



Test report No. : 10670414S-A-R1
Page : 1 of 52
Issued date : May 26, 2015
Revised date : June 11, 2016
FCC ID : A269ZUA145

RADIO TEST REPORT

Test Report No.: 10670414S-A-R1

Applicant : Alpine Electronics, Inc.
Type of Equipment : Car Navigation Unit
Model No. : X108U
FCC ID : A269ZUA145
Test regulation : FCC Part15 Subpart C: 2015
Test result : Complied

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4. The test results in this test report are traceable to the national or international standards.
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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 "10670414S-A ". "10670414S-A " is replaced with this report.

Date of test: April 4 to 10, 2015

Representative test engineer:

Y. Ishikawa

Yosuke Ishikawa
Engineer
Consumer Technology Division

Approved by :

T. Imamura

Toyokazu Imamura
Leader
Consumer Technology Division



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

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10670414S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10670414S-A	May 21, 2015	-	-
1	10670414S-A-R1	May 26, 2015	-(Full revision)	Addition of Data
2	10670414S-A-R1	June 11, 2016	4	Correction of antenna gain and clock frequency

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SECTION 1: Customer information

Company Name : Alpine Electronics, Inc.
Address : 20-1, Yoshima-Kogyodanchi, Iwaki-shi Fukushima 970-1192 Japan
Telephone Number : +81-246-36-4111
Facsimile Number : +81-246-36-6492
Contact Person : Mitsuru Yoshida

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

2.1 Identification of E.U.T.

Type of Equipment : Car Navigation Unit
Model No. : X108U
Serial No. : Refer to 4.2 of this report.
Rating : DC 14.4V
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No modification by the test lab.
Receipt Date of Sample : February 18, 2015

2.2 Product description

Model: X108U (referred to as the EUT in this report) is a Car Navigation Unit.

The Maximum clock frequency used in the EUT: 38.4 MHz

Radio specification:

Bluetooth:

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth & channel spacing : 79MHz & 1MHz
Type of modulation : GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna type : PCB F-Inverted Antenna
Antenna gain with cable loss : -9.5dBi
Antenna connector type : N/A

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: 2015, final revised on January 21, 2015
 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

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		Complied
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		0.6 dB Polarization: Vertical Detection: Average Freq.: 3147.273 MHz Mode: Tx 2441MHz, BDR Freq.: 3147.484 MHz Mode: Tx 2441MHz, EDR Freq.: 3147.420 MHz Mode: Tx 2480MHz, EDR

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.

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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 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	3.5 dB	3.5 dB
	30MHz-300MHz	4.9 dB	4.9 dB	4.7 dB
	300MHz-1GHz	5.0 dB	5.0 dB	4.8 dB
	1GHz-15GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1m)	15GHz-18GHz	5.7 dB	5.7 dB	5.7 dB
	18GHz-40GHz	4.5 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 report meets the limits unless the uncertainty is taken into consideration.

Antenna port conducted test

Power Measurement uncertainty above 1GHz for this test was: (±) 0.68dB

Conducted emissions, Power Density Measurement (below 1GHz) uncertainty for this test was: (±) 1.5dB

Conducted emissions, Power Density Measurement (1G-3GHz) uncertainty for this test was: (±) 1.7dB

Conducted emissions, Power Density Measurement (3G-18GHz) uncertainty for this test was: (±) 2.4dB

Conducted emissions Measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB

Bandwidth Measurement uncertainty for this test was: (±) 0.66%

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3.5 Test location

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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 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 checked="" 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.7 Shielded room	-	2.76 x 3.76 x 2.4	2.76 x 3.76	-
<input type="checkbox"/> No.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
<input type="checkbox"/> No.1 Measurement room	-	2.55 x 4.1 x 2.5	2.55 x 4.1	-

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
Band edge compliance & Spurious emission	Transmitting (DH5 / 3-DH5), Payload: PRBS9 -Hopping OFF	Band edge compliance: 2402MHz, 2480MHz Spurious emission: 2402MHz, 2441MHz, 2480MHz
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.

Power settings	Fixed
Software	BT RADIO TEST ver. 1.10

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.

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

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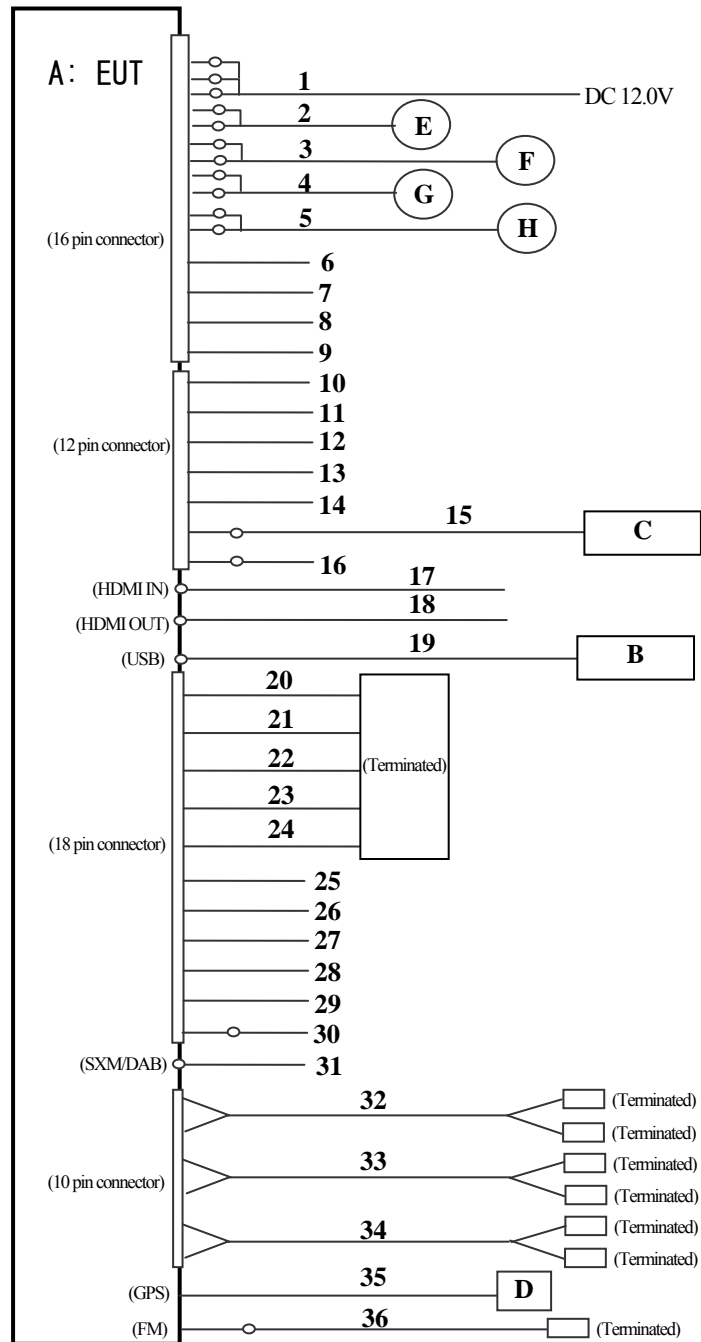
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4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

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Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Navigation Unit		57 *1) 39 *2)	ALPINE	EUT
B	USB Memory	SDK-USM4GL(B)	-	Sony	-
C	Microphone	-	-	ALPINE	-
D	GPS Antenna	-	-	ALPINE	-
E	Speaker	LV-002	S11014200773	L&V	-
F	Speaker	LV-002	S11014200773	L&V	-
G	Speaker	LV-002	S11014200775	L&V	-
H	Speaker	LV-002	S11014200775	L&V	-

*1): For Antenna port conducted tests

*2): For Radiated emission tests

List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	DC	0.3 + 1.9	Unshielded	Unshielded	16 pin connector (Power)
2	Speaker	1.75+2.9	Unshielded	Unshielded	
3	Speaker	1.75+2.9	Unshielded	Unshielded	
4	Speaker	1.75+2.9	Unshielded	Unshielded	
5	Speaker	1.75+2.9	Unshielded	Unshielded	
6	Power Antenna	1.75	Unshielded	Unshielded	
7	Remote Turn-on	1.75	Unshielded	Unshielded	
8	ILL	1.5	Unshielded	Unshielded	
9	P Brake	1.5	Unshielded	Unshielded	
10	REMOTE IN	1.75	Unshielded	Unshielded	12 pin connector (Remote)
11	REMOTE OUT	1.75	Unshielded	Unshielded	
12	DVD REMOUT	1.75	Unshielded	Unshielded	
13	DVD STATUS IN	1.75	Unshielded	Unshielded	
14	MON REMOUT	1.75	Unshielded	Unshielded	
15	MIC IN	0.2+4.0	Shielded	Unshielded	
16	STEERING REMOTE	0.1+4.0	Shielded	Unshielded	-
17	HDMI IN	1.5	Shielded	Shielded	-
18	HDMI OUT	1.5	Shielded	Shielded	-
19	USB	1.5	Shielded	Shielded	-
20	Camera 1	2.5	Unshielded	Unshielded	18 pin connector (CAN/IF)
21	Camera 2	2.5	Unshielded	Unshielded	
22	Camera 3	2.5	Unshielded	Unshielded	
23	Camera 4	2.5	Unshielded	Unshielded	
24	Camera 5	2.5	Unshielded	Unshielded	
25	IDATALINK I/F 1	1.6	Unshielded	Unshielded	
26	IDATALINK I/F 2	1.6	Unshielded	Unshielded	
27	IDATALINK I/F 3	1.6	Unshielded	Unshielded	
28	IDATALINK I/F 4	1.6	Unshielded	Unshielded	
29	Speed sensor	2.0	Unshielded	Unshielded	-
30	AUX INPUT	0.1+2.0	Shielded	Unshielded	-
31	SXM/DAB	0.15	Shielded	Shielded	-
32	FRONT OUT L/R	0.2+1.5	Shielded	Unshielded	10 pin connector (PRE OUT)
33	REAR OUT L/R	0.3+1.5	Shielded	Unshielded	
34	SUBW L/R	0.15+1.5	Shielded	Unshielded	
35	GPS	3.5	Shielded	Shielded	-
36	FM Antenna	0.15+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.

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.

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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SECTION 11: Radiated emission

11.1 Operating environment

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

11.2 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.

11.3 Test conditions

Frequency range : 30MHz - 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		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 axis of EUT was fixed at angle of 34 deg. based on the product specification.

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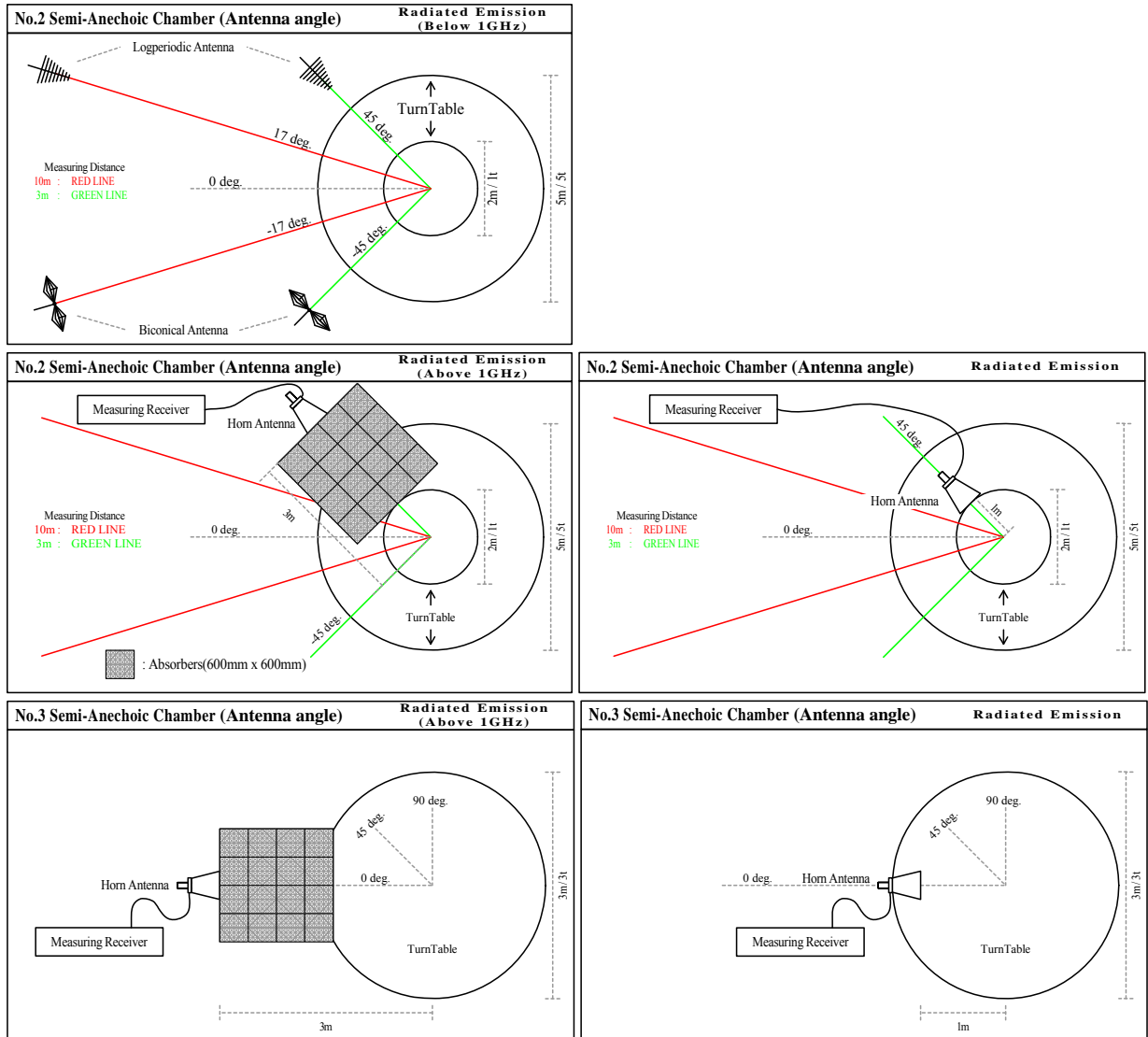
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Figure 1. Antenna angle



11.5 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.

11.6 Results

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

Refer to APPENDIX 1.

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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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APPENDIX 1: Data of Radio tests

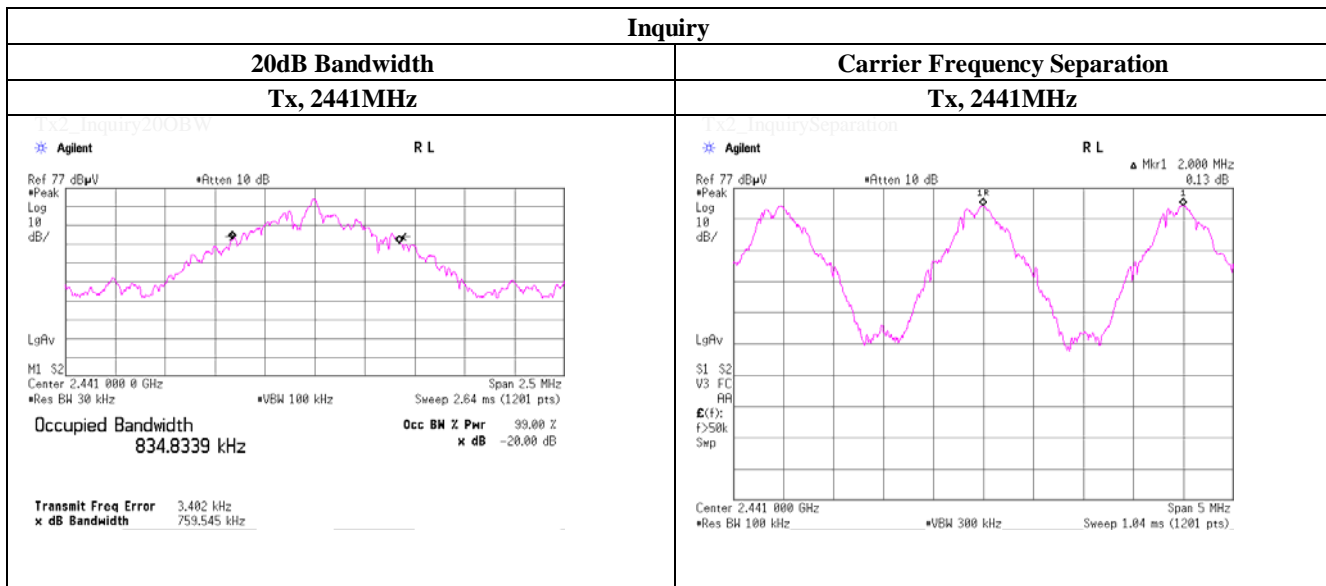
20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa
 Mode Tx, Bluetooth, BDR, PRBS9

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency Separation [MHz]
DH5	2402.0	0.863	1.000	>= 0.575
DH5	2441.0	0.925	1.000	>= 0.616
DH5	2480.0	0.814	1.000	>= 0.542
Inquiry	2441.0	0.760	2.000	>= 0.506

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

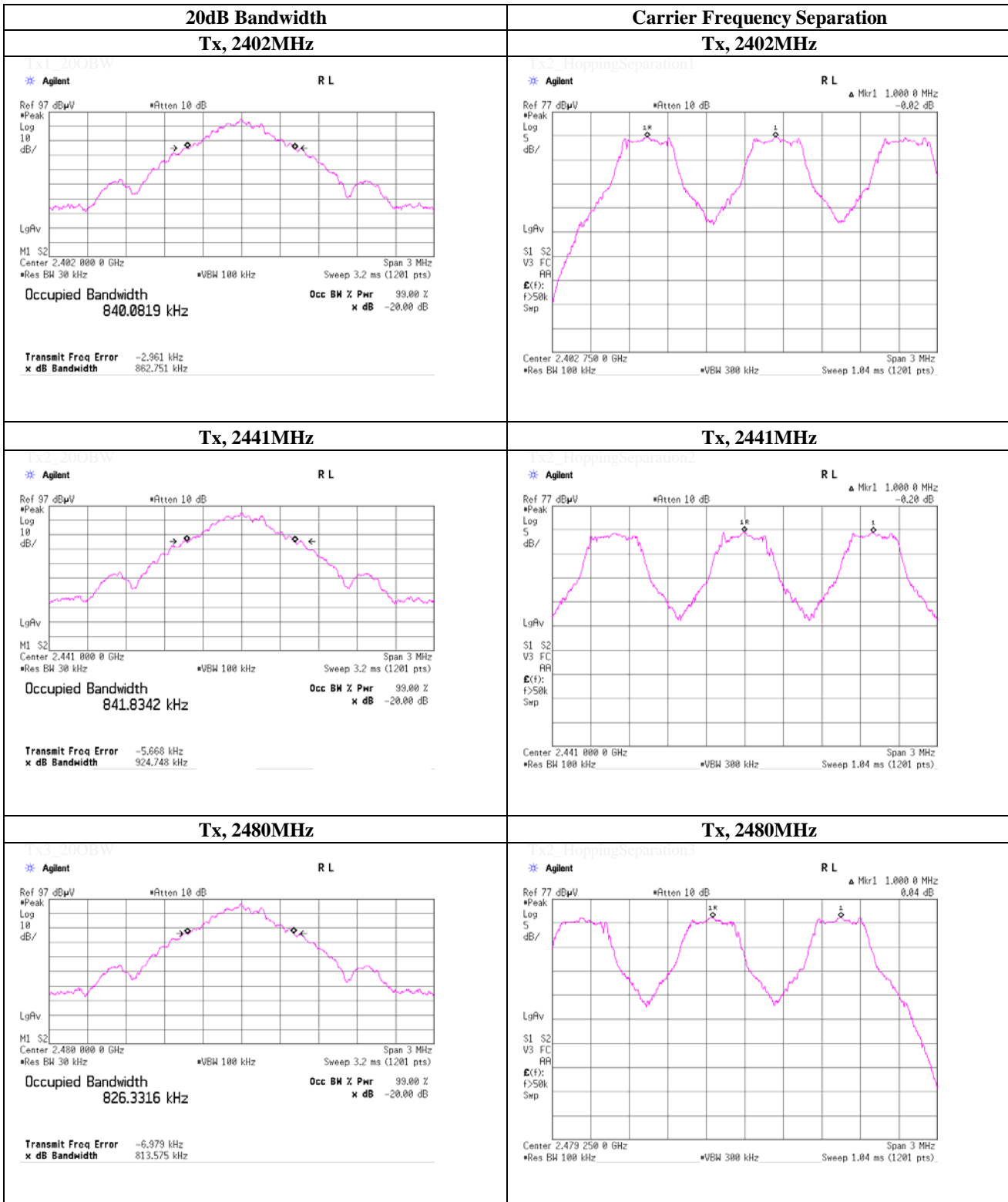
No limit applies to 20dB Bandwidth.



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20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, BDR, PRBS9



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20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa
 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	1.279	1.000	>= 0.853
3-DH5	2441.0	1.290	1.000	>= 0.860
3-DH5	2480.0	1.291	1.000	>= 0.861

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

No limit applies to 20dB Bandwidth.

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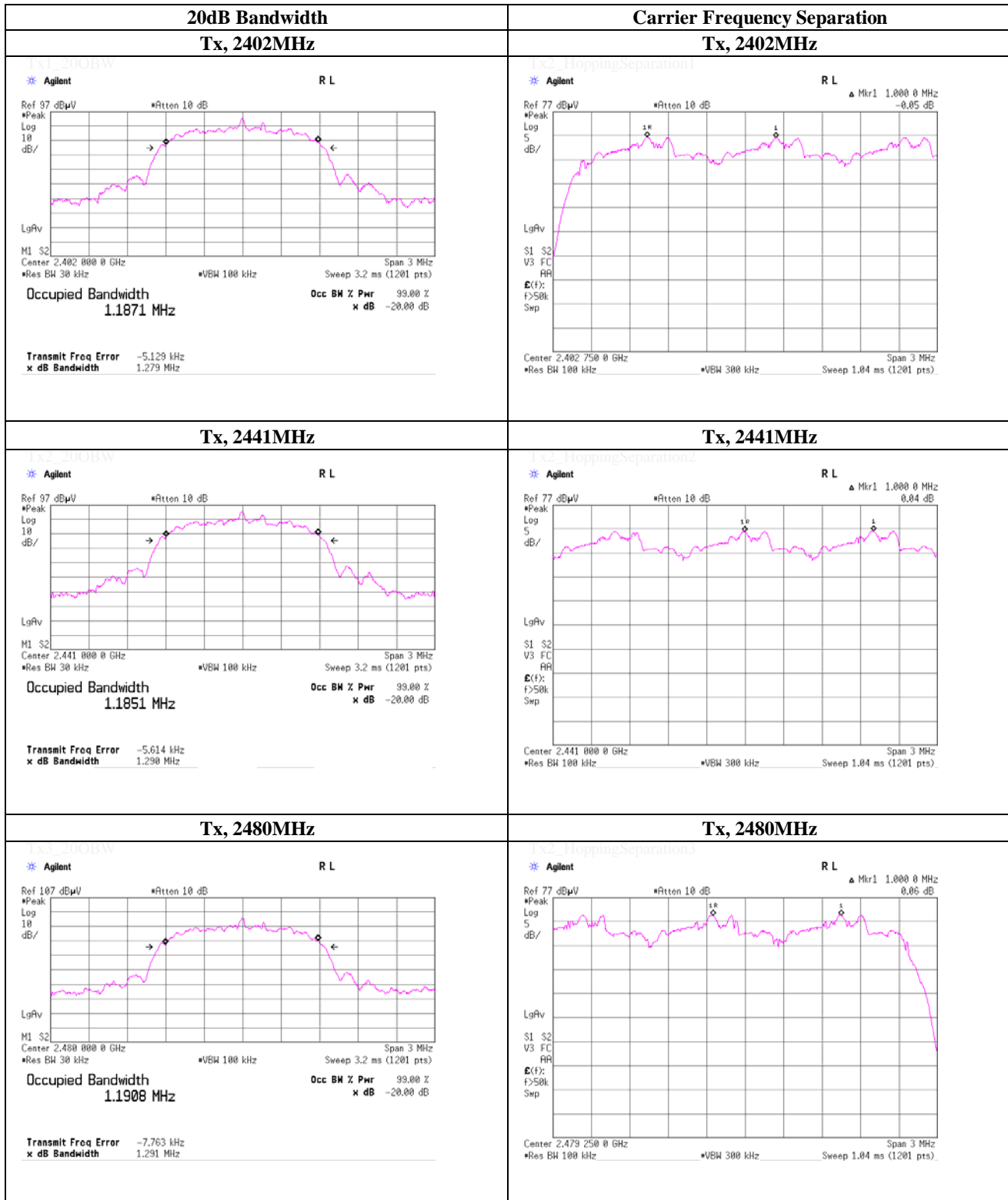
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20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, EDR, PRBS9



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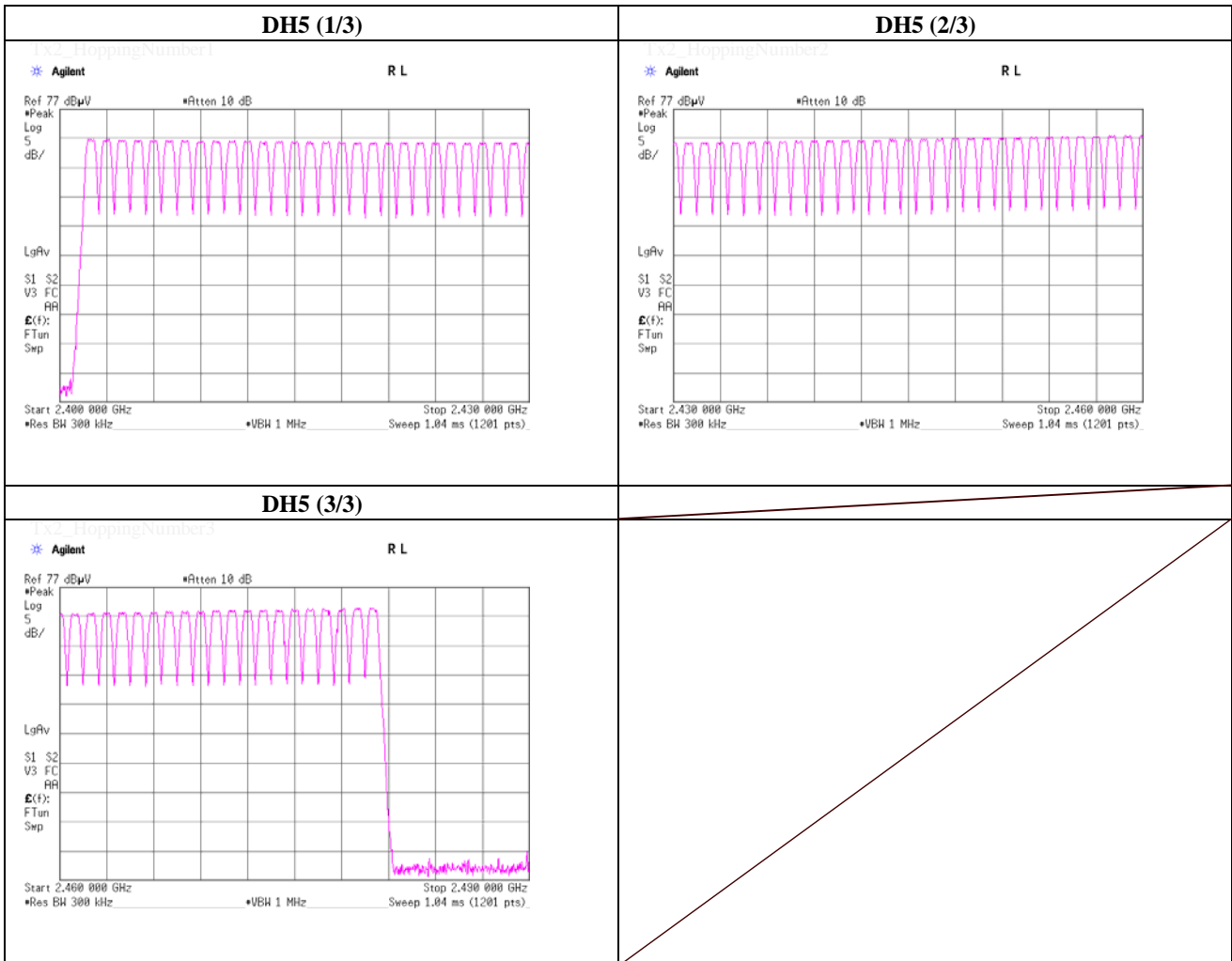
Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	April 10, 2015	
Temperature / Humidity	21 deg.C , 30 %RH	
Engineer	Yosuke Ishikawa	
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.

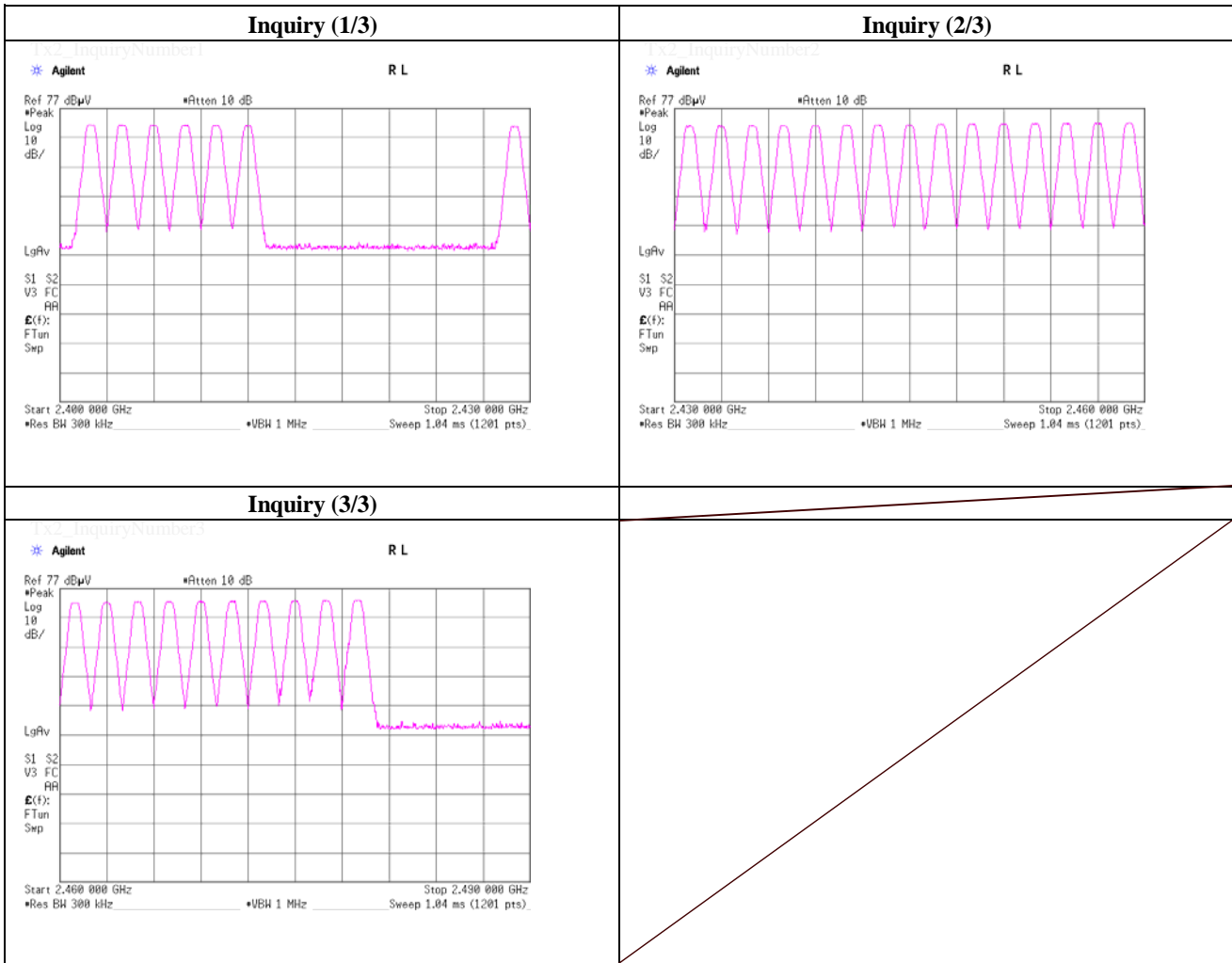


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Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	April 10, 2015	
Temperature / Humidity	21 deg.C , 30 %RH	
Engineer	Yosuke Ishikawa	
Mode	Tx, Bluetooth, Inquiry	

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



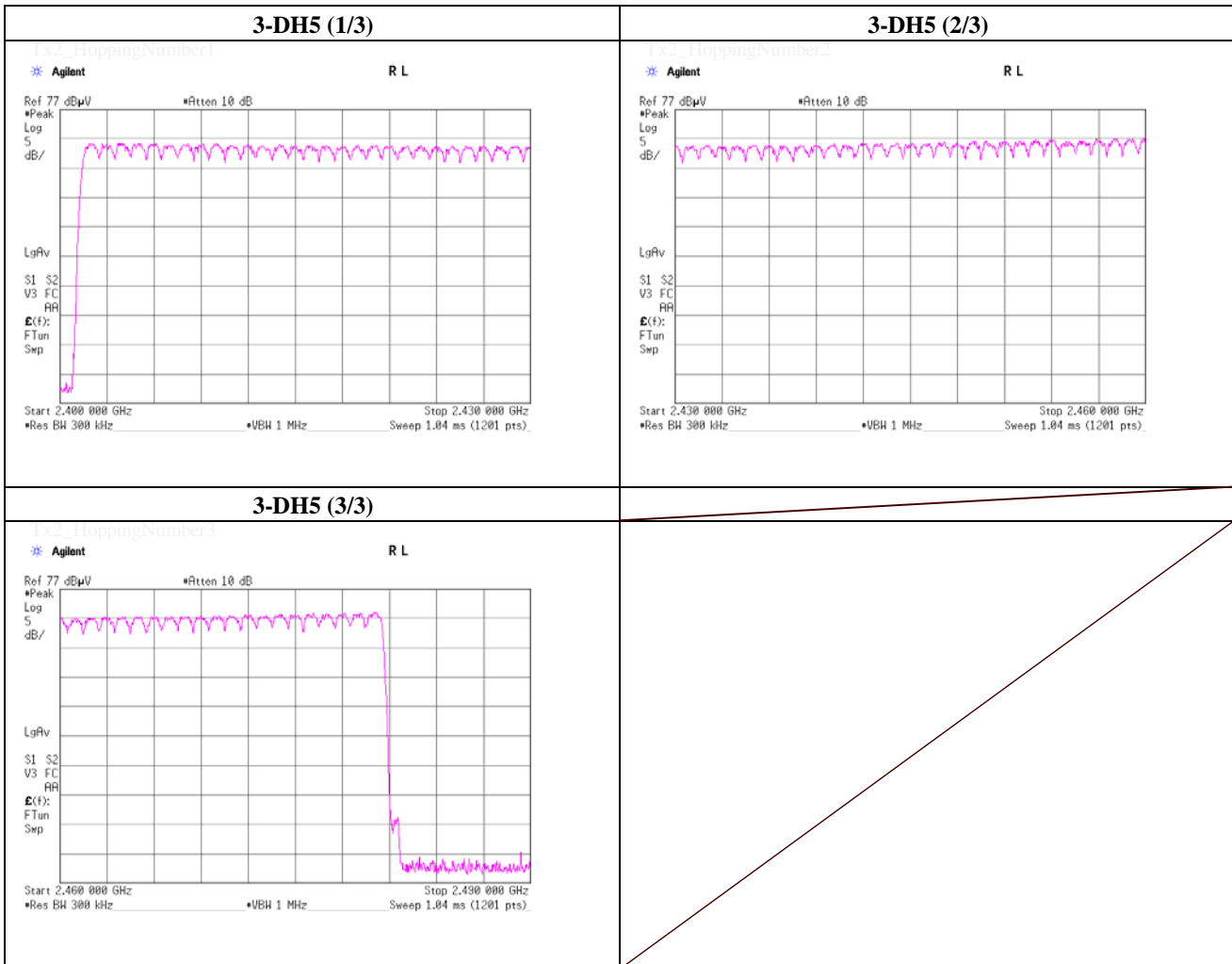
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Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	April 10, 2015	
Temperature / Humidity	21 deg.C , 30 %RH	
Engineer	Yosuke Ishikawa	
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 April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa
 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	50.4 / 5.0 sec. x 31.6 sec. = 319 times	0.408	130	400
DH3	26.8 / 5.0 sec. x 31.6 sec. = 170 times	1.664	283	400
DH5	17.8 / 5.0 sec. x 31.6 sec. = 113 times	2.913	329	400
Inquiry	100.0 / 1.0 sec. x 12.8 sec. = 1280 times	0.108	138	400

Sample Calculation

Result = Number of transmission x Length of transmission time

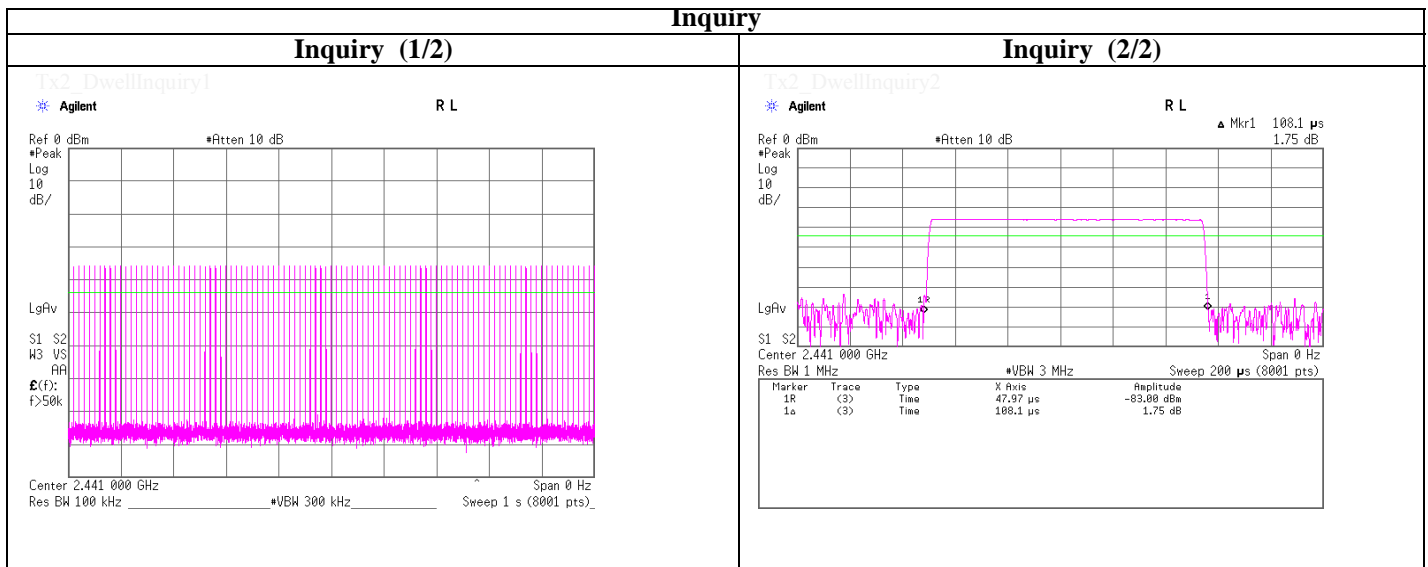
*Average data of 5 tests.(except Inquiry)

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	52	49	51	50	50	50.4
DH3	25	29	28	25	27	26.8
DH5	15	16	18	21	19	17.8

Sample Calculation

Average= Summation(Sampling 1 to 5) / 5

* This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in $N \times 0.4s$, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless of packet size (DH1, DH3 or DH5). This is confirmed in the test report for $N=79$.



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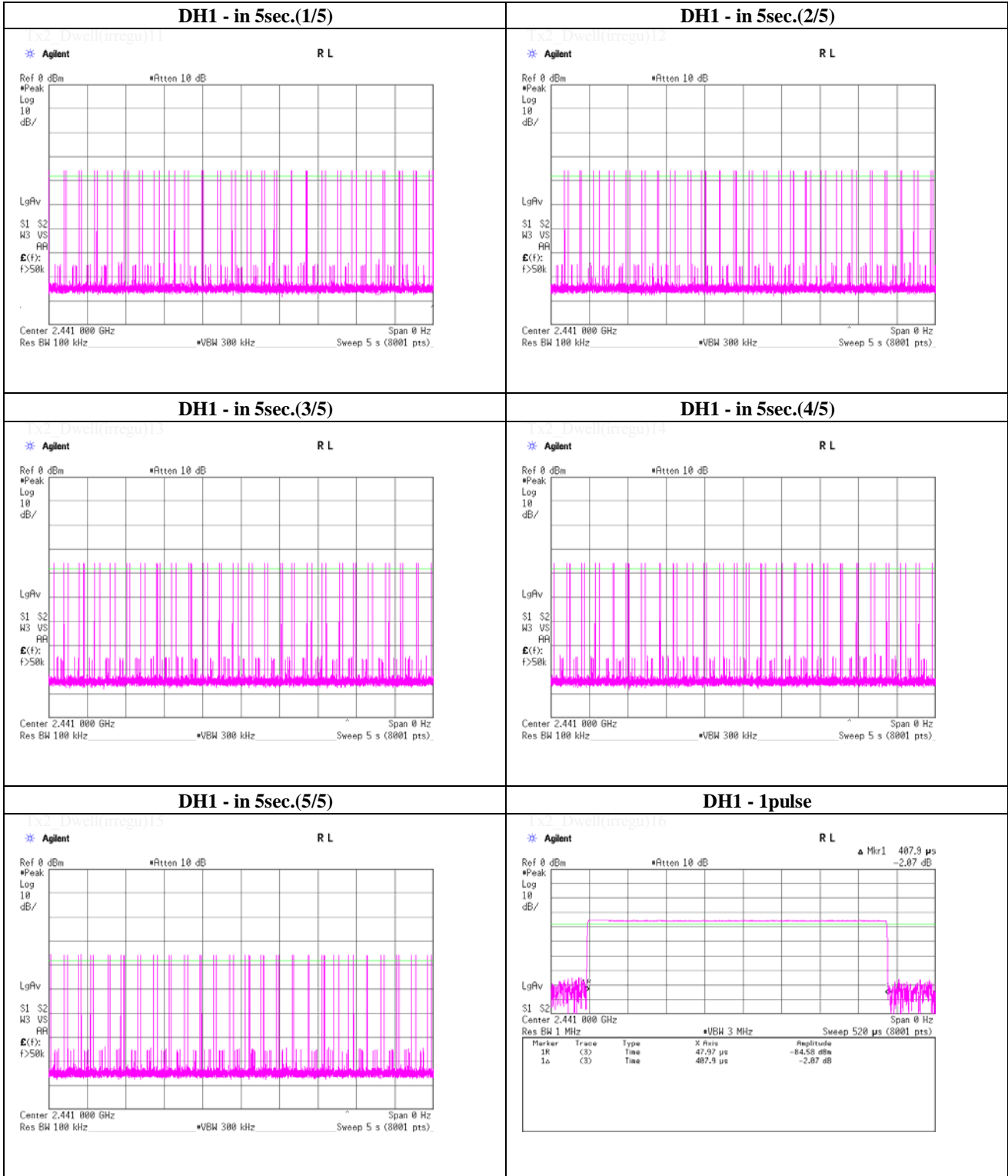
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Dwell time

Tx, Bluetooth, BDR, PRBS9



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Shonan EMC Lab.

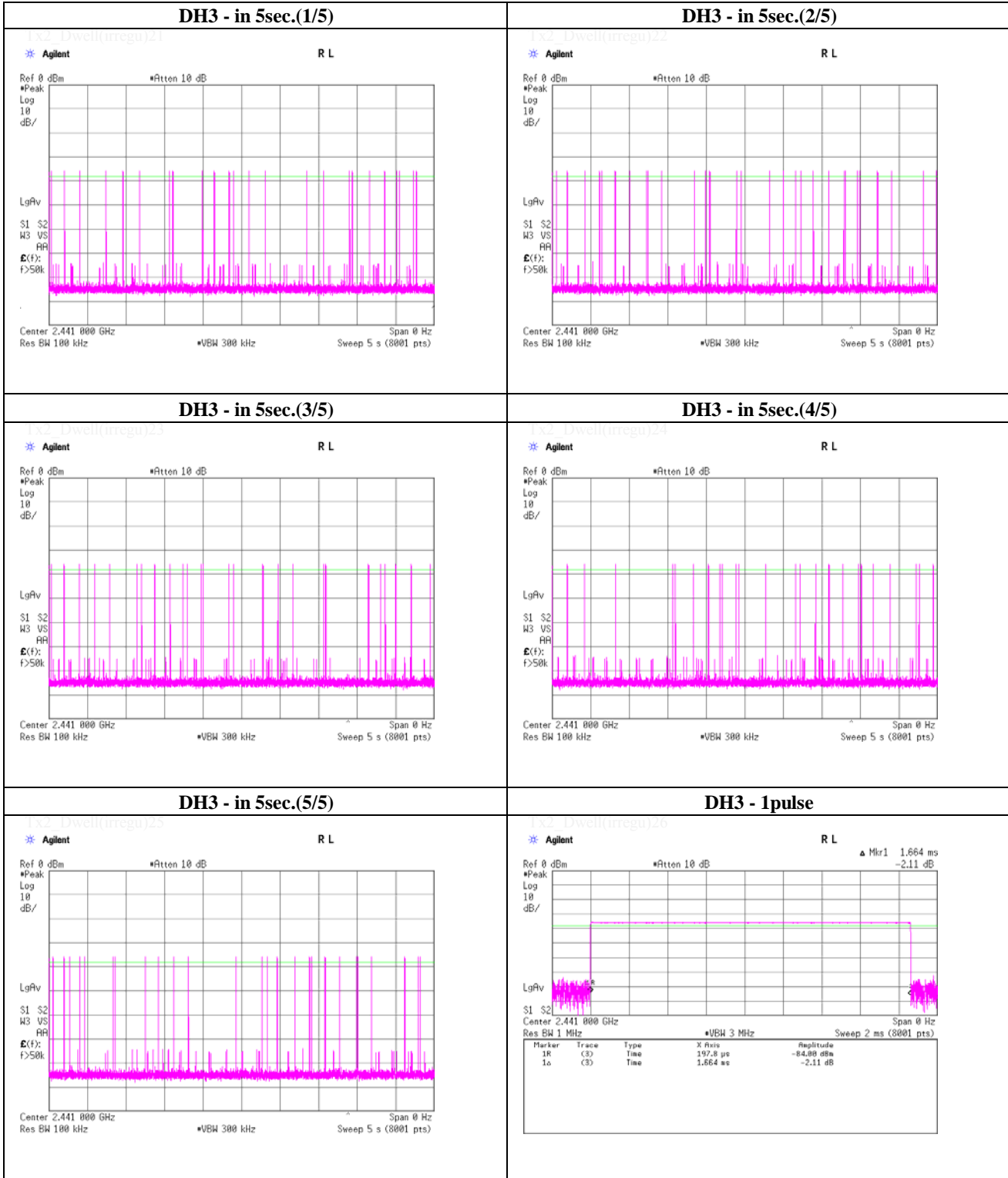
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Dwell time

Tx, Bluetooth, BDR, PRBS9



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Shonan EMC Lab.

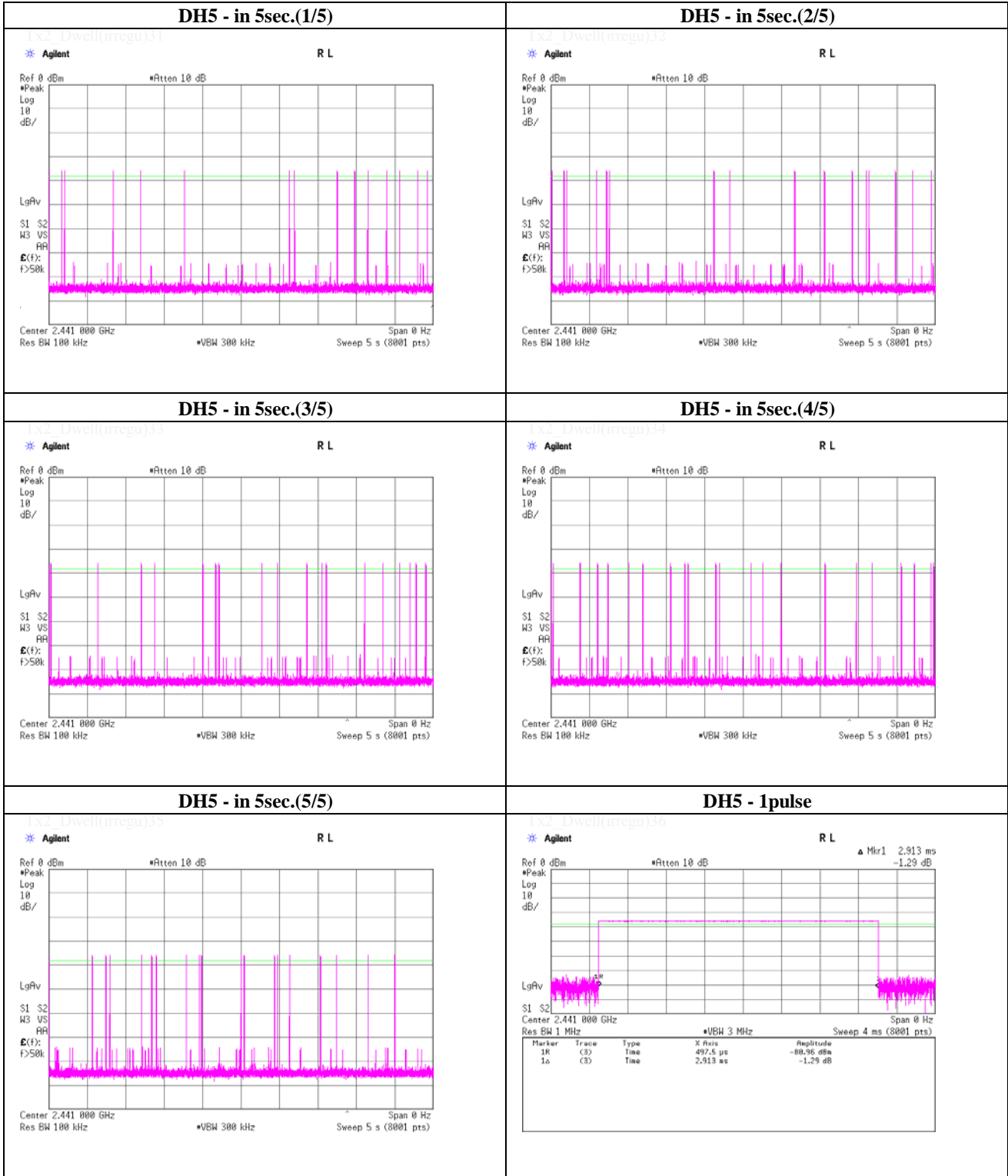
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Dwell time

Tx, Bluetooth, BDR, PRBS9



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Dwell Time

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date April 10, 2015
Temperature / Humidity 21 deg.C , 30 %RH
Engineer Yosuke Ishikawa
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	50.0 / 5.0 sec. x 31.6 sec. = 316 times	0.416	131	400
3-DH3	26.8 / 5.0 sec. x 31.6 sec. = 170 times	1.664	283	400
3-DH5	15.8 / 5.0 sec. x 31.6 sec. = 100 times	2.916	292	400

Sample Calculation

Result = Number of transmission x Length of transmission time

*Average data of 5 tests.(except Inquiry)

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
3-DH1	50	50	49	51	50	50.0
3-DH3	29	24	22	26	33	26.8
3-DH5	14	14	18	16	17	15.8

Sample Calculation

Average= Summation(Sampling 1 to 5) / 5

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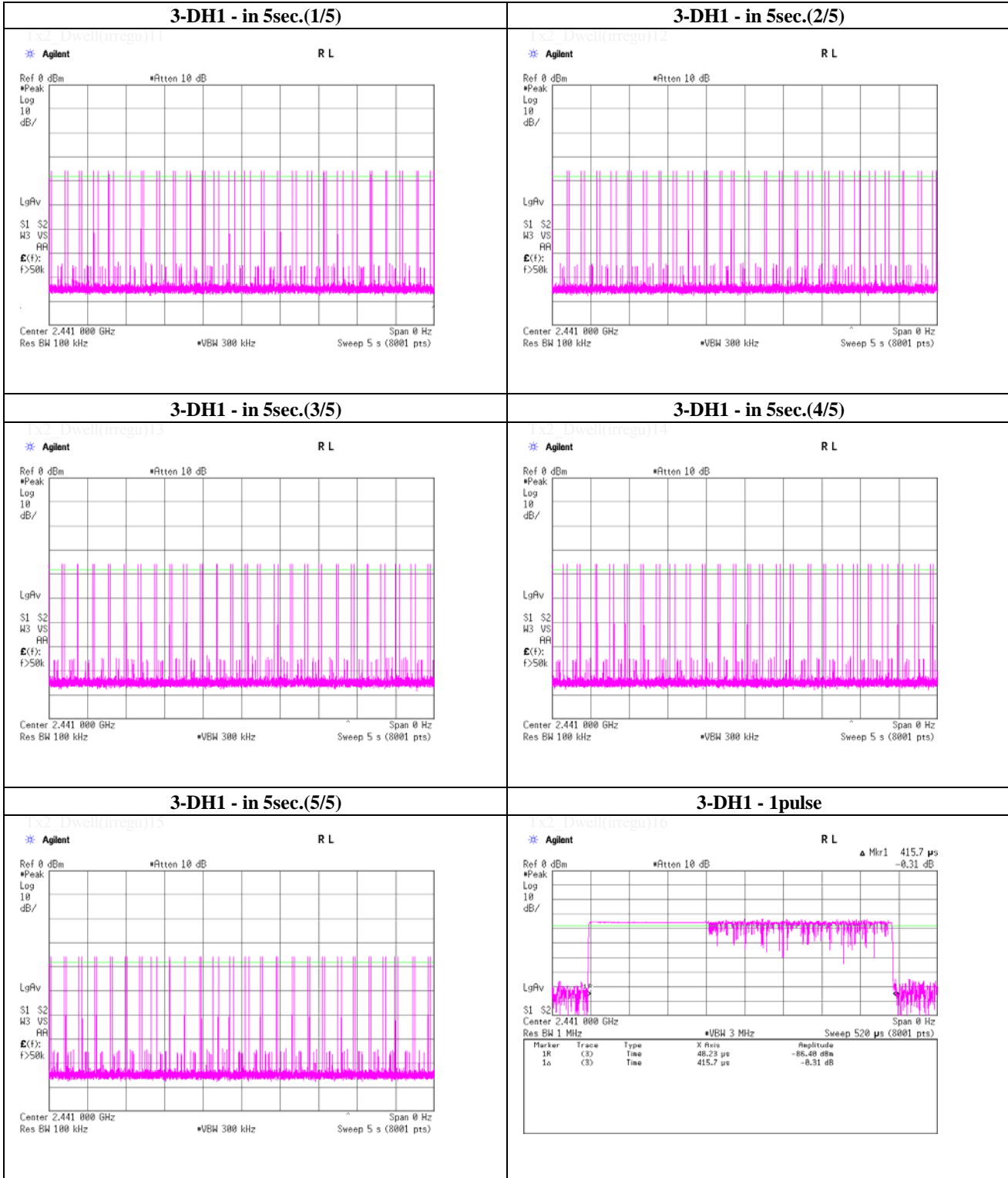
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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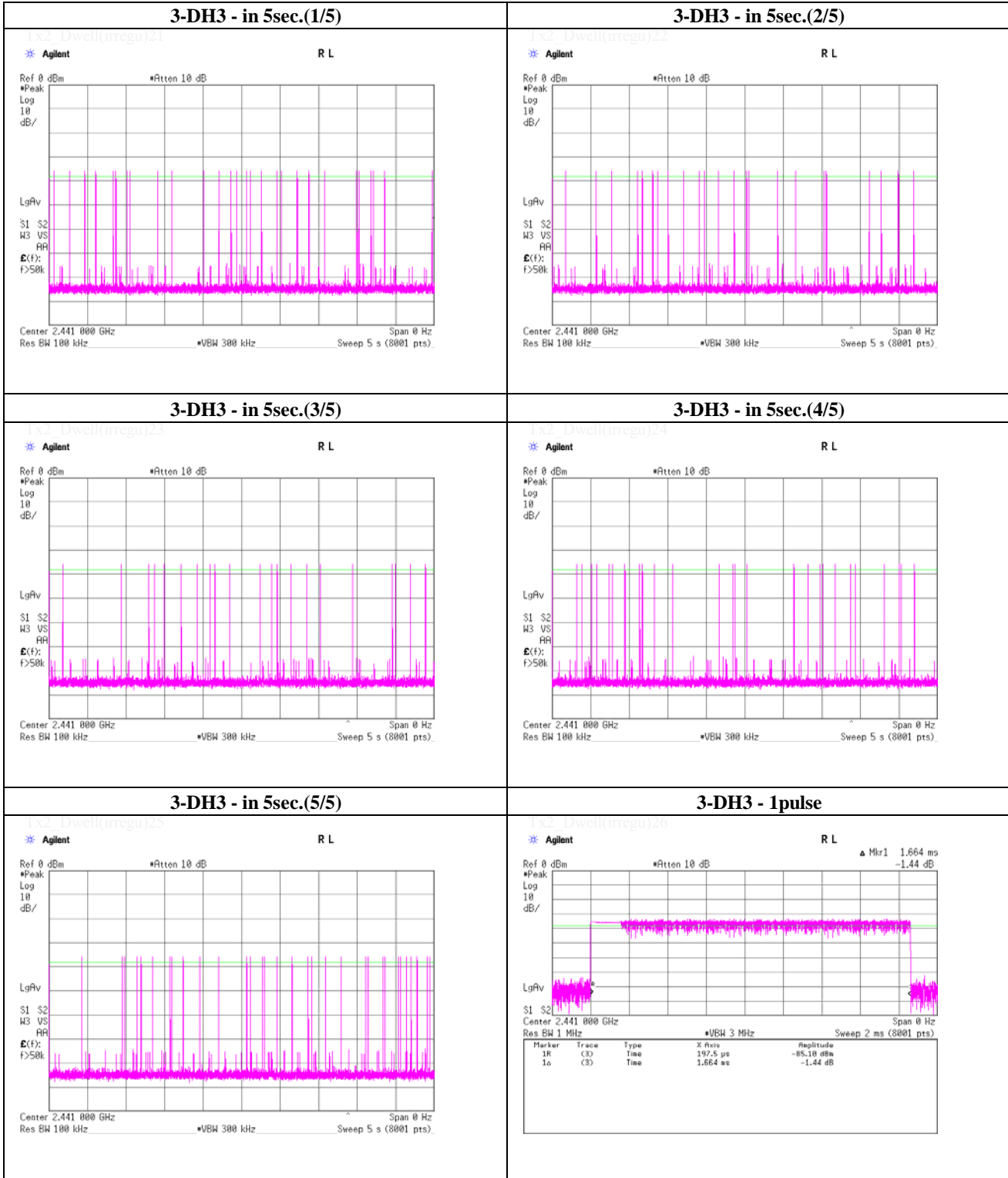
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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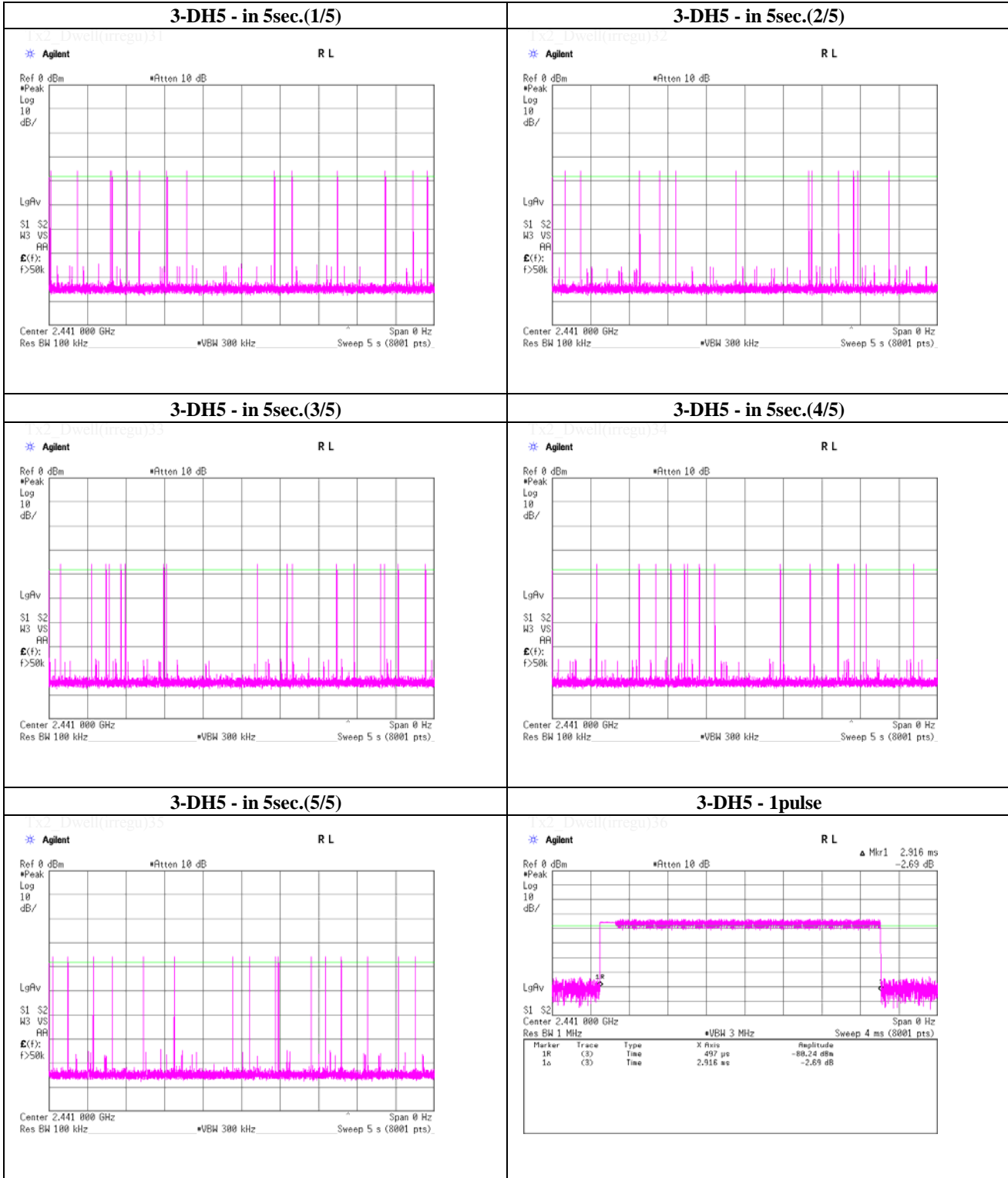
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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Maximum Peak Conducted Output Power (Conducted)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa
 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	-14.10	1.87	9.90	-2.33	0.58	20.97	125	23.30
DH5	2441.0	-13.51	1.88	9.89	-1.74	0.67	20.97	125	22.71
DH5	2480.0	-13.08	1.89	9.89	-1.30	0.74	20.97	125	22.27
2-DH5	2402.0	-12.33	1.87	9.90	-0.56	0.88	20.97	125	21.53
2-DH5	2441.0	-11.73	1.88	9.89	0.04	1.01	20.97	125	20.93
2-DH5	2480.0	-11.15	1.89	9.89	0.63	1.16	20.97	125	20.34
3-DH5	2402.0	-11.51	1.87	9.90	0.26	1.06	20.97	125	20.71
3-DH5	2441.0	-11.10	1.88	9.89	0.67	1.17	20.97	125	20.30
3-DH5	2480.0	-10.63	1.89	9.89	1.15	1.30	20.97	125	19.82

Sample Calculation:

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

(Reference maximum conducted power (average))

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

	Freq. [MHz]	P/M (Average) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty factor [dB]	Result		Typical Power [dBm]	Power Range [dB]	Deviation [dB]
						[dBm]	[mW]			
DH5	2402.0	-16.04	1.87	9.90	1.11	-3.16	0.48	-1.0	-	2.16
DH5	2441.0	-15.42	1.88	9.89	1.11	-2.54	0.56	-1.0	-	1.54
DH5	2480.0	-14.83	1.89	9.89	1.11	-1.94	0.64	-1.0	-	0.94
2-DH5	2402.0	-16.48	1.87	9.90	1.11	-3.60	0.44	-1.0	-	2.60
2-DH5	2441.0	-15.83	1.88	9.89	1.11	-2.95	0.51	-1.0	-	1.95
2-DH5	2480.0	-15.09	1.89	9.89	1.11	-2.20	0.60	-1.0	-	1.20
3-DH5	2402.0	-16.19	1.87	9.90	1.11	-3.31	0.47	-1.0	-	2.31
3-DH5	2441.0	-15.67	1.88	9.89	1.11	-2.79	0.53	-1.0	-	1.79
3-DH5	2480.0	-15.04	1.89	9.89	1.11	-2.15	0.61	-1.0	-	1.15

Sample Calculation:

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

Deviation = Typical Power + Power Range - Result

* Duty factor is refer to the page of "(Reference) duty chart for Maximum conducted power"

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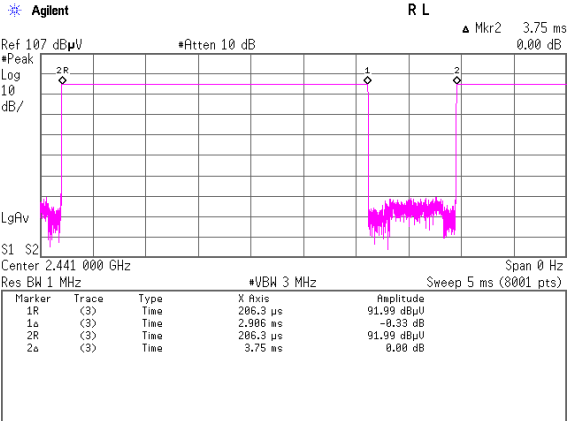
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

(Reference) duty chart for Maximum conducted power

(Reference duty chart for Maximum conducted power)



on time [ms] 2.906 1cycle[ms] 3.75 duty 0.775
 duty factor [dB] 1.11

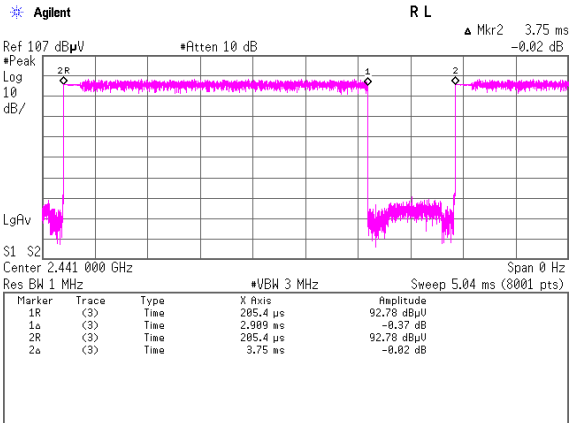
* calculation: duty factor [dB] = 10 x log (1cycle [ms] / on time [ms])

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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

(Reference) duty chart for Maximum conducted power

(Reference duty chart for Maximum conducted power)



on time [ms] 2.909 1cycle[ms] 3.75 duty 0.776
 duty factor [dB] 1.1
 * calculation: duty factor [dB] = 10 x log (1cycle [ms] / on time [ms])

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Radiated Emission

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber
 Date April 4, 2015 April 5, 2015
 Temperature / Humidity 22 deg.C, 51 %RH 18 deg.C, 45 %RH
 Engineer Shinichi Takano Makoto Hosaka
 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.	146.989	QP	43.8	14.6	8.5	31.8	35.1	43.5	8.4	331	44	
Hori.	527.960	QP	44.1	17.9	7.8	31.6	38.2	46.0	7.8	100	164	
Hori.	761.759	QP	41.3	20.5	8.9	31.4	39.3	46.0	6.7	126	237	
Hori.	960.058	QP	44.7	22.6	9.7	30.4	46.6	53.9	7.3	105	123	
Hori.	2390.000	PK	42.7	25.9	14.5	38.1	45.0	73.9	28.9	111	159	
Hori.	3147.490	PK	57.7	27.3	6.5	38.0	53.5	73.9	20.4	100	187	
Hori.	4409.526	PK	46.8	29.2	7.2	37.2	46.0	73.9	27.9	100	200	
Hori.	4804.000	PK	42.0	30.4	7.5	36.8	43.1	73.9	30.8	100	0	
Hori.	7206.000	PK	47.3	36.3	9.0	39.1	53.5	73.9	20.4	122	253	
Hori.	9608.000	PK	41.6	38.3	9.8	36.9	52.8	73.9	21.1	100	0	
Hori.	12010.000	PK	45.7	39.3	11.2	38.1	58.1	73.9	15.8	100	265	
Hori.	19524.271	PK	47.8	40.4	2.1	47.6	42.7	73.9	31.2	100	216	
Hori.	2390.000	AV	30.5	25.9	14.5	38.1	32.8	53.9	21.1	111	159	
Hori.	3147.490	AV	56.3	27.3	6.5	38.0	52.1	53.9	1.8	100	187	
Hori.	4409.526	AV	39.8	29.2	7.2	37.2	39.0	53.9	14.9	100	200	
Hori.	4804.000	AV	30.0	30.4	7.5	36.8	31.1	53.9	22.8	100	0	
Hori.	7206.000	AV	35.9	36.3	9.0	39.1	42.1	53.9	11.8	122	253	
Hori.	9608.000	AV	30.2	38.3	9.8	36.9	41.4	53.9	12.5	100	0	
Hori.	12010.000	AV	32.2	39.3	11.2	38.1	44.6	53.9	9.3	100	265	
Hori.	19524.271	AV	42.2	40.4	2.1	47.6	37.1	53.9	16.8	100	216	
Vert.	146.990	QP	41.3	14.6	8.5	31.8	32.6	43.5	10.9	100	117	
Vert.	186.994	QP	35.9	16.1	8.7	31.8	28.9	43.5	14.6	100	114	
Vert.	527.972	QP	39.7	17.9	7.8	31.6	33.8	46.0	12.2	100	179	
Vert.	761.774	QP	40.0	20.5	8.9	31.4	38.0	46.0	8.0	100	34	
Vert.	960.055	QP	40.0	22.6	9.7	30.4	41.9	53.9	12.0	110	224	
Vert.	2390.000	PK	43.3	25.9	14.5	38.1	45.6	73.9	28.3	100	202	
Vert.	3147.490	PK	58.9	27.3	6.5	38.0	54.7	73.9	19.2	100	0	
Vert.	4409.526	PK	46.0	29.2	7.2	37.2	45.2	73.9	28.7	100	220	
Vert.	4804.000	PK	46.5	30.4	7.5	36.8	47.6	73.9	26.3	100	220	
Vert.	7206.000	PK	48.0	36.3	9.0	39.1	54.2	73.9	19.7	178	202	
Vert.	9608.000	PK	40.7	38.3	9.8	36.9	51.9	73.9	22.0	100	0	
Vert.	12010.000	PK	43.1	39.3	11.2	38.1	55.5	73.9	18.4	100	0	
Vert.	2390.000	AV	30.8	25.9	14.5	38.1	33.1	53.9	20.8	100.0	202.0	
Vert.	3147.490	AV	57.4	27.3	6.5	38.0	53.2	53.9	0.7	100.0	0.0	
Vert.	4409.526	AV	38.0	29.2	7.2	37.2	37.2	53.9	16.7	100.0	220.0	
Vert.	4804.000	AV	38.2	30.4	7.5	36.8	39.3	53.9	14.6	100.0	220.0	
Vert.	7206.000	AV	37.4	36.3	9.0	39.1	43.6	53.9	10.3	178.0	202.0	
Vert.	9608.000	AV	30.0	38.3	9.8	36.9	41.2	53.9	12.7	100.0	0.0	
Vert.	12010.000	AV	31.9	39.3	11.2	38.1	44.3	53.9	9.6	100.0	0.0	

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

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

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	76.1	25.9	14.5	38.1	78.4	-	-	Carrier
Hori.	2400.000	PK	33.0	25.9	14.5	38.1	35.3	58.4	23.1	
Vert.	2402.000	PK	77.9	25.9	14.5	38.1	80.2	-	-	Carrier
Vert.	2400.000	PK	33.5	25.9	14.5	38.1	35.8	60.2	24.4	

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

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Radiated Emission

Test place	No.2 Semi Anechoic Chamber	No.2 Semi Anechoic Chamber	No.3 Semi Anechoic Chamber
Date	April 4, 2015	April 5, 2015	April 6, 2015
Temperature / Humidity	22 deg.C, 51 %RH	18 deg.C, 45 %RH	26 deg.C, 40 %RH
Engineer	Shinichi Takano	Makoto Hosaka	Hikaru Shirasawa
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.	146.984	QP	43.9	14.6	8.5	31.8	35.2	43.5	8.3	217	47	
Hori.	293.975	QP	39.1	19.2	9.6	31.7	36.2	46.0	9.8	114	241	
Hori.	527.968	QP	43.1	17.9	7.8	31.6	37.2	46.0	8.8	100	144	
Hori.	761.804	QP	41.1	20.5	8.9	31.4	39.1	46.0	6.9	123	231	
Hori.	960.054	QP	44.1	22.6	9.7	30.4	46.0	53.9	7.9	104	125	
Hori.	3147.248	PK	61.2	27.7	5.1	40.8	53.2	73.9	20.7	100	149	
Hori.	4409.624	PK	50.8	29.4	5.3	40.2	45.3	73.9	28.6	133	150	
Hori.	4882.000	PK	45.9	30.9	5.5	39.7	42.6	73.9	31.3	100	212	
Hori.	7323.000	PK	47.5	36.8	6.8	40.3	50.8	73.9	23.1	155	205	
Hori.	9764.000	PK	37.0	38.6	8.0	40.0	43.6	73.9	30.3	100	183	
Hori.	12205.000	PK	46.8	39.4	9.0	39.8	55.4	73.9	18.5	100	359	
Hori.	19524.000	PK	47.3	40.4	2.1	47.6	42.2	73.9	31.7	106	218	
Hori.	3147.248	AV	59.9	27.7	5.1	40.8	51.9	53.9	2.0	100	149	
Hori.	4409.624	AV	45.7	29.4	5.3	40.2	40.2	53.9	13.7	133	150	
Hori.	4882.000	AV	33.5	30.9	5.5	39.7	30.2	53.9	23.7	100	212	
Hori.	7323.000	AV	37.9	36.8	6.8	40.3	41.2	53.9	12.7	155	205	
Hori.	9764.000	AV	33.4	38.6	8.0	40.0	40.0	53.9	13.9	100	183	
Hori.	12205.000	AV	33.5	39.4	9.0	39.8	42.1	53.9	11.8	100	359	
Hori.	19524.000	AV	41.4	40.4	2.1	47.6	36.3	53.9	17.6	106	218	
Vert.	146.984	QP	41.7	14.6	8.5	31.8	33.0	43.5	10.5	100	300	
Vert.	293.974	QP	34.6	19.2	9.6	31.7	31.7	46.0	14.3	100	357	
Vert.	761.763	QP	40.1	20.5	8.9	31.4	38.1	46.0	7.9	100	27	
Vert.	960.054	QP	40.1	22.6	9.7	30.4	42.0	53.9	11.9	112	224	
Vert.	3147.273	PK	62.5	27.7	5.1	40.8	54.5	73.9	19.4	100	179	
Vert.	4409.597	PK	48.9	29.4	5.3	40.2	43.4	73.9	30.5	100	162	
Vert.	4882.000	PK	45.5	30.9	5.5	39.7	42.2	73.9	31.7	100	197	
Vert.	7323.000	PK	45.4	36.8	6.8	40.3	48.7	73.9	25.2	100	176	
Vert.	9764.000	PK	45.0	38.6	8.0	40.0	51.6	73.9	22.3	100	231	
Vert.	12205.000	PK	45.9	39.4	9.0	39.8	54.5	73.9	19.4	100	0	
Vert.	3147.273	AV	61.3	27.7	5.1	40.8	53.3	53.9	0.6	100	179	
Vert.	4409.597	AV	42.8	29.4	5.3	40.2	37.3	53.9	16.6	100	162	
Vert.	4882.000	AV	35.4	30.9	5.5	39.7	32.1	53.9	21.8	100	197	
Vert.	7323.000	AV	34.8	36.8	6.8	40.3	38.1	53.9	15.8	100	176	
Vert.	9764.000	AV	33.5	38.6	8.0	40.0	40.1	53.9	13.8	100	231	
Vert.	12205.000	AV	33.8	39.4	9.0	39.8	42.4	53.9	11.5	100	0	

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

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

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Radiated Emission

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber
 Date April 4, 2015 April 5, 2015
 Temperature / Humidity 22 deg.C, 51 %RH 18 deg.C, 45 %RH
 Engineer Shinichi Takano Makoto Hosaka
 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.	146.985	QP	44.0	14.6	8.5	31.8	35.3	43.5	8.2	230	46	
Hori.	761.774	QP	41.4	20.5	8.9	31.4	39.4	46.0	6.6	132	231	
Hori.	960.057	QP	42.6	22.6	9.7	30.4	44.5	53.9	9.4	105	125	
Hori.	2483.500	PK	42.3	25.9	14.6	38.0	44.8	73.9	29.1	110	210	
Hori.	3147.519	PK	58.1	27.3	6.5	38.0	53.9	73.9	20.0	100	188	
Hori.	4409.622	PK	47.4	29.2	7.2	37.2	46.6	73.9	27.3	100	201	
Hori.	4960.000	PK	43.4	31.0	7.7	36.7	45.4	73.9	28.5	100	192	
Hori.	7440.000	PK	46.1	36.5	9.0	39.2	52.4	73.9	21.5	100	204	
Hori.	9920.000	PK	42.1	38.4	9.8	37.1	53.2	73.9	20.7	100	0	
Hori.	12400.000	PK	45.9	39.1	11.4	37.9	58.5	73.9	15.4	100	231	
Hori.	19524.295	PK	48.3	40.4	2.1	47.6	43.2	73.9	30.7	100	217	
Hori.	2483.500	AV	31.1	25.9	14.6	38.0	33.6	53.9	20.3	110	210	
Hori.	3147.519	AV	56.4	27.3	6.5	38.0	52.2	53.9	1.7	100	188	
Hori.	4409.622	AV	40.6	29.2	7.2	37.2	39.8	53.9	14.1	100	201	
Hori.	4960.000	AV	31.8	31.0	7.7	36.7	33.8	53.9	20.1	100	192	
Hori.	7440.000	AV	33.9	36.5	9.0	39.2	40.2	53.9	13.7	100	204	
Hori.	9920.000	AV	30.9	38.4	9.8	37.1	42.0	53.9	11.9	100	0	
Hori.	12400.000	AV	33.2	39.1	11.4	37.9	45.8	53.9	8.1	100	231	
Hori.	19524.295	AV	41.7	40.4	2.1	47.6	36.6	53.9	17.3	100	217	
Vert.	146.985	QP	41.8	14.6	8.5	31.8	33.1	43.5	10.4	100	306	
Vert.	761.767	QP	40.0	20.5	8.9	31.4	38.0	46.0	8.0	100	28	
Vert.	960.056	QP	39.7	22.6	9.7	30.4	41.6	53.9	12.3	100	227	
Vert.	2483.500	PK	42.6	25.9	14.6	38.0	45.1	73.9	28.8	100	204	
Vert.	3147.519	PK	58.7	27.3	6.5	38.0	54.5	73.9	19.4	100	220	
Vert.	4409.622	PK	46.8	29.2	7.2	37.2	46.0	73.9	27.9	100	202	
Vert.	4960.000	PK	43.5	31.0	7.7	36.7	45.5	73.9	28.4	100	175	
Vert.	7440.000	PK	45.3	36.5	9.0	39.2	51.6	73.9	22.3	100	238	
Vert.	9920.000	PK	42.5	38.4	9.8	37.1	53.6	73.9	20.3	100	0	
Vert.	12400.000	PK	46.8	39.1	11.4	37.9	59.4	73.9	14.5	100	212	
Vert.	2483.500	AV	31.2	25.9	14.6	38.0	33.7	53.9	20.2	100	204	
Vert.	3147.519	AV	57.2	27.3	6.5	38.0	53.0	53.9	0.9	100	220	
Vert.	4409.622	AV	38.9	29.2	7.2	37.2	38.1	53.9	15.8	100	202	
Vert.	4960.000	AV	31.3	31.0	7.7	36.7	33.3	53.9	20.6	100	175	
Vert.	7440.000	AV	35.6	36.5	9.0	39.2	41.9	53.9	12.0	100	238	
Vert.	9920.000	AV	31.0	38.4	9.8	37.1	42.1	53.9	11.8	100	0	
Vert.	12400.000	AV	34.3	39.1	11.4	37.9	46.9	53.9	7.0	100	212	

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

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

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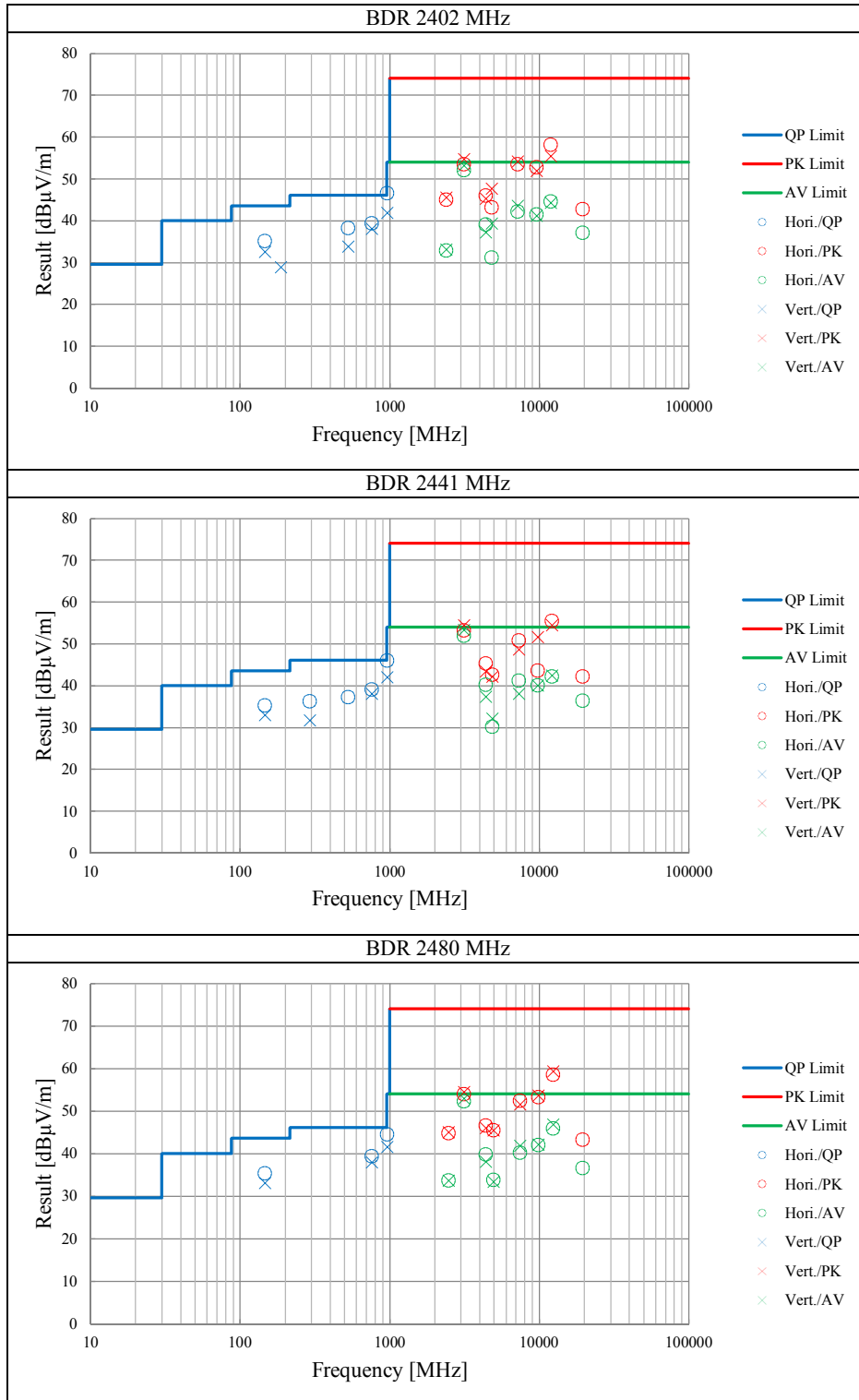
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Radiated Emission (All band chart)

Test place	Refer to previous sheet
Date	Refer to previous sheet
Temperature / Humidity	Refer to previous sheet
Engineer	Refer to previous sheet
Mode	Tx, Bluetooth, BDR, PRBS9,



UL Japan, Inc.

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Radiated Emission

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber
 Date April 4, 2015 April 5, 2015
 Temperature / Humidity 22 deg.C, 51 %RH 18 deg.C, 45 %RH
 Engineer Shinichi Takano Makoto Hosaka
 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.	146.987	QP	44.3	14.6	8.5	31.8	35.6	43.5	7.9	227	42	
Hori.	761.771	QP	41.3	20.5	8.9	31.4	39.3	46.0	6.7	137	233	
Hori.	960.054	QP	42.8	22.6	9.7	30.4	44.7	53.9	9.2	103	125	
Hori.	2390.000	PK	41.9	25.9	14.5	38.1	44.2	73.9	29.7	157	158	
Hori.	3147.448	PK	57.6	27.3	6.5	38.0	53.4	73.9	20.5	100	187	
Hori.	4409.576	PK	47.3	29.2	7.2	37.2	46.5	73.9	27.4	130	200	
Hori.	4804.000	PK	40.8	30.4	7.5	36.8	41.9	73.9	32.0	100	0	
Hori.	7206.000	PK	46.6	36.3	9.0	39.1	52.8	73.9	21.1	100	252	
Hori.	9608.000	PK	42.4	38.3	9.8	36.9	53.6	73.9	20.3	100	0	
Hori.	12010.000	PK	44.9	39.3	11.2	38.1	57.3	73.9	16.6	100	262	
Hori.	19524.156	PK	47.2	40.4	2.1	47.6	42.1	73.9	31.8	100	217	
Hori.	2390.000	AV	30.6	25.9	14.5	38.1	32.9	53.9	21.0	157	158	
Hori.	3147.448	AV	56.0	27.3	6.5	38.0	51.8	53.9	2.1	100	187	
Hori.	4409.576	AV	40.7	29.2	7.2	37.2	39.9	53.9	14.0	130	200	
Hori.	4804.000	AV	30.2	30.4	7.5	36.8	31.3	53.9	22.6	100	0	
Hori.	7206.000	AV	33.7	36.3	9.0	39.1	39.9	53.9	14.0	100	252	
Hori.	9608.000	AV	29.4	38.3	9.8	36.9	40.6	53.9	13.3	100	0	
Hori.	12010.000	AV	31.5	39.3	11.2	38.1	43.9	53.9	10.0	100	262	
Hori.	19524.156	AV	41.5	40.4	2.1	47.6	36.4	53.9	17.5	100	217	
Vert.	146.982	QP	41.9	14.6	8.5	31.8	33.2	43.5	10.3	100	310	
Vert.	761.776	QP	39.2	20.5	8.9	31.4	37.2	46.0	8.8	100	28	
Vert.	960.057	QP	40.1	22.6	9.7	30.4	42.0	53.9	11.9	107	228	
Vert.	2390.000	PK	41.9	25.9	14.5	38.1	44.2	73.9	29.7	100	200	
Vert.	3147.448	PK	58.8	27.3	6.5	38.0	54.6	73.9	19.3	100	223	
Vert.	4409.576	PK	46.1	29.2	7.2	37.2	45.3	73.9	28.6	100	215	
Vert.	4804.000	PK	42.3	30.4	7.5	36.8	43.4	73.9	30.5	100	0	
Vert.	7206.000	PK	46.6	36.3	9.0	39.1	52.8	73.9	21.1	100	201	
Vert.	9608.000	PK	42.2	38.3	9.8	36.9	53.4	73.9	20.5	100	0	
Vert.	12010.000	PK	44.8	39.3	11.2	38.1	57.2	73.9	16.7	100	256	
Vert.	2390.000	AV	30.3	25.9	14.5	38.1	32.6	53.9	21.3	100	200	
Vert.	3147.448	AV	57.4	27.3	6.5	38.0	53.2	53.9	0.7	100	223	
Vert.	4409.576	AV	38.1	29.2	7.2	37.2	37.3	53.9	16.6	100	215	
Vert.	4804.000	AV	29.8	30.4	7.5	36.8	30.9	53.9	23.0	100	0	
Vert.	7206.000	AV	34.2	36.3	9.0	39.1	40.4	53.9	13.5	100	201	
Vert.	9608.000	AV	29.4	38.3	9.8	36.9	40.6	53.9	13.3	100	0	
Vert.	12010.000	AV	32.0	39.3	11.2	38.1	44.4	53.9	9.5	100	256	

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

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

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

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	76.6	25.9	14.5	38.1	78.9	-	-	Carrier
Hori.	2400.000	PK	33.7	25.9	14.5	38.1	36.0	58.9	22.9	
Vert.	2402.000	PK	76.3	25.9	14.5	38.1	78.6	-	-	Carrier
Vert.	2400.000	PK	33.2	25.9	14.5	38.1	35.5	58.6	23.1	

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

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Radiated Emission

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber
 Date April 4, 2015 April 5, 2015
 Temperature / Humidity 22 deg.C, 51 %RH 18 deg.C, 45 %RH
 Engineer Shinichi Takano Makoto Hosaka
 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.	146.986	QP	44.3	14.6	8.5	31.8	35.6	43.5	7.9	219	44	
Hori.	761.775	QP	42.1	20.5	8.9	31.4	40.1	46.0	5.9	132	235	
Hori.	960.053	QP	43.0	22.6	9.7	30.4	44.9	53.9	9.0	104	124	
Hori.	3147.484	PK	58.3	27.3	6.5	38.0	54.1	73.9	19.8	115	186	
Hori.	4409.622	PK	47.2	29.2	7.2	37.2	46.4	73.9	27.5	100	197	
Hori.	4882.000	PK	44.1	30.7	7.6	36.8	45.6	73.9	28.3	100	207	
Hori.	7323.000	PK	47.7	36.4	8.9	39.1	53.9	73.9	20.0	100	209	
Hori.	9764.000	PK	40.7	38.3	9.9	37.0	51.9	73.9	22.0	100	0	
Hori.	12205.000	PK	43.8	39.2	11.2	38.0	56.2	73.9	17.7	100	0	
Hori.	19524.236	PK	46.8	40.4	2.1	47.6	41.7	73.9	32.2	100	218	
Hori.	3147.484	AV	57.0	27.3	6.5	38.0	52.8	53.9	1.1	115	186	
Hori.	4409.622	AV	39.7	29.2	7.2	37.2	38.9	53.9	15.0	100	197	
Hori.	4882.000	AV	32.7	30.7	7.6	36.8	34.2	53.9	19.7	100	207	
Hori.	7323.000	AV	33.6	36.4	8.9	39.1	39.8	53.9	14.1	100	209	
Hori.	9764.000	AV	30.1	38.3	9.9	37.0	41.3	53.9	12.6	100	0	
Hori.	12205.000	AV	31.1	39.2	11.2	38.0	43.5	53.9	10.4	100	0	
Hori.	19524.236	AV	41.2	40.4	2.1	47.6	36.1	53.9	17.8	100	218	
Vert.	146.990	QP	42.0	14.6	8.5	31.8	33.3	43.5	10.2	100	322	
Vert.	748.272	QP	39.2	20.5	8.8	31.4	37.1	46.0	8.9	100	25	
Vert.	960.054	QP	40.7	22.6	9.7	30.4	42.6	53.9	11.3	109	225	
Vert.	3147.484	PK	59.4	27.3	6.5	38.0	55.2	73.9	18.7	100	218	
Vert.	4409.622	PK	46.9	29.2	7.2	37.2	46.1	73.9	27.8	100	216	
Vert.	4882.000	PK	44.8	30.7	7.6	36.8	46.3	73.9	27.6	100	186	
Vert.	7323.000	PK	45.9	36.4	8.9	39.1	52.1	73.9	21.8	100	203	
Vert.	9764.000	PK	41.1	38.3	9.9	37.0	52.3	73.9	21.6	100	0	
Vert.	12205.000	PK	44.9	39.2	11.2	38.0	57.3	73.9	16.6	100	226	
Vert.	3147.484	AV	57.5	27.3	6.5	38.0	53.3	53.9	0.6	100	218	
Vert.	4409.622	AV	39.9	29.2	7.2	37.2	39.1	53.9	14.8	100	216	
Vert.	4882.000	AV	32.3	30.7	7.6	36.8	33.8	53.9	20.1	100	186	
Vert.	7323.000	AV	33.7	36.4	8.9	39.1	39.9	53.9	14.0	100	203	
Vert.	9764.000	AV	30.1	38.3	9.9	37.0	41.3	53.9	12.6	100	0	
Vert.	12205.000	AV	31.9	39.2	11.2	38.0	44.3	53.9	9.6	100	226	

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

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

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Radiated Emission

Test place No.2 Semi Anechoic Chamber No.2 Semi Anechoic Chamber
Date April 4, 2015 April 5, 2015
Temperature / Humidity 22 deg.C, 51 %RH 18 deg.C, 45 %RH
Engineer Shinichi Takano Makoto Hosaka
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.	146.988	QP	44.6	14.6	8.5	31.8	35.9	43.5	7.6	224	42	
Hori.	761.762	QP	41.8	20.5	8.9	31.4	39.8	46.0	6.2	136	237	
Hori.	960.054	QP	42.2	22.6	9.7	30.4	44.1	53.9	9.8	109	124	
Hori.	2483.500	PK	43.1	25.9	14.6	38.0	45.6	73.9	28.3	107	207	
Hori.	3147.420	PK	57.1	27.3	6.5	38.0	52.9	73.9	21.0	100	186	
Hori.	4409.687	PK	47.4	29.2	7.2	37.2	46.6	73.9	27.3	100	197	
Hori.	4960.000	PK	43.8	31.0	7.7	36.7	45.8	73.9	28.1	100	190	
Hori.	7440.000	PK	45.2	36.5	9.0	39.2	51.5	73.9	22.4	100	0	
Hori.	9920.000	PK	42.1	38.4	9.8	37.1	53.2	73.9	20.7	100	0	
Hori.	12400.000	PK	45.6	39.1	11.4	37.9	58.2	73.9	15.7	100	224	
Hori.	19524.283	PK	47.0	40.4	2.1	47.6	41.9	73.9	32.0	100	218	
Hori.	2483.500	AV	30.6	25.9	14.6	38.0	33.1	53.9	20.8	107	207	
Hori.	3147.420	AV	55.7	27.3	6.5	38.0	51.5	53.9	2.4	100	186	
Hori.	4409.687	AV	40.5	29.2	7.2	37.2	39.7	53.9	14.2	100	197	
Hori.	4960.000	AV	31.0	31.0	7.7	36.7	33.0	53.9	20.9	100	190	
Hori.	7440.000	AV	32.3	36.5	9.0	39.2	38.6	53.9	15.3	100	0	
Hori.	9920.000	AV	30.3	38.4	9.8	37.1	41.4	53.9	12.5	100	0	
Hori.	12400.000	AV	32.7	39.1	11.4	37.9	45.3	53.9	8.6	100	224	
Hori.	19524.283	AV	41.0	40.4	2.1	47.6	35.9	53.9	18.0	100	218	
Vert.	146.982	QP	42.0	14.6	8.5	31.8	33.3	43.5	10.2	100	303	
Vert.	761.784	QP	37.9	20.5	8.9	31.4	35.9	46.0	10.1	100	35	
Vert.	960.054	QP	40.6	22.6	9.7	30.4	42.5	53.9	11.4	107	227	
Vert.	2483.500	PK	43.4	25.9	14.6	38.0	45.9	73.9	28.0	110	199	
Vert.	3147.420	PK	60.2	27.3	6.5	38.0	56.0	73.9	17.9	100	217	
Vert.	4409.687	PK	45.8	29.2	7.2	37.2	45.0	73.9	28.9	100	217	
Vert.	4960.000	PK	45.9	31.0	7.7	36.7	47.9	73.9	26.0	100	238	
Vert.	7440.000	PK	45.9	36.5	9.0	39.2	52.2	73.9	21.7	100	248	
Vert.	9920.000	PK	43.0	38.4	9.8	37.1	54.1	73.9	19.8	100	0	
Vert.	12400.000	PK	46.2	39.1	11.4	37.9	58.8	73.9	15.1	100	233	
Vert.	2483.500	AV	31.2	25.9	14.6	38.0	33.7	53.9	20.2	110	199	
Vert.	3147.420	AV	57.5	27.3	6.5	38.0	53.3	53.9	0.6	100	217	
Vert.	4409.687	AV	37.9	29.2	7.2	37.2	37.1	53.9	16.8	100	217	
Vert.	4960.000	AV	32.7	31.0	7.7	36.7	34.7	53.9	19.2	100	238	
Vert.	7440.000	AV	33.4	36.5	9.0	39.2	39.7	53.9	14.2	100	248	
Vert.	9920.000	AV	30.2	38.4	9.8	37.1	41.3	53.9	12.6	100	0	
Vert.	12400.000	AV	33.3	39.1	11.4	37.9	45.9	53.9	8.0	100	233	

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

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

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

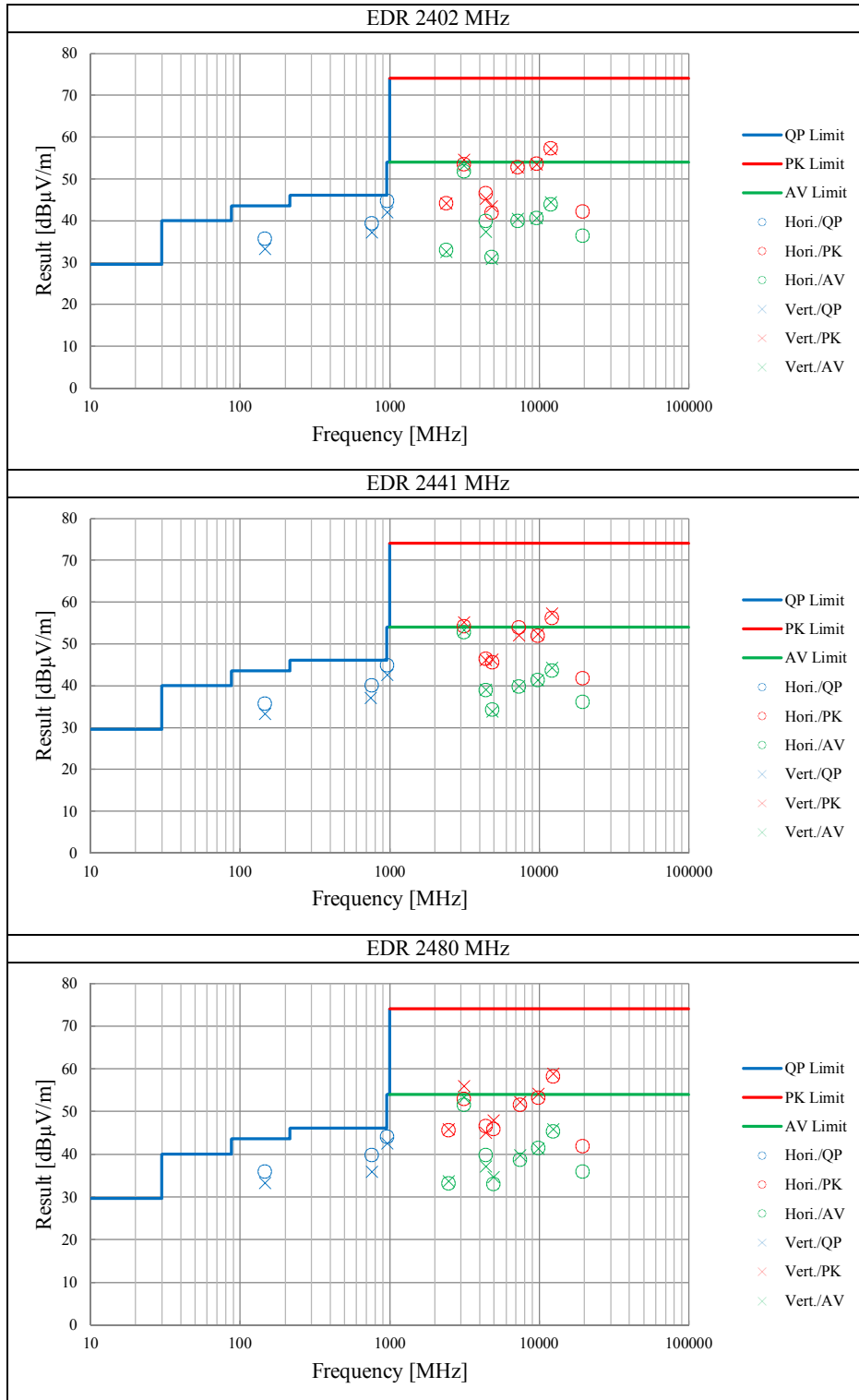
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Emission (All band chart)

Test place Refer to previous sheet
 Date Refer to previous sheet
 Temperature / Humidity Refer to previous sheet
 Engineer Refer to previous sheet
 Mode Tx, Bluetooth, EDR, PRBS9,



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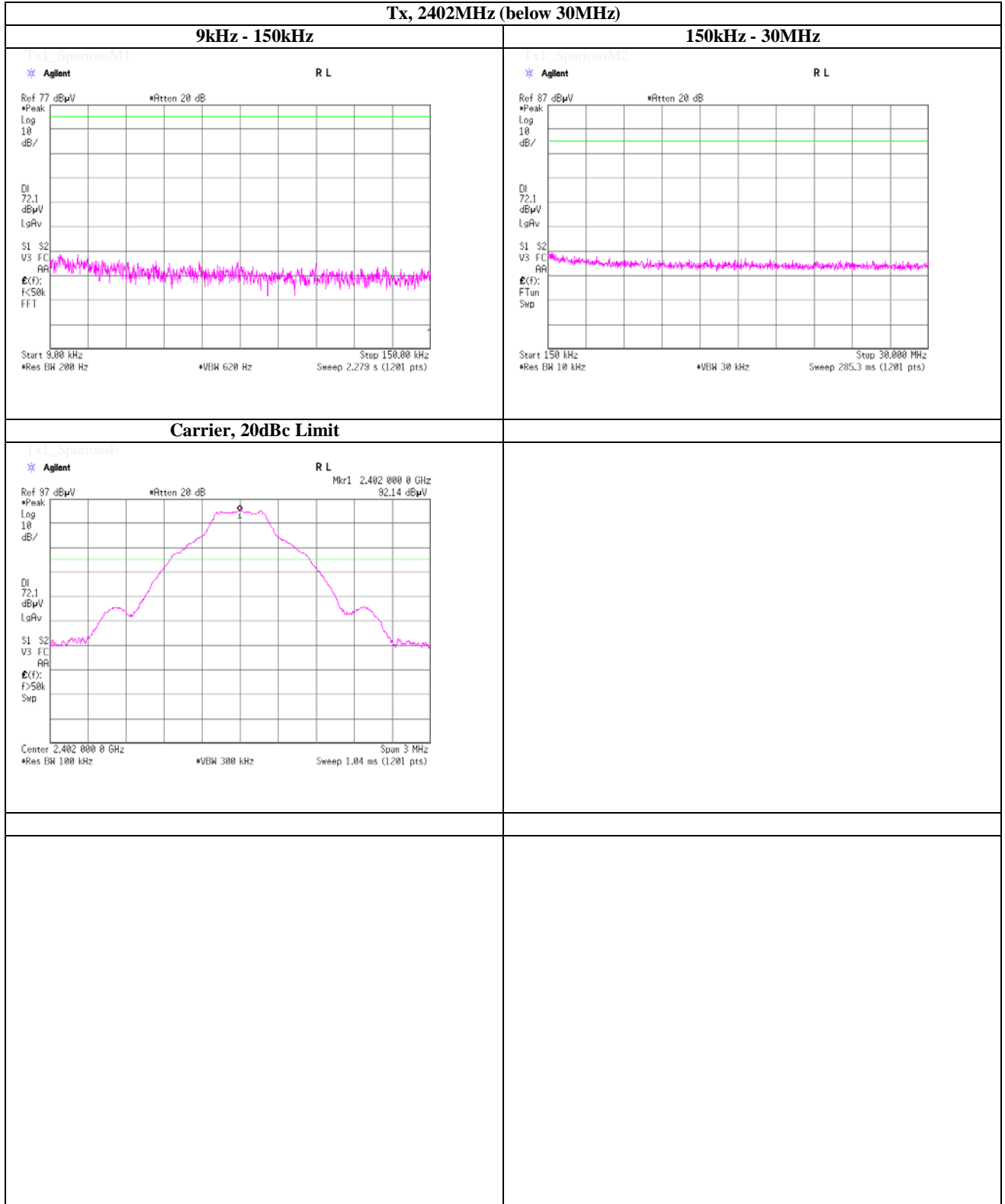
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2402MHz (below 30MHz)



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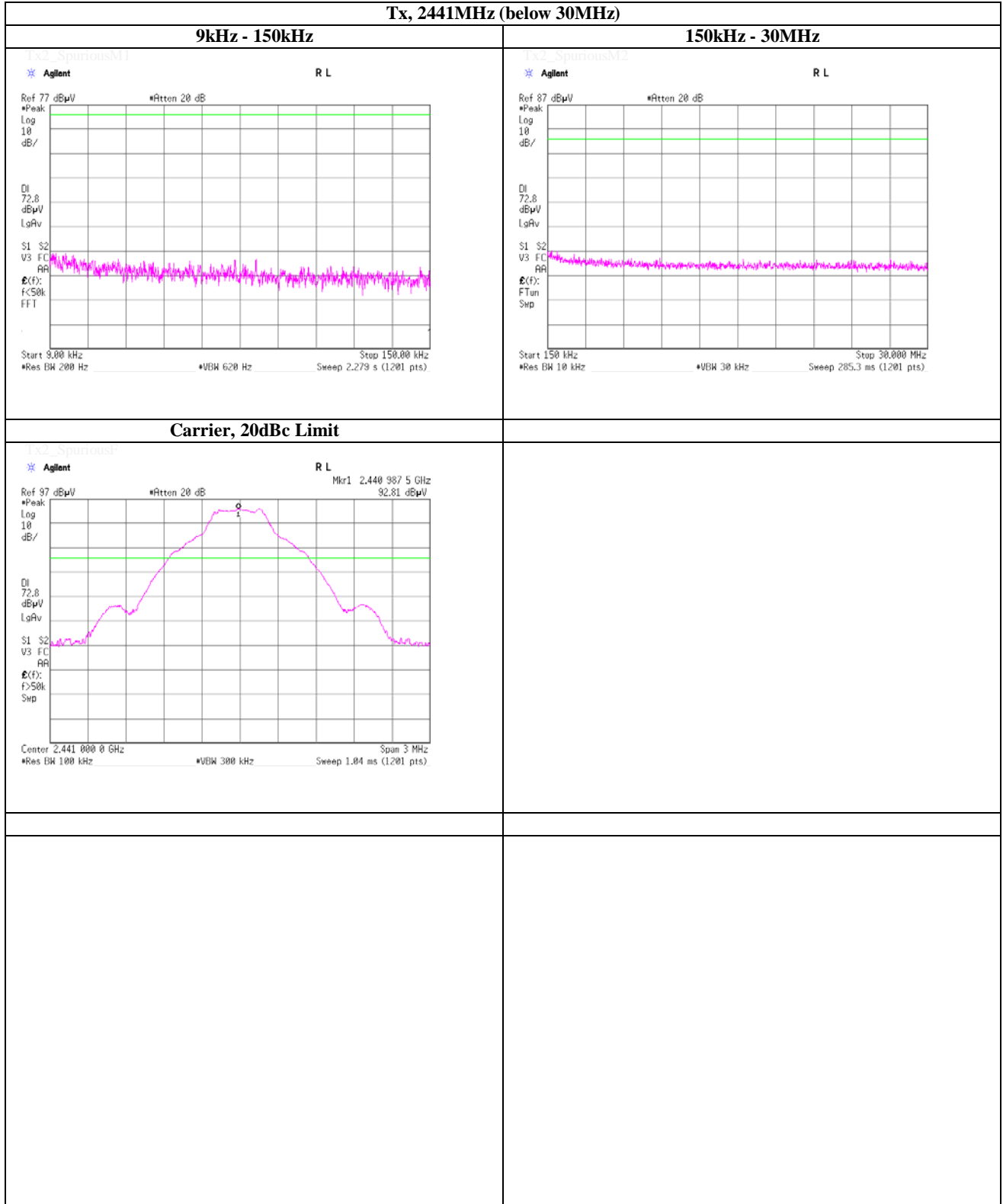
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2441MHz (below 30MHz)



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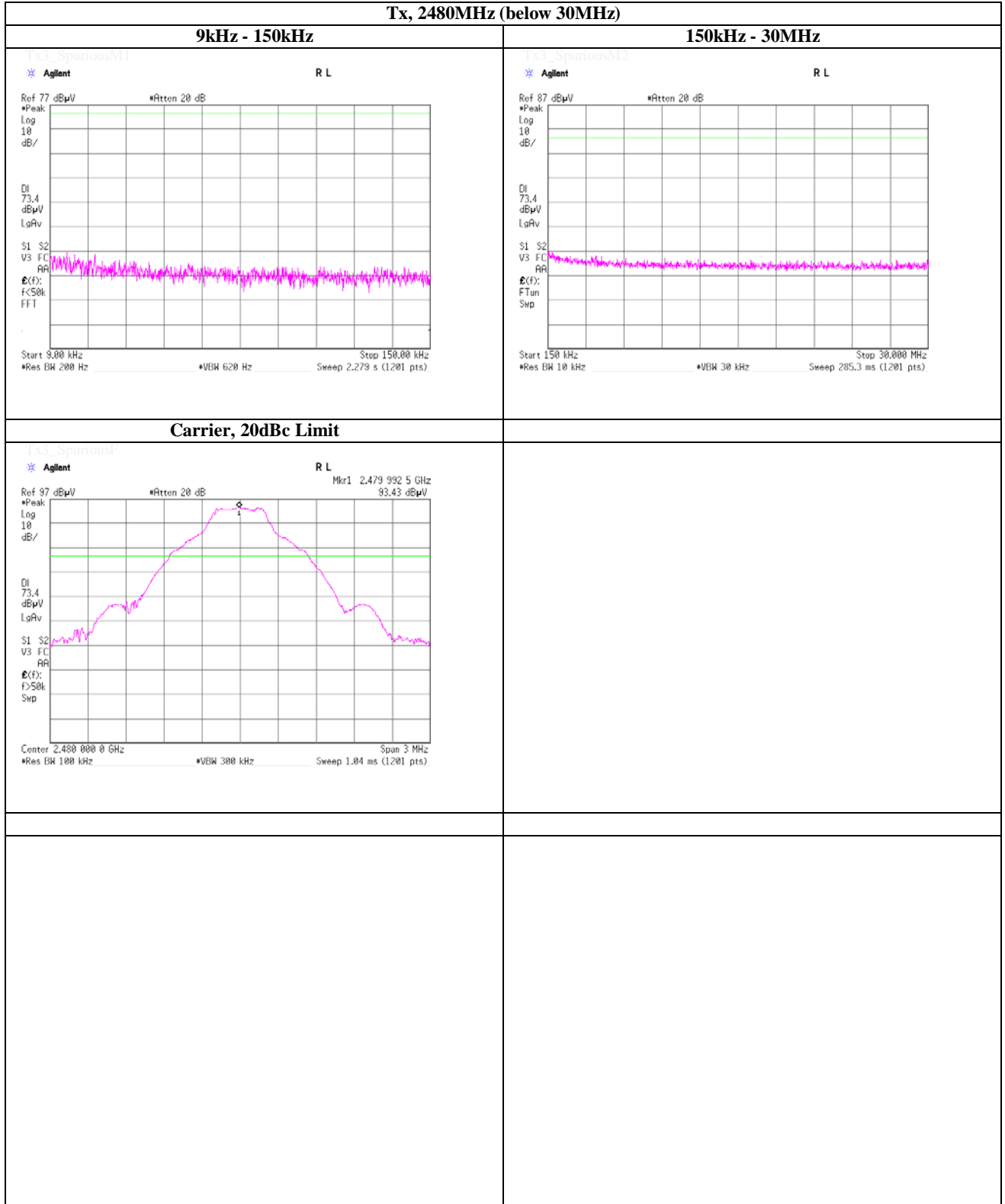
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2480MHz (below 30MHz)



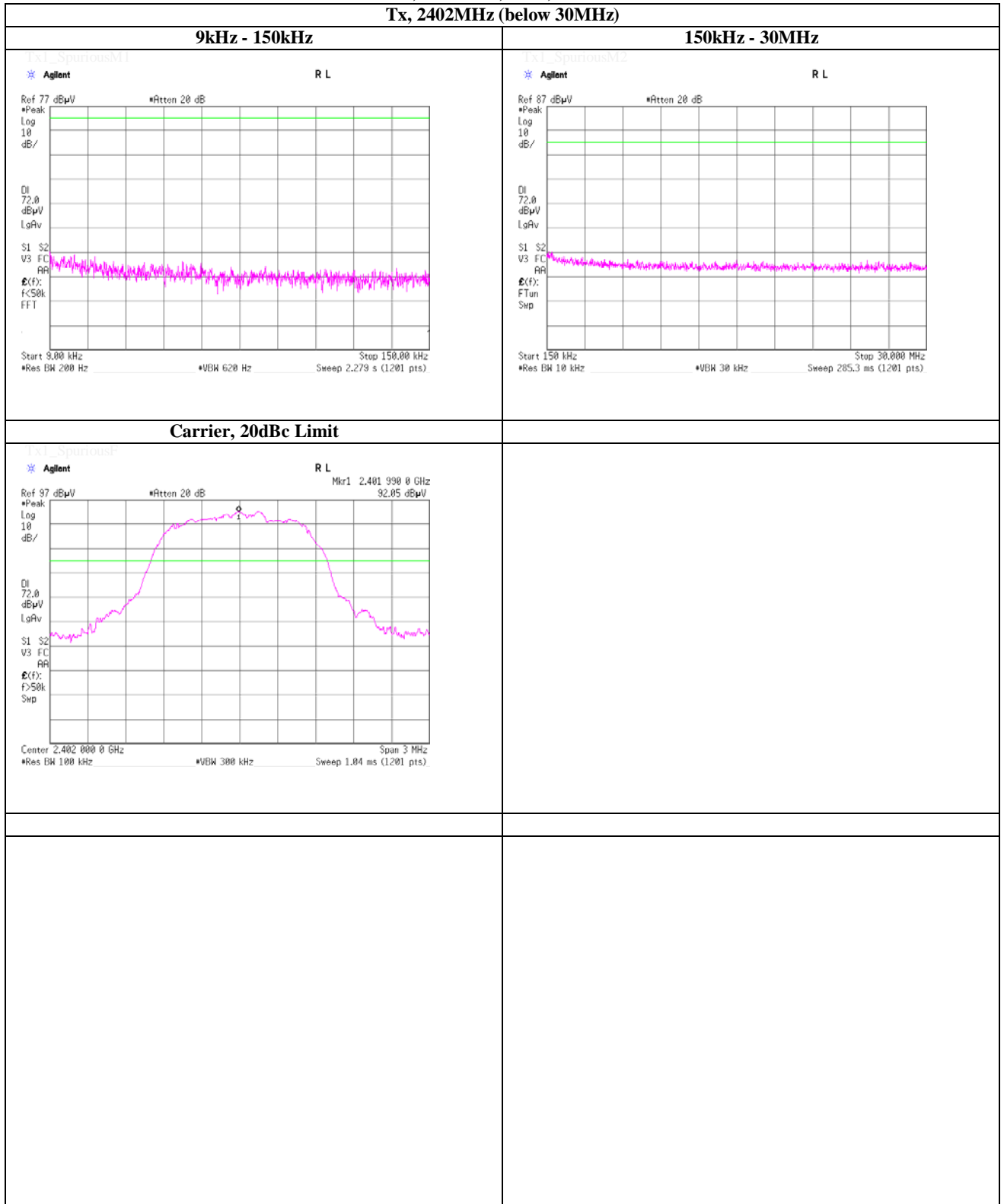
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Shonan EMC Lab.
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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2402MHz (below 30MHz)



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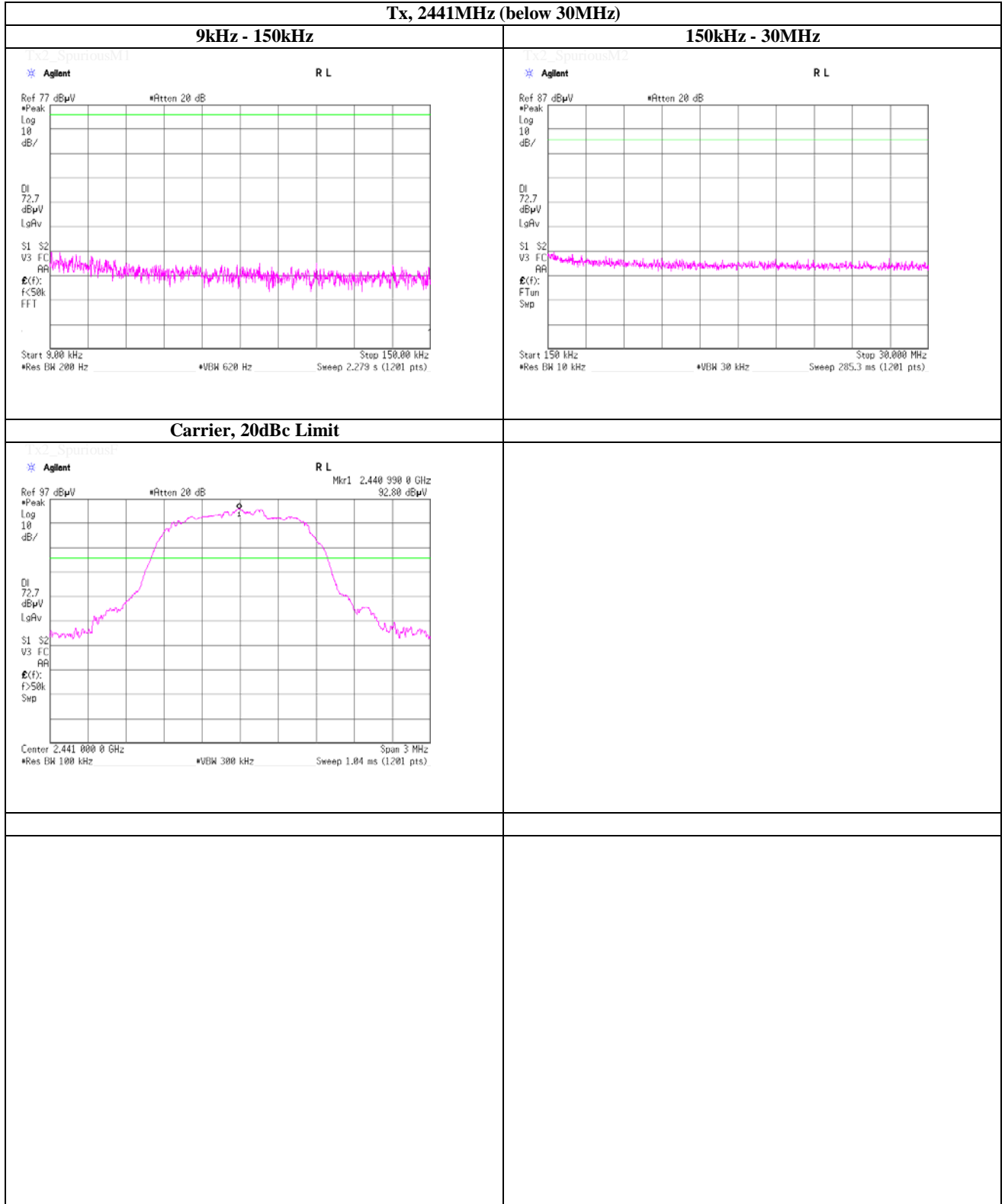
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2441MHz (below 30MHz)



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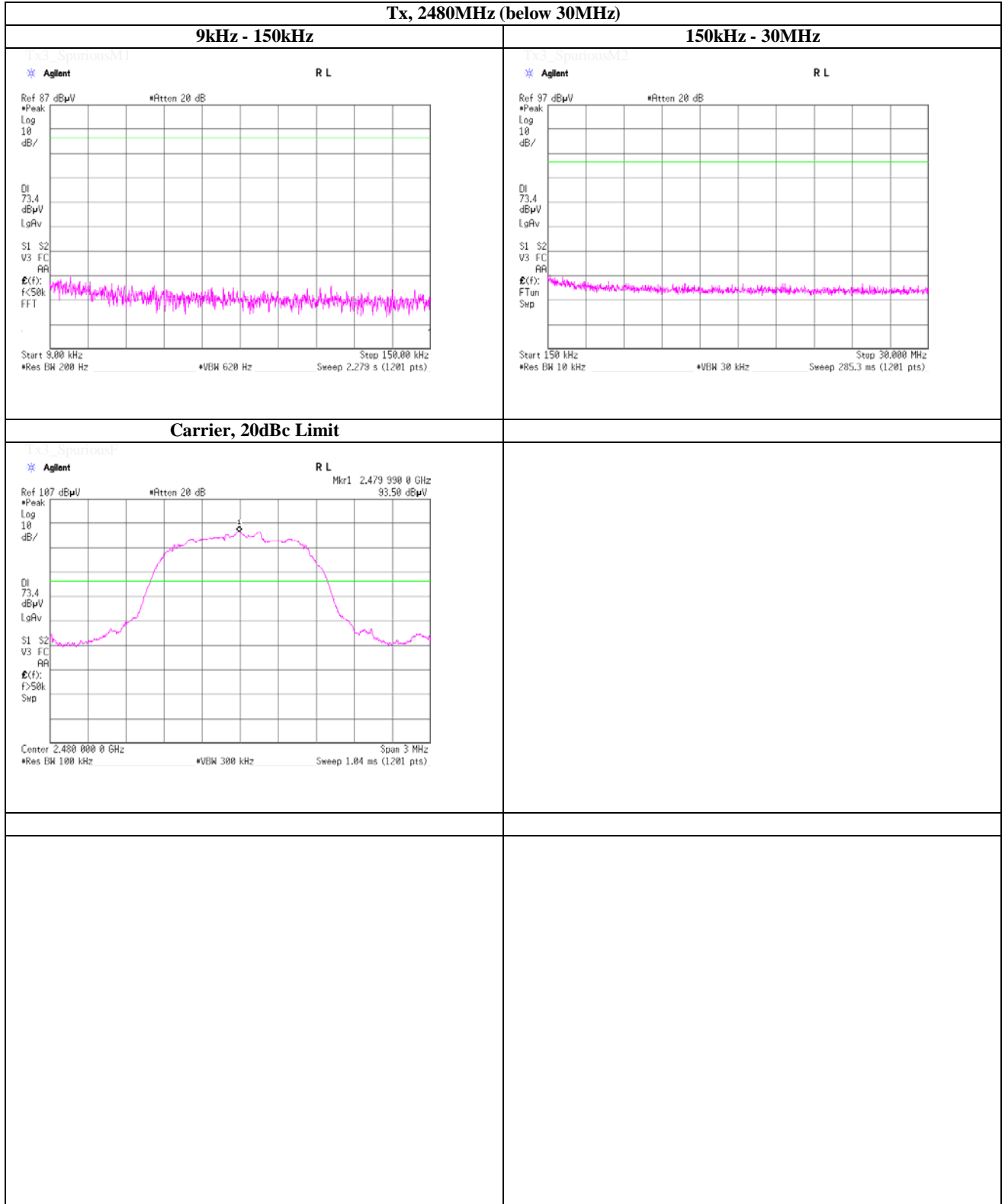
Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2480MHz (below 30MHz)



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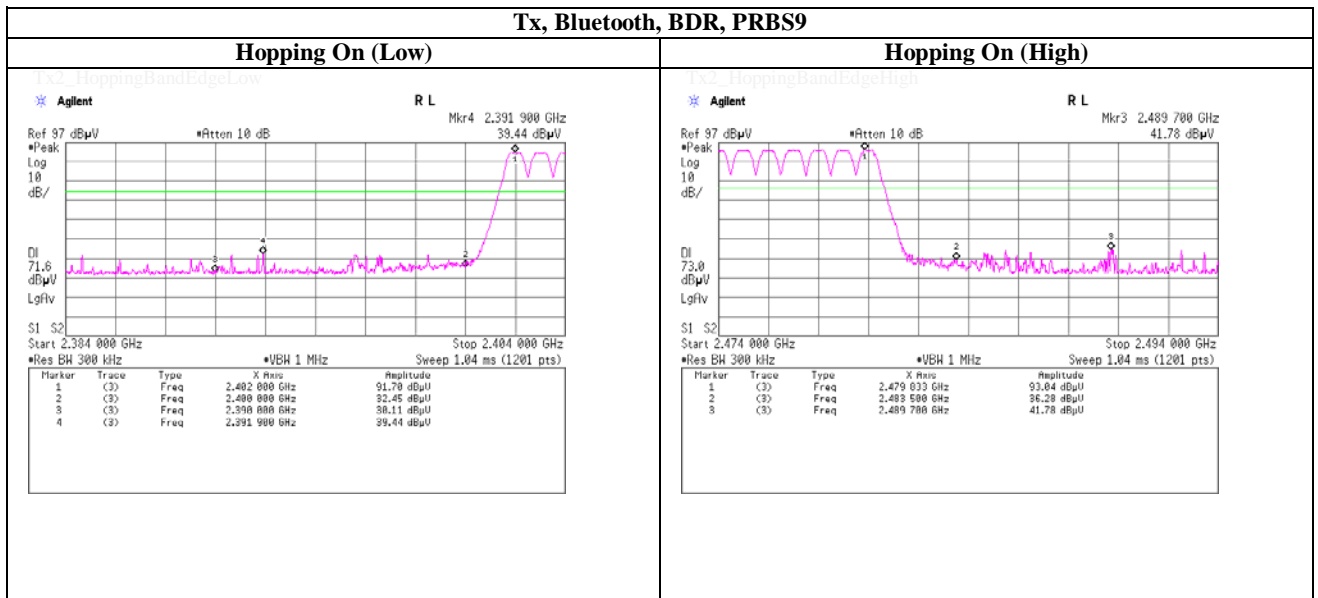
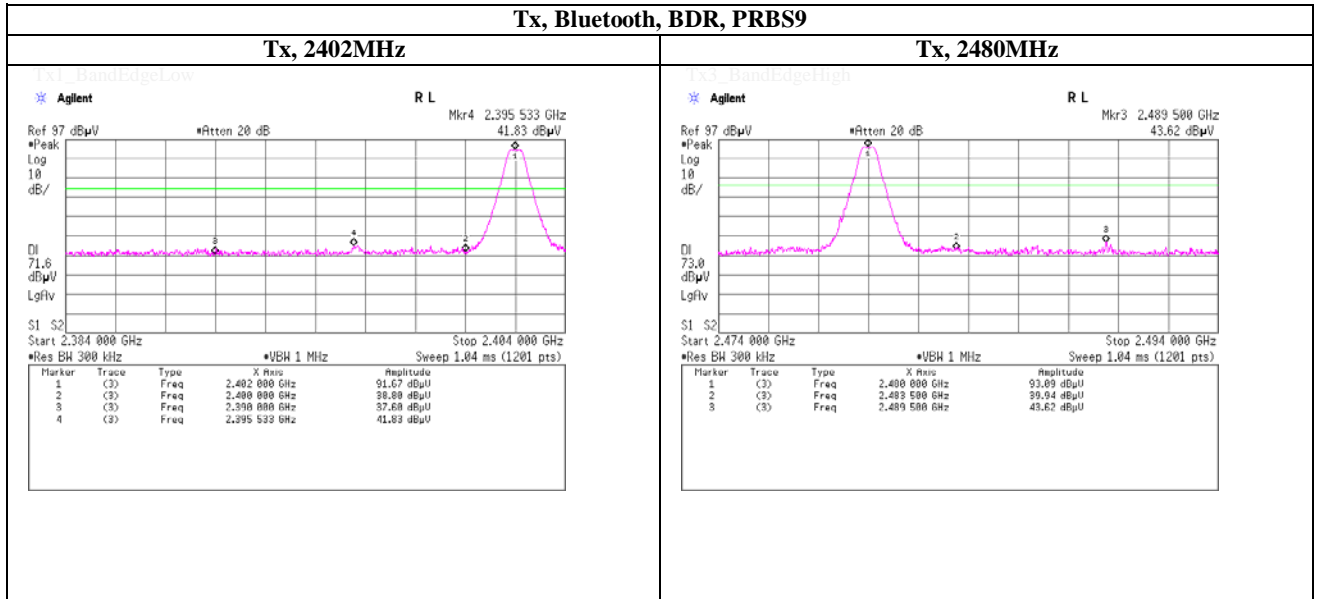
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date May 25, 2015
 Temperature / Humidity 27 deg.C , 36 %RH
 Engineer Makoto Hosaka

Spurious emission (Conducted)

Band Edge compliace

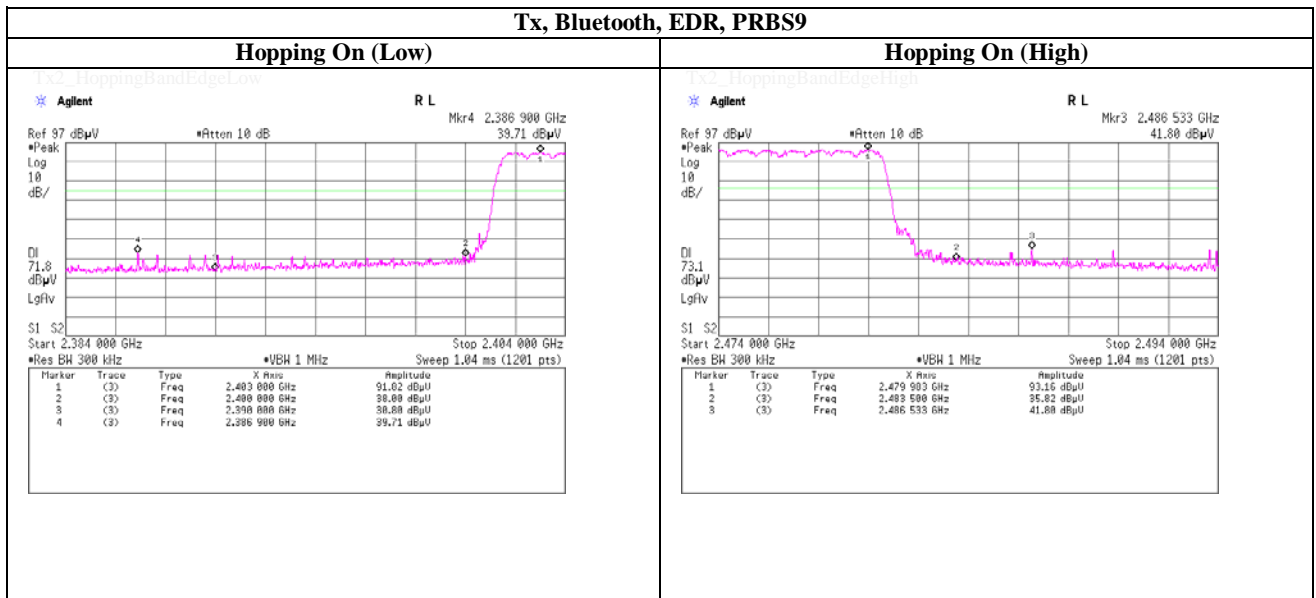
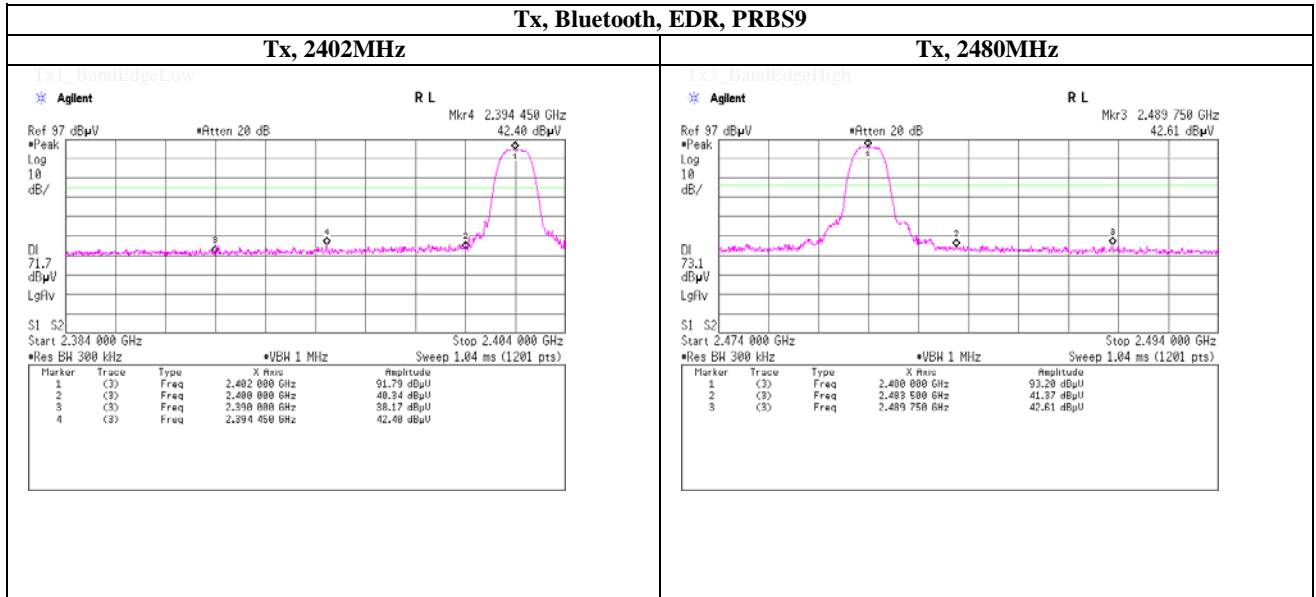


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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date May 25, 2015
 Temperature / Humidity 27 deg.C , 36 %RH
 Engineer Makoto Hosaka

Spurious emission (Conducted)

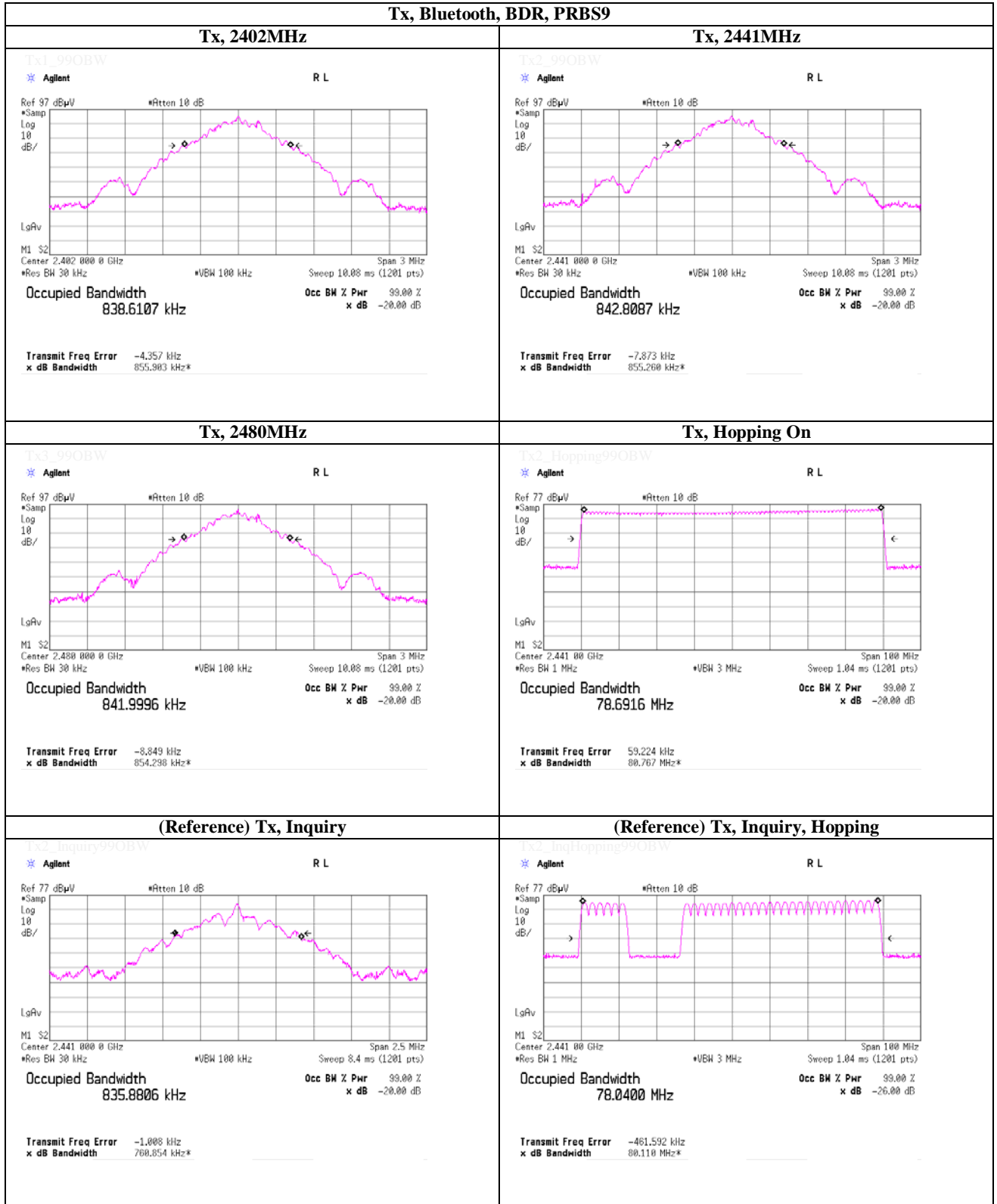
Band Edge compliance



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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

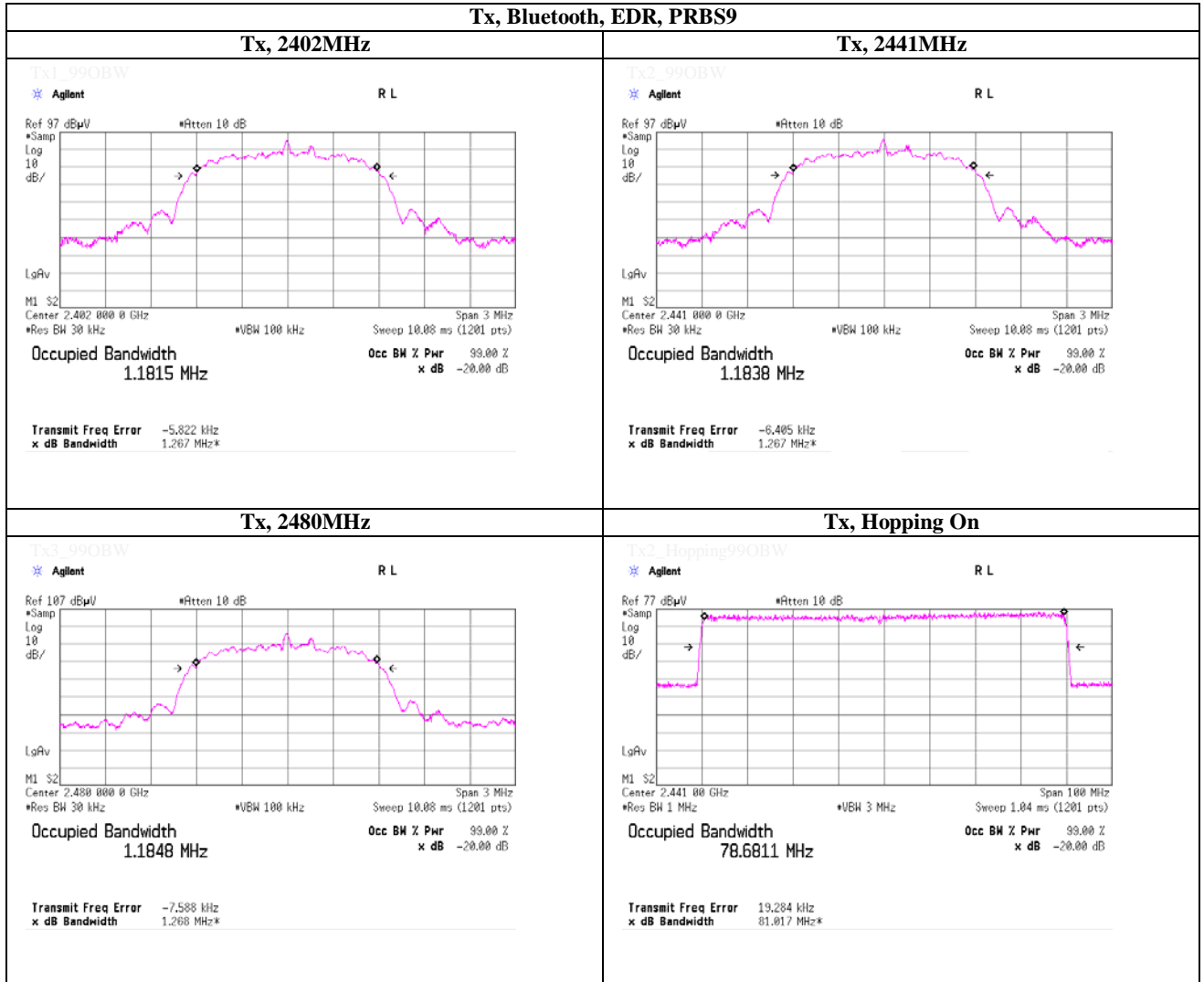
99% Occupied Bandwidth



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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 10, 2015
 Temperature / Humidity 21 deg.C , 30 %RH
 Engineer Yosuke Ishikawa

99% Occupied Bandwidth



Tx2_Inquiry99OBW

Tx2_InqHopping99OBW

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APPENDIX 2 Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2014/11/21 * 12
SCC-G02	Coaxial Cable	Suhner	SUCOFLEX 104A	46498/4A	RE	
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2015/05/19 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2014/08/12 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2014/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2015/03/23 * 12
SJM-14	Measure	ASKUL	-	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	RE	-
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2014/11/21 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2014/11/21 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2015/03/17 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2015/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2015/02/18 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2015/02/18 * 12
KAT3-11	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2014/08/27 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2014/11/22 * 12
SCC-B1/B3/B5 /B7/B8/B13/S RSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/ Suhner/Suhner/Suhner/ TOYO	8D2W/12DSFA/14 1PE/141PE/141PE /141PE/NS4906	-/0901-270(RF Selector)	RE	2015/04/17 * 12
SCC-B2/B4/B6 /B7/B8/B13/S RSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/ Suhner/Suhner/Suhner/ TOYO	8D2W/12DSFA/14 1PE/141PE/141PE /141PE/NS4906	-/0901-270(RF Selector)	RE	2015/04/17 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0893	RE	2014/11/22 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2014/09/03 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2014/07/08 * 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	2015/05/19 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2014/08/12 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2014/10/30 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2015/03/26 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2015/04/09 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2015/02/24 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2015/04/02 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2015/04/02 * 12
SAT10-11	Attenuator	Weinschel Corp.	54A-10	37588	AT	2015/04/09 * 12
SCC-G14	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	AT	2015/03/11 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/12/24 * 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 disturbance voltage