



RADIO TEST REPORT

Test Report No.: 32KE0289-SH-01-A

Applicant : Welcat Inc.
Type of Equipment : Wireless 2D-code Handy Terminal
Model No. : GTX-221-G
FCC ID : Q98GTX221G
Test regulation : FCC Part15 Subpart C: 2012
Test result : Complied

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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.
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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.

Date of test: August 2 to 22, 2012

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

Approved by : *T. Amamura*
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".



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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 32KE0289-SH-01-A

[illegible]

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SECTION 1: Customer information

Company Name : Welcat Inc.
Address : 4-12-8 Higashi-Shinagawa, Shinagawa Seaside East Tower 6F,
Shinagawa-ku, Tokyo 140-0002 Japan
Telephone Number : +81-3-5463-8582
Facsimile Number : +81-3-5463-8587
Contact Person : Masakiyo Yamazaki

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless 2D-code Handy Terminal
Model Number : GTX-221-G
Serial Number : Refer to clause 4.2.
Rating : DC3.8V
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : August 2, 2012
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: GTX-221-G (referred to as the EUT in this report) is a Wireless 2D-code Handy Terminal.

Clock frequency(ies) in the system : MAIN CPU:13MHz,32.768MHz
Bluetooth Module:16MHz, 26MHz
WLAN Module: 38.4MHz

Radio specification (WLAN part)

Equipment type : Transceiver
Frequency of operation : 2412-2462MHz
Bandwidth & channel spacing : 20MHz & 5MHz
Type of modulation : DSSS: CCK, DQPSK, DBPSK
OFDM: 64QAM, 16QAM, QPSK, BPSK
ITU code : D1D, G1D
Antenna type : PWB Pattern antenna
Antenna connector type : None
Antenna gain : -0.90 dBi
Operation temperature range : -5 to 45 deg.C.

* For WLAN part, Refer to the test report: 32KE0289-SH-01-B.

Radio specification (Bluetooth part)

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth / Channel spacing : 79MHz & 1MHz
Type of modulation : FHSS (GFSK, $\pi/4$ -DQPSK, 8DPSK)
Antenna type : Chip antenna
Antenna connector type : None
Antenna gain with cable loss : 1.0dBi
ITU code : F1D, G1D
Operation temperature range : -5 to 45 deg.C.

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FCC 15.31 (e)

The RF transmitter is constantly provided voltage (DC1.8V and DC3.3V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC 15.203

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the requirement.

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SECTION 3: Test specification, procedures & results**3.1 Test specification**

Test specification : FCC Part 15 Subpart C: 2012, final revised on July 23, 2012 and effective August 22, 2012
 Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted limits
 Section 15.209 Radiated emission limits, general requirements
 Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,
 and 5725-5850MHz

* The revision on July 23, 2012 does not affect the test specification applied to the EUT.

The EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report 32KE0289-SH-01-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	24.1 dB Freq.: 0.15000MHz Detector: Quasi-Peak Phase: N Mode: DH5 Tx 2441MHz	Complied
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	5.7dB Freq.: 4882.000MHz Polarization: Horizontal Detection: Average Mode: DH5 Tx 2441MHz	Complied

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

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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 (±)
Conducted emission (AC Mains) AMN/LISN	150kHz-30MHz	3.6 dB	3.6 dB	3.5 dB
Radiated emission (Measurement distance: 3m)	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

Conducted emission test

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

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

Frequency Measurement uncertainty for this test was: (±) 5.3×10^{-6} .

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

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3.5 Test location

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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 Full-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	-

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

*EUT has the power settings by the software as follows;

Power settings: Fixed

(The setting is not controlled by the software and it is equivalent to that of mass-produced items.)

Software: Bluetooth RF TEST (Ver1.04)

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

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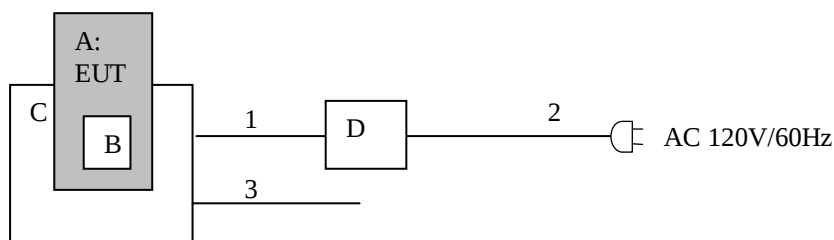
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4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless 2D-code Handy Terminal	GTX-221-G	*1)	Welcat Inc.	EUT
B	Li-ion Battery pack	BP-004	1106-17	Welcat Inc.	-
C	Cradle	-	-	Welcat Inc.	-
D	AC Adaptor	GPE402-055300W	-	Welcat Inc.	-

*1) Conducted/Radiated emission: 21C01, Antenna terminal conducted test: 21C15

* Radiated emission test was performed also in stand-alone(Item A and B).

List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	DC	1.7	Unshielded	Unshielded	-
2	AC	1.7	Unshielded	Unshielded	-
3	USB	1.5	Shielded	Shielded	-

* All cables used for the measurement are exclusive use or marketed.

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SECTION 5: Conducted emission

5.1 Operating environment

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

5.2 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 tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals was aligned and was flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN and excess AC cable was bundled in center. 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.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the input power source. All unused 50ohm connectors of the LISN were resistively terminated in 50ohm when not connected to the measuring equipment.

Photographs of the set up are shown in APPENDIX 3.

5.3 Test conditions

Frequency range : 0.15 - 30MHz
EUT position : Table top

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT via AC adaptor within a Shielded room. The EUT was connected to a Line Impedance Stabilization Network (LISN) via AC adaptor.

An overview sweep with peak detection has been performed.

The measurements had been performed with a quasi-peak detector and if required, an average detector.

The conducted emission measurements were made with the following detection of the test receiver.

Detection Type : Quasi-Peak/ Average
IF Bandwidth : 9kHz

5.5 Results

Summary of the test results : Pass

Refer to APPENDIX 1

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SECTION 6: 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 7: 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 8: 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 9: 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 10: Maximum peak output power

Test procedure

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

Detection type: Peak / Average *1)

Summary of the test results: Pass
Refer to APPENDIX 1

*1) Testing using an average detector was performed in order to confirm that the output power of the EUT met the exclusion limits stated in FCC Part 2 Section 2.1093 and FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET 65 and the EUT was exempt from RF exposure SAR evaluation.

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SECTION 11: Spurious emissions (Antenna port conducted)

Test procedure

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

SECTION 12: Radiated emission

12.1 Operating environment

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

12.2 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 peripherals was aligned and was 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.

12.3 Test conditions

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

12.4 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 of the test receiver.

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

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

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

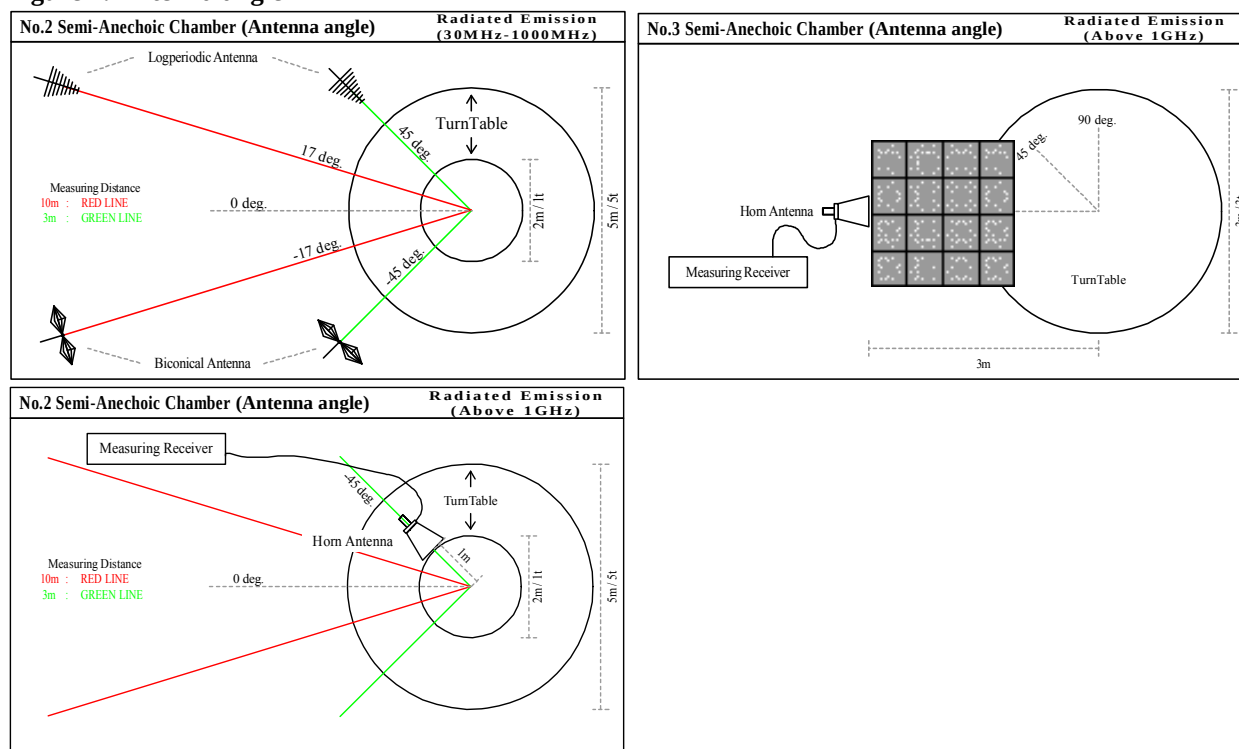
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Figure 1. Antenna angle

12.5 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.

12.6 Results

Summary of the test results : Pass

Refer to APPENDIX 1

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Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

Conducted emission
6dB bandwidth
Maximum peak output power
Radiated emission
Spurious emission (Antenna port conducted)
Peak power density
99% Occupied bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Conducted emission
Radiated emission
Pre-check of worst position

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APPENDIX 1: Data of Radio tests

DATA OF CONDUCTED EMISSION TEST

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Date : 2012/08/17

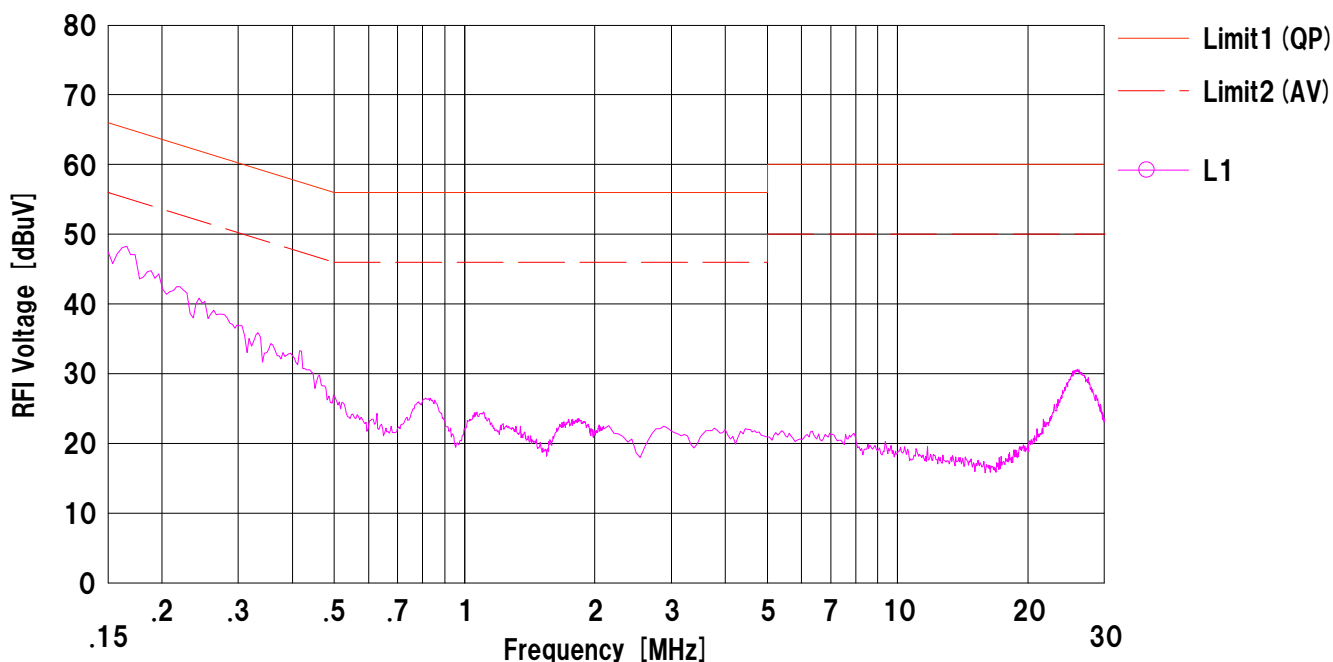
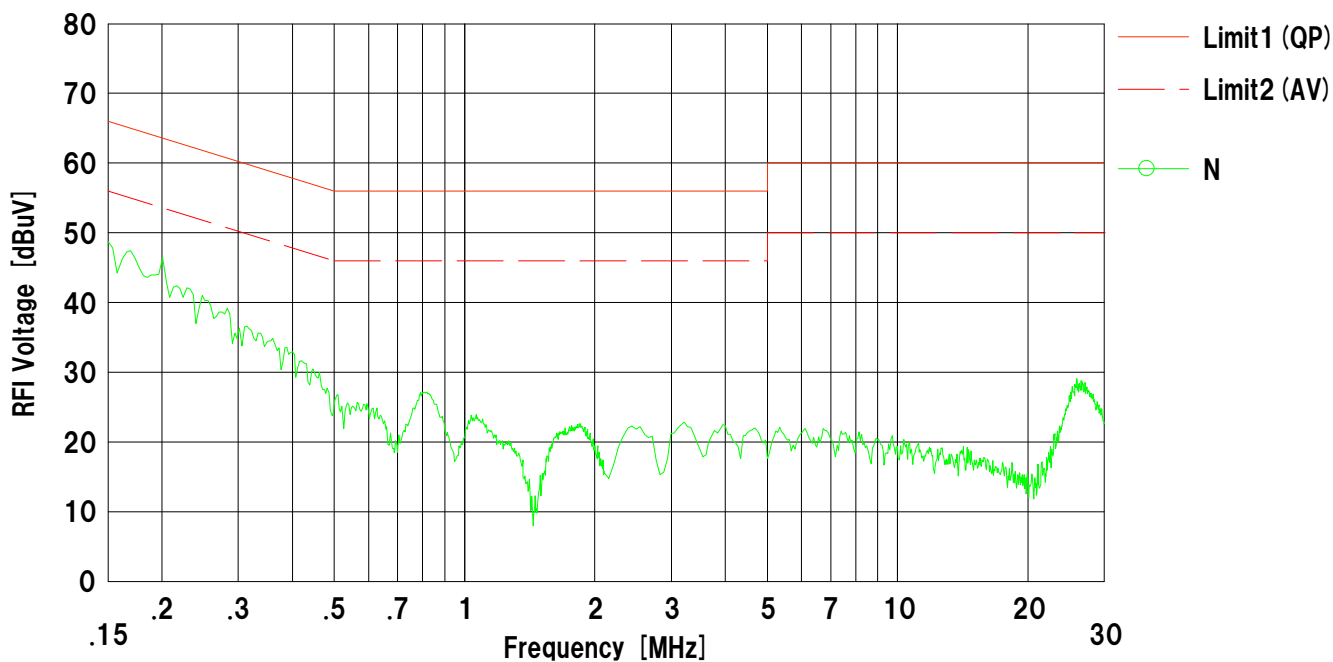
Company : Welcat Inc.
Kind of EUT : Wireless 2D-code Handy Terminal
Model No. : GTX-221-G
Serial No. : 21C01

Mode : DH5 Tx2402MHz
Report No. : 32KE0289-SH-01-A
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C. / 64%RH

Remarks : Cradle

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

Engineer : Makoto Hosaka



Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/08/17

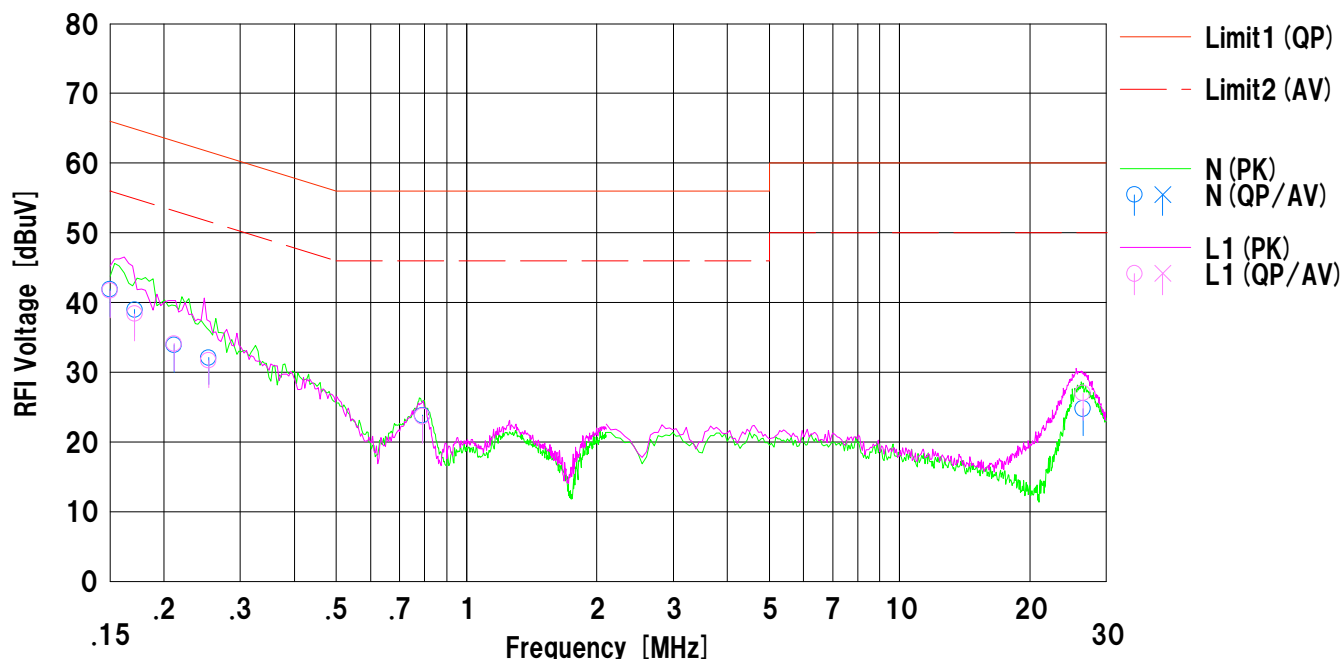
Company : Welcat Inc.
Kind of EUT : Wireless 2D-code Handy Terminal
Model No. : GTX-221-G
Serial No. : 21C01

Mode : DH5 Tx2441MHz
Report No. : 32KE0289-SH-01-A
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C. / 64%RH

Remarks : Cradle

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

Engineer : Makoto Hosaka



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	29.2	---	12.7	41.9	---	66.0	56.0	24.1	---	N	
2	0.17123	26.3	---	12.7	39.0	---	64.9	54.9	25.9	---	N	
3	0.21119	21.2	---	12.7	33.9	---	63.1	53.1	29.2	---	N	
4	0.25365	19.4	---	12.7	32.1	---	61.6	51.6	29.5	---	N	
5	0.79100	11.1	---	12.7	23.8	---	56.0	46.0	32.2	---	N	
6	26.51605	11.0	---	13.8	24.8	---	60.0	50.0	35.2	---	N	
7	0.15000	29.0	---	12.7	41.7	---	66.0	56.0	24.3	---	L1	
8	0.17123	25.7	---	12.7	38.4	---	64.9	54.9	26.5	---	L1	
9	0.21119	21.4	---	12.7	34.1	---	63.1	53.1	29.0	---	L1	
10	0.25365	19.0	---	12.7	31.7	---	61.6	51.6	29.9	---	L1	
11	0.79100	11.0	---	12.7	23.7	---	56.0	46.0	32.3	---	L1	
12	26.51605	13.2	---	13.8	27.0	---	60.0	50.0	33.0	---	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/08/17

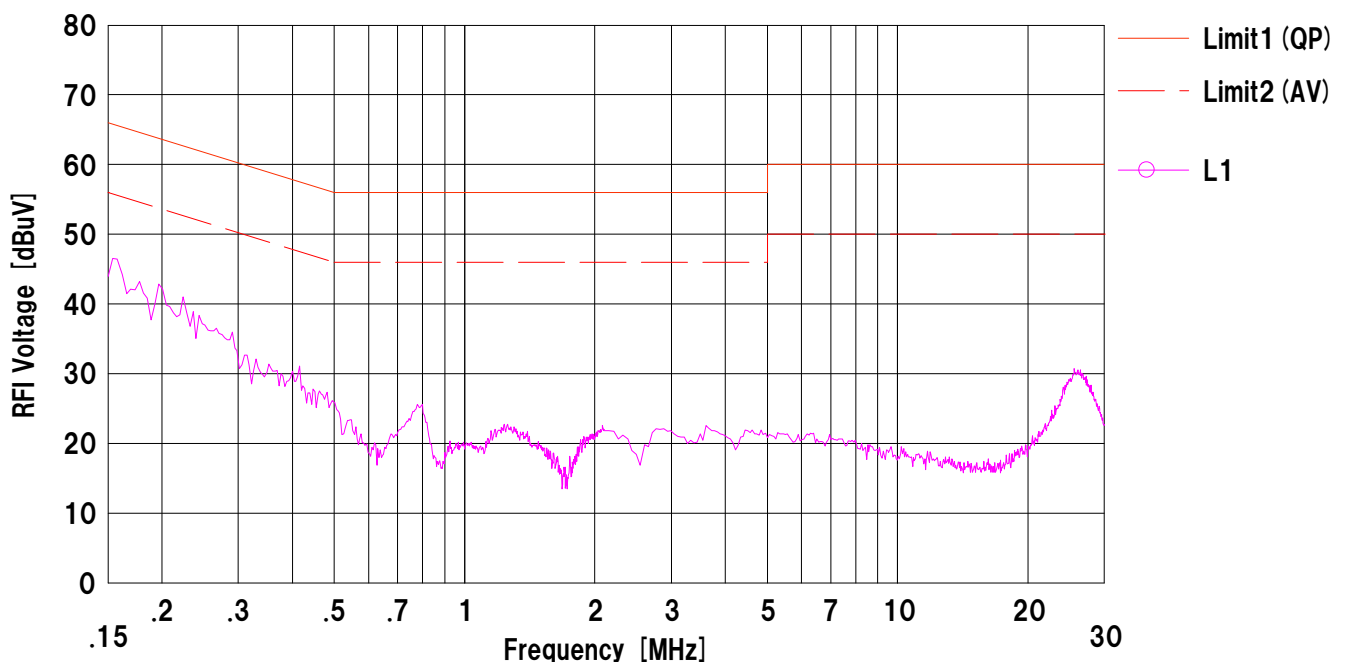
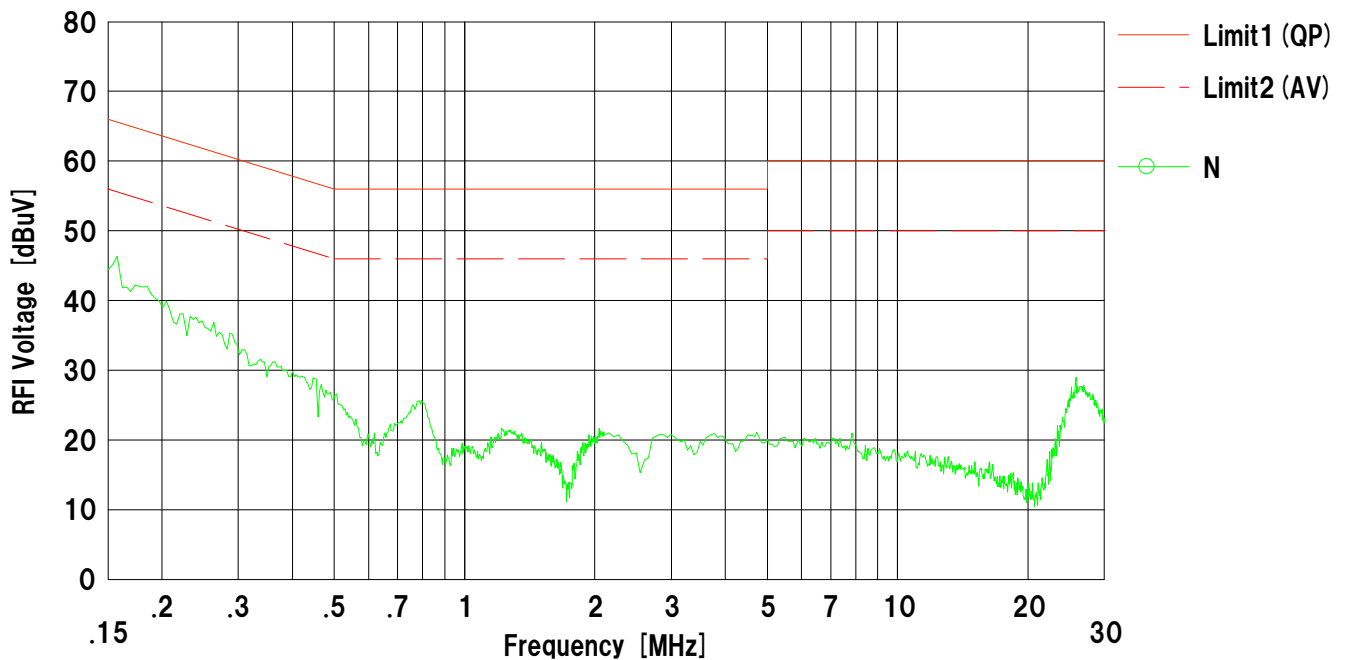
Company : Welcat Inc.
Kind of EUT : Wireless 2D-code Handy Terminal
Model No. : GTX-221-G
Serial No. : 21C01

Mode : DH5 Tx2480MHz
Report No. : 32KE0289-SH-01-A
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C. / 64%RH

Remarks : Cradle

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

Engineer : Makoto Hosaka



Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/08/17

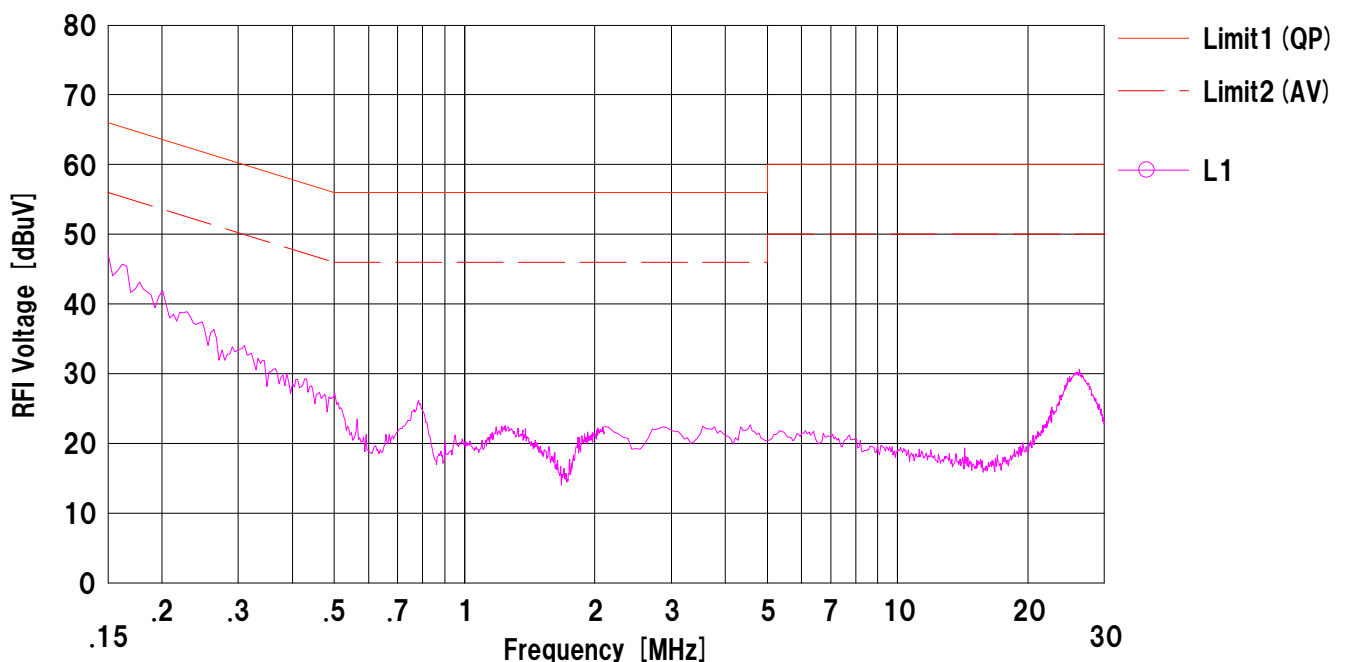
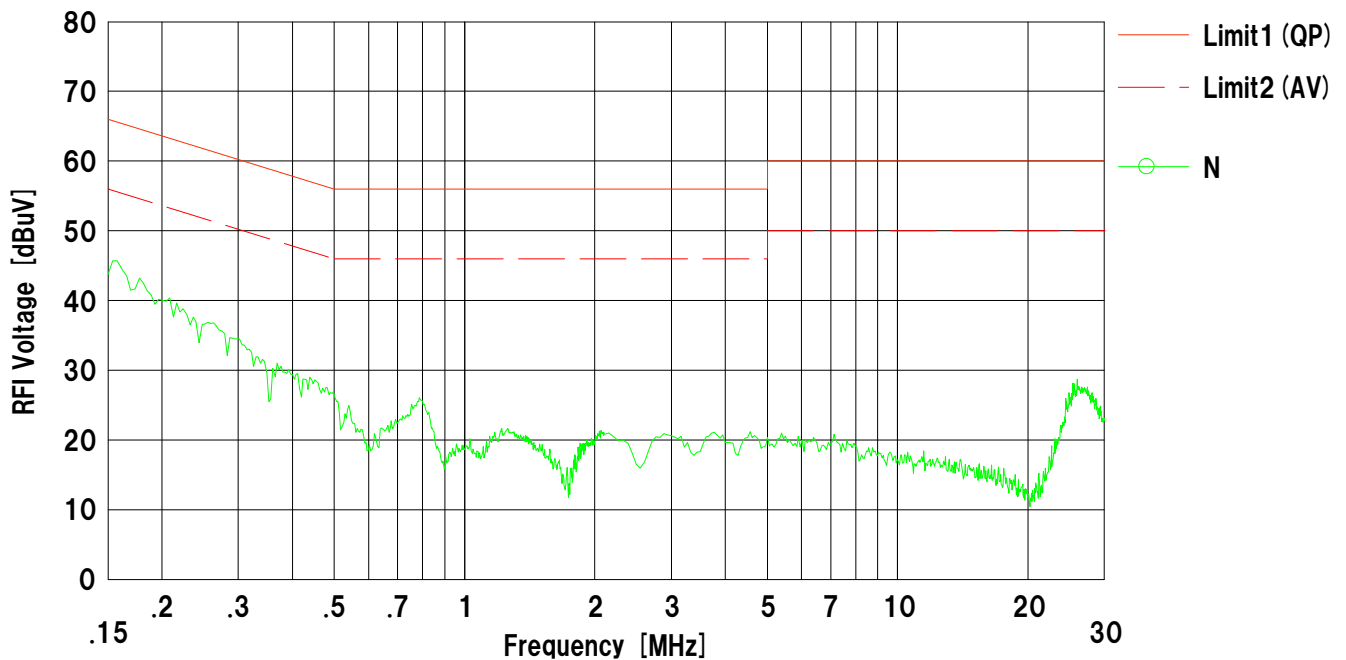
Company : Welcat Inc.
Kind of EUT : Wireless 2D-code Handy Terminal
Model No. : GTX-221-G
Serial No. : 21C01

Mode : 3-DH5 Tx2402MHz
Report No. : 32KE0289-SH-01-A
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C. / 64%RH

Remarks : Cradle

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

Engineer : Makoto Hosaka



Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/08/17

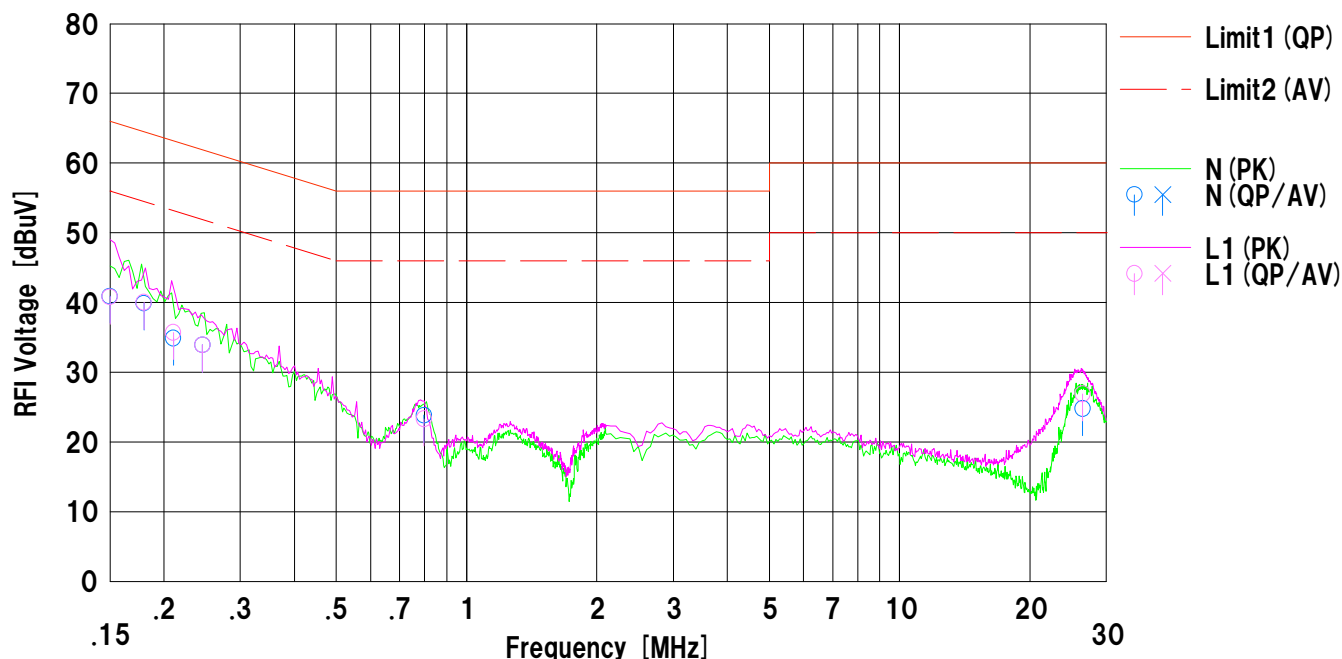
Company : Welcat Inc.
Kind of EUT : Wireless 2D-code Handy Terminal
Model No. : GTX-221-G
Serial No. : 21C01

Mode : 3-DH5 Tx2441MHz
Report No. : 32KE0289-SH-01-A
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C. / 64%RH

Remarks : Cradle

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

Engineer : Makoto Hosaka



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	28.2	---	12.7	40.9	---	66.0	56.0	25.1	---	N	
2	0.17988	27.2	---	12.7	39.9	---	64.4	54.4	24.5	---	N	
3	0.21040	22.2	---	12.7	34.9	---	63.1	53.1	28.2	---	N	
4	0.24577	21.2	---	12.7	33.9	---	61.8	51.8	27.9	---	N	
5	0.79790	11.1	---	12.7	23.8	---	56.0	46.0	32.2	---	N	
6	26.49167	11.0	---	13.8	24.8	---	60.0	50.0	35.2	---	N	
7	0.15000	28.1	---	12.7	40.8	---	66.0	56.0	25.2	---	L1	
8	0.17988	27.3	---	12.7	40.0	---	64.4	54.4	24.4	---	L1	
9	0.21040	23.0	---	12.7	35.7	---	63.1	53.1	27.4	---	L1	
10	0.24577	21.2	---	12.7	33.9	---	61.8	51.8	27.9	---	L1	
11	0.79790	10.6	---	12.7	23.3	---	56.0	46.0	32.7	---	L1	
12	26.49167	13.1	---	13.8	26.9	---	60.0	50.0	33.1	---	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/08/17

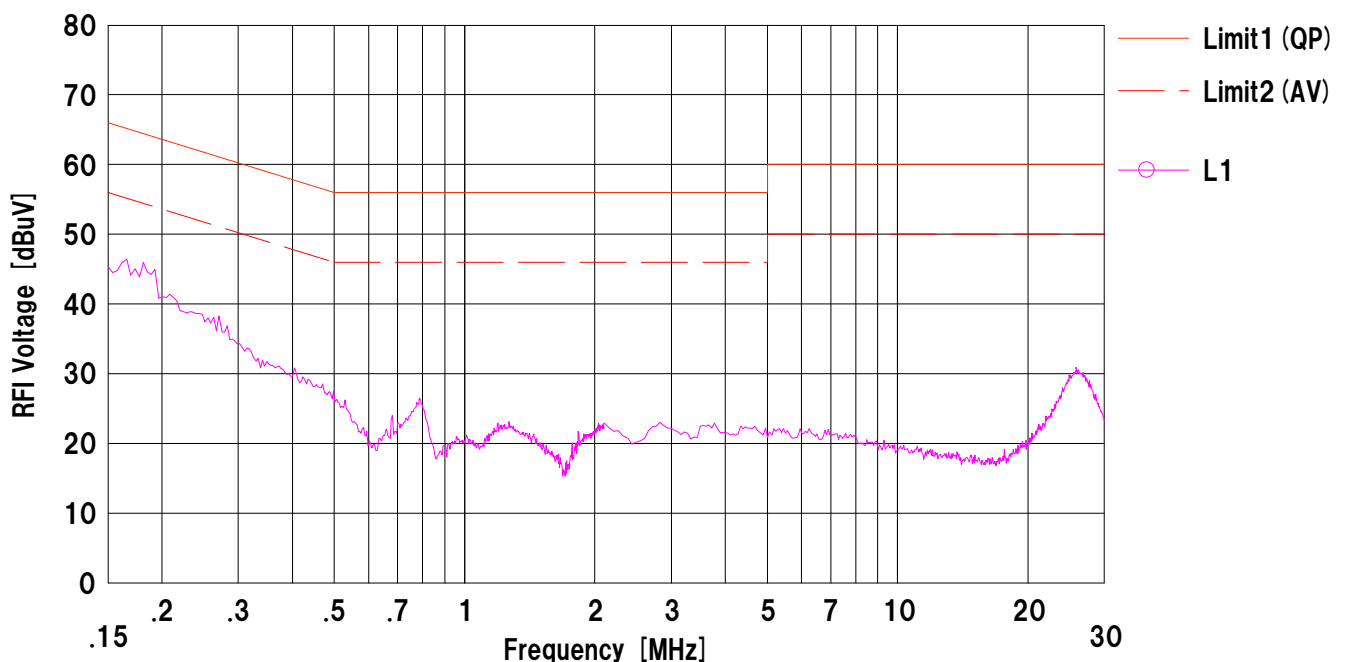
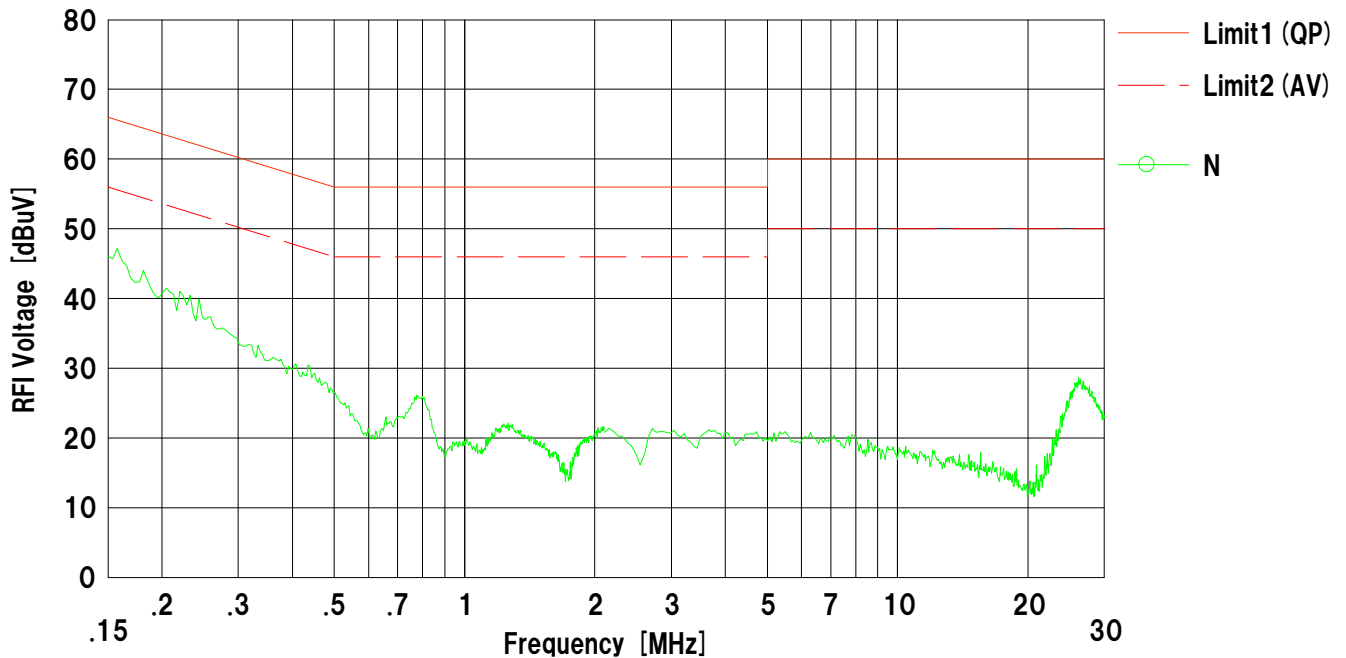
Company : Welcat Inc.
Kind of EUT : Wireless 2D-code Handy Terminal
Model No. : GTX-221-G
Serial No. : 21C01

Mode : 3-DH5 Tx2480MHz
Report No. : 32KE0289-SH-01-A
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C. / 64%RH

Remarks : Cradle

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

Engineer : Makoto Hosaka



Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

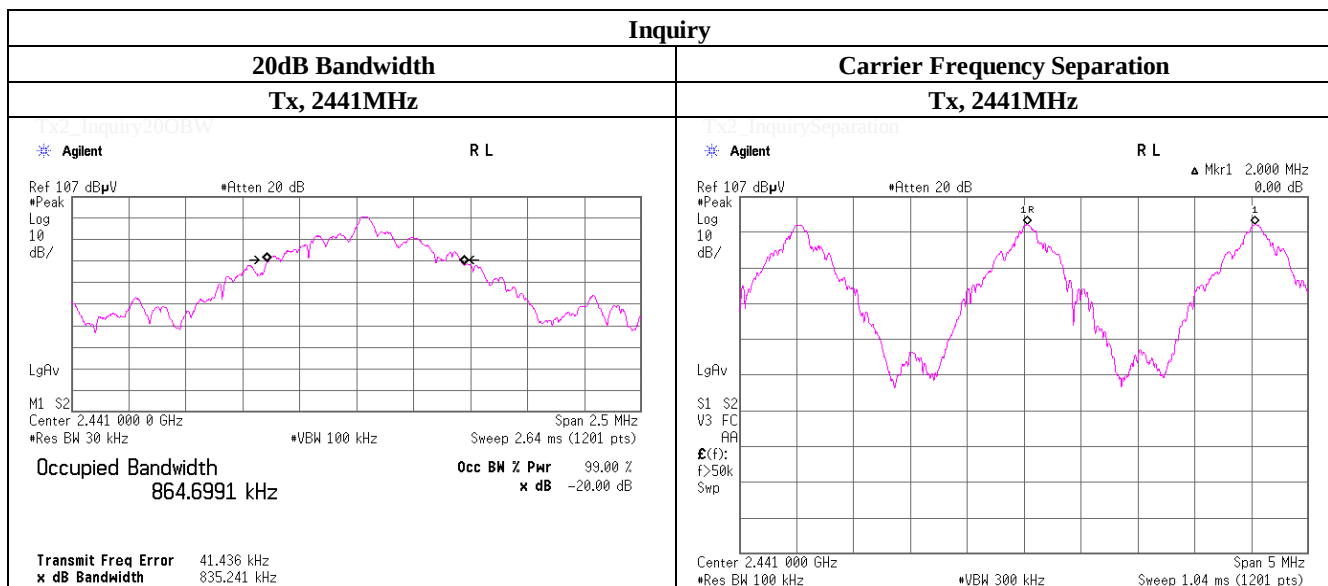
20dB Bandwidth and Carrier Frequency Separation

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	August 3, 2012	
Temperature / Humidity	26deg.C , 49%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	0.944	1.000	>= 0.629
DH5	2441.0	0.946	1.000	>= 0.631
DH5	2480.0	0.951	1.000	>= 0.634
Inquiry	2441.0	0.835	2.000	>= 0.557

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

No limit applies to 20dB Bandwidth.



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Shonan EMC Lab.

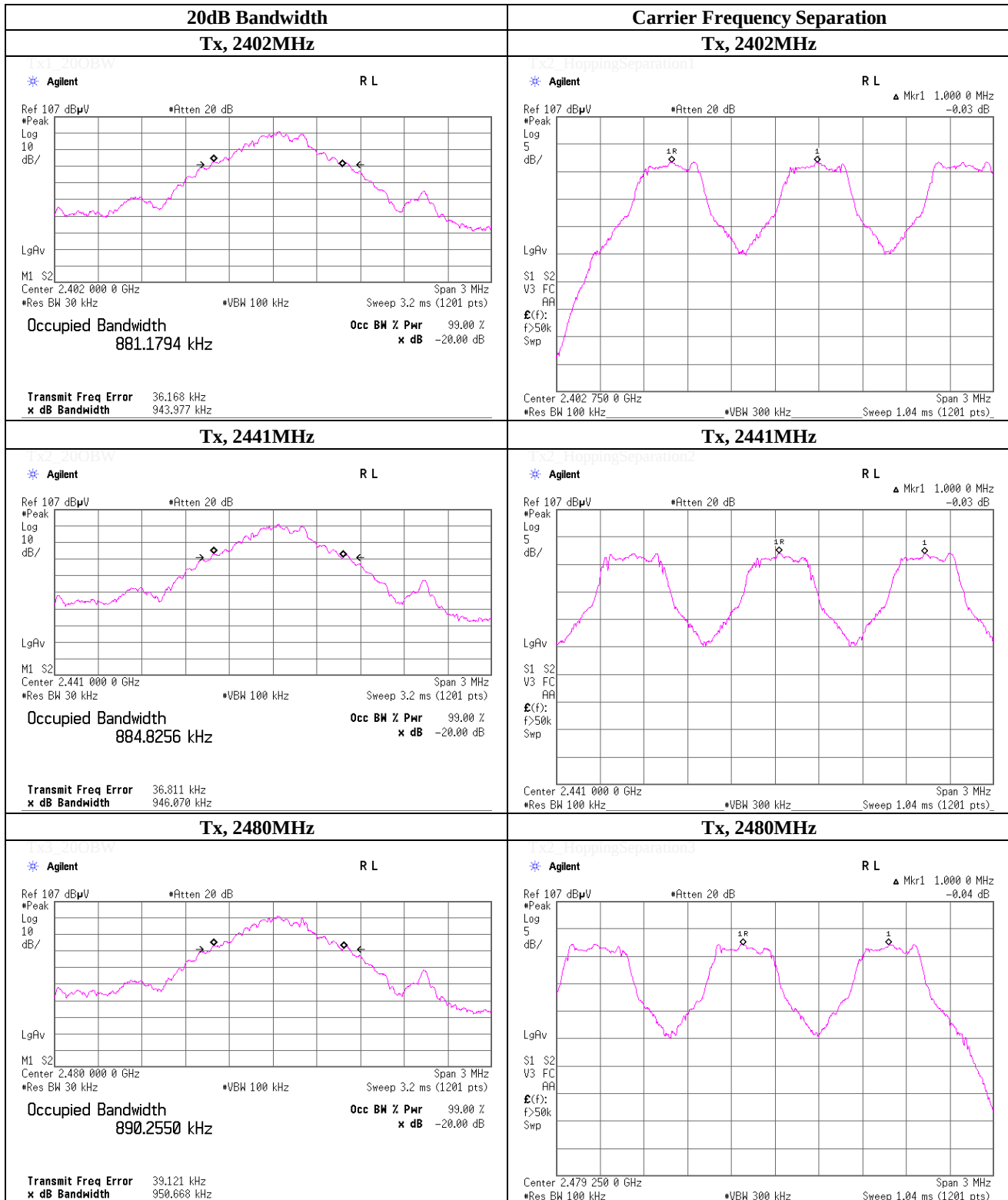
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

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 August 3, 2012
Temperature / Humidity 26deg.C , 49%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	1.266	1.000	>= 0.844
3-DH5	2441.0	1.302	1.000	>= 0.868
3-DH5	2480.0	1.274	1.000	>= 0.849

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

No limit applies to 20dB Bandwidth.

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Shonan EMC Lab.

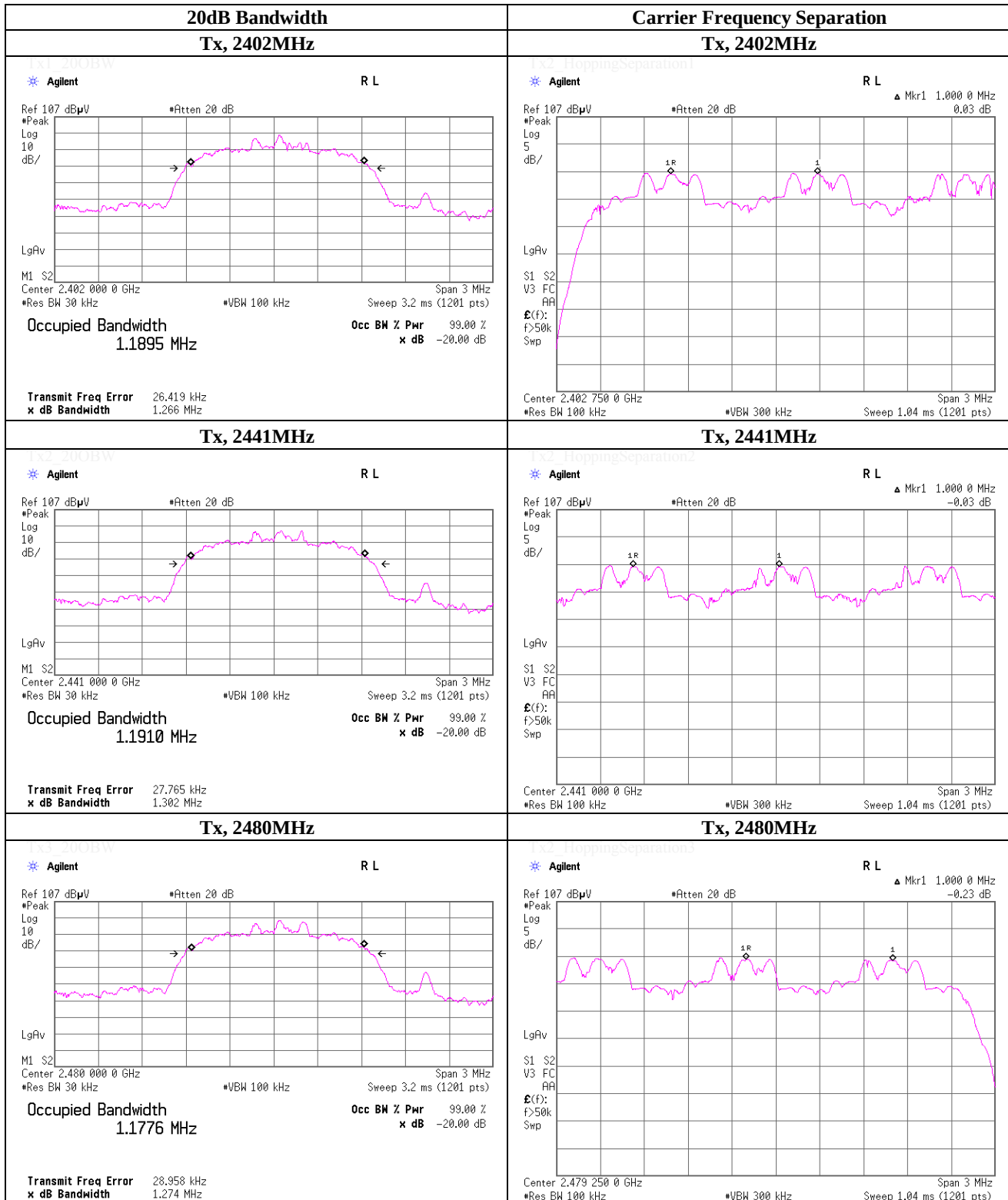
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

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20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, EDR, PRBS9



UL Japan, Inc.

Shonan EMC Lab.

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Telephone : +81 463 50 6400

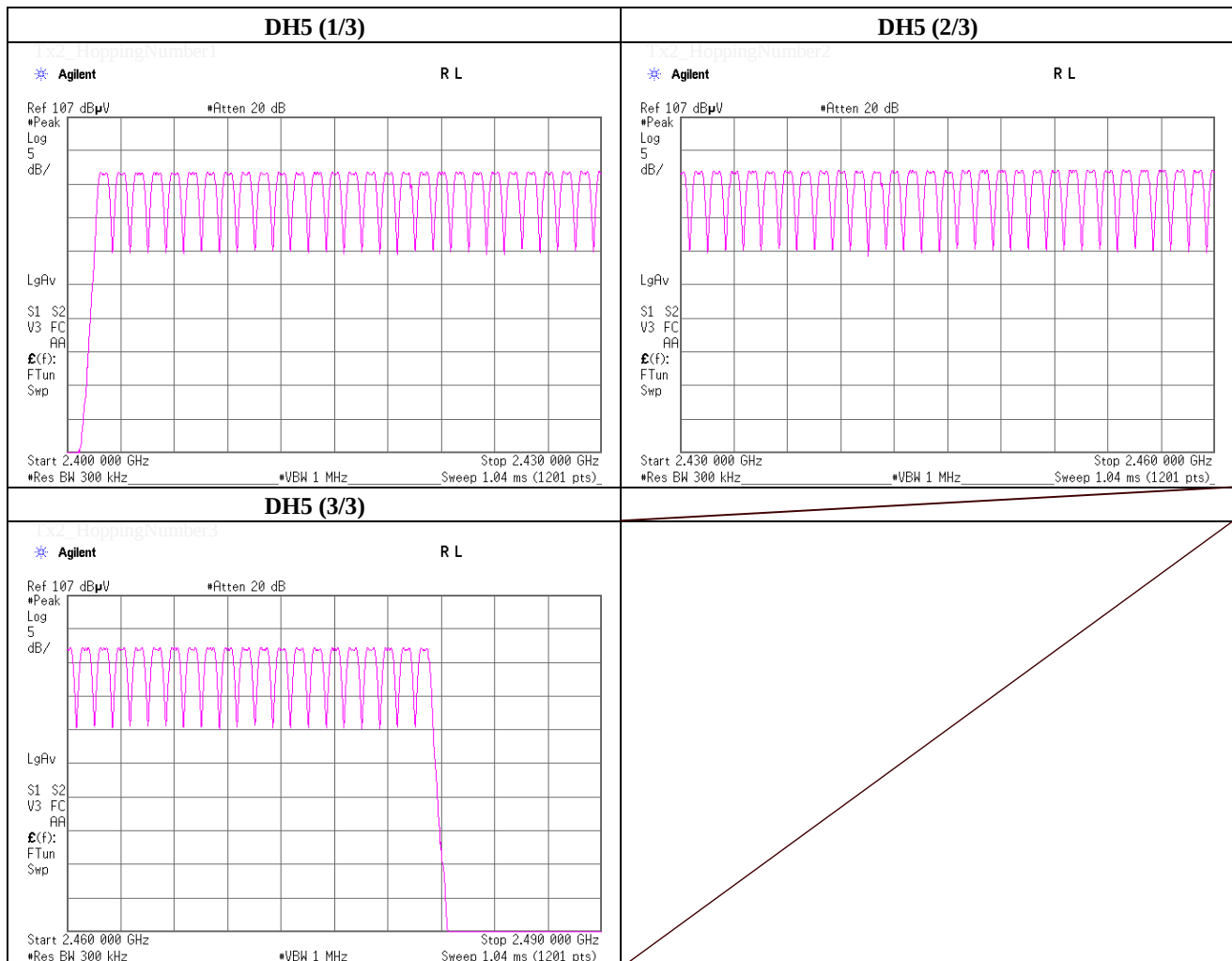
Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	August 3, 2012	
Temperature / Humidity	26deg.C , 49%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.

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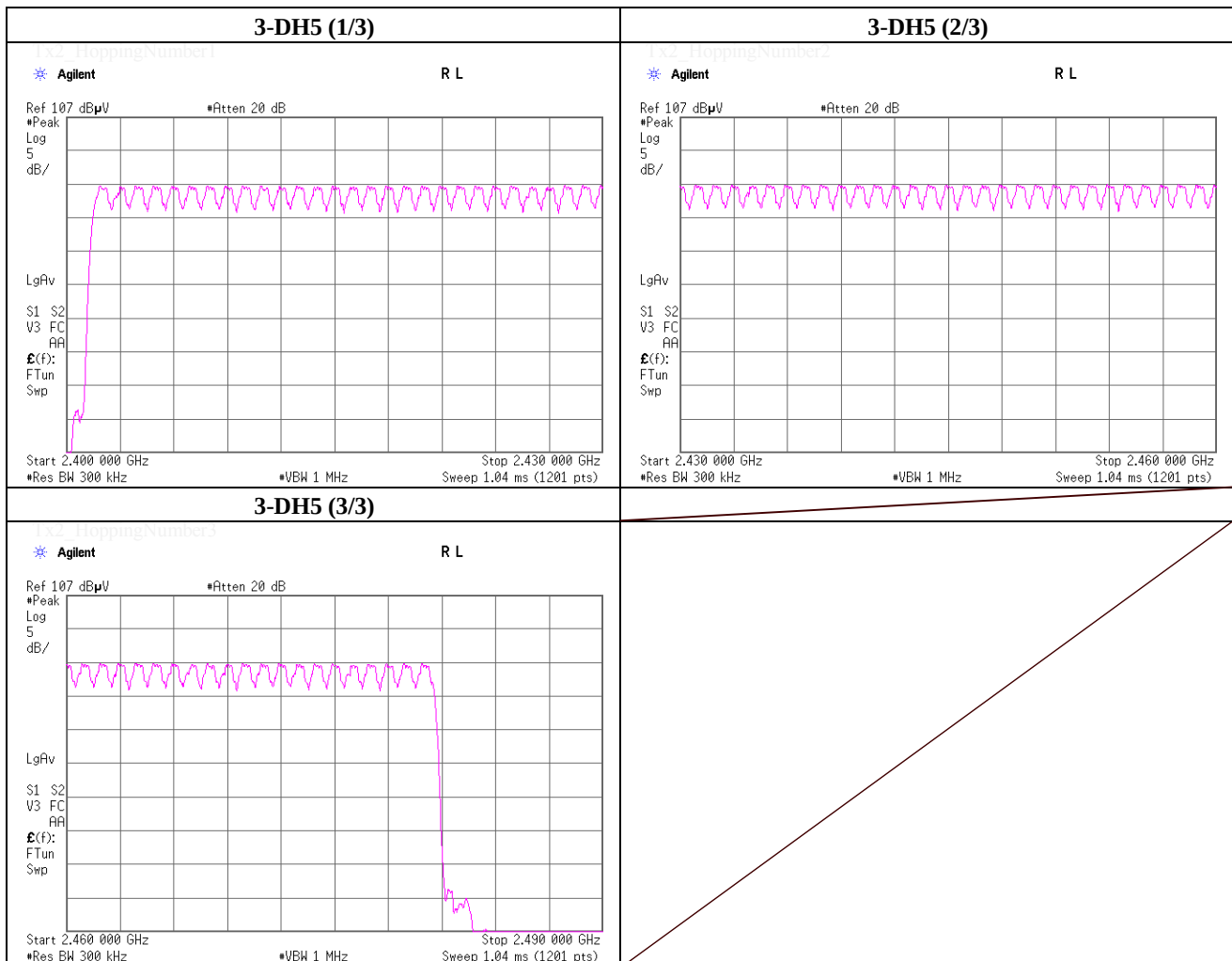
Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	August 3, 2012	
Temperature / Humidity	26deg.C , 49%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.



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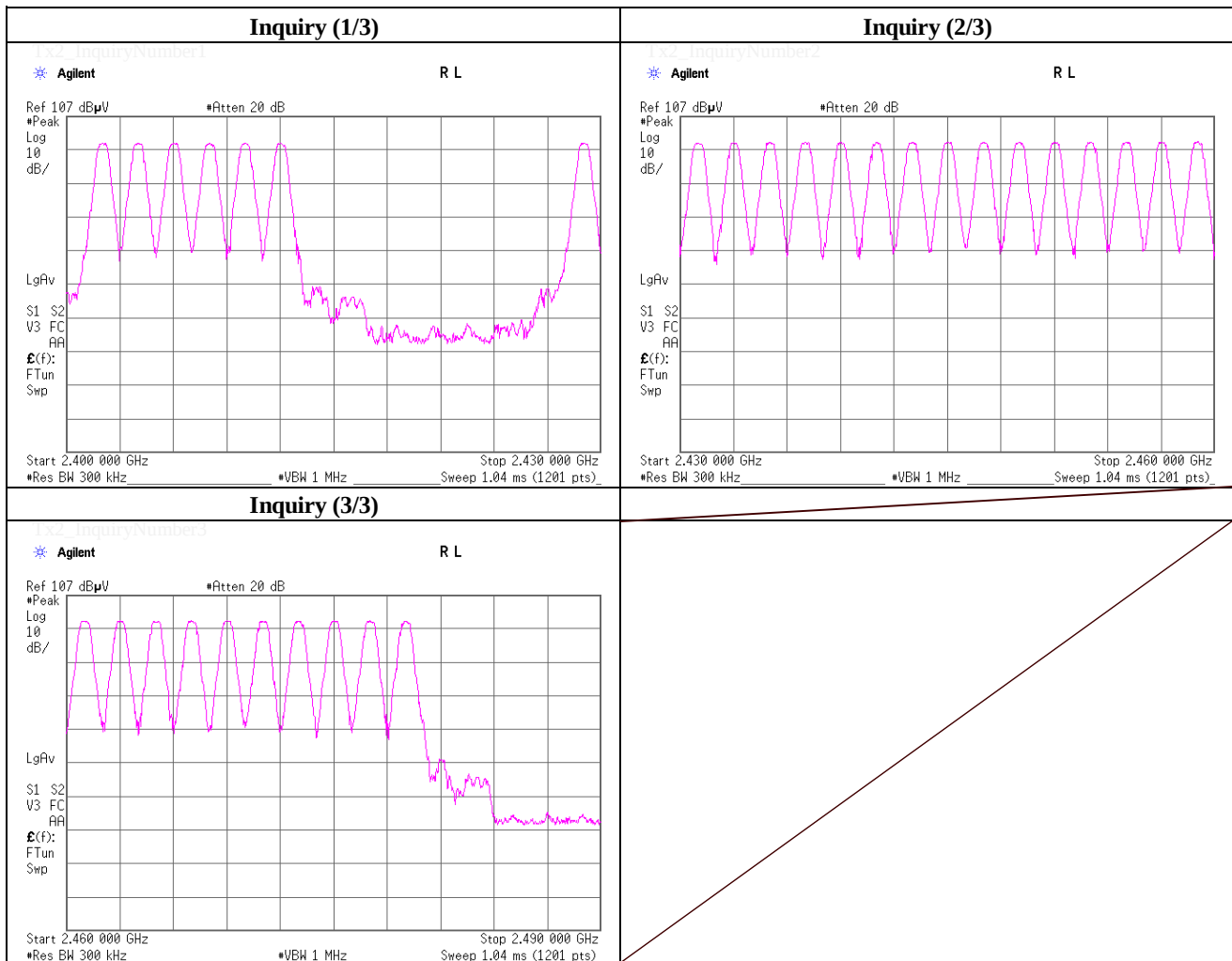
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	August 3, 2012	
Temperature / Humidity	26deg.C , 49%RH	
Engineer	Shinichi Takano	
Mode	Tx, Bluetooth, Inquiry	

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



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Dwell Time

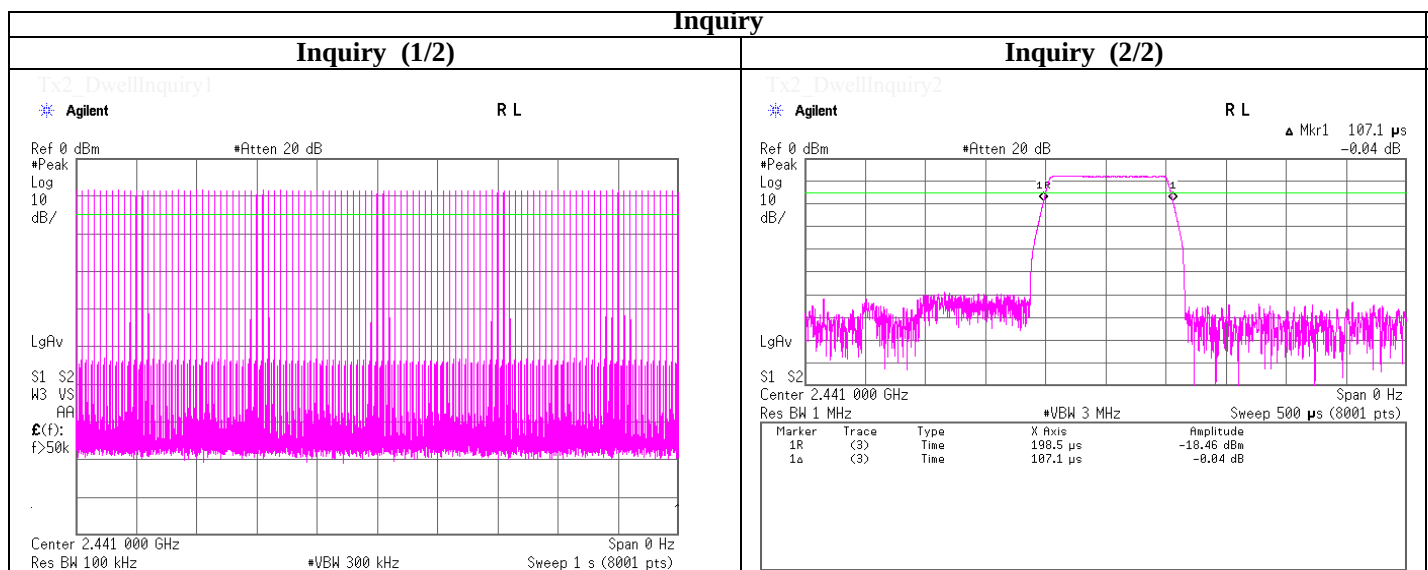
Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	August 7, 2012	
Temperature / Humidity	25deg.C , 53%RH	
Engineer	Shinichi Takano	
Mode	Tx, Bluetooth, BDR, PRBS9	

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period		Length of transmission time [msec]	Result [msec]	Limit [msec]
DH1	51.0	/ 5.0 sec. x 31.6 sec. = 323 times	0.405	131	400
DH3	26.0	/ 5.0 sec. x 31.6 sec. = 165 times	1.662	274	400
DH5	17.0	/ 5.0 sec. x 31.6 sec. = 108 times	2.911	314	400
Inquiry	100.0	/ 1.0 sec. x 12.8 sec. = 1280 times	0.107	137	400

Sample Calculation

Result = Number of transmission x Length of transmission time

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



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Shonan EMC Lab.

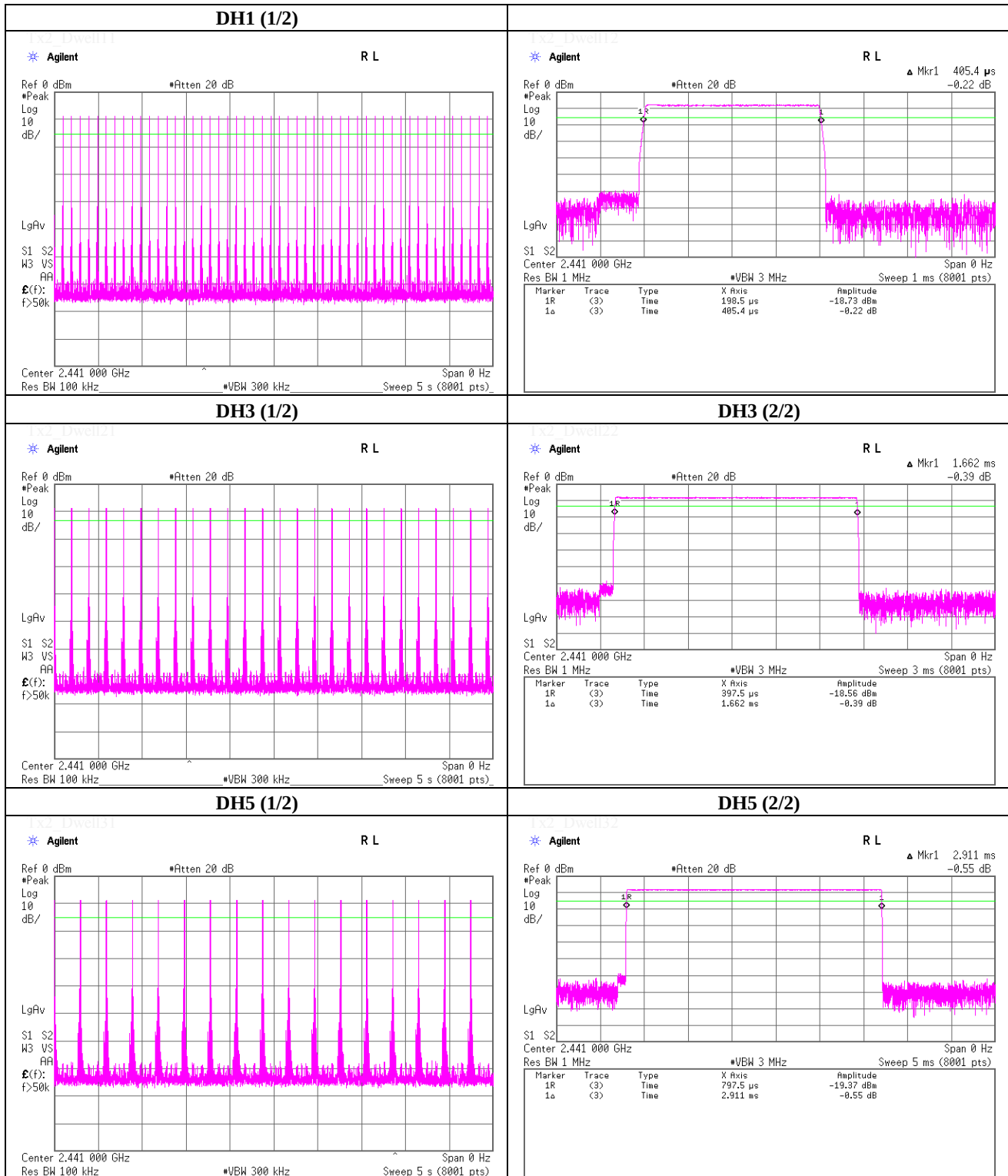
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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Dwell time

Tx, Bluetooth, BDR, PRBS9



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Shonan EMC Lab.

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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 August 7, 2012
 Temperature / Humidity 25deg.C , 53%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	0.417	135	400
3-DH3	26.0 / 5.0 sec. x 31.6 sec. = 165 times	1.668	275	400
3-DH5	17.0 / 5.0 sec. x 31.6 sec. = 108 times	2.919	315	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.

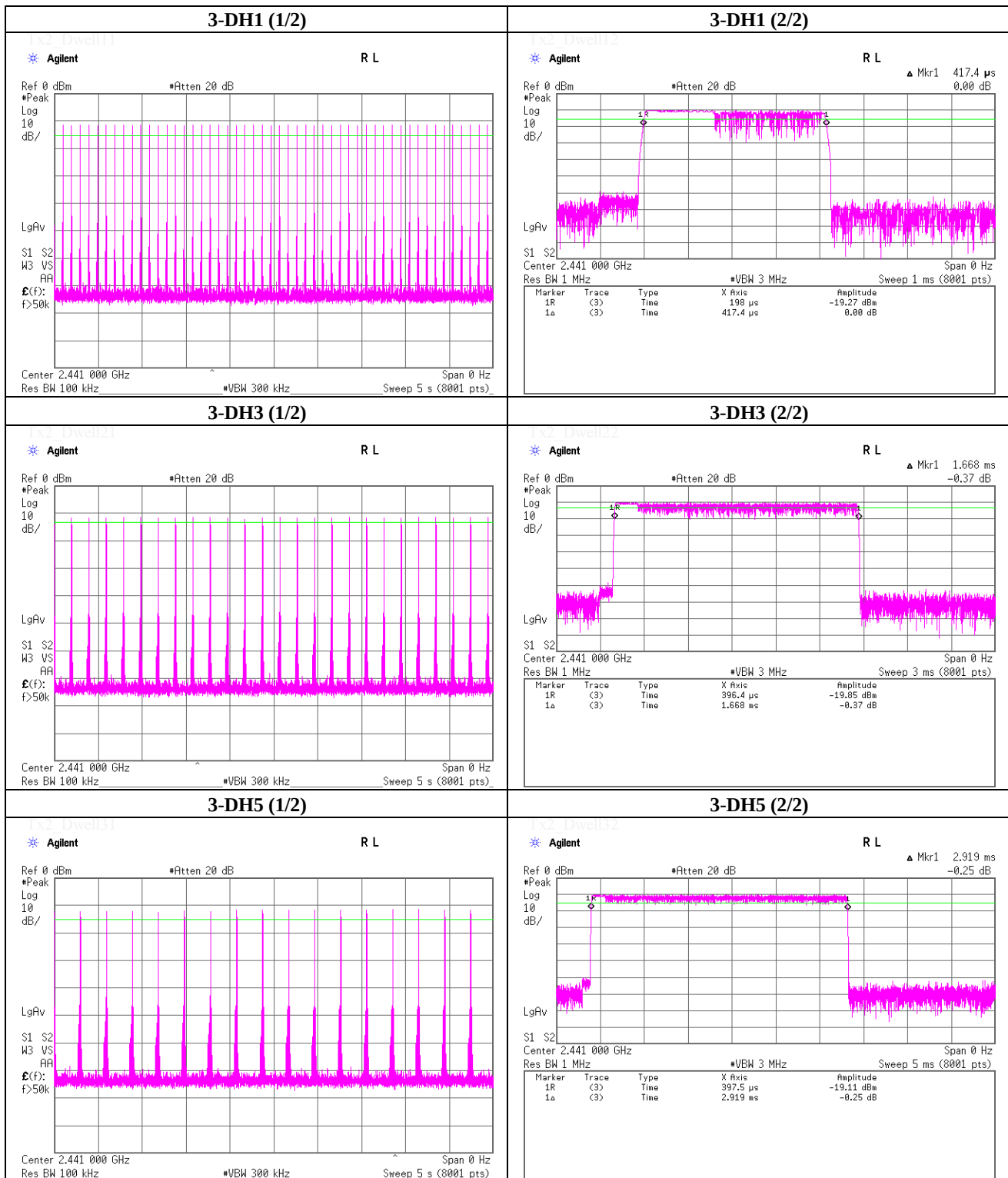
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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Facsimile : +81 463 50 6401

Dwell time

Tx, Bluetooth, EDR, PRBS9



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Peak Output Power (Conducted)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date August 2, 2012
 Temperature / Humidity 25deg.C , 52%RH
 Engineer Shinichi Takano
 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	-8.23	0.83	9.86	2.46	1.76	20.97	125	18.51
DH5	2441.0	-7.99	0.84	9.86	2.71	1.87	20.97	125	18.26
DH5	2480.0	-7.86	0.85	9.86	2.85	1.93	20.97	125	18.12
2-DH5	2402.0	-9.73	0.83	9.86	0.96	1.25	20.97	125	20.01
2-DH5	2441.0	-9.77	0.84	9.86	0.93	1.24	20.97	125	20.04
2-DH5	2480.0	-9.80	0.85	9.86	0.91	1.23	20.97	125	20.06
3-DH5	2402.0	-9.71	0.83	9.86	0.98	1.25	20.97	125	19.99
3-DH5	2441.0	-9.72	0.84	9.86	0.98	1.25	20.97	125	19.99
3-DH5	2480.0	-9.75	0.85	9.86	0.96	1.25	20.97	125	20.01

Reference data for SAR testing

(* AV: Average)

	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result	
					[dBm]	[mW]
DH5	2402.0	-9.48	0.83	9.86	1.21	1.32
DH5	2441.0	-9.26	0.84	9.86	1.44	1.39
DH5	2480.0	-9.13	0.85	9.86	1.58	1.44

Sample Calculation:

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

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Shonan EMC Lab.

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

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Facsimile : +81 463 50 6401

Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.2 and 3 Semi Anechoic Chamber
Date	August 20, 2012 (No.3SAC)	August 21, 2012 (No.2SAC) August 22, 2012 (No.2SAC)
Temperature / Humidity	23 deg.C , 71 %RH	24 deg.C , 56 %RH 23 deg.C , 56 %RH
Engineer	Makoto Hosaka	Akio Hayashi
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.	434.348	QP	38.8	16.7	7.8	31.7	31.6	46.0	14.4	100	241	Y-axis
Hori.	545.995	QP	41.3	18.2	8.5	31.7	36.3	46.0	9.7	178	238	Y-axis
Hori.	614.813	QP	37.9	19.4	8.8	31.7	34.4	46.0	11.6	146	45	Y-axis
Hori.	633.171	QP	38.1	19.6	8.9	31.7	34.9	46.0	11.1	144	39	Y-axis
Hori.	651.519	QP	36.8	19.7	9.0	31.7	33.8	46.0	12.2	143	44	Y-axis
Hori.	1628.000	PK	50.9	25.4	13.4	40.8	48.9	73.9	25.0	117	39	Z-axis
Hori.	3256.000	PK	46.6	29.0	5.7	41.6	39.7	73.9	34.2	100	0	X-axis
Hori.	4882.000	PK	58.7	31.2	6.9	41.1	55.7	73.9	18.2	118	37	X-axis
Hori.	7323.000	PK	47.6	36.8	8.6	41.4	51.6	73.9	22.3	100	355	X-axis
Hori.	9764.000	PK	44.2	38.5	9.5	38.9	53.3	73.9	20.6	100	0	X-axis
Hori.	12205.000	PK	45.8	39.3	10.8	39.3	56.6	73.9	17.3	100	0	X-axis
Hori.	1628.000	AV	45.2	25.4	13.4	40.8	43.2	53.9	10.7	117	39	Z-axis
Hori.	3256.000	AV	33.5	29.0	5.7	41.6	26.6	53.9	27.3	100	0	X-axis
Hori.	4882.000	AV	51.2	31.2	6.9	41.1	48.2	53.9	5.7	118	37	X-axis
Hori.	7323.000	AV	35.6	36.8	8.6	41.4	39.6	53.9	14.3	100	355	X-axis
Hori.	9764.000	AV	31.6	38.5	9.5	38.9	40.7	53.9	13.2	100	0	X-axis
Hori.	12205.000	AV	32.5	39.3	10.8	39.3	43.3	53.9	10.6	100	0	X-axis
Vert.	88.000	QP	43.3	7.9	8.2	31.9	27.5	40.0	12.5	107	80	Cradle
Vert.	90.704	QP	44.9	8.4	8.2	31.9	29.6	43.5	13.9	107	80	Cradle
Vert.	110.750	QP	47.2	11.7	8.0	31.9	35.0	43.5	8.5	100	94	Cradle
Vert.	131.525	QP	40.4	13.9	8.3	31.9	30.7	43.5	12.8	100	110	Cradle
Vert.	1628.000	PK	52.0	25.4	13.4	40.8	50.0	73.9	23.9	107	0	Cradle
Vert.	3256.000	PK	46.0	29.0	5.7	41.6	39.1	73.9	34.8	100	0	Y-axis
Vert.	4882.000	PK	53.2	31.2	6.9	41.1	50.2	73.9	23.7	111	223	Y-axis
Vert.	7323.000	PK	48.2	36.8	8.6	41.4	52.2	73.9	21.7	100	310	Y-axis
Vert.	9764.000	PK	44.3	38.5	9.5	38.9	53.4	73.9	20.5	100	0	Y-axis
Vert.	12205.000	PK	45.3	39.3	10.8	39.3	56.1	73.9	17.8	100	0	Y-axis
Vert.	1628.000	AV	46.8	25.4	13.4	40.8	44.8	53.9	9.1	107	0	Cradle
Vert.	3256.000	AV	33.8	29.0	5.7	41.6	26.9	53.9	27.0	100	0	Y-axis
Vert.	4882.000	AV	44.4	31.2	6.9	41.1	41.4	53.9	12.5	111	223	Y-axis
Vert.	7323.000	AV	35.4	36.8	8.6	41.4	39.4	53.9	14.5	100	310	Y-axis
Vert.	9764.000	AV	31.6	38.5	9.5	38.9	40.7	53.9	13.2	100	0	Y-axis
Vert.	12205.000	AV	32.4	39.3	10.8	39.3	43.2	53.9	10.7	100	0	Y-axis

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

*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.2 and 3 Semi Anechoic Chamber
Date	August 20, 2012 (No.3SAC)	August 21, 2012 (No.2SAC) August 22, 2012 (No.2SAC)
Temperature / Humidity	23 deg.C , 71 %RH	24 deg.C , 56 %RH 23 deg.C , 56 %RH
Engineer	Makoto Hosaka	Akio Hayashi
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.	434.345	QP	38.9	16.7	7.8	31.7	31.7	46.0	14.3	100	242	Y-axis
Hori.	545.992	QP	41.5	18.2	8.5	31.7	36.5	46.0	9.5	170	230	Y-axis
Hori.	605.637	QP	36.2	19.3	8.8	31.7	32.6	46.0	13.4	154	56	Y-axis
Hori.	614.817	QP	37.8	19.4	8.8	31.7	34.3	46.0	11.7	154	50	Y-axis
Hori.	633.168	QP	38.3	19.6	8.9	31.7	35.1	46.0	10.9	149	46	Y-axis
Hori.	1654.000	PK	51.0	25.5	13.4	40.9	49.0	73.9	24.9	100	24	Z-axis
Hori.	2483.500	PK	54.0	27.5	14.3	41.4	54.4	73.9	19.5	100	243	Z-axis
Hori.	3308.000	PK	46.4	29.1	5.6	41.7	39.4	73.9	34.5	100	0	X-axis
Hori.	4960.000	PK	57.9	31.4	6.9	41.0	55.2	73.9	18.7	114	28	X-axis
Hori.	7440.000	PK	47.7	37.0	8.8	41.5	52.0	73.9	21.9	100	0	X-axis
Hori.	9920.000	PK	43.9	38.8	9.7	38.9	53.5	73.9	20.4	100	0	X-axis
Hori.	12400.000	PK	45.2	39.4	10.8	39.3	56.1	73.9	17.8	100	0	X-axis
Hori.	1654.000	AV	45.6	25.5	13.4	40.9	43.6	53.9	10.3	100	24	Z-axis
Hori.	2483.500	AV	44.5	27.5	14.3	41.4	44.9	53.9	9.0	100	243	Z-axis
Hori.	3308.000	AV	33.5	29.1	5.6	41.7	26.5	53.9	27.4	100	0	X-axis
Hori.	4960.000	AV	50.5	31.4	6.9	41.0	47.8	53.9	6.1	114	28	X-axis
Hori.	7440.000	AV	35.8	37.0	8.8	41.5	40.1	53.9	13.8	100	0	X-axis
Hori.	9920.000	AV	31.5	38.8	9.7	38.9	41.1	53.9	12.8	100	0	X-axis
Hori.	12400.000	AV	32.3	39.4	10.8	39.3	43.2	53.9	10.7	100	0	X-axis
Vert.	88.000	QP	45.5	7.9	8.2	31.9	29.7	40.0	10.3	120	91	Cradle
Vert.	89.862	QP	46.8	8.2	8.2	31.9	31.3	43.5	12.2	120	91	Cradle
Vert.	111.600	QP	43.2	11.8	8.0	31.9	31.1	43.5	12.4	100	96	Cradle
Vert.	131.527	QP	42.3	13.9	8.3	31.9	32.6	43.5	10.9	100	123	Cradle
Vert.	1654.000	PK	53.3	25.5	13.4	40.9	51.3	73.9	22.6	100	0	Cradle
Vert.	2483.500	PK	55.2	27.5	14.3	41.4	55.6	73.9	18.3	109	215	X-axis
Vert.	3308.000	PK	46.9	29.1	5.6	41.7	39.9	73.9	34.0	100	0	Y-axis
Vert.	4960.000	PK	54.1	31.4	6.9	41.0	51.4	73.9	22.5	179	350	Y-axis
Vert.	7440.000	PK	47.7	37.0	8.8	41.5	52.0	73.9	21.9	100	313	Y-axis
Vert.	9920.000	PK	44.1	38.8	9.7	38.9	53.7	73.9	20.2	100	0	Y-axis
Vert.	12400.000	PK	45.8	39.4	10.8	39.3	56.7	73.9	17.2	100	0	Y-axis
Vert.	1654.000	AV	48.8	25.5	13.4	40.9	46.8	53.9	7.1	100	0	Cradle
Vert.	2483.500	AV	45.3	27.5	14.3	41.4	45.7	53.9	8.2	109	215	X-axis
Vert.	3308.000	AV	33.5	29.1	5.6	41.7	26.5	53.9	27.4	100	0	Y-axis
Vert.	4960.000	AV	46.4	31.4	6.9	41.0	43.7	53.9	10.2	179	350	Y-axis
Vert.	7440.000	AV	35.3	37.0	8.8	41.5	39.6	53.9	14.3	100	313	Y-axis
Vert.	9920.000	AV	31.5	38.8	9.7	38.9	41.1	53.9	12.8	100	0	Y-axis
Vert.	12400.000	AV	32.4	39.4	10.8	39.3	43.3	53.9	10.6	100	0	Y-axis

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

*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.2 and 3 Semi Anechoic Chamber
Date August 20, 2012 (No.3SAC) August 21, 2012 (No.2SAC) August 22, 2012 (No.2SAC)
Temperature / Humidity 23 deg.C , 71 %RH 24 deg.C , 56 %RH 23 deg.C , 56 %RH
Engineer Makoto Hosaka Akio Hayashi Akio Hayashi
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.	434.347	QP	38.8	16.7	7.8	31.7	31.6	46.0	14.4	100	248	Y-axis
Hori.	545.992	QP	41.5	18.2	8.5	31.7	36.5	46.0	9.5	175	236	Y-axis
Hori.	614.815	QP	38.0	19.4	8.8	31.7	34.5	46.0	11.5	148	39	Y-axis
Hori.	633.166	QP	38.3	19.6	8.9	31.7	35.1	46.0	10.9	146	40	Y-axis
Hori.	651.524	QP	36.9	19.7	9.0	31.7	33.9	46.0	12.1	144	52	Y-axis
Hori.	1602.000	PK	51.7	25.4	13.3	40.8	49.6	73.9	24.3	121	39	Z-axis
Hori.	2390.000	PK	48.1	27.2	14.2	41.4	48.1	73.9	25.8	100	72	Z-axis
Hori.	3204.000	PK	45.5	29.0	5.7	41.6	38.6	73.9	35.3	100	0	X-axis
Hori.	4804.000	PK	52.7	31.1	6.8	41.2	49.4	73.9	24.5	130	316	X-axis
Hori.	7206.000	PK	46.2	36.5	8.3	41.4	49.6	73.9	24.3	100	0	X-axis
Hori.	9608.000	PK	43.9	38.2	9.4	38.9	52.6	73.9	21.3	100	0	X-axis
Hori.	12010.000	PK	45.4	39.3	10.7	39.4	56.0	73.9	17.9	100	0	X-axis
Hori.	1602.000	AV	45.5	25.4	13.3	40.8	43.4	53.9	10.5	121	39	Z-axis
Hori.	2390.000	AV	35.5	27.2	14.2	41.4	35.5	53.9	18.4	100	72	Z-axis
Hori.	3204.000	AV	33.3	29.0	5.7	41.6	26.4	53.9	27.5	100	0	X-axis
Hori.	4804.000	AV	38.1	31.1	6.8	41.2	34.8	53.9	19.1	130	316	X-axis
Hori.	7206.000	AV	33.6	36.5	8.3	41.4	37.0	53.9	16.9	100	0	X-axis
Hori.	9608.000	AV	31.9	38.2	9.4	38.9	40.6	53.9	13.3	100	0	X-axis
Hori.	12010.000	AV	33.0	39.3	10.7	39.4	43.6	53.9	10.3	100	0	X-axis
Vert.	88.000	QP	46.0	7.9	8.2	31.9	30.2	40.0	9.8	116	111	Cradle
Vert.	89.781	QP	47.3	8.2	8.2	31.9	31.8	43.5	11.7	116	111	Cradle
Vert.	110.469	QP	43.6	11.6	8.0	31.9	31.3	43.5	12.2	100	90	Cradle
Vert.	131.530	QP	42.3	13.9	8.3	31.9	32.6	43.5	10.9	100	123	Cradle
Vert.	1602.000	PK	51.6	25.4	13.3	40.8	49.5	73.9	24.4	100	0	Cradle
Vert.	2390.000	PK	47.5	27.2	14.2	41.4	47.5	73.9	26.4	113	217	X-axis
Vert.	3204.000	PK	45.0	29.0	5.7	41.6	38.1	73.9	35.8	100	0	Y-axis
Vert.	4804.000	PK	49.4	31.1	6.8	41.2	46.1	73.9	27.8	100	230	Y-axis
Vert.	7206.000	PK	46.7	36.5	8.3	41.4	50.1	73.9	23.8	100	0	Y-axis
Vert.	9608.000	PK	44.8	38.2	9.4	38.9	53.5	73.9	20.4	100	0	Y-axis
Vert.	12010.000	PK	45.3	39.3	10.7	39.4	55.9	73.9	18.0	100	0	Y-axis
Vert.	1602.000	AV	45.6	25.4	13.3	40.8	43.5	53.9	10.4	100	0	Cradle
Vert.	2390.000	AV	35.2	27.2	14.2	41.4	35.2	53.9	18.7	113	217	X-axis
Vert.	3204.000	AV	33.6	29.0	5.7	41.6	26.7	53.9	27.2	100	0	Y-axis
Vert.	4804.000	AV	35.5	31.1	6.8	41.2	32.2	53.9	21.7	100	230	Y-axis
Vert.	7206.000	AV	33.6	36.5	8.3	41.4	37.0	53.9	16.9	100	0	Y-axis
Vert.	9608.000	AV	31.8	38.2	9.4	38.9	40.5	53.9	13.4	100	0	Y-axis
Vert.	12010.000	AV	33.0	39.3	10.7	39.4	43.6	53.9	10.3	100	0	Y-axis

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	94.8	27.3	14.2	41.4	94.9	-	-	Z-axis, Carrier
Hori.	2400.000	PK	44.1	27.3	14.2	41.4	44.2	74.9	30.7	Z-axis
Vert.	2402.000	PK	94.0	27.3	14.2	41.4	94.1	-	-	Z-axis, Carrier
Vert.	2400.000	PK	43.2	27.3	14.2	41.4	43.3	74.1	30.8	Z-axis

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

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Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.2 and 3 Semi Anechoic Chamber
Date	August 20, 2012 (No.3SAC)	August 21, 2012 (No.2SAC) August 22, 2012 (No.2SAC)
Temperature / Humidity	23 deg.C , 71 %RH	24 deg.C , 56 %RH 23 deg.C , 56 %RH
Engineer	Makoto Hosaka	Akio Hayashi
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.	434.350	QP	39.0	16.7	7.8	31.7	31.8	46.0	14.2	100	234	Y-axis
Hori.	545.994	QP	41.2	18.2	8.5	31.7	36.2	46.0	9.8	173	247	Y-axis
Hori.	614.811	QP	38.0	19.4	8.8	31.7	34.5	46.0	11.5	150	48	Y-axis
Hori.	633.170	QP	38.2	19.6	8.9	31.7	35.0	46.0	11.0	142	35	Y-axis
Hori.	651.522	QP	37.0	19.7	9.0	31.7	34.0	46.0	12.0	141	44	Y-axis
Hori.	1628.000	PK	51.2	25.4	13.4	40.8	49.2	73.9	24.7	118	37	Z-axis
Hori.	3256.000	PK	45.9	29.0	5.7	41.6	39.0	73.9	34.9	100	0	X-axis
Hori.	4882.000	PK	54.0	31.2	6.9	41.1	51.0	73.9	22.9	123	30	X-axis
Hori.	7323.000	PK	46.4	36.8	8.6	41.4	50.4	73.9	23.5	100	0	X-axis
Hori.	9764.000	PK	44.1	38.5	9.5	38.9	53.2	73.9	20.7	100	0	X-axis
Hori.	12205.000	PK	44.9	39.3	10.8	39.3	55.7	73.9	18.2	100	0	X-axis
Hori.	1628.000	AV	45.2	25.4	13.4	40.8	43.2	53.9	10.7	118	37	Z-axis
Hori.	3256.000	AV	33.5	29.0	5.7	41.6	26.6	53.9	27.3	100	0	X-axis
Hori.	4882.000	AV	39.9	31.2	6.9	41.1	36.9	53.9	17.0	123	30	X-axis
Hori.	7323.000	AV	34.2	36.8	8.6	41.4	38.2	53.9	15.7	100	0	X-axis
Hori.	9764.000	AV	31.7	38.5	9.5	38.9	40.8	53.9	13.1	100	0	X-axis
Hori.	12205.000	AV	32.5	39.3	10.8	39.3	43.3	53.9	10.6	100	0	X-axis
Vert.	88.000	QP	46.9	7.9	8.2	31.9	31.1	40.0	8.9	130	96	Cradle
Vert.	88.300	QP	47.4	7.9	8.2	31.9	31.6	43.5	11.9	130	96	Cradle
Vert.	117.440	QP	43.2	12.6	8.0	31.9	31.9	43.5	11.6	100	107	Cradle
Vert.	131.532	QP	42.0	13.9	8.3	31.9	32.3	43.5	11.2	100	140	Cradle
Vert.	1628.000	PK	51.6	25.4	13.4	40.8	49.6	73.9	24.3	100	354	Cradle
Vert.	3256.000	PK	45.8	29.0	5.7	41.6	38.9	73.9	35.0	100	0	Y-axis
Vert.	4882.000	PK	48.8	31.2	6.9	41.1	45.8	73.9	28.1	116	222	Y-axis
Vert.	7323.000	PK	46.2	36.8	8.6	41.4	50.2	73.9	23.7	100	0	Y-axis
Vert.	9764.000	PK	43.8	38.5	9.5	38.9	52.9	73.9	21.0	100	0	Y-axis
Vert.	12205.000	PK	45.3	39.3	10.8	39.3	56.1	73.9	17.8	100	0	Y-axis
Vert.	1628.000	AV	46.2	25.4	13.4	40.8	44.2	53.9	9.7	100	354	Cradle
Vert.	3256.000	AV	33.7	29.0	5.7	41.6	26.8	53.9	27.1	100	0	Y-axis
Vert.	4882.000	AV	35.3	31.2	6.9	41.1	32.3	53.9	21.6	116	222	Y-axis
Vert.	7323.000	AV	34.1	36.8	8.6	41.4	38.1	53.9	15.8	100	0	Y-axis
Vert.	9764.000	AV	31.7	38.5	9.5	38.9	40.8	53.9	13.1	100	0	Y-axis
Vert.	12205.000	AV	32.5	39.3	10.8	39.3	43.3	53.9	10.6	100	0	Y-axis

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

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

Radiated Emission

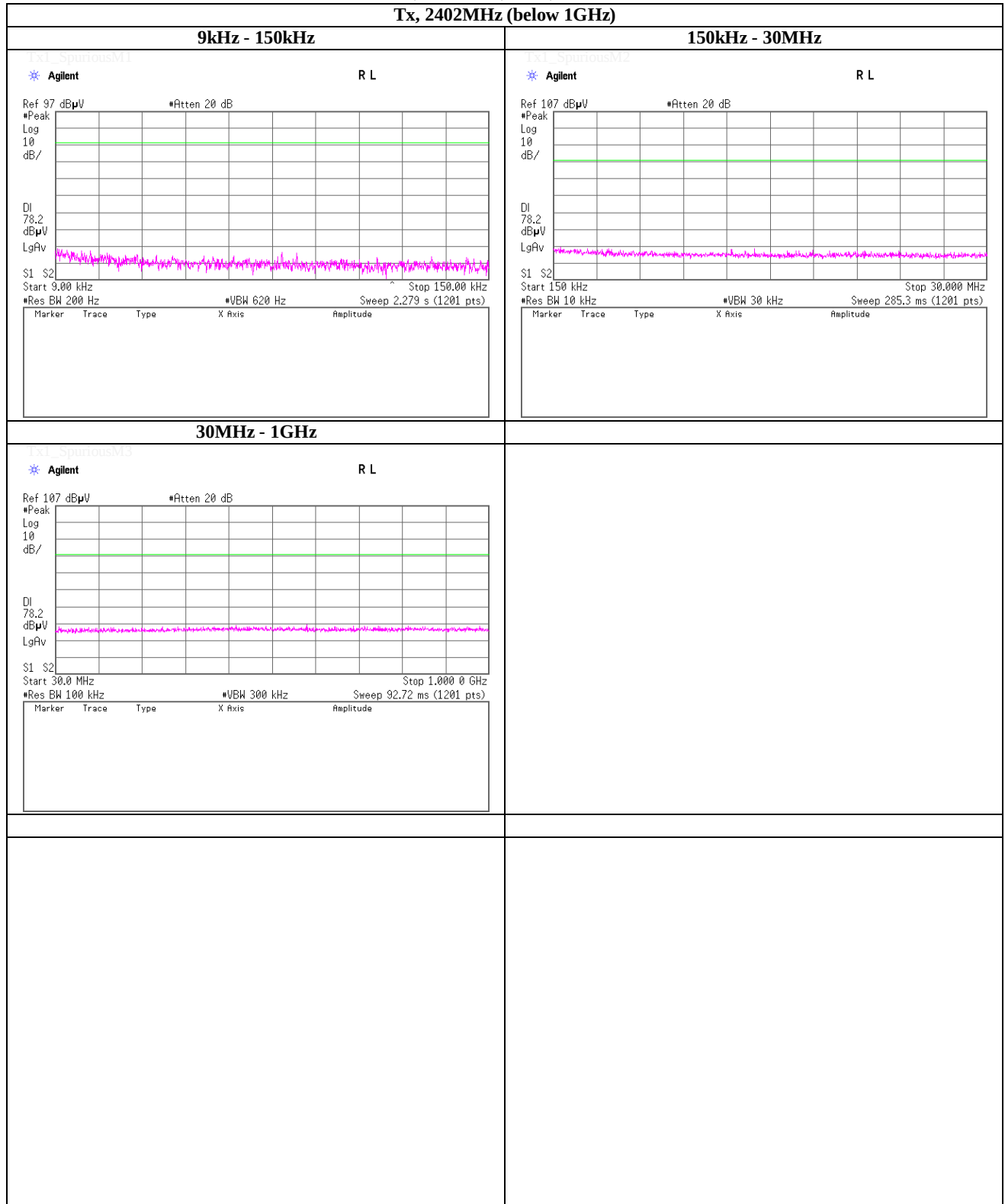
Test place	UL Japan, Inc. Shonan EMC Lab.	No.2 and 3 Semi Anechoic Chamber
Date	August 20, 2012 (No.3SAC)	August 21, 2012 (No.2SAC) August 22, 2012 (No.2SAC)
Temperature / Humidity	23 deg.C , 71 %RH	24 deg.C , 56 %RH 23 deg.C , 56 %RH
Engineer	Makoto Hosaka	Akio Hayashi
Mode	Tx, 2480 MHz	
	Tx, Bluetooth, 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.	434.342	QP	38.9	16.7	7.8	31.7	31.7	46.0	14.3	100	235	Y-axis
Hori.	545.990	QP	41.0	18.2	8.5	31.7	36.0	46.0	10.0	193	292	Y-axis
Hori.	614.817	QP	38.0	19.4	8.8	31.7	34.5	46.0	11.5	154	51	Y-axis
Hori.	633.169	QP	38.2	19.6	8.9	31.7	35.0	46.0	11.0	147	39	Y-axis
Hori.	651.520	QP	37.1	19.7	9.0	31.7	34.1	46.0	11.9	142	48	Y-axis
Hori.	1654.000	PK	51.3	25.5	13.4	40.9	49.3	73.9	24.6	100	37	Z-axis
Hori.	2483.500	PK	57.1	27.5	14.3	41.4	57.5	73.9	16.4	129	80	Z-axis
Hori.	3308.000	PK	46.0	29.1	5.6	41.7	39.0	73.9	34.9	100	0	X-axis
Hori.	4960.000	PK	52.5	31.4	6.9	41.0	49.8	73.9	24.1	100	34	X-axis
Hori.	7440.000	PK	46.8	37.0	8.8	41.5	51.1	73.9	22.8	100	0	X-axis
Hori.	9920.000	PK	44.1	38.8	9.7	38.9	53.7	73.9	20.2	100	0	X-axis
Hori.	12400.000	PK	43.8	39.4	10.8	39.3	54.7	73.9	19.2	100	0	X-axis
Hori.	1654.000	AV	45.7	25.5	13.4	40.9	43.7	53.9	10.2	100	37	Z-axis
Hori.	2483.500	AV	45.0	27.5	14.3	41.4	45.4	53.9	8.5	129	80	Z-axis
Hori.	3308.000	AV	33.6	29.1	5.6	41.7	26.6	53.9	27.3	100	0	X-axis
Hori.	4960.000	AV	39.3	31.4	6.9	41.0	36.6	53.9	17.3	100	34	X-axis
Hori.	7440.000	AV	34.4	37.0	8.8	41.5	38.7	53.9	15.2	100	0	X-axis
Hori.	9920.000	AV	31.5	38.8	9.7	38.9	41.1	53.9	12.8	100	0	X-axis
Hori.	12400.000	AV	32.4	39.4	10.8	39.3	43.3	53.9	10.6	100	0	X-axis
Vert.	85.320	QP	44.6	7.4	8.2	31.9	28.3	40.0	11.7	114	92	Cradle
Vert.	111.644	QP	45.4	11.8	8.0	31.9	33.3	43.5	10.2	100	93	Cradle
Vert.	131.528	QP	41.6	13.9	8.3	31.9	31.9	43.5	11.6	100	141	Cradle
Vert.	1654.000	PK	53.7	25.5	13.4	40.9	51.7	73.9	22.2	100	0	Cradle
Vert.	2483.500	PK	57.7	27.5	14.3	41.4	58.1	73.9	15.8	110	226	X-axis
Vert.	3308.000	PK	46.6	29.1	5.6	41.7	39.6	73.9	34.3	100	0	Y-axis
Vert.	4960.000	PK	47.1	31.4	6.9	41.0	44.4	73.9	29.5	108	226	Y-axis
Vert.	7440.000	PK	46.8	37.0	8.8	41.5	51.1	73.9	22.8	100	0	Y-axis
Vert.	9920.000	PK	43.6	38.8	9.7	38.9	53.2	73.9	20.7	100	0	Y-axis
Vert.	12400.000	PK	44.4	39.4	10.8	39.3	55.3	73.9	18.6	100	0	Y-axis
Vert.	1654.000	AV	49.0	25.5	13.4	40.9	47.0	53.9	6.9	100	0	Cradle
Vert.	2483.500	AV	45.1	27.5	14.3	41.4	45.5	53.9	8.4	110	226	X-axis
Vert.	3308.000	AV	34.1	29.1	5.6	41.7	27.1	53.9	26.8	100	0	Y-axis
Vert.	4960.000	AV	34.7	31.4	6.9	41.0	32.0	53.9	21.9	108	226	Y-axis
Vert.	7440.000	AV	34.5	37.0	8.8	41.5	38.8	53.9	15.1	100	0	Y-axis
Vert.	9920.000	AV	31.5	38.8	9.7	38.9	41.1	53.9	12.8	100	0	Y-axis
Vert.	12400.000	AV	32.4	39.4	10.8	39.3	43.3	53.9	10.6	100	0	Y-axis

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

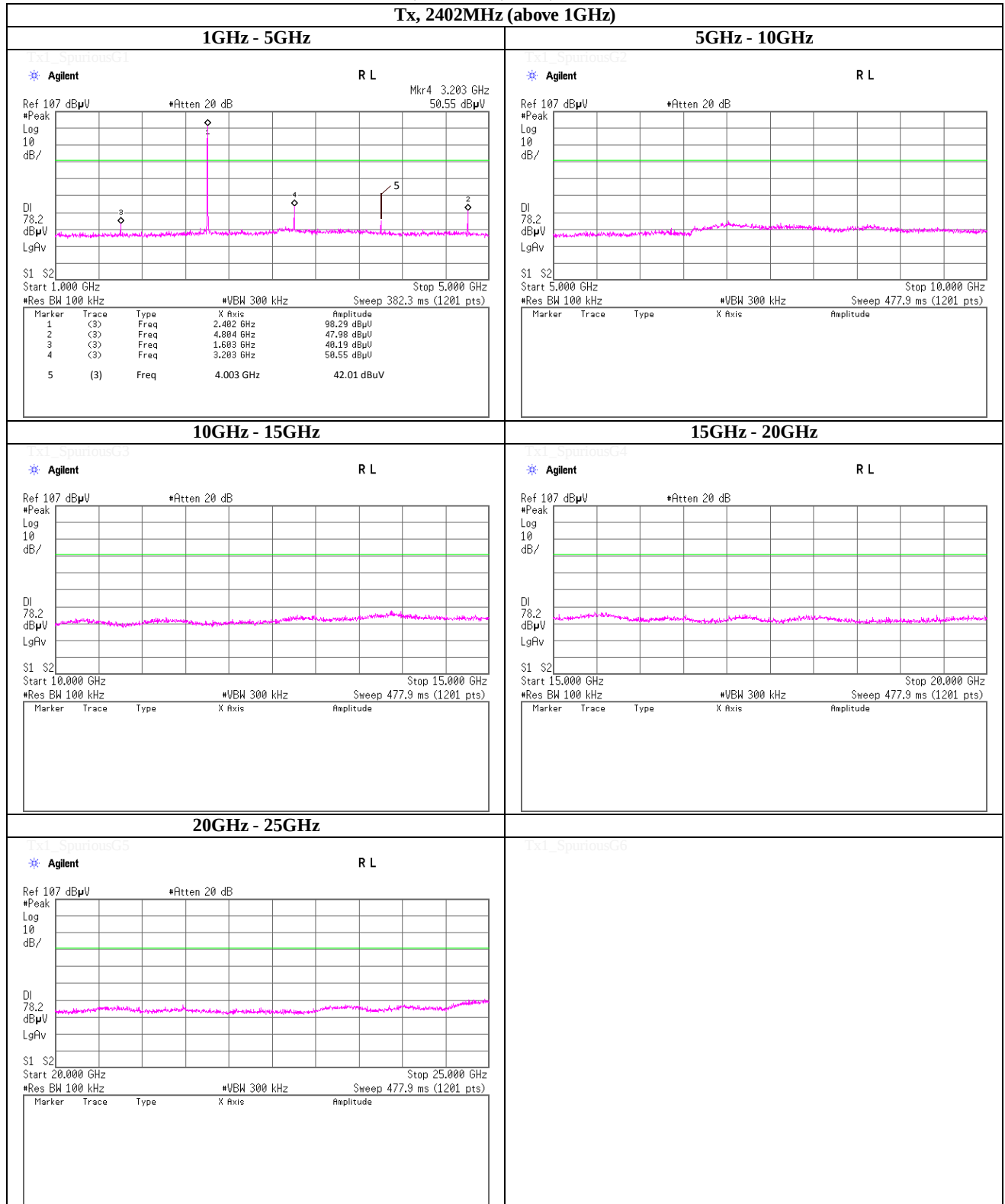
*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

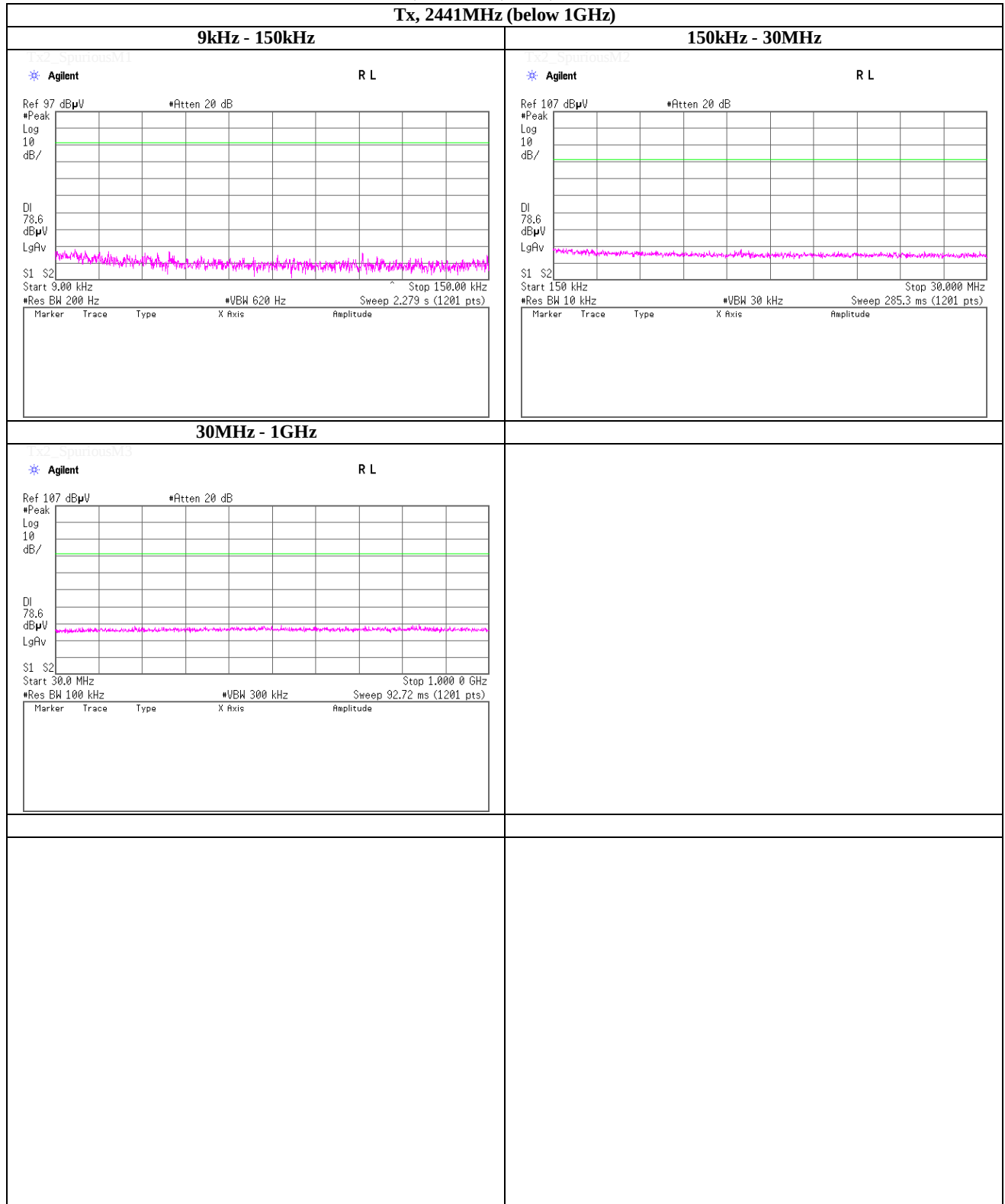
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2402MHz (below 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

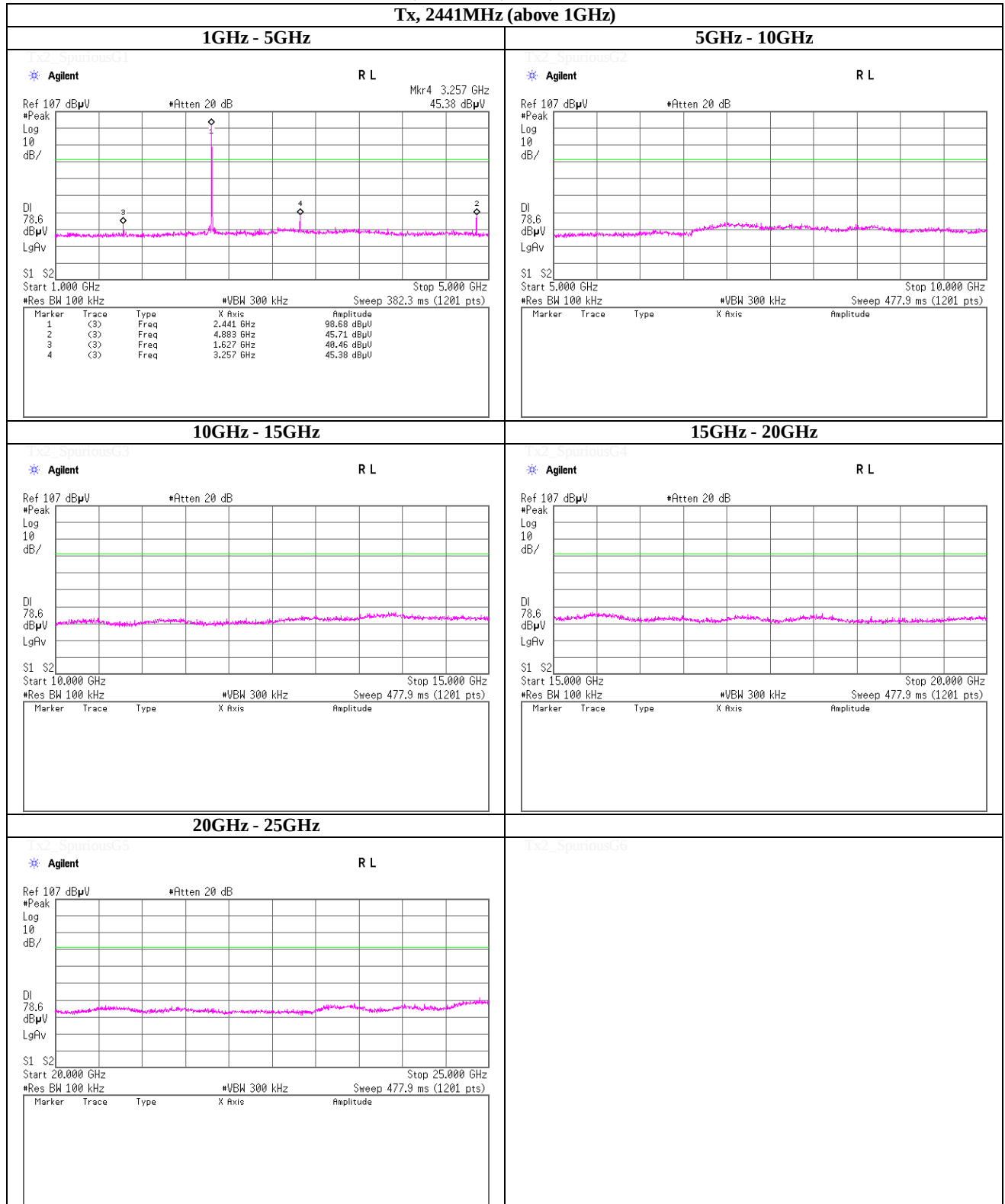
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

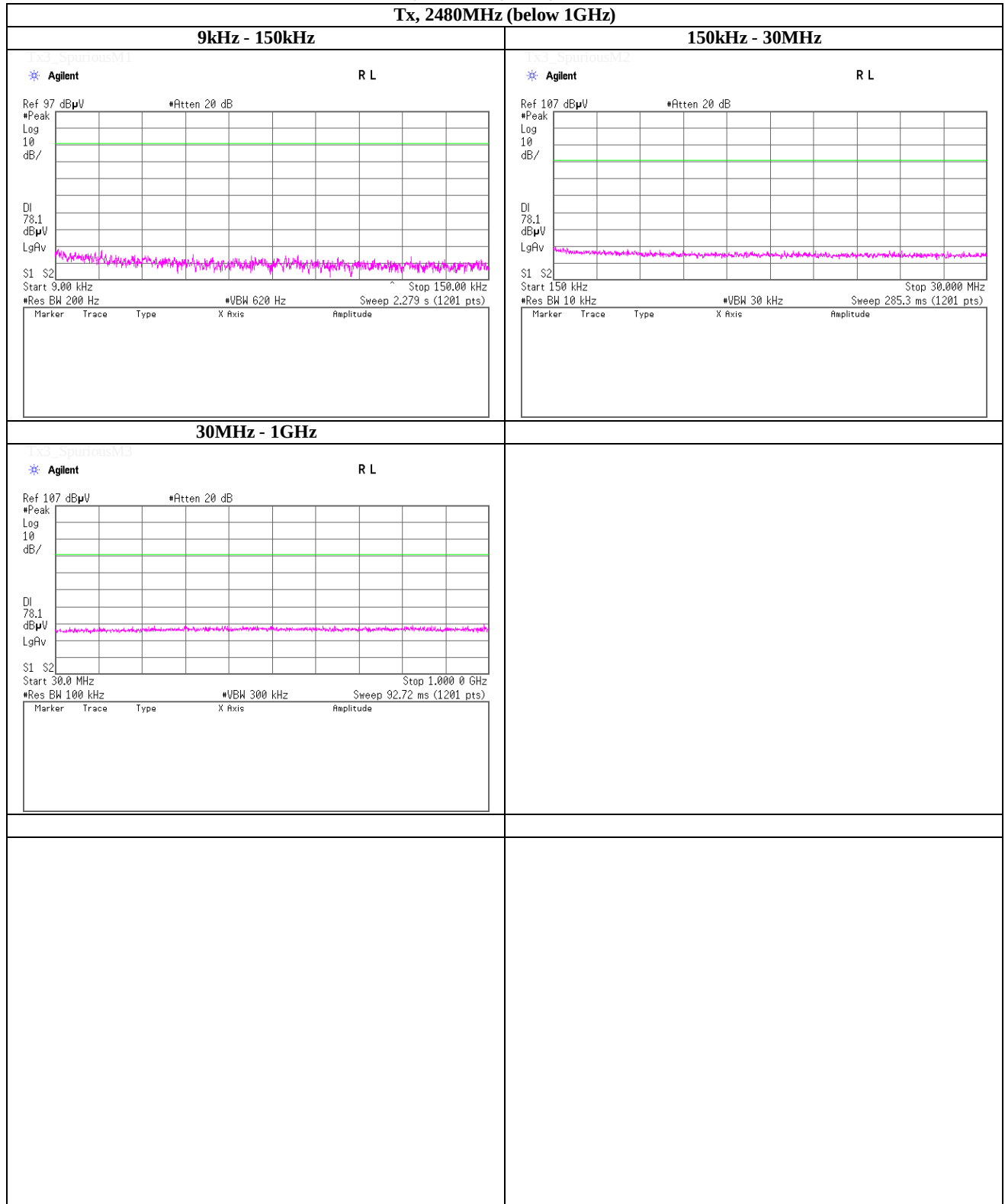
Telephone : +81 463 50 6400

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**

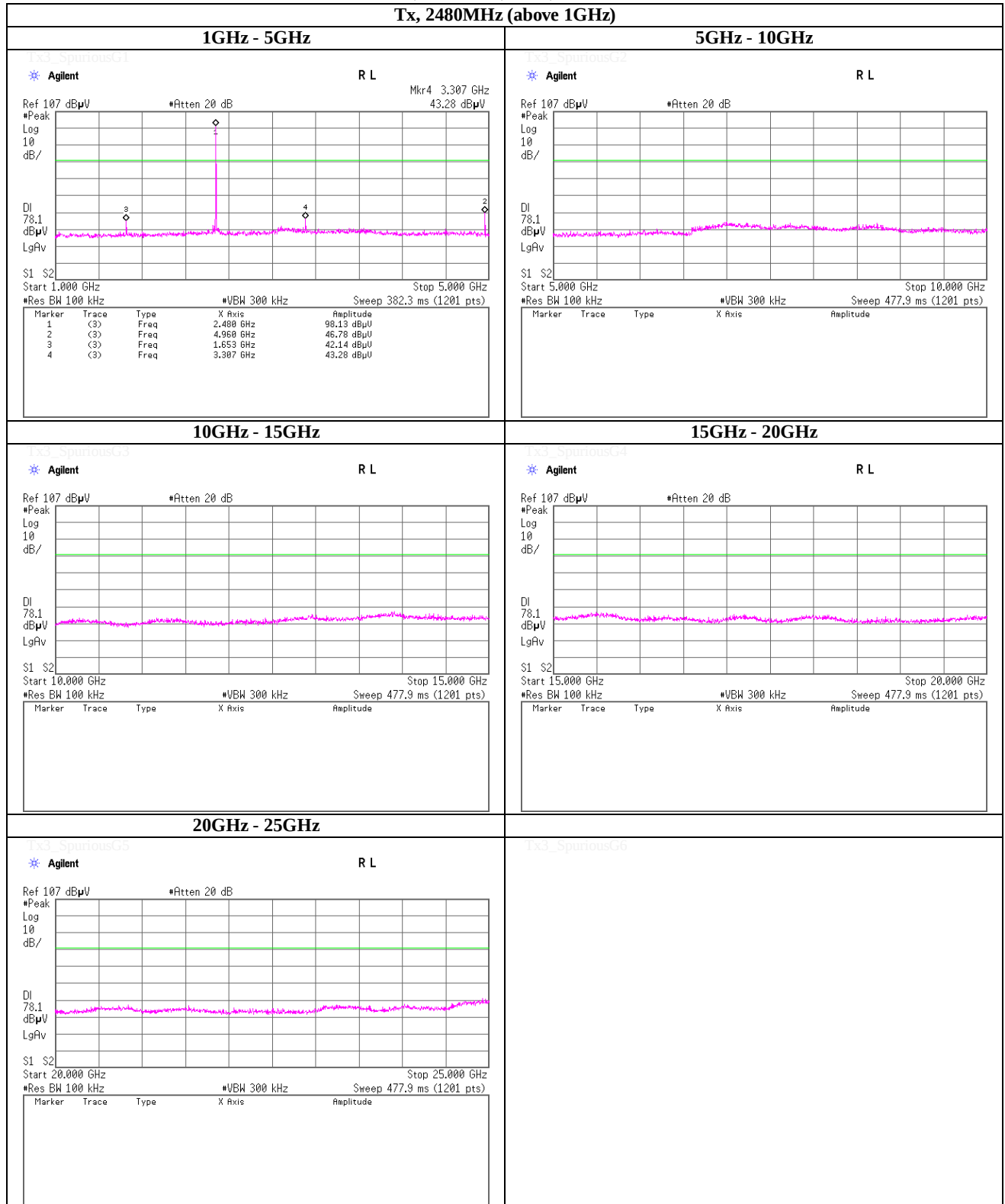
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2441MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

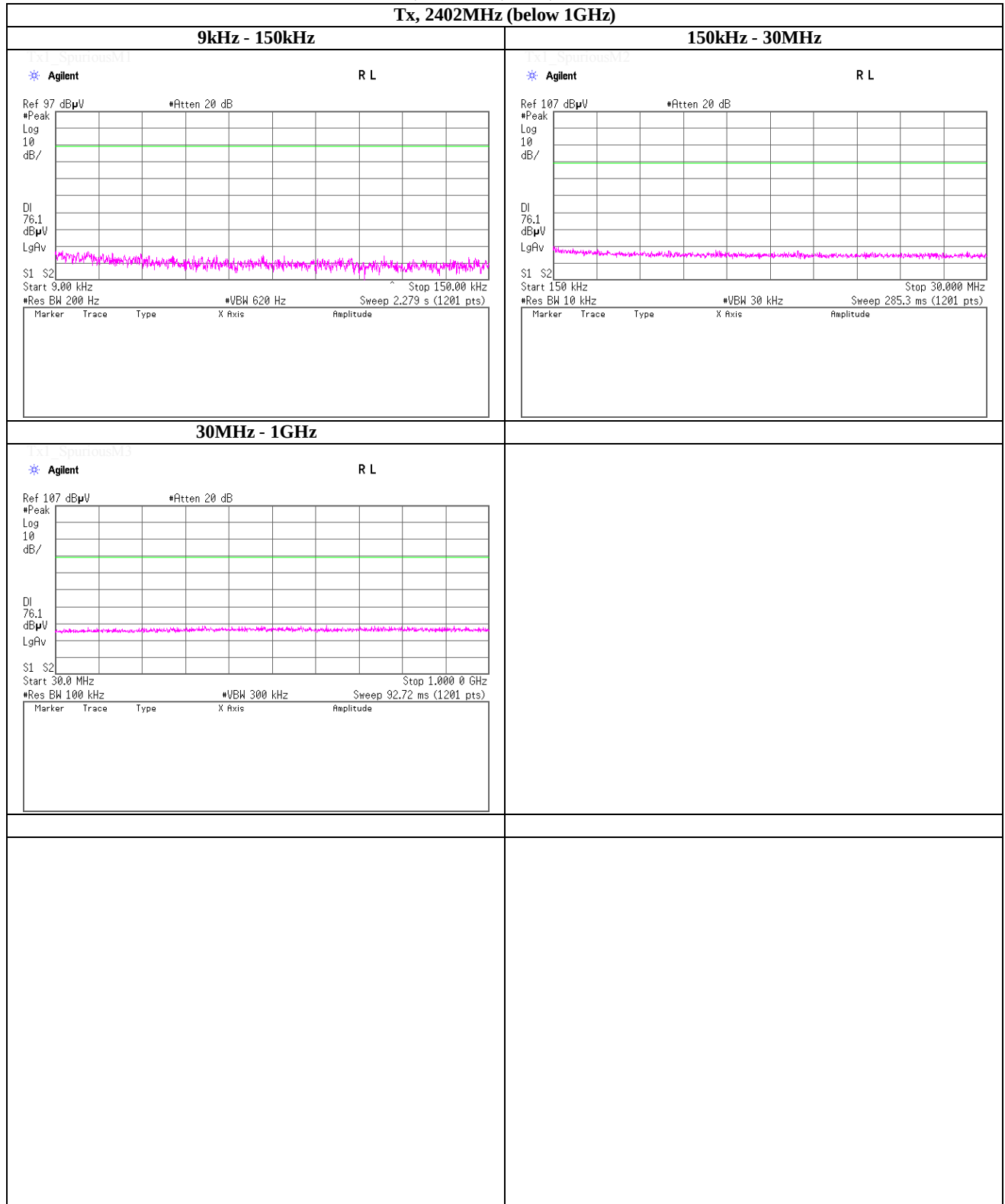
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2480MHz (below 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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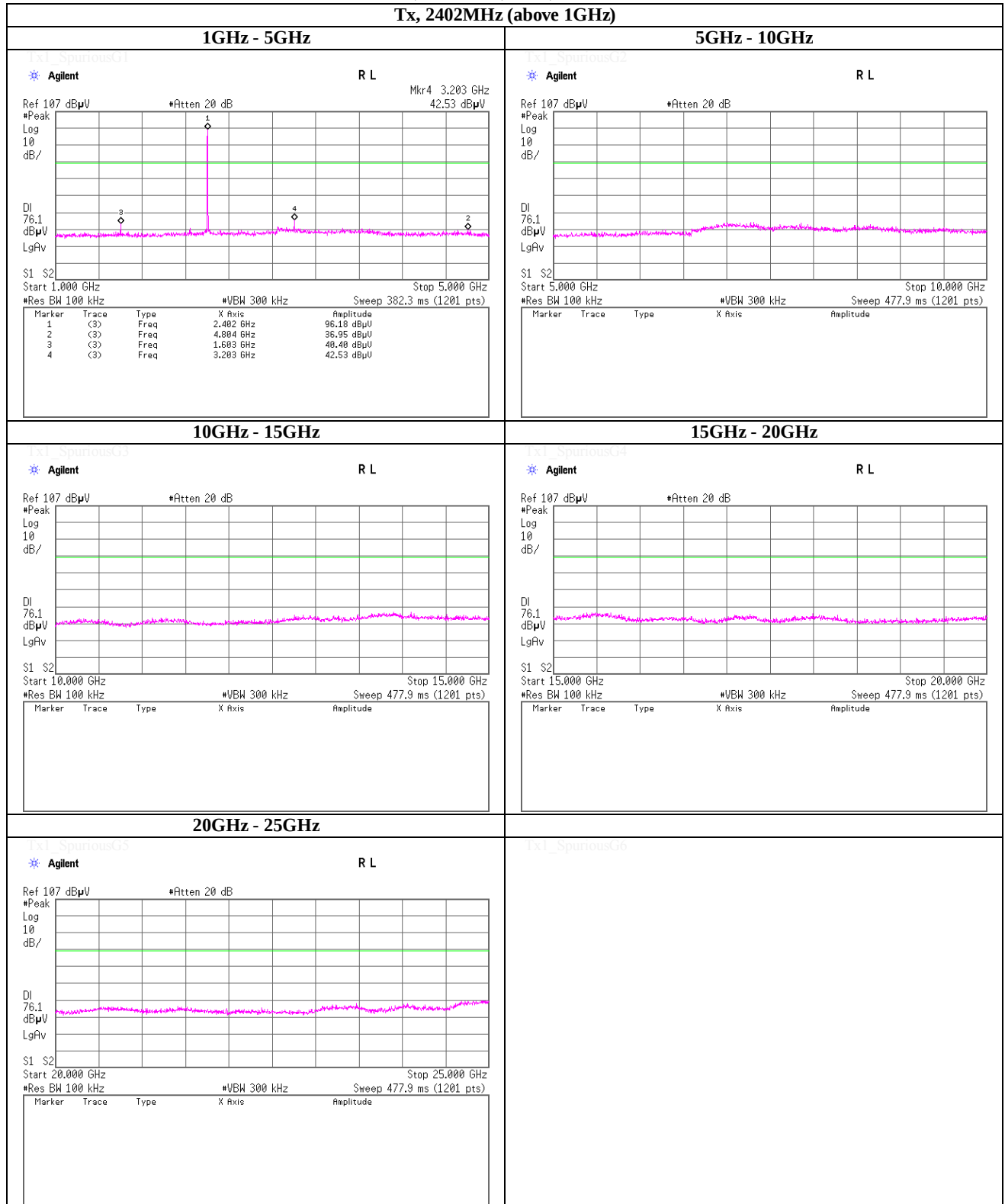
Spurious emission (Conducted)**Tx, Bluetooth, BDR, PRBS9****Tx, 2480MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

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)



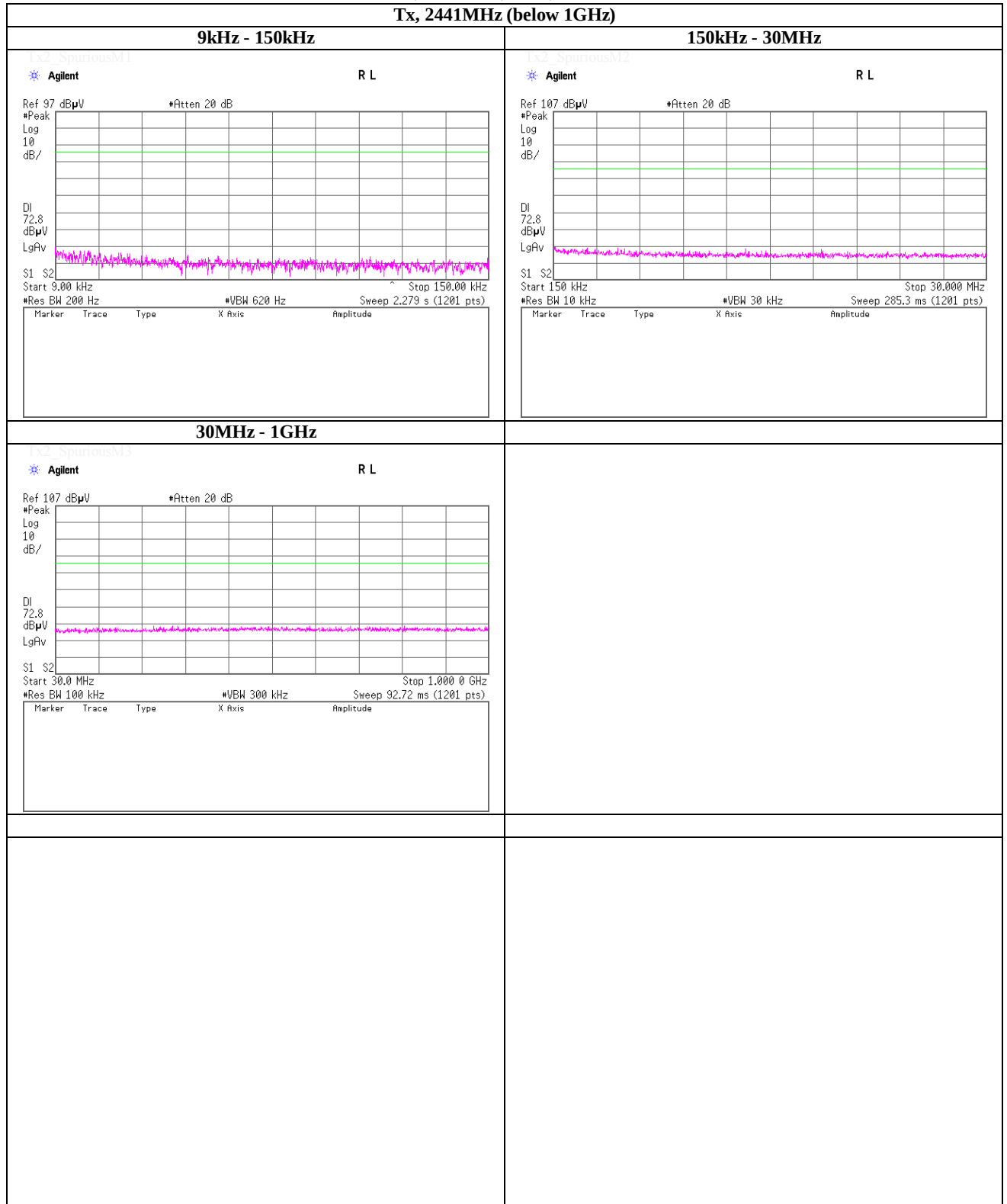
UL Japan, Inc.

Shonan EMC Lab.

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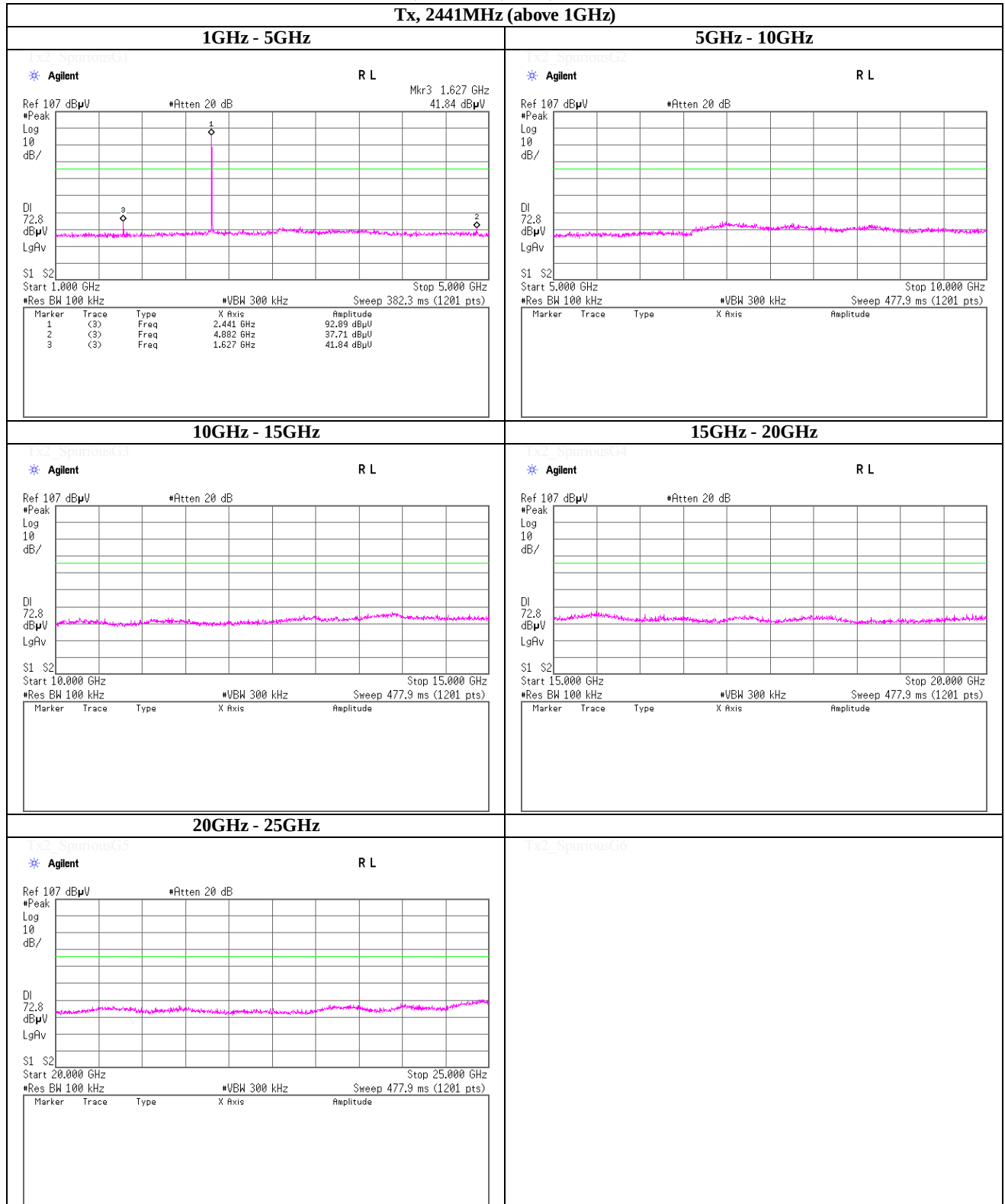
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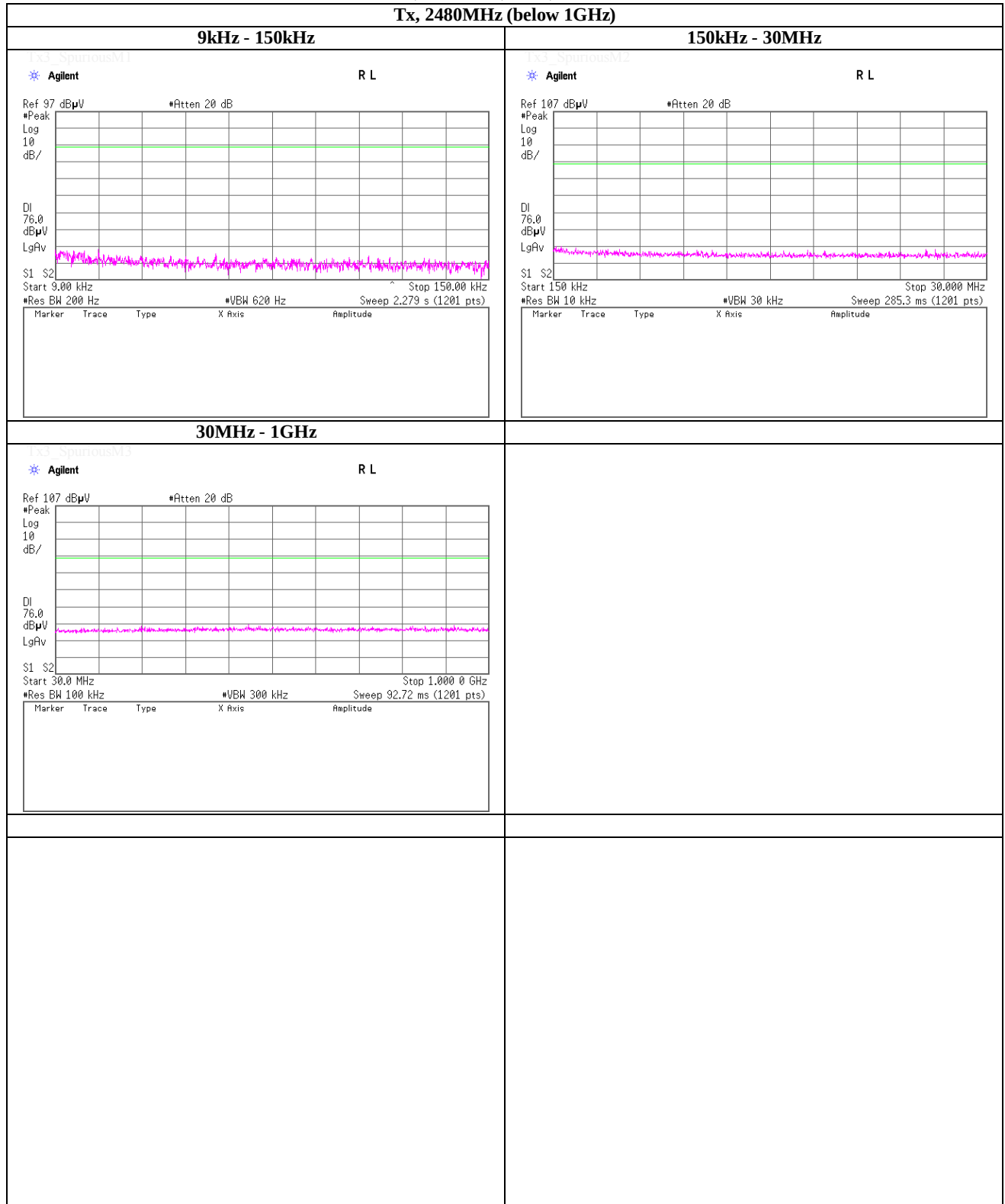
Spurious emission (Conducted)**Tx, Bluetooth, EDR, PRBS9****Tx, 2441MHz (below 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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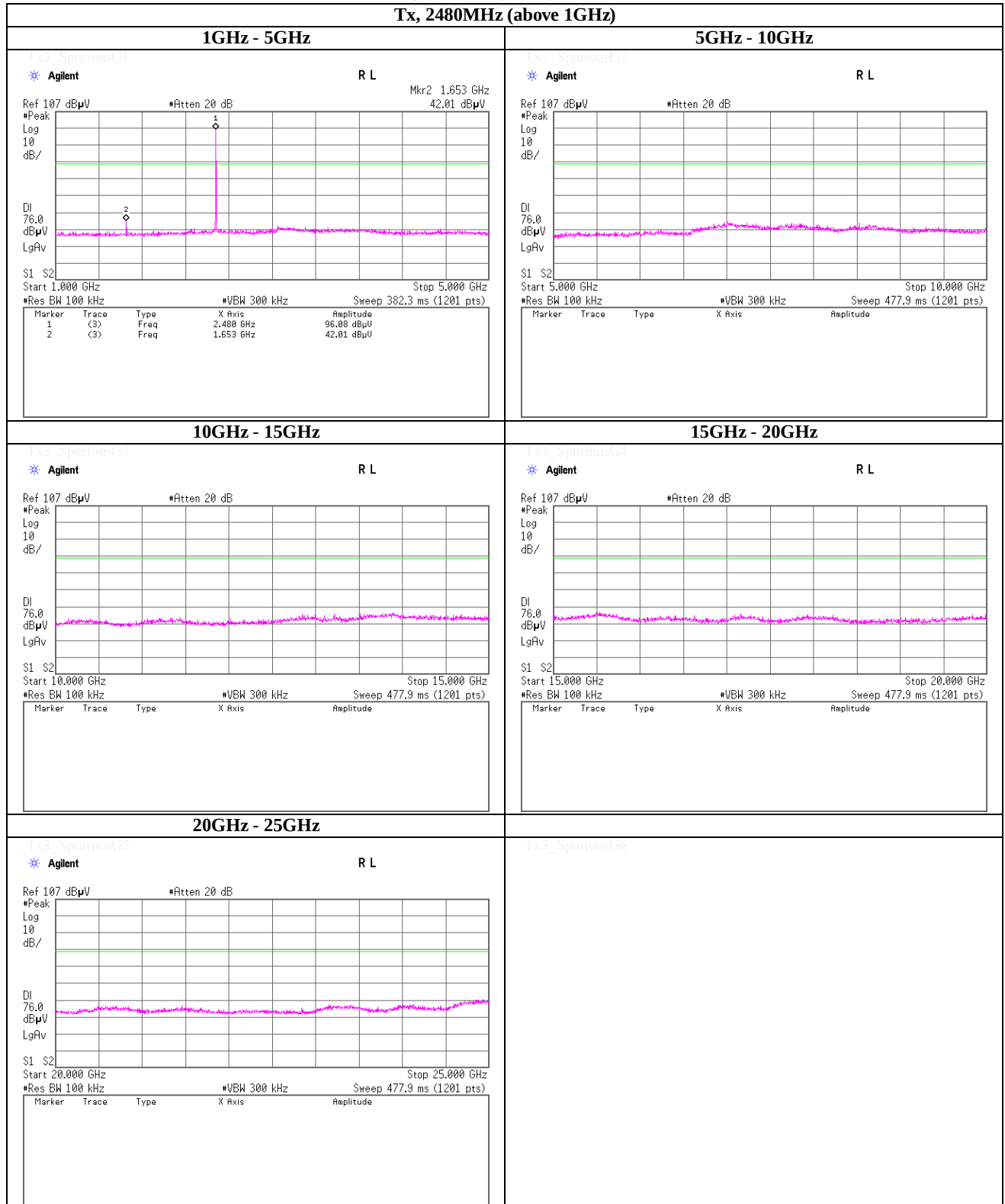
Telephone : +81 463 50 6400

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Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2480MHz (above 1GHz)



UL Japan, Inc.

Shonan EMC Lab.

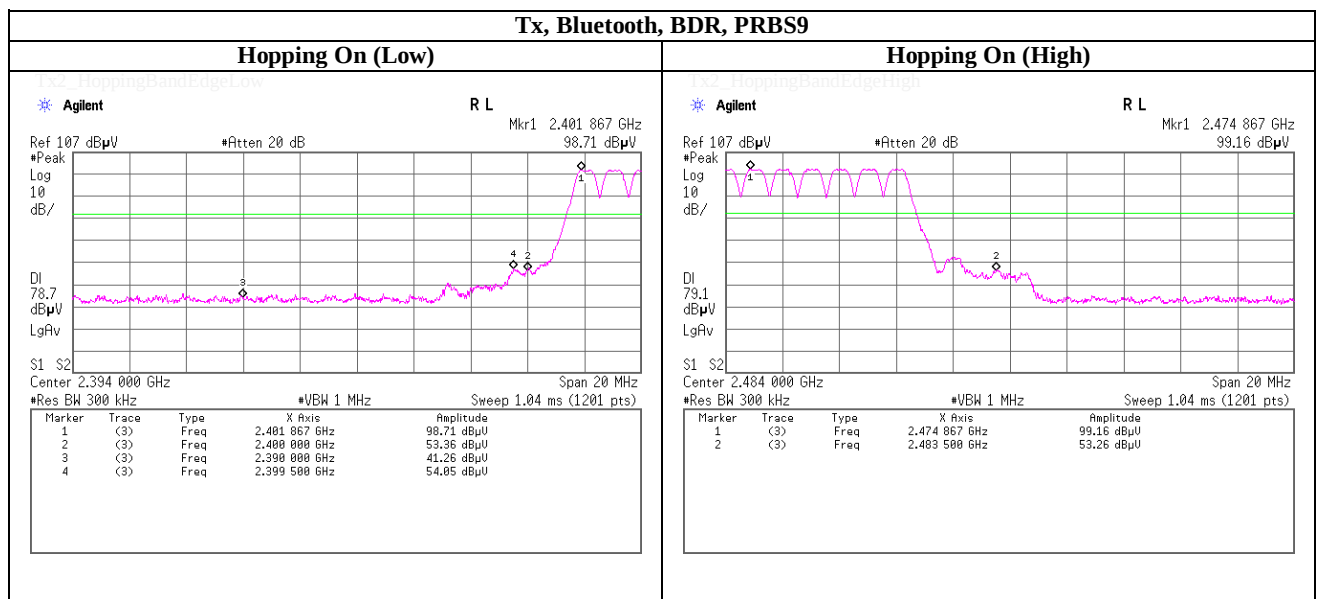
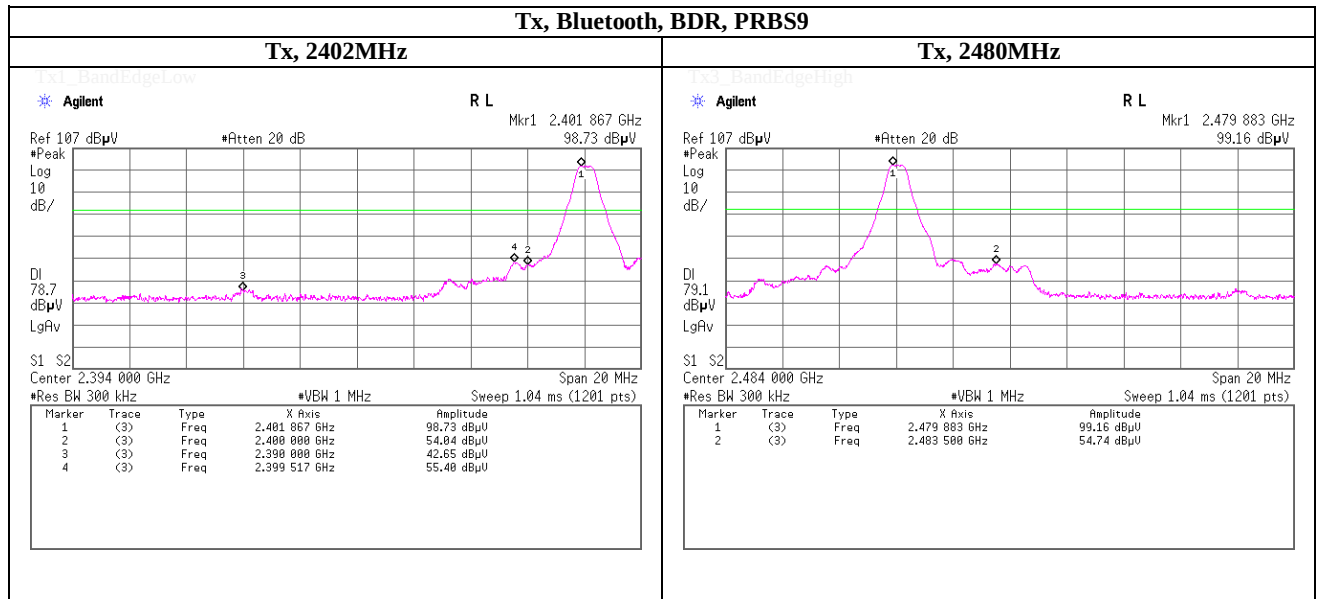
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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Spurious emission (Conducted)

Band Edge compliance



UL Japan, Inc.

Shonan EMC Lab.

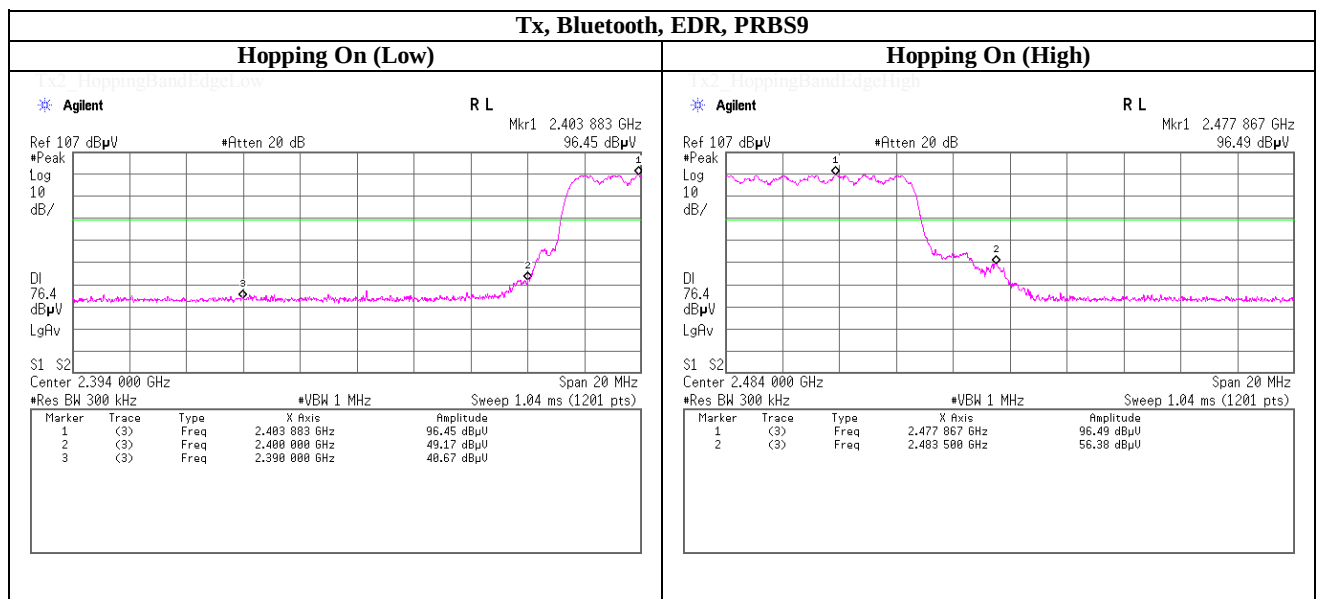
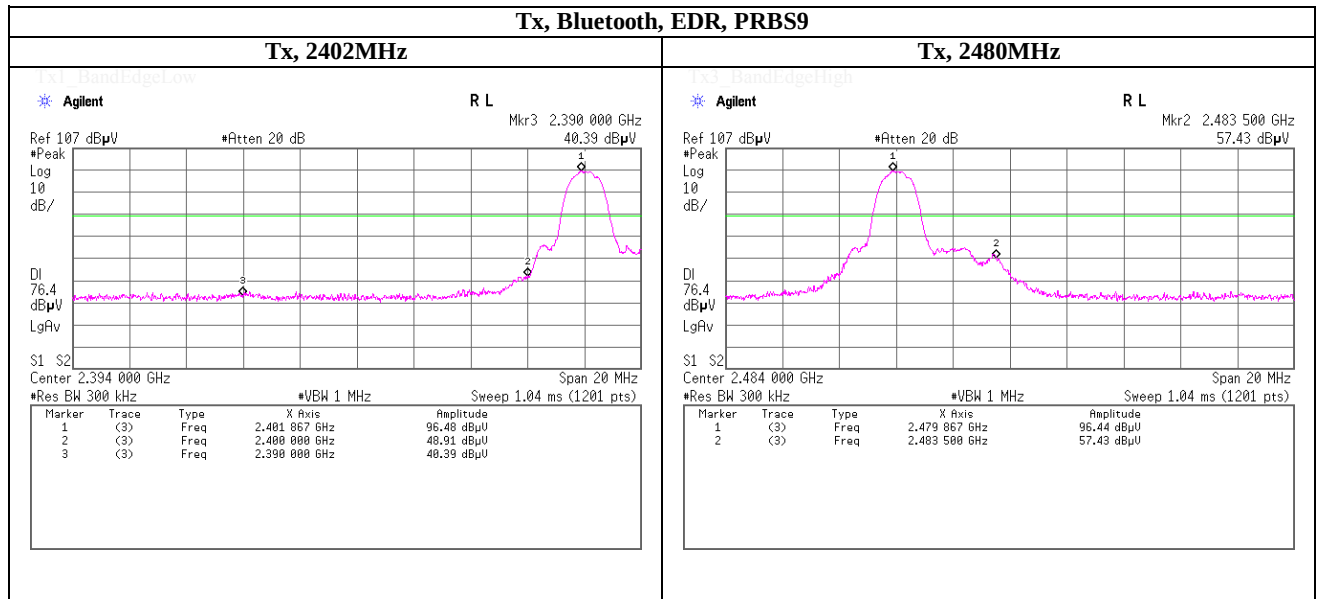
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Spurious emission (Conducted)

Band Edge compliance



UL Japan, Inc.

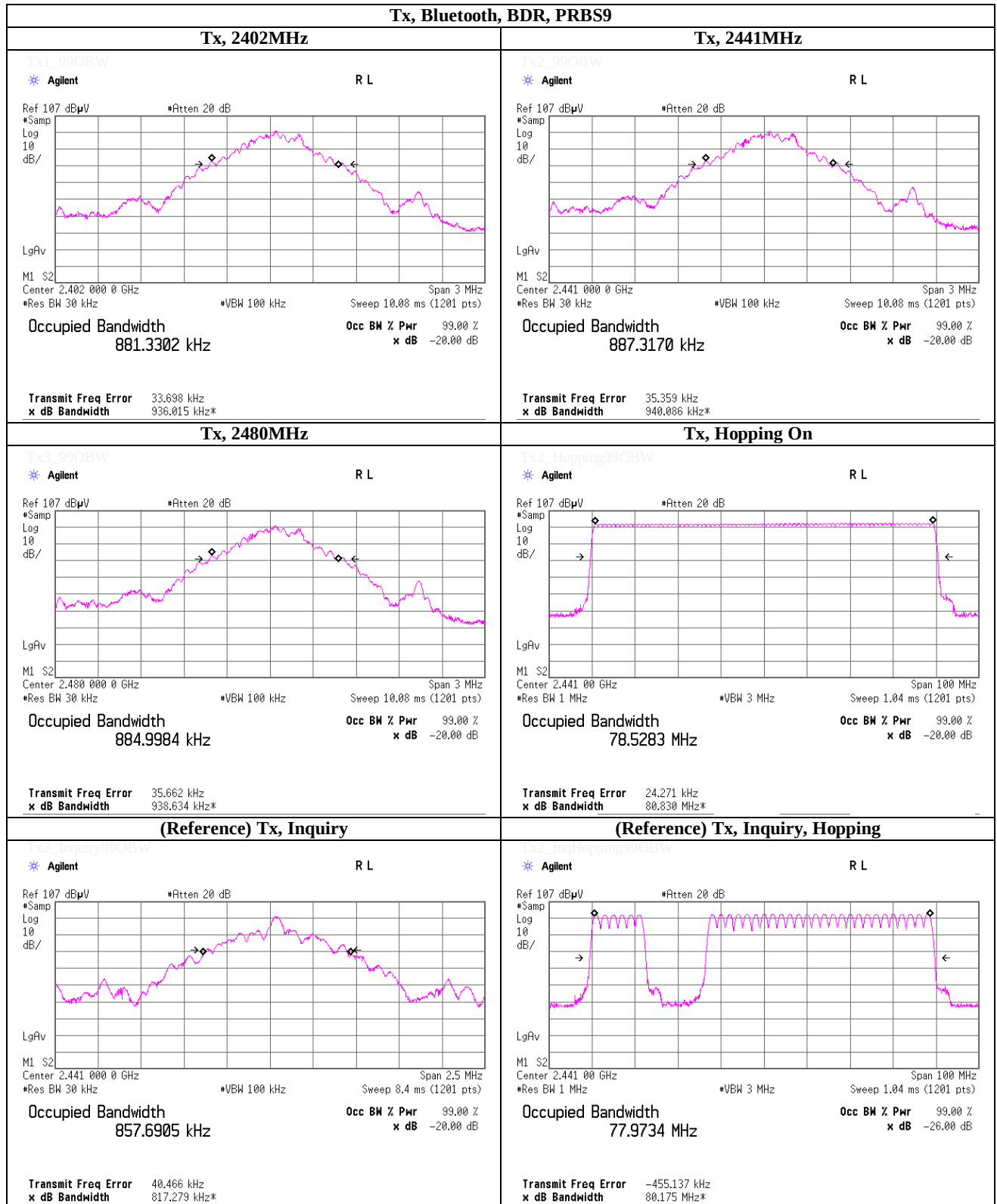
Shonan EMC Lab.

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99% Occupied Bandwidth



UL Japan, Inc.

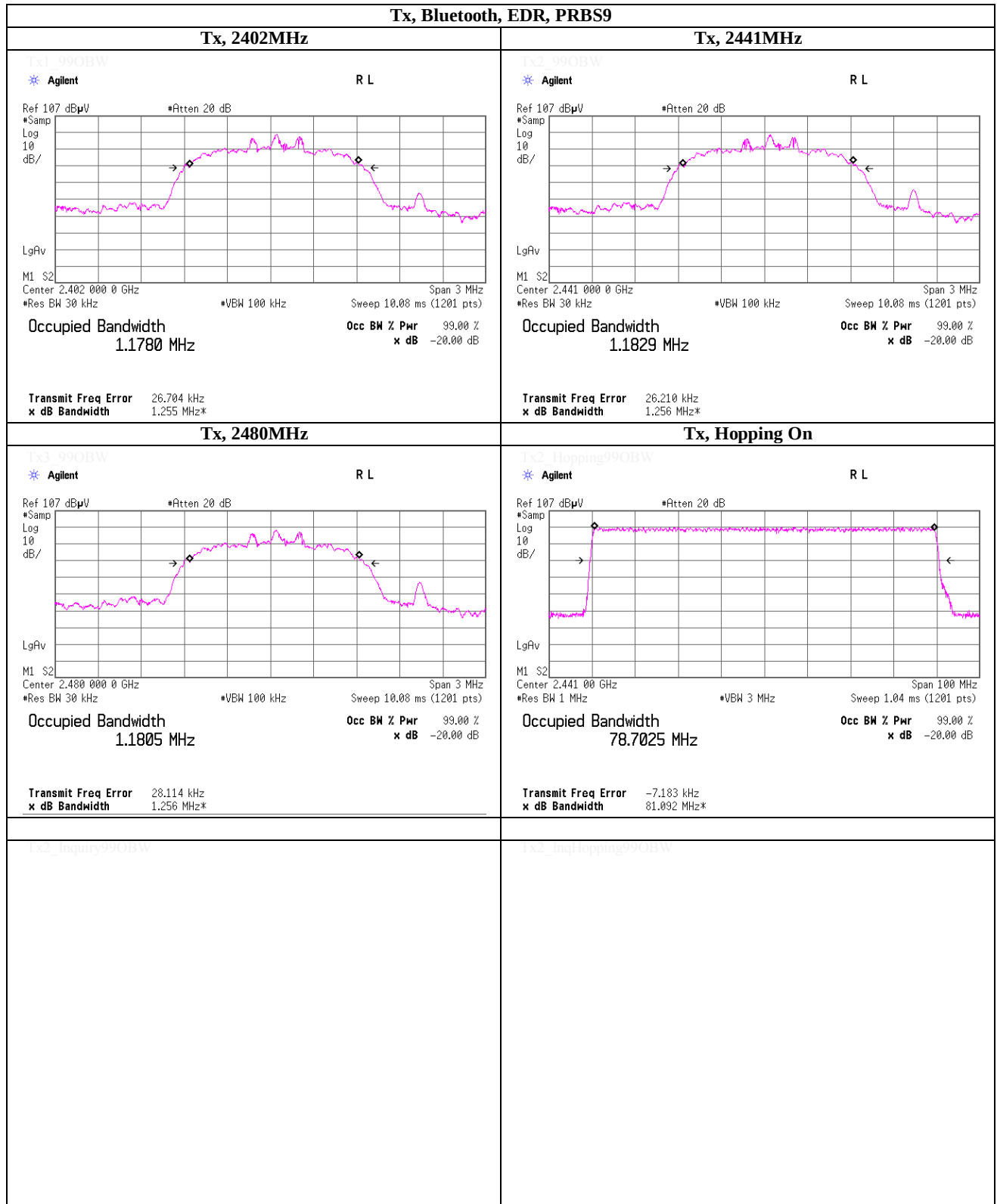
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99% Occupied Bandwidth



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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)
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2012/02/16 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2011/11/09 * 12
SCC-G11	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	AT	2012/03/12 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2012/04/19 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2012/04/19 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2012/03/26 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/N S4906	-/0901-271 (RF Selector)	CE	2012/04/10 * 12
SLS-05	LISN	Rohde & Schwarz	ENV216	100516	CE	2012/02/23 * 12
SAT3-03	Attenuator	JFW	50HF-003N	-	CE	2012/02/17 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2012/03/26 * 12
STR-03	Test Receiver	Rohde & Schwarz	ES140	100054/040	CE	2012/06/14 * 12
SJM-10	Measure	PROMART	SEN1935	-	CE/RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	CE/RE	-
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2011/09/23 * 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	2012/04/10 * 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	2012/02/06 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	RE	2011/12/05 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2011/12/27 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2011/12/27 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2012/02/10 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2012/02/10 * 12
KAT3-11	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2012/08/07 * 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 :

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

APPENDIX 2

Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2011/11/16 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2012/04/10 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2012/04/10 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP9108-A 0893	RE	2011/11/16 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2012/02/06 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2012/02/07 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2011/09/25 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2012/03/30 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2012/03/12 * 12
SCC-G17	Coaxial Cable	Suhner	SUCOFLEX 104A	46291/4A	RE	2012/03/12 * 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 :

CE: Conducted emission ,

RE: Radiated emission ,

AT: Antenna terminal conducted test