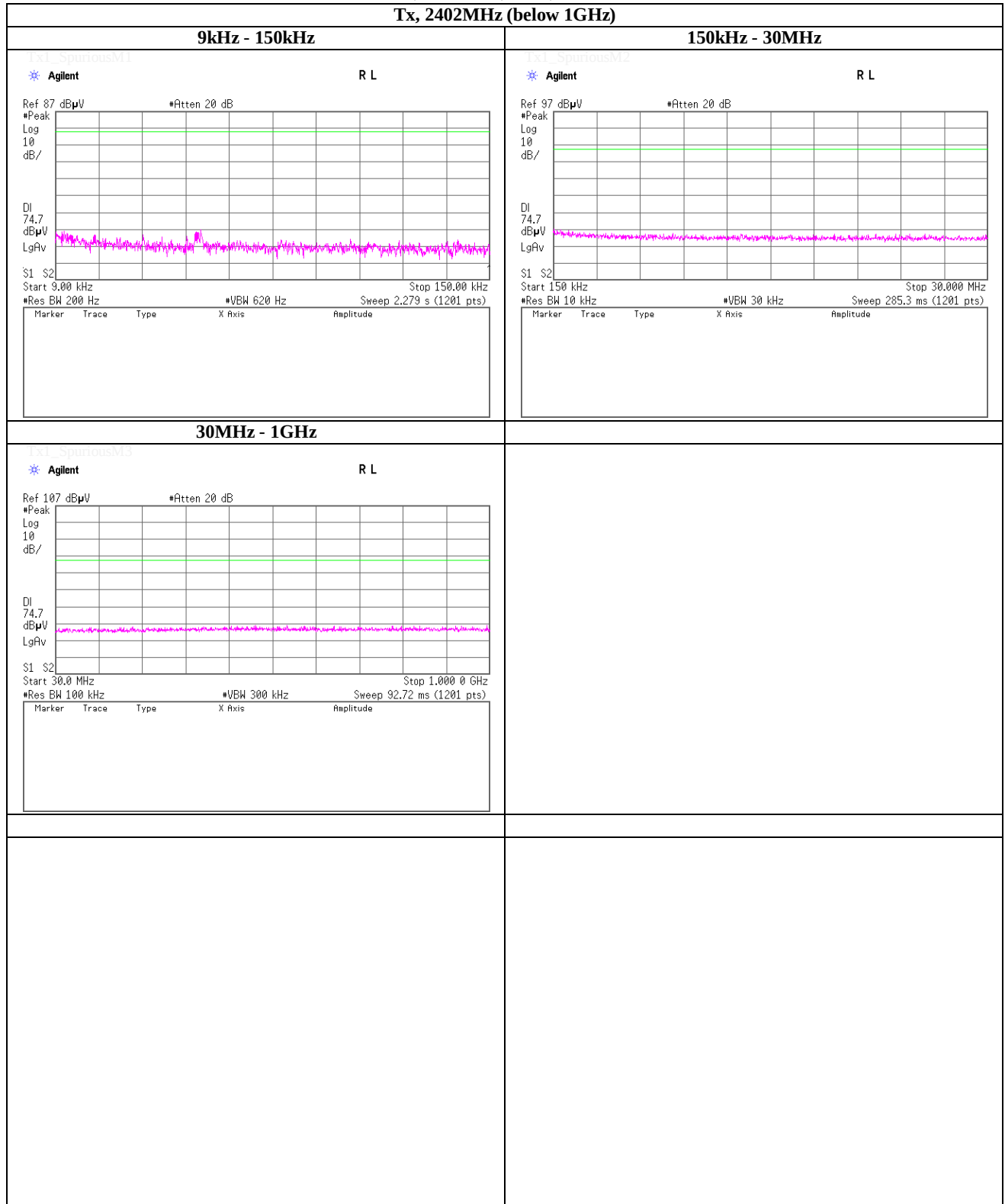
UL Japan, Inc.

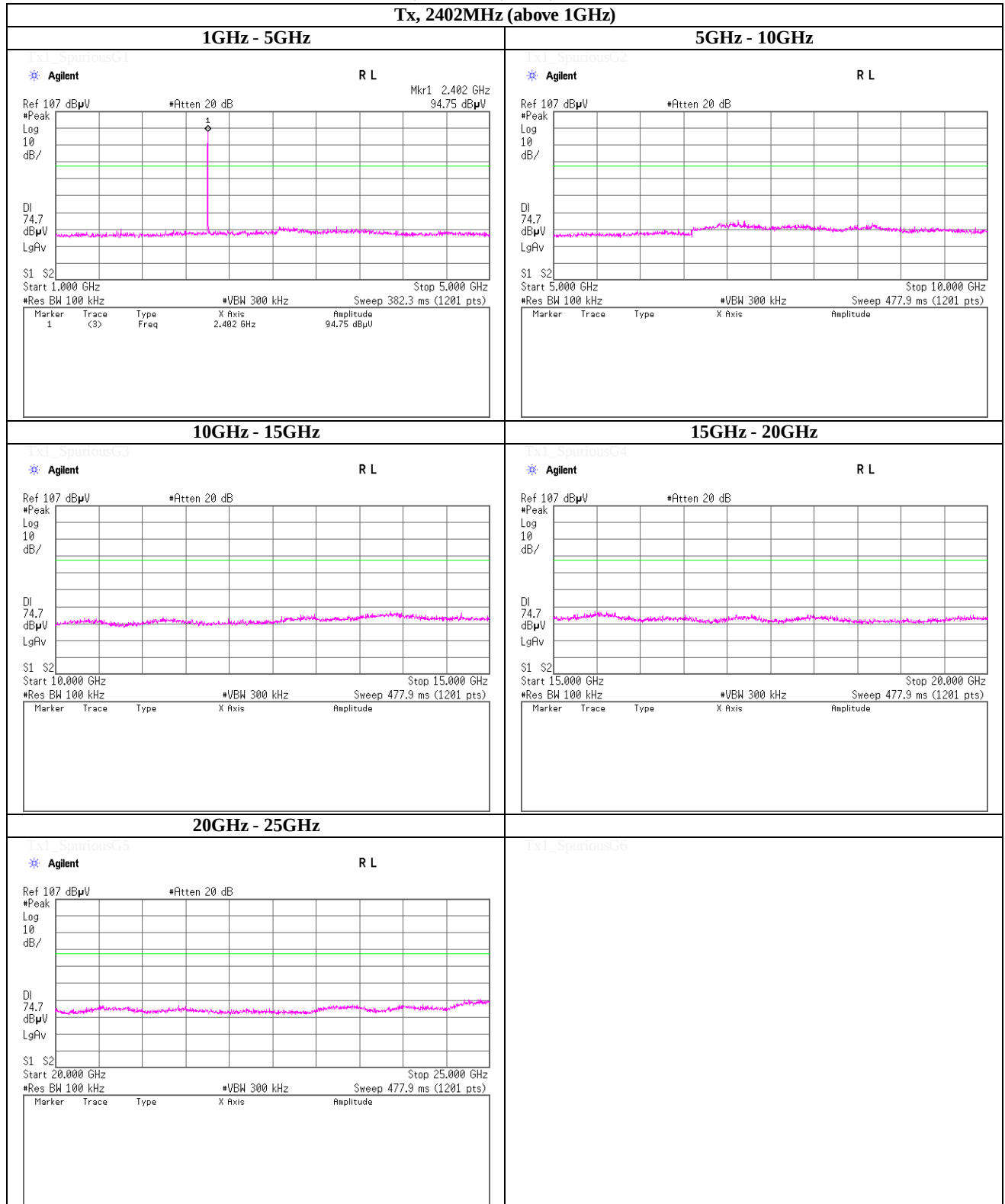
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

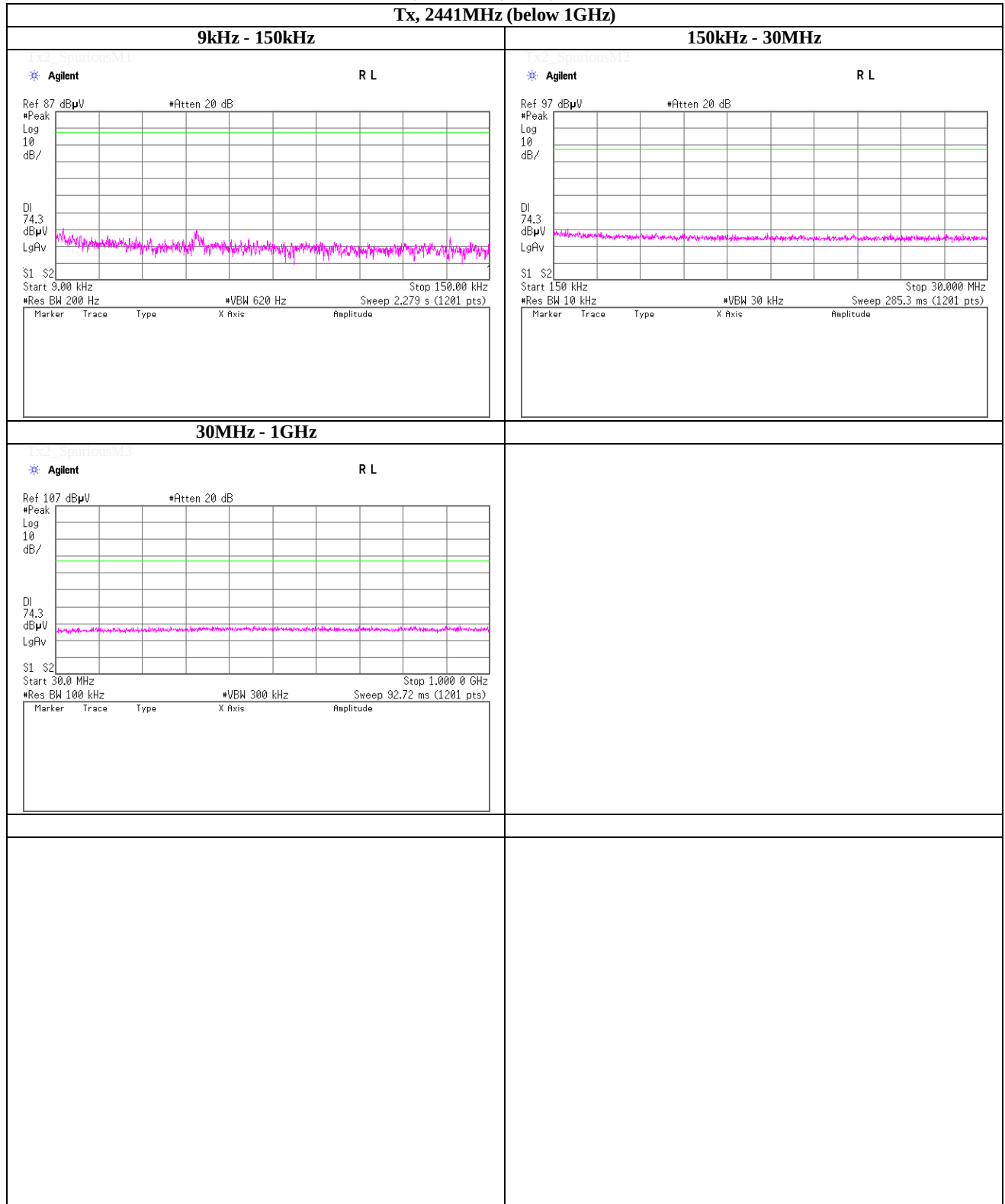
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2402MHz (below 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

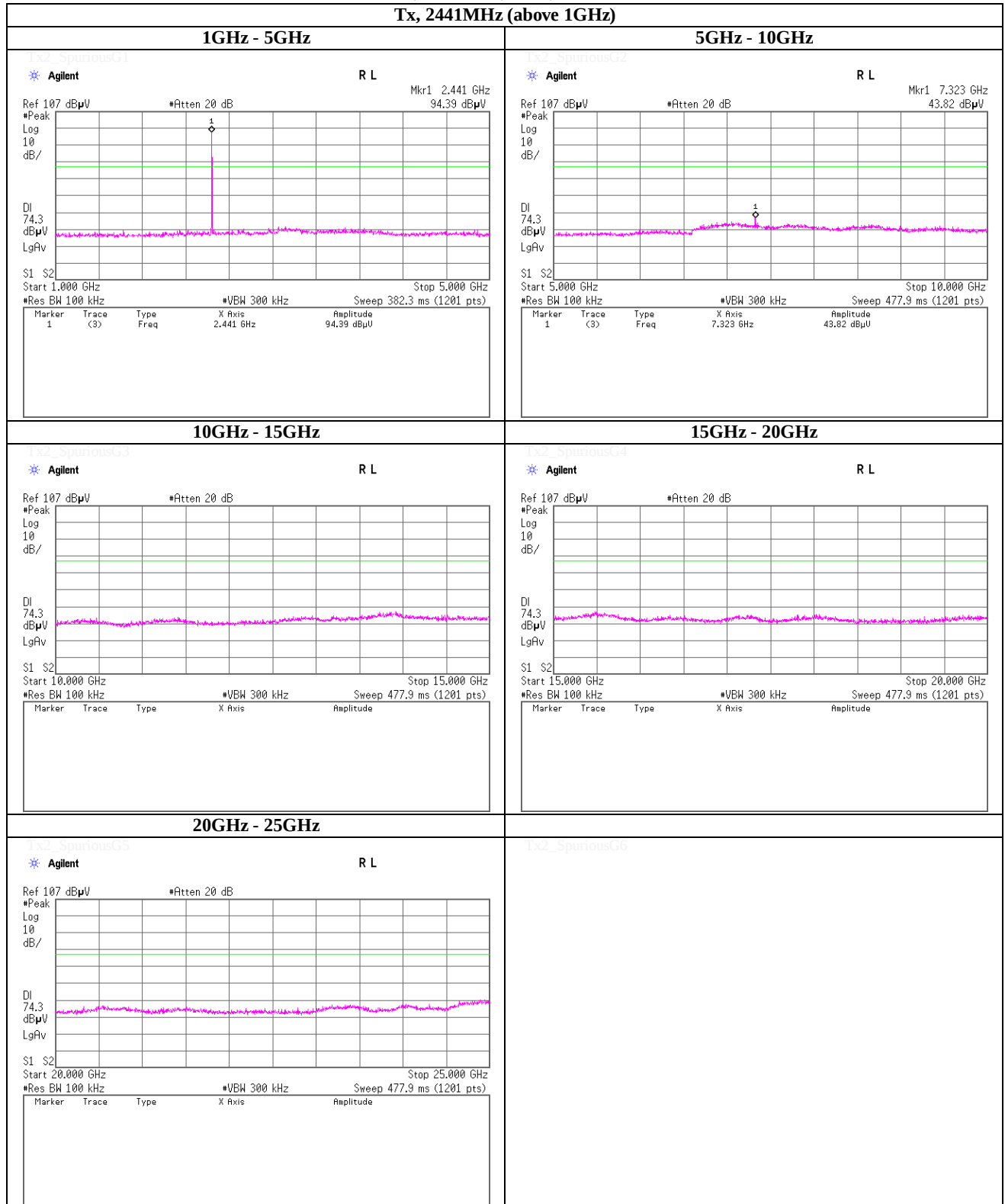
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2402MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

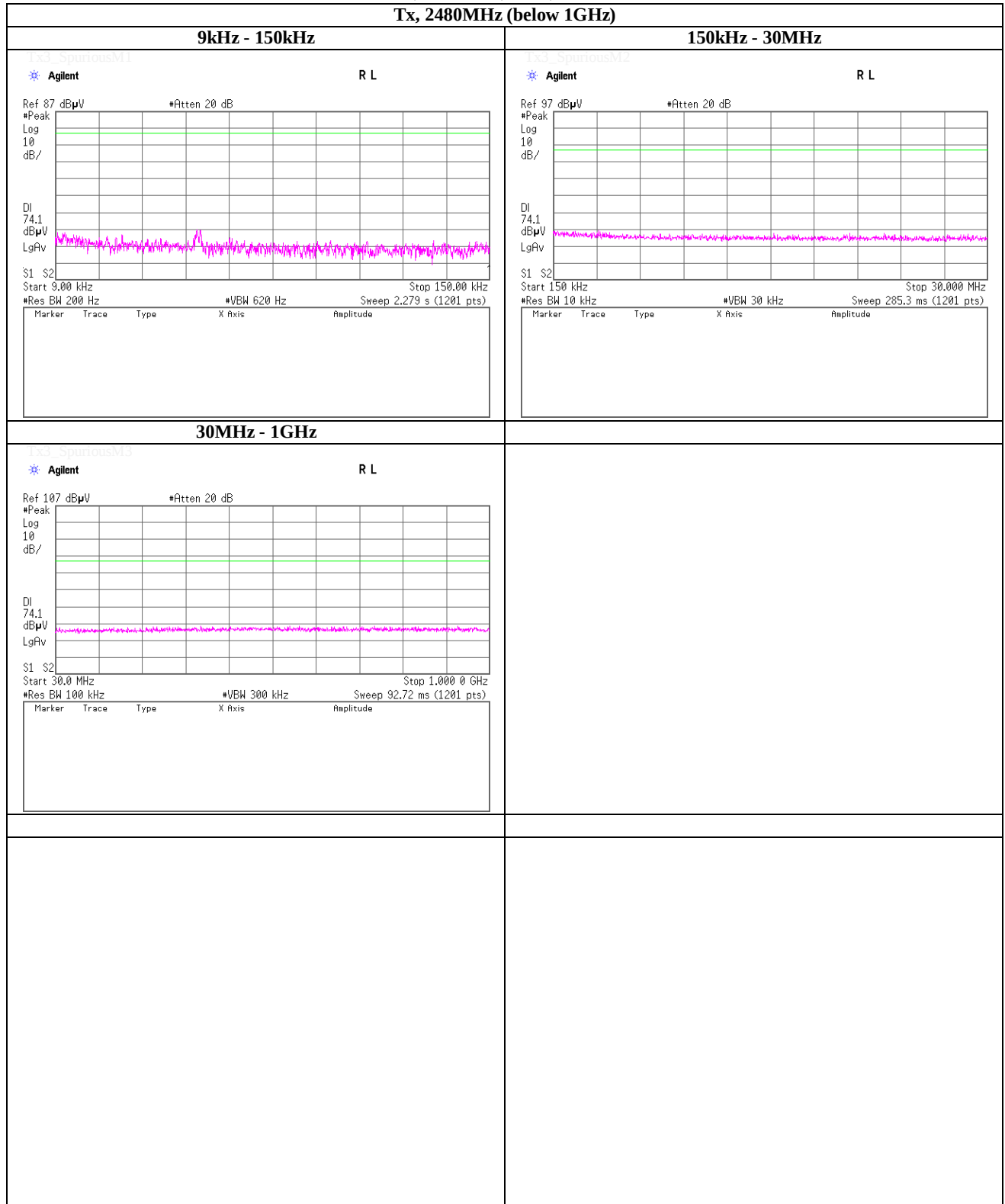
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2441MHz (below 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

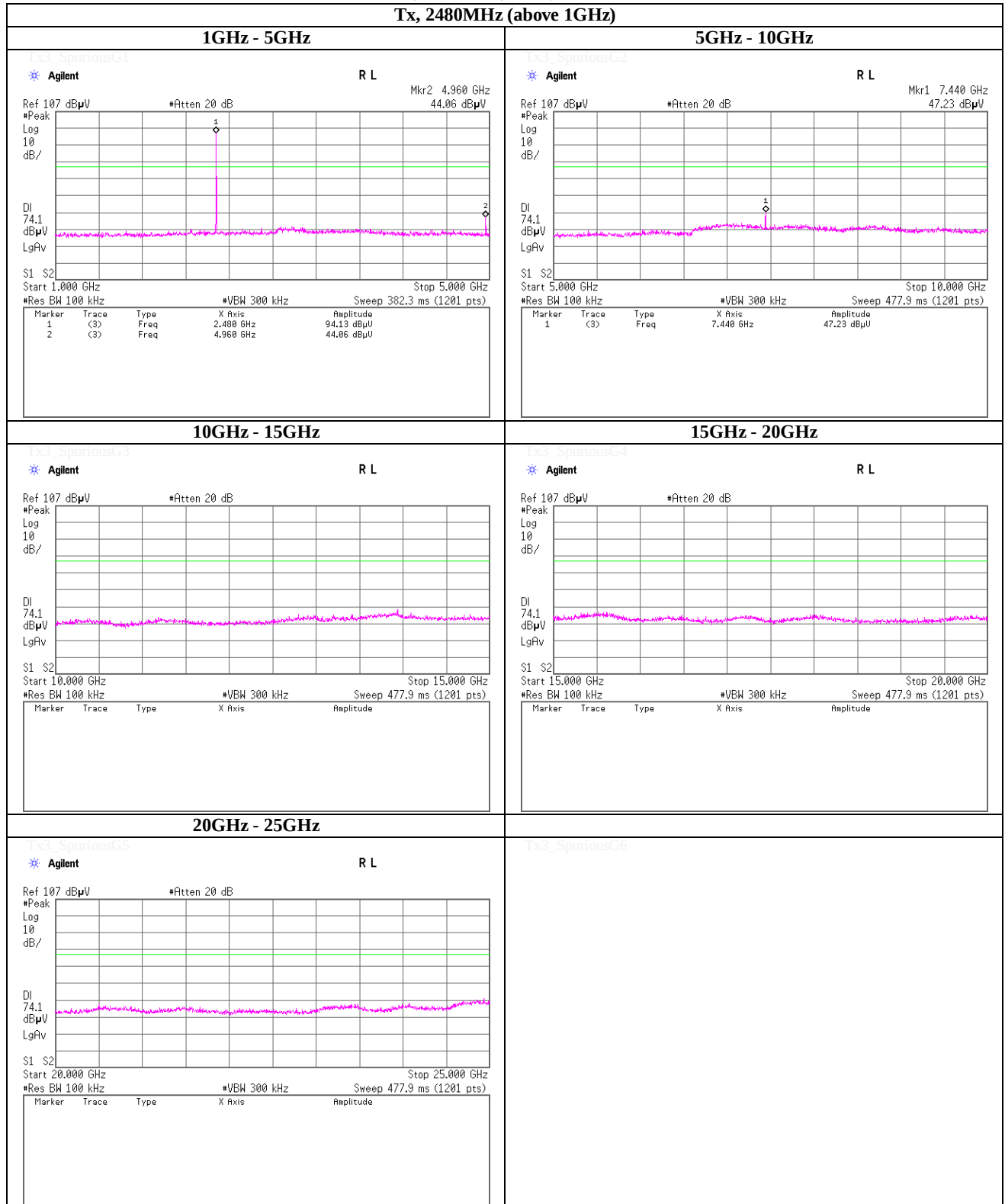
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2441MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

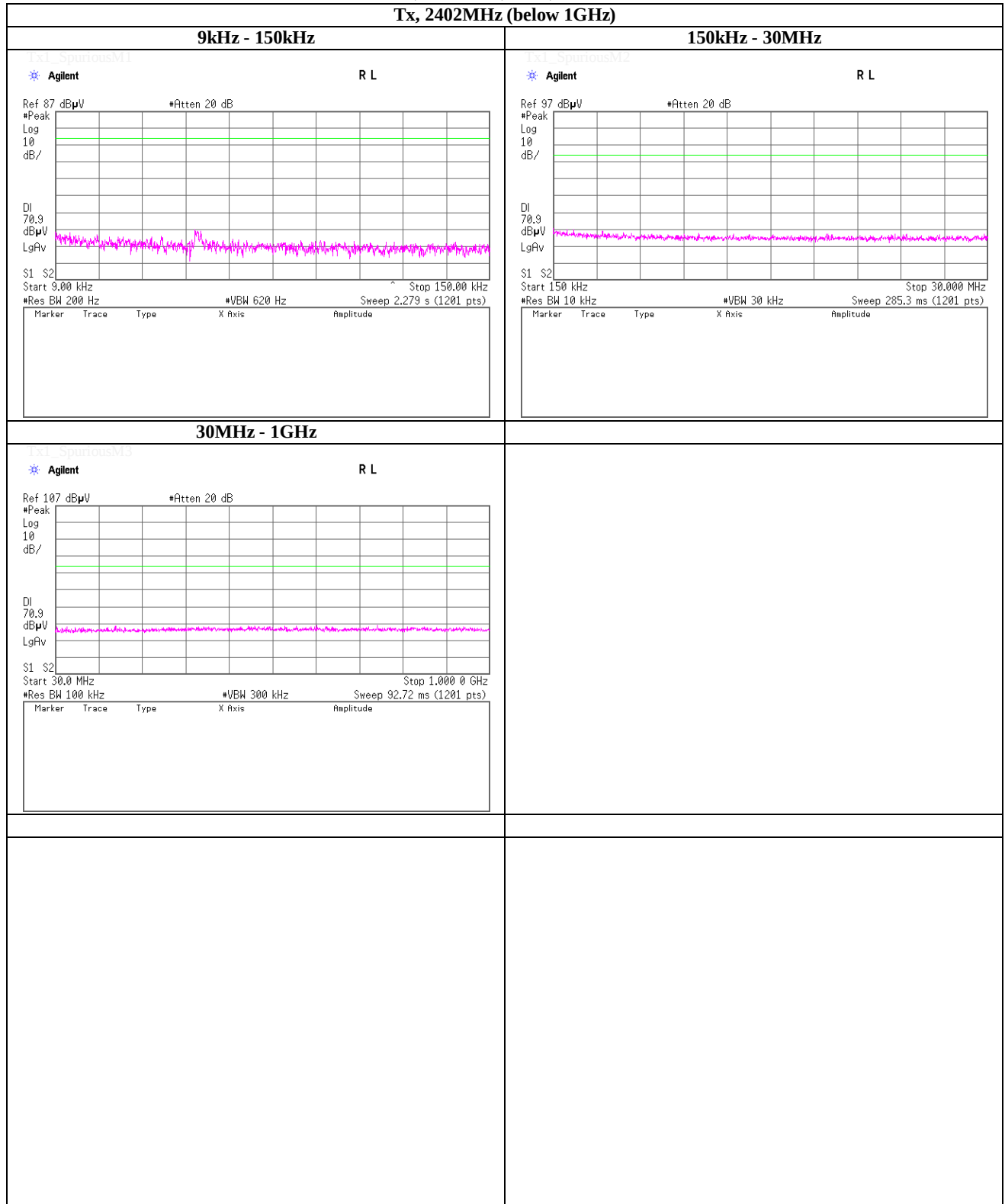
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

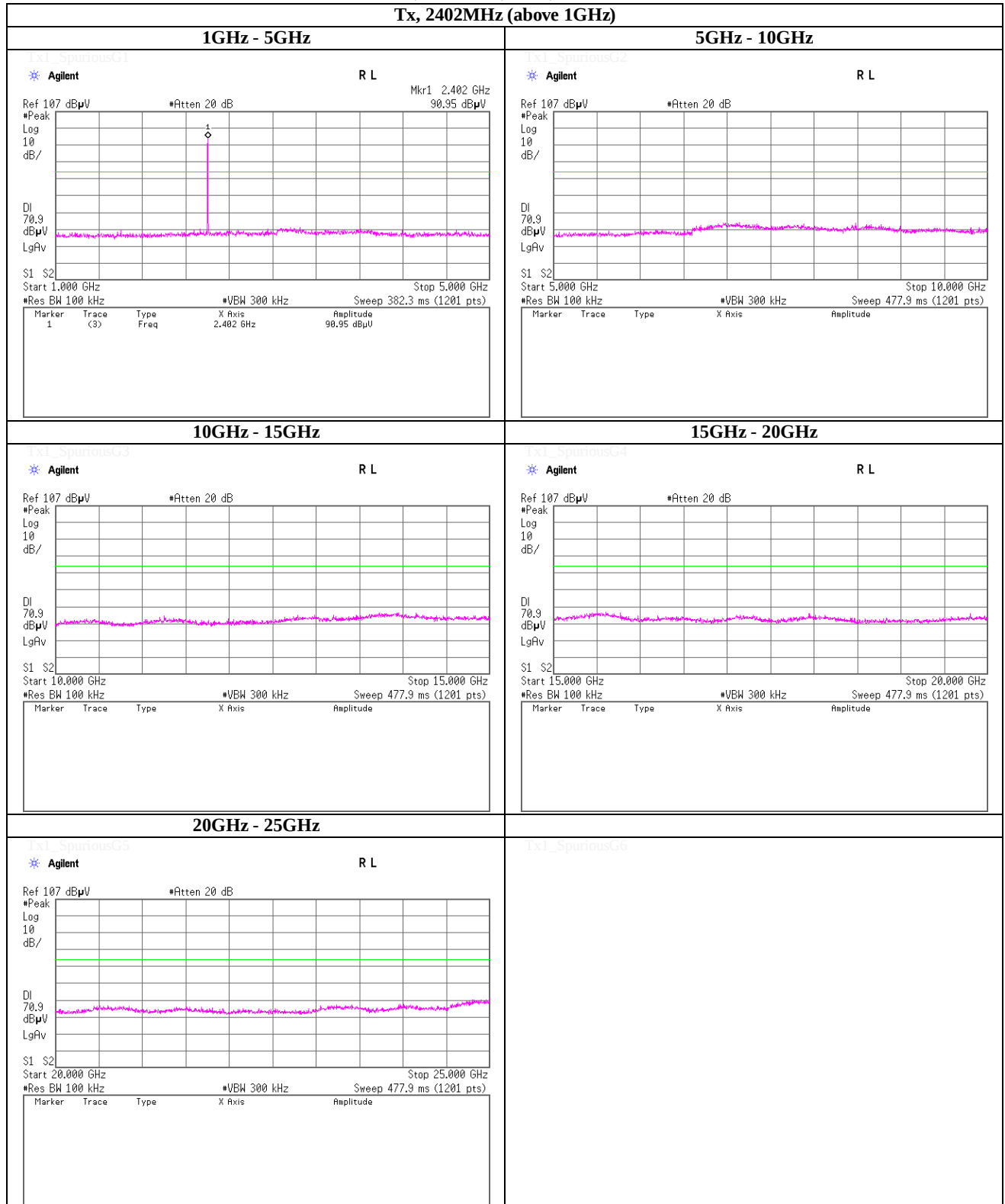
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2480MHz (below 1GHz)****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**

Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2480MHz (above 1GHz)****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**

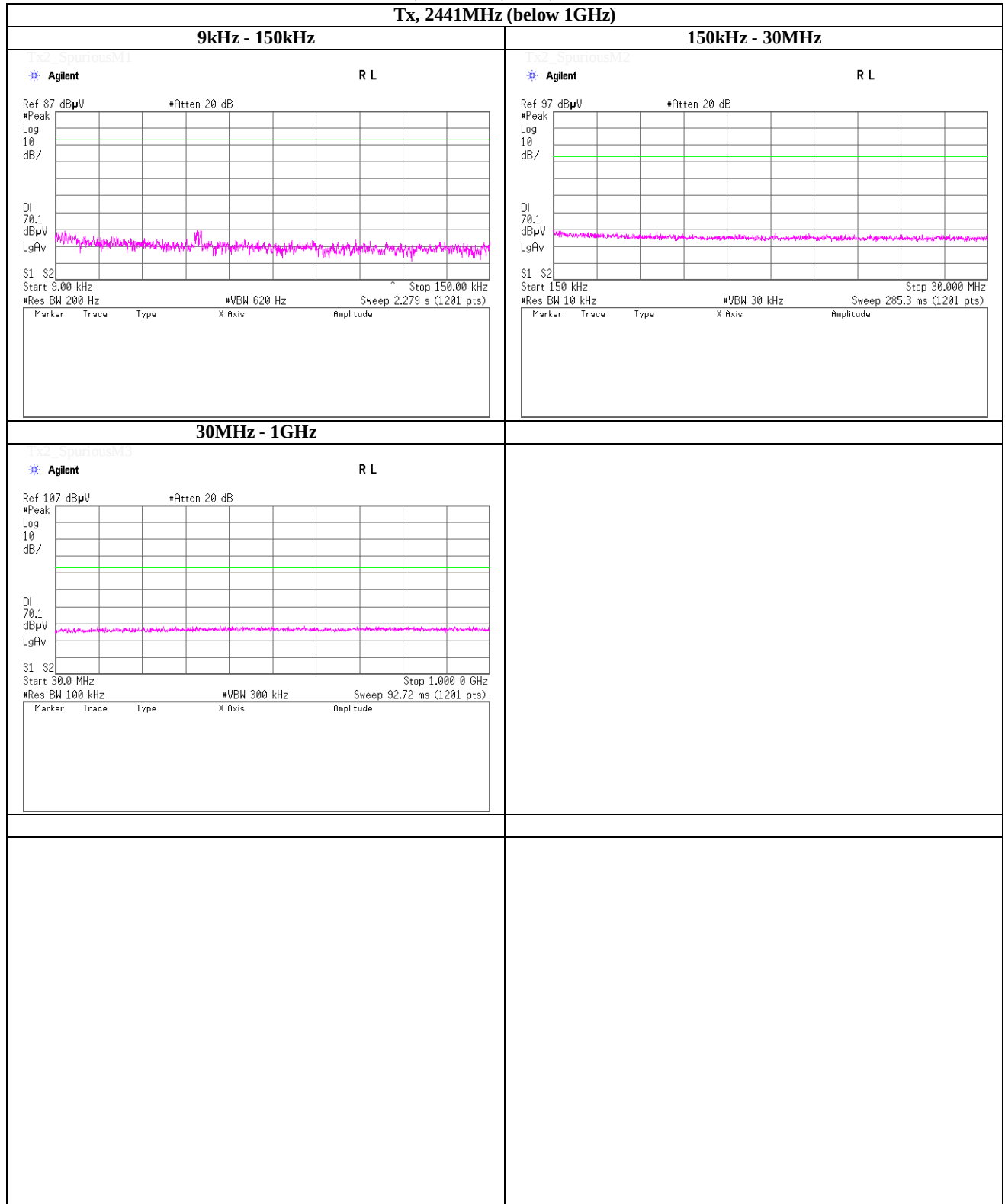
Spurious emission (Conducted)**Tx, Bluetooth, EDR, PRBS9****Tx, 2402MHz (below 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

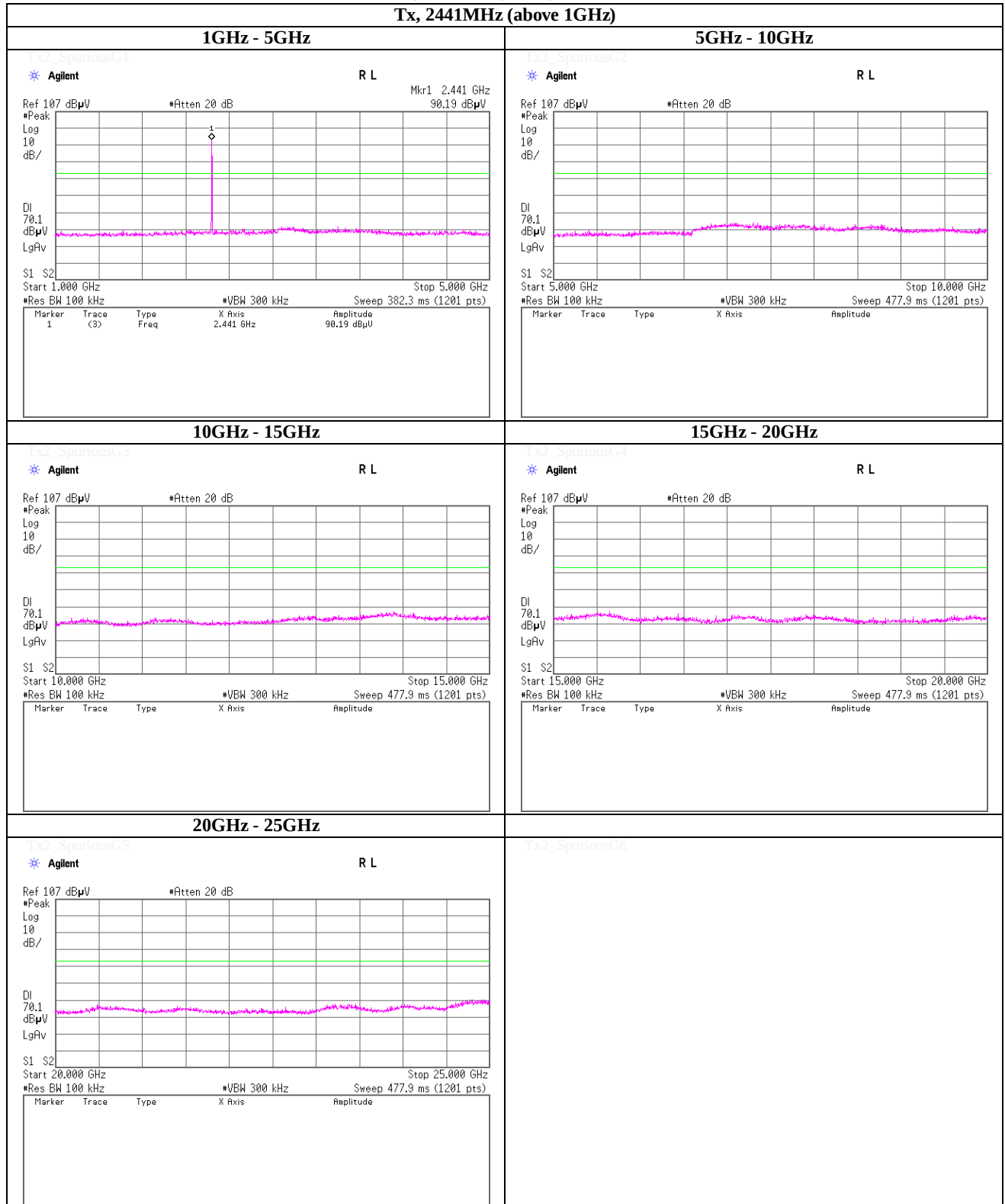
Spurious emission (Conducted)**Tx, Bluetooth, EDR, PRBS9****Tx, 2402MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

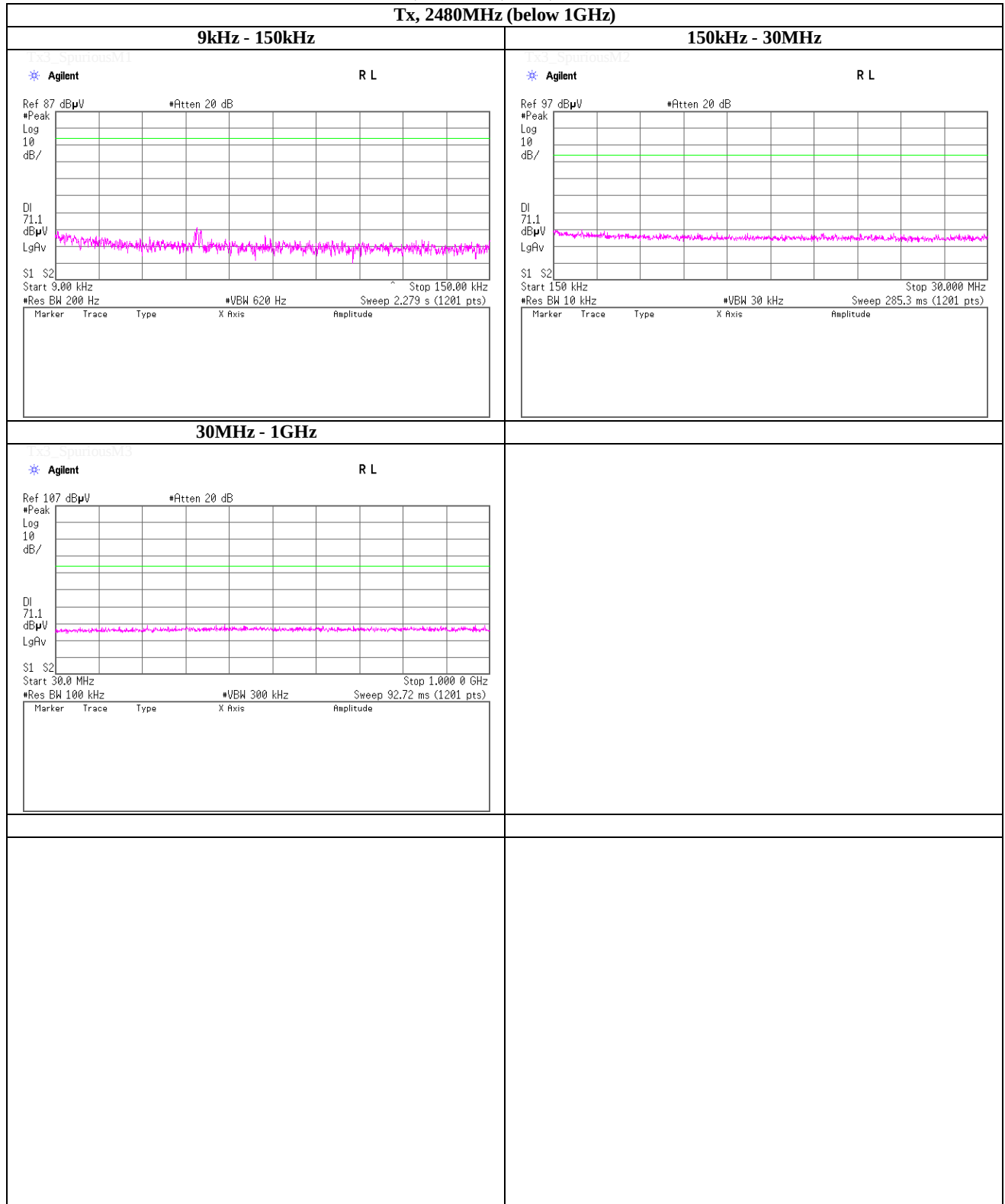
Spurious emission (Conducted)**Tx, Bluetooth, EDR, PRBS9****Tx, 2441MHz (below 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

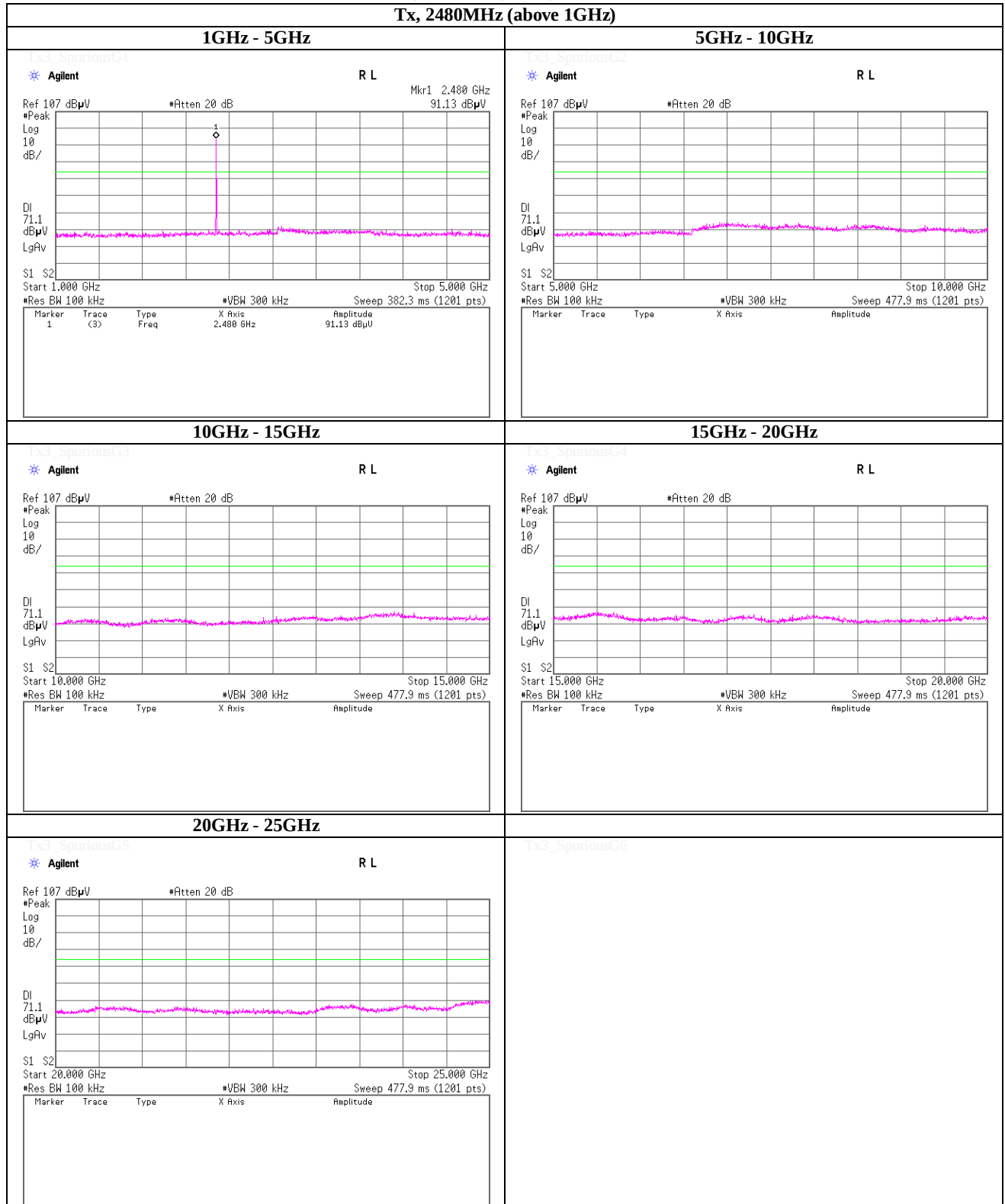
Spurious emission (Conducted)**Tx, Bluetooth, EDR, PRBS9****Tx, 2441MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)**Tx, Bluetooth, EDR, PRBS9****Tx, 2480MHz (below 1GHz)****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**

Spurious emission (Conducted)**Tx, Bluetooth, EDR, PRBS9****Tx, 2480MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

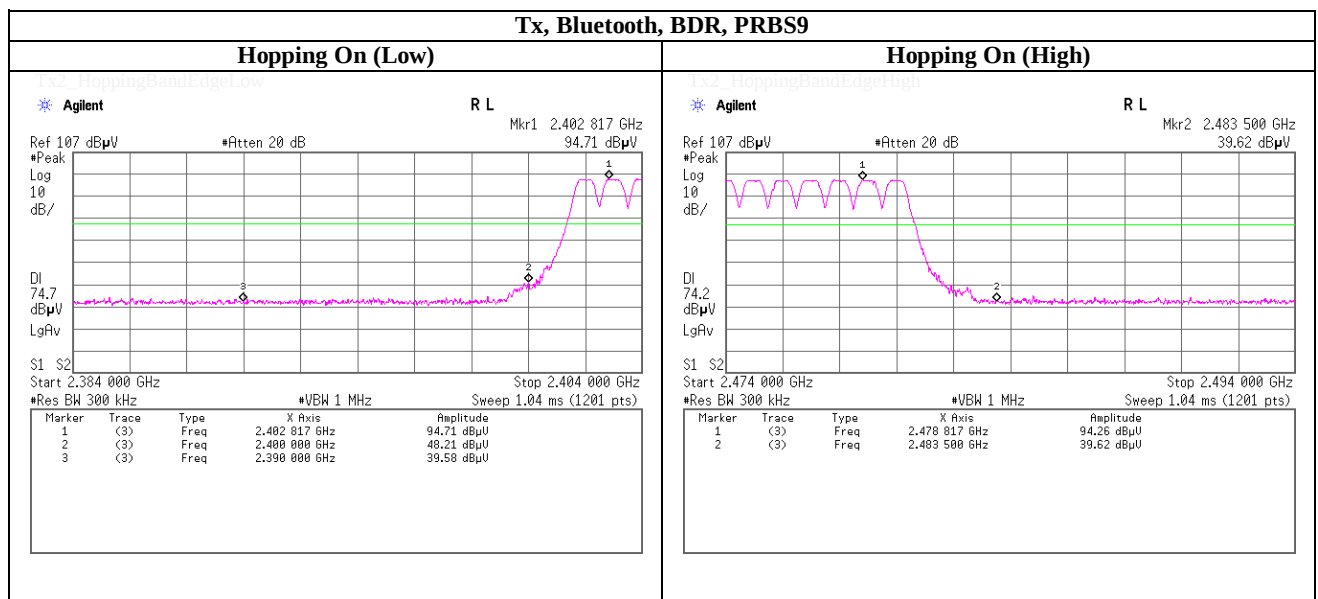
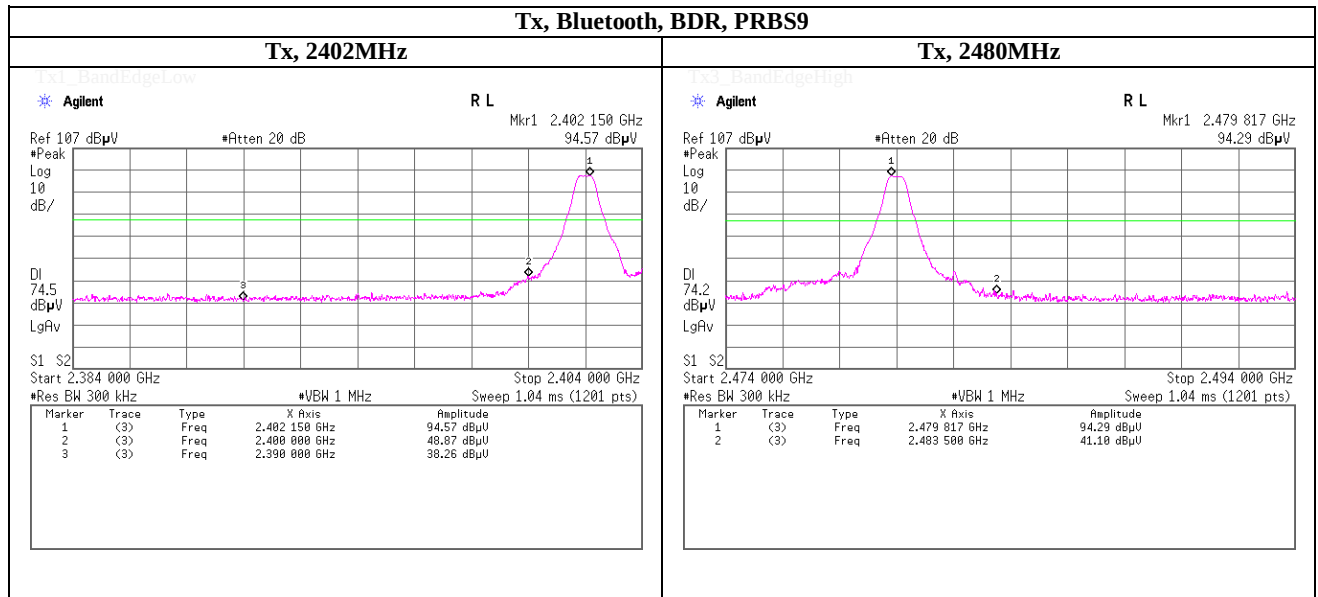
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Band Edge compliance



UL Japan, Inc.

Shonan EMC Lab.

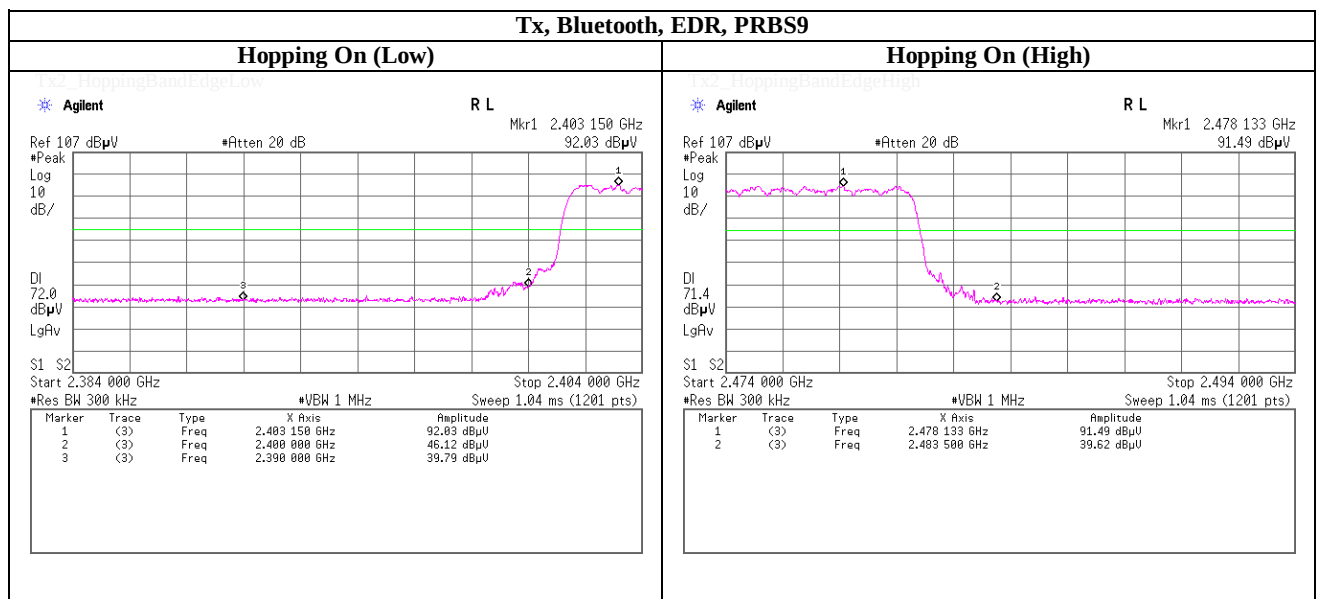
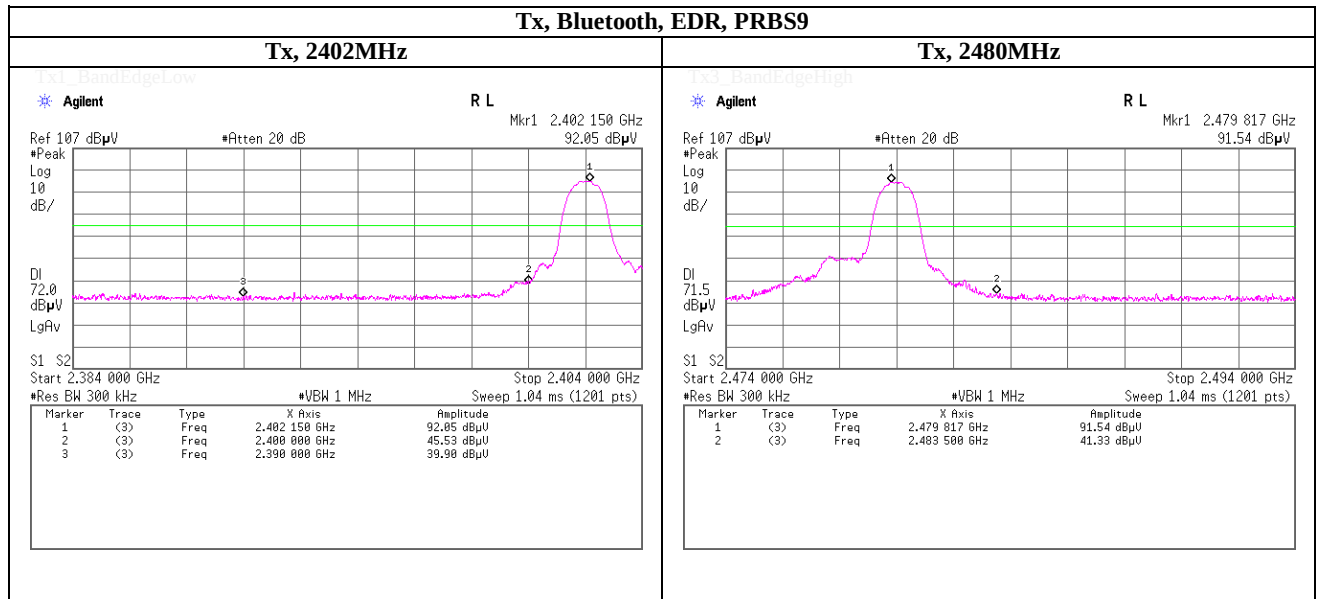
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Band Edge compliance



UL Japan, Inc.

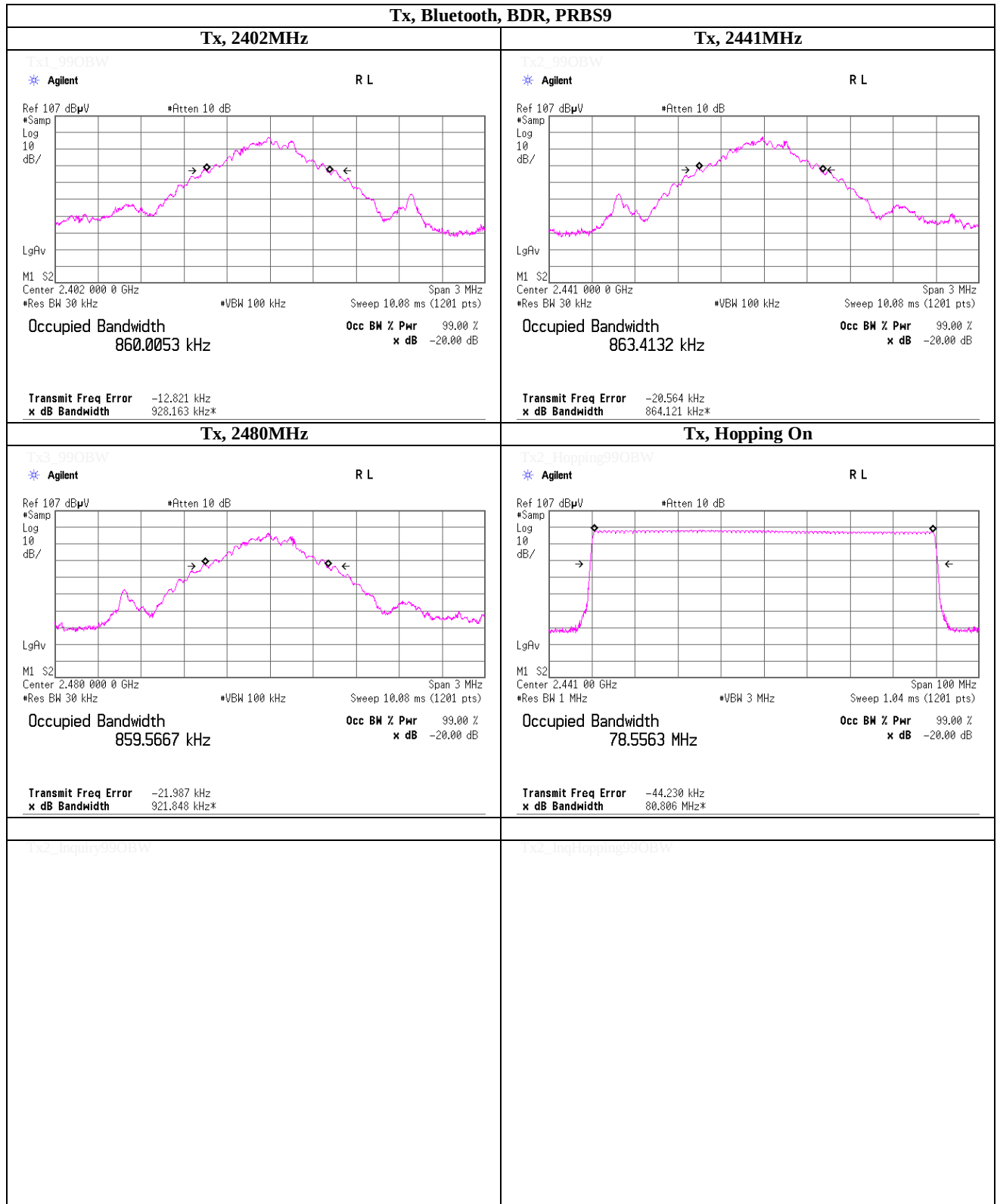
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth



UL Japan, Inc.

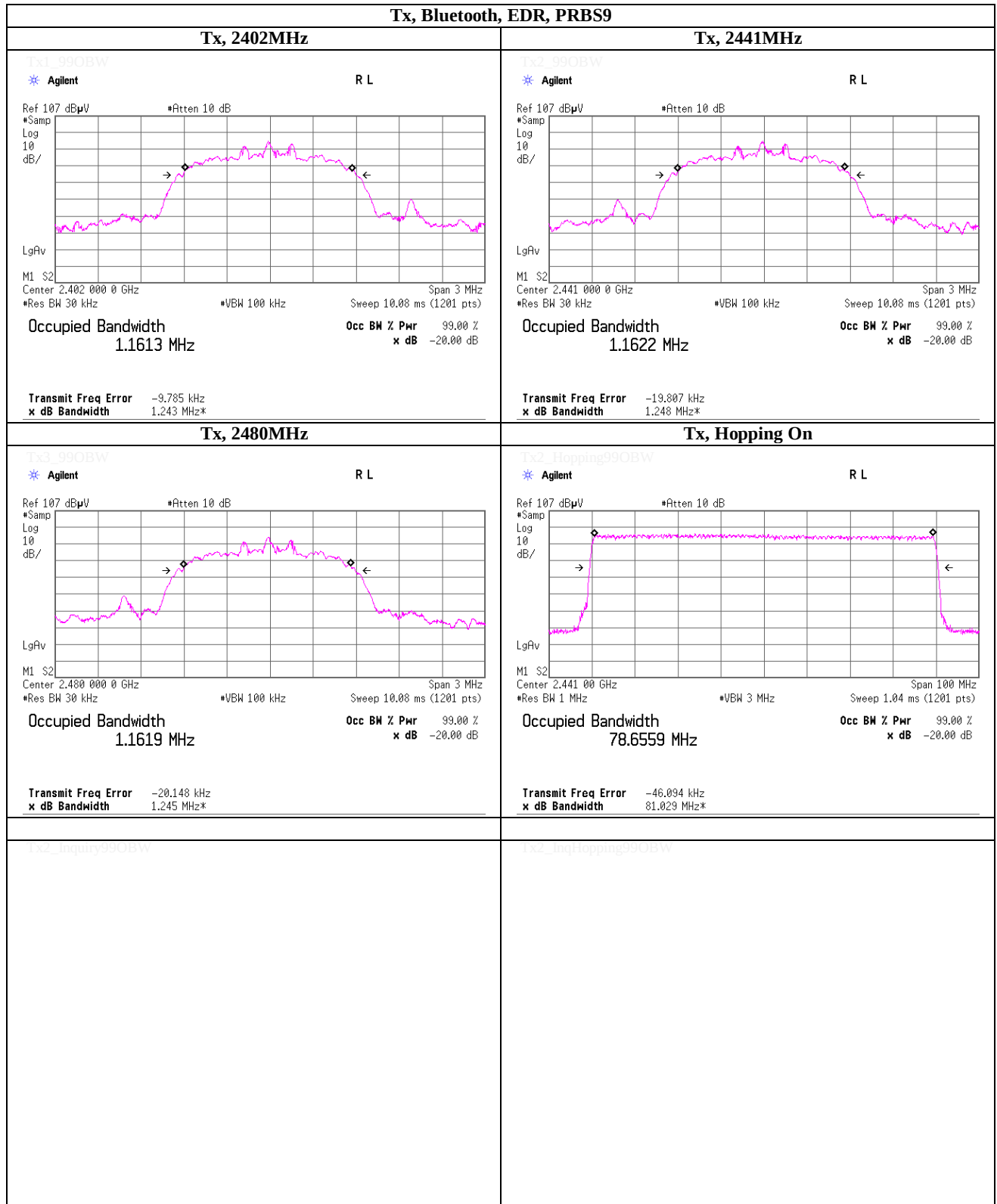
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth



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

APPENDIX 2

Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2012/07/18 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	2013/04/11 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2012/05/22 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2012/08/17 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2013/02/27 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	RE	2013/01/08 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFLMF)	-	RE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2012/12/18 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2012/12/18 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2013/03/14 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2013/03/19 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2013/03/16 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2013/02/12 * 12
SAT6-06	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2012/10/08 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271 (RF Selector)	RE	2013/04/03 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2012/10/08 * 12
STR-03	Test Receiver	Rohde & Schwarz	ES140	100054/040	RE	2012/06/14 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2013/02/27 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2013/03/04 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2013/03/16 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2013/04/09 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2013/04/09 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2013/04/09 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2013/03/07 * 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: Out of Band Emission (Radiated)

AT: Antenna terminal conducted test